PHILIPS

Video and associated systems
Types TDA1524A to TEA2000

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Data handbook

Electronic components and materials

Integrated circuits

Book IC02b 1986

Video and associated systems

Bipolar, MOS

Types TDA1524A to TEA2000

VIDEO AND ASSOCIATED SYSTEMS
BIPOLAR, MOS
Types TDA1524A to TEA2000

SELECTION GUIDE

FUNCTIONAL INDEX

NUMERICAL INDEX

Operating temperature range: 0 to 70 °C.
Extended temperature range: −40 to + 85 °C.
Automotive temperature range: −40 to + 110 °C.

type number	RAM	ROM	description	package code	page
SINGLE-CHIP 8-BIT MICROCONTROLLERS (continued)					
MAF8051AHWP	128	4K	like MAB8051AH; extended temperature	44-PLCC, SOT-187A	33
MAF80A51AHP	128	4K	like MAB8051AH; automotive temperature; reduced frequency	DIL-40, SOT-129	33
MAF80A51AHWP	128	4K	like MAB8051AH; automotive temperature; reduced frequency	44-PLCC, SOT-187A	33
MAF8411P	64	1K	plus 8-bit LED driver and extended temperature	DIL-28, SOT-117D	41
MAF84A11P	64	1K	plus 8-bit LED driver; automotive temperature; reduced frequency	DIL-28, SOT-117D	41
MAF8421P	64	2K	plus 8-bit LED driver and extended temperature	DIL-28, SOT-117D	41
MAF84A21P	64	2K	plus 8-bit LED driver; automotive temperature; reduced frequency	DIL-28, SOT-117D	41
MAF8422P	64	2K	plus 8-bit LED driver and extended temperature	DIL-20, SOT-146	43
MAF84A22P	64	2K	plus 8-bit LED driver; automotive temperature; reduced frequency	DIL-20, SOT-146	43
MAF8441P	128	4K	plus 8-bit LED driver; extended temperature	DIL-28, SOT-117D	41
MAF84A41P	128	4K	plus 8-bit LED driver; automotive temperature; reduced frequency	DIL-28, SOT-117D	41
MAF8442P	128	4K	plus 8-bit LED driver; extended temperature	DIL-20, SOT-146	43
MAF84A42P	128	4K	plus 8-bit LED driver; automotive temperature; reduced frequency	DIL-20, SOT-146	43
MAF8461P	128	6K	plus 8-bit LED driver; extended temperature	DIL-28, SOT-117D	41
MAF84A61P	128	6K	plus 8-bit LED driver; automotive temperature; reduced frequency	DIL-28, SOT-117D	41
PCB80C31P	128	–	ROM-less version of PCB80C51	DIL-40, SOT-129	45
PCB80C31WP	128	–	ROM-less version of PCB80C51	44-PLCC, SOT-187A	45
PCB80C39P	128	–	ROM-less version of PCB80C49	DIL-40, SOT-129	47
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PCB80C49P	128	2K		DIL-40, SOT-129	47
PCB80C49WP	128	2K		44-PLCC, SOT-187A	47
PCB80C51P	128	4K	mask-programmable ROM	DIL-40, SOT-129	45
PCB80C51WP	128	4K	mask-programmable ROM	44-PLCC, SOT-187A	45

Operating temperature range: 0 to 70 °C.
Extended temperature range: −40 to + 85 °C.
Automotive temperature range: −40 to + 110 °C.

SINGLE-CHIP 8-BIT MICROCONTROLLERS (continued)

MAINTENANCE TYPE LIST

PNA7507; A	7-bit A/D converter	
SAA1056P	PLL frequency synthesizer	
SAA1082P	remote transmitter	
SAA3027	infrared remote control transmitter	
SAB3034	analogue and timing circuit (A & T)	
SAF3019	clock/timer with serial I/O; μC controlled	
TBA540	reference combination	
TBA750C; CQ	limiter/amplifier	
TDA2502	tacho motor speed controller	
TDA2503	track sensing amplifier for VCR	
TDA3571B	sync combination with transmitter identification	
TDA3576B	sync combination with transmitter identification	
TDA3590	SECAM processor circuit	(successor TDA3590A)
TDA3591	SECAM processor circuit	
TDA3591A	SECAM processor circuit	
TDA3650	vertical deflection circuit	
TDA3701	PAL sync processor for VCR	
TDA3710	chrominance signal/mixer for VCR	
TDA3720	SECAM processor for VCR	(successor TDA3725)
TDB2033	preamplifier for infrared remote control transmission	
TEA1002	PAL colour encoder and video summer	(successor TEA2000)

DEVICE DATA

STEREO-TONE/VOLUME CONTROL CIRCUIT

GENERAL DESCRIPTION

The device is designed as an active stereo-tone/volume control for car radios, TV receivers and mains-fed equipment. It includes functions for bass and treble control, volume control with built-in contour (can be switched off) and balance. All these functions can be controlled by d.c. voltages or by single linear potentiometers.

Features

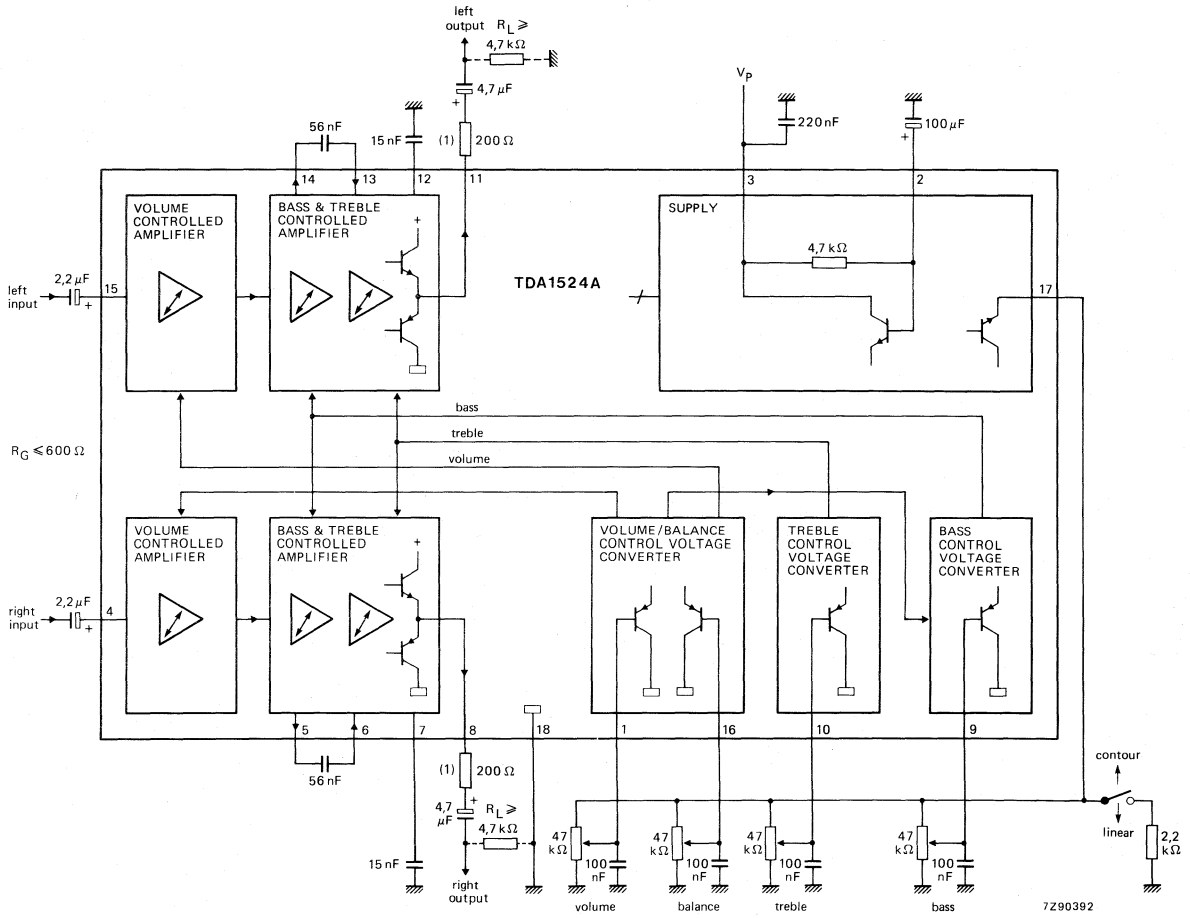
- Few external components necessary
- Low noise due to internal gain
- Bass emphasis can be increased by a double-pole low-pass filter
- Wide power supply voltage range

QUICK REFERENCE DATA

Supply voltage (pin 3)	$V_P = V_{3\text{-}18}$	typ.	12 V
Supply current (pin 3)	$I_P = I_3$	typ.	35 mA
Maximum input signal with d.c. feedback (r.m.s. value)	$V_{i(rms)}$	typ.	2,5 V
Maximum output signal with d.c. feedback (r.m.s. value)	$V_{o(rms)}$	typ.	3 V
Volume control range	G_v		−80 to + 21,5 dB
Bass control range at 40 Hz	ΔG_v	typ.	± 15 dB
Treble control range at 16 kHz	ΔG_v	typ.	± 15 dB
Total harmonic distortion	THD	typ.	0,3 %
Output noise voltage (unweighted; r.m.s. value) at f = 20 Hz to 20 kHz; V_P = 12 V;			
for max. voltage gain	$V_{no(rms)}$	typ.	310 μV
for voltage gain G_v = −40 dB	$V_{no(rms)}$	typ.	100 μV
Channel separation at G_v = −20 to + 21,5 dB	α_{cs}	typ.	60 dB
Tracking between channels at G_v = −20 to + 26 dB	ΔG_v	max.	2,5 dB
Ripple rejection at 100 Hz	RR	typ.	50 dB
Supply voltage range (pin 3)	$V_P = V_{3\text{-}18}$		7,5 to 16,5 V
Operating ambient temperature range	T_{amb}		−30 to + 80 °C

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102HE).



(1) Series resistor is recommended in the event of the capacitive loads exceeding 200 pF.

Fig. 1 Block diagram and application circuit with single-pole filter.

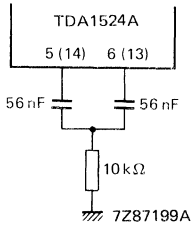


Fig. 2 Double-pole low-pass filter for improved bass-boost.

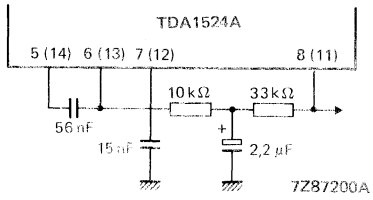


Fig. 3 D.C. feedback with filter network for improved signal handling.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 3)	$V_P = V_{3-18}$	max.	20	V
Total power dissipation	P_{tot}	max.	1200	mW
Storage temperature range	T_{stg}		−55 to + 150	°C
Operating ambient temperature range	T_{amb}		−30 to + 80	°C

D.C. CHARACTERISTICS

$V_P = V_{3-18} = 12$ V; $T_{amb} = 25$ °C; measured in Fig. 1; $R_G \leqslant 600\ \Omega$; $R_L \geqslant 4{,}7$ kΩ; $C_L \leqslant 200$ pF; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 3)					
Supply voltage	$V_P = V_{3-18}$	7,5	–	16,5	V
Supply current					
at $V_P = 8{,}5$ V	$I_P = I_3$	19	27	35	mA
at $V_P = 12$ V	$I_P = I_3$	25	35	45	mA
at $V_P = 15$ V	$I_P = I_3$	30	43	56	mA
D.C. input levels (pins 4 and 15)					
at $V_P = 8{,}5$ V	$V_{4,15-18}$	3,8	4,25	4,7	V
at $V_P = 12$ V	$V_{4,15-18}$	5,3	5,9	6,6	V
at $V_P = 15$ V	$V_{4,15-18}$	6,5	7,3	8,2	V
D.C. output levels (pins 8 and 11) under all control voltage conditions with d.c. feedback (Fig. 3)					
at $V_P = 8{,}5$ V	$V_{8,11-18}$	3,3	4,25	5,2	V
at $V_P = 12$ V	$V_{8,11-18}$	4,6	6,0	7,4	V
at $V_P = 15$ V	$V_{8,11-18}$	5,7	7,5	9,3	V
Pin 17					
Internal potentiometer supply voltage at $V_P = 8{,}5$ V	V_{17-18}	3,5	3,75	4,0	V
Contour on/off switch (control by I_{17})					
contour (switch open)	$-I_{17}$	–	–	0,5	mA
linear (switch closed)	$-I_{17}$	1,5	–	10	mA
Application without internal potentiometer supply voltage at $V_P \geqslant 10{,}8$ V (contour cannot be switched off)					
Voltage range forced to pin 17	V_{17-18}	4,5	–	$V_P/2-V_{BE}$	V
D.C. control voltage range for volume, bass, treble and balance (pins 1, 9, 10 and 16 respectively)					
at $V_{17-18} = 5$ V	$V_{1,9,10,16}$	1,0	–	4,25	V
using internal supply	$V_{1,9,10,16}$	0,25	–	3,8	V
Input current of control inputs (pins 1, 9, 10 and 16)	$-I_{1,9,10,16}$	–	–	5	μA

A.C. CHARACTERISTICS

$V_P = V_{3-18} = 8{,}5$ V; $T_{amb} = 25\ ^oC$; measured in Fig. 1; contour switch closed (linear position); volume, balance, bass, and treble controls in mid-position; $R_G \leqslant 600\ \Omega$; $R_L \geqslant 4{,}7$ kΩ; $C_L \leqslant 200$ pF; f = 1 kHz; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Control range					
Max. gain of volume (Fig. 5)	$G_{V\,max}$	20,5	21,5	23	dB
Volume control range; $G_{V\,max}/G_{V\,min}$	ΔG_V	90	100	–	dB
Balance control range; $G_V = 0$ dB (Fig. 6)	ΔG_V	–	–40	–	dB
Bass control range at 40 Hz (Fig. 7)	ΔG_V	±12	±15	–	dB
Treble control range at 16 kHz (Fig. 8)	ΔG_V	±12	±15	–	dB
Contour characteristics		see Figs 9 and 10			
Signal inputs, outputs					
Input resistance; pins 4 and 15 (note 1)					
at gain of volume control: $G_V = 20$ dB	$R_{i4,15}$	10	–	–	kΩ
$G_V = -40$ dB	$R_{i4,15}$	–	160	–	kΩ
Output resistance (pins 8 and 11)	$R_{o8,11}$	–	–	300	Ω
Signal processing					
Power supply ripple rejection					
at $V_{P(rms)} \leqslant 200$ mV; f = 100 Hz; $G_V = 0$ dB	RR	35	50	–	dB
Channel separation (250 Hz to 10 kHz)					
at $G_V = -20$ to + 21,5 dB	α_{cs}	46	60	–	dB
Spread of volume control with					
constant control voltage $V_{1-18} = 0{,}5\ V_{17-18}$	ΔG_V	–	–	±3	dB
Gain tolerance between left and right					
channel $V_{16-18} = V_{1-18} = 0{,}5\ V_{17-18}$	$\Delta G_{V,L-R}$	–	–	1,5	dB
Tracking between channels					
for $G_V = 21{,}5$ to -26 dB					
f = 250 Hz to 6,3 kHz; balance adjusted at					
$G_V = 10$ dB	ΔG_V	–	–	2,5	dB

A.C. CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Signal handling with d.c. feedback (Fig. 3)					
Input signal handling					
at V_P = 8,5 V; THD = 0,5%; f = 1 kHz (r.m.s. value)	$V_{i(rms)}$	1,4	–	–	V
at V_P = 8,5 V; THD = 0,7%; f = 1 kHz (r.m.s. value)	$V_{i(rms)}$	1,8	2,4	–	V
at V_P = 12 V; THD = 0,5%; f = 40 Hz to 16 kHz (r.m.s. value)	$V_{i(rms)}$	1,4	–	–	V
at V_P = 12 V; THD = 0,7%; f = 40 Hz to 16 kHz (r.m.s. value)	$V_{i(rms)}$	2,0	3,2	–	V
at V_P = 15 V; THD = 0,5%; f = 40 Hz to 16 kHz (r.m.s. value)	$V_{i(rms)}$	1,4	–	–	V
at V_P = 15 V; THD = 0,7%; f = 40 Hz to 16 kHz (r.m.s. value)	$V_{i(rms)}$	2,0	3,2	–	V
Output signal handling (note 2 and note 3)					
at V_P = 8,5 V; THD = 0,5%; f = 1 kHz (r.m.s. value)	$V_{o(rms)}$	1,8	2,0	–	V
at V_P = 8,5 V; THD = 10%; f = 1 kHz (r.m.s. value)	$V_{o(rms)}$	–	2,2	–	V
at V_P = 12 V; THD = 0,5%; f = 40 Hz to 16 kHz (r.m.s. value)	$V_{o(rms)}$	2,5	3,0	–	V
at V_P = 15 V; THD = 0,5%; f = 40 Hz to 16 kHz (r.m.s. value)	$V_{o(rms)}$	–	3,5	–	V
Noise performance (V_P = 8,5 V)					
Output noise voltage (unweighted; Fig. 15)					
at f = 20 Hz to 20 kHz (r.m.s. value)					
for maximum voltage gain (note 4)	$V_{no(rms)}$	–	260	–	μV
for G_v = –3 dB (note 4)	$V_{no(rms)}$	–	70	140	μV
Output noise voltage; weighted as DIN 45405 of 1981, CCIR recommendation 468-2 (peak value)					
for maximum voltage gain (note 4)	$V_{no(m)}$	–	890	–	μV
for maximum emphasis of bass and treble (contour off; G_v = –40 dB)	$V_{no(m)}$	–	360	–	μV
Noise performance (V_P = 12 V)					
Output noise voltage (unweighted; Fig. 15)					
at f = 20 Hz to 20 kHz (r.m.s. value; note 5)					
for maximum voltage gain (note 4)	$V_{no(rms)}$	–	310	–	μV
for G_v = –16 dB (note 4)	$V_{no(rms)}$	–	100	200	μV
Output noise voltage; weighted as DIN 45405 of 1981, CCIR recommendation 468-2 (peak value)					
for maximum voltage gain (note 4)	$V_{no(m)}$	–	940	–	μV
for maximum emphasis of bass and treble (contour off; G_v = –40 dB)	$V_{no(m)}$	–	400	–	μV

parameter	symbol	min.	typ.	max.	unit
Noise performance (V_P = 15 V)					
Output noise voltage (unweighted; Fig. 15)					
at f = 20 Hz to 20 kHz (r.m.s. value; note 5)					
for maximum voltage gain (note 4)	$V_{no(rms)}$	–	350	–	μV
for G_V = 16 dB (note 4)	$V_{no(rms)}$	–	110	220	μV
Output noise voltage; weighted as DIN 45405					
of 1981, CCIR recommendation 468-2 (peak value)					
for maximum voltage gain (note 4)	$V_{no(m)}$	–	980	–	μV
for maximum emphasis of bass and treble					
(contour off; G_V = −40 dB)	$V_{no(m)}$	–	420	–	μV

Notes to characteristics

1. Equation for input resistance (see also Fig. 4)

$$R_i = \frac{160\ k\Omega}{1 + G_V}\ ;\ G_{V\ max} = 12.$$

2. Frequencies below 200 Hz and above 5 kHz have reduced voltage swing, the reduction at 40 Hz and at 16 kHz is 30%.
3. In the event of bass boosting the output signal handling is reduced. The reduction is 1 dB for maximum bass boost.
4. Linear frequency response.
5. For peak values add 4,5 dB to r.m.s. values.

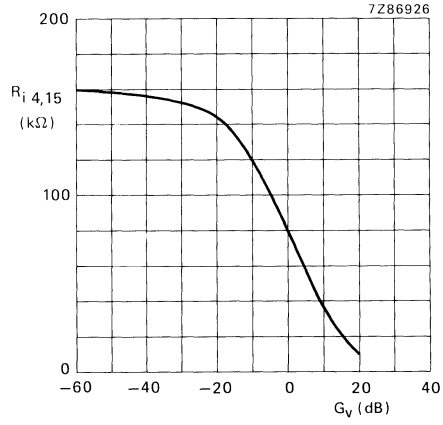


Fig. 4 Input resistance (R_i) as a function of gain of volume control (G_V). Measured in Fig. 1.

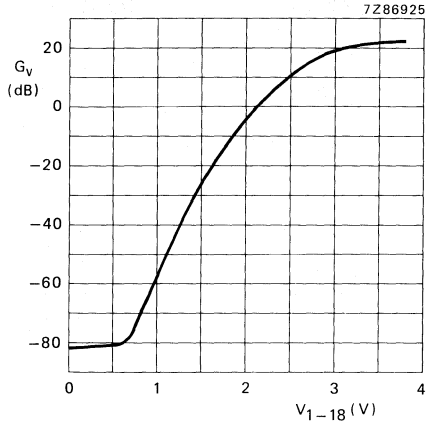


Fig. 5 Volume control curve; voltage gain (G_v) as a function of control voltage ($V_{1\text{-}18}$). Measured in Fig. 1 (internal potentiometer supply from pin 17 used); V_P = 8,5 V; f = 1 kHz.

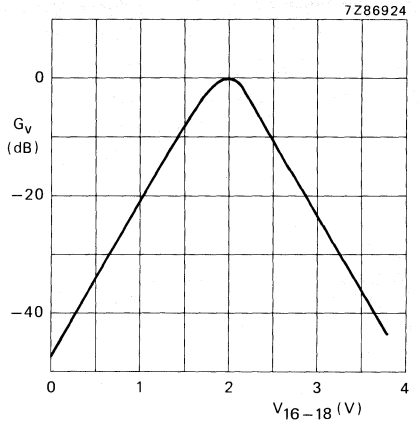


Fig. 6 Balance control curve; voltage gain (G_v) as a function of control voltage ($V_{16\text{-}18}$). Measured in Fig. 1 (internal potentiometer supply from pin 17 used); V_P = 8,5 V.

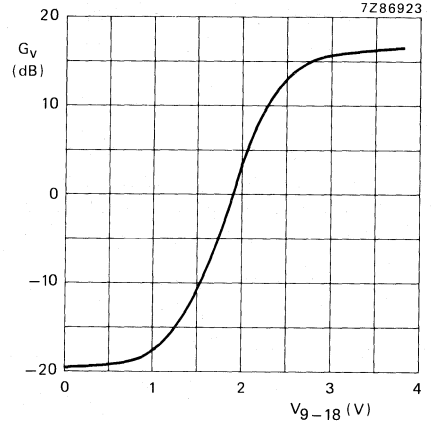


Fig. 7 Bass control curve; voltage gain (G_v) as a function of control voltage ($V_{9\text{-}18}$). Measured in Fig. 1 with single-pole filter (internal potentiometer supply from pin 17 used); V_P = 8,5 V; f = 40 Hz.

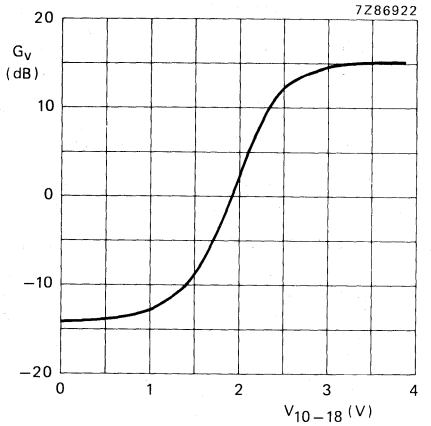


Fig. 8 Treble control curve; voltage gain (G_v) as a function of control voltage ($V_{10\text{-}18}$). Measured in Fig. 1 (internal potentiometer supply from pin 17 used); V_P = 8,5 V; f = 16 kHz.

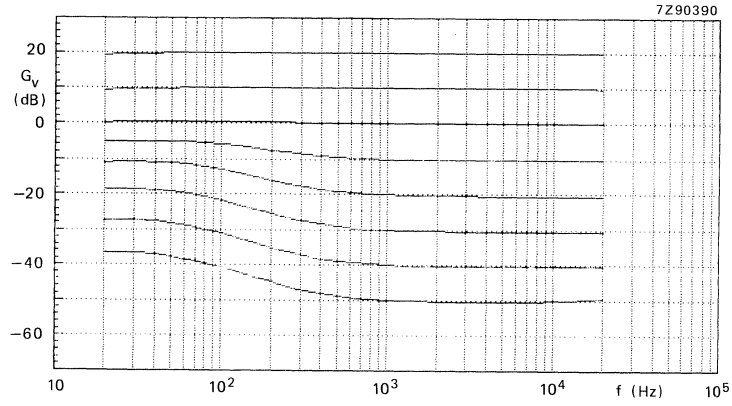


Fig. 9 Contour frequency response curves; voltage gain (G_V) as a function of audio input frequency. Measured in Fig. 1 with single-pole filter; V_P = 8,5 V.

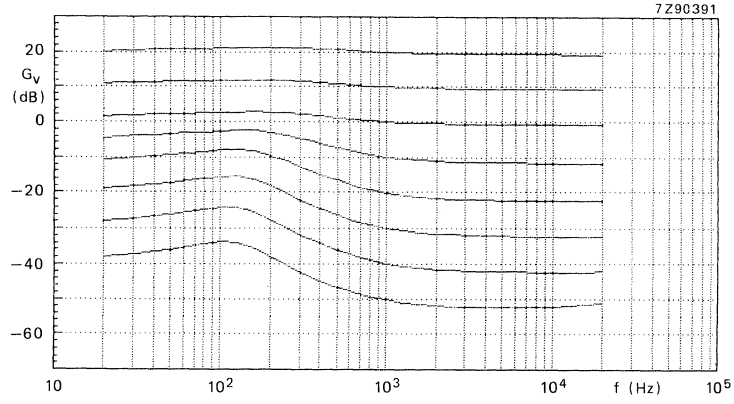


Fig. 10 Contour frequency response curves; voltage gain (G_V) as a function of audio input frequency. Measured in Fig. 1 with double-pole filter; V_P = 8,5 V.

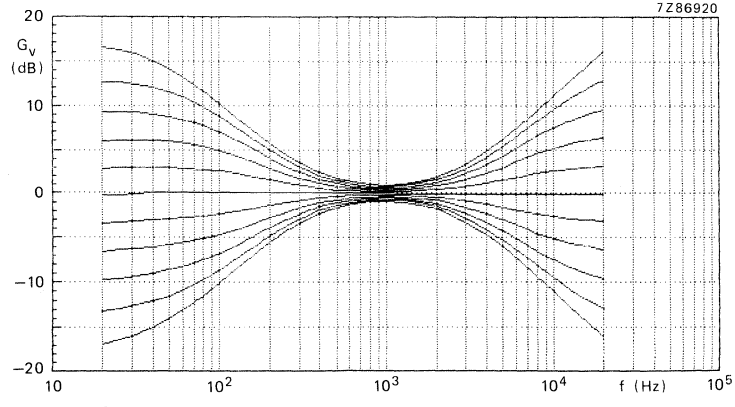


Fig. 11 Tone control frequency response curves; voltage gain (G_V) as a function of audio input frequency. Measured in Fig. 1 with single-pole filter; V_P = 8,5 V.

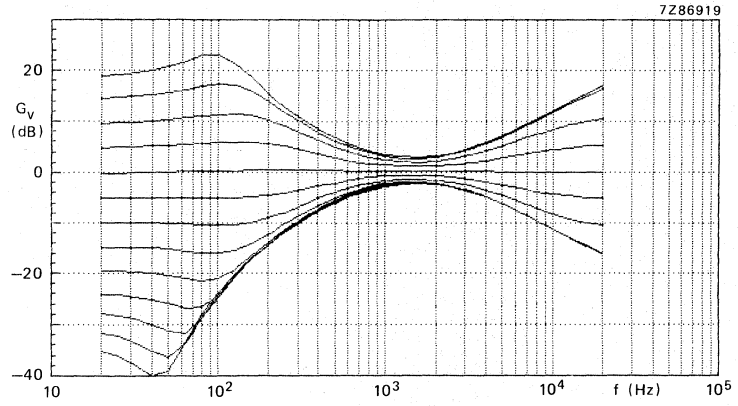


Fig. 12 Tone control frequency response curves; voltage gain (G_V) as a function of audio input frequency. Measured in Fig. 1 with double-pole filter; V_P = 8,5 V.

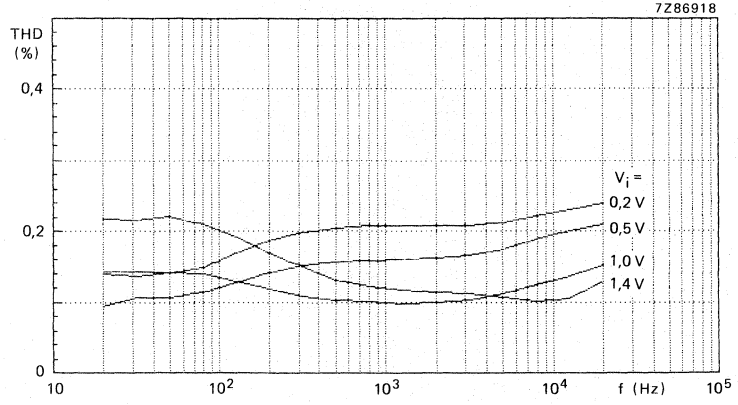


Fig. 13 Total harmonic distortion (THD); as a function of audio input frequency. Measured in Fig. 1; V_P = 8,5 V; volume control voltage gain at

$$G_V = 20 \log \frac{V_o}{V_i} = 0 \text{ dB}.$$

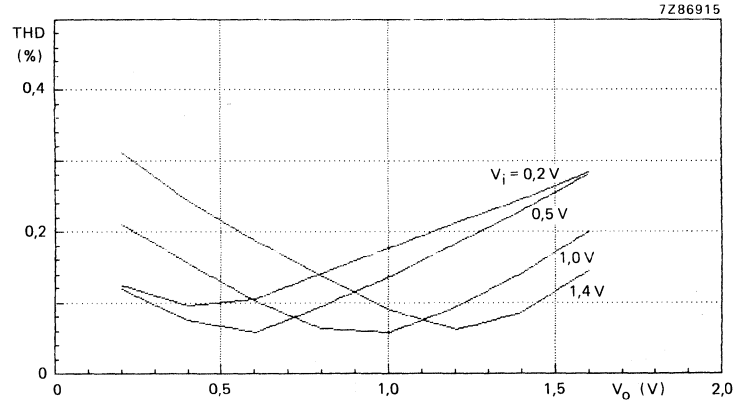
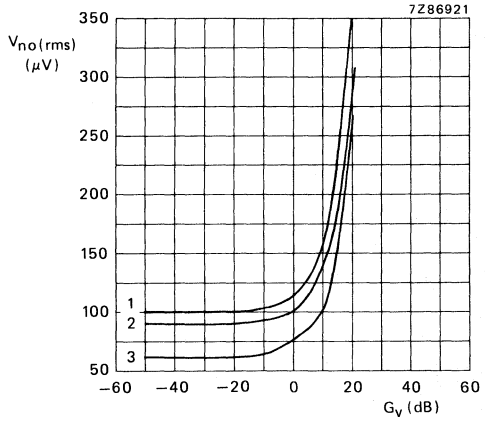


Fig. 14 Total harmonic distortion (THD); as a function of output voltage (V_O). Measured in Fig. 1; V_P = 8,5 V; f_i = 1 kHz.



(1) V_P = 15 V.
(2) V_P = 12 V.
(3) V_P = 8,5 V.

Fig. 15 Noise output voltage ($V_{no(rms)}$; unweighted); as a function of voltage gain (G_V). Measured in Fig. 1; f = 20 Hz to 20 kHz.

14-BIT ANALOGUE TO DIGITAL CONVERTER (ADC)

An integrated 14-bit analogue to digital converter (ADC) which uses the successive approximation conversion technique and includes the comparator, reference source and clock on the same chip.
The high linearity makes it very suitable for signal processing while the accurate, temperature-compensated reference source makes it applicable for instrumentation purposes.
The ADC accepts unipolar or bipolar input signals.
Digital output data is in serial form.
All digital outputs are fully TTL compatible.

QUICK REFERENCE DATA

Positive supply voltage (pin 5)	V_P	typ.	5 V
Negative supplu voltage 1 (pin 6)	$-V_{N1}$	typ.	5 V
Negative supply voltage 2 (pin 9)	$-V_{N2}$	typ.	17 V
Signal-to-noise ratio	S/N	typ.	84 dB
Linearity error		typ.	± ½ LSB
Total power dissipation	P_{tot}	typ.	500 mW
Operating ambient temperature range	T_{amb}	−20 to	+ 70 °C
Storage temperature range	T_{stg}	−55 to	+ 150 °C
Resolution			14 bits
Full scale input current	I_{FS}	typ.	4 mA

PACKAGE OUTLINE

28-lead dual in-line; plastic (with internal heat spreader) (SOT-117BE).

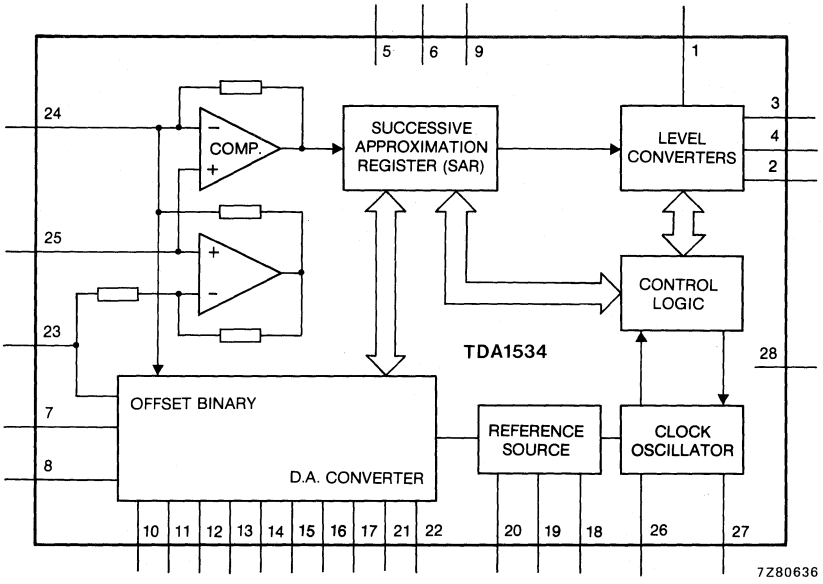


Fig. 1 Block diagram.

PIN DESIGNATION

1	start conversion
2	status out
3	data out
4	data strobe
5	positive supply voltage
6	negative supply voltage 1
7	oscillator input
8	oscillator input
9	negative supply voltage 2
10, 11, 12, 13, 14	decoupling binary weighted current sources
15, 16, 17	decoupling binary weighted current sources
18	I_{ref1}
19	I_{ref2}
20	I_{ref3}
21, 22	decoupling binary weighted current sources
23	offset binary input
24	analogue signal input
25	analogue ground
26	oscillator
27	oscillator
28	digital ground

FUNCTIONAL DESCRIPTION

The circuit consists of the following parts:

14-bit D/A converter

Using "dynamic element matching", which results in high accuracy, linearity and longterm stability, without the need of trimming. The main parts of the DAC are the binary wieghted current sources and the bit switches. The DAC also delivers an offset binary current for bipolar operation of the ADC.

Fast settling comparator/substractor

Consisting of a high speed, clamped operational amplifier with special frequency compensation system.

Successive approximation register (SAR)

This register is an array of fourteen addressable latches, with the outputs connected to the bit switches of the D/A converter.

Logic-level converters

Converting the internally used current-mode-logic (CML) levels to TTL levels, for easy interface of the ADC with standard logic families.

Clock oscillator and control logic

Delivering the pulses and timing for the SAR and takes care of the communication with the peripheral circuits.

Reference source

Based on the bandgap voltage of silicon, with extra temperature compensation circuit.

For the timing of the output signals see Fig. 3. At the leading edge of the start conversion (SC) pulse the ADC starts converting the input voltage. During the conversion cycle the following signals appear at the output pins:

Status (pin 2)

This signal can be used to force the Sample-Hold-Circuit, in front of the ADC, in hold mode.

Data strobe (pin 4)

This signal is used to clock the data-out signal into the peripheral devices.

Data out (pin 3)

The 14 bits serial, binary, output code of the A/D converter starting with the most significant bit (MSB). The data must be considered valid at the trailing edge of the data-strobe signal.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Positive supply (pin 5)	V_P	0 to 7 V
Negative supply voltage (pin 6)	$-V_{N1}$	0 to 7 V
Negative supply voltage (pin 9)	$-V_{N2}$	0 to 20 V
Storage temperature	T_{stg}	−55 to + 150 °C
Operating ambient temperature range	T_{amb}	−20 to + 70 °C
Total power dissipation	P_{tot}	derating curve (Fig. 2)

CHARACTERISTICS (see application circuit Fig. 4)

V_P = 5 V; $-V_{N1}$ = 5 V; $-V_{N2}$ = 17 V; T_{amb} = + 25 °C, unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
Positive supply voltage (pin 5)	V_P	4	5	6	V
Negative supply voltage 1 (pin 6)	$-V_{N1}$	–	5	–	V
Negative supply voltage 2 (pin 9)	$-V_{N2}$	16,5	17	18	V
Positive supply current	I_P	–	30	40	mA
Negative supply current	$-I_{N1}$	–	37	45	mA
Negative supply current	$-I_{N2}$	–	10	13	mA
Total power dissipation	P_{tot}	–	500	–	mW
Resolution		–	14	–	bits
Analogue input					
Full scale input current offset-binary current switched off	I_{FS}	3,8	4,0	4,2	mA
Temperature coefficient pin 23 short-circuited	TC	–	t.b.f.	–	10^{-6}/K
Zero-offset offset-binary current switched off					
Offset voltage	$-V_o$	10	20	30	mV
Temperature coefficient	TC	–	t.b.f.	–	μV/K
Offset current	I_o	–	500	–	nA
Temperature coefficient	TC	–	t.b.f.	–	nA/K
Linearity					
Linearity error		–	± ¼	–	LSB
Linearity from −20 to + 70 °C		–	± ½	–	LSB
Offset binary current	I_{BO}	$0{,}45 \cdot I_{FS}$	$0{,}50 \cdot I_{FS}$	$0{,}55 \cdot I_{FS}$	mA
Temperature coefficient	TC	–	t.b.f.	–	10^{-6}/K
Signal to noise ratio*	S/N	80	84	–	dB

parameter	symbol	min.	typ.	max.	unit
Start conversion (pin 1)					
Input current					
V_{IL} (< 0,8 V)	$-I_1$	–	–	1,6	mA
V_{IH} (> 2,0 V)	I_1	–	–	40	μA
Data, strobe, status (pins 3, 4 and 2)					
Output current					
V_{OL} (< 0,6 V)	$I_{3, 4, 2}$	6,4	16	–	mA
V_{OH} (> 2,4 V)	$-I_{3, 4, 2}$	160	400	–	μA
Conversion time					
$C_{26\text{-}27}$ = 220 pF ± 1%	t_C	–	8,5	–	μs
Signal width (pin 1)					
start conversion	t_{SC}	0,2	–	t_C	μs
Delay time (pin 2)					
status out	t_{SD}	–	60	–	ns
Set-up time (pin 3)					
data out	t_{DS}	–	25	–	ns
Pulse duration (pin 4)					
data strobe high	t_{DSH}	–	125	–	ns

* Signal-to-noise ratio within 10 Hz and 20 kHz bandwidth of a 1 kHz full scale sinewave, generated at a sample rate of 44 kHz.

DEVELOPMENT DATA

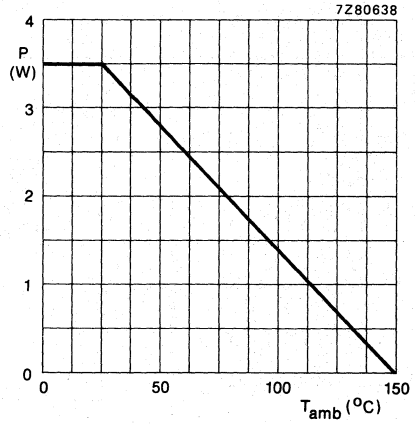


Fig. 2 Power derating curve.

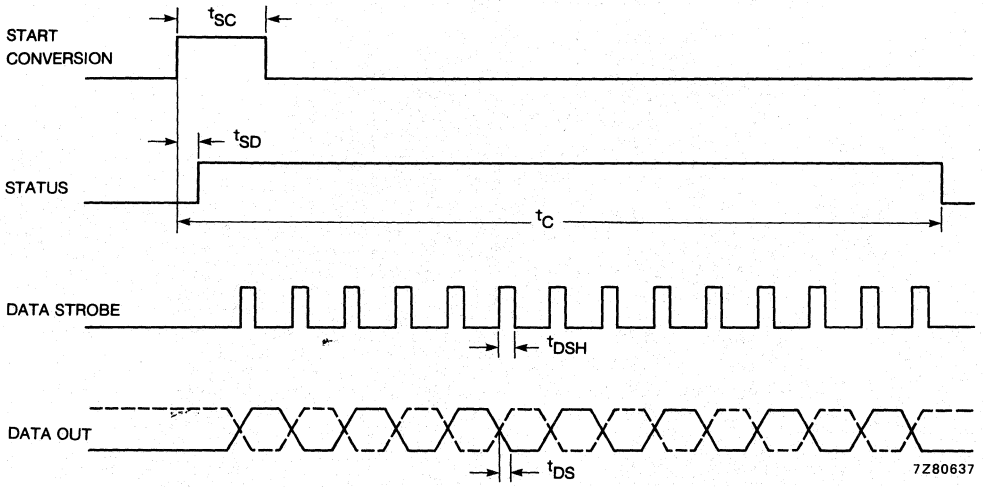


Fig. 3 Switching times waveforms.

DEVELOPMENT DATA

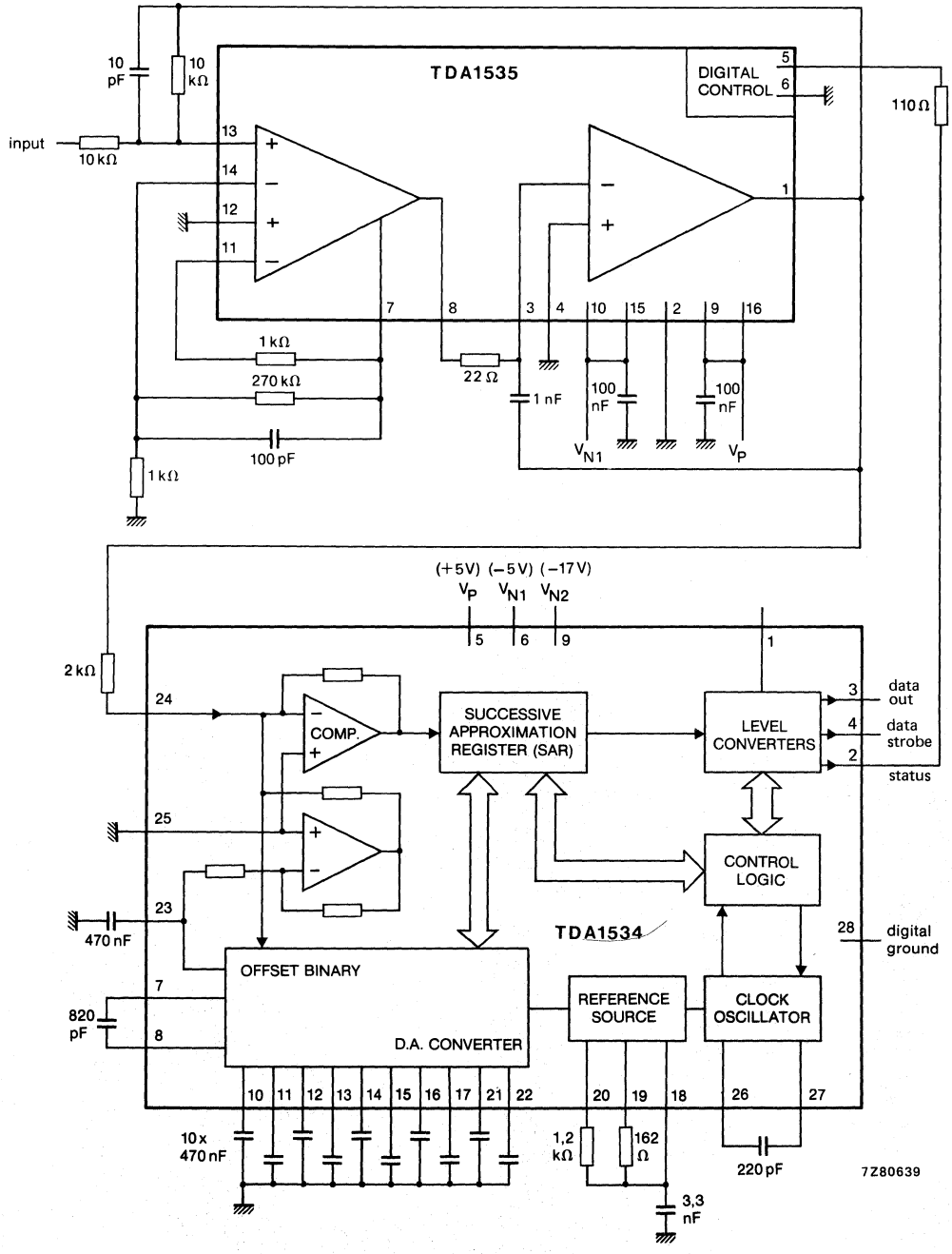


Fig. 4 Application and test circuit.

All earthed components connected to analogue ground (pin 25).

PAL – NTSC ENCODER

The TDA2501 encodes two colour-difference signals R-Y and B-Y onto one subcarrier. Quadrature modulation allows the coding to be in accordance with either the PAL or NTSC system.

Functions:

- Generates two sinusoidal subcarriers with a relative phase of 90° (also accepts external subcarriers)
- Modulates the two subcarriers with the colour difference signals
- Inverts the output from one modulator on command of an external signal (as in case of PAL)
- Sums the output from the modulators to obtain a quadrature modulated output signal
- Clamps the output d.c. level to a reference voltage
- Divides the frequency of horizontal sync pulses by three so that the output level can be clamped and the balance of the two modulators sequentially controlled during the line-blanking minus burst-key period

QUICK REFERENCE DATA

Supply voltage (pin 6)	V_P	typ.	6 V
Supply current	I_P	typ.	40 mA
Output chrominance voltage (pin 9)	$V_{9(p-p)}$	max.	1,4 V
Storage temperature	T_{stg}	−65 to +150	°C
Operating ambient temperature	T_{amb}	−25 to +70	°C

PACKAGE OUTLINE

16-lead DIL; plastic with internal heat spreader (SOT-38WE-2).

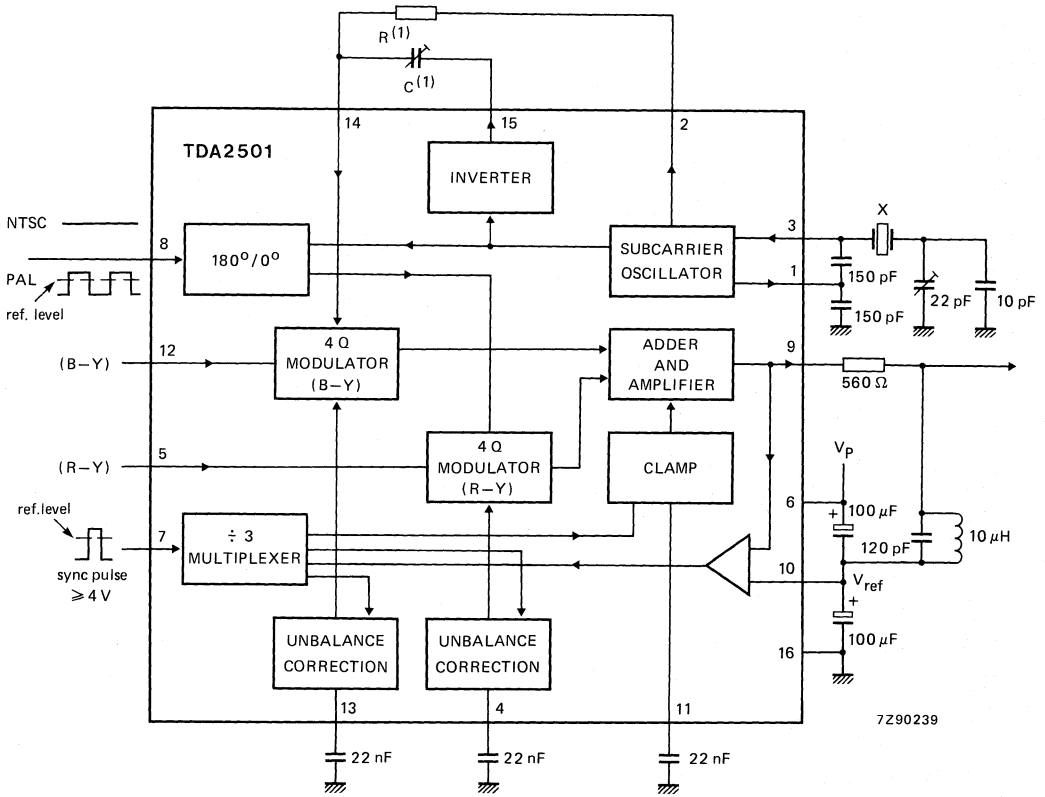


Fig. 1 Block diagram. Also test and application diagram.

(1) R = 0,885 (2 π fC); for PAL f = 4,433 619 MHz, R = 963 Ω and C = 33 pF.

DESCRIPTION

The colour difference signals B-Y and R-Y with a maximum amplitude of 1,4 volt are to be applied at pin 12 and pin 5. D.C.-coupling of the input signals is allowed if their d.c. levels are within specified limits from the d.c. level at pin 10 (V_{ref}). The following table shows these limits as a function of supply voltage. The table also shows the limits of the reference voltage range as a function of the supply voltage.

supply voltage V_{6-16} (V)	input d.c. (R-Y) (B-Y) min. (V)*	V_{5-16} V_{12-16} (V) max. (V)*	reference voltage • V_{10-16} (V)		
			min	typ.	max.
5,5	2,4	3,3	2,3	3,0	3,5
6,0	$> V_{ref} - 1,4$ V	3,8	2,4	3,3	3,9
7,0	$> V_{ref} - 1,4$ V	4,8	2,6	4,0	4,7
8,0	$> V_{ref} - 1,4$ V	5,8	2,8	4,8	5,5
9,0	$> V_{ref} - 1,4$ V	6,8	3,0	5,5	6,3
10,0	$> V_{ref} - 1,4$ V	7,8	3,2	6,3	7,1

* Minimum 2,4 V.

** At $V_S - 2,2$ V.

• Minimum values at $0,2\ V_S + 1,2$ V.
Typical values without pull-up or pull-down resistor.
Maximum values at $0,8\ V_S - 0,9$ V.

The inputs (B-Y) and (R-Y) should be zero, independent of their (limited) d.c.-levels, during the line-blanking minus burst-key period (LB – BK). Clamping the output and correcting the out-of-balance of the modulators, is done by applying a HIGH level to pin 7 within the (LB – BK) period (e.g. line sync pulse).

Modulation at output:
V_8 = LOW; output = sc x (B-Y) + sc' x (R-Y)
V_8 = HIGH; output = sc x (B-Y) – sc' x (R-Y)
in which sc' = subcarrier
sc = 90° phase-shifted subcarrier to sc' (sc lags).

The bandpass filter at the output suppresses the d.c. components of the (R-Y) + (B-Y) signal. Luminance (Y) is not processed by this circuit.

Internal subcarrier

The internal subcarrier oscillator is crystal controlled. The oscillator generates a sinewave with low harmonic distortion and an amplitude of about 500 mV peak-to-peak. The amplitude can be changed if necessary with a current input at pin 1. The adjustment range is 0 to 800 mV, with a corresponding current range of +250 to –150 μA.

Phase shift

To obtain a 90° phase-shifted carrier, two low impedance subcarrier outputs are provided, pins 2 and 15, the last being the inverse of the first. Between pins 2 and 15 an external RC combination must be used to obtain the desired 90° shift. The capacitor value must be limited to 33 pF to minimize subcarrier distortion.

The resistor required between pins 2 and 14 is 0,885 (2π fC).

External subcarrier

The (B-Y) and (R-Y) signals can also be multiplied with an external subcarrier. In this case the external subcarrier is connected to pin 1. For maximum input impedance at pin 1 $V_3 = V_{16}$ ($Z_{mi} > 1400\,\Omega$). The same RC network generate the 90° phase-shifted subcarrier. For the use of an externally generated subcarrier, applied at pin 14, the d.c. level must be the same as in the case of an RC-network generated one.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage V_{6-16}	V_P	max. 13,2 V
Total power dissipation	see derating curve (Fig. 2)	
Storage temperature range	T_{stg}	−65 to +150 °C
Operating ambient temperature	T_{amb}	−25 to +70 °C

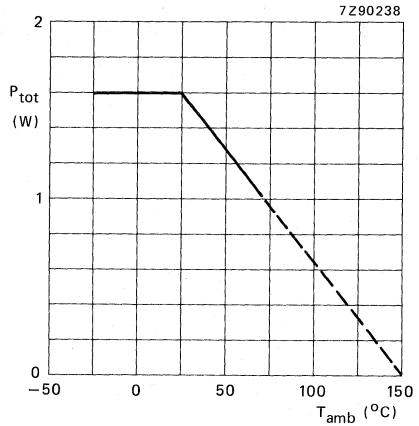


Fig. 2 Power derating curve.

D.C. CHARACTERISTICS

$V_{6-10} = -V_{16-10} = 3$ V; $T_{amb} = 25$ °C; see Fig. 1

		min.	typ.	max.	
Single power supply	V_{6-16}	5,5	6	10	V
Dual power supply					
positive	V_{6-10}	2	3	5	V
negative	$-V_{16-10}$	2,3	3	5	V
Supply current					
at pin 10	I_{10}	−1	0	3,5	mA
positive (pin 6)	I_6	28	40	64	mA
negative (pin 6)	$-I_{16}$	28	40	64	mA
Limitation d.c. level					
oscillator feedback	V_1	−30	0	+30	mV
Nominal amplitude input signal					
a.c. peak-to-peak	$V_{5(p-p)}$ $V_{12(p-p)}$	–	1	1,4	V
Input voltages (R-Y) and (B-Y)					
zero d.c. level	V_5, V_{12}	2,4	3,3	3,9	V
Required level sync input					
HIGH	V_7	4	–	V_P	V
LOW	V_7	–	–	V_{10}	V
Required level PAL pulse (H/2)					
HIGH	V_8	$V_{10} + 0,8$	–	V_P	V
LOW	V_8	$-V_P$	–	0	V
Input current sync input					
$V_7 = V_P + 1$ V	I_7	–	4	15	μA
Input current PAL input (H/2)					
$V_8 = V_{10} + 0,8$ V	I_8	–	1,5	5	μA
Output chroma voltage swing (R-Y) = (B-Y) = 1,4 V					
subcarrier pulse = 0,5 V	$V_{9(p-p)}$	–	–	1,4	V
Amplitude of suppressed subcarrier	V_9	0	7	16	mV
Input currents					
$V_4 = V_{10}$	I_4	0	1,5	5	μA
$V_{11} = V_{10}$	I_{11}	0	1,5	5	μA
$V_{13} = V_{10}$	I_{13}	0	1,5	5	μA
$V_5 = V_{10}$	I_5	0	9	30	μA
$V_{12} = V_{10}$	I_{12}	0	9	30	μA
$V_{14} = V_{16} + 2,3$ V	I_{14}	–	6	–	μA
Input impedance (R-Y)	Z_5	–	160	–	kΩ
Input impedance (B-Y)	Z_{12}	–	160	–	kΩ

FM MODEM FOR VIDEO RECORDERS

GENERAL DESCRIPTION

The TDA2504 is a monolithic integrated circuit for FM audio signal processing for both record and playback in video recorders.
The circuit incorporates the following functions:
Record
- Preamplifier
- Automatic level control circuit (ALC)

} for microphone

- Frequency modulator (in combination with the CCO)
- H.F. output buffer

Playback
- H.F. amplifier/limiter
- Phase detector
- Current controlled oscillator (CCO)
- Sample and hold circuit (S/H) in which the hold information is generated by a hold time setting circuit driven by the head identification pulse (HID)

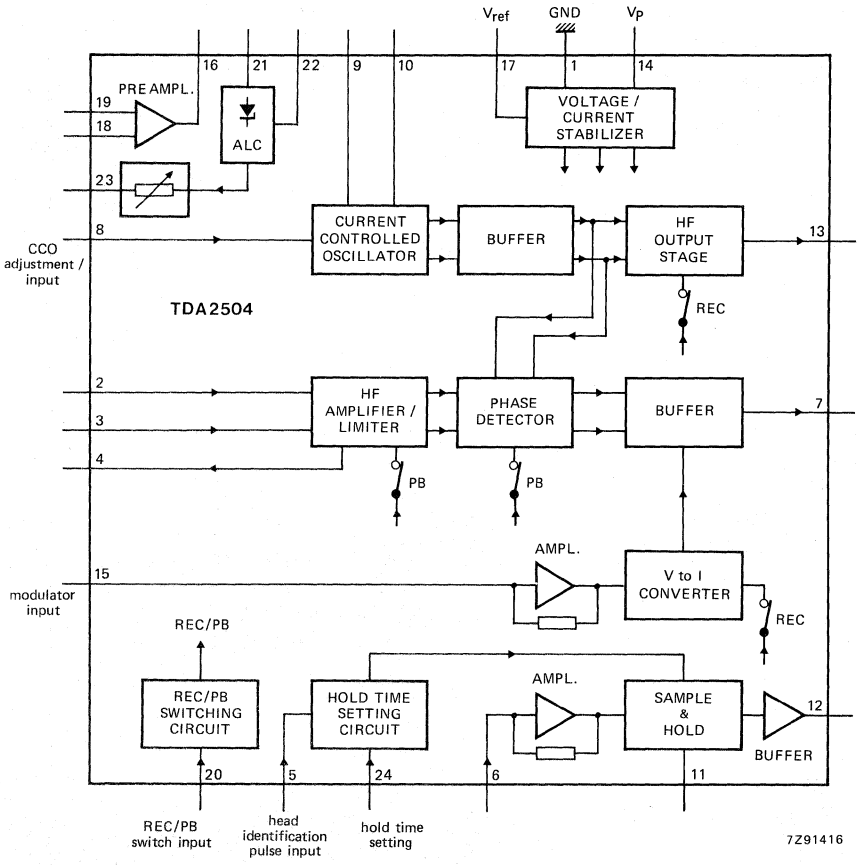
Furthermore
- Internal voltage/current stabilizer
- Record/playback switching circuit

QUICK REFERENCE DATA

Supply voltage (pin 14)	$V_P = V_{14-1}$	typ.	5 V
Supply current (pin 14)			
for record at $V_{20-1} > 2{,}0$ V	$I_P = I_{14}$	typ.	17 mA
for playback at $V_{20-1} < 0{,}8$ V	$I_P = I_{14}$	typ.	20 mA
RECORD			
Preamplifier + ALC			
A.F. output voltage at V_i = 2 mV	V_o	typ.	600 mV
Total harmonic distortion			
at V_i = 2 mV	THD	typ.	0,3 %
at V_i = 40 mV	THD	typ.	0,5 %
Signal-to-noise ratio related to V_o = 600 mV; R_S = 1 kΩ	S/N	typ.	60 dB
Modulator			
A.F. input current for Δf = 100 kHz	ΔI_M	typ.	2,8 μA
H.F. output stage (pin 13)			
Output voltage (peak-to-peak value)	$V_{o(p-p)}$	typ.	2,5 V
PLAYBACK			
Current controlled oscillator (CCO)			
Nominal frequency	f_{CCO}	typ.	1,5 MHz
Limiter + S/H amplifier			
A.F. output voltage at V_i = 10 mV	V_o	typ.	435 mV
Signal-to-noise ratio at V_o = 435 mV	S/N	typ.	56 dB
Total harmonic distortion at V_i = 10 mV	THD	typ.	0,5 %

PACKAGE OUTLINES

TDA2504P: 24-lead DIL; plastic (with internal heat spreader) (SOT-101).
TDA2504T: 24-lead mini-pack; plastic (SO-24; SOT-137A).



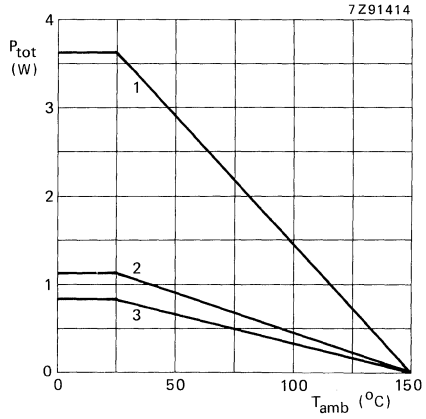
REC = record
PB = playback
ALC = automatic level control
CCO = current controlled oscillator

Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 14)	$V_P = V_{14-1}$	max. 13,2 V
Total power dissipation	P_{tot}	see Fig. 2
Storage temperature range	T_{stg}	−55 to + 150 °C
Operating ambient temperature range	T_{amb}	−20 to + 70 °C



(1) SOT-101 with internal heatspreader.
(2) SOT-137 mounted on ceramic substrate (50 x 50 x 0,7 mm).
(3) SOT-137 mounted on printed circuit board (50 x 50 x 1,5 mm).

Fig. 2 Power derating curves.

D.C. CHARACTERISTICS

V_P = 5 V; T_{amb} = 25 °C; measured in Fig. 6; all voltages with reference to pin 1; all currents positive into the IC; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply					
Supply voltage (pin 14)	$V_P = V_{14-1}$	4,75	5,0	13,2	V
Reference voltage (pin 17)*	$V_{ref} = V_{17-1}$	–	2,7	–	V
Supply current (pin 14)					
record at $V_{20-1} > 2{,}0$ V	$I_P = I_{14}$	–	17	–	mA
playback at $V_{20-1} < 0{,}8$ V	$I_P = I_{14}$	–	20	–	mA
Total power dissipation					
record at $V_{20-1} > 2{,}0$ V	P_{tot}	–	85	–	mW
playback at $V_{20-1} < 0{,}8$ V	P_{tot}	–	100	–	mW
Input voltage					
pins 2, 3, and 4	$V_{2,3,4-1}$	–	3,0	–	V
pin 6	V_{6-1}	–	2,1	–	V
pin 8	V_{8-1}	–	1,9	–	V
pin 15	V_{15-1}	–	2,7	–	V
pins 18, 19	$V_{18,19-1}$	–	2,7	–	V
Output voltage					
pin 12	V_{12-1}	–	2,1	–	V
pin 13					
record	V_{13-1}	–	3,7	–	V
playback	V_{13-1}	–	V_P	–	V
Input current					
pin 17	$-I_{17}$	–	–	500	μA

* Temperature drift V_{17-1} = typ. 0,5 mV/°C.

A.C. CHARACTERISTICS

V_P = 5 V; T_{amb} = 25 °C; f_i = 1,5 MHz (h.f.), Δf = 100 kHz, f_m = 1 kHz measured in Fig. 6; unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
PLAYBACK PART ($V_{20-1} < 0{,}8$ V)					
H.F. amplifier/limiter					
Sensitivity (PLL locked)	V_i	–	100	300	μV
Signal-to-noise ratio					
at V_i = 300 μV	S/N	–	50	–	dB
at V_i = 10 mV	S/N	–	56	–	dB
A.M. rejection					
at V_i = 300 μV	α	–	45	–	dB
at V_i = 10 mV	α	–	50	–	dB
Input conductance	g_{ie}	–	tbf	–	μs
Input capacitance	C_{ie}	–	tbf	–	pF
Current controlled oscillator (CCO)					
Nominal frequency (adjustable with R_{8-1})	f_{CCO}	–	1,5	–	MHz
Capture range (deviation from 1,5 MHz)					
at V_i = 10 mV	Δf_{CCO}	–	150	–	kHz
Temperature coefficient	TC	–	$300 \cdot 10^{-6}$	–	K^{-1}
Phase detector					
A.F. output voltage (pin 7)					
at V_i = 10 mV	V_o	–	435	–	mV
Output impedance	$\|Z_o\|$	–	100	–	kΩ
Hold time setting circuit					
(HID pulse is 25 Hz with a duty factor of 50%)					
HID input (pin 5)					
Input voltage HIGH	V_{iH}	2,0	–	V_P	V
Input voltage LOW	V_{iL}	0,2	–	0,8	V
Input current HIGH	I_{iH}	–	–	1	μA
Input current LOW	$-I_{iL}$	10	–	–	μA
Hold time pulse (pin 24)					
with adjustable resistor R13 = 50 kΩ and C16 = 1 nF	t_{Hold}	3	–	33	μs
with fixed resistor R13 = 33 kΩ and C16 = 1 nF	t_{Hold}	–	20	–	μs

A.C. CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
PLAYBACK PART (continued)					
Sample and hold circuit (pin 12 to pin 6)					
Total gain V_o/V_i					
with resistor R2 + R3 = 27 kΩ	$G_{v\,tot}$	−2	0	+ 2	dB
Gain of input amplifier (adjustable)					
$\frac{R_{internal} = 28\ k\Omega}{R2 + R3}$	G_v	–	–	20	dB
Output impedance (pin 12)	$\|Z_o\|$	–	–	300	Ω
Maximum a.f. output voltage (THD ⩽ 1%)	V_o	–	–	500	mV
D.C. voltage shift during hold pulse	$\Delta V_{12\text{-}1}$	–	20	–	mV
Residual hold pulse	$V_{12\text{-}1}$	–	tbf	–	mV
Delay of HID pulse to hold pulse	t_d	–	1	–	μs
Overall performance (H.F. input to A.F. output)					
(f_{HF} = 1,5 MHz; Δf = 100 kHz; f_m = 1 kHz)					
Output voltage at V_i = 10 mV	$V_{12\text{-}1}$	–	435	–	mV
Signal-to-noise ratio at V_i = 10 mV	S/N	–	56	–	dB
Total harmonic distortion	THD	–	0,5	–	%
RECORDING PART ($V_{20\text{-}1} > 2{,}0$ V)					
(A.F. input frequency f_i = 1 kHz)					
Preamplifier for microphone					
Open loop voltage gain	G_o	–	98	–	dB
Closed loop voltage gain (note 1)	G_c	52	52,5	53	dB
A.F. output voltage					
at THD = 1%	V_o	–	–	1	V
at THD = 0,2%	V_o	–	0,9	–	V
Noise input voltage (r.m.s. value)					
R_S = 1 kΩ; B = 60 Hz to 15 kHz	$V_{n(rms)}$	–	1,2	2,0	μV
Input impedance	$\|Z_i\|$	100	–	–	kΩ
Output current (pin 16)	I_o	–	–	1	mA
Automatic level control (ALC)					
A.F. output voltage variation					
at ΔV_i = 26 dB (note 2)	ΔV_o	–	1	3	dB
ALC timing for ΔV_i = 20 dB (note 3)					
limiting time	t_l	–	10	50	ms
level setting time	t_s	–	5	50	ms
recovery time (without R12 = 1 MΩ)	t_r	50	300	–	s

parameter	symbol	min.	typ.	max.	unit
Preamplifier + ALC					
A.F. output voltage with ALC					
at V_i = 2 mV	V_o	–	600	–	mV
Total harmonic distortion with ALC					
at V_i = 2 mV	THD	–	0,3	1	%
at V_i = 40 mV	THD	–	0,5	3	%
Signal-to-noise ratio					
related to V_o = 600 mV; R_S = 1 kΩ; B = 60 Hz to 15 kHz (see also Fig. 4)	S/N	–	60	–	dB
Current controlled oscillator (CCO)					
Frequency shift from playback to record	Δf_{CCO}	–	5	2,0	kHz
Input current (pin 8)					
for Δf = 100 kHz	I_{iM}	–	40	–	μA
Modulator (pin 15 to pin 13)					
A.F. input current					
for Δf = 100 kHz at pin 13	ΔI_M	–	2,8	–	μA
Total gain V_o/V_1					
with R14 = 100 kΩ (note 4)	$G_{v\,tot}$	–	7,5	–	dB
H.F. output stage (pin 13)					
Output voltage	V_o	2	2,5	–	V
Output resistance	R_{13-1}	1,0	1,2	1,4	kΩ
Record/playback switching circuit					
Switching voltage level (pin 20)					
for record	V_{HIGH}	2,0	–	8,0	V
for playback	V_{LOW}	–	–	0,8	V
Switching current level (pin 20)					
for record	I_{HIGH}	–	–	5	μA
for playback	I_{LOW}	100	60	–	μA

Notes

1. The minimum closed loop gain is restricted to 35 dB; see also Fig. 4.
2. With respect to V_i = 2 mV; R_S = 1 kΩ; see also Fig. 5.
3. With respect to V_i = 1,2 mV; see also Fig. 3.
4. Total gain adjustable with R14.

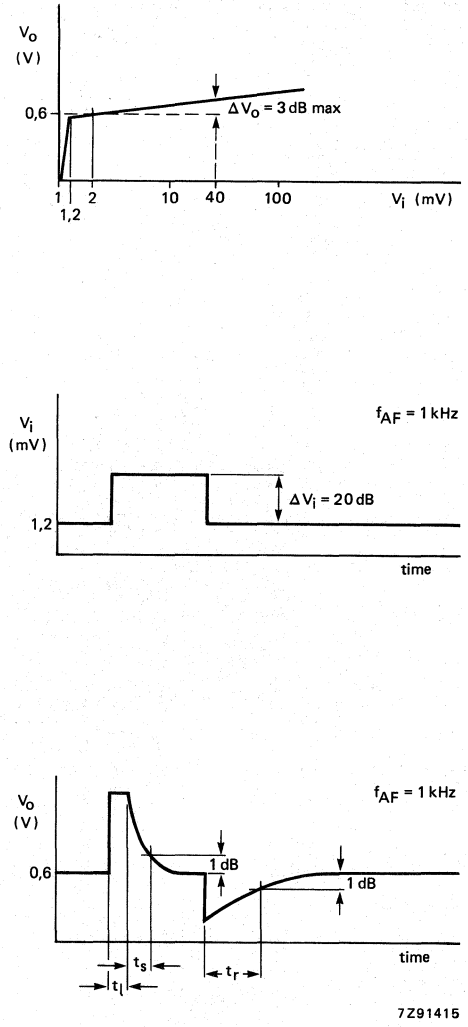
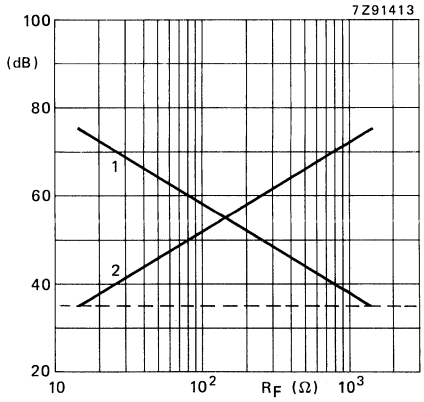


Fig. 3 Typical ALC curve with R_S = 1 kΩ.

Where:

t_l limiting time
t_s level setting time
t_r recovery time



– – – restricted minimum 35 dB.
(1) voltage gain as a function of resistor R_F.
(2) signal-to-noise ratio (S/N) at the output (pin 16) as a function of resistor R_F.

Fig. 4 Typical curves of preamplifier with automatic level control.

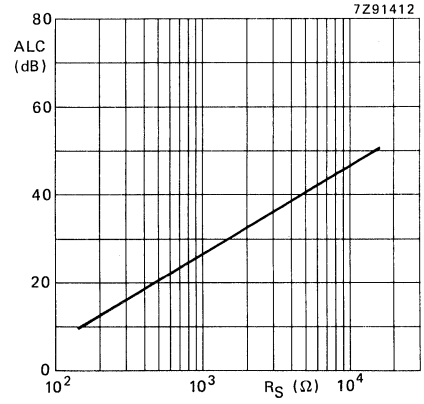
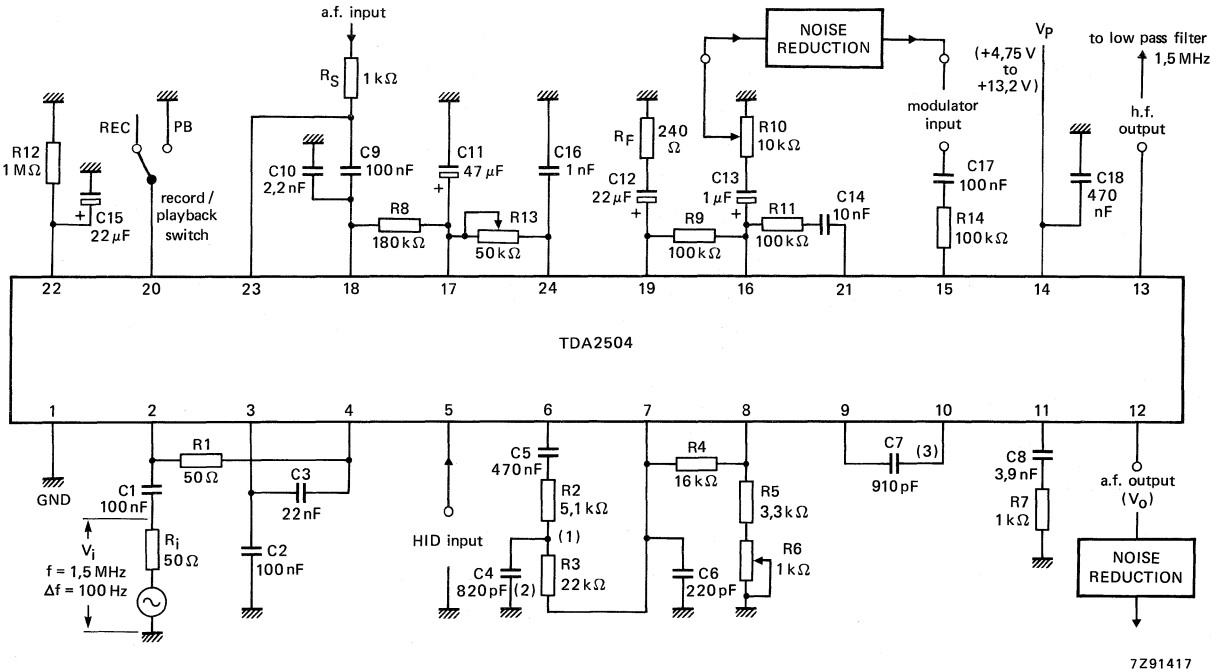


Fig. 5 Automatic level control as a function of source resistor R_S; a.f. output voltage (ΔV_o) = 1 dB.



(1) R2 + R3 determines gain of amplifier
(2) R3 + C4 = low-pass filter
(3) micro poco

REC = record
PB = playback
HID = head identification pulse

Fig. 6 Application diagram; also used as test circuit.

SECAM ENCODER

GENERAL DESCRIPTION

The TDA2505 converts the colour difference signals, **after** low-frequency pre-emphasis, into a frequency modulated signal according to the SECAM system. The circuit is intended to be used with the sync generator SAA1043 in video games and homecomputers. The inaccuracy of the subcarrier frequency of about 20 kHz becomes invisible at highly saturated colours.

The required input signals are:
Horizontal drive (positive or negative pulse) pin 12;
H/2 pulse (using a positive horizontal drive) pin 11;
Frame pulse (positive) pin 13;
Chrominance blanking, according to the SECAM system (positive) pin 14;
Colour killing pulse if required (positive) pin 14.

Features

- Chrominance processing
- Frame identification signal generator
- Two frequency reference sources
- Control circuit for the FM-modulator.

QUICK REFERENCE DATA

Supply voltage	V_{5-1}	typ.	6 V
Supply current	I_5	typ.	80 mA
Reference voltage	V_{9-1}	typ.	4,2 V
Clamping pulse voltage	V_{12-1}	typ.	6 V
Clamping pulse current	I_{12}	typ.	0,51 mA
Frame input current	I_{13}	typ.	0,3 mA
Chrominance switching voltage	V_{14-1}	>	2 V
Colour killer switching voltage	V_{14-1}	>	4 V
Storage temperature	T_{stg}	−65 to +150	°C
Operating ambient temperature	T_{amb}	−25 to +70	°C

PACKAGE OUTLINE

28-lead dual in-line; plastic (SOT-117).

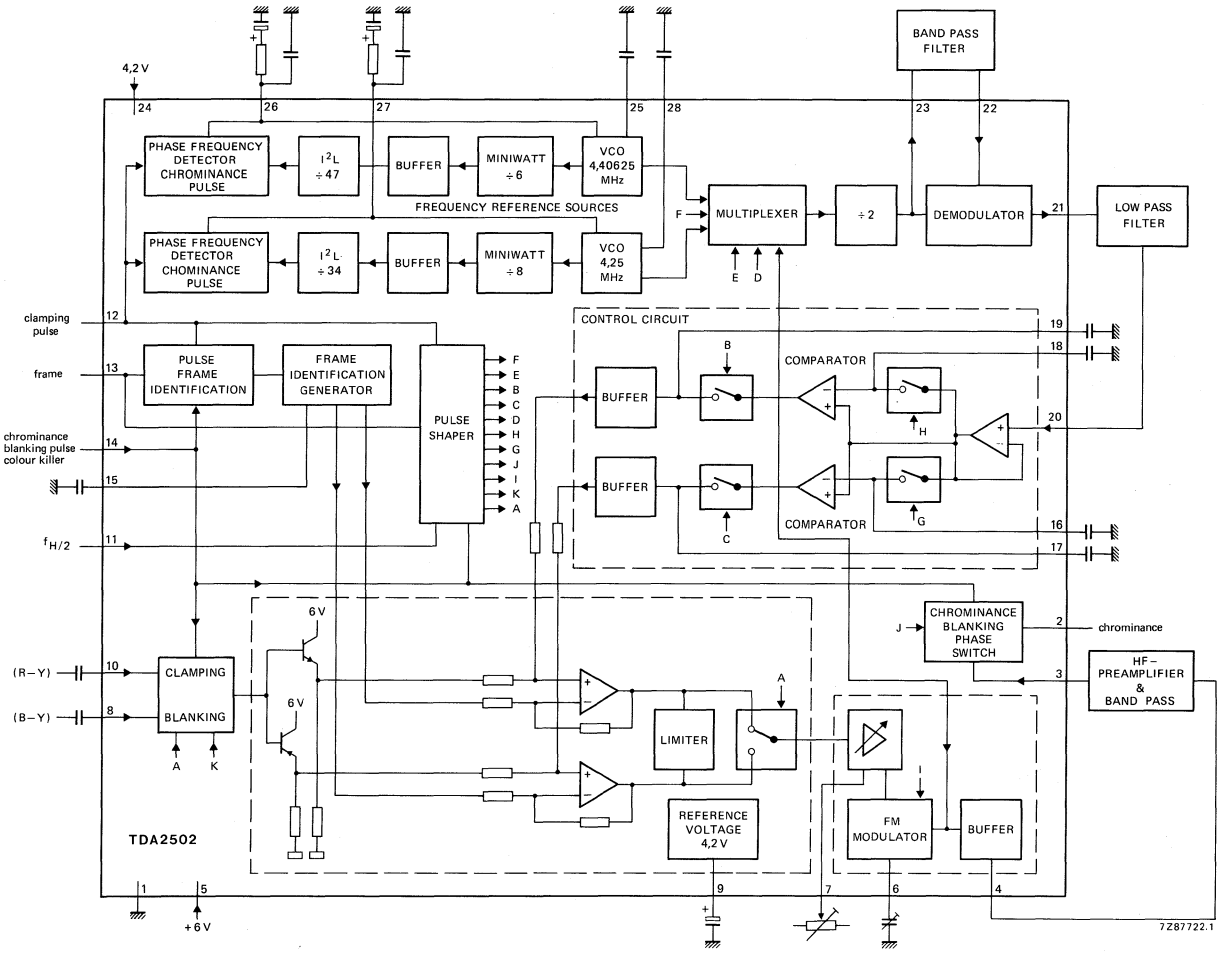


Fig. 1 Block diagram, also test circuit.

Pin functions

1. Ground.
2. Chrominance output.
3. Input chrominance blanking stage.
   (connected to output h.f. pre-emphasis and bandpass filter).
4. Output FM modulator (connected to input h.f. pre-emphasis).
5. Positive supply voltage.
6. Tuning the FM modulator.
7. Gain adjustment of the sequential colour difference signals at the output of the FM modulator.
8. Input (B-Y) signal.
9. Output of the internal reference supply voltage.
10. Input (R-Y) signal.
11. Input H/2 pulse.
12. Input horizontal drive.
13. Input frame pulse.
14. Input chrominance blanking pulse and colour killing pulse.
15. Frame identification sawtooth pulse.
16. 4,250 MHz frequency adjustment.
17. (B-Y) control.
18. 4,40625 MHz frequency adjustment.
19. (R-Y) control.
20. Input buffer amplifier (connected to OUTPUT of low-pass filter).
21. Output sync demodulator (connected to INPUT of low-pass filter).
22. Input sync demodulator (connected to output of band-pass filter).
23. Output divider-by-two (internal connected to input sync demodulator).
24. Reference voltage (from pin 9) for the two frequency reference stages.
25. Tuning reference oscillator 4,40625 MHz.
26. Phase frequency detector 4,40625 MHz reference.
27. Phase frequency detector 4,250 MHz reference.
28. Tuning reference oscillator 4,250 MHz.

FUNCTIONAL DESCRIPTION

Chrominance processing

The signal (R-Y) and (B-Y) are connected to clamp circuits, where the black level is clamped to the reference voltage. Then the signals are blanked during the chrominance pulse from pin 14. It is also possible to blank (R-Y) and (B-Y) signals in the active line by adding a blanking pulse to the chrominance blanking pulse at pin 14 of 1,7 to 1,9 V. Colour killing can be done by increasing this voltage to 3,6 V.

After clamping and blanking the (R-Y) signals are each fed to a summing amplifier. Other input signals are a d.c. level and the frame identification sawtooth. The output signals of the amplifiers are limited for both upper and lower limit. By switching the summing amplifiers with $f_{H/2}$ pulse, the signal connected to the FM modulator is sequentially (R-Y) if $f_{H/2}$ = HIGH and (B-Y) if $f_{H/2}$ = LOW.

By means of the built-in limiter, the gain adjusting of pin 7 and the FM tuning capacitor of pin 6, it is possible to obtain the correct frequency band according to the SECAM system. By using a stop-start pulse the FM modulator starts every line in the same phase. After the high-frequency pre-emphasis and bandpass filter outside the IC the FM signal is connected to the chrominance blanking circuit. The d.c. level must be equal to the reference voltage at pin 9. The FM signal is blanked during the chrominance blaning pulse. By means of an inverting and a none inverting amplifier at the chrominance blanking stage the initial phase of the FM signal is defined by the following rule:

from frame to frame 0^o, 180^o, 0^o, 180^o and so on

from line to line 0^o, 0^o, 180^o, 0^o, 0^o, 180^o and so on.

Frame identification signal generator

By using the horizontal drive, colour killing pulse and frame pulse the TDA2505 generates pulses for the frame identification according the SECAM system. The pulses are connected to a sawtooth generator with a capacitor at pin 15. The sawtooth signals for both (R-Y) and (B-Y) are connected to the negative inputs of their summing amplifiers. Limitation to the required shape is caused by the built-in limiter.

Frequency reference source

The frequency source consist of a voltage controlled oscillator (VCO), several drivers and a phase-frequency detector. The nominal adjusting of the VCO occurs by means of the capacitor at pin 25 (4,40625 MHz) and pin 28 (4,250 MHz).
The signal of the 4,40625 MHz is divided by 282 and the signal of the 4,250 MHz is divided by 272. The divided signals are each connected to the input of a phase frequency detector.

The second input of the phase frequency detector is connected to the horizontal drive input (pin 12). The output of the detector is via a loop filter; pin 26 for the 4,40625 and pin 27 for the 4,250 MHz) connected to the control input of the VCO.

The supply of the dividers and the phase frequency detectors is delivered from pin 24, which is externally connected to pin 9 (reference voltage supply). The dividers and detectors can be switched off by connecting pin 24 to ground. Then it is possible to use external oscillator signals at pin 28 and pin 25. The nominal current consumption decreases then by about 20 mA.

Control circuit for the FM modulator

This control circuit consists of:
a. Multiplexer
b. Divider-by-2
c. Demodulator
d. Buffer amplifier
e. Comparators
f. Pulse shaper

The signal from the reference oscillators and the signal from the FM modulator are connected to the multiplexer. At the output of the multiplexer the signal is in sequence:
2 lines 4.40625 MHz, 1 line FM-signal of (R-Y), two lines 4,250 MHz and 1 line FM-signal of (B-Y) and so on.
The multiplexer output is connected to a divider-by-2 followed by a synchronous demodulator. The divider equalizes the amplitude and shape of the signals of the reference oscillators ans the FM modulator. Via a low pass filter and a buffer amplifier the demodulated signal is sampled during each period of the reference signals. There is one hold capacitor for the 4,250 MHz (pin 16) and one for the 4,40625 MHz reference (pin 18). The buffer amplifier is also connected to the positive inputs of two comparators. One comparator for the (R-Y) control loop and one comparator for the (B-Y) loop. The negative inputs of the comparators are connected to the hold capacitors of the reference sources. Each comparator output is sampled and stored in a capacitor during the blanking of the demodulated FM signal (pin 17 for the (B-Y) loop and pin 19 for the (R-Y) loop. The stored information controls the d.c. level of the summing amplifiers. The input pulses (pins 11, 12, 13 and 14) are used in the pulse-shaper to generate the correct switch- and sample pulses.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage	V_{5-1}	max. 13,2 V
Total power dissipation		see derating curve
Storage temperature	T_{stg}	−65 to + 150 °C
Operating ambient temperature	T_{amb}	−25 to + 70 °C

CHARACTERISTICS

All voltages refer to pin 1 (GND). Values measured in test circuit Fig. 1. T_{amb} = 25 °C; V_{5-1} = 6 V.

parameter	symbol	min.	typ.	max.	unit
Supply voltage	V_{5-1}	5,5	6,0	10	V
Supply current					
V_{24} = 0 V	I_5	–	60	–	mA
V_{24} = 9 V	I_5	–	80	–	mA
Reference voltage (pin 9)	V_{ref}	4,0	4,2	4,4	V
Output voltage blanked chrominance (V_{14} HIGH)	V_2	4,0	4,2	4,4	V
V_2 inverts after frame pulse V_{13} = L H L	V_2	$V_{ref} \pm (V_3 - V_{ref})$			
Output amplitude FM modulator	V_4	0,9	1,0	1,1	V
Input current phase switch and chrominance blanking	I_3	–	3	6	μA
Modulator tuning current sink current at $V_6 > V_9$ source current at $V_6 < V_9$; V_7 = 3,06 V	I_6	163	–	305	μA
Bias current gain-control	I_7	0	–	1	μA
Input voltage (R-Y) and (B-Y) clamped	$V_{8,\ 10}$	$V_9 - 0,1$	V_9	$V_9 + 0,1$	V
Inputs bias currents (R-Y) and (B-Y)	$I_{8,10}$	–	–	1,5	μA
Bias voltage H/2 input	V_{11}	1,1	1,2	1,3	V
Input current clamping pulse $V_{12} = V_6$	I_{12}	0,4	0,31	0,8	mA
Input current frame pulse $V_{13} = V_9$	I_{13}	0,1	0,3	0,5	mA
Input current chrominance blanking at V_{14} = 6 V	I_{14}	–	40	50	μA
Switching voltage chrominance blanking input signals	V_{14}	1,7	–	1,9	V
Switching voltage colour killing	V_{14}	3,6	–	–	V
Frame identification					
Voltage LOW	V_{15L}	$V_9 - 0,1$	V_9	$V_9 + 0,1$	V
Maximum voltage	V_{15}	$V_9 + 0,5$	$V_9 + 0,7$	$V_9 + 1$	V
Level during line clamping; $V_{14} > 4$ V	V_{15}	$V_9 - 0,1$	V_9	$V_9 + 0,1$	V
Ramp current from 7th to 15th line from start frame pulse	I_{15}	0,2	0,25	0,3	mA
Input impedance (ref. freq.)	Z_{16}	–	10	–	kΩ
Input impedance (ref. freq.)	Z_{18}	–	10	–	kΩ
Input impedance (zero freq.)	Z_{17}	–	10	–	kΩ
Input impedance (zero freq.)	Z_{19}	–	10	–	kΩ
Buffer input bias current	I_{20}	–	–	1,5	μA
Bias voltage demodulator input	V_{22}	1,8	1,0	2,2	V
Demodulator output current polarity polarity = $V_{22} - 2$ V x $V_{23} - V_{ref}$	I_{21}	0,7	0,9	1,1	mA
Maximum deviation zero level frequencies	Δf_2	–	20	–	kHz

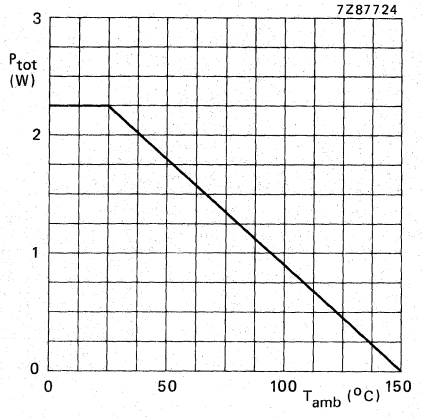


Fig. 2 Power derating curve.

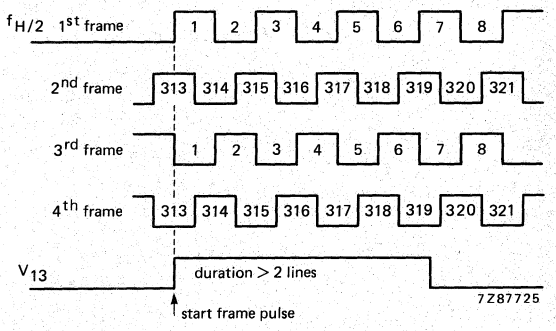


Fig. 3 Frame pulse waveform.

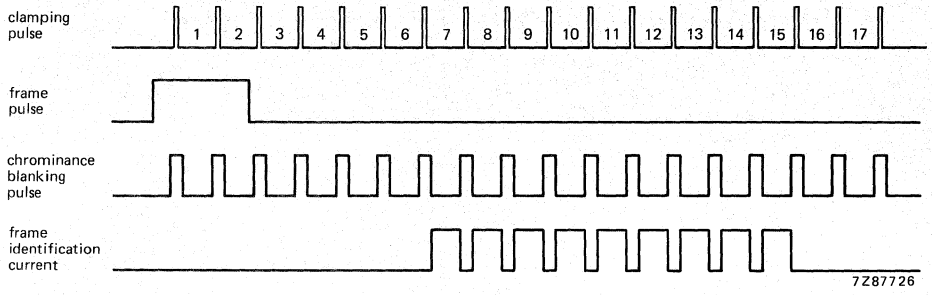


Fig. 4 Pulse waveforms.

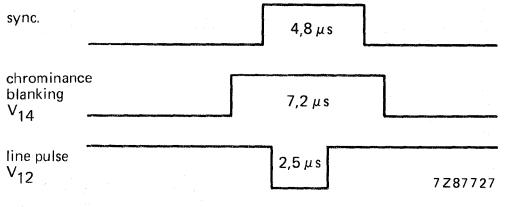


Fig. 5 Chrominance blanking and line pulse waveform.

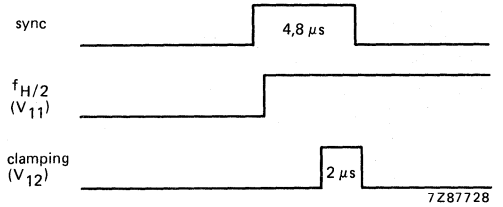


Fig. 6 Chrominance blanking H/2 and clamping pulse waveform.
These two pulses eventually instead of line pulse.

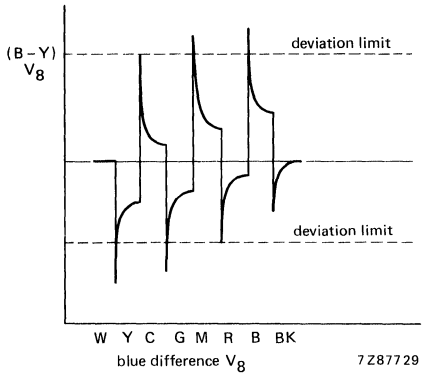


Fig. 7 Blue difference V_8 waveform.

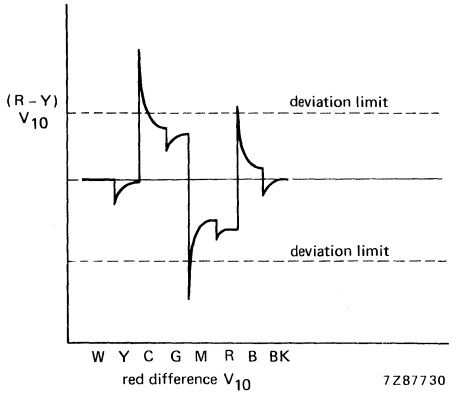


Fig. 8 Red difference V_{10} waveform.

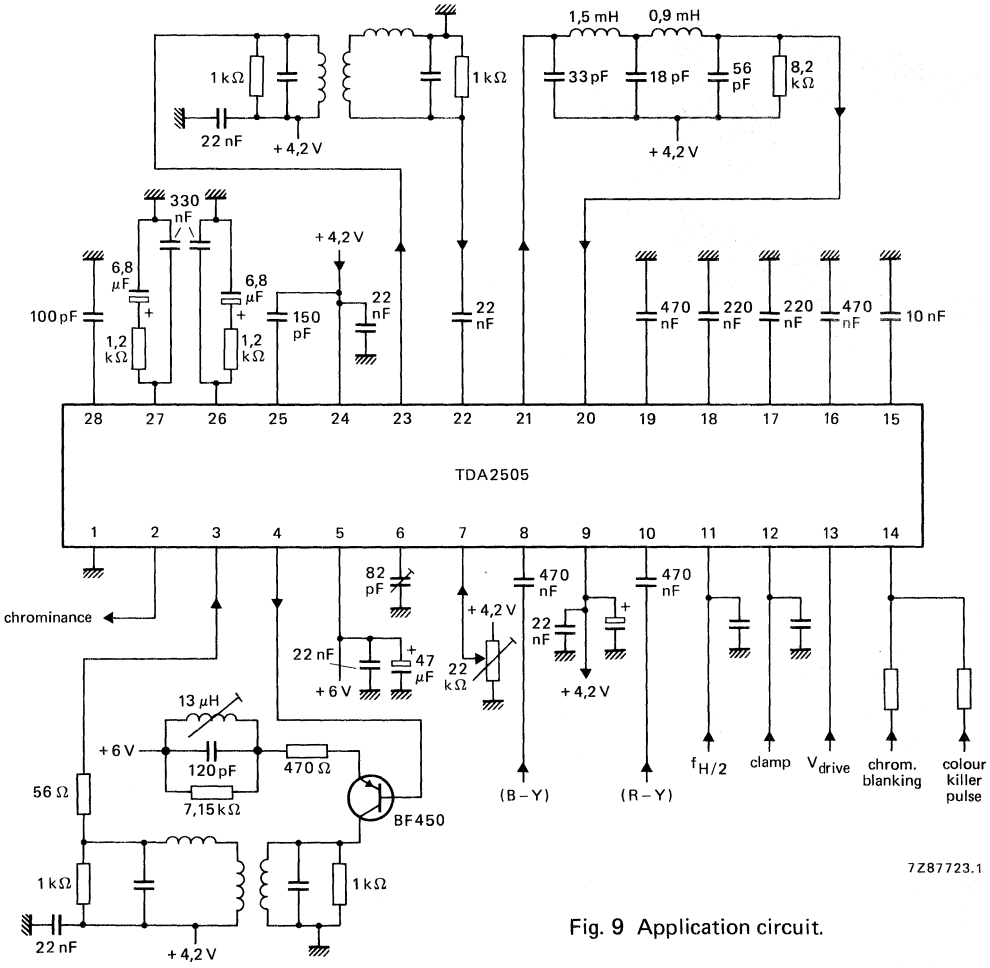


Fig. 9 Application circuit.

SECAM ENCODER

GENERAL DESCRIPTION

The TDA2506 converts colour-difference signals (D'_R and D'_B) into sequential, frequency modulated signals according to the SECAM system. The signals (D'_R) and (D'_B) are the colour difference signals before low-frequency pre-emphasis; $D'_R = -1{,}9\ (R\text{-}Y)$ and $D'_B = \neq 1{,}5(B\text{-}Y)$. The circuit is intended for use in video cameras, games, recorders and players, PAL-SECAM transcoding circuits and SECAM test signal generators.

Synchronizing pulses required for operation of the TDA2506 may be obtained from a universal sync generator SAA1043 or other pulse generator. All pulses are to be active HIGH and are as follows:

Horizontal sync pulses to pin 11
Half-rate horizontal sync (H/2) pulses to pin 9
Vertical sync pulses to pin 12
Chrominance blanking pulses to pin 13 (may include colour-killer pulses)

Frequency modulation is performed in conjunction with modulator-controller TDA2507.

Features

- Chrominance processor
- Vertical identification signal generator
- Timing pulse output to TDA2507
- Sample and hold circuit for control signal from TDA2507
- No adjustments of external components required (except high-frequency pre-emphasis (bell filter) stage)

QUICK REFERENCE DATA

Supply voltage	$V_{4\text{-}2}$	typ.	5 V
Supply current	I_4	typ.	45 mA
Reference voltage	$V_{7\text{-}2}, V_{22\text{-}24}$	typ.	3,5 V
Operating ambient temperature range	T_{amb}		−25 to +70 °C
Storage temperature range	T_{stg}		−65 to +150 °C

PACKAGE OUTLINES

24-lead DIL; plastic (with internal heat spreader) (SOT-101B).

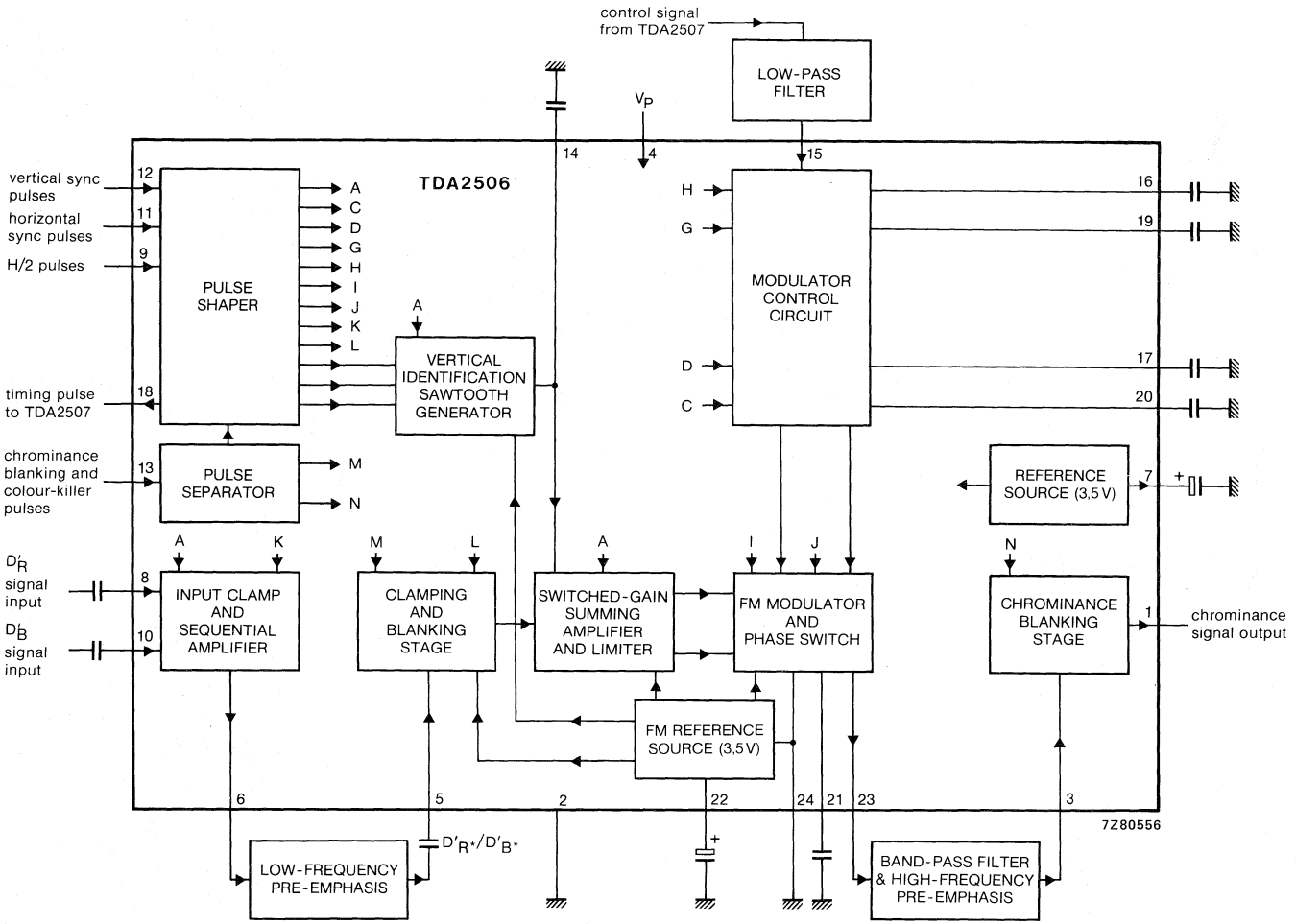


Fig. 1 Block diagram.

Pin functions

1. Chrominance signal output.
2. Ground.
3. Input to chrominance blanking stage from high-frequency pre-emphasis and band-pass filter.
4. Positive supply voltage.
5. Input to clamping and blanking stage from low-frequency pre-emphasis filter.
6. Output from sequential amplifier to low-frequency pre-emphasis filter.
7. Reference voltage output.
8. D'_R signal input.
9. H/2 pulse input (required only if specific phase sequencing is desired).
10. D'_B signal input.
11. Horizontal sync pulse input.
12. Vertical sync pulse input.
13. Chrominance blanking and colour-killer pulse input.
14. Capacitor for vertical identification sawtooth.
15. Control signal input from TDA2507 via low-pass filter.
16. 4 406,250 kHz frequency adjustment.
17. (R-Y) control.
18. Timing pulse output to TDA2507.
19. 4 250,000 kHz frequency adjustment.
20. (B-Y) control.
21. FM modulator tuning capacitor (fixed).
22. FM reference voltage output.
23. FM modulator output to high frequency pre-emphasis and band-pass filter.
24. Ground connection for FM modulator.

FUNCTIONAL DESCRIPTION

Input clamp and sequential amplifier

This circuit clamps the zero levels of the D'_R and D'_B input signals (pins 8 and 10) to the reference voltage from pin 7. The input signals are switched into the amplifier sequentially by an internally delayed H/2 waveform. The amplifier output at pin 6 is D'_R when the delayed H/2 waveform is HIGH and D'_B when it is LOW. The stage gain is 1,5.

Clamping and blanking stage

After external low-frequency pre-emphasis, the sequential $D'_R{}^*$ and $D'_B{}^*$ signals are returned to the IC at pin 5. The signal amplitude at pin 5 is typically 0,5 V (peak-to-peak value) for 75% colour bar (EBU). Black levels are clamped to the FM reference voltage (pin 22). Blanking takes place during the chrominance blanking pulse and, if required, during the video blanking and/or colour killing pulses.

FUNCTIONAL DESCRIPTION (continued)

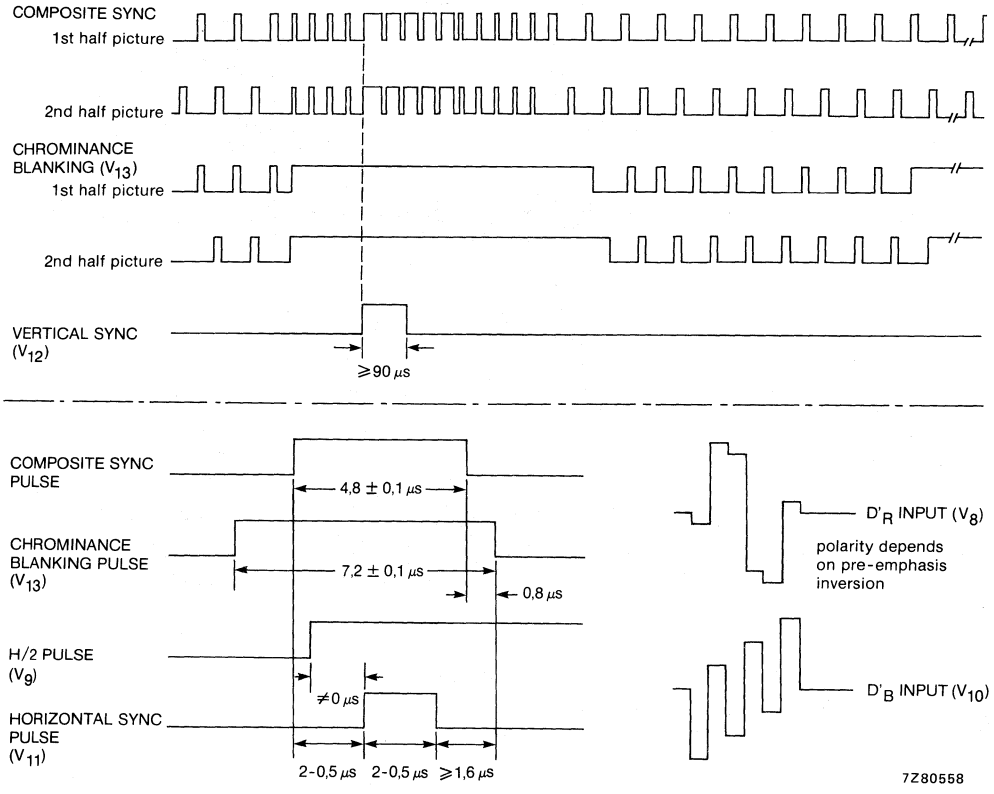


Fig. 2 Survey of input signals in relation to composite sync.

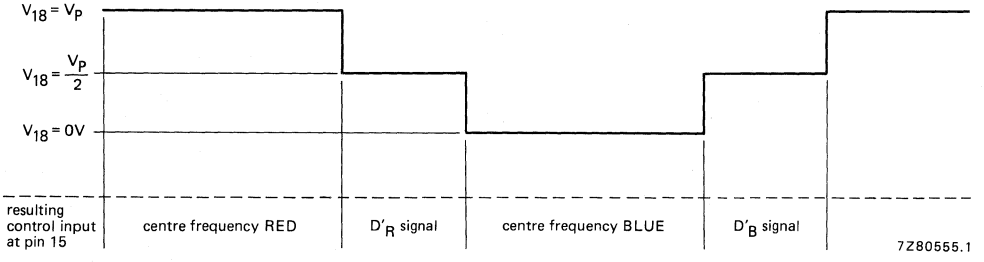


Fig. 3 Timing pulse output (pin 18) and resulting control input (pin 15).

Switched-gain summing amplifier and limiter

Inputs into the summing amplifier are the sequential $D'_R{}^*$ and $D'_B{}^*$ signals, the vertical identification sawtooth waveform and reference d.c. levels. The gain of the amplifier is switched by the internally delayed H/2 waveform to give the correct input amplitudes for the FM modulator ($D'_R{}^*$ gain = 280/230 x $D'_B{}^*$ gain). An offset is also introduced between the black levels of the $D'_R{}^*$ and $D'_B{}^*$ signals which corresponds to the upper and lower thresholds of the limiter.

FM modulator and phase switch

The FM modulator provides accurate FM modulation which follows the amplitude envelopes of the sequential $D'_R{}^*$ and $D'_B{}^*$ waveforms. The centre frequencies of 4 406,250 kHz for the $D'_R{}^*$ signal and 4 250,000 kHz for the $D'_B{}^*$ signal are controlled by d.c. levels from the sample and hold circuit (which in turn are controlled by the TDA2507). The upper and lower frequency limits are 4 756,000 ± 35 kHz and 3 900,000 ± 35 kHz.

Reference d.c. levels are switched within the FM modulator to define the starting phase of the modulator output (pin 23) at the initiation of each horizontal and vertical scan. The starting phase sequence is as follows:

vertical scan (frame to frame) 0^o, 180^o, 0^o, 180^o, repeating;

horizontal scan (line to line) 0^o, 0^o, 180^o, 0^o, 0^o, 180^o, repeating.

Chrominance blanking stage

The frequency modulated colour difference signals are passed via high-frequency pre-emphasis and band-pass filters to the chrominance blanking input at pin 3. The d.c. level of this input should be equal to the reference voltage at pin 7. Blanking occurs during the chrominance blanking pulse. The stage gain is 1,75.

Vertical identification sawtooth generator

Vertical sync, horizontal sync and chrominance blanking pulses are used to determine vertical identification (see Fig. 4). The vertical identification sawtooth generator is driven in opposite directions for identification signals IdR and IdB; the capacitor for the generator is connected at pin 14. If no vertical identification is required, pin 14 should be connected to the FM reference voltage at pin 22.

Pulse shaper

This stage developes all pulses that are required within the TDA2506 and also the timing pulses required for the modulator controller TDA2507 (see Fig. 3). Internal H/2 pulses are generated by a flip-flop working from the horizontal sync input (pin 11), this makes the H/2 input at pin 9 necessary only if it is required to lock the modulator into a specific phase sequence. If the H/2 input is not required, pin 9 should be connected to ground. A pulse separator at the chrominance blanking/colour-killer input (pin 13) allows this input to be used for blanking the sequential $D'_R{}^*/D'_B{}^*$ signal.

Sample and hold circuit

This circuit provides reference voltages to the FM modulator which set the centre modulation frequencies for the sequential $D'_R{}^*$ and $D'_B{}^*$ signals. The reference voltage levels are supplied to pin 15 from the TDA2507 in a sequence that is time-related to $D'_R{}^*/D'_B{}^*$ switching. The levels are sampled and then held for $D'_R{}^*$ using capacitors at pins 16 and 17, and for $D'_B{}^*$ using capacitors at pins 19 and 20.

FUNCTIONAL DESCRIPTION (continued)

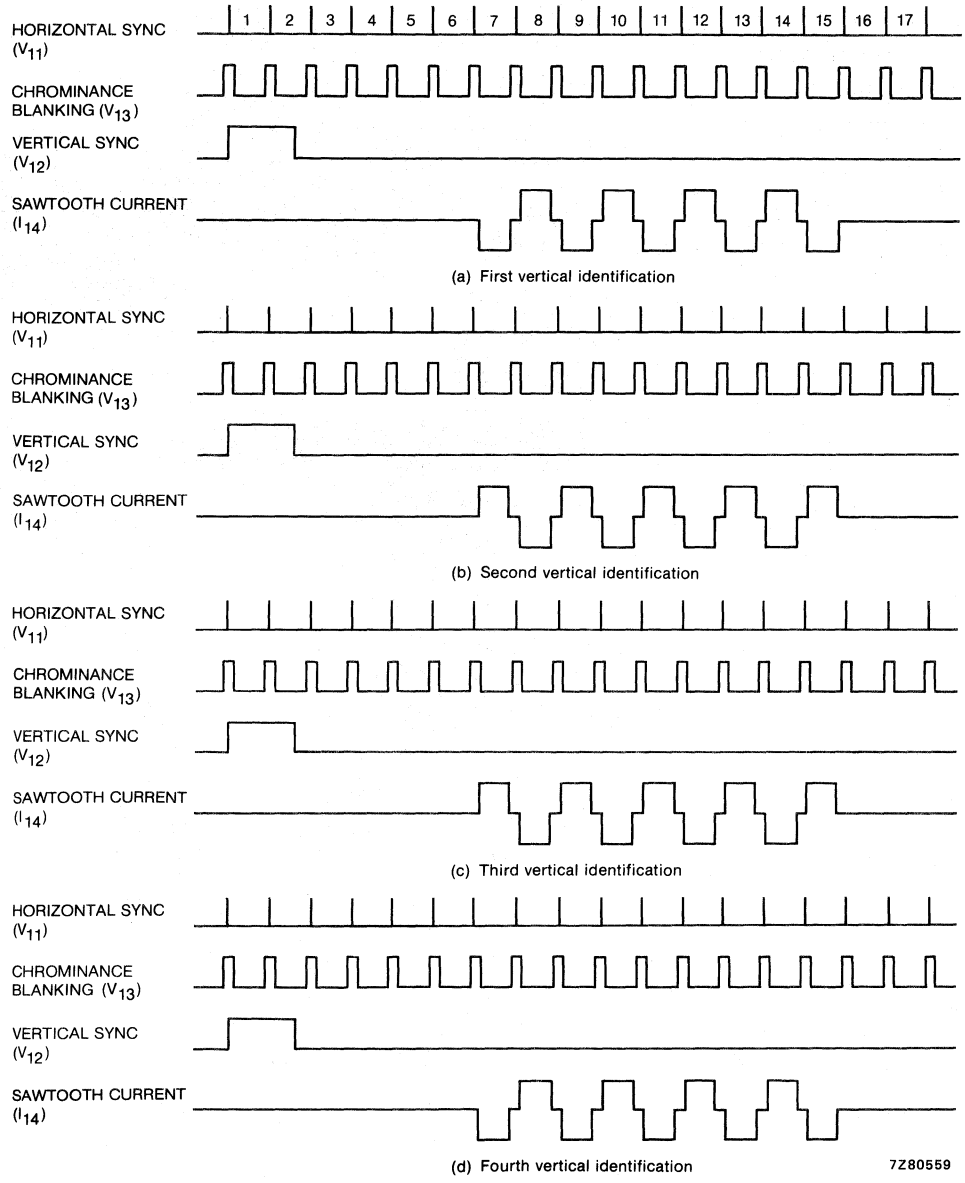


Fig. 4 Vertical identification generation.

RATINGS

Limiting values in accordance with the Absolute Maximum Rating system IEC 134

Supply voltage	V_{4-1}	max. 13,2 V
Total power dissipation	P_{tot}	see Figs 5 and 6
Operating ambient temperature range	T_{amb}	−25 to +70 °C
Storage temperature range	T_{stg}	−65 to +150 °C

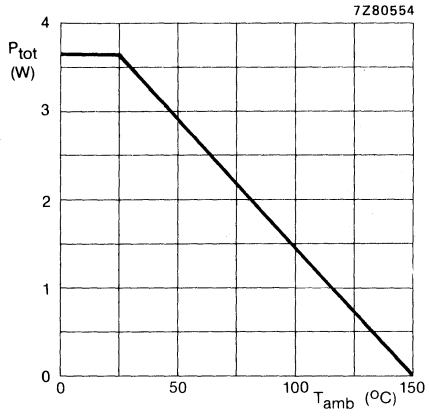


Fig. 5 Power derating curve for DIL package (SOT-101B).

CHARACTERISTICS

$V_p = V_{4-2} = 5$ V; $T_{amb} = 25$ °C; all voltages are with reference to ground (pins 2 and 24); all currents stated are positive into the IC; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supplies					
Supply voltage (pin 4)	$V_p = V_{4-2}$	4,75	5	7	V
Supply current	$I_p = I_4$	30	45	60	mA
Reference voltage (pin 7)	V_{7-2}	3,35	3,5	3,65	V
Reference voltage (pin 22)	V_{22-24}	3,35	3,5	3,65	V
Pulse shaper (pins 9,11 and 12, emitter follower inputs; pin 18, collector output)					
Bias current (pin 9,11,12)	I_9, I_{11}, I_{12}	–	–	10	μA
Input resistance (pin 9,11,12)	R_9, R_{11}, R_{12}	200	–	–	kΩ
Input pulse amplitude (pin 9,11,12)	V_9, V_{11}, V_{12}	2	–	–	V
Timing pulse output (pin 18) high level	V_{18}	4,7	–	–	V
intermediate ($V_p/2$) level	V_{18}	2,3	–	2,7	V
low level	V_{18}	–	–	0,3	V
Pulse separator (pin 13, emitter follower)					
Input resistance	R_{13}	100	–	–	kΩ
Chrominance blanking pulse amplitude	V_{13}	3,6	–	–	V
D'_R*/D'_B* blanking pulse amplitude (colour killing)	V_{13}	1,7	1,8	1,9	V
Vertical identification sawtooth generator (pin 14)					
Voltage clamping level	V_{14}	V_{22}–7 mV	V_{22}	V_{22}+7 mV	V
Ramp current (occurs in lines 7 to 15 after vertical sync)	$\pm I_{14}$	50	70	85	μA
Maximum voltage level	V_{14}	V_{22}+0,6	V_{22}+0,7	V_{22}+0,8	V
Minimum voltage level	V_{14}	V_{22}–0,8	V_{22}–0,7	V_{22}–0,6	V
Voltage level during line blanking	V_{14}	V_{22}–7 mV	V_{22}	V_{22}+7 mV	V
Inputs D'_R*, D'_B* (pins 8 and 10)					
Signal level during clamping ($I_8, I_{10} = \pm 50$ μA)	V_8, V_{10}	V_7–20 mV	V_7	V_7+20 mV	V
Input bias current	I_8, I_{10}	–	–	1,5	μA

parameter	symbol	min.	typ.	max.	unit
Sequential amplifier output (pin 6)					
(Pins 8 and 10 a.c. coupled to fixed d.c. voltage)					
D.C. output	V_6	1,6	$\frac{V_7}{2}$ − 10 mV	1,85	V
Output resistance	R_6	–	12	16	Ω
Amplifier voltage gain (pin 8 or 10 to pin 6)	$G_{8,10-6}$	1,46	1,5	1,54	
Clamping and blanking stage (pin 5)					
Input voltage (clamped; $I_5 = \pm 50\ \mu A$)	V_5	V_{22} − 10 mV	V_{22}	V_{22} + 10 mV	V
Input bias current	I_5	–	–	1,0	μA
Modulator control circuit (pin 15, buffer amplifier non-inverting input)					
Bias current	I_{15}	–	–	1,25	μA
Permitted input signal d.c. levels	V_{15}	2	–	4,3	V
FM modulator output (pin 23, emitter follower)					
Output resistance	R_{23}	–	50	70	Ω
High d.c. output level at $V_{21} = 4$ V	V_{23}	V_{22} − 0,85	–	V_{22} − 0,7	V
Output signal amplitude	V_{23}	0,9	1,0	1,1	V

CHARACTERISTICS (Continued)

parameter	symbol	min.	typ.	max.	unit
Chrominance blanking stage (pin 3, emitter follower input; pin 1, amplifier output)					
Input current	I_3	–	–	15	μA
Input resistance	R_3	300	–	–	kΩ
Required d.c. level of input signal	V_3	–	V_7	–	V
Output resistance	R_1	–	–	5	Ω
Temperature coefficient of output d.c. level	TC	–	1,8	—	mV/K
Amplifier gain	G_{3-1}	1,70	1,75	1,80	
Output d.c. level during blanking(V_{13} = HIGH)	V_1	V_7–0,76	V_7–0,70	V_7–0,60	V
Output d.c. level unblanked ($V_3 = V_7$; V_{13} = LOW)	V_1	V_7–0,76	V_7–0,70	V_7–0,60	V

A.C. CHARACTERISTICS

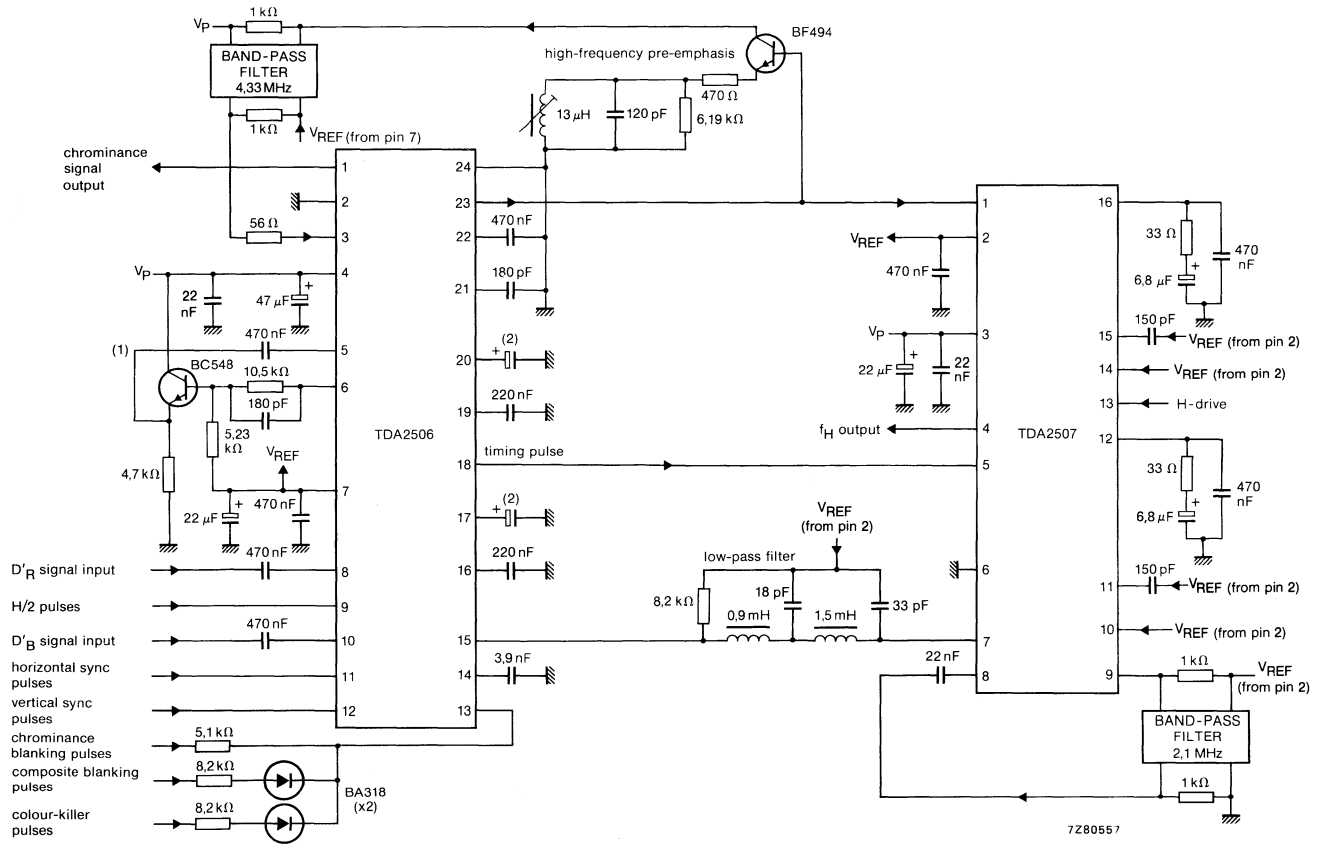
Values are valid for TDA2506 operating with TDA2507. Horizontal frequency (f_H) = 15 625 Hz.

parameter	symbol	min.	typ.	max.	unit
Centre frequency RED	f_{0R}	–	4 406,250 ± 2	–	kHz
Centre frequency BLUE	f_{0B}	–	4 250,000 ± 2	–	kHz
Ident. frequency RED *	f_{IdR}	–	4 756,250 ± 35	–	kHz
Ident. frequency BLUE *	f_{IdB}	–	3 900,000 ± 35	–	kHz
Minimum frequency RED **	$-f_R$	–	4 126,250 ± 10	–	kHz
Maximum frequency RED **	$+f_R$	–	4 686,250 ± 10	–	kHz
Minimum frequency BLUE **	$-f_B$	–	4 020,000 ± 10	–	kHz
Maximum frequency BLUE **	$+f_B$	–	4 480,000 ± 10	–	kHz

* The ident. frequencies are also the maximum and minimum output frequencies of the encoder.

** Values are valid for 75% colour bar saturation (EBU) (V_5 = ± 250 mV deviation from clamping level).

APPLICATION INFORMATION



(1) Signal amplitude for 75% colour bar (EBU) = 0,5 V (peak-to-peak value).
(2) For V_P = 4,75 to 5,3 V, $C_{17} = C_{20}$ = 0,68 μF; for $V_P > 5,3$ V, $C_{17} = C_{20}$ = 2,2 μF.

Fig. 6 Application using TDA2507 with PLL tuning: Vp = 5 V.

SECAM ENCODER

GENERAL DESCRIPTION

The TDA2506 converts colour-difference signals (D'_R and D'_B) into sequential, frequency modulated signals according to the SECAM system. The signals (D'_R) and (D'_B) are the colour difference signals before low-frequency pre-emphasis; D'_R = -1,9 (R-Y) and D'_B = ≠1,5(B-Y). The circuit is intended for use in video cameras, games, recorders and players, PAL-SECAM transcoding circuits and SECAM test signal generators.

Synchronizing pulses required for operation of the TDA2506 may be obtained from a universal sync generator SAA1043 or other pulse generator. All pulses are to be active HIGH and are as follows:

Horizontal sync pulses to pin 11
Half-rate horizontal sync (H/2) pulses to pin 9
Vertical sync pulses to pin 12
Chrominance blanking pulses to pin 13 (may include colour-killer pulses)

Frequency modulation is performed in conjunction with modulator-controller TDA2507.

Features

- Chrominance processor
- Vertical identification signal generator
- Timing pulse output to TDA2507
- Sample and hold circuit for control signal from TDA2507
- No adjustments of external components required (except high-frequency pre-emphasis (bell filter) stage)

QUICK REFERENCE DATA

Supply voltage	V_{4-2}	typ.	5 V
Supply current	I_4	typ.	45 mA
Reference voltage	V_{7-2}, V_{22-24}	typ.	3,5 V
Operating ambient temperature range	T_{amb}		−25 to +70 °C
Storage temperature range	T_{stg}		−65 to +150 °C

PACKAGE OUTLINES

24-lead mini-pack ; plastic (SO-24 ; SOT-137A).

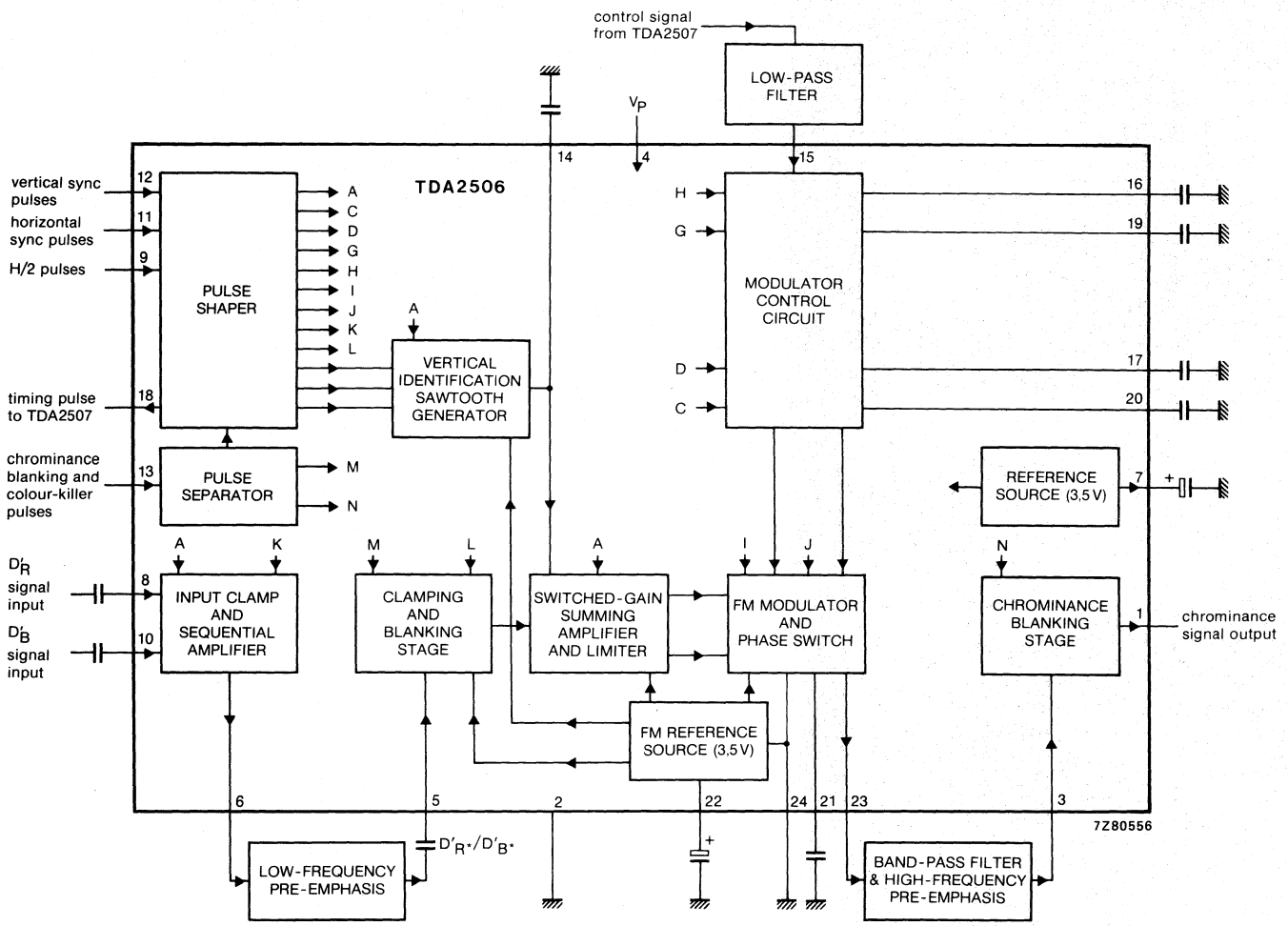


Fig. 1 Block diagram.

Pin functions

1. Chrominance signal output.
2. Ground.
3. Input to chrominance blanking stage from high-frequency pre-emphasis and band-pass filter.
4. Positive supply voltage.
5. Input to clamping and blanking stage from low-frequency pre-emphasis filter.
6. Output from sequential amplifier to low-frequency pre-emphasis filter.
7. Reference voltage output.
8. D'_R signal input.
9. H/2 pulse input (required only if specific phase sequencing is desired).
10. D'_B signal input.
11. Horizontal sync pulse input.
12. Vertical sync pulse input.
13. Chrominance blanking and colour-killer pulse input.
14. Capacitor for vertical identification sawtooth.
15. Control signal input from TDA2507 via low-pass filter.
16. 4 406,250 kHz frequency adjustment.
17. (R-Y) control.
18. Timing pulse output to TDA2507.
19. 4 250,000 kHz frequency adjustment.
20. (B-Y) control.
21. FM modulator tuning capacitor (fixed).
22. FM reference voltage output.
23. FM modulator output to high frequency pre-emphasis and band-pass filter.
24. Ground connection for FM modulator.

FUNCTIONAL DESCRIPTION

Input clamp and sequential amplifier

This circuit clamps the zero levels of the D'_R and D'_B input signals (pins 8 and 10) to the reference voltage from pin 7. The input signals are switched into the amplifier sequentially by an internally delayed H/2 waveform. The amplifier output at pin 6 is D'_R when the delayed H/2 waveform is HIGH and D'_B when it is LOW. The stage gain is 1,5.

Clamping and blanking stage

After external low-frequency pre-emphasis, the sequential D'_R* and D'_B* signals are returned to the IC at pin 5. The signal amplitude at pin 5 is typically 0,5 V (peak-to-peak value) for 75% colour bar (EBU). Black levels are clamped to the FM reference voltage (pin 22). Blanking takes place during the chrominance blanking pulse and, if required, during the video blanking and/or colour killing pulses.

FUNCTIONAL DESCRIPTION (continued)

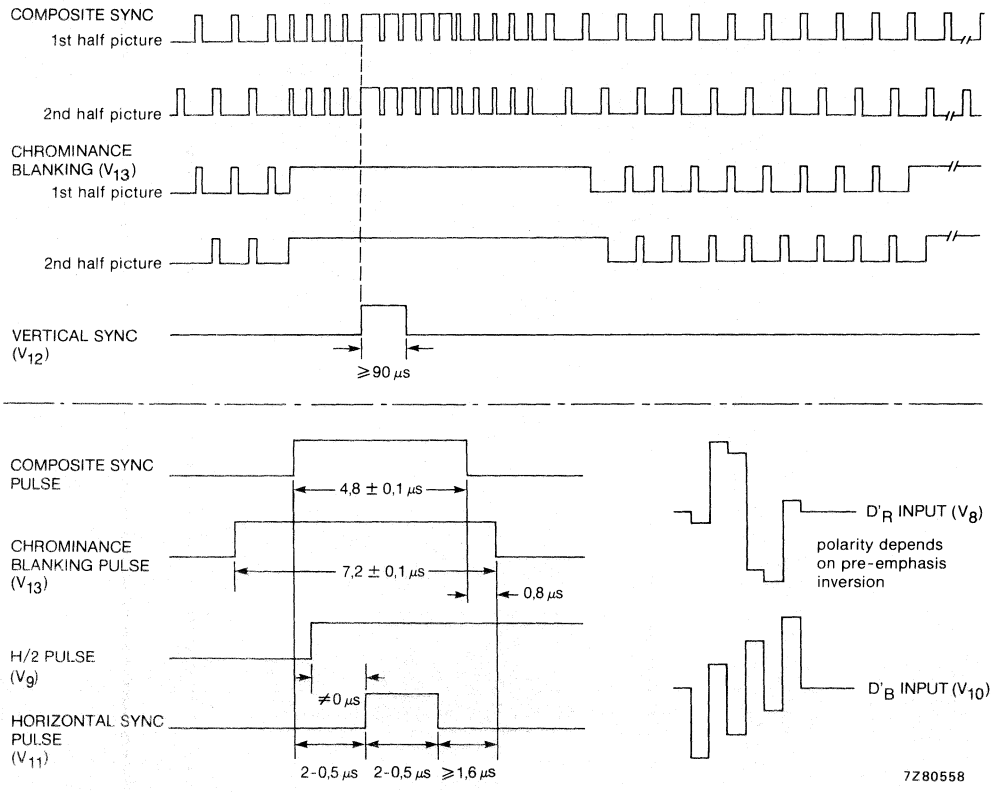


Fig. 2 Survey of input signals in relation to composite sync.

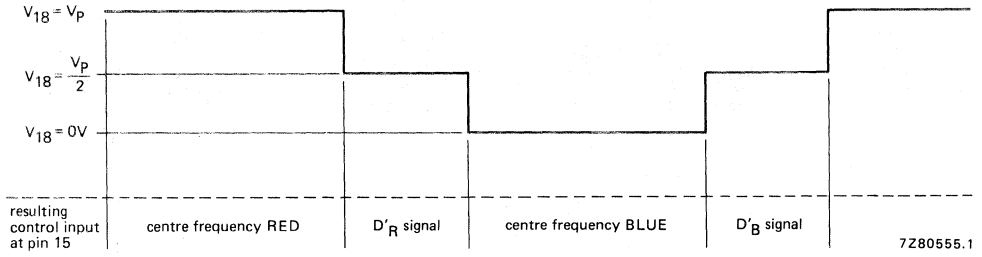


Fig. 3 Timing pulse output (pin 18) and resulting control input (pin 15).

Switched-gain summing amplifier and limiter

Inputs into the summing amplifier are the sequential D'_R* and D'_B* signals, the vertical identification sawtooth waveform and reference d.c. levels. The gain of the amplifier is switched by the internally delayed H/2 waveform to give the correct input amplitudes for the FM modulator (D'_R* gain = 280/230 x D'_B* gain). An offset is also introduced between the black levels of the D'_R* and D'_B* signals which corresponds to the upper and lower thresholds of the limiter.

FM modulator and phase switch

The FM modulator provides accurate FM modulation which follows the amplitude envelopes of the sequential D'_R* and D'_B* waveforms. The centre frequencies of 4 406,250 kHz for the D'_R* signal and 4 250,000 kHz for the D'_B* signal are controlled by d.c. levels from the sample and hold circuit (which in turn are controlled by the TDA2507). The upper and lower frequency limits are 4 756,250 ± 35 kHz and 3 900,000 ± 35 kHz.

Reference d.c. levels are switched within the FM modulator to define the starting phase of the modulator output (pin 23) at the initiation of each horizontal and vertical scan. The starting phase sequence is as follows:

vertical scan (frame to frame) 0^o, 180^o, 0^o, 180^o, repeating;

horizontal scan (line to line) 0^o, 0^o, 180^o, 0^o, 0^o, 180^o, repeating.

Chrominance blanking stage

The frequency modulated colour difference signals are passed via high-frequency pre-emphasis and band-pass filters to the chrominance blanking input at pin 3. The d.c. level of this input should be equal to the reference voltage at pin 7. Blanking occurs during the chrominance blanking pulse. The stage gain is 1,75.

Vertical identification sawtooth generator

Vertical sync, horizontal sync and chrominance blanking pulses are used to determine vertical identification (see Fig. 4). The vertical identification sawtooth generator is driven in opposite directions for identification signals IdR and IdB; the capacitor for the generator is connected at pin 14. If no vertical identification is required, pin 14 should be connected to the FM reference voltage at pin 22.

Pulse shaper

This stage developes all pulses that are required within the TDA2506 and also the timing pulses required for the modulator controller TDA2507 (see Fig. 3). Internal H/2 pulses are generated by a flip-flop working from the horizontal sync input (pin 11), this makes the H/2 input at pin 9 necessary only if it is required to lock the modulator into a specific phase sequence. If the H/2 input is not required, pin 9 should be connected to ground. A pulse separator at the chrominance blanking/colour-killer input (pin 13) allows this input to be used for blanking the sequential D'_R*/D'_B* signal.

Sample and hold circuit

This circuit provides reference voltages to the FM modulator which set the centre modulation frequencies for the sequential D'_R* and D'_B* signals. The reference voltage levels are supplied to pin 15 from the TDA2507 in a sequence that is time-related to D'_R*/D'_B* switching. The levels are sampled and then held for D'_R* using capacitors at pins 16 and 17, and for D'_B* using capacitors at pins 19 and 20.

FUNCTIONAL DESCRIPTION (continued)

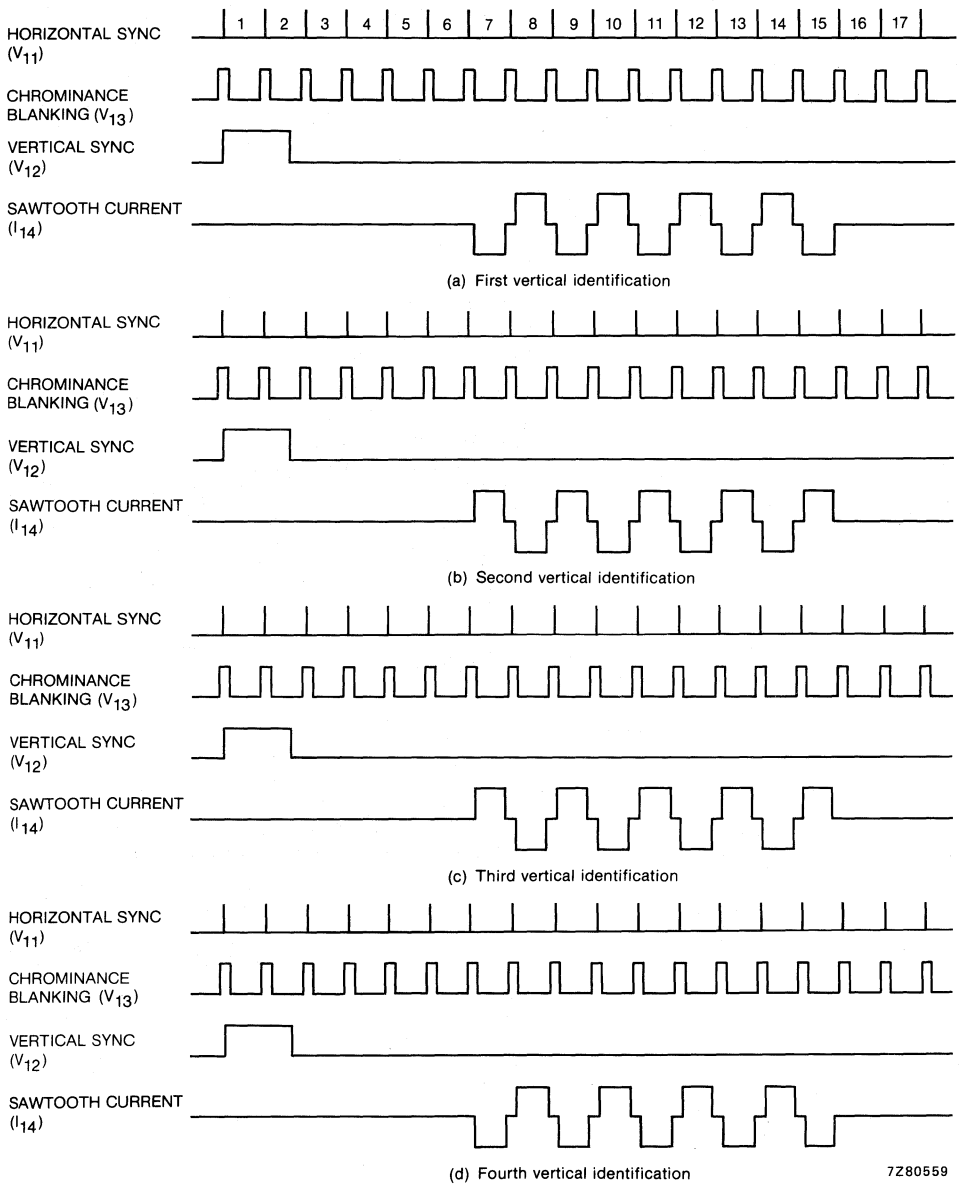


Fig. 4 Vertical identification generation.

RATINGS

Limiting values in accordance with the Absolute Maximum Rating system IEC 134

Supply voltage	V_{4-1}	max. 13,2 V
Total power dissipation	P_{tot}	see Fig. 5
Operating ambient temperature range	T_{amb}	−25 to +70 °C
Storage temperature range	T_{stg}	−65 to +150 °C

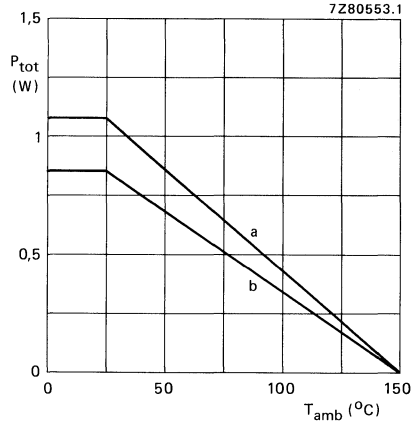


Fig. 5 Power derating curve.

a = device mounted on a ceramic substrate.
b = device mounted on a printed circuit board.

CHARACTERISTICS

$V_p = V_{4-2} = 5$ V; $T_{amb} = 25$ °C; all voltages are with reference to ground (pins 2 and 24); all currents stated are positive into the IC; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supplies					
Supply voltage (pin 4)	$V_p = V_{4-2}$	4,75	5	7	V
Supply current	$I_p = I_4$	30	45	60	mA
Reference voltage (pin 7)	V_{7-2}	3,35	3,5	3,65	V
Reference voltage (pin 22)	V_{22-24}	3,35	3,5	3,65	V
Pulse shaper (pins 9,11 and 12, emitter follower inputs; pin 18, collector output)					
Bias current (pin 9,11,12)	I_9, I_{11}, I_{12}	–	–	10	μA
Input resistance (pin 9,11,12)	R_9, R_{11}, R_{12}	200	–	–	kΩ
Input pulse amplitude (pin 9,11,12)	V_9, V_{11}, V_{12}	2	–	–	V
Timing pulse output (pin 18) high level	V_{18}	4,7	–	–	V
intermediate (V_p/2) level	V_{18}	2,3	–	2,7	V
low level	V_{18}	–	–	0,3	V
Pulse separator (pin 13, emitter follower)					
Input resistance	R_{13}	100	–	–	kΩ
Chrominance blanking pulse amplitude	V_{13}	3,6	–	–	V
D'_R*/D'_B* blanking pulse amplitude (colour killing)	V_{13}	1,7	1,8	1,9	V
Vertical identification sawtooth generator (pin 14)					
Voltage clamping level	V_{14}	V_{22}–7 mV	V_{22}	V_{22}+7 mV	V
Ramp current (occurs in lines 7 to 15 after vertical sync)	$\pm I_{14}$	50	70	85	μA
Maximum voltage level	V_{14}	V_{22}+0,6	V_{22}+0,7	V_{22}+0,8	V
Minimum voltage level	V_{14}	V_{22}–0,8	V_{22}–0,7	V_{22}–0,6	V
Voltage level during line blanking	V_{14}	V_{22}–7 mV	V_{22}	V_{22}+7 mV	V
Inputs D'_R*, D'_B* (pins 8 and 10)					
Signal level during clamping ($I_8, I_{10} = \pm 50$ μA)	V_8, V_{10}	V_7–20 mV	V_7	V_7+20 mV	V
Input bias current	I_8, I_{10}	–	–	1,5	μA

parameter	symbol	min.	typ.	max.	unit
Sequential amplifier output (pin 6)					
(Pins 8 and 10 a.c. coupled to fixed d.c. voltage)					
D.C. output	V_6	1,6	$\frac{V_7 - 10\ mV}{2}$	1,85	V
Output resistance	R_6	–	12	16	Ω
Amplifier voltage gain (pin 8 or 10 to pin 6)	$G_{8,10-6}$	1,46	1,5	1,54	
Clamping and blanking stage (pin 5)					
Input voltage (clamped; $I_5 = \pm 50\ \mu A$)	V_5	$V_{22}-10$ mV	V_{22}	$V_{22}+10$ mV	V
Input bias current	I_5	–	–	1,0	μA
Modulator control circuit (pin 15, buffer amplifier non-inverting input)					
Bias current	I_{15}	–	–	1,25	μA
Permitted input signal d.c. levels	V_{15}	2	–	4,3	V
FM modulator output (pin 23, emitter follower)					
Output resistance	R_{23}	–	50	70	Ω
High d.c. output level at $V_{21} = 4$ V	V_{23}	$V_{22}-0,85$	–	$V_{22}-0,7$	V
Output signal amplitude	V_{23}	0,9	1,0	1,1	V

CHARACTERISTICS (Continued)

parameter	symbol	min.	typ.	max.	unit
Chrominance blanking stage (pin 3, emitter follower input; pin 1, amplifier output)					
Input current	I_3	–	–	15	μA
Input resistance	R_3	300	–	–	kΩ
Required d.c. level of input signal	V_3	–	V_7	–	V
Output resistance	R_1	–	–	5	Ω
Temperature coefficient of output d.c. level	TC	–	1,8	—	mV/K
Amplifier gain	G_{3-1}	1,70	1,75	1,80	
Output d.c. level during blanking(V_{13} = HIGH)	V_1	V_7–0,76	V_7–0,70	V_7–0,60	V
Output d.c. level unblanked ($V_3 = V_7$; V_{13} = LOW)	V_1	V_7–0,76	V_7–0,70	V_7–0,60	V

A.C. CHARACTERISTICS

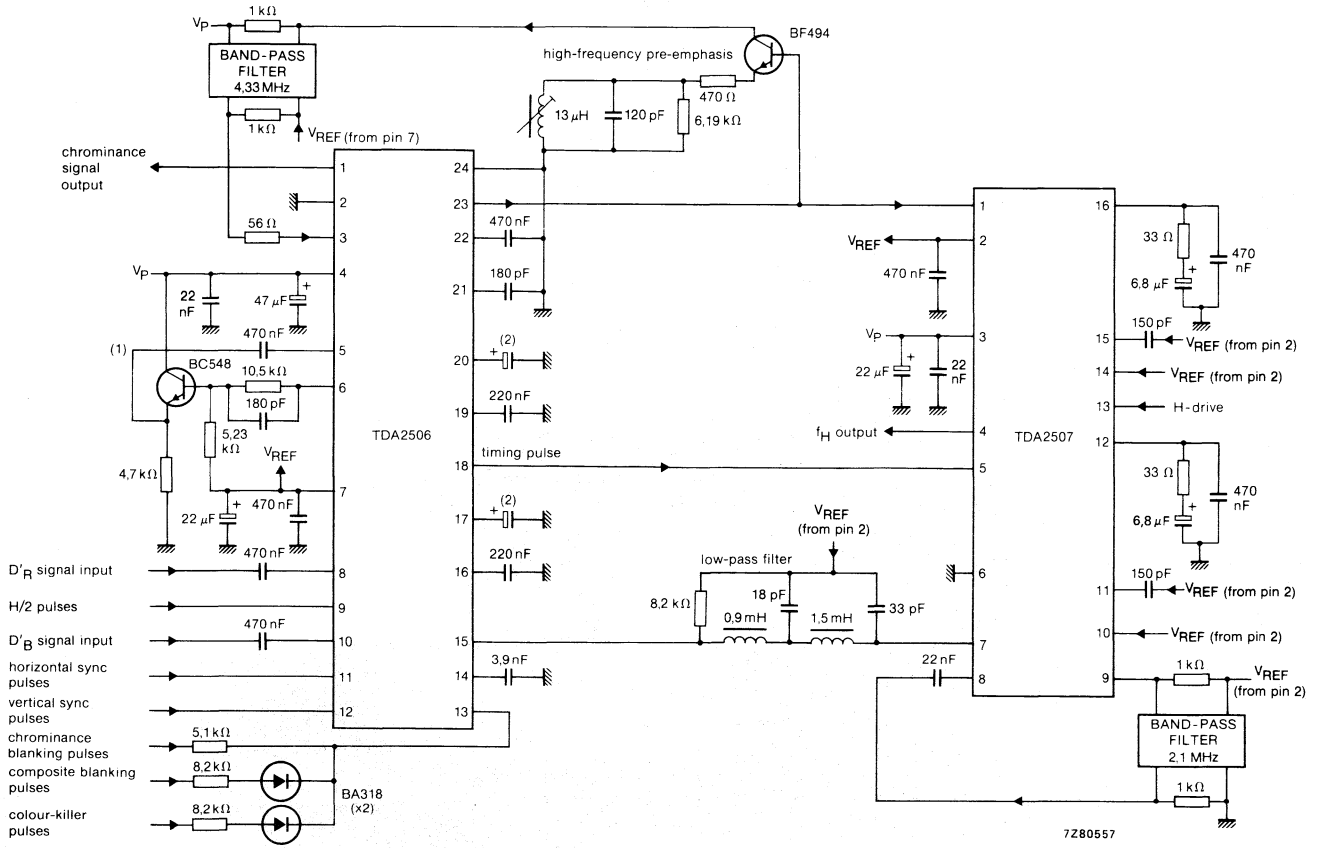
Values are valid for TDA2506 operating with TDA2507. Horizontal frequency (f_H) = 15 625 Hz.

parameter	symbol	min.	typ.	max.	unit
Centre frequency RED	f_{0R}	–	4 406,250 ± 2	–	kHz
Centre frequency BLUE	f_{0B}	–	4 250,000 ± 2	–	kHz
Ident. frequency RED *	f_{IdR}	–	4 756,250 ± 35	–	kHz
Ident. frequency BLUE *	f_{IdB}	–	3 900,000 ± 35	–	kHz
Minimum frequency RED **	$-f_R$	–	4 126,250 ± 10	–	kHz
Maximum frequency RED **	$+f_R$	–	4 686,250 ± 10	–	kHz
Minimum frequency BLUE **	$-f_B$	–	4 020,000 ± 10	–	kHz
Maximum frequency BLUE **	$+f_B$	–	4 480,000 ± 10	–	kHz

* The ident. frequencies are also the maximum and minimum output frequencies of the encoder.

** Values are valid for 75% colour bar saturation (EBU) (V_5 = ± 250 mV deviation from clamping level).

APPLICATION INFORMATION



(1) Signal amplitude for 75% colour bar (EBU) = 0,5 V (peak-to-peak value).
(2) For V_P = 4,75 to 5,3 V, $C_{17} = C_{20}$ = 0,68 µF; for $V_P > 5,3$ V, $C_{17} = C_{20}$ = 2,2 µF.

Fig. 6 Application using TDA2507 with PLL tuning: Vp = 5 V.

FM MODULATOR CONTROLLER

GENERAL DESCRIPTION

The TDA2507 accepts FM signals that are sequentially modulated by two alternating subcarrier frequencies (SECAM signals) and provides sequential d.c. output levels to control the FM modulator.

The IC is intended for use with the SECAM encoder TDA2506 but can be adapted for other applications. Timing reference pulses from the modulator are required.

Two frequency reference phase-lock loops are contained within the IC; one for 4,406 25 MHz, and one for 4,250 MHz. Other frequencies can be accomplished by using external reference sources.

QUICK REFERENCE DATA

Supply voltage	$V_P = V_{3-6}$	typ.	5 V
Supply current at V_P = 5 V and with both PLL circuits functioning	I_3	typ.	40 mA
Reference voltage	V_{2-6}	typ.	3,5 V
Operating ambient temperature range	T_{amb}	−25 to	+70 °C
Storage temperature range	T_{stg}	−65 to	+150 °C

PACKAGE OUTLINES

TDA2507 : 16-lead DIL; plastic (with internal heat spreader) (SOT-38WE-9).
TDA2507T: 16-lead mini-pack; plastic (SO-16L; SOT-162A).

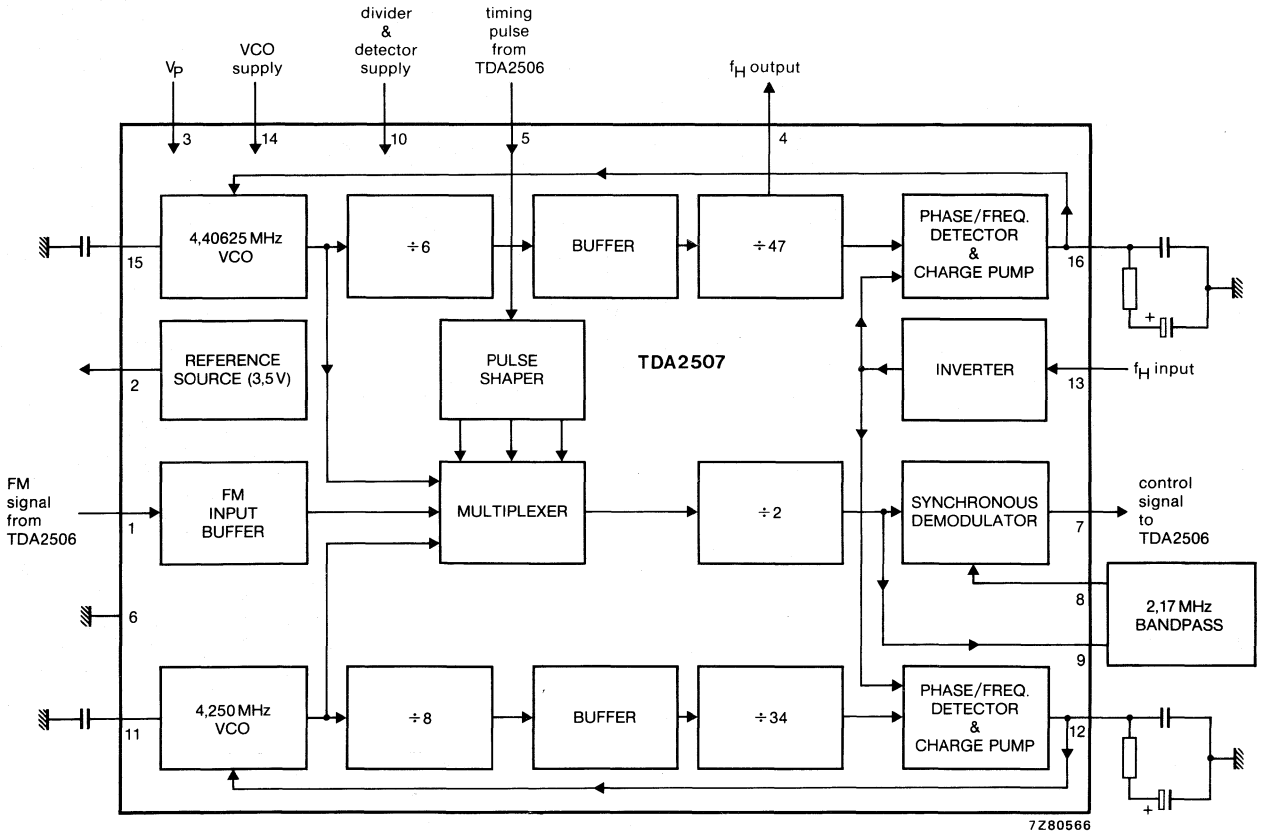


Fig. 1 Block diagram.

Pin functions

1. FM signal input (from TDA2506 pin 23).
2. Reference voltage output.
3. Positive supply voltage.
4. Horizontal sync output (f_H = 4 406,250/282 = 15,625 kHz).
5. Timing pulse input (from TDA2506 pin 18).
6. Ground.
7. Control signal output to TDA2506 via low-pass filter.
8. Input to synchronous demodulator from band-pass filter.
9. Output to band-pass filter.
10. Supply voltage for the divider stages and phase/frequency detectors of the two phase-lock loops.
11. Tuning capacitor for the 4,250 MHz reference oscillator.
12. Filter for the phase/frequency detector of the 4,250 MHz phase-lock loop.
13. Horizontal sync input (f_H).
14. Supply voltage for the two reference oscillators.
15. Tuning capacitor for the 4,406 25 MHz reference oscillator.
16. Filter for the phase/frequency detector of the 4,406 25 MHz phase-lock loop.

FUNCTIONAL DESCRIPTION

Phase-lock loops

The two phase-lock loops each comprise a voltage-controlled reference oscillator, two frequency divider stages and a phase/frequency detector circuit. The loops are closed by charge pumping the reference oscillators from the phase/frequency detector outputs. The centre frequencies of the loops are set by external capacitors at pin 15 (4,406 25 MHz) and pin 11 (4,250 MHz). The divider stages which follow the reference oscillators reduce the frequencies of both the loops to 15,625 kHz (f_H) at their respective inputs to the phase/frequency detectors. The reference signals to both phase/frequency detectors are obtained from the horizontal sync input at pin 13.

The divider and phase/frequency detector circuits can be switched off by connecting pin 10 to ground. This leaves only the VCO of each PLL in circuit and allows external signals to be injected at pins 15 and 11, or crystals to be used for tuning the oscillators.

The accuracy of crystal tuning using only one crystal can be obtained by connecting pins 10, 14 and 16 to the reference voltage at pin 2 and connecting a 4,406 25 MHz crystal to pin 15. The 4,250 MHz PLL will follow the crystal-derived f_H reference from pin 4 via pin 13 and its phase/frequency detector.

Multiplexer and pulse shaper

The multiplexer receives the 4,406 25 and 4,250 MHz reference frequencies from the two VCOs and the FM signals $D'_R{}^*$ and $D'_B{}^*$ from the TDA2506 modulator. The signals are gated one at a time to the multiplexer output in a sequence determined by the timing pulses from TDA2506. The levels of the timing pulses (pin 5) are used in the pulse shaper to generate enable pulses for the multiplexer (Fig. 2a + b). The multiplexer output sequence is as follows:

4,406 25 MHz (2 lines); $D'_R{}^*$ FM signal (1 line); 4,250 MHz (2 lines); $D'_B{}^*$ FM signal (1 line); repeating. The selection of $D'_R{}^*$ or $D'_B{}^*$ FM signal is a feature of the timing of the input at pin 5.

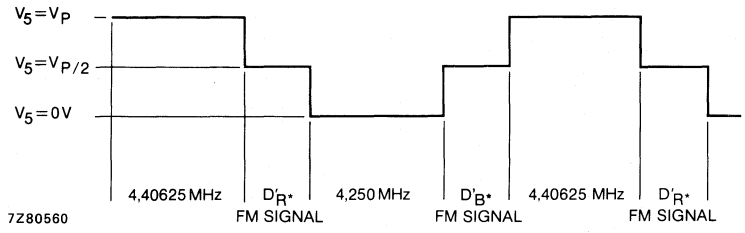


Fig. 2a Timing pulse waveform showing multiplexer output sequence.

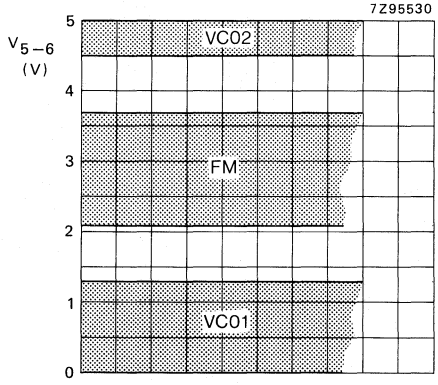


Fig. 2b Graph showing switching-levels of the timing pulse at pin 5. Duty cycle and timing not important.

Divide-by-two stage and synchronous demodulator

The divide-by-two stage halves the frequencies present in the multiplexer output and equalizes the amplitude and pulse shapes of the sequential signals.

Demodulation of the multiplexed signal is performed by filtering the signal via a 2,17 MHz band-pass filter (between pins 8 and 9) and using this filtered signal as a synchronous switch for the main signal. The d.c. level of the signal from pin 9 is referred externally to the reference voltage from pin 2. An external low-pass filter is required for the output signal from pin 7.

RATINGS

Limiting values in accordance with the Absolute Maximum Rating system IEC 134

Supply voltage	V_{3-6}	max.	13,2 V
Total power dissipation	P_{tot}	see Fig. 3	
Operating ambient temperature range	T_{amb}	−25 to +70	°C
Storage temperature range	T_{stg}	−65 to +150	°C

CHARACTERISTICS

$V_P = V_{3-6} = 5$ V; $T_{amb} = 25$ °C; all voltages are with reference to ground; unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
Supplies					
Supply voltage (pin 3)	$V_P = V_{3-6}$	4,75	5	7	V
Supply current at $V_{14} = V_{10} = V_2$	$I_p = I_3$	–	35	–	mA
Supply current at $V_{14} = V_2$	$I_P = I_3$	–	20	–	mA
Reference voltage (pin 2)	V_{2-6}	3,38	3,5	3,6	V
Phase-lock loops					
D.C. level at pins 11 and 15 (oscillator tuning capacitor outputs)	V_{11}, V_{15}	2,4	2,6	2,8	V
Amplitude of oscillation at pins 11 and 15 (peak-to-peak value)	$V_{11(p-p)}$ | $V_{15(p-p)}$	–	130	–	mV
Current into pins 11 and 15 when $V_{12}, V_{16} = 1,5$ V (see Fig. 4)	I_{11}, I_{15}	–	130	–	μA
Limiting values for VCO control voltages at pins 12 and 16	V_{12}, V_{16}	0,8	–	1,9	V
Output resistance at pin 4 (f_H output); V_4 = HIGH	R_4	5,1	6,8	8,5	kΩ
Input resistance at pin 13 (f_H input)	R_{13}	200	–	–	kΩ
Amplitude of f_H pulse required at pin 13 (duty factor and timing are not important)	V_{13}	2	–	–	V
FM input buffer					
Input resistance at pin 1 (FM signal input)	R_1	180	–	–	kΩ
Switching level of FM input	V_1	2,2	2,3	2,4	V
Required input amplitude	V_1	0,5	–	2,0	V
Pulse shaper input					
Input resistance at pin 5 (timing pulse input	R_5	200	–	–	kΩ
Demodulator					
Sink current at pin 9 into divide-by-two circuit; V_9 = LOW	I_9	0,6	0,9	1,2	mA
Demodulator input bias voltage at pin 8	V_8	1,60	1,68	1,76	V
Demodulator output current from pin 7 (see Fig. 5)					
output current at 'A'	$-I_7$	0,6	0,9	1,2	mA
output current at 'B'	$+I_7$	1,2	0,9	0,6	mA

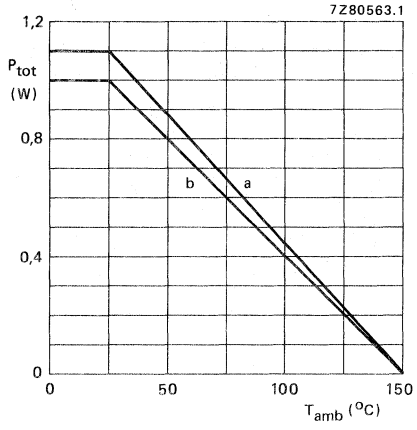


Fig. 3 Power derating curve.

a = device mounted on a ceramic substrate.
b = device mounted on a printed circuit board.

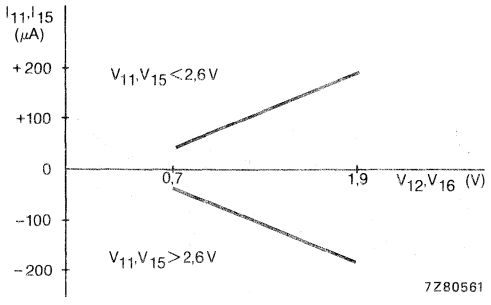


Fig. 4 Graph showing current into pins 11 and 15 against voltage at pins 12 and 16 (typical values).

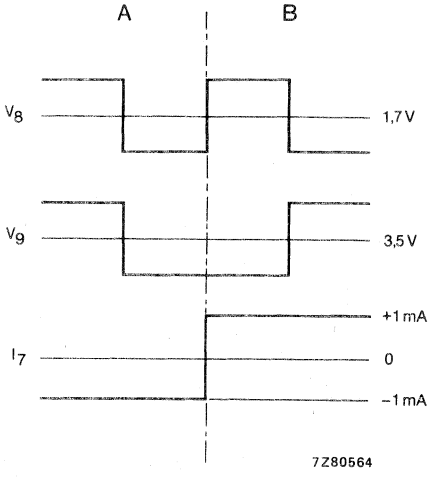


Fig. 5 Graph showing demodulator output current from pin 7 (typical values).

APPLICATION INFORMATION

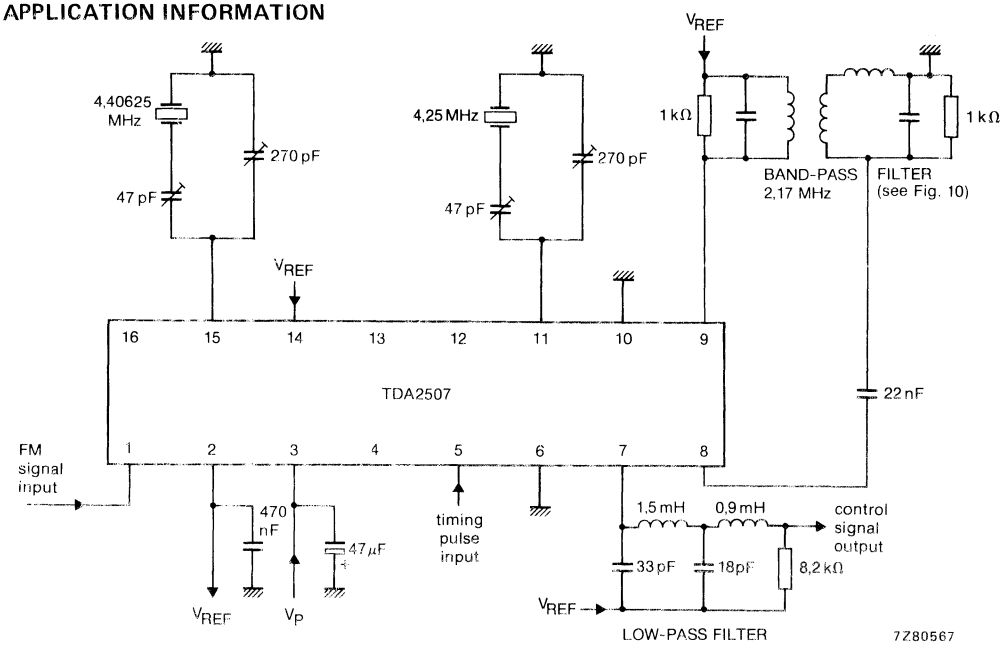


Fig. 6 Application of TDA2507 using two crystals for tuning; V_P = 5 V.

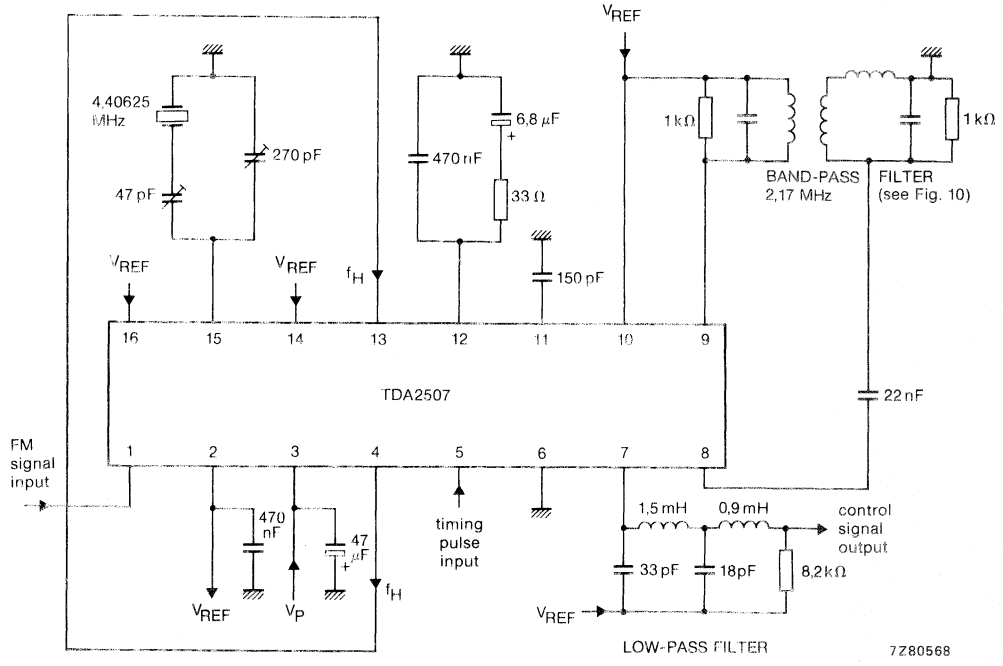


Fig. 7 Application of TDA2507 using single crystal tuning; V_P = 5 V.

APPLICATION INFORMATION (continued)

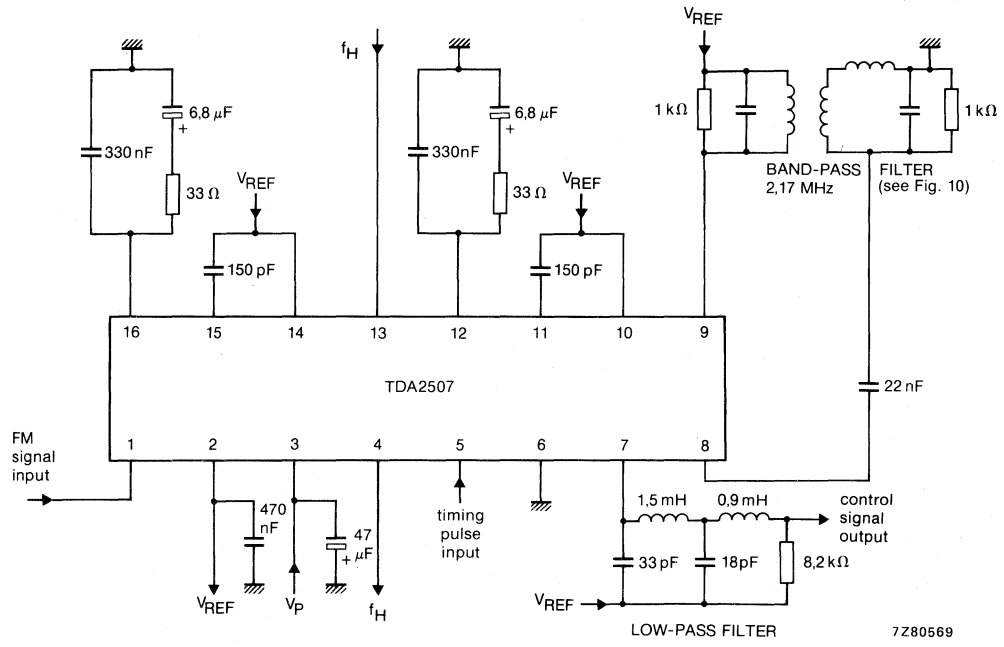


Fig. 8 Application of TDA2507 using PLL tuning; V_P = 5 V.

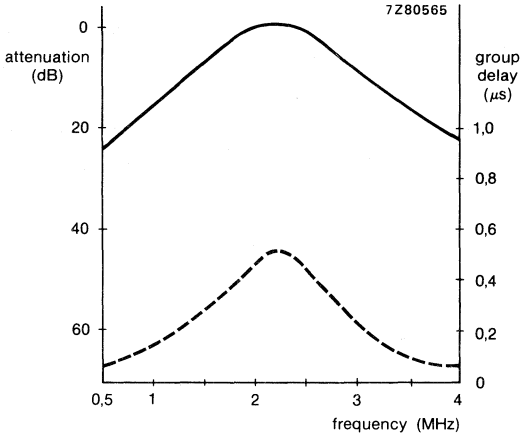


Fig. 9 Typical response of 2,17 MHz band-pass filter.

Note

See data sheet TDA2506 for TDA2506/TDA2507 application using PLL tuning.

TELEVISION I.F. AMPLIFIER AND DEMODULATOR

The TDA2540 is an i.f. amplifier and demodulator circuit for colour and black and white television receivers using n-p-n tuners.
It incorporates the following functions:

- gain-controlled wide-band amplifier, providing complete i.f. gain
- synchronous demodulator
- white spot inverter
- video preamplifier with noise protection
- a.f.c. circuit which can be switched on/off by a d.c. level, e.g. during tuning
- a.g.c. circuit with noise gating
- tuner a.g.c. output (n-p-n tuners)
- VCR switch, which switches off the video output; e.g. for insertion of a VCR playback signal

QUICK REFERENCE DATA

Supply voltage	V_{11-13}	typ.	12	V
Supply current	I_{11}	typ.	50	mA
I.F. input voltage at f = 38,9 MHz (r.m.s. value)	$V_{1-16\ (rms)}$	typ.	100	μV
Video output voltage (white at 10% of top sync)	$V_{12(p-p)}$	typ.	2,7	V
I.F. voltage gain control range	G_v	typ.	64	dB
Signal-to-noise ratio at V_i = 10 mV	S/N	typ.	58	dB
A.F.C. output voltage swing for Δf = 100 kHz	ΔV_{5-13}	typ.	10	V

PACKAGE OUTLINES

TDA2540 : 16-lead DIL; plastic (SOT-38).
TDA2540Q: 16-lead QIL; plastic (SOT-58).

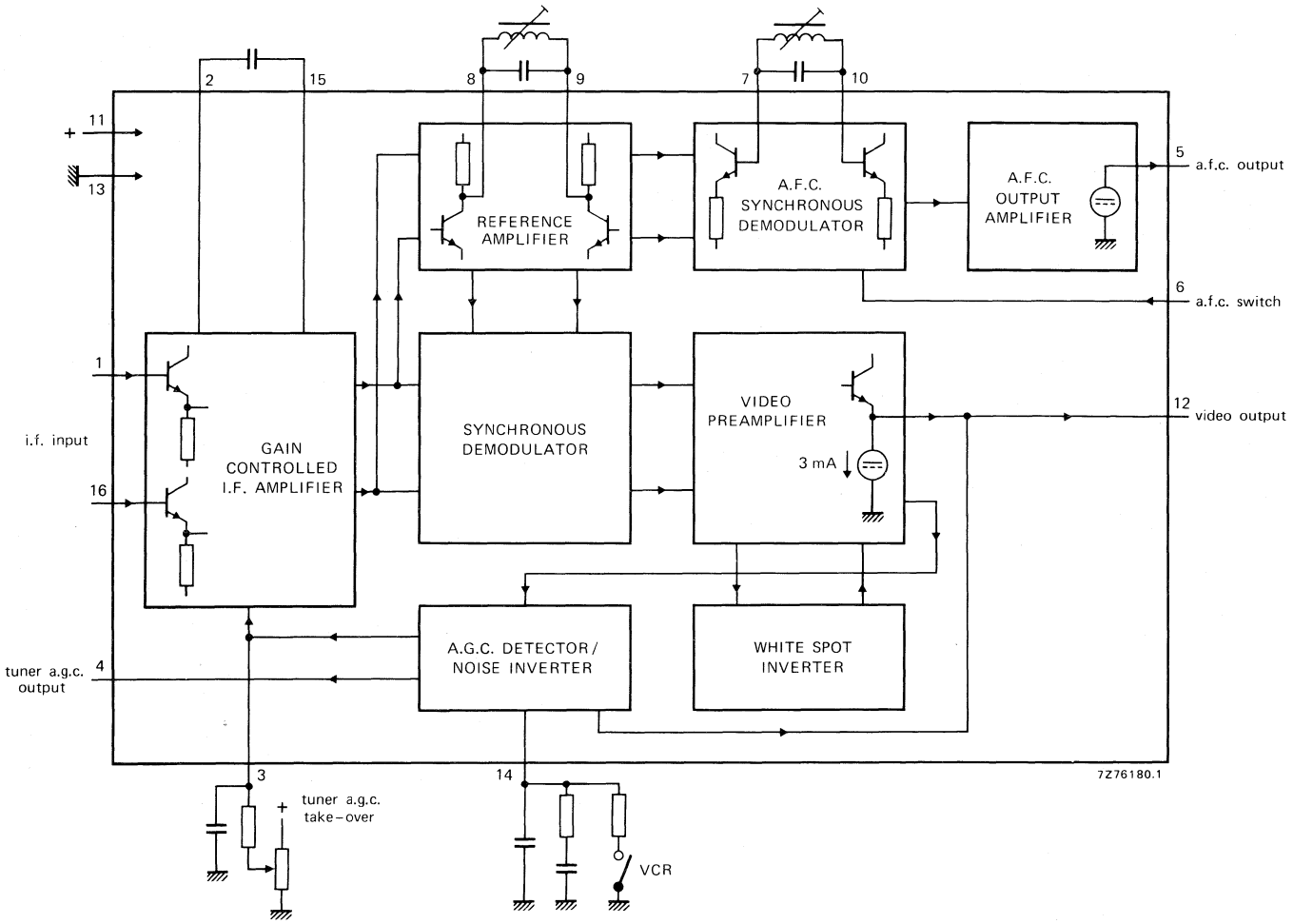


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage	$V_{11\text{-}13}$	max.	13,2 V
Tuner a.g.c. voltage	$V_{4\text{-}13}$	max.	12 V
Total power dissipation	P_{tot}	max.	900 mW
Storage temperature	T_{stg}		−55 to + 125 °C
Operating ambient temperature	T_{amb}		−25 to + 60 °C

CHARACTERISTICS (measured in Fig. 5)

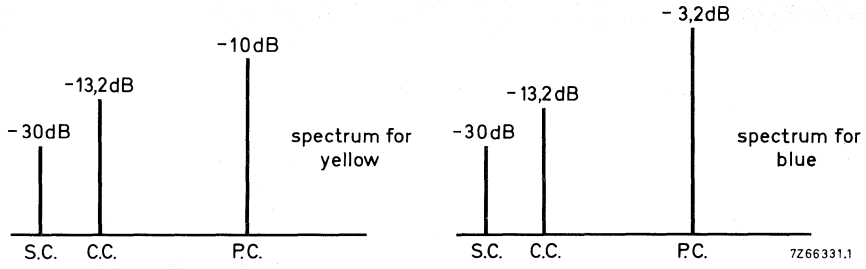
Supply voltage range	$V_{11\text{-}13}$	typ.	12 V
			10,2 to 13,2 V
The following characteristics are measured at T_{amb} = 25 °C; $V_{11\text{-}13}$ = 12 V; f = 38,9 MHz			
I.F. input voltage for onset of a.g.c. (r.m.s. value)	$V_{1\text{-}16(rms)}$	typ.	100 μV
		<	150 μV
Differential input impedance	$\lvert Z_{1\text{-}16} \rvert$	typ.	2 kΩ in parallel with 2 pF
Zero-signal output level	$V_{12\text{-}13}$	typ.	6 ± 0,3 V*
Top sync output level	$V_{12\text{-}13}$	typ.	3,07 V
			2,9 to 3,2 V
I.F. voltage gain control range	G_v	typ.	64 dB
Bandwidth of video amplifier (3 dB)	B	typ.	6 MHz
Signal-to-noise ratio at V_i = 10 mV	S/N	typ.	58 dB**
Differential gain	dG	typ.	4 %
		<	10 %
Differential phase	$d\varphi$	typ.	2°
		<	10°

* So-called 'projected zero point', e.g. with switched demodulator.

** $S/N = \dfrac{V_o \text{ black-to-white}}{V_{n(rms)} \text{ at } B = 5 \text{ MHz}}$.

CHARACTERISTICS (continued)

Intermodulation at 1,1 MHz: blue*	>	46 dB
	typ.	60 dB
yellow*	>	46 dB
	typ.	50 dB
at 3,3 MHz**	>	46 dB
	typ.	54 dB



S.C.: sound carrier level
C.C.: chrominance carrier level
P.C.: picture carrier level
} with respect to top sync level

Fig. 2 Input conditions for intermodulation measurements; standard colour bar with 75% contrast.

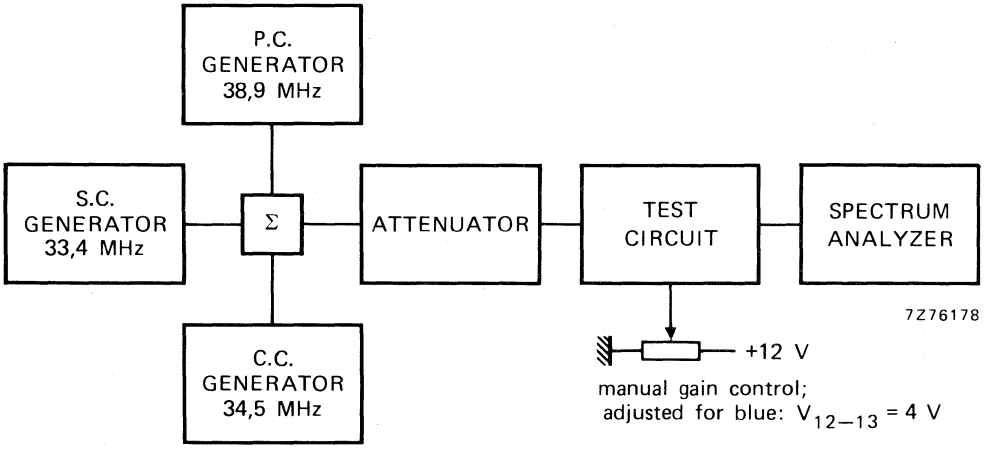


Fig. 3 Test set-up for intermodulation.

* $20 \log \frac{V_o \text{ at } 4{,}4 \text{ MHz}}{V_o \text{ at } 1{,}1 \text{ MHz}} + 3{,}6$ dB. ** $20 \log \frac{V_o \text{ at } 4{,}4 \text{ MHz}}{V_o \text{ at } 3{,}3 \text{ MHz}}$.

Carrier signal at video output		typ. 	4 mV 30 mV
2nd harmonic of carrier at video output		typ. 	20 mV 30 mV
White spot inverter threshold level (Fig. 4)		typ.	6,6 V
White spot insertion level (Fig. 4)		typ.	4,7 V
Noise inverter threshold level (Fig. 4)		typ.	1,8 V
Noise insertion level (Fig. 4)		typ.	3,8 V
External video switch (VCR) switches off the output at:	V_{14-13}	<	1,1 V

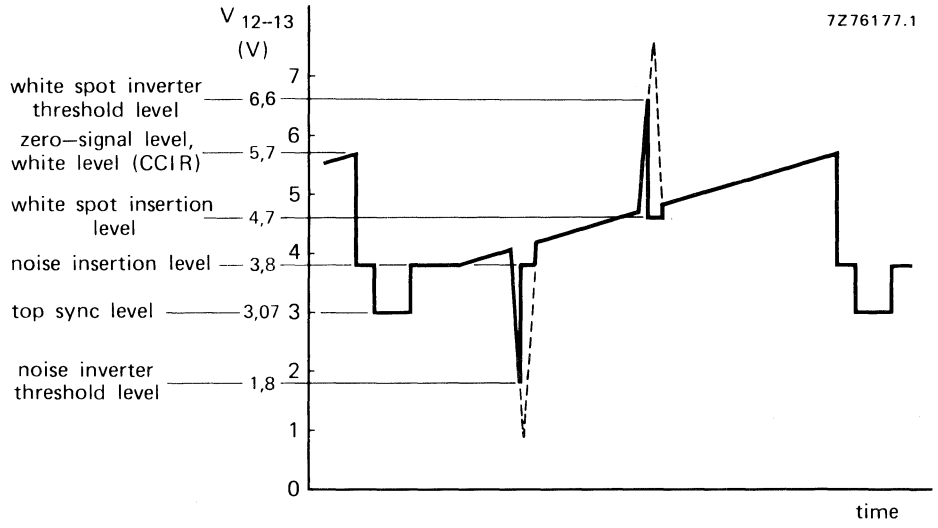


Fig. 4 Video output waveform showing white spot and noise inverter threshold levels.

Tuner a.g.c. output current range	I_4		10 to 0 mA
Tuner a.g.c. output voltage at I_4 = 10 mA	V_{4-13}	<	0,3 V
Tuner a.g.c. output leakage current V_{14-13} = 5 V; V_{4-13} = 12 V	I_4	<	15 μA
Maximum a.f.c. output voltage swing	ΔV_{5-13}	> typ.	10 V 11 V
Detuning for a.f.c. output voltage swing of 10 V	Δf	typ. <	100 kHz 200 kHz
A.F.C. zero-signal output voltage (minimum gain)	V_{5-13}	typ. 	6 V 4 to 8 V
A.F.C. switches on at:	V_{6-13}	>	3,2 V
A.F.C. switches off at:	V_{6-13}	<	1,5 V

APPLICATION INFORMATION

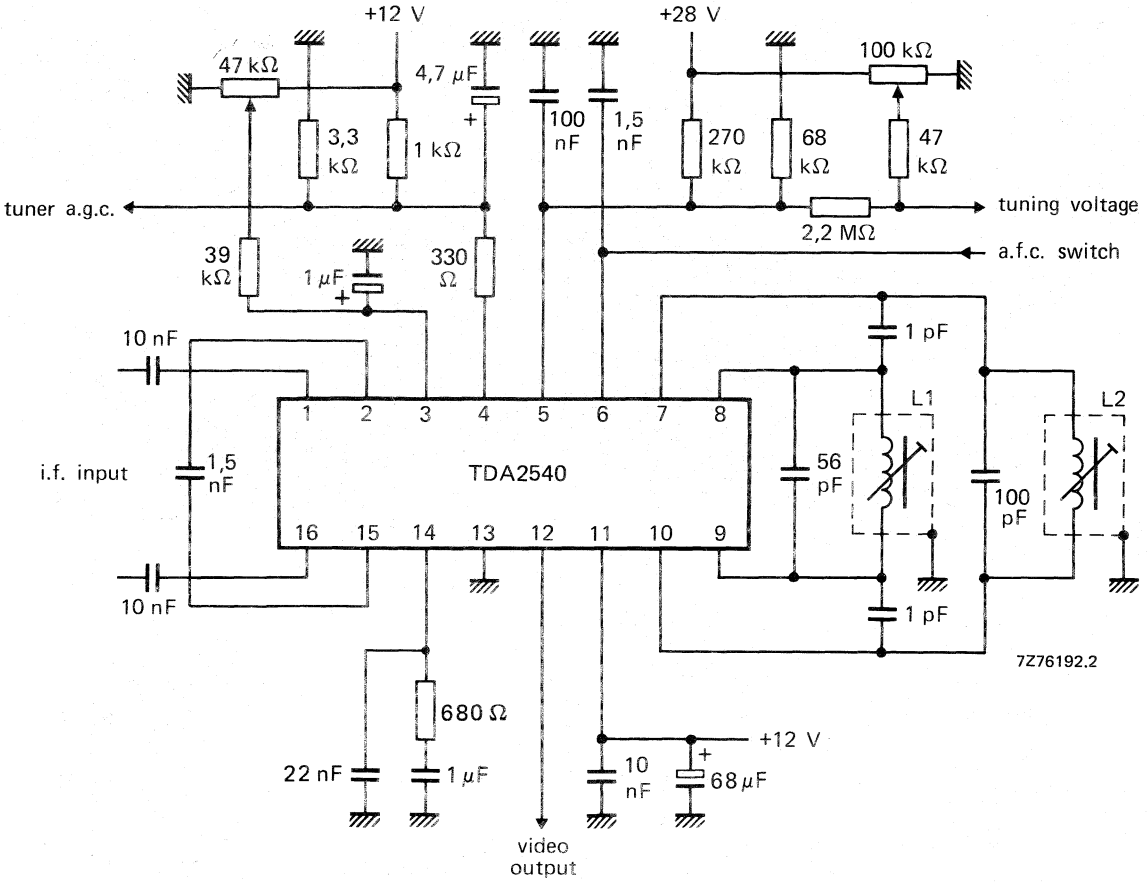


Fig. 5 Typical application circuit diagram; Q of L1 and L2 ≈ 80; f = 38,9 MHz.

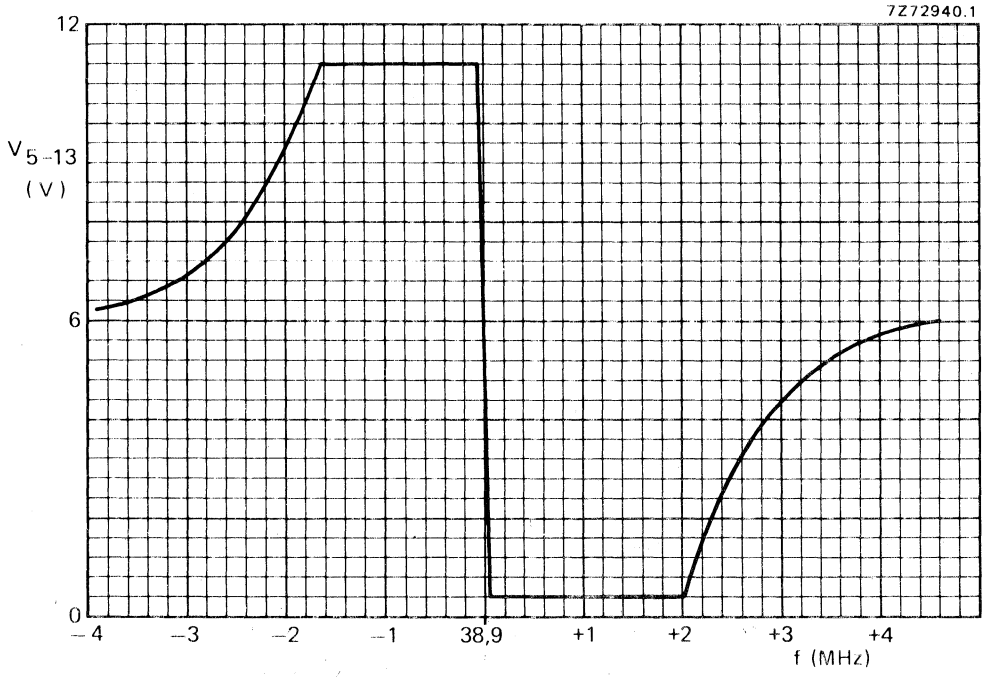


Fig. 6 A.F.C. output voltage (V_{5-13}) as a function of the frequency.

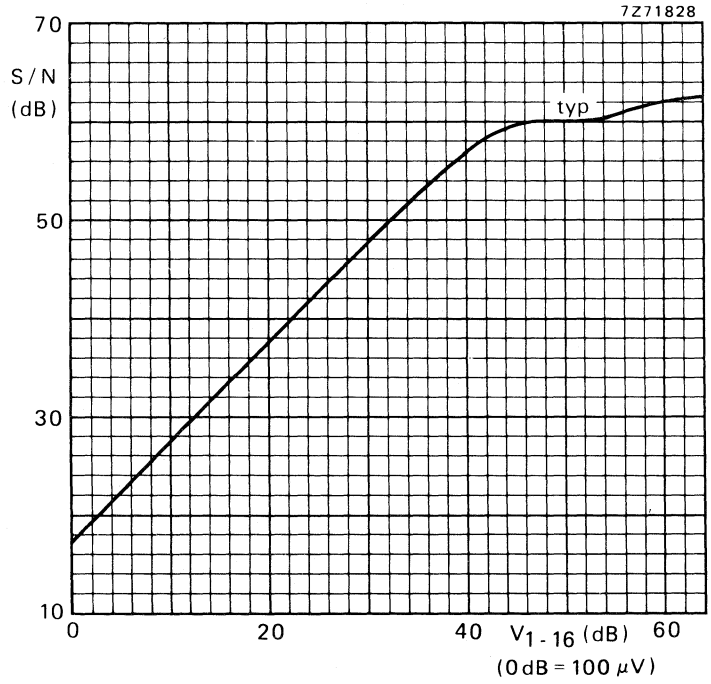


Fig. 7 Signal-to-noise ratio as a function of the input voltage (V_{1-16}).

TELEVISION I.F. AMPLIFIER AND DEMODULATOR

The TDA2541 is an i.f. amplifier and demodulator circuit for colour and black and white television receivers using p-n-p tuners.
It incorporates the following functions:

- gain-controlled wide-band amplifier, providing complete i.f. gain
- synchronous demodulator
- white spot inverter
- video preamplifier with noise protection
- a.f.c. circuit which can be switched on/off by a d.c. level, e.g. during tuning
- a.g.c. circuit with noise gating
- tuner a.g.c. output (p-n-p tuners)
- VCR switch, which switches off the video output; e.g. for insertion of a VCR playback signal.

QUICK REFERENCE DATA

Supply voltage	V_{11-13}	typ.	12 V
Supply current	I_{11}	typ.	50 mA
I.F. input voltage at f = 38,9 MHz (r.m.s. value)	$V_{1-16(rms)}$	typ.	100 μV
Video output voltage (white at 10% of top sync)	$V_{12(p-p)}$	typ.	2,7 V
I.F. voltage gain control range	G_v	typ.	64 dB
Signal-to-noise ratio at V_i = 10 mV	S/N	typ.	58 dB
A.F.C. output voltage swing for Δf = 100 kHz	ΔV_{5-13}	typ.	10 V

PACKAGE OUTLINES

TDA2541 : 16-lead DIL; plastic (SOT-38).
TDA2541Q: 16-lead QIL; plastic (SOT-58).

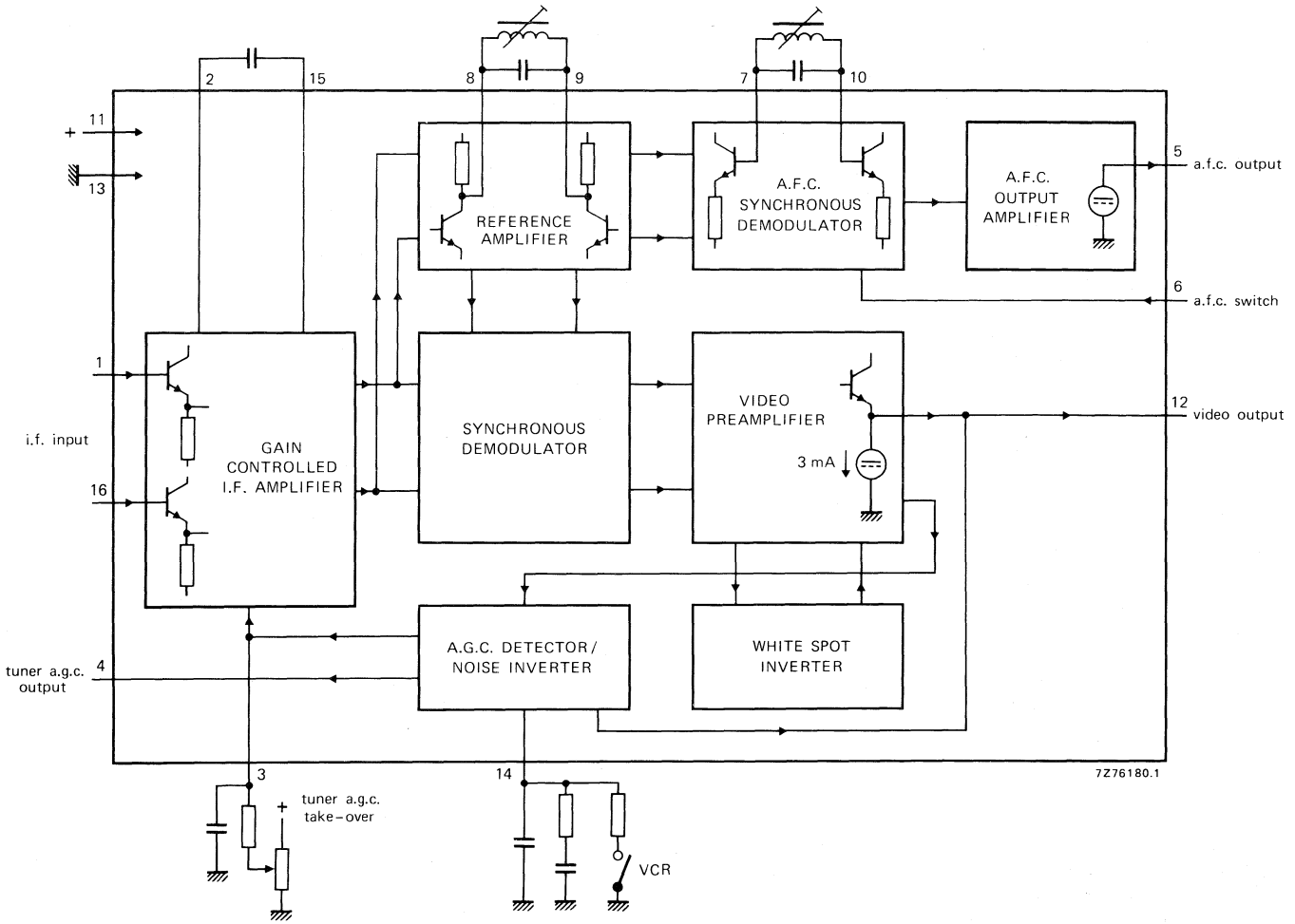


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage	V_{11-13}	max.	13,2	V
Tuner a.g.c. voltage	V_{4-13}	max.	12	V
Total power dissipation	P_{tot}	max.	900	mW
Storage temperature	T_{stg}		−55 to + 125	°C
Operating ambient temperature	T_{amb}		−25 to + 60	°C

CHARACTERISTICS (measured in Fig. 5)

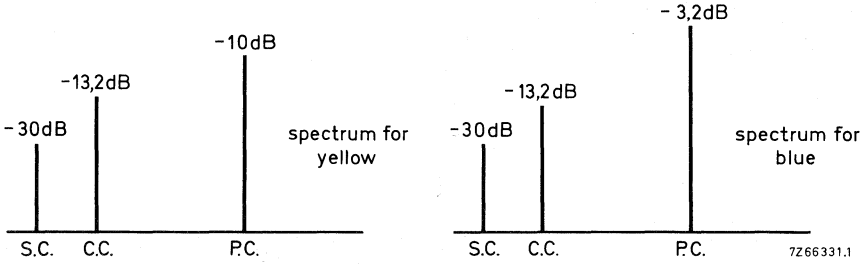
Supply voltage range	V_{11-13}	typ.	12	V
			10,2 to 13,2	V
The following characteristics are measured at T_{amb} = 25 °C; V_{11-13} = 12 V; f = 38,9 MHz				
I.F. input voltage for onset of a.g.c. (r.m.s. value)	$V_{1-16(rms)}$	typ.	100	μV
		<	150	μV
Differential input impedance	$\lvert Z_{1-16} \rvert$	typ.	2 kΩ in parallel with 2 pF	
Zero-signal output level variation	V_{12-13}	typ.	5,95	V*
			± 0,35	V
Top sync output level	V_{12-13}	typ.	3,00	V
			2,85 to 3,15	V
I.F. voltage gain control range	G_v	typ.	64	dB
Bandwidth of video amplifier (3 dB)	B	typ.	6	MHz
Signal-to-noise ratio at V_i = 10 mV	S/N	typ.	58	dB**
Differential gain	dG	typ.	4	%
		<	10	%
Differential phase	$d\varphi$	typ.	2°	
		<	10°	

* So-called 'projected zero point', e.g. with switched demodulator.

** $$S/N = \frac{V_o \text{ black-to-white}}{V_{n(rms)} \text{ at } B = 5 \text{ MHz}}.$$

CHARACTERISTICS (continued)

Intermodulation at 1,1 MHz: blue*	>	46 dB
	typ.	60 dB
yellow*	>	46 dB
	typ.	50 dB
at 3,3 MHz**	>	46 dB
	typ.	54 dB



S.C. : sound carrier level
C.C. : chrominance carrier level
P.C. : picture carrier level
} with respect to top sync level

Fig. 2 Input conditions for intermodulation measurements; standard colour bar with 75% contrast.

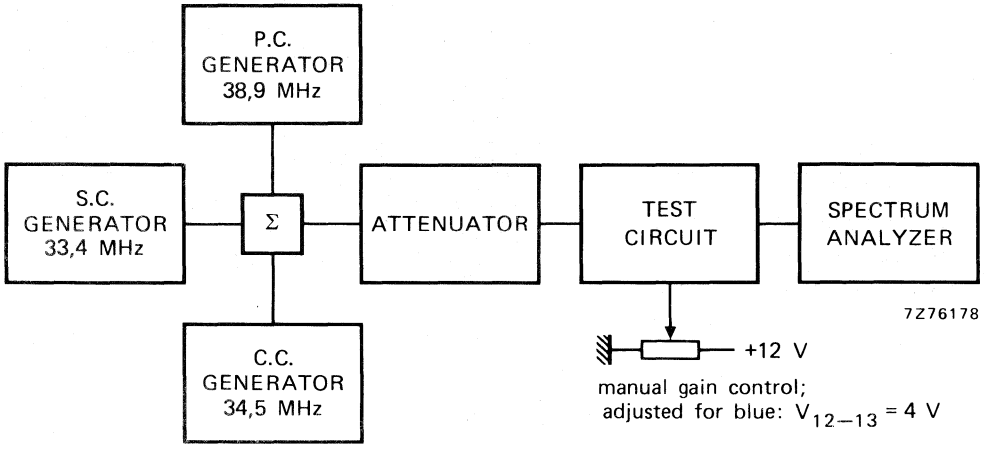


Fig. 3 Test set-up for intermodulation.

* $20 \log \frac{V_o \text{ at } 4{,}4 \text{ MHz}}{V_o \text{ at } 1{,}1 \text{ MHz}} + 3{,}6$ dB.

** $20 \log \frac{V_o \text{ at } 4{,}4 \text{ MHz}}{V_o \text{ at } 3{,}3 \text{ MHz}}$

Carrier signal at video output		typ. 	4 mV 30 mV
2nd harmonic of carrier at video output		typ. 	20 mV 30 mV
White spot inverter threshold level (Fig. 4)		typ.	6,6 V
White spot insertion level (Fig. 4)		typ.	4,7 V
Noise inverter threshold level (Fig. 4)		typ.	1,8 V
Noise insertion level (Fig. 4)		typ.	3,8 V
External video switch (VCR) switches off the output at:	V_{14-13}	<	1,1 V

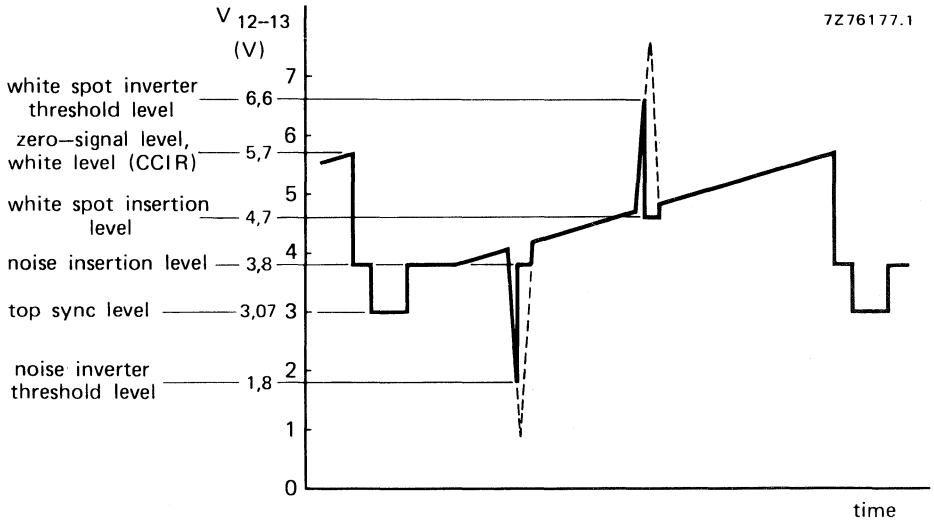


Fig. 4 Video output waveform showing white spot and noise inverter threshold levels.

Tuner a.g.c. output current range	I_4		0 to 10 mA
Tuner a.g.c. output voltage at I_4 = 10 mA	V_{4-13}	<	0,3 V
Tuner a.g.c. output leakage current V_{14-13} = 11 V; V_{4-13} = 12 V	I_4	<	15 μA
Maximum a.f.c. output voltage swing	ΔV_{5-13}	> typ.	10 V 11 V
Detuning for a.f.c. output voltage swing of 10 V	Δf	typ. <	100 kHz 200 kHz
A.F.C. zero-signal output voltage (minimum gain)	V_{5-13}	typ. 	6 V 4 to 8 V
A.F.C. switches on at:	V_{6-13}	>	3,2 V
A.F.C. switches off at:	V_{6-13}	<	1,5 V

APPLICATION INFORMATION

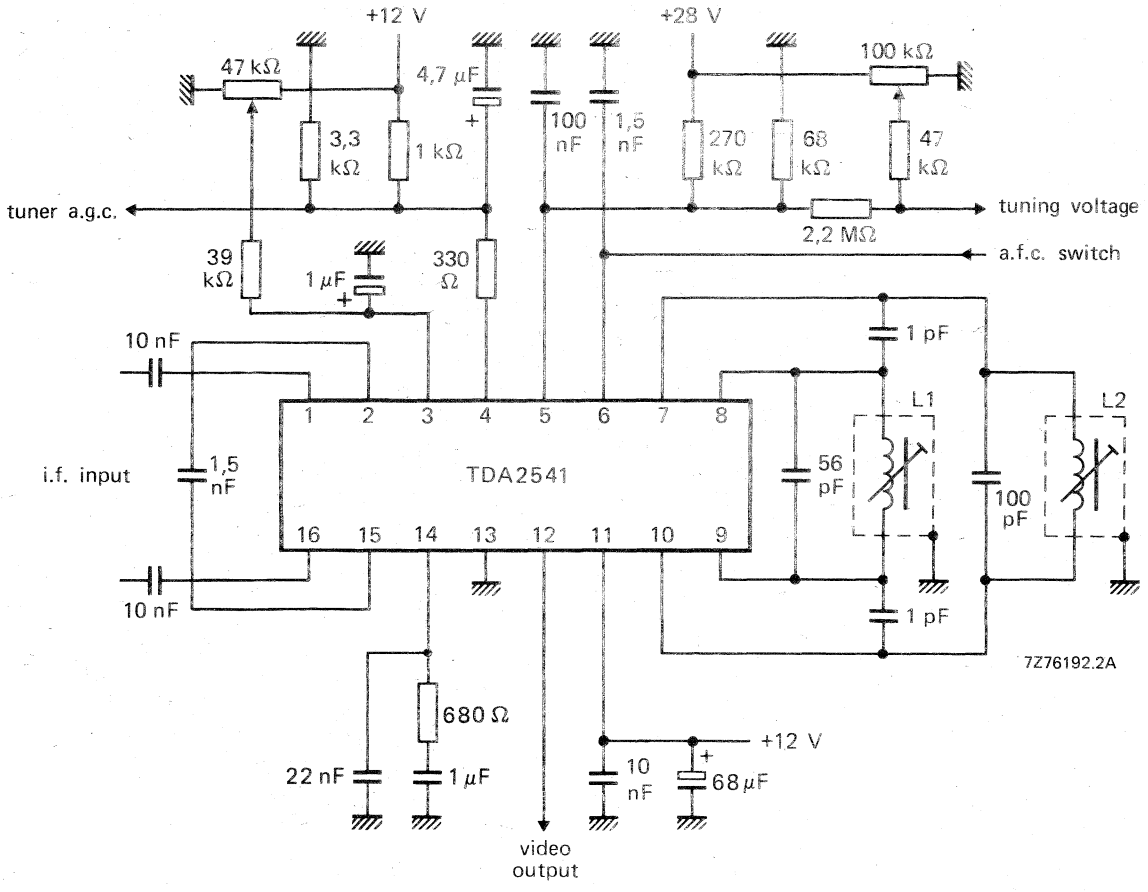
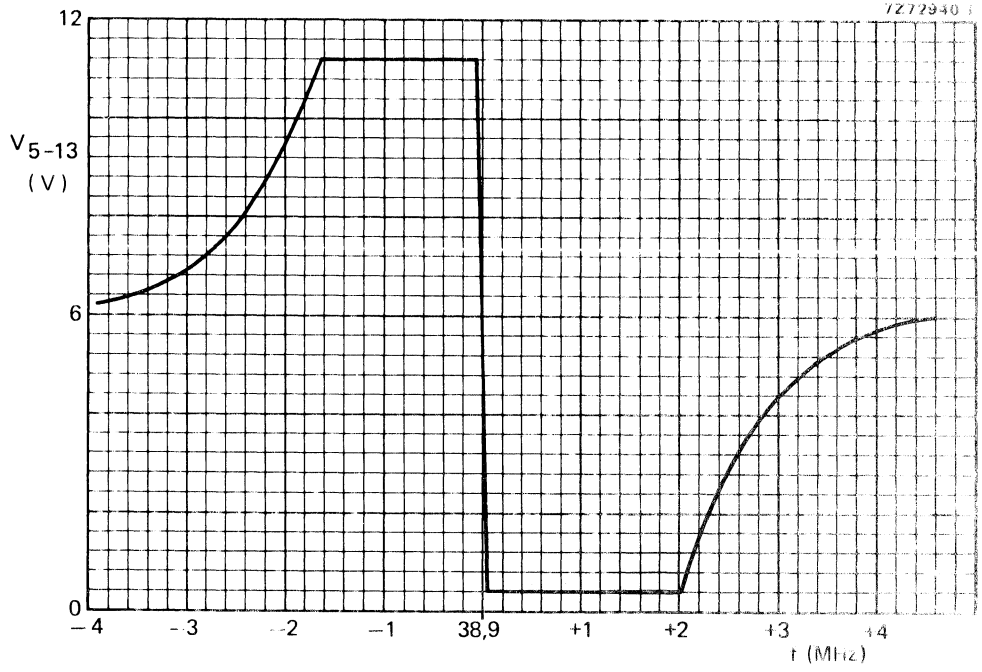


Fig. 5 Typical application circuit diagram; Q of L1 and L2 ≈ 80; f_o = 38,9 MHz.



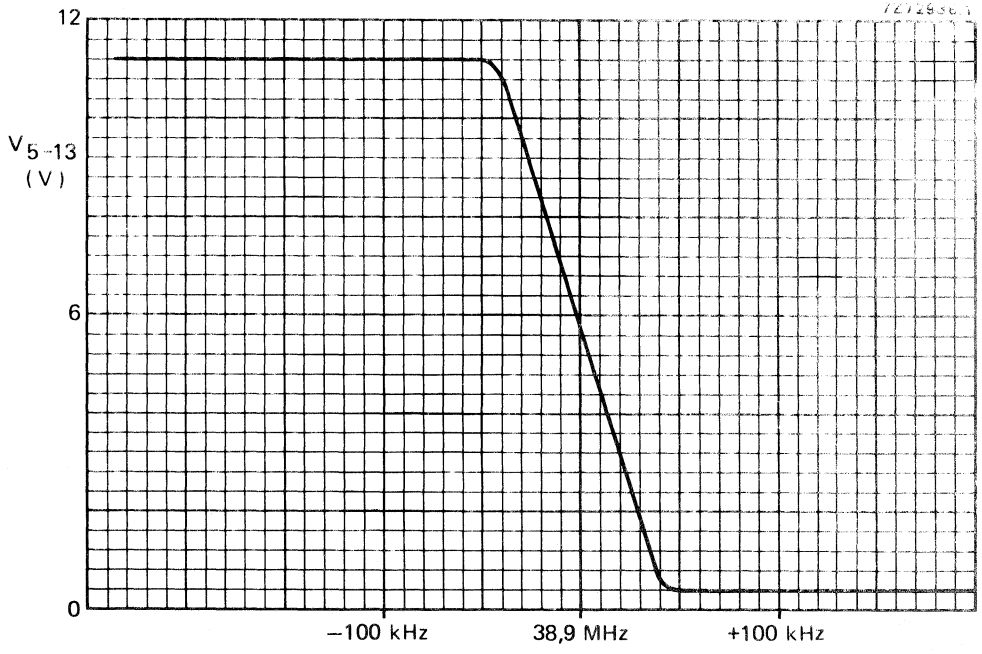


Fig. 6 A.F.C. output voltage (V_{5-13}) as a function of the frequency.

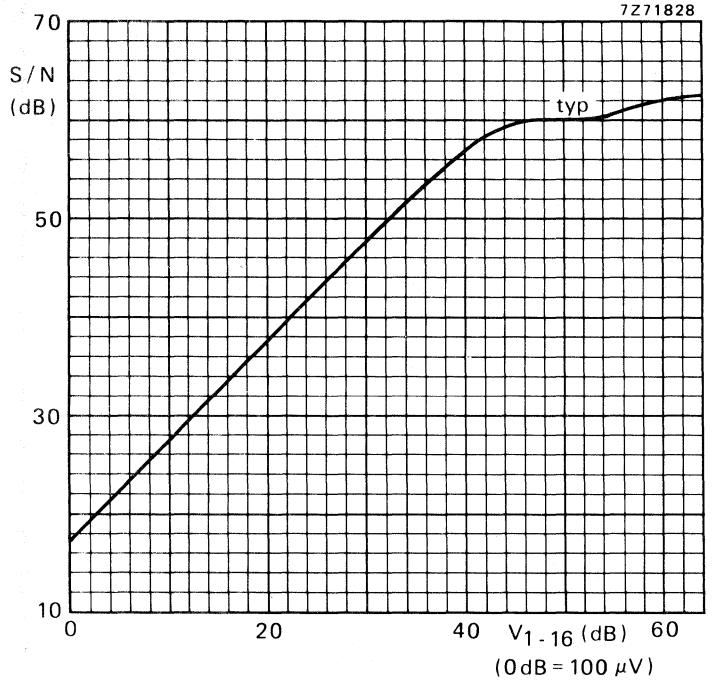


Fig. 7 Signal-to-noise ratio as a function of the input voltage (V_{1-16}).

TELEVISION I.F. AMPLIFIER AND DEMODULATOR

The TDA2542 is an i.f. amplifier and demodulator circuit for E and L standards in colour and black and white television receivers using p-n-p tuners.
It incorporates the following functions:

- gain-controlled wide-band amplifier, providing complete i.f. gain
- synchronous demodulator
- video preamplifier
- a.f.c. circuit which can be switched on/off by a d.c. level, e.g. during tuning
- a.g.c. circuit
- tuner a.g.c. output (p-n-p tuners)

QUICK REFERENCE DATA

Supply voltage	$V_{11\text{-}13}$	typ.	12 V
Supply current	I_{11}	typ.	50 mA
I.F. input voltage at f = 32,7 MHz (r.m.s. value)	$V_{1\text{-}16(rms)}$	typ.	100 μV
Video output voltage (peak-to-peak value)	$V_{12(p\text{-}p)}$	typ.	3 V
I.F. voltage gain control range	G_v	typ.	64 dB
Signal-to-noise ratio at V_i = 10 mV	S/N	typ.	58 dB
A.F.C. output voltage swing for Δf = 100 kHz	$\Delta V_{5\text{-}13}$	typ.	10 V

PACKAGE OUTLINES

TDA2542 : 16-lead DIL; plastic (SOT-38).
TDA2542Q: 16-lead QIL; plastic (SOT-58).

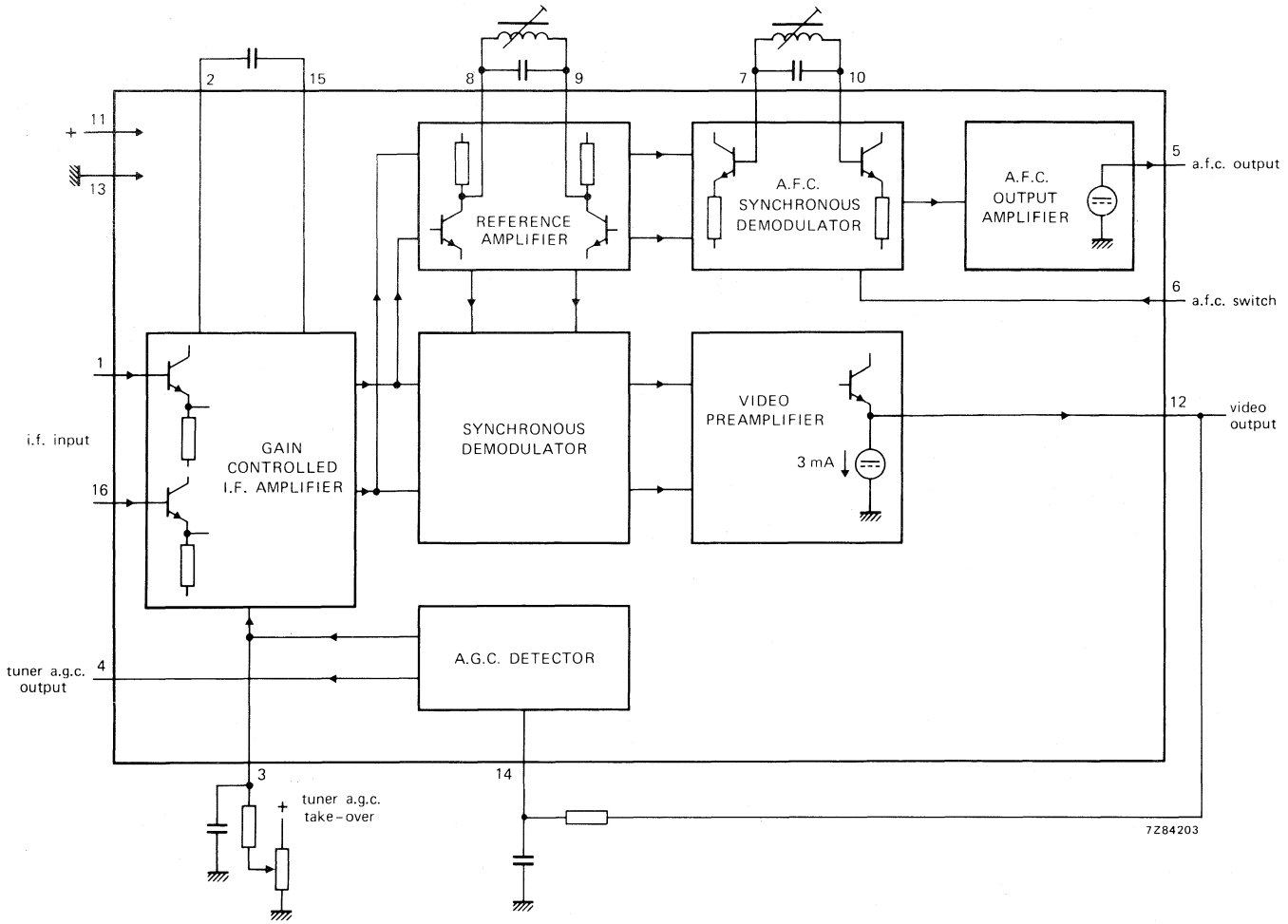


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage	$V_{11\text{-}13}$	max.	13,8	V
Tuner a.g.c. voltage	$V_{4\text{-}13}$	max.	12	V
Total power dissipation	P_{tot}	max.	900	mW
Storage temperature	T_{stg}		−55 to + 125	°C
Operating ambient temperature	T_{amb}		−25 to + 60	°C

CHARACTERISTICS (measured in Fig. 2)

Supply voltage range	$V_{11\text{-}13}$	typ.	12	V
			10,2 to 13,8	V

The following characteristics are measured at T_{amb} = 25 °C; $V_{11\text{-}13}$ = 12 V; f = 32,7 MHz

I.F. input voltage for onset of a.g.c. (r.m.s. value)	$V_{1\text{-}16(rms)}$	typ.	100	μV
		<	150	μV
Differential input impedance	$\lvert Z_{1\text{-}16} \rvert$	typ.	2 kΩ in parallel with 2 pF	
Zero-signal output level	$V_{12\text{-}13}$	typ.	2,9	V
Maximum video output voltage (peak-to-peak value)	$V_{12(p\text{-}p)}$	>	4	V
Video output voltage variation at 50 dB input voltage variation	$\Delta V_{12\text{-}13}$	<	0,5	dB
I.F. voltage gain control range	G_v	typ.	64	dB
Bandwidth of video amplifier (3 dB)	B	typ.	6	MHz
Signal-to-noise ratio at V_i = 10 mV	S/N	typ.	58	dB*
Differential gain	dG	typ.	4	%
		<	10	%
Differential phase	dφ	typ.	2°	
		<	10°	

* $S/N = \dfrac{V_o \text{ black-to-white}}{V_{n(rms)} \text{ at } B = 5 \text{ MHz}}$.

CHARACTERISTICS (continued)

Carrier signal at video output		typ. <	4 mV 30 mV
2nd harmonic of carrier at video output		typ. <	20 mV 30 mV
Tuner a.g.c. output current range	I_4		0 to 10 mA
Tuner a.g.c. output voltage at I_4 = 10 mA	V_{4-13}	<	0,3 V
Tuner a.g.c. output leakage current V_{14-13} = 3 V; V_{4-13} = 12 V	I_4	<	15 μA
Maximum a.f.c. output voltage swing	ΔV_{5-13}	> typ.	10 V 11 V
Detuning for a.f.c. output voltage swing of 10 V	Δf	typ. <	100 kHz 200 kHz
A.F.C. switches on at:	V_{6-13}	>	3,2 V
A.F.C. switches off at:	V_{6-13}	<	1,5 V
A.G.C. detector reference voltage	V_{14-13}	typ.	3,9 V

APPLICATION INFORMATION

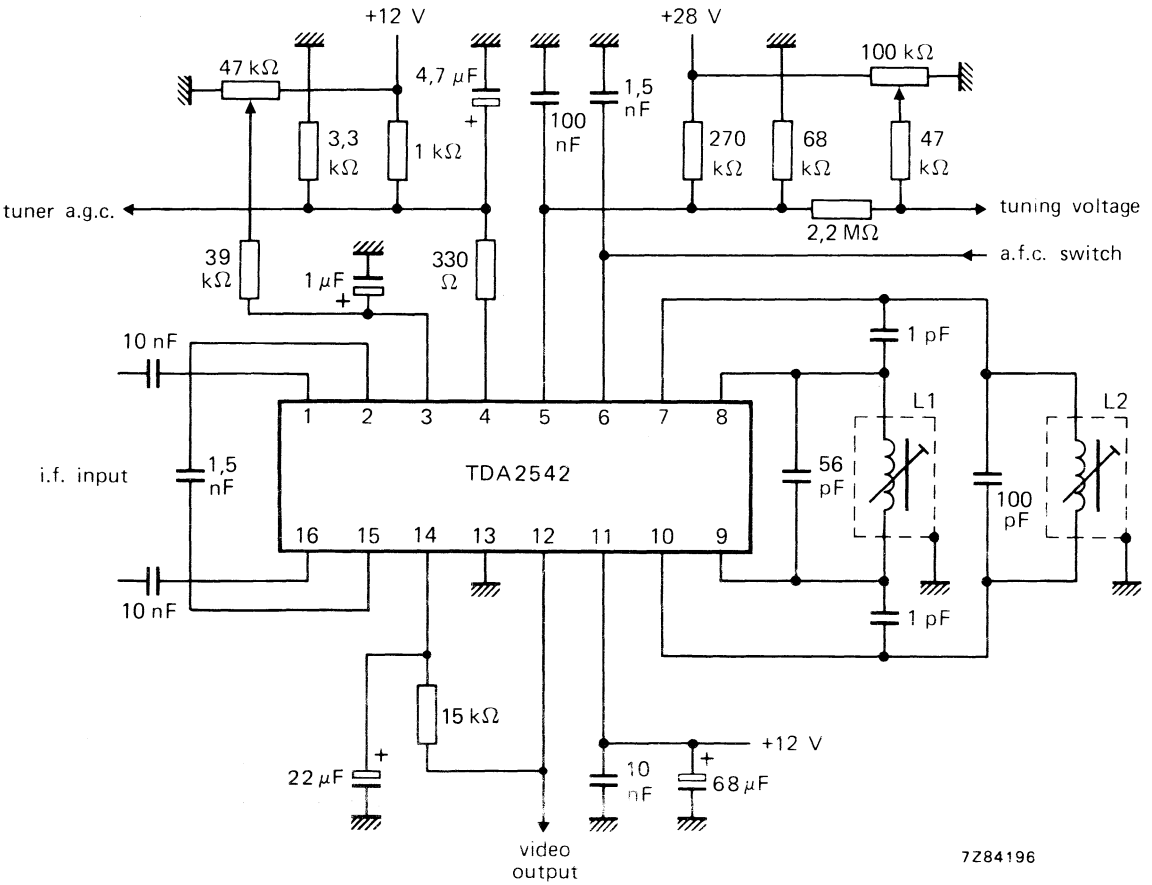
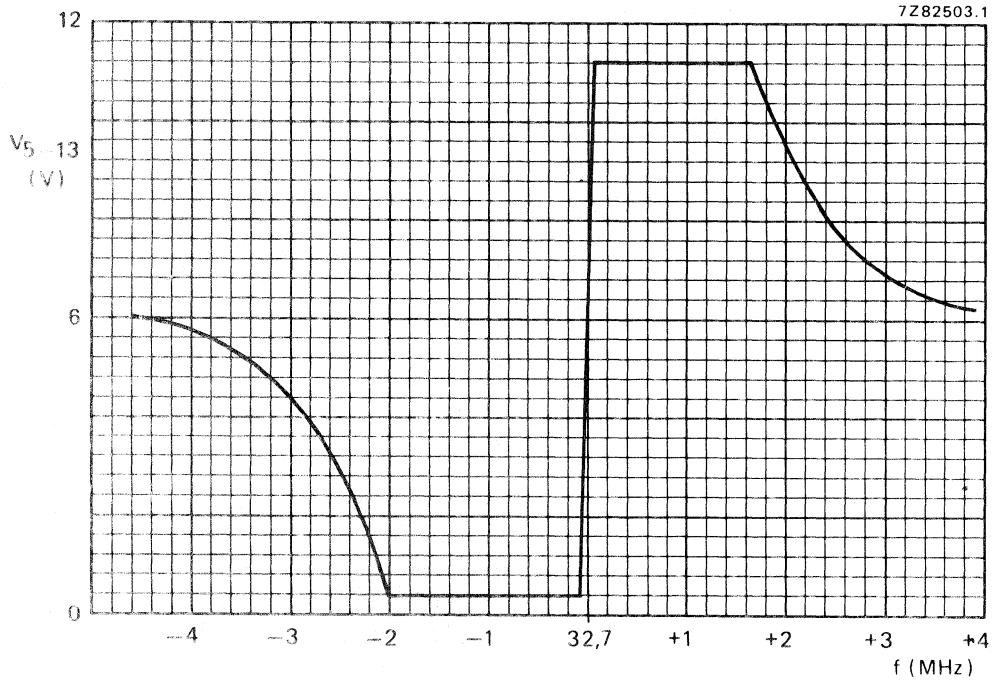


Fig. 2 Typical application circuit diagram; Q of L1 and L2 ≈ 80; f = 32,7 MHz.



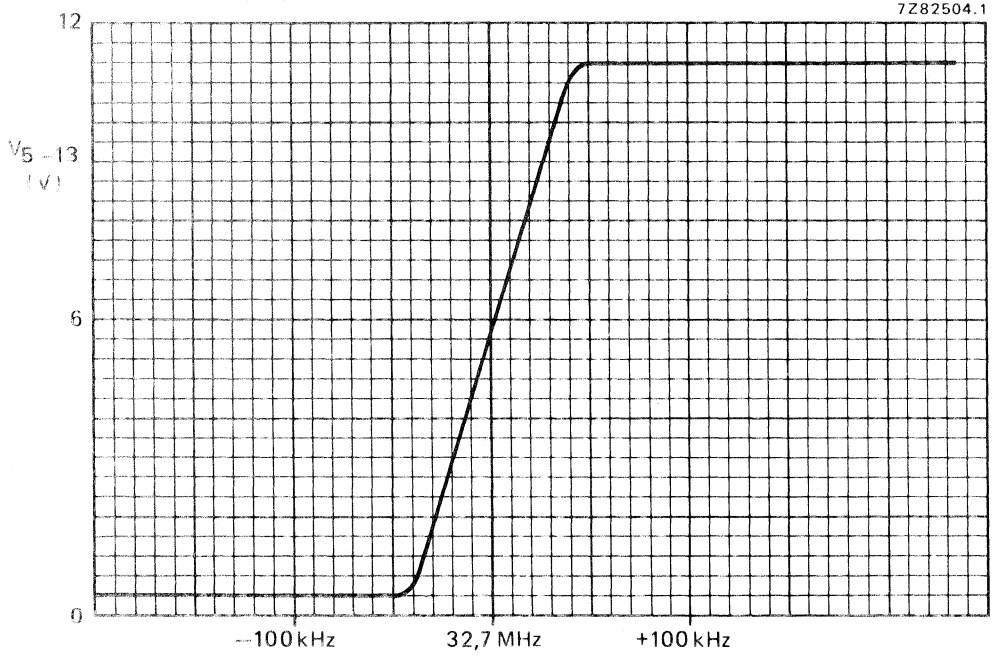


Fig. 3 A.F.C. output voltage (V_{5-13}) as a function of the frequency.

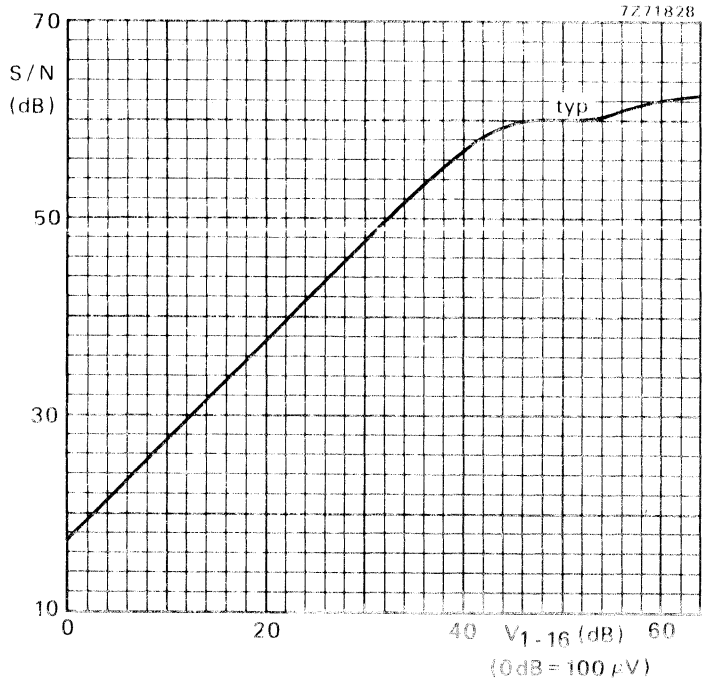


Fig. 4 Signal-to-noise ratio as a function of the input voltage (V_{1-16}).

AM SOUND I.F. CIRCUIT FOR FRENCH STANDARD

GENERAL DESCRIPTION

The TDA2543 is a monolithic integrated AM sound i.f. circuit in television receivers for the French standards L and L'.

The circuit incorporates the following functions:

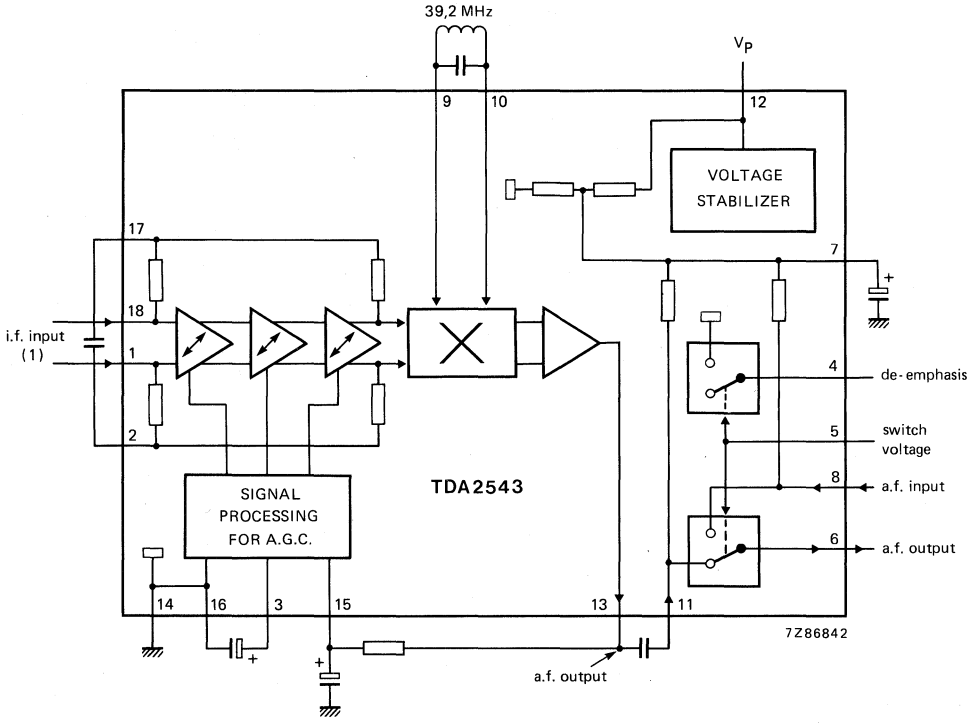
- 3-stage gain controlled i.f. amplifier, providing complete i.f. gain
- Synchronous AM demodulator
- A.G.C. circuit
- Audio input circuit with two external audio inputs and switching facilities to provide for either the demodulated i.f. or an external signal output
- Demodulated i.f. output is available from the input of the switching circuit

QUICK REFERENCE DATA

Supply voltage (pin 12)	$V_{12\text{-}14} = V_P$	typ.	12 V
Minimum i.f. vision carrier input voltage (r.m.s. value) for an output signal $V_{13\text{-}14(rms)} = 480$ mV	$V_{VC1\text{-}18(rms)}$	max.	30 μV
I.F. control range	ΔG_v	min.	60 dB
A.F. output voltage (r.m.s. value)	$V_{13\text{-}14(rms)}$	typ.	680 mV
Distortion at $V_{VC1\text{-}18(rms)} = 5$ mV	d_{tot}	max.	1 %
Signal-to-weighted-noise ratio according to CCIR 468	S + N/N	min.	50 dB
Maximum signal amplitude for the a.f. switch (r.m.s. value)	$V_{8;11\text{-}14(rms)}$	min.	2 V

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102CS).



(1) I.F. signal: vision carrier (V.C.) and sound carrier (S.C.).

Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage range (pin 12)	$V_{12-14} = V_P$	max.	13,2 V
Switch voltage (pin 5)	V_{5-14}	max.	V_P V
Current at pin 4	I_4	max.	5 mA
	$-I_4$		short-circuit proof
Storage temperature range	T_{stg}		−25 to +150 °C
→ Operating ambient temperature range	T_{amb}		0 to + 70 °C

CHARACTERISTICS

V_P = 12 V; T_{amb} = 25 °C; input signal (vision carrier V.C.) with f_{VC} = 39,2 MHz; sound carrier (S.C.) modulated with f_m = 1 kHz and m = 0,8; measured in Fig. 2; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply					
Supply voltage range (pin 12)	V_P	10,8	–	13,2	V
Supply current (pin 12)	I_P	–	50	–	mA
I.F. input (pins 1 and 18)					
Minimum i.f. vision carrier input voltage (r.m.s. value) for an output signal $V_{13\text{-}14(rms)}$ = 480 mV	$V_{VC1\text{-}18(rms)}$	–	–	30	μV
Maximum i.f. vision carrier input voltage (r.m.s. value)	$V_{VC1\text{-}18(rms)}$	–	50	–	mV
Input resistance	$R_{1\text{-}18}$	–	2	–	kΩ
Input capacitance	$C_{1\text{-}18}$	–	2	–	pF
I.F. control range (–3 dB)	ΔG_v	60	–	–	dB
A.F. output (pin 13)					
A.F. output voltage (r.m.s. value) at $V_{VC1\text{-}18(rms)}$ = 5 mV	$V_{13\text{-}14(rms)}$	–	680	–	mV
Output resistance	$R_{13\text{-}14}$	–	100	–	Ω
Distortion at $V_{VC1\text{-}18(rms)}$ = 5 mV	d_{tot}	–	–	1	%
Signal-to-weighted-noise ratio at a.f. output (pin 13) according to CCIR 468 at $V_{VC1\text{-}18(rms)}$ = 5 mV	S + N/N	50	–	–	dB
A.F. switch (pins 8, 11 and 6)					
Maximum input voltage (r.m.s. value)	$V_{8\text{-}14(rms)}$	2	–	–	V
	$V_{11\text{-}14(rms)}$	2	–	–	V
Voltage gain	G_v	–	0 ± 1	–	dB
Amplitude frequency response (–3 dB)	f	20	–	20 000	Hz
Crosstalk between the non-switched input and the output	α	60	–	–	dB
Input resistance	$R_{8;\ 11\text{-}14}$	10	–	–	kΩ
Output resistance	$R_{6\text{-}14}$	–	400	–	Ω
De-emphasis switch (pin 4)					
Input resistance for:					
ON ($V_{5\text{-}14} > 3$ V)	$R_{4\text{-}14}$	–	–	200	Ω
OFF ($V_{5\text{-}14} < 1$ V)	$R_{4\text{-}14}$	100	–	–	kΩ
Switch voltage (pin 5)					
A.F. switch ON (pin 8 switched)	$V_{5\text{-}14}$	3	–	V_P	V
A.F. switch OFF (pin 11 switched)	$V_{5\text{-}14}$	0	–	1	V

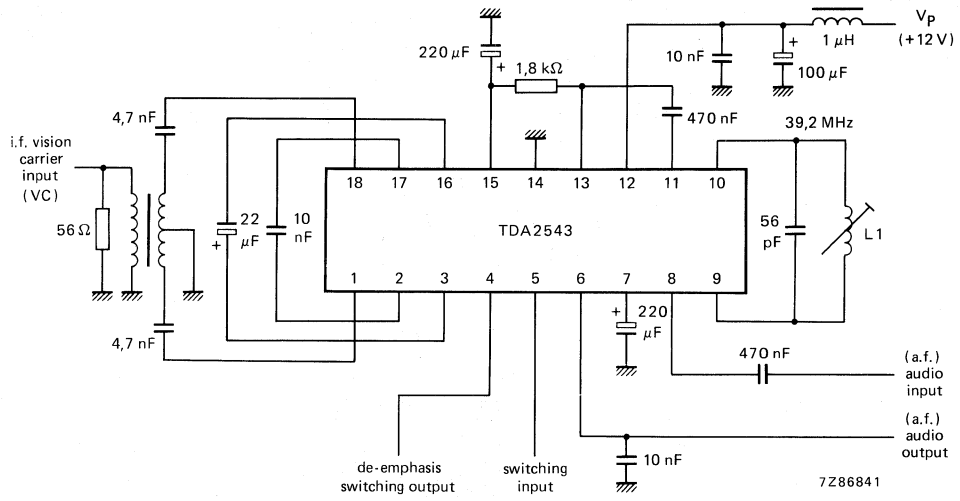


Fig. 2 Measuring circuit; L1 adjusted to minimum distortion at the a.f. output.

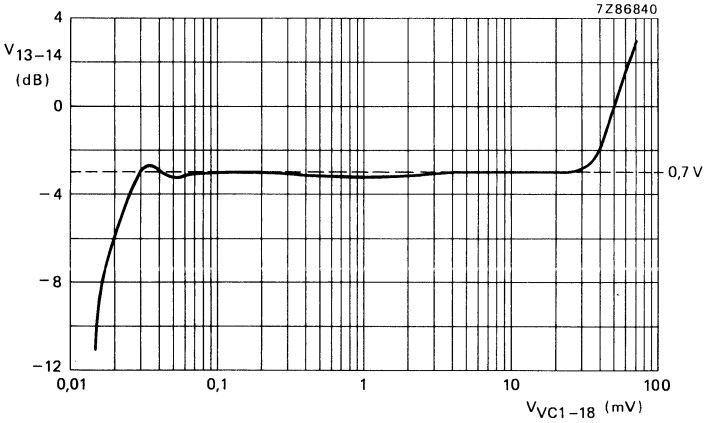


Fig. 3 Control curve of the i.f. amplifier; the r.m.s. a.f. output voltage at pin 13 ($V_{13\text{-}14(rms)}$) as a function of the r.m.s. i.f. vision carrier input voltage ($V_{VC1\text{-}18(rms)}$) at f_m = 1 kHz and m = 0,8.

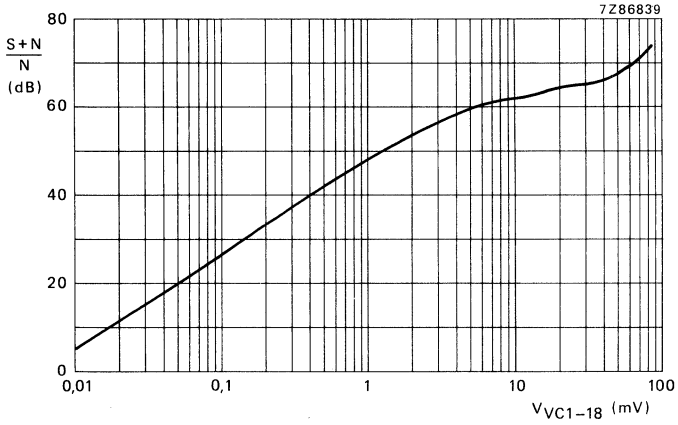


Fig. 4 Signal-to-weighted-noise ratio (S + N/N) at the output (pin 13) as a function of the r.m.s. i.f. vision carrier input voltage ($V_{VC1\text{-}18(rms)}$).

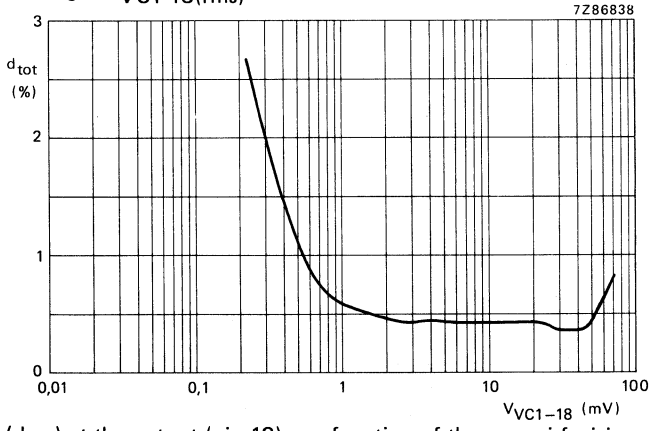


Fig. 5 Distortion (d_{tot}) at the output (pin 13) as a function of the r.m.s. i.f. vision carrier input voltage ($V_{VC1\text{-}18(rms)}$) at f_m = 1 kHz and m = 0,8.

TELEVISION I.F. AMPLIFIER AND DEMODULATOR

The TDA2544 is an i.f. amplifier and demodulator circuit for colour and black and white television receivers.
It incorporates the following functions:

- gain-controlled wide-band amplifier, providing complete i.f. gain
- low-level synchronous demodulator
- white spot inverter
- video preamplifier with noise protection
- a.f.c. circuit with balanced output
- a.g.c. circuit with noise gating
- tuner a.g.c. output for control of MOS tuners
- external video switch

QUICK REFERENCE DATA

Supply voltage	V_{11-13}	typ.	12 V
Supply current	I_{11}	typ.	50 mA
I.F. input sensitivity at f = 45,75 MHz (r.m.s. value)	$V_{1-16(rms)}$	typ.	150 μV
Video output voltage (white at 12,5% of top sync)	$V_{12(p-p)}$	typ.	2,6 V
I.F. voltage gain control range	G_v	typ.	63 dB
Signal-to-noise ratio V_i = 10 mV	S/N	typ.	58 dB
A.F.C. sensitivity		typ.	80 mV/kHz

PACKAGE OUTLINES

TDA2544 16-lead DIL; plastic (SOT-38).
TDA2544Q: 16-lead QIL; plastic (SOT-58).

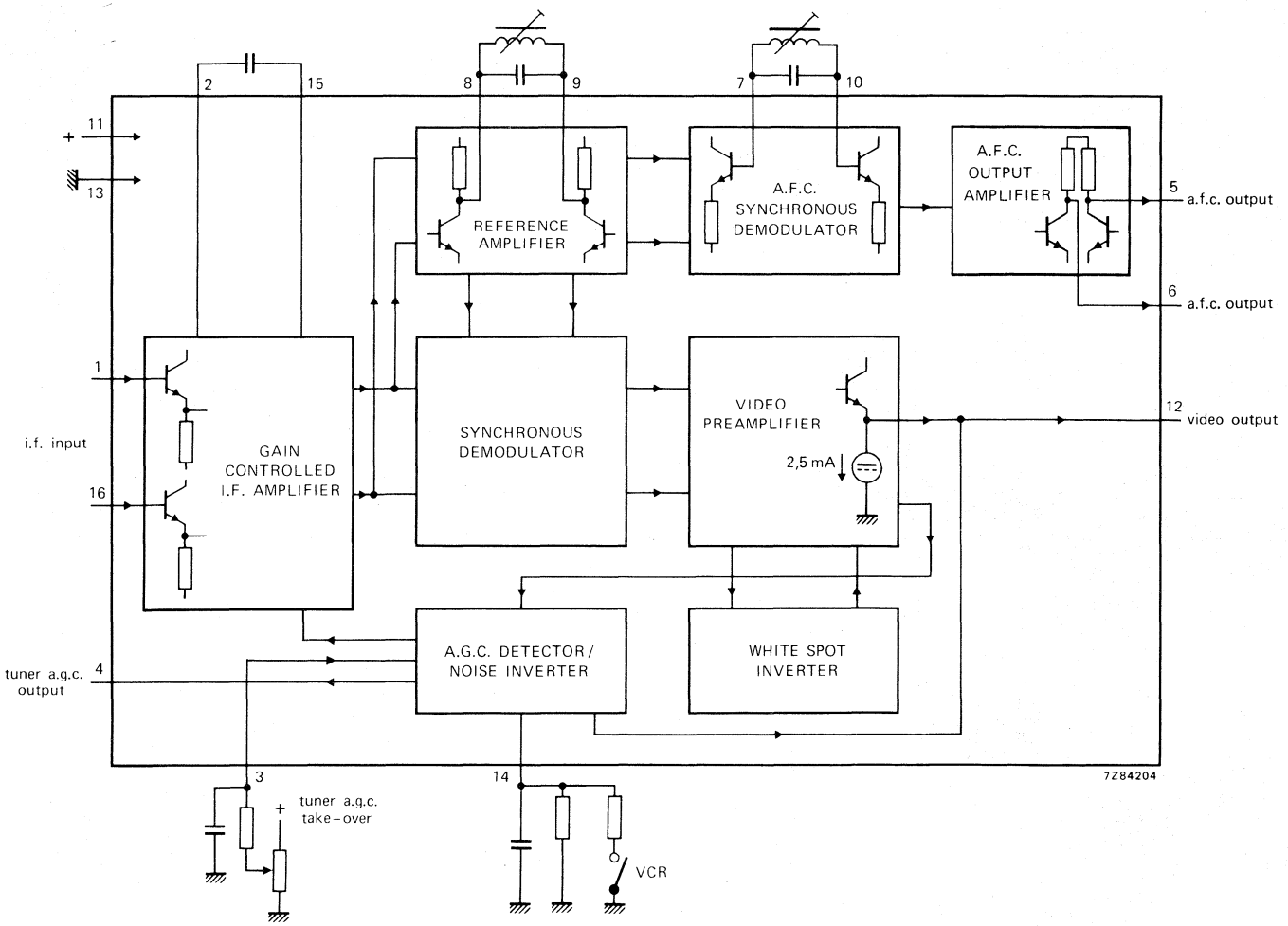


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage	$V_{11\text{-}13}$	max. 13,8	V
Tuner a.g.c. voltage	$V_{4\text{-}13}$	max. 12	V
Total power dissipation	P_{tot}	max. 1,2	W
Storage temperature	T_{stg}	−55 to + 125	°C
Operating ambient temperature	T_{amb}	−25 to + 65	°C

CHARACTERISTICS (measured in Fig. 5)

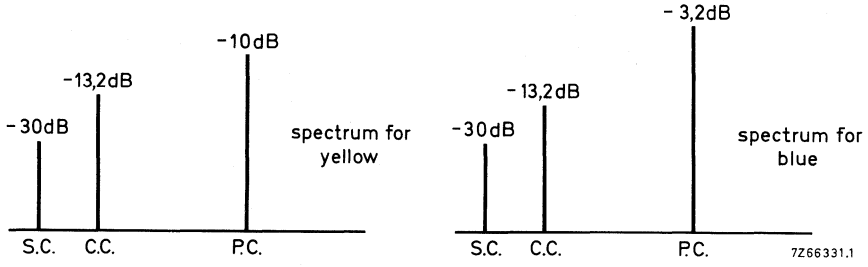
Supply voltage range	$V_{11\text{-}13}$	typ. 12 10,2 to 13,8	V V
The following characteristics are measured at T_{amb} = 25 °C; $V_{11\text{-}13}$ = 12 V			
I.F. input voltage for onset of a.g.c. (r.m.s. value) at f = 45,75 MHz	$V_{1\text{-}16(rms)}$	typ. 150	μV
Differential input impedance	$\lvert Z_{1\text{-}16} \rvert$	typ. 3 kΩ in parallel with 2 pF	
Zero-signal output level	$V_{12\text{-}13}$	typ. 5,5	V*
Top sync output level	$V_{12\text{-}13}$	typ. 2,5	V
I.F. voltage gain control range	G_v	typ. 63	dB
Bandwidth of video amplifier (3 dB)	B	typ. 6	MHz
Signal-to-noise ratio at V_i = 10 mV	S/N	typ. 58	dB**
Differential gain	dG	typ. 4 < 10	% %
Differential phase	dφ	typ. 2° < 10°	

* So-called 'projected zero point', e.g. with switched demodulator.

** $S/N = \dfrac{V_o \text{ black-to-white}}{V_{n(rms)} \text{ at } B = 5 \text{ MHz}}$.

CHARACTERISTICS (continued)

Intermodulation at 0,9 MHz: blue*	typ.	50	dB
yellow*	typ.	46	dB
at 2,6 MHz**	typ.	49	dB



S.C. : sound carrier level
C.C. : chrominance carrier level
P.C. : picture carrier level
} with respect to top sync level

Fig. 2 Input conditions for intermodulation measurements; standard colour bar with 75% contrast.

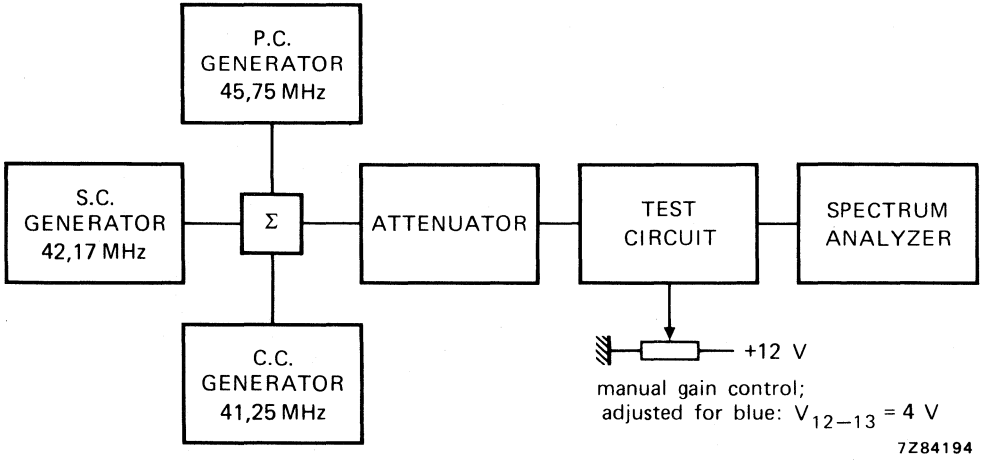


Fig. 3 Test set-up for intermodulation.

* $20 \log \frac{V_o \text{ at } 3{,}6 \text{ MHz}}{V_o \text{ at } 0{,}9 \text{ MHz}} + 3{,}6$ dB. ** $20 \log \frac{V_o \text{ at } 3{,}6 \text{ MHz}}{V_o \text{ at } 2{,}6 \text{ MHz}}$.

Carrier signal at video output		<	30 mV
2nd harmonic of carrier at video output		<	30 mV
White spot inverter threshold level (Fig. 4)		typ.	6,4 V
White spot insertion level (Fig. 4)		typ.	4,1 V
Noise inverter threshold level (Fig. 4)		typ.	1,6 V
Noise insertion level (Fig. 4)		typ.	3,3 V
External video switch (VCR) switches off the output at	V_{14-13}	<	1,0 V

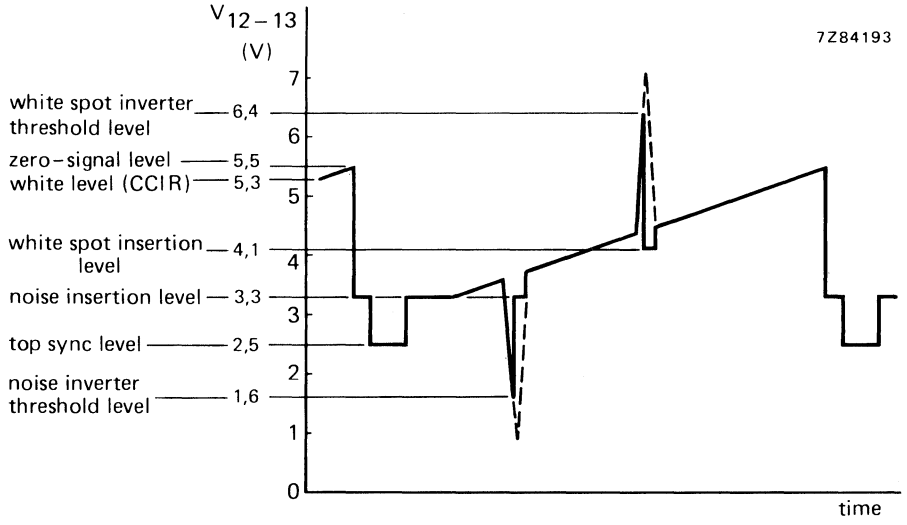


Fig. 4 Video output waveform showing white spot and noise inverter threshold levels.

Tuner a.g.c. output current range	I_4		0 to 0,3 mA
Tuner a.g.c. output voltage at I_4 = 0,3 mA	V_{4-13}	<	0,3 V
Tuner a.g.c. output leakage current V_{14-13} = 3 V; V_{4-13} = 12 V	I_4	<	10 μA
A.F.C. output voltage (d.c. value)	$V_{5;6-13}$	typ.	6,8 V
A.F.C. output offset voltage	$\lvert V_{5-6} \rvert$	<	1,5 V
Maximum a.f.c. output voltage	$V_{5;6-13}$	>	11,6 V
Minimum a.f.c. output voltage	$V_{5;6-13}$	<	2,8 V
A.F.C. sensitivity		typ.	80 mV/kHz

APPLICATION INFORMATION

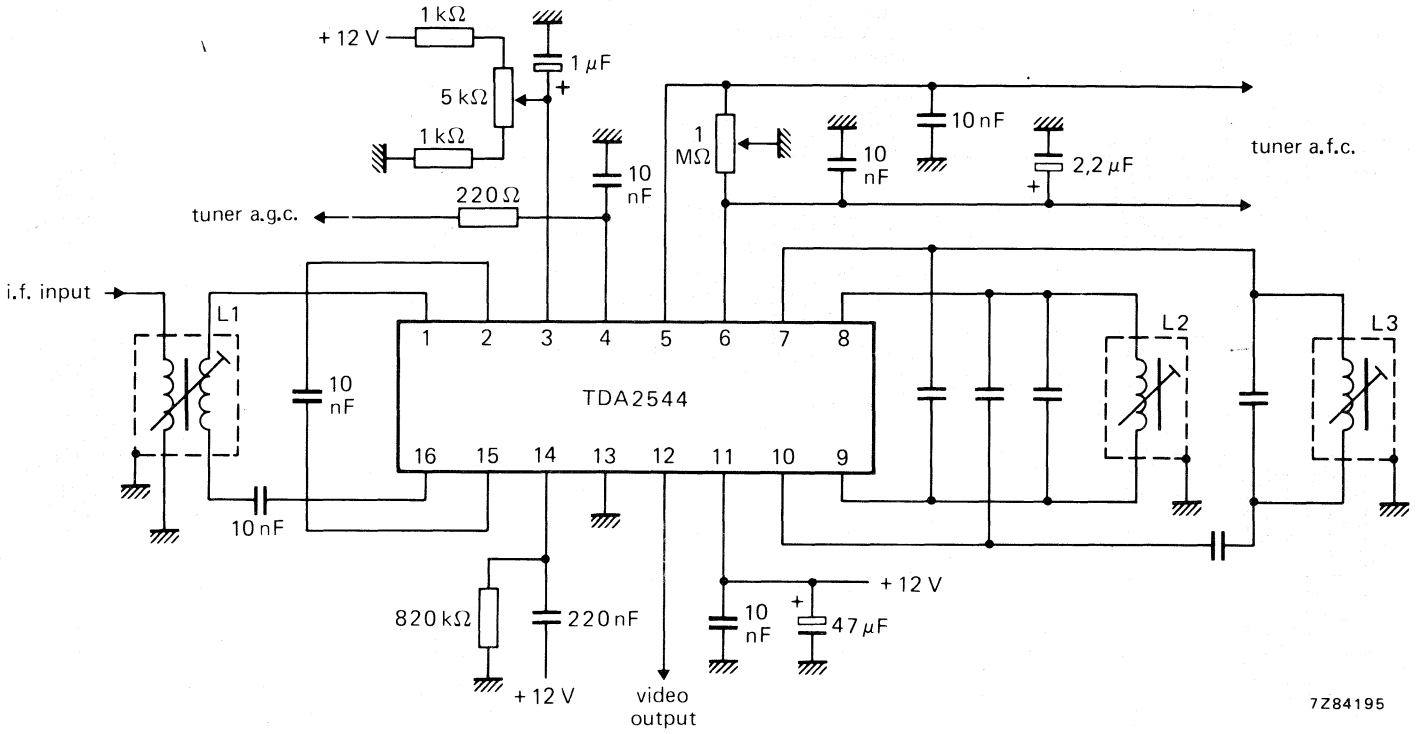


Fig. 5 Typical application diagram.

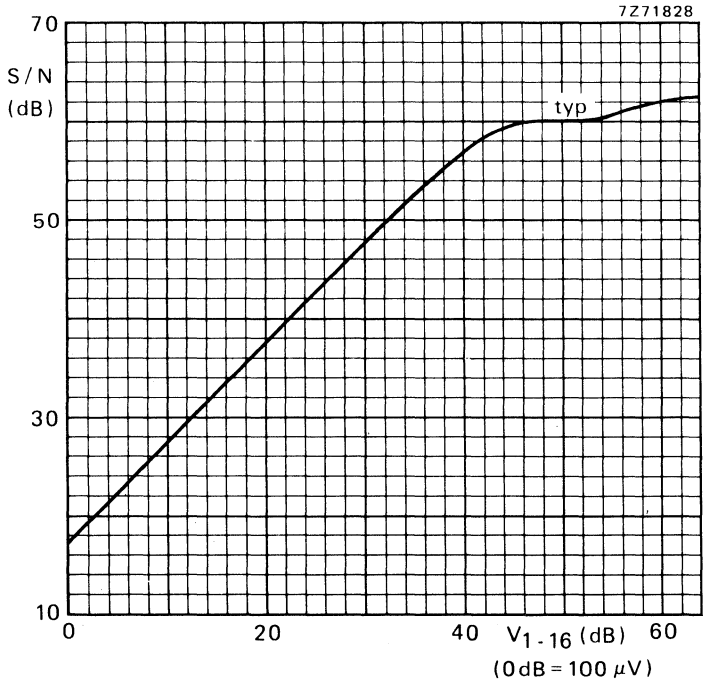


Fig. 6 Signal-to-noise ratio as a function of the input voltage (V_{1-16}).

QUASI-SPLIT-SOUND CIRCUIT

GENERAL DESCRIPTION

The TDA2545A is a monolithic integrated circuit for quasi-split-sound processing in television receivers.

Features

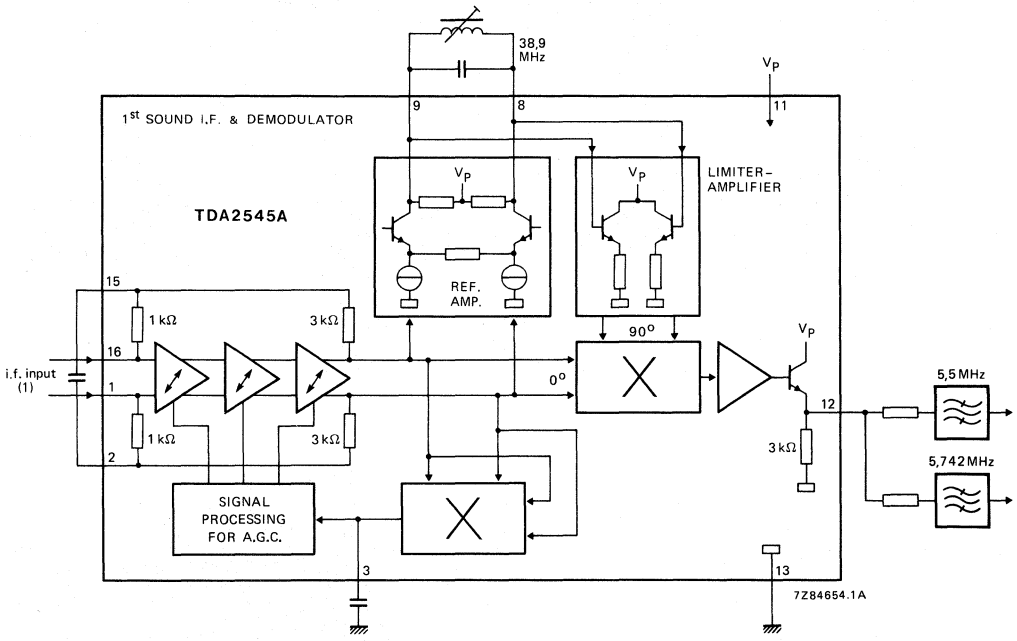
- 3-stage gain controlled i.f. amplifier
- A.G.C. circuit
- Reference amplifier and limiter amplifier for vision carrier (V.C.) processing
- Linear multiplier for quadrature demodulation

QUICK REFERENCE DATA

Supply voltage (pin 11)	$V_P = V_{11\text{-}13}$	typ.	12 V
Supply current (pin 11)	$I_P = I_{11}$	typ.	45 mA
Minimum i.f. vision carrier input voltage (r.m.s. value)	$V_{VC1\text{-}16(rms)}$	typ.	150 μV
Output voltage; 5,5 MHz (r.m.s. value)	$V_{12\text{-}13(rms)}$	typ.	100 mV
Output voltage; 5,742 MHz (r.m.s. value)	$V_{12\text{-}13(rms)}$	typ.	45 mV
I.F. control range	ΔG_v	typ.	64 dB
Signal-to-weighted-noise ratio (rel. to 1 kHz; 30 kHz deviation)			
at 5,5 MHz } for 2T/20T pulses with white bars	S + W/W	typ.	58 dB
at 5,742 MHz } for 2T/20T pulses with white bars	S + W/W	typ.	56 dB

PACKAGE OUTLINES

16-lead DIL; plastic (SOT-38).



(1) I.F. signal: vision carrier (V.C.) and sound carrier (S.C.).

Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 11)	$V_P = V_{11-13}$	max.	13,2 V
Storage temperature range	T_{stg}	−25 to	+150 °C
Operating ambient temperature range	T_{amb}	0 to	+70 °C

CHARACTERISTICS

$V_P = V_{11-13} = 12$ V; $T_{amb} = 25$ °C; measured at $f_{VC} = 38{,}9$ MHz, $f_{SC1} = 33{,}4$ MHz, $f_{SC2} = 33{,}158$ MHz:

Vision carrier (V.C.) modulated with different video signals (see below); modulation depth 100% (proportional to 10% residual carrier).

Vision carrier amplitude (r.m.s. value) is $V_{VC} = 10$ mV.
Vision-to-sound carrier ratios are VC/SC1 = 13 dB and VC/SC2 = 20 dB.

Sound carriers (SC1, SC2) modulated with f = 1 kHz and deviation $\Delta f = \pm 30$ kHz.
For measuring circuit see Fig. 2; unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
Supply (pin 11)					
Supply voltage	$V_P = V_{11-13}$	10,8	12	13,2	V
Supply current	$I_P = I_{11}$	33	45	55	mA
I.F. amplifier					
Input voltage for start of gain control (intercarrier signals −3 dB)	$V_{VC1-16(rms)}$	–	150	200	μV
Input voltage for end of gain control (intercarrier signals + 1 dB)	$V_{VC1-16(rms)}$	100	250	–	mV
I.F. gain control range	ΔG_v	60	64	–	dB
Control voltage range (see Fig. 3)	V_{3-13}	4	–	V_p	V
Input resistance	R_{1-16}	–	2,5	–	kΩ
Input capacitance	C_{1-16}	–	1,5	–	pF
Intercarrier generation					
Output voltage; 5,5 MHz (r.m.s. value)	$V_{12-13(rms)}$	60	100	140	mV
Output voltage; 5,742 MHz (r.m.s. value)	$V_{12-13(rms)}$	27	45	63	mV
D.C. output voltage	V_{12-13}	–	5,9	–	V
Allowable d.c. load resistance at the output	R_{12-13}	7	–	–	kΩ
Allowable output current	$-I_{12}$	–	–	1	mA
Intercarrier signal-to-noise (see note 1) (measured behind the FM demodulators) weighted according to CCIR 468-2, quasi-peak					
a. 2T/20T pulses with white bars (see also Fig. 4)					
at 5,5 MHz	S+W/W	53	58	–	dB
at 5,742 MHz	S+W/W	51	56	–	dB
b. 6 kHz sinewave					
at 5,5 MHz	S+W/W	50	53	–	dB
at 5,742 MHz	S+W/W	50	53	–	dB
c. black level (sync pulses only)					
at 5,5 MHz	S+W/W	60	65	–	dB
at 5,742 MHz	S+W/W	58	63	–	dB

Note 1.
Incidental phase on the vision carrier, caused by TV transmitter, has to be less than 0,5 degrees for black to white transient (equivalent to S+W/W = 56 dB for 6 kHz sinewave).

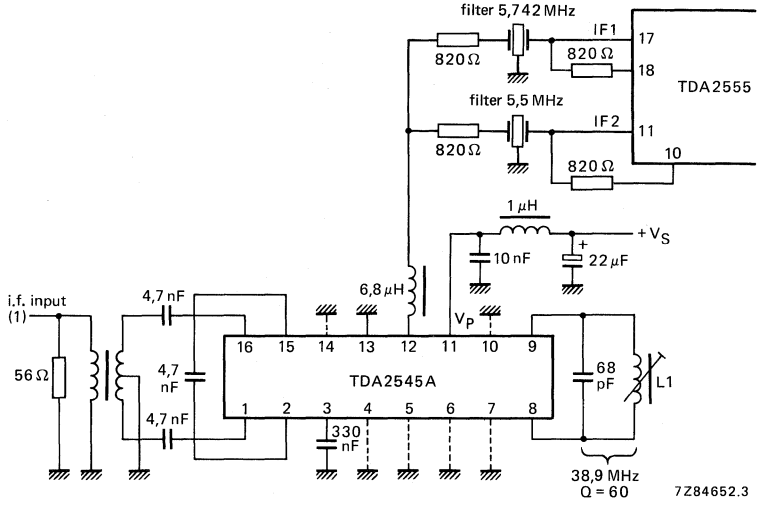


Fig. 2 Measuring circuit for TDA2545A.

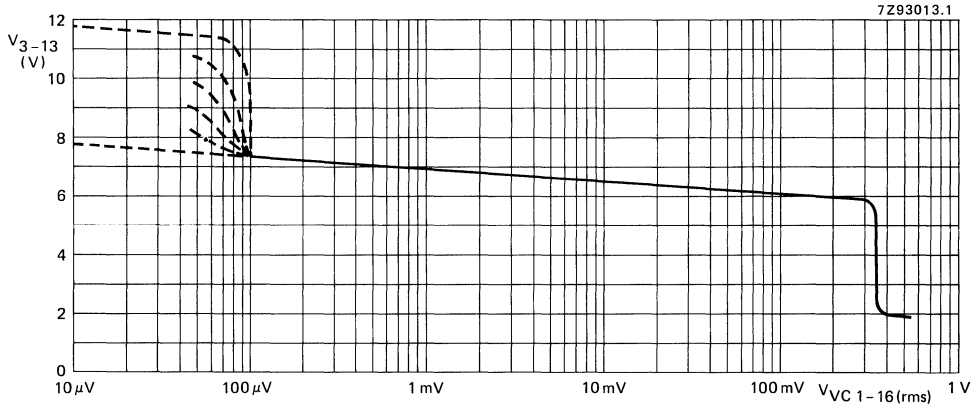


Fig. 3 Control voltage at pin 3 as a function of the input voltage $V_{VC1-16\,(rms)}$.

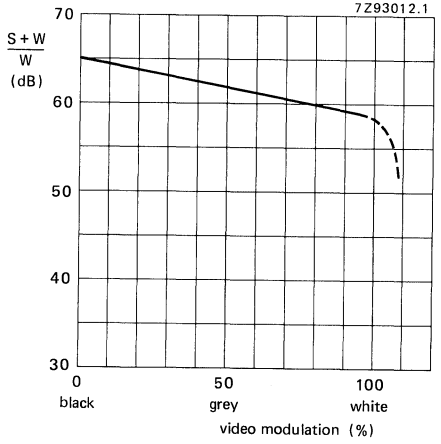


Fig. 4 Signal-to-weighted-noise ratio depending on video modulation.

QUASI-SPLIT-SOUND CIRCUIT WITH 5,5 MHz DEMODULATION

GENERAL DESCRIPTION

The TDA2546A is a monolithic integrated circuit for quasi-split-sound processing, including 5,5 MHz demodulation, in television receivers.

Features

1st i.f. (V.C.: vision carrier plus S.C.: sound carrier)

- 3-stage gain controlled i.f. amplifier
- A.G.C. circuit
- Reference amplifier and limiter amplifier for vision carrier (V.C.) processing
- Linear multiplier for quadrature demodulation

2nd i.f. (5,5 MHz signal)

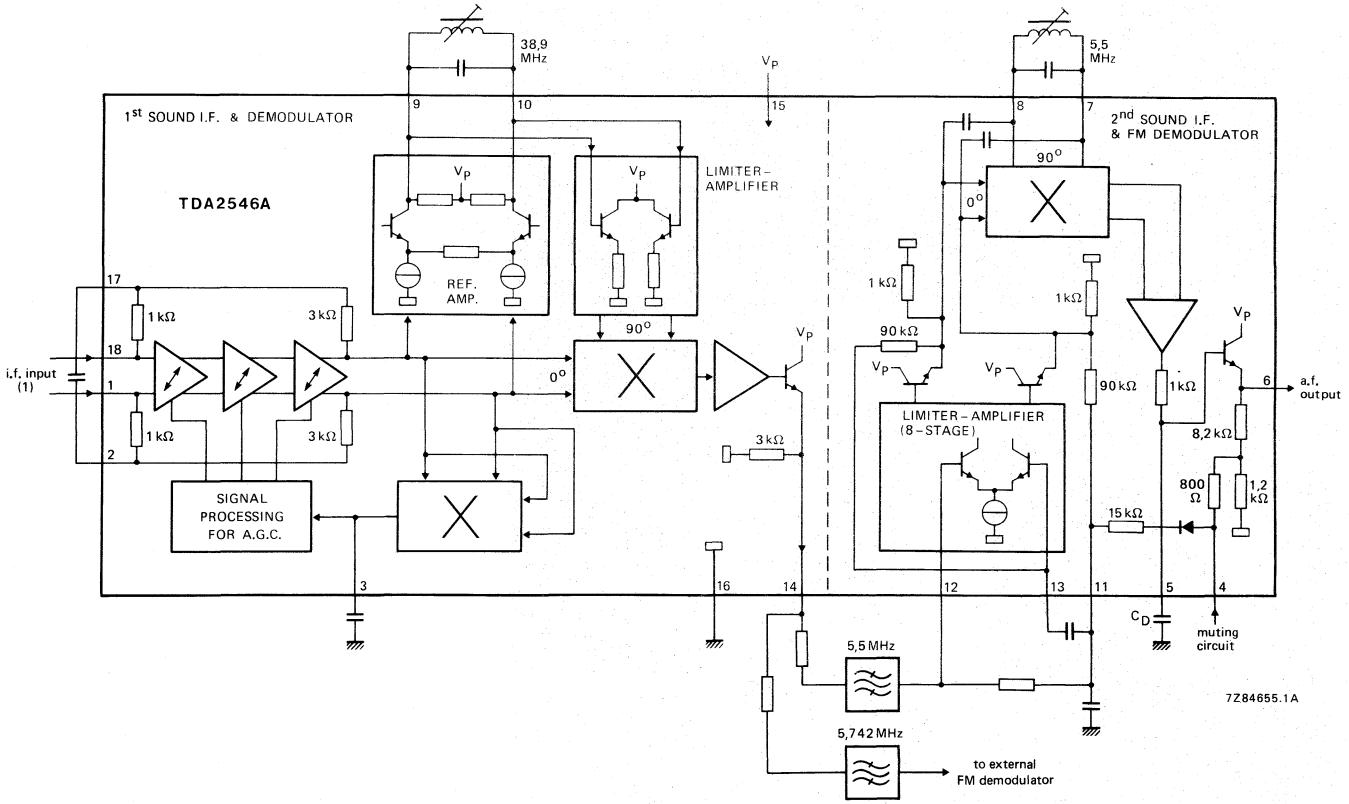
- 8-stage limiter amplifier
- Quadrature demodulator
- A.F. amplifier with de-emphasis
- AV switch

QUICK REFERENCE DATA

Supply voltage (pin 15)	$V_P = V_{15\text{-}16}$	typ.	12 V
Supply current (pin 15)	$I_P = I_{15}$	typ.	57 mA
Minimum i.f. vision carrier input voltage (r.m.s. value)	$V_{VC1\text{-}18(rms)}$	typ.	150 μV
Output voltage; 5,5 MHz (r.m.s. value)	$V_{14\text{-}16(rms)}$	typ.	100 mV
Output voltage; 5,742 MHz (r.m.s. value)	$V_{14\text{-}16(rms)}$	typ.	45 mV
I.F. control range	ΔG_v	typ.	64 dB
Signal-to-weighted-noise ratio (rel. to 1 kHz; 30 kHz deviation)			
at 5,5 MHz for 2T/20T pulses with white bars	S + W/W	typ.	58 dB
at 5,742 MHz	S + W/W	typ.	56 dB
A.F. output voltage (r.m.s. value)	$V_{o6\text{-}16(rms)}$	typ.	0,6 V

PACKAGE OUTLINES

18-lead DIL; plastic (SOT-102CS).



(1) I.F. signal: vision carrier (V.C.) and sound carrier (S.C.)

Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 15)	$V_P = V_{15-16}$	max.	13,2	V
Input current (pin 4)	I_4	max.	7	mA
Storage temperature range	T_{stg}	−25 to	+150	°C
Operating ambient temperature range	T_{amb}	0 to	+70	°C

CHARACTERISTICS

$V_P = V_{15-16} = 12$ V; $T_{amb} = 25\ ^oC$; measured at $f_{VC} = 38{,}9$ MHz, $f_{SC1} = 33{,}4$ MHz, $f_{SC2} = 33{,}158$ MHz:

Vision carrier (V.C.) modulated with different video signals (see below); modulation depth 100% (proportional to 10% residual carrier).

Vision carrier amplitude (r.m.s. value) is $V_{VC} = 10$ mV.
Vision-to-sound carrier ratios are VC/SC1 = 13 dB and VC/SC2 = 20 dB.

Sound carriers (SC1, SC2) modulated with f = 1 kHz and deviation $\Delta f = \pm 30$ kHz.
For measuring circuit see Fig. 2; unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
Supply (pin 15)					
Supply voltage	$V_P = V_{15-16}$	10,8	12	13,2	V
Supply current	$I_P = I_{15}$	40	57	75	mA
I.F. amplifier					
Input voltage for start of gain control (intercarrier signals −3 dB)	$V_{VC1-18(rms)}$	–	150	200	μV
Input voltage for end of gain control (intercarrier signals + 1 dB)	$V_{VC1-18(rms)}$	100	250	–	mV
I.F. gain control range	ΔG_v	60	64	–	dB
Control voltage range (see Fig. 3)	V_{3-16}	4	–	V_p	V
Input resistance	R_{1-18}	–	2,5	–	kΩ
Input capacitance	C_{1-18}	–	1,5	–	pF
Intercarrier generation					
Output voltage; 5,5 MHz (r.m.s. value)	$V_{14-16(rms)}$	60	100	140	mV
Output voltage; 5,742 MHz (r.m.s. value)	$V_{14-16(rms)}$	27	45	63	mV
D.C. output voltage	V_{14-16}	–	5,9	–	V
Allowable d.c. load resistance at the output	R_{14-16}	7	–	–	V
Allowable output current	$-I_{14}$	–	–	1	mA
Frequency demodulator (measured at f = 5,5 MHz)					
Input voltage vor start of limiting (r.m.s. value)	$V_{12-16(rms)}$	–	–	100	μV
Maximum input voltage (r.m.s. value)	$V_{12-16(rms)}$	–	200	–	mV
D.C. output voltage	$V_{11,12,13-16}$	–	2,2	–	V

parameter	symbol	min.	typ.	max.	unit
A.F. output voltage (r.m.s. value)	$V_{6\text{-}16(rms)}$	450	600	810	mV
D.C. output voltage	$V_{6\text{-}16}$	–	4	–	V
Allowable d.c. load resistance at the output	$R_{6\text{-}16}$	27	–	–	kΩ
Allowable a.c. load impedance at the output	$Z_{6\text{-}16}$	10	–	–	kΩ
Total harmonic distortion	THD	–	–	1	%
Internal de-emphasis resistance	$R_{i5\text{-}16}$	–	1	–	kΩ
Switching voltage (pin 4)					
for mute	$V_{4\text{-}16}$	9	–	–	V
for a.f. on	$V_{4\text{-}16}$	–	–	2,5	V
Intercarrier signal-to-noise (measured behind the FM demodulators)					
Signal-to-weighted-noise ratio according to CCIR 468-2, quasi-peak 2T/20T pulses with white bars (see also Fig. 4)					
at 5,5 MHz	S+W/W	53	58	–	dB
at 5,742 MHz	S+W/W	51	56	–	dB
6 kHz sine wave					
at 5,5 MHz	S+W/W	50	53	–	dB
at 5,742 MHz	S+W/W	50	53	–	dB
with black level (vision carrier modulated with sync pulses only)					
at 5,5 MHz	S+W/W	60	65	–	dB
at 5,742 MHz	S+W/W	58	63	–	dB

NOTES TO THE CHARACTERISTICS

1. Incidential phase on the vision carrier, caused by TV-transmitter, has to be less than 0,5 degrees for black to white transient.
   (Equivalent to S+W/W = 56 dB for 6 kHz sine wave).

(1) I.F. signal: vision carrier (V.C.) and sound carrier (S.C.)

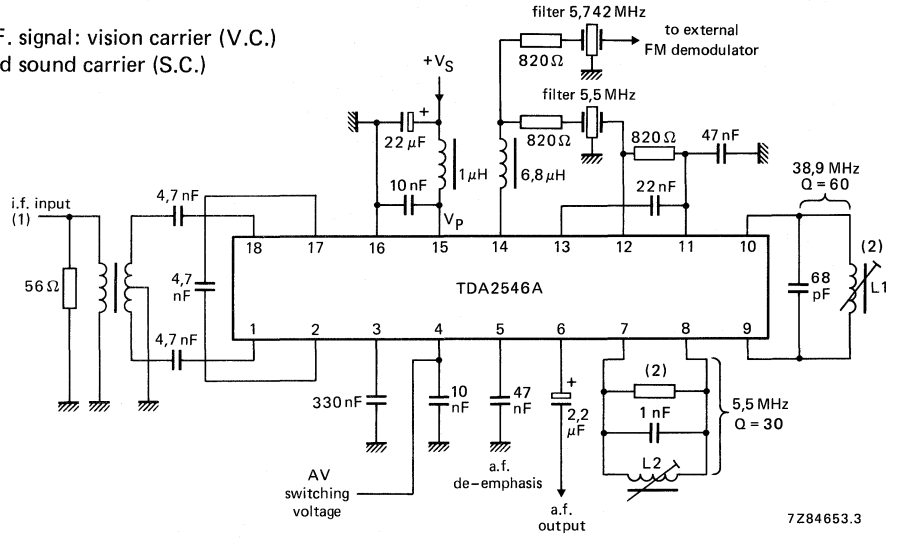


Fig. 2 Measuring circuit for TDA2546A.

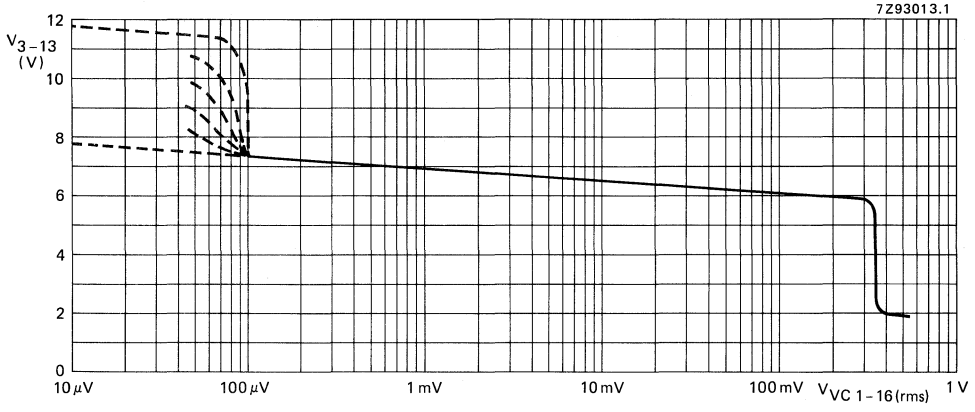


Fig. 3 Control voltage at pin 3 as a function of the input voltage $V_{VC1\text{-}18(rms)}$.

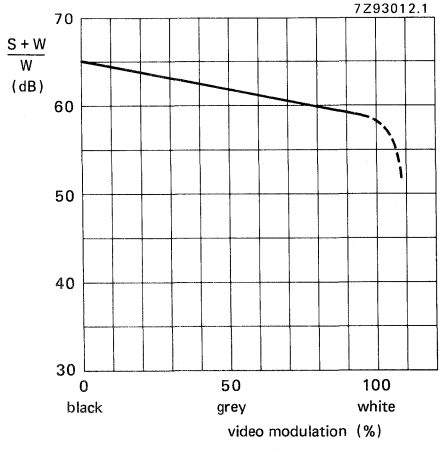


Fig. 4 Signal-to-weighted-noise ratio depending on video modulation.

TELEVISION I.F. AMPLIFIER AND DEMODULATOR

GENERAL DESCRIPTION

The TDA2548 is an i.f. amplifier and demodulator circuit for colour and black and white television receivers using p-n-p tuners.
It incorporates the following functions:

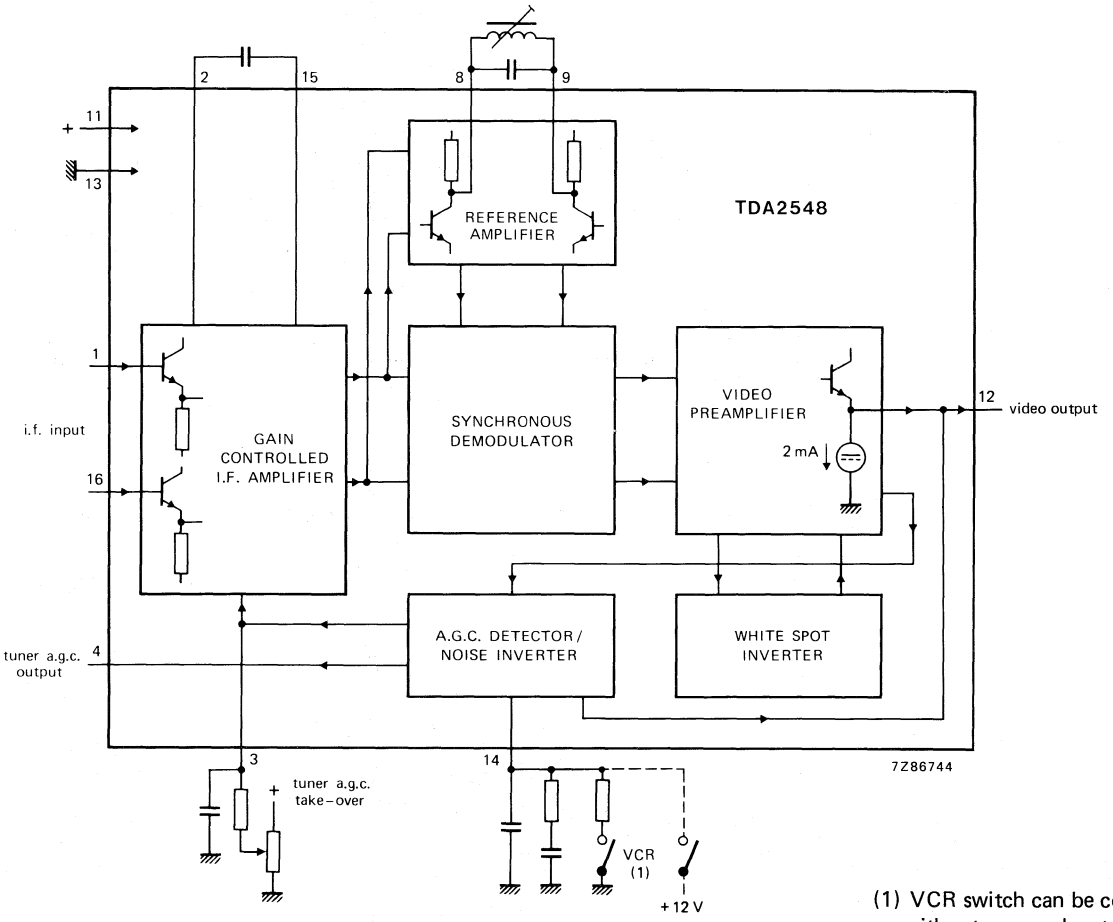
- gain-controlled wide-band amplifier, providing complete i.f. gain
- synchronous demodulator
- white spot inverter
- video preamplifier with noise protection
- a.g.c. circuit with noise gating
- tuner a.g.c. output (p-n-p tuners)
- VCR switch, which switches off the video output; e.g. for insertion of a VCR playback signal.

QUICK REFERENCE DATA

Supply voltage	V_{11-13}	typ.	12 V
Supply current	I_{11}	typ.	50 mA
I.F. input voltage at f = 38,9 MHz (r.m.s. value)	$V_{1-16(rms)}$	typ.	100 μV
Video output voltage (white at 10% of top sync)	$V_{12(p-p)}$	typ.	2,7 V
I.F. voltage gain control range	G_v	typ.	64 dB
Signal-to-noise ratio at V_i = 10 mV	S/N	typ.	58 dB

PACKAGE OUTLINES

TDA2548 : 16-lead DIL; plastic (SOT-38).
TDA2548Q: 16-lead QIL; plastic (SOT-58).



(1) VCR switch can be connected either to ground or to +12 V.

Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage	V_{11-13}	max.	13,2	V
Tuner a.g.c. voltage	V_{4-13}	max.	12	V
Total power dissipation	P_{tot}	max.	900	mW
Storage temperature	T_{stg}		−55 to + 125	°C
Operating ambient temperature	T_{amb}		−25 to + 60	°C

CHARACTERISTICS (measured in Fig. 5)

Supply voltage range	V_{11-13}	typ.	12	V
			10,2 to 13,2	V

The following characteristics are measured at T_{amb} = 25 °C; V_{11-13} = 12 V; f = 38,9 MHz

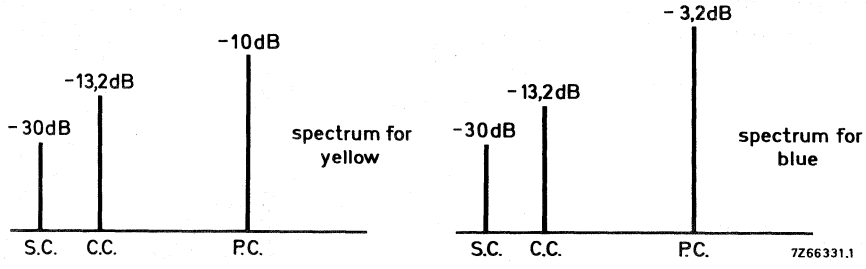
I.F. input voltage for onset of a.g.c. (r.m.s. value)	$V_{1-16(rms)}$	typ.	100	μV
		<	150	μV
Differential input impedance	$\lvert Z_{1-16} \rvert$	typ.	2 kΩ in parallel with 2 pF	
Zero-signal output level variation	V_{12-13}	typ.	5,95	V*
			± 0,35	V
Top sync output level	V_{12-13}	typ.	3,00	V
			2,85 to 3,15	V
I.F. voltage gain control range	G_v	typ.	64	dB
Bandwidth of video amplifier (3 dB)	B	typ.	6	MHz
Signal-to-noise ratio at V_i = 10 mV	S/N	typ.	58	dB**
Differential gain	dG	typ.	4	%
		<	10	%
Differential phase	$d\varphi$	typ.	2°	
		<	10°	

* So-called 'projected zero point', e.g. with switched demodulator.

** $$S/N = \frac{V_o \text{ black-to-white}}{V_{n(rms)} \text{ at } B = 5 \text{ MHz}}.$$

CHARACTERISTICS (continued)

Intermodulation at 1,1 MHz: blue*	>	46 dB
	typ.	60 dB
yellow*	>	46 dB
	typ.	50 dB
at 3,3 MHz**	>	46 dB
	typ.	54 dB



S.C. : sound carrier level
C.C. : chrominance carrier level
P.C. : picture carrier level
} with respect to top sync level

Fig. 2 Input conditions for intermodulation measurements; standard colour bar with 75% contrast.

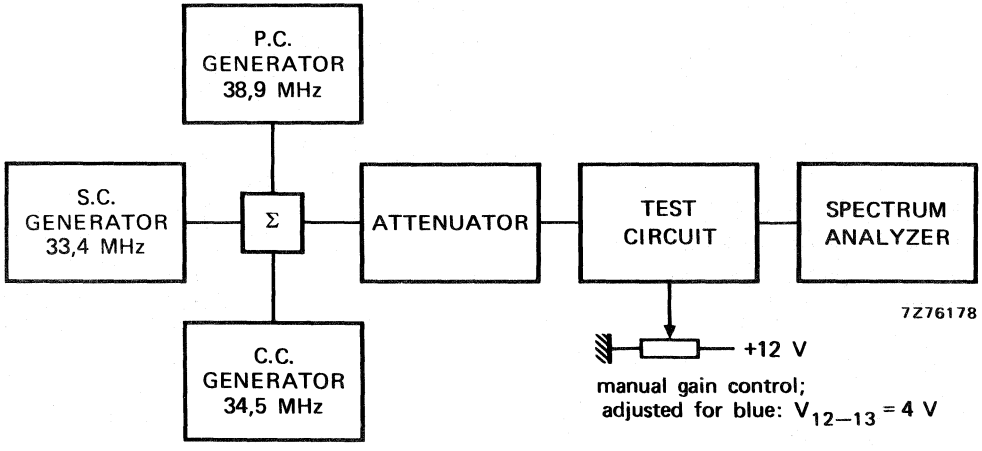


Fig. 3 Test set-up for intermodulation.

* $20 \log \frac{V_o \text{ at } 4,4 \text{ MHz}}{V_o \text{ at } 1,1 \text{ MHz}} + 3,6$ dB.

** $20 \log \frac{V_o \text{ at } 4,4 \text{ MHz}}{V_o \text{ at } 3,3 \text{ MHz}}$

Carrier signal at video output		typ.	4 mV
		<	30 mV
2nd harmonic of carrier at video output		typ.	20 mV
		<	30 mV
White spot inverter threshold level (Fig. 4)		typ.	6,6 V
White spot insertion level (Fig. 4)		typ.	4,7 V
Noise inverter threshold level (Fig. 4)		typ.	1,8 V
Noise insertion level (Fig. 4)		typ.	3,8 V
External video switch (VCR) switches off the output at:	V_{14-13}	<	1,1 V

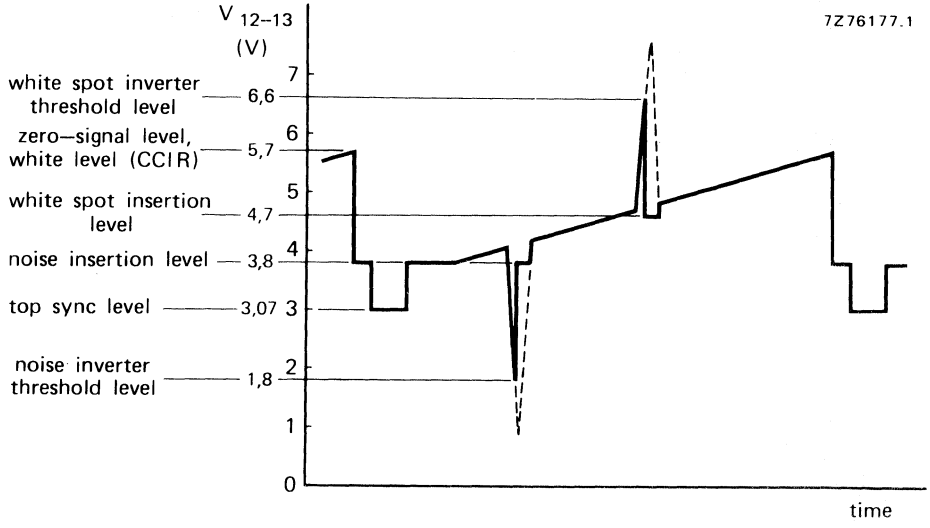


Fig. 4 Video output waveform showing white spot and noise inverter threshold levels.

Tuner a.g.c. output current range	I_4		0 to 10 mA
Tuner a.g.c. output voltage at I_4 = 10 mA	V_{4-13}	<	0,3 V
Tuner a.g.c. output leakage current V_{14-13} = 11 V; V_{4-13} = 12 V	I_4	<	15 μA

APPLICATION INFORMATION

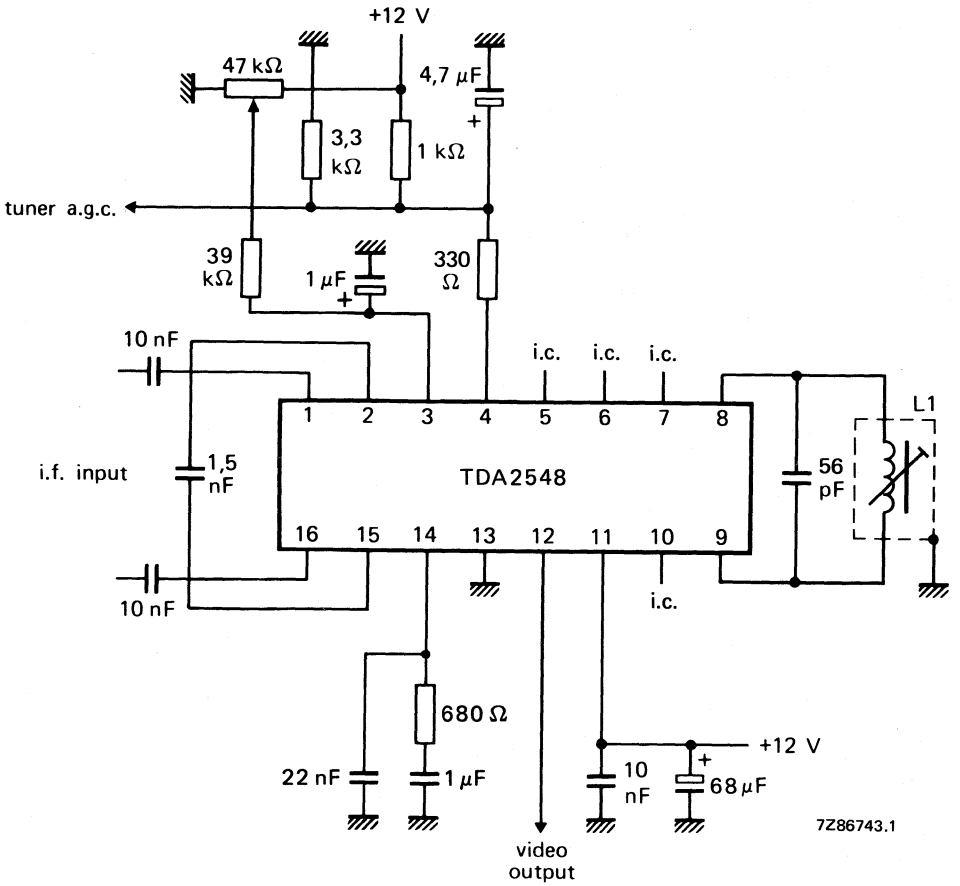


Fig. 5 Typical application circuit diagram; Q of L1 ≈ 80; f_o 38,9 MHz.

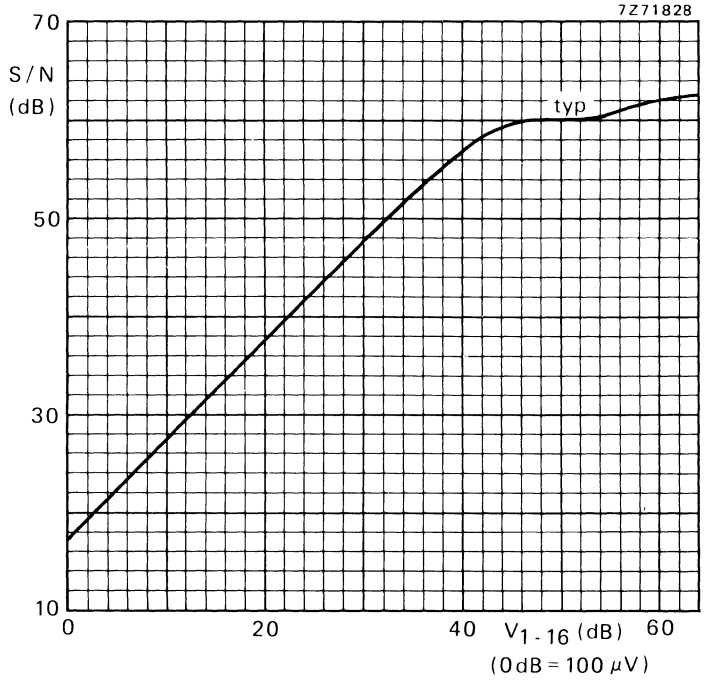


Fig. 6 Signal-to-noise ratio as a function of the input voltage (V_{1-16}).

I.F. AMPLIFIER AND DEMODULATOR FOR MULTISTANDARD TV RECEIVERS

GENERAL DESCRIPTION

The TDA2549 is a complete i.f. circuit with a.f.c., a.g.c., demodulation and video preamplification facilities for multistandard television receivers. It is capable of handling positively and negatively modulated video signals in both colour and black/white receivers.

Features

- Gain-controlled wide-band amplifier providing complete i.f. gain
- Synchronous demodulator for positive and negative modulation
- Video preamplifier with noise protection for negative modulation
- Auxiliary video input and output (75 Ω)
- Video switch to select between auxiliary video input signal and demodulated video signal
- A.F.C. circuit with on/off switch and inverter switch
- A.G.C. circuit for positive modulation (mean level) and negative modulation (noise gate)
- A.G.C. output for controlling MOSFET tuners

QUICK REFERENCE DATA

Supply voltage (pins 13 and 21)	$V_P = V_{13;21-3}$	typ.	12 V
Supply current (pins 13 and 21)	$I_P = I_{13;21-3}$	typ.	82 mA
I.F. input signal at V_o = 2 V (between pins 6 and 7)	$V_i = V_{6-7}$	typ.	50 μV
Video output voltage at V_i = 0 V (between pins 22 and 3)			
positive modulation	$V_o = V_{22-3}$	typ.	2 V
negative modulation	$V_o = V_{22-3}$	typ.	4 V
Gain control range	G_v	typ.	74 dB
Signal-to-noise ratio at V_i = 10 mV	S/N	typ.	57 dB
A.F.C. output voltage swing (pin 15)	V_{15-3}	min.	10 V
Max. tuner a.g.c. output current (pin 10)	I_{10}	min.	0,3 mA
Video bandwidth (3 dB)	B	typ.	5,5 MHz
Auxiliary video input voltage (pin 12) at V_o = 2 V (peak-to-peak value)	$V_{12-3(p-p)}$	typ.	1 V
Auxiliary video output impedance (pin 14)	$\lvert Z_{14-3} \rvert$	typ.	7 Ω
Auxiliary video output voltage (pin 14)	V_{14-3}	typ.	2 V

PACKAGE OUTLINE

24-lead DIL; plastic (SOT-101A).

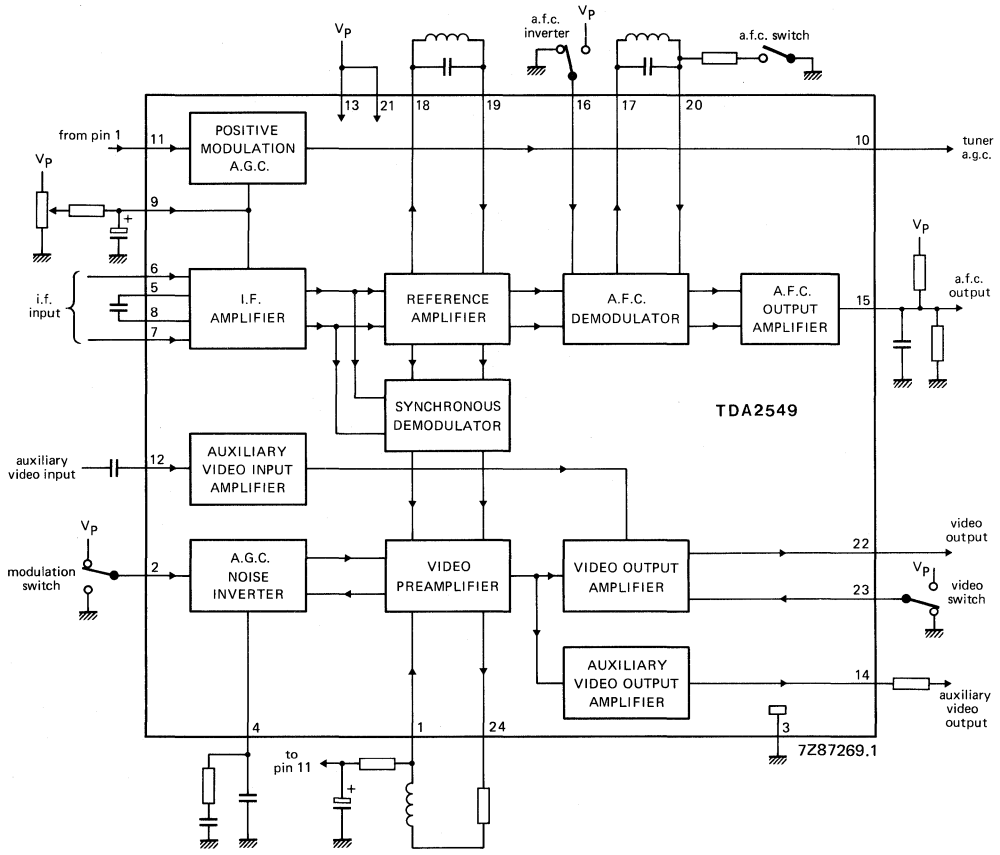


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pins 13 and 21)	V_P	13,8 V
Storage temperature range	T_{stg}	−25 to +125 °C
Operating ambient temperature range	T_{amb}	−25 to +70 °C

CHARACTERISTICS (measured in Fig. 5)

V_P = 12 V; T_{amb} = 25 °C

paramater	symbol	min.	typ.	max.	unit
Supply voltage range	V_P	10,8	12	13,2	V
Supply current (pins 13 and 21)	I_P	–	82	–	mA
I.F. input signal for V_o = 2 V (between pins 6 and 7)	$V_i = V_{6-7}$	–	50	150	μV
Input impedance (differential)	$\lvert Z_{6-7} \rvert$	–	2	–	kΩ
Input capacitance (differential)	C_{6-7}	–	2	–	pF
Zero signal output level positive modulation	V_{22-3}	1,6	2	2,3	V
negative modulation	V_{22-3}	3,7	4	4,3	V
Top sync output level	V_{22-3}	1,7	2	2,3	V
Gain control range	G_v	50	74	–	dB
Signal-to-noise ratio at V_i = 10 mV (note 1)	S/N	50	57	–	dB
Maximum video output amplitude for positive modulation (peak-to-peak value)	$V_{22-3(p-p)}$	4,5	–	–	V
Bandwidth of video amplifier (3 dB)	B	–	5,5	–	MHz
Differential gain at V_o = 2 V	dG	–	4	10	%
Differential phase at V_o = 2 V	$d\varphi$	–	2	10	%
Residual carrier signal (r.m.s. value)	$V_{24-3(rms)}$	–	10	20	mV
Residual second harmonic of carrier signal (r.m.s. value)	$V_{24-3(rms)}$	–	20	60	mV

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
A.F.C. output voltage swing	V_{15-3}	10	–	–	V
Change of frequency required for a.f.c. output voltage swing of 10 V	Δf	–	70	200	kHz
A.F.C. switch off for a voltage lower than:	V_{17-3}	–	–	1,5	V
A.F.C. inverter switch					
positive a.f.c. (Fig. 2)	V_{16-3}	0	–	1,5	V
negative a.f.c. (Fig. 3)	V_{16-3}	4	–	12	V
Tuner A.G.C.					
Leakage current	I_{10}	–	–	15	μA
Saturation voltage					
I_{10} = 0,3 mA	V_{10-3}	–	0,1	0,3	V
take-over point LOW	V_i	–	–	3	mV
take-over point HIGH	V_i	10	–	–	mV
Signal expansion at G_v = 50 dB	ΔV_{22-3}	–	–	0,5	dB
Negative modulation (Fig. 4)					
white spot inverter threshold level	V_{22-3}	–	4,6	–	V
white spot insertion level	V_{22-3}	–	3,2	–	V
noise inverter threshold level	V_{22-3}	–	0,9	–	V
noise insertion level	V_{22-3}	–	2,5	–	V
Positive modulation a.g.c. detector reference level	V_{11-3}	3,0	3,2	3,4	V
Auxiliary video input signal for $V_{o(p-p)}$ = 2 V	V_{12-3}	0,7	1	1,4	V
Auxiliary video output					
output signal (note 2)	V_{14-3}	–	1	–	V
top sync level	V_{14-3}	1	2	3	V
output impedance	$\lvert Z_{14-3} \rvert$	–	7	–	Ω
Levels for video switches					
positive video	V_{2-3}	–	–	1	V
negative video	V_{2-3}	3	–	–	V
internally demodulated signal	V_{23-3}	–	–	1	V
auxiliary video signal	V_{23-3}	3	–	–	V

Notes to the characteristics

1. Signal-to-noise ratio $S/N = \dfrac{V_o \text{ black-to-white}}{V_{n(rms)} \text{ at } B = 5 \text{ MHz}}$.
2. Measured in application of Fig. 5.

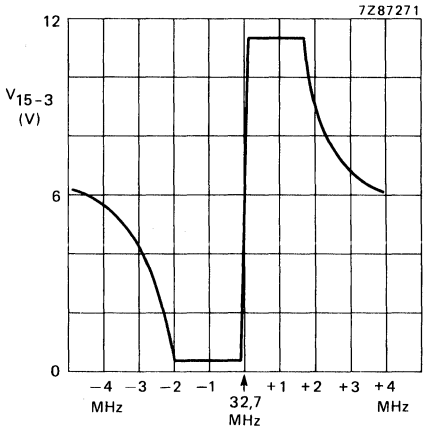


Fig. 2 A.F.C. output voltage V_{15-3} for positive a.f.c.

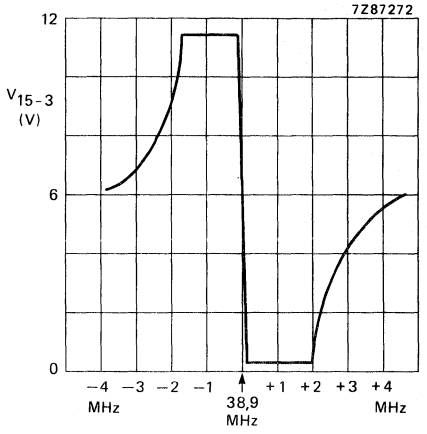


Fig. 3 A.F.C. output voltage V_{15-3} for negative a.f.c.

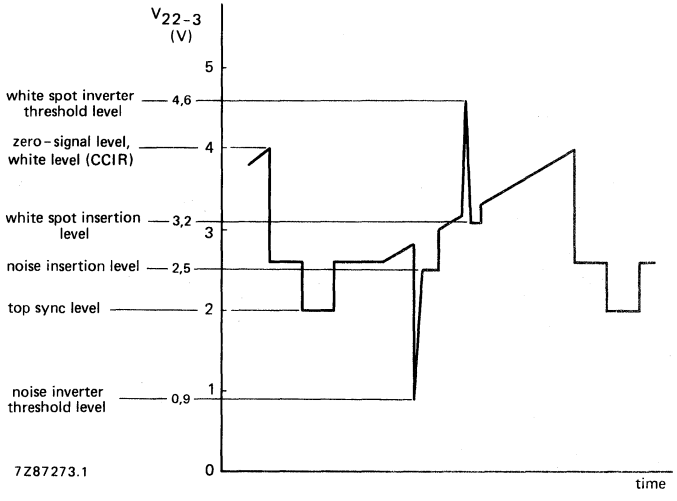


Fig. 4 Video output waveform showing white spot and noise inverter threshold levels.

APPLICATION INFORMATION

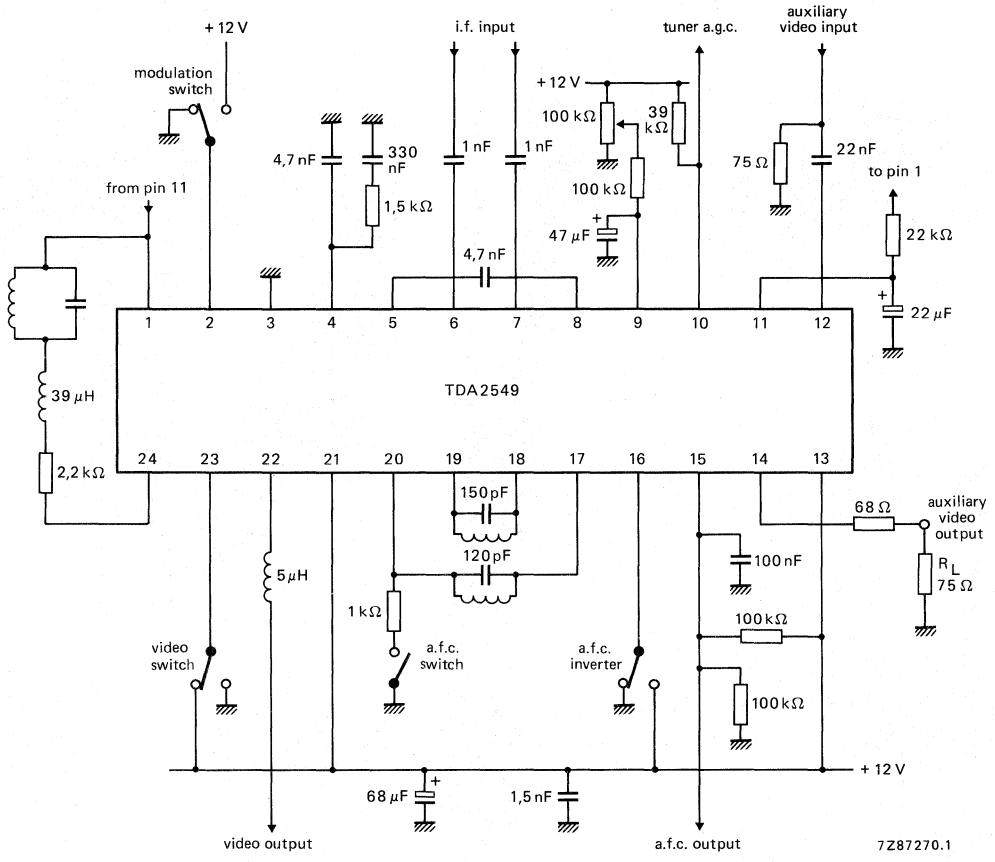


Fig. 5 Application diagram.

DUAL TV SOUND DEMODULATOR CIRCUITS

GENERAL DESCRIPTION

The circuits incorporate two FM demodulator systems to perform the demodulator functions required in a dual sound carrier TV system for demodulating the sound carriers.
The difference between TDA2555 and TDA2557 is the number of stages of the limiting amplifier.

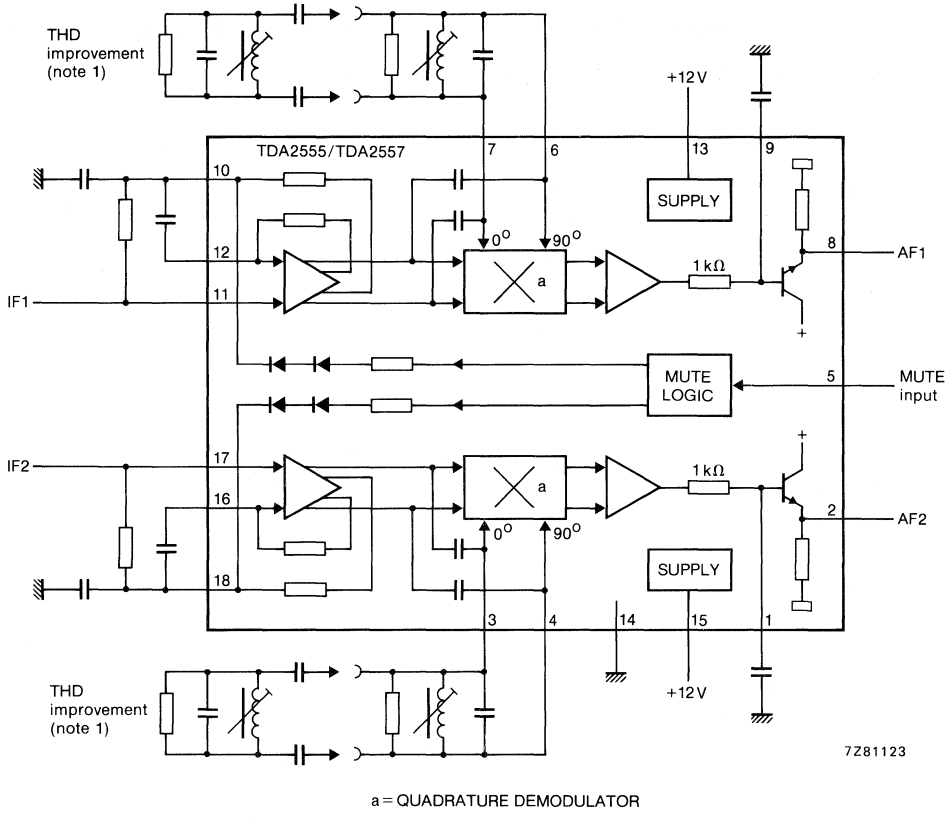
- **Eight** (TDA2555) or **five** (TDA2557) stage limiting amplifier
- Quadrature demodulator for FM detection
- De-emphasis stage
- Output amplifier
- Mute function for each FM demodulator

QUICK REFERENCE DATA

Supply voltage (pins 13 and 15)	V_P	typ.	12 V
Supply current (pins 13 and 15)	I_P	typ.	24,5 mA
AF output voltage (pins 2 and 8)	$V_{o(rms)}$	typ.	600 mV
Total harmonic distortion (note 1)	THD	<	0,1 %
Signal to weighted noise ratio	(S + N)/N	typ.	70 dB

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102HE).



a = QUADRATURE DEMODULATOR

Fig. 1 Block diagram.
TDA2555 with 8-stage limiting amplifier;
TDA2557 with 5-stage limiting amplifier.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pins 13 and 15)	V_P	max.	13,2 V
Total power dissipation	P_{tot}	max.	400 mW
Storage temperature range	T_{stg}	−40 to + 150	°C
Operating ambient temperature	T_{amb}	0 to + 70	°C

CHARACTERISTICS

$V_P = V_{13,\ 15\text{-}14} = 12$ V; $T_{amb} = 25$ °C; $f_{IF1} = 5{,}5$ MHz; $f_{IF2} = 5{,}74$ MHz; $f_{m1} = 1$ kHz;
$\Delta f = \pm 30$ kHz;
$V_{i(rms)} = 5$ mV for TDA2555;
$V_{i(rms)} = 10$ mV for TDA2557;
see test circuit Fig. 3, voltages with respect to ground (pin 14), unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
Total current consumption	$I_{13,15}$	18	24,5	30	mA
LIMITING AMPLIFIER					
Maximum input voltage	$V_{11\text{-}12(rms)}$ $V_{16\text{-}17(rms)}$	–	200	–	mV
Input voltage for start of limiting (3 dB AF signal reduction)					
TDA2555	$V_{11\text{-}12(rms)}$ $V_{16\text{-}17(rms)}$	–	50	100	μV
TDA2557	$V_{11\text{-}12(rms)}$ $V_{16\text{-}17(rms)}$	–	250	500	μV
DC voltage (input limiting amplifier) pins 11, 12, 16, 17 to 14	V_i	–	2,0	–	V
DC voltage (feedback loop)	$V_{10,18\text{-}14}$	–	2,0	–	V
FM DEMODULATOR					
IF reference signal voltage	$V_{3\text{-}4(rms)}$ $V_{6\text{-}7(rms)}$	–	200	–	mV
DC voltage	$V_{3,4,6,7\text{-}14}$	–	3,1	–	V
AF output voltage	$V_{2\text{-}14(rms)}$	450	600	750	mV
Difference of output signals	$\frac{V_{2\text{-}14}}{V_{8\text{-}14}}$	–	± 0,1	± 0,5	dB
Total harmonic distortion at outputs AF1 and AF2 (note 1)	THD	–	–	0,5	%
A.M. suppression at outputs AF1 and AF2, $f_{FM} = 70$ Hz; $\Delta f = \pm 50$ kHz; $f_{AM} = 1$ kHz; m = 0,3	AMS	50	–	–	dB

DEVELOPMENT DATA

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
FM DEMODULATOR (continued)					
Signal to noise ratio at outputs AF1 and AF2 (CCIR weighted, quasi peak)	$(S+N)/N$	65	70	–	dB
Residual IF-signal without deemphasis	$V_{2,8\text{-}14(rms)}$	–	30	–	mV
Ripple rejection at outputs AF1 and AF2 f = 50 Hz to 20 kHz; $V_{i(rms)}$ = 200 mV	RR	–	40	–	dB
AUDIO OUTPUT STAGE					
emitter follower with 1,0 mA bias current					
DC output voltage	$V_{2,8\text{-}14}$	3,0	4,0	5,0	V
External DC load resistance	$R_{2,8\text{-}14}$	2	–	–	kΩ
AC output current (note 2)	$-I_{2,8\text{-}14(p\text{-}p)}$	–	–	0,5	mA
Deemphasis input resistance (note 3)	$R_{1,9\text{-}14}$	0,8	1,0	1,2	kΩ
DC voltage (deemphasis)	$V_{1,9\text{-}14}$	3,7	4,7	5,7	V
Crosstalk attenuation f = 1 kHz (note 4)	$\alpha_{12,21}$	60	–	–	dB
Crosstalk attenuation f = 10 kHz (note 4)	$\alpha_{12,21}$	60	–	–	dB
Output impedance	$R_{2,8\text{-}14}$	–	25	–	Ω
AF output level (Fig. 2, note 5) MUTE function $V_{i(rms)} < 60$ mV	α	60	–	–	dB
Switching input current					
$V_{5\text{-}14} = 0$ V	$-I_5$	–	–	500	μA
$V_{5\text{-}14} = V_P$	I_5	–	–	500	μA
Internal d.c. voltage no mute (pin 5 not connected)	$V_{5\text{-}14}$	–	6,2	–	V

Notes to the characteristics

1. THD < 0,1% requires a double tuned demodulator circuit (Q_L = 20). With a single tuned circuit a THD of < 0,5% is possible (see Figs 1 and 3).
2. If higher a.c. output current is required an external resistor must be applied from output (pins 2 and 8) to ground (min. 2 kΩ) in order to improve the THD performance ($-I_{2,8} < 4$ mA).
3. The deemphasis time constant is 50 μs.
4. Crosstalk attenuation is defined as:

$$o_{12} = \frac{V_{2\text{-}14 \text{ unmodulated}}}{V_{8\text{-}14}} \qquad o_{21} = \frac{V_{8\text{-}14 \text{ unmodulated}}}{V_{2\text{-}14}}.$$

5. In the MUTE state the a.f. output level attenuation is more than 60 dB. The MUTE function is only guaranteed for an r.m.s. value of the input voltage lower than 60 mV. See also Fig. 2.

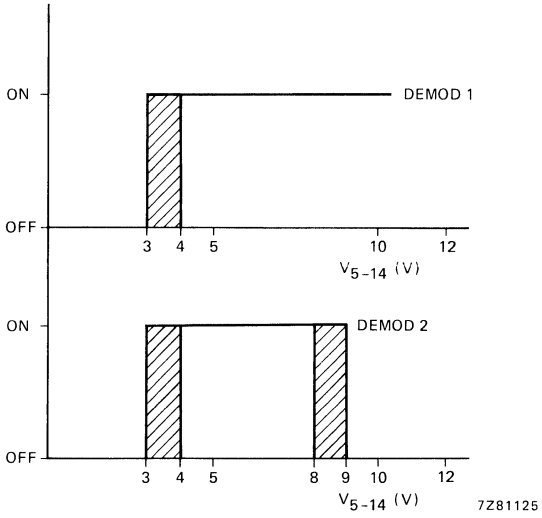


Fig. 2 Mute function.

DEVELOPMENT DATA

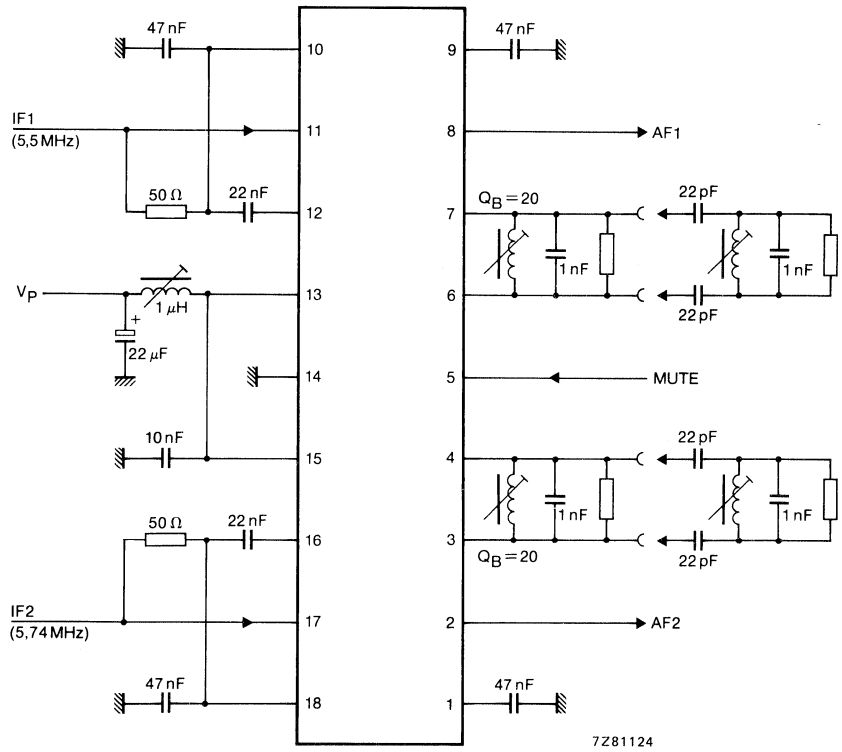


Fig. 3 Test and application circuit.

QUASI-SPLIT-SOUND CIRCUIT WITH DUAL SOUND DEMODULATORS

GENERAL DESCRIPTION

The TDA2556 is a monolithic integrated circuit for quasi-split-sound processing, including two FM demodulators, for two carrier stereo TV receivers and VTR.

Features

First IF (vision carrier plus sound carrier).

- 3 stage gain controlled IF amplifier
- AGC circuit
- Reference amplifier and limiter amplifier for vision carrier (V.C.) processing
- Linear multiplier for quadrature demodulation

Second IF (two separate channels for both FM sound signals).

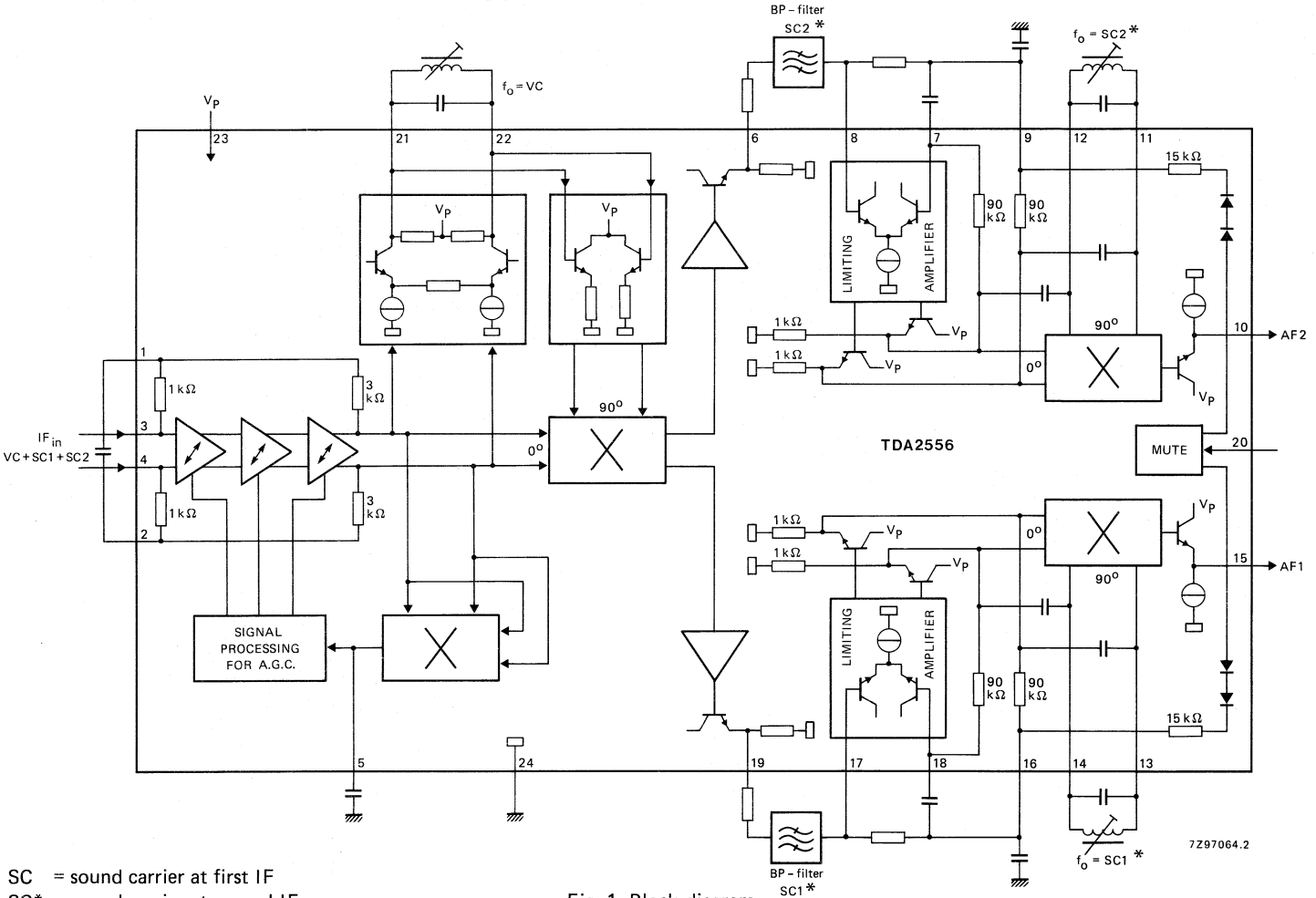
- 4-stage-limiting amplifier
- Quadrature demodulator
- AF amplifier with de-emphasis
- Output buffer
- Muting for one or both AF outputs

QUICK REFERENCE DATA

Supply voltage, pin 23		$V_P = V_{23-24}$	typ.	12 V
Supply current, pin 23		$I_P = I_{23}$	typ.	73 mA
Minimum IF vision carrier input voltage (rms value)		$V_{VC} = V_{3-4}$	typ.	150 μV
IF control range		ΔG_V	typ.	64 dB
AF output voltage		$V_{O\ 10,\ 15-24(rms)}$	typ.	600 mV
Signal-to-weighted-noise ratio (relative to 1 kHz; 30 kHz deviation)				
at 5,5 MHz	for 2T/20T pulses with white bars	S + W/W	typ.	58 dB
at 5,74 MHz	for 2T/20T pulses with white bars	S + W/W	typ.	56 dB

PACKAGE OUTLINE

24-lead DIL; plastic (SOT-101BE).



SC = sound carrier at first IF
SC* = sound carrier at second IF

Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage, pin 23	$V_P = V_{23-24}$	max.	13,2	V
Supply current, pin 23	$I_P = I_{23}$	max.	95	mA
Storage temperature range	T_{stg}	−25 to	+ 150	°C
Operating ambient temperature range	T_{amb}	0 to	+ 70	°C

CHARACTERISTICS

$V_P = V_{23-24} = 12$ V; $T_{amb} = 25$ °C; measured at $f_{VC} = 38{,}9$ MHz, $f_{SC1} = 33{,}4$ MHz, $f_{SC2} = 33{,}158$ MHz.
Vision carrier (V.C.) modulated with different video signals (see below); modulation depth 100% (proportional to 10% residual carrier).
Vision carrier amplitude: $V_{VC(rms)} = 10$ mV.
Vision-to-sound carrier ratios: VC/SC1 = 13 dB, VC/SC2 = 20 dB.
Sound carrier (SC1, SC2) modulated with f = 1 kHz and deviation $\Delta f = \pm 30$ kHz.
For measuring circuit see Fig. 2; unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
Supply (pin 23)					
Supply voltage	$V_P = V_{23-24}$	10,8	12	13,2	V
Supply current	$I_P = I_{23}$	–	73	95	mA
First IF amplifier					
Input voltage for start of gain control (intercarrier signals −3 dB)	$V_{VC} = V_{3-4\ (rms)}$	–	150	200	μV
Input voltage for end of gain control (intercarrier signals + 1 dB)	$V_{VC} = V_{3-4\ (rms)}$	100	250	–	mV
Gain control range	ΔG_V	60	64	–	dB
Control voltage range (see Fig. 6)	V_{5-24}	4	–	V_P	V
Input resistance (differential)	R_{3-4}	–	2	–	kΩ
Input capacitance (differential)	C_{3-4}	–	2	–	pF
Intercarrier signal					
Output voltage; 5,5 MHz (SC1*)	$V_{19-24(rms)}$	60	100	140	mV
Output voltage; 5,742 MHz (SC2*)	$V_{6-24(rms)}$	27	45	63	mV
Output voltage d.c. (emitter follower with minimum 1,5 mA bias current)	$V_{6-24/19-24}$	–	5,9	–	V
Allowable d.c. load resistance	$R_{6-24/19-24}$	7	–	–	kΩ
Second IF					
Input voltage for start of limiting	$V_{8-24/17-24(rms)}$	–	700	–	μV
Maximum input voltage	$V_{8-24/17-24(rms)}$	–	200	–	mV
Voltage level d.c.	$V_{7-24/18-24}$	–	2,2	–	V
Voltage level d.c.	$V_{9-24/16-24}$	–	2,2	–	V

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Second IF (continued)					
AF output voltage	$V_{10\text{-}24/15\text{-}24}$	450	600	810	mV
Output voltage d.c. (emitter follower with 1,0 mA bias current)	$V_{10\text{-}24/15\text{-}24}$	–	4,5	–	V
External d.c. load resistance	$R_{10\text{-}24/15\text{-}24}$	2	–	–	kΩ
External a.c. load current (note 5)	$I_{10/15}$	–	–	0,5	mA
Total harmonic distortion of $V_{10\text{-}24/15\text{-}24}$ (note 3)	THD	–	0,4	1	%
(note 4)	THD	–	–	0,1	%
AM suppression; f_{AM} = 1 kHz, M = 0,3; f_{FM} = 70 Hz; f = ± 50 kHz (note 2)		50	60	–	dB
Crosstalk attenuation (note 2)		60	–	–	dB
S/N ratio (second IF) (note 2) f = 1 kHz; f = ± 50 kHz	$V_{10\text{-}24/15\text{-}24}$	65	70	–	dB
Mute (see Fig. 4)					
Switching voltage for:					
demodulator 1 ON	$V_{20\text{-}24}$	4	–	V_P	V
demodulator 1 OFF	$V_{20\text{-}24}$	0	–	3	V
demodulator 2 ON	$V_{20\text{-}24}$	4	–	8	V
demodulator 2 OFF	$V_{20\text{-}24}$	0 or 9	–	3 or V_P	V
Input current	I_{20}	–500	–	+ 200	μA
Input d.c. potential	$V_{20\text{-}24}$	–	6,3	–	V
AF signal performance, weighted S/N ratio at audio outputs, pins 10, 15; $V_{3\text{-}4}$ = 20 mV rms weighted according to CCIR 468-2, quasi-peak, (see note 1)					
(a) 2T/20T pulse with white bars (see also Fig. 5)					
at 5,5 MHz	(S + W)/W	–	58	–	dB
at 5,74 MHz	(S + W)/W	–	56	–	dB
(b) 6 kHz sine wave					
at 5,5 MHz	(S + W)/W	–	52	–	dB
at 5,74 MHz	(S + W)/W	–	50	–	dB
(c) black level (sync pulses only)					
at 5,5 MHz	(S + W)/W	–	65	–	dB
at 5,74 MHz	(S + W)/W	–	63	–	dB

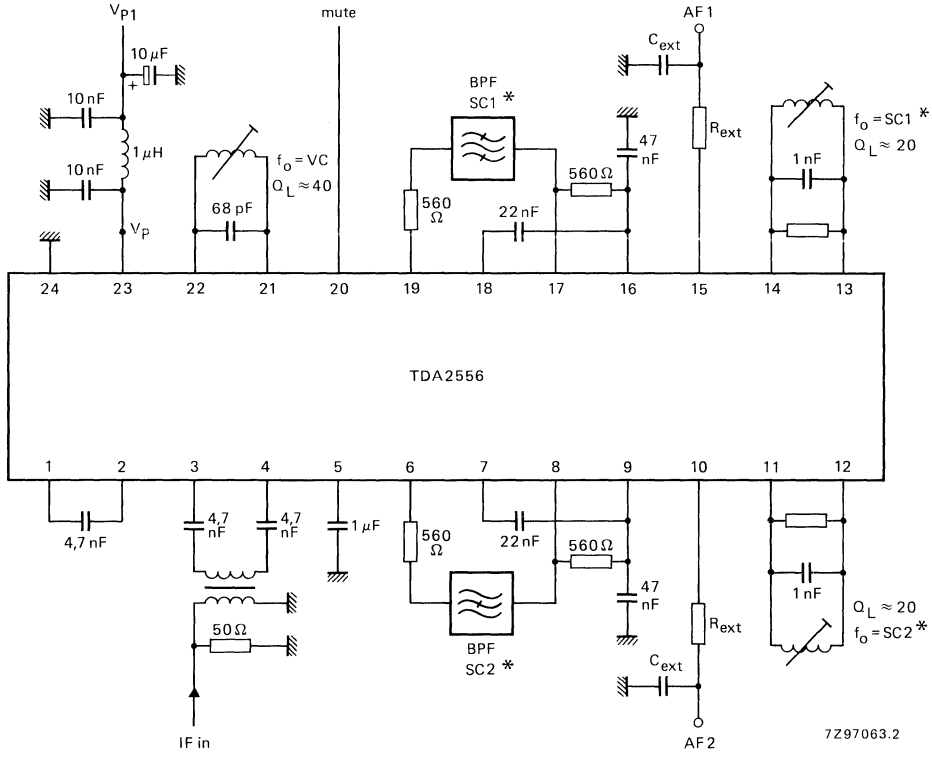


Fig. 2 Application diagram ($\tau_{deemph} = R_{ext} \cdot C_{ext}$)
(Input transformer "IF in" only for testing)

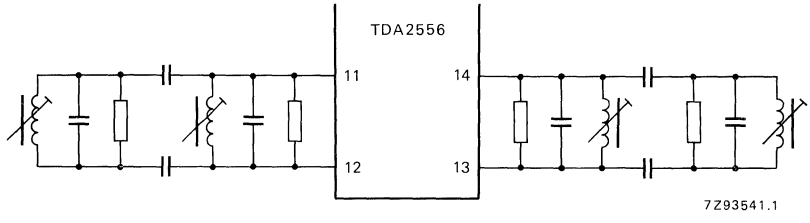


Fig. 3 Distortion improvement (see note 3 and 4).

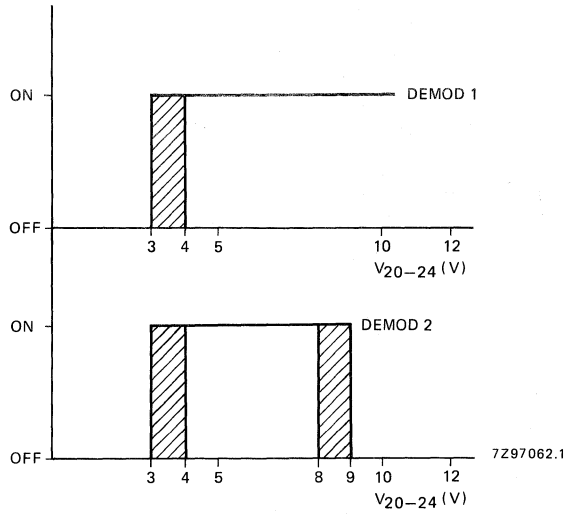


Fig. 4 Mute function.

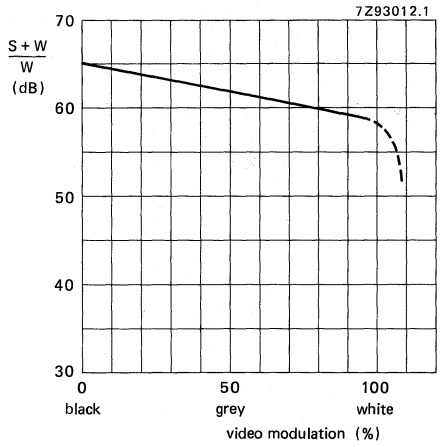


Fig. 5 Signal to weighted noise ratio depending on video modulation.

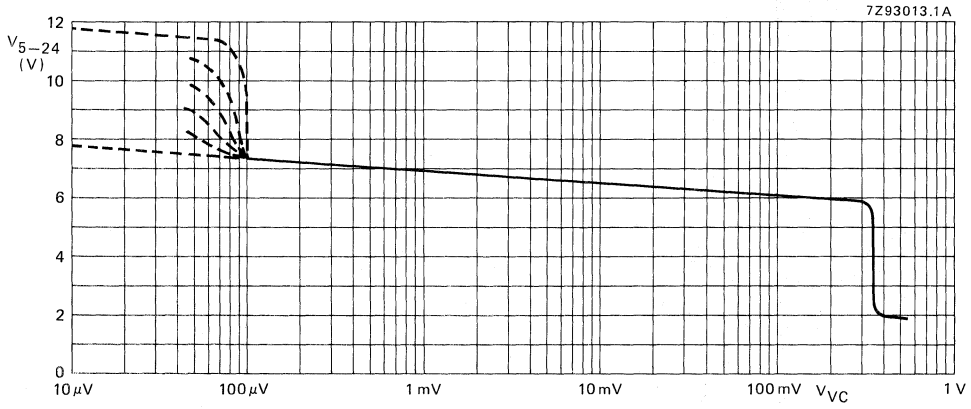


Fig. 6 Control voltage at pin 5 as a function of the input voltage $V_{VC} = V_{3\text{-}4(rms)}$.

Notes to the characteristics

1. Incidential phase on the vision carrier, caused by the TV transmitter, has to be less than 0,5 degrees for black and white transient; this is equivalent to S + W/W = 56 dB for a 6 kHz sine wave.
2. Input signal second IF $V_{8\text{-}24/17\text{-}24}$ = 10 mVrms.
3. THD value is valid for ceramic bandpass filters of SC* and single resonance circuits at pins 11 and 12 and pins 13 and 14.
4. THD value is valid for LC bandpass filters of SC* and double resonance circuits at pins 11 and 12 and pins 13 and 14.
5. If higher a.c. output current is required an external resistor has to be applied from output (pins 10 and 15) to ground (minimum 2 kΩ) in order to improve the THD performance.

SYNCHRONIZATION CIRCUIT WITH VERTICAL OSCILLATOR AND DRIVER STAGES

GENERAL DESCRIPTION

The TDA2577A separates the vertical and horizontal sync pulses from the composite TV video signal and uses them to synchronize horizontal and vertical oscillators.

Features

- Horizontal sync separator and noise inverter
- Horizontal oscillator
- Horizontal output stage
- Horizontal phase detector (sync to oscillator)
- Time constant switch for phase detector (fast time constant during catching)
- Slow time constant for noise only conditions
- Time constant externally switchable (e.g. fast for VCR)
- Inhibit of horizontal phase detector and video transmitter identification circuit during vertical oscillator flyback
- Second phase detector ($\varphi 2$) for storage compensation of horizontal deflection stage
- Sandcastle pulse generator (3-levels)
- Video transmitter identification circuit
- Stabilizer and supply circuit for starting the horizontal oscillator and output stage directly from the mains rectifier
- Duty factor of horizontal output pulse is 50% when flyback pulse is absent
- Vertical sync separator
- Bandgap 6,5 V reference voltage for vertical oscillator and comparator
- Synchronized vertical oscillator/sawtooth generator (synchronization inhibited when no video transmitter is detected)
- Internal circuit for 3% parabolic pre-correction of the oscillator/sawtooth generator. Comparator supplied with pre-corrected sawtooth and external feedback input
- Vertical comparator with internal 3% pre-correction circuit for vertical oscillator/sawtooth generator
- Vertical driver stage
- Vertical blanking pulse generator with external adjustment of pulse duration (50 Hz: 21 lines; 60Hz: 17 lines)
- Vertical guard circuit

QUICK REFERENCE DATA

Supply			
Minimum current required to start horizontal oscillator and output stage (pin 16)	I_{16}	>	4,5 mA
Main supply voltage (pin 10)	$V_P = V_{10-9}$	typ.	12 V
Supply current	$I_P = I_{10}$	typ.	55 mA
Input signals			
Sync pulse input voltage (peak-to-peak value; negative-going)	$V_{5-9(p-p)}$		0,15 to 1 V
Output signals			
Horizontal output pulse (open collector) at I_{11} = 40 mA	V_{11-9}	<	0,5 V
Vertical output pulse (emitter-follower) at I_1 = 10 mA	V_{1-9}	>	4 V

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102HE).

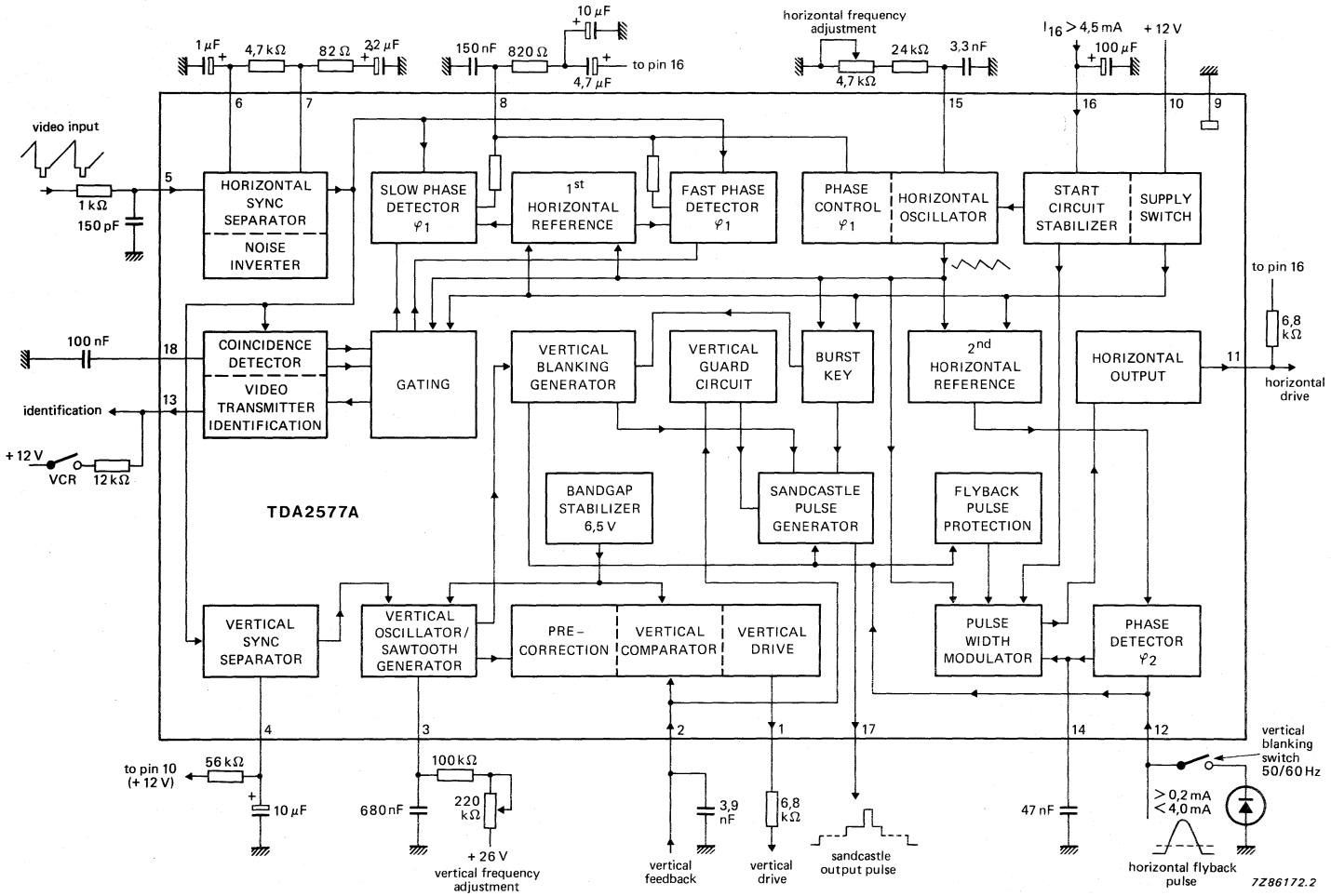


Fig. 1 Block diagram.

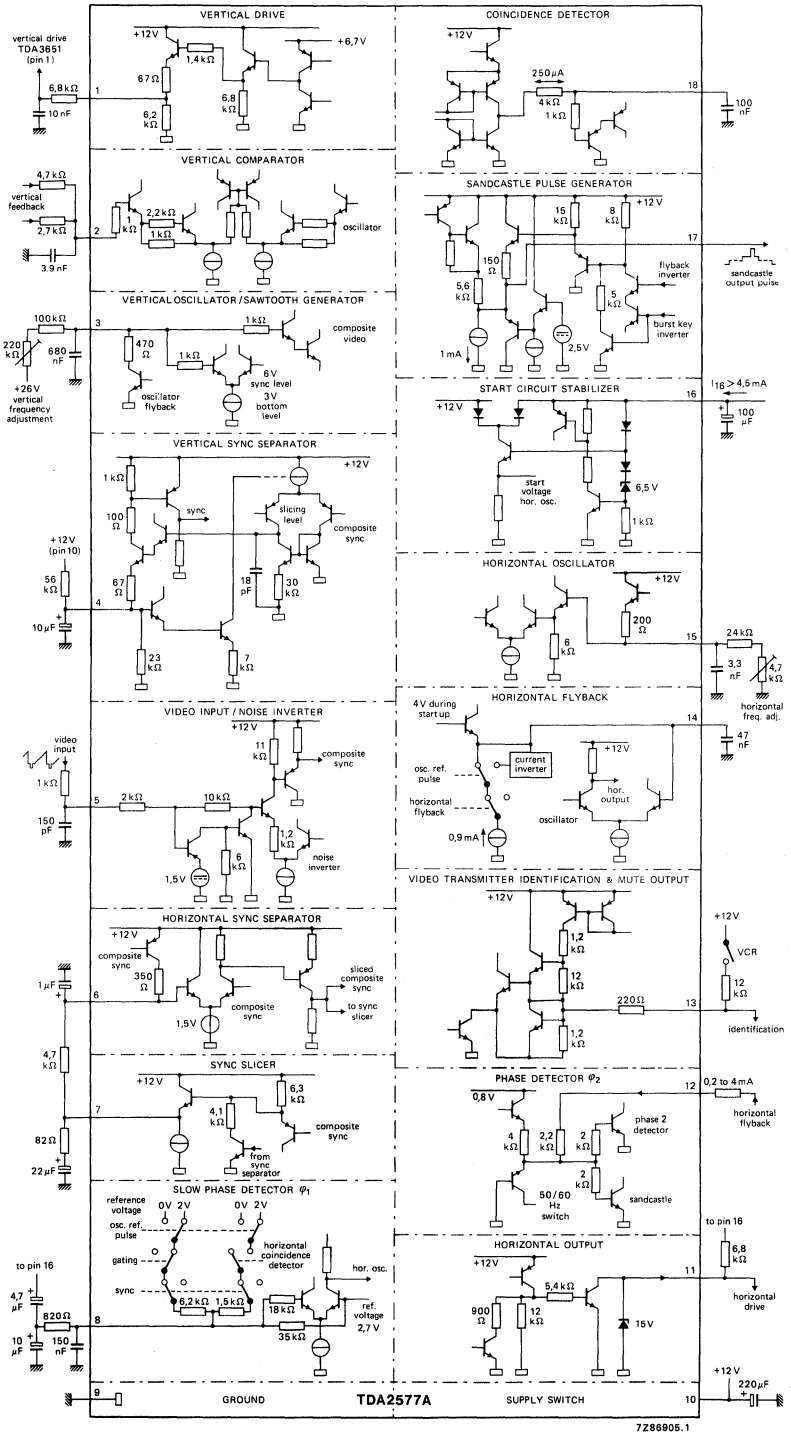


Fig. 2 TDA2577A circuit diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Start current (pin 16)	I_{16}	max.	8	mA
Supply voltage (pin 10)	$V_P = V_{10-9}$	max.	13,2	V
Total power dissipation	P_{tot}	max.	1,1	W
Storage temperature range	T_{stg}		−55 to + 150	°C
Operating ambient temperature range	T_{amb}		−25 to + 65	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	typ.	50	K/W

CHARACTERISTICS

I_{16} = 5 mA; V_P = 12 V; T_{amb} = 25 °C; unless otherwise specified

Supply				
Supply current at pin 16	I_{16}		4,5 to 8	mA
Stabilized supply voltage (pin 16)	V_{16-9}	typ.	8,7	V
			8,0 to 9,5	V
Supply current (pin 10)	I_{10}	typ.	55	mA
		<	70	mA
Supply voltage (pin 10)	$V_P = V_{10-9}$	typ.	12	V
			10 to 13,2	V
Video input (pin 5)				
Top-sync level	V_{5-9}	typ.	3,1	V
			1,5 to 3,75	V
Sync pulse amplitude (peak-to-peak value) (note 1)	$V_{5-9(p-p)}$	typ.	0,6	V
			0,15 to 1	V
Slicing level		typ.	50	%
			35 to 65	%
Delay between video input and detector output	t_1	typ.	0,35	μs
Noise gate (pin 5)				
Switching level	V_{5-9}	typ.	0,7	V
		<	1	V
First control loop (sync to oscillator; pin 8)				
Holding range	Δf	typ.	± 800	Hz
Catching range	Δf	typ.	± 800	Hz
			±600 to ±1100	Hz
Control sensitivity video with respect to oscillator, burst key and flyback pulse				
for slow time constant		typ.	1	kHz/μs
for fast time constant		typ.	2,75	kHz/μs

Second control loop (horizontal output to flyback; pin 14)				
Control sensitivity; static (see note 2)	$\Delta t_d/\Delta t_o$	typ.	400	$\mu s/\mu s$
Control range	t_d		1 to 50	μs
Controlled edge	negative			
Phase adjustment (via 2nd control loop; pin 14)				
Control sensitivity		typ.	25	$\mu A/\mu s$
Maximum permissible control current	$\pm I_{14}$	<	60	μA
Horizontal oscillator (pin 15)				
Frequency (no sync)	f_{osc}	typ.	15 625	Hz
Frequency spread (C_{osc} = 3,3 nF; R_{osc} = 24 kΩ)	Δf_{osc}	<	4	%
Frequency deviation between starting point of output signal and stabilized condition	Δf_{osc}	typ. <	6 8	% %
Temperature coefficient	TC	typ.	$1 \cdot 10^{-4}$	K^{-1}
Horizontal output (pin 11)				
Output voltage; high level	V_{11-9}	<	13,2	V
Voltage at which protection starts	V_{11-9}		13 to 15,8	V
Output voltage; low level start condition at I_{11} = 10 mA	V_{11-9}	typ. <	0,3 0,5	V V
normal condition at I_{11} = 40 mA	V_{11-9}	typ. <	0,3 0,5	V V
Duty factor of output signal during starting (no phase shift; voltage at pin 11 low)	δ	typ.	65	%
Duty factor of output signal without flyback pulse	δ	typ. 	50 47 to 57	% %
Controlled edge	negative			
Duration of output pulse (see Fig. 3)			$t_d + t_o + 2,5$	μs
Sandcastle output pulse (pin 17)				
Output voltage during: burst key	V_{17-9}	>	10	V
horizontal blanking	V_{17-9}	typ. 	4,6 4,2 to 5	V V
vertical blanking	V_{17-9}	typ. 	2,5 2 to 3	V V
Pulse duration				
burst key	t_p	typ. 	3,7 3,3 to 4,1	μs μs
horizontal blanking	flyback pulse (see note 3)			
vertical blanking for 50 Hz application ($-I_{12}$: 0 to 0,1 mA) for 60 Hz application ($-I_{12}$: typ. 0,2 mA)			21 17	lines lines

CHARACTERISTICS (continued)

Delay between the start of the sync at the video input and the rising edge of the burst key pulse	t_2	typ.	5,2 μs
			4,8 to 5,6 μs
Delay between the start of the sync and the trailing edge of the burst key	t_2	typ.	8,8 μs
			8,1 to 9,3 μs
Coincidence detector; video transmitter identification circuit; time constant switches (pin 18); see also Fig. 2			
Detector output current	$\pm I_{18}$	typ.	300 μA
Voltage during noise (note 4)	V_{18-9}	typ.	0,3 V
Voltage level for in-sync condition	V_{18-9}	typ.	7,5 V
Switching level slow to fast	V_{18-9}	typ.	3,5 V
			3,2 to 3,8 V
Switching level mute function active; φ_1 fast to slow	V_{18-9}	typ.	1,2 V
			1,0 to 1,4 V
vertical period counter 3 periods fast	V_{18-9}	typ.	0,12 V
			0,08 to 0,16 V
Switching level slow to fast (locking) mute function inactive	V_{18-9}	typ.	1,7 V
			1,5 to 1,9 V
Switching level fast to slow (locking)	V_{18-9}	typ.	5,0 V
			4,7 to 5,3 V
Switching level for VCR (fast time constant) without mute function	V_{18-9}	typ.	8,6 V
			8,2 to 9,0 V
Video transmitter identification output (pin 13)			
Output voltage active (no sync) at I_{13} = 1 mA	V_{13-9}	>	10 V
		typ.	11 V
Output voltage active (no sync) at I_{13} = 5 mA	V_{13-9}	>	7 V
		typ.	10 V
Output voltage inactive	V_{13-9}	<	0,5 V
		typ.	0,1 V
VCR switching (pin 13)			
Input current for fast time constant phase detector φ_1, with mute function active	I_{13}	typ.	0,6 mA
			0,4 to 0,8 mA
Flyback input pulse (pin 12)			
Switching level	V_{12-9}	typ.	1 V
Input current	I_{12}		0,2 to 4 mA
Input pulse amplitude (peak-to-peak value)	$V_{12-9(p-p)}$	<	12 V
Input resistance	R_{12-9}	typ.	2,7 kΩ
Delay time of sync pulse (measured in φ_1) to flyback at switching level; t_{fl} = 12 μs (see also note 2 and Fig. 4)	t_o	typ.	1,3 μs

Duration of vertical blanking pulse (pin 12)

Required input current (negative)			
for 50 Hz application; 21 lines blanking	$-I_{12}$	typ.	0,2 mA
		$>0,15$ to $<0,3$	mA
for 60 Hz application; 17 lines blanking	$-I_{12}$	$<$	0,1 mA
Maximum allowed input current	$-I_{12}$	$<$	0,4 mA

Vertical sawtooth generator (pin 3)

Vertical frequency (no sync)	f_s	typ.	46 Hz
Frequency spread (C_{osc} = 680 nF; R_{osc} = 187 kΩ; at + 26 V)	Δf_s	$<$	4 %
Synchronization range		typ.	22 %
Input current at V_{3-9} = 6 V	I_3	$<$	2 μA
Frequency shift for V_P = 10 to 13 V	Δf_s	$<$	0,2 %
Temperature coefficient	TC	typ.	$1 \cdot 10^{-4}$ K^{-1}

Comparator (pin 2)

Input voltage; d.c. level	V_{2-9}	typ.	4,4 V
		4,0 to 4,8	V
a.c. level (peak-to-peak value)	$V_{2-9(p-p)}$	typ.	1,5 V
Input current at V_{2-9} = 6 V	I_2	$<$	2 μA
Sawtooth internal pre-correction (parabolic convex)		typ.	3 %

Vertical output stage; emitter follower (pin 1)

Output voltage at I_1 = 10 mA	V_{1-9}	typ.	3,6 V
		3,2 to 5	V
Output current	I_1	$<$	20 mA

Vertical guard circuit

Activating voltage levels (vertical blanking level is 2,5 V)

switching level low	V_{2-9}	typ.	3 V
		2,7 to 3,3	V
switching level high	V_{2-9}	typ.	5,8 V
		5,4 to 6,3	V

Notes to characteristics

1. Up to 1 V peak-to-peak the slicing level is constant; at amplitudes exceeding 1 V peak-to-peak the slicing level will increase.
2. t_d = delay between negative transient of horizontal output pulse and the rising edge of the flyback pulse.
   t_o = delay between the rising edge of the flyback pulse and the start of the current in φ_1 (pin 8).
3. The duration of the flyback pulse is measured at the input switching level, which is about 1 V (t_{fl}).
4. Depends on d.c. level at pin 5; value given applicable for $V_{5-9} \approx 5$ V.

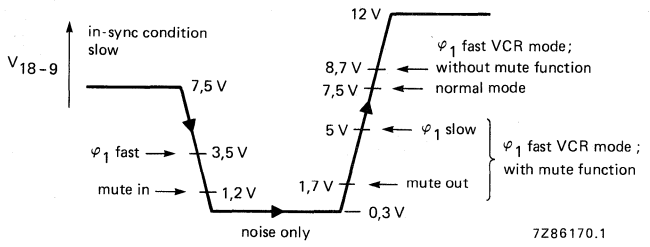


Fig. 3 Voltage levels at pin 18 (V_{18-9}).

APPLICATION INFORMATION

The TDA2577A generates the signal for driving the horizontal deflection output circuit. It also contains a synchronized vertical sawtooth generator for direct drive of the vertical deflection output stage.

The horizontal oscillator and output stage can start operating on a very low supply current ($I_{16} \geqslant 4{,}5$ mA), which can be taken directly from the mains rectifier. Therefore, it is possible to derive the main supply (pin 10) from the horizontal deflection output stage. The duty factor of the horizontal output signal is about 65% during the starting-up procedure. After starting-up, the second phase detector (φ_2) is activated to control the timing of the negative-going edge of the horizontal output signal.

A bandgap reference voltage (6,5 V) is provided for supply and reference of the vertical oscillator and comparator stage.

The slicing level of the horizontal sync separator is independent of the amplitude of the sync pulse at the input. The resistor between pins 6 and 7 determines its value. A 4,7 kΩ resistor gives a slicing level at the middle of the sync pulse. The nominal top sync level at the input is 3,1 V. The amplitude selective noise inverter is activated at a level of 0,7 V.

Good stability is obtained by means of the two control loops. In the first loop, the phase of the horizontal sync signal is compared with a waveform of which the rising edge refers to the top of the horizontal oscillator signal. In the second loop, the phase of the flyback pulse is compared with another reference waveform, the timing of which is such that the top of the flyback pulse is situated symmetrically on the horizontal blanking interval of the video signal. Therefore the first loop can be designed for a good noise immunity, whereas the second loop can be as fast as desired for compensation of switch-off delays in the horizontal output stage.

The first phase detector is gated with a pulse derived from the horizontal oscillator signal. This gating (slow time constant) is switched off during catching. Also, the output current of the phase detector is increased fivefold, during the catching time and VCR conditions (fast time constant). The first phase detector is inhibited during the retrace time of the vertical oscillator.

The in-sync, out-of-sync or no video condition is detected by the video transmitter identification/coincidence detector circuit (pin 18). The voltage on pin 18 defines the time constant and gating of the first phase detector. The relationship between this voltage and the various switching levels is shown in Fig. 3. The complete survey of the switching actions is given in Table 1.

APPLICATION INFORMATION (continued)

Table 1 Switching levels at pin 18.

voltage at pin 18	first phase detector φ_1				mute output at pin 13		receiving conditions
	time constant		gating				
	slow	fast	on	off	on	off	
7,5 V	X		X			X	video signal detected
7,5 to 3,5 V	X		X			X	video signal detected
3,5 to 1,2 V		X		X		X	video signal detected
1,2 to 0,1 V	X		X		X		noise only
0,1 to 1,7 V	X	*	X	*	X		new video signal detected
1,7 to 5,0 V		X		X		X	horizontal oscillator locked
							VCR playback with mute function
5,0 to 7,5 V	X		X			X	horizontal oscillator locked
8,7 V		X		X		X	VCR playback without mute function

Where: * = 3 vertical periods.

The stability of displayed video information (e.g. channel number), during noise only conditions, is improved by the first phase detector time constant being set to slow.

The average voltage level of the video input on pin 5 during noise only conditions should not exceed 5,5 V otherwise the time constant switch may be set to fast due to the average voltage level on pin 18 dropping below 0,1 V. When the voltage on pin 18 drops below 100 mV a counter is activated which sets the time constant switch to fast, and not gated for 3 vertical periods. This condition occurs when a new video signal is present at pin 5. When the horizontal oscillator is locked the voltage on pin 18 increases. Nominally a level of 5 V is reached within 15 ms (1 vertical period). The mute switching level of 1,2 V is reached within 5 ms (C_{18} = 47 nF). If the video transmitter identification circuit is required to operate under VCR playback conditions the first phase detector can be set to fast by connecting a resistor of 180 kΩ between pin 18 and ground. Also a current of 0,6 mA into pin 13 sets the first phase detector to fast without affecting the mute output function (active HIGH with no video signal detected). For VCR playback without mute function, the first phase detector can be set to fast by connecting a resistor of 1 kΩ to the supply (pin 10).

The supply for the horizontal oscillator (pin 15) and horizontal output stage (pin 11) is derived from the voltage at pin 16 during the start condition. The horizontal output signal starts at a nominal supply current into pin 16 of 3,8 mA, which will result in a supply voltage of about 5,5 V (for guaranteed operation of all devices $I_{16} > 4{,}5$ mA). It is possible that the main supply voltage at pin 10 is 0 V during starting, so the main supply of the IC can be taken from the horizontal deflection output stage. The start of the other IC functions depends on the value of the main supply voltage at pin 10. At 5,5 V all IC functions start operating except the second phase detector (oscillator to flyback pulse). The output voltage of the second phase detector at pin 14 is clamped by means of an internally loaded n-p-n emitter follower. This ensures that the duty factor of the horizontal output signal (pin 11) remains at about 65%. The second phase detector will close if the supply voltage at pin 10 reaches 8,8 V. At this value the supply current for the horizontal oscillator and output stage is delivered by pin 10, which also causes the voltage at pin 16 to change to a stabilized 8,7 V. This change switches off the n-p-n emitter follower at pin 14 and activates the second phase detector. The supply voltage for the horizontal oscillator will, however, still be referred to the stabilized voltage at pin 16, and the duty factor of the output signal at pin 12 is at the value required by the delay at the horizontal deflection stage. Thus switch-off delays

in the horizontal output stage are compensated. When no horizontal flyback signal is detected the duty factor of the horizontal output signal is 50%.

Horizontal picture shift is possible by externally charging or discharging the 47 nF capacitor connected to pin 14.

The IC also contains a synchronized vertical oscillator/sawtooth generator. The oscillator signal is connected to the internal comparator (the other side of which is connected to pin 2), via an inverter and amplitude divider stage. The output of the comparator drives an emitter-follower output stage at pin 1. For a linear sawtooth in the oscillator, the load resistor at pin 3 should be connected to a voltage source of 26 V or higher. The sawtooth amplitude is not influenced by the main supply at pin 10. The feedback signal is applied to pin 2 and compared to the sawtooth signal at pin 3. For an economical feedback circuit with less picture bounce the sawtooth signal is internally precorrected by 3% (convex) referred to pin 2. The linearity of the vertical deflection current depends upon the oscillator signal at pin 3 and the feedback signal at pin 2.

Synchronization of the vertical oscillator is inhibited when the mute output is present at pin 13.

To minimize the influence of the horizontal part on the vertical part a 6,5 V bandgap reference source is provided for supply and reference of the vertical oscillator and comparator.

The sandcastle pulse, generated at pin 17, has three different voltage levels. The highest level (11 V) can be used for burst gating and black level clamping. The second level (4,6 V) is obtained from the horizontal flyback pulse at pin 12 and used for horizontal blanking. The third level (2,5 V) is used for vertical blanking and is derived by counting the horizontal frequency pulses. For 50 Hz the blanking pulse duration is 21 lines and for 60 Hz it is 17 lines. The blanking pulse duration is set by the negative voltage value of the horizontal flyback pulse at pin 12.

The IC also incorporates a vertical guard circuit, which monitors the vertical feedback signal at pin 2. If this level is below 3 V or higher than 5,8 V, the guard circuit will insert a continuous level of 2,5 V into the sandcastle output signal. This will result in complete blanking of the screen if the sandcastle pulse is used for blanking in the TV set.

APPLICATION INFORMATION (continued)

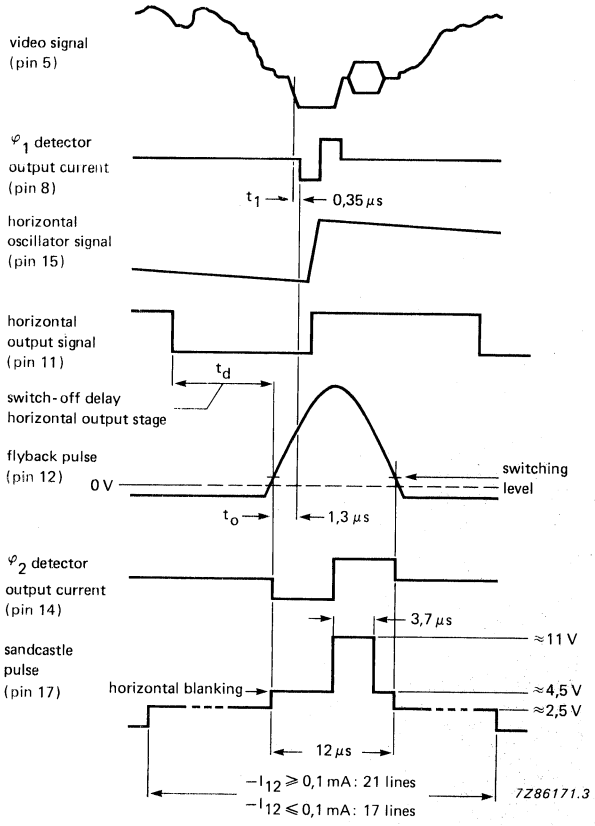


Fig. 4 Timing diagram of the TDA2577A.

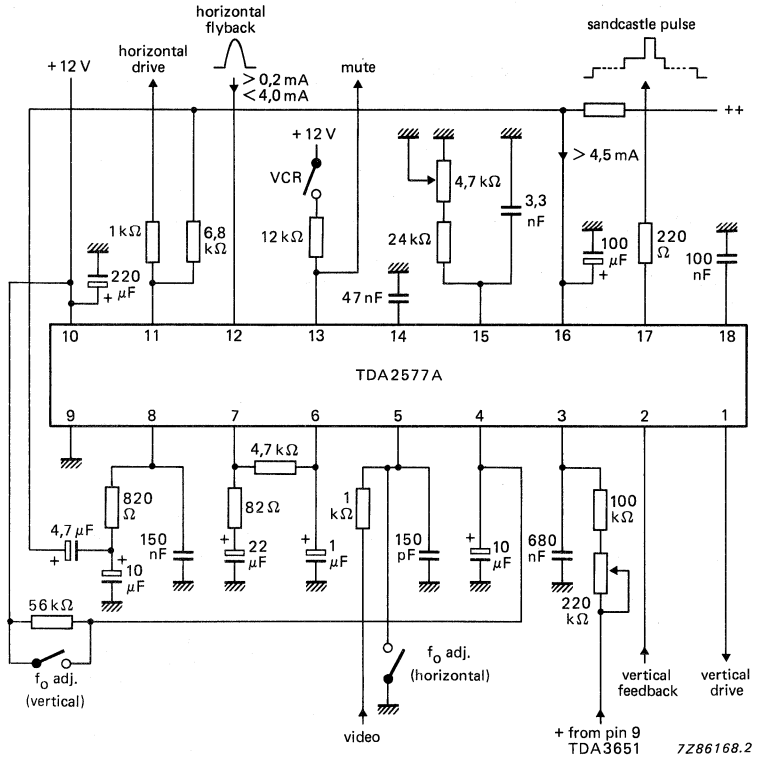


Fig. 5 Typical application circuit diagram; for combination of the TDA2577A with the TDA3651 see Fig. 7.

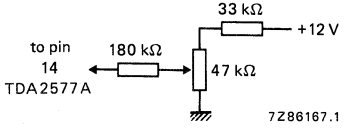


Fig. 6 Circuit configuration at pin 14 for phase adjustment.

APPLICATION INFORMATION (continued)

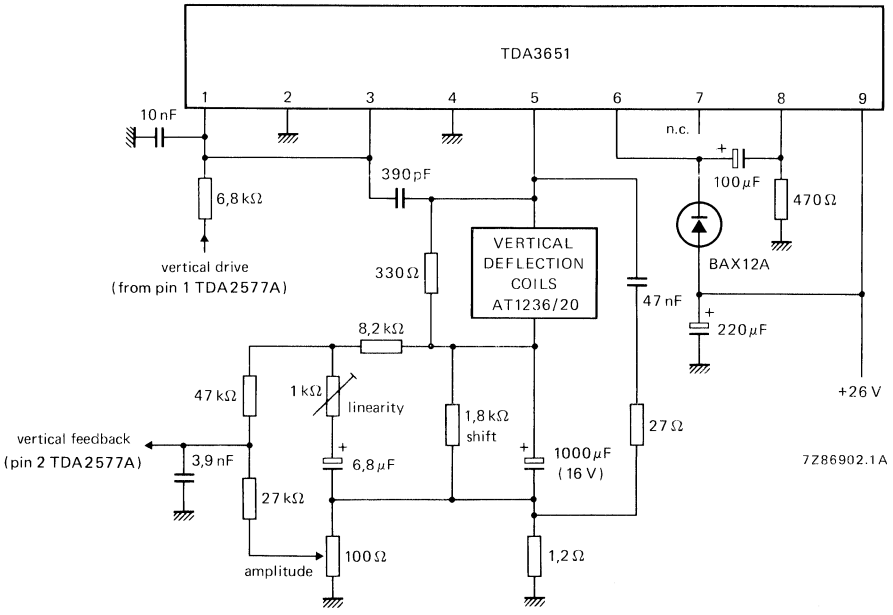


Fig. 7 Typical application circuit diagram of the TDA3651 (vertical output), when used in combination with the TDA2577A (90° application).

SYNCHRONIZATION CIRCUIT WITH VERTICAL OSCILLATOR AND DRIVER STAGES

GENERAL DESCRIPTION

The TDA2578A separates the vertical and horizontal sync pulses from the composite TV video signal and uses them to synchronize horizontal and vertical oscillators.

Features

- Horizontal sync separator and noise inverter
- Horizontal oscillator
- Horizontal output stage
- Horizontal phase detector (sync to oscillator)
- Time constant switch for phase detector (fast time constant during catching)
- Slow time constant for noise only conditions
- Time constant externally switchable (e.g. fast for VCR)
- Inhibit of horizontal phase detector and video transmitter identification circuit during vertical oscillator flyback
- Second phase detector (φ_2) for storage compensation of horizontal deflection stage
- Sandcastle pulse generator (3-levels)
- Video transmitter identification circuit
- Stabilizer and supply circuit for starting the horizontal oscillator and output stage directly from the mains rectifier
- Duty factor of horizontal output pulse is 50% when flyback pulse is absent
- Vertical sync separator
- Bandgap 6,5 V reference voltage for vertical oscillator and comparator
- Synchronized vertical oscillator/sawtooth generator (synchronization inhibited when no video transmitter is detected)
- Internal circuit for 6% parabolic pre-correction of the oscillator/sawtooth generator. Comparator supplied with pre-corrected sawtooth and external feedback input
- Vertical driver stage
- Vertical blanking pulse generator
- 50/60 Hz detector
- 50/60 Hz identification output
- Automatic amplitude adjustment for 60 Hz
- Automatic adjustment of blanking pulse duration (50 Hz: 21 lines; 60 Hz: 17 lines)
- Vertical guard curcuit

QUICK REFERENCE DATA

Supply			
Minimum current required to start horizontal oscillator and output stage (pin 16)	I_{16}	>	4,5 mA
Main supply voltage (pin 10)	$V_P = V_{10-9}$	typ.	12 V
Supply current	$I_P = I_{10}$	typ.	55 mA
Input signals			
Sync pulse input voltage (peak-to-peak value; negative-going)	$V_{5-9(p-p)}$		0,15 to 1 V
Output signals			
Horizontal output pulse (open collector) at I_{11} = 40 mA	V_{11-9}	<	0,5 V
Vertical output pulse (emitter-follower) at I_1 = 10 mA	V_{1-9}	>	4 V

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102HE).

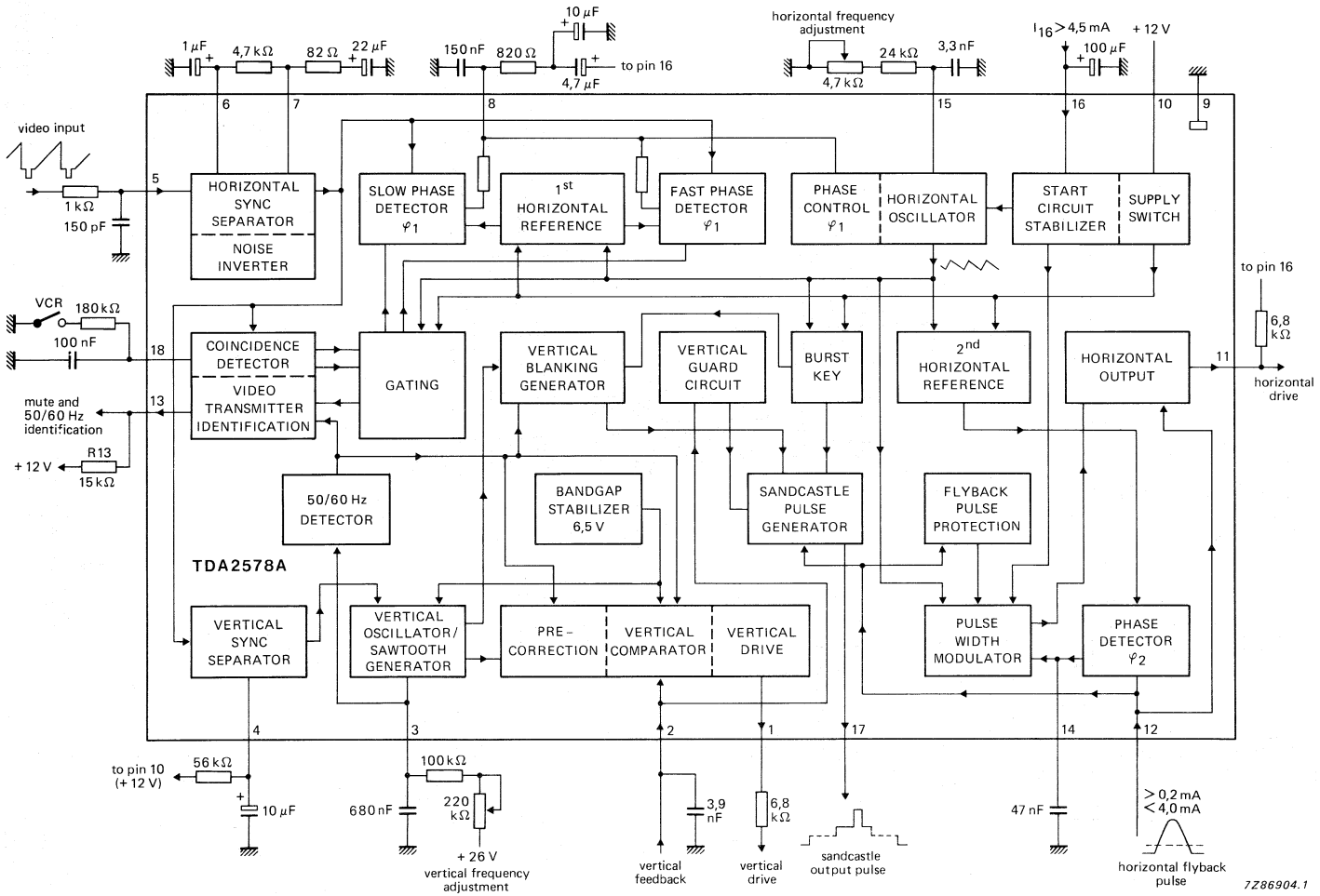


Fig. 1 Block diagram.

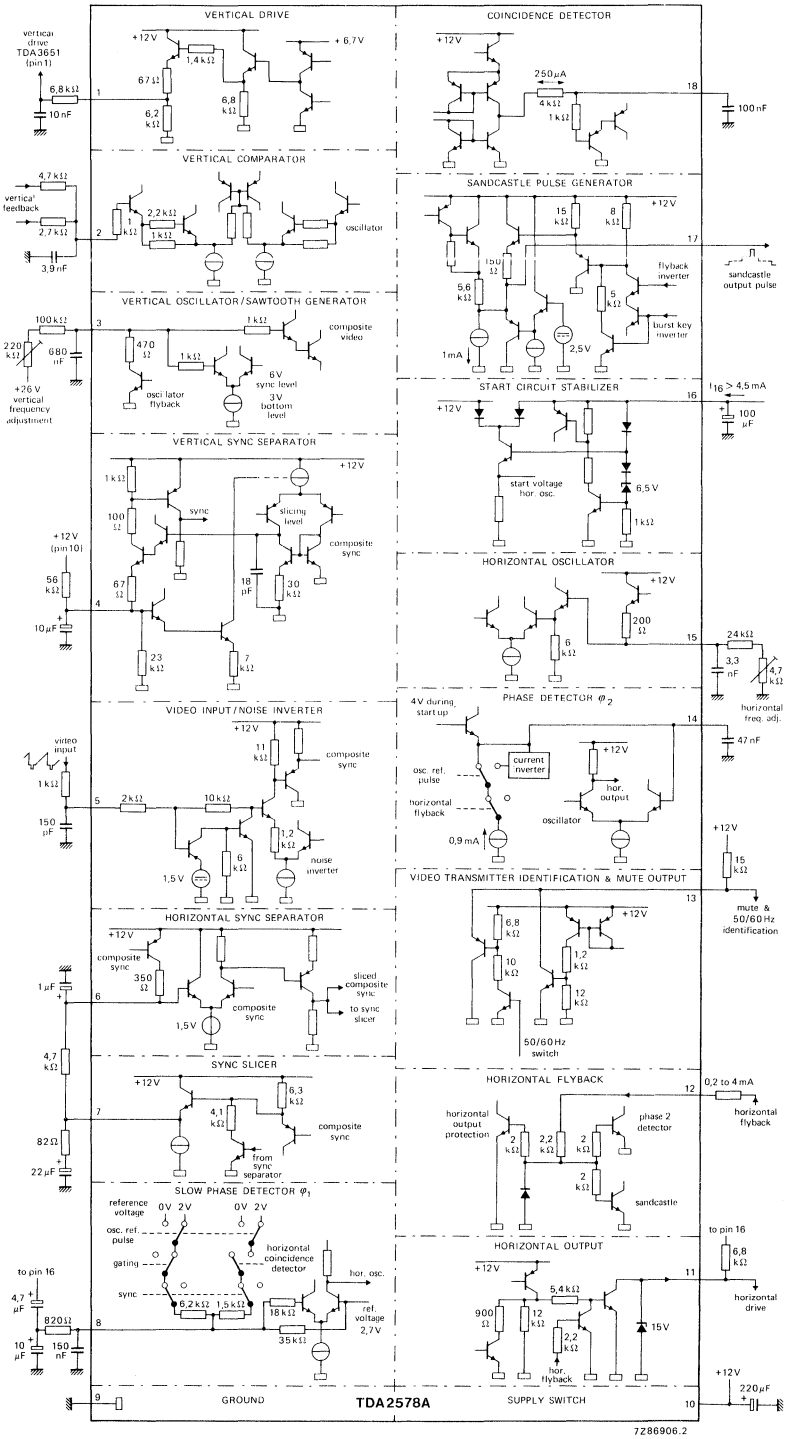


Fig. 2 TDA2578A circuit diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Start current (pin 16)	I_{16}	max.	8	mA
Supply voltage (pin 10)	$V_P = V_{10-9}$	max.	13,2	V
Total power dissipation	P_{tot}	max.	1,1	W
Storage temperature range	T_{stg}		−55 to + 150	°C
Operating ambient temperature range	T_{amb}		−25 to + 65	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	typ.	50	K/W

CHARACTERISTICS

I_{16} = 5 mA; V_P = 12 V; T_{amb} = 25 °C; unless otherwise specified

Supply

Supply current at pin 16	I_{16}		4,5 to 8	mA
Stabilized supply voltage (pin 16)	V_{16-9}	typ.	8,7	V
			8,0 to 9,5	V
Supply current (pin 10)	I_{10}	typ.	55	mA
		<	70	mA
Supply voltage (pin 10)	$V_P = V_{10-9}$	typ.	12	V
			10 to 13,2	V

Video input (pin 5)

Top-sync level	V_{5-9}	typ.	3,1	V
			1,5 to 3,75	V
Sync pulse amplitude (peak-to-peak value) (note 1)	$V_{5-9(p-p)}$	typ.	0,6	V
			0,15 to 1	V
Slicing level		typ.	50	%
			35 to 65	%
Delay between video input and detector output	t_1	typ.	0,35	μs

Noise gate (pin 5)

Switching level	V_{5-9}	typ.	0,7	V
		<	1	V

First control loop (sync to oscillator; pin 8)

Holding range	Δf	typ.	± 800	Hz
Catching range	Δf	typ.	± 800	Hz
			±600 to ±1100	Hz
Control sensitivity video with respect to oscillator, burst key and flyback pulse				
for slow time constant		typ.	1	kHz/μs
for fast time constant		typ.	2,75	kHz/μs

Second control loop (horizontal output to flyback; pin 14)				
Control sensitivity; static (see note 2)	$\Delta t_d/\Delta t_o$	typ.	400	$\mu s/\mu s$
Control range	t_d		1 to 45	μs
Controlled edge	positive			
Phase adjustment (via 2nd control loop; pin 14)				
Control sensitivity		typ.	25	$\mu A/\mu s$
Maximum permissible control current	$\pm I_{14}$	$<$	60	μA
Horizontal oscillator (pin 15)				
Frequency (no sync)	f_{osc}	typ.	15 625	Hz
Frequency spread (C_{osc} = 3,3 nF; R_{osc} = 24 kΩ; no sync)	Δf_{osc}	$<$	4	%
Frequency deviation between starting point of output signal and stabilized condition	Δf_{osc}	typ. $<$	6 8	% %
Temperature coefficient	TC	typ.	$1 \cdot 10^{-4}$	K^{-1}
Horizontal output (pin 11)				
Output voltage; high level	$V_{11\text{-}9}$	$<$	13,2	V
Voltage at which protection starts	$V_{11\text{-}9}$		13 to 15,8	V
Output voltage; low level start condition at I_{11} = 10 mA	$V_{11\text{-}9}$	typ. $<$	0,3 0,5	V V
normal condition at I_{11} = 40 mA	$V_{11\text{-}9}$	typ. $<$	0,3 0,5	V V
Duty factor of output signal during starting (no phase shift) I_{16} = 4 mA (voltage at pin 11 low)	δ	typ.	65	%
Duty factor of output signal without flyback pulse	δ	typ. 	50 45 to 55	% %
Controlled edge	positive			
Duration of output pulse (see Fig. 4)	t_d + horizontal flyback pulse			
Sandcastle output pulse (pin 17)				
Output voltage during:				
burst key	$V_{17\text{-}9}$	$>$	10	V
horizontal blanking	$V_{17\text{-}9}$	typ. 	4,6 4,2 to 5	V V
vertical blanking	$V_{17\text{-}9}$	typ. 	2,5 2 to 3	V V
Pulse duration				
burst key	t_p	typ. 	3,7 3,3 to 4,1	μs μs
horizontal blanking	flyback pulse (see note 3)			
vertical blanking				
at 50 Hz	21 lines			
at 60 Hz	17 lines			

CHARACTERISTICS (continued)

Delay between the start of the sync at the video input and the rising edge of the burst key pulse	t_2	typ.	5,2 μs 4,8 to 5,6 μs
Delay between start of sync and trailing edge of burst key	t_2	typ.	8,8 μs 8,1 to 9,3 μs
Coincidence detector; video transmitter identification circuit; time constant switches (pin 18); see also Fig. 3			
Detector output current	$\pm I_{18}$	typ.	300 μA
Voltage during noise (note 4)	V_{18-9}	typ.	0,3 V
Voltage level for in-sync condition	V_{18-9}	typ.	7,5 V
Switching level slow to fast	V_{18-9}	typ.	3,5 V 3,2 to 3,8 V
Switching level mute function active; φ_1 fast to slow	V_{18-9}	typ.	1,2 V 1,0 to 1,4 V
vertical period counter 3 periods fast	V_{18-9}	typ.	0,12 V 0,08 to 0,16 V
Switching level slow to fast (locking) mute function inactive	V_{18-9}	typ.	1,7 V 1,5 to 1,9 V
Switching level fast to slow (locking)	V_{18-9}	typ.	5,0 V 4,7 to 5,3 V
Switching level for VCR (fast time constant) without mute function	V_{18-9}	typ.	8,6 V 8,2 to 9,0 V
Video transmitter identification output (pin 13)			
Output voltage active (no sync) at I_{13} = 1 mA	V_{13-9}	<	0,5 V
		typ.	0,3 V
Sink current active (no sync)	I_{13}	⩽	5 mA
Output current inactive (svnc: 50 Hz)	I_{13}	<	1 μA
50/60 Hz identification (pin 13)			
R13 = 15 kΩ to + 12 V (note 5) at f = 50 Hz (in sync condition)	V_{13-9}	typ.	V_{10-9} V
at f = 60 Hz (in sync condition)	V_{13-9}	typ.	7,6 V 7,2 to 8 V
Flyback input pulse (pin 12)			
Switching level	V_{12-9}	typ.	1 V
Input current	I_{12}		0,2 to 4 mA
Input pulse amplitude (peak-to-peak value)	$V_{12-9(p-p)}$	<	12 V
Input resistance	R_{12-9}	typ.	2,7 kΩ
Delay time of sync pulse (measured in φ_1) to flyback at switching level; t_{fl} = 12 μs (see also note 2 and Fig. 4)	t_o	typ.	1,3 μs

Vertical sawtooth generator (pin 3)

Vertical frequency (no sync)	f_s	typ.	46 Hz
Frequency spread (C_{osc} = 680 nF; R_{osc} = 187 kΩ; at + 26 V)	Δf_s	<	4 %
Synchronization range (note 6)		typ.	33 %
Input current at V_{3-9} = 6 V	I_3	<	3 μA
Frequency shift for V_P = 10 to 13 V	Δf_s	<	0,2 %
Temperature coefficient	TC	typ.	$1 \cdot 10^{-4}$ K^{-1}

Comparator (pin 2)

Input voltage; d.c. level	V_{2-9}	typ.	4,4 V
			4,0 to 4,8 V
a.c. level (peak-to-peak value)	$V_{2-9(p-p)}$	typ.	0,8 V
Input current at V_{2-9} = 6 V	I_2	<	2 μA
Sawtooth internal pre-correction (parabolic convex)		typ.	6 %

Vertical output stage; emitter follower (pin 1)

Output voltage at I_1 = 10 mA	V_{1-9}	typ.	3,6 V
			3,2 to 5 V
Output current	I_1	<	20 mA

Vertical guard circuit

Activating voltage levels (vertical blanking level is 2,5 V)			
switching level low	V_{2-9}	typ.	3,35 V
			3,0 to 3,7 V
switching level high	V_{2-9}	typ.	5,15 V
			4,75 to 5,55 V

Notes to characteristics

1. Up to 1 V peak-to-peak the slicing level is constant; at amplitudes exceeding 1 V peak-to-peak the slicing level will increase.
2. t_d = delay between positive transient of horizontal output pulse and the rising edge of the flyback pulse.
   t_o = delay between the rising edge of the flyback pulse and the start of the current in φ_1 (pin 8).
3. The duration of the flyback pulse is measured at the input switching level, which is about 1 V (t_{fl}).
4. Depends on d.c. level at pin 5; value given applicable for $V_{5-9} \approx 5$ V.
5. For 60 Hz a p-n-p emitter clamp is activated.
6. When f_o = 46 Hz the 50/60 Hz detector switches over to 60 Hz; video input signal at pin 5 ≈ 55 Hz.

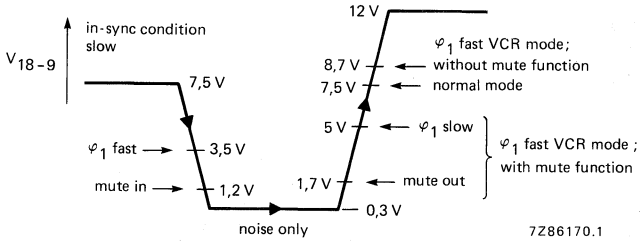


Fig. 3 Voltage levels at pin 18 (V_{18-9}).

APPLICATION INFORMATION

The TDA2578A generates the signal for driving the horizontal deflection output circuit. It also contains a synchronized vertical sawtooth generator for direct drive of the vertical deflection output stage.

The horizontal oscillator and output stage can start operating on a very low supply current ($I_{16} \geqslant 4{,}5$ mA), which can be taken directly from the mains rectifier. Therefore, it is possible to derive the main supply (pin 10) from the horizontal deflection output stage. The duty factor of the horizontal output signal is about 65% during the starting-up procedure. After starting-up, the second phase detector (φ_2) is activated to control the timing of the positive-going edge of the horizontal output signal.

A bandgap reference voltage (6,5 V) is provided for supply and reference of the vertical oscillator and comparator stage.

The slicing level of the horizontal sync separator is independent of the amplitude of the sync pulse at the input. The resistor between pins 6 and 7 determines its value. A 4,7 kΩ resistor gives a slicing level at the middle of the sync pulse. The nominal top sync level at the input is 3,1 V. The amplitude selective noise inverter is activated at a level of 0,7 V.

Good stability is obtained by means of the two control loops. In the first loop, the phase of the horizontal sync signal is compared with a waveform of which the rising edge refers to the top of the horizontal oscillator signal. In the second loop, the phase of the flyback pulse is compared with another reference waveform, the timing of which is such that the top of the flyback pulse is situated symmetrically on the horizontal blanking internal of the video signal. Therefore the first loop can be designed for a good noise immunity, whereas the second loop can be as fast as desired for compensation of switch-off delays in the horizontal output stage.

The first phase detector is gated with a pulse derived from the horizontal oscillator signal. This gating (slow time constant) is switched off during catching. Also, the output current of the phase detector is increased fivefold, during the catching time and VCR conditions (fast time constant). The first phase detector is inhibited during the retrace time of the vertical oscillator.

The in-sync, out-of-sync or no video condition is detected by the video transmitter identification/coincidence detector circuit (pin 18). The voltage on pin 18 defines the time constant and gating of the first phase detector. The relationship between this voltage and the various switching levels is shown in Fig. 3. The complete survey of the switching actions is given in Table 1.

Table 1 Switching levels at pin 18.

voltage at pin 18	first phase detector φ_1				mute output at pin 13		receiving conditions
	time constant		gating				
	slow	fast	on	off	on	off	
7,5 V	X		X			X	video signal detected
7,5 to 3,5 V	X		X			X	video signal detected
3,5 to 1,2 V		X		X		X	video signal detected
1,2 to 0,1 V	X		X		X		noise only
0,1 to 1,7 V	X	*	X	*	X		new video signal detected
1,7 to 5,0 V		X		X		X	horizontal oscillator locked VCR playback with mute function
5,0 to 7,5 V	X		X			X	horizontal oscillator locked
8,7 V		X		X		X	VCR playback without mute function

Where: * = 3 vertical periods.

APPLICATION INFORMATION (continued)

The stability of displayed video information (e.g. channel number), during noise only conditions, is improved by the first phase detector time constant being set to slow.

The average voltage level of the video input on pin 5 during noise only conditions should not exceed 5,5 V otherwise the time constant switch may be set to fast due to the average voltage level on pin 18 dropping below 0,1 V. When the voltage on pin 18 drops below 100 mV a counter is activated which sets the time constant switch to fast, and not gated for 3 vertical periods. This condition occurs when a new video signal is present at pin 5. When the horizontal oscillator is locked the voltage on pin 18 increases. Nominally a level of 5 V is reached within 15 ms (1 vertical period). The mute switching level of 1,2 V is reached within 5 ms (C_{18} = 47 nF). If the video transmitter identification circuit is required to operate under VCR playback conditions the first phase detector can be set to fast by connecting a resistor of 180 kΩ between pin 18 and ground (see Fig. 7).

The supply for the horizontal oscillator (pin 15) and horizontal output stage (pin 11) is derived from the voltage at pin 16 during the start condition. The horizontal output signal starts at a nominal supply current into pin 16 of 4,2 mA, which will result in a supply voltage of about 5,5 V (for guaranteed operation of all devices $I_{16} > 4{,}5$ mA). It is possible that the main supply voltage at pin 10 is 0 V during starting, so the main supply of the IC can be taken from the horizontal deflection output stage. The start of the other IC functions depends on the value of the main supply voltage at pin 10. At 5,5 V all IC functions start operating except the second phase detector (oscillator to flyback pulse). The output voltage of the second phase detector at pin 14 is clamped by means of an internally loaded n-p-n emitter follower. This ensures that the duty factor of the horizontal output signal (pin 11) remains at about 65%. The second phase detector will close if the supply voltage at pin 10 reaches 8,8 V. At this value the supply current for the horizontal oscillator and output stage is delivered by pin 10, which also causes the voltage at pin 16 to change to a stabilized 8,7 V. This change switches off the n-p-n emitter follower at pin 14 and activates the second phase detector. The supply voltage for the horizontal oscillator will, however, still be referred to the stabilized voltage at pin 16, and the duty factor of the output signal at pin 12 is at the value required by the delay at the horizontal deflection stage. Thus switch-off delays in the horizontal output stage are compensated. When no horizontal flyback signal is detected the duty factor of the horizontal output signal is 50%.

Horizontal picture shift is possible by externally charging or discharging the 47 nF capacitor connected to pin 14.

The IC also contains a synchronized vertical oscillator/sawtooth generator. The oscillator signal is connected to the internal comparator (the other side of which is connected to pin 2), via an inverter and amplitude divider stage. The output of the comparator drives an emitter-follower output stage at pin 1. For a linear sawtooth in the oscillator, the load resistor at pin 3 should be connected to a voltage source of 26 V or higher. The sawtooth amplitude is not influenced by the main supply at pin 10. The feedback signal is applied to pin 2 and compared to the sawtooth signal at pin 3. For an economical feedback circuit with less picture bounce the sawtooth signal is internally pre-corrected by 6% (convex) referred to pin 2. The linearity of the vertical deflection current depends upon the oscillator signal at pin 3 and the feedback signal at pin 2.

Synchronization of the vertical oscillator is inhibited when the mute output is present at pin 13.

To minimize the influence of the horizontal part on the vertical part a 6,7 V bandgap reference source is provided for supply and reference of the vertical oscillator and comparator.

The sandcastle pulse, generated at pin 17, has three different voltage levels. The highest level (11 V) can be used for burst gating and black level clamping. The second level (4,6 V) is obtained from the horizontal flyback pulse at pin 12 and used for horizontal blanking. The third level (2,5 V) is used for vertical blanking and is derived by counting the horizontal frequency pulses. For 50 Hz the blanking pulse duration is 21 lines and for 60 Hz it is 17 lines. The blanking pulse duration and sawtooth amplitude is automatically adjusted via the 50/60 Hz detector.

The IC also incorporates a vertical guard circuit, which monitors the vertical feedback signal at pin 2. If this level is below 3,35 V or higher than 5,15 V, the guard circuit will insert a continuous level of 2,5 V into the sandcastle output signal. This will result in complete blanking of the screen if the sandcastle pulse is used for blanking in the TV set.

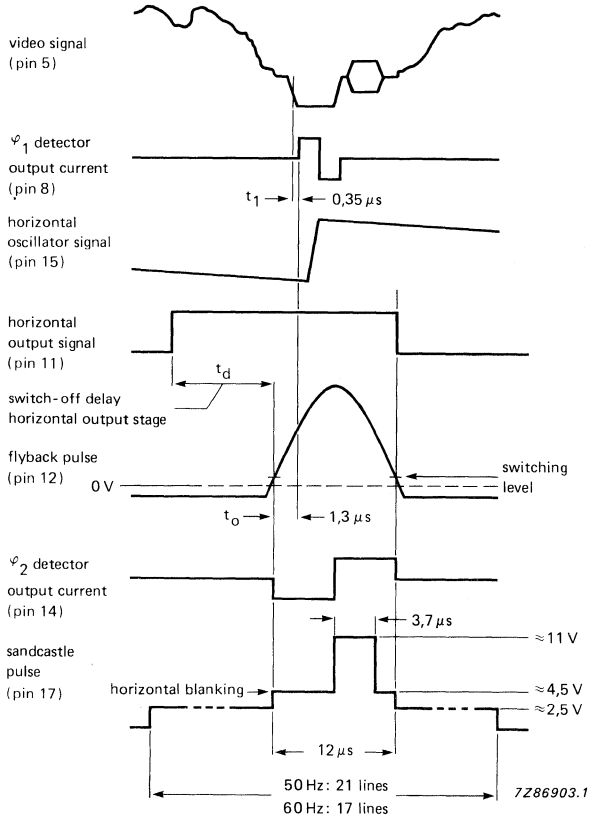
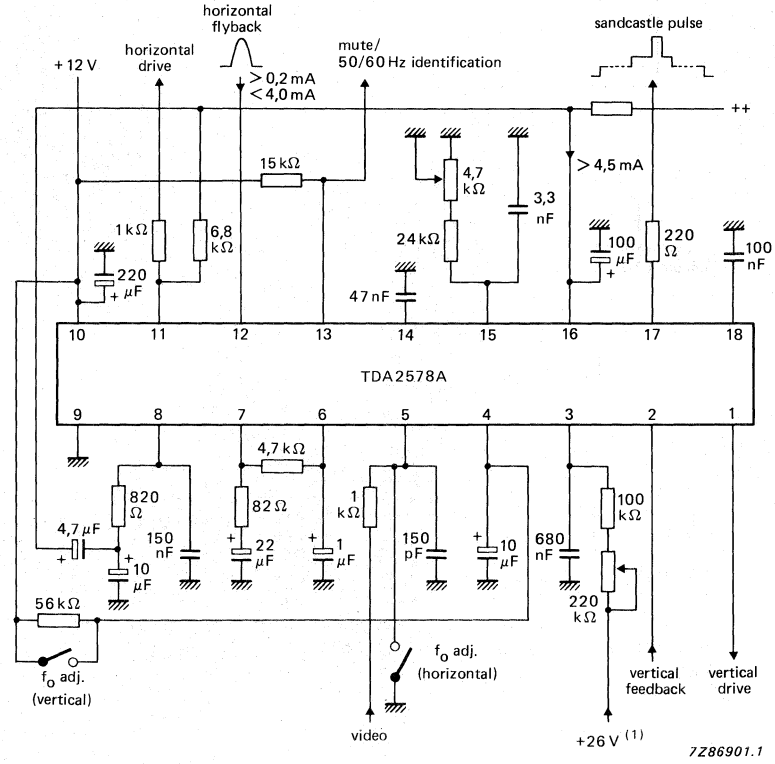


Fig. 4 Timing diagram of the TDA2578A.

APPLICATION INFORMATION (continued)



(1) ⩾ 26 V for linear scan.

Fig. 5 Typical application circuit diagram; for application of the TDA2578A with the TDA3651 see Fig. 8.

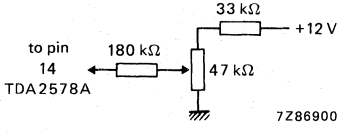


Fig. 6 Circuit configuration at pin 14 for phase adjustment.

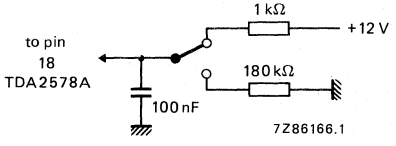


Fig. 7 Circuit configuration at pin 18 for VCR mode.
1 kΩ resistor between pin 18 and + 12 V: without mute function.
180 kΩ between pin 18 and ground: with mute function.

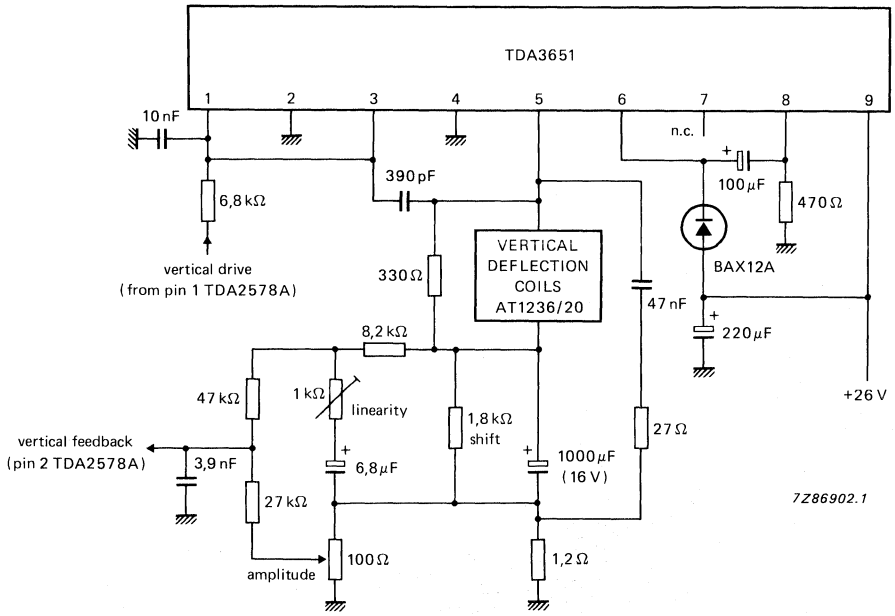


Fig. 8 Typical application circuit diagram of the TDA3651 (vertical output), when used in combination with the TDA2578A, (90° application).

SYNCHRONIZATION CIRCUIT

GENERAL DESCRIPTION

The TDA2579 generates and synchronizes horizontal and vertical signals. The device has a 3 level sandcastle output; a transmitter identification signal and also 50/60 Hz identification.

Features

- Horizontal phase detector, (sync to osc), sync separator and noise inverter
- Triple current source in the phase detector with automatic selection
- Inhibit of horizontal phase detector and video transmitter identification
- Second phase detector for storage compensation of the horizontal output stage
- Stabilized direct starting of the horizontal oscillator and output stage
- Horizontal output pulse with constant duty cycle value of 29 μs
- Duty factor of the horizontal output pulse is 50% when horizontal flyback pulse is absent
- Internal vertical sync separator, and two integration selection times
- Divider system with three different reset enable windows
- Synchronization is set to 628 divider ratio when no vertical sync pulses and no video transmitter is identified
- Vertical comparator with a low d.c. feedback signal
- 50/60 Hz identification output combined with mute function
- Automatic amplitude adjustment for 50 and 60 Hz and blanking pulse duration

QUICK REFERENCE DATA

Supply			
Minimum required current for starting horizontal oscillator and output stage	I_{16}		6,5 mA
Main supply voltage	V_{10}	typ.	12 V
Supply current	I_{10}	typ.	68 mA
Input signals			
Sync. pulse input amplitude	$V_{5\text{-}9\ (p\text{-}p)}$		0,1 to 1 V
Horizontal flyback pulse input current	I_{12}	typ.	+1 mA
Vertical comparator input signal			
Voltage a.c.	$V_{2\ (p\text{-}p)}$	typ.	0,8 V
Voltage d.c.	V_2	typ.	1 V
Output signals			
Horizontal output (open collector)			
I_{11} = 25 mA	$V_{11\text{-}9}$	$<$	0,5 V
Vertical output stage driver			
(emitter follower) I_1 = 1,5 mA	$V_{1\text{-}9}$	$>$	5 V
Sandcastle output levels			
V_{17} burstkey	$V_{17\text{-}9}$	$>$	10 V
Horizontal blanking	$V_{17\text{-}9}$	typ.	4,5 V
Vertical blanking	$V_{17\text{-}9}$	typ.	2,5 V
Video transmitter identification output stage (open collector loaded with external resistor to positive supply)			
No sync. pulse present	$V_{13\text{-}9}$	$<$	0,5 V
	I_{13}	$>$	5 mA
Sync. pulse present			
Divider ratio $>$ 576	$V_{13\text{-}9}$		$V_{10\text{-}9}$ V
Divider ratio $<$ 576	$V_{13\text{-}9}$	typ.	7,65 V

PACKAGE OUTLINE

18-lead dual in line; plastic (SOT-102 HE).

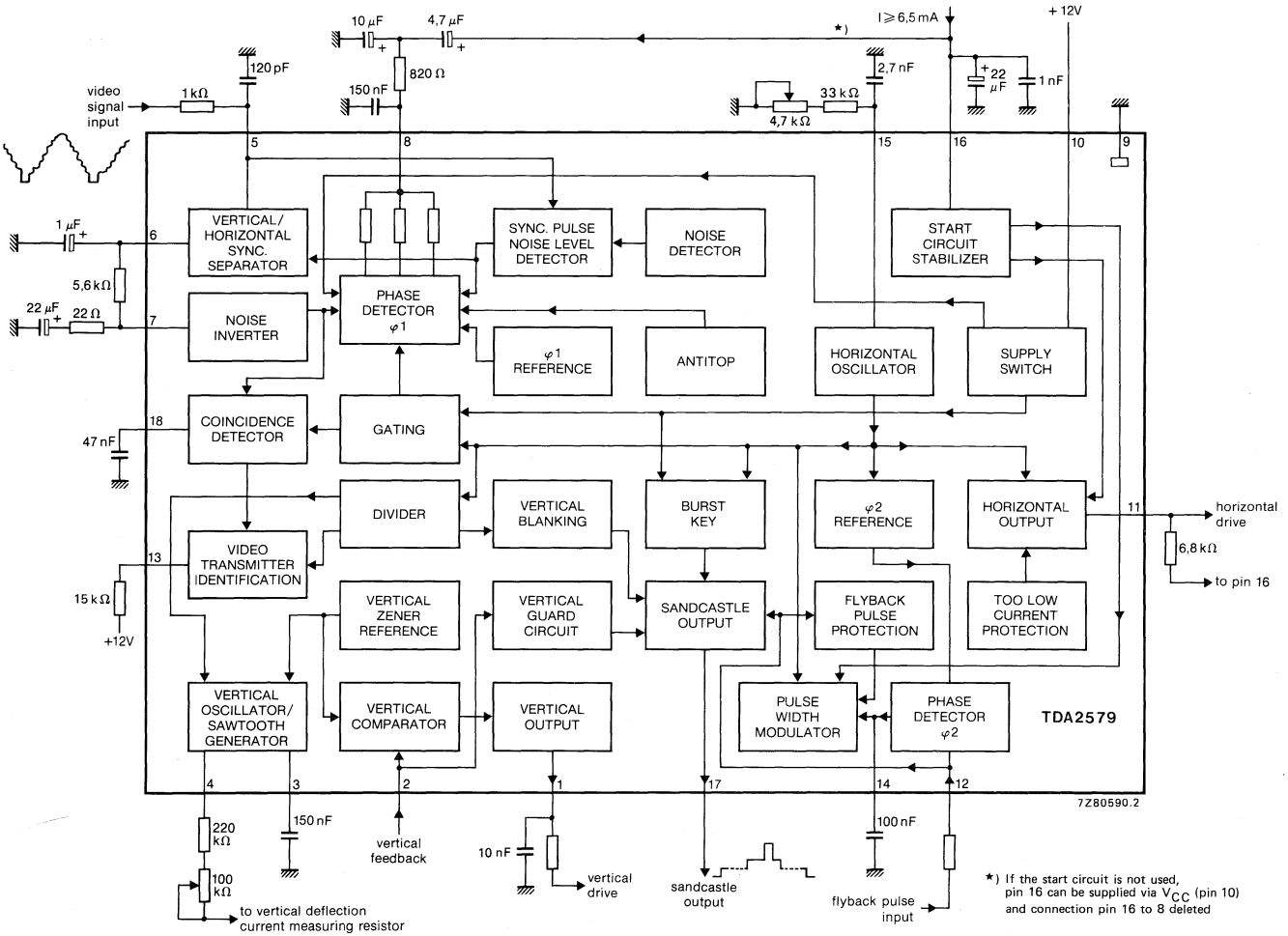


Fig. 1 Block diagram.

FUNCTIONAL DESCRIPTION

Vertical part (pins 1,2,3,4)

The IC embodies a synchronized divider system for generating the vertical sawtooth at pin 3. The divider system has an internal frequency doubling circuit, so the horizontal oscillator is working at its normal line frequency and one line period equals 2 clock pulses. Due to the divider system no vertical frequency adjustment is needed. The divider has a discriminator window for automatically switching over from the 60 Hz to 50 Hz system. The divider system operates with 3 different divider reset windows for maximum interference/disturbance protection.

The windows are activated via an up/down counter. The counter increases its counter value by 1 for each time the separated vertical sync. pulse is within the searched window. The count is reduced by 1 when the vertical sync. pulse is not present.

Large (search) window: divider ratio between 488 and 722

This mode is valid for the following conditions:

1. Divider is looking for a new transmitter.
2. Divider ratio found, not whithin the narrow window limits.
3. Non standard TV-signal condition detected while a double or enlarged vertical sync. pulse is still found after the internally generated antitop flutter pulse has ended. This means a vertical sync. pulse width larger than 8 clock pulses (50 Hz), that is, 10 clock pulses (60 Hz). In general this mode is activated for video tape recorders operating in the feature/trick mode.
4. Up/down counter value of the divider system operating in the narrow window mode drops below count 1.
5. Externally setting. This can be reached by loading pin 18 with a resistor of 180 kΩ to earth or connecting a 3,6 V diode stabistor between pin 18 and ground.

Narrow window: divider ratio between 522-528 (60 Hz) or 622-628 (50 Hz).

The divider system switches over to this mode when the up/down counter has reached its maximum value of 12 approved vertical sync. pulses. When the divider operates in this mode and a vertical sync. pulse is missing within the window the divider is reset at the end of the window and the counter value is lowered by 1. At a counter value below count 1 the divider system switches over to the large window mode.

Standard TV-norm

When the up/down counter has reached its maximum value of 12 in the narrow window mode, the information applied to the up/down counter is changed such that the standard divider ratio value is tested. When the counter has reached a value of 14 the divider system is changed over to the standard divider ratio mode. In this mode the divider is always reset at the standard value even if the vertical sync. pulse is missing. A missed vertical sync. pulse lowers the counter value by 1. When the counter reaches the value of 10 the divider system is switched over to the large window mode. The standard TV-norm condition gives maximum protection for video recorders playing tapes with anti-copy guards.

No-TV-transmitter found: (pin 18 $<$ 1,2 V)

In this condition, only noise is present, the divider is rest to count 628. In this way a stable picture display at normal height is achieved.

DEVELOPMENT DATA

Video tape recorders in feature mode

It should be noted that some VTR's operating in the feature modes, such as picture search, generate such distorted pictures that the no-TV-transmitter detection circuit can be activated as pin V_{18} drops below 1,2 V. This would imply a rollowing picture (condition d). In general VTR-machines use a re-inserted vertical sync. pulse in the feature mode. Therefore the divider system has been made such that the automatic reset of the divider at count 628 when V_{18} is below 1,2 V is inhibited when a vertical sync. pulse is detected.

The divider system also generates the anti-topflutter pulse which inhibits the phase 1 detector during the vertical sync. pulse. The width of this pulse depends on the divider mode. For the divider mode a the start is generated at the reset of the divider. In mode b and c the anti-top flutter pulse starts at the beginning of the first equalizing pulse. The anti-top flutter pulse ends at count 8 for 50 Hz and count 10 for 60 Hz. The vertical blanking pulse is also generated via the divider system. The start is at the reset of the divider while the blanking pulse ends at count 34 (17 lines) for 60 Hz, and at count 42 (21 lines) for 50 Hz systems. The vertical blanking pulse generated at the sandcastle output pin 17 is made by adding the anti-top flutter pulse and the blanking pulse. In this way the vertical blanking pulse starts at the beginning of the first equalizing pulse when the divider operates in the b or c mode. For generating a vertical linear sawtooth voltage a capacitor should be connected to pin 3. The recommended value is 150 nF to 330 nF. See Fig. 1.

The capacitor is charged via an internal current source starting at the reset of the divider system. The voltage on the capacitor is monitored by a comparator which is activated also at reset. When the capacitor has reached a voltage value of 5,5 V for the 50 Hz system or 4,7 V for the 60 Hz system the voltage is kept constant until the charging period ends. The charge period width is 26 clock pulses. At clock pulse 26 the comparator is switched off and the capacitor is discharged by an npn transistor current source, the value of which can be set by an external resistor between pin 4 and ground (pin 9). Pin 4 is connected to an pnp transistor current source which determimes the current of the npn current source. The pnp current source on pin 4 is connected to an internal zener diode reference voltage which has a typical voltage of $\approx$ 7,1 volts. The recommended operating current range is 10 to 50 μA. The resistance at pin R_4 should be 140 to 700 kΩ. By using a double current mirror concept the vertical sawtooth pre-correction can be set on the desired value by means of external components between pin 4 and pin 3, or by connecting the pin 4 resistor to the vertical current measuring resistor of the vertical output stage. The vertical amplitude is set by the current of pin 4. The vertical feedback voltage of the output stage has to be applied to pin 2. For the normal amplitude adjustment the values are d.c. = 1 V and a.c. = 0,8 V. Due to the automatic system adaption both values are valid for 50 Hz and 60 Hz.

The low d.c.-voltage value improves the picture bounce behaviour as less parabola compensation is necessary. Even a fully d.c.-coupled feedback circuit is possible.

Vertical guard

The IC also contains a vertical guard circuit. This circuit monitors the vertical feedback signal on pin 2. When the level on pin 2 is below 0,4 V or higher than 1,9 V the guard circuit inserts a continuous level of 2,5 V in the sandcastle output signal of pin 17. This results in the blanking of the picture displayed, thus preventing a burnt-in horizontal line. The guard levels specified refer to the zener diode reference voltage source level.

Driver output

The driver output is at pin 1, it can deliver a drive current of 1,5 mA at 5 V output. The internal impedance is about 150 Ω. The output pin is also connected to an internal current source with a sinking current of 0,25 mA.

Sync. separator, phase detector and TV-station identification (pins 5,6,7,8, and 18)

The video input signal is connected to pin 5. The sync. separator is designed such that the slicing level is independent of the amplitude of the sync. pulse. The black level is measured and stored in the capacitor at pin 7. The slicing level value is stored in the capacitor at pin 6. The slicing level value can be chosen by the value of the external resistor between pins 6 and 7. The value is given by the formula:

$$P = \frac{R_S}{5{,}3 + R_S} \times 100 \quad (R_S \text{ value in k}\Omega)$$

Where R_S is the resistor between pins 6 and 7 and top sync. level equals 100%. The recommended resistor value is 5,6 kΩ.

Black level detector

A gating signal is used for the black level detector. This signal is composed of an internal horizontal reference pulse with a duty cycle of 50% and the flyback pulse at pin 12. In this way the TV-transmitter identification operates also for all d.c.-conditions at input pin 5 (no video modulation, plain carrier only).
During the frame interval the slicing level detector is inhibited by a signal which starts with the anti-top flutter pulse and ends with the reset vertical divider circuit. In this way shift of the slicing level due to the vertical sync. signal is reduced and separation of the vertical sync. pulse is improved.

DEVELOPMENT DATA

Noise inverter

An internal noise inverter is activated when the video level at pin 5 drops below 0,7 V. The IC embodies also a built in sync. pulse noise level detection circuit. This circuit is directly connected to pin 5 and measured the noise level at the middle of the horizontal sync. pulse. When a noise level of 600 mV (p-p) is detected a counter circuit is activated. A video input signal is processed as "acceptable noise free" when 12 out of 16 sync. pulses have a noise level below 600 mV for two succeeding frame periods. The sync. pulses are processed during a 16 line width gating period generated by the divider system. The measuring circuit has a built-in noise level hysteresis of about 150 mV (≈ 3 dB).
When the "acceptable noise free" condition is found the phase detector of pin 8 is switched to not gated and normal time constant. When a higher sync. pulse noise level is found the phase detector is switched over to slow time constant and gated sync. pulse phase detection. At the same time the integration time of the vertical sync. pulse separator is adapted.

Phase detector

The phase detector circuit is connected to pin 8. This circuit consists of 3 separate phase detectors which are activated depending on the voltage of pin 18 and the state of the sync. pulse noise detection circuit.
All three phase detectors are activated during the vertical blanking period, this with the exception of the anti-top flutter pulse period, and the separated vertical sync. pulse time.
As a result, phase jumps in the video signal related to video head, take over of video recorders are quickly restored within the vertical blanking period. At the end of the blanking period the phase detector time constant is lowered by 2,5 times. In this way no need for external VTR time constant switching exists, and so all station numbers are suitable for signals from VTR, video games or home computers.
For quick locking of a new TV station starting from a noise only signal condition (normal time constant) a special circuit is incorporated. A new TV station which is not locked to the horizontal oscillator will result in a voltage drop below 0,1 V at pin 18. This will activate a frame period counter which switches the phase detector to fast for 3 frame periods.

Horizontal oscillator

The horizontal oscillator will now lock to the new TV-station and as a result, the voltage on pin 18 will increase to about 6,5 V. When pin 18 reaches a level of 1,8 V the mute output transistor of pin 13 is switched off and the divider is set to the large window. In general the mute signal is switched off within 5 ms (pin C_{18} = 47 nF) after reception of a new TV-signal. When the voltage on pin 18 reaches a level of 5 V, usually within 15 ms, the frame counter is switched off and the time constant is switched from fast to normal.

If the new TV station is weak, the sync. noise detector is activated. This will result in a change over of pin 18 voltage from 7 V to ≈ 10 V. When pin 18 exceeds the level of 7,8 V the phase detector is switched to slow time constant and gated sync. pulse condition.
When desired, most conditions of the phase detector can also be set by external means in the following way:

a. Fast time constant TV transmitter identification circuit not active, connect pin 18 to earth (pin 9).
b. Fast time constant TV transmitter identification circuit active, connect a resistor of 180 kΩ between pin 18 and ground.
   This condition can also be set by using a 3,6 V stabistor diode instead of a resistor.
c. Slow time constant, (with exception of frame blanking period), connect pin 18 via a resistor of 10 kΩ to +12 V, pin 10. In this condition the transmitter identification circuit is not active.
d. No switching to slow time constant desired (transmitter identification circuit active), connect a 6,8 V zener diode between pin 18 and ground.

Fig. 2 illustrates the operation of the 3 phase detector circuits.

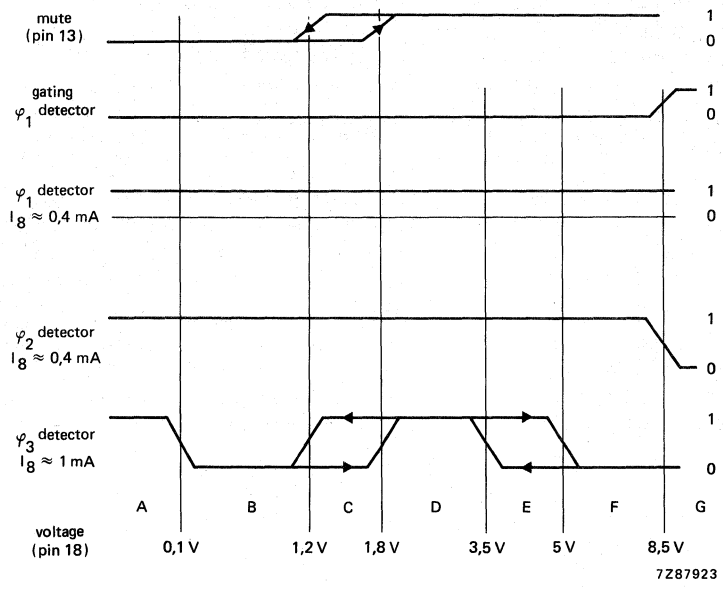


Fig. 2 Timing diagram, phase detectors.

Supply (pins 9, 10 and 16)

The IC has been designed such that the horizontal oscillator and output stage can start operating by application of a very low supply current into pin 16.

The horizontal oscillator starts at a supply current of about 4,5 mA. The horizontal output stage is forced into the non-conducting stage until the supply current has a typical value of 5,5 mA. The circuit has been disigned so that after starting the horizontal output function a current drop of $\approx$ 1 mA is allowed. The starting circuit gives the possibility to derive the main supply (pin 10), from the horizontal output stage. The horizontal output signal can also be used as the oscillator signal for synchronized switched mode power supplies. The maximum allowed starting current is 10 mA. The main supply should be connected to pin 10, and pin 9 should be used as ground. When the voltage on pin 10 increases from zero to its final value (typically 12 V) a part of the supply current of the starting circuit is taken from pin 10 via internal diodes, and the voltage on pin 16 will stabilize to a typical value of 8,7 V.

In stabilized condition (pin $V_{10} > 9{,}5$ V) the minimum required supply current to pin 16 is $\approx$ 2,5 mA. All other IC functions are switched on via the main supply voltage on pin 10. When the voltage on pin 10 reaches a value of $\approx$ 7 V the horizontal phase detector circuit is activated and the vertical ramp on pin 3 is started. The second phase detector circuit and burst pulse circuit are started when the voltage on pin 10 reaches the stabilized voltage value of pin 16 which is typically 8,7 V.

For closing the second phase detector loop, a flyback pulse must be applied to pin 12. When no flyback pulse is detected the duty cycle of the horizontal output stage is 50%.

For remote switch-off pin 16 can be connected to ground (via an npn transistor with a series resistor of $\approx$ 500 Ω) which switches off the horizontal output.

Horizontal oscillator, horizontal output transistor, and second phase detector (pins 11, 12, 14 and 15)

The horizontal oscillator is connected to pin 15. The frequency is set by an external RC combination between pin 15 and ground, pin 9. The open collector horizontal output stage is connected to pin 11. An internal zener diode configuration limits the open voltage of pin 11 to $\approx$ 14,5 V.
The horizontal output transistor at pin 11 is blocked until the current into pin 16 reaches a value of $\approx$ 5,5 mA.
A higher current results in a horizontal output signal at pin 11, which starts with a duty cycle of $\approx$ 35% HIGH.

The duty cycle is set by an internal current-source-loaded npn emitter follower stage connected to pin 14 during starting. When pin 16 changes over to voltage stabilization the npn emitter follower and current source load at pin 14 are switched off and the second phase detector circuit is activated, provided a horizontal flyback pulse is present at pin 12. When no flyback pulse is detected at pin 12 the duty cycle of the horizontal output stage is set to 50%.

The phase detector circuit at pin 14 compensates for storage time in the horizontal deflection output stage. The horizontal output pulse duration in 29 μs HIGH for storage times between 1 μs and 17 μs (29 μs flyback pulse of 12 μs). A higher storage time increases the HIGH time. Horizontal picture shift is possible by forcing an external charge or discharge current into the capacitor of pin 14.

Mute output and 50/60 Hz identification (pin 13)

The collector of an npn transistor is connected to pin 13. When the voltage on pin 18 drops below 1,2 V (no TV-transmitter) the npn transistor is switched ON.
When the voltage on pin 18 increases to a level of $\approx$ 1,8 V (new TV-transmitter found) the npn transistor is switched OFF.

Pin 13 has also the possibility for 50/60 Hz identification. This function is available when pin 13 is connected to pin 10 (+12 V) via an external pull-up resistor of 10-20 kΩ. When no TV-transmitter is identified the voltage on pin 13 will be LOW ($<$ 0,5 V). When a TV-transmitter with a divider ratio $>$ 576 (50 Hz) is detected the output voltage of pin 13 is HIGH (+12).
When a TV-transmitter with a divider ratio $<$ 576 (60 Hz) is found an internal pnp transistor with its emitter connected to pin 13 will force this pin output voltage down to $\approx$ 7,5 V.

Sandcastle output (pin 17)

The sandcastle output pulse generated at pin 17, has three different voltage levels. The highst level, (11 V), can be used for burst gating and black level clamping. The second level, (4,5 V), is obtained from the horizontal flyback pulse at pin 12, and is used for horizontal blanking. The third level, (2,5 V), is used for vertical blanking and is derived via the vertical divider system. For 50 Hz the blanking pulse duration is 42 clock pulses and for 60 Hz it is 34 clock pulses started from the vertical divider reset. For TV-signals which have a divider ratio between 622 and 628 or 522 and 528 the blanking pulse is started at the first equalizing pulse.

RATINGS

Limiting values in accordance with Absolute Maximum System (IEC 134)

Start current	I_{16}	max.	10	mA
Supply voltage	V_{10}	max.	13,2	V
Power dissipation	P_{tot}		1,2	W
Storage temperature	T_{stg}		−55 to +150	°C
Operating ambient temperature	T_{amb}		−25 to +65	°C

Thermal resistance

From junction to ambient in free air	$R_{th\text{-}j\text{-}a}$	typ.	50	K/W

DEVELOPMENT DATA

CHARACTERISTICS

T_{amb} = 25 °C; I_{16} = 6,5 mA; V_{10} = 12 V; unless otherwise specified
Voltage measurements are taken with respect to pin 9 (ground)

parameter	symbol	min.	typ.	max.	unit
Supply					
Supply current, pin 16 V_{10} = 0 V	I_{16}	6,5	–	10	mA
Supply current, pin 16 V_{10} = 9,5 V	I_{16}	2,5	–	10	mA
Stabilized voltage, pin 16	V_{16}	8,1	8,7	9,3	V
Current consumption, pin 10	I_{10}	–	68	85	mA
Supply voltage range, pin 10	V_P	9,5	12	13,2	V
Video input pin 5					
Top sync. level	V_5	1,5	3,1	3,75	V
Sync. pulse amplitude (note 1)	$V_{5\ (p\text{-}p)}$	0,1	0,6	1	V
Slicing level (note 2)		35	50	65	%
Delay between video input and det. output (see also Fig. 2)		0,2	0,3	0,5	μs
Sync. pulse noise level detector circuit active	$V_{(p\text{-}p)}$	–	600	–	mV
Sync. pulse					
Noise level detector circuit hysteresis		–	3	–	dB
Noise gate pin 5					
Switching level	V_5	–	+0,7	+1	V
First control loop pin 8 (Horizontal osc. to sync.)					
Holding range	Δf	–	±800	–	Hz
Catching range	Δf	±600	±800	±1100	Hz
Control sensitivity video with respect to burstkey and flyback pulse					
Slow time constant kHz/μs		–	2,5	–	
Normal time constant kHz/μs			10	–	
Fast time constant kHz/μs		–	5	–	
Phase modulation due to hum on the supply line pin 10 (note 3)		–	0,2	–	μs/V
Phase modulation due to hum on input current pin 16 (note 3)			0,08	–	μs/mA

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Second control loop, pin 14 (Horizontal flyback to horizontal oscillator)					
Control sensitivity t_d = 10 µs	$\Delta t_d/\Delta t_o$	200	300	600	µs
Control range	t_d	1	–	>45	µs
Control range for constant duty cycle horizontal output	t_d	1	29 (–t flyback pulse)		
Controlled edge of horizontal output signal pin 11			positive		
Phase adjustment, pin 14 (Via second control loop)					
Control sensitivity td = 10 µs		–	25	–	µA/µs
Max. allowed control current	I_{14}	–	–	±60	µA
Horizontal oscillator, pin 15 (C = 2,7 nF; R osc = 33 kΩ)					
Frequency (no sync.)	f	–	15625	–	Hz
Spread (fixed external component, no sync.)	Δf	–	–	±4	%
Frequency deviation between starting point output signal and stabilized condition	Δf	–	+5	+8	%
Temperature coefficient	TC	–	10^{-4}	–	K^{-1}
Horizontal output (pin 11) (Open collector)					
Output voltage high	V_{11}	–	–	13,2	V
Start voltage protection (internal zener diode)	V_{11}	13	–	15,8	V
Low input current pin 16 protection output enabled	I_{16}	–	5,5	6,5	mA
Output voltage low start condition (I_{11} = 10 mA)	V_{11}	–	0,1	0,5	V
Duty cycle output current during starting I_{16} = 6,5 mA		55	65	75	%
Output voltage low normal condition (I_{11} = 25 mA)	V_{11}	–	0,3	0,5	V
Duty cycle output current without flyback pulse pin 12		45	50	55	%
Duration of the output pulse high T_d = 8 µs		27	29	31	µs
Controlled edge			positive		
Temperature coefficient horizontal output pulse		–	–0,05	–	µs/K

DEVELOPMENT DATA

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Sandcastle output signal, pin 17 (I_{load} = 1 mA)					
Output voltage during:					
Burstkey	V_{17}	9,75	10,6	–	V
Horizontal blanking	V_{17}	4,1	4,5	4,9	V
Vertical blanking	V_{17}	2	2,5	3	V
Zero level output voltage I_{sink} = 0,5 mA	V_{17}	–	–	0,7	V
Pulse width:					
Burstkey	t_p	3,45	3,75	4,1	μs
Horizontal blanking	V_{12}	–	1	–	V
Phase position burstkey time between middle sync. pulse at pin 5 and start burst at pin 17		2,3	2,7	3,1	μs
Time between start sync. pulse and end of burst pulse, pin 17		–	–	9,2	μs
Coincidence detector, video transmitter identification circuit and time constant switching levels (see also Fig. 1)					
Detector output current	I_{18}	–	0,25	–	mA
Voltage level for in sync. condition (φ_1 normal)	V_{18}	–	6,5	–	V
Voltage for noisy sync. pulse (φ_1 slow and gated)	V_{18}	9	10	–	V
Voltage level for noise only (note 5)	V_{18}	–	0,3	–	V
Switching level normal to fast	V_{18}	<3,2	3,5	3,8	V
Switching level mute output active and fast to slow	V_{18}	<1,0	1,2	1,4	V
Switching level frame period counter (3 periods fast)	V_{18}	<0,08	0,12	0,16	V
Switching level: slow to fast (locking) mute output in-active	V_{18}	>1,5	1,7	1,9	V
Switching level fast to normal (locking)	V_{18}	>4,7	5,0	5,3	V
Switching level normal to slow (gated sync. pulse)	V_{18}	7,4	7,8	8,2	V

DEVELOPMENT DATA

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Video transmitter identification output, pin 13					
Output voltage active (no sync., I_{13} = 2 mA)	V_{13}	–	0,15	0,32	V
Sink current active (no sync.), $V_{13} < 1$ V	I_{13}	–	–	5	mA
Output current inactive (sync. 50 Hz)	I_{13}	–	–	1	μA
50/60 Hz identification, pin 13 (R_{13} positive supply 15 kΩ)					
Emitter follower, pnp:					
60 Hz: $\frac{2xfH}{fV} < 576$ voltage	V_{13}	7,2	7,65	8,1	V
50 Hz: $\frac{2xfH}{fV} > 576$ voltage	V_{13}	–	V_{10}	–	V
Flyback input pulse, pin 12					
Switching level	V_{12}	–	+1	–	V
Input current	I_{12}	+0,2	–	+4	mA
Input pulse	$V_{12\ (p\text{-}p)}$	–	–	12	V
Input resistance		–	3	–	kΩ
Phase position without shift					
Time between the middle of the sync. pulse at pin 5 and the middle of the horizontal blanking pulse of pin 17	t_d	–	2,5	–	μs
Vertical ramp generator, pin 3					
Pulse width charge current		–	26	–	clock pulses
Charge current	I_3	–	3	–	mA
Top level ramp signal voltage					
Divider in 50 Hz mode (note 6)	V_3	5,1	5,5	5,9	V
Divider in 60 Hz mode (note 6)	V_3	4,35	4,7	5,05	V
Ramp amplitude C_3 = 150 nF,					
R_4 = 330 kΩ 50 Hz (note 6)	$V_{(p\text{-}p)}$	–	3,1	–	V
R_4 = 330 kΩ 60 Hz (note 6)	$V_{(p\text{-}p)}$	–	2,5	–	V

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Current source, pin 4					
Output voltage I_4 = 20 μA	V_{4-9}	6,6	7,1	7,6	V
Allowed current range	I_4	10	–	55	μA
Temperature coefficient output voltage					
I_4 = 20 μA	TC	–	+50	–	10^{-6}/K
I_4 = 40 μA	TC	–	+20	–	10^{-6}/K
I_4 = 50 μA	TC	–	–40	–	10^{6}/K
Comparator, pin 2					
C_3 = 150 nF; R_4 = 330 kΩ					
Input voltage					
d.c. level (note 6)	V_{2-9}	0,9	1	1,1	V
a.c. level	$V_{2-9(p-p)}$	–	0,8	–	V
Deviation amplitude 50/60 Hz		–	–	2,5	%
Vertical output stage, pin 1 (npn) emitter follower)					
Output voltage I_o pin 1 = +1,5 mA (note 6)	V_{1-9}	4,8	5,2	5,6	V
R_s, sync. separator resistor		–	160	–	Ω
Continuous sink current		–	0,25	–	mA
Vertical guard circuit, pin 2					
Active (V_{17} = 2,5 V)					
Switching level low (note 6)	V_2	>1,7	1,9	2,1	V
Switching level high (note 6)	V_2	<0,3	0,4	0,5	V

NOTES TO THE CHARACTERISTICS

1. Up to 1 V peak-to-peak the slicing level is constant, at amplitudes exceeding 1 V peak-to-peak the slicing level will increase.
2. The slicing level is fixed by the formula: $P = \frac{R_s}{5{,}3 + R_s} \times 100\%$ (R_s value in kΩ)
3. Measured between pin 5 and sandcastle output pin 17; the values for voltage and current in the unit are peak-to-peak.
4. Divider in search (large) mode:
   start: reset divider = start vertical sync. plus 1 clock pulse
   stop: $n = \frac{2 \times fH}{fV} > 576$ clock pulse 42

   $n = \frac{2 \times fH}{fV} < 576$ clock pulse 34

   Divider in small window mode:
   start: clock pulse 517 (60 Hz) clock pulse 619 (50 Hz)
   stop: clock pulse 34 (60 Hz) clock pulse 42 (50 Hz)
5. Depends on d.c. level of pin 5, given value is valid for $V_5 \approx 5$ V.
6. Value related to internal zener diode reference voltage source spread includes the complete spread of reference voltage.

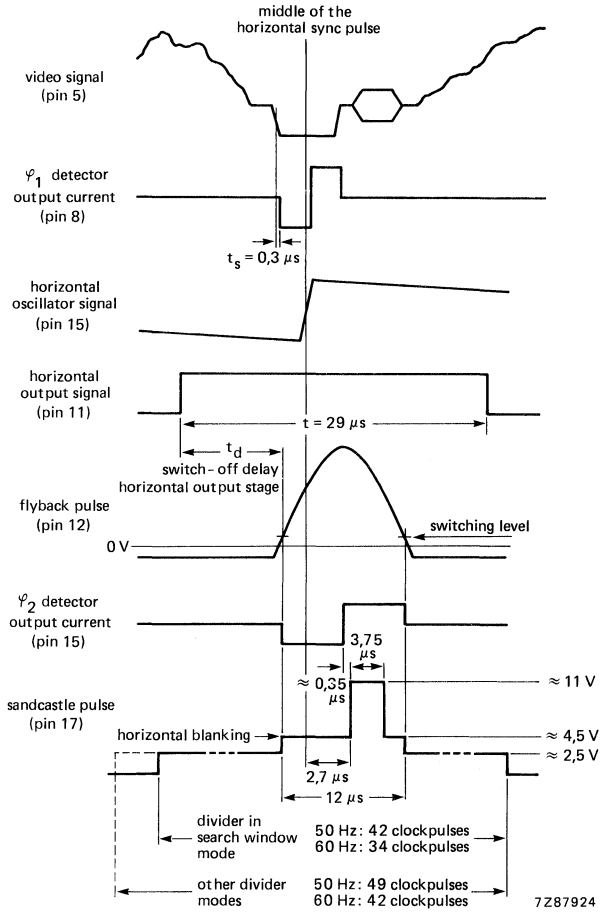


Fig. 3 Timing diagram of the TDA2579.

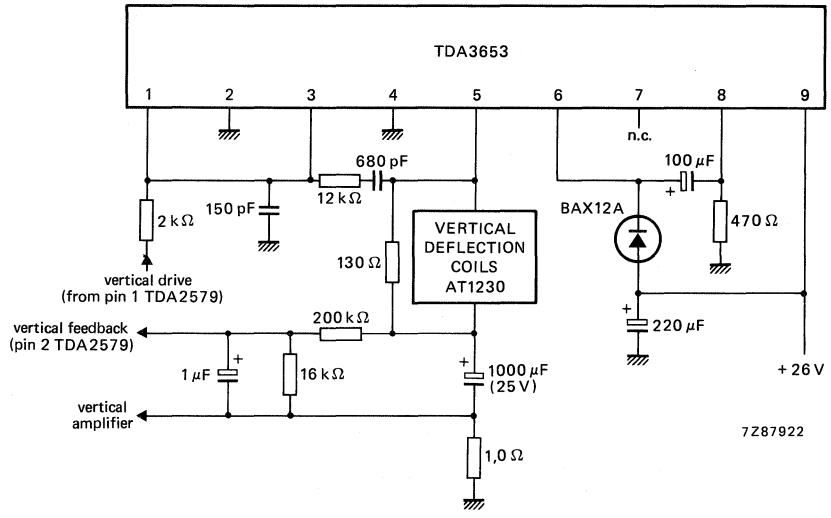


Fig. 4 Typical application of the TDA3653 (vertical output), when used in combination with the TDA2579 90° application.

CONTROL CIRCUIT FOR SMPS

The TDA2581 is a monolithic integrated circuit for controlling switched-mode power supplies (SMPS) which are provided with the drive for the horizontal deflection stage.

The circuit features the following:
- Voltage controlled horizontal oscillator.
- Phase detector.
- Duty factor control for the positive-going transient of the output signal.
- Duty factor increases from zero to its normal operation value.
- Adjustable maximum duty factor.
- Over-voltage and over-current protection with automatic re-start after switch-off.
- Counting circuit for permanent switch-off when n-times over-current or over-voltage is sensed.
- Protection for open-reference voltage.
- Protection for too low supply voltage.
- Protection against loop faults.
- Positive tracking of duty factor and feedback voltage when the feedback voltage is smaller than the reference voltage minus 1,5 V.

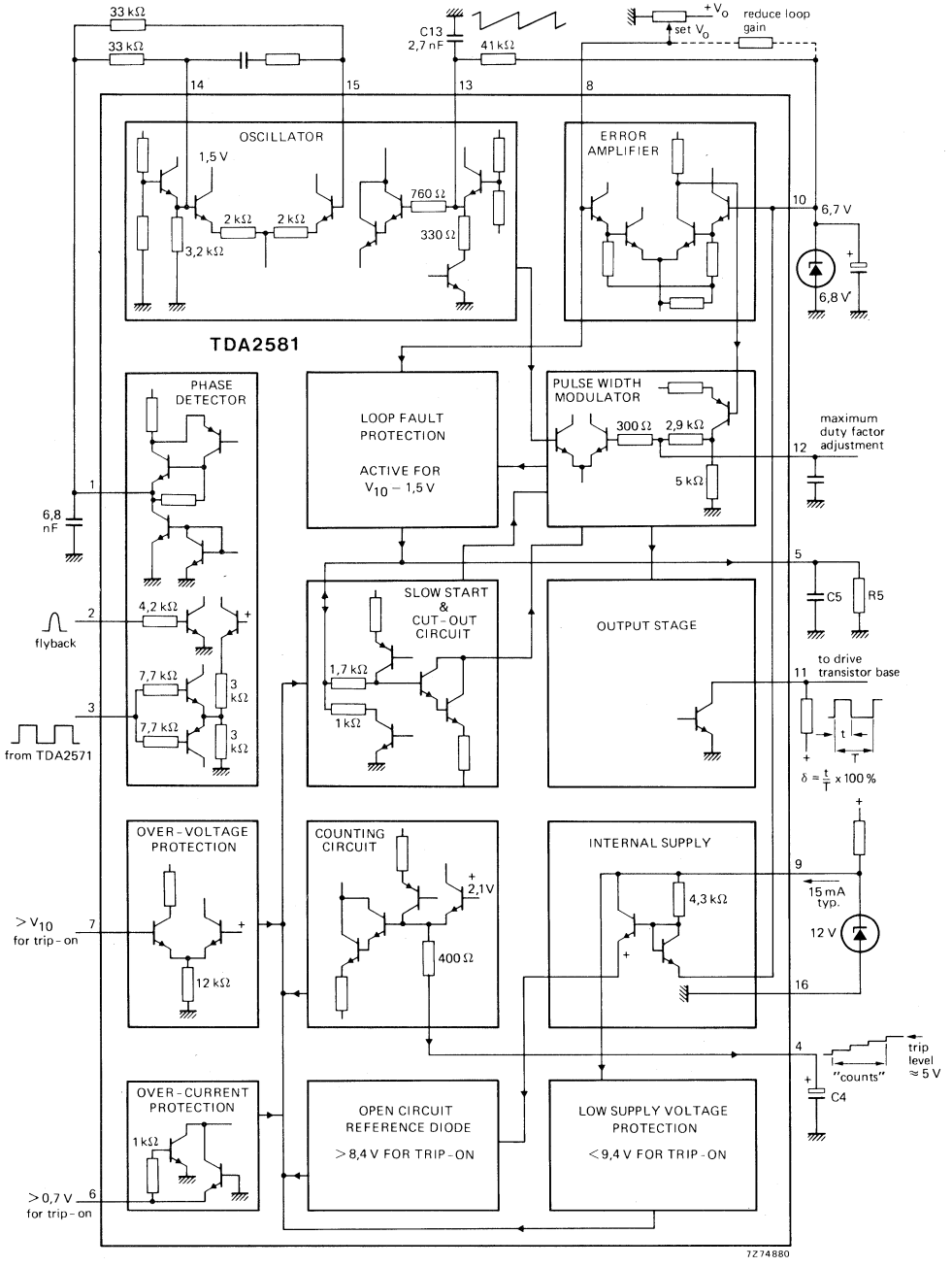
QUICK REFERENCE DATA

Supply voltage	$V_{9\text{-}16}$	typ.	12	V
Supply current	I_9	typ.	15	mA
Input signals				
Horizontal drive pulse (peak-to-peak value)	$V_{3\text{-}16(p\text{-}p)}$	typ.	11	V
Flyback pulse (differentiated deflection current); peak-to-peak value	$V_{2\text{-}16(p\text{-}p)}$	typ.	5	V
External reference voltage	$V_{10\text{-}16}$	typ.	6,7	V
Output signals				
Duty factor of output pulse	δ	$>$	0	%
		$<$	$98 \pm 0{,}6$	%
Output voltage at $I_o < 20$ mA (peak value)	$V_{11\text{-}16M}$	typ.	11,8	V
Output current (peak value)	I_{11M}	$<$	40	mA

PACKAGE OUTLINES

TDA2581: 16-lead DIL; plastic (SOT-38).
TDA2581Q: 16-lead QIL; plastic (SOT-58).

BLOCK DIAGRAM



Note: trip levels are nominal values.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage	$V_{9\text{-}16}$	max.	14 V
Voltage at pin 11	$V_{11\text{-}16}$		0 to 14 V
Output current	I_{11}	max.	40 mA
Total power dissipation	P_{tot}	max.	340 mW
Storage temperature	T_{stg}		−25 to +125 °C
Operating ambient temperature	T_{amb}		−25 to +80 °C

CHARACTERISTICS

$V_{9\text{-}16}$ = 12 V; $V_{10\text{-}16}$ = 6,7 V; T_{amb} = 25 °C; measured in the circuit on page 314

Supply voltage range	$V_{9\text{-}16}$	typ.	12 V 10 to 14 V
Protection voltage too low supply voltage	$V_{9\text{-}16}$	typ.	9,4 V 8,6 to 9,9 V
Supply current at δ = 50%	I_9	typ.	15 mA
Supply current during protection	I_9	typ.	15 mA
Minimum required supply current	I_9	<	18,5 mA*
Power consumption	P	typ.	180 mW
Required input signals			
Reference voltage	$V_{10\text{-}16}$	typ.	6,7 V 5,6 to 7,5 V**
High reference voltage protection: threshold voltage	$V_{10\text{-}16}$	typ.	8,4 V 7,9 to 8,9 V
Feedback input impedance at pin 8	$\lvert Z_{8\text{-}16}\rvert$	typ.	200 kΩ
Horizontal drive pulse (square-wave or differentiated; negative transient is reference) peak-to-peak value	$V_{3\text{-}16(p\text{-}p)}$	typ.	11 V 5 to 12 V
Flyback pulse or differential deflection current	$V_{2\text{-}16}$		1 to 5 V
Over-current protection: threshold voltage	$-V_{6\text{-}16}$	typ.	640 mV 690 to 695 mV▲
	$+V_{6\text{-}16}$	typ.	680 mV 640 to 735 mV▲
Over-voltage protection: threshold voltage	$V_{7\text{-}16}$	typ. $V_{10\text{-}16}$	$V_{10\text{-}16}$ −60 mV −130 to $V_{10\text{-}16}$ −0 mV

* This value refers to the minimum required supply current that will start all devices under the following conditions: $V_{9\text{-}16}$ = 10 V; $V_{10\text{-}16}$ = 6,8 V; δ = 50%.

** Voltage obtained via an external reference diode. Specified voltages do not refer to the nominal voltages of reference diodes.

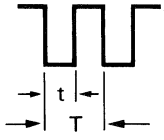
▲ This spread is inclusive temperature rise of the IC due to warming up. For other ambient temperatures the values must be corrected by using a temperature coefficient of typical −1,85 mV/°C.

CHARACTERISTICS (continued)

Remote control voltage; switch off	$V_{4\text{-}16}$	>	5,8 V*
switch on	$V_{4\text{-}16}$	<	4,5 V*
Delivered output signals			
Horizontal drive pulse (loaded with a resistor of 560 Ω to +12 V) peak-to-peak value	$V_{11\text{-}16(p\text{-}p)}$	>	11,6 V
Output current; peak value	I_{11M}	<	40 mA
Saturation voltage of output transistor at I_{11} = 20 mA	V_{CEsat}	typ. <	200 mV 400 mV
at I_{11} = 40 mA	V_{CEsat}	<	525 mV
Duty factor of output pulse**	δ	> < 98 ± 0,6	0 % %
Charge current for capacitor on pin 4	I_4	typ.	120 μA
Charge current for capacitor on pin 5	I_5	typ.	130 μA
Supply current for reference	I_{10}	typ. 0,6 to 1,45	1 mA mA
Oscillator			
Temperature coefficient		typ. <	−300 ppm/°C −400 ppm/°C
Relative frequency deviation for $V_{10\text{-}16}$ changing from 6 to 7 V		typ. ⩽	−1,5 % −2 %
Oscillator frequency spread (with fixed external components)		⩽	±3 %
Frequency control sensitivity at pin 15		typ.	4,5 kHz/V▲
Phase control loop			
Loop gain of APC-system (automatic phase control)		typ.	5 kHz/μs
Catching range	Δf	typ.	±1,5 kHz
Phase relation between negative transient of sync pulse and middle of flyback	t	typ.	1 μs
Tolerance of phase relation	Δt	⩽	±0,4 μs

* See application information pin 4.

** The duty factor is specified as follows:



$$\delta = \frac{t}{T} \times 100\%.$$

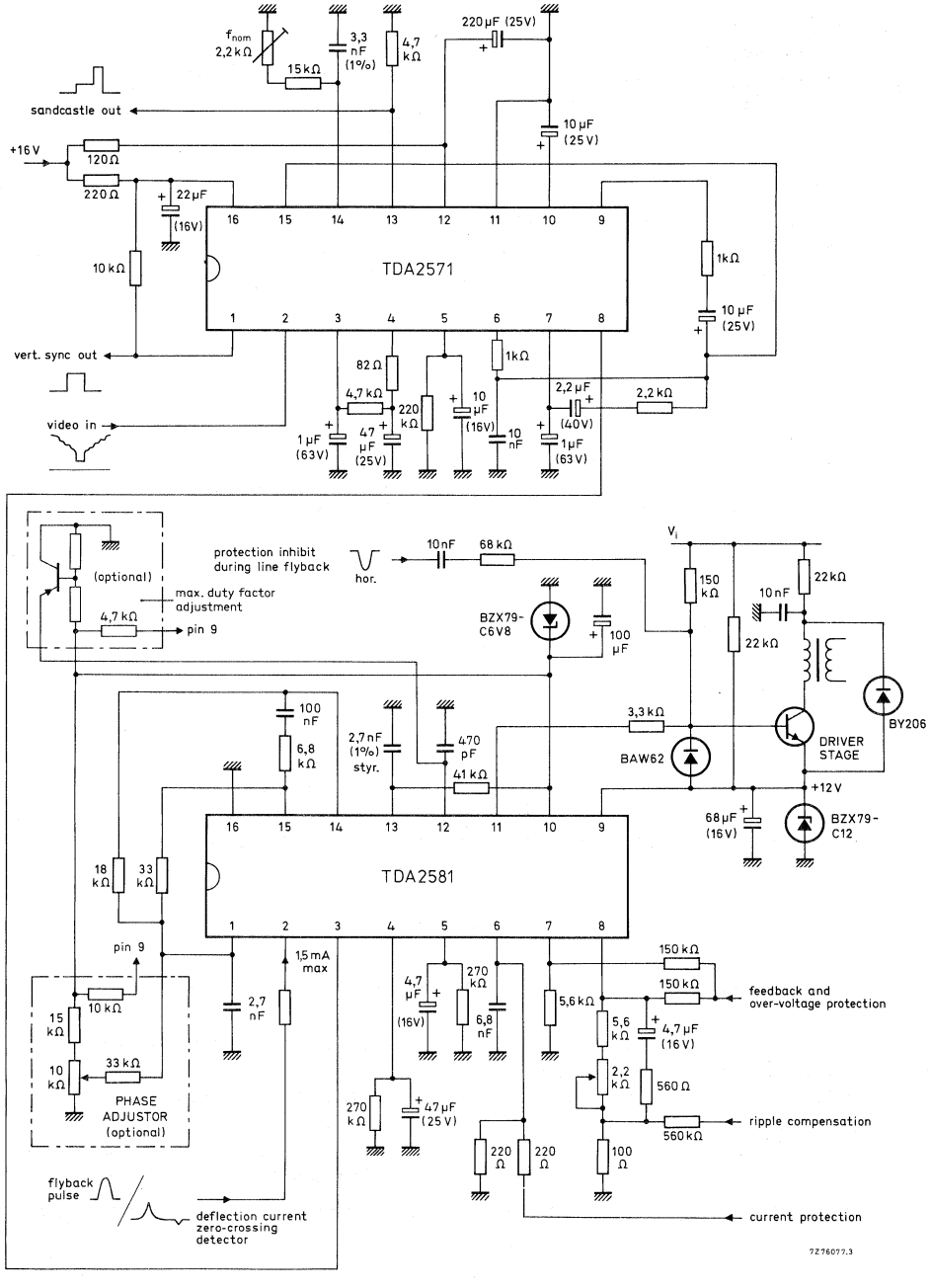
The maximum duty factor value can be set to a desired value (see application information pin 12).

▲ For component values see block diagram.

PINNING

1. Phase detector output
2. Flyback pulse position input
3. Reference frequency input
4. Re-start count capacitor/remote control input
5. Slow start and transfer characteristic for low feedback voltages
6. Over-current protection input
7. Over-voltage protection input
8. Feedback voltage input
9. Positive supply
10. Reference input
11. Output
12. Maximum duty factor adjustment/smoothing
13. Oscillator timing network
14. Reactance stage reference voltage
15. Reactance stage input
16. Negative supply (ground)

APPLICATION INFORMATION



The TDA2571 and TDA2581 controlling an SMPS driver stage.

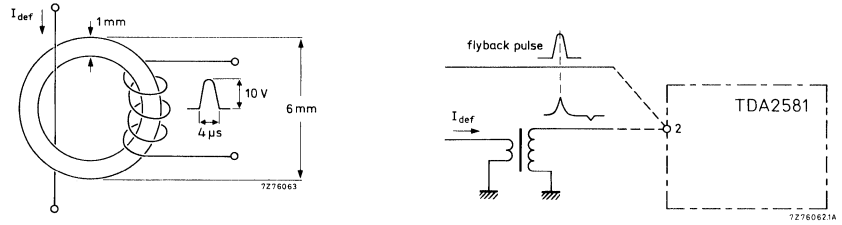
The function is quoted against the corresponding pin number

1. Phase detector output

The output circuit consists of a bidirectional current source which is active for the time that the signal on pin 2 exceeds 1 V.
The current values are chosen such that the correct phase relation is obtained when the reference signal on pin 3 is delivered by the TDA2571.
With a resistor of 18 kΩ and a capacitor of 2,7 nF the control steepness is 0,55 V/μs.

2. Flyback pulse input

The signal applied to pin 2 is normally a flyback pulse with a duration of about 12 μs. However, the phase detector system also accepts a signal derived by differentiating the deflection current by means of a small toroidal core (pulse duration > 3 μs).



(a) (b)

The toroidal transformer in (a) is for obtaining a pulse representing the mid-flyback from the deflection current. The connection of the picture phase information is shown in (b).

3. Reference frequency input

The input circuit can be driven directly by the square-wave output voltage from pin 8 of the TDA2571.
The negative-going transient switches the current source connected to pin 1 from positive to negative.
The input circuit is made such that a differentiated signal of the square-wave from the TDA2571 is also accepted (this enables mains isolation). The input circuit switching level is about 3 V and the input impedance is about 10 kΩ.

4. Re-start count capacitor/remote control input

Counting

An external capacitor (C4 = 47 μF) is connected between pins 4 and 16. This capacitor controls the characteristics of the protection circuits as follows.
If the protection circuits are required to operate, e.g. over-current at pin 6, the duty factor will be set to zero thus turning off the power supply.
After a short interval (determined by the time constant on pin 5) the power supply will be restarted via the slow start circuit.
If the fault condition has cleared, then normal operation will be resumed. If the fault condition is persistent, the duty factor of the pulses is again reduced to zero and the protection cycle is repeated.

The number of times this action is repeated (n) for a persisting fault condition is now determined by: n = C4/C5.

APPLICATION INFORMATION (continued)

Remote control input

For this application the capacitor on pin 4 has to be replaced by a resistor with a value between 4,7 and 18 kΩ. When the externally applied voltage $V_{4\text{-}16} > 5{,}8$ V, the circuit switches off; switching on occurs when $V_{4\text{-}16} < 4{,}5$ V and the normal starting-up procedure is followed. Pin 4 is internally connected to an emitter-follower, with an emitter voltage of 1,5 V.

5. Slow start and transfer characteristics for low feedback voltages

Slow start

An external shunt capacitor (C5 = 4,7 μF) and resistor (R5 = 270 kΩ) are connected between pins 5 and 16. The network controls the rate at which the duty factor increases from zero to its steady-state value after switch-on. It provides protection against surges in the power transistor.

Transfer characteristic for low feedback voltages

The duty factor transfer characteristic for low feedback voltages can be influenced by R5. The transfer for three different resistor values is given in the graph on page 322.

6. Over-current protection input

A voltage proportional to the current in the power switching device is applied to the integrated circuit between pins 6 and 16. The circuit trips on both positive and negative polarity.

7. Over-voltage protection input

When the voltage applied to this pin exceeds the threshold level, the protection circuit will operate. When this function is not used, pin 7 should be connected to pin 16.

8. Feedback voltage input

The control loop input is applied to pin 8. This pin is internally connected to one input of a differential amplifier, functioning as an amplitude comparator, the other input of which is connected to the reference source on pin 10.
Under normal operating conditions, the voltage on pin 8 will be about equal to the reference voltage on pin 10. For further information refer to the graphs on pages 322 and 323.

9. 12 V positive supply

The maximum voltage that may be applied is 14 V. Where this is derived from an unstabilized supply rail, a regulator diode (12 V) should be connected between pins 9 and 16 to ensure that the maximum voltage does not exceed 14 V. When the voltage on this pin falls below a minimum of 8,6 V (typically 9,4 V), the protection circuit will switch-off the power supply.

10. Reference input

An external reference diode must be connected between this pin and pin 16.
The reference voltage must be between 5,6 and 7,5 V. The IC delivers about 1 mA into the external regulator diode. When the external load on the regulator diode approaches this current, replenishment of the current can be obtained by connecting a suitable resistor between pins 9 and 10.

11. Output

An external resistor determines the output current fed into the base of the driver transistor. The output circuit uses an n-p-n transistor with 3 series-connected clamping diodes to the internal 12 V supply rail. This provides a low impedance in the "ON" state, that is with the drive transistor turned-off.

12. Maximum duty factor adjustment/smoothing

Maximum duty factor adjustment

Pin 12 is connected to the output voltage of the amplitude comparator ($V_{10\text{-}8}$). This voltage is internally connected to one input of a differential amplifier, the other input of which is connected to the sawtooth voltage of the horizontal oscillator. A low voltage on pin 12 results in a low duty factor. This enables the maximum duty factor to be adjusted by limiting the voltage by connecting pin 12 to the emitter of a p-n-p transistor used as a voltage source.
The graph on page 10 plots the maximum duty factor as a function of the voltage applied to pin 12.
If some spread is acceptable the maximum duty factor can also be limited by connecting a resistor from pin 12 to pin 16. A resistor of 12 kΩ limits the maximum duty factor to about 50%.
This application also reduces the total IC gain.

Smoothing

Any double pulsing of the IC due to circuit layout can be suppressed by connecting a capacitor of about 470 pF between pins 12 and 16.

13. Oscillator timing network

The timing network comprises a capacitor between pins 13 and 16, and a resistor between pin 13 and the reference voltage on pin 10.
The charging current for the capacitor (C13) is derived from the voltage reference diode connected to pin 10 and discharged via an internal resistor of about 330 Ω.

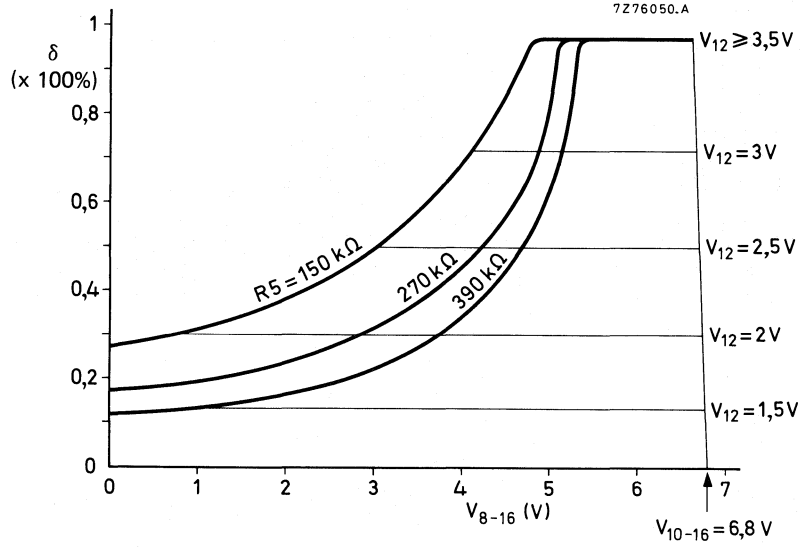
14. Reactance stage reference voltage

This pin is connected to an emitter follower which determines the nominal reference voltage for the reactance stage (1,5 V for reference voltage $V_{10\text{-}16} = 6{,}7$ V). Free-running frequency is obtained when pins 14 and 15 are short-circuited.

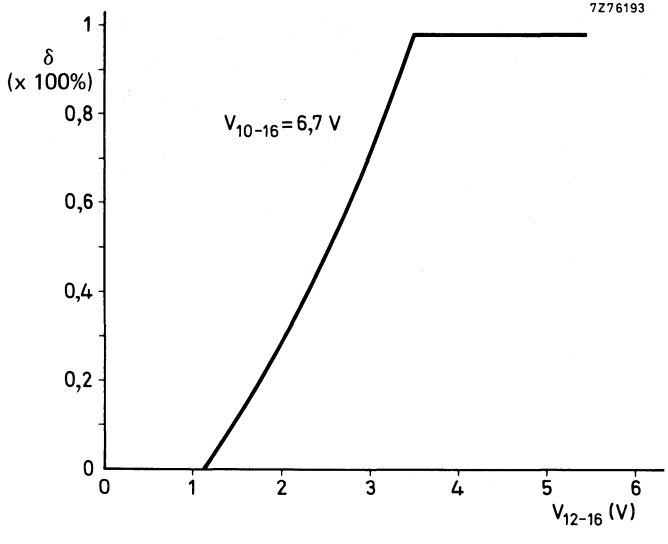
15. Reactance stage input

The output voltage of the phase detector (pin 1) is connected to pin 15 via a resistor. The voltage applied to pin 15 shifts the upper level of the voltage sensor of the oscillator thus changing the oscillator frequency and phase. The time constant network is connected between 14 and 15.
Control sensitivity is typically 4,5 kHz/V.

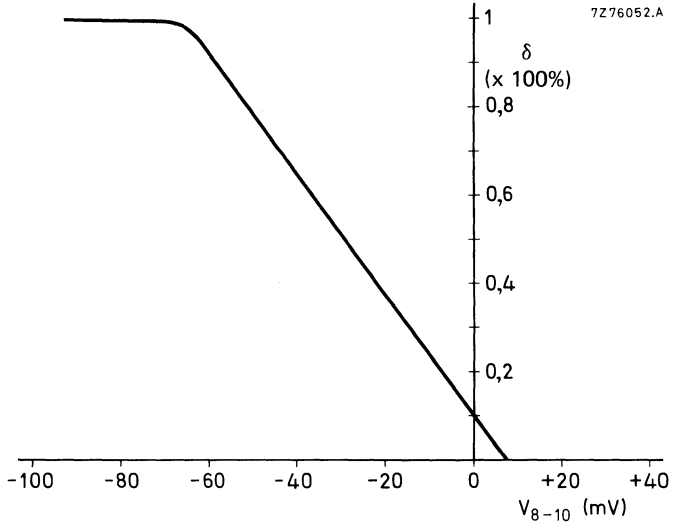
16. Negative supply (ground)



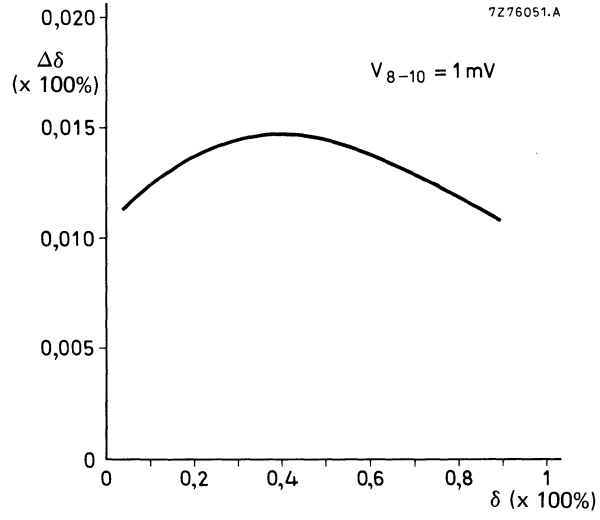
Duty factor of output pulses as a function of V_{8-16} with R5 as a parameter, and with V_{12} as a limiting value; $V_{10-16} = 6,8$ V.



Maximum duty factor limitation as a function of V_{12-16}.



Duty factor of output pulses as a function of error amplifier input (V_{8-10}).



Change in duty factor of output pulses for a 1 mV error amplifier input change (V_{8-10}) as a function of initial duty factor.

CONTROL CIRCUIT FOR POWER SUPPLIES

The TDA2582 is a monolithic integrated circuit for controlling power supplies which are provided with the drive for the horizontal deflection stage.
The circuit features the following:

- Voltage controlled horizontal oscillator.
- Phase detector.
- Duty factor control for the negative-going transient of the output signal.
- Duty factor increases from zero to its normal operation value.
- Adjustable maximum duty factor.
- Over-voltage and over-current protection with automatic re-start after switch-off.
- Counting circuit for permanent switch-off when n-times over-current or over-voltage is sensed.
- Protection for open-reference voltage.
- Protection for too low supply voltage.
- Protection against loop faults.
- Positive tracking of duty factor and feedback voltage when the feedback voltage is smaller than the reference voltage minus 1,5 V.
- Normal and 'smooth' remote ON/OFF possibility.

QUICK REFERENCE DATA

Supply voltage	$V_{9\text{-}16}$	typ.	12 V
Supply current	I_9	typ.	14 mA
Input signals			
Horizontal drive pulse (peak-to-peak value)	$V_{3\text{-}16(p\text{-}p)}$		5 to 11 V
Flyback pulse (differentiated deflection current); peak-to-peak value	$V_{2\text{-}16(p\text{-}p)}$		1 to 5 V
External reference voltage	$V_{10\text{-}16}$	typ.	6,1 V
Output signals			
Duty factor of output pulse	δ	$>$ $<$	0 % 98 ± 0,8 %
Output voltage at $I_O < 20$ mA (peak value)	$V_{11\text{-}16M}$	typ.	11,8 V
Output current (peak value)	I_{11M}	$<$	40 mA

PACKAGE OUTLINES

TDA2582 : 16-lead DIL; plastic (SOT-38).
TDA2582Q: 16-lead QIL; plastic (SOT-58).

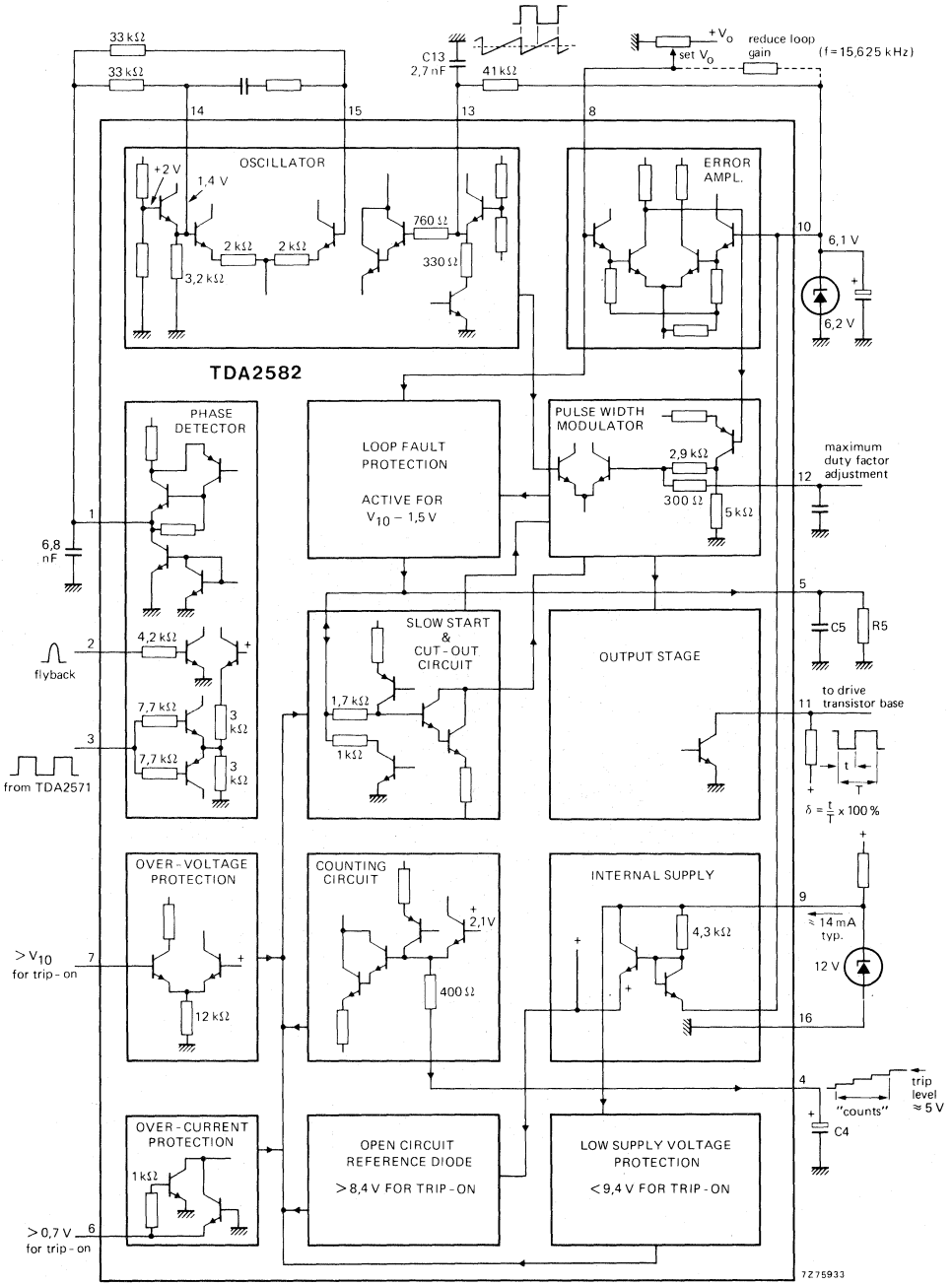


Fig. 1 Block diagram.

Note: trip levels are nominal values.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage at pin 9	$V_{9\text{-}16}$	max.	14 V
Voltage at pin 11	$V_{11\text{-}16}$		0 to 14 V
Output current (peak value)	I_{11M}	max.	40 mA
Total power dissipation	P_{tot}	max.	280 mW
Storage temperature	T_{stg}		−25 to + 125 °C
Operating ambient temperature	T_{amb}		−25 to + 80 °C

CHARACTERISTICS

$V_{9\text{-}16}$ = 12 V; $V_{10\text{-}16}$ = 6,1 V; T_{amb} = 25 °C; measured in Fig. 4

Supply voltage range	$V_{9\text{-}16}$	typ.	12 V
			10 to 14 V
Protection voltage too low supply voltage	$V_{9\text{-}16}$	typ.	9,4 V
			8,6 to 9,9 V
Supply current at δ = 50%	I_9	typ.	14 mA
Supply current during protection	I_9	typ.	14 mA
Minimum required supply current (note 1)	I_9	<	17 mA
Power consumption	P	typ.	170 mW
Required input signals			
Reference voltage (note 2)	$V_{10\text{-}16}$	typ.	6,1 V
			5,6 to 6,6 V
Feedback input impedance	$\lvert Z_{8\text{-}16} \rvert$	typ.	200 kΩ
High reference voltage protection: threshold voltage	$V_{10\text{-}16}$	typ.	8,4 V
			7,9 to 8,9 V
Horizontal reference signal (square-wave or differentiated; negative transient is reference)			
Voltage driven (peak-to-peak value)	$V_{3\text{-}16(p\text{-}p)}$		5 to 12 V
Current driven (peak value)	I_{3M}		−1 to + 1,5 mA
Switching level current	$\pm I_3$	<	100 μA
Flyback pulse or differential deflection current	$V_{2\text{-}16}$		1 to 5 V
Flyback pulse current (peak value)	I_{2M}	<	1,5 mA
Over-current protection: (note 3) threshold voltage	$-V_{6\text{-}16}$	typ.	640 mV
			600 to 695 mV
	$+V_{6\text{-}16}$	typ.	680 mV
			640 to 735 mV

Notes

1. This value refers to the minimum required supply current that will start all devices under the following conditions: $V_{9\text{-}16}$ = 10 V; $V_{10\text{-}16}$ = 6,2 V; δ = 50%.
2. Voltage obtained via an external reference diode. Specified voltages do not refer to the nominal voltages of reference diodes.
3. This spread is inclusive temperature rise of the IC due to warming up. For other ambient temperatures the values must be corrected by using a temperature coefficient of typical −1,85 mV/°C.

CHARACTERISTICS (continued)

Over-voltage protection: ($V_{ref} = V_{10\text{-}16}$) threshold voltage	$V_{7\text{-}16}$	typ.	$V_{ref}-60$ mV $V_{ref}-130$ to $V_{ref}-0$ mV
Remote control voltage; switch-off (note 1)	$V_{4\text{-}16}$	>	5,6 V
Remote control voltage; switch-on	$V_{4\text{-}16}$	<	4,5 V
'Smooth' remote control; switch-off (note 2)	$V_{5\text{-}16}$	>	4,5 V
'Smooth' remote control; switch-on	$V_{5\text{-}16}$	<	3 V
Remote control switch-off current	I_4	<	1 mA
Delivered output signals			
Horizontal drive pulse (loaded with a resistor of 560 Ω to + 12 V peak-to-peak value	$V_{11\text{-}16(p\text{-}p)}$	>	11,6 V
Output current; peak value	I_{11M}	<	40 mA
Saturation voltage of output transistor at I_{11} = 20 mA	V_{CEsat}	typ. <	200 mV 400 mV
at I_{11} = 40 mA	V_{CEsat}	<	525 mV
Duty factor of output pulse (note 3)	δ	> <	0 % 98 ± 0,8 %
Charge current for capacitor on pin 4	I_4	typ.	110 μA
Charge current for capacitor on pin 5	I_5	typ.	120 μA
Supply current for reference	I_{10}	typ.	1 mA 0,6 to 1,45 mA
Oscillator			
Temperature coefficient		typ. <	0,0003 $^oC^{-1}$ 0,0004 $^oC^{-1}$
Relative frequency deviation for $V_{10\text{-}16}$ changing from 5,6 to 6,6 V		typ. <	−1,4 % −2 %
Oscillator frequency spread (with fixed external components)		<	3 %
Frequency control sensitivity at pin 15 f_{nom} = 15,625 kHz		typ.	5 kHz/V

Notes

1. See application information pin 4.
2. See application information pin 5.
3. The duty factor is specified as follows: $\delta = \frac{t_p}{T} \times 100\%$ (see Fig. 2). After switch-on the duty factor rises gradually from 0% to the steady value. The relationship between $V_{8\text{-}16}$ and the duty factor is given in Fig. 7 and the relationship between $V_{12\text{-}16}$ and the duty factor is shown in Fig. 9.

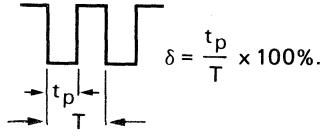


Fig. 2.

Phase control loop

Loop gain of APC-system (automatic phase control) *		typ.	5	kHz/μs
Catching range (f_{nom} = 15,625 kHz)	Δf	>	1300	Hz
		<	2100	Hz
Phase relation between negative transient of sync pulse and middle of flyback	t	typ.	1	μs
Tolerance of phase relation	Δt	⩽	± 0,4	μs

PINNING

1. Phase detector output
2. Flyback pulse position input
3. Reference frequency input
4. Re-start count capacitor/remote control input
5. Slow start and transfer characteristic for low feedback voltages
6. Over-current protection input
7. Over-voltage protection input
8. Feedback voltage input
9. Positive supply
10. Reference input
11. Output
12. Maximum duty factor adjustment/smoothing
13. Oscillator timing network
14. Reactance stage reference voltage
15. Reactance stage input
16. Negative supply (ground)

* For component values see Fig. 1.

APPLICATION INFORMATION

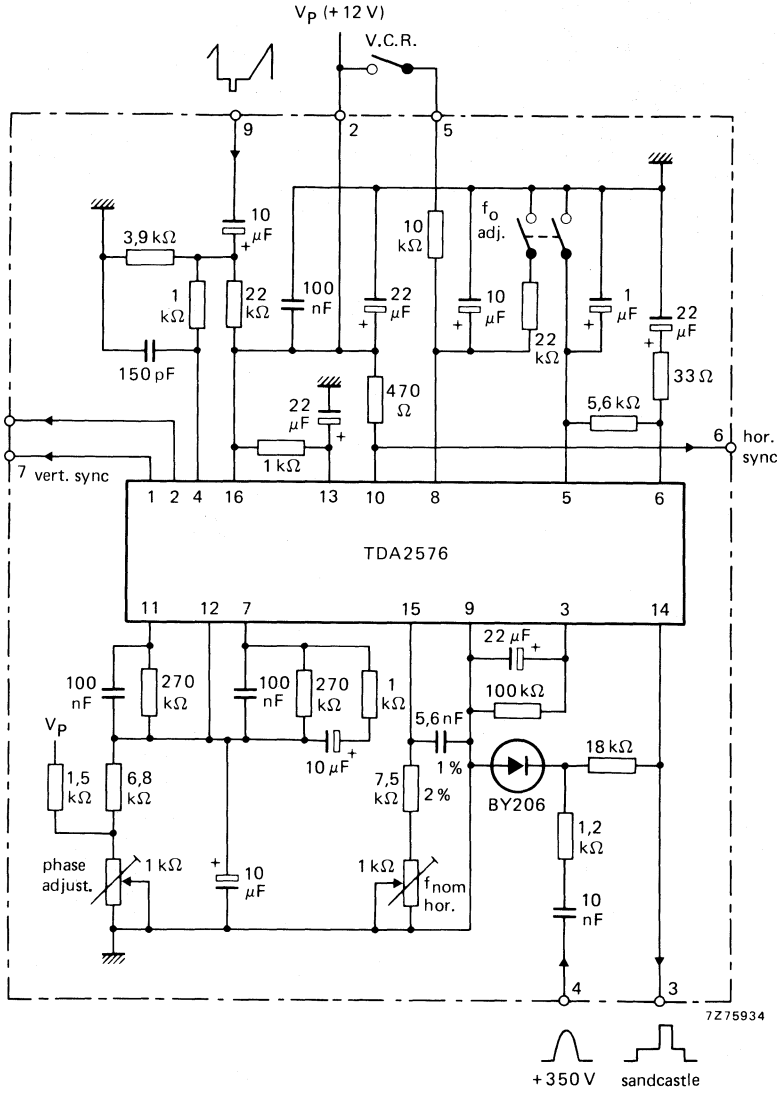


Fig. 3a.

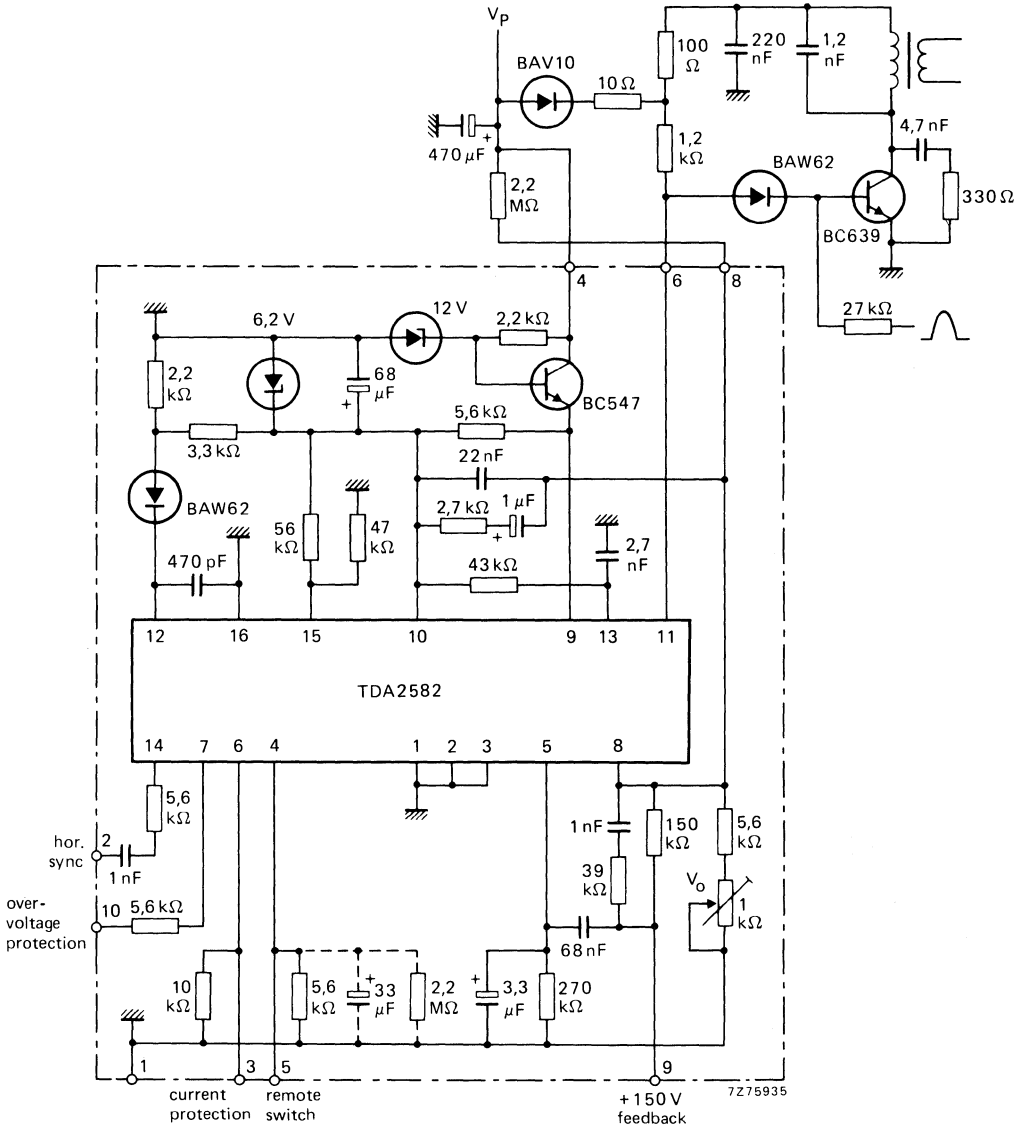


Fig. 3b.

Lead 6 (pin 10) of circuit TDA2576 connected to lead 2 (pin 14) of circuit TDA2582.

APPLICATION INFORMATION

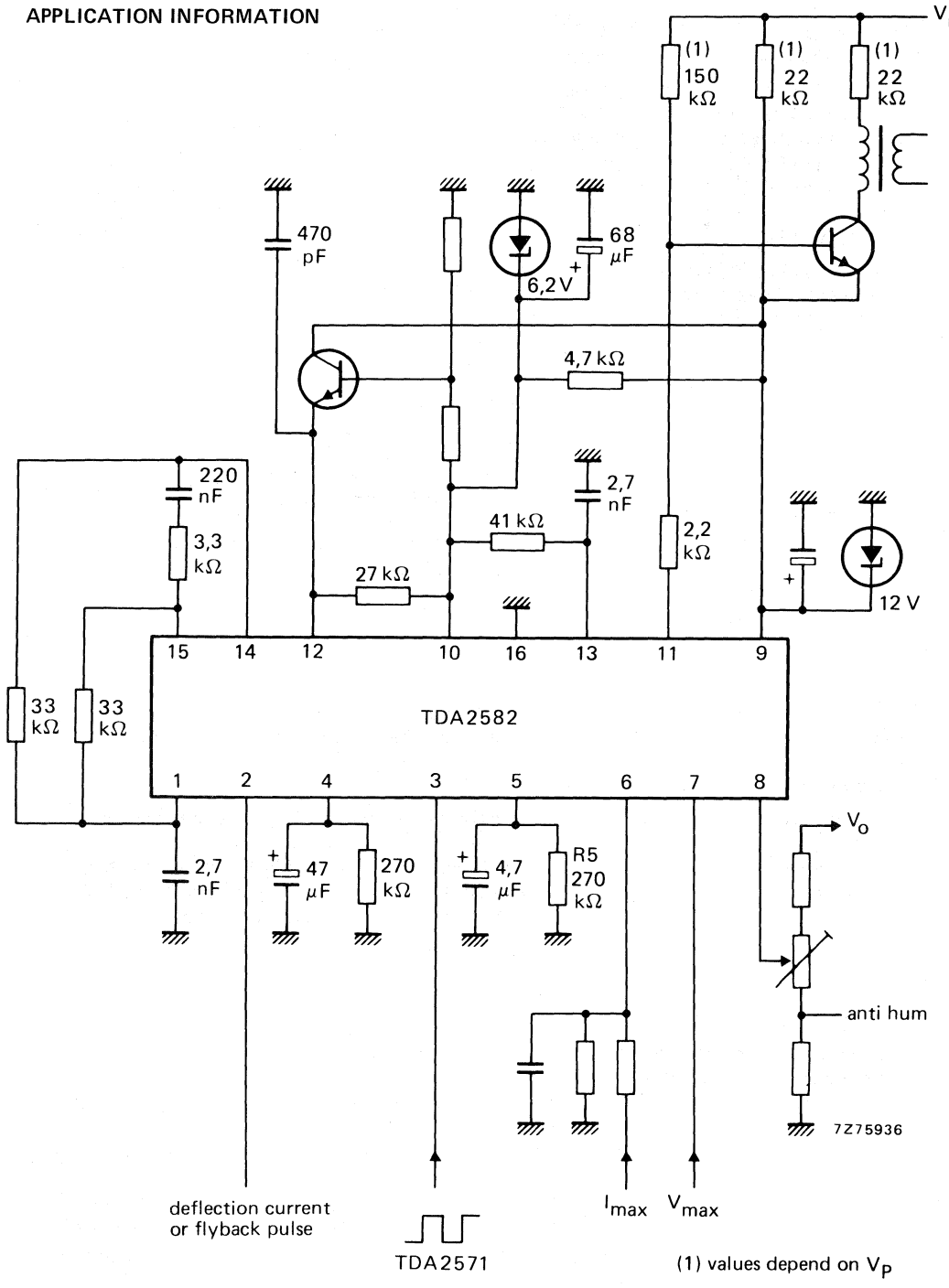


Fig. 4 Circuit diagram.

The function is described against the corresponding pin number

1. Phase detector output

The output circuit consists of a bidirectional current source which is active for the time that the signal on pin 2 exceeds 1 V.
The current values are chosen such that the correct phase relation is obtained when the output signal of the TDA2571 is applied to pin 3.
With a resistor of 2 x 33 kΩ and a capacitor of 2,7 nF the control steepness is 0,55 V/μs (Fig. 4).

2. Flyback pulse input

The signal applied to pin 2 is normally a flyback pulse with a duration of about 12 μs. However, the phase detector system also accepts a signal derived by differentiating the deflection current by means of a small toroidal core (pulse duration > 3 μs).

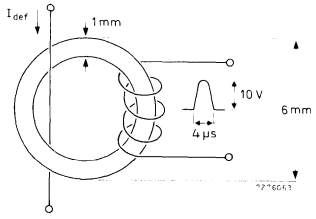


Fig. 5a.

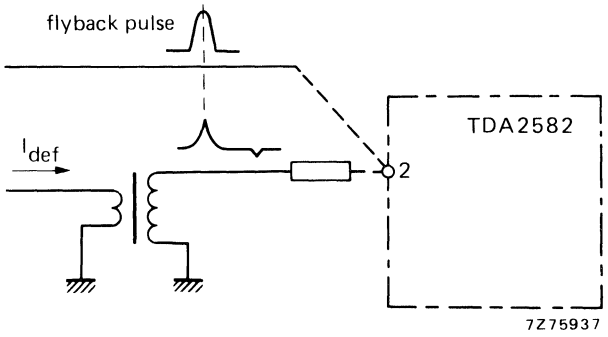


Fig. 5b.

The toroidal transformer in Fig. 5a is for obtaining a pulse representing the mid-flyback from the deflection current. The connection of the picture phase information is shown in Fig. 5b.

3. Reference frequency input

The input circuit can be driven directly by the square-wave output voltage from pin 8 of the TDA2571.
The negative-going transient switches the current source connected to pin 1 from positive to negative.
The input circuit is made such that a differentiated signal of the square-wave from the TDA2571 is also accepted (this enables mains isolation). The input circuit switching level is about 3 V and the input impedance is about 8 kΩ.

4. Re-start count capacitor/remote control input

Counting

An external capacitor (C4 = 47 μF) is connected between pins 4 and 16. This capacitor controls the characteristics of the protection circuits as follows.
If the protection circuits are required to operate, e.g. over-current at pin 6, the duty factor will be set to zero thus turning off the power supply.
After a short interval (determined by the time constant on pin 5) the power supply will be restarted via the slow start circuit.
If the fault condition has cleared, then normal operation will be resumed. If the fault condition is persistent, the duty factor of the pulses is again reduced to zero and the protection cycle is repeated.

The number of times this action is repeated (n) for a persisting fault condition is now determined by: n = C4/C5.

APPLICATION INFORMATION (continued)

Remote control input

For this application the capacitor on pin 4 has to be replaced by a resistor with a value between 4,7 and 18 kΩ. When the externally applied voltage $V_{4\text{-}16} > 5{,}6$ V, the circuit switches off; switching on occurs when $V_{4\text{-}16} < 4{,}5$ V and the normal starting-up procedure is followed. Pin 4 is internally connected to an emitter-follower, with an emitter voltage of 1,5 V.

5. Slow start and transfer characteristics for low feedback voltages

Slow start

An external shunt capacitor (C5 = 4,7 μF) and resistor (R5 = 270 kΩ) are connected between pins 5 and 16. The network controls the rate at which the duty factor increases from zero to its steady-state value after switch-on. It provides protection against surges in the power transistor.

Transfer characteristic for low feedback voltages

The duty factor transfer characteristic for low feedback voltages can be influenced by R5. The transfer for three different resistor values is given in Fig. 7.

'Smooth' remote ON/OFF

The ON/OFF information should be applied to pin 5 via a high ohmic resistor, a high OFF-level gives a slow rising voltage at pin 5, which results in a slowly decreasing duty factor.

6. Over-current protection input

A voltage proportional to the current in the power switching device is applied to the integrated circuit between pins 6 and 16. The circuit trips on both positive and negative polarity. When the tripping level is reached, the output pulse is immediately blocked and the starting circuit is activated again.

7. Over-voltage protection input

When the voltage applied to this pin exceeds the threshold level the protection circuit will operate. The tripping level is about the same as the reference voltage on pin 10.

8. Feedback voltage input

The control loop input is applied to pin 8. This pin is internally connected to one input of a differential amplifier, functioning as an amplitude comparator, the other input of which is connected to the reference source on pin 10.
Under normal operating conditions, the voltage on pin 8 will be about equal to the reference voltage on pin 10. For further information refer to the Figs 7 and 8.

9. 12 V positive supply

The maximum voltage that may be applied is 14 V. Where this is derived from an unstabilized supply rail, a regulator diode (12 V) should be connected between pins 9 and 16 to ensure that the maximum voltage does not exceed 14 V. When the voltage on this pin falls below a minimum of 8,6 V (typically 9,4 V), the protection circuit will switch-off the power supply.

10. Reference input

An external reference diode must be connected between this pin and pin 16.
The reference voltage must be between 5,6 and 6,6 V. The IC delivers about 1 mA into the external regulator diode. When the external load on the regulator diode approaches this current, replenishment of the current can be obtained by connecting a suitable resistor between pins 9 and 10. A higher reference voltage value up to 7,5 V is allowed when use is made of a duty factor limiting resistor < 27 kΩ between pins 12 and 16.

11. Output

An external resistor determines the output current fed into the base of the driver transistor. The output circuit uses an n-p-n transistor with 3 series-connected clamping diodes to the internal 12 V supply rail. This provides a low impedance in the "ON" state, that is with the drive transistor turned-off.

12. Maximum duty factor adjustment/smoothing

Maximum duty factor adjustment

Pin 12 is connected to the output voltage of the amplitude comparator ($V_{10\text{-}8}$). This voltage is internally connected to one input of a differential amplifier, the other input of which is connected to the sawtooth voltage of the horizontal oscillator. A high voltage on pin 12 results in a low duty factor. This enables the maximum duty factor to be adjusted by limiting the voltage by connecting pin 12 to the emitter of an n-p-n transistor used as a voltage source.
Fig. 9 plots the maximum duty factor as a function of the voltage applied to pin 12. If some spread is acceptable the maximum duty factor can also be limited by connecting a resistor from pin 12 to pin 16. A resistor of 12 kΩ limits the maximum duty factor to about 50%. This application also reduces the total IC gain.

Smoothing

Any double pulsing of the IC due to circuit layout can be suppressed by connecting a capacitor of about 470 pF between pins 12 and 16.

13. Oscillator timing network

The timing network comprises a capacitor between pins 13 and 16, and a resistor between pin 13 and the reference voltage on pin 10.
The charging current for the capacitor (C13) is derived from the voltage reference diode connected to pin 10 and discharged via an internal resistor of about 330 Ω.

14. Reactance stage reference voltage

This pin is connected to an emitter follower which determines the nominal reference voltage for the reactance stage (1,4 V for reference voltage $V_{10\text{-}16} = 6{,}1$ V). Free-running frequency is obtained when pins 14 and 15 are short-circuited.

15. Reactance stage input

The output voltage of the phase detector (pin 1) is connected to pin 15 via a resistor. The voltage applied to pin 15 shifts the upper level of the voltage sensor of the oscillator thus changing the oscillator frequency and phase. The time constant network is connected between 14 and 15. Control sensitivity is typically 5 kHz/V.

16. Negative supply (ground)

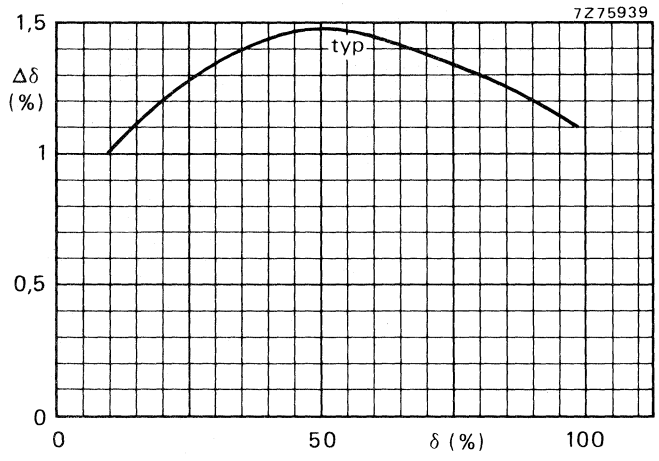


Fig. 6 Duty factor change as a function of initial duty factor; at 1 mV error amplifier input change; $\Delta V_{8\text{-}10(p\text{-}p)}$ = 1 mV.

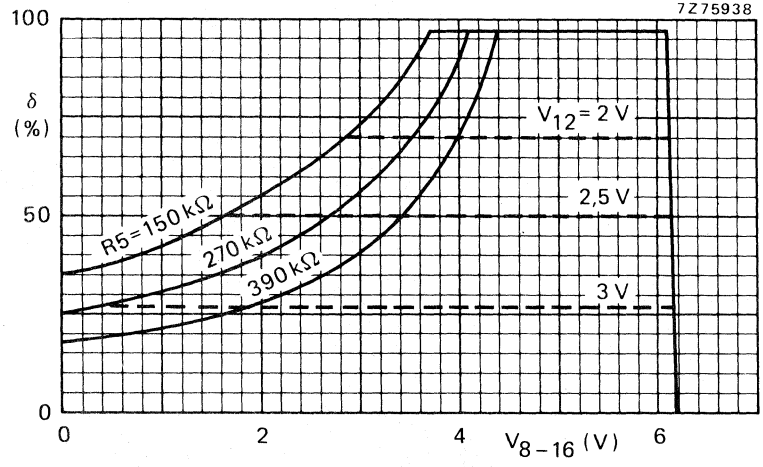


Fig. 7 Duty factor of output pulses as a function of feedback input voltage ($V_{8\text{-}16}$) with R5 as a parameter and $V_{12\text{-}16}$ as a limiting value; $V_{10\text{-}16}$ = 6,1 V.

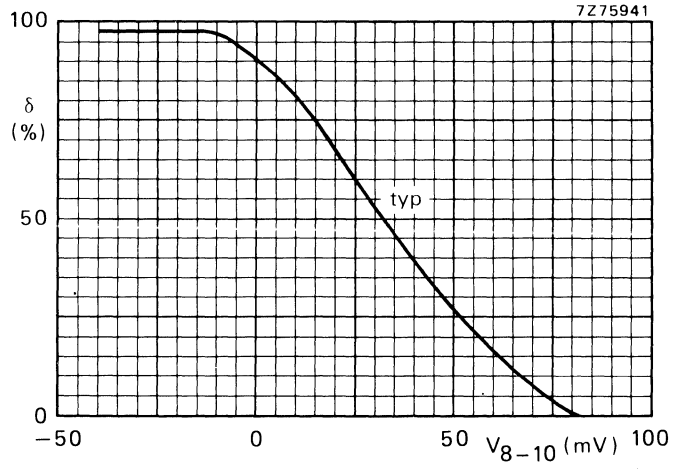


Fig. 8 Duty factor of output pulses as a function of error amplifier input ($V_{8\text{-}10}$); $V_{10\text{-}16}$ = 6,1 V.

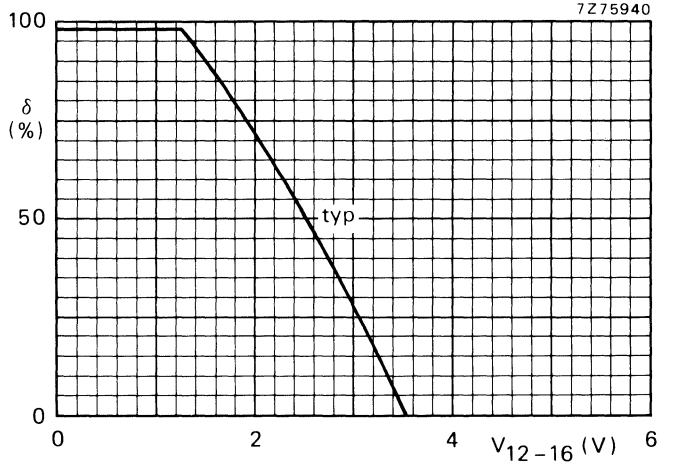


Fig. 9 Maximum duty factor limitation as a function of the voltage applied to pin 12; $V_{10\text{-}16}$ = 6,1 V.

HORIZONTAL COMBINATION

The TDA2593 is a monolithic integrated circuit intended for use in colour television receivers in combination with TDA2510, TDA2520, TDA2560 as well as with TDA3500, TDA3510 and TDA3520. The circuit incorporates the following functions:

- horizontal oscillator based on the threshold switching principle
- phase comparison between sync pulse and oscillator voltage (φ_1)
- internal key pulse for phase detector (φ_1) (additional noise limiting)
- phase comparison between line flyback pulse and oscillator voltage (φ_2)
- larger catching range obtained by coincidence detector (φ_3; between sync and key pulse)
- switch for changing the filter characteristic and the gate circuit (VCR-operation)
- sync separator
- noise separator
- vertical sync separator and output stage
- colour burst keying and line flyback blanking pulse generator
- phase shifter for the output pulse
- output pulse duration switching
- output stage with separate supply voltage for direct drive of thyristor deflection circuits
- low supply voltage protection

QUICK REFERENCE DATA

Supply voltage	$V_{1\text{-}16}$	typ.	12 V
Supply current	I_1	typ.	30 mA
Input signals			
Sync separator input voltage (peak-to-peak value)	$V_{9\text{-}16(p\text{-}p)}$		3 to 4 V
Noise separator input voltage (peak-to-peak value)	$V_{10\text{-}16(p\text{-}p)}$		3 to 4 V
Pulse duration switch input voltage			
at t = 7 μs (thyristor driving)	$V_{4\text{-}16}$		9,4 to $V_{1\text{-}16}$ V
at t = 14 μs + t_d (transistor driving)	$V_{4\text{-}16}$		0 to 3,5 V
at t = 0 (input 4 open or $V_{3\text{-}16}$ = 0)	$V_{4\text{-}16}$		5,4 to 6,6 V
Output signals			
Vertical sync output pulse (peak-to peak value)	$V_{8\text{-}16(p\text{-}p)}$	typ.	11 V
Burst gating output pulse (peak-to-peak value)	$V_{7\text{-}16(p\text{-}p)}$	typ.	11 V
Line drive pulse (peak-to-peak value)	$V_{3\text{-}16(p\text{-}p)}$	typ.	10,5 V

PACKAGE OUTLINE

16-lead DIL; plastic (SOT-38).

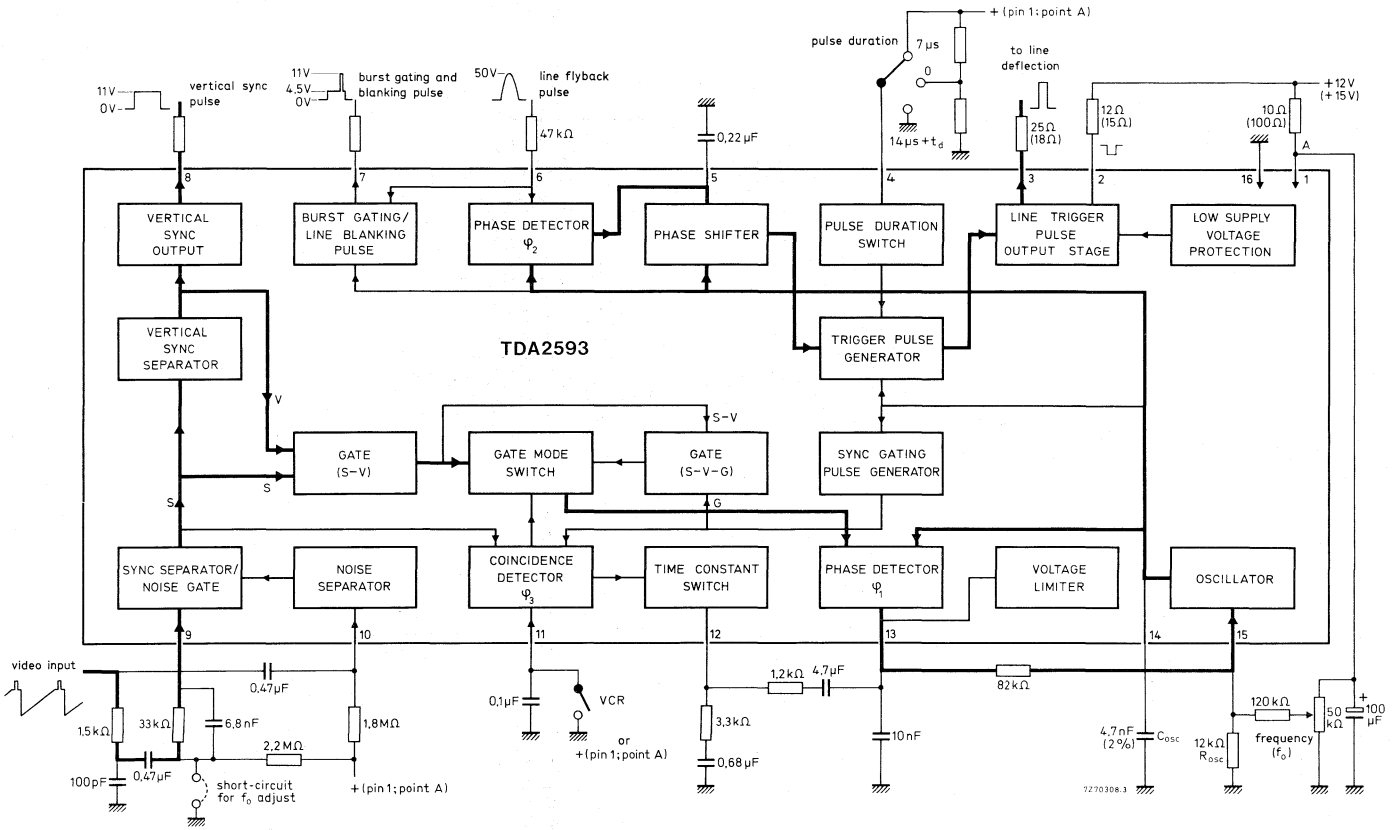


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage			
at pin 1 (voltage source)	V_{1-16}	max.	13,2 V
at pin 2	V_{2-16}	max.	18 V
Voltages			
Pin 4	V_{4-16}	max.	13,2 V
Pin 9	$+V_{9-16}$	max.	6 V
Pin 10	$\pm V_{10-16}$	max.	6 V
Pin 11	V_{11-16}	max.	13,2 V
Currents			
Pins 2 and 3 (thyristor driving) (peak value)	$I_{2M}, -I_{3M}$	max.	650 mA
Pins 2 and 3 (transistor driving) (peak value)	$I_{2M}, -I_{3M}$	max.	400 mA
Pin 4	I_4	max.	1 mA
Pin 6	$\pm I_6$	max.	10 mA
Pin 7	$-I_7$	max.	10 mA
Pin 11	I_{11}	max.	2 mA
Total power dissipation	P_{tot}	max.	800 mW
Storage temperature	T_{stg}		−25 to + 125 °C
Operating ambient temperature	T_{amb}		0 to + 70 °C ←

CHARACTERISTICS at V_{1-16} = 12 V; T_{amb} = 25 °C; measured in Fig. 1

Sync separator

Input switching voltage	V_{9-16}	typ.	0,8 V
Input keying current	I_9		5 to 100 μA
Input leakage current at V_{9-16} = −5 V	I_9	<	1 μA
Input switching current	I_9	⩽	5 μA
Switch off current	I_9	>	100 μA
		typ.	150 μA
Input signal (peak-to-peak value)	$V_{9-16(p-p)}$		3 to 4 V*

* Permissible range 1 to 7 V.

Noise separator				
Input switching voltage	V_{10-16}	typ.	1,4	V
Input keying current	I_{10}		5 to 100	μA
Input switching current	I_{10}	>	100	μA
		typ.	150	μA
Input leakage current at $V_{10-16} = -5$ V	I_{10}	<	1	μA
Input signal (peak-to-peak value)	$V_{10-16(p-p)}$		3 to 4	V *
Permissible superimposed noise signal (peak-to-peak value)	$V_{10-16(p-p)}$	<	7	V
Line flyback pulse				
Input current	I_6	typ.	1	mA
			0,02 to 2	mA
Input switching voltage	V_{6-16}	typ.	1,4	V
Input limiting voltage	V_{6-16}		−0,7 to + 1,4	V
Switching on VCR				
Input voltage	V_{11-16}		0 to 2,5	V
	V_{11-16}		9 to V_{1-16}	V
Input current	$-I_{11}$	<	200	μA
	I_{11}	<	2	mA
Pulse duration switch				
For t = 7 μs (thyristor driving)				
Input voltage	V_{4-16}		9,4 to V_{1-16}	V
Input current	I_4	>	200	μA
For t = 14 μs + t_d (transistor driving)				
Input voltage	V_{4-16}		0 to 3,5	V
Input current	$-I_4$	>	200	μA
For t = 0; $V_{3-16} = 0$ or input pin 4 open				
Input voltage	V_{4-16}		5,4 to 6,6	V
Input current	I_4	typ.	0	μA

* Permissible range 1 to 7 V.

Vertical sync pulse (positive-going)			
Output voltage (peak-to-peak value)	$V_{8\text{-}16(p\text{-}p)}$	$>$	10 V
		typ.	11 V
Output resistance	R_8	typ.	2 kΩ
Delay between leading edge of input and output signal	t_{on}	typ.	15 μs
Delay between trailing edge of input and output signal	t_{off}	typ.	t_{on} μs
Burst gating pulse (positive-going)			
Output voltage (peak-to-peak value)	$V_{7\text{-}16(p\text{-}p)}$	$>$	10 V
		typ.	11 V
Output resistance	R_7	typ.	70 Ω
Pulse duration; $V_{7\text{-}16} = 7$ V	t_p	typ.	4 μs
			3,7 to 4,3 μs
Phase relation between middle of sync pulse at the input and the leading edge of the burst gating pulse; $V_{7\text{-}16} = 7$ V	t	typ.	2,65 μs
			2,15 to 3,15 μs
Output trailing edge current	I_7	typ.	2 mA
Line flyback-blanking pulse (positive-going)			
Output voltage (peak-to-peak value)	$V_{7\text{-}16(p\text{-}p)}$		4 to 5 V
Output resistance	R_7	typ.	70 Ω
Output trailing edge current	I_7	typ.	2 mA
Line drive pulse (positive-going)			
Output voltage (peak-to-peak value)	$V_{3\text{-}16(p\text{-}p)}$	typ.	10,5 V
Output resistance			
for leading edge of line pulse	R_3	typ.	2,5 Ω
for trailing edge of line pulse	R_3	typ.	20 Ω
Pulse duration (thyristor driving) $V_{4\text{-}16}$ = 9,4 to $V_{1\text{-}16}$ V	t_p	typ.	7 μs
			5,5 to 8,5 μs
Pulse duration (transistor driving) $V_{4\text{-}16}$ = 0 to 4 V; t_{fp} = 12 μs	t_p		14 + t_d μs*
Supply voltage for switching off the output pulse	$V_{1\text{-}16}$	typ.	4 V
Overall phase relation			
Phase relation between middle of sync pulse and the middle of the flyback pulse	t	typ.	2,6 μs**
Tolerance of phase relation	$\lvert \Delta t \rvert$	$<$	0,7 μs

* t_d = switch-off delay of line output stage.
** Line flyback pulse duration t_{fp} = 12 μs.

The adjustment of the overall phase relation and consequently the leading edge of the line drive pulse occurs automatically by phase control φ_2. If additional adjustment is applied it can be arranged by current supply at pin 5 such that	$\Delta I_5/\Delta t$	typ.	30	$\mu A/\mu s$
Oscillator				
Threshold voltage low level	$V_{14\text{-}16}$	typ.	4,4	V
Threshold voltage high level	$V_{14\text{-}16}$	typ.	7,6	V
Discharge current	$\pm I_{14}$	typ.	0,47	mA
Frequency; free running (C_{osc} = 4,7 nF; R_{osc} = 12 kΩ)	f_o	typ.	15,625	kHz
Spread of frequency	$\Delta f_o/f_o$	<	± 5	%*
Frequency control sensitivity	$\Delta f_o/\Delta I_{15}$	typ.	31	$Hz/\mu A$
Adjustment range of network in circuit (Fig. 1)	$\Delta f_o/f_o$	typ.	± 10	%
Influence of supply voltage on frequency	$\frac{\Delta f_o/f_o}{\Delta V/V_{nom}}$	<	± 0,05	%*
Change of frequency when $V_{1\text{-}16}$ drops to 5 V	Δf_o	<	± 10	%*
Temperature coefficient of oscillator frequency		<	$\pm 10^{-4}$	Hz/K*
Phase comparison φ_1				
Control voltage range	$V_{13\text{-}16}$		3,8 to 8,2	V
Control current (peak value)	$\pm I_{13M}$		1,9 to 2,3	mA
Output leakage current at $V_{13\text{-}16}$ = 4 to 8 V	I_{13}	<	1	μA
Output resistance				
at $V_{13\text{-}16}$ = 4 to 8 V	R_{13}	high ohmic		**
at $V_{13\text{-}16}$ < 3,8 V or > 8,2 V	R_{13}	low ohmic		▲
Control sensitivity		typ.	2	$kHz/\mu s$
Catching and holding range (82 kΩ beteeen pins 13 and 15)	Δf	typ.	± 780	Hz
Spread of catching and holding range	$\Delta(\Delta f)$	typ.	± 10	%*

* Excluding external component tolerances.
** Current source.
▲ Emitter follower.

Phase comparison φ_2 and phase shifter			
Control voltage range	$V_{5\text{-}16}$	5,4 to 7,6	V
Control current (peak value)	$\pm I_{5M}$	typ. 1	mA
Output resistance			
at $V_{5\text{-}16}$ = 5,4 to 7,6 V		high ohmic	*
at $V_{5\text{-}16}$ < 5,4 V or > 7,6 V	R_5	typ. 8	kΩ
Input leakage current			
$V_{5\text{-}16}$ = 5,4 to 7,6 V	I_5	< 5	μA
Permissible delay between leading edge of output pulse and leading edge of flyback pulse (t_{fp} = 12 μs)	t_d	< 15	μs
Static control error	$\Delta t/\Delta t_d$	< 0,2	%
Coincidence detector φ_3			
Output voltage	$V_{11\text{-}16}$	0,5 to 6	V
Output current (peak value)			
without coincidence	I_{11M}	typ. 0,1	mA
with coincidence	$-I_{11M}$	typ. 0,5	mA
Time constant switch			
Output voltage	$V_{12\text{-}16}$	typ. 6	V
Output current (limited)	$\pm I_{12}$	< 1	mA
Output resistance			
at $V_{11\text{-}16}$ = 2,5 to 7 V	R_{12}	typ. 0,1	kΩ
at $V_{11\text{-}16}$ < 1,5 V or > 9 V	R_{12}	typ. 60	kΩ
Internal gating pulse			
Pulse duration	t_p	typ. 7,5	μs

* Current source.

HORIZONTAL COMBINATION

The TDA2594 is a monolithic integrated circuit intended for use in colour television receivers. The circuit incorporates the following functions:

- Horizontal oscillator based on the threshold switching principle.
- Phase comparison between sync pulse and oscillator voltage (φ_1).
- Internal key pulse for phase detector (φ_1) (additional noise limiting).
- Phase comparison between line flyback pulse and oscillator voltage (φ_2).
- Larger catching range obtained by coincidence detector (φ_3; between sync and key pulse).
- Switch for changing the filter characteristic and the gate circuit (VCR-operation).
- Sync separator.
- Noise separator.
- Vertical sync separator and output stage.
- Colour burst keying and line flyback blanking pulse generator and clamp circuit for vertical blanking.
- Phase shifter for the output pulse.
- Output pulse duration for transistor deflection systems.
- External switching off of the line trigger pulse.
- Output stage with separate supply voltage.
- Low supply voltage protection.
- Transmitter identification and muting circuit, and vertical sync switch-off.

QUICK REFERENCE DATA

Supply voltage	$V_{1-18} = V_S$	typ.	12 V
Supply current	I_1	typ.	30 mA
Input signals			
Sync separator input voltage (peak-to-peak value)	$V_{11-18(p-p)}$	typ.	3 V*
Noise separator input voltage (peak-to-peak value)	$V_{12-18(p-p)}$	typ.	3 V*
Pulse duration switch input voltage			
at $t = 14\ \mu s + t_d$ (transistor driving)	V_{4-18}		0 to 3,5 V
at $t = 0$ ($V_{3-18} = 0$); input 4 open ($I_4 = 0$)	V_{4-18}		5,4 to 6,6 V
Output signals			
Vertical sync output pulse (peak-to-peak value)	$V_{8-18(p-p)}$	typ.	11 V
Burst key output pulse (peak-to-peak value)	$V_{7-18(p-p)}$	typ.	11 V
Line drive-pulse (peak-to-peak value)	$V_{3-18(p-p)}$	typ.	10 V

* Permissible range: 1 to 7 V.

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102CS).

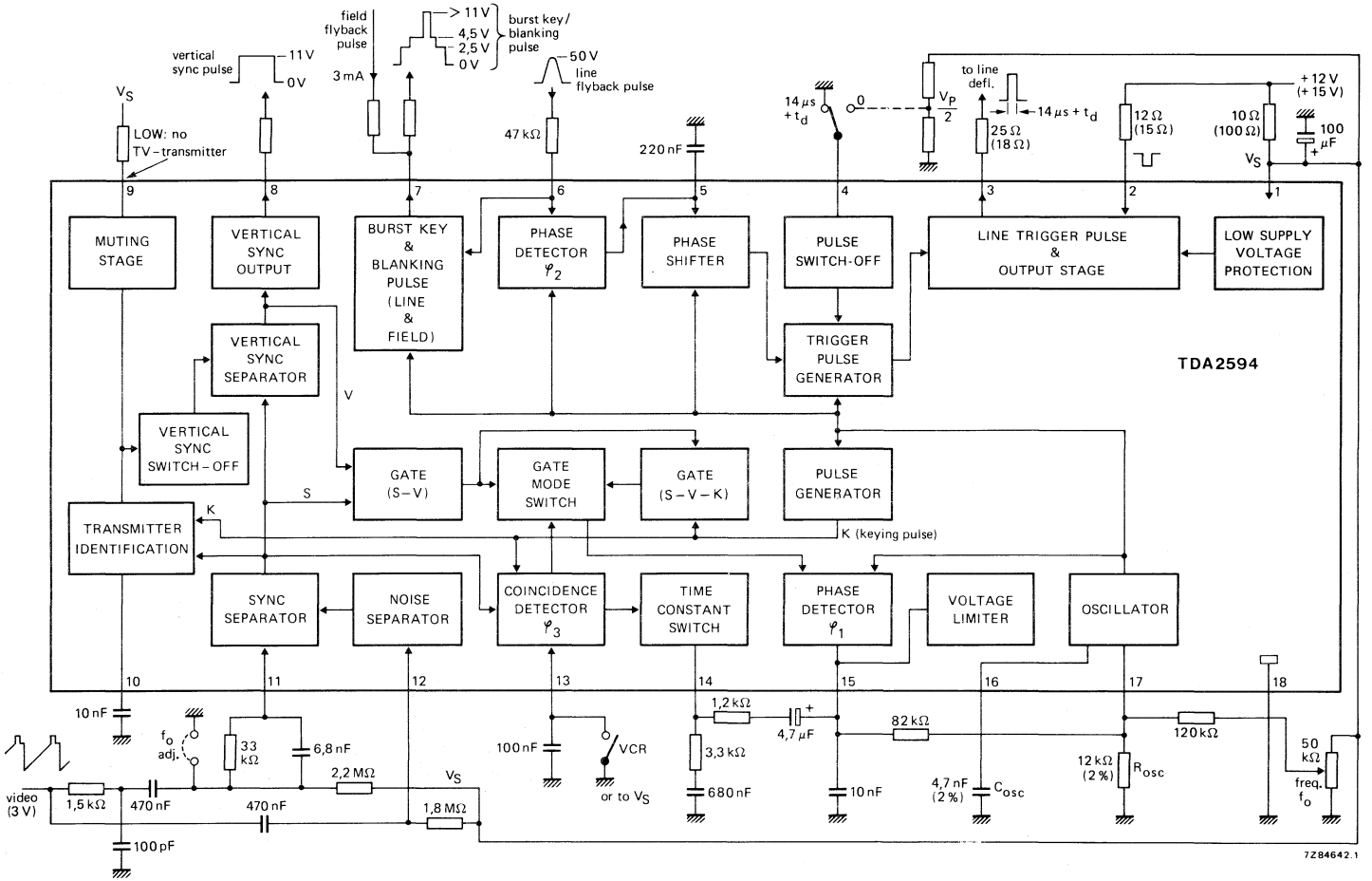


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage				
at pin 1 (voltage source)	$V_{1-18} = V_S$	max.	13,2	V
at pin 2	V_{2-18}	max.	18	V
Voltages				
Pin 4	V_{4-18}	max.	13,2	V
Pin 9	V_{9-18}	max.	18	V
	$-V_{9-18}$	max.	0,5	V
Pin 11	$\pm V_{11-18}$	max.	6	V
Pin 12	$\pm V_{12-18}$	max.	6	V
Pin 13	V_{13-18}	max.	13,2	V
Currents				
Pins 2 and 3 (transistor driving) (peak value)	$I_{2M}, -I_{3M}$	max.	400	mA
Pin 4	I_4	max.	1	mA
Pin 6	$\pm I_6$	max.	10	mA
Pin 7	$-I_7$	max.	5	mA
Pin 9	I_9	max.	10	mA
Pin 13	I_{13}	max.	2	mA
Total power dissipation	P_{tot}	max.	800	mW
Storage temperature range	T_{stg}		−25 to +125	°C
Operating ambient temperature range	T_{amb}		0 to + 70	°C ←

CHARACTERISTICS at $V_{1-18} = 12$ V; $T_{amb} = 25$ °C; measured in Fig. 1

Sync separator (pin 11)

Input switching voltage	V_{11-18}	typ.	0,8	V
Input keying current	I_{11}		5 to 100	μA
Input leakage current at $V_{11-18} = -5$ V	I_{11}	⩽	1	μA
Input switching current	I_{11}	⩽	5	μA
Switch off current	I_{11}	⩾	100	μA
		typ.	150	μA
Input signal (peak-to-peak value)	$V_{11-18(p-p)}$		3 to 4	V*

* Permissible range 1 to 7 V.

Noise separator (pin 12)			
Input switching voltage	V_{12-18}	typ.	1,4 V
Input keying current	I_{12}		5 to 100 μA
Input switching current	I_{12}	⩾	100 μA
		typ.	150 μA
Input leakage current at $V_{12-18} = -5$ V	I_{12}	⩽	1 μA
Input signal (peak-to-peak value)	$V_{12-18(p-p)}$		3 to 4 V*
Permissible superimposed noise signal (peak-to-peak value)	$V_{12-18(p-p)}$	⩽	7 V
Line flyback pulse (pin 6)			
Input current	I_6	⩾	0,02 mA
		typ.	1 mA
Input switching voltage	V_{6-18}	typ.	1,4 V
Input limiting voltage	V_{6-18}		−0,7 to +1,4 V
Switching on VCR (pin 13)			
Input voltage	V_{13-18}		0 to 2,5 V
	or: V_{13-18}		9 to V_S V
Input current	$-I_{13}$	⩽	200 μA
	or: I_{13}	⩽	2 mA
Pulse switching off (pin 4)			
For t = 0; input pin 4 open or $V_{3-18} = 0$			
Input voltage	V_{4-18}		5,4 to 6,6 V
Input current	I_4	typ.	0 μA
Vertical sync pulse (positive-going) (pin 8)			
Output voltage (peak-to-peak value)	$V_{8-18(p-p)}$	⩾	10 V
		typ.	11 V
Output resistance	R_8	typ.	2 kΩ
Delay between leading edge of input and output signal	t_{on}	typ.	15 μs
Delay between trailing edge of input and output signal	t_{off}	⩾	t_{on} μs
Switching off the vertical sync pulse	V_{10-18}	⩽	3 V
Burst key pulse (positive-going) (pin 7)			
Output voltage	V_{7-18}	⩾	10 V
		typ.	11 V
Output resistance	R_7	typ.	70 Ω
Pulse duration; $V_{7-18} = 7$ V	t_p	typ.	4 μs
			3,7 to 4,3 μs
Phase relation between middle of sync pulse at the input and the leading edge of the burst key pulse; $V_{7-18} = 7$ V	t	typ.	2,65 μs
			2,15 to 3,15 μs
Output trailing edge current	I_7	typ.	2 mA
Saturation voltage during line scan	V_{7-18}	⩽	1 V

* Permissible range 1 to 7 V.

Line flyback-blanking pulse (positive-going) (pin 7)

Output voltage	$V_{7\text{-}18}$	4,1 to 4,9	V
Output resistance	R_7	typ. 70	Ω
Output trailing edge current	I_7	typ. 2	mA

Field flyback/blanking pulse (pin 7)

Output voltage with externally forced in current I_7 = 2,4 to 3,6 mA	$V_{7\text{-}18}$	2 to 3	V
Output resistance at I_7 = 3 mA	R_7	typ. 70	Ω

TV-transmitter identification output (pin 9; open collector)

Output voltage at I_9 = 3 mA; no TV-transmitter	$V_{9\text{-}18}$	≤ 0,5	V
Output resistance at I_9 = 3 mA; no TV-transmitter	R_9	≤ 100	Ω
Output current at $V_{10\text{-}18} \geqslant 3$ V; TV-transmitter identified	I_9	≤ 5	μA

TV-transmitter identification (pin 10)

When receiving a TV signal the voltage $V_{10\text{-}18}$ will change from ≤ 1 V to ≥ 7 V.

Line drive pulse (positive-going)

Output voltage (peak-to-peak value)	$V_{3\text{-}18(p\text{-}p)}$	typ. 10	V
Output resistance			
for leading edge of line pulse	R_3	typ. 2,5	Ω
for trailing edge of line pulse	R_3	typ. 20	Ω
Pulse duration (transistor driving) $V_{4\text{-}18}$ = 0 to 3,5 V; $-I_4 \geqslant 200$ μA; t_{fp} = 12 μs	t_p	$14 + t_d$	μs*
Supply voltage for switching off the output pulse	$V_{1\text{-}18}$	typ. 4	V

Overall phase relation

Phase relation between middle of sync pulse and the middle of the flyback pulse	Δt	typ. 2,6 ± 0,7	μs**

The adjustment of the overall phase relation and consequently the leading edge of the line drive pulse occurs automatically by phase control φ_2.

If additional adjustment is applied it can be arranged by current supply at pin 5, such that:

Supplying current	$\Delta I/\Delta t$	typ. 30	μA/μs

* t_d = switch-off delay of line output stage.

** Line flyback pulse duration t_{fp} = 12 μs.

Oscillator (pins 16 and 17)

Threshold voltage low level	$V_{16\text{-}18}$	typ.	4,4	V
Threshold voltage high level	$V_{16\text{-}18}$	typ.	7,6	V
Charging current	$\pm I_{16}$	typ.	0,47	mA
Frequency; free running (C_{osc} = 4,7 nF; R_{osc} = 12 kΩ)	f_o	typ.	15,625	kHz
Spread of frequency	Δf_o	⩽	± 5	%▲
Frequency control sensitivity	$\Delta f_o/\Delta_{17}$	typ.	31	Hz/μA
Adjustment range of network in circuit (Fig. 1)	Δf_o	typ.	± 10	%
Influence of supply voltage on frequency; reference at V_S = 12 V	$\frac{\Delta f_o/f_o}{\Delta V/V_{nom}}$	⩽	± 0,05	%▲
Change of frequency when V_S drops to 5 V; reference at V_S = 12 V	Δf_o	⩽	± 10	%▲
Temperature coefficient of oscillator frequency	TC	⩽	$\pm 10^{-4}$	K^{-1}▲

Phase comparison φ_1 (pin 15)

Control voltage range	$V_{15\text{-}18}$		4,1 to 7,9	V
Control current (peak value)	$\pm I_{15M}$		1,8 to 2,2	mA
Output leakage current at $V_{15\text{-}18}$ = 4,3 to 7,7 V	I_{15}	⩽	1	μA
Output resistance				
at $V_{15\text{-}18}$ = 4,3 to 7,7 V	R_{13}	high ohmic		*
at $V_{15\text{-}18}$ ⩽ 4,1 V or ⩾ 7,9 V	R_{13}	low ohmic		**
Control sensitivity		typ.	2	kHz/μs
Catching and holding range (82 kΩ between pins 15 and 17)	Δf	typ.	± 680	Hz
Spread of catching and holding range	Δ(Δf)	typ.	± 12	%▲

Phase comparison φ_2 **and phase shifter** (pin 5)

Control voltage range	$V_{5\text{-}18}$		5,4 to 7,6	V
Control current (peak value)	$\pm I_{5M}$	typ.	1	mA
Output resistance at $V_{5\text{-}18}$ = 5,4 to 7,6 V	R_5	high ohmic		*
Input leakage current at $V_{5\text{-}18}$ = 5,4 to 7,6 V	I_5	⩽	5	μA
Permissible delay between leading edge of output pulse and leading edge of flyback pulse (t_{fp} = 12 μs)	t_d	⩽	15,5	μs
Static control error	$\Delta t/\Delta t_d$	⩽	0,2	%

Coincidence detector φ_3 (pin 13)

Output voltage	$V_{13\text{-}18}$		0,5 to 6	V
Output current (peak value)				
without coincidence	I_{13M}	typ.	0,1	mA
with coincidence	$-I_{13M}$	typ.	0,5	mA

* Current source.
** Emitter follower.
▲ Excluding external component tolerances.

Time constant switch (pin 14)

Output voltage	$V_{14\text{-}18}$	typ.	6 V
Output current (limited)	$\pm I_{14}$	typ.	1 mA
Output resistance			
at $V_{13\text{-}18}$ = 3,5 to 7 V	R_{14}	typ.	0,1 kΩ
at $V_{13\text{-}18} \leqslant 2{,}5$ V or $\geqslant 9$ V	R_{14}	typ.	60 kΩ

Internal keying pulse

Pulse duration	t_p	typ.	7,5 μs

HORIZONTAL COMBINATION

GENERAL DESCRIPTION

The TDA2595 is a monolithic integrated circuit intended for use in colour television receivers. The circuit incorporates the following functions:

- Positive video input; capacitively coupled (source impedance $< 200\ \Omega$)
- Adaptive sync separator; slicing level at 50% of sync amplitude
- Internal vertical pulse separator with double slope integrator
- Output stage for vertical sync pulse or composite sync depending on the load; both are switched off at muting
- φ_1 phase control between horizontal sync and oscillator
- Coincidence detector φ_3 for automatic time-constant switching; overruled by the VCR switch
- Time-constant switch between two external time-constants or loop-gain; both controlled by the coincidence detector φ_3
- φ_1 gating pulse controlled by coincidence detector φ_3
- Mute circuit depending on TV transmitter identification
- φ_2 phase control between line flyback and oscillator; the slicing levels for φ_2 control and horizontal blanking can be set separately
- Burst keying and horizontal blanking pulse generation, in combination with clamping of the vertical blanking pulse (three-level sandcastle)
- Horizontal drive output with constant duty cycle inhibited by the protection circuit or the supply voltage sensor
- Detector for too low supply voltage
- Protection circuit for switching off the horizontal drive output continuously if the input voltage is below 4 V or higher than 8 V
- Line flyback control causing the horizontal blanking level at the sandcastle output continuously in case of a missing flyback pulse
- Spot-suppressor controlled by the line flyback control

QUICK REFERENCE DATA

Supply voltage (pin 15)	$V_{15\text{-}5} = V_P$	typ.	12 V
Sync pulse amplitude (positive video)	$V_{i(p\text{-}p)}$	min.	50 mV
Horizontal output current	I_4	typ.	30 mA

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102CS).

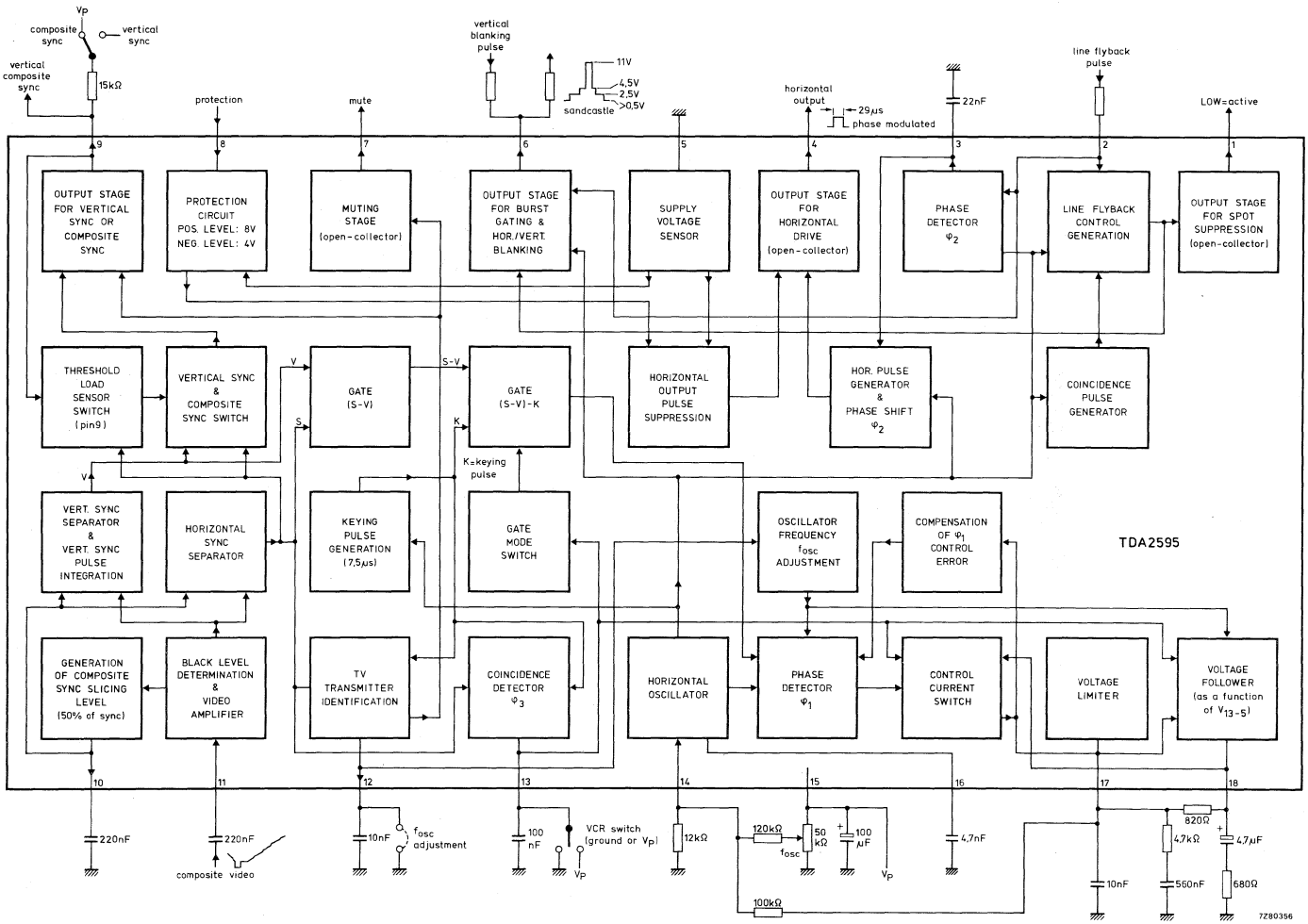


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 15)	$V_{15-5} = V_P$	max.	13,2	V
Voltages at:				
pins 1, 4 and 7	$V_{1;4;7-5}$	max.	18	V
pins 8, 13 and 18	$V_{8;13;18-5}$	max.	V_P	V
pin 11 (range)	V_{11-5}		−0,5 to + 6	V
Currents at:				
pin 1	I_1	max.	10	mA
pin 2 (peak value)	$\pm I_{2M}$	max.	10	mA
pin 4	I_4	max.	100	mA
pin 6 (peak value)	$\pm I_{6M}$	max.	6	mA
pin 7	I_7	max.	10	mA
pin 8 (range)	I_8		−5 to + 1	mA
pin 9 (range)	I_9		−10 to + 3	mA
pin 18	$\pm I_{18}$	max.	10	mA
Total power dissipation	P_{tot}	max.	800	mW
Storage temperature range	T_{stg}		−25 to + 125	°C
Operating ambient temperature range	T_{amb}		0 to + 70	°C ←

CHARACTERISTICS

V_P = 12 V; T_{amb} = 25 °C; measured in Fig. 1; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Composite video input and sync separator (pin 11) (internal black level determination)					
Input signal (positive video; standard signal; peak-to-peak value)	$V_{11\text{-}5(p\text{-}p)}$	0,2	1	3	V
Sync pulse amplitude (independent of video content)	$V_{11\text{-}5(p\text{-}p)}$	50	–	–	mV
Generator resistance	R_G	–	–	200	Ω
Input current during:					
video	I_{11}	–	5	–	μA
sync pulse	$-I_{11}$	–	40	–	μA
black level	$-I_{11}$	–	25	–	μA
Composite sync generation (pin 10) horizontal slicing level at 50% of the sync pulse amplitude					
Capacitor current during:					
video	I_{10}	–	12	–	μA
sync pulse	$-I_{10}$	–	170	–	μA
Vertical sync pulse generation slicing level at 25% (50% between black level and horizontal slicing level); pin 9					
Output voltage	$V_{9\text{-}5}$	10	–	–	V
Pulse duration	t_p	–	190	–	μs
Delay with respect to the vertical sync pulse (leading edge)	t_d	–	45	–	μs
Pulse-mode control					
output current for vertical sync pulse (dual integrated)		no current applied at pin 9			
output current for horizontal and vertical sync pulse (non-integrated separated signal)		current applied via a resistor of 15 kΩ from V_P to pin 9			

parameter	symbol	min.	typ.	max.	unit
Horizontal oscillator (pins 14 and 16)					
Frequency; free running	f_{osc}	—	15 625	—	Hz
Reference voltage for f_{osc}	V_{14-5}	—	6	—	V
Frequency control sensitivity	$\Delta f_{osc}/\Delta I_{14}$	—	31	—	Hz/μA
Adjustment range of circuit Fig. 1	Δf_{osc}	—	± 10	—	%
Spread of frequency	Δf_{osc}	—	—	5	%
Frequency dependency (excluding tolerance of external components)					
with supply voltage (V_P = 12 V)	$\frac{\Delta f_{osc}/f_{osc}}{\Delta V_{15-5}/V_{15-5}}$	—	± 0,05	—	
with supply voltage drop of 5 V	Δf_{osc}	—	—	10	%
with temperature	TC	—	—	$\pm 10^{-4}$	K^{-1}
Capacitor current during:					
discharging	$+I_{16}$	—	1024	—	μA
charging	$-I_{16}$	—	313	—	μA
Sawtooth voltage timing (pin 14)					
rise time	t_r	—	49	—	μs
fall time	t_f	—	15	—	μs
Horizontal output pulse (pin 4)					
Output voltage LOW at I_4 = 30 mA	V_{4-5}	—	—	0,5	V
Pulse duration (HIGH)	t_p	—	29 ± 1,5	—	μs
Supply voltage for switching off the output pulse (pin 15)	V_P	—	4	—	V

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Phase comparison φ_1 (pin 17)					
Control voltage range	$V_{17\text{-}5}$	3,55	–	8,3	V
Leakage current at $V_{17\text{-}5}$ = 3,55 to 8,3 V	I_{17}	–	–	1	μA
Control current for external time-constant switch	$\pm I_{17}$	1,8	2	2,2	mA
Control current at $V_{18\text{-}5} = V_{15\text{-}5}$ and $V_{13\text{-}5} < 2$ V or $V_{13\text{-}5} > 9,5$ V	$\pm I_{17}$	–	8	–	mA
Control current at $V_{18\text{-}5} = V_{15\text{-}5}$ and $V_{13\text{-}5}$ = 2 to 9,5 V	$\pm I_{17}$	1,8	2	2,2	mA
Horizontal oscillator control					
control sensitivity	S_φ	6	–	–	kHz/μs
catching and holding range	$\pm\Delta f_{osc}$	–	680	–	Hz
spread of catching and holding range	$\pm\Delta f_{osc}$	–	10	–	%
Internal keying pulse at $V_{13\text{-}5}$ = 2,9 to 9,5 V	t_p	–	7,5	–	μs
Time-constant switch					
slow time-constant at	$V_{13\text{-}5}$	9,5	–	2	V
fast time-constant at	$V_{13\text{-}5}$	2	–	9,5	V
Impedance converter offset voltage (slow time-constant)	$\pm V_{17\text{-}18}$	–	–	3	mV
Output resistance					
slow time-constant	$R_{18\text{-}5}$	–	–	10	Ω
fast time-constant	$R_{18\text{-}5}$	high impedance			
Leakage current	I_{18}	–	–	1	μA

parameter	symbol	min.	typ.	max.	unit
Coincidence detector φ_3 (pin 13)					
Output voltage					
without coincidence with composite video signal	V_{13-5}	–	–	1	V
without coincidence without composite video signal (noise)	V_{13-5}	–	–	2	V
with coincidence with composite video signal	V_{13-5}	–	6	–	V
Output current					
without coincidence with composite video signal	I_{13}	–	50	–	μA
with coincidence with composite video signal	$-I_{13}$	–	300	–	μA
Switching current					
at $V_{13-5} = V_P - 0{,}5$ V	I_{13}	–	–	100	μA
at $V_{13-5} = 0{,}5$ V (average value)	$I_{13(av)}$	–	–	100	μA
Phase comparison φ_2 (pins 2 and 3) (see note 1)					
Input for line flyback pulse (pin 2)					
Switching level for φ_2 comparison and flyback control	V_{2-5}	–	3	–	V
Switching level for horizontal blanking	V_{2-5}	–	0,3	–	V
Input voltage limiting	V_{2-5}	–	–0,7	–	V
	or:	–	+4,5	–	V
Switching current					
at horizontal flyback	I_2	0,01	1	–	mA
at horizontal scan	I_2	–	–	2	μA
Phase detector output (pin 3)					
Control current for φ_2	$\pm I_3$	–	1	–	mA
Control range	$\Delta t_{\varphi 2}$	–	19	–	μs
Static control error	$\Delta t/\Delta t_d$	–	–	0,2	%
Leakage current	I_3	–	–	5	μA

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Phase comparison φ_2 (pins 2 and 3) (continued)					
Phase relation between middle of the horizontal sync pulse and the middle of the line flyback pulse at t_{fp} = 12 μs (note 2)	Δt	–	2,6 ± 0,7	–	μs
If additional adjustment is required, it can be arranged by applying a current at pin 3	$\Delta I/\Delta t$	–	30	–	μA/μs
Burst gating pulse (pin 6; note 3)					
Output voltage	V_{6-5}	10	11	–	V
Pulse duration	t_p	3,7	4	4,3	μs
Phase relation between middle of sync pulse at the input and the leading edge of the burst gating pulse at V_{6-5} = 7 V	$t_{\varphi 6}$	2,15	2,65	3,15	μs
Output trailing edge current	I_6	–	2	–	mA
Horizontal blanking pulse (pin 6) (note 3)					
Output voltage	V_{6-5}	4,1	4,5	4,9	V
Output trailing edge current	I_6	–	2	–	mA
Saturation voltage at horizontal scan	V_{6-5sat}	–	–	0,5	V
Clamping circuit for vertical blanking pulse (pin 6; note 3)					
Output voltage at I_6 = 2,8 mA	V_{6-5}	2,15	2,5	3	V
Minimum output current at $V_{6-5} > 2,15$ V	I_{6min}	–	2,3	–	mA
Maximum output current at $V_{6-5} < 3$ V	I_{6max}	–	3,3	–	mA
TV-transmitter identification (pin 12)					
Output voltage					
no TV transmitter	V_{12-5}	–	–	1	V
TV transmitter identified	V_{12-5}	7	–	–	V

parameter	symbol	min.	typ.	max.	unit
Mute output (pin 7)					
Output voltage at I_7 = 3 mA no TV transmitter	V_{7-5}	–	–	0,5	V
Output resistance at I_7 = 3 mA no TV transmitter	R_{7-5}	–	–	100	Ω
Output leakage current at $V_{12-5} > 3$ V TV transmitter identified	I_7	–	–	5	μA
Protection circuit (beam-current/ EHT voltage protection) (pin 8)					
No-load voltage for $I_8 = 0$ (operative condition)	V_{8-5}	–	6	–	V
Threshold at positive-going voltage	V_{8-5}	–	8 ± 0,8	–	V
Threshold at negative-going voltage	V_{8-5}	–	4 ± 0,4	–	V
Current limiting for V_{8-5} = 1 to 8,5 V	$\pm I_8$	–	60	–	μA
Input resistance for $V_{8-5} > 8,5$ V	R_{8-5}	–	3	–	kΩ
Response delay of threshold switch	t_d	–	10	–	μs
Control output of line flyback pulse control (pin 1)					
Saturation voltage at standard operation; I_1 = 3 mA	V_{1-5sat}	–	–	0,5	V
Output leakage current in case of disturbance of line flyback pulse	I_1	–	–	5	μA

Notes to the characteristics

1. Phase comparison between horizontal oscillator and the line flyback pulse. Generation of a phase modulated (φ_2) horizontal output pulse with constant duration.
2. t_{fp} is the line flyback pulse duration.
3. Three-level sandcastle pulse.

5 W AUDIO POWER AMPLIFIER

The TDA2611A is a monolithic integrated circuit in a 9-lead single in-line (SIL) plastic package with a high supply voltage audio amplifier. Special features are:

- **possibility for increasing the input impedance**
- single in-line (SIL) construction for easy mounting
- very suitable for application in mains-fed apparatus
- extremely low number of external components
- thermal protection
- well defined open loop gain circuitry with simple quiescent current setting and fixed integrated closed loop gain

QUICK REFERENCE DATA

Supply voltage range	V_P		6 to 35	V
Repetitive peak output current	I_{ORM}	$<$	1,5	A
Output power at d_{tot} = 10%				
V_P = 18 V; R_L = 8 Ω	P_o	typ.	4,5	W
V_P = 25 V; R_L = 15 Ω	P_o	typ.	5	W
Total harmonic distortion at $P_o < 2$ W; R_L = 8 Ω	d_{tot}	typ.	0,3	%
Input impedance	$\lvert Z_i \rvert$	typ.	45	kΩ
Total quiescent current at V_P = 18 V	I_{tot}	typ.	25	mA
Sensitivity for P_o = 2,5 W; R_L = 8 Ω	V_i	typ.	55	mV
Operating ambient temperature	T_{amb}		−25 to + 150	°C
Storage temperature	T_{stg}		−55 to + 150	°C

PACKAGE OUTLINE

9-lead SIL; plastic (SOT-110B).

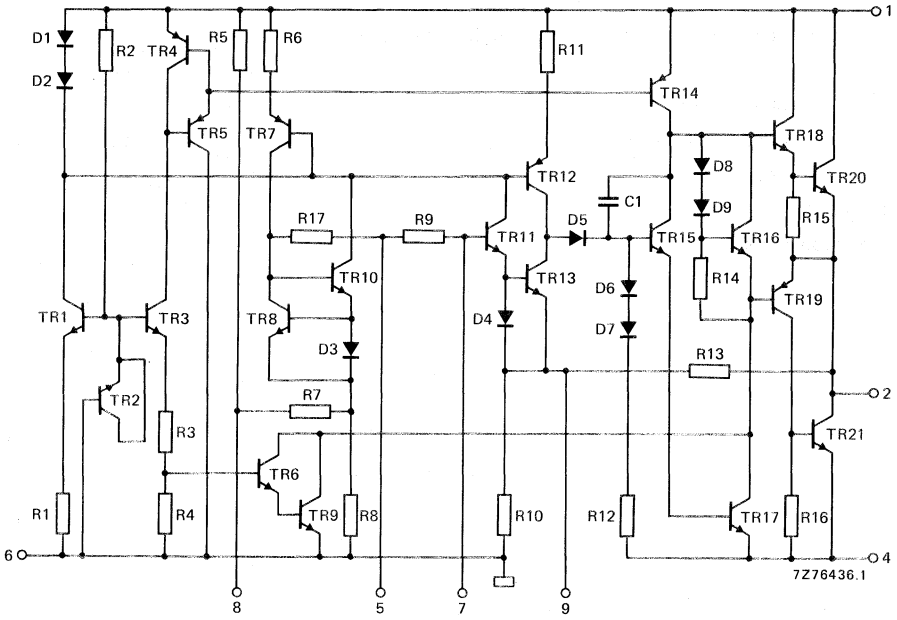


Fig. 1 Circuit diagram; pin 3 not connected.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage	V_P	max.	35 V
Non-repetitive peak output current	I_{OSM}	max.	3 A
Repetitive peak output current	I_{ORM}	max.	1,5 A
Total power dissipation	see derating curves Fig. 2		
Storage temperature	T_{stg}	−55 to + 150	°C
Operating ambient temperature	T_{amb}	−25 to + 150	°C

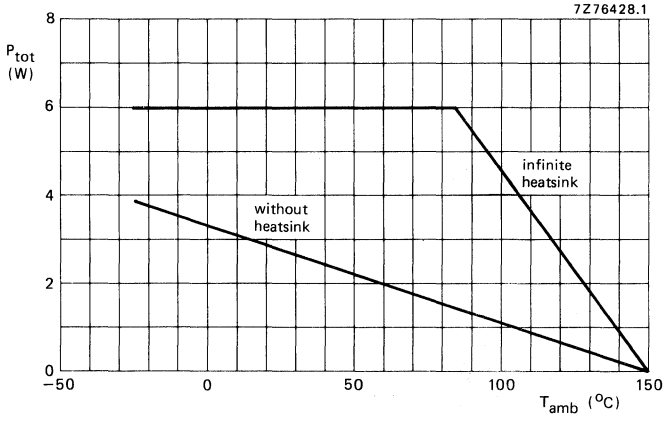


Fig. 2 Power derating curves.

HEATSINK EXAMPLE

Assume V_P = 18 V; R_L = 8 Ω; T_{amb} = 60 °C maximum; T_j = 150 °C (max. for a 4 W application into an 8 Ω load, the maximum dissipation is about 2,2 W).
The thermal resistance from junction to ambient can be expressed as:

$$R_{th\ j\text{-}a} = R_{th\ j\text{-}tab} + R_{th\ tab\text{-}h} + R_{th\ h\text{-}a} = \frac{150 - 60}{2,2} = 41\ K/W.$$

Since $R_{th\ j\text{-}tab}$ = 11 K/W and $R_{th\ tab\text{-}h}$ = 1 K/W, $R_{th\ h\text{-}a}$ = 41 − (11 + 1) = 29 K/W.

D.C. CHARACTERISTICS

Supply voltage range	V_P		6 to 35 V
Repetitive peak output current	I_{ORM}	<	1,5 A
Total quiescent current at V_P = 18 V	I_{tot}	typ.	25 mA

A.C. CHARACTERISTICS

T_{amb} = 25 °C; V_P = 18 V; R_L = 8 Ω; f = 1 kHz unless otherwise specified; see also Fig. 3

A.F. output power at d_{tot} = 10%			
V_P = 18 V; R_L = 8 Ω	P_o	>	4 W
		typ.	4,5 W
V_P = 12 V; R_L = 8 Ω	P_o	typ.	1,7 W
V_P = 8,3 V; R_L = 8 Ω	P_o	typ.	0,65 W
V_P = 20 V; R_L = 8 Ω	P_o	typ.	6 W
V_P = 25 V; R_L = 15 Ω	P_o	typ.	5 W
Total harmonic distortion at P_o = 2 W	d_{tot}	typ.	0,3 %
		<	1 %
Frequency response		>	15 kHz
Input impedance	$\lvert Z_i \rvert$	typ.	45 kΩ *
Noise output voltage at R_S = 5 kΩ; B = 60 Hz to 15 kHz	V_n	typ.	0,2 mV
		<	0,5 mV
Sensitivity for P_o = 2,5 W	V_i	typ.	55 mV
			44 to 66 mV

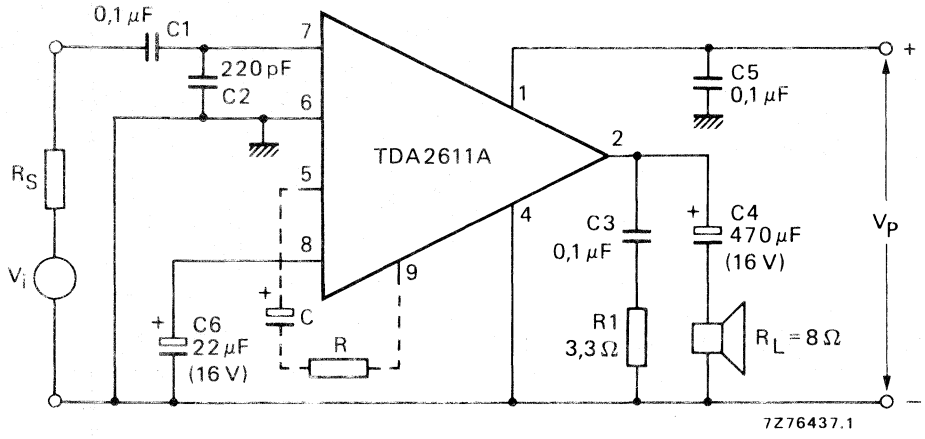


Fig. 3 Test circuit; pin 3 not connected.

* Input impedance can be increased by applying C and R between pins 5 and 9 (see also Figures 6 and 7).

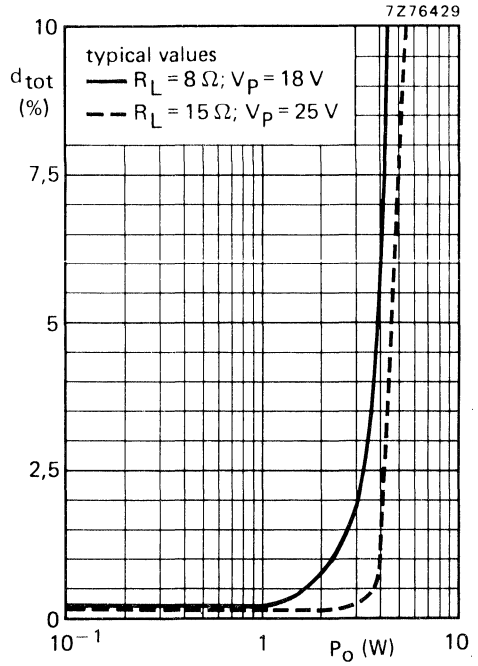


Fig. 4 Total harmonic distortion as a function of output power.

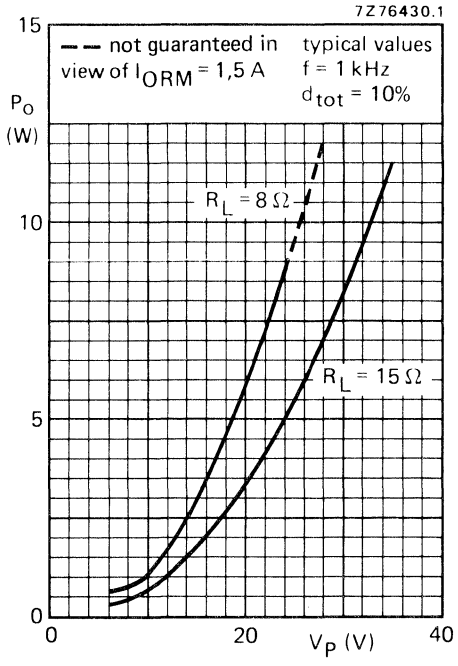


Fig. 5 Output power as a function of supply voltage.

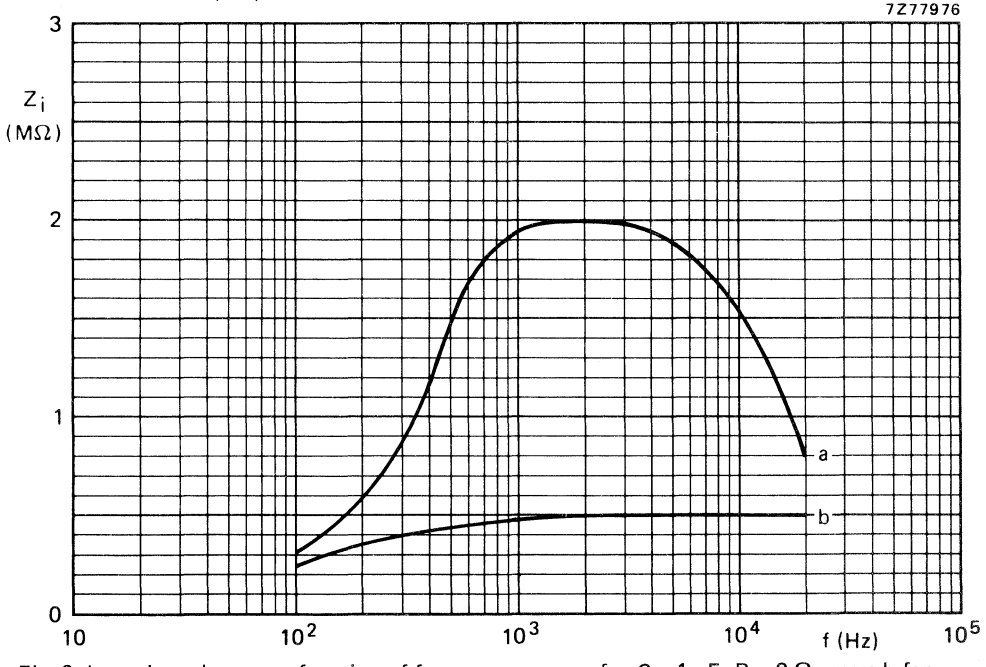


Fig. 6 Input impedance as a function of frequency; curve a for C = 1 μF, R = 0 Ω; curve b for C = 1 μF, R = 1 kΩ; circuit of Fig. 3; C2 = 10 pF; typical values.

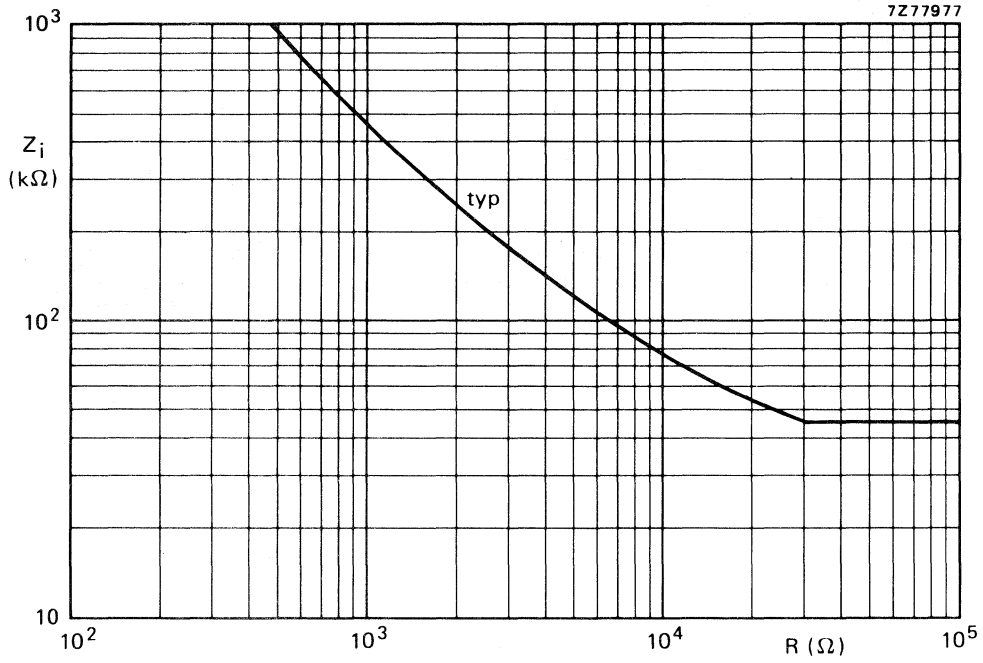


Fig. 7 Input impedance as a function of R in circuit of Fig. 3; C = 1 μF; f = 1 kHz.

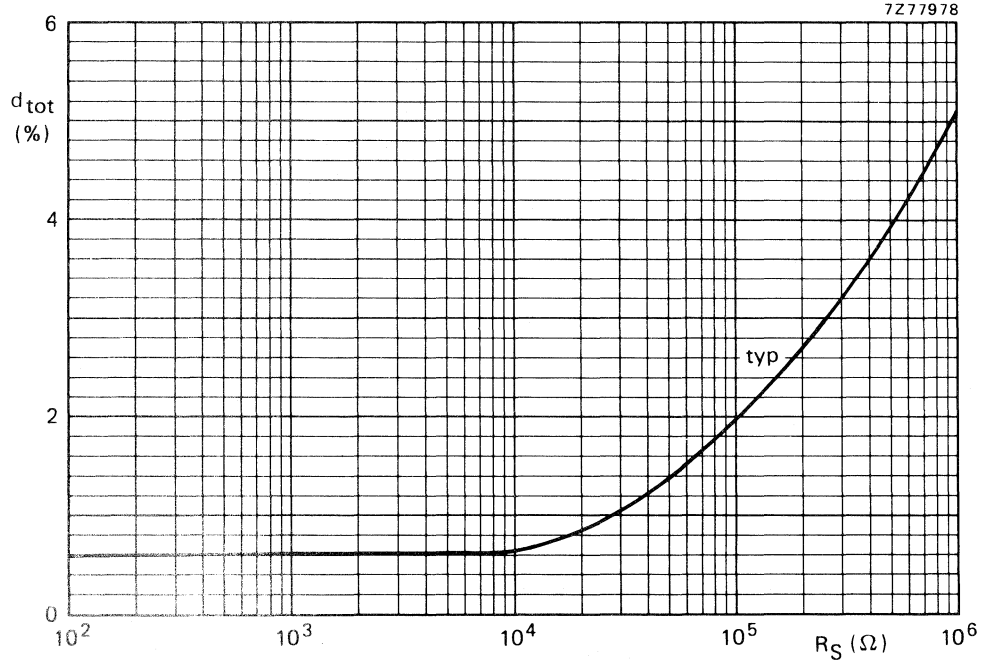


Fig. 8 Total harmonic distortion as a function of R_S in the circuit of Fig. 3; P_o = 3,5 W; f = 1 kHz.

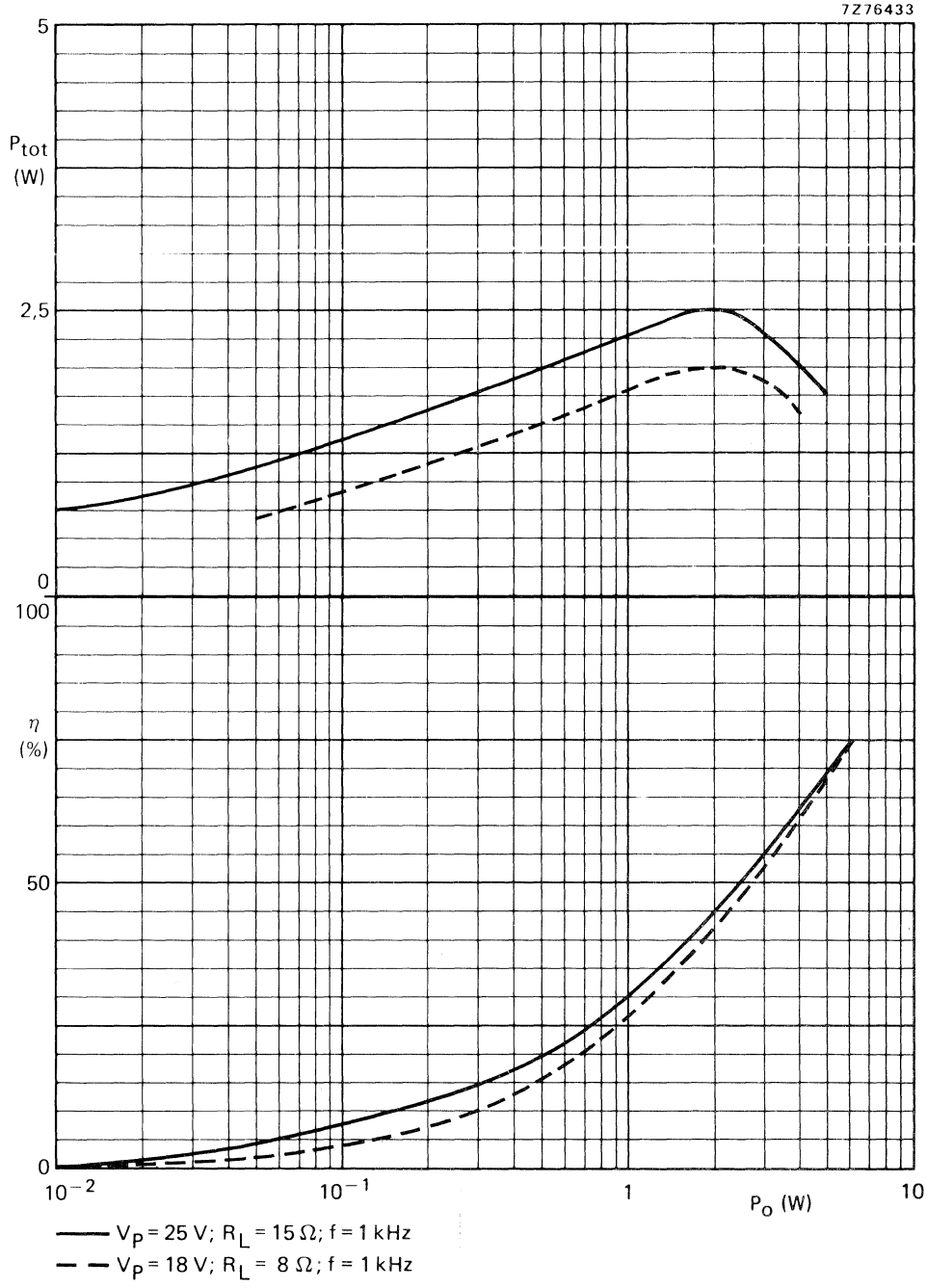


Fig. 9 Total power dissipation and efficiency as a function of output power.

APPLICATION INFORMATION

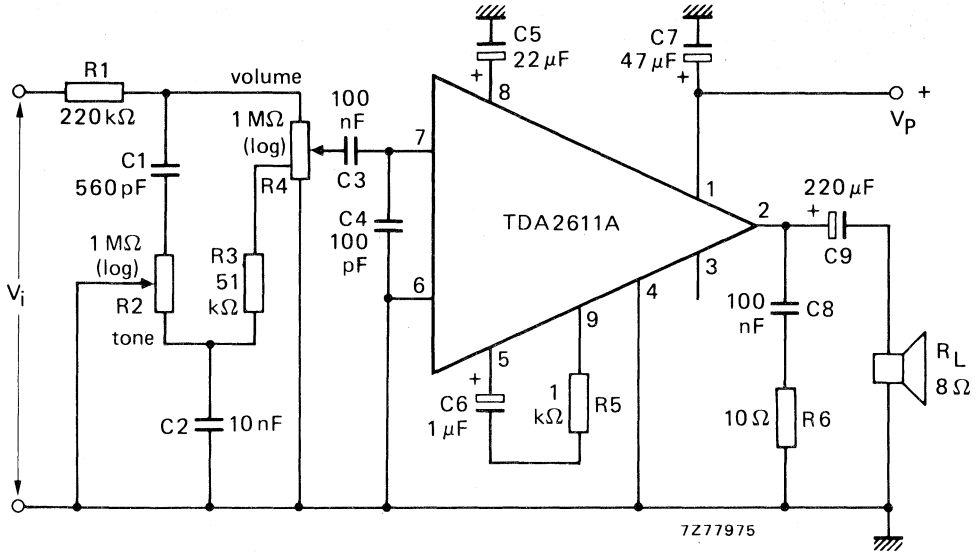


Fig. 10 Ceramic pickup amplifier circuit.

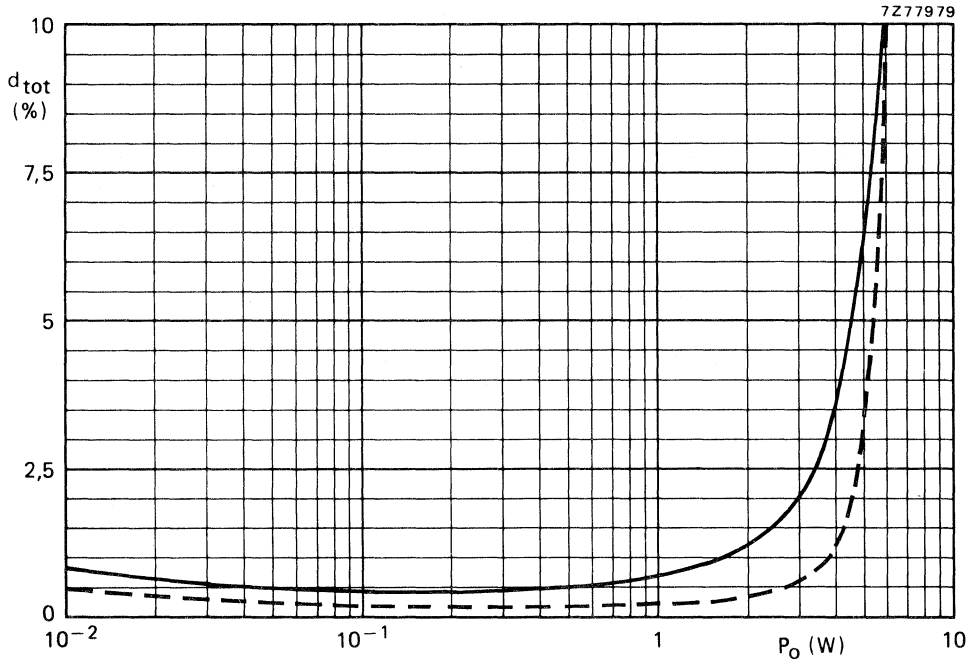


Fig. 11 Total harmonic distortion as a function of output power; —— with tone control; – – – without tone control; in circuit of Fig. 10; typical values.

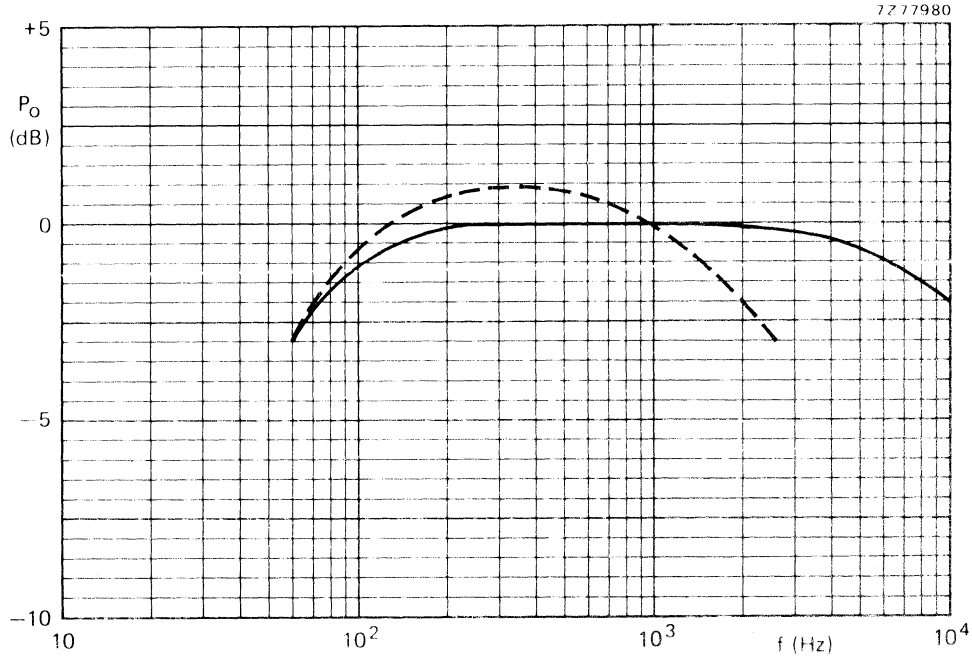


Fig. 12 Frequency characteristics of the circuit of Fig. 10; —— tone control max. high; – – – tone control min. high; P_O relative to 0 dB = 3 W; typical values.

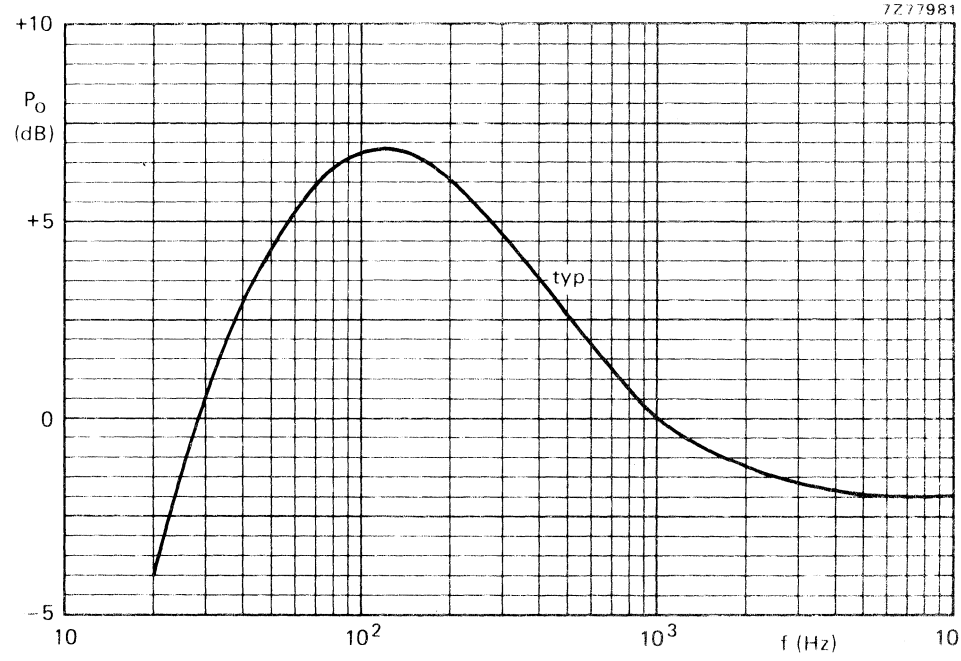


Fig. 13 Frequency characteristic of the circuit of Fig. 10; volume control at the top; tone control max. high.

VERTICAL DEFLECTION CIRCUIT

The TDA2653A is a monolithic integrated circuit for vertical deflection in large screen colour television receivers, e.g. 30AX and PIL-S4 systems.

The circuit incorporates the following functions:

- Oscillator; switch capability for 50 Hz/60 Hz operation.
- Synchronization circuit.
- Blanking pulse generator with guard circuit.
- Sawtooth generator with buffer stage.
- Preamplifier with fed-out inputs.
- Output stage with thermal and short-circuit protection.
- Flyback generator.
- Voltage stabilizer.

QUICK REFERENCE DATA

For 30AX system				
Supply voltage (pin 9)	$V_{9\text{-}8} = V_S$	typ.	26	V
Supply current (pin 5 + pin 9)	$I_5 + I_9 = I_S$	typ.	325	mA
Output current (peak-to-peak value)	$I_{6(p\text{-}p)}$	typ.	2,2	A
Picture frequency	f		50 Hz/60	Hz
Sync input pulse (peak-to-peak value)	$V_{2\text{-}8(p\text{-}p)}$	$\geqslant$	1	V
Thermal resistance from junction to mounting base	$R_{th\ j\text{-}mb}$	$\leqslant$	5	K/W

PACKAGE OUTLINE

13-lead DIL; plastic power (SOT-141BA).

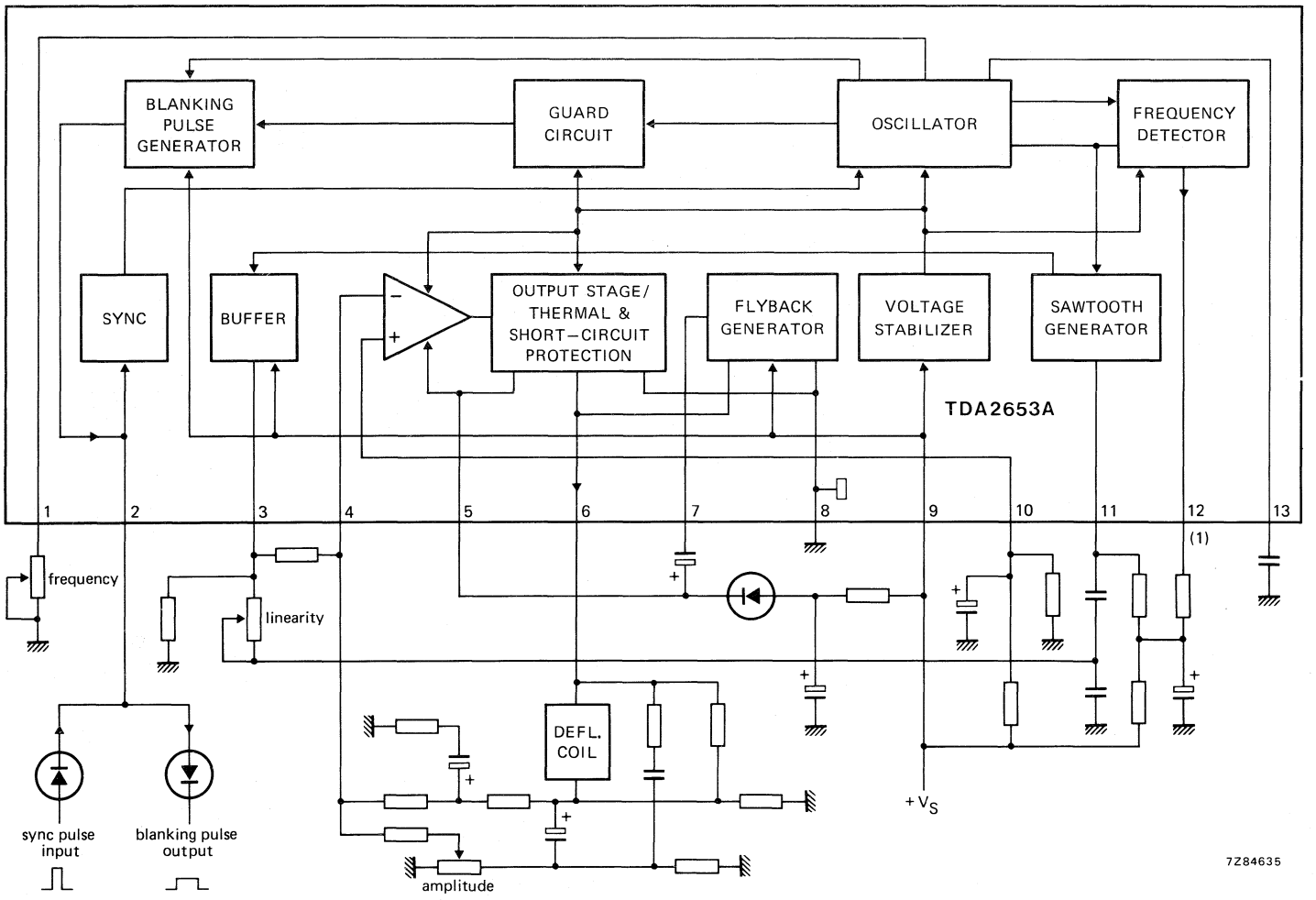


Fig. 1 Block diagram.

(1) Condition for pin 12: LOW voltage level = 50 Hz; HIGH voltage level = 60 Hz.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 9)	$V_{9-8} = V_S$	max.	40 V
Supply voltage output stage (pin 5)	V_{5-8}	max.	58 V
Voltages			
Pin 3	V_{3-11}	max.	7 V
Pin 13	V_{13-8}	max.	7 V
Pins 4 and 10	$V_{4;10-8}$	max.	24 V
Pin 6	V_{6-8}	max.	58 V
	$-V_{6-8}$	max.	0 V
Pins 7 and 11	$V_{7;11-8}$	max.	40 V
Currents			
Pin 1	I_1	max.	0 mA
	$-I_1$	max.	1 mA
Pin 2	$\pm I_2$	max.	10 mA
Pin 3	I_3	max.	0 mA
	$-I_3$	max.	5 mA
Pin 7	I_7	max.	1,2 A
	$-I_7$	max.	1,5 A
Pin 11	I_{11}	max.	50 mA
	$-I_{11}$	max.	1 mA
Pin 12	I_{12}	max.	3 mA
	$-I_{12}$	max.	0 mA

Pins 5, 6 and 8: internally limited by the short-circuit protection circuit.

Total power dissipation: internally limited by the thermal protection circuit.

Storage temperature range	T_{stg}	−25 to + 150 °C
Operating ambient temperature range	T_{amb}	0 °C to limiting value ←

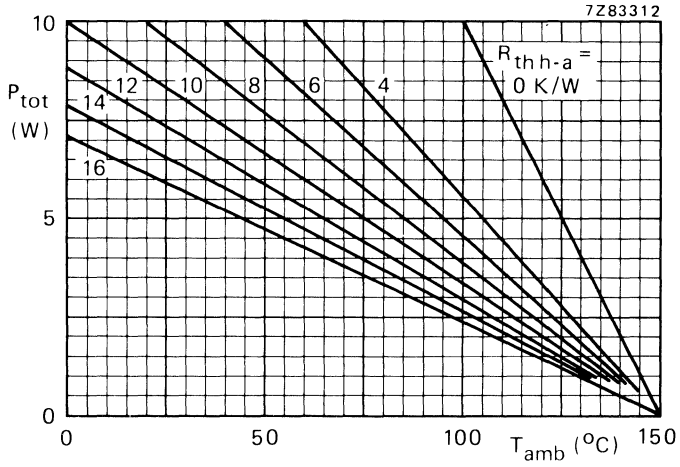


Fig. 2 Total power dissipation. $R_{th\ h-a}$ includes $R_{th\ mb-h}$ which is expected when heat-sink compound is used. $R_{th\ j-mb} \leqslant 5$ K/W.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

Supply voltage/output stage			
Supply voltage	$V_{9-8} = V_S$		9 to 30 V
Output voltage			
at $-I_6$ = 1,1 A	V_{6-8}	⩾	$V_{5-8} - 2,2$ V
		typ.	$V_{5-8} - 1,9$ V
at I_6 = 1,1 A	V_{6-8}	typ.	1,3 V
		⩽	1,6 V
Flyback generator output voltage at $-I_6$ = 1,1 A	V_{7-8}	typ.	$V_S - 2,2$ V
Peak output current	$\pm I_6$	⩽	1,2 A
Flyback generator peak current	$\pm I_7$	⩽	1,2 A
Feedback			
Input quiescent current	$-I_{4;10}$	typ.	0,1 μA
Synchronization			
Sync input pulse	V_{2-8}		1 to 12 V
Tracking range		typ.	28 %
Oscillator/sawtooth generator			
Oscillator frequency control input voltage	V_{1-8}		6 to 9 V
Sawtooth generator output voltage	V_{3-8}		0 to $V_S - 1$ V
	V_{11-8}		0 to $V_S - 2$ V
Sawtooth generator output current	$-I_3$		0 to 4 mA
	I_{11}	⩾	−2 μA
		⩽	+30 mA
Oscillator temperature dependency			
T_{case} = 20 to 100 °C	$(\Delta f/f)/\Delta T_{case}$	typ.	10^{-4} K^{-1}
Oscillator voltage dependency			
V_S = 10 to 30 V	$(\Delta f/f)/\Delta V_S$	typ.	4×10^{-4} V^{-1}
Blanking pulse generator			
Output voltage			
at V_S = 24 V; I_2 = 1 mA	V_{2-8}	typ.	18,5 V
Output current	$-I_2$	⩽	3 mA
Output resistance	R_{2-8}	typ.	410 Ω
Blanking pulse duration at 50 Hz sync	t_b	typ.	1,4 ± 0,07 ms
50 Hz/60 Hz switch capability			
Saturation voltage; LOW voltage level	V_{12-8}	typ.	1 V
Output leakage current	I_{12}	typ.	1 μA

Thermal resistance/junction temperature

From junction to mounting base	$R_{th\ j\text{-}mb}$	$\leqslant$	5 K/W
Junction temperature; switching point thermal protection	T_j	typ.	150 ± 8 °C

PINNING

1. Oscillator adjustment
2. Synchronization input/blanking output
3. Sawtooth generator output
4. Preampiifier input
5. Positive supply of output stage
6. Output
7. Flyback generator output
8. Ground
9. Positive supply (V_S)
10. Reference voltage
11. Sawtooth capacitor
12. 50 Hz/ 60 Hz switching voltage
13. Oscillator capacitor

APPLICATION INFORMATION

The function is described against the corresponding pin number

1, 13. Oscillator

The oscillator frequency is determined by a potentiometer at pin 1 and a capacitor at pin 13.

2. Sync input/blanking output

Combination of sync input and blanking output. The oscillator has to be synchronized by a positive-going pulse between 1 and 12 V. The integrated frequency detector delivers a switching level at pin 12.
The blanking pulse amplitude is 20 V with a load of 1 mA.

3. Sawtooth generator output

The sawtooth signal is fed via a buffer stage to pin 3. It delivers the signal which is used for linearity control, and drive of the preamplifier. The sawtooth is applied via a shaping network to pin 11 (linearity) and via a resistor to pin 4 (preamplifier).

4. Preamplifier input

The d.c. voltage is proportional to the output voltage (d.c. feedback). The a.c. voltage is proportional to the sum of the buffered sawtooth voltage at pin 3 and the voltage, with opposite polarity, at the feedback resistor (a.c. feedback).

5. Positive supply of output stage

This supply is obtained from the flyback generator. An electrolytic capacitor between pins 7 and 5, and a diode between pins 5 and 9 have to be connected for proper operation of the flyback generator.

6. Output of class-B power stage

The vertical deflection coil is connected to this pin, via a series connection of a coupling capacitor and a feedback resistor, to ground.

7. Flyback generator output

An electrolytic capacitor has to be connected between pins 7 and 5 to complete the flyback generator.

8. Negative supply (ground)

Negative supply of output stage and small signal part.

9. Positive supply

The supply voltage at this pin is used to supply the flyback generator, voltage stabilizer, blanking pulse generator and buffer stage.

APPLICATION INFORMATION (continued)

10. Reference voltage of preamplifier

    External adjustment and decoupling of reference voltage of the preamplifier.

11. Sawtooth capacitor

    This sawtooth capacitor has been split to realize linearity control.

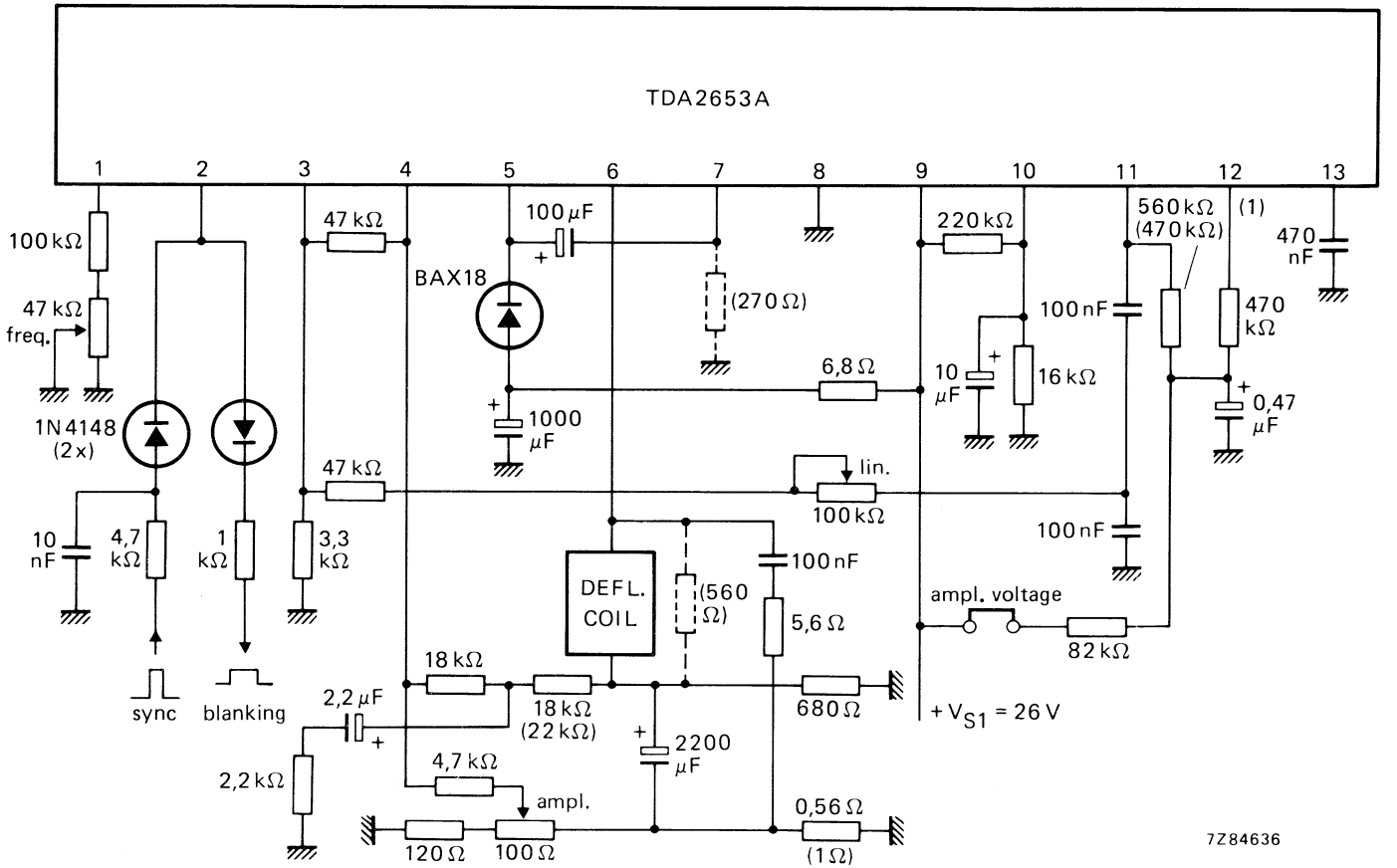
12. 50 Hz/60 Hz switching level

    This pin delivers a LOW voltage level for 50 Hz and a HIGH voltage level for 60 Hz. The amplitudes of the sawtooth signals can be made equal for 50 Hz and 60 Hz with these levels.

The following application data are measured in Figs 3 and 4.

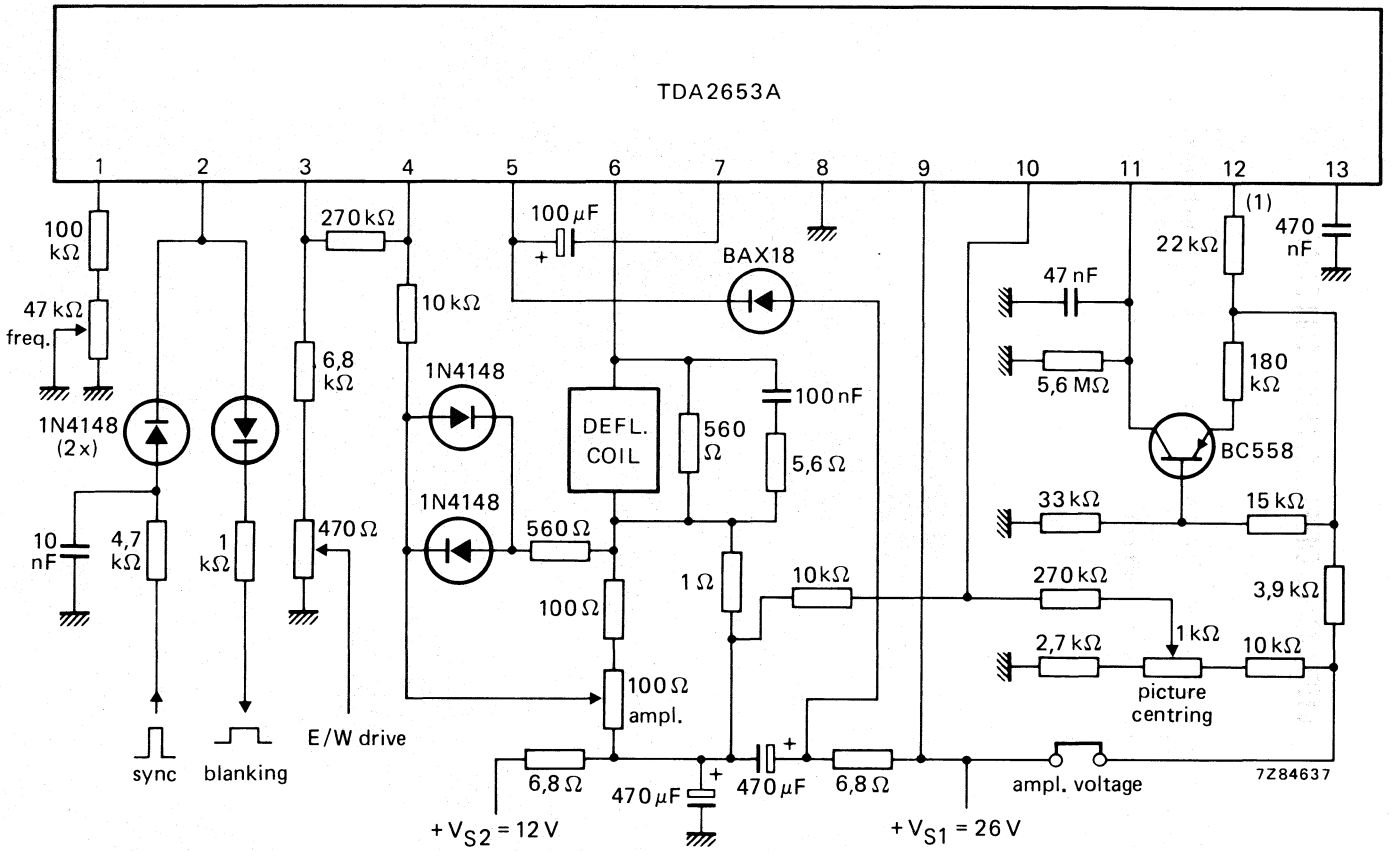
			30AX system (26 V) Fig. 3	30AX system (26 V/12 V) Fig. 4	PIL-S4 system Fig. 3
System supply voltages	V_{S1}	typ.	26	26	26 V
	V_{S2}	typ.	–	12	– V
System supply currents	I_{S1}	typ.	315	330	195 mA
	I_{S2}	typ.	–	−35	– mA
Output voltage	$V_{6\text{-}8}$	typ.	14	14,6	13,5 V
Output voltage (peak value)	$V_{6\text{-}8}$	typ.	42	42	49 V
Deflection current (peak-to-peak value)	$I_{6(p\text{-}p)}$	typ.	2,2	2,2	1,32 A
Flyback time	t_{fl}	typ.	1	0,9	1,1 ms
Total power dissipation per package	P_{tot}	typ.	4,1	4	3 W
		max.	4,8	4,8	3,4 W*
Oscillator frequency unsynchronized	f	typ.	46,5	46,5	46,5 Hz

* Calculated with $\Delta V_S = +5\%$ and $\Delta R_{yoke} = -7\%$.



(1) Condition for pin 12: LOW voltage level = 50 Hz; HIGH voltage level = 60 Hz.

Fig. 3 Typical vertical deflection circuit for 30AX system (26 V). The values given in parentheses and the dotted components are valid for the PIL-S4 system.



(1) Condition for pin 12: LOW voltage level = 50 Hz; HIGH voltage level = 60 Hz.

Fig. 4 Typical vertical deflection circuit for 30AX system (V_{S1} = 26 V, V_{S2} = 12 V) in quasi-bridge connection.

VERTICAL DEFLECTION CIRCUIT

The TDA2654 is a monolithic integrated circuit for vertical deflection in monochrome and tiny-vision colour television receivers.

The circuit incorporates the following functions:

- Oscillator
- Synchronization circuit
- Blanking pulse generator
- Sawtooth generator
- S-correction and linearity circuit
- Comparator and drive circuit
- Output stage
- Supply for pre-stages via internal voltage divider
- Thermal protection circuit
- Controlled switch-on

QUICK REFERENCE DATA

Supply voltage range (ref. to tab = ground)	V_P		10 to 36	V
Output current (peak-to-peak value)	$I_{9(p-p)}$	max.	2	A
Total power dissipation	P_{tot}	max.	5	W
Operating junction temperature	T_j	max.	150	°C
Thermal resistance from junction to tab	$R_{th\ j\text{-}tab}$	=	10	°C/W

PACKAGE OUTLINE

9-lead SIL; plastic (SOT-110B).

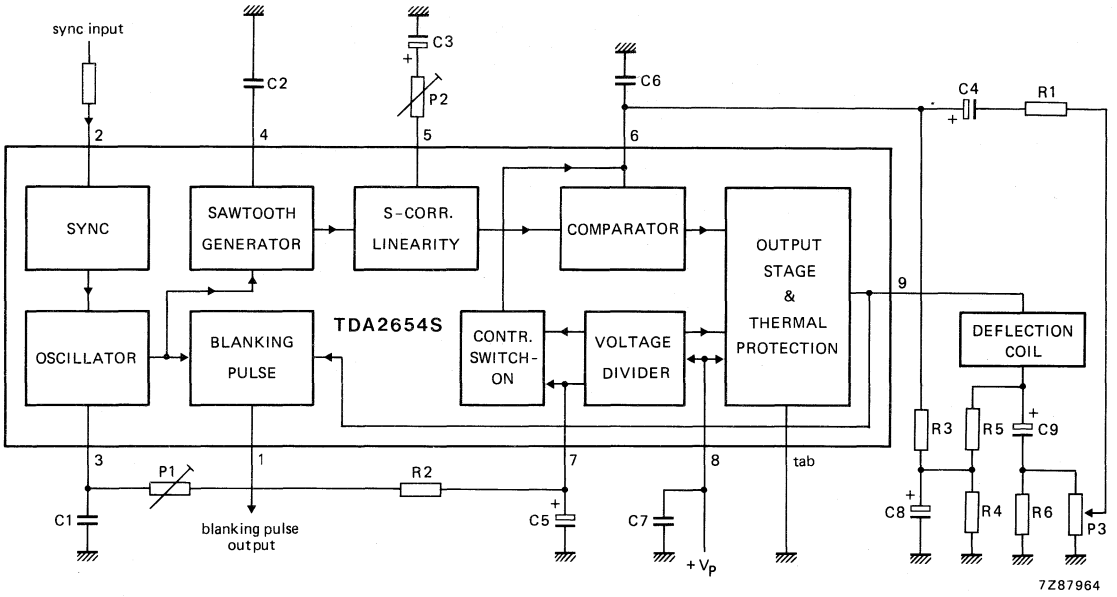


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

All voltages and currents refer to the tab (ground) connection.

Voltages			
Pin 2	V_2	max.	5 V
Pin 3	V_3	max.	17 V
Pin 4	V_4	max.	17 V
Pin 5	V_5	max.	6 V
Pin 6	V_6	max.	13 V
Pin 7	V_7	max.	18 V
Pin 8	V_8 (V_P)	max.	36 V
Currents			
Pin 1	$+I_1$	max.	1 mA
	$-I_1$	max.	5 mA
Pin 2	I_2	max.	2,5 mA
Pin 3	I_3	max.	30 mA
Pin 4	I_4	max.	30 mA
Pin 5	$\pm I_5$	max.	1 mA
Pin 6	$\pm I_6$	max.	3 mA
Pin 9 (repetitive)	$\pm I_9$	max.	1 A
Pin 9 (non-repetitive)	$\pm I_9$	max.	1,25 A
Total power dissipation (see also Fig. 2)	P_{tot}	max.	5 W
Storage temperature	T_{stg}	−25 to + 150	°C
Operating junction temperature	T_j	max.	150 °C

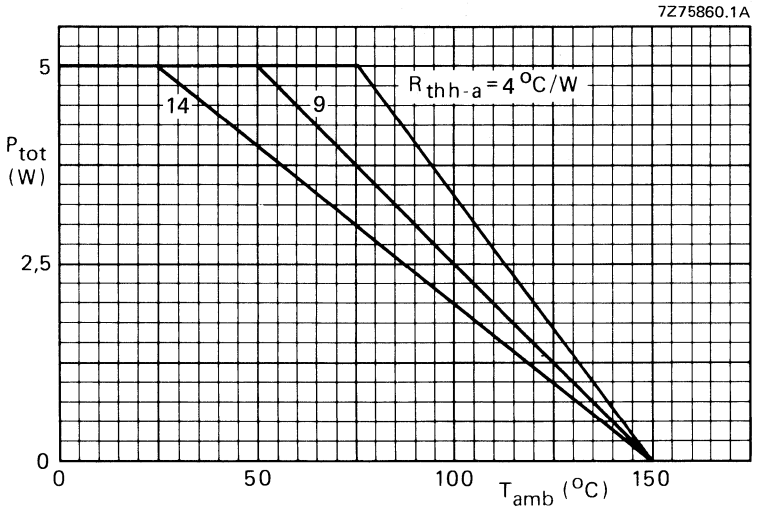


Fig. 2 Total power dissipation. The graph takes into account an $R_{th\ tab-h}$ = 1 °C/W which is to be expected when the tab is connected to a heatsink with one 3 mm bolt, without using heatsink compound. $R_{th\ j-tab}$ = 10 °C/W.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified; voltages and currents ref. to tab (ground)

			monochrome (Fig. 3)	portable mono-chrome (Fig. 4)	
Supply voltage (pin 8)	V_P	typ.	25	12	V
Supply current (pin 8)	I_P	typ.	175	170	mA
Total power dissipation	P_{tot}	typ.	3,3	1,5	W
Output voltage (peak-to-peak value)	$V_{9\ (p\text{-}p)}$	typ.	22	8,5	V
Blanking pulse; I_1 = 1 mA	V_1	typ.	11	6,5	V
Blanking pulse duration	t_p	typ.	1,3	1,5	ms
D.C. input voltage (pin 6)	V_6	typ.	3,7	2,2	V
Deflection current (peak-to-peak value)	$I_{9\ (p\text{-}p)}$	typ.	1,1	1,1	A
Flyback time	t	typ.	1,3	1,5	ms
Free running oscillator frequency	f_{osc}	typ.	46	46	Hz
Oscillator thermal drift		typ.	−0,01	−0,01	Hz/°C
Oscillator voltage shift		typ.	−0,13	−0,13	Hz/V
Tracking range oscillator		typ.	18	18	%
Synchronization input voltage	V_2	>	1	1	V
Voltage divider ratio	V_7/V_8	typ.	0,51	0,51	
Input resistance pin 7	R_7	typ.	2,8	2,8	kΩ
Recommended thermal resistance of heatsink for T_{amb} up to 70 °C	$R_{th\ h\text{-}a}$	<	13	24*	°C/W

* Recommended value, heatsink not strictly required.

PINNING

1. Blanking pulse output
2. Synchronization input
3. Oscillator timing network
4. Sawtooth generator
5. S-correction and linearity control
6. Feedback input
7. Voltage divider
8. Positive supply
9. Output

Tab. Negative supply (ground)

APPLICATION INFORMATION (see also Fig. 1)

The function is described against the corresponding pin number

1. Blanking pulse output

   When the IC is adjusted on a free running frequency of 46 Hz the internal blanking pulse generator delivers a blanking pulse with a duration between 1,2 ms and 1,5 ms. The circuit is, however, made such that when the flyback time of the deflection current is longer, the blanking pulse corresponds to the flyback time. The output voltage is high when the voltage at pin 9 is lower than nominal 0,34 x V_{pin7}.

2. Synchronization input

   The oscillator has to be synchronized by a positive-going pulse. The circuit is made such that synchronization is inhibited during the flyback time.

APPLICATION INFORMATION (continued)

3. Oscillator

The oscillator frequency is set by the potentiometer P1 and resistor R2 between pins 3 and 7 and capacitor C1 between pin 3 and ground. For 50 Hz systems the free running frequency is preferably adjusted to 46 Hz.

4. Sawtooth generator

This pin supplies the charging and discharging currents of the capacitor between pin 4 and ground (C2).

5. S-correction and linearity control

The amount of S-correction can be set by the value of C3. For 110° deflection coils, e.g. AT1040/15, a capacitor of 15 μF will give the right value for S-correction. For 90° deflection systems (e.g. AT1235/00) a nearly linear deflection current is required, this can be achieved by increasing C3 to 100 μF. The linearity can be adjusted by potentiometer P2.

6. Output current feedback

To this pin is applied a part of the output current measured across R6 and superimposed on a d.c. voltage derived from the voltage across the output coupling capacitor. This signal is compared with the internal reference sawtooth. The internal reference sawtooth has an amplitude of about 0,54 V peak to peak and a d.c. level of about 3,7 V, for a supply voltage of 25 V at pin 8.

7. Internal voltage divider decoupling

The voltage on this pin is about half the supply voltage at pin 8 and is applied to the bases of emitter followers supplying the pre-stages of the IC. This voltage controls the amplitude of the internal reference sawtooth. In this way tracking with the line deflection system is achieved when the supply voltage at pin 8 is derived from the line output transformer.

8. Positive supply

The value depends on the deflection coil.

9. Output

The deflection coil is connected to ground via coupling capacitor C9 and current sensing resistor R6. The line frequency superimposed on the output voltage may be too high due to the current feedback system. The line frequency ripple can be decreased by connecting a resistor across the deflection coil. The flyback time can be influenced by the resistor divider (R4, R5) for the d.c. feedback to pin 6.

Tab

The tab is used as negative supply (ground) connection. Therefore, the tab should be well connected to the negative side of the power supply.

Controlled switch-on

This feature is achieved by charging the a.c. coupling capacitor (C4; connected to pin 6) from an internal current source of about 3 mA (voltage limited to maximum 15 V) for a short period after switch-on. The charging time can be influenced by the value of C5 (connected to pin 7). Discharging of C4 results in a slowly increasing deflection current after a delay of about 1 second. The blanking voltage at pin 1 is high during this delay.

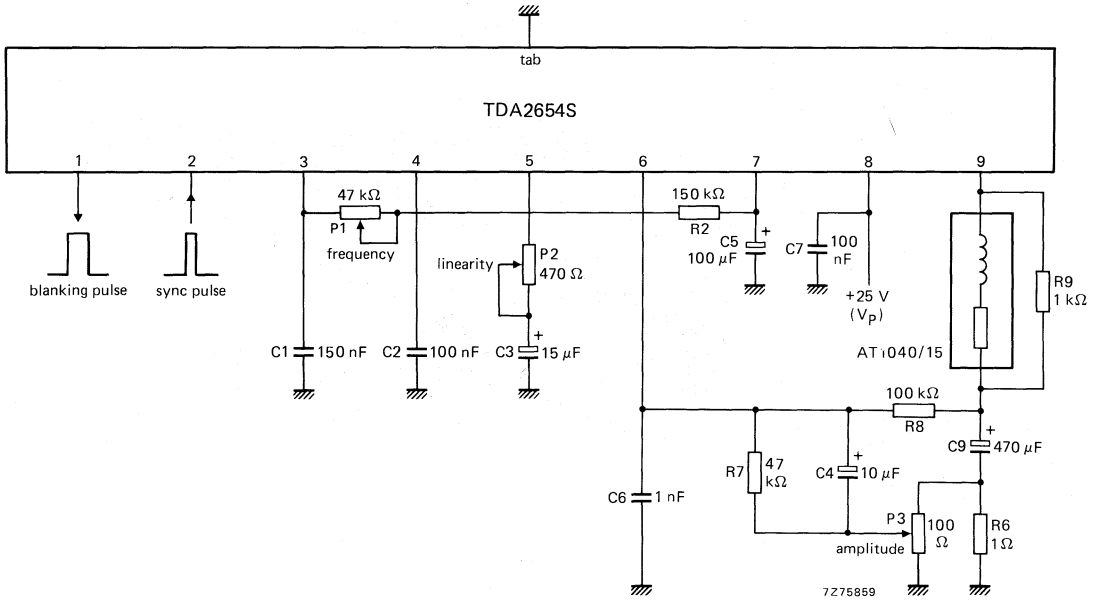


Fig. 3 Monochrome 110° vertical deflection system.

APPLICATION INFORMATION (continued)

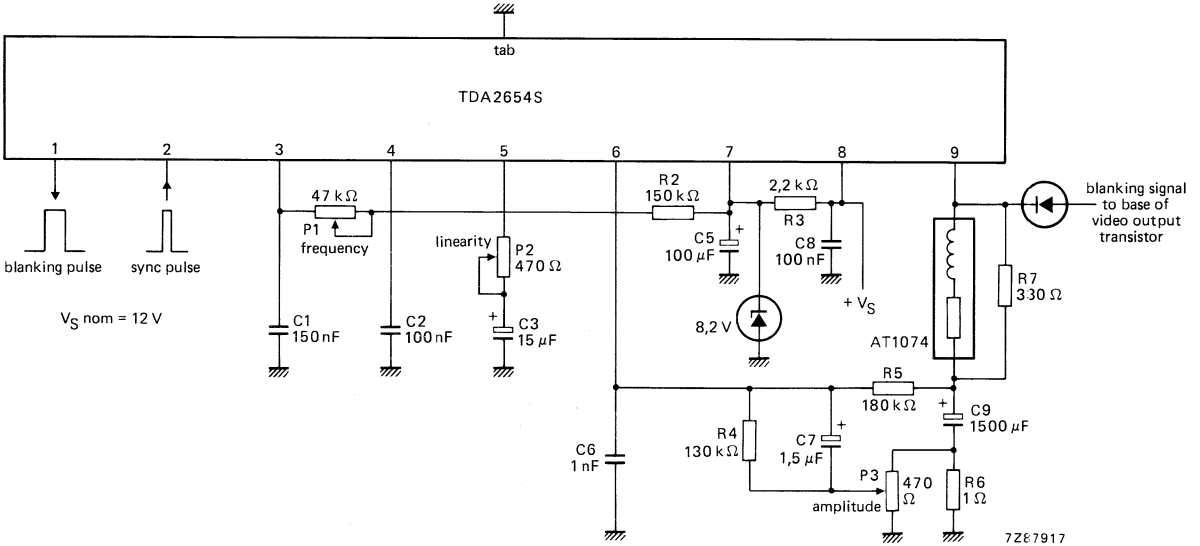


Fig. 4 Monochrome 110° vertical deflection system.

VERTICAL DEFLECTION CIRCUIT

GENERAL DESCRIPTION

The TDA2655B is a monolithic integrated circuit for vertical deflection in colour television receivers with 90° picture tubes.

Features

- Synchronization circuit
- Vertical oscillator; 50/60 Hz switch
- Sawtooth generator with buffer stage
- Preamplifier with fed-out inputs
- Output stage with termal and short-circuit protection
- Flyback generator
- Blanking pulse generator with guard circuit
- Voltage stabilizer
- Frequency detector with memory and storage

QUICK REFERENCE DATA

For 90° deflection; measured with respect to cooling fin (ground)

			concept 1*	concept 2*	
System supply voltages	V_{P1}	typ.	22	22	V
	V_{P2}	typ.	12	–	V
System supply currents	I_{P1}	typ.	135	140	mA
	$-I_{P2}$	typ.	8	–	mA
Deflection current (peak-to-peak value)	$I_{9(p-p)}$	typ.	450	450	mA
Synchronization input voltage (peak-to-peak value)	$V_{5(p-p)}$	min.	1	1	V

*Concept 1: with two supply voltages ; concept 2: with one supply voltage. (See also Figs 2 and 3).

PACKAGE OUTLINE

12-lead DIL; plastic with metal cooling fin (SOT-150).

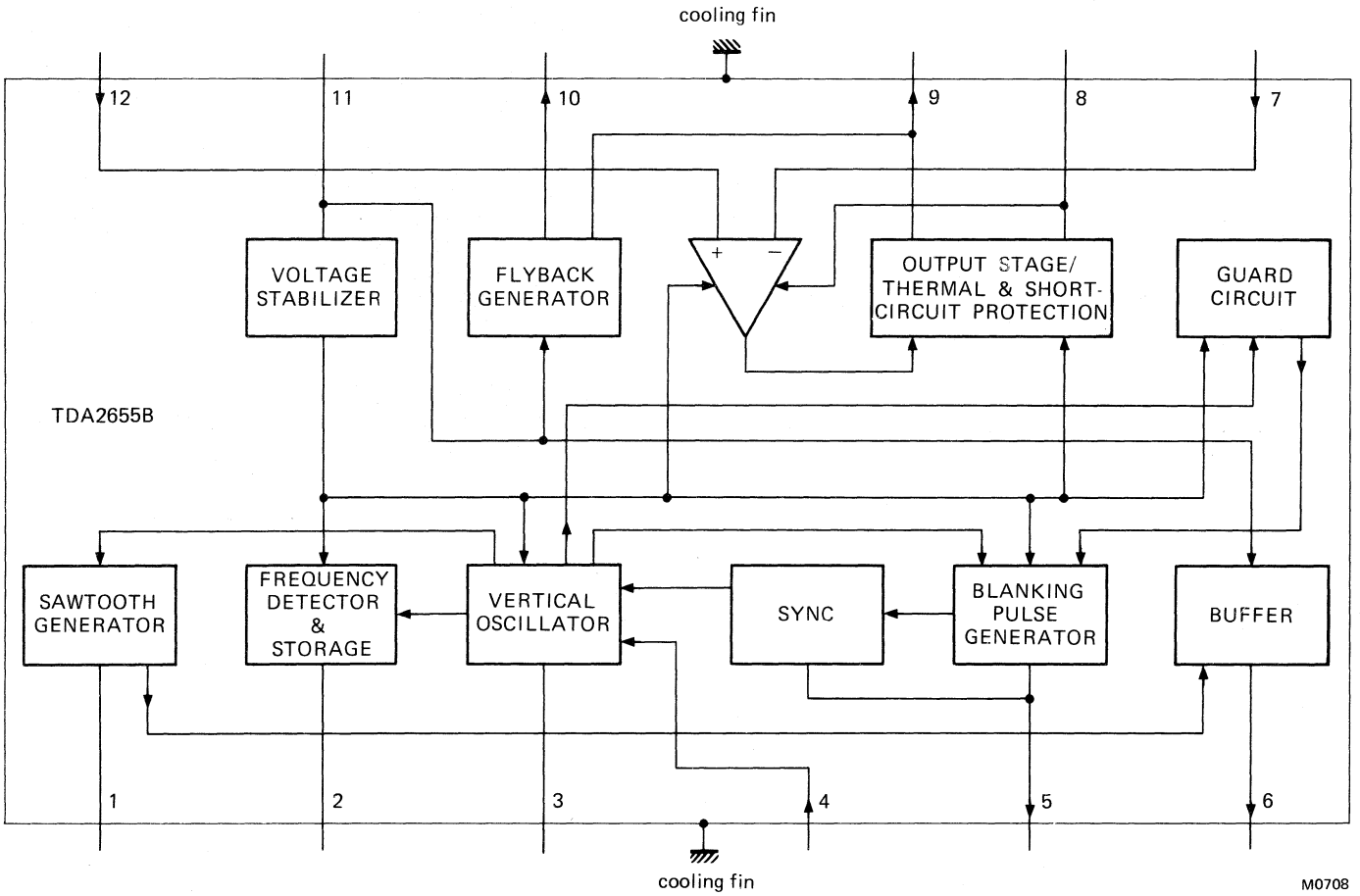


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

with respect to cooling fin (ground)

Supply voltage (pin 11)	$V_{11} = V_P$	max.	40	V
Supply voltage output stage (pin 8)	V_8	max.	60	V
Pin 9	V_9	max.	60	V
	$-V_9$	max.	0	V
Pin 10	V_{10}	max.	40	V
Pin 3	V_3	max.	7	V
Pin 1	V_1	max.	40	V
Pin 6	V_6	max.	7	V
Pins 7 and 12	$V_7; V_{12}$	max.	24	V

Currents

Pin 10	I_{10}	max.	1,2	A
	$-I_{10}$	max.	1,5	A
Pin 5	$\pm I_5$	max.	10	mA
Pin 2	I_2	max.	3	mA
Pin 1	I_1	max.	50	mA
	$-I_1$	max.	0,1	mA
Pin 6	$-I_6$	max.	5	mA
Pin 4	$-I_4$	max.	1	mA
Pin 8, pin 9 and cooling fin	internally limited by the short-circuit protection circuit			

Temperatures

Total power dissipation	internally limited by the short-circuit protection circuit	
Storage temperature range	T_{stg}	−55 to +150 °C
Operating ambient temperature range	T_{amb}	0 °C to limiting values

PINNING

pin number	function	pin number	function
1.	sawtooth capacitor	7.	feedback input
2.	frequency storage information	8.	positive supply of output stage
3.	oscillator capacitor	9.	output
4.	oscillator resistor (adjustment)	10.	flyback generator output
5.	synchronization input/blanking output	11.	positive supply (V_P)
6.	sawtooth buffer stage output	12.	preamplifier input

CHARACTERISTICS

V_P = 22 V; T_{amb} = 25 °C; these characteristics are measured with respect to cooling fin (ground), unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
Supply voltage/output stage					
Supply voltage	$V_{11} = V_P$	9	–	30	V
Output voltage					
at I_9 = 0,75 A	V_9	–	1,2	1,4	V
at $-I_9$ = 0,75 A	V_9	(V_P – 1,9)	(V_P – 1,7)	–	V
Flyback generator output voltage at I_{10} = 0,75 A	V_{10}	–	(V_P – 2,0)	–	V
Supply currents (without load)					
pin 11	I_{11}	–	10	–	mA
pin 8	I_8	–	3	–	mA
Output current	$\pm I_9$	–	–	1,2	A
Flyback generator peak current	$\pm I_{10}$	–	–	1,2	A
Feedback					
Preamplifier quiescent input currents	$-I_7 = -I_{12}$	–	0,1	–	μA
Synchronization					
Sync input voltage range	V_5	1,0	–	–	V
Synchronizing range		–	28	–	%
Oscillator/sawtooth generator					
Frequency setting input voltage	V_4	6	–	9	V
Sawtooth generator output voltage (peak value)	$V_{1(m)}$	0	(V_P – 2)	–	V
Sawtooth generator output current	I_1	–	–	30	mA
Sawtooth generator leakage current	$-I_1$	2	–	–	μA
Oscillator temperature dependency T_{case} = 20 to 100 °C	$(\Delta f/f)/\Delta T_{case}$	–	10^{-4}	–	K^{-1}
Oscillator voltage dependency V_P = 10 to 30 V	$(\Delta f/f)/\Delta V_P$	–	10^{-3}	–	V^{-1}
Blanking pulse generator					
Output voltage (at I_5 = 1 mA)	V_5	–	20	–	V
Output resistance	R_5	–	410	–	Ω
Output current (at V_P = 21 V)	$-I_5$	–	–	5	mA
Blanking pulse duration at 50 Hz sync	t_b	1,33	1,4	1,47	ms
50/60 Hz frequency detector					
Output saturation voltage (LOW level for 50 Hz)	V_2	–	1	–	V
Leakage current	I_2	–	1	–	μA

parameter	symbol	min.	typ.	max.	unit
Buffer stage					
Output voltage	$V_{6(m)}$	0	$(V_P - 1)$	–	V
Output current	$-I_6$	–	–	4	mA
Thermal resistance					
From junction to case (cooling fin)	$R_{th\ j\text{-}c}$	–	–	15	K/W
Junction temperature					
Switching point thermal protection	T_j	142	150	158	°C

APPLICATION INFORMATION

The following application data is obtained from measurements made on the circuits shown in Figs 2 and 3, application circuits for 90° deflection systems. Measurements are made with respect to the cooling fin (ground).

			Fig. 2 concept 1*	Fig. 3 concept 2*	
System supply voltages	V_{P1}	typ.	22	22	V
	V_{P2}	typ.	12	–	V
Supply currents	I_{P1}	typ.	135	140	mA
	$-I_{P2}$	typ.	8	–	mA
Output voltage (d.c. value)	V_9	typ.	12,2	13,8	V
Output voltage (peak-to-peak value)	$V_{9(p\text{-}p)}$	typ.	42	43	V
Output current (peak value)	$-I_{9(m)}$	typ.	450	450	mA
Deflection current (peak-to-peak value)	$I_{defl\ (p\text{-}p)}$	typ.	850	850	mA
Flyback time	t_{fl}	typ.	0,9	1,0	ms
Oscillator frequency adjustment without sync	f_o	typ.	46,5	46,5	Hz
Total power dissipation per package (see note)	P_{tot}	max.	1,8	1,8	W
Ambient temperature	T_{amb}	max.	70	70	°C
Thermal resistance (junction to ambient)	$R_{th\ j\text{-}a}$	max.	40	40	K/W

*Concept 1 : with two supply voltages; concept 2 : with one supply voltage.

Note

Calculated with ΔV_{P1} of +5% and ΔR_{defl} of −7%.

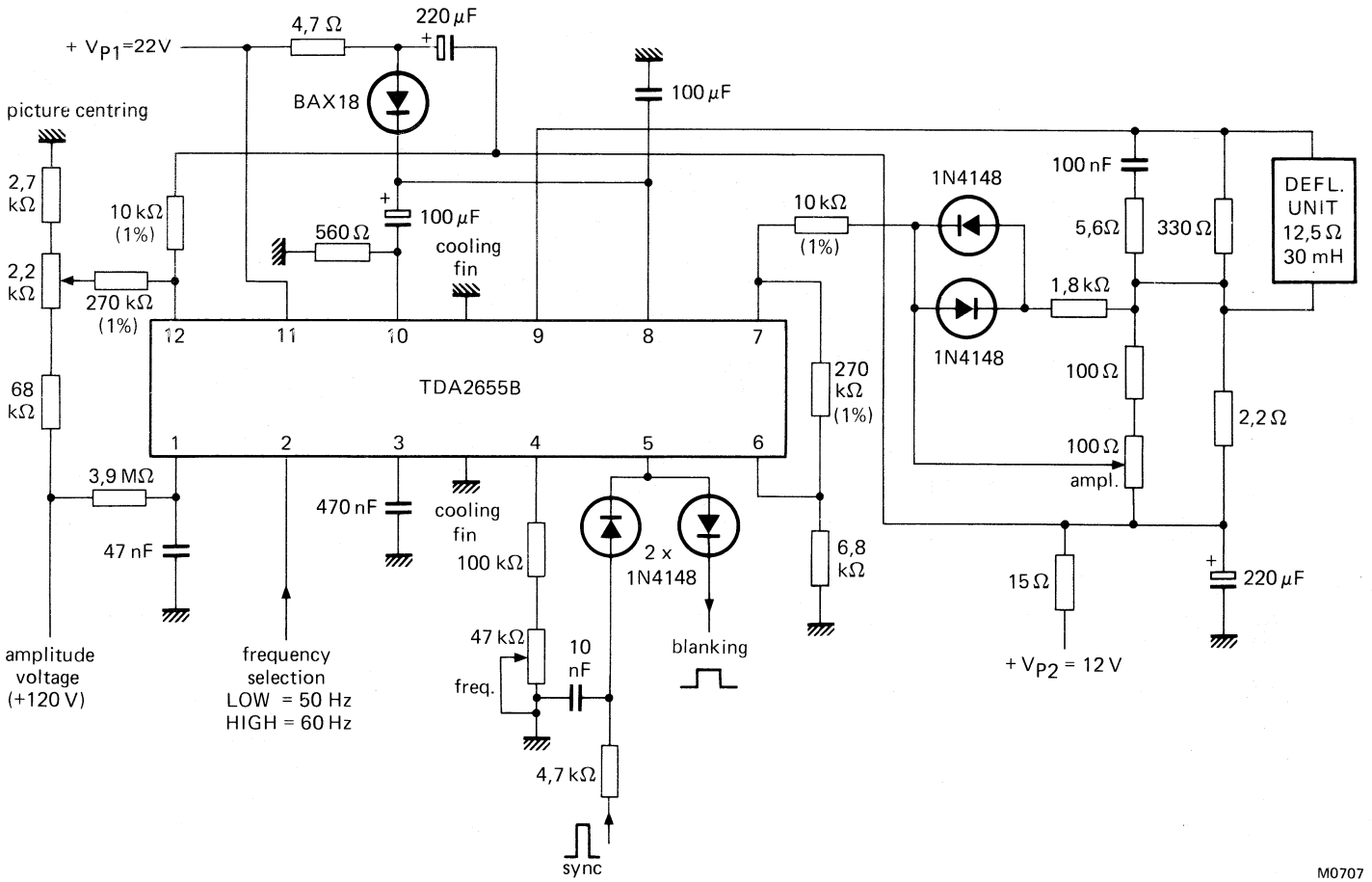


Fig. 2 Typical application circuit with two supply voltages; for use with 90° picture tubes.

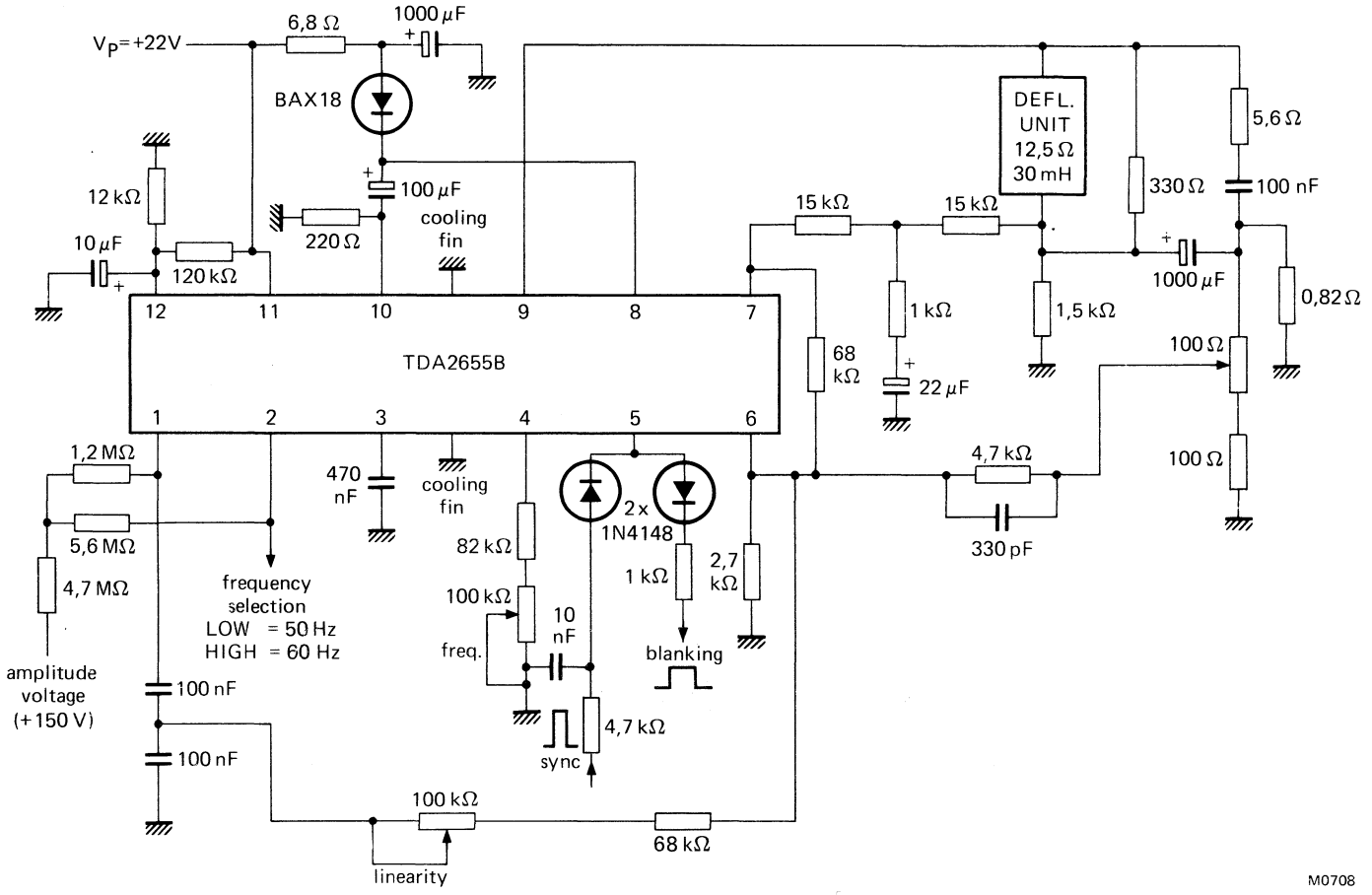


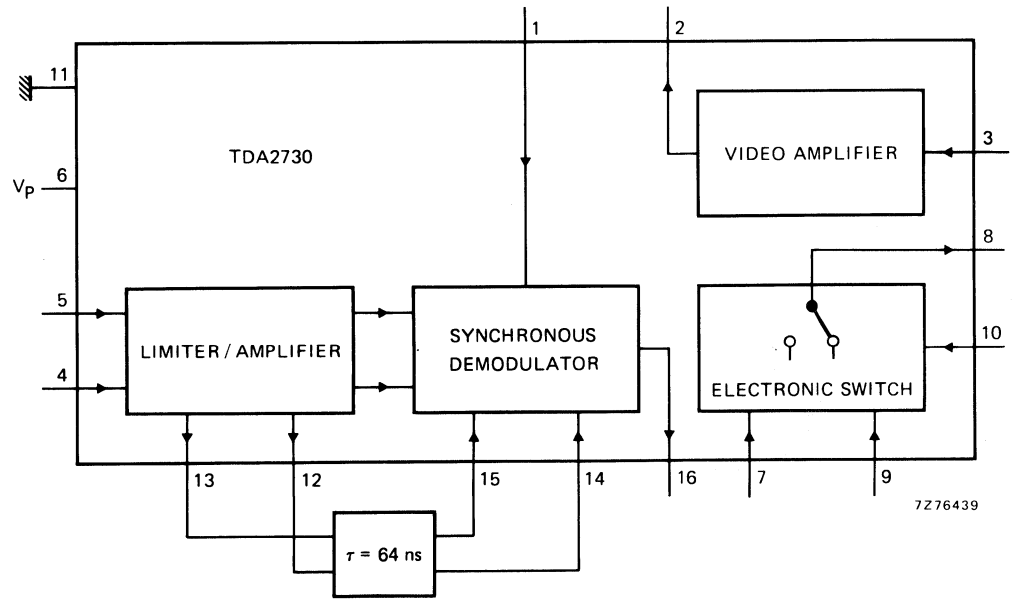
Fig. 3 Typical application circuit for a single supply voltage; for use with 90° picture tubes.

FM LIMITER/DEMODULATOR

The TDA2730 is a monolithic integrated circuit for use in audio-visual equipment, e.g.; video recorders and video disc players.
The circuit comprises an f.m. limiter/demodulator for the playback signal, a video amplifier and an electronic switch, which can be used for drop-out elimination.

QUICK REFERENCE DATA				
Supply voltage	V_{6-11}	typ.	12	V
Supply current	I_6	typ.	42	mA
Input signal range (peak-to-peak value)	$V_{4-5(p-p)}$		30 to 2000	mV
Video output signal (peak-to-peak value)	$V_{2-11(p-p)}$	typ.	4	V

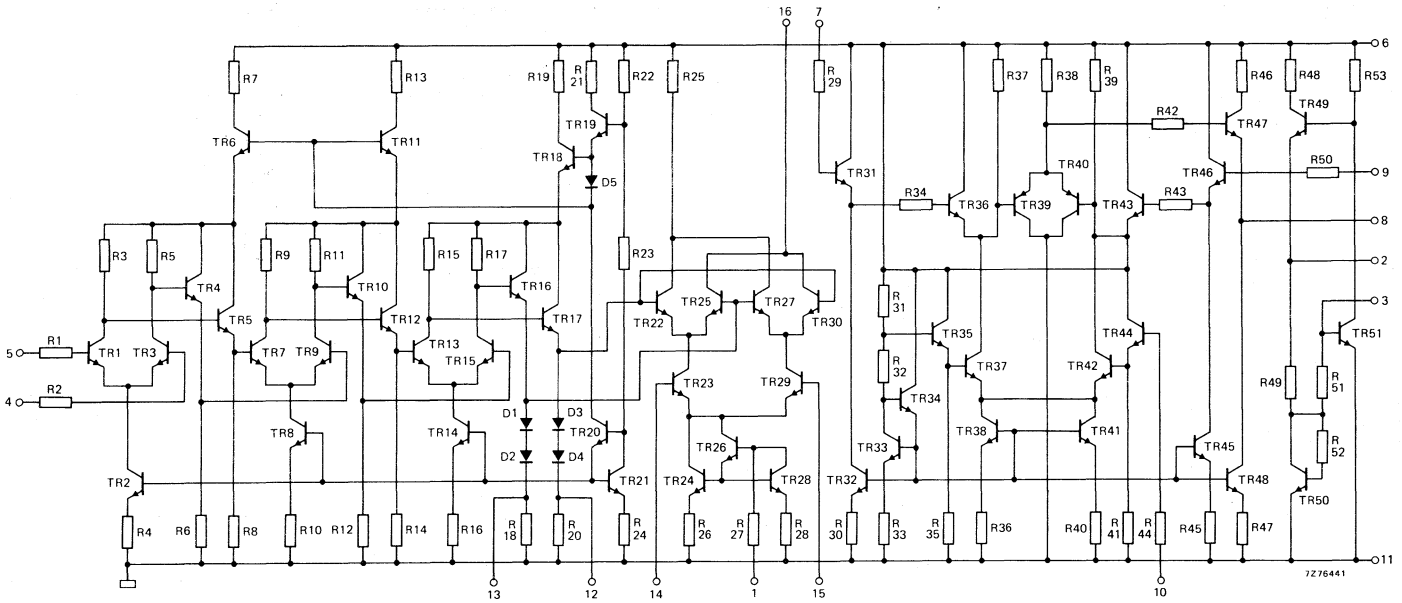
BLOCK DIAGRAM



PACKAGE OUTLINE

16-lead DIL; plastic (SOT-38).

CIRCUIT DIAGRAM



RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltage

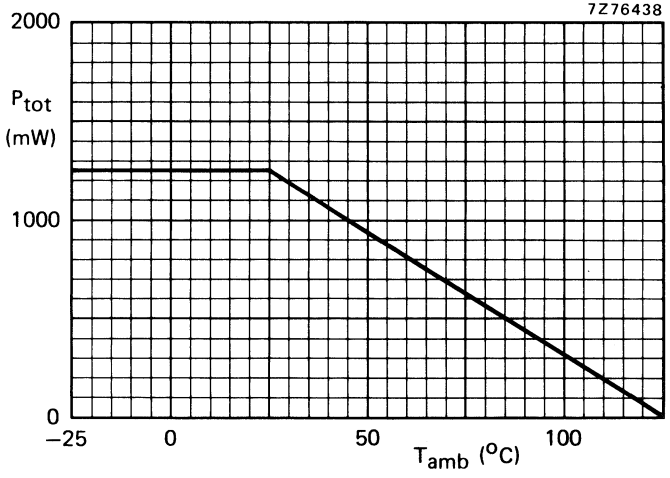
Supply voltage	V_{6-11}	max.	13	V

Power dissipation

Total power dissipation (see also derating curve below)	P_{tot}	max.	1,25	W

Temperatures

Storage temperature	T_{stg}	−65 to +125	°C
Operating ambient temperature	see derating curve below		



CHARACTERISTICS measured in the circuit on in Fig. 1

Supply voltage range	V_{6-11}	typ.	12	V
			11 to 13	V

The following characteristics are measured at V_{6-11} = 12 V; T_{amb} = 25 °C

Supply current	I_6	typ.	42	mA
			25 to 54	mA

Limiter

Start of limiting (−3 dB) f_o = 4 MHz; peak-to-peak value	$V_{4-5(p-p)}$	typ.	0,8	V
Input signal range for constant luminance output (peak-to-peak value)	$V_{4-5(p-p)}$		30 to 2000	mV
Output voltage (peak-to-peak value)	$V_{12-13(p-p)}$	typ.	750	mV
Available output voltage at an external load of 1 kΩ; peak-to-peak value	$V_{12-13(p-p)}$	>	5	V

Demodulator

Measured at I_1 = 4 mA; $|Z_{16-11}|$ = 1,5 kΩ; delay time τ = 64 ns; Δf = 1,4 MHz (f_L = 3,0 MHz, f_H = 4,4 MHz)

Current ratio	I_1/I_{16}	typ.	1	
Output voltage (peak-to-peak value)	V_{16-11}	typ.	540	mV

Drop-out switch

Input drive voltage range	$V_{7;9-11}$		6,5 to 12	V
Voltage drop between input and output				
for signal flow from pin 7 to pin 8	V_{7-8}	typ.	1,5	V
for signal flow from pin 9 to pin 8	V_{9-8}	typ.	1,5	V
Input offset voltage	$\lvert V_{7-8} - V_{9-8} \rvert$	<	20	mV
Switch actuating input voltage				
for signal flow from pin 7 to pin 8	V_{10-11}		0 to 2,7	V
for signal flow from pin 9 to pin 8	V_{10-11}		3,7 to 6,0	V
Output impedance at 1,5 mA by internal load	Z_{8-11}		emitter follower	

CHARACTERISTICS (continued)

Video amplifier

Input voltage level	V_{3-11}	typ.	730	mV
Output voltage level	V_{2-11}	typ.	5,5	V
Open loop gain	G	typ.	43	dB
Bandwidth (3 dB)	B	typ.	8,8	MHz
Output voltage (peak-to-peak value; see note)	$V_{2-11(p-p)}$	typ.	4	V

Note

The gain of the amplifier is determined by the feedback network comprising the impedances between pins 2 and 3, and pins 8 and 3. The values quoted apply to the circuit in Fig. 1.

PINNING

1. Current setting demodulator
2. Video amplifier output
3. Video amplifier input
4. F.M. signal input
5. F.M. signal input
6. Positive supply
7. Switch input
8. Switch output
9. Switch input
10. Switch actuating input
11. Negative supply (ground)
12. Limiter output
13. Limiter output
14. Demodulator input
15. Demodulator input
16. Demodulator output

APPLICATION INFORMATION

The function is quoted against the corresponding pin number

1. Current setting of demodulator

   The current into this pin directly determines the amplitude and the d.c. level of the demodulator output. At I_1 = 4 mA, optimum temperature compensation is obtained.

2. Video amplifier output

   A signal up to 4 V peak-to-peak is available from this output (Fig. 1).
   This can be the video signal (Fig. 1) or the f.m. signal to the delay line (drop-out elimination; Fig. 2).

3. Video amplifier input

   The demodulator output signal is the input signal to this pin (Fig. 1) or the f.m. modulated signal (Fig. 2).

4. F.M. signal input (in conjunction with pin 5)

   A frequency modulated signal of 1 V peak-to-peak is applied between pins 4 and 5. D.C. feedback from the limiter output is applied to stabilize the operation.

5. F.M. signal input

   See pin 4.

APPLICATION INFORMATION (continued)

6. Positive supply

   Correct operation can be obtained in the range 11 to 13 V.

7. Switch input

   The signal applied to pin 7 or to pin 9 is transferred to pin 8, depending on the switch position. For an input level between 0 and 2,7 V at pin 10, the signal at pin 7 is transferred to pin 8, and when between 3,7 and 6 V the input signal at pin 9 is transferred to pin 8.
   The signal at pin 7 or pin 9 may vary from 6,5 to 12 V.
   The signal at pin 8 is 1,5 V below the value at pin 7 or 9.
   The difference in input level at pins 7 and 9, to obtain equal output at pin 8, will be less than 20 mV.

8. Switch output

   See pin 7.

9. Switch input

   See pin 7.

10. Switch actuating input

    See pin 7.

11. Negative supply (ground)

12. Limiter output

    A balanced signal is available between pins 12 and 13. The signal amplitude is limited to 750 mV at both outputs.

13. Limiter output

    See pin 12.

14. Demodulator input

    A phase shifted signal (with respect to the internally applied signal) is applied between pins 14 and 15.

15. Demodulator input

    See pin 14.

16. Demodulator output

    The output signal is proportional to :
    - current into pin 1
    - slope of the phase characteristic of the network between pins 12 and 13, and pins 14 and 15
    - impedance level at the output
    - the sweep (Δf) of the f.m. signal.

    A signal of typically 540 mV is available at this pin when using the component values in Fig.1 and Δf = 1,4 MHz.

APPLICATION INFORMATION (continued)

Test circuit

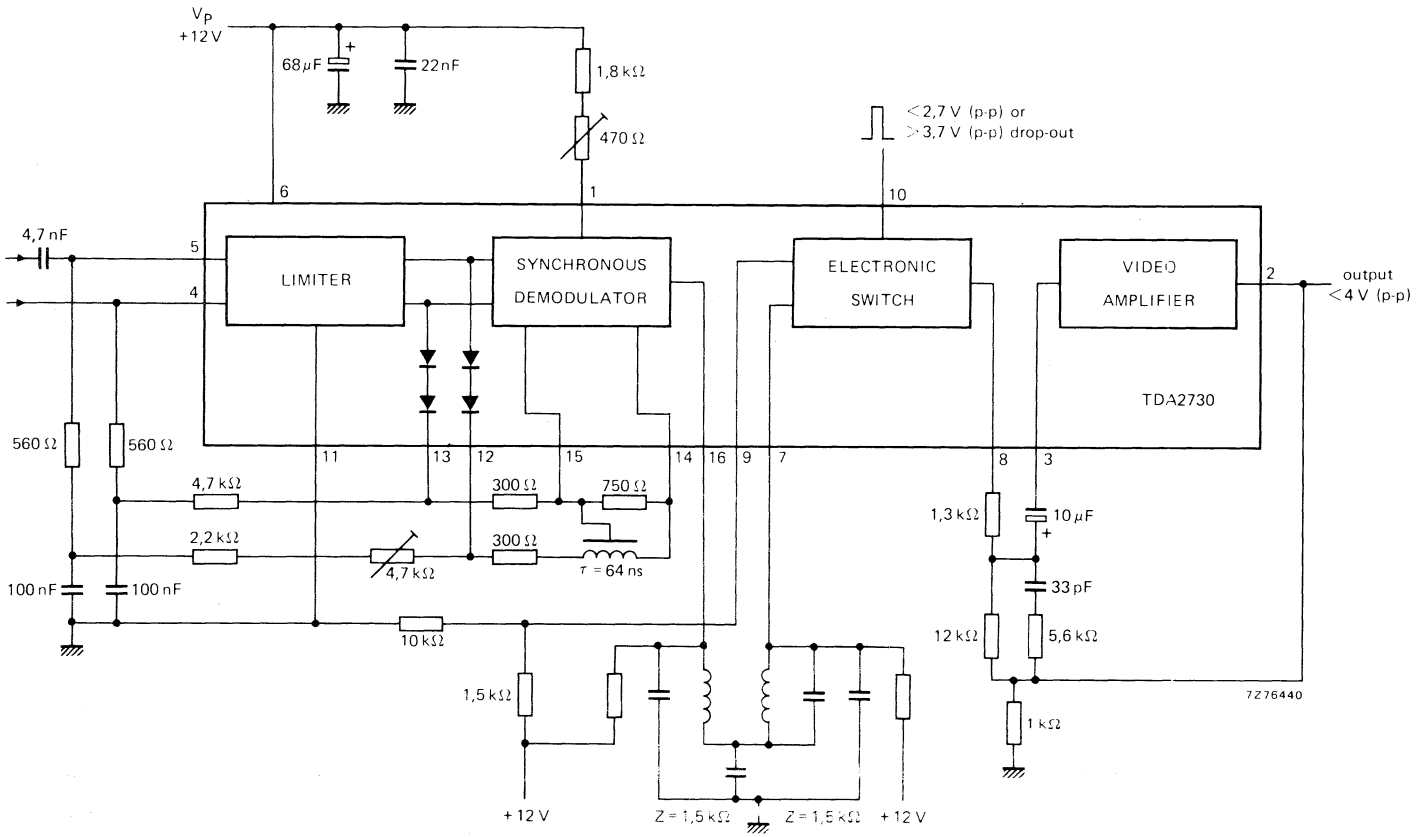


Fig. 1

APPLICATION INFORMATION (continued)

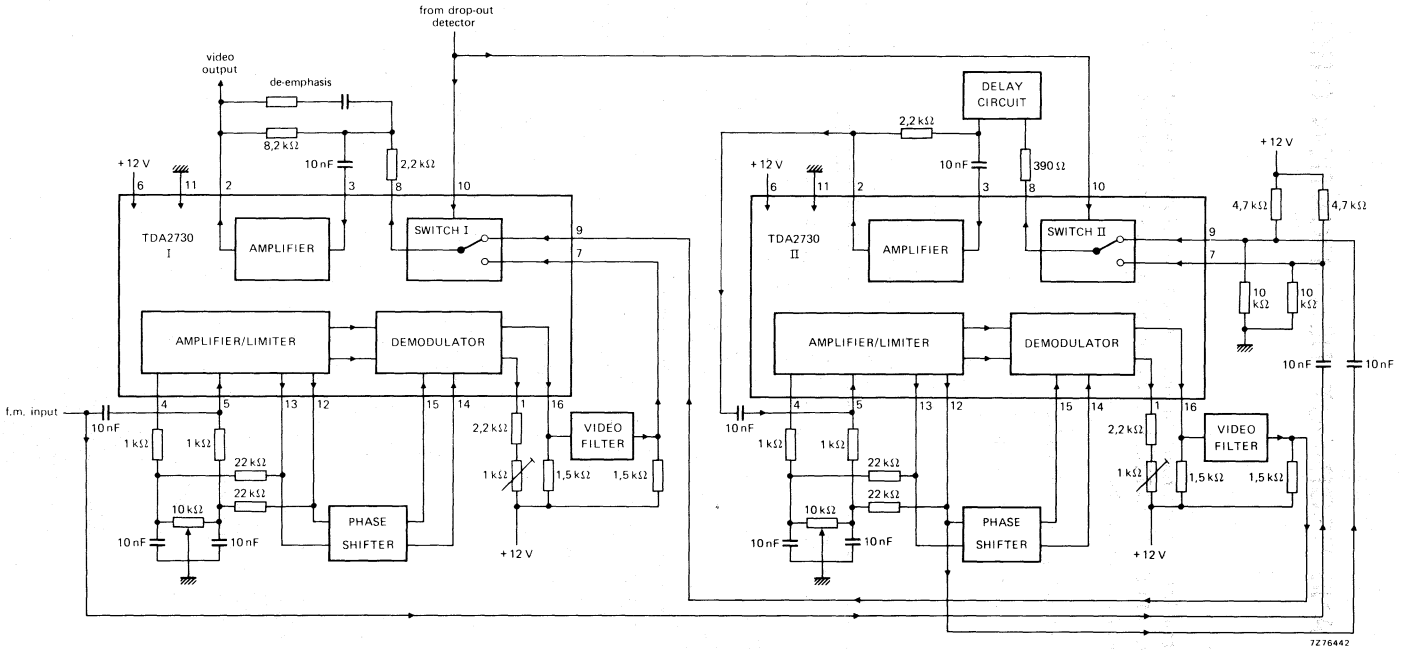


Fig. 2. Drop-out eliminator.

AMPLIFIER AND DROP-OUT IDENTIFICATION CIRCUIT

GENERAL DESCRIPTION

The TDA2740 is a monolithic integrated circuit intended for use in colour television receivers. It also can be used, in conjunction with the TDA2730, in the reproduction part of video recorder sets. The circuit incorporates the following functions:

- Electronic switch
- A.G.C. FM amplifier with display drive capability
- Drop-out detector
- Schmitt-trigger for generating a drop-out pulse

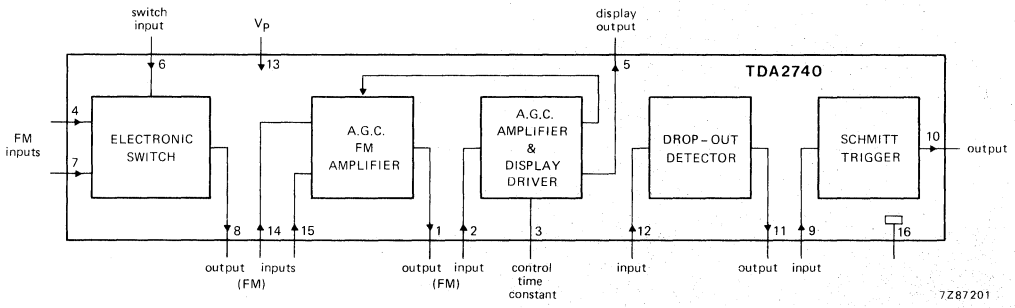


Fig. 1 Block diagram.

PACKAGE OUTLINE

16-lead DIL; plastic (SOT-38).

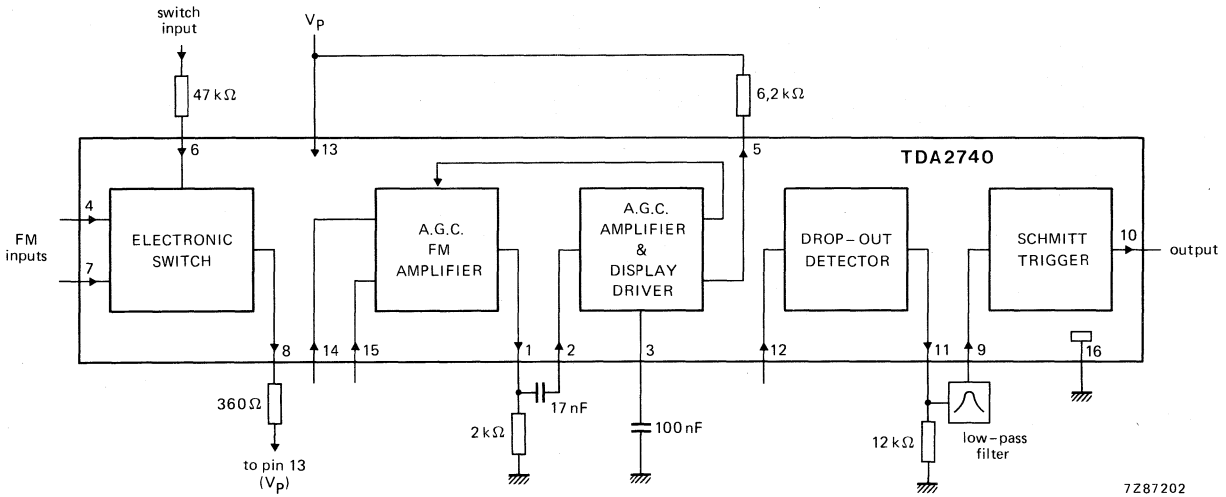


Fig. 2 Test circuit.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 13)	$V_{13-16} = V_P$	max.	13	V
Total power dissipation	P_{tot}	max.	780	mW
Storage temperature range	T_{stg}		−25 to +150	°C
Operating ambient temperature range	T_{amb}		−20 to +90	°C

CHARACTERISTICS

V_P = 12 V; T_{amb} = 25 °C; measured in Fig. 2; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply					
Supply voltage range (pin 13)	V_P	11,5	12	13	V
Supply current (pin 13)	I_P	30	40	60	mA
Electronic switch					
Input voltages (d.c.)	$V_{4;7-16}$	6,5	7,1	7,5	V
Input impedances	$\lvert Z_{4;7-16}\rvert$	—	1	—	kΩ
Input voltages (pin 6)					
for signal from pin 7 to pin 8	V_6	0	—	1,7	V
for signal from pin 4 to pin 8	V_6	2,7	—	V_P	V
Input current (pin 6)	I_6	—	—	60	μA
Output pin 8		open collector			
Output current (d.c.)	I_8	1,3	1,8	2,5	mA
Output voltage	V_{8-16}	6,7	—	V_P	V
Forward transfer admittance	$\lvert Y_f\rvert$	2,45	3,3	4,45	mS
2nd harmonic suppression referred to a sinusoidal signal at pin 4 or 7 of $V_{4;7(p-p)}$ = 500 mV; f = 4 MHz	α	—	−43	—	dB
A.G.C. amplifier and display driver					
Input voltages (d.c.)	$V_{14;15-16}$	2,3	2,6	2,9	V
Input impedance	$\lvert Z_{14-15}\rvert$	—	1,2	—	kΩ
Input voltage range (peak-to-peak value)	$V_{14-15(p-p)}$	6	—	60	mV
Output voltage (peak-to-peak value)	$V_{1(p-p)}$	0,7	1	1,4	V
Open-loop voltage gain at f = 4 MHz	G_{ov}	43	46	49	dB
Bandwidth (−3 dB) within control range	B	7	—	—	MHz
Output voltage (d.c.)	V_{1-16}	5,0	6,7	8,5	V
Output impedance	Z_{1-16}	emitter follower			
Input voltage (d.c.)	V_{2-16}	2,2	2,5	2,8	V
Input impedance	$\lvert Z_{2-16}\rvert$	—	2,3	—	kΩ
Output pin 5		open collector			

CHARACTERISTICS (continued)

paramter	symbol	min.	typ.	max.	unit
A.G.C. amplifier and display driver (continued)					
Display current (pin 5)					
without input signal	I_5	–	–	400	μA
with input signal of 60 mV (peak to peak)	I_5	–	1,3	–	mA
D.C. voltage at pin 3					
without input signal	V_{3-16}	1,1	1,5	1,9	V
with input signal	V_{3-16}	2,4	2,7	3,2	V
Drop-out detector					
Input voltage (d.c.)	V_{12-16}	2,6	2,8	3,0	V
Input impedance	$\lvert Z_{12-16}\rvert$	–	1	–	kΩ
Input voltage (a.c.) (peak-to-peak value)					
for negative-going threshold (t_{PLH})	$V_{12(p-p)}$	9	18	36	mV
for positive-going threshold (t_{PHL})	$V_{12(p-p)}$	11	26	60	mV
Output pin 11			open collector		
Maximum output current	I_{11}	–	2,3	–	mA
Output current (d.c.) without input signal	I_{11}	–	1,3	–	mA
Schmitt-trigger (see Fig. 3)					
Threshold voltage: ON	V_{9-16}	10,05	10,15	10,30	V
Threshold voltage: OFF	V_{9-16}	9,65	9,80	9,95	V
Input impedance	$\lvert Z_{9-13}\rvert$	–	1,2	–	kΩ
Output voltage HIGH	V_{10-16H}	3,7	3,9	4,2	V
Output voltage LOW	V_{10-16L}	2,1	2,4	2,7	V
Output impedance	Z_{10-16}		emitter follower		

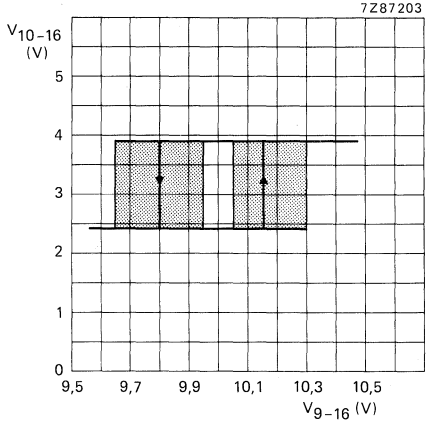


Fig. 3 Schmitt-trigger output voltage as a function of the input voltage.

TELEVISION SOUND COMBINATION

The TDA2791 contains the following functions:

- Limiter/amplifier
- F.M. detector.
- Physiological d.c. volume control.
- D.C. tone control.

The limiter/amplifier is designed as a four-stage differential amplifier, to obtain good noise and interference suppression. The detector is a balanced quadrature demodulator.

During VTR operation audio signals can be inserted before the tone and volume control circuits. The limiter amplifier and demodulator must be switched off by grounding pin 2. This switching action occurs without a d.c. shift, so that no transients will be noticed in the speaker. The circuit is very flexible in its application because the characteristics of the various controls can be adapted by changing external component values.

QUICK REFERENCE DATA

Supply voltage	$V_{13\text{-}3}$	typ.	12	V
Total current drain	I_{13}	typ.	61	mA
Frequency	f_o		5,5	MHz
Input voltage at start of limiting (r.m.s. value)	$V_{i(rms)}$	typ.	100	μV
A.M. rejection at V_i = 5 mV	α	typ.	60	dB
A.F. output voltage at $\Delta f = \pm 27$ kHz (r.m.s. value) (at pin 7 after de-emphasis)	$V_{o(rms)}$	typ.	700	mV
D.C. bass control range		<	$^{+16}_{-19}$	dB
D.C. treble control range		<	$^{+12}_{-15}$	dB
D.C. volume control range		>	−75	dB

PACKAGE OUTLINE

16-lead DIL; plastic (SOT-38).

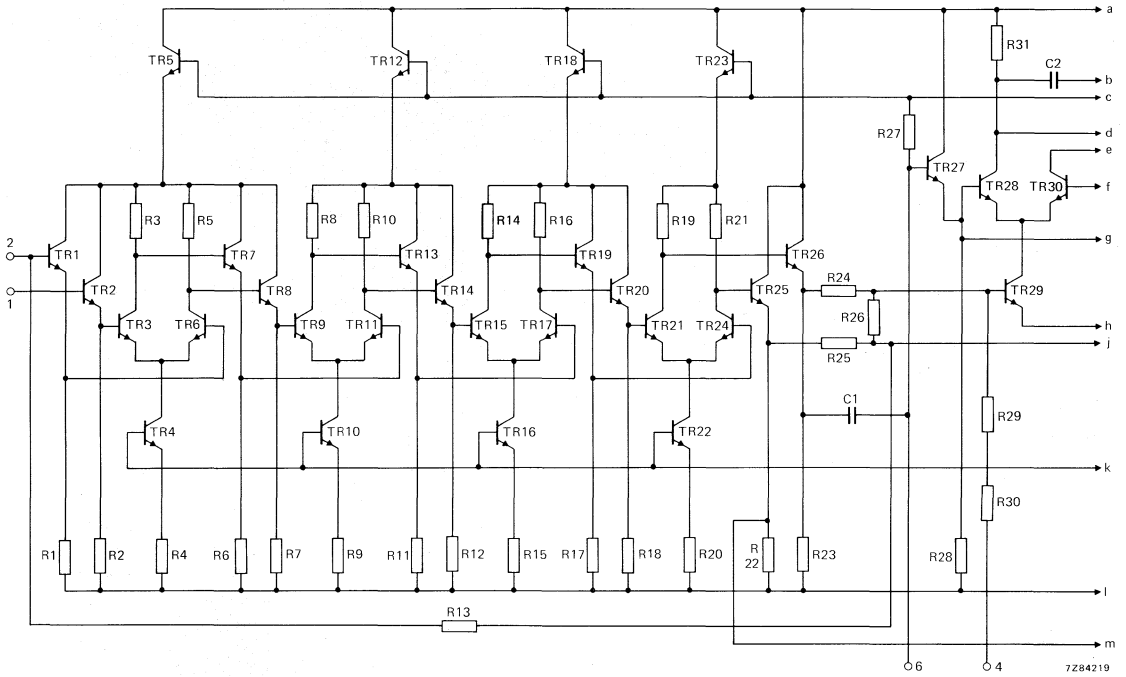


Fig. 1a Circuit diagram; continued in Fig. 1b.

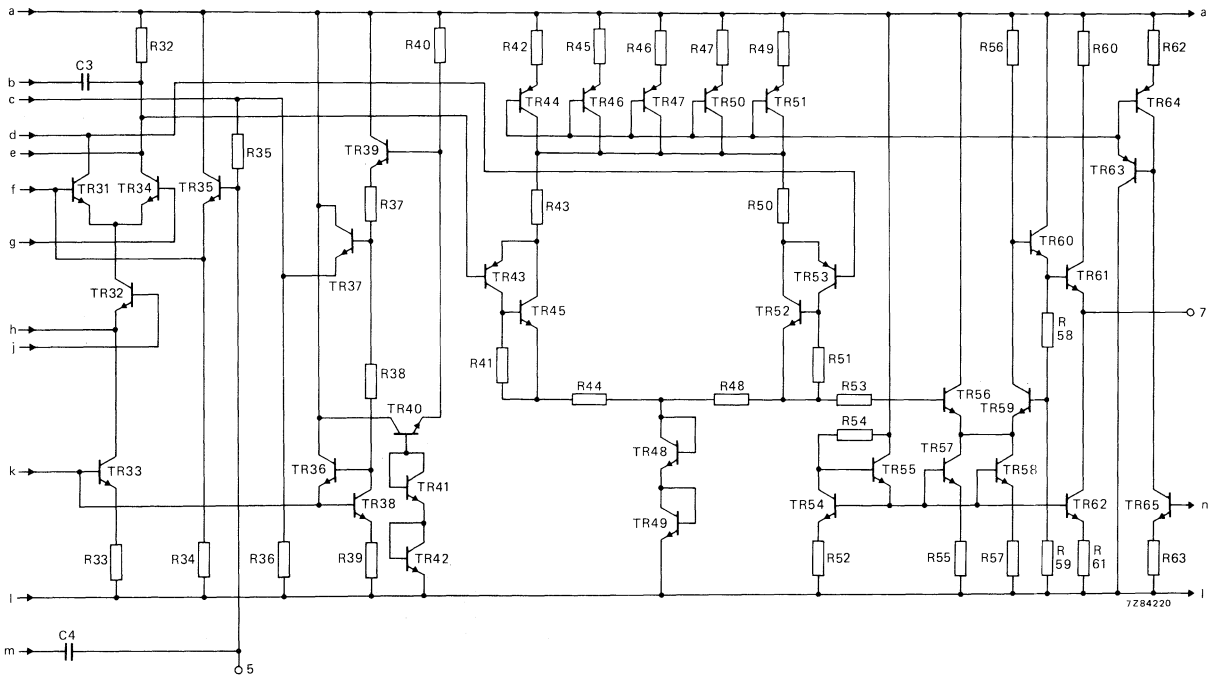


Fig. 1b Circuit diagram; continued from Fig. 1a; continued in Fig. 1c, for line 'n' see Fig. 1d.

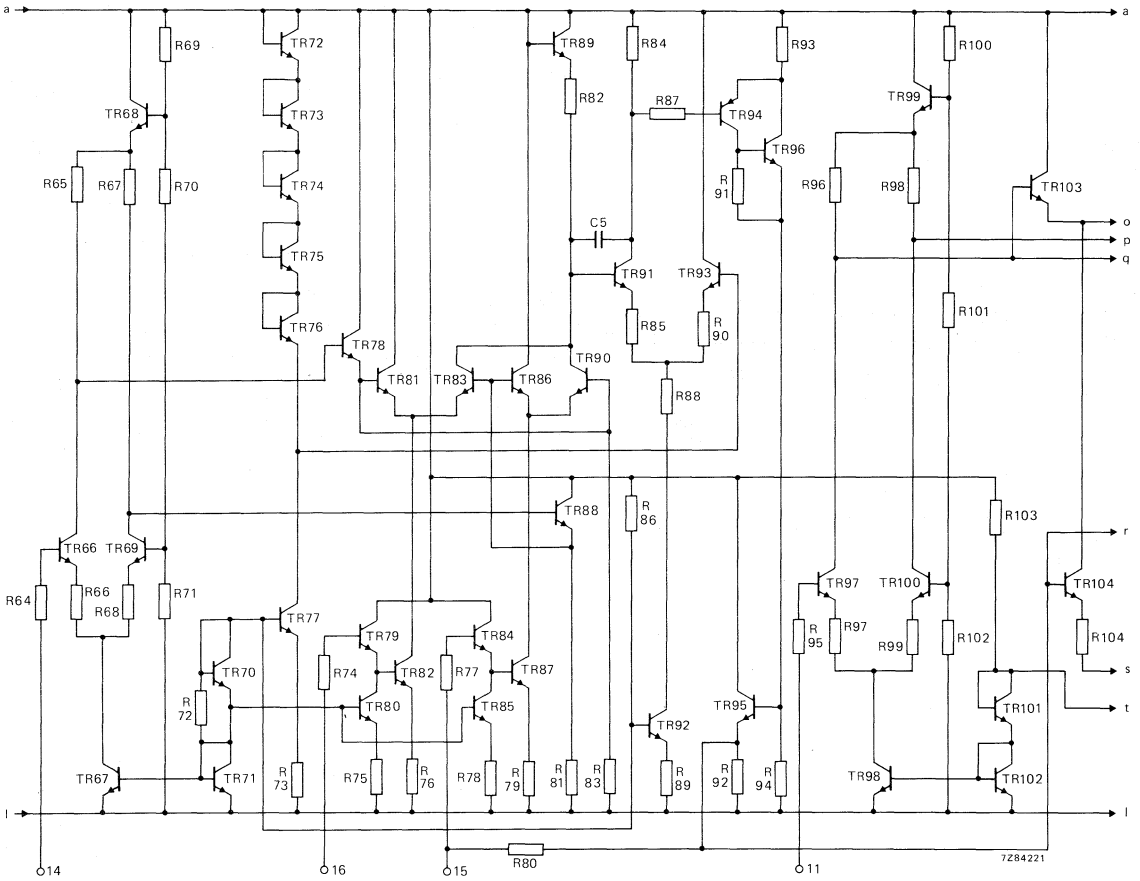


Fig. 1c Circuit diagram; continued from Fig. 1b; continued in Fig. 1d.

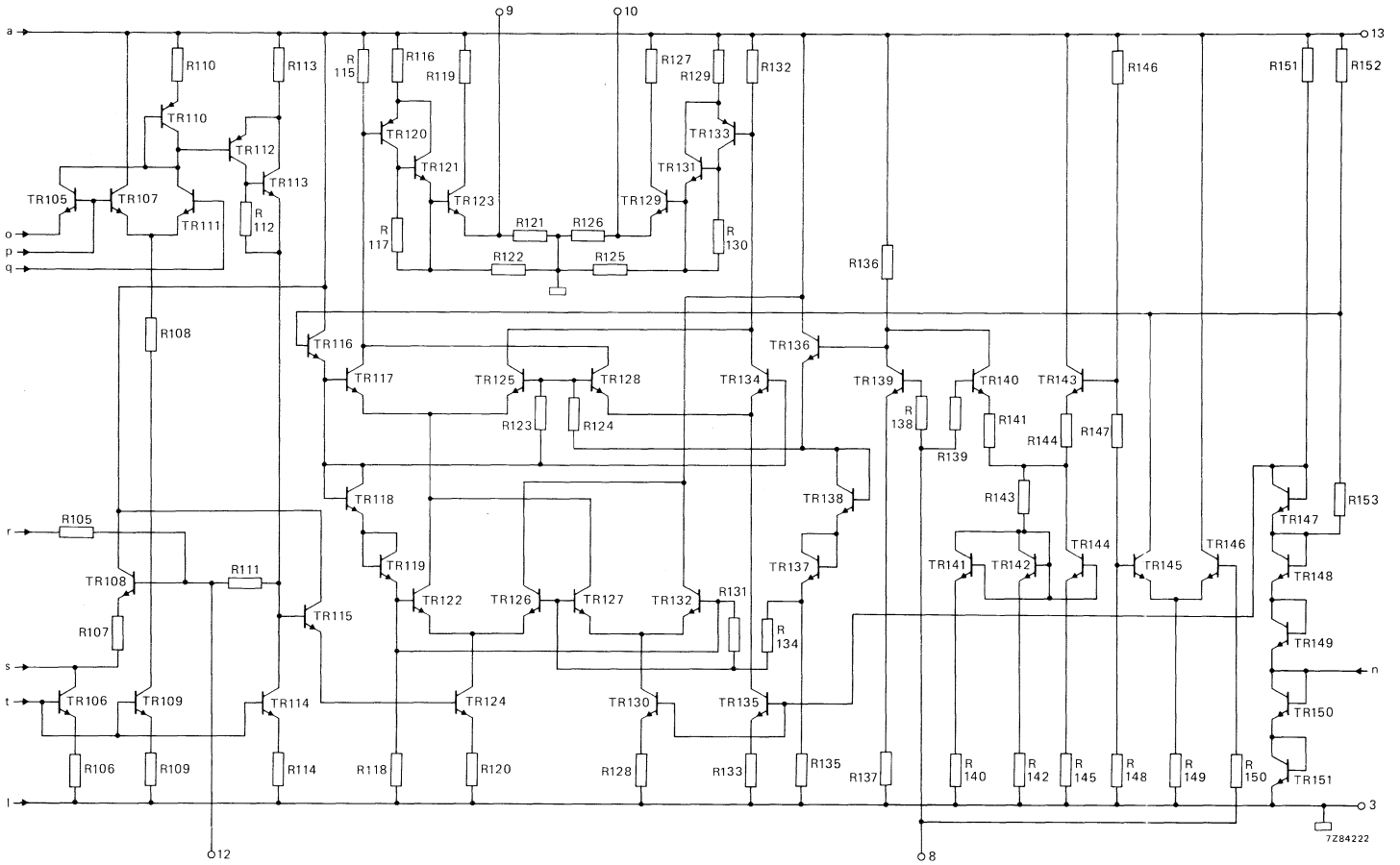


Fig. 1d Circuit diagram; continued from Fig. 1c and Fig. 1b.

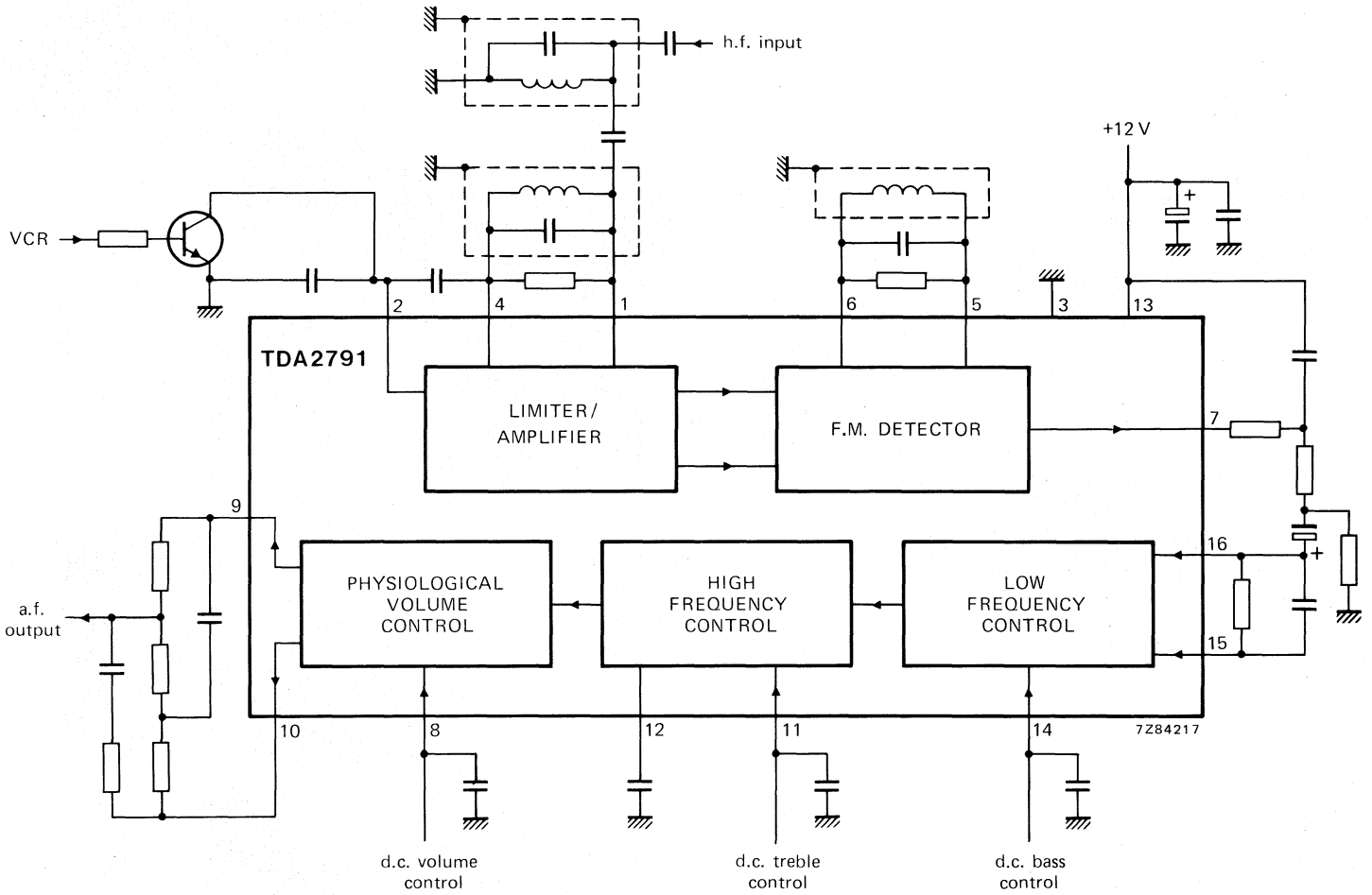


Fig. 2 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage	V_{13-3}	max.	13,2 V

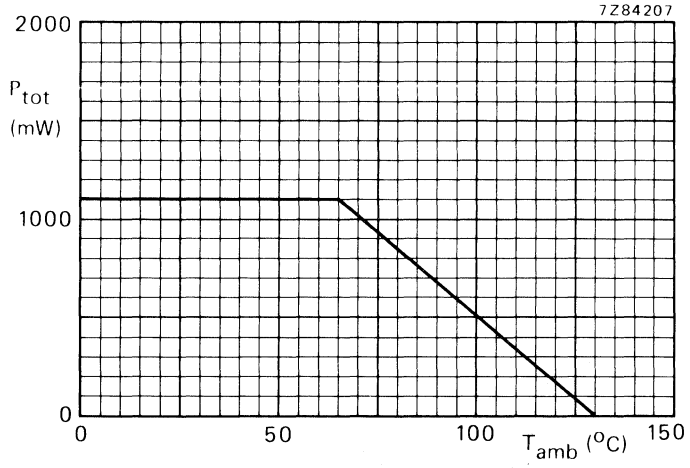


Fig. 3 Power derating curve.

Storage temperature	T_{stg}		−25 to + 130 °C
Operating ambient temperature	T_{amb}		−25 to + 65 °C

CHARACTERISTICS

Measured in Fig. 9 at T_{amb} = 25 °C; V_{13-3} = 12 V; f = 5,5 MHz (unless otherwise specified)

Supply voltage range	V_{13-3}		10,8 to 13,2 V
Total current drain	I_{13}		43 to 79 mA
Limiter/amplifier/demodulator (note 1)			
Input limiting voltage at V_{7-3} = −3 dB (r.m.s. value)	$V_{i(rms)}$	typ.	100 μV
Input impedance	$\lvert Z_{1-3} \rvert$	typ.	200 kΩ
A.M. rejection (note 2)			
V_i = 0,5 mV	α	typ.	50 dB
V_i = 1 mV	α	typ.	50 dB
V_i = 5 mV	α	typ.	60 dB
V_i = 50 mV	α	typ.	55 dB
A.F. output voltage at pin 7 (r.m.s. value)			
f_m = 1 kHz; Δf = ± 27 kHz; V_i = 5 mV; Q_{L3} = 12,5	$V_{o(rms)}$	typ.	700 mV

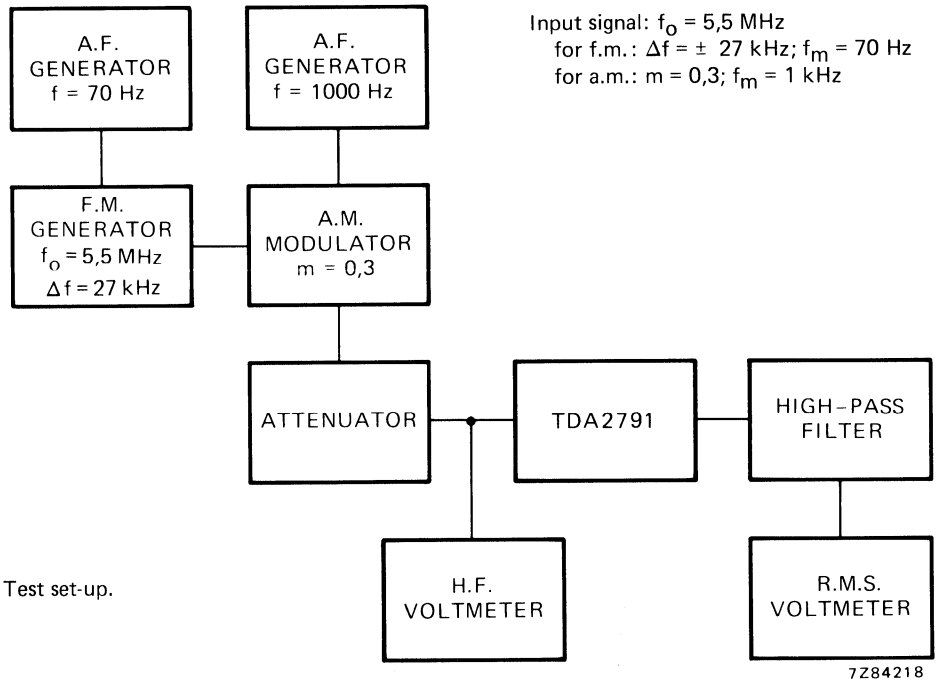
Notes

1. The quadrature reference circuit must be tuned in such a way that there is no difference in the demodulator d.c. output voltage when the limiter input is switched from signal to no signal.
2. See test set-up Fig. 4.

CHARACTERISTICS (continued)

Total harmonic distortion at pin 7 f_m = 1 kHz; Δf = ± 27 kHz; V_i = 5 mV	d_{tot}	typ.	0,35 %
Zero-point stability at 30 μV to 10 mV; pin 7		typ.	2 kHz
Hum suppression; pin 7		typ.	20 dB
Signal-to-noise ratio at pin 7 f_m = 1 kHz; Δf = ± 27 kHz; V_i = 5 mV (note 1)	S/N	typ.	63 dB
Demodulator output impedance	$\lvert Z_{7\text{-}3}\rvert$	typ.	25 Ω
A.F. amplifier			
Input voltage bass control circuit at pin 16 (r.m.s. value) at Δf = ± 27 kHz	$V_{i(rms)}$	typ.	215 mV
Bass control	see graph, Fig. 5		
Input impedance	$\lvert Z_{14\text{-}3}\rvert$	typ.	500 kΩ
Treble control	see graph, Fig. 6		
Input impedance	$\lvert Z_{11\text{-}3}\rvert$	typ.	500 kΩ
Control voltages for flat frequency characteristic	$V_{11\text{-}3}$ $V_{14\text{-}3}$	typ. typ.	3,2 V 3,2 V
Volume control	see graph, Fig. 7		
Input current at $V_{8\text{-}3}$ = 4 V	I_8	typ.	40 μA
Physiological volume control (bass and treble compensation)	see graph, Fig. 8		
Voltage gain of audio part f = 1 kHz; $V_{11\text{-}3}$ = 3,2 V; $V_{14\text{-}3}$ = 3,2 V; $V_{8\text{-}3}$ = 4 V	G_v	typ.	4 dB
D.C. volume control range		>	−75 dB
Weighted signal-to-noise ratio $V_{i(rms)}$ = 215 mV; −24 dB volume control (notes 1 and 2)		typ.	56 dB
Total harmonic distortion at output f = 1 kHz; $V_{i(rms)}$ = 215 mV (related to max. output; note 2) at: 0 dB −20 dB	 d_{tot} d_{tot}	 typ. typ.	 0,2 % 0,4 %

Notes
1. Specified according to DIN 45405; weighted noise (peak value).
2. Measured at flat-tone control characteristics.



Input signal: f_o = 5,5 MHz
for f.m.: Δf = ± 27 kHz; f_m = 70 Hz
for a.m.: m = 0,3; f_m = 1 kHz

Fig. 4 Test set-up.

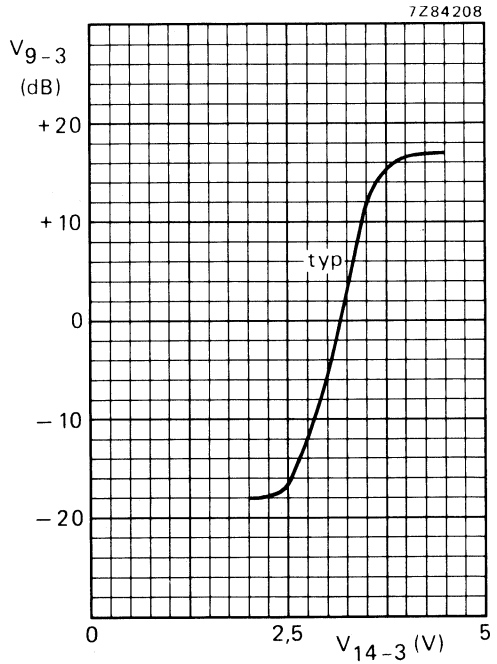


Fig. 5 Bass control curve; f = 40 Hz;
V_{11-3} = 3,2 V; V_{8-3} = 4 V.

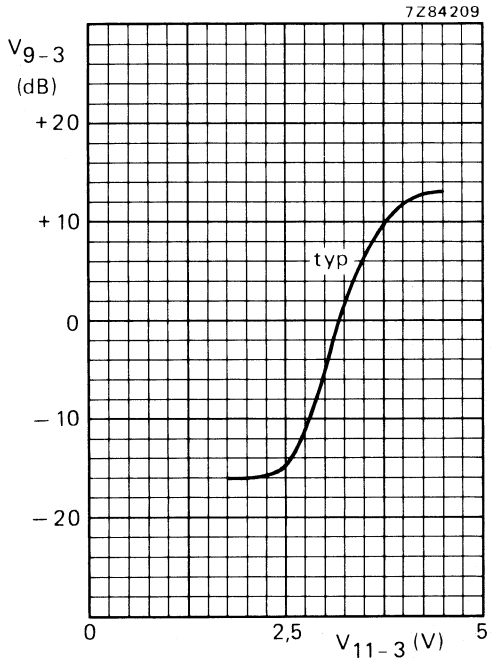
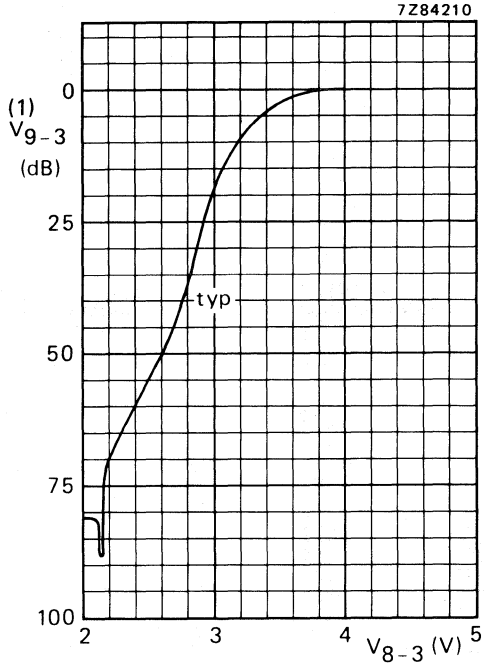
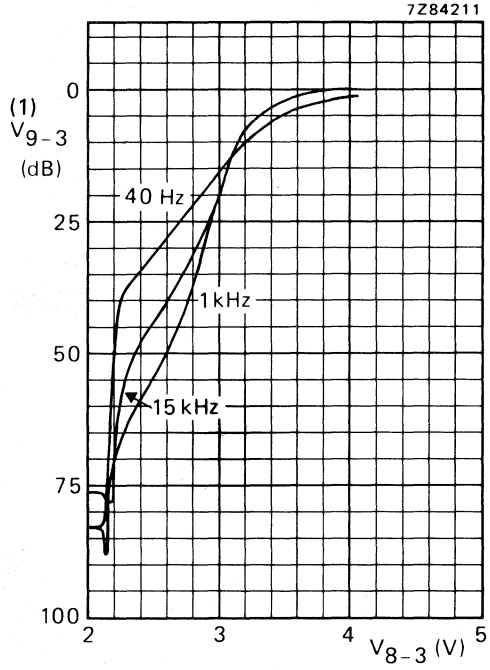


Fig. 6 Treble control curve; f = 15 kHz;
V_{14-3} = 3,2 V; V_{8-3} = 4 V.





(1) This is actually the a.f. output voltage as shown in Fig. 9.

Fig. 7 Volume control curve; f = 1 kHz. V_{14-3} = 3,2 V; V_{11-3} = 3,2 V.

Fig. 8 Physiological volume control curves (typical values); V_{14-3} = 3,2 V; V_{11-3} = 3,2 V.

APPLICATION INFORMATION

The function is quoted against the corresponding pin number

1. Limiter input.
2. The decoupling capacitor for the internal limiter feedback is connected to this pin.
3. Negative supply (ground).
4. Limiter output for external feedback to pin 1.

5 and 6. External tank circuit (demodulator reference signal).

7. Demodulator output.
8. D.C. volume control.

9 and 10. External circuit for physiological volume control.

11. D.C. treble control.
12. External capacitor for treble control.
13. Positive supply.
14. D.C. bass control.

15 and 16. External circuit for bass control.

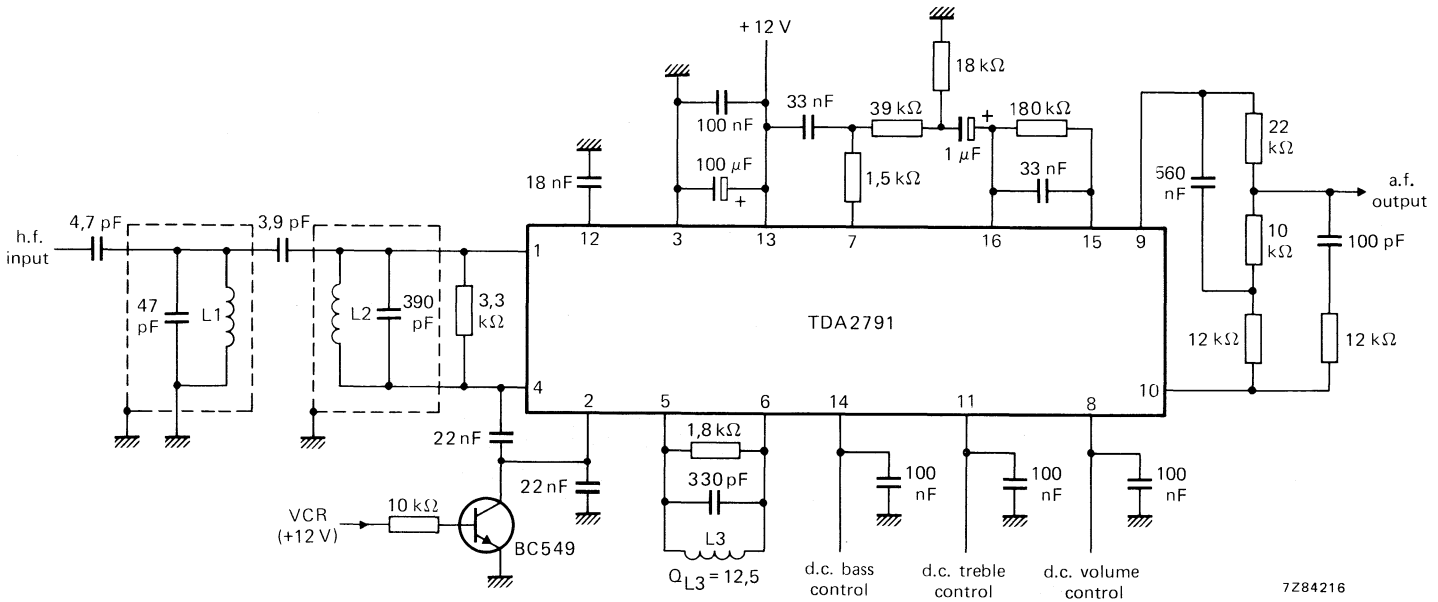


Fig. 9 Application circuit diagram.

TV STEREO/DUAL SOUND IDENTIFICATION DECODER

The TDA2795 is a monolithic integrated circuit for stereo/dual sound in television receivers.

The circuit incorporates the following functions:

- Controlled pilot signal amplifier.
- Envelope demodulator.
- Two separate signal paths for processing the identification frequencies: operational amplifier for active filter, integral evaluation circuit with TTL compatible 'open collector' outputs.
- Stereo indicator driver.

QUICK REFERENCE DATA

Supply voltage	V_S	typ.	12 V
Supply current	I_S	typ.	8 mA
Nominal input voltage at f = 54,6875 kHz	V_i	typ.	10 mV
Input impedance	$\|Z_i\|$	$\geqslant$	500 kΩ
Operational amplifier			
open loop voltage gain at 200 Hz	G_o	$\geqslant$	78 dB
input resistance	R_i	$\geqslant$	1 MΩ
output resistance	R_o	$\leqslant$	3,5 kΩ
Supply voltage range	V_S		10,8 to 13,2 V
Operating ambient temperature range	T_{amb}		0 to + 70 °C

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102DS).

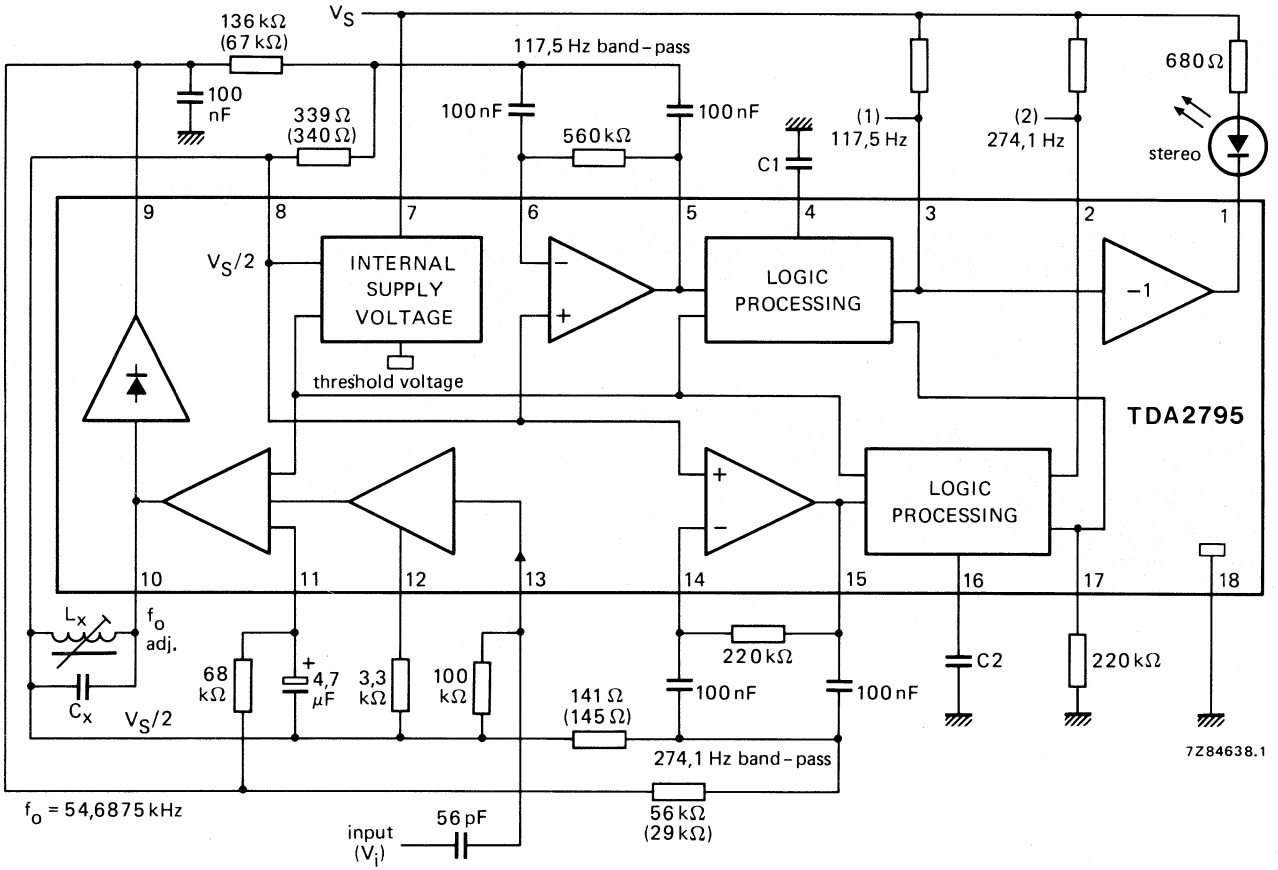


Fig. 1 Block diagram; C1 and C2 values 22 to 150 nF (dependent on switching time); values given in parenthesis are for G = 4 at 117,5/274,1 Hz; C_x = 3,3 nF.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 7)	$V_{7-18} = V_S$	max.	15	V
Signal input (pin 13)	V_{13-18}	max.	V_S	V
	$-V_{13-18}$	max.	0,5	V
Switch outputs (pins 1, 2 and 3)	V_{1-18}	max.	18	V
	I_1	max.	50	mA
	$V_{2;3-18}$	max.	15	V
	$I_{2;3}$	max.	5	mA
	$-V_{1;2;3-18}$	max.	0,5	V
Total power dissipation	P_{tot}	max.	800	mW
Storage temperature range	T_{stg}		−25 to +125	°C
Operating ambient temperature range	T_{amb}		0 to + 70	°C

CHARACTERISTICS

V_S = 12 V; T_{amb} = 25 °C, unless otherwise specified; measured in Fig. 1, at V_i = 10 mV; f = 54,6875 kHz amplitude modulated with f_{m1} = 117,5 Hz or f_{m2} = 274,1 Hz; $m_1 = m_2$ = 50%.

Supply voltage range	V_S	10,8 to	13,2	V
Supply current	I_S	typ.	8	mA
		⩽	12	mA

Pilot signal amplifier and envelope demodulator

Maximum input voltage (peak-to-peak value)	$V_{i(p-p)}$	typ.	2	V
Input impedance	$\|Z_{13-18}\|$	⩾	500	kΩ
Voltage gain (V_{9-18}/V_{13-18}) at V_i = 1 mV	G_{v9-13}	typ.	42	dB
Start of control at V_i	see Fig. 3			
Control range	ΔG_v	⩾	40	dB
Controlled output voltage (r.m.s. value) (pin 9)	$V_{o(rms)}$	typ.	550	mV

Operational amplifiers

Input bias current (pins 6 and 14)	$\pm I_6; \pm I_{14}$	⩽	70	nA
Open loop voltage gain at f = 200 Hz	G_o	⩾	78	dB
Available output current (pins 5 and 15)	$\pm I_5; \pm I_{15}$	⩾	1,5	mA
Output resistance (pins 5 and 15)	R_o	typ.	2	kΩ
		⩽	3,5	kΩ
Allowable load capacitance	C_L	⩽	30	pF
Output offset voltage at R_{5-6} = 560 kΩ	$\pm V_{o5-8}$	⩽	70	mV

CHARACTERISTICS (continued)

Evaluation circuitry

Switch-on threshold voltage (pins 5 and 15)	$V_5; V_{15}$	typ.	1,0 V
Switch hysteresis	$\frac{V_{5on}}{V_{5off}} = \frac{V_{15on}}{V_{15off}}$	typ.	3,8 ± 0,5 dB
Switch outputs (pins 2 and 3)			
allowable output current	$I_3; I_2$	$\leqslant$	2 mA
saturation voltage at $I_3 = I_2 = 1{,}5$ mA	$V_{3;2\text{-}18sat}$	$\leqslant$	0,35 V
leakage voltage at $I_3 = I_2 \leqslant 5\ \mu A$	$V_{3;2\text{-}18}$	$\leqslant$	15 V
Indicator driver (pin 1)			
allowable output current	I_1	$\leqslant$	40 mA
saturation voltage at $I_1 = 20$ mA	$V_{1\text{-}18sat}$	$\leqslant$	0,8 V
leakage voltage at $I_1 < 10\ \mu A$	$V_{1\text{-}18}$	$\leqslant$	18 V

Internal reference voltage

Reference voltage (pin 8)	$V_{8\text{-}18}$	typ.	6 V
Available output current (pin 8)	$-I_8$	$\geqslant$	2 mA
	$+I_8$	$\geqslant$	0,6 mA

Reference current source

Reference voltage (pin 17)	$V_{17\text{-}18}$	typ.	5,3 V
Internal bias resistor	R_{i17}	typ.	5 kΩ
Allowable load resistor (pin 17)	R_L		180 to 270 kΩ

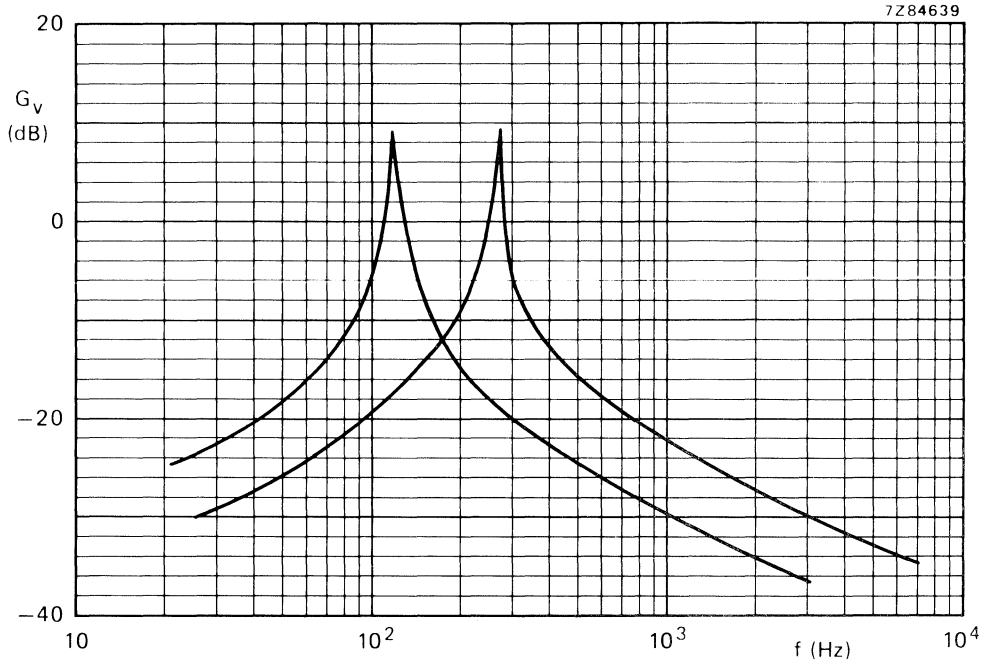


Fig. 2 Band-pass curves for 117,5 Hz and 274,1 Hz.

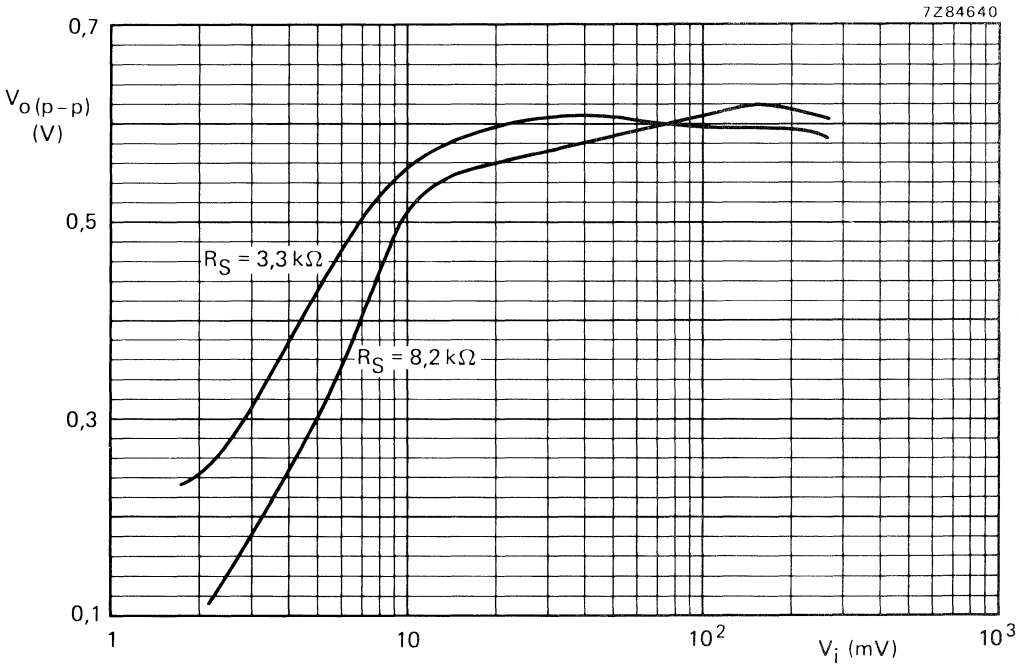


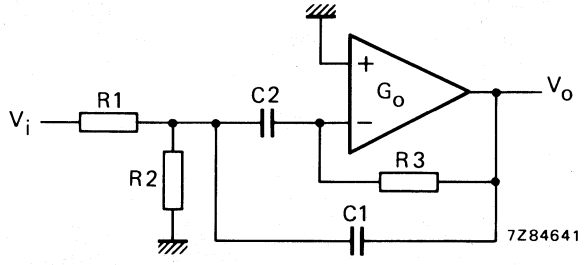
Fig. 3 Controlled output voltage as a function of the input signal (Q_o = 80); pilot frequency f_o = 54,6875 kHz; R_S is source resistance.

GENERAL FILTER CALCULATIONS

1. Gain

Amplifier conditions: $G_o >> G_v$ and $G_o >> 2 \cdot Q^2$

$$G_v = - \frac{\frac{p}{R1 \cdot C1}}{p^2 + p\frac{C1 + C2}{R3 \cdot C1 \cdot C2} + \frac{R1 + R2}{R1 \cdot R2 \cdot R3 \cdot C1 \cdot C2}}, \text{ in which: } p = j\omega; G_v = \frac{V_o}{V_i}$$



2. Resonance frequency

$$\omega_r = \frac{1}{\sqrt{\frac{R1 \cdot R2}{R1 + R2} \cdot R3 \cdot C1 \cdot C2}}$$

3. Gain at $\omega = \omega_r$

$$-G_{vr} = \frac{C2}{C1 + C2} \cdot \frac{R3}{R1}$$

4. Quality

$$Q = \frac{\sqrt{C1 \cdot C2}}{C1 + C2} \cdot \sqrt{\frac{R3\,(R1 + R2)}{R1 \cdot R2}}$$

5. Recommended components

C1 and C2: 5% MKC (metallized polycarbonate film capacitor)
R1, R2 and R3: 2% MR (metal film resistor)

or:

C1 and C2: 5% MKT (metallized polyester film capacitor)
R1, R2 and R3: 2% CR (carbon film resistor)

INFRARED RECEIVER

The TDA3047 is for infrared reception with low power consumption.
The difference between the TDA3047 and TDA3048 is the polarity of the output signal.

Features

- H.F. amplifier with a control range of 66 dB
- Synchronous demodulator and reference amplifier
- A.G.C. detector
- Pulse shaper
- Q-factor killing of the input selectivity, which is controlled by the a.g.c. circuit
- Input voltage limiter

QUICK REFERENCE DATA

Supply voltage (pin 8)	$V_P = V_{8\text{-}16}$	typ.	5 V
Supply current (pin 8)	$I_P = I_8$	typ.	2,1 mA
Input signal (peak-to-peak value) (100% AM; f = 36 kHz)	$V_{2\text{-}15(p\text{-}p)}$	0,02 to 200	mV
Output signal (peak-to-peak value)	$V_{9\text{-}16(p\text{-}p)}$	typ.	4,5 V

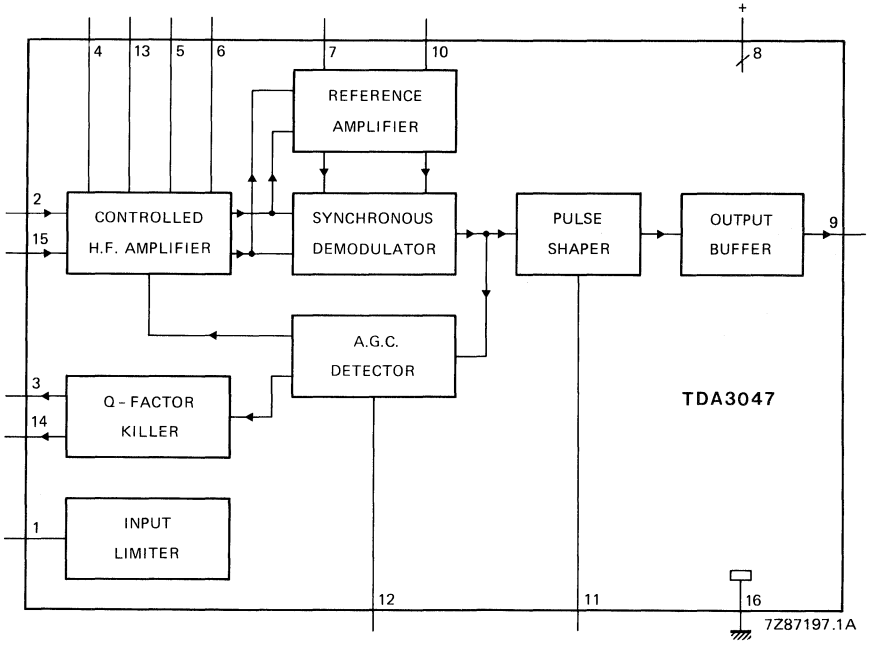


Fig. 1 Block diagram of TDA3047.

PACKAGE OUTLINES

TDA3047P: 16-lead DIL; plastic (SOT-38).
TDA3047T: 16-lead mini-pack; plastic (SO-16L; SOT-162A).

FUNCTIONAL DESCRIPTION

General

The circuit operates from a 5 V supply and has a current consumption of 2 mA. The output is a current source which can drive or suppress a current of $> 75\ \mu A$ with a voltage swing of 4,5 V. The Q-killer circuit eliminates distortion of the output pulses due to the decay of the tuned input circuit at high input voltages. The input circuit is protected against signals of > 600 mV by an input limiter. The typical input is an AM signal at a frequency of 36 kHz. Figures 3 and 4 show the circuit diagrams for the application of narrow-band and wide-band receivers respectively. Circuit description of the eight sections shown in Fig. 1 are given below.

Controlled h.f. amplifier

The input signal is amplified by the gain-controlled amplifier. This circuit comprises three d.c. amplifier stages connected in cascade. The overall gain of the circuit is approximately 83 dB and the gain control range is in the order of 66 dB. Gain control is initially active in the second amplifier stage and is transferred to the first stage as limiting in the second stage occurs, thus maintaining optimum signal-to-noise ratio. Offset voltages in the d.c. coupled amplifier are minimized by two negative feedback loops; these also allow the circuit to have some series resistance of the decoupling capacitor. The output signal of the amplifier is applied to the reference amplifier and to the synchronous demodulator inputs.

Reference amplifier

The reference amplifier amplifies and limits the input signal. The voltage gain is approximately 0 dB. The output signal of this amplifier is applied to the synchronous demodulator.

Synchronous demodulator

In the synchronous demodulator the input signal and reference signal are multiplied. The demodulator output current is 25 μA peak-to-peak. The output signal of the demodulator is fed to the input of the a.g.c. detector and to the input of the pulse-shaper circuit.

A.G.C. detector

The a.g.c. detector comprises two n-p-n transistors operating as a differential pair. The top level of the output signal from the synchronous demodulator is detected by the a.g.c. circuit. Noise pulses are integrated by an internal capacitor. The output signal is amplified and applied to the first and second stages of the amplifier and to the Q-factor killer circuit.

Pulse-shaper

The pulse-shaper comprises two n-p-n transistors operating as a differential pair connected in parallel with the a.g.c. differential pair. The slicing level of the pulse shaper is lower than the slicing level of the a.g.c. detector. The output of the pulse-shaper is determined by the voltage of the capacitor connected to pin 11, which is applied directly to the output buffer.

Output buffer

The voltage of the pulse-shaper capacitor is fed to the base of the first transistor of a differential pair. To obtain a correct RC-5 code, a hysteresis circuit protects the output against spikes. The output at pin 9 is active *high*.

Q-factor killer

Figure 3 shows the Q-factor killer in the narrow-band application. In this application it is necessary to decrease the Q-factor of the input selectivity particularly when large input signals occur at pins 2 and 15. In the narrow-band application the output of the Q-factor killer can be directly coupled to the input; pin 3 to pin 2 and pin 14 to pin 15.

Input limiter

In the narrow-band application high voltage peaks can occur on the input of the selectivity circuit. The input limiter limits these voltage peaks to approximately 0,7 V. Limiting is 0,9 V max. at I_1 = 3 mA.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 8)	$V_P = V_{8-16}$	max.	13,2 V
Output current pulse shaper (pin 11)	I_{11}	max.	10 mA
Voltages between pins*			
pins 2 and 15	V_{2-15}	max.	4,5 V
pins 4 and 13	V_{4-13}	max.	4,5 V
pins 5 and 6	V_{5-6}	max.	4,5 V
pins 7 and 10	V_{7-10}	max.	4,5 V
pins 9 and 11	V_{9-11}	max.	4,5 V
Storage temperature range	T_{stg}		−65 to + 150 °C
Operating ambient temperature range	T_{amb}		−25 to + 125 °C

* All pins except pin 11 are short-circuit protected.

CHARACTERISTICS

$V_P = V_{8-16} = 5$ V; $T_{amb} = 25$ °C; measured in Fig. 4; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 8)					
Supply voltage	$V_P = V_{8-16}$	4,65	5,0	5,35	V
Supply current	$I_P = I_8$	1,2	2,1	3,0	mA
Controlled h.f. amplifier (pins 2 and 15)					
Minimum input signal (peak-to-peak value)					
at f = 36 kHz (note 1)	$V_{2-15(p-p)}$	–	15	25	μV
at f = 36 kHz (note 2)	$V_{2-15(p-p)}$	–	–	5	μV
A.G.C. control range (without Q-killing)		60	66	–	dB
Input signal for correct operation (peak-to-peak value; note 3)	$V_{2-15(p-p)}$	0,02	–	200	mV
Q-killing inactive ($I_3 = I_{14} < 0{,}5$ μA) (peak-to-peak value)	$V_{2-15(p-p)}$	–	–	140	μV
Q-killing active ($I_{14} = I_3$ = max.) (peak-to-peak value)	$V_{2-15(p-p)}$	28	–	–	mV
Q-killing range			see Fig. 2		
Inputs					
Input voltage (pin 2)	V_{2-16}	2,25	2,45	2,65	V
Input voltage (pin 15)	V_{15-16}	2,25	2,45	2,65	V
Input resistance (pin 2)	R_{2-15}	10	15	20	kΩ
Input capacitance (pin 2)	C_{2-15}	–	3	–	pF
Input limiting (pin 1) at I_1 = 3 mA	V_{1-16}	–	0,8	0,9	V
Outputs					
Output voltage *high* (pin 9) at $-I_9 = 75$ μA	$-V_{9-8}$	–	0,1	0,5	V
Output voltage *low* (pin 9) at $I_9 = 75$ μA	V_{9-16}	–	0,1	0,5	V
Output current; output voltage *high*					
at $V_{9-16} = 4{,}5$ V	$-I_9$	75	120	–	μA
at $V_{9-16} = 3{,}0$ V	$-I_9$	75	130	–	μA
at $V_{9-16} = 1{,}0$ V	$-I_9$	75	140	–	μA
Output current; output voltage *low* at $V_{9-16} = 0{,}5$ V	I_9	75	120	–	μA
Output resistance between pins 7 and 10	R_{7-10}	3,1	4,7	6,2	kΩ

Notes

1. Voltage pin 9 is *high*; $-I_9 = 75$ μA.
2. Voltage pin 9 remains *low*.
3. Undistorted output pulse with 100% AM input.

parameter	symbol	min.	typ.	max.	unit
Pulse shaper (pin 11)					
Trigger level in positive direction (voltage pin 9 changes from *high* to *low*)	V_{11-16}	3,75	3,9	4,05	V
Trigger level in negative direction (voltage pin 9 changes from *low* to *high*)	V_{11-16}	3,4	3,55	3,7	V
Hysteresis of trigger levels	ΔV_{11-16}	0,25	0,35	0,45	V
A.G.C. detector (pin 12)					
A.G.C. capacitor charge current	$-I_{12}$	3,3	4,7	6,1	μA
A.G.C. capacitor discharge current	I_{12}	67	100	133	μA
Q-factor killer (pins 3 and 14)					
Output current (pin 3) at $V_{12-16} = 2$ V	$-I_3$	2,5	7,5	15	μA
Output current (pin 14) at $V_{12-16} = 2$ V	$-I_{14}$	2,5	7,5	15	μA

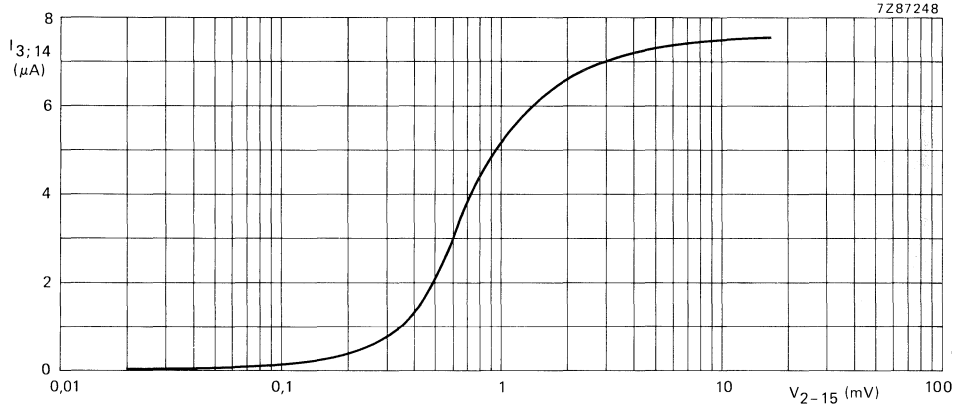
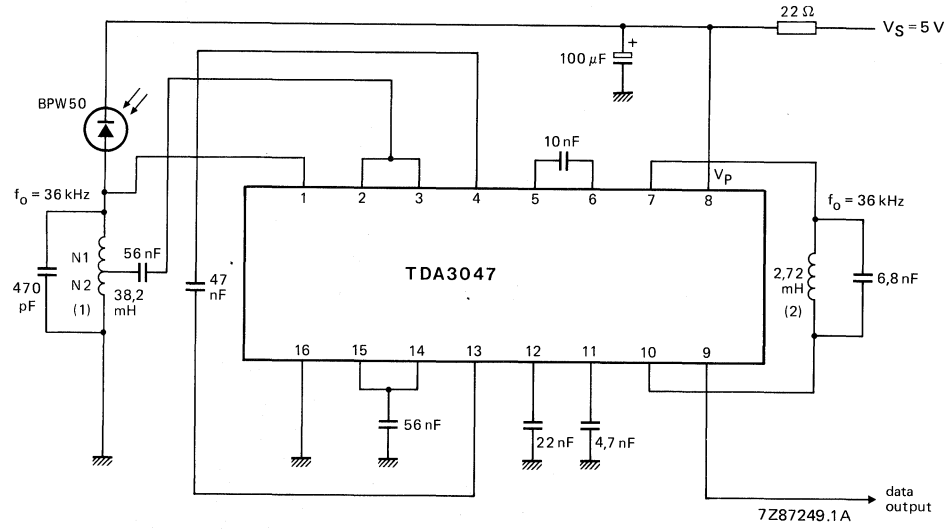


Fig. 2 Typical Q-factor killer current (pins 3 and 14) as a function of the peak-to-peak input voltage (V_{2-15}); $I_{3,14}$ is measured to ground, $V_{2-15(p-p)}$ is a symmetrical square wave. Measured in Fig. 4; $V_P = 5$ V.

APPLICATION INFORMATION



(1) N1 = 3,21
N2 = 1
Q = 16

(2) Q = 6

Fig. 3 Narrow-band receiver using TDA3047.

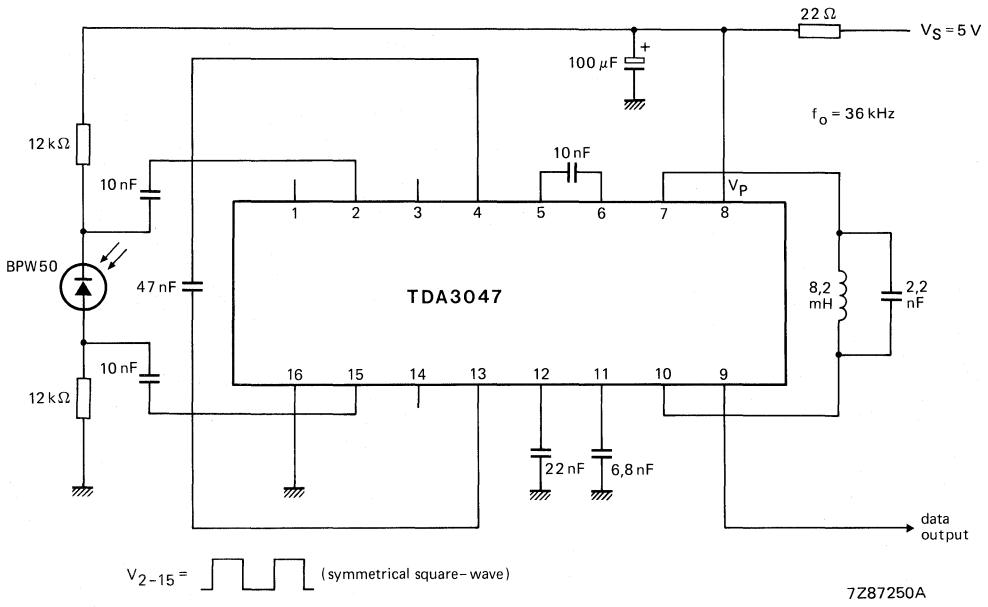


Fig. 4 Wide-band receiver with TDA3047.

For better sensitivity both 12 kΩ resistors may have a higher value.

INFRARED RECEIVER

The TDA3048 is for infrared reception with low power consumption.
The difference between the TDA3048 and TDA3047 is the polarity of the output signal.

Features

- H.F. amplifier with a control range of 66 dB
- Synchronous demodulator and reference amplifier
- A.G.C. detector
- Pulse shaper
- Q-factor killing of the input selectivity, which is controlled by the a.g.c. circuit
- Input voltage limiter

QUICK REFERENCE DATA

Supply voltage (pin 8)	$V_P = V_{8\text{-}16}$	typ.	5 V
Supply current (pin 8)	$I_P = I_8$	typ.	2,1 mA
Input signal (peak-to-peak value) (100% AM; f = 36 kHz)	$V_{2\text{-}15(p\text{-}p)}$		0,02 to 200 mV
Output signal (peak-to-peak value)	$V_{9\text{-}16(p\text{-}p)}$	typ.	4,5 V

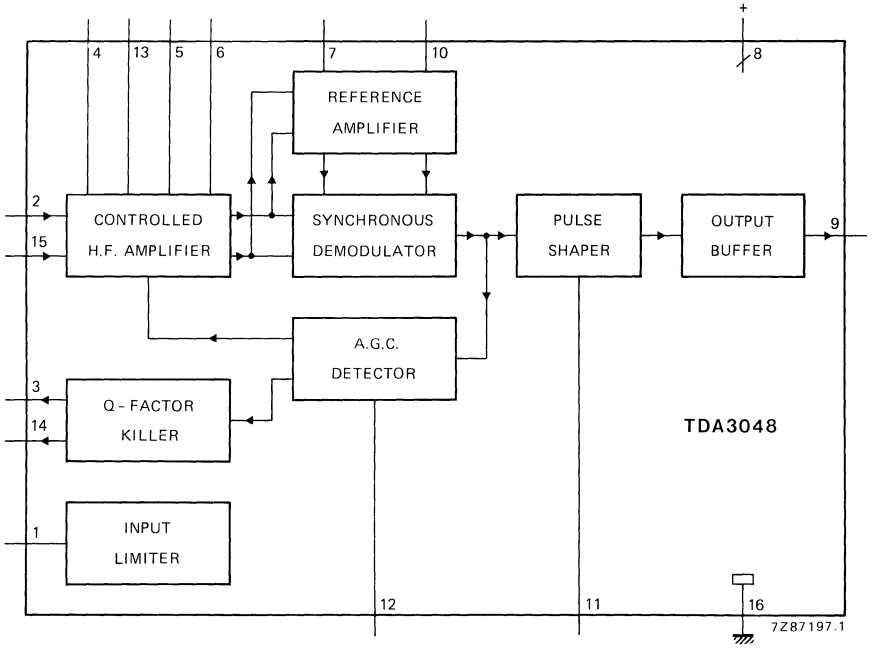


Fig. 1 Block diagram of TDA3048.

PACKAGE OUTLINES

TDA3048P: 16-lead DIL; plastic (SOT-38).
TDA3048T: 16-lead mini-pack; plastic (SO-16L; SOT-162A).

FUNCTIONAL DESCRIPTION

General

The circuit operates from a 5 V supply and has a current consumption of 2 mA. The output is a current source which can drive or suppress a current of $> 75\ \mu A$ with a voltage swing of 4,5 V. The Q-killer circuit eliminates distortion of the output pulses due to the decay of the tuned input circuit at high input voltages. The input circuit is protected against signals of > 600 mV by an input limiter. The typical input is an AM signal at a frequency of 36 kHz. Figures 3 and 4 show the circuit diagrams for the application of narrow-band and wide-band receivers respectively. Circuit description of the eight sections shown in Fig. 1 are given below.

Controlled h.f. amplifier

The input signal is amplified by the gain-controlled amplifier. This circuit comprises three d.c. amplifier stages connected in cascade. The overall gain of the circuit is approximately 83 dB and the gain control range is in the order of 66 dB. Gain control is initially active in the second amplifier stage and is transferred to the first stage as limiting in the second stage occurs, thus maintaining optimum signal-to-noise ratio. Offset voltages in the d.c. coupled amplifier are minimized by two negative feedback loops; these also allow the circuit to have some series resistance of the decoupling capacitor. The output signal of the amplifier is applied to the reference amplifier and to the synchronous demodulator inputs.

Reference amplifier

The reference amplifier amplifies and limits the input signal. The voltage gain is approximately 0 dB. The output signal of this amplifier is applied to the synchronous demodulator.

Synchronous demodulator

In the synchronous demodulator the input signal and reference signal are multiplied. The demodulator output current is 25 μA peak-to-peak. The output signal of the demodulator is fed to the input of the a.g.c. detector and to the input of the pulse-shaper circuit.

A.G.C. detector

The a.g.c. detector comprises two n-p-n transistors operating as a differential pair. The top level of the output signal from the synchronous demodulator is detected by the a.g.c. circuit. Noise pulses are integrated by an internal capacitor. The output signal is amplified and applied to the first and second stages of the amplifier and to the Q-factor killer circuit.

Pulse-shaper

The pulse-shaper comprises two n-p-n transistors operating as a differential pair connected in parallel with the a.g.c. differential pair. The slicing level of the pulse shaper is lower than the slicing level of the a.g.c. detector. The output of the pulse-shaper is determined by the voltage of the capacitor connected to pin 11, which is applied directly to the output buffer.

Output buffer

The voltage of the pulse-shaper capacitor is fed to the base of the first transistor of a differential pair. To obtain a correct RC-5 code, a hysteresis circuit protects the output against spikes. The output at pin 9 is active *low*.

Q-factor killer

Figure 3 shows the Q-factor killer in the narrow-band application. In this application it is necessary to decrease the Q-factor of the input selectivity particularly when large input signals occur at pins 2 and 15. In the narrow-band application the output of the Q-factor killer can be directly coupled to the input; pin 3 to pin 2 and pin 14 to pin 15.

Input limiter

In the narrow-band application high voltage peaks can occur on the input of the selectivity circuit. The input limiter limits these voltage peaks to approximately 0,7 V. Limiting is 0,9 V max. at I_1 = 3 mA.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 8)	$V_P = V_{8-16}$	max.	13,2 V
Output current pulse shaper (pin 11)	I_{11}	max.	10 mA
Voltages between pins*			
pins 2 and 15	V_{2-15}	max.	4,5 V
pins 4 and 13	V_{4-13}	max.	4,5 V
pins 5 and 6	V_{5-6}	max.	4,5 V
pins 7 and 10	V_{7-10}	max.	4,5 V
pins 9 and 11	V_{9-11}	max.	4,5 V
Storage temperature range	T_{stg}		−65 to + 150 °C
Operating ambient temperature range	T_{amb}		−25 to + 125 °C

* All pins except pin 11 are short-circuit protected.

CHARACTERISTICS

$V_P = V_{8-16} = 5$ V; $T_{amb} = 25$ °C; measured in Fig. 4; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 8)					
Supply voltage	$V_P = V_{8-16}$	4,65	5,0	5,35	V
Supply current	$I_P = I_8$	1,2	2,1	3,0	mA
Controlled h.f. amplifier (pins 2 and 15)					
Minimum input signal (peak-to-peak value)					
at f = 36 kHz (note 1)	$V_{2-15(p-p)}$	–	15	25	μV
at f = 36 kHz (note 2)	$V_{2-15(p-p)}$	–	–	5	μV
A.G.C. control range (without Q-killing)		60	66	–	dB
Input signal for correct operation (peak-to-peak value; note 3)	$V_{2-15(p-p)}$	0,02	–	200	mV
Q-killing inactive ($I_3 = I_{14} < 0{,}5$ μA) (peak-to-peak value)	$V_{2-15(p-p)}$	–	–	140	μV
Q-killing active ($I_{14} = I_3$ = max.) (peak-to-peak value)	$V_{2-15(p-p)}$	28	–	–	mV
Q-killing range			see Fig. 2		
Inputs					
Input voltage (pin 2)	V_{2-16}	2,25	2,45	2,65	V
Input voltage (pin 15)	V_{15-16}	2,25	2,45	2,65	V
Input resistance (pin 2)	R_{2-15}	10	15	20	kΩ
Input capacitance (pin 2)	C_{2-15}	–	3	–	pF
Input limiting (pin 1) at I_1 = 3 mA	V_{1-16}	–	0,8	0,9	V
Outputs					
Output voltage *high* (pin 9) at $-I_9 = 75$ μA	$-V_{9-8}$	–	0,1	0,5	V
Output voltage *low* (pin 9) at $I_9 = 75$ μA	V_{9-16}	–	0,1	0,5	V
Output current; output voltage *low*					
$-V_{9-8} = 4{,}5$ V	I_9	75	120	–	μA
$-V_{9-8} = 3{,}0$ V	I_9	75	130	–	μA
$-V_{9-8} = 1{,}0$ V	I_9	75	140	–	μA
Output current; output voltage *high*					
$-V_{9-8} = 0{,}5$ V	$-I_9$	75	120	–	μA
Output resistance between pins 7 and 10	R_{7-10}	3,1	4,7	6,2	kΩ

Notes

1. Voltage pin 9 is *low*; $I_9 = 75$ μA.
2. Voltage pin 9 remains *high*.
3. Undistorted output pulse with 100% AM input.

parameter	symbol	min.	typ.	max.	unit
Pulse shaper (pin 11)					
Trigger level in positive direction (voltage pin 9 changes from *high* to *low*	V_{11-16}	3,75	3,9	4,05	V
Trigger level in negative direction (voltage pin 9 changes from *low* to *high*	V_{11-16}	3,4	3,55	3,7	V
Hysteresis of trigger levels	ΔV_{11-16}	0,25	0,35	0,45	V
A.G.C. detector (pin 12)					
A.G.C. capacitor charge current	$-I_{12}$	3,3	4,7	6,1	μA
A.G.C. capacitor discharge current	I_{12}	67	100	133	μA
Q-factor killer (pins 3 and 14)					
Output current (pin 3) at V_{12-16} = 2 V	$-I_3$	2,5	7,5	15	μA
Output current (pin 14) at V_{12-16} = 2 V	$-I_{14}$	2,5	7,5	15	μA

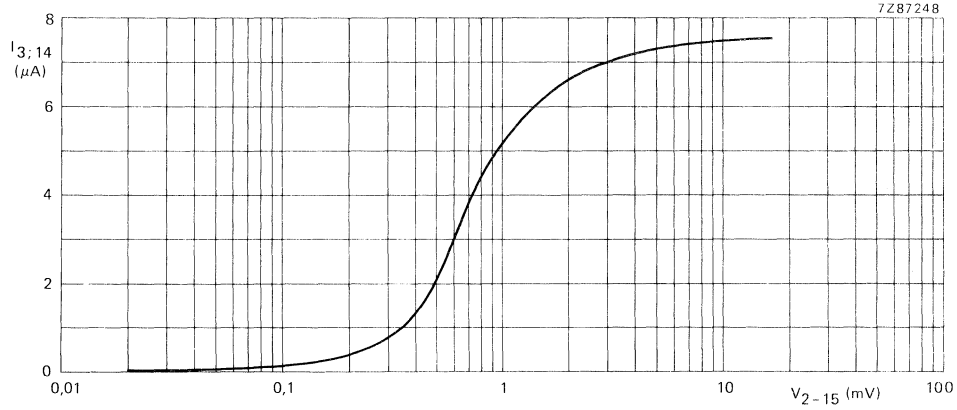
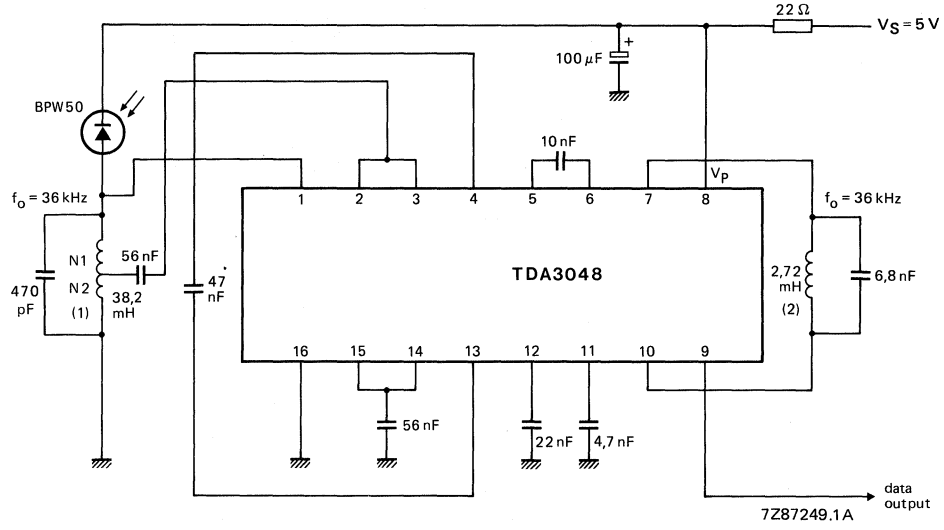


Fig. 2 Typical Q-factor killer current (pins 3 and 14) as a function of the peak-to-peak input voltage (V_{2-15}); $I_{3,14}$ is measured to ground, $V_{2-15(p-p)}$ is a symmetrical square wave. Measured in Fig. 4; V_P = 5 V.

APPLICATION INFORMATION



(1) N1 = 3,21
N2 = 1
Q = 16

(2) Q = 6

Fig. 3 Narrow-band receiver using TDA3048.

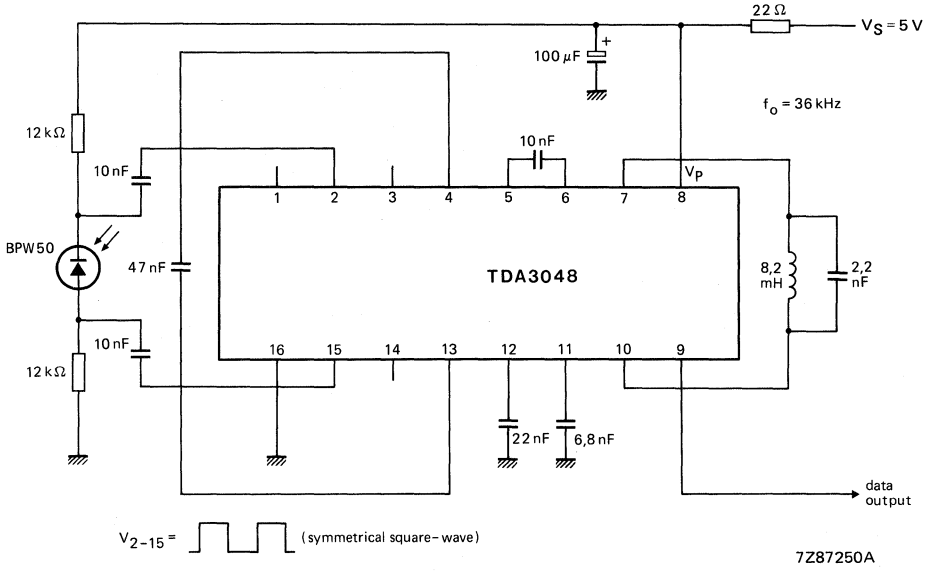


Fig. 4 Wide-band receiver with TDA3048.
For better sensitivity both 12 kΩ resistors may have a higher value.

VIDEO CONTROL COMBINATION

The TDA3501 is a monolithic integrated circuit performing the control functions in a PAL/SECAM decoder which additionally comprises the integrated circuits TDA3510 (PAL decoder) and/or TDA3520 (SECAM decoder).
The required input signals are: luminance and colour difference −(R-Y) and −(B-Y), while linear RGB signals can be inserted from an external source.
RGB signals are provided at the output to drive the video output stages.
The TDA3501 has the following features:

- capacitive coupling of the input signals
- linear saturation control
- (G-Y) and RGB matrix
- insertion possibility of linear RGB signals, e.g. video text, video games, picture-in-picture, camera or slide-scanner
- equal black level for inserted and matrixed signals by clamping
- 3 identical channels for the RGB signals
- linear contrast and brightness control, operating on both the inserted and matrixed RGB signals
- horizontal and vertical blanking (black and ultra-black respectively) and black-level clamping obtained via a 3-level sandcastle pulse
- differential amplifiers with feedback-inputs for stabilization of the RGB output stages
- 2 d.c. gain controls for the green and blue output signals (white point adjustment)
- beam current limiting possibility

QUICK REFERENCE DATA

Supply voltage	$V_{6\text{-}24}$	typ.	12 V
Supply current	I_6	typ.	100 mA
Luminance input signal (peak-to-peak value)	$V_{15\text{-}24(p\text{-}p)}$	typ.	0,45 V
Luminance input resistance	$R_{15\text{-}24}$	typ.	12 kΩ
Colour difference input signals (peak-to-peak values)			
−(B-Y)	$V_{18\text{-}24(p\text{-}p)}$	typ.	1,33 V
−(R-Y)	$V_{17\text{-}24(p\text{-}p)}$	typ.	1,05 V
Inserted RGB signals (peak-to-peak values)	$V_{12,13,14\text{-}24(p\text{-}p)}$	typ.	1 V
Three-level sandcastle pulse detector	$V_{10\text{-}24}$	typ.	2,5/4,5/8,0 V
Control voltage ranges			
brightness	$V_{20\text{-}24}$		1 to 3 V
contrast	$V_{19\text{-}24}$		2 to 4 V
saturation	$V_{16\text{-}24}$		2,1 to 4 V

PACKAGE OUTLINE

28-lead DIL; plastic (SOT-117).

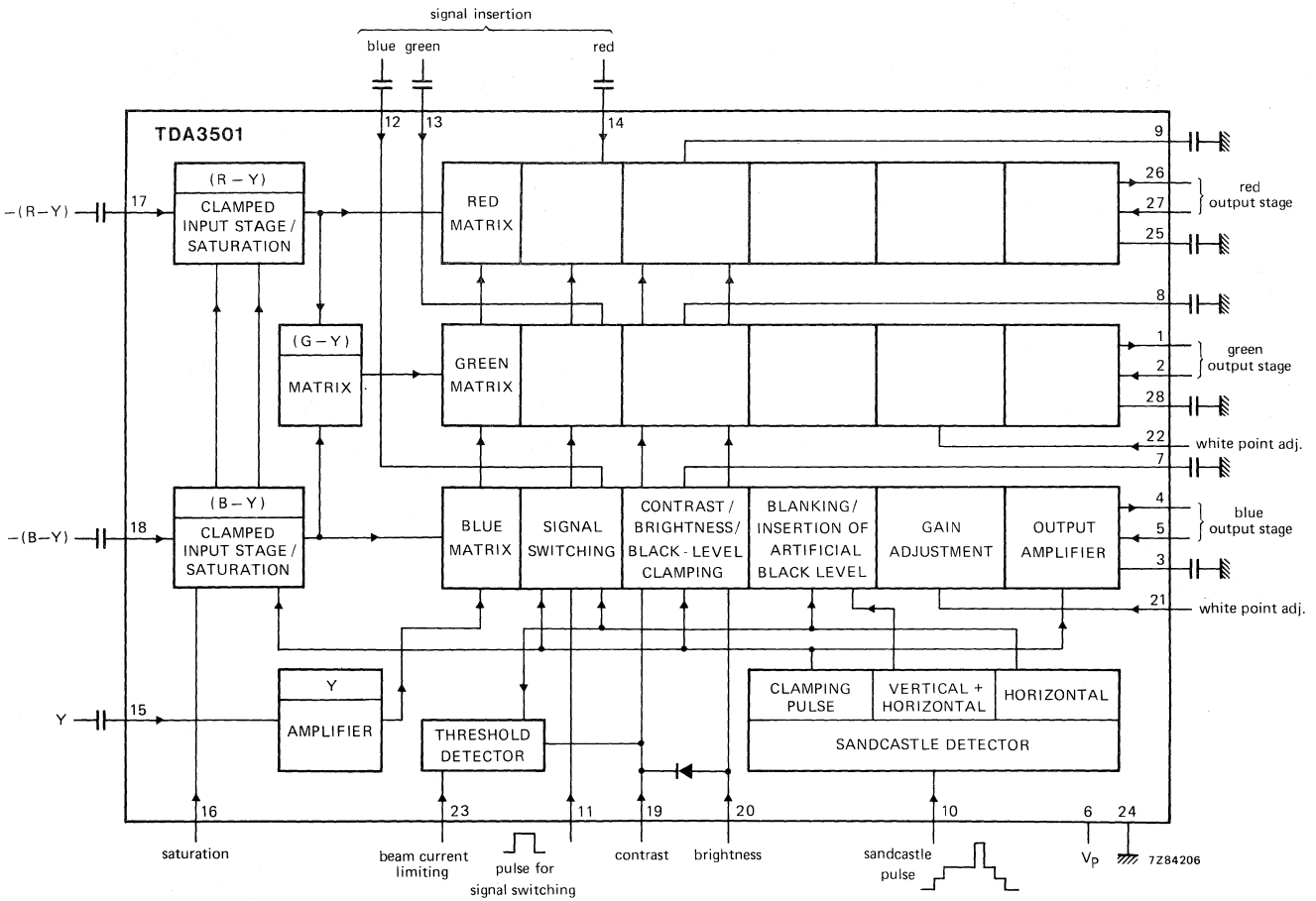


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			min.	max.	
Supply voltage	$V_P = V_{6-24}$		–	13,2	V
Voltages with respect to pin 24					
pins 1,4,26	$V_{1,4,26-24}$		½V_P	V_P + 1	V
pins 2,5,27	$V_{2,5,27-24}$		0	V_P	V
pin 10	V_{10-24}		0	V_P	V
pin 11	V_{11-24}		–0,5	3	V
pins 16,19,20	$V_{16,19,20-24}$		0	½V_P	V
pins 21,22	$V_{21,22-24}$		0	V_P	V
pin 23	V_{23-24}		0	V_P	V
pins 3,25,28; 7,8,9; 12,13,14; 15,17,18	no external d.c. voltage				
Current at pin 20	I_{20}	max.		5	mA
Total power dissipation	P_{tot}	max.		1,7	W
Storage temperature	T_{stg}		–25 to + 125		°C
Operating ambient temperature	T_{amb}		0 to + 70		°C

CHARACTERISTICS

Supply voltage range	V_P		10,8 to 13,2	V
The following characteristics are measured in Fig. 2; V_P = 12 V; T_{amb} = 25 °C; $V_{18-24(p-p)}$ = 1,33 V; $V_{17-24(p-p)}$ = 1,05 V; $V_{15-24(p-p)}$ = 0,45 V; $V_{12,13,14-24(p-p)}$ = 1 V; unless otherwise specified				
Current consumption	I_6	typ.	100	mA
Colour difference inputs				
–(B-Y) input signal (peak-to-peak value)*	$V_{18-24(p-p)}$		1,33	V
–(R-Y) input signal (peak-to-peak value)*	$V_{17-24(p-p)}$		1,05	V
Internal resistance of colour difference sources		<	200	Ω
Input resistance	$R_{17,18-24}$	>	100	kΩ
Internal d.c. voltage due to clamping	$V_{17,18-24}$	typ.	4,2	V
Saturation control				
control voltage range for a change of saturation from –20 dB to + 6 dB	V_{16-24}		2,1 to 4	V
control voltage for attenuation > 40 dB	V_{16-24}	<	1,8	V
nominal saturation (6 dB below max.)	V_{16-24}	typ.	3	V
input current	I_{16}	<	20	μA

* For saturated colour bar with 75% of maximum amplitude.

CHARACTERISTICS (continued)

(G-Y) matrix

Matrixed according the equation	$V_{(G-Y)} = -0{,}51\ V_{(R-Y)} - 0{,}19\ V_{(B-Y)}$		

Luminance amplifier

Input signal (peak-to-peak)	$V_{15\text{-}24(p\text{-}p)}$		0,45 V
Input resistance	$R_{15\text{-}24}$	typ.	12 kΩ
Internal d.c. voltage	$V_{15\text{-}24}$	typ.	2,7 V

RGB channels

Signal switching input voltage for insertion			
on level	$V_{11\text{-}24}$		0,9 to 1,5 V
off level	$V_{11\text{-}24}$		−0,5 to + 0,3 V
Input current	I_{11}		−100 to + 200 μA
Signal insertion			
external RGB input signal (peak-to-peak value)*	$V_{12,13,14\text{-}24(p\text{-}p)}$		1 V
internal d.c. voltage due to clamping	$V_{12,13,14\text{-}24}$	typ.	3,5 V
input current	$I_{12,13,14}$	<	5 μA
Contrast control			
control voltage range for a change of contrast from −17 dB to + 3 dB	$V_{19\text{-}24}$		2 to 4 V
nominal contrast (3 dB below max.)	$V_{19\text{-}24}$	typ.	3,4 V
control voltage for −6 dB	$V_{19\text{-}24}$	typ.	2,7 V
input current at $V_{23\text{-}24} \geqslant 6$ V	I_{19}	<	2,5 μA
Beam current limiting			
internal d.c. voltage	$V_{23\text{-}24}$	typ.	6 V
input resistance	$R_{23\text{-}24}$	typ.	10 kΩ
input current contrast control			
$V_{23\text{-}24} = 5{,}8$ V	I_{19}	typ.	0,7 mA
$V_{23\text{-}24} = 5{,}7$ V	I_{19}	typ.	10 mA
$V_{23\text{-}24} = 5{,}6$ V	I_{19}	typ.	16 mA
Brightness control			
control voltage range	$V_{20\text{-}24}$		1 to 3 V
nominal brightness voltage	$V_{20\text{-}24}$		2 V
input current	I_{20}	<	10 μA
control voltage for nominal black level which equals the inserted artificial black level	$V_{20\text{-}24}$	typ.	2 V
change of black level in the control range related to the nominal luminance signal (black-white)		typ.	± 50 %

* During the clamping time (see sandcastle detector Fig. 1), the inserted RGB signals are clamped to the same black level as the internal RGB signals. For proper clamping, the internal resistance of the external signal sources should be < 200 Ω.

Internal signal limiting*			
signal limiting for nominal luminance (black to white = 100%)			
black		typ.	−25 %
white		typ.	125 %
White point adjustment			
A.C. voltage gain **			
at $V_{21,22\text{-}24}$ = 6 V			100 %
at $V_{21,22\text{-}24}$ = 0 V		<	60 %
at $V_{21,22\text{-}24}$ = 12 V		>	140 %
Input resistance	$R_{21,22\text{-}24}$	typ.	20 kΩ
Differential output amplifier			
Feedback inputs (pins 2,5,27)			
d.c. voltage during clamping	$V_{2,5,27\text{-}24}$	5,79 to 5,95	V
voltage difference between the feedback inputs	ΔV	<	80 mV
input resistance	$R_{2,5,27\text{-}24}$	>	100 kΩ
Output amplifiers (pins 1,4,26)			
transconductance	$\frac{\Delta I_1}{\Delta V_{2\text{-}24}} = \frac{\Delta I_4}{\Delta V_{5\text{-}24}} = \frac{\Delta I_{26}}{\Delta V_{27\text{-}24}}$	typ.	20 mA/V
integrated load resistance	$R_{1,4,26\text{-}24}$	typ.	610 Ω
output current (peak value)			
at $V_{1,4,26\text{-}24}$ = 8,2 V	$\pm I_{1,4,26\ m}$	typ.	5 mA
Gain data			
At nominal contrast, saturation and white point adjustment			
Voltage gain between Y-input (pin 15) and feedback inputs (pins 2,5,27)	$G_{2,5,27\text{-}15}$	typ.	10 dB
Frequency response (0 to 5 MHz)	$d_{2,5,27\text{-}15}$	<	3 dB
Voltage gain between colour difference inputs (pins 17 and 18) and feedback inputs (pin 5 and 27)	$G_{5\text{-}18} = G_{27\text{-}17}$	typ.	0 dB
Frequency response (0 to 2 MHz)	$d_{5\text{-}18} = d_{27\text{-}17}$	<	3 dB
Voltage gain between signal display inputs (pins 12,13,14) and feedback inputs (pins 2,5,27)	$G_{2\text{-}13} = G_{5\text{-}12} = G_{27\text{-}14}$	typ.	0 dB
Frequency response (0 to 5 MHz)	$d_{2\text{-}13} = d_{5\text{-}12} = d_{27\text{-}14}$	<	3 dB

* Brightness, contrast and saturation control in nominal position.

** With input pins 21 and 22 not connected an internal bias voltage of 6 V is supplied.

CHARACTERISTICS (continued)

Sandcastle detector

There are 3 internal thresholds (proportional to V_P) the following amplitudes are required for separating the various pulses:

horizontal and vertical blanking pulses (note 1)	V_{10-24}	$>$	2 V
		$<$	3 V
horizontal pulse (note 2)	V_{10-24}	$>$	4 V
		$<$	5 V
clamping pulse (note 3)	V_{10-24}	$>$	7,5 V
d.c. voltage for artificial black level (note 4) (scan and flyback)	V_{10-24}	$>$	7,5 V
no keying	V_{10-24}	$<$	1 V
Input current	$-I_{10}$	$<$	100 μA

Notes

1. Blanking to ultra-black (−20%).
2. Insertion of artificial black level.
3. Pulse duration $>$ 3,5 μs.
4. This function will also be obtained by leaving pin 10 open.

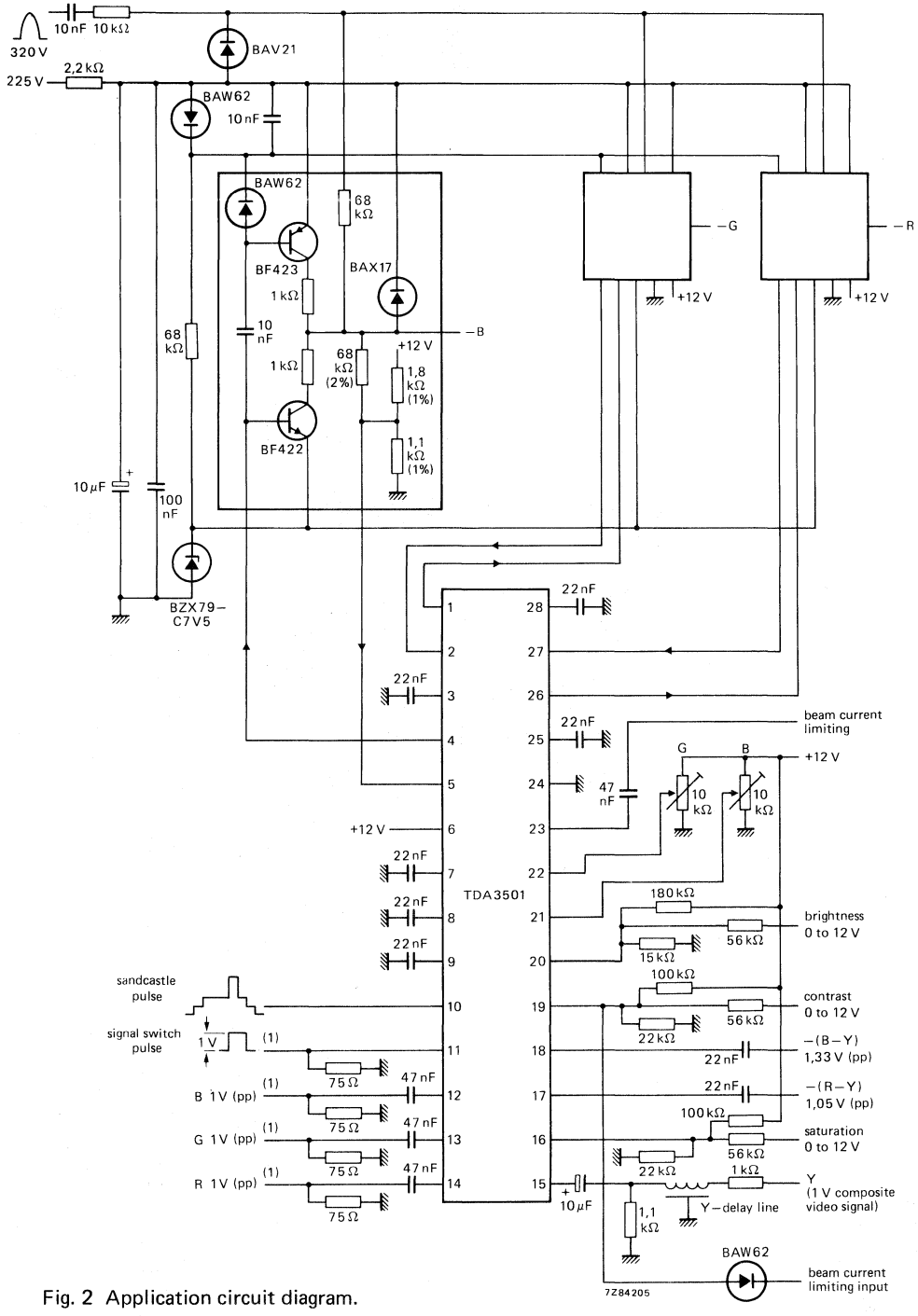


Fig. 2 Application circuit diagram.

VIDEO CONTROL COMBINATION CIRCUIT

with automatic cut-off control

The TDA3505 performs the control functions in a PAL/SECAM decoder, which also comprises the TDA3510 (PAL decoder) and/or TDA3530 (SECAM decoder).

The required input signals are: luminance and colour difference −(R-Y) and −(B-Y), while linear RGB signals can be inserted from external sources. RGB output signals are delivered for driving the video output stages. This circuit provides automatic cut-off control of the picture tube. The TDA3505 has the following features:

- capacitive coupling of the colour difference and luminance input signals with black level clamping in the input stages
- linear saturation control in the colour difference stages
- (G-Y) and RGB matrix
- linear transmission of inserted signals
- equal black levels for inserted and matrixed signals
- 3 identical channels for the RGB signals
- linear contrast and brightness control, operating on both the inserted and matrixed RGB signals
- peak beam current limiting input
- horizontal and vertical blanking and clamping of the three input signals obtained via a 3-level sandcastle pulse
- d.c. gain controls for each of the RGB output signals (white point adjustment)
- emitter-follower outputs for driving the RGB output stages
- input for automatic cut-off control of the picture tube
- compensation for leakage current of the picture tube

QUICK REFERENCE DATA

Supply voltage	$V_{6\text{-}24} = V_P$	typ.	12 V
Supply current	$I_6 = I_P$	typ.	85 mA
Composite video input signal (peak-to-peak value)	$V_{15\text{-}24(p\text{-}p)}$	typ.	0,45 V
Input resistance	$R_{15\text{-}24}$	>	100 kΩ
Colour difference input signals (peak-to-peak values)			
−(B-Y)	$V_{18\text{-}24(p\text{-}p)}$	typ.	1,33 V
−(R-Y)	$V_{17\text{-}24(p\text{-}p)}$	typ.	1,05 V
Inserted RGB signals (black-to-white values)	$V_{12,13,14\text{-}24(p\text{-}p)}$	typ.	1 V
Three-level sandcastle pulse (required input voltage)	$V_{10\text{-}24}$	typ.	2,5/4,5/8,0 V
Control voltage ranges			
brightness	$V_{20\text{-}24}$		1,0 to 3,0 V
contrast	$V_{19\text{-}24}$		2,0 to 4,3 V
saturation	$V_{16\text{-}24}$		2,0 to 4,3 V

PACKAGE OUTLINE

28-lead DIL; plastic (SOT-117).

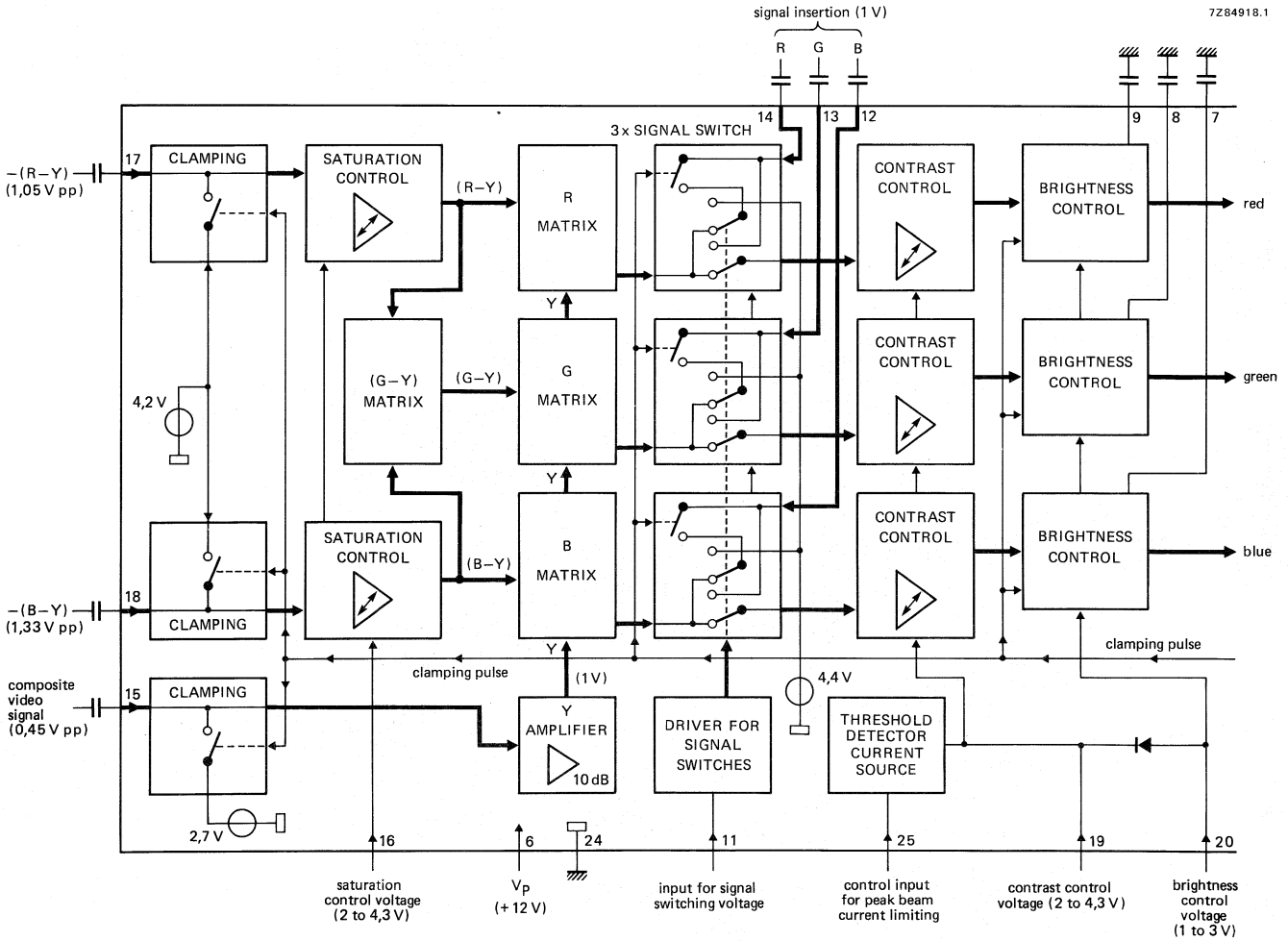


Fig. 1a Part of block diagram; continued in Fig. 1b.

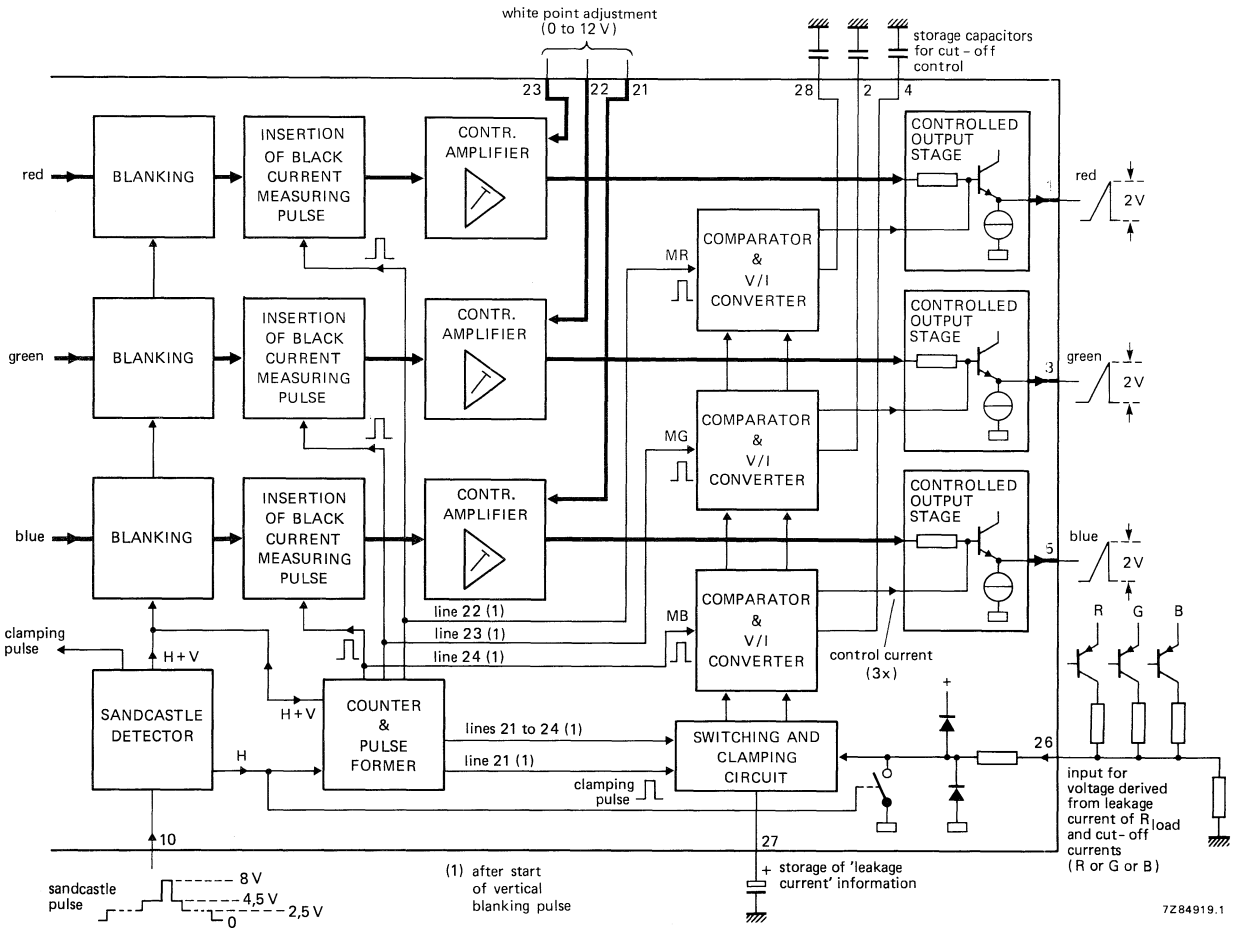


Fig. 1b Part of block diagram; continued from Fig. 1a.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

		min.	max.	
Supply voltage	$V_P = V_{6-24}$	–	13,2	V
Voltages with respect to pin 24				
pin 26	V_{26-24}	0	V_P	V
pin 25	V_{25-24}	0	V_P	V
pin 10	V_{10-24}	0	V_P	V
pin 11	V_{11-24}	−0,5	3	V
pins 16, 19, 20	$V_{16,19,20-24}$	0	0,5 V_P	V
pins 21, 22, 23	$V_{21,22,23-24}$	0	V_P	V
pins 1, 3, 5; 2, 4, 28; 7, 8, 9; 12, 13, 14; 15, 17, 18; 27	no external d.c. voltage			
Currents				
pins 1, 3, 5	$-I_{1, 3, 5}$	max.	3	mA
pin 19	I_{19}	max.	10	mA
pin 20	I_{20}	max.	5	mA
pin 25	$-I_{25}$	max.	5	mA
Total power dissipation	P_{tot}	max.	1,7	W
Storage temperature range	T_{stg}		−25 to +125	°C
→ Operating ambient temperature range	T_{amb}		0 to + 70	°C

CHARACTERISTICS

Supply voltage range	$V_P = V_{6-24}$		10,8 to 13,2	V
The following characteristics are measured in a circuit similar to Fig. 2; V_P = 12 V; T_{amb} = 25 °C; $V_{18-24(p-p)}$ = 1,33 V; $V_{17-24(p-p)}$ = 1,05 V; $V_{15-24(p-p)}$ = 0,45 V; $V_{12,13,14-24(p-p)}$ = 1 V; unless otherwise specified				
Supply current	$I_6 = I_P$	typ.	85	mA
Colour difference inputs				
−(B-Y) input signal at pin 18 (peak-to-peak value)	*$V_{18-24(p-p)}$	typ.	1,33	V
−(R-Y) input signal at pin 17 (peak-to-peak value)	*$V_{17-24(p-p)}$	typ.	1,05	V
Input current during scanning	$I_{17, 18}$	<	1	μA
Input resistance	$R_{17,18-24}$	>	100	kΩ
Internal d.c. voltage due to clamping	$V_{17,18-24}$	typ.	4,2	V
Saturation control at pin 16				
control voltage range for a change of saturation from −20 dB to +6 dB	V_{16-24}		2,1 to 4,3	V
control voltage for attenuation > 40 dB	V_{16-24}	<	1,8	V
nominal saturation (6 dB below max.)	V_{16-24}	typ.	3,1	V
input current	I_{16}	<	20	μA

* For saturated colour bar with 75% of maximum amplitude.

(G-Y) matrix

Matrixed according to the equation $V_{(G-Y)} = -0,51\ V_{(R-Y)} - 0,19\ V_{(B-Y)}$

Luminance amplifier (pin 15)

Composite video input signal (peak-to-peak value)	$V_{15-24(p-p)}$	typ.	0,45	V
Input resistance	R_{15-24}	>	100	kΩ
Internal d.c. voltage	V_{15-24}	typ.	2,7	V
Input current during scanning	I_{15}	<	1	μA

RGB channels

Signal switching input voltage for insertion (pin 11)				
on level	V_{11-24}		0,9 to 3	V
off level	V_{11-24}	<	0,4	V
Input current	I_{11}		−100 to + 200	μA
Signal insertion (pin 12: blue; pin 13: green; pin 14: red)				
external RGB input signal (black-to-white values)	$V_{12,13,14-24(p-p)}$	=	1	V
internal d.c. voltage due to clamping*	$V_{12,13,14-24}$	typ.	4,4	V
input current during scanning	$I_{12,13,14}$	<	1	μA
Contrast control (pin 19)				
control voltage range for a change of contrast from −18 dB to + 3 dB	V_{19-24}		2 to 4,3	V
nominal contrast (3 dB below max.)	V_{19-24}	typ.	3,6	V
control voltage for −6 dB	V_{19-24}	typ.	2,8	V
input current at $V_{25-24} \geqslant 6$ V	I_{19}	<	2	μA
Peak beam current limiting (pin 25)				
internal d.c. bias voltage	V_{25-24}	typ.	5,5	V
input resistance	R_{25-24}	typ.	10	kΩ
input current at contrast control input at $V_{25-24} = 5,1$ V	I_{19}	typ.	17	mA
Brightness control (pin 20)				
control voltage range	V_{20-24}		1 to 3	V
input current	$-I_{20}$	⩽	10	μA
control voltage for nominal black level which equals the inserted artificial black level	V_{20-24}	typ.	2	V
change of black level in the control range related to the nominal luminance signal (black-white) for $\Delta V_{20-24} = 1$ V		typ.	50	%

* $V_{11-24} < 0,4$ V during clamping time: the black levels of the inserted RGB signals are clamped on the black levels of the internal RGB signals.
$V_{11-24} > 0,9$ V during clamping time: the black levels of the inserted signals are clamped on an internal d.c. voltage.
Correct clamping of the external RGB signals is only possible when they are synchronous with the sandcastle pulse.

CHARACTERISTICS (continued)

Internal signal limiting				
signal limiting for nominal luminance (black to white = 100%)				
black		typ.	−25	%
white		typ.	120	%
White point adjustment (pin 21: blue; pin 22: green; pin 23: red)				
A.C. voltage gain (note 1)				
at $V_{21,22,23\text{-}24}$ = 5,5 V		typ.	100	%
at $V_{21,22,23\text{-}24}$ = 0 V		=	60	%
at $V_{21,22,23\text{-}24}$ = 12 V		=	140	%
Input resistance	$R_{21,22,23\text{-}24}$	typ.	20	kΩ
Emitter-follower outputs (pin 1: red; pin 3: green; pin 5: blue)				
At nominal contrast, saturation and white point adjustment				
Output voltage (black-to-white signal, positive)	$V_{1,3,5\text{-}24(p\text{-}p)}$	typ.	2	V
Black level without automatic cut-off control ($V_{28,2,4\text{-}24}$ = 10 V)	$V_{1,3,5\text{-}24}$	typ.	6,7	V
Internal current source	I_{source}	typ.	3	mA
Cut-off current control range	$-\Delta V_{1,3,5\text{-}24}$	typ.	4,6	V
Automatic cut-off control (pin 26)				
The measurement occurs in the following lines after start of the vertical blanking pulse:				
→ line 20: measurement of leakage current				
→ line 21: measurement of red cut-off current				
→ line 22: measurement of green cut-off current				
→ line 23: measurement of blue cut-off current				
Input voltage range	$V_{26\text{-}24}$		0 to + 6,5	V
Voltage difference between cut-off current measurement (note 2) and leakage current				
→ measurement (note 3)	$\Delta V_{26\text{-}24}$	typ.	0,65	V
Input 26 switches to ground during horizontal flyback				

Notes

1. With input pins 21, 22 and 23 not connected an internal bias voltage of 5,5 V is supplied.
2. Black level of measured channel is nominal; the other two channels are blanked to ultra-black.
3. All three channels blanked to ultra-black.
   The cut-off control cycle occurs when the vertical blanking part of the sandcastle pulse contains more than 3 line pulses.
   The internal signal blanking continues until the end of the last measurement line.
   The vertical blanking pulse is not allowed to contain more than 34 line pulses otherwise another control cycle begins.

Gain data

At nominal contrast, saturation and white point adjustment

Voltage gain with respect to Y-input (pin 15)	$G_{1,3,5\text{-}15}$	typ.	16 dB
Frequency response (0 to 5 MHz)	$d_{1,3,5\text{-}15}$	$\leqslant$	3 dB
Voltage gain with respect to colour difference inputs (pins 17 and 18)	$G_{5\text{-}18} = G_{1\text{-}17}$	typ.	6 dB
Frequency response (0 to 2 MHz)	$d_{5\text{-}18} = d_{1\text{-}17}$	$\leqslant$	3 dB
Voltage gain of inserted signals	$G_{1\text{-}14} = G_{3\text{-}13} = G_{5\text{-}12}$	typ.	6 dB
Frequency response (0 to 6 MHz)	$d_{1\text{-}14} = d_{3\text{-}13} = d_{5\text{-}12}$	$\leqslant$	3 dB

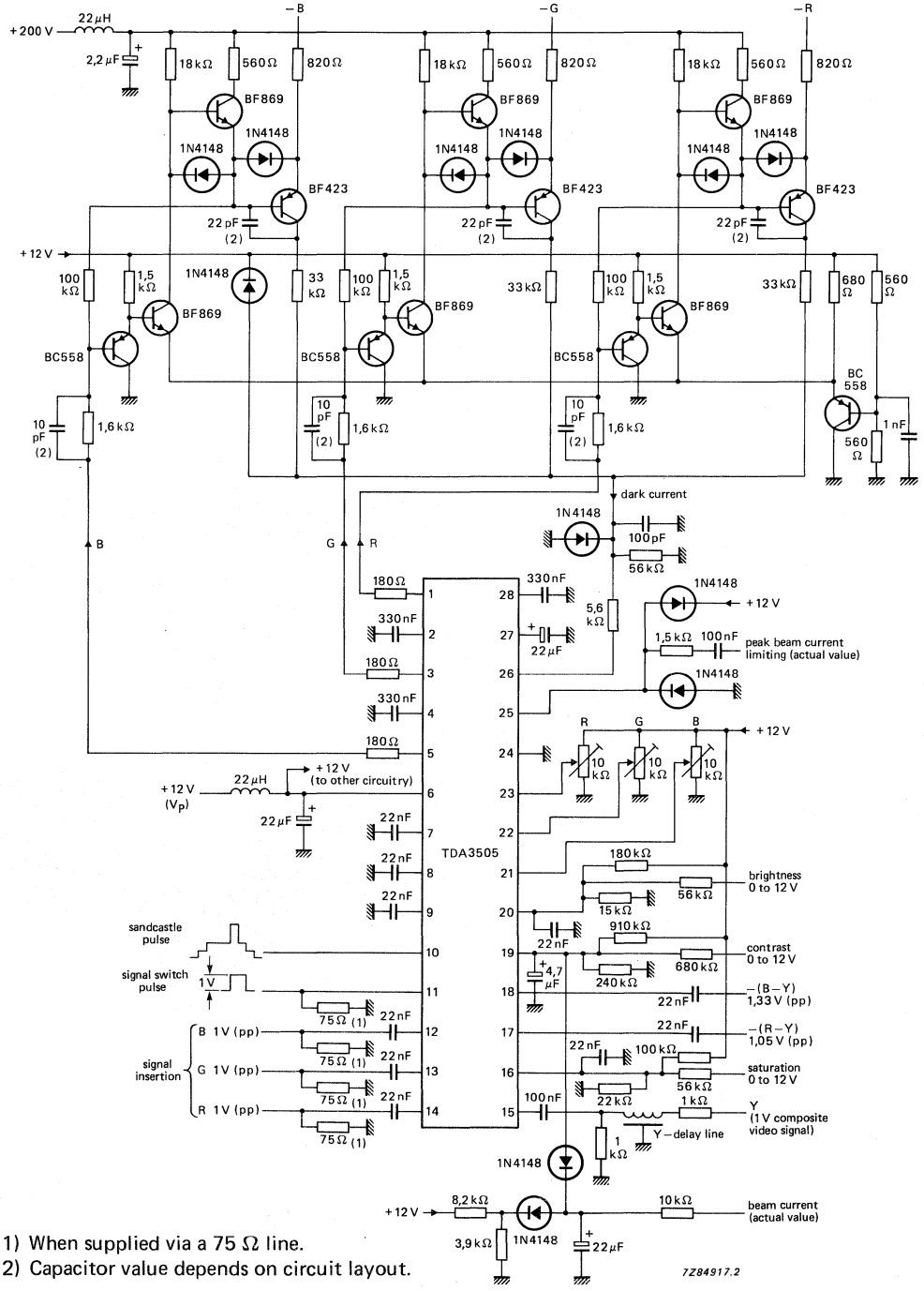
Sandcastle detector (pin 10)

There are 3 internal thresholds (proportional to V_P); note 1. The following amplitudes are required for separating the various pulses:

horizontal and vertical blanking pulses (note 2)	$V_{10\text{-}24}$	$>$ $<$	2 V 3 V
horizontal pulse	$V_{10\text{-}24}$	$>$ $<$	4 V 5 V
clamping pulse (note 3)	$V_{10\text{-}24}$	$>$	7,5 V
d.c. voltage for artificial black level (scan and flyback)	$V_{10\text{-}24}$	$>$	7,5 V
no keying	$V_{10\text{-}24}$	$<$	1 V
input current	$-I_{10}$	$<$	110 μA

Notes

1. The thresholds are for
   horizontal and vertical blanking: $V_{10\text{-}24} = 1{,}5$ V
   horizontal pulse: $V_{10\text{-}24} = 3{,}5$ V
   clamping pulse: $V_{10\text{-}24} = 7{,}0$ V
2. Blanking to ultra-black (−25%).
3. Pulse duration $\geqslant 3{,}5\ \mu$s.



(1) When supplied via a 75 Ω line.
(2) Capacitor value depends on circuit layout.

Fig. 2 Typical application circuit diagram using the TDA3505.

VIDEO CONTROL COMBINATION CIRCUIT

with automatic cut-off control

The TDA3506 performs the control functions in a PAL/SECAM decoder, which also comprises the TDA3510 (PAL decoder) and/or TDA3530 (SECAM decoder).

The required input signals are: luminance and colour difference +(R-Y) and +(B-Y), while linear RGB signals can be inserted from external sources. RGB output signals are delivered for driving the video output stages. This circuit provides automatic cut-off control of the picture tube. The TDA3506 has the following features:

- capacitive coupling of the colour difference and luminance input signals with black level clamping in the input stages
- linear saturation control in the colour difference stages
- (G-Y) and RGB matrix
- linear transmission of inserted signals
- equal black levels for inserted and matrixed signals
- 3 identical channels for the RGB signals
- linear contrast and brightness control, operating on both the inserted and matrixed RGB signals
- peak beam current limiting input
- horizontal and vertical blanking and clamping of the three input signals obtained via a 3-level sandcastle pulse
- d.c. gain controls for each of the RGB output signals (white point adjustment)
- emitter-follower outputs for driving the RGB output stages
- input for automatic cut-off control of the picture tube
- compensation for leakage current of the picture tube

QUICK REFERENCE DATA

Supply voltage	$V_{6\text{-}24} = V_P$	typ.	12 V
Supply current	$I_6 = I_P$	typ.	85 mA
Composite video input signal (peak-to-peak value)	$V_{15\text{-}24(p\text{-}p)}$	typ.	0,45 V
Input resistance	$R_{15\text{-}24}$	>	100 kΩ
Colour difference input signals (peak-to-peak values)			
+(B-Y)	$V_{18\text{-}24(p\text{-}p)}$	typ.	1,33 V
+(R-Y)	$V_{17\text{-}24(p\text{-}p)}$	typ.	1,05 V
Inserted RGB signals (black-to-white values)	$V_{12,13,14\text{-}24(p\text{-}p)}$	typ.	1 V
Three-level sandcastle pulse (required input voltage)	$V_{10\text{-}24}$	typ.	2,5/4,5/8,0 V
Control voltage ranges			
brightness	$V_{20\text{-}24}$		1,0 to 3,0 V
contrast	$V_{19\text{-}24}$		2,0 to 4,3 V
saturation	$V_{16\text{-}24}$		2,0 to 4,3 V

PACKAGE OUTLINE

28-lead DIL; plastic (SOT-117).

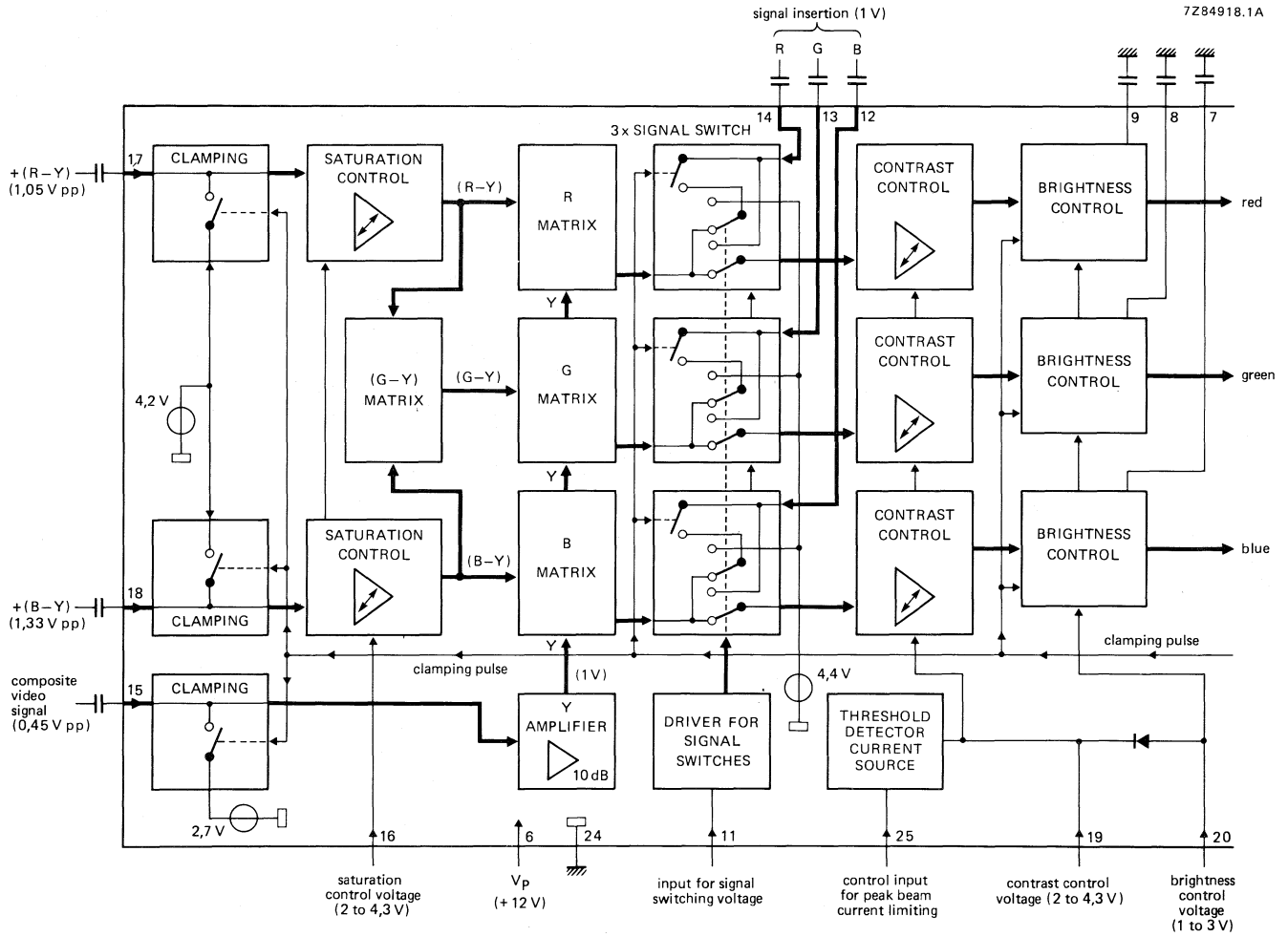


Fig. 1a Part of block diagram; continued in Fig. 1b.

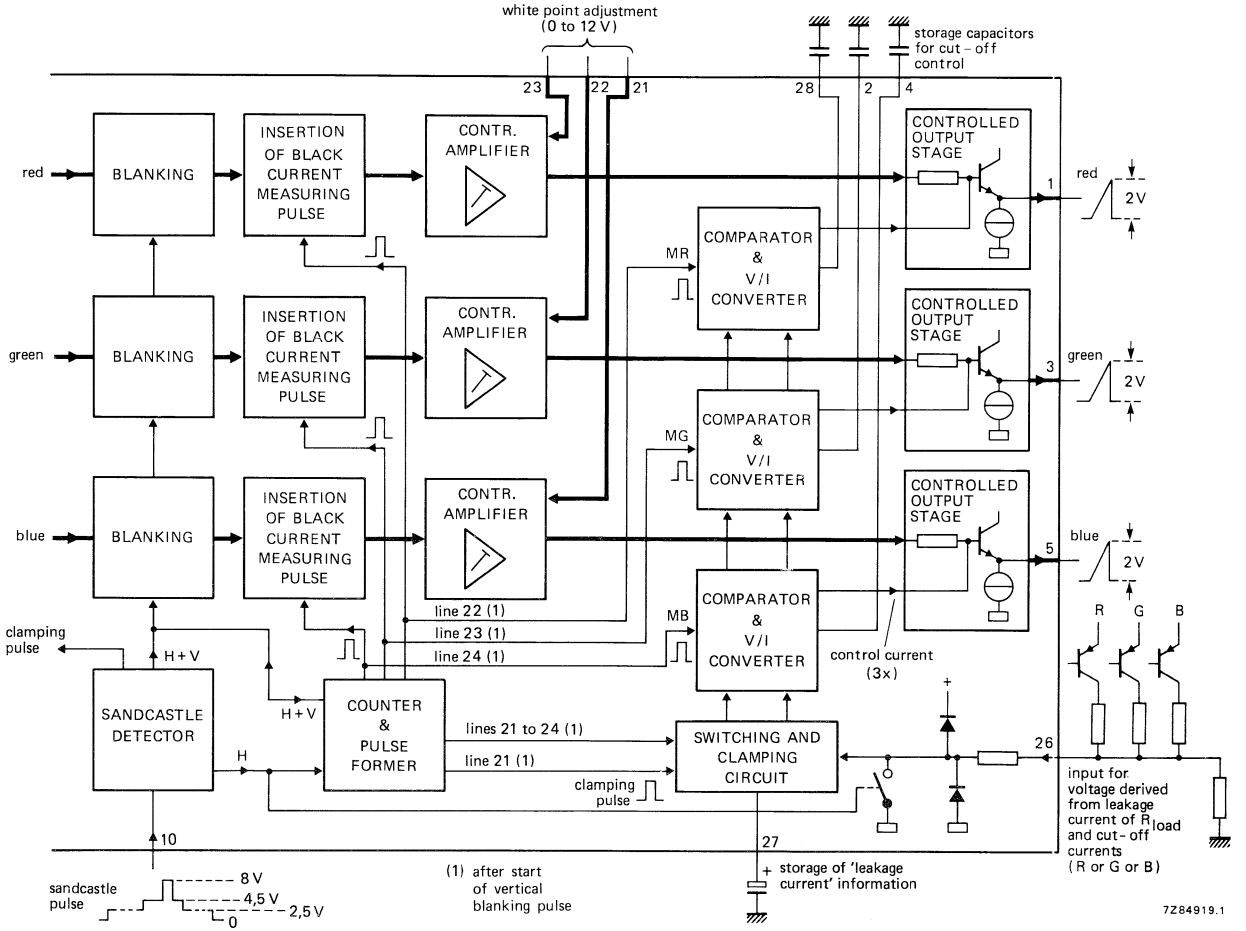


Fig. 1b Part of block diagram; continued from Fig. 1a.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

		min.	max.	
Supply voltage	$V_P = V_{6-24}$	–	13,2	V
Voltages with respect to pin 24				
pin 26	V_{26-24}	0	V_P	V
pin 25	V_{25-24}	0	V_P	V
pin 10	V_{10-24}	0	V_P	V
pin 11	V_{11-24}	−0,5	3	V
pins 16, 19, 20	$V_{16,19,20-24}$	0	0,5 V_P	V
pins 21, 22, 23	$V_{21,22,23-24}$	0	V_P	V
pins 1, 3, 5; 2, 4, 28; 7, 8, 9; 12, 13, 14; 15, 17, 18; 27	no external d.c. voltage			
Currents				
pins 1, 3, 5	$-I_{1, 3, 5}$	max.	3	mA
pin 19	I_{19}	max.	10	mA
pin 20	I_{20}	max.	5	mA
pin 25	$-I_{25}$	max.	5	mA
Total power dissipation	P_{tot}	max.	1,7	W
Storage temperature range	T_{stg}		−25 to +125	°C
Operating ambient temperature range	T_{amb}		−20 to +70	°C

CHARACTERISTICS

Supply voltage range	$V_P = V_{6-24}$		10,8 to 13,2	V
The following characteristics are measured in a circuit similar to Fig. 2; V_P = 12 V; T_{amb} = 25 °C; $V_{18-24(p-p)}$ = 1,33 V; $V_{17-24(p-p)}$ = 1,05 V; $V_{15-24(p-p)}$ = 0,45 V; $V_{12,13,14-24(p-p)}$ = 1 V; unless otherwise specified				
Supply current	$I_6 = I_P$	typ.	85	mA
Colour difference inputs				
+(B-Y) input signal at pin 18 (peak-to-peak value) *	$V_{18-24(p-p)}$	typ.	1,33	V
+(R-Y) input signal at pin 17 (peak-to-peak value) *	$V_{17-24(p-p)}$	typ.	1,05	V
Input current during scanning	$I_{17, 18}$	<	1	μA
Input resistance	$R_{17,18-24}$	>	100	kΩ
Internal d.c. voltage due to clamping	$V_{17,18-24}$	typ.	4,2	V
Saturation control at pin 16				
control voltage range for a change of saturation from −20 dB to +6 dB	V_{16-24}		2,1 to 4,3	V
control voltage for attenuation > 40 dB	V_{16-24}	<	1,8	V
nominal saturation (6 dB below max.)	V_{16-24}	typ.	3,1	V
input current	I_{16}	<	20	μA

* For saturated colour bar with 75% of maximum amplitude.

(G-Y) matrix

Matrixed according to the equation $V_{(G-Y)} = -0,51\ V_{(R-Y)} - 0,19\ V_{(B-Y)}$

Luminance amplifier (pin 15)

Composite video input signal (peak-to-peak value)	$V_{15-24(p-p)}$	typ.	0,45	V
Input resistance	R_{15-24}	>	100	kΩ
Internal d.c. voltage	V_{15-24}	typ.	2,7	V
Input current during scanning	I_{15}	<	1	μA

RGB channels

Signal switching input voltage for insertion (pin 11)				
on level	V_{11-24}		0,9 to 3	V
off level	V_{11-24}	<	0,4	V
Input current	I_{11}		−100 to + 200	μA
Signal insertion (pin 12: blue; pin 13: green; pin 14: red)				
external RGB input signal (black-to-white values)	$V_{12,13,14-24(p-p)}$	=	1	V
internal d.c. voltage due to clamping*	$V_{12,13,14-24}$	typ.	4,4	V
input current during scanning	$I_{12,13,14}$	<	1	μA
Contrast control (pin 19)				
control voltage range for a change of contrast from −18 dB to + 3 dB	V_{19-24}		2 to 4,3	V
nominal contrast (3 dB below max.)	V_{19-24}	typ.	3,6	V
control voltage for −6 dB	V_{19-24}	typ.	2,8	V
input current at $V_{25-24} \geqslant 6$ V	I_{19}	<	2	μA
Peak beam current limiting (pin 25)				
internal d.c. bias voltage	V_{25-24}	typ.	5,5	V
input resistance	R_{25-24}	typ.	10	kΩ
input current at contrast control input at $V_{25-24} = 5,1$ V	I_{19}	typ.	17	mA
Brightness control (pin 20)				
control voltage range	V_{20-24}		1 to 3	V
input current	$-I_{20}$	⩽	10	μA
control voltage for nominal black level which equals the inserted artificial black level	V_{20-24}	typ.	2	V
change of black level in the control range related to the nominal luminance signal (black-white) for $\Delta V_{20-24} = 1$ V		typ.	50	%

* $V_{11-24} < 0,4$ V during clamping time: the black levels of the inserted RGB signals are clamped on the black levels of the internal RGB signals.
$V_{11-24} > 0,9$ V during clamping time: the black levels of the inserted signals are clamped on an internal d.c. voltage.
Correct clamping of the external RGB signals is only possible when they are synchronous with the sandcastle pulse.

CHARACTERISTICS (continued)

Internal signal limiting				
signal limiting for nominal luminance (black to white = 100%)				
black		typ.	−25	%
white		typ.	120	%
White point adjustment (pin 21: blue; pin 22: green; pin 23: red)				
A.C. voltage gain (note 1)				
at $V_{21,22,23\text{-}24}$ = 5,5 V		typ.	100	%
at $V_{21,22,23\text{-}24}$ = 0 V		=	60	%
at $V_{21,22,23\text{-}24}$ = 12 V		=	140	%
Input resistance	$R_{21,22,23\text{-}24}$	typ.	20	kΩ
Emitter-follower outputs (pin 1: red; pin 3: green; pin 5: blue)				
At nominal contrast, saturation and white point adjustment				
Output voltage (black-to-white signal, positive)	$V_{1,3,5\text{-}24(p\text{-}p)}$	typ.	2	V
Black level without automatic cut-off control ($V_{28,2,4\text{-}24}$ = 10 V)	$V_{1,3,5\text{-}24}$	typ.	6,7	V
Internal current source	I_{source}	typ.	3	mA
Cut-off current control range	$-\Delta V_{1,3,5\text{-}24}$	typ.	4,6	V
Automatic cut-off control (pin 26)				
The measurement occurs in the following lines after start of the vertical blanking pulse: line 20: measurement of leakage current; line 21: measurement of red cut-off current; line 22: measurement of green cut-off current; line 23: measurement of blue cut-off current				
Input voltage range	$V_{26\text{-}24}$		0 to + 6,5	V
Voltage difference between cut-off current measurement (note 2) and leakage current measurement (note 3)	$\Delta V_{26\text{-}24}$	typ.	0,65	V
Input 26 switches to ground during horizontal flyback				

Notes

1. With input pins 21, 22 and 23 not connected an internal bias voltage of 5,5 V is supplied.
2. Black level of measured channel is nominal; the other two channels are blanked to ultra-black.
3. All three channels blanked to ultra-black.
   The cut-off control cycle occurs when the vertical blanking part of the sandcastle pulse contains more than 3 line pulses.
   The internal signal blanking continues until the end of the last measurement line.
   The vertical blanking pulse is not allowed to contain more than 34 line pulses otherwise another control cycle begins.

Gain data

At nominal contrast, saturation and white point adjustment

Voltage gain with respect to Y-input (pin 15)	$G_{1,3,5\text{-}15}$	typ.	16 dB
Frequency response (0 to 5 MHz)	$d_{1,3,5\text{-}15}$	$\leqslant$	3 dB
Voltage gain with respect to colour difference inputs (pins 17 and 18)	$G_{5\text{-}18} = G_{1\text{-}17}$	typ.	6 dB
Frequency response (0 to 2 MHz)	$d_{5\text{-}18} = d_{1\text{-}17}$	$\leqslant$	3 dB
Voltage gain of inserted signals	$G_{1\text{-}14} = G_{3\text{-}13} = G_{5\text{-}12}$	typ.	6 dB
Frequency response (0 to 6 MHz)	$d_{1\text{-}14} = d_{3\text{-}13} = d_{5\text{-}12}$	$\leqslant$	3 dB

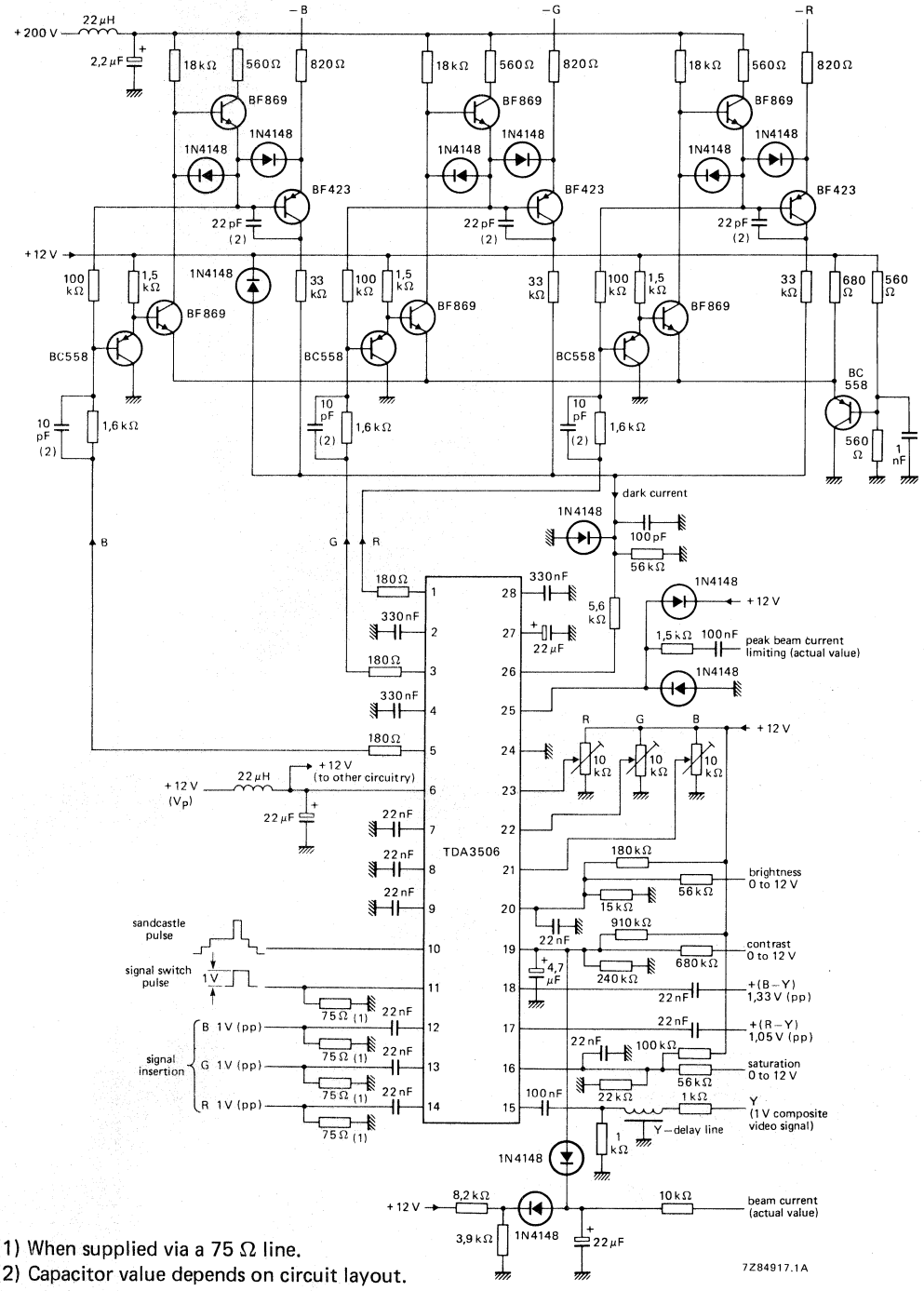
Sandcastle detector (pin 10)

There are 3 internal thresholds (proportional to V_P); note 1. The following amplitudes are required for separating the various pulses:

horizontal and vertical blanking pulses (note 2)	$V_{10\text{-}24}$	$>$ $<$	2 V 3 V
horizontal pulse	$V_{10\text{-}24}$	$>$ $<$	4 V 5 V
clamping pulse (note 3)	$V_{10\text{-}24}$	$>$	7,5 V
d.c. voltage for artificial black level (scan and flyback)	$V_{10\text{-}24}$	$>$	7,5 V
no keying	$V_{10\text{-}24}$	$<$	1 V
input current	$-I_{10}$	$<$	110 μA

Notes

1. The thresholds are for
   horizontal and vertical blanking: $V_{10\text{-}24} = 1{,}5$ V
   horizontal pulse: $V_{10\text{-}24} = 3{,}5$ V
   clamping pulse: $V_{10\text{-}24} = 7{,}0$ V
2. Blanking to ultra-black (−25%).
3. Pulse duration $\geqslant 3{,}5\ \mu$s.



(1) When supplied via a 75 Ω line.
(2) Capacitor value depends on circuit layout.

Fig. 2 Typical application circuit diagram using the TDA3506.

PAL DECODER

The TDA3510 is a monolithic integrated colour decoder for the PAL standard.
The circuit incorporates the following functions:

Chrominance part

- Controlled chrominance amplifier
- Chrominance output stage with automatic standard switch for driving the 64 μs delay line
- Blanking circuit for the colour burst signal

Reference voltage and control voltage part

- 8,8 MHz reference oscillator with divider stage to obtain both the 4,4 MHz reference signals
- Gated phase comparison for an optimum noise ratio
- Circuit for obtaining the chrominance control voltage and a reference voltage
- Circuit for generating the colour killer signal and the identification signal

Demodulator part

- Two synchronous demodulators for the (B-Y) and (R-Y) signals
- PAL flip-flop and PAL switch
- Flyback blanking incorporated in the synchronous demodulators
- (R-Y) and (B-Y) signal output stages, which are controlled by the colour killer with switchable d.c. voltage levels

QUICK REFERENCE DATA

Supply voltage	$V_P = V_{9-24}$	typ.	12 V
Supply current	I_9	typ.	58 mA
Chrominance input signal (peak-to-peak value)	$V_{1-24(p-p)}$		10 to 200 mV
Sandcastle pulse			
burst gating level	V_{20-24}	>	7,5 V
blanking level	V_{20-24}	>	1,8 V
Colour difference output signals			
peak-to-peak values			
−(R-Y) signal	$V_{11-24(p-p)}$	typ.	1,05 V ± 3 dB
−(B-Y) signal	$V_{10-24(p-p)}$	typ.	1,33 V ± 3 dB

PACKAGE OUTLINE

24-lead DIL; plastic (SOT-101A).

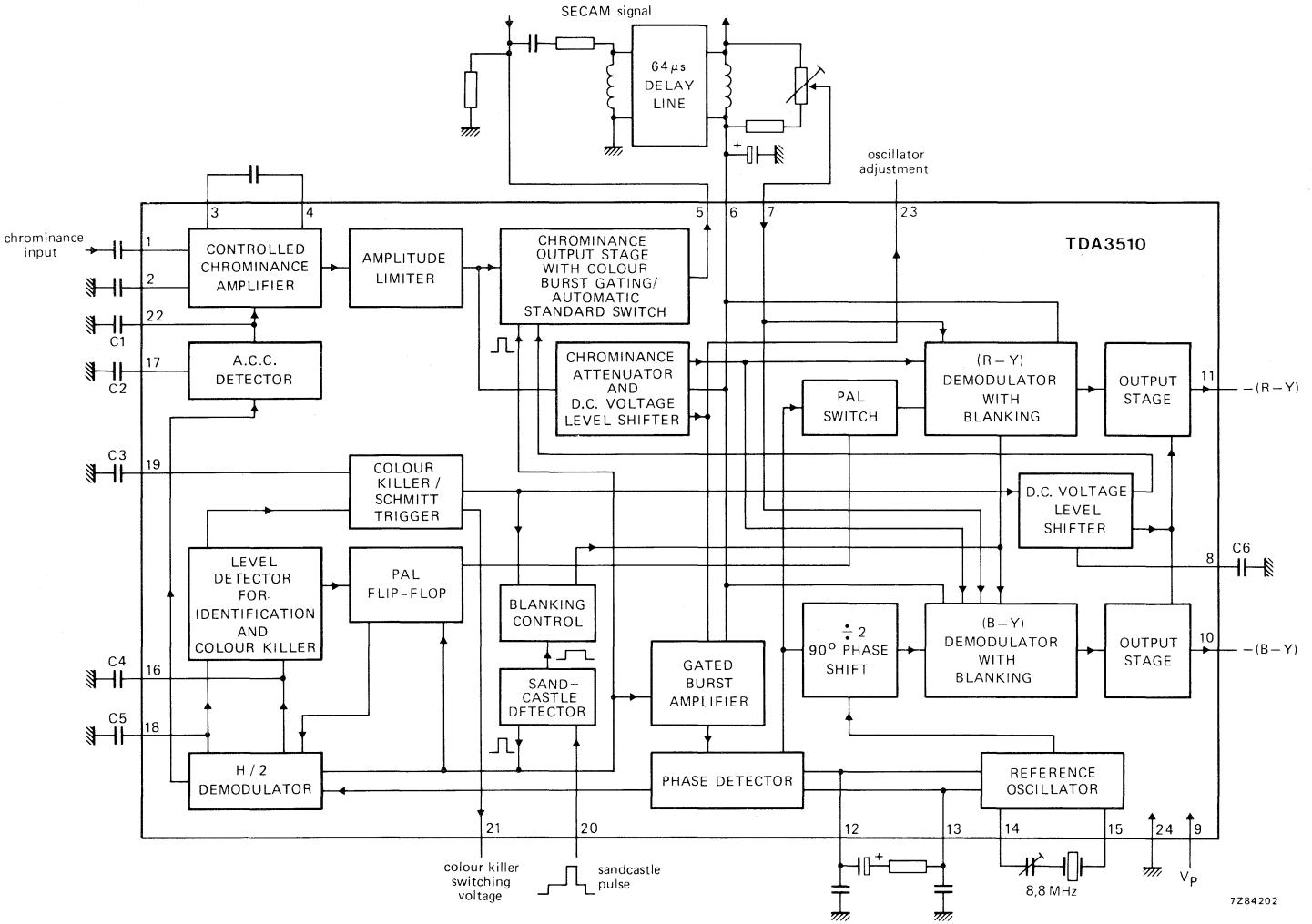


Fig. 1 Block diagram; for external capacitors see next page.

External capacitors in Fig. 1

capacitor	pins	
C1	22 – 24	filter capacitor for control voltage
C2	17 – 24	time constant for control voltage
C3	19 – 24	time constant for colour ON
C4	16 – 24	identification signal and colour OFF time constant
C5	18 – 24	load capacitor for the reference voltage
C6	8 – 24	time constant for the rise or fall time of the d.c. voltage level of the colour difference signal

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage range	$V_P = V_{9-24}$	10,8 to 13,2		V
Currents				
at pin 5	$-I_5$	max.	10	mA
at pins 10 and 11	$-I_{10}, -I_{11}$	max.	1	mA
at pin 21	I_{21}	max.	10	mA
Total power dissipation	P_{tot}	max.	1,1	W
Storage temperature	T_{stg}	−20 to + 125		°C
Operating ambient temperature	T_{amb}	0 to + 70		°C ←

CHARACTERISTICS

V_P = 12 V; T_{amb} = 25 °C

Supply current	I_9	typ.	58	mA
Chrominance part				
Chrominance signal is asymmetric (pins 1, 2)				
Input voltage range (peak-to-peak value)	$V_{1-24(p-p)}$	10 to 200		mV
Nominal input voltage (peak-to-peak value) with 75% colour bar signal	$V_{1-24(p-p)}$	typ.	100	mV
Input impedance	$\lvert Z_i \rvert$	typ.	3,3	kΩ
Colour ON				
chrominance output voltage (peak-to-peak value) with 75% colour bar signal	$V_{5-24(p-p)}$	typ.	2	V
d.c. voltage at chrominance output	V_{5-24}	typ.	8	V
Colour OFF				
chrominance suppression		>	56	dB
d.c. voltage at chrominance output	V_{5-24}	typ.	4	V

CHARACTERISTICS (continued)

Reference voltage and control voltage part

Oscillator (8,8 MHz)			
Gain	$G_{14\text{-}15}$	>	8 dB
Input resistance	$R_{15\text{-}24}$	typ.	270 Ω
Output resistance	$R_{14\text{-}24}$	<	200 Ω
Catching range	Δf	typ.	500 Hz
Sandcastle pulse (pin 20)			
Burst gating level	$V_{20\text{-}24}$	>	7,5 V
Blanking level	$V_{20\text{-}24}$	>	1,8 V
Colour switching voltage (open collector)			
Maximum output current	I_{21max}	typ.	10 mA
Colour ON	$V_{21\text{-}24}$	typ.	V_P
Colour OFF	$V_{21\text{-}24}$	<	0,5 V
Reference output voltage	$V_{18\text{-}24}$	typ.	5,5 V
Colour killer voltages			
colour OFF at	$V_{18\text{-}16}$	typ.	0 V
or at	$V_{19\text{-}24}$	>	6 V
colour ON at	$V_{18\text{-}16}$	typ.	1,5 V
or at	$V_{19\text{-}24}$	<	4 V
Colour unkill delay; depends on C3	t_d	typ.	20 ms/μF
Identification ON	$V_{16\text{-}18}$	<	200 mV

Demodulator part

Delayed chrominance input signal (peak-to-peak value) with 75% colour bar signal	$V_{7\text{-}24(p\text{-}p)}$	typ.	250 mV
Colour difference output signals (peak-to-peak values)			
−(R-Y) signal	$V_{11\text{-}24(p\text{-}p)}$	typ.	1,05 V ± 3 dB
−(B-Y) signal	$V_{10\text{-}24(p\text{-}p)}$	typ.	1,33 V ± 3 dB
Ratio of colour difference output signals (R-Y)/(B-Y)	$\frac{V_{11\text{-}24}}{V_{10\text{-}24}}$	typ.	0,79 ± 10 %
D.C. voltage at colour difference outputs			
at colour ON	$V_{10;\,11\text{-}24}$	typ.	8 V
at colour OFF	$V_{10;\,11\text{-}24}$	typ.	4 V
Signal attenuation at colour OFF		>	60 dB
Residual 4,4 MHz signal	$V_{10;\,11\text{-}24}$	<	20 mV
H/2 ripple at (R-Y) output (peak-to-peak value) without input signal	$V_{11\text{-}24(p\text{-}p)}$	<	10 mV

TELEVISION I.F. AMPLIFIERS AND DEMODULATORS

The TDA3540 and TDA3541 are i.f. amplifier and demodulator circuits for colour and black and white television receivers, using n p n tuners for the TDA3540 and p-n-p tuners for the TDA3541.

They incorporate the following functions:

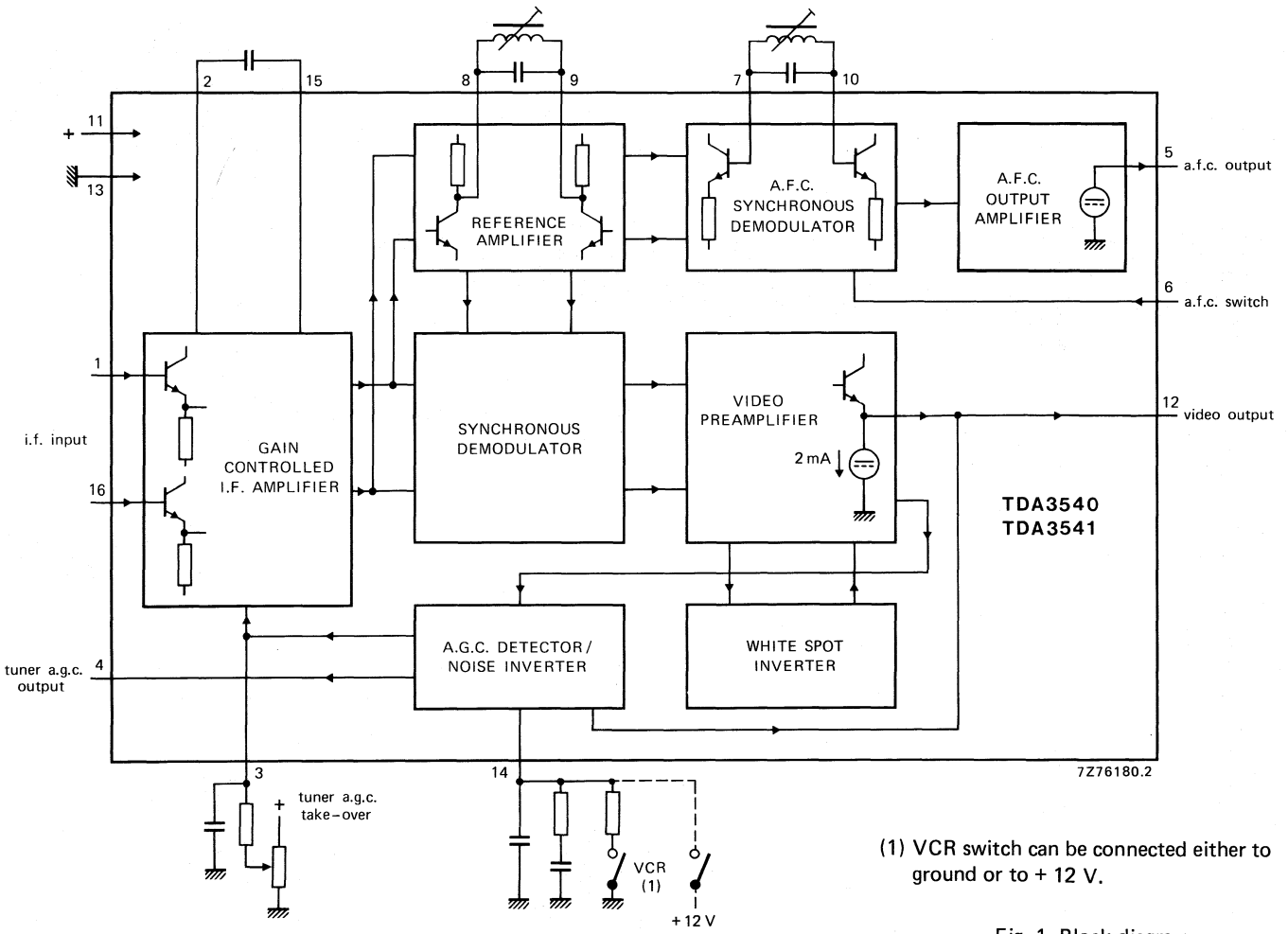
- gain-controlled wide-band amplifier, providing complete i.f. gain
- synchronous demodulator with excellent intermodulation
- white spot inverter
- video preamplifier with noise protection
- a.f.c. circuit with a.f.c. on/off switch
- a.g.c. circuit with noise gating
- tuner a.g.c. output (n-p-n tuners: **TDA3540**; p-n-p tuners: **TDA3541**)
- external video switch which switches off the video output; e.g. for insertion of a VCR playback signal, by either a high or a low level.

QUICK REFERENCE DATA

Supply voltage	$V_{11\text{-}13}$	typ.	12 V
Supply current	I_{11}	typ.	50 mA
I.F. input sensitivity at 38,9 MHz (r.m.s. value)	$V_{1\text{-}16(rms)}$	typ.	60 μV
Video output voltage (white at 10% of top sync)	$V_{12\text{-}13(p\text{-}p)}$	typ.	2,7 V
I.F. voltage gain control range	G_v	typ.	64 dB
Signal-to-noise ratio at V_i = 10 mV	S/N	typ.	58 dB
A.F.C. output voltage swing (peak-to-peak value)	$V_{5\text{-}13(p\text{-}p)}$	typ.	10,7 V

PACKAGE OUTLINES

TDA3540; TDA3541: 16-lead DIL; plastic (SOT-38).
TDA3540Q; TDA3541Q: 16-lead QIL; plastic (SOT-58).



(1) VCR switch can be connected either to ground or to + 12 V.

Fig. 1 Block diagram.

PINNING

1 - 16	Balanced i.f. input.
2 - 15	Decoupling capacitor for the d.c. feedback loop of the i.f. amplifier.
3	Adjusting pin for starting point of tuner a.g.c.
4	Tuner a.g.c. output.
5	A.F.C. output.
6	A.F.C. on/off switch.
7 - 10	A.F.C. circuitry to obtain $\pi/2$ phase shift of the reference carrier.
8 - 9	Circuitry for passive regeneration of the i.f. picture carrier.
11	Positive power supply.
12	Video output.
13	Ground.
14	I.F. a.g.c.; VCR switch.

RATINGS

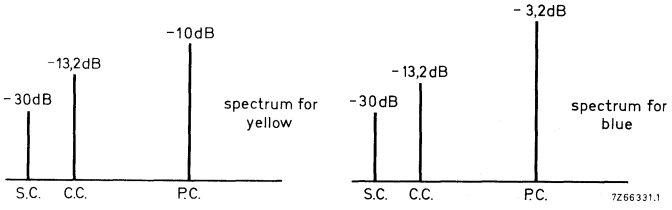
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage	V_{11-13}	max.	13,2 V
I.F. a.g.c. voltage/VCR switch	V_{14-13}	max.	13,2 V
Tuner a.g.c. voltage	V_{4-13}	max.	12 V
A.F.C. switch voltage	V_{6-13}	max.	13,2 V
Maximum voltage level at pin 12 with VCR switch active	V_{12-13}	max.	5,0 V
D.C. output current at video output	I_{12}	max.	10 mA
Total power dissipation	P_{tot}	max.	1,2 W
Storage temperature range	T_{stg}		−65 to + 150 °C
Operating ambient temperature range	T_{amb}		−25 to + 70 °C

CHARACTERISTICS (measured in Fig. 8)

Supply voltage range	$V_{11\text{-}13}$	typ.	12 V 10,2 to 13,2 V
The following characteristics are measured at T_{amb} = 25 °C; $V_{11\text{-}13}$ = 12 V			
Current consumption (no input signal)	I_{11}	typ.	50 mA 35 to 70 mA
I.F. amplifier (note 1)			
I.F. sensitivity (onset of a.g.c.)	$V_{1\text{-}16}$	typ. <	60 μV 100 μV
Input resistance (differential)	$R_{1\text{-}16}$	typ.	2 kΩ 1,5 to 3 kΩ
Input capacitance (differential)	$C_{1\text{-}16}$	typ. <	2 pF 5 pF
Gain control range	G_v	typ.	64 dB
Output signal expansion for 50 dB input signal variation (note 2)	$\Delta V_{12\text{-}13}$	<	0,5 dB
Maximum input signal	$V_{1\text{-}16}$	>	70 mV
Tuner a.g.c. (note 1)			
Starting point tuner a.g.c.; adjustable (note 3) pin 3 connected with 39 kΩ to pin 11			
TDA3540	$V_{1\text{-}16}$	<	3 mV
TDA3541	$V_{1\text{-}16}$	<	3 mV
pin 3 connected with 39 kΩ to ground	$V_{1\text{-}16}$	>	70 mV
Maximum tuner a.g.c. output current swing	I_4	>	10 mA
Input signal variation (note 4) for a tuner a.g.c. current variation of:			
9 mA to 1 mA (**TDA3540**)	$\Delta V_{1\text{-}16}$	typ.	5 dB
1 mA to 9 mA (**TDA3541**)	$\Delta V_{1\text{-}16}$	typ.	5 dB
Output saturation voltage at I_4 = 7 mA	$V_{4\text{-}13sat}$	typ. <	200 mV 300 mV
Leakage current at $V_{4\text{-}13}$ = 12 V	I_4	<	1 μA
Tuner a.g.c. characteristic	see Fig. 5		
Video output (note 5)			
Zero-signal output level (note 6)	$V_{12\text{-}13}$	typ.	6 V 5,7 to 6,3 V
Top sync output level	$V_{12\text{-}13}$	typ.	2,95 V 2,80 to 3,10 V
Video output signal (peak-to-peak value) white at 10% of top sync	$V_{12\text{-}13(p\text{-}p)}$	typ.	2,7 V

Internal bias current of n-p-n emitter-follower output transistor		typ.	2 mA
			1 to 3 mA
Bandwidth of demodulated output signal	B	>	5,5 MHz
		typ.	6,5 MHz
Differential gain (note 7)	dG	typ.	3 %
		<	10 %
Differential phase (note 8)	$d\varphi$	typ.	2^o
		<	10^o
Residual carrier signal (r.m.s. value)	$V_{12\text{-}13(rms)}$	typ.	3,5 mV
		<	30,0 mV
Residual 2nd harmonic of carrier signal (r.m.s. value)	$V_{12\text{-}13(rms)}$	typ.	15 mV
		<	30 mV
Intermodulation (see Figs 2 and 3) at 1,1 MHz: blue (note 9)		>	56 dB
		typ.	62 dB
yellow (note 9)		>	53 dB
		typ.	57 dB
at 3,3 MHz (note 10)		>	66 dB



S.C. : sound carrier level
C.C. : chrominance carrier level
P.C. : picture carrier level
} with respect to top sync level

Fig. 2 Input conditions for intermodulation measurements; standard colour bar with 75% contrast.

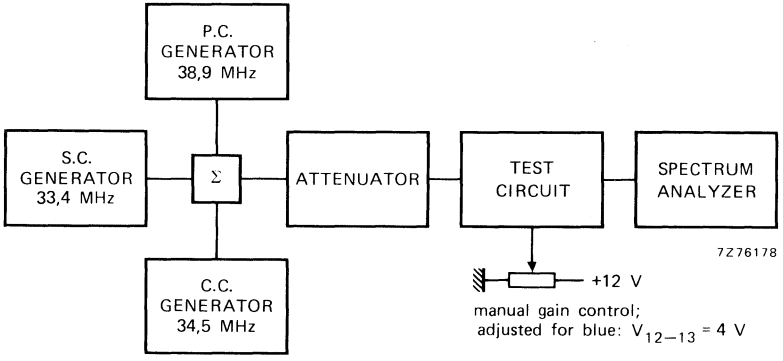


Fig. 3 Test set-up for intermodulation.

CHARACTERISTICS (continued)

Signal-to-noise ratio (note 11)		
at 10 mV input signal	S/N	> 50 dB typ. 58 dB
at end of gain control range	S/N	> 54 dB typ. 61 dB
as a function of the input signal	see Fig. 6	

White spot and noise inverter (see Fig. 4)

White spot inverter threshold level	$V_{12\text{-}13}$	typ. 6,8 V 6,3 to 7,3 V
White spot insertion level	$V_{12\text{-}13}$	typ. 4,5 V 4,2 to 4,8 V
Noise inverter threshold level	$V_{12\text{-}13}$	typ. 1,8 V 1,6 to 2,0 V
Noise insertion level	$V_{12\text{-}13}$	typ. 3,8 V 3,4 to 4,1 V

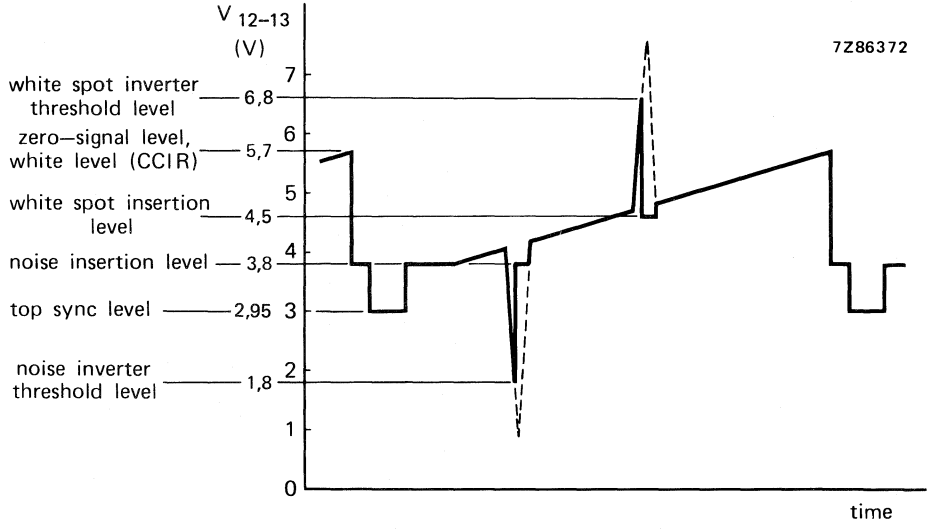


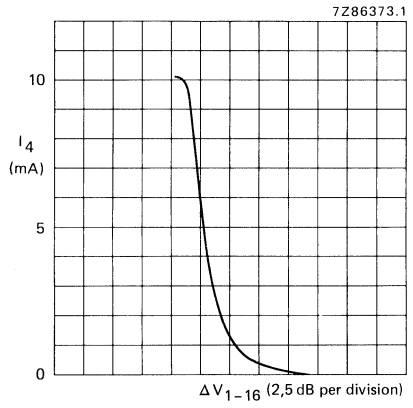
Fig. 4 Video output waveform showing white spot and noise inverter threshold levels.

VCR switch

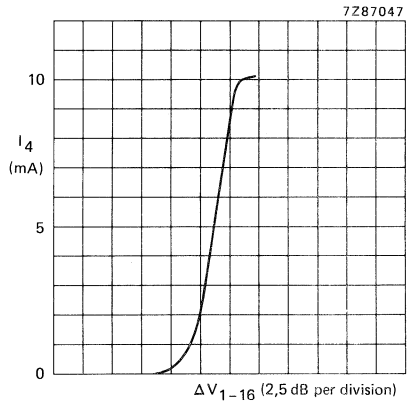
Switches the output off:		
below	$V_{14\text{-}13}$	typ. 1,9 V 1,4 to 2,4 V
above	$V_{14\text{-}13}$	typ. 10,7 V 10 to 11,3 V

A.F.C. (note 12)

A.F.C. output voltage swing (peak-to-peak value)	$V_{5\text{-}13(p\text{-}p)}$	> typ.	10 V 10,7 V
Change of frequency for an a.f.c. output voltage swing of 10 V at 100% picture carrier	Δf	typ. <	70 kHz 150 kHz
at 10% picture carrier	Δf	typ. <	100 kHz 200 kHz
A.F.C. output voltage when tuned at 38,9 MHz	$V_{5\text{-}13}$	typ.	6 V
A.F.C. output voltage (no input signal)	$V_{5\text{-}13}$	typ.	6 V 4 to 8 V
A.F.C. switch switches off below	$V_{6\text{-}13}$	typ.	2,9 V 1,6 to 3,5 V
Recommended a.f.c. active voltage	$V_{6\text{-}13}$ or: pin 6 floating		3,5 to 6 V
A.F.C. switch leakage current at $V_{6\text{-}13}$ = 6 V	I_6	<	1 μA
A.F.C. output current during a.f.c. off measured with $f_o \pm 300$ kHz and $V_{6\text{-}13}$ = 1,5 V	I_5		−2,5 to + 2,5 μA
A.F.C. output current during a.f.c. on	I_5	> typ.	1 mA 2 mA



(a)



(b)

Fig. 5 Typical tuner a.g.c. characteristics;
pin 3 connected to the supply voltage (pin 11) with 39 kΩ.

a: TDA3540
b: TDA3541

CHARACTERISTICS (continued)

Notes to characteristics

1. All input signals are measured r.m.s. at top sync and 38,9 MHz.
2. Measured with 0 dB = 200 μV.
3. Starting point of the tuner a.g.c. is defined as the input signal level where the tuner a.g.c. current is 9 mA for the **TDA3540** and 1 mA for the **TDA3541**.
4. Measured with pin 3 connected with 39 kΩ to the supply voltage (pin 11).
5. Measured at 10 mV r.m.s. top sync input signal.
6. So-called 'projected zero point', e.g. with switched demodulator.
7. Measured according to EBU test, line 330.
   The differential gain is expressed as a percentage of the difference in peak amplitudes between the largest and smallest section relative to the sub-carrier amplitude at blanking level.
8. Measured according to EBU test, line 330.
   The differential phase is defined as the difference in degrees between the largest and smallest phase angle of the six sections.
9. $20 \log \frac{V_o \text{ at } 4{,}4 \text{ MHz}}{V_o \text{ at } 1{,}1 \text{ MHz}} + 3{,}6 \text{ dB}$.
10. $20 \log \frac{V_o \text{ at } 4{,}4 \text{ MHz}}{V_o \text{ at } 3{,}3 \text{ MHz}}$.
11. Measured with a 75 Ω source; $S/N = 20 \log \frac{V_o \text{ black-to-white}}{V_{n(rms)} \text{ at } B = 5 \text{ MHz}}$.
12. Measured with an input signal $V_{1\text{-}16}$ = 10 mV and a.f.c. output pin 5 symmetrically loaded with 100 kΩ to the supply voltage ($V_{11\text{-}13}$) and 100 kΩ to ground.

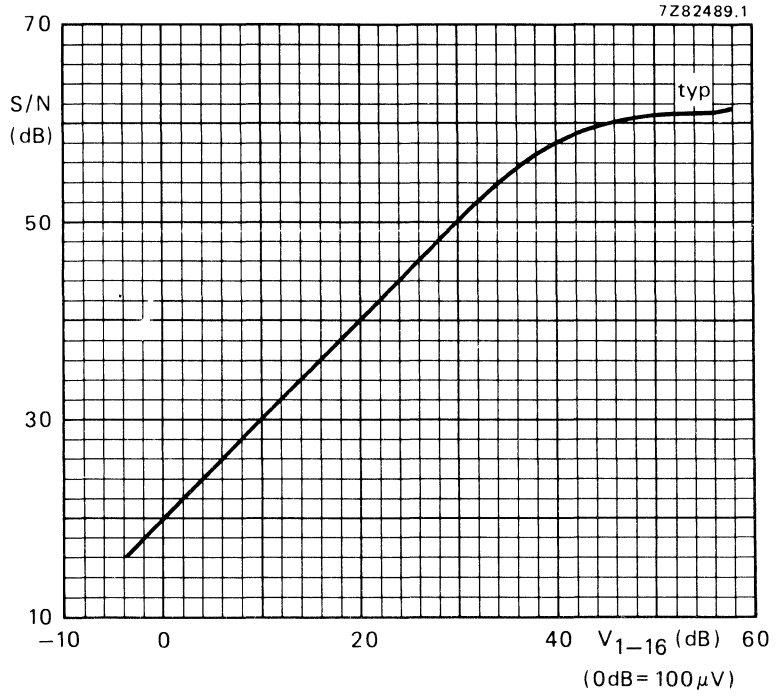


Fig. 6 Signal-to-noise ratio as a function of the input voltage (V_{1-16}).

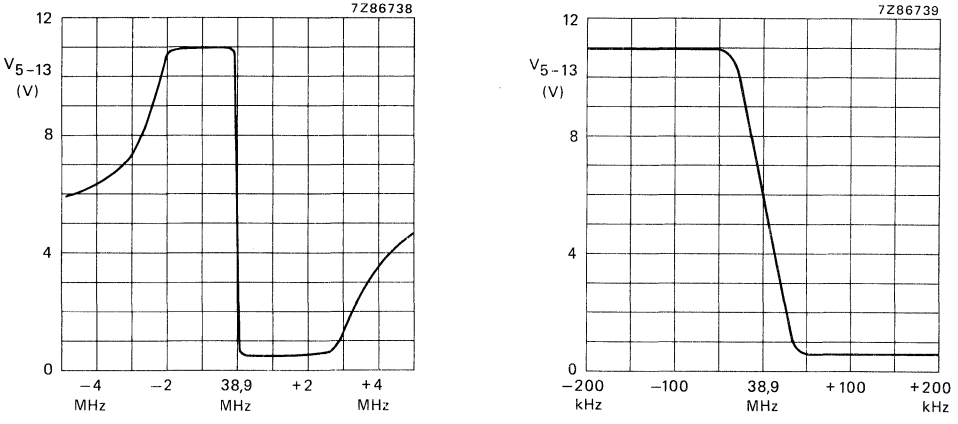


Fig. 7 A.F.C. output voltage (V_{5-13}) as a function of deviation of the i.f. vision carrier from its nominal frequency.

APPLICATION INFORMATION

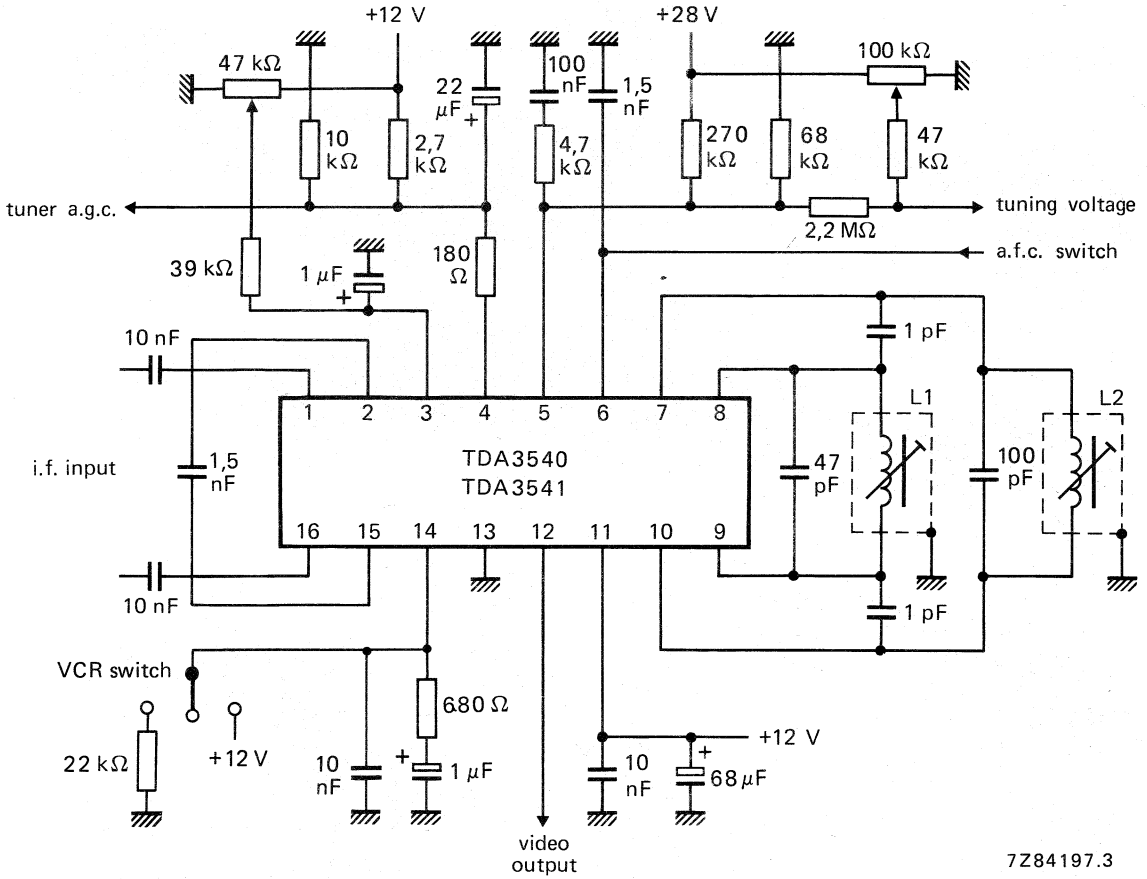


Fig. 8 Typical application circuit diagram; Q of L1 and L2 = 80; f_o = 38,9 MHz.

PAL DECODER

The TDA3560 is a monolithic integrated colour decoder for the PAL standard. It combines all functions required for the identification and demodulation of PAL signals. Furthermore it contains a luminance amplifier, an RGB-matrix and amplifier. These amplifiers supply output signals up to 5 V peak-to-peak (picture information) enabling direct drive of the output stages. The circuit also contains separate inputs for data insertion, analogue as well as digital, which can be used for Teletext information, channel number display, etc.

QUICK REFERENCE DATA

Supply voltage	V_{1-27}	typ.	12 V
Supply current	I_1	typ.	85 mA
Luminance input signal (peak-to-peak value)	$V_{10-27(p-p)}$	typ.	0,45 V
Chrominance input signal (peak-to-peak value)	$V_{3-27(p-p)}$	55 to	1100 mV
Data input signals (peak-to-peak value)	$V_{13,15,17-27(p-p)}$	typ.	1 V
RGB output signals at nominal contrast and saturation (peak-to-peak value)	$V_{12,14,16-27(p-p)}$	typ.	5 V
Contrast control range		typ.	20 dB
Saturation control range		typ.	50 dB
Input for fast video-data signal switching	V_{9-27}	typ.	1 V
Blanking input voltage	V_{8-27}	typ.	1,5 V
Burst gating and black-level gating input voltage	V_{8-27}	typ.	7 V

PACKAGE OUTLINE

28-lead DIL; plastic (SOT-117).

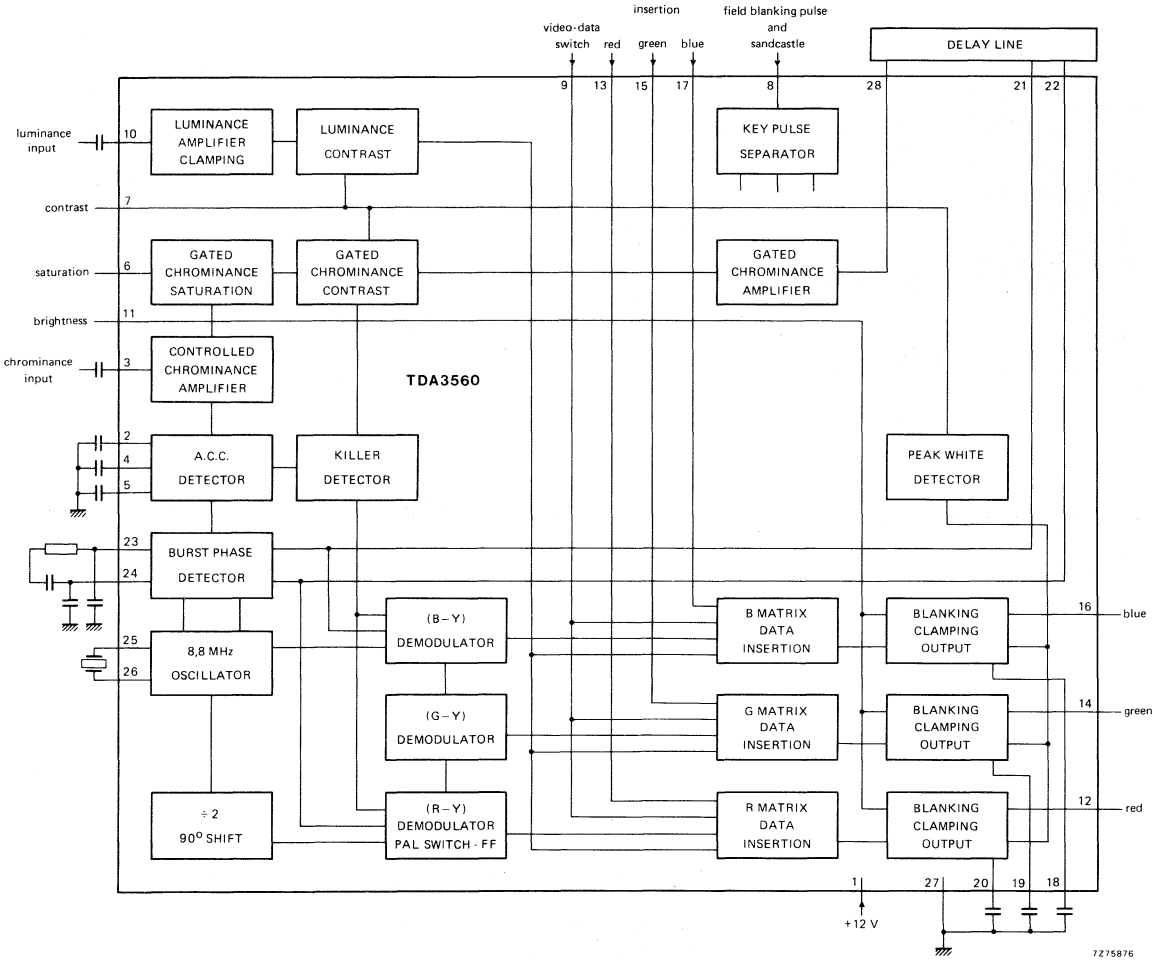


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

		min.	max.	
Supply voltage	$V_P = V_{1-27}$	–	13,2	V
Input saturation voltage	V_{6-27}	0	V_P	V
Input contrast voltage	V_{7-27}	0	V_P	V
Input blanking pulse and sandcastle	V_{8-27}	0	V_P	V
Input video-data switch voltage	V_{9-27}	0	V_P	V
Input brightness voltage	V_{11-27}	0	V_P	V
Power dissipation	see Fig. 2			
Storage temperature	T_{stg}	−25 to	+ 150	°C
Operating ambient temperature	T_{amb}	−25 to	+ 65	°C

CHARACTERISTICS

V_{1-27} = 12 V; $V_{10-27(p-p)}$ = 0,45 V; $V_{3-27(p-p)}$ = 500 mV; T_{amb} = 25 °C; measured in Fig. 6; unless otherwise specified

Supply voltage range	V_P	typ.	12	V
			8 to 13,2	V
Supply current	I_1	typ.	85	mA
Luminance amplifier				
Input voltage (peak-to-peak value)	$V_{10-27(p-p)}$	typ.	0,45	V
Input current	I_{10}	<	1	μA
Contrast control range			−17 to + 3	dB
Contrast control voltage range	see Fig. 3			
Chrominance amplifier				
Input voltage (peak-to-peak value)	$V_{3-27(p-p)}$		55 to 1100	mV
A.C.C. control range		>	30	dB
Output signal (peak-to-peak value) * burst signal (peak-to-peak value) = 0,5 V	$V_{28-27(p-p)}$	typ.	1,7	V
Saturation control range		>	50	dB
Saturation control voltage range	see Fig. 4			
Phase shift between burst and chrominance *		<	5°	
Tracking between luminance and chrominance with contrast control over a range of 10 dB, starting at maximum contrast		typ.	1	dB

* At nominal contrast and saturation setting. Nominal setting = maximum contrast −3 dB; maximum saturation −6 dB.

CHARACTERISTICS (continued)

Reference oscillator

Phase locked loop:			
– catching range (note 1)		>	500 Hz
– phase shift (note 2)		<	5°
Oscillator:			
– input resistance	$R_{26\text{-}27}$	typ.	300 Ω
– input capacitance	$C_{26\text{-}27}$	<	10 pF
– output resistance	$R_{25\text{-}27}$	typ.	200 Ω
A.C.C. generation:			
– reference voltage	$V_{4\text{-}27}$	typ.	4,6 V
– control voltage at nominal input signal	$V_{2\text{-}27}$	typ.	4,7 V
– control voltage without burst	$V_{2\text{-}27}$	typ.	2,4 V

Demodulator circuit

Input burst signal amplitude (peak-to-peak value)	$V_{21,22\text{-}27(p\text{-}p)}$	typ.	60 mV
Ratio of demodulated signals without luminance input signal			
(B-Y)/(R-Y)	$\frac{V_{16\text{-}27}}{V_{12\text{-}27}}$	typ.	1,78
(G-Y)/(R-Y)	$\frac{V_{14\text{-}27}}{V_{12\text{-}27}}$	typ.	–0,51
(G-Y)/(B-Y)	$\frac{V_{14\text{-}27}}{V_{16\text{-}27}}$	typ.	–0,19

RGB matrix and amplifiers

Output voltage (peak-to-peak value) (note 3)	$V_{12,14,16\text{-}27(p\text{-}p)}$	typ.	5 V
Maximum white level		typ.	9,3 V
Birghtness control voltage range	see Fig. 5		
Relative spread between R, G and B output signals		<	10 %
Variation of black level with contrast control	ΔV	<	200 mV
Relative black-level variation between the three stages during variation of contrast saturation, brightness and supply voltage		<	20 mV
Differential black-level drift over a temperature range of 40 °C		<	20 mV
Blanking level at RGB outputs		typ.	2,1 V
Signal-to-noise ratio of output signals (note 4)	S/N	>	62 dB

Notes

1. Frequency referred to 4,4 MHz carrier frequency.
2. For ± 400 Hz deviation of the oscillator frequency.
3. For nominal setting of the controls.
4. The signal-to-noise ratio is specified as the nominal peak-to-peak output signal with respect to r.m.s. noise.

Residual 8,8 MHz and higher harmonics on RGB-outputs (peak-to-peak value)		<	150 mV
Output impedance RGB outputs	$\lvert Z_o \rvert$	typ.	50 Ω
Frequency response of total luminance and RGB amplifier circuits for f = 0 to 5 MHz		<	−3 dB
Signal insertion			
Input signals for an RGB output voltage of 5 V (peak-to-peak value)	$V_{13,15,17-27(p-p)}$	typ.	1 V
Difference between the black levels of the RGB signals and the inserted signals at the output	ΔV	<	260 mV
Output rise time	t_r	typ.	50 ns
Differential delay time for the three channels	t_d	<	40 ns
Video-data switching			
Input voltage for switching from video to inserted signals	V_{9-27}		0,9 to 2 V
Input voltage for no data insertion	V_{9-27}	<	0,3 V
Delay between signal switching at the output and the signal switching input pulse at pin 9	t_d	<	20 ns
Sandcastle and field blanking input (pin 8)			
Burst gate and clamping pulse	V_{8-27}	>	7,5 V
RGB blanking level			
on	V_{8-27}		2 to 6,5 V
off	V_{8-27}	<	0,8 V

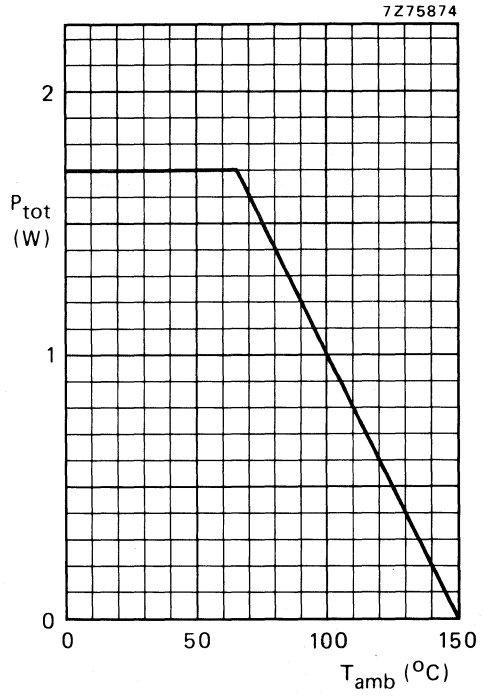


Fig. 2 Power derating curve.

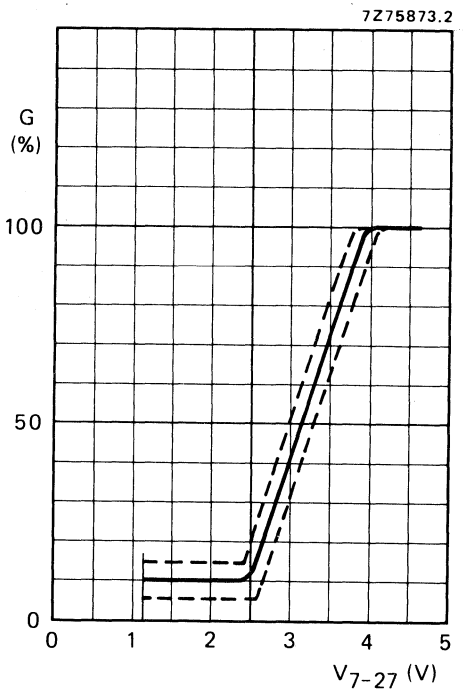


Fig. 3 Contrast control voltage range.

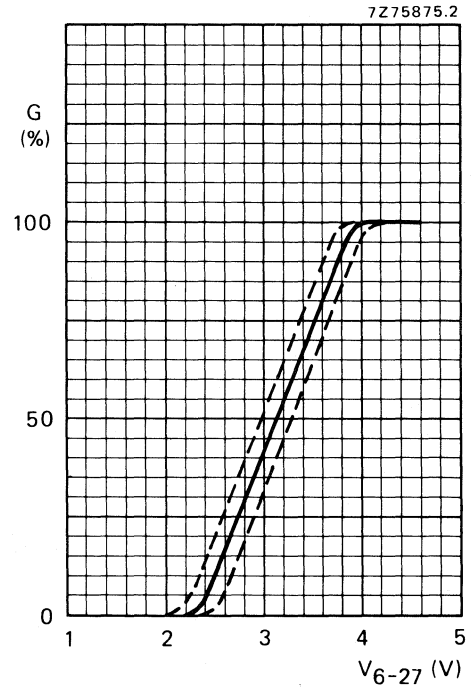


Fig. 4 Saturation control voltage range.

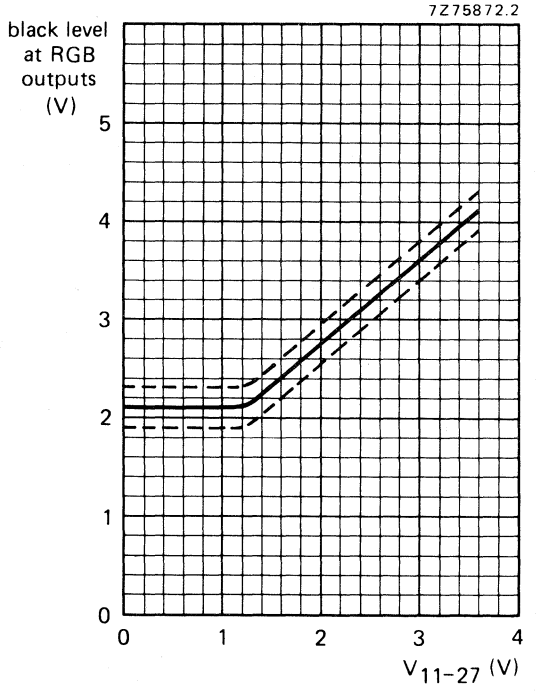


Fig. 5 Brightness control voltage range.

APPLICATION INFORMATION

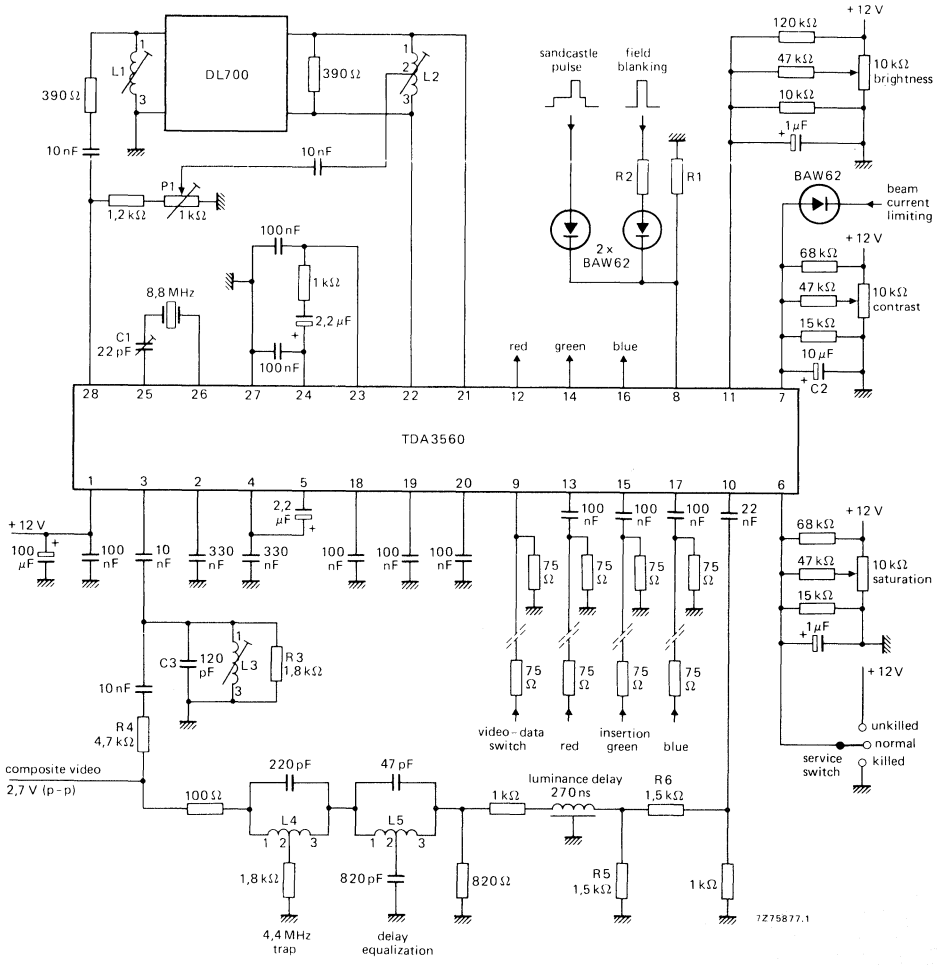


Fig. 6 Application circuit.

For adjustments see application information.

APPLICATION INFORMATION

The function is described against the corresponding pin number.

1. + 12 V power supply

The circuit gives good operation in a supply voltage range between 8 and 13,2 V provided that the supply voltage for the controls is equal to the supply voltage for the TDA3560. All signal and control levels have a linear dependency on the supply voltage. The current taken by the device at 12 V is typically 85 mA. It is linearly dependent on the supply voltage.

2. Control voltage for identification

This pin requires a detection capacitor of about 330 nF for correct operation. The voltages available under various signal conditions are given in the specification.

3. Chrominance input

The chroma signal must be a.c.-coupled to the input. Its amplitude must be between 55 mV and 1100 mV peak-to-peak (25 mV to 500 mV peak-to-peak burst signal). All figures for the chroma signals are based on a colour bar signal with 75% saturation, that is the burst-to-chroma ratio of the input signal is 1 : 2,25.

4. Reference voltage A.C.C. detector

This pin must be decoupled by a capacitor of about 330 nF. The voltage at this pin is 4,6 V.

5. Control voltage A.C.C.

The A.C.C. is obtained by synchronous detection of the burst signal followed by a peak detector. A good noise immunity is obtained in this way and an increase of the colour for weak input signals is prevented. The recommended capacitor value at this pin is 2,2 μF.

6. Saturation control

The saturation control range is in excess of 50 dB. The control voltage range is 2 to 4 V. Saturation control is a linear function of the control voltage.

When the colour killer is active, the saturation control voltage is reduced to a low level if the resistance of the external saturation control network is sufficiently high. Then the chroma amplifier supplies no signal to the demodulator. Colour switch-on can be delayed by proper choice of the time constant for the saturation control setting circuit.

When the saturation control pin is connected to the power supply the colour killer circuit is overruled so that the colour signal is visible on the screen. In this way it is possible to adjust the oscillator frequency without using a frequency counter (see also pins 25 and 26).

7. Contrast control

The contrast control range is 20 dB for a control voltage change from + 2 to + 4 V. Contrast control is a linear function of the control voltage. The output signal is suppressed when the control voltage is 1 V or less. If one or more output signals surpasses the level of 9 V the peak white limiter circuit becomes active and reduces the output signals via the contrast control by discharging C2 via an internal current sink.

8. Sandcastle and field blanking input

The output signals are blanked if the amplitude of the input pulse is between 2 and 6,5 V. The burst gate and clamping circuits are activated if the input pulse exceeds a level of 7,5 V.
The higher part of the sandcastle pulse should start just after the sync pulse to prevent clamping of video signal on the sync pulse. The width should be about 4 μs for proper A.C.C. operation.

9. Video-data switching

The insertion circuit is activated by means of this input by an input pulse between 1 V and 2 V. In that condition, the internal RGB signals are switched off and the inserted signals are supplied to the output amplifiers. If only normal operation is wanted this pin should be connected to the negative supply. The switching times are very short ($<$ 20 ns) to avoid coloured edges of the inserted signals on the screen.

10. Luminance signal input

The input signal should have a peak-to-peak amplitude of 0,45 V (peak white to sync) to obtain a black-white output signal of 5 V at nominal contrast. It must be a.c.-coupled to the input by a capacitor of about 22 nF. The signal is clamped at the input to an internal reference voltage.
A 1 kΩ luminance delay line can be applied because the luminance input impedance is made very high. Consequently the charging and discharging currents of the coupling capacitor are very small and do not influence the signal level at the input noticeably. Additionally the coupling capacitor value may be small.

11. Brightness control

The black level of the RGB outputs can be set by the voltage on this pin (see Fig. 5). The minimum black level is identical to the blanking level. The black level can be set higher than 4 V however the available output signal amplitude is reduced (see pin 7). Brightness control also operates on the black level of the inserted signals.

12, 14, 16. RGB outputs

The output circuits for red, green and blue are identical. Output signals are 5 V (black-white) for nominal input signals and control settings. The black levels of the three outputs have the same value. The blanking level at the outputs is 2 V. The peak white level is limited to 9 V. When this level is exceeded the output signal amplitude is reduced via the contrast control (see pin 7).

13, 15, 17. Inputs for external RGB signals

The external signals must be a.c.-coupled to the inputs via a coupling capacitor of about 100 nF. Source impedance should not exceed 150 Ω. The input signal required for a 5 V peak-to-peak output signal is 1 V peak -to-peak. At the RGB outputs the black level of the inserted signal is identical to that of normal RGB signals. When these inputs are not used the coupling capacitors have to be connected to the negative supply.

18, 19, 20. Black level clamp capacitors

The black level clamp capacitors for the three channels are connected to these pins. The value of each capacitor should be about 100 nF.

21, 22. Inputs (B-Y) and (R-Y) demodulators

The input signal is automatically fixed to the required level by means of the burst phase detector and A.C.C. generator which are connected to this pin and pin 22. As the burst (applied differentially to those pins) is kept constant by the A.C.C., the colour difference signals automatically have the correct value.

APPLICATION INFORMATION (continued)

23, 24. Burst phase detector outputs

At these pins the output of the burst phase detector is filtered and controls the reference oscillator. An adequate catching range is obtained with the time constants given in the application circuit (see Fig. 6).

25, 26. Reference oscillator

The frequency of the oscillator is adjusted by the variable capacitor C1. For frequency adjustment interconnect pin 23 and pin 24. The frequency can be measured by connecting a suitable frequency counter to pin 25.

28. Output of the chroma amplifier

Both burst and chroma signals are available at the output. The burst-to-chroma ratio at the output is identical to that at the input for nominal control settings. The burst signal is not affected by the controls. The amplitude of the input signal to the demodulator is kept constant by the A.C.C. Therefore the output signal at pin 28 will depend on the signal loss in the delay line.

Adjustments (see Fig. 6)

C1	8,8 MHz oscillator	
L1	phase delay line	= 10,7 μH
L2	nominal value	= 10,7 μH
L3	4,4 MHz chrominance input filter	= 10,7 μH = L1
L4	4,4 MHz trap in luminance signal line	= 5,6 μH
L5	delay equalization	= 66,1 μH
P1	amplitude of direct chroma signal	
R1 R2	field blanking $\frac{R1}{R1 + R2}$ x field blanking amplitude 2,0 V to 6,5 V.	

For a video input voltage of 1 V peak-to-peak: R4 = 1 kΩ; R3, R5 and R6 can be omitted.

PAL DECODER

The TDA3561A is a decoder for the PAL colour television standard. It combines all functions required for the identification and demodulation of PAL signals. Furthermore it contains a luminance amplifier, an RGB-matrix and amplifier. These amplifiers supply output signals up to 5 V peak-to-peak (picture information) enabling direct drive of the discrete output stages. The circuit also contains separate inputs for data insertion, analogue as well as digital, which can be used for text display systems (e.g. (Teletext/ broadcast antiope), channel number display, etc. Additional to the TDA3560, the circuit includes the following features:

- The peak white limiter is only active during the time that the 9,3 V level at the output is exceeded. The start of the limiting function is delayed by one line period. This avoids peak white limiting by test patterns which have abrupt transitions from colour to white signals.
- The brightness control is obtained by inserting a variable pulse in the luminance channel. Therefore the ratio of brightness variation and signal amplitude at the three outputs will be identical and independent of the difference in gain of the three channels. Thus discolouring due to adjustment of contrast and brightness is avoided.
- Improved suppression of the internal RGB signals when the device is switched to external signals, and vice versa.
- Non-synchronized external RGB signals do not disturb the black level of the internal signals.
- Improved suppression of the residual 4,4 MHz signal in the RGB output stages.
- Cascoded stages in the demodulators and burst phase detector minimize the radiation of the colour demodulator inputs.
- High current capability of the RGB outputs and the chrominance output.

QUICK REFERENCE DATA

Supply voltage	V_{1-27}	type.	12	V
Supply current	I_1	typ.	85	mA
Luminance input signal (peak-to-peak value)	$V_{10-27(p-p)}$	typ.	0,45	V
Chrominance input signal (peak-to-peak value)	$V_{3-27(p-p)}$	55 to	1100	mV
Data input signals (peak-to-peak value)	$V_{13,15,17-27(p-p)}$	typ.	1	V
RGB output signals at nominal contrast and saturation (peak-to-peak value)	$V_{12,14,16-27(p-p)}$	typ.	5,25	V
Contrast control range		typ.	20	dB
Saturation control range		min.	50	dB
Input voltage for data insertion	V_{9-27}	min.	0,9	V
Blanking input voltage	V_{8-27}	typ.	1,5	V
Burst gating and black-level gating input voltage	V_{8-27}	typ.	7	V

PACKAGE OUTLINE

28-lead DIL; plastic (SOT-117).

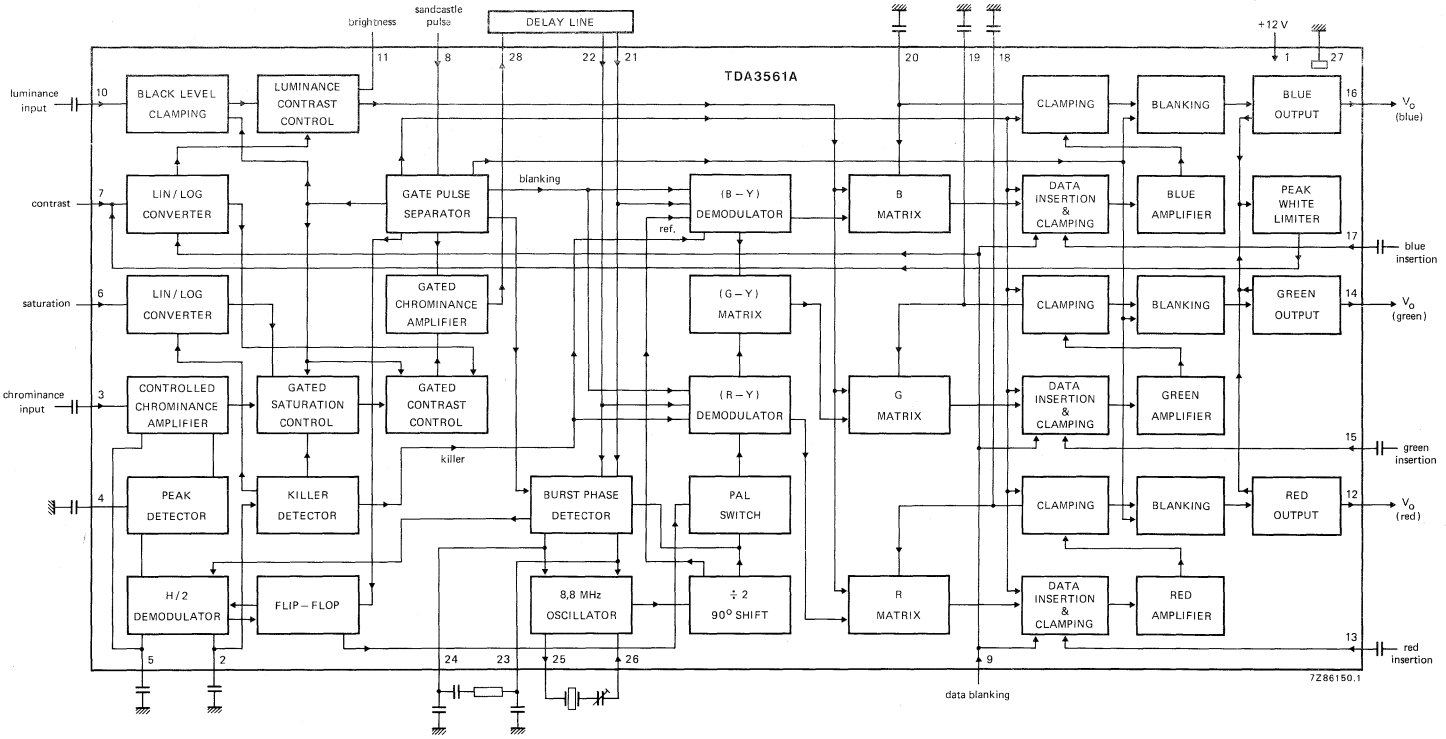


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage	$V_P = V_{1-27}$	max.	13,2 V
Total power dissipation; see also Fig. 2	P_{tot}	max.	1,7 W
Storage temperature range	T_{stg}		−25 to + 150 °C
Operating ambient temperature range	T_{amb}		−25 to + 65 °C

THERMAL RESISTANCE

From junction to ambient	$R_{th\ j-a}$	=	50 K/W

CHARACTERISTICS

$V_P = V_{1-27} = 12$ V; $T_{amb} = 25$ °C; unless otherwise specified

Supply voltage	$V_P = V_{1-27}$	typ. 	12 V 8 to 13,2 V
Supply current		typ. <	85 mA 115 mA
Total power dissipation	P_{tot}	typ. <	1,0 W 1,4 W
Luminance input (pin 10)			
Input voltage (peak-to-peak value); note 1	$V_{10-27(p-p)}$	typ.	0,45 V
Input level before clipping	V_{10-27}	<	2 V
Input current; input level 2 V, clamp not active	I_{10}	typ. <	0,15 μA 1 μA
Contrast control range (see Fig. 3)			−17 to + 3 dB
Control voltage for 40 dB attenuation	V_{7-27}	typ.	1,2 V
Input current contrast control at $V_{7-27} = 3$ V	I_7	<	10 μA
Chrominance amplifier			
Input voltage (peak-to-peak value); note 2	$V_{3-27(p-p)}$	typ. 	550 mV 55 to 1100 mV
Input impedance	$\lvert Z_{3-27}\rvert$	typ. 	9 kΩ 6 to 12 kΩ
Input capacitance	C_{3-27}	typ. <	4 pF 6 pF
A.C.C. control range		>	30 dB
Change of the burst signal at the output over the whole control range		<	1,5 dB
Gain at nominal contrast/saturation pin 3 to pin 28; note 3		>	32 dB
Output signal (peak-to-peak value) at nominal contrast/saturation; burst signal: 0,5 V peak to peak	$V_{28-27(p-p)}$	typ.	1,7 V
Maximum output voltage (peak-to-peak value) $R_L = 2$ kΩ	$V_{28-27(p-p)}$	typ.	4,0 V

CHARACTERISTICS (continued)

Chrominance amplifier (continued)

Distortion of chrominance amplifier at $V_{28\text{-}27(p\text{-}p)}$ = 2 V up to $V_{3\text{-}27(p\text{-}p)}$ = 1 V	d	typ. <	1,5 % 5 %
Frequency response between 0 and 5 MHz			−2 dB
Saturation control range (see Fig. 4)		>	50 dB
Input current saturation control at $V_{6\text{-}27}$ = 3 V	I_6	<	15 μA
Tracking between luminance and chrominance with contrast control over a range of 10 dB		<	2 dB
Cross-coupling between luminance and chrominance amplifier; note 10		<	−46 dB
Signal-to-noise ratio at nominal input signal; note 11	S/N	>	56 dB
Phase shift between burst and chrominance at nominal contrast/saturation	$\Delta\varphi$	<	± 5°
Output impedance of chrominance amplifier	$\lvert Z_{28\text{-}27}\rvert$	typ.	25 Ω
Maximum output current	I_{28}	<	15 mA

Reference part

Phase locked loop:			
– catching range; note 4		> typ.	500 Hz 700 Hz
– phase shift; note 5		<	5°
Oscillator:			
– temperature coefficient of oscillator frequency; note 4		typ.	−1,5 Hz/K
– frequency deviation for V_P changing from 10 to 13,2 V; note 4		typ.	40 Hz
– input resistance (pin 26)	$R_{26\text{-}27}$	typ. 260 to 420	340 Ω Ω
– input capacitance (pin 26)	$C_{26\text{-}27}$	<	10 pF
– output resistance (pin 25)	$R_{25\text{-}27}$	typ. 100 to 200	150 Ω Ω
– output voltage (peak-to-peak value; pin 25)	$V_{25\text{-}27(p\text{-}p)}$	typ.	700 mV
A.C.C. generation:			
– reference voltage (pin 4)	$V_{4\text{-}27}$	typ.	4,9 V
– control voltage at nominal input signal (pin 2)	$V_{2\text{-}27}$	typ.	5,1 V
– control voltage without chrominance input (pin 2)	$V_{2\text{-}27}$	typ.	2,65 V
– colour-off voltage (pin 2)	$V_{2\text{-}27}$	typ.	3,15 V
– colour-on voltage (pin 2)	$V_{2\text{-}27}$	typ.	3,4 V
– identification-on voltage (pin 2)	$V_{2\text{-}27}$	typ.	1,9 V
– change in burst amplitude with supply voltage (± 10%)		proportional	
– change in burst amplitude with temperature		typ. <	0,1 %/K 0,25 %/K
– voltage at pin 5 at nominal input signal	$V_{5\text{-}27}$	typ.	5 V

Demodulator part

Input burst signal amplitude (peak-to-peak value) between pins 21 and 22; note 6	$V_{21\text{-}22(p\text{-}p)}$	typ.	100 mV
Input impedance between pins 21 and 22	$\lvert Z_{21\text{-}22}\rvert$	typ.	2 kΩ
Ratio of demodulated signals for equal input signals at pins 21 and 22 (B−Y)/(R−Y)	$\frac{V_{16\text{-}27}}{V_{12\text{-}27}}$	typ.	1,78 ± 10%
(G−Y)/(R−Y); no (B−Y) signal	$\frac{V_{14\text{-}27}}{V_{12\text{-}27}}$	typ.	−0,51 ± 10%
(G−Y)/(B−Y); no (R−Y) signal	$\frac{V_{14\text{-}27}}{V_{16\text{-}27}}$	typ.	−0,19 ± 25%
Frequency response between 0 and 1 MHz			−3 dB
Cross talk between colour demodulated signals		>	40 dB
Phase difference between (R−Y) signal and (R−Y) reference signal		<	5°
Phase difference between (R−Y) and (B−Y) reference signals		typ.	90° 85 to 95°

R.G.B. matrix and amplifiers

Output voltage (peak-to-peak value) at nominal luminance/contrast (black to white); note 3	$V_{12,14,16\text{-}27(p\text{-}p)}$	typ.	5,4 V 4,5 to 6,3 V
Output voltage (peak-to-peak value) of the RED channel at nominal contrast/saturation and no luminance signal at the input, (R−Y) signal	$V_{12\text{-}27(p\text{-}p)}$	typ.	5,25 V 3,7 to 6,7 V
Maximum peak white level; note 7		typ.	9,3 V 9,0 to 9,6 V
Maximum output current	$I_{12,14,16}$	<	15 mA
Black level at the output for a brightness control voltage of 2 V	$V_{12,14,16\text{-}27}$	typ.	2,6 V
Difference in black level between the three channels at an output level of 3 V; note 8	ΔV	<	200 mV
Black level shift with vision contents		<	40 mV
Brightness control voltage range	see Fig. 5		
Input current brightness control	I_{11}	<	50 μA
Variation of black level with temperature	ΔV	typ. <	0,35 mV/K 1,0 mV/K
Variation of black level with contrast control	ΔV	typ. <	10 mV 200 mV
Relative spread between the R, G and B output signals		<	10 %
Relative black-level variation between the three channels during variation of contrast and supply voltage		typ. <	0 mV 20 mV

CHARACTERISTICS (continued)

RGB matrix and amplifier (continued)

Differential black-level drift over a temperature range of 40 °C		typ. <	0 mV 20 mV
Blanking level at the RGB outputs		typ. 1,9 to 2,3	2,1 V V
Difference in blanking level of the three channels		typ.	0 mV
Differential blanking level drift over a temperature range of 40 °C		typ.	0 mV
Tracking of output black level with supply voltage	$\frac{\Delta V_{bl}}{V_{bl}} \times \frac{V_P}{\Delta V_P}$	typ.	1,1
Signal-to-noise ratio of output signals; note 11	S/N	>	62 dB
Residual 4,4 MHz signal at RGB outputs (peak-to-peak value)		typ. <	40 mV 150 mV
Residual 8,8 MHz signal and higher harmonics at the RGB outputs (peak-to-peak value)		typ. <	75 mV 150 mV
Output impedance of RGB outputs	$\lvert Z_{12,14,16\text{-}27} \rvert$	typ.	50 Ω
Frequency response of total luminance and RGB amplifier circuits for f = 0 to 5 MHz		<	−3 dB

Signal insertion (pins 13,15 and 17)

Input signals (peak-to-peak value) for an RGB output voltage of 5 V peak-to-peak	$V_{13,15,17\text{-}27(p\text{-}p)}$	typ. 0,85 to 1,1	1 V V
Difference between the black levels of the RGB signals and the inserted signals at the output; note 9	ΔV	<	260 mV
Output rise time	t_r	typ. <	40 ns 80 ns
Differential delay time for the three channels	t_d	typ. <	0 ns 40 ns
Input current	$I_{13,15,17}$	<	10 μA

Data blanking (pin 9)

Input voltage for no data insertion	$V_{9\text{-}27}$	<	0,4 V
Input voltage for data insertion	$V_{9\text{-}27}$	>	0,9 V
Maximum input voltage	$V_{9\text{-}27}$	<	3 V
Delay of data blanking	t_d	<	20 ns
Input current	I_9	<	35 μA
Input impedance	$\lvert Z_{9\text{-}27} \rvert$	typ.	10 kΩ
Suppression of the internal RGB signals when $V_{9\text{-}27} > 0,9$ V		>	46 dB

Sandcastle input (pin 8)

Level at which the RGB blanking is activated	$V_{8\text{-}27}$	typ. 1,5 V 1 to 2 V
Level at which burst gating and clamping pulse are separated	$V_{8\text{-}27}$	typ. 7,0 V 6,5 to 7,5 V
Delay between black level clamping and burst gating pulse	t_d	typ. 0,4 μs
Input current for:		
$V_{8\text{-}27}$ = 0 to 1 V	$-I_8$	< 1 mA
$V_{8\text{-}27}$ = 1 to 8,5 V	I_8	typ. 20 μA
$V_{8\text{-}27}$ = 8,5 to 12 V	I_8	< 2 mA

Notes to the characteristics

1. Signal with the negative-going sync; amplitude includes sync pulse amplitude.
2. Indicated is a signal for a colour bar with 75% saturation, so chrominance to burst ratio is 2,2 : 1.
3. Nominal contrast is specified as the maximum contrast −3 dB and nominal saturation as the maximum saturation −6 dB.
4. All frequency variations are referred to the 4,4 MHz carrier frequency.
5. For ± 400 Hz deviation of the oscillator frequency.
6. These signal amplitudes are determined by the a.c.c. circuit of the reference part.
7. When this level is exceeded, the amplitude of the output signal is reduced via a discharge of the capacitor at pin 7 (contrast control). The start of the peak white limiting action has a delay of one line period.
8. The variation of the black level depends directly on the gain of each channel during brightness control in the three channels. As a consequence, the black levels at the outputs (for output levels above or below 3 V) can have a difference which exceeds 200 mV. Because the amplitude and the black level change with brightness control have a direct relationship, no discolouring can occur, caused by adjustment of contrast and brightness.
9. This difference occurs when the source impedance of the data signal inputs is 150 Ω and the black level clamp pulse duration is 4 μs (sandcastle pulse). A lower difference is obtained when the impedance is lower.
10. Cross-coupling is measured under the following condition. Input signals nominal, contrast and saturation such that nominal output signals are obtained. The signals at the output at which no signal should be available must be compared with the nominal output signal at that output.
11. The signal-to-noise ratio is specified as peak-to-peak signal with respect to r.m.s. noise.

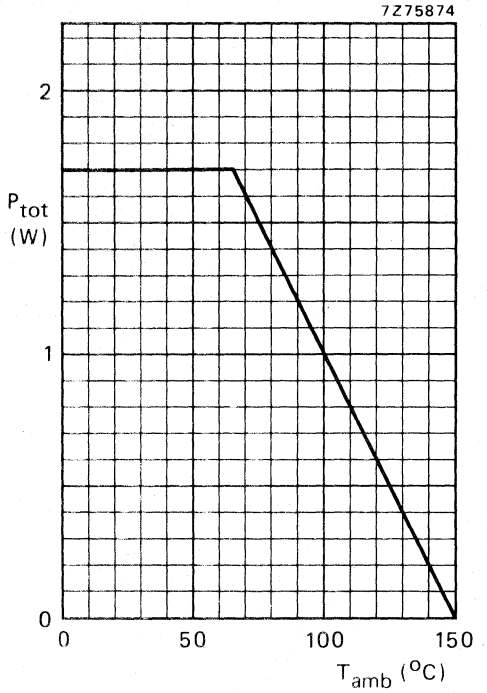


Fig. 2 Power derating curve.

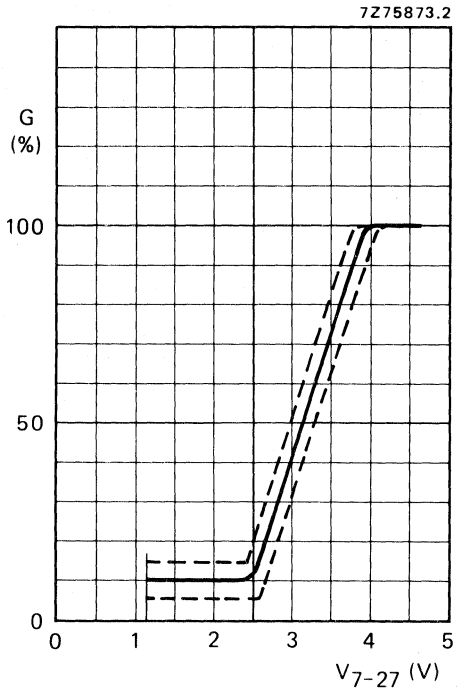


Fig. 3 Contrast control voltage range.

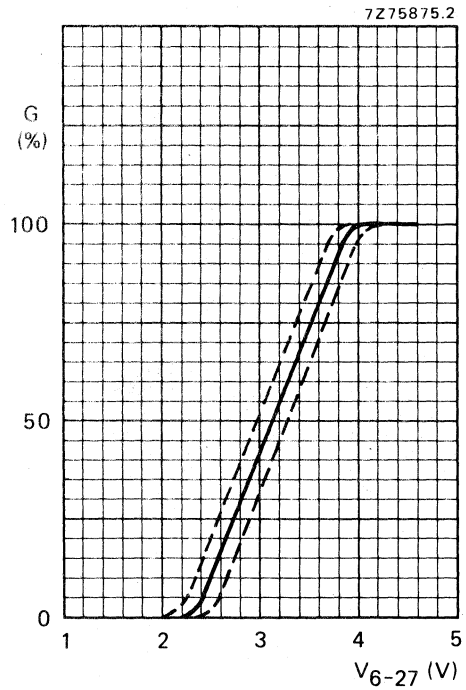


Fig. 4 Saturation control voltage range.

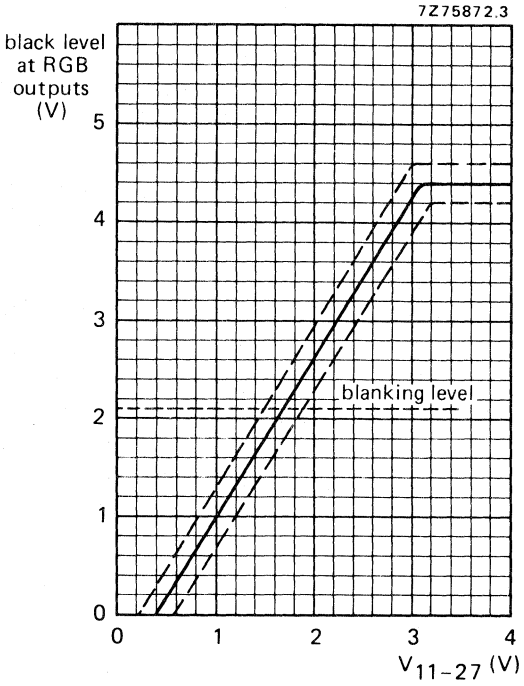


Fig. 5 Brightness control voltage range.

APPLICATION INFORMATION

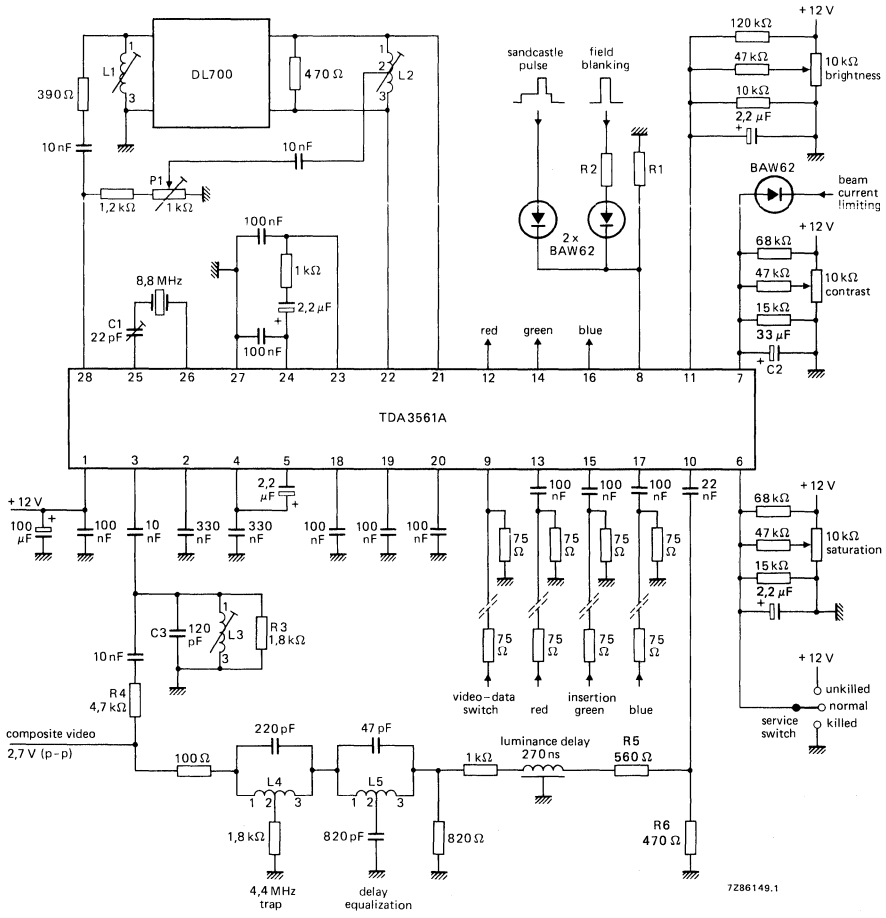


Fig. 6 Application circuit.

Adjustments (see Fig. 6)

C1	8,8 MHz oscillator	
L1	phase delay line	= 10,7 μH
L2	nominal value	= 10,7 μH
L3	4,4 MHz chrominance input filter	= 10,7 μH = L1
L4	4,4 MHz trap in luminance signal line	= 5,6 μH
L5	delay equalization	= 66,1 μH
P1	amplitude of direct chroma singal	
R1 R2	field blanking $\frac{R1}{R1 + R2}$ x field blanking amplitude 2,0 V to 6,5 V.	

For a video input voltage of 1 V peak-to-peak: R3 can be omitted; R4 = 1 kΩ; R5 must be short-circuited; R6 = 1 kΩ.

APPLICATION INFORMATION

The function is described against the corresponding pin number.

1. + 12 V power supply

The circuit gives good operation in a supply voltage range between 8 and 13,2 V provided that the supply voltage for the controls is equal to the supply voltage for the TDA3561A. All signal and control levels have a linear dependency on the supply voltage. The current taken by the device at 12 V is typically 85 mA. It is linearly dependent on the supply voltage.

2. Control voltage for identification

This pin requires a detection capacitor of about 330 nF for correct operation. The voltages available under various signal conditions are given in the specification.

3. Chrominance input

The chroma signal must be a.c.-coupled to the input. Its amplitude must be between 55 mV and 1100 mV peak-to-peak (25 mV to 500 mV peak-to-peak burst signal). All figures for the chroma signals are based on a colour bar signal with 75% saturation, that is the burst-to-chroma ratio of the input signal is 1 : 2,25.

4. Reference voltage A.C.C. detector

This pin must be decoupled by a capacitor of about 330 nF. The voltage at this pin is 4,9 V.

5. Control voltage A.C.C.

The A.C.C. is obtained by synchronous detection of the burst signal followed by a peak detector. A good noise immunity is obtained in this way and an increase of the colour for weak input signals is prevented. The recommended capacitor value at this pin is 2,2 μF.

6. Saturation control

The saturation control range is in excess of 50 dB. The control voltage range is 2 to 4 V. Saturation control is a linear function of the control voltage.

When the colour killer is active, the saturation control voltage is reduced to a low level if the resistance of the external saturation control network is sufficiently high. Then the chroma amplifier supplies no signal to the demodulator. Colour switch-on can be delayed by proper choice of the time constant for the saturation control setting circuit.

When the saturation control pin is connected to the power supply the colour killer circuit is overruled so that the colour signal is visible on the screen. In this way it is possible to adjust the oscillator frequency without using a frequency counter (see also pins 25 and 26).

7. Contrast control

The contrast control range is 20 dB for a control voltage change from + 2 to + 4 V. Contrast control is a linear function of the control voltage. The output signal is suppressed when the control voltage is 1 V or less. If one or more output signals surpasses the level of 9 V the peak white limiter circuit becomes active and reduces the output signals via the contrast control by discharging C2 via an internal current sink.

8. Sandcastle and field blanking input

The output signals are blanked if the amplitude of the input pulse is between 2 and 6,5 V. The burst gate and clamping circuits are activated if the input pulse exceeds a level of 7,5 V.
The higher part of the sandcastle pulse should start just after the sync pulse to prevent clamping of video signal on the sync pulse. The width should be about 4 μs for proper A.C.C. operation.

9. Video-data switching

The insertion circuit is activated by means of this input by an input pulse between 1 V and 2 V. In that condition, the internal RGB signals are switched off and the inserted signals are supplied to the output amplifiers. If only normal operation is wanted this pin should be connected to the negative supply. The switching times are very short ($<$ 20 ns) to avoid coloured edges of the inserted signals on the screen.

10. Luminance signal input

The input signal should have a peak-to-peak amplitude of 0,45 V (peak white to sync) to obtain a black-white output signal of 5 V at nominal contrast. It must be a.c.-coupled to the input by a capacitor of about 22 nF. The signal is clamped at the input to an internal reference voltage.
A 1 kΩ luminance delay line can be applied because the luminance input impedance is made very high. Consequently the charging and discharging currents of the coupling capacitor are very small and do not influence the signal level at the input noticeably. Additionally the coupling capacitor value may be small.

11. Brightness control

The black level of the RGB outputs can be set by the voltage on this pin (see Fig. 5). The black level can be set higher than 4 V however the available output signal amplitude is reduced (see pin 7). Brightness control also operates on the black level of the inserted signals.

12, 14, 16. RGB outputs

The output circuits for red, green and blue are identical. Output signals are 5,25 V (R, G and B) at nominal input signals and control settings. The black levels of the three outputs have the same value. The blanking level at the outputs is 2,1 V. The peak white level is limited to 9,3 V. When this level exceeded the output signal amplitude is reduced via the contrast control (see pin 7).

13, 15, 17. Inputs for external RGB signals

The external signals must be a.c.-coupled to the inputs via a coupling capacitor of about 100 nF. Source impedance should not exceed 150 Ω. The input signal required for a 5 V peak-to-peak output signal is 1 V peak -to-peak. At the RGB outputs the black level of the inserted signal is identical to that of normal RGB signals. When these inputs are not used the coupling capacitors have to be connected to the negative supply.

18, 19, 20. Black level clamp capacitors

The black level clamp capacitors for the three channels are connected to these pins. The value of each capacitor should be about 100 nF.

21, 22. Inputs (B-Y) and (R-Y) demodulators

The input signal is automatically fixed to the required level by means of the burst phase detector and A.C.C. generator which are connected to pin 21 and pin 22. As the burst (applied differentially to those pins) is kept constant by the A.C.C., the colour difference signals automatically have the correct value.

APPLICATION INFORMATION (continued)

23, 24. Burst phase detector outputs

At these pins the output of the burst phase detector is filtered and controls the reference oscillator. An adequate catching range is obtained with the time constants given in the application circuit (see Fig. 6).

25, 26. Reference oscillator

The frequency of the oscillator is adjusted by the variable capacitor C1. For frequency adjustment interconnect pin 21 and pin 22. The frequency can be measured by connecting a suitable frequency counter to pin 25.

28. Output of the chroma amplifier

Both burst and chroma signals are available at the output. The burst-to-chroma ratio at the output is identical to that at the input for nominal control settings. The burst signal is not affected by the controls. The amplitude of the input signal to the demodulator is kept constant by the A.C.C. Therefore the output signal at pin 28 will depend on the signal loss in the delay line.

PAL/NTSC DECODER

GENERAL DESCRIPTION

The TDA3562A is a decoder for the PAL and/or NTSC colour television standards. It combines all functions required for the identification and demodulation of PAL/NTSC signals.
Furthermore it contains a luminance amplifier, an RGB-matrix and amplifier. These amplifiers supply output signals up to 4 V peak-to-peak (picture information) enabling direct drive of the discrete output stages. The circuit also contains separate inputs for data insertion, analogue as well as digital, which can be used for text display systems (e.g. Teletext/broadcast Antiope), channel number display, etc.

Features

- A black-current stabilizer which controls the black-currents of the three electron-guns to a level low enough to omit the black-level adjustment
- Contrast control of inserted RGB signals
- No black-level disturbance when non-synchronized external RGB signals are available on the inputs
- NTSC capability with hue control

QUICK REFERENCE DATA

Supply voltage (pin 1)	$V_P = V_{1-27}$	typ.	12 V
Supply current (pin 1)	$I_P = I_1$	typ.	80 mA
Luminance amplifier (pin 8)			
Input voltage (peak-to-peak value)	$V_{8-27(p-p)}$	typ.	450 mV
Contrast control range		typ.	20 dB
Chrominance amplifier (pin 4)			
Input voltage range (peak-to-peak value)	$V_{4-27(p-p)}$		40 to 1100 mV
Saturation control range		min.	50 dB
RGB matrix and amplifiers			
Output voltage at nominal luminance and contrast (peak-to-peak value)	$V_{13,15,17-27(p-p)}$	typ.	4 V
Data insertion			
Input signals (peak-to-peak value)	$V_{12,14,16-27(p-p)}$	typ.	1 V
Data blanking (pin 9)			
Input voltage for data insertion	V_{9-27}	min.	0,9 V
Sandcastle input (pin 7)			
Blanking input voltage	V_{7-27}	typ.	1,5 V
Burst gating and clamping input voltage	V_{7-27}	typ.	7 V

PACKAGE OUTLINE

28-lead DIL; plastic, with internal heat spreader (SOT-117).

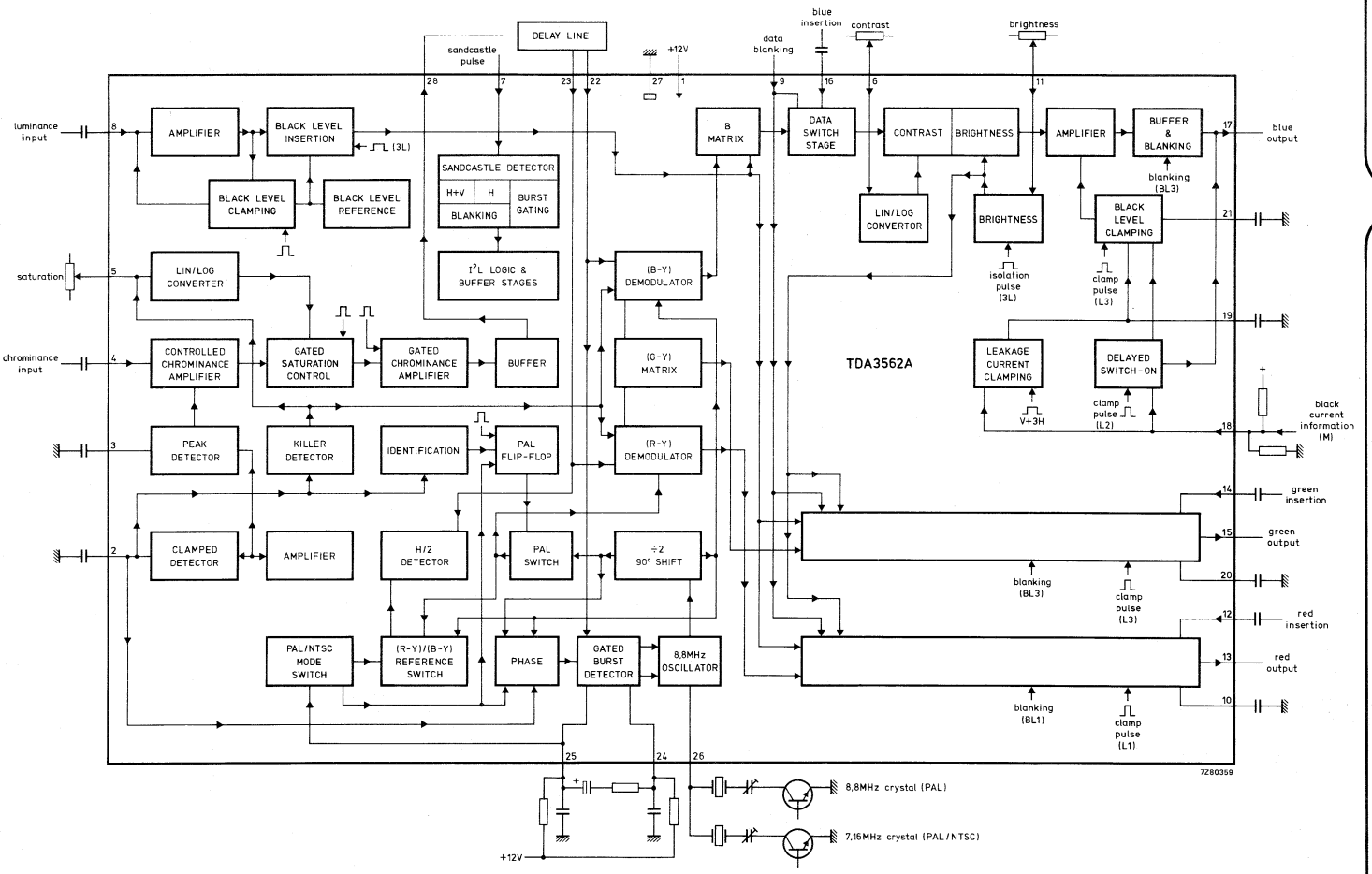


Fig. 1 Block diagram; for explanation of pulse mnemonics see Fig. 6.

FUNCTIONAL DESCRIPTION

Luminance amplifier

The luminance amplifier is voltage driven and requires an input signal of 450 mV peak-to-peak (positive video). The luminance delay line must be connected between the i.f. amplifier and the decoder. The input signal is a.c. coupled to the input (pin 8). After amplification, the black level at the output of the preamplifier is clamped to a fixed d.c. level by the black level clamping circuit.

During three line periods after vertical blanking, the luminance signal is blanked out and the black level reference voltage is inserted by a switching circuit. This black level reference voltage is controlled via pin 11 (brightness). At the same time the RGB signals are clamped. Noise and residual signals have no influence during clamping thus simple internal clamping circuitry is used.

Chrominance amplifiers

The chrominance amplifier has an asymmetrical input. The input signal must be a.c. coupled (pin 4) and have a minimum amplitude of 40 mV peak-to-peak. The gain control stage has a control range in excess of 30 dB, the maximum input signal must not exceed 1,1 V peak-to-peak, otherwise clipping of the input signal will occur. From the gain control stage the chrominance signal is fed to the saturation control stage. Saturation is linear controlled via pin 5. The control voltage range is 2 to 4 V, the input impedance is high and the saturation control range is in excess of 50 dB. The burst signal is not affected by saturation control. The signal is then fed to a gated amplifier which has a 12 dB higher gain during the chrominance signal. As a result the signal at the output (pin 28) has a burst to chrominance ratio which is 6 dB lower than that of the input signal when the saturation control is set at −6 dB. The chrominance output signal is fed to the delay line and, after matrixing, is applied to the demodulator input pins (pins 22 and 23). These signals are fed to the burst phase detector.

Oscillator and identification circuit

The burst phase detector is gated with the narrow part of the sandcastle pulse (pin 7). In the detector the (R-Y) and (B-Y) signals are added to provide the composite burst signal again. This composite signal is compared with the oscillator signal divided-by-2 (R-Y) reference signal. The control voltage is available at pins 24 and 25, and is also applied to the 8,8 MHz oscillator. The 4,4 MHz signal is obtained via the divide-by-2 circuit, which generates both the (B-Y) and (R-Y) reference signals and provides a 90° phase shift between them.

The flip-flop is driven by pulses obtained from the sandcastle detector. For the identification of the phase at PAL mode, the (R-Y) reference signal coming from the PAL switch, is compared to the vertical signal (R-Y) of the PAL delay line. This is carried out in the H/2 detector, which is gated during burst. When the phase is incorrect, the flip-flop gets a reset from the identification circuit. When the phase is correct, the output voltage of the H/2 detector is directly related to the burst amplitude so that this voltage can be used for the a.c.c. To avoid 'blooming-up' of the picture under weak input signal conditions the a.c.c. voltage is generated by peak detection of the H/2 detector output signal.

The killer and identification circuits get their information from a gated output signal of the H/2 detector. Killing is obtained via the saturation control stage and the demodulators to obtain good suppression. The time constant of the saturation control (pin 5) provides a delayed switch-on after killing.

Adjustment of the oscillator is achieved by variation of the burst phase detector load resistance between pins 24 and 25 (see Fig. 7). With this application the trimmer capacitor in series with the 8,8 MHz crystal (pin 26) can be replaced by a fixed value capacitor to compensate for unbalance of the phase detector.

FUNCTIONAL DESCRIPTION (continued)

Demodulator

The (R-Y) and (B-Y) demodulators are driven by the colour difference signals from the delay-line matrix circuit and the reference signals from the 8,8 MHz divider circuit. The (R-Y) reference signal is fed via the PAL-switch. The output signals are fed to the R and B matrix circuits and to the (G-Y) matrix to provide the (G-Y) signal which is applied to the G-matrix. The demodulation circuits are killed and blanked by by-passing the input signals.

NTSC mode

The NTSC mode is switched on when the voltage at the burst phase detector outputs (pins 24 and 25) is adjusted below 9 V. To ensure reliable application the phase detector load resistors are external. When the TDA3562A is used only for PAL these two 33 kΩ resistors must be connected to + 12 V (see Fig. 7). For PAL/NTSC application the value of each resistor must be reduced to 10 kΩ and connected to the slider of a potentiometer (see Fig. 8). The switching transistor brings the voltage at pins 24 and 25 below 9 V which switches the circuit to the NTSC mode. The position of the PAL flip-flop ensures that the correct phase of the (R-Y) reference signal is supplied to the (R-Y) demodulator. The drive to the H/2 detector is now provided by the (B-Y) reference signal. In the PAL mode it is driven by the (R-Y) reference signal.

Hue control is realized by changing the phase of the reference drive to the burst phase detector. This is achieved by varying the voltage at pins 24 and 25 between 7,5 and 8,5 V, nominal position 8,0 V. The hue control characteristic is shown in Fig. 5.

RGB matrix and amplifiers

The three matrix and amplifier circuits are identical and only one circuit will be described.

The luminance and the colour difference signals are added in the matrix circuit to obtain the colour signal, which is then fed to the contrast control stage. The contrast control voltage is supplied to pin 6 (high-input impedance). The control range is +5 dB to −15 dB nominal. The relationship between the control voltage and the gain is linear (see Fig. 2).

During the 4-line period after blanking a pulse is inserted at the output of the contrast control stage. The amplitude of this pulse is varied by a control voltage at pin 11. This applies a variable offset to the normal black level, thus providing brightness control. The brightness control range is 1 V to 3 V.

While this offset level is present, the 'black-current' input impedance (pin 18) is high and the internal clamp circuit is activated. The clamp circuit then compares the reference voltage at pin 19 with the voltage developed across the external resistor network R_A and R_B (pin 18) which is provided by picture tube beam current. The output of the comparator is stored in capacitors connected from pins 10, 20 and 21 to ground which controls the black level at the output. The reference voltage is composed by the resistor divider network and the leakage current of the picture tube into this bleeder. During the sample pulse L_0, this voltage is stored in the capacitor connected to pin 19, which ensures that the leakage current of the CRT does not influence the black current measurement.

The RGB output signals can never exceed a level of 10 V. When the signal tends to exceed this level the output signal is clipped. The black level at the outputs (pins 13, 15 and 17) will be about 3 V. This level depends on the spread of the guns of the picture tube. If a beam current stabilizer is not used it is possible to stabilize the black levels at the outputs, which in this application must be connected to the black current measuring input (pin 18) via a resistor network.

Data insertion

Each colour amplifier has a separate input for data insertion. A 1 V peak-to-peak input signal provides a 4 V peak-to-peak output signal. To avoid the 'black-level' of the inserted signal differing from the black level of the normal video signal, the data is clamped to the black level of the luminance signal. Therefore a.c. coupling is required for the data inputs. To avoid a disturbance of the blanking level due to the clamping circuit, the source impedance of the driver circuit must not exceed 150 Ω.

The data insertion circuit is activated by the data blanking input (pin 9). When the voltage at this pin exceeds a level of 0,9 V, the RGB matrix circuits are switched off and the data amplifiers are switched on. To avoid coloured edges, the data blanking switching time is short.

The amplitude of the data output signals is controlled by the contrast control at pin 6. The black level is equal to the video black level and can be varied between 2 and 4 V (nominal condition) by the brightness control voltage at pin 11.

Non-synchronized data signals do not disturb the black level of the internal signals.

Blanking of RGB and data signals

Both the RGB and data signals can be blanked via the sandcastle input (pin 7). A slicing level of 1,5 V is used for this blanking function, so that the wide part of the sandcastle pulse is separated from the remainder of the pulse. During blanking a level of + 1 V is available at the output.

DEVELOPMENT DATA

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 1)	$V_P = V_{1-27}$	max.	13,2 V
Total power dissipation	P_{tot}	max.	1,7 W
Storage temperature range	T_{stg}		−25 to + 150 °C
Operating ambient temperature range	T_{amb}		−25 to + 70 °C

THERMAL RESISTANCE

From junction to ambient (in free air)	$R_{th\ j\text{-}a}$	=	40 K/W

CHARACTERISTICS

$V_P = V_{1-27} = 12$ V; $T_{amb} = 25$ V; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 1)					
Supply voltage	$V_P = V_{1-27}$	10,8	12	13,2	V
Supply current	$I_P = I_1$	–	80	110	mA
Total power dissipation	P_{tot}	–	0,95	1,3	W
Luminance amplifier (pin 8)					
Input voltage (note 1) (peak-to-peak value)	$V_{8-27(p-p)}$	–	0,45	–	V
Input level before clipping	V_{8-27}	–	–	1	V
Input current	I_8	–	0,1	1	μA
Contrast control range (see Fig. 2)		–15	–	+5	dB
Input current contrast control	I_7	–	–	15	μA
Chrominance amplifier (pin 4)					
Input voltage (note 2) (peak-to-peak value)	$V_{4-27(p-p)}$	40	390	1100	mV
Input impedance	$\|Z_{4-27}\|$	–	10	–	kΩ
Input capacitance	C_{4-27}	–	–	6,5	pF
A.C.C. control range		30	–	–	dB
Change of the burst signal at the output over the whole control range		–	–	1	dB
Gain at nominal contrast/saturation pin 4 to pin 28 (note 3)		34	–	–	dB
Chrominance to burst ratio at nominal saturation (notes 2 and 3) at pin 28		–	12	–	dB
Maximum output voltage (peak-to-peak value); $R_L = 2$ kΩ	$V_{28-27(p-p)}$	4	5	–	V
Distortion of chrominance amplifier at $V_{28-27(p-p)} = 2$ V (output) up to $V_{4-27(p-p)} = 1$ V (input)	d	–	–	5	%
Frequency response between 0 and 5 MHz	α_{28-4}	–	–	–2	dB
Saturation control range (see Fig. 3)		50	–	–	dB
Input current saturation control (pin 5)	I_5	–	–	20	μA
Cross-coupling between luminance and chrominance amplifier (note 4)		–	–	–46	dB
Signal-to-noise ratio at nominal input signal (note 5)	S/N	56	–	–	dB
Phase shift between burst and chrominance at nominal contrast/saturation	$\Delta\varphi$	–	–	± 5	deg
Output impedance of chrominance amplifier	$\|Z_{28-27}\|$	–	10	–	Ω
Output current	I_{28}	–	–	15	mA

DEVELOPMENT DATA

parameter	symbol	min.	typ.	max.	unit
Reference part					
Phase-locked-loop catching range (note 6)	Δf	500	700	–	Hz
phase shift for ± 400 Hz deviation of f_{osc} (note 6)	$\Delta\varphi$	–	–	5	deg
Oscillator temperature coefficient of oscillator frequency (note 6)	TC_{osc}	–	–2	–	Hz/K
frequency variation when supply voltage increases from 10 V to 13,2 V (note 6)	Δf_{osc}	–	40	–	Hz
input resistance (pin 26)	$R_{26\text{-}27}$	–	400	–	Ω
input capacitance (pin 26)	$C_{26\text{-}27}$	–	–	10	pF
A.C.C. generation (pin 2) control voltage at nominal input signal	$V_{2\text{-}27}$	–	4,9	–	V
control voltage without chrominance input	$V_{2\text{-}27}$	–	2,6	–	V
colour-off voltage	$V_{2\text{-}27}$	–	3,4	–	V
colour-on voltage	$V_{2\text{-}27}$	–	3,6	–	V
identification-on voltage	$V_{2\text{-}27}$	–	2,1	–	V
change in burst amplitude with temperature		–	0,1	0,25	%/K
voltage at pin 3 at nominal input signal	$V_{3\text{-}27}$	–	5,1	–	V
Demodulator part					
Input burst signal amplitude (peak-to-peak value) between pins 23 and 27 (note 7)	$V_{23\text{-}27(p\text{-}p)}$	–	80	–	mV
Input impedance between pins 22 or 23 and 27	$\lvert Z_{22\text{-}27/23\text{-}27}\rvert$	–	1	–	kΩ
Ratio of demodulated signals (note 8) (B-Y)/(R-Y)	$\frac{V_{17\text{-}27}}{V_{13\text{-}27}}$	–	1,78 ± 10%	–	
(G-Y)/(R-Y); no (B-Y) signal	$\frac{V_{15\text{-}27}}{V_{13\text{-}27}}$	–	–0,51 ± 10%	–	
(G-Y)/(B-Y); no (R-Y) signal	$\frac{V_{15\text{-}27}}{V_{17\text{-}27}}$	–	–0,19 ± 25%	–	
Frequency response between 0 and 1 MHz		–	–	–3	dB
Cross-talk between colour difference signals		40	–	–	dB
Phase difference between (R-Y) signal and (R-Y) reference signal	$\Delta\varphi$	–	–	5	deg
Phase difference between (R-Y) and (B-Y) reference signals	$\Delta\varphi$	85	90	95	deg

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
RGB matrix and amplifiers					
Output voltage (peak-to-peak value) at nominal luminance/contrast (black-to-white) (note 3)	$V_{13,15,17\text{-}27(p\text{-}p)}$	3,5	4	4,5	V
Output voltage at pin 13 (peak-to-peak value) at nominal contrast/saturation and no luminance signal to (R-Y)	$V_{13\text{-}27(p\text{-}p)}$	–	4,2	–	V
Maximum peak-white level	$V_{13,15,17(m)}$	9,7	10	10,3	V
Available output current (pins 13,15,17)	$I_{13,15,17}$	10	–	–	mA
Difference between black level and measuring level at the output for a brightness control voltage at pin 11 of 2 V (note 9)	$\Delta V_{13,15,17\text{-}27}$	–	0	–	V
Difference in black level between the three channels without black current stabilization (note 10)		–	–	100	mV
Control range of black-current stabilization at V_{b1} = 3 V; $V_{11\text{-}27}$ = 2 V		–	–	± 2	V
Black level shift with vision contents		–	–	40	mV
Brightness control voltage range			see Fig. 4		
Brightness control input current	I_{11}	–	–	5	μA
Variation of black level with temperature	$\Delta V/\Delta T$	–	0	–	mV/K
Variation of black level with contrast*	ΔV	–	–	100	mV
Relative spread between the R, G and B output signals		–	–	10	%
Relative black-level variation between the three channels during variation of contrast, brightness and supply voltage (± 10%)		–	0	20	mV
Differential black-level drift over a temperature range of 40 °C*		–	0	20	mV
Blanking level at the RGB outputs		–	0,95	1,1	V
Difference in blanking level of the three channels		–	0	–	mV
Differential drift of the blanking levels over a temperature range of 40 °C		–	0	–	mV
Tracking of output black level with supply voltage	$\frac{\Delta V_{bl}}{V_{bl}} \times \frac{V_P}{\Delta V_P}$	–	1	–	
Tracking of contrast control between the three channels over a control range at 10 dB		–	–	0,5	dB

* With respect to the measuring pulses.

parameter	symbol	min.	typ.	max.	unit
Output signal during the clamp pulse (3L) after switch-on		7,5	–	–	V
Signal-to-noise ratio of output signals (note 5)	S/N	62	–	–	dB
Residual 4,4 MHz signal at RGB outputs (peak-to-peak value)		–	–	50	mV
Residual 8,8 MHz signal and higher harmonics at the RGB outputs (peak-to-peak value)		–	–	150	mV
Output impedance of RGB outputs	$\lvert Z_{13,15,17-27} \rvert$	–	50	–	Ω
Frequency response of total luminance and RGB amplifier circuits for f = 0 to 5 MHz		–	–1	–3	dB
Current source of output stage		2	3	–	mA
Difference of black level at the three outputs at nominal brightness *		–	–	10	mV
Tracking of brightness control		–	–	2	%
Data insertion (pins 12, 14 and 16)					
Input signals (peak-to-peak value) for an RGB output voltage of 4 V (peak-to-peak) at nominal contrast	$V_{12,14,16-27(p-p)}$	0,9	1	1,1	V
Difference between the black levels of the RGB signals and the inserted signals at the output (note 11)	ΔV	–	–	100	mV
Output rise time	t_r	–	–	80	ns
Differential delay time for the three channels	t_d	–	0	40	ns
Input current	$I_{12,14,16}$	–	–	10	μA
Data blanking (pin 9)					
Input voltage for no data insertion	V_{9-27}	–	–	0,4	V
Input voltage for data insertion	V_{9-27}	0,9	–	–	V
Maximum input voltage	$V_{9-27(m)}$	–	–	3	V
Delay of data blanking	t_d	–	–	20	ns
Input resistance	R_{9-27}	7	10	13	kΩ
Suppression of the internal RGB signals when $V_{9-27} > 0,9$ V		46	–	–	dB

DEVELOPMENT DATA

* With respect to the measuring pulses.

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Sandcastle input (pin 7)					
Level at which the RGB blanking is activated	V_{7-27}	1	1,5	2	V
Level at which the horizontal pulses are separated	V_{7-27}	3	3,5	4	V
Level at which burst gating and clamping pulse are separated	V_{7-27}	6,5	7,0	7,5	V
Delay between black level clamping and burst gating pulse	t_d	–	0,6	–	μs
Input current					
at V_{7-27} = 0 to 1 V	$-I_7$	–	–	1	mA
at V_{7-27} = 1 to 8,5 V	I_7	–	50	–	μA
at V_{7-27} = 8,5 to 12 V	I_7	–	–	2	mA
Black current stabilization (pin 18)					
D.C. bias voltage	V_{18-27}	3,5	5	7,0	V
Difference between input voltage for 'black' current and leakage current	ΔV	–	0,5	–	V
Input current during 'black' current	I_{18}	–	–	1	μA
Input current during scan	I_{18}	–	–	10	mA
Internal limiting at pin 18	V_{18-27}	–	9	–	V
Switching threshold for 'black' current control ON	V_{18-27}	–	8	–	V
Input resistance during scan	R_{18-27}	–	1,5	–	kΩ
D.C. input current during scan at pins 10, 20 and 21	$I_{10,20,21}$	–	–	50	nA
Maximum charge/discharge current during measuring time at pins 10,19,20 and 21	$I_{c/d}$	–	1,0	–	mA
NTSC					
Level at which the PAL/NTSC switch is activated (pins 24 and 25)	V_{24-25}	–	9	–	V
Average output current (note 12)	I_{24+25}	75	90	105	μA
Hue control			see Fig. 5		

Notes to the characteristics

1. Signal with the negative-going sync; amplitude includes sync amplitude.
2. Indicated is a signal for a colour bar with 75% saturation; chrominance to burst ratio is 2,2 : 1.
3. Nominal contrast is specified as the maximum contrast −5 dB and nominal saturation as the maximum saturation −6 dB.
4. Cross coupling is measured under the following condition: input signal nominal, contrast and saturation such that nominal output signals are obtained. The signals at the output at which no signal should be available must be compared with the nominal output signal at that output.
5. The signal-to-noise ratio is defined as peak-to-peak signal with respect to r.m.s. noise.
6. All frequency variations are referred to 4,4 MHz carrier frequency.
7. These signal amplitudes are determined by the a.c.c. circuit of the reference part.
8. The demodulators are driven by a chrominance signal of equal amplitude for the (R-Y) and the (B-Y) components. The phase of the (R-Y) chrominance signal equals the phase of the (R-Y) reference signal. This also applies to the (B-Y) signals.
9. This value depends on the gain setting of the RGB output amplifiers and the drift of the picture tube guns. Higher black level values are possible (up to 5 V) but in that application the amplitude of the output signal is reduced.
10. The variation of the black-level during brightness control in the three different channels is directly dependent on the gain of each channel. Discolouration during adjustments of contrast and brightness does not occur because amplitude and the black-level change with brightness control are directly related.
11. This difference occurs when the source impedance of the data signals is 150 Ω and the black level clamp pulse width is 4 μs (sandcastle pulse). For a lower impedance the difference will be lower.
12. The voltage at pins 24 and 25 can be changed by connecting the load resistors (10 kΩ in this application) to the slider bar of the hue control potentiometer (see Fig. 8). When the transistor is switched on, the voltage at pins 24 and 25 is reduced below 9 V, and the circuit is switched to NTSC mode.

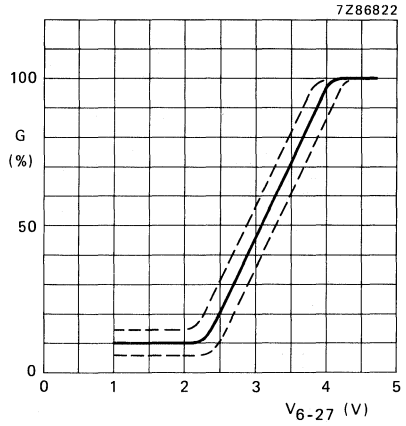


Fig. 2 Contrast control voltage range.

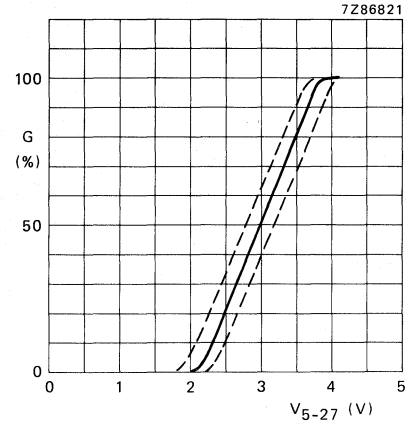


Fig. 3 Saturation control voltage range.

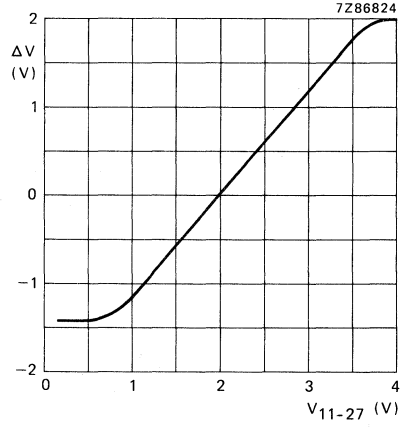


Fig. 4 Difference between black level and measuring level at the RGB outputs (ΔV) as a function of the brightness control input voltage (V_{11-27}).

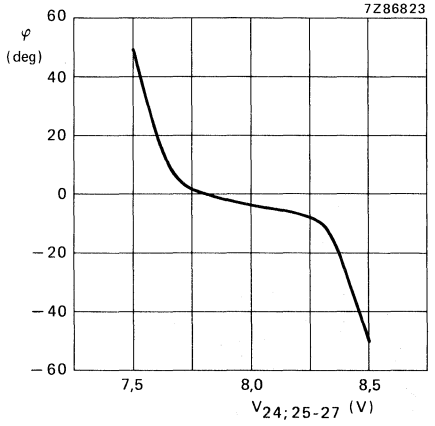


Fig. 5 Hue control voltage range.

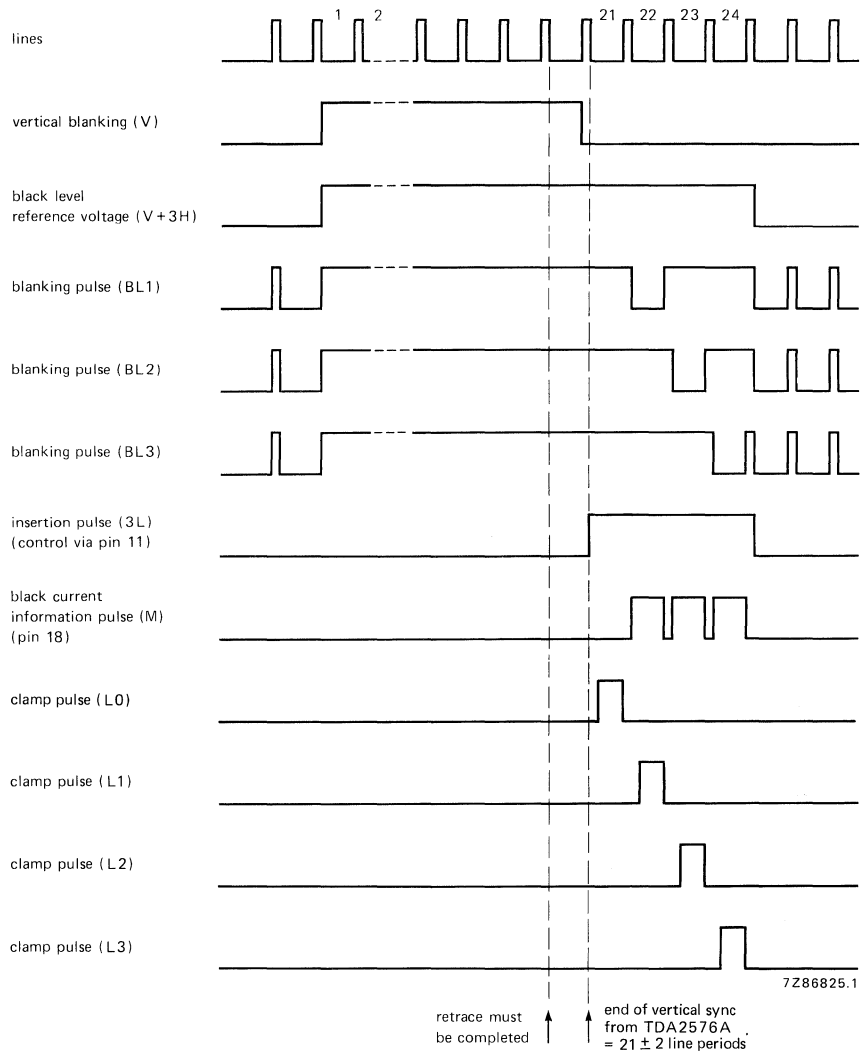


Fig. 6 Timing diagram for black-current stabilizing.

APPLICATION INFORMATION

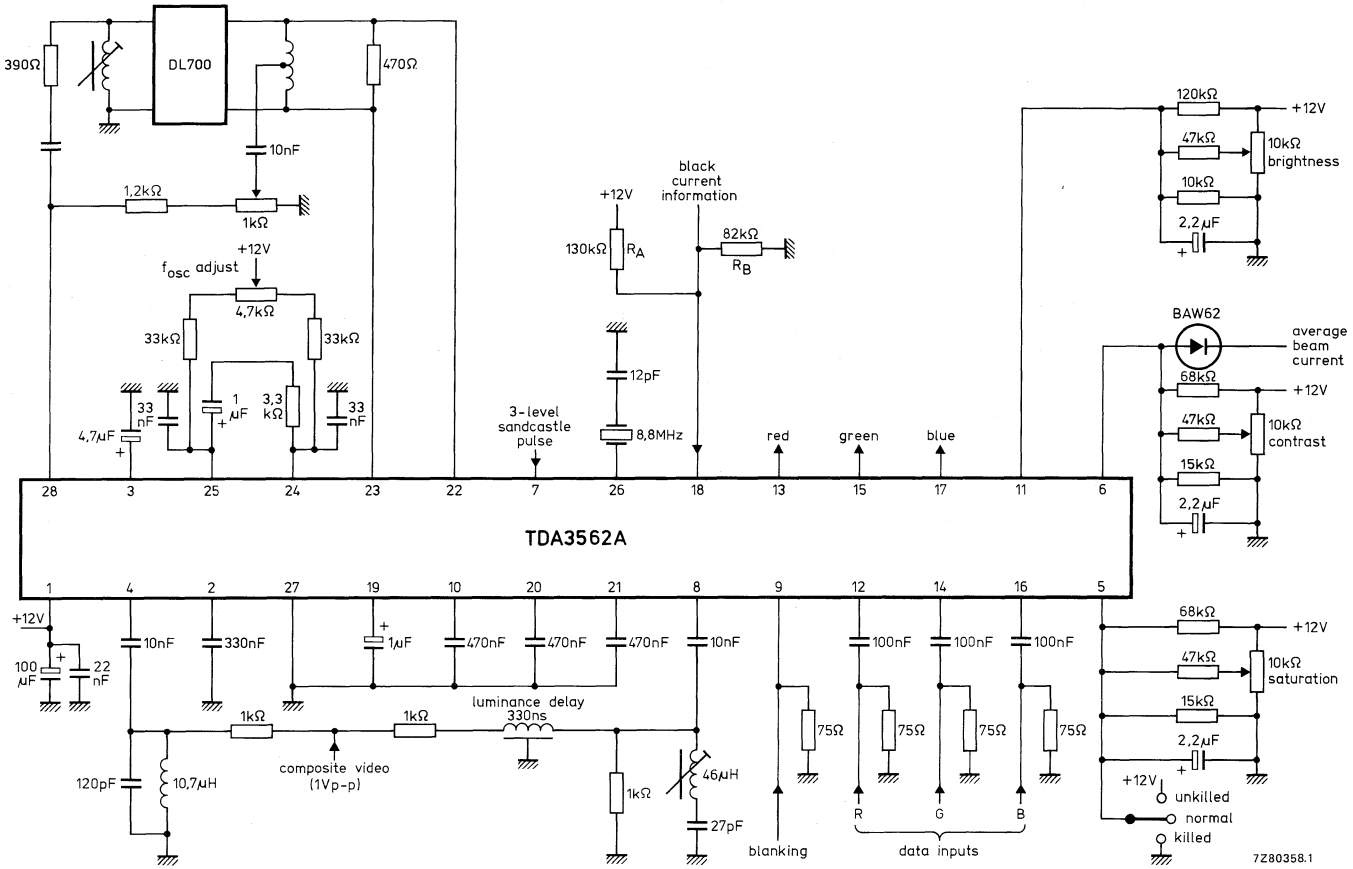


Fig. 7 Application diagram showing the TDA3562A for a PAL decoder.

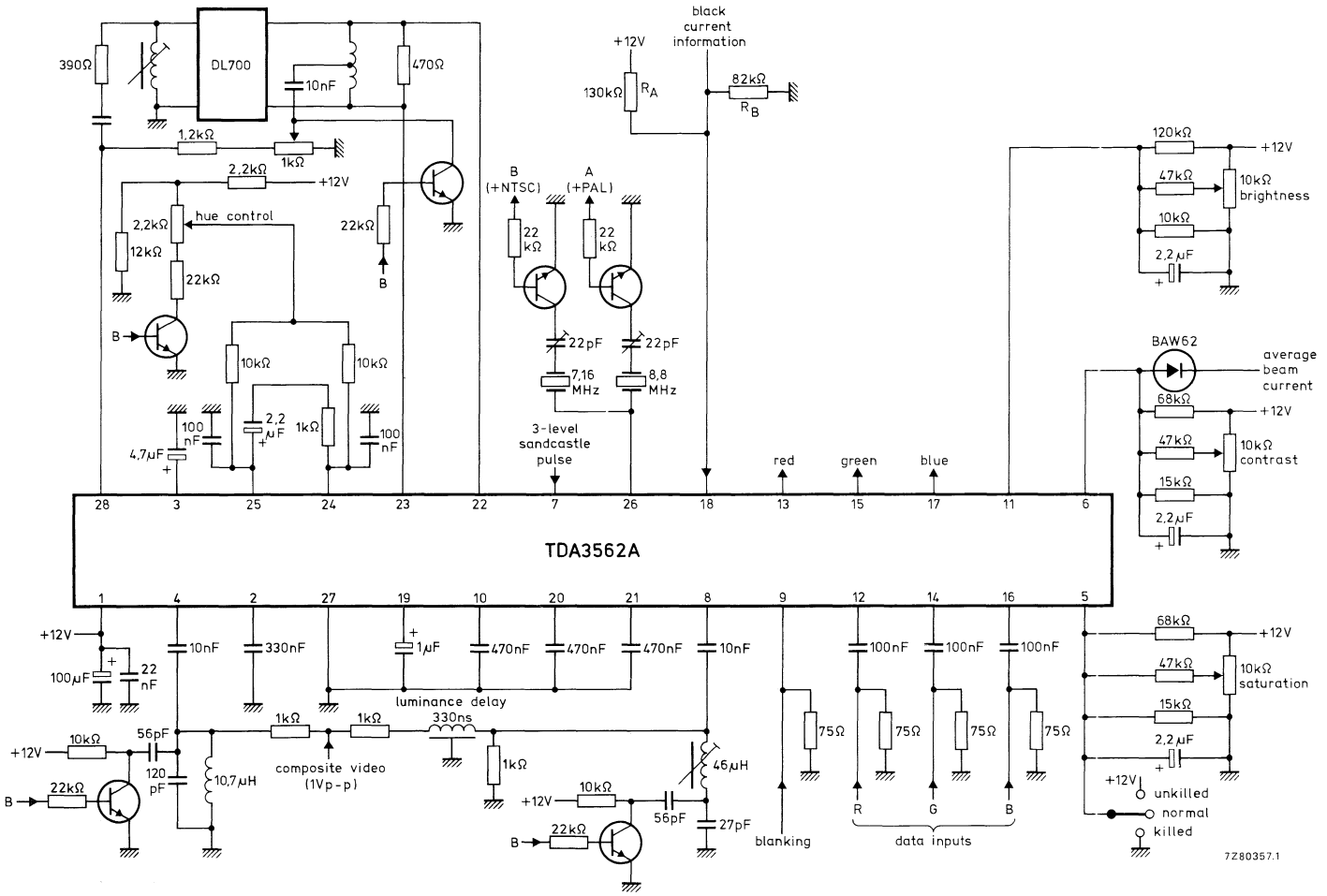


Fig. 8 Application diagram showing the TDA3562A for a PAL/NTSC decoder.

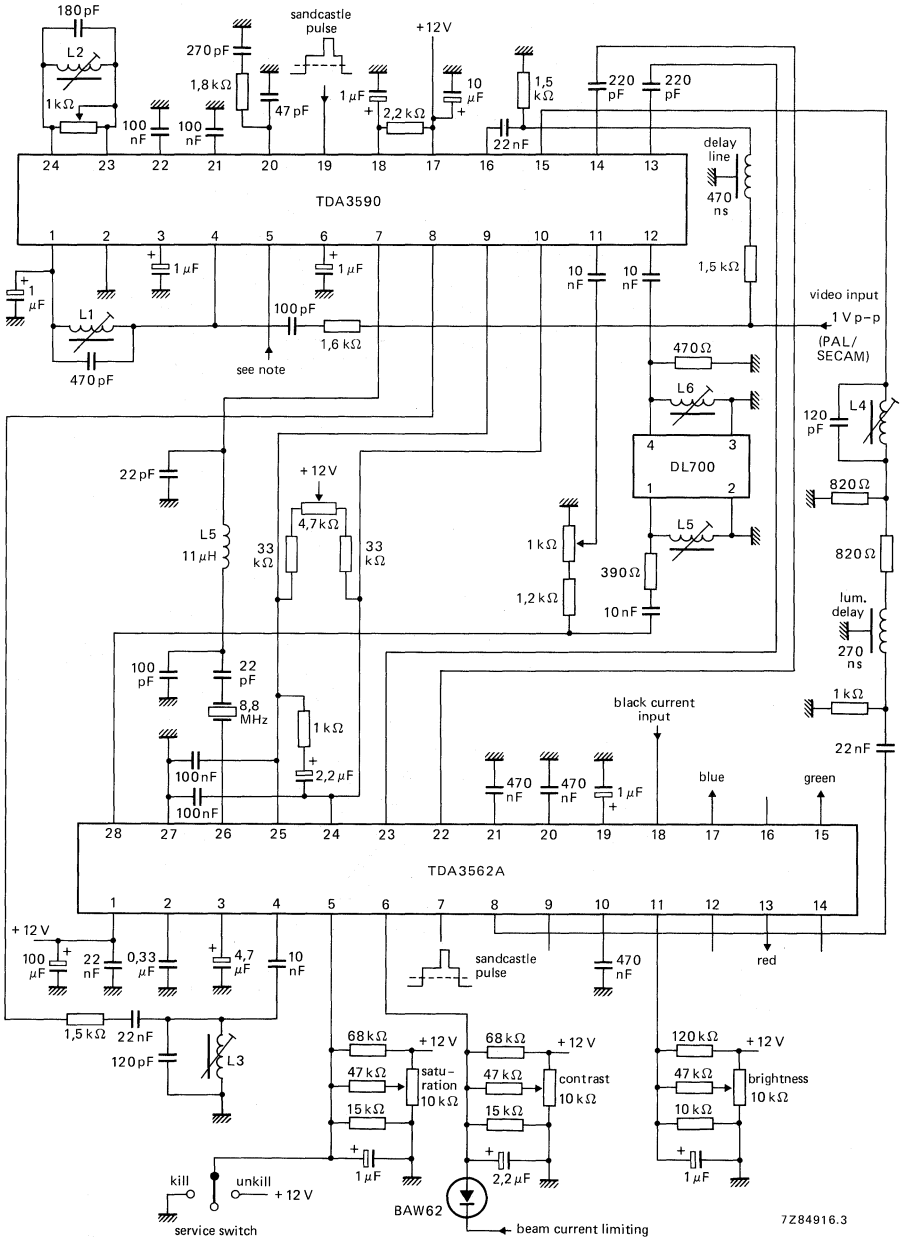


Fig. 9 PAL/SECAM application circuit diagram using the TDA3590 and TDA3562A.

Note to pin 5 TDA3590:

$V_{5\text{-}2} < 1$ V; horizontal identification and black level clamping.
$V_{5\text{-}2} > 11$ V; vertical identification and artificial black level.
$V_{5\text{-}2} = 5$ to 7 V; horizontal identification and artificial black level.

NTSC DECODER

GENERAL DESCRIPTION

The TDA3563 is a monolithic integrated colour decoder for the NTSC standard. It combines all functions required for the identification and demodulation of NTSC signals. Furthermore it contains a luminance amplifier, an RGB-matrix and amplifier. These amplifiers supply signals up to 5,3 V peak-to-peak (picture information) enabling direct drive of the output stages. The circuit also contains inputs for data insertion, analogue as well as digital, which can be used for Teletext information, channel number display, etc.

QUICK REFERENCE DATA

Supply voltage (pin 1)	$V_P = V_{1-27}$	typ.	12	V
Supply current (pin 1)	$I_P = I_1$	typ.	85	mA
Luminance input signal (peak-to-peak value)	$V_{10-27(p-p)}$	typ.	0,45	V
Chrominance input signal (peak-to-peak value)	$V_{3-27(p-p)}$		55 to 1100	mV
Data input signals (peak-to-peak value)	$V_{13;15;17-27(p-p)}$	typ.	1	V
RGB output signals at nominal contrast and saturation (peak-to-peak value)	$V_{12;14;16-27(p-p)}$	typ.	5,3	V
Contrast control range		typ.	20	dB
Saturation control range		min.	50	dB
Input voltage for fast video-data signal switching	V_{9-27}	min.	0,9	V
Blanking input voltage	V_{8-27}	typ.	1,5	V
Burst gating and black-level gating input voltage	V_{8-27}	typ.	7	V

PACKAGE OUTLINE

28-lead DIL; plastic, with internal heat spreader (SOT-117).

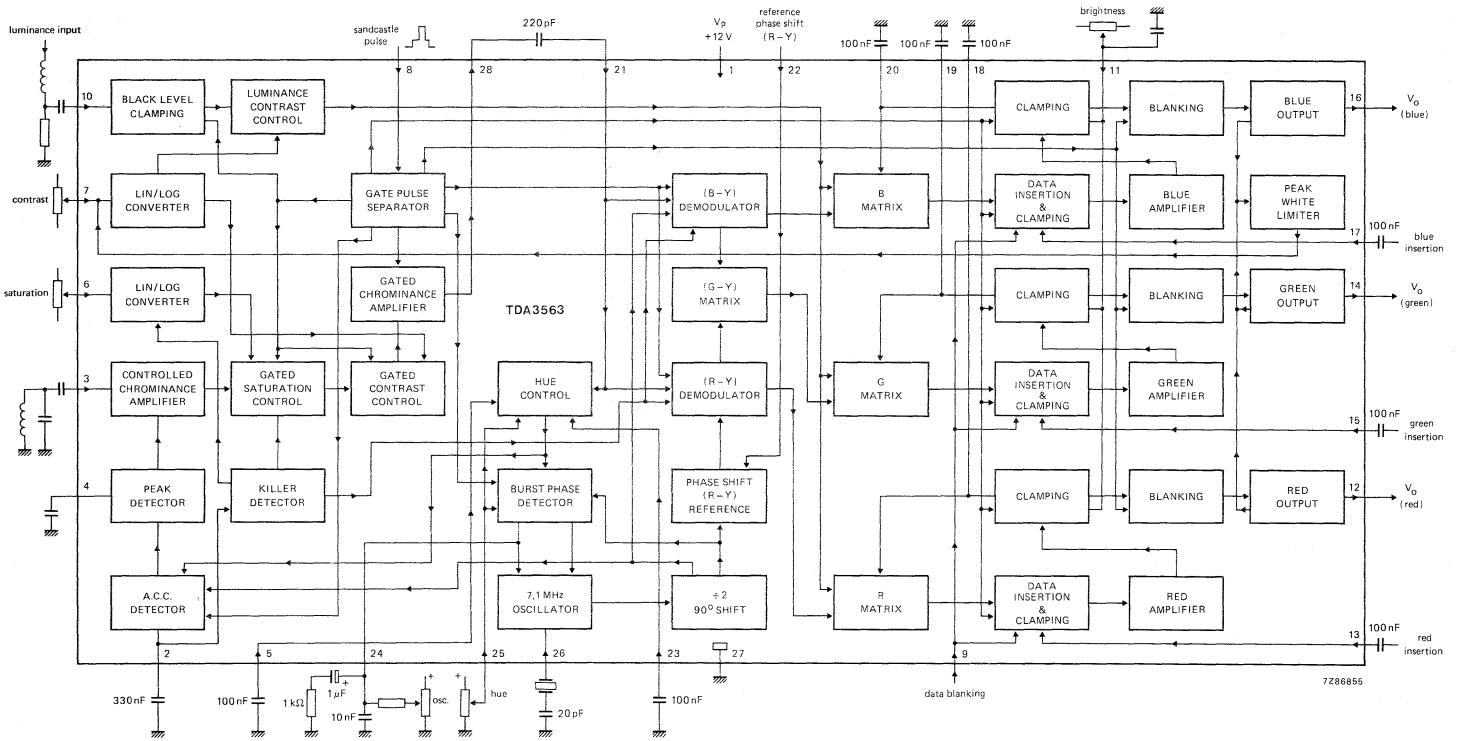


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 1)	$V_P = V_{1-27}$	max.	13,2	V
Total power dissipation	P_{tot}	max.	1,7	W
Storage temperature range	T_{stg}		−25 to +150	°C
Operating ambient temperature range	T_{amb}		−25 to +65	°C

THERMAL RESISTANCE

From junction to ambient (in free air)	$R_{th\ j-a}$	=	50	K/W

DEVELOPMENT DATA

CHARACTERISTICS

$V_P = V_{1-27} = 12$ V; $T_{amb} = 25$ °C; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 1)					
Supply voltage	$V_P = V_{1-27}$	10	12	13,2	V
Supply current	$I_P = I_1$	–	85	115	mA
Total power dissipation	P_{tot}	–	1	1,4	W
Luminance amplifier					
Input voltage (note 1) (peak-to-peak value)	$V_{10-27(p-p)}$	–	0,45	–	V
Contrast control range (see Fig. 2)		–17	–	+3	dB
Control voltage for an attenuation of 40 dB		–	1,2	–	V
Contrast control input current	I_7	–	–	15	μA
Chrominance amplifier					
Input voltage (note 2) (peak-to-peak value)	$V_{3-27(p-p)}$	55	550	1100	mV
A.C.C. control range		30	–	–	dB
Change of the burst signal at the output over the whole control range		–	–	1	dB
Output voltage (note 3) (peak-to-peak value) at a burst signal of 0,3 V peak to peak	V_{28-27}	–	0,15	–	V
Maximum output voltage range (peak-to-peak value); $R_L = 2$ kΩ	V_{28-27}	–	4	–	V
Frequency response between 0 and 5 MHz	α_{28-3}	–	–	–2	dB
Saturation control range (see Fig. 3)		50	–	–	dB
Saturation control input current	I_6	–	–	20	μA
Output impedance of chrominance amplifier	$\lvert Z_{28-27}\rvert$	–	25	–	Ω
Output current	I_{28}	–	–	10	mA
Reference part					
Phase-locked loop					
Catching range (note 4)	Δf	500	700	–	Hz
Phase shift (notes 4 and 5)	$\Delta\varphi$	–	–	5	deg
Oscillator					
Temperature coefficient of oscillator frequency (note 4)	TC_{osc}	–	–1,5	–	Hz/K
Frequency variation when supply voltage increases from 10 V to 13,2 V (note 4)	Δf_{osc}	–	40	–	Hz

DEVELOPMENT DATA

parameter	symbol	min.	typ.	max.	unit
Reference part (continued)					
Oscillator (continued)					
Input resistance (pin 26)	$R_{26\text{-}27}$	–	400	–	Ω
Input capacitance (pin 26)	$C_{26\text{-}27}$	–	–	10	pF
A.C.C. generation (pin 2)					
Control voltage at nominal input signal	$V_{2\text{-}27}$	–	5,0	–	V
Control voltage without chrominance input	$V_{2\text{-}27}$	–	2,7	–	V
Colour-off voltage	$V_{2\text{-}27}$	–	3,0	–	V
Colour-on voltage	$V_{2\text{-}27}$	–	3,3	–	V
Hue control					
Control range		±50	–	–	deg
Demodulator part					
Input burst signal amplitude (peak-to-peak value)	$V_{21\text{-}27(p\text{-}p)}$	–	300	–	mV
Ratio for demodulated signals for equal input signal amplitudes					
(B-Y)/(R-Y)	$\frac{V_{16\text{-}27}}{V_{12\text{-}27}}$	–	1,06±10%	–	
(G-Y)/(R-Y); no (B-Y) signal	$\frac{V_{14\text{-}27}}{V_{12\text{-}27}}$	–	−0,27±20%	–	
(G-Y)/(B-Y); no (R-Y) signal	$\frac{V_{14\text{-}27}}{V_{16\text{-}27}}$	–	−0,2±20%	–	
Frequency response between 0 and 1 MHz		–	–	−3	dB
RGB matrix and amplifiers					
Output voltage (note 3) (peak-to-peak value) at nominal luminance/contrast (black-to-white)	$V_{12;14;16\text{-}27}$	4,5	5,3	6,3	V
Maximum peak-white level (note 6)	$V_{12;14;16\text{-}27}$	9,0	9,3	9,6	V
Maximum output current	$I_{12;14;16}$	–	–	10	mA
Output black level voltage for brightness control of 2 V		–	2,7	–	V
Brightness control voltage range			see Fig. 4		
Brightness control input current	I_{11}	–	–	50	μA
Relative spread between R, G and B output signals		–	–	10	%
Blanking level at RGB outputs		1,9	2,1	2,3	V
Tracking of output black level with supply voltage	$\frac{\Delta V_{bl}}{V_{bl}} \times \frac{V_P}{\Delta V_P}$	–	1,1	–	

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
RGB matrix and amplifiers (continued)					
Output impedance of RGB outputs	$\lvert Z_{12;14;16\text{-}27} \rvert$	–	50	–	Ω
Frequency response of total luminance and RGB amplifier circuits for f = 0 to 5 MHz		–	–	–3	dB
Data insertion					
Input signals (peak-to-peak value) for an RGB output voltage of 5 V (peak-to-peak)	$V_{13;15;17\text{-}27(p\text{-}p)}$	0,9	1	1,1	V
Data blanking (pin 9)					
Input voltage for no data insertion	$V_{9\text{-}27}$	–	–	0,3	V
Input voltage for data insertion	$V_{9\text{-}27}$	0,9	–	–	V
Maximum input voltage	$V_{9\text{-}27(m)}$	–	–	2	V
Delay of data blanking	t_d	–	–	20	ns
Input current	I_9	–	–	35	μA
Sandcastle input (pin 8)					
Level at which RGB blanking is activated	$V_{8\text{-}27}$	1	1,5	2	V
Level at which burst gating and clamping pulse are separated	$V_{8\text{-}27}$	6,5	7,0	7,5	V
Delay between black level clamping and burst gating pulse	t_d	–	0,4	–	μs
Input current					
at $V_{8\text{-}27}$ = 0 to 1 V	$-I_8$	–	–	1	mA
at $V_{8\text{-}27}$ = 1 to 8,5 V	I_8	–	20	–	μA
at $V_{8\text{-}27}$ = 8,5 to 12 V	I_8	–	–	2	mA

Notes to the characteristics

1. Signal with negative-going sync; amplitude includes sync amplitude.
2. Indicated is a signal for a colour bar with 75% saturation; chrominance to burst ratio is 2,2 : 1.
3. At nominal contrast and saturation. Nominal contrast is specified as the maximum contrast –3 dB and nominal saturation as the maximum saturation –6 dB.
4. All frequency variations are referred to 3,58 MHz carrier frequency.
5. For ± 400 Hz deviation of the oscillator frequency.
6. If the typical voltage for this white level is exceeded, the output voltage is reduced by discharging the capacitor at pin 7 (contrast control); discharge current is 1,5 mA.

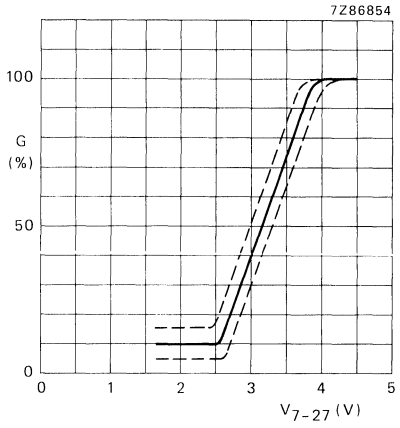


Fig. 2 Contrast control voltage range.

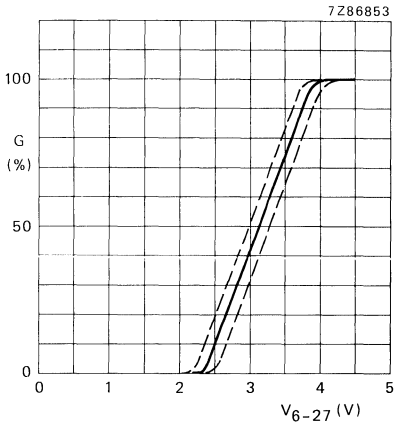


Fig. 3 Saturation control voltage range.

DEVELOPMENT DATA

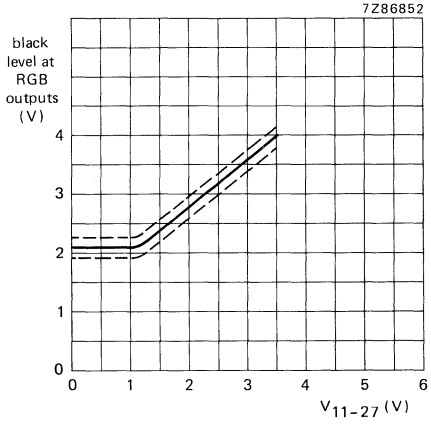


Fig. 4 Brightness control voltage range.

APPLICATION INFORMATION

The function is described against the corresponding pin number.

1. + 12 V power supply

The circuit gives good operation in a supply voltage range between 8 and 13,2 V provided that the supply voltage for the controls is equal to the supply voltage of the TDA3563. All signal and control levels have a linear dependency on the supply voltage. The current consumed by the IC at + 12 V is typically 85 mA. It is linearly dependent on the supply voltage.

2. Control voltage for identification

The output pulses of the a.c.c. detector are detected with a sample-and-hold circuit to obtain information for the colour killer. The output is available at pin 2.

3. Chrominance input

The chrominance signal must be a.c.-coupled to the input. Its amplitude must be between 55 and 1100 mV peak-to-peak (25 to 500 mV peak-to-peak burst signal). All figures for the chrominance signals are based on a colour bar signal with 75% saturation, that is if the burst-to-chrominance ratio of the input is 1 : 2,2.

4. Control voltage a.c.c. detector

The shifted burst signal is synchronously demodulated in a separate a.c.c. detector to generate the a.c.c. voltage. The output pulses of this detector are peak detected to control the gain of the chrominance amplifier, thus preventing blooming-up of the colour during weak signal reception.

5. Decoupling of the 90° phase shift circuit

A control circuit is required in the 90° phase shift circuit to make the chrominance voltage independent of the hue setting. The control circuit is decoupled by a capacitor at this pin.

6. Saturation control

The saturation control range is in excess of 50 dB. The control voltage range is 2 to 4 V. Saturation control is a linear function of the control voltage.

When the colour killer is active, the saturation control voltage is reduced to a low level if the resistance of the external control network is sufficiently high. Then the chrominance amplifier supplies no signal to the demodulator. Colour switch-on can be delayed by proper choice of the time constant for the saturation control setting circuit.

When the saturation control pin is connected to the power supply the colour killer circuit is overruled so that the colour signal is visible on the screen. In this way it is possible to adjust the oscillator frequency without using a frequency counter (see also pins 24 and 26).

7. Contrast control

The contrast control range is 20 dB for a control voltage change from + 2 V to + 4 V. Contrast control is a linear function of the control voltage. The output signal is suppressed when the control voltage is 1 V or less. If one or more output signals surpasses the level of 9 V the peak-white limiter circuit becomes active and reduces the output signals via the contrast control by discharging a 10 μF capacitor via an internal current sink.

8. Sandcastle and vertical blanking input

The output signals are blanked if the amplitude of the pulse is between 2 V and 6,5 V. The burst gate and clamping circuits are activated if the input pulse exceeds a level of 7,5 V. The higher part of the sandcastle pulse should start just after the sync pulse to prevent clamping of the video signal on the sync pulse. The duration should be about 4 μs for proper a.c.c. operation.

9. Video-data switching

The insertion circuit is activated by means of this input by an input pulse between 1 and 2 V. In that condition, the internal RGB signals are switched off and the inserted signals are supplied to the output amplifiers. If only normal operation is wanted this pin should be connected to ground (pin 27).

The switching times are very short (< 20 ns) to avoid coloured edges of the inserted signals on the screen.

10. Luminance signal input

The input signal should have a peak-to-peak amplitude of 0,45 V (peak-white to sync) to obtain a black-white output signal of 5,3 V at nominal contrast. It must be a.c.-coupled to the input by a capacitor of about 22 nF. The signal is clamped at the input to an internal reference voltage. The 1 kΩ luminance delay line can be applied because the luminance impedance is very high. Consequently the charging and discharging currents of the coupling capacitor are very small and do not influence the signal level at the input noticeably. Additionally the coupling capacitor value may be small.

11. Brightness control

The black level of the RGB outputs can be set by the voltage on this pin (see Fig. 4). The minimum black level is identical to the blanking level. The black level can be set higher than 4 V, however, the available output signal amplitude is reduced (see also pin 7). Brightness control also operates on the black level of the inserted signals.

12, 14, 16. RGB outputs

The output circuits for red, green and blue are identical. Output signals are 5,3 V (black-white) for nominal input signals and control settings. The black levels of the three outputs have the same value. The blanking level at the outputs is 2,1 V. The peak-white level is limited to 9 V. When this level is exceeded the output signal amplitude is reduced via the contrast control (see also pin 7).

13, 15, 17. Inputs for external RGB signals

The external signals must be a.c.-coupled to the inputs via a coupling capacitor of about 100 nF. Source impedance should not exceed 150 Ω. The input signal required for a 5 V peak-to-peak output signal is 1 V peak to peak. At the RGB outputs the black level of the inserted signal is identical to that of normal RGB signals. When these inputs are not used the coupling capacitors have to be connected to ground (pin 27).

18, 19, 20. Black level clamp capacitors

The black level clamp capacitors for the three channels are connected to these pins. The value of each capacitor should be about 100 nF.

21, 22. Demodulator input and reference signal phase adjustment

The (R-Y) and (B-Y) demodulator inputs are internally connected (pin 21). The phase angle between the two reference carriers is 115°. At the nominal hue adjustment the (B-Y) signal is demodulated with a difference of 0°. The phase shift of 115° can be changing the voltage at pin 22. The gain at the two demodulators is identical. The (G-Y) is composed of $-0{,}27$(R-Y) $-0{,}22$(B-Y).

23, 25. Hue control

The hue control is obtained by changing the phase of the input signal of the burst phase detector with respect to the demodulator input signal. This phase shift is obtained by generating a 90° shifted sine-wave via a Miller integrator (biased via pin 23) which is mixed with the original burst signal.

DEVELOPMENT DATA

APPLICATION INFORMATION (continued)

24, 26. Reference oscillator

As the burst phase detector has an asymmetrical output the oscillator can be adjusted by changing the voltage of the output (pin 24) via a high-ohmic resistor. The capacitor in series with the oscillator crystal must then have a fixed value. When pin 6 (saturation control) is connected to the positive supply line the burst phase detector is based in its nominal position and the colour killer is overruled. This position can therefore be used for the adjustment of the oscillator.

27. Ground

28. Output of the chrominance amplifier

The (R-Y) and (B-Y) demodulator input (pin 21) is a.c.-coupled to this output.

NTSC DECODER

GENERAL DESCRIPTION

The TDA3564 is a monolithic integrated decoder for the NTSC colour television standards. It combines all functions required for the demodulation of NTSC signals. Furthermore it contains a luminance amplifier, an RGB-matrix and amplifier. These amplifiers supply output signals up to 5 V peak-to-peak (picture information) enabling direct drive of the discrete output stages.

QUICK REFERENCE DATA

Supply voltage (pin 1)	$V_P = V_{1-23}$	typ.	12 V
Supply current (pin 1)	$I_P = I_1$	typ.	85 mA
Luminance input signal (pin 9)			
Input voltage (peak-to-peak value)	$V_{9-23(p-p)}$	typ.	450 mV
Contrast control range		typ.	−17 to +3 dB
Chrominance amplifier (pin 3)			
Input voltage range (peak-to-peak value)	$V_{3-23(p-p)}$		55 to 1100 mV
Saturation control range		min.	50 dB
RGB matrix and amplifiers			
Output voltage at nominal luminance input signal and nominal contrast (peak-to-peak value)	$V_{13,\ 14,\ 15-23(p-p)}$	typ.	5 V
Sandcastle input (pin 8)			
Blanking input voltage	V_{8-23}	typ.	1,5 V
Burst gating and clamping input voltage	V_{8-23}	typ.	7 V

PACKAGE OUTLINE

24-lead DIL; plastic, with internal heat spreader (SOT-101A).

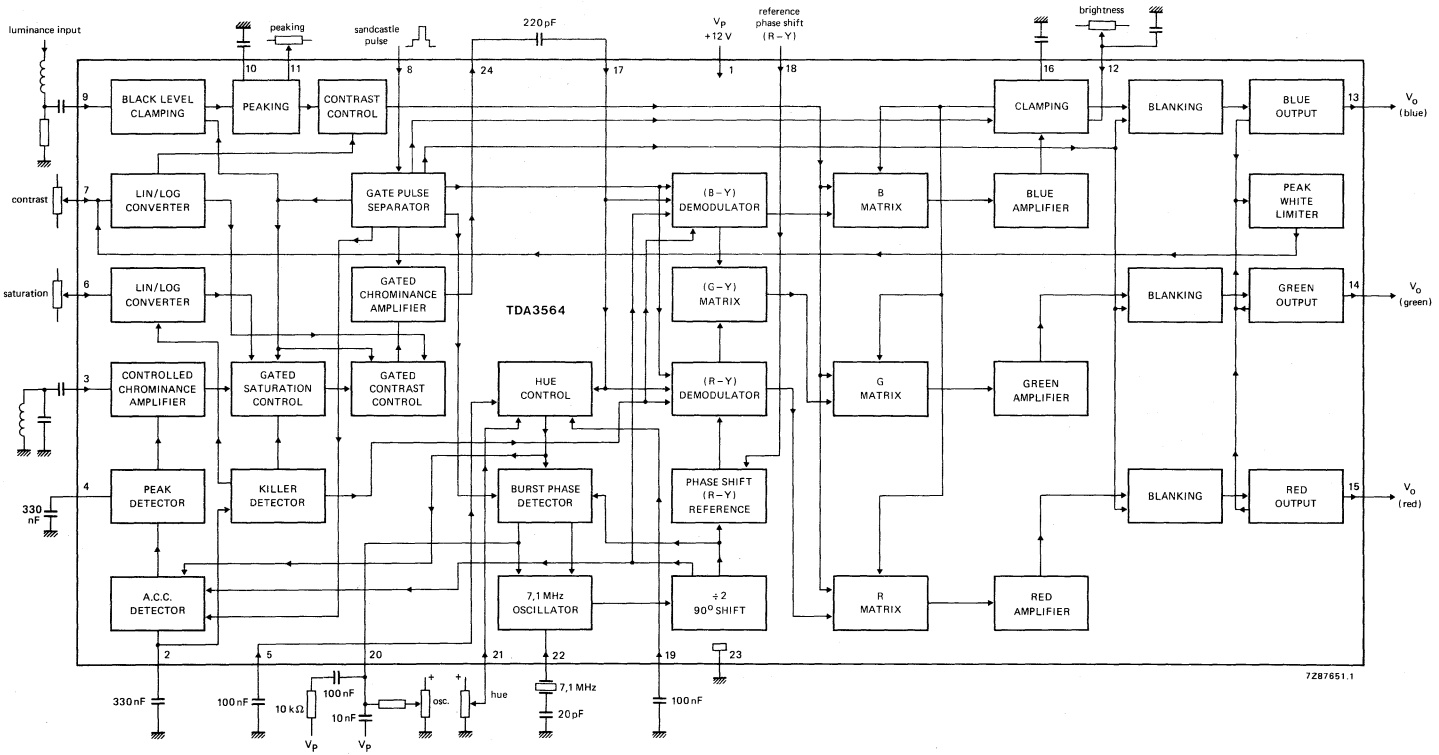


Fig. 1 Block diagram.

FUNCTIONAL DESCRIPTION

Luminance amplifier

The luminance amplifier is voltage driven and requires an input signal of 450 mV peak-to-peak (positive video). The luminance delay line must be connected between the i.f. amplifier and the decoder. The input signal is a.c. coupled to the input (pin 9).

The black level at the output of the preamplifier is clamped to a fixed d.c. level by the black level clamping circuit. The high input impedance of the luminance amplifier minimizes disturbance of the input signal black level by the source impedance (delay line matching resistors).

During clamping the low input impedance reduces noise and residual signals. After clamping the signal is fed to a peaking stage. The overshoot is defined by the capacitor connected to pin 10 and the peaking is adjusted by the control voltage at pin 11.

The peaking stage is followed by a contrast control stage. The contrast control voltage range (pin 7) is nominally −17 to + 3 dB. The linear relationship between the contrast control voltage and the gain is shown in Fig. 2.

Chrominance amplifier

The chrominance amplifier has an asymmetrical input. The input signal must be a.c. coupled (pin 3) and have a minimum amplitude of 55 mV peak-to-peak. The gain control stage has a control range in excess of 30 dB, the maximum input signal must not exceed 1,1 V peak-to-peak, otherwise clipping of the input signal will occur. From the gain control stage the chrominance signal is fed to the saturation and contrast control stages. Chrominance and luminance contrast control stages are directly coupled to obtain good tracking. Saturation is linearly controlled via pin 6 (see Fig. 3). The control voltage range is 2 V to 4 V, the input impedance is high and the saturation control range is in excess of 50 dB. The burst signal is not affected by saturation control. The output signal at pin 24 is a.c. coupled to the demodulators via pin 17.

DEVELOPMENT DATA

Oscillator and a.c.c. detector

The 7,16 MHz reference oscillator operates at twice the subcarrier frequency. The reference signals for the (R-Y) and (B-Y) demodulators, burst phase detector and a.c.c. detector are obtained via the divide-by-2 circuit, which provides a 90° phase shift. The oscillator is controlled by the burst phase detector, which is gated with the narrow part of the sandcastle pulse (pin 8). As the burst phase detector has an asymmetrical output the oscillator can be adjusted by changing the voltage of the output (pin 21) via a high-ohmic resistor. The capacitor in series with the oscillator crystal must then have a fixed value. When pin 6 (saturation control) is connected to the positive supply line the burst signal is suppressed and the colour killer is overruled. This position can therefore be used for adjustment of the oscillator. The adjustment is visible on the screen.

The hue control is obtained by changing the phase of the input signal of the burst phase detector with respect to the chrominance signal applied to the demodulators. This phase shift is obtained by generating a 90° shifted sine-wave via a Miller integrator (biased via pin 19) which is mixed with the original burst signal. A control circuit is required in the 90° phase shift circuit to make the chrominance voltage independent of the hue setting. This control circuit is decoupled by a capacitor connected to pin 5.

Oscillator and a.c.c. detector

As the shifted burst signal is synchronously demodulated in a separate a.c.c. detector to generate the a.c.c. voltage, it is not affected by the hue control. The output pulses of this detector are peak detected (pin 4) to control the gain of the chrominance amplifier, thus preventing blooming-up of the colour during weak signal reception. This ensures reliable operation of the colour killer. During colour killing the colour channel is blocked by switching-off saturation control and the demodulators.

FUNCTIONAL DESCRIPTION (continued)

Demodulators

The (R-Y) and (B-Y) demodulators are driven by the chrominance signal (pin 24) and the reference signals from the 7,16 MHz divider circuit. The phase angle between the two reference carriers is 115°. This is achieved by the (R-Y) demodulator receiving an additional phase shift by mixing the two signals from the divider circuit. The phase shift of 115° can be varied between 90° and 140° by changing the bias voltage at pin 18. The demodulator output signals are fed to R and B matrix circuits and to the (G-Y) matrix to provide the (G-Y) signal which is applied to the G matrix. The demodulator circuits are killed and blanked by by-passing the input signals.

RGB matrix and amplifiers

The three matrix and amplifier circuits are identical and only one circuit will be described.
The luminance and the colour difference signals are added in the matrix circuit to obtain the colour signal. Output signals are 5 $V_{(p-p)}$ (black-white) for the following nominal input signals and control settings.

- Luminance 450 $mV_{(p-p)}$
- Chrominance 550 $mV_{(p-p)}$ (burst-to-chrominance ratio of the input 1: 2,2)
- Contrast −3 dB max.
- Saturation −6 dB max.

The maximum output voltage is approximately 7 $V_{(p-p)}$.
The black level of the blue channel is compared with a variable external reference level (pin 12) which provides brightness control. The brightness control range is 1 V to 3,2 V (see Fig. 4). The control voltage is stored in a capacitor (connected to pin 16) and controls the black level at the output (pin 15) between 2 V and 4 V, via a change of the level of the luminance signal before matrixing.

Note

Black levels of up to approximately 6 V are possible, but amplitude of the output signal is reduced to 3 $V_{(p-p)}$.
If the output signal surpasses the level of 9 V the peak-white limiter circuit becomes active and reduces the output signal via the contrast control.

Blanking of RGB signals

The RGB signals can be blanked via the sandcastle input (pin 8). A slicing level of 1,5 V is used for this blanking function, so that the wide part of the sandcastle pulse is separated from the remainder of the pulse. During blanking a level of + 2 V is available at the output.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 1)	$V_P = V_{1-23}$	max.	13,2 V
Total power dissipation	P_{tot}	max.	1,7 W
Storage temperature range	T_{stg}	−25 to + 150	°C
Operating ambient temperature range	T_{amb}	−25 to + 65	°C

THERMAL RESISTANCE

From junction to ambient (in free air)	$R_{th\ j-a}$	=	50 K/W

CHARACTERISTICS

$V_P = V_{1-23} = 12$ V; $T_{amb} = 25\ ^oC$; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 1)					
Supply voltage	$V_P = V_{1-23}$	8	12	13,2	V
Supply current	$I_P = I_1$	–	85	–	mA
Total power dissipation	P_{tot}	–	1,0	–	W
Luminance amplifier (pin 9)					
Input voltage (note 1) (peak-to-peak value)	$V_{9-23(p-p)}$	–	450	–	mV
Input level before clipping	V_{9-23}	–	–	2	V
Input current	I_9	–	0,15	1	μA
Contrast control range (see Fig. 2)		−17	–	+3	dB
Control voltage for an attenuation of 40 dB		–	1,2	–	V
Input current contrast control	I_7	–	–	15	μA
Peaking of luminance signal					
Output impedance (pin 10)	$\|Z_{10-23}\|$	–	200	–	Ω
Ratio of internal/external current when pin 10 is short-circuited		–	3	–	
Control voltage for peaking adjustment (pin 11)	V_{11-23}	–	2-4	–	V
Input impedance (pin 11)	$\|Z_{11-23}$	–	10	–	kΩ
Chrominance amplifier (pin 3)					
Input voltage (note 2) (peak-to-peak value)	$V_{3-23(p-p)}$	55	550	1100	mV
Input impedance	$\|Z_{3-23}\|$	–	8	–	kΩ
Input capacitance	C_{3-23}	–	4	6	pF
A.C.C. control range		30	–	–	dB
Change of the burst signal at the output over the whole control range		–	–	1	dB
Gain at nominal contrast/saturation pin 3 to pin 24 (note 3)		13	–	–	dB
Output voltage (note 3) (peak-to-peak value) at a burst signal of 300 $mV_{(p-p)}$	$V_{24-23(p-p)}$	–	240	–	mV
Maximum output voltage range (pin 24) (peak-to-peak value)	$V_{24-23(p-p)}$	–	1-7	–	V
Distortion of chrominance amplifier at $V_{24-23(p-p)} = 0,5$ V (output) up to $V_{3-23(p-p)} = 1$ V (input)	d	–	3,0	5	%

DEVELOPMENT DATA

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Chrominance amplifier (continued)					
Frequency response between 0 and 5 MHz	$\alpha_{24\text{-}3}$	–	–	–2	dB
Saturation control range (see Fig. 3)		50	–	–	dB
Input current saturation control (pin 6)	I_6	–	–	20	μA
Tracking between luminance and chrominance contrast control		–	–	2	dB
Cross-coupling between luminance and chrominance amplifier (note 4)		–	–	–46	dB
Signal-to-noise ratio at nominal input signal (note 5)	S/N	56	–	–	dB
Phase shift between burst and chrominance at nominal contrast/saturation	$\Delta\phi$	–	–	± 5	deg
Output impedance of chrominance amplifier	$\lvert Z_{24\text{-}23}\rvert$	–	25	–	Ω
Output current	I_{24}	–	–	10	mA
Reference part					
Phase-locked loop					
Catching range (note 6)	Δf	500	700	–	Hz
Phase shift for ± 400 Hz deviation of f_{osc} (note 6)	$\Delta\phi$	–	–	5	deg
Oscillator					
Temperature coefficient of oscillator frequency (note 6)	TC_{osc}	–	–1,5	–	Hz/K
Frequency variation when supply voltage increases from 10 to 13,2 V (note 6)	Δf_{osc}	–	40	–	Hz
Input resistance (pin 22)	$R_{22\text{-}23}$	–	300	–	Ω
Input capacitance (pin 22)	$C_{22\text{-}23}$	–	–	10	pF
A.C.C. generation (pin 2)					
Control voltage at nominal input signal	$V_{2\text{-}23}$	–	5,3	–	V
Control voltage without chrominance input	$V_{2\text{-}23}$	–	2,8	–	V
Colour-off voltage	$V_{2\text{-}23}$	–	3,4	–	V
Colour-on voltage	$V_{2\text{-}23}$	–	3,6	–	V
Change in burst amplitude with supply voltage		independent			
Voltage at pin 4 at nominal input signal	$V_{4\text{-}23}$	–	5,2	–	V
Hue control					
Control range		± 50	–	–	deg
Control voltage range		see Fig. 5			V

parameter	symbol	min.	typ.	max.	unit
Demodulator part					
Input burst signal amplitude (pin 17) (peak-to-peak value)	$V_{17\text{-}23(p\text{-}p)}$	–	320	–	mV
Input impedance (pin 17; note 7)	$\lvert Z_{17\text{-}23}\rvert$	–	2	–	kΩ
Ratio of demodulated signals (B-Y)/(R-Y)	$\frac{V_{15\text{-}23}}{V_{13\text{-}23}}$	–	1,1	–	
(G-Y)/(R-Y); no (B-Y) signal	$\frac{V_{14\text{-}23}}{V_{13\text{-}23}}$	–	0,26	–	
(G-Y)/(B-Y); no (R-Y) signal	$\frac{V_{14\text{-}23}}{V_{15\text{-}23}}$	–	0,22	–	
Frequency response between 0 and 1 MHz		–	–	–3	dB
Cross-talk between colour difference signals		40	–	–	dB
Control range reference signal (R-Y) demodulator (pin 18; note 8)	ϕ		see Fig. 6		deg
RGB matrix and amplifiers					
Output voltage (peak-to-peak value) at nominal input signal (black-to-white) (note 3)	$V_{13,14,15\text{-}23(p\text{-}p)}$	–	5	–	V
Output voltage at pin 13 (peak-to-peak value) at nominal contrast/saturation and no luminance signal to (R-Y)	$V_{13\text{-}23(p\text{-}p)}$	–	5,25	–	V
Maximum peak-white level (note 9)	$V_{13,14,15\text{-}23}$	9,0	9,3	9,6	V
Maximum output current (pins 13, 14, 15)	$I_{13,14,15}$	–	–	10	mA
Output black level voltage for a brightness control voltage at pin 12 of 2 V	$V_{13,14,15\text{-}23}$	–	2,7	–	V
Black level shift with vision contents		–	–	40	mV
Brightness control voltage range			see Fig. 4		V
Brightness control input current	I_{12}	–	–	5	μA
Variation of black level with temperature	$\Delta V/\Delta T$	–	0,35	1,0	mV/K
with contrast	ΔV	–	10	100	mV
Relative spread between the R, G and B output signals		–	–	10	%
Relative black-level variation between the three channels during variation of contrast, brightness and supply voltage		–	0	20	mV
Differential black-level drift over a temperature range of 40 °C		–	0	20	mV
Blanking level at the RGB outputs		1,9	2,1	2,3	V
Difference in blanking level of the three channels		–	0	–	mV

DEVELOPMENT DATA

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
RGB matrix and amplifiers (continued)					
Differential drift of the blanking levels over a temperature range of 40 °C		–	0	–	mA
Tracking of output black level with supply voltage	$\frac{\Delta V_{b1}}{V_{b1}} \times \frac{V_P}{\Delta V_P}$	–	1,1	–	
Signal-to-noise ratio of output signals (note 5)	S/N	62	–	–	dB
Residual 7,1 MHz signal and higher harmonics at the RGB outputs (peak-to-peak value)		–	75	150	mV
Output impedance of RGB outputs	$\lvert Z_{13,14,15\text{-}23} \rvert$	–	50	–	Ω
Frequency response of total luminance and RGB amplifier circuits for f = 0 to 5 MHz		–	–	–3	dB
Sandcastle input (pin 8)					
Level at which the RGB blanking is activated	$V_{8\text{-}23}$	1	1,5	2	V
Level at which burst gating and clamping pulse are separated	$V_{8\text{-}23}$	6,5	7,0	7,5	V
Delay between black level clamping and burst gating pulse	t_d	–	0,4	–	μs
Input current					
at $V_{8\text{-}23}$ = 0 to 1 V	$-I_8$	–	–	1	mA
at $V_{8\text{-}23}$ = 1 to 8,5 V	I_8	–	20	–	μA
at $V_{8\text{-}23}$ = 8,5 to 12 V	I_8	–	–	2	mA

Notes to the characteristics

1. Signal with the negative-going sync; amplitude includes sync amplitude.
2. Indicated is a signal for a colour bar with 75% saturation; chrominance to burst ratio is 2,2 : 1.
3. Nominal contrast is specified as the maximum contrast –3 dB and nominal saturation as the maximum saturation –6 dB.
4. Cross coupling is measured under the following conditions:
   - Input signals nominal
   - Contrast and saturation such that nominal output signals are obtained
   - The signals at the output at which no signal should be available must be compared with the nominal output signal at that output.
5. The signal-to-noise ratio is defined as peak-to-peak signal with respect to r.m.s. noise.
6. All frequency variations are referred to 3,58 MHz carrier frequency.
7. These signal amplitudes are determined by the a.c.c. circuit of the reference part.
8. When pin 18 is open circuit the phase shift between the (R-Y) and (B-Y) reference carrier is 115°. This phase shift can be varied by changing the voltage applied to pin 18.
9. If the typical voltage for this white level is exceeded, the output voltage is reduced by discharging the capacitor at pin 7 (contrast control); discharge current is 1,5 mA.

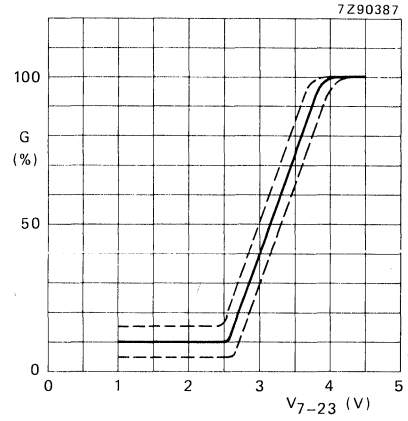


Fig. 2 Contrast control voltage range.

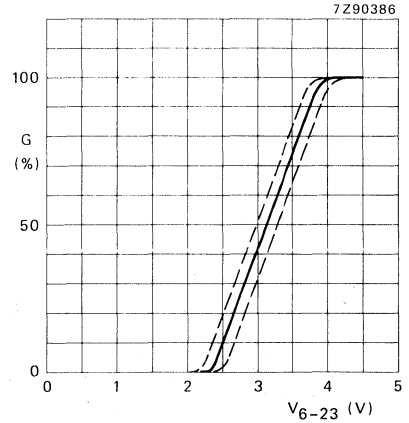


Fig. 3 Saturation control voltage range.

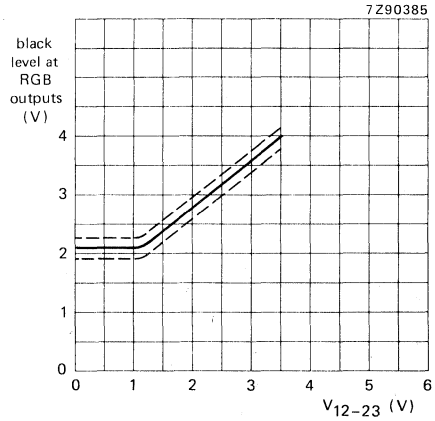


Fig. 4 Brightness control voltage range.

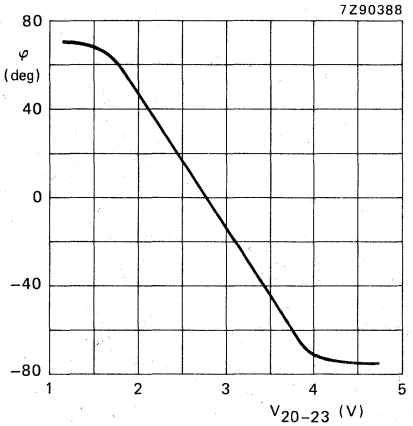


Fig. 5 Hue control voltage range.

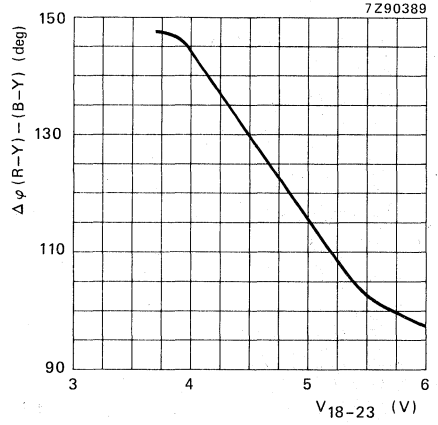


Fig. 6 Phase shift between (R-Y) and (B-Y) as a function of V_{18-23}.

DEVELOPMENT DATA

PAL DECODER

GENERAL DESCRIPTION

The TDA3565 PAL decoder contains all the functions required for PAL signal decoding and colour matrixing and is contained within an 18-pin package. The oscillator, a.c.c. detector and burst phase detector each have single-pin outputs and the coupling capacitor for the luminance input at pin 8 doubles as a storage capacitor for the black level clamping circuit. Black level clamping of the three colour channels is performed using feedback proportional to the red channel black level. This feedback (variable with the brightness control) controls the input level of the luminance amplifier and therefore the clamping levels of all three colour signal outputs.

QUICK REFERENCE DATA

Supply voltage	$V_p = V_{1-17}$	typ.	12 V
Supply current	$I_P = I_1$	typ.	85 mA
Luminance input signal (peak-to-peak value)	$V_{8-17(p-p)}$	typ.	0,45 V
Chrominance input signal (peak-to peak value)	$V_{3-17(p-p)}$	typ.	550 mV
RGB output signal amplitudes (peak-to peak value) at nominal luminance and contrast	$V_{10,11,12-17(p-p)}$	typ.	5 V
Contrast control range			−17 to +3 dB
Saturation control range		>	50 dB
A.C.C. control range		>	30 dB
Level at which RGB blanking is activated	V_{7-17}	typ.	1,5 V
Level at which burst gate/clamping pulse are separated	V_{7-17}	typ.	7 V

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102HE).

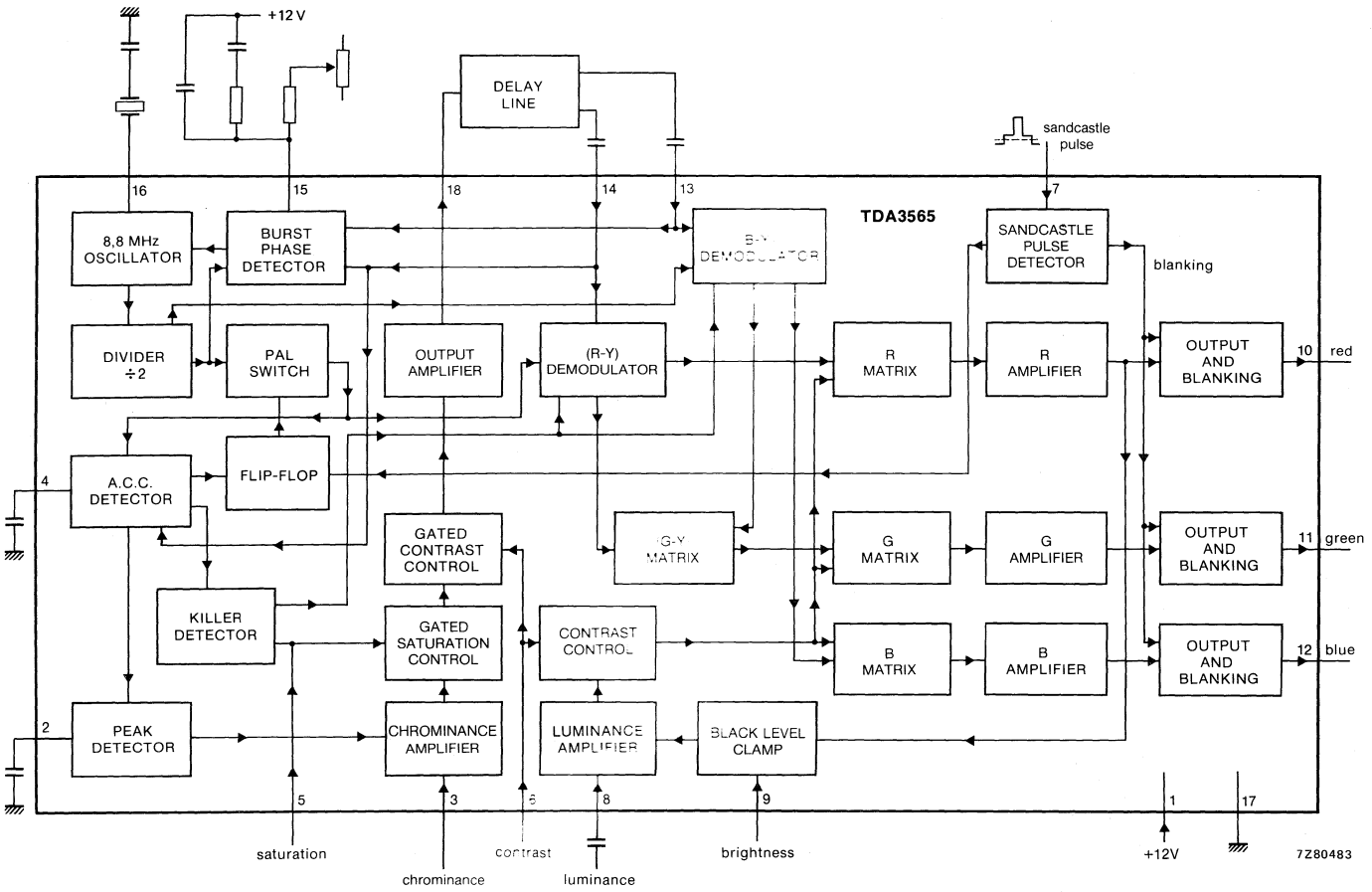


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 1)	$V_P = V_{1-17}$	max.	13,2 V
Total power dissipation	P_{tot}	max.	1,7 W
Operating ambient temperature range	T_{amb}		−25 to +65 °C
Storage temperature range	T_{stg}		−25 to +150 °C

THERMAL RESISTANCE

From junction to ambient (in free air)	$R_{th\ j-a}$	max.	50 K/W

CHARACTERISTICS

$V_P = V_{1-17} = 12$ V; $T_{amb} = 25$ °C unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 1)					
Supply voltage	V_{1-17}	9,0	12,0	13,2	V
Supply current	I_1	–	85	–	mA
Total power dissipation	P_{tot}	–	1,0	–	W
Luminance amplifier					
Input signal amplitude (note 1) (peak-to-peak value)	$V_{8-17(p-p)}$	–	0,45	–	V
Input level before clipping occurs *	$V_{8-17(p-p)}$	–	–	0,7	V
Input current at $V_{8-17} = 2$ V; clamp not active	I_8	–	0,15	1,0	μA
Contrast control range (Fig. 2)		–	−17 to +3	–	dB
Input current when peak white limiter is active ($V_{6-17} = 2{,}5$ V)	I_8	–	5,5	–	mA
Input resistance $V_{6-17} > 6$ V	R_i	1,4	2,0	2,6	kΩ
Chrominance amplifier					
Input signal amplitude (note 2)	$V_{3-17(p-p)}$	55	550	1100	mV
Minimum burst signal amplitude within the control range (peak-peak)		30	–	–	mV
Input impedance	Z_{3-17}	–	8,0	–	kΩ
Input capacitance	C_{3-17}	–	4,0	6,0	pF
A.C.C. control range		30	–	–	dB
Change of burst signal at output over whole a.c.c. control range		–	–	1	dB
Amplification pin 3 to pin 18 at nominal contrast/saturation (note 3)		32	–	–	dB

* At nominal contrast and nominal brightness.

DEVELOPMENT DATA

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Chrominance amplifier (continued)					
Chroma to burst ratio (note 3)		–	3,8	–	dB
Max. output voltage range (pin 18) R_L = 2 kΩ		4,0	4,5	–	V
Chrominance amplifier distortion at $V_{8\text{-}17(p\text{-}p)}$ = 2 V (output) up to $V_{3\text{-}17(p\text{-}p)}$ = 1 V (input)	$d_{8\text{-}3}$	–	3,0	5,0	%
Frequency response between 0 and 5 MHz		–	–	–2	dB
Saturation control range (Fig. 3)		50	–	–	dB
Saturation control input current at $V_{5\text{-}17} < 6$ V	I_5	–	1	20	μA
Input impedance for V_5 between 6 and 10 V	Z_i	1,4	2,0	2,6	kΩ
Input impedance when colour killer is active	Z_i	1,4	2,0	2,6	kΩ
Input impedance for $V_5 > 10$ V (adjustment procedure)	Z_i	0,7	1,0	1,3	kΩ
Tracking between luminance and chrominance over 10 dB of contrast control range		–	–	2	dB
Cross coupling between luminance and chrominance amplifiers (note 4)		–	–	–46	dB
Signal-to-noise ratio at nominal input signal (note 5)	S/N	56	–	–	dB
Burst phase shift with respect to chrominance at nominal contrast/saturation (note 3)	$\Delta\varphi$	–	–	±5	deg
Chrominance amplifier output impedance	$Z_{18\text{-}17}$	–	25	–	Ω
Output current (pin 18)	I_{18}	–	–	10	mA
Reference part					
Phase-locked loop					
Catching range	Δf	500	700	–	Hz
Phase shift for ± 400 Hz deviation of oscillator frequency	$\Delta\varphi$	–	–	5	deg
Oscillator					
Temperature coefficient of oscillator frequency	TC_{osc}	–	2	3	Hz/K
Frequency deviation when supply voltage changes from 10 to 13,2 V	Δf_{osc}	–	200	300	Hz

DEVELOPMENT DATA

parameter	symbol	min.	typ.	max.	unit
Input resistance	$R_{16\text{-}17}$	250	290	330	Ω
Input capacitance	$C_{16\text{-}17}$	–	–	10	pF
A.C.C. generation					
Voltage with nominal input signal	$V_{4\text{-}17}$	–	5,0	–	V
Voltage without chrominance input	$V_{4\text{-}17}$	–	2,5	–	V
Colour-off voltage	$V_{4\text{-}17}$	–	3,2	–	V
Colour-on voltage	$V_{4\text{-}17}$	–	3,5	–	V
Identification-on voltage	$V_{4\text{-}17}$	–	2,5	–	V
Pin 2 voltage at nominal input signal	$V_{2\text{-}17}$	–	5,1	–	V
Demodulator part					
Burst signal amplitude (peak-to-peak value) at pins 13 and 14 (note 6)	$V_{13\text{-}17(p\text{-}p)}$ $V_{14\text{-}17(p\text{-}p)}$	–	80	–	mV
Input impedance of pins 13 or 14 to pin 17	$Z_{13,\ 14\text{-}17}$	–	1,0	–	kΩ
Ratios of demodulated signals with equal signal inputs to pins 13 and 14 and no luminance input signal:					
(B-Y)/(R-Y)	$\frac{V_{12\text{-}17}}{V_{10\text{-}17}}$	–	1,78±10%	–	
(G-Y)/(R-Y) (no (B-Y) signal)	$\frac{V_{11\text{-}17}}{V_{10\text{-}17}}$	–	−0,51±10%	–	
(G-Y)/(B-Y) (no (R-Y) signal)	$\frac{V_{11\text{-}17}}{V_{12\text{-}17}}$	–	−0,19±10%	–	
Frequency response between 0 and 1 MHz		–	–	−3	dB
Separation of colour difference channels		40	–	–	dB
Phase difference between (R-Y) signal and (R-Y) reference signal	$\Delta\varphi$	–	–	5	deg
Phase difference between (R-Y) and (B-Y) reference signals	$\Delta\varphi$	85	90	95	deg
RGB matrix and amplifiers					
Output signal amplitudes (peak-to-peak value) at nominal luminance signal and contrast inputs (black-white) (note 3)	$V_{10\text{-}17(p\text{-}p)}$ $V_{11\text{-}17(p\text{-}p)}$ $V_{12\text{-}17(p\text{-}p)}$	4,5	5,0	5,5	V
Red channel output amplitude (peak-to-peak value) at nominal contrast/saturation (note 3) and no luminance signal to (R-Y)	$V_{10\text{-}17(p\text{-}p)}$	3,7	5,25	7,4	V

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Maximum peak white level (note 7)		9,0	9,3	9,6	V
Maximum output current	$I_{10,11,12}$	–	–	15	mA
Red channel black level output when brightness control $V_{9-17} = 2$ V	V_{10-17}	–	2,7	–	V
Difference between black levels in R, G and B outputs		–	–	600	mV
Black level shift with picture content		–	–	40	mV
Brightness control voltage range	V_{9-17}		see Fig. 3		
Brightness control input current at $V_{9-17} = 2$ V	I_9	–	–	–50	μA
Variation of black level with temperature		–	+0,35	1,0	mV/K
Variation of black level with contrast control		–	10	100	mV
Relative spread between the three channel outputs		–	–	10	%
Relative variation in black level between the three channels during normal variations of contrast and supply voltage		–	0	20	mV
Differential drift of black level over a temperature range of 40 °C		–	0	20	mV
Blanking level at the three channel outputs		1,9	2,1	2,3	V
Difference in blanking level of the three channel outputs		–	0	–	mV
Differential drift of blanking levels over a temperature range of 40 °C		–	0	–	mV
Tracking of output black levels with variation of supply voltage	$\frac{\Delta V_{bl}}{V_{bl}} \times \frac{V_P}{\Delta V_P}$	–	1,1	–	
Signal-to-noise ratio of output signals (note 5)	S/N	62	–	–	dB
Residual 4,4 MHz component in output signals (peak-to-peak value)		–	25	50	mV
Residual 8,8 MHz and higher harmonic components in output signals (peak-to-peak value)		–	25	50	mV
Output impedance	$Z_{10,11,12-17}$	–	50	–	Ω
Frequency response of total luminance/RGB amplifier circuits for 0 to 5 MHz		–	–	–3	dB

parameter	symbol	min.	typ.	max.	unit
Sandcastle pulse detector					
Level at which RGB blanking is activated	V_{7-17}	1,0	1,5	2,0	V
Level at which burst gate and clamping pulse are separated	V_{7-17}	6,5	7,0	7,5	V
Delay between black level clamping and burst gating pulse		–	0,4	–	μs
Input current at:					
V_{7-17} = 0 to 1 V	I_7	–	–	−1	mA
V_{7-17} = 1 to 8,5 V	I_7	–	20	40	μA
V_{7-17} = 8,5 to 12 V	I_7	–	–	2	mA

Notes to the characteristics

1. Signal with negative-going sync pulse, amplitude includes sync pulse amplitude.
2. The signal indicated is for a colour bar with 75% saturation, so the chroma burst ratio of 2,2 : 1.
3. Nominal contrast is defined as (maximum contrast −3 dB) and nominal saturation is (maximum saturation −6 dB).
4. Cross coupling is measured under the following condition; input signals nominal and contrast/saturation such that nominal output signals are obtained. The signals at the output at which no signal should be available must be compared with the nominal signal at that output.
5. The signal-to-noise ratio is specified as peak-to-peak signal with respect to r.m.s. noise.
6. These signal amplitudes are determined by the a.c.c. circuit of the reference part.
7. When this level is exceeded the amplitude of the output signal is reduced via a discharge of the capacitor at pin 6 (contrast control). The discharge current is 5,5 mA.

DEVELOPMENT DATA

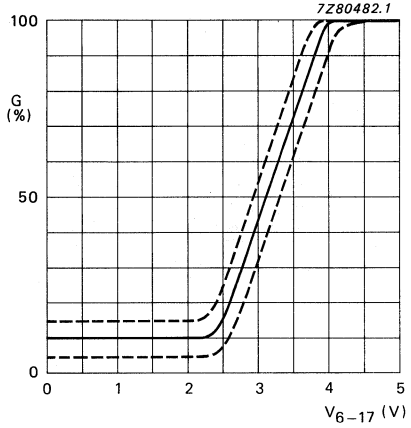


Fig. 2 Luminance contrast control voltage range.

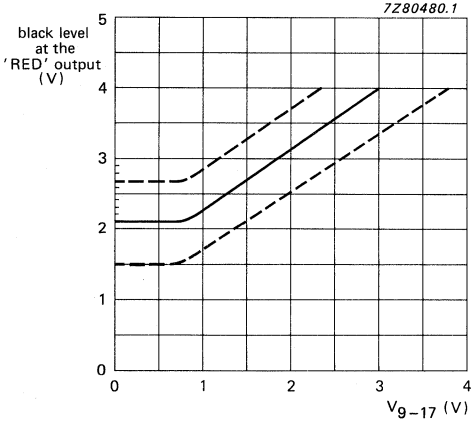


Fig. 3 Brightness control voltage range.

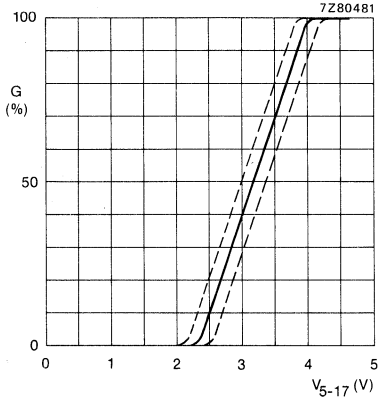


Fig. 4 Saturation control voltage range.

PAL/NTSC DECODER

GENERAL DESCRIPTION

The TDA3566 is a monolithic integrated decoder for the PAL and/or NTSC colour television standards. It combines all functions required for the identification and demodulation of PAL/NTSC signals. Furthermore it contains a luminance amplifier, an RGB-matrix and amplifier. These amplifiers supply output signals up to 4 V peak-to-peak (picture information) enabling direct drive of the discrete output stages. The circuit also contains separate inputs for data insertion, analogue as well as digital, which can be used for text display systems (e.g. Teletext/broadcast antiope), channel number display, etc.

Features

- A black-current stabilizer which controls the black-currents of the three electron-guns to a level low enough to omit the black-level adjustment
- Contrast control of inserted RGB signals
- No black-level disturbance when non-synchronized external RGB signals are available on the inputs
- NTSC capability with hue control

QUICK REFERENCE DATA

Supply voltage (pin 1)	$V_P = V_{1-27}$	typ.	12 V
Supply current (pin 1)	$I_P = I_1$	typ.	80 mA
Luminance amplifier (pin 8)			
Input voltage (peak-to-peak value)	$V_{8-27(p-p)}$	typ.	450 mV
Contrast control range		typ.	20 dB
Chrominance amplifier (pin 4)			
Input voltage range (peak-to-peak value)	$V_{4-27(p-p)}$	40 to	1100 mV
Saturation control range		min.	50 dB
RGB matrix and amplifiers			
Output voltage at nominal luminance and contrast (peak-to-peak value)	$V_{13, 15, 17-27(p-p)}$	typ.	4 V
Data insertion			
Input signals (peak-to-peak value)	$V_{12, 14, 16-27(p-p)}$	typ.	1 V
Data blanking (pin 9)			
Input voltage for data insertion	V_{9-27}	min.	0,9 V
Sandcastle input (pin 7)			
Blanking input voltage	V_{7-27}	typ.	1,5 V
Burst gating and clamping input voltage	V_{7-27}	typ.	7 V

PACKAGE OUTLINE

28-lead DIL; plastic, with internal heat spreader (SOT-117).

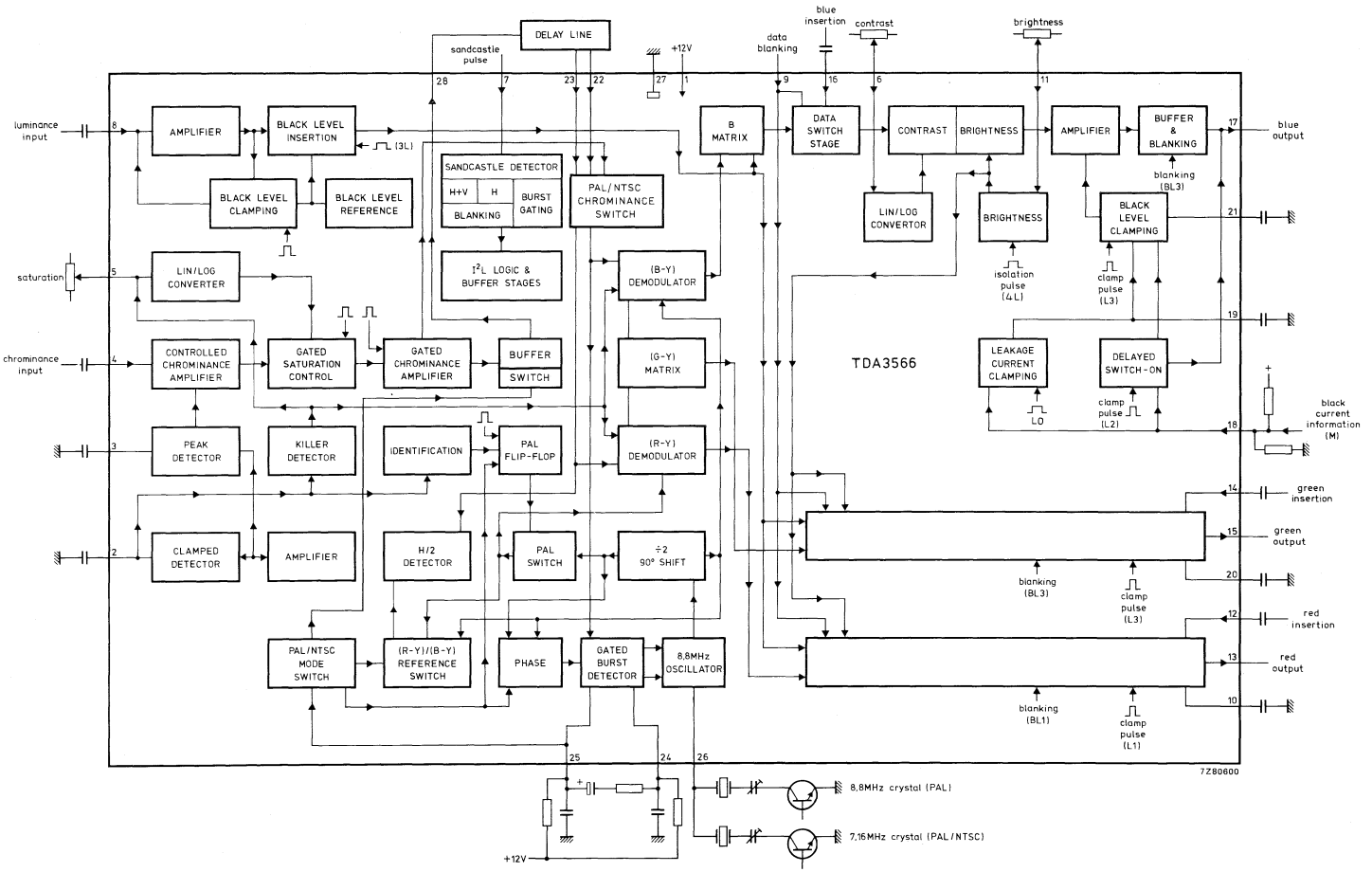


Fig. 1 Block diagram; for explanation of pulse mnemonics see Fig. 6.

FUNCTIONAL DESCRIPTION

The TDA3566 is a further development of the TDA3562A. It has the same pinning and almost the same application. The differences between the TDA3562A and the TDA3566 are as follows:

- The NTSC-application has largely been simplified. In the case of NTSC the chroma signal is now internally coupled to the demodulators, ACC and phase detectors. The chroma output signal (pin 28) is suppressed in this case. It follows that the external switches and filters which are needed for the TDA3562A are not needed for the TDA3566.
  Furthermore there is no difference between the amplitude of the colour output signals in the PAL or NTSC mode. The PAL/NTSC-switch and the hue control of the TDA3566 and the TDA3562A are identical.
- The switch-on and the switch-off behaviour of the TDA3566 has been improved. This has been obtained by suppressing the output signals during the switch-on and switch-off periods.
- The clamp capacitors connected to the pins 10, 20 and 21 can be reduced to 100 nF for the TDA3566. The clamp capacitors also receive a pre-bias voltage to avoid coloured background during switch-on.
- The crystal oscillator circuit has been changed to prevent parasitic oscillations on the third overtone of the crystal. This has the consequence that optimal tuning capacitance must be reduced to 10 pF.

Luminance amplifier

The luminance amplifier is voltage driven and requires an input signal of 450 mV peak-to-peak (positive video). The luminance delay line must be connected between the i.f. amplifier and the decoder The input signal is a.c. coupled to the input (pin 8). After amplification, the black level at the output of the preamplifier is clamped to a fixed d.c. level by the black level clamping circuit. During three line periods after vertical blanking, the luminance signal is blanked out and the black level reference voltage is inserted by a switching circuit. This black level reference voltage is controlled via pin 11 (brightness). At the same time the RGB signals are clamped. Noise and residual signals have no influence during clamping thus simple internal clamping circuitry is used.

Chrominance amplifiers

The chrominance amplifier has an asymmetrical input. The input signal must be a.c. coupled (pin 4) and have a minimum amplitude of 40 mV peak-to-peak. The gain control stage has a control range in excess of 30 dB, the maximum input signal must not exceed 1,1 V peak-to-peak, otherwise clipping of the input signal will occur. Form the gain control stage the chrominance signal is fed to the saturation control stage. Saturation is linear controlled via pin 5. The control voltage range is 2 to 4 V, the input impedance is high and the saturation control range is in excess of 50 dB. The burst signal is not affected by saturation control. The signal is then fed to a gated amplifier which has a 12 dB higher gain during the chrominance signal. As a result the signal at the output (pin 28) has a burst to chrominance ratio which is 6 dB lower than that of the input signal when the saturation control is set at −6 dB. The chrominance output signal is fed to the delay line and, after matrixing, is applied to the demodulator input pins (pins 22 and 23). These signals are fed to the burst phase detector.
In the case of NTSC the chroma signal is internally coupled to the demodulators, ACC and phase detector.

FUNCTIONAL DESCRIPTION (continued)

Oscillator and identification circuit

The burst phase detector is gated with the narrow part of the sandcastle pulse (pin 7). In the detector the (R-Y) and (B-Y) signals are added to provide the composite burst signal again. This composite signal is compared with the oscillator signal divided-by-2 ((R-Y) reference signal). The control voltage is available at pins 24 and 25, and is also applied to the 8,8 MHz oscillator. The 4,4 MHz signal is obtained via the divide-by-2 circuit, which generates both the (B-Y) and (R-Y) reference signals and provides a 90^{o} phase shift between them.
The flip-flop is driven by pulses obtained from the sandcastle detector. For the identification of the phase at PAL mode, the (R-Y) reference signal coming from the PAL switch, is compared to the vertical signal (R-Y) of the PAL delay line. This is carried out in the H/2 detector, which is gated during burst. When the phase is incorrect, the flip-flop gets a reset from the identification circuit. When the phase is correct, the output voltage of the H/2 detector is directly related to the burst amplitude so that this voltage can be used for the a.c.c. To avoid 'blooming-up' of the picture under weak input signal conditions the a.c.c. voltage is generated by peak detection of the H/2 detector output signal.

The killer and identification circuits get their information from a gated output signal of the H/2 detector. Killing is obtained via the saturation control stage and the demodulators to obtain good suppression. The time constant of the saturation control (pin 5) provides a delayed switch-on after killing.
Adjustment of the oscillator is achieved by variation of the burst phase detector load resistance between pins 24 and 25 (see Fig. 7). With this application the trimmer capacitor in series with the 8,8 MHz crystal (pin 26) can be replaced by a fixed value capacitor to compensate for unbalance of the phase detector.

Demodulator

The (R-Y) and (B-Y) demodulators are driven by the colour difference signals from the delay-line matrix circuit and the reference signals from the 8,8 MHz divider circuit. The (R-Y) reference signal is fed via the PAL-switch. The output signals are fed to the R and B matrix circuits and to the (G-Y) matrix to provide the (G-Y) signal which is applied to the G-matrix. The demodulation circuits are killed and blanked by by-passing the input signals.

NTSC mode

The NTSC mode is switched on when the voltage at the burst phase detector outputs (pins 24 and 25) is adjusted below 9 V. To ensure reliable application the phase detector load resistors are external. When the TDA3566 is used only for PAL these two 33 kΩ resistors must be connected to + 12 V (see Fig. 7). For PAL/NTSC application the value of each resistor must be reduced to 10 kΩ and connected to the slider of a potentiometer (see Fig. 8). The switching transistor brings the voltage at pins 24 and 25 below 9 V which switches the circuit to the NTSC mode. The position of the PAL flip-flop ensures that the correct phase of the (R-Y) reference signal is supplied to the (R-Y) demodulator. The drive to the H/2 detector is now provided by the (B-Y) reference signal. (In the PAL mode it is driven by the (R-Y) reference signal.)
Hue control is realized by changing the phase of the reference drive to the burst phase detector. This is achieved by varying the voltage at pins 24 and 25 between 7,5 V and 8,5 V, nominal position 8,0 V. The hue control characteristic is shown in Fig. 5.

RGB matrix and amplifiers

The three matrix and amplifier circuits are identical and only one circuit will be described.
The luminance and the colour difference signals are added in the matrix circuit to obtain the colour signal, which is then fed to the contrast control stage. The contrast control voltage is supplied to pin 6 (high-input impedance). The control range is + 3 dB to −17 dB nominal. The relationship between the control voltage and the gain is linear (see Fig. 2).
During the 3-line period after blanking a pulse is inserted at the output of the contrast control stage. The amplitude of this pulse is varied by a control voltage at pin 11. This applies a variable offset to the normal black level, thus providing brightness control. The brightness control range is 1 V to 3 V.

While this offset level is present, the 'black-current' input impedance (pin 18) is high and the internal clamp circuit is activated. The clamp circuit then compares the reference voltage at pin 19 with the voltage developed across the external resistor network R_A and R_B (pin 18) which is provided by picture tube beam current. The output of the comparator is stored in capacitors connected from pins 10, 20 and 21 to ground which controls the black level at the output. The reference voltage is composed by the resistor divider network and the leakage current of the picture tube into this bleeder. During vertical blanking, this voltage is stored in the capacitor connected to pin 19, which ensures that the leakage current of the CRT does not influence the black current measurement.
The RGB output signals can never exceed a level of 10 V. When the signal tends to exceed this level the output signal is clipped. The black level at the outputs (pins 13, 15 and 17) will be about 3 V. This level depends on the spread of the guns of the picture tube. If a beam current stabilizer is not used it is possible to stabilize the black levels at the outputs, which in this application must be connected to the black current measuring input (pin 18) via a resistor network.

DEVELOPMENT DATA

Data insertion

Each colour amplifier has a separate input for data insertion. A 1 V peak-to-peak input signal provides a 4 V peak-to-peak output signal. To avoid the 'black-level' of the inserted signal differing from the black level of the normal video signal, the data is clamped to the black level of the luminance signal. Therefore a.c. coupling is required for the data inputs.
To avoid a disturbance of the blanking level due to the clamping circuit, the source impedance of the driver circuit must not exceed 150 Ω.
The data insertion circuit is activated by the data blanking input (pin 9). When the voltage at this pin exceeds a level of 0,9 V, the RGB matrix circuits are switched off and the data amplifiers are switched on. To avoid coloured edges, the data blanking switching time is short.
The amplitude of the data output signals is controlled by the contrast control at pin 6. The black level is equal to the video black level and can be varied between 2 and 4 V (nominal condition) by the brightness control voltage at pin 11.
Non-synchronized data signals do not disturb the black level of the internal signals.

Blanking of RGB and data signals

Both the RGB and data signals can be blanked via the sandcastle input (pin 7). A slicing level of 1,5 V is used for this blanking function, so that the wide part of the sandcastle pulse is separated from the remainder of the pulse. During blanking a level of + 1 V is available at the output.
To prevent parasitic oscillations on the third overtone of the crystal the optimal tuning capacitance should be 10 pF.

RATINGS

Limiting values in accordance with Absolute Maximum System (IEC 134)

Supply voltage (pin 1)	$V_P = V_{1-27}$	max.	13,2	V
Total power dissipation	P_{tot}	max.	1,7	W
Storage temperature range	T_{stg}	−25 to	+ 150	°C
Operating ambient temperature range	T_{amb}	−25 to	+ 70	°C

THERMAL RESISTANCE

From junction to ambient (in free air)	$R_{th\ j\text{-}a}$	=	40	K/W

CHARACTERISTICS

$V_P = V_{1-27} = 12$ V; $T_{amb} = 25$ °C; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 1)					
Supply voltage	$V_P = V_{1-27}$	10,8	12	13,2	V
Supply current	$I_P = I_1$	–	80	110	mA
Total power dissipation	P_{tot}	–	0,95	1,3	W
Luminance amplifier (pin 8)					
Input voltage (note 1) (peak-to-peak value)	$V_{8-27(p-p)}$	–	0,45	0,63	V
Input level before clipping	V_{8-27}	–	–	1	V
Input current	I_8	–	0,1	1	μA
Contrast control range (see Fig. 2)		–15	–	+ 5	dB
Input current contrast control	I_7	–	–	15	μA
Chrominance amplifier (pin 4)					
Input voltage (note 2) (peak-to-peak value)	$V_{4-27(p-p)}$	40	390	1100	mV
Input impedance (pin 4)	$\lvert Z_{4-27}\rvert$	–	10	–	kΩ
Input capacitance	C_{4-27}	–	–	6,5	pF
A.C.C. control range		30	–	–	dB
Change of the burst signal at the output over the whole control range	ΔV	–	–	1	dB
Gain at nominal contrast/saturation pin 4 to pin 28 (note 3)	G	34	–	–	dB
Chrominance to burst ratio at nominal saturation (notes 2 and 3) at pin 28		–	12	–	dB
Maximum output voltage range (peak-to-peak value); $R_L = 2$ kΩ	$V_{28-27(p-p)}$	4	5	–	V
Distortion of chrominance amplifier at $V_{28-27(p-p)} = 2$ V (output) up to $V_{4-27(p-p)} = 1$ V (input)	d	–	–	5	%
Frequency response between 0 and 5 MHz	α_{28-4}	–	–	–2	dB
Saturation control range (see Fig. 3)		50	–	–	dB
Input current saturation control (pin 5)	I_5	–	–	20	μA
Cross-coupling between luminance and chrominance amplifier (note 4)		–	–	–46	dB
Signal-to-noise ratio at nominal input signal (note 5)	S/N	56	–	–	dB

DEVELOPMENT DATA

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Chrominance amplifier (continued)					
Phase shift between burst and chrominance at nominal contrast/saturation	$\Delta\varphi$	–	–	± 5	deg
Output impedance of chrominance amplifier	$\lvert Z_{28\text{-}27}\rvert$	–	10	–	Ω
Output current	I_{28}	–	–	15	mA
Reference part					
Phase-locked-loop					
catching range (note 6)	Δf	500	700	–	Hz
phase shift for ± 400 Hz deviation of f_{osc} (note 6)	$\Delta\varphi$	–	–	5	deg
Oscillator					
temperature coefficient of oscillator frequency (note 6)	TC_{osc}	–	−2	−3	Hz/K
frequency variation when supply voltage increases from 10 to 13,2 V (note 6)	Δf_{osc}	–	40	100	Hz
input resistance (pin 26)	$R_{26\text{-}27}$	280	400	520	Ω
input capacitance (pin 26)	$C_{26\text{-}27}$	–	–	10	pF
A.C.C. generation (pin 2)					
control voltage at nominal input signal	$V_{2\text{-}27}$	–	4,6	–	V
control voltage without chrominance input	$V_{2\text{-}27}$	–	2,6	–	V
colour-off voltage	$V_{2\text{-}27}$	–	3,4	–	V
colour-on voltage	$V_{2\text{-}27}$	–	3,6	–	V
identification-on voltage	$V_{2\text{-}27}$	–	2,0	–	V
change in burst amplitude with temperature		–	0,1	0,25	%/K
voltage at pin 3 at nominal input signal	$V_{3\text{-}27}$	–	5,1	–	V
Demodulator part					
Input burst signal amplitude (peak-to-peak value between pins 23 and 27 (note 7)	$V_{23\text{-}27(p\text{-}p)}$	68	80	95	mV
Input impedance between pins 22 or 23 and 27	$\lvert Z_{22\text{-}27/23\text{-}27}\rvert$	0,7	1	1,3	kΩ
Ratio of demodulated signals (note 8)					
(B-Y)/(R-Y)	$\frac{V_{17\text{-}27}}{V_{13\text{-}27}}$	–	1,78 ± 10%	–	
(G-Y)/(R-Y); no (B-Y) signal	$\frac{V_{15\text{-}27}}{V_{13\text{-}27}}$	–	−0,51 ± 10%	–	
(G-Y)/(B-Y); no (R-Y) signal	$\frac{V_{15\text{-}27}}{V_{17\text{-}27}}$	–	−0,19 ± 10%	–	

DEVELOPMENT DATA

parameter	symbol	min.	typ.	max.	unit
Demodulator part (continued)					
Frequency response between 0 and 1 MHz	α_{17}	–	–	–3	dB
Cross talk between colour difference signals		40	–	–	dB
Phase difference between (R-Y) signal and (R-Y) reference signals	$\Delta\varphi$	–	–	5	deg
Phase difference between (R-Y) signal and (B-Y) reference signals	$\Delta\varphi$	85	90	95	deg
RGB matrix and amplifiers					
Output voltage (peak-to-peak value) at nominal luminance/contrast (black-to-white) (note 3)	$V_{13,15,17\text{-}27(p\text{-}p)}$	3,5	4	4,5	V
Output voltage at pin 13 (peak-to-peak value) at nominal contrast/saturation and no luminance signal to (R-Y)	$V_{13\text{-}27(p\text{-}p)}$	–	4,2	–	V
Maximum peak-white level	$V_{13,15,17\ (m)}$	9,7	10	10,3	V
Available output current (pins 13, 15 17)	$I_{13,15,17}$	10	–	–	mA
Difference between black level and measuring level at the output for a brightness control voltage at pin 11 of 2 V (note 9)	$\Delta V_{13,15,17\text{-}27}$	–	0	–	V
Difference in black level between the three channels without black current stabilization (note 10)	ΔV	–	–	100	mV
Control range of black-current stabilization at V_{b1} = 3 V; $V_{11\text{-}17}$ = 2 V		–	–	± 2	V
Black level shift with vision contents	ΔV	–	–	40	mV
Brightness control voltage range		see Fig. 4			
Brightness control input current	I_{11}	–	–	5	μA
Variation of black level with temperature	$\Delta V/\Delta T$	–	0	–	mV/K
Variation of black level with contrast*	ΔV	–	–	100	mV
Relative spread between the R, G and B output signals		–	–	10	%
Relative black-level variation between the three channels during variation of contrast, brightness and supply voltage (± 10%)*	ΔV	–	0	20	mV
Differential black-level drift over a temperature range of 40 °C	ΔV	–	0	20	mV
Blanking level at the RGB outputs	V_{bl}	–	0,95	1,1	V

* With respect to the measuring pulses.

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
RGB matrix and amplifiers (continued)					
Difference in blanking level of the three channels	V_{bl}	–	0	–	mV
Differential drift of the blanking levels over a temperature range of 40 °C	V_{bl}	–	0	10	mV
Tracking of output black level with supply voltage	$\frac{\Delta V_{bl}}{V_{bl}} \times \frac{V_P}{\Delta V_P}$	0,9	1	1,1	
Tracking of contrast control between the three channels over a control range at 10 dB		–	–	0,5	dB
Output signal during the clamp pulse (3L) after switch-on	V_O	7,5	–	–	V
Signal-to-noise ratio of output signals (note 5)	S/N	62	–	–	dB
Residual 4,4 MHz signal at RGB outputs (peak-to-peak value)	$V_{R(p-p)}$	–	–	50	mV
Residual 8,8 MHz signal and higher harmonics at the RGB outputs (peak-to-peak value)	$V_{R(p-p)}$	–	–	150	mV
Output impedance of RGB outputs	$\lvert Z_{13,15,17-27} \rvert$	–	50	–	Ω
Frequency response of total luminance and RGB amplifier circuits for f = 0 to 5 MHz	α	–	−1	−3	dB
Current source of output stage	I_O	2	3	–	mA
Difference of black level at the three outputs at nominal brightness*	ΔV	–	–	10	mV
Tracking of brightness control		–	–	2	%
Signal insertion (pins 12, 14 and 16)					
Input signals (peak-to-peak value) for and RGB output voltage of 4 V (peak-to-peak) at nominal contrast	$V_{12,14,16-27(p-p)}$	0,9	1	1,1	V
Difference between the black levels of the RGB signals and the inserted signals at the output (note 11)	ΔV	–	–	100	mV
Output rise time	t_r	–	50	80	ns
Differential delay time for the three channels	t_d	–	0	40	ns
Input current	$I_{12,14,16}$	–	–	10	μA

* With respect to the measuring pulses.

DEVELOPMENT DATA

parameter	symbol	min.	typ.	max.	unit
Data blanking (pin 9)					
Input voltage for no data insertion	$V_{9\text{-}27}$	–	–	0,4	V
Input voltage for data insertion	$V_{9\text{-}27}$	0,9	–	–	V
Maximum input voltage	$V_{9\text{-}27(m)}$	–	–	3	V
Delay of data blanking	t_d	–	–	20	ns
Input resistance	$R_{9\text{-}27}$	7	10	13	kΩ
Suppression of the internal RGB signals when $V_{9\text{-}27} > 0{,}9$ V		46	–	–	dB
Sandcastle input (pin 7)					
Level at which the RGB blanking is activated	$V_{7\text{-}27}$	1	1,5	2	V
Level at which the horizontal pulses are separated	$V_{7\text{-}27}$	3	3,5	4	V
Level at which burst gating and clamping pulse are separated	$V_{7\text{-}27}$	6,5	7,0	7,5	V
Delay between black level clamping and burst gating pulse	t_d	–	0,6	–	μs
Input current					
at $V_{7\text{-}27}$ = 0 to 1 V	$-I_7$	–	–	1	mA
at $V_{7\text{-}27}$ = 1 to 8,5 V	I_7	–	–	50	μA
at $V_{7\text{-}27}$ = 8,5 to 12 V	I_7	–	–	2	mA
Black current stabilization (pin 18)					
Bias voltage (d.c.)	$V_{18\text{-}27}$	3,5	5	7,0	V
Difference between input voltage for 'black' current and leakage current	ΔV	0,35	0,5	0,65	V
Input current during 'black' current	I_{18}	–	–	1	μA
Input current during scan	I_{18}	–	–	10	mA
Internal limiting at pin 10	$V_{18\text{-}27}$	8,5	9	9,5	V
Switching threshold for 'black' current control ON	$V_{18\text{-}27}$	7,6	8	8,4	V
Input resistance during scan	$R_{18\text{-}27}$	1	1,5	2	kΩ
Input current during scan at pins 10, 20 and 21 (d.c.)	$I_{10,\ 20,\ 21}$	–	–	tbf	nA
Maximum charge/discharge current during measuring time		–	1	–	nA
NTSC					
Level at which the PAL/NTSC switch is activated (pins 24 and 25)	$V_{24\text{-}25}$	–	8,8	9,2	V
Average output current (note 12)	$I_{24\ +\ 25(AV)}$	75	90	105	μA
Hue control		see Fig. 5			

Notes to the characteristics

1. Signal with the negative-going sync; amplitude includes sync amplitude.
2. Indicated is a signal for a colour bar with 75% saturation; chrominance to burst ratio is 2,2 : 1.
3. Nominal contrast is specified as the maximum contrast −5 dB and nominal saturation as the maximum saturation −6 dB.
4. Cross coupling is measured under the following condition: input signal nominal, contrast and saturation such that nominal output signals are obtained. The signals at the output at which no signal should be available must be compared with the nominal output signal at that output.
5. The signal-to-noise ratio is defined as peak-to-peak signal with respect to r.m.s. noise.
6. All frequency variations are referred to 4,4 MHz carrier frequency.
7. These signal amplitudes are determined by the a.c.c. circuit of the reference part.
8. The demodulators are driven by a chrominance signal of equal amplitude for the (R-Y) and the (B-Y) components. The phase of the (R-Y) chrominance signal equals the phase of the (R-Y) reference signal. This also applies to the (B-Y) signals.
9. This value depends on the gain setting of the RGB output amplifiers and the drift of the picture tube guns. Higher black level values are possible (up to 5 V) but in that application the amplitude of the output signal is reduced.
10. The variation of the black-level during brightness control in the three different channels is directly dependent on the gain of each channel. Discolouration during adjustments of contrast and brightness does not occur because amplitude and the black-level change with brightness control are directly related.
11. This difference occurs when the source impedance of the data signals is 150 Ω and the black level clamp pulse width is 4 μs (sandcastle pulse). For a lower impedance the difference will be lower.
12. The voltage at pins 24 and 25 can be changed by connecting the load resistors (10 kΩ in this application) to the slider bar of the hue control potentiometer (see Fig. 8). When the transistor is switched on, the voltage at pins 24 and 25 is reduced below 9 V, and the circuit is switched to NTSC mode. The width of the burst gate is assumed to be 4 μs typical.

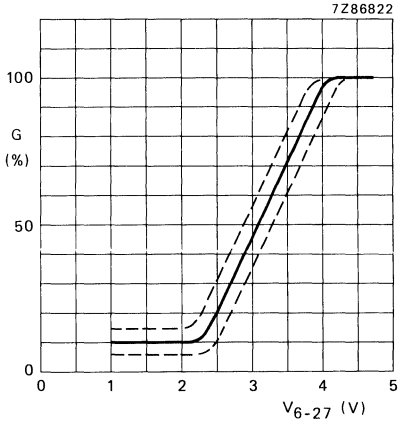


Fig. 2 Contrast control voltage range.

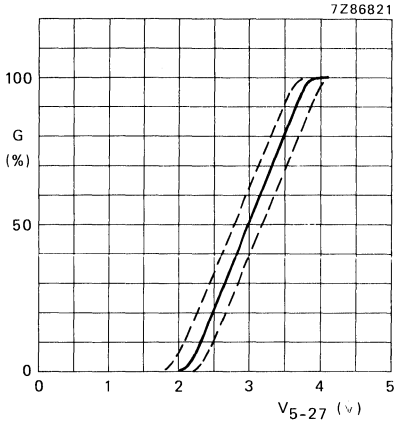


Fig. 3 Saturation control voltage range.

DEVELOPMENT DATA

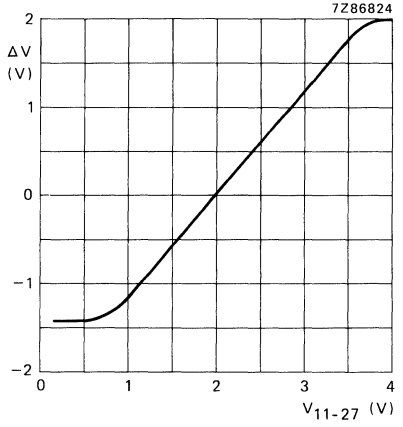


Fig. 4 Difference between black level and measuring level at the RGB outputs (ΔV) as a function of the brightness control input voltage (V_{11-27}).

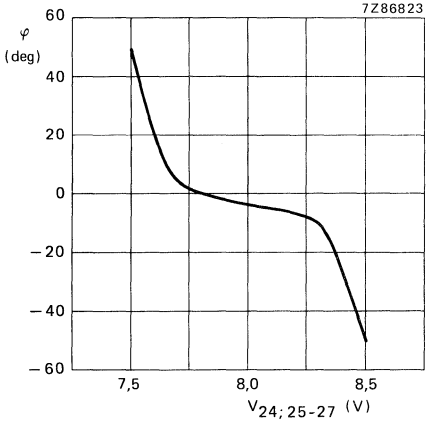


Fig. 5 Hue control voltage range.

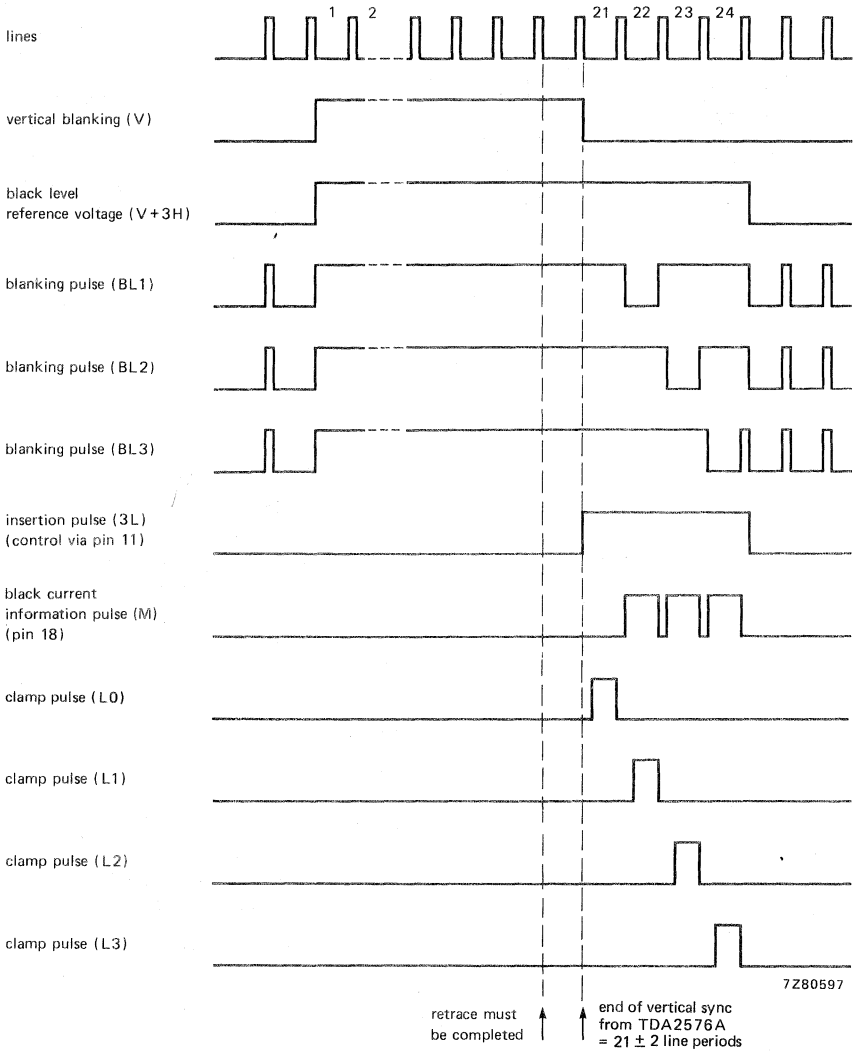


Fig. 6 Timing diagram for black-current stabilizing.

APPLICATION INFORMATION

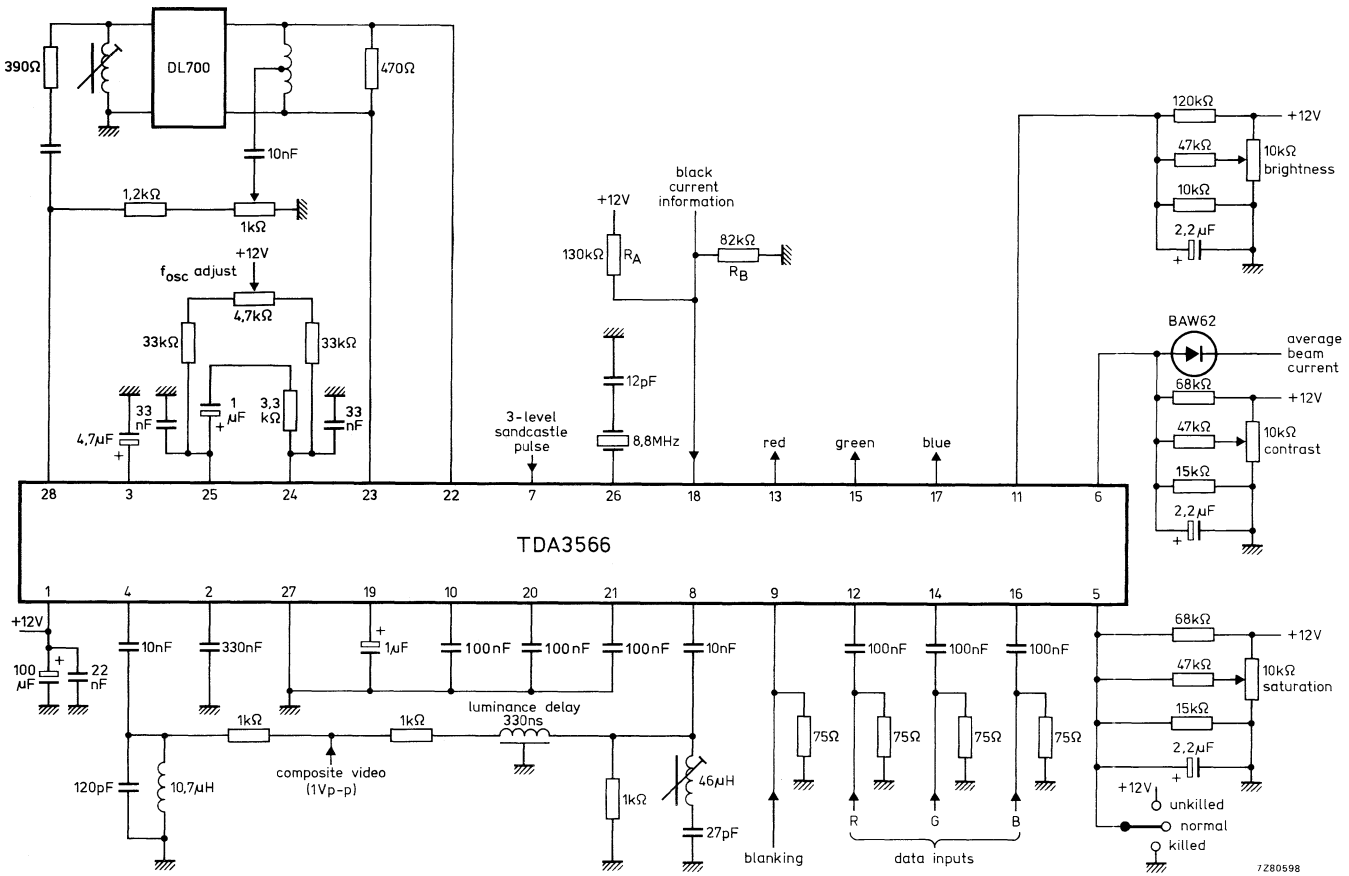


Fig. 7 Application diagram showing the TDA3566 for a PAL decoder.

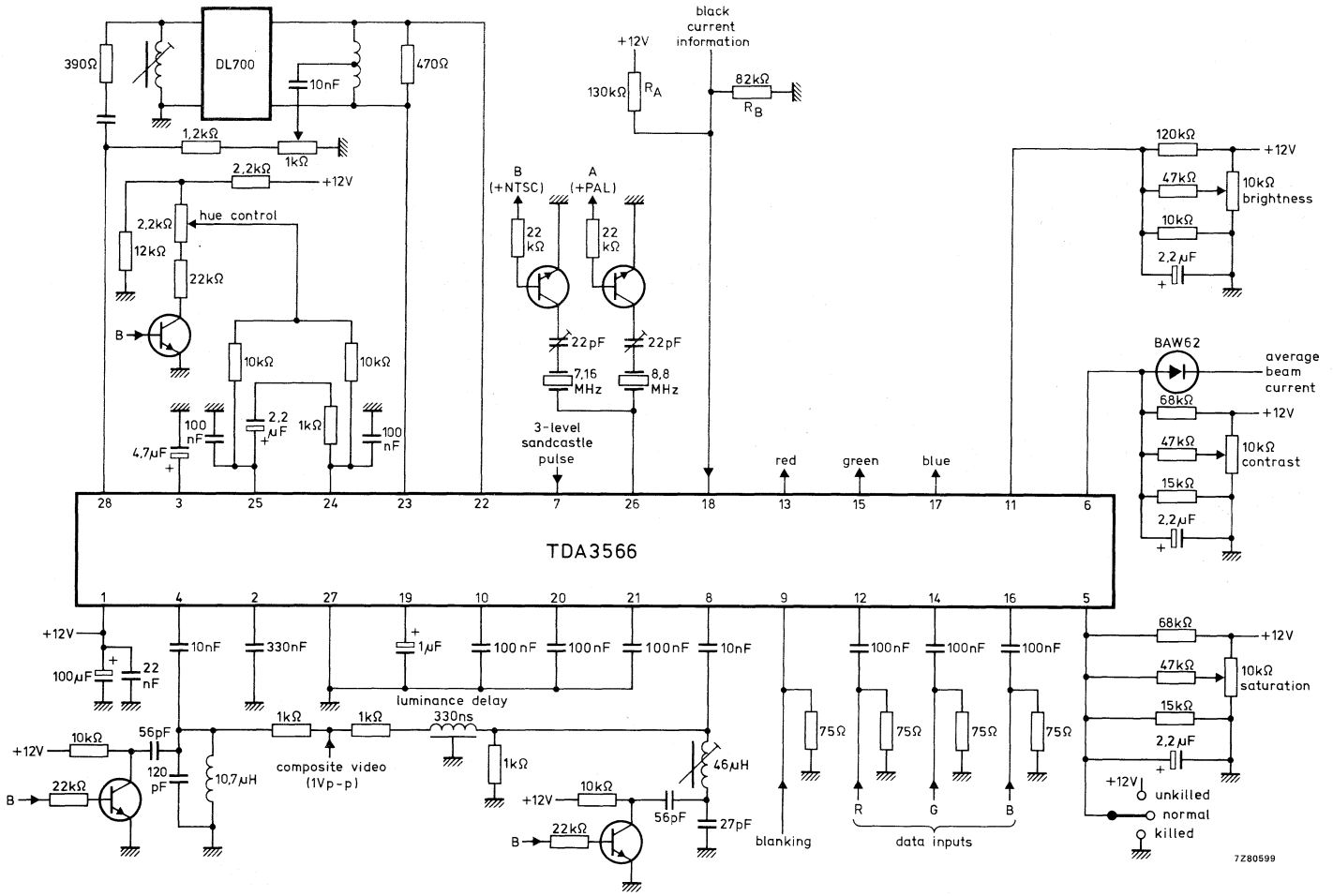


Fig. 8 Application diagram showing the TDA3566 for a PAL/NTSC decoder.

DEVELOPMENT DATA

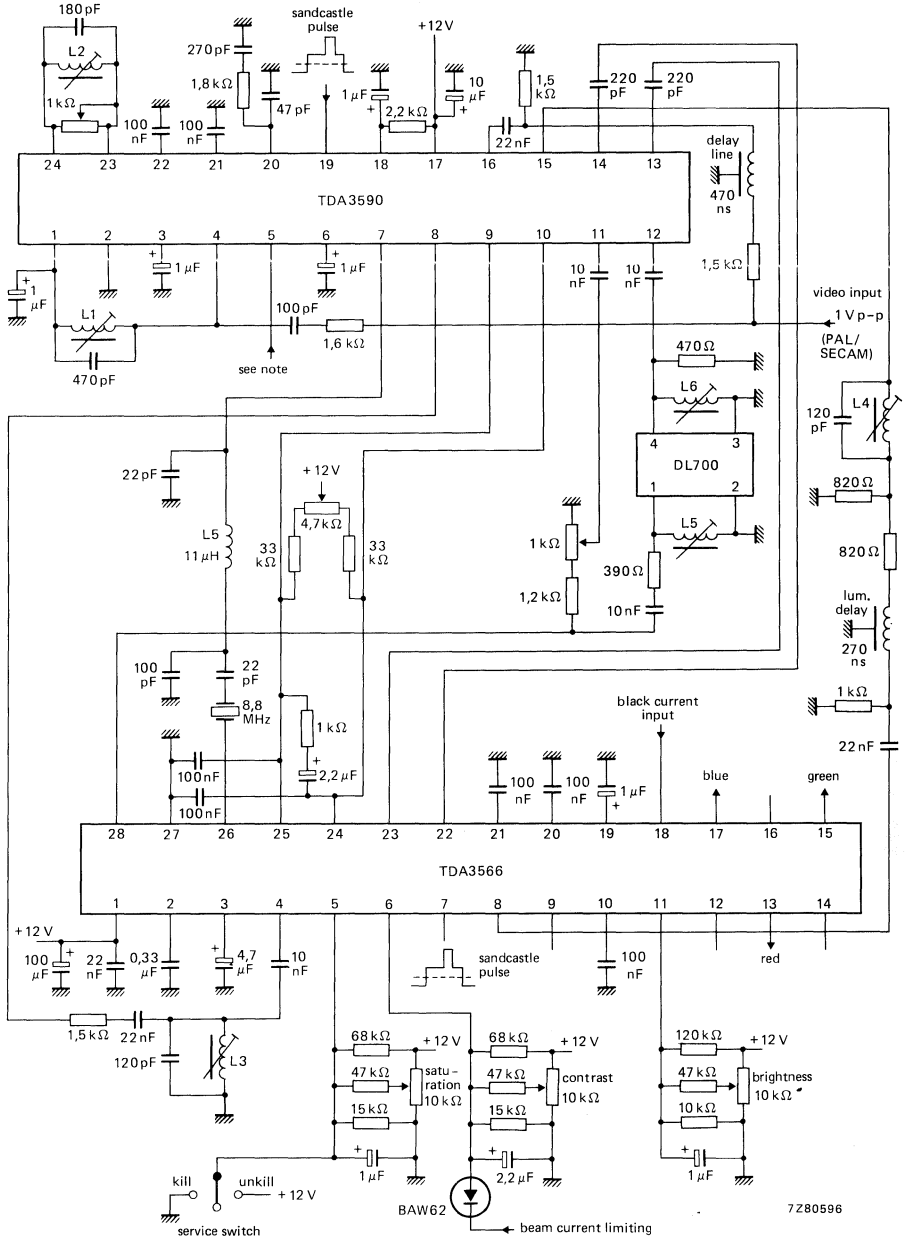


Fig. 9 PAL/SECAM application circuit diagram using the TDA3590 and TDA3566.

Note to pin 5 TDA3590:

$V_{5-2} < 1$ V; horizontal identification and black level clamping.
$V_{5-2} > 11$ V; vertical identification and artificial black level.
V_{5-2} = 5 to 7 V; horizontal identification and artificial black level.

HORIZONTAL AND VERTICAL SYNC PROCESSOR

GENERAL DESCRIPTION

This synchronization circuit for colour TV receivers incorporates a voltage-controlled reference oscillator from which the horizontal/vertical synchronization is derived. Division of the reference frequency to obtain the horizontal and vertical frequencies is performed by triggered divider networks and phase relationships between the waveforms are maintained by phase-locked loops. Horizontal and vertical output driver stages are provided.

Features

- Positive video input; capacitive coupling (source impedance $< 200\ \Omega$)
- Adaptive sync separator; slicing level at 50% of sync amplitude
- Internal vertical pulse separator with double slope integrator
- Video identification and mute function
- Reference voltage-controlled oscillator operates with low-cost 503 kHz ceramic resonator (32 x horizontal frequency)
- Phase comparator 1 controls phasing between horizontal sync and horizontal scan: with no tv signal, or when in VCR mode, the loop gain is increased by 3-times for faster synchronization
- Phase comparator 2 controls phasing between horizontal flyback and horizontal scan
- Horizontal ramp generator
- Horizontal output driver with constant duty cycle
- Sandcastle pulse generator (three levels)
- Vertical timing logic and 50/60 Hz identification
- Vertical ramp generator with automatic amplitude compensation for 60 Hz mode
- Vertical output driver
- Open-collector vertical blanking output
- Pulse output for keyed a.g.c.
- Protection feature switches off the horizontal drive:
  during the next horizontal flyback;
  permanently after three transitory failures have been sensed;
  permanently when a constant failure condition is sensed.

PACKAGE OUTLINE

28-lead DIL; plastic (SOT-117).

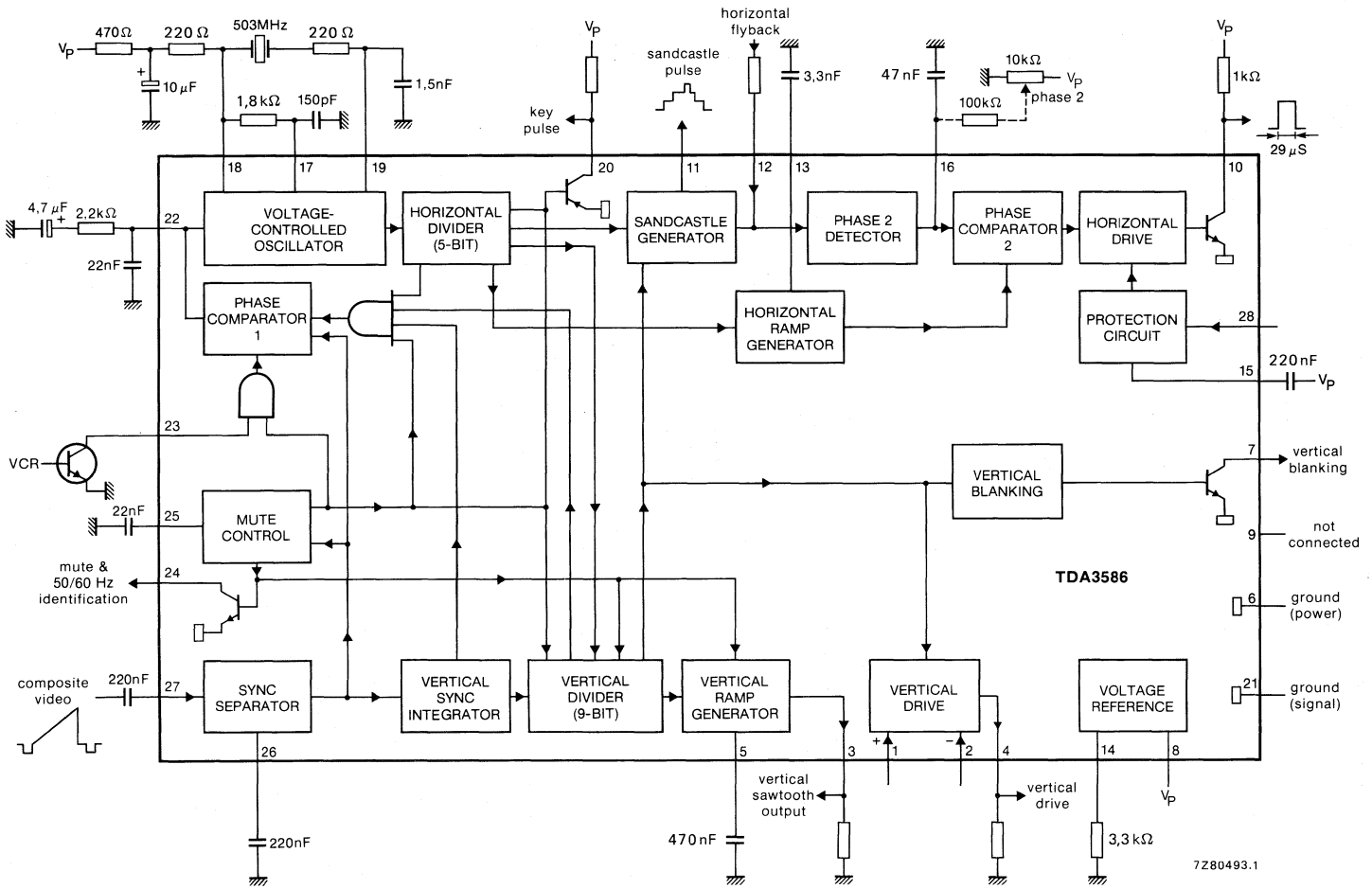


Fig. 1 Block diagram.

DEVELOPMENT DATA

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 8)	$V_P = V_{8\text{-}6/21}$	max.	13,2 V
Voltages at:			
pins 1 and 2	$V_{1\text{-}6/21}$, $V_{2\text{-}6/21}$		0 to V_P V
pin 16	$V_{16\text{-}6/21}$		0 to V_P V
pin 20	$V_{20\text{-}6/21}$	max.	V_P V
pin 23	$V_{23\text{-}6/21}$		0 to V_P V
pin 24	$V_{24\text{-}6/21}$		0 to V_P V
pin 26	$V_{26\text{-}6/21}$		0 to 8 V
pin 27	$V_{27\text{-}6/21}$		1 to V_P V
pin 28	$V_{28\text{-}6/21}$		0 to V_P V
Currents at:			
pin 3	$-I_3$	max.	20 mA
pin 4	I_4		−200 to + 10 mA
pin 7	I_7		−150 to + 10 mA
pin 10	I_{10}		−10 to + 150 mA
pin 11	I_{11}		−30 to + 30 mA
pin 12	I_{12}		−10 to + 10 mA
pin 20	I_{20}	max.	20 mA
pin 24	I_{24}		−5 to + 20 mA
Total power dissipation	P_{tot}	max.	2 W
Storage temperature range	T_{stg}		−25 to + 150 °C
Operating ambient temperature range	T_{amb}		0 to + 70 °C

CHARACTERISTICS

$V_P = V_{8\text{-}6/21} = 12$ V; $T_{amb} = 25$ °C; as measured in Fig. 1; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Composite video and sync separator input (pin 27)					
Positive video input signal; internal black level determination					
Standard signal (peak-to-peak value)	$V_{27(p\text{-}p)}$	0,2	1,0	3,0	V
Generator resistance	R_G	–	–	200	Ω
Input current during sync	$-I_{27}$	–	40	–	μA
Input current during video	I_{27}	–	5	–	μA

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Composite sync generation (pin 26)					
Horizontal slicing level at 50% of sync pulse amplitude {V27-21 (p-p) < 1,5 V}					
Current during sync	$-I_{26}$	–	340	–	μA
Current during video	I_{26}	–	17	–	μA
Internal vertical sync pulse generation					
Vertical slicing level at 50% between black level and horizontal slicing level					
Pulse for keyed a.g.c. (pin 20, open collector)					
With no video input, pin 20 voltage is at high level					
Output current	I_{20}	–	–	5	mA
Saturation voltage at I_{20} = 5 mA	V_{20-6}	–	–	0,4	V
Width of key pulse (sync pulse is always inside the key pulse)		6,5	8,0	9,0	μs
Voltage-controlled oscillator (pins 17, 18 and 19)					
Operating voltage	V_{18-6}	5	–	13,2	V
Horizontal frequency control range:					
minimum frequency	f_{Hmin}	–	–	15,2	kHz*
maximum frequency	f_{Hmax}	16,1	–	–	kHz
Phase comparator 1 (pin 22)					
Loop gain low					
Output current	I_{22}	0,35	0,5	0,65	mA
	$-I_{22}$	0,35	0,5	0,65	mA
Transfer gain		–	1,2	–	kHz/μs
Loop gain high					
Output current	I_{22}	1	1,5	2	mA
	$-I_{22}$	1	1,5	2	mA
Transfer gain		–	3,6	–	kHz/μs
VCR switching (pin 23)					
VCR mode selected	$V_{23-6/21}$	–	< 1,5	–	V
VCR mode not selected	Pin 23		open circuit		
Input current (V_{23-21} = 0 V)	$-I_{23}$	30	–	200	μA

* For V_p = 11 to 13 V; f = 503 kHz; TK = 30 10^{-6}/K.

parameter	symbol	min.	typ.	max.	unit
Video identification (pins 24 and 25)					
Output saturation voltage at I_{24} = 5 mA without video signal	$V_{24\text{-}6/21}$	–	–	1,5	V
Output voltage at I_{24} = 2,5 mA and 60 Hz video signal	$V_{24\text{-}6/21}$	5	6	7	V
Output current with 50 Hz video signal	I_{24}	–	–	5	μA
Charging current	$-I_{25}$	0,5	0,75	1,0	mA
Charge/discharge current ratio	$-_{25}/+I_{25}$	–	3	–	
Threshold level for positively increasing voltage	$V_{25\text{-}6/21}$	4,0	4,5	5,0	V
Hysteresis	$\Delta V_{25\text{-}6/21}$	250	–	550	mV
Horizontal ramp generator					
C_{13} = 3,3 nF; circuit in sync					
Sawtooth amplitude (peak-to-peak value)	$V_{13(p\text{-}p)}$	–	2,7	–	V
Charging current	$-I_{13}$	132	155	178	μA
Sawtooth starting level (Fig. 2)	$V_{13\text{-}6/21}$	1,1	1,22	1,32	V
Dead time (Fig. 2)	t_D	5,8	6,0	7	μs
Sandcastle pulse generator (pin 11)					
Voltage level for burst key at $-I_{11}$ = 0 to 4 mA	$V_{11\text{-}6/21}$	9,0	–	–	V
Voltage level for horizontal blanking at ± I_{11} = 0 to 1 mA	$V_{11\text{-}6/21}$	3,9	4,5	5,2	V
Voltage level for vertical blanking	$V_{11\text{-}6/21}$	1,9	2,5	3,1	V
Delay between centre of sync pulse and leading edge of burst key pulse		2,15	–	3,15	μs
Width of burst key pulse		3,7	4,0	5,0	μs
Horizontal blanking time			flyback pulse		
Vertical blanking time (starting from reset of vertical divider)	t_{11}	–	21	–	lines
Horizontal flyback input (pin 12)					
Threshold for blanking	$V_{12\text{-}6/21}$	0,1	0,3	0,5	V
Threshold for phase comparator 2	$V_{12\text{-}6/21}$	2,5	3	3,5	V
Phase comparator 2 (pin 16)					
Charging current	$-I_{16}$	0,4	0,6	0,8	mA
Charge/discharge current ratio	$+I_{16}/-I_{16}$	0,95	–	1,05	
Delay between comparable edges of waveforms for phase comparators 1 and 2		1,5	2,0	2,5	μs

DEVELOPMENT DATA

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Horizontal drive output (pin 10, oper. collector)					
Saturation voltage at I_{10} = 20 mA	$V_{10-6/21}$	–	–	0,5	V
Horizontal drive pulse width (constant duty cycle; voltage level high during horizontal flyback)		26	28	30	µs
Phase comparator 2 delay range		14	16	17	µs
Vertical divider logic (TV mode)					
Timing of no-sync signal		315			lines
Timing of search window		247	–	359	lines
Timing of 50 Hz window		309	–	315	lines
Timing of 60 Hz window		255	–	267	lines
Vertical divider logic (VCR mode)					
Timing of no-sync signal		327			lines
Timing of search window		247	–	359	lines
Timing of 50 Hz window		299	–	327	lines
Timing of 60 Hz window		247	–	279	lines
Vertical ramp generator (pin 5)					
Internal current source	$-I_5$	65	80	95	µA
Additional current supplied when in 60 Hz mode	$-I_5$	15	20	25	µA
Discharge time at C_5 = 470 nF		–	64	–	µs
Vertical sawtooth output (pin 3)					
Sawtooth starting level (Fig. 2)	V_{3-6}	1,0	1,26	1,4	V
Sawtooth starting level drift with temperature		–	–	1,5	%
Sawtooth amplitude (peak-to-peak value) at I_3 = 10 mA	$V_{3(p-p)}$	–	3,3	–	V
Vertical amplifier differential inputs (pins 1 and 2)					
Input current	I_1, I_2	–	–	10	µA
Common mode range		2	–	8	V
Vertical protection					
Condition for continuous vertical blanking	ΔV_{1-21}	–	–	35	mV

parameter	symbol	min.	typ.	max.	unit
Vertical drive output (pin 4)					
Output current	$-I_4$	–	–	80	mA
Voltage gain of vertical amplifier	G_V	160	–	600	
Vertical blanking output (pin 7, open collector)					
Saturation voltage at i_7 = 15 mA	$V_{7\text{-}6/21}$	–	–	0,5	V
Duration of vertical blanking and vertical protection		–	21	–	lines
Protection circuit input (pin 28)					
Condition for protection function active	$V_{28\text{-}6/21}$	–	–	$<1,15$	V
Maximum thermal drift		–	–	1,5	%
Input current when $V_{28\text{-}6/21} = V_{14\text{-}6/21}$	I_{28}	–	–	3	μA
Condition for protection function inactive	$V_{28\text{-}6/21}$	1,37	–	V_S	V
Normal operation of protection function (horizontal drive switched off during next horizontal flyback)	$V_{28\text{-}6/21}$	–	–	$<V_{14\text{-}6/21}$	V
Protection circuit delay (pin 15)					
Charging current	$-I_{15}$	70	–	130	μA
Charge/discharge current ratio	$-I_{15}/+I_{15}$	0,8	–	1,2	
Charging time	t_{15}	3	4	5	μs
Charge/discharge time ratio		1,6	2,0	–	
Current reference input (pin 14)					
External resistor (pin 14) = 3,32 kΩ ± 1%					
Voltage reference	$V_{14\text{-}6}$	1,18	1,26	1,35	V
Maximum thermal drift		–	–	1	%

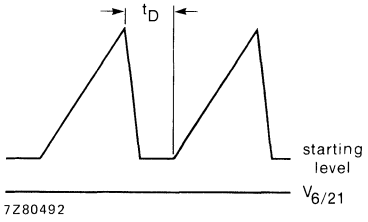


Fig. 2 Horizontal sawtooth waveform.

APPLICATION INFORMATION

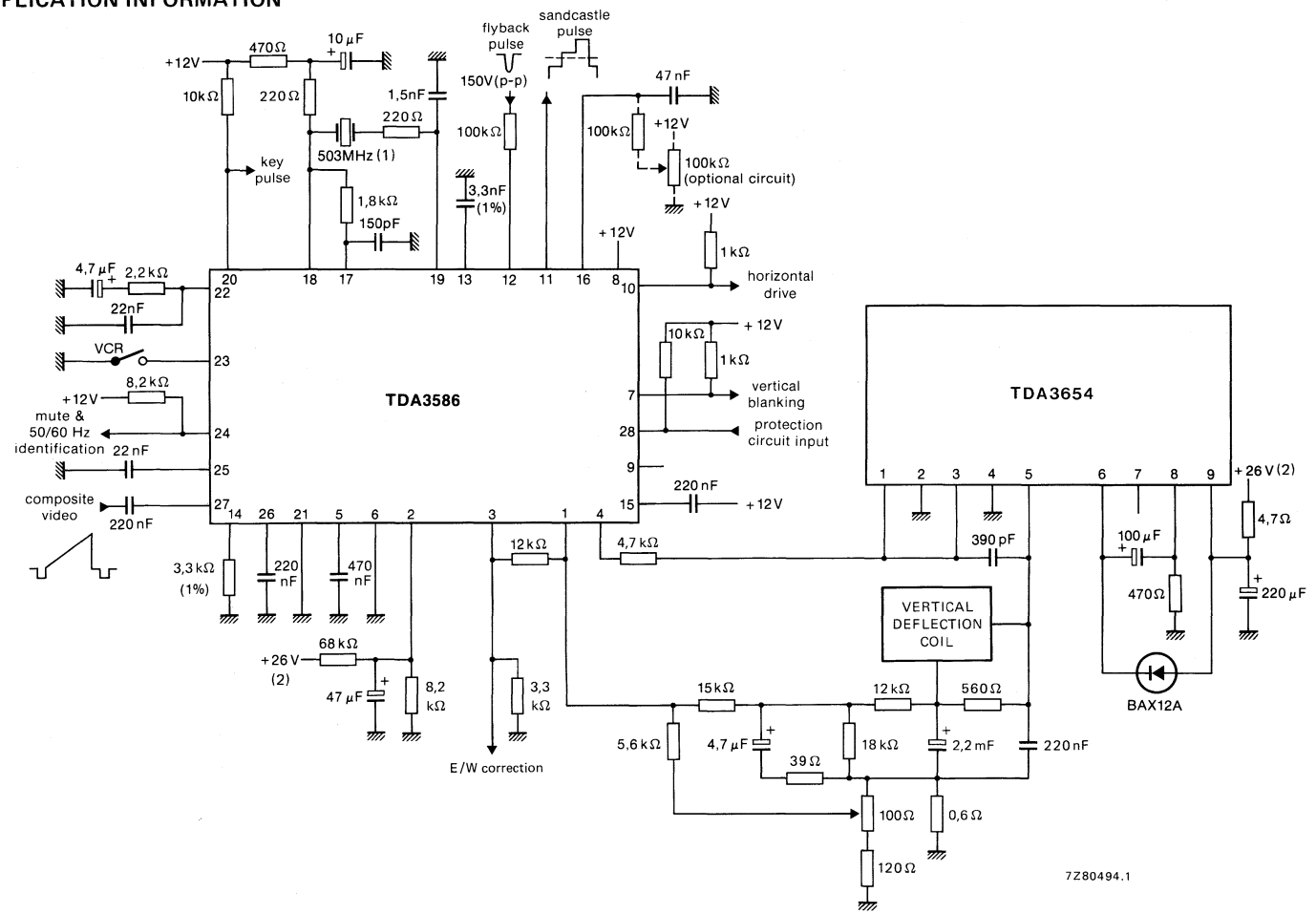


Fig. 3 Application for 110° deflection using TDA3586 in combination with vertical deflection circuit TDA3654.

(1) Ceramic resonator MURATA CSB503B.

(2) Unstabilized voltage from EHT transformer.

SECAM PROCESSOR CIRCUIT

GENERAL DESCRIPTION

The TDA3590A processor circuit converts SECAM signals into sequential phase-modulated (quasi-PAL) signals. It combines all the functions of the TDA3590, TDA3591 and TDA3591A to provide a complete SECAM processor system. The circuit is intended for use in conjunction with TDA3560, TDA3561, TDA3561A, TDA3562A or TDA3566 to provide SECAM/PAL/NTSC/black-and-white processor combinations.

Features

- Limiter/amplifier for chrominance signal
- SECAM demodulator
- Clamp circuits and de-emphasis for colour difference signals
- Modulator to convert colour difference signals into sequential, phase-modulated signals
- Identification circuit for horizontal, vertical or combined horizontal and vertical SECAM identification
- Divider circuit to provide 4,4 MHz carrier from 8,8 MHz signals generated in TDA3560/61/61A/62A/66
- Sandcastle pulse detector
- SECAM switch and PAL matrix
- Video amplifier
- Pin compatibility with TDA3590, TDA3591 and TDA3591A when application requires SECAM ident priority (does not apply with PAL ident priority)

QUICK REFERENCE DATA

Supply voltage	$V_P = V_{17-2}$	typ.	12 V
Supply current	$I_P = I_{17}$	typ.	100 mA
Chrominance amplifier and demodulator			
Input signal PAL (peak-to-peak value)	$V_{4-2(p-p)}$	typ.	550 mV
Input signal SECAM (peak-to-peak value)	$V_{4-2(p-p)}$	typ.	100 mV
Output signal PAL (peak-to-peak value) at $V_{16(p-p)} = 1,2$ V	$V_{8-2(p-p)}$	typ.	900 mV
Output signal SECAM (peak-to-peak value)	$V_{8-2(p-p)}$	typ.	500 mV
Identification			
Input voltage range for horizontal identification (pin 5)	V_{5-2}		0 to 8 V
Input voltage range for vertical identification (pin 5)	V_{5-2}		10,5 to 12,0 V
Voltage at pin 6 for PAL	V_{6-2}	typ.	10,2 V
Voltage at pin 6 for SECAM	V_{6-2}	typ.	7,0 V
Sandcastle pulse detector			
Vertical blanking level	V_{19-2}	typ.	1,5 V
Horizontal blanking level	V_{19-2}	typ.	3,5 V
Burst gating level	V_{19-2}	typ.	7,2 V
Luminance amplifier			
Luminance input signal (peak-to-peak value)	$V_{16-2(p-p)}$	typ.	1,2 V
Luminance output signal (peak-to-peak value)	$V_{15-2(p-p)}$	typ.	3,0 V
PAL matrix and SECAM switch			
Burst signal amplitude (peak-to-peak value)	$V_{11;\,12-2(p-p)}$	typ.	60 mV
Amplification for PAL		typ.	0 dB
Amplification for SECAM		typ.	6 dB

PACKAGE OUTLINE

24-lead DIL; plastic (with internal heat spreader) (SOT-101B).

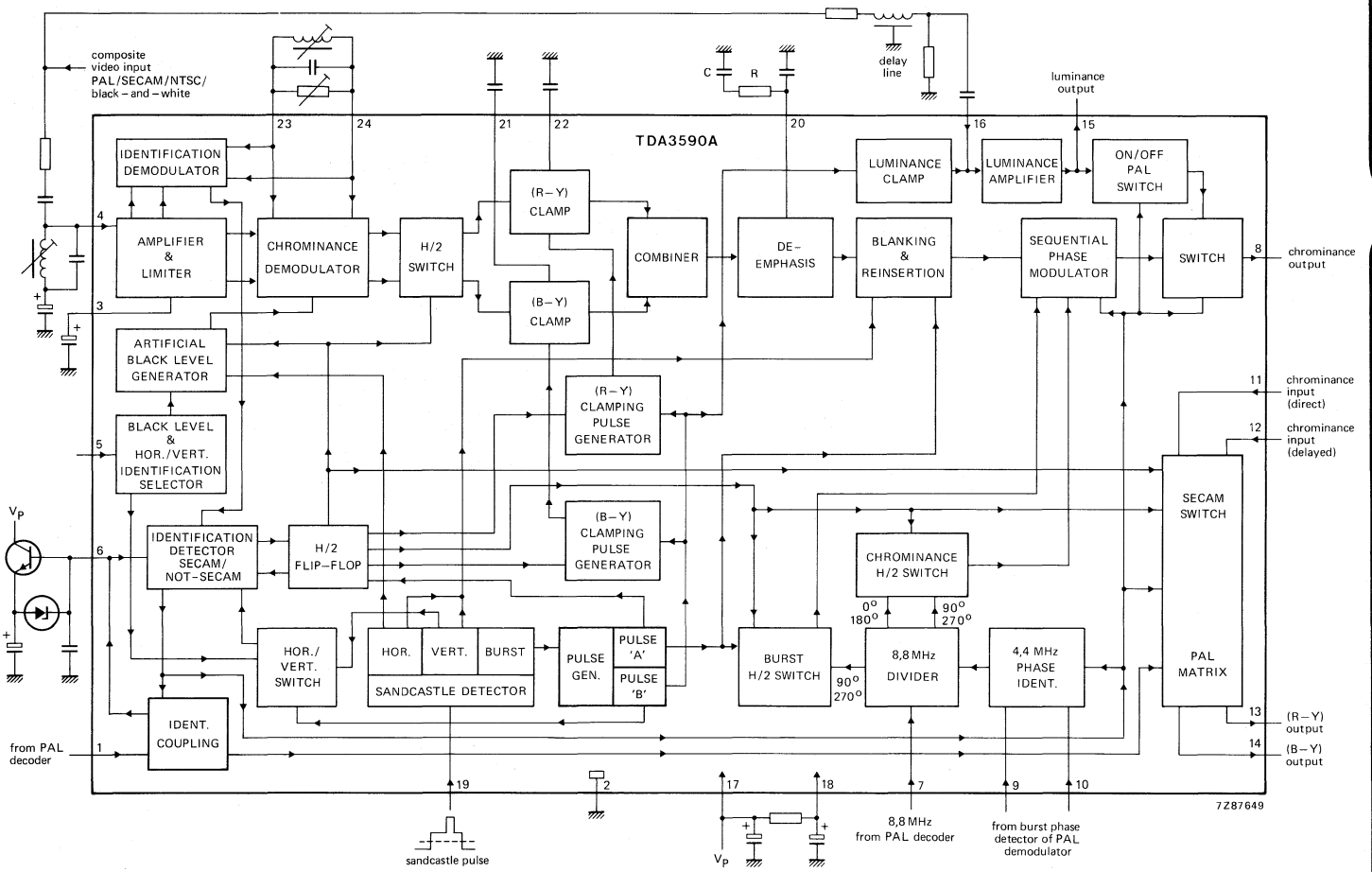


Fig. 1 Block diagram.

PINNING

1. Identification coupling input for PAL/not-PAL identification using half the saturation voltage of the PAL decoder.
2. Ground.
3. Limiter feedback.
4. SECAM video input.
5. Identification selection input using a d.c. level to preset the identification mode of horizontal/vertical detection + black level clamping/insertion.
6. Storage circuit input to SECAM/not-SECAM identification detector.
7. Divider circuit input of 8,8 MHz from the PAL decoder.
8. Chrominance signal output comprising PAL or processed SECAM (quasi-PAL).
9. Carrier signal phase identification input from the burst phase detector of the PAL decoder.
10. As for pin 9.
11. Direct chrominance input to SECAM switch/PAL matrix.
12. Delayed chrominance input to SECAM switch/PAL matrix.
13. Colour difference output (R-Y).
14. Colour difference output (B-Y).
15. Luminance output.
16. Luminance/PAL input.
17. Positive supply voltage (V_P).
18. Decoupled positive supply voltage.
19. Three-level sandcastle pulse input.
20. De-emphasis circuit connection.
21. Storage capacitor connection for (B-Y) clamp.
22. Storage capacitor connection for (R-Y) clamp.
23. Connection for reference tuned circuit for SECAM chrominance and identification demodulators.
24. As for pin 23.

FUNCTIONAL DESCRIPTION

Demodulation

The chrominance and identification demodulators of the TDA3590A both share the same reference tuned circuit (pins 23 and 24). The identification circuit automatically detects whether the incoming signal is SECAM or not-SECAM.

When the incoming signals are not-SECAM (PAL/NTSC/black-and-white) they are diverted via pin 16 to the chrominance output at pin 8 and no signal demodulation takes place. The delay line connected to pin 16 delays the signals to equalize the delay of the SECAM processor circuitry. When SECAM signals are received the PAL signal path is switched off.

Incoming SECAM signals are applied to pin 4 via an external bell filter. The signals are amplified, limited and then demodulated. The limiters give optimum i.f. interference suppression. Only one demodulator is necessary as the colour difference signals are available sequentially. After demodulation the colour difference signals are separated by an H/2 switch and then applied to (R-Y) and (B-Y) clamp circuits where the black levels are clamped to the same d.c. level. The optimum black level can be obtained at the end of the horizontal burst, so the timing of the (R-Y) and (B-Y) clamp is determined by the last 1,5 μs of the burst gate pulse.

The two colour difference signals are combined again after clamping and then applied to the modulator via de-emphasis, blanking and reinsertion circuits.

The ratio of (R-Y) to (B-Y) at the de-emphasis output (pin 20) is 1,78. The external de-emphasis components of R = 1 kΩ and C = 470 pF give a spread at the internal de-emphasis network $< 20\%$.

FUNCTIONAL DESCRIPTION (continued)

If artificial black level reinsertion is required the burst gating pulse (Fig. 2) is used to time black level clamping. Artificial black levels are inserted during the horizontal blanking period when $V_{5\text{-}2} > 2$ V. The clamp circuits then react to the artificial levels instead of the demodulated burst signals (this is necessary when no horizontal burst signals are available). The inserted signals may not be identical to the demodulated signals because of circuitry spread but this can be corrected by detuning the demodulator reference tuned circuit.

Modulation

A burst signal is reinserted into the combined SECAM signal at the input to the sequential phase modulator. The nominal duration of this burst is 2,6 μs which approximates to the duration of the PAL burst and, in combination with the horizontal blanking pulse (used as keying pulse in the SECAM switch), minimizes interference in the a.c.c. loop of the TDA3560/61/62.

At the input to the modulator the (R-Y) and (B-Y) signals have a positive phase position for magenta colour. The modulation carriers for the (R-Y) and (B-Y) signals are 90° out of phase; the burst is modulated in the + (R-Y) direction and is only present during an (R-Y) line, the modulated (R-Y) component has the same phase position as the (R-Y) burst for magenta colour.

The chrominance output from pin 8, in the SECAM mode, is a quasi-PAL signal with alternate line, sequential modulation. Odd and even harmonics of the 4,4 MHz carrier introduced by the modulator are suppressed by internal filters. A correction is made to the burst-chrominance ratio of the quasi-PAL signals for equal saturation of PAL and SECAM signals.

Identification

Identification of the SECAM signal is performed using the fact that only SECAM has a line-to-line difference in demodulated voltage level. This is detected during the last 1,5 μs of the burst gate pulse. A flip-flop, which is switched by the burst gate pulse, provides the reference input to the identification detector. Here the phase of the flip-flop is compared with that of the changing voltage levels from the demodulator. The SECAM identification circuits operate when selected by the voltage on pin 5; this may be horizontal, vertical or combined horizontal and vertical identification, depending on the switching arrangements of pin 5. An internal voltage divider presets pin 5 to 6 V to give automatic selection of horizontal identification plus black level re-insertion. Vertical identification is selected by taking the voltage on pin 5 above 10,5 V, then the system compares the demodulator output voltage only during line scanning of the vertical blanking.

Information obtained from the identification detector is also used for colour killing and, if required, for switching to PAL.

Luminance amplification

The luminance amplifier input at pin 16 can be up to 1,2 V (peak-to-peak value) which equates to a peak-to-peak voltage of 2,7 V −7 dB. The amplifier gain is typically 8 dB. The luminance clamping circuit is activated during the SECAM identification timing (see Fig. 2).

Sandcastle pulse detection

The sandcastle pulse detector requires a three-level sandcastle pulse to provide horizontal blanking, vertical blanking and burst gate pulses. The detected burst gate pulse triggers a pulse generator which produces two timing pulses, pulse 'A' and pulse 'B' (see Fig. 2). Pulse 'A' is used to time the PAL burst modulator and to trigger the H/2 flip-flop. Pulse 'B' provides the timing of the (R-Y) clamp (present only during a red line); the (B-Y) clamp (present only during a blue line); the luminance clamp (present every line); and the SECAM horizontal identification circuit.

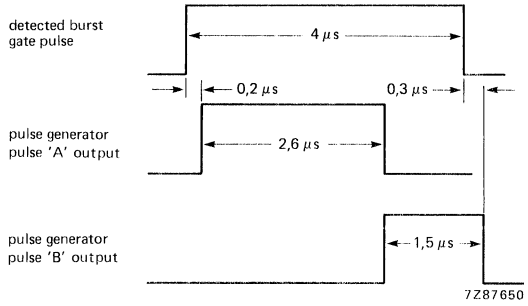


Fig. 2 Burst gate timing pulse generation.

PAL matrix and SECAM switch

The PAL matrix and SECAM switch is included in the TDA3590A to facilitate handling of the two chrominance signal types, PAL and SECAM. For PAL, the direct chrominance signal and the chrominance signal delayed by the PAL delay line are used by the PAL matrix to separate the two colour difference signals. Phase accuracy is not critical for this operation as the colour difference signals are not mixed. For SECAM, the quasi-PAL sequential colour difference signals are separated by switching. The gain of the switching circuit is two times that for normal PAL reception to maintain signal balance between the two systems. The (B-Y) output from the SECAM switch is a signal with no burst; the (R-Y) output has a burst modulated in the + (R-Y) direction during the + (R-Y) line. There is minimal crosstalk between the colour difference signals in the SECAM switch.

Carrier generation

The carrier for the sequential phase modulator is obtained using the 8,8 MHz input from the PAL decoder. This input is divided by two to provide two 4,4 MHz signals with a phase relationship of 90°. Correct phasing between the 4,4 MHz and the PAL decoder is ensured by the 4,4 MHz phase identifier circuit which resets the divider if the phasing is wrong (see Figs 3 and 4 for inter-connections). The inputs/outputs to the phase identifier have internal current sources in the case of SECAM.

Coupling of identification systems

Coupling of system identification between TDA3590A and a PAL decoder is performed using the functions of pins 1 and 6. The voltage level at pin 1 is controlled by the PAL/not-PAL detection of the PAL decoder; the voltage level at pin 6 is a function of SECAM/not-SECAM detection of the TDA3590A modified by the action of pin 6 external circuit.

The circuit action is as follows and is summarized in Table 1.

Channel switching — During channel switching pin 6 is taken rapidly to a high voltage (± 10,2 V) by the external circuit. This corresponds to the not-SECAM mode of the TDA3590A.

PAL — The high voltage level at pin 6 caused by channel switching is maintained by the TDA3590A when it recognizes the signal as not-SECAM. An internal current source keeps pin 6 voltage high, locking the TDA3590A in the not-SECAM mode. This condition is maintained even if reflected PAL signals are present. The PAL decoder recognizes the signal as PAL and takes pin 1 of TDA3590A to a voltage of between 0,5 and 2,6 V, depending on the setting of the saturation voltage. The system is thus locked in the PAL mode.

FUNCTIONAL DESCRIPTION (continued)

SECAM

The initial high voltage level (± 10,2 V) at pin 6 caused by channel switching sets the TDA3590A in the not-SECAM mode and during this time the PAL decoder detects a not-PAL signal. This causes a voltage at pin 1 of $< 0{,}4$ V which prevents the internal current source of TDA3590A maintaining the high voltage level of pin 6 which, in turn, allows the TDA3590A to detect SECAM. The initiation of SECAM detection is delayed by the action of pin 6 external circuit and commences when pin 6 approaches 9,1 V. The SECAM signals are converted by TDA3590A to quasi-PAL signals at pin 8 which are detected by the PAL decoder as PAL signals. The resulting modes of operation are SECAM for the TDA3590A and PAL for the PAL decoder, together giving a system operation in the SECAM mode.

Black-and-white

The TDA3590A is initially set in the not-SECAM mode as previously described. The PAL decoder detects not-PAL and the TDA3590A detects not-SECAM which results in a system operation in the colour-killing mode.

Table 1 System operating modes

TDA3590A mode	PAL decoder mode	system operating mode
SECAM	PAL	SECAM
SECAM	not-PAL	condition not used
not-SECAM	PAL	PAL
not-SECAM	not-PAL	black-and-white

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 17)	$V_P = V_{17\text{-}2}$	max.	13,2 V
Total power dissipation	P_{tot}	max.	1,88 W
Operating ambient temperature range	T_{amb}	−25 to + 65	°C
Storage temperature range	T_{stg}	−25 to + 150	°C

CHARACTERISTICS

$V_P = V_{17-2} = 12$ V; $T_{amb} = 25$ °C; unless otherwise specified. The parameter values are valid only when the reference tuned circuit has been aligned as detailed in note 1.

parameter	symbol	min.	typ.	max.	unit
Supplies					
Supply voltage range (pin 17)	V_{17-2}	10,8	12,0	13,2	V
Supply current (pin 17)	I_{17}	–	100	–	mA
Input current (pin 18)	I_{18}	–	–	170	μA
Total power dissipation	P_{tot}	–	1,2	–	W
Chrominance amplifier and demodulator					
Input signal PAL (peak-to-peak value)	$V_{4-2(p-p)}$	–	–	1,1	V
Input signal SECAM (peak-to-peak value)	$V_{4-2(p-p)}$	15	100	300	mV
Input resistance (pin 4)	R_{4-2}	–	10	–	kΩ
Input capacitance (pin 4)	C_{4-2}	–	–	5	pF
(R-Y)/(B-Y) ratio before modulation (pin 20)		–	1,78	–	
Relative black level deviation of colour difference signals before modulation (note 2)					
Output signal PAL (peak-to-peak value) at $V_{16(p-p)} = 1,2$ V	$V_{8-2(p-p)}$	–	900	–	mV
Output signal SECAM (peak-to-peak value)	$V_{8-2(p-p)}$	–	500	–	mV
Output impedance	$\lvert Z_{8-2} \rvert$	–	65	–	Ω
Input voltage for clamping on back porch of colour difference signals	V_{5-2}	–	–	0,5	V
Input voltage for artificial black level insertion after demodulation	V_{5-2}	2	–	–	V
Input resistance between pins 23 and 24	R_{23-24}	–	4	–	kΩ
Input capacitance between pins 23 and 24	C_{23-24}	–	12	–	pF
Linearity of (B-Y) signal (pin 8) (note 3)		85	92	–	%
Linearity of (R-Y) signal (pin 8) (note 4)		88	95	–	%
Input resistance (pin 5)	R_{5-2}	–	10	–	kΩ
Chrominance demodulator zero point stability (pin 20) (note 5)	f_0	–	5	–	kHz
Offset (B-Y) black level (pin 8) at f_0 clamping; $f_{offset} = 4,4$ MHz		–	−15	–	kHz
Offset (R-Y) black level (pin 8) at f_0 clamping; $f_{offset} = 4,4$ MHz		–	−25	–	kHz

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Identification SECAM/not-SECAM					
Input voltage range for horizontal identification (pin 5)	V_{5-2}	0	–	8	V
Input voltage range for vertical identification (pin 5)	V_{5-2}	10,5	–	12,0	V
Voltage at pin 6 for PAL	V_{6-2}	–	10,2	–	V
Voltage at pin 6 for SECAM	V_{6-2}	–	7,0	–	V
Identification ON for SECAM	V_{6-2}	–	10,7	–	V
Colour OFF for SECAM	V_{6-2}	–	9,8	–	V
Colour ON for SECAM	V_{6-2}	–	9,1	–	V
Voltage at pins 9 and 10 for SECAM	$V_{9-2;\ 10-12}$	–	10,5	–	V
Voltage between pins 9 and 10 for SECAM	V_{9-10}	–	–	3	mV
Permissible voltage range at pins 9 and 10 for PAL	$V_{9-2;\ 10-2}$	6,8	–	10,2	V
Sandcastle pulse detector and clamping pulse generator					
Voltage level at which the vertical blanking pulse is separated	V_{19-2}	1,0	1,5	2,0	V
required pulse amplitude (peak-to-peak value)	$V_{19-2(p-p)}$	2,1	–	2,9	V
Voltage level at which the horizontal blanking pulse is separated	V_{19-2}	3,0	3,5	4,0	V
required pulse amplitude (peak-to-peak value)	$V_{19-2(p-p)}$	4,1	–	6,6	V
Voltage level at which the burst gating pulse is separated	V_{19-2}	6,7	7,2	7,7	V
required pulse amplitude (peak-to-peak value)	$V_{19-2(p-p)}$	7,8	–	–	V
Input current at $V_{19-2} = 7$ V	I_{19}	–	–	40	μA
Carrier generator (note 6)					
Input signal from TDA3560/61/61A/62A/66 (peak-to-peak value)	$V_{7-2(p-p)}$	150	–	–	mV
Input resistance	R_{7-2}	–	4	–	kΩ
Input capacitance	C_{7-2}	–	5	–	pF

parameter	symbol	min.	typ.	max.	unit
Luminance amplifier					
Input signal (peak-to-peak value)	$V_{16\text{-}2(p\text{-}p)}$	–	1,2	1,7	V
Chrominance input signal when no luminance information is present (peak-to-peak value)	$V_{16\text{-}2(p\text{-}p)}$	–	–	1	V
Gain (pin 16 to 15) at f_{16} = 4,4 MHz	$G_{16\text{-}15}$	–	8	–	dB
Input current (pin 16)	I_{16}	–	–	1	μA
Input resistance during clamping (pin 16)	$R_{16\text{-}2}$	–	4	–	kΩ
Output impedance (pin 15) at I_{15} = 2 mA	$\lvert Z_{15\text{-}2}\rvert$	–	20	–	Ω
Frequency response at −3 dB (pin 16 to 15)	f	6	–	–	MHz
Gain (pin 16 to 8) at f_{16} = 4,4 MHz; not-SECAM condition	$G_{16\text{-}8}$	–	7	–	dB
Frequency response at −3 dB (pin 16 to 8) not-SECAM condition	f	–	5	–	MHz
PAL matrix and SECAM switch					
Burst signal amplitude (peak-to-peak value)	$V_{11;\,12(p\text{-}p)}$	–	60	–	mV
Input resistance	$R_{11;\,12\text{-}2}$	–	900	–	Ω
Input capacitance	$C_{11;\,12\text{-}2}$	–	3	–	pF
Amplification for PAL	A	–	0	–	dB
Amplification for SECAM	A	–	6	–	dB
Difference in amplification from inputs to one output for PAL	ΔA	–	–	0,5	dB
Line-to-line phase error in (R-Y) output for zero error in (B-Y) output for PAL		–	–	3,5	deg
Output impedance	$\lvert Z_{13;\,14\text{-}2}\rvert$	–	50	–	Ω
Identification PAL/not-PAL					
Input condition for PAL (pin 1)	$V_{1\text{-}2}$	0,5	–	2,5	V
Input conditions for not-PAL (pin 1):					
lower voltage level	$V_{1\text{-}2}$	–	–	$<0,4$	V
upper voltage level	$V_{1\text{-}2}$	$>2,6$	–	–	V

Notes to the characteristics

1. The parameter values given in the characteristics are valid only when the following alignment procedure is performed:
   a. Supply a SECAM signal input to pin 4 at 100 mV (peak-to-peak value) without deviation during a red and blue line (SECAM black colour information).
   b. Align the reference tuned circuit so that the output signal from pin 8 to the PAL decoder is minimum during scan (PAL black colour information).
2. When an artificial black level is inserted after demodulation the resulting black level deviation depends on the adjustment of the demodulator tuned circuit. It is therefore possible to obtain a value of 0%.
3. (B-Y) linearity is defined by $V_{out(yellow)}/V_{out(blue)}$ where f_{yellow} = (typ.) 4,02 MHz; f_{blue} = (typ.) 4,48 MHz; $V_{5\text{-}2}$ = 2,0 V.
4. (R-Y) linearity is defined by $V_{out(cyan)}/V_{out(red)}$ where f_{cyan} = (typ.) 4,68 MHz; f_{red} = (typ.) 4,12 MHz; $V_{5\text{-}2}$ = 2,0 V.
5. When the input signal to the limiter (pin 4) changes from 300 to 15 mV (peak-to-peak value) the zero point of the chrominance demodulator shifts by a typical value of 5 kHz.
6. The phase delay between the oscillator output of TDA3560/61/61A/62A/66 and the input to TDA3590A pin 7 must be adjusted for minimum burst amplitude at pin 28 of the PAL decoder.

APPLICATION INFORMATION

The pin-to-pin functions of the application shown in Fig. 3 are described against the corresponding pin numbers.

Pin 4. Chrominance input

Typical input signal values (peak-to-peak) are: SECAM 100 mV; PAL 0,55 V. The input signal, which should be free from any sound modulation, is applied single-ended to pin 4 via a filter which has the bell-shaped bandpass required for SECAM signals.

Pin 5. Horizontal/vertical identification

Selection of horizontal or vertical identification depends on the external voltage applied to pin 5. When the d.c. level on pin 5 changes with time (pulse information) a combination of horizontal and vertical identification is possible.

Horizontal identification

When the voltage at pin 5 is $< 0,5$ V horizontal identification and black level clamping occur. The clamping is during the back porch of the colour difference signals. If artificial black level insertion is required the voltage at pin 5 should be between 2 and 8 V.

Vertical identification

When the voltage on pin 5 is $> 10,5$ V vertical identification occurs (identification on 9 lines in the vertical blanking period). In this mode the black level is artificially inserted after demodulation.

Pin 6. System identification

During PAL reception the typical voltage at pin 6 is 10,2 V. This causes the luminance stage to be connected internally to the chrominance output at pin 8 and also activates the PAL matrix for normal PAL signals. During SECAM reception the typical voltage at pin 6 is 7 V. This changes the internal connection of the output from the luminance stage to the sequential phase modulator and enables the SECAM switch. Noisy SECAM signals cause the voltage at pin 6 to increase, colour killing occurs at 9,8 V and colour is reinstated at 9,1 V.

Pin 7. Carrier generation

An 8,8 MHz signal from the PAL decoder is applied via pin 7 to the divider circuit in the TDA3590A. From this two 4,4 MHz signals are obtained with a phase shift of 90° with respect to each other. These signals are applied to the modulator via an H/2 switch. The delay of the 8,8 MHz input must be adjusted for minimum burst amplitude of the chrominance signal at pin 28 of the PAL decoder. With this condition the burst generated by the TDA3590A is in phase with the (R-Y) reference signal for the PAL decoder demodulator (the a.c.c. of the PAL decoder operates in the + (R-Y) direction).

Pin 8. Chrominance output

During PAL reception this output is connected internally to the luminance stage and a composite PAL video signal is present at pin 8. During SECAM reception the sequential phase modulator is connected to this output to give a quasi-PAL signal from pin 8. Typical peak-to-peak amplitudes of the signal from pin 8 are 900 mV for PAL (with peak-to-peak input at pin 16 of 1,2 V) and 500 mV for SECAM. The output signals are applied via a chrominance bandpass filter to the chrominance a.c.c. amplifier input of the PAL decoder.

Pins 9 and 10. Divider resetting

The output of the PAL decoder burst phase detector is connected to pins 9 and 10 of TDA3590A. During SECAM reception this signal carries differential a.c. current information about the phase relationship of the 4,4 MHz dividers of both ICs. The TDA3590A generates a minimum relative voltage between pins 9 and 10 at an absolute voltage level of 10,5 V. This overrules the PAL decoder oscillator control function causing the oscillator to run at 2 x 4,43 MHz.

Pins 11, 12, 13 and 14. SECAM switch and PAL matrix

The PAL matrix circuit is enabled by system identification of PAL reception. The signal inputs to the matrix are the (direct) a.c.c. composite video output from the PAL decoder via an attenuator to pin 11 and a delayed version of the same signal via a glass delay line to pin 12. Active matrixing takes place in the IC and the separated (R-Y) and (B-Y) signals are available at pins 13 and 14 respectively.

The SECAM switch circuit is selected by system identification of SECAM reception. The inputs to the SECAM switch are the sequentially modulated quasi-PAL signals, direct and delayed, to pins 11 and 12 respectively. The SECAM switch separates the (R-Y) and (B-Y) signals which are then available at pins 13 and 14 respectively.

Pins 15 and 16. Luminance signals

The maximum peak-to-peak amplitude of the input to pin 16 should be 1,7 V. The relatively high input impedance of the luminance amplifier allows a 22 nF coupling capacitor to be used. The luminance amplifier has internal input clamping and a gain of 8 dB. The output is available at pin 15.

During SECAM reception the luminance signal is delayed approximately 470 ns by an external delay line to equalize the SECAM processing delay. The luminance and chrominance outputs are then correctly timed.

During PAL reception the PAL composite video signal passes through the external delay line and, after amplification, is available at pins 15 and 8.

APPLICATION INFORMATION (continued)

Pins 17 and 18. Supply voltage (+ 12 V)

Correct operation is ensured within the supply voltage range of 10,8 to 13,2 V. The typical power dissipation of the IC at 12 V is 1,2 W.

Pins 17 and 18 are separated by an external RC filter. Pin 18 supplies all the output stages and the biasing for several current sinks in the IC. Separation of the supply voltages minimizes crosstalk between the various parts of the IC. The capacitor at pin 18 must be small ($\approx 1\ \mu F$) to avoid the possibility of internal damage to the IC by discharge current should pin 17 be short-circuited to ground.

Pin 19. Sandcastle pulse

The required three-level sandcastle pulse may be coupled directly to the sandcastle pulse detector input at pin 19. The horizontal blanking, vertical blanking and burst gate pulses are separated by the IC.

Pin 20. De-emphasis

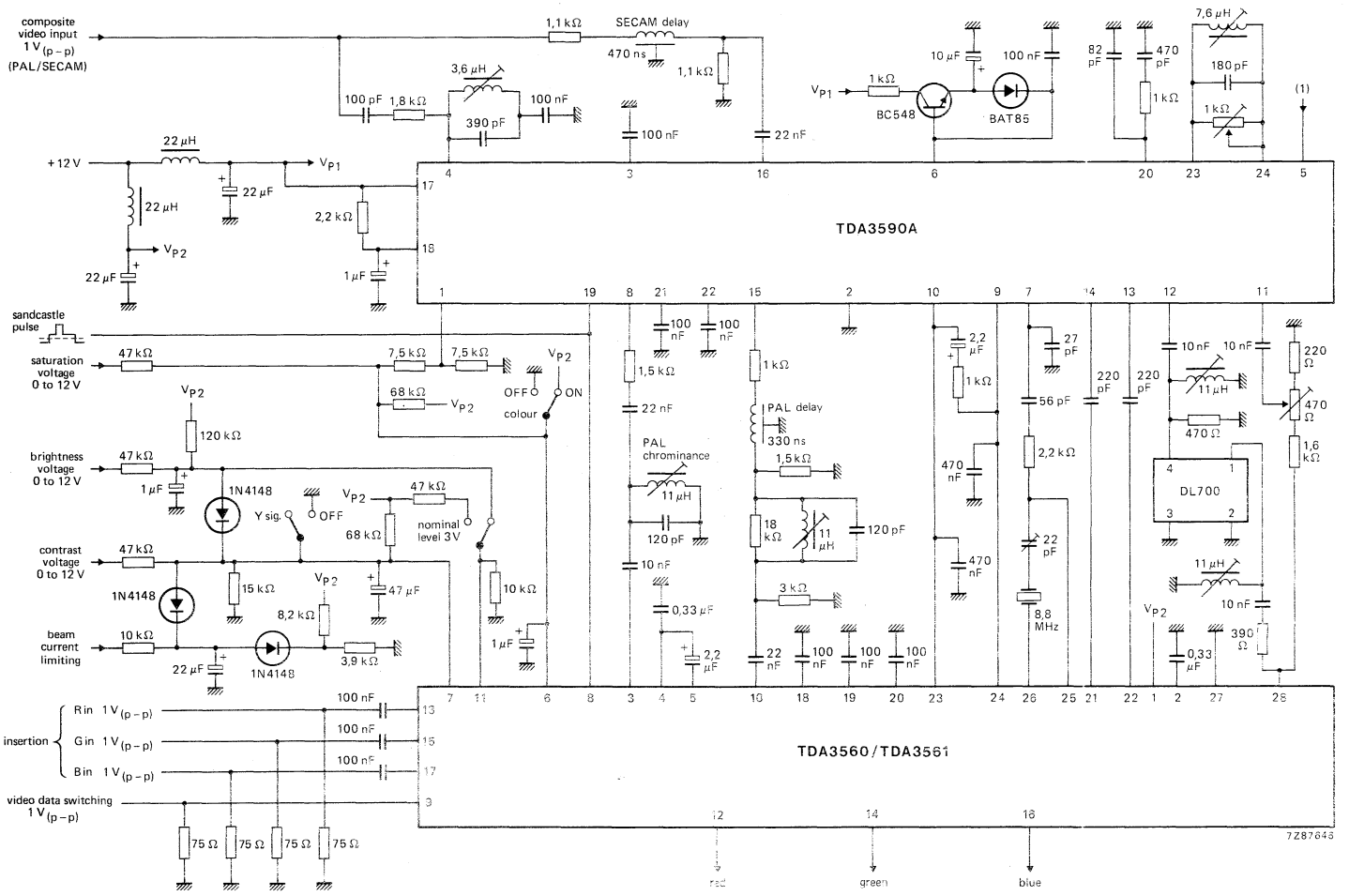
De-emphasis is performed at this pin with a 1 kΩ resistor and a 470 pF capacitor. Additional filtering of the 8,8 MHz signal using an 82 pF coupling capacitor prevents moiré patterns appearing on the screen.

Pins 21 and 22. Clamping of (R-Y) and (B-Y) signals

Clamping of the colour difference signals is performed after they have been separated. The normal value for the clamping storage capacitors is 100 nF but this may be increased to 470 nF if required.

Pins 23 and 24. Demodulator reference tuned circuit

The SECAM signal is applied to the demodulator via a bell filter and a limiter amplifier. Only one chrominance demodulator is used because of the sequential nature of the signal. The reference signal from the tuned circuit is applied to pins 23 and 24. Tuning and damping adjustments of the reference tuned circuit should be performed at $V_{5\text{-}2} > 2$ V (SECAM video (R-Y) (B-Y) information switched off). Adjustments should be such that minimum modulator voltage appears at pin 8, then any deviations between the black levels (when clamping on the back porch and when an artificial black level is filled in) can be made minimum.



(1) See Application Information for pin 5 – horizontal/vertical identification.

Fig. 3 PAL/SECAM decoder application.

APPLICATION INFORMATION (continued)

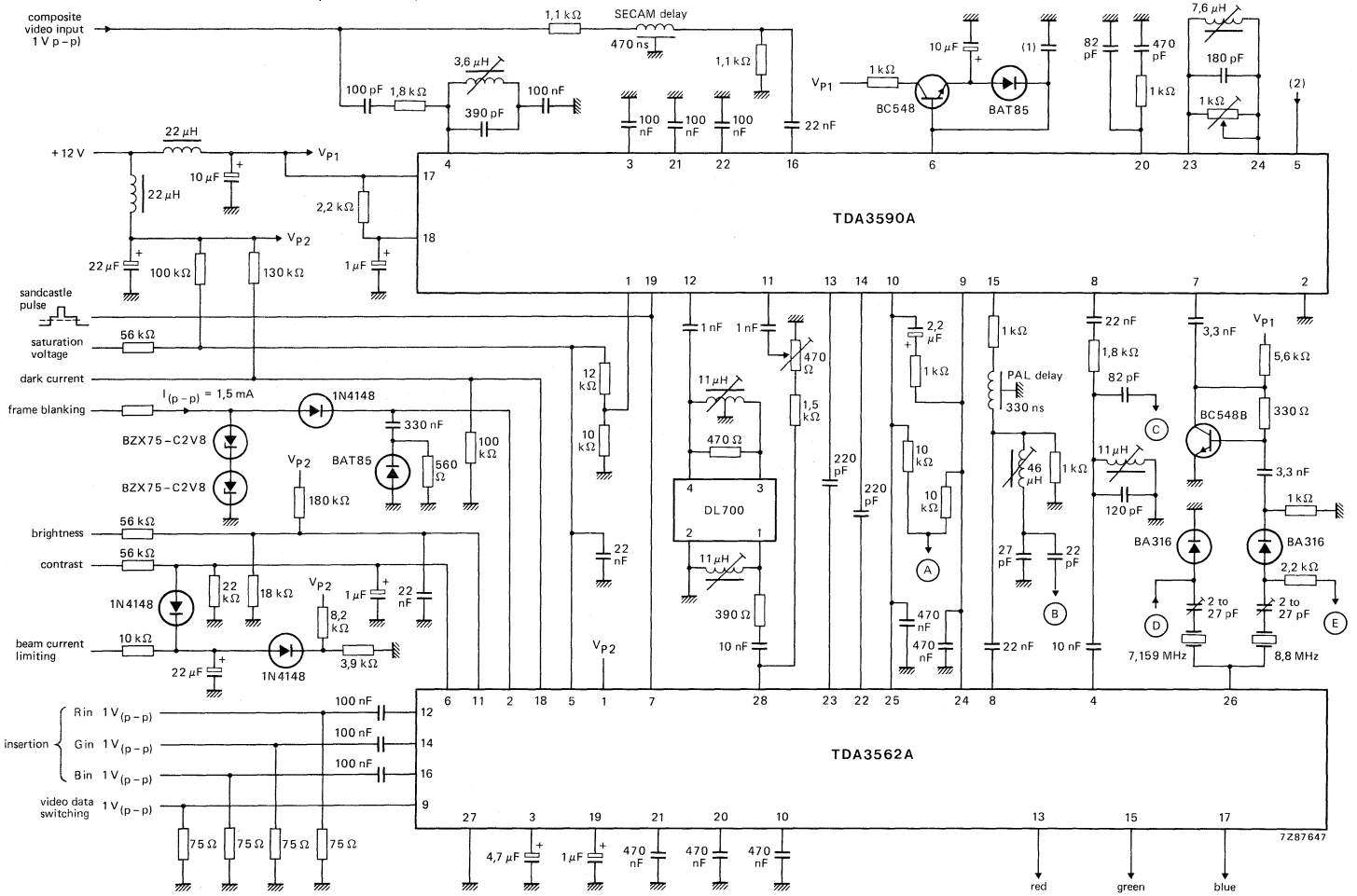
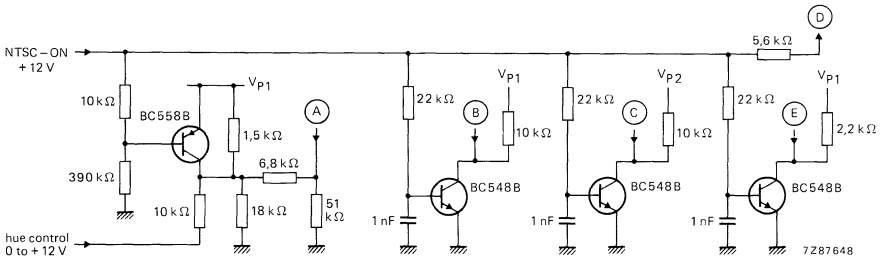


Fig. 4a PAL/SECAM/NTSC decoder application (continued in Fig. 4b).



(1) Capacitor value = 100 nF for horizontal identification or 1 μF for vertical identification.
(2) See Application Information for pin 5 – horizontal/vertical identification.

Fig. 4b PAL/SECAM/NTSC decoder application (continued from Fig. 4a).

SECAM-PAL TRANSCODER

GENERAL DESCRIPTION

The TDA3592A transcoder circuit converts SECAM input signals into true PAL signals. It can be used in combination with all types of PAL decoder.

Features

- Limiter input for chrominance signal
- SECAM demodulator
- Clamp circuits and de-emphasis for colour difference signals
- Modulator to provide true PAL signals
- 4,4 MHz oscillator
- Sandcastle pulse detector
- Identification circuit for horizontal and vertical SECAM identification
- Can be used with all types of PAL decoder
- Power-saving feature operates when supply voltage falls to (typ.) 5 V: SECAM processing shuts down but $\overline{\text{SECAM}}$ signal path remains active

QUICK REFERENCE DATA

Supply voltage	$V_P = V_{17-1}$	typ.	12 V
Supply current at V_P = 12 V	$I_P = I_{17}$	typ.	90 mA
Supply current at V_P = 5 V ($\overline{\text{SECAM}}$ only)	$I_P = I_{17} + I_{18}$	typ.	20 mA
Chrominance amplifier and demodulator			
Input signal $\overline{\text{SECAM}}$ (peak-to-peak value)	$V_{3-1(p-p)}$	max.	1100 mV
Input signal SECAM (peak-to-peak value)	$V_{3-1(p-p)}$	typ.	100 mV
Output signal PAL (peak-to-peak value) when input to pin 3 Δf = 280 kHz	$V_{9-1(p-p)}$	typ.	550 mV
Identification			
Input voltage range for horizontal identification (pin 4)	V_{4-1}		4,1 to V_{SUP} V
Input voltage range for vertical identification (pin 4)	V_{4-1}		0 to 2,9 V
Identification at pin 6	V_{6-1}	typ.	10,6 V
Slicing level reference voltage (pin 5)	V_{5-1}	typ.	7,0 V
Sandcastle pulse detector			
Vertical blanking level	V_{19-1}	typ.	1,5 V
Horizontal blanking level	V_{19-1}	typ.	3,5 V
Burst gating level	V_{19-1}	typ.	7,0 V
Luminance amplifier			
Luminance input signal (peak-to-peak value)	$V_{16-1(p-p)}$	typ.	1,2 V
Luminance amplifier gain at 4,4 MHz	G_{16-15}	typ.	7 dB

PACKAGE OUTLINE

24-lead DIL; plastic with internal heat spreader (SOT-101B).

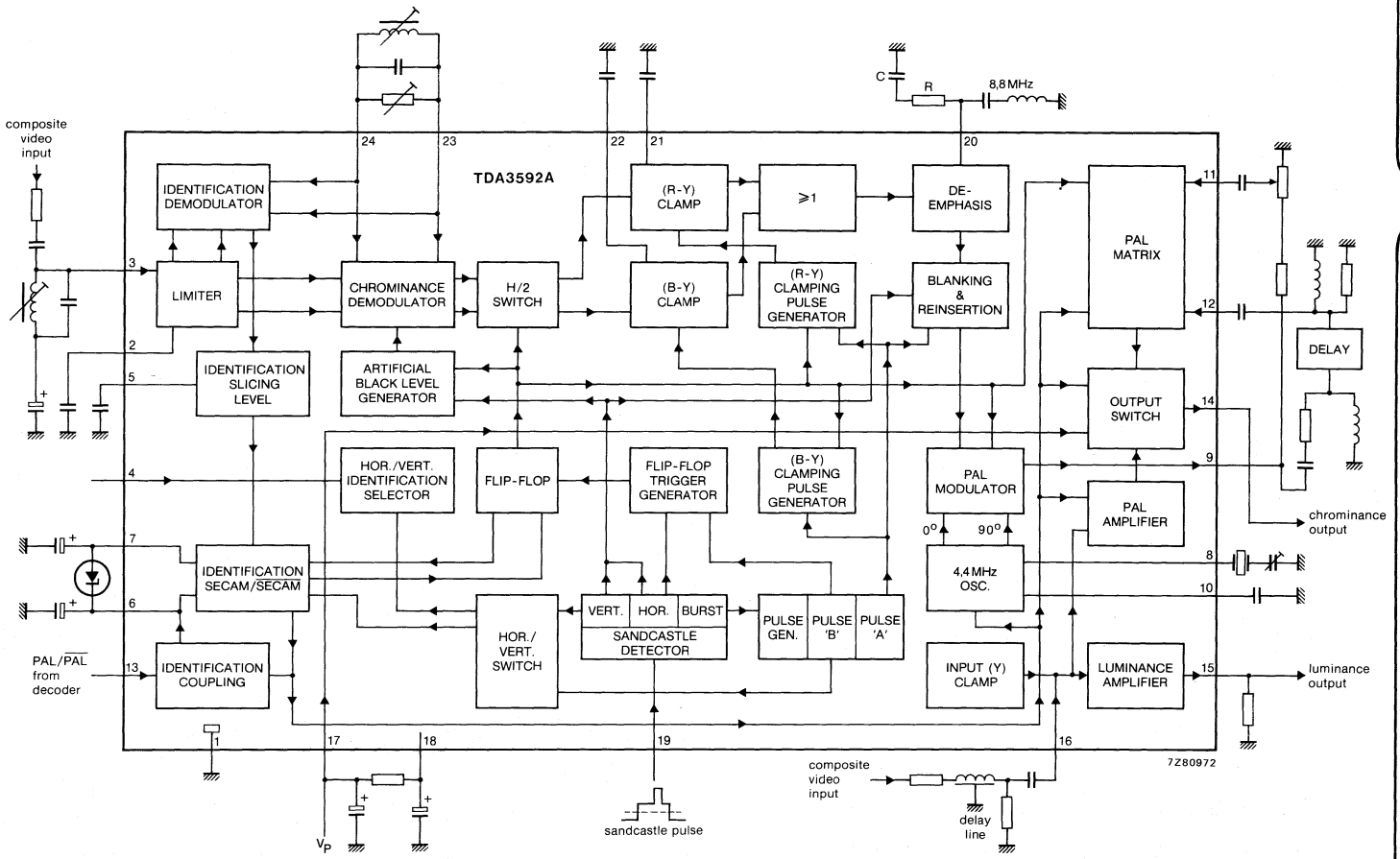


Fig. 1 Block diagram.

PINNING

1. Ground.
2. Limiter feedback.
3. Limiter input: chrominance input SECAM; identification input SECAM/$\overline{\text{SECAM}}$.
4. Identification selection input using a d.c. level to preset the identification mode of horizontal/vertical detection.
5. Storage capacitor input to identification slicing level circuit.
6. Storage capacitor input to SECAM/$\overline{\text{SECAM}}$ identification circuit.
7. Double time-constant input to SECAM/$\overline{\text{SECAM}}$ identification circuit.
8. 4,43 MHz oscillator.
9. Sequentially modulated output.
10. Decoupling capacitor.
11. Direct input chrominance signal.
12. Delayed input chrominance signal.
13. PAL/$\overline{\text{PAL}}$ input signal from PAL decoder.
14. Chrominance output signal.
15. Luminance output signal.
16. Luminance/$\overline{\text{SECAM}}$ input signal.
17. Positive supply voltage (V_P).
18. Decoupled positive supply voltage.
19. Three-level sandcastle pulse input.
20. De-emphasis circuit connection: R = 560 Ω; C = 910 pF.
21. Storage capacitor connection for (R-Y) clamp.
22. Storage capacitor connection for (B-Y) clamp.
23. Demodulator reference tuned circuit: nominal frequency = 4,33 MHz; nominal Q_L = 2,45.
24. As for pin 23.

DEVELOPMENT DATA

FUNCTIONAL DESCRIPTION

Demodulation

The chrominance and identification demodulators of the TDA3592A both share the same reference tuned circuit (pins 23 and 24). The identification circuit automatically detects whether the incoming signal is SECAM or $\overline{\text{SECAM}}$ (NTSC, PAL or black-and-white).

When the incoming signals are PAL they are diverted via pin 16 to the chrominance output at pin 14 and no signal demodulation takes place. The delay line connected to pin 16 delays the signals to equalize the delay of the SECAM-PAL transcoding process. When SECAM signals are received, the PAL signal path is switched off.

Incoming SECAM signals are applied to pin 3 via an external bell filter. The signals are amplified, limited and then demodulated. Only one demodulator is necessary as the colour difference signals are available sequentially. After demodulation the colour difference signals are separated by an H/2 switch and then applied to (R-Y) and (B-Y) clamp circuits where the black levels are clamped to the same d.c. level. With all conditions at pin 4, artificial black levels are inserted during the horizontal blanking period. This is done because of the possibility of horizontal burst signals not being available. The artificial levels may not be identical to the detected black level due to circuit spread but this can be corrected by detuning the reference tuned circuit.

The two colour difference signals are combined again after clamping and then applied to the modulator via de-emphasis, blanking and reinsertion circuits. The ratio of (R-Y) to (B-Y) at the de-emphasis output (pin 20) is 1,78.

Modulation

A burst signal is reinserted into the combined SECAM signal at the input to the PAL modulator. At this input the phase relationship for magenta colour is +(R-Y) and −(B-Y). The modulation carriers for the (R-Y) and (B-Y) signals are 90° out of phase; for a magenta colour the modulated (R-Y) component has the same phase position as the (R-Y) burst. The (B-Y) burst is modulated 180° out of phase with respect to the (B-Y) component of a magenta-coloured input signal.

Identification SECAM/$\overline{\text{SECAM}}$

Identification of the SECAM signal is performed using the fact that only SECAM signals have a line-to-line difference in voltage level. The identification circuit compares the phase of the demodulated voltage difference waveform with the phase of the flip-flop output. If the phase relationship is not correct, the flip-flop is reset by an extra pulse from the flip-flop trigger generator. For horizontal identification the phase comparison is performed during the 1,6 μs period of pulse 'B' (see Fig. 2). When vertical identification is selected, the comparison is performed only during the horizontal scan of the vertical blanking. The SECAM identification circuits operate when selected by the voltage on pin 4; this may be horizontal, vertical or combined horizontal and vertical identification, depending on the switching arrangements of pin 4.
These are as follows:

Horizontal identification preset when $V_{4\text{-}1} < 2{,}9$ V;

Vertical identification preset when $V_{4\text{-}1} > 4{,}1$ V;

Horizontal/vertical combination when sandcastle pulse is present on pin 4.

Information obtained from the identification detector is also used for colour killing and, if required, for switching to PAL.

Sandcastle pulse detection

The sandcastle pulse detector requires a three-level sandcastle pulse to provide horizontal blanking, vertical blanking and burst gate pulses. The detected burst gate pulse triggers a pulse generator which produces two timing pulses, pulse 'A' and pulse 'B' (see Fig. 2). Pulse 'A' is used to time the PAL modulator burst and to sample the (R-Y) and (B-Y) clamping pulse generators. A (R-Y) clamping pulse is generated only during a red line and a (B-Y) clamping pulse only during a blue line. Pulse 'B' times the SECAM horizontal identification.

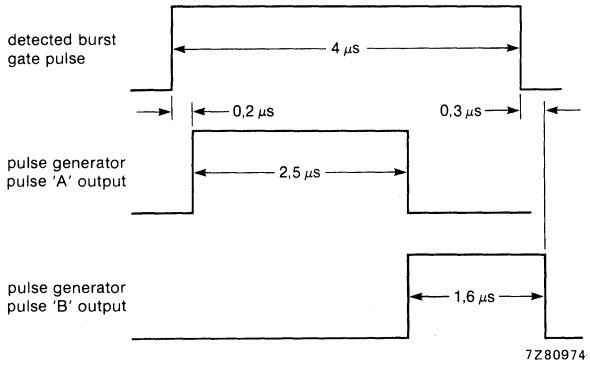


Fig. 2 Burst gate timing pulse generation.

Carrier generation

The carrier signal for the PAL modulator is obtained from a 4,4 MHz oscillator. An internal Miller integrator operates in conjunction with the decoupling capacitor at pin 10 to provide the required 90° phase shift.

PAL matrix

The signal output from the PAL modulator at pin 9 is sequentially modulated with (R-Y) burst phased in the +(R-Y) direction, and (B-Y) burst phased in the −(B-Y) direction. This PAL signal is applied directly to pin 11 and via a 64 μs delay to pin 12. A true PAL signal is constructed in the PAL matrix by means of an additional/substraction process using the delayed and undelayed inputs.

Coupling of identification systems

Coupling of a TDA3592A and a PAL decoder can be performed to obtain an optimum identification system. The system operates using the functions of pins 13, 6 and 7: the voltage level at pin 13 is controlled by the PAL/$\overline{\text{PAL}}$ detection of the PAL decoder; and the voltage level at pins 6 and 7 are functions of SECAM/$\overline{\text{SECAM}}$ detection in the TDA3592A.

FUNCTIONAL DESCRIPTION (continued)

Coupling of identification systems (continued)

The circuit action is as follows and is summarized in Table 1.

Channel switching	During channel switching pin 6 is taken rapidly to a high voltage (± 10,2 V), this corresponds to the $\overline{\text{SECAM}}$ mode of the TDA3592A.
PAL	The high voltage level at pin 6 caused by channel switching is maintained by the TDA3592A when it recognizes the signal as $\overline{\text{SECAM}}$ (this condition is maintained even if reflected PAL signals are present). The PAL decoder recognizes the signal as PAL and takes pin 13 of TDA3592A to a voltage greater than 1,7 V. The TDA3592A is now held in the $\overline{\text{SECAM}}$ condition by an internal current source at pin 6.
SECAM	The initial high voltage level (+ 10,2 V) at pin 6 caused by channel switching sets the TDA3592A in the $\overline{\text{SECAM}}$ mode and during this time the PAL decoder detects a $\overline{\text{PAL}}$ signal. This causes a voltage at pin 13 of $< 1{,}1$ V which prevents the internal current source of TDA3592A maintaining the high voltage level of pin 6 which, in turn, allows the TDA3592A to detect SECAM. The initiation of SECAM detection is delayed by the action of the external circuit at pins 6 and 7 and commences as pin 6 approaches 9,0 V. The SECAM signals are converted by TDA3592A to PAL signals at pin 14, which results in the PAL decoder switching to the PAL mode (the TDA3592A remains in the SECAM mode).
Black-and-white	The TDA3592A is initially set in the $\overline{\text{SECAM}}$ mode as previously described. The PAL decoder detects $\overline{\text{PAL}}$ and the TDA3592A detects $\overline{\text{SECAM}}$ which results in a system operation in the colour-killing mode.

Table 1 System operating modes

TDA3592A	PAL decoder mode	System operating mode
SECAM	PAL	SECAM
SECAM	$\overline{\text{PAL}}$	condition not used
$\overline{\text{SECAM}}$	PAL	PAL
$\overline{\text{SECAM}}$	PAL	black-and-white

System priorities

When TDA3592A pin 13 is connected to the PAL/$\overline{\text{PAL}}$ output of a PAL decoder, the system will give PAL priority in signal identification. Connecting TDA3592A pin 13 to ground will give SECAM priority.

Luminance and chrominance signal paths

The signal input at pin 16 is clamped by a circuit which detects the top of the luminance signal sync pulse. This clamp, the luminance signal path to pin 15 and the $\overline{\text{SECAM}}$ signal path to pin 14 remain active when the supply voltage falls to (typ.) 5 V. At this level of supply voltage the SECAM processing circuits are switched off, giving a reduction in total power dissipation.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134

Supply voltage (pin 17)	$V_P = V_{17-1}$	max.	13,2 V
Total power dissipation	P_{tot}	max.	1,9 W
Operating ambient temperature range	T_{amb}		−25 to + 65 °C
Storage temperature range	T_{stg}		−25 to + 150 °C

CHARACTERISTICS

$V_P = V_{17-1} = 12$ V; $T_{amb} = 25$ °C; unless otherwise specified.
The parameter values are valid only when the reference tuned circuit has been aligned as detailed in note 1.

parameter	symbol	min.	typ.	max.	unit
Supplies					
Supply voltage (pin 17)	V_{17-1}	9	12	13,2	V
Supply current (pin 17)	I_{17}	65	90	115	mA
Supply current (pin 17) at $V_{17-1} = 5$ V	I_{17}	16	20	24	mA
Supply voltage (pin 18)	V_{18-1}	8,8	11,8	13,2	V
Supply current (pin 18)	I_{18}	20	–	80	μA
External capacitance (pin 18)	C_{18-1}	–	–	10	μF
Total power dissipation	P_{tot}	–	1,08	1,38	W
Thermal resistance, junction to ambient	$R_{th\ j-a}$	–	40	45	K/W
Chrominance amplifier and demodulator					
Input signal $\overline{\text{SECAM}}$ (peak-to-peak value)	$V_{3-1(p-p)}$	–	–	1100	mV
Input signal SECAM at which correct limiting occurs (peak-to-peak value)	$V_{3-1(p-p)}$	15	100	300	mV
Input resistance (pin 3)	R_{3-1}	10,0	12,5	15,0	kΩ
Input capacitance (pin 3)	C_{3-1}	–	–	5	pF
Input resistance between pins 23 and 24	R_{23-24}	3,2	4,0	4,8	kΩ
Input capacitance between pins 23 and 24	C_{23-24}	–	12	–	pF
De-emphasis output resistance (pin 20)	R_{20-1}	1,0	1,2	1,4	kΩ
Chrominance demodulator zero point stability (pin 20) (note 2)	f_0	–	5	–	kHz
Linearity of (B-Y) demodulation (pin 20) (note 3)		–	92	–	%
Linearity of (R-Y) demodulation (pin 20) (note 4)		–	100	–	%
(R-Y)/(B-Y) ratio (pin 20)		–	1,78	–	
Relative deviation of reinserted black level/demodulated black level (pin 20) as a function of temperature (note 5)					
(R-Y) signals		–	0,22	–	kHz/K
(B-Y) signals		–	0,22	–	kHz/K

DEVELOPMENT DATA

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Identification SECAM/$\overline{\text{SECAM}}$					
Input voltage for horizontal identification (pin 4)	V_{4-1}	4,1	–	V_P	V
Input voltage for vertical identification (pin 4)	V_{4-1}	0	–	2,9	V
Switching level for horizontal/ vertical identification (pin 4)	V_{4-1}	3,0	3,5	4,0	V
Input current (pin 4)	$-I_4$	–	5	25	μA
Voltage at pin 6 during $\overline{\text{SECAM}}$/PAL	V_{6-1}	–	10,2	–	V
Voltage at pin 6 during $\overline{\text{SECAM}}$/PAL	V_{6-1}	–	11,5		V
Voltage at pin 6 during SECAM	V_{6-1}	–	7,0	–	V
Identification at pin 6	V_{6-1}	–	10,6	–	V
Colour OFF for SECAM	V_{6-1}	–	9,7	–	V
Colour ON for SECAM	V_{6-1}	–	9,0	–	V
Slicing level reference voltage (pin 5)	V_{5-1}	–	7,0	–	V
Sandcastle pulse detector and clamping pulse generator					
Voltage level at which the vertical blanking pulse is separated	V_{19-1}	1,0	1,5	2,0	V
required pulse amplitude frame voltage (peak-to-peak value)	$V_{19-1(p-p)}$	2,1	–	2,9	V
Voltage level at which the horizontal blanking pulse is separated	V_{19-1}	3,0	3,5	4,0	V
required pulse amplitude line voltage (peak-to-peak value)	$V_{19-1(p-p)}$	4,1	–	6,4	V
Voltage level at which the burst gating pulse is separated	V_{19-1}	6,5	7,0	7,5	V
required pulse amplitude burst voltage (peak-to-peak value)	$V_{19-1(p-p)}$	7,6	–	–	V
Input current at $V_{19-1} = 0$ V	$-I_{19}$	–	30	100	μA
Width of pulse 'A' (Fig. 2) at burst gate pulse width = 4 μs	P_{WA}	2,0	2,5	3,0	μs
Width of pulse 'B' (Fig. 2) at burst gate pulse width = 4 μs	P_{WB}	1,1	1,6	2,1	μs

parameter	symbol	min.	typ.	max.	unit
Luminance amplifier					
Input signal (peak-to-peak value)	$V_{16\text{-}1(p\text{-}p)}$	–	1,2	1,7	V
Gain (pin 16 to 15) at f_{16} = 4,4 MHz	$G_{16\text{-}15}$	6	7	8	dB
Input current (pin 16)	I_{16}	–	1	5	μA
Output resistance (pin 15)	$\lvert R_{15\text{-}1}\rvert$	–	20	–	Ω
Minimum load resistance (pin 15)	$R_{L(15)}$	2	–	–	kΩ
Frequency response at −3 dB (pin 16 to 15)	f	6	–	–	MHz
Gain (pin 16 to 14) at f_{16} = 4,4 MHz	$G_{16\text{-}14}$	6	7	8	dB
Frequency response at −3 dB (pin 16 to 14)	f	6	–	–	MHz
Limiter, chrominance demodulator and PAL modulator					
Output resistance (pin 9)	$R_{9\text{-}1}$	–	25	–	Ω
D.C. output voltage during horizontal blanking (pin 9)	$V_{9\text{-}1}$	–	9,6	–	V
Internal biasing resistor for emitter follower (pin 9)		–	9	–	kΩ
External load resistance (pin 9)	$R_{L(9)}$	2	–	–	kΩ
Output signal (pin 9) when input to pin 3 = 280 kHz (peak-to-peak value)	$V_{9\text{-}1(p\text{-}p)}$	–	550	–	mV
(R-Y)/(B-Y) ratio (pin 9)		–	1,78	–	
Chrominance/burst ratio for SECAM (pin 9)		2,5	3,0	3,5	
Linearity of (B-Y) signal (pin 9) (note 3)		85	92	99	%
Linearity of (R-Y) signal (pin 9) (note 4)		93	100	107	%
Black level shift as a function of temperature (pin 9) (note 6)					
(R-Y) signals		–	0,22	–	kHz/K
(B-Y) signals		–	0,22	–	kHz/K
Phase relationship of modulated (R-Y) burst to modulated (B-Y) burst (pin 9)		–	90	–	deg
Amplitude relationship of modulated (R-Y) burst to modulated (B-Y) burst (pin 9)		–	0	–	dB

DEVELOPMENT DATA

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Oscillator					
Oscillator frequency at pin 9 (set with series capacitor)	f_{OSC}	–	4,433 619	–	MHz
Frequency deviation without spread of external components (pin 9)	Δf_{OSC}	–	–	± 150	Hz
Temperature coefficient of oscillator frequency (pin 9)		–	–2	–3	Hz/K
Frequency deviation for change of V_P from 9 to 13,2 V	Δf_{OSC}	–	–	150	Hz
D.C. voltage at pin 8	$V_{8\text{-}1}$	–	3,8	–	V
Input resistance at pin 8	$R_{8\text{-}1}$	–	800	–	Ω
D.C. voltage at pin 10	$V_{10\text{-}1}$	–	4,4	–	V
Input resistance at pin 10	$R_{10\text{-}1}$	–	2	–	kΩ
PAL matrix					
Input resistance at pin 11	$R_{11\text{-}1}$	700	900	1100	Ω
Input resistance at pin 12	$R_{12\text{-}1}$	700	900	1100	Ω
Output resistance at pin 14 (SECAM and $\overline{\text{SECAM}}$ modes)	$R_{14\text{-}1}$	–	40	–	Ω
Internal emitter follower load resistance (pin 14)	$R_{INT(14)}$	–	7	–	kΩ
Minimum external load resistance (pin 14)	$R_{L(14)}$	2,4	–	–	kΩ
D.C. voltage at pin 11	$V_{11\text{-}1}$	–	4,0	–	V
D.C. voltage at pin 12	$V_{12\text{-}1}$	–	4,0	–	V
D.C. voltage at pin 14 (SECAM mode)	$V_{14\text{-}1}$	–	4,8	–	V
D.C. voltage at pin 14 ($\overline{\text{SECAM}}$ mode and line blanking)	$V_{14\text{-}1}$	–	3,9	–	V
H/2 ripple on chrominance output at pin 14 (SECAM mode) (peak-to-peak value)	$V_{14(p\text{-}p)}$	–	–	50	mV
Gain A; pin 11 to 14	G_A	9	10	11	dB
Gain B; pin 12 to 14 { (R-Y) at pin 9 }	G_B	9	10	11	dB
Gain C; pin 12 to 14 { (B-Y) at pin 9 }	G_C	9	10	11	dB
Gain A – gain B	$G_A\text{-}G_B$	–0,5	–	+ 0,5	dB
Gain A – gain C	$G_A\text{-}G_C$	–0,5	–	+ 0,5	dB
Gain B – gain C	$G_B\text{-}G_C$	–0,5	–	+ 0,5	dB
Phase A (pin 11–14) – (pin 12–14) (R-Y) at pin 9	αA	–	181,5	–	deg
Phase B (pin 11–14) – (pin 12–14) (B-Y) at pin 9	αB	–	1,5	–	deg
Phase A – phase B	$\alpha A - \alpha B$	–	180	–	deg

CHARACTERISTICS AT LOW SUPPLY VOLTAGE

$V_P = V_{17-1} = 5$ V; $T_{amb} = 25$ °C; unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
Supplies					
Supply current	$I_{17}+I_{18}$ 16		20	24	mA
Supply voltage switching level for preset SECAM signal path (SECAM processing off)	V_{17-1}	7,1	7,5	7,9	V
Luminance amplifier					
Input signal (peak-to-peak value)	$V_{16-1(p-p)}$	–	0,45	0,56	V
Gain (pin 16 to 15) at f_{16} = 4,4 MHz	G_{16-15}	6	7	8	dB
Input curernt (pin 16)	I_{16}	–	1	5	μA
Output resistance (pin 15)	$\lvert R_{15-1} \rvert$	–	20	–	Ω
Minimum load resistance (pin 15)	$R_{L(15)}$	2	–	–	kΩ
Frequency response at –3 dB (pin 16 to 15)	f	6	–	–	MHz
Gain (pin 16 to 14) at f_{16} = 4,4 MHz	G_{16-14}	6	7	8	dB
Frequency response at –3 dB (pin 16 to 14)	f	6	–	–	MHz

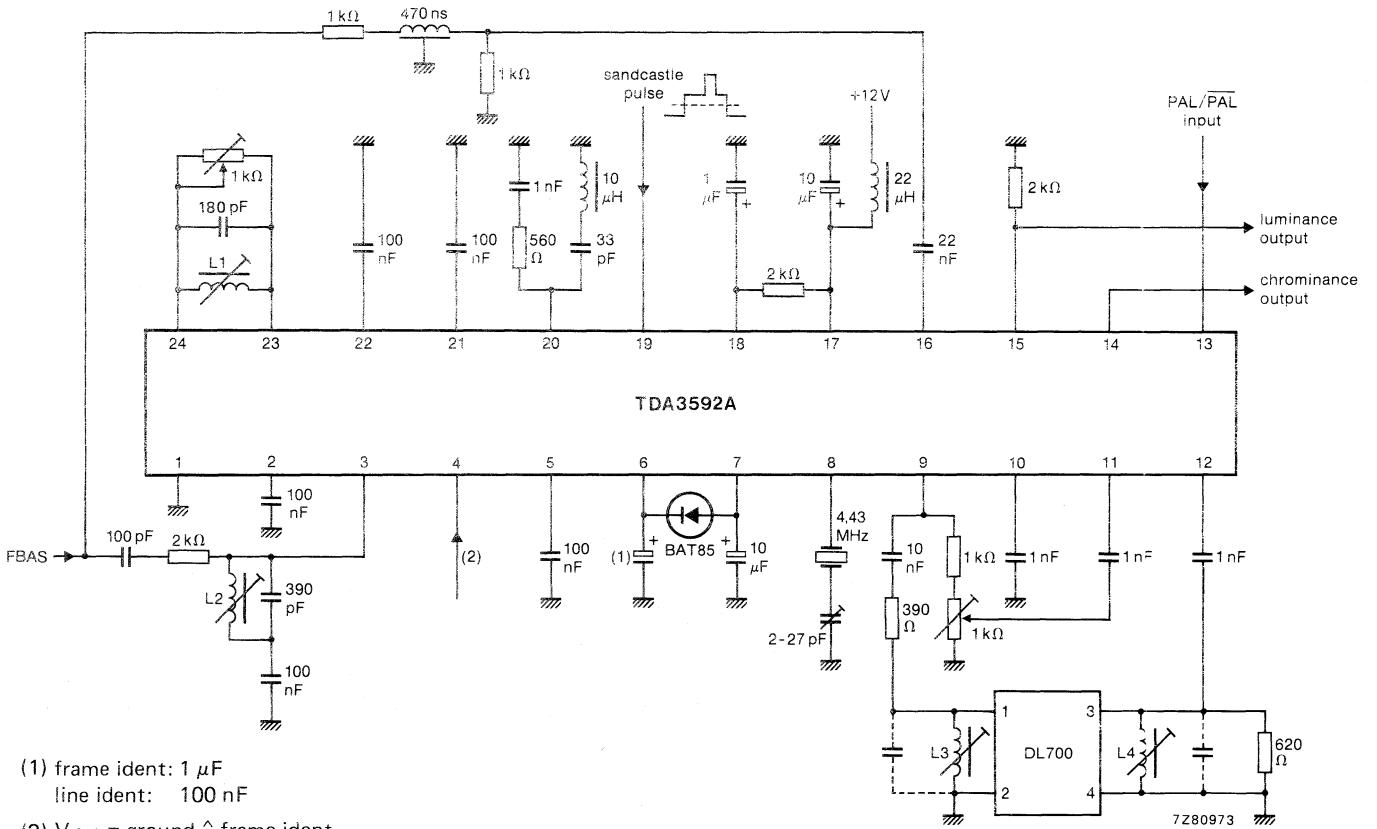
DEVELOPMENT DATA

Notes to the characteristics

1. The parameter values given in the characteristics are valid only when the following alignment procedure is performed:
   a. Supply a SECAM signal input to pin 3 at 100 mV (peak-to-peak value) without deviation during a red and blue line (SECAM black colour information).
   b. Align the reference tuned circuit so that the output signal from pin 14 to the PAL decoder is minimum during scan (PAL black colour information).
2. When the input signal to the limiter (pin 3) changes from 300 to 15 mV (peak-to-peak value) the zero point of the chrominance demodulator shifts by a typical value of 5 kHz; f = 4,33 MHz (typ.).
3. (B-Y) linearity is defined by $V_{out(yellow)}/V_{out(blue)}$ where f_{yellow} = (typ.) 4,02 MHz; f_{blue} = (typ.) 4,48 MHz.
4. (R-Y) linearity is defined by $V_{out(cyan)}/V_{out(red)}$ where f_{cyan} = (typ.) 4,68 MHz; f_{red} = (typ.) 4,12 MHz.
5. The parameter value is equated by: $\frac{(B\text{-}D)/F - (A\text{-}C)/E}{Y\text{-}X}$ x 230 (or 280) kHz.

   where A = demodulated black level at temperature X
   B = demodulated black level at temperature Y
   C = artificial black level at temperature X
   D = artificial black level at temperature Y
   E = demodulated output signal (230 or 280 kHz) at temperature X
   F = demodulated output signal (230 or 280 kHz) at temperature Y
6. The parameter value is equated by: 2 (B-A)/(E+F) x 230 (or 280) kHz (definitions for A, B, E, and F are as note 5).

APPLICATION INFORMATION



(1) frame ident: 1 µF
line ident: 100 nF

(2) V_{4-1} = ground ≙ frame ident
$V_{4-1} = V_{sup.}$ ≙ line ident
Identification switching: horizontal, $V_{4-1} = Vp$;
vertical, V_{4-1} = ground.

Fig. 3 Circuit diagram for typical application.

VERTICAL DEFLECTION CIRCUIT

The TDA3651 is a vertical deflection output circuit for drive of various deflection systems with deflection currents up to 2 A peak-to-peak.

The circuit incorporation the following functions:

- Driver
- Output stage
- Thermal protection and output stage protection
- Flyback generator
- Voltage stabilizer

QUICK REFERENCE DATA

Supply voltage (pin 9)	$V_{9-4} = V_P$		0 to 50	V
Peak output voltage during flyback (pin 5)	V_{5-4M}	<	55	V
Output current (peak-to-peak value)	$I_{5(p-p)}$	<	1,5	A
Operating junction temperature	T_j	max.	150	°C
Thermal resistance from junction to tab	$R_{th\ j-tab}$	typ.	10	K/W

PACKAGE OUTLINE

9-lead SIL; plastic (SOT-110B).

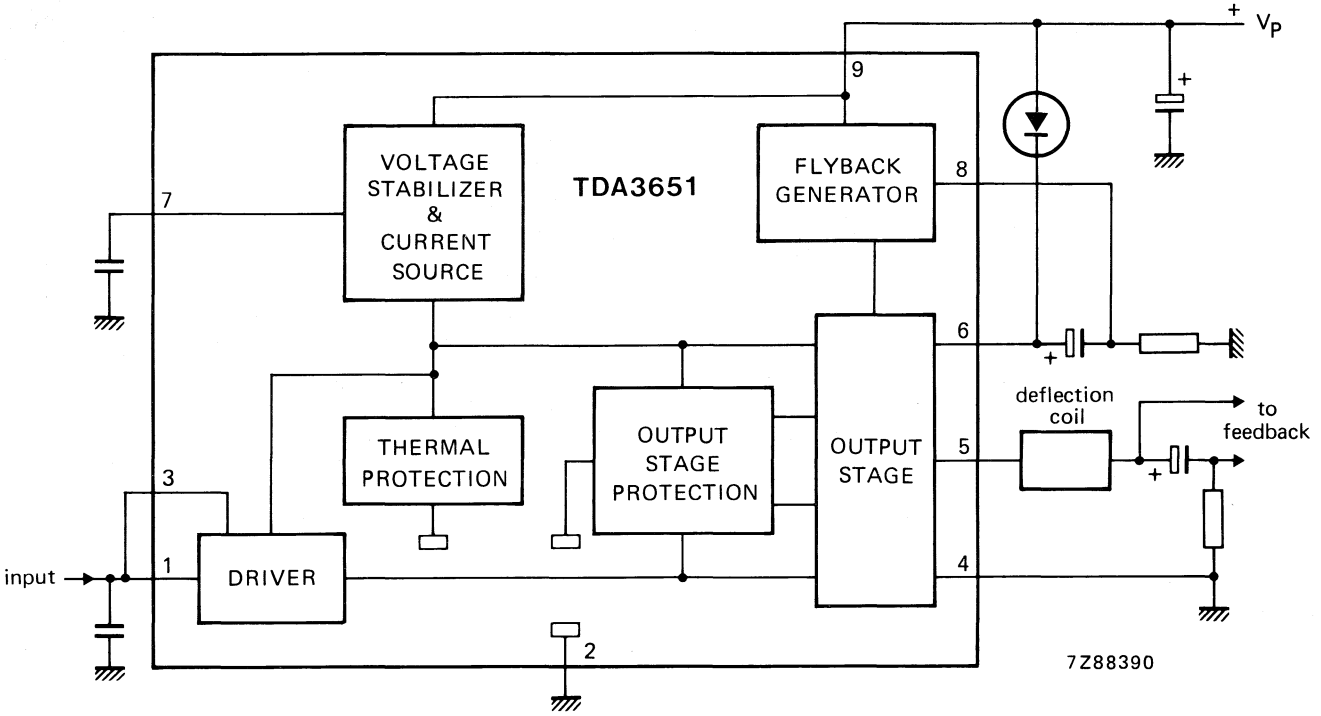


Fig. 1 Block diagram.

GENERAL DESCRIPTION

Output stage and protection circuit

Pin 5 is the output pin. The supply for the output stage is fed to pin 6 and the output stage ground is connected to pin 4. The output transistors of the class-B output stage can each deliver 1 A maximum. The 'upper' power transistor is protected against short-circuit currents to ground, whereas, during flyback, the 'lower' power transistor is protected against too high voltages which may occur during adjustments.
Moreover, the output transistors have been given extra solidity by means of special measures in the internal circuit layout.
A thermal protection circuit is incorporated to protect the IC against too high dissipation. This circuit is 'active' at 175 ^{o}C and then reduces the deflection current to such a value that the dissipation cannot increase.

Driver and switching circuit

Pin 1 is the input for the driver of the output stage. The signal at pin 1 is also applied to pin 3 which is the input of a switching circuit. When the flyback starts, this switching circuit rapidly turns off the lower output stage and so limits the turn-off dissipation. It also allows a quick start of the flyback generator.
Pin 3 is connected externally to pin 1, in order to allow for different applications in which pin 3 is driven separately from pin 1.

Flyback generator

The capacitor at pin 6 is charged to a maximum voltage, which is equal to the supply voltage V_P (pin 9), during scan.
When the flyback starts and the voltage at the output pin (pin 5) exceeds the supply voltage (pin 9), the flyback generator is activated. Then V_P is connected in series (via pin 8) with the voltage across the capacitor.
The voltage at the supply pin (pin 6) of the output stage will then be maximum twice V_P. Lower voltages can be chosen by changing the value of the external resistor at pin 8.

Voltage stabilizer

The internal voltage stabilizer provides a stabilized supply of 6 V for drive of the output stage, so the drive current of the output stage is not affected by supply voltage variations. The stabilized voltage is available at pin 7.
A decoupling capacitor of 2,2 μF can be connected to this pin.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages (pins 4 and 2 externally connected to ground)

Output voltage (pin 5)	V_{5-4}	max.	55 V
Supply voltage (pin 9)	$V_{9-4} = V_P$	max.	50 V
Supply voltage output stage (pin 6)	V_{6-4}	max.	55 V
Input voltage (pins 1 and 3)	V_{1-2}; V_{3-2}	max.	V_P

Currents

Repetitive peak output current (pin 5)	$\pm I_{5RM}$	max.	0,75 A
Non-repetitive peak output current (pin 5)	$\pm I_{5SM}$	max.	1,5 A*
Repetitive peak flyback generator output current (pin 8)	I_{8RM}	max.	−0,75 A +0,85 A
Non-repetitive peak flyback generator output current (pin 8)	I_{8SM}	max.	−1,5 A +1,6 A*

Temperatures

Storage temperature range	T_{stg}	−65 to + 150 °C
Operating ambient temperature range	T_{amb}	−25 to + 65 °C
Operating junction temperature range	T_j	−25 to + 150 °C

CHARACTERISTICS

T_{amb} = 25 °C; V_P = 26 V; pins 4 and 2 externally connected to ground; unless otherwise specified.

Output current (peak-to-peak value)	$I_{5(p-p)}$	typ. <	1,2 A 1,5 A
Flyback generator output current	$-I_8$	typ. <	0,7 A 0,85 A
Flyback generator output current	I_8	typ. <	0,6 A 0,75 A

Output voltages

Peak voltage during flyback	V_{5-4M}	<	55 V
Saturation voltage to supply at $-I_5$ = 1 A	$-V_{5-6sat}$	typ. <	2,5 V 3,0 V
Saturation voltage to ground at I_5 = 1 A	V_{5-4sat}	typ. <	2,5 V 3,0 V
Saturation voltage to supply at $-I_5$ = 0,75 A	$-V_{5-6sat}$	typ. <	2,2 V 2,7 V
Saturation voltage to ground at I_5 = 0,75 A	V_{5-4sat}	typ. <	2,2 V 2,7 V

* Non-repetitive duty factor maximum 3,3%.

Supply

Supply voltage	$V_{9-2;4}$		10 to 50	V*
Supply voltage output stage	V_{6-4}	<	55	V*
Supply current (no load and no quiescent current)	I_9	typ.	9	mA
		<	12	mA
Quiescent current (see Fig. 2)	I_4	typ.	38	mA
			25 to 52	mA
Variation of quiescent current with temperature		typ.	−0,04	mA/K

Flyback generator

Saturation voltage at $-I_8$ = 1,1 A	V_{9-8sat}	typ.	1,6	V
		<	2,1	V
Saturation voltage at I_8 = 1 A	V_{8-9sat}	typ.	2,5	V
		<	3,0	V
Saturation voltage at I_8 = 0,85 A	V_{9-8sat}	typ.	1,4	V
		<	1,9	V
Saturation voltage at I_8 = 0,75 A	V_{8-9sat}	typ.	2,3	V
		<	2,8	V
Flyback generator active if:	V_{5-9}	>	4	V
Leakage current	$-I_8$	typ.	5	μA
		<	100	μA
Input current for ± I_5 = 1 A	I_1	typ.	230	μA
			175 to 380	μA
Input voltage during scan	V_{1-2}	typ.	1,9	V
			0,9 to 2,7	V
Input current during scan	I_3		0,01 to 2,5	mA
Input voltage during scan	V_{3-2}		0,9 to V_P	V
Input voltage during flyback	V_{3-2}		0 to 0,2	V
Voltage at pin 7	V_{7-2}	typ.	6,1	V
			5,6 to 6,6	V
Load current of pin 7	I_7	<	2	mA
Unloaded voltage at pin 7 during flyback	V_{7-2}	typ.	15	V
Junction temperature of switching on the thermal protection	T_j	typ.	175	°C
			158 to 192	°C
Thermal resistance from junction to tab	$R_{th\,j\text{-}tab}$	typ.	10	K/W
		<	12	K/W
Power dissipation	see Fig. 3			
Open loop gain at 1 kHz; R_{load} = 1 kΩ	G_o	typ.	36	dB
Frequency response (−3 dB); R_{load} = 1 kΩ	f	typ.	60	kHz

* The maximum supply voltage should be chosen such that during flyback the voltage at pin 5 does not exceed 55 V.

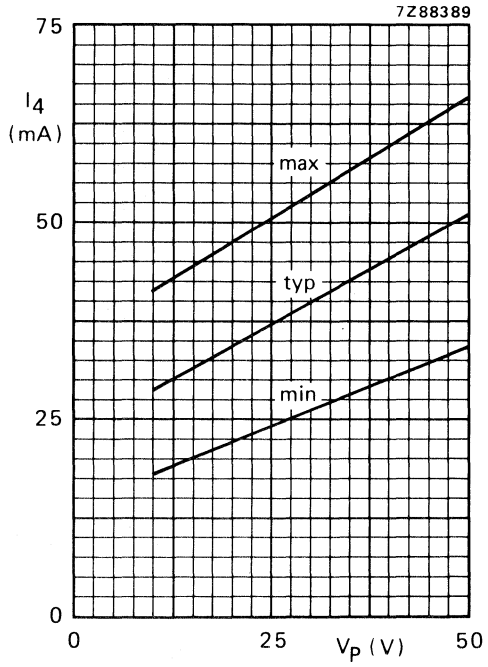


Fig. 2 Quiescent current I_4 as a function of supply voltage V_P.

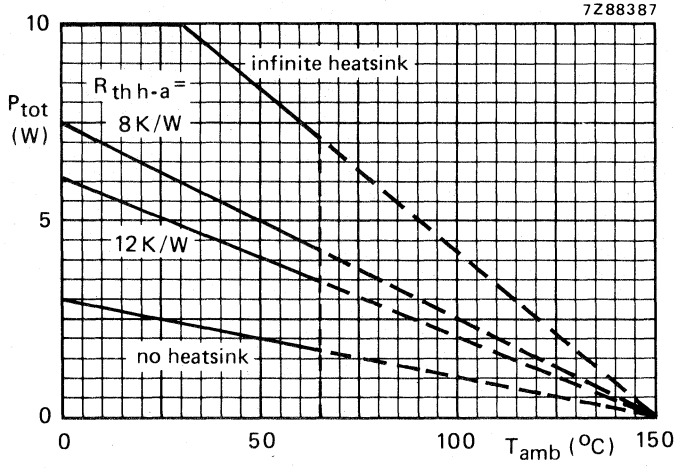


Fig. 3 Power derating curves.

APPLICATION INFORMATION

The following application data are measured in a typical application as shown in Figs 4 and 5.

Deflection current (including 6% overscan) peak-to-peak value	$I_{5(p-p)}$	typ.	0,87 A
Supply voltage	V_{9-4}	typ.	26 V
Total supply current	I_{tot}	typ.	148 mA
Peak output voltage during flyback	V_{5-4M}	<	50 V
Saturation voltage to supply	V_{5-6sat}	typ. <	2,0 V 2,5 V
Saturation voltage to ground	V_{5-4sat}	typ. <	2,0 V 2,5 V
Flyback time	t_{fl}	typ. <	0,95 ms 1,2 ms
Total power dissipation in IC	P_{tot}	typ.	2,5 W
Operating ambient temperature	T_{amb}	<	65 °C

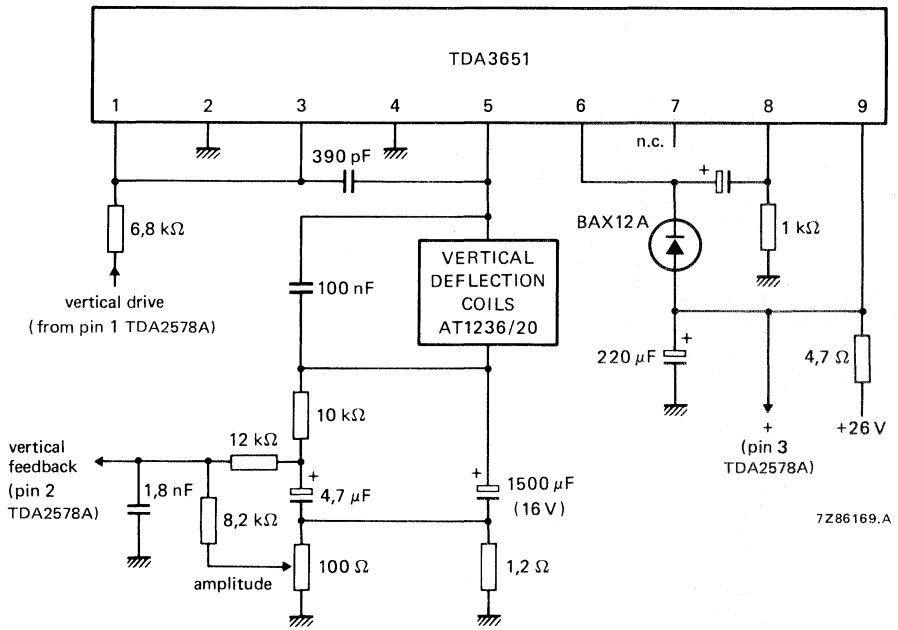


Fig. 4 Typical application circuit diagram of the TDA3651 (vertical output), when used in combination with the TDA2578A (see Fig. 5).

Note to deflection coils AT1236/20: L = 29 mH, R = 13,6 Ω; deflection current without overscan is 0,82 A peak-to-peak and EHT voltage is 25 kV.

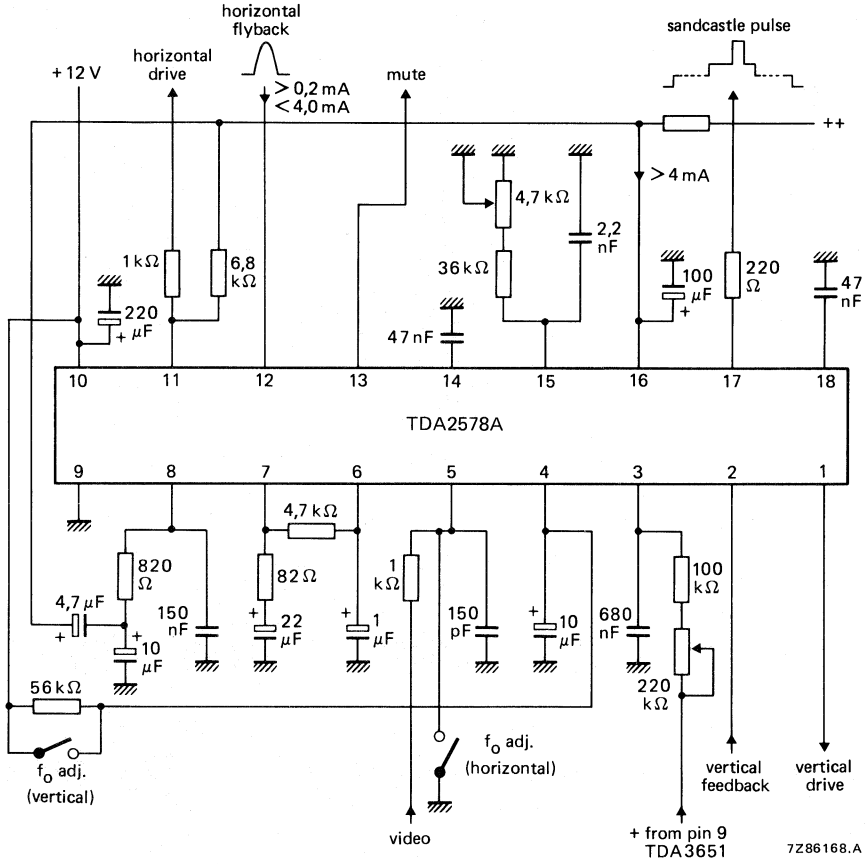


Fig. 5 Typical application circuit diagram; for combination of the TDA2578A with the TDA3651 see Fig. 4.

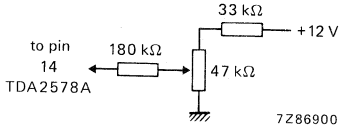


Fig. 6 Circuit configuration at pin 14 for phase adjustment.

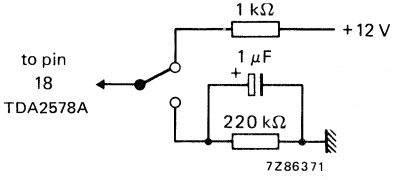


Fig. 7 Circuit configuration at pin 18 for VCR mode.
1 kΩ resistor between pin 18 and + 12 V: without mute function.
220 kΩ between pin 18 and ground: with mute function.

VERTICAL DEFLECTION CIRCUIT

The TDA3651A;AQ is a vertical deflection output circuit for drive of various deflection systems with deflection currents up to 2 A peak-to-peak.

The circuit incorporates the following functions:

- Driver
- Output stage
- Thermal protection and output stage protection
- Flyback generator
- Voltage stabilizer

QUICK REFERENCE DATA

Supply voltage (pin 9)	$V_{9-4} = V_P$		0 to 50	V
Peak output voltage during flyback (pin 5)	V_{5-4M}	<	55	V
Output current (peak-to-peak value)	$I_{5(p-p)}$	<	1,5	A
Operating junction temperature	T_j	max.	150	°C
Thermal resistance from junction to mounting base	$R_{th\ j-mb}$	typ.	3	K/W

PACKAGE OUTLINES

TDA3651A: 9-lead SIL; plastic power (SOT-131B).
TDA3651AQ: 9-lead SIL bent to DIL; plastic power (SOT-157B).

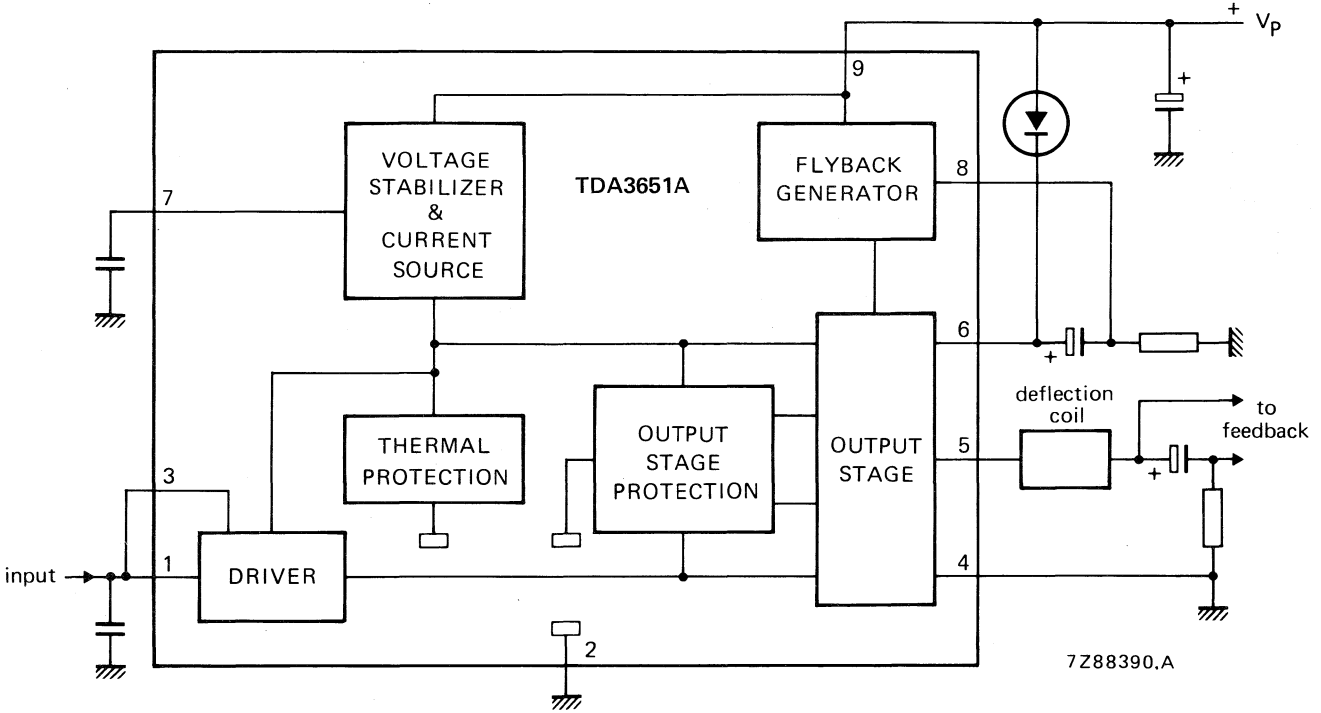


Fig. 1 Block diagram.

GENERAL DESCRIPTION

Output stage and protection circuit

Pin 5 is the output pin. The supply for the output stage is fed to pin 6 and the output stage ground is connected to pin 4. The output transistors of the class-B output stage can each deliver 1 A maximum. The 'upper' power transistor is protected against short-circuit currents to ground, whereas, during flyback, the 'lower' power transistor is protected against too high voltages which may occur during adjustments.
Moreover, the output transistors have been given extra solidity by means of special measures in the internal circuit layout.
A thermal protection circuit is incorporated to protect the IC against too high dissipation. This circuit is 'active' at 175 °C and then reduces the deflection current to such a value that the dissipation cannot increase.

Driver and switching circuit

Pin 1 is the input for the driver of the output stage. The signal at pin 1 is also applied to pin 3 which is the input of a switching circuit. When the flyback starts, this switching circuit rapidly turns off the lower output stage and so limits the turn-off dissipation. It also allows a quick start of the flyback generator. Pin 3 is connected externally to pin 1, in order to allow for different applications in which pin 3 is driven separate from pin 1.

Flyback generator

The capacitor at pin 6 is charged to a maximum voltage, which is equal to the supply voltage V_P (pin 9), during scan.
When the flyback starts and the voltage at the output pin (pin 5) exceeds the supply voltage (pin 9), the flyback generator is activated. The V_P is connected in series (via pin 8) with the voltage across the capacitor.
The voltage at the supply pin (pin 6) of the output stage will then be maximum twice V_P. Lower voltages can be chosen by changing the value of the external resistor at pin 8.

Voltage stabilizer

The internal voltage stabilizer provides a stabilized supply of 6 V for drive of the output stage, so the drive current of the output stage is not affected by supply voltage variations. The stabilized voltage is available at pin 7.
A decoupling capacitor of 2,2 μF can be connected to this pin.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages (pins 4 and 2 externally connected to ground)			
Output voltage (pin 5)	V_{5-4}	max.	55 V
Supply voltage (pin 9)	$V_{9-4} = V_P$	max.	50 V
Supply voltage output stage (pin 6)	V_{6-4}	max.	55 V
Input voltage (pins 1 and 3)	V_{1-2}; V_{3-2}	max.	V_P
Currents			
Repetitive peak output current (pin 5)	$\pm I_{5RM}$	max.	0,75 A
Non-repetitive peak output current (pin 5)	$\pm I_{5SM}$	max.	1,5 A*
Repetitive peak flyback generator output current (pin 8)	I_{8RM}	max.	−0,75 A +0,85 A
Non-repetitive peak flyback generator output current (pin 8)	I_{8SM}	max.	−1,5 A +1,6 A*
Temperatures			
Storage temperature range	T_{stg}		−65 to + 150 °C
Operating ambient temperature range	T_{amb}		−25 to + 65 °C
Operating junction temperature range	T_j		−25 to + 150 °C

CHARACTERISTICS

T_{amb} = 25 °C; V_P = 26 V; pins 4 and 2 externally connected to ground; unless otherwise specified.

Output current (peak-to-peak value)	$I_{5(p-p)}$	typ. <	1,2 A 1,5 A
Flyback generator output current	$-I_8$	typ. <	0,7 A 0,85 A
Flyback generator output current	I_8	typ. <	0,6 A 0,75 A
Output voltages			
Peak voltage during flyback	V_{5-4M}	<	55 V
Saturation voltage to supply at $-I_5$ = 1 A	$-V_{5-6sat}$	typ. <	2,5 V 3,0 V
Saturation voltage to ground at I_5 = 1 A	V_{5-4sat}	typ. <	2,5 V 3,0 V
Saturation voltage to supply at $-I_5$ = 0,75 A	$-V_{5-6sat}$	typ. <	2,2 V 2,7 V
Saturation voltage to ground at I_5 = 0,75 A	V_{5-4sat}	typ. <	2,2 V 2,7 V

* Non-repetitive duty factor maximum 3,3%.

Supply

Supply voltage	$V_{9-2;4}$		10 to 50	V*
Supply voltage output stage	V_{6-4}	<	55	V*
Supply current (no load and no quiescent current)	I_9	typ.	9	mA
		<	12	mA
Quiescent current (see Fig. 2)	I_4	typ.	38	mA
			25 to 52	mA
Variation of quiescent current with temperature		typ.	−0,04	mA/K

Flyback generator

Saturation voltage at $-I_8$ = 1,1 A	V_{9-8sat}	typ.	1,6	V
		<	2,1	V
Saturation voltage at I_8 = 1 A	V_{8-9sat}	typ.	2,5	V
		<	3,0	V
Saturation voltage at I_8 = 0,85 A	V_{9-8sat}	typ.	1,4	V
		<	1,9	V
Saturation voltage at I_8 = 0,75 A	V_{8-9sat}	typ.	2,3	V
		<	2,8	V
Flyback generator active if:	V_{5-9}	>	4	V
Leakage current	$-I_8$	typ.	5	μA
		<	100	μA
Input current for ± I_5 = 1 A	I_1	typ.	230	μA
			175 to 380	μA
Input voltage during scan	V_{1-2}	typ.	1,9	V
			0,9 to 2,7	V
Input current during scan	I_3		0,01 to 2,5	mA
Input voltage during scan	V_{3-2}		0,9 to V_P	V
Input voltage during flyback	V_{3-2}		0 to 0,2	V
Voltage at pin 7	V_{7-2}	typ.	6,1	V
			5,6 to 6,6	V
Load current of pin 7	I_7	<	2	mA
Unloaded voltage at pin 7 during flyback	V_{7-2}	typ.	15	V
Junction temperature of switching on the thermal protection	T_j	typ.	175	°C
			158 to 192	°C
Thermal resistance from junction to mounting base	$R_{th\ j\text{-}mb}$	typ.	3	K/W
		<	4	K/W
Power dissipation	see Fig. 3			
Open loop gain at 1 kHz; R_{load} = 1 kΩ	G_o	typ.	36	dB
Frequency response (−3 dB); R_{load} = 1 kΩ	f	typ.	60	kHz

* The maximum supply voltage should be chosen such that during flyback the voltage at pin 5 does not exceed 55 V.

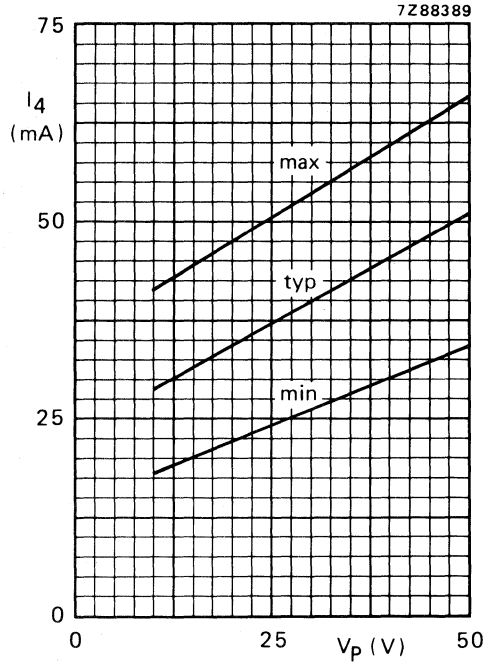


Fig. 2 Quiescent current I_4 as a function of supply voltage V_P.

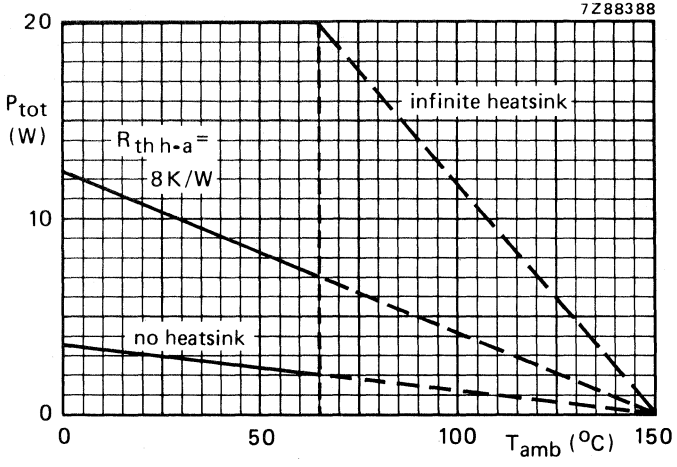


Fig. 3 Power derating curves.

APPLICATION INFORMATION

The following application data are measured in a typical application as shown in Figs 4 and 5.

Deflection current (including 6% overscan) peak-to-peak value	$I_{5(p-p)}$	typ.	0,87	A
Supply voltage	V_{9-4}	typ.	26	V
Total supply current	I_{tot}	typ.	148	mA
Peak output voltage during flyback	V_{5-4M}	<	50	V
Saturation voltage to supply	V_{5-6sat}	typ.	2,0	V
		<	2,5	V
Saturation voltage to ground	V_{5-4sat}	typ.	2,0	V
		<	2,5	V
Flyback time	t_{fl}	typ.	0,95	ms
		<	1,2	ms
Total power dissipation in IC	P_{tot}	typ.	2,5	W
Operating ambient temperature	T_{amb}	<	65	°C

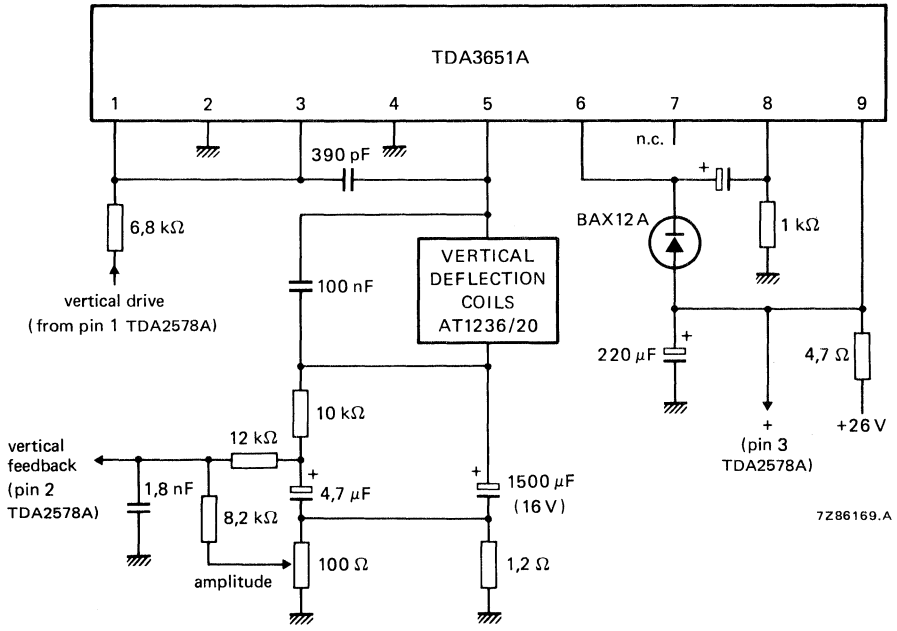


Fig. 4 Typical application circuit diagram of the TDA3651A (vertical output), when used in combination with the TDA2578A (see Fig. 5).

Note to deflection coils AT1236/20: L = 29 mH, R = 13,6 Ω; deflection current without overscan is 0,82 A peak-to-peak and EHT voltage is 25 kV.

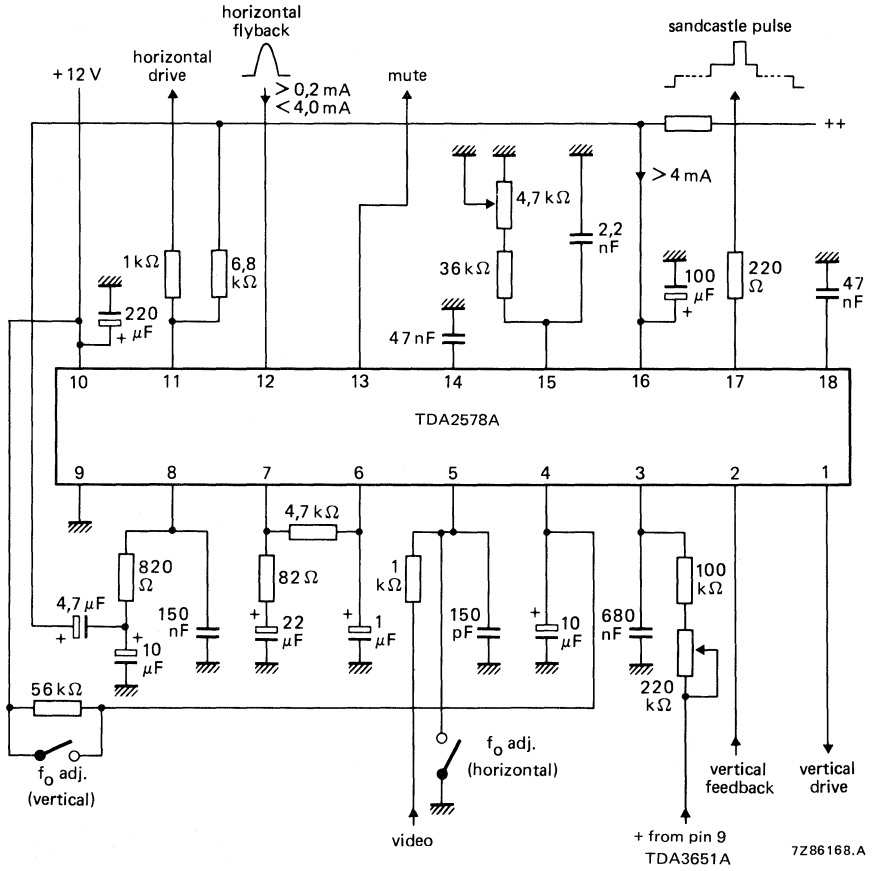


Fig. 5 Typical application circuit diagram; for combination of the TDA2578A with the TDA3651A see Fig. 4.

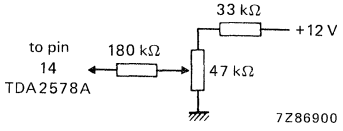


Fig. 6 Circuit configuration at pin 14 for phase adjustment.

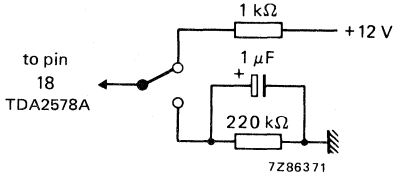


Fig. 7 Circuit configuration at pin 18 for VCR mode.
1 kΩ resistor between pin 18 and + 12 V: without mute function.
220 kΩ between pin 18 and ground: with mute function.

VERTICAL DEFLECTION CIRCUIT

GENERAL DESCRIPTION

The TDA3652 is an integrated power output circuit for vertical deflection in systems with deflection currents up to 3 A peak to peak.

Features

- Driver
- Output stage and protection circuits
- Flyback generator
- Voltage stabilizer

QUICK REFERENCE DATA

Supply voltage (pin 9)	$V_{9-4} = V_P$		0 to 40 V
Peak output voltage during flyback (pin 5)	V_{5-4M}	<	55 V
Output current (peak-to-peak value)	$I_{5(p-p)}$	max.	3 A
Operating junction temperature	T_j	max.	150 °C
Thermal resistance from junction to mounting base	$R_{th\ j-mb}$	max.	4 K/W

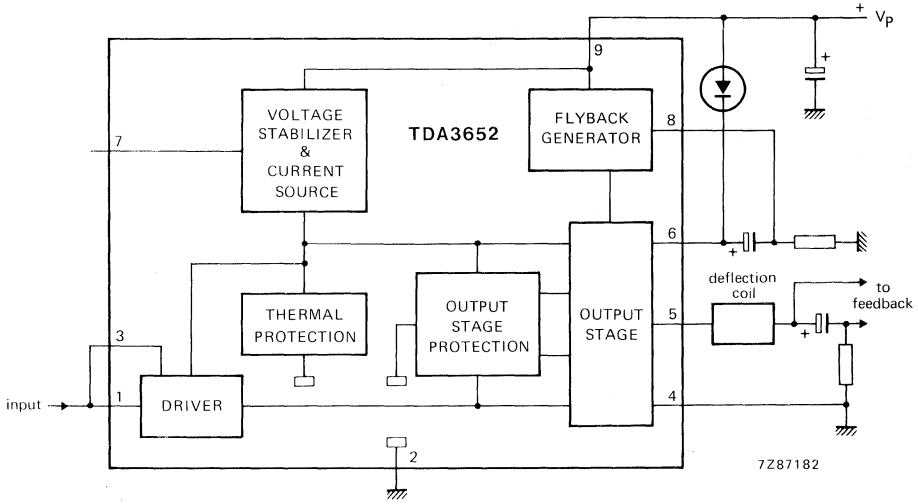


Fig. 1 Block diagram.

PACKAGE OUTLINES

TDA3652: 9-lead SIL; plastic (SOT-131B).
TDA3652Q: 9-lead SIL bent to DIL; plastic (SOT-157B).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages (pins 4 and 2 externally connected to ground)			
Output voltage (pin 5)	V_{5-4}	0 to 55	V
Supply voltage (pin 9)	$V_{9-4} = V_P$	0 to 40	V
Supply voltage output stage (pin 6)	V_{6-4}	0 to 55	V
Driver input voltage (pin 1)	V_{1-2}	0 to V_P	V*
Switching circuit input voltage (pin 3)	V_{3-2}	0 to 5,6	V
Currents			
Repetitive peak output current (pin 5)	$\pm I_{5RM}$	max. 1,5	A
Non-repetitive peak output current (pin 5)	$\pm I_{5SM}$	max. 3	A**
Repetitive peak flyback generator output current (pin 8)	I_{8RM}	max. −1,5 +1,6	A A
Non-repetitive peak flyback generator output current (pin 8)	$\pm I_{8SM}$	max. 3	A**
Temperatures			
Storage temperature range	T_{stg}	−65 to +150	°C
Operating ambient temperature range	T_{amb}	−25 to +65	°C
Operating junction temperature range	T_j	−25 to +150	°C

* The maximum input voltage should not exceed the supply voltage (V_P at pin 9). In most applications pin 1 is connected to pin 3; the maximum input voltage should then not exceed 5,6 V.

** Non-repetitive duty factor maximum 3,3%.

CHARACTERISTICS

V_P = 26 V; T_{amb} = 25 °C; pins 4 and 2 externally connected to ground; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply					
Supply voltage; pin 9	V_P	10	–	40	V*
Supply voltage output stage; pin 6	V_{6-4}	–	–	55	V*
Supply current (no load and no quiescent current); pin 9	I_P	–	9	12	mA
Quiescent current (see Fig. 2)	I_4	25	40	65	mA
Variation of quiescent current with temperature	ΔI_4	–	−0,04	–	mA/K
Output current					
Output current (pin 5) (peak-to-peak value)	$I_{5(p-p)}$	–	2,5	3,0	A
Output current flyback generator (pin 8)	$-I_8$	–	1,35	1,6	A
Output current flyback generator (pin 8)	I_8	–	1,25	1,5	A
Output voltage					
Peak voltage during flyback	V_{5-4M}	–	–	55	V
Saturation voltage to supply at $-I_5$ = 1,5 A	$-V_{5-6sat}$	–	2,5	3,0	V
Saturation voltage to ground at I_5 = 1,5 A	V_{5-4sat}	–	2,5	3,0	V
Saturation voltage to supply at $-I_5$ = 1 A	$-V_{5-6sat}$	–	2,2	2,7	V
Saturation voltage to ground at I_5 = 1 A	V_{5-4sat}	–	2,2	2,7	V
Flyback generator					
Saturation voltage at $-I_8$ = 1,6 A	V_{9-8sat}	–	1,6	2,1	V
Saturation voltage at I_8 = 1,5 A	V_{8-9sat}	–	2,5	3,0	V
Saturation voltage at $-I_8$ = 1,1 A	V_{9-8sat}	–	1,4	1,9	V
Saturation voltage at I_8 = 1 A	V_{8-9sat}	–	2,3	2,8	V
Flyback generator active if:	V_{5-9}	4	–	–	V
Leakage current at pin 8	$-I_8$	–	5	100	μA
Input current for I_5 = 4 A at pin 1 (peak-to-peak value)	$I_{1(p-p)}$	190	240	400	μA
Input voltage during scan (pin 1)	V_{1-2}	1,3	2,0	3,5	V
Input current during scan (pin 3)	I_3	0,01	–	2,5	mA

* The maximum supply voltage should be chosen such that during flyback the voltage at pin 5 does not exceed 55 V.

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Flyback generator (continued)					
Input voltage during scan (pin 3)	V_{3-2}	0,9	–	5,6	V
Input voltage during flyback (pin 3)	V_{3-2}	0	–	0,2	V
General data					
Junction temperature of switching on the thermal protection	T_j	158	175	192	°C
Thermal resistance from junction to mounting base	$R_{th\ j\text{-}mb}$	–	–	4	K/W
Total power dissipation	P_{tot}		see Fig. 3		
Open-loop gain at 1 kHz	G_o	–	36	–	dB
Frequency response (–3 dB) at R_L = 1 kΩ	f	–	50	–	kHz

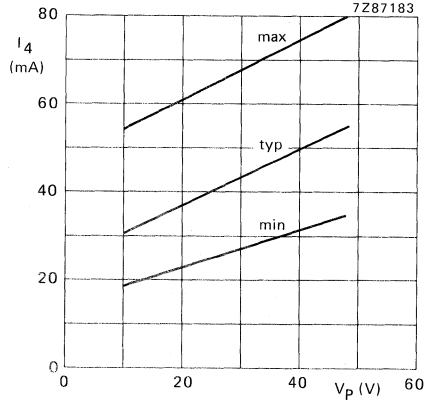


Fig. 2 Quiescent current (I_4) as a function of supply voltage (V_P).

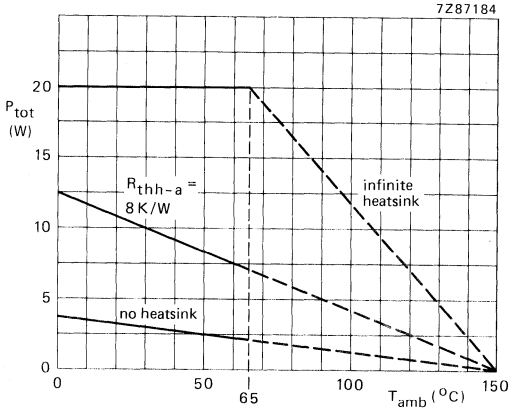


Fig. 3 Power derating curve.

APPLICATION INFORMATION

The function is described against the corresponding pin number.

1. Driver

This is the input for the driver of the output stage.

2. Negative supply (ground)

3. Switching circuit

This pin is normally connected externally to pin 1. It is also possible to use this pin to drive the switching circuit for different applications. This switching circuit rapidly turns off the lower output stage at the end of scan and also allows for a quick start of the flyback generator.

4. Output stage ground

5 and 6. Output stage and protection circuits

Pin 5 is the output pin and pin 6 is the output stage supply pin. The output stage is a class-B type with each transistor capable of delivering 1,5 A maximum. The "upper" output transistor is protected against short-circuit currents to ground. The base of the "lower" power transistor is connected to ground during flyback and so it is protected against too high flyback pulses which may occur during adjustments. In addition the output transistors are protected by a special layout of the internal circuit. The circuit is protected thermally against excessive dissipation by a circuit which operates at temperatures of 175 ^{o}C upwards causing the output current to drop to a value such that the dissipation cannot increase.

7. Voltage stabilizer

The internal voltage stabilizer provides a stabilized supply voltage of 6 V for drive of the output stage, so the drive current is not influenced by the various voltages of different applications.

8 and 9. Flyback generator

Pin 8 is the output pin of the flyback generator. Depending on the value of the external resistor at pin 8, the capacitor at pin 6 will be charged to a fixed level during the scan period. The maximum height of this level is equal to the supply voltage at pin 9 (V_P). When the flyback starts and the flyback pulse at pin 5 exceeds the supply voltage, the flyback generator is activated and then the supply voltage is connected in series (via pin 8) with the voltage across the capacitor. The voltage at the supply pin (pin 6) of the output stage will then be not more than twice the supply voltage.

VERTICAL DEFLECTION CIRCUIT

GENERAL DESCRIPTION

The TDA3653 is a vertical deflection output circuit for drive of various deflection systems with currents up to 1,5 A peak-to-peak.

Features

- Driver
- Output stage
- Thermal protection and output stage protection
- Flyback generator
- Voltage stabilizer
- Guard circuit

QUICK REFERENCE DATA

Supply voltage range (pin 9)	$V_P = V_{9-4}$		0 to 40	V
Peak output voltage during flyback (pin 5)	V_{5-4M}	max.	60	V
Output current (peak-to-peak value)	$I_{5(p-p)}$	max.	1,5	A
Operating junction temperature	T_j	max.	150	°C
Thermal resistance from junction to mounting base				
(SOT-110B)	$R_{th\ j-mb}$	typ.	10	K/W
(SOT-131B)	$R_{th\ j-mb}$	typ.	3,5	K/W

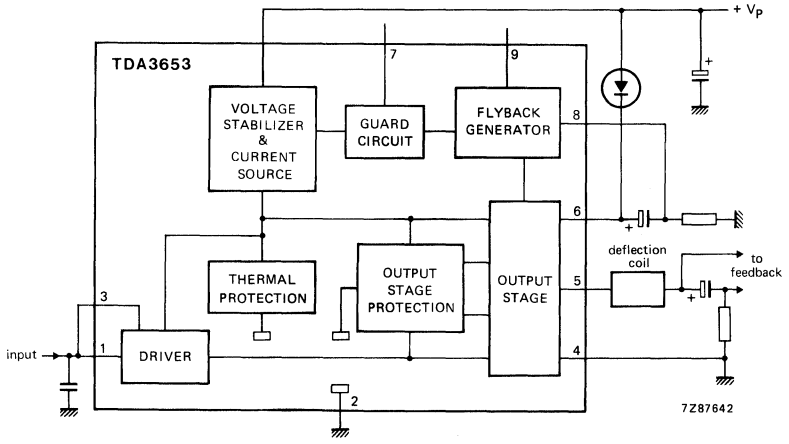


Fig. 1 Block diagram.

PACKAGE OUTLINES

TDA3653: 9-lead SIL; plastic (SOT-110B).
TDA3653A: 9-lead SIL; plastic power (SOT-131B).

FUNCTIONAL DESCRIPTION

Output stage and protection circuit

Pin 5 is the output pin. The supply for the output stage is fed to pin 6 and the output stage ground is connected to pin 4. The output transistors of the class-B output stage can each deliver 0,75 A maximum. The maximum voltage for pin 5 and 6 is 60 V.

The output power transistors are protected such that their operation remains within the SOAR area. This achieved by the co-operation of the thermal protection circuit, the current-voltage detector, the short-circuit protection and the special measures in the internal circuit layout.

Driver and switching circuit

Pin 1 is the input for the driver of the output stage. The signal at pin 1 is also applied to pin 3 which is the input of a switching circuit. When the flyback starts, this switching circuit rapidly turns off the lower output stage and so limits the turn-off dissipation. It also allows a quick start of the flyback generator.

External connection of pin 1 to pin 3 allows for applications in which the pins are driven separately.

Flyback generator

During scan the capacitor at pin 6 is charged to a maximum voltage, which is dependent on the value of the resistor at pin 8. During normal operation the voltage at pin 8 may not be lower than 2,2 V.

When the flyback starts and the voltage at the output pin (pin 5) exceeds the supply voltage (pin 9), the flyback generator is activated. Then V_P = 2 V is connected in series (via pin 8) with the voltage across the capacitor.

The voltage at the supply pin (pin 6) of the output stage will then be maximum $2V_P$–2 V. Lower voltages can be obtained, determined by the value of the resistor at pin 8.

Guard circuit

When there is no deflection current and the flyback generator is not activated, the voltage at pin 8 reduces to less than 2 V. The guard circuit will then produce a d.c. voltage at pin 7, which can be used to blank the picture tube and thus prevent screen damage.

Voltage stabilizer

The internal voltage stabilizer provides a stabilized supply of 6 V to drive the output stage, which prevents the drive current of the output stage being affected by supply voltage variations.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134); pins 4 and 2 externally connected to ground.

Supply voltage (pin 9)	$V_P = V_{9-4}$	max.	40 V
Supply voltage output stage (pin 6)	V_{6-4}	max.	60 V
Output voltage (pin 5)	V_{5-4}	max.	60 V
Input voltage (pins 1 and 3)	$V_{1;3-2}$	max.	V_P V
External voltage at pin 7	V_{7-2}	max.	5,6 V
Peak output current (pin 5)			
repetitive	$\pm I_{5RM}$	max.	0,75 A
non-repetitive	$\pm I_{5SM}$	max.	1,5 A*
Peak output current (pin 8)			
repetitive	I_{8RM}		−0,85 to + 0,75 A
non-repetitive	$\pm I_{8SM}$	max.	1,5 A*
Total power dissipation	P_{tot}	see Fig. 2	
Storage temperature range	T_{stg}		−65 to + 150 °C
Operating ambient temperature range	T_{amb}	see Fig. 2	
Operating junction temperature range	T_j		−25 to + 150 °C

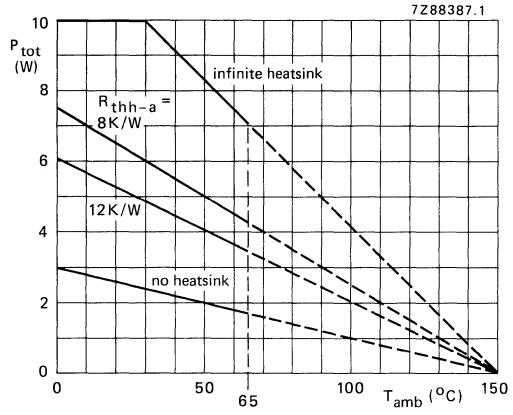


Fig. 2 Power derating curves (for SOT-110B).

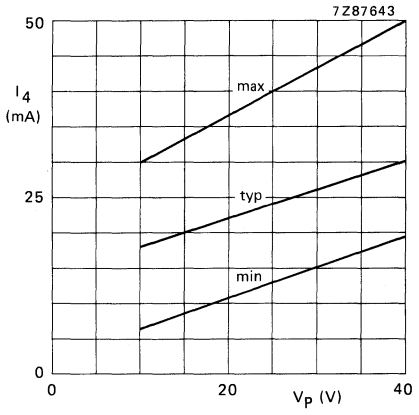


Fig. 3 Quiescent current I_4 as a function of supply voltage V_P.

* Non-repetitive duty factor maximum 3,3%.

CHARACTERISTICS

$V_P = V_{9-4} = 26$ V; $T_{amb} = 25$ °C; pins 2 and 4 externally connected to ground; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply					
Supply voltage; pin 9 (note 1)	$V_P = V_{9-4}$	10	–	40	V
Supply voltage; pin 6 (note 1)	V_{6-4}	–	–	60	V
Supply current; pin 9 (note 2)	$I_P = I_9$	–	10	20	mA
Quiescent current; pin 4 (see Fig. 3)	I_4	6	25	40	mA
Variation of quiescent current with temperature	ΔI_4	–	−0,04	–	mA/K
Output current					
Output current (pin 5) (peak-to-peak value)	$I_{5(p-p)}$	–	1,2	1,5	A
Output current flyback generator (pin 8)	$-I_8$	–	0,7	0,85	A
Output current flyback generator (pin 8)	I_8	–	0,6	0,75	A
Output voltage					
Peak voltage during flyback	V_{5-4M}	–	–	60	V
Saturation voltage to supply					
at $-I_5 = 0,75$ A	V_{6-5sat}	–	2,5	3,0	V
at $I_5 = 0,75$ A (note 3)	V_{5-6sat}	–	2,5	3,0	V
at $-I_5 = 0,6$ A	V_{6-5sat}	–	2,2	2,7	V
at $I_5 = 0,6$ A (note 3)	V_{5-6sat}	–	2,3	2,8	V
Saturation voltage to ground					
at $I_5 = 0,75$ A	V_{5-4sat}	–	2,0	2,5	V
at $I_5 = 0,6$ A	V_{5-4sat}	–	1,7	2,2	V
Flyback generator					
Saturation voltage					
at $-I_8 = 0,85$ A	V_{9-8sat}	–	1,6	2,1	V
at $I_8 = 0,75$ A (note 3)	V_{8-9sat}	–	2,3	2,8	V
at $-I_8 = 0,7$ A	V_{9-8sat}	–	1,4	1,9	V
at $I_8 = 0,6$ A (note 3)	V_{8-9sat}	–	2,2	2,7	V
Flyback generator active if:	V_{5-9}	4	–	–	V
Leakage current at pin 8	$-I_8$	–	5	100	μA
Input current (pin 1) at $I_{5(p-p)} = 1,5$ A	I_1	–	–	1,3	mA
Input voltage during scan (pin 1)	V_{1-2}	–	–	3,2	V
Input voltage during scan (pin 3) pins 1 and 3 not connected	V_{3-2}	0,9	–	V_P	V

parameter	symbol	min.	typ.	max.	unit
Input current during scan (pin 3) pins 1 and 3 not connected	I_3	0,01	–	–	mA
Input current during scan (pin 3) pins 1 and 3 connected	I_3	–	–	0,52	mA
Input resistance (pin 3)	R_3	3,75	5,0	6,25	kΩ
Input voltage during flyback (pin 1)	V_{1-2}	–	–	250	mV
Input voltage during flyback (pin 3)	V_{3-2}	–	–	250	mV
Guard circuit					
Output voltage; pin 7 (note 4)					
loaded with 100 kΩ	V_{7-2}	4,4	5,0	5,6	V
loaded with 0,5 mA	V_{7-2}	3,5	4,4	5,1	V
Internal series resistance of pin 7	R_{i7}	0,9	1,2	1,5	kΩ
Guard circuit active if V_{8-2} is lower than (note 6)	V_{8-2}	–	–	2,0	V
General data					
Thermal protection becomes active if junction temperature exceeds	T_j	158	175	192	°C
Thermal resistance junction to mounting base	$R_{th\ j\text{-}mb}$	–	10	12	K/W
Open loop gain at 1 kHz (note 5)	G_o	–	42	–	dB
Frequency response (−3 dB) (note 7)	f	–	40	–	kHz

Notes to the characteristics

1. The maximum supply voltage should be chosen such that during flyback the voltage at pin 5 does not exceed 60 V.
2. These values are obtained (pin 9) at no load and no quiescent current.
3. Duty factor maximum 3,3%.
4. Guard circuit is active.
5. $R_{load} = 8\ \Omega$; $I_{load(rms)} = 125$ mA.
6. During normal operation the voltage V_{8-2} may not be lower than 2,2 V.
7. With 220 pF between pins 1 and 5.

APPLICATION INFORMATION

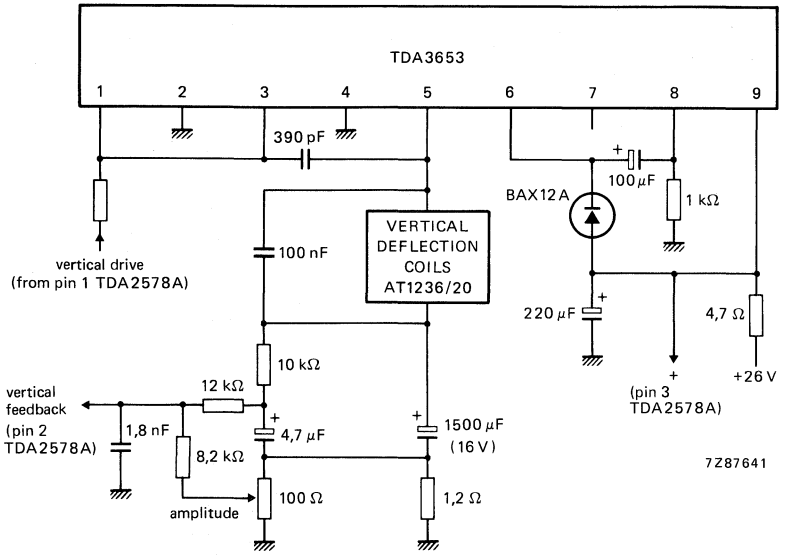


Fig. 4 Typical application circuit diagram of the TDA3653 (vertical output), when used in combination with the TDA2578A (see Fig. 5).

Note to deflection coils AT1236/20: L = 29 mH, R = 13,6 Ω; deflection current without overscan is 0,82 A peak-to-peak and e.h.t. voltage is 25 kV.

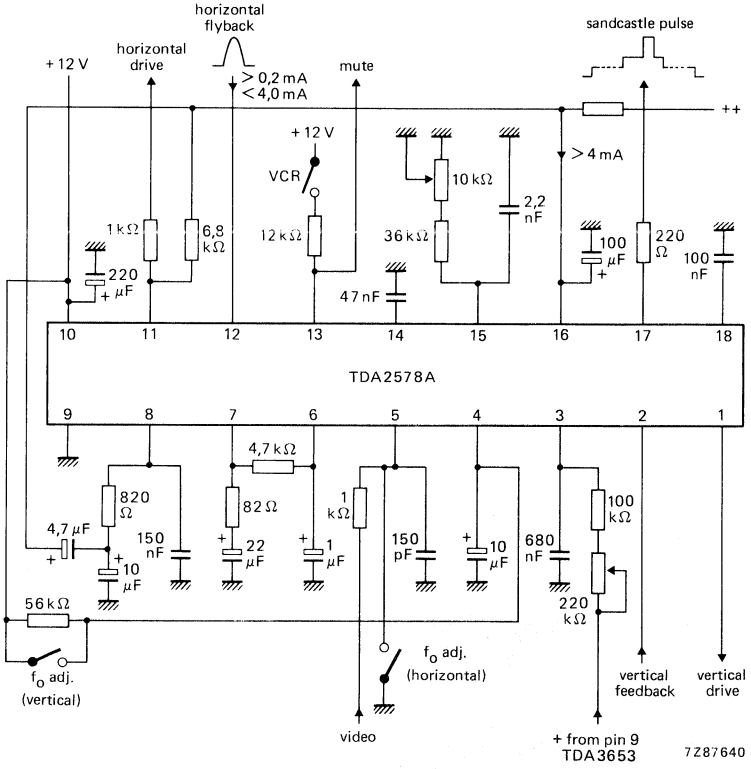


Fig. 5 Typical application circuit diagram; for combination of the TDA2578A with the TDA3653 (see Fig. 4).

VERTICAL DEFLECTION OUTPUT CIRCUIT

GENERAL DESCRIPTION

The TDA3654 is a full performance vertical deflection output circuit in a 9-lead in line encapsulation. The circuit is intended for direct drive of the deflection coils and it can be used for a wide range of 90° and 110° deflection systems.
The TDA3654 is provided with a guard circuit which blanks the picture tube screen in case of absence of the deflection current.

Features

- Direct drive to the deflection coils
- 90° and 110° deflection system
- Internal blanking guard circuit
- Internal voltage stabilizer

QUICK REFERENCE DATA

Output voltage	V_{5-2}	max.	60 V
Output current (peak-to-peak)	$I_{5(p-p)}$	max.	3 A
Supply voltage	V_{9-2}	max.	40 V
Guard circuit output voltage	V_{7-2}	max.	5,6 V
Operating ambient temperature range	T_{amb}		−25 to + 60 °C
Storage temperature	T_{stg}		−65 to + 150 °C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	3,5 to 4 K/W

PACKAGE OUTLINES

TDA3654 : 9-lead SIL; plastic power (SOT-131B).
TDA3654Q : 9-lead SIL bent to DIL; plastic power (SOT-157B).

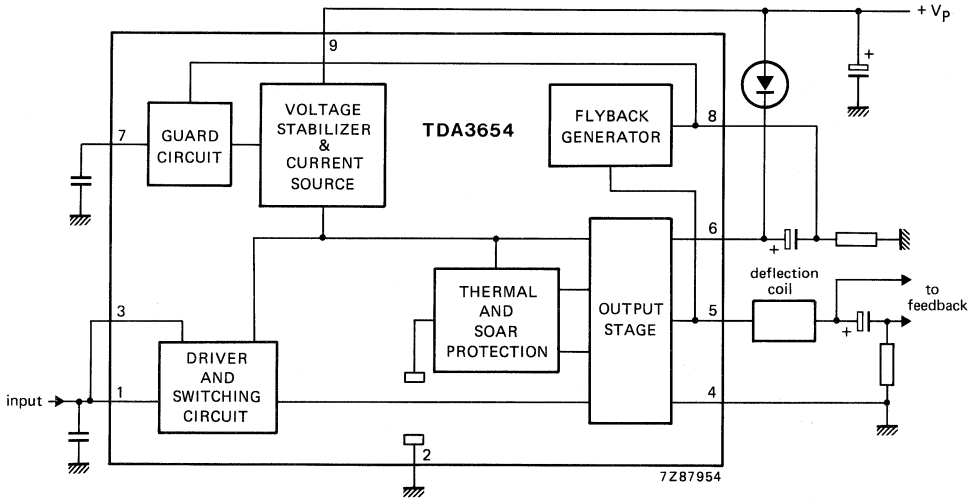


Fig. 1 Block diagram.

FUNCTIONAL DESCRIPTION

Output stage and protection circuits

The output stage consists of two Darlington configurations in class B arrangement.
Each output transistor can deliver 1,5 A maximum and the V_{CEO} is 60 V.
Protection of the output stage is such that the operation of the transistors remains well within the SOAR area in all circumstances at the output pin, (pin 5). This is obtained by the cooperation of the thermal protection circuit, the current-voltage detector and the short circuit protection.
Special measures in the internal circuit layout give the output transistors extra solidity, this is illustrated in Fig. 5 where typical SOAR curves of the lower output transistor are given. The same curves also apply for the upper output device. The supply for the output stage is fed to pin 6 and the output stage ground is connected to pin 4.

Driver and switching circuit

Pin 1 is the input for the driver of the output stage. The signal at pin 1 is also applied to pin 3 which is the input of a switching circuit, (pin 1 and 3 are externally connected).
This switching circuit rapidly turns off the lower output stage when the flyback starts and it, therefore, allows a quick start of the flyback generator. The maximum required input signal for the maximum output current peak-to-peak value of 3 A is only 3 V, the sum of the currents in pins 1 and 3 is then maximum 1 mA.

Flyback generator

During scan, the capacitor between pins 6 and 8 is charged to a level which is dependent on the value of the resistor at pin 8 (see Fig. 1).
When the flyback starts and the voltage at the output pin (pin 5) exceeds the supply voltage, the flyback generator is activated.
The supply voltage is then connected in series, via pin 8, with the voltage across the capacitor during the flyback period.
This implies that during scan the supply voltage can be reduced to the required scan voltage plus saturation voltage of the output transistors.
The amplitude of the flyback voltage can be chosen by changing the value of the external resistor at pin 8.
It should be noted that the application is chosen such that the lowest voltage at pin 8 is $> 1{,}5$ V, during normal operation.

Guard circuit

When there is no deflection current, for any reason, the voltage at pin 8 becomes less than 1 V, the guard circuit will produce a d.c. voltage at pin 7. This voltage can be used to blank the picture tube, so that the screen will not burn in.

Voltage stabilizer

The internal voltage stabilizer provides a stabilized supply of 6 V to drive the output stage, so the drive current is not affected by supply voltage variations.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134).
Pins 2 and 4 are externally connected to ground.

Voltages			
Output voltage	V_{5-4}	0 to 60	V
Supply voltage	V_{9-4}	0 to 40	V
Supply voltage output stage	V_{6-4}	0 to 60	V
Input voltage	V_{1-2}	0 to V_{9-4}	V
Input voltage switching circuit	V_{3-2}	0 to V_{9-4}	V
External voltage at pin 7	V_{7-2}	0 to 5,6	V
Currents			
Repetitive peak output current	$\pm I_{5RM}$	max. 1,5	A
Non-repetitive peak output current (note 1)	$\pm I_{5SM}$	max. 3	A
Repetitive peak output current of flyback generator	I_{8RM}	max. + 1,5 −1,6	A A
Non-repetitive peak output current of flyback generator (note 1)	$\pm I_{8SM}$	max. 3	A
Temperatures			
Storage temperature range	T_{stg}	−65 to + 150	°C
Operating ambient temperature range (see Fig. 3)	T_{amb}	−25 to + 60	°C
Operating junction temperature range	T_j	−25 to + 150	°C

CHARACTERISTICS

T_{amb} = 25 °C, supply voltage (V_{9-4}) = 26 V; unless otherwise stated; pin 1 externally connected to pin 3. Pins 2 and 4 externally connected to ground.

parameter	symbol	min.	typ.	max.	unit
Supply					
Supply voltage, pin 9 (note 2)	V_{9-4}	10	–	40	V
Supply voltage output stage	V_{6-4}	–	–	60	V
Supply current, pins 6 and 9 (note 3)	I_6+I_9	35	55	85	mA
Quiescent current (note 4)	I_4	25	40	65	mA
Variation of quiescent current with temperature	TC	–	–0,04	–	mA/K
Output current					
Output current, pin 5 (peak-to-peak)	$I_{5(p-p)}$	–	2,5	3	A
Output current flyback generator, pin 8	$+I_{8(p-p)}$	–	1,25	1,5	A
	$-I_{8(p-p)}$	–	1,35	1,6	A
Output voltage					
Peak voltage during flyback	V_{5-4}	–	–	60	V
Saturation voltage to supply					
at I_5 = –1,5 A	$V_{6-5(sat)}$		2,5	3,2	V
at I_5 = 1,5 A (note 5)	$V_{5-6(sat)}$		2,5	3,2	V
at I_5 = –1,2 A	$V_{6-5(sat)}$		2,2	2,7	V
at I_5 = 1,2 A (note 5)	$V_{5-6(sat)}$		2,3	2,8	V
Saturation voltage to ground					
at I_5 = 1,2 A	$V_{5-4(sat)}$	–	2,2	2,7	V
at I_5 = 1,5 A	$V_{5-4(sat)}$	–	2,5	3,2	V
Flyback generator					
Saturation voltage					
at I_8 = –1,6 A	$V_{9-8(sat)}$	–	1,6	2,1	V
at I_8 = 1,5 A (note 5)	$V_{8-9(sat)}$	–	2,3	3	V
at I_8 = –1,3 A	$V_{9-8(sat)}$	–	1,4	1,9	V
at I_8 = 1,2 A (note 5)	$V_{8-9(sat)}$	–	2,2	2,7	V
Leakage current at pin 8	$-I_8$	–	5	100	μA
Flyback generator active if:	V_{5-9}	4	–	–	V

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Input					
Input current, pin 1, for I_5 = 1,5 A	I_1	–	0,33	0,55	mA
Input voltage during scan, pin 1	V_{1-2}	–	2,35	3	V
Input current, pin 3, during scan (note 6)	I_3	0,03	–	–	mA
Input voltage, pin 3, during scan (note 6)	V_{3-2}	0,8	–	V_{9-4}	V
Input voltage, pin 1, during flyback	V_{1-2}	–	–	250	mV
Input voltage, pin 3, during flyback	V_{3-2}	–	–	250	mV
Guard circuit					
Output voltage, pin 7 R_L = 100 kΩ (note 9)	V_{7-2}	4,1	4,5	5,5	V
Output voltage, pin 7 at I_L = 0,5 mA (note 9)	V_{7-2}	3,4	3,9	5,1	V
Internal series resistance of pin 7	Ri_7	0,95	1,35	1,7	kΩ
Guard circuit activates (note 7)	V_{8-2}	–	–	1,0	V
General data					
Thermal protection activation range	T_j	158	175	192	°C
Thermal resistance					
From junction to mounting base	$R_{th\ j\text{-}mb}$	–	3,5	4	K/W
Power dissipation	P_{tot}	–	see Fig. 3		
Open loop gain at 1 kHz; (note 8)	G_o	–	33	–	
Frequency response, –3 dB; (note 10)	f	–	60	–	kHz

Notes to the characteristics

1. Non-repetitive duty factor 3,3%.
2. The maximum supply voltage should be chosen so that during flyback the voltage at pin 5 does not exceed 60 V.
3. When V_{5-4} is 13 V and no load at pin 5.
4. See Fig. 4.
5. Duty cycle, d = 5% or d = 0,05.
6. When pin 3 is driven separately from pin 1.
7. During normal operation the voltage V_{8-2} may not be lower than 1,5 V.
8. $R_L = 8\ \Omega$; $I_L = 125$ mA (r.m.s.).
9. If guard circuit is active.
10. With a 22 pF capacitor between pins 1 and 5.

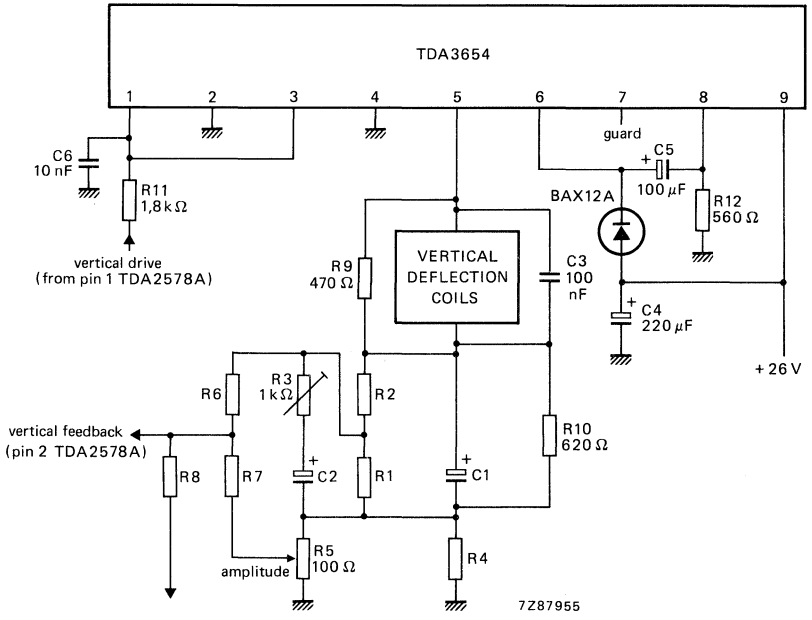


Fig. 2 Application diagram.

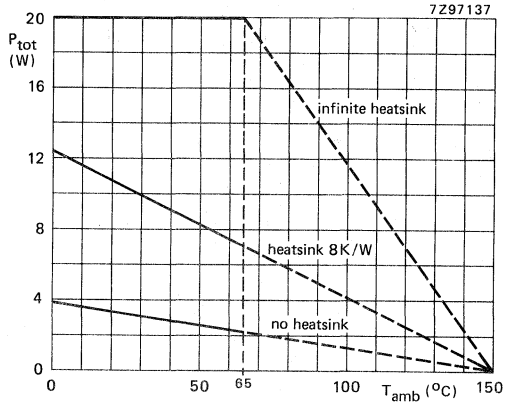


Fig. 3 Power derating curve.

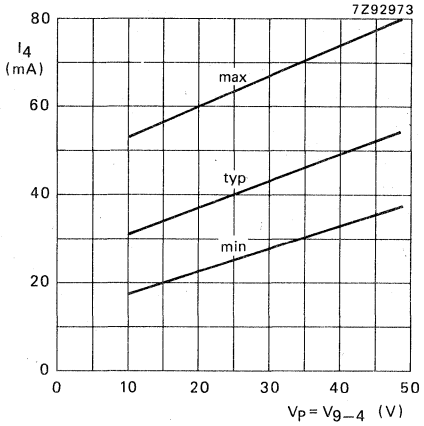
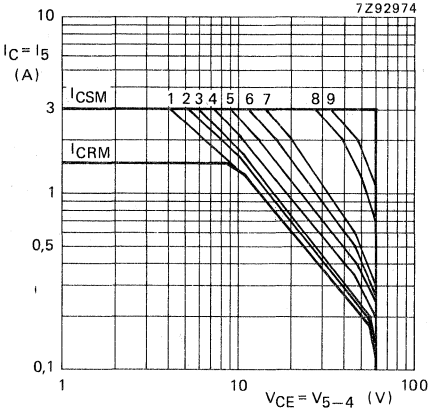


Fig. 4 Quiescent current as a function of the supply voltage.

curve	t_p	δ	peak junction temperature
1	d.c.	—	150 °C
2	10 ms	0,5	150 °C
3	10 ms	0,25	150 °C
4	1 ms	0,5	150 °C
5	1 ms	0,25	150 °C
6	1 ms	0,05	150 °C
7	1 ms	0,05	180 °C
8	0,2 ms	0,1	150 °C
9	0,2 ms	0,1	180 °C



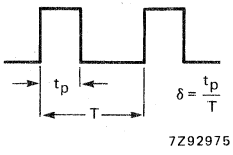


Fig. 5 Typical SOAR of lower output transistor.

SECAM IDENTIFICATION CIRCUIT

GENERAL DESCRIPTION

The TDA3724 is a monolithic integrated circuit for SECAM identification in PAL/SECAM (B,G) video tape recorders.

QUICK REFERENCE DATA

Supply voltage (pin 10)	$V_P = V_{10-8}$	typ.	10 V
Supply current (pin 10)	$I_P = I_{10}$	typ.	16 mA
Identification inputs	V_{3-8} (p-p)	min.	0,22 V
Identification inputs	V_{4-8} (p-p)	min.	0,22 V
Identification output current	I_1	min.	3 mA

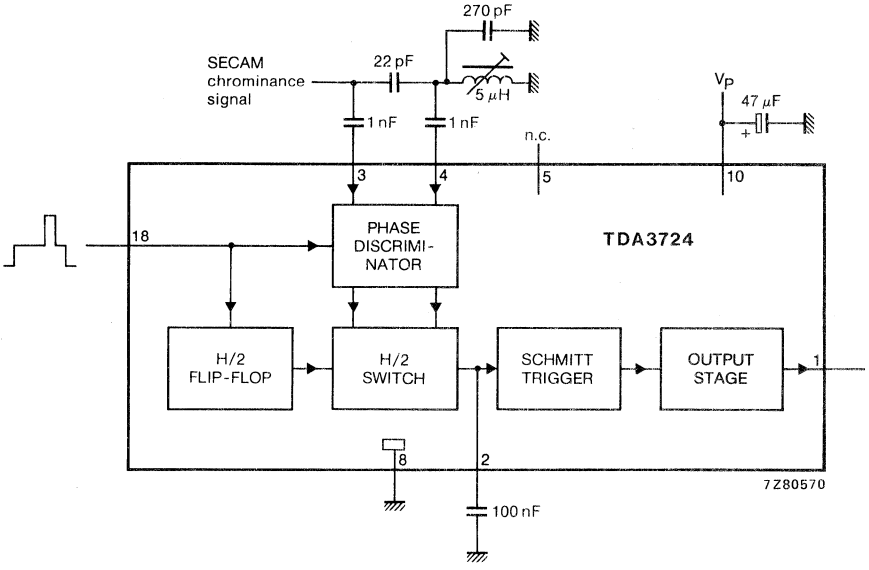


Fig. 1 Block diagram.

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102KE).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage	$V_P = V_{10-8}$	max.	13,2	V
Voltage range at pins 3,4,18	V_{n-8}		0 to V_P	V
Voltage range at pin 2	V_{2-8}		½V_P to V_P	V
Current at pin 1	$-I_1$		5	mA
Storage temperature range	T_{stg}		−25 to +150	°C
Operating ambient temperature range	T_{amb}		0 to 70	°C

CHARACTERISTICS

V_P = 10 V; T_{amb} = 25 °C; measured in Fig. 1; unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
Supply at pin 10					
Supply voltage	$V_P = V_{10-8}$	9,6	10	13,2	V
Supply current at V_P = 10 V	I_{10}	–	16	21	mA
Supply current at V_P = 13,2 V	I_{10}	–	–	28	mA
Output voltage at pin 1 (open collector of pnp transistor) at SECAM mode	V_{1-8}	9,3	–	–	V
Output current pin 1 at SECAM mode	$-I_1$	3	–	–	mA
Output current pin 1 at NOT SECAM mode	$-I_1$	–	–	10	μA
Charge capacitor for ident. integration	C_{2-8}	100	–	2000	nF
Identification inputs pin 3,4					
input voltage	$V_{3,\,4-8\,(p-p)}$	0,22	–	1,0	V
input resistance	$R_{3,\,4-8}$	14	–	22	kΩ
Sandcastle input pin 18					
input voltage for active discriminating stage	V_{18-8}	6,0	–	V_P	V

SECAM (L) CHROMINANCE PROCESSOR FOR VIDEO RECORDERS

GENERAL DESCRIPTION

The TDA3725 is a monolithic integrated circuit for chrominance processing in SECAM (L) video recorders.

Features

- SECAM identification with output stage of SECAM/NOT SECAM identification
- Input to force recording or playback mode
- A.G.C. amplifier and soft limiting amplifier for SECAM chrominance inputs
- Divide by 4 of the chrominance frequencies for recording mode
- Rectifier and multiplier to generate 4 times SECAM chrominance frequencies at playback mode with external filtering
- Output for monitoring

QUICK REFERENCE DATA

parameter	symbol	min.	typ.	max.	unit
Supply voltage (pin 10)	$V_P = V_{10-8}$	–	10	–	V
Supply current (pin 10)	$I_p = I_{13}$	–	38	–	mA
Chroma input signal (record)	$V_{11-8(p-p)}$	25	–	–	mV
Chroma input signal (playback)	$V_{9-8(p-p)}$	25	–	–	mV
Identification inputs	$V_{3-8(p-p)}$	0,22	–	1	V
Identification inputs	$V_{4-8(p-p)}$	0,22	–	1	V
Identification output current	I_1	3	–	–	mA
Monitor output	$V_{14-8(p-p)}$	–	0,6	–	V
Suppression of 2,2 MHz	α_{14}	–	35	–	dB
Suppression of 8,8 MHz	α_{14}	–	10	–	dB
Recording output (a.c.)	$V_{16-8(p-p)}$	–	3	–	V

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102KE).

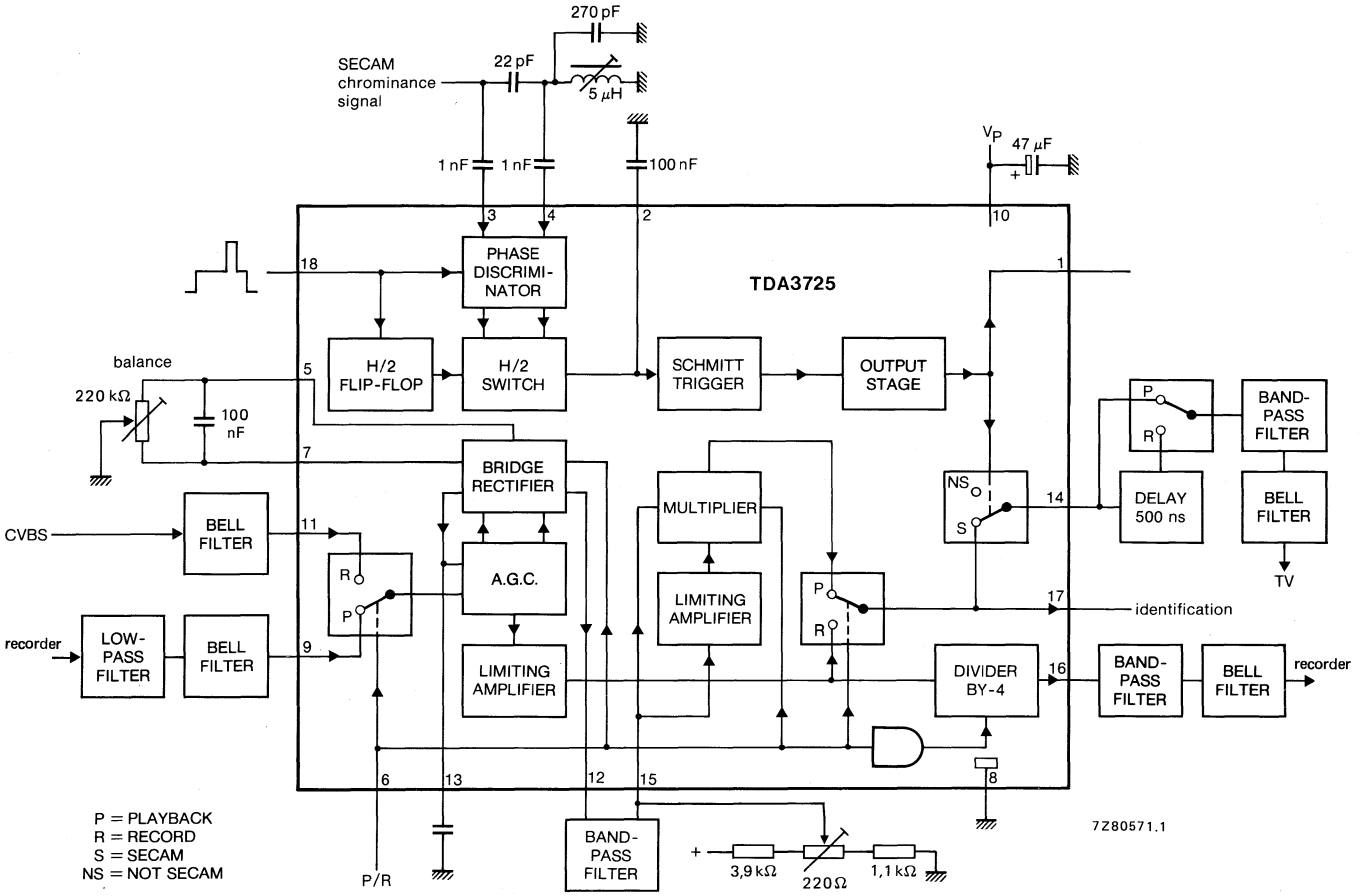


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

parameter	symbol	min.	typ.	max.	unit
Supply voltage pin 10	$V_P = V_{10-8}$	–	–	13,2	V
Voltage range at pins 3,4,5,6, 7,9,11,15,18 to pin 8 (ground)	V_{n-8}	0	–	V_P	V
Voltage range at pin 2 to pin 8	V_{2-8}	$\frac{1}{2}V_P$	–	V_P	V
Currents at pins 1,12,13,14,16,17	$-I_n$	–	–	5	mA
Storage temperature range	T_{stg}	−25	–	+ 150	°C
Operating ambient temperature range	T_{amb}	0	–	+ 70	°C

CHARACTERISTICS

V_P = 10 V; T_{amb} = 25 °; measured in Fig. 1, unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 10)					
Supply voltage	$V_P = V_{10-8}$	9,6	10	13,2	V
Supply current at V_P = 10 V	I_{10}	–	38	50	mA
Supply current at V_P = 13,2 V	I_{10}	–	–	66	mA
Input switch and a.g.c.					
Input signal at record mode	$V_{11-8(p-p)}$	25	–	500	mV
Input signal at playback mode	$V_{9-8(p-p)}$	25	–	150	mV
Output signal (rectified) pin 12 (2,2 MHz)	$V_{12-8(p-p)}$	–	300	–	mV
d.c. level	V_{12-8}	5,0	5,5	–	V
Suppression of 1,1 MHz	α_{12}	30	32	–	dB
Suppression of 3,3 MHz	α_{12}	40	42	–	dB
Suppression of 4,4 MHz	α_{12}	10	14	–	dB
Output resistance	R_{12-8}	–	V_T/I_C	–	Ω
Mixer and limiter					
Input resistance pin 15	R_{15-8}	0,5	–	–	MΩ
Output signal pin 14 (4,4 MHz)	$V_{14-8(p-p)}$	0,3	0,4	–	V
d.c. level	V_{14-8}	5,0	5,5	–	V
Suppression of 2,2 MHz and 6,6 MHz	α_{14}	30	35	–	dB
Suppression of 8,8 MHz	α_{14}	12	14	–	dB
Output resistance	R_{14-8}	–	V_T/I_C	–	Ω
Output signal pin 17 (4,4 MHz)	$V_{17-8(p-p)}$	0,3	0,4	–	V
d.c. level	$V_{17-8(p-p)}$	6,0	6,5	–	V
Output resistance	R_{17-8}	–	V_T/I_C	–	Ω
Divider and limiter					
Output signal pin 16	$V_{16-8(p-p)}$	2,5	3	–	V
d.c. level	V_{16-8}	3,5	4	–	V
Output resistance	R_{16-8}	–	V_T/I_C	–	Ω
Input for playback/record switching					
Input voltage record	V_{6-8}	0	–	5	V
Input voltage playback	V_{6-8}	7	–	V_P	V
Identification					
Output voltage pin 1 (open collector of pnp transistor) in SECAM mode	V_{1-8}	9,3	–	–	V
Output current pin 1 in SECAM mode	$-I_1$	3	–	–	mA
Output current pin 1 in NOT SECAM mode	$-I_1$	–	–	1	μA
Charge capacitor for ident integration	C_{2-8}	100	–	1000	nF
Threshold colour forced on	V_{2-8}	8	–	V_P	V
Threshold killer forced on	V_{2-8}	5,8	–	6,2	V
Identification input voltage pin 3	$V_{3-8(p-p)}$	0,22	–	1	V
Identification input voltage pin 4	$V_{4-8(p-p)}$	0,22	–	1	V
Input resistance pins 3,4	$R_{3,4-8}$	14	18	22	kΩ
Sandcastle input pin 18					
Input voltage for inactive discriminating stage	V_{18-8}	0	–	4,8	V
Input voltage for active discriminating stage	V_{18-8}	6	–	V_P	V

FREQUENCY DEMODULATOR AND DROP OUT COMPENSATOR FOR VIDEO RECORDERS

GENERAL DESCRIPTION

The TDA3730 is a monolithic integrated circuit for luminance processing in the playback path of video recorders. The device incorporates two signal channels, one for the main signal and one for the drop out signal.

Features

- FM preamplifier
- Limiter in main and drop out channel
- Demodulator in main and drop out channel
- Drop out detector with Schmitt-trigger
- Electronic switches for FM and video signal controlled by drop out detector
- Linear and dynamic video de-emphasis
- D.C. reference stabilizer

QUICK REFERENCE DATA

Supply voltage (pin 7 and pin 23)	$V_P = V_{7,\ 23\text{-}5,\ 25}$	typ.	10 V
Supply current (pin 7 + pin 23)	$I_P = I_7 + I_{23}$	typ.	40 mA
FM input signal (pin 17) (peak-to-peak value)	$V_{17\text{-}25(p\text{-}p)}$	typ.	100 mV
Video output signal (pin 26) (peak-to-peak value)	$V_{26\text{-}5(p\text{-}p)}$	typ.	2 V

PACKAGE OUTLINE

28-lead DIL; plastic (SOT-117).

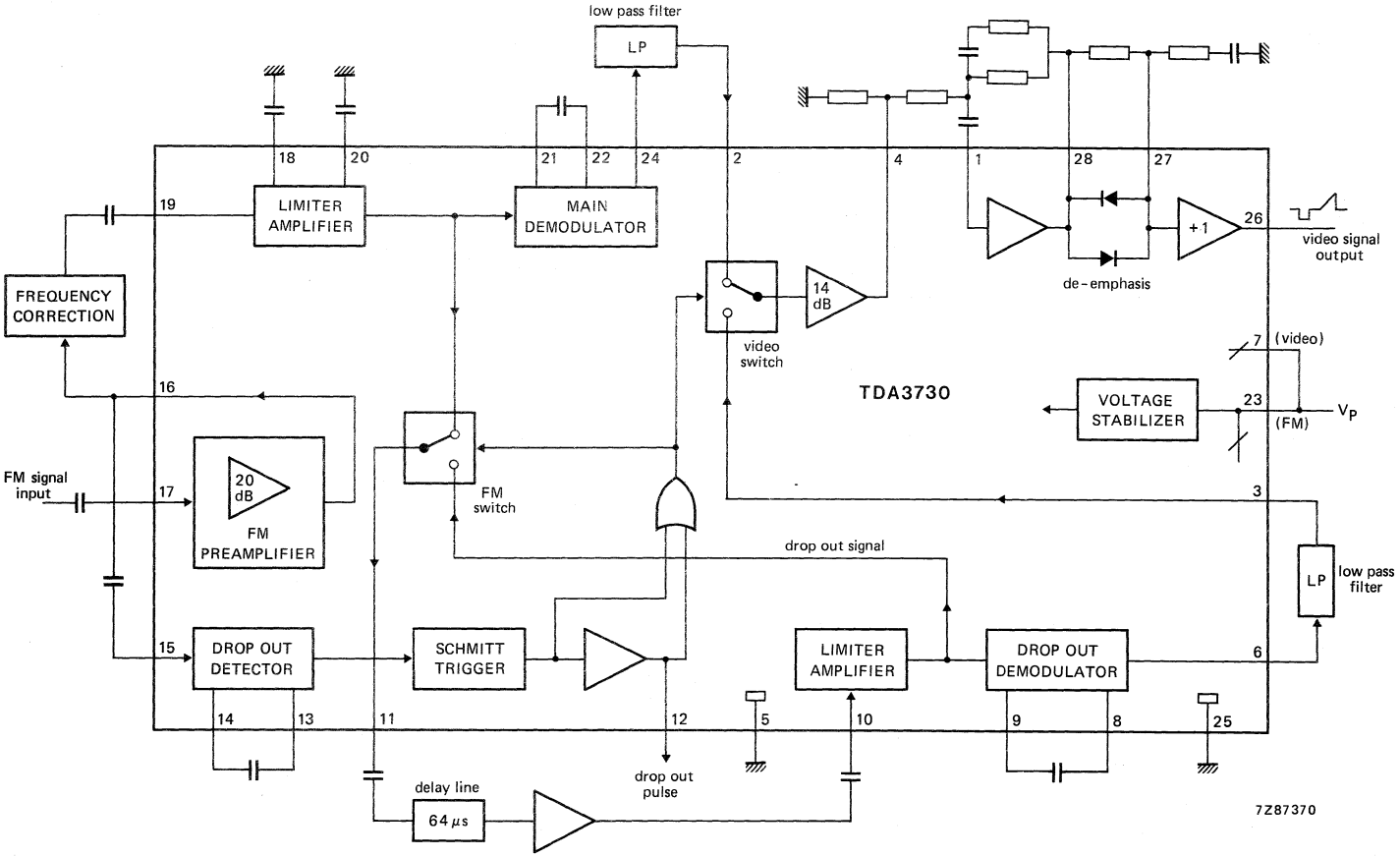


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pins 7 and 23)	$V_P = V_{7,23-5,25}$	max.	13,2 V
Voltage range at pins 1, 2, 3, 4, 5, 6, 10, 11, 12, 15, 16, 17, 18, 19, 20, 24, 26 to pin 5 and 25 (ground)	$V_{n-5,25}$		0 to V_P V
Voltage at pins 8, 9, 13, 14, 21, 22 to pin 5 and 25 (ground)	$V_{n-5,25}$	max.	V_P V
Voltage at pins 27, 28 to pin 5 and 25 (ground)	$V_{n-5,25}$	min.	0 V
Currents			
at pins 8, 9, 13, 14, 21, 22	$-I_n$	max.	3 mA
at pins 27 and 28	I_n	max.	3 mA
Total power dissipation	P_{tot}	max.	1,4 W
Storage temperature range	T_{stg}		−25 to + 150 °C
Operating ambient temperature range	T_{amb}		0 to + 70 °C

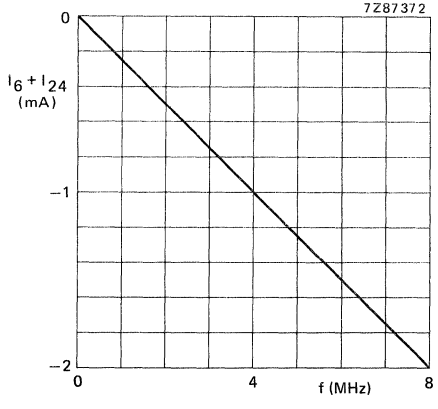


Fig. 2 Steepness of the main and drop out demodulator.

CHARACTERISTICS

$V_P = V_{7,\ 23\text{-}5,\ 25} = 10$ V; $T_{amb} = 25\ ^oC$; measured in test circuit Fig. 3; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 7 and pin 23)					
Supply voltage	$V_P = V_{7,\ 23\text{-}5,\ 25}$	9,6	10	13,2	V
Supply current	$I_{P1} = I_7$	–	23	–	mA
	$I_{P2} = I_{23}$	–	17	–	mA
FM amplifier					
Input voltage (pin 17) (peak-to-peak value)	$V_{17\text{-}25(p\text{-}p)}$	–	100	–	mV
Input resistance	$R_{17\text{-}25}$	10	–	–	kΩ
Gain	G_v	–	20	–	dB
Bandwidth ($R_G \leqslant 50\ \Omega$)	B	–	12	–	MHz
Output signal amplitude (pin 16) (peak-to-peak value)	$V_{16\text{-}25(p\text{-}p)}$	–	–	1,3	V
Main limiter amplifier (pin 19)					
FM input signal (peak-to-peak value)	$V_{19\text{-}25(p\text{-}p)}$	–	0,5	1	V
Input resistance	$R_{19\text{-}25}$	–	600	–	Ω
Start of limiting (referred to pin 11) (peak-to-peak value)	$V_{19\text{-}25(p\text{-}p)}$	–	–	2,5	mV
Drop out limiter amplifier (pin 10)					
FM input signal (peak-to-peak value)	$V_{10\text{-}5(p\text{-}p)}$	–	–	0,8	V
Input resistance	$R_{10\text{-}5}$	–	1	–	kΩ
Start of limiting (referred to pin 11) (peak-to-peak value)	$V_{10\text{-}5(p\text{-}p)}$	–	–	80	mV
Main and drop out demodulators					
Range of output voltages (pin 6 and pin 24) (peak-to-peak value)	$V_{6,\ 24\text{-}5,\ 25(p\text{-}p)}$	–	–	3,5	V
Linearity (bandwidth = 1 to 6 MHz)		–5	–	+5	%
Steepness (see Fig. 2)	S	–	0,25	–	mA/MHz
FM switch (pin 11)					
Output amplitude (peak-to-peak value)	$V_{11\text{-}5(p\text{-}p)}$	–	0,5	–	V
D.C. output voltage	$V_{11\text{-}5}$	–	8,4	–	V

parameter	symbol	min.	typ.	max.	unit
Video switch (pin 4)					
Input voltage (pin 2 and pin 3) (peak-to-peak value)	$V_{2,\,3\text{-}5(p\text{-}p)}$	–	–	0,5	V
Input resistance (open base)	$R_{2,\,3\text{-}5}$	20	–	–	kΩ
Voltage gain	G_V	–	14	–	dB
D.C. output voltage at $V_{2,\,3\text{-}5} = 9{,}5$ V	$V_{4\text{-}5}$	–	5,4	–	V
De-emphasis amplifier (linear)					
Video output signal (pin 28) (peak-to-peak value)	$V_{28\text{-}5(p\text{-}p)}$	–	–	3	V
Gain-bandwidth product	G.B.	30	–	–	MHz
D.C. output voltage	$V_{28\text{-}5}$	–	4,8	–	V
Dynamic de-emphasis					
Output signal (pin 26) (peak-to-peak value) at $V_{28\text{-}5(p\text{-}p)} = 1$ V; f = 1 MHz sine	$V_{26\text{-}5(p\text{-}p)}$	–	632	–	mV
D.C. output voltage	$V_{26\text{-}5}$	–	3,4	–	V
Output current (emitter follower)	$-I_{26}$	–	–	5	mA
Drop out detector and Schmitt-trigger					
Input voltage for lower drop out threshold (pin 15) (peak-to-peak value)	$V_{15\text{-}5(p\text{-}p)}$	–	110	–	mV
Hysteresis of the Schmitt-trigger	V/V	–	1,5	–	dB
Input resistance	$R_{15\text{-}5}$	1,4	–	–	kΩ
D.C. output voltage without drop out	$V_{12\text{-}5}$	–	–	2	V
D.C. output voltage with drop out	$V_{12\text{-}5}$	5	–	–	V
OR-gate (internal)					
Switching voltage threshold (pin 12) for signal flow from pin 2 to pin 4	$V_{12\text{-}5}$	–	–	1,5	V
for signal flow from pin 3 to pin 4	$V_{12\text{-}5}$	3	–	–	V

APPLICATION INFORMATION

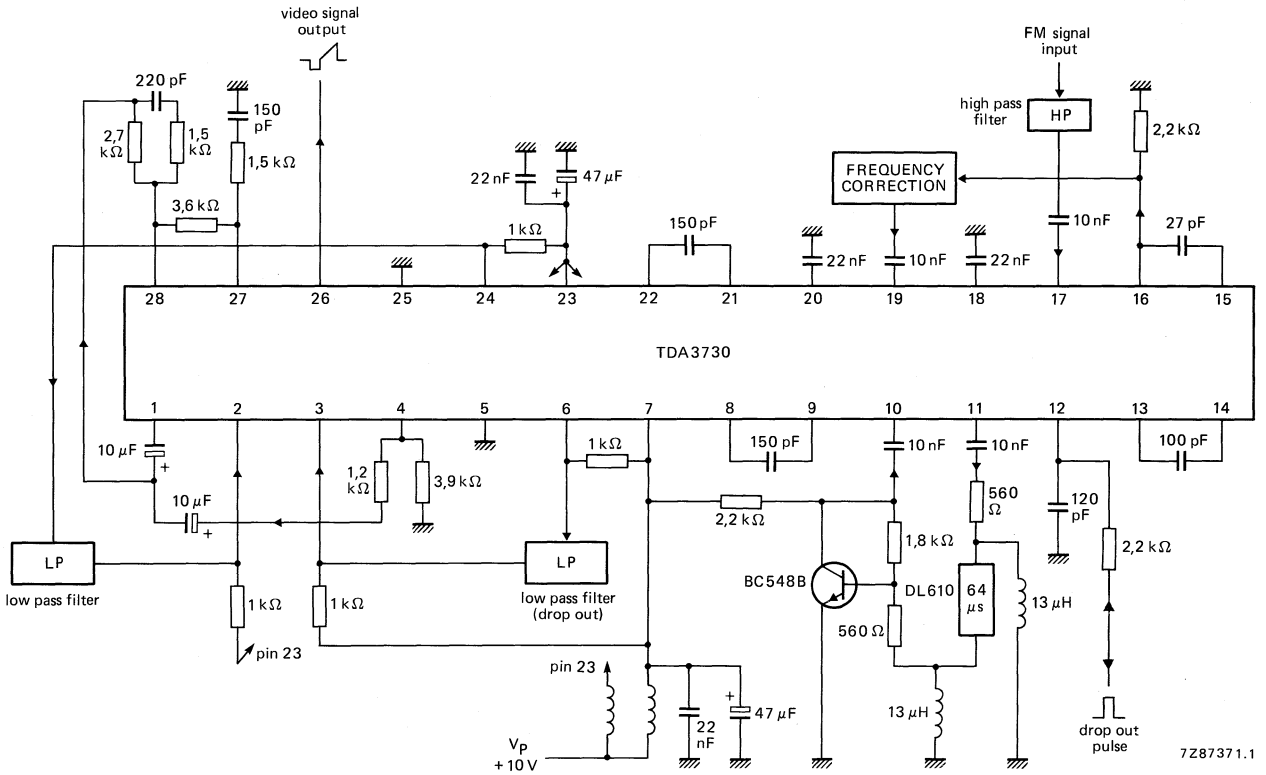


Fig. 3 Application diagram; also used as test circuit.

VIDEO PROCESSOR AND FREQUENCY MODULATOR FOR VIDEO RECORDERS

GENERAL DESCRIPTION

The TDA3740 is a monolithic integrated circuit for video signal processing and frequency modulation in video recorders.

Features

- Video controlled amplifier with clamping stage
- Fast and slow white amplitude detector
- Sync amplitude detector
- Black and white clip
- Insertion of sync and composite video signals
- Adder stage for composite video and chrominance signals
- Two-stage amplification for the composite video signal with dynamic (adjustable) and linear pre-emphasis
- White clip with external determination of clipping level
- Voltage controlled oscillator (frequency modulator)
- Blanking stage for the voltage controlled oscillator and limiter amplifier
- Reference voltage source

QUICK REFERENCE DATA

Supply voltage (pin 18, 28)	$V_P = V_{18,\ 28\text{-}27}$	typ.	10 V
Supply current (pin 18, 28) (record mode)	$I_P = I_{18,\ 28}$	typ.	58 mA
Supply current (pin 18) (playback mode)	$I_P = I_{18}$	typ.	28 mA
Composite video input signal (peak-to-peak value)	$V_{3\text{-}27(p\text{-}p)}$	typ.	350 mV
Composite colour video output signal (peak-to-peak value)	$V_{7\text{-}27(p\text{-}p)}$	typ.	2 V
Chrominance input signal (peak-to-peak value)	$V_{9\text{-}27(p\text{-}p)}$	typ.	240 mV
Output current (pin 22, 23)	$I_{22,\ 23}$	typ.	8,5 mA

PACKAGE OUTLINE

28-lead DIL; plastic (SOT-117).

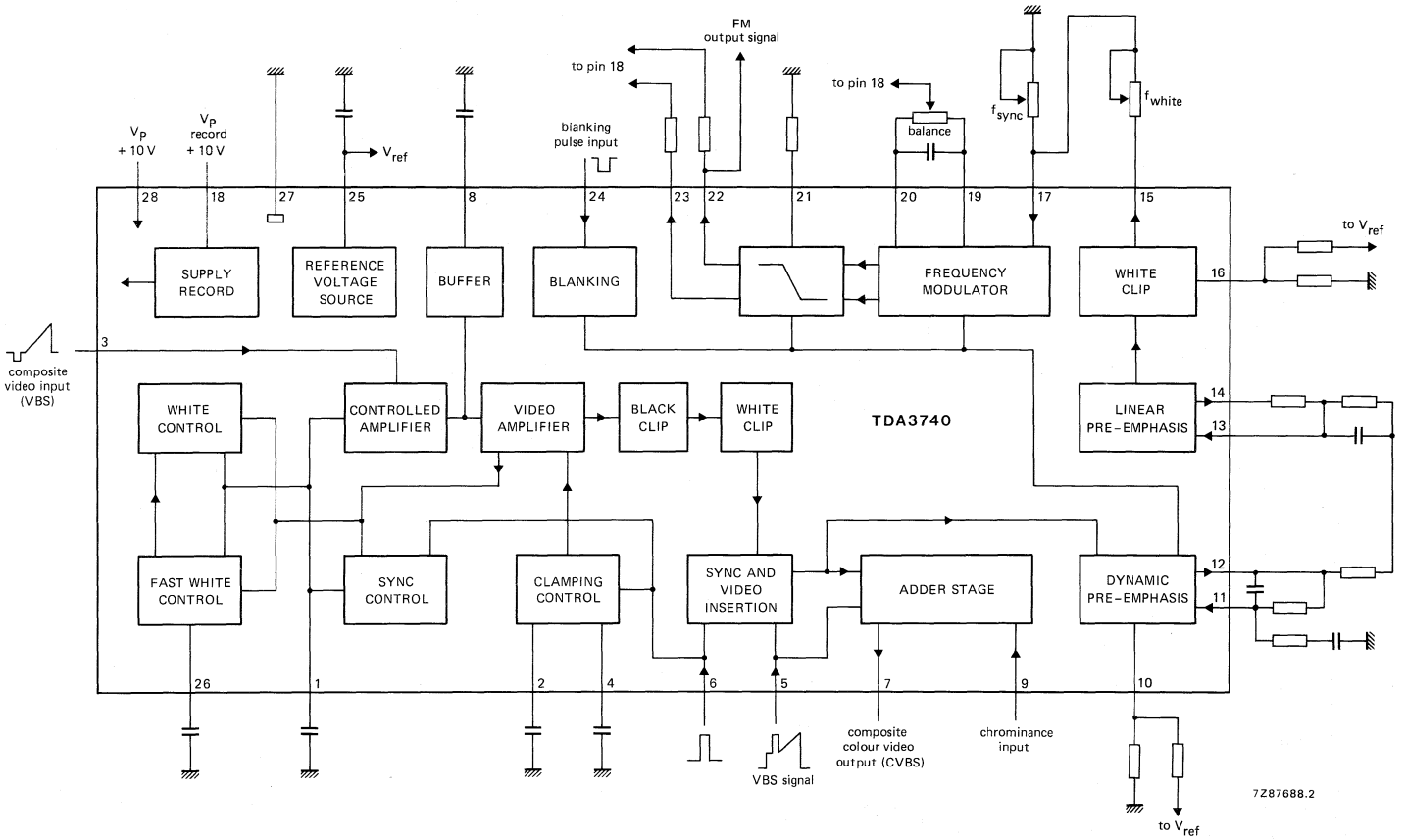


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 18, 28)	$V_P = V_{18,28-27}$	max.	13,2	V

With pin 27 connected to ground and pin 18 and 28 to supply voltage (V_P) all voltages between 0 and V_P are allowed.

Total power dissipation	P_{tot}	max.	1,4	W
Storage temperature range	T_{stg}		−25 to +150	°C
Operating ambient temperature range	T_{amb}		0 to +70	°C

CHARACTERISTICS

$V_P = V_{18-28} = 10$ V; $T_{amb} = 25$ °C; measured in test circuit Fig. 2; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 18, 28)					
Supply voltage	$V_P = V_{18,28-27}$	9	10	13,2	V
Supply current					
at record (FM kill inactive)	$I_P = I_{18,28}$	–	58	–	mA
at playback	$I_P = I_{28}$	–	28	–	mA
Controlled amplifier					
Composite video input signal (peak-to-peak value)	$V_{3-27(p-p)}$	0,20	0,35	0,62	V
Video signal control range (referred to 0,35 V input signal at pin 3)	α_{3-27}	±5	±6	–	dB
Input resistance	R_{3-27}	7	10	13	kΩ
Input capacitance	C_{3-27}	–	–	10	pF
Composite colour video output signal (peak-to-peak value)	$V_{7-27(p-p)}$	1,9	2	2,1	V
Frequency response (0 to 3 MHz)	α_{7-3}	−0,5	–	0,5	dB
Sync recovering and insertion of composite video signal					
Threshold voltage for sync recovering	V_{6-27}	3,0	3,5	4,0	V
Input resistance	R_{6-27}	100	–	–	kΩ

DEVELOPMENT DATA

parameter	symbol	min.	typ.	max.	unit
Insertion of composite video signal					
insertion inactive	V_{5-27}	0	–	0,9	V
video + chroma mute	V_{5-27}	2,5	–	3,0	V
insertion black level	V_{5-27}	3,1	3,25	3,4	V
insertion white level (90% CVBS)	V_{5-27}	3,7	4,0	4,3	V
Input resistance	V_{5-27}	100	–	–	kΩ
Gain	G_{7-5}	2,9	4,5	6,5	dB
Frequency response (0 to 5 MHz)	α_{7-5}	–	–	3	dB
Signal suppression pin 7 at mute		−40	–	–	dB
Clamping control					
Duration of clamping pulse (note 1) with C_{2-27} = 100 nF; C_{4-27} = 2,2 nF	t_d	1	3	4,5	μs
Max. leakage current of external capacitor	I_{L2}	–	–	1	μA
Black and white clip					
Black clip relative to black level	ΔV_{7-27}	−40	−25	0	mV
White clip at pin 7 (referred to nominal VBS)		103	105	107	%
Chrominance signal adder and output stage					
Burst input signal (peak-to-peak value)	$V_{9-27(p-p)}$	–	240	400	mV
Input resistance	R_{9-27}	4	5,6	–	kΩ
D.C. level of top sync	V_{7-27}	2,4	2,7	3,0	V
Sync amplitude at CVBS output pin 7	$V_{7-27(p-p)}$	570	600	630	mV
Gain (f = 4,43 MHz)	G_{7-9}	7	8	9	dB
Output resistance	R_{7-27}	–	–	30	Ω
Frequency response (0 to 5 MHz)	α_{7-9}	−0,5	–	+0,5	dB
Dynamic and linear pre-emphasis; white limiter					
Input resistance pin 11	R_{11-27}	15	–	–	kΩ
Output resistance (emitter follower with internal current source)	R_{12-27}	–	–	30	Ω
Gain-bandwidth product					
dynamic (V_{24-27} = Vp)		24	36	–	MHz
linear		30	–	–	MHz

parameter	symbol	min.	typ.	max.	unit
Range of dynamic pre-emphasis (fixed by external resistors at pin 10)	$V_{10\text{-}27}$	0	–	2,5	V
Gain adjustment range at 1 MHz and $V_{7\text{-}27}$ = 632 mV	$G_{12\text{-}7}$	1,5	–	8	dB
Output resistance (emitter follower with internal current source)	$R_{14\text{-}27}$	–	–	30	Ω
White clip level deviation relative to $V_{16\text{-}27}$ = 1,5 V	$V_{16\text{-}15}$	75	–	125	mV
Range of clipping determination (note 2)	$V_{16\text{-}27}$	1	–	3	V
Frequency modulator					
D.C. level at pin 21 (note 3)	$V_{21\text{-}27}$	1,8	1,9	2,0	V
FM output voltage (note 3) $R_{21\text{-}27}$ = 1,5 kΩ, $R_{22,\ 23\text{-}18}$ = 470 Ω	$V_{22,\ 23\text{-}27}$	–	660	–	mV
Slope between 3 MHz and 6 MHz	$\frac{\Delta f_{22,23}}{\Delta I_{17}}$	–	10,5	–	$\frac{KHz}{\mu A}$
Linearity between 3 MHz and 6 MHz	m	95	–	–	%
Suppression of the 2nd harmonic referred to the 1st harmonic 3,8 MHz (balanced)	α_{harm}	40	46	–	dB
Frequency drift dependent on: drift of supply voltage (V_P = 9 – 13,2 V)	$\frac{\Delta f_{22,23}}{\Delta V_P}$	–	5	10	$\frac{KHz}{V}$
drift of ambient temperature (T_{amb} = 0 – 70 °C) at 3,8 MHz	$\Delta f_{22,23}$	–85	–	+85	kHz
at 4,8 MHz	$\Delta f_{22,23}$	–85	–	+85	kHz
Drift of frequency span dependent on temperature drift (T_{amb} = 0 – 70 °C)	Δf	–70	–	+70	kHz
Input voltage to switch FM off	$V_{24\text{-}27}$	–	–	2	V
Input voltage to switch FM on	$V_{24\text{-}27}$	3	–	–	V
Input resistance	$R_{24\text{-}27}$	10	–	–	kΩ

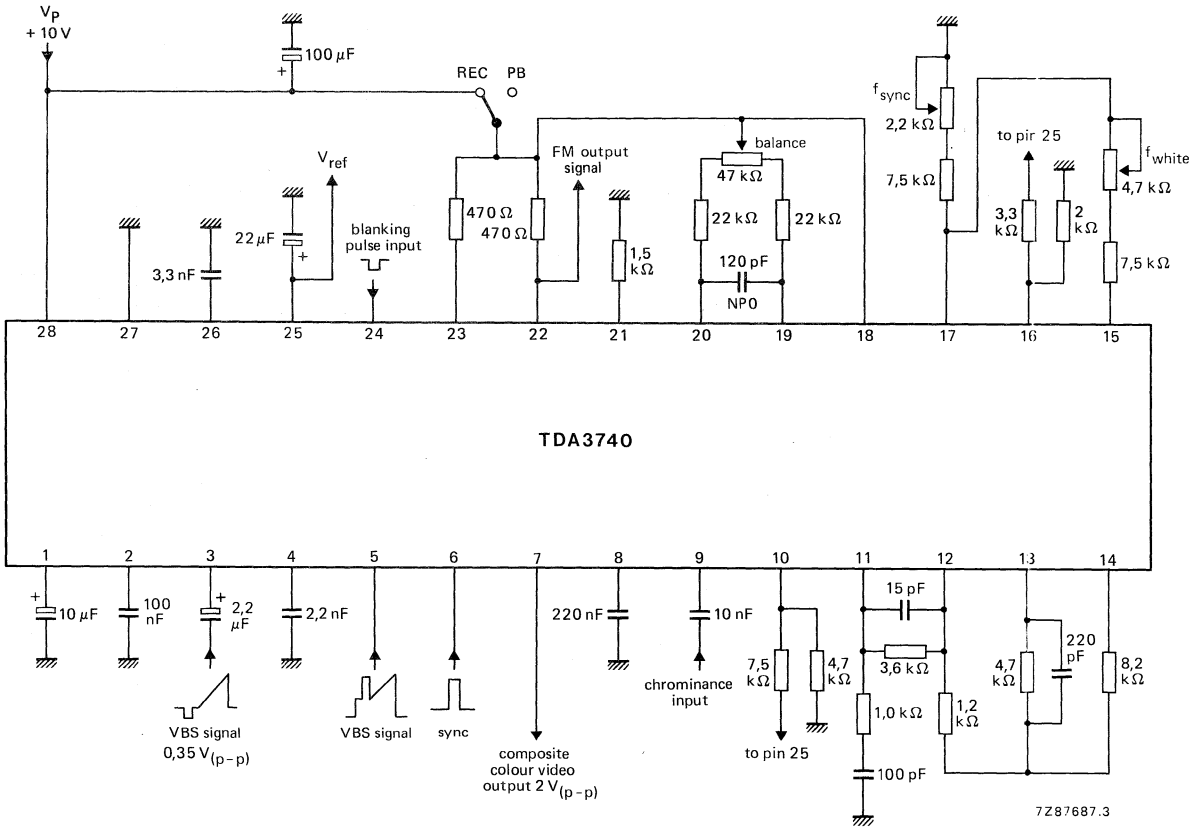
DEVELOPMENT DATA

parameter	symbol	min.	typ.	max.	unit
Reference voltage source (pin 25)					
Output voltage	$V_{25\text{-}27}$	–	5,5	–	V
Output current (additional to application)	I_{25}	−3	–	+5	mA
Output voltage drift dependent on drift of supply voltage (V_P = 9 – 13,2 V)	$\frac{\Delta V_{25\text{-}27}}{\Delta V_P}$	−10	–	+10	$\frac{mV}{V}$
drift of ambient temperature (T_{amb} = 0 – 70 °C)	$\Delta V_{25\text{-}27}$	−90	–	+90	mV

Notes

1. Duration of clamping pulse is determined by $C_{4\text{-}27}$ as follows: t_d (μs) = 1,364 . $C_{4\text{-}27}$ (nF).
2. White clipping level is fixed by the external resistors at pin 16, e.g. $R_{16\text{-}25}$ = 3,3 kΩ and $R_{16\text{-}27}$ = 2 kΩ results in 160% clipping level.
3. FM output amplitude at pins 22 and 23 is determined by the external fixed resistors $R_{21\text{-}27}$, $R_{22\text{-}18}$ and $R_{23\text{-}18}$.

APPLICATION INFORMATION



REC = record.
PB = playback.

Fig. 2 Application diagram; also used as test circuit.

PAL/NTSC/SECAM SYNCHRONIZATION PROCESSOR FOR VIDEO RECORDERS

GENERAL DESCRIPTION

The TDA3755 is a monolithic integrated circuit for PAL/NTSC SECAM synchronization processing in VHS video recorders.

Features

- Adaptive sync separator
- Internal vertical sync pulse integrator
- Composite sync and vertical pulse output
- Current controlled oscillator (CCO) with 320/321 times horizontal frequency
- Horizontal phase detector with current output
- Video identification and mute circuit
- Burst gating pulse output (externally adjustable phase relationship)
- Test-picture output
- Subcarrier frequency output switched in phase in accordance with VHS standard
- Fast phase correction of subcarrier frequency
- Selection input to force PAL or NTSC function
- Still picture input

QUICK REFERENCE DATA

Supply voltage (pin 13)	$V_P = V_{13-15}$	typ.	10 V
Supply current (pin 13)	$I_P = I_{13}$	typ.	24 mA
Sync separator			
Sync pulse input voltage (peak-to-peak value)	$V_{3-15(p-p)}$	typ.	300 mV
Sync pulse output voltage (peak-to-peak value)	$V_{1-15(p-p)}$	min.	7,3 V
Vertical sync pulse			
Output voltage (peak-to-peak value)	$V_{18-15(p-p)}$	min.	2,7 V
Phase detector			
Catching range	Δf	min.	± 3,0 %
Oscillator			
Oscillator frequency			
PAL	f_{osc}	typ.	5,02 MHz
NTSC	f_{osc}	typ.	5,04 MHz
Output frequency			
PAL	f_o	typ.	627 kHz
NTSC	f_o	typ.	629 kHz
Output sinewave (peak-to-peak value)	$V_{8-15(p-p)}$	typ.	3 V

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102HE).

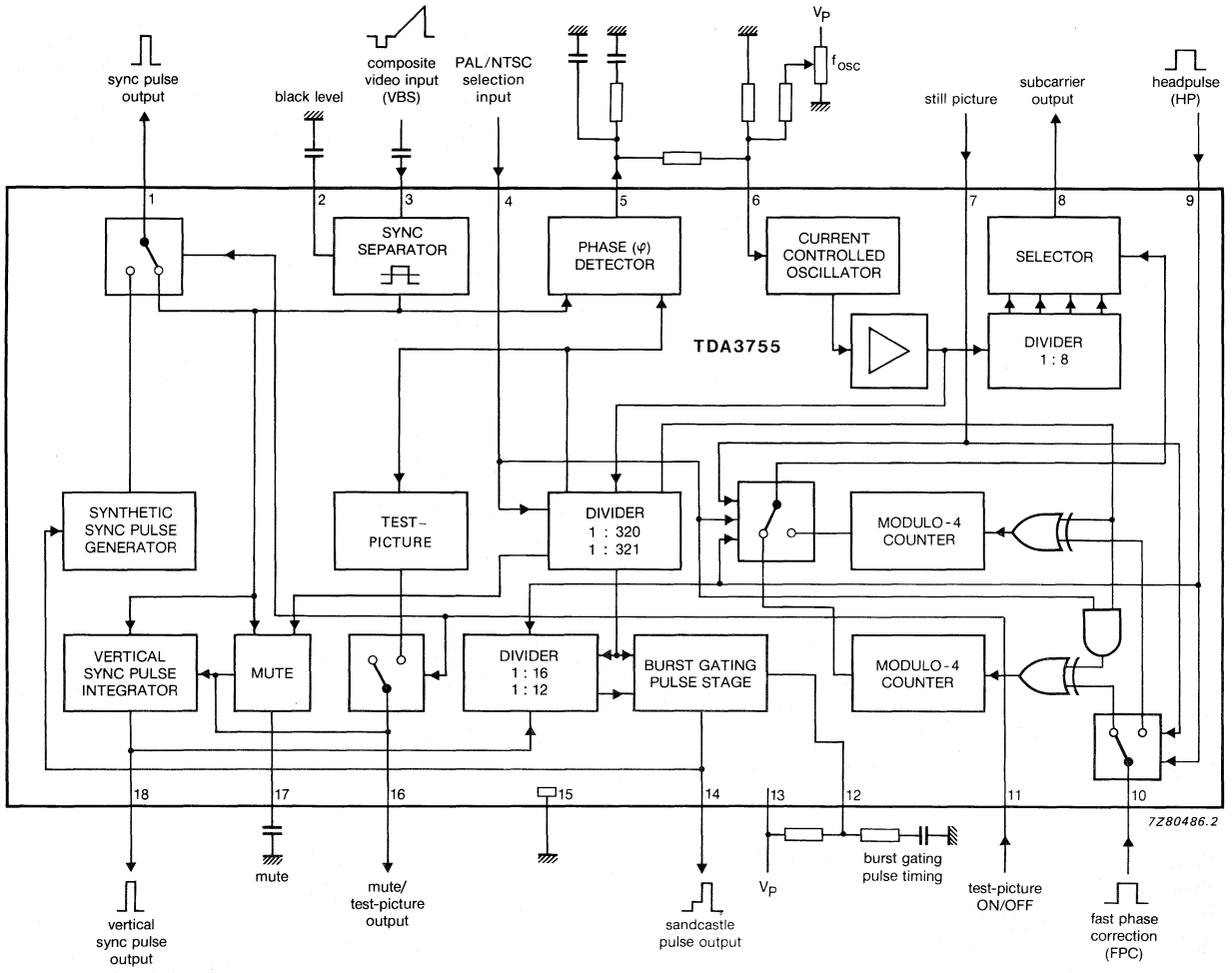


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 13)	$V_P = V_{13-15}$	max.	13,2	V
Voltage range at pins 2, 3, 4, 7, 9, 10, 11, 17 to pin 15 (ground)	V_{n-15}		0 to V_P	V
Voltage range at pin 12	V_{12-15}	min.	0	V
Voltage range at pin 6	V_{6-15}	max.	8	V
Currents				
at pins 1, 5, 8, 14, 16, 18	$\pm I_n$	max.	5	mA
at pin 6	$-I_6$	max.	1	mA
at pin 12	I_{12}	max.	2	mA
Total power dissipation	P_{tot}	max.	1	W
Storage temperature range	T_{stg}		−25 to + 150	°C
Operating ambient temperature range	T_{amb}		0 to + 70	°C

CHARACTERISTICS

V_P = 10 V; T_{amb} = 25 °C; measured in Fig. 4; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 13)					
Supply voltage range	$V_P = V_{13-15}$	9,6	–	13,2	V
Supply current	$I_P = I_{13}$	–	24	–	mA
Sync separator (pin 3)					
Colour composite video input voltage (note 1) (peak-to-peak value)	$V_{3-15(p-p)}$	–	1	–	V
Sync pulse amplitude (peak-to-peak value)	$V_{3-15(p-p)}$	75	–	600	mV
Slicing level, relative to sync pulse amplitude (note 2)		–	50	–	%
Internal resistance of video source	R_G	–	–	1	kΩ
Sync output voltage HIGH at $-I_1$ = 1 mA	V_{1-15}	7,8	–	–	V
Sync output voltage LOW at I_1 = 1 mA	V_{1-15}	–	–	0,5	V
Delay between signal at input pin 3 and sync pulse at output pin 1	t_d	–	0,2	–	μs
Vertical sync pulse (pin 18; note 3)					
Output voltage HIGH at $-I_{18}$ = 1 mA	V_{18-15}	2,7	–	5,0	V
Output voltage LOW at I_{18} = 1,6 mA	V_{18-15}	–	–	0,5	V
Duration of HIGH state of internally generated output pulse	t_p	–	190	–	μs
Delay between leading edge of input signal at pin 3 and leading edge of output pulse at pin 18	t_d	32	–	64	μs
Selection input (pin 4)					
Input voltage for NTSC state	V_{4-15}	–	–	0,3	V
Input current at V_{4-15} = 0 V	$-I_4$	–	–	20	μA
Input voltage for PAL state pin 4 open circuit or	V_{4-15}	2	–	–	V

parameter	symbol	min.	typ.	max.	unit
Test picture/mute/synthetic sync pulse					
Minimum voltage at pin 11 for test picture mode **active** (note 4)	$V_{11\text{-}15}$	4,8	–	–	V
Maximum voltage at pin 11 for test picture mode **inactive**	$V_{11\text{-}15}$	–	–	3,8	V
Output voltage at pin 16					
at test picture "black" or at mute	$V_{16\text{-}15}$	–	2,75	–	V
at test picture "white"	$V_{16\text{-}15}$	–	4,50	–	V
at "in sync condition"	$V_{16\text{-}15}$	–	–	0,5	V
Input current (pin 11)	$-I_{11}$	–	–	25	μA
Oscillator/phase detector					
Oscillator frequency (note 5)					
PAL	f_{osc}	–	5,02	–	MHz
NTSC	f_{osc}	–	5,04	–	MHz
Oscillator conversion gain	k_o	–	16,13	–	MHz/mA
D.C. control voltage	$V_{6\text{-}15}$	–	2,1	–	V
Input current for f = 5,016 MHz	$-I_{16}$	–	310	–	μA
Holding range (note 6)	Δf	±3,2	–	–	%
Catching range (note 6)	Δf	±3,0	–	–	%
Control loop gain	k_v	–	380 x 10^3	–	s^{-1}
Output of lower subcarrier (note 7) (peak-to-peak value)	$V_{8\text{-}15(p\text{-}p)}$	–	3	–	V
Output current	I_8	–	–	2	mA
D.C. output voltage	$V_{8\text{-}15}$	–	3,1	–	V
2nd harmonic suppression without switching	α_{2nd}	20	–	–	dB
Switching position prior to centre of sync pulse (pin 3)	t_s	–	2	–	μs
Output peak current of phase detector during sync pulse	$\pm I_5$	–	3,78	–	mA
Output voltage range (note 8)	$V_{5\text{-}15}$	1,4	–	2,8	V

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Sandcastle pulse (pin 14; note 9)					
Output voltage HIGH (note 10) at $-I_{14}$ = 1 mA	V_{14-15}	7,8	–	–	V
Output voltage INTERMEDIATE at $-I_{14}$ = 1 mA	V_{14-15}	2,3	3,0	3,7	V
Output voltage LOW at I_{14} = 1 mA	V_{14-15}	–	–	0,5	V
Lower part is starting prior to the centre of sync pulse at pin 3 and ending with the upper part	t_{14-3}	–	2,6	–	µs
Fast phase correction/head pulse					
Threshold voltage for fast phase correction (note 11)	V_{10-15}	–	7,2	–	V
Input current	$-I_{10}$	–	–	20	µA
Threshold voltage of head pulse input	V_{9-15}	–	1,4	–	V
Input current	$-I_9$	–	–	20	µA
D.C. input voltage	V_{7-15}	–	5,6	–	V
Input resistance	R_{7-15}	3	–	–	kΩ
Subcarrier phase switching (note 12)					
Phase switching of subcarrier phase in accordance with head pulse if	V_{7-15}	–	5,6*	–	V
LOW state of still picture input	V_{7-15}	–	–	0,5	V
Continuous phase switching regardless of head pulse if	V_{7-15}	–	V_P	–	V

* Or not connected.

Notes to characteristics

1. The sync separator input signal is shown in Fig. 2.

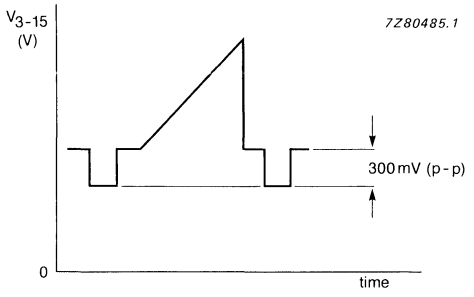
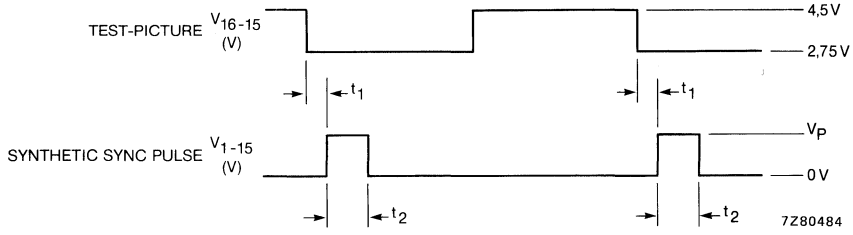


Fig. 2 Colour composite video input signal at pin 3.

2. The black level and the top sync level are detected internally and stored in capacitors at pin 2 and pin 3 respectively.
3. The vertical sync pulse output is disabled by mute.
4. In test picture mode the synthetic sync pulse is fed to output pin 1 and the vertical pulse consists of an uninterrupted block pulse of 192 μs triggering at every transition of head pulse (HP) at pin 9. The timing of test picture and synthetic sync pulse is shown in Fig. 3.



Where: The value of t_1 is dependent upon adjustment of the burst gating pulse delay.
Time t_2 is the burst gating pulse duration.

Fig. 3 Timing of test picture and synthetic sync pulse.

5. Oscillator adjustment during test picture mode made only, at $V_{11-15} > 4{,}8$ V, $V_{7-15} = 0$ V and $V_{4-15} > 2$ V or open circuit; measurement is $f_{osc}/8$ at output pin 8.
6. The holding range and catching range are both determined by the resistor connected between pin 5 and pin 6.
7. The phase of the lower subcarrier is switched in accordance with the VHS standard. PNP emitter follower, internal resistive load of 10 kΩ (typ.) to V_P.
8. The output voltage at pin 5 is disabled during test picture mode.

Notes to characteristics (continued)

9. The burst gating pulse is superimposed on an uninterrupted horizontal pulse. It is suppressed 16 times starting with every transition of the head pulse at pin 9. If a vertical pulse is detected during that time the burst gating pulses are additionally suppressed until line 12 and line 324 respectively. In any event the number of suppressed burst gating pulses is even.
10. The timing of the upper part of the sandcastle pulse is determined by the components connected to pin 12 (Fig. 4) and is independent of supply voltage variations.
11. The fast phase correction pulses have to be in the burst gating reference pulse. For any HIGH to LOW transitions of the correction pulse the phase is corrected by -90^{o} if the head pulse input is LOW and by $+90^{o}$ if the head pulse input is HIGH.
12. Subcarrier phase switching is detailed in Table 1.
    Subcarrier is 40,000 x f_H for NTSC state and 40,125 x f_H for PAL state.

Table 1 Subcarrier phase switching

still picture input	PAL		NTSC	
	HP = HIGH	HP = LOW	HP = HIGH	HP = LOW
HIGH	-90^{o}	-90^{o}	-90^{o}	-90^{o}
not connected	0^{o}	-90^{o}	$+90^{o}$	-90^{o}
LOW	0^{o}	0^{o}	$+90^{o}$	$+90^{o}$

APPLICATION INFORMATION

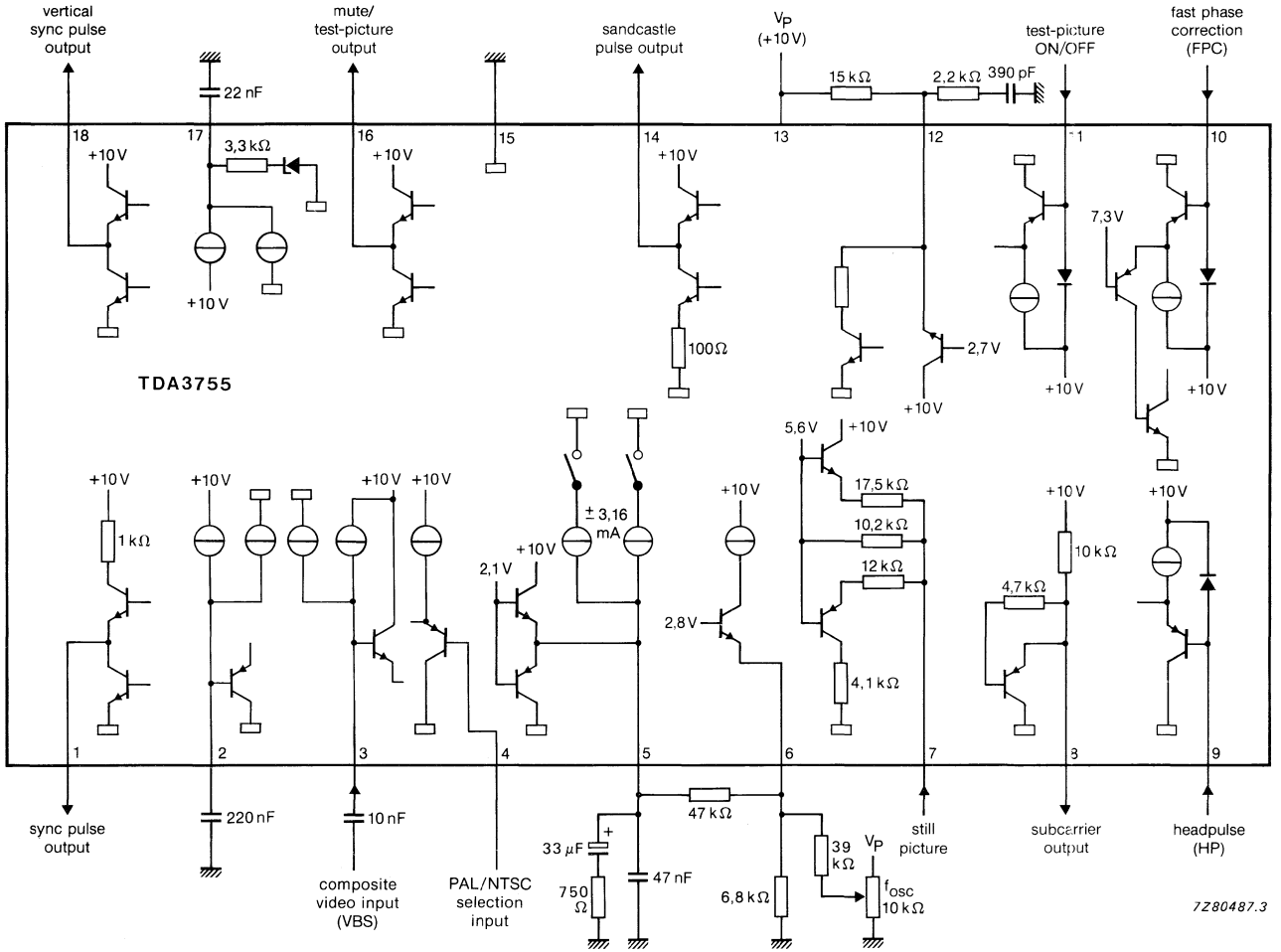


Fig. 4 Application circuit diagram.

PAL CHROMINANCE SIGNAL PROCESSOR FOR VIDEO RECORDERS

GENERAL DESCRIPTION

The TDA3760 is a monolithic integrated circuit for chrominance signal processing in video recorders.

Features

- Automatic gain controlled pre-amplifier with record/playback selection
- Signal mixer with balancing stage
- Output stage for the 627 kHz chrominance signal, with facility for being disabled by colour killer and record/playback mode switch
- Amplitude detector with automatic gain control for the preamplifier
- 4,43 MHz voltage controlled oscillator (VCO) for recording and playback
- 4,43 MHz fixed oscillator for playback
- Phase detector controlled synchronization of the VCO
- Subcarrier mixer
- H/2 demodulator for the production of PAL identification and colour killing signals
- Flip-flop for PAL identification
- Sandcastle pulse processing
- Colour killing stage with hysteresis
- Internal record/playback selection
- Second phase detector for fast phase correction of sub-carrier

QUICK REFERENCE DATA

Supply voltage (pin 9)	$V_P = V_{9\text{-}15}$	typ.	10 V
Supply current (pin 9)	$I_P = I_9$	typ.	45 mA
Inputs			
Chrominance signal			
4,43 MHz for record (peak-to-peak value)	$V_{2\text{-}15(p\text{-}p)}$	typ.	200 mV
627 kHz for playback (peak-to-peak value)	$V_{1\text{-}15(p\text{-}p)}$	typ.	200 mV
Outputs			
Chrominance signal			
4,43 MHz (peak-to-peak value)	$V_{24\text{-}15(p\text{-}p)}$	typ.	490 mV
627 kHz (peak-to-peak value)	$V_{26\text{-}15(p\text{-}p)}$	typ.	2 V

PACKAGE OUTLINE

28-lead DIL; plastic (SOT-117).

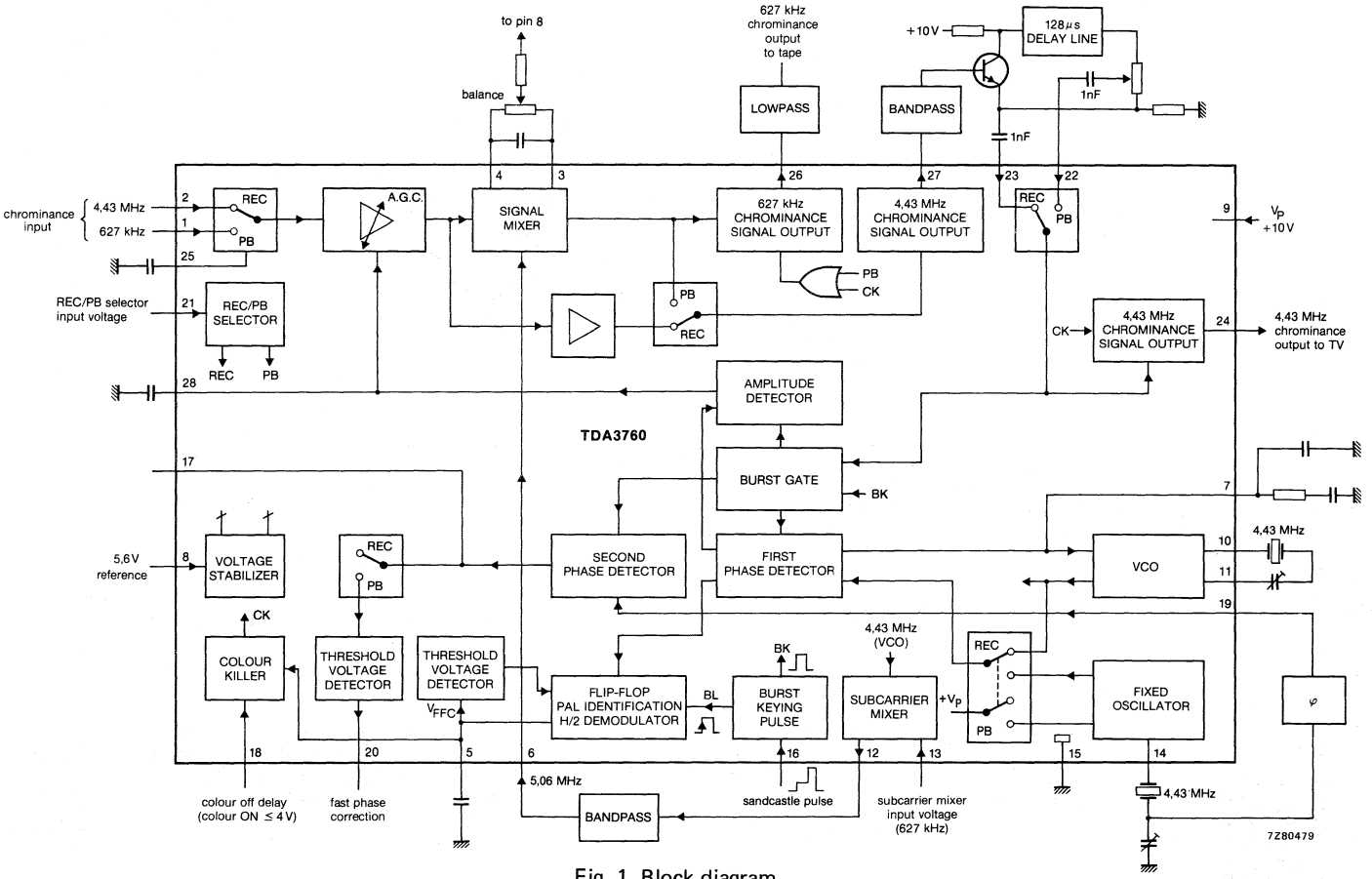


Fig. 1 Block diagram.

BK = burst key pulse
BL = blanking pulse
FFC = flip-flop correction
FPC = fast phase correction

REC = record
PB = playback
CK = colour killer

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 9)	$V_P = V_{9-15}$	max.	13,2	V
Voltage range at pins 1, 2, 5, 7, 8, 9, 16, 17, 18, 19, 20, 21, 22, 23 to pin 15 (ground)	V_{n-15}		0 to V_P	V
Voltage ranges				
at pins 3, 4, 28*	$V_{3, 4, 28-15}$		3 to 6	V
at pin 6, 25*	$V_{6, 25-15}$		0 to 5	V
at pin 10*	V_{10-15}		1,5 to 4	V
at pin 13*	V_{13-15}		0 to 3	V
at pin 14*	V_{14-15}		0 to 8	V
Voltages				
at pin 12	V_{12-15}	max.	V_P	V
at pin 24	V_{24-15}	max.	7	V
Currents				
at pins 11, 18	$-I_{11, 18}$	max.	2	mA
at pins 12, 26, 27	$-I_{12, 26, 27}$	max.	5	mA
at pin 24	$-I_{24}$	max.	3	mA
Total power dissipation	P_{tot}	max.	1,4	W
Storage temperature range	T_{stg}		−25 to +150	°C
Operating ambient temperature range	T_{amb}		0 to +70	°C

* Measured with V_{8-15} = 5,6 V

CHARACTERISTICS

$V_P = V_{9-15} = 10$ V; $V_{8-15} = 5{,}6$ V; $T_{amb} = 25\ ^oC$; burst key duration 4 μs; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 9)					
Supply voltage	$V_P = V_{9-15}$	9,6	–	13,2	V
Supply current for playback and burst keying					
at $-I_{12, 18, 24, 26, 27} = 0$	$I_P = I_9$	–	45	–	mA
at $-I_{12, 18, 24, 26, 27} = 0$; $V_P = 12$ V	$I_P = I_9$	–	46	–	mA
A.G.C. preamplifier (pins 1 and 2)					
Input voltage* (f = 4,43 MHz) during record (peak-to-peak value)	$V_{2-15(p-p)}$	20	–	400	mV
Input voltage* (f = 627 kHz) during playback (peak-to-peak value)	$V_{1-15(p-p)}$	30	–	400	mV
Input resistance	$R_{1, 2-15}$	7	–	–	kΩ
Input capacitance	$C_{1, 2-15}$	–	–	5	pF
627 kHz chrominance signal (pin 26)* (transposed on to 627 kHz signal)					
Output voltage (peak-to-peak value)	$V_{26-15(p-p)}$	–	2	–	V
Signal suppression at output for f = 1,25 MHz	α_{26}	–	35	–	dB
for f = 5,06 MHz (externally balanced via pins 3 and 4)	α_{26}	–	40	–	dB
during colour killing (pin 25)	α_{26}	40	–	–	dB
D.C. output voltage	V_{26-15}	–	6,7	–	V
4,43 MHz chrominance signal (pin 27)*					
Output voltage during record (peak-to-peak value)	$V_{27-15(p-p)}$	–	1,15	–	V
during playback after signal mixing (peak-to-peak value)	$V_{27-15(p-p)}$	–	–	3,1	V
Signal suppression at output for f = 5,06 MHz (externally balanced)	α_{27}	–	40	–	dB
for f = 8,86 MHz	α_{27}	–	30	–	dB
for f = 3,81 MHz	α_{27}	–	38	–	dB
for f = 3,18 MHz	α_{27}	–	30	–	dB
D.C. output voltage	V_{27-15}	–	7	–	V

* The chrominance signal values hold for a 75% saturated colour bar signal.

parameter	signal	min.	typ.	max.	unit
4,43 MHz chrominance signal amplifier*					
Burst input signal					
at pin 22 (peak-to-peak value)	$V_{22\text{-}15(p\text{-}p)}$	–	225	–	mV
at pin 23 (peak-to-peak value)	$V_{23\text{-}15(p\text{-}p)}$	–	225	–	mV
Input resistance					
at pin 22	$R_{22\text{-}15}$	6	–	–	kΩ
at pin 23	$R_{23\text{-}15}$	6	–	–	kΩ
Output voltage of the chrominance signal at pin 24 (peak-to-peak value)	$V_{24\text{-}15(p\text{-}p)}$	–	490	–	mV
Signal suppression at output (pin 24) during colour killing	α_{24}	35	–	–	dB
D.C. output voltage					
during colour-on	$V_{24\text{-}15}$	–	2,4	–	V
during colour-off (killed)	$V_{24\text{-}15}$	–	0,7	–	V
Subcarrier mixer					
627 kHz input voltage; sine-wave (peak-to-peak value)	$V_{13\text{-}15(p\text{-}p)}$	220	–	–	mV
Input resistance	$R_{13\text{-}15}$	1	–	–	kΩ
D.C. output voltage	$V_{12\text{-}15}$	–	7,9	–	V
5,06 MHz output voltage selective** (peak-to-peak value)	$V_{12\text{-}15(p\text{-}p)}$	–	800	–	mV
Signal suppression at output**					
for f = 4,43 MHz	α_{12}	20	–	–	dB
for f = 5,68 MHz	α_{12}	30	–	–	dB
Subcarrier input					
5,06 MHz input voltage (peak-to-peak value)	$V_{6\text{-}15(p\text{-}p)}$	250	–	–	mV
Input resistance	$R_{6\text{-}15}$	1,9	–	–	kΩ
Input capacitance	$C_{6\text{-}15}$	–	–	5	pF

* Chrominance signal values hold for a 75% saturated colour bar signal.

** Measured with a 0,32 V (peak-to-peak), 627 kHz input signal on pin 13 ($-I_{12}$ = 1 mA).

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
4,43 MHz voltage controlled oscillator (VCO)					
Input resistance	$R_{10\text{-}15}$	–	430	–	Ω
Input capacitance	$C_{10\text{-}15}$	–	–	10	pF
Output resistance	$R_{11\text{-}15}$	–	–	200	Ω
PLL-controlled oscillator catching range	Δf	± 500	–	–	Hz
Phase difference between oscillator and burst signal for ± 400 Hz deviation of crystal frequency	φ	± 7	–	–	deg
4,43 MHz fixed oscillator					
Oscillator temperature coefficient*	TC	–	–	–3	Hz/K
Record/playback selector (pin 21)					
Input voltage for record**	$V_{21\text{-}15}$	–	–	4	V
Input current with $V_{21\text{-}15}$ = 4 V	I_{21}	–	–	130	μA
Input voltage for playback	$V_{21\text{-}15}$	8	–	–	V
Input current with $V_{21\text{-}15}$ = 8 V	I_{21}	–	–	430	μA
Input resistance	$R_{21\text{-}15}$	7	–	–	kΩ
Colour (on/off) killer delay					
Delay for chrominance signal OFF at ΔV = 1 V; C = 1 μF; PNP emitter follower with internal current of 0,1 mA	t_d	–	10	–	ms
Input voltage (pin 18)					
for forced colour ON	$V_{18\text{-}15}$	–	–	4	V
for forced colour OFF	$V_{18\text{-}15}$	5,5	–	9	V
Voltage stabilizer (pin 8)					
Range of external reference voltage	$V_{8\text{-}15}$	5,3	–	5,8	V
Input current	$-I_8$	–	–	120	μA

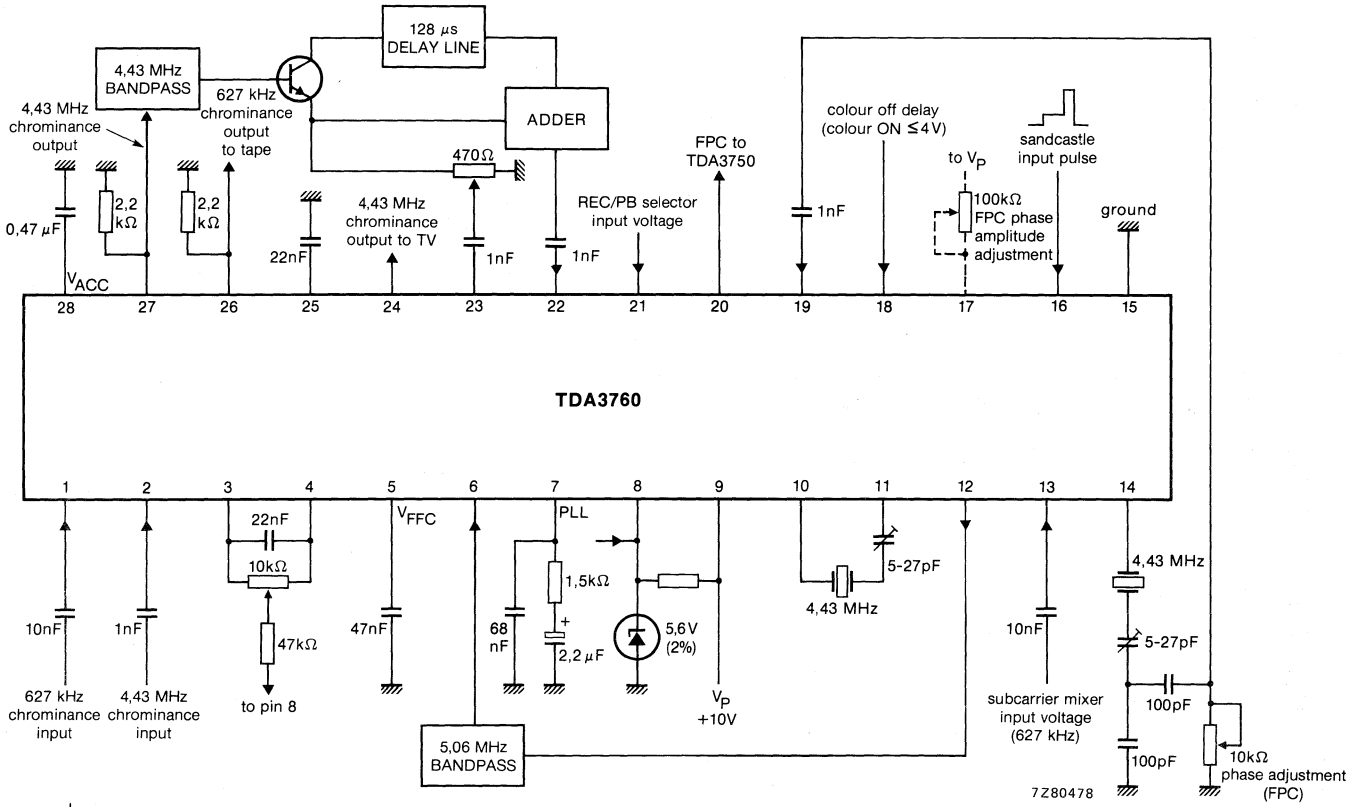
* Not considering the effects of external components.

** Pin open: record.

parameter	symbol	min.	typ.	max.	unit
Sandcastle pulse input (pin 16)					
Input voltage for burst keying	$V_{16\text{-}15}$	7,1	–	–	V
Input current	I_{16}	–	–	5	μA
Delay time of BK	t_d	–	0,55	–	μs
Input voltage for triggering of flip-flop	$V_{16\text{-}15}$	2	–	–	V
Fast phase correction					
Input voltage* (peak-to-peak value)	$V_{19\text{-}15(p\text{-}p)}$	200	–	400	mV
Input resistance	$R_{19\text{-}15}$	3,3	–	–	kΩ
Output voltage					
without correction					
below phase differences of ± 50°					
at $I_{20} < \pm$ 20 μA and $V_{17\text{-}15} < 6{,}5$ V	$V_{20\text{-}15}$	–	–	5,2	V
with correction					
above phase differences of ± 65°					
at $I_{20} < \pm$ 20 μA and $V_{17\text{-}15} > 7{,}1$ V	$V_{20\text{-}15}$	9	–	–	V
Output resistance	$R_{20\text{-}15}$	–	35	–	kΩ

* Phase difference between output pin 14 and input pin 19 should be $\varphi = 90°$.

APPLICATION INFORMATION



REC = record
PB = playback
FPC = fast phase correction
FFC = flip-flop correction

Fig. 2 Application diagram.

NTSC CHROMINANCE SIGNAL PROCESSOR FOR VIDEO RECORDERS

GENERAL DESCRIPTION

The TDA3765 is a monolithic integrated circuit for chrominance signal processing in video recorders.

Features

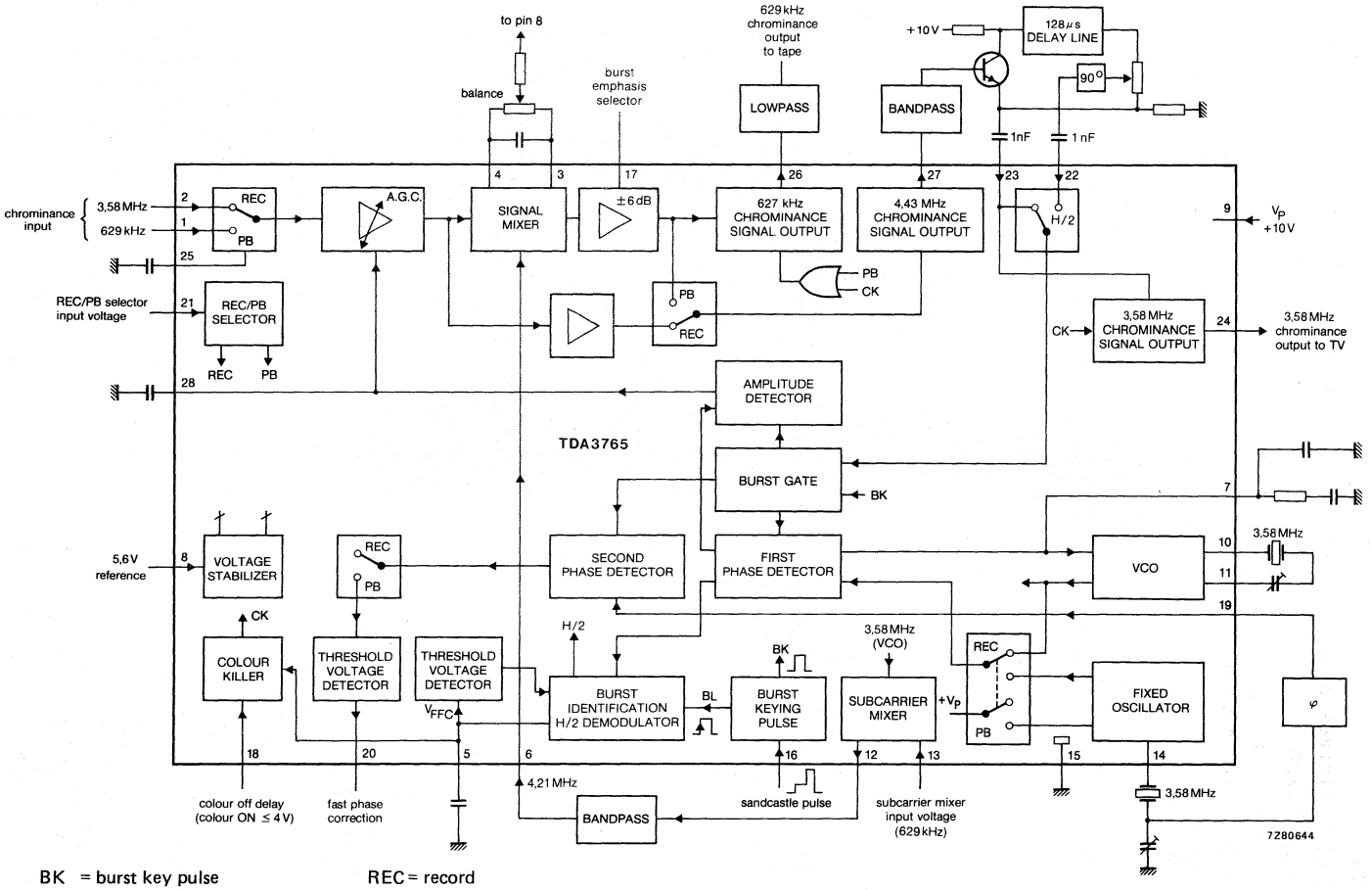
- Automatic gain controlled pre-amplifier with record/playback selection
- Signal mixer with balancing stage
- Output stage for the 629 kHz chrominance signal, with facility for being disabled by colour killer and record/playback mode switch
- Amplitude detector with automatic gain control for the preamplifier
- 3,58 MHz voltage controlled oscillator (VCO) for recording and playback
- 3,58 MHz fixed oscillator for playback
- Phase detector controlled synchronization of the VCO
- Subcarrier mixer
- Sandcastle pulse processing
- Colour killing stage with hysteresis
- Internal record/playback selection
- Second phase detector for fast phase correction of sub-carrier

QUICK REFERENCE DATA

Supply voltage (pin 9)	$V_P = V_{9\text{-}15}$	typ.	10 V
Supply current (pin 9)	$I_P = I_9$	typ.	45 mA
Inputs			
Chrominance signal			
3,58 MHz for record (peak-to-peak value)	$V_{2\text{-}15(p\text{-}p)}$	typ.	200 mV
629 kHz for playback (peak-to-peak value)	$V_{1\text{-}15(p\text{-}p)}$	typ.	200 mV
Outputs			
Chrominance signal			
3,58 MHz (peak-to-peak value)	$V_{24\text{-}15(p\text{-}p)}$	typ.	490 mV
629 kHz (peak-to-peak value)	$V_{26\text{-}15(p\text{-}p)}$	typ.	2 V

PACKAGE OUTLINE

28-lead DIL; plastic (SOT-117).



BK = burst key pulse
BL = blanking pulse
FFC = flip-flop correction
FPC = fast phase correction

REC = record
PB = playback
CK = colour killer

Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 9)	$V_P = V_{9\text{-}15}$	max.	13,2	V
Voltage range at pins 1, 2, 5, 7, 8, 9, 16, 18, 19, 20, 21, 22, 23 to pin 15 (ground)	$V_{n\text{-}15}$		0 to V_P	V
Voltages ranges				
at pins 3, 4, 28*	$V_{3,\ 4,\ 28\text{-}15}$		3 to 6	V
at pin 6, 25*	$V_{6,\ 25\text{-}15}$		0 to 5	V
at pin 10*	$V_{10\text{-}15}$		1,5 to 4	V
at pin 13*, 17*	$V_{13,\ 17\text{-}15}$		0 to 3	V
at pin 14*	$V_{14\text{-}15}$		0 to 8	V
Voltages				
at pin 12	$V_{12\text{-}15}$	max.	V_P	V
at pin 24	$V_{24\text{-}15}$	max.	7	V
Currents				
at pins 11, 18	$-I_{11,\ 18}$	max.	2	mA
at pins 12, 26, 27	$-I_{12,\ 26,\ 27}$	max.	5	mA
at pin 24	$-I_{24}$	max.	3	mA
Total power dissipation	P_{tot}	max.	1,4	W
Storage temperature range	T_{stg}		−25 to + 150	°C
Operating ambient temperature range	T_{amb}		0 to + 70	°C

* Measured with $V_{8\text{-}15} = 5{,}6$ V.

CHARACTERISTICS

$V_P = V_{9-15} = 10$ V; $V_{8-15} = 5{,}6$ V; $T_{amb} = 25$ °C; burst key duration 4 μs; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 9)					
Supply voltage	$V_P = V_{9-15}$	9,6	–	13,2	V
Supply current for playback and burst keying					
at $-I_{12, 18, 24, 26, 27} = 0$	$I_P = I_9$	–	47	–	mA
at $-I_{12, 18, 24, 26, 27} = 0$; $V_P = 12$ V	$I_P = I_9$	–	49	–	mA
A.G.C. preamplifier (pins 1 and 2)					
Input voltage* (f = 3,58 MHz) during record (peak-to-peak value)	$V_{2-15(p-p)}$	20	–	400	mV
Input voltage* (f = 629 kHz) during playback (peak-to-peak value)	$V_{1-15(p-p)}$	30	–	400	mV
Input resistance	$R_{1, 2-15}$	7	–	–	kΩ
Input capacitance	$C_{1, 2-15}$	–	–	5	pF
629 kHz chrominance signal (pin 26)* (transposed on to 629 kHz signal)					
Output voltage (peak-to-peak value)	$V_{26-15(p-p)}$	–	2	–	V
Signal suppression at output					
for f = 1,26 MHz	α_{26}	–	35	–	dB
for f = 4,21 MHz (externally balanced via pins 3 and 4)	α_{26}	–	40	–	dB
during colour killing (pin 25	α_{26}	40	–	–	dB
D.C. output voltage	V_{26-15}	–	6,7	–	V
3,58 MHz chrominance signal (pin 27)*					
Output voltage					
during record (peak-to-peak value)	$V_{27-15(p-p)}$	–	1,15	–	V
during playback after signal mixing (peak-to-peak value)	$V_{27-15(p-p)}$	–	–	3,1	V
Signal suppression at output					
for f = 4,21 MHz (externally balanced)	α_{27}	–	40	–	dB
for f = 7,16 MHz	α_{27}	–	30	–	dB
for f = 2,95 MHz	α_{27}	–	38	–	dB
for f = 2,32 MHz	α_{27}	–	30	–	dB
D.C. output voltage	V_{27-15}	–	7	–	V

* The chrominance signal values hold for a 75% saturated colour bar signal.

parameter	symbol	min.	typ.	max.	unit
3,58 MHz chrominance signal amplifier*					
Burst input signal					
at pin 22 (peak-to-peak value)	$V_{22\text{-}15(p\text{-}p)}$	–	225	–	mV
at pin 23 (peak-to-peak value)	$V_{23\text{-}15(p\text{-}p)}$	–	225	–	mV
Input resistance					
at pin 22	$R_{22\text{-}15}$	6	–	–	kΩ
at pin 23	$R_{23\text{-}15}$	6	–	–	kΩ
Output voltage of the chrominance signal at pin 24 (peak-to-peak value)	$V_{24\text{-}15(p\text{-}p)}$	–	490	–	mV
Signal suppression at output (pin 24) during colour killing	α_{24}	35	–	–	dB
D.C. output voltage					
during colour-on	$V_{24\text{-}15}$	–	2,4	–	V
during colour-off (killed)	$V_{24\text{-}15}$	–	0,7	–	V
Subcarrier mixer					
629 kHz input voltage; sine-wave (peak-to-peak value)	$V_{13\text{-}15(p\text{-}p)}$	220	–	–	mV
Input resistance	$R_{13\text{-}15}$	1	–	–	kΩ
D.C. output voltage	$V_{12\text{-}15}$	–	7,9	–	V
4,21 MHz output voltage selective** (peak-to-peak value)	$V_{12\text{-}15(p\text{-}p)}$	–	800	–	mV
Signal suppression at output**					
for f = 3,58 MHz	α_{12}	20	–	–	dB
for f = 4,84 MHz	α_{12}	30	–	–	dB
Subcarrier input					
4,21 MHz input voltage (peak-to-peak value)	$V_{6,15(p\text{-}p)}$	250	–	–	mV
Input resistance	$R_{6\text{-}15}$	1,9	–	–	kΩ
Input capacitance	$C_{6\text{-}15}$	–	–	5	pF
3,58 MHz voltage controlled oscillator (VCO)					
Input resistance	$R_{10\text{-}15}$	–	430	–	Ω
Input capacitance	$C_{10\text{-}15}$	–	–	10	pF
Output resistance	$R_{11\text{-}15}$	–	–	200	Ω
PLL-controlled oscillator catching range	Δf	± 500	–	–	Hz
Phase difference between oscillator and burst signals for ± 400 Hz deviation of crystal frequency	φ	–	–	± 7	deg

* Chrominance signal values hold for a 75% saturated colour bar signal.

** Measured with a 0,32 V (peak-to-peak), 629 kHz input signal on pin 13 ($-I_{12}$ = 1 mA).

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
3,58 MHz fixed oscillator					
Oscillator temperature coefficient*	TC	–	–	–3	Hz/K
Record/playback selector (pin 21)					
Input voltage for record**	$V_{21\text{-}15}$	–	–	4	V
Input current with $V_{21\text{-}15}$ = 4 V	I_{21}	–	–	130	μA
Input voltage for playback	$V_{21\text{-}15}$	8	–	–	V
Input current with $V_{21\text{-}15}$ = 8 V	I_{21}	–	–	430	μA
Input resistance	$R_{21\text{-}15}$	7	–	–	kΩ
Colour (on/off) killer delay					
Delay for chrominance signal OFF at AV = 1 V; C = 1 μF; PNP emitter follower with internal current of 0,1 mA	t_d	–	10	–	ms
Input voltage (pin 18)					
for forced colour ON	$V_{18\text{-}15}$	–	–	4	V
for forced colour OFF	$V_{18\text{-}15}$	5,5	–	9	V
Voltage stabilizer (pin 8)					
Range of external reference voltage	$V_{8\text{-}15}$	5,3	–	5,8	V
Input current	$-I_8$	–	–	120	μA
Sandcastle pulse input (pin 16)					
Input voltage for burst keying	$V_{16\text{-}15}$	7,1	–	–	V
Input current	I_{16}	–	–	5	μA
Delay time of BK	t_d	–	0,55	–	μs
Input voltage for triggering of flip-flop	$V_{16\text{-}15}$	2	–	–	V
Fast phase correction					
Input voltage▲ (peak-to-peak value)	$V_{19\text{-}15(p\text{-}p)}$	200	–	400	mV
Input resistance	$R_{19\text{-}15}$	3,3	–	–	kΩ
Output voltage					
without correction					
below phase differences of ± 50°					
at $I_{20} < \pm 20$ μA and $V_{17\text{-}15} = < 6{,}5$ V	$V_{20\text{-}15}$	–	–	5,2	V
with correction					
above phase differences of ± 65°					
at $I_{20} < \pm 20$ μA and $V_{17\text{-}15} = > 7{,}1$ V	$V_{20\text{-}15}$	9	–	–	V
Output resistance	$R_{20\text{-}15}$	–	35	–	kΩ

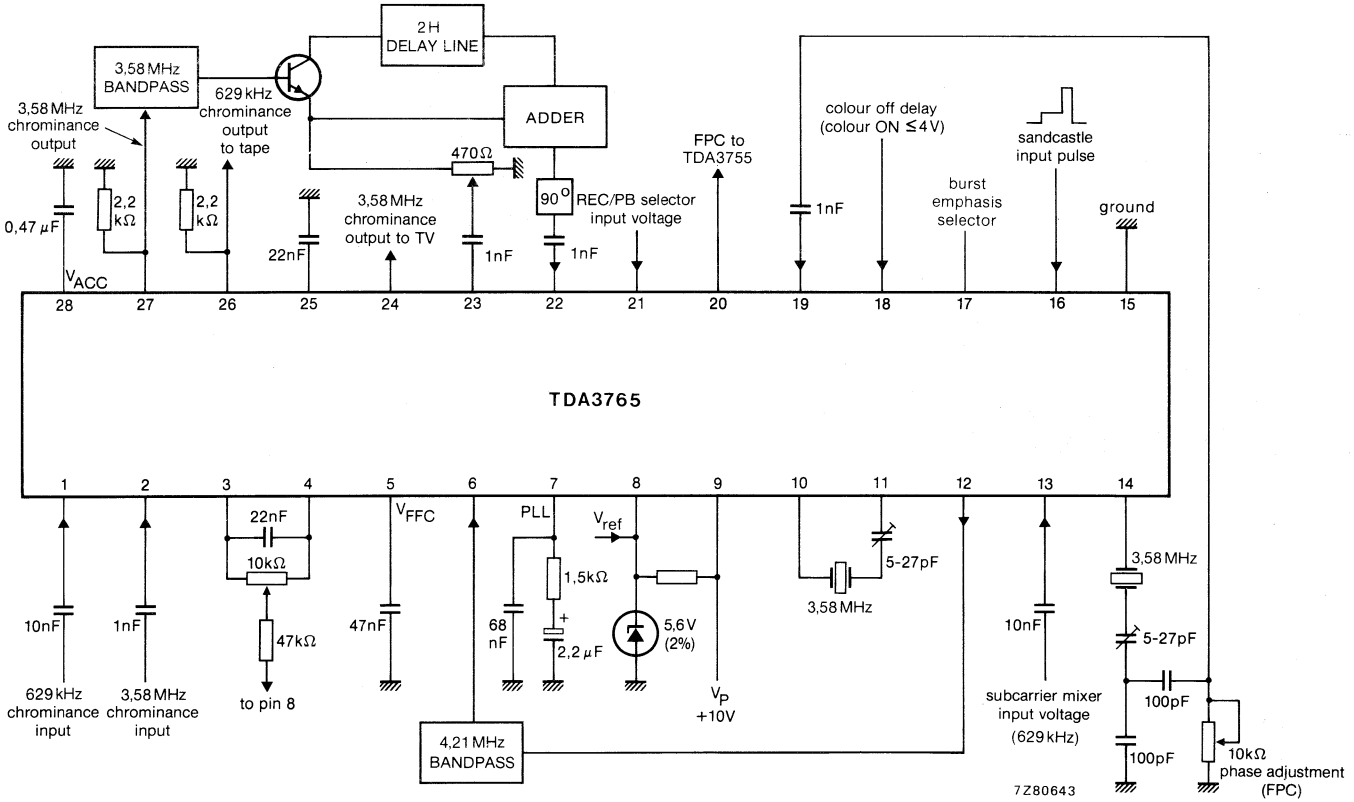
* Not considering the effects of external components.

** Pin open: record.

▲ Phase difference between output pin 14 and input pin 19 should be $\varphi = 90°$.

parameter	symbol	min.	typ.	max.	unit
Burst emphasis selector (pin 17)					
Input voltage active emphasis	V_{17-15}		open connection		
Input voltage inactive emphasis	V_{17-15}	–	–	0,5	V
Burst pre-emphasis at REC chroma output pin 26		–	6	–	dB
Burst de-emphasis at PB chroma output pin 27		–	5,3	–	dB

APPLICATION INFORMATION



REC = record
PB = playback
FPC = fast phase correction
FFC = flip-flop correction

Fig. 2 Application diagram.

VIDEO PROCESSOR FOR VIDEO RECORDERS

GENERAL DESCRIPTION

The TDA3771 is a monolithic integrated circuit for video signal processing in video recorders. It incorporates the following features:

Features

- 3 channel input selector
- 4 dB preamplifier
- A.G.C. amplifier:
  during record: controlled to sync pulse level and peak white level
  during playback: controlled to sync pulse level
- Gated clamping control stage
- Regeneration of the sync pulse
- Adder stage for the luminance signal (with reinserted sync pulse) and chrominance signal
- Emitter follower output stage for the luminance signal (composite video)
- Two emitter follower output stages for the composite colour video signal.

QUICK REFERENCE DATA

Supply voltage (pin 14)	$V_P = V_{14\text{-}11}$	typ.	12 V
Supply current (pin 14)	$I_P = I_{14}$	typ.	60 mA
Preamplifier			
Composite colour video input signals (peak-to-peak value)	$V_{2,3,4\text{-}11(p\text{-}p)}$	typ.	1 V
Gain	$G_{18\text{-}2,3,4}$	typ.	4 dB
A.G.C. amplifier			
Composite video signal (peak-to-peak value)	$V_{12\text{-}11(p\text{-}p)}$	typ.	0,4 V ± 6 dB
Composite video output signal (controlled) (peak-to-peak value)	$V_{6\text{-}11(p\text{-}p)}$	typ.	4 V
Adder stage			
Chrominance input voltage (peak-to-peak value)	$V_{16\text{-}11(p\text{-}p)}$	typ.	0,3 V
Gain	$G_{15,17\text{-}16}$	typ.	12 dB
Composite colour video output signals (peak-to-peak value)			
negative going	$V_{15\text{-}11(p\text{-}p)}$	typ.	2 V
positive going	$V_{17\text{-}11(p\text{-}p)}$	typ.	2 V

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102CS).

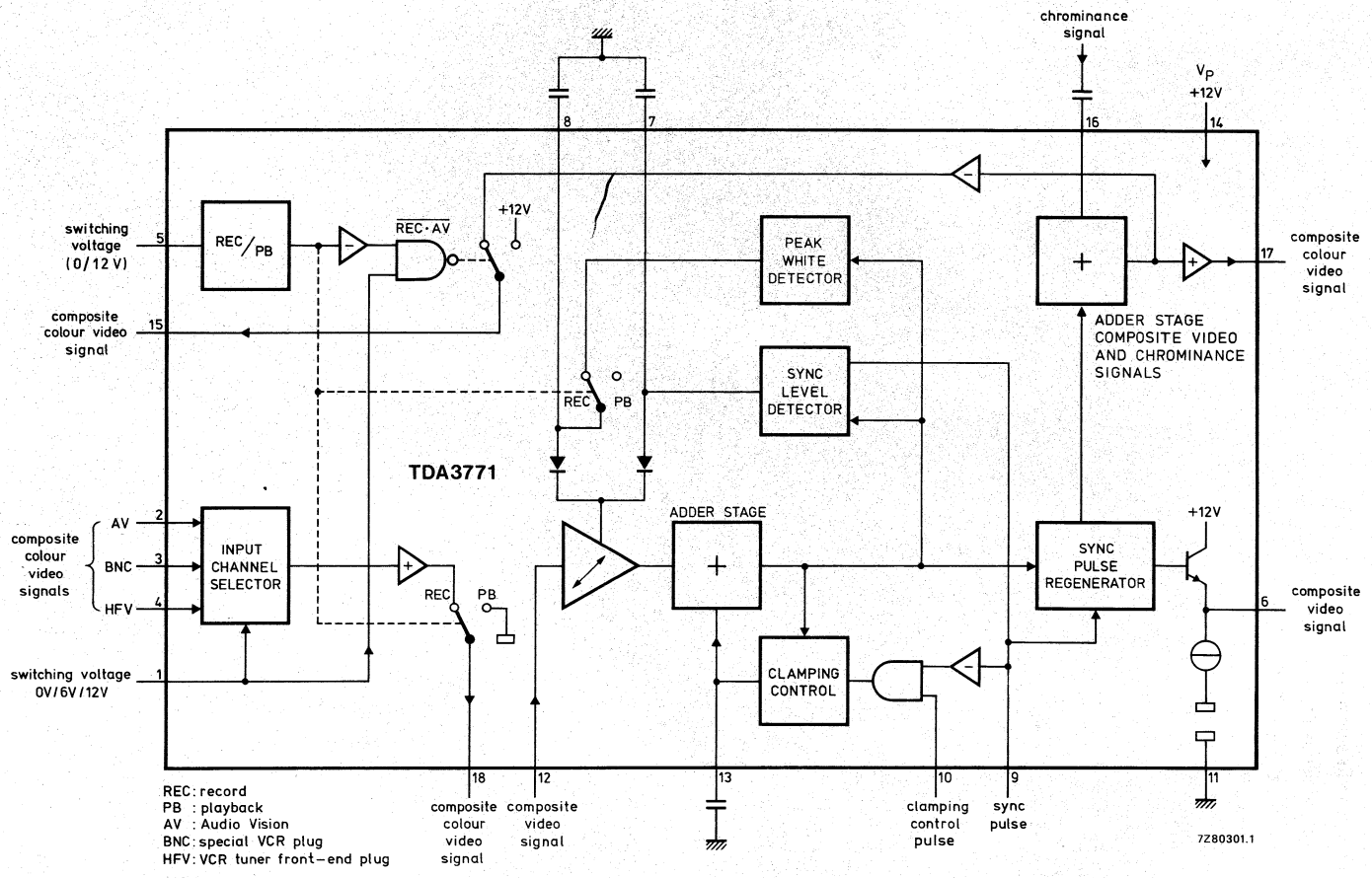


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage range (pin 14)	$V_P = V_{14-11}$	0 to 13,2	V
Voltage range at pins 1, 5, 9, 10, 12, 16 to pin 11 (ground)	V_{n-11}	0 to V_P	V
Voltage ranges			
at pins 2, 3, 4	$V_{2,3,4-11}$	0 to 0,8V_P	V
at pins 7, 8	$V_{7,8-11}$	0,7V_P to V_P	V
at pin 13	V_{13-11}	0,25V_P to V_P	V
Currents			
at pins 6, 15, 17	$I_{6,15,17}$	max. 10	mA
at pin 18	I_{18}	max. 20	mA
Total power dissipation	P_{tot}	max. 1	W
Storage temperature range	T_{stg}	−25 to +150	°C
Operating ambient temperature range	T_{amb}	0 to +70	°C

CHARACTERISTICS

$V_P = V_{14-11} = 12$ V; trigger pulse on pin 10 with a width of 4 μs; $T_{amb} = 25\ ^oC$; measured in test circuit Fig. 2; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 14)					
Supply voltage	$V_P = V_{14-11}$	9,6	–	13,2	V
Supply current	$I_P = I_{14}$	–	60	–	mA
Input channel selector					
Input resistance	R_{1-11}	–	7,5	–	kΩ
Internal bias voltage	V_{1-11}	–	6	–	V
Selector switching voltages on pin 1-11					
to select input pin 4	V_{1-11}	–	–	2	V
to select input pin 3	V_{1-11}	4	–	8	V
to select input pin 2	V_{1-11}	10	–	–	V
Preamplifier					
Composite colour video input signals (peak-to-peak value)	$V_{2,3,4-11(p-p)}$	–	2	–	V
Input resistance	$R_{2,3,4-11}$	–	10	–	kΩ
Input capacitance	$C_{2,3,4-11}$	–	10	–	pF
Gain	$G_{18-2,3,4}$	–	4	–	dB
D.C. output voltage					
during record	V_{18-11}	–	–	5,8	V
during playback	V_{18-11}	–	1	–	V
Frequency response (0 to 3 MHz)	$\alpha_{18-2,3,4}$	–	–	1	dB
Signal suppression at output (pin 18)					
with no input selected	α_{18}	43	–	–	dB
during playback	α_{18}	50	–	–	dB
A.G.C. amplifier					
Input voltage (composite video signal) (peak-to-peak value)	$V_{12-11(p-p)}$	–	0,4 ± 6 dB	–	V
Input resistance	R_{12-11}	–	10	–	kΩ
Input capacitance	C_{12-11}	–	10	–	pF
Frequency response (0 to 3 MHz)	$\alpha_{15,17-12}$	–	1	–	dB
Peak-white and sync-pulse level detectors					
Capacitor currents					
charging current on pin 8	$-I_8$	–	15	–	mA
discharging current on pin 8	I_8	–	0,8	–	μA
charging current on pin 7	$-I_7$	–	0,3	–	mA
discharging current on pin 7	I_7	–	0,3	–	mA

parameter	symbol	min.	typ.	max.	unit
Gated clamping control and sync pulse regeneration					
Threshold voltage for clamping control ON $V_{9-11} = 0$ V	V_{10-11}	7	–	–	V
Input current	$-I_{10}$	–	–	50	μA
Threshold voltage for active sync pulse generation and clamping control OFF	V_{9-11}	6	–	–	V
Input current	$-I_9$	–	–	50	μA
Charging current	$-I_{13}$	–	0,3	–	mA
Discharging current	I_{13}	–	0,3	–	mA
Black level voltage	V_{6-11}	–	5,5	–	V
Sync pulse cut-off level	V_{6-11}	–	5,2	–	V
Controlled output signal (peak-to-peak value)	$V_{6-11(p-p)}$	–	4,0	–	V
Record/playback selector					
Input voltage for playback	V_{5-11}	7	–	–	V
for record	V_{5-11}	–	–	5	V
Input current	$-I_5$	–	–	50	μA
Chrominance signal adder and output stage					
Input voltage (peak-to-peak value)	$V_{16-11(p-p)}$	–	0,3	–	V
Gain	$G_{15,17-16}$	–	12	–	dB
Input resistance	R_{16-11}	–	10	–	kΩ
Input capacitance	C_{16-11}	–	10	–	pF
Output signal (peak-to-peak values) composite colour video signal: negative	$V_{15-11(p-p)}$	–	2	–	V
composite colour video signal: positive	$V_{17-11(p-p)}$	–	2	–	V
2nd harmonic suppression	α_{17}	40	–	–	dB
Black level composite colour video signal: negative	V_{15-11}	–	9,3	–	V
composite colour video signal: positive	V_{17-11}	–	3,7	–	V
Signal suppression during record and with input pin 2 selected	α_{15}	40	–	–	dB
D.C. voltage during record and with input pin 2 selected	V_{15-11}	–	12	–	V
Output resistance during record and with input pin 2 selected	R_{15-11}	–	30	–	kΩ

APPLICATION INFORMATION

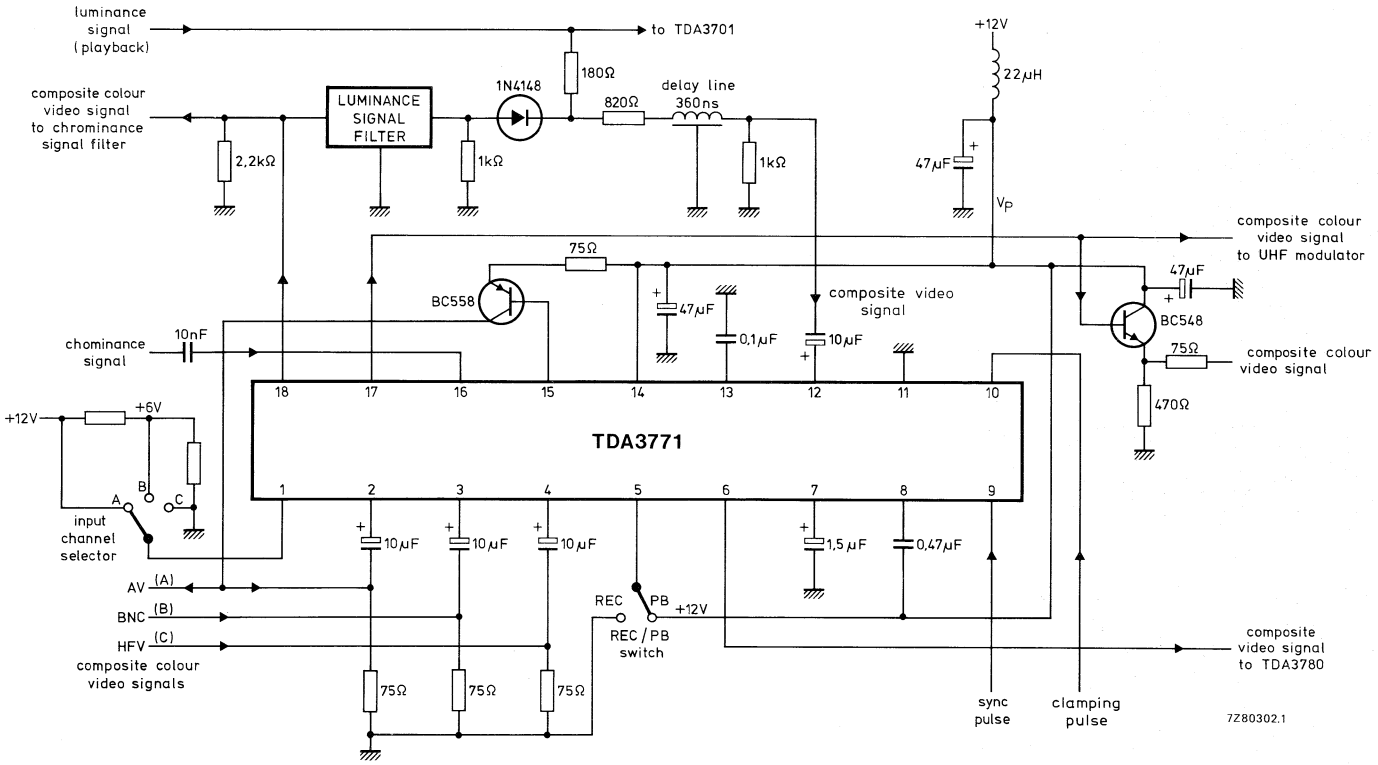


Fig. 2 Application diagram; also used as test circuit.

FREQUENCY MODULATOR FOR VIDEO RECORDERS

GENERAL DESCRIPTION

The TDA3780 is a monolithic integrated circuit for frequency modulation in video recorders.

Features

- Voltage clamping control stage
- Two-stage amplification of the luminance signal with dynamic (adjustable) and linear pre-emphasis
- Adjustable white limiter
- Voltage controlled oscillator (VCO)
- Limiting stage with facility to disconnect from output stage
- Blanking pulse for VCO and output stage

QUICK REFERENCE DATA

Supply voltage (pin 1)	$V_P = V_{1-18}$	typ.	12 V
Supply current (pin 1)	$I_P = I_1$	typ.	52 mA
Clamping stage and pre-emphasis (dynamic) **amplifier**			
Luminance input signal (pin 2) (peak-to-peak value)	$V_{2-18(p-p)}$	typ.	2,0 V
Output voltage (pin 4)	V_{4-18}	2,5 to	8,0 V
Pre-emphasis (linear) **amplifier stage**			
Output voltage (pin 7)	V_{7-18}	2,5 to	8,0 V
Oscillator			
Output frequency	f_{osc}	typ.	3,3 MHz
Output stage			
D.C. output voltage	V_{17-18}	typ.	6,0 V
FM signal output voltage (peak-to-peak value)	$V_{17-18(p-p)}$	typ.	4,2 V

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102CS).

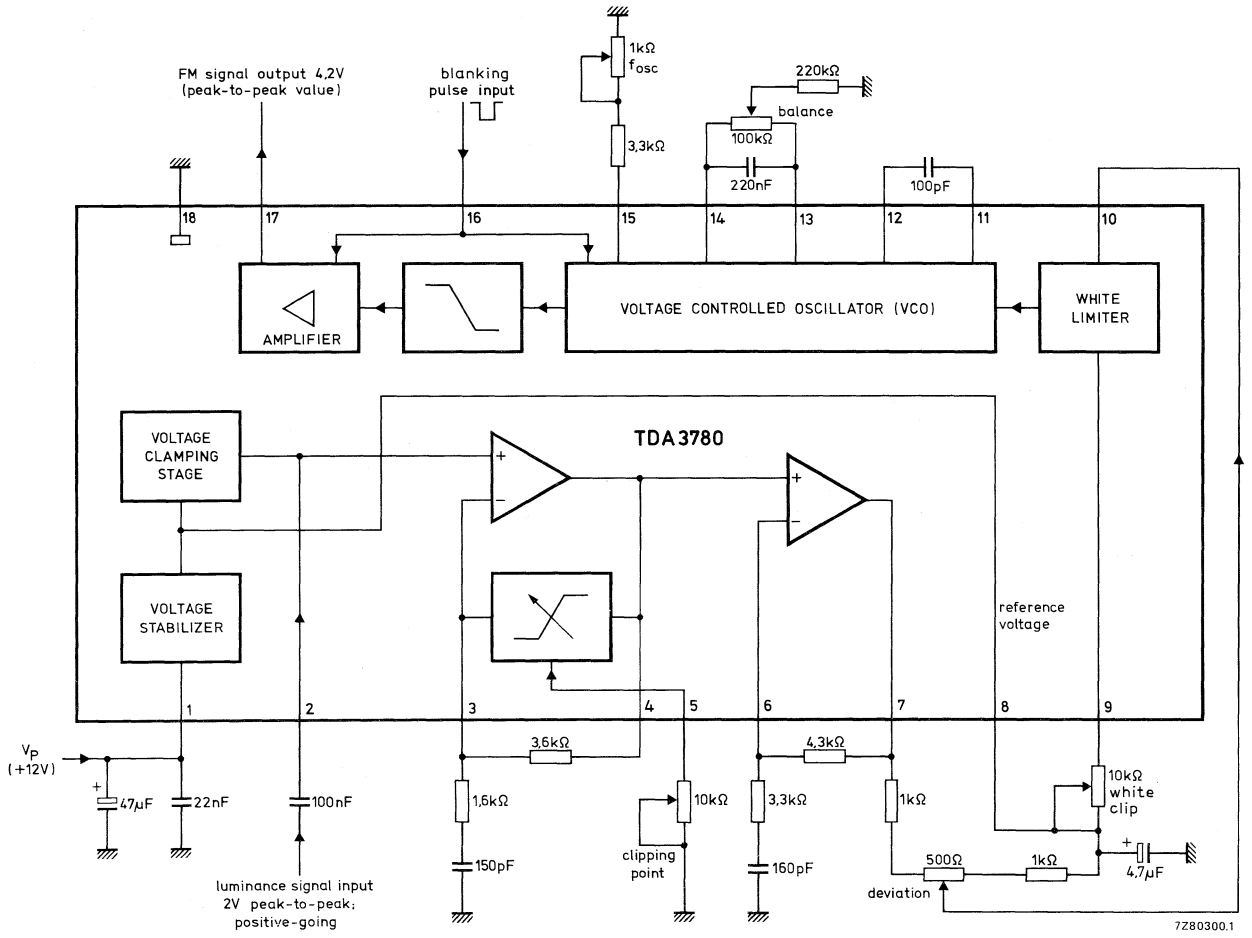


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 1)	$V_P = V_{1-18}$	max.	13,2 V
Voltage range at pins 2, 3, 4, 5, 6, 7, 9, 10, 13, 14, 15, 16, 17 to pin 18 (ground)	V_{n-18}		0 to V_P V
Voltage at pin 8	V_{8-18}	max.	10 V
Currents at pins 11 and 12	$\pm I_{11, 12}$	max.	5 mA
Total power dissipation	P_{tot}	max.	920 mW
Storage temperature range	T_{stg}		−25 to + 150 °C
Operating ambient temperature range	T_{amb}		0 to + 70 °C

CHARACTERISTICS

$V_P = V_{1-18} = 12$ V; balancing the 2nd harmonic to the minimum level; $T_{amb} = 25$ °C; measured in test circuit Fig. 1; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 1)					
Supply voltage	$V_P = V_{1-18}$	9,6	12	13,2	V
Supply current	$I_P = I_1$	–	52	–	mA
Reference voltage	V_{8-18}	–	4	–	V
Clamping stage and pre-emphasis (dynamic) **amplifier**					
Luminance input signal (pin 2) (peak-to-peak value)	$V_{2-18(p-p)}$	–	2	–	V
Input impedance at $V_{2-18} < V_{8-18}$; $-I_2 = 1$ mA	$\lvert Z_{2-18}\rvert$	–	25	–	Ω
Input current at $V_{2-18} > V_{8-18}$	I_2	–	2	–	μA
Input bias current	I_3	–	1	–	μA
Clamping voltage for the input signal clamped at top sync	V_{2-18}	–	4	–	V
Gain-bandwidth product		30	–	–	MHz
Output voltage (pin 4)	V_{4-18}	2,5	–	8	V
Start of gain reduction (adjustable at pin 5)	V_{4-3}	100	–	–	mV

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Pre-emphasis (linear) **amplifier**					
Input bias current	I_6	–	–	1	μA
Gain-bandwidth product		–	30	–	MHz
Output voltage (pin 7)	$V_{7\text{-}18}$	2,5	–	8	V
White limiter (pin 10)					
Limitation					
at $I_9 = 0$	$V_{10\text{-}18}$	7,5	–	–	V
at $I_9 = 0{,}5$ mA	$V_{10\text{-}18}$	–	4	–	V
Voltage controlled oscillator (VCO)					
Output frequency with $C_{osc} = 100$ pF (pin 11-12); $R_{osc} = 3{,}8$ kΩ (pin 15)	f_{osc}	3,04	3,30	3,56	MHz
Oscillator steepness	$f_{osc}/\Delta V_{10\text{-}18}$	–	1,5	–	MHz/V
FM output signal switching stage					
Input voltage to switch FM off	$V_{16\text{-}18}$	–	–	4	V
Input voltage to switch FM on	$V_{16\text{-}18}$	6	–	–	V
Output voltage suppression with FM switched off	α_o	50	–	–	dB
Output stage (pin 17)					
D.C. output voltage	$V_{17\text{-}18}$	–	6	–	V
FM signal output voltage (peak-to-peak value)	$V_{17\text{-}18(p\text{-}p)}$	–	4,2	–	V
Suppression of the 2nd harmonic					
$\frac{V\ (1st\ harmonic)}{V\ (2nd\ harmonic)}$	α_{harm}	40	–	–	dB
AM suppression	α_{AM}	40	–	–	dB
Crosstalk between output and input	$\frac{V_{17\text{-}18}}{V_{2\text{-}18}}$	40	–	–	dB

BAND SELECTOR AND WINDOW DETECTOR

GENERAL DESCRIPTION

The TDA3791 is a monolithic integrated circuit intended for application in search-tuning systems for video recorders. It is designed to select one out of four tuners, each representing a particular band. Band selection tuning is indicated by a variable voltage V_{AFC}.

Features

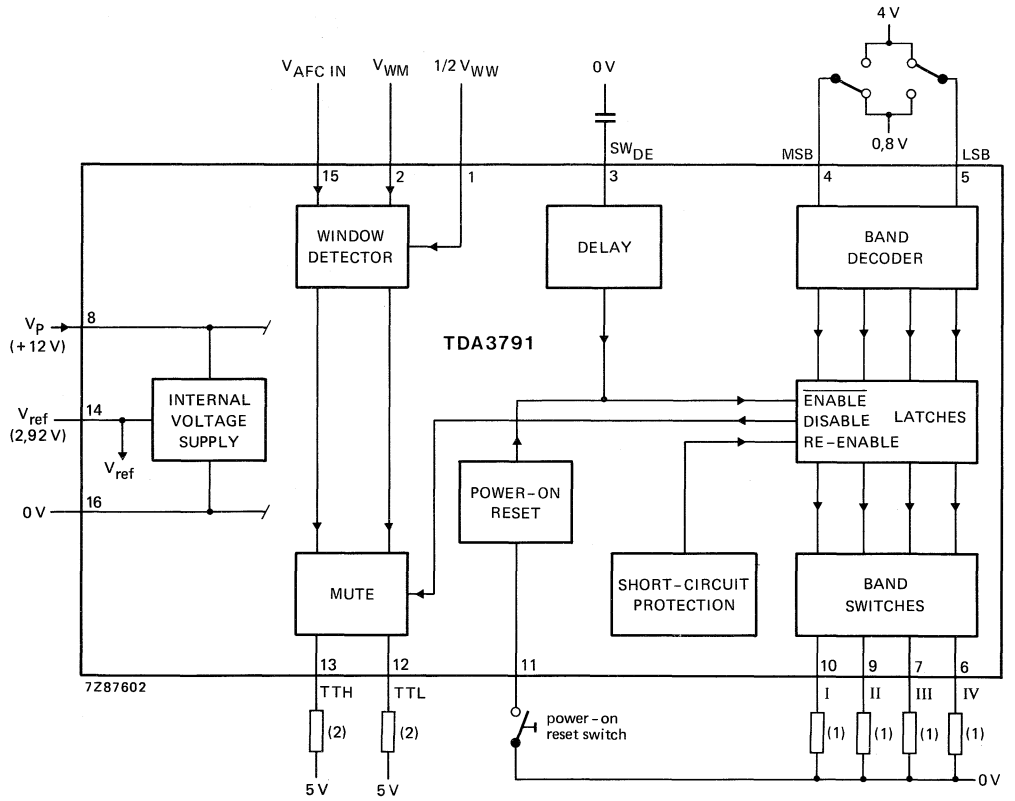
- Voltage window detector
- Band switch selector
- 4 short-circuit protected band switches
- Muting circuit
- Delay circuit
- Short-circuit protection circuit
- Power-on reset

QUICK REFERENCE DATA

Supply voltage (pin 8)	$V_P = V_{8\text{-}16}$	typ.	12 V
Supply current (pin 8)	$I_P = I_8$		
unloaded band switches ON		typ.	25 mA
all band switches OFF		typ.	12 mA
Power dissipation	P_{tot}	max.	1,8 W
Storage temperature range	T_{stg}	−65 to +150	°C
Operating ambient temperature range	T_{amb}	0 to 70	°C

PACKAGE OUTLINE

16-lead DIL; plastic with internal heat spreader (SOT-38WE-2).



(1) $R = \frac{10\ V}{35\ mA}$. (2) $R = \frac{5\ V}{2\ mA}$.

Fig. 1 Block diagram.

FUNCTIONAL DESCRIPTION

Voltage window detector (see Table 1)

The voltage window is dependent upon two inputs; V_{WM} (pin 2) and $1/2V_{WW}$ (pin 1), which represent the centre of the window and the (window width)/2 respectively.

The voltage window range is from $V_{WM} - 1/2V_{WW}$ to $V_{WM} + 1/2V_{WW}$. A variable input voltage $V_{AFC\ IN}$ (pin 15) is compared with these window edges.

Table 1 Truth table; window detector

inputs	outputs	
$V_{AFC\ IN} = V_{15-16}$; $V_{WM} = V_{2-16}$; $V_{WW} = V_{1-16}$	V_{12-16}	V_{13-16}
$V_{AFC\ IN} < V_{WM} - 1/2V_{WW}$	HIGH	LOW
$V_{WM} - 1/2V_{WW} < V_{AFC\ IN} < V_{WM} + 1/2V_{WW}$	HIGH	HIGH
$V_{AFC\ IN} > V_{WM} + 1/2V_{WW}$	LOW	HIGH

Where: V_{12-16} = tuning too low (TTL); V_{13-16} = tuning too high (TTH).

During transitions of the outputs (V_{12-16} and V_{13-16}), a hysteresis value of approximately 20 mV is applied at the window edges.

Band-switch selector (see Table 2)

Selection of the band switches is determined by the input voltage levels of MSB (pin 4) and LSB (pin 5).

- If MSB or LSB $>$ 4 V, the input is HIGH
- If MSB or LSB $<$ 0,8 V, the input is LOW.

The band switches are selected as confirmed by Table 2.

Table 2 Truth table; band switch selector

MSB (V_{4-16})	LSB (V_{5-16})	switch	HIGH output
HIGH	HIGH	I	V_{10-16}
HIGH	LOW	II	V_{9-16}
LOW	HIGH	III	V_{7-16}
LOW	LOW	IV	V_{6-16}

Short-circuit protected band switches

A selected band switch has a minimum output voltage of $V_P - 0,3$ V provided the current is not more than 35 mA (I_{10}, I_9, I_7, I_6). If the output voltage at pins 10, 9, 7 or 6 is less than 9 V a short-circuit condition exists, and the output current will not be more than 80 mA. In this event the band switch is switched off, after an externally determined delay.

Muting

The muting circuit is active when a selected band switch is switched off. Both outputs TTL (pin 12) and TTH (pin 13) will then be LOW.

FUNCTIONAL DESCRIPTION (continued)

Delay circuit

After selection of a band switch, it will be in a conducting state. If after selection and a delay, the output voltage has not reached 9 V, the band is switched off. This delay is determined by an external capacitor on output SW_{DE} (pin 3).

Short-circuit protection

The short-circuit protection of each switch is provided by a flip-flop. If the condition of a band switch $V_O < 9$ V is detected, its flip-flop will be set and the band switch is switched off.

In the event of an incidental short-circuit to a band switch output, the band switch can be reset by applying 0 V to the power-on reset input (pin 11) or 0 V to the switch delay output SW_{DE} (pin 3).

Power-on reset

Before the voltage supply reaches 9,6 V, the short-circuit protection flip-flops are reset to enable the selection of a band switch.

The power-on reset circuit also supplies the voltage level for short-circuit detection.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 8)	$V_P = V_{8\text{-}16}$	max. 13,2 V
Total power dissipation	P_{tot}	see Fig. 2
Storage temperature range	T_{stg}	−65 to +150 °C
Operating ambient temperature range	T_{amb}	0 to +70 °C

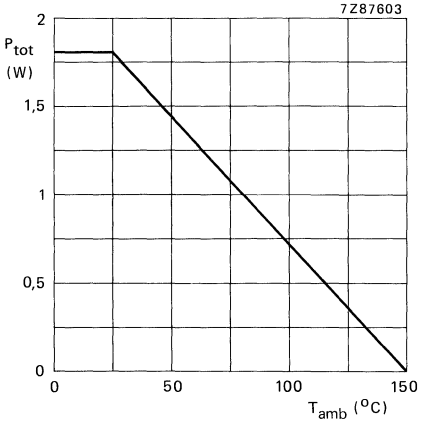


Fig. 2 Power derating curve.

CHARACTERISTICS

$V_P = V_{8-16} = 12$ V; $T_{amb} = 25$ °C; measured in Fig. 1; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply					
Supply voltage (pin 8)	$V_P = V_{8-16}$	10	12	13,2	V
Supply current (pin 8)					
unloaded band switches ON	$I_P = I_8$	18	25	38	mA
all band switches OFF	$I_P = I_8$	9	12	16	mA
Voltage range					
$1/2V_{WW}$ (pin 1)	V_{1-16}	0,1	–	4,5	V
V_{WM} (pin 2)	V_{2-16}	1,8	–	10,5	V
$V_{WM} + 1/2V_{WW}$ at $V_{8-16} - 1,4$ V	$V_{2-16} \pm V_{1-16}$	1,7	–	10,6	V
$V_{AFC\ IN}$ (pin 15)	V_{15-16}	0,5	–	11,5	V
Input current					
$1/2V_{WW}$ (pin 1)	$-I_1$	–	–	2	μA
V_{WM} (pin 2)	I_2	–	–	0,2	μA
$V_{AFC\ IN}$ (pin 15)	I_{15}	–	0,2	0,4	μA
Hysteresis voltage V_{AFC}*	ΔV_{15-16}	–	20	50	mV
Delta current at $V_{AFC\ IN}$*	ΔI_{15}	–	–	25	nA
Temperature coefficient $I_{AFC\ IN}$	$TC(I_{15})$	–	–0,42	–	nA/°C
Temperature coefficient I_{WM}	$TC(I_2)$	–	–0,27	–	nA/°C
Deviation of applied voltage (pin 1)					
at $V_{1-16} = 100$ mV	ΔV_{1-16}	–35	–	+35	mV
at $V_{1-16} = 4,0$ V; $V_{2-16} = 6$ V	ΔV_{1-16}	–200	–	+200	mV
Input current (pin 4)					
at MSB $< 0,8$ V	I_4	–	–	0,1	μA
at MSB > 4 V	I_4	–	–	1,0	μA
Input current (pin 5)					
at LSB > 4 V	I_5	–	–	1,0	μA
at LSB $< 0,8$ V	I_5	–	–	0,1	μA
Voltage level (pin 4)					
at MSB HIGH	V_{4-16}	4	–	–	V
at MSB LOW	V_{4-16}	–	–	0,8	V
Voltage level (pin 5)					
at LSB HIGH	V_{5-16}	4	–	–	V
at LSB LOW	V_{5-16}	–	–	0,8	V
Short-circuit current of band switches I, II, III, IV (pins 10, 9, 7, 6)	$-I_{10, 9, 7, 6}$	35	50	80	mA
Voltage drop of band switches I, II, III, IV (pins 10, 9, 7, 6) at $I_{o(max)} = 35$ mA; $V_P = 10$ V	$V_{10, 9, 7, 6-16}$	–	–	0,3	V

* During switching of outputs V_{12-16} and/or V_{13-16}.

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Voltage level short-circuit detection at 0,75V_P	$V_{10, 9, 7, 6\text{-}16}$	8,0	9,0	9,5	V
Output voltage (pin 13) TTH at I_{13} = 2 mA (LOW)	$V_{13\text{-}16}$	–	–	0,3	V
Output voltage (pin 12) TTL at I_{12} = 2 mA (LOW)	$V_{12\text{-}16}$	–	–	0,3	V
Leakage current (pin 13) TTH at $V_{13\text{-}16}$ = 13,2 V	I_{13}	–	–	10	μA
Leakage current (pin 12) TTH at $V_{12\text{-}16}$ = 13,2 V	I_{12}	–	–	10	μA
Output current (pin 3) SW_{DE} at $V_{3\text{-}16}$ = 6 V	$-I_3$	5	12	20	μA
Maximum value of delay capacitor	C_3	–	–	40	nF
Maximum delay time at ± C_3 (nF)/(I_3/10) ms	t_d	–	–	50	ms
Power-on-reset voltage	$V_{8\text{-}16}$	6	–	9,6	V
Leakage current unswitched band switches at $V_{10, 9, 7, 6\text{-}16}$ = −12 V	$I_{10, 9, 7, 6}$	–	–	5	μA

STEREO/DUAL TV SOUND PROCESSING CIRCUITS

GENERAL DESCRIPTION

The TDA3800G; GS are stereo/dual TV sound decoder circuits for processing an a.f. and a sound i.f. signal in TV and VCR equipment, using active filters in selective frequency processing.

In deviation of our standard terms and conditions of sale the supply of the TDA3800 (ABS) does not imply any patent indemnity whatsoever with respect to the stereo-tone patent rights of I.G.R. Germany.

Features

- Signal processing of one a.f. signal and one i.f. signal
- 2nd i.f. limiter/amplifier and FM demodulator (5,742 MHz) for the second sound channel
- Pilot carrier processing with digital identification, hysteresis and short switching times
- De-matrixing of the signals for the two audio channels
- De-emphasis
- Two dual channel, independently controllable a.f. outputs
- Low-resistance a.f. outputs (short-circuit protected); can be used for headphone
- Standardized switched output for controlling external audio/video equipment
- Signal path control by an identification bit (also in audio/video mode)
- LED indication of selected mode (also in audio/video mode)
- Possibility to apply a.f. signals from external equipment via the de-emphasis inputs (audio/video mode)
- Mode selection of stereo/mono or sound I/sound II
  TDA3800G dynamic selection with internal storage
  TDA3800GS static selection

QUICK REFERENCE DATA

Supply voltage (pin 20)	$V_P = V_{20\text{-}15}$	typ.	12 V
2nd sound i.f. input voltage for start of limiting (r.m.s. value)	$V_{i(rms)}$	typ.	50 μV
Pilot carrier amplifier control range	ΔG_v	min.	20 dB
A.F. input voltage (r.m.s. value)	$V_{i(rms)}$	typ.	1 V
A.F. demodulator output voltage (r.m.s. value)	$V_{o(rms)}$	typ.	0,6 V
LED output current	I_{LED}	typ.	15 mA
Signal-to-noise ratio of the a.f. signal switches	S/N	typ.	80 dB
Crosstalk in stereo mode	α_S	min.	40 dB
Crosstalk in dual sound mode	α_{DS}	min.	60 dB

PACKAGE OUTLINES

28-lead DIL; plastic (SOT-117).

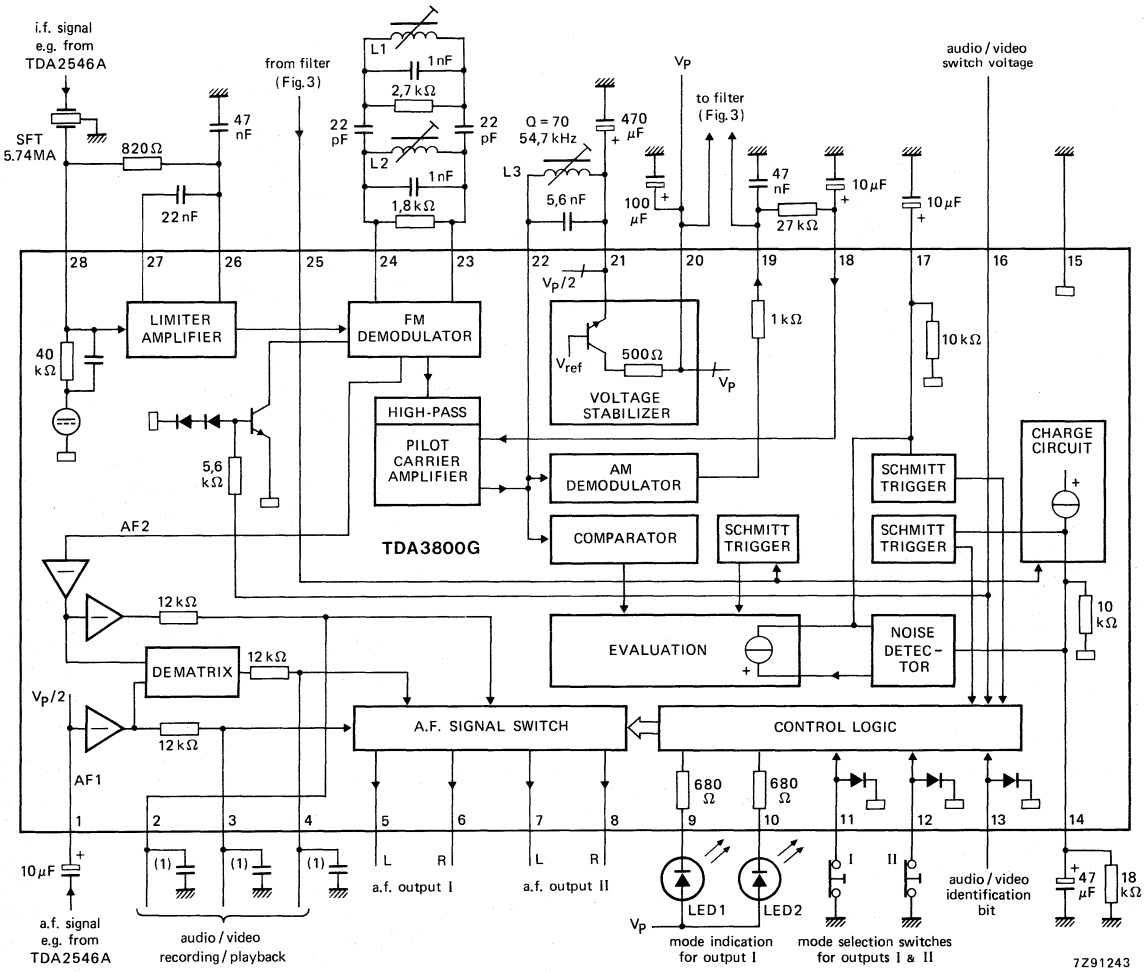


Fig. 1 TDA3800G block diagram and test circuit in accordance with Fig. 3.

(1) De-emphasis 3,9 nF.
(2) TDA3800G application using active filters.

Coil data

L1 and L2: TOKO 7 k;
$Q = 25$, $f_o = 5{,}74$ MHz.

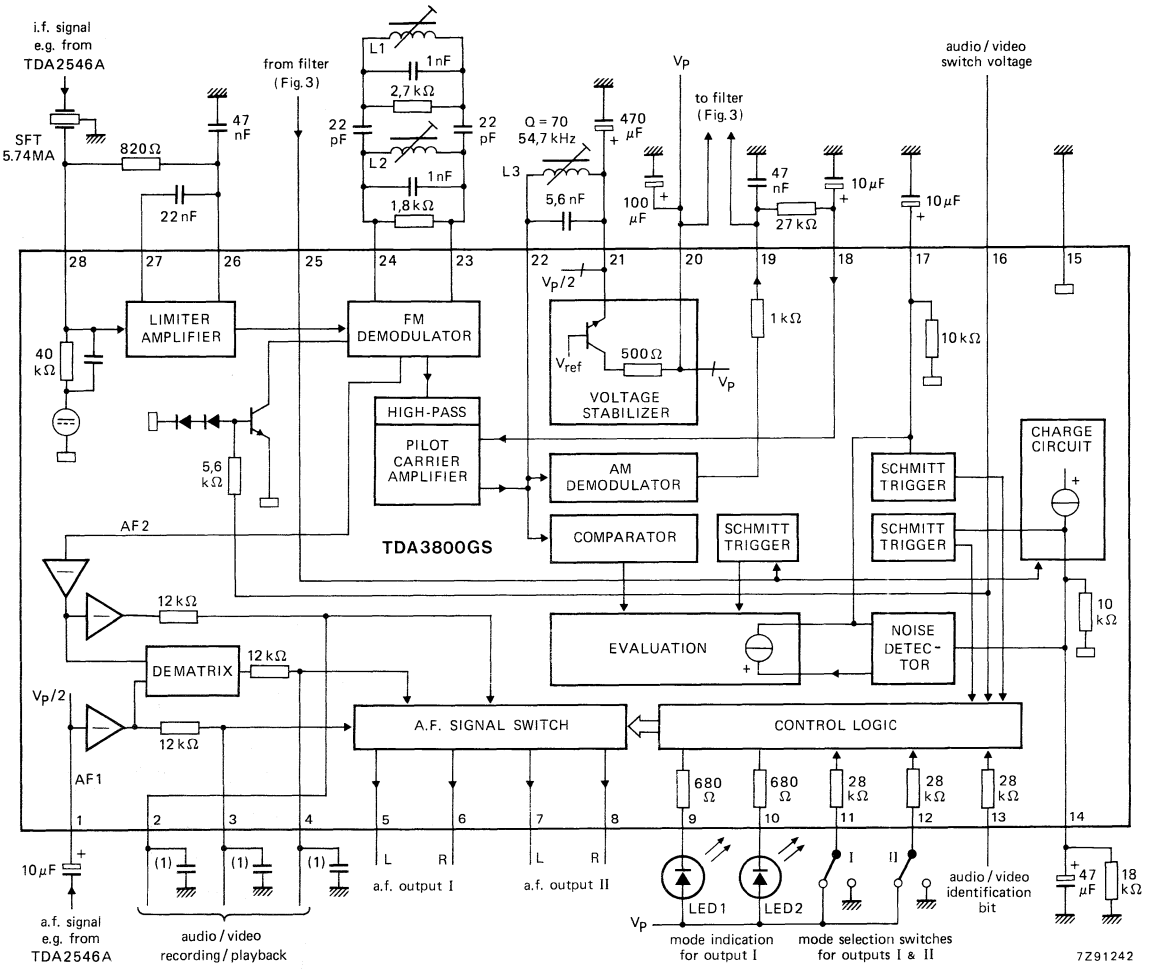


Fig. 2 TDA3800GS block diagram and test circuit in accordance with Fig. 3.

(1) De-emphasis 3,9 nF.
(2) TDA3800GS application using active filters.

Coil data

L1 and L2: TOKO 7 k;
Q = 25, f_o = 5,74 MHz.

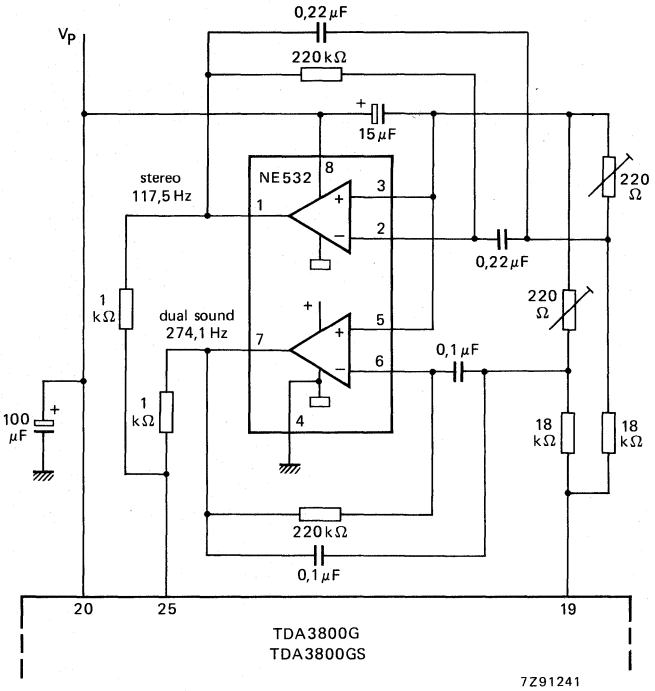


Fig. 3 External filter circuit for the identification frequencies 117,5 Hz and 247,1 Hz.

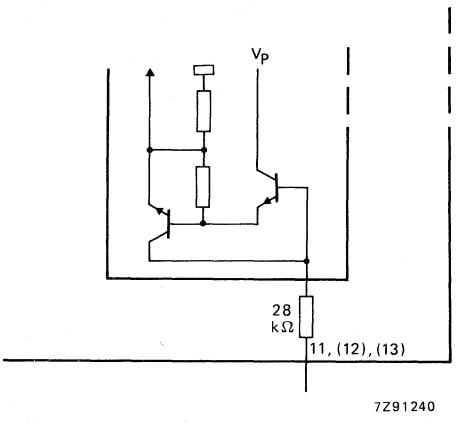


Fig. 4 TDA3800GS internal circuit for the control input leads 11, 12 and 13.

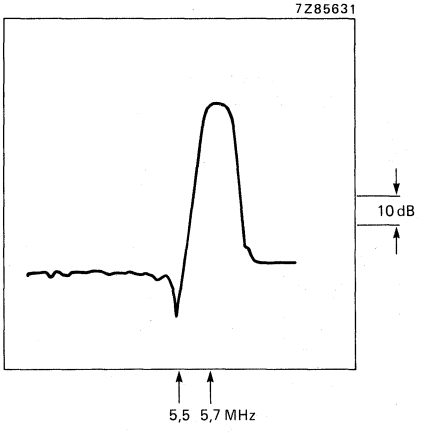


Fig. 5 IF2 filter selection.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 20)	$V_P = V_{20-15}$	max.	14 V
Voltage			
at pins 1; 9; 10; 16 and 25	V_{n-15}	max.	V_P
at pins 11; 12 and 13*	$V_{11;12;13-15}$	max.	V_P
Current			
at pins 11; 12 and 13**	$I_{11;12;13}$	max.	1 mA
at pin 21	short-circuit protected		
Total power dissipation	P_{tot}	max.	1,5 W
Storage temperature range	T_{stg}		−25 to +150 °C
Operating ambient temperature range	T_{amb}		0 to +70 °C

* TDA3800GS only.
** TDA3800G only.

CHARACTERISTICS

V_P = 12 V; T_{amb} = 25 °C; measured in Fig. 1/Fig. 2 with a 1 kHz signal. $V_{1\text{-}15(rms)}$ = 0,5 V, an i.f. signal $V_{28\text{-}15(rms)}$ = 5 mV (VC/2SC = 20 dB, Δf = ± 50 kHz, f_m = 400 Hz) and with adjusted de-matrix circuit; i.f. filter selection at input pin 28 as in Fig. 5; unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
Supply (pin 20)					
Supply voltage range	$V_P = V_{20\text{-}15}$	10,8	12	13,2	V
Supply current (without LED current; mono)	$I_P = I_{20}$	40	–	87	mA
FM limiter/amplifier and demodulator					
Start of limiting	$V_{28\text{-}15(rms)}$	–	–	60	μV
Input resistance	$R_{28\text{-}15}$	–	40	–	kΩ
Input capacitance (Fig. 5)	$C_{28\text{-}15}$	–	4,5	–	pF
AM suppression at V_i = 0,5 mV; Δf = ± 30 kHz	α_{AMS}	50	–	–	dB
Pilot carrier processing					
D.C. input voltage	$V_{18\text{-}15}$	–	7,2	–	V
D.C. voltage (reference via tuning coil)	$V_{22\text{-}15}$	–	6,0	–	V
AM demodulator output voltage	$V_{19\text{-}15}$	–	7,3	–	V
Controlled pilot carrier output voltage (peak-to-peak value)	$V_{22\text{-}21(p\text{-}p)}$	–	250	–	mV
Output resistance	$R_{22\text{-}15}$	50	–	–	kΩ
Identification frequency evaluation					
No identification signal (lower threshold)	$V_{14\text{-}15}$	–	–	2	V
Identification signal (upper threshold)	$V_{14\text{-}15}$	4	–	–	V
Stereo transmission	$V_{17\text{-}15}$	–	–	2	V
Dual sound transmission	$V_{17\text{-}15}$	4	–	–	V
De-matrixing					
Output voltages	$V_{2;3;4\text{-}15}$	–	5,3	–	V
De-emphasis output resistances	$R_{2;3;4\text{-}15}$	–	12	–	kΩ
A.F. output signal of 2nd i.f. (r.m.s. value)	$V_{2\text{-}15(rms)}$	–	0,6	–	V
Attenuation of the demodulator output signal AF2 at audio/video mode	α_{AF2}	75	–	–	dB
Distortion of the AF2 signal $V_{o2\text{-}15}$	d_{tot}	–	0,4	–	%

parameter	symbol	min.	typ.	max.	unit
AF1 input					
D.C. input voltage	$V_{1\text{-}15}$	–	6	–	V
Input resistance	$R_{1\text{-}15}$	–	14	–	kΩ
Maximum input signal (r.m.s. value)	$V_{1\text{-}15(rms)}$	–	2	–	V
A.F. signal switches					
D.C. output voltages	$V_{5;6;7;8\text{-}15}$	–	5,3	–	V
Output resistances	$R_{5;6;7;8\text{-}15}$	–	200	–	Ω*
Maximum a.f. output signals (r.m.s. value)					
for $V_{AFI(rms)}$	$V_{5;6\text{-}15(rms)}$	–	2	–	V
for $V_{AFII(rms)}$	$V_{7;8\text{-}15(rms)}$	–	2	–	V
Total distortion when applying a signal at $V_{2;3;4\text{-}15(rms)} = 0{,}5$ V	d_{tot}	–	–	0,1	%
Signal plus noise-to-noise ratio	S + S/N	–	80	–	dB
Crosstalk attenuation					
in stereo mode (f = 1 kHz at pin 2)	α_S	40	–	–	dB
in dual sound mode (f = 20 Hz to 20 kHz)	α_{DS}	60	–	–	dB
Audio/video switch					
Audio/video switch voltage					
for playback (HIGH)	$V_{16\text{-}15}$	7	–	V_P	V
for recording (LOW)	$V_{16\text{-}15}$	0	–	2,5	V
Audio/video identification bit (TDA3800G)					
for stereo mode (LOW)	$V_{13\text{-}15}$	0	–	0,2	V
for dual sound mode (HIGH) at $V_{13\text{-}15} \approx 0{,}7$ V	I_{13}	–	0	–	mA
Audio/video switch voltage (TDA3800GS) (stereo/dual sound)					
for stereo mode (LOW)	$V_{13\text{-}15}$	–	–	0,8	V
for dual sound mode (HIGH)	$V_{13\text{-}15}$	2,4	–	–	V
Mode selection switches for outputs I and II					
Active LOW (TDA3800G) input voltage LOW	$V_{11;12\text{-}15}$	0	–	0,2	V
switch open condition at $V_{11;12\text{-}15} \approx 0{,}7$ V	$I_{11;12}$	–	0	–	mA
Pulse duration	t_p	1	–	–	μs

* Connection of high-impedance headphones is possible.

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Switching voltage (TDA3800GS)					
Mono transmission both equals I and II mono					
Dual sound transmission switching voltage to pin 11 (pin 12 not affected)					
a.f. output II sound I and a.f. output I sound II	V_{11-15}	–	–	0,8	V
a.f. output I sound I and a.f. output II and II	V_{11-15}	2,4	–	–	V
Stereo transmission switching voltage to pin 12 (pin 11 not affected)					
a.f. outputs I and II mono	V_{12-15}	–	–	0,8	V
a.f. outputs I and II stereo	V_{12-15}	2,4	–	–	V
Mode indication (pins 9 and 10; see also Table 1)					
Only the mode for output I is indicated					
Maximum output current	$I_{9;10}$	–	15	–	mA
Voltage stabilizer (pin 21)					
Output voltage	V_{21-15}	–	6	–	V
Maximum d.c. output current short-circuit protected	$\pm I_{21}$	–	0,5	–	mA

Notes to the characteristics (TDA3800G only)

1. Serial commands for stereo/mono or sound I/sound II selection are determined by the identification bit of the transmission.
2. The pushbuttons at pins 11 and 12 are assigned to the a.f. outputs I and II respectively.
3. When a transmitter changes its identification from dual sound to stereo and then back to dual sound again, the last selected dual sound signal is available automatically because of the internal storage of the choice. This is also applicable for mono/stereo selection.
4. Power-on reset: when applying the supply voltage, the stereo or the AF1 signal appears at both outputs I and II depending on the type of transmission.

Table 1 Mode indication possibilities

LED 1	LED 2	selected reception mode
OFF	OFF	mono at mono or stereo transmission
ON	ON	stereo at stereo transmission
OFF	ON	AF1 signal at dual sound transmission
ON	OFF	AF2 signal at dual sound transmission

STEREO/DUAL TV SOUND DECODER CIRCUIT

GENERAL DESCRIPTION

The TDA3803A is a stereo/dual TV sound decoder circuit with static switching for processing two a.f. signals in TV and VCR equipment. The LOW/HIGH static switching signals control the a.f. output selector. Two operational amplifiers perform bandpass filtering of the identification signals.

Features

- Amplification of the two a.f. input signals by integrated operational amplifiers
- Low distortion stereo de-matrix
- All operational amplifiers offset compensated
- De-emphasis with operational amplifiers, preferably applied to the output terminals
- Two output ports each with two channels for headphones and loudspeakers
- Dual sound information at one port, each port individually switchable from sound I to sound II and sound II to sound I
- Mute function; while mute is active, it is possible to connect an external mono a.f. input signal to pin 10 appearing at pins 20 to 23.
- Identification without additional signals (horizontal etc.)

QUICK REFERENCE DATA

Supply voltage (pin 13)	$V_P = V_{13-12}$	typ.	12 V
Supply current (pin 13)	$I_P = I_{13}$	typ.	28 mA
Pilot carrier amplifier gain control range	ΔG_v	>	40 dB
A.F. input signals; at G_v = 0 dB (r.m.s. value)	$V_{i(max)}$	=	1 V
LED output current	I_{LED}	typ.	12 mA
Weighted signal-to-noise ratio of the a.f. signal switches (CCIR468/2)	S/N	⩾	60 dB
Crosstalk in stereo mode	α_S	>	40 dB
Crosstalk in dual sound mode	α_{DS}	>	60 dB

PACKAGE OUTLINE

28-lead DIL; plastic (SOT-117).

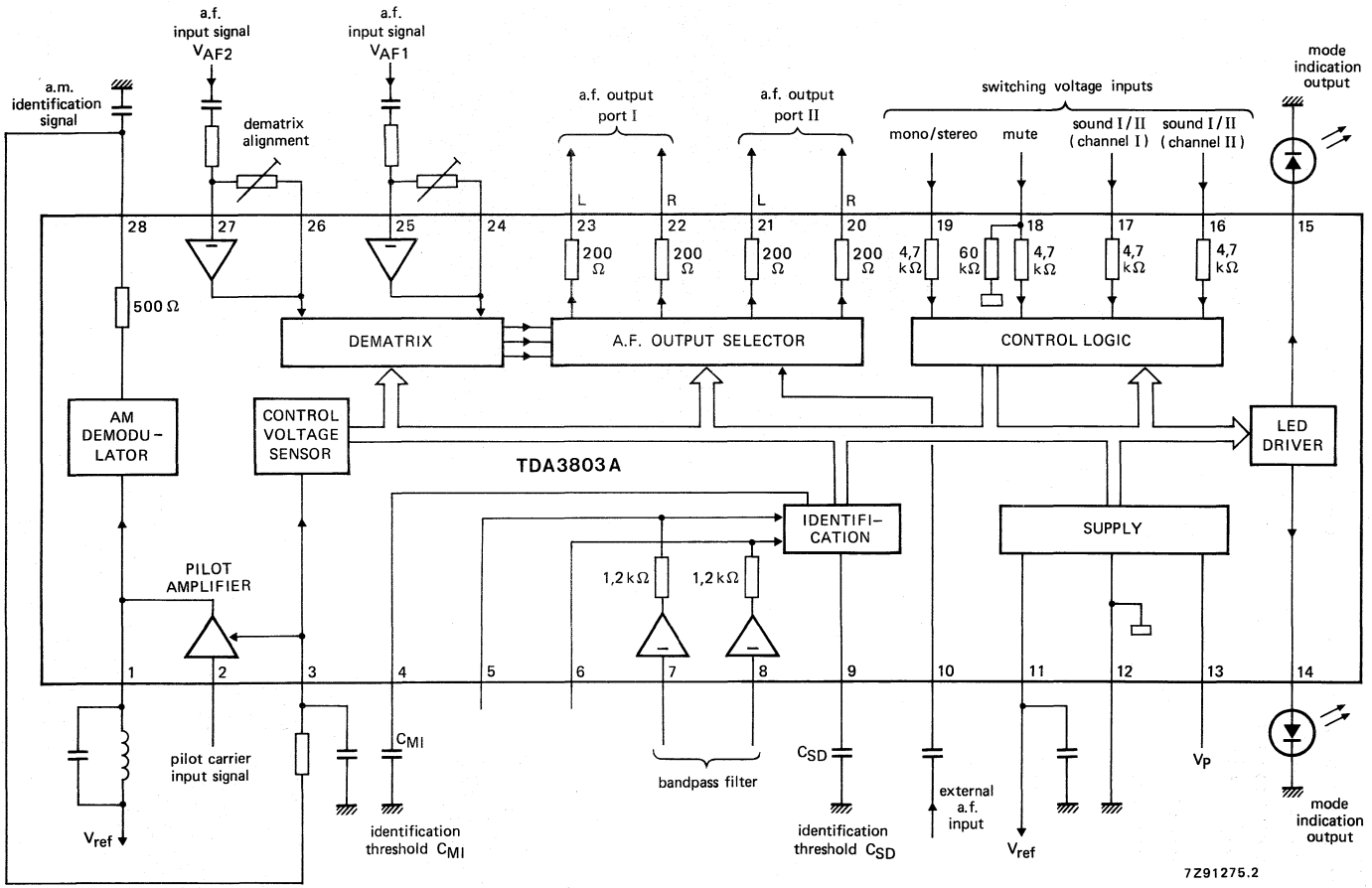


Fig. 1 TDA3803A block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 13)	$V_P = V_{13-12}$	max.	14	V
Voltages with respect to pin 12 (ground)				
pins 25; 27 and 28	$V_{25;27;28-12}$	max.	V_P	
Voltages				
pin 1 to pin 10	V_{n-12}	max.	V_P	
pin 14 to pin 19	V_{n-12}	max.	V_P	
Currents				
pin 11	I_{11}	max.	3	mA
pins 20; 21; 22; 23	$I_{20;21;22;23}$	max.	10	mA
pin 28	$-I_{28}$	max.	3	mA
Total power dissipation	P_{tot}	max.	1,5	W
Storage temperature range	T_{stg}		−25 to +125	°C
Operating ambient temperature range	T_{amb}		0 to +70	°C

CHARACTERISTICS

V_P = 12 V; T_{amb} = 25 °C; overall voltage gain $|g_{af}|$ = 1; ($R_S = R_R$); measured in Fig. 2 with a 1 kHz signal. A.F. input AF2 = AF1 = 0,5 V, pilot carrier input signal $V_{2\text{-}12(rms)}$ = 16 mV, m = 0,5 and with adjusted de-matrix circuit; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 13)					
Supply voltage range	$V_P = V_{13\text{-}12}$	10,8	12	13,2	V
Supply current (without LED current)	$I_P = I_{13}$	–	28	35	mA
Reference voltage (pin 11)	V_{ref}	–	6	–	V
Input resistance (dynamic)	$R_{11\text{-}12}$	–	4	–	kΩ
A.F. part					
Amplification	$\|G_{af}\|$	–40	–	18	dB
Input signal at $\|G_{af}\| = 1$	$V_{AF1} = V_{AF2}$	–	–	1	V
Mono a.f. input signal (pin 10)*					
Input signal	$V_{10\text{-}12}$	–	–	2	V
D.C. input voltage level	$V_{10\text{-}12}$	–	6	–	V
Input resistance	$R_{10\text{-}12}$		16	–	kΩ
Stereo mode a.f. output port I pin 22: right pin 23: left					
a.f. output port II pin 20: right pin 21: left					
Output signal (THD ≤ 0,5%)					
port I ($V_{23\text{-}12} = V_{22\text{-}12}$)	V_{oI}	–	–	2	V
port II ($V_{21\text{-}12} = V_{20\text{-}12}$)	V_{oII}	–	–	2	V
Weighted signal-to-noise ratio of the a.f. signal switches (in accordance with CCIR468/2)	S+W/W		65	–	dB
Unweighted signal-to-noise	S+N/N	60	–	–	dB
Total harmonic distortion ($V_{20;21;22;23\text{-}12}$ = 0,5 V; $\|g_{af}\| = 1$)	THD	–	0,05	–	%
Crosstalk attenuation (selective)					
stereo mode (f_1 = 1 kHz; f_2 = 400 Hz)	α_S	40	–	–	dB
dual sound mode (f = 250 Hz to 12,5 kHz)	α_{DS}	60	–	–	dB

* An input signal at pin 10 appears at pins 20 to 23 if the mute input (pin 18) is activated ($V_{18\text{-}12} \geq 2$ V).

parameter	symbol	min.	typ.	max.	unit
D.C. input voltage level at pins 25 and 27	$V_{25;27\text{-}12}$	–	6	–	V
D.C. output voltage level at pins 20; 21; 22 and 23	$V_{n\text{-}12}$	–	6	–	V
Output resistance at pins 20; 21; 22 and 23	$V_{n\text{-}12}$	–	200	–	Ω
Identification part					
Pilot carrier amplifier input signal (pin 2)	$V_{2\text{-}12}$	5	–	–	mV
gain control range	ΔG_v	40	–	–	dB
controlled output signal (pin 1) (peak-to-peak value)	$V_{1\text{-}12(p\text{-}p)}$	–	300	–	mV
Input resistance (pin 2)	$R_{2\text{-}12}$	–	60	–	kΩ
Output resistance (pin 1)	$R_{1\text{-}12}$	1	–	–	MΩ
D.C. input voltage level (pin 2) applied externally (see Fig. 2)	$V_{2\text{-}12}$	–	6	–	V
D.C. output voltage level (pin 28) without gain control	$V_{28\text{-}12}$	–	6	–	V
with gain control	$V_{28\text{-}12}$	–	7,9	–	V
Identification signal (pin 28) (peak-to-peak value)	$V_{28\text{-}12(p\text{-}p)}$	–	2,0	–	V
Filter operational amplifiers open loop gain	G_{oFT}	78	–	–	dB
Identification frequency evaluation					
No identification signal (lower threshold)	$V_{4\text{-}12}$	–	–	2,5	V
Identification signal (upper threshold)	$V_{4\text{-}12}$	4,7	–	–	V
Stereo transmission (lower threshold)	$V_{9\text{-}12}$	–	–	2,5	V
Dual sound transmission (upper threshold)	$V_{9\text{-}12}$	4,7	–	–	V
Control logic part					
Mute input voltage (pin 18) mute OFF	$V_{18\text{-}12}$	–	–	0,8	V
mute ON (see the remarks to pin 10)	$V_{18\text{-}12}$	2	–	–	V
Switching stereo/mono and sound I/sound II					
Stereo transmission switching voltage to pin 19 (pin 17 and 16 not affected)					
output ports I and II mono	$V_{19\text{-}12}$	–	–	0,8	V
output ports I and II stereo	$V_{19\text{-}12}$	2	–	–	V

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Control logic part (continued)					
Mono transmission both output ports I and II mono					
Dual sound transmission					
switching voltage to pin 16 (pin 19 and 17 not affected)					
output port II sound I	$V_{16\text{-}12}$	2	–	–	V
output port II sound II	$V_{16\text{-}12}$	–	–	0,8	V
switching voltage to pin 17 (pin 16 and 19 not affected)					
output port I sound I	$V_{17\text{-}12}$	–	–	0,8	V
output port I sound II	$V_{17\text{-}12}$	2	–	–	V
Mode indication (pins 14 and 15; see also Table 1)					
Output current	$-I_{14;\ 15}$	9	12	15	mA
Output voltage (note 2)	$V_{14;\ 15\text{-}12}$	0	–	8	V
Stereo/mono transmission: LED indication is valid for the transmission mode					
Dual sound transmission: LED indication is valid for port I					

Table 1 Mode indication (note 1)

transmission mode	LED pin 15	LED pin 14
mono	OFF	OFF
stereo:		
stereo selection; $V_{19\text{-}12} \geqslant 2$ V	ON	ON
mono selection; $V_{19\text{-}12} \geqslant 0{,}8$ V	ON	ON
dual sound:		
sound I selection; $V_{17\text{-}12} \leqslant 0{,}8$ V	ON	OFF
sound II selection; $V_{17\text{-}12} \geqslant 2$ V	OFF	ON

Notes to the characteristics

1. LED indication not affected by $V_{18\text{-}12}$.
2. Pin 14 and 15 are also suitable as output switches to control TDA3810. At "LED OFF" and $I_{14,15} \leqslant 100\ \mu A$ is $V_{14,15\text{-}12} \leqslant 200$ mA.

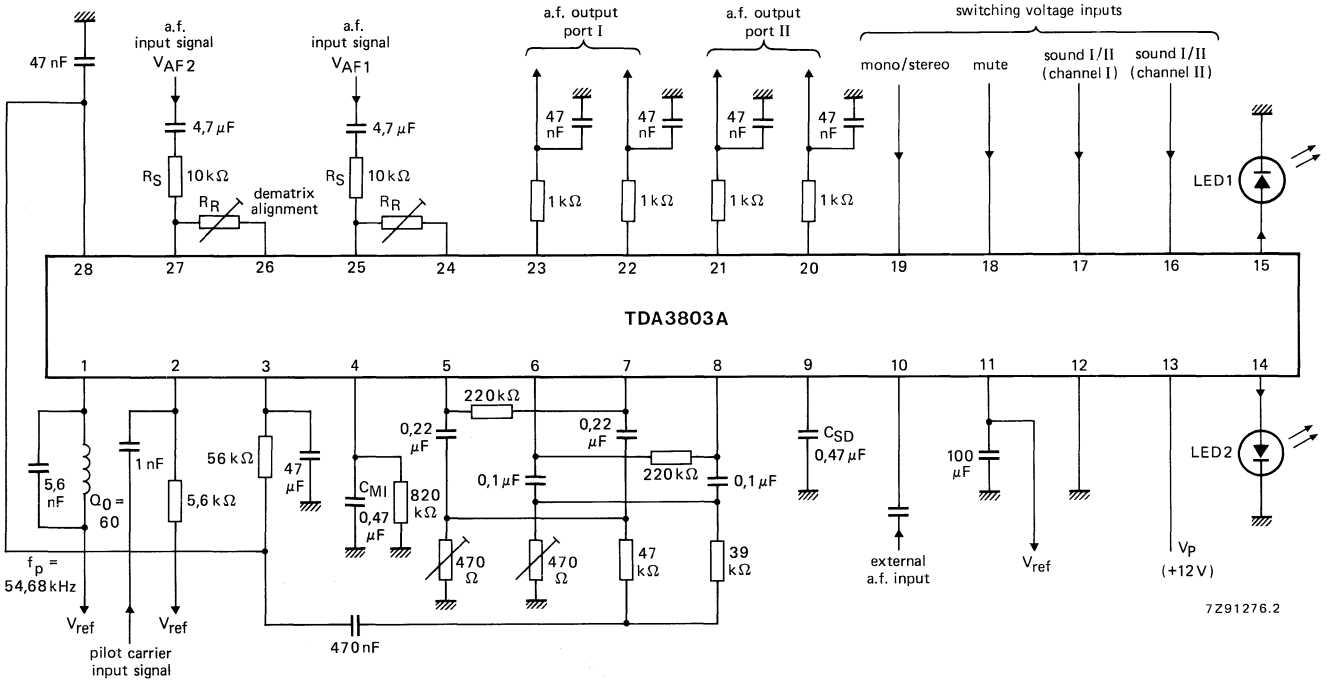


Fig. 2 TDA3803A application diagram and test circuit.

MULTIPLEX PLL STEREO DECODER

The TDA3806 is a phase-locked loop (PLL) stereo decoder for decoding the stereo multiplex signal. The decoding signal is generated by a phase-locked loop system. Second audio program (SAP) and adjacent channel interference (ACI) are suppressed by the internal circuitry. The decoder has a main signal and a sub-signal output. It is possible to apply a separate noise reduction system to the sub-signal. Main signal and noise reduced sub-signal have to be combined at an external matrix to both L and R.

Features

- Adjustable gain by external resistors (separate for main and sub-signal)
- D.C. input for smooth mono-stereo takeover control (without influencing the pilot indicator)
- Pilot dependent mono-stereo switch
- Pilot indicator driver
- PLL oscillator switch-off facility
- Buffered oscillator frequency measuring facility
- Internal suppression of Second Audio Program (SAP) distortion (5th harmonic of pilot)
- Suppression of Adjacent Channel Interference (ACI) distortion (3rd harmonic of sub carrier)
- Electronic hum filtering

QUICK REFERENCE DATA

parameter	symbol	min.	typ.	max.	unit
Supply voltage range (pin 8)	V_P	7,5	12	15	V
Supply current at V_P = 12 V	I_P	15	22	30	mA
D.C. output voltage range	$V_{15,\ 16\text{-}7}$	1	–	11	V
A.C. output voltage (r.m.s. value)	$V_{15,\ 16\text{-}7(rms)}$	–	1,25	–	
Voltage gain sub-signal	V_{15}/V_{sub}	–	13,5	–	dB
Voltage gain main signal	V_{16}/V_{main}	–	19,5	–	dB
Total harmonic distortion	THD	–	0,1	0,5	%
Operating ambient temperature range	T_{amb}	0	–	+70	°C
Storage temperature range	T_{stg}	–25	–	+150	°C

PACKAGE OUTLINE

18-lead dual in-line; plastic (SOT-102)

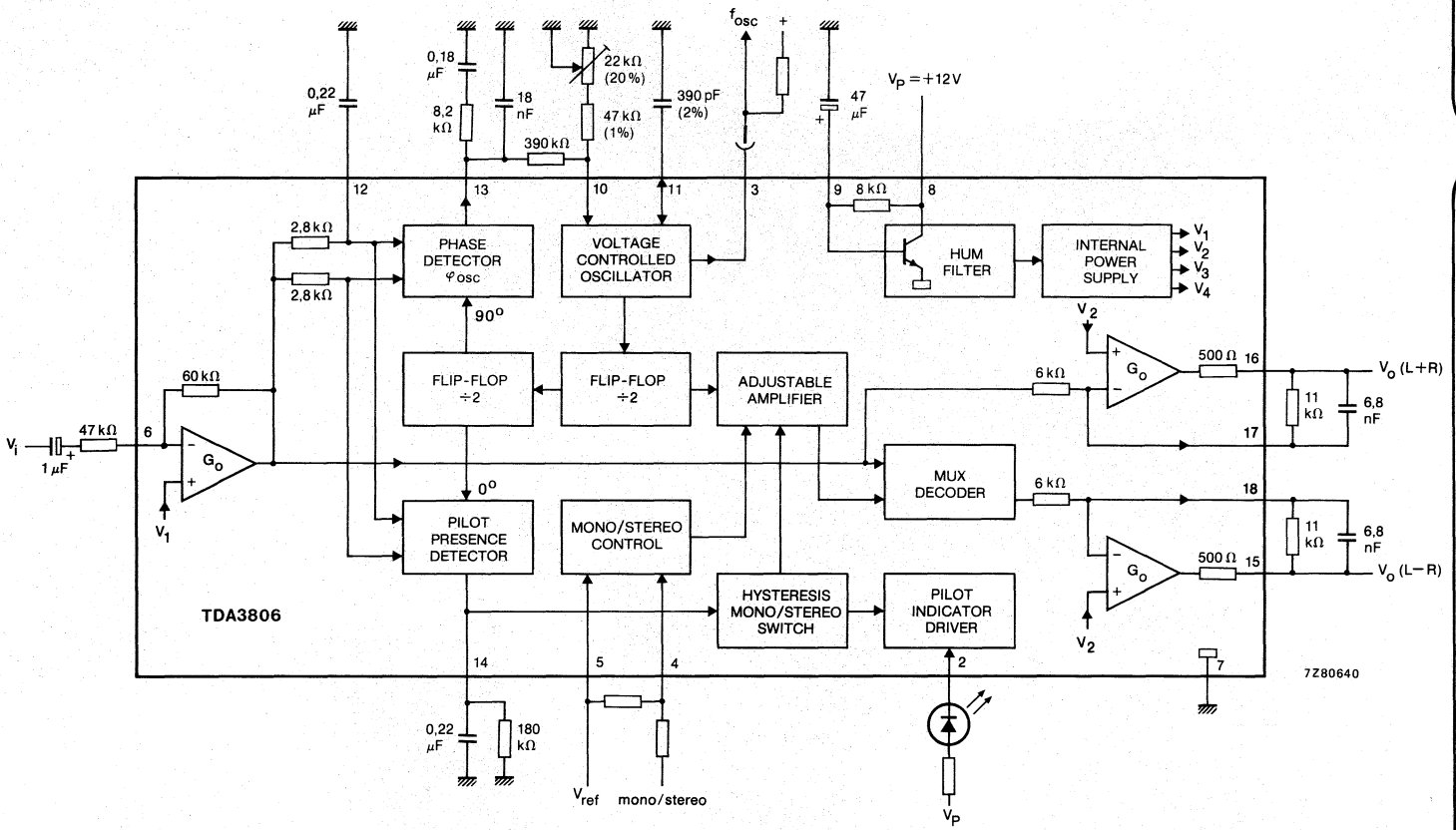


Fig. 1 Block diagram and test circuit.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

parameter	symbol	min.	typ.	max.	unit
Supply voltage	V_{8-7}	–	–	16	V
Input voltage (d.c.)	$V_{4,\,5-7}$	0	–	12	V
Input voltage osc. frequency	V_{3-7}	0	–	V_P	V
Indicator driver voltage	V_{2-7}	–	–	16	V
Indicator driver output current	I_2	–	–	20	mA
Total power dissipation at T_{amb} = 25 °C (see Fig. 2)	P_{tot}	–	–	1200	mW
Storage temperature	T_{stg}	–25	–	+150	°C
Operating ambient temperature	T_{amb}	0	–	+70	°C

D.C. CHARACTERISTICS

Supply voltage (V_P) = 12 V; T_{amb} = 25 °C; unless otherwise specified.
See Fig. 1.

parameter	symbol	min.	typ.	max.	unit
Supply voltage range V_P	V_{8-7}	7,5	12	15	V
Supply current without indicator current	I_8	15	22	30	mA
Bias input voltage	V_{6-7}	–	5	–	V
Bias voltage output stages	$V_{17,\,18-7}$	–	6,7	–	V
Offset current via ext. feedback resistors	I_{17-16} I_{18-15}	–	30	–	μA
Output voltage range	$V_{15,\,16-7}$	1	–	V_P–1	V
Oscillator frequency voltage range	V_{3-7}	0	–	12	V
Voltage range M/St control	V_{4-7}	0	–	4	V
Reference voltage	V_{5-7}	0	–	4	V
Saturation voltage pilot indicator; I_2 = 20 mA	$V_{2-7(sat)}$	–	0,5	–	V

A.C. CHARACTERISTICS

Multiplex input voltage $V_{6-7(p-p)}$ = 0,85 V inclusive 9 % pilot
(m = 100 % ≙ Δf = ±55 kHz, f_{mod} = 1 kHz), circuit as Fig. 1, unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
Input impedance (to be selected)	R_i	–	47	–	kΩ
Output current	$\pm I_{15,16}$	–	4	–	mA
Output voltage (r.m.s. value)	$V_{15,\,16-7(rms)}$	–	1,25	–	V
Voltage gain sub-signal					
sub-signal	V_{out15}/V_{sub}	–	13,5	–	dB
main signal	V_{out16}/V_{main}	–	19,5	–	dB

DEVELOPMENT DATA

parameter	symbol	min.	typ.	max.	unit
Difference of gain	G_{16}/G_{15}	5	6	7	dB
Total harmonic distortion $V_{15,\ 16\text{-}7}$ = 1,25 V	THD	–	0,1	0,5	%
Electronic hum filter					
Ripple rejection $V_{P\ ripple(rms)}$ = 200 mV f = 100 Hz	RR	32	35	–	dB
Carrier suppression V_o = 1,25 V pilot suppression					
1st harmonic	α 1	30	32	–	dB
2nd harmonic	α 2	40	50	–	dB
3rd harmonic	α 3	–	45	–	dB
4th harmonic	α 4	–	55	–	dB
Suppression of frequencies generated by interference SAP suppression	α_{SAP}	60	75	–	dB
Unweighted output noise voltage r.m.s. value, b = 20 Hz to 16 kHz	$V_{N(15)}$	–	30	–	μV
	$V_{N(16)}$	–	50	–	μV
Weighted output noise voltage according to CCIR 468; peak value	$V_{N(15)}$	–	90	–	μV
	$V_{N(16)}$	–	150	–	μV
Voltage controlled oscillator (VCO)					
Nominal frequency *	f_{osc}	–	63,4	–	kHz
Capture range	$\pm\Delta f/f$	2	–	–	%
Temperature coefficient	$\pm TK_{osc}$	–	1	–	10^{-4}/K
Mono-stereo switch					
Pilot threshold "stereo on" voltage (peak-to-peak)	$V_{pilot\ on}$	–	–	50	mV
Pilot threshold "stereo off" voltage (peak-to-peak)	$V_{pilot\ off}$	8	–	–	mV
Hysteresis	α	–	2,5	–	dB

* The oscillator frequency can be measured at pin 3 (low impedance output), when a resistor of 10 kΩ is switched from pin 3 to the supply voltage ($V_{3\text{-}7} > 6$ V).

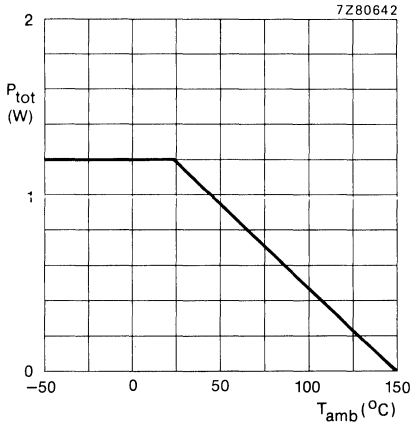


Fig. 2 Power derating curve.

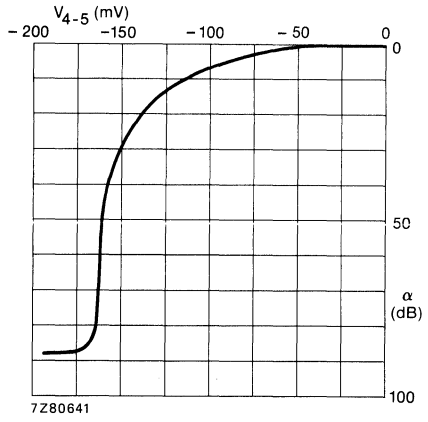


Fig. 3 Sub-signal attenuation as a function of the control voltage (V_{4-5}).

DEVELOPMENT DATA

SPATIAL, STEREO AND PSEUDO-STEREO SOUND CIRCUIT

The TDA3810 integrated circuit provides spatial, stereo and pseudo-stereo sound for radio and television equipment.

Features

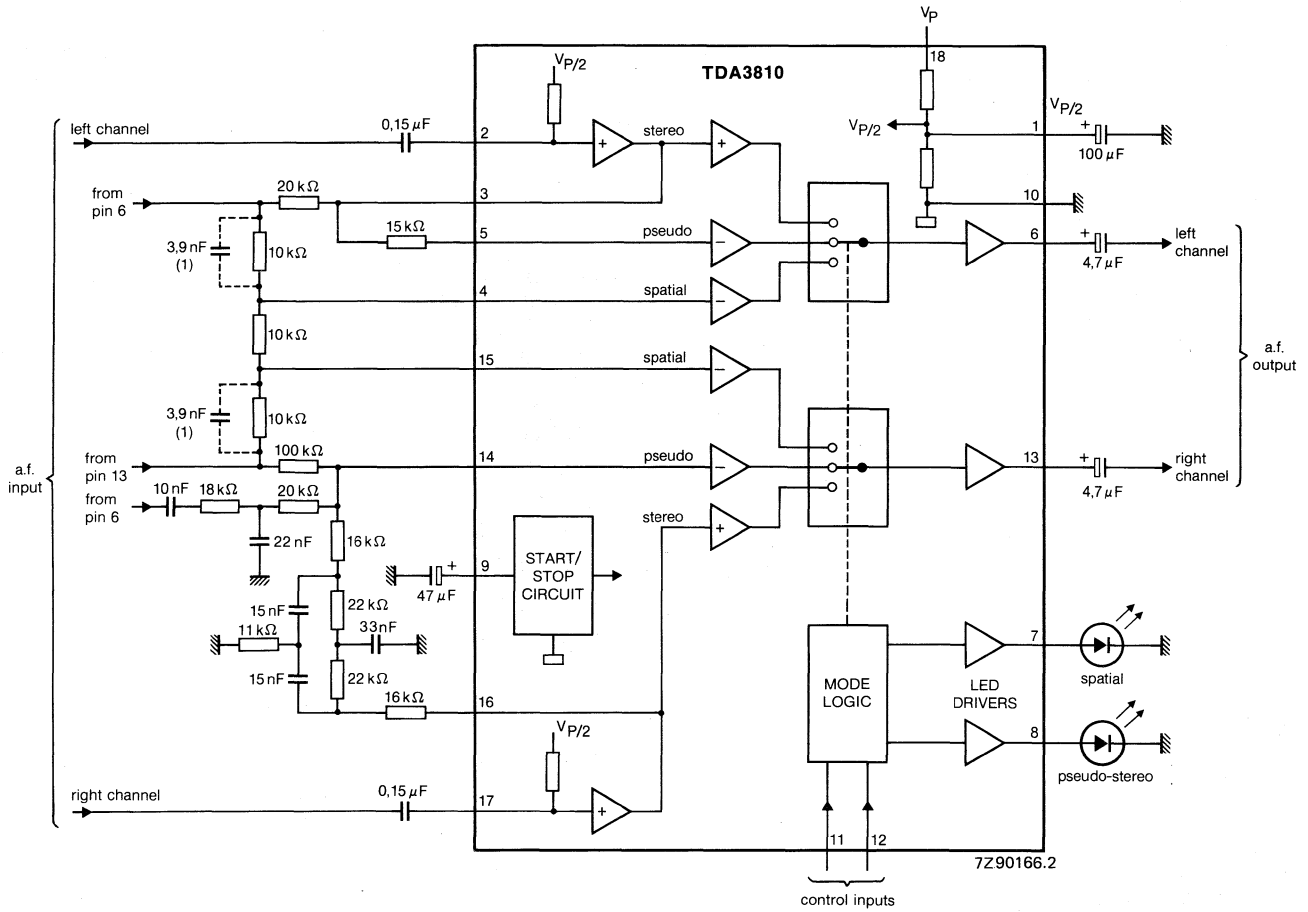
- Three switched functions: spatial (widened stereo image)
  stereo
  pseudo-stereo (artificial stereo from a mono source)
- Offset compensated operational amplifiers to reduce switch noise
- LED driver outputs to facilitate indication of selected operating mode
- Start/stop circuit to reduce switch noise and to prevent LED-flicker
- TTL-compatible control inputs

QUICK REFERENCE DATA

Supply voltage (pin 18)	V_P	typ.	12 V
Supply current (LEDs off)	I_P	typ.	6 mA
Operating ambient temperature range	T_{amb}	0 to	+ 70 °C
Input signal (r.m.s. value)	$V_{i(rms)}$	<	2 V
Total harmonic distortion (stereo)	THD	typ.	0,1 %
Channel separation (stereo)	α	typ.	70 dB
Gain (stereo)	G_v	typ.	0 dB

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102HE).



(1) Used in spatial mode for correction of high frequency only (optimal performance).

Fig. 1 Block diagram/test circuit showing external components; for control inputs to pins 11 and 12 see truth table.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 18)	V_P	max.	18 V
Storage temperature range	T_{stg}	−25 to + 150	°C
Operating ambient temperature range	T_{amb}	0 to + 70	°C

THERMAL RESISTANCE

From crystal to ambient	$R_{th\ cr\text{-}a}$	=	80 K/W

CHARACTERISTICS

V_P = 12 V; T_{amb} = 25 °C; test circuit Fig. 1 stereo mode (pin 11 to ground) unless otherwise specified. Output load: $R_{6\text{-}10,13\text{-}10} \geqslant 4{,}7$ kΩ; $C_{6\text{-}10,13\text{-}10} \leqslant 150$ pF.

parameter	symbol	min.	typ.	max.	unit
Supply voltage range (pin 18)	V_P	4,5	–	16,5	V
Supply current	I_P	–	6	12	mA
Reference voltage	V_S	5,3	6	6,7	V
Input voltage (pin 2 or 17) THD = 0,2% (stereo mode)	$V_{i(rms)}$	–	–	2	V
Input resistance (pin 2 or 17)	R_i	50	75	–	kΩ
Voltage gain V_o/V_i	G_v	–	0	–	dB
Channel separation (R/L)	α	60	70	–	dB
Total harmonic distortion f = 40 to 16 000 Hz; $V_{o(rms)}$ = 1 V	THD	–	0,1	–	%
Power supply ripple rejection	RR	–	50	–	dB
Noise output voltage (unweighted) left and right output	$V_{n(rms)}$	–	10	–	μV
SPATIAL MODE (pins 11 and 12 HIGH) Antiphase crosstalk	α	–	50	–	%
Voltage gain	G_v	1,4	2,4	3,4	dB

PSEUDO-STEREO MODE

The quality and strength of the pseudo-stereo effect is determined by external filter components.

parameter	symbol	min.	typ.	max.	unit
CONTROL INPUTS (pins 11 and 12)					
Input resistance	R_i	70	120	–	kΩ
Switching current	$-I_i$	–	35	100	μA
LED DRIVERS (pins 7 and 8)					
Output current for LED	$-I_o$	10	12	15	mA
Forward voltage	V_F	–	–	6	V

Truth table

mode	control input state		LED spatial pin 7	LED pseudo pin 8
	pin 11	pin 12		
Mono pseudo-stereo	HIGH	LOW	off	on
Spatial stereo	HIGH	HIGH	on	off
Stereo	LOW	X	off	off

LOW = 0 to 0,8 V (the less positive voltage)
HIGH = 2 V to 5,5 V (the more positive voltage)
X = don't care

VERTICAL DRIVER

GENERAL DESCRIPTION

This monolithic integrated circuit is an inverting buffer between the pulse pattern generator SAA1008 (LOCMOS technology) and the image sensors NXA1010 to NXA1040.

The circuit consists of four drivers either for all vertical transfer clocks for image part (1A to 4A), or all vertical transfer clocks for storage part (1B to 4B) electrodes, and one driver for a transfer gate (TG) electrode.

QUICK REFERENCE DATA

parameter	symbol	min.	typ.	max.	unit
Supply voltage range (pin 13)	V_{13-16}	4,5	5,0	5,5	V
Supply voltage range (pin 1)	V_{1-16}	11,00	11,25	11,50	V
Supply current at V_P = 5 V	I_{13}	–	14	–	mA
Operating current V_{1-16} = 11,25 V	I_1	–	9,25	–	mA
Storage temperature	T_{stg}	−25	–	+ 150	°C
Operating ambient temperature	T_{amb}	−20	–	+ 70	°C

PACKAGE OUTLINE

16-lead dual in-line; plastic (SOT-38).

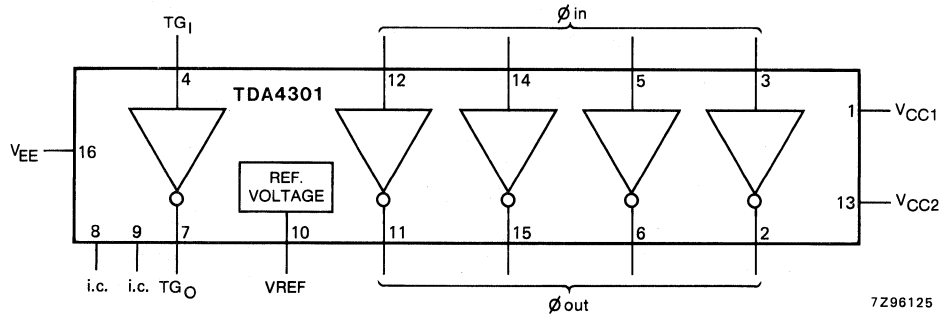


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

parameter	symbol	min.	typ.	max.	unit
Supply voltage (pin 1)	V_{CC1}	–	–	+ 12	V
Supply voltage (pin 13)	V_{CC2}	–	–	+ 12	V
D.C. output currents					
pins 2, 6, 11 and 15; $t < 1$ s	I_O	–	–	250	mA
pin 7; $t < 1$ s	I_{TGO}	–	–	10	mA
Total power dissipation	P_{tot}	–	–	550	mW
Operating ambient temperature	T_{amb}	–20	–	+ 70	°C
Storage temperature	T_{stg}	–25	–	+ 150	°C

D.C. CHARACTERISTICS

parameter	symbol	min.	typ.	max.	unit
Supply voltage (pin 13)	V_{CC2}	4,5	5,0	5,5	V
Supply voltage (pin 1)	V_{CC1}	11,00	11,25	11,50	V
Reference voltage (pin 10)	V_{ref}	3,60	3,75	3,90	V
Supply current (pin 13)	I_{CC2}	–	14,0	–	mA
Operating current (pin 1)	I_{CC1}	–	9,25	–	mA

A.C. CHARACTERISTICS

$V_{CC1} = V_{1-16} = 11{,}25$ V; $V_{CC2} = V_{13-16} = 5{,}0$ V; $T_{amb} = 25$ °C

parameter	symbol	min.	typ.	max.	unit
Inputs ϕ and TGI (pins 3, 5, 4, 12 and 14)					
Input voltage range	V_ϕ	0	–	5	V
Input threshold voltage	$V_{\phi TH}$	0,9	1,1	1,3	V
Input current ($V_\phi = 5$ V)	I_ϕ	–	10,0	30,0	μA
Outputs ϕ (pins 2, 6, 15 and 11)					
Load $C_L = 2000$ pF					
Output voltage swing	$V_{\phi\,(p\text{-}p)}$	–	10,0	–	V
Timing (Fig. 2)					
delay neg. slope	t_{d1}	–	–	100	ns
negative slope (fall time)	t_{d5}	50	70	90	ns
delay pos. slope	t_{d3}	–	–	100	ns
positive slope (rise time)	t_{d6}	30	50	70	ns
Output TG (pin 7)					
Load $C_L = 68$ pF					
Output voltage swing	$V_{TGO\,(p\text{-}p)}$	–	10,0	–	V
Timing (Fig. 2)					
delay neg. slope	t_{d1}	–	–	100	ns
negative slope (fall time)	t_{d5}	70	100	120	ns
delay pos. slope	t_{d3}	–	–	100	ns
positive slope (rise time)	t_{d6}	50	70	90	ns

DEVELOPMENT DATA

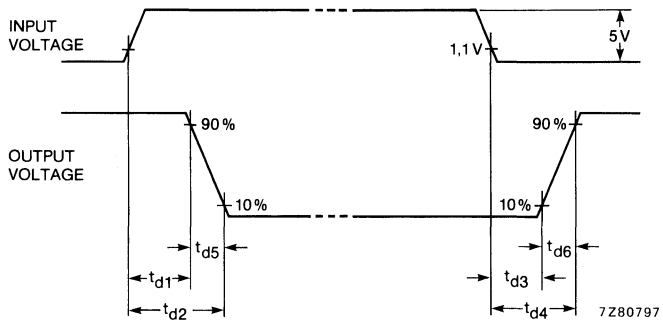


Fig. 2 Timing diagram.

Load output (ϕ_{out}) capacitor $C_L = 2000$ pF; output TG_O load $C_L = 68$ pF. At the specified load only one switching may be done at a time.

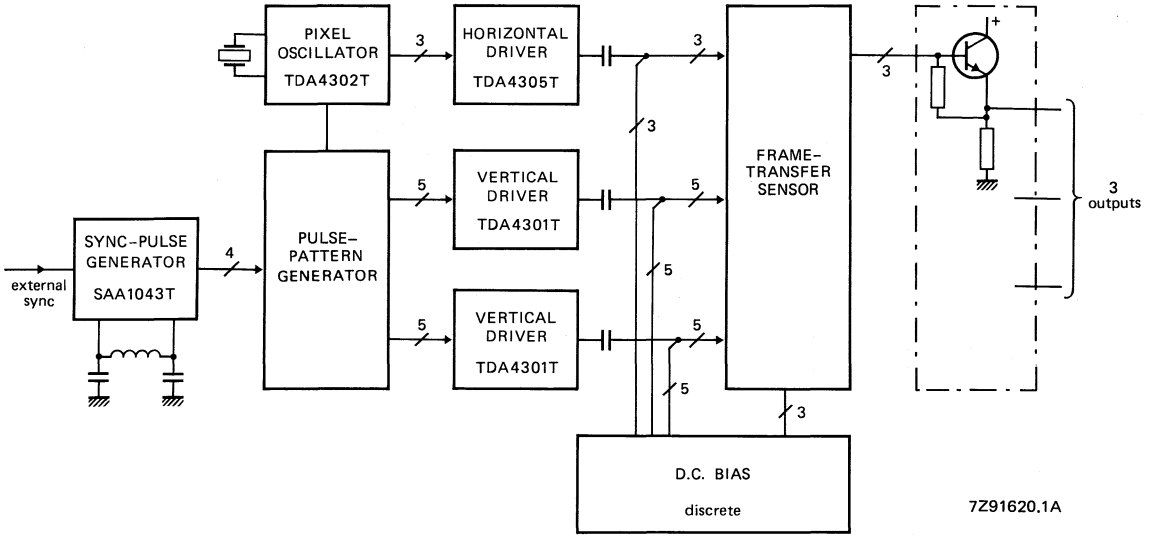


Fig. 3 Control circuitry for driving the NXA1010 to NXA1040 frame-transfer sensors.

VERTICAL DRIVER

GENERAL DESCRIPTION

This monolithic integrated circuit is an inverting buffer between the pulse pattern generator SAA1008 (LOCMOS technology) and the image sensors NXA1010 to NXA1040.

The circuit consists of four drivers either for all vertical transfer clocks for image part (1A to 4A), or all vertical transfer clocks for storage part (1B to 4B) electrodes, and one driver for a transfer gate (TG) electrode.

QUICK REFERENCE DATA

parameter	symbol	min.	typ.	max.	unit
Supply voltage range (pin 11)	V_{11-14}	4,5	5,0	5,5	V
Supply voltage range (pin 1)	V_{1-14}	11,00	11,25	11,50	V
Supply current at V_P = 5 V	I_{11}	–	14	–	mA
Operating current V_{1-14} = 11,25 V	I_1	–	9,25	–	mA
Storage temperature	T_{stg}	−25	–	+ 150	°C
Operating ambient temperature	T_{amb}	−20	–	+ 70	°C

PACKAGE OUTLINE

TDA4301T: 14-lead mini-pack; plastic (SO-14; SOT-108A).

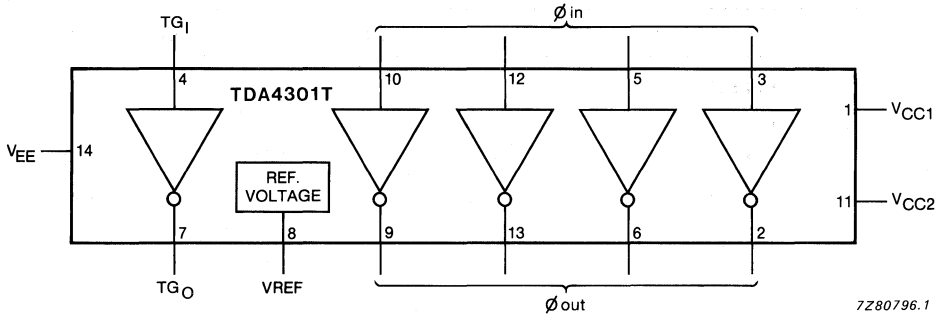


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

parameter	symbol	min.	typ.	max.	unit
Supply voltage (pin 1)	V_{CC1}	–	–	+ 12	V
Supply voltage (pin 11)	V_{CC2}	–	–	+ 12	V
D.C. output currents					
pins 2, 6, 9 and 13; $t < 1$ s	I_O	–	–	250	mA
pin 7; $t < 1$ s	I_{TGO}	–	–	10	mA
Total power dissipation	P_{tot}	–	–	550	mW
Operating ambient temperature	T_{amb}	–20	–	+ 70	°C
Storage temperature	T_{stg}	–25	–	+ 150	°C

D.C. CHARACTERISTICS

parameter	symbol	min.	typ.	max.	unit
Supply voltage (pin 11)	V_{CC2}	4,5	5,0	5,5	V
Supply voltage (pin 1)	V_{CC1}	11,00	11,25	11,50	V
Reference voltage (pin 8)	V_{ref}	3,60	3,75	3,90	V
Supply current (pin 11)	I_{CC2}	–	14,0	–	mA
Operating current (pin 1)	I_{CC1}	–	9,25	–	mA

A.C. CHARACTERISTICS

$V_{CC1} = V_{1-14} = 11{,}25$ V; $V_{CC2} = V_{11-14} = 5{,}0$ V; $T_{amb} = 25$ °C

parameter	symbol	min.	typ.	max.	unit
Inputs ϕ and TGI (pins 3, 5, 4, 10 and 12)					
Input voltage range	V_ϕ	0	–	5	V
Input threshold voltage	$V_{\phi TH}$	0,9	1,1	1,3	V
Input current (V_ϕ = 5 V)	I_ϕ	–	10,0	30,0	μA
Outputs ϕ (pins 2, 6, 13 and 9)					
Load C_L = 2000 pF					
Output voltage swing	$V_{\phi\,(p\text{-}p)}$	–	10,0	–	V
Timing (Fig. 2)					
delay neg. slope	t_{d1}	–	–	100	ns
negative slope (fall time)	t_{d5}	50	70	90	ns
delay pos. slope	t_{d3}	–	–	100	ns
positive slope (rise time)	t_{d6}	30	50	70	ns
Output TG (pin 7)					
Load C_L = 68 pF					
Output voltage swing	$V_{TGO\,(p\text{-}p)}$	–	10,0	–	V
Timing (Fig. 2)					
delay neg. slope	t_{d1}	–	–	100	ns
negative slope (fall time)	t_{d5}	70	100	120	ns
delay pos. slope	t_{d3}	–	–	100	ns
positive slope (rise time)	t_{d6}	50	70	90	ns

DEVELOPMENT DATA

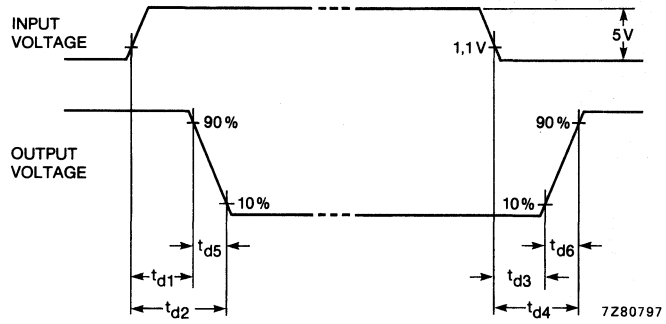


Fig. 2 Timing diagram.

Load output (ϕ_{out}) capacitor C_L = 2000 pF; output TG_O load C_L = 68 pF. At the specified load only one switching may be done at a time.

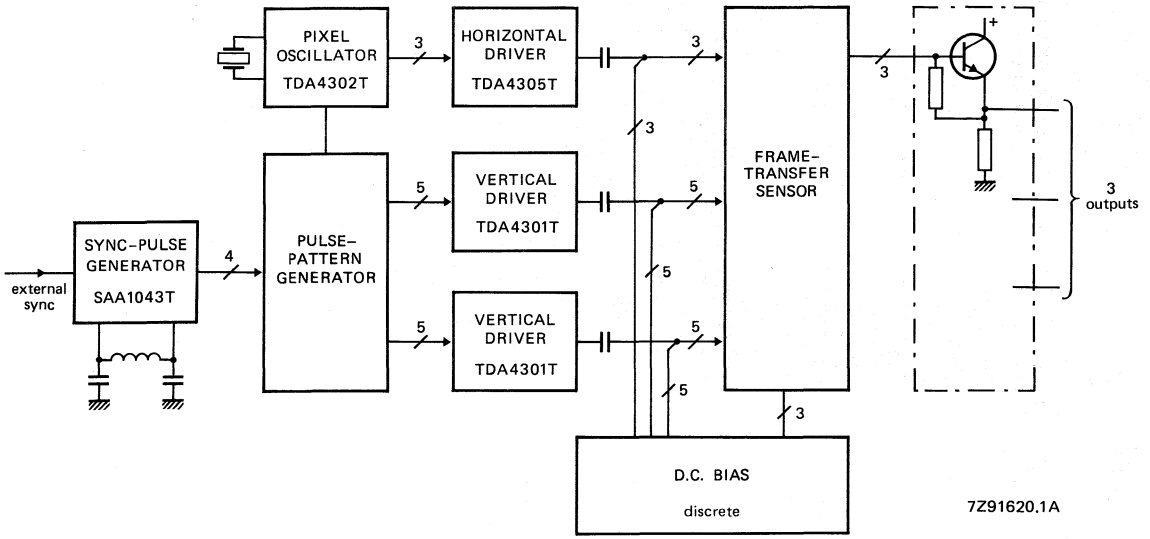


Fig. 3 Control circuitry for driving the NXA frame-transfer sensors.

PIXEL GENERATOR

GENERAL DESCRIPTION

The TDA4302 is a monolithic integrated circuit that generates the pulses for the read out registers of the NXA1010/1040 image sensors. The device operates in conjunction with the horizontal driver IC (TDA4305; TDA4305T).

Features

- Start.Stop RC oscillator with high accuracy over a wide temperature range
- Frequency doubler for maximum sensor drive symmetry
- Synchronous divide by 6 counter that generates the three-phase signals for the horizontal drivers
- Stop.Start oscillator controller which also selects the $\phi C'$ inputs or the divide by 6 counter outputs
- Voltage reference circuit

QUICK REFERENCE DATA

parameter	symbol	min.	typ.	max.	unit
Supply voltage (pin 1)	$V_P = V_{1-3}$	4,5	4,0	5,5	V
Supply current (pin 1)	I_P	–	50	–	mA
Storage temperature range	T_{stg}	−25	–	+ 150	°C
Operating ambient temperature range	T_{amb}	−20	–	+ 70	°C

PACKAGE OUTLINES

TDA4302 : 16-lead DIL; plastic with internal heat spreader (SOT-38WE-2).
TDA4302T: 16-lead mini-pack; plastic (SO-16L; SOT-162A).

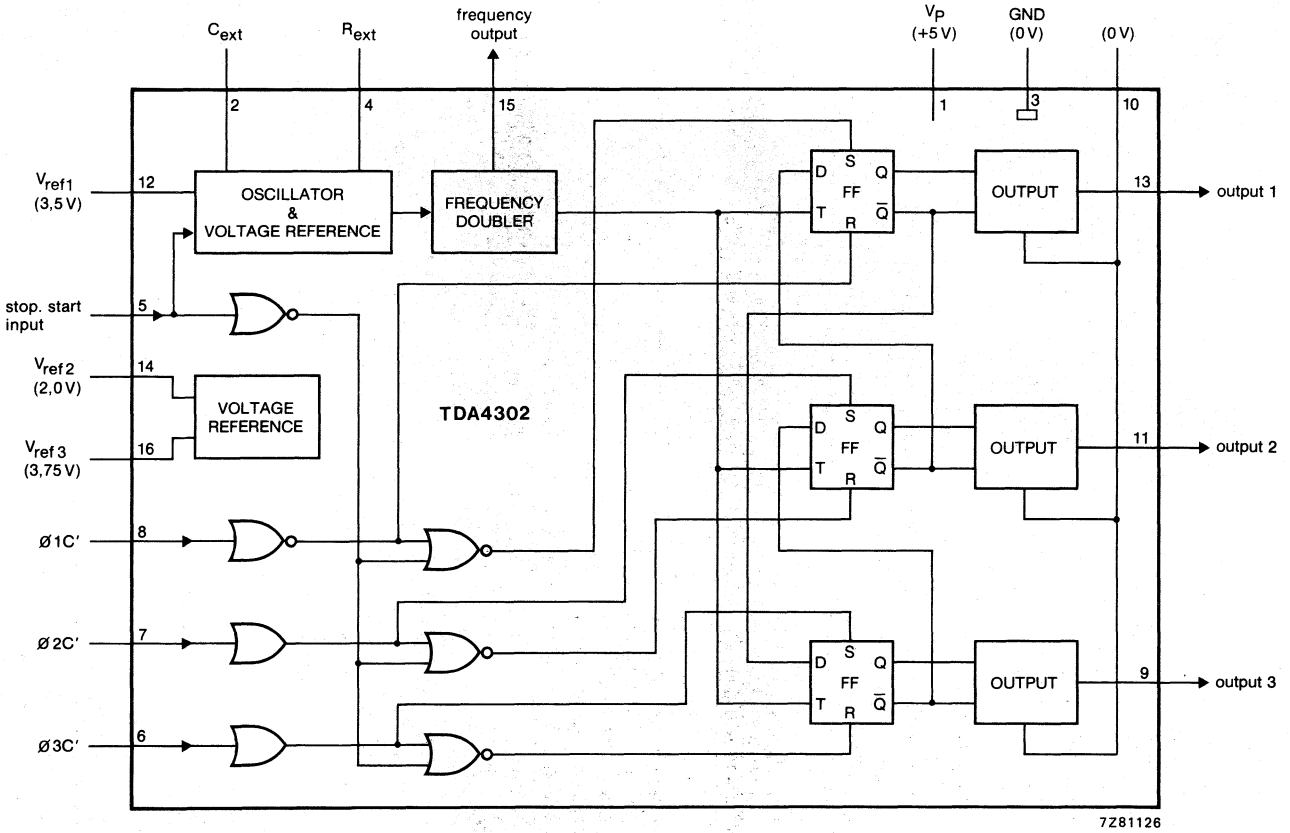


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 1)	V_P	max.	12	V
Input voltage (pins 2, 4, 5, 6, 7 and 8)	V_I	max.	V_P	V
Short-circuit current (d.c.) max. 1 s				
pin 2	I_2	max.	10	mA
pin 12	I_{12}	max.	100	mA
Total power dissipation				
SO package*	P_{tot}	max.	340	mW
DIL package	P_{tot}	max.	1000	mW
Storage temperature range	T_{stg}		−25 to + 150	°C
Operating ambient temperature range	T_{amb}		−20 to + 70	°C

DEVELOPMENT DATA

* Mounted on p.c.b.

CHARACTERISTICS

$V_P = V_{1-3} = 5$ V; $T_{amb} = 25$ °C; unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
Supply					
Supply voltage (pin 1)	V_P	4,5	5	5,5	V
Supply current (pin 1)	I_P	–	50	–	mA
Reference voltages					
3,5 V reference voltage (pin 12)*	V_{ref1}	3,35	–	3,65	V
2,0 V reference voltage (pin 14)	V_{ref2}	1,9	2,0	2,1	V
3,75 V reference voltage (pin 16)	V_{ref3}	3,6	3,75	3,9	V
Source current (pins 2 and 15)	$I_{2, 15}$	–	–	5	mA
Oscillator					
(C_{ext} = 100 pF; R_{ext} = 450 Ω)					
Stop.Start/HIGH: stop condition					
Stop.Start/LOW: run condition					
Output frequency (pin 15) without adjustment	f_{osc}	10,9	11,5	12,1	MHz
Frequency stability at −20 to + 60 °C		–	–	1	%
Stop.Start input (pin 5)					
Stop = "0": oscillator running**					
Stop = "1": oscillator stops					
Threshold voltage	V_{5-3}	0,9	–	1,8	V
Input current at V_I = 5 V	I_5	–	–	30	μA
φC' inputs (pins 8, 7 and 6)					
Threshold voltage	$V_{8, 7, 6-3}$	1,4	1,6	1,8	V
Input current at V_I = 5 V	$I_{8, 7, 6}$	–	–	30	μA
Outputs (pins 9, 11 and 13)					
Output voltage amplitude	$V_{9, 11, 13-3}$	–	1,5	–	V
Timing			(see Fig. 2)		
Average d.c. output voltage	$V_{9, 11, 13-3\ (AV)}$	–	2	–	V

* No d.c. load allowed at pin 12.

** Extra running condition to obtain correct outputs.
φ1C' = HIGH (pin 8)
φ2C' = LOW (pin 7)
φ3C' = LOW (pin 6)

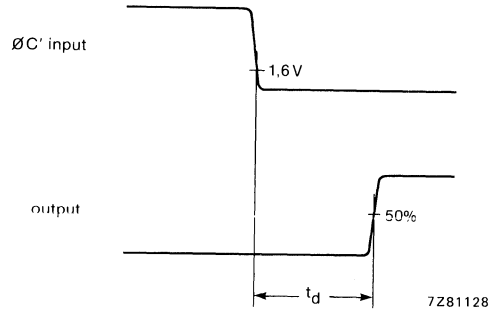


Fig. 2 Output timing.

DEVELOPMENT DATA

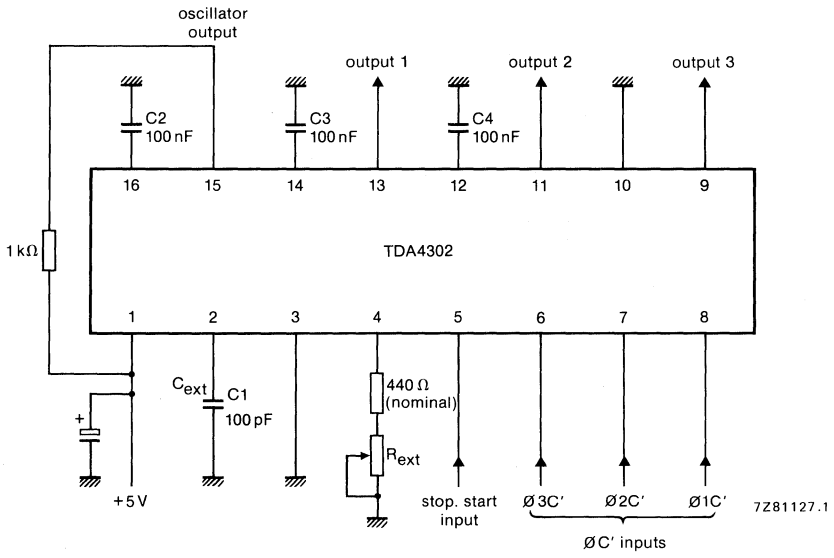


Fig. 3 Application diagram.

WHITE PROCESSING ENCODER

GENERAL DESCRIPTION

The TDA4303 is a monolithic integrated circuit that operates in conjunction with the PAL-NTSC encoder (TDA2501) to form the colour encoder part of a television camera. This circuit can also operate in conjunction with the SECAM encoder (TDA2506) and the FM modulator controller (TDA2507) for the SECAM system.

Features

Processing part

- Four input clamping circuits to determine the black levels
- Three $1/\gamma$ correction circuits
- Four blanking circuits
- Four white clipping circuits
- Colour matrix; that delivers
  - U (with respect to colour difference signal D'_B
  - V (with respect to colour difference signal D'_R
  - Y and the W signal

CVBS part

- Chrominance, luminance and synchronized summation circuit
- Contour amplifier
- A black and a white clipping circuit in the output stage
- Output stage with the capability to drive a 75 Ω coaxial cable system

QUICK REFERENCE DATA

parameter	symbol	min.	typ.	max.	unit
Supply voltage (pin 13)	$V_P = V_{13-27}$	4,75	5,0	5,25	V
Supply current (pin 13)	I_P	–	65	–	mA
Storage temperature range	T_{stg}	–25	–	+ 150	°C
Operating ambient temperature range	T_{amb}	–20	–	+ 70	°C

PACKAGE OUTLINES

TDA4303: 28-lead DIL; plastic with internal heat spreader (SOT-117).
TDA4303T: 28-lead mini-pack; plastic (SO-28; SOT-136A).

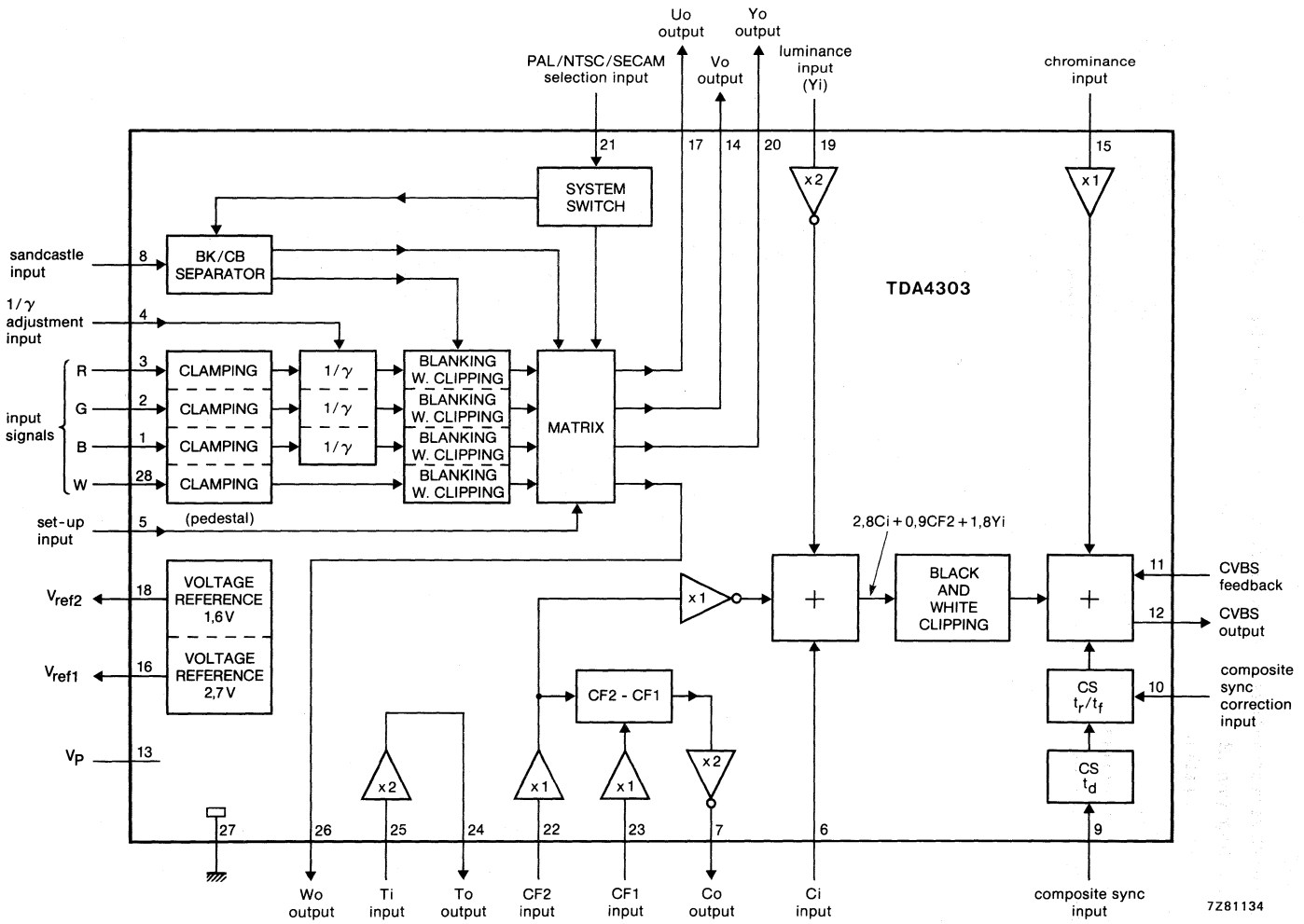


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 13)	V_P	max.	12 V
Total power dissipation			
SO package *	P_{tot}	max.	730 mW
DIL package	P_{tot}	max.	1000 mW
Storage temperature range	T_{stg}		−25 to + 150 °C
Operating ambient temperature range	T_{amb}		−20 to + 70 °C

DEVELOPMENT DATA

* Mounted on p.c.b.

CHARACTERISTICS

$V_P = V_{13-27} = 5$ V; $T_{amb} = 25$ °C; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply					
Supply voltage (pin 13)	V_P	4,75	5	5,25	V
Supply current (pin 13) (75 Ω resistor to CVBS output)	I_P	–	65	–	mA
PROCESSING PART					
Input signals RGB and W					
R (pin 3); G (pin 2); B (pin 1); W (pin 28) (peak-to-peak value)	$V_{n-27(p-p)}$	–	1,0	1,3	V
Uo output signal (pin 17; peak value) at $V_{1-27(p-p)} = 1$ V	$V_{17-27(M)}$	0,68	0,72	0,75	V
Vo output signal (pin 14; peak value) for PAL and NTSC at $V_{3-27(p-p)} = 1$ V	$V_{14-27(M)}$	0,95	1,0	1,05	V
Vo (D'_R) output signal (pin 14; peak value) for SECAM at $V_{3-27(p-p)} = 1$ V	$V_{14-27(M)}$	0,68	0,72	0,75	V
Yo output (pin 20; peak value) at $V_{3, 2, 1-27(p-p)} = 1$ V and $V_{28-27(p-p)} = 0$ V	$V_{20-27(M)}$	0,95	1,0	1,05	V
Wo output (pin 26; peak value) at $V_{28-27(p-p)} = 1$ V	$V_{26-27(P)}$	0,95	1,0	1,05	V
$1/\gamma$ tracking between Uo, Vo and Yo outputs		–	1	2	%
$1/\gamma$ correction of Uo, Vo and Yo*		0,50	0,55	0,65	
Ratio $\frac{Yo}{Wo}$ at $V_{28-27(p-p)} = 1$ V		0,95	1,00	1,05	
Set-up Yo output at $V_{pedestal} = V_{ref2} - 0{,}1$ V		–	0,1	–	V
White clipping Uo, Yo and Wo outputs with respect to 1 V(p-p)		–	120	–	%

* 2,2 kΩ (± 5%) load resistor connected between $1/\gamma$ control input (pin 4) and ground (pin 27).

parameter	symbol	min.	typ.	max.	unit
Burst amplitude during PAL					
(system switch V_{21-27} = 5 V)					
Uo output (with respect to black level) (peak-to-peak value)	$V_{17-27(p-p)}$	−233	−246	−258	mV
Vo output (with respect to black level) (peak-to-peak value)	$V_{14-27(p-p)}$	233	246	258	mV
Ratio $\frac{\text{Burst Uo}}{\text{Burst Vo}}$	$\frac{V_{17-27}}{V_{14-27}}$	0,965	1,0	1,035	
Burst amplitude during NTSC					
(system switch V_{21-27} = 0 V)					
Uo output (with respect to black level) (peak-to-peak value)	$V_{17-27(p-p)}$	−330	−350	−370	mV
D.C. output voltage levels					
Uo and Vo outputs	$V_{17,\ 14-27}$	2,3	2,5	2,7	V
Yo and Wo outputs	$V_{20,\ 26-27}$	–	1,6	–	V
Black level decay of Vo, Uo, Yo and Wo outputs (during video scanning)	V_{n-27}	–	–	6	mV
Reference voltage V_{ref2}	V_{18-27}	1,4	1,6	1,8	V
Reference voltage V_{ref1}	V_{16-27}	2,5	2,7	2,9	V
Power supply rejection ratio at Vo, Uo, Yo and Wo outputs (1 kHz)	R/R	–	tbf	–	dB
System switch (pin 21)					
PAL system ON	V_{21-27}	3,8	–	–	V
SECAM system ON	V_{21-27}	1,4	–	3,1	V
NTSC system ON	V_{21-27}	–	–	1,0	V
Sandcastle input (pin 8)					
Threshold burst key	V_{8-27}	2,5	3,75	V_P	V
Input current at V_{8-27} = 5 V	I_8	–	500	–	μA
Threshold composite blanking	V_{8-27}	–	1,25	2,5	V
Input current at V_{8-27} = 2,5 V	I_8	–	5	–	μA
Input leakage current at V_{8-27} = 0 V	$\pm I_L$	–	tbf	–	μA

DEVELOPMENT DATA

CHARACTERISTICS (continued)

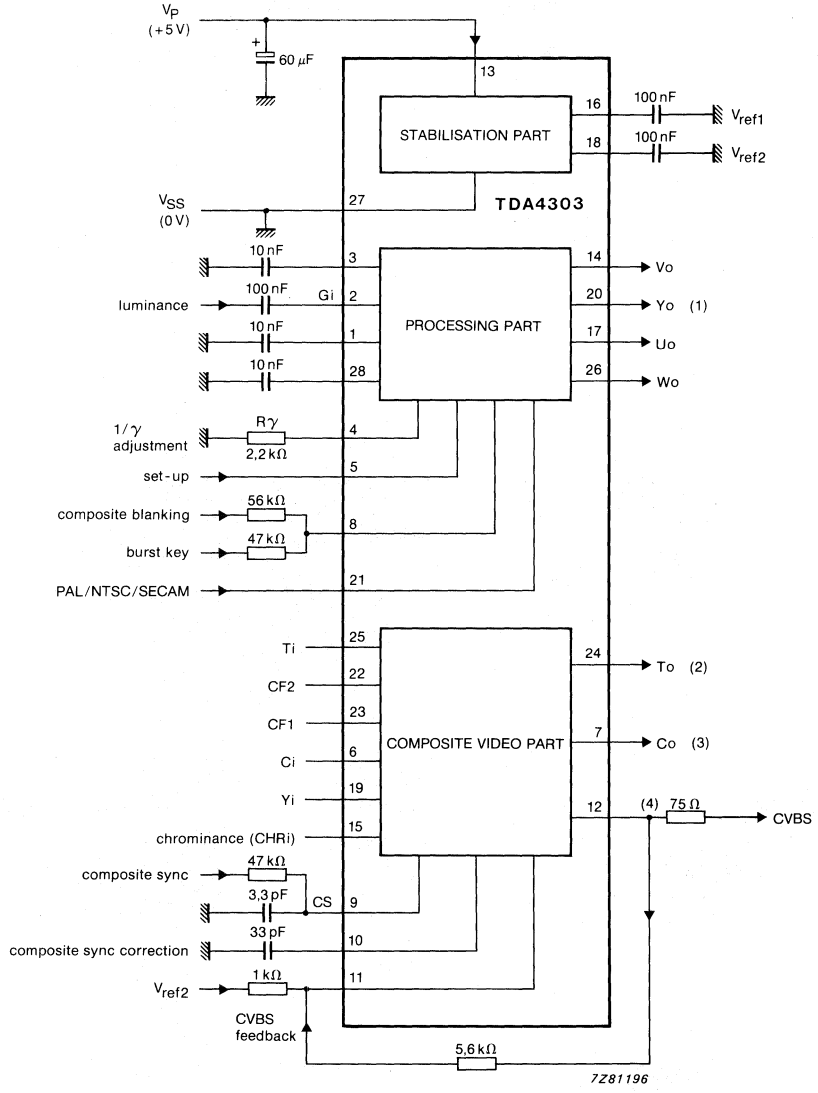
parameter	symbol	min.	typ.	max.	unit
CVBS PART (A.C. coupled, 150 Ω output load)					
Chrominance input (pin 15)					
D.C. input bias voltage = V_{ref2}					
Input voltage range (100% saturated) (peak-to-peak value)	$V_{15\text{-}27}$	–	0,5	0,55	V
Input resistance	R_{15}	100	–	–	kΩ
Input capacitance	C_I	–	–	5	pF
CVBS amplitude (pin 12)					
Black level CVBS output signal	$V_{12\text{-}27}$	–	1,6	–	V
Maximum output voltage swing (peak-to-peak value)	$V_{12\text{-}27(p\text{-}p)}$	2,7	3,6	–	V
Synchronization input pulse (CS) (peak-to-peak value)	$V_{9\text{-}27(p\text{-}p)}$	0,6	–	V_P	V
Delay between CS input to CVBS output *	t_d	200	–	–	ns
Luminance output component with Y input = 0,5 V(p-p) (peak-to-peak value)	$V_{12\text{-}27(p\text{-}p)}$	–	1,4	–	V
Chrominance output component with chrominance input = 0,6 V(p-p) (peak-to-peak value)	$V_{12\text{-}27(p\text{-}p)}$	–	2,15	–	V
Differential gain	dG	–	–	2	%
Differential phase	$d\phi$	–	–	1	deg.
Power supply rejection ratio (1 kHz) $20 \log \frac{V_{CVBS}}{V_P}$	RR	–	30	–	dB
Y input (pin 19)					
Input voltage range (peak-to-peak value)	$V_{19\text{-}27(p\text{-}p)}$	–	0,5	0,55	V
Input resistance	R19	100	–	–	kΩ
Input capacitance	C_I	–	–	5	pF

* See application information; Figs 2 and 3.

parameter	symbol	min.	typ.	max.	unit
Contour inputs (CF1 pin 23; CF2 pin 22)					
Input voltage range (peak-to-peak value)	$V_{23,22-27(p-p)}$	–	1,0	1,2	V
Contour gain range between Ci input and CVBS output	G_{6-12}	–	4,4	–	
White clipping level (with respect to 1,4 V Yo component of the CVBS output signal)		–	120	–	%
Black clipping level (with respect to 1,4 V Yo component of the CVBS output signal)		–10	–7	–5	%
WT3 buffer gain		–	2	–	
Delay between CF1 input and CVBS output	t_{d1}	–	20	–	ns
Delay between CF2 input and CVBS output	t_{d2}	–	40	–	ns

DEVELOPMENT DATA

APPLICATION INFORMATION



(1) Yo output (pin 20) = (0,587 E'G_i) – set-up.
With: E' (input amplitude) = E_i 1/γ; γ = 0,55; Rγ = 2,2 kΩ.

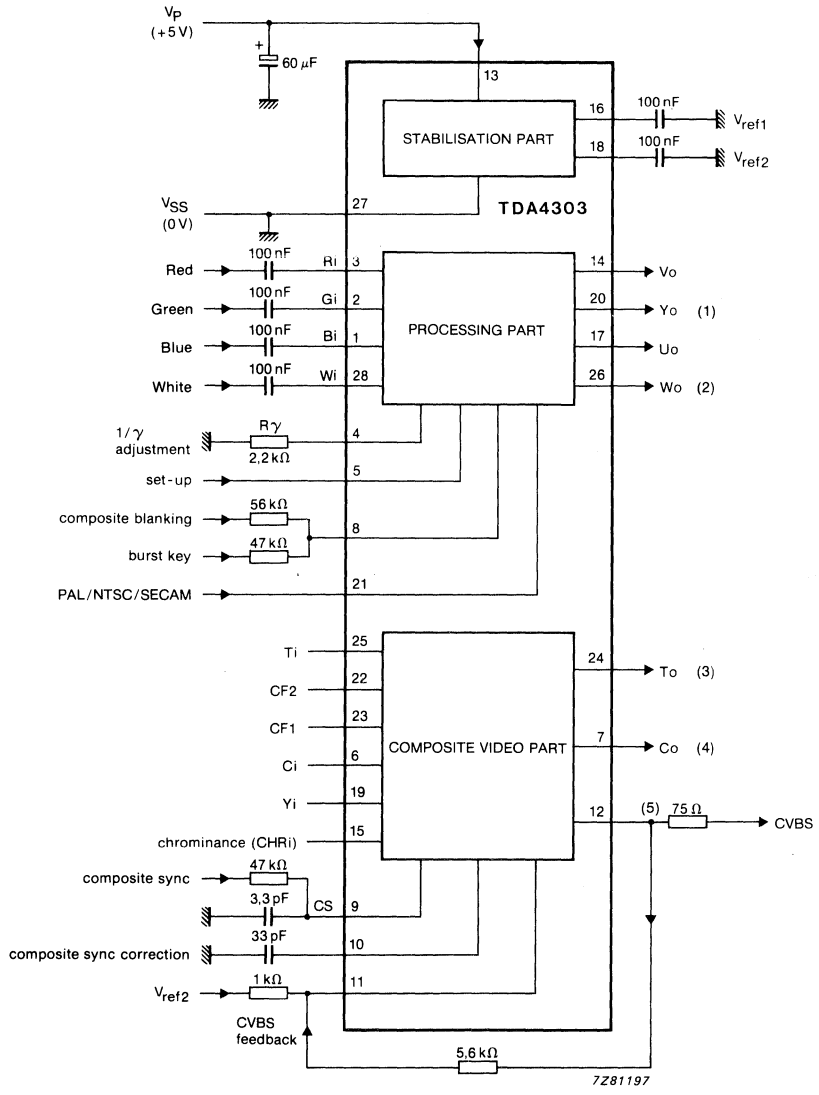
(2) To output (pin 24) = 2 x Ti.
(input Ti biassed to V_{ref2} when not used).

(3) Co output (pin 7) = 2 x (CF2 – CF1).
(inputs CF1, CF2 biassed to V_{ref2} when not used).

(4) CVBS output (pin 12) = (1,4 CF2 + 4,4 Ci + 2,8 Yi + 3,58 CHRi) – 0,615 CS
(inputs CF2, Ci, Yi, CHRi, CS biassed to V_{ref2} when not used).

Fig. 2 Application diagram for black and white television camera.

DEVELOPMENT DATA



(1) Yo output (pin 20) = (Y − Wo) − set-up.
With: Y = 0,299 E_iRi + 0,587 E'Gi + 0,114 E'Bi and
E' (input amplitude) = E_i 1/γ; γ = 0,55; Rγ = 2,2 kΩ.

(2) Wo output (pin 26) = Wi.

(3) To output (pin 24) = 2 x Ti.
(input Ti biassed to V_{ref2} when not used).

(4) Co output (pin 7) = 2 x (CF2 − CF1).
(inputs CF1, CF2 biassed to V_{ref2} when not used).

(5) CVBS output (pin 12) = (1,4 CF2 + 4,4 Ci + 2,8 Yi + 3,58 CHRi) − 0,615 CS
(inputs CF2, Ci, Yi, CHRi, CS biassed to V_{ref2} when not used).

Fig. 3 Application diagram for colour television camera.

HORIZONTAL DRIVER

GENERAL DESCRIPTION

The TDA4305 is a monolithic integrated circuit which drives the output registers of the frame transfer sensors (NXA1010/1040).

Features

- Three inverting buffers
- Adjustable duty cycle control
- Voltage reference circuit

QUICK REFERENCE DATA

parameter	symbol	min.	typ.	max.	unit
Supply voltages					
pin 15	$V_{P1} = V_{15-6}$	4,5	5,0	5,5	V
pin 10	$V_{P2} = V_{10-6}$	11,0	11,25	11,5	V
pin 16	$V_{P3} = V_{16-6}$	11,0	11,25	11,5	V
Supply current (quiescent)					
pin 15 (outputs HIGH)	I_{P1}	–	17	–	mA
pin 15 (outputs LOW)	I_{P1}	–	8	–	mA
pin 10	I_{P2}	–	9	–	mA
pin 16	I_{P3}	–	5	–	mA
Total power dissipation	P_{tot}	–	360	–	mW
Storage temperature range	T_{stg}	–25	–	+ 150	°C
Operating ambient temperature range	T_{amb}	–20	–	+ 70	°C

PACKAGE OUTLINE

16-lead DIL; plastic with internal heat spreader (SOT-38WE-2).

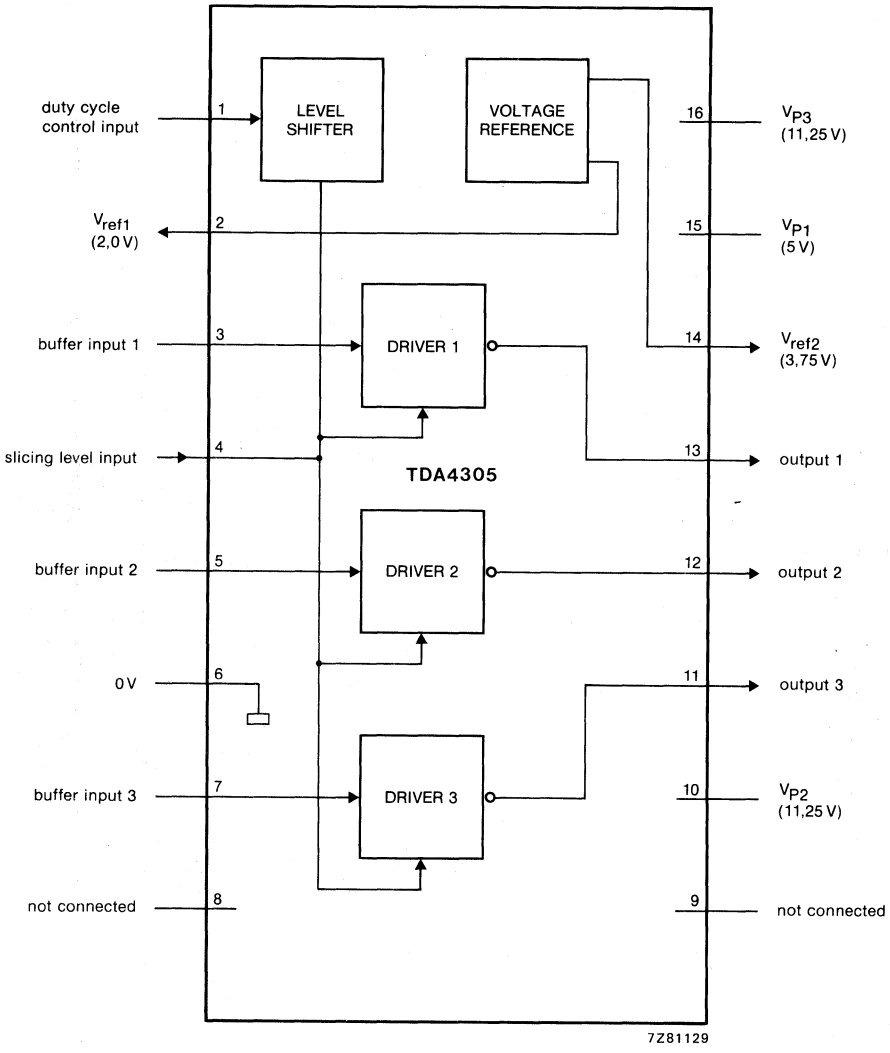


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltages				
pin 15	V_{P1}	max.	12	V
pin 10	V_{P2}	max.	12	V
pin 16	V_{P3}	max.	12	V
Input voltage (pins 1, 3, 4, 5 and 7)	V_I	max.	V_{P1}	V
Short-circuit current (pin 14)				
$t < 1$ s	I_{14}	max.	100	mA
Output current (pins 11, 12 and 13)				
$t < 1$ s	I_O	max.	15	mA
Total power dissipation	P_{tot}	max.	1000	mW
Storage temperature range	T_{stg}		−25 to + 150	°C
Operating ambient temperature range	T_{amb}		−20 to + 70	°C

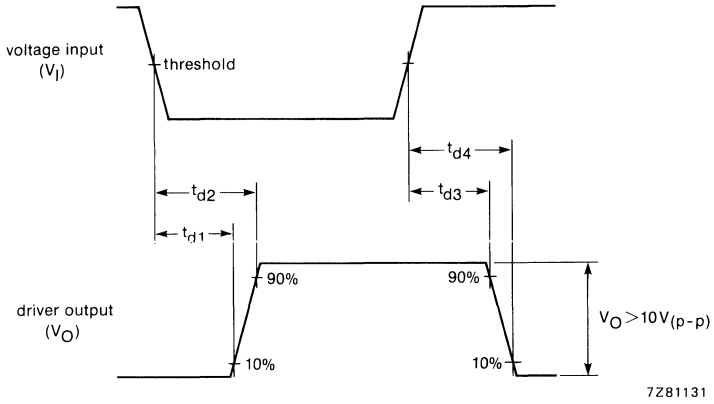
DEVELOPMENT DATA

CHARACTERISTICS

$V_{P1} = V_{15-6} = 5$ V; $V_{P2} = V_{10-6} = 11{,}25$ V; $V_{P3} = V_{16-6} = 11{,}25$ V; $T_{amb} = 25\ ^{o}C$; unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
Supply					
Supply voltage					
pin 15	V_{P1}	4,5	5,0	5,5	V
pin 10	V_{P2}	11,0	11,25	11,50	V
pin 16	V_{P3}	11,0	11,25	11,50	V
Supply current (quiescent)					
pin 15 (outputs HIGH)	I_{P1}	–	17	–	mA
pin 15 (outputs LOW)	I_{P1}	–	8	–	mA
pin 10	I_{P2}	–	9	–	mA
pin 16	I_{P3}	–	5	–	mA
Supply current (peak)*					
pin 10 (one transition only)	I_M	–	30	–	mA
Total power dissipation with NXA1020	P_{tot}	–	360	–	mW
Reference voltages					
2,0 V reference voltage (pin 2)	V_{ref1}	1,8	2,0	2,2	V
3,75 V reference voltage (pin 14)	V_{ref2}	3,6	3,75	3,9	V
Source current (pins 2 and 14)	$I_{2, 14}$	–	–	3	mA
Duty cycle control input (pin 1)					
Input voltage	V_{1-6}	1,75	–	2,75	V
Input current at $V_{1-6} = 2{,}75$ V	I_1	–	–	30	μA
Buffer inputs (pins 3, 5 and 7)					
Input current at $V_{3, 5, 7-6} = 5$ V	$I_{3, 5, 7}$	–	–	30	μA
Threshold voltage	$V_{3, 5, 7-6}$	–	2	–	V
Timing ($C_L = 68$ pF; see Fig. 2)					
Rise time	t_r	20	–	40	ns
Fall time	t_f	20	–	40	ns
Delay time	t_d	–	70	100	ns
Outputs (pins 11, 12 and 13)					
Output voltage swing	$V_{11, 12, 13-6}$	–	10	–	V

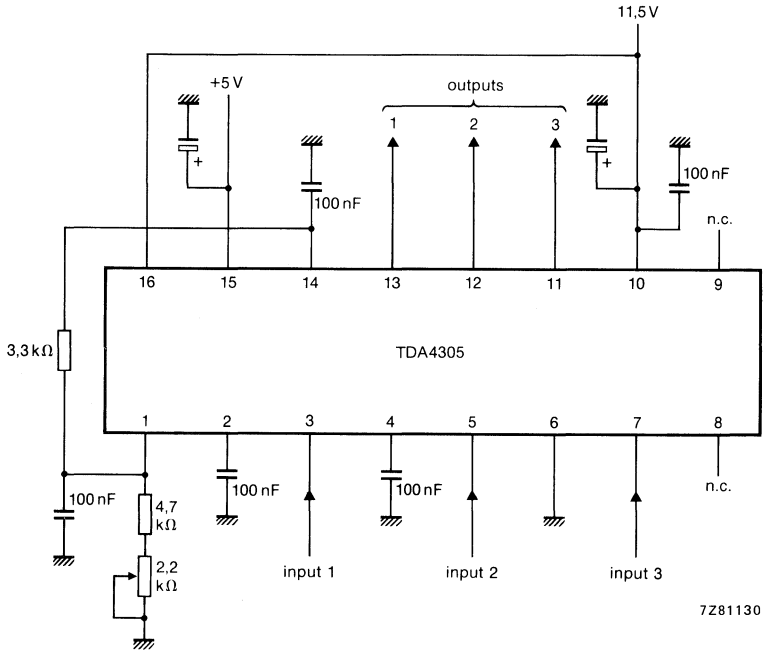
* Pulses shifted 120 degrees.



Where: $t_{d1} = t_d$; $t_{d3} = t_d$; t_{d2}-$t_{d1} = t_r$; t_{d4}-$t_{d3} = t_f$.

Fig. 2 Output timing.

DEVELOPMENT DATA



Where: n.c. = not connected.

Fig. 3 Application diagram.

HORIZONTAL DRIVER

GENERAL DESCRIPTION

The TDA4305T is a monolithic integrated circuit which drives the output registers of the frame transfer sensors (NXA1010/1040).

Features

- Three inverting buffers
- Adjustable duty cycle control
- Voltage reference circuit

QUICK REFERENCE DATA

parameter	symbol	min.	typ.	max.	unit
Supply voltages					
pin 13	$V_{P1} = V_{13-6}$	4,5	5,0	5,5	V
pin 8	$V_{P2} = V_{8-6}$	11,0	11,25	11,5	V
pin 14	$V_{P3} = V_{14-6}$	11,0	11,25	11,5	V
Supply current (quiescent)					
pin 13 (outputs HIGH)	I_{P1}	–	17	–	mA
pin 13 (outputs LOW)	I_{P1}	–	8	–	mA
pin 8	I_{P2}	–	9	–	mA
pin 14	I_{P3}	–	5	–	mA
Total power dissipation	P_{tot}	–	360	–	mW
Storage temperature range	T_{stg}	–25	–	+ 150	°C
Operating ambient temperature range	T_{amb}	–20	–	+ 70	°C

PACKAGE OUTLINE

14-lead mini-pack; plastic (SO-14; SOT-108A).

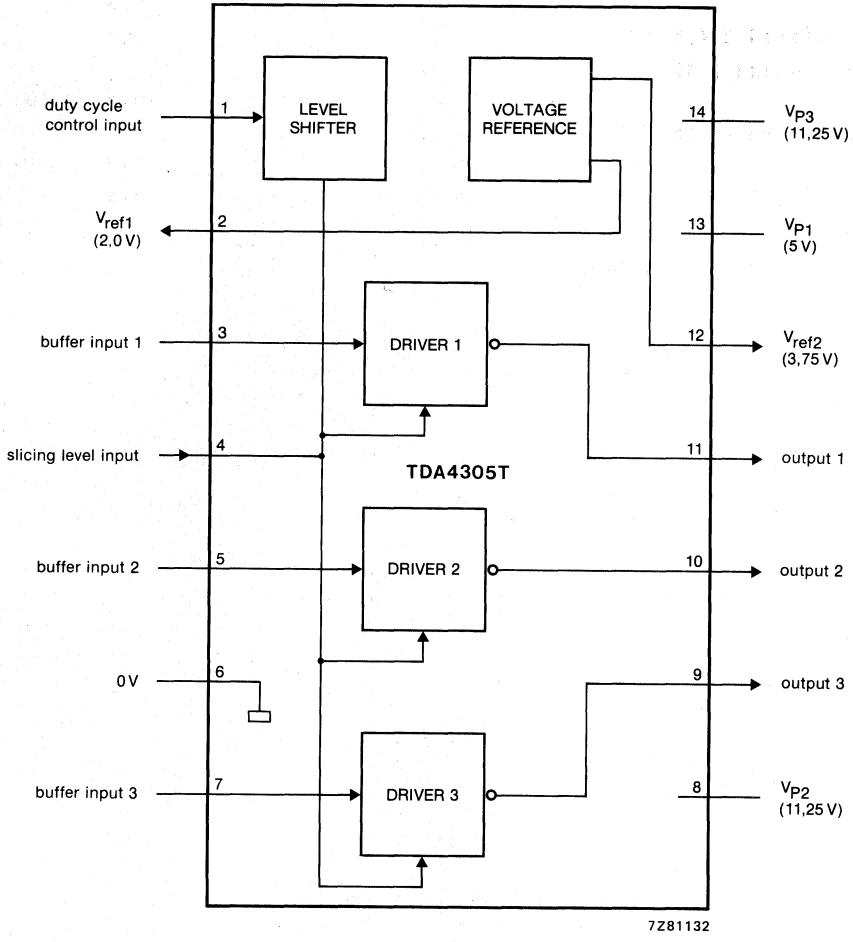


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltages			
pin 13	V_{P1}	max.	12 V
pin 8	V_{P2}	max.	12 V
pin 14	V_{P3}	max.	12 V
Input voltage (pins 1, 3, 4, 5 and 7)	V_I	max.	V_{P1} V
Short-circuit current (pin 12)			
$t < 1$ s	I_{12}	max.	100 mA
Output current (pins 9, 10 and 11)			
$t < 1$ s	I_O	max.	15 mA
Total power dissipation*	P_{tot}	max.	400 mW
Storage temperature range	T_{stg}		−25 to + 150 °C
Operating ambient temperature range	T_{amb}		−20 to + 70 °C

DEVELOPMENT DATA

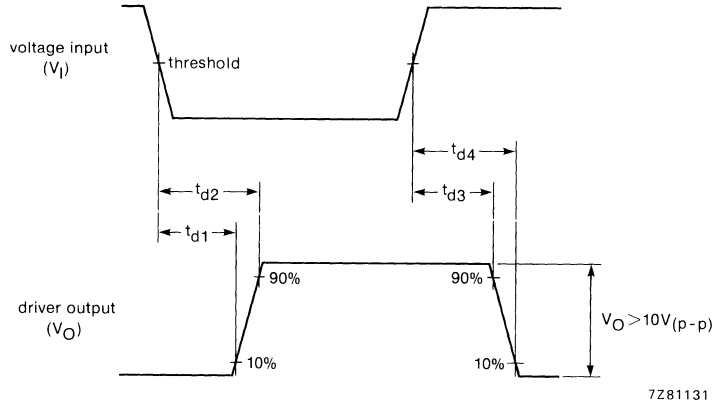
* Mounted on p.c.b.

CHARACTERISTICS

$V_{P1} = V_{13-6} = 5$ V; $V_{P2} = V_{8-6} = 11{,}25$ V; $V_{P3} = V_{14-6} = 11{,}25$ V; $T_{amb} = 25\ ^{o}C$; unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
Supply					
Supply voltage					
pin 13	V_{P1}	4,5	5,0	5,5	V
pin 8	V_{P2}	11,0	11,25	11,50	V
pin 14	V_{P3}	11,0	11,25	11,50	V
Supply current (quiescent)					
pin 13 (outputs HIGH)	I_{P1}	–	17	–	mA
pin 13 (outputs LOW)	I_{P1}	–	8	–	mA
pin 8	I_{P2}	–	9	–	mA
pin 14	I_{P3}	–	5	–	mA
Supply current (peak)*					
pin 8 (one transition only)	I_M	–	30	–	mA
Total power dissipation with NXA1020	P_{tot}	–	360	–	mW
Reference voltages					
2,0 V reference voltage (pin 2)	V_{ref1}	1,8	2,0	2,2	V
3,75 V reference voltage (pin 12)	V_{ref2}	3,6	3,75	3,9	V
Source current (pins 2 and 12)	$I_{2, 12}$	–	–	3	mA
Duty cycle control input (pin 1)					
Input voltage	V_{1-6}	1,75	–	2,75	V
Input current at $V_{1-6} = 2{,}75$ V	I_1	–	–	30	μA
Buffer inputs (pins 3, 5 and 7)					
Input current at $V_{3, 5, 7-6} = 5$ V	$I_{3, 5, 7}$	–	–	30	μA
Threshold voltage	$V_{3, 5, 7-6}$	–	2	–	V
Timing ($C_L = 68$ pF; see Fig. 2)					
Rise time	t_r	20	–	40	ns
Fall time	t_f	20	–	40	ns
Delay time	t_d	–	70	100	ns
Outputs (pins 9, 10 and 11)					
Output voltage swing	$V_{9, 10, 11-6}$	–	10	–	V

* Pulses shifted 120 degrees.



Where: $t_{d1} = t_d$; $t_{d3} = t_d$; t_{d2}-$t_{d1} = t_r$; t_{d4}-$t_{d3} = t_f$.

Fig. 2 Output timing.

DEVELOPMENT DATA

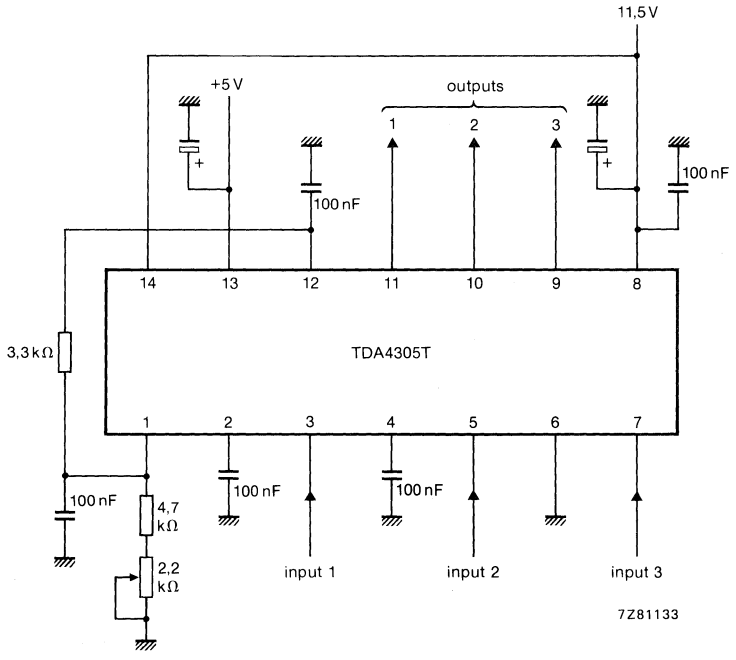


Fig. 3 Application diagram.

MASTER GAIN

GENERAL DESCRIPTION

The TDA4306 is a monolithic integrated circuit which controls the amplification of the four output signals (White, Yellow, Green and Cyan) from the frame transfer sensors (NXA1020/40). The matching of the four channels is excellent over the whole control and temperature range. An on-chip white clipping circuit protects the white processor (TDA4303) from output signals that are too large. If white clipping occurs, a pulse is available to kill the colour information. Highlights will always be white, not coloured.

Features

- Four variable gain amplifiers
- White clipping circuit
- Blanking switch
- 2,1 V reference voltage

QUICK REFERENCE DATA

parameter	symbol	min.	typ.	max.	unit
Supply voltage (pin 20)	$V_P = V_{20\text{-}10}$	4,75	5,0	5,25	V
Reference voltage (pin 6)	V_{ref}	1,9	2,1	2,3	V
Total power dissipation	P_{tot}	90	140	200	mW
Storage temperature range	T_{stg}	−25	–	+ 150	°C
Operating ambient temperature range	T_{amb}	−20	–	+ 70	°C

PACKAGE OUTLINES

TDA4306 : 20-lead DIL; plastic (SOT-146).
TDA4306T: 20-lead mini-pack; plastic (SO-20; SOT-163A).

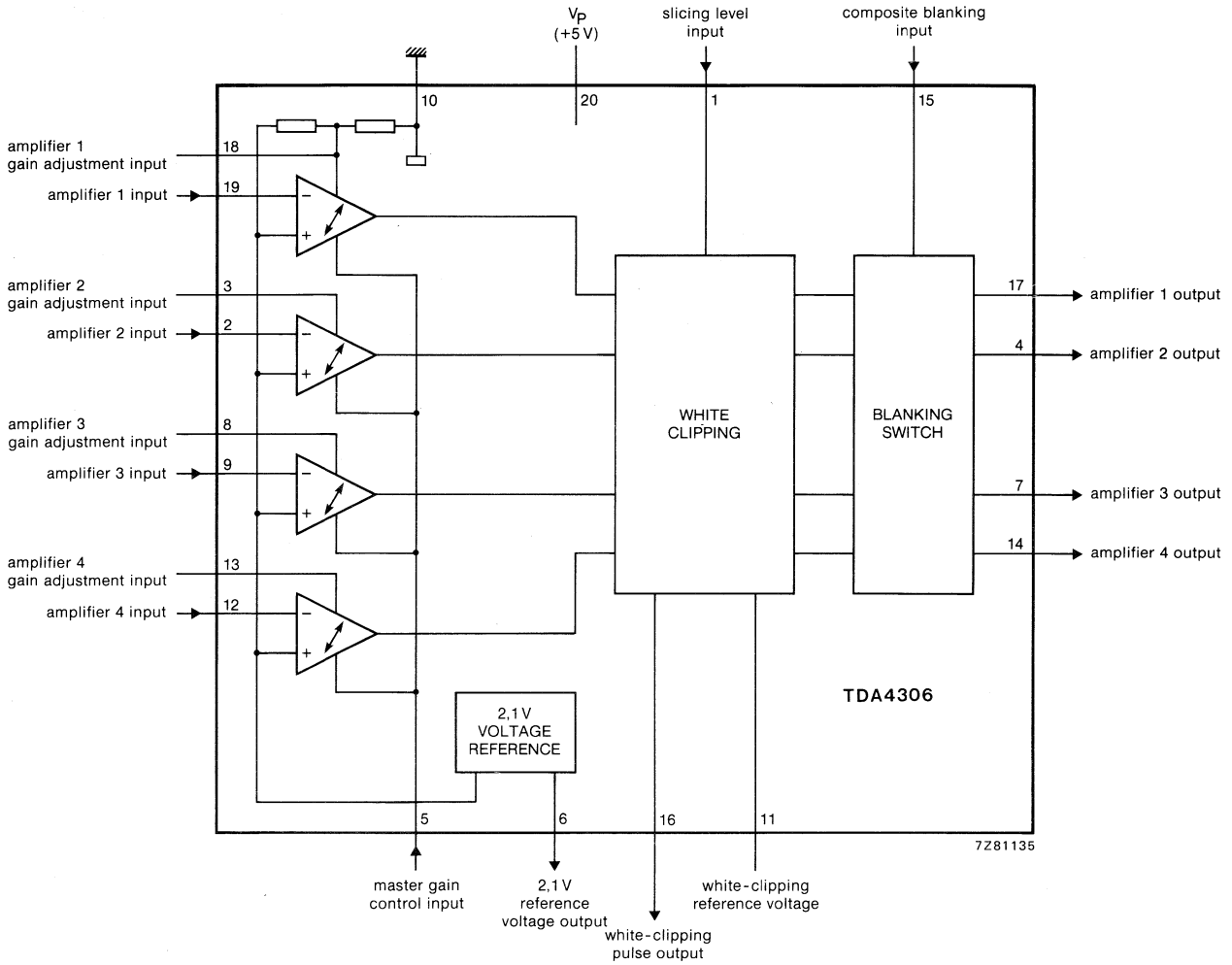


Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 20)	V_P	max.	12 V
Input voltage (pins 1, 2, 3, 5, 8, 9, 12, 13, 15, 18 and 19)	V_I	max.	5 V
Output current (pins 17, 4, 7 and 14) $t < 1$ s	I_O	max.	100 mA
Total power dissipation			
SO package*	P_{tot}	max.	370 mW
DIL package	P_{tot}	max.	1000 mW
Storage temperature range	T_{stg}	−25 to + 150	°C
Operating ambient temperature range	T_{amb}	−20 to + 70	°C

DEVELOPMENT DATA

* Mounted on p.c.b.

CHARACTERISTICS

$V_P = V_{20-10} = 5$ V; $T_{amb} = 25$ °C; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply					
Supply voltage (pin 20)	V_P	4,75	5,0	5,25	V
Reference voltage (pin 6)	V_{ref}	1,9	2,1	2,3	V
Temperature drift of V_{ref}	ΔV_{ref}	–	0,18	–	mV/°C
External load current	$I_{L(ext.)}$	–	–	10	mA
Total power dissipation	P_{tot}	90	140	200	mW
Variable gain amplifiers					
Inputs (pins 2, 9, 12 and 19; note 1)					
Input voltage (peak-to-peak value)					
negative video	$V_{n-10(p-p)}$	–	–	−1100	mV
positive video (gain = 1)	$V_{n-10(p-p)}$	–	–	400	mV
Input bias current at $V_I = 2{,}6$ V	$I_{n(bias)}$	–	2,2	5	μA
Input resistance	$R_{2, 9, 12, 19}$	–	300	–	kΩ
Outputs (pins 17, 4, 7 and 14)					
D.C. offset voltage of input to output (output = V_{ref})		–	–	−220	mV
D.C. offset voltage of input to output (output = V_{ref})		–	–	100	mV
Offset voltage between blanked output and V_{ref}		–	–	2	mV
Drift of blanked output voltages	ΔV_O	10	–	–	μV/°C
Output sink current	I_{OS}	–	–	100	μA
Resistive load of output to ground	R_L	1,5	–	–	kΩ
Output voltage swing at $V_{ref} = 2{,}1$ V		–	V_{ref}−500 mV	–	
Output voltage swing at $V_{ref} = 2{,}1$ V		–	V_{ref}+ 1200 mV	–	
Output impedance	$\lvert Z_O \rvert$	–	100	–	Ω
Power supply rejection ratio (1 kHz)	RR	–	30	–	dB
Bandwidth	B	6	–	–	MHz

parameter	symbol	min.	typ.	max.	unit
Master gain control input (pin 5)					
Gain control range			see Fig. 2		
Input current at V_{5-10} = 0 V	I_5	–	–	30	μA
Matching of gain (note 2) between the 4 channels ($f_{temp.\ range}$ and as $f_{gain\ range\ 2\ to\ x\ 8}$)		–	–	1	%
Gain stability = $f_{temp.range}$ $-20 < t < 60$ °C		–	3	–	%
Differential gain	dG	–	–	1	%
Differential phase	dϕ	–	–	2	deg.
Gain adjustment inputs (pins 18, 3, 8, 13)					
Input voltage range	V_{adj}	0,9	–	1,9	V
Overall gain (MG = 2) at V_{adj} = 0,9 V	G	–	–	2,2	
at V_{adj} = 1,9 V	G	1,5	–	–	
Input current (pins 3, 8 and 13) at V_I = 1,6 V	I_I	–	–	2	μA
Input resistance (pin 18)	R_{18}	–	3,25	–	kΩ
Input voltage (pin 18; open-circuit)	V_I	–	1,2	–	V
White clipping circuit					
Slicing level (pin 1) input voltage range	V_{1-10}	0,5	–	1,8	V
input current at V_{1-10} = 1 V	I_1	–	–	2	μA
White clipping reference voltage (pin 11)	V_{11-10}	–	V_{1-10} x 2,5 V	–	V
Output pulse (pin 16) (peak-to-peak value)	$V_{16-10(p-p)}$	3,0	–	–	V
Output voltage (pin 16) LOW	V_{OL}	–	–	1	V
HIGH	V_{OH}	4	–	–	V
Output sink current (pin 16)	I_{OS}	–	–	0,1	mA
Delay of a variable gain amplifier input to white clipping output	t_d	–	–	100	ns

DEVELOPMENT DATA

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Blanking switch (pin 15)					
Composite blanking input voltage					
active HIGH	$V_{15\text{-}10}$	2,4	–	V_P	V
active LOW	$V_{15\text{-}10}$	–	–	1,4	V
Input current at $V_{15\text{-}10}$ = 5 V	I_{15}	–	–	2	μA
Input capacitance	C_I	–	–	5	pF
Delay between blanking input and one of the 4 amplifier outputs	t_d	–	40	100	ns

Notes to the characteristics

1. The maximum input voltage is permitted only if the input voltage minus the d.c. offset voltage = 2,1 V. If the input voltage minus the d.c. offset voltage = 1,6 V, the maximum input voltage is 1 V(p-p).
2. Over the range 2 to x 8, after that each channel is adjusted to 0. This is possible only if the blanking pulse is switched off and the d.c. input voltage is equal to V_{ref}.

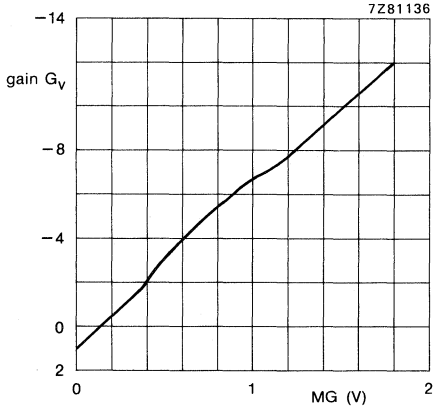


Fig. 2 Gain as a function of V_{MG}.

SMALL SIGNAL COMBINATION IC FOR MONOCHROME TV

GENERAL DESCRIPTION

The TDA4500 combines all small signal functions (except the tuner) which are required for a monochrome television receiver.

For a complete monochrome television receiver only output stages are required to be added for horizontal and vertical deflection, video and sound. The TDA4500 can also be used in simple colour television receivers. In this application an external sandcastle pulse generator is required.

It incorporates the following functions:

- vertical sync separator/oscillator
- vertical output
- coincidence detector (sound mute)
- phase detector/frequency control
- a.g.c. detector
- sync separator
- horizontal oscillator
- synchronous demodulator
- vision i.f. amplifier
- tuner a.g.c.
- d.c. volume control
- a.f.c. detector
- video output
- sound demodulator
- audio output
- gate pulse generator
- sound limiter/feedback
- 90° phase shift
- overload detector
- horizontal output

QUICK REFERENCE DATA

Supply voltage	V_{7-10}, V_{22-10}	typ.	10,5	V
Supply current	I_7	typ.	75	mA
Supply current	I_{22}	typ.	4,5	mA
Operating ambient temperature range	T_{amb}		−25 to +65	°C
Storage temperature range	T_{stg}		−25 to +150	°C
Power dissipation	P_{tot}	max.	1,7	W

PACKAGE OUTLINE

28-lead DIL; plastic, with internal heat spreader (SOT-117).

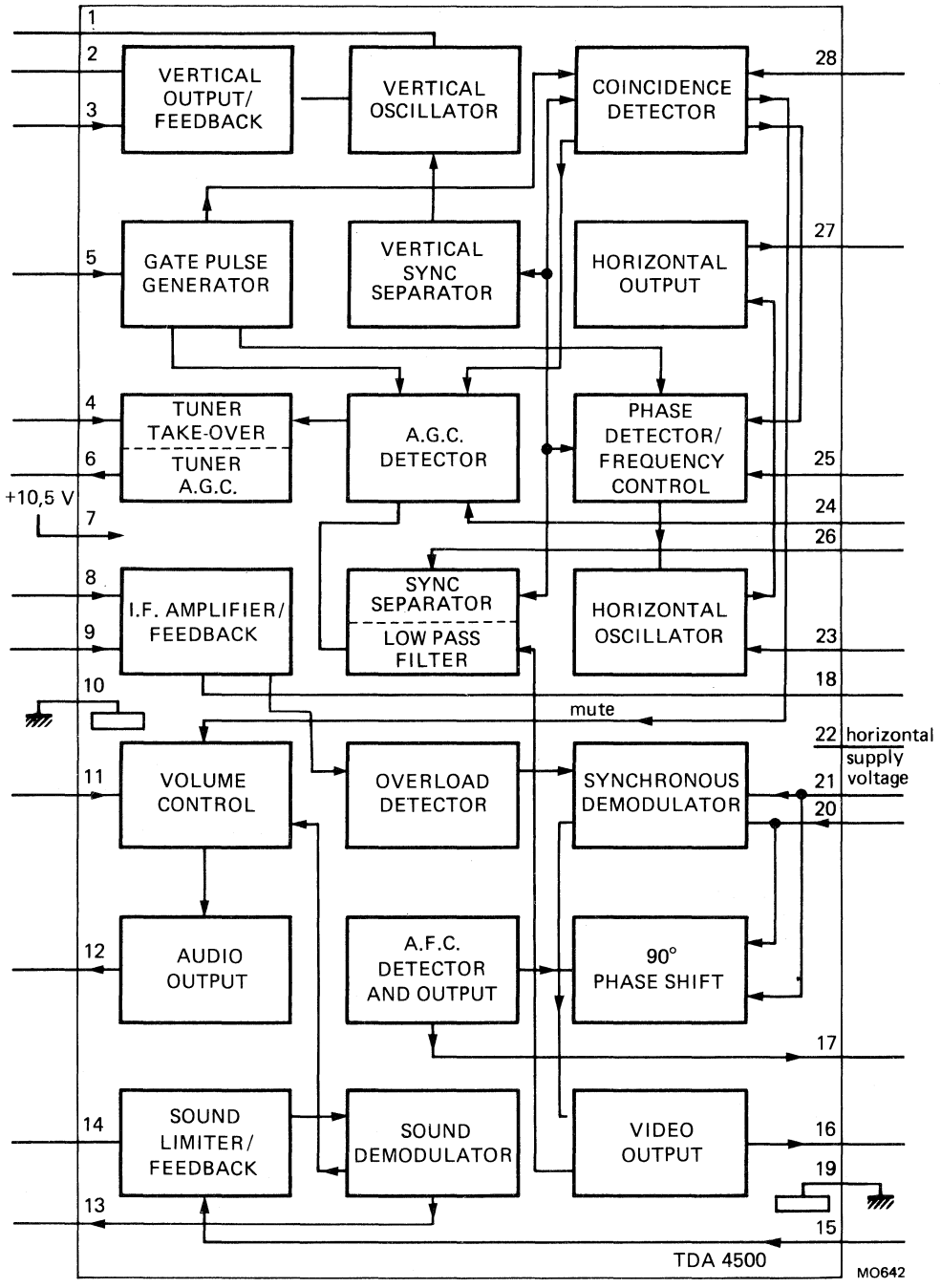


Fig. 1 Block diagram.

PINNING

Pin number	function	Pin number	function
1.	vertical oscillator	15.	sound i.f.
2.	vertical output	16.	video output
3.	vertical feedback	17.	a.f.c. output
4.	top linearity	18.	decoupling capacitor
5.	flyback pulse	19.	ground
6.	tuner a.g.c.	20.	38,5 MHz reference
7.	+10,5 V supply	21.	(38,9 MHz reference)
8.	i.f. input	22.	horizontal supply voltage
9.		23.	horizontal oscillator
10.	ground	24.	top sync detector
11.	volume control	25.	phase detector
12.	sound output	26.	sync separator
13.	6 MHz tuning (5,5 MHz tuning)	27.	horizontal output
14.	decoupling	28.	mute/coincidence detector

FUNCTIONAL DESCRIPTION (Fig. 1)

A complete black-and-white receiver can be built around this circuit by adding only the output stages for horizontal and vertical deflection with the video and sound output stages. The TDA4500 can also be used in simple colour television receivers using an external circuit to generate the sandcastle.

The block diagram (Fig. 1) depicts the various functions which are described briefly below.

The sensitivity of the i.f. amplifier is 70 μV for a peak-to-peak output voltage of 3 V (compare the TDA3541). This amplifier has a symmetrical input (pins 8 and 9) and is followed by a synchronous demodulator. The external tuned circuit is connected to pins 20 and 21. This circuit provides the information for the a.f.c. circuit, the 90^{o} phase shift being supplied by internal RC-networks. An a.f.c. output with a voltage swing of about 9 V is obtained from pin 17 (V_{7-10} = 10,5 V).

The a.g.c. detector is gated to reduce sensitivity to external electrical noise and the a.g.c. time constant network is connected to pin 24. Gain control range of the i.f. amplifier is greater than 60 dB. Adjustments of the tuner take-over point is made at pin 4. When the voltage at pin 4 is approximately 3,5 V the direction of the tuner control voltage is positive-going. When the voltage at pin 4 is approximately 8 V the direction of the tuner control voltage is negative-going.

An output signal of 3 V (p-p) is obtained from the video amplifier (top sync level 1,5 V) with negative-going sync. Since the sound signal is derived from pin 16 (see Fig. 4) the video output is not blanked during the flyback period. As shown in the application circuit (Fig. 4) the band-pass filter for the sound must be connected between video output (pin 16) and sound i.f. input (pin 15). Sound information passes through a sound limiter network and a sound demodulator circuit with an external tuned circuit for this stage connected to pin 13. The demodulator is followed by a volume control stage with a control range of 80 dB and an output amplifier with an audio output signal of 170 mV (r.m.s.) for a Δf of 7,5 kHz and at maximum volume setting.

The slicing level of the sync separator is referred to the top sync and is determined by the values of external resistors, the recommended slicing level being 30%. Noise protection is provided for the sync separator stage. Separated sync pulses are supplied to the gated phase detector which compare the sync pulses with the sawtooth voltage obtained from the horizontal flyback pulse (pin 5). During catching the gating of the phase detector is switched off and the phase detector output current is increased.

The in-sync or out-of-sync condition is detected with the coincidence detector which is also used for transmitter identification. Sound output is suppressed when no input signal is available. Clamping the voltage on pin 28 to a level of 3,5 V sets the phase detector to a high output current, short time constant mode. This is appropriate for the reception of VCR signals.

Phase detector output voltage levels maintain the horizontal oscillator at its correct operating frequency. The push-pull output (pin 27) has a typical duty cycle of 40%.

Vertical sync pulses are obtained from an internal integrating network with the vertical sawtooth being generated in the vertical oscillator. This sawtooth voltage is compared with the feedback voltage from the deflection coil via pin 3. The comparator generates the drive voltage for the vertical deflection output stage.

The TDA4500 has four supply pins. Pin 7 and pin 10 are for the main positive supply and circuit ground respectively.

Critical circuits are grounded by pin 19. Pin 22 is the supply for the horizontal oscillator. A low current supply (5 mA minimum) can be used to start the oscillator from an external high voltage supply rail.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Supply voltage	V_{7-10}, V_{22-10}	max.	13,2	V
Total power dissipation	P_{tot}	max.	1,7	W
Storage temperature range	T_{stg}		−25 to +150	°C
Operating ambient temperature range	T_{amb}		−25 to +65	°C

CHARACTERISTICS

V_{7-10} = 10,5 V, V_{22-10} = 10,5 V and T_{amb} = 25 °C unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply voltage	V_{7-10}	9,5	10,5	13,2	V
Supply current	I_7	–	75	–	mA
Supply voltage (horizontal oscillator)	V_{22-10}	9,5	10,5	13,2	V
Supply current (horizontal oscillator, note 1)	I_{22}	–	4,5	–	mA
Power dissipation	P_{tot}	–	850	–	mW
Vision i.f. amplifier (pin 8)					
Input sensitivity (onset of a.g.c.) at 39,5 MHz (note 2)	$V_{i(rms)}$	–	70	–	μV
Differential input resistance (note 3)	R_i	–	800	–	Ω
Differential input capacitance (note 3)	C_i	–	6	–	pF
Gain control range	ΔG	–	56	–	dB
Output signal expansion for 50 dB input signal variation (note 4)	ΔV_o	–	1	–	dB
Maximum input signal	$V_{i\ max}$	–	50	–	mV
Video amplifier (note 5)					
Zero signal output level (note 6)	V_{16-10}	–	5	–	V
Top sync output level (note 7)	V_{16-10}	1,2	1,4	1,6	V
Video output signal amplitude (peak-to-peak value)	$V_{16-10(p-p)}$	2,75	3,0	3,25	V
Internal bias current of n-p-n emitter follower output transistor	I_B	1,4	2,0	–	mA
Bandwidth of demodulated output signal	B	5	6	–	MHz
Video non-linearity (note 8)		–	–	10	%

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Tuner a.g.c.					
Take-over voltage (pin 4) for positive-going tuner a.g.c. (n-p-n tuner)	V_{4-10}	–	3,5	–	V
Take-over voltage (pin 4) for negative-going tuner a.g.c. (p-n-p tuner)	V_{4-10}	–	8	–	V
Maximum tuner a.g.c. output swing	$I_{6\ max}$	2	3	–	mA
Output saturation voltage at I_6 = 2 mA	$V_{6-10(sat)}$	–	–	300	mV
Leakage current	I_6	–	–	1	μA
A.F.C. circuit (note 9)					
A.F.C. output voltage swing	V_{17-19}	9	–	10	V
Available output current	$\pm I_{17}$	–	1	–	mA
Output voltage at nominal tuning of the reference tuned circuit	V_{17-19}	–	5,25	–	V
Sound circuit					
Input limiting voltage when $V_O = V_{Omax} - 3$ dB (note 10)	$V_{14\ lim}$	–	400	–	μV
Input resistance at pin 15 (note 11)	R_i	–	3	–	kΩ
A.F. output signal at pin 12 (note 12) (r.m.s. value)	$V_{12-10(rms)}$	170	–	240	mV
Volume control (pin 11) (Fig. 3)					
Voltage with pin 11 disconnected	V_{11-10}	–	6,5	–	V
Current pin 11 short-circuited to ground	I_{11}	–	1	–	mA
Volume control characteristic (note 13)			See Fig. 3		
Value of external control resistor	R_{11-10}	–	5	–	kΩ

parameter	symbol	min.	typ.	max.	unit
Horizontal synchronization circuit					
Slicing level sync separator (note 14)		–	30	–	%
Holding range PLL		–	±1000	–	Hz
Catching range PLL		–	±600	–	Hz
Control sensitivity video to flyback (note 15)		–	2	–	kHz/μs
Horizontal oscillator					
Free running frequency	f_{osc}	–	15625	–	Hz
Spread with fixed external components	Δf_{osc}	–	–	4	%
Frequency variations due to supply voltage changes (note 16)	$\Delta f_{osc}/\Delta V$	–	0	–	%
Frequency variation with temperature	$\Delta f_{osc}/\Delta T$	–	–	1×10^{-4}	K^{-1}
Maximum frequency shift	Δf_{osc}	–	–	10	%
Maximum frequency deviation between starting point output and nominal condition	Δf_{osc}	–	–	10	%
Horizontal (push-pull) output					
Output current	I_{27}	10	–	–	mA
Output impedance	R_{27-10}	–	200	–	Ω
Voltage when I_{27} = 10 mA	V_{27-10}	–	2	–	V
	V_{27-22}	–	3	–	V
Duty cycle of output pulse (note 17)	δ	0,35	0,40	0,45	
Flyback input (note 18)					
Minimum required input amplitude (peak-to-peak value)	$V_{5-10(p-p)}$	–	4	–	V
Phase detector switching voltage		–	0	–	V

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Coincidence detector (mute) (note 19)					
Voltage in synchronized condition	V_{28-19}	–	9,5	–	V
Voltage in non-synchronized condition (no-signal)	V_{28-19}	–	1,0	1,5	V
Switching level to switch phase detector from slow to fast	V_{28-19}	4,5	5,0	5,5	V
Switching level to activate the 'mute' function (transmitter identification)	V_{28-19}	2,25	2,5	2,75	V
Output current; in-sync (peak-to-peak value)	$I_{28(p-p)}$	–	1	–	mA
Vertical oscillator					
Free running frequency	f_{osc}	–	47,5	–	Hz
Spread with fixed external components	Δf_{osc}	–	–	4	%
Holding range at nominal frequency		52,5	–	–	Hz
Temperature coefficient	TC	–	1×10^{-4}	–	K^{-1}
Frequency shift due to a supply voltage change from 9,5 to 12 V	$\Delta f_{osc}/\Delta V$	–	5	–	%
Vertical output (pin 2)					
Output current	I_2	1	1,3	–	mA
Output resistance	R_{2-10}	–	2	–	kΩ
Feedback input (pin 3)					
D.C. input voltage	V_{3-10}	4,75	5	5,25	V
A.C. input voltage (peak-to-peak value)	$V_{3-10(p-p)}$	–	1,2	–	V
Input current	I_3	–	–	10	μA
Non-linearity of deflection current at V_P = 10,5 V		–	–	2,5	%

Notes to characteristics

1. It is possible to start the horizontal oscillator by supplying a current of 5 mA which can be taken from the mains rectifier, to pin 22. The main supply (pin 7) can then be derived from the horizontal output stage.
2. I.F. input voltage (r.m.s.) – value at top sync level at which the video amplitude has dropped 0,5 dB compared with the amplitude at an input signal of 10 mV.
3. The input impedance has been chosen such that a SAW-filter can be applied. 800 Ω is an acceptable compromise between the requirements for triple transient suppression and power loss.
4. Measured with 0 dB = 150 μV.
5. Measured at 10 mV(r.m.s.) top sync input signal.
6. With switched demodulator.
7. Signal with negative-going sync with top white being 10% of the top sync amplitude (Fig. 2).
8. This figure is valid for the complete video signal amplitude (peak-white to top sync).
9. Measured with an input signal (V_{8-9}) of 10 mV(r.m.s.); the a.f.c. output (pin 7) loaded with 2 x 100 kΩ between the supply and ground. The Q factor of the reference tuned circuit is 50.
10. Voltage at pin 15 is the r.m.s. value. Q_L of the demodulator tuned circuit is 20. Audio frequency is 1 kHz and the carrier frequency is 5,5 MHz.
11. Measured with an input signal of 1 mV(r.m.s.)
12. The tuned demodulator circuit must give an output level equal to that given in the "mute" condition.
13. Volume can be controlled using a variable resistor connected to ground (nominal 5 kΩ) or by means of a variable d.c. voltage. In this latter case the rather low impedance at pin 11 must be taken into account.

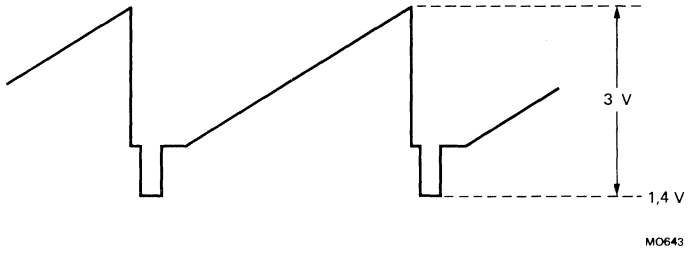


Fig. 2 Video output signal.

Notes to characteristics (continued)

14. The sync separator is noise gated. The slicing level is referred to top sync level and is independent of the video information. The value given is a percentage of the sync pulse amplitude. The slicing depends on the values of external resistors connected to pin 26.
15. Phase detector current increases by a factor of 7 during "catching" and when phase detector operates in the 'FAST' mode (pin 28). This ensures a high catching range and a higher dynamic loop gain.
16. Supply voltage variation in the range 8 to 12 V.
17. The negative-going edge of this pulse initiates the switch-off of the horizontal output transistor (simultaneous driver).
18. The circuit requires an integrated flyback pulse. The gate pulses for a.g.c. and the coincidence detector are obtained from the sawtooth.
19. The functions of in-sync/out-of-sync and transmitter identification have been combined on pin 28. For reception of VCR-signals the voltage on this pin must be fixed between 3 V and 4,5 V so that the time constant is fast and the sound is still available.

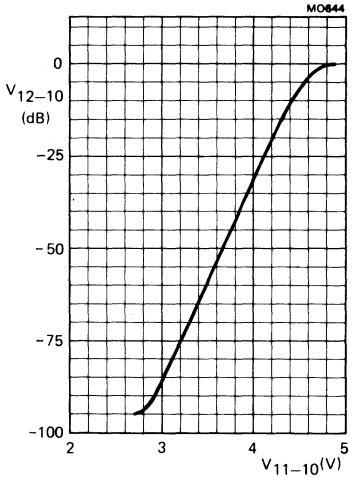


Fig. 3 Volume control characteristic at f = 1 kHz.

APPLICATION INFORMATION

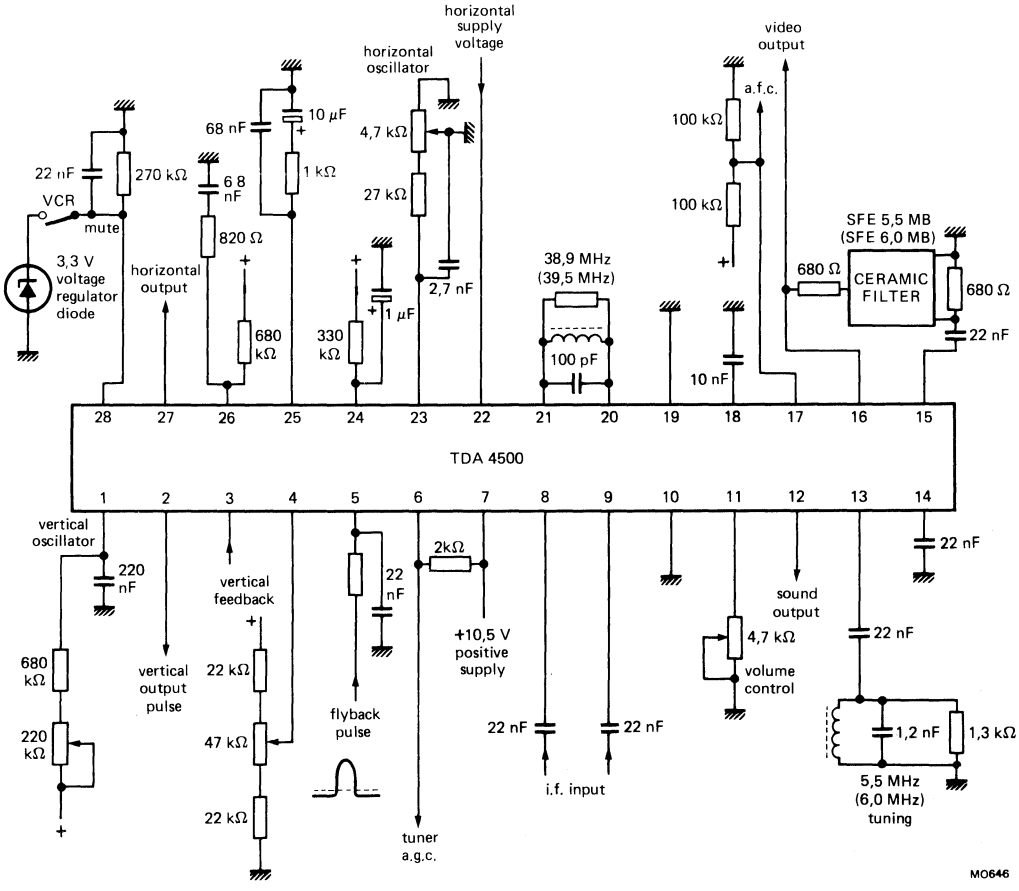


Fig. 4 Typical application circuit.

SMALL SIGNAL COMBINATION IC FOR COLOUR TV

GENERAL DESCRIPTION

The integration into a single package of all small-signal functions required for colour tv reception is achieved in the TDA4501. The only additional circuits needed to complete the receiver are a tuner, the deflection output stages and a colour decoder.
The IC includes a vision IF amplifier with synchronous demodulator and AFC circuit; an AGC detector with tuner output; an integral three-level sandcastle pulse generator; and fully synchronized vertical and horizontal drive outputs. A triggered vertical divider automatically adapts to 50 or 60 Hz working and eliminates the need for an external vertical frequency control.
Signal-strength dependent time-constant switches in the horizontal phase detector make external VCR switching unnecessary.
Sound signals are demodulated and amplified within the IC in a circuit which includes volume control and muting.

Features

- Vision IF amplifier with synchronous demodulator
- AGC detector for negative modulation
- AGC output to tuner
- AFC circuit
- Video and audio preamplifiers
- Sound IF amplifier and demodulator
- Choice of sound volume control or horizontal oscillator starting function
- Horizontal synchronization circuit with two control loops
- Triggered divider system for vertical synchronization and sawtooth generation giving automatic amplitude adjustment for 50 or 60 Hz working
- Transmitter identification circuit with mute output
- Sandcastle pulse generator

QUICK REFERENCE DATA

Supply voltage	V_{7-6}	typ.	10,5 V
Supply voltage	V_{11-6}	typ.	10,5 V
Operating ambient temperature range	T_{amb}	−25 to	+ 65 °C
Storage temperature	T_{stg}	−25 to	+ 150 °C
Power dissipation	P_{tot}	max.	1,7 W

PACKAGE OUTLINE

28-lead DIL; plastic (with internal heat spreader) (SOT-117).

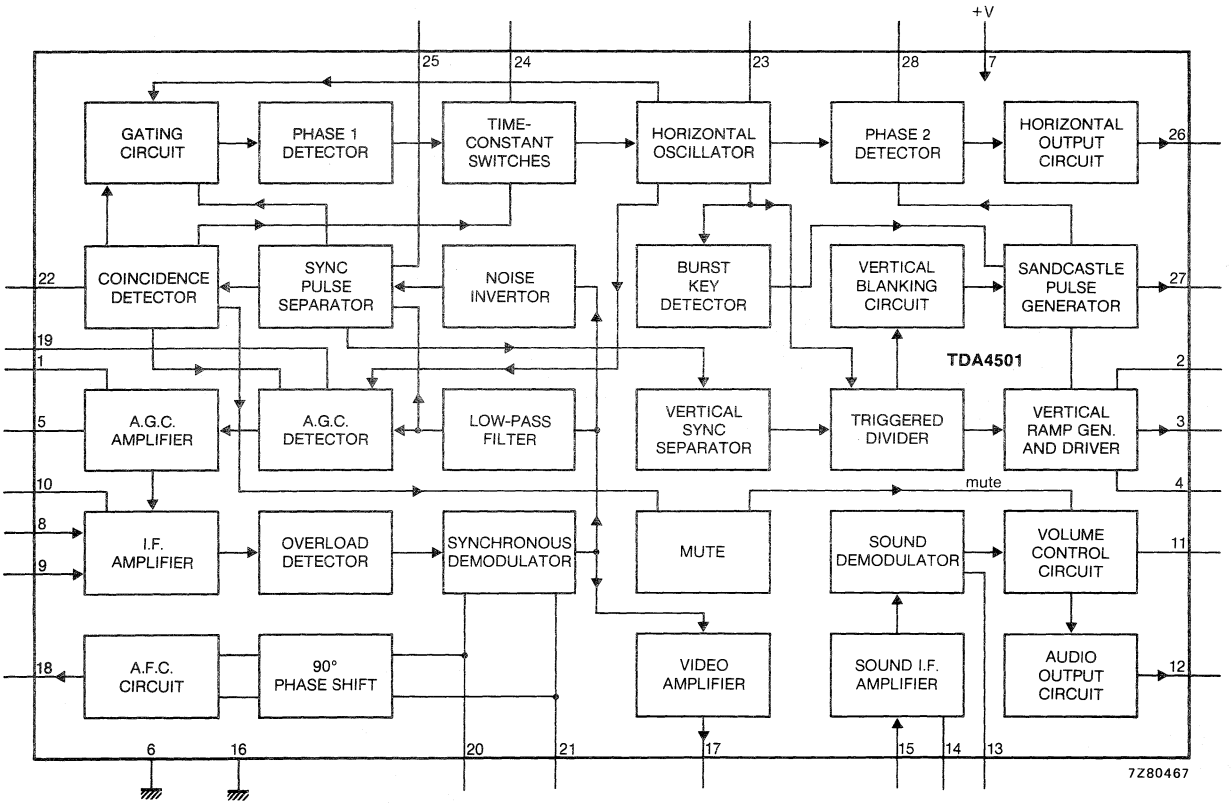


Fig. 1 Block diagram.

PINNING

1. AGC take over
2. Ramp generator
3. Vertical drive
4. Vertical feedback
5. Tuner AGC
6. Ground
7. Supply
8. IF input
9. IF input
10. Decoupling capacitor
11. Volume control/start Hor. osc.
12. Audio output
13. Sound demodulator
14. Sound IF decoupling
15. Sound IF input
16. Ground
17. Video output
18. AFC
19. AGC detection
20. Sync demodulator
21. Sync demodulator
22. Coincidence detector decoupling
23. Horizontal oscillator
24. Frequency control
25. Sync separator
26. Horizontal drive
27. Sandcastle out/flyback in
28. Phase detection

FUNCTIONAL DESCRIPTION

IF amplifier, demodulator and AFC

The IF amplifier has a symmetrical input (pins 8 and 9), the input impedance of which is suitable for SAW-filtering to be used. The synchronous demodulator and the AFC circuit share an external reference tuned circuit (pins 20 and 21). An internal RC-network provides the necessary phase-shifting for AFC operation. The AFC circuit provides a control voltage output with a swing greater than 9 V from pin 18.

AGC circuit

Gating of the AGC detector is performed to reduce sensitivity of the IF amplifier to external electrical noise. The AGC time constant is provided by an RC-circuit connected to pin 19. Tuner AGC voltage is supplied from pin 5 and is suitable for tuners with p-n-p or n-p-n RF stages. The sense of the AGC (to increase in a positive or negative direction) and the point of tuner take-over are preset by the voltage level at pin 1.

Video amplifier

The signal through the video amplifier comprises video and sound information, therefore no gating of the video amplifier is performed during flyback periods.

Sound circuit and horizontal oscillator starting function

The input to the sound IF amplifier is obtained by a bandpass filter coupling from the video output (pin 17). The sound is demodulated and passed via a dual-function volume control stage to the audio output amplifier. The volume control function is obtained by connecting a variable resistor (10 kΩ) between pin 11 and ground, or by supplying pin 11 with a variable voltage. Sound output is suppressed by an internal mute signal when no input signal is present.

The horizontal oscillator starting function is obtained by supplying pin 11 with a current of 6 mA during the switching-on period. The IC then uses this current to generate drive pulses for the horizontal deflection. For this application, the main supply voltage for the IC can be obtained from the horizontal deflection circuit.

FUNCTIONAL DESCRIPTION (continued)

Vertical divider system

A triggered divider system is used to synchronize the vertical drive waveforms, adjusting automatically to 50 or 60 Hz working. A large window (search window) is opened between counts of 488 and 722; when a separated vertical sync pulse occurs before count 576, the system works in the 60 Hz mode, otherwise 50 Hz working is chosen.
A narrow window is opened when 15 approved sync pulses have been detected. Divider ratio between 522 and 528 switches to 60 Hz mode; between 622 and 628 switches to 50 Hz mode.
The vertical blanking pulse is also generated via the divider system by adding the anti-topflutter pulse and the blanking pulse.

Line phase detector

The circuit has three operating conditions:
a. Strong input signal and synchronized.
b. Weak signal and synchronized.
c. Non synchronized (weak and strong) signal.
The input signal condition is obtained from the AGC circuit.

D.C. volume control/horizontal oscillator start

The operation depends on the application. When during switch-on no current is supplied pin 11 will act as volume control. When a current of 6 mA is applied the volume control is set to maximum and the circuit will generate drive pulses for the horizontal deflection.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 7)	$V_P = V_{7-6}$	max.	13,2 V
Total power dissipation	P_{tot}	max.	1,7 W
Operating ambient temperature range	T_{amb}	−25 to	+ 65 °C
Storage temperature range	T_{stg}	−25 to	+ 150 °C

DEVELOPMENT DATA

CHARACTERISTICS

$V_P = V_{7-6} = 10{,}5$ V; $T_{amb} = 25\ ^oC$; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supplies					
Supply voltage (pin 7)	V_{7-6}	9,5	10,5	13,2	V
Supply current (pin 7)	I_7	–	120	–	mA
Supply voltage (pin 11)	V_{11-6}	–	10,5	–	V
Supply current (pin 11) for horizontal oscillator start	I_{11}	–	6	–	mA
Vision IF amplifier (pins 8 and 9)					
Input sensitivity at 38,9 MHz (note 1)	V_{8-9}	40	70	120	μV
Input sensitivity at 45,75 MHz (note 1)	V_{8-9}	–	90	–	μV
Differential input resistance (pin 8 to 9)	R_{8-9}	–	1,3	–	kΩ
Differential input capacitance (pin 8 to 9)	C_{8-9}	–	5	–	pF
AGC range		–	60	–	dB
Maximum input signal	V_{8-9}	50	70	–	mV
Expansion of output signal for 50 dB variation of input signal with V_{8-9} at 150 μV (0 dB)	ΔV_{17-6}	–	1	–	dB
Video amplifier					
Output level for zero signal input (zero point of switched demodulator)	V_{17-6}	–	4,5	–	V
Output signal top sync level (note 2)	V_{17-6}	–	1,4	–	V
Amplitude of video output signal (peak-to-peak value)	$V_{17-6(p-p)}$	–	2,8	–	V
Internal bias current of output transistor (n-p-n emitter follower)	$I_{17(int)}$	1,4	2,0	–	mA
Bandwidth of demodulated output signal	B	–	6	–	MHz
Differential gain (Fig. 4)	G_{17}	–	6	–	%
Differential phase (Fig. 4)		–	4	–	%
Video non-linearity complete video signal amplitude		–	–	10	%
Intermodulation (Fig. 5) at gain control = 45 dB					
f = 1,1 MHz; blue;		55	60	–	dB
f = 1,1 MHz; yellow;		50	54	–	dB
f = 3,3 MHz; blue;		60	66	–	dB
f = 3,3 MHz; yellow		55	59	–	dB

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Video amplifier (continued)					
Signal to noise ratio (note 3)					
Z_S = 75 Ω					
V_i = 10 mV	S/N	50	54	–	dB
end of gain control range	S/N	50	56	–	dB
Residual carrier signal		–	7	30	mV
Residual 2nd harmonic of carrier signal		–	3	30	mV
Tuner AGC *					
Take-over voltage (pin 1 for positive-going tuner AGC (NPN tuner)	$V_{1\text{-}6}$	–	3,5	–	V
Starting point take over; V = 5 V	$V_{1\text{-}6(rms)}$	–	0,4	2	mV
Starting point take over; V = 1,2 V	$V_{1\text{-}6(rms)}$	50	70	–	mV
Take-over voltage (pin 1) for negative-going tuner AGC (PNP tuner)	$V_{1\text{-}6}$	–	8	–	V
Starting point take over; V = 9,5 V	$V_{1\text{-}6(rms)}$	–	0,3	2	mV
Starting point take over; V = 5,6 V	$V_{1\text{-}6(rms)}$	50	70	–	mV
Maximum output swing	$I_{5\,max}$	2	3	–	mA
Output saturation voltage I = 2 mA	$V_{5\text{-}6(sat)}$	–	–	300	mV
Leakage current	I_5	–	–	1	μA
Input signal variation complete tuner control	ΔV_i	0,5	2	4	dB
AFC circuit (pin 18; note 4)					
AFC output voltage swing	$V_{18\text{-}6(p\text{-}p)}$	9	–	10	V
Available output current	$\pm I_{18}$	–	1	–	mA
Control steepness					
–100% picture carrier		20	40	80	mV/kHz
–10% picture carrier		–	15	–	mV/kHz
Output voltage at nom. tuning of the reference tuned circuit	$V_{18\text{-}6}$	–	5,25	–	V
Output voltage without input signal	$V_{18\text{-}6}$	2,7	5,25	8,5	V

* Starting point tuner take-over NPN current 1,8 mA; PNP tuner I = 0,2 mA.

DEVELOPMENT DATA

parameter	symbol	min.	typ.	max.	unit
Sound circuit					
Input limiting voltage $V_o = V_o$ max. −3 dB; Q_L = 16 f_{AF} = 1 kHz; f_c = 5,5 MHz	V_{15lim}	–	400	–	μV
Input resistance $V_{i(rms)}$ = 1 mV	R_{15-6}	–	2,6	–	kΩ
input capacitance $V_{i(rms)}$ = 1 mV	C_{15-6}	–	6	–	pF
AM rejection (Figs 8 and 9)					
V_i = 10 mV	AMR	–	35	–	dB
V_i = 50 mV	AMR	–	43	–	dB
AF output signal Δf = 7,5 kHz; min. distortion	$V_{12-6(rms)}$	220	320	–	mV
AF output impedance	Z_{12-6}	–	150	–	Ω
Total harmonic distortion Δf = 27,5 kHz	THD	–	1	–	%
Ripple rejection					
f_k = 100 Hz, volume control 20 dB	RR	–	22	–	dB
when muted	RR	–	26	–	dB
Output voltage mute condition	V_{12-6}	–	2,6	–	V
Signal to noise ratio weighted noise (CCIR 468)	S/N	–	47	–	dB
Volume control					
Voltage (pin 11 disconnected)	V_{11-6}	–	4,8	–	V
Current (pin 11 short circuited)	I_{11}	–	1	–	mA
External control resistor	R_{11-6}	–	10	–	kΩ
Suppression output signal during mute condition		–	66	–	dB
Horizontal synchronization					
Slicing level sync separator		–	30	–	%
Holding range PLL		800	1100	1500	Hz
Catching range PLL		600	1000	–	Hz
Control sensitivity					
video to oscillator; at weak signal		–	2	–	kHz/μs
at strong signal during scan		–	3	–	kHz/μs
during vert. retrace and during catching		–	6	–	kHz/μs

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Second control loop (positive edge)					
Control sensitivity	$\Delta t_d/\Delta t_o$	–	300	–	μs
Control range	t_d	–	25	–	μs
Phase adjustment via second control loop; control sensitivity		–	25	–	μA/μs
Maximum allowed phase shift		–	± 2	–	μs
Horizontal oscillator (pin 23)					
Free running frequency R = 35 kΩ; C = 2,7 nF	f_{fr}	–	15625	–	Hz
Spread with fixed external components		–	–	4	%
Frequency variation due to change of supply voltage from 8 to 12 V	Δf_{fr}	–	0	0,5	%
Frequency variation with temperature	Δf_{fr}	–	–	1×10^{-4}	K^{-1}
Maximum frequency shift	Δf_{fr}	–	–	10	%
Maximum frequency deviation (V_{7-6} = 8 V)	Δf_{fr}	–	–	10	%
Horizontal output (pin 26)					
Output voltage high	V_{26-6}	–	–	13,2	V
Output voltage at which protection commences	V_{26-6}	–	–	15,8	V
Output voltage low at I_{26} = 10 mA	V_{26-6}	–	0,3	0,5	V
Duty cycle of horizontal output signal	δ_0	–	45	–	%
Rise and fall times of output pulse	t_r, t_f	–	150	–	ns
Flyback input and sandcastle output					
Input current required during flyback pulse	I_{27}	0,1	–	2	mA
Output voltage during burst key pulse	V_{27-6}	7,5	–	–	V
Output voltage during horizontal blanking	V_{27-6}	3,5	4,0	4,5	V
Output voltage during vertical blanking	V_{27-6}	1,8	2,2	2,6	V
Width of burst key pulse		3,1	3,5	3,9	μs
Width of horizontal blanking pulse		flyback pulse width			
Width of vertical blanking pulse 50 Hz working		–	21	–	lines
60 Hz working		–	17	–	lines
Delay between start of sync pulse at video output and rising edge of burst key pulse		–	5,2	–	μs

parameter	symbol	min.	typ.	max.	unit
Coincidence detector mute output (pin 22)					
Voltage for in-sync condition	V_{22-6}	–	9,5	–	V
Voltage for no-sync condition no signal	V_{22-6}	–	1,0	1,5	V
Switching level to switch phase detector from slow to fast	V_{22-6}	4,9	5,3	5,8	V
Fast-to-slow hysteresis		–	1	–	V
Switching level to activate mute function (transmitter identification)	V_{22-6}	2,25	2,5	2,75	V
Output current for in-sync condition (peak-to-peak value)	$I_{22(p-p)}$	0,7	1,0	–	mA
Vertical ramp generator (pin 2)					
Input current during scan	I_2	–	12	–	μA
Discharge current during retrace	I_2	–	0,5	–	mA
Minimum voltage	V_{2-6}	–	1,5	–	V
Vertical output (pin 3)					
Output current	I_3	–	–	10	mA
Output impedance	R_{3-6}	–	400	–	Ω
Feedback input (pin 4)					
Input voltage					
d.c. component	V_{4-6}	–	3	–	V
a.c. component (peak-to-peak value)	$V_{4-6(p-p)}$	–	1,2	–	V
Input current	I_4	–	–	12	μA
Internal precorrection to sawtooth		–	6	–	%
Deviation amplitude 50/60 Hz		–	–	5	%

DEVELOPMENT DATA

Notes

1. Typical value taken at starting level of AGC.
2. Signal with negative going sync, maximum white level 10% of the maximum sync amplitude (see Fig. 3).
3. Signal-to-noise ratio equals $20 \log \frac{V_{o(\text{black to white})}}{V_{n(rms)} \text{ at } B = 5 \text{ MHz}}$.
4. $V_{i(rms)} = 10$ mV; see Fig. 2; Q-factor = 36.

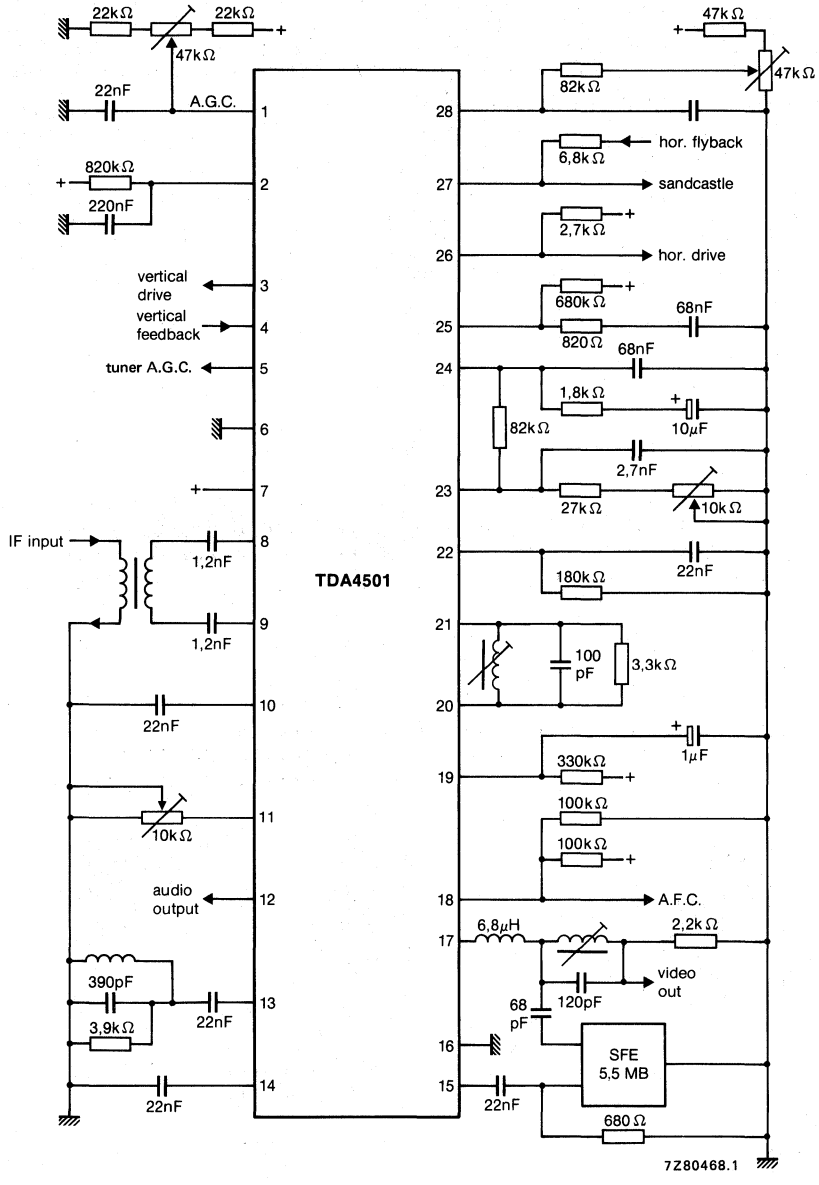


Fig. 2 Application diagram.

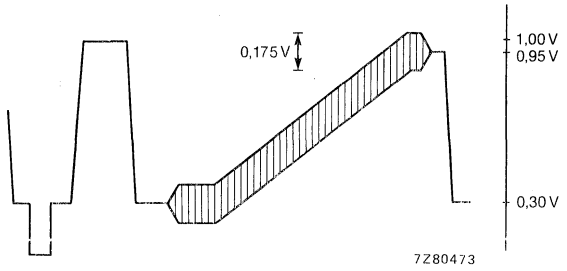


Fig. 3 Video output signal.

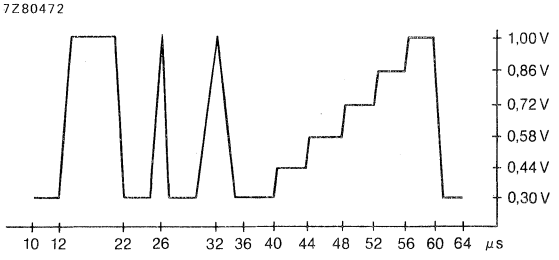


Fig. 4 E.B.U. test signal waveform (line 330).

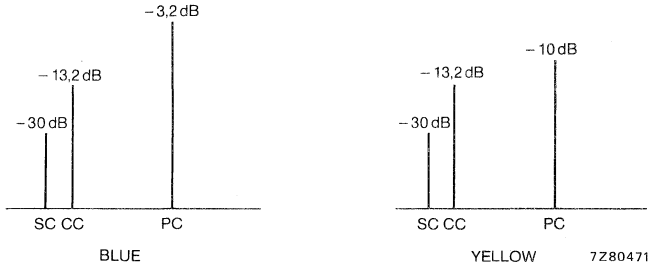


Fig. 5 Input signal conditions.
SC = sound carrier
CC = chrominance carrier
PC = picture carrier
all with respect to top sync level.

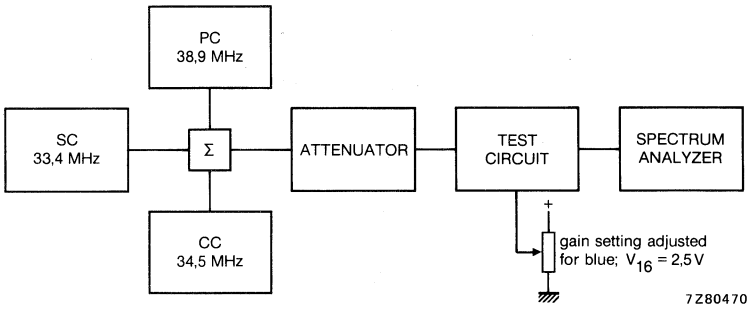


Fig. 6 Test set-up intermodulation.

Value at 1,1 MHz: $20 \log \frac{V_o \text{ at } 4{,}4 \text{ MHz}}{V_o \text{ at } 1{,}1 \text{ MHz}} + 3{,}6 \text{ dB}$

Value at 3,3 MHz: $20 \log \frac{V_o \text{ at } 4{,}4 \text{ MHz}}{V_o \text{ at } 3{,}3 \text{ MHz}}$.

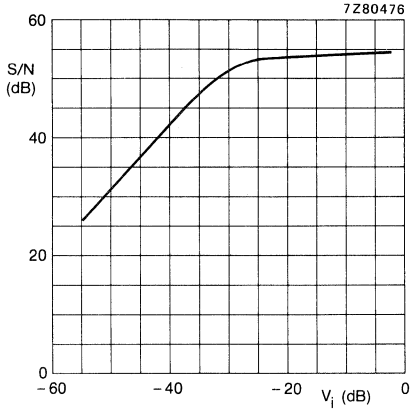


Fig. 7 S/N ratio as a function of the input voltage.

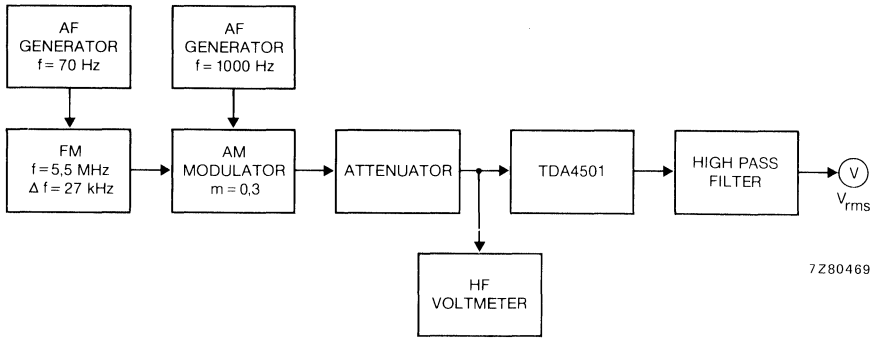


Fig. 8 Test set-up AM suppression.

DEVELOPMENT DATA

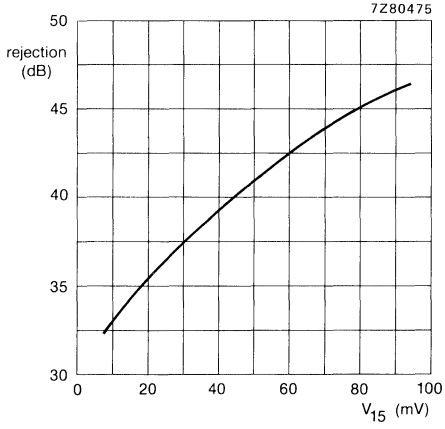


Fig. 9 AM rejection.

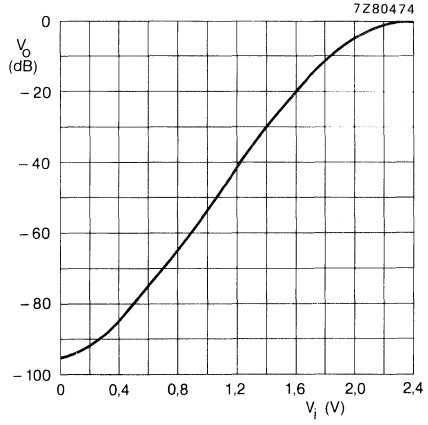


Fig. 10 Volume control characteristics.

SMALL-SIGNAL COMBINATION IC FOR BLACK-AND-WHITE TV

GENERAL DESCRIPTION

This IC contains all small-signal functions required for black-and-white tv reception. The only additional circuits needed to complete the receiver are a tuner and the deflection output stages.

The IC includes a vision i.f. amplifier with synchronous demodulator and a.f.c. circuit, an a.g.c. detector with tuner output and fully synchronized vertical and horizontal drive outputs.

Sound signals are demodulated and amplified within the IC in a circuit which includes volume control and internal muting.

The TDA4503 may also be adapted for simple colour tv reception by the use of an external, three-level sandcastle pulse generator.

Features

- Vision i.f. amplifier with synchronous demodulator
- A.G.C. detector and amplifier with a.g.c. output to tuner
- A.F.C. circuit
- Video preamplifier
- Audio preamplifier
- Sound i.f. amplifier and demodulator
- D.C. volume control
- Horizontal synchronization circuit
- Transmitter identification and mute circuit
- Vertical synchronization circuit and sawtooth generator

QUICK REFERENCE DATA

Supply voltage (pin 7)	$V_{7\text{-}10}$	typ.	10,5	V
Supply current (pin 7)	I_7	typ.	82	mA
Supply voltage (pin 22)	$V_{22\text{-}10}$	typ.	10,5	V
Supply current (pin 22)	I_{22}	typ.	5	mA
Operating ambient temperature range	T_{amb}		−25 to + 65	°C
Storage temperature range	T_{stg}		−25 to +150	°C
Power dissipation	P_{tot}	typ.	920	mW

PACKAGE OUTLINE

28-lead DIL; plastic (with internal heat spreader) (SOT-117).

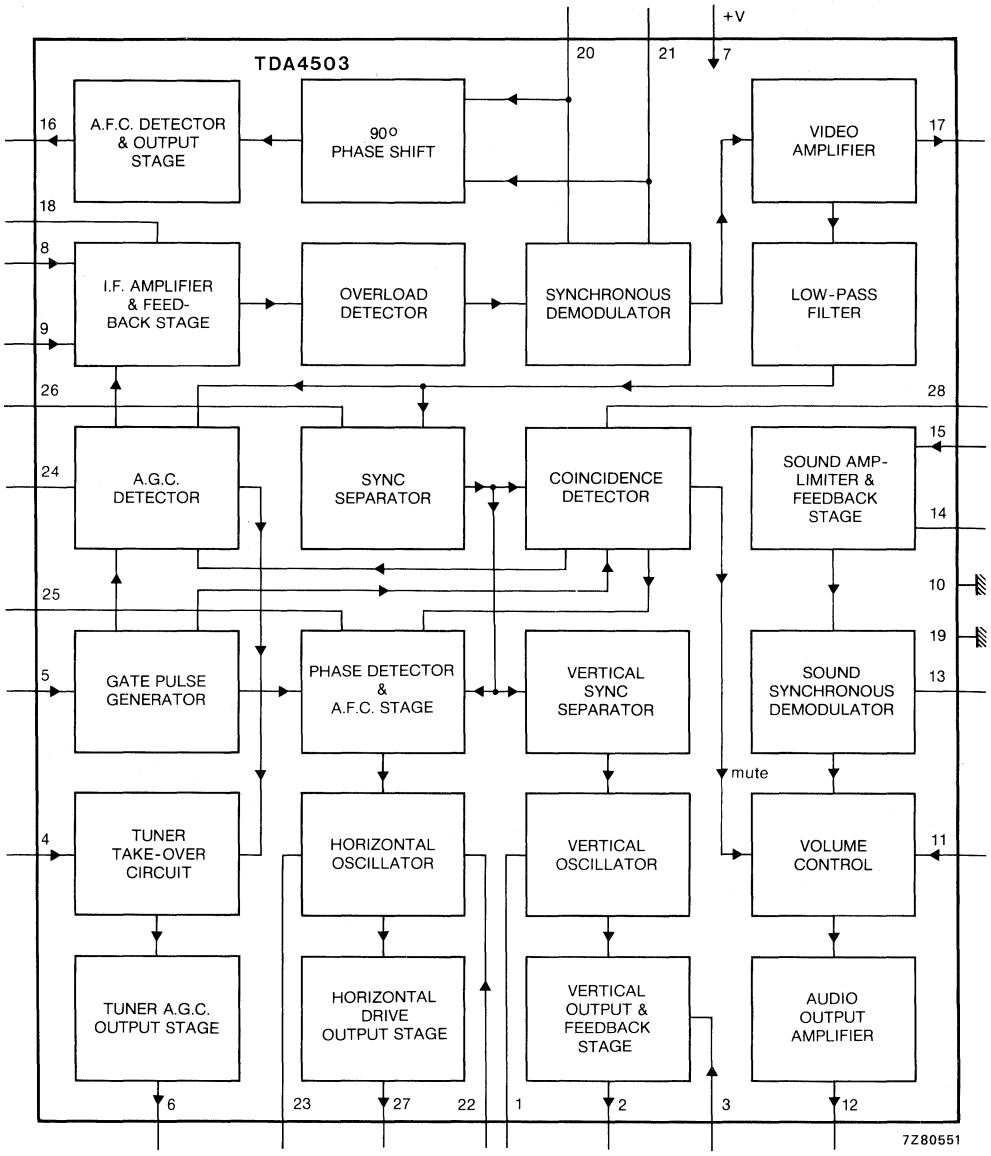


Fig. 1 Block diagram.

PINNING

1. Vertical oscillator input
2. Vertical drive output
3. Vertical drive feedback
4. Tuner take-over input
5. Flyback pulse input
6. A.G.C. output to tuner
7. Power supply input
8. I.F. input
9. I.F. input
10. Power supply return (ground)
11. Volume control
12. Audio output
13. Sound demodulator reference input
14. Sound i.f. decoupling
15. Sound i.f. input
16. A.F.C. output
17. Video output
18. I.F. amplifier decoupling
19. Ground (for critical circuits)
20. Synchronous demodulator
21. Synchronous demodulator
22. Horizontal oscillator start input
23. Horizontal oscillator
24. A.G.C. time constant
25. Horizontal phase detector filter
26. Sync separator slicing level
27. Horizontal drive output
28. Coincidence detector time constant

FUNCTIONAL DESCRIPTION

I.F. amplifier, demodulator and A.F.C.

The i.f. amplifier operates with symmetrical inputs at pins 8 and 9 and has an input impedance suitable for SAW filter application. The amplifier sensitivity gives a peak-to-peak output voltage of 3 V for an r.m.s. input of 70 μV. The demodulator and the a.f.c. circuit share an external reference tuned circuit (pins 20 and 21) and an internal RC-network provides the phase-shifting necessary for a.f.c. operation. The a.f.c. circuit provides a control voltage output with a (typical) swing of 9 V from pin 16 (V_P = 10,5 V).

A.G.C. circuit

Gating of the a.g.c. detector is performed to reduce sensitivity of the i.f. amplifier to external electrical noise. The a.g.c. time constant is provided by an RC-network connected to pin 24. The typical gain control range of the i.f. amplifier is 60 dB. Tuner a.g.c. voltage is supplied from pin 6 and is suitable for tuners with pnp or npn RF stages. The sense of the AGC (to incease in a positive or negative direction) and the point of tuner take-over are preset by the voltage level at pin 4 (V_4 = 3,5 V (typ) for positive a.g.c.; V_4 = 8 V (typ) for negative a.g.c.).

Video amplifier

The video signal output from pin 17 has a peak-to-peak value of 3 V (top sync level = 1,5 V) and carries negative-going sync. In order to retain sound information at pin 17, the video signal is not blanked during flyback periods.

Sound circuit

The sound i.f. signal present at the video output (pin 17) is coupled to the sound circuit by a band-pass filter to pin 15. The sound circuit has an amplifier-limiter stage, a synchronous demodulator with reference tuned circuit at pin 13, a volume control stage and an output amplifier. The volume control has a range of approximately 80 dB and the audio output signal at maximum volume and with Δf = 7,5 kHz is 320 mV (r.m.s. value). The sound output signal is suppressed when no input signal is detected.

Synchronization circuits

The sync separator slicing level is determined by an external resistor network at pin 26. The slicing level is referred to the top sync level and the recommended value for slicing is 30%. Internal protection from electrical noise is included.

A gated phase detector compares the phase of the separated sync pulses with a sawtooth waveform obtained from the flyback pulse at pin 5. In-sync and out-of-sync conditions are detected by the coincidence detector at pin 28 (this circuit also gives transmitter identification). During the out-of-sync condition, gating of the phase detector is switched off and the output current from the phase detector increases to give the detector a short time-constant and thus a fast response. This condition can be imposed by clamping the voltage at pin 28 to 3,5 V for the reception of VCR signals.

The horizontal oscillator frequency is controlled by the output voltage of the phase detector circuit. The horizontal drive output from pin 27 has a duty factor of 40%.

Vertical sync pulses are separated by an internal integrating network and are used to trigger the vertical oscillator. A comparator circuit compares the vertical sawtooth waveform, generated by the vertical oscillator, with feedback from the deflection coils and supplies the drive voltage for the output stage at pin 2.

Power supplies

The main supply is to pin 7 (positive supply) and pin 10 (ground). The horizontal oscillator is supplied from pin 22 to facilitate starting of the oscillator from a high-voltage rail. A special ground connection at pin 19 is used by critical voltage dividers in the feedback loops of the vision and sound i.f. circuits.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 7)	$V_P = V_{7-10}$	max.	13,2 V
Total power dissipation	P_{tot}	max.	1,7 W
Operating ambient temperature range	T_{amb}		−25 to + 65 °C
Storage temperature range	T_{stg}		−25 to +150 °C

CHARACTERISTICS

V_{7-10} = 10,5 V; V_{22-10} = 10,5 V; T_{amb} = 25 °C; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supplies					
Supply voltage (pin 7)	V_{7-10}	9,5	10,5	13,2	V
Supply current (pin 7)	I_7	–	82	100	mA
Supply voltage (pin 22)	V_{22-10}	9,5	10,5	13,2	V
Supply current (pin 22) (note 1)	I_{22}	–	5	6,5	mA
Total power dissipation	P_{tot}	–	920	1150	mW
Vision i.f. amplifier (pins 8 and 9)					
Input sensitivity at 38,9 MHz (note 2)	V_{8-9}	40	80	120	μV
Input sensitivity at 45,75 MHz (note 2)	V_{8-9}	–	90	–	μV
Differential input resistance (pin 8 to 9)	R_{8-9}	–	1,3	–	kΩ
Differential input capacitance (pin 8 to 9)	C_{8-9}	–	5	–	pF
A.G.C. range		–	59	–	dB
Maximum input signal	V_{8-9}	50	70	–	mV
Expansion of output signal (pin 17) for 50 dB variation of input signal (pins 8 and 9) (note 3)	ΔV_{17-10}	–	0,5	1,0	dB
Video amplifier (note 4)					
Output level for zero signal input (zero point of switched demodulator)	V_{17-10}	4,2	4,5	4,8	V
Output signal top sync level (note 5)	V_{17-10}	1,25	1,45	1,65	V

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Amplitude of video output signal (peak-to-peak value)	$V_{17\text{-}10(p\text{-}p)}$	2,4	2,7	3,0	V
Internal bias current of output transistor (npn emitter follower)	$I_{17(int)}$	1,4	2,0	–	mA
Bandwidth of demodulated output signal	B	–	5	–	MHz
Differential gain (Fig. 4 and note 6)	G_{17}	–	6	–	%
Differential phase (Fig. 4 and note 6)		–	4	–	%
Video non-linearity over total video amplitude (peak white to black)		–	–	10	%
Intermodulation (Figs 5 and 6) at gain control = 45 dB					
f = 1,1 MHz; blue;		55	60	–	dB
f = 1,1 MHz; yellow;		50	54	–	dB
f = 3,3 MHz; blue;		60	66	–	dB
f = 3,3 MHz; yellow;		55	59	–	dB
Signal-to-noise ratio (note 7)					
at V_i = 10 mV	S/N	50	54	–	dB
at end of a.g.c. range	S/N	50	56	–	dB
as a function of input signal		see Fig. 7			
Residual A.M. of intercarrier output signal (note 8)		–	5	10	%
Residual carrier signal		–	7	30	mV
Residual 2nd harmonic of carrier signal		–	3	30	mV
Tuner a.g.c. (note 9)					
Take-over voltage (pin 4) for positive-going tuner a.g.c. (NPN tuner)	$V_{4\text{-}10}$	–	3,5	–	V
Starting point take-over at $V_{4\text{-}10}$ = 5 V (r.m.s. value)	$V_{8\text{-}9(rms)}$	–	0,4	2,0	mV
Starting point take-over at $V_{4\text{-}10}$ = 1,2 V (r.m.s. value)	$V_{8\text{-}9(rms)}$	50	70	–	mV
Take-over voltage (pin 1) for negative-going tuner a.g.c. (PNP tuner)	$V_{4\text{-}10}$	–	8	–	V
Starting point take over at $V_{4\text{-}10}$ = 9,5 V (r.m.s. value)	$V_{8\text{-}9(rms)}$	–	0,3	2,0	mV
Starting point take over at $V_{4\text{-}10}$ = 5,6 V (r.m.s. value)	$V_{8\text{-}9(rms)}$	50	70	–	mV
Maximum tuner a.g.c. output swing	I_{6max}	2	3	–	mA
Output saturation voltage at I_6 = 2 mA	$V_{6\text{-}10(sat)}$	–	–	300	mV
Leakage current at pin 6	I_6	–	–	1	μA
Input signal variation required for complete tuner control	$\Delta V_{8\text{-}9}$	0,5	2	4	dB

parameter	symbol	min.	typ.	max.	unit
A.F.C. circuit (pin 16; note 10)					
A.F.C. output voltage swing (peak-to-peak value)	$V_{16\text{-}10(p\text{-}p)}$	9	–	10	V
Available output current	$\pm I_{16}$	–	1	–	mA
Control steepness at					
100% picture carrier		20	40	80	mV/kHz
10% picture carrier		–	15	–	mV/kHz
Output voltage at nominal tuning of the reference tuned circuit	$V_{16\text{-}10}$	–	5,25	–	V
Output voltage without input signal	$V_{16\text{-}10}$	2,7	6,0	8,5	V
Sound circuit					
Input limiting voltage (note 11) (r.m.s. value) at $V_o = V_{o\ max}$ - 3 dB	$V_{15\ lim}$	–	2	–	mV
Input resistance at $V_{i(rms)}$ = 1 mV	$R_{15\text{-}10}$	–	2,6	–	kΩ
input capacitance at $V_{i(rms)}$ = 1 mV	$C_{15\text{-}10}$	–	6	–	pF
A.M. rejection (Figs 8 and 9) at					
V_i = 10 mV	AMR	–	35	–	dB
V_i = 50 mV	AMR	–	43	–	dB
A.F. output signal (note 12) (r.m.s. value)	$V_{12\text{-}6(rms)}$	220	320	–	mV
A.F. output impedance	$Z_{12\text{-}10}$	–	150	–	Ω
Total harmonic distortion (note 12)	THD	–	1	–	%
Ripple rejection at					
f_k = 100 Hz, volume control 20 dB	RR	–	22	–	dB
when muted	RR	–	26	–	dB
Output voltage in mute condition	$V_{12\text{-}10}$	–	2,6	–	V
Signal-to-noise ratio; weighted noise (CCIR 468)	S/N	–	47	–	dB
Volume control					
Voltage (pin 11 disconnected)	$V_{11\text{-}10}$	–	6,9	–	V
Current (pin 11 connected to ground)	I_{11}	–	1	–	mA
External control resistor (note 13)	$R_{11\text{-}10}$	–	5	–	kΩ
Suppression of output signal during mute condition		–	66	–	dB

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Horizontal synchronization					
Slicing level sync separator (note 14)		–	30	–	%
Phase-lock loop holding range		±800	±1100	±1500	Hz
Phase-lock loop catching range		±600	1000	–	Hz
Control sensitivity video to flyback (note 15)		–	2,3	–	kHz/μs
Delay between leading edge of sync pulse and zero cross-over of sawtooth (pin 5)		–	3	–	μs
Horizontal oscillator (pin 23)					
Free-running frequency R = 35 kΩ; C = 2,7 nF	f_{fr}	–	15625	–	Hz
Spread with fixed external components		–	–	4	%
Frequency variation due to change of supply voltage from 8 to 12 V	Δf_{fr}	–	0	0,5	%
Temperature coefficient	TC	–	–	1×10^{-4}	K^{-1}
Maximum frequency shift	Δf_{fr}	–	–	10	%
Maximum frequency deviation (V_{7-10} = 8 V)	Δf_{fr}	–	–	10	%
Horizontal output (pin 27)					
Output current	I_{27}	5	–	–	mA
Output impedance	R_{27}	–	200	–	Ω
Output voltage at I_{27} = 5 mA	V_{27-10}	–	1,4	–	V
	V_{27-22}	–	2,5	–	V
Duty factor of horizontal output signal (note 16)	α	0,35	0,40	0,45	%
Rise and fall times of output pulse	t_r, t_f	–	400	–	ns
Flyback input (pin 5)					
Amplitude of input pulse	V_5	2	4	6	V
Voltage at which gate pulse generator changes state (note 17)	V_5	–	0	–	V

parameter	symbol	min.	typ.	max.	unit
Coincidence detector mute output (pin 28) (note 18)					
Voltage for in-sync condition	V_{28-10}	–	9,5	–	V
Voltage for no-sync condition (no input signal)	V_{28-10}	–	1,0	1,5	V
Voltage level for phase detector to switch from slow to fast	V_{28-10}	3,7	4,1	4,5	V
Fast-to-slow hysteresis		–	1	–	V
Voltage level to activate mute function (transmitter identification)	V_{28-10}	2,25	2,5	2,75	V
Output current for in-sync condition (peak-to-peak value)	$I_{22(p-p)}$	0,7	1,0	–	mA
Vertical oscillator (pin 1)					
Free-running frequency at C = 220 nF; R = 560 kΩ	f_{fr}	–	47,5	–	Hz
Spread with fixed external components		–	–	4	%
Holding range at nominal frequency		52,5	–	–	Hz
Temperature coefficient	TC	–	–	$2x10^{-4}$	K^{-1}
Frequency variation due to change of supply voltage from 9,5 to 12 V	Δf_{fr}	–	3	5	%
Leakage current at pin 1	I_1	–	–	1,6	μA
Vertical output (pin 2)					
Output current	I_2	1	1,3	–	mA
Output resistance	R_2	–	2	–	kΩ
Feedback input (pin 3)					
Input voltage d.c. component a.c. component (peak-to-peak value)	 V_{3-10} $V_{3-10(p-p)}$	 4,0 –	 5,0 1,2	 5,5 –	 V V
Input current	I_3	–	–	12	μA
Non-linearity of deflection current at V_{7-10} = 10,5 V	ΔI_3	–	–	2,5	%
Delay between leading edge of vertical sync and start of vertical oscillator flyback		6	–	10	μs

Notes to the characteristics

1. The horizontal oscillator can be started by supplying a current of 6 mA to pin 22. Taking this current from the mains rectifier allows the positive supply voltage to pin 7 to be derived from the horizontal output stage (the load current of pin 27 is additional to the 6 mA quoted).
2. At start of a.g.c.
3. Measured with 0 dB = 200 μV.
4. Measured at 10 mV (rms) top sync output signal.
5. Signal with negative-going sync; top white = 10% of the top sync amplitude.
6. Measured with test line as shown in Fig. 4. The differential gain is expressed as a percentage of the difference in peak amplitudes between the largest and smallest values relative to the subcarrier amplitude at blanking level. The differential phase is defined as the difference in degrees between the largest and smallest phase angles.
7. Measured with a source impedance of 75 Ω.

$$\text{Signal-to-noise ratio} = 20\log \frac{V_o \text{ black-to-white}}{V_{i(rms)} \text{ at } B = 5 \text{ MHz}}.$$

8. Measured with a sawtooth-modulated input signal: m = 90%; $V_{i(rms)}$ = 10 mV;

$$\text{Amplitude modulation} = \frac{V_o \text{ SC at top sync} - V_o \text{ SC at white}}{V_o \text{ SC at top sync} + V_o \text{ SC at white}} \times 100\%.$$

(SC = sound carrier)

9. Starting point of tuner take-over for an npn tuner is when I_6 = 1,8 mA, and for a pnp tuner is when I_6 = 0,2 mA.
10. Measured at $V_{8\text{-}9(rms)}$ = 10 mV and pin 16 loaded with 2 x 100 kΩ between V_7 and ground. Reference tuned circuit Q-factor = 36.
11. Reference tuned circuit Q-factor = 16; audio frequency = 1 kHz; carrier frequency = 5,5 MHz.
12. The demodulator tuned circuit must be tuned for minimum distortion; output signal is measured at Δf = 7,5 kHz; other measurements are at Δf = 27,5 kHz.
13. Volume control can be realized by a variable resistor (5 kΩ) connected between pin 11 and ground, or by a variable voltage direct to pin 11 (the low value of input impedance to pin 11 must be taken into account).
14. The sync separator is noise-gated; the slicing level is referred to the top sync level and is independent of the video signal. The value stated is a percentage of the sync pulse amplitude, the level being dependent on external resistors connected to pin 26.
15. The phase detector current is increased by a factor of 7 during catching and when the phase detector is switched to 'fast' via pin 28, thus ensuring a wide catching range and a high dynamic loop gain.
16. The negative-going edge initiates switching-off of the line output transistor (simultaneous driver).
17. The circuit requires an integrated flyback pulse. Gate pulses for a.g.c. and coincidence detectors are obtained from the sawtooth waveform.
18. The functions of in-sync, out-of-sync and transmitter identification are combined on pin 28. For the reception of VCR signals, V_{28} must be fixed between 3 V and 4,5 V so that the time constant is fast and sound information is preserved.

APPLICATION INFORMATION

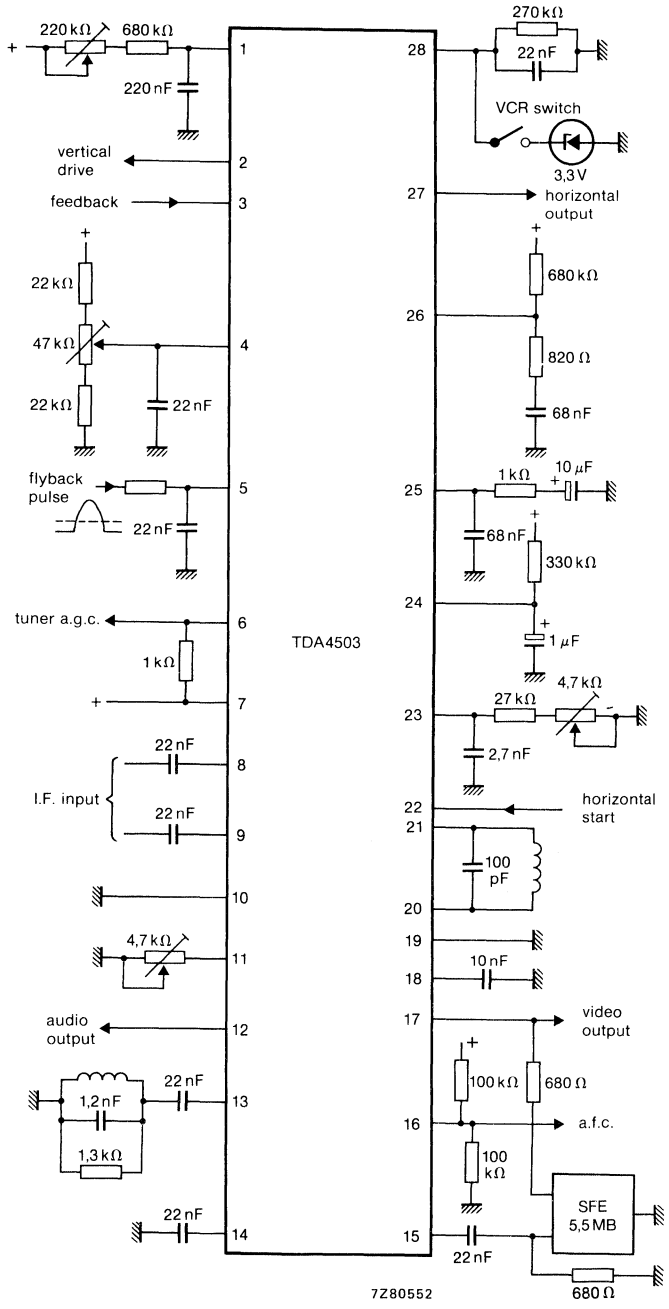


Fig. 2 Application circuit diagram.

APPLICATION INFORMATION (continued)

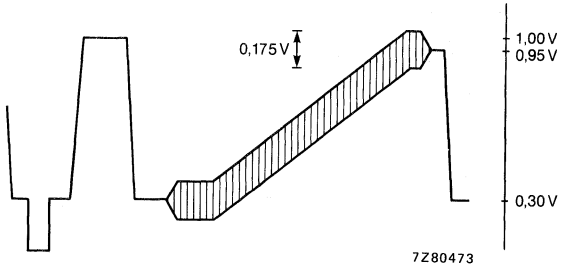


Fig. 3 Video output signal.

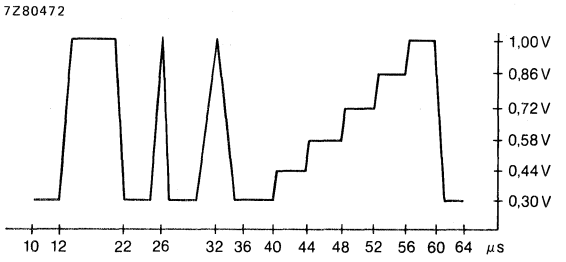


Fig. 4 E.B.U. test signal - line 330.

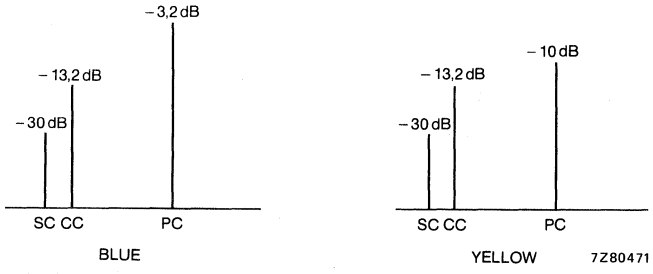


Fig. 5 Input signal conditions for intermodulation test: SC = sound carrier; CC = chrominance carrier; PC = picture carrier; all values are with respect to the top sync level.

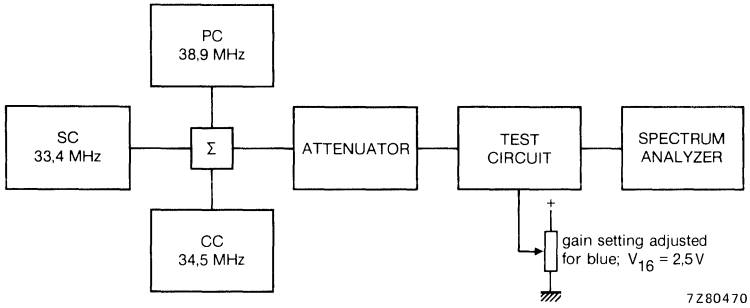


Fig. 6 Circuit for intermodulation test:

$$\text{value at 1,1 MHz} = 20\log \frac{V_o \text{ at 4,4 MHz}}{V_o \text{ at 1,1 MHz}} + 3{,}6 \text{ dB};$$

$$\text{value at 3,3 MHz} = 20\log \frac{V_o \text{ at 4,4 MHz}}{V_o \text{ at 3,3 MHz}}$$

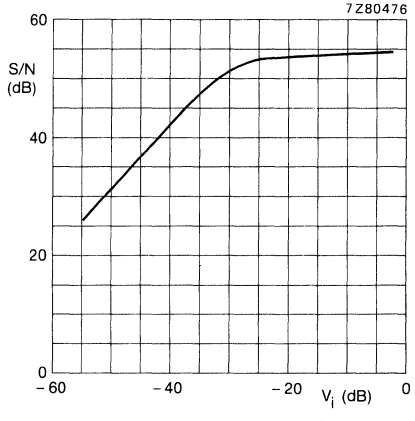


Fig. 7 Signal-to-noise ratio as a function of input voltage.

APPLICATION INFORMATION (continued)

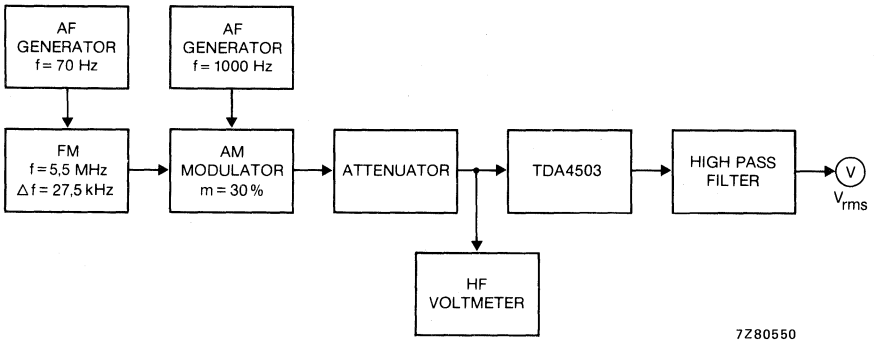


Fig. 8 Circuit for amplitude modulation rejection test.

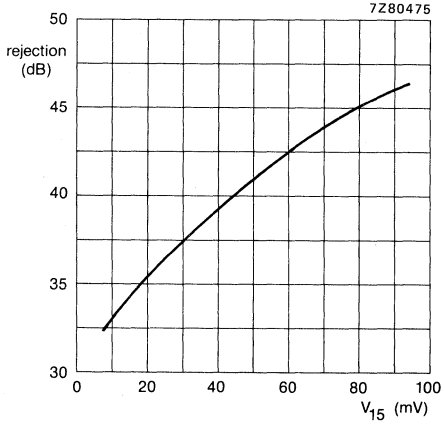


Fig. 9 Typical amplitude modulation rejection curve.

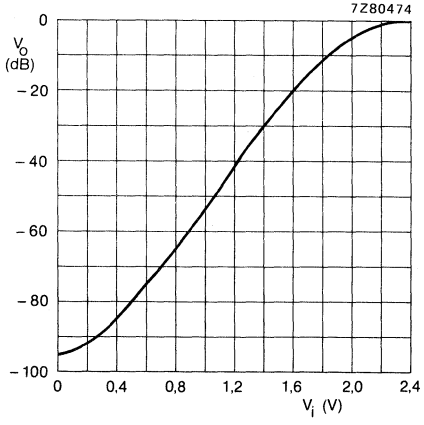


Fig. 10 Volume control characteristic.

SMALL SIGNAL COMBINATION IC FOR COLOUR TV

GENERAL DESCRIPTION

The TDA4505 is a TV sub-system circuit, intended to be used in colour television receivers. For a complete colour television receiver only a tuner, a colour decoder and output stages have to be added.

Features

- Vision IF amplifier with synchronous demodulator
- Tuner AGC (negative going control voltage with increasing signal)
- AGC detector suited for negative modulation
- AFC circuit
- Video preamplifier
- Sound IF amplifier, demodulator and preamplifier
- DC volume control **or** separate supply for starting the oscillator
- Horizontal synchronization circuit with two control loops
- Extra time constant switches in the horizontal phase detector
- Vertical synchronization (divider system) and sawtooth generation with automatic amplitude adjustment for 50 or 60 Hz
- Transmitter identification (mute)
- Three level sandcastle pulse generation

QUICK REFERENCE DATA

Supply voltage	V_{7-6}	typ.	12 V
Operating ambient temperature range	T_{amb}	−25 to + 65	°C
Storage temperature	T_{stg}	−25 to + 150	°C
Power dissipation	P_{tot}	max.	2,3 W

PACKAGE OUTLINE

28-lead DIL; plastic (with internal heat spreader) (SOT-117).

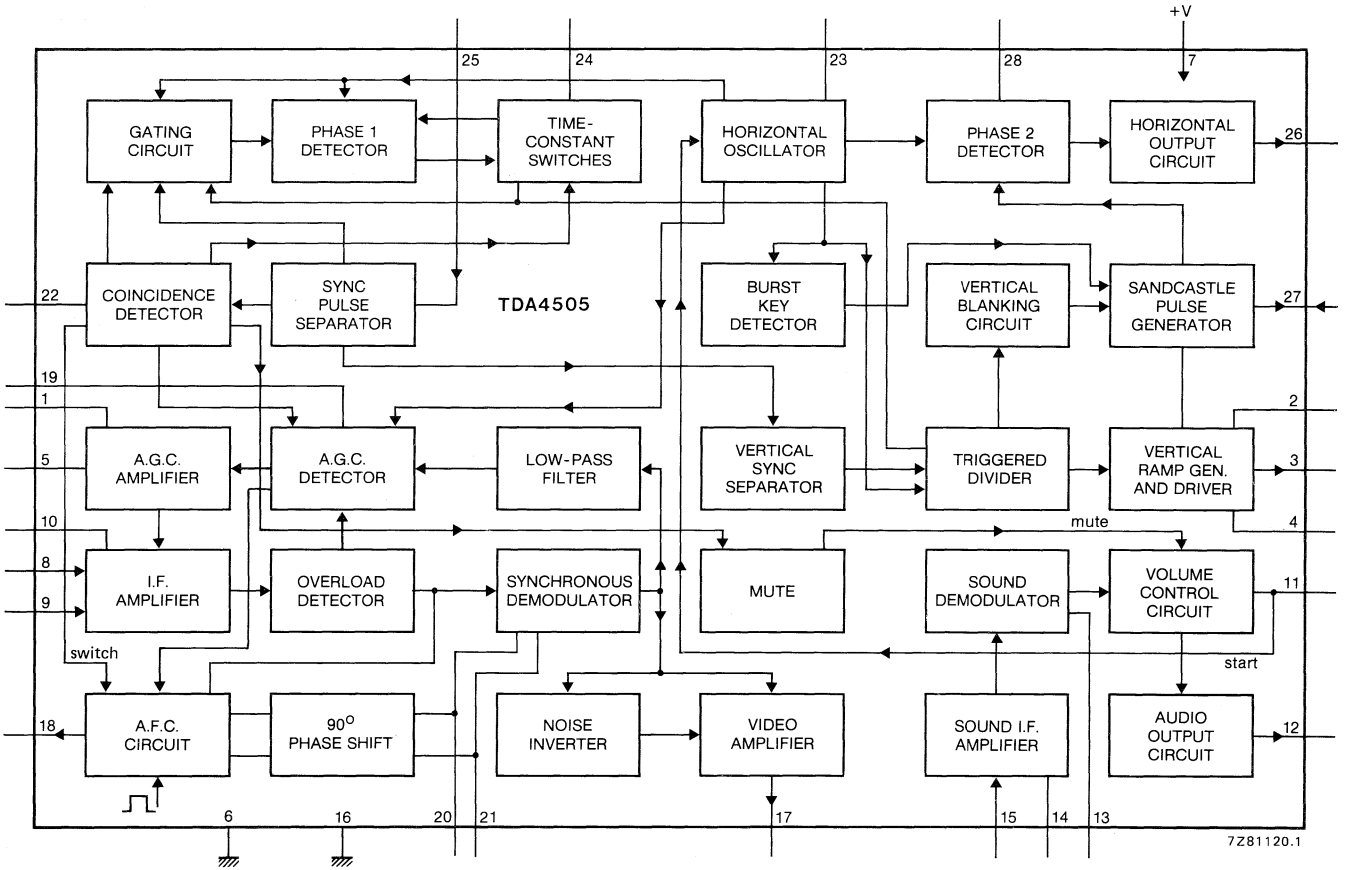


Fig. 1 Block diagram.

PINNING

1. AGC take over
2. Vertical ramp generator
3. Vertical drive
4. Vertical feedback
5. Tuner AGC
6. Ground
7. Supply
8. Vision IF input
9. Vision IF input
10. Decoupling capacitor
11. Volume control/start hor. osc.
12. Audio output
13. Sound demodulator
14. Sound IF decoupling
15. Sound IF input
16. Ground
17. Video output
18. AFC output
19. AGC detection
20. Synchronous demodulator
21. Synchronous demodulator
22. Coinc. det. decoupling
23. Hor. oscillator
24. Phase 1 detector
25. Sync separator
26. Hor. drive
27. Sandcastle out/flyback input
28. Phase 2 detector

FUNCTIONAL DESCRIPTION

IF amplifier, demodulator and AFC

The IF amplifier has a symmetrical input (pins 8 and 9). The synchronous demodulator and the AFC circuit share an external reference tuned circuit (pins 20 and 21). An internal RC-network provides the necessary phase-shifting for AFC operation. The AFC circuit is gated by means of an internally generated gating pulse. As a result the AFC output voltage contains no video information. The AFC circuit provides a control voltage output with a swing greater than 10 V from pin 18.

AGC circuit

Gating of the AGC detector is performed to reduce sensitivity of the IF amplifier to external electrical noise. The AGC time constant is provided by an RC-circuit connected to pin 19. The point of tuner take-over is preset by the voltage level at pin 1.

Video amplifier

The signal through the video amplifier comprises video and sound information.

Sound circuit and horizontal oscillator starting function

The input to the sound IF amplifier is obtained by a bandpass filter coupling from the video output (pin 17). The sound is demodulated and passed via a dual-function volume control stage to the audio output amplifier. The volume control function is obtained by connecting a variable resistor (5 kΩ) between pin 11 and ground, or by supplying pin 11 with a variable voltage. Sound output is suppressed by an internal mute signal when no TV signal is identified.

D.C. volume control/Horizontal oscillator start

The circuit can be used with a d.c. volume control **or** with a starting possibility of the horizontal oscillator. The operation depends on the application. When during switch-on no current is supplied to pin 11 this pin will act as volume control. When a current of 6 mA is supplied to pin 11 the volume control is set to a fixed output signal and the IC will generate drive pulses for the horizontal deflection. The main supply of the IC can then be derived from the horizontal deflection.

FUNCTIONAL DESCRIPTION (continued)

Horizontal synchronization

The video input signal (positive video) is connected to pin 25.
The horizontal synchronization has two control loops. This has been introduced because a sandcastle pulse had to be generated. An accurate timing of the burstkey pulse can be made in an easy way when the oscillator sawtooth is used. Therefore, the phase of this sawtooth must have a fixed relation with respect to the sync pulse. That can only be realized when a second loop is used.

Horizontal phase detector

The circuit has the following operating conditions.

a) Strong input signal, synchronized or not synchronized.
(The input signal condition is obtained from the AGC-circuit, the in-sync./out-of-sync from the coincidence detector). In this condition the time constant is optimal for VCR-playback i.e.; fast time constant during the vertical retrace (to be able to correct head-errors of the VCR) and such a time constant during scan that fluctuations of the sync. are corrected. In this condition the phase detector is not gated.

b) Weak signal.
In this condition the time constant is doubled compared with the previous condition. Furthermore the phase detector is gated when the oscillator is synchronized. This ensures a stable display which is not disturbed by the noise in the video signal.

c) Not synchronized (weak signal).
In this condition the time constant during scan and vertical retrace are the same as during scan in condition a).

Vertical sync pulse

The vertical sync pulse integrator will not be disturbed when the vertical sync pulses have a width of only 10 μs with a separation of 22 μs. This type of vertical sync pulses are generated by certain video tapes with anti-copy guard.

Vertical ramp generator

To avoid problems during VCR-playback in the so-called feature modes (fast or slow), the vertical ramp generator is not coupled to the horizontal oscillator when such signals are received. For normal signals the coupling between vertical ramp generator and horizontal oscillator is maintained. This to ensure a reliable interlace.

Vertical divider system

The IC embodies a synchronized divider system for generating the vertical sawtooth at pin 2.
The divider system has an internal frequency doubling circuit, so the Horizontal oscillator is working at its normal line frequency and one line period equals 2 clock pulses.
Due to the divider system no vertical frequency adjustment is needed. The divider has a discriminator window for automatically switching over from the 60 Hz to 50 Hz system. When the trigger pulse comes before line 576 the system works in the 60 Hz mode, otherwise 50 Hz mode is chosen.
The divider system operates with 2 different divider reset windows for max. interference/disturbance protection.
The windows are activated via an up down counter.
The counter increases its counter value with 1 for each time the separated vertical sync. pulse is within the search window. When not the counter value is lowered with 1.
Below the different working modes of the divider system are specified.

a. Large (search) window: divider ratio between 488 and 722.

This mode is valid for the following conditions:
1) Divider is locking for a new transmitter.
2) Divider ratio found, not within the narrow window limits.
3) Non-standard TV-signal condition detected while a double or enlarged vertical sync. pulse is still found after the internally generated anti-topflutter pulse has ended. This means a vertical sync. pulse width larger than 10 clock pulses (50 Hz) viz. 12 clock pulses (60 Hz).
   In general this mode is activated for Video tape recorders operating in the feature trick mode.
   When the wide vertical sync. pulses are detected the vertical ramp generator is decoupled from the horizontal oscillator. As a consequence the retrace time of this ramp generator is now determined by the external capacitor and the discharge current. This decoupling prevents instability of the picture due to irregular incoming signals (variable number of lines per field).
4) Up/down counter value of the divider system operating in the narrow window mode drops below count 6.

b. Narrow window: divider ratio between 522-528 (60 Hz) or 622-628 (50 Hz).

The divider system switches over to this mode when the up/down counter has reached its max. value of 15 approved vertical sync pulses. When the divider operates in this mode and a vertical sync. pulse is missing within the window the divider is reset at the end of the window and the counter value is lowered with 1. At a counter value below 6 the divider system switches over the large window mode.
The divider system generates also the so-called anti-topflutter pulse which inhibits the phase 1 detector during the vertical sync pulse. The width of this pulse depends on the divider mode. For the divider mode **a** the start is generated at the reset of the divider. In mode **b** the anti-topflutter pulse starts at the beginning of the first equalizing pulse.
The anti-topflutter pulse ends at count 10 for 50 Hz and count 12 for 60 Hz. The vertical blanking pulse is also generated via the divider system. The start is at the reset of the divider while the blanking pulse width is 34 (17 lines) for 60 Hz and at count 42 (21 lines) for 50 Hz systems.
The vertical blanking pulse generated at the sandcastle output pin 27 is made by adding the anti-topflutter pulse and the blanking pulse. In this way the vertical blanking pulse starts at the beginning of the first equalizing pulse when the divider operates in the **b** mode. The total length of the vertical blanking in this condition is 21 lines in the 60 Hz mode and 25 lines in the 50 Hz mode.

DEVELOPMENT DATA

Application when external video signals have to be synchronized

The input of the sync. separator is externally available. For the normal application the video output signal (pin 17) is a.c. coupled to this input (see Fig. 2). It is possible to interrupt this connection and to drive the sync separator from another source e.g.: a teletext decoder in serial mode or a signal coming from the P.T.-plug. When a teletext decoder is applied the IF-amplifier and synchronization circuit are running in the same phase so that the various connections between the two parts (like A.G.C. gating) can remain active. When external signals are applied to the sync separator the connections between the two parts must be interrupted. This can be obtained by connecting pin 22 to ground.
This results in the following condition:
- AGC detector is not gated.
- AFC circuit is active.
- Mute circuit not active so that the sound channel remains switched-on.
- The first phase detector has an optimal time constant for external video sources.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 7)	$V_P = V_{7-6}$	max.	13,2 V
Total power dissipation	P_{tot}	max.	2,3 W
Operating ambient temperature range	T_{amb}	−25 to	+ 65 °C
Storage temperature range	T_{stg}	−25 to	+ 150 °C

CHARACTERISTICS

$V_P = V_{7-6} = 12$ V; $T_{amb} = 25$ °C; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supplies					
Supply voltage (pin 7)	V_{7-6}	9,5	12	13,2	V
Supply current (pin 7)	I_7	–	135	–	mA
Supply voltage (pin 11); note 1	V_{11-6}	–	8,6	–	V
Supply current (pin 11) for horizontal oscillator start	I_{11}	–	6	8	mA
Vision IF amplifier (pins 8 and 9)					
Input sensitivity at 38,9 MHz on set AGC	V_{8-9}	60	100	140	μV
Input sensitivity at at 45,75 MHz on set AGC	V_{8-9}	–	120	–	μV
Differential input resistance (pin 8 to 9)	R_{8-9}	800	1300	1800	Ω
Differential input capacitance (pin 8 to 9)	C_{8-9}	–	5	–	pF
Gain control range	G_{8-9}	56	60	–	dB
Maximum input signal	V_{8-9}	50	100	–	mV
Expansion of output signal for 50 dB variation of input signal with V_{8-9} at 150 μV (0 dB)	ΔV_{17-6}	–	1	–	dB
Video amplifier					
Measured at top sync input signal voltage (r.m.s. value) of 10 mV					
Output level for zero signal input (zero point of switched demodulator)	V_{17-6}	–	5,8	–	V
Output signal top sync level (note 2)	V_{17-6}	2,7	2,9	3,1	V
Amplitude of video output signal (peak-to-peak value)	$V_{17-6(p-p)}$	–	2,6	–	V
Internal bias current of output transistor (npn emitter follower)	$I_{17(int)}$	1,4	2,0	–	mA
Bandwidth of demodulated output signal	B	5	–	–	MHz

parameter	symbol	min.	typ.	max.	unit
Differential gain (Fig. 4) (note 3)	G_{17}	–	4	10	%
Differential phase (Fig. 4) (note 3)	φ	–	3	10	deg.
Video non-linearity (note 4)					
complete video signal amplitude		–	–	10	%
Intermodulation (Fig. 5)					
at gain control = 45 dB					
f = 1,1 MHz; blue		55	60	–	dB
f = 1,1 MHz; yellow		50	54	–	dB
f = 3,3 MHz; blue		60	66	–	dB
f = 3,3 MHz; yellow		55	59	–	dB
Signal to noise ratio (note 5)					
Z_S = 75 Ω; V_i = 10 mV	S/N	50	54	–	dB
end of gain control range	S/N	50	56	–	dB
Residual acrrier signal		–	7	30	mV
Residual 2nd harmonic of carrier signal		–	24	30	mV
Tuner AGC*					
Minimum starting point take over	$V_{1\text{-}6(rms)}$	–	–	0,5	mV
Maximum starting point take over	$V_{1\text{-}6(rms)}$	50	100	–	mV
Maximum output swing	I_{5max}	6	8	–	mA
Output saturation voltage					
I = 2 mA	$V_{5\text{-}6(sat)}$	–	–	300	mV
Leakage current	I_5	–	–	1	μA
Input signal variation					
complete tuner control (ΔI_5 = 2 mA)	ΔV_i	0,5	2	5	dB
AFC circuit (pin 18; note 6)					
AFC output voltage swing	$V_{18\text{-}6(p\text{-}p)}$	9,5	10,35	11	V
Available output current	$\pm I_{18}$	–	2,6	–	mA
Control steepness		–	70	–	mV/kHz
Output voltage at nom. tuning of					
the reference tuned circuit	$V_{18\text{-}6}$	–	6	–	V
Offset current AFC output					
(pins 20 and 21 short circuited)	I_{18}	–	tbf	–	μA

DEVELOPMENT DATA

* Starting point tuner take-over at I = 0,2 mA.
Take-over to be adjusted with a potentiometer of 47 kΩ.

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Sound circuit					
Input limiting voltage $V_o = V_{o\ max} - 3$ dB; $Q_L = 16$; $f_{AF} = 1$ kHz; $f_c = 5{,}5$ MHz)	V_{15lim}	–	400	800	μV
Input resistance $V_{i(rms)} = 1$ mV	$R_{15\text{-}6}$	–	2,6	–	kΩ
Input capacitance $V_{i(rms)} = 1$ mV	$C_{15\text{-}6}$	–	6	–	pF
AM rejection (Figs 8 and 9)					
$V_i = 10$ mV	AMR	–	46	–	dB
$V_i = 50$ mV	AMR	–	50	–	dB
AF output signal $\Delta f = 7{,}5$ kHz; min. distortion	$V_{12\text{-}6(rms)}$	400	600	800	mV
AF output signal; $\Delta f = 50$ kHz pin 11 used as starting pin	$V_{12\text{-}6(rms)}$	300	700	1200	mV
AF output impedance	$Z_{12\text{-}6}$	–	25	100	Ω
Total harmonic distortion volume control 20 dB, $\Delta f = 27{,}5$ kHz; weighted acc. CCIR 468	THD	–	1	3	%
Ripple rejection					
$f_k = 100$ Hz, volume control 20 dB	RR	–	35	–	dB
when muted	RR	–	30	–	dB
Output voltage in MUTE condition	$V_{12\text{-}6}$	–	3,0	–	V
Signal to noise ratio; $\Delta f = 27{,}5$ kHz weighted noise (CCIR 468)	S/N	–	45	–	dB
Volume control (Fig. 9)					
Voltage (pin 11 disconnected)	$V_{11\text{-}6}$	–	5,0	–	V
Current (pin 11 short circuited)	I_{11}	–	0,9	–	mA
External control resistor	$R_{11\text{-}6}$	–	5	–	kΩ
Suppression output signal during mute condition	OSS	–	66	–	dB
Sync separator and first control loop					
Required sync pulse amplitude $R_{17\text{-}25} = 2$ kΩ (note 7)	$V_{25\text{-}6(p\text{-}p)}$	200	800	–	mV
Input current					
$V_{25\text{-}6} > 5$ V	I_{25}	–	10	–	μA
$V_{25\text{-}6} = 0$ V	I_{25}	–	tbf	–	mA
Holding range PLL	$\pm \Delta f$	–	1100	1500	Hz
Catching range PLL	$\pm \Delta f$	600	1000	–	Hz

DEVELOPMENT DATA

parameter	symbol	min.	typ.	max.	unit
Control sensitivity (note 8)					
video to oscillator; at weak signal		–	2,5	–	kHz/μs
at strong signal during scan		–	3,75	–	kHz/μs
during vert. retrace and catching		–	7,5	–	kHz/μs
Second control loop (positive edge)					
Control sensitivity					
R_{28-6} = see Fig. 2	$\Delta t_d/\Delta t_o$	–	50	–	
Control range	t_d	–	25	–	μs
Phase adjustment (via second control loop)					
Control sensitivity		–	25	–	μA/μs
Maximum allowed phase shift	α	–	± 2	–	μs
Horizontal oscillator (pin 23)					
Free running frequency					
R = 34 kΩ; C = 2,7 nF	f_{fr}	–	15625	–	Hz
Spread with fixed external components	Δf	–	0,4	4	%
Frequency variation due to change of supply voltage from 9,5 to 13,2 V	Δf_{fr}	–	0	0,5	%
Frequency variation with temperature	TC	–	–	1×10^{-4}	K^{-1}
Maximum frequency shift	Δf_{fr}	–	–	10	%
Maximum frequency deviation at start H-out	Δf_{fr}	–	8	10	%
Horizontal output (pin 26)					
Output voltage high level	V_{26-6}	–	–	13,2	V
Output voltage at which protection commences	V_{26-6}	–	–	15,8	V
Output voltage low at I_{26} = 10 mA	V_{26-6}	–	0,15	0,5	V
Duty cycle of horizontal output signal at t_p = 10 μs	d	–	0,45	–	
Rise time of output pulse	t_r	–	260	–	ns
Fall time of output pulse	t_f	–	100	–	ns
Flyback input and sandcastle output (note 9)					
Input current required during flyback pulse	I_{27}	0,1	–	2	mA
Output voltage during burst key pulse	V_{27-6}	8	9,0	–	V
Output voltage during horizontal blanking	V_{27-6}	4	4,35	5	V
Output voltage during vertical blanking	V_{27-6}	2,1	2,5	2,9	V
Width of burst key pulse (60 Hz)	t_W	3,1	3,5	3,9	μs
Width of burst key pulse (50 Hz)	t_W	3,6	4,0	4,4	μs
Width of horizontal blanking pulse		flyback pulse width			

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Flyback input and sandcastle output (note 9) (continued)					
Width of vertical blanking pulse					
50 Hz divider in search window		–	21	–	lines
60 Hz divider in search window		–	17	–	lines
50 Hz divider in narrow window		–	25	–	lines
60 Hz divider in narrow window		–	21	–	lines
Delay between start of sync pulse at video output and rising edge of burst key pulse		–	5,2	–	μs
Coincidence detector mute output (note 10)					
Voltage for in-sync condition	V_{22-6}	–	10,3	–	V
Voltage for no-sync condition no signal	V_{22-6}	–	1,5	–	V
Switching level to switch off the AFC	V_{22-6}	–	6,4	–	V
Hysteresis AFC switch	V_{22-6}	–	0,4	–	V
Switching level to activate mute function (transmitter identification)	V_{22-6}	–	2,4	–	V
Hysteresis MUTE function	V_{22-6}	–	0,5	–	V
Charge current in sync condition 4,7 μs	$I_{22(p-p)}$	0,7	1,0	–	mA
Discharge current in sync condition 1,3 μs	$I_{22(p-p)}$	–	0,5	–	mA
Vertical ramp generator (note 11)					
Input current during scan	I_2	–	0,5	2	μA
Discharge current during retrace	I_2	–	0,4	–	mA
Sawtooth amplitude	$V_{2-6(p-p)}$	–	0,8	1,1	V
Vertical output (pin 3)					
Output current	I_3	–	–	7	mA
Maximum output voltage	V_{3-6}	–	5,7	–	V
Feedback input (pin 4)					
Input voltage					
d.c. component	V_{4-6}	–	3,3	–	V
a.c. component (peak-to-peak value)	$V_{4-6(p-p)}$	–	1,2	–	V
Input current	I_4	–	–	12	μA
Internal precorrection to sawtooth	Δt_p	–	5	–	%
Deviation amplitude 50/60 Hz		–	0	2	%

parameter	symbol	min.	typ.	max.	unit
Vertical guard (note 12)					
Active at a deviation with respect to the d.c. feedback level; V_{27-6} = 2,5 V;					
at switching level low	ΔV_{4-6}	–	1,3	–	V
at switching level high	ΔV_{4-6}	–	1,9	–	V

Notes to the characteristics

1. Pin 11 has a double function. When during switch-on a current of 6 mA is supplied to this pin, this current is used to start the horizontal oscillator. The main supply can then be obtained from the horizontal deflection stage. When no current is supplied to this pin it can be used as volume control. The indicated maximum value is the current at which all ICs will start. Higher currents are allowed. the excess current is bypassed to ground.
2. Signal with negative going sync. top white 10% of the top sync. amplitude (Fig. 3).
3. Measured according the test line given in Fig. 4.
   - The differential gain is expressed as a percentage of the difference in peak amplitudes between the largest and smallest value relative to the subcarrier amplitude at blanking level.
   - The differential phase is defined as the difference in degrees between the largest and smallest phase angle.
4. This figure is valid for the complete video signal amplitude (peak white to black).
5. The $S/N = 20 \log \frac{V_{\text{out black-to-white}}}{V_{n(rms)} \text{ at } B = 5 \text{ MHz}}$.
6. The AFC control voltage is obtained by multiplying the IF-output signal (which is also used to drive the synchronous demodulator) with a reference carrier. This reference carrier is obtained from the demodulator tuned circuit via a 90° phase shift network. The IF-output signal has an asymmetrical frequency spectrum with respect to the carrier frequency. To avoid problems due to this asymmetrical signal the AFC circuit is gated by means of an internally generated gating pulse. As a result the detector is operative only during black level at a constant carrier amplitude which contains no additional side bands. As a result the AFC output voltage contains no video information.
   At very weak input signals the drive signal for the AFC circuit will contain a lot of noise. This noise signal has again an asymmetrical frequency spectrum and this will cause an offset of the AFC output voltage. To avoid problems due to this effect the AFC is switched-off when the AGC is controlled to maximum gain.
   The measured figures are obtained at an input signal r.m.s. voltage of 10 mV and the AFC output loaded with 2 times 220 kΩ between + V_s and ground. The unloaded Q-factor of the reference tuned circuit is 70. The AFC is switched-off when no signal is detected by the coincidence detector or when the voltage at pin 22 is between 1,2 V and 6,4 V. This can be realized by a resistor of 68 kΩ connected between pin 22 and ground.
7. The slicing level can be varied by changing the value of R_{17-25}. A higher resistor value results in a larger value of the minimum sync pulse amplitude. The slicing level is independent of the video information.

DEVELOPMENT DATA

Notes to the characteristics (continued)

8. Frequency control is obtained by supplying a correction current to the oscillator RC-network via a resistor, connected between the phase 1 detector output and the oscillator network. The oscillator can be adjusted to the right frequency in one of the two following ways:
   a) Interrupt $R_{23\text{-}24}$.
   b) Short circuit the sync separator bias network (pin 25) to + V_P.

   To avoid the need of a VCR switch the time constant of phase detector at strong input signal is sufficient short to get a stable picture during VCR playback. During the vertical retrace period the time constant is even shorter so that the head errors of the VCR are compensated at the beginning of the scan. Only at weak signal conditions (information derived from the AGC circuit) the time constant is increased to obtain a good noise immunity.
9. The flyback input and sandcastle output have been combined on one pin.
   The flyback pulse is clamped to a level of 4,5 V. The minimum current to drive the second control loop is 0,1 mA.
10. The functions in-sync/out-of-sync and transmitter identification have been combined on this pin. The capacitor is charged during the sync pulse and discharged during the time difference between gating and sync pulse.
11. The vertical scan is synchronized by means of a divider system. Therefore no adjustment is required for the ramp generator. The divider detects whether the incoming signal has a vertical frequency of 50 or 60 Hz and corrects the vertical amplitude.
12. To avoid screenburn due to a collapse of the vertical deflection a continuous blanking level is inserted into the sandcastle pulse when the feedback voltage of the vertical deflection is not within the specified limits.

DEVELOPMENT DATA

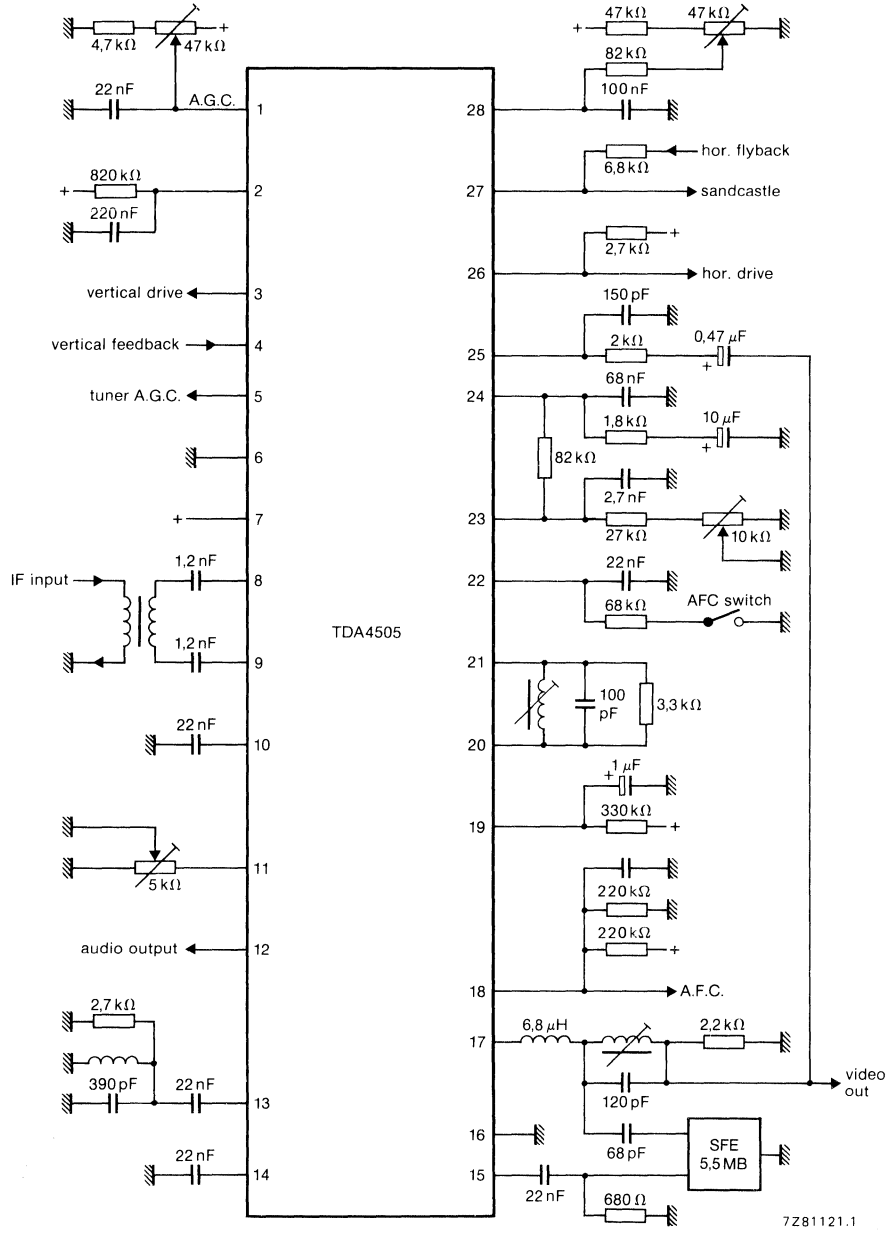


Fig. 2 Application diagram.

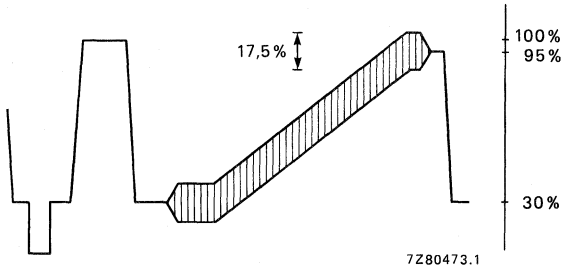


Fig. 3 Video output signal.

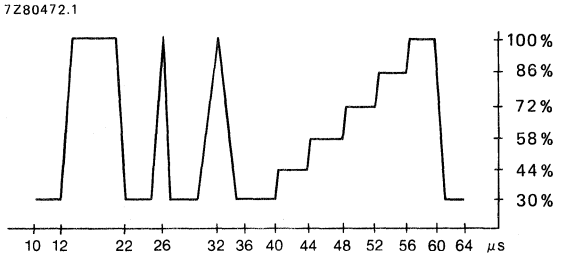


Fig. 4 E.B.U. test signal waveform (line 330).

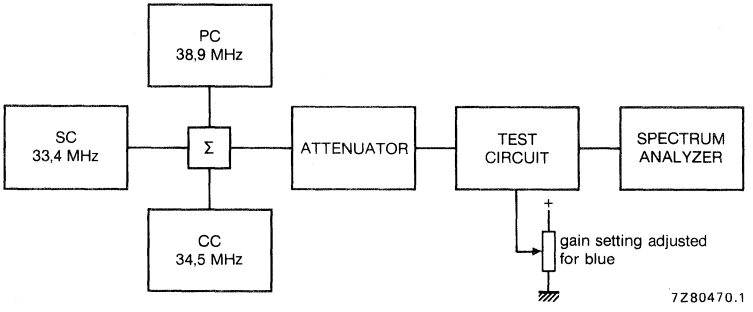


Fig. 5 Test set-up intermodulation.

Value at 1,1 MHz: $20 \log \frac{V_o \text{ at } 4{,}4 \text{ MHz}}{V_o \text{ at } 1{,}1 \text{ MHz}} + 3{,}6 \text{ dB}$

Value at 3,3 MHz: $20 \log \frac{V_o \text{ at } 4{,}4 \text{ MHz}}{V_o \text{ at } 3{,}3 \text{ MHz}}$.

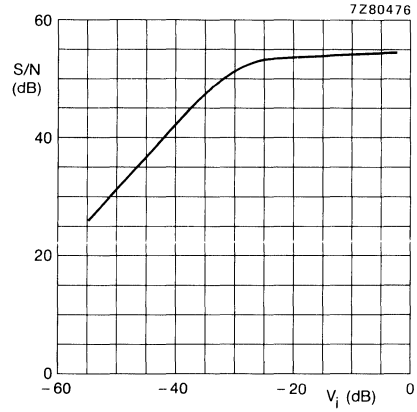


Fig. 6 S/N ratio as a function of the input voltage.

DEVELOPMENT DATA

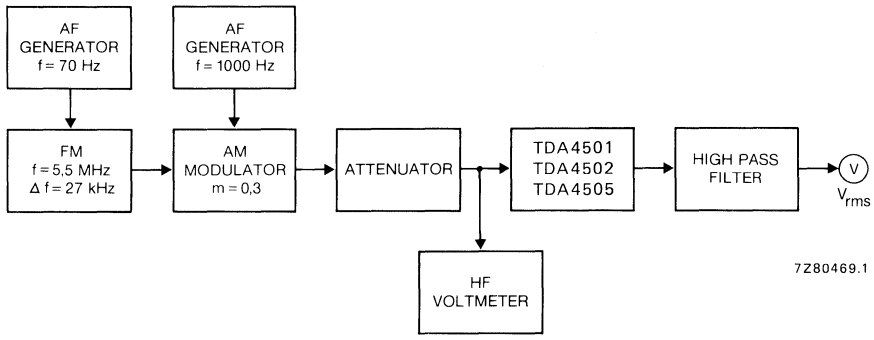


Fig. 7 Test set-up AM suppression.

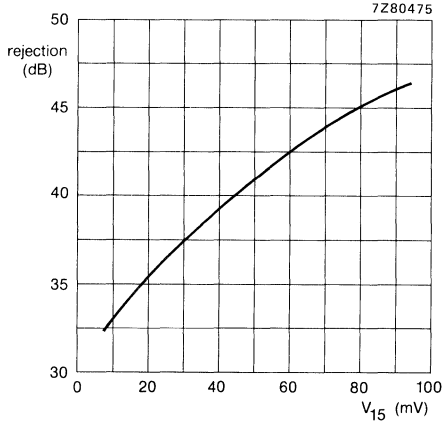


Fig. 8 AM rejection.

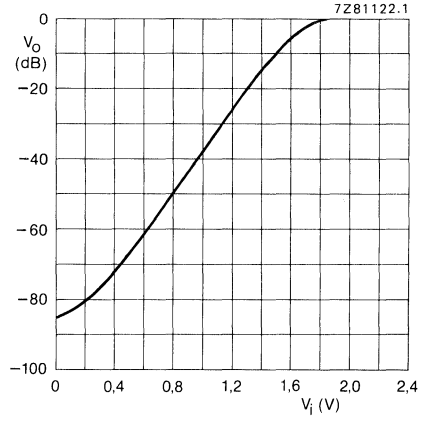


Fig. 9 Volume control characteristics.

PAL DECODER

The TDA4510 is a colour decoder for the PAL standard, which is pin sequent compatible with multi-standard decoder TDA4555 and also pin compatible with NTSC decoder TDA4570. It incorporates the following functions:

Chrominance part

- Gain controlled chrominance amplifier with operating point control stage
- Chrominance output stage for driving the 64 μs delay line
- Blanking circuit for the colour burst signal
- Automatic chrominance control (ACC) with sampled rectifier during burst-key

Oscillator and control voltage part

- Reference oscillator for double subcarrier frequency
- Gated phase comparison
- Identification demodulator and automatic colour killer
- Sandcastle pulse detector
- Service switch

Demodulator part

- Two synchronous demodulators for the (B-Y) and (R-Y) signals
- PAL flip-flop and PAL switch
- Colour switching stages
- Separate colour switching output
- (B-Y) and (R-Y) signal output stages
- Internal filtering of residual carrier

QUICK REFERENCE DATA

Supply voltage	$V_P = V_{7-3}$	typ.	12 V
Supply current	$I_P = I_7$	typ.	50 mA
Chrominance input signal (peak-to-peak)	$V_{9-3(p-p)}$		10 to 400 mV
Chrominance output signal (peak-to-peak)	$V_{6-3(p-p)}$	typ.	1,6 V
Colour difference output signals (peak-to-peak values)			
—(R-Y) signal	$V_{1-3(p-p)}$	typ.	1,05 V ± 2 dB
—(B-Y) signal	$V_{2-3(p-p)}$	typ.	1,33 V ± 2 dB
Sandcastle pulse, required amplitude for			
burst gating level	V_{15-3}	typ.	7,7 V
horizontal pulse separation	V_{15-3}	typ.	4,5 V
vertical and horizontal pulse separation	V_{15-3}	typ.	2,5 V

PACKAGE OUTLINE

16-lead DIL; plastic (SOT-38).

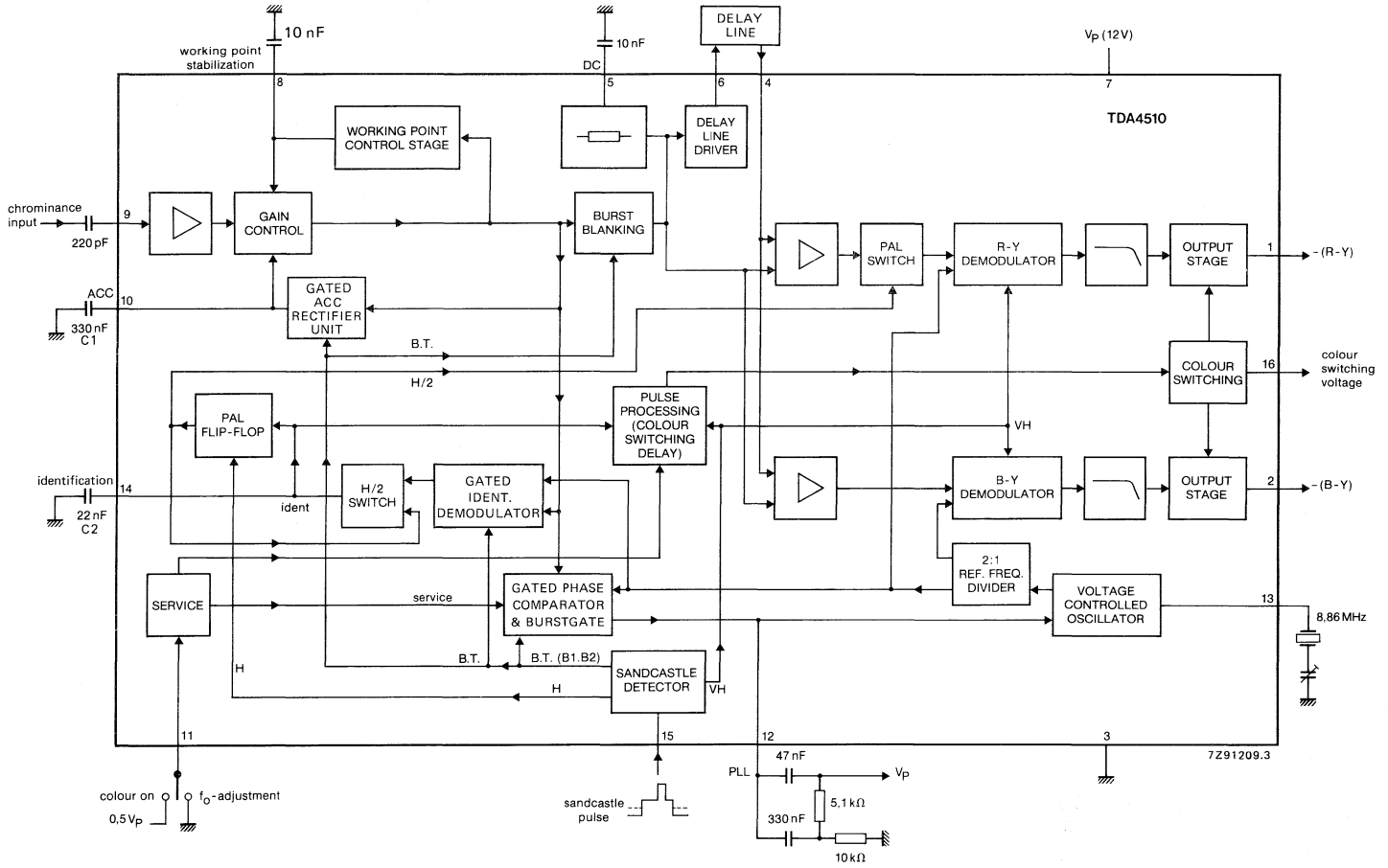


Fig. 1 Block diagram.

External capacitors in Fig. 1

C1 filter capacitor for control voltage (pin 10)
C2 filter capacitor for identification signal (pin 14)

FUNCTIONAL DESCRIPTION

DIVIDER STAGES

The divider stages provide −(R-Y) and −(B-Y) reference signals with the correct 90 degrees relation for the demodulators.

PHASE COMPARATOR

The phase comparator compares the −(R-Y) reference signal with the burst pulse and controls the frequency and phase of the reference oscillator.

IDENTIFICATION DEMODULATOR

The identification demodulator delivers a positive going identification signal for PAL-signals at pin 14, also used for the automatic colour-killer.

SERVICE SWITCH

The service switch has two functions. The first position ($V_{14-3} < 1$ V) allows the adjustment of the reference oscillator. Therefore the colour is switched on and the burst for the oscillator PLL is switched off. The second position ($V_{14-3} > 5$ V) switches the colour on and the output signals can be observed.

DEVELOPMENT DATA

SANDCASTLE PULSE DETECTOR

Sandcastle pulse detector for burst-gate, line and blanking (horizontal and vertical) pulse detection. The vertical part of the sandcastle pulse is needed for the internal colour-on and colour-off delay.

PULSE PROCESSING PART

Pulse processing part which shall prevent a premature switching on of the colour. The colour-on delay, two or three field periods after identification of the PAL signal, is achieved by a counter. The colour is switched off immediately or at the latest one field period after disappearance of the identification voltage.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage range	$V_P = V_{7-3}$	10,8 to 13,2	V
Currents			
at pins 1 and 2	$-I_{1,2}$	max. 5	mA
at pin 6	$-I_6$	max. 15	mA
at pin 16	$-I_{16}$	max. 5	mA
Total power dissipation	P_{tot}	max. 800	mW
Storage temperature	T_{stg}	−25 to + 150	°C
Operating ambient temperature	T_{amb}	0 to + 70	°C

CHARACTERISTICS

V_P = 12 V; T_{amb} = 25 °C; measured in Fig. 2 unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply current	I_7	–	50	–	mA
Chrominance part					
Input voltage range (peak-to-peak value)	$V_{9\text{-}3(p\text{-}p)}$	10	–	400	mV
Nominal input voltage (peak-to-peak value) with 75% colour bar signal	$V_{9\text{-}3(p\text{-}p)}$	–	100	–	mV
Input impedance	$Z_{9\text{-}3}$	–	3,3	–	kΩ
Input capacitance	$C_{9\text{-}3}$	–	4	–	pF
Colour ON					
Chrominance output voltage (peak-to-peak) with 75% colour bar signal	$V_{6\text{-}3(p\text{-}p)}$	–	1,6	–	V
d.c. voltage at chrominance output	$V_{6\text{-}3}$	–	8,2	–	V
Oscillator and control voltage part					
Oscillator frequency	f_o	–	8,8	–	MHz
Input resistance	$R_{13\text{-}3}$	–	350	–	Ω
Catching range (depending on RC-network at pin 12)	f	± 400	–	–	Hz
Control voltage					
without burst signal	$V_{14\text{-}3}$	–	6,0	–	V
colour on switching threshold	$V_{14\text{-}3}$	–	6,6	–	V
hysteresis of colour switching	$V_{14\text{-}3}$	–	150	–	mV
flip-flop correction (FFC) voltage	$V_{14\text{-}3}$	–	5,5	–	V
hysteresis of FFC	$V_{14\text{-}3}$	–	170	–	mV
Colour-on delay		2	–	3	f.p.*
Colour-off delay		0	–	1	f.p.*
First service position (PLL is inactive for oscillator adjustment, colour on)	$V_{11\text{-}3}$	0	–	1	V
second service position (colour on)	$V_{11\text{-}3}$	5	–	–	V
Colour switching output (open npn emitter)					
output current	$-I_{16}$	–	–	5	mA
colour-on voltage	$V_{16\text{-}3}$	–	6	–	V
colour-off voltage	$V_{16\text{-}3}$	–	0	–	V
Demodulator part					
Delayed chrominance input signal (peak-to-peak value) with 75% colour bar signal	$V_{4\text{-}3(p\text{-}p)}$	–	200	–	mV
Colour difference output signals (peak-to-peak value)					
–(R-Y) signal	$V_{1\text{-}3(p\text{-}p)}$	0,84	1,05	1,32	V
–(B-Y) signal	$V_{2\text{-}3(p\text{-}p)}$	1,06	1,33	1,67	V

parameter	symbol	min.	typ.	max.	unit
Ratio of colour difference output signals (R-Y)/(B-Y)	$V_{1\text{-}3}/V_{2\text{-}3}$	0,71	0,79	0,87	V
D.C. voltage at colour difference outputs	$V_{1;\,2\text{-}3}$	–	7,7	–	V
Residual carrier voltage at colour difference outputs					
1 x subcarrier frequency (4,4 MHz)	$V_{1,2\text{-}3(p\text{-}p)}$	–	–	20	mV
2 x subcarrier frequency (8,8 MHz)	$V_{1,2\text{-}3(p\text{-}p)}$	–	–	20	mV
Sandcastle pulse detector					
Thresholds:					
Field- and line-pulse separation pulse ON	$V_{15\text{-}3}$	1,3	1,6	1,9	V
Required pulse amplitude	$V_{15\text{-}3}$	2,0	2,5	3,0	V
Line pulse separation; pulse ON	$V_{15\text{-}3}$	3,3	3,6	3,9	V
Required pulse amplitude	$V_{15\text{-}3}$	4,1	4,5	4,9	V
Burst pulse separation; pulse ON	$V_{15\text{-}3}$	6,6	7,1	7,6	V
Required pulse amplitude	$V_{15\text{-}3}$	7,7	–	–	V
Input voltage during horizontal scanning	$V_{15\text{-}3}$	–	–	1,1	V
Input current	$-I_{15}$	–	–	100	μA

DEVELOPMENT DATA

* f.p. is shortening for field periods in this case.

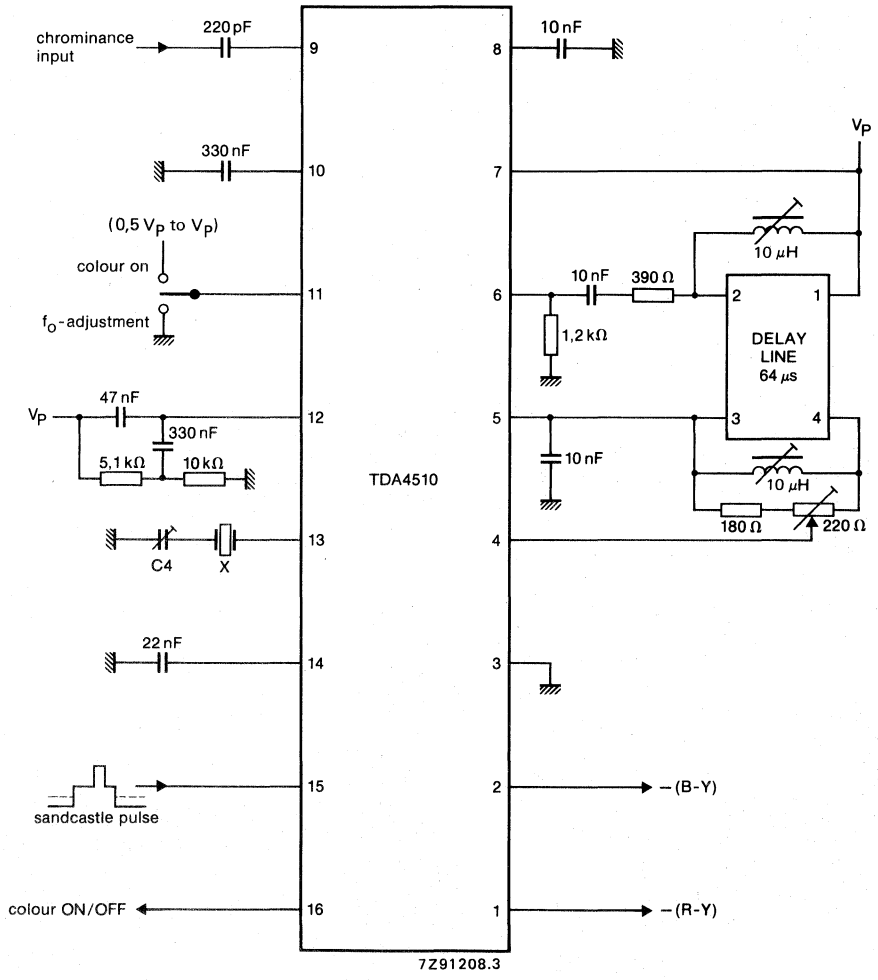


Fig. 2 Application information and test circuit.

C4 = 5 to 27 pF, X = 8,8 MHz; nominal frequency 8,867 238 MHz; resonance resistance 60 Ω, load capacitance 20 pF, dynamic capacitance 22 fF and static capacitance 5,5 pF.

MULTISTANDARD DECODER

GENERAL DESCRIPTION

The TDA4555 and TDA4556 are monolithic integrated multistandard colour decoders for the PAL, SECAM, NTSC 3,58 MHz and NTSC 4,43 MHz standards. The difference between the TDA4555 and the TDA4556 is the polarity of the colour difference output signals (B-Y) and (R-Y).

Features

Chrominance part

- Gain controlled chrominance amplifier for PAL, SECAM and NTSC
- ACC rectifier circuits (PAL/NTSC, SECAM)
- Burst blanking (PAL) in front of 64 μs glass delay line
- Chrominance output stage for driving the 64 μs glass delay line (PAL, SECAM)
- Limiter stages for direct and delayed SECAM signal
- SECAM permutator

Demodulator part

- Flyback blanking incorporated in the two synchronous demodulators (PAL, NTSC)
- PAL switch
- Internal PAL matrix
- Two quadrature demodulators with external reference tuned circuits (SECAM)
- Internal filtering of residual carrier
- De-emphasis (SECAM)
- Insertion of reference voltages as achromatic value (SECAM) in the (B-Y) and (R-Y) colour difference output stages (blanking)

Identification part

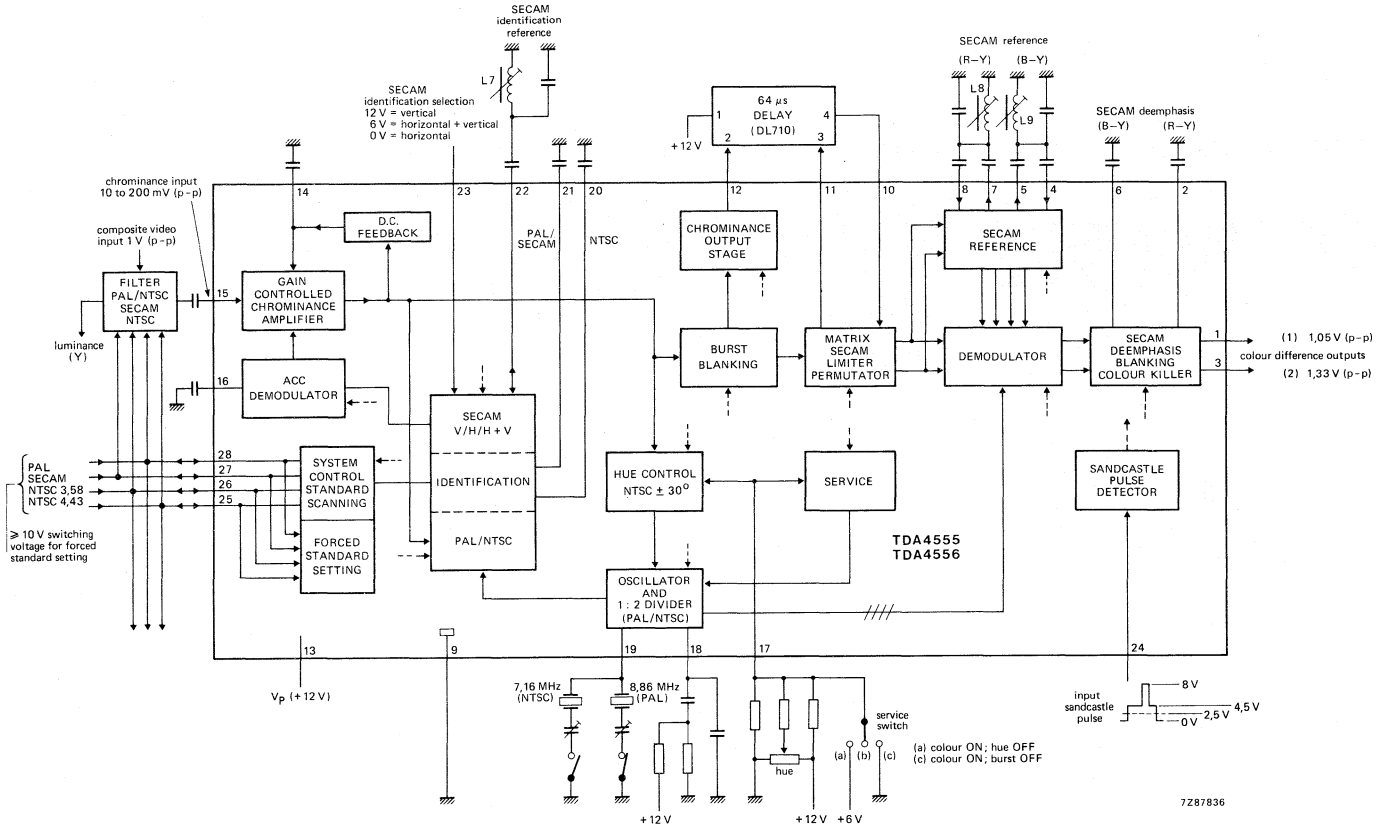
- Automatic standard recognition by sequential inquiry
- Delay for colour-on and scanning-on
- Reliable SECAM identification by PAL priority circuit
- Forced switch-on of a standard
- Four switching voltages for chrominance filters, traps and crystals
- Two identification circuits for PAL/SECAM (H/2) and NTSC
- PAL/SECAM flip-flop
- SECAM identification mode switch (horizontal, vertical or combined horizontal and vertical)
- Crystal oscillator with divider stages and PLL circuitry (PAL, NTSC) for double colour subcarrier frequency
- HUE control (NTSC)
- Service switch

QUICK REFERENCE DATA

Supply voltage (pin 13)	$V_P = V_{13-9}$	typ.	12 V
Supply current (pin 13)	$I_P = I_{13}$	typ.	65 mA
Chrominance input signal (peak-to-peak)	$V_{15-9(p-p)}$		20 to 200 mV
Chrominance output signal (peak-to-peak)	$V_{12-9(p-p)}$	typ.	1,6 V
Colour difference output signals (peak-to-peak values)			
TDA4555: –(R-Y); **TDA4556:** + (R-Y)	$V_{1-9(p-p)}$	typ.	1,05 V ± 2 dB
TDA4555: –(B-Y); **TDA4556:** + (B-Y)	$V_{3-9(p-p)}$	typ.	1,33 V ± 2 dB
Sandcastle pulse; required amplitude for			
vertical and horizontal pulse separation	V_{24-9}	typ.	2,5 V
horizontal pulse separation	V_{24-9}	typ.	4,5 V
burst gating	V_{24-9}	typ.	7,7 V

PACKAGE OUTLINE

28-lead DIL; plastic (SOT-117).



(1) TDA4555: –(R-Y); TDA4556: + (R-Y)
(2) TDA4555: –(B-Y); TDA4556: + (B-Y)

Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 13)	$V_P = V_{13-9}$	max.	13,2	V
Voltage range at pins 10, 11, 17, 23, 24, 25, 26, 27, 28 to pin 9 (ground)	V_{n-9}		0 to V_P	V
Current at pin 12	I_{12}	max.	8	mA
Peak value	I_{12M}	max.	15	mA
Total power dissipation	P_{tot}	max.	1,4	W
Storage temperature range	T_{stg}		−25 to +150	°C
Operating ambient temperature range	T_{amb}		0 to +70	°C

CHARACTERISTICS

$V_P = V_{13-9} = 12$ V; $T_{amb} = 25$ °C; measured in Fig. 1; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 13)					
Supply voltage range	$V_P = V_{13-9}$	10,8	–	13,2	V
Supply current	$I_P = I_{13}$	–	65	–	mA
Chrominance part					
Chrominance input signal (pin 15)					
input voltage with 75% colour bar signal (peak-to-peak value)	$V_{15-9(p-p)}$	20	100	200	mV
input impedance	$\|Z_{15-9}\|$	2,3	3,3	–	kΩ
Chrominance output signal (pin 12)					
output voltage (peak-to-peak value)	$V_{12-9(p-p)}$	–	1,6	–	V
output impedance (n-p-n emitter follower)	$\|Z_{12-9}\|$	–	–	20	Ω
d.c. output voltage	V_{12-9}	–	8,2	–	V
Input for delayed signal (pin 10)					
d.c. input current	I_{10}	–	–	10	μA
input resistance	R_{10-9}	10	–	–	kΩ
Demodulator part (PAL/NTSC)					
Colour difference output signals					
output voltage (proportional to V_{13-9}) (peak-to-peak value)					
TDA4555					
– (R-Y) signal (pin 1)	$V_{1-9(p-p)}$	–	1,05 V ± 2 dB	–	V
– (B-Y) signal (pin 3)	$V_{3-9(p-p)}$	–	1,33 V ± 2 dB	–	V
TDA4556					
+ (R-Y) signal (pin 1)	$V_{1-9(p-p)}$	–	1,05 V ± 2 dB	–	V
+ (B-Y) signal (pin 3)	$V_{3-9(p-p)}$	–	1,33 V ± 2 dB	–	V
Ratio of colour difference output signals (R-Y)/(B-Y)	$V_{1/3-9}$	–	0,79 ± 10%	–	
Residual carrier (subcarrier frequency) (peak-to-peak value)	$V_{1,3-9(p-p)}$	–	–	30	mV
Residual carrier (PAL only) (peak-to-peak value)	$V_{1,3-9(p-p)}$	–	10	–	mV
H/2 ripple at (R-Y) output (pin 1) (peak-to-peak value) without input signal	$V_{1-9(p-p)}$	–	–	10	mV
D.C. output voltage n-p-n emitter follower with internal current source of 0,3 mA	$V_{1,3-9}$	–	7,7	–	V
output impedance	$\|Z_{1,3-9}\|$	–	–	150	Ω

parameter	symbol	min.	typ.	max.	unit
Demodulator part (SECAM)					
Colour difference signals (see note 1) output voltage (proportional to V_{13-9}) (peak-to-peak value) TDA4555					
–(R-Y) signal (pin 1	$V_{1-9(p-p)}$	–	1,05	–	V
– (B-Y) signal (pin 3)	$V_{3-9(p-p)}$	–	1,33	–	V
TDA4556					
+ (R-Y) signal (pin 1)	$V_{1-9(p-p)}$	–	1,05	–	V
+ (B-Y) signal (pin 3)	$V_{3-9(p-p)}$	–	1,33	–	V
Ratio of colour difference output signals (R-Y)/(B-Y)	$V_{1/3-9}$	–	0,79* ± 10%	–	
Residual carrier (4 to 5 MHz) (peak-to-peak value)	$V_{1,3-9(p-p)}$	–	20	30	mV
Residual carrier (8 to 10 MHz) (peak-to-peak value)	$V_{1,3-9(p-p)}$	–	20	30	mV
H/2 ripple at (R-Y) (B-Y) outputs (pins 1 and 3) (peak-to-peak value) with f_o signals	$V_{1,3-9(p-p)}$	–	–	20	mV
D.C. output voltage	$V_{1,3-9}$	–	7,7	–	V
Shift of inserted levels relative to levels of demodulated f_o frequencies (IC only)	$\Delta V/\Delta T$(R-Y)	–	–0,55	–	mV/K
	$\Delta V/\Delta T$(B-Y)	–	+0,25	–	mV/K
HUE control (NTSC)/service switch					
Phase shift of reference carrier at V_{17-9} = 2 V	$-\phi$	–	30**	–	deg
at V_{17-9} = 3 V	ϕ	–	0	–	deg
at V_{17-9} = 4 V	$+\phi$	–	30**	–	deg
Input resistance	R_{17-9}	–	5	–	kΩ
Service position					
Switching voltage (pin 17) burst OFF; colour ON (for oscillator adjustment)	V_{17-9}	–	–	0,5	V
HUE control OFF; colour ON (for forced colour ON)	V_{17-9}	6	–	–	V
Crystal oscillator (pin 19)					
For double colour subcarrier frequency input resistance	R_{19-9}	–	350	–	Ω
lock-in-range referred to subcarrier frequency	Δf	± 400	–	–	Hz

* Value measured without influence of external circuitry.

** Relative to phase at V_{17-9} = 3 V.

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Identification part					
Switching voltages for chrominance filters and crystals at pin 28 (PAL) at pin 27 (SECAM) at pin 26 (NTSC 3,58 MHz) at pin 25 (NTSC 4,43 MHz)					
Control voltage OFF state	$V_{25,26,27,28-9}$	–	–	0,5	V
Control voltage ON state					
during scanning; colour OFF	$V_{25,26,27,28-9}$	–	2,45	–	V
colour ON	$V_{25,26,27,28-9}$	–	5,8	–	V
Output current	$-I_{25,26,27,28-9}$	–	–	3	mA
Voltage for forced switching ON					
PAL	V_{28-9}	9	–	–	V
SECAM	V_{27-9}	9	–	–	V
NTSC 3,58 MHz	V_{26-9}	9	–	–	V
NTSC 4,43 MHz	V_{25-9}	9	–	–	V
Delay time for					
restart of scanning	t_{dS}	2 to 3 vertical periods			
colour ON	t_{dC1}	2 to 3 vertical periods			
colour OFF	t_{dC2}	0 to 1 vertical periods			
SECAM identification (pin 23)					
Input voltage for					
horizontal identification (H)	V_{23-9}	–	–	2	V
vertical identification (V)	V_{23-9}	10	–	–	V
combined (H) and (V) identification	V_{23-9}	–	6*	–	V
Sequence of standard inquiry PAL-SECAM-NTSC 3,58 MHz-NTSC 4,43 MHz					
Reliable SECAM identification by PAL priority circuit					
Scanning time for each standard	t_S	4 vertical periods			

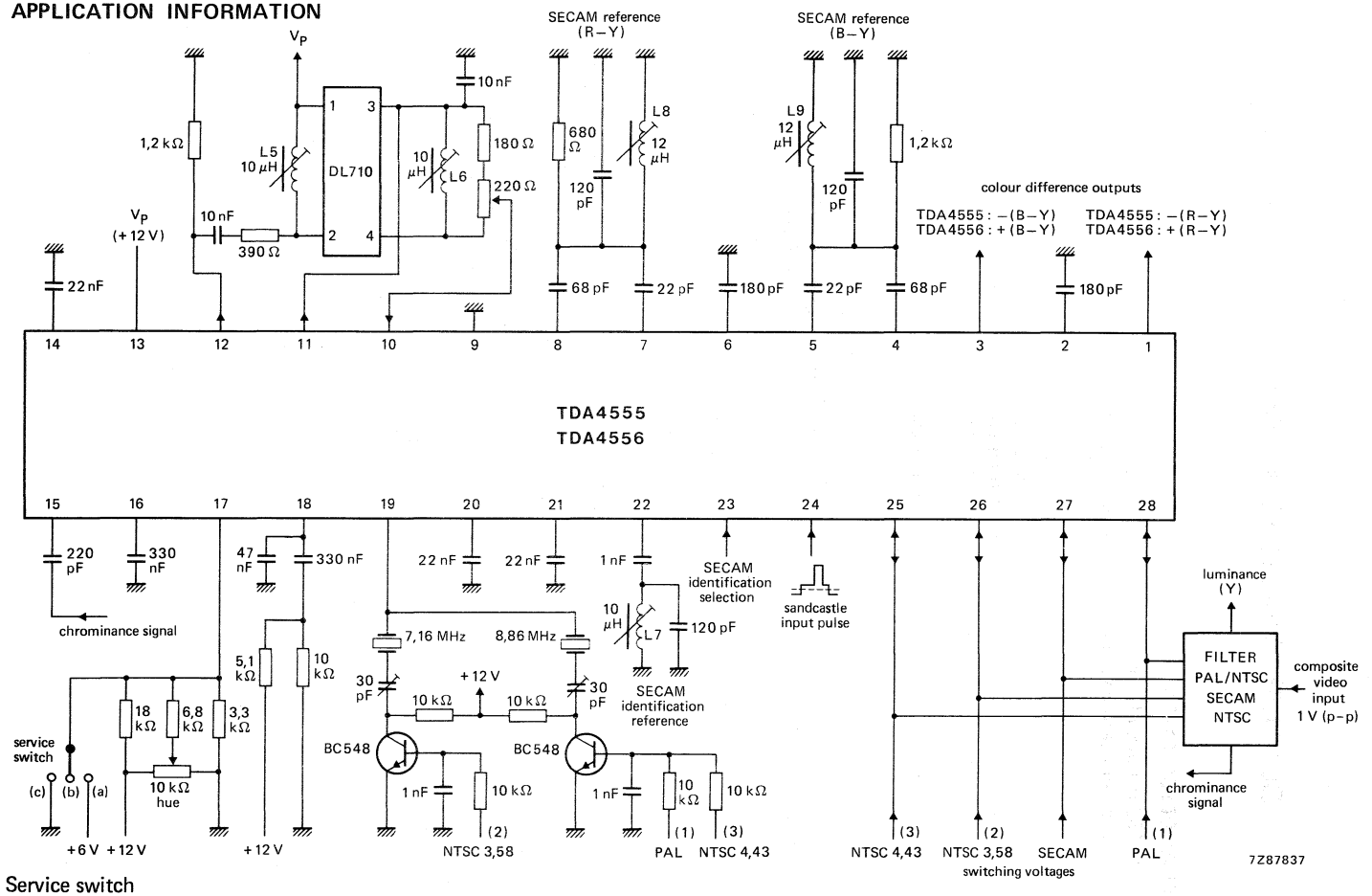
* Or not connected.

parameter	symbol	min.	typ.	max.	unit
Sandcastle pulse detector (see note 2)					
Input voltage pulse levels (pin 24) to separate vertical and horizontal blanking pulses	$V_{24\text{-}9}$	1,2	–	2,0	V
required pulse amplitude	$V_{24\text{-}9(p\text{-}p)}$	2,0	–	3,0	V
to separate horizontal blanking pulse	$V_{24\text{-}9}$	3,2	–	4,0	V
required pulse amplitude	$V_{24\text{-}9(p\text{-}p)}$	4,0	–	5,0	V
to separate burst gating pulse	$V_{24\text{-}9}$	6,5	–	7,7	V
required pulse amplitude	$V_{24\text{-}9(p\text{-}p)}$	7,7	–	V_P	V
Input voltage during horizontal scanning	$V_{24\text{-}9}$	–	–	1,0	V
Input current	$-I_{24}$	–	–	100	μA

Notes to the characteristics

1. The signal amplitude of the colour difference signals (R-Y) and B-Y) is dependent on the characteristics of the external tuned circuits at pins 7, 8 and 4, 5 respectively. Adjustment of the amplitude is achieved by varying the Q-factor of these tuned circuits. The resonant frequency must be adjusted such that the demodulated output frequency (f_o) provides the same output level as the internally inserted reference voltage (achromatic value).
2. The sandcastle pulse is compared with three internal threshold levels, which are proportional to the supply voltage.

APPLICATION INFORMATION



Service switch

(a) colour ON; hue OFF
(c) colour ON; burst OFF

Fig. 2 Application diagram.

COLOUR TRANSIENT IMPROVEMENT CIRCUIT

GENERAL DESCRIPTION

The TDA4560 is a monolithic integrated circuit for colour transient improvement (CTI) and luminance delay line in gyrator technique in colour television receivers.

Features

- Colour transient improvement for colour difference signals (R-Y) and (B-Y) with transient detecting-, storage- and switching stages resulting in high transients of colour difference output signals
- A luminance signal path (Y) which substitutes the conventional Y-delay coil with an integrated Y-delay line
- Switchable delay time from 720 ns to 1035 ns in steps of 45 ns
- Output for the option of velocity modulation

QUICK REFERENCE DATA

Supply voltage (pin 10)	$V_P = V_{10\text{-}18}$	typ.	12 V
Supply current (pin 10)	$I_P = I_{10}$	typ.	35 mA
(R-Y) and (B-Y) attenuation	α_{cd}	typ.	0 dB
(R-Y) and (B-Y) output transient time	t_{tr}	typ.	150 ns
Adjustable Y-delay time	t_d	720 to	1035 ns
Y-attenuation	α_y	typ.	7 dB

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102CS).

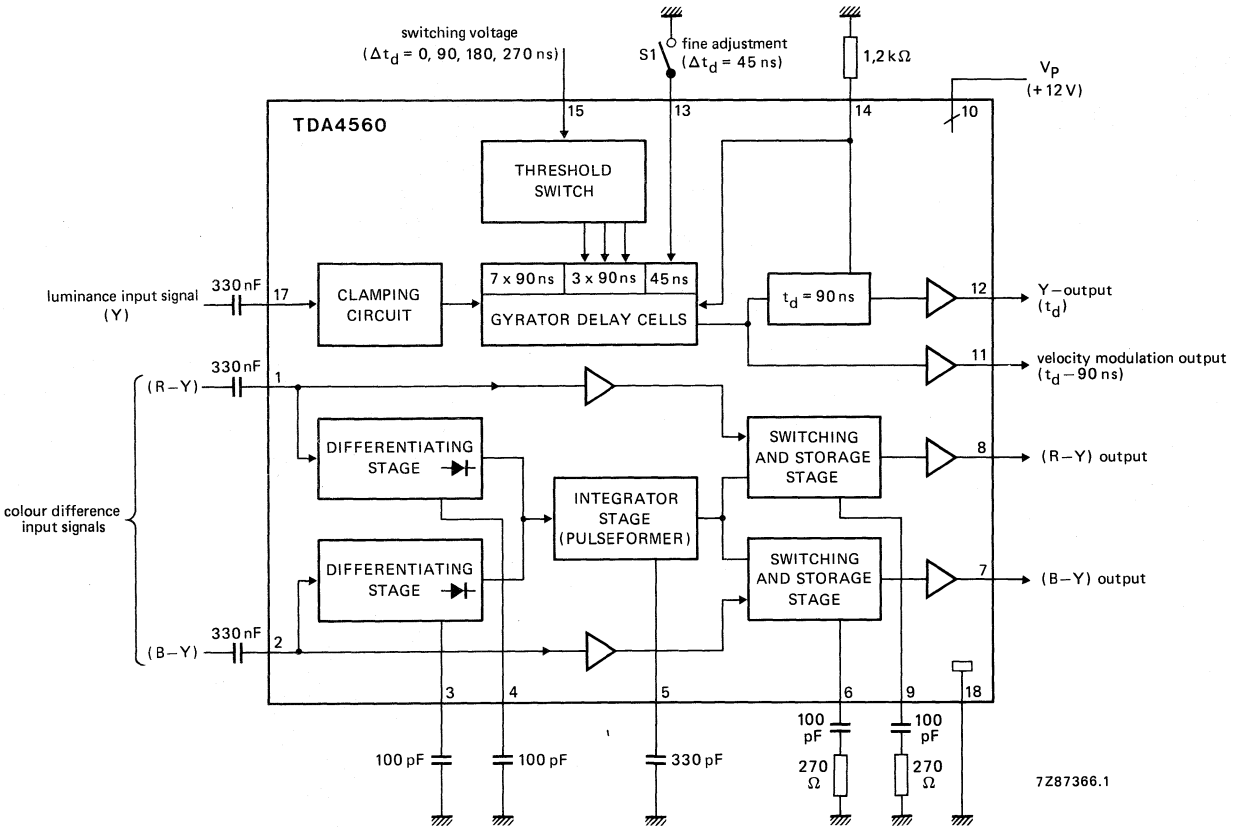


Fig. 1 Block diagram.

FUNCTIONAL DESCRIPTION

The IC consists of two colour difference channels (B-Y) and (R-Y) and a luminance signal path (Y) as shown in Fig. 1.

Colour difference channels

The (B-Y) and (R-Y) colour difference channels consist of a buffer amplifier at the input, a switching stage and an output amplifier. The switching stages, which are controlled by transient detecting stages (differentiators), switch to a value that has been stored at the beginning of the transients. The differentiating stages get their signal direct from the colour difference detecting signal (pins 1 and 2). Two parallel storage stages are incorporated in which the colour difference signals are stored during the transient time of the signal. After a time of about 600 ns they are switched immediately (transient time of 150 ns) to the outputs. The colour difference channels are not attenuated.

Y-signal path

The Y-signal input (pin 17) is capacitively coupled to an input clamping circuit. Gyrator delay cells provide a maximum delay of 1035 ns including an additional delay of 45 ns via the fine adjustment switch (S1) at pin 13. Three delay cells are switched with two interstage switches dependent on the voltage at pin 15. Thus three switchable delay times of 90 ns, 180 ns or 270 ns less than the maximum delay time are available. A tuning compensation circuit ensures accuracy of delay time despite process tolerances. The Y-signal path has a 7 dB attenuation as a normal Y-delay coil and can replace this completely. The output is fed to pin 12 via a buffer amplifier. An additional output stage provides a signal of 90 ns less delay at pin 11 for the option of velocity modulation.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC)

Supply voltage (pin 10)	$V_P = V_{10-18}$	max.	13,2 V
Voltage ranges to pin 18 (ground)			
at pins 1,2,12,15	V_{n-18}		0 to V_P V
at pin 11	V_{11-18}		0 to (V_P–3V) V
at pin 17	V_{17-18}		0 to 7 V
Voltage ranges			
at pin 7 to pin 6	V_{7-6}		0 to 5 V
at pin 8 to pin 9	V_{8-9}		0 to 5 V
Currents			
at pins 6,9	$\pm I_{6,9}$	max.	15 mA
at I_7, I_8, I_{11}, I_{12}		internally limited	
Total power dissipation	P_{tot}	max.	1,1 W
Storage temperature range	T_{stg}		–25 to +150 °C
Operating ambient temperature range	T_{amb}		0 to +70 °C

Note

Pins 3, 4, 5, 6, 9, 13 and 14 d.c. potential not published.

CHARACTERISTICS

$V_P = V_{10-18} = 12$ V; $T_{amb} = 25$ °C; measured in application circuit Fig. 2; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 10)					
Supply voltage	$V_P = V_{10-18}$	10,8	12	13,2	V
Supply current	$I_P = I_{10}$	–	35	50	mA
Colour difference channels (pins 1 and 2);					
(R-Y) input voltage (peak-to-peak value) 75% colour bar signal	V_{1-18}	–	1,05	–	V
(B-Y) input voltage (peak-to-peak value) 75% colour bar signal	V_{2-18}	–	1,33	–	V
Input resistance	$R_{1,\,2-18}$	–	12	–	kΩ
Internal bias (input)	$V_{1,\,2-18}$	–	4,3	–	V
(B-Y), (R-Y) signal attenuation $\frac{V_8}{V_1}, \frac{V_7}{V_2}$	α_{cd}	–	0	–	dB
Output voltage (d.c.)	$V_{7,\,8-18}$	–	4,4	–	V
Output current (emitter follower with constant current source 0,65 mA)	$-I_{7,8}$	–	1,2	–	mA
(R-Y) and B-Y) output signal transient time	t_{tr}	–	150	–	ns
Y-signal path (pin 17)					
Y-input voltage (composite signal) (peak-to-peak value)	$V_{17-18(p-p)}$	–	1	–	V
Internal bias voltage (during clamping)	V_{17-18}	–	1,5	–	V
Input current during picture content	I_{17}	–	8	–	μA
during synchronizing pulse	$-I_{17}$	–	100	–	μA
Y-signal attenuation $\frac{V_{11}}{V_{17}}$	α_Y	–	8	–	dB
Y-signal attenuation $\frac{V_{12}}{V_{17}}$	α_Y	–	7	–	dB
Output voltage (d.c.)	V_{11-18}	–	2,3	–	V
Output voltage (d.c.)	V_{12-18}	–	10,3	–	V
Output current (emitter follower with constant current source 0,45 mA)	$-I_{11,12}$	–	1,2	–	mA
Frequency response (note 1) $R_{14-18} = 1{,}2$ kΩ; $V_{15-18} = 12$ V	f_{12-17}	–	5	–	MHz

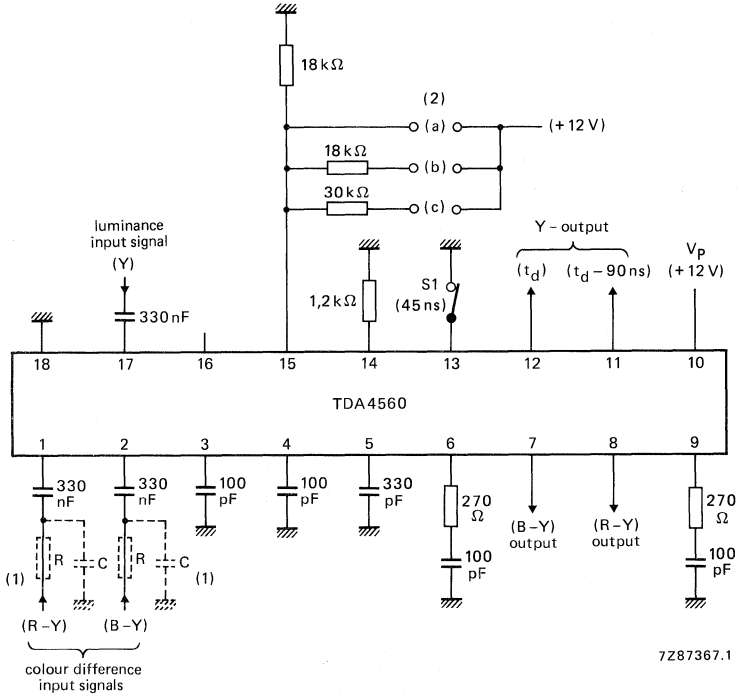
CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Y-signal path (pin 17)					
Adjustable delay (note 2) (switch open)					
at $V_{15\text{-}18}$ = 0 to 2,5 V; $R_{14\text{-}18}$ = 1,2 kΩ	t_d	–	720	–	ns
at $V_{15\text{-}18}$ = 3,5 to 5,5 V; $R_{14\text{-}18}$ = 1,2 kΩ	t_d	–	810	–	ns
at $V_{15\text{-}18}$ = 6,5 to 8,5 V; $R_{14\text{-}18}$ = 1,2 kΩ	t_d	–	900	–	ns
at $V_{15\text{-}18}$ = 9,5 to 12 V; $R_{14\text{-}18}$ = 1,2 kΩ	t_d	–	990	–	ns
Fine adjustment delay (switch S1 closed)					
at $V_{13\text{-}18}$ = 0 V	Δt_d	–	45	–	ns
Signal delay for velocity modulation (pin 11)	t		t_d – 90 ns		
Thermal resistance					
From junction to ambient (in free air)	$R_{th\ j\text{-}a}$	–	–	70	K/W

NOTES TO THE CHARACTERISTICS

1. $R_{14\text{-}18}$ influences the bandwidth.
2. Delay time is proportional to resistor $R_{14\text{-}18}$.

APPLICATION INFORMATION



(1) Residual carrier reduced to 20 mV peak-to-peak (R = 1 kΩ, C = 100 pF).
(2) Switching sequence for delay times shown in Table 1.

Fig. 2 Application diagram and test circuit.

Table 1 Switching sequence for delay times.

connection			voltage at pin 15	delay time (ns)*
(a)	(b)	(c)		
O	O	O	0 to 2,5 V	720
O	O	X	3,5 to 5,5 V	810
O	X	X	6,5 to 8,5 V	900
X	X	X	9,5 to 12 V	990

Where: X = connection closed; O = connection open.

* When switch (S1) is closed the delay time is increased by 45 ns.

COLOUR TRANSIENT IMPROVEMENT CIRCUIT

GENERAL DESCRIPTION

The TDA4565 is a monolithic integrated circuit for colour transient improvement (CTI) and luminance delay line in gyrator technique in colour television receivers.

Features

- Colour transient improvement for colour difference signals (R-Y) and (B-Y) with transient detecting-, storage- and switching stages resulting in high transients of colour difference output signals
- A luminance signal path (Y) which substitutes the conventional Y-delay coil with an integrated Y-delay line
- Switchable delay time from 690 ns to 1005 ns in steps of 45 ns
- Two Y output signals; one of 180 ns less delay

QUICK REFERENCE DATA

Supply voltage (pin 10)	$V_P = V_{10\text{-}18}$	typ.	12	V
Supply current (pin 10)	$I_P = I_{10}$	typ.	35	mA
(R-Y) and (B-Y) attenuation	α_{cd}	typ.	0	dB
(R-Y) and (B-Y) output transient time	t_{tr}	typ.	150	ns
Adjustable Y-delay time	t_d	690 to	1005	ns
Y-attenuation	α_y	typ.	6,5	dB

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102CS).

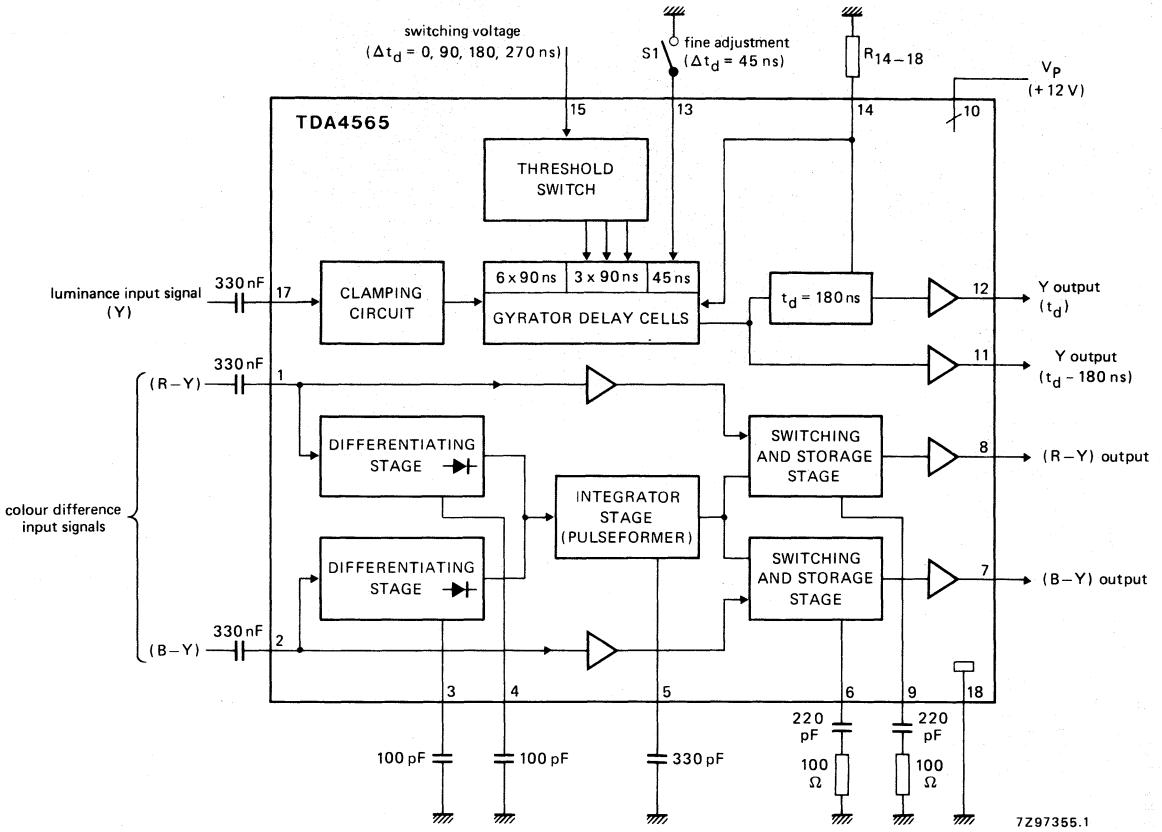


Fig. 1 Block diagram.

FUNCTIONAL DESCRIPTION

The IC consists of two colour difference channels (B-Y) and (R-Y) and a luminance signal path (Y) as shown in Fig. 1.

Colour difference channels

The (B-Y) and (R-Y) colour difference channels consist of a buffer amplifier at the input, a switching stage and an output amplifier. The switching stages, which are controlled by transient detecting stages (differentiators), switch to a value that has been stored at the beginning of the transients. The differentiating stages get their signal direct from the colour difference detecting signal (pins 1 and 2). Two parallel storage stages are incorporated in which the colour difference signals are stored during the transient time of the signal. At the end of this transient time they are switched immediately (transient time of 150 ns) to the outputs. The colour difference channels are not attenuated.

Y-signal path

The Y-signal input (pin 17) is capacitively coupled to an input clamping circuit. Gyrator delay cells provide a maximum delay of 1005 ns including an additional delay of 45 ns via the fine adjustment switch (S1) at pin 13. Three delay cells are switched with two interstage switches dependent on the voltage at pin 15. Thus three switchable delay times of 90 ns, 180 ns or 270 ns less than the maximum delay time are available. A tuning compecsation circuit ensures accuracy of delay time despite process tolerances. The Y-signal path has a 6,5 dB attenuation as a normal Y-delay coil and can replace this completely. The output is fed to pin 12 via a buffer amplifier. An additional output stage provides a signal of 180 ns less delay at pin 11.

DEVELOPMENT DATA

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC)

Supply voltage (pin 10)	$V_P = V_{10-18}$	max. 13,2	V
Voltage ranges to pin 18 (ground)			
at pins 1,2,12 and 15	V_{n-18}	0 to V_P	V
at pin 11	V_{11-18}	0 to (V_P–3V)	V
at pin 17	V_{17-18}	0 to 7	V
Voltage ranges			
at pin 7 to pin 6	V_{7-6}	0 to 5	V
at pin 8 to pin 9	V_{8-9}	0 to 5	V
Currents			
at pins 6,9	$\pm I_{6,9}$	max. 15	mA
at pins 7, 8, 11 and 12	$I_{7,8,11,12}$	internally limited	
Total power dissipation	P_{tot}	max. 1,1	W
Storage temperature range	T_{stg}	–25 to +150	°C
Operating ambient temperature range	T_{amb}	0 to +70	°C

Note

Pins 3, 4, 5, 6, 9, 13 and 14 d.c. potential not published.

CHARACTERISTICS

$V_P = V_{10-18} = 12$ V; $T_{amb} = 25$ °C; measured in application circuit Fig. 2; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 10)					
Supply voltage	$V_P = V_{10-18}$	10,8	12	13,2	V
Supply current	$I_P = I_{10}$	–	35	50	mA
Colour difference channels (pins 1 and 2);					
(R-Y) input voltage (peak-to-peak value) 75% colour bar signal	V_{1-18}	–	1,05	–	V
(B-Y) input voltage (peak-to-peak value) 75% colour bar signal	V_{2-18}	–	1,33	–	V
Input resistance	$R_{1,\ 2-18}$	–	12	–	kΩ
Internal bias (input)	$V_{1,\ 2-18}$	–	4,3	–	V
(B-Y), (R-Y) signal attenuation $\frac{V_8}{V_1}, \frac{V_7}{V_2}$	α_{cd}	–	0	–	dB
Output voltage (d.c.)	$V_{7,\ 8-18}$	–	4,3	–	V
Output current (emitter follower with constant current source 0,6 mA)	$-I_{7,8}$	–	1,2	–	mA
(R-Y) and B-Y) output signal transient time	t_{tr}	–	150	–	ns
Y-signal path (pin 17)					
Y-input voltage (composite signal) (peak-to-peak value)	$V_{17-18(p-p)}$	–	1	–	V
Internal bias voltage (during clamping)	V_{17-18}	–	1,5	–	V
Input current during picture content	I_{17}	–	8	–	μA
during synchronizing pulse	$-I_{17}$	–	100	–	μA
Y-signal attenuation $\frac{V_{11}}{V_{17}}$	α_Y	–	6,5	–	dB
Y-signal attenuation $\frac{V_{12}}{V_{17}}$	α_Y	–	6,5	–	dB
Output voltage (d.c.)	V_{11-18}	–	2,3	–	V
Output voltage (d.c.)	V_{12-18}	–	10,3	–	V
Output current (emitter follower with constant current source 0,6 mA)	$-I_{11,12}$	–	1,2	–	mA
Cut-off frequency (notes 1 and 3) $R_{14-18} = 1{,}2$ kΩ; $V_{15-18} = 12$ V; S1 open	$f_{11,12-17}$	–	5	–	MHz

CHARACTERISTICS (continued)

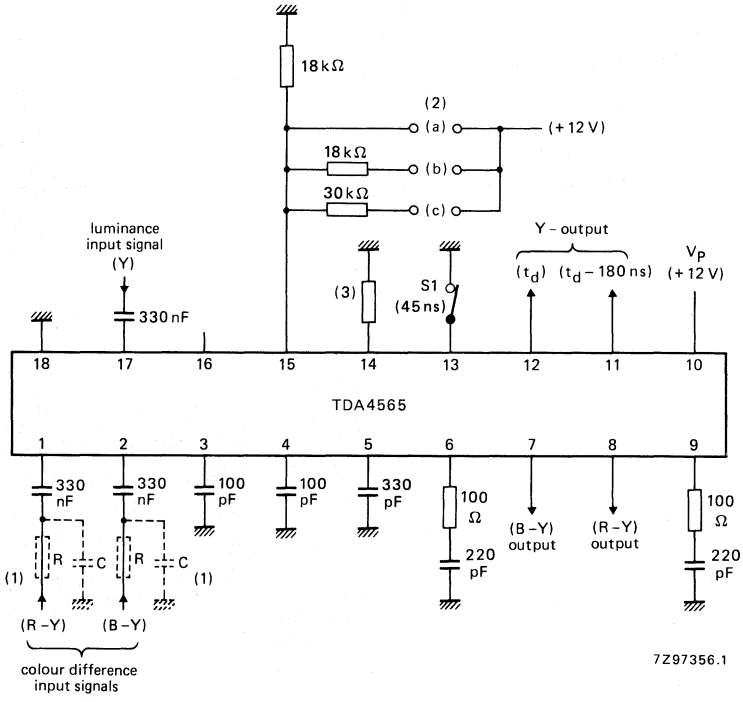
parameter	symbol	min.	typ.	max.	unit
Y-signal path (pin 17)					
Adjustable delay (notes 2 and 3) (S1 open)					
at $V_{15\text{-}18}$ = 0 to 2,5 V; $R_{14\text{-}18}$ = 1,2 kΩ	t_d	630	690	750	ns
at $V_{15\text{-}18}$ = 3,5 to 5,5 V; $R_{14\text{-}18}$ = 1,2 kΩ	t_d	720	780	840	ns
at $V_{15\text{-}18}$ = 6,5 to 8,5 V; $R_{14\text{-}18}$ = 1,2 kΩ	t_d	810	870	930	ns
at $V_{15\text{-}18}$ = 9,5 to 12 V; $R_{14\text{-}18}$ = 1,2 kΩ	t_d	900	960	1020	ns
Fine adjustment delay (S1 closed)					
at $V_{13\text{-}18}$ = 0 V	Δt_d	–	45	–	ns
Signal delay for velocity modulation (pin 11)	t		t_d –180 ns		
Thermal resistance					
From junction to ambient (in free air)	$R_{th\ j\text{-}a}$	–	–	70	K/W

DEVELOPMENT DATA

Notes to the characteristics

1. $R_{14\text{-}18}$ influences the bandwidth.
2. Delay time is proportional to resistor $R_{14\text{-}18}$.
3. Devices with suffix "A" require the value of resistor $R_{14\text{-}18}$ to be 1,1 kΩ, but the cut-off frequency and delay times remain as stated in these characteristics.

APPLICATION INFORMATION



(1) Residual carrier reduced to 20 mV peak-to-peak (R = 1 kΩ, C = 100 pF).
(2) Switching sequence for delay times shown in Table 1.
(3) $R_{14\text{-}18}$ = 1,2 kΩ for TDA4565
$R_{14\text{-}18}$ = 1,1 kΩ for TDA4565A.

Fig. 2 Application diagram and test circuit.

Table 1 Switching sequence for delay times.

connection			voltage at pin 15	delay time (ns)*
(a)	(b)	(c)		
O	O	O	0 to 2,5 V	690
O	O	X	3,5 to 5,5 V	780
O	X	X	6,5 to 8,5 V	870
X	X	X	9,5 to 12 V	960

Where: X = connection closed; O = connection open.

* When switch (S1) is closed the delay time is increased by 45 ns.

VIDEO CONTROL COMBINATION CIRCUIT

with automatic cut-off control

GENERAL DESCRIPTION

The TDA4580 is a monolithic integrated circuit which performs video control functions in television receivers with a colour difference interface. For example it operates in conjunction the multistandard colour decoder TDA4555. The required input signals are: luminance and negative colour difference −(R-Y) and −(B-Y), and a 3-level sandcastle pulse for control purposes. Analogue RGB signals can be inserted from two sources. One with full performance adjustment possibilities. RGB output signals are available for driving the video output stages. This circuit provides automatic cut-off control of the picture tube.

Features

- Capacitive coupling of the colour difference, luminance and RGB input signals with black level clamping
- Two sets of analogue RGB inputs via fast switch 1 and fast switch 2
- First RGB inputs and fast switch 1 in accordance with peritelevision connector specification
- Saturation, contrast and brightness control acting on first RGB inputs
- Brightness control acting on second RGB inputs
- Equal black levels for television and inserted signals
- Clamping, horizontal and vertical blanking, and timing of automatic cut-off, controlled by a 3-level sandcastle pulse
- Automatic cut-off control with compensation for leakage current of the picture tube
- Measuring pulses of cut-off control start immediately after end of vertical part of sandcastle pulse
- Three selectable blanking intervals for PAL, SECAM and NTSC/PAL-M
- Two switch-on delays for run-in without discolouration
- Adjustable peak drive limiter
- Average beam current limiter
- G-Y and RGB matrix coefficients selectable for PAL/SECAM and NTSC (correction for FCC primaries)
- Bandwidth 10 MHz (typ.)
- Emitter-follower outputs for driving the RGB output stages

QUICK REFERENCE DATA

Supply voltage (pin 6)	$V_P = V_{6-24}$	typ.	12 V
Supply current (pin 6)	$I_P = I_6$	typ.	110 mA
Luminance input (pin 15)			
Composite video input signal (VBS) (peak-to-peak value)	$V_{15-24(p-p)}$	typ.	0,45 V
Colour difference input signals (peak-to-peak values)			
−(B-Y)	$V_{18-24(p-p)}$	typ.	1,33 V
−(R-Y)	$V_{17-24(p-p)}$	typ.	1,05 V
Inserted RGB signals (black to white values)	$V_{14, 13, 12-24}$	typ.	0,7 V
Inserted RGB signals for teletext use (black to white values)	$V_{23, 22, 21-24}$	typ.	1 V
Three-level sandcastle pulse (required input voltage)	V_{10-24}	typ.	2,5/4,5/8,0 V

PACKAGE OUTLINE

28-lead DIL; plastic (SOT-117).

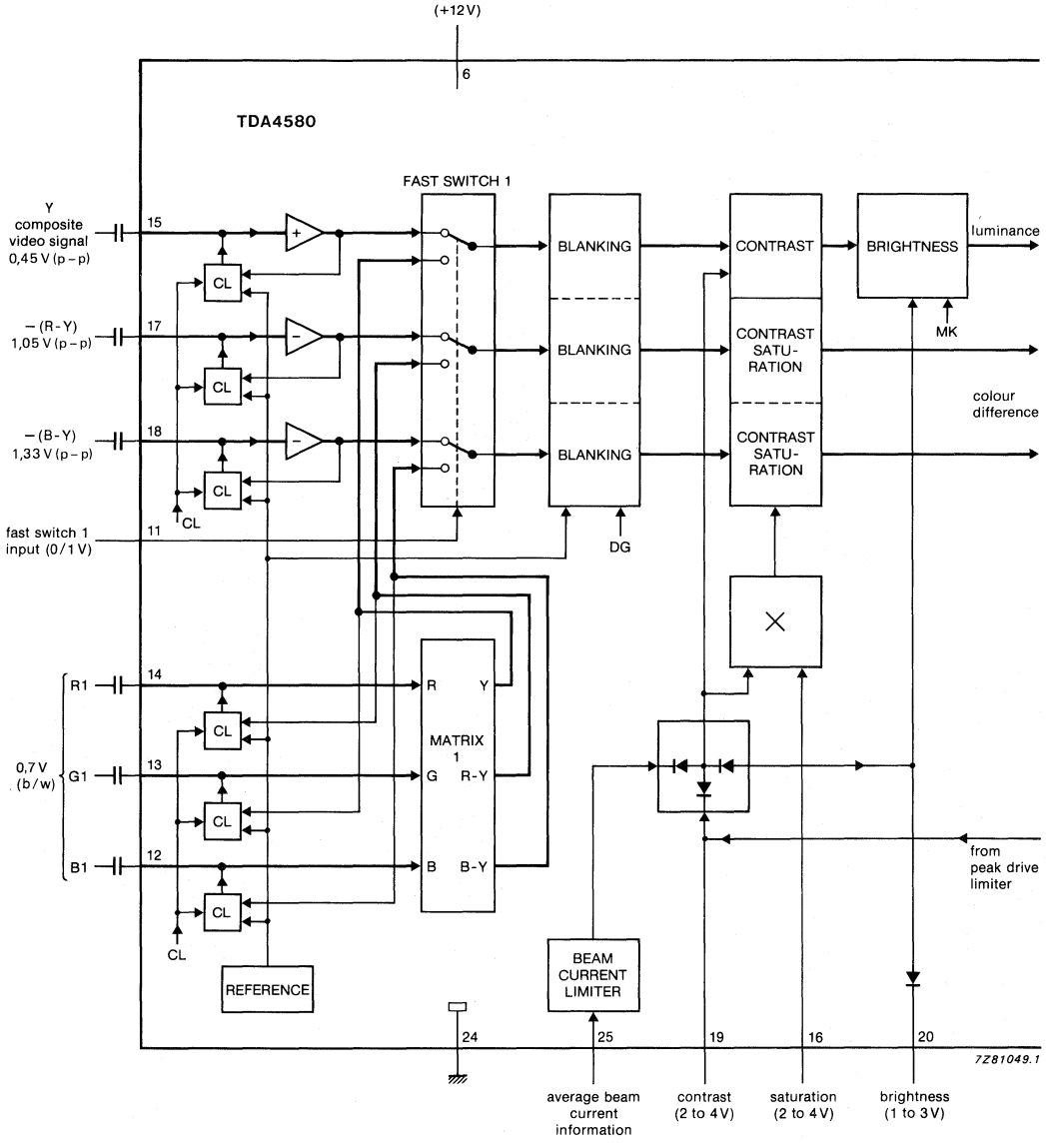


Fig. 1a Part of block diagram; continued in Fig. 1b.

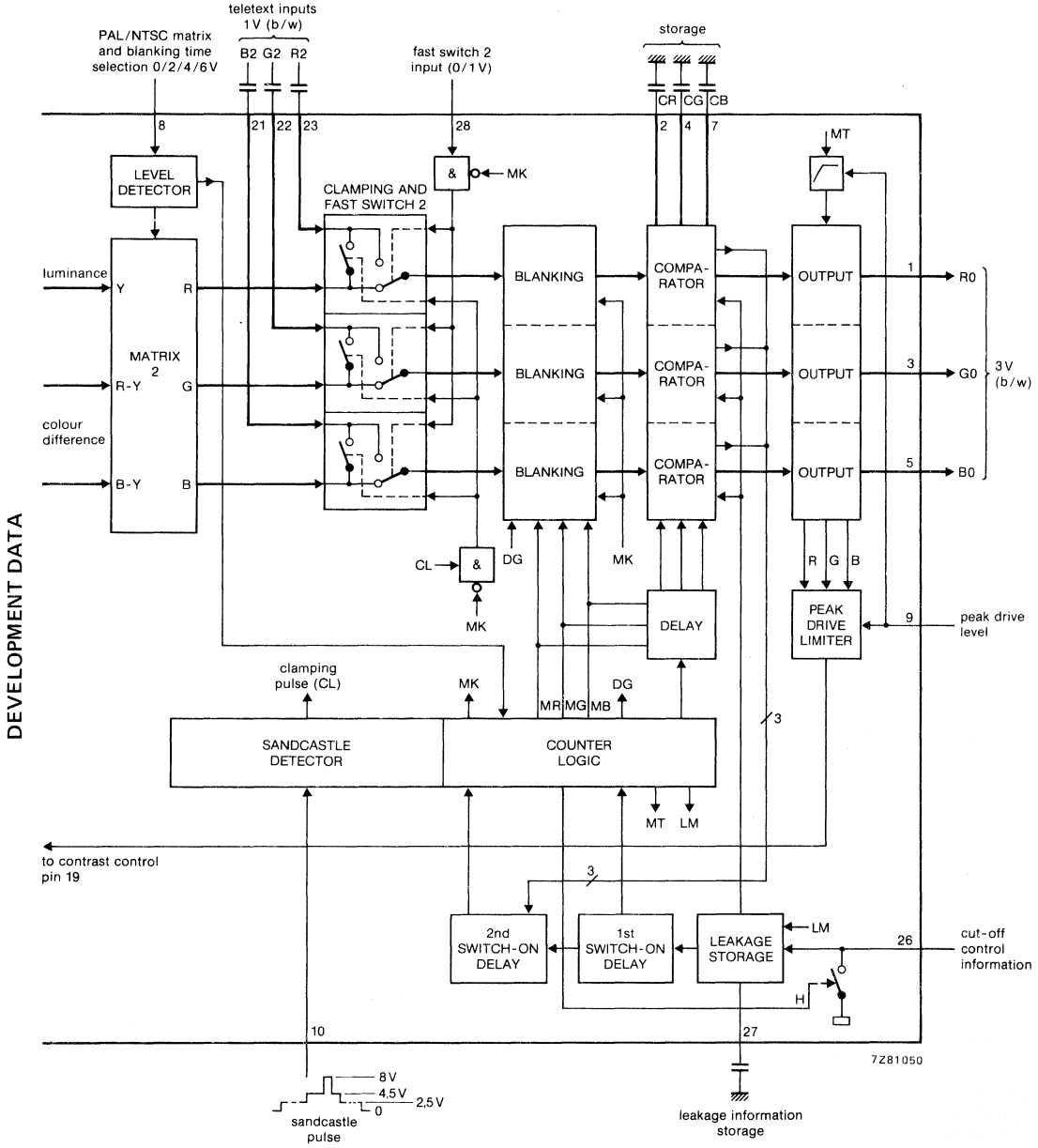


Fig. 1b Part of block diagram; continued from Fig. 1a.

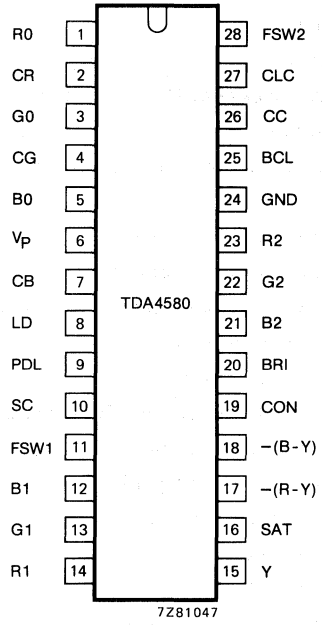


Fig. 2 Pinning diagram.

PINNING

pin no.	mnemonic	description
1	R0	Red output
2	CR	Red storage capacitor for cut-off control
3	G0	Green output
4	CG	Green storage capacitor for cut-off control
5	B0	Blue output
6	V_P	Positive supply voltage (+ 12 V)
7	CB	Blue storage capacitor for cut-off control
8	LD	PAL/NTSC matrix and blanking time level detector input
9	PDL	Peak drive limiting input
10	SC	Sandcastle pulse input
11	FSW1	Fast switch 1 for Y, CD and RGB inputs
12	B1	Blue input (external signal)
13	G1	Green input (external signal)
14	R1	Red input (external signal)
15	Y	Luminance input
16	SAT	Saturation control input
17	−(R-Y)	Colour difference input −(R-Y)
18	−(B-Y)	Colour difference input −(B-Y)
19	CON	Contrast control input
20	BRI	Brightness control input
21	B2	Teletext blue input
22	G2	Teletext green input
23	R2	Teletext red input
24	GND	Ground
25	BCL	Average beam current limiting input
26	CC	Automatic cut-off control input
27	CLC	Storage capacitor for leakage current
28	FSW2	Fast switch 2 for teletext inputs

DEVELOPMENT DATA

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage range (pin 6)	$V_P = V_{6-24}$		0 to 13,2	V
Voltage range at pins 2, 4, 7, 9, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 27 to pin 24 (ground)	V_{n-24}		0 to V_P	V
Voltages ranges				
at pins 8, 11, 28	$V_{8, 11, 28-24}$		−0,5 to V_P	V
at pin 10	V_{10-24}		0 to V_P + 0,7	V
at pin 26	V_{26-24}		−0,7 to V_P + 0,7	V
Currents				
at pins 1, 3, 5 (average)	$-I_{1, 3, 5(AV)}$	max.	3	mA
at pins 1, 3, 5 (peak)	$-I_{1, 3, 5(M)}$	max.	10	mA
at pin 19 (average)	$I_{19(AV)}$	max.	5	mA
at pin 26	I_{26}	max.	1	mA
Total power dissipation	P_{tot}	max.	2	W
Storage temperature range	T_{stg}		−20 to + 150	°C
Operating ambient temperature range	T_{amb}		0 to + 70	°C

THERMAL RESISTANCE

From junction to ambient	$R_{th\ j-a}$	=	37	K/W

CHARACTERISTICS

V_P = 12 V; T_{amb} = 25 °C; measured in a circuit similar to Fig. 4 at nominal settings (saturation, contrast, brightness), no beam current or peak drive limiting; all voltages with respect to pin 24 (ground) unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
Supply (pin 6)					
Supply voltage range	$V_P - V_{6-24}$	10,8	–	13,2	V
Supply current	$I_P = I_6$	–	110	–	mA
Colour difference inputs (pins 17 and 18)					
–(R-Y) input signal at pin 17 (notes 1 and 2) (peak-to-peak value)	$V_{17-24(p-p)}$	–	1,05	–	V
–(B-Y) input signal at pin 18 (notes 1 and 2) (peak-to-peak value)	$V_{18-24(p-p)}$	–	1,33	–	V
Input current during scanning	$\|I_{17,\ 18}\|$	–	–	0,3	μA
Input resistance	$R_{17,\ 18}$	5	–	–	MΩ
Internal d.c. bias voltage during clamping time	$V_{17,\ 18-24}$	–	7,5	–	V
Luminance input (pin 15; note 2)					
Composite video input signal (VBS) (peak-to-peak value)	$V_{15-24(p-p)}$	–	0,45	–	V
Input current during scanning	$\|I_{15}\|$	–	–	0,3	μA
Input resistance	R_{15}	5	–	–	MΩ
Internal d.c. bias voltage during clamping time	V_{15-24}	–	7,4	–	V
Signal switch 1 input (pin 11)					
Input voltage level for insertion of Y and CD signals	V_{11-24}	–	–	0,4	V
RGB1 signals	V_{11-24}	0,9	–	3,0	V
Internal resistor to ground	R_{11}	–	10	–	kΩ
RGB1 inputs (R1 pin 14, G1 pin 13, B1 pin 12; note 2) (signals controlled by saturation, contrast and brightness)					
Input signal (black to white value)	$V_{12,\ 13,\ 14-24}$	–	0,7	–	V
Input current during scanning	$\|I_{12,\ 13,\ 14}\|$	–	–	0,3	μA
Input resistance	$R_{12,\ 13,\ 14}$	5	–	–	MΩ
Internal d.c. bias voltage during clamping time	$V_{12,\ 13,\ 14-24}$	–	8,2	–	V

DEVELOPMENT DATA

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
RGB/Y, (R-Y), (B-Y) – Matrix					
Matrixed according to the equations $V_{(R-Y)} = 0{,}7\ V_R - 0{,}59\ V_G - 0{,}11\ V_B$ $V_{(B-Y)} = -0{,}3\ V_R - 0{,}59\ V_G + 0{,}89\ V_B$ $V_{(Y)} = 0{,}3\ V_R + 0{,}59\ V_G + 0{,}11\ V_B$					
Contrast control input (pin 19; note 3) (contrast control acts on Y and CD signals or RGB1 signals respectively)					
Maximum contrast	V_{19-24}	–	4	–	V
Nominal contrast (6 dB below max.)	V_{19-24}	–	3	–	V
Attenuation of contrast at V_{19-24} = 2 V (related to max.)		–	22	–	dB
Input current at V_{19-24} = 2 to 4 V	$-I_{19}$	–	–	3	μA
Peak drive limiting input (pin 9; note 4)					
Internal d.c. bias voltage	V_{9-24}	–	9	–	V
Input resistance at $V_{9-24} > 9$ V	R_9	–	10	–	kΩ
Control current into contrast input (pin 19) during peak drive $V_{1,\ 2\ or\ 3-24} > V_{9-24}$	I_{19}	–	20	–	mA
Average beam current limiting input (pin 25; note 5)					
Start of contrast reduction at maximum contrast setting	V_{25-24}	–	8,5	–	V
Input range for full contrast reduction	ΔV_{25-24}	–	1,0	–	V
Input resistance at $V_{25-24} < 6$ V	R_{25}	–	2,2	–	kΩ
Saturation control input (pin 16) (saturation control acts on CD signals or RGB1 signals respectively)					
Maximum saturation	V_{16-24}	–	4	–	V
Nominal saturation (6 dB below max.)	V_{16-24}	–	3	–	V
Attenuation of saturation at V_{16-24} = 1,8 V (related to max. at 100 kHz)		50	–	–	dB
Input current at V_{16-24} = 1,8 to 4 V	I_{16}	–	–	10	μA

parameter	symbol	min.	typ.	max.	unit
Brightness control input (pin 20; note 6 and 7)					
Control voltage range	$V_{20\text{-}24}$	1	–	3	V
Input current at $V_{20\text{-}24}$ = 1 to 3 V	$-I_{20}$	–	–	10	μA
Control voltage for nominal brightness	$V_{20\text{-}24}$	–	2,2	–	V
Change of black level in the control range related to the nominal output signal (black/white) for $\Delta V_{20\text{-}24}$ = 1 V		–	33	–	%
Signal switched off and black level equal to cut-off measuring level at	$V_{20\text{-}24}$	11,5	–	–	V
Y, (R-Y), (B-Y)/RGB – Matrix (note 8)					
PAL matrix ($V_{8\text{-}24} = < 4{,}5$ V)					
Matrixed according to the equation $V_{(G\text{-}Y)} = -0{,}51\ V_{(R\text{-}Y)} - 0{,}19\ V_{(B\text{-}Y)}$					
NTSC matrix ($V_{8\text{-}24} = > 5{,}5$ V)					
(Adaption for NTSC-FCC primaries, nominal hue control set on -5^{o})					
Matrixed according to the equation $V_{(G\text{-}Y)}{}^{*} = -0{,}43\ V_{(R\text{-}Y)} - 0{,}11\ V_{(B\text{-}Y)}$					
$V_{(R\text{-}Y)}{}^{*} = 1{,}57\ V_{(R\text{-}Y)} - 0{,}41\ V_{(B\text{-}Y)}$					
$V_{(B\text{-}Y)}{}^{*} = V_{(B\text{-}Y)}$					
RGB2 inputs (Teletext) (R2 pin 23, G2 pin 22, B2 pin 21; note 2)					
(RGB signals controlled by brightness control)					
Input signal for 100% output signals (black to white value)	$V_{21,\ 22,\ 23\text{-}24}$	–	1	–	V
Input current during scanning	$I_{21,\ 22,\ 23}$	–	–	0,3	μA
Input resistance	$R_{21,\ 22,\ 23}$	5	–	–	MΩ
Signal switch 2 input (pin 28)					
Input voltage level for insertion of Y, CD signals or RGB1 signals respectively RGB signals from matrix (note 9)	$V_{28\text{-}24}$	–	–	0,4	V
RGB2 signals (note 9)	$V_{28\text{-}24}$	0,9	–	3,0	V
Internal resistor to ground	$R_{28\text{-}24}$	–	10	–	kΩ

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Automatic cut-off control input (pin 26; note 10) (leakage current measuring time and insertion of RGB cut-off measuring lines see Fig. 5; types of ultra-black level see Fig. 3)					
Allowed maximum external D.C. bias voltage	$V_{26\text{-}24}$	5,5	–	–	V
Voltage difference between cut-off current measurement and leakage current measurement	$\Delta V_{26\text{-}24}$	–	0,5	–	V
Warm-up test pulse	$V_{1,\ 3,\ 5\text{-}24}$	–	$V_{9\text{-}24}$*	–	V
Threshold for warm-up detector	$V_{26\text{-}24}$	–	8	–	V
Storage input for leakage current (pin 27)					
Internal resistance during leakage current measuring time (current limiting at I_{27} = 0,2 mA)	R_{27}	–	400	–	Ω
Input current except during cut-off control cycle	$\|I_{27}\|$	–	–	0,5	μA
Storage inputs for automatic cut-off control (pins 2, 4, 7)					
Charge and discharge currents	$\|I_{2,\ 4,\ 7}\|$	–	0,3	–	mA
Input currents of storage inputs out of control time	$\|I_{2,\ 4,\ 7}\|$	–	–	0,1	μA
Switch input for PAL/NTSC matrix and vertical blanking time (pin 8; note 11)					
Switching voltage input for					
PAL matrix and vertical blanking period of					
25 lines	$V_{8\text{-}24}$	–	0	0,5	V
22 lines	$V_{8\text{-}24}$	1,5	2	2,5	V
18 lines	$V_{8\text{-}24}$	3,5	4	4,5	V
NTSC matrix and vertical blanking period of					
18 lines	$V_{8\text{-}24}$	5,5	6	12	V
Input current	I_8	–	–	50	μA

* Maximum 8 V.

parameter	symbol	min.	typ.	max.	unit
Sandcastle pulse detector (pin 10; note 12)					
The following amplitudes are required for separating the various pulses:					
horizontal and vertical blanking pulses	V_{10-24}	2,0	2,5	3,0	V
horizontal pulses for counter logic	V_{10-24}	4,0	4,5	5,0	V
clamping pulses	V_{10-24}	7,5	–	–	V
delay of leading edge of clamping pulse	t_d	–	1	–	µs
Input current at V_{10-24} = 0 V	$-I_{10}$	–	–	100	µA
Outputs for positive RGB signals (R0 pin 1, G0 pin 3, B0 pin 5; note 13)					
Nominal signal amplitude (black/white)	$V_{1, 3, 5-24}$	–	3	–	V
Spreads between channels		–	–	10	%
Maximum signal amplitude (black/white)	$V_{1, 3, 5-24}$	4	–	–	V
Internal current source	$I_{1, 3, 5}$	–	3	–	mA
Output resistance	$R_{1, 3, 5}$	–	160	220	Ω
Minimum output voltage	$V_{1, 3, 5-24}$	–	1	–	V
Maximum output voltage	$V_{1, 3, 5-24}$	–	10	–	V
Horizontal and vertical blanking to ultra-black level 2 related to nominal signal black level in percentage of nominal signal amplitude		45	55	–	%
Vertical blanking to ultra-black level 1 related to cut-off measuring level in percentage of nominal signal amplitude		25	35	–	%
Recommendation:					
Range for cut-off measuring level 1,5 to 5,0 V; nominal value at 3 V (note 14)					
Gain data (note 15)					
Frequency response of Y path (0 to 8 MHz) pins 1, 3 and 5 to pin 15	d	–	–	3	dB
Frequency response of CD path (0 to 8 MHz) pin 1 to pin 17 = pin 5 to pin 18	d	–	–	3	dB
Frequency response of RGB1 path (0 to 8 MHz) pin 1 to pin 14 = pin 3 to pin 13 = pin 5 to pin 12	d	–	–	3	dB
Frequency response of RGB2 path (0 to 10 MHz) pin 1 to pin 23 = pin 3 to pin 22 = pin 5 to pin 21	d	–	–	3	dB

DEVELOPMENT DATA

Notes to the characteristics

1. The value of the colour difference input signals, $-(B\text{-}Y)$ and $-(R\text{-}Y)$, is given for saturated colour bar with 75% of maximum amplitude.
2. Capacitive coupled to a low ohmic source; recommended value 600 Ω (max.).
3. At pin 19 for $V_{19\text{-}24} \leqslant 2{,}0$ V, no further decrease of contrast is possible.
4. The peak drive limiting of output signals is achieved by contrast reduction. The limiting level of the output signals is equal to the voltage $V_{9\text{-}24}$, adjustable in the range 5 to 11 V. After exceeding the adjusted limiting level at peak drive limiter will not be active during the first line.
5. The average beam current limiting acts on contrast and at minimum contrast on brightness (the external contrast voltage at pin 19 is not affected).
6. At nominal brightness the black level at the output is 0,3 V ($\triangleq -10\%$ of nominal signal amplitude) below the measuring level.
7. The internal control voltage can never be more positive than 0,7 V above the internal contrast voltage.
8. Matrix equation

   $V_{(R\text{-}Y)}$, $V_{(B\text{-}Y)}$: output of NTSC decoder of PAL type demodulating axis and amplitudes

   $V_{(G\text{-}Y)}{}^*$, $V_{(R\text{-}Y)}{}^*$, $V_{(B\text{-}Y)}{}^*$: for NTSC modified CD signals; equivalent to demodulation with the following axes and amplification factors:–

(B-Y)* demodulator axis	0°	
(R-Y)* demodulator axis	115°	(PAL 90°)
(R-Y)* amplification factor	1,97	(PAL 1,14)
(B-Y)* amplification factor	2,03	(PAL 2,03)

   $V_{(G\text{-}Y)}{}^* = -0{,}27\ V_{(R\text{-}Y)}{}^* - 0{,}22\ V_{(B\text{-}Y)}{}^*$.
9. During clamping time, in each channel the black level of the inserted signal is clamped on the black level of the internal signal behind the matrix (dependent on brightness control).
10. During warm-up time of the picture tube, the RGB outputs (pins 1, 3 and 5) are blanked to minimum output voltage. An inserted white pulse during the vertical flyback is used for beam current detection. If the beam current exceeds the threshold of the warm-up detector at pin 26, the cut-off current control starts operating, but the video signal is still blanked. After run-in of the cut-off current control loop, the video signal will be released.
    The first measuring pulse occurs in the first complete line after the end of the vertical part of the sandcastle pulse. The absolute minimum vertical part must contain 9 line-pulses. The cycle time of the counter is 63 lines. When the vertical pulse is longer than 61 lines, the IC is reset to the switch-on condition. In this event the video signal is blanked and the RGB-outputs are blanked to minimum output voltage as during warm-up time.
    During leakage current measurement, all three channels are blanked to ultra-black level 1. With the measuring level only in the controlled channel, the other two channels are blanked to ultra-black level 1.
    The brightness control shifts both the signal black level and the ultra-black level 2. The brightness control is disabled from line 4 to the end of the last measuring line (see Fig. 3).
    With the most adverse conditions (maximum brightness and minimum black level 2) the blanking level is located 30% of nominal signal amplitude below the cut-off measuring level.

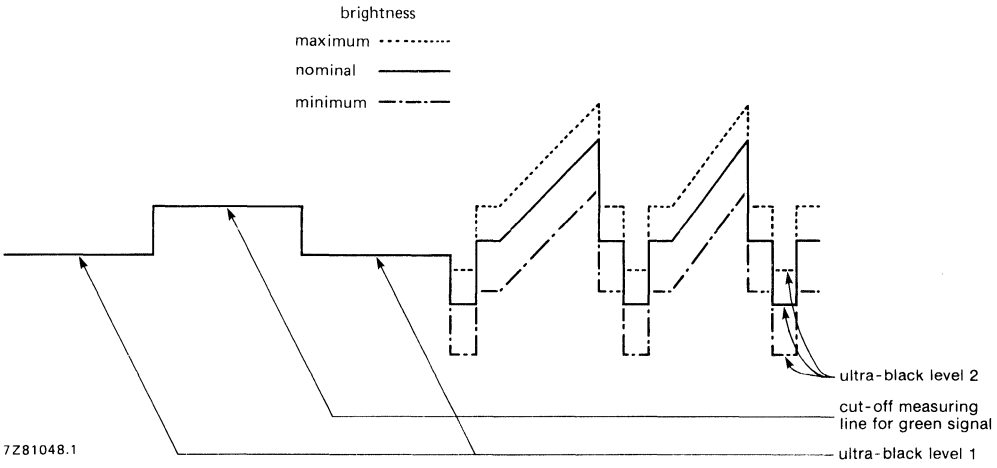
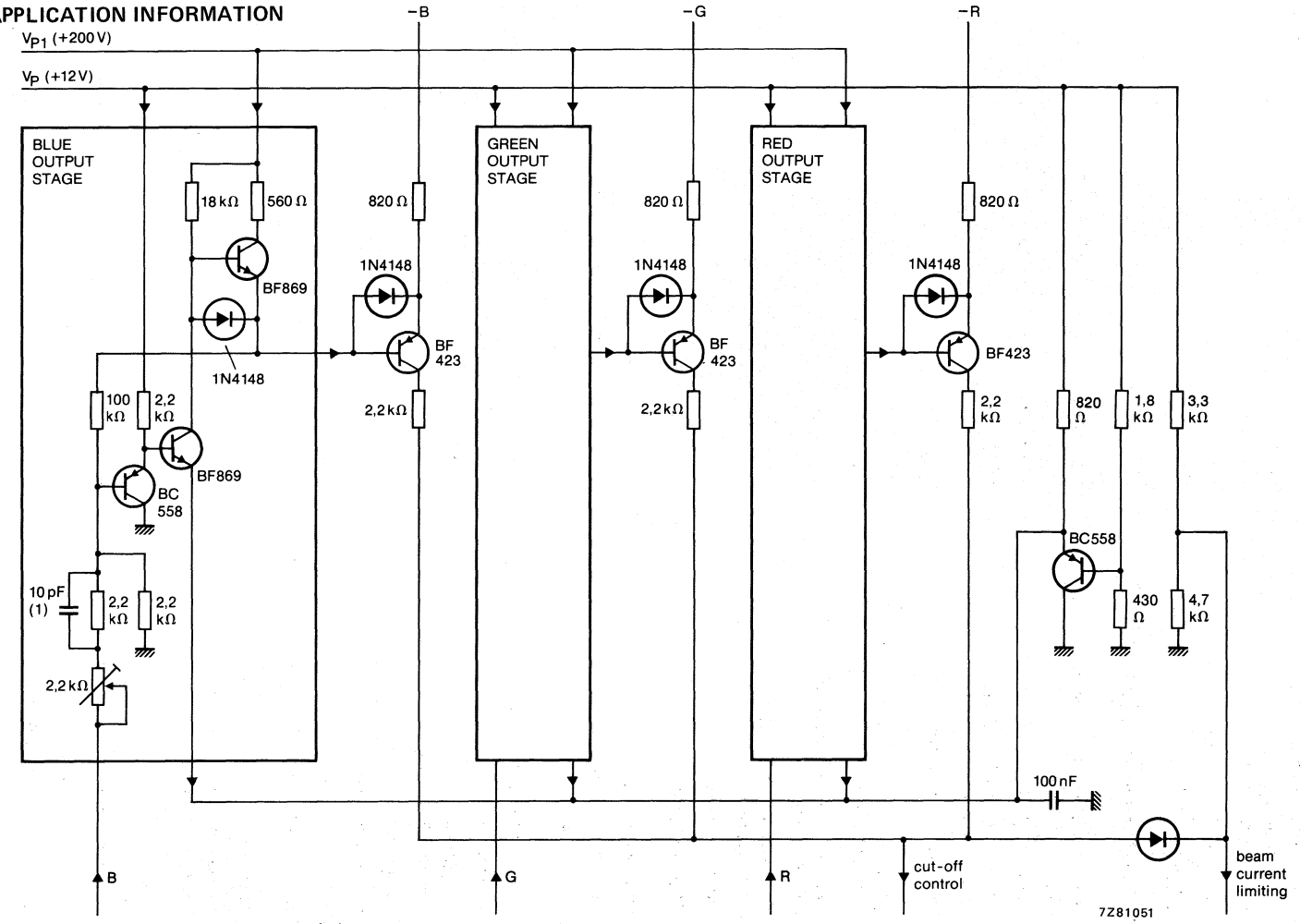


Fig. 3 Types of ultra-black levels.

DEVELOPMENT DATA

11. The given blanking times are valid for the vertical part of the sandcastle pulse of 9 to 15 lines. If the vertical part is longer and the cut-off lines are outside the vertical blanking period of 18, 22 or 25 lines respectively, the blanking of the signal ends with the end of last of the three cut-off measuring pulses as shown in Fig. 5.
12. The sandcastle pulse is compared with three internal thresholds (proportional to Vp) to separate the various pulses. The internal pulses are generated when the input pulse at pin 10 exceeds the thresholds. The thresholds are for:
    - Horizontal and vertical blanking $V_{10\text{-}24} = 1{,}5$ V
    - Horizontal pulse $V_{10\text{-}24} = 3{,}5$ V
    - Clamping pulse $V_{10\text{-}24} = 7{,}0$ V
13. The outputs at pins 1, 3 and 5 are emitter followers with current sources and emitter protection resistors.
14. The value of the cut-off control range for the positive RGB output signals is given for a nominal output signal. If the signal amplitude is reduced, the cut-off range can be increased.
15. The gain data is given for a nominal setting of the contrast and saturation controls, measured without load at the RGB outputs (pins 1, 3 and 5).

APPLICATION INFORMATION



(1) Capacitor value depends on circuit layout.

Fig. 4a Part of typical application circuit diagram using the TDA4580; continued in Fig. 4b.

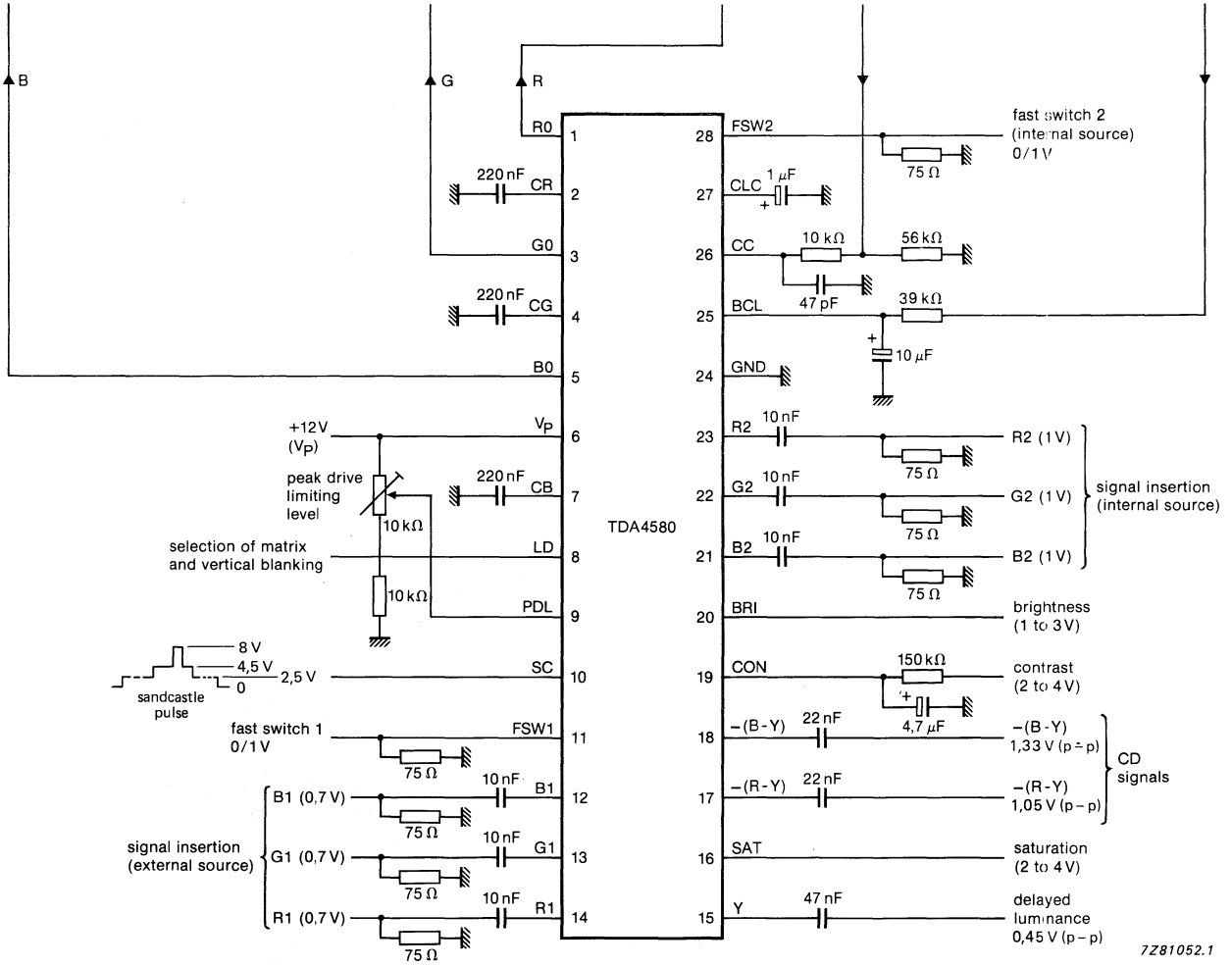
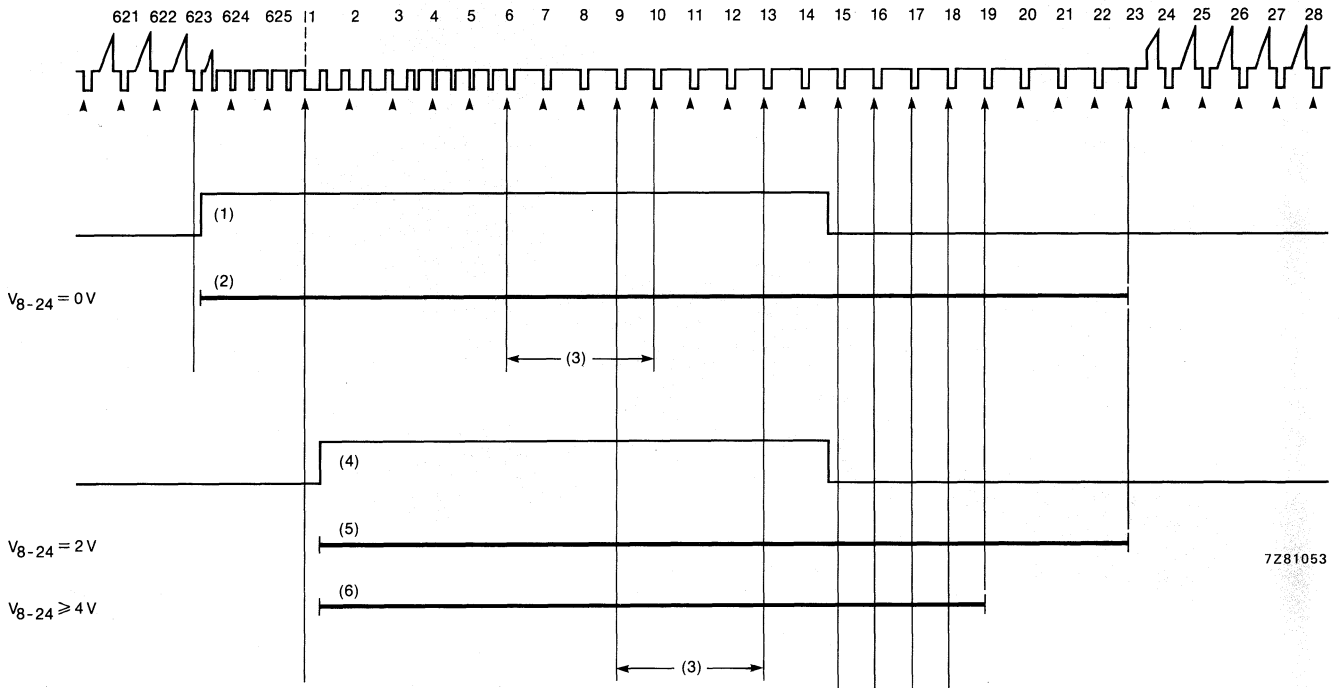


Fig. 4b Part of typical application circuit diagram using the TDA4580; continued from Fig. 4a.

APPLICATION INFORMATION (continued)



(1) vertical part of sandcastle pulse starts with equalizing pulses and ends with flyback.
(2) blanking period of 25 complete lines.
(3) leakage measuring period (LM).
(4) vertical part of sandcastle pulse starts and ends with flyback.
(5) blanking period of 22 complete lines.
(6) blanking period of 18 complete lines.
(7) cut-off measuring line for red signal (MR).
(8) cut-off measuring line for green signal (MG).
(9) cut-off measuring line for blue signal (MB).

Fig. 5 Blanking and measuring lines.

V.H.F. MIXER/OSCILLATOR CIRCUIT

GENERAL DESCRIPTION

The TDA5030 performs the v.h.f. mixer, v.h.f. oscillator; SAW filter i.f. amplifier and u.h.f. i.f. amplifier functions in television tuners.

Functions:

- A balanced v.h.f. mixer
- An amplitude-controlled v.h.f. local oscillator
- A surface accoustic wave filter i.f. amplifier
- A u.h.f. i.f. preamplifier
- A buffer stage for driving an external prescaler with the local oscillator signal
- A voltage stabilizer
- A u.h.f./v.h.f. switching circuit

QUICK REFERENCE DATA

Supply voltage (pin 15)	V_P	10	to	13,2	V
Supply current	I_P	typ.		42	mA
Frequency range v.h.f. mixer	f	50	to	470	MHz
Storage temperature	T_{stg}	−55	to	+125	°C
Operating ambient temperature	T_{amb}	−25	to	+85	°C

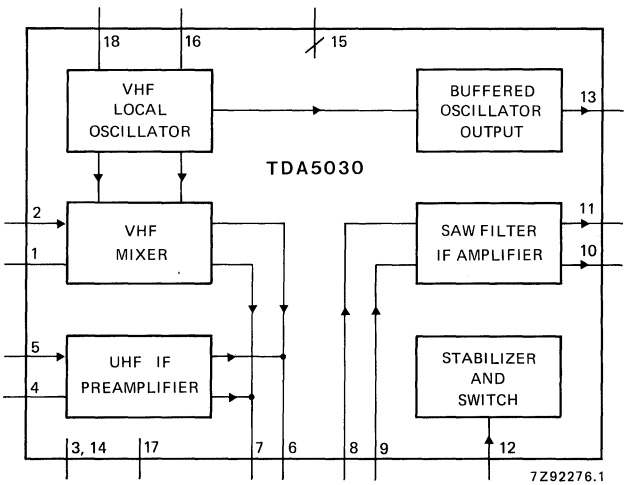


Fig. 1 Block diagram.

PACKAGE OUTLINE

18-lead DIL, plastic (SOT-102HE).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 15)	V_P	max.	14	V
Input voltage (pins 1, 2, 4 and 5)	V_i		0 to 5	V
Switching voltage (pin 12)	V_{12}		0 to 14	V
Output currents	$-I_{10,11,13}$	max.	10	mA
Short-circuit time on outputs (pins 10 and 11)	t_{ss}	max.	10	s
Storage temperature	T_{stg}		−55 to +125	°C
Operating ambient temperature	T_{amb}		−25 to +85	°C
Junction temperature	T_j	max.	+125	°C

THERMAL RESISTANCE

From junction to ambient	$R_{th\ j\text{-}a}$	55	K/W

CHARACTERISTICS

Measured in circuit of Fig. 2; V_P = 12 V; T_{amb} = 25 °C; unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
Supply					
Supply voltage	$V_{15\text{-}3}$	10	–	13,2	V
Supply current	I_{15}	–	42	55	mA
Switching voltage v.h.f.	V_{12}	0	–	2,5	V
Switching voltage u.h.f.	V_{12}	9,5	–	0 to 14	V
Switching current u.h.f.	I_{12}	–	–	0,7	mA
V.H.F. mixer (including i.f. amplifier)					
Frequency range	f	50	–	470	MHz
Noise figure (pin 2)					
50 MHz	F	–	7,5	9	dB
225 MHz	F	–	9	10	dB
300 MHz	F	–	10	12	dB
Optimum source admittance					
50 MHz	S_c	–	0,5	–	mS
225 MHz	S_c	–	1,1	–	mS
300 MHz	S_c	–	1,2	–	mS
Input conductance					
50 MHz	G_2	–	0,23	–	mS
225 MHz	G_2	–	0,5	–	mS
300 MHz	G_2	–	0,67	–	mS
Input capacitance					
50 MHz	C_i	–	3	–	pF
Input voltage for 1% cross-modulation (in channel); $R_p > 1$ kΩ; tuned circuit with C_p = 22 pF; f_{res} = 36 MHz	$V_{2\text{-}3}$	97	99	–	dBμV

parameter	symbol	min.	typ.	max.	unit
Input voltage for 10 kHz pulling (in channel) at < 300 MHz	$V_{2\text{-}14}$	100	–	–	dBμV
Voltage gain	A_v	22,5	24,5	26,5	dB
U.H.F. preamplifier (including i.f. amplifier)					
Input conductance	G_5	–	0,3	–	mS
Input capacitance	C_5	–	2,2	–	pF
Noise figure	F	–	5	6	dB
Input voltage for 1% cross-modulation (in channel)	$V_{5\text{-}14}$	88	90	–	dBμV
Voltage gain	A_v	31,5	33,5	35,5	dB
Optimum source admittance	G_5	–	3,3	–	mS
V.H.F. mixer					
Conversion transadmittance	$Sc_{2\text{-}6,7}$	–	5,7	–	mS
Output impedance	Z_o	–	1,6	–	kΩ
V.H.F. oscillator					
Frequency range	f	70	–	520	MHz
Frequency shift ΔV_P = 10%; 70 to 330 MHz	Δf	–	–	200	kHz
Frequency drift ΔT = 15 K; 70 to 330 MHz	Δf	–	–	250	kHz
Frequency drift from 5 s to 15 min after switching on	Δf	–	–	200	kHz
SAW filter i.f. amplifier					
Input impedance $Z_{10,11}$ = 2 kΩ, f = 36 MHz	$Z_{8,9}$	–	340+j120	–	Ω
Transimpedance	$Z_{8,9\text{-}10,11}$	–	2,9	–	kΩ
Output impedance $Z_{8,9}$ = 1,6 kΩ; f = 36 MHz	$Z_{10,11}$	–	50+j40	–	Ω
V.H.F. local oscillator buffer stage					
Output voltage R_L = 75 Ω; f < 100 MHz	V_{13}	14	20	–	mV
R_L = 75 Ω; f > 100 MHz	V_{13}	10	20	–	mV
Output impedance f = 100 MHz	Z_{13}	–	130	–	Ω
RF signal on LO output	$RF/_{RF+LO}$	–	–	–17	dB

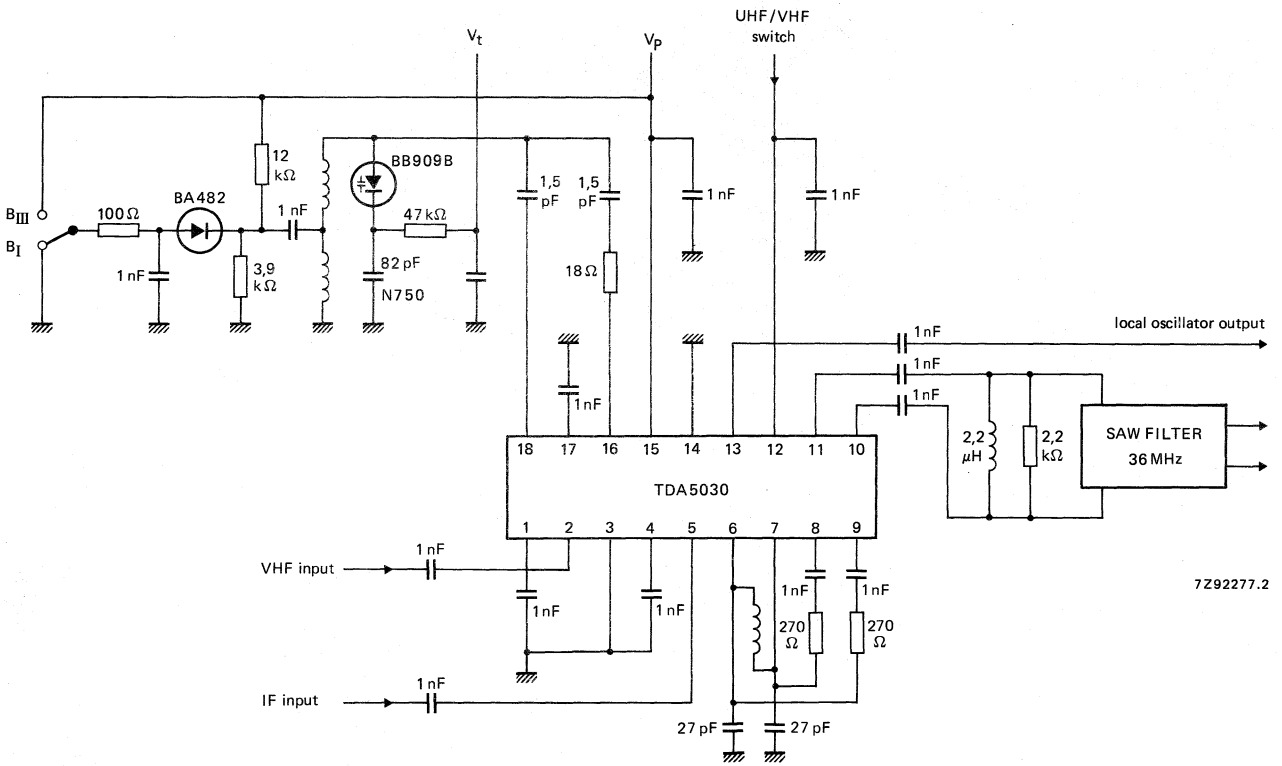


Fig. 2 Test circuit.

VIDEO MODULATOR CIRCUIT

GENERAL DESCRIPTION

The TDA6800 is a modulator circuit for modulation of video signals on a VHF/UHF carrier. The circuit requires a 5 V power supply and few external components for the negative modulation mode. For positive modulation an external clamp circuit is required. This circuit can be used as a general purpose modulator without additional external components.

Features

- Balanced modulator
- Symmetrical oscillator
- Video clamp circuit for negative modulation
- Frequency range 50 to 800 MHz

QUICK REFERENCE DATA

		min.	typ.	max.	
Supply voltage range	V_{5-4}	4,5	–	5,5	V
Supply current consumption	I_5	–	9	–	mA
Video input voltage	$V_{8(p-p)}$	–	1	–	V
Input impedance	R_8	30	–	–	kΩ
Output voltage (50 MHz)	V_{6-7}	–	13	–	mV
Output voltage (600 MHz)	V_{6-7}	–	10	–	mV
Differential gain	Δ_G	–	–	10	%
Differential phase	Δ_ϕ	–	–	10	deg.
Intermodulation distortion	d_{int}	–	–80	–	dB

PACKAGE OUTLINE

TDA6800 : 8-lead dual in-line; plastic (SOT-97A).
TDA6800T: 8-lead mini-pack; plastic (SO-8; SOT-96A).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage	V_{5-4}	max.	7 V
Input voltage	V_{8-4}	max.	4 V
Output voltage	$V_{6,7-4}$	max.	9 V
Storage temperature	T_{stg}	max.	125 °C
Junction temperature	T_j	max.	125 °C
Operating ambient temperature range	T_{amb}	−25 to + 85	°C

THERMAL RESISTANCE

From junction to ambient in free air

TDA6800T	$R_{th\ j\text{-}a}$	260 K/W
TDA6800	$R_{th\ j\text{-}a}$	120 K/W

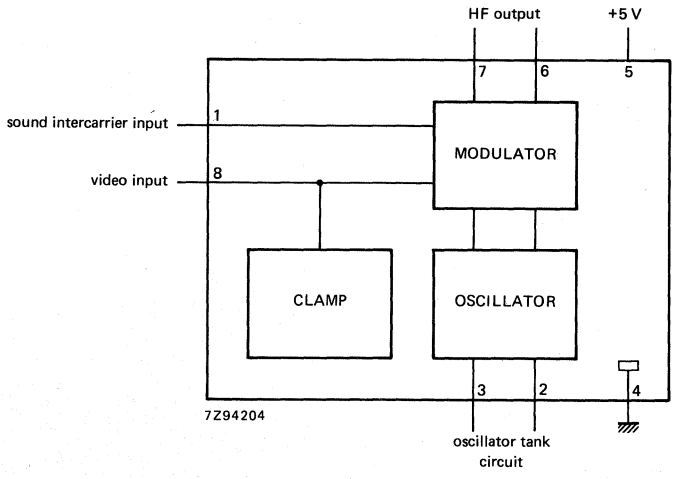


Fig. 1 Block diagram TDA6800 and TDA6800T.

DEVELOPMENT DATA

CHARACTERISTICS

V_P = 5 V; T_{amb} = 25 °C; measured in Fig. 1; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply voltage range	V_{5-4}	4,5	–	5,5	V
Supply current consumption	I_5	–	9	13	mA
Video input voltage	$V_{8(p-p)}$	–	1	–	V
Input impedance	R_8	30	–	–	kΩ
Voltage (d.c.) at video input (clamp voltage)	V_8	–	1,4	–	V
Voltage (d.c.) at sound input	V_1	–	2,5	–	V
Output voltage f = 50 MHz; R_L = 75 Ω	V_{6-7}	–	13	–	mV
Output voltage f = 600 MHz; R_L = 75 Ω	V_{6-7}	–	10	–	mV
Differential gain	Δ_G	–	–	10	%
Differential phase	Δ_ϕ	–	–	10	deg.
Intermodulation (1,1 MHz) (note 1)		–	−80	−60	dB
Frequency shift V_b = 5%, f = 600 MHz	Δ_f	–	–	100	kHz
Frequency shift V_b = 5%, f = 800 MHz	Δ_f	–	tbf	–	kHz
Frequency drift 25 to 40 °C	Δ_f	–	–	100	kHz
Frequency drift 15 to 55 °C	Δ_f	–	–	300	kHz
Positive modulation (see Fig. 3)					
Residual carrier voltage	V_r	–	–	2,5	%
Cross modulation (note 2)	α	–	0,1	0,25	%

NOTES TO THE CHARACTERISTICS

1. Input signal: d.c. 0,45 V (V_{8-4} = 1,85 V)
   4,4 MHz; input voltage (p-p) = 0,6 V
   5,5 MHz; input voltage (p-p) = 1,26 V
   measured with respect to picture carrier, at f = 600 MHz.
2. Input signal: d.c. 1 V (V_{8-4} = 3,5 V)
   5,5 MHz AM modulated, f_m = 100 kHz
   m = 0,8; input voltage (p-p) = 2,27 V (including modulation)
   measured with respect to the picture carrier, at f = 600 MHz.

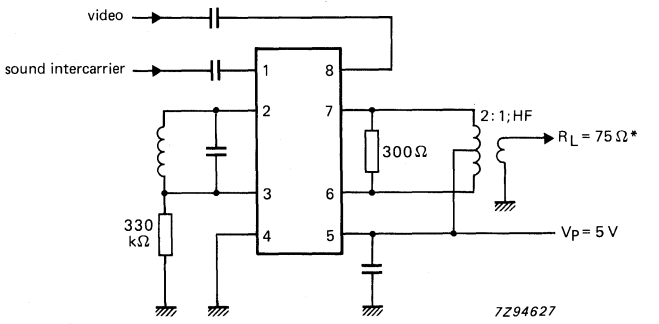


Fig. 2.
Application for negative modulation.

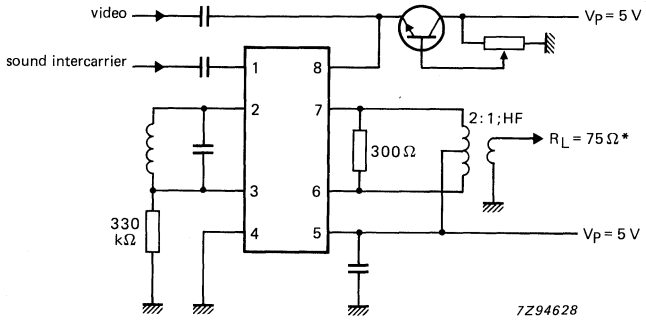


Fig. 3.
Application for positive modulation.

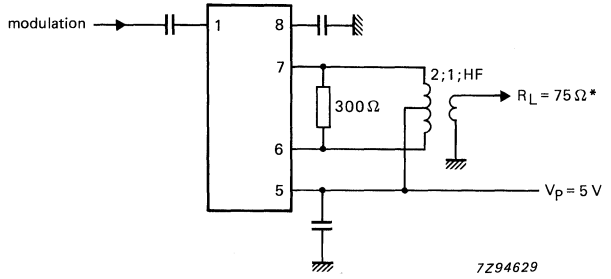


Fig. 4.
Application for general purpose modulation.

* Close to output transformer.

COMPUTER INTERFACED PRESCALER-SYNTHESIZER

GENERAL DESCRIPTION

The TDA8400 provides closed-loop digital tuning of TV receivers, with or without a.f.c., as required. It comprises a 1,1 GHz prescaler, with the divide-by-64 ratio, which drives a tuning interface providing a tuning voltage of 33 V (max.) via an external output transistor. The TDA8400 can also drive external p-n-p transistors to provide 4 high-current outputs for tuner band selection.

The IC is used in conjunction with a microcomputer from the MAB8400 family and is controlled via a two-wire, bidirectional I²C bus.

Features

- Combined analogue and digital circuitry minimizes the number of additional interfacing components required
- Frequency measurement with resolution of 50 kHz
- On-chip prescaler divisor of 64
- 33 V tuning voltage amplifier
- 4 high-current outputs for direct band selection
- Tuning with control of speed
- Tuning with or without a.f.c.
- Single-pin, 4 MHz on-chip oscillator
- I²C bus slave transceiver

QUICK REFERENCE DATA

Supply voltages			
(pin 10)	V_{CCS}	typ.	5 V
(pin 15)	V_{CCP}	typ.	5 V
Supply currents			
(pin 10)	I_{CCS}	typ.	12 mA
(pin 15)	I_{CCP}	typ.	43 mA
Power dissipation	P_{tot}	typ.	275 mW
Operating ambient temperature range	T_{amb}	0 to + 70	°C

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102HE).

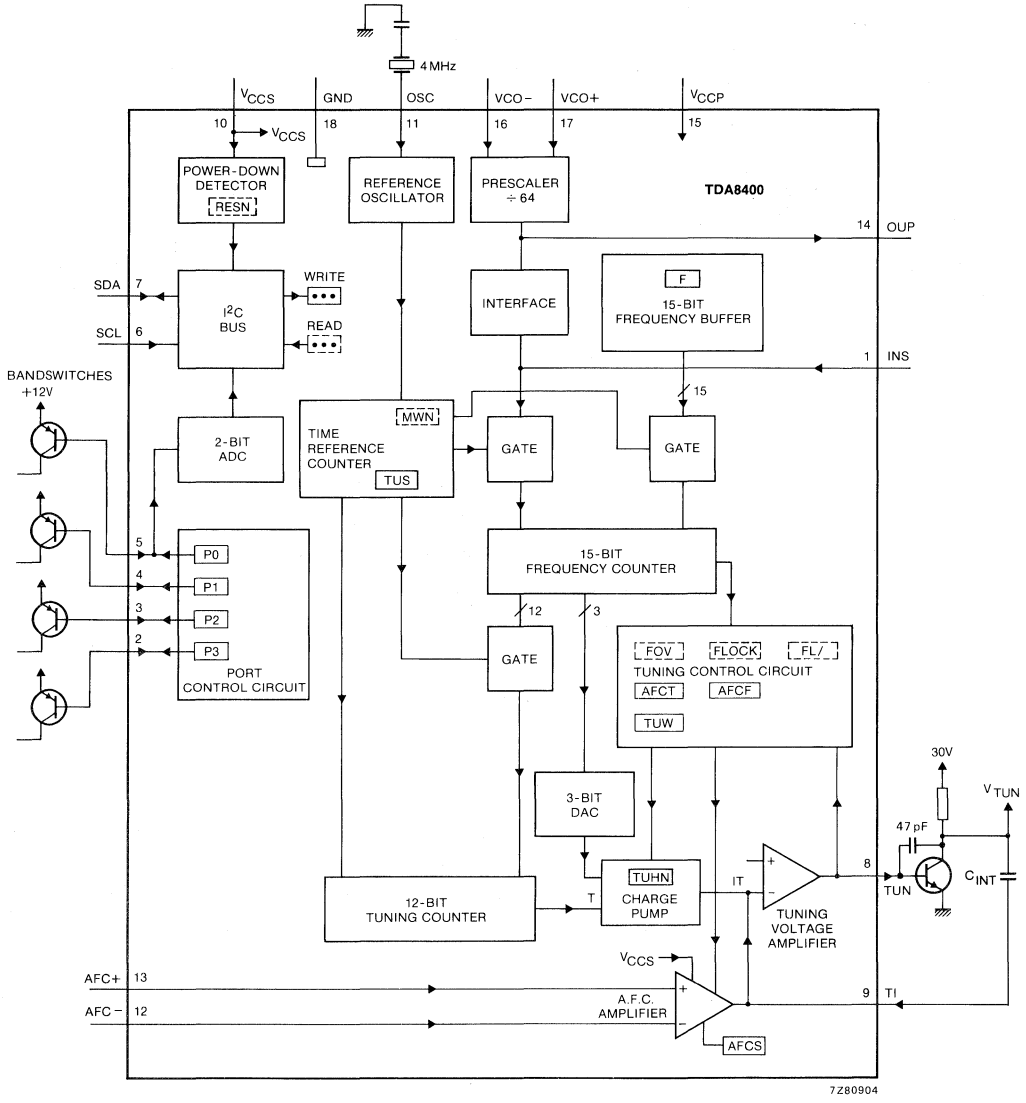


Fig. 1 Block diagram.

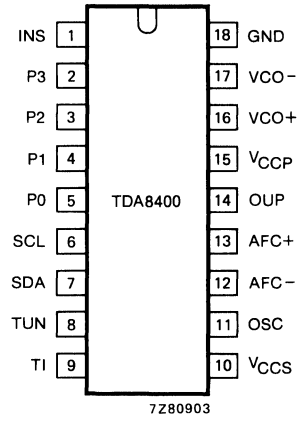


Fig. 2 Pinning diagram.

PINNING

1	INS	input synthesizer (test) *
2	P3	high-current band-selection output ports
3	P2	
4	P1	
5	P0	
6	SCL	serial clock line (I^2C bus)
7	SDA	serial data line (I^2C bus)
8	TUN	tuning voltage amplifier output
9	TI	tuning voltage amplifier inverting input
10	V_{CCS}	+ 5 V supply voltage (synthesizer)
11	OSC	crystal oscillator input
12	AFC−	a.f.c. amplifier inputs
13	AFC+	
14	OUP	output from prescaler (test)
15	V_{CCP}	+ 5 V supply voltage (prescaler) **
16	VCO+	inputs to prescaler
17	VCO−	
18	GND	ground

DEVELOPMENT DATA

* Connected to ground for application.
** Left open-circuit for application.

FUNCTIONAL DESCRIPTION

Prescaler

The integrated prescaler has a divide-by-64 ratio with a maximum input frequency of 1,1 GHz. It will oscillate in the absence of an input signal within the frequency range of 800 MHz to 1,1 GHz.

Tuning

This is performed using frequency-locked loop digital control. Data corresponding to the required tuner frequency is stored in the 15-bit frequency buffer. The actual tuner frequency (1,1 GHz max.) is applied to the circuit on the two complementary inputs VCO+ and VCO– which drive the integrated prescaler. The resulting frequency (FDIV) is measured over a period controlled by a time reference counter and fed via a gate to a 15-bit frequency counter where it is compared to the contents of the frequency buffer. The result of the comparison is used to control the tuning voltage so that the tuner frequency equals the contents of the frequency buffer multiplied by 50 kHz within a programmable tuning window (TUW).

The system cycles over a period of 2,56 ms, controlled by the time reference counter which is clocked by an on-chip 4 MHz reference oscillator. Regulation of the tuning voltage is performed by a charge pump frequency-locked loop system. The charge IT flowing into the tuning voltage amplifier (external capacitance C_{INT} = 0,5 μF) is controlled by the tuning counter, 3-bit DAC and the charge pump circuit. The charge IT is linear with the frequency deviation Δf in steps of 50 kHz. For loop gain control, the relationship $\Delta IT/\Delta f$ is programmable. In the normal mode (control bit TUHN = logic 1; see Table 2) the minimum charge IT at Δf = 50 kHz equals 125 $\mu A \cdot \mu s$ (typ.).

By programming the tuning sensitivity bits (TUS; see Table 3) the charge IT can be doubled up to 6 times. From this, the maximum charge IT at Δf = 50 kHz equals 2^6 x 125 $\mu A \cdot \mu s$ (typ.). The maximum tuning current I is 440 μA, while T is limited to the duration of the tuning cycle (2,56 ms).

In the tuning-hold mode (TUHN = logic 0) the tuning current I is reduced and as a consequence the charge into the tuning amplifier is also reduced. An in-lock situation can be detected by reading FLOCK. The TDA8400 can be programmed to tune in the digital mode or the AFC mode by setting AFCF. In the digital mode (AFCF = logic 0), the tuning window is programmable through the TUW flag. When the tuner oscillator frequency is within the programmable tuning window (TUW), FLOCK is set to logic 1.

In the AFC mode, FLOCK will remain at logic 1 provided the tuner frequency is within a ± 800 kHz hold range. Switching from digital mode to AFC mode is determined by the microcontroller (AFCF flag). Switching from AFC mode to digital mode can be determined by the microcontroller, but if the frequency of the tuning oscillator does not remain within the hold range, the system automatically reverts to digital tuning. Switching back to the AFC mode will then have to be effected externally again. The tuning mode can be checked by reading the AFCT flag.

The occurance of positive and negative transitions in the FLOCK signal can be read by FL/1N and FL/0N. The AFC amplifier has programmable transconductance to 2 pre-defined values.

Control

For tuner band selection there are four output ports P0 to P3 which are capable of driving external p-n-p transistors (open collector) as current sources. Output port P0 can also be used as valid address input with an active level determined by module address bits MA0 and MA1.

Reset

The TDA8400 goes into the power-down-reset mode when V_{P1} is below 3 V (typ.). In this mode all registers are set to a defined state.

OPERATION

Write

The TDA8400 is controlled via a bidirectional two-wire I²C bus; additional information on the I²C bus is available on request.

For programming, a module address, R/$\overline{W}$ bit (logic 0), an instruction byte and a data/control byte are written into the device in the format shown in Fig. 3.

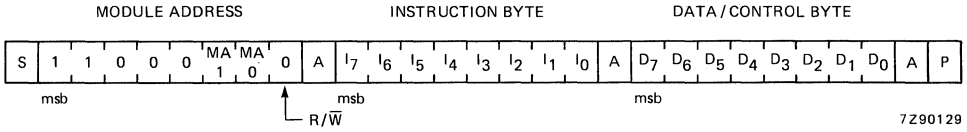


Fig. 3 I²C bus write format.

The module address bits MA1, MA0 are used to give a 2-bit module address as a function of the voltage at port input P0 as shown in Table 1.

Acknowledge (A) is generated by the TDA8400 only when a valid address is received and the device is not in the power-down-reset mode.

DEVELOPMENT DATA

Table 1 Valid module addresses

P0	MA1	MA0
don't care	0	0
GND	0	1
½V_{CCS}	1	0
V_{CCS}	1	1

Tuning

Tuning is controlled by the instruction and data/control bytes as shown in Fig. 4.

	INSTRUCTION BYTE								DATA / CONTROL BYTE							
	I_7	I_6	I_5	I_4	I_3	I_2	I_1	I_0	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
freq.	1	F14	F13	F12	F11	F10	F9	F8	F7	F6	F5	F4	F3	F2	F1	F0
TCD0	0	0	1	0	1	0	0	1	TUW	AFCS	AFCF	1	TUHN	TUS2	TUS1	TUS0
TCD1	0	0	1	0	1	0	1	0	1	1	1	1	P3	P2	P1	P0
TEST	0	1	0	0	0	0	0	0								

7Z93534

Fig. 4 Tuning control format.

Frequency

Frequency is set when bit I_7 of the instruction byte is set to logic 1; the remaining bits of this byte are processed as being data. Instruction bytes are fully decoded. All frequency bits are set to logic 1 and control bits to logic 0 at reset. The test instruction byte cannot be used for any other purpose.

OPERATION (continued)

Tuning hold

The TUHN bit is used to decrease the maximum tuning current (I) and, as a consequence, the minimum charge IT (at $\Delta f = 50$ kHz) into the tuning amplifier.

Table 2 Tuning current control

TUHN	typ. I_{max} (μA)	typ. IT_{min} ($\mu A \cdot \mu s$)
0	18*	5*
1	440	125

Tuning sensitivity

To be able to program an optimum loop gain, the charge IT can be programmed by changing T using tuning sensitivity (TUS). Table 3 shows the minimum charge IT obtained by programming the TUS bits at $\Delta f = 50$ kHz; TUHN = logic 1.

Table 3 Minimum charge IT as a function of TUS

TUS2	TUS1	TUS0	typ. IT_{min} ($\mu A \cdot \mu s$)
0	0	0	0,125
0	0	1	0,25
0	1	0	0,5
0	1	1	1
1	0	0	2
1	0	1	4
1	1	0	8

The minimum tuning pulse is 2 μs.

Tuning mode

AFCF determines whether the TDA8400 has to tune in the digital mode or the AFC mode as shown in Table 4.

Table 4 Selection of tuning mode as a function of AFCF

AFCF	tuning mode
0	digital
1	AFC

If the tuner oscillator frequency comes out of the hold range when in the AFC mode, the device will automatically switch to digital tuning and AFCF is reset to logic 0.

* Values after reset.

Tuning window

In the digital tuning mode TUW determines the tuning window (see Table 5) and the device is said to be in the "in-lock" situation.

Table 5 Tuning window programming

TUW	tuning window (kHz)
0	0
1	± 200

Transconductance

The transconductance (g) of the AFC amplifier is programmed via the AFC sensitivity bit AFCS as shown in Table 6.

Table 6 Transconductance programming

AFCS	typ. transconductance (μA/V)
1	10
0	50

Band-selection control ports (PX)

For band-selection control there are four output ports P0 to P3 which are capable of driving external p-n-p transistors (open collector) as current sources. If a logic 1 is programmed on any of the PX bits P0 to P3, the p-n-p transistor will conduct and the relevant output goes LOW. All outputs are HIGH after reset.

Read

Information is read from the TDA8400 when the R/$\overline{W}$ bit is set to logic 1. Only one information byte is sent from the device. No acknowledge is required from the master after transmitting. The format of the information byte is shown in Fig. 5.

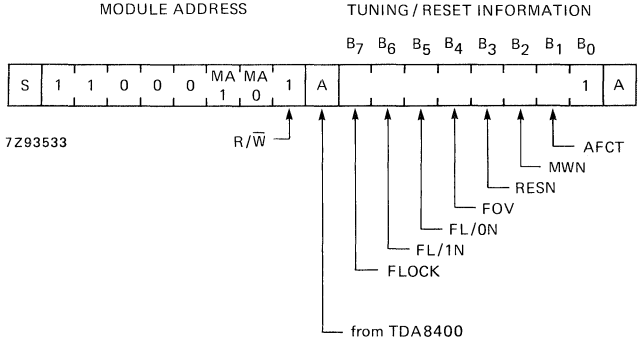


Fig. 5 Information byte format.

OPERATION (continued)

Tuning/reset information bits

FLOCK — Set to logic 1 when the tuning oscillator frequency is within the programmed tuning window (TUW) in the digital tuning mode or within the ± 800 kHz AFC hold range in the AFC mode.

FL/1N — Set to logic 0 (active LOW) when FLOCK changes from 0 to 1 and is reset to logic 1 automatically after tuning information has been read.

FL/0N — As for FL/IN buts is set to logic 0 when FLOCK changes from 1 to 0.

FOV — Indicates frequency overflow. When the tuner oscillator frequency is too high with respect to the programmed frequency, FOV is at logic 1, and when too low, FOV is at logic 0.

RESN — Set to logic 0 (active LOW) by a power-down-reset. It is reset to logic 1 automatically after tuning/reset information has been read.

MWN — MWN (frequency measuring window, active LOW) is at logic 1 for a period of 1,28 ms, during which time the results of frequency measurement are processed. During the remaining time, MWN is at logic 0 and the received frequency is measured.

AFCT — AFCT (tuning mode flag) is set to logic 1 when the TDA8400 is in AFC mode and reset to logic 0 when in the digital mode.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage:				
(pin 10)	V_{CCS}	max.	6	V
(pin 15)	V_{CCP}	max.	6	V
Input/output voltage (each pin)	V_n	max.	6	V
Total power dissipation	P_{tot}	max.	350	mW
Storage temperature range	T_{stg}	−25 to +	150	°C
Operating ambient temperature	T_{amb}	−10 to +	80	°C

DEVELOPMENT DATA

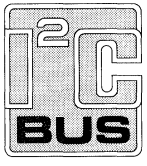
CHARACTERISTICS

T_{amb} = 25 °C; V_{P1}, V_{P2} at typical voltages, unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply voltage					
synthesizer (pin 10)	V_{CCS}	4,5	5	5,5	V
prescaler (pin 15)	V_{CCP}	4,5	5	5,5	V
Supply current					
synthesizer (pin 10)	I_{CCS}	–	12	–	mA
prescaler (pin 15)	I_{CCP}	–	43	–	mA
Total power dissipation	P_{tot}	–	275	–	mW
Operating ambient temperature range	T_{amb}	0	–	+ 70	°C
Operating storage temperature range	T_{stg}	−10	–	+ 85	°C
I²C bus inputs/outputs					
Inputs: SDA (pin 7); SCL (pin 6)					
Input voltage HIGH	V_{IH}	3,1	–	5,5	V
Input voltage LOW	V_{IL}	−0,3	–	1,6	V
Input current HIGH	I_{IH}	–	–	10	μA
Input current LOW	I_{IL}	–	–	10	μA
SDA output (pin 7, open collector)					
Output voltage LOW at I_{OL} = 3 mA	V_{OL}	–	–	0,4	V
Output sink current	I_{OL}	–	–	5	mA
Tuning voltage amplifier					
Input TI, output TUN (pins 9, 8)					
Input bias current	I_{TI}	−5	–	+ 5	nA
Output current LOW at V_{TUN} = 0,4 V	$-I_{TUNL}$	20	–	–	μA
Minimum charge IT to tuning amplifier					
TUHN = 0	CH_0	–	5	–	μA·μs
TUHN = 1	CH_1	–	125	–	μA·μs
Maximum current I into tuning amplifier					
TUHN = 0	I_{T0}	–	18	–	μA
TUHN = 1	I_{T1}	–	440	–	μA
AFC amplifier (Inputs AFC+, AFC− pins 13, 12)					
Differential input voltage	V_{DIF}	–	–	1	V
Transconductance at AFCS = 1	g_1	5	10	15	μA/V
Transconductance at AFCS = 0	g_0	30	50	70	μA/V
Common mode input voltage	V_{CM}	2,5	–	$V_{P1}-1$	V
Common mode rejection ratio	CMRR	–	50	–	dB
Power supply (V_{P1}) rejection ratio	PSRR	–	50	–	dB
Input current	I_I	–	–	1	μA

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Main band-selection output ports					
P0, P1, P2, P3 (pins 5 to 2, open collector)					
Output sink current					
LOW impedance	I_{BSL1}	0,8	1	1,2	mA
HIGH impedance	I_{BSH1}	–	–	10	μA
Prescaler inputs (VCO+ pin 16; VCO– pin 17)					
Input differential voltage (r.m.s. value)					
at f = 70 MHz	$V_{I(rms)}$	17,5	–	200	mV
at f = 150 MHz	$V_{I(rms)}$	10	–	200	mV
at f = 300 MHz	$V_{I(rms)}$	10	–	200	mV
at f = 500 MHz	$V_{I(rms)}$	10	–	200	mV
at f = 900 MHz	$V_{I(rms)}$	10	–	200	mV
at f = 1,1 GHz	$V_{I(rms)}$	25	–	200	mV
Input frequency	f_i	0,07	–	1,1	GHz
OSC input (pin 11)					
Crystal resistance at resonance (4 MHz)	R_{XTAL}	–	–	150	Ω
Power-down-reset					
Maximum supply voltage V_{P1} at which power-down reset is active	V_{PD}	3	–	4	V
Voltage level for valid module address					
Voltage level P0 (pin 5) for valid module address as a function of MA1, MA0					
MA1 MA0					
0 0		pin used as an output			
0 1	V_{VA01}	–0,3	–	0,8	V
1 0	V_{VA10}	2,4	–	V_{CCS}–1,6	V
1 1	V_{VA11}	V_{CCS}–0,3	–	V_{CCS}	V



Purchase of Philips' I²C components conveys a license under the Philips' I²C patent to use the components in the I²C-system provided the system conforms to the I²C specifications defined by Philips.

TV AND VTR STEREO/DUAL SOUND PROCESSOR WITH I²C BUS CONTROL

GENERAL DATA

The TDA8405 integrated circuit is a processor for stereo/dual-language signals for stereo-sound television receivers and VTR. The modulated signals at the TDA8405 inputs need to be "(L+R)/2" or "language A" on one channel and "R" or "language B" on the second channel (where L = left and R = right). The second channel is also modulated with the pilot carrier. The IC is controlled via the two-line, bidirectional I²C bus.

Features

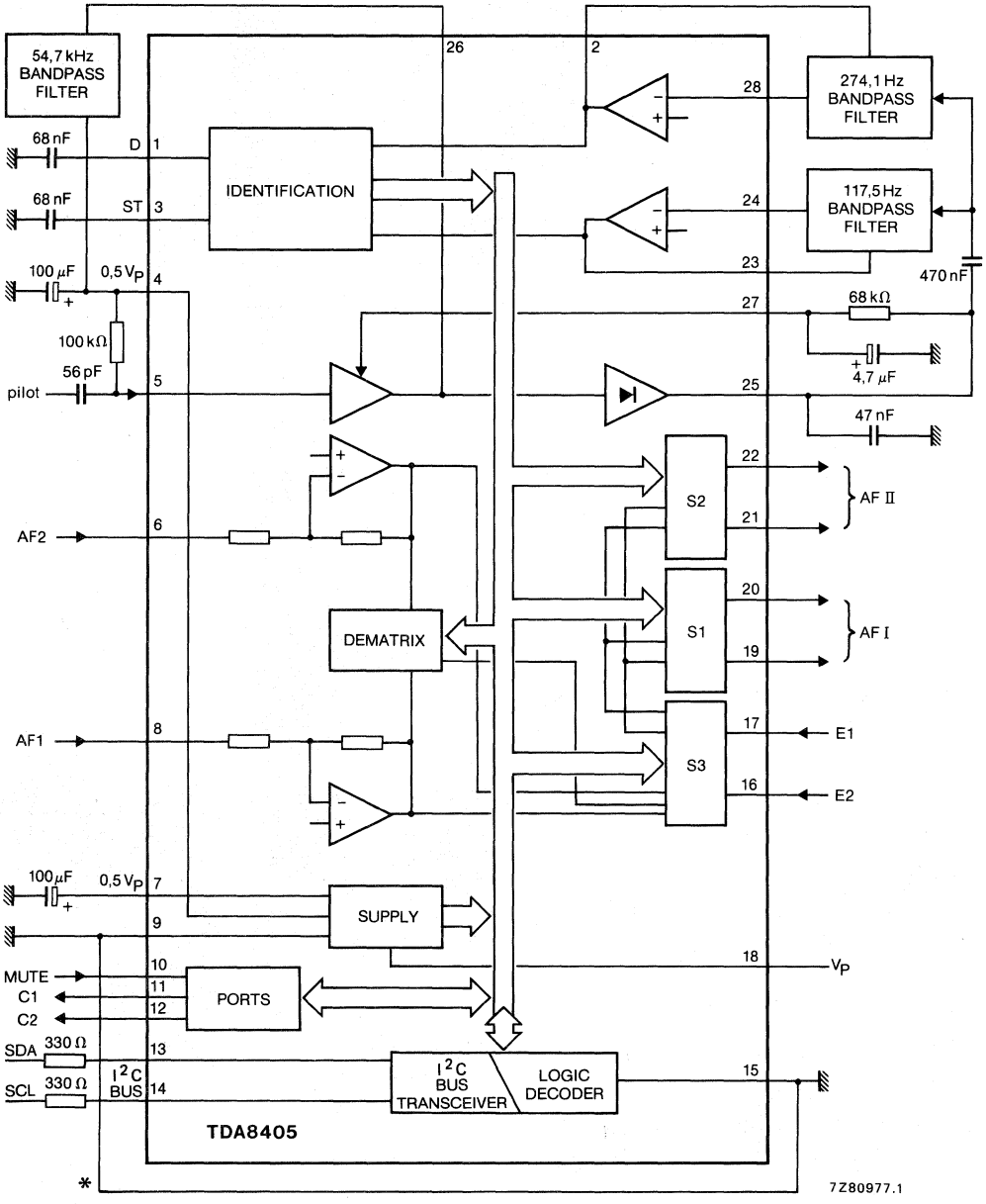
- Amplification of the two a.f. input signals by integrated operational amplifiers.
- Low distortion stereo dematrix
- All operational amplifiers are offset compensated
- I²C bus transceiver for system control (port control, mute, mode select, identification, etc.)
- Input port for fast muting
- Two general purpose output ports (three-state, bus-controlled)

QUICK REFERENCE DATA

Supply voltage	$V_P = V_{18\text{-}9\text{-}15}$	typ.	12 V
Supply current	$I_P = I_{18}$	typ.	25 mA
A.F. input signal	$V_{i(rms)} = V_{6\text{-}9}, V_{8\text{-}9}$	typ.	1 V
Weighted signal-to-noise ratio of the a.f. output-signals (CCIR 468/2)	(S+N)/N	$\geqslant$	70 dB
Crosstalk attenuation: stereo mode at f = 1 kHz	α_S	$>$	40 dB
dual sound mode at f = 40 to 12 500 Hz	α_{DS}	$>$	70 dB
Pilot signal input sensitivity	$V_i = V_{5\text{-}9(rms)}$	typ.	5 mV
Pilot signal amplifier gain control range	ΔG_V	$>$	40 dB

PACKAGE OUTLINE

28-lead DIL; plastic (SOT-117).



* Direct connection between pins 9 and 15 is needed.

Fig. 1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 18)*	$V_P = V_{18-9,15}$	max.	13,2 V
Output current (pins 19, 20, 21, 22)	I_n	max.	5 mA
Output current (pins 2, 23)	I_n	max.	1 mA
Output current (pins 11, 12)	I_n	max.	3 mA
Voltage range at any pin	V_n		0 to V_P V
Total power dissipation	P_{tot}	max.	1 W
Storage temperature range	T_{stg}		−40 to + 150 °C
Operating ambient temperature range	T_{amb}		0 to + 70 °C

DEVELOPMENT DATA

* Supply voltage may be applied only when pins 9 and 15 are connected to ground.

CHARACTERISTICS

T_{amb} = 25 °C; V_P = 12 V; $V_{i(af)rms}$ = 1 V; f = 1 kHz; dematrix aligned; $V_{i\ pilot(rms)}$ = 16 mV; test circuit Fig. 2; unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
Supply voltage	$V_P = V_{18\text{-}9,\ 15}$	10,8	12	13,2	V
Supply current at V_P = 12 V	$I_P = I_{18}$	–	25	–	mA
Reference voltage	$V_{ref} = V_{4\text{-}9,\ 15}$	–	$V_P/2$	–	V
DC levels (pins 5, 6, 7, 8, 16 17, 19, 20, 21, 22, 24, 28)	$V_{n\text{-}9,\ 15}$	–	$V_P/2$	–	V
BUS TRANSCEIVER (pins 13, 14) (note 1)					
Clock SCL					
Voltage level LOW	$V_{14\text{-}15}$	−0,3	–	1,5	V
Voltage level HIGH	$V_{14\text{-}15}$	3,0	–	–	V
Timing LOW period	t_{PL}	4,7	–	–	μs
Timing HIGH period	t_{PH}	4,0	–	–	μs
Rise time	t_r	–	–	1	μs
Fall time	t_f	–	–	0,3	μs
Input current HIGH	I_{IH}	–	–	10	μA
Input current LOW	$-I_{IL}$	–	–	10	μA
Data					
Voltage level LOW	$V_{13\text{-}15}$	−0,3	–	1,5	V
Voltage level HIGH	$V_{13\text{-}15}$	3,0	–	–	V
Rise time	t_r	–	–	1,0	μs
Fall time	t_f	–	–	0,3	μs
Set-up time data	t_{SU}	0,25	–	–	μs
Input current HIGH	I_{13}	–	–	10	μA
Input current LOW	$-I_{13}$	–	–	10	μA
Output current LOW	$+I_{13}$	3,0	–	–	mA
MUTE PORT (pin 10) note 2					
Input voltage LOW	$V_{10\text{-}15}$	–	–	1,5	V
Input voltage HIGH	$V_{10\text{-}15}$	8	–	–	V

parameter	symbol	min.	typ.	max.	unit
CONTROL PORTS (pins 11, 12)					
3-state HIGH, LOW, high ohmic					
Output resistance in open state	$R_{11, 12\text{-}15}$	50	–	–	kΩ
Output voltage LOW	$V_{11, 12\text{-}15}$	–	–	0,8	V
Output voltage HIGH	$V_{11, 12\text{-}15}$	V_P-1	–	–	V
Output current LOW	$I_{11, 12}$	500	–	–	μA
Output current HIGH	$-I_{11, 12}$	80	–	–	μA
IDENTIFICATION (See Fig. 3)					
Input amplifier and demodulator					
Input voltage	$V_{5\text{-}9(p\text{-}p)}$	–	–	2,0	V
Min. input voltage	$V_{5\text{-}9(rms)}$	5,0	–	–	mV
Input resistance	$R_{5\text{-}9}$	500	–	–	kΩ
Gain	$G_{25\text{-}9}$	–	42	–	dB
Gain control range	ΔG	40	–	–	dB
Output voltage (gain-controlled)	$V_{25\text{-}9(p\text{-}p)}$	–	1,5	–	V
Operational amplifiers					
Input current	$I_{24, 28}$	–	70	–	nA
Gain at f = 200 Hz	$G_{23\text{-}24}$, $G_{2\text{-}28}$	78	–	–	dB
Output current	$I_{2, 23}$	1,5	–	–	mA
Output resistance	$R_{2, 23\text{-}9}$	–	2	–	kΩ
Output load capacitance	$C_{2, 23\text{-}9}$	–	–	30	pF
Schmitt trigger					
A.C. input signal	$V_{2, 23\text{-}9(rms)}$	–	1	–	V
Internal discharge resistors	$R_{1, 3\text{-}9}$	–	3	–	kΩ
A.F. STAGES					
Input resistance (pins 6, 8, 16 and 17)	$R_{n\text{-}9}$	10	–	–	kΩ
Gain ($V_{19, 20, 21, 22\text{-}9}/V_{6, 8\text{-}9}$)	G1	–	6	–	dB
Gain ($V_{19, 20, 21, 22\text{-}9}/V_{16, 17\text{-}9}$)	G2	–	0	–	dB
Input voltage	$V_{6, 8\text{-}9(rms)}$	–	1	–	V
Crosstalk attenuation (notes 3, 4 and 9)					
dual sound	α_{DS}	70	–	–	dB
stereo f = 250 Hz to 6,3 kHz	α_S	40	–	–	dB
stereo f = 40 Hz to 250 Hz; 6,3 kHz to 12,5 kHz	α_S	30	–	–	dB

DEVELOPMENT DATA

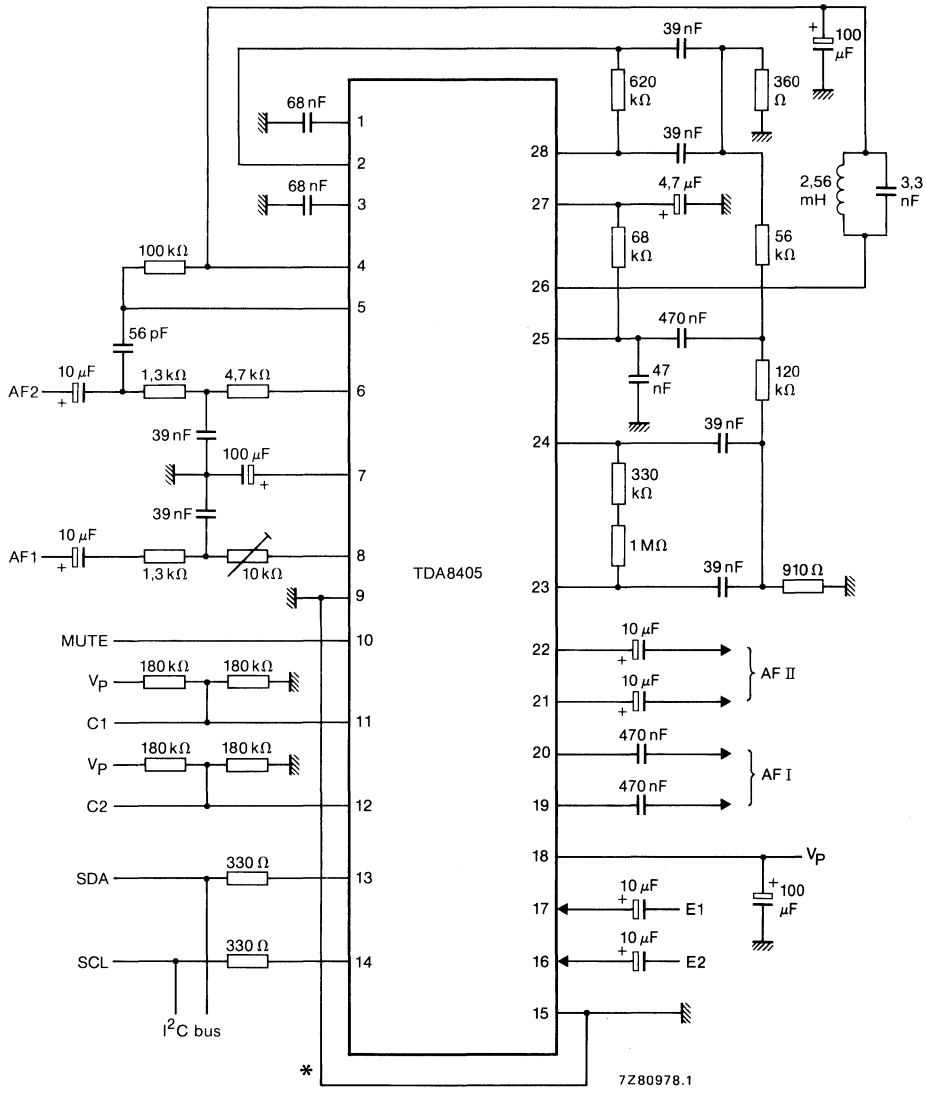
CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
A.F. STAGES (continued)					
Output resistance	$R_{19,20,21,22}$	–	200	300	Ω
Output load capacitance (pins 19, 20, 21 and 22)	$C_{n\text{-}9}$	–	–	1,5	nF
D.C. offsets (note 8) at pins 19,20,21 and 22	Δ_V	–	–	30	mV
Total harmonic distortion (notes 4 and 5)	THD	–	0,1	0,5	%
Output signal (r.m.s. value) (pins 19, 20, 21 and 22)	$V_{n\text{-}9(rms)}$	–	–	2,0	V
Ripple rejection (note 6)	RR	30	35	–	dB
Noise rejection (note 7) (noise from I^2C bus)	NR	80	–	–	dB
Signal-to-noise ratio (note 7)	(S+N)/N	70	–	–	dB
Ident signal suppression		70	–	–	dB
Signal suppression during mute (notes 4 and 7)		70	–	–	dB

Notes to the characteristics

1. Full specification of the I^2C bus will be supplied on request.
2. Programmable mute state. If the SC3 bit in the I^2C bus is LOW then the mute input is active LOW; if the mute bit is set to HIGH then the mute input is active HIGH.
3. Crosstalk attenuation definition: 20 log (unwanted output signal/input signal).
4. Frequency range: 40 Hz $<$ f $<$ 12,5 kHz.
5. In dual sound mode.
6. Test circuit as in Fig. 4: ripple rejection = output modulation due to hum on the supply line.
7. Related to 2 V (r.m.s.) output signal at pin 19, 20, 21 or 22; noise weighted according to CCIR 468/2.
8. Caused by any change of the switch position.
9. α_S measured without de-emphasis network.

DEVELOPMENT DATA



* Direct connection between pins 9 and 15 is needed.

Fig. 2 Test circuit.

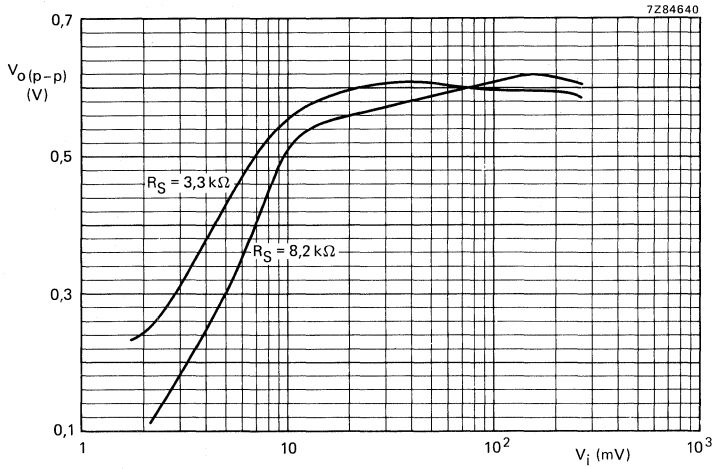


Fig. 3 Controlled output voltage as a function of the input signal (Q = 80); pilot frequency f_o = 54 kHz; R_S = source resistance.

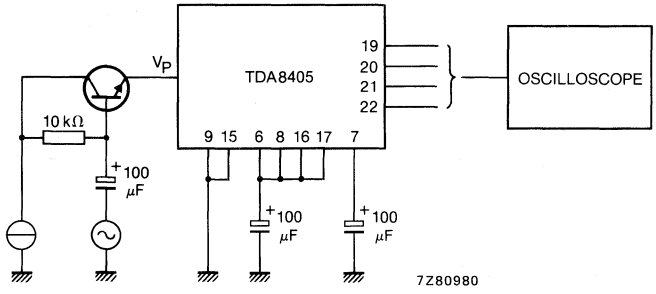
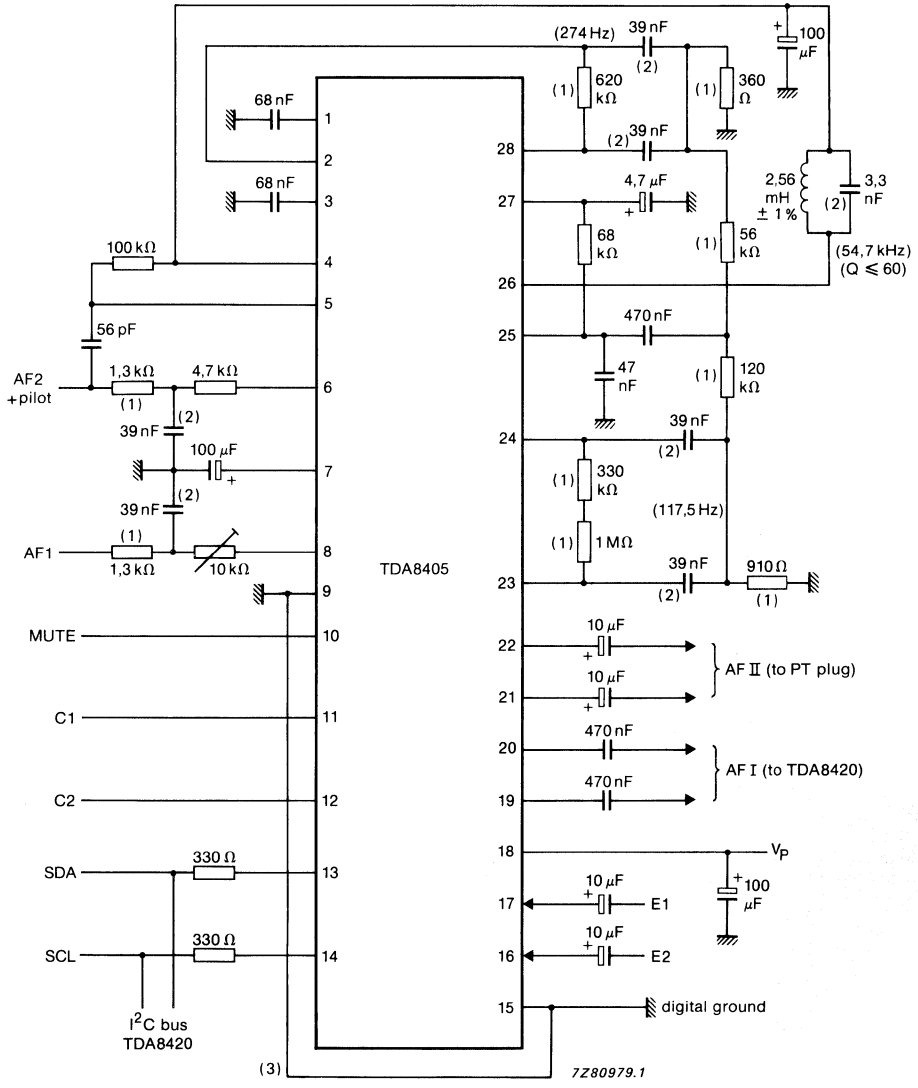


Fig. 4 Test circuit for ripple rejection: supply (d.c.) + pulse (r.m.s.) voltage at 100 Hz = 12 V + 50 mV.

DEVELOPMENT DATA



(1) ± 1 % tolerance

(2) polystyrene film/foil capacitors (KS) : ± 1 % tolerance

metallized polyethylenetherephthalate film capacitors (MKT) : ± 10 % tolerance

(3) Direct connection is needed between pins 9 and 15

Fig. 5 Application diagram.

Purchase of Philips' I²C components conveys a license under the Philips' I²C patent to use the components in the I²C system provided the system conforms to the I²C specifications defined by Philips.

SWITCH FOR CTV RECEIVERS

GENERAL DESCRIPTION

The TDA8440 is a versatile video/audio switch, intended to be used in CTV receivers equipped with an AUXILIARY VIDEO/AUDIO plug.

It provides two 3-state switches for audio channels and one 3-state switch for the video channel and a video amplifier with selectable gain (times 1 or times 2).

The integrated circuit can be used in conjunction with a microcontroller from the MAB8400 family, and is controlled via a bidirectional I²C bus. Sufficient sub-addressing is provided for the I²C bus mode. It can also be controlled directly by d.c. switching signals.

Features

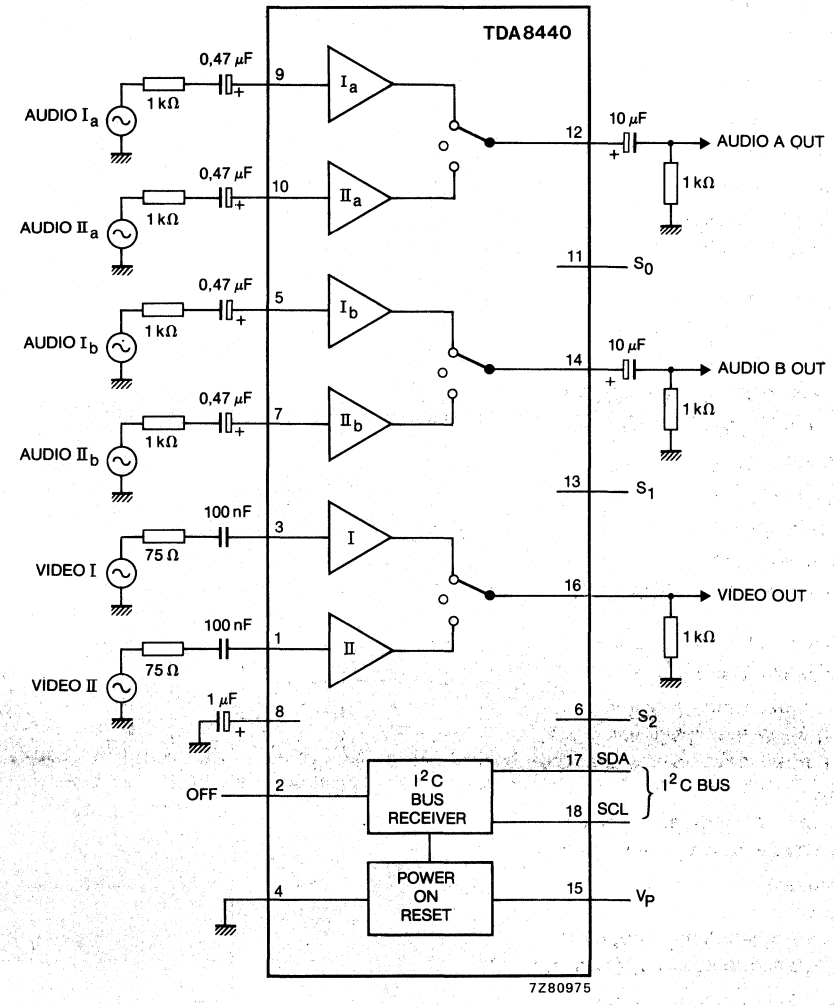
- Combined analogue and digital circuitry gives maximum flexibility in channel switching
- 3-state switches for all channels
- Selectable gain for the video channels
- Sub-addressing facility
- I²C bus or non-I²C bus mode (controlled by d.c. voltages)
- Slave receiver in the I²C bus mode
- External OFF command
- System expansion possible up to 7 devices (14 sources)
- Static short-circuit proof outputs

QUICK REFERENCE DATA

Supply voltage range	V_{15-4}	10 to 13,2	V
Supply current (without load)	I_{15}	typ. 33 max. 50	mA mA
Storage temperature	T_{stg}	max. + 125	°C
Operating ambient temperature range	T_{amb}	0 to + 70	°C

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102).



S0, S1, S2 and OFF (pins 11, 13, 6 and 2) connected to V_P or GND.
If more than 1 device is used, then the outputs and the pins 8 (bias decoupling of the audio inputs) mau may be connected in parallel.

Fig. 1 Block diagram and test circuit.

DEVELOPMENT DATA

FUNCTIONAL DESCRIPTION

The TDA8440 is a monolithic system of switches and can be used in CTV receivers equipped with an AUXILIARY VIDEO/AUDIO plug.

The IC incorporates 3-state switches they comprise:

a) An electronic video switch with selectable gain (times 1 or times 2) for switching between an internal video signal (from the IF amplifier) and an AUXILIARY input signal.

b) Two electronic audio switches, for two sound channels (stereo or dual language), for switching between internal audio sources and signals from the AUXILIARY VIDEO/AUDIO plug.

A selection can be made between two input signals and an OFF-state. The OFF-state is necessary if more than one TDA8440 device is used.

The SDA and SCL pins can be connected to the I^2C bus or to d.c. switching voltages. Inputs S_0 (pin 11), S_1 (pin 13), and S_2 (pin 6) are used for selection of sub-addresses or switching to the non-I^2C mode. Inputs S_0, S_1 and S_2 can be connected to the supply voltage (H) or to ground (L). In this way no peripheral components are required for selection.

Table 1 Sub-addressing

			sub-address		
S_2	S_1	S_0	A_2	A_1	A_0
L	L	L	0	0	0
L	L	H	0	0	1
L	H	L	0	1	0
L	H	H	0	1	1
H	L	L	1	0	0
H	L	H	1	0	1
H	H	L	1	1	0
H	H	H	non I^2C addressable		

NON-I^2C BUS CONTROL

If the TDA8440 switching device has to be operated via the AUXILIARY VIDEO/AUDIO plug, inputs S_2, S_1 and S_0 must be connected to the supply line (12 V).

The sources (internal and external) and the gain of the video amplifier can be selected via the SDA and SCL pins with the switching voltage from the AUXILIARY VIDEO/AUDIO plug:

- Sources I are selected if SDA = 12 V (external source)
- Sources II are selected if SDA = 0 V (TV mode)
- Video amplifier gain is 2 x if SCL = 12 V (external source)
- Video amplifier gain is 1 x if SCL = 0 V (TV mode)

If more than one TDA8440 device is used in the non-I^2C bus system, the OFF pin can be used to switch off the desired devices. This can be done via the 12 V switching voltage on the AUXILIARY VIDEO/AUDIO plug.

- All switches are in the OFF position if OFF = H (12 V)
- All switches are in the selected position via SDA and SCL pins if OFF = L (0 V)

I²C BUS CONTROL

Detailed information on the I²C bus is available on request.

Table 2 TDA8440 I²C bus protocol.

STA	A_6	A_5	A_4	A_3	A_2	A_1	A_0	R/W	AC	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0	AC	STO

STA = start condition
A_6 = 1
A_5 = 0
A_4 = 0
A_3 = 1
} Fixed address bits
A_2 = sub-address bit, fixed via S_2 input
A_1 = sub-address bit, fixed via S_1 input
A_0 = sub-address bit, fixed via S_0 input
R/W = read/write bit (has to be 0, only write mode allowed)
AC = acknowledge bit (= 0) generated by the TDA8440
D_7 = 1 audio Ia is selected to audio output a
D_7 = 0 audio Ia is not selected
D_6 = 1 audio IIa is selected to audio output a
D_6 = 0 audio IIa is not selected
D_5 = 1 audio Ib is selected to audio output b
D_5 = 0 audio Ib output is not selected
D_4 = 1 audio IIb is selected to audio output b
D_4 = 0 audio IIb is not selected
D_3 = 1 video I is selected to video output
D_3 = 0 video I is not selected
D_2 = 1 video II is selected to video output
D_2 = 0 video II is not selected
D_1 = 1 video amplifier gain is times 2
D_1 = 0 video amplifier gain is times 1
D_0 = 1 OFF-input inactive
D_0 = 0 OFF-input active
STO = stop condition

OFF FUNCTION

With the OFF input all outputs can be switched off (mode high ohmic), depending on the value of D_0.

D_0/OFF gating

D_0	OFF input	Outputs
0 (off input active)	H	OFF
0	L	in accordance with last defined D_7-D_1 (may be entered while OFF = HIGH)
1 (off input inactive)	H	in accordance with D_7-D_1
1	L	in accordance with D_7-D_1

Power-on reset

The circuit is provided with a power-on reset function.

When the power supply is switched on an internal pulse will be generated that will reset the internal memory S_0, in the initial state all the switches will be in the off position and the OFF input is active (D_7-D_0 = 0) (I^2C mode), position defined via SDA and SCL inputs (non-I^2C mode).

When the power supply decreases below 5 V a pulse will be generated and the internal memory will be reset. The behaviour of the switches will be the same as described above.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

		min.	typ.	max.	unit
Supply voltage	pin 15 V_P	–	–	14	V
Input voltage range	pin 17 V_{SDA}	−0,3	–	V_P + 0,3	V
	pin 18 V_{SCL}	−0,3	–	V_P + 0,3	V
	pin 2 V_{OFF}	−0,3	–	V_P + 0,3	V
	pin 11 V_{S0}	−0,3	–	V_P + 0,3	V
	pin 13 V_{S1}	−0,3	–	V_P + 0,3	V
	pin 6 V_{S2}	−0,3	–	V_P + 0,3	V
Video output current	pin 16 $-I_{16}$	–	–	50	mA
Storage temperature range	T_{stg}	–	–	+ 125	°C
Operating ambient temperature range	T_{amb}	0	–	+ 70	°C
Junction temperature	T_j	–	–	+ 150	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=		50	K/W

CHARACTERISTICS

T_{amb} = 25 °C; V_P = 12 V; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply					
Supply voltage	V_{15-4}	10	–	13,2	V
Supply current (without load)	I_{15}	–	37	50	mA
Video switch					
Input coupling capacitor	C_1C_3	100	–	–	nF
Voltage gain (times 1; SLC = L)	A_{3-16}	−1	0	+ 1	dB
(times 2; SCL = H)	A_{3-16}	+5	+ 6	+ 7	dB
Voltage gain (times 1; SCL = L)	A_{1-16}	−1	0	+ 1	dB
(times 2; SCL = H)	A_{1-16}	+5	+ 6	+ 7	dB
Input video signal amplitude (gain times 1)	V_{3-4}	–	–	4,5	V
Input video signal amplitude (gain times 1)	V_{1-4}	–	–	4,5	V
Output impedance	Z_{16-4}	–	7	–	Ω
Output impedance in 'OFF' state	Z_{16-4}	100	–	–	kΩ
Isolation (off state) (f_o = 5 MHz)		60	–	–	dB
Signal-to-noise ratio (note 2)	S/S + N	60	–	–	dB
Output top-sync level	V_{16-4}	2,4	2,8	3,2	V
Differential gain	G	–	–	3	%
Minimum crosstalk attenuation (note 1)	V_{16-4}	60	–	–	dB
Supply voltage rejection (note 3)	RR	36	–	–	dB
Bandwidth (1 dB)	B	10	–	–	MHz
Crosstalk attenuation for interference caused by bus signals (source impedance 75 Ω)	α	60	–	–	dB
Audio switch a and b					
Input signal level	$V_{9-4(rms)}$	–	–	2	V
	$V_{10-4(rms)}$	–	–	2	V
	$V_{5-4(rms)}$	–	–	2	V
	$V_{7-4(rms)}$	–	–	2	V
Input impedance	Z_{9-4}	50	100	–	kΩ
	Z_{10-4}	50	100	–	kΩ
	Z_{5-4}	50	100	–	kΩ
	Z_{7-4}	50	100	–	kΩ
Output impedance	Z_{12-4}	–	–	10	Ω
	Z_{14-4}	–	–	10	Ω
Output impedance (off state)	Z_{14-4}	100	–	–	kΩ

parameter	symbol	min.	typ.	max.	unit
Voltage gain	$V_{9\text{-}12}$	−1	0	+ 1	dB
	$V_{10\text{-}12}$	−1	0	+ 1	dB
	$V_{5\text{-}14}$	−1	0	+ 1	dB
	$V_{7\text{-}14}$	−1	0	+ 1	dB
Isolation (off state) (f = 20 kHz)		90	–	–	dB
Signal-to-noise ratio (note 4)	S/S + N	90	–	–	dB
Total harmonic distortion (note 6)	THD	–	–	0,1	%
Crosstalk attenuation for interferences caused by video signals (note 5)					
Weighted	α	80	–	–	dB
Unweighted	α	80	–	–	dB
Crosstalk attenuation for interferences caused by sinusoidal sound signals (note 5)	α	80	–	–	dB
Crosstalk attenuation for interferences caused by the bus signal (weighted) (source impedance = 1 kΩ)		80	–	–	dB
Supply voltage rejection	RR	50	–	–	dB
Bandwidth (−1 dB)	B	50	–	–	kHz
I^2C bus inputs/outputs SDA (pin 17) and SCL (pin 18)					
Input voltage HIGH	V_{IH}	3	–	V_P	V
Input voltage LOW	V_{IL}	−0,3	–	+ 1,5	V
Input current HIGH*	I_{IH}	–	–	10	μA
Input current LOW*	I_{IL}	–	–	10	μA
Output voltage LOW at I_{OL} = 3 mA	V_{OL}	–	–	0,4	V
Maximum output sink current	I_{OL}	–	5	–	mA
Capacitance of SDA and SDL inputs, pins 17 and 18	C_I	–	–	10	pF
Sub-address inputs S_0 (pin 11), S_1 (pin 13), S_2 (pin 6)					
Input voltage HIGH	V_{IH}	3	–	V_P	V
Input voltage LOW	V_{IL}	−0,3	–	+ 0,4	V
Input current HIGH	I_{IH}	–	–	10	μA
Input current LOW	I_{IL}	−50	–	0	μA
OFF input (pin 2)					
Input voltage HIGH	V_{IH}	+3	–	V_P	V
Input voltage LOW	V_{IL}	−0,3	–	+ 0,4	V
Input current HIGH	I_{IH}	–	–	20	μA
Input current LOW	I_{IL}	−10	–	2	μA

* Also if the supply is switched off.

DEVELOPMENT DATA

CHARACTERISTICS (continued)

I^2C bus load conditions are as follows:
4 kΩ pull-up resistor to + 5 V; 200 pF to GND.
All values are referred to V_{IH} = 3 V and V_{IL} = 1,5 V.

parameter	symbol	min.	typ.	max.	unit
Bus free before start	t_{BUF}	4	–	–	μs
Start condition set-up time	$t_{s(STA)}$	4	–	–	μs
Start condition hold time	$t_{h(STA)}$	4	–	–	μs
SCL, SDA LOW period	t_{LOW}	4	–	–	μs
SCL, SDA HIGH period	t_{HIGH}	4	–	–	μs
SCL, SDA rise time	t_r	–	–	1	μs
SCL, SDA fall time	t_f	–	–	0,3	μs
Data set-up time (write)	$t_{s(DAT)}$	1	–	–	μs
Data hold time (write)	$t_{h(DAT)}$	1	–	–	μs
Acknowledge (from TDA8440) set-up time	$t_{s(CAC)}$	–	–	2	μs
Acknowledge (from TDA8440) hold time	$t_{h(CAC)}$	0	–	–	μs
Stop condition set-up time	$t_{s(STO)}$	4	–	–	μs

Notes to the characteristics

1. Caused by drive on any other input at maximum level, measured in B = 5 MHz, source impedance for the used input 75 Ω,

   $$\text{crosstalk} = 20 \log \frac{V_{out}}{V_{IN\ max}}.$$

2. $$S/N = 20 \log \frac{V_O \text{ video noise (p-p) (2 V)}}{V_O \text{ noise rms B = 5 MHz}}.$$

3. $$\text{Supply voltage ripple rejection} = 20 \log \frac{V_r \text{ supply}}{V_r \text{ on output}} \text{ at f = max. 100 kHz.}$$

4. $$S/N = 20 \log \frac{V_O \text{ nominal (0,5 V)}}{V_O \text{ noise B = 20 kHz}}.$$

5. Caused by drive of any other input at maximum level, measured in B = 20 kHz, source impedance of the used input = 1 kΩ,

   $$\text{crosstalk} = 20 \log \frac{V_{out}}{V_{in\ max}}$$ according to DIN 45405 (CCIR 468).

6. f = 20 Hz to 20 kHz.
7. All outputs are short-circuit proof (static).
8. The inputs and output (apart from SDA, SCL and OFF) withstand tests of MIL-STD-883 C. It is advisable to connected series resistors to these pins.
9. Timings $t_{S,\ DAT}$ and $t_{H,\ DAT}$ deviate from the I^2C bus specification. After reset has been activated, transmission may only be started after a 50 μs delay.

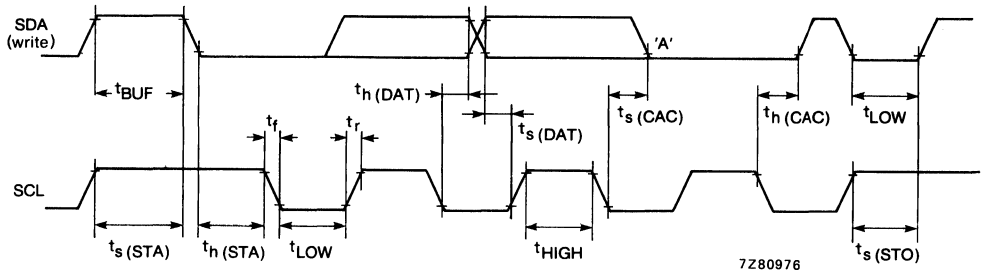


Fig. 2 Timing diagram I²C bus.

DEVELOPMENT DATA

Purchase of Philips' I²C components conveys a license under the Philips' I²C patent to use the components in the I²C system provided the system conforms to the I²C specifications defined by Philips.

I²C BUS INTERFACE FOR COLOUR DECODERS

GENERAL DESCRIPTION

The TDA8442 provides control of four analogue functions and has one high-current and two switching outputs. Control of the IC is performed via the two-line, bidirectional I²C bus.

Features

- Four analogue control outputs
- One high-current output port (npn open emitter)
- Two switching output ports (npn collector with internal pull-up resistor)
- I²C bus slave receiver
- Power-down reset

QUICK REFERENCE DATA

Supply voltage	$V_P = V_{9-8}$	typ.	12 V
Supply current (no outputs loaded)	$I_P = I_9$	typ.	13 mA
Total power dissipation (no outputs loaded)	P_{tot}	max.	1 W
Operating ambient temperature range	T_{amb}		−20 to +70 °C

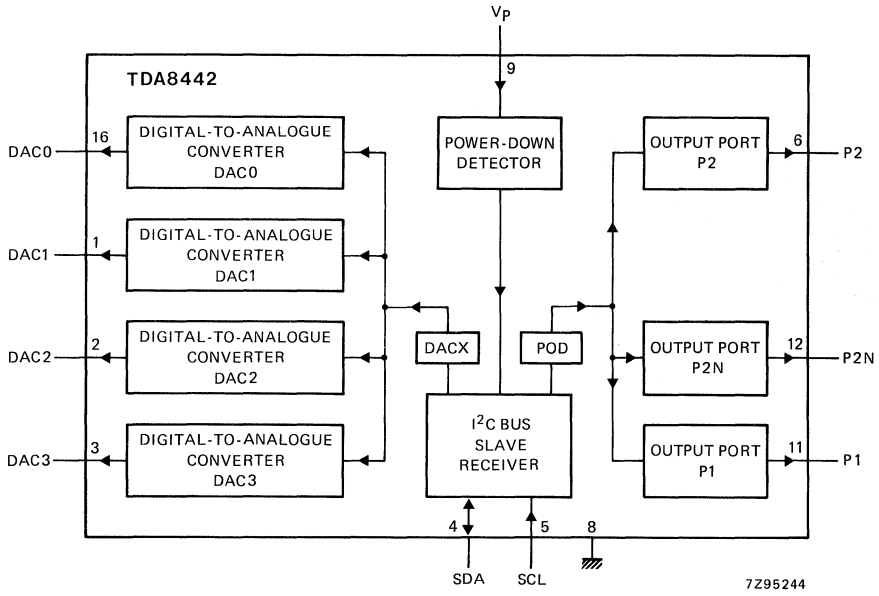


Fig. 1 Block diagram.

PACKAGE OUTLINE

16-lead DIL; plastic (SOT-38).

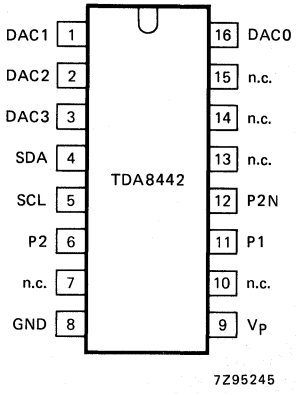


Fig. 2 Pinning diagram.

PINNING

1	DAC1	analogue output 1
2	DAC2	analogue output 2
3	DAC3	analogue output 3
4	SDA	serial data line } I^2C bus
5	SCL	serial clock line } I^2C bus
6	P2	port 2 npn collector output with internal pull-up resistor
7	n.c.	not connected
8	GND	supply return (ground)
9	V_P	positive supply voltage
10	n.c.	not connected
11	P1	port 1 open npn emitter output
12	P2N	inverted P2 output
13	n.c.	not connected
14	n.c.	not connected
15	n.c.	not connected
16	DAC0	analogue output 0

FUNCTIONAL DESCRIPTION

Control

Analogue control is facilitated by four 6-bit digital-to-analogue converters (DAC0 to DAC3). The values of the output voltages from the DACs are set via the I^2C bus.

The high-current output port (P1) is suitable for switching between internal and external RGB signals. It is an open npn emitter output capable of sourcing 14 mA (minimum).

The two output ports (P2 and P2N) can be used for NTSC/PAL switching. These are npn collector outputs with internal pull-up resistors of 10 kΩ (typical). Both outputs are capable of sinking up to 2 mA with a voltage drop of less than 400 mV. If one output is switched on (LOW), the the other output is switched off, and vice versa.

Reset

The power-down-reset mode occurs whenever the positive supply voltage falls below 8,5 V (typical) and resets all registers to a defined state.

OPERATION

Write

The TDA8442 is controlled via the I²C bus (specifications for the I²C bus will be supplied on request). Programming of the TDA8442 is performed using the format shown in Fig. 3.

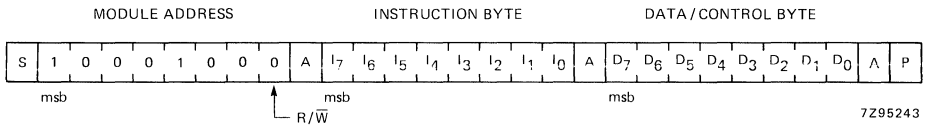
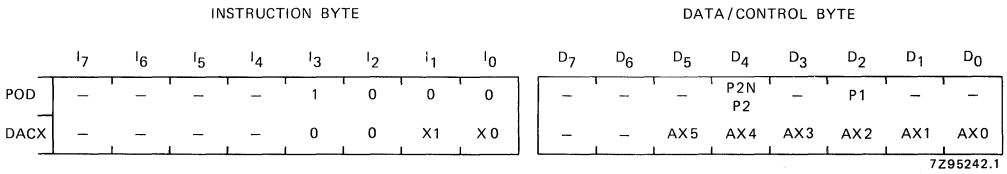


Fig. 3 TDA8442 programming format.

Acknowledge (A) is generated by the TDA8442 only when a valid address is received and the device is not in the power-down-reset mode ($V_P > 8{,}5$ V (typ)).

Control

Control is implemented by the instruction bytes POD (port output data) and DACX (digital-to-analogue convertor control) together with the corresponding data/control bytes (see Fig. 4).



– = don't care

Fig. 4 Control programming.

POD bit P1. If a '1' is programmed, the P1 output is switched on. If a '0' is programmed or after a power-down-reset, the P1 output is switched off (high-impedance state).

POD bit P2/P2N. If a '1' is programmed, the P2 output is switched off and the P2N output is switched on (LOW). If a '0' is programmed, or after a power-down-reset, the P2 output is switched on (LOW) and the P2N output is switched off.

DAX bits AX5 to AX0. The digital-to-analogue convertor selected corresponds to the decimal equivalent of the two bits X1 and X0. The output voltage of the selected DAC is programmed using bits AX5 to AX0, the lowest value being with all data AX5 to AX0 at '0' or when power-down-reset has been activated.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage range (pin 9)	V_P	−0,3 to +13,2	V
Input/output voltage ranges			
(pin 4)	V_{SDA}	−0,3 to +13,2	V
(pin 5)	V_{SCL}	−0,3 to +13,2	V
(pin 6)	V_{P2}	−0,3 to V_P*	V
(pin 12)	V_{P2N}	−0,3 to V_P*	V
(pin 11)	V_{P1}	−0,3 to V_P*	V
(pins 1 to 3 and pin 16)	V_{DAX}	−0,3 to V_P*	V
Total power dissipation	P_{tot}	max. 1	W
Operating ambient temperature range	T_{amb}	−20 to +70	°C
Storage temperature range	T_{stg}	−55 to +125	°C

CHARACTERISTICS

T_{amb} = +25 °C; V_P = 12 V; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supplies					
Supply voltage (pin 9)	V_P	10,8	12,0	13,2	V
Supply currents (no outputs loaded) (pin 9)	I_P	6,5	13	20	mA
I²C bus inputs SDA (pin 4) **and SCL** (pin 5)					
Input voltage HIGH (note 1)	V_{IH}	3,0	–	V_P−1	V
Input voltage LOW	V_{IL}	−0,3	–	1,5	V
Input current HIGH (note 1)	I_{IH}	–	–	10	μA
Input current LOW (note 1)	I_{IL}	–	–	10	μA
I²C bus output SDA (pin 4) (open collector)					
Output voltage LOW at I_{OL} = 3,0 mA	V_{OL}	–	–	0,4	V
Maximum output sink current	I_{OL}	3	5	–	mA

* Pin voltage may exceed V_P if the current in that pin is limited to 10 mA.

parameter	symbol	min.	typ.	max.	unit
Ports P2 and P2N (pins 6 and 12) (npn collector output with pull-up resistor to V_P)					
Internal pull-up resistor to V_P	R_O	5	10	15	kΩ
Output voltage switched on (LOW) at I_{OL} = 2 mA	V_{OL}	–	–	0,4	V
Maximum output sink current	I_{OL}	2	5	–	mA
Leakage current output switched off	$-I_{leak}$	–	–	25	μA
Port P1 (pin 11) (open npn emitter output)					
Output current switched on V_O = 0 to 5 V	I_O	14	–	–	mA
Leakage current switched off V_O = 0 to V_P V	$\pm I_{leak}$	–	–	100	μA
Digital-to-analogue outputs (note 2)					
Output DAC0 (pin 16)					
Maximum output voltage (unloaded) (note 3)	V_{Omax}	3,0	–	–	V
Minimum output voltage (unloaded) (note 3)	V_{Omin}	–	–	1,0	V
Positive value of smallest step at I_O = 2 mA (1 lsb) (note 3)	V_{Olsb}	24	–	100	mV
Deviation from linearity at I_O = 2 mA	ΔV	–	–	150	mV
Output impedance at I_O = −2 to + 2 mA	Z_O	–	–	70	Ω
Maximum output source current	$-I_{OH}$	2	–	6,0	mA
Maximum output sink current	I_{OL}	2	8	–	mA
Output DAC1 (pin 1)					
Maximum output voltage (unloaded) (note 3)	V_{Omax}	4,0	–	–	V
Minimum output voltage (unloaded) (note 3)	V_{Omin}	–	–	1,7	V
Positive value of smallest step at I_O = 2 mA (1 lsb) (note 3)	V_{Olsb}	27	–	120	mV
Deviation from linearity at I_O = 2 mA		–	–	170	mV
Output impedance at I_O = −2 to + 2 mA	Z_O	–	–	70	Ω
Maximum output source current	$-I_{OH}$	2	–	6,0	mA
Maximum output sink current	I_{OL}	2	8	–	mA

CHARACTERISTICS (continued)

parameter	symbol	min.	typ.	max.	unit
Output DAC2 (pin 2)					
Maximum output voltage (unloaded) (note 3)	V_{Omax}	4,0	–	–	V
Minimum output voltage (unloaded) (note 3)	V_{Omin}	–	–	1,7	V
Positive value of smallest step at I_O = 2 mA (1 lsb) (note 3)	V_{Olsb}	27	–	120	mV
Deviation from linearity at I_O = 2 mA		–	–	170	mV
Output impedance at I_O = −2 to + 2 mA	Z_O	–	–	70	Ω
Maximum output source current	$-I_{OH}$	2	–	6,0	mA
Maximum output sink current	I_{OL}	2	8	–	mA
Output DAC3 (pin 3)					
Maximum output voltage (unloaded) (note 3)	V_{Omax}	10,0	–	–	V
Minimum output voltage (unloaded) (note 3)	V_{Omin}	–	–	1,0	V
Positive value of smallest step at I_O = 2 mA (1 lsb) (note 3)	V_{Olsb}	107	–	350	mV
Deviation from linearity at I_O = 2 mA		–	–	0,50	V
Output impedance at I_O = −2 to + 2 mA	Z_O	–	–	70	Ω
Maximum output source current	$-I_{OH}$	2	–	6,0	mA
Maximum output sink current	I_{OL}	2	8	–	mA
Power-down reset					
Maximum value of V_P at which power-down reset is active	V_{PD}	6	–	10	V
Rise time of V_P during power-on (V_P rising from 0 V to V_{PD})	t_r	5	–	–	μs

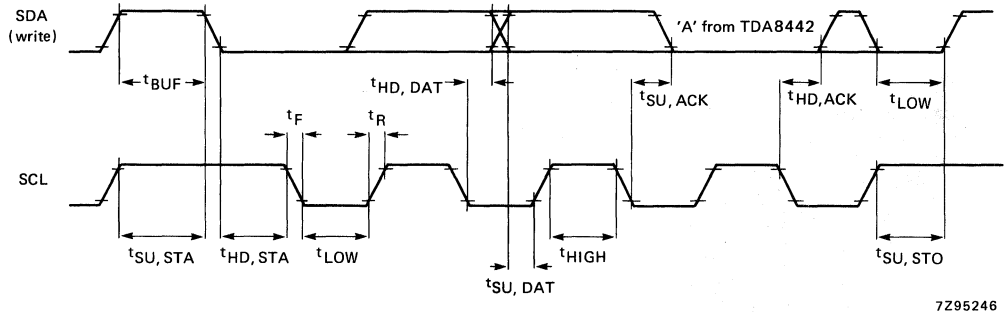
Notes to the characteristics

1. If $V_P < 1$ V, the input current is limited to 10 μA at input voltages up to 13,2 V.
2. Pure capacitive load should be avoided because of possible oscillations.
3. Values are proportional to V_P.

I²C BUS TIMING

Bus loading conditions: 4 kΩ pull-up resistor to +5 V; 200 pF capacitor to GND.
All values are referred to V_{IH} = 3 V and V_{IL} = 1,5 V.

parameter	symbol	min.	typ.	max.	unit
Bus free before start	t_{BUF}	4,0	–	–	μs
Start condition set-up time	$t_{SU,STA}$	4,0	–	–	μs
Start condition hold time	$t_{HD,STA}$	4,0	–	–	μs
LOW period SCL, SDA	t_{LOW}	4,0	–	–	μs
HIGH period SCL	t_{HIGH}	4,0	–	–	μs
Rise time SCL, SDA	t_R	–	–	1,0	μs
Fall time SCL, SDA	t_F	–	–	0,30	μs
Data set-up time (write)	$t_{SU,DAT}$	1	–	–	μs
Data hold time (write)	$t_{HD,DAT}$	1	–	–	μs
Acknowledge (from TDA8442) set-up time	$t_{SU,ACK}$	–	–	3,5	μs
Acknowledge (from TDA8442) hold time	$t_{HD,ACK}$	0	–	–	μs
Stop condition set-up time	$t_{SU,STO}$	4,0	–	–	μs



Reference levels are 10 and 90%

Fig. 5 I²C bus timing, TDA8442.

Purchase of Philips' I²C components conveys a license under the Philips' I²C patent to use the components in the I²C-system provided the system conforms to the I²C specifications defined by Philips.

CONTROL CIRCUIT FOR SWITCHED-MODE POWER SUPPLY

GENERAL DESCRIPTION

The TEA1039 is a bipolar integrated circuit intended for the control of a switched-mode power supply. Together with an external error amplifier and a voltage regulator (e.g. a regulator diode) it forms a complete control system. The circuit is capable of directly driving the SMPS power transistor in small SMPS systems.

It has the following features:

- Suited for frequency and duty factor regulation.
- Suited for flyback converters and forward converters.
- Wide frequency range.
- Adjustable input sensitivity.
- Adjustable minimum frequency or maximum duty factor limit.
- Adjustable overcurrent protection limit.
- Supply voltage out-of-range protection.
- Slow-start facility.

QUICK REFERENCE DATA

Supply voltage	V_{CC}	nom.	14 V
Supply current	I_{CC}	max.	13 mA
Output pulse repetition frequency range	f_o	1 Hz to	100 kHz
Output current LOW	I_{OL}	max.	1 A
Operating ambient temperature range	T_{amb}	−25 to +	125 °C

PACKAGE OUTLINE

9-lead SIL; plastic (SOT-110B).

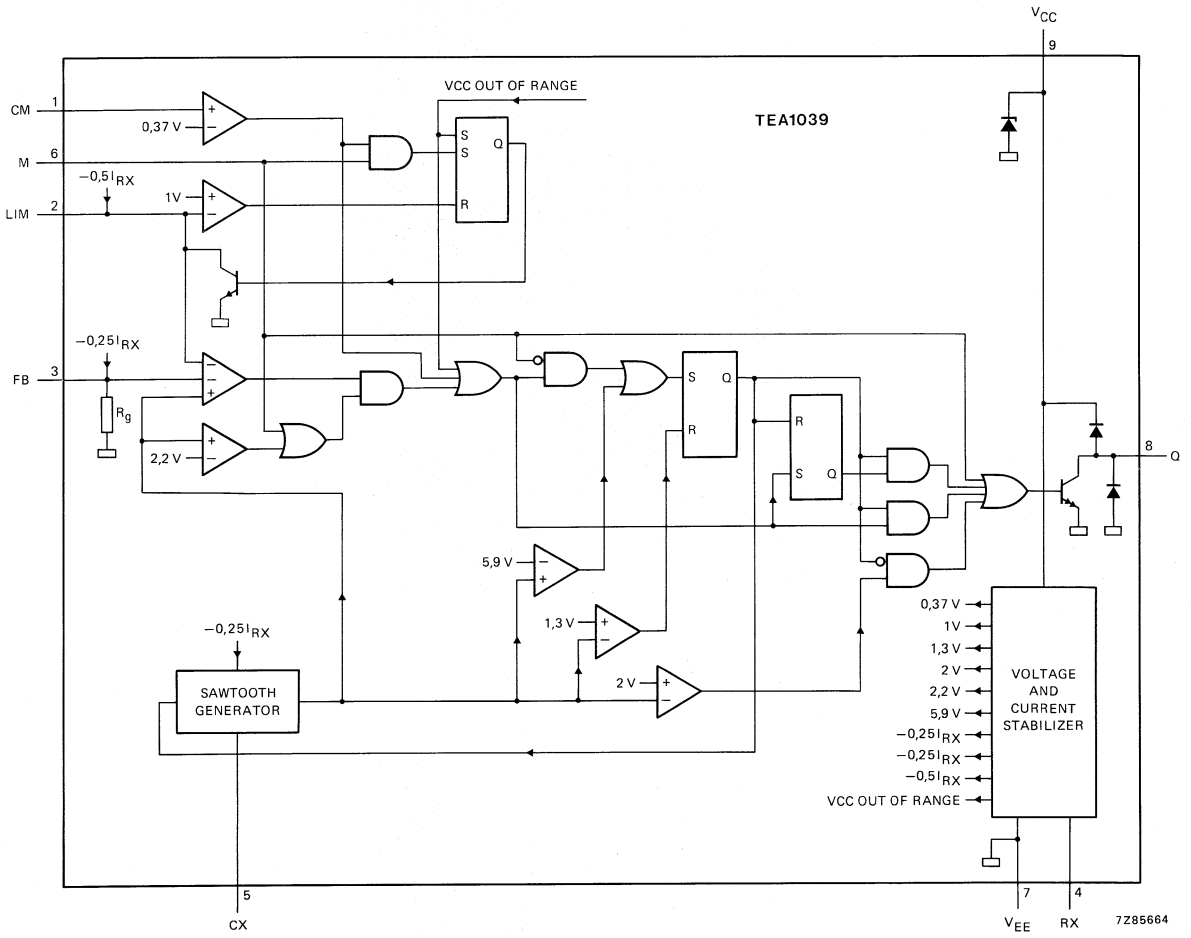


Fig. 1 Block diagram.

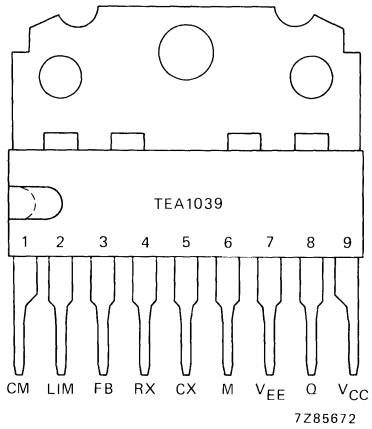


Fig. 2 Pinning diagram.

PINNING

1	CM	overcurrent protection input
2	LIM	limit setting input
3	FB	feedback input
4	RX	external resistor connection
5	CX	external capacitor connection
6	M	mode input
7	V_{EE}	common
8	Q	output
9	V_{CC}	positive supply connection

FUNCTIONAL DESCRIPTION

The TEA1039 produces pulses to drive the transistor in a switched-mode power supply. These pulses may be varied either in frequency (frequency regulation mode) or in width (duty factor regulation mode).

The usual arrangement is such that the transistor in the SMPS is ON when the output of the TEA1039 is HIGH, i.e. when the open-collector output transistor is OFF. The duty factor of the SMPS is the time that the output of the TEA1039 is HIGH divided by the pulse repetition time.

Supply V_{CC} (pin 9)

The circuit is usually supplied from the SMPS that it regulates. It may be supplied either from its primary d.c. voltage or from its output voltage. In the latter case an auxiliary starting supply is necessary.

The circuit has an internal V_{CC} out-of-range protection. In the frequency regulation mode the oscillator is stopped; in the duty factor regulation mode the duty factor is made zero. When the supply voltage returns within its range, the circuit is started with the slow-start procedure.

When the circuit is supplied from the SMPS itself, the out-of-range protection also provides an effective protection against any interruption in the feedback loop.

Mode input M (pin 6)

The circuit works in the frequency regulation mode when the mode input M is connected to ground (V_{EE}, pin 7). In this mode the circuit produces output pulses of a constant width but with a variable pulse repetition time.

The circuit works in the duty factor regulation mode when the mode input M is left open. In this mode the circuit produces output pulses with a variable width but with a constant pulse repetition time.

FUNCTIONAL DESCRIPTION (continued)

Oscillator resistor and capacitor connections RX and CX (pins 4 and 5)

The output pulse repetition frequency is set by an oscillator whose frequency is determined by an external capacitor C5 connected between the CX connection (pin 5) and ground (V_{EE}, pin 7), and an external resistor R_4 connected between the RX connection (pin 4) and ground. The capacitor C5 is charged by an internal current source, whose current level is determined by the resistor R4. In the frequency regulation mode these two external components determine the minimum frequency; in the duty factor regulation mode they determine the working frequency (see Fig. 4). The output pulse repetition frequency varies less than 1% with the supply voltage over the supply voltage range.

In the frequency regulation mode the output is LOW from the start of the cycle until the voltage on the capacitor reaches 2 V. The capacitor is further charged until its voltage reaches the voltage on either the feedback input FB or the limit setting input LIM, provided it has exceeded 2,2 V. As soon as the capacitor voltage reaches 5,9 V the capacitor is discharged rapidly to 1,3 V and a new cycle is initiated (see Figs 5 and 6).

For voltages on the FB and LIM inputs lower than 2,2 V, the capacitor is charged until this voltage is reached; this sets an internal maximum frequency limit.

In the duty factor regulation mode the capacitor is charged from 1,3 V to 5,9 V and discharged again at a constant rate. The output is HIGH until the voltage on the capacitor exceeds the voltage on the feedback input FB; it becomes HIGH again after discharge of the capacitor (see Figs 7 and 8). An internal maximum limit is set to the duty factor of the SMPS by the discharging time of the capacitor.

Feedback input FB (pin 3)

The feedback input compares the input current with an internal current source whose current level is set by the external resistor R4. In the frequency regulation mode, the higher the voltage on the FB input, the longer the external capacitor C5 is charged, and the lower the frequency will be. In the duty factor regulation mode external capacitor C5 is charged and discharged at a constant rate, the voltage on the FB input now determines the moment that the output will become LOW. The higher the voltage on the FB input, the longer the output remains HIGH, and the higher the duty factor of the SMPS.

Limit setting input LIM (pin 2)

In the frequency regulation mode this input sets the minimum frequency, in the duty factor regulation mode it sets the maximum duty factor of the SMPS. The limit is set by an external resistor R2 connected from the LIM input to ground (pin 7) and by an internal current source, whose current level is determined by external resistor R4.

A slow-start procedure is obtained by connecting a capacitor between the LIM input and ground. In the frequency regulation mode the frequency slowly decreases from f_{max} to the working frequency. In the duty factor regulation mode the duty factor slowly increases from zero to the working duty factor.

Overcurrent protection input CM (pin 1)

A voltage on the CM input exceeding 0,37 V causes an immediate termination of the output pulse. In the duty factor regulation mode the circuit starts again with the slow-start procedure.

Output Q (pin 8)

The output is an open-collector n-p-n transistor, only capable of sinking current. It requires an external resistor to drive an n-p-n transistor in the SMPS (see Figs 9 and 10).

The output is protected by two diodes, one to ground and one to the supply.

At high output currents the dissipation in the output transistor may necessitate a heatsink. See the power derating curve (Fig. 3).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage range, voltage source	V_{CC}	−0,3 to +20	V
Supply current range, current source	I_{CC}	−30 to +30	mA
Input voltage range, all inputs	V_I	−0,3 to +6	V
Input current range, all inputs	I_I	−5 to +5	mA
Output voltage range	V_{8-7}	−0,3 to +20	V
Output current range			
output transistor ON	I_8	0 to 1	A
output transistor OFF	I_8	−100 to + 50	mA
Storage temperature range	T_{stg}	−55 to +150	°C
Operating ambient temperature range (see Fig. 3)	T_{amb}	−25 to +125	°C
Power dissipation (see Fig. 3)	P_{tot}	max. 2	W

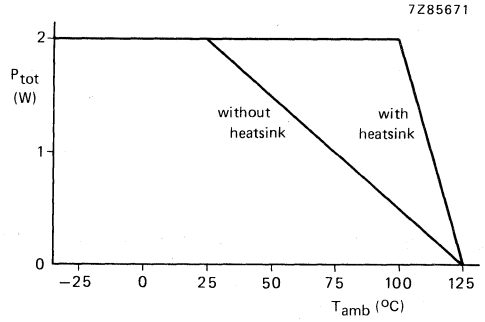


Fig. 3 Power derating curve.

CHARACTERISTICS

V_{CC} = 14 V; T_{amb} = 25 °C unless otherwise specified

	symbol	min.	typ.	max.	unit
Supply V_{CC} (pin 9)					
Supply voltage, operating	V_{CC}	11	14	20	V
Supply current					
at V_{CC} = 11 V	I_{CC}	–	7,5	11	mA
at V_{CC} = 20 V	I_{CC}	–	9	12	mA
variation with temperature	$\frac{\Delta I_{CC}/I_{CC}}{\Delta T}$	–	–0,3	–	%/K
Supply voltage, internally limited					
at I_{CC} = 30 mA	V_{CC}	23,5	–	28,5	V
variation with temperature	$\Delta V_{CC}/\Delta T$	–	18	–	mV/K
Low supply threshold voltage	V_{CCmin}	9	10	11	V
variation with temperature	$\Delta V_{CC}/\Delta T$	–	–5	–	mV/K
High supply threshold voltage	V_{CCmax}	21	23	24,6	V
variation with temperature	$\Delta V_{CC}/\Delta T$	–	10	–	mV/K
Feedback input FB (pin 3)					
Input voltage for duty factor = 0; M input open	V_{3-7}	0	–	0,3	V
Internal reference current	$-I_{FB}$	–	0,5 I_{RX}	–	mA
Internal resistor R_g	R_g	–	130	–	kΩ
Limit setting input LIM (pin 2)					
Threshold voltage	V_{2-7}	–	1	–	V
Internal reference current	$-I_{LIM}$	–	0,25 I_{RX}	–	mA
Overcurrent protection input CM (pin 1)					
Threshold voltage	V_{1-7}	300	370	420	mV
variation with temperature	$\Delta V_{1-7}/\Delta T$	–	0,2	–	mV/K
Propagation delay, CM input to output	t_{PHL}	–	500	–	ns

CHARACTERISTICS (continued)

	symbol	min.	typ.	max.	unit
Oscillator connections RX and CX (pins 4 and 5)					
Voltage at RX connection at $-I_4$ = 0,15 to 1 mA	V_{4-7}	6,2	7,2	8,1	V
variation with temperature	$\Delta V_{4-7}/\Delta T$	–	2,1	–	mV/K
Lower sawtooth level	V_{LS}	–	1,3	–	V
Threshold voltage for output H to L transition in F mode	V_{FT}	–	2	–	V
Threshold voltage for maximum frequency in F mode	V_{FM}	–	2,2	–	V
Higher sawtooth level	V_{HS}	–	5,9	–	V
Internal capacitor charging current, CX connection	$-I_{CX}$	–	0,25 I_{RX}	–	mA
Oscillator frequency (output pulse repetition frequency)	f_o	1	–	10^5	Hz
Minimum frequency in F mode, initial deviation	$\Delta f/f$	−10	–	10	%
variation with temperature	$\frac{\Delta f/f}{\Delta T}$	–	0,034	–	%/K
Maximum frequency in F mode, initial deviation	$\Delta f/f$	−20	–	+20	%
variation with temperature	$\frac{\Delta f/f}{\Delta T}$	–	−0,16	–	%/K
Output LOW time in F mode, initial deviation	$\Delta t/t$	−25	–	+25	%
variation with temperature	$\frac{\Delta t/t}{\Delta T}$	–	0,2	–	%/K
Pulse repetition frequency in D mode, initial deviation	$\Delta f/f$	−10	–	10	%
variation with temperature	$\frac{\Delta f/f}{\Delta T}$	–	0,034	–	%/K
Minimum output LOW time in D mode at C_5 = 3,6 nF	t_{OLmin}	–	1	–	μs
variation with temperature	$\frac{\Delta t/t}{\Delta T}$	–	0,2	–	%/K
Output Q (pin 8)					
Output voltage LOW at I_8 = 100 mA	V_{8-7}	–	0,8	1,2	V
variation with temperature	$\Delta V_{8-7}/\Delta T$	–	1,5	–	mV/K
Output voltage LOW at I_8 = 1 A	V_{8-7}	–	1,7	2,1	V
variation with temperature	$\Delta V_{8-7}/\Delta T$	–	−1,4	–	mV/K

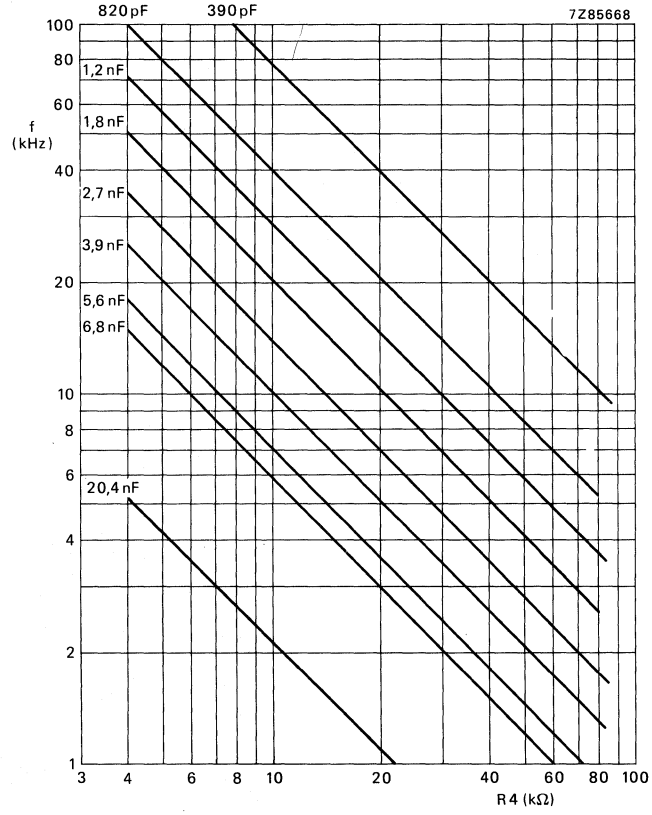


Fig. 4 Minimum pulse repetition frequency in the frequency regulation mode, and working pulse repetition frequency in the duty factor regulation mode, as a function of external resistor R4 connected between RX and ground with external capacitor C5 connected between CX and ground as a parameter.

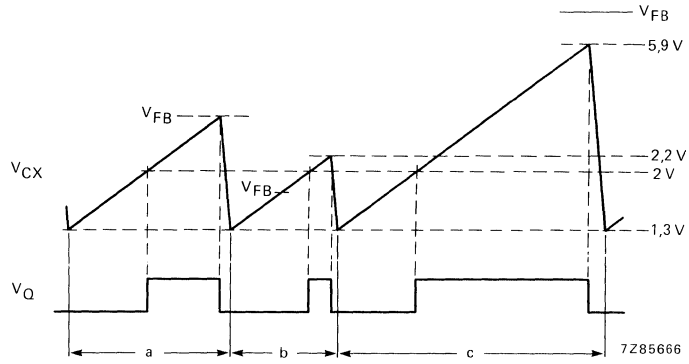


Fig. 5 Timing diagram for the frequency regulation mode showing the voltage on external capacitor C5 connected between CX and ground and the output voltage as a function of time for three combinations of input signals. *a:* The voltages on inputs FB or LIM are between 2,2 V and 5,9 V. The circuit is in its normal regulation mode. *b:* The voltage on input FB or input LIM is lower than 2,2 V. The circuit works at its maximum frequency. *c:* The voltages on inputs FB and LIM are higher than 5,9 V. The circuit works at its minimum frequency.

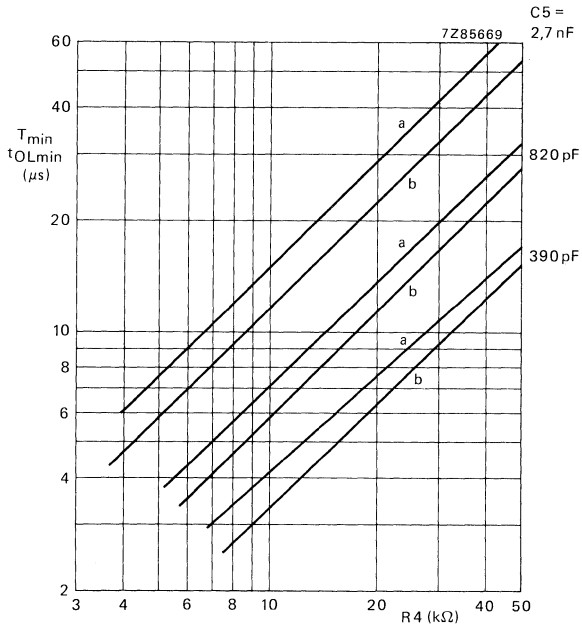


Fig. 6 Minimum output pulse repetition time T_{min} (curves a) and minimum output LOW time t_{OLmin} (curves b) in the frequency regulation mode as a function of external resistor R4 connected between RX and ground with external capacitor C5 connected between CX and ground as a parameter.

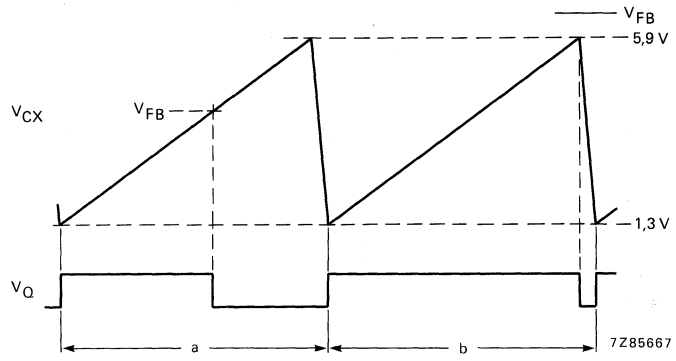


Fig. 7 Timing diagram for the duty factor regulation mode showing the voltage on external capacitor C5 connected between CX and ground and the output voltage as a function of time for two combinations of input signals. *a:* The voltages on inputs FB or LIM are below 5,9 V. The circuit is in its normal regulation range. *b:* The voltages on inputs FB and LIM are higher than 5,9 V. The circuit produces its minimum output LOW time, giving the maximum duty factor of the SMPS.

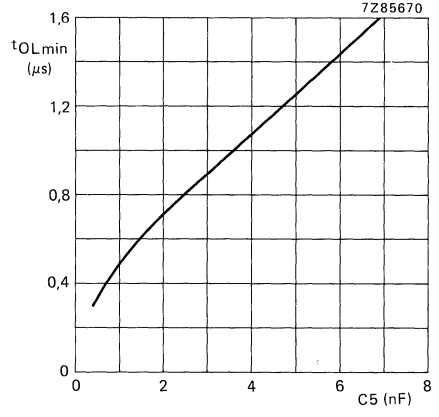


Fig. 8 Minimum output LOW time t_{OLmin} in the duty factor regulation mode as a function of external capacitor C5 connected between CX and ground. In this mode the minimum output LOW time is independent of R4 for values of R4 between 4 kΩ and 80 kΩ.

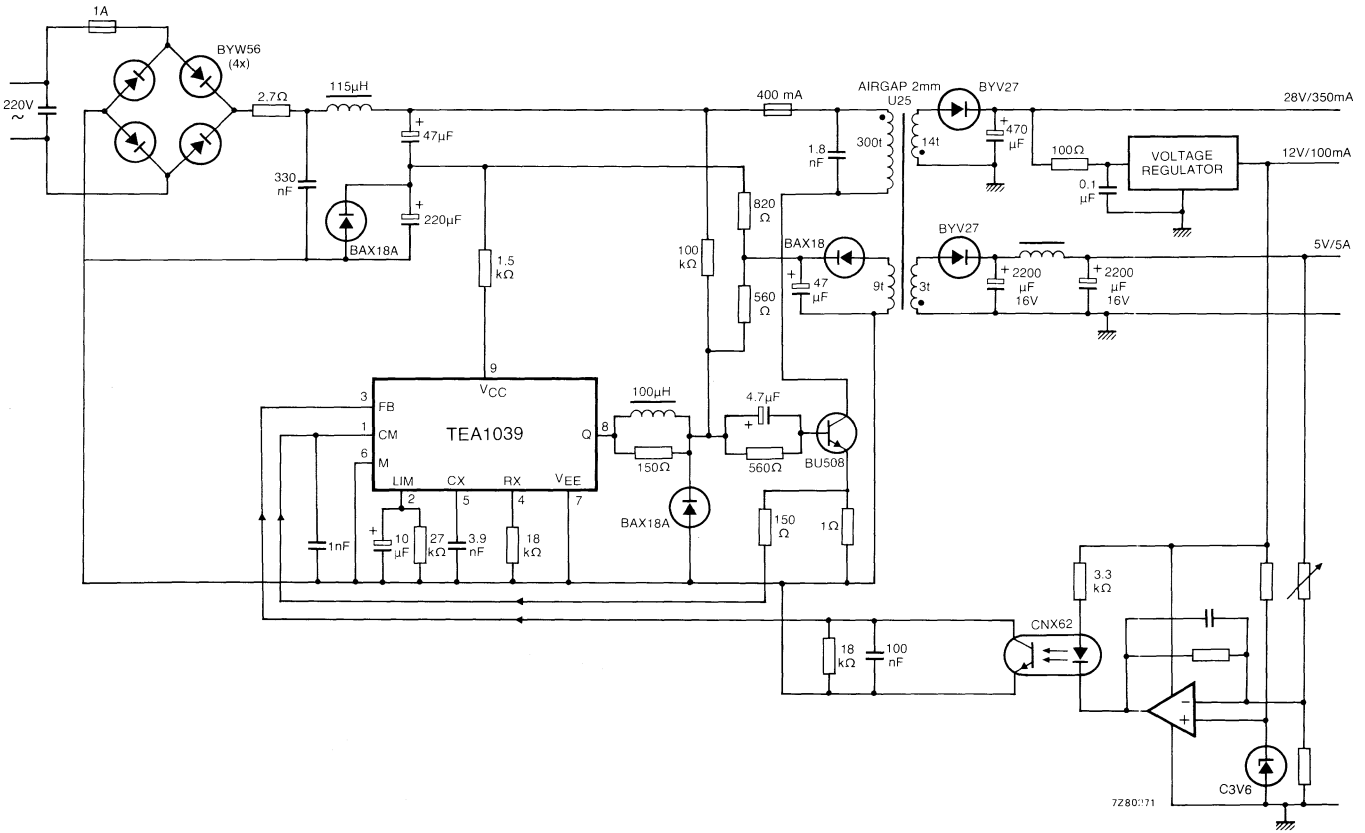


Fig. 9 Typical application of the TEA1039 in a variable-frequency flyback converter switched-mode power supply. An optocoupler CNX62 is used for voltage separation.

APPLICATION INFORMATION SUPPLIED ON REQUEST

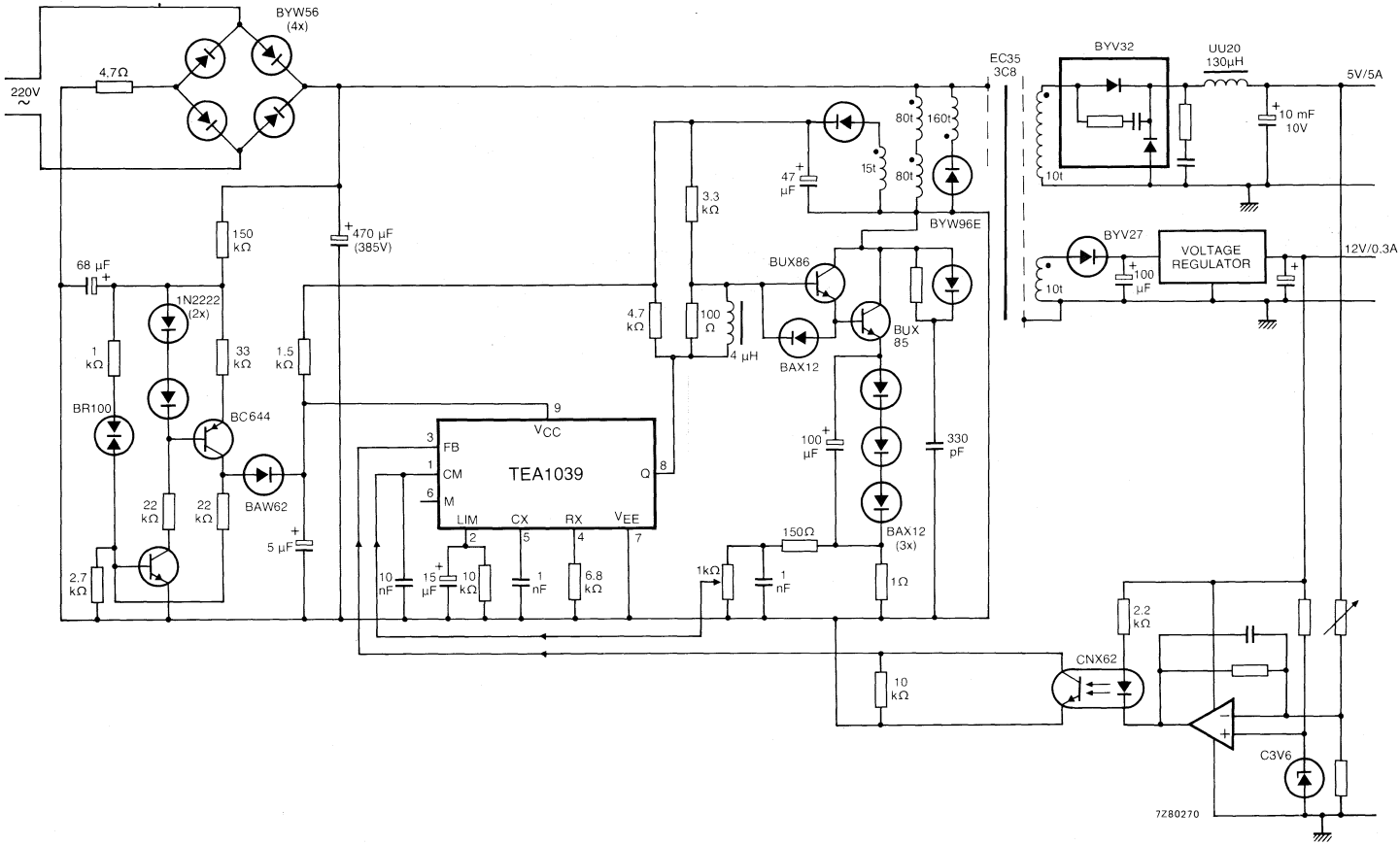


Fig. 10 Typical application of the TEA1039 in a fixed-frequency, variable duty factor forward converter switched-mode power supply. An optocoupler CNX62 is used for voltage separation.

APPLICATION INFORMATION SUPPLIED ON REQUEST

PAL/NTSC COLOUR ENCODER

GENERAL DESCRIPTION

The TEA2000 is a monolithic integrated circuit, which encodes colour information and provides composite video output for driving a VHF or UHF modulator.

Features

- European PAL and American NTSC/M standard selectable
- Internal generation of burst timing and PAL-switch-function
- 6 bit binary TTL compatible input provides 64 different colours
- TTL compatible colour blanking input
- TTL compatible sync input

QUICK REFERENCE DATA

Supply voltage	$V_{11\text{-}9}$	typ.	12 V
Supply current at $V_{11\text{-}9}$ = 12 V	I_{11}	typ.	55 mA
Input voltage pins 1,2,3,4,5,14,16,17,18	V_{IL}	max.	0,8 V
	V_{IH}	min.	2,0 V
Composite video output (sync tip to white)	$V_{6\text{-}9(p\text{-}p)}$	typ.	2,0 V
Operating temperature range	T_{amb}		0 to + 70 °C ←

PACKAGE OUTLINE

18-lead DIL; plastic with internal heat spreader (SOT-102).

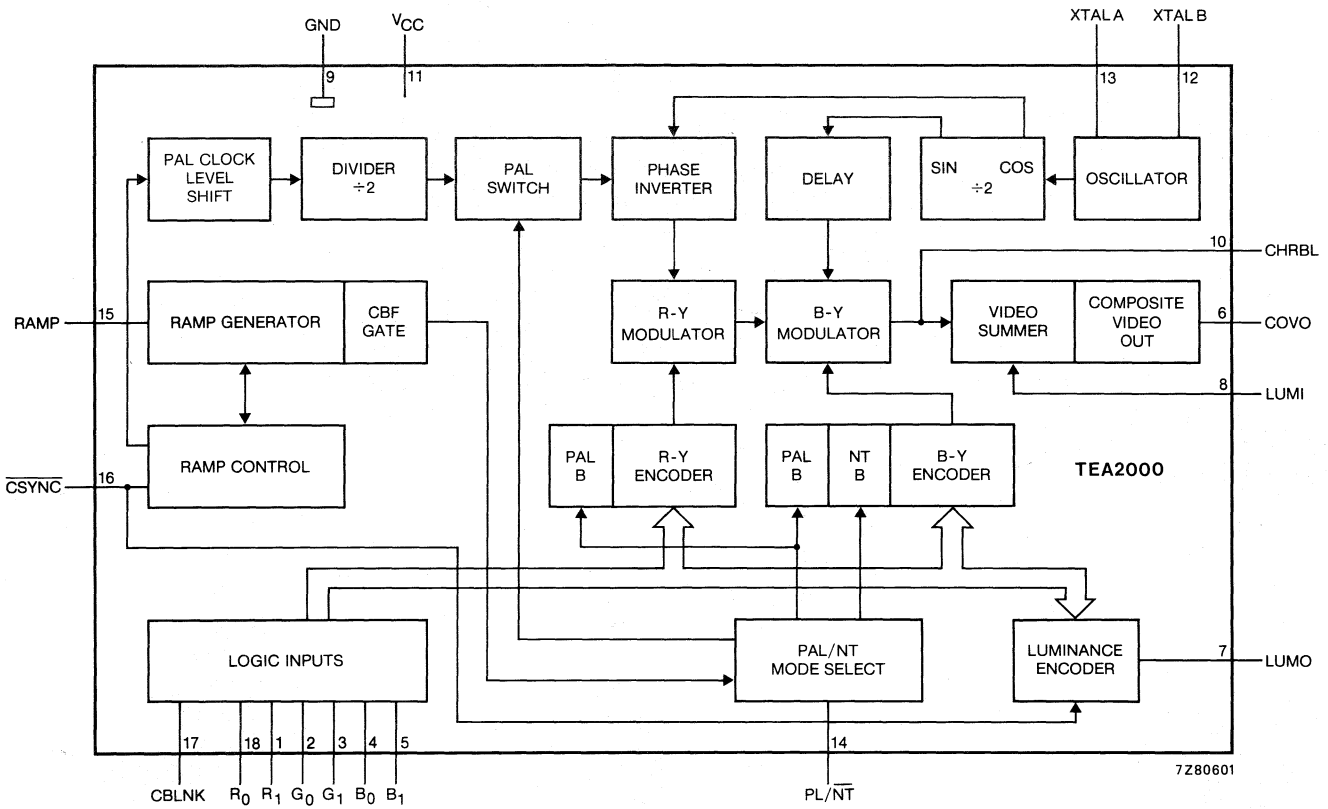


Fig. 1 Block diagram.

PINNING

1. Red 1 binary input
2. Green 0 binary input
3. Green 1 binary input
4. Blue 0 binary input
5. Blue 1 binary input
6. Composite video output
7. Luminance output to delay line
8. Luminance input from delay line
9. Ground 0 volt
10. Chrominance band limiting
11. Supply voltage
12. } Oscillator inputs { 7,16 MHz crystal for NTSC
13. } { 8,86 MHz crystal for PAL
14. PAL/NTSC switch
15. Ramp
16. Composite sync input ($\overline{\text{CSYNC}}$)
17. Composite blanking input (CBLNK)
18. Red 0 binary input

FUNCTIONAL DESCRIPTION

The TEA2000 PAL/NTSC colour encoder and video summer integrated circuit has an internal oscillator from which the (R-Y) and (B-Y) waveforms are generated. The TEA2000 accepts timing signals (composite sync, composite blanking) and a 6 bit binary coded input giving colour information. The inputs are organized as 2 bits per primary colour and gamma correction is applied to the resultant luminance and chrominance levels. Each of the equally spaced intensity levels (for each primary colour) is combined with those of the other primary colours. This produces 64 output colours comprising a wide range of saturated and desaturated colours, black, white and two levels of grey. The resultant output is a composite video signal compatible with the PAL and NTSC/M standards.

PIN DESCRIPTION

R0, R1, G0, G1, B0, B1, pins 18, 1,2,3,4 and 5.
These are the red, green and blue logic inputs. 2 bits per primary colour. These inputs are TTL compatible.

$\overline{\text{CSYNC}}$, pin 16.

Composite sync input requiring a negative logic signal, TTL compatible. For PAL operation the field sync must include line sync information.

XTALA, XTALB, pins 12 and 13.

Oscillator inputs. A crystal in series with a trimmer capacitor is connected between pins 12 and 13. The output of the oscillator is divided to provide the four subcarrier phases required in the encoder. The crystal frequencies are:

PAL mode 8,867238 MHz
NTSC mode 7,15909 MHz

LUMO, LUMI, pins 7 and 8.

Luminance output and input. The combined luminance and sync signal appearing at pin 7 must be d.c. coupled to pin 8 via an appropriate luminance delay line or resistor network. Resistors must have a tolerence of ± 5%, or better, as they affect the d.c. level at COVO, pin 6.

CHRBL, pin 10.

Chrominance filtering can be accomplished by connecting a chrominance frequency tuned filter (4,43 MHz or 3,57 MHZ), via a blocking capacitor to pin 10. This point is the chrominance summing junction and has a nominal internal impedance of 1,5 kΩ. If a filter is used at this point then the delay caused to the chrominance signal should be compensated by an appropriate luminance delay line.

COVO, pin 6.

Composite video output is internally buffered giving a nominal output voltage swing of 2 V sync-white and a nominal sync 5 V level.

PL/$\overline{\text{NT}}$, pin 14.

PAL/NTSC, select input selects PAL mode when HIGH and NTSC mode when LOW. This input is TTL compatable. An internal pull-up resistor selects PAL if the pin is not connected.

RAMP, pin 15.

Ramp timing component connection. A capacitor and resistor connected to pin 15 provide timing information for the colour burst and for PAL phase switching. Alternative components may be used to optimise for NTSC operation.

V_{CC}, pin 11.

12 volt supply.

GND, pin 9.

Ground connection, zero volts.

CBLNK, pin 17.

Blanking input when high, switches off colour inputs. CBLNK must be high during sync and colour burst unless colour inputs are all low at this time. This input is TTL compatible.

RATINGS

Limiting values in accordance with Absolute Maximum System (IEC 134)

Supply voltage V_{11-9}	max.	13,2	V
Voltages, pin 1,2,3,4,5,14,16,17,18	max.	V_{11-9}	V
Storage temperature		−20 to +125	°C
→ Operating ambient temperature		0 to + 70	°C

CHARACTERISTICS

V_{11-9} = 12 V; T_{amb} = 25 °C; measured in Fig. 3 unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply					
Supply voltage	V_{11-9}	10,8	12	13,2	V
Supply current V_{11-9} = 12 V	I_{11}	–	55	–	mA
Oscillator stability, pins 12 and 13					
Crystal type 4322 143 04051					
V_P = 10,8 to 12 V		–	+50	–	Hz
V_P = 12 to 13,2 V		–	–50	–	Hz
Digital inputs					
$\overline{CSYNC}$, CBLNK, PL/$\overline{NT}$ pins 16,17,14					
R0,R1,G0,G1,B0,B1 pins 18,1,2,3,4,5					
V_{IN} (LOW)	V_{IL}	–0,5	–	0,8	V
V_{IN} (HIGH)	V_{IH}	2	–	V_{11-9}	V
Input capacitance	C_i	–	–	10	pF
Input rise and fall times	t_r,t_f	–	–	200	ns
$\overline{CSYNC}$, CBLNK, R0,R1,G0,G1,B0,B1 pins 16,17,18,1,2,3,4,5					
Input current d.c. for V_{IN} = 0 V	I_{IL}	–	–	–100	μA
Input current d.c. for V_{IN} = 2 V	I_{IH}	–	–	20	μA
PL/$\overline{NT}$, pin 14					
Input current d.c. for V_{IN} = 0 V	I_{IL}	–	–	–500	μA
Input current d.c. for V_{IN} = 2 V	I_{IH}	–	–	–200	μA
Composite video output, pin 6					
Output amplitude (sync tip-white)	$V_{6-9\ (p-p)}$	–	2	–	V
Sync tip level	V_{6-9}	–	5	–	V
Output load resistor	R_{6-9}	0,47	1	–	kΩ
Variation of output amplitude					
T_{amb} = 0 to +70 °C	$V_{(p-p)}$	–	–	tbf	%
Over supply range					
V_{11-9} = 10,8 to 13,2 V	ΔV	–	–	tbf	%
Output impedance (with 1 kΩ load)	R_L	–	15	–	Ω
Residual chrominance on white	ΔV_{rms}	–	30	–	mV
Tolerance on luminance amplitude	ΔV	–	10	–	%
Tolerance on chrominance amplitude	ΔV	–	10	–	%
Tolerance on chrominance phase	ΔΩ	–	tbf	–	%
Chrominance band limiting, pin 10					
Internal resistance	R_{10-11}	–	1,5	–	kΩ
Luminance delay, pins 7 and 8					
Nominal series resistor (±5%)	R_S	–	1,2	–	kΩ
Nominal load resistor at luminance input (±5%)	R_L	–	1	–	kΩ
Ramp timing, pin 15 (see Fig. 4)					
With external RC circuit					
R = 36 kΩ; C = 330 pF (note 1)					
Start of burst from line sync	t_b	–	5,7	–	μs
Burst width	t_w	–	2,5	–	μs
Threshold for seperation of equalizing pulses and sync pulses	t	36	44	56	μs

Note: 1. A figure of 5 pF is assumed for external capacitance. This figure includes temperature dependence of the components.

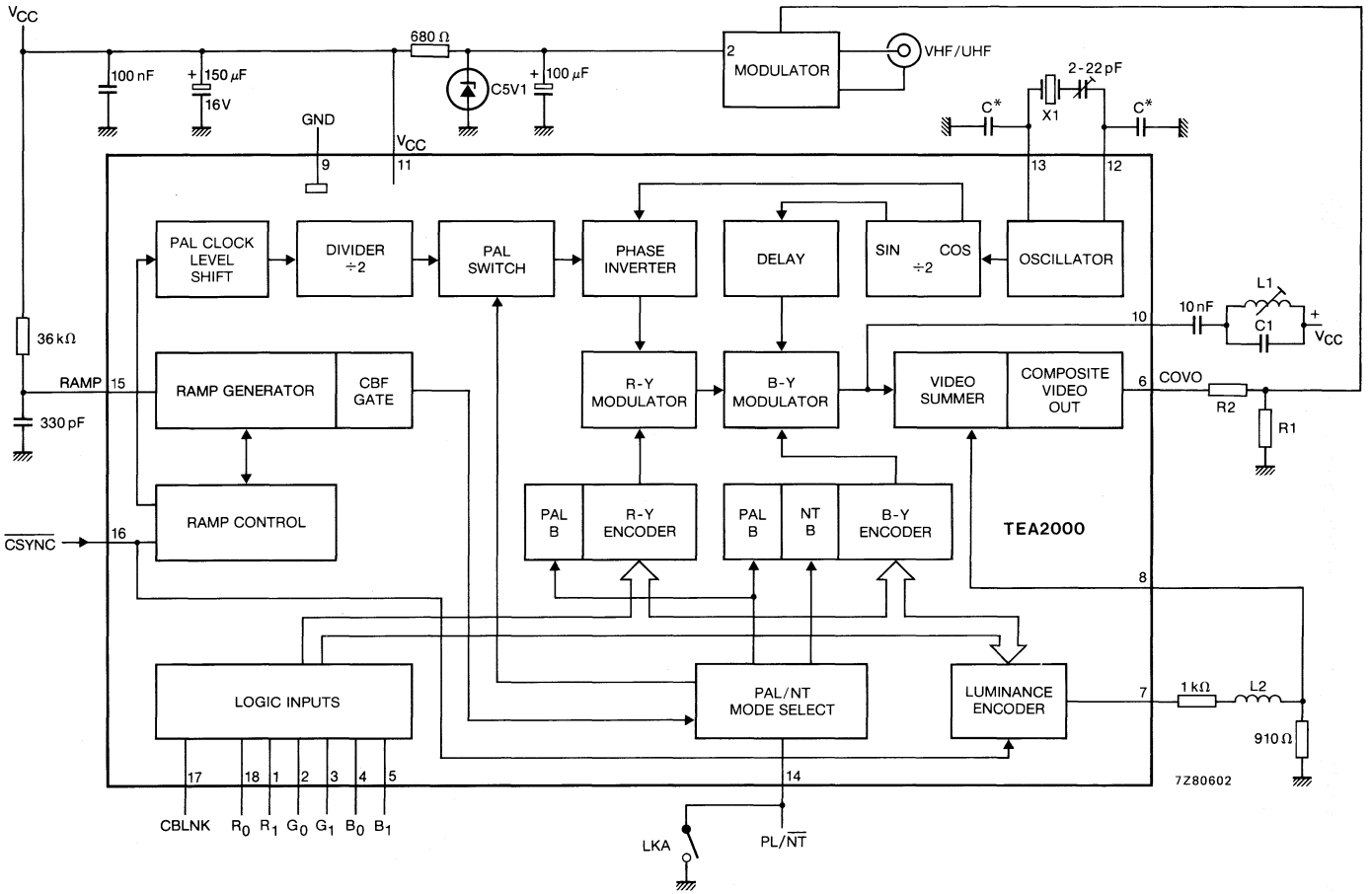


Fig. 2 Internal circuit details and typical external connections.

X1 (PAL) = 8,867238 MHz
X1 (NTSC) = 7,159100 MHz
C* = 5,6 pF only for mask version 1

COMPONENT	PAL	NTSC
L1	15 μH	18 μH
C1	82 pF	100 pF
L2	DL270	DL330
R1	430 Ω	510 Ω
R2	510 Ω	750 Ω
M1	UM1233	UM1622
LKA	o/c	made

Component list for Fig. 2.

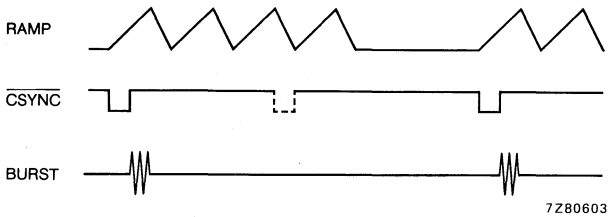
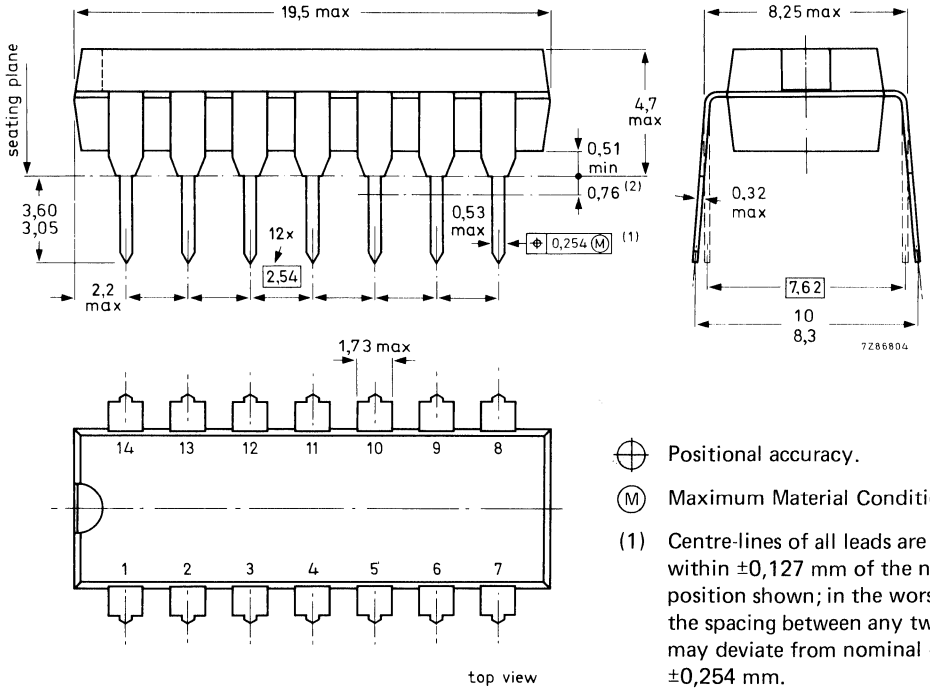


Fig. 3 Ramp timing.

PACKAGE OUTLINES

14-LEAD DUAL IN-LINE; PLASTIC (SOT-27K,M,T,P)



⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

Dimensions in mm

SOLDERING

1. By hand

Apply the soldering iron below the seating plane (or not more than 2 mm above it).
If its temperature is below 300 °C it must not be in contact for more than 10 seconds; if between 300 °C and 400 °C, for not more than 5 seconds.

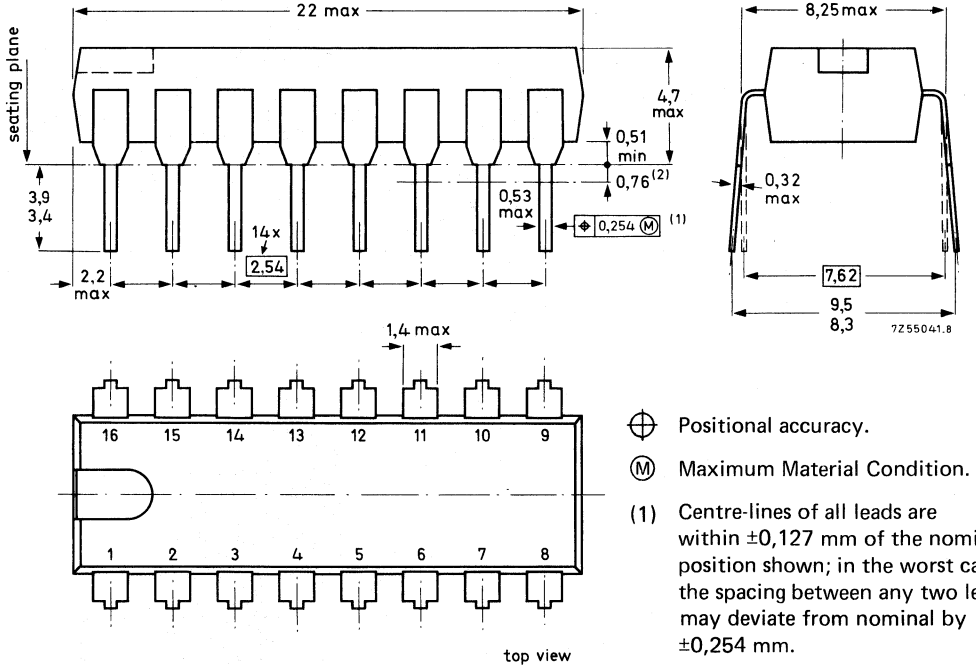
2. By dip or wave

The maximum permissible temperature of the solder is 260 °C; this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.
The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified storage maximum. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

3. Repairing soldered joints

The same precautions and limits apply as in (1) above.

16-LEAD DUAL IN-LINE; PLASTIC (SOT-38)



⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

Dimensions in mm

SOLDERING

1. By hand

Apply the soldering iron below the seating plane (or not more than 2 mm above it).
If its temperature is below 300 °C it must not be in contact for more than 10 seconds; if between 300 °C and 400 °C, for not more than 5 seconds.

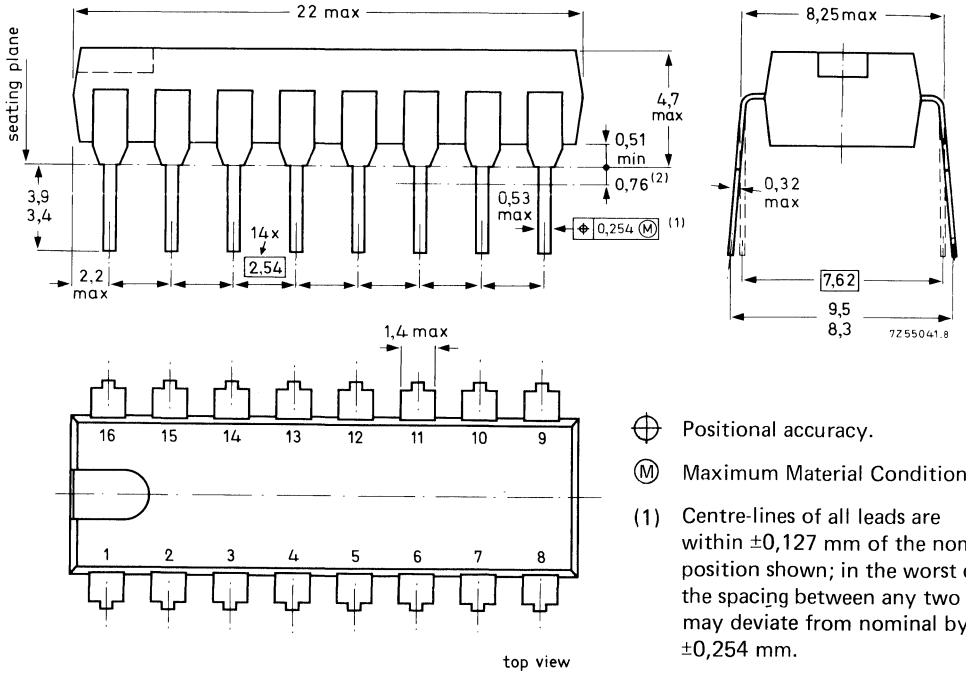
2. By dip or wave

The maximum permissible temperature of the solder is 260 °C; this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.
The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified storage maximum. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

3. Repairing soldered joints

The same precautions and limits apply as in (1) above.

16-LEAD DUAL IN-LINE; PLASTIC (SOT-38WE-1)



⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

Dimensions in mm

SOLDERING

1. By hand

Apply the soldering iron below the seating plane (or not more than 2 mm above it).
If its temperature is below 300 °C it must not be in contact for more than 10 seconds; if between 300 °C and 400 °C, for not more than 5 seconds.

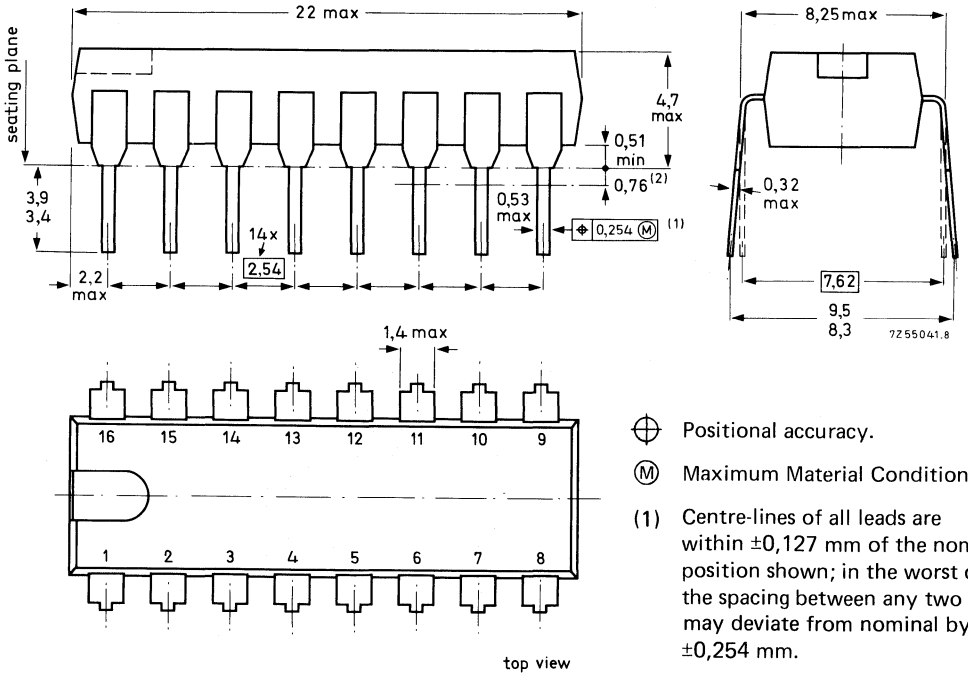
2. By dip or wave

The maximum permissible temperature of the solder is 260 °C; this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.
The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified storage maximum. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

3. Repairing soldered joints

The same precautions and limits apply as in (1) above.

16-LEAD DUAL IN-LINE; PLASTIC WITH INTERNAL HEAT SPREADER (SOT-38WE-2)(SOT-38WE-9)



⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

Dimensions in mm

SOLDERING

1. By hand

Apply the soldering iron below the seating plane (or not more than 2 mm above it).
If its temperature is below 300 °C it must not be in contact for more than 10 seconds; if between 300 °C and 400 °C, for not more than 5 seconds.

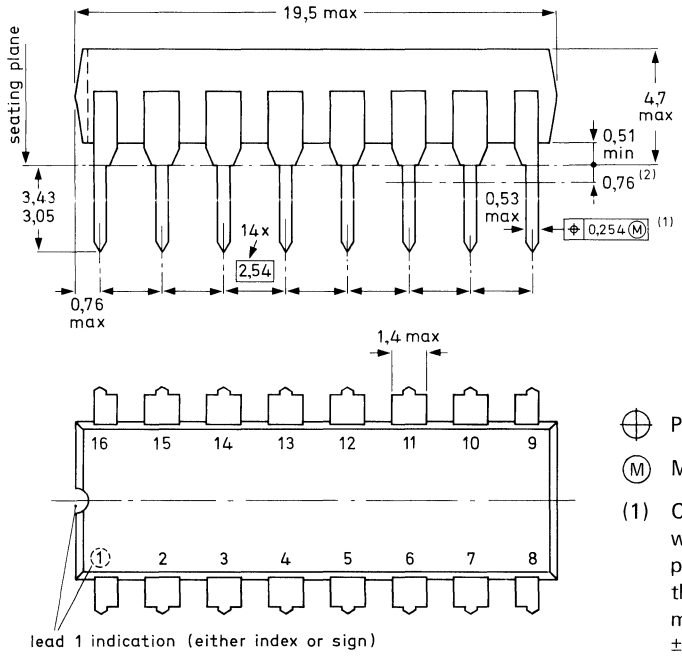
2. By dip or wave

The maximum permissible temperature of the solder is 260 °C; this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.
The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified storage maximum. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

3. Repairing soldered joints

The same precautions and limits apply as in (1) above.

16-LEAD DUAL IN-LINE; PLASTIC (SOT-38Z)



⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

Dimensions in mm

SOLDERING

1. By hand

Apply the soldering iron below the seating plane (or not more than 2 mm above it).
If its temperature is below 300 °C it must not be in contact for more than 10 seconds; if between 300 °C and 400 °C, for not more than 5 seconds.

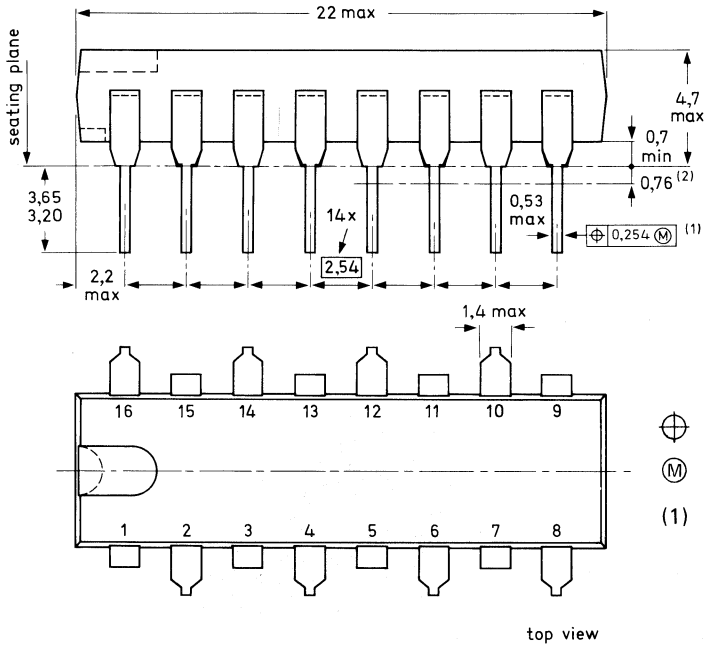
2. By dip or wave

The maximum permissible temperature of the solder is 260 °C; this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.
The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified storage maximum. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

3. Repairing soldered joints

The same precautions and limits apply as in (1) above.

16-LEAD QUADRUPLE IN-LINE; PLASTIC (SOT-58)



⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

Dimensions in mm

SOLDERING

1. By hand

Apply the soldering iron below the seating plane (or not more than 2 mm above it).
If its temperature is below 300 °C it must not be in contact for more than 10 seconds; if between 300 °C and 400 °C, for not more than 5 seconds.

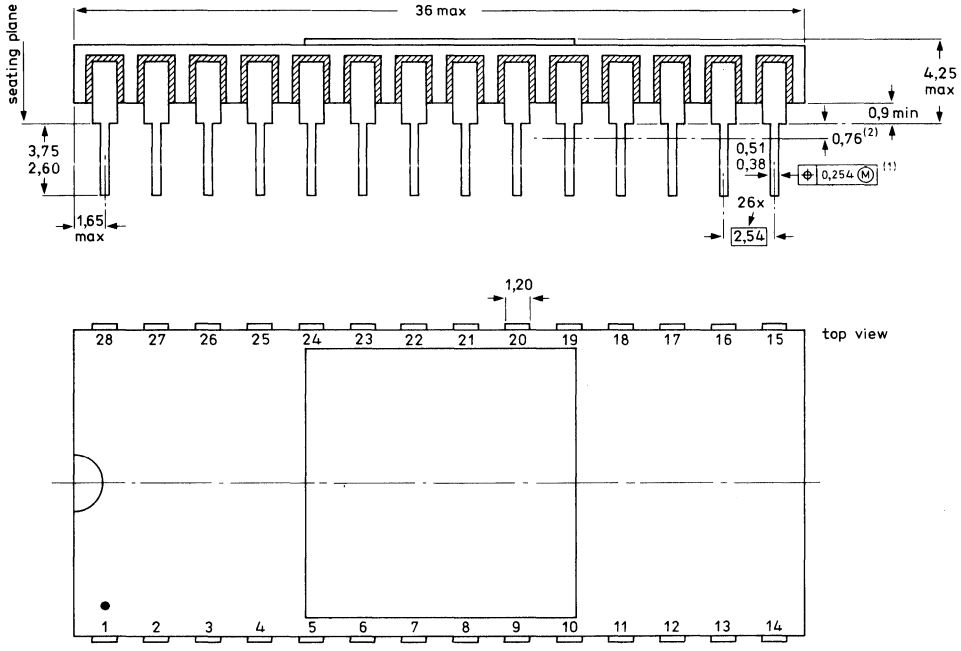
2. By dip or wave

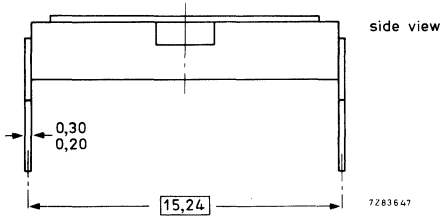
The maximum permissible temperature of the solder is 260 °C; this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.
The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified storage maximum. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

3. Repairing soldered joints

The same precautions and limits apply as in (1) above.

28-LEAD DUAL IN-LINE; METAL CERAMIC (CERDIL) (SOT-87B)





Dimensions in mm

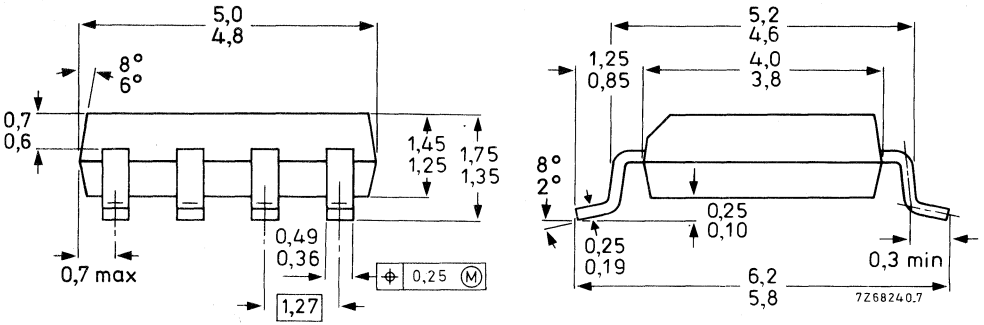
⊕ Positional accuracy.

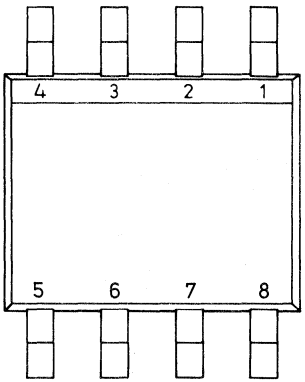
Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

8-LEAD MINI-PACK; PLASTIC (SO-8; SOT-96A)





top view

Dimensions in mm

⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

SOLDERING

The reflow solder technique

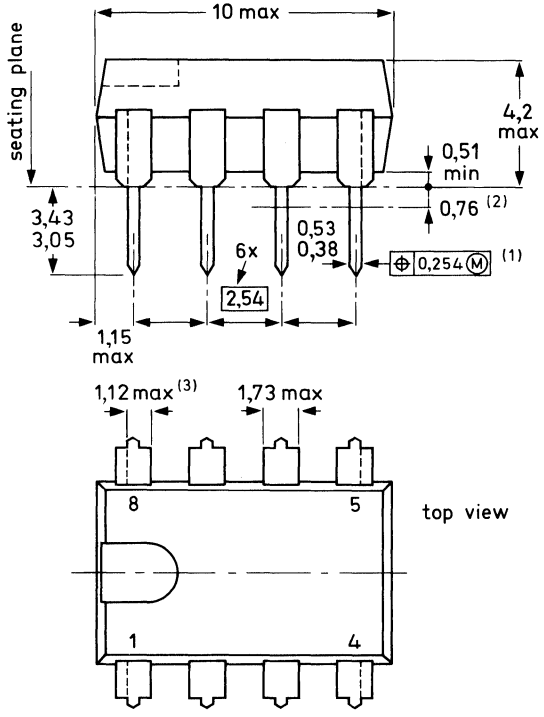
The preferred technique for mounting miniature components on hybrid thick or thin-film circuits is reflow soldering. Solder is applied to the required areas on the substrate by dipping in a solder bath or, more usually, by screen printing a solder paste. Components are put in place and the solder is reflowed by heating.

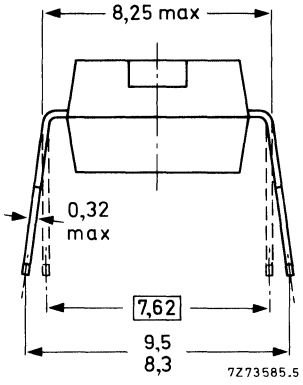
Solder pastes consist of very finely powdered solder and flux suspended in an organic liquid binder. They are available in various forms depending on the specification of the solder and the type of binder used. For hybrid circuit use, a tin-lead solder with 2 to 4% silver is recommended. The working temperature of this paste is about 220 to 230 °C when a mild flux is used.

For printing the paste onto the substrate a stainless steel screen with a mesh of 80 to 105 μm is used for which the emulsion thickness should be about 50 μm. To ensure that sufficient solder paste is applied to the substrate, the screen aperture should be slightly larger than the corresponding contact area.

The contact pins are positioned on the substrate, the slight adhesive force of the solder paste being sufficient to keep them in place. The substrate is heated to the solder working temperature preferably by means of a controlled hot plate. The soldering process should be kept as short as possible: 10 to 15 seconds is sufficient to ensure good solder joints and evaporation of the binder fluid.
After soldering, the substrate must be cleaned of any remaining flux.

8-LEAD DUAL IN-LINE; PLASTIC (SOT-97A)





Dimensions in mm

⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

(3) Only for devices with asymmetrical end-leads.

SOLDERING

1. By hand

Apply the soldering iron below the seating plane (or not more than 2 mm above it).
If its temperature is below 300 °C it must not be in contact for more than 10 seconds; if between 300 °C and 400 °C, for not more than 5 seconds.

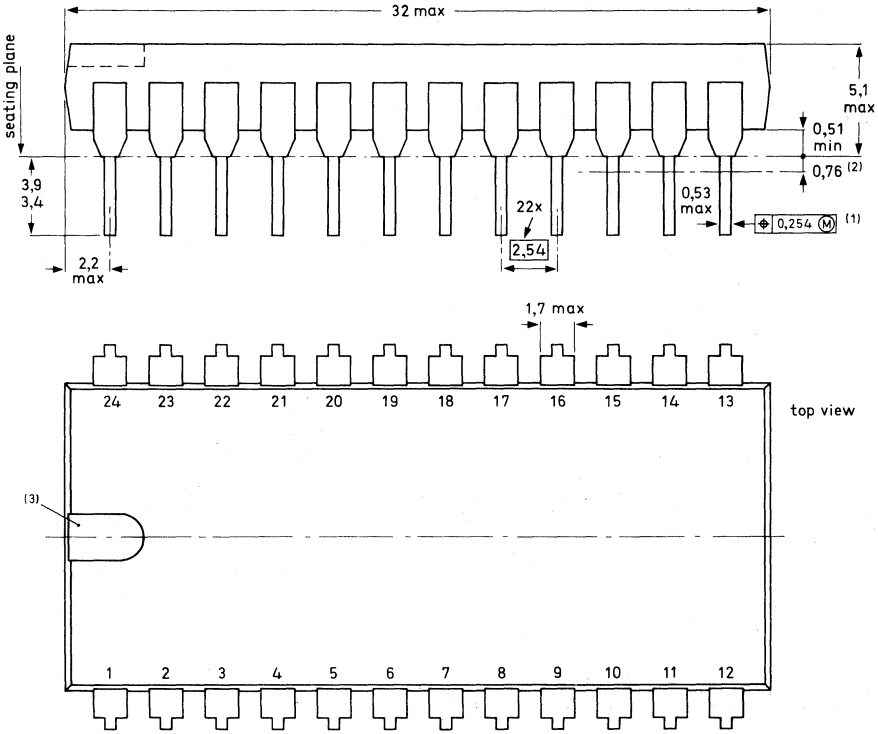
2. By dip or wave

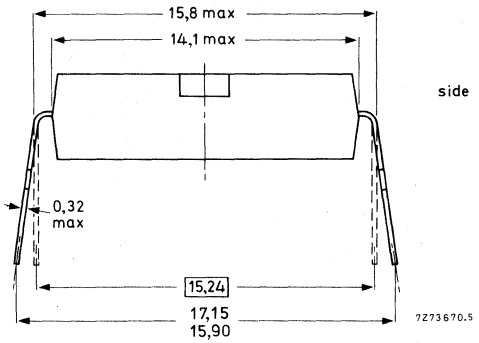
The maximum permissible temperature of the solder is 260 °C; this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.
The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified storage maximum. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

3. Repairing soldered joints

The same precautions and limits apply as in (1) above.

24-LEAD DUAL IN-LINE; PLASTIC (WITH INTERNAL HEAT SPREADER) (SOT-101,A,B,BE)





⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

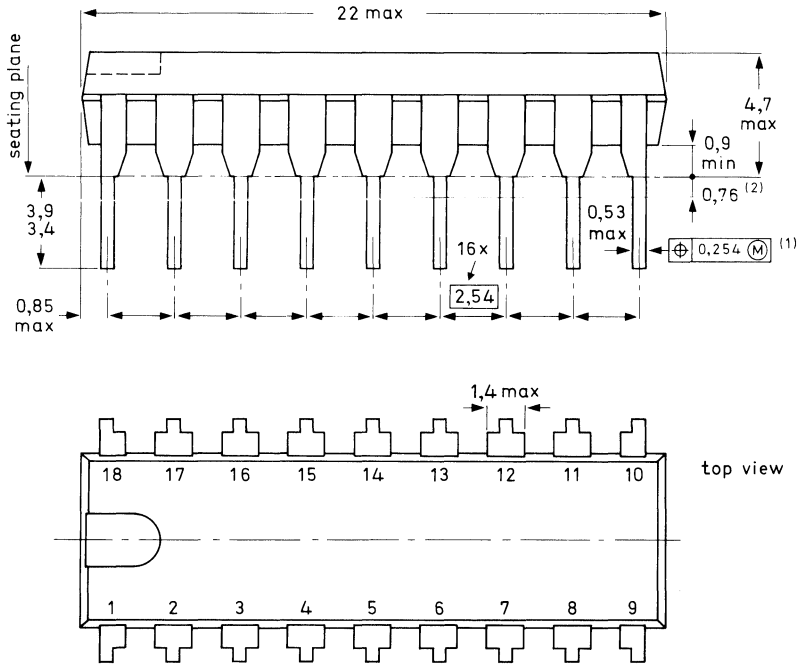
(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

(3) Index may be horizontal as shown, or vertical.

Dimensions in mm

18-LEAD DUAL IN-LINE; PLASTIC (SOT-102CS, HE, KE)



⊕ Positional accuracy.

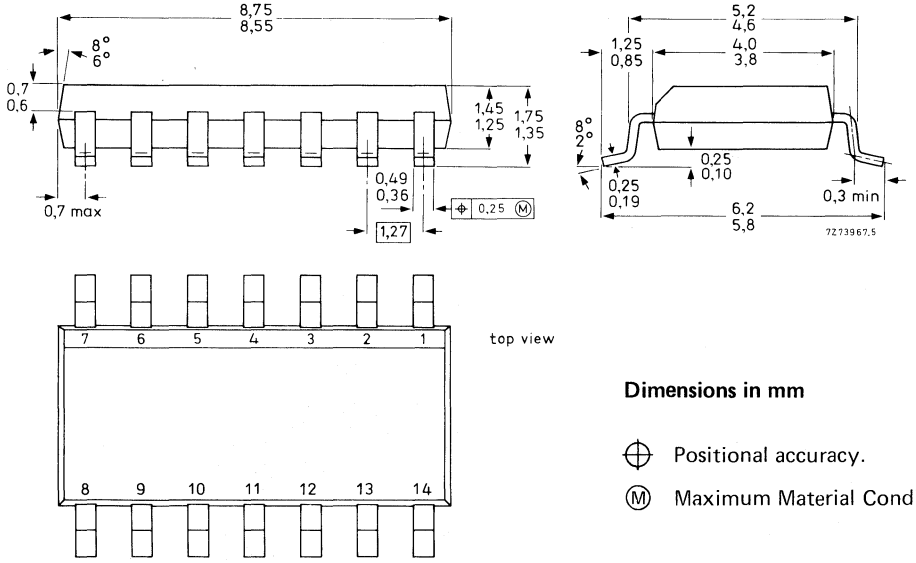
Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

Dimensions in mm

14-LEAD MINI-PACK; PLASTIC (SO-14; SOT-108A)



Dimensions in mm

⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

SOLDERING

The reflow solder technique

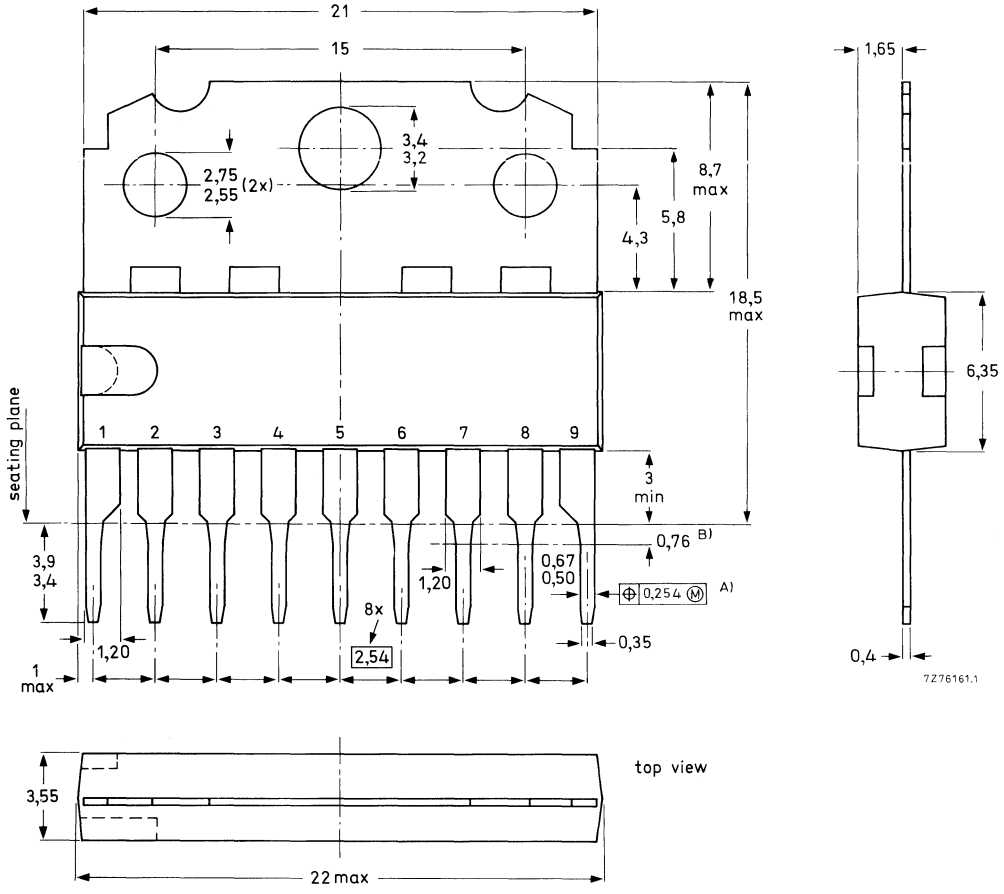
The preferred technique for mounting miniature components on hybrid thick or thin-film circuits is reflow soldering. Solder is applied to the required areas on the substrate by dipping in a solder bath or, more usually, by screen printing a solder paste. Components are put in place and the solder is reflowed by heating.

Solder pastes consist of very finely powdered solder and flux suspended in an organic liquid binder. They are available in various forms depending on the specification of the solder and the type of binder used. For hybrid circuit use, a tin-lead solder with 2 to 4% silver is recommended. The working temperature of this paste is about 220 to 230 °C when a mild flux is used.

For printing the paste onto the substrate a stainless steel screen with a mesh of 80 to 105 μm is used for which the emulsion thickness should be about 50 μm. To ensure that sufficient solder paste is applied to the substrate, the screen aperture should be slightly larger than the corresponding contact area.

The contact pins are positioned on the substrate, the slight adhesive force of the solder paste being sufficient to keep them in place. The substrate is heated to the solder working temperature preferably by means of a controlled hot plate. The soldering process should be kept as short as possible: 10 to 15 seconds is sufficient to ensure good solder joints and evaporation of the binder fluid.
After soldering, the substrate must be cleaned of any remaining flux.

9-LEAD SINGLE IN-LINE; PLASTIC (SOT-110B)



Dimensions in mm

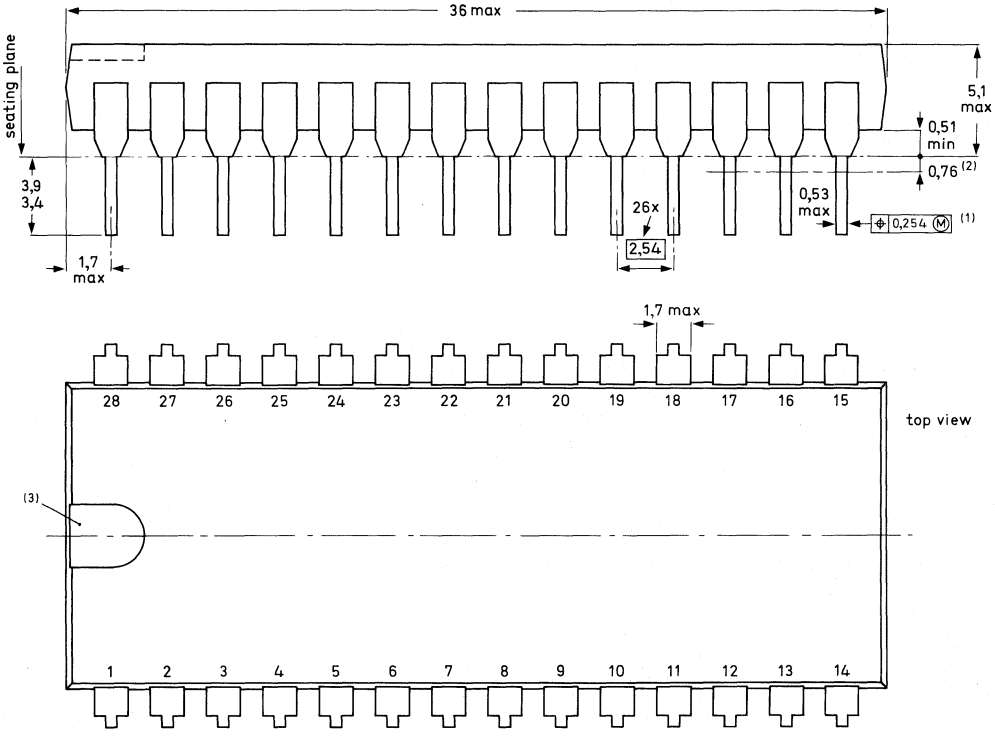
⊕ Positi··al accuracy.

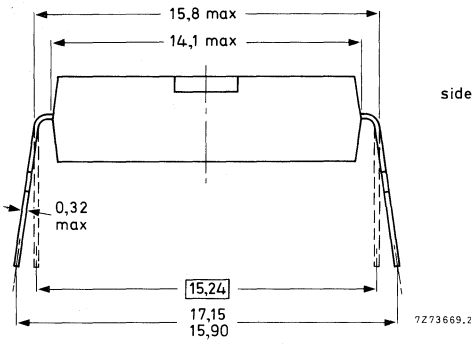
Ⓜ · Material Condition.

·f all leads are
·mm of the nominal
in the worst case,
·en any two leads
·ominal by

· apply
line

28-LEAD DUAL IN-LINE; PLASTIC (SOT-117)





⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

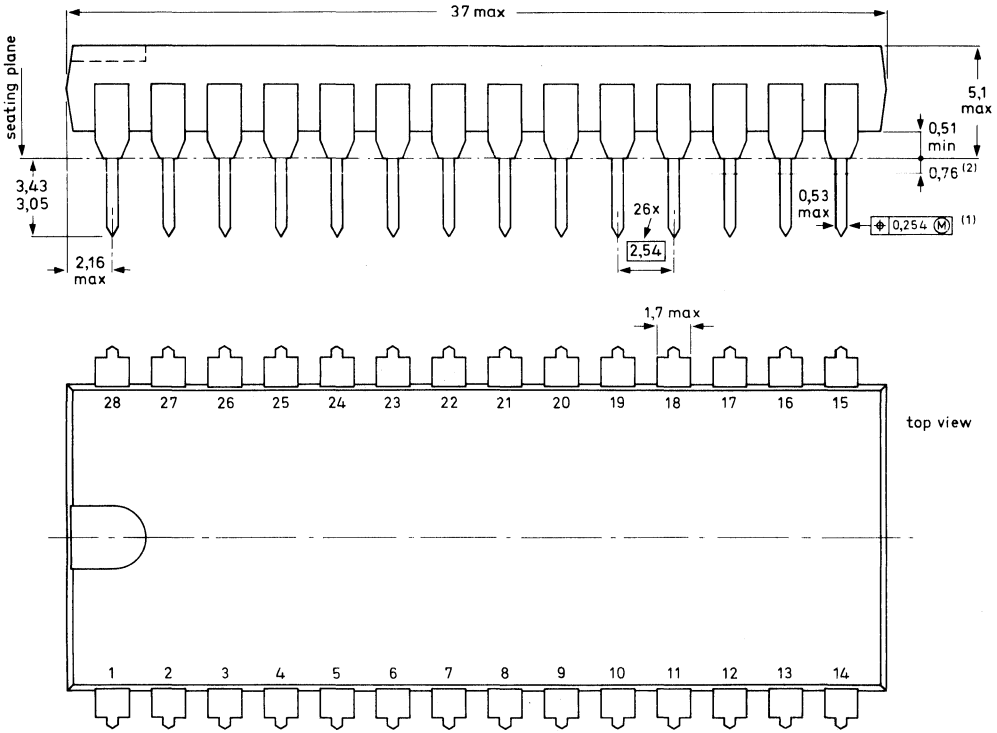
(3) Index may be horizontal as shown, or vertical.

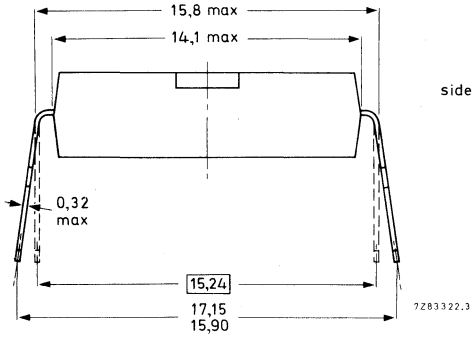
Dimensions in mm

SOLDERING

See SOT-38.

28-LEAD DUAL IN-LINE; PLASTIC (SOT-117A,D)





⊕ Positional accuracy.

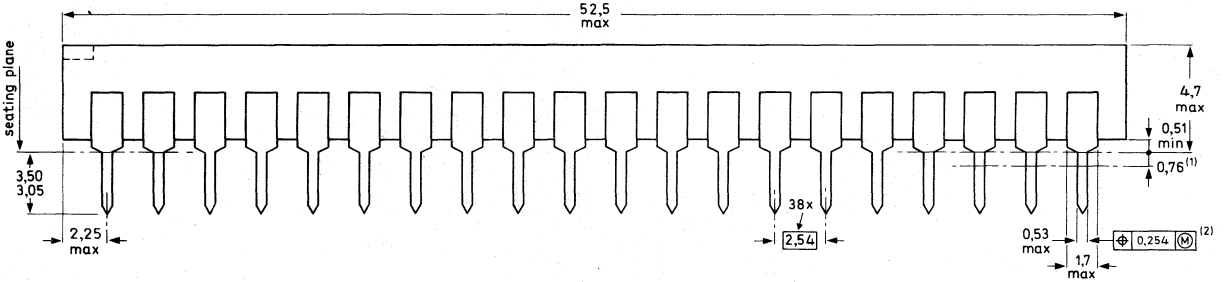
Ⓜ Maximum Material Condition.

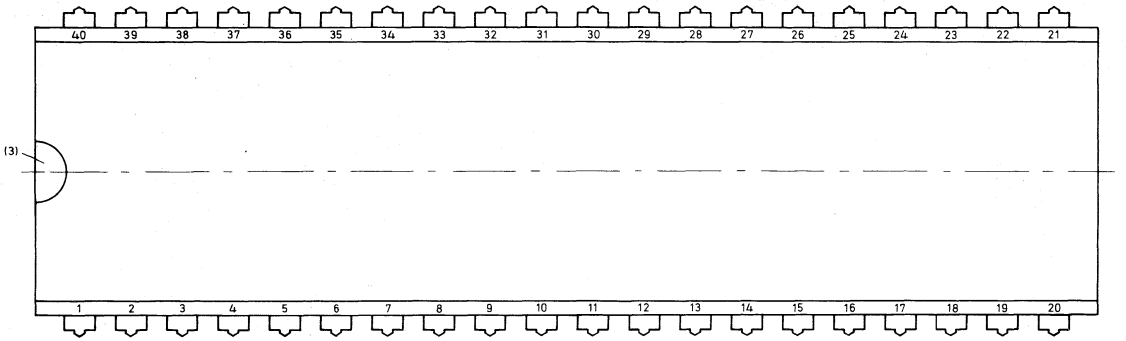
(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

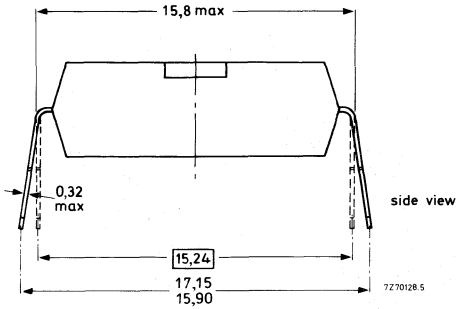
Dimensions in mm

40-LEAD DUAL IN-LINE; PLASTIC (SOT-129)





top view



side view

⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

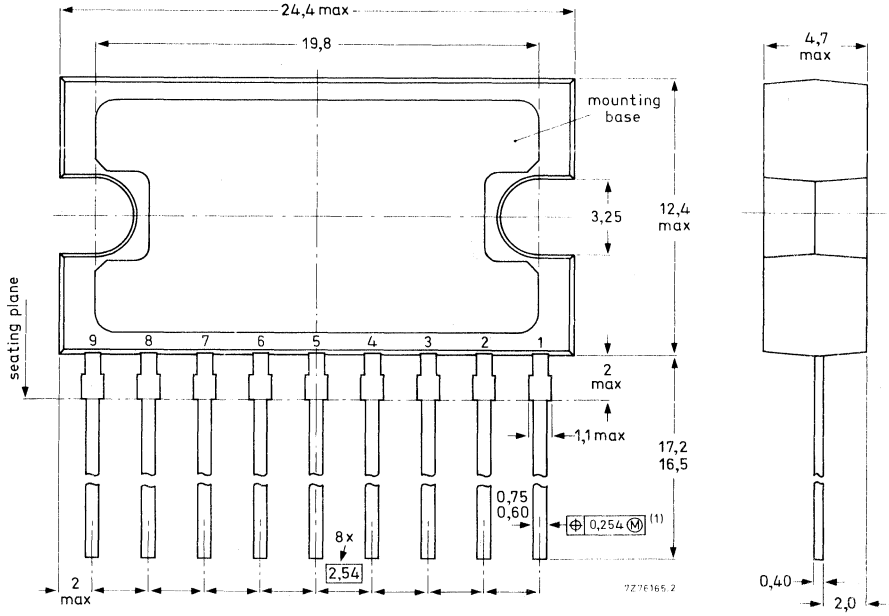
(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

(3) Index may be horizontal as shown, or vertical.

Dimensions in mm

9-LEAD SINGLE IN-LINE; PLASTIC POWER (SOT-131A, B)



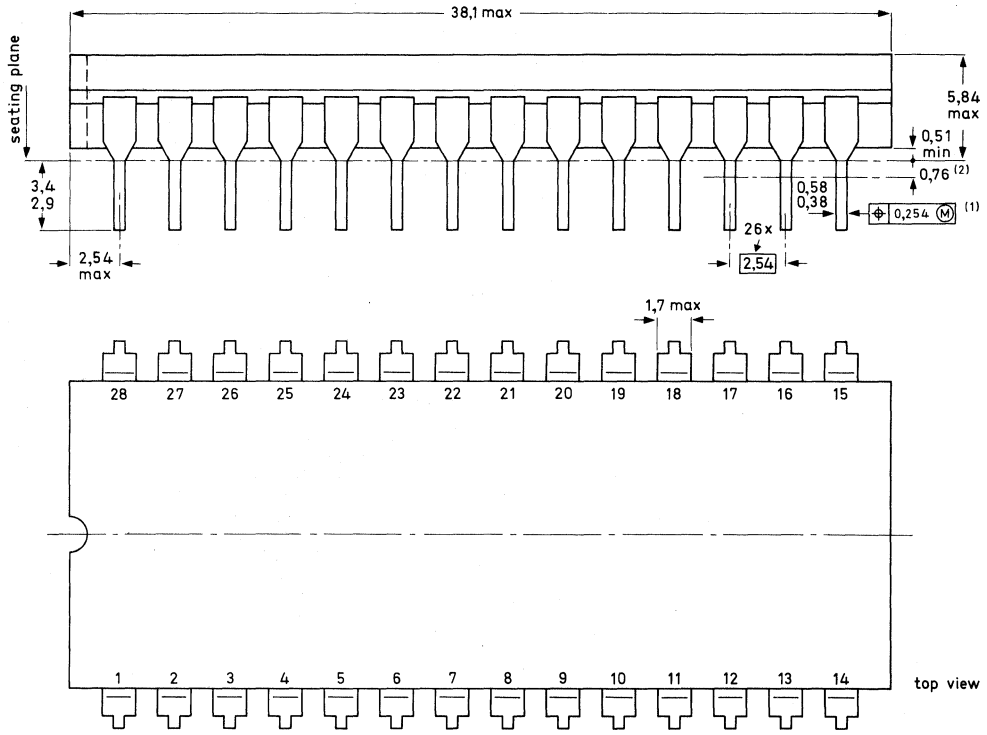
Dimensions in mm

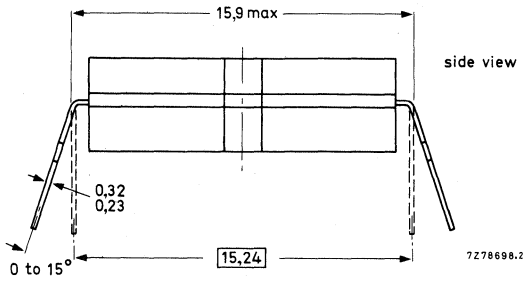
⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

28-LEAD DUAL IN-LINE; CERAMIC (CERDIP) (SOT-135A)





⊕ Positional accuracy.

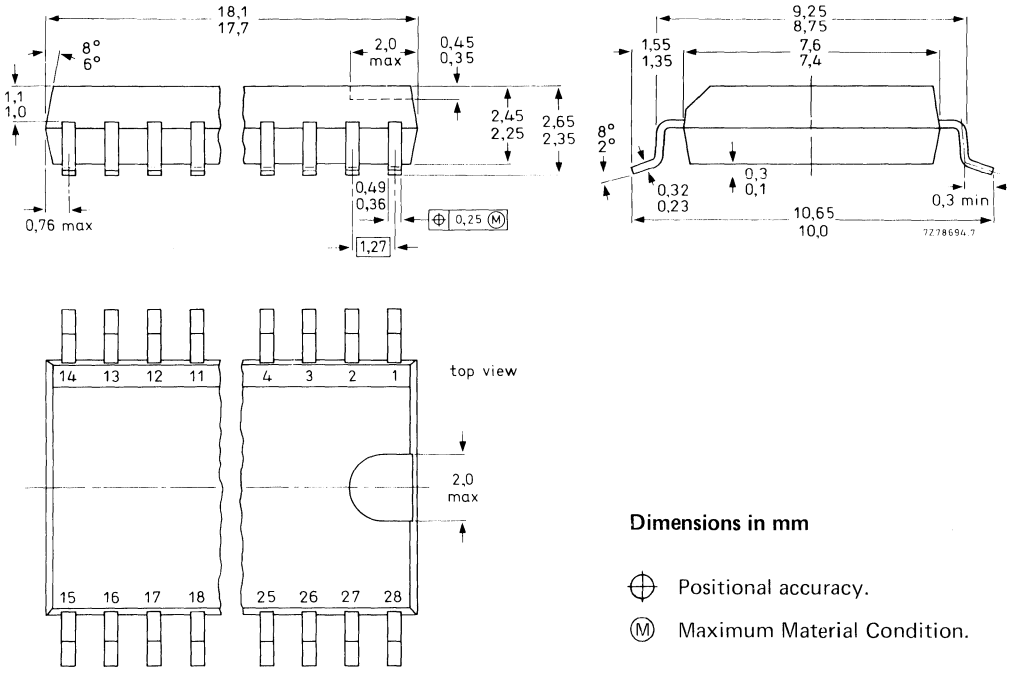
Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

Dimensions in mm

28-LEAD MINI-PACK; PLASTIC (SO-28; SOT-136A)



Dimensions in mm

⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

SOLDERING

1. Soldering iron or pulse heated solder tool

Apply the heating tool to the flat part of the pin only.
Limit the contact time to maximum 10 seconds up to 300 °C, or 5 seconds up to maximum 400 °C.
When using the proper tools, all pins can be soldered in one operation within 2 to 5 seconds and 270 to 320 °C.

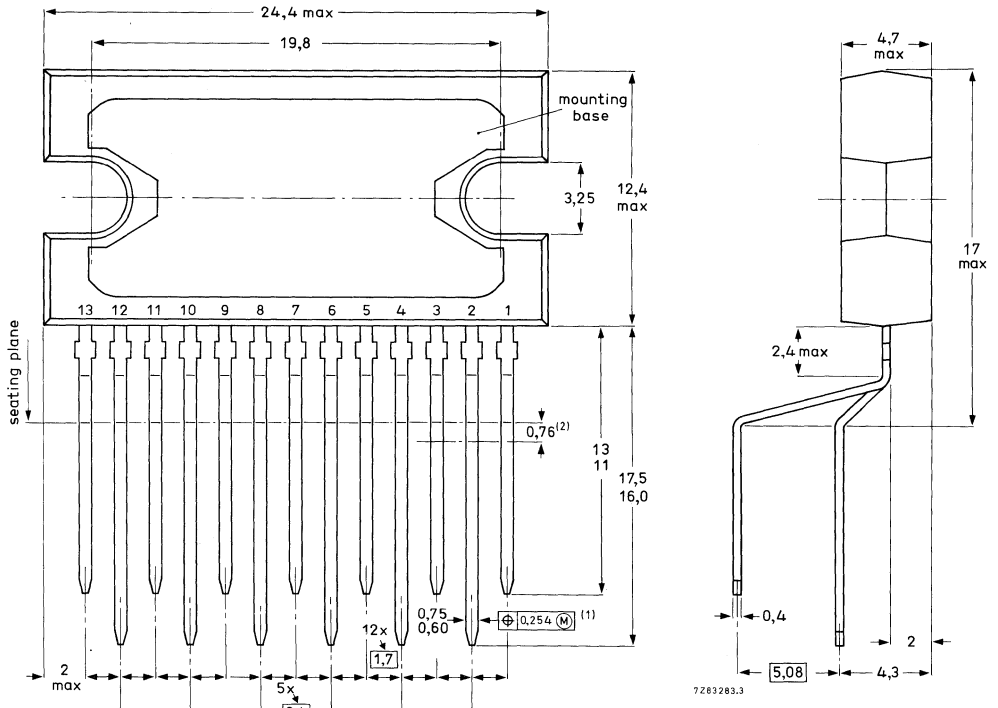
2. By dip or wave

The maximum permissible temperature of the solder is 260 °C. The permissible total time of immersing the whole package in the bath is 10 seconds, if it is allowed to cool down to less than 150 °C within 6 seconds.

3. Repairing soldered joints

The same precautions and limits apply as in (1) above.
If the vertical part of the pin needs heating, reduce the soldering iron temperature to 260 °C.

13-LEAD SIL-BENT-TO-DIL; PLASTIC POWER (SOT-141B)



Dimensions in mm

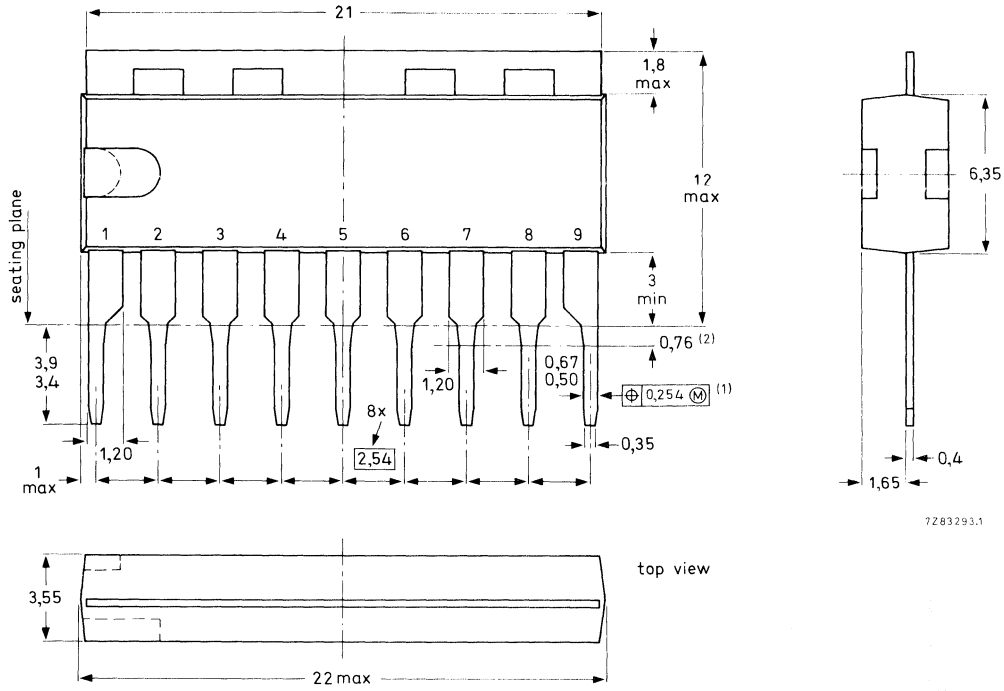
⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

9-LEAD SINGLE IN-LINE; PLASTIC (SOT-142B)



Dimensions in mm

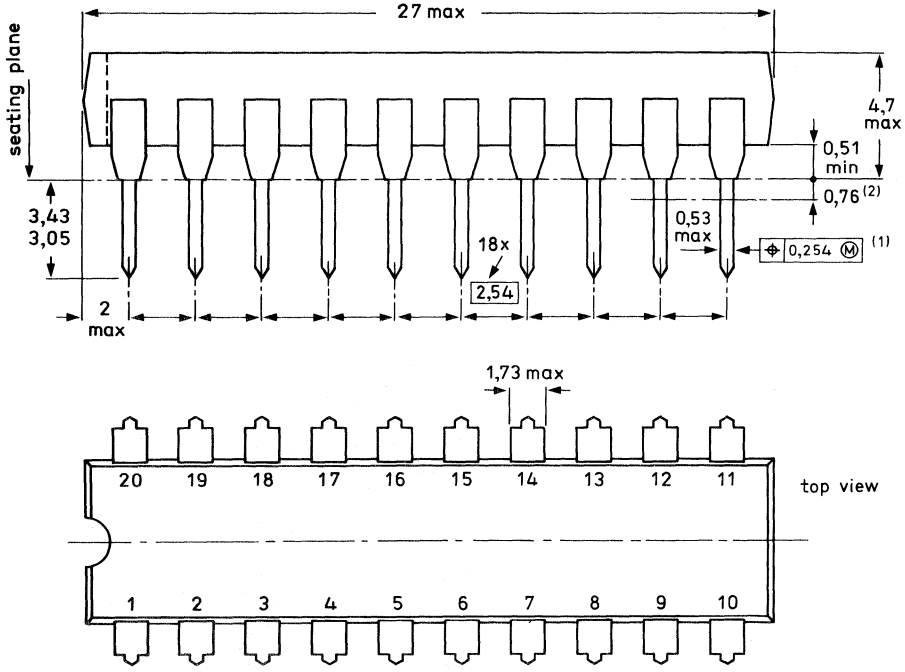
⊕ Positional accuracy.

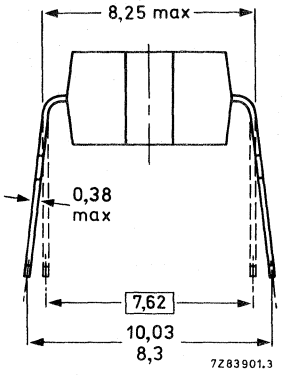
Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

20-LEAD DUAL IN-LINE; PLASTIC (SOT-146)





side view

⊕ Positional accuracy.

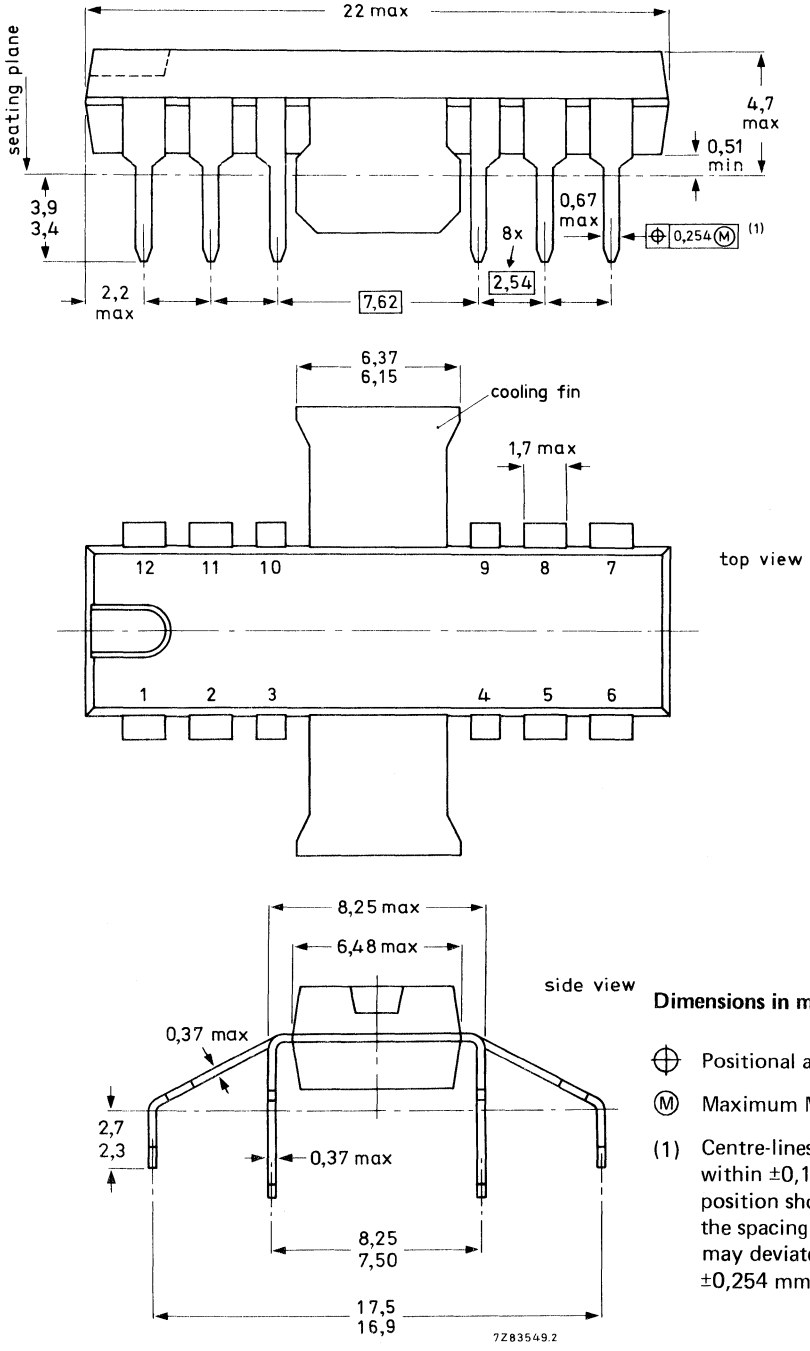
Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

Dimensions in mm

12-LEAD DUAL IN-LINE; PLASTIC WITH METAL COOLING FIN (SOT-150)



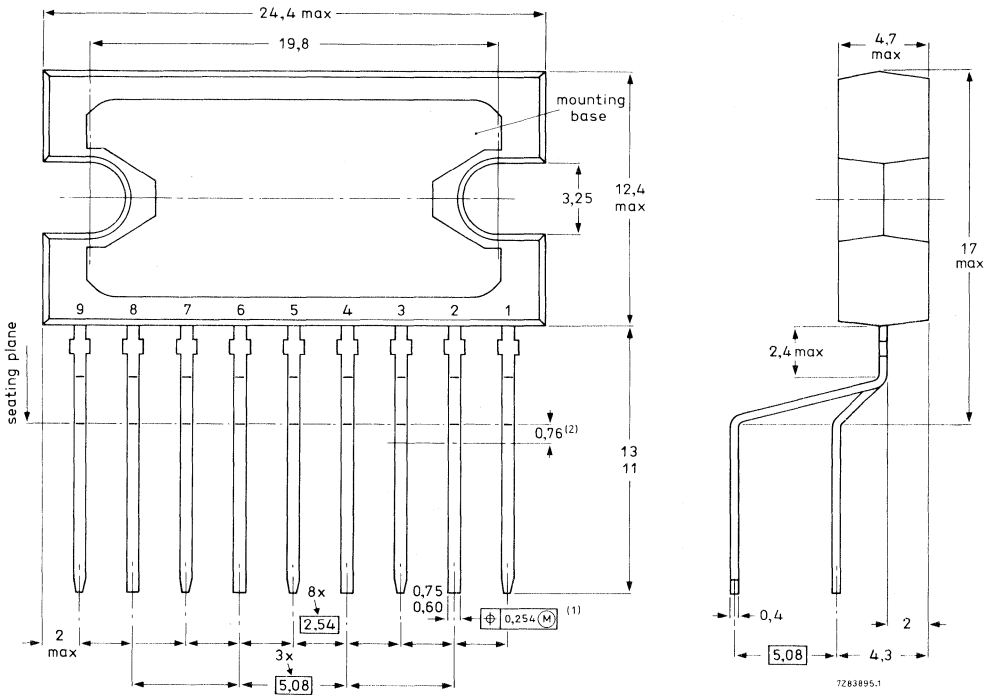
Dimensions in mm

⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

9-LEAD SIL-BENT-TO-DIL; PLASTIC POWER (SOT-157A,B)



Dimensions in mm

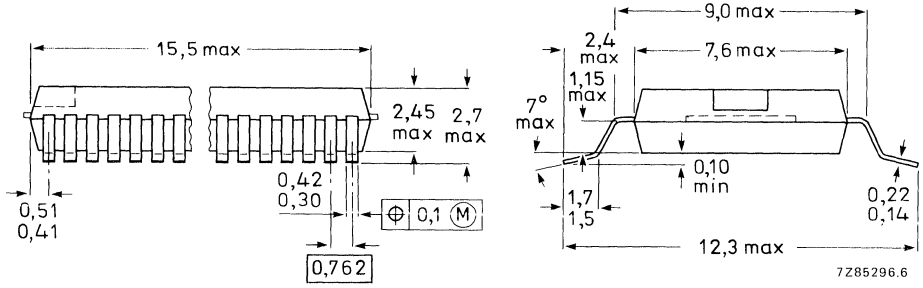
⊕ Positional accuracy.

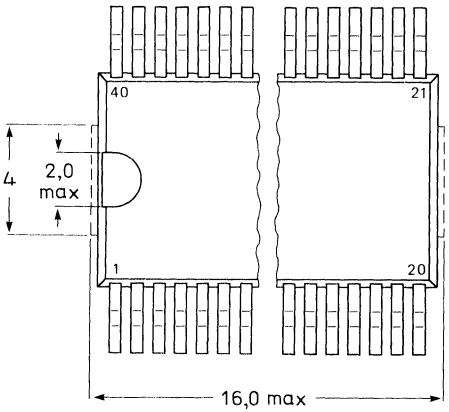
Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

40-LEAD MINI-PACK; PLASTIC (VSO-40; SOT-158A)





top view

Dimensions in mm

⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

SOLDERING

The reflow solder technique

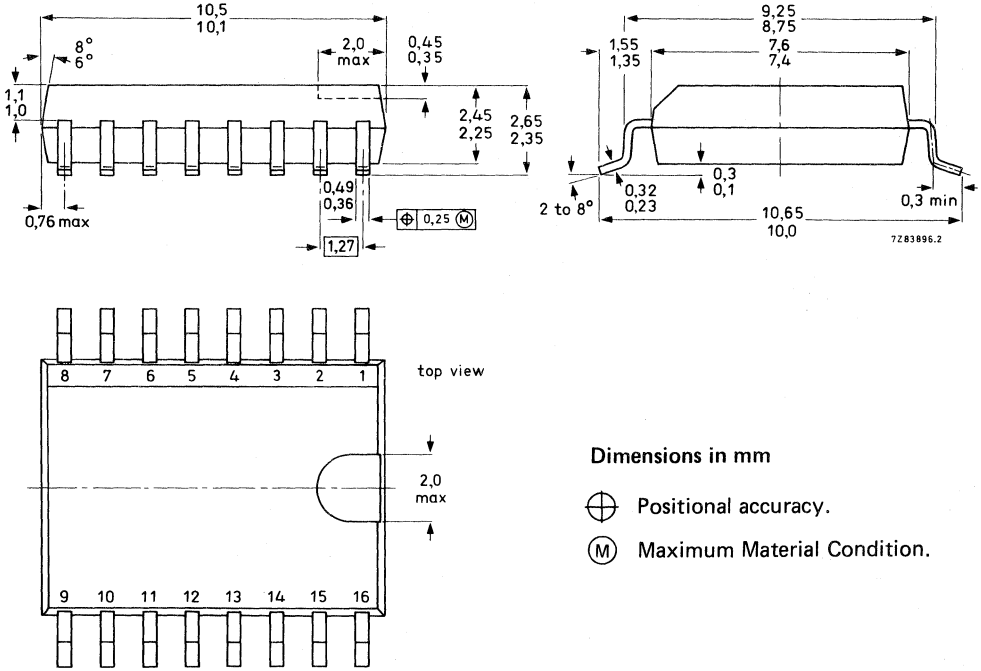
The preferred technique for mounting miniature components on hybrid thick or thin-film circuits is reflow soldering. Solder is applied to the required areas on the substrate by dipping in a solder bath or, more usually, by screen printing a solder paste. Components are put in place and the solder is reflowed by heating.

Solder pastes consist of very finely powdered solder and flux suspended in an organic liquid binder. They are available in various forms depending on the specification of the solder and the type of binder used. For hybrid circuit use, a tin-lead solder with 2 to 4% silver is recommended. The working temperature of this paste is about 220 to 230 °C when a mild flux is used.

For printing the paste onto the substrate a stainless steel screen with a mesh of 80 to 105 μm is used for which the emulsion thickness should be about 50 μm. To ensure that sufficient solder paste is applied to the substrate, the screen aperture should be slightly larger than the corresponding contact area.

The contact pins are positioned on the substrate, the slight adhesive force of the solder paste being sufficient to keep them in place. The substrate is heated to the solder working temperature preferably by means of a controlled hot plate. The soldering process should be kept as short as possible: 10 to 15 seconds is sufficient to ensure good solder joints and evaporation of the binder fluid.
After soldering, the substrate must be cleaned of any remaining flux.

16-LEAD MINI-PACK; PLASTIC (SO-16L; SOT-162A)



Dimensions in mm

⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

SOLDERING

The reflow solder technique

The preferred technique for mounting miniature components on hybrid thick or thin-film circuits is reflow soldering. Solder is applied to the required areas on the substrate by dipping in a solder bath or, more usually, by screen printing a solder paste. Components are put in place and the solder is reflowed by heating.

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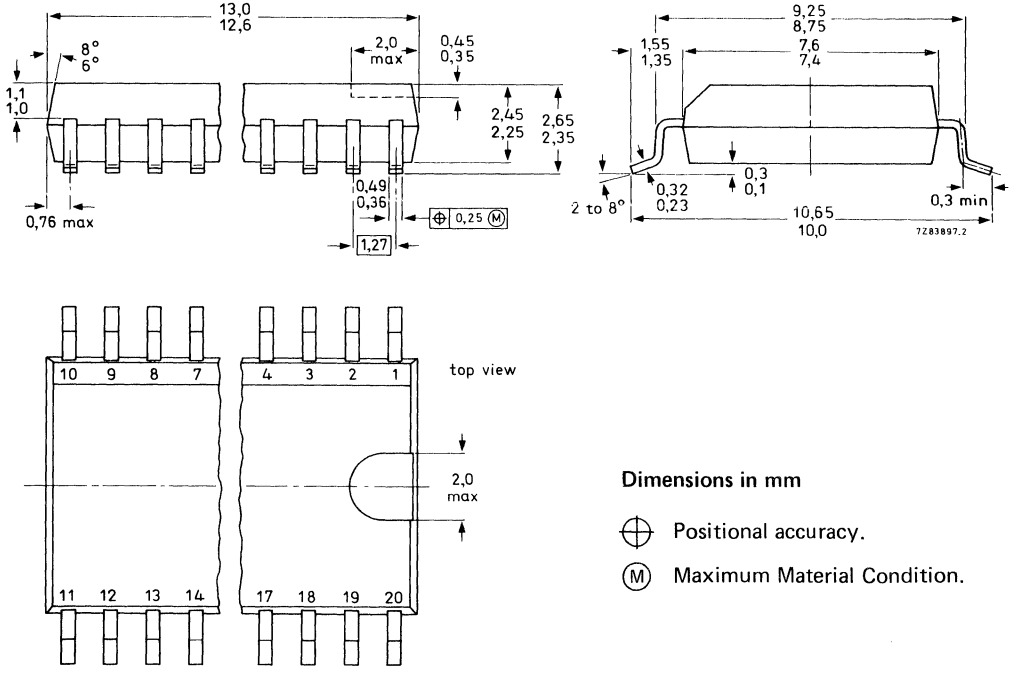
After soldering, the substrate must be cleaned of any remaining flux.

20-LEAD MINI-PACK; PLASTIC (SO-20; SOT-163A)



Dimensions in mm

⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

SOLDERING

The reflow solder technique

The preferred technique for mounting miniature components on hybrid thick or thin-film circuits is reflow soldering. Solder is applied to the required areas on the substrate by dipping in a solder bath or, more usually, by screen printing a solder paste. Components are put in place and the solder is reflowed by heating.

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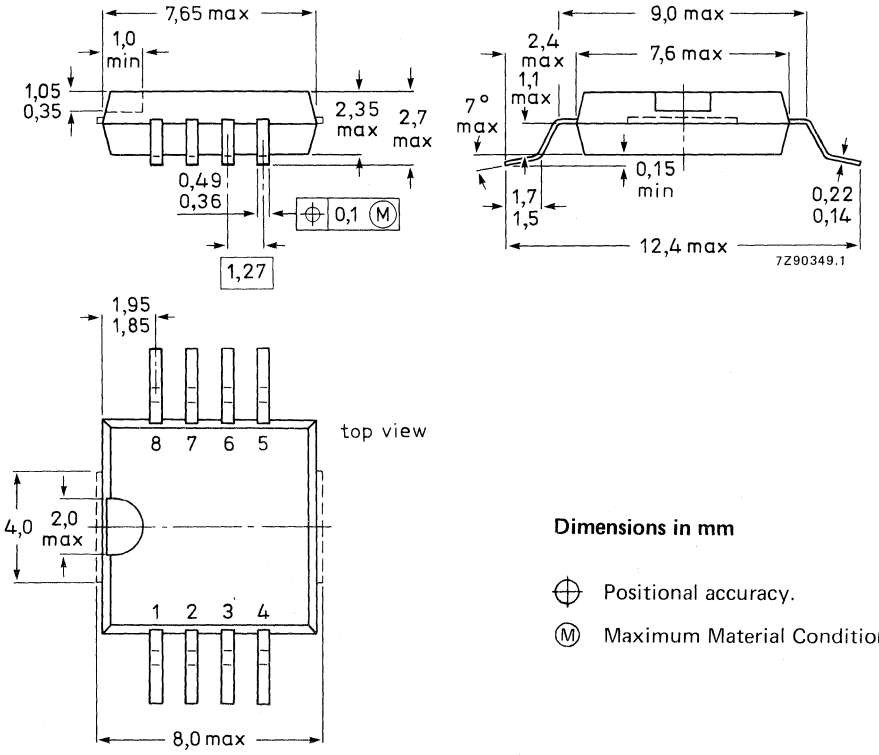
After soldering, the substrate must be cleaned of any remaining flux.

8-LEAD MINI-PACK; PLASTIC (VSO-8; SOT-176)



Dimensions in mm

⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

SOLDERING

The reflow solder technique

The preferred technique for mounting miniature components on hybrid thick or thin-film circuits is reflow soldering. Solder is applied to the required areas on the substrate by dipping in a solder bath or, more usually, by screen printing a solder paste. Components are put in place and the solder is reflowed by heating.

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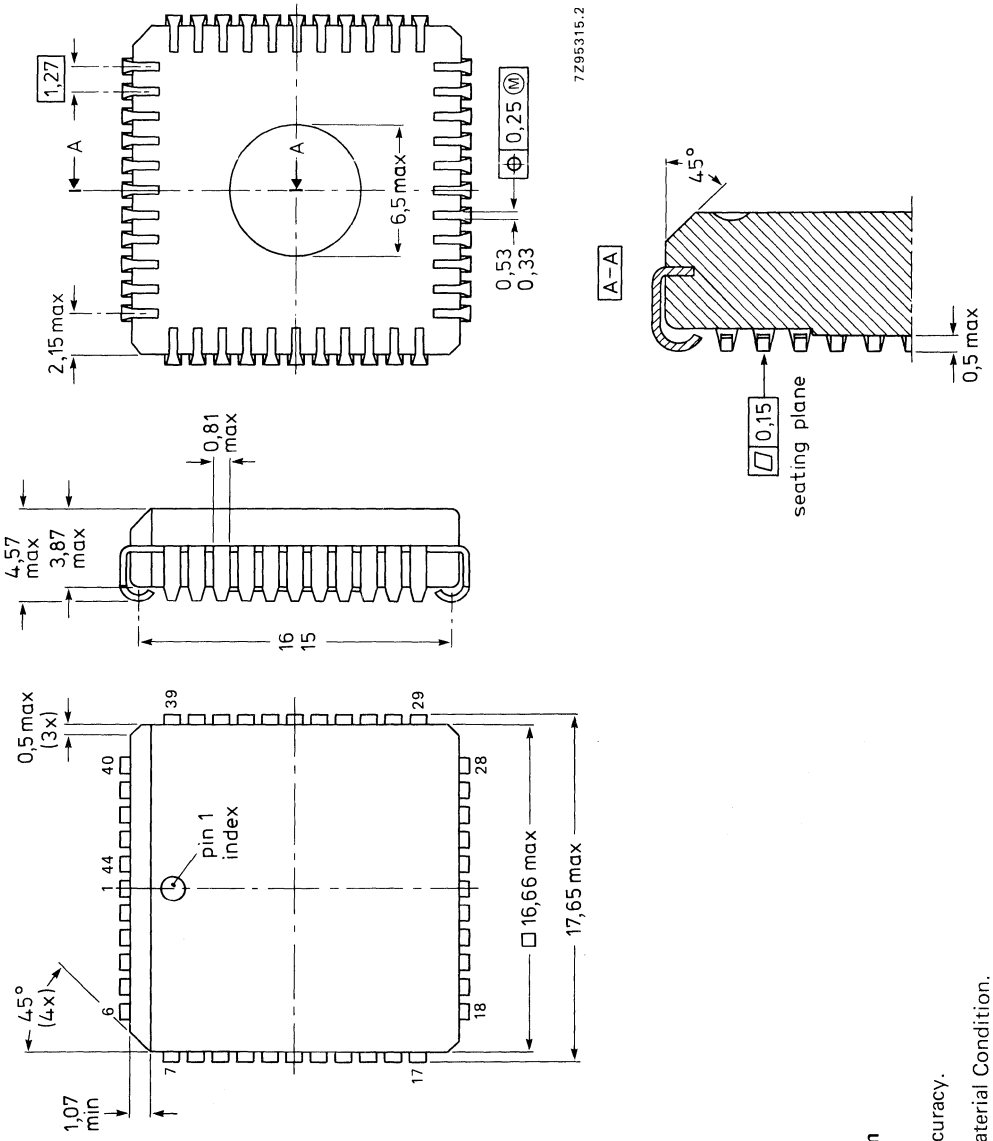
After soldering, the substrate must be cleaned of any remaining flux.

44-LEAD PLASTIC LEADED CHIP-CARRIER (PLCC); SOT-187A

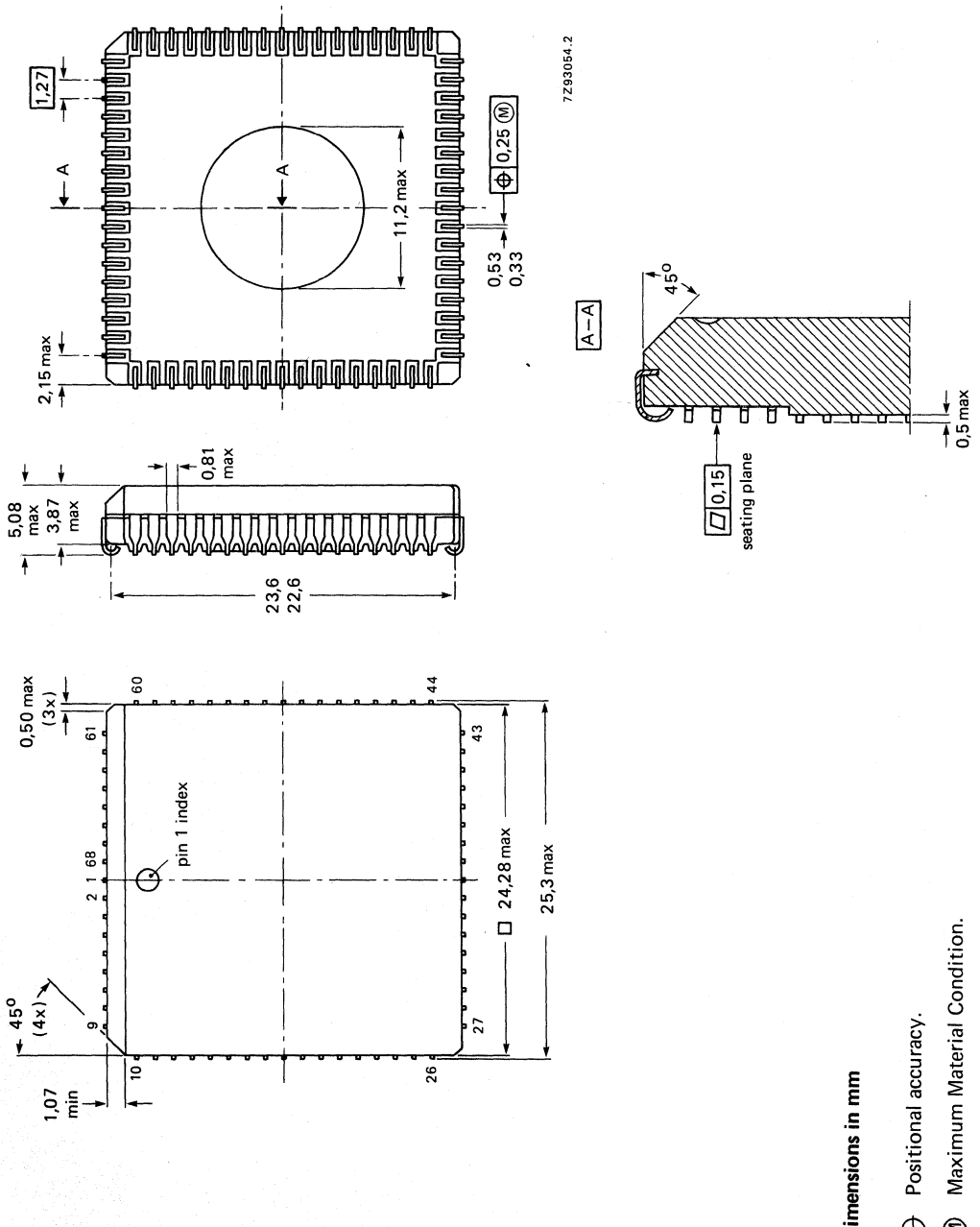


Dimensions in mm

⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

68-LEAD PLASTIC LEADED CHIP-CARRIER (PLCC); SOT-188A

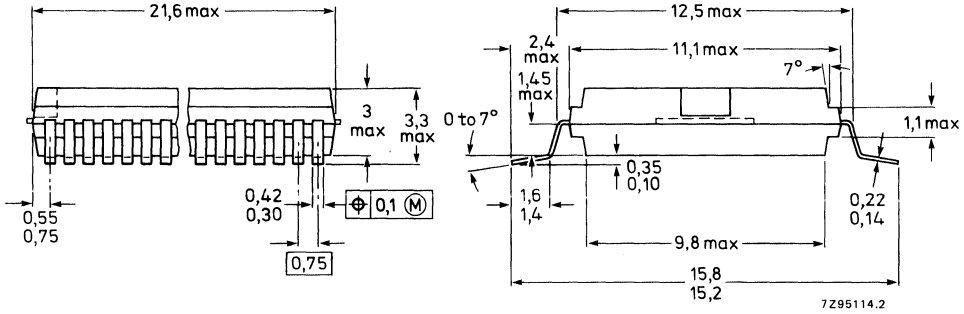


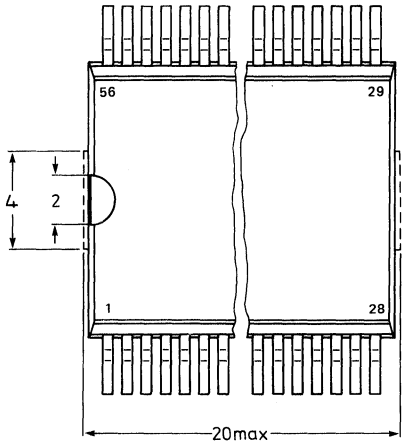
Dimensions in mm

⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

56-LEAD MINI-PACK; PLASTIC (VSO-56; SOT-190)





top view

Dimensions in mm

⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

SOLDERING

1. Soldering iron or pulse heated solder tool

Apply the heating tool to the flat part of the pin only.
Limit the contact time to maximum 10 seconds up to 300 °C, or 5 seconds up to maximum 400 °C.
When using the proper tools, all pins can be soldered in one operation within 2 to 5 seconds and 270 to 320 °C.

2. By dip or wave

The maximum permissible temperature of the solder is 260 °C. The permissible total time of immersing the whole package in the bath is 10 seconds, if it is allowed to cool down to less than 150 °C within 6 seconds.

3. Repairing soldered joints

The same precautions and limits apply as in (1) above.
If the vertical part of the pin needs heating, reduce the soldering iron temperature to 260 °C.

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