

DATA SHEET

TDA9811 Multistandard VIF-PLL with QSS-IF and AM demodulator

Preliminary specification
File under Integrated Circuits, IC02

1995 Oct 03

Multistandard VIF-PLL with QSS-IF and AM demodulator

TDA9811

FEATURES

- 5 V supply voltage
- Two switched VIF inputs, gain controlled wide band VIF-amplifier (AC-coupled)
- True synchronous demodulation with active carrier regeneration (very linear demodulation, good intermodulation figures, reduced harmonics, excellent pulse response)
- Gated phase detector for L/L accent standard
- VCO frequency switchable between L and L accent (alignment external) picture carrier frequency
- Separate video amplifier for sound trap buffering with high video bandwidth
- VIF AGC detector for gain control, operating as peak sync detector for B/G (optional external AGC) and peak white detector for L; signal controlled reaction time for L
- Tuner AGC with adjustable takeover point (TOP)
- AFC detector without extra reference circuit
- SIF input for single reference QSS mode (PLL controlled); SIF AGC detector for gain controlled SIF amplifier; single reference QSS mixer able to operate in high performance single reference QSS mode
- AM demodulator without extra reference circuit
- AM mute (especially for NICAM)
- Stabilizer circuit for ripple rejection and to achieve constant output signals.

GENERAL DESCRIPTION

The TDA9811 is an integrated circuit for multistandard vision IF signal processing and sound AM demodulation, with single reference QSS-IF in TV and VCR sets.

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TDA9811	SDIP32	plastic shrink dual in-line package; 32 leads (400 mil)	SOT232-1

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QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_P	supply voltage		4.5	5	5.5	V
I_P	supply current		93	109	125	mA
$V_{i\text{ VIF(rms)}}$	vision IF input signal voltage sensitivity (RMS value)	-1 dB video at output	-	60	100	μV
$V_{o\text{ CVBS(p-p)}}$	CVBS output signal voltage (peak-to-peak value)		1.7	2.0	2.3	V
B_{-3}	-3 dB video bandwidth on pin CVBS	B/G and L standard; $C_L < 20\text{ pF}$; $R_L > 1\text{ k}\Omega$; AC load	7	8	-	MHz
S/N (W)	weighted signal-to-noise ratio for video		56	60	-	dB
$IM_{\alpha 1.1}$	intermodulation attenuation at 'blue'	$f = 1.1\text{ MHz}$	58	64	-	dB
$IM_{\alpha 3.3}$	intermodulation attenuation at 'blue'	$f = 3.3\text{ MHz}$	58	64	-	dB
$\alpha_{H(\text{sup})}$	suppression of harmonics in video signal		35	40	-	dB
$V_{i\text{ SIF(rms)}}$	sound IF input signal voltage sensitivity (RMS value)	-3 dB at intercarrier output	-	30	70	μV
$V_{o(\text{rms})}$	audio output signal voltage (RMS value)	L standard; 54% modulation	-	0.5	-	V
THD	total harmonic distortion	54% modulation	-	0.5	1.0	%
S/N (W)	weighted signal-to-noise ratio	54% modulation	47	53	-	dB

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BLOCK DIAGRAM

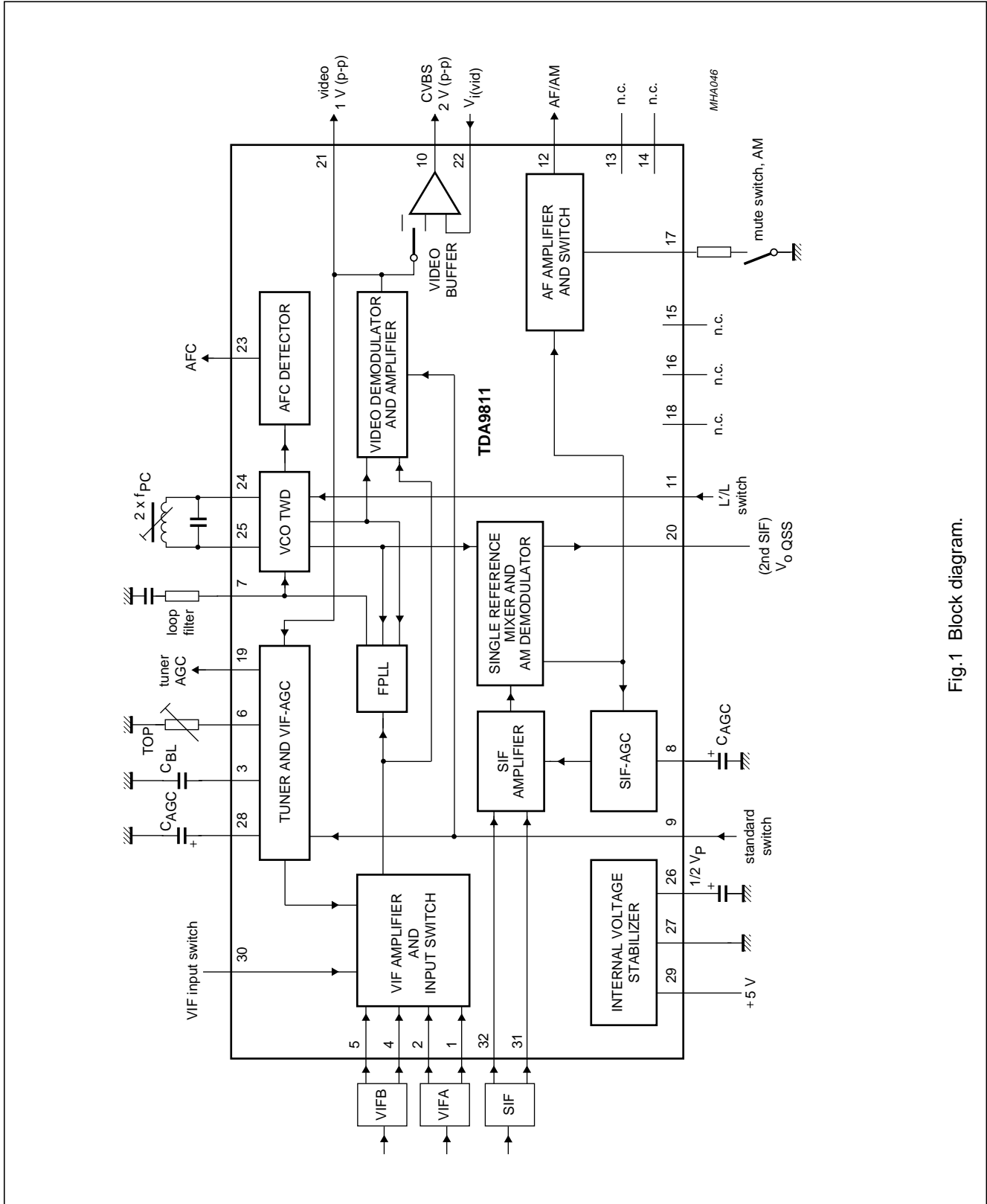


Fig.1 Block diagram.

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PINNING

SYMBOL	PIN	DESCRIPTION
$V_{i\ VIF1}$	1	VIF differential input signal voltage 1
$V_{i\ VIF2}$	2	VIF differential input signal voltage 2
C_{BL}	3	black level detector
$V_{i\ VIF3}$	4	VIF differential input signal voltage 3
$V_{i\ VIF4}$	5	VIF differential input signal voltage 4
TADJ	6	tuner AGC takeover adjust (TOP)
T_{PLL}	7	PLL loop filter
C_{SAGC}	8	SIF AGC capacitor
STD	9	standard switch
$V_{o\ CVBS}$	10	CVBS output signal voltage
LSWI	11	L/L accent switch
$V_{o\ AF}$	12	AM audio voltage frequency output
n.c.	13	not connected
n.c.	14	not connected
n.c.	15	not connected
n.c.	16	not connected
MUTE	17	AM mute
n.c.	18	not connected
TAGC	19	tuner AGC output
$V_{o\ QSS}$	20	single reference QSS output voltage
$V_{o(vid)}$	21	composite video output voltage
$V_{i(vid)}$	22	video buffer input voltage
AFC	23	AFC output
VCO1	24	VCO1 reference circuit for $2f_{PC}$
VCO2	25	VCO2 reference circuit for $2f_{PC}$
C_{ref}	26	$\frac{1}{2}V_P$ reference capacitor
GND	27	ground
C_{VAGC}	28	VIF AGC capacitor
V_P	29	supply voltage
INSWI	30	VIF input switch
$V_{i\ SIF1}$	31	SIF differential input signal voltage 1
$V_{i\ SIF2}$	32	SIF differential input signal voltage 2

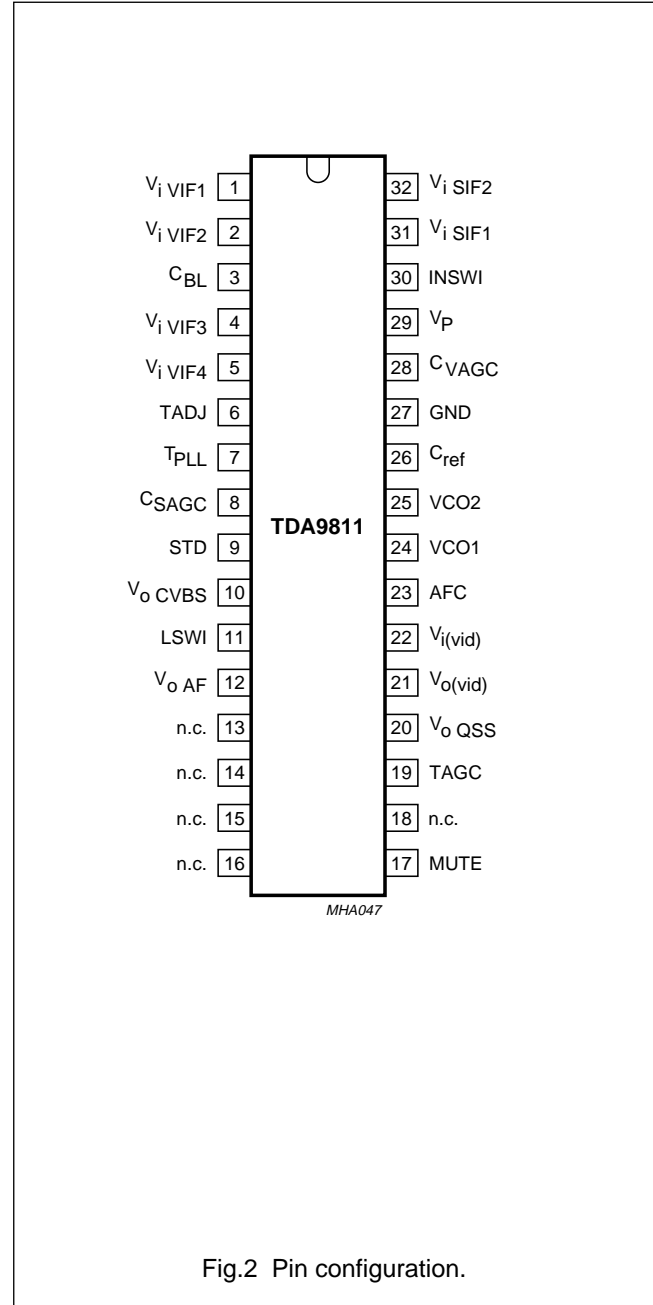


Fig.2 Pin configuration.

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FUNCTIONAL DESCRIPTION

Vision IF amplifier and input switch

The vision IF amplifier consists of three AC-coupled differential amplifier stages. Each differential stage comprises a feedback network controlled by emitter degeneration. The first differential stage is extended by two pairs of emitter followers to provide two IF input channels. The VIF input can be selected by pin 30.

Tuner and VIF AGC

The AGC capacitor voltage is transferred to an internal IF control signal, and is fed to the tuner AGC to generate the tuner AGC output current (open-collector output).

The tuner AGC takeover point can be adjusted. This allows the tuner and the SWIF filter to be matched to achieve the optimum IF input level.

The AGC detector charges/discharges the AGC capacitor to the required voltage for setting of VIF and tuner gain in order to keep the video signal at a constant level.

Therefore for negative video modulation the sync level and for positive video modulation the peak white level of the video signal is detected. In order to reduce the reaction time for positive modulation, where a very large time constant is needed, an additional level detector increases the discharging current of the AGC capacitor (fast mode) in the event of a decreasing VIF amplitude step. The additional level information is given by the black-level detector voltage.

Frequency Phase Locked Loop detector (FPLL)

The VIF-amplifier output signal is fed into a frequency detector and into a phase detector via a limiting amplifier. During acquisition the frequency detector produces a DC current proportional to the frequency difference between the input and the VCO signal. After frequency lock-in the phase detector produces a DC current proportional to the phase difference between the VCO and the input signal. The DC current of either frequency detector or phase detector is converted into a DC voltage via the loop filter, which controls the VCO frequency. In the event of positive modulated signals the phase detector is gated by composite sync in order to avoid signal distortion for overmodulated VIF signals.

VCO, Travelling Wave Divider (TWD) and AFC

The VCO operates with a resonance circuit (with L and C in parallel) at double the PC frequency. The VCO is controlled by two integrated variable capacitors.

The control voltage required to tune the VCO from its free-running frequency to actually double the PC frequency is generated by the frequency-phase detector and fed via the loop filter to the first variable capacitor (FPLL). This control voltage is amplified and additionally converted into a current which represents the AFC output signal. The VCO centre frequency can be decreased (required for L accent standard) by activating an additional internal capacitor. This is achieved by using the L accent switch. In this event the second variable capacitor can be controlled by a variable resistor at the L accent switch for setting the VCO centre frequency to the required L accent value. At centre frequency the AFC output current is equal to zero.

The oscillator signal is divided-by-two with a TWD which generates two differential output signals with a 90 degree phase difference independent of the frequency.

Video demodulator and amplifier

The video demodulator is realized by a multiplier which is designed for low distortion and large bandwidth. The vision IF input signal is multiplied with the 'in phase' signal of the travelling wave divider output. In the demodulator stage the video signal polarity can be switched in accordance with the TV standard.

The demodulator output signal is fed via an integrated low-pass filter for attenuation of the carrier harmonics to the video amplifier. The video amplifier is realized by an operational amplifier with internal feedback and high bandwidth. A low-pass filter is integrated to achieve an attenuation of the carrier harmonics for B/G and L standard. The standard dependent level shift in this stage delivers the same sync level for positive and negative modulation. The video output signal is 1 V (p-p) for nominal vision IF modulation.

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Video buffer

For an easy adaption of the sound traps an operational amplifier with internal feedback is used in the event of B/G and L standard. This amplifier is featured with a high bandwidth and 7 dB gain. The input impedance is adapted for operating in combination with ceramic sound traps. The output stage delivers a nominal 2 V (p-p) positive video signal. Noise clipping is provided.

SIF amplifier and AGC

The sound IF amplifier consists of two AC-coupled differential amplifier stages. Each differential stage comprises a controlled feedback network provided by emitter degeneration.

The SIF AGC detector is related to the SIF input signals (average level of AM or FM carriers) and controls the SIF amplifier to provide a constant SIF signal to the AM demodulator and single reference QSS mixer. The SIF AGC reaction time is set to 'slow' for nominal video conditions. But with a decreasing VIF amplitude step the SIF AGC is set to 'fast' mode controlled by the VIF AGC detector. In FM mode this reaction time is also set to 'fast' controlled by the standard switch.

Single reference QSS mixer

The single reference QSS mixer is realized by a multiplier. The SIF amplifier output signal is fed to the single reference QSS mixer and converted to intercarrier frequency by the regenerated picture carrier (VCO). The mixer output signal is fed via a high-pass for attenuation of the video signal components to the output pin 20. With this system a high performance hi-fi stereo sound processing can be achieved.

AM demodulator

The AM demodulator is realized by a multiplier. The modulated SIF amplifier output signal is multiplied in phase with the limited (AM is removed) SIF amplifier output signal. The demodulator output signal is fed via an integrated low-pass filter for attenuation of the carrier harmonics to the AF amplifier.

Internal voltage stabilizer and $\frac{1}{2}V_P$ -reference

The bandgap circuit internally generates a voltage of approximately 1.25 V, independent of supply voltage and temperature. A voltage regulator circuit, connected to this voltage, produces a constant voltage of 3.6 V which is used as an internal reference voltage.

For all audio output signals the constant reference voltage cannot be used because large output signals are required. Therefore these signals refer to half the supply voltage to achieve a symmetrical headroom, especially for the rail-to-rail output stage. For ripple and noise attenuation the $\frac{1}{2}V_P$ voltage has to be filtered via a low-pass filter by using an external capacitor together with an integrated resistor ($f_g = 5$ Hz). For a fast setting to $\frac{1}{2}V_P$ an internal start-up circuit is added.

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LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_P	supply voltage (pin 29)	maximum chip temperature of 125 °C; note 1	0	7.0	V
V_i	voltage at pins 1 to 9, 11, 12, 19, 22, 23 and 26 to 32		0	V_P	V
$t_{s(max)}$	maximum short-circuit time		–	10	s
V_{19}	tuner AGC output voltage		0	13.2	V
T_{stg}	storage temperature		–25	+150	°C
T_{amb}	operating ambient temperature		–20	+70	°C
V_{es}	electrostatic handling voltage	note 2	–300	+300	V

Notes

- $I_P = 125$ mA; $T_{amb} = 70$ °C; $R_{th\ j-a} = 60$ K/W.
- Machine model class B.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j-a}$	thermal resistance from junction to ambient in free air	60	K/W

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CHARACTERISTICS

$V_P = 5\text{ V}$; $T_{\text{amb}} = 25\text{ °C}$; see Table 1 for input frequencies and level; input level $V_{i\text{IF } 1, 2, 3, 4} = 10\text{ mV}$ RMS value (sync-level for B/G, peak white level for L); video modulation DSB; residual carrier B/G: 10%; L = 3%; video signal in accordance with "CCIR, line 17"; measurements taken in Fig.13; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply (pin 29)						
V_P	supply voltage	note 1	4.5	5	5.5	V
I_P	supply current		93	109	125	mA
Vision IF amplifier (pins 1, 2, 4 and 5)						
$V_{i\text{ VIF(rms)}}$	input signal voltage sensitivity (RMS value)	B/G standard; -1 dB video at output	-	60	100	μV
$V_{i\text{ max(rms)}}$	maximum input signal voltage (RMS value)	B/G standard; +1 dB video at output	120	200	-	mV
$\Delta V_{o(\text{int})}$	internal IF amplitude difference between picture and sound carrier	within AGC range; B/G standard; $\Delta f = 5.5\text{ MHz}$	-	0.7	1	dB
G_{IFcr}	IF gain control range	see Fig.3	65	70	-	dB
$R_{i(\text{diff})}$	differential input resistance	note 2; activated input	1.7	2.2	2.7	$\text{k}\Omega$
$C_{i(\text{diff})}$	differential input capacitance	note 2; activated input	1.2	1.7	2.5	pF
$V_{1, 2, 4, 5}$	DC input voltage	note 2; activated input	-	3.4	-	V
R_i	input resistance to ground	note 2; not activated input	-	1.1	-	$\text{k}\Omega$
$V_{1, 2, 4, 5}$	DC input voltage	note 2; not activated input	-	0.2	-	V
$\alpha_{\text{ct IF}}$	crosstalk attenuation of IF input switch at pins 1, 2, 4 and 5	notes 2 and 3	55	60	-	dB
True synchronous video demodulator; note 4						
$f_{\text{VCO(max)}}$	maximum oscillator frequency for carrier regeneration	$f = 2f_{\text{PC}}$	125	130	-	MHz
$\Delta f_{\text{osc}}/\Delta T$	oscillator drift as a function of temperature	oscillator is free-running; $I_{\text{AFC}} = 0$; note 5	-	-	± 20	ppm/K
$V_{0\text{ ref(rms)}}$	oscillator voltage swing at pins 24 and 25 (RMS value)		70	100	130	mV
$f_{\text{PC CR}}$	picture carrier capture range	B/G and L standard	± 1.5	± 2.0	-	MHz
		L accent standard; $f_{\text{PC}} = 33.9\text{ MHz}$; $R_{11} = 5.6\text{ k}\Omega$	± 1.0	± 1.3	-	MHz
$Q_{f_{\text{PC(fr)}}$	picture carrier frequency (free-running) accuracy	L accent standard; $f_{\text{PC}} = 33.9\text{ MHz}$; $R_{11} = 5.6\text{ k}\Omega$	-	± 200	± 400	kHz
$f_{\text{PC(alg)CR}}$	L accent alignment frequency range	$I_{\text{AFC}} = 0$	± 400	± 600	-	kHz
t_{acq}	acquisition time	BL = 180 kHz; note 6	-	-	30	ms
$V_{i\text{ VIF(rms)}}$	VIF input signal voltage sensitivity for PLL to be locked (RMS value; pins 1, 2, 4 and 5)	maximum IF gain; note 7	-	30	70	μV
$I_{\text{FPLL(offset)}}$	FPLL offset current at pin 7	note 8	-	-	± 4.5	μA

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Composite video amplifier (pin 21; sound carrier off)						
$V_{o\text{ video(p-p)}}$	output signal voltage (peak-to-peak value)	see Fig.8	0.88	1.0	1.12	V
$V_{21(\text{sync})}$	sync voltage level	B/G and L standard	–	1.5	–	V
$V_{21(\text{clu})}$	upper video clipping voltage level		$V_P - 1.1$	$V_P - 1$	–	V
$V_{21(\text{cll})}$	lower video clipping voltage level		–	0.3	0.4	V
$R_{o,21}$	output resistance	note 2	–	–	10	Ω
$I_{\text{int } 21}$	internal DC bias current for emitter-follower		2.2	3.0	–	mA
$I_{21\text{ max(sink)}}$	maximum AC and DC output sink current		1.6	–	–	mA
$I_{21\text{ max(source)}}$	maximum AC and DC output source current		2.9	–	–	mA
B_{-1}	–1 dB video bandwidth	B/G and L standard; $C_L < 50\text{ pF}$; $R_L > 1\text{ k}\Omega$; AC load	5	6	–	MHz
B_{-3}	–3 dB video bandwidth	B/G and L standard; $C_L < 50\text{ pF}$; $R_L > 1\text{ k}\Omega$; AC load	7	8	–	MHz
$\alpha_{H(\text{sup})}$	suppression of harmonics in video signal	$C_L < 50\text{ pF}$; $R_L > 1\text{ k}\Omega$; AC load; note 9a	35	40	–	dB
PSRR	power supply ripple rejection at pin 21	video signal; grey level; see Fig.11 B/G standard L standard	32 26	35 30	– –	dB dB

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
CVBS buffer amplifier (only) and noise clipper (pins 10 and 22)						
$R_{i,22}$	input resistance	note 2	2.6	3.3	4.0	$k\Omega$
$C_{i,22}$	input capacitance	note 2	1.4	2	3.0	pF
$V_{i,22}$	DC input voltage		1.4	1.7	2.0	V
G_v	voltage gain	B/G and L standard; note 10	6.5	7	7.5	dB
$V_{10(clu)}$	upper video clipping voltage level		3.9	4.0	–	V
$V_{10(cll)}$	lower video clipping voltage level		–	1.0	1.1	V
$R_{o,10}$	output resistance	note 2	–	–	10	Ω
$I_{int\ 10}$	DC internal bias current for emitter-follower		2.0	2.5	–	mA
$I_{o,10\ max(sink)}$	maximum AC and DC output sink current		1.4	–	–	mA
$I_{o,10\ max(source)}$	maximum AC and DC output source current		2.4	–	–	mA
B_{-1}	–1 dB video bandwidth	B/G and L standard; $C_L < 20\ pF$; $R_L > 1\ k\Omega$; AC load	8.4	11	–	MHz
B_{-3}	–3 dB video bandwidth	B/G and L standard; $C_L < 20\ pF$; $R_L > 1\ k\Omega$; AC load	11	14	–	MHz

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Measurements from IF input to CVBS output (pin 10; 330 Ω between pins 21 and 22, sound carrier off)						
$V_{o\text{ CVBS}(p-p)}$	CVBS output signal voltage on pin 10 (peak-to-peak value)	note 10	1.7	2.0	2.3	V
$V_{o\text{ CVBS}(sync)}$	sync voltage level	B/G standard	–	1.35	–	V
		L standard	–	1.35	–	V
ΔV_o	deviation of CVBS output signal voltage at B/G	50 dB gain control	–	–	0.5	dB
		30 dB gain control	–	–	0.1	dB
$\Delta V_{o(bB/G)}$	black level tilt in B/G standard	gain variation; note 11	–	–	1	%
$\Delta V_{o(bL)}$	black level tilt for worst case in L standard	picture carrier modulated by test line (VITS) only; gain variation; note 11	–	–	1.9	%
G_{diff}	differential gain	"CCIR, line 330"	–	2	5	%
ϕ_{diff}	differential phase	"CCIR, line 330"	–	1	2	deg
B_{-1}	–1 dB video bandwidth	$C_L < 20$ pF; $R_L > 1$ k Ω ; AC load; B/G and L standard	5	6	–	MHz
B_{-3}	–3 dB video bandwidth	$C_L < 20$ pF; $R_L > 1$ k Ω ; AC load; B/G and L standard	7	8	–	MHz
S/N (W)	weighted signal-to-noise ratio	see Fig.5 and note 12	56	60	–	dB
S/N	unweighted signal-to-noise ratio	see Fig.5 and note 12	49	53	–	dB
$IM\alpha_{1,1}$	intermodulation attenuation at 'blue'	$f = 1.1$ MHz; see Fig.6 and note 13	58	64	–	dB
	intermodulation attenuation at 'yellow'	$f = 1.1$ MHz; see Fig.6 and note 13	60	66	–	dB
$IM\alpha_{3,3}$	intermodulation attenuation at 'blue'	$f = 3.3$ MHz; see Fig.6 and note 13	58	64	–	dB
	intermodulation attenuation at 'yellow'	$f = 3.3$ MHz; see Fig.6 and note 13	59	65	–	dB
$\alpha_{pc(rms)}$	residual picture carrier (RMS value)	fundamental wave and harmonics; B/G and L standard	–	2	5	mV
$\alpha_{H(sup)}$	suppression of harmonics in video signal	note 9a	35	40	–	dB
$\alpha_{H(spur)}$	spurious elements	note 9b	40	–	–	dB
PSRR	power supply ripple rejection at pin 10	video signal; grey level; see Fig.11				
		B/G standard	25	28	–	dB
		L standard	20	23	–	dB

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
VIF-AGC detector (pin 28)						
I ₂₈	charging current	B/G and L standard; note 11	0.75	1	1.25	mA
	additional charging current	L standard in event of missing VITS pulses and no white video content	1.9	2.5	3.1	μA
	discharging current	B/G standard	15	20	25	μA
normal mode L		225	300	375	nA	
fast mode L		30	40	50	μA	
t _{resp}	AGC response to an increasing VIF step	B/G and L standard; note 14	–	0.05	0.1	ms/dB
	AGC response to a decreasing VIF step	B/G standard	–	2.2	3.5	ms/dB
		fast mode L	–	1.1	1.8	ms/dB
		normal mode L; note 14	–	150	240	ms/dB
ΔIF	VIF amplitude step for activating fast AGC mode	L standard	–2	–6	–10	dB
V _{3(th)}	threshold voltage level additional charging current	see Fig.8				
		L standard	–	1.95	–	V
		L standard; fast mode L	–	1.65	–	V
Tuner AGC (pin 19)						
V _{i(rms)}	IF input signal voltage for minimum starting point of tuner takeover (RMS value)	input at pins 1, 2, 4 and 5; R _{TOP} = 22 kΩ; I ₁₉ = 0.4 mA	–	2	5	mV
	IF input signal voltage for maximum starting point of tuner takeover (RMS value)	input at pins 1, 2, 4 and 5; R _{TOP} = 0 Ω; I ₁₉ = 0.4 mA	50	100	5	mV
V _{o,19}	permissible output voltage	from external source; note 2	–	–	13.2	V
V _{sat,19}	saturation voltage	I ₁₉ = 1.5 mA	–	–	0.2	V
ΔV _{TOP,19} /ΔT	variation of takeover point by temperature	I ₁₉ = 0.4 mA	–	0.03	0.07	dB/K
I _{19(sink)}	sink current	see Fig.3				
		no tuner gain reduction; V ₁₉ = 13.2 V	–	–	5	μA
		maximum tuner gain reduction	1.5	2	2.6	mA
ΔG _{IF}	IF slip by automatic gain control	tuner gain current from 20 to 80%	–	6	8	dB

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
AFC circuit (pin 23); see Fig.7 and note 15						
S	control steepness $\Delta I_{23}/\Delta f$	note 16	0.5	0.72	1.0	$\mu\text{A}/\text{kHz}$
$\Delta f_{\text{F}}/\Delta T$	frequency variation by temperature	$I_{\text{AFC}} = 0$; note 6	–	–	± 20	ppm/K
$V_{\text{o},23}$	output voltage upper limit	see Fig.7	$V_{\text{P}} - 0.6$	$V_{\text{P}} - 0.3$	–	V
	output voltage lower limit	see Fig.7	–	0.3	0.6	V
$I_{\text{o},23(\text{source})}$	output source current		150	200	250	μA
$I_{\text{o},23(\text{sink})}$	output sink current		150	200	250	μA
$\Delta I_{23(\text{p-p})}$	residual video modulation current (peak-to-peak value)	B/G and L standard	–	20	30	μA
Sound IF amplifier (pins 31 and 32)						
$V_{\text{i SIF}(\text{rms})}$	input signal voltage sensitivity (RMS value)	FM mode; –3 dB at intercarrier output pin 20	–	30	70	μV
		AM mode; –3 dB at AF output pin 12	–	70	100	μV
$V_{\text{i max}(\text{rms})}$	maximum input signal voltage (RMS value)	FM mode; +1 dB at intercarrier output pin 20	50	70	–	mV
		AM mode; +1 dB at AF output pin 12	80	140	–	mV
G_{SIFcr}	SIF gain control range	FM and AM mode; see Fig.4	60	67	–	dB
$R_{\text{i}(\text{diff})}$	differential input resistance	note 2	1.7	2.2	2.7	$\text{k}\Omega$
$C_{\text{i}(\text{diff})}$	differential input capacitance	note 2	1.2	1.7	2.5	pF
$V_{\text{i}(31,32)}$	DC input voltage		–	3.4	–	V
$\alpha_{\text{ct}(\text{SIF,VIF})}$	crosstalk attenuation between SIF and VIF input	between pins 1, 2, 4 and 5 and pins 31 and 32; note 3	50	–	–	dB
SIF-AGC detector (pin 8)						
I_{8}	charging current	FM mode	8	12	16	μA
		AM mode	0.8	1.2	1.6	μA
	discharging current	FM mode	8	12	16	μA
		normal mode AM	1	1.4	1.8	μA
	fast mode AM	60	85	110	μA	

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Single reference QSS intercarrier mixer (B/G standard; pin 20)						
$V_{o(rms)}$	IF intercarrier level (RMS value)	SC ₁ ; sound carrier 2 off	75	100	125	mV
B_{-3}	-3 dB intercarrier bandwidth	upper limit	7.5	9	–	MHz
$\alpha_{SC(rms)}$	residual sound carrier (RMS value)	fundamental wave and harmonics	–	2	–	mV
$R_{o,20}$	output resistance	note 2	–	–	25	Ω
$V_{O,20}$	DC output voltage		–	2.0	–	V
$I_{int\ 20}$	DC internal bias current for emitter-follower		1.5	1.9	–	mA
$I_{20\ max(sink)}$	maximum AC and DC output sink current		1.1	1.5	–	mA
$I_{20\ max(source)}$	maximum AC and DC output source current		3.0	3.5	–	mA
AM mute switch (pin 17)						
V_{17}	DC voltage	pin 11: 2.8 V to V_P	–	2.8	–	V
		pin 11: 0 to 2 V	–	1.8	–	V
I_{17}	DC current	mute	–	-230	–	μ A
Single reference QSS AF performance for FM operation (B/G standard); notes 17 to 20; see Table 1						
S/N (W)	weighted signal-to-noise ratio (SC ₁ /SC ₂)	PC/SC ₁ ratio at pins 1 and 2; 27 kHz (54% FM deviation); "CCIR 468-4"	40	–	–	dB
		black picture	53/48	58/55	–	dB
		white picture	52/46	55/52	–	dB
		6 kHz sine wave (black to white modulation)	44/42	48/46	–	dB
		250 kHz square wave (black to white modulation)	35/25	41/30	–	dB
		sound carrier subharmonics; f = 2.75 MHz \pm 3 kHz	45/44	51/50	–	dB
		sound carrier subharmonics; f = 2.87 MHz \pm 3 kHz	46/45	52/51	–	dB

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
AM operation (L standard; pin 12); note 21						
$V_{o\ AF\ 12(rms)}$	AF output signal voltage (RMS value)	54% modulation	400	500	600	mV
THD	total harmonic distortion	54% modulation; see Fig.10	–	0.5	1.0	%
B_{-3}	–3 dB AF bandwidth		100	125	–	kHz
S/N (W)	weighted signal-to-noise ratio	"CCIR 468-4"; see Fig.9	47	53	–	dB
V_{12}	DC potential voltage	tracked with supply voltage	–	$\frac{1}{2}V_P$	–	V
PSRR	power supply ripple rejection	see Fig.11	22	25	–	dB
Standard switch (pin 9); see also Table 2						
V_9	DC potential voltage for preferred settings					
	input voltage for negative standard	B/G standard; note 22	2.8	–	V_P	V
	input voltage for negative standard	negative AGC off	1.3	–	2.3	V
	input voltage for positive standard	L standard	0	–	0.8	V
I_{IL}	LOW level input current	$V_9 = 0\ V$	190	250	310	μA
VIF input switch (pin 30); see also Table 2						
V_{30}	DC potential voltage for preferred settings					
	input voltage for VIF input A	B/G and L standard; note 22	2.8	–	V_P	V
	input voltage for VIF input B	B/G and L standard	0	–	0.8	V
I_{IL}	LOW level input current	$V_{30} = 0\ V$	170	230	290	μA
L accent switch (pin 11)						
V_{11}	DC potential voltage for L standard VCO frequency switching					
	L standard	note 22	2.8	–	V_P	V
	L accent standard and alignment		0	–	2.0	V
I_{IL}	LOW level input current	$V_{11} = 0\ V$	150	200	250	μA

Notes to the characteristics

1. Values of video and sound parameters are decreased at $V_P = 4.5\ V$.
2. This parameter is not tested during production and is only given as application information for designing the television receiver.
3. Source impedance: 2.3 k Ω in parallel to 12 pF (SAW filter); $f_{IF} = 38.9\ MHz$.

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4. Loop bandwidth $BL = 180$ kHz (natural frequency $f_n = 15$ kHz; damping factor $d \approx 5$; calculated with sync level within gain control range). Resonance circuit of VCO: $Q_0 > 50$; $C_{ext} = 8.2$ pF ± 0.25 pF; $C_{int} \approx 8.5$ pF (loop voltage approximately 2.7 V).
5. Temperature coefficient of external LC-circuit is equal to zero.
6. $V_{iIF} = 10$ mV (RMS); $\Delta f = 1$ MHz (VCO frequency offset related to picture carrier frequency); white picture video modulation.
7. V_{iIF} signal for nominal video signal.
8. Offset current measured between pin 7 and half of supply voltage ($V_P = 2.5$ V) under the following conditions: no input signal at VIF input (pins 1, 2, 4 and 5) and VIF amplifier gain at minimum ($V_{28} = V_P$). Due to sample-and-hold mode of the FPLL in L standard, the leakage current of the loop filter capacitor ($C = 220$ nF) should not exceed 500 nA.
9. Measurements taken with SAW filter G3962 (sound carrier suppression: 40 dB); loop bandwidth $BL = 180$ kHz:
 - a) Modulation VSB; sound carrier **off**; $f_{video} > 0.5$ MHz.
 - b) Sound carrier **on**; SIF SAW filter L9453; $f_{video} = 10$ kHz to 10 MHz.
10. The 7 dB buffer gain accounts for 1 dB loss in the sound trap. Buffer output signal is typical 2 V (p-p), in event of CVBS video amplifier output typical 1 V (p-p). If no sound trap is applied a 330 Ω resistor must be connected from output to input (from pin 21 to pin 22).
11. The leakage current of the AGC capacitor should not exceed 1 μ A at B/G standard respectively 10 nA current at L standard. Larger currents will increase the tilt.
12. S/N is the ratio of black-to-white amplitude to the black level noise voltage (RMS value, pin 10). $B = 5$ MHz weighted in accordance with "CCIR 567".
13. The intermodulation figures are defined:

$$\alpha_{1.1} = 20 \log \left(\frac{V_0 \text{ at } 4.4 \text{ MHz}}{V_0 \text{ at } 1.1 \text{ MHz}} \right) + 3.6 \text{ dB}; \alpha_{1.1} \text{ value at } 1.1 \text{ MHz referenced to black/white signal};$$

$$\alpha_{3.3} = 20 \log \left(\frac{V_0 \text{ at } 4.4 \text{ MHz}}{V_0 \text{ at } 3.3 \text{ MHz}} \right); \alpha_{3.3} \text{ value at } 3.3 \text{ MHz referenced to colour carrier}.$$
14. Response speed valid for a VIF input level range of 200 μ V up to 70 mV.
15. To match the AFC output signal to different tuning systems a current source output is provided. The test circuit is given in Fig.7. The AFC-steepness can be changed by the resistors at pin 23.
16. Depending on the ratio $\Delta C/C_0$ of the LC resonant circuit of VCO ($Q_0 > 50$; see note 4; $C_0 = C_{int} + C_{ext}$).
17. The V_{oQSS} output (pin 20) is analysed by a test demodulator TDA9820. The S/N of this equipment should be higher than 60 dB, related to a deviation of ± 27 kHz, in accordance with "CCIR 468-4".
18. For all S/N measurements the used vision IF modulator has to meet the following specifications:
 - a) Incidental phase modulation for black-to-white jump less than 0.5 degrees.
 - b) QSS AF performance, measured with the television-demodulator AMF2 (audio output, weighted S/N ratio) better than 60 dB (deviation 27 kHz) for 6 kHz sine wave black-to-white video modulation.
 - c) Picture-to-sound carrier ratio; $PC/SC_1 = 13$ dB (transmitter).
19. Measurements taken with SAW filter G3962 (Siemens) for vision IF (suppressed sound carrier) and G9350 (Siemens) for sound IF (suppressed picture carrier). Input level $V_{iSIF} = 10$ mV (RMS), 27 kHz (54% FM deviation).
20. The PC/SC ratio at pins 1 and 2 is calculated as the addition of TV transmitter PC/SC ratio and SAW filter PC/SC ratio. This PC/SC ratio is necessary to achieve the S/N(W) values as noted. A different PC/SC ratio will change these values.
21. Measurements taken with SAW filter L9453 (Siemens) for AM sound IF (suppressed picture carrier).
22. The input voltage has to be $V_i > 2.8$ V or open-circuit.

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Table 1 Input frequencies and carrier ratios

DESCRIPTION	SYMBOL	B/G STANDARD	L STANDARD	L ACCENT STANDARD	UNIT
Picture carrier	f_{PC}	38.9	38.9	33.9	MHz
Sound carrier	f_{SC1}	33.4	32.4	40.4	MHz
	f_{SC2}	33.158	–	–	MHz
Picture-to-sound carrier ratio	SC_1	13	10	10	dB
	SC_2	20	–	–	dB

Table 2 Switch logic

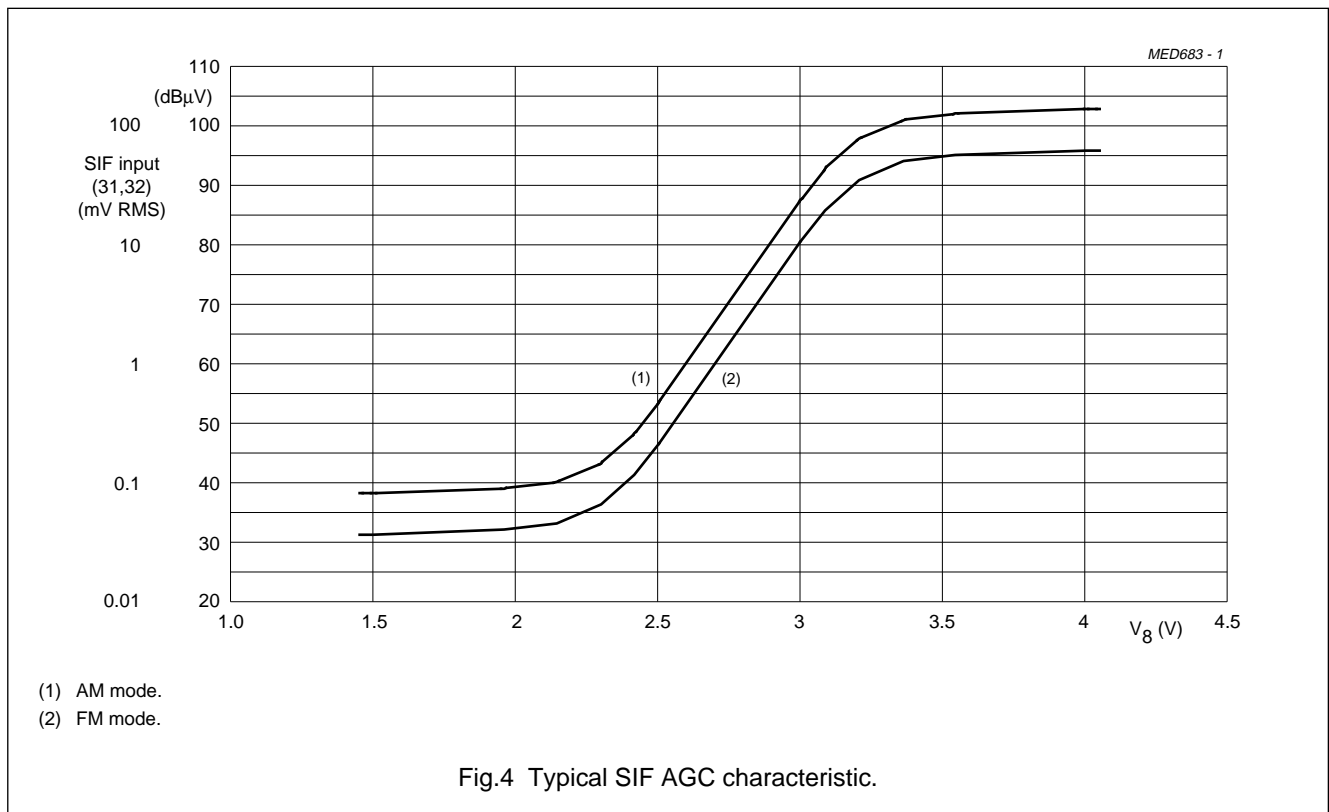
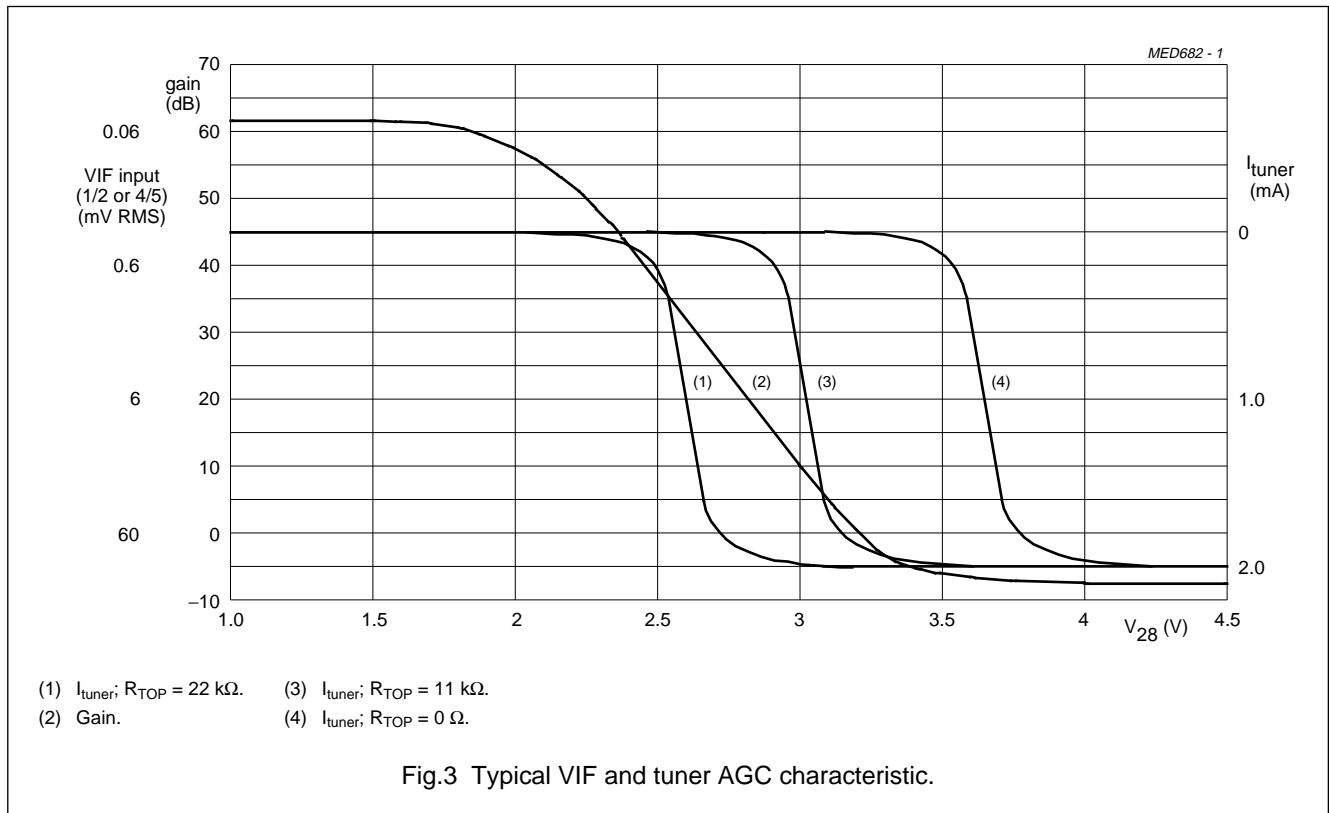
INPUT SWITCH (PIN 30)	STANDARD SWITCH (PIN 9)	SELECTED VIF INPUT	SELECTED STANDARD	VIDEO POLARITY	AF-AMPLIFIER
2.8 V to V_P	2.8 V to V_P	A	B/G	negative	–
	1.3 to 2.3 V	A	B/G, with external VIF AGC	negative	–
	0 to 0.8 V	A	L	positive	AM
1.3 to 2.3 V	0 to 0.8 V	B	L (note 1)	positive	AM
0 to 0.8 V	2.8 V to V_P	B	B/G	negative	–
	1.3 to 2.3 V	B	B/G, with external VIF AGC	negative	–
	0 to 0.8 V	B	L	positive	AM

Note

- Without external sound trap (video signal internally switched to video buffer).

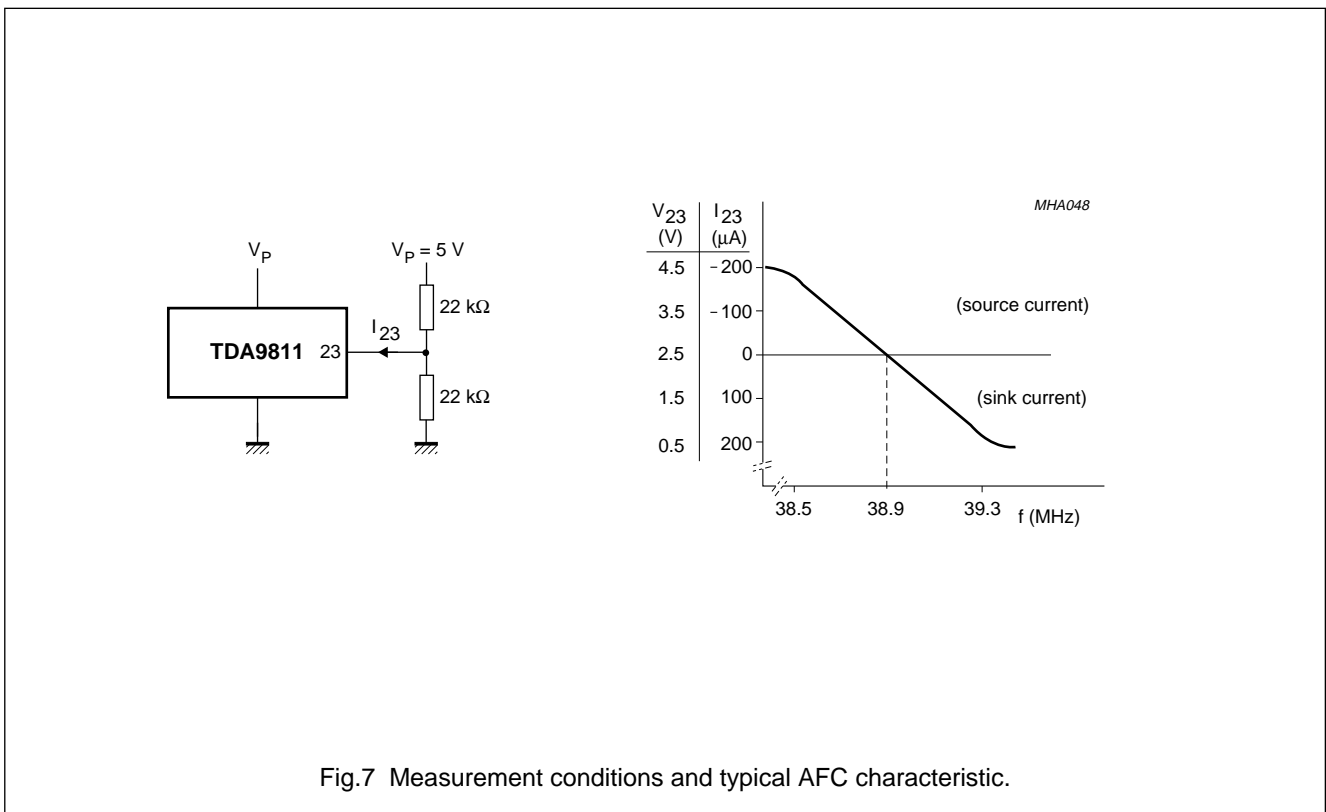
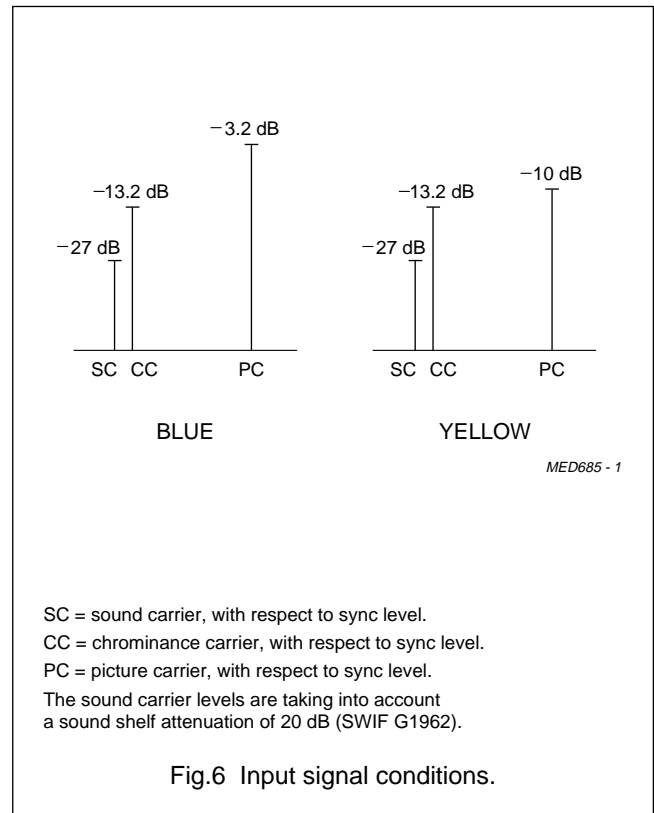
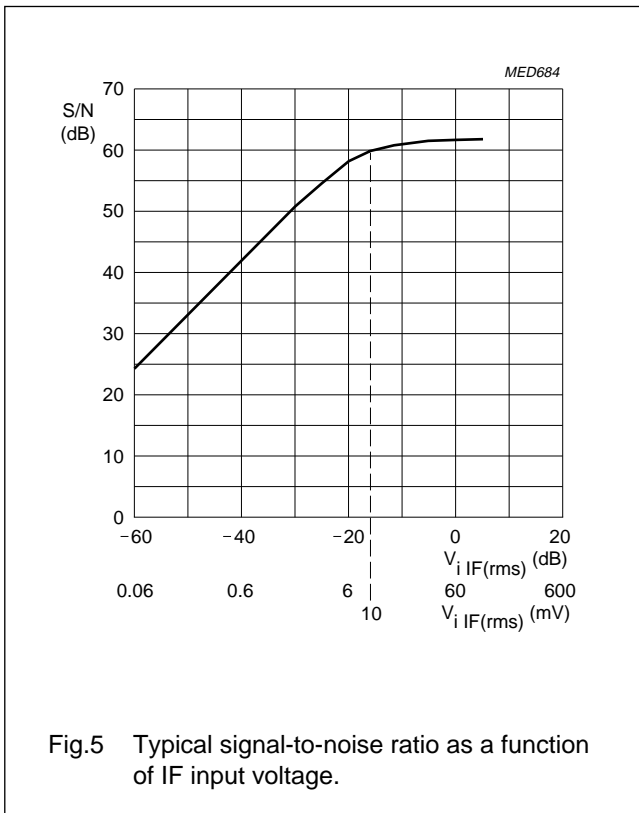
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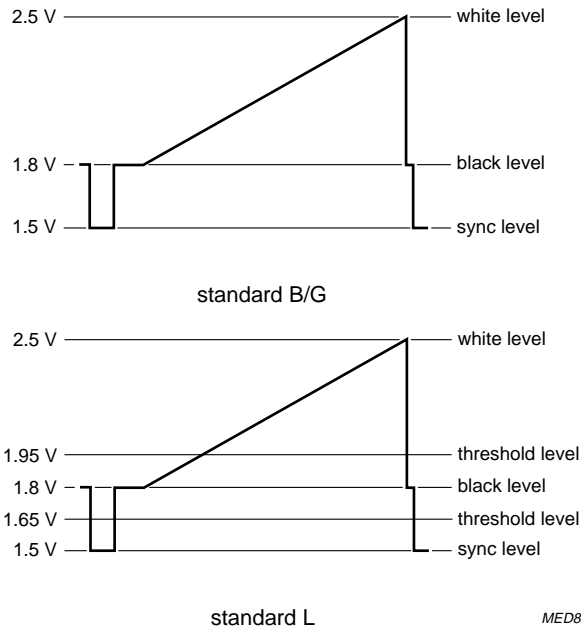


Fig.8 Typical video signal levels on output pin 21 (sound carrier **off**).

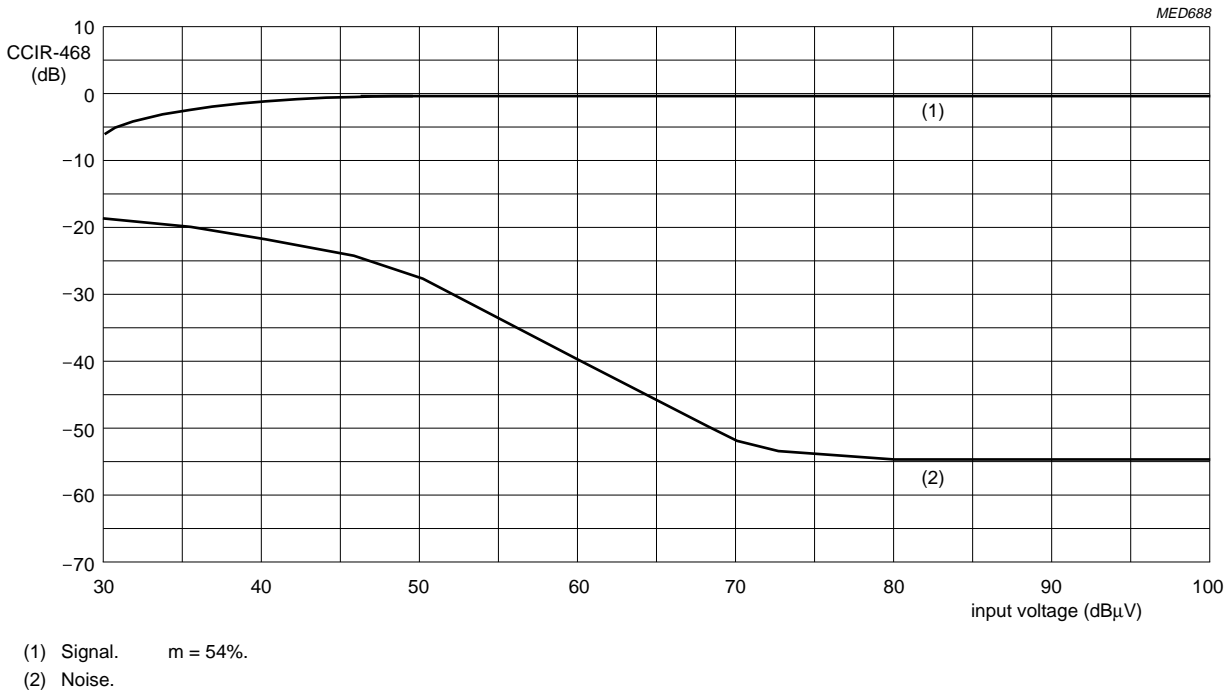
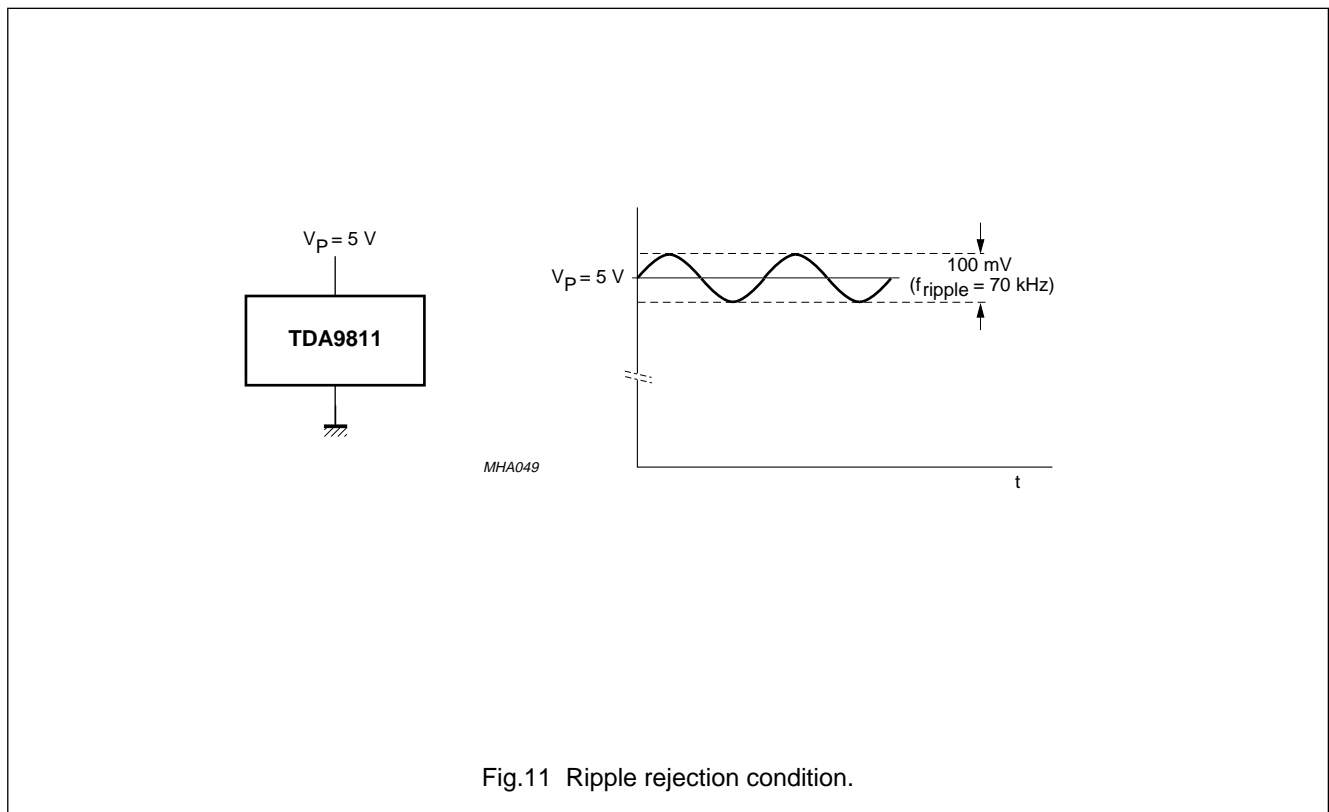
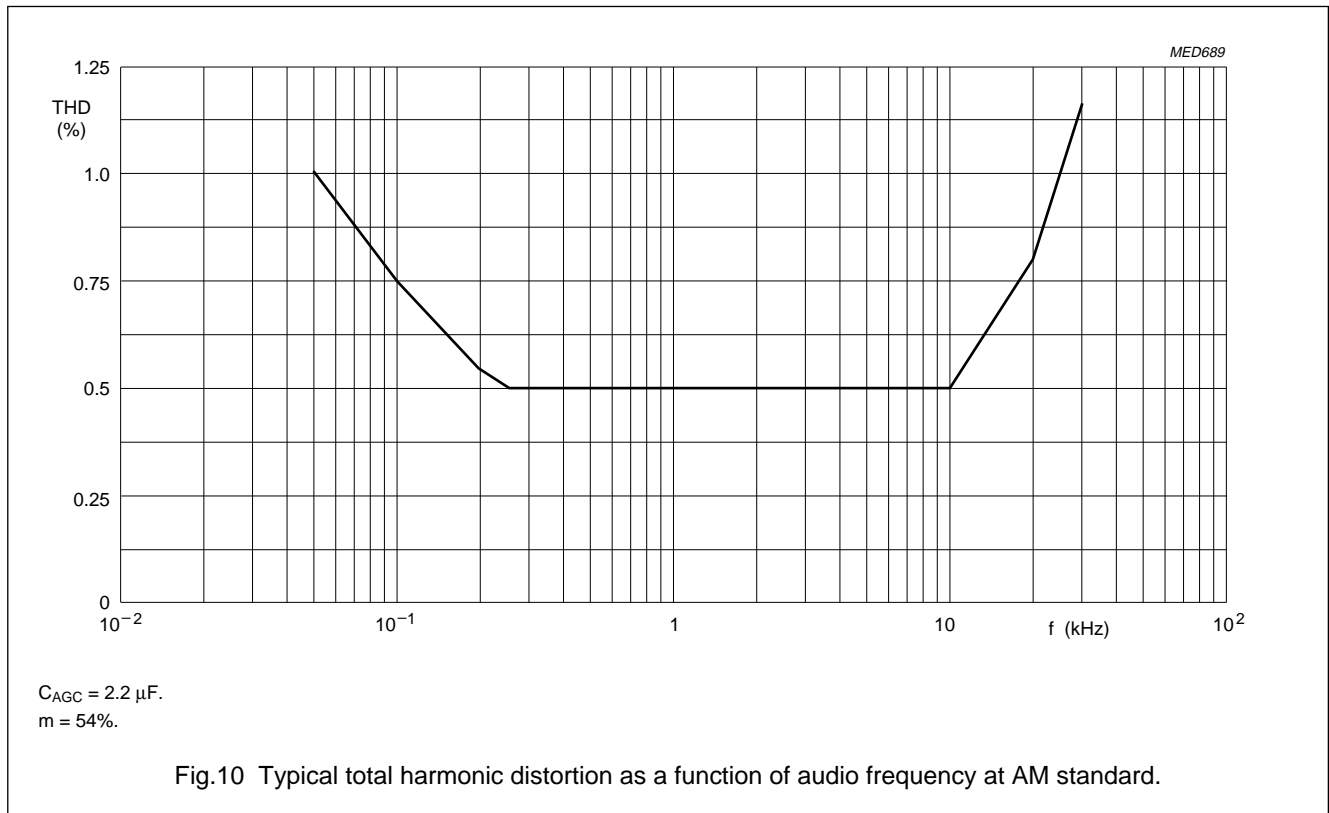


Fig.9 Typical audio sound-to-noise ratio as a function of input signal at AM standard.

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INTERNAL PIN CONFIGURATION

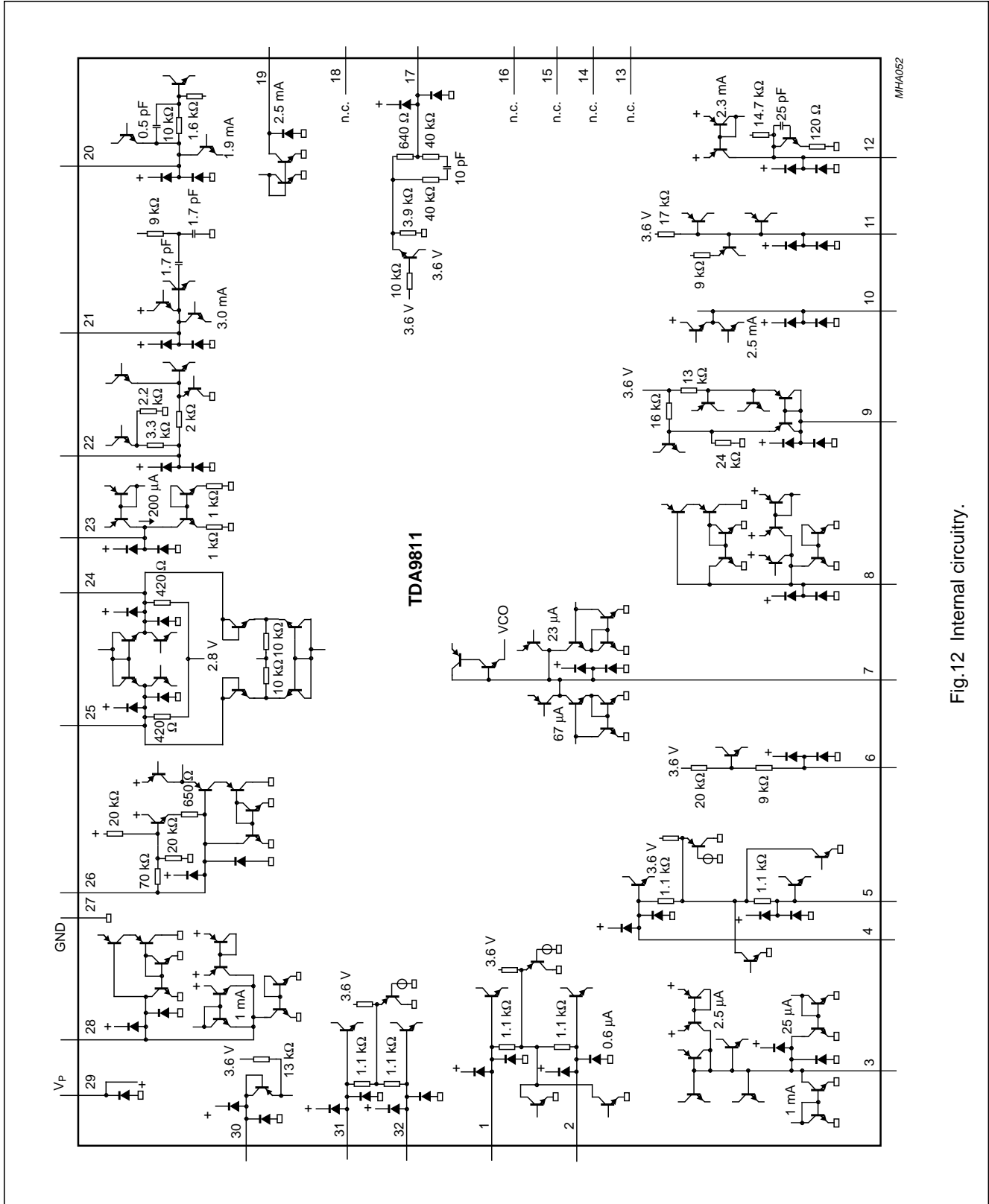


Fig.12 Internal circuitry.

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TEST AND APPLICATION INFORMATION

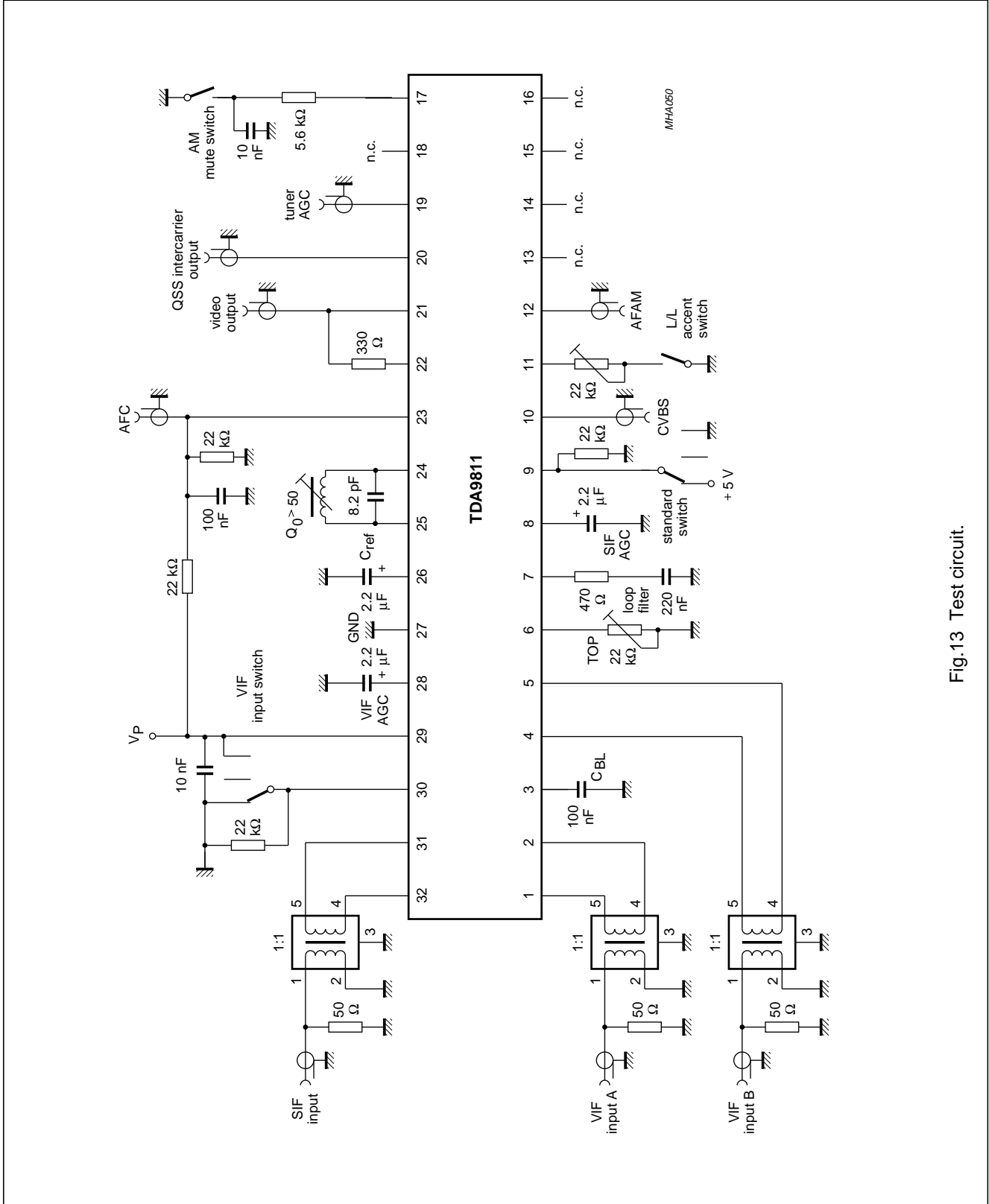


Fig.13 Test circuit.

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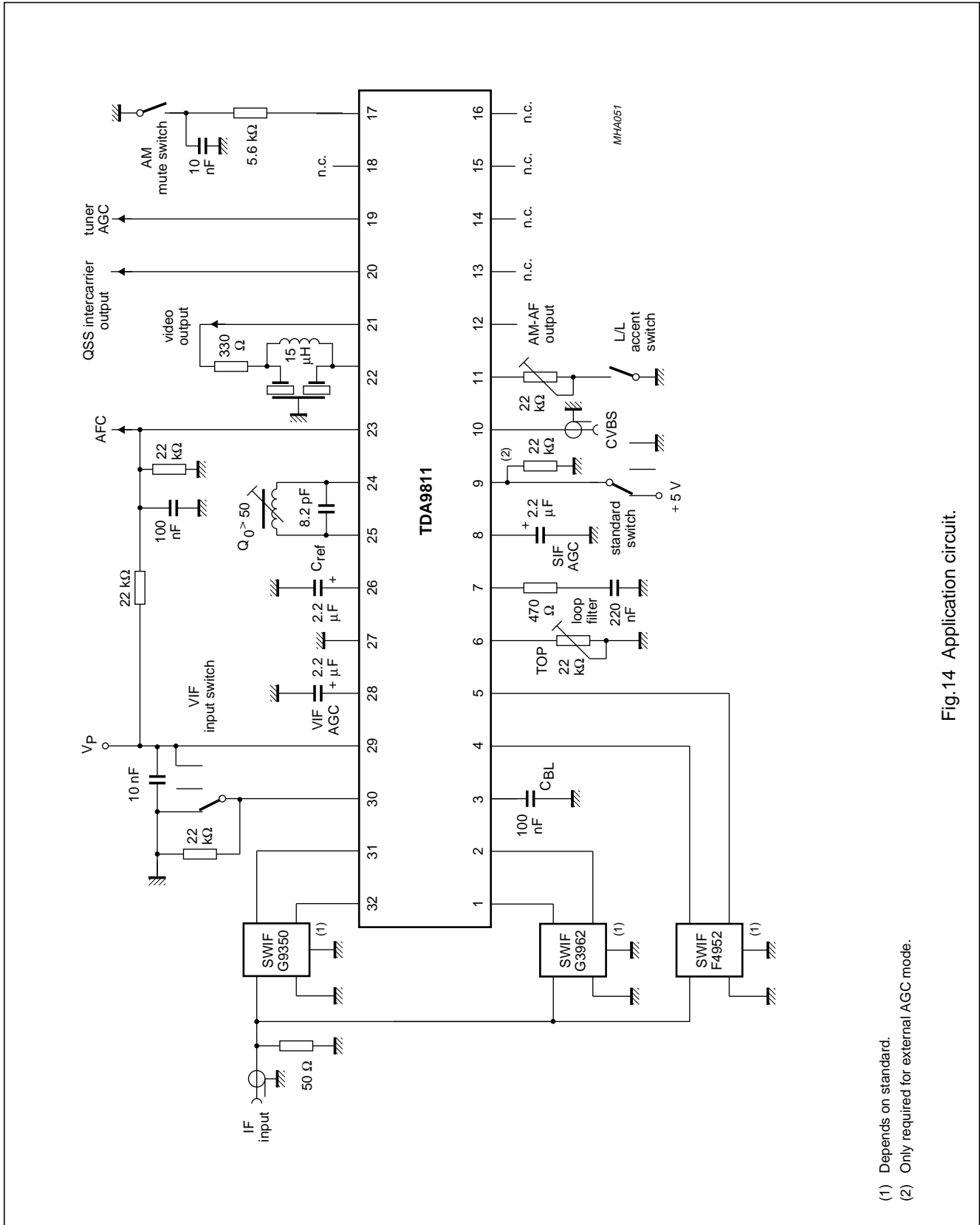


Fig.14 Application circuit.

- (1) Depends on standard.
- (2) Only required for external AGC mode.

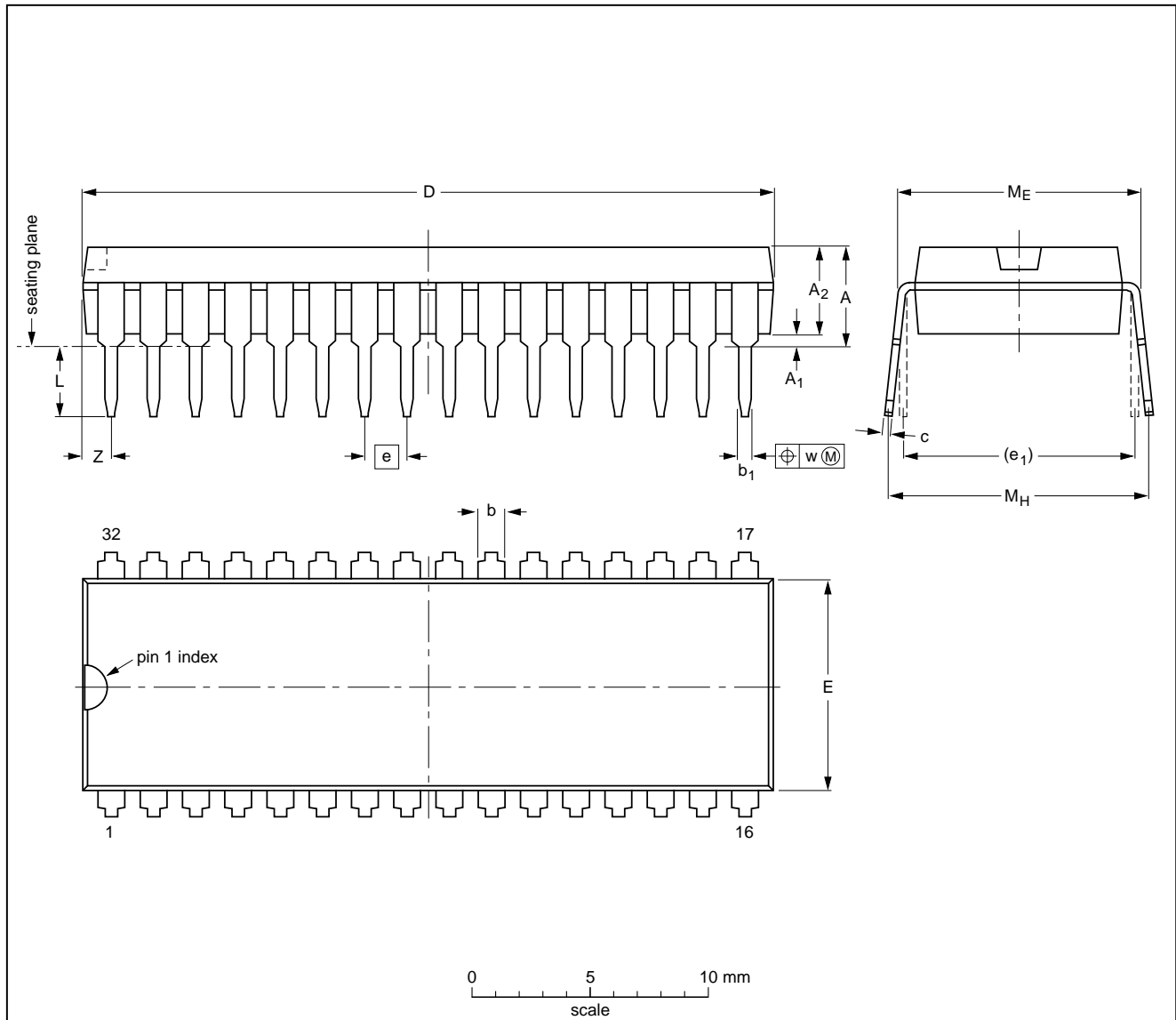
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PACKAGE OUTLINE

SDIP32: plastic shrink dual in-line package; 32 leads (400 mil)

SOT232-1



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A ₁ min.	A ₂ max.	b	b ₁	c	D ⁽¹⁾	E ⁽¹⁾	e	e ₁	L	M _E	M _H	w	z ⁽¹⁾ max.
mm	4.7	0.51	3.8	1.3 0.8	0.53 0.40	0.32 0.23	29.4 28.5	9.1 8.7	1.778	10.16	3.2 2.8	10.7 10.2	12.2 10.5	0.18	1.6

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ		
SOT232-1					92-11-17 95-02-04

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SOLDERING

Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our "IC Package Databook" (order code 9398 652 90011).

Soldering by dipping or by wave

The maximum permissible temperature of the solder is 260 °C; solder at 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 maximum storage temperature ($T_{stg\ max}$). 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.

Repairing soldered joints

Apply a low voltage soldering iron (less than 24 V) to the lead(s) of the package, below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.