DATA SHEET

TDA9817; TDA9818

Single/multistandard VIF/SIF-PLL and FM-PLL/AM demodulators

Preliminary specification

1997 May 12

File under Integrated Circuits, IC02

PHILIPS

Single/multistandard VIF/SIF-PLL and FM-PLL/AM demodulators

TDA9817; TDA9818

FEATURES

- 5 V supply voltage
- Applicable for IFs (Intermediate Frequencies) of 38.9 MHz, 45.75 MHz and 58.75 MHz
- Gain controlled wide band Video IF (VIF)-amplifier (AC-coupled)
- True synchronous demodulation with active carrier regeneration (very linear demodulation, good intermodulation figures, reduced harmonics, excellent pulse response)
- Robustness for over-modulation better than 105% due to gated phase detector at L/L accent standard and PLL-bandwidth control at negative modulated standards
- VCO (Voltage Controlled Oscillator) frequency switchable between L and L accent (alignment external) picture carrier frequency
- VIF AGC (Automatic Gain Control) detector for gain control, operating as peak sync detector for B/G, peak white detector for L; signal controlled reaction time for L
- Tuner AGC with adjustable TakeOver Point (TOP)
- AFC (Automatic Frequency Control) detector without extra reference circuit

- AC-coupled limiter amplifier for sound intercarrier signal
- Alignment-free FM PLL (Phase Locked Loop) demodulator with high linearity
- SIF (Sound IF) input for single reference QSS (Quasi Split Sound) 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 and in intercarrier mode
- AM demodulator without extra reference circuit
- Stabilizer circuit for ripple rejection and to achieve constant output signals
- ESD (Electrostatic Discharge) protection for all pins.

GENERAL DESCRIPTION

The TDA9817 is an integrated circuit for single standard vision IF signal processing and FM demodulation.

The TDA9818 is an integrated circuit for multistandard vision IF signal processing, sound AM and FM demodulation.

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TDA9817	SDIP24	plastic shrink dual in-line package; 24 leads (400 mil)	SOT234-1
TDA9818	SDIP24	plastic shrink dual in-line package; 24 leads (400 mil)	SOT234-1

Single/multistandard VIF/SIF-PLL and
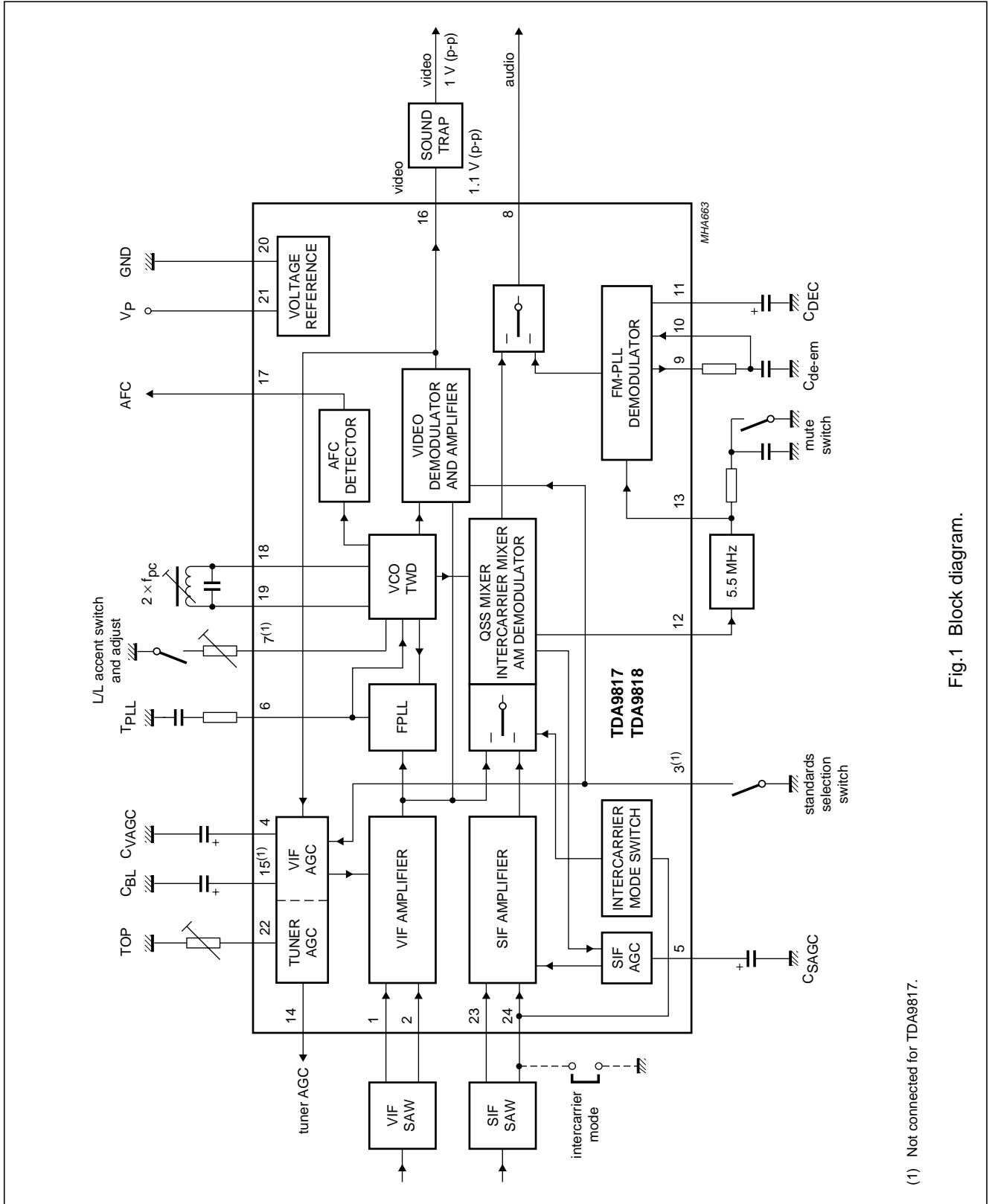FM-PLL/AM demodulators

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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		76	90	104	mA
$V_{i(VIF)(rms)}$	vision IF input signal voltage sensitivity (RMS value)	−1 dB video at output	–	60	100	μV
$V_{o(video)(p-p)}$	video output signal voltage (peak-to-peak value)		0.97	1.1	1.23	V
B_{-3}	−3 dB video bandwidth on pin 16	B/G and L standard; C_L < 20 pF; R_L > 1 kΩ; AC load	7	8	–	MHz
S/N_W	weighted signal-to-noise ratio for video		56	60	–	dB
$\alpha_{IM(1.1)}$	intermodulation attenuation at 'blue'	f = 1.1 MHz	58	64	–	dB
$\alpha_{IM(3.3)}$	intermodulation attenuation at 'blue'	f = 3.3 MHz	58	64	–	dB
$\alpha_{H(sup)}$	suppression of harmonics in video signal		35	40	–	dB
$V_{i(SIF)(rms)}$	sound IF input signal voltage sensitivity (RMS value)	−3 dB at intercarrier output	–	50	100	μV
$V_{o(rms)}$	audio output signal voltage for FM (RMS value)	B/G standard; 27 kHz modulation (54%)	0.4	0.5	0.6	V
		M, N standard; 25 kHz modulation	0.36	0.45	0.54	V
	audio output signal voltage for AM (RMS value)	L standard; 54% modulation	0.4	0.5	0.6	V
THD_{audio}	total harmonic distortion audio signal	54% modulation				
	FM		–	0.2	0.5	%
	AM		–	0.5	1.0	%
$S/N_{W(audio)}$	weighted signal-to-noise ratio audio signal	54% modulation				
	FM		55	60	–	dB
	AM		47	53	–	dB

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BLOCK DIAGRAM

Fig.1 Block diagram.

(1) Not connected for TDA9817.

Single/multistandard VIF/SIF-PLL and
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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
STD[1]	3	standard switch
C_{VAGC}	4	VIF AGC capacitor
C_{SAGC}	5	SIF AGC capacitor
T_{PLL}	6	PLL loop filter
LADJ[1]	7	L/L accent switch and adjust
$V_{o\,AF}$	8	audio output
V_{de-em}	9	de-emphasis input
C_{de-em}	10	de-emphasis output
C_{DEC}	11	decoupling capacitor
$V_{o\,QSS}$	12	single reference QSS/intercarrier output voltage
$V_{i\,FM}$	13	sound intercarrier input voltage
TAGC	14	tuner AGC output
C_{BL}[1]	15	black level detector
$V_{o(vid)}$	16	composite video output voltage
AFC	17	AFC output
VCO1	18	VCO1 resonance circuit
VCO2	19	VCO2 resonance circuit
GND	20	ground
V_P	21	supply voltage
TADJ	22	tuner AGC takeover point adjust
$V_{i\,SIF1}$	23	SIF differential input signal voltage 1
$V_{i\,SIF2}$	24	SIF differential input signal voltage 2

Note
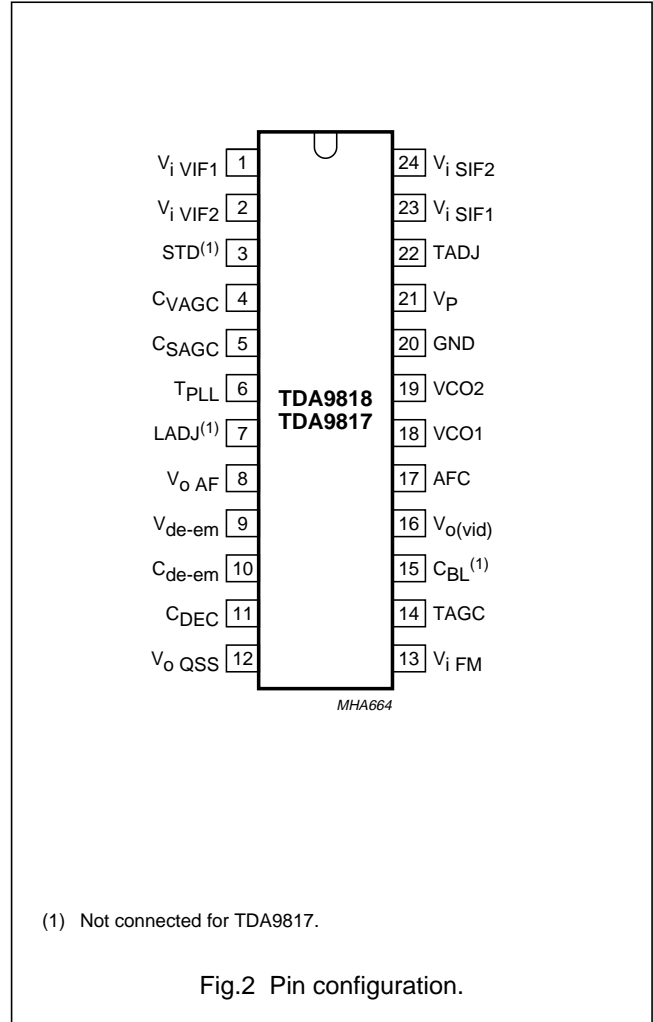
1. Not connected for TDA9817.

(1) Not connected for TDA9817.

Fig.2 Pin configuration.

FUNCTIONAL DESCRIPTION

The integrated circuit comprises the functional blocks as shown in Fig.1:

- Vision IF amplifier and VIF AGC detector
- Tuner AGC
- Frequency Phase Locked Loop detector (FPLL)
- VCO, Travelling Wave Divider (TWD) and AFC
- Video demodulator and amplifier
- SIF amplifier and SIF AGC
- Single reference QSS mixer
- AM demodulator
- FM-PLL demodulator
- AF (Audio Frequency) signal processing
- Internal voltage stabilizer.

Vision IF amplifier and VIF AGC detector

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

The AGC detector generates the required VIF gain control voltage for constant video output by charging/discharging the AGC capacitor. 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.

Tuner AGC

The AGC capacitor voltage is converted to an internal IF control signal, and is fed to the tuner AGC to generate the tuner AGC output current at pin TAGC (open-collector output). The tuner AGC takeover point can be adjusted at pin TADJ. This allows to match the tuner to the SAW filter in order to achieve the optimum IF input level.

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 (FPLL) and fed via the loop filter to the first variable capacitor. This control voltage is amplified and additionally converted into a current which represents the AFC output signal. At centre frequency the AFC output current is equal to zero.

For TDA9818: 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.

The oscillator signal is divided by 2 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 at $V_{o(vid)}$ is 1.1 V (p-p) for nominal vision IF modulation, in order to achieve 1 V (p-p) at sound trap output.

SIF amplifier and SIF 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 signal (average level of AM or FM carrier) and controls the SIF amplifier to provide a constant SIF signal to the AM demodulator and single reference QSS mixer. At L standard (AM sound) 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 always 'fast'.

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 12. With this system a high performance hi-fi stereo sound processing can be achieved.

For a simplified application without a sound IF SAW filter the single reference QSS mixer can be switched to the intercarrier mode by connecting pin 24 to ground. In this mode the sound IF passes the vision IF SAW filter and the composite IF signal is fed to the single reference QSS mixer. This IF signal is multiplied with the 90 degree TWD output signal for converting the sound IF to intercarrier frequency. This composite intercarrier signal is fed to the output pin 12, too. By using this quadrature detection, the low frequency video signals are removed.

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.

FM-PLL demodulator

The FM-PLL demodulator consists of a limiter and an FM-PLL. The limiter provides the amplification and limitation of the FM sound intercarrier signal. The result is high sensitivity and AM suppression. The amplifier consists of 7 stages which are internally AC-coupled in order to minimize the DC offset.

Furthermore the AF output signal can be muted by connecting a resistor between the limiter input pin 13 and ground.

The FM-PLL consists of an integrated relaxation oscillator, an integrated loop filter and a phase detector. The oscillator is locked to the FM intercarrier signal, output from the limiter. As a result of locking, the oscillator frequency tracks with the modulation of the input signal and the oscillator control voltage is superimposed by the AF voltage. The FM-PLL operates as an FM demodulator.

AF signal processing

The AF amplifier consists of two parts:

1. The AF pre-amplifier for FM sound is an operational amplifier with internal feedback, high gain and high common mode rejection. The AF voltage from the PLL demodulator, by principle a small output signal, is amplified by approximately 33 dB. The low-pass characteristic of the amplifier reduces the harmonics of the intercarrier signal at the sound output terminal pin 9 at which the de-emphasis network for FM sound is applied. An additional DC control circuit is implemented to keep the DC level constant, independent of process spread.

2. The AF output amplifier (10 dB) provides the required output level by a rail-to-rail output stage. This amplifier makes use of an input selector for switching to AM, FM de-emphasis or mute state, controlled by the standard switching voltage and the mute switching voltage.

Internal voltage stabilizer

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.

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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	maximum chip temperature of 110 °C; note 1	–	5.5	V
V_i	voltage at pins 1 to 6, 9 to 11, 13 to 15, 17 and 21 to 24		0	V_P	V
$t_{sc(max)}$	maximum short-circuit time to ground or V_P		–	10	s
V_{TAGC}	tuner automatic gain control 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

1. $I_P = 104$ mA; $T_{amb} = 70$ °C; $R_{th\ j\text{-}a} = 65$ K/W.

2. Machine model class B.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air	65	K/W

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CHARACTERISTICS

V_P = 5 V; T_{amb} = 25 °C; see Table 1 for input frequencies and level; input level $V_{i(VIF)(rms)}$ = 10 mV (sync-level for B/G, peak white level for L); IF input from 50 Ω via broadband transformer 1 : 1; video modulation DSB; residual carrier B/G: 10%; L = 3%; video signal in accordance with *"CCIR, line 17"* or *"NTC-7 Composite"*; measurements taken in Fig.13; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply (pin 21)						
V_P	supply voltage	note 1	4.5	5	5.5	V
I_P	supply current		76	90	104	mA
Vision IF amplifier (pins 1 and 2)						
$V_{i(VIF)(rms)}$	input signal voltage sensitivity (RMS value)	B/G standard; −1 dB video at output	–	60	100	μV
$V_{i(max)(rms)}$	maximum input signal voltage (RMS value)	B/G standard; +1 dB video at output	120	200	–	mV
$\Delta V_{o(int)}$	internal IF amplitude difference between picture and sound carrier	within AGC range; B/G standard; Δf = 5.5 MHz	–	0.7	1	dB
$G_{IF(cr)}$	IF gain control range	see Fig.3	65	70	–	dB
$R_{i(diff)}$	differential input resistance	note 2	1.7	2.2	2.7	kΩ
$C_{i(diff)}$	differential input capacitance	note 2	1.2	1.7	2.5	pF
$V_{I(1,2)}$	DC input voltage	note 2	–	3.4	–	V
True synchronous video demodulator; note 3						
$f_{VCO(max)}$	maximum oscillator frequency for carrier regeneration	f = 2 f_{pc}	125	130	–	MHz
$\Delta f_{osc}/\Delta T$	oscillator drift as a function of temperature	oscillator is free-running; I_{AFC} = 0; note 4	–	–	$\pm 20 \times 10^{-6}$	K^{-1}
$\Delta f_{osc}/\Delta V_P$	oscillator shift as a function of supply voltage	oscillator is free-running; note 4	–	–	$\pm 1.5 \times 10^{-3}$	V^{-1}
$V_{VCO(rms)}$	oscillator voltage swing at pins 18 and 19 (RMS value)		50	80	110	mV
$f_{cr(pc)}$	picture carrier capture range	B/G, M, N and L standard	±1.4	±1.8	–	MHz
		L accent standard; f_{pc} = 33.9 MHz; R_7 = 5.6 kΩ	±0.9	±1.2	–	MHz
$\Delta f_{pc(fr)}$	picture carrier frequency (free-running) accuracy	L accent standard; f_{pc} = 33.9 MHz; R_7 = 5.6 kΩ	–	±200	±400	kHz
$f_{alg(L\ accent)}$	L accent alignment frequency range	L accent standard; I_{AFC} = 0	±400	±600	–	kHz
t_{acq}	acquisition time	BL = 70 kHz; note 5	–	–	30	ms

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{i(IF)(rms)}$	IF input signal voltage sensitivity for PLL to be locked (RMS value; pins 1 and 2)	maximum IF gain; note 6	–	30	70	µV
Composite video amplifier (pin 16; sound carrier off)						
$V_{o(video)(p-p)}$	output signal voltage (peak-to-peak value)	see Fig.8	0.97	1.1	1.23	V
V/S	ratio between video (black-to-white) and sync level		1.9	2.33	3.0	
$\Delta V_{o(video)}$	output signal voltage difference	difference between B/G and L standard	–	–	±12	%
$V_{sync(16)}$	sync voltage level	B/G and L standard	1.4	1.5	1.6	V
$V_{clu(16)}$	upper video clipping voltage level		$V_P - 1.1$	$V_P - 1$	–	V
$V_{cll(16)}$	lower video clipping voltage level		–	0.7	0.9	V
$R_{o(16)}$	output resistance	note 2	–	–	10	Ω
$I_{bias(16)(int)}$	internal DC bias current for emitter-follower		2.2	3.0	–	mA
$I_{o(sink)(16)(max)}$	maximum AC and DC output sink current		1.6	–	–	mA
$I_{o(source)(16)(max)}$	maximum AC and DC output source current		2.9	–	–	mA
ΔV_o	deviation of CVBS output signal voltage at B/G standard	50 dB gain control	–	–	0.5	dB
		30 dB gain control	–	–	0.1	dB
$\Delta V_{o(blBG)}$	black level tilt in B/G standard	gain variation; note 7	–	–	1	%
$\Delta V_{o(blL)}$	vertical black level tilt for worst case in L standard	vision carrier modulated by test line (VITS) only; gain variation; note 7	–	–	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	B/G and L standard; $C_L < 50$ pF; $R_L > 1$ kΩ; AC load	5	6	–	MHz
B_{-3}	–3 dB video bandwidth	B/G and L standard; $C_L < 50$ pF; $R_L > 1$ kΩ; AC load	7	8	–	MHz
S/N_W	weighted signal-to-noise ratio	see Fig.5 and note 8	56	60	–	dB
S/N	unweighted signal-to-noise ratio	see Fig.5 and note 8	49	53	–	dB

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$\alpha_{IM(1.1)}$	intermodulation attenuation at 'blue'	f = 1.1 MHz; see Fig.6 and note 9	58	64	–	dB
	intermodulation attenuation at 'yellow'	f = 1.1 MHz; see Fig.6 and note 9	60	66	–	dB
$\alpha_{IM(3.3)}$	intermodulation attenuation at 'blue'	f = 3.3 MHz; see Fig.6 and note 9	58	64	–	dB
	intermodulation attenuation at 'yellow'	f = 3.3 MHz; see Fig.6 and note 9	59	65	–	dB
$\Delta f_{unwanted(p-p)}$	robustness for unwanted frequency deviation of picture carrier (peak-to-peak value)	L standard; residual carrier: 3%; serration pulses: 50%; note 2	–	–	12	kHz
$\Delta\varphi$	robustness for modulator imbalance	L standard; residual carrier: 0%; serration pulses: 50%; note 2	–	–	3	%
$\alpha_{c(rms)}$	residual vision carrier (RMS value)	fundamental wave and harmonics; B/G and L standard	–	2	5	mV
$\alpha_{H(sup)}$	suppression of video signal harmonics	note 10a	35	40	–	dB
$\alpha_{H(spur)}$	spurious elements	note 10b	40	–	–	dB
PSRR	power supply ripple rejection at pin 16	video signal; grey level; see Fig.11				
		B/G standard	30	35	–	dB
		L standard	26	30	–	dB
VIF-AGC detector (pin 4)						
I_4	charging current	B/G and L standard; note 7	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 11	–	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 11	–	150	240	ms/dB
ΔIF	VIF amplitude step for activating fast AGC mode	L standard	−2	−6	−10	dB

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{th(15)}$	threshold voltage level additional charging current	see Fig.8				
		L standard	1.95	2.0	2.05	V
		L standard; fast mode L	1.6	1.66	1.72	V
Tuner AGC (pin 14)						
$V_{i(rms)}$	IF input signal voltage for minimum starting point of tuner takeover (RMS value)	input at pins 1 and 2; R_{TOP} = 22 kΩ; I_{14} = 0.4 mA	–	2	5	mV
	IF input signal voltage for maximum starting point of tuner takeover (RMS value)	input at pins 1 and 2; R_{TOP} = 0 Ω; I_{14} = 0.4 mA	50	100	–	mV
$V_{o(14)}$	permissible output voltage	from external source; note 2	–	–	13.2	V
$V_{sat(14)}$	saturation voltage	I_{14} = 1.5 mA	–	–	0.2	V
$\Delta V_{TOP(14)}/\Delta T$	variation of takeover point by temperature	I_{14} = 0.4 mA	–	0.03	0.07	dB/K
$I_{14(sink)}$	sink current	see Fig.3				
		no tuner gain reduction; V_{14} = 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
AFC circuit (pin 17); see Fig.7 and note 12						
S	control steepness $\Delta I_{17}/\Delta f$	note 13				
		33.9 MHz	0.5	0.75	1.0	µA/kHz
		38.9 MHz	0.5	0.75	1.0	µA/kHz
		45.75 MHz	0.45	0.65	0.85	µA/kHz
		58.75 MHz	0.38	0.55	0.72	µA/kHz
$\Delta f_{IF}/\Delta T$	frequency variation by temperature	B/G and L standard; I_{AFC} = 0; note 4	–	–	$\pm 20 \times 10^{-6}$	K^{-1}
		L accent standard; I_{AFC} = 0; note 4	–	–	$\pm 60 \times 10^{-6}$	K^{-1}
$V_{o(17)}$	output voltage upper limit		V_P – 0.6	V_P – 0.3	–	V
	output voltage lower limit		–	0.3	0.6	V
$I_{o(source)(17)}$	output source current		150	200	250	µA
$I_{o(sink)(17)}$	output sink current		150	200	250	µA
$\Delta I_{17(p-p)}$	residual video modulation current (peak-to-peak value)	B/G and L standard	–	20	30	µA

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Sound IF amplifier (pins 23 and 24)						
$V_{i(SIF)(rms)}$	input signal voltage sensitivity (RMS value)	FM mode; −3 dB at intercarrier output pin 12	−	50	100	μV
		AM mode; −3 dB at AF output pin 8	−	50	100	μV
$V_{i(max)(rms)}$	maximum input signal voltage (RMS value)	FM mode; +1 dB at intercarrier output pin 12	65	100	−	mV
		AM mode; +1 dB at AF output pin 8	65	100	−	mV
$G_{cr(SIF)}$	SIF gain control range	FM and AM mode; see Fig.4	60	66	−	dB
$R_{i(diff)}$	differential input resistance	note 2	1.7	2.2	2.7	kΩ
$C_{i(diff)}$	differential input capacitance	note 2	1.2	1.7	2.5	pF
$V_{I(23,24)}$	DC input voltage		−	3.4	−	V
$\alpha_{SIF,VIF}$	crosstalk attenuation between SIF and VIF input	between pins 1 and 2 and pins 23 and 24; note 14	50	−	−	dB
SIF AGC detector (pin 5)						
$I_{ch(5)}$	charging current	FM mode	8	12	16	μA
		AM mode	0.8	1.2	1.6	μA
$I_{dch(5)}$	discharging current	FM mode	8	12	16	μA
		normal mode AM	1	1.4	1.8	μA
		fast mode AM	60	85	110	μA
Single reference QSS intercarrier mixer (B/G standard; pin 12)						
$V_{o(rms)}$	IF intercarrier level (RMS value)	QSS mode; SC_1; sound carrier 2 off	100	140	180	mV
		L standard; without modulation	100	140	180	mV
		intercarrier mode; SC1; sound carrier 2 off	−	note 15	−	mV
$V_{o(peak)}$	IF intercarrier level (peak value)	QSS mode	141	198	225	mV
		L standard; 80% AM modulation	255	356	458	mV
B_{-3}	−3 dB intercarrier bandwidth	upper limit	7.5	9	−	MHz
$\alpha_{SC(rms)}$	residual sound carrier (RMS value)	QSS mode; fundamental wave and harmonics	−	2	5	mV
		intercarrier mode; fundamental wave and harmonics	−	2	5	mV

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$\alpha_{C(rms)}$	residual vision carrier (RMS value)	QSS mode; fundamental wave and harmonics	–	2	5	mV
		intercarrier mode; fundamental wave and harmonics	–	5	20	mV
$\alpha_{H(sup)}$	suppression of video signal harmonics	intercarrier mode; $f_{video} \leq 5$ MHz	39	–	–	dB
$R_{o(12)}$	output resistance	note 2	–	–	25	Ω
$V_{O(12)}$	DC output voltage		–	2.0	–	V
$I_{int(12)}$	DC internal bias current for emitter-follower		1.9	2.5	–	mA
$I_{sink(max)(12)}$	maximum AC and DC output sink current		1.4	1.9	–	mA
$I_{source(max)(12)}$	maximum AC and DC output source current		3.0	3.5	–	mA
Limiter amplifier (pin 13); note 16						
$V_{i(FM)(rms)}$	input signal voltage for lock-in (RMS value)		–	–	100	μV
$V_{i(FM)(rms)}$	input signal voltage (RMS value)	$\left(\dfrac{S+N}{N}\right)$weighted $= 40$ dB	–	250	400	μV
	allowed input signal voltage (RMS value)		200	–	–	mV
α_{AM}	AM suppression	50 μs de-emphasis; AM: f = 1 kHz; m = 0.3 refer to 27 kHz (54% FM deviation)	46	50	–	dB
$R_{i(13)}$	input resistance	note 2	480	600	720	Ω
$V_{I(13)}$	DC input voltage		–	2.8	–	V
FM-PLL demodulator						
f_{cr}	catching range of PLL	upper limit	7.0	–	–	MHz
		lower limit	–	–	4.0	MHz
f_{hr}	holding range of PLL	upper limit	9.0	–	–	MHz
		lower limit	–	–	3.5	MHz
t_{acq}	acquisition time		–	–	4	μs

Single/multistandard VIF/SIF-PLL and
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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
FM operation (B/G standard; pin 8); notes 16 and 16a						
$V_{o(AF)(rms)}$	AF output signal voltage (RMS value)	27 kHz (54% FM deviation); see Fig.13 and note 17				
		$R_x = 470\ \Omega$	200	250	300	mV
		$R_x = 0\ \Omega$	400	500	600	mV
		25 kHz (50% FM deviation); $R_x = 0\ \Omega$; see Fig.13 and note 17	360	450	540	mV
$V_{o(AF)(cl)}$	AF output clipping signal voltage level	THD < 1.5%	1.0	–	1.2	V
Δf_{AF}	frequency deviation	THD < 1.5%; note 17	–	–	±53	kHz
$\Delta V_o/\Delta T$	temperature drift of AF output signal voltage		–	3×10^{-3}	7×10^{-3}	dB/K
V_9	DC voltage at decoupling capacitor	voltage dependent on VCO frequency; note 18	1.2	–	3.0	V
R_8	output resistance	note 2	–	–	100	Ω
V_8	DC output voltage		–	2.3	–	V
$I_{sink(max)(8)}$	maximum AC and DC output sink current		–	–	0.5	mA
$I_{source(max)(8)}$	maximum AC and DC output source current		–	–	0.5	mA
B_{-3}	−3 dB audio frequency bandwidth	without de-emphasis capacitor	100	125	–	kHz
THD	total harmonic distortion	27 kHz (54% FM deviation)	–	0.2	0.5	%
S/N_W	weighted signal-to-noise ratio	FM-PLL only; with 50 µs de-emphasis; 27 kHz (54% FM deviation); "CCIR 468-4"	55	60	–	dB
$\alpha_{SC(rms)}$	residual sound carrier (RMS value)	fundamental wave and harmonics	–	–	75	mV
α_8	mute attenuation of AF signal	B/G and L standard	70	75	–	dB
ΔV_8	DC jump voltage of AF output terminal for switching AF output to mute state and vice versa	FM-PLL in lock mode	–	±50	±150	mV
PSRR	power supply ripple rejection at pin 8	$R_x = 0\ \Omega$; f = 70 Hz; see Figs 11 and 13	20	26	–	dB

Single/multistandard VIF/SIF-PLL and
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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Single reference QSS AF performance for FM operation (B/G standard); notes 19, 20 and 21; see Table 1						
S/N_W	weighted signal-to-noise ratio	PC/SC$_1$ ratio at pins 1 and 2; 27 kHz (54% FM deviation); *"CCIR 468-4"*	40	–	–	dB
		black picture	53	58	–	dB
		white picture	50	55	–	dB
		6 kHz sine wave (black-to-white modulation)	42	48	–	dB
		sound carrier subharmonics; f = 2.75 MHz ±3 kHz	45	51	–	dB
Intercarrier AF performance for FM operation (standard B/G) notes 19, 20 and 22; see Table 1						
S/N_W	weighted signal-to-noise ratio	PC/SC$_1$ ratio at pins 1 and 2; 27 kHz (54% FM deviation); *"CCIR 468-4"*	27	–	–	dB
		black picture	47	51	–	dB
		white picture	47	51	–	dB
		6 kHz sine wave (black-to-white modulation)	40	46	–	dB
		sound carrier subharmonics; f = 2.75 MHz ±3 kHz	35	39	–	dB
AM operation (L standard; pin 8); note 23						
$V_{o(AF)(rms)}$	AF output signal voltage (RMS value)	54% modulation	400	500	600	mV
THD	total harmonic distortion	54% modulation	–	0.5	1.0	%
B_{-3}	−3 dB AF bandwidth		100	125	–	kHz
S/N_W	weighted signal-to-noise ratio	*"CCIR 468-4"*	47	53	–	dB
V_8	DC potential voltage		–	2.3	–	V
PSRR	power supply ripple rejection at pin 8	see Fig.11	20	26	–	dB
Switching level for standard switch (pin 3)						
V_{logic}	DC potential for logic 1 or pin not connected	B/G standard	2.8	–	V_P	V
	DC potential for logic 0	L/L accent standard	0	–	0.8	V
I_{IL}	LOW level input current	V = 0 V	190	250	310	µA

Single/multistandard VIF/SIF-PLL and
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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 an application information for designing the television receiver.

3. Loop bandwidth BL = 70 kHz (natural frequency f_n = 12 kHz; damping factor d $\approx$ 3; calculated with sync level within gain control range). Resonance circuit of VCO: Q_0 > 50; C_{ext} = 8.2 pF $\pm$0.25 pF; C_{int} $\approx$ 8.5 pF (loop voltage approximately 2.7 V).

4. Temperature coefficient of external LC-circuit is equal to zero.

5. $V_{i(IF)(rms)}$ = 10 mV; Δf = 1 MHz (VCO frequency offset related to picture carrier frequency); white picture video modulation.

6. $V_{i\,IF}$ signal for nominal video signal.

7. The leakage current of the AGC capacitor should not exceed 1 μA at B/G standard respectively 10 nA current at L standard. Larger currents will increase the tilt.

8. S/N is the ratio of black-to-white amplitude to the black level noise voltage (RMS value, pin 16). B = 5 MHz weighted in accordance with *"CCIR 567"*.

9. The intermodulation figures are defined:

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

$$\alpha_{3.3} = 20 \; \log\left(\frac{V_0 \; \text{at 4.4 MHz}}{V_0 \; \text{at 3.3 MHz}}\right); \; \alpha_{3.3} \; \text{value at 3.3 MHz referenced to colour carrier.}$$

10. Measurements taken with SAW filter K3953 (sound carrier suppression: 40 dB); loop bandwidth BL = 70 kHz:

   a) Modulation VSB; sound carrier **off**; f_{video} > 0.5 MHz.

   b) Sound carrier **on**; SIF SAW filter K9453; f_{video} = 10 kHz to 10 MHz.

11. Response speed valid for a VIF input level range of 200 μV up to 70 mV.

12. 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 17.

13. Depending on the ratio $\Delta C/C_0$ of the LC resonant circuit of VCO (Q_0 > 50; see note 3; $C_0 = C_{int} + C_{ext}$).

14. Source impedance: 2.3 kΩ in parallel to 12 pF (SAW filter); f_{IF} = 38.9 MHz.

15. Without using an SIF SAW filter the mixer can be switched to intercarrier mode by connecting pin 23 and/or pin 24 to ground. In this mode the SIF passes the VIF SAW filter and IF intercarrier levels are depending on the sound shelf of the VIF SAW filter. The intercarrier output signal at pin 12 can be calculated by the following formula taking into account the video output signal at pin 16 ($V_{o(video)(p-p)}$ = 1.1 V typical) as a reference:

$$V_{o(rms)} = 1.1 \; V \; (p-p) \times \frac{1}{2\sqrt{2}} \times 10^{\frac{\frac{V_{i(SC)}}{V_{i(PC)}} (dB) + 6 \; dB \pm 3 \; dB}{20}}$$

with $\dfrac{1}{2\sqrt{2}}$ = correction term for RMS value,

$\dfrac{V_{i(SC)}}{V_{i(PC)}}$ (dB) = sound-to-picture carrier ratio at VIF input (pins 1 and 2) in dB,

6 dB = correction term of internal circuitry
and $\pm$3 dB = tolerance of video output and intercarrier output amplitude $V_{o(rms)}$.

Example: SAW filter G1962 (sound shelf: 20 dB) $\Rightarrow$ $\dfrac{V_{i(SC)}}{V_{i(PC)}}$ = $-$27 dB $\Rightarrow$ $V_{o(rms)}$ = 32 mV typical.

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16. Input level for second IF from an external generator with 50 Ω source impedance. AC-coupled with 10 nF capacitor, f_{mod} = 1 kHz, 27 kHz (54% FM deviation) of audio references. A VIF/SIF input signal is not permitted. Pins 5 and 4 have to be connected to positive supply voltage for minimum IF gain. S/N and THD measurements are taken at 50 μs de-emphasis at pin 9 (modulator pre-emphasis has to be activated). The FM demodulator steepness $\Delta V_{o(AF)}/\Delta f_{AF}$ is positive.

a) Second IF input level 10 mV (RMS).

17. Measured with an FM deviation of 27 kHz the typical AF output signal is 500 mV (RMS) (R_x = 0 Ω). By using R_x = 470 Ω the AF output signal is attenuated by 6 dB (250 mV RMS). For handling a frequency deviation of more than 53 kHz the AF output signal has to be reduced by using R_x in order to avoid clipping (THD < 1.5%). For an FM deviation up to 100 kHz an attenuation of 6 dB is recommended with R_x = 470 Ω.

18. The leakage current of the decoupling capacitor (2.2 μF) should not exceed 1 μA.

19. 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).

20. The PC/SC_1 ratio is calculated as the addition of TV transmitter PC/SC_1 ratio and SAW filter PC/SC_1 ratio. This PC/SC_1 ratio is necessary to achieve the S/N_W values as noted. A different PC/SC_1 ratio will change these values.

21. Measurements taken with SAW filter K3953 for vision IF (suppressed sound carrier) and K9453 for sound IF (suppressed picture carrier). Input level $V_{i(SIF)(rms)}$ = 10 mV, 27 kHz (54% FM deviation).

22. Measurements taken with SAW filter G1962 (sound shelf: 20 dB) for vision and sound IF. Pin 23 and/or pin 24 has to be connected to ground for switching the single reference QSS mixer to intercarrier mode.

23. Measurements taken with SAW filter K9453 (Siemens) for AM sound IF (suppressed picture carrier).

Table 1 Input frequencies and carrier ratios

DESCRIPTION	SYMBOL	B/G STANDARD	M, N STANDARD	L STANDARD	L ACCENT STANDARD	UNIT
Picture/IF carrier	f_{pc} or f_{IF}	38.9	45.75/58.75	38.9	33.9	MHz
Sound carrier	f_{SC1}	33.4	41.25/54.25	32.4	40.4	MHz
	f_{SC2}	33.158	–	–	–	MHz
Picture-to-sound carrier	SC_1	13	7	10	10	dB
	SC_2	20	–	–	–	dB

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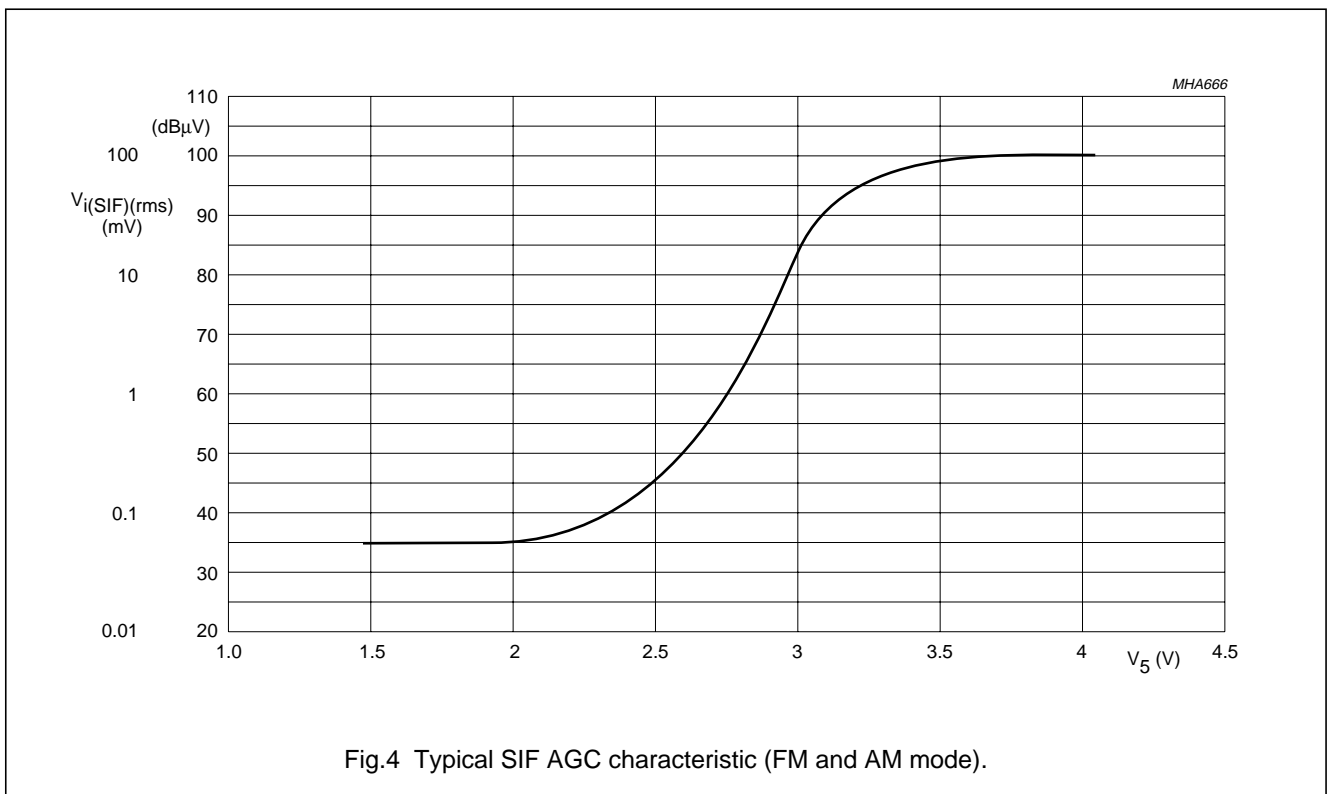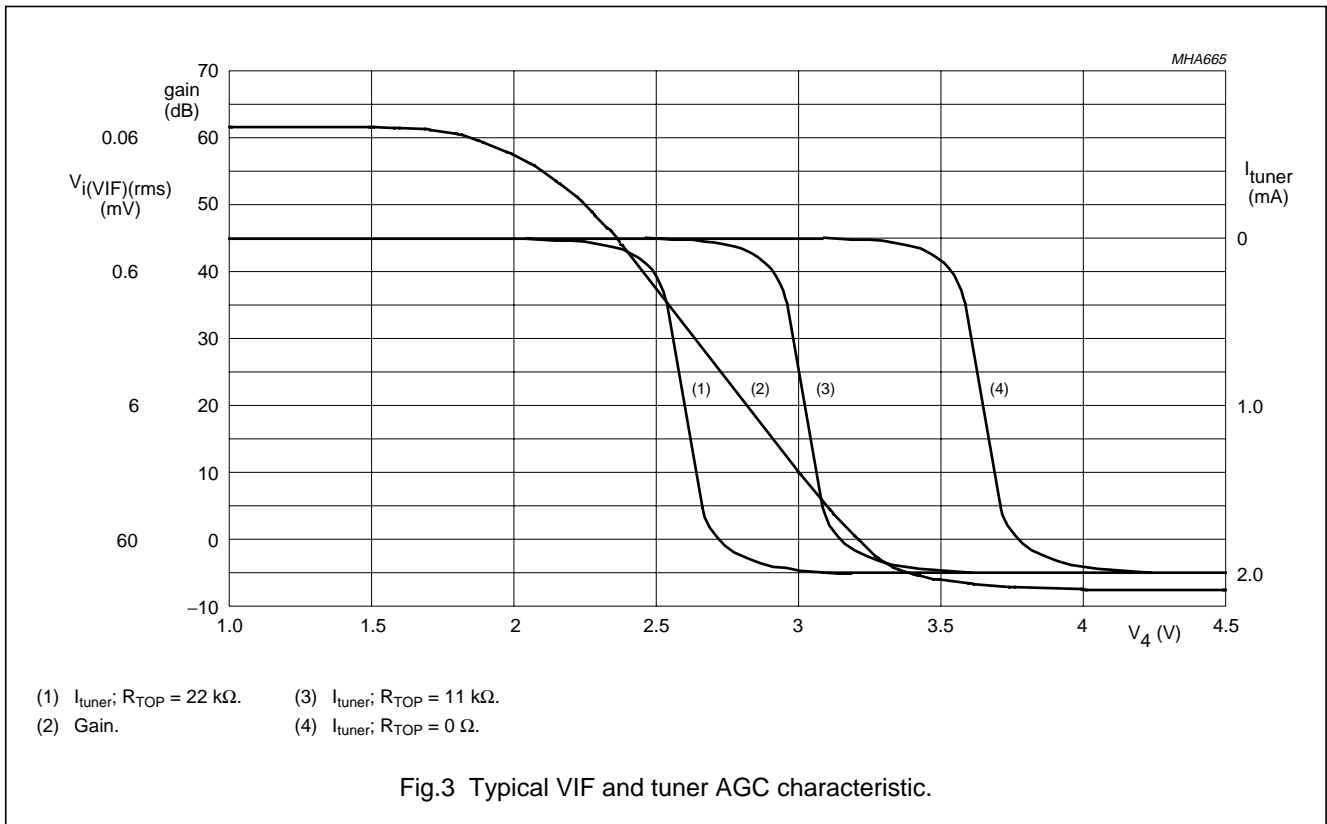
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(1) I_{tuner}; R_{TOP} = 22 kΩ.   (3) I_{tuner}; R_{TOP} = 11 kΩ.
(2) Gain.   (4) I_{tuner}; R_{TOP} = 0 Ω.

Fig.3 Typical VIF and tuner AGC characteristic.

Fig.4 Typical SIF AGC characteristic (FM and AM mode).

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S/N
(dB)
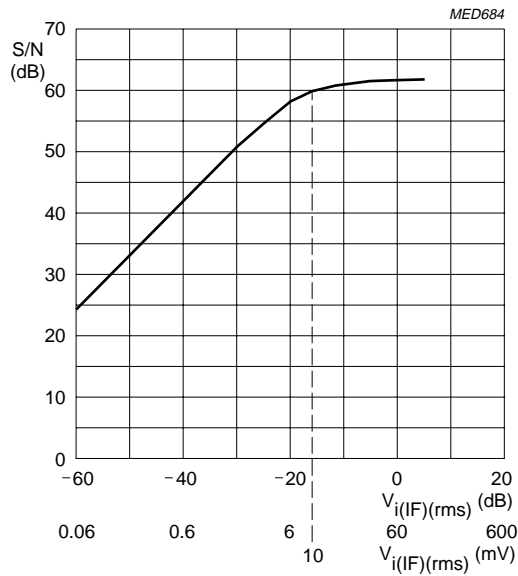
Fig.5 Typical signal-to-noise ratio as a function of IF input voltage.

−3.2 dB

−13.2 dB

−27 dB

SC CC   PC

BLUE

−10 dB

−13.2 dB

−27 dB

SC CC   PC

YELLOW
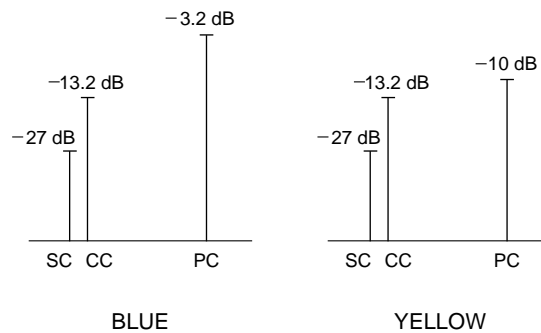
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SC = sound carrier, with respect to sync level.
CC = chrominance carrier, with respect to sync level.
PC = picture carrier, with respect to sync level.
The sound carrier levels are taking into account a sound shelf attenuation of 20 dB (SAW filter G1962).

Fig.6 Input signal conditions.
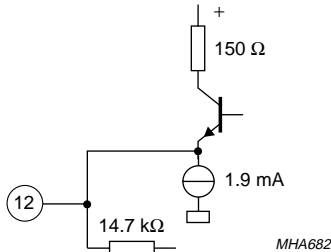
Single/multistandard VIF/SIF-PLL and
FM-PLL/AM demodulators   TDA9817; TDA9818
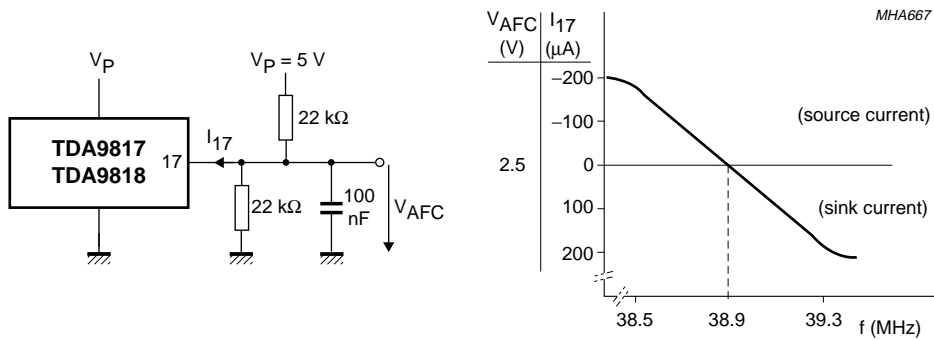
Fig.7 Measurement conditions and typical AFC characteristic.
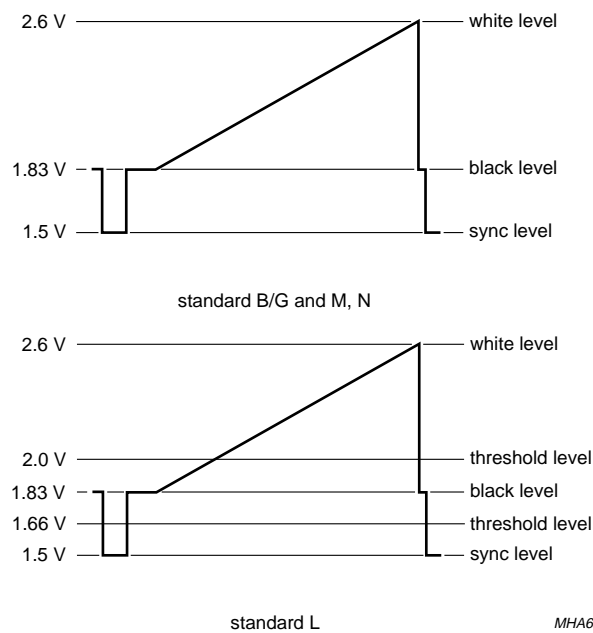
Fig.8 Typical video signal levels on output pin 16 (sound carrier **off**).

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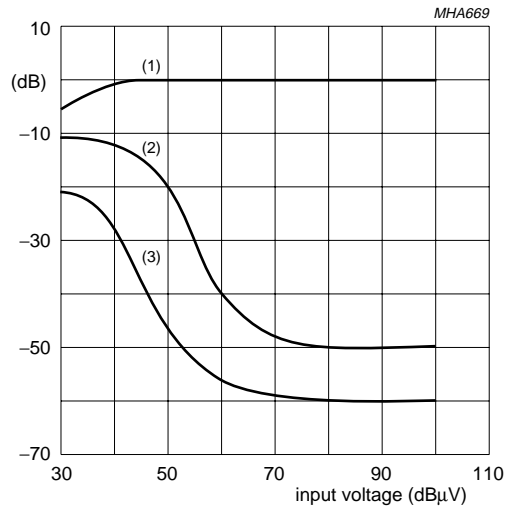
(1) Signal.
(2) AM rejection.
(3) Noise.

Fig.9 Typical audio level, noise and AM rejection (54% FM deviation) for FM.
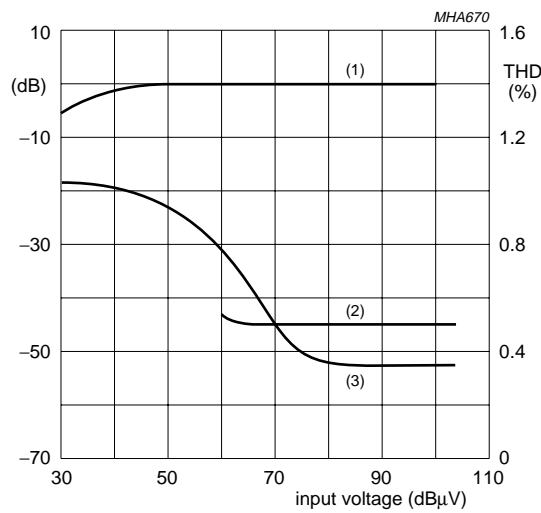
(1) Signal.
(2) THD.
(3) Noise.

Fig.10 Typical audio level, noise and THD (54% AM modulation) for AM.

Fig.11 Ripple rejection condition.
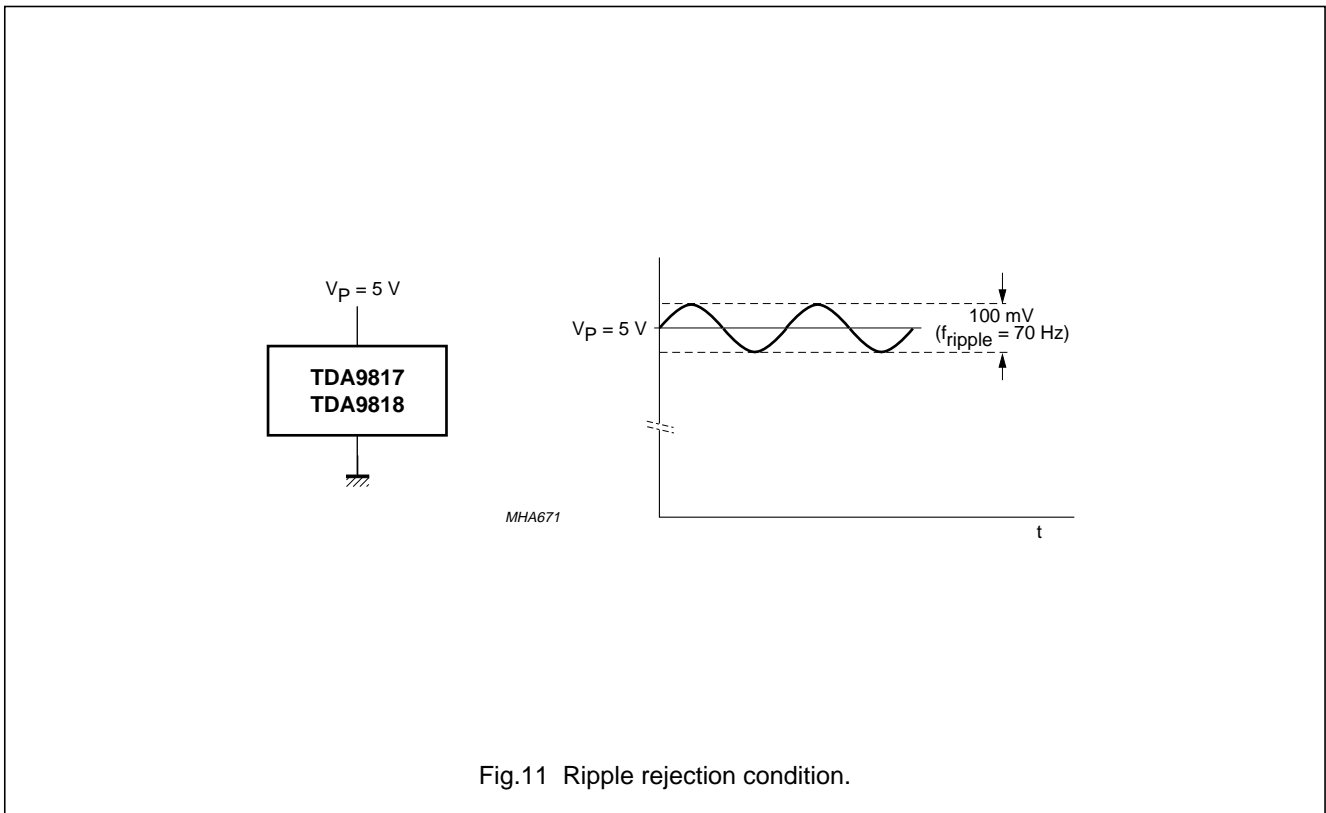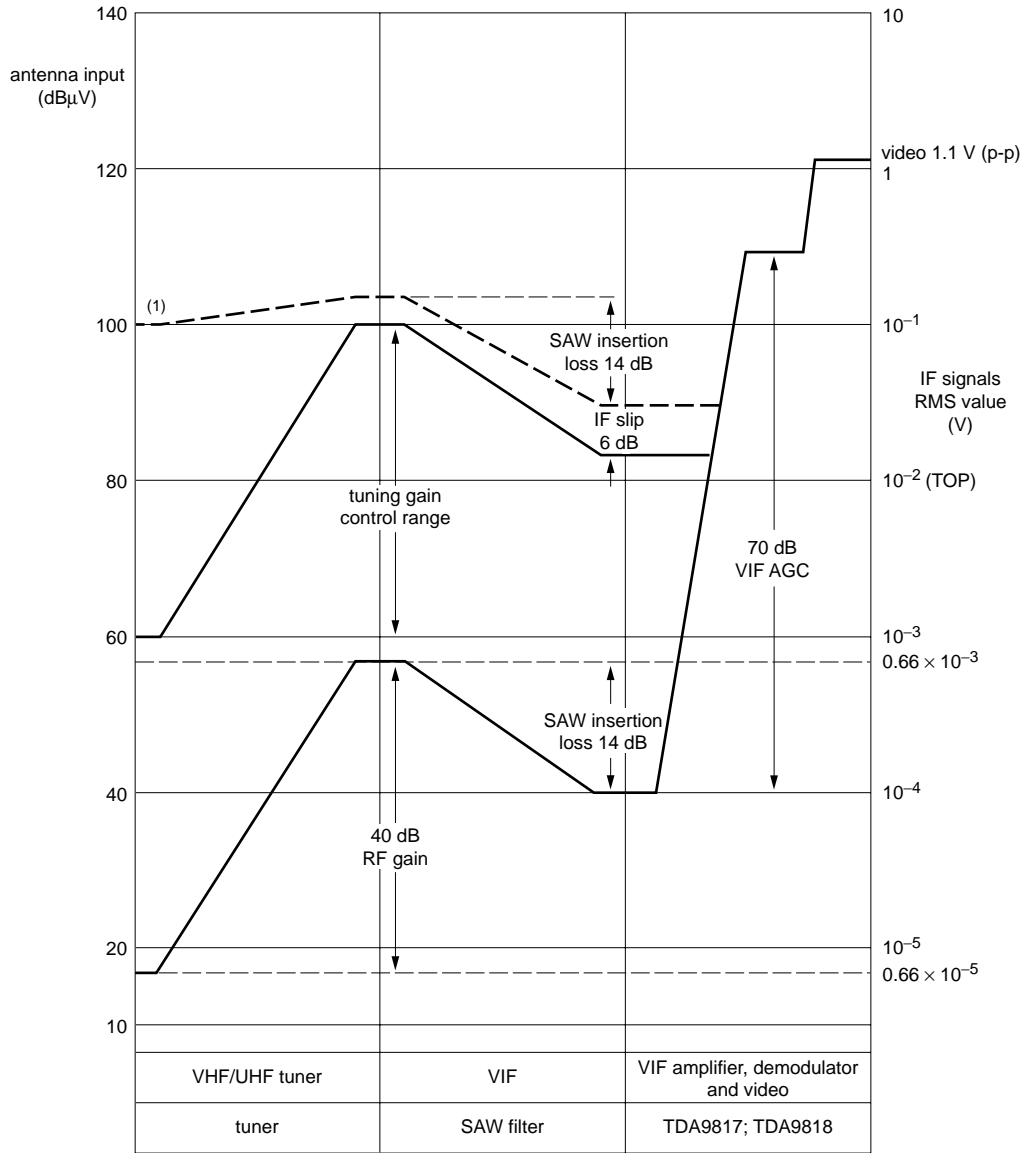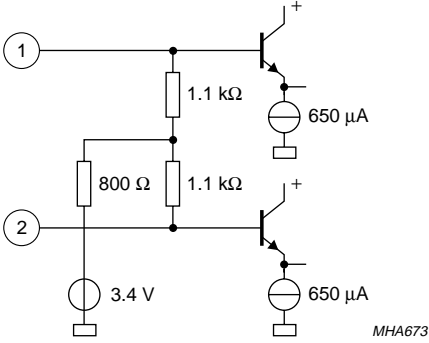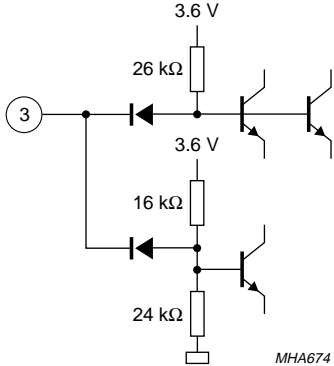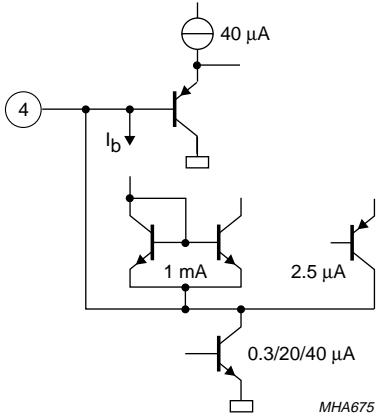
Fig.12 Front end level diagram.

(1) Depends on TOP.

Single/multistandard VIF/SIF-PLL and
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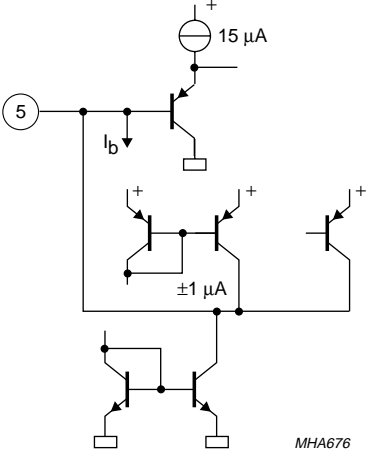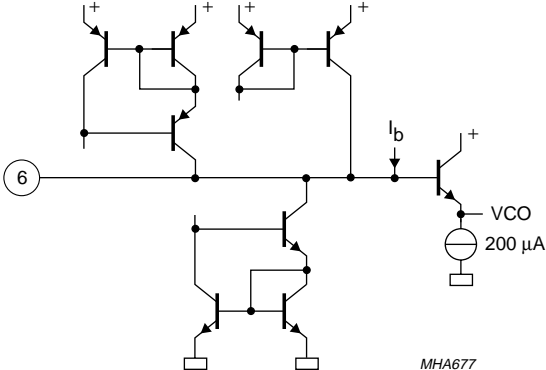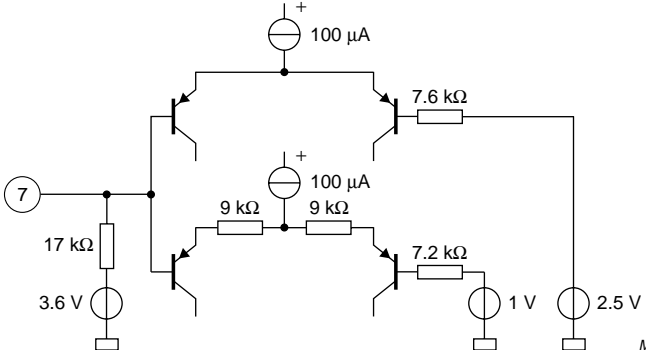
INTERNAL CIRCUITRY

Table 2 Equivalent pin circuits and pin voltages

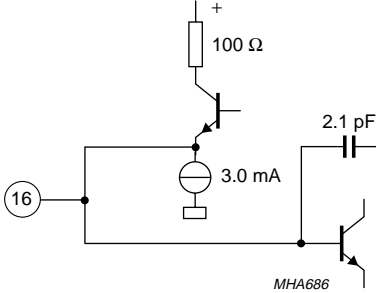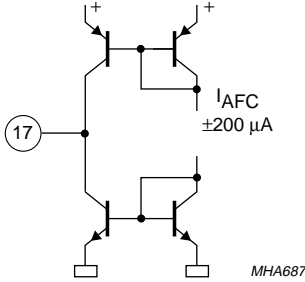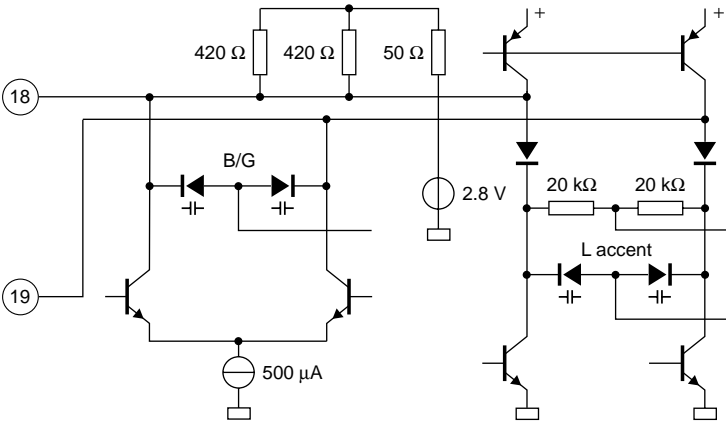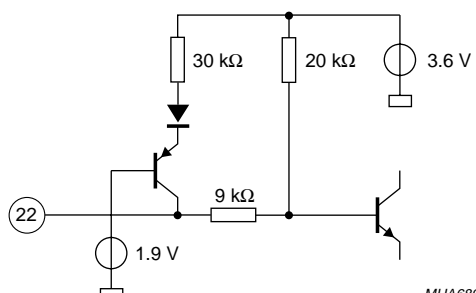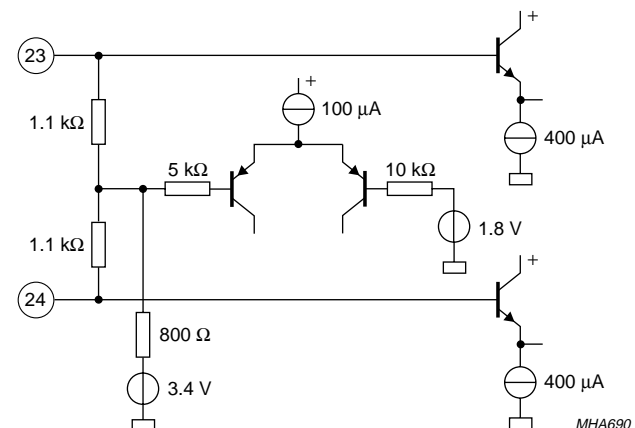| PIN NO.	PIN SYMBOL	DC VOLTAGE (V)	EQUIVALENT CIRCUIT (WITHOUT ESD PROTECTION CIRCUIT)
1	$V_{i\ VIF1}$	3.4	
2	$V_{i\ VIF2}$	3.4	
3	STD[1]	0 to V_P	
4	C_{VAGC}	1.5 to 4.0	
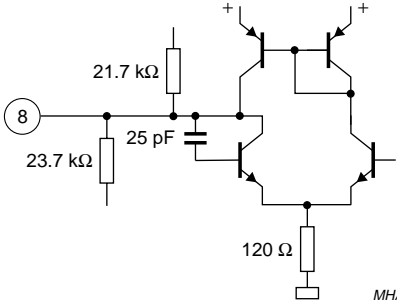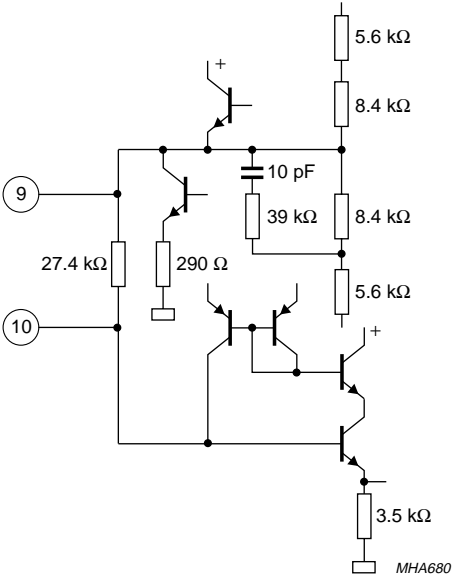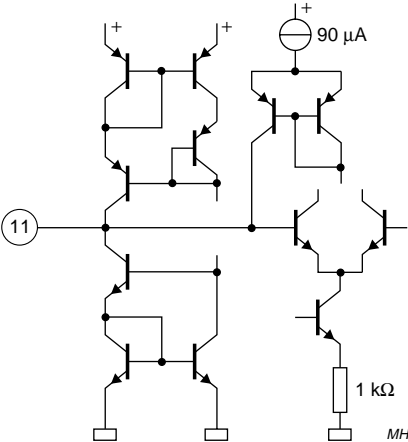
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PIN NO.	PIN SYMBOL	DC VOLTAGE (V)	EQUIVALENT CIRCUIT (WITHOUT ESD PROTECTION CIRCUIT)
5	C_{SAGC}	1.5 to 4.0	
6	T_{PLL}	1.5 to 4.0	
7	LADJ[1]	0 to V_P	
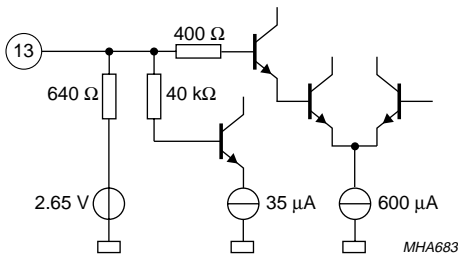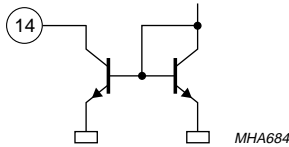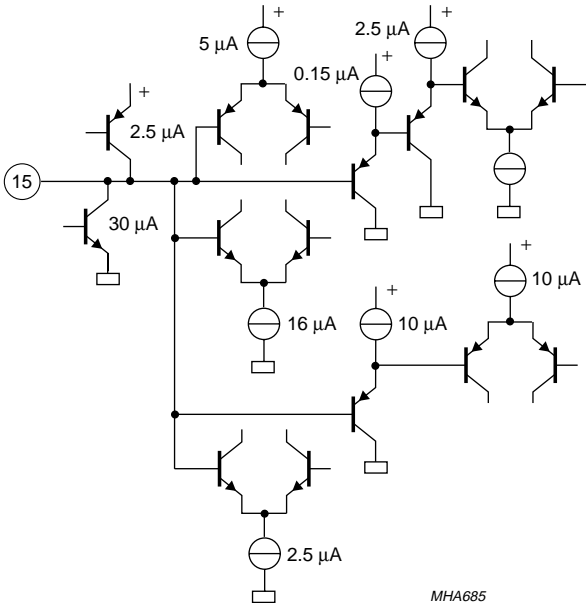
PIN NO.	PIN SYMBOL	DC VOLTAGE (V)	EQUIVALENT CIRCUIT (WITHOUT ESD PROTECTION CIRCUIT)
8	$V_{o\,AF}$	2.3	
9	V_{de-em}	2.3	
10	C_{de-em}	2.3	
11	C_{DEC}	1.2 to 3.0	

PIN NO.	PIN SYMBOL	DC VOLTAGE (V)	EQUIVALENT CIRCUIT (WITHOUT ESD PROTECTION CIRCUIT)
12	$V_{o\ QSS}$	2.0	
13	$V_{i\ FM}$	2.65	
14	TAGC	0 to 13.2	
15	C_{BL}[1]	0 to 3.2	

PIN NO.	PIN SYMBOL	DC VOLTAGE (V)	EQUIVALENT CIRCUIT (WITHOUT ESD PROTECTION CIRCUIT)
16	$V_{o(vid)}$	sync level: 1.5	
17	AFC	0.3 to V_P − 0.3	
18	VCO1	2.7	
19	VCO2	2.7	
20	GND	0	
21	V_P	V_P	

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PIN NO.	PIN SYMBOL	DC VOLTAGE (V)	EQUIVALENT CIRCUIT (WITHOUT ESD PROTECTION CIRCUIT)
22	TADJ (TOP)	0 to 1.9	
23	$V_{i\,SIF1}$	3.4	
24	$V_{i\,SIF2}$	3.4	

Note

1. Not connected for TDA9817.

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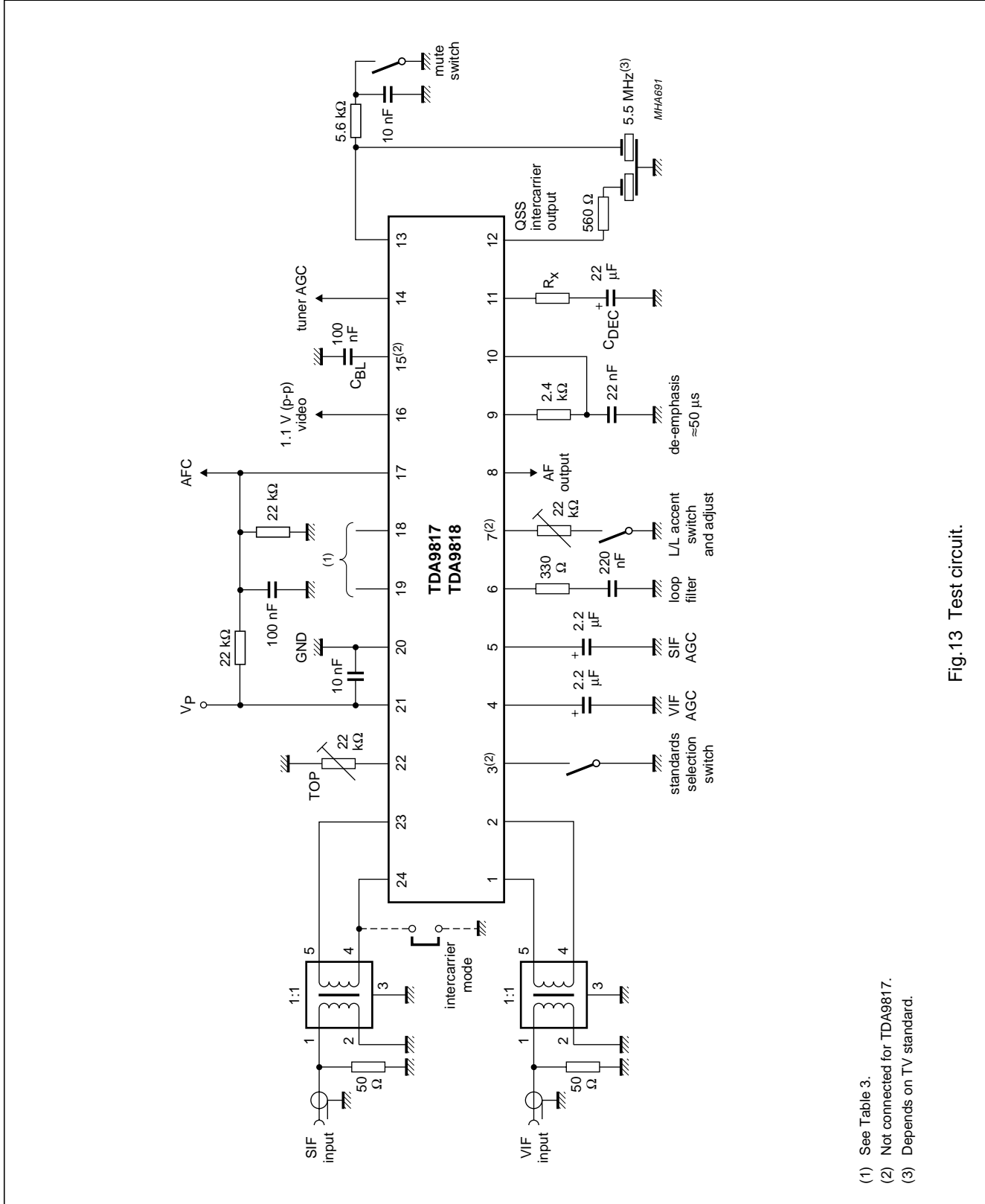
TDA9817; TDA9818

TEST AND APPLICATION INFORMATION

Fig.13 Test circuit.

(1) See Table 3.
(2) Not connected for TDA9817.
(3) Depends on TV standard.
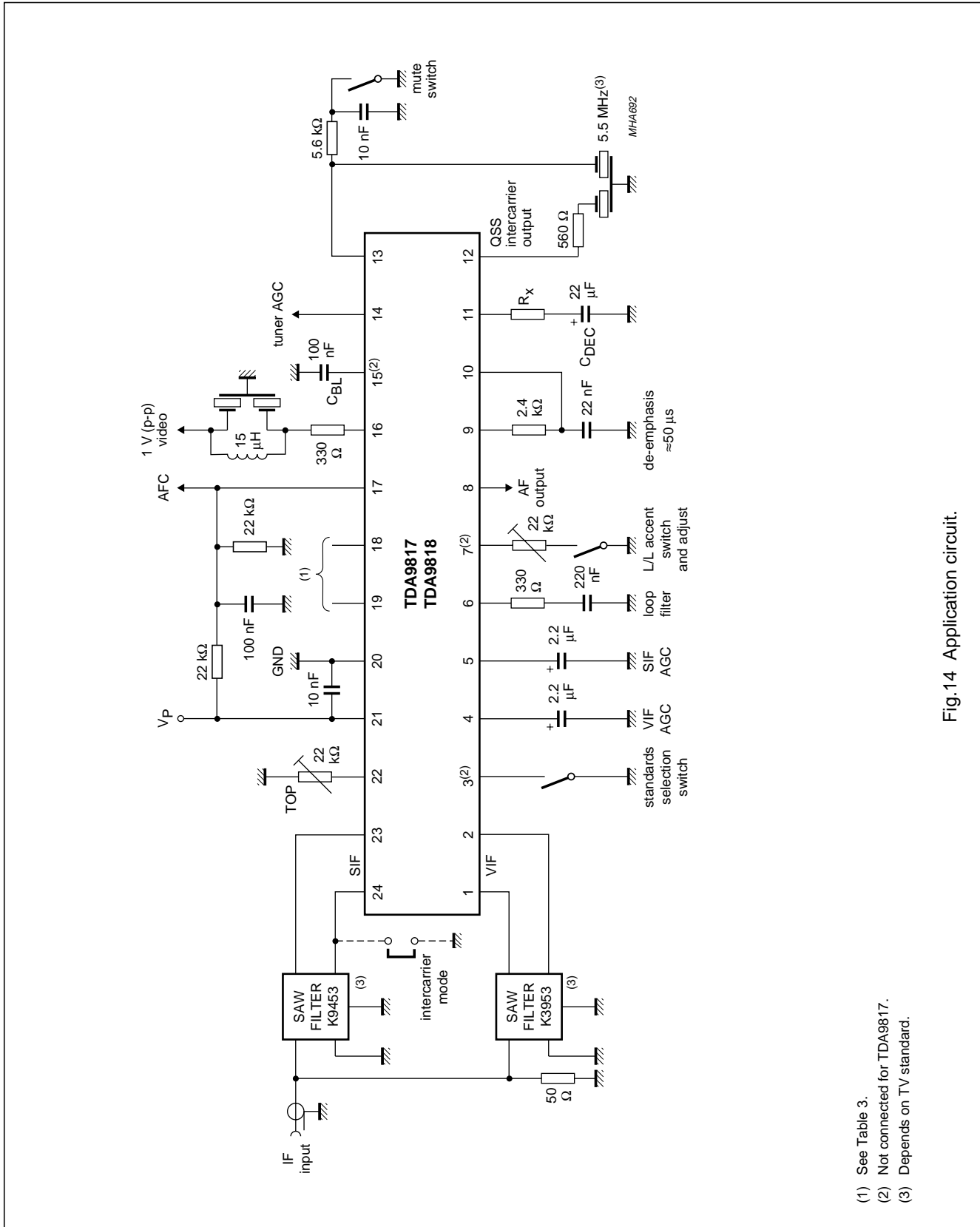
Fig.14 Application circuit.

(1) See Table 3.
(2) Not connected for TDA9817.
(3) Depends on TV standard.

Table 3 Oscillator circuit for the different TV standards

| PARAMETER	EUROPE	USA	JAPAN
IF frequency	38.9 MHz	45.75 MHz	58.75 MHz
VCO frequency	77.8 MHz	91.5 MHz	117.5 MHz
Oscillator circuit			
e.g. Toko coil	5KM 369SNS-2010Z	5KMC V369SCS-2370Z	MC139 NE545SNAS100108
Philips ceramic capacitor	2222 632 51828	inside of coil	15 pF SMD; size = 0805

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PACKAGE OUTLINE

SDIP24: plastic shrink dual in-line package; 24 leads (400 mil)

SOT234-1
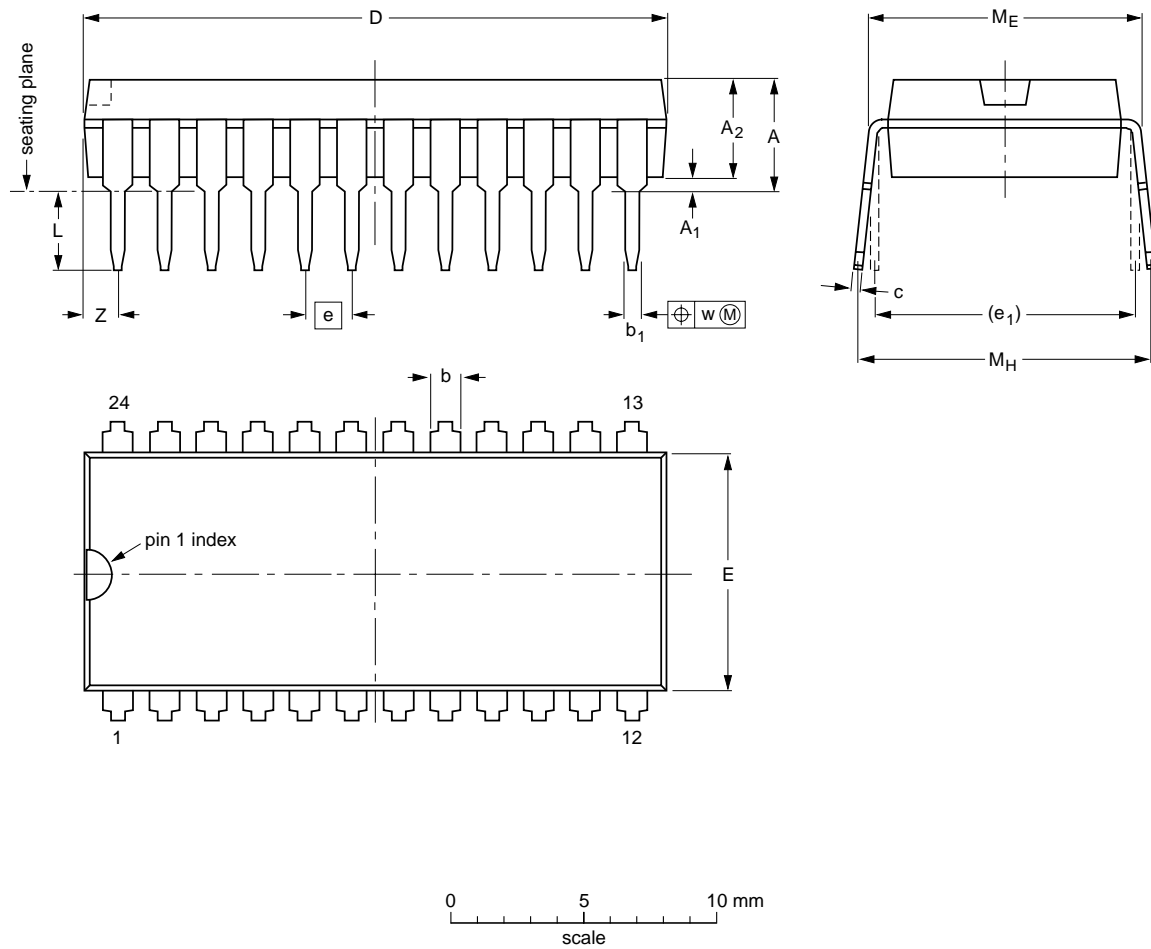
DIMENSIONS (mm are the original dimensions)

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	22.3 21.4	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			
SOT234-1						~~92-11-17~~ 95-02-04

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

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