DATA SHEET

TDA9817; TDA9818
Single/multistandard VIF/SIF-PLL and FM-PLL/AM demodulators

Product specification
Supersedes data of 2001 Oct 19

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Single/multistandard VIF/SIF-PLL and FM-PLL/AM demodulators   TDA9817; TDA9818

FEATURES

- 5 V supply voltage
- Applicable for Intermediate Frequencies (IFs) of 38.9, 45.75 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 and 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
- Voltage Controlled Oscillator (VCO) frequency switchable between L and L accent (alignment external) picture carrier frequency
- VIF Automatic Gain Control (AGC) 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)
- Automatic Frequency Control (AFC) detector without extra reference circuit

- AC-coupled limiter amplifier for sound intercarrier signal
- Alignment-free FM Phase-Locked Loop (PLL) demodulator with high linearity
- Sound IF (SIF) input for single reference Quasi Split Sound (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 and in intercarrier mode
- AM demodulator without extra reference circuit
- Stabilizer circuit for ripple rejection and to achieve constant output signals
- ElectroStatic Discharge (ESD) 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
TDA9817T	SO24	plastic small outline package; 24 leads; body width 7.5 mm		SOT137-1
TDA9817TS	SSOP24	plastic shrink small outline package; 24 leads; body width 5.3 mm		SOT340-1
TDA9818	SDIP24	plastic shrink dual in-line package; 24 leads (400 mil)		SOT234-1
TDA9818T	SO24	plastic small outline package; 24 leads; body width 7.5 mm		SOT137-1
TDA9818TS	SSOP24	plastic shrink small outline package; 24 leads; body width 5.3 mm		SOT340-1

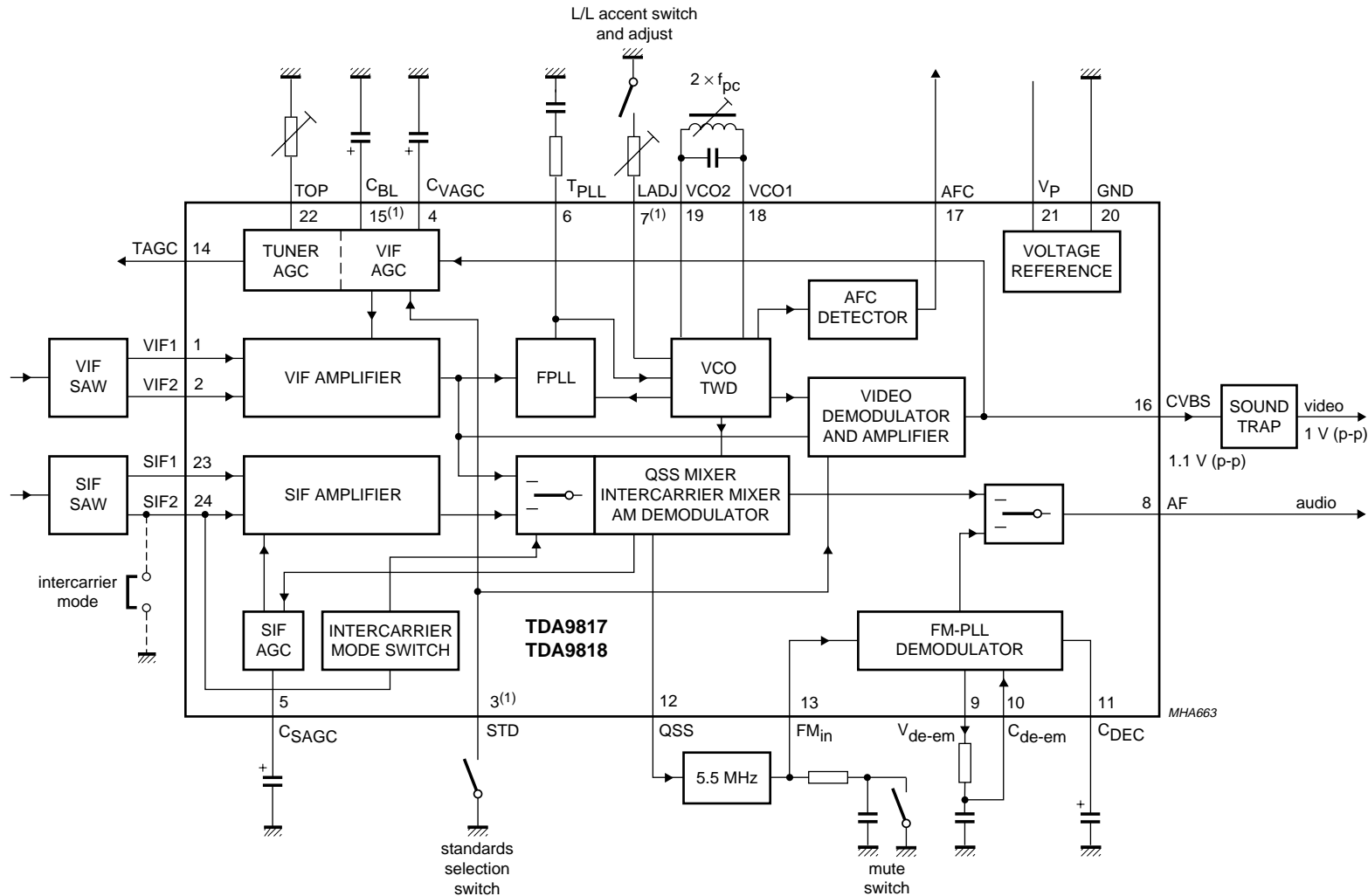Single/multistandard VIF/SIF-PLL and
FM-PLL/AM demodulators

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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
$V_{o(CVBS)(p-p)}$	video output signal voltage (peak-to-peak value)		0.97	1.1	1.23	V
$B_{v(-3dB)}$	−3 dB video bandwidth on pin CVBS	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 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 video signal harmonics		35	40	–	dB
$V_{i(SIF)(rms)}$	sound IF input signal voltage sensitivity (RMS value)	−3 dB at intercarrier output	–	50	100	μV
$V_{o(FM)(rms)}$	audio output signal voltage for FM (RMS value)	B/G standard; 27 kHz, 54% modulation	0.4	0.5	0.6	V
		M/N standard; 25 kHz modulation	0.36	0.45	0.54	V
$V_{o(AM)(rms)}$	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

BLOCK DIAGRAM

(1) Not connected for TDA9817T and TDA9817TS.

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Fig.1 Block diagram.

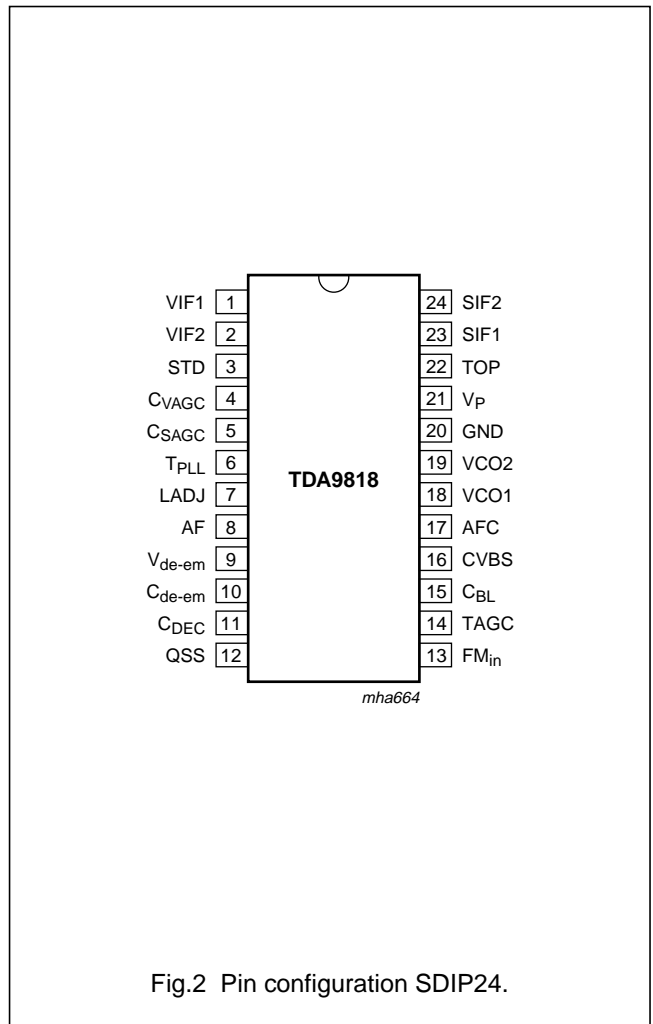## Single/multistandard VIF/SIF-PLL and FM-PLL/AM demodulators

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PINNING

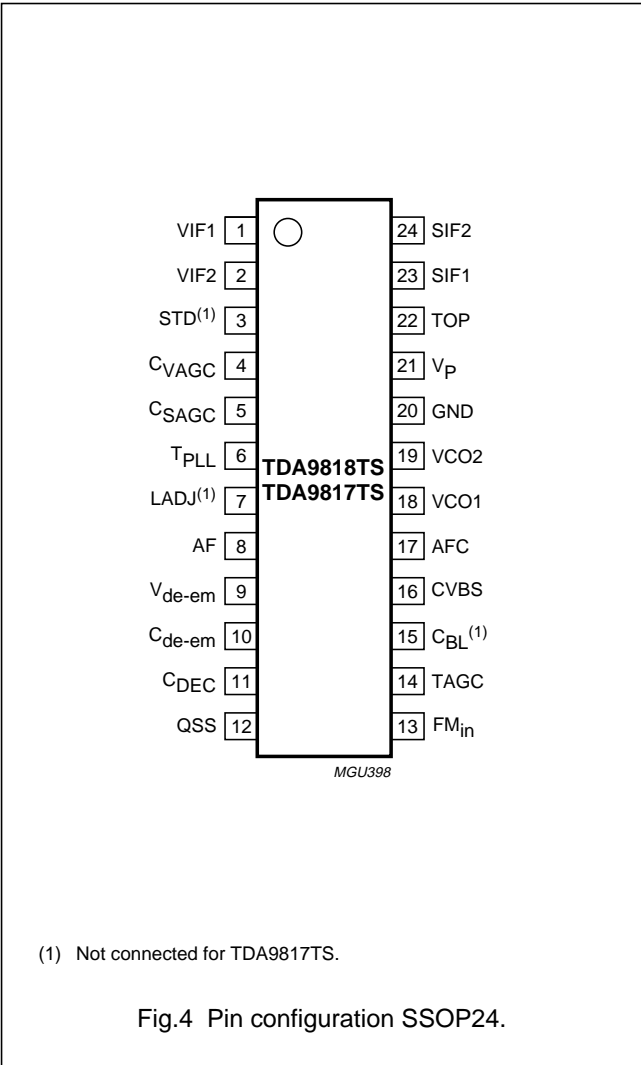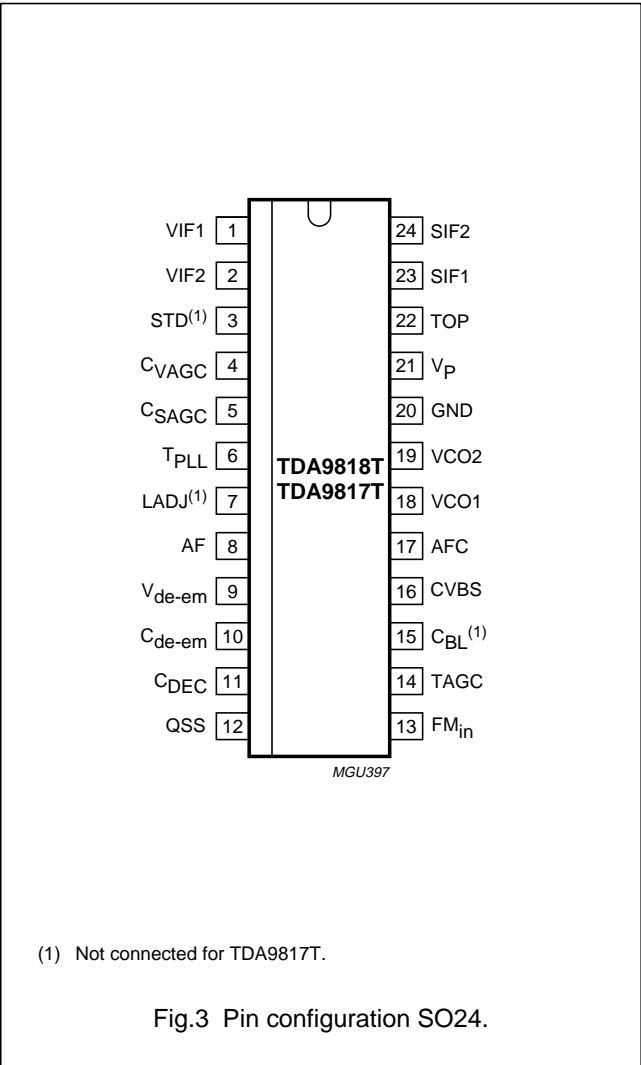| SYMBOL	PIN	DESCRIPTION
VIF1	1	VIF differential input signal voltage 1
VIF2	2	VIF differential input signal voltage 2
STD	3	standards selection switch; note 1
C_{VAGC}	4	VIF AGC capacitor
C_{SAGC}	5	SIF AGC capacitor
T_{PLL}	6	PLL filter
LADJ	7	L/L accent switch and adjust; note 1
AF	8	audio output
V_{de-em}	9	de-emphasis output
C_{de-em}	10	de-emphasis input
C_{DEC}	11	decoupling capacitor
QSS	12	single reference QSS/intercarrier output voltage
FM_{in}	13	sound intercarrier input voltage
TAGC	14	tuner AGC output
C_{BL}	15	black level detector; note 1
CVBS	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
TOP	22	tuner AGC takeover point adjust
SIF1	23	SIF differential input signal voltage 1
SIF2	24	SIF differential input signal voltage 2

Fig.2 Pin configuration SDIP24.

Note

1. Not connected for TDA9817T and TDA9817TS.

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(1) Not connected for TDA9817T.

Fig.3 Pin configuration SO24.

(1) Not connected for TDA9817TS.

Fig.4 Pin configuration SSOP24.

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
- Sound IF amplifier and SIF AGC
- Single reference QSS mixer
- AM demodulator
- FM-PLL demodulator
- Audio Frequency (AF) 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 picture carrier 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 picture carrier 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 pin CVBS is 1.1 V (p-p) for nominal vision IF modulation, in order to achieve 1 V (p-p) at sound trap output.

Sound IF 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 QSS. 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 SIF2 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 QSS, 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 FM_{in}
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.

Audio Frequency 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 V_{de-em} 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 60134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_P	supply voltage	TDA9817T, TDA9818 and TDA9818T: maximum chip temperature of 120 °C; note 1	–	5.5	V
		TDA9817TS and TDA9818TS: maximum chip temperature of 130 °C; note 1	–	5.5	V
V_n	voltage at pins VIF1, VIF2, STD, C_{VAGC}, C_{SAGC}, T_{PLL}, V_{de-em}, C_{de-em}, C_{DEC}, FM_{in}, TAGC, C_{BL}, AFC, V_P, TOP, SIF1 and SIF2		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}	ambient temperature		−20	+70	°C
V_{esd}	electrostatic handling voltage	note 2	−300	+300	V

Notes

1. I_P = 104 mA; T_{amb} = 70 °C; $R_{th(j-a)}$ = 65 K/W for TDA9818, $R_{th(j-a)}$ = 85 K/W for TDA9817T and TDA9818T, $R_{th(j-a)}$ = 110 K/W for TDA9817TS and TDA9818TS.

2. Machine model class B (L = 2.5 µH).

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air		
	TDA9818		65	K/W
	TDA9817T; TDA9818T		85	K/W
	TDA9817TS; TDA9818TS		110	K/W

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CHARACTERISTICS

V_P = 5 V; T_{amb} = 25 °C; see Table 1 for input frequencies and levels; 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.15; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply (pin V_P)						
V_P	supply voltage	note 1	4.5	5	5.5	V
I_P	supply current		76	90	104	mA
Vision IF amplifier (pins VIF1 and VIF2)						
$V_{i(VIF)(rms)}$	input signal voltage sensitivity (RMS value)	B/G standard; −1 dB video at output	–	60	100	μV
$V_{i(VIF)(max)(rms)}$	maximum input signal voltage (RMS value)	B/G standard; 1 dB video at output	120	200	–	mV
$\Delta V_{(IF)(int)}$	internal IF amplitude difference between picture and sound carrier	within AGC range; B/G standard; Δf = 5.5 MHz	–	0.7	1	dB
$G_{IF(ctrl)}$	IF gain control range	see Fig.5	65	70	–	dB
$R_{i(dif)}$	differential input resistance	note 2	1.7	2.2	2.7	kΩ
$C_{i(dif)}$	differential input capacitance	note 2	1.2	1.7	2.5	pF
$V_{I(VIF)}$	DC input voltage	note 2	–	3.4	–	V
True synchronous video demodulator; note 3						
$f_{VCO(max)}$	maximum oscillator frequency for carrier regeneration	f = 2f_{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	–	–	±20 × 10^{-6}	K^{-1}
$\Delta f_{osc}/\Delta V_P$	oscillator shift as a function of supply voltage	oscillator is free-running; note 4	–	–	±1.5 × 10^{-3}	V^{-1}
$V_{VCO(rms)}$	oscillator voltage swing at pins VCO1 and VCO2 (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_{LADJ} = 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_{LADJ} = 5.6 kΩ	–	±200	±400	kHz
$f_{algn(Laccent)}$	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
$V_{i(VIF)(sens)(rms)}$	VIF input signal voltage sensitivity for PLL to be locked (RMS value); pins VIF1 and VIF2	maximum IF gain; note 6	–	30	70	μV
Composite video amplifier (pin CVBS); sound carrier off						
$V_{o(CVBS)(p-p)}$	output signal voltage (peak-to-peak value)	see Fig.10	0.97	1.1	1.23	V
V/S	ratio between video (black-to-white) and sync level		1.9	2.33	3.0	
$\Delta V_{o(CVBS)}$	output signal voltage difference	difference between B/G and L standard	–	–	± 12	%
V_{sync}	sync voltage level	B/G and L standard	1.4	1.5	1.6	V
$V_{clip(u)}$	upper video clipping voltage level		$V_P - 1.1$	$V_P - 1$	–	V
$V_{clip(l)}$	lower video clipping voltage level		–	0.7	0.9	V
R_o	output resistance	note 2	–	–	10	Ω
$I_{bias(int)}$	internal DC bias current for emitter-follower		2.2	3.0	–	mA
$I_{o(sink)(max)}$	maximum AC and DC output sink current		1.6	–	–	mA
$I_{o(source)(max)}$	maximum AC and DC output source current		2.9	–	–	mA
$\Delta V_{o(CVBS)(B/G)}$	deviation of CVBS output signal voltage at B/G standard	50 dB gain control	–	–	0.5	dB
		30 dB gain control	–	–	0.1	dB
$\Delta V_{o(BL)(B/G)}$	black level tilt in B/G standard	gain variation; note 7	–	–	1	%
$\Delta V_{o(BL)(L)}$	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_{dif}	differential gain	"CCIR, line 330"	–	2	5	%
φ_{dif}	differential phase	"CCIR, line 330"	–	1	2	deg
$B_{v(-1dB)}$	–1 dB video bandwidth	B/G and L standard; $C_L < 50$ pF; $R_L > 1$ kΩ; AC load	5	6	–	MHz
$B_{v(-3dB)}$	–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.7; note 8	56	60	–	dB
S/N	unweighted signal-to-noise ratio	see Fig.7; note 8	49	53	–	dB

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$\alpha_{IM(1.1)}$	intermodulation attenuation at 'blue'	f = 1.1 MHz; see Fig.8; note 9	58	64	–	dB
	intermodulation attenuation at 'yellow'	f = 1.1 MHz; see Fig.8; note 9	60	66	–	dB
$\alpha_{IM(3.3)}$	intermodulation attenuation at 'blue'	f = 3.3 MHz; see Fig.8; note 9	58	64	–	dB
	intermodulation attenuation at 'yellow'	f = 3.3 MHz; see Fig.8; 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	%
$\alpha_{vc(rms)}$	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 CVBS	video signal; grey level; see Fig.13				
		B/G standard	30	35	–	dB
		L standard	26	30	–	dB
VIF AGC detector (pins C_{VAGC} and C_{BL})						
I_{ch}	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
I_{dch}	discharging current	B/G standard	15	20	25	µA
		normal mode L	225	300	375	nA
		fast mode L	30	40	50	µA
$t_{resp(inc)}$	AGC response to an increasing VIF step	B/G and L standard; note 11	–	0.05	0.1	ms/dB
$t_{resp(dec)}$	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
$V_{th(CBL)}$	threshold voltage level additional charging current	see Fig.10				
		L standard	1.95	2.0	2.05	V
		L standard; fast mode L	1.6	1.66	1.72	V

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Tuner AGC (pin TAGC)						
$V_{i(rms)}$	IF input signal voltage for minimum starting point of tuner takeover (RMS value)	input at pins VIF1 and VIF2; R_{TOP} = 22 kΩ; I_{TAGC} = 0.4 mA	–	2	5	mV
	IF input signal voltage for maximum starting point of tuner takeover (RMS value)	input at pins VIF1 and VIF2; R_{TOP} = 0 Ω; I_{TAGC} = 0.4 mA	50	100	–	mV
$V_{o(TAGC)}$	permissible output voltage	from external source; note 2	–	–	13.2	V
$V_{sat(TAGC)}$	saturation voltage	I_{TAGC} = 1.5 mA	–	–	0.2	V
$\Delta V_{TOP(TAGC)}/\Delta T$	variation of takeover point by temperature	I_{TAGC} = 0.4 mA	–	0.03	0.07	dB/K
$I_{TAGC(sink)}$	sink current	see Fig.5				
		no tuner gain reduction; V_{TAGC} = 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 AFC); see Fig.9; note 12						
CR_{stps}	control steepness $\Delta I_{AFC}/\Delta f$	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}
$V_{o(AFC)}$	output voltage	upper limit	$V_P - 0.6$	$V_P - 0.3$	–	V
		lower limit	–	0.3	0.6	V
$I_{o(source)(AFC)}$	output source current		150	200	250	μA
$I_{o(sink)(AFC)}$	output sink current		150	200	250	μA
$\Delta I_{AFC(p-p)}$	residual video modulation current (peak-to-peak value)	B/G and L standard	–	20	30	μA

Single/multistandard VIF/SIF-PLL and
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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Sound IF amplifier (pins SIF1 and SIF2)						
$V_{i(SIF)(rms)}$	input signal voltage sensitivity (RMS value)	FM mode; −3 dB at intercarrier output pin QSS	–	50	100	µV
		AM mode; −3 dB at AF output pin AF	–	50	100	µV
$V_{i(max)(rms)}$	maximum input signal voltage (RMS value)	FM mode; 1 dB at intercarrier output pin QSS	65	100	–	mV
		AM mode; 1 dB at AF output pin AF	65	100	–	mV
$G_{SIF(ctrl)}$	SIF gain control range	FM and AM mode; see Fig.6	60	66	–	dB
$R_{i(dif)}$	differential input resistance	note 2	1.7	2.2	2.7	kΩ
$C_{i(dif)}$	differential input capacitance	note 2	1.2	1.7	2.5	pF
$V_{I(SIF)}$	DC input voltage		–	3.4	–	V
$\alpha_{SIF,VIF}$	crosstalk attenuation between SIF and VIF inputs	between pins VIF1 and VIF2, and pins SIF1 and SIF2; note 14	50	–	–	dB
SIF AGC detector (pin C$_{SAGC}$)						
$I_{ch(CSAGC)}$	charging current	FM mode	8	12	16	µA
		AM mode	0.8	1.2	1.6	µA
$I_{dch(CSAGC)}$	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 QSS)						
$V_{o(rms)}$	IF intercarrier output level (RMS value)	QSS mode; sound carrier 1; sound carrier 2 off	100	140	180	mV
		L standard; without modulation	100	140	180	mV
		intercarrier mode; sound carrier 1; sound carrier 2 off	–	note 15	–	mV
$V_{o(peak)}$	IF intercarrier output level (peak value)	QSS mode	141	198	225	mV
		L standard; 80% AM modulation	255	356	458	mV
$B_{s(-3dB)}$	−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
$\alpha_{vc(rms)}$	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
$R_{o(QSS)}$	output resistance	note 2	–	–	25	Ω
$V_{O(QSS)}$	DC output voltage		–	2.0	–	V
$I_{int(QSS)}$	DC internal bias current for emitter follower		1.9	2.5	–	mA
$I_{sink(max)(QSS)}$	maximum AC and DC output sink current		1.4	1.9	–	mA
$I_{source(max)(QSS)}$	maximum AC and DC output source current		3.0	3.5	–	mA
Limiter amplifier (pin FM$_{in}$); note 16						
$V_{i(FMin)(rms)}$	input signal voltage for lock-in (RMS value)		–	–	100	μV
$V_{i(FMin)(rms)}$	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
$R_{i(FMin)}$	input resistance	note 2	480	600	720	Ω
$V_{I(FMin)}$	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 AF); notes 16 and 16a						
$V_{o(AF)(rms)}$	AF output signal voltage (RMS value)	27 kHz (54% FM deviation); see Fig.15; 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.15; note 17	360	450	540	mV
$V_{o(AF)(clip)}$	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
$V_{de\text{-}em(DC)}$	DC voltage at decoupling capacitor	voltage dependent on VCO frequency; note 18	1.2	−	3.0	V
R_{AF}	output resistance	note 2	−	−	100	Ω
V_{AF}	DC output voltage		−	2.3	−	V
$I_{sink(max)(AF)}$	maximum AC and DC output sink current		−	−	0.5	mA
$I_{source(max)(AF)}$	maximum AC and DC output source current		−	−	0.5	mA
$B_{AF(-3dB)}$	−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_{AF}	mute attenuation of AF signal	B/G and L standard	70	75	−	dB
ΔV_{AF}	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 AF	$R_x = 0 \ \Omega$; f = 70 Hz; see Figs 13 and 15	20	26	−	dB

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Single reference QSS AF performance for FM operation (B/G standard); see Table 1; notes 19, 20 and 21						
S/N_W	weighted signal-to-noise ratio	pc/sc1 ratio at pins VIF1 and VIF2; 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); see Table 1; notes 19, 20 and 22						
S/N_W	weighted signal-to-noise ratio	pc/sc1 ratio at pins VIF1 and VIF2; 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 AF); 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	%
$B_{AF(-3dB)}$	−3 dB AF bandwidth		100	125	–	kHz
S/N_W	weighted signal-to-noise ratio	*"CCIR 468-4"*	47	53	–	dB
V_{AF}	DC potential voltage		–	2.3	–	V
PSRR	power supply ripple rejection at pin AF	see Fig.13	20	26	–	dB
Switching level for standard switch (pin STD)						
V_{logic}	DC potential for logic HIGH or pin not connected	B/G standard	2.8	–	V_P	V
	DC potential for logic LOW	L/L accent standard	0	–	0.8	V
I_{IL}	LOW level input current	V_i = 0 V	190	250	310	μA

Notes

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 ≈ 3; 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} ≈ 8.5 pF (loop voltage approximately 2.7 V).

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

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

6. VIF 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 CVBS). B = 5 MHz weighted in accordance with *"CCIR 567"*.

9. The intermodulation figures are defined:

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

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

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.9. The AFC-steepness can be changed by the resistors at pin AFC.

13. Depending on the ratio $\Delta C/C_0$ of the LC resonant circuit of VCO (Q_0 > 50; 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 SIF1 and/or pin SIF2 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 QSS can be calculated by the following formula taking into account the video output signal at pin CVBS ($V_{o(CVBS)(p-p)}$ = 1.1 V typical) as a reference:

$$V_{o(rms)} = 1.1 \text{ V}(p-p) \times \frac{1}{2\sqrt{2}} \times 10^{\frac{\frac{V_{i(sc)}}{V_{i(pc)}}(dB) + 6 \text{ dB} \pm 3 \text{ dB}}{20}} \qquad \text{where:}$$

   a) $\dfrac{1}{2\sqrt{2}}$ = correction term for RMS value

   b) $\dfrac{V_{i(sc)}}{V_{i(pc)}}$ (dB) = sound-to-picture carrier ratio at VIF inputs in dB

   c) 6 dB = correction term of internal circuitry

   d) ±3 dB = tolerance of video output and intercarrier output amplitude $V_{o(rms)}$

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e) Example for SAW filter G1962: sound shelf value = 20 dB,

$$\frac{V_{i(sc)}}{V_{i(pc)}} = -27 \text{ dB} \Rightarrow V_{o(rms)} = 32 \text{ mV (typical value)}$$

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 C_{VAGC} and C_{SAGC} 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 $V_{de\text{-}em}$ (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 value).

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/sc1 = 13 dB (transmitter).

20. The pc/sc1 ratio is calculated as the addition of TV transmitter pc/sc1 ratio and SAW filter pc/sc1 ratio. This pc/sc1 ratio is necessary to achieve the S/N_W values as noted. A different pc/sc1 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 SIF1 and/or pin SIF2 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 or 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	sc1	13	7	10	10	dB
	sc2	20	–	–	–	dB

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

Fig.5 Typical VIF and tuner AGC characteristics.
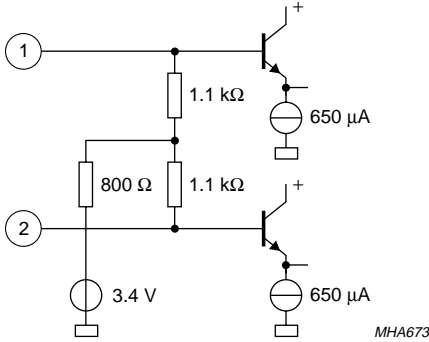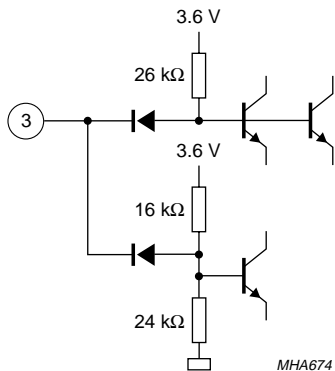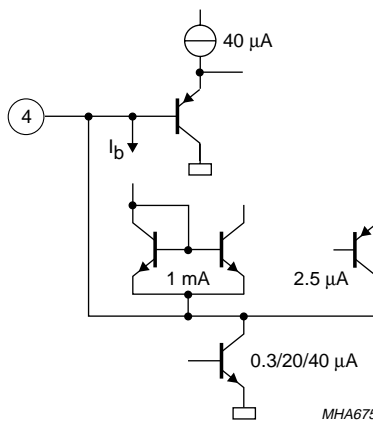

Fig.6 Typical SIF AGC characteristic (FM and AM mode).
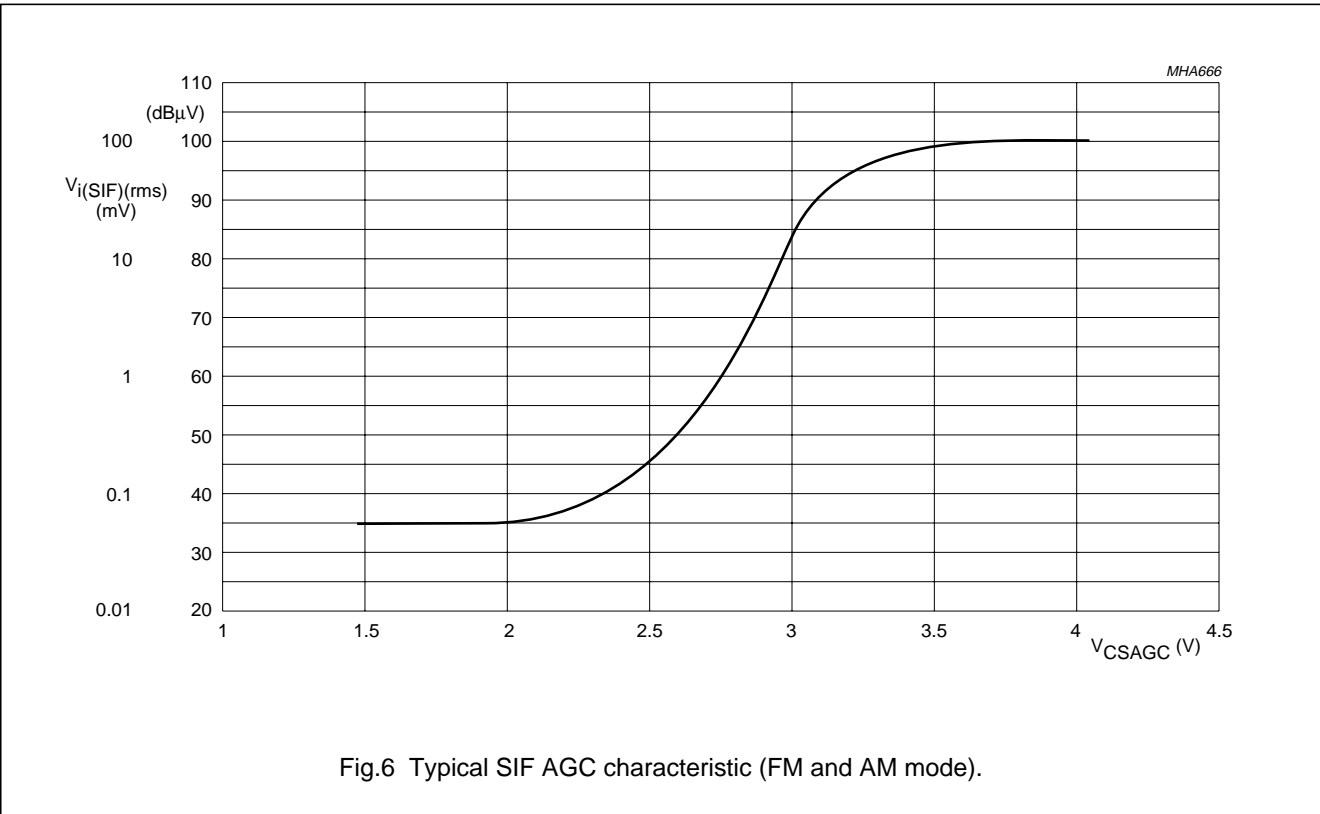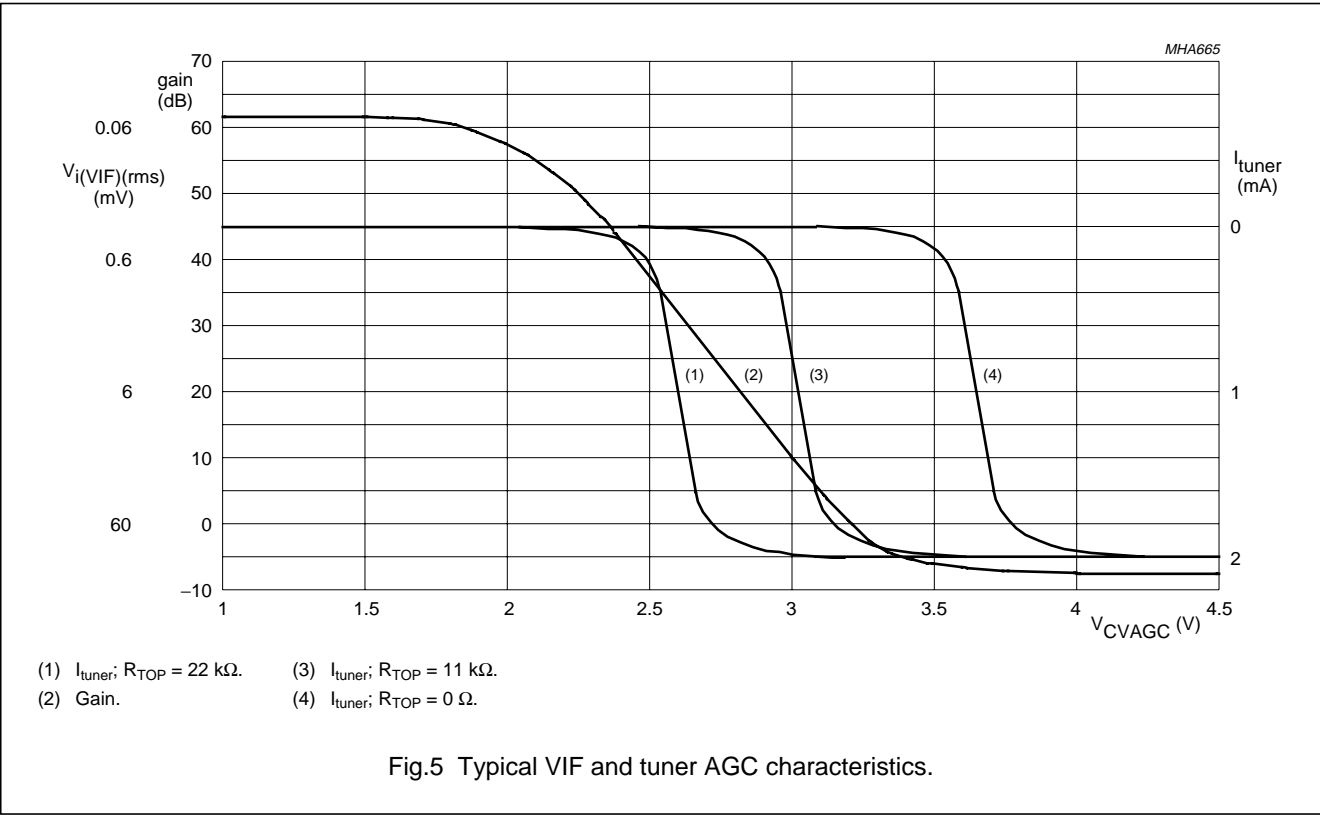
Single/multistandard VIF/SIF-PLL and
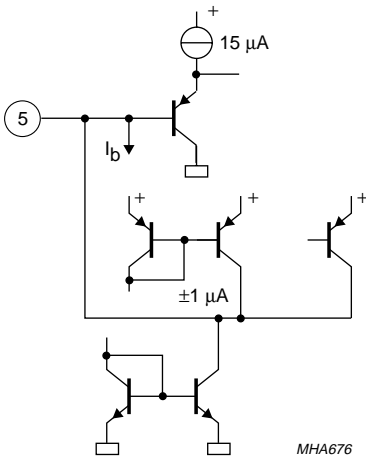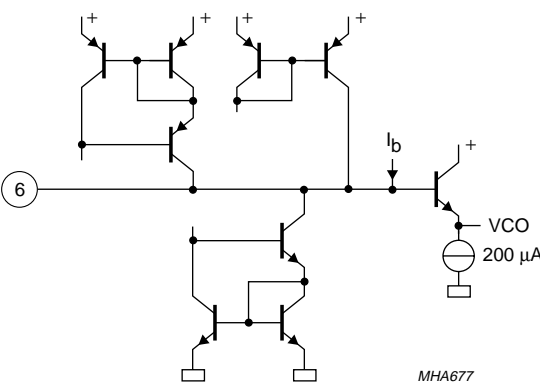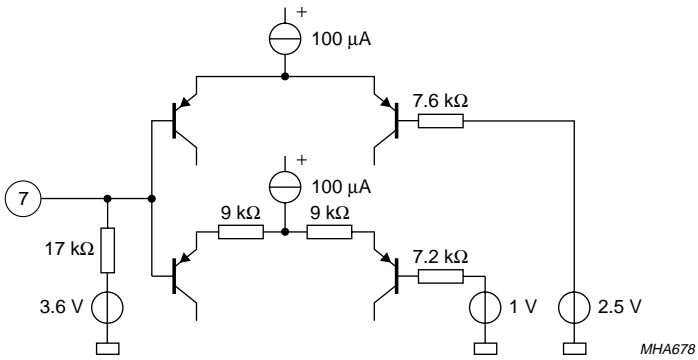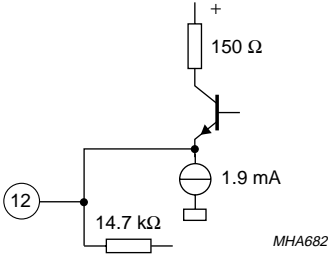FM-PLL/AM demodulators

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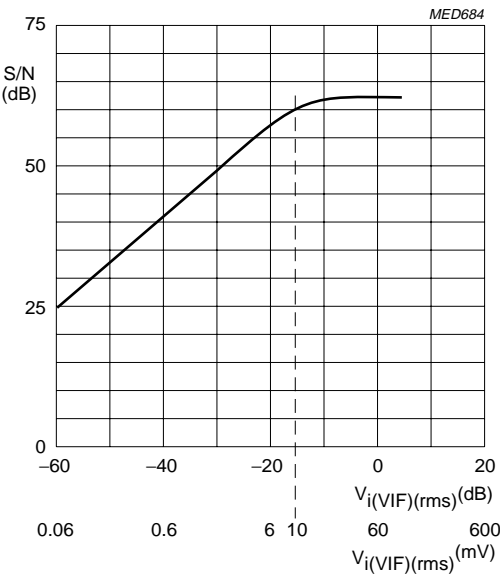
Fig.7 Typical signal-to-noise ratio as a function of IF input voltage.
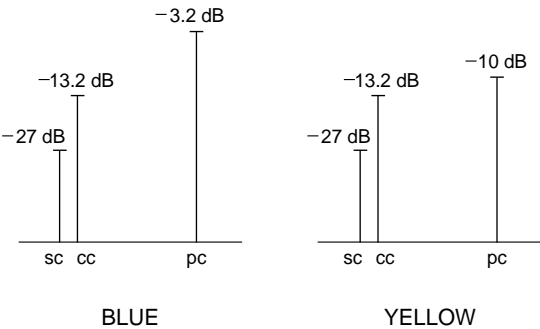
sc = sound carrier, with respect to sync level.
cc = chrominance carrier, with respect to sync level.
pc = picture carrier, with respect to sync level.
The sound carrier levels are taking into account a sound shelf attenuation of 20 dB (SAW filter G1962).

Fig.8 Input signal conditions.

Fig.9 Measurement conditions and typical AFC characteristic.

Fig.10 Typical video signal levels on output pin CVBS (sound carrier off).
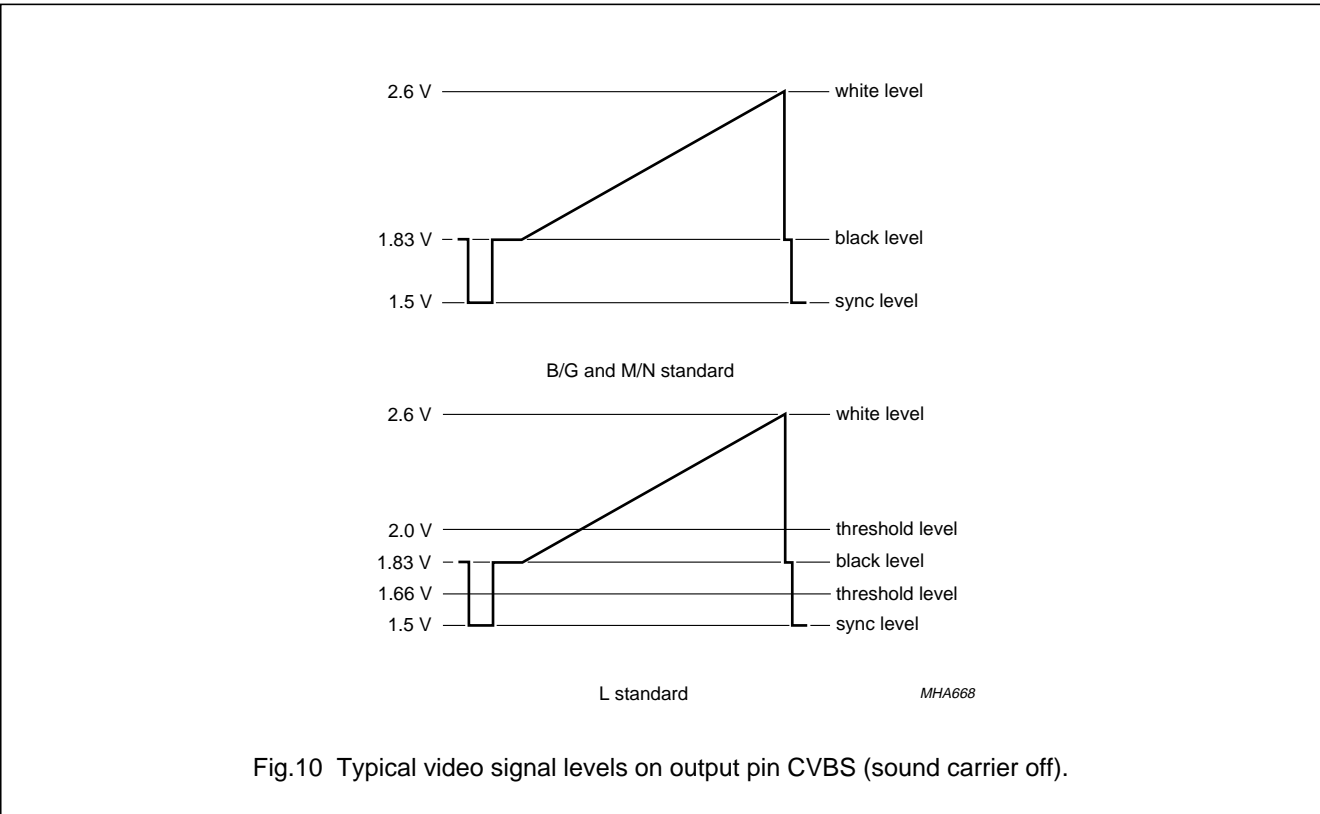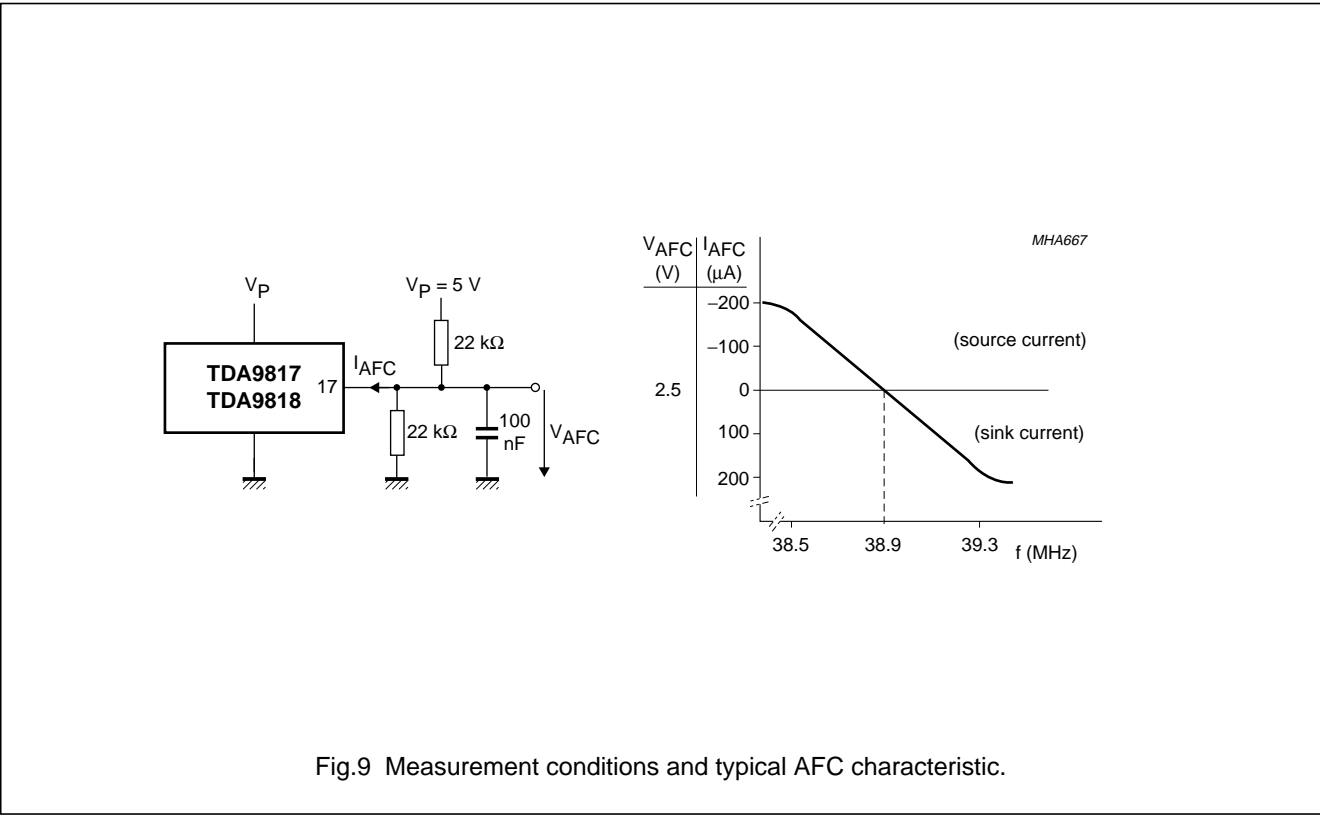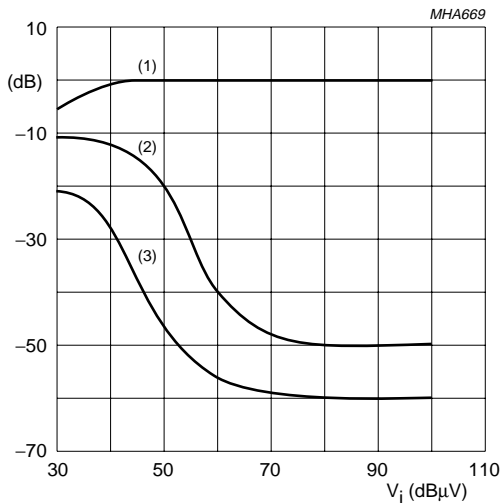
(1) Signal.
(2) AM rejection.
(3) Noise.

Fig.11 Typical audio level, noise and AM rejection
(54% FM deviation) for FM.
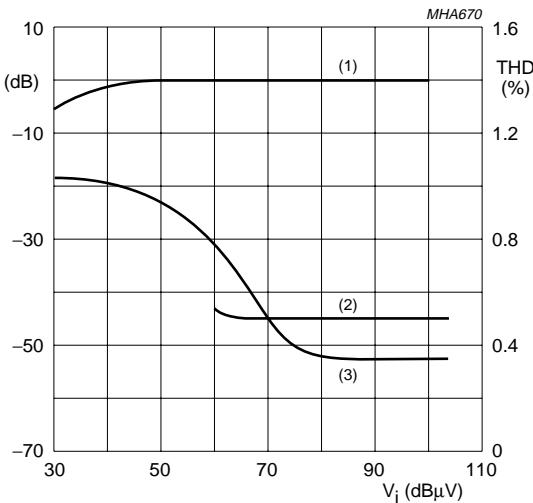
(1) Signal.
(2) THD.
(3) Noise.

Fig.12 Typical audio level, noise and THD
(54% AM modulation) for AM.
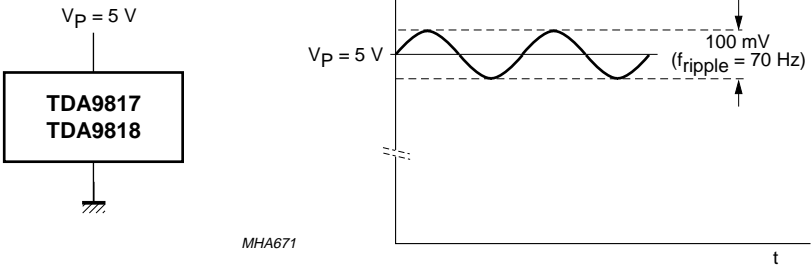
Fig.13 Ripple rejection condition.

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140
antenna input
(dBμV)

10
IF signals
RMS value
(V)

120

video 1.1 V (p-p)
1

(1)

100

10^{-1}

SAW insertion
loss 14 dB

IF slip
6 dB

80

tuning gain
control range

10^{-2} (TOP)

70 dB
VIF AGC

60

10^{-3}
0.66×10^{-3}

SAW insertion
loss 14 dB

40

10^{-4}

40 dB
RF gain

20

10^{-5}
0.66×10^{-5}

10

| VHF/UHF tuner | VIF | VIF amplifier, demodulator and video |
| tuner | SAW filter | TDA9817; TDA9818 |

MHA672

(1) Depends on TOP.

Fig.14 Front end level diagram.
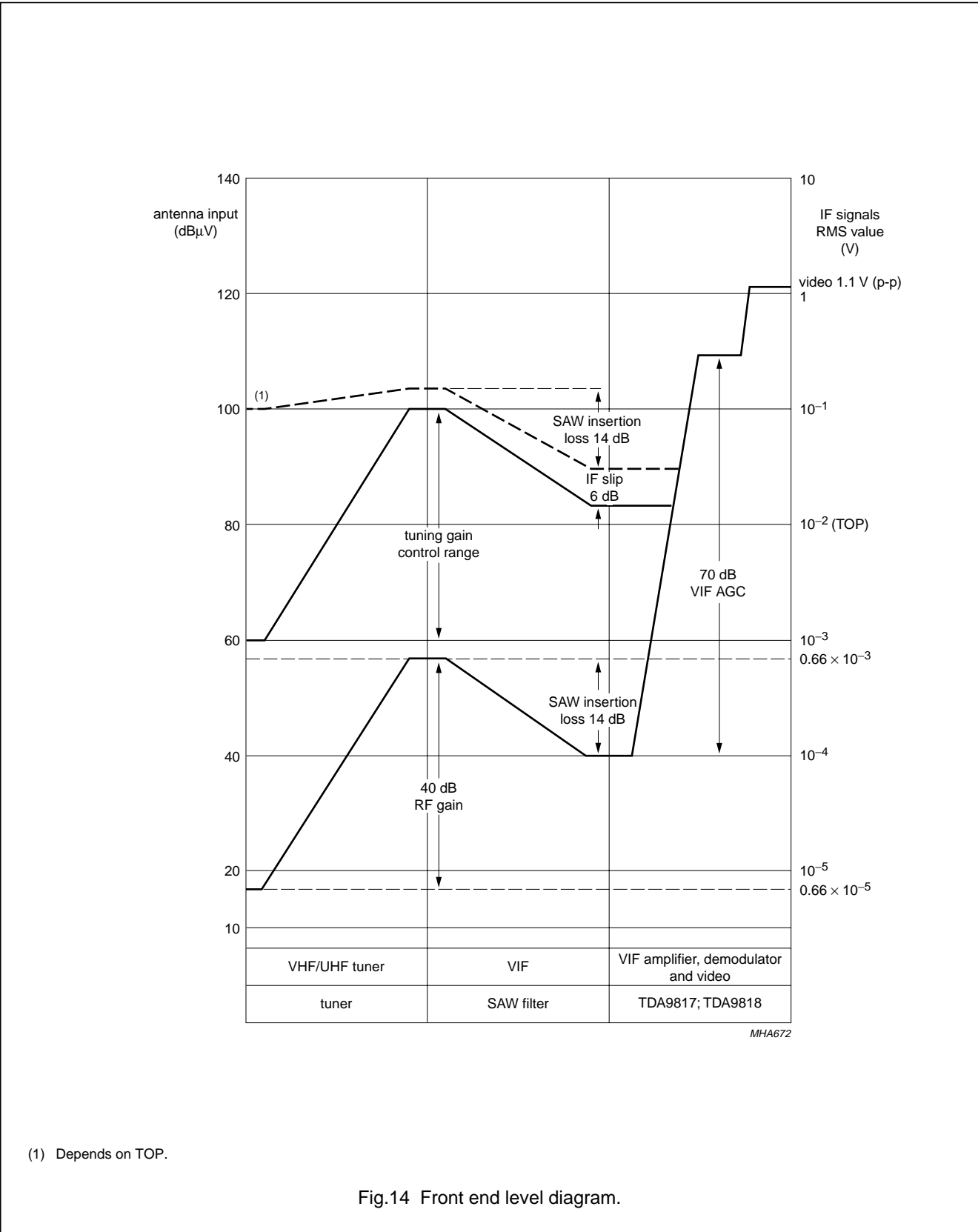
Single/multistandard VIF/SIF-PLL and
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INTERNAL CIRCUITRY

Table 2 Equivalent pin circuits and pin voltages

PIN NO.	PIN SYMBOL	DC VOLTAGE (V)	EQUIVALENT CIRCUIT (WITHOUT ESD PROTECTION CIRCUIT)
1	VIF1	3.4	
2	VIF2	3.4	
3	STD[1]	0 to V_P	
4	C_{VAGC}	1.5 to 4.0	
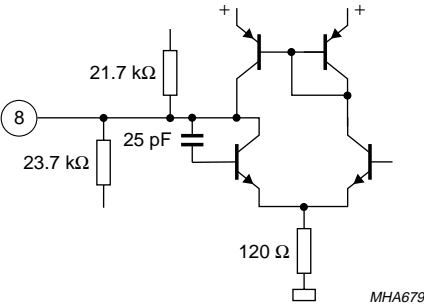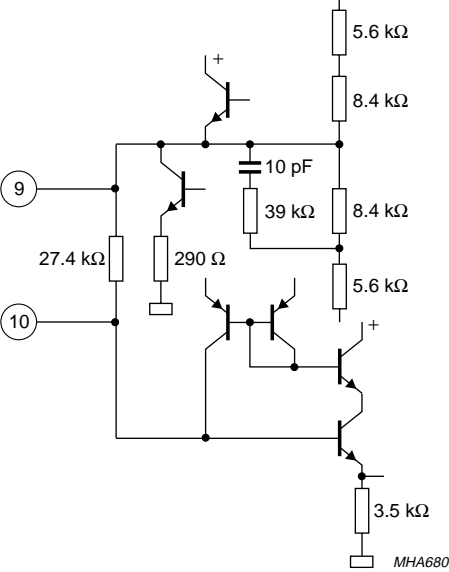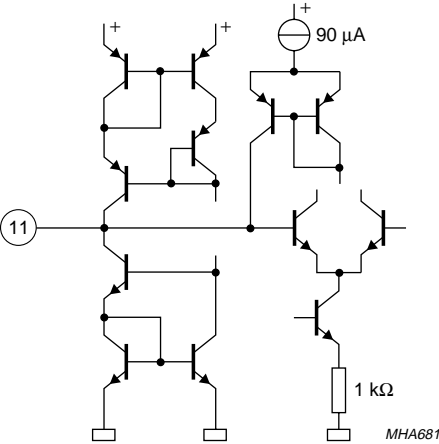
PIN NO.	PIN SYMBOL	DC VOLTAGE (V)	EQUIVALENT CIRCUIT (WITHOUT ESD PROTECTION CIRCUIT)
5	C_{SAGC}	1.5 to 4.0	
6	PLL	1.5 to 4.0	
7	LADJ[1]	0 to V_P	
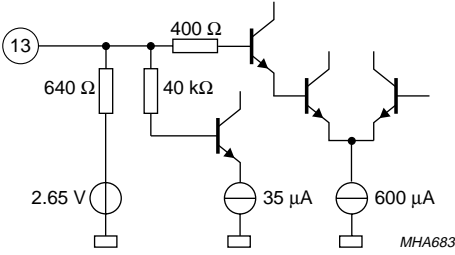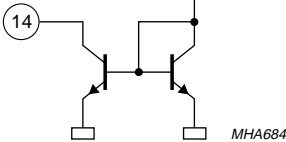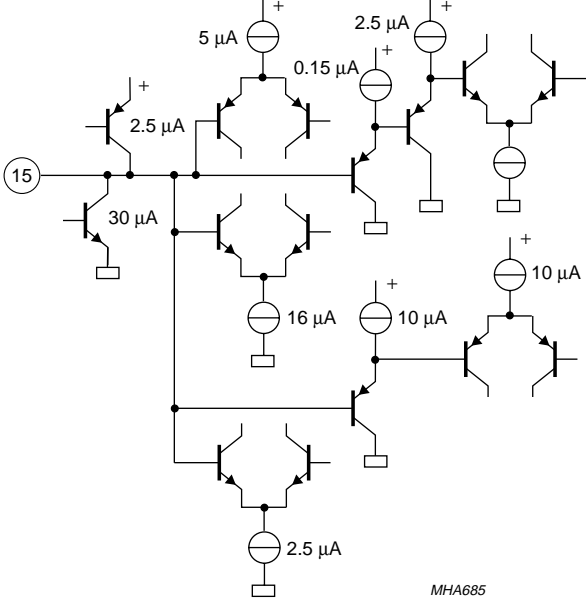
PIN NO.	PIN SYMBOL	DC VOLTAGE (V)	EQUIVALENT CIRCUIT (WITHOUT ESD PROTECTION CIRCUIT)
8	AF	2.3	MHA679
9	V_{de-em}	2.3	MHA680
10	C_{de-em}	2.3	
11	C_{DEC}	1.2 to 3.0	MHA681
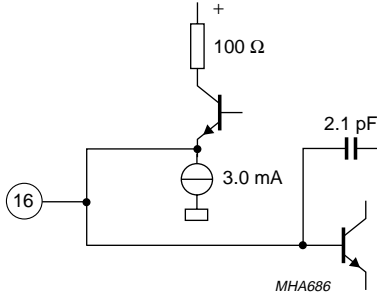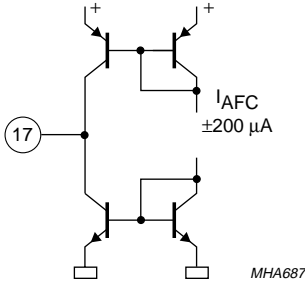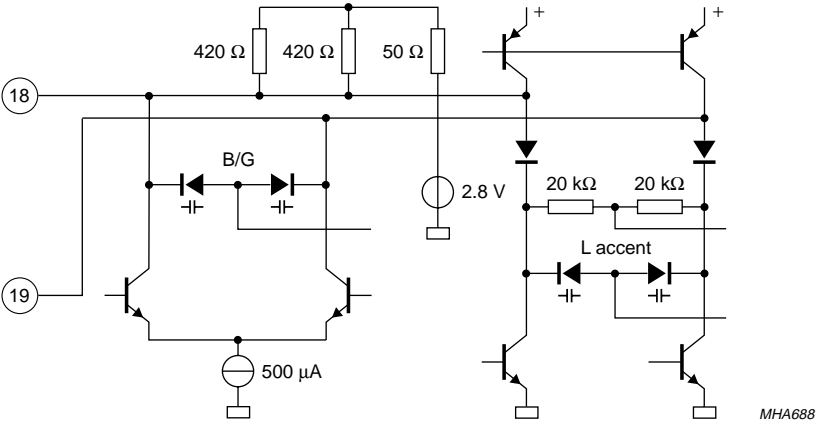
PIN NO.	PIN SYMBOL	DC VOLTAGE (V)	EQUIVALENT CIRCUIT (WITHOUT ESD PROTECTION CIRCUIT)
12	QSS	2.0	
13	FM_{in}	2.65	
14	TAGC	0 to 13.2	
15	C_{BL}[1]	0 to 3.2	
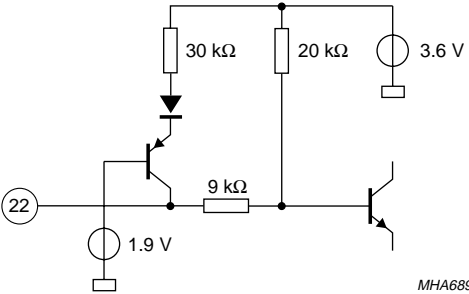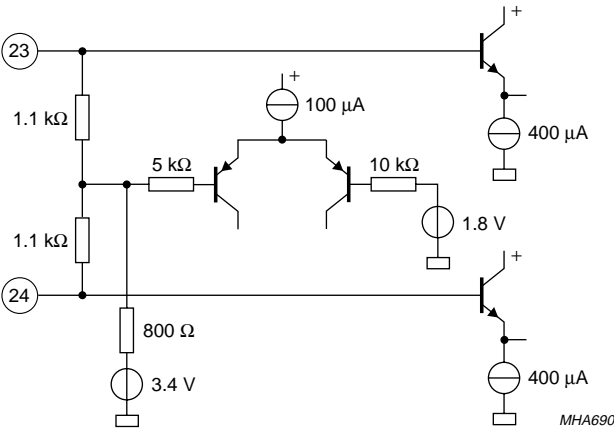
PIN NO.	PIN SYMBOL	DC VOLTAGE (V)	EQUIVALENT CIRCUIT (WITHOUT ESD PROTECTION CIRCUIT)
16	CVBS	sync level: 1.5	
17	AFC	0.3 to V_P − 0.3	
18	VCO1	2.7	
19	VCO2	2.7	
20	GND	0	
21	V_P	V_P	

PIN NO.	PIN SYMBOL	DC VOLTAGE (V)	EQUIVALENT CIRCUIT (WITHOUT ESD PROTECTION CIRCUIT)
22	TOP	0 to 1.9	
23	SIF1	3.4	
24	SIF2	3.4	

Note

1. Not connected for TDA9817T and TD9817TS.

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

TDA9817; TDA9818

TEST AND APPLICATION INFORMATION

V_P

AFC

22 kΩ

100 nF

22 kΩ

1.1 V (p-p) video

tuner AGC

1:1

SIF input

50 Ω

1   5

2   4

3

TOP

22 kΩ

GND

10 nF

(1)

C_{BL}

100 nF

5.6 kΩ

10 nF

mute switch

24   23   22   21   20   19   18   17   16   15(2)   14   13

TDA9817
TDA9818

intercarrier mode

1   2   3(2)   4   5   6   7(2)   8   9   10   11   12

1:1

VIF input

50 Ω

1   5

2   4

3

QSS intercarrier output

standards selection switch

VIF AGC

+ 2.2 μF

SIF AGC

+ 2.2 μF

330 Ω

220 nF

loop filter

22 kΩ

L/L accent switch and adjust

AF output

2.4 kΩ

22 nF

de-emphasis ≈50 μs

C_{DEC} + 22 μF

R_X

560 Ω

5.5 MHz(3)

MHA691
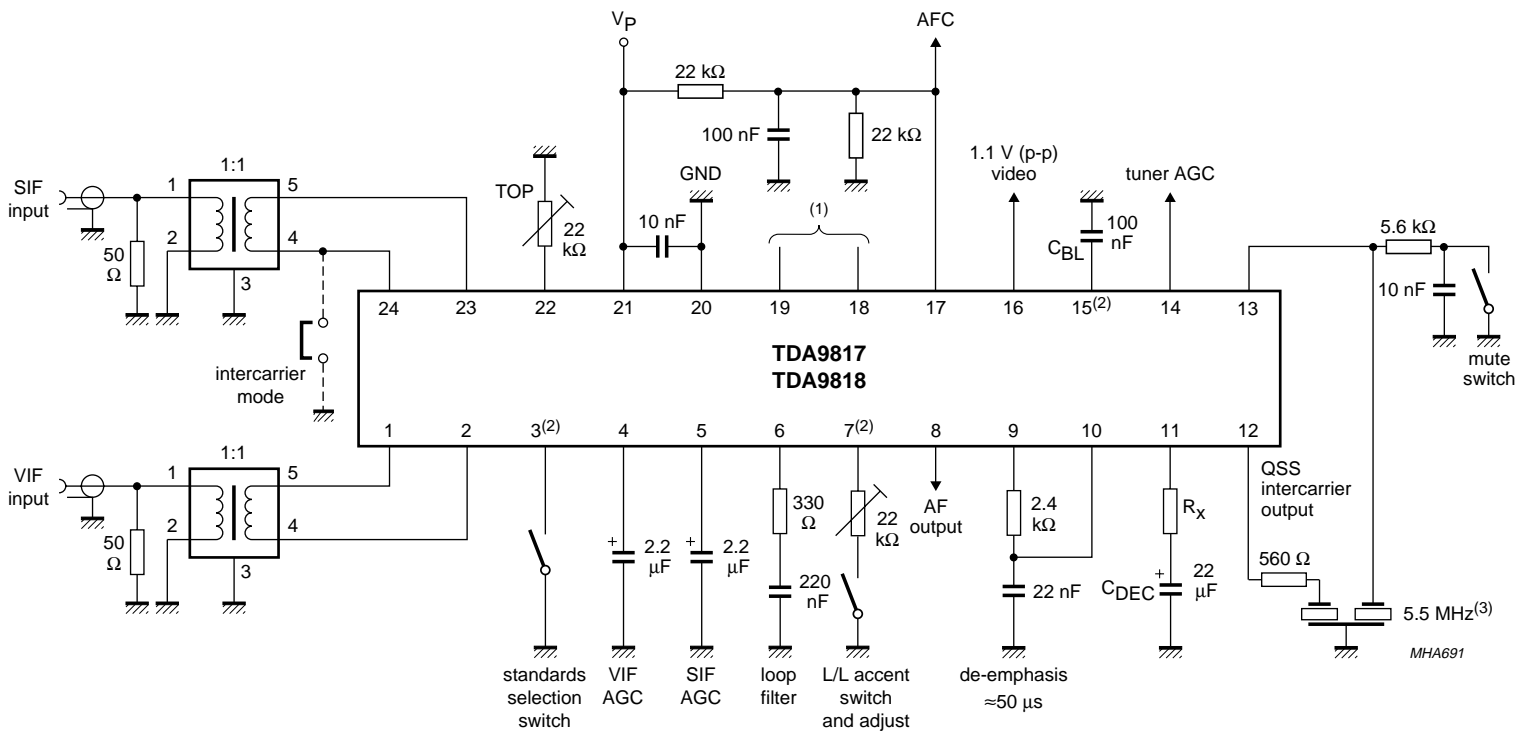
(1) See Table 3.

(2) Not connected for TDA9817T and TDA9817TS.

(3) Depends on TV standard.

Fig.15 Test circuit.

(1) See Table 3.

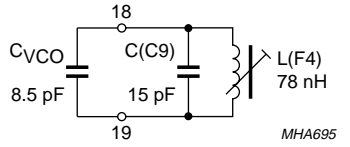(2) Not connected for TDA9817T and TDA9817TS.

(3) Depends on TV standard.

Fig.16 Application circuit.

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

TDA9817; TDA9818

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	MC 139 NE545SNAS100108
Philips ceramic capacitor	2222 632 51828	inside of coil	15 pF SMD; size = 0805

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

TDA9817; TDA9818

PACKAGE OUTLINES

SDIP24: plastic shrink dual in-line package; 24 leads (400 mil)   **SOT234-1**
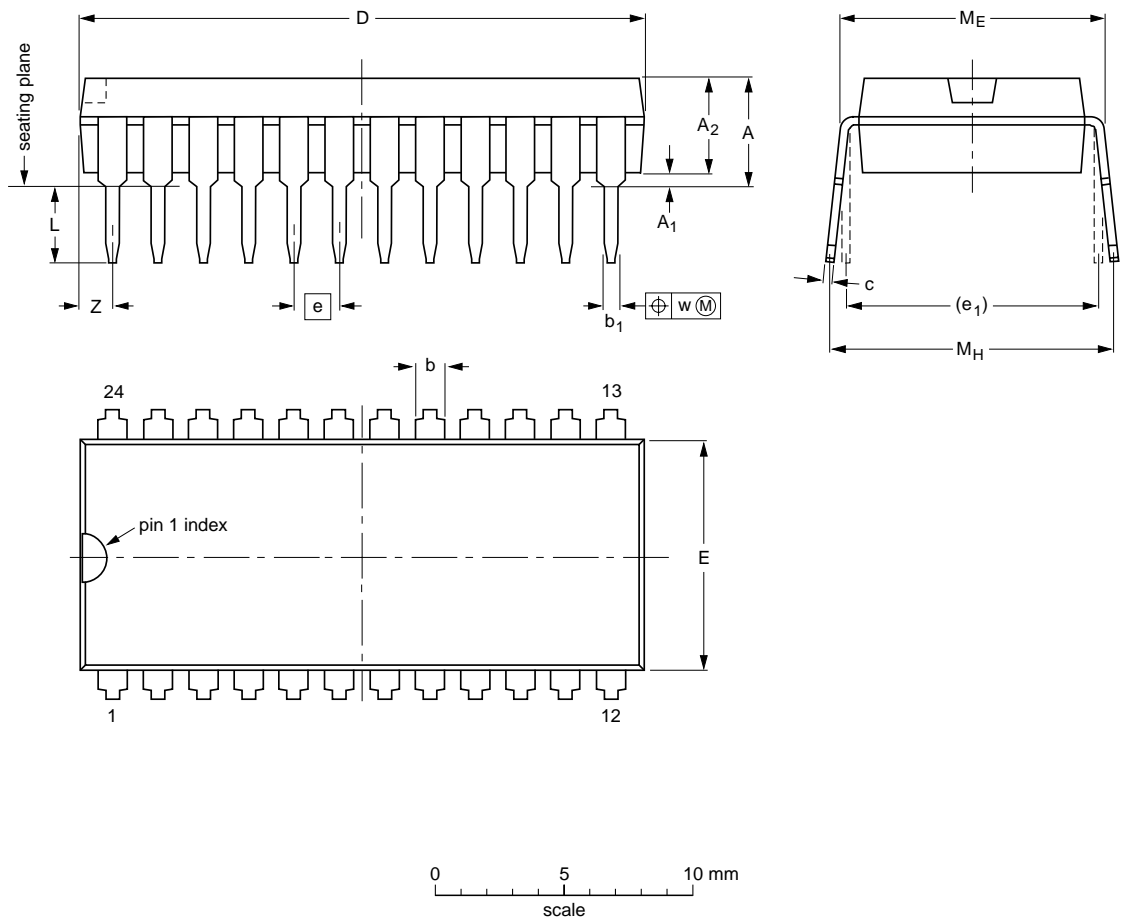
DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A₁ min.	A₂ max.	b	b₁	c	D (1)	E (1)	e	e₁	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	JEITA			
SOT234-1						~~95-02-04~~ 03-02-13

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

TDA9817; TDA9818

SO24: plastic small outline package; 24 leads; body width 7.5 mm **SOT137-1**

pin 1 index

detail X
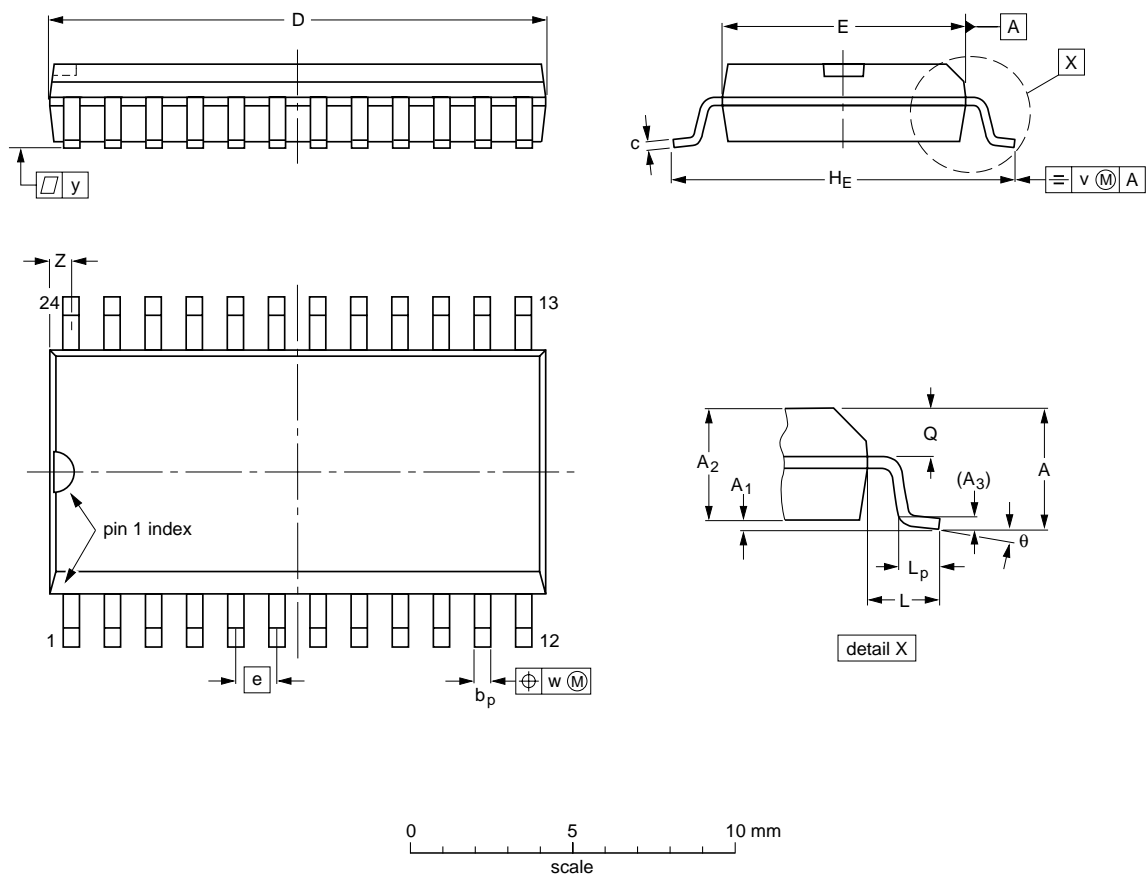
DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	2.65	0.3 0.1	2.45 2.25	0.25	0.49 0.36	0.32 0.23	15.6 15.2	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8° 0°
inches	0.1	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.61 0.60	0.30 0.29	0.05	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

Note

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT137-1	075E05	MS-013				99-12-27 03-02-19

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

TDA9817; TDA9818

SSOP24: plastic shrink small outline package; 24 leads; body width 5.3 mm

SOT340-1

pin 1 index

detail X

```
0        2.5       5 mm
|_._._._._._._._._|
        scale
```
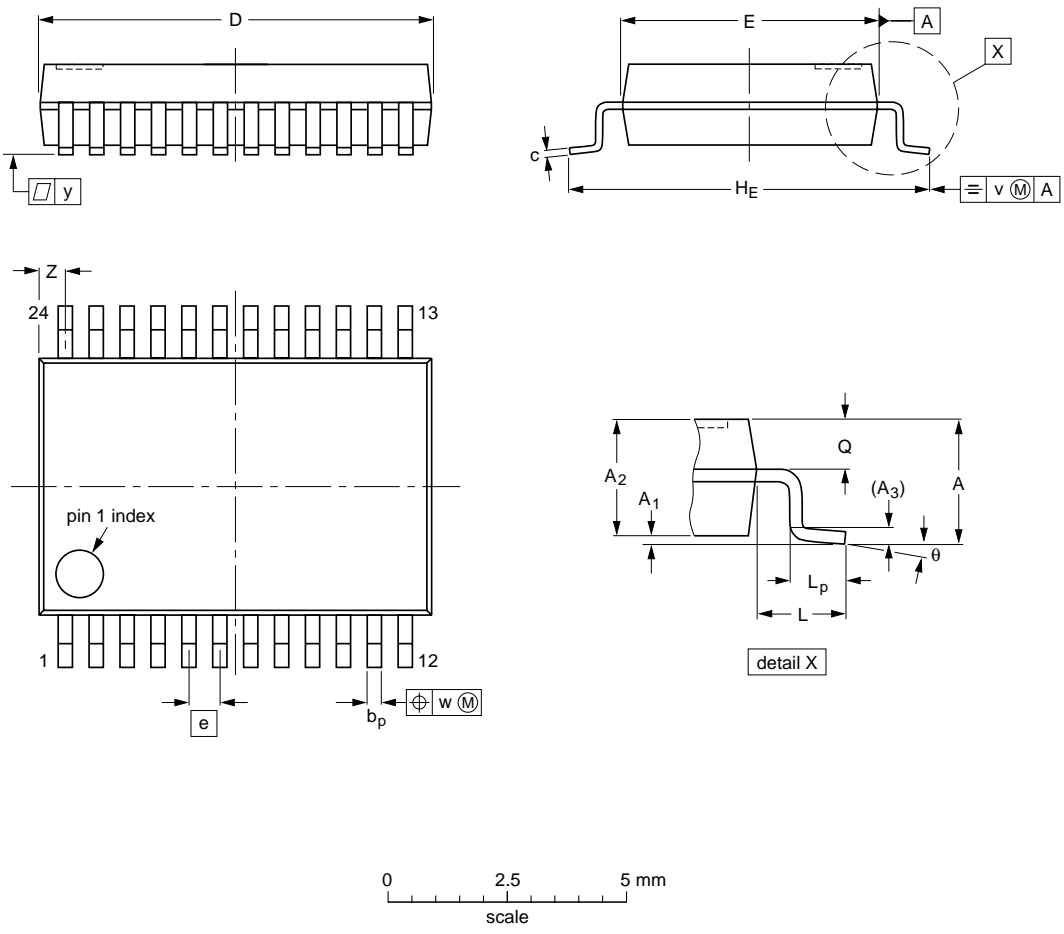
DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A₁	A₂	A₃	b_p	c	D(1)	E(1)	e	H_E	L	L_p	Q	v	w	y	Z(1)	θ
mm	2	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	8.4 8.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	0.8 0.4	8° 0°

Note

1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT340-1		MO-150				99-12-27 03-02-19

SOLDERING

Introduction

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"Data Handbook IC26; Integrated Circuit Packages"* (document order number 9398 652 90011).

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mount components are mixed on one printed-circuit board. Wave soldering can still be used for certain surface mount ICs, but it is not suitable for fine pitch SMDs. In these situations reflow soldering is recommended. Driven by legislation and environmental forces the worldwide use of lead-free solder pastes is increasing.

Through-hole mount packages

SOLDERING BY DIPPING OR BY SOLDER WAVE

Typical dwell time of the leads in the wave ranges from 3 to 4 seconds at 250 °C or 265 °C, depending on solder material applied, SnPb or Pb-free respectively.

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.

MANUAL SOLDERING

Apply the soldering iron (24 V or less) to the lead(s) of the package, either 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.

Surface mount packages

REFLOW SOLDERING

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several methods exist for reflowing; for example, convection or convection/infrared heating in a conveyor type oven. Throughput times (preheating, soldering and cooling) vary between 100 and 200 seconds depending on heating method.

Typical reflow peak temperatures range from 215 to 270 °C depending on solder paste material. The top-surface temperature of the packages should preferably be kept:

- below 225 °C (SnPb process) or below 245 °C (Pb-free process)
  - for all the BGA, HTSSON..T and SSOP-T packages
  - for packages with a thickness ≥ 2.5 mm
  - for packages with a thickness < 2.5 mm and a volume ≥ 350 mm^3 so called thick/large packages.
- below 240 °C (SnPb process) or below 260 °C (Pb-free process) for packages with a thickness < 2.5 mm and a volume < 350 mm^3 so called small/thin packages.

Moisture sensitivity precautions, as indicated on packing, must be respected at all times.

WAVE SOLDERING

Conventional single wave soldering is not recommended for surface mount devices (SMDs) or printed-circuit boards with a high component density, as solder bridging and non-wetting can present major problems.

To overcome these problems the double-wave soldering method was specifically developed.

If wave soldering is used the following conditions must be observed for optimal results:

- Use a double-wave soldering method comprising a turbulent wave with high upward pressure followed by a smooth laminar wave.
- For packages with leads on two sides and a pitch (e):
  - larger than or equal to 1.27 mm, the footprint longitudinal axis is **preferred** to be parallel to the transport direction of the printed-circuit board;
  - smaller than 1.27 mm, the footprint longitudinal axis **must** be parallel to the transport direction of the printed-circuit board.

The footprint must incorporate solder thieves at the downstream end.

- For packages with leads on four sides, the footprint must be placed at a 45° angle to the transport direction of the printed-circuit board. The footprint must incorporate solder thieves downstream and at the side corners.

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Typical dwell time of the leads in the wave ranges from 3 to 4 seconds at 250 °C or 265 °C, depending on solder material applied, SnPb or Pb-free respectively.

A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

MANUAL SOLDERING

Fix the component by first soldering two diagonally-opposite end leads. Use a low voltage (24 V or less) soldering iron applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C. When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

Suitability of IC packages for wave, reflow and dipping soldering methods

MOUNTING	PACKAGE[1]	SOLDERING METHOD		
		WAVE	REFLOW[2]	DIPPING
Through-hole mount	CPGA, HCPGA	suitable	–	suitable
	DBS, DIP, HDIP, RDBS, SDIP, SIL	suitable[3]	–	–
Through-hole-surface mount	PMFP[4]	not suitable	not suitable	–
Surface mount	BGA, HTSSON..T[5], LBGA, LFBGA, SQFP, SSOP-T[5], TFBGA, USON, VFBGA	not suitable	suitable	–
	DHVQFN, HBCC, HBGA, HLQFP, HSO, HSOP, HSQFP, HSSON, HTQFP, HTSSOP, HVQFN, HVSON, SMS	not suitable[6]	suitable	–
	PLCC[7], SO, SOJ	suitable	suitable	–
	LQFP, QFP, TQFP	not recommended[7][8]	suitable	–
	SSOP, TSSOP, VSO, VSSOP	not recommended[9]	suitable	–
	CWQCCN..L[11], PMFP[10], WQCCN32L[11]	not suitable	not suitable	–

Notes

1. For more detailed information on the BGA packages refer to the *"(LF)BGA Application Note"* (AN01026); order a copy from your Philips Semiconductors sales office.

2. All surface mount (SMD) packages are moisture sensitive. Depending upon the moisture content, the maximum temperature (with respect to time) and body size of the package, there is a risk that internal or external package cracks may occur due to vaporization of the moisture in them (the so called popcorn effect). For details, refer to the Drypack information in the *"Data Handbook IC26; Integrated Circuit Packages; Section: Packing Methods"*.

3. For SDIP packages, the longitudinal axis must be parallel to the transport direction of the printed-circuit board.

4. Hot bar soldering or manual soldering is suitable for PMFP packages.

5. These transparent plastic packages are extremely sensitive to reflow soldering conditions and must on no account be processed through more than one soldering cycle or subjected to infrared reflow soldering with peak temperature exceeding 217 °C $\pm$ 10 °C measured in the atmosphere of the reflow oven. The package body peak temperature must be kept as low as possible.

6. These packages are not suitable for wave soldering. On versions with the heatsink on the bottom side, the solder cannot penetrate between the printed-circuit board and the heatsink. On versions with the heatsink on the top side, the solder might be deposited on the heatsink surface.

7. If wave soldering is considered, then the package must be placed at a 45° angle to the solder wave direction. The package footprint must incorporate solder thieves downstream and at the side corners.

8. Wave soldering is suitable for LQFP, QFP and TQFP packages with a pitch (e) larger than 0.8 mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.65 mm.

9. Wave soldering is suitable for SSOP, TSSOP, VSO and VSSOP packages with a pitch (e) equal to or larger than 0.65 mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.5 mm.

10. Hot bar or manual soldering is suitable for PMFP packages.

11. Image sensor packages in principle should not be soldered. They are mounted in sockets or delivered pre-mounted on flex foil. However, the image sensor package can be mounted by the client on a flex foil by using a hot bar soldering process. The appropriate soldering profile can be provided on request.

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

TDA9817; TDA9818

DATA SHEET STATUS

LEVEL	DATA SHEET STATUS[1]	PRODUCT STATUS[2][3]	DEFINITION
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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2. The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

3. For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

DEFINITIONS

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). 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.

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