DATA SHEET

TDA9808
Single standard VIF-PLL with QSS-IF and FM-PLL demodulator

Preliminary specification
File under Integrated Circuits, IC02

February 1995

Philips
Semiconductors

PHILIPS

FEATURES

- 5 V positive supply voltage
- Applicable for IF frequencies of 38.9 MHz, 45.75 MHz and 58.75 MHz
- Gain controlled wide band VIF-amplifier (AC-coupled)
- True synchronous demodulation with active carrier regeneration (very linear demodulation, good intermodulation figures, reduced harmonics, excellent pulse response)
- VIF AGC detector for gain control, operating as peak sync detector
- Tuner AGC with adjustable take over point (TOP)
- AFC detector without extra reference circuit
- SIF input for Single Reference QSS mode (PLL controlled); SIF AGC detector for gain controlled SIF amplifier; Single Reference QSS for high performance
- AC coupled limiter amplifier for sound intercarrier signal
- PLL-FM demodulator with high linearity, alignment-free
- Stabilizer circuit for ripple rejection and to achieve constant output signals.

GENERAL DESCRIPTION

The TDA9808 is an integrated circuit for singlestandard (negative modulated) vision IF signal processing and FM demodulation, with single reference QSS-IF in TV and VTR sets.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V_P	positive supply voltage (pin 18)	4.5	5	5.5	V
I_P	supply current	72	85	98	mA
$V_{i\ VIF}$	vision IF input signal sensitivity (RMS value; pins 1 and 2)	–	60	100	μV
$V_{o\ CVBS}$	CVBS output signal on pin 9 (peak-to-peak value)	1.2	1.35	1.5	V
B	–3 dB video bandwidth on pin 9	7	8	–	MHz
S/N (W)	weighted signal-to-noise ratio for video	56	60	–	dB
$\alpha_{0.92}$	intermodulation attenuation	58	64	–	dB
$\alpha_{2.76}$		58	64	–	dB
α_H	suppression of harmonics in video signal	35	40	–	dB
$V_{i\ SIF}$	sound IF input signal sensitivity (RMS value; pins 19 and 20)	–	50	100	μV
V_o	audio output signal for FM standard M, N (RMS value; 25 kHz modulation)	–	0.5	–	V
THD	total harmonic distortion; 25 kHz modulation for FM	–	0.15	–	%
S/N (W)	weighted signal-to-noise ratio; 25 kHz modulation for FM	–	60	–	dB

ORDERING INFORMATION

EXTENDED TYPE NUMBER	PACKAGE			
	PINS	PIN POSITION	MATERIAL	CODE
TDA9808	20	DIL	plastic	SOT146(1)
TDA9808T	20	SO	plastic	SOT163A(2)

Note

1. SOT146-1; 1996 November 22.
2. SOT163-1; 1996 November 22.

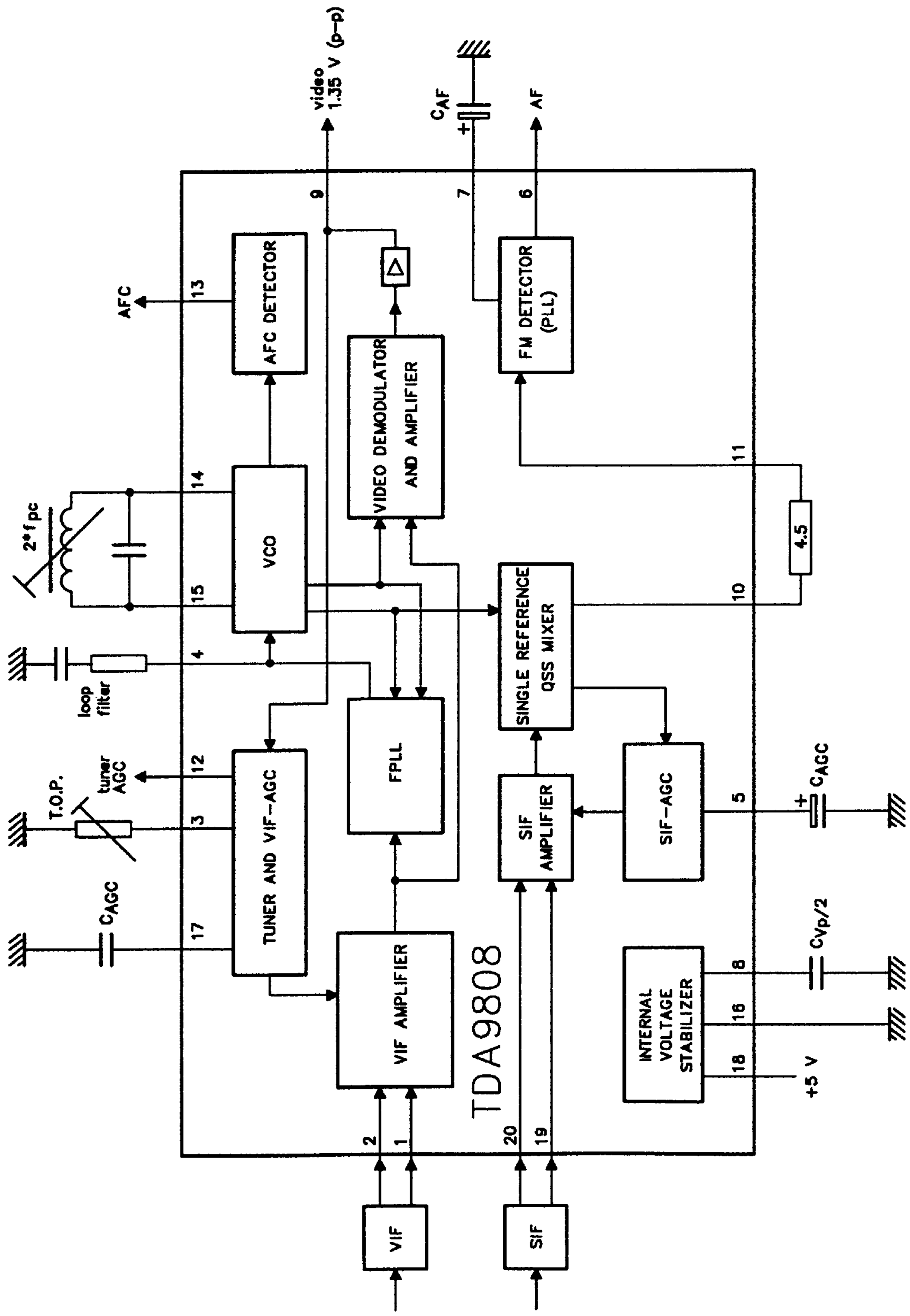


Fig.1 Block diagram.

PINNING

SYMBOL	PIN	DESCRIPTION
$V_{i\ VIF}$	1	VIF differential input signal
	2	
TADJ	3	tuner AGC takeover adjust (TOP)
T_{PLL}	4	PLL loop filter
C_{SAGC}	5	SIF AGC capacitor
$V_{o\ AF}$	6	audio frequency output
C_{AF}	7	decoupling capacitor
$C_{Vp/2}$	8	$V_P/2$ reference capacitor
$V_{o\ CVBS}$	9	CVBS output signal
$V_{o\ QSS}$	10	single reference QSS output
$V_{i\ FM}$	11	sound intercarrier input
TAGC	12	tuner AGC output
AFC	13	AFC output
VCO1	14	VCO reference circuit for $2f_{PC}$
VCO2	15	
GND	16	ground
C_{VAGC}	17	VIF AGC capacitor
V_P	18	positive supply voltage
$V_{i\ SIF}$	19	SIF differential input signal
	20	

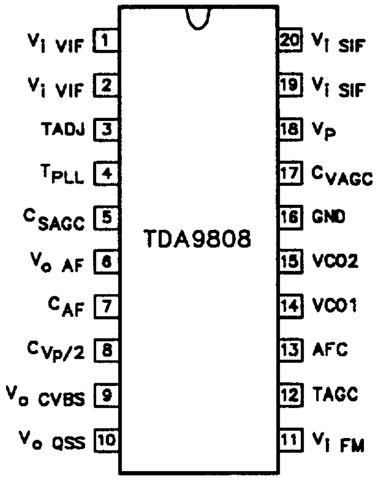


Fig.2 Pin configuration.

FUNCTIONAL DESCRIPTION

Vision IF amplifier

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

Tuner and VIF AGC

The AGC capacitor voltage is transferred to an internal IF control signal, to control the vision IF amplifier. Additionally it is fed into the tuner AGC amplifier to generate the tuner AGC output current on pin 12 (open-collector output). The tuner AGC take over point can be adjusted at pin 3. This allows the tuner and the SWIF filter to be matched to achieve the optimum IF input level.
The AGC detector charges/discharges the AGC capacitor to the required voltage for setting of VIF and tuner gain in order to keep the video signal at a constant level. Therefore the sync level of the video signal is detected.

Frequency-Phase 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 which is 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. Via the loop filter the DC current of either frequency detector or phase detector is converted into a DC voltage, which controls the VCO frequency.

VCO and AFC

The VCO operates with a symmetrically connected resonance circuit (with L and C in parallel). It is tuned to the double VIF picture carrier frequency. The VCO is controlled by two integrated varicaps. The control voltage required to tune the VCO from its free running frequency to actual double the PC frequency is generated by the frequency-phase detector and fed via the loop filter to the first varicap (FPLL). 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.
The oscillator signal is divided-by-two. Two differential output signals were generated with 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’ VCO output signal.
The demodulator output signal is fed via an integrated low-pass 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. The video output signal at pin 9 is 1.35 V (p-p) for nominal vision IF modulation.

SIF amplifier and AGC

The sound IF amplifier consists of two AC coupled differential amplifier stages. Each differential stage comprises a controlled feedback network provided by emitter degeneration.
The SIF AGC detector is related to the SIF signals (average level of FM carriers) at pin 19 and pin 20 (SIF input) and controls the SIF amplifier to provide a constant SIF signal at the SIF amplifier output.

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 10. With this system a high performance Hi-Fi stereo sound processing can be achieved.

FM detector

The FM detector consists of a limiter, an FM-PLL and an AF amplifier. The limiter provides the amplification and limitation of the FM sound intercarrier signal before demodulation. 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 and to save pins for DC decoupling.

The FM-PLL consists of an integrated RC oscillator, an integrated loop filter and a phase detector. The oscillator is locked to the limited FM intercarrier signal. As a result of locking, the oscillator tracks with the frequency modulation of the input signal. The oscillator control voltage is superimposed by the AF voltage. By this way the FM-PLL operates as an FM-demodulator.
The AF amplifier consists of two parts:

1. The AF pre-amplifier is an operational amplifier with internal feedback, high gain and high common mode rejection. The AF output voltage from the PLL demodulator, by principle a small output signal, is amplified by approximately 33 dB. The low-pass characteristic of this pre-amplifier reduces the harmonics of the intercarrier signal at the sound output terminal.
   An additional DC control circuit is implemented to keep the DC level constant, independent of process spreadings.
2. The AF output amplifier (10 dB) provides the required output level by means of a rail-to-rail output stage.

Internal voltage stabilizer and V_P/2-reference

The bandgap circuit internally generates a voltage of approximately 1.25 V, independent of supply voltage and temperature.
A voltage regulator circuit, connected to this voltage, produces a constant voltage of 3.6 V which is used as an internal reference voltage.
For all audio output signals this constant reference voltage cannot be used because large output signals are required. Therefore these signals refer to half the supply voltage to achieve a symmetrical headroom, especially for the rail-to-rail output stage. For ripple and noise attenuation the V_P/2 voltage has to be filtered via a low-pass by using an external capacitor at pin 8 together with an integrated resistor ($f_g \approx 5$ Hz). For a fast setting to V_P/2 an internal start-up circuit is added.

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_P	supply voltage (pin 18) for a maximum chip temperature (note 1)			
	SOT146 at +120 °C	–	7.6	V
	SOT163A at +120 °C	–	5.9	V
V_i	voltage at pins 1 to 8, 11 to 13, 16 to 20	0	5.5	V
$t_{s\ max}$	maximum short-circuit time	–	10	s
V_{12}	tuner AGC output voltage	0	13.2	V
T_{stg}	storage temperature	–25	+150	°C
T_{amb}	operating ambient temperature	–20	+70	°C
V_{ESD}	electrostatic handling for all pins (note 2)	–	±300	V

Notes to the Limiting Values

1. I_{18} = 98 mA; T_{amb} = +70 °C.
2. Charge device model class B: equivalent to discharging a 200 pF capacitor through a 0 Ω series resistor.

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient in free air	
	SOT146	65 K/W
	SOT163A	85 K/W

CHARACTERISTICS

The following characteristics apply for T_{amb} = +25 °C, V_P = 5 V, f_{pc} = 45.75 MHz (M), f_{pc} = 58.75 MHz (M), f_{SC} = 41.25 MHz (M), f_{SC} = 54.25 MHz (M); input level $V_{i\ IF1,2}$ = 10 mV RMS value (sync-level); $V_{i\ IF19,20}$ = 4.5 mV RMS value (SC), IF input from 50 Ω via broadband transformer 1:1; video modulation DSB; residual carrier M: 10%; video signal: NTC-7 composite; test circuit according to Fig.3 unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply (pin 18)						
V_{18}	supply voltage	note 1	4.5	5	5.5	V
I_{18}	supply current		72	85	98	mA
Vision IF amplifier (pins 1 and 2)						
$V_{i\ VIF}$	input sensitivity (RMS value) at 45.75 MHz	−1 dB video at output	–	60	90	μV
	input sensitivity (RMS value) at 58.75 MHz		–	70	100	μV
	maximum input signal (RMS value) at 45.75 MHz	+1 dB video at output	140	200	–	mV
	maximum input signal (RMS value) at 58.75 MHz		200	300	–	mV
$\Delta V_{o\ int.}$	internal IF amplitude difference between picture and sound carrier	within AGC range; M standard; Δf = 4.5 MHz	–	0.7	1	dB
G_{IF}	IF gain control range	see Fig.4				
		45.75 MHz	65	70	–	dB
		58.75 MHz	68	73	–	dB
R_i	input resistance (differential)	note 2	1.7	2.2	2.7	kΩ
C_i	input capacitance (differential)		1.2	1.7	2.5	pF
$V_{1/2}$	DC voltage		–	3.4	–	V
True synchronous video demodulator (note 3)						
f_{VCO}	maximum oscillator frequency for carrier regeneration	$f = 2f_{pc}$	125	130	–	MHz
Δf_{VCO}	oscillator drift (free running) as a function of temperature	note 4	–	–	±750	Hz/K
$V_{0\ ref}$	oscillator swing at pins 14 and 15 (RMS value)	f_{pc} = 45.75 MHz	–	100	–	mV
		f_{pc} = 58.75 MHz	–	80	–	mV
Δf_{pc}	vision carrier capture range	M standard	±1.5	±2	–	MHz
t_{acqu}	acquisition time	note 5; BL = 60 kHz	–	–	30	ms
$V_{i\ VIF}$	VIF input signal sensitivity for PLL to be locked (RMS value; pins 1 and 2)	note 6; maximum IF gain	–	60	90	μV
I_{Loop}	FPLL loop offset current at pin 4	note 7	–	–	±4.5	μA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Composite video amplifier (pin 9; sound carrier off)						
$V_{o\ video}$	output signal (peak-to-peak value)	see Fig.9	1.2	1.35	1.5	V
V_9	sync level		–	1.5	–	V
	upper video clipping level		V_P – 1.1	V_P – 1	–	V
	lower video clipping level		–	0.3	0.4	V
R_9	output resistance	note 2	–	–	10	Ω
$I_{int\ 9}$	internal bias current for emitter-follower	DC	1.6	2.0	–	mA
I_9	maximum output sink current	DC and AC	1.0	–	–	mA
	maximum output source current		2.0	–	–	mA
ΔV_o	deviation of output signal	50 dB gain control	–	–	0.5	dB
		30 dB gain control	–	–	0.1	dB
	black level tilt	note 8	–	–	1	%
ΔG	differential gain	NTC-7 Composite	–	2	5	%
$\Delta\varphi$	differential phase		–	2	4	deg
B	–1 dB video bandwidth	M standard;	5	6	–	MHz
	–3 dB video bandwidth	C_9 < 30 pF; R_L > 1.5 kΩ; AC load	7	8	–	MHz
S/N (W)	signal-to-noise ratio; weighted	see Fig.6 and note 9	56	60	–	dB
S/N	signal-to-noise ratio; unweighted		49	53	–	dB
$\alpha_{0.92}$	intermodulation at ‘blue’	see Fig.7 and note 10; f = 0.92 MHz	58	64	–	dB
	intermodulation at ‘yellow’		60	66	–	dB
$\alpha_{2.76}$	intermodulation at ‘blue’	see Fig.7 and note 10; f = 2.76 MHz	58	64	–	dB
	intermodulation at ‘yellow’		59	65	–	dB
α_c	residual vision carrier (RMS value)	fundamental wave and harmonics	–	2	10	mV
α_H	suppression of video signal harmonics	note 11; C_9 < 30 pF; R_L > 1.5 kΩ; AC load	35	40	–	dB
α_{sp}	spurious elements	note 12	40	–	–	dB
RR	ripple rejection at pin 9	see Fig.10; video signal: grey level	25	30	–	dB
VIF-AGC detector (pin 17)						
t_{resp}	response to an increasing amplitude step of 50 dB in the IF-input signal	+3 dB at video output pin 9	–	1	10	ms
	response to a decreasing amplitude step of 50 dB in the IF-input signal	–3 dB at video output pin 9	–	150	300	ms
I_{17}	charging current		55	75	95	μA
	discharging current	note 8	1.0	1.4	1.8	μA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Tuner AGC (pin 12)						
V_i	IF input signal for minimum starting point of tuner take over (RMS value)	input at pins 1/2; R_{TOP} = 22 Ω; I_{12} = 0.4 mA	–	2	5	mV
	IF input signal for maximum starting point of tuner take over (RMS value)	input at pins 1/2; R_{TOP} = 0 Ω; I_{12} = 0.4 mA	50	100	–	mV
V_{12}	permissible output voltage	note 2; from external source	–	–	13.2	V
	saturation voltage	I_{12} = 1.7 mA	–	–	0.2	V
ΔV_{12}	variation of take over point by temperature	I_{12} = 0.4 mA	–	0.03	0.07	dB/K
I_{12}	sink current	see Fig.4				
		no tuner gain reduction	–	–	5	μA
		maximum tuner gain reduction	1.7	2.2	2.8	mA
ΔG_{IF}	IF slip by automatic gain control	tuner gain current from 20 to 80%	–	6	8	dB
AFC circuit (pin 13; see Fig.8 and note 13)						
S	control steepness ΔI_{13} / Δf	note 14				
		45.75 MHz	0.45	0.65	0.85	μA/kHz
		58.75 MHz	0.38	0.55	0.72	μA/kHz
f_{IF}	frequency variation by temperature	note 4	–	–	±750	Hz/K
V_{13}	output voltage upper limit	see Fig.8	V_P – 0.6	V_P – 0.3	–	V
	output voltage lower limit		–	0.3	0.6	V
I_{13}	output current source		150	200	250	μA
	output current sink		150	200	250	μA
ΔV_{13}	residual video modulation current (peak-to-peak value)		–	20	30	μA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Sound IF amplifier (pins 19 and 20)						
$V_{i\ SIF}$	input sensitivity (RMS value) at 41.25 MHz	–1 dB at intercarrier output pin 10	–	50	80	μV
	input sensitivity (RMS value) at 54. 25 MHz		–	70	100	μV
	maximum input signal (RMS value) at 41.25 MHz	+1 dB at intercarrier output pin 10	40	80	–	mV
	maximum input signal (RMS value) at 54.25 MHz		80	110	–	mV
G_{SIF}	SIF gain control range	see Fig.5				
		41.25 MHz	59	64	–	dB
		54.25 MHz	59	64	–	dB
R_i	input resistance (differential)	note 2	1.7	2.2	2.7	kΩ
C_i	input capacitance (differential)		1.2	1.7	2.5	pF
$V_{19/20}$	DC voltage		–	3.4	–	V
SIF AGC detector (pin 5)						
I_5	charging current		3.5	5	6.5	μA
	discharging current		4.5	6	7.5	μA
Single reference QSS intercarrier mixer (pin 10)						
V_o	IF intercarrier level (RMS value)	SC_1	75	100	125	mV
B	–3 dB intercarrier bandwidth	upper limit	7.5	9	–	MHz
α_H	residual sound carrier (RMS value)	fundamental wave	–	2	–	mV
		harmonics	–	0.75	–	mV
R_{10}	output resistance	note 2	–	–	10	Ω
V_{10}	DC voltage		–	2.0	–	V
I_{int10}	internal bias current for emitter-follower	DC	1.5	1.9	–	mA
I_{10}	output current (RMS value)	AC; $R_L > 1$ kΩ; $C_{10} < 50$ pF	–	–	1.2	mA
	output current	DC; $R_L > 1$ kΩ	2.0	2.5	–	mA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Limiter amplifier (pin 11)						
$V_{i\ FM}$	input signal for lock-in		–	–	100	μV
	input signal (RMS value)	(S+N)/N = 40 dB	–	300	400	μV
	permitted input signal (RMS value)		200	–	–	mV
R_{11}	input resistance	note 2	480	600	720	Ω
V_{11}	DC voltage		–	1.8	–	V
FM-PLL demodulator						
$f_{i\ FM}$	catching range of PLL		4.0	–	7	MHz
	holding range of PLL		3.5	–	8	MHz
t_{acqu}	acquisition time		–	–	4	μs
FM operation (standard M, N) (pin 6; notes 15 and 15a)						
$V_{o\ AF}$	AF output signal (RMS value)	25 kHz FM deviation; see Fig.3 and note 16; R_x = 0 Ω	400	500	600	mV
	clipping level (RMS value)	THD < 1.5%	1.3	1.4	–	V
Δf_{AF}	frequency deviation	THD < 1.5%				
		R_x = 0 Ω; see Fig.3	–	–	±53	kHz
		R_x = 470 Ω; see Fig.3	–	–	±106	kHz
ΔV_o	temperature drift of AF output signal		–	3	7	10^{-3}dB/K
V_7	DC voltage at decoupling capacitor	voltage dependent on VCO frequency; note 17	1.2	–	3.0	V
R_6	output resistance	note 2	–	–	100	Ω
V_6	DC voltage	tracked with supply voltage	–	$V_P/2$	–	V
I_6	output sink and source current	DC and AC	–	–	1.1	mA
B	–3 dB audio frequency bandwidth		100	125	–	kHz
THD	total harmonic distortion	without ceramic filter; Δf = 25 kHz	–	0.15	0.5	%
S/N(W)	signal-to-noise ratio; weighted	FM-PLL only; with 75 μs de-emphasis; 25 kHz FM deviation; CCIR468-4	55	60	–	dB
V_{sc}	residual sound carrier and harmonics (RMS value)		–	–	75	mV
α_{AM}	AM suppression	with 75 μs de-emphasis; AM: f = 1 kHz; m = 0.3 refer to 25 kHz FM deviation	46	50	–	dB
α_6	mute attenuation of AF signal	pin 6	70	75	–	dB
ΔV_6	DC jump of AF output terminal for switching from FM to mute state and vice versa	FM PLL has to be in locked mode	–	±50	±150	mV
RR	ripple rejection at pin 6	R_x = 470 Ω; see Fig.10	22	28	–	dB

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Single reference QSS AF performance for FM operation (standard M) notes 18 and 19 picture to sound carrier ratio: PC/SC = 7 dB sound attenuation of VIF SAW filter: minimum 33 dB						
measurement condition: PC/SC ratio at pins 1 and 2; note 20			40	–	–	dB
S/N(W)	signal-to-noise ratio; weighted	25 kHz FM deviation; CCIR 468-4; 75 μs de-emphasis				
	black picture		50	56	–	dB
	white picture		47	53	–	dB
	colour bar		45	51	–	dB

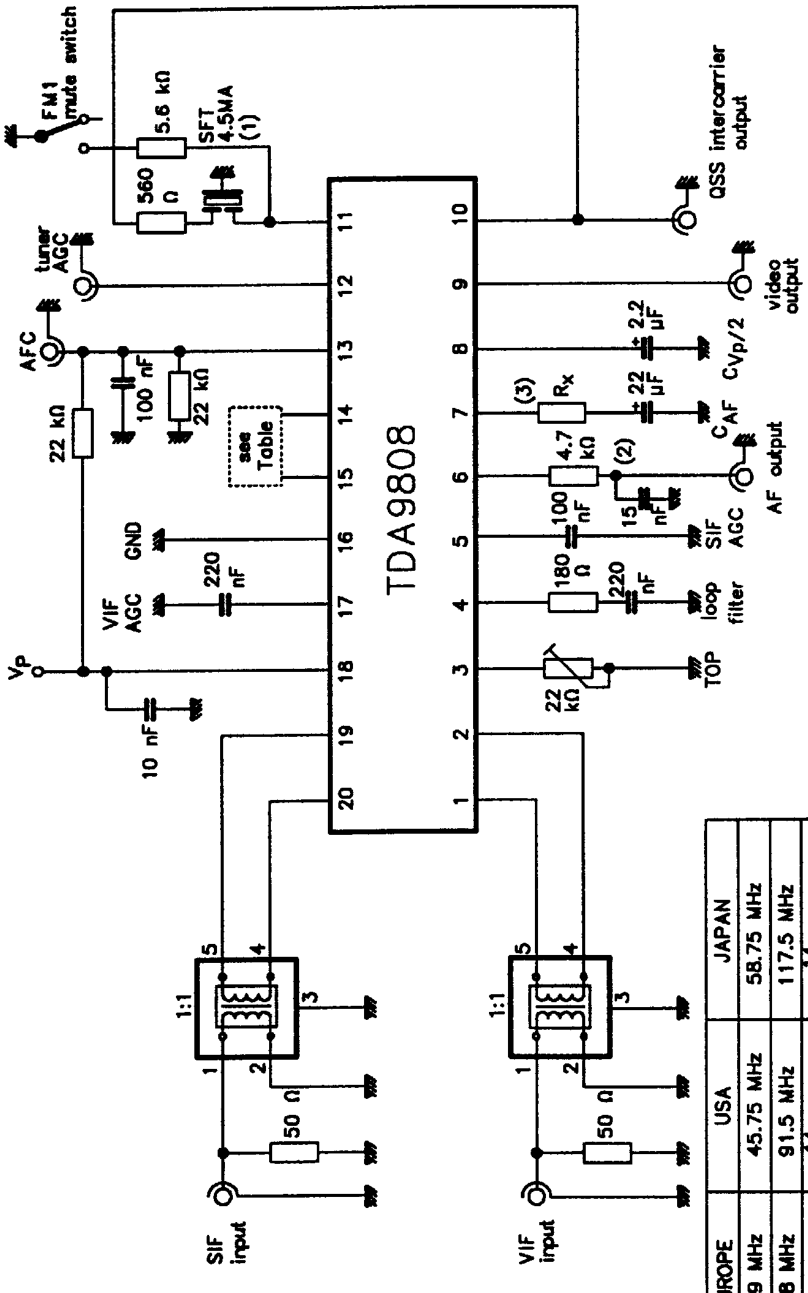
Notes to the characteristics

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 = 60 kHz (natural frequency f_n = 15 kHz; damping factor d = 2; calculated with sync level within gain control range). Resonance circuit of VCO: $Q_0 > 50$; C_{ext} see Fig.11; $C_{int} \approx 10$ pF (loop voltage approximately 2.7 V).
4. The oscillator drift is related to the picture carrier frequency (at external temperature-compensated LC-circuit).
5. $V_{i\ IF}$ = 10 mV RMS; Δf = 1 MHz (VCO frequency offset related to picture carrier frequency); white picture video modulation.
6. $V_{i\ IF}$ for 1.2 V (peak-to-peak value) output signal at composite video output pin 9; PLL is still locked.
7. Offset current between pin 4 and half of supply voltage (V = 2.5 V) under the following conditions: no input signal at VIF input (pins 1 and 2) and VIF amplifier gain at minimum ($V_{17} = V_P$).
8. The leakage current of the AGC capacitor should not exceed 100 nA at M, N standard. Larger currents will increase the tilt.
9. S/N is the ratio of black-to-white amplitude to the black level noise voltage (RMS value, pin 9). B = 4.2 MHz weighted in accordance with CCIR 567 at a source impedance of 50 Ω.
10. The intermodulation figures are defined:
    $\alpha_{0.92}$ = 20 log (V_0 at 3.58 MHz / V_0 at 0.92 MHz) + 3.6 dB; $\alpha_{0.92}$ value at 0.92 MHz related to black/white signal
    $\alpha_{2.76}$ = 20 log (V_0 at 3.58 MHz / V_0 at 2.76 MHz); $\alpha_{2.76}$ value at 2.76 MHz related to colour carrier.
11. Measurements taken with SAW filter M3951M (Siemens, M standard); modulation: VSB, $f_{video} > 0.5$ MHz, loop bandwidth BL = 60 kHz.
12. Measurements taken with SAW filter M3951M and M9352M (Siemens, M standard); loop bandwidth BL = 60 kHz, frequency range = 10 kHz to 5 MHz. Sound carrier on, PC/SC ratio 7 dB (transmitter).
13. To match the AFC output signal to different tuning systems a current source output is provided. The test circuit is given in Fig.8. The AFC-steepness can be changed by the resistors R11 and R12.
14. Depending on the ratio $\Delta C / C_0$ of the LC resonant circuit of VCO (Q > 50; see note 3; $C_0 = C_{int} + C_{ext}$).
15. Input level for second IF from an external generator with 50 Ω source impedance. AC-coupled with 10 nF capacitor, f_{mod} = 400 Hz, 25 kHz (50% FM deviation) of audio references. A VIF/SIF input signal is not permitted. Pins 5 and 17 have to be connected to positive supply voltage for minimum IF gain. S/N and THD measurements are taken at 75 μs de-emphasis. The FM demodulator steepness $\Delta V_{o\ AF}/\Delta f_{AF}$ is positive.
    a) Second IF input level 10 mV RMS.

16. Measured at de-emphasis circuitry with an FM deviation of 25 kHz (f_{mod} = 400 Hz) the typical AF output signal is 500 mV RMS ($R_x = 0\ \Omega$; see Fig.3). By using $R_x = 470\ \Omega$ the AF output signal is attenuated by 6 dB (250 mV RMS). For handling an FM 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 $R_x = 470\ \Omega$.
17. The leakage current of the decoupling capacitor (2.2 µF) should not exceed 1 µA.
18. For all S/N measurements the used vision IF modulator has to meet the following specifications:

    - Incidental phase modulation for black-to-white jump less than 0.5 degree.

    - QSS AF performance, measured with the television-demodulator AMF2 (audio output, weighted S/N ratio) better than 60 dB for 6 kHz sinewave black-to-white video modulation.
19. Measurements are taken with SAW filter M3951M (Siemens) for vision IF (suppressed sound carrier) and M9352M (Siemens) for sound IF (suppressed picture carrier). Input level $V_{i\ SIF}$ = 10 mV RMS, 25 kHz FM deviation.
20. The PC/SC ratio is calculated as the addition of TV transmitter PC/SC ratio and SAW filter PC/SC ratio. This PC/SC ratio is necessary to achieve the S/N(W) values as noted. A different PC/SC ratio will change these values.



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	14, 15; c(VCO) c(C9) L(F4); 9.5 pF 8.2 pF 236 nH	14, 15; c(VCO) c(C9) L(F4); 9.5 pF 10 pF 155 nH	14, 15; c(VCO) c(C9) L(F4); 9.5 pF 15 pF 85 nH
e.g. Toko coil	5KM 369SNS–2010Z	5KMC V369SCS–2370Z	MC139 NE545SNAS100108
Philips ceramic capacitor	222263251828	(inside of coil)	15 pF SMD size = 0805

(1) depends on TV standard
(2) de-emphasis circuitry for 75 µs
(3) see note 16 of the characteristics

Fig.3 Test circuit.

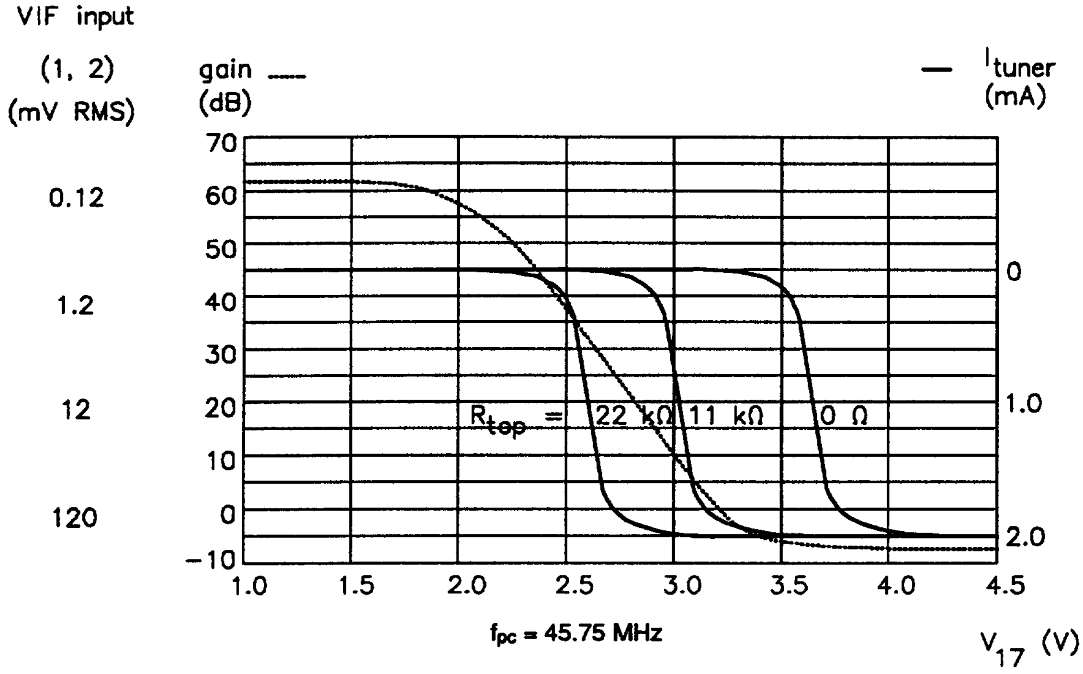


Fig.4 Typical VIF and tuner AGC characteristic.

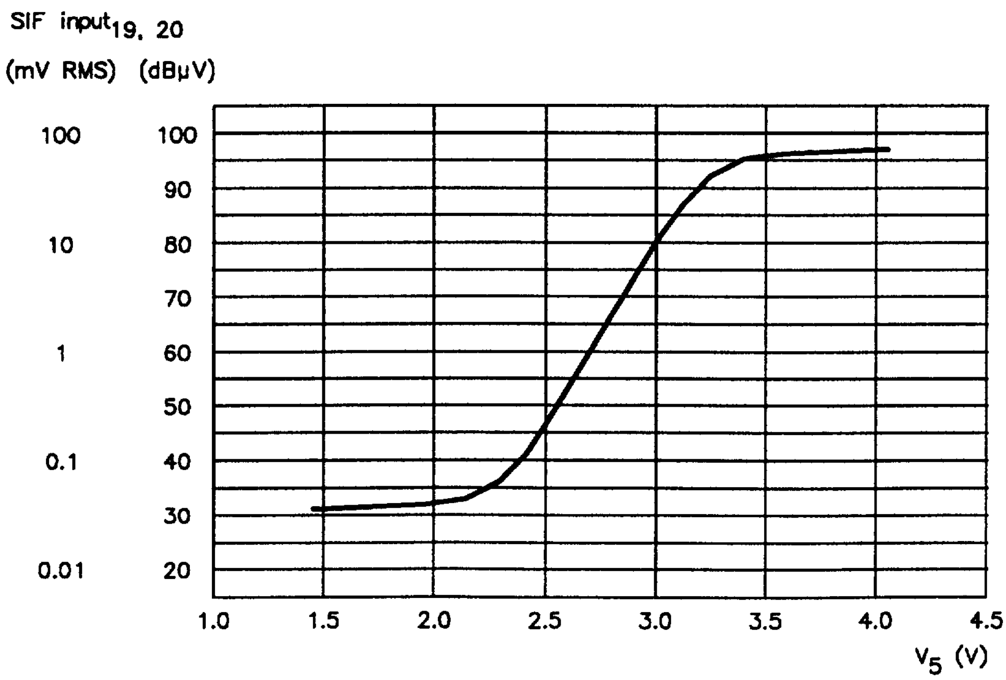


Fig.5 Typical SIF AGC characteristic.

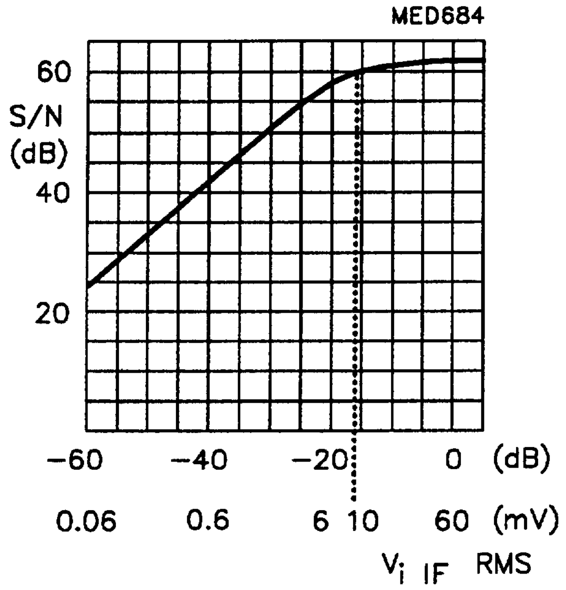
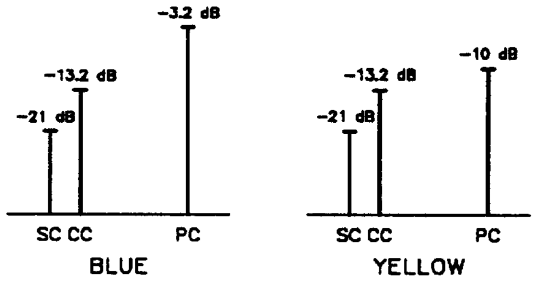


Fig.6 Typical S/N as a function of IF input voltage.



SC = sound carrier
CC = chrominance carrier
PC = picture carrier
all with respect to sync level

The sound carrier levels are taking into account a sound shelf attenuation of 20 dB.

Fig.7 Input signal conditions.

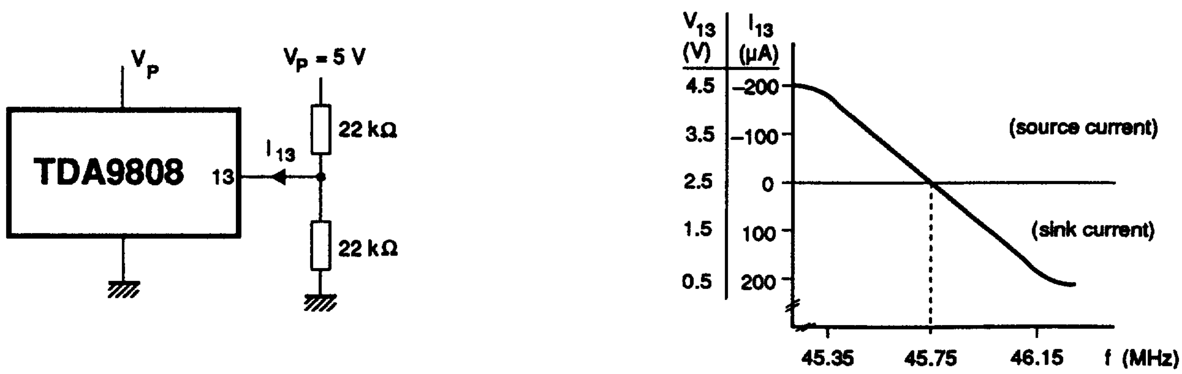


Fig.8 Measurement conditions and typical AFC characteristic.

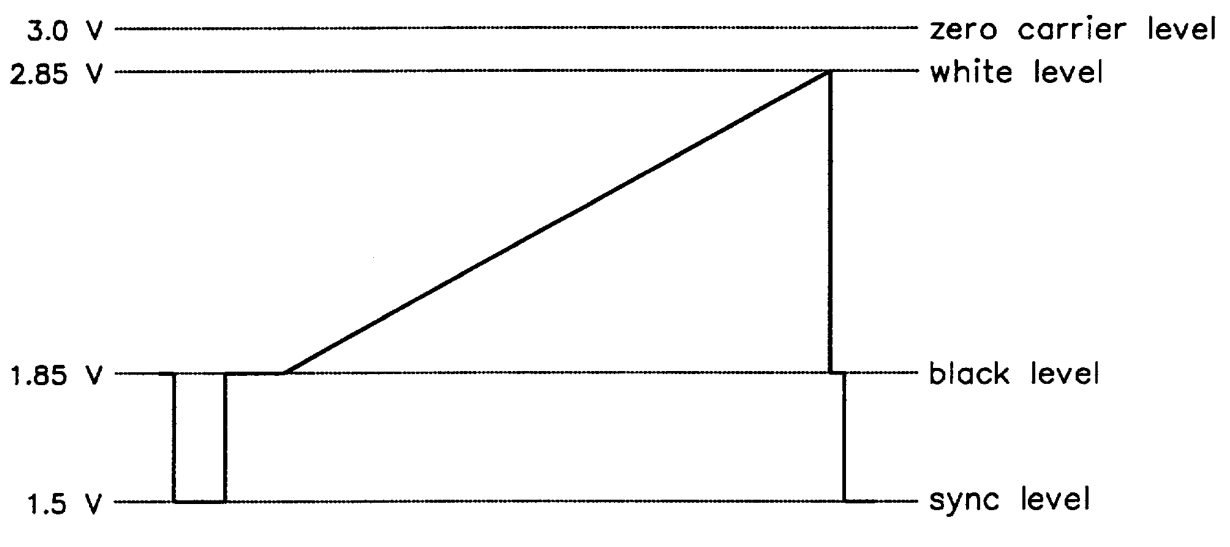


Fig.9 Video signal levels on output pin 9 (sound carrier off).

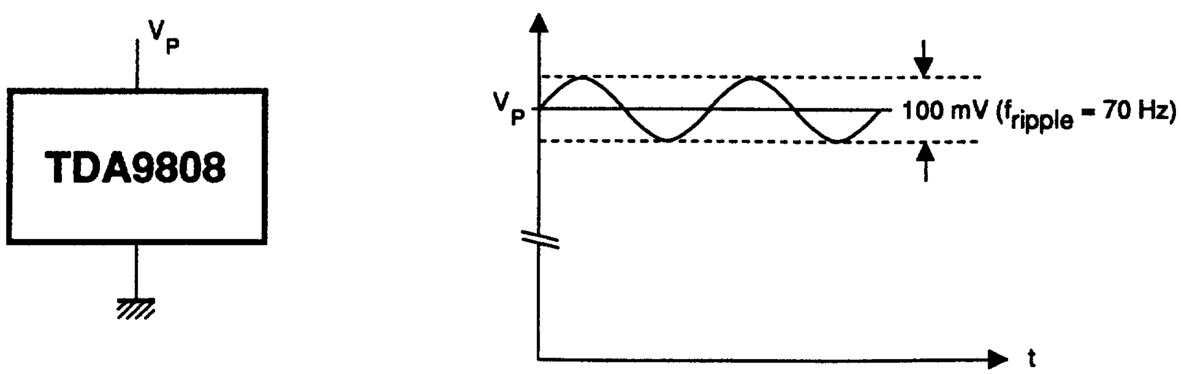
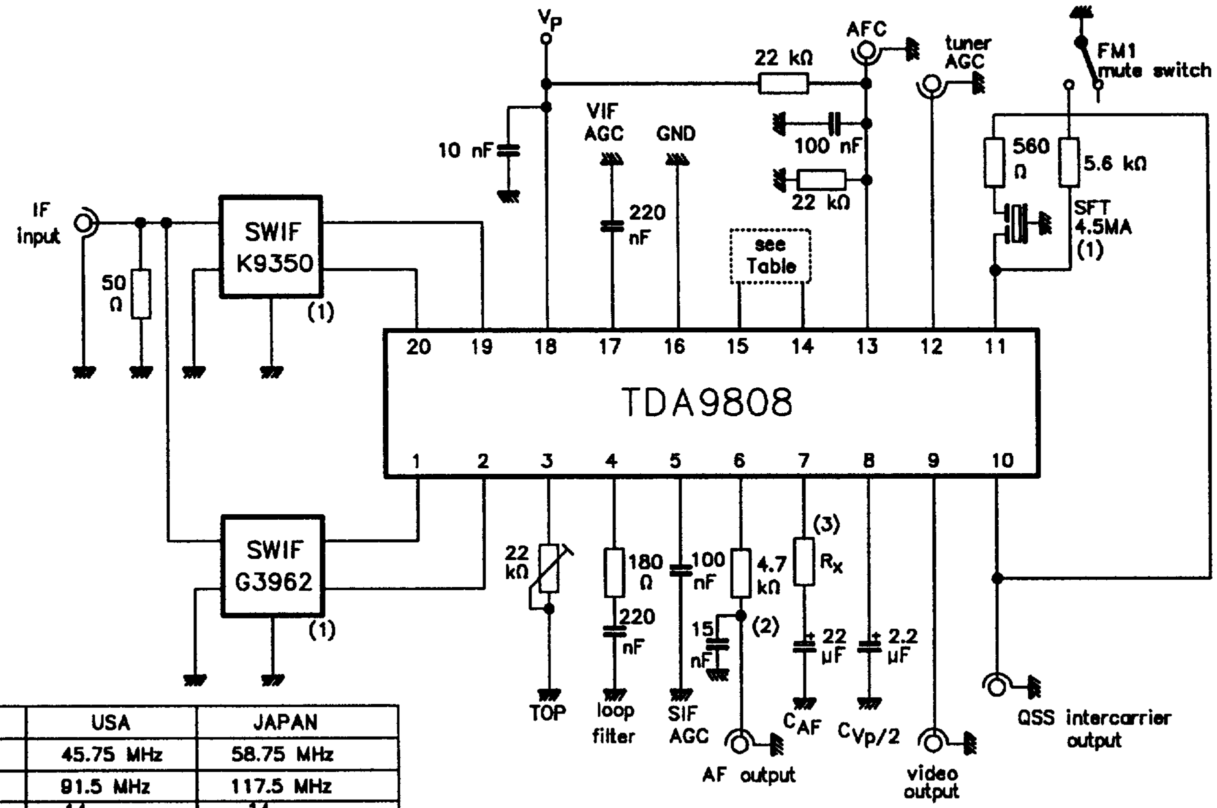


Fig.10 Ripple rejection condition.



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	14 15 C(VCO) C(C9) L(F4) 9.5 pF 8.2 pF 236 nH	14 15 C(VCO) C(C9) L(F4) 9.5 pF 10 pF 155 nH	14 15 C(VCO) C(C9) L(F4) 9.5 pF 15 pF 85 nH
e.g. Toko coil	5KM 369SNS-2010Z	5KMC V369SCS-2370Z	MC139 NE545SNAS100108
Philips ceramic capacitor	222263251828	(inside of coil)	15 pF SMD size = 0805

(1) depends on TV standard.
(2) de-emphasis circuitry for 75 μs.
(3) see note 16 of the characteristics.

Fig.11 Application circuit.

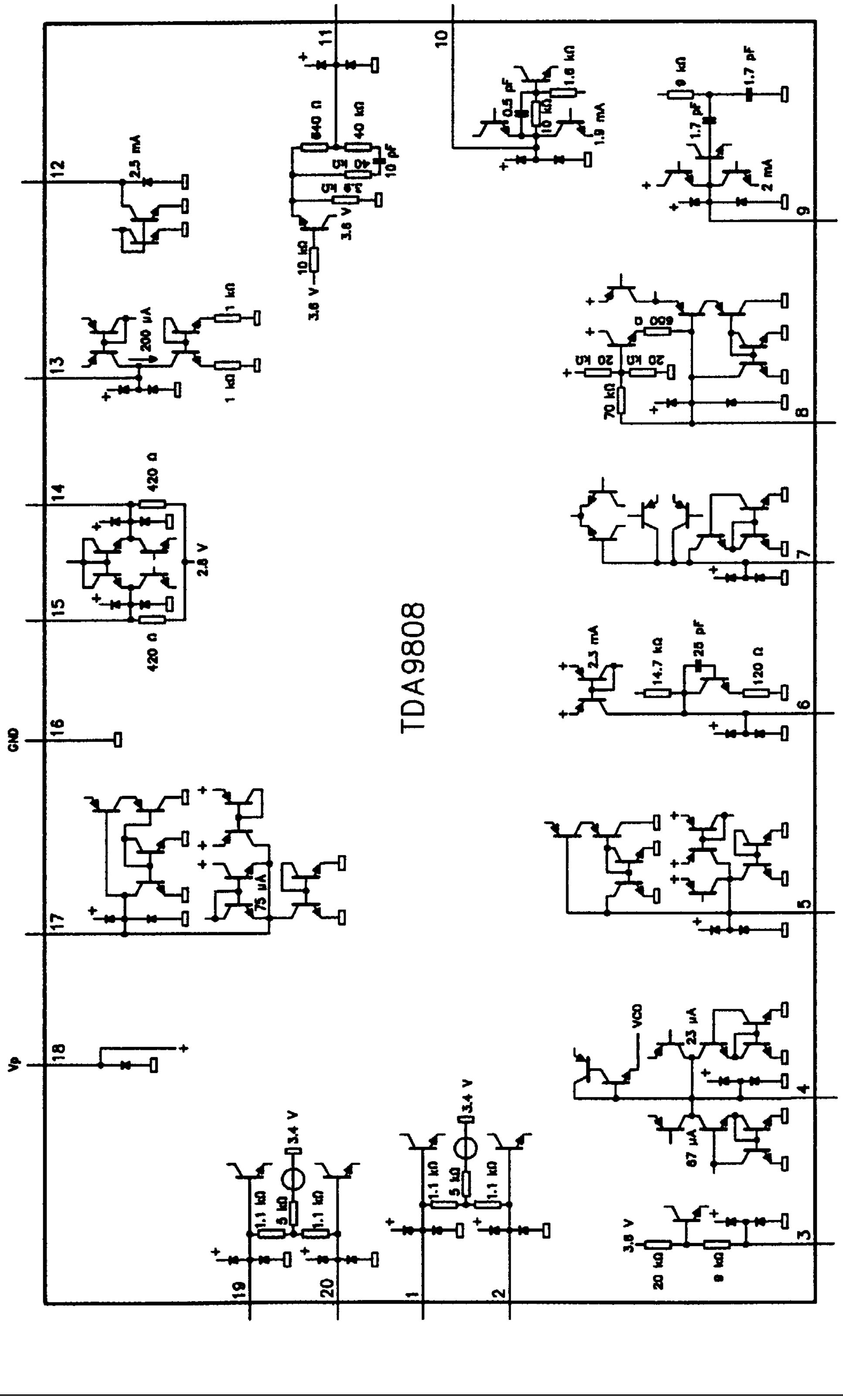
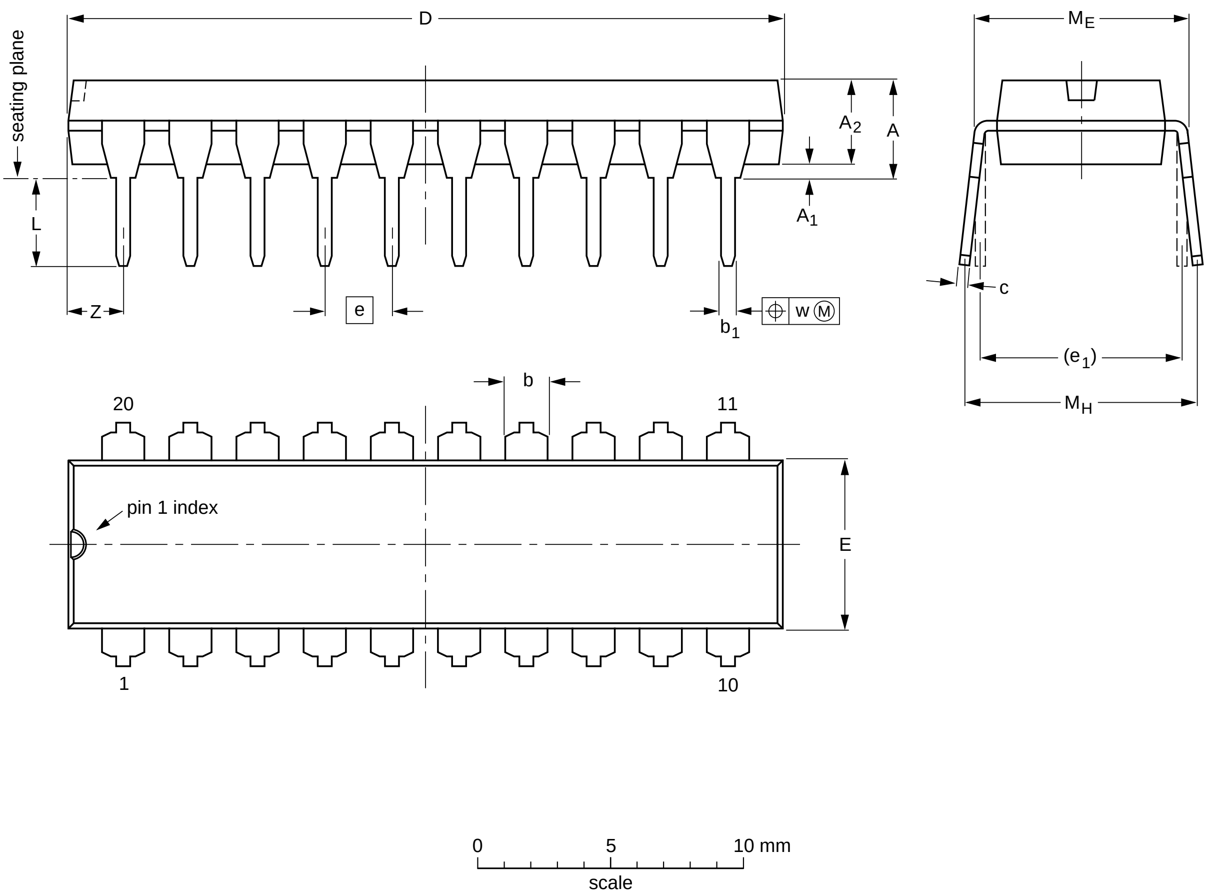


Fig.12 Internal circuits.

PACKAGE OUTLINE

DIP20: plastic dual in-line package; 20 leads (300 mil) **SOT146-1**



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

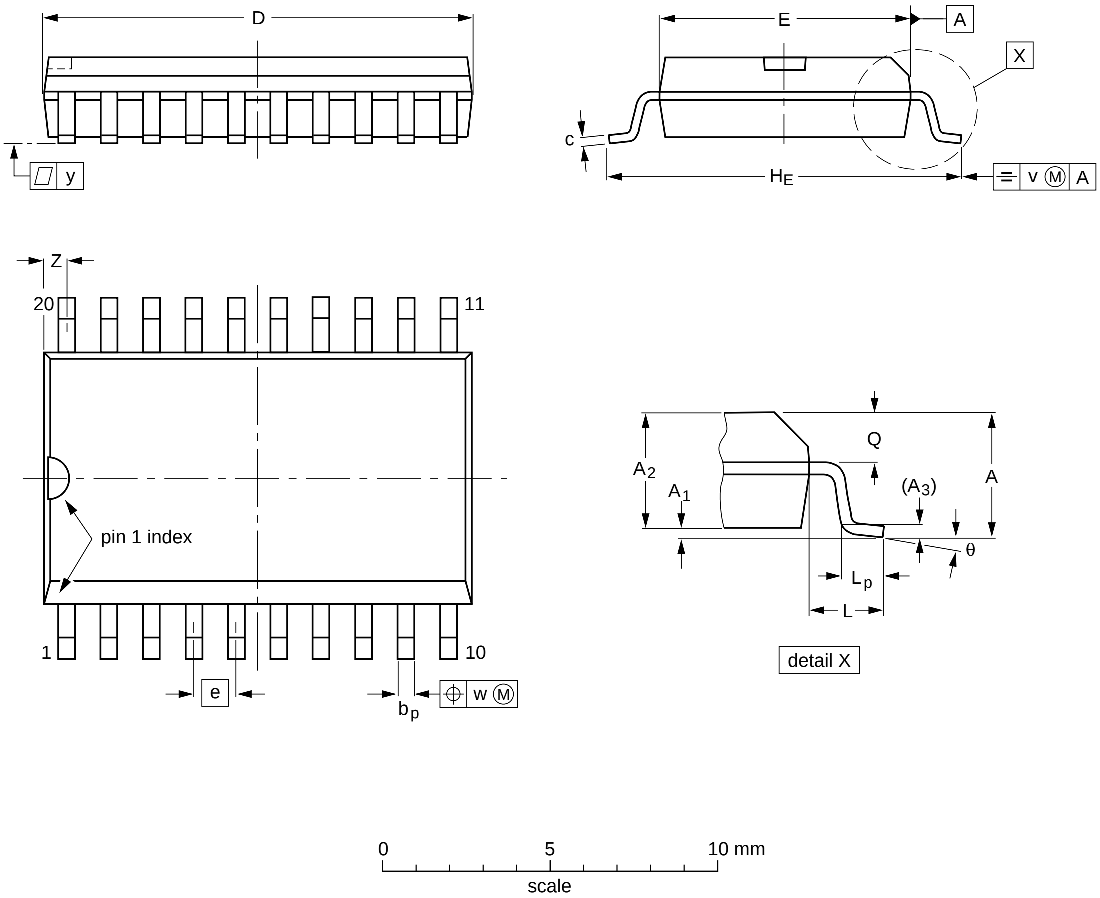
UNIT	A max.	A_1 min.	A_2 max.	b	b_1	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	0.36 0.23	26.92 26.54	6.40 6.22	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	2.0
inches	0.17	0.020	0.13	0.068 0.051	0.021 0.015	0.014 0.009	1.060 1.045	0.25 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.078

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			
SOT146-1			SC603			~~92-11-17~~ 95-05-24

SO20: plastic small outline package; 20 leads; body width 7.5 mm | **SOT163-1**



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	0.30 0.10	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	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^o 0^o
inches	0.10	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	0.050	0.42 0.39	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 maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT163-1	075E04	MS-013AC				~~92-11-17~~ 95-01-24

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).

DIP

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.

SO

REFLOW SOLDERING

Reflow soldering techniques are suitable for all SO packages.

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 techniques exist for reflowing; for example, thermal conduction by heated belt. Dwell times vary between 50 and 300 seconds depending on heating method. Typical reflow temperatures range from 215 to 250 °C.

Preheating is necessary to dry the paste and evaporate the binding agent. Preheating duration: 45 minutes at 45 °C.

WAVE SOLDERING

Wave soldering techniques can be used for all SO packages if the following conditions are observed:

- A double-wave (a turbulent wave with high upward pressure followed by a smooth laminar wave) soldering technique should be used.
- The longitudinal axis of the package footprint must be parallel to the solder flow.
- The package footprint must incorporate solder thieves at the downstream end.

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.

Maximum permissible solder temperature is 260 °C, and maximum duration of package immersion in solder is 10 seconds, if cooled to less than 150 °C within 6 seconds. Typical dwell time is 4 seconds at 250 °C.

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

REPAIRING SOLDERED JOINTS

Fix the component by first soldering two diagonally-opposite end leads. Use only a low voltage soldering iron (less than 24 V) 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.

DEFINITIONS

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

LIFE SUPPORT APPLICATIONS

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