DATA SHEET

TDA3856
Quasi-split sound processor for all standards

Product specification
Supersedes data of October 1990
File under Integrated Circuits, IC02

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Philips Semiconductors

PHILIPS

Quasi-split sound processor for all standards TDA3856

FEATURES

- Quasi-split sound processor for all standards e. g. B/G (FM sound) and L (AM sound)
- Automatic muting of the AF2 signal (at B/G) by the input level
- AM signal processing for L standard and switching over the audio signal
- Layout-compatible with TDA3858 (32 pins) and TDA3857 (20 pins).

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V_P	supply voltage (pin 21)	4.5	5	8.8	V
I_P	supply current	–	60	72	mA
$V_{i\,IF}$	IF input sensitivity (–3 dB)	–	70	100	μV
$V_{o\,(RMS)}$	audio output signal for FM (B/G)	–	1	–	V
$V_{o\,(RMS)}$	audio output signal for AM (L)	–	0.6	–	V
THD	total harmonic distortion				
	for FM	–	0.5	–	%
	for AM	–	1	–	%
S/N (W)	weighted signal-to-noise ratio				
	for FM	–	68	–	dB
	for AM	–	56	–	dB

GENERAL DESCRIPTION

Separate symmetrical IF inputs for FM or AM sound.
Gain controlled wideband IF amplifier, input select switch.
AGC generation due to peak sync for FM or mean signal level for AM.
Reference amplifier for the regeneration of the vision carrier.
Optimized limiting amplifier for AM suppression in the regenerated vision carrier signal and 90° phase shifter.
Intercarrier mixer for FM sound, output with low-pass filter.
Separate signal processing for 5.5 and 5.74 MHz intercarriers.
Wide supply voltage range, only 300 mW power dissipation at 5 V.

ORDERING INFORMATION

EXTENDED TYPE NUMBER	PACKAGE			
	PINS	PIN POSITION	MATERIAL	CODE
TDA3856	24	shrink DIL	plastic	SOT234
TDA3856T	24	SO	plastic	SOT137

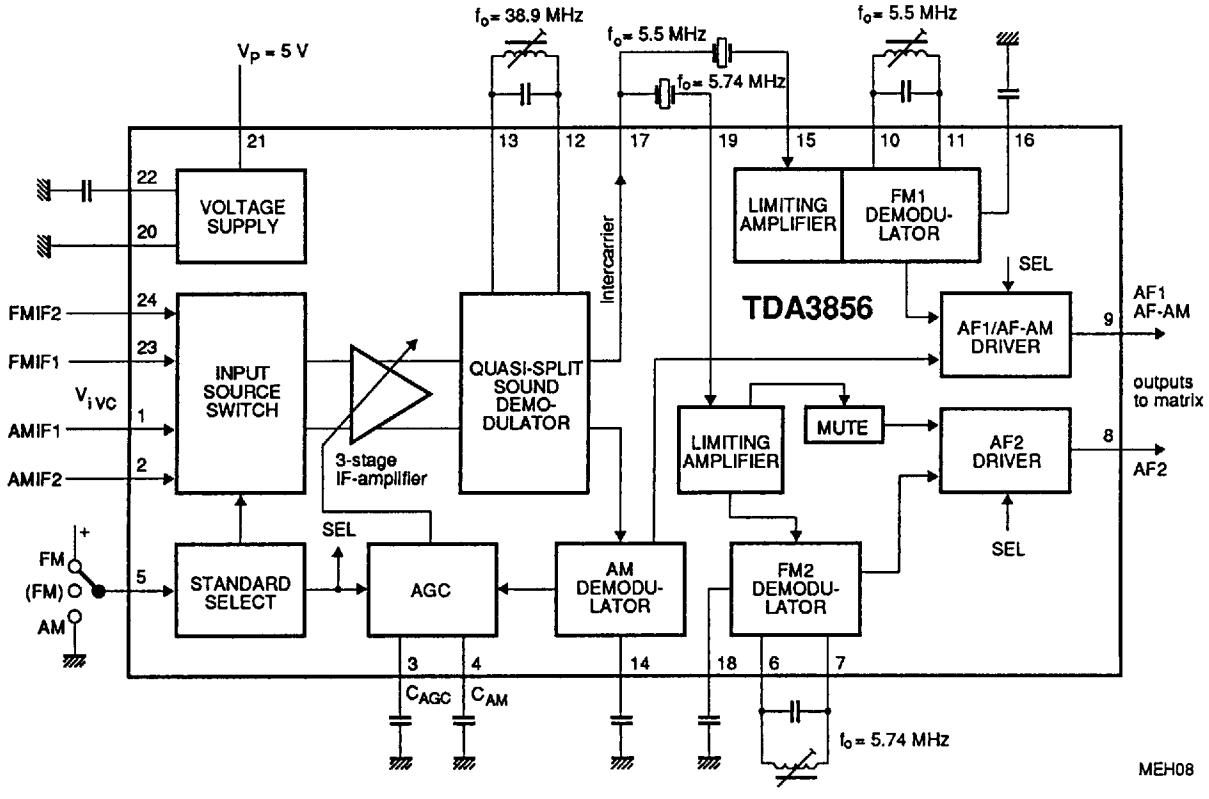


Fig.1 Block diagram (B/G and L).

PINNING

SYMBOL	PIN	DESCRIPTION
AMIF1	1	AM IF difference input 1 for L standard (32.4 MHz)
AMIF2	2	AM IF difference input 2 for L standard (32.4 MHz)
C_{AGC}	3	charge capacitor for AGC (FM and AM)
C_{AM}	4	charge capacitor for AM AGC
MODE	5	3-state input for standard select
FM2R1	6	reference circuit for FM2 (5.74 MHz)
FM2R2	7	reference circuit for FM2 (5.74 MHz)
AF2	8	AF2 output (AF out of 5.74 MHz)
AF1	9	AF1 output (AF out of 5.5 MHz or AM)
FM1R1	10	reference circuit for FM1 (5.5 MHz)
FM1R2	11	reference circuit for FM1 (5.5 MHz)
VC-R1	12	reference circuit for the vision carrier (38.9 MHz)
VC-R2	13	reference circuit for the vision carrier (38.9 MHz)
C_{AFAM}	14	DC decoupling capacitor for AM demodulator (AF-AM)
FM1I	15	intercarrier input for FM1 (5.5 MHz)
C_{AF1}	16	DC decoupling capacitor for FM1 demodulator (AF1)
ICO	17	intercarrier output signal (5.5/5.74 MHz)
C_{AF2}	18	DC decoupling capacitor for FM2 demodulator (AF2)
FM2I	19	intercarrier input for FM2 (5.74 MHz)
GND	20	ground (0 V)
V_P	21	+5 to +8 V supply voltage
C_{REF}	22	charge capacitor for reference voltage
FMIF1	23	IF difference input 1 for B/G standard (38.9 MHz)
FMIF2	24	IF difference input 2 for B/G standard (38.9 MHz)

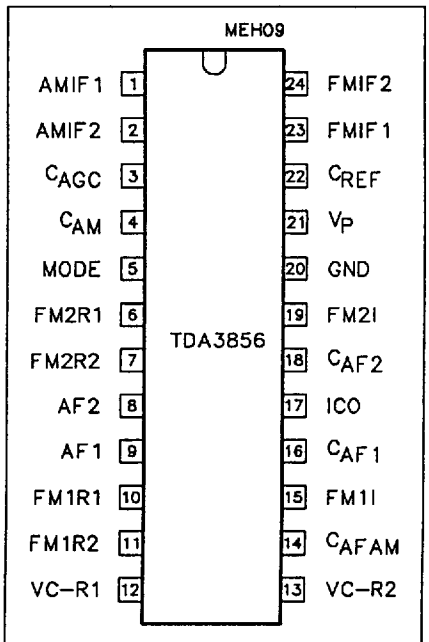


Fig.2 Pin configuration.

FUNCTIONAL DESCRIPTION

The quasi-split sound processor is suitable for all standards.
Dependent on the voltage at pin 5 either FM mode (B/G) or AM mode (L) is selected.

B/G standard (FM mode)

Pins 23 and 24 are active, AGC detector uses peak sync level.
Sound carrier SC1 (5.5 MHz) provides AF1, sound carrier SC2 (5.74 MHz) provides AF2.

Muting

With no sound carrier SC2 at pin 19, AF2 output is muted (in mid-position of the standard select switch FM mode without muting of AF2 is selected).
The mute circuit prevents false signal recognition in the stereo decoder at high IF signal levels when no second sound carrier exists (mono) and an AF signal is present in the identification signal frequency range.
With 1 mV at pin 19, under measurement conditions, AF2 is switched on (see limiting amplifier).
Weak input signals at pins 23 and 24 generate noise at pin 19, which is present in the intercarrier signal and passes through the 5.74 MHz filter. Noise at pin 19 inhibits muting. No misinterpretation due to white noise occurs in the stereo decoder, when non-correlated noise masks the identification signal frequencies, which may be present in sustained tone signals. The stereo decoder remains switched to mono.

L standard (AM mode)

Pins 1 and 2 are active, AGC detector uses mean signal level.
The audio signal from the AM demodulator is output on AF1, with AF2 output muted.

Sound carrier notch filter for an improved intercarrier buzz

The series capacitor C_S in the 38.9 MHz resonant circuit provides a notch at the sound carrier frequency in order to provide more attenuation for the sound carrier in the vision carrier reference channel. The ratio of parallel/series capacitor depends on the ratio of VC/SC frequency and has to be adapted to other TV transmission standards if necessary, according to the formula
$C_S = C_P (f_{VC}/f_{SC})^2 - C_P$.
The result is an improved intercarrier buzz (up to 10 dB improvement in sound channel 2 with 250 kHz video modulation for B/G stereo) or suppression of 350 kHz video modulated beat frequency in the digitally-modulated NICAM subcarrier.

Intercarrier buzz fine tuning with 250 kHz square wave video modulation

The picture carrier for quadrature demodulation in the intercarrier mixer is not exactly 90 degrees due to the shift variation in the integrated phase shift network. The tuning of the LC reference circuit to provide optimal video suppression at the intercarrier output is not the same as that to provide optimal intercarrier buzz suppression. In order to optimize the AF signal performance, a fine tuning for the optimal S/N at the sound channel 2 (from 5.74 MHz) may be performed with a 250 kHz square wave video modulation.

Measurements at the demodulators

For all signal-to-noise measurements the generator must meet the following specifications:
phase modulation errors < 0.5° for B/W-jumps
intercarrier signal-to-noise ratio as measured with 'TV-demodulator AMF2' (weighted S/N) must be > 60 dB at 6 kHz sine wave modulation of the B/W-signal.
Signal-to-noise ratios are measured with $\Delta f = \pm 50$ kHz deviation and $f_{mod} = 1$ kHz; with a deviation of ±30 kHz the S/N ratio is deteriorated by 4.5 dB.

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{P1}	supply voltage (pin 21)	–	8.8	V
V_I	voltage (pins 1, 2, 5, 8, 9, 15, 17, 19, 23 and 24)	0	V_P	V
P_{tot}	total power dissipation	0	650	mW
T_{stg}	storage temperature	–25	+150	°C
T_{amb}	operating ambient temperature	0	+70	°C
V_{ESD}	electrostatic handling (note 1)			
	all pins except pins 1, 2, 23 and 24	±500	–	V
	pins 1, 2, 23 and 24	+400	–	V
		–500	–	V

Note to the Limiting Values

1. Equivalent to discharging a 200 pF capacitor through a 0 Ω series resistor.

CHARACTERISTICS

V_P = 5 V and T_{amb} = +25 °C; measurements taken in Fig.3 with f_{VC} = 38.9 MHz, f_{SC1} = 33.4 MHz and f_{SC2} = 33.158 MHz. Vision carrier (VC) modulated with different video signals, modulation depth 100% (proportional to 10% residual carrier).
Vision carrier amplitude (RMS value) $V_{i\,VC}$ = 10 mV; vision to sound carrier ratios are VC/SC1 = 13 dB and VC/SC2 = 20 dB. Sound carriers (SC1, SC2) modulated with f = 1 kHz and deviation Δf = 50 kHz, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_P	supply voltage (pin 21)		4.5	5	8.8	V
I_P	supply current (pin 21)		48	60	72	mA
IF source control (pin 5)						
V_5	input voltage in order to obtain standards B/G (FM) with automatic muting	pin 5 connected	2.8	–	V_P	V
		pin 5 open-circuit	–	2.8	–	V
	B/G (FM) without muting	pin 5 connected or alternative measure: 22 kΩ to GND	1.3	–	2.3	V
	L (AM sound)	pin 5 connected	0	–	0.8	V
I_5	input current	$V_5 = V_P$	–	–	100	μA
		V_5 = 0 V	–	–	–300	μA
IF input not activated (pins 1-2 or 23-24)						
R_I	input resistance		–	–	100	Ω
V_I	DC input voltage (pins 1, 2 or 23, 24)	LOW set internally	–	–	0.1	V
$\alpha_{12\text{-}13}$	crosstalk attenuation of IF input switch	note 1	50	56	–	dB
IF amplifier (pins 1-2 or 23-24)						
R_I	input resistance		1.8	2.2	–	kΩ
C_I	input capacitance		–	2.0	2.6	pF
V_I	DC potential, voltage (pins 1, 2, 23, 24)		–	1.75	–	V
$V_{i\,IF\,(RMS)}$	maximum input signal (RMS value)	V_o = +1 dB	70	100	–	mV
	input signal sensitivity B/G standard (RMS value, pins 23-24)	–3 dB intercarrier signal reduction at pin 17	–	70	100	μV
	input signal sensitivity L standard (RMS value, pins 1-2)	–3 dB intercarrier signal reduction at pin 9	–	70	100	μV
V_3	voltage for gain control (pin 3)		1.7	–	2.6	V
ΔG_v	IF gain control		60	63	–	dB
B	IF bandwidth	–3 dB	50	70	–	MHz
Resonance amplifier (pins 12-13)						
$V_{o\,(p\text{-}p)}$	vision carrier amplitude (peak-to-peak value)	f_o = 38.9 MHz	–	270	–	mV
$R_{12\text{-}13}$	operating resistance		–	4	–	kΩ
L	inductance	Figs 3 and 5	–	0.247	–	μH
C	capacitance		–	68	–	pF
Q_L	Q-factor of resonant circuit	Q_o = 90	–	40	–	
$V_{12,\,13}$	DC voltage (pins 12 and 13)		–	V_P – 1	–	V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Intercarrier mixer output (pin 17)						
$V_{o\,(RMS)}$	output signal for 5.5 MHz (RMS value)		71	95	125	mV
	output signal for 5.74 MHz (RMS value)		32	43	56	mV
B	IF bandwidth	−1 dB	6	8.5	–	MHz
		−3 dB	7	10	–	MHz
V_{VID}/V_{17}	residual video AM on intercarrier	note 2	–	3	10	%
$V_{VC\,(RMS)}$	residual vision carrier (RMS value)	1st/2nd harmonic (38.9/77.8 MHz)	–	0.5	1	mV
R_{17}	output resistance (emitter follower)	1 mA emitter current	–	30	–	Ω
I_o	allowable AC output current (pin 17)		–	–	±0.7	mA
I_{17}	allowable DC output current		–	–	−2	mA
V_{17}	DC voltage	LC-circuit at pin 12, 13 adjusted to minimum video content at pin 17	1.5	1.75	2.0	V
Limiting amplifiers (pins 15 and 19)						
$V_{i\,(RMS)}$	minimum input signal (RMS value)	−3 dB AF signal	–	300	450	µV
	maximum input signal (RMS value)		200	–	–	mV
$R_{15,\,19}$	input resistance		450	560	700	Ω
$V_{15,\,19}$	DC voltage		–	0	–	V
$V_{i\,(RMS)}$	level detector threshold for no muting (RMS value, pin 19)	only 5.74 MHz channel	0.8	1.2	1.7	mV
ΔV_i	hysteresis of level detector		4	7	12	dB
FM1 and FM2 demodulators Measurements with FM IF input signals of 5.5 MHz and 5.74 MHz with $V_{i\,IF\,(RMS)}$ = 10 mV (f_{mod} = 1 kHz, deviation Δf = ±50 kHz) at pins 15 and 19 without ceramic filters, R_S = 50 Ω. De-emphasis 50 µs and $V_5 = V_P$ (B/G standard). Q_L-factor = 11 for resonant circuits at pins 6-7 and 10-11 (including IC).						
$V_{IC\,(RMS)}$	intercarrier signals (RMS values, pins 6-7 and 10-11)		–	100	–	mV
V	DC voltage (pins 6, 7, 10 and 11)		–	1.8	–	V
$V_{o\,(RMS)}$	AF output signals (RMS values, pins 8 and 9)		0.84	0.95	1.07	V
ΔV_o	difference of AF signals between channels (pins 8 and 9)		–	–	1	dB
$R_{8,\,9}$	output resistance		75	100	130	Ω
$V_{8,\,9}$	DC voltage		1.8	2.1	2.4	V
$I_{8,\,9\,(M)}$	allowed AC current of emitter output (peak value)	note 3	–	–	±1.5	mA
$I_{8,\,9}$	maximum allowed DC output current		–	–	−2	mA
THD	total harmonic distortion		–	0.5	1.0	%
$V_{o\,(RMS)}$	AF output signal (RMS value)	THD = 1.5%	1.25	–	–	V
α_{AM}	AM suppression	1 kHz; m = 0.3	48	54	–	dB
S/N(W)	weighted signal-to-noise ratio	CCIR468-3	64	68	–	dB

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
B	AF bandwidth (–3 dB)					
	lower limit		–	–	20	Hz
	upper limit		100	–	–	kHz
α_{CR}	crosstalk attenuation (pins 9-8)		60	70	–	dB
$V_{16,18}$	DC voltage (pins 16 and 18)		–	1.8	–	V
AM demodulator V_5 = 0 V (AM mode) input signals at pins 1-2: SC = 32.4 MHz; f_{mod} = 1 kHz; m = 0.8; $V_{i\,AM\,(RMS)}$ = 10 mV						
$V_{o\,(RMS)}$	AF output signal at pin 9 (RMS value)		530	600	675	mV
R_9	output resistance (pin 9)		75	100	130	Ω
$I_{o\,(M)}$	maximum AC output current (peak value)	note 3	–	–	±1.5	mA
I_9	maximum DC output current		–	–	–2	mA
V_9	DC voltage		1.8	2.1	2.4	V
THD	total harmonic distortion	Fig.4	–	1	2	%
S/N(W)	weighted signal-to-noise ratio	CCIR468-3	50	56	–	dB
B	AF bandwidth (–3 dB)					
	lower limit		–	–	20	Hz
	upper limit		100	–	–	kHz
V_{14}	DC voltage (pin 14)		–	2	–	V
AF signal switches input signals: AM carrier into pin 1, 2 — see part AM demodulator; FM intercarrier into pin 15 — see part FM demodulator; no signal in pin 19 (AF2). the output signals are related to the signals described in the demodulator parts.						
V_o/V_{omute}	AF2 mute attenuation (pin 8)	B/G mode; $V_5 = V_P$	70	–	–	dB
V_{oAM}/V_{oFM}	AF1 AM signal (pin 9) attenuation of unwanted FM signal	L mode; V_5 = 0; FM: modulated; AM: unmodulated	70	–	–	dB
V_{oFM}/V_{oAM}	AF1 FM signal (pin 9) attenuation of unwanted AM signal	B/G mode; $V_5 = V_P$; FM: unmodulated; AM: modulated	70	–	–	dB
$dV_{8,9}$	DC jump at the AF outputs	switching to FM or AM sound or Mute	–	5	25	mV
AF performance for FM operation (standard B/G) input signals: B/G IF input signal (pin 23, 24); unmodulated sound carriers; different video modulation (100%). the output signals are related to the signals described in the demodulator parts.						
(S+N)/N(W)	weighted signal-to-noise ratio	CCIR468-3; de-emphasis 50 µs				
	black picture	f_i = 5.5 MHz	59	63	–	dB
	2T/20T pulses with white bar	f_i = 5.5 MHz	57	61	–	dB
	6 kHz sine wave, B/W-modulated	f_i = 5.5 MHz	52	56	–	dB
	250 kHz square wave, B/W-modulated	f_i = 5.5 MHz	50	54	–	dB

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
	black picture	f_i = 5.742 MHz	57	61	–	dB
	2T/20T pulses with white bar	f_i = 5.742 MHz	55	59	–	dB
	6 kHz sine wave, B/W-modulated	f_i = 5.742 MHz	50	54	–	dB
	250 kHz square wave, B/W-modulated	f_i = 5.742 MHz	48	52	–	dB
Ripple rejection of the AF outputs (B/G and L standard)						
RR	ripple rejection V_{ripple} on V_P / V_{ripple} on V_{out}	$V_{R(p-p)}$ = 200 mV; f_R = 70 Hz	30	40	–	dB

Notes to the characteristics

1. Crosstalk attenuation of IF input switch, measured at R_{12-13} = 470 Ω (instead of LC circuit); input signal $V_{i\,(RMS)}$ = 20 mV (pins 23-24). AGC voltage V_3 set to a value to achive $V_{o\,(RMS)}$ = 20 mV (pins 12-13). After switching (V_5 = 0 V) measure attenuation. IF coupling with OFWG3203 and OFWL9350 (Siemens).
2. Spurious intercarrier AM: m = (A – B)/A (A = signal at sync; B = signal with 100% picture modulation).
3. For larger current: R_L > 2.2 kΩ (pin 8 or 9 to GND) in order to increase the bias current of the output emitter follower.

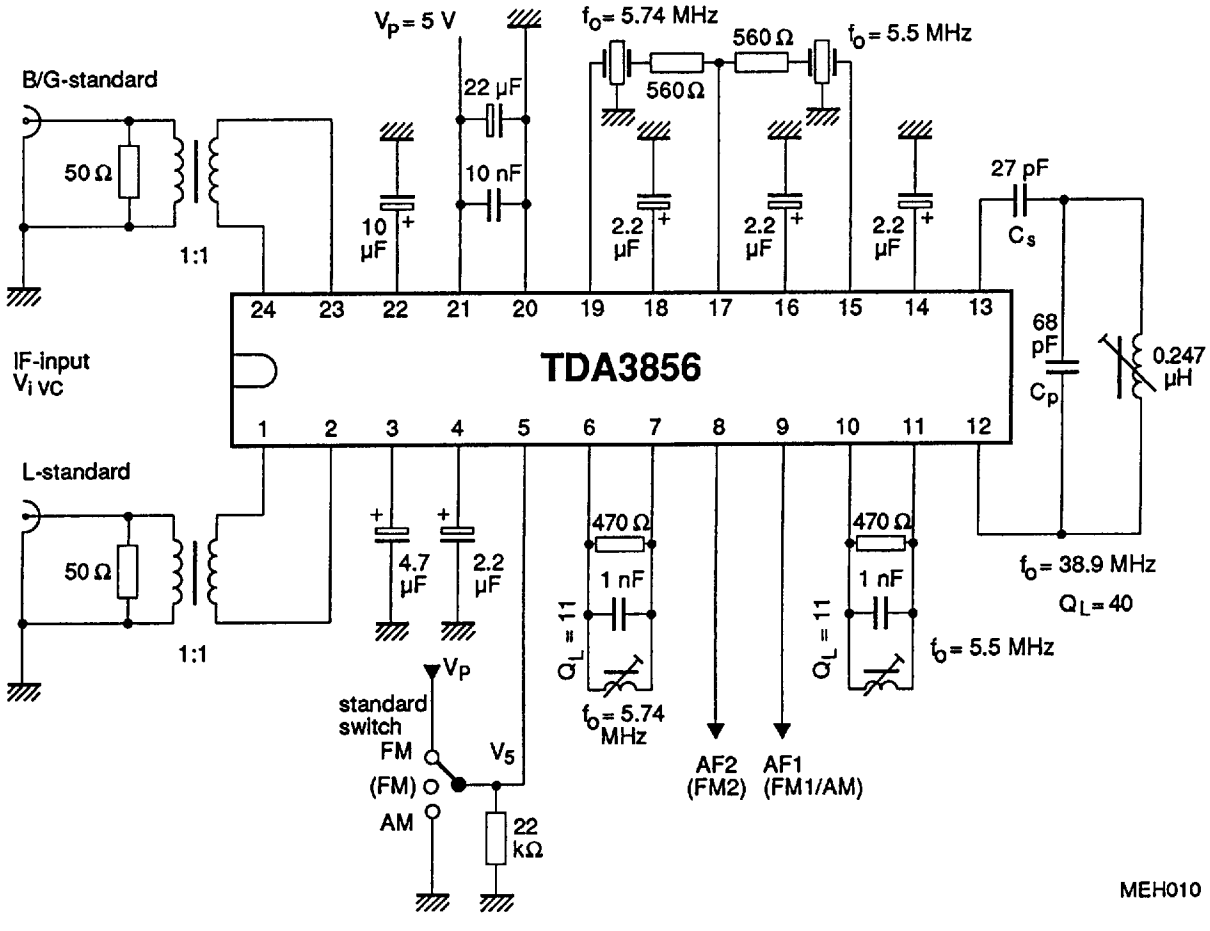


Fig.3 Test and application circuit for standards B/G and L (for application SAW-filters must be used).

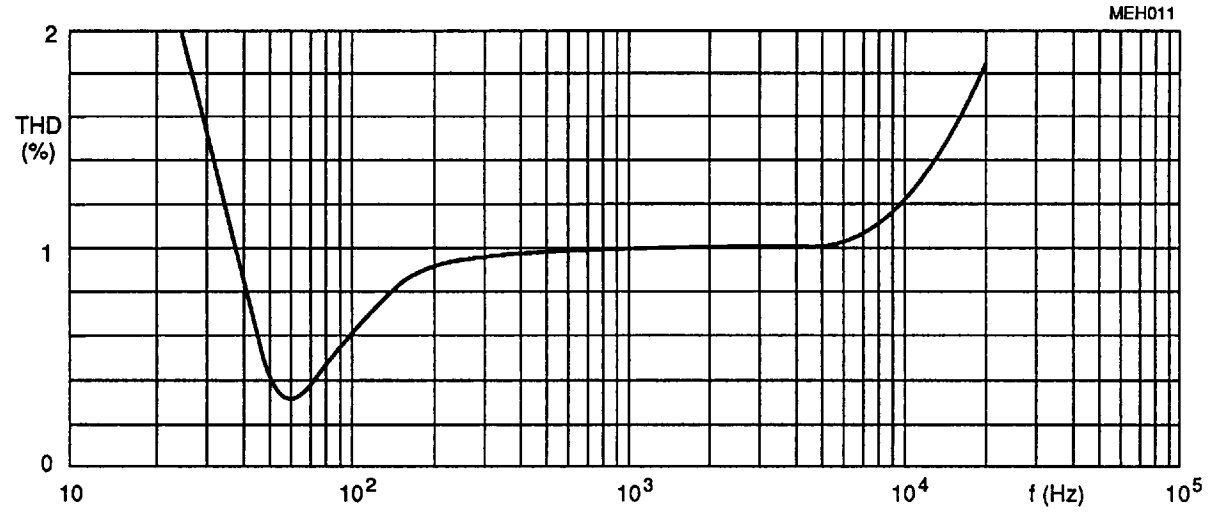
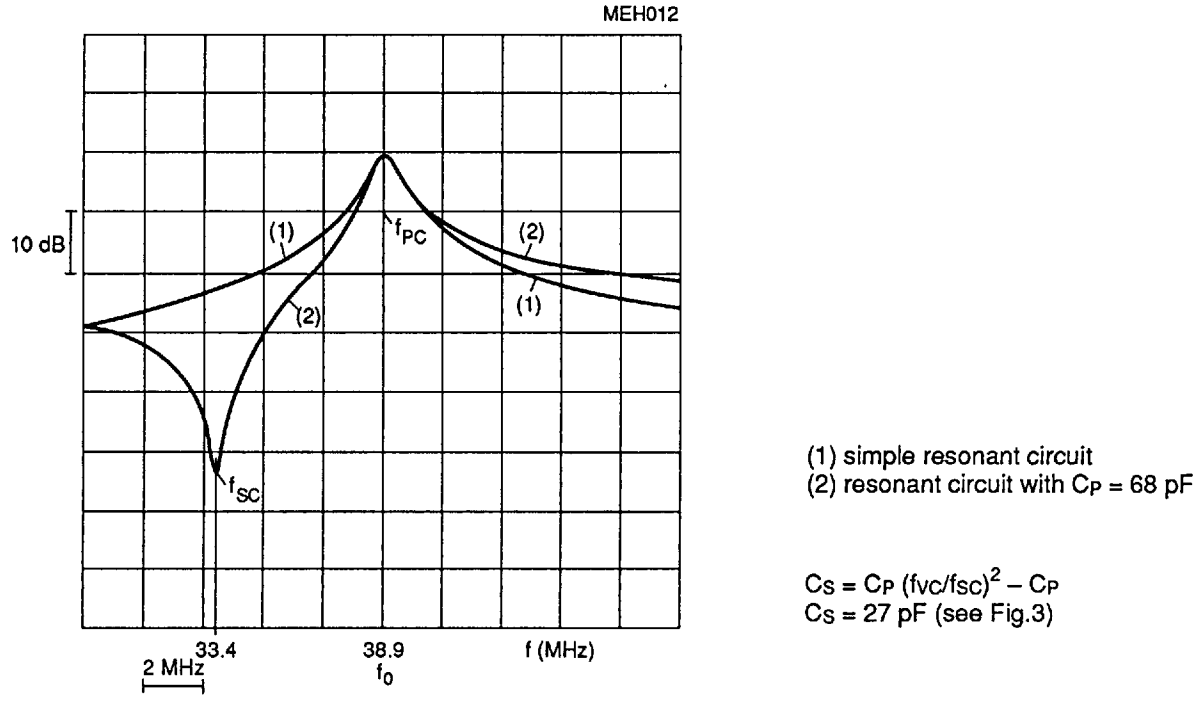


Fig.4 Total harmonic distortion (THD) as a function of audio frequency at AM standard ($V_5 = 0$).



(1) simple resonant circuit
(2) resonant circuit with C_P = 68 pF

$C_S = C_P (f_{VC}/f_{SC})^2 - C_P$
C_S = 27 pF (see Fig.3)

Fig.5 Frequency response of the 38.9 MHz reference circuit.

APPLICATION INFORMATION

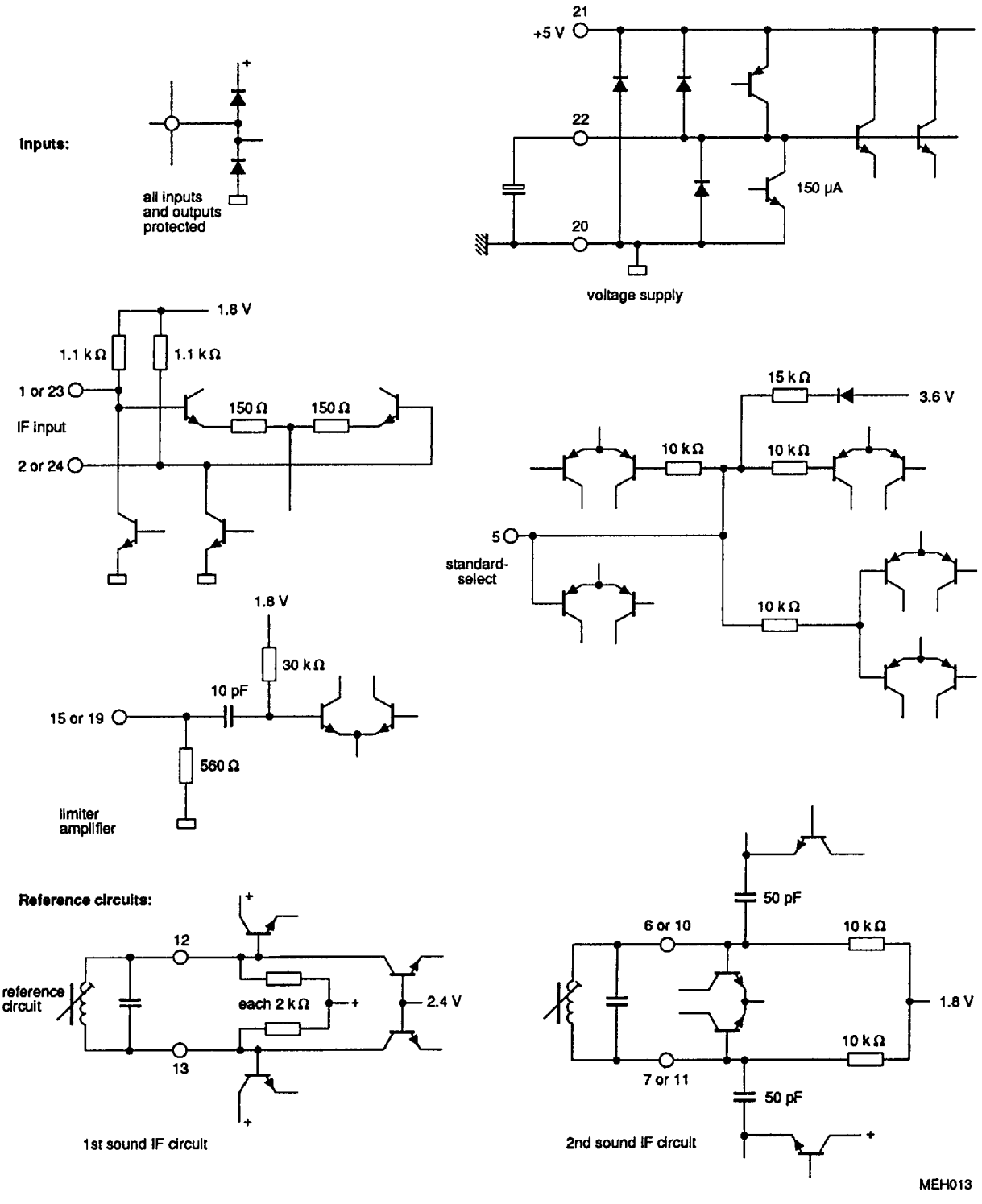


Fig.6 Internal circuits (continued in Fig.7).

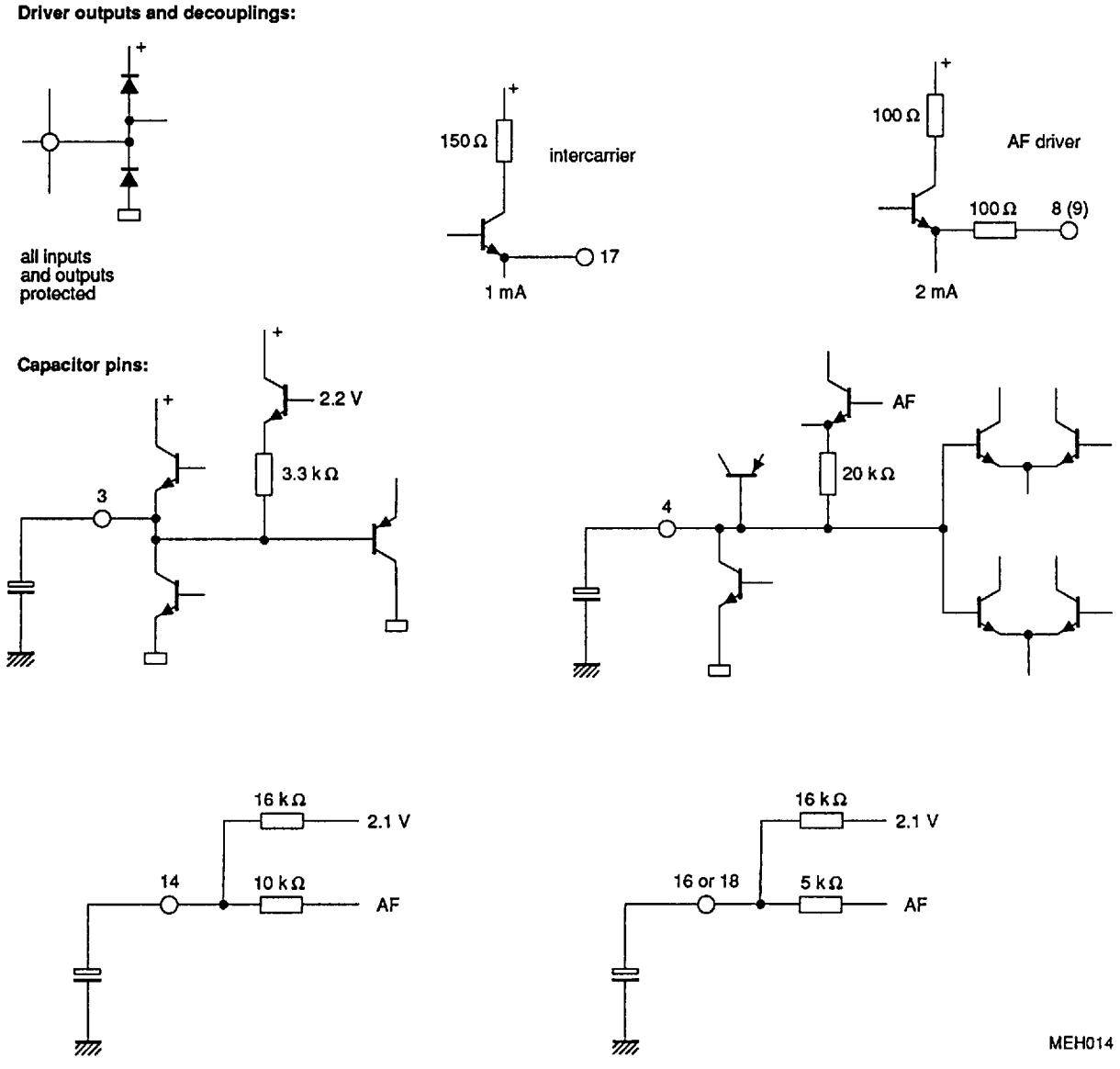
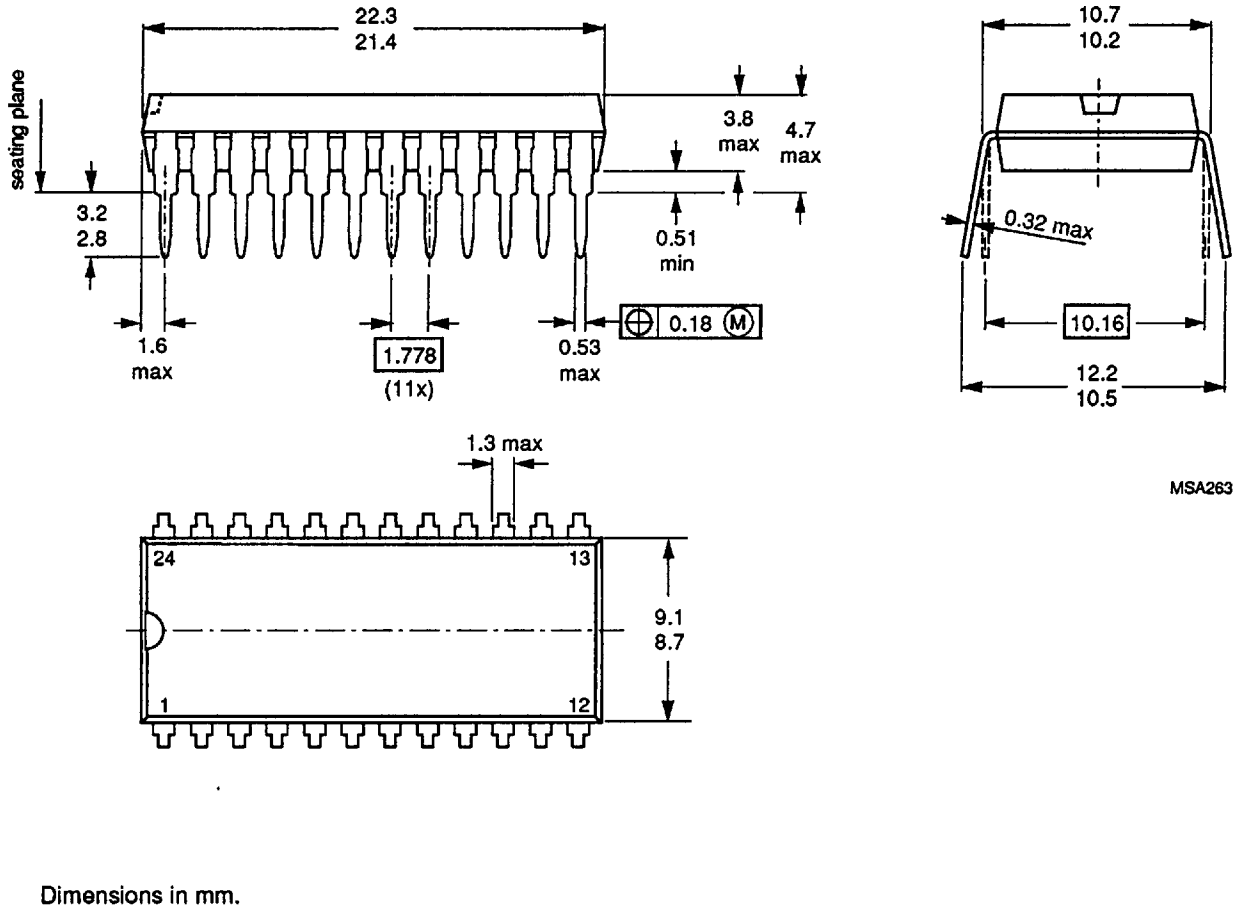


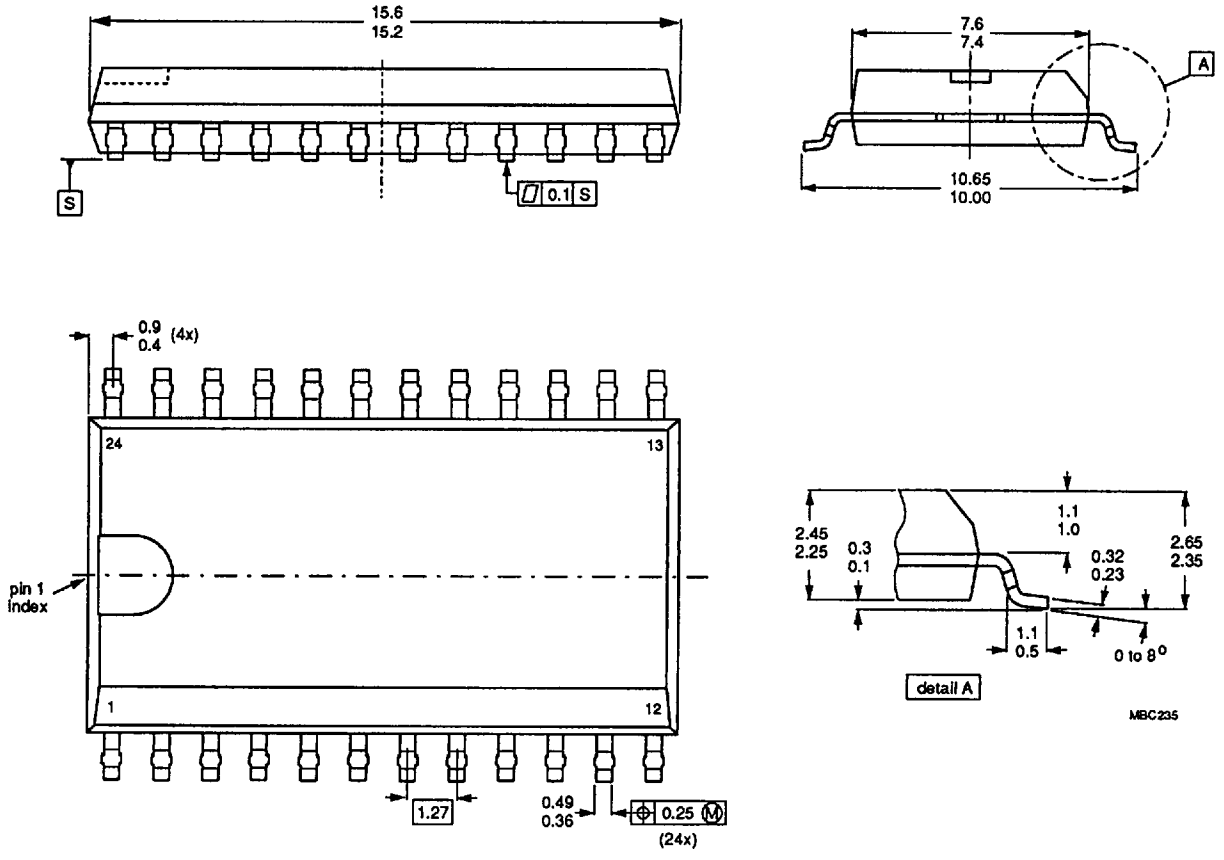
Fig.7 Internal circuits (continued from Fig.6).

PACKAGE OUTLINES



Dimensions in mm.

Fig.8 24-lead shrink dual in-line; plastic (SOT234).



Dimensions in mm.

Fig.9 24-lead mini-pack; plastic (SO24; SOT137).

SOLDERING

Plastic dual in-line packages

BY DIP OR WAVE

The maximum permissible temperature of the solder is 260 °C; this temperature must not be in contact with the joint for more than 5 s. The total contact time of successive solder waves must not exceed 5 s.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified storage maximum. If the printed-circuit board has been preheated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

REPAIRING SOLDERED JOINTS

Apply the soldering iron below the seating plane (or not more than 2 mm above it). If its temperature is below 300 °C it must not be in contact for more than 10 s; if between 300 and 400 °C, for not more than 5 s.

Plastic mini-packs

BY WAVE

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

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

A modified wave soldering technique is recommended using two solder waves (dual-wave) in which a turbulent wave with high upward pressure is followed by a smooth laminar wave. Using a mildly-activated flux eliminates the need for removal of corrosive residues in most applications.

BY SOLDER PASTE REFLOW

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

Several techniques exist for reflowing; for example, thermal conduction by heated belt, infrared, and vapour-phase reflow. Dwell times vary between 50 and 300 s according to 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 min at 45 °C.

REPAIRING SOLDERED JOINTS (BY HAND-HELD SOLDERING IRON OR PULSE-HEATED SOLDER TOOL)

Fix the component by first soldering two, diagonally opposite, end pins. Apply the heating tool to the flat part of the pin only. Contact time must be limited to 10 s at up to 300 °C. When using proper tools, all other pins can be soldered in one operation within 2 to 5 s at between 270 and 320 °C. (Pulse-heated soldering is not recommended for SO packages).

For pulse-heated solder tool (resistance) soldering of VSO packages, solder is applied to the substrate by dipping or by an extra thick tin/lead plating before package placement.

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 this specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

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