

DATA SHEET

TDA3866

Quasi-split sound processor for all standards

Preliminary specification
File under Integrated Circuits, IC02

January 1992

Quasi-split sound processor for all standards

TDA3866

FEATURES

- Quasi-split sound processor for all standards e. g. B/G (FM sound) and L (AM sound)
- AF2 signal automatically muted (at B/G) by the input signal level
- AM signal processing for L standard and switching over the audio signal
- Stereo-matrix correction
- Layout-compatible with TDA3858 (32 pins) and TDA3857 (20 pins)
- AM output level typically 500 mV at $m = 0.54$ (+2.5 dB in comparison to TDA3856)

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.

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 |
| $V_{i\text{ IF}}$ | IF input sensitivity (–3 dB) | – | 70 | 100 | μV |
| V_o | audio output signal for FM standard B/G (RMS value) | – | 1 | – | V |
| | audio output signal for AM standard L (RMS value) | – | 0.5 | – | 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 |

ORDERING AND PACKAGE INFORMATION

| EXTENDED TYPE NUMBER | PACKAGE | | | |
|----------------------|---------|--------------|----------|-----------------------|
| | PINS | PIN POSITION | MATERIAL | CODE |
| TDA3866 | 24 | shrink DIL | plastic | SOT234 ⁽¹⁾ |

Note

1. SOT234-1; 1997 January 8.

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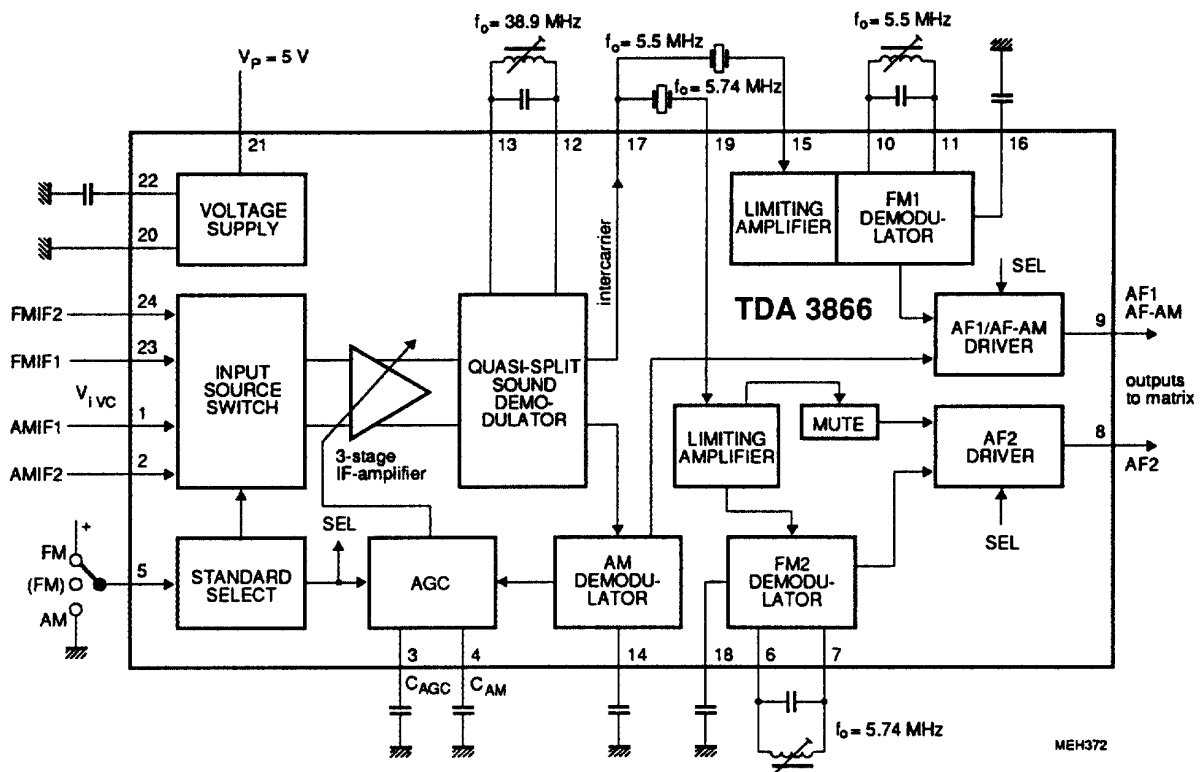


Fig.1 Block diagram (B/G and L).

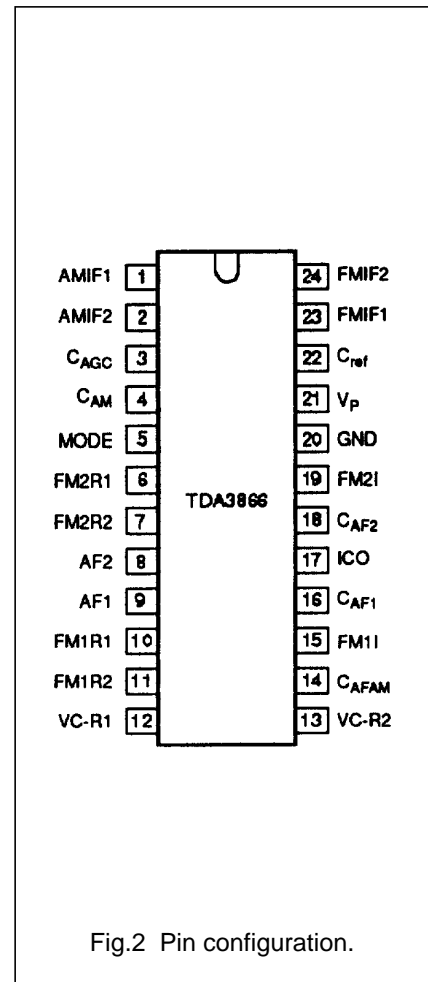
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PINNING

| 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 |
| 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 ... +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) |

PIN CONFIGURATION



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FUNCTIONAL DESCRIPTION

The quasi-split sound processor is for all standards. Dependent on the voltage on 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. With no sound carrier SC2 on 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 on pin 19, under measurement conditions, AF2 is switched on (see limiting amplifier). Weak input signals at pins 23 and 24 generate noise on pin 19, which is present in the intercarrier signal and passes through the 5.74 MHz filter. Noise on 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.

The series capacitor C_S in 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.

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 degree 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 ± 27 kHz the S/N ratio is deteriorated by 5.3 dB.

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.

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LIMITING VALUES

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

| SYMBOL | PARAMETER | MIN. | MAX. | UNIT |
|-----------|--|------|-------|------|
| V_P | supply voltages (pin 21) | – | 8.8 | V |
| V_n | input and output voltage (pins 1, 2, 5, 8, 9, 15, 17, 19, 23 and 24) | 0 | V_P | V |
| P_{tot} | total power dissipation | 0 | 635 | mW |
| T_{stg} | storage temperature range | –25 | 150 | °C |
| T_{amb} | operating ambient temperature range | 0 | 70 | °C |
| V_{ESD} | electrostatic handling ⁽¹⁾ all pins except 1, 2, 23 and 24 | ±500 | – | V |
| | pins 1, 2, 23 and 24 | +400 | – | V |
| | pins 1, 2, 23 and 24 | –500 | – | V |

Note

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

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CHARACTERISTICS

$V_P = 5\text{ V}$ and $T_{\text{amb}} = 25\text{ °C}$, measurements taken in Fig.3 with $f_{\text{VC}} = 38.9\text{ MHz}$, $f_{\text{SC1}} = 33.4\text{ MHz}$ and $f_{\text{SC2}} = 33.158\text{ MHz}$. Vision carrier (VC) modulated with different video signals, modulation depth 100 % (proportional to 10 % residual carrier).

Vision carrier amplitude (RMS value) $V_{i\text{VC}} = 10\text{ mV}$; vision to sound carrier ratios are $\text{VC/SC1} = 13\text{ dB}$ and $\text{VC/SC2} = 20\text{ dB}$. Sound carriers (SC1, SC2) modulated with $f = 1\text{ kHz}$ and deviation $\Delta f = 50\text{ kHz}$ unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|--|--|------|------|-------|---------------|
| V_P | supply voltage range (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 | 1.3 | – | 2.3 | V |
| | | 22 k Ω to GND (alternative measure) | – | 1.8 | – | V |
| | L (AM sound) | pin 5 connected | 0 | – | 0.8 | V |
| I_5 | input current | $V_5 = V_P$ | – | – | 100 | μA |
| | | $V_5 = 0$ | – | – | –300 | μA |
| IF input not activated (pins 1-2 or 23-24) | | | | | | |
| R_I | input resistance | | – | – | 100 | Ω |
| V_{DC} | DC input voltage (pins 1, 2, 23 and 24) | internally set LOW | – | – | 0.1 | V |
| $\alpha_{1,2-23,24}$ | crosstalk attenuation of IF input switch | note 1 | 50 | 56 | – | dB |
| IF amplifier (pins 1-2 or 23-24) | | | | | | |
| R_I | input resistance | | 1.75 | 2.2 | 2.65 | k Ω |
| C_I | input capacitance | | 1.0 | 1.5 | 2.2 | pF |
| V_I | DC potential, voltage (pins 1, 2, 23, 24) | | – | 1.75 | – | V |
| $V_{i\text{IF}}$ | maximum input signal (RMS value) | $V_o = +1\text{ dB}$ | 70 | 100 | – | mV |
| | input signal sensitivity B/G standard (RMS value, pins 23-24) | –3 dB intercarrier signal reduction on pin 17 | – | 70 | 100 | μV |
| | input signal sensitivity L standard (RMS value, pins 1-2) | –3 dB intercarrier signal reduction on pin 9 | – | 70 | 100 | μV |
| ΔG_V | IF gain control range | | 60 | 63 | – | dB |
| B | IF bandwidth | –3 dB | 50 | 70 | – | MHz |
| V_3 | voltage range for gain control (pin 3) | $G_{\text{min}} - G_{\text{max}}$ | 1.7 | – | 2.6 | V |

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| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|--|--------------------------------------|------|---------|-----------|------------|
| Resonance amplifier (pins 12-13) | | | | | | |
| V_o | vision carrier amplitude (peak-to-peak value) | $f_o = 38.9$ MHz | – | 270 | – | mV |
| R_{12-13} | operating resistance | | – | 4 | – | k Ω |
| L | inductance | Fig.3 and 5 | – | 0.247 | – | μ H |
| C | capacitance | $C_S = 27$ pF | – | 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 |
| Intercarrier mixer output (pin 17) | | | | | | |
| V_o | 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 | – | 8.5 | – | MHz |
| | | –3 dB | – | 10 | – | MHz |
| V_{VID}/V_{17} | residual video AM on intercarrier | note 2 | – | 3 | 10 | % |
| V_{VC} | 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 | | – | 1.75 | – | V |
| Limiting amplifiers (pins 15 and 19) | | | | | | |
| V_i | minimum input signal (RMS value) | –3 dB AF signal | – | 300 | 450 | μ V |
| | maximum input signal (RMS value) | | 200 | – | – | mV |
| $R_{15, 19}$ | input resistance | | – | 560 | – | Ω |
| $V_{15, 19}$ | DC voltage | | – | 0 | – | V |
| V_i | level detector threshold for no muting (RMS value, pin 19) | only 5.74 MHz channel | – | 1 | – | mV |
| ΔV_i | hysteresis of level detector | | – | 5 | – | dB |

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| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|------|------|-----------|----------|
| FM1 and FM2 demodulators | | | | | | |
| Measurements with FM IF input signals of 5.5 MHz and 5.74 MHz with $V_{i\text{IF}}(\text{rms}) = 10 \text{ mV}$ ($f_{\text{mod}} = 1 \text{ kHz}$, deviation $\Delta f = \pm 50 \text{ kHz}$) at pins 15 and 19 without ceramic filters, $R_S = 50 \Omega$. De-emphasis $50 \mu\text{s}$ and $V_5 = V_P$ (B/G standard). Q_L -factor = 11 for resonant circuits at pins 6-7 and 10-11. | | | | | | |
| V_{IC} | intercarrier signals (RMS values, pins 6-7 and 10-11) | | – | 100 | – | mV |
| V_{DC} | DC voltage (pins 6-7 and 10-11) | | – | 1.8 | – | V |
| V_o | AF output signals (RMS values, pins 8 and 9) | | 0.75 | 0.95 | 1.20 | V |
| ΔV_o | difference of AF signals between channels (pins 8 and 9) | | – | – | 1 | dB |
| $R_{8,9}$ | output resistance | | – | 100 | – | Ω |
| $V_{8,9}$ | DC voltage | | – | 2.1 | – | V |
| $I_{8,9}$ | 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 | 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 | CCIR 468-3 | 64 | 68 | – | dB |
| B | AF bandwidth | –3 dB | 0.02 | – | 100 | kHz |
| α_{CR} | crosstalk attenuation (pins 9-8) | | 60 | 70 | – | dB |
| $V_{16,18}$ | DC voltage (pins 16 and 18) | | – | 1.7 | – | V |
| AM mode, input signal at pins 1-2 | | SC = 32.4 MHz; $f_{\text{mod}} = 1 \text{ kHz}$, $m = 0.54$; $V_{i\text{AM}} = 10 \text{ mV rms}$ | | | | |
| V_o | AF output signal on pin 9 (RMS value) | | 400 | 500 | 600 | mV |
| R_9 | output resistance (pin 9) | | – | 100 | – | Ω |
| I_o | maximum AC output current (peak value) | note 3 | – | – | ± 1.5 | mA |
| I_9 | maximum DC output current | | – | – | –2 | mA |
| V_9 | DC voltage | | – | 2.1 | – | V |
| THD | total harmonic distortion | Fig.4 | – | 1 | 2 | % |
| S/N(W) | weighted signal-to-noise ratio | CCIR 468-3 | 50 | 56 | – | dB |
| B | AF bandwidth | –3 dB | 0.02 | – | 100 | kHz |
| V_{14} | DC voltage (pin 14) | | – | 2 | – | V |

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| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|--|------|------|------|------|
| Audio frequency performance for FM operation in B/G standard ($V_5 = V_P$) unless otherwise specified. | | | | | | |
| Measurements on AF outputs (pins 8 and 9) | | | | | | |
| V_o | signals attenuation of AF signal switches mute: AF2 on pin 8 | $V_5 = 0$ | 70 | – | – | dB |
| | AM mode: not required signal AF1 on pin 9 (from FM) | 5.5 MHz on pin 18; $V_5 = 0$; $V_i = 10$ mV | 70 | – | – | dB |
| | FM mode: not required signal AF1 on pin 9 (from AM) | signal for L standard (pins 1-2); $V_5 = V_P$ | 70 | – | – | dB |
| $dV_{8,9}$ | DC level deviation (pins 8 and 9) | when switching to FM or AM sound or Mute | – | 5 | 25 | mV |
| S/N(W) | weighted signal-to-noise ratio on output pin 9 | CCIR 468-3 de-emphasis 50 μ s | | | | |
| | 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 | 56 | – | dB |
| | on output pin 8 | | | | | |
| | 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 | 50 | 56 | – | dB |
| RR | ripple rejection | all standards; $f_R = 70$ Hz $V_R = 200$ mV (p-p) | 30 | 40 | – | dB |

Notes to the characteristics

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

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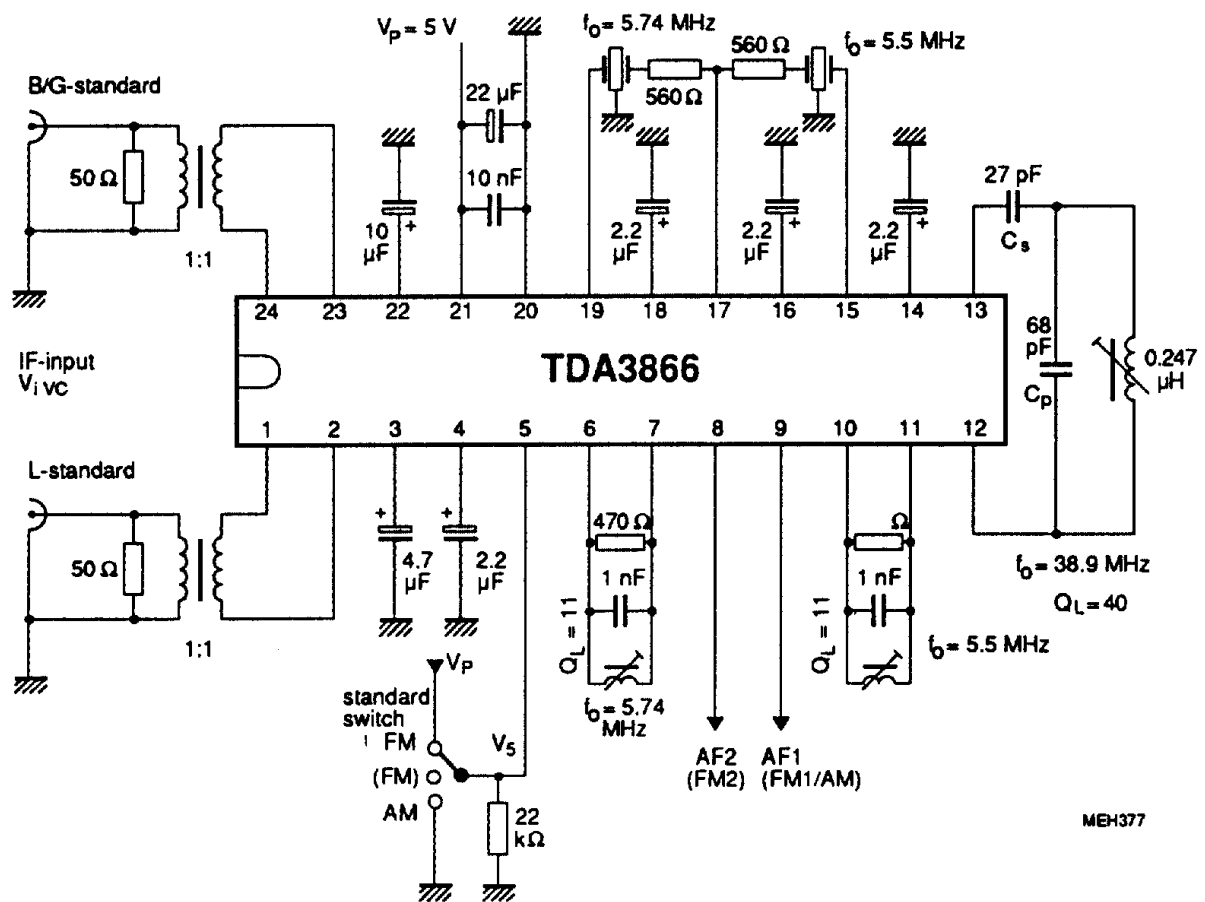


Fig.3 Test and application circuit for standards B/G and L (for application SAW-filters must be used).

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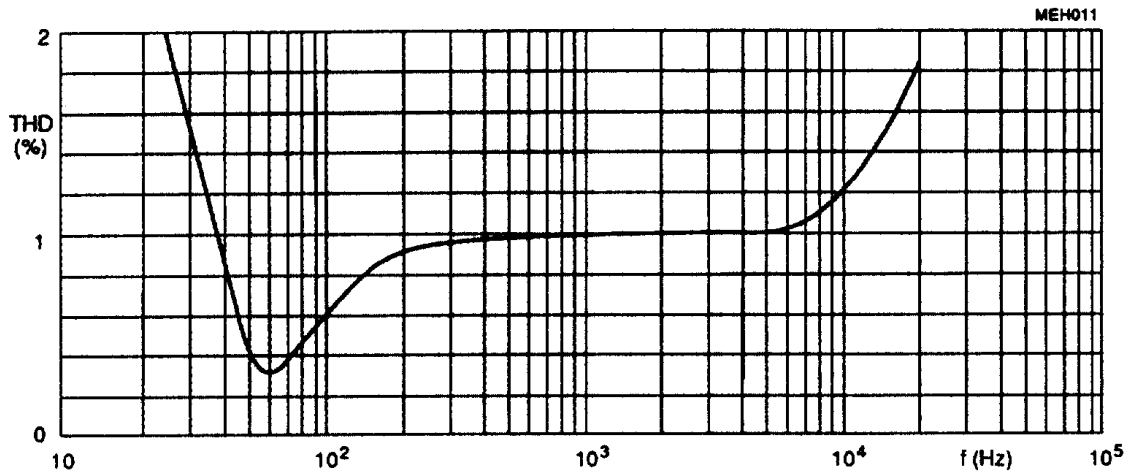
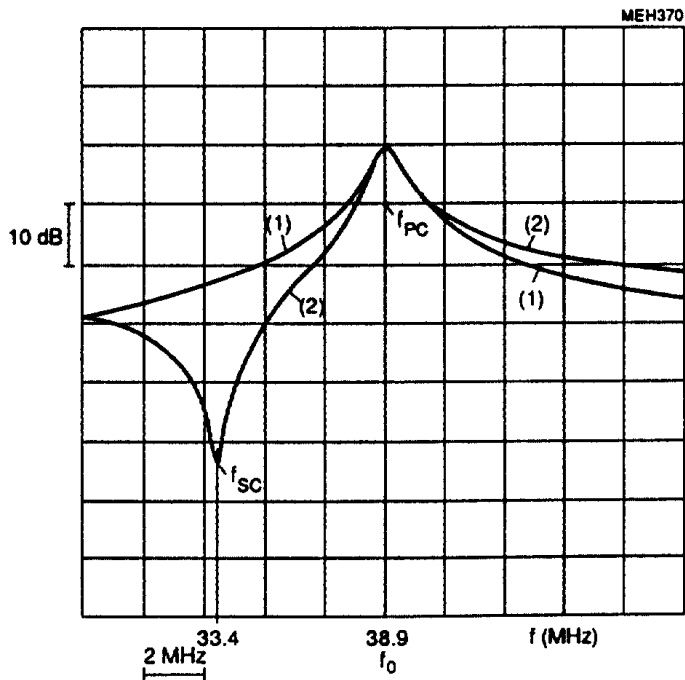


Fig.4 Total harmonic distortion (THD) as a function of audio frequency at AM standard ($V_5 = 0$).



- (1) simple resonance circuit (without C_S)
- (2) resonance circuit with $C_S = 27$ pF

$$C_S = C_P (f_0/f_{SC})^2 - C_P$$

$C_S = 27$ pF (Fig.3)

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

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APPLICATION INFORMATION

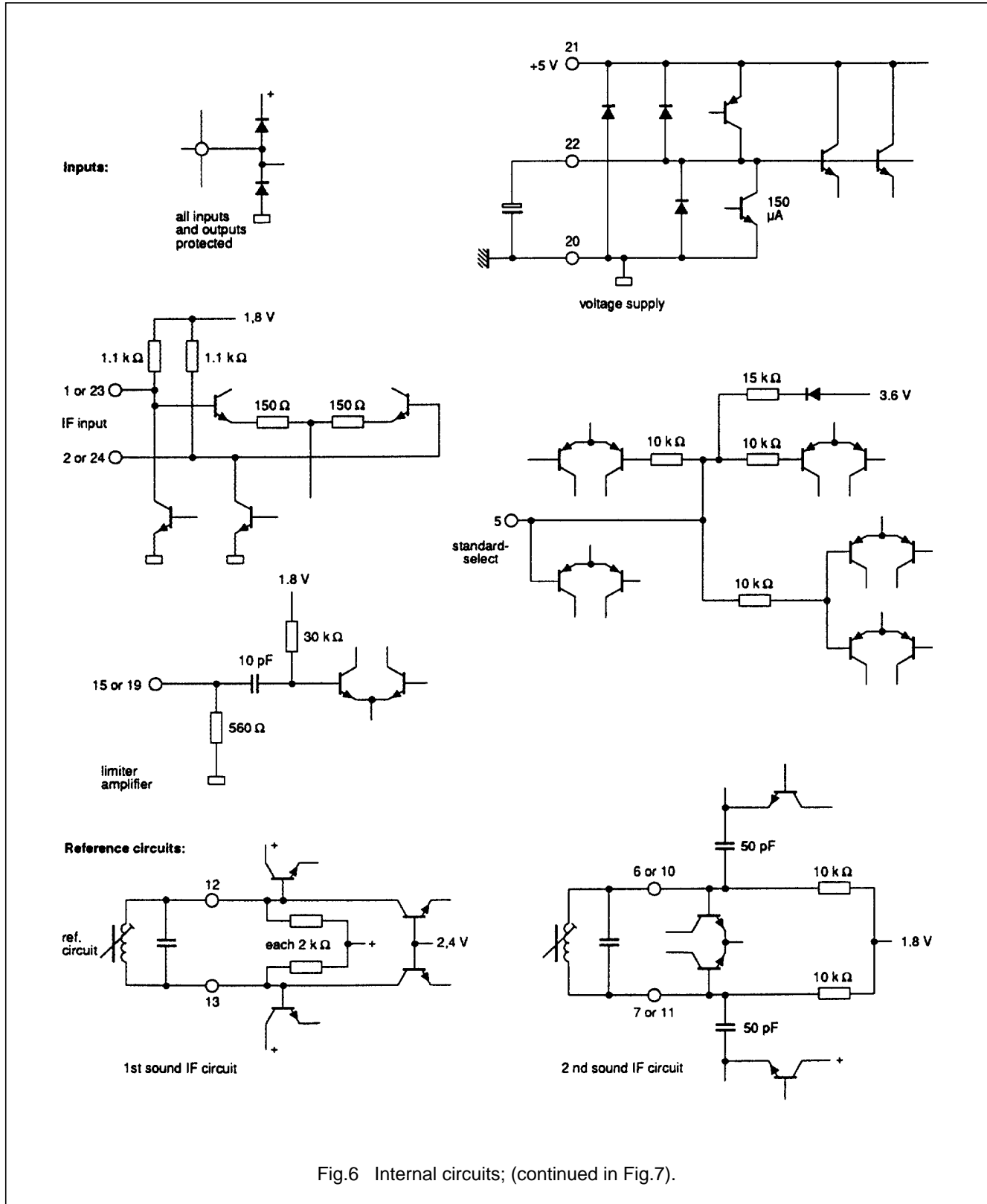
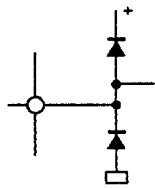


Fig.6 Internal circuits; (continued in Fig.7).

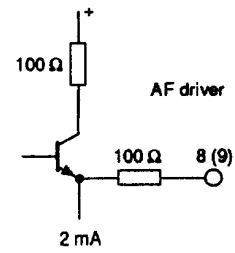
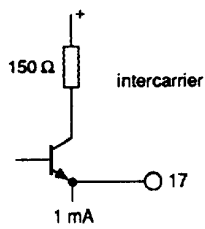
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Driver outputs and decouplings:



all inputs and outputs protected



Capacitor pins:

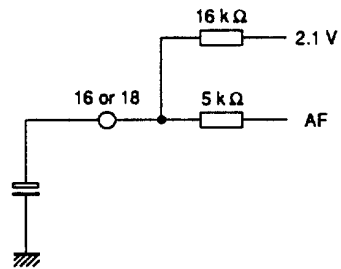
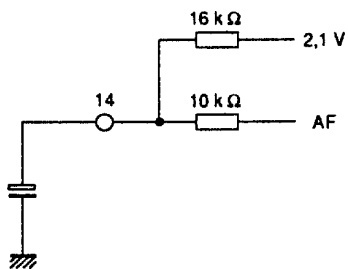
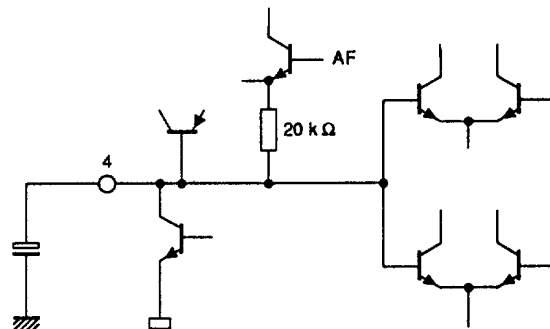
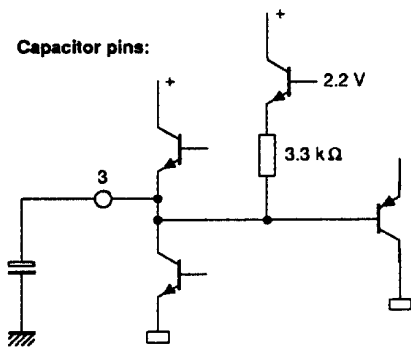


Fig.7 Internal circuits; (continued from Fig.6)

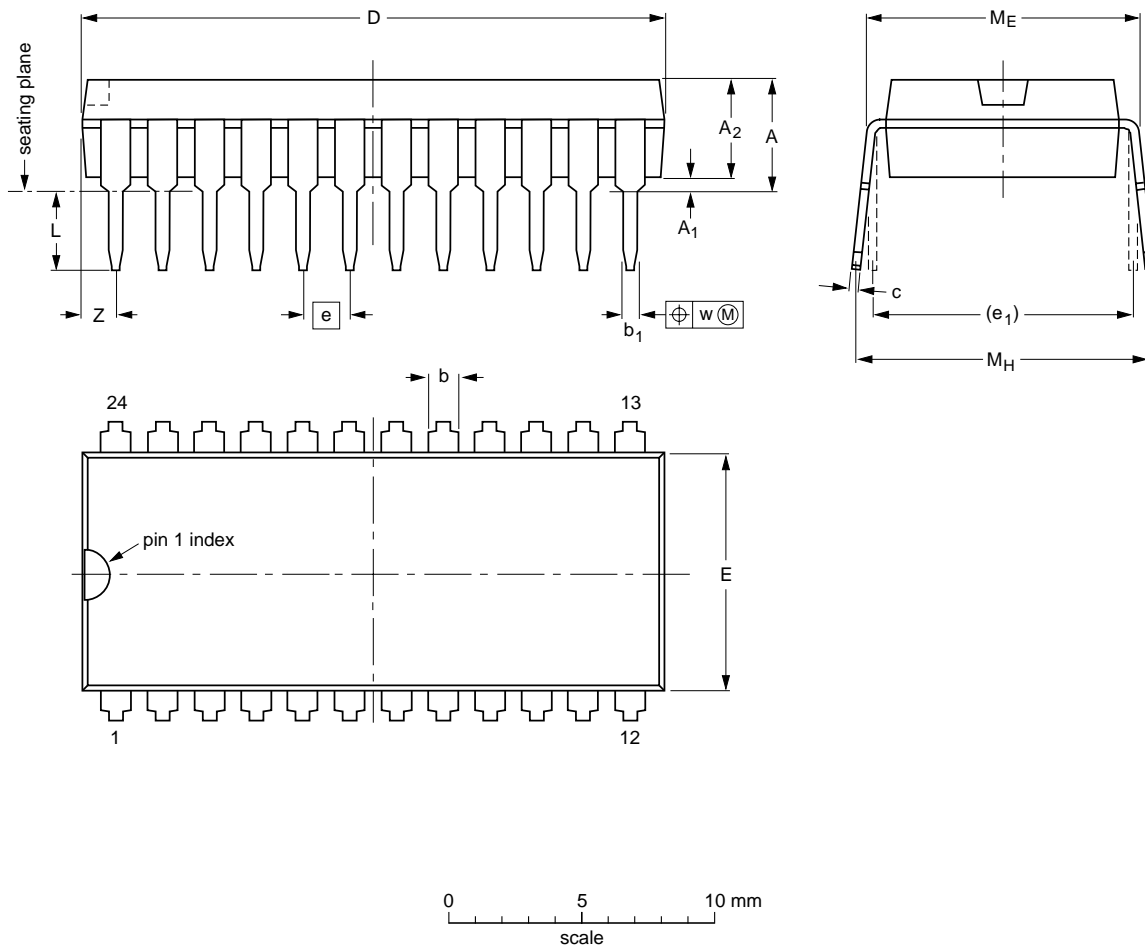
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PACKAGE OUTLINE

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

SOT234-1



DIMENSIONS (mm are the original dimensions)

| UNIT | A max. | A ₁ min. | A ₂ max. | b | b ₁ | c | D ⁽¹⁾ | E ⁽¹⁾ | e | e ₁ | L | M _E | M _H | w | Z ⁽¹⁾ max. |
|------|--------|---------------------|---------------------|------------|----------------|--------------|------------------|------------------|-------|----------------|------------|----------------|----------------|------|-----------------------|
| mm | 4.7 | 0.51 | 3.8 | 1.3 0.8 | 0.53 0.40 | 0.32 0.23 | 22.3 21.4 | 9.1 8.7 | 1.778 | 10.16 | 3.2 2.8 | 10.7 10.2 | 12.2 10.5 | 0.18 | 1.6 |

Note

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

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|-------|------|--|---------------------|----------------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT234-1 | | | | | | 92-11-17 95-02-04 |

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SOLDERING

Introduction

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

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

Soldering by dipping or by wave

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact

with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ($T_{stg\ max}$). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

Repairing soldered joints

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

DEFINITIONS

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

LIFE SUPPORT APPLICATIONS

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