

DATA SHEET

TDA7052A/AT

**1 W BTL mono audio amplifier with
DC volume control**

Product specification
File under Integrated circuits, IC01

July 1994

1 W BTL mono audio amplifier with DC volume control

TDA7052A/AT

FEATURES

- DC volume control
- Few external components
- Mute mode
- Thermal protection
- Short-circuit proof
- No switch-on and off clicks
- Good overall stability
- Low power consumption
- Low HF radiation
- ESD protected on all pins

GENERAL DESCRIPTION

The TDA7052A/AT are mono BTL output amplifiers with DC volume control. They are designed for use in TV and monitors, but also suitable for battery-fed portable recorders and radios.

Missing Current Limiter (MCL)

A MCL protection circuit is built-in. The MCL circuit is activated when the difference in current between the output terminal of each amplifier exceeds 100 mA (typical 300 mA). This level of 100 mA allows for headphone applications (single-ended).

QUICK REFERENCE DATA

| SYMBOL | PARAMETERS | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|--------|-------------------------------|---------------------------------|------|------|------|------|
| V_P | positive supply voltage range | | 4.5 | – | 18 | V |
| P_O | output power | | | | | |
| | TDA7052A | $R_L = 8 \Omega$; $V_P = 6 V$ | 1.0 | 1.1 | – | W |
| | TDA7052AT | $R_L = 16 \Omega$; $V_P = 6 V$ | 0.5 | 0.55 | – | W |
| G_v | maximum total voltage gain | | 34.5 | 35.5 | 36.5 | dB |
| ϕ | gain control range | | 75 | 80 | – | dB |
| I_P | total quiescent current | $V_P = 6 V$; $R_L = \infty$ | – | 7 | 12 | mA |
| THD | total harmonic distortion | | | | | |
| | TDA7052A | $P_O = 0.5 W$ | – | 0.3 | 1 | % |
| | TDA7052AT | $P_O = 0.25 W$ | – | 0.3 | 1 | % |

ORDERING INFORMATION

| EXTENDED TYPE NUMBER | PACKAGE | | | |
|----------------------|---------|--------------|----------|-----------------------|
| | PINS | PIN POSITION | MATERIAL | CODE |
| TDA7052A | 8 | DIL | plastic | SOT97 ⁽¹⁾ |
| TDA7052AT | 8 | mini-pack | plastic | SOT96A ⁽²⁾ |

Notes

1. SOT97-1; 1996 September 10.
2. SOT96-1; 1996 September 10.

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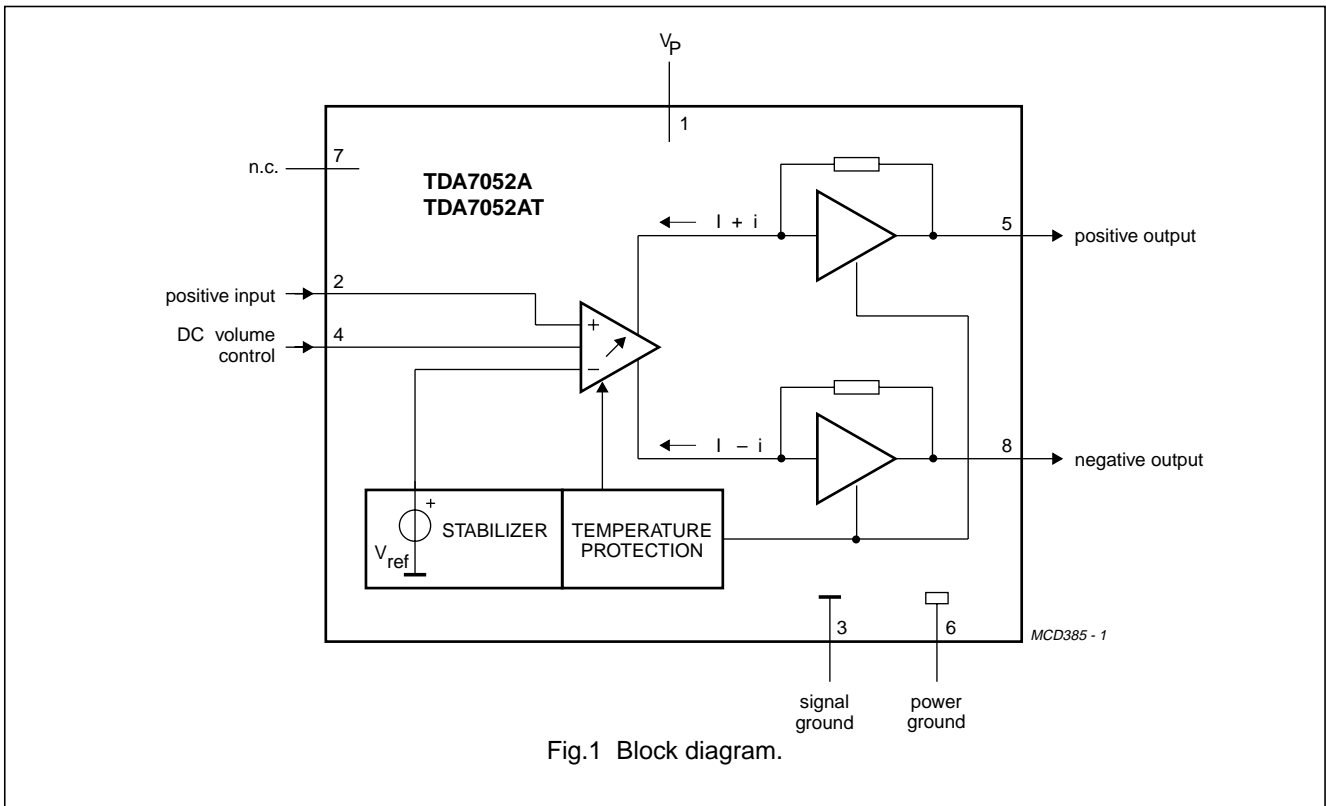


Fig.1 Block diagram.

PINNING

| SYMBOL | PIN | DESCRIPTION |
|----------------|-----|-------------------------|
| V _P | 1 | positive supply voltage |
| IN+ | 2 | positive input |
| GND1 | 3 | signal ground |
| VC | 4 | DC volume control |
| OUT+ | 5 | positive output |
| GND2 | 6 | power ground |
| n.c | 7 | not connected |
| OUT- | 8 | negative output |

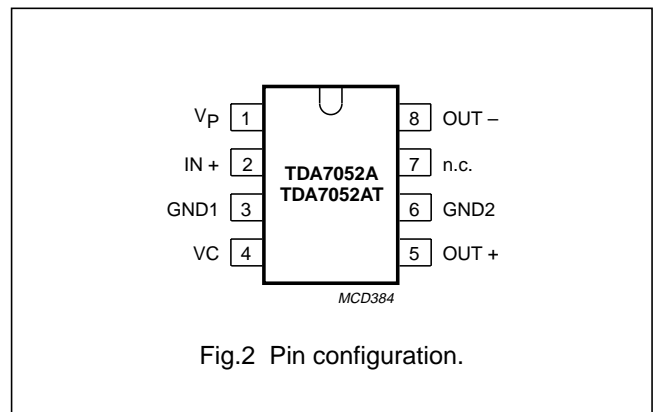


Fig.2 Pin configuration.

1 W BTL mono audio amplifier with DC volume control

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FUNCTIONAL DESCRIPTION

The TDA7052A/AT are mono BTL output amplifiers with DC volume control, designed for use in TV and monitors but also suitable for battery fed portable recorders and radios.

In conventional DC volume circuits the control or input stage is AC coupled to the output stage via external capacitors to keep the offset voltage low.

In the TDA7052A/AT the DC volume control stage is integrated into the input stage so that no coupling capacitors are required and yet a low offset voltage is maintained. At the same time the minimum supply remains low.

The BTL principle offers the following advantages:

- Lower peak value of the supply current
- The frequency of the ripple on the supply voltage is twice the signal frequency.

Thus a reduced power supply with smaller capacitors can be used which results in cost savings.

For portable applications there is a trend to decrease the supply voltage, resulting in a reduction of output power at conventional output stages. Using the BTL principle increases the output power.

The maximum gain of the amplifier is fixed at 35.5 dB. The DC volume control stage has a logarithmic control characteristic.

The total gain can be controlled from 35.5 dB to -44 dB. If the DC volume control voltage is below 0.3 V, the device switches to the mute mode.

The amplifier is short-circuit proof to ground, V_P and across the load. Also a thermal protection circuit is implemented. If the crystal temperature rises above +150 °C the gain will be reduced, so the output power is reduced.

Special attention is given to switch on and off clicks, low HF radiation and a good overall stability.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134)

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|-----------|-------------------------------------|---------------------|------|------|------|
| V_P | supply voltage range | | - | 18 | V |
| I_{ORM} | repetitive peak output current | | - | 1.25 | A |
| I_{OSM} | non-repetitive peak output current | | - | 1.5 | A |
| P_{tot} | total power dissipation | $T_{amb} \leq 25\%$ | - | 1.25 | W |
| | TDA7052A TDA7052AT | | - | 0.8 | W |
| T_{amb} | operating ambient temperature range | | -40 | +85 | °C |
| T_{stg} | storage temperature range | | -55 | +150 | °C |
| T_{vj} | virtual junction temperature | | - | +150 | °C |
| T_{sc} | short-circuit time | | - | 1 | hr |
| V_2 | input voltage pin 2 | | - | 8 | V |
| V_4 | input voltage pin 4 | | - | 8 | V |

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TDA7052A/AT**THERMAL RESISTANCE**

| SYMBOL | PARAMETER | THERMAL RESISTANCE |
|---------------|---|---------------------------|
| $R_{th\ j-a}$ | from junction to ambient in free air TDA7052A TDA7052AT | 100 K/W 155 K/W |

Notes to the thermal resistance

TDA7052A: $V_P = 6\text{ V}$; $R_L = 8\ \Omega$. The maximum sine-wave dissipation is 0.9 W.
Therefore $T_{amb(max)} = 150 - 100 \times 0.9 = 60\text{ }^\circ\text{C}$.

TDA7052AT: $V_P = 6\text{ V}$; $R_L = 16\ \Omega$. The maximum sine-wave dissipation is 0.46 W.
Therefore $T_{amb(max)} = 150 - 155 \times 0.46 = 78\text{ }^\circ\text{C}$.

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CHARACTERISTICS

$V_P = 6\text{ V}$; $T_{\text{amb}} = 25\text{ °C}$; $f = 1\text{ kHz}$; TDA7052A: $R_L = 8\ \Omega$; TDA7052AT: $R_L = 16\ \Omega$; unless otherwise specified (see Fig.6).

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|--|--|---|------------|---------------------|--------|---------------|
| V_P | positive supply voltage range | | 4.5 | – | 18 | V |
| I_P | total quiescent current | $V_P = 6\text{ V}$; $R_L = \infty$ note 1 | – | 7 | 12 | mA |
| Maximum gain; $V_4 = 1.4\text{ V}$ | | | | | | |
| P_O | output power TDA7052A TDA7052AT | THD = 10% | 1.0 0.5 | 1.1 0.55 | – – | W W |
| THD | total harmonic distortion TDA7052A TDA7052AT | $P_O = 0.5\text{ W}$ $P_O = 0.25\text{ W}$ | – – | 0.3 0.3 | 1 1 | % % |
| G_V | voltage gain | | 34.5 | 35.5 | 36.5 | dB |
| V_I | input signal handling | $V_4 = 0.8\text{ V}$; THD < 1% | 0.5 | 0.65 | – | V |
| $V_{\text{no(rms)}}$ | noise output voltage (RMS value) | $f = 500\text{ kHz}$; note 2 | – | 210 | – | μV |
| B | bandwidth | –1 dB | – | 20 Hz to 300 kHz | – | |
| SVRR | supply voltage ripple rejection | note 3 | 38 | 46 | – | dB |
| $ V_{\text{offl}} $ | DC output offset voltage | | – | 0 | 150 | mV |
| Z_I | input impedance (pin 2) | | 15 | 20 | 25 | k Ω |
| Minimum gain; $V_4 = 0.5\text{ V}$ | | | | | | |
| G_V | voltage gain | | – | –44 | – | dB |
| $V_{\text{no(rms)}}$ | noise output voltage (RMS value) | note 4 | – | 20 | 30 | μV |
| Mute position | | | | | | |
| V_O | output voltage in mute position | $V_4 \leq 0.3\text{ V}$; $V_I = 600\text{ mV}$ | – | – | 30 | μV |
| DC volume control | | | | | | |
| ϕ | gain control range | | 75 | 80 | – | dB |
| I_4 | control current | $V_4 = 0.4\text{ V}$ | 60 | 70 | 80 | μA |

Notes to the characteristics

1. With a load connected to the outputs the quiescent current will increase, the maximum value of this increase being equal to the DC output offset voltage dividend by R_L .
2. The noise output voltage (RMS value) at $f = 500\text{ kHz}$ is measured with $R_S = 0\ \Omega$ and bandwidth = 5 kHz.
3. The ripple rejection is measured with $R_S = 0\ \Omega$ and $f = 100\text{ Hz}$ to 10 kHz. The ripple voltage of 200 mV, (RMS value) is applied to the positive supply rail.
4. The noise output voltage (RMS value) is measured with $R_S = 5\text{ k}\Omega$ unweighted.

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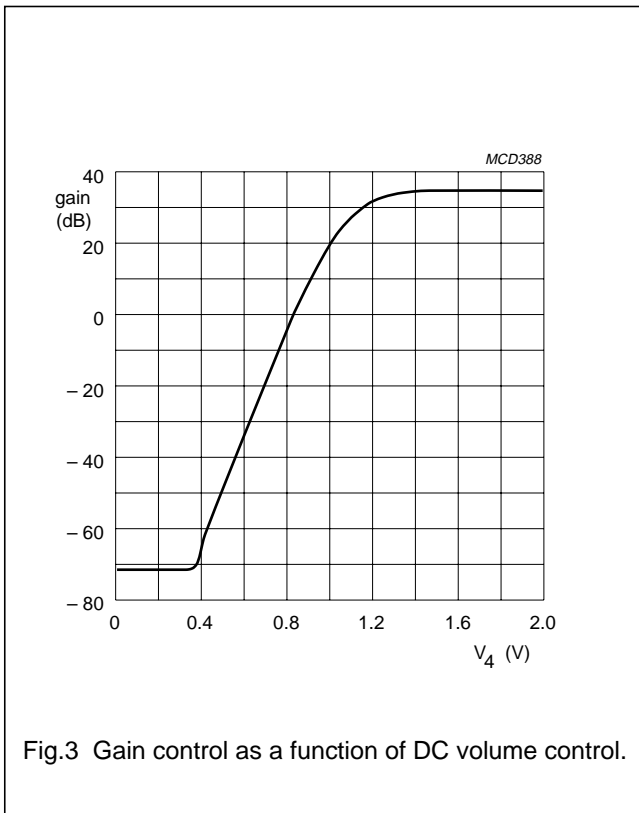


Fig.3 Gain control as a function of DC volume control.

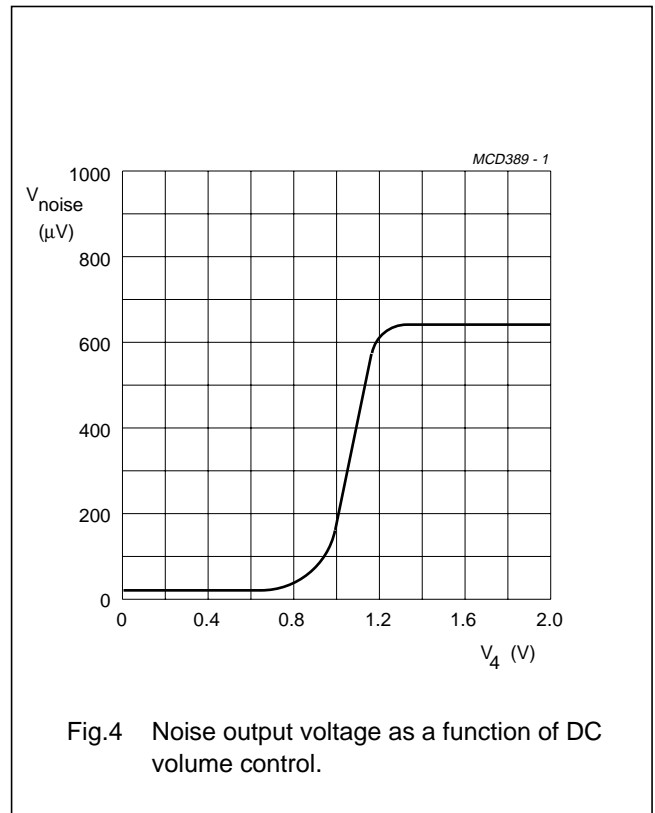


Fig.4 Noise output voltage as a function of DC volume control.

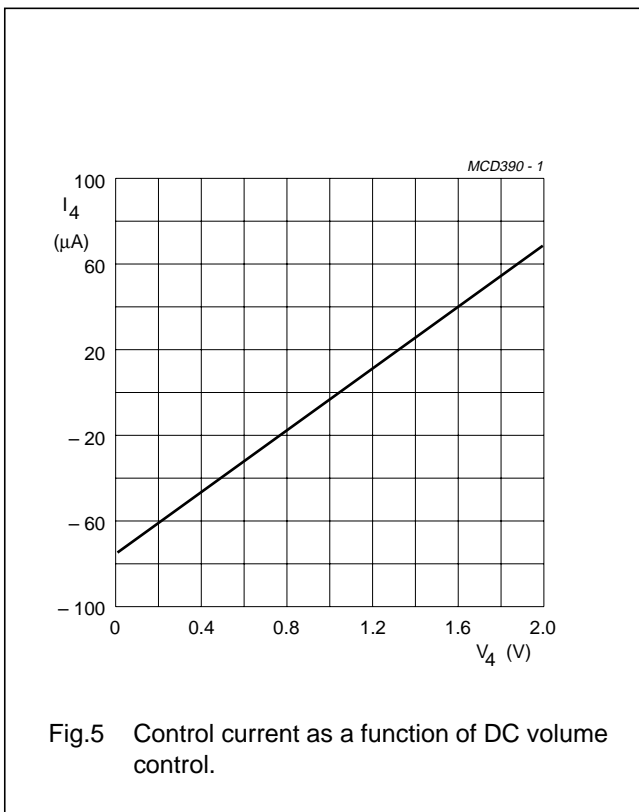
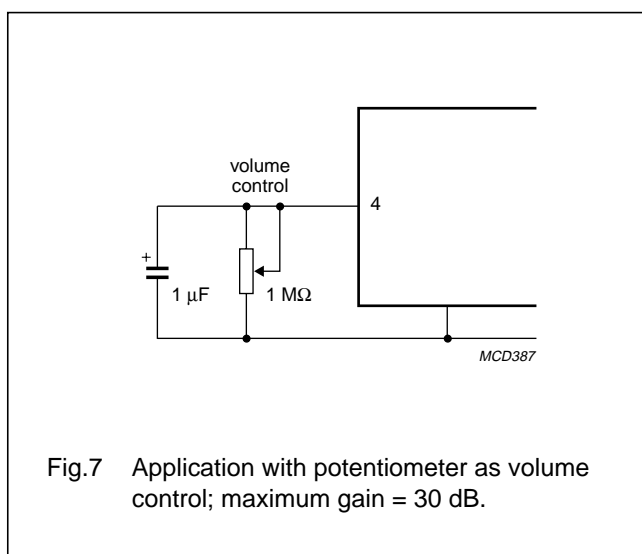
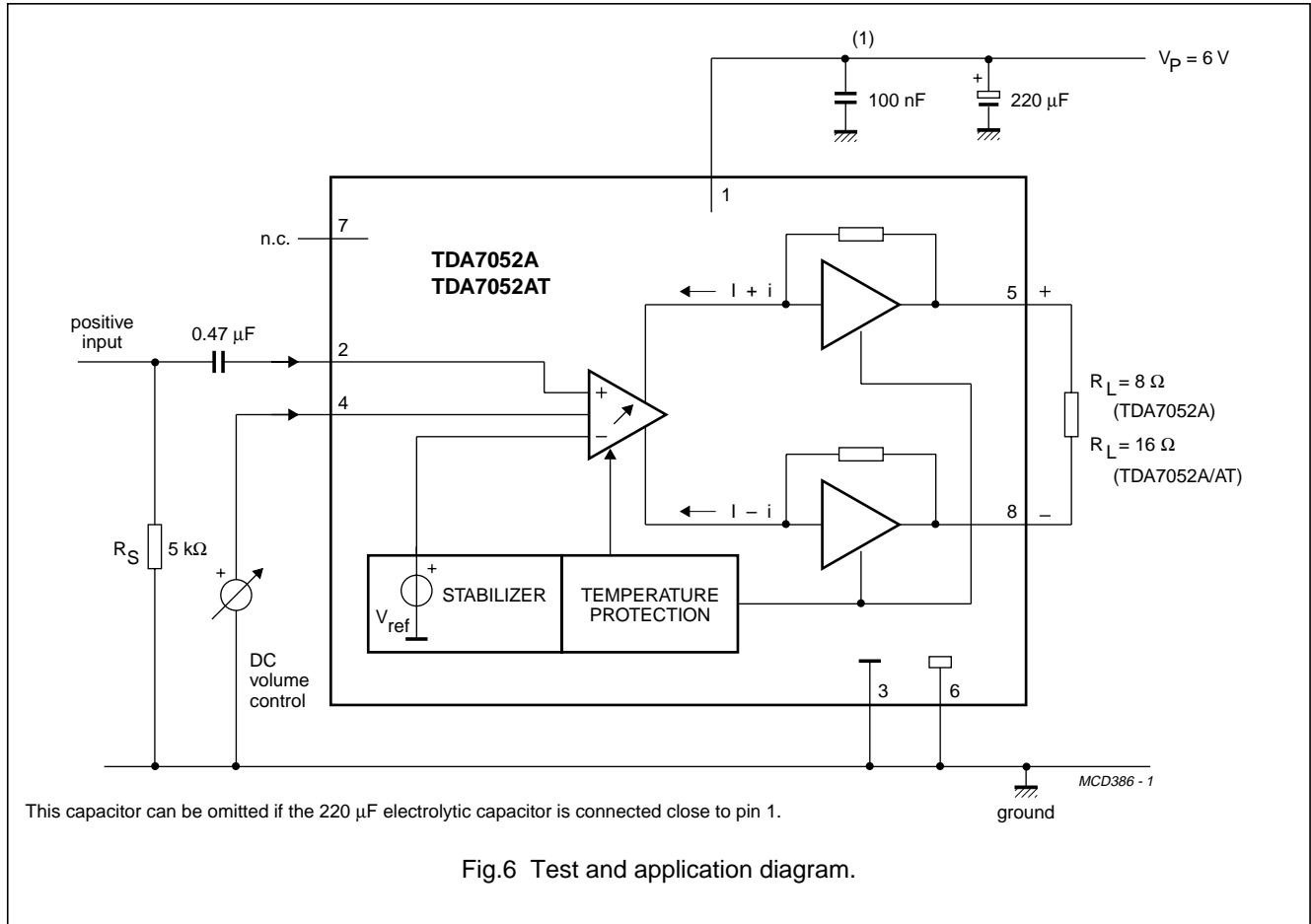


Fig.5 Control current as a function of DC volume control.

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APPLICATION INFORMATION



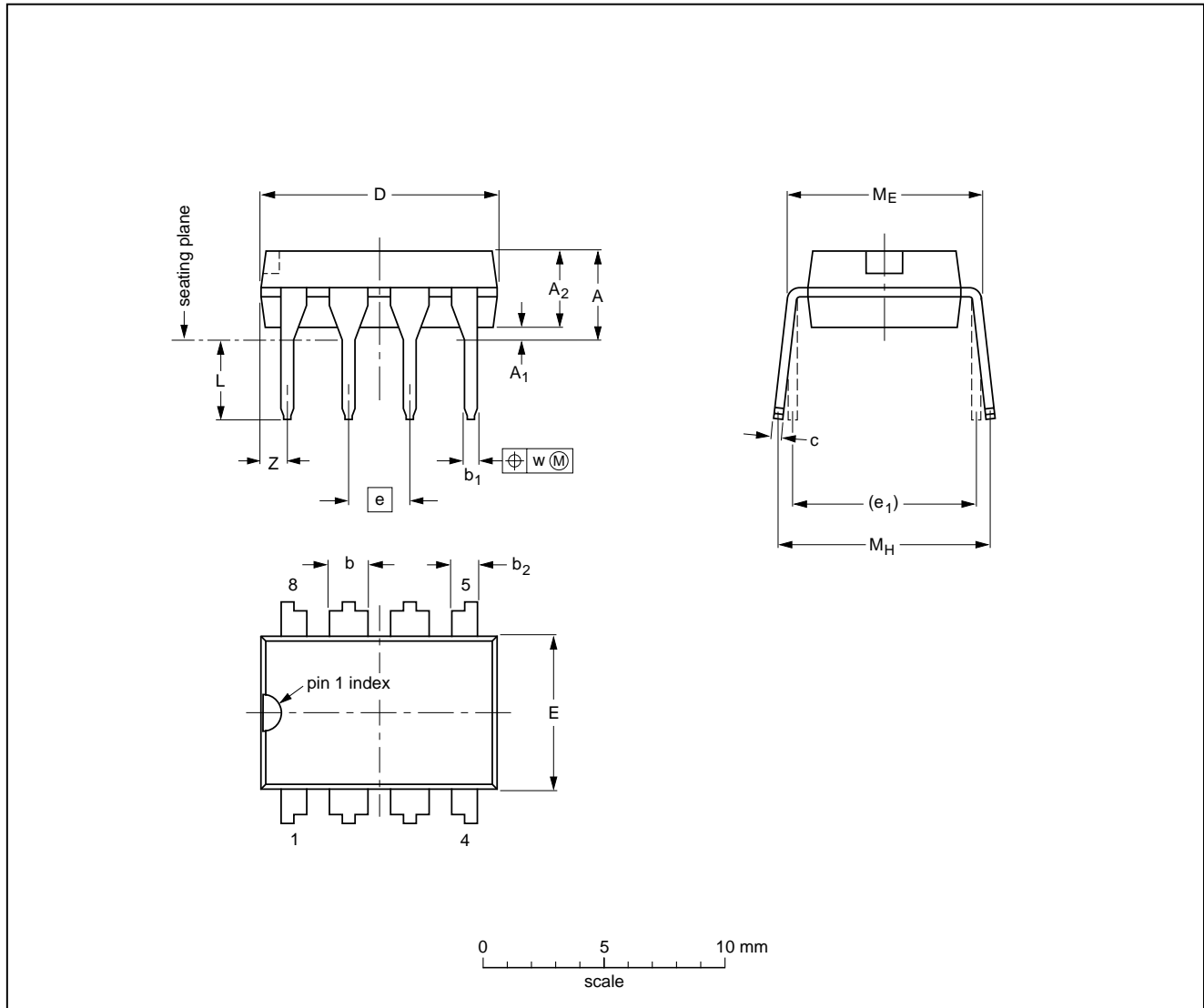
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PACKAGE OUTLINES

DIP8: plastic dual in-line package; 8 leads (300 mil)

SOT97-1



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

| UNIT | A max. | A ₁ min. | A ₂ max. | b | b ₁ | b ₂ | 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 1.14 | 0.53 0.38 | 1.07 0.89 | 0.36 0.23 | 9.8 9.2 | 6.48 6.20 | 2.54 | 7.62 | 3.60 3.05 | 8.25 7.80 | 10.0 8.3 | 0.254 | 1.15 |
| inches | 0.17 | 0.020 | 0.13 | 0.068 0.045 | 0.021 0.015 | 0.042 0.035 | 0.014 0.009 | 0.39 0.36 | 0.26 0.24 | 0.10 | 0.30 | 0.14 0.12 | 0.32 0.31 | 0.39 0.33 | 0.01 | 0.045 |

Note

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

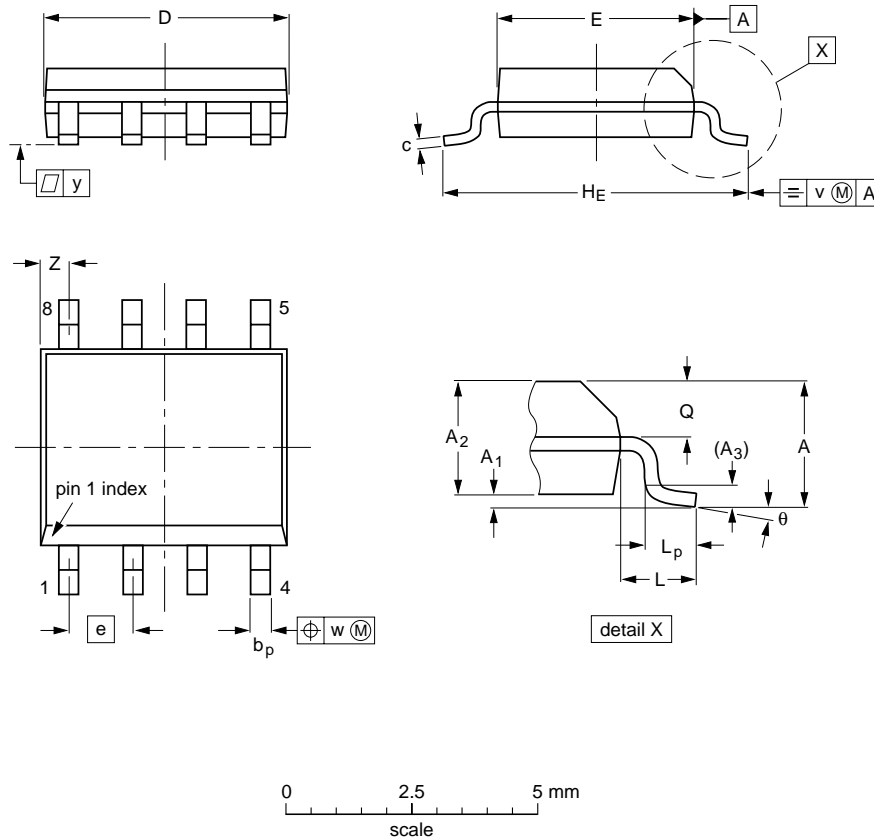
| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|----------|------|--|---------------------|----------------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT97-1 | 050G01 | MO-001AN | | | | 92-11-17 95-02-04 |

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S08: plastic small outline package; 8 leads; body width 3.9 mm

SOT96-1



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 ⁽²⁾ | e | H _E | L | L _p | Q | v | w | y | z ⁽¹⁾ | θ |
|--------|--------|----------------|----------------|----------------|----------------|------------------|------------------|------------------|-------|----------------|-------|----------------|----------------|------|------|-------|------------------|----------|
| mm | 1.75 | 0.25 0.10 | 1.45 1.25 | 0.25 | 0.49 0.36 | 0.25 0.19 | 5.0 4.8 | 4.0 3.8 | 1.27 | 6.2 5.8 | 1.05 | 1.0 0.4 | 0.7 0.6 | 0.25 | 0.25 | 0.1 | 0.7 0.3 | 8° 0° |
| inches | 0.069 | 0.010 0.004 | 0.057 0.049 | 0.01 | 0.019 0.014 | 0.0100 0.0075 | 0.20 0.19 | 0.16 0.15 | 0.050 | 0.244 0.228 | 0.041 | 0.039 0.016 | 0.028 0.024 | 0.01 | 0.01 | 0.004 | 0.028 0.012 | |

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|----------|------|---------------------|----------------------|
| | IEC | JEDEC | EIAJ | | |
| SOT96-1 | 076E03S | MS-012AA | | | 95-02-04 97-05-22 |

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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).

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.

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DEFINITIONS

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

LIFE SUPPORT APPLICATIONS

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