

DATA SHEET

TDA7056A

**3 W BTL mono audio output
amplifier with DC volume control**

Product specification

July 1994



3 W BTL mono audio output amplifier with DC volume control

TDA7056A

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 TDA7056A is a mono BTL output amplifier with DC volume control. It is designed for use in TV and monitors, but also suitable for battery-fed portable recorders and radios.

Missing Current Limiter (MCL)

A MCL protection circuits 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 | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|--------|-------------------------------|--|------|------|------|------|
| V_P | positive supply voltage range | | 4.5 | – | 18 | V |
| P_O | output power | $R_L = 16 \Omega$; $V_P = 12 \text{ V}$ | 3 | 3.5 | – | W |
| G_v | voltage gain | | 34.5 | 35.5 | 36.5 | dB |
| ϕ | gain control range | | 75 | 80 | – | dB |
| I_P | total quiescent current | $V_P = 12 \text{ V}$; $R_L = \infty$ | – | 8 | 16 | mA |
| THD | total harmonic distortion | $V_P = 0.5 \text{ W}$ | – | 0.3 | 1 | % |

ORDERING INFORMATION

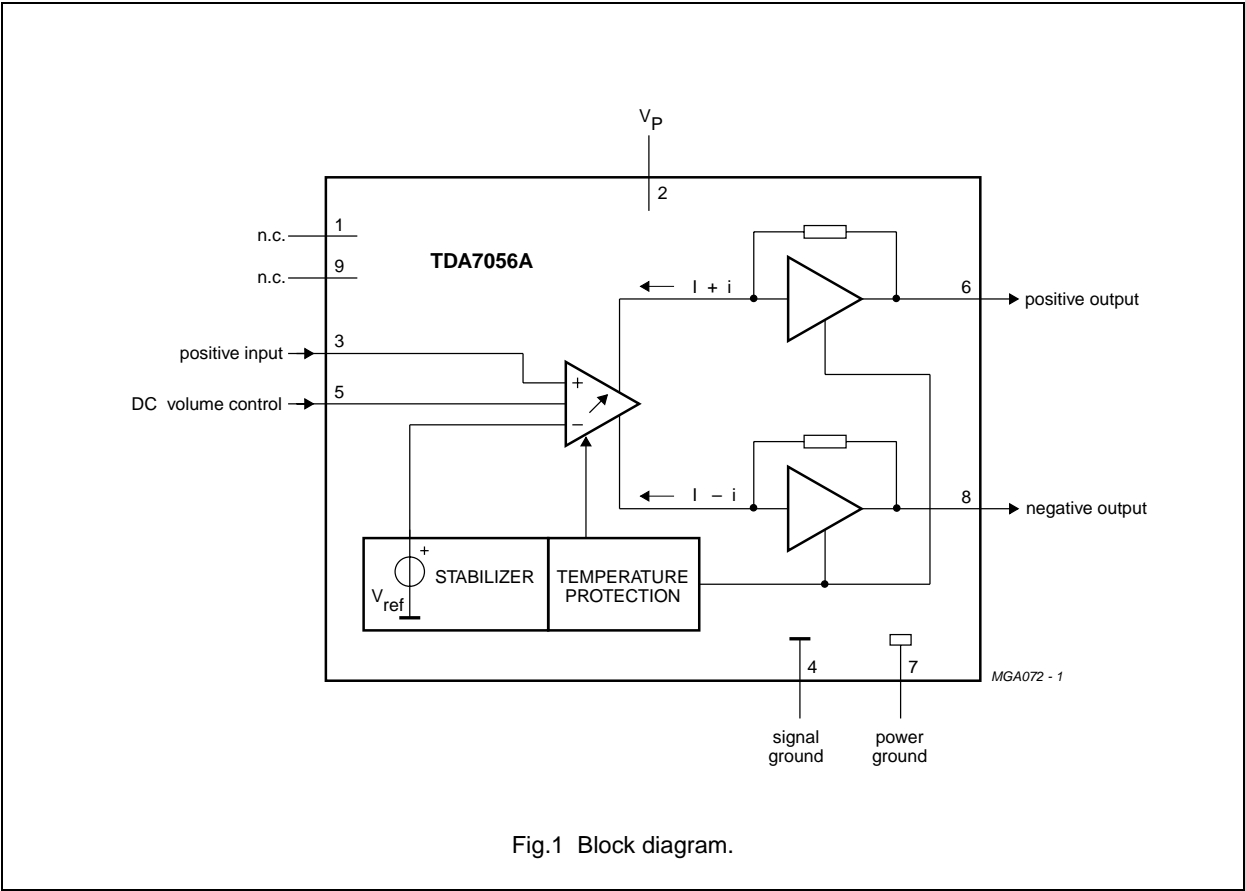
| EXTENDED TYPE NUMBER | PACKAGE | | | |
|----------------------|---------|--------------|----------|-----------------------|
| | PINS | PIN POSITION | MATERIAL | CODE |
| TDA7056A | 9 | SIL | plastic | SOT110 ⁽¹⁾ |

Note

1. SOT110-1.

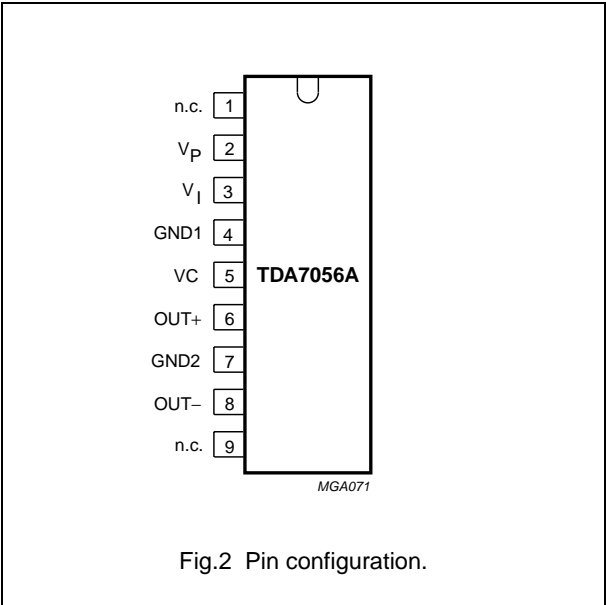
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PINNING

| SYMBOL | PIN | DESCRIPTION |
|--------|-----|-------------------------|
| n.c. | 1 | not connected |
| V_P | 2 | positive supply voltage |
| V_I | 3 | voltage input |
| GND1 | 4 | signal ground |
| VC | 5 | DC volume control |
| OUT+ | 6 | positive output |
| GND2 | 7 | power ground |
| OUT- | 8 | negative output |
| n.c. | 9 | not connected |



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FUNCTIONAL DESCRIPTION

The TDA7056A is a mono BTL output amplifier with DC volume control, designed for use in TV and monitor 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 capacitor to keep the offset voltage low.

In the TDA7056A the DC volume stage is integrated into the input stage so that coupling capacitors are not required and a low offset voltage is maintained.

At the same time the minimum supply voltage 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 and 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. A thermal protection circuit is also implemented. If the crystal temperature rises above +150 °C the gain will be reduced, thereby reducing the output power.

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 | $T_{case} < 60\text{ °C}$ | – | 9 | 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_3 | input voltage pin 3 | | – | 8 | V |
| V_5 | input voltage pin 5 | | – | 8 | V |

THERMAL RESISTANCE

| SYMBOL | PARAMETER | THERMAL RESISTANCE |
|---------------|--------------------------------------|--------------------|
| $R_{th\ j-a}$ | from junction to ambient in free air | 55 K/W |
| $R_{th\ j-c}$ | from junction to case | 10 K/W |

Note to the thermal resistance

$V_P = 12\text{ V}$; $R_L = 16\text{ }\Omega$; The maximum sine-wave dissipation is = 1.8 W. The $R_{th\ vj-a}$ of the package is 55 K/W;
 $T_{amb\ (max)} = 150 - 55 \times 1.8 = 51\text{ °C}$

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CHARACTERISTICS

$V_P = 12\text{ V}$; $f = 1\text{ kHz}$; $R_L = 16\ \Omega$; $T_{\text{amb}} = 25\text{ }^\circ\text{C}$; 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 | $V_P = 12\text{ V}$; $R_L = \infty$; note 1 | – | 8 | 16 | mA |
| Maximum gain ($V_5 = 1.4\text{ V}$) | | | | | | |
| P_O | output power | THD = 10%; $R_L = 16\ \Omega$ THD = 10%; $R_L = 8\ \Omega$ | 3 – | 3.5 5.2 | – – | W W |
| THD | total harmonic distortion | $P_O = 0.5\text{ W}$ | – | 0.3 | 1 | % |
| G_V | voltage gain | | 34.5 | 35.5 | 36.5 | dB |
| V_I | input signal handling | $V_5 = 0.8\text{ V}$; 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 | at –1 dB | – | 20 Hz to 300 kHz | – | |
| SVRR | supply voltage ripple rejection | note 3 | 38 | 46 | – | dB |
| $ V_{\text{off}} $ | DC output offset voltage | | – | 0 | 150 | mV |
| Z_I | input impedance pin 3 | | 15 | 20 | 25 | k Ω |
| Minimum gain ($V_5 = 0.5\text{ V}$) | | | | | | |
| 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 | $V_5 \leq 0.3\text{ V}$; $V_I = 600\text{ mV}$ | – | – | 30 | μV |
| DC volume control | | | | | | |
| ϕ | gain control range | | 75 | 80 | – | dB |
| I_5 | control current | $V_5 = 0\text{ V}$ | 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 divided 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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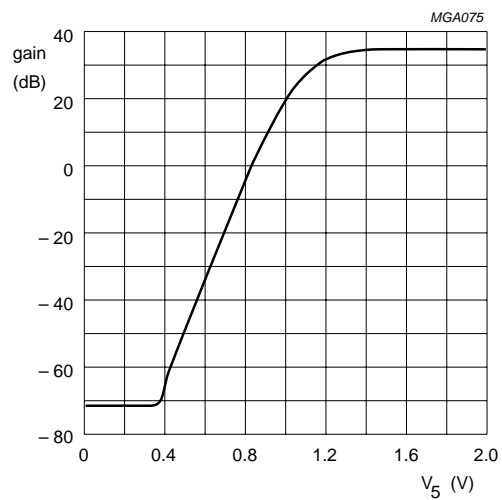
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Fig.3 Gain as a function of DC volume control.

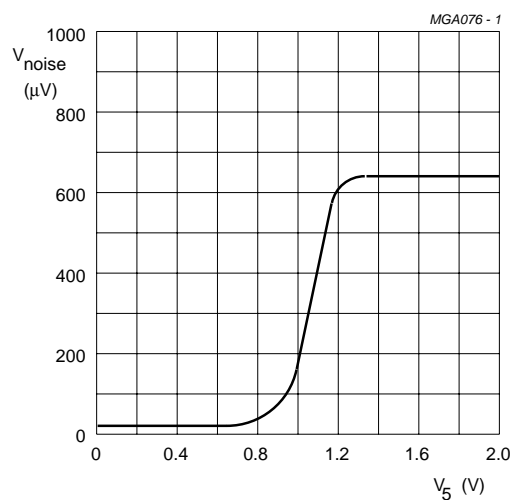


Fig.4 Noise output voltage as a function of DC volume control.

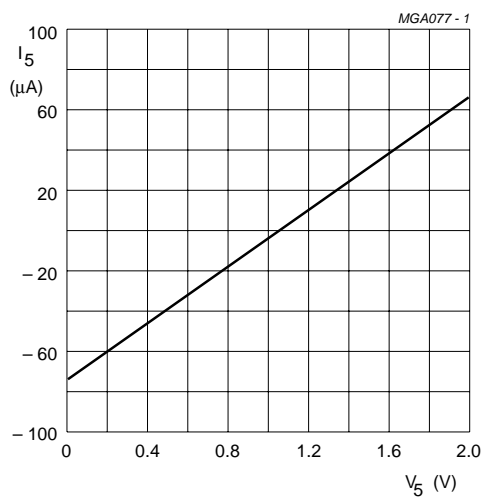
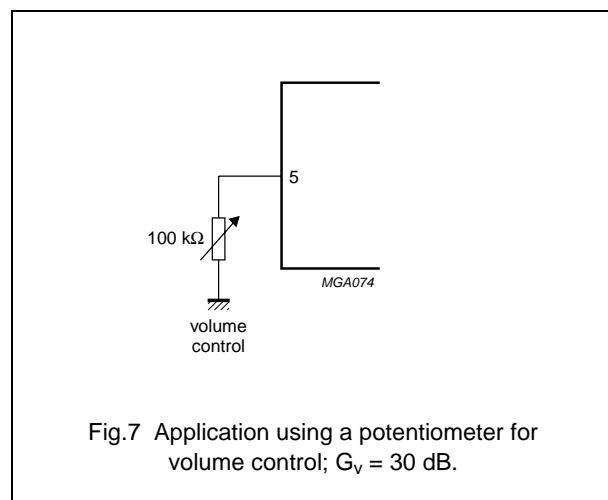
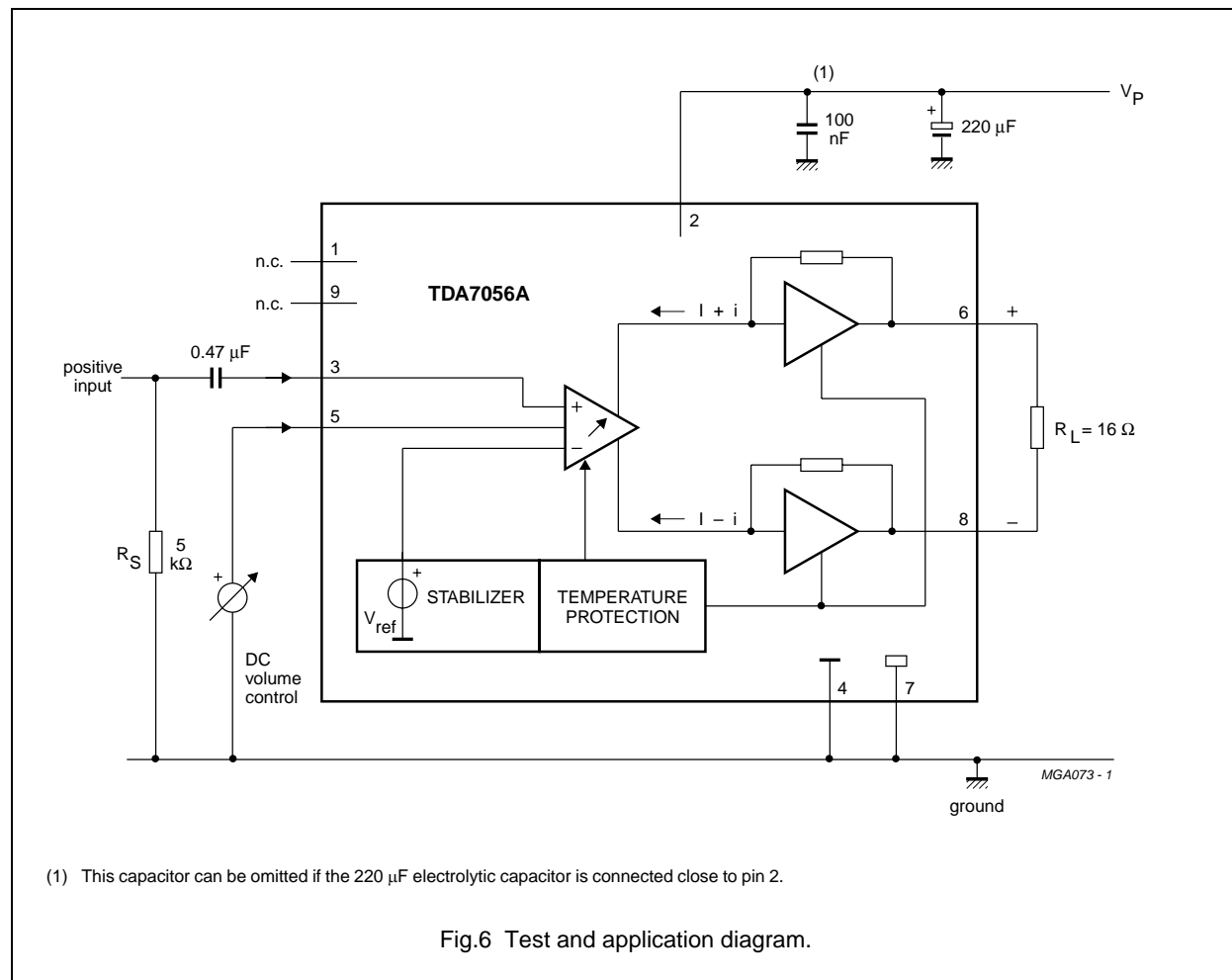


Fig.5 Control current as a function of DC volume control.

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APPLICATION INFORMATION



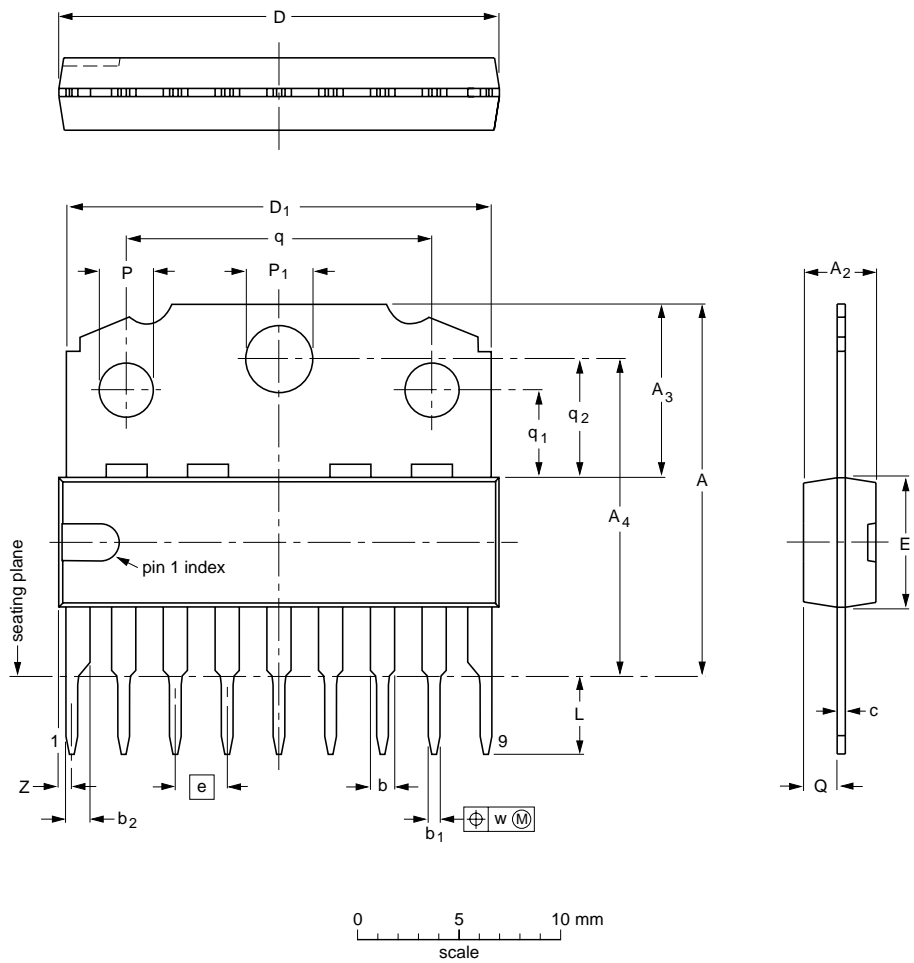
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PACKAGE OUTLINE

SIL9MPF: plastic single in-line medium power package with fin; 9 leads

SOT110-1

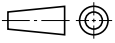


DIMENSIONS (mm are the original dimensions)

| UNIT | A | A ₂ max. | A ₃ | A ₄ | b | b ₁ | b ₂ | c | D ⁽¹⁾ | D ₁ | E ⁽¹⁾ | e | L | P | P ₁ | Q | q | q ₁ | q ₂ | w | Z ⁽¹⁾ max. |
|------|--------------|------------------------|----------------|----------------|--------------|----------------|----------------|--------------|------------------|----------------|------------------|------|------------|--------------|----------------|--------------|--------------|----------------|----------------|------|--------------------------|
| mm | 18.5 17.8 | 3.7 | 8.7 8.0 | 15.8 15.4 | 1.40 1.14 | 0.67 0.50 | 1.40 1.14 | 0.48 0.38 | 21.8 21.4 | 21.4 20.7 | 6.48 6.20 | 2.54 | 3.9 3.4 | 2.75 2.50 | 3.4 3.2 | 1.75 1.55 | 15.1 14.9 | 4.4 4.2 | 5.9 5.7 | 0.25 | 1 |

Note

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

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|--------------------|------------|-------|-------|--|---|----------------------|
| | IEC | JEDEC | JEITA | | | |
| SOT110-1 | | | | |  | 95-02-25 03-03-12 |

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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 ($T_{\text{stg max}}$). 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.

DATA SHEET STATUS

| DOCUMENT STATUS ⁽¹⁾ | PRODUCT STATUS ⁽²⁾ | DEFINITION |
|--------------------------------|-------------------------------|---|
| Objective data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary data sheet | Qualification | This document contains data from the preliminary specification. |
| Product data sheet | Production | This document contains the product specification. |

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