

# DATA SHEET

## **TDA7056B**

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

Product specification  
Supersedes data of 1996 May 28  
File under Integrated Circuits, IC01

1997 Aug 15

## 5 W mono BTL audio amplifier with DC volume control

### TDA7056B

#### FEATURES

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

#### GENERAL DESCRIPTION

The TDA7056B is a mono Bridge-Tied Load (BTL) output amplifier with DC volume control.

It is designed for use in TV and monitors, but is also suitable for battery-fed portable recorders and radios. The device is contained in a 9-pin medium power package.

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

#### QUICK REFERENCE DATA

| SYMBOL              | PARAMETER                  | CONDITIONS   | MIN.   | TYP.       | MAX.   | UNIT   |
|---------------------|----------------------------|--|--------|------------|--------|--------|
| $V_P$               | supply voltage             |  | 4.5    | –          | 18     | V      |
| $P_O$               | output power               | $V_P = 12\text{ V}$<br>$R_L = 16\ \Omega$<br>$R_L = 8\ \Omega$ | 3<br>5 | 3.5<br>5.5 | –<br>– | W<br>W |
| $G_{V(\max)}$       | maximum total voltage gain |  | 39.5   | 40.5       | 41.5   | dB     |
| $\phi$              | gain control               |  | 68     | 73.5       | –      | dB     |
| $I_{q(\text{tot})}$ | total quiescent current    | $V_P = 12\text{ V}; R_L = \infty$                              | –      | 9.2        | 13     | mA     |
| THD                 | total harmonic distortion  | $P_O = 0.5\text{ W}$   | –      | 0.3        | 1      | %      |

#### ORDERING INFORMATION

| TYPE NUMBER | PACKAGE |   |          |
|-------------|---------|---|----------|
|             | NAME    | DESCRIPTION   | VERSION  |
| TDA7056B    | SIL9MPF | plastic single in-line medium power package with fin; 9 leads | SOT110-1 |

# 5 W mono BTL audio amplifier with DC volume control

TDA7056B

## BLOCK DIAGRAM

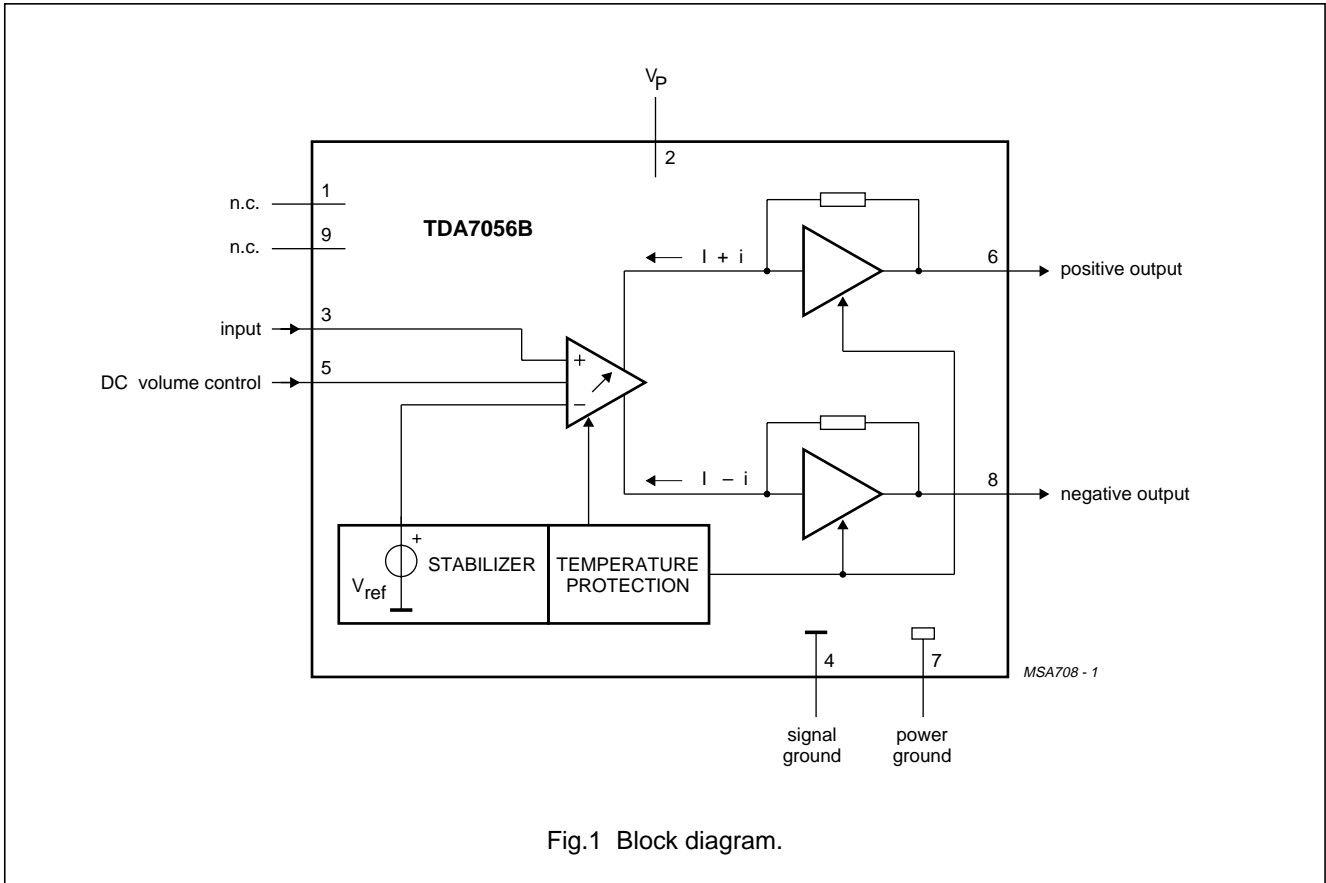


Fig.1 Block diagram.

## 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           |

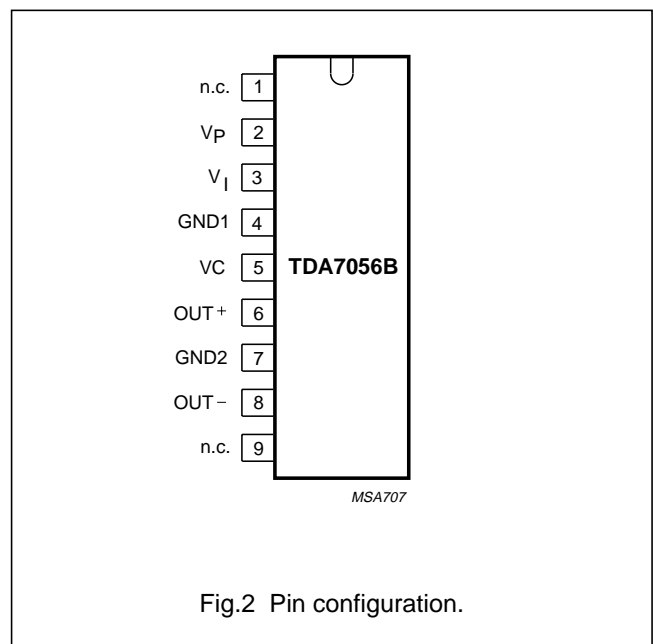


Fig.2 Pin configuration.

## 5 W mono BTL audio amplifier with DC volume control

TDA7056B

### FUNCTIONAL DESCRIPTION

The TDA7056B is a mono BTL output amplifier with DC volume control, designed for use in TV and monitor but is 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 TDA7056B the DC volume control stage is integrated into the input stage so that no coupling capacitors are required. With this configuration, a low offset voltage is still maintained and 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.

Consequently, a reduced power supply with smaller capacitors can be used which results in cost reductions. 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 40.5 dB. The DC volume control stage has a logarithmic control characteristic. Therefore, the total gain can be controlled from 40.5 dB to -33 dB. If the DC volume control voltage falls below 0.4 V, the device will switch 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, thereby reducing the output power. Special attention is given to switch-on and switch-off clicks, low HF radiation and a good overall stability.

### Power dissipation

Assume  $V_P = 12$  V;  $R_L = 16$  Ω.

The maximum sine wave dissipation is = 1.8 W.

The  $R_{th\ j-a}$  of the package is 55 K/W.

Therefore  $T_{amb\ (max)} = 150 - 55 \times 1.8 = 51$  °C.

### LIMITING VALUES

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

| SYMBOL    | PARAMETER                          | CONDITIONS         | MIN. | MAX. | UNIT |
|-----------|------------------------------------|--------------------|------|------|------|
| $V_P$     | supply voltage                     |                    | -    | 18   | V    |
| $V_{3,5}$ | input voltage pins 3 and 5         |                    | -    | 5    | 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            | $T_{case} < 60$ °C | -    | 9    | W    |
| $T_{amb}$ | operating ambient temperature      |                    | -40  | +85  | °C   |
| $T_{stg}$ | storage temperature                |                    | -55  | +150 | °C   |
| $T_{vj}$  | virtual junction temperature       |                    | -    | +150 | °C   |
| $T_{sc}$  | short-circuit time                 |                    | -    | 1    | h    |

### THERMAL CHARACTERISTICS

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

# 5 W mono BTL audio amplifier with DC volume control

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## CHARACTERISTICS

$V_P = 12\text{ V}$ ;  $V_{DC} = 1.4\text{ V}$ ;  $f = 1\text{ kHz}$ ;  $R_L = 16\ \Omega$ ;  $T_{amb} = 25\text{ }^\circ\text{C}$ ; unless otherwise specified (see Fig.13).

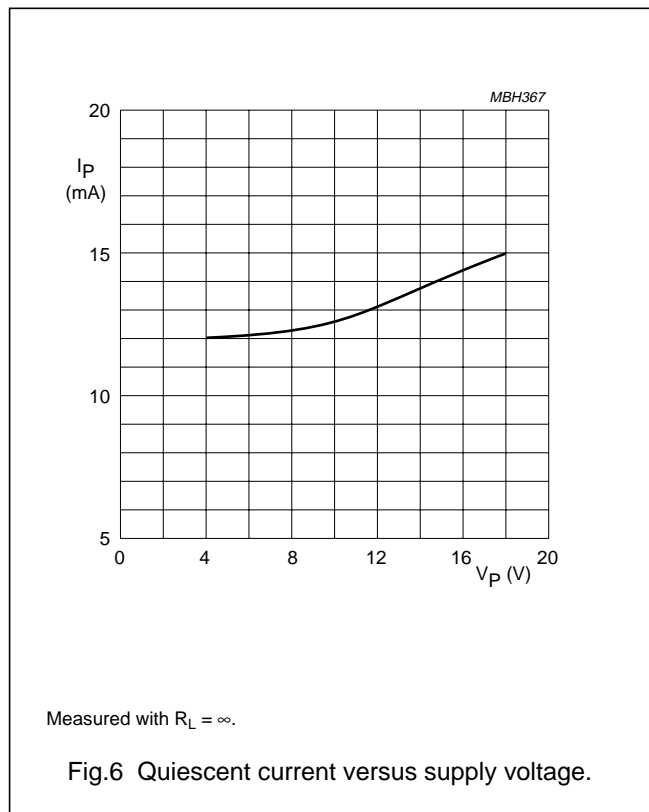
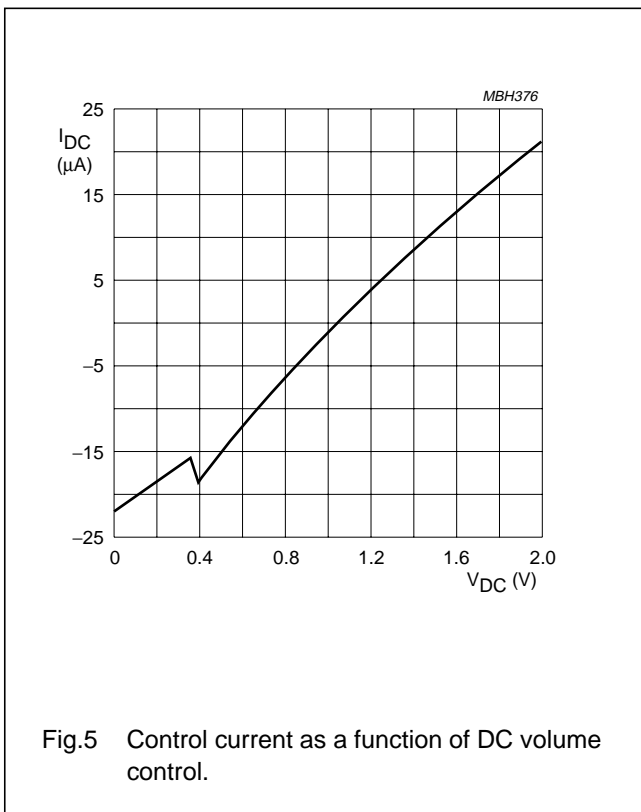
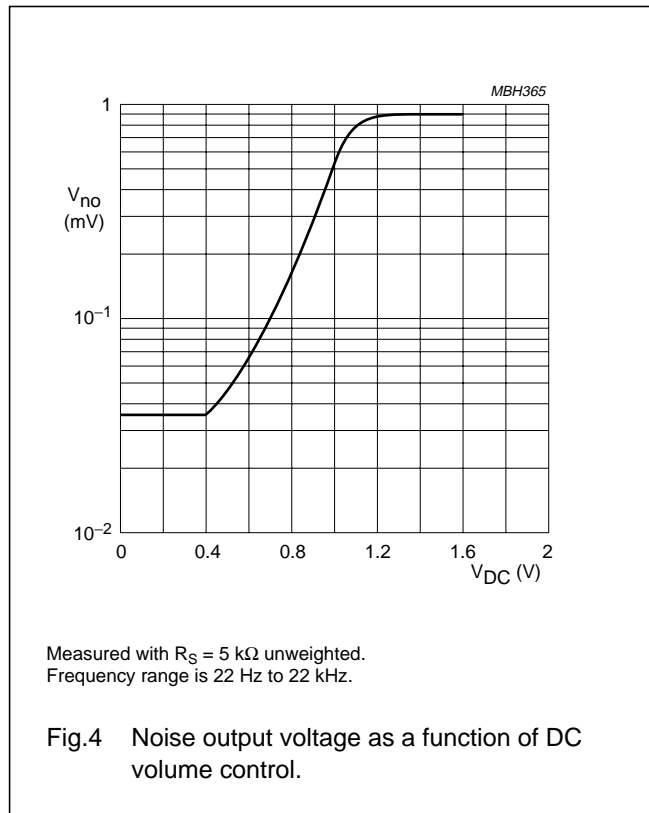
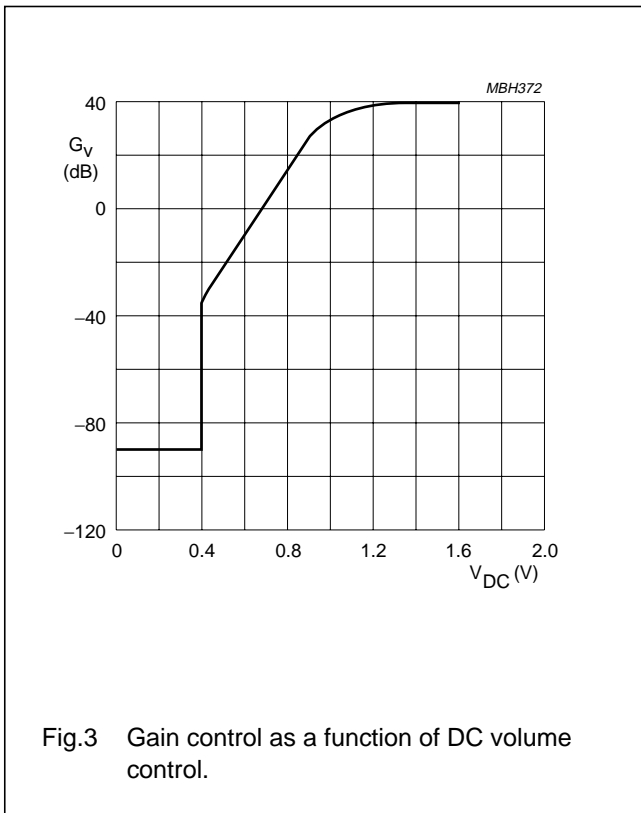
| SYMBOL  | PARAMETER                         | CONDITIONS  | MIN. | TYP.        | MAX. | UNIT             |
|---|-----------------------------------|---|------|-------------|------|------------------|
| <b>Supply</b>   |                                   |   |      |             |      |                  |
| $V_P$   | positive supply voltage           |   | 4.5  | –           | 18   | V                |
| $I_{q(\text{tot})}$                                   | total quiescent current           | note 1; $R_L = \infty$                                    | –    | 9.2         | 13   | mA               |
| <b>Maximum gain (<math>V_5 = 1.4\text{ V}</math>)</b> |                                   |   |      |             |      |                  |
| $P_O$   | output power                      | THD = 10%; $R_L = 16\ \Omega$                             | 3    | 3.5         | –    | W                |
|   |                                   | THD = 10%; $R_L = 8\ \Omega$                              | 5    | 5.5         | –    | W                |
| THD   | total harmonic distortion         | $P_O = 0.5\text{ W}$                                      | –    | 0.3         | 1    | %                |
| $G_{V(\text{max})}$                                   | maximum total voltage gain        |   | 39.5 | 40.5        | 41.5 | dB               |
| $V_I$   | input signal handling (RMS value) | $G_{V(\text{max})} = 0\text{ dB}$ ; THD < 1%              | 1.0  | –           | –    | V                |
| $V_{no}$  | noise output voltage (RMS value)  | note 2; $f = 500\text{ kHz}$                              | –    | 210         | –    | $\mu\text{V}$    |
| B   | bandwidth                         | at –1 dB  | –    | 0.02 to 300 | –    | kHz              |
| SVRR  | supply voltage ripple rejection   | note 3  | 34   | 38          | –    | dB               |
| $ \Delta V_O $  | DC output offset voltage          | $ V_8 - v_6 $   | –    | 0           | 200  | mV               |
| $Z_I$   | input impedance (pin 3)           |   | 15   | 20          | 25   | $\text{k}\Omega$ |
| <b>Mute position</b>                                  |                                   |   |      |             |      |                  |
| $V_O$   | output voltage in mute position   | note 4; $V_5 \leq 0.4\text{ V}$ ;<br>$V_I = 1.0\text{ V}$ | –    | 35          | 45   | $\mu\text{V}$    |
| <b>DC volume control; note 5</b>                      |                                   |   |      |             |      |                  |
| $\phi$  | gain control                      |   | 68   | 73.5        | –    | dB               |
| $I_5$   | control current                   | $V_5 = 0\text{ V}$  | –20  | –25         | –30  | $\mu\text{A}$    |

## Notes

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  $B = 5\text{ kHz}$ .
3. The ripple rejection is measured with  $R_S = 0\ \Omega$  and  $f = 100\text{ Hz}$  to  $10\text{ kHz}$ . The ripple voltage  $V_R$  of  $200\text{ mV}$  (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.
5. The DC volume control can be configured in several ways. Two possible circuits are shown in Figs 14 and 15. The circuits at the volume control pin will influence the switch-on and switch-off behaviour and the maximum voltage gain.

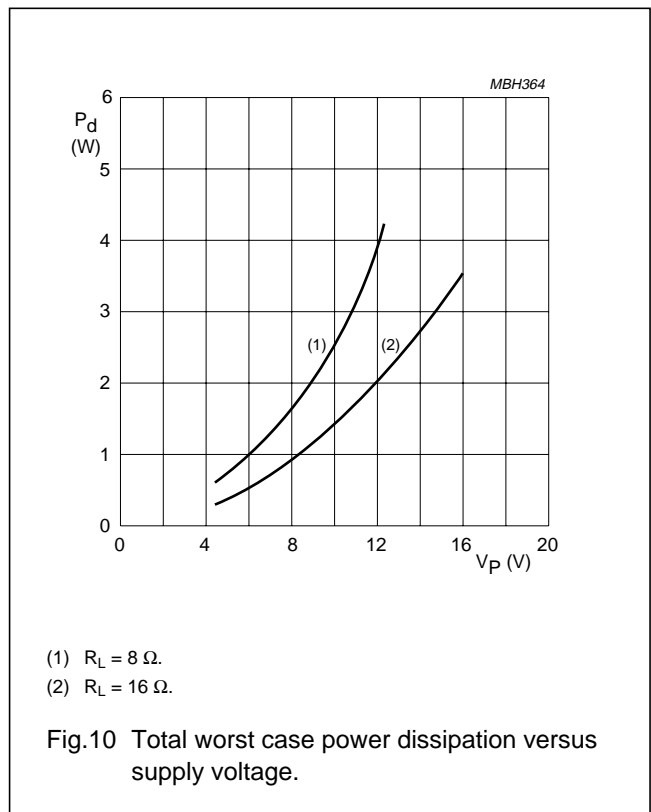
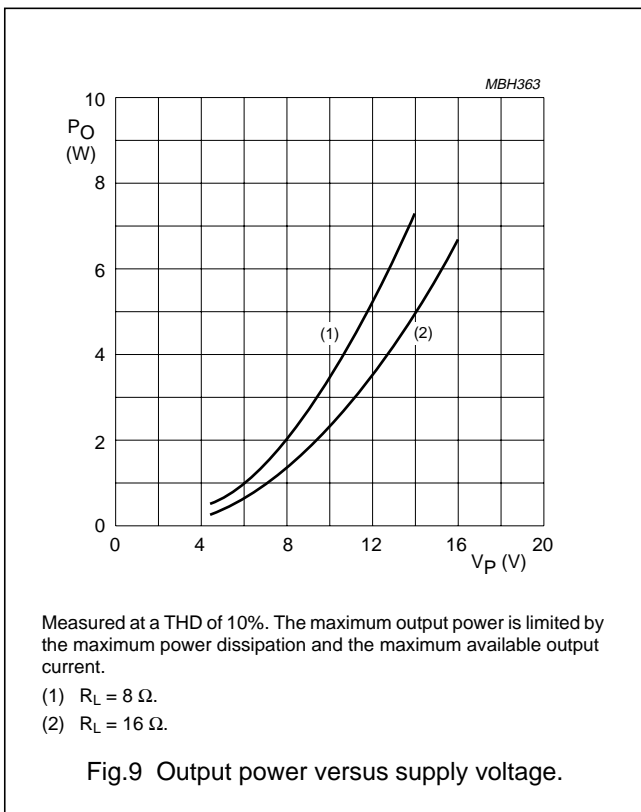
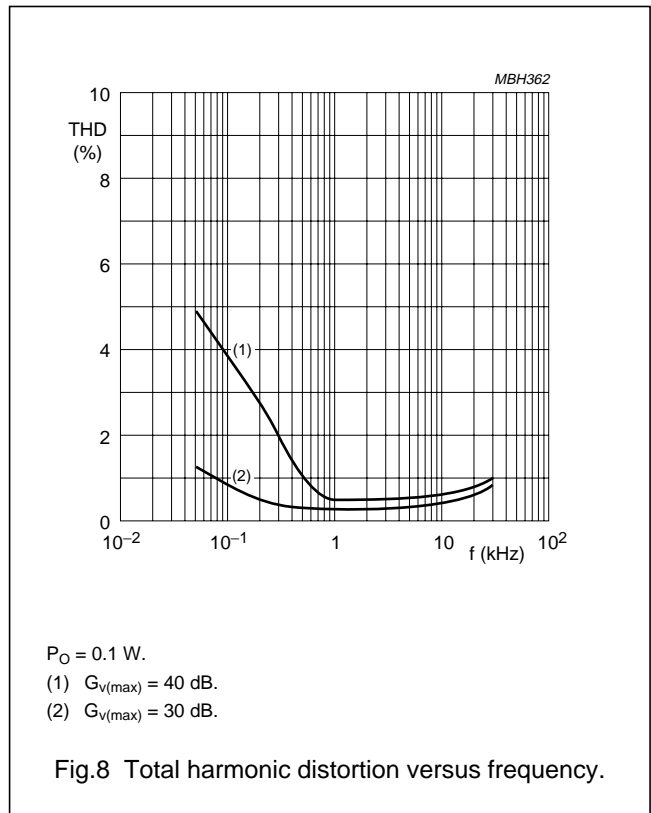
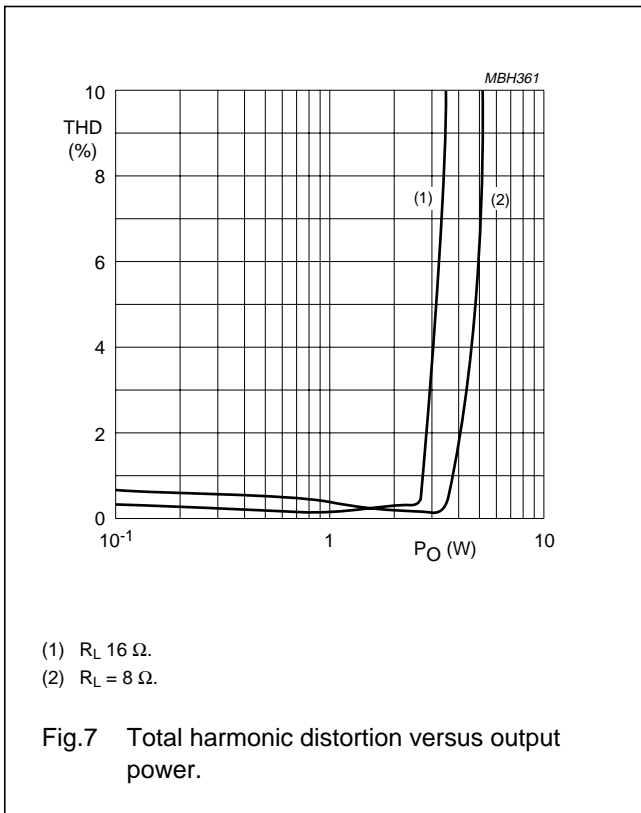
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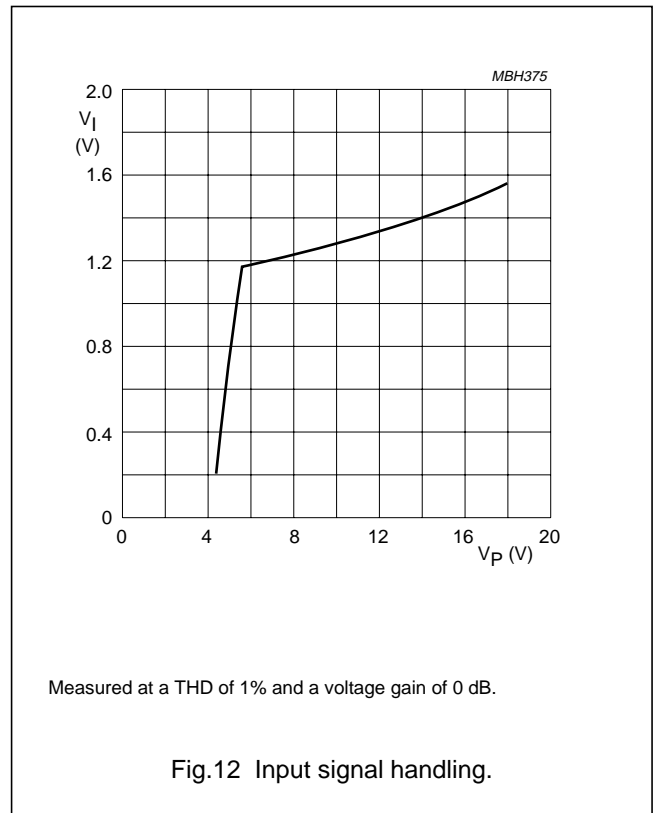
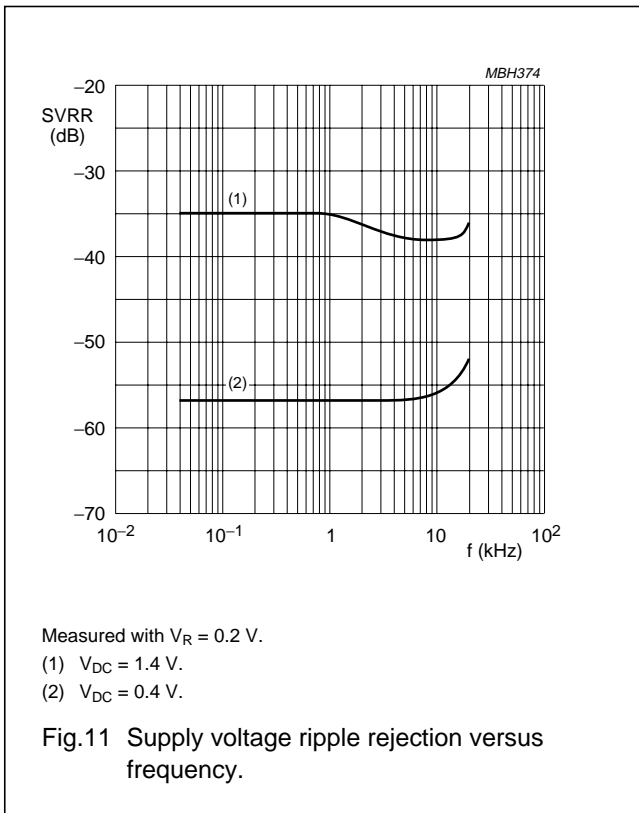
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5 W mono BTL audio amplifier with DC volume control

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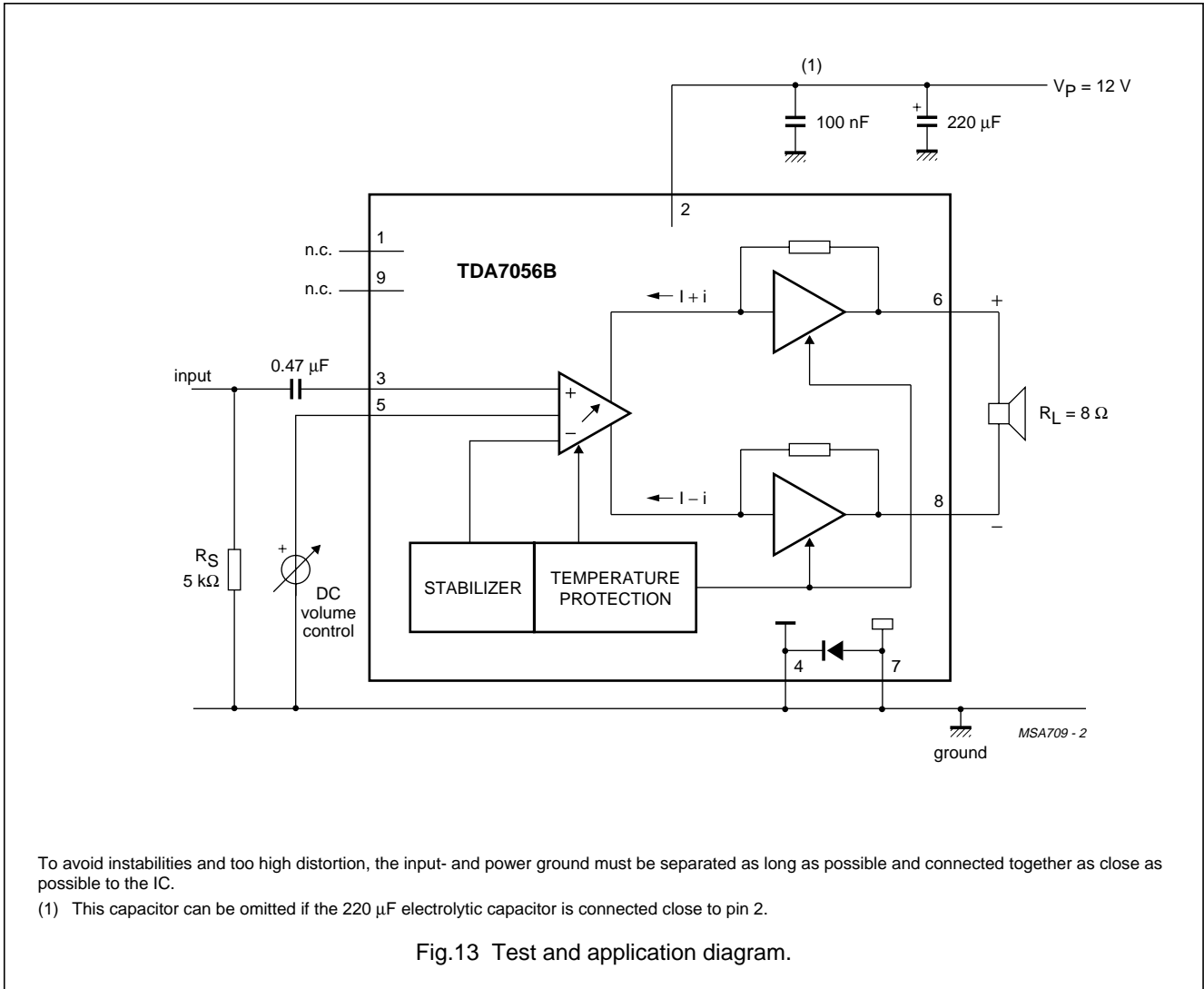




5 W mono BTL audio amplifier with DC volume control

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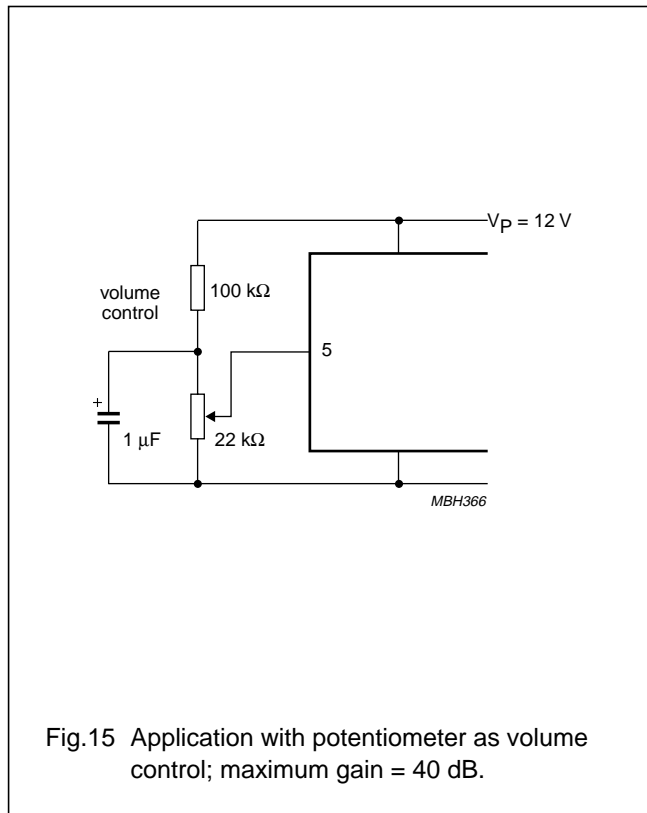
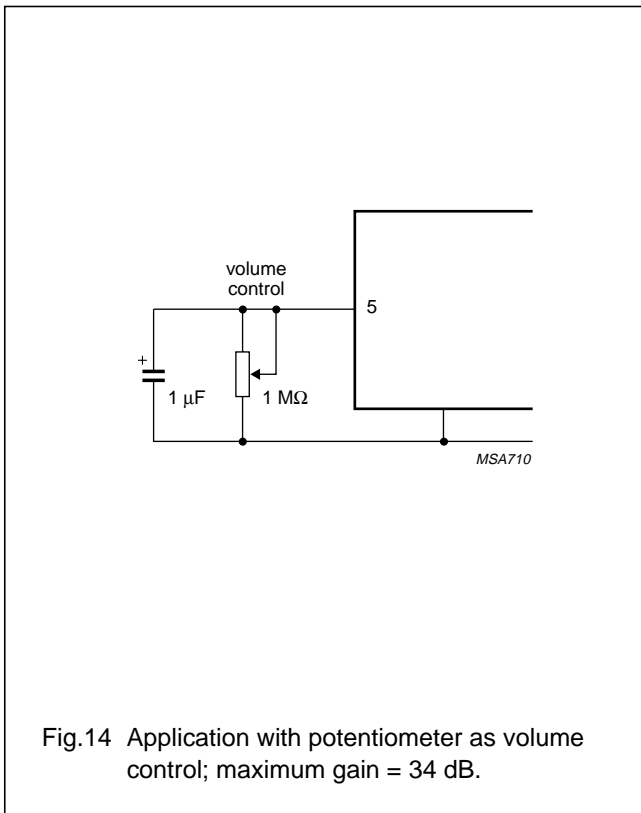
TEST AND APPLICATION INFORMATION



For single-end application the output peak current may not exceed 100 mA; at higher output currents the short circuit protection (MLC) will be activated.

# 5 W mono BTL audio amplifier with DC volume control

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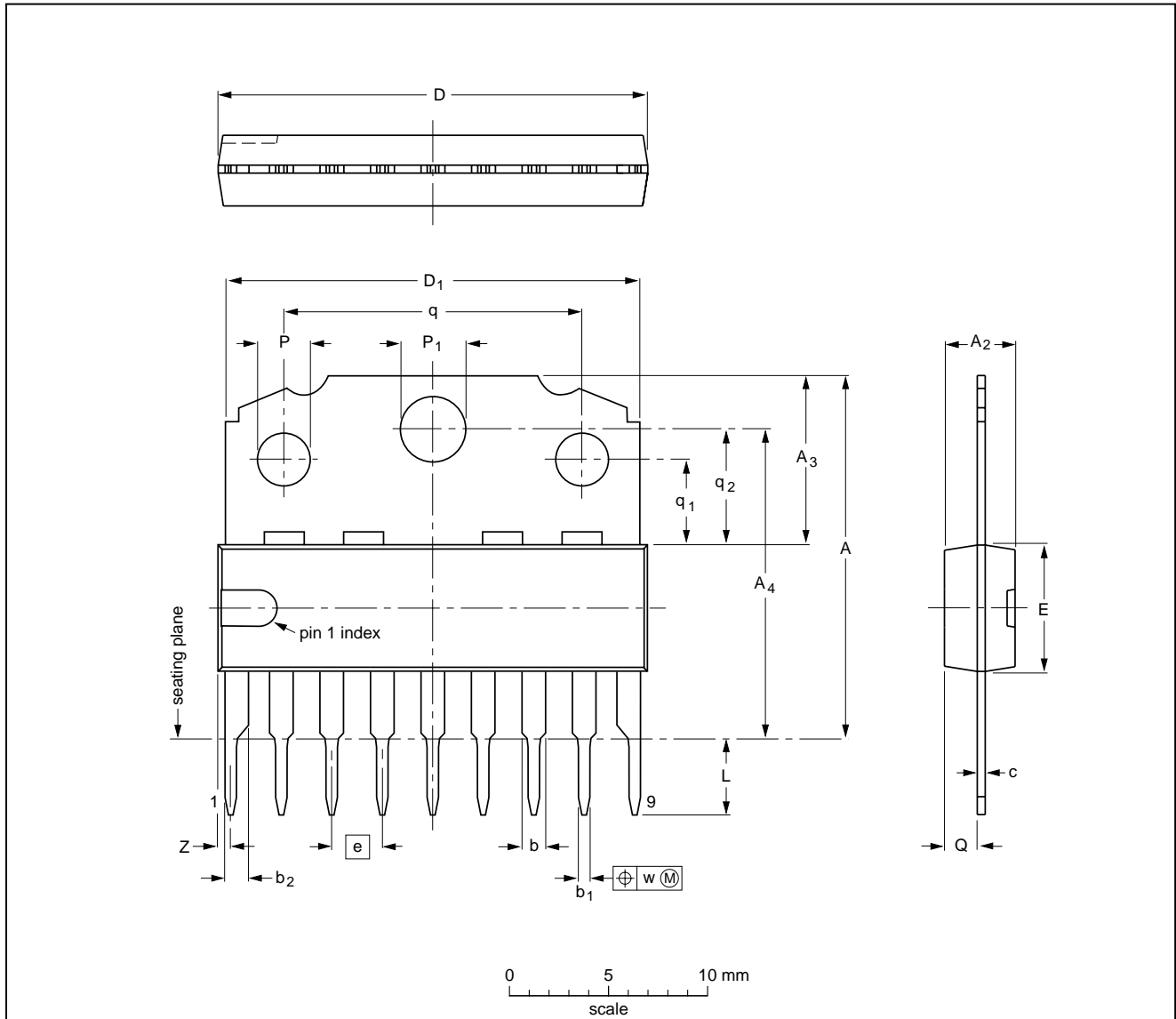
5 W mono BTL audio amplifier with DC volume control

TDA7056B

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 <sub>2</sub> max. | A <sub>3</sub> | A <sub>4</sub> | b            | b <sub>1</sub> | b <sub>2</sub> | c            | D <sup>(1)</sup> | D <sub>1</sub> | E <sup>(1)</sup> | e    | L          | P            | P <sub>1</sub> | Q            | q            | q <sub>1</sub> | q <sub>2</sub> | w    | Z <sup>(1)</sup> max. |
|------|--------------|---------------------|----------------|----------------|--------------|----------------|----------------|--------------|------------------|----------------|------------------|------|------------|--------------|----------------|--------------|--------------|----------------|----------------|------|-----------------------|
| mm   | 18.5<br>17.8 | 3.7                 | 8.7<br>8.0     | 15.8<br>15.4   | 1.40<br>1.14 | 0.67<br>0.50   | 1.40<br>1.14   | 0.48<br>0.38 | 21.8<br>21.4     | 21.4<br>20.7   | 6.48<br>6.20     | 2.54 | 3.9<br>3.4 | 2.75<br>2.50 | 3.4<br>3.2     | 1.75<br>1.55 | 15.1<br>14.9 | 4.4<br>4.2     | 5.9<br>5.7     | 0.25 | 1.0                   |

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 |  |                     |                      |
| SOT110-1        |            |       |      |  |                     | 92-11-17<br>95-02-25 |

## 5 W mono BTL audio amplifier with DC volume control

TDA7056B

### 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.   |   |

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5 W mono BTL audio amplifier with DC  
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Printed in The Netherlands

547027/1200/03/pp16

Date of release: 1997 Aug 15

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