

DATA SHEET

TDA1013B

**4 W audio power amplifier with
DC volume control**

Product specification
File under Integrated Circuits, IC01

July 1994

4 W audio power amplifier with DC volume control

TDA1013B

GENERAL DESCRIPTION

The TDA1013B is an integrated audio amplifier circuit with DC volume control, encapsulated in a 9-lead single in-line (SIL) plastic package. The wide supply voltage range makes this circuit ideal for applications in mains and battery-fed apparatus such as television receivers and record players.

The DC volume control stage has a logarithmic control characteristic with a range of more than 80 dB; control is by means of a DC voltage variable between 2 and 6.5 V.

The audio amplifier has a well defined open loop gain and a fixed integrated closed loop. This device requires only a few external components and offers stability and performance.

Features

- Few external components
- Wide supply voltage range
- Wide control range
- Pin compatible with TDA1013A
- Fixed gain
- High signal-to-noise ratio
- Thermal protection

QUICK REFERENCE DATA

| PARAMETER | CONDITIONS | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|--------------------------------|----------------------------------------------------|----------------|------|------|------|------------|
| Supply voltage | | V_P | 10 | 18 | 40 | V |
| Repetitive peak output current | | I_{ORM} | — | — | 1.5 | A |
| Total sensitivity | $P_o = 2.5 \text{ W}$; DC control at max. gain | V_i | 44 | 55 | 69 | mV |
| Audio amplifier | | | | | | |
| Output power | $\text{THD} = 10\%$; $R_L = 8 \Omega$ | P_o | 4.0 | 4.2 | — | W |
| Total harmonic distortion | $P_o = 2.5 \text{ W}$; $R_L = 8 \Omega$ | THD | — | 0.15 | 0.1 | % |
| Sensitivity | $P_o = 2.5 \text{ W}$ | V_i | 100 | 125 | 160 | mV |
| DC volume control unit | | | | | | |
| Gain control range | | $ \Delta G_v $ | 80 | — | — | dB |
| Signal handling | $\text{THD} < 1\%$; DC control = 0 dB | V_i | 1.2 | 1.7 | — | V |
| Sensitivity (pin 6) | $V_o = 125 \text{ mV}$; max. voltage gain | V_i | 39 | 45 | 55 | mV |
| Input impedance (pin 8) | | $ Z_i $ | 23 | 29 | 35 | k Ω |

PACKAGE OUTLINE

9-lead SIL; plastic (SOT110B); SOT110-1; 1996 July 23.

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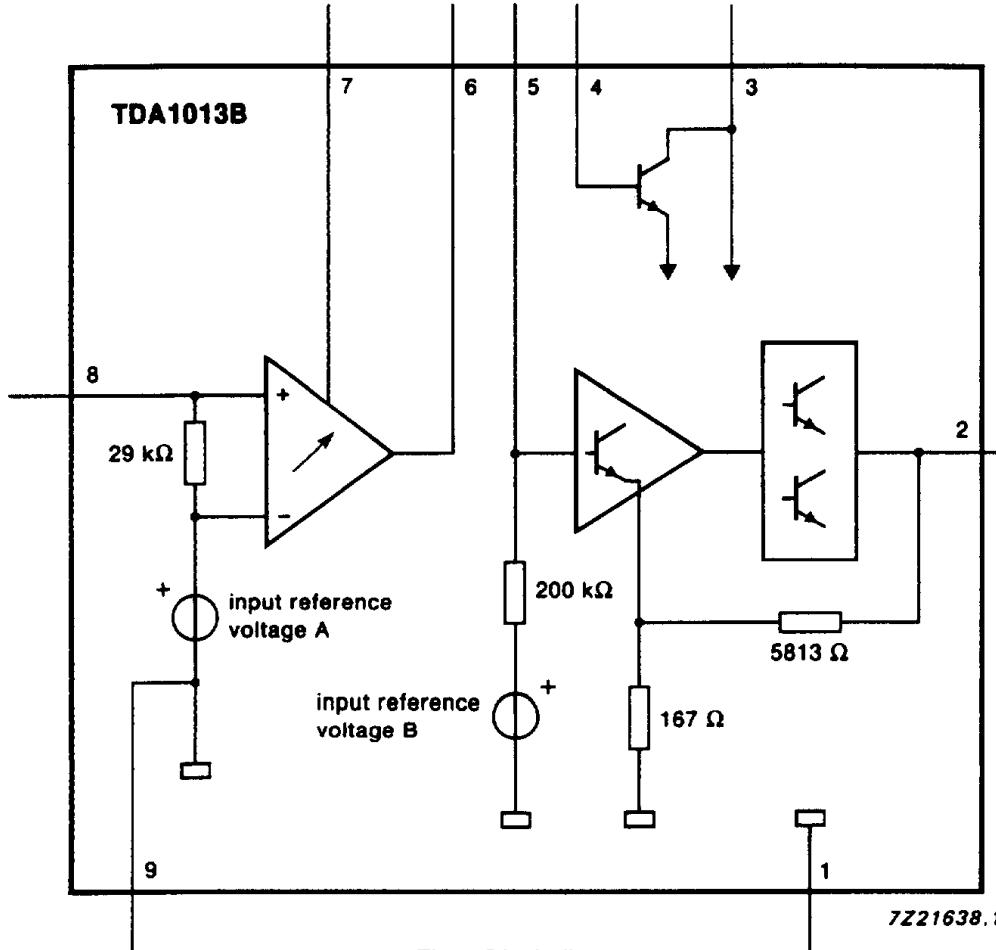


Fig.1 Block diagram.

PINNING

1. power ground
2. amplifier output
3. supply voltage
4. electronic filter
5. amplifier input
6. control unit output
7. control voltage
8. control unit input
9. signal ground (substrate)

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RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

| SYMBOL | PARAMETER | MIN. | MAX. | UNIT |
|-----------|------------------------------------|-----------|------|------|
| V_P | Supply voltage | — | 40 | V |
| I_{OSM} | Non-repetitive peak output current | — | 3 | A |
| I_{ORM} | Repetitive peak output current | — | 1.5 | A |
| T_{stg} | Storage temperature range | -55 | +150 | °C |
| T_c | Crystal temperature | — | +150 | °C |
| P_{tot} | Total power dissipation | see Fig.2 | | |

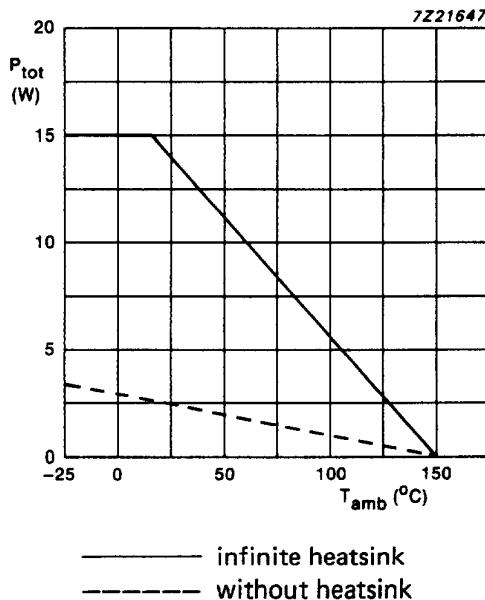


Fig.2 Power derating curve.

HEATSINK DESIGN EXAMPLE

Assume $V_P = 18$ V; $R_L = 8 \Omega$; $T_{amb} = 60$ °C; $T_c = 150$ °C (max.); for a 4 W application, the maximum dissipation is approximately 2.5 W. The thermal resistance from junction to ambient can be expressed as:

$$R_{th\ j-a} = R_{th\ j-tab} + R_{th\ tab-h} + R_{th\ h-a} =$$

$$\frac{T_{j\ max} - T_{amb\ max}}{P_{max}} = \frac{150 - 60}{2.5} = 36 \text{ K/W}$$

Since $R_{th\ j-tab} = 9$ K/W and $R_{th\ tab-h} = 1$ K/W, $R_{th\ h-a} = 36 - (9 + 1) = 26$ K/W.

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CHARACTERISTICS

$V_P = 18 \text{ V}$; $R_L = 8 \Omega$; $f = 1 \text{ kHz}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$; see Fig.10; unless otherwise specified

| PARAMETER | CONDITIONS | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|--------------------------------|----------------------------------------------------|------------------|------|-----------------|------|------------|
| Supply voltage range | | V_P | 10 | 18 | 40 | V |
| Total quiescent current | | I_{tot} | — | 25 | 60 | mA |
| Noise output voltage | note 1 | | | | | |
| at maximum gain | $R_S = 0 \Omega$ | V_n | — | 0.5 | — | mV |
| at maximum gain | $R_S = 5 \text{ k}\Omega$ | V_n | — | 0.6 | 1.4 | mV |
| at minimum gain | $R_S = 0 \Omega$ | V_n | — | 0.25 | — | mV |
| Total sensitivity | $P_o = 2.5 \text{ W}$; DC control at max. gain | V_i | 44 | 55 | 69 | mV |
| Audio amplifier | | | | | | |
| Repetitive peak output current | | I_{ORM} | — | — | 1.5 | A |
| Output power | $\text{THD} = 10\%;$ $R_L = 8 \Omega$ | P_o | 4.0 | 4.2 | — | W |
| Total harmonic distortion | $P_o = 2.5 \text{ W};$ $R_L = 8 \Omega$ | THD | — | 0.15 | 1.0 | % |
| Sensitivity | $P_o = 2.5 \text{ W}$ | V_i | 100 | 125 | 160 | mV |
| Input impedance (pin 5) | | $ Z_i $ | 100 | 200 | 500 | k Ω |
| Power bandwidth | | B_P | — | 30 to 40 000 | — | Hz |
| DC volume control unit | | | | | | |
| Gain control range | | $ \Delta G_v $ | 80 | 90 | — | dB |
| Signal handling | $\text{THD} < 1\%;$ DC control = 0 dB | V_i | 1.2 | 1.7 | — | V |
| Sensitivity (pin 6) | $V_o = 125 \text{ mV};$ max. voltage gain | V_i | 39 | 44 | 55 | mV |
| Input impedance (pin 8) | | $ Z_i $ | 23 | 29 | 35 | k Ω |
| Output impedance (pin 6) | | $ Z_o $ | 45 | 60 | 75 | Ω |

Note to the characteristics

1. Measured in a bandwidth in accordance with IEC 179, curve 'A'.

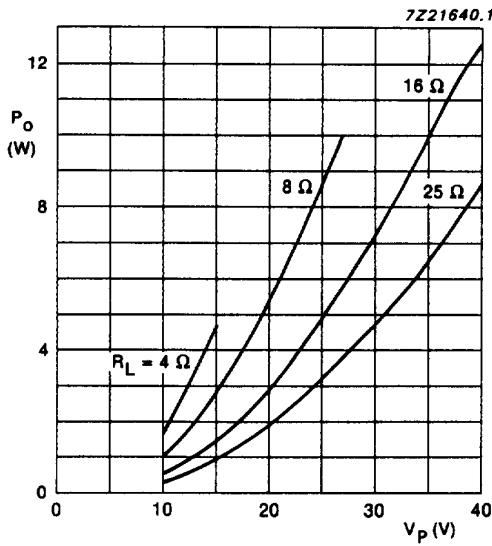
**4 W audio power amplifier with
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Fig.3 Output power as a function of supply voltage; $f = 1$ kHz; THD = 10% and control voltage (V_7) = 6.5 V.

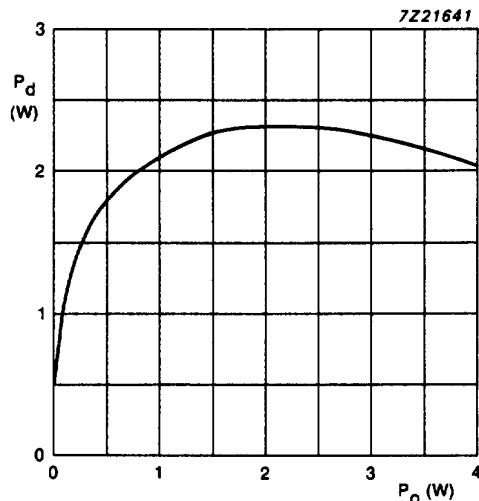


Fig.4 Power dissipation as a function of output power; $V_P = 18$ V; $f = 1$ kHz; $R_L = 8 \Omega$ and control voltage (V_7) = 6.5 V.

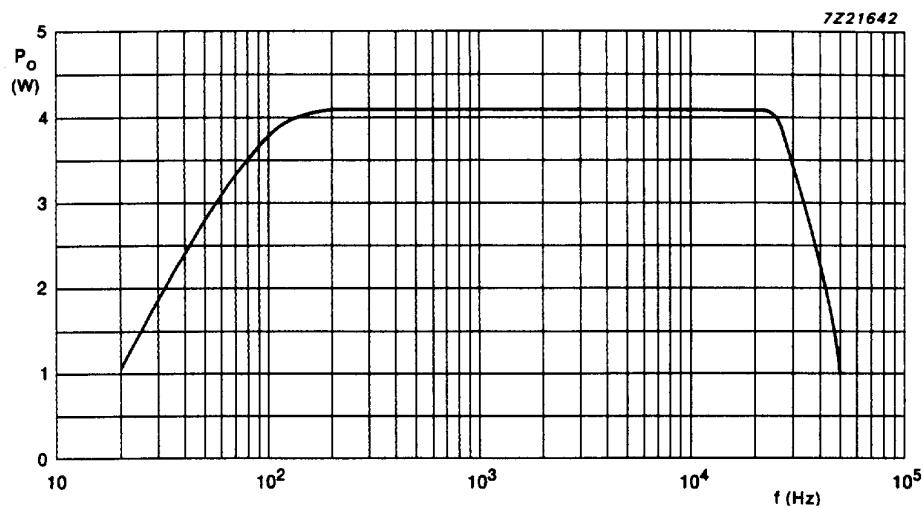
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Fig.5 Power bandwidth; $V_P = 18$ V; $R_L = 8 \Omega$; THD = 10% and control voltage (V_7) = 6.5 V.

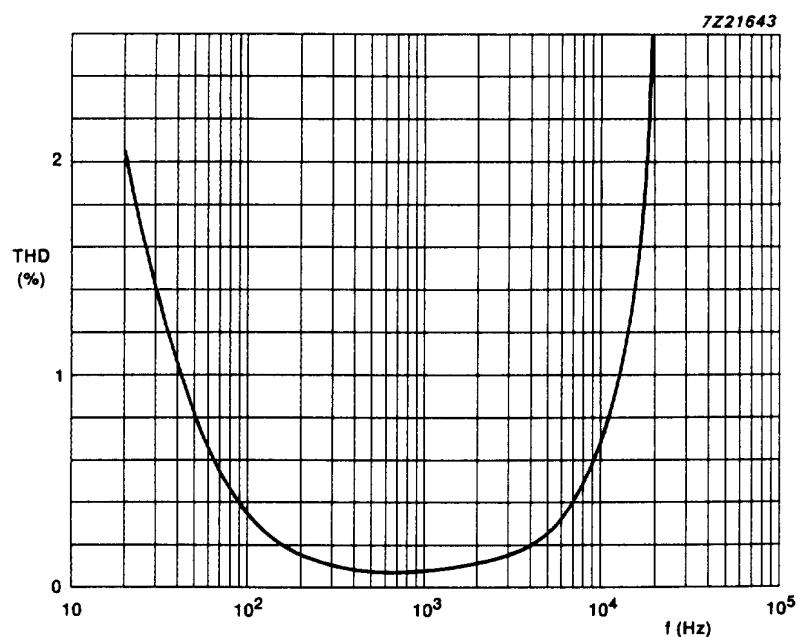


Fig.6 Total harmonic distortion as a function of frequency;
 $V_P = 18$ V; $R_L = 8 \Omega$; $P_o = 2.5$ W and control voltage = 6.5 V.

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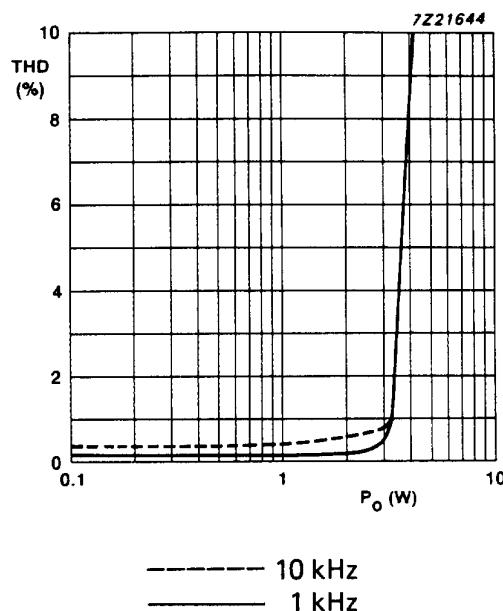
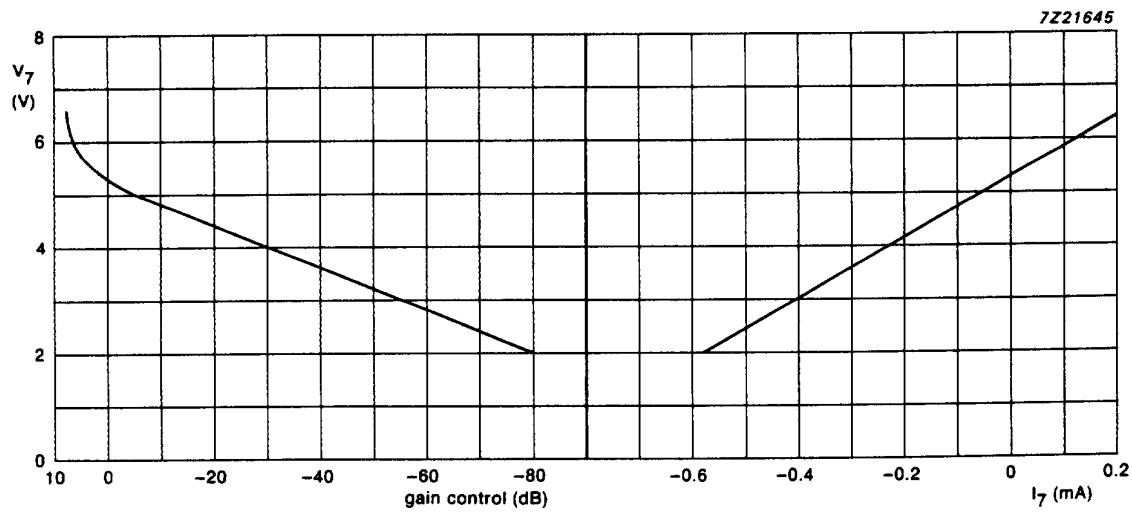
Fig.7 Total harmonic distortion as a function of output power; $V_P = 18$ V; $R_L = 8 \Omega$ and control voltage = 6.5 V.

Fig.8 Typical control curve.

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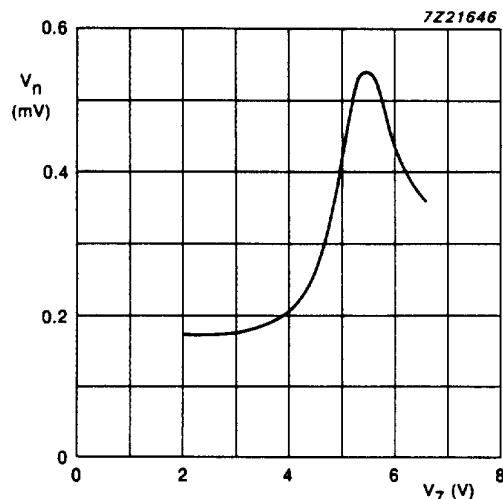
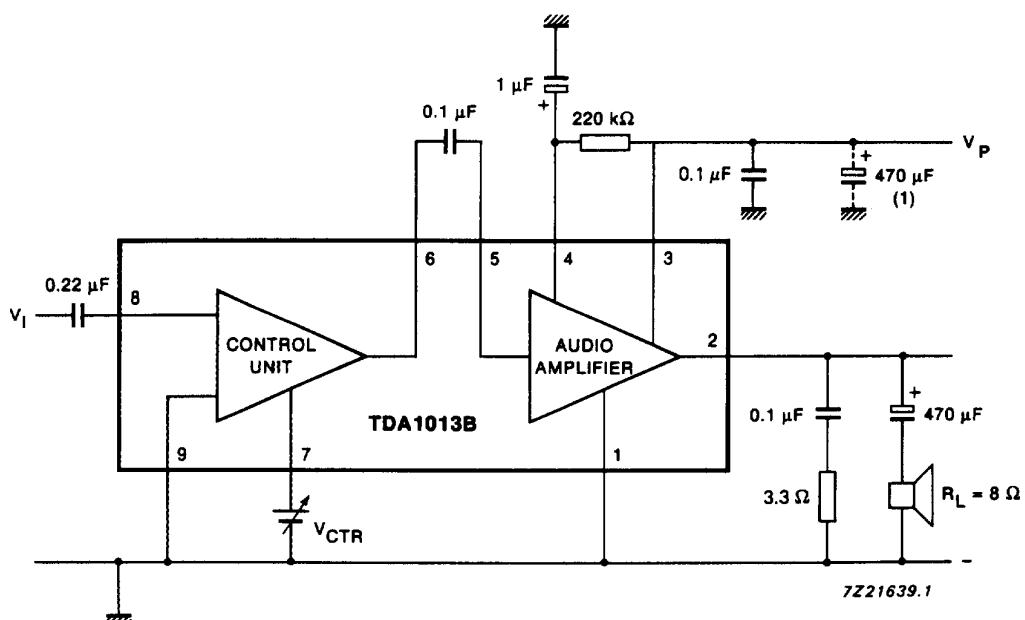


Fig.9 Noise output voltage as a function of the control voltage; $V_P = 18$ V;
 $R_L = 8 \Omega$ (in accordance with IEC 179, curve 'A').



(1) Belongs to power supply circuitry.

Fig.10 Application diagram.

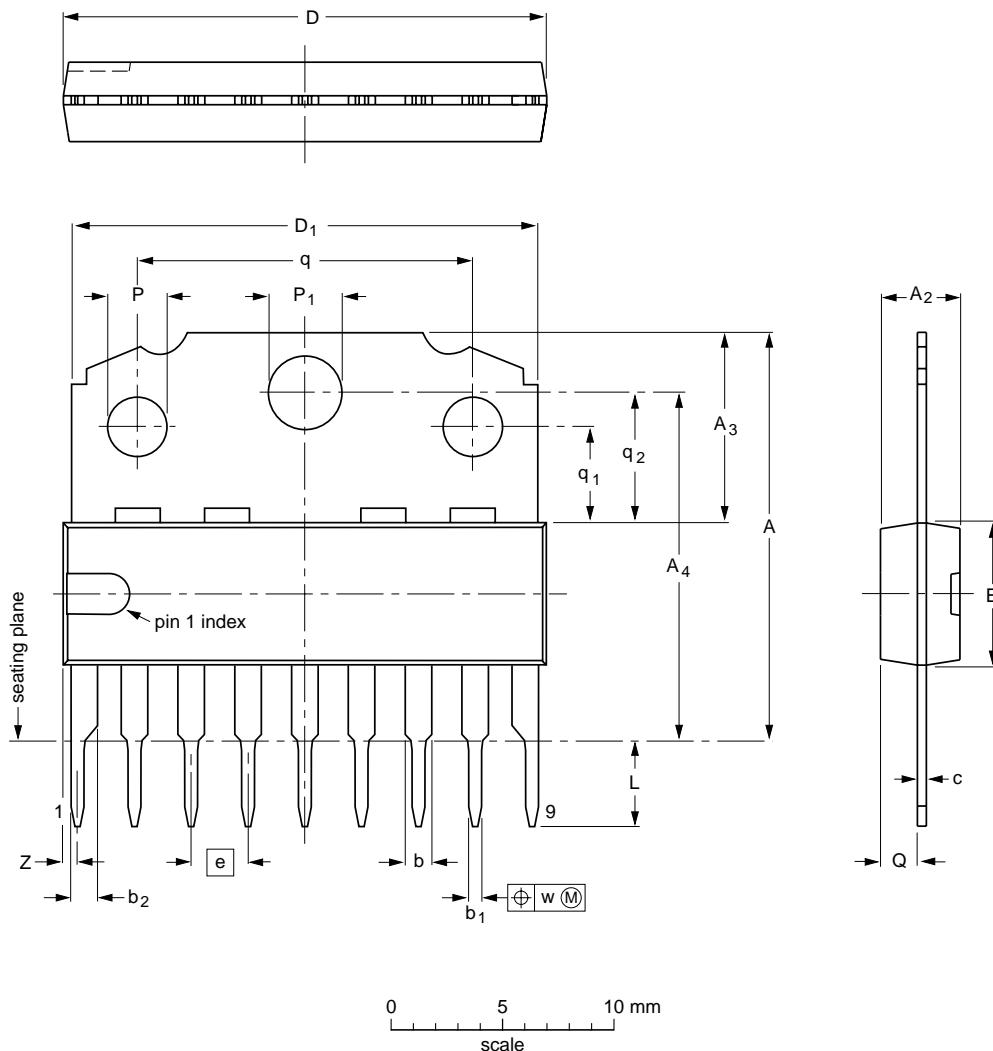
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PACKAGE OUTLINE

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 3.4 | 3.9 2.50 | 2.75 3.2 | 3.4 1.55 | 1.75 1.55 | 15.1 14.9 | 4.4 4.2 | 5.9 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 95-02-25 |

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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

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