

DATA SHEET

TDA8567Q

4 × 25 W BTL quad car radio power amplifier

Product specification
Supersedes data of 1997 Feb 12
File under Integrated Circuits, IC01

1998 Sep 23

4 × 25 W BTL quad car radio power amplifier

TDA8567Q

FEATURES

- Requires very few external components
- High output power
- Low output offset voltage
- Fixed gain
- Diagnostic facility (distortion, short-circuit and temperature pre-warning)
- Good ripple rejection
- Mode select switch (operating, mute and standby)
- Load dump protection
- Short-circuit safe to ground and to V_P and across the load
- Low power dissipation in any short-circuit condition
- Thermally protected
- Reverse polarity safe
- Electrostatic discharge protection
- No switch-on/switch-off plop
- Flexible leads
- Low thermal resistance
- Pin compatible with the TDA8568Q, except for the gain.

GENERAL DESCRIPTION

The TDA8567Q is an integrated class-B output amplifier in a 23-lead Single-In-Line (SIL) plastic power package. It contains four amplifiers in BTL configuration, each with a gain of 26 dB. The output power is 4 × 25 W in a 4 Ω load.

APPLICATIONS

- The device is primarily developed for car radio applications.

QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|----------------|---------------------------------|----------------------------|------|------|------|------|
| V_P | operating supply voltage | | 6 | 14.4 | 18 | V |
| I_{ORM} | repetitive peak output current | | – | – | 7.5 | A |
| $I_{q(tot)}$ | total quiescent current | | – | 230 | – | mA |
| I_{stb} | standby current | | – | 0.2 | 100 | μA |
| I_{sw} | switch-on current | | – | – | 80 | μA |
| $ Z_i $ | input impedance | | 25 | 30 | – | kΩ |
| P_o | output power | THD = 10% | – | 25 | – | W |
| SVRR | supply voltage ripple rejection | $R_s = 0 \Omega$ | – | 60 | – | dB |
| α_{cs} | channel separation | $R_s = 10 \text{ k}\Omega$ | – | 50 | – | dB |
| G_v | closed loop voltage gain | | 25 | 26 | 27 | dB |
| $V_{n(o)}$ | noise output voltage | $R_s = 0 \Omega$ | – | – | 120 | μV |
| $ \Delta V_O $ | DC output offset voltage | | – | – | 150 | mV |

ORDERING INFORMATION

| TYPE NUMBER | PACKAGE | | |
|-------------|---------|--|----------|
| | NAME | DESCRIPTION | VERSION |
| TDA8567Q | DBS23P | plastic DIL-bent-SIL power package; 23 leads (straight lead length 3.2 mm) | SOT411-1 |

4 × 25 W BTL quad car radio power amplifier

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BLOCK DIAGRAM

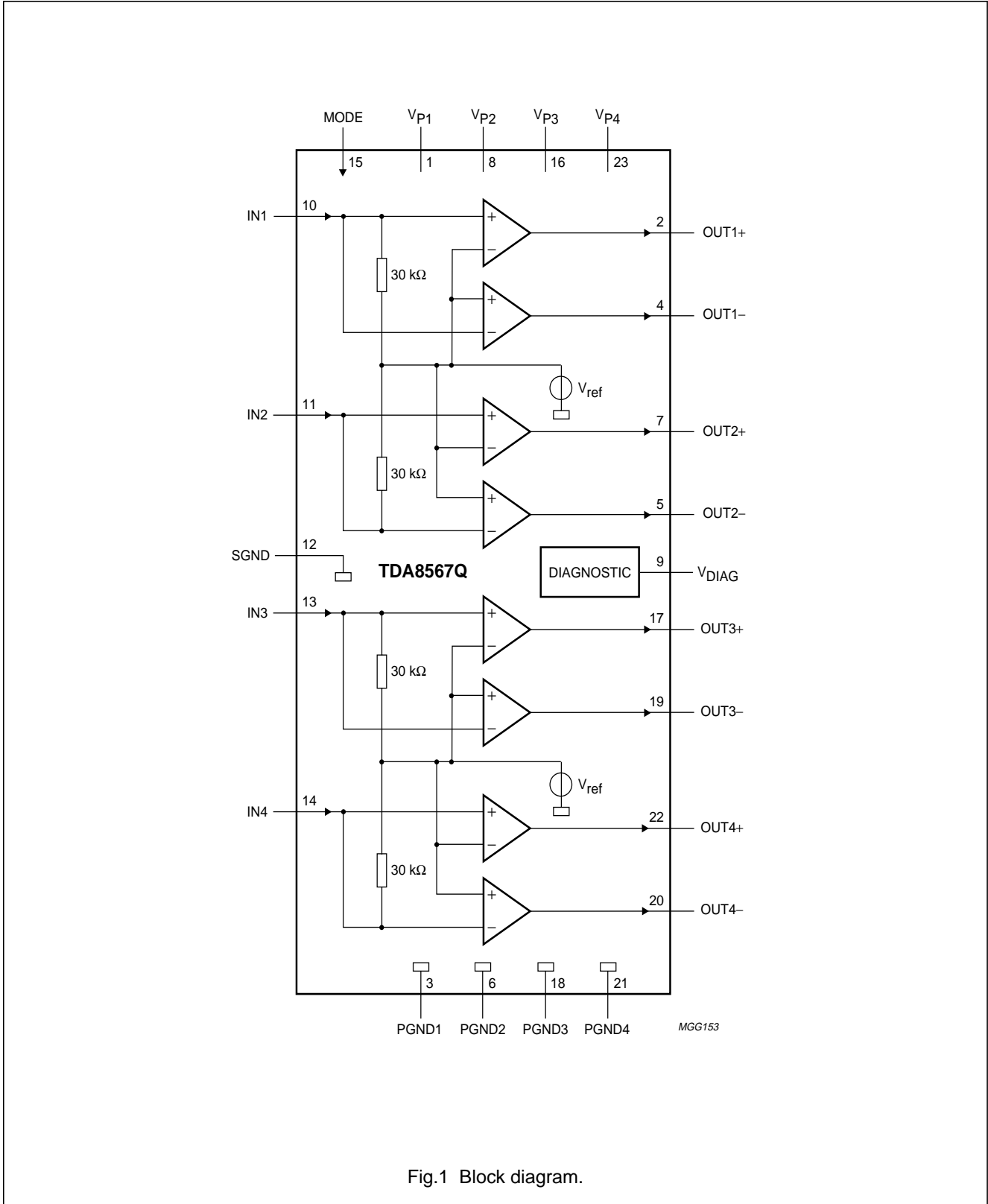


Fig.1 Block diagram.

4 × 25 W BTL quad car radio power amplifier

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PINNING

| SYMBOL | PIN | DESCRIPTION |
|-------------------|-----|--------------------------|
| V _{P1} | 1 | supply voltage 1 |
| OUT1+ | 2 | output 1+ |
| PGND1 | 3 | power ground 1 |
| OUT1- | 4 | output 1- |
| OUT2- | 5 | output 2- |
| PGND2 | 6 | power ground 2 |
| OUT2+ | 7 | output 2+ |
| V _{P2} | 8 | supply voltage 2 |
| V _{DIAG} | 9 | diagnostic output |
| IN1 | 10 | input 1 |
| IN2 | 11 | input 2 |
| SGND | 12 | signal ground |
| IN3 | 13 | input 3 |
| IN4 | 14 | input 4 |
| MODE | 15 | mode select switch input |
| V _{P3} | 16 | supply voltage 3 |
| OUT3+ | 17 | output 3+ |
| PGND3 | 18 | power ground 3 |
| OUT3- | 19 | output 3- |
| PGND4 | 21 | power ground 4 |
| OUT4+ | 22 | output 4+ |
| V _{P4} | 23 | supply voltage 4 |

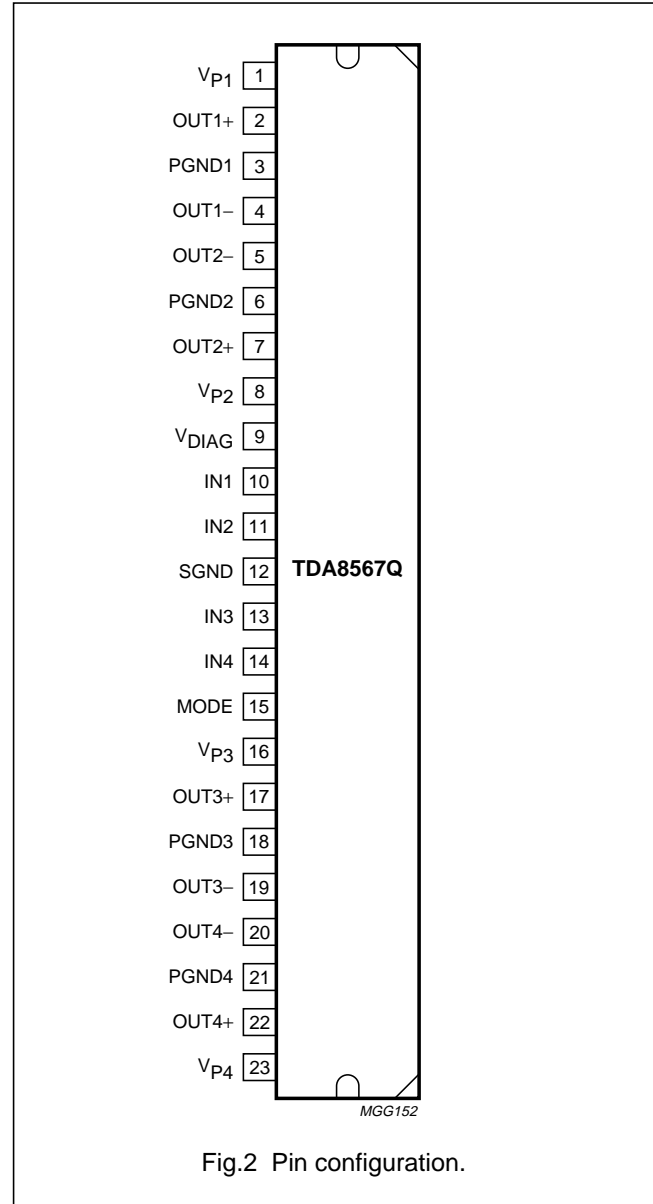


Fig.2 Pin configuration.

4 × 25 W BTL quad car radio power amplifier

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FUNCTIONAL DESCRIPTION

The TDA8567Q contains four identical amplifiers which can be used for bridge applications. The gain of each amplifier is fixed at 26 dB.

Mode select switch (pin 15)

- Standby: low supply current (<100 μ A)
- Mute: input signal suppressed
- Operating: normal on condition.

Since this pin has a low input current (<80 μ A), a low cost supply switch can be applied.

To avoid switch-on plops, it is advised to keep the amplifier in the mute mode during ≥ 150 ms (charging of the input capacitors at pins 10, 11, 13 and 14). When switching from standby to mute, the slope should be at least 18 V/s.

This can be realized by:

- Microprocessor control
- External timing circuit (see Fig.3).

Diagnostic output (pin 9)

DYNAMIC DISTORTION DETECTOR (DDD)

At the onset of clipping of one or more output stages, the dynamic distortion detector becomes active and pin 9 goes LOW. This information can be used to drive a sound processor or DC volume control to attenuate the input signal and so limit the distortion. The output level of pin 9 is independent of the number of channels that are clipping (see Fig.4).

SHORT-CIRCUIT DIAGNOSTIC

When a short-circuit occurs at one or more outputs to ground or to the supply voltage, the output stages are switched off until the short-circuit is removed and the device is switched on again, with a delay of approximately 10 ms after removal of the short-circuit. During this short-circuit condition, pin 9 is continuously LOW.

When a short-circuit occurs across the load of one or more channels, the output stages are switched off during approximately 10 ms. After that time it is checked during approximately 50 μ s to determine whether the short-circuit is still present.

Due to this duty cycle of 50 μ s/10 ms the average current consumption during this short-circuit condition is very low.

During this short-circuit condition, pin 9 is LOW for 10 ms and HIGH for 50 μ s (see Fig.5). The protection circuits of all channels are coupled. This means that if a short-circuit condition occurs in **one** of the channels, **all** channels are switched off. Consequently, the power dissipation in any short-circuit condition is very low.

TEMPERATURE PRE-WARNING

When the virtual junction temperature T_{vj} reaches 145 $^{\circ}$ C, pin 9 goes LOW.

OPEN COLLECTOR OUTPUTS

The diagnostic pin has an open collector output, so more devices can be tied together. An external pull-up resistor is needed.

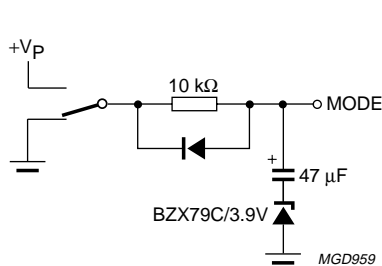


Fig.3 Mode select switch circuitry.

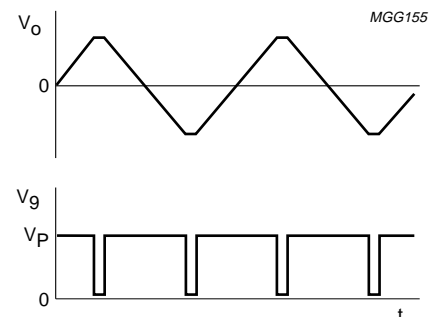


Fig.4 Distortion detector waveform.

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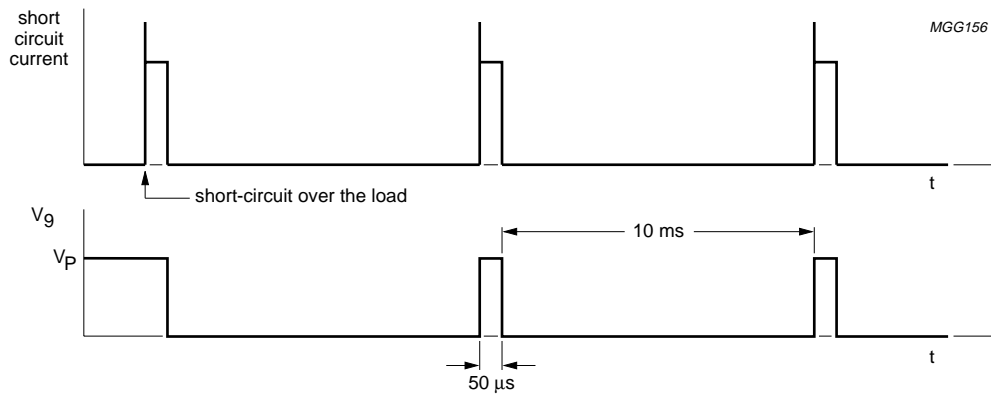


Fig.5 Short-circuit waveform.

4 × 25 W BTL quad car radio power amplifier

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LIMITING VALUES

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

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|-----------------------|------------------------------------|--|------|------|------|
| V _P | supply voltage | operating | – | 18 | V |
| | | non-operating | – | 30 | V |
| | | load dump protection; during 50 ms; t _r ≥ 2.5 ms | – | 45 | V |
| V _{sc(safe)} | short-circuit safe voltage | | – | 18 | V |
| V _{rp} | reverse polarity voltage | | – | 6 | V |
| I _{OSM} | non-repetitive peak output current | | – | 10 | A |
| I _{ORM} | repetitive peak output current | | – | 7.5 | A |
| P _{tot} | total power dissipation | | – | 60 | W |
| T _{stg} | storage temperature | | –55 | +150 | °C |
| T _{amb} | operating ambient temperature | | –40 | +85 | °C |
| T _{vj} | virtual junction temperature | | – | 150 | °C |

THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | VALUE | UNIT |
|---------------------|---|-------|------|
| R _{th j-a} | thermal resistance from junction to ambient in free air | 40 | K/W |
| R _{th j-c} | thermal resistance from junction to case (see Fig.6) | 1 | K/W |

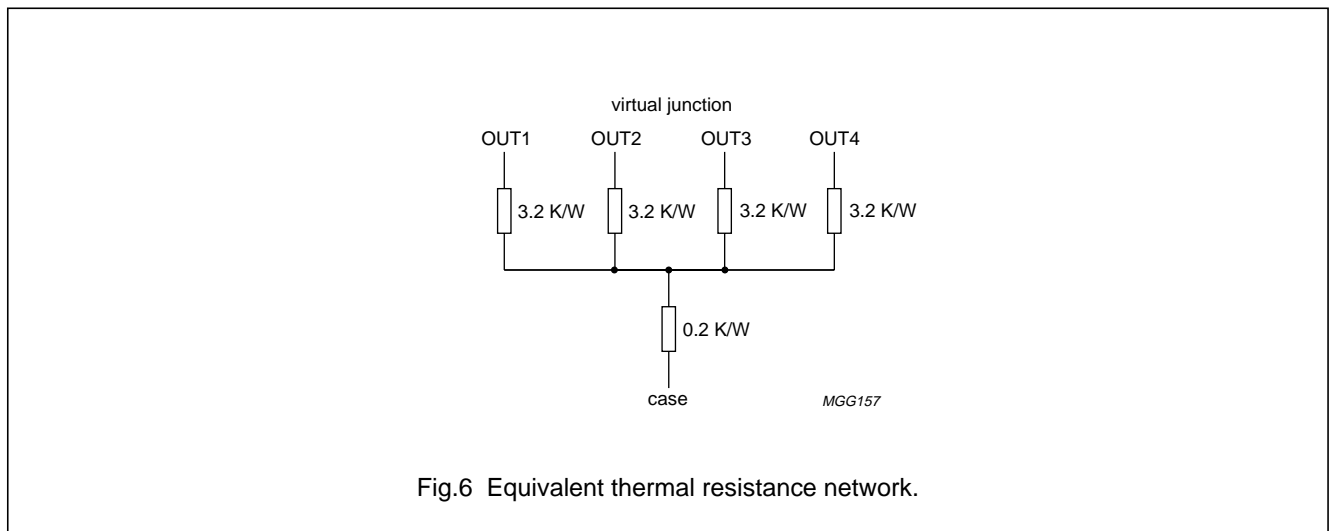


Fig.6 Equivalent thermal resistance network.

QUALITY SPECIFICATION

In accordance with "SNW-FQ-611E". The number of the quality specification can be found in the "Quality Reference Handbook". The handbook can be ordered using the code 9397 750 00192.

4 × 25 W BTL quad car radio power amplifier

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DC CHARACTERISTICS

$V_P = 14.4$ V; $T_{amb} = 25$ °C; measured in Fig.7; unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|----------------------------|----------------------------|----------------------------|------|------|-------|------|
| Supply | | | | | | |
| V_P | supply voltage | note 1 | 6 | 14.4 | 18 | V |
| $I_{q(tot)}$ | total quiescent current | $R_L = \infty$ | – | 230 | 360 | mA |
| Operating condition | | | | | | |
| V_{15} | mode select switch level | | 8.5 | – | V_P | V |
| I_{15} | mode select switch current | $V_{15} = 14.4$ V | – | 30 | 80 | μA |
| V_O | output voltage | note 2 | – | 7.0 | – | V |
| $ \Delta V_O $ | output offset voltage | | – | – | 150 | mV |
| Mute condition | | | | | | |
| V_{15} | mode select switch level | | 3.3 | – | 6.4 | V |
| V_O | output voltage | note 2 | – | 7.0 | – | V |
| $ \Delta V_O $ | output offset voltage | | – | – | 150 | mV |
| Standby condition | | | | | | |
| V_{15} | mode select switch level | | 0 | – | 2 | V |
| I_{stb} | standby current | | – | 0.2 | 100 | μA |
| Diagnostic | | | | | | |
| V_9 | diagnostic output voltage | during any fault condition | – | – | 0.6 | V |
| T_{vj} | temperature pre-warning | $V_9 = 0.6$ V | – | 145 | – | °C |

Notes

1. The circuit is DC adjusted at $V_P = 6$ to 18 V and AC operating at $V_P = 8.5$ to 18 V.
2. At 18 V < V_P < 30 V the DC output voltage $\leq \frac{1}{2}V_P$.

4 × 25 W BTL quad car radio power amplifier

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AC CHARACTERISTICS

$V_P = 14.4\text{ V}$; $R_L = 4\ \Omega$; $f = 1\text{ kHz}$; $T_{\text{amb}} = 25\text{ °C}$; measured in Fig.7; unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|----------------|---------------------------------|---|------|-------------|------|---------------|
| P_o | output power | THD = 0.5% | 16 | 19 | – | W |
| | | THD = 10% | 21 | 25 | – | W |
| | | THD = 30% | 28 | 35 | – | W |
| | | $V_P = 13.2\text{ V}$; THD = 0.5% | – | 15 | – | W |
| | | $V_P = 13.2\text{ V}$; THD = 10% | – | 21 | – | W |
| THD | total harmonic distortion | $P_o = 1\text{ W}$ | – | 0.05 | – | % |
| | | $V_g \leq 0.6\text{ V}$; note 8 | – | 10 | – | % |
| B_p | power bandwidth | THD = 0.5%; $P_o = -1\text{ dB}$ with respect to 16 W | – | 20 to 20000 | – | Hz |
| $f_{ro(l)}$ | low frequency roll-off | at -1 dB ; note 1 | – | 25 | – | Hz |
| $f_{ro(h)}$ | high frequency roll-off | at -1 dB | 20 | – | – | kHz |
| G_v | closed loop voltage gain | | 25 | 26 | 27 | dB |
| SVRR | supply voltage ripple rejection | on; note 2 | 50 | – | – | dB |
| | | mute; note 2 | 50 | – | – | dB |
| | | standby; note 2 | 80 | – | – | dB |
| $ Z_i $ | input impedance | | 25 | 30 | 38 | k Ω |
| $V_{n(o)}$ | noise output voltage | on; note 3 | – | 85 | 120 | μV |
| | | on; note 4 | – | 100 | – | μV |
| | | mute; note 5 | – | 60 | – | μV |
| α_{cs} | channel separation | note 6 | 45 | – | – | dB |
| $ \Delta G_v $ | channel unbalance | | – | – | 1 | dB |
| V_o | output signal in mute | note 7 | – | – | 2 | mV |

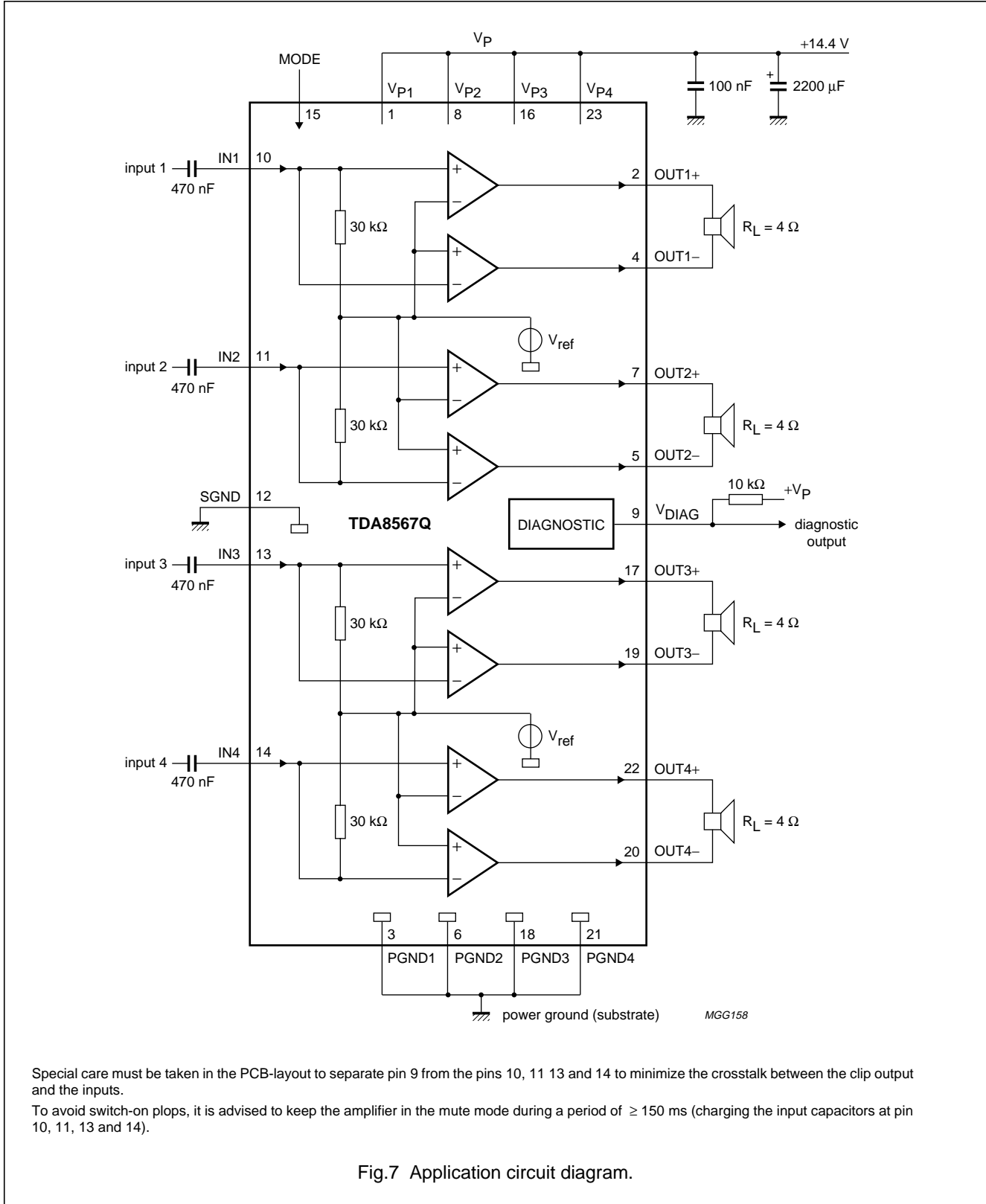
Notes

1. Frequency response externally fixed.
2. $V_{\text{ripple}} = V_{\text{ripple(max)}} = 2\text{ V}$ (p-p); $R_s = 0\ \Omega$.
3. $B = 20\text{ Hz}$ to 20 kHz ; $R_s = 0\ \Omega$.
4. $B = 20\text{ Hz}$ to 20 kHz ; $R_s = 10\text{ k}\Omega$.
5. $B = 20\text{ Hz}$ to 20 kHz ; independent of R_s .
6. $P_o = 16\text{ W}$; $R_s = 10\text{ k}\Omega$.
7. $V_i = V_{i(\text{max})} = 1\text{ V}$ (RMS).
8. Dynamic Distortion Detector (DDD) active, pin 9 is set to logic 0.

4 × 25 W BTL quad car radio power amplifier

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TEST AND APPLICATION INFORMATION

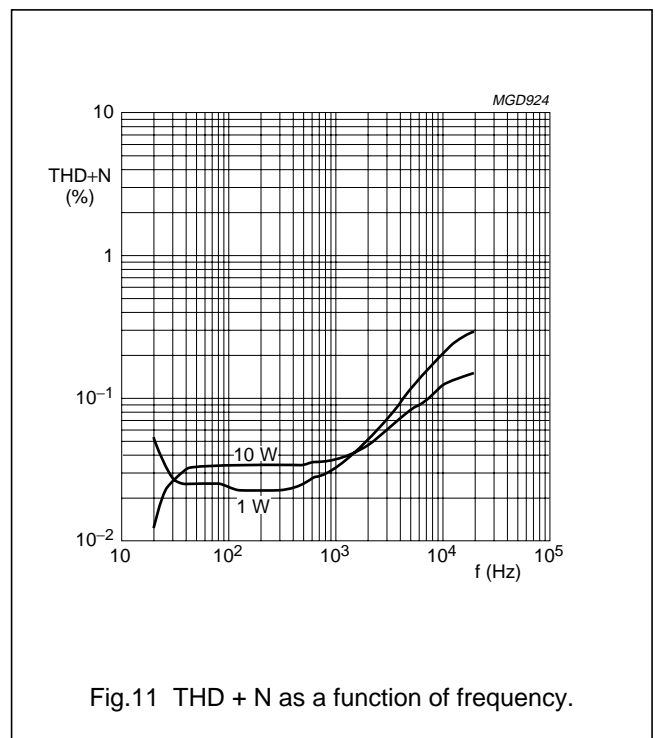
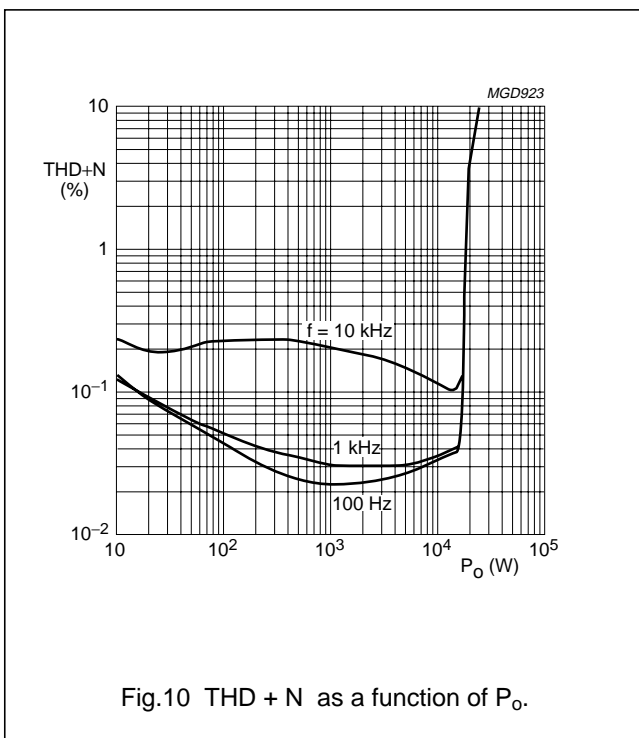
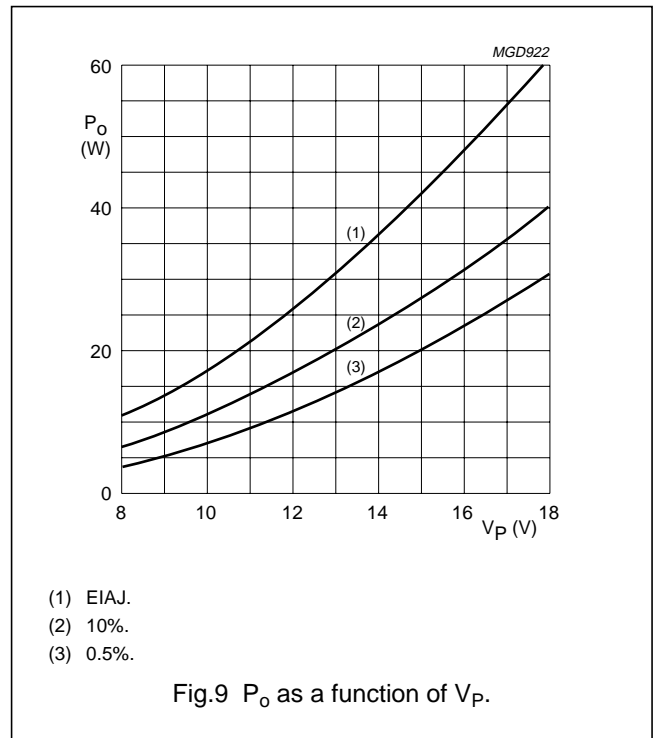
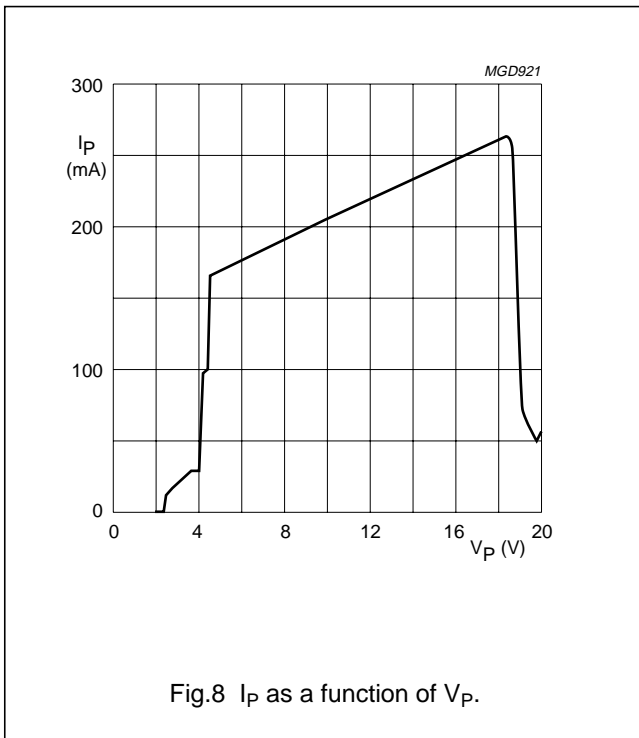


4 × 25 W BTL quad car radio power amplifier

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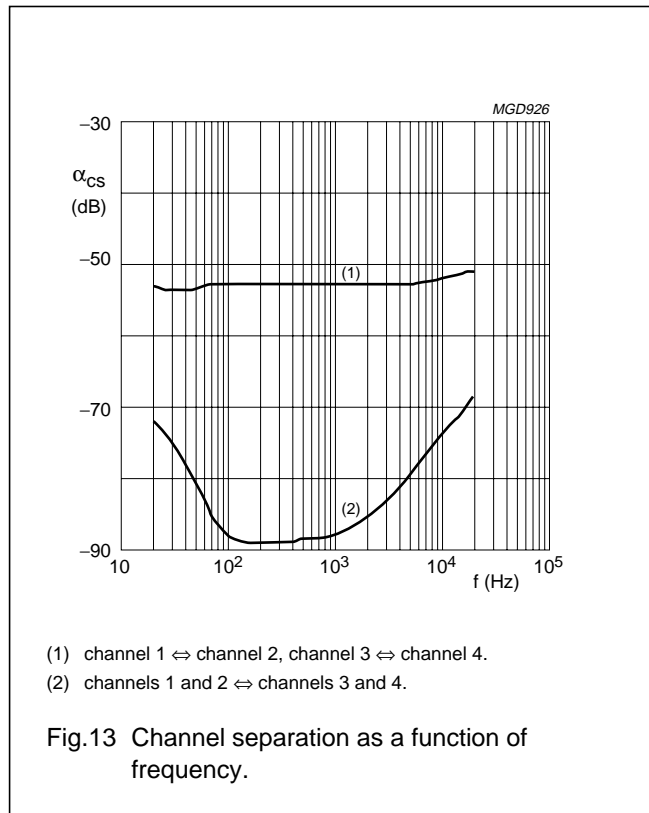
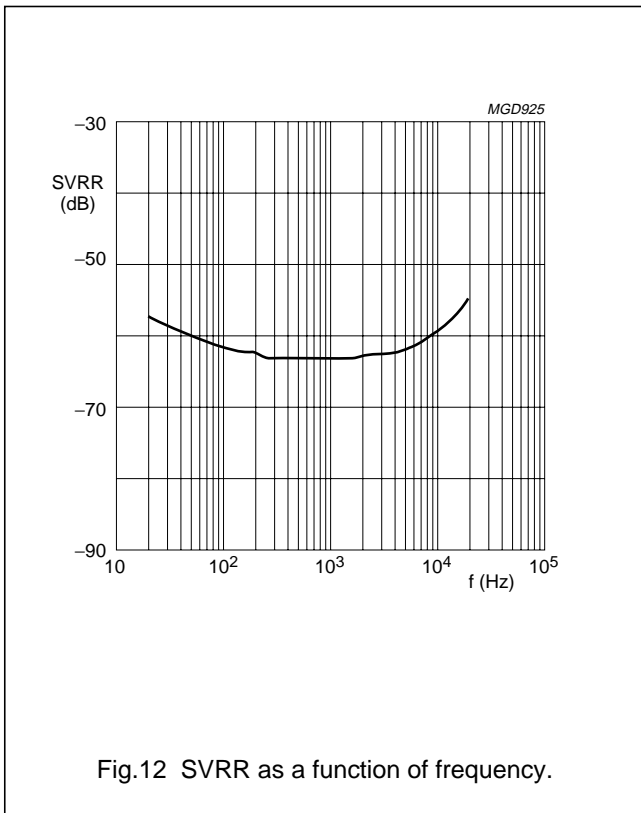
Test information

Figures 8 to 13 have the following conditions: $V_P = 14.4\text{ V}$; $R_L = 4\ \Omega$; $f = 1\text{ kHz}$; 80 kHz filter used; unless otherwise specified.



4 × 25 W BTL quad car radio power amplifier

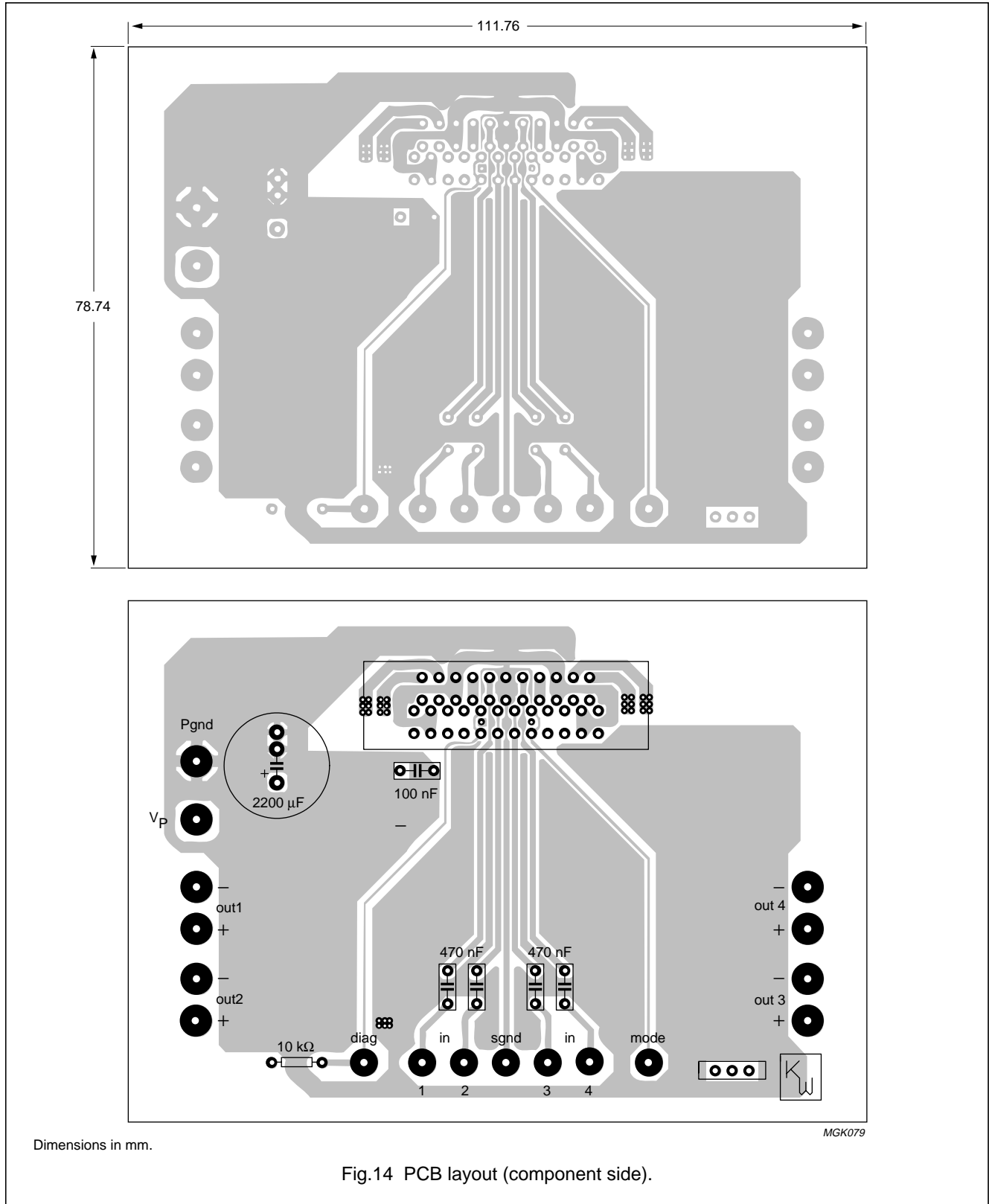
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4 × 25 W BTL quad car radio power amplifier

TDA8567Q

PCB layout

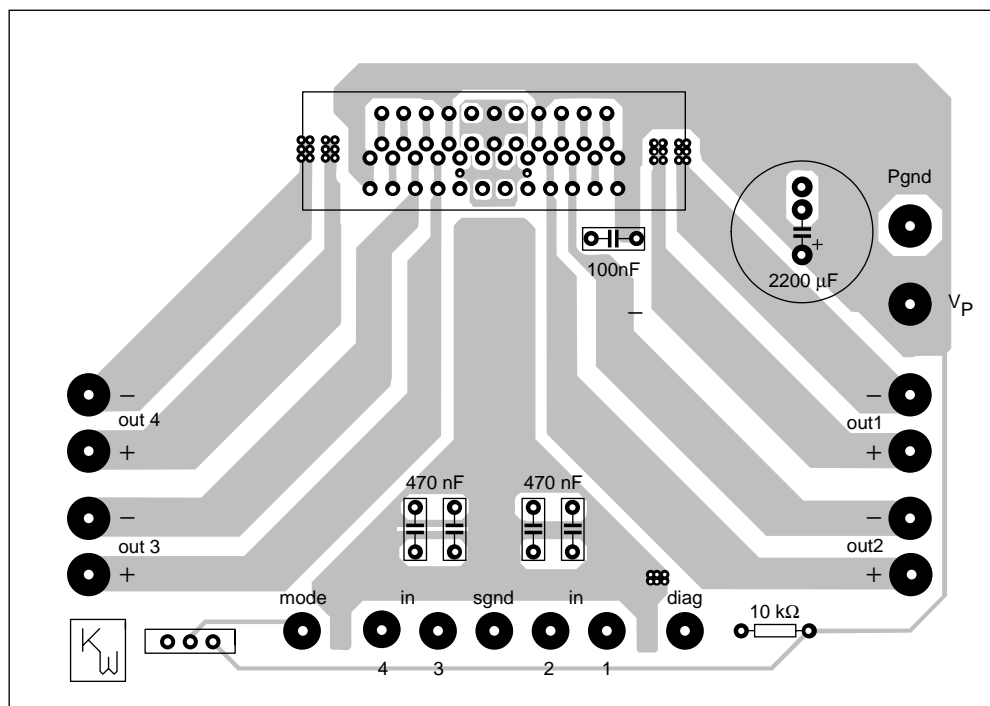
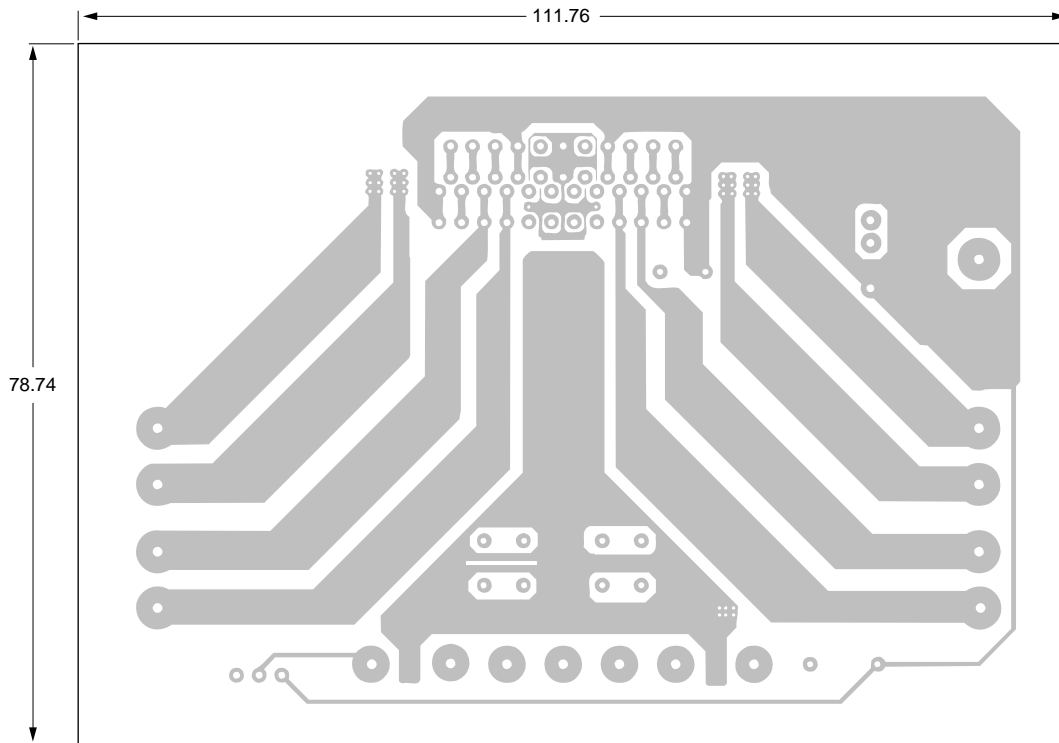


Dimensions in mm.

Fig.14 PCB layout (component side).

4 × 25 W BTL quad car radio power amplifier

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Dimensions in mm.

Fig.15 PCB layout (soldering side).

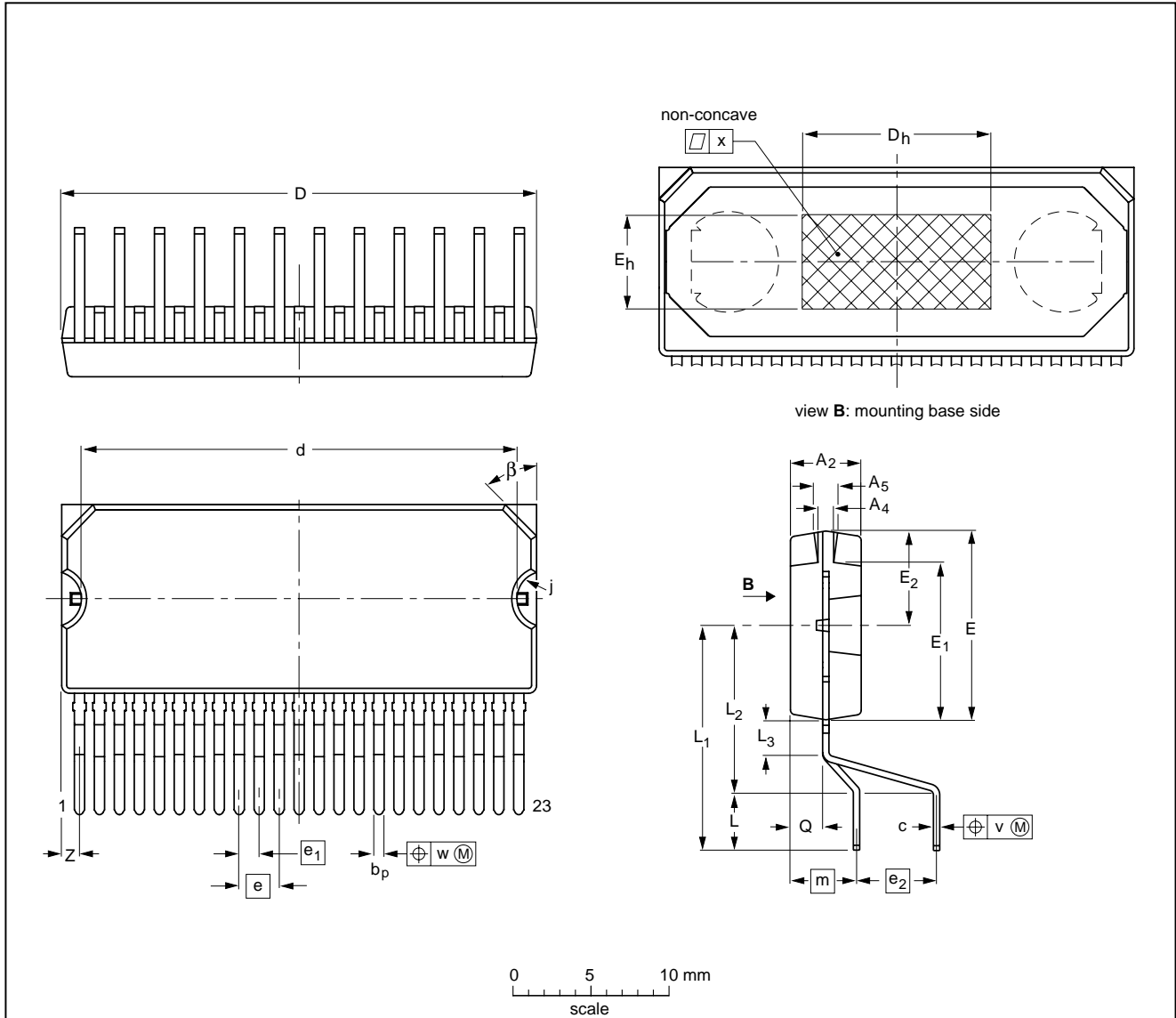
4 × 25 W BTL quad car radio power amplifier

TDA8567Q

PACKAGE OUTLINE

DBS23P: plastic DIL-bent-SIL power package; 23 leads (straight lead length 3.2 mm)

SOT411-1



DIMENSIONS (mm are the original dimensions)

| UNIT | A ₂ | A ₄ | A ₅ | b _p | c | D ⁽¹⁾ | d | D _h | E ⁽¹⁾ | e | e ₁ | e ₂ | E _h | E ₁ | E ₂ | j | L | L ₁ | L ₂ | L ₃ | m | Q | v | w | x | β | Z ⁽¹⁾ |
|------|----------------|----------------|----------------|----------------|------|------------------|------|----------------|------------------|------|----------------|----------------|----------------|----------------|----------------|------|-----|----------------|----------------|----------------|-----|-----|-----|------|------|-----|------------------|
| mm | 4.6 | 1.15 | 1.65 | 0.75 | 0.55 | 30.4 | 28.0 | 12 | 12.2 | 2.54 | 1.27 | 5.08 | 6 | 10.15 | 6.2 | 1.85 | 3.6 | 14.0 | 10.7 | 2.4 | 4.3 | 2.1 | 0.6 | 0.25 | 0.03 | 45° | 1.43 |
| | 4.3 | 0.85 | 1.35 | 0.60 | 0.35 | 29.9 | 27.5 | | 11.8 | | | | | 9.85 | 5.8 | 1.65 | 2.8 | 13.0 | 9.9 | 1.6 | | 1.8 | | | | | 0.78 |

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 | | | |
| SOT411-1 | | | | | | 96-10-11 98-02-20 |

4 × 25 W BTL quad car radio power amplifier

TDA8567Q

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 *"Data Handbook IC26; Integrated Circuit Packages"* (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.

4 × 25 W BTL quad car radio power
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NOTES

4 × 25 W BTL quad car radio power
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NOTES

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NOTES

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