# DATA SHEET

**TDA8925**

Power stage 2 x 15 to 25 W class-D audio amplifier

Product specification

Supersedes data of 2004 Jan 05

2004 May 06

**Philips**
Semiconductors

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**Power stage 2 x 15 to 25 W class-D
audio amplifier**

**TDA8925**

**CONTENTS**

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## 1 FEATURES

- High efficiency (> 94 %)
- Operating voltage from ±7.5 V to ±30 V
- Very low quiescent current
- High output power
- Diagnostic output
- Usable as a stereo Single-Ended (SE) amplifier
- Electrostatic discharge protection (pin to pin)
- No heatsink required.

## 2 APPLICATIONS

- Television sets
- Home-sound sets
- Multimedia systems
- All mains fed audio systems.

## 3 GENERAL DESCRIPTION

The TDA8925 is a switching power stage for a high efficiency class-D audio power amplifier system.

With this power stage a compact $2 \times 15$ W self oscillating digital amplifier system can be built, operating with high efficiency and very low dissipation. No heatsink is required. The system operates over a wide supply voltage range from ±7.5 V up to ±30 V and consumes a very low quiescent current.

## 4 QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|--------|-----------|------------|------|------|------|------|
| **General** | | | | | | |
| $V_P$ | supply voltage | | ±7.5 | ±15 | ±30 | V |
| $I_{q(tot)}$ | total quiescent current | no load connected; $V_P$ = ±15 V | – | 25 | 45 | mA |
| $\eta$ | efficiency endstage | $P_o$ = 15 W; $R_L$ = 8 $\Omega$; $V_P$ = ±15 V | – | 94 | – | % |
| **Stereo single-ended configuration** | | | | | | |
| $P_o$ | output power | $R_L$ = 8 $\Omega$; THD = 10 %; $V_P$ = ±15 V | 14 | 15 | – | W |
| | | $R_L$ = 6 $\Omega$; THD = 10 %; $V_P$ = ±15 V | – | 20 | – | W |

## 5 ORDERING INFORMATION

| TYPE NUMBER | PACKAGE | | | |
|-------------|---------|---|---|---|
| | NAME | DESCRIPTION | | VERSION |
| TDA8925ST | RDBS17P | plastic rectangular-DIL-bent-SIL power package; 17 leads (row spacing 2.54 mm) | | SOT577-2 |
| TDA8925J | DBS17P | plastic DIL-bent-SIL power package; 17 leads (lead length 7.7 mm) | | SOT243-3 |

Power stage 2 x 15 to 25 W class-D
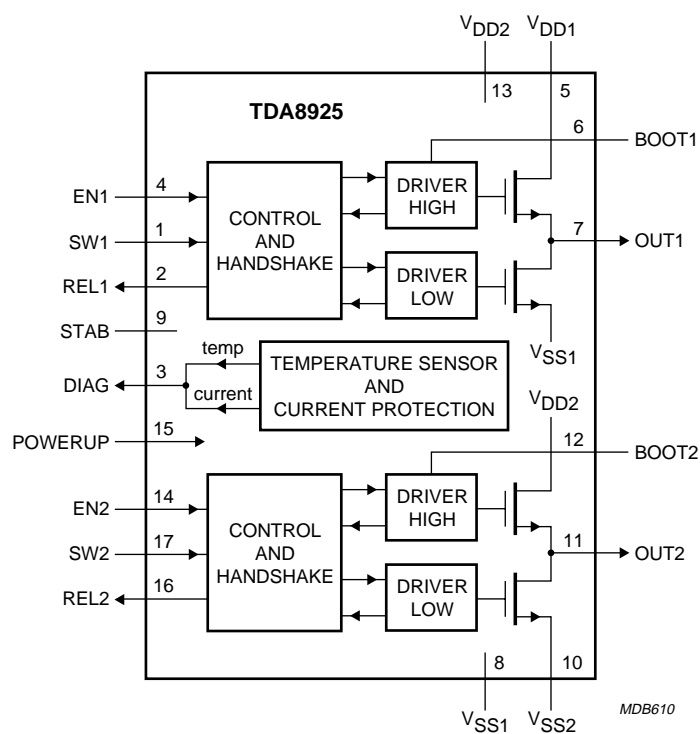audio amplifier

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## 6 BLOCK DIAGRAM



Fig.1 Block diagram.

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## 7   PINNING

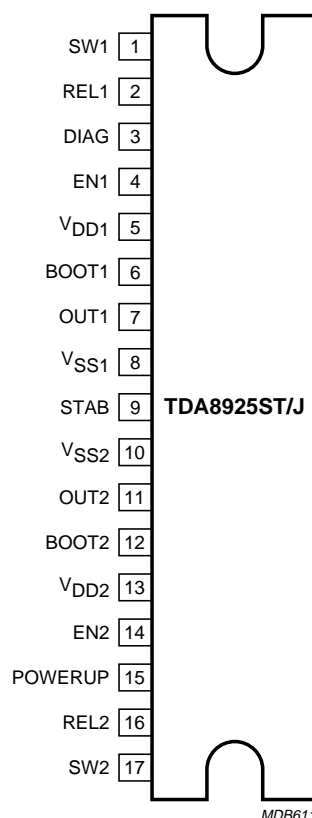| SYMBOL | PIN | DESCRIPTION |
|--------|-----|-------------|
| SW1 | 1 | digital switch input; channel 1 |
| REL1 | 2 | digital control output; channel 1 |
| DIAG | 3 | digital open-drain output for overtemperature and overcurrent report |
| EN1 | 4 | digital enable input; channel 1 |
| $V_{DD1}$ | 5 | positive power supply; channel 1 |
| BOOT1 | 6 | bootstrap capacitor; channel 1 |
| OUT1 | 7 | PWM output; channel 1 |
| $V_{SS1}$ | 8 | negative power supply; channel 1 |
| STAB | 9 | decoupling internal stabilizer for logic supply |
| $V_{SS2}$ | 10 | negative power supply; channel 2 |
| OUT2 | 11 | PWM output; channel 2 |
| BOOT2 | 12 | bootstrap capacitor; channel 2 |
| $V_{DD2}$ | 13 | positive power supply; channel 2 |
| EN2 | 14 | digital enable input; channel 2 |
| POWERUP | 15 | enable input for switching on internal reference sources |
| REL2 | 16 | digital control output; channel 2 |
| SW2 | 17 | digital switch input; channel 2 |

SW1    1
REL1   2
DIAG   3
EN1    4
$V_{DD1}$  5
BOOT1  6
OUT1   7
$V_{SS1}$  8
STAB   9    **TDA8925ST/J**
$V_{SS2}$  10
OUT2   11
BOOT2  12
$V_{DD2}$  13
EN2    14
POWERUP 15
REL2   16
SW2    17

*MDB611*

Fig.2  Pin configuration.

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|---|---|

## 8    FUNCTIONAL DESCRIPTION

The TDA8925 is a two-channel audio power amplifier system using the class-D technology (see Fig.1).

The power stage TDA8925S is used for driving the loudspeaker load. It performs a level shift from the low-power digital PWM signal, at logic levels, to a high-power PWM signal that switches between the main supply lines. A 2nd-order low-pass filter converts the PWM signal into an analog audio signal across the loudspeaker.

### 8.1    Power stage

The power stage contains the high-power DMOS switches, the drivers, timing and handshaking between the power switches and some control logic (see Fig.1). For protection, a temperature sensor and a maximum current detector are built-in on the chip.

The following functions are available:

- Switch (pins SW1 and SW2): digital inputs; switching from $V_{SS}$ to $V_{SS}$ + 12 V and driving the power DMOS switches

- Release (pins REL1 and REL2): digital outputs; switching from $V_{SS}$ to $V_{SS}$ + 12 V; follow SW1 and SW2 with a small delay. Note: for self oscillating applications this pin is not used.

- Power-up (pin POWERUP): must be connected to a continuous supply voltage of at least $V_{SS}$ + 5 V with respect to $V_{SS}$

- Enable (pins EN1 and EN2): digital inputs; at a level of $V_{SS}$ the power DMOS switches are open and the PWM outputs are floating; at a level of $V_{SS}$ + 12 V the power stage is operational

- Diagnostics (pin DIAG): digital open-drain output; pulled to $V_{SS}$ if the temperature or maximum current is exceeded.

### 8.2    Protection

Temperature and short-circuit protection sensors are included in the TDA8925. In the event that the maximum current or maximum temperature is exceeded the diagnostic output is pulled down to $V_{SS}$. Since the diagnostic is connected to the enable pins in the application the system shuts down itself.

#### 8.2.1    OVERTEMPERATURE

If the junction temperature ($T_j$) exceeds 150 °C, then pin DIAG becomes LOW. The diagnostic pin is released if the temperature is dropped to approximately 130 °C, so there is a hysteresis of approximately 20 °C.

#### 8.2.2    SHORT-CIRCUIT ACROSS THE LOUDSPEAKER TERMINALS

When the loudspeaker terminals are short-circuited this will be detected by the current protection. If the output current exceeds the maximum output current of 3 A, then pin DIAG becomes LOW. Using pin DIAG in combination with the enable pins the system will shut down immediately, and restart again. The result is that the output current is limited at the overcurrent detection level.

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## 9   LIMITING VALUES

In accordance with the Absolute Maximum Rate System (IEC 60134).

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| $V_P$ | supply voltage | | – | $\pm30$ | V |
| $V_{P(sc)}$ | supply voltage for short-circuits across the load | | – | $\pm30$ | V |
| $I_{ORM}$ | repetitive peak current in output pins | | – | 3.5 | A |
| $T_{stg}$ | storage temperature | | –55 | +150 | °C |
| $T_{amb}$ | ambient temperature | | –40 | +85 | °C |
| $T_{vj}$ | virtual junction temperature | | – | 150 | °C |
| $V_{esd(HBM)}$ | electrostatic discharge voltage (HBM) | note 1 | | | |
| | | all pins with respect to $V_{DD}$ (class 1a) | –500 | +500 | V |
| | | all pins with respect to $V_{SS}$ (class 1a) | –1500 | +1500 | V |
| | | all pins with respect to each other (class 1a) | –1500 | +1500 | V |
| $V_{esd(MM)}$ | electrostatic discharge voltage (MM) | note 2 | | | |
| | | all pins with respect to $V_{DD}$ (class B) | –250 | +250 | V |
| | | all pins with respect to $V_{SS}$ (class B) | –250 | +250 | V |
| | | all pins with respect to each other (class B) | –250 | +250 | V |

**Notes**

1.   Human Body Model (HBM); $R_s$ = 1500 $\Omega$; C = 100 pF.

2.   Machine Model (MM); $R_s$ = 10 $\Omega$; C = 200 pF; L = 0.75 $\mu$H.

## 10   THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | CONDITIONS | 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 | in free air | 1.5 | K/W |

## 11   QUALITY SPECIFICATION

In accordance with *"SNW-FQ611"* if this device is used as an audio amplifier.

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| --- | --- |

## 12 DC CHARACTERISTICS

$V_P = \pm15$ V; $T_{amb} = 25$ °C; measured in test diagram of Fig.4; unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
| --- | --- | --- | --- | --- | --- | --- |
| **Supply** | | | | | | |
| $V_P$ | supply voltage | | $\pm7.5$ | $\pm15$ | $\pm30$ | V |
| $I_{q(tot)}$ | total quiescent current | no load connected | – | 25 | 45 | mA |
| | | outputs floating | – | 5 | 10 | mA |
| **Internal stabilizer logic supply (pin STAB)** | | | | | | |
| $V_{O(STAB)}$ | stabilizer output voltage | referenced to $V_{SS}$ | 11.7 | 13 | 14.3 | V |
| **Switch inputs (pins SW1 and SW2)** | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | referenced to $V_{SS}$ | 10 | – | 15 | V |
| $V_{IL}$ | LOW-level input voltage | referenced to $V_{SS}$ | 0 | – | 2 | V |
| **Control outputs (pins REL1 and REL2)** | | | | | | |
| $V_{OH}$ | HIGH-level output voltage | referenced to $V_{SS}$ | 10 | – | 15 | V |
| $V_{OL}$ | LOW-level output voltage | referenced to $V_{SS}$ | 0 | – | 2 | V |
| **Diagnostic output (pin DIAG, open-drain)** | | | | | | |
| $V_{OL}$ | LOW-level output voltage | $I_{DIAG} = 1$ mA; note 1 | 0 | – | 1.0 | V |
| $I_{LO}$ | output leakage current | no error condition | – | – | 50 | µA |
| **Enable inputs (pins EN1 and EN2)** | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | referenced to $V_{SS}$ | 9 | – | 15 | V |
| $V_{IL}$ | LOW-level input voltage | referenced to $V_{SS}$ | 0 | 5 | – | V |
| $V_{EN(hys)}$ | hysteresis voltage | | – | 4 | – | V |
| $I_{I(EN)}$ | input current | | – | – | 300 | µA |
| **Switching-on input (pin POWERUP)** | | | | | | |
| $V_{POWERUP}$ | operating voltage | referenced to $V_{SS}$ | 5 | – | 12 | V |
| $I_{I(POWERUP)}$ | input current | $V_{POWERUP} = 12$ V | – | 100 | 170 | µA |
| **Temperature protection** | | | | | | |
| $T_{diag}$ | temperature activating diagnostic | $V_{DIAG} = V_{DIAG(LOW)}$ | 150 | – | – | °C |
| $T_{hys}$ | hysteresis on temperature diagnostic | $V_{DIAG} = V_{DIAG(LOW)}$ | – | 20 | – | °C |
| **Current protection** | | | | | | |
| $I_{O(ocpl)}$ | overcurrent protection level | | – | 3.5 | – | A |

**Note**

1. Temperature sensor or maximum current sensor activated.

## 13  AC CHARACTERISTICS

$V_P = \pm15$ V; $T_{amb}$ = 25 °C; unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| **Single-ended application;** note 1 | | | | | | |
| $P_o$ | output power | $R_L$ = 8 $\Omega$ | | | | |
| | | THD = 0.5 % | 10[2] | 12 | – | W |
| | | THD = 10 % | 14[2] | 15 | – | W |
| | | $R_L$ = 6 $\Omega$ | | | | |
| | | THD = 0.5 % | – | 16 | – | W |
| | | THD = 10 % | – | 20 | – | W |
| THD | total harmonic distortion | $P_o$ = 1 W; note 3 | | | | |
| | | $f_i$ = 1 kHz | – | 0.05 | 0.1 | % |
| | | $f_i$ = 10 kHz | – | 0.2 | – | % |
| $\eta$ | efficiency endstage | $P_o$ = 2 $\times$ 15 W; $f_i$ = 1 kHz; note 4 | – | 94 | – | % |

**Notes**

1. $V_P = \pm15$ V; $R_L$ = 8 $\Omega$; $f_i$ = 1 kHz; $f_{osc}$ = 310 kHz; $R_s$ = 0.1 $\Omega$ (series resistance of filter coil); $T_{amb}$ = 25 °C; measured in reference design (SE application) shown in Fig.5; unless otherwise specified.

2. Indirectly measured; based on $R_{ds(on)}$ measurement.

3. Total Harmonic Distortion (THD) is measured in a bandwidth of 22 Hz to 20 kHz (AES 17 brickwall filter). When distortion is measured using a low-order low-pass filter a significantly higher value will be found, due to the switching frequency outside the audio band. Measured using the typical application circuit, given in Fig.5.
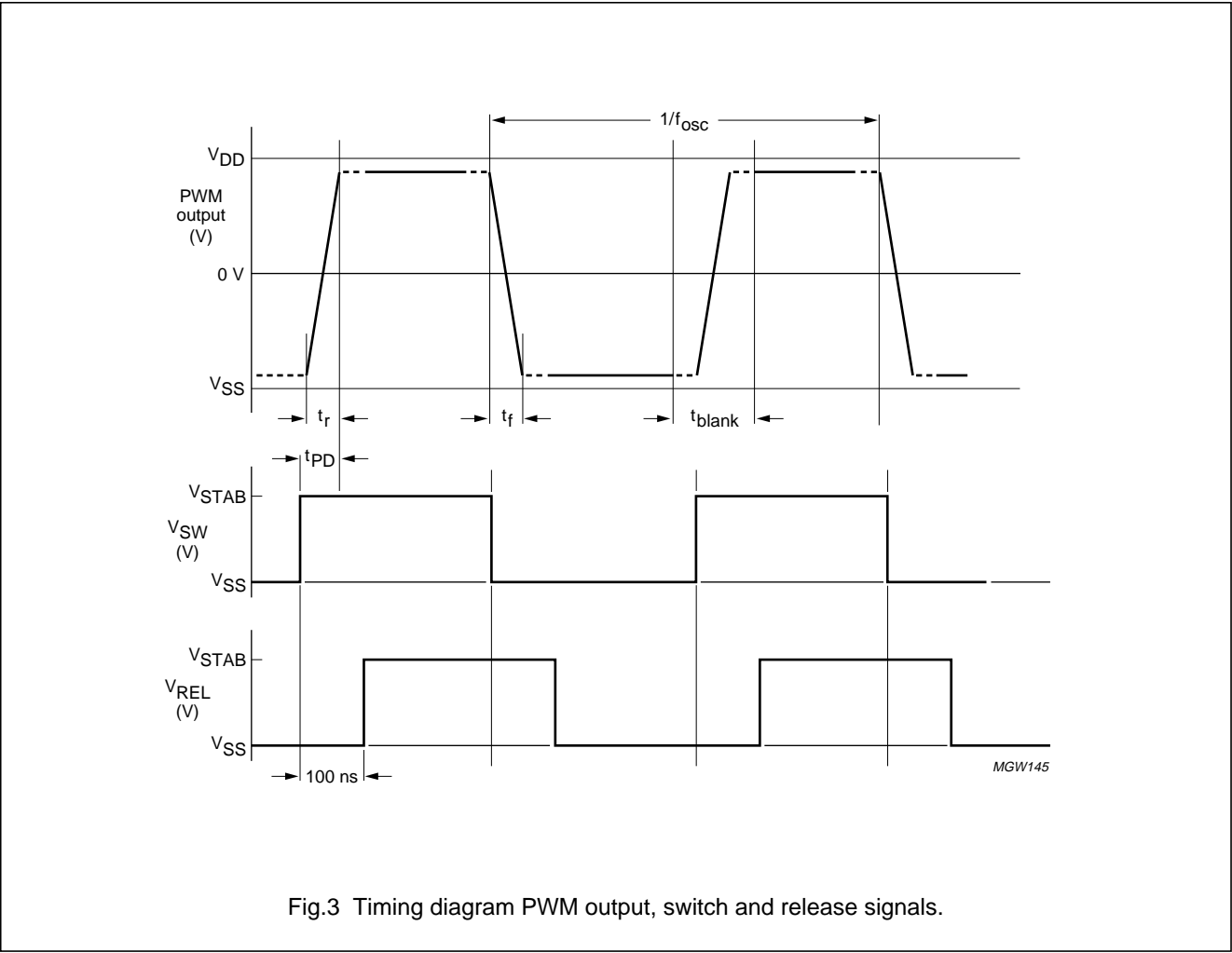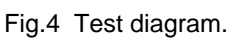
4. Efficiency for power stage.

## 14 SWITCHING CHARACTERISTICS

$V_P = \pm 15$ V; $T_{amb} = 25$ °C; measured in Fig.4; unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|--------|-----------|------------|------|------|------|------|
| **PWM outputs (pins OUT1 and OUT2);** see Fig.3 | | | | | | |
| $t_r$ | rise time | | – | 30 | – | ns |
| $t_f$ | fall time | | – | 30 | – | ns |
| $t_{blank}$ | blanking time | | – | 70 | – | ns |
| $t_{PD}$ | propagation delay | from pin SW1 (SW2) to pin OUT1 (OUT2) | – | 200 | – | ns |
| $t_{W(min)}$ | minimum pulse width | | – | 220 | 270 | ns |
| $R_{ds(on)}$ | on-resistance of the output transistors | | – | 0.2 | 0.4 | Ω |



Fig.3  Timing diagram PWM output, switch and release signals.

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**15  TEST AND APPLICATION INFORMATION**



Fig.4  Test diagram.

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## 15.1 SE application

For SE application the application diagram as shown in Fig.5 can be used.

## 15.2 Package ground connection

The heatsink of the TDA8925 is connected internally to $V_{SS}$.

## 15.3 Output power

The output power in SE self oscillating class-D applications can be estimated using the formula

$$P_{o(1\%)} = \frac{\left[\dfrac{R_L}{R_L + R_{ds(on)} + R_s} \times V_P\right]^2}{2 \times R_L}$$

The maximum current $I_{O(max)} = \dfrac{V_P}{R_L + R_{ds(on)} + R_s}$ should not exceed 3 A.

Where:

   $R_L$ = load impedance

   $R_s$ = series resistance of filter coil

   $P_{o(1\%)}$ = output power just at clipping.

The output power at THD = 10 %: $P_{o(10\%)} = 1.25 \times P_{o(1\%)}$.

## 15.4 Reference design

The reference design for a self oscillating class-D system for the TDA8925 is shown in Fig.5. The Printed-Circuit Board (PCB) layout is shown in Figs 6, 7 and 8. The bill of materials is given in Section 15.5.1.

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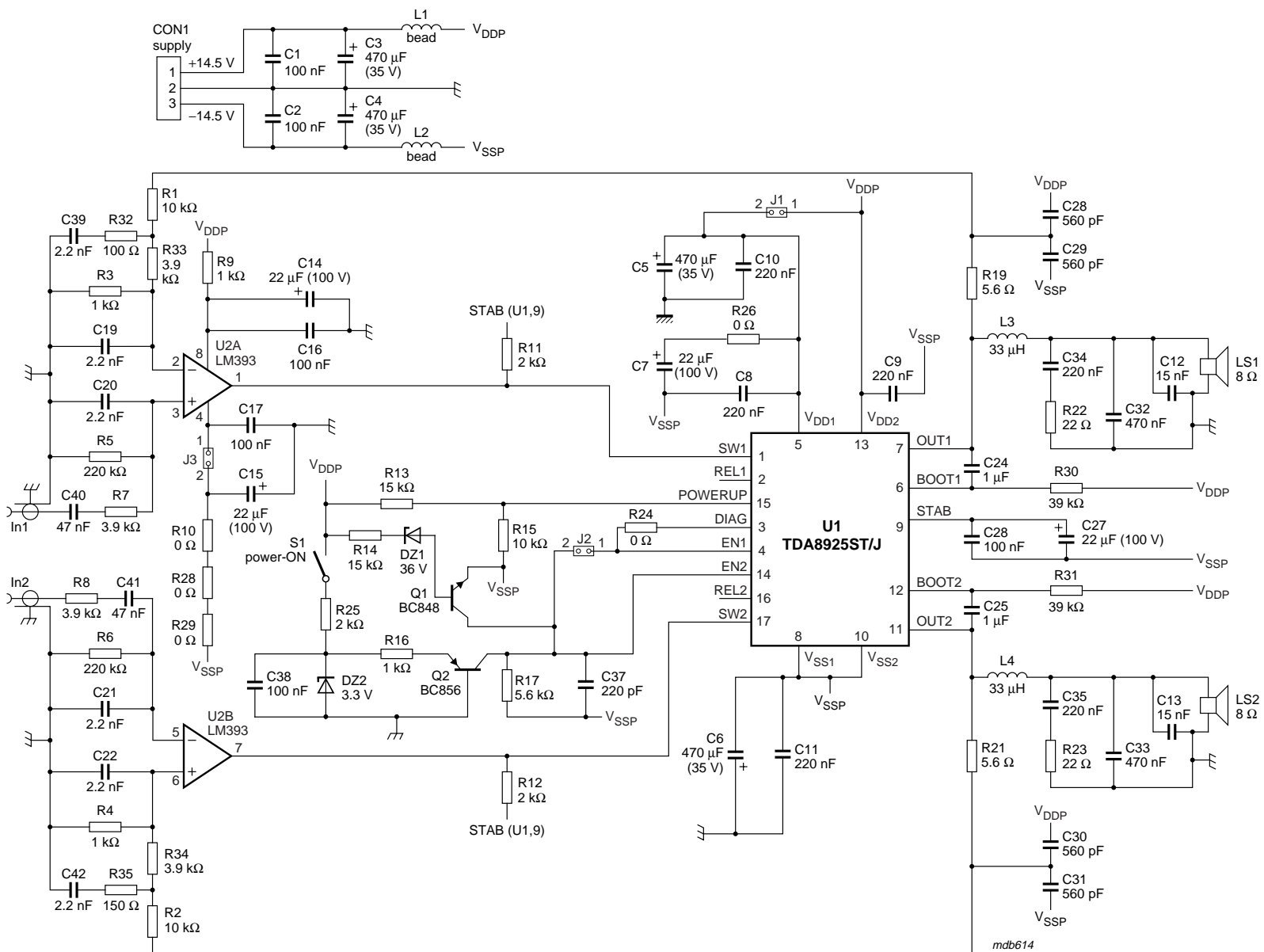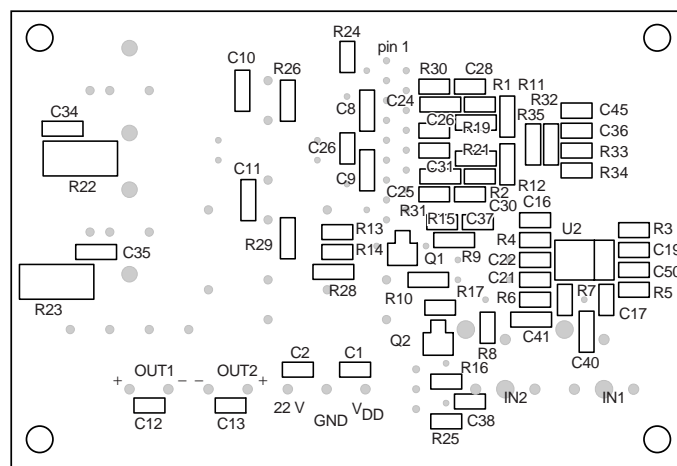TDA8925

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Fig.5 SE self oscillating class-D system application diagram for TDA8925.

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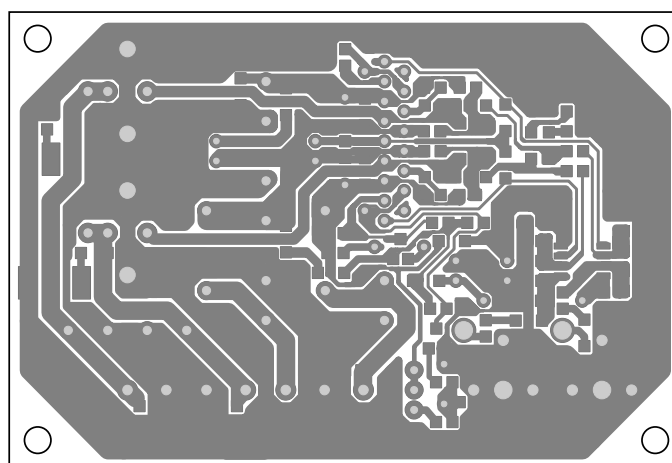Fig.6  Printed-circuit board (bottom silk) layout for TDA8925ST.



Fig.7  Printed-circuit board (bottom copper) layout for TDA8925ST.

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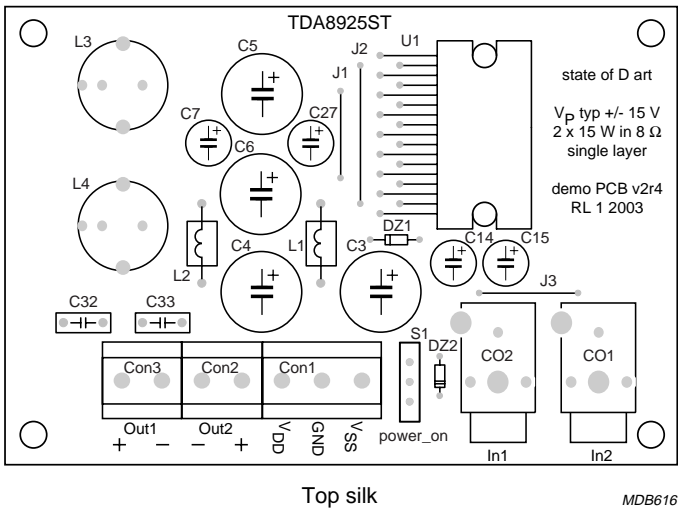
Fig.8  Printed-circuit board (top silk) layout for TDA8925ST.

## 15.5  Reference design bill of material

### 15.5.1  Version 2; revision 5

| COMPONENT | DESCRIPTION | TYPE | COMMENTS |
|---|---|---|---|
| U1 | TDA8925ST | Philips Semiconductors, SOT577-2 | |
| U2 | LM393AD | National, SO8 | alternatives: TI semiconductors and On semiconductors |
| DZ1 | 36 V Zener diode | BZX-79C36V, DO-35 | used as jumper |
| DZ2 | 3.3 V Zener diode | BZX-79C3V3, DO-35 | used as jumper, optional |
| Q1 | BC848 transistor | NPN, SOT23 | |
| Q2 | BC856 transistor | PNP, SOT23 | |
| L1, L2 | bead | Murata BL01RN1-A62 | used as jumper |
| L3, L4 | 33 µH coil | Toko 11RHBP-330M ws | totally shielded |
| S1 | power-on switch | PCB switch, SACME 09-03290-01 | optional |
| CON1 | $V_{SS}$, GND, $V_{DD}$ connector | Augat 5KEV-03 | optional |
| CON2, CON3 | Out2, Out1 connector | Augat 5KEV-02 | optional |
| CO1, CO2 | In1, In2 connector | Cinch Farnell 152-396 | optional |
| J1, J2, J3 | wire | Jumpers, D = 0.5 mm | |
| **Capacitors** | | | |
| C37 | 220 pF/50 V | SMD0805 | |

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| COMPONENT | DESCRIPTION | TYPE | COMMENTS |
|---|---|---|---|
| C28, C29, C30, C31 | 560 pF/100 V | SMD0805 | 50 V is OK |
| C19, C20, C21, C22, C39, C42 | 2.2 nF/50 V | SMD0805 | |
| C12, C13 | 15 nF/50 V | SMD0805 | |
| C40, C41 | 47 nF/50 V | SMD1206 | |
| C1, C2, C16, C17, C26, C38 | 100 nF/50 V | SMD0805 | |
| C8, C9, C10, C11, C34, C35 | 220 nF/50 V | SMD1206 | C8 to C11 used as jumper |
| C32, C33 | 470 nF/63 V | MKT | |
| C24, C25 | 1 μF/16 V | SMD1206 | 1206 due to supply range |
| C7, C14, C15, C27 | 22 μF/100 V | Panasonic NHG Series ECA1JHG220 | 63 V is OK |
| C3, C4, C5, C6 | 470 μF/35 V | Panasonic M Series ECA1VM471 | |
| C18, C23, C36 | these capacitors have been removed | | |
| **Resistors** | | | |
| R10, R26, R28, R29 | 0 Ω | SMD1206 | used as jumpers |
| R24 | 0 Ω | SMD0805 | short-circuited in a new printed-circuit board layout |
| R19, R21 | 5.6 Ω/0.25 W | SMD1206 | 1206 due to dissipation |
| R22, R23 | 22 Ω/1 W | SMD2512 | 2512 due to dissipation |
| R35 | 150 Ω | SMD1206 | used as jumper |
| R32 | 100 Ω | SMD1206 | used as jumper |
| R9 | 1 kΩ | SMD1206 | used as jumper |
| R3, R4, R16 | 1 kΩ | SMD0805 | |
| R11, R12 | 2 kΩ | SMD1206 | used as jumpers |
| R25 | 2 kΩ | SMD0805 | |
| R7, R8, R33, R34 | 3.9 kΩ | SMD0805 | |
| R17 | 5.6 kΩ | SMD0805 | |
| R1, R2, R15 | 10 kΩ | SMD0805 | |
| R13, R14 | 15 kΩ | SMD0805 | |
| R30, R31 | 39 kΩ | SMD0805 | |
| R5, R6 | 220 kΩ | SMD0805 | |
| R18, R20, R27 | these resistors have been removed | | |

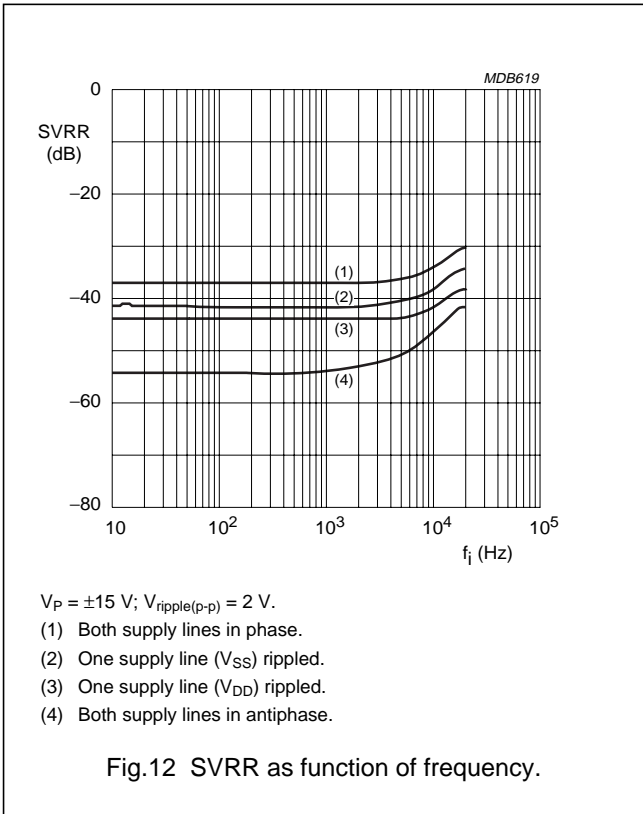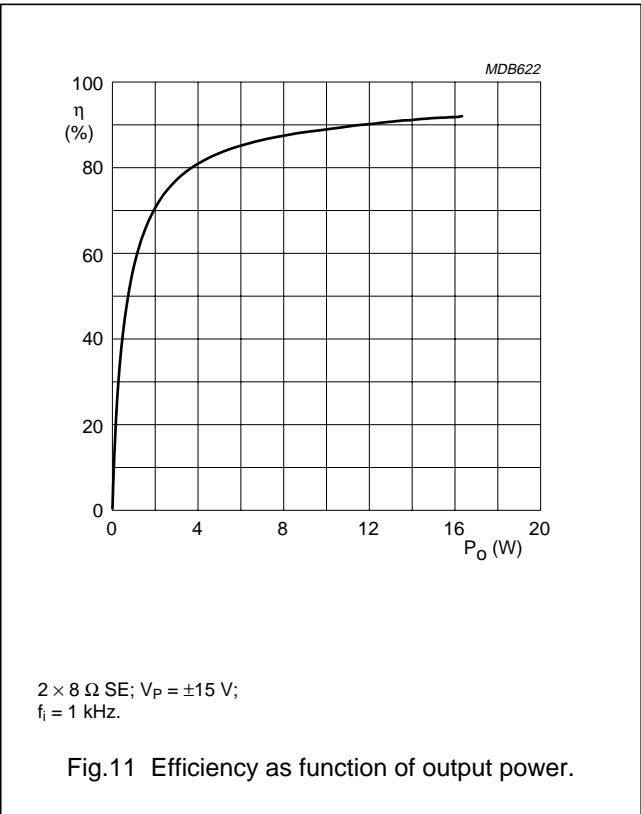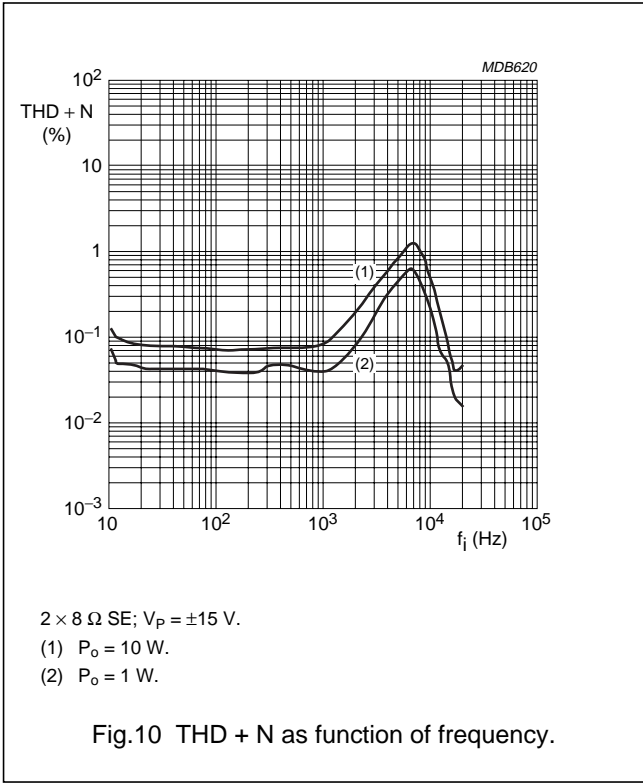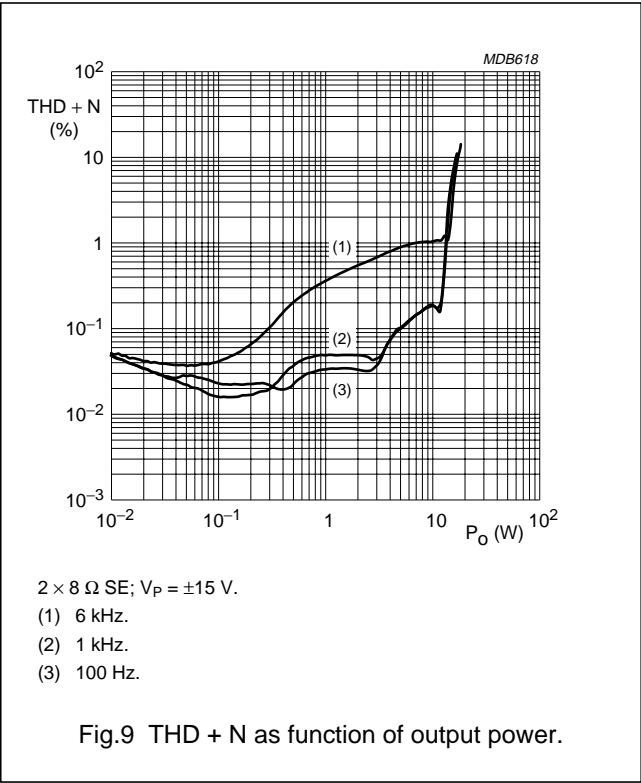15.5.2 PRINTED-CIRCUIT BOARD

The printed-circuit board dimensions are 8.636 × 5.842 cm; single-sided copper of 35 μm; silk screen on both sides;
79 holes; 94 components (32 resistors and 41 capacitors).
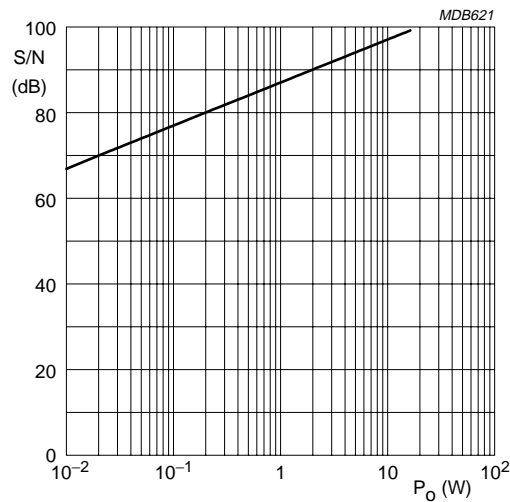
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### 15.6 Curves measured in reference design



$2 \times 8\ \Omega$ SE; $V_P = \pm 15$ V.
(1) 6 kHz.
(2) 1 kHz.
(3) 100 Hz.

Fig.9 THD + N as function of output power.



$2 \times 8\ \Omega$ SE; $V_P = \pm 15$ V.
(1) $P_o = 10$ W.
(2) $P_o = 1$ W.

Fig.10 THD + N as function of frequency.



$2 \times 8\ \Omega$ SE; $V_P = \pm 15$ V;
$f_i = 1$ kHz.

Fig.11 Efficiency as function of output power.



$V_P = \pm 15$ V; $V_{ripple(p-p)} = 2$ V.
(1) Both supply lines in phase.
(2) One supply line ($V_{SS}$) rippled.
(3) One supply line ($V_{DD}$) rippled.
(4) Both supply lines in antiphase.

Fig.12 SVRR as function of frequency.

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2 × 8 Ω SE; $V_P = \pm15$ V.
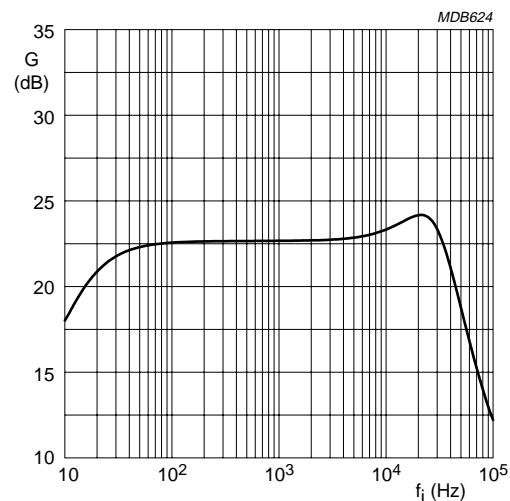
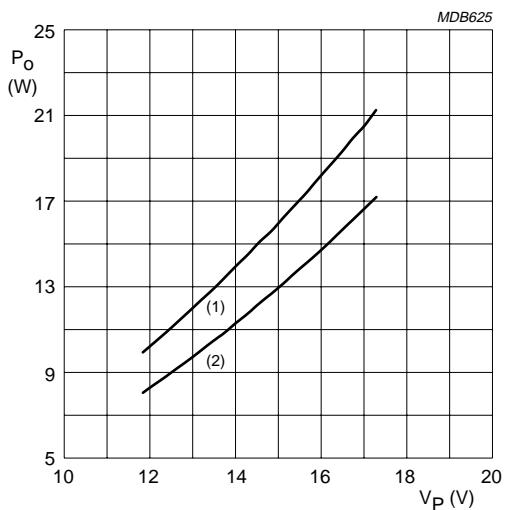Fig.13  S/N as function of output power.
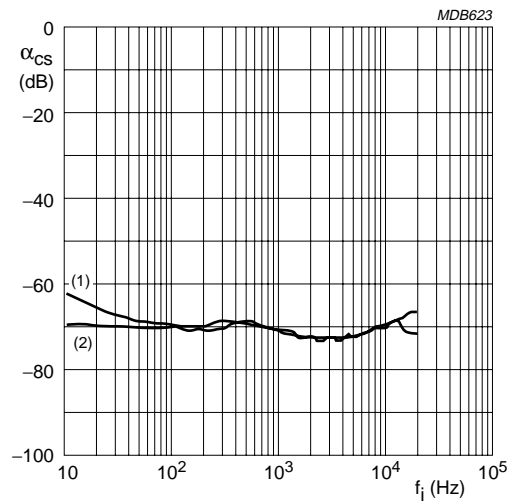


2 × 8 Ω SE; $V_P = \pm15$ V.
(1)   $P_o = 1$ W.
(2)   $P_o = 10$ W.

Fig.14  Channel separation as function of
           frequency.



2 × 8 Ω SE; $V_P = \pm15$ V;
$V_i = 100$ mV.

Fig.15  Gain as function of frequency.



2 × 8 Ω SE; $f_i = 1$ kHz.
(1)   THD + N = 10 %.
(2)   THD + N = 1 %.

Fig.16  Output power as function of supply voltage.
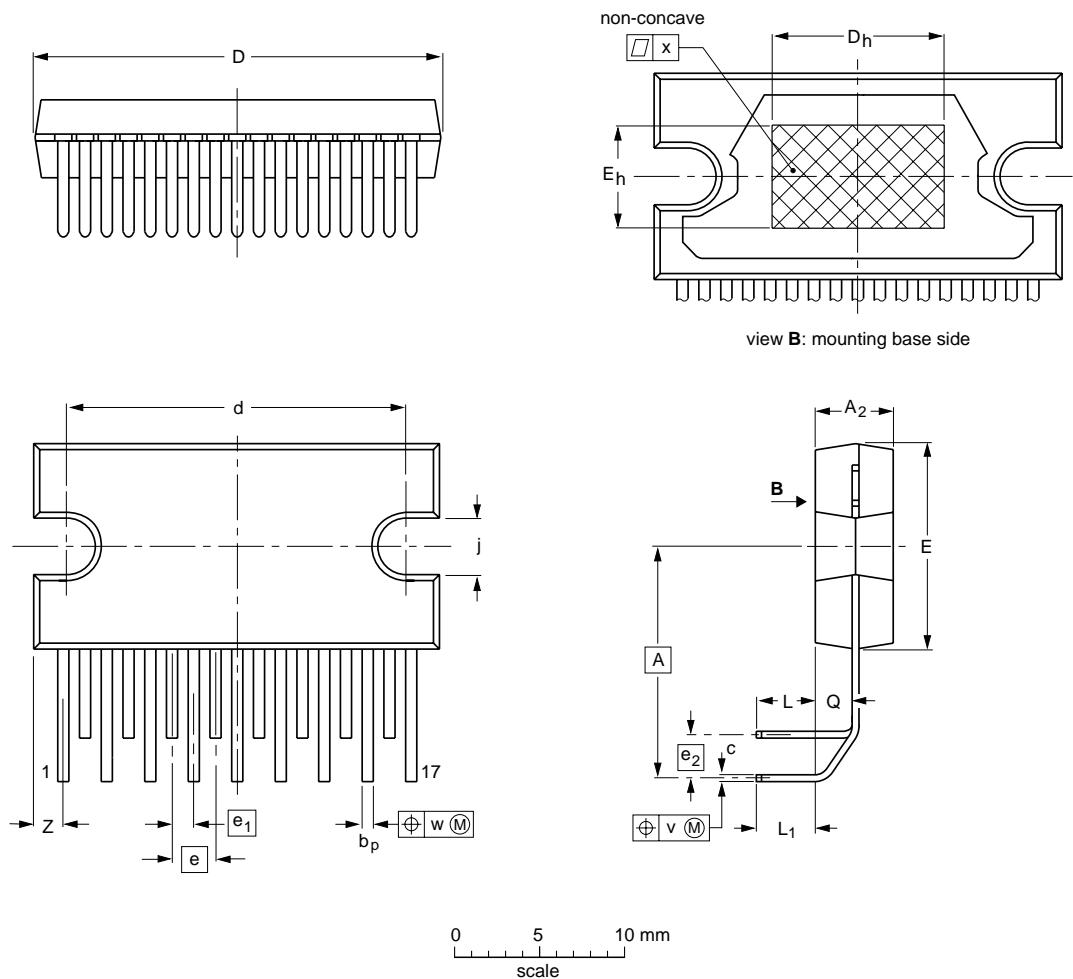
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## 16 PACKAGE OUTLINES

**RDBS17P: plastic rectangular-DIL-bent-SIL power package; 17 leads
(row spacing 2.54 mm)**

SOT577-2

non-concave

$D_h$

view **B**: mounting base side

$E_h$

1

17

0   5   10 mm
scale

**DIMENSIONS (mm are the original dimensions)**

| UNIT | A | $A_2$ | $b_p$ | c | $D^{(1)}$ | d | $D_h$ | $E^{(1)}$ | e | $e_1$ | $e_2$ | $E_h$ | j | L | $L_1$ | Q | v | w | x | $Z^{(1)}$ |
|------|---|-------|-------|---|-----------|---|-------|-----------|---|-------|-------|-------|---|---|-------|---|---|---|---|-----------|
| mm | 13.5 | 4.6 4.4 | 0.75 0.60 | 0.48 0.38 | 24.0 23.6 | 20.0 19.6 | 10 | 12.2 11.8 | 2.54 | 1.27 | 2.54 | 6 | 3.4 3.1 | 3.75 3.15 | 3.75 3.15 | 2.1 1.8 | 0.6 | 0.4 | 0.03 | 2.00 1.45 |

**Note**

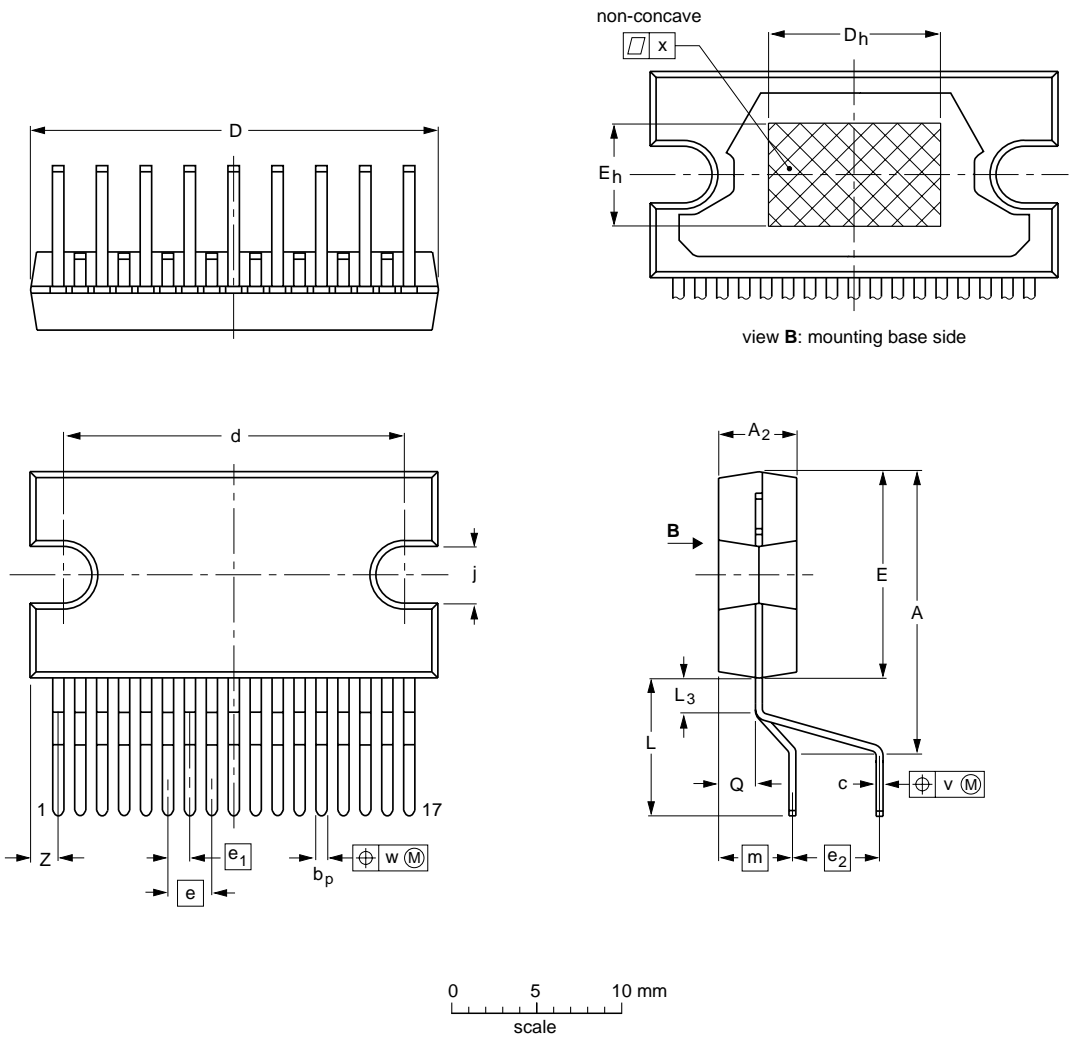1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|--------|--------|--|---------------------|------------|
|  | IEC | JEDEC | JEITA | | | |
| SOT577-2 | | | | | | 01-01-05 03-03-12 |

Power stage 2 x 15 to 25 W class-D
audio amplifier

TDA8925

**DBS17P: plastic DIL-bent-SIL power package; 17 leads (lead length 7.7 mm)**     **SOT243-3**



non-concave

view **B**: mounting base side

0     5     10 mm
scale

**DIMENSIONS (mm are the original dimensions)**

| UNIT | A | A₂ | bₚ | c | D(1) | d | Dₕ | E(1) | e | e₁ | e₂ | Eₕ | j | L | L₃ | m | Q | v | w | x | Z(1) |
|------|---|-----|-----|-----|------|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| mm | 17.0 15.5 | 4.6 4.4 | 0.75 0.60 | 0.48 0.38 | 24.0 23.6 | 20.0 19.6 | 10 | 12.2 11.8 | 2.54 | 1.27 | 5.08 | 6 | 3.4 3.1 | 8.4 7.0 | 2.4 1.6 | 4.3 | 2.1 1.8 | 0.6 | 0.25 | 0.03 | 2.00 1.45 |

**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 | | | |
| SOT243-3 | | | | | | ~~99-12-17~~ 03-03-12 |

Power stage 2 x 15 to 25 W class-D
audio amplifier

TDA8925

## 17 SOLDERING

### 17.1 Introduction to soldering through-hole mount packages

This text gives a brief insight to wave, dip and manual soldering. A more in-depth account of soldering ICs can be found in our *"Data Handbook IC26; Integrated Circuit Packages"* (document order number 9398 652 90011).

Wave soldering is the preferred method for mounting of through-hole mount IC packages on a printed-circuit board.

### 17.2 Soldering by dipping or by solder wave

Driven by legislation and environmental forces the worldwide use of lead-free solder pastes is increasing. Typical dwell time of the leads in the wave ranges from 3 to 4 seconds at 250 °C or 265 °C, depending on solder material applied, SnPb or Pb-free respectively.

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.

### 17.3 Manual soldering

Apply the soldering iron (24 V or less) to the lead(s) of the package, either 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.

### 17.4 Suitability of through-hole mount IC packages for dipping and wave soldering methods

| PACKAGE | SOLDERING METHOD | |
|---|---|---|
| | DIPPING | WAVE |
| DBS, DIP, HDIP, RDBS, SDIP, SIL | suitable | suitable[1] |
| PMFP[2] | – | not suitable |

**Notes**

1. For SDIP packages, the longitudinal axis must be parallel to the transport direction of the printed-circuit board.

2. For PMFP packages hot bar soldering or manual soldering is suitable.

Power stage 2 x 15 to 25 W class-D
audio amplifier

TDA8925

## 18 DATA SHEET STATUS

| LEVEL | DATA SHEET STATUS[1] | PRODUCT STATUS[2][3] | DEFINITION |
|---|---|---|---|
| I | Objective data | Development | This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice. |
| II | Preliminary data | Qualification | This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product. |
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1. Please consult the most recently issued data sheet before initiating or completing a design.

2. The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

3. For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). 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.

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