

**Multi-purpose power amplifier****TDA8580****FEATURES****General**

- Operating voltage from 5 to 32 V
- Very low quiescent current
- Dynamic quiescent current control
- Low distortion
- Few external components, fixed again
- High output power
- Can be used as a stereo amplifier in bridge-tied load (BTL) or quad single-ended (SE) amplifiers
- Single-ended mode without loudspeaker capacitor
- Mute and standby mode with one or two pin operation (at low supply voltage only two pin operation)
- Diagnostic information for Dynamic Distortion Detector (DDD), thermal protection and short-circuit
- No switch on/off plops when switching between standby to mute and from mute to on
- Low offset variation at outputs between mute and on
- Fast mute on supply voltage drops.

**Protection**

- Reverse polarity safe (down to -18 V without high reverse current)
- Able to withstand voltages up to 18 V at the outputs (positive supply line can be connected to ground)
- Short-circuit proof to ground, positive supply voltage on all pins and across load
- ESD protected on all pins
- Thermal protection over 150 °C
- Load dump protection
- Protected against open-circuit ground pins and output short-circuited to supply ground.

**GENERAL DESCRIPTION**

The TDA8580 is a stereo bridge-tied load (BTL) or a quad single-ended amplifier that operates over a wide supply voltage range from 5 to 32 V and consumes a very low quiescent current. This makes it suitable for many applications, such as battery fed applications, car radios, television and home-sound systems.

Because of an internal voltage buffer, this device can be used with, or without, a capacitor connected in series with the load (SE application). A combined BTL and 2 × SE application can also be configured.

**ORDERING INFORMATION**

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TDA8580	DBS17P	plastic DIL-bent-SIL power package; 17 leads (lead length 12 mm)	SOT243-1

## Multi-purpose power amplifier

TDA8580

## QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_P$	operating supply voltage		5.0	–	32	V
$I_{q(\text{tot})}$	total quiescent current	$V_P = 14.4 \text{ V}$	–	15	30	mA
$I_{\text{stb}}$	standby supply current	$V_P = 14.4 \text{ V}$	–	1	50	$\mu\text{A}$
$G_v$	closed loop voltage gain	single-ended	25	26	27	dB
		bridge-tied load	31	32	33	dB
<b>Single-ended application</b>						
$P_o$	output power	THD = 0.5%; $V_P = 14.4 \text{ V}$ ; $R_L = 4 \Omega$	–	5	–	W
		THD = 0.5%; $V_P = 32 \text{ V}$ ; $R_L = 4 \Omega$	–	25	–	W
$V_{\text{os}}$	DC output offset voltage	$V_P = 14.4 \text{ V}$ ; mute	–	–	20	mV
		$V_P = 14.4 \text{ V}$ ; on	–	–	50	mV
$V_{\text{no}}$	noise output voltage	single-ended; $R_s = 0 \Omega$	–	70	100	$\mu\text{V}$
SVRR	supply voltage ripple rejection	on and mute	50	–	–	dB
<b>Bridge-tied load application</b>						
$P_o$	output power	THD = 0.5%; $V_P = 14.4 \text{ V}$ ; $R_L = 4 \Omega$	–	17	–	W
		THD = 0.5%; $V_P = 32 \text{ V}$ ; $R_L = 8 \Omega$	–	40	–	W
THD	total harmonic distortion	$f_i = 1 \text{ kHz}$ ; $P_o = 1 \text{ W}$ ; $V_P = 14.4 \text{ V}$ ; $R_L = 8 \Omega$	–	0.05	–	%
		$f_i = 1 \text{ kHz}$ ; $P_o = 20 \text{ W}$ ; $V_P = 32 \text{ V}$ ; $R_L = 8 \Omega$	–	0.05	–	%
$V_{\text{os}}$	DC output offset voltage	$V_P = 14.4 \text{ V}$ ; mute	–	–	20	mV
		$V_P = 14.4 \text{ V}$ ; on	–	–	60	mV
$V_{\text{no}}$	noise output voltage	single-ended; $R_s = 0 \Omega$	–	100	150	$\mu\text{V}$
SVRR	supply voltage ripple rejection	on and mute	55	–	–	dB

# Multi-purpose power amplifier

# TDA8580

## BLOCK DIAGRAM

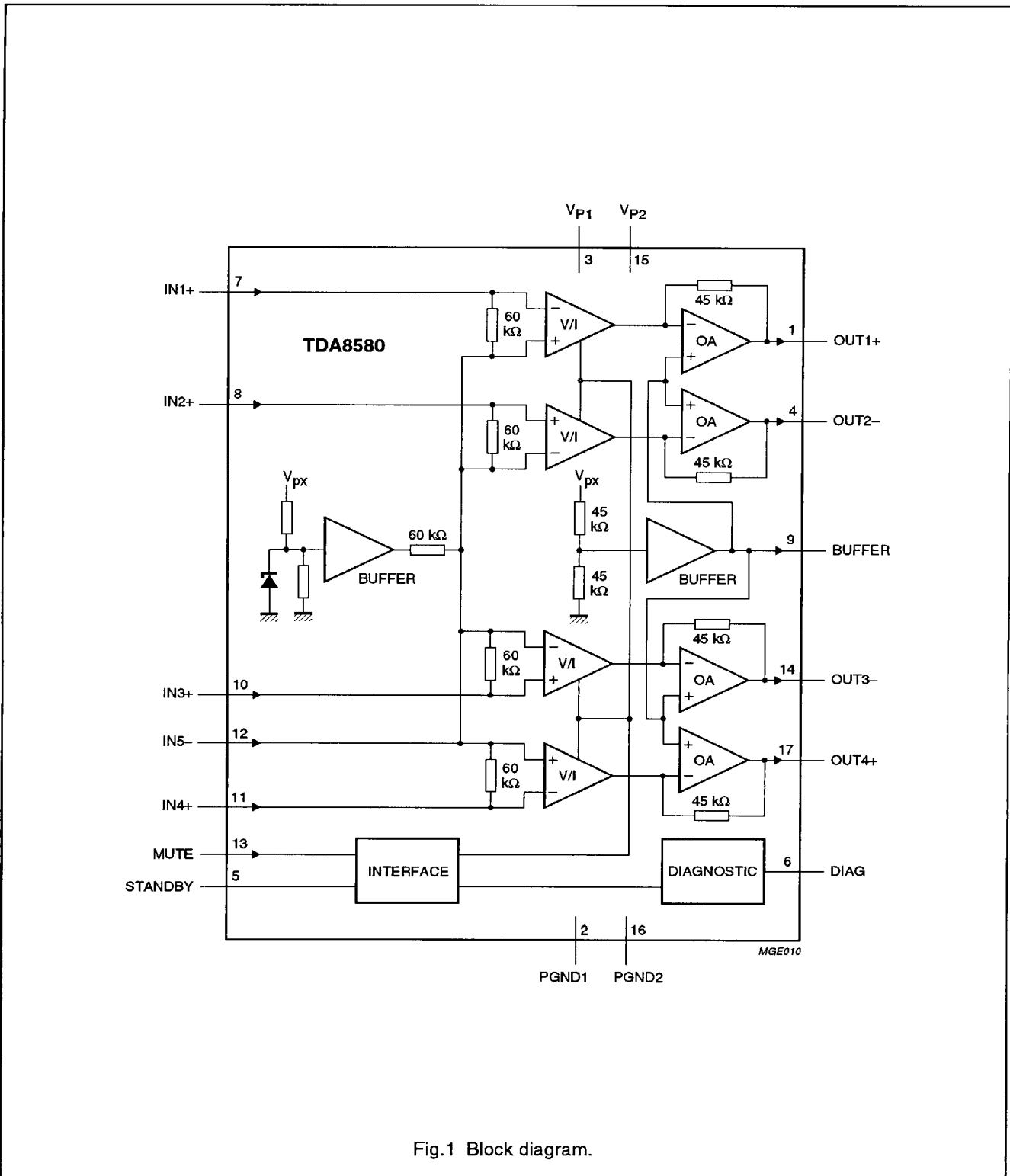


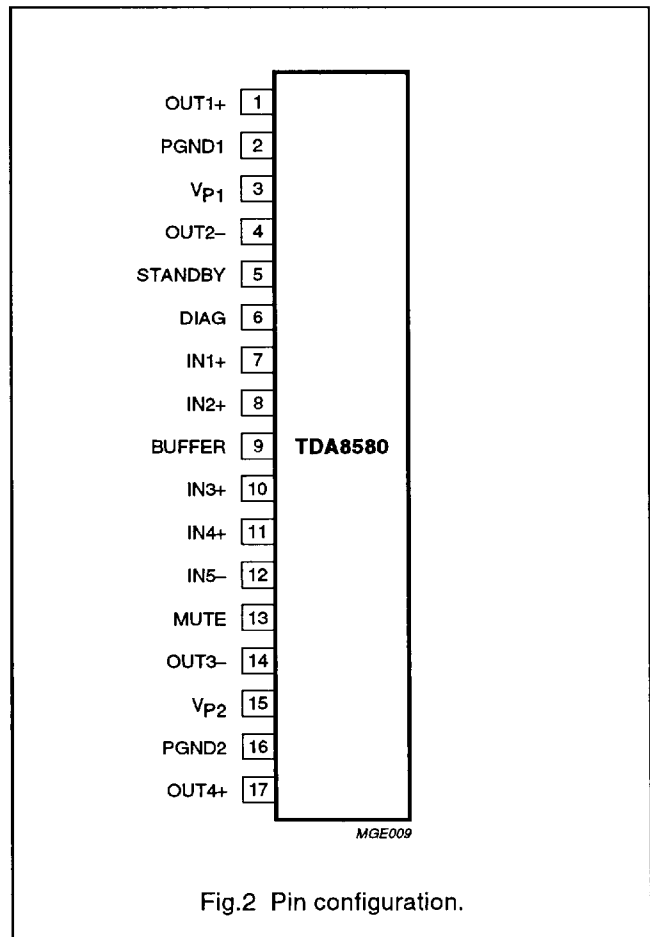
Fig.1 Block diagram.

## Multi-purpose power amplifier

TDA8580

## PINNING

SYMBOL	PIN	DESCRIPTION
OUT1+	1	non-inverting output 1
PGND1	2	power ground 1
V <sub>P1</sub>	3	supply voltage 1
OUT2-	4	inverting output 2
STANDBY	5	standby/mute/on
DIAG	6	diagnostic
IN1+	7	non-inverting input 1
IN2+	8	inverting input 2
BUFFER	9	buffer output (single-ended output buffer)
IN3+	10	inverting input 3
IN4+	11	non-inverting input 4
IN5-	12	inverting input 5; signal ground
MUTE	13	mute/on
OUT3-	14	inverting output 3
V <sub>P2</sub>	15	supply voltage 2
PGND2	16	power ground 2
OUT4+	17	non-inverting output 4



## Multi-purpose power amplifier

TDA8580

**FUNCTIONAL DESCRIPTION**

The TDA8580 is a multi-purpose power amplifier with four independent amplifiers which can be connected in the following configurations with high output power and low distortion (at minimum quiescent current);

1. Dual bridge-tied load (BTL) amplifiers.
2. Quad single-ended amplifiers.
3. Dual single-ended amplifiers and one bridge-tied load amplifier.

The amplifier can be switched on (play or mute) and off (standby) by a dual mute standby pin (for interfacing directly with a microcontroller). One pin operation is also possible by applying a voltage greater than 7 V to the standby/mute/on pin.

Special attention is given to the dynamic behaviour as follows;

1. Noise suppression during engine start.
2. No pops when switching from standby to on.
3. Slow offset change between mute and on (controlled by mute/standby circuit).
4. Low noise levels, which are independent of the supply voltage.

Protections are included to avoid the IC being damaged at;

1. Over temperature  $T > 150\text{ }^{\circ}\text{C}$ .
2. Short-circuit of the output pin(s) to ground or supply rail. When shorted, the power dissipation is limited.
3. A maximum current limiter which limits the maximum output current to 4 A. During this limiting action the load resistance is measured and when the load is less than  $1\ \Omega$ , the amplifier is switched off (every 20 ms the IC tries to restart). The dissipation will be minimized because of a low duty-cycle. The chip temperature is protected by the temperature protection.
4. ESD protection (human body 3000 V and machine model 300 V).
5. Energy handling. A DC voltage of 18 V can be connected to the output of any amplifier while the supply pins are shorted to ground. No high DC current will flow from the supply pins of the amplifier.
6. Reverse battery to avoid a high current flowing.

Diagnostics are available for the following conditions (see Figs 5 to 8).

1. Amplifier in MUTE.
2. Chip temperature greater than  $135\text{ }^{\circ}\text{C}$ .
3. Distortion over 10% due to clipping.
4. Short-circuit protection active.

**LIMITING VALUES**

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_P$	supply voltage	operating	5	32	V
		non-operating	-18	-	V
		load dump protected; see Fig.3	-	50	V
$V_{DIAG}$	voltage on diagnostic pin		-	18	V
$I_{OSM}$	peak output current non-repetitive		-	6	A
$I_{ORM}$	peak output current repetitive		-	4.5	A
$V_{rev}$	reverse polarity voltage		-	18	V
$V_{sc}$	AC and DC short-circuit voltage of output pins across loads and to ground/supply		-	32	V
$P_{tot}$	total power dissipation		-	75	W
$T_j$	junction temperature		-	150	$^{\circ}\text{C}$
$T_{stg}$	storage temperature		-55	+150	$^{\circ}\text{C}$
$T_{amb}$	operating ambient temperature		-40	-	$^{\circ}\text{C}$

## Multi-purpose power amplifier

TDA8580

## 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	1.5	K/W

## QUALITY SPECIFICATION

In accordance with "SNW-FQ-611 part E", if this type is used as an audio amplifier. The numbers of the quality specification can be found in the "Quality Reference Handbook". The handbook can be ordered using the code 9398 510 63011.

## CHARACTERISTICS

$V_P = 14.4\text{ V}$ ;  $T_{amb} = 25\text{ }^\circ\text{C}$ ;  $f_i = 1\text{ kHz}$ ;  $R_L = \infty$ ; measured in test circuit of Fig.9; unless otherwise specified).

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Supply</b>						
$V_P$	operating supply voltage		5.0	14.4	32	V
$I_{q(\text{tot})}$	total quiescent current		–	15	30	mA
$I_{stb}$	standby current		–	1	50	$\mu\text{A}$
$V_O$	DC output voltage	$V_P = 14.4\text{ V}$	–	7.0	–	V
$V_{sw}$	low supply voltage switch off	see Fig.4	2.7	3.1	3.5	V
$V_{pm}$	low supply voltage mute		6.0	7.0	8.0	V
$V_{os}$	single-ended offset voltage	$V_P = 14.4\text{ V}$ ; on	–	0	50	mV
$V_{os}$	bridge-tied load offset voltage	$V_P = 14.4\text{ V}$ ; on	–	0	60	mV
$V_o$	single-ended and bridge-tied load output voltage	$V_P = 14.4\text{ V}$ ; mute	–	–	20	mV
$V_I$	DC input voltage	$V_P = 14.4\text{ V}$	–	4.0	–	V
<b>STANDBY, MUTE AND ON (see Table 1)</b>						
$V_5$	standby condition		0	–	0.8	V
$V_5$	standby hysteresis	note 1	–	0.2	–	V
$V_5$	mute condition	$V_{13} < 1\text{ V}$	2.0	–	5.5	V
$V_5$	on condition	$V_{13} < 1\text{ V}$ ; $V_P > 11\text{ V}$	8.0	–	18	V
<b>MUTE AND ON</b>						
$V_{13}$	mute condition	$V_5 = 5\text{ V}$	0	–	1.0	V
$V_{13}$	on condition	$V_5 = 5\text{ V}$	3.5	–	5.5	V
<b>Diagnostic; output buffer (open-collector); see Figs 5, 6, 7 and 8</b>						
$V_{OL}$	low level output voltage	$I_{\text{sink}} = 1\text{ mA}$	–	0.2	0.8	V
$I_{LI}$	leakage current	$V_{\text{DIAG}} = 14.4\text{ V}$	–	–	1	$\mu\text{A}$
CD	clip detector	$V_{\text{DIAG}} < 0.8\text{ V}$	5	10	15	%
$T_{\text{junc}}$	thermal protection	$V_{\text{DIAG}} < 0.8\text{ V}$	135	–	–	$^\circ\text{C}$

## Multi-purpose power amplifier

TDA8580

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Stereo BTL application</b> (see Fig.9)						
THD	total harmonic distortion	$P_o = 1\text{ W}; f_i = 1\text{ kHz}; R_L = 4\ \Omega$	–	0.05	0.1	%
		$P_o = 1\text{ W}; f_i = 10\text{ kHz}; R_L = 4\ \Omega$	–	0.1	–	%
$P_o$	output power	THD = 0.5%; $V_P = 14.4\text{ V}; R_L = 4\ \Omega$	15	17	–	W
		THD = 0.5%; $V_P = 32\text{ V}; R_L = 8\ \Omega$	37	40	–	W
		THD = 10%; $V_P = 14.4\text{ V}; R_L = 4\ \Omega$	18	21	–	W
		THD = 10%; $V_P = 32\text{ V}; R_L = 8\ \Omega$	–	50	–	W
$G_V$	voltage gain		31	32	33	dB
$\alpha_{cs}$	channel separation		40	55	–	dB
$ \Delta G_V $	channel unbalance		–	–	1	dB
$V_{no}$	noise voltage	$R_s = 1\text{ k}\Omega; V_P = 14.4\text{ V};$ note 2	–	100	150	$\mu\text{V}$
$V_{nom}$	noise voltage mute	note 2	–	–	20	$\mu\text{V}$
$V_o$	output voltage mute	$V_i = 1\text{ V (RMS)}$	–	3	500	$\mu\text{V}$
SVRR	supply voltage ripple rejection	$f_i = 1\text{ kHz}; V_{ripple} = 2\text{ V}_{tt};$ on/mute condition; $R_s = 0\ \Omega$	55	–	–	dB
$Z_i$	input impedance		23	30	37	k $\Omega$
CMRR	common mode rejection ratio	$V_i = 1\text{ V (RMS)}$	–	68	–	dB
<b>Quad SE application</b> (see Fig.10)						
THD	total harmonic distortion	$P_o = 1\text{ W}; f_i = 1\text{ kHz}; R_L = 4\ \Omega$	–	0.05	0.1	%
		$P_o = 1\text{ W}; f_i = 10\text{ kHz}; R_L = 4\ \Omega$	–	0.1	–	%
$P_o$	output power	THD = 0.5%; $V_P = 14.4\text{ V}; R_L = 4\ \Omega$	4	5	–	W
		THD = 0.5%; $V_P = 32\text{ V}; R_L = 8\ \Omega$	21	25	–	W
		THD = 10%; $V_P = 14.4\text{ V}; R_L = 4\ \Omega$	–	6	–	W
		THD = 10%; $V_P = 32\text{ V}; R_L = 8\ \Omega$	25	30	–	W
$G_V$	voltage gain		25	26	27	dB
$\alpha_{cs}$	channel separation		40	46	–	dB
$ \Delta G_V $	channel unbalance		–	–	1	dB
$V_{no}$	noise voltage	$R_s = 1\text{ k}\Omega; V_P = 14.4\text{ V};$ note 2	–	80	120	$\mu\text{V}$
$V_{nom}$	noise voltage mute	note 2	–	–	20	$\mu\text{V}$
$V_o$	output voltage mute	$V_{in} = 1\text{ V (RMS)}$	–	3	500	$\mu\text{V}$
SVRR	supply voltage ripple rejection	$f_i = 1\text{ kHz}; V_{ripple} = 2\text{ V}_{tt};$ on/mute condition; $R_s = 0\ \Omega$	55	–	–	dB
$Z_i$	input impedance		46	60	74	k $\Omega$
CMRR	common mode rejection ratio	$V_i = 1\text{ V (RMS)}$	–	68	–	dB

# Multi-purpose power amplifier

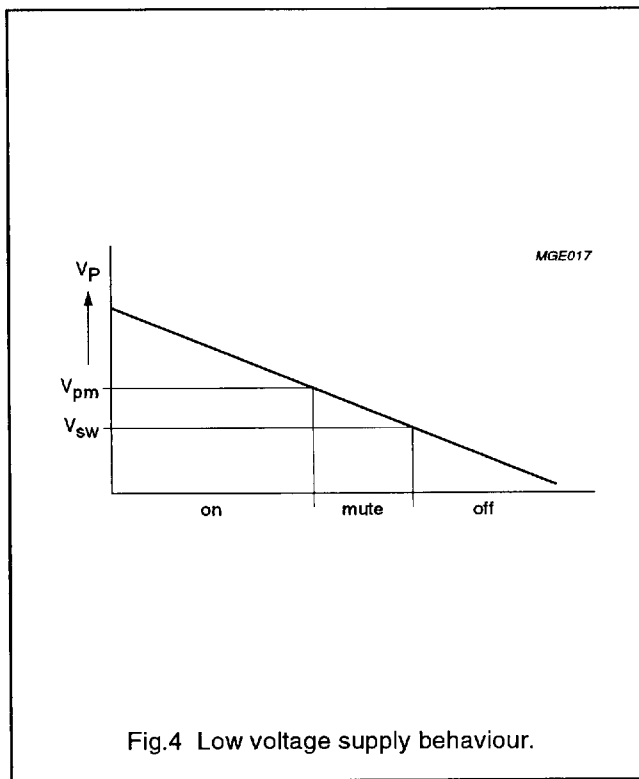
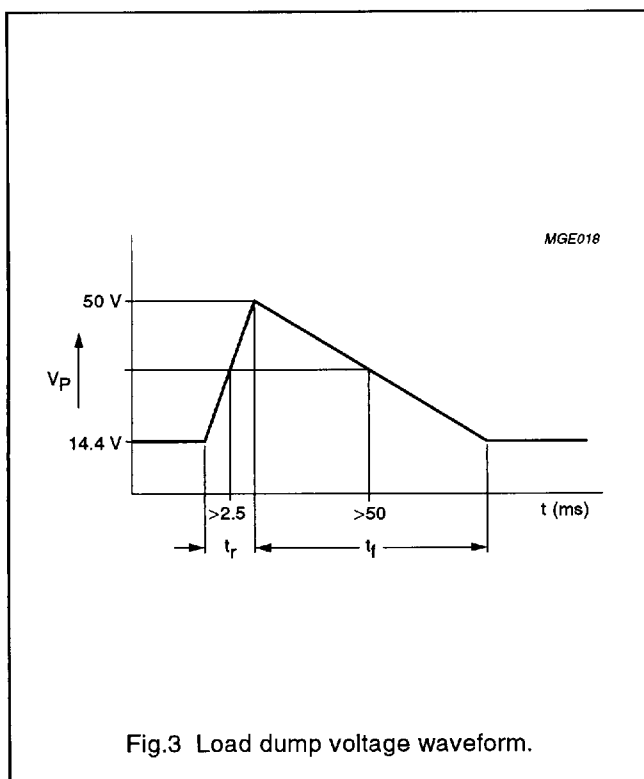
# TDA8580

### Notes to the characteristics

1. Hysteresis between rise and fall voltage.
2. The noise output is measured in a bandwidth of 20 Hz to 20 kHz.

**Table 1** Standby/Mute and On

PIN 5	PIN 13	FUNCTION
<0.8	don't care	standby (off)
$V_5 = 2$ to $5.3$ V	$V_{13} < 1$ V	mute (DC settled)
$V_5 = 2$ to $5$ V	$3.5 \ll 5.3$ V	on (AC operating)
>8.0	don't care	on (AC operating)



# Multi-purpose power amplifier

## TDA8580

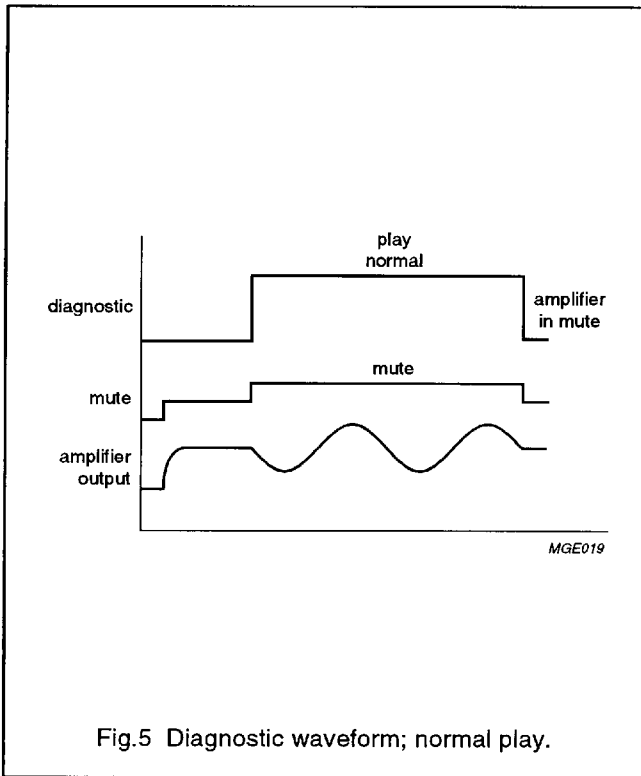


Fig.5 Diagnostic waveform; normal play.

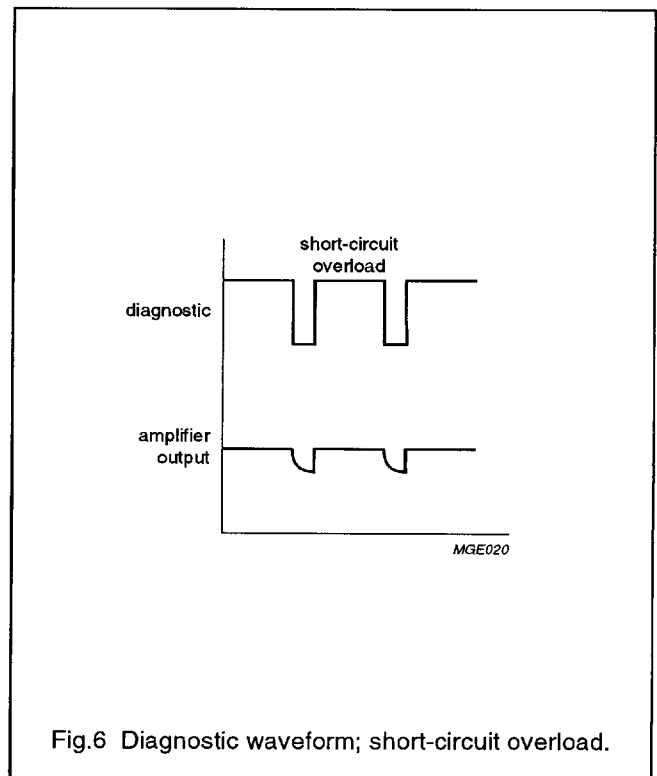


Fig.6 Diagnostic waveform; short-circuit overload.

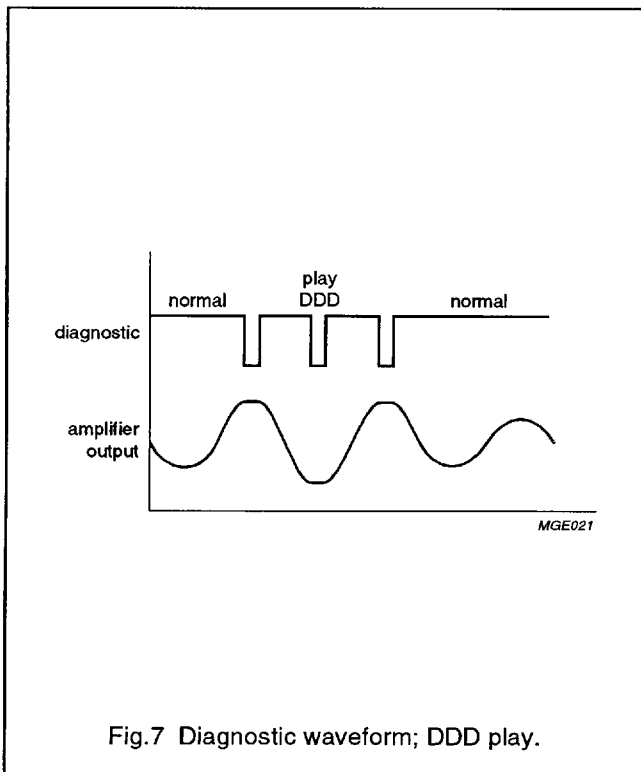


Fig.7 Diagnostic waveform; DDD play.

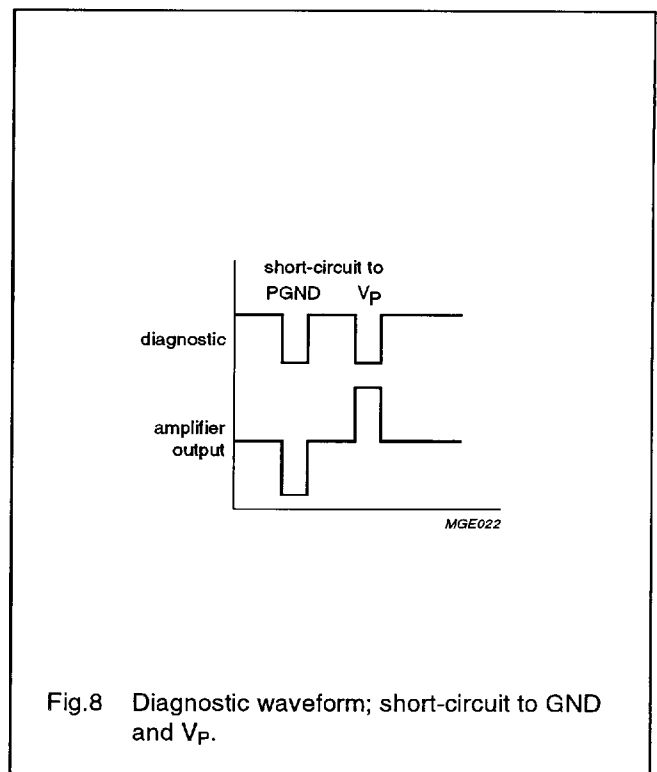


Fig.8 Diagnostic waveform; short-circuit to GND and V<sub>p</sub>.

Multi-purpose power amplifier

TDA8580

APPLICATION INFORMATION

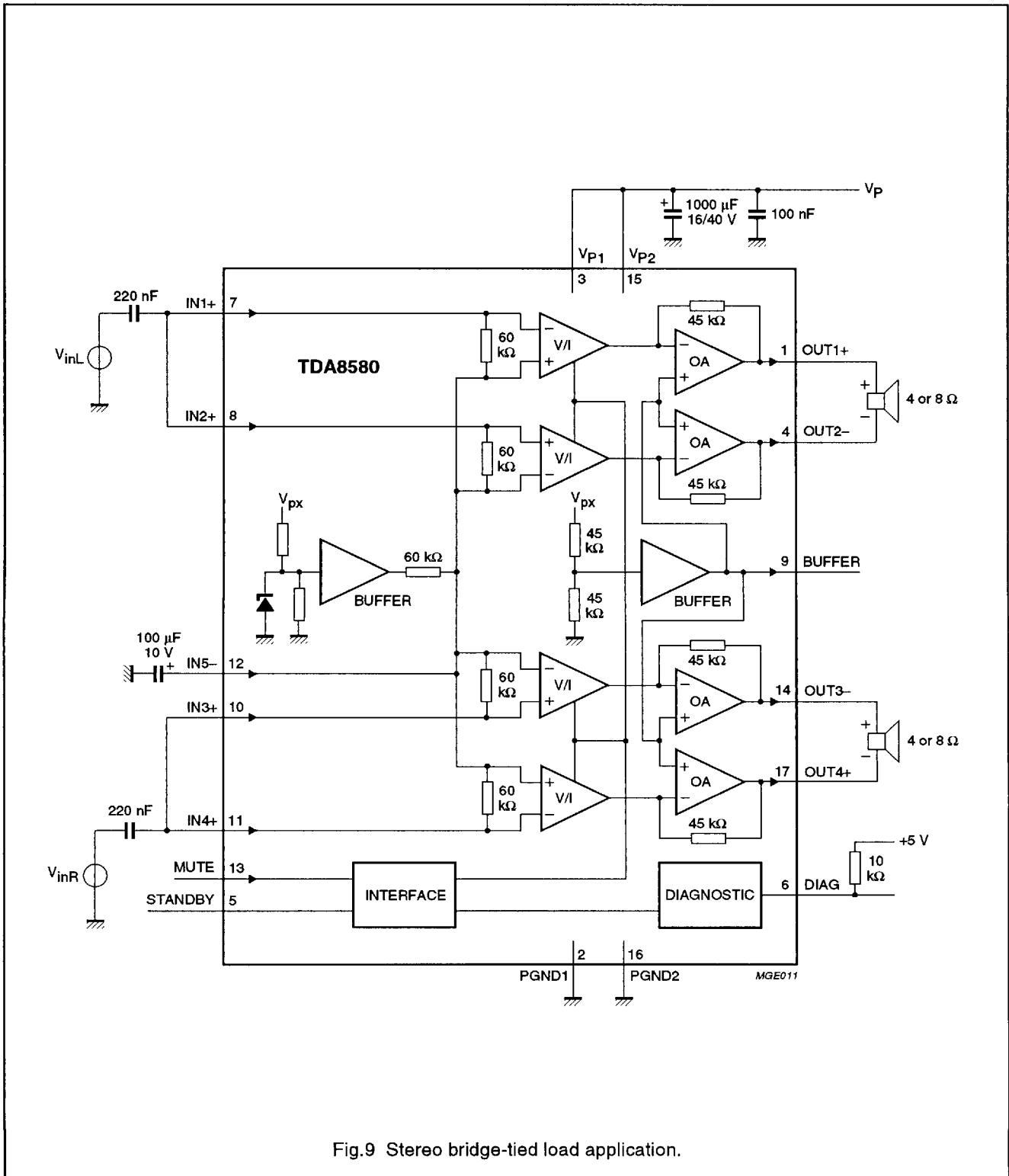


Fig.9 Stereo bridge-tied load application.

Multi-purpose power amplifier

TDA8580

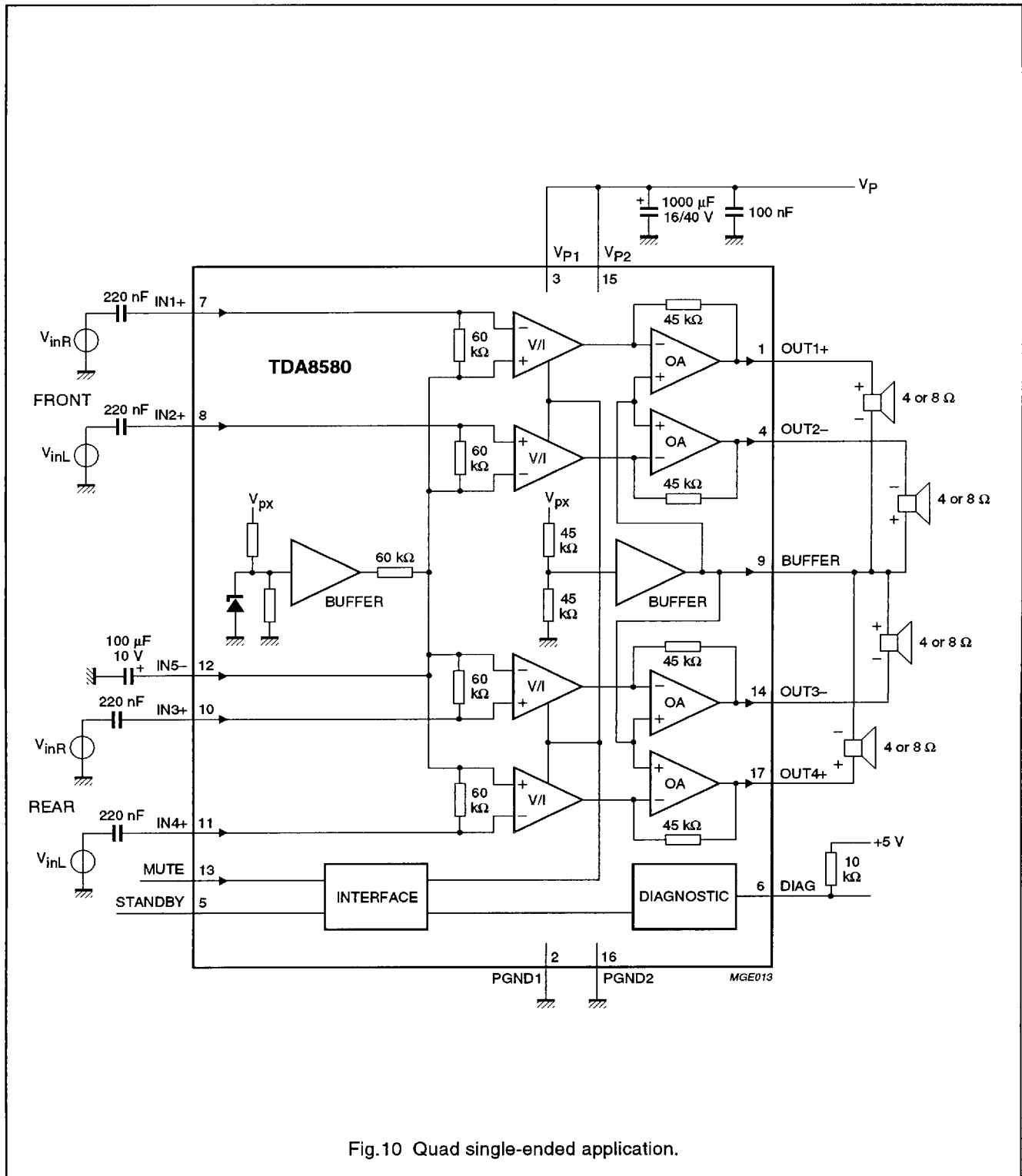


Fig.10 Quad single-ended application.

Multi-purpose power amplifier

TDA8580

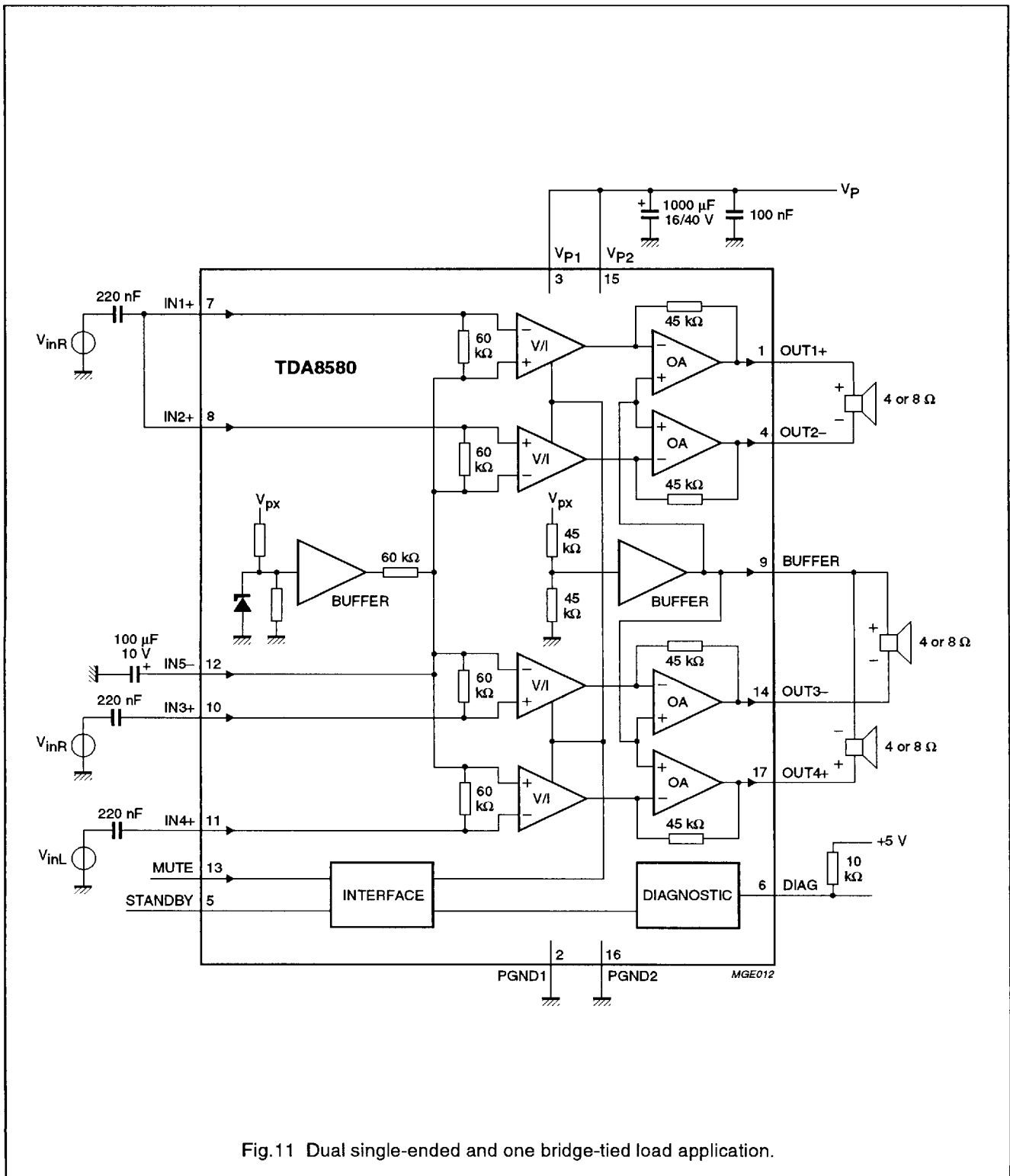
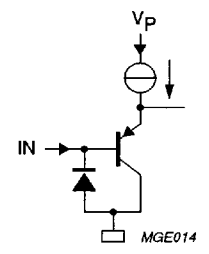
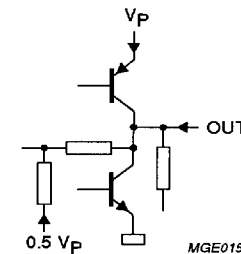
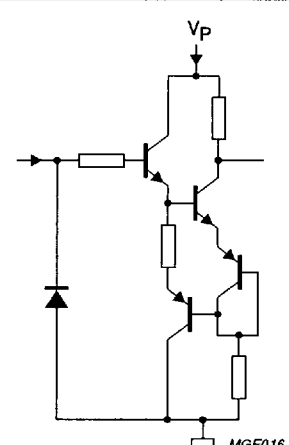


Fig.11 Dual single-ended and one bridge-tied load application.

Multi-purpose power amplifier

TDA8580

INTERNAL PIN CONFIGURATION

PIN	NAME	EQUIVALENT CIRCUIT
7, 8, 10, 11 and 12	inputs	
1, 4, 14 and 17	outputs	
5 and 13	mode select	

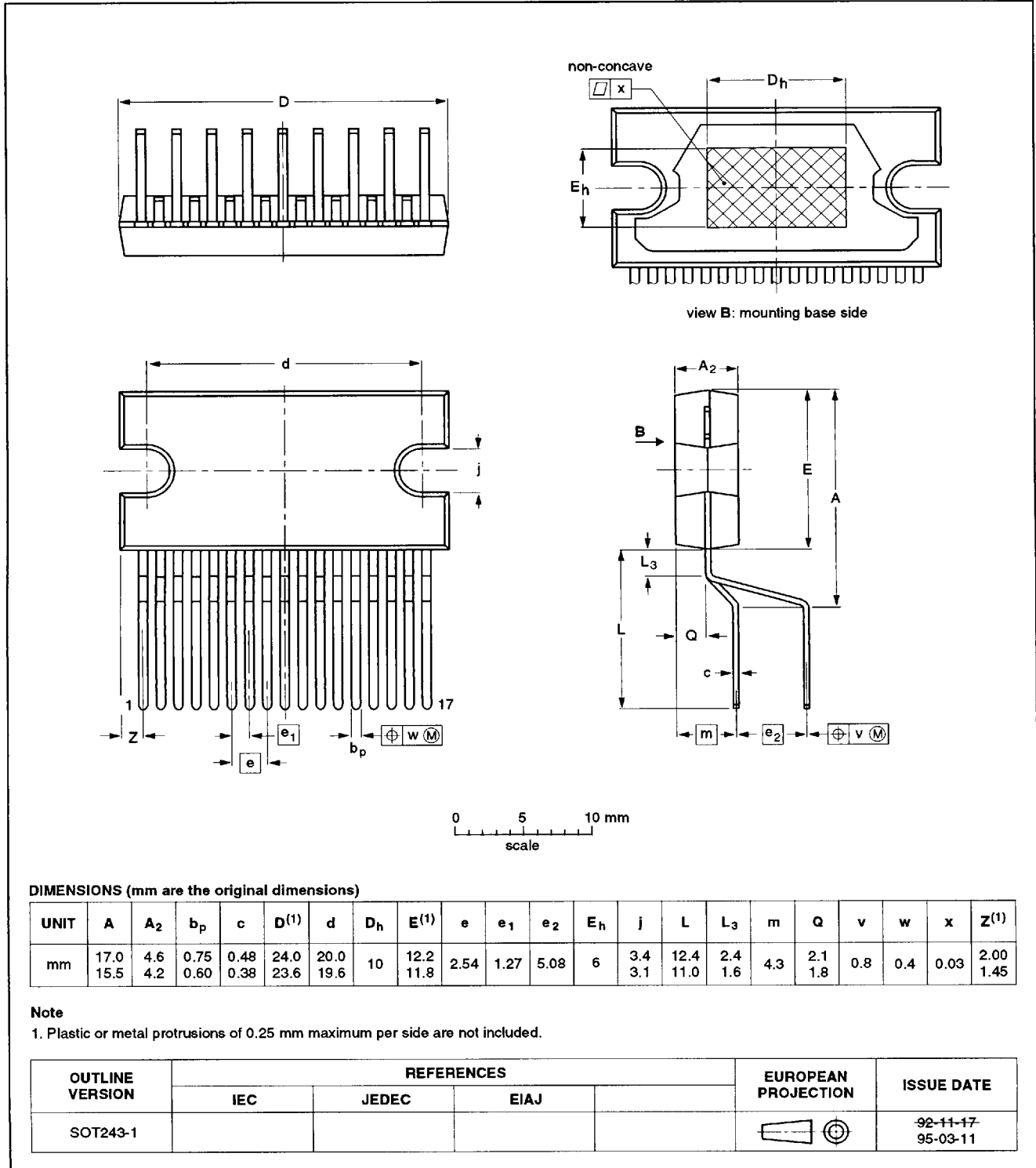
Multi-purpose power amplifier

TDA8580

PACKAGE OUTLINE

DBS17P: plastic DIL-bent-SIL power package; 17 leads (lead length 12 mm)

SOT243-1



# Multi-purpose power amplifier

# TDA8580

## 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

<b>Data sheet status</b>	
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.
<b>Limiting values</b>	
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.	
<b>Application information</b>	
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.