DATA SHEET

TDA8580
Multi-purpose power amplifier

Preliminary specification
Supersedes data of 1996 Jan 4
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Philips
Semiconductors

PHILIPS

Multi-purpose power amplifier TDA8580

FEATURES

General

- Operating voltage from 8 to 28 V
- Low distortion
- Few external components, fixed gain
- 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
- Diagnostic information for Dynamic Distortion Detector (DDD), high temperature (145 °C) 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
- Short-circuit proof to ground, positive supply voltage on all pins and across load
- ESD protected on all pins
- Thermal protection against temperatures exceeding 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 8 to 28 V. This makes it suitable for many applications, such as car radios, television and home-sound systems.

Because of an internal voltage buffer, this device can be used 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

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_P	operating supply voltage		8.0	–	28	V
$I_{q(tot)}$	total quiescent current	V_P = 14.4 V	–	120	140	mA
I_{stb}	standby supply current	V_P = 14.4 V	–	1	50	μA
G_v	voltage gain	single-ended	25	26	27	dB
		bridge-tied load	31	32	33	dB
Bridge-tied load application						
P_o	output power	THD = 0.5%; V_P = 14.4 V; R_L = 4 Ω	–	16	–	W
		THD = 0.5%; V_P = 24 V; R_L = 8 Ω	–	28	–	W
THD	total harmonic distortion	f_i = 1 kHz; P_o = 1 W; V_P = 14.4 V; R_L = 4 Ω	–	0.05	–	%
		f_i = 1 kHz; P_o = 10 W; V_P = 24 V; R_L = 8 Ω	–	0.05	–	%
$V_{offset(DC)}$	DC output offset voltage	V_P = 14.4 V; ‘mute’ condition; R_L = 4 Ω	–	10	20	mV
		V_P = 14.4 V; ‘on’ condition	–	0	100	mV
V_{no}	noise output voltage	R_S = 1 kΩ; V_P = 14.4 V	–	100	150	μV
SVRR	supply voltage ripple rejection	f_i = 1 kHz; $V_{ripple(p-p)}$ = 2 V; ‘on’ or ‘mute’ condition; R_S = 0 Ω	55	–	–	dB
Single-ended application						
P_o	output power	THD = 0.5%; V_P = 14.4 V; R_L = 4 Ω	–	4.2	–	W
		THD = 0.5%; V_P = 24 V; R_L = 4 Ω	–	13	–	W
$V_{offset(DC)}$	DC output offset voltage	V_P = 14.4 V; ‘mute’ condition; R_L = 4 Ω	–	10	20	mV
		V_P = 14.4 V; ‘on’ condition	–	0	100	mV
V_{no}	noise output voltage	R_S = 1 kΩ; V_P = 14.4 V	–	80	120	μV
SVRR	supply voltage ripple rejection	f_i = 1 kHz; $V_{ripple(p-p)}$ = 2 V; ‘on’ or ‘mute’ condition; R_S = 0 Ω	45	–	–	dB

BLOCK DIAGRAM

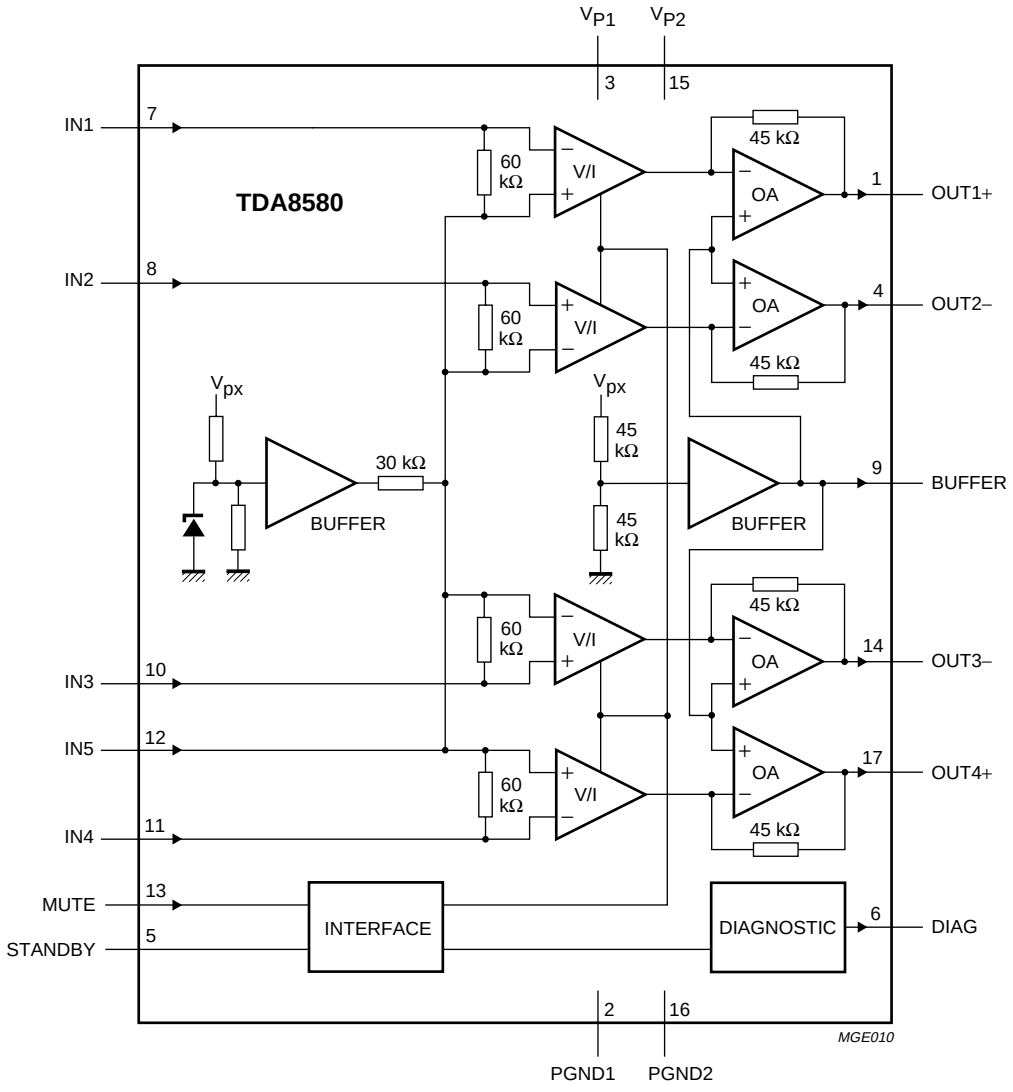


Fig.1 Block diagram.

PINNING

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

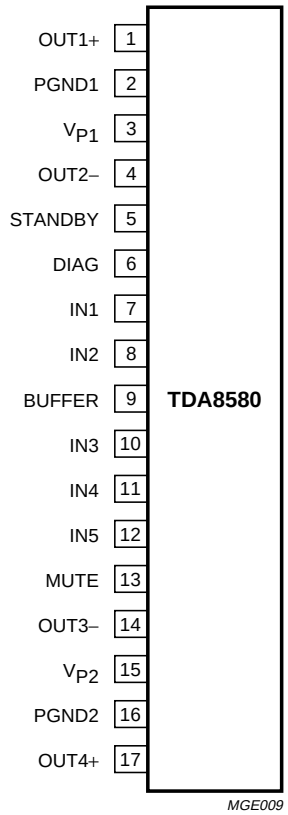


Fig.2 Pin configuration.

FUNCTIONAL DESCRIPTION

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

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

The amplifier can be switched on (play or 'mute') and off ('standby') by the MUTE and STANDBY pins (for interfacing directly with a microcontroller). One-pin operation is also possible by applying a voltage greater than 8 V to the 'standby'/'mute'/'on' selection pin (pin 5) to switch the amplifier in 'on' mode.

Special attention is given to the dynamic behaviour as follows:

- Noise suppression during engine start.
- No plops when switching from 'standby' to 'on'.
- Slow offset change between 'mute' and 'on' (controlled by MUTE and STANDBY pins).
- Low noise levels, which are independent of the supply voltage.

Protections are included to avoid the IC being damaged at:

- Over temperature: T > 150 °C.
- Short-circuit of the output pin(s) to ground or supply rail. When short-circuited, the power dissipation is limited.
- A missing-current limiter which limits the maximum short circuit output current to PGND or V_P pins to 1 A. The dissipation and speaker current will be minimized because the short-circuited amplifier is switched off. The chip temperature is limited by the temperature protection.
- ESD protection (Human Body Model 3000 V, Machine Model 300 V).
- Energy handling. A DC voltage of 6 V can be connected to the output of any amplifier while the supply pins are short-circuited to ground. No high DC current will flow from the supply pins of the amplifier.

Diagnostics are available for the following conditions (see Figs 4 to 7).

- Amplifier in 'mute'
- Chip temperature greater than 145 °C
- Distortion over 2% due to clipping
- 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	8	28	V
		load dump protected; see Fig.3	–	45	V
V_{DIAG}	voltage on diagnostic pin		–	18	V
I_{OSM}	non-repetitive peak output current		–	6	A
I_{ORM}	repetitive peak output current		–	4.5	A
V_{rev}	reverse polarity voltage		–	6	V
V_{sc}	AC and DC short-circuit voltage of output pins across loads and to ground or supply pins	no external series resistor in supply line; note 1	–	24	V
P_{tot}	total power dissipation		–	75	W
T_j	junction temperature		–	150	°C
T_{stg}	storage temperature		–55	+150	°C
T_{amb}	operating ambient temperature		–40	+150	°C

Note

1. The maximum supply voltage under short circuit conditions is 28 V with an additional resistor in the supply line of tbf Ω.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air	40	K/W
$R_{th\ j\text{-}c}$	thermal resistance from junction to case		1.5	K/W

CHARACTERISTICS

V_P = 14.4 V; T_{amb} = 25 °C; f_i = 1 kHz; R_L = ∞; measured in test circuit of Fig.8; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply						
V_P	operating supply voltage		8.0	14.4	28	V
$I_{q(tot)}$	total quiescent current		–	120	140	mA
I_{stb}	standby current		–	1	50	µA
V_O	DC output voltage	V_P = 14.4 V	–	7.0	–	V
$V_{P(mute)}$	low supply voltage mute		6.0	7.0	8.0	V
V_o	single-ended and bridge-tied load output voltage	V_P = 14.4 V; ‘mute’ condition; R_L = 4 Ω	–	–	20	mV
V_I	DC input voltage	V_P = 14.4 V	–	4.0	–	V
STANDBY PIN (see Table 1)						
$V_{5(stb)}$	voltage at STANDBY pin for ‘standby’ condition		0	–	0.8	V
$V_{hys(5)(stb)}$	hysteresis voltage at STANDBY pin for ‘standby’ condition	note 1	–	0.2	–	V
$V_{5(mute)}$	voltage at STANDBY pin for ‘mute’ condition	V_{13} < 1 V	2.0	–	5.5	V
$V_{5(on)}$	voltage at STANDBY pin for ‘on’ condition	V_{13} < 1 V; V_P > 9 V; note 2	8.0	–	18	V
MUTE PIN (see Table 1)						
$V_{13(mute)}$	voltage at MUTE pin for ‘mute’ condition	V_5 = 5 V	0	–	1.0	V
$V_{13(on)}$	voltage at MUTE pin for ‘on’ condition	V_5 = 5 V	3.5	–	5.5	V
Diagnostic; output buffer (open-collector); see Figs 4, 5, 6 and 7						
V_{OL}	low level output voltage	I_{sink} = 1 mA	–	0.2	0.8	V
I_{LI}	leakage current	V_{DIAG} = 14.4 V	–	–	1	µA
CD	clip detector	V_{DIAG} < 0.8 V	tbf	2	tbf	%
$T_{j(diag)}$	junction temperature for high temperature warning	V_{DIAG} < 0.8 V	–	145	–	°C

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Stereo BTL application (see Fig.8)						
THD	total harmonic distortion	f_i = 1 kHz; P_o = 1 W; R_L = 4 Ω	–	0.05	0.1	%
		f_i = 10 kHz; P_o = 1 W; R_L = 4 Ω; Filter: 22 Hz < f < 30 kHz	–	0.2	–	%
		f_i = 1 kHz; P_o = 1 W; V_P = 14.4 V; R_L = 4 Ω	–	0.05	–	%
		f_i = 1 kHz; P_o = 10 W; V_P = 24 V; R_L = 8 Ω	–	0.05	–	%
P_o	output power	THD = 0.5%; V_P = 14.4 V; R_L = 4 Ω	15	16	–	W
		THD = 0.5%; V_P = 24 V; R_L = 8 Ω	25	28	–	W
		THD = 10%; V_P = 14.4 V; R_L = 4 Ω	18	20	–	W
		THD = 10%; V_P = 24 V; R_L = 8 Ω	–	35	–	W
G_v	voltage gain	$V_{o(rms)}$ = 3 V	31	32	33	dB
α_{cs}	channel separation	P_o = 2 W; f_i = 1 kHz; R_L = 4 Ω	40	55	–	dB
$\lvert\Delta G_v\rvert$	channel unbalance		–	–	1	dB
$V_{offset(DC)}$	DC output offset voltage	V_P = 14.4 V; ‘on’ condition	–	0	100	mV
		V_P = 14.4 V; ‘mute’ condition; R_L = 4 Ω	–	10	20	mV
V_{no}	noise output voltage	R_s = 1 kΩ; V_P = 14.4 V; note 3	–	100	150	μV
$V_{no(mute)}$	noise output voltage mute	note 3	–	0	20	μV
$V_{o(mute)}$	output voltage mute	$V_{i(rms)}$ = 1 V	–	3	500	μV
SVRR	supply voltage ripple rejection	R_s = 0 Ω; f_i = 1 kHz; $V_{ripple(p-p)}$ = 2 V; ‘on’ or ‘mute’ condition	55	–	–	dB
Z_i	input impedance		23	30	37	kΩ
CMRR	common mode rejection ratio	R_s = 0 Ω; $V_{i(rms)}$ = 0.5 V; f_i = 1 kHz	–	60	–	dB
Quad SE application (see Fig.9)						
THD	total harmonic distortion	f_i = 1 kHz; P_o = 1 W; R_L = 4 Ω	–	0.05	0.1	%
		f_i = 10 kHz; P_o = 1 W; R_L = 4 Ω; Filter: 22 Hz < f < 30 kHz	–	0.2	–	%

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
P_o	output power	THD = 0.5%; V_P = 14.4 V; R_L = 4 Ω	4	4.2	–	W
		THD = 0.5%; V_P = 24 V; R_L = 4 Ω	11.5	13	–	W
		THD = 10%; V_P = 14.4 V; R_L = 4 Ω	–	5.5	–	W
		THD = 10%; V_P = 24 V; R_L = 4 Ω	14	16	–	W
G_v	voltage gain	$V_{o(rms)}$ = 3 V	25	26	27	dB
α_{cs}	channel separation	P_o = 2 W; f_i = 1 kHz; R_L = 4 Ω	40	46	–	dB
$\lvert\Delta G_v\rvert$	channel unbalance		–	–	1	dB
$V_{offset(DC)}$	DC output offset voltage	V_P = 14.4 V; ‘on’ condition	–	0	100	mV
		V_P = 14.4 V; ‘mute’ condition; R_L = 4 Ω	–	10	20	mV
V_{no}	noise output voltage	R_s = 1 kΩ; V_P = 14.4 V; note 3	–	80	120	μV
$V_{no(mute)}$	noise output voltage mute	note 3	–	0	20	μV
$V_{o(mute)}$	output voltage mute	$V_{i(rms)}$ = 1 V	–	3	500	μV
SVRR	supply voltage ripple rejection	f_i = 1 kHz; $V_{ripple(p-p)}$ = 2 V, ‘on’ or ‘mute’ condition; R_s = 0 Ω	45	–	–	dB
Z_i	input impedance		46	60	74	kΩ
CMRR	common mode rejection ratio	$V_{i(rms)}$ = 0.5 V; f_i = 1 kHz; R_s = 0 Ω	–	60	–	dB

Notes to the characteristics

1. Hysteresis between rise and fall voltage when MSB pin is controlled with real voltage source (the hysteresis depends on resistor connected to MSB pin).
2. At lower V_P the voltage at the STANDBY pin for ‘on’ condition will be adjusted automatically to maintain an ‘on’ condition at low battery voltage (down to 8 V) when using one-pin operation.
3. The noise output is measured in a bandwidth of 20 Hz to 20 kHz.

Table 1 Selection of ‘standby’, ‘mute’ and ‘on’.

VOLTAGE AT PIN 5	VOLTAGE AT PIN 13	FUNCTION
V_5 < 0.8 V	don’t care	‘standby’ (off)
2 V < V_5 < 5.3 V	V_{13} < 1 V	‘mute’ (DC settled)
2 V < V_5 < 5.3 V	3.5 V < V_{13} < 5.3 V	‘on’ (AC operating)
$V_5 \geq$ 8.0 V	don’t care	‘on’ (AC operating)

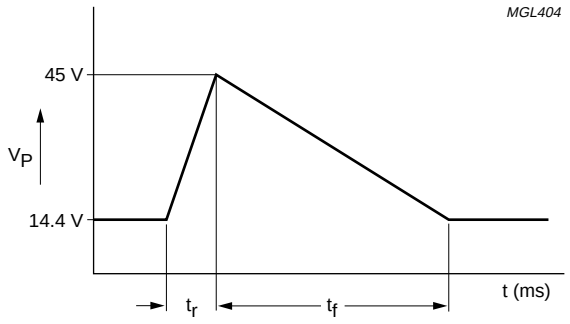


Fig.3 Load dump voltage waveform.

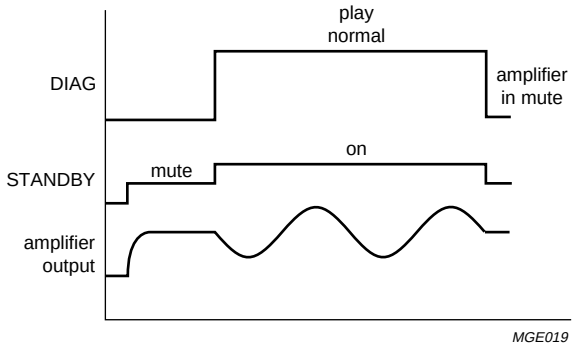


Fig.4 Diagnostic waveform: normal play.

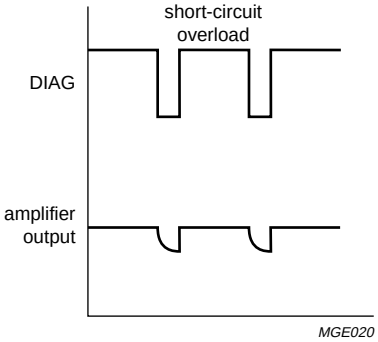


Fig.5 Diagnostic waveform: short-circuit overload.

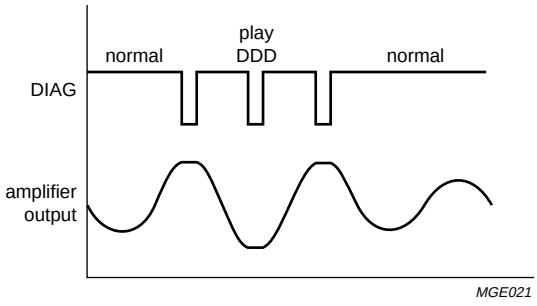


Fig.6 Diagnostic waveform: DDD play.

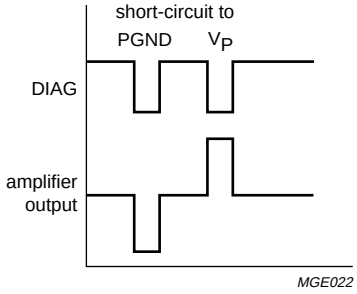


Fig.7 Diagnostic waveform: short-circuit to GND and V_P.

APPLICATION INFORMATION

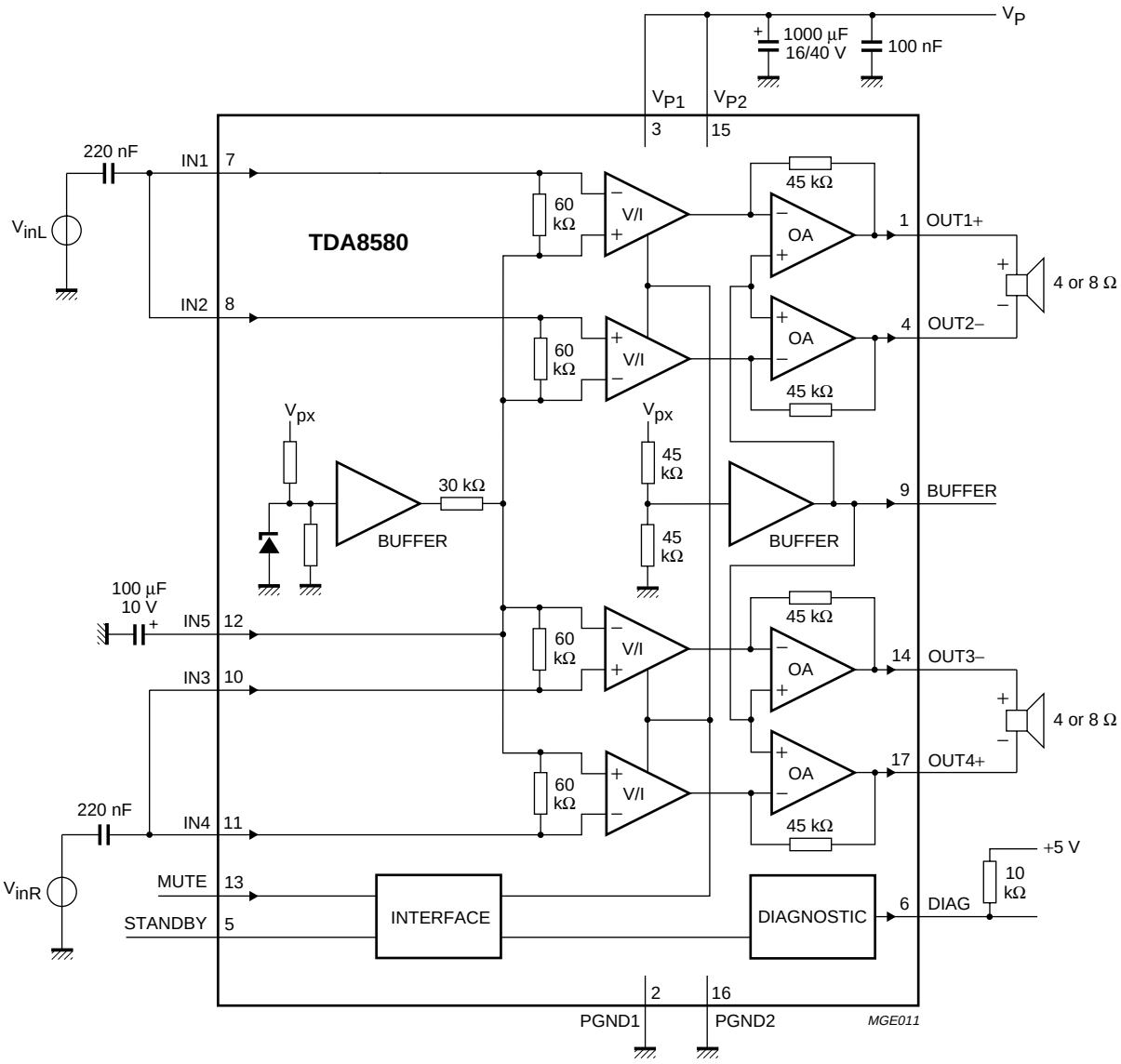


Fig.8 Stereo bridge-tied load application.

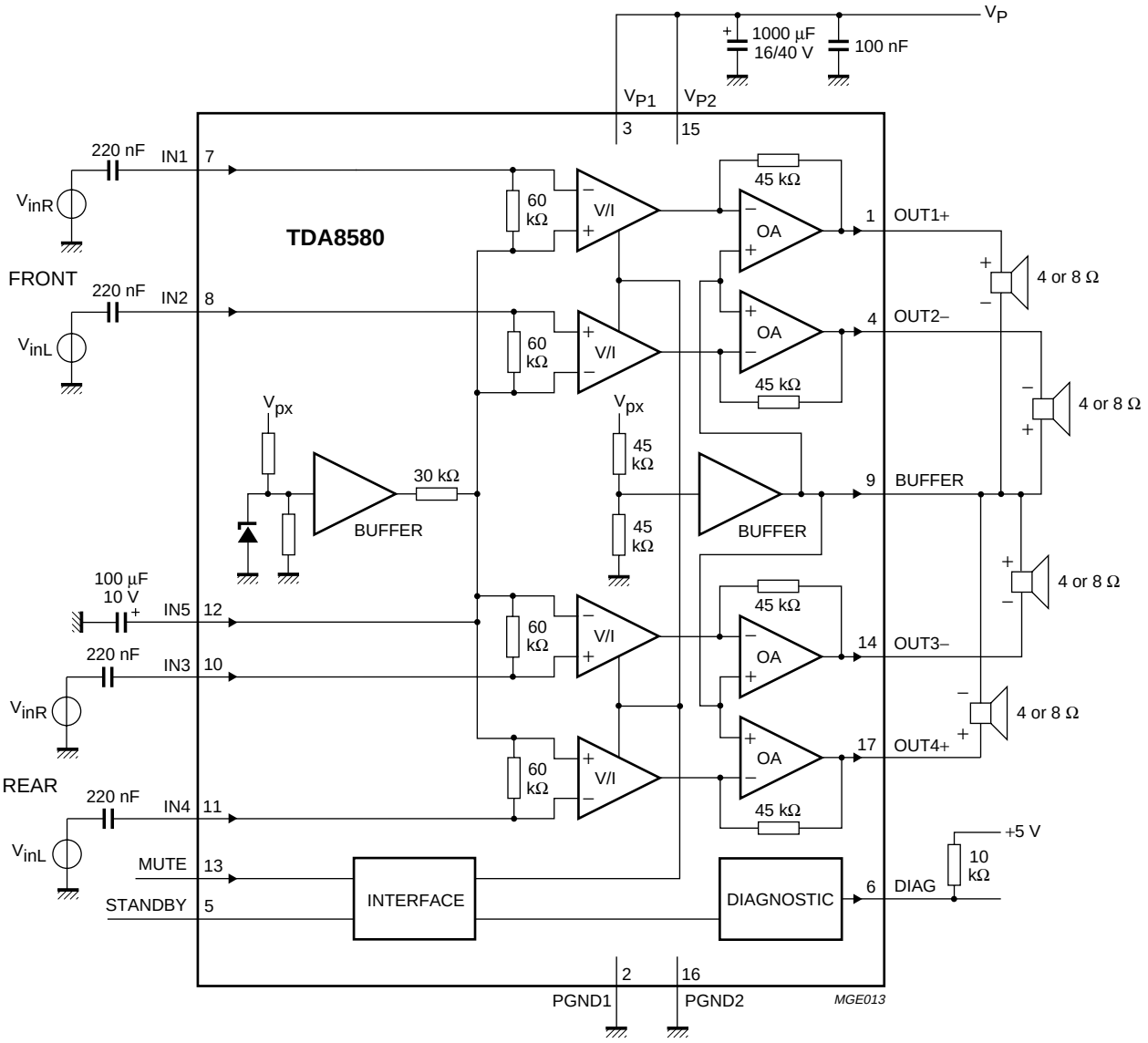


Fig.9 Quad single-ended application.

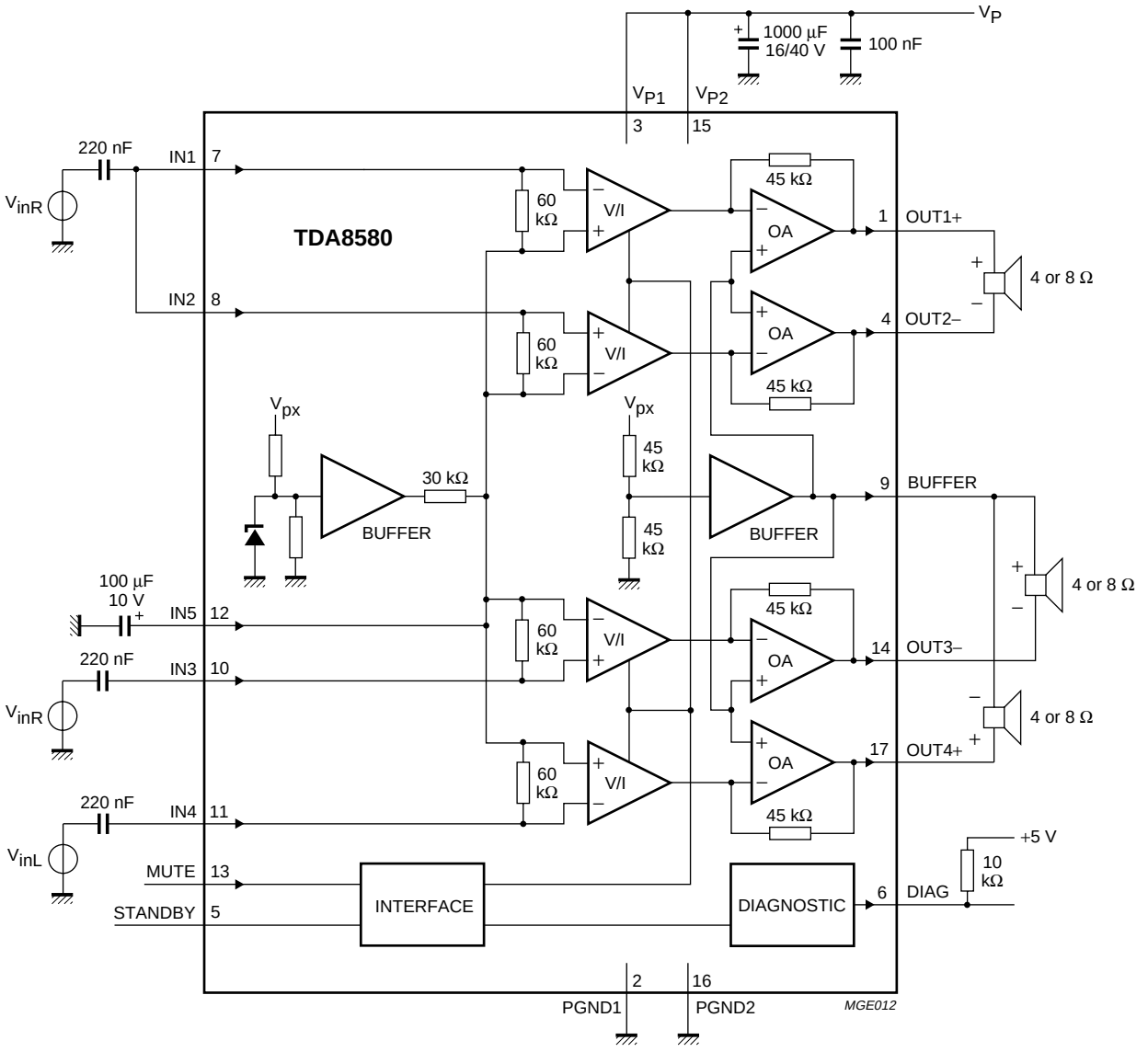
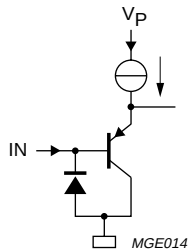
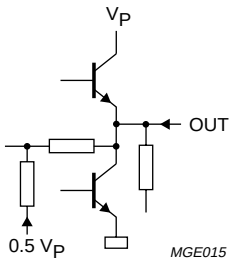
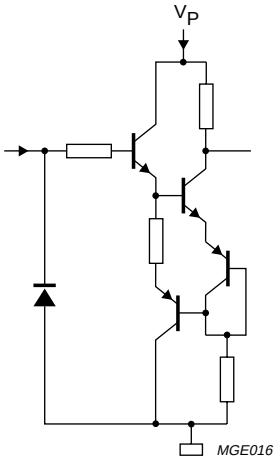


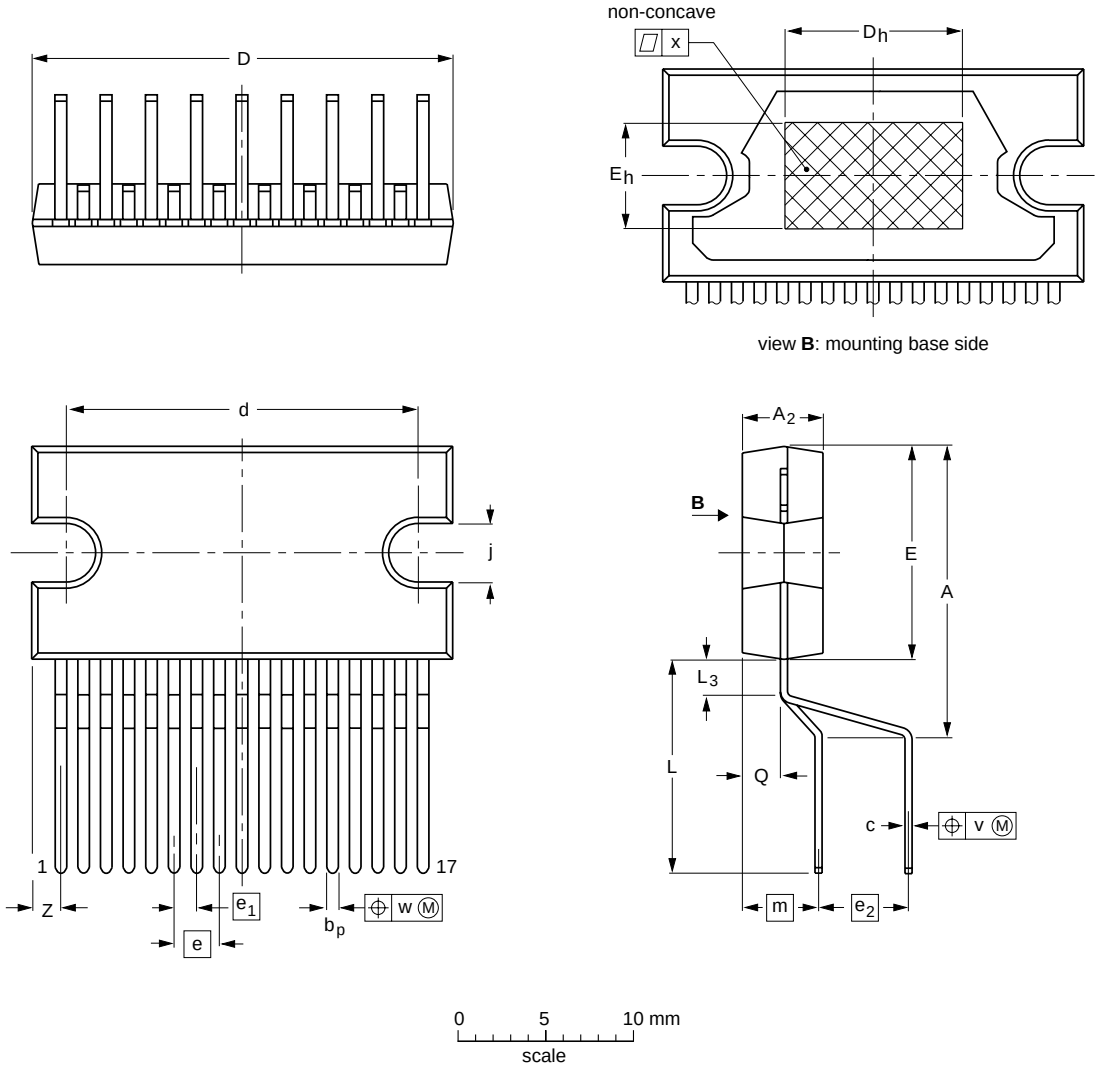
Fig.10 Dual single-ended and one bridge-tied load application.

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	

PACKAGE OUTLINE

DBS17P: plastic DIL-bent-SIL power package; 17 leads (lead length 12 mm) **SOT243-1**



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_3	m	Q	v	w	x	$Z^{(1)}$
mm	17.0 15.5	4.6 4.2	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	12.4 11.0	2.4 1.6	4.3	2.1 1.8	0.8	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	EIAJ			
SOT243-1						~~95-03-11~~ 97-12-16

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

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.