DATA SHEET

TDA1562Q
70 W high efficiency power amplifier with diagnostic facility

Preliminary specification
File under Integrated Circuits, IC01

1998 Apr 07

Philips
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70 W high efficiency power amplifier with diagnostic facility

TDA1562Q

FEATURES

- Very high output power, operating from a single low supply voltage
- Low power dissipation, when used for music signals
- Switches to low output power at too high case temperatures
- Few external components
- Fixed gain
- Differential inputs with high common mode rejection
- Mode select pin (on, mute and standby)
- Status I/O pin (class-H, class-B and fast mute)
- All switching levels with hysteresis
- Diagnostic pin with information about:
  - Dynamic Distortion Detector (DDD)
  - Any short-circuit at outputs
  - Open load detector
  - Temperature protection.
- No switch-on or switch-off plops
- Fast mute on supply voltage drops
- Quick start option (e.g. car-telephony/navigation)
- Low (delta) offset voltage at the outputs
- Load dump protection
- Short-circuit safe to ground, supply voltage and across the load
- Low power dissipation in any short-circuit condition
- Protected against electrostatic discharge
- Thermally protected
- Flexible leads.

GENERAL DESCRIPTION

The TDA1562Q is a monolithic integrated 70 W/4 Ω Bridge-Tied Load (BTL) class-H high efficiency power amplifier in a 17-lead DIL-bent-SIL plastic power package.

The device can be used for car audio systems (e.g. car, radio and boosters) as well as mains fed applications (e.g. midi/mini audio combinations and TV sound).

QUICK REFERENCE DATA

Test conditions: V_P = 14.4 V; R_L = 4 Ω; R_s = 0 Ω; f = 1 kHz; T_{amb} = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_P	supply voltage	operating	8	14.4	18	V
		non-operating	–	–	30	V
		load dump	–	–	45	V
$I_{q(tot)}$	total quiescent current	on and mute; R_L = open circuit	–	110	150	mA
I_{stb}	standby current	standby	–	1	50	μA
$\|V_{OO}\|$	output offset voltage	on and mute	–	–	100	mV
$\|\Delta V_{OO}\|$	delta output offset voltage	on ↔ mute	–	–	30	mV
G_v	voltage gain		25	26	27	dB
$\|Z_{i(dif)}\|$	differential input impedance		90	150	–	kΩ
P_o	output power	THD = 0.5%	45	55	–	W
		THD = 10%	60	70	–	W
THD	total harmonic distortion	P_o = 1 W	–	0.03	–	%
		P_o = 20 W	–	0.06	–	%
		DDD active	–	10	–	%
SVRR	supply voltage ripple rejection	on and mute	60	70	–	dB
CMRR	common mode rejection ratio	on	70	80	–	dB
ISRR	input signal rejection ratio	mute	80	90	–	dB
$V_{n(o)}$	noise output voltage	on	–	100	150	μV

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TDA1562Q	DBS17P	plastic DIL-bent-SIL power package; 17 leads (lead length 12 mm)	SOT243-1

BLOCK DIAGRAM

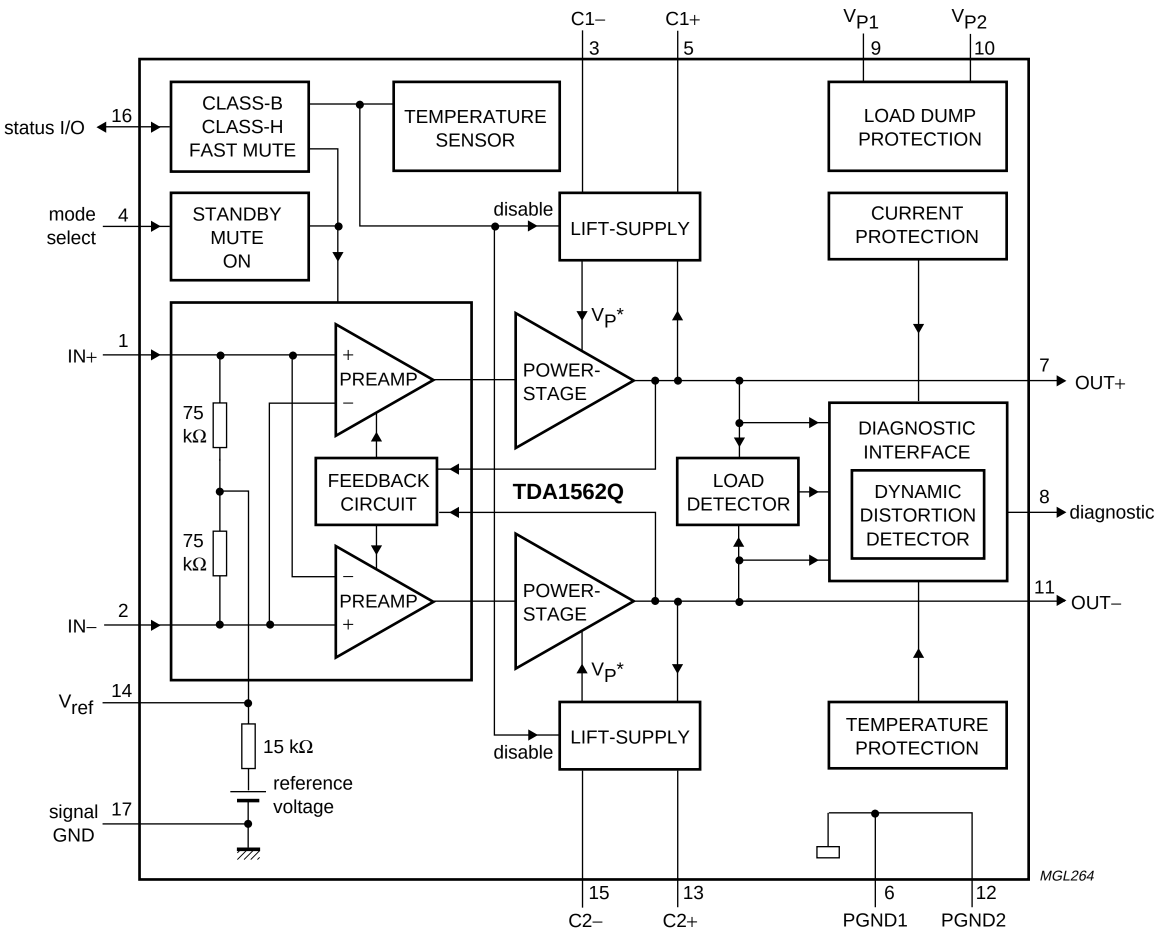


Fig.1 Block diagram.

PINNING

SYMBOL	PIN	DESCRIPTION
IN+	1	signal input (positive)
IN–	2	signal input (negative)
C1–	3	negative terminal of lift electrolytic capacitor 1
MODE	4	mode select input
C1+	5	positive terminal of lift electrolytic capacitor 1
PGND1	6	power ground 1
OUT+	7	positive output
DIAG	8	diagnostic output (open collector)
V_{P1}	9	supply voltage 1
V_{P2}	10	supply voltage 2
OUT–	11	negative output
PGND2	12	power ground 2
C2+	13	positive terminal of lift electrolytic capacitor 2
V_{ref}	14	internal reference voltage
C2–	15	negative terminal of lift electrolytic capacitor 2
STAT	16	status I/O
SGND	17	signal ground

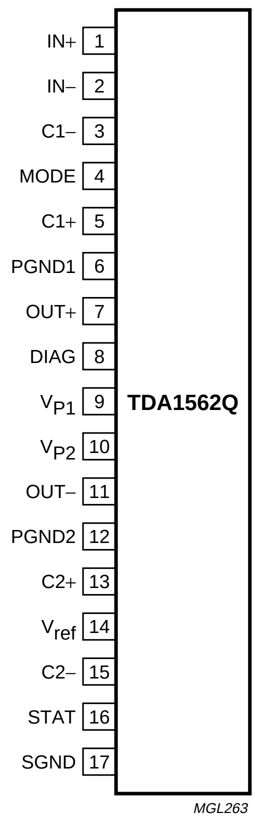


Fig.2 Pin configuration.

FUNCTIONAL DESCRIPTION

The TDA1562Q contains a mono class-H BTL output power amplifier. At low output power, up to 18 W, the device operates as a normal BTL amplifier. When a larger output voltage swing is required, the internal supply voltage is lifted by means of the external electrolytic capacitors. Due to this momentarily higher supply voltage the obtainable output power is 70 W.

In normal use, when the output is driven with music-like signals, the high output power is only needed during a small percentage of time. Under the assumption that a music signal has a normal (Gaussian) amplitude distribution, the reduction in dissipation is about 50% when compared to a class-B output amplifier with the same output power. The heatsink should be designed for use with music signals. If the case temperature exceeds 120 °C, the device will switch back from class-H to class-B operation. The high power supply voltage is then disabled and the output power is limited to 20 W.

When the supply voltage drops below the minimum operating level, the amplifier will be muted immediately.

Mode select input (pin MODE)

This pin has 3 modes:

1. LOW, ‘standby’: the complete circuit is switched off, the supply current is very low
2. MID, ‘mute’: the circuit is switched on, but the input signal is suppressed
3. HIGH, ‘on’: normal operation, the input signal is amplified by 26 dB.

When the circuit is switched from mute to on or vice versa the actual switching takes place at a zero crossing of the input signal. The circuit contains a **quick start** option, i.e. when it is switched directly from standby to on, the amplifier is fully operational within 50 ms (important for applications like car telephony and car navigation).

Status I/O input (pin STAT)

INPUT

This input has 3 possibilities:

1. LOW, ‘fast mute’: the circuit remains switched on, but the input signal is suppressed
2. MID, ‘class-B’: the circuit operates as class-B amplifier, the high power supply voltage is disabled, independent of the case temperature
3. HIGH, ‘class-H’: the circuit operates as class-H amplifier, the high power supply voltage is enabled, independent of the case temperature.

When the circuit is switched from fast mute to class-B/H or vice versa the switching is immediately carried out. When the circuit is switched from class-B to class-H or vice versa the actual switching takes place at a zero crossing of the input signal.

OUTPUT

This output has 3 possibilities:

1. LOW, ‘mute’: acknowledge of muted amplifier
2. MID, ‘class-B’: the circuit operates as class-B amplifier, the high power supply voltage is disabled, caused by the case temperature T_c > 120 °C
3. HIGH, ‘class-H’: the circuit operates as class-H amplifier, the high power supply voltage is enabled, because the case temperature T_c < 120 °C.

When the circuit is switched from class-B to class-H or vice versa the actual switching takes place at a zero crossing of the input signal.

The status I/O pins of **maximum 8 devices** may be tied together for synchronizing purposes.

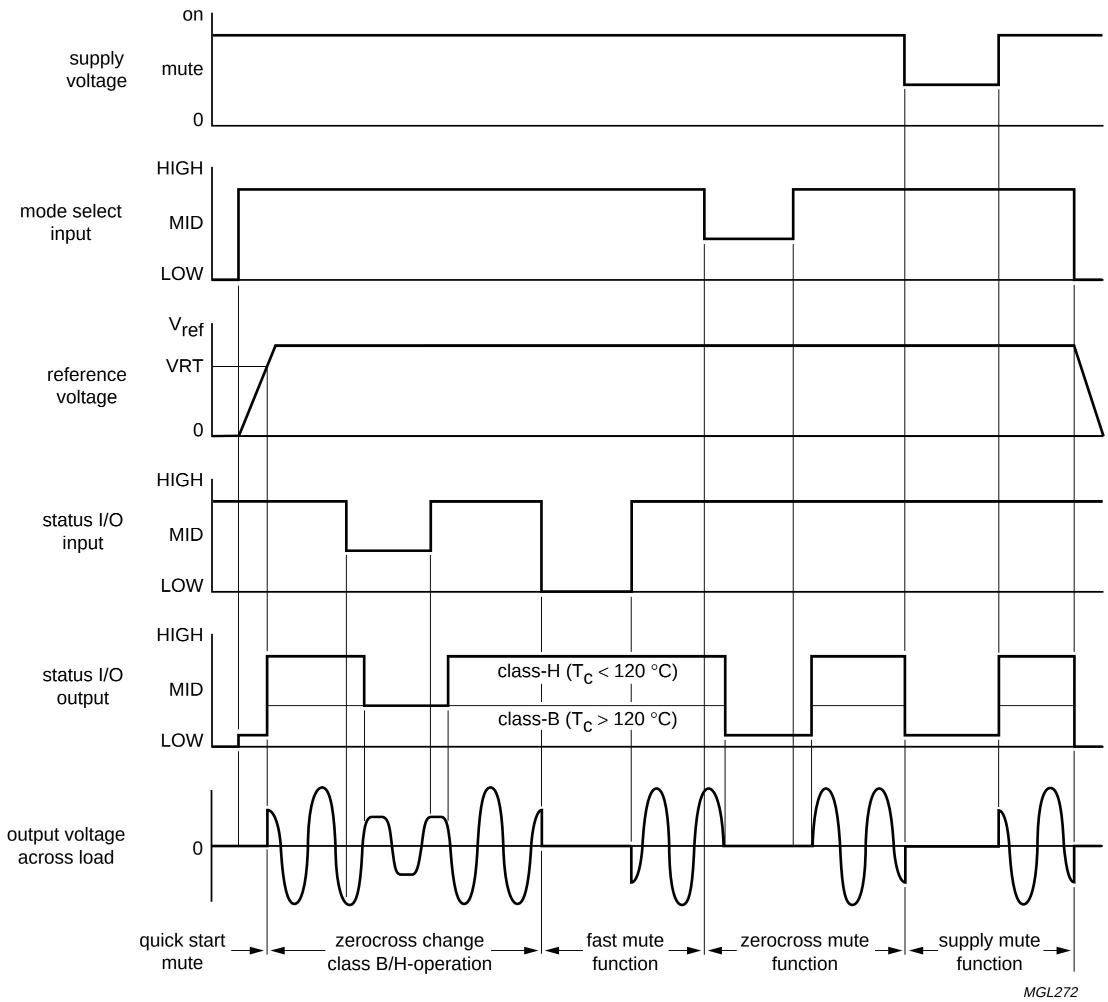


Fig.3 Switching characteristics.

Diagnostic output (pin DIAG)

DYNAMIC DISTORTION DETECTOR (DDD)

At the onset of clipping of the output stages, the DDD becomes active. This information can be used to drive a sound processor or DC-volume control to attenuate the input signal and so limit the distortion.

SHORT-CIRCUIT PROTECTION

When a short-circuit occurs at the outputs to ground or to the supply voltage, the output stages are switched off. They will be switched on again approximately 20 ms after removing the short-circuit. During this short-circuit condition the diagnostic output is continuously LOW.

When a short-circuit occurs across the load, the output stages are switched off during approximately 20 ms. After that time is checked during approximately 50 µs whether the short-circuit is still present. During this short-circuit condition the diagnostic output is LOW for 20 ms and high for 50 µs. The power dissipation in any short-circuit condition is very low.

TEMPERATURE DETECTION

Just before the temperature protection becomes active the diagnostic output becomes continuously LOW.

Load detection: directly after the circuit is switched from standby to mute or on, a build in detection circuit checks whether a load is present. The results of this check can be detected at the diagnostic output, by switching the mode select input in the mute mode.

Since the diagnostic output is an open collector output, more devices can be tied together.

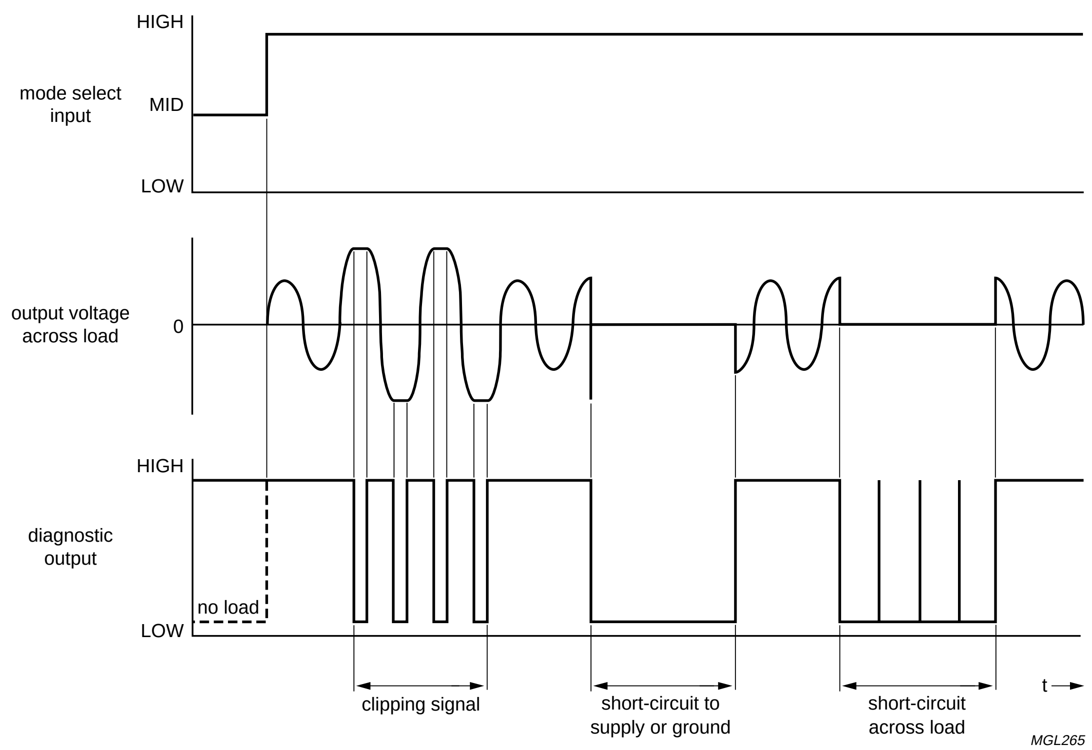


Fig.4 Diagnostic information.

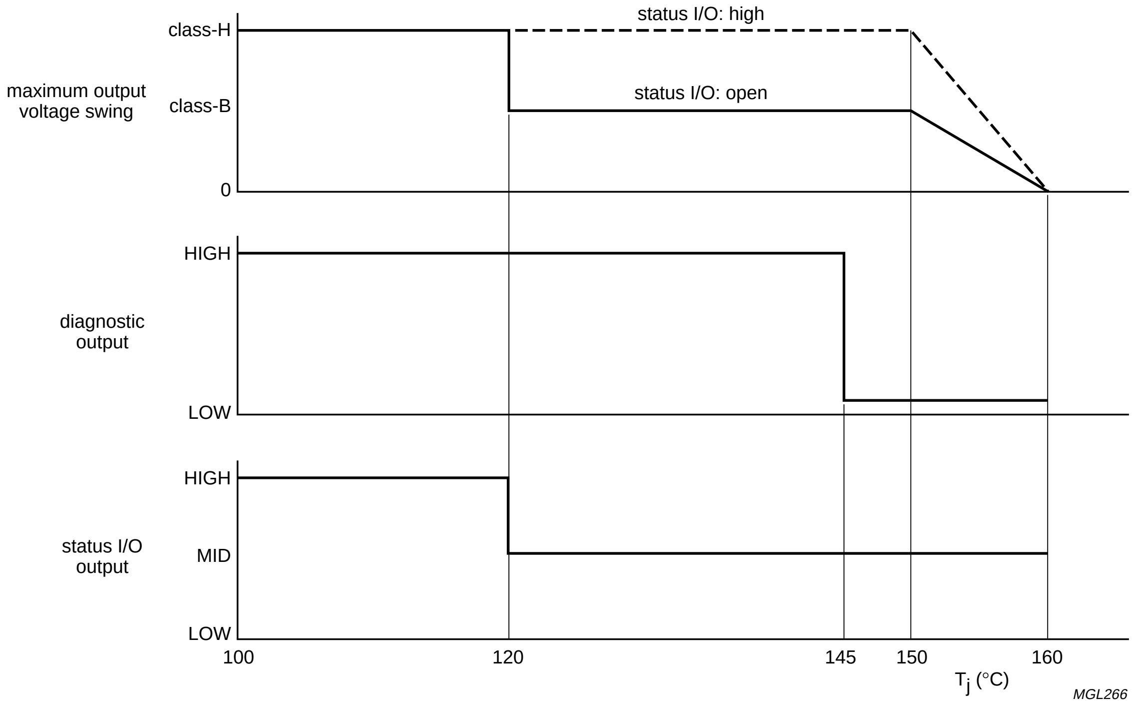


Fig.5 Behaviour as a function of temperature.

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; t_r > 2.5 ms; T = 50 ms	–	45	V
I_{OSM}	non-repetitive peak output current		–	10	A
	repetitive peak output current		–	8	A
V_{sc}	short-circuit safe voltage		–	18	V
T_{stg}	storage temperature		–55	+150	°C
T_{amb}	ambient temperature		–40	–	°C
T_j	junction temperature	note 1	–	150	°C
P_{tot}	total power dissipation		–	60	W

Note

1. T_j is a theoretical temperature which is based on a simplified representation of the thermal behaviour of the device. $T_j = T_c + P \times R_{th(j-c)}$, where $R_{th(j-c)}$ is a fixed value to be used for the calculation of T_j. The rating for T_j limits the allowable combinations of power dissipation P and case temperature T_c (in accordance with IEC 747-1).

THERMAL CHARACTERISTICS

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

DC CHARACTERISTICS

V_P = 14.4 V; R_L = 4 Ω; T_{amb} = 25 °C; measurements in accordance with Fig.10; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supplies V_{P1} and V_{P2} (pins 9 and 10)						
V_P	supply voltage		8	14.4	18	V
V_{th+}	supply threshold voltage	mute → on	–	–	9	V
V_{th-}	supply threshold voltage	on → mute	7	–	–	V
V_{PH1}	hysteresis $\lvert(V_{th+} - V_{th-})\rvert$		–	200	–	mV
I_q	quiescent current	on and mute; R_L = open circuit	–	110	150	mA
I_{stb}	standby current	standby	–	1	50	μA
Amplifier outputs OUT+ and OUT– (pins 7 and 11)						
V_O	DC output voltage	on and mute	–	6.5	–	V
$\lvert V_{OO}\rvert$	output offset voltage	on and mute	–	–	100	mV
$\lvert \Delta V_{OO}\rvert$	delta output offset voltage	on ↔ mute	–	–	30	mV
Mode select input MODE (pin 4)						
V_I	input voltage range		0	–	V_p	V
I_I	input current	V_{MODE} = 14.4 V	–	–	20	μA
V_{th1+}	threshold voltage	standby → mute	–	–	2	V
V_{th1-}	threshold voltage	mute → standby	1	–	–	V
V_{msH1}	hysteresis $\lvert(V_{th1+} - V_{th1-})\rvert$		–	200	–	mV
V_{th2+}	threshold voltage	mute → on	–	–	4.2	V
V_{th2-}	threshold voltage	on → mute	3.3	–	–	V
V_{msH2}	hysteresis $\lvert(V_{th2+} - V_{th2-})\rvert$		–	200	–	mV
Status I/O STAT (pin 16)						
PIN STAT AS INPUT						
V_{st}	input voltage		0	–	V_P	V
I_{stH}	HIGH-level input current	V_{STAT} = 14.4 V	–	–	4	mA
I_{stL}	LOW-level input current	V_{STAT} = 0 V	–	–	–400	μA
V_{th1+}	threshold voltage	fast mute → class B	–	–	2	V
V_{th1-}	threshold voltage	class B → fast mute	1	–	–	V
V_{stH1}	hysteresis $\lvert(V_{th1+} - V_{th1-})\rvert$		–	200	–	mV
V_{th2+}	threshold voltage	class B → class H	–	–	4.2	V
V_{th2-}	threshold voltage	class H → class B	3.3	–	–	V
V_{stH2}	hysteresis $\lvert(V_{th2+} - V_{th1-})\rvert$		–	200	–	mV

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
PIN STAT AS OUTPUT						
$I_{st(mute)}$	mute acknowledge sink current		2.2	–	–	mA
$V_{st(mute)}$	mute acknowledge output voltage	I_{st} = 2.2 mA	–	–	0.5	V
$I_{st(clB)}$	class B operation output current		15	–	–	μA
$V_{st(clB)}$	class B operation output voltage	I_{Ist} = 15 μAI	2.0	–	3.0	V
$I_{st(clH)}$	class H operation source current		–140	–	–	μA
$V_{st(clH)}$	class H operation output voltage	I_{st} = –140 μA	V_P – 2.5	–	–	V
$T_{c(th)}$	threshold case temperature sensor		–	120	–	°C
Diagnostic output DIAG (pin 8)						
V_{DIAG}	output voltage	active LOW	–	–	0.6	V
R_L	load resistance for open load detection		100	–	–	Ω
$T_{j(th)}$	threshold junction temperature sensor		–	145	–	°C

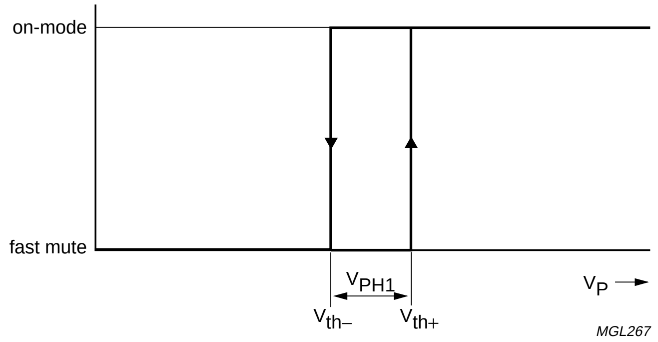


Fig.6 Supply voltage transfer characteristic.

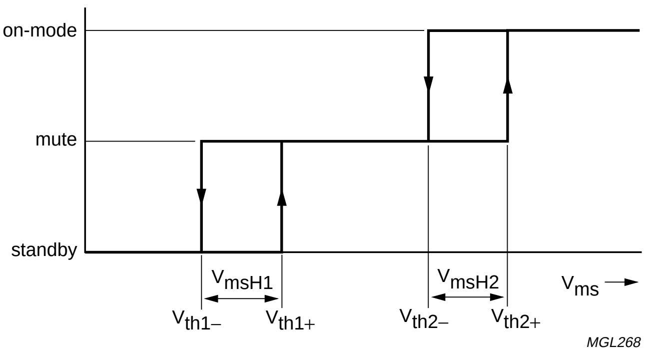


Fig.7 Mode select transfer characteristic.

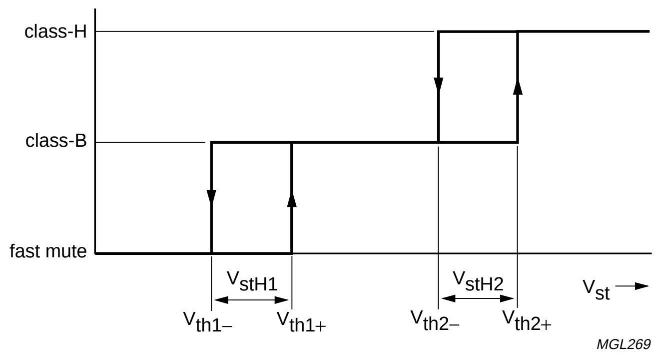


Fig.8 Status I/O transfer characteristic.

AC CHARACTERISTICS

V_P = 14.4; R_L = 4 Ω; R_s = 0 Ω; f = 1 kHz; T_{amb} = 25 °C; measurements in accordance with Fig.10; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
P_o	output power	class-B; THD = 10%	16	20	–	W
		class-H; THD = 10%	60	70	–	W
		class-H; THD = 0.5%	45	55	–	W
$f_{ro(h)(P)}$	high frequency power roll-off	P_o (–1 dB); THD = 0.5%; note 1	–	20	–	kHz
THD	total harmonic distortion	P_o = 1 W	–	0.03	–	%
		P_o = 20 W	–	0.06	–	%
		DDD active	–	10	–	%
G_v	voltage gain		25	26	27	dB
$f_{ro(h)(G)}$	high frequency gain roll-off	G_v (–1 dB); note 2	20	–	–	kHz
$\|Z_{i(dif)}\|$	differential input impedance		90	150	–	kΩ
SVRR	supply voltage ripple rejection	on and mute; note 3	60	70	–	dB
		standby; note 3		90	–	dB
CMRR	common mode rejection ratio	on; note 4	70	80	–	dB
ISRR	input signal rejection ratio	mute; note 5	80	90	–	dB
$V_{n(o)}$	noise output voltage	on; note 6	–	100	150	µV
		mute; notes 6 and 7	–	60	–	µV

Notes

1. The low frequency power roll-off is determined by the value of the electrolytic lift capacitors.
2. The low frequency gain roll-off is determined by the value of the input coupling capacitors.
3. Supply voltage ripple rejection is measured across R_L; V_{ripple} = V_{ripple} max. = 2 V_{PP}.
4. Common mode rejection ratio is measured across R_L; Vcm = Vcm max. = 2 V_{PP}. CMMR [dB] = differential gain (G_v) + common mode attenuation (Ac), (Test setup according Fig. 9; mismatch of input coupling capacitors **excluded**).
5. Input signal rejection ratio is measured across R_L; V_i = $V_{i(max)}$ = 2 V_{PP}. ISSR [dB] = different gain (G_v) + mute attenuation (Am)
6. Noise output voltage is measured in a bandwidth of 20 Hz to 20 kHz.
7. Noise output voltage is independent of source impedance R_s.

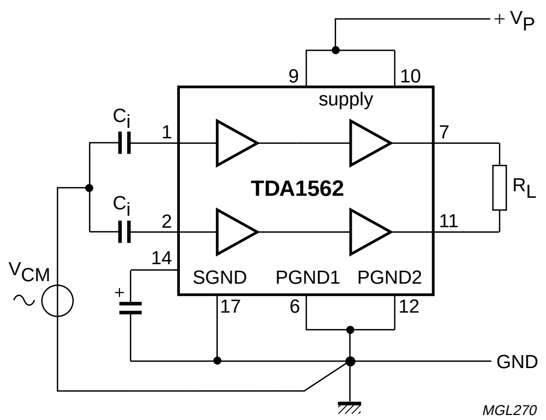


Fig.9 CMRR test setup.

QUALITY SPECIFICATION

Quality in accordance with *"SNW-FQ-611 part E"*, if this type is used as an audio amplifier.

TEST AND APPLICATION INFORMATION

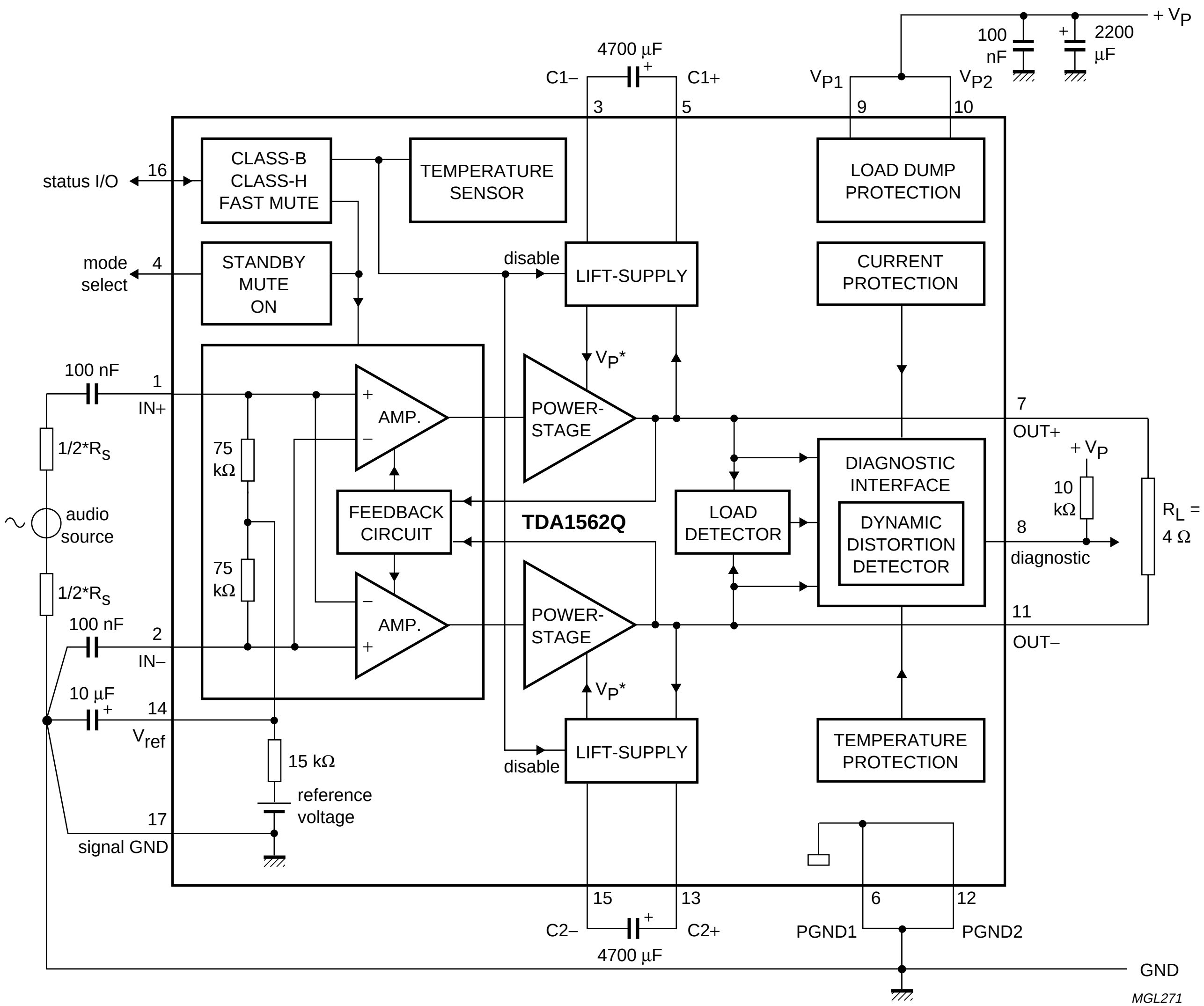
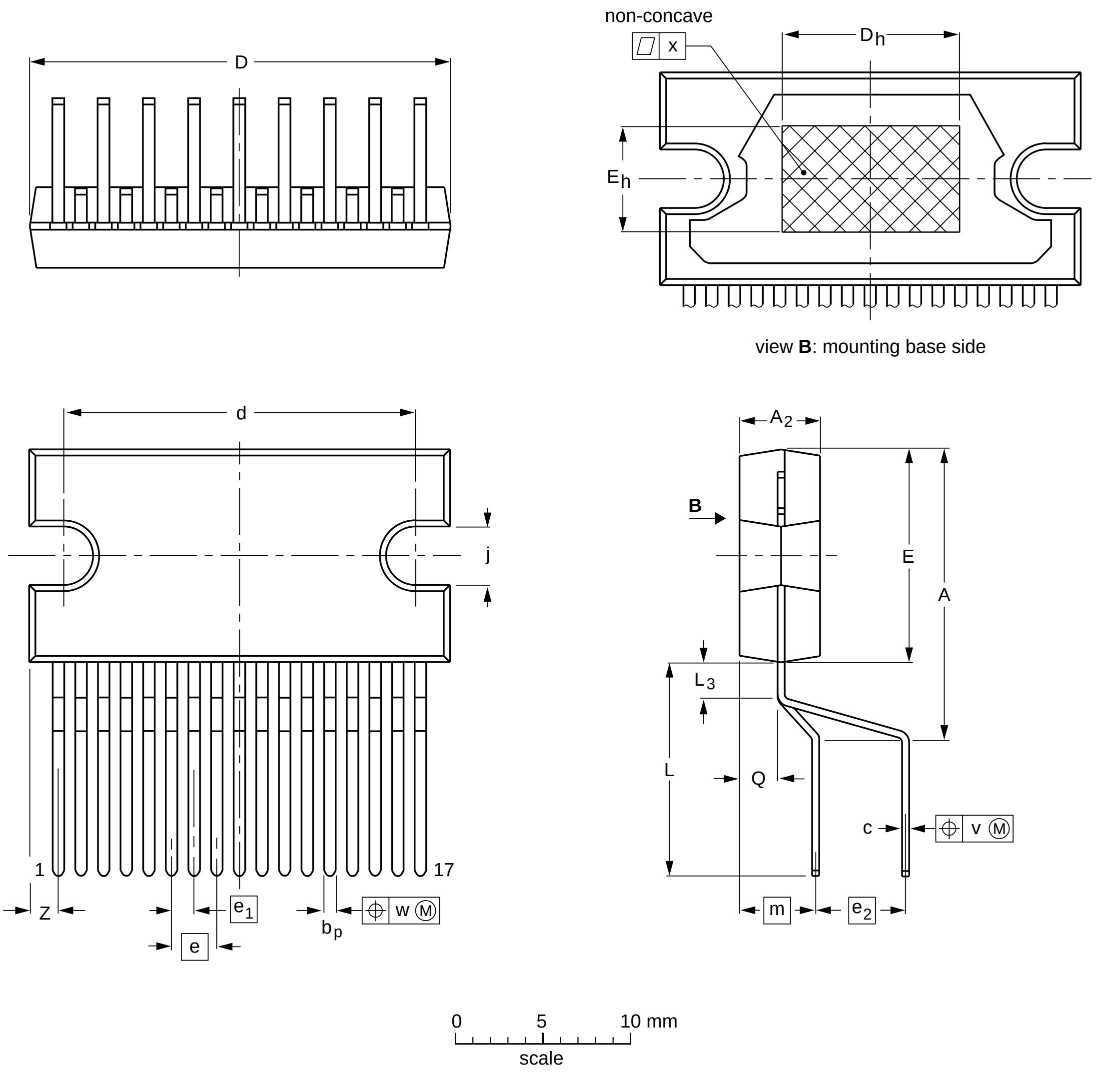


Fig.10 Test and application circuit.

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.

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Printed in The Netherlands   545102/1200/01/pp20   Date of release: 1998 Apr 07   Document order number: 9397 750 03043

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