50W high-performance hi-fi amplifier

TDA1514A

GENERAL DESCRIPTION

The TDA1514A integrated circuit is a hi-fi power amplifier for use as a building block in radio, tv and other audio applications. The high performance of the IC meets the requirements of digital sources (e.g. Compact Disc equipment).
The circuit is totally protected, the two output transistors both having thermal and SOAR protection (see Fig.3). The circuit also has a mute function that can be arranged for a period after power-on with a delay time fixed by external components.
The device is intended for symmetrical power supplies but an asymmetrical supply may also be used.

Features

- High output power (also without bootstrap)
- Low offset voltage
- Good ripple rejection
- Mute/stand-by facilities
- Thermal protection
- Protected against electrostatic discharge
- No switch-on or switch-off clicks
- Very low thermal resistance
- Safe Operating Area (SOAR) protection
- Short-circuit protection

QUICK REFERENCE DATA

parameter	conditions	symbol	min.	typ.	max.	unit
Supply voltage range (pin 6 to pin 4)		V_P	± 9	–	± 30	V
Total quiescent current	V_P = ± 27.5 V	I_{tot}	–	60	–	mA
Output power	THD = –60 dB; V_P = ± 27.5 V; R_L = 8 Ω	P_o	–	40	–	W
	V_P = ± 23 V; R_L = 4 Ω	P_o	–	50	–	W
Closed loop voltage gain	determined externally	G_c	–	30	–	dB
Input resistance	determined externally	R_i	–	20	–	kΩ
Signal plus noise-to-noise ratio	P_o = 50 mW	(S+N)/N	–	82	–	dB
Supply voltage ripple rejection	f = 100 Hz	SVRR	–	72	–	dB

PACKAGE OUTLINE

9-lead SIL, plastic power (SOT131A).

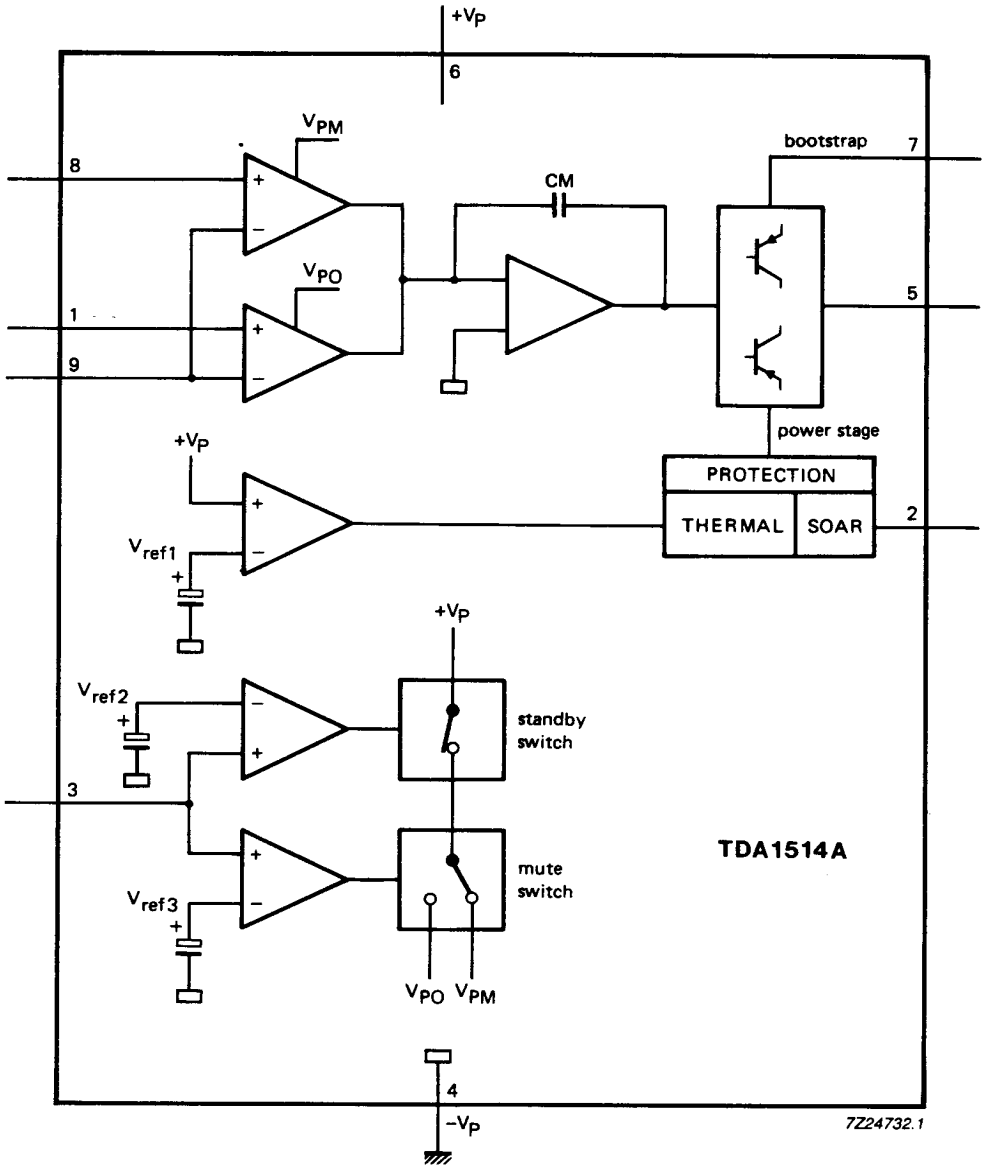


Fig.1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

parameter	symbol	min.	max.	unit
Supply voltage (pin 6 to pin 4)	V_P	–	±30	V
Bootstrap voltage (pin 7 to pin 4)	V_{bstr}	–	70	V
Output current (repetitive peak)	I_o	–	8	A
Operating ambient temperature range	T_{amb}	see Fig.2		
Storage temperature range	T_{stg}	–65	+150	°C
Power dissipation		see Fig.2		
Thermal shut-down protection time	t_{pr}	–	1	hour
Short circuit protection time*	t_{sc}	–	10	min
Mute voltage (pin 3 to pin 4)	V_m	–	7	V

THERMAL RESISTANCE

From junction to mounting base $R_{th\ j\text{-}mb}$ max. = 1 K/W

* Symmetrical power supply: AC and DC short-circuit protected.
Asymmetrical power supply: AC short-circuit protected.
Driven by a pink-noise voltage.

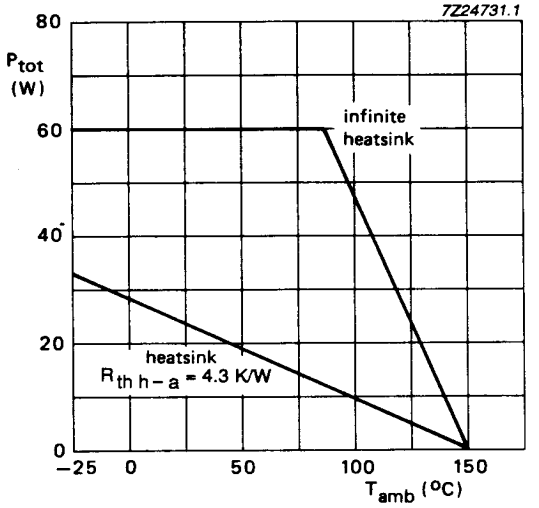


Fig.2 Power derating curve.

The theoretical maximum power dissipation for P_o = 40 W with a stabilized power supply is:

$$\frac{V_P^2}{2\pi^2 R_L} = 19\ W; \text{ where } V_P = \pm 27.5\ V;\ R_L = 8\ \Omega$$

Considering, for example, a maximum ambient temperature of 50 °C and a maximum junction temperature of 150 °C the total thermal resistance is:

$$R_{th\ j\text{-}a} = \frac{150 - 50}{19} = 5.3\ K/W$$

Since the thermal resistance of the SOT131A encapsulation is $R_{th\ j\text{-}mb} < 1$ K/W, the thermal resistance required of the heatsink is $R_{th\ h\text{-}a} < 4.3$ K/W.

SAFE OPERATING AREA (SOAR) PROTECTION

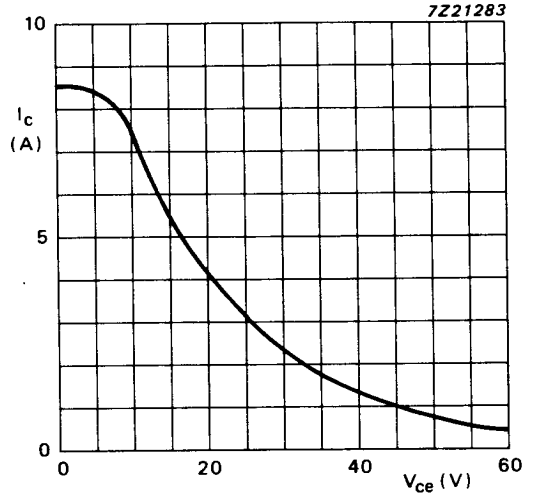


Fig.3 SOAR protection curve.

CHARACTERISTICS

V_P = ± 27.5 V; R_L = 8 Ω; f = 1 kHz; T_{amb} = 25 °C; test circuit as Fig.4; unless otherwise specified.

parameter	conditions	symbol	min.	typ.	max.	unit
Supply voltage range (pin 6 to pin 4)		V_P	± 9	–	± 30	V
Maximum output current (peak value)		I_{OMmax}	6.4	–	–	A
Operating state						
Input voltage (pins 3 to 4)		V_{3-4}	6	–	7	V
Total quiescent current	$R_L = \infty$	I_{tot}	30	60	90	mA
Output power	THD = –60 dB	P_o	37	40	–	W
	THD = –20 dB	P_o	–	51	–	W
Output power	V_P = ± 23 V; THD = –60 dB					
	R_L = 8 Ω	P_o	–	28	–	W
	R_L = 4 Ω	P_o	–	50	–	W
Total harmonic distortion	P_o = 32 W	THD	–	–90	–80	dB
Intermodulation distortion	P_o = 32 W note 1	d_{im}	–	–80	–	dB
Power bandwidth	(–3 dB); THD = –60 dB	B	–	20 to 25 000		Hz
Slew rate		dV/dt	–	10	–	V/μs
Closed loop voltage gain	note 2	G_c	–	30	–	dB
Open loop voltage gain		G_o	–	85	–	dB
Input impedance	note 3	$\|Z_i\|$	1	–	–	MΩ
Signal-to-noise ratio	note 4 P_o = 50 mW	S/N	80	–	–	dB
Output offset voltage		V_o	–	2	*	mV
Input bias current		I_I	–	0.1	*	μA
Output impedance		$\|Z_o\|$	–	–	0.1	Ω
Supply voltage ripple rejection	ripple frequency = 100 Hz; ripple voltage = 500 mV_{eff}; (RMS value) source resistance = 2 kΩ	SVRR	*	–	–	dB
Quiescent current into pin 2	note 5	I_2	–	–	*	μA

* Value to be fixed.

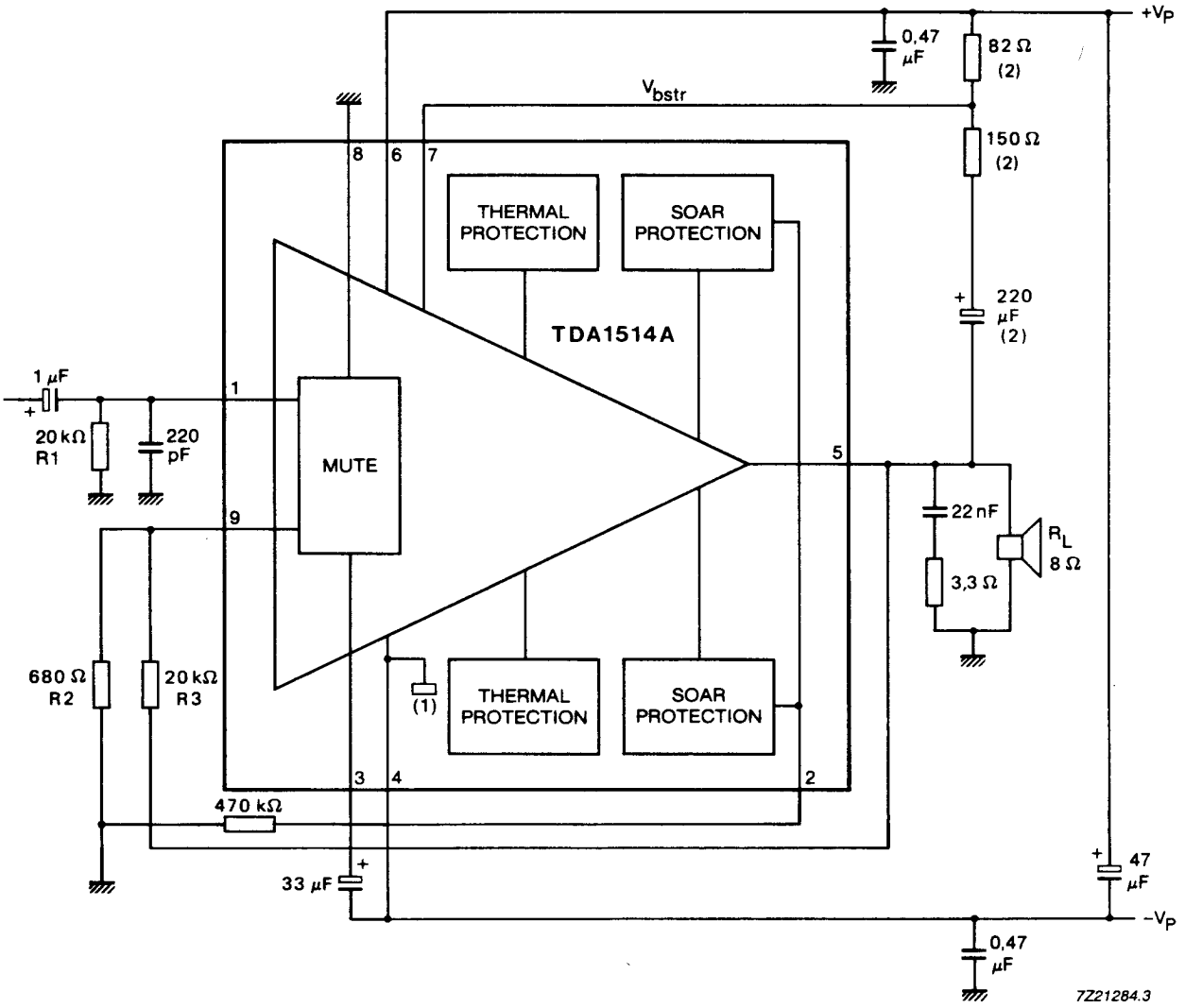
CHARACTERISTICS (continued)

parameter	conditions	symbol	min.	typ.	max.	unit
Mute state						
Voltage on pin 3		V_{3-4}	2	–	4.5	V
Offset voltage		V_o	–	*	–	V
Output voltage	$V_{i(rms)}$ = 2 V f = 1 kHz	V_o	–	100	–	μV
Ripple rejection		RR	–	70	–	dB
Standby state						
Voltage on pin 3		V_{3-4}	0	–	1	V
Total quiescent current		I_{tot}	–	20	–	mA
Ripple rejection		RR	–	70	–	dB
Supply voltage to obtain standby state		$\pm V_P$	4.5	–	7.0	V

Notes to the characteristics

1. Measured with two superimposed signals of 50 Hz and 7 kHz with an amplitude relationship of 4 : 1.
2. The closed loop gain is determined by external resistors (Fig.4, R2 and R3) and is variable between 20 and 46 dB.
3. The input impedance in the test circuit (Fig.4) is determined by the bias resistor R1.
4. The noise output voltage is measured in a bandwidth of 20 Hz to 20 kHz with a source resistance of 2 kΩ.
5. The quiescent current into pin 2 has an impact on the mute time.

* Value to be fixed.



(1) Mounting base connected to $-V_P$.

(2) When used without a bootstrap these components are disconnected and pin 6 is connected to pin 7 thus decreasing the output power by approximately 4 W.

Fig.4 Application and test circuit.