2 x 22 W BTL stereo car radio power amplifier with speaker protection

TDA1557Q

FEATURES

- Requires very few external components
- High output power
- Low offset voltage at output
- Fixed gain
- Good ripple rejection
- Mute/stand-by switch
- Load dump protection
- AC and DC short-circuit-safe to ground and V_P
- Thermally protected
- Reverse polarity safe
- Capability to handle high energy on outputs ($V_P = 0$)
- Protected against electrostatic discharge
- No switch-on/switch-off plop
- Flexible leads
- Low thermal resistance.

GENERAL DESCRIPTION

The TDA1557Q is a monolithic integrated class-B output amplifier in a 13-lead single-in-line (SIL) plastic power package. The device contains 2 x 22 W amplifiers in BTL configuration and has been primarily developed for car radio applications.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_P	positive supply voltage range					
		operating	6.0	14.4	18	V
		non-operating	–	–	30	V
		load dump	–	–	45	V
IORM	repetitive peak output current		–	–	4	A
I_{tot}	total quiescent current		–	80	–	mA
I_{sb}	stand-by current		–	0.1	100	µA
I_{sw}	switch-on current		–	–	60	µA
$\|Z_I\|$	input impedance		25	–	–	kΩ
T_{XTAL}	crystal temperature		–	–	+150	°C
Stereo application						
P_O	output power	THD = 10%; 4 Ω	–	22	–	W
SVRR	supply voltage ripple rejection	$R_S = 0$; f = 100 Hz to 10 kHz	45	–	–	dB
$\|\Delta V_O\|$	DC output offset voltage		–	–	250	mV
α	channel separation		40	–	–	dB
$\|\Delta G_v\|$	channel unbalance		–	–	1	dB
G_v	closed loop voltage gain		45	46	47	dB

ORDERING INFORMATION

EXTENDED TYPE NUMBER	PACKAGE			
	PINS	PIN POSITION	MATERIAL	CODE
TDA1557Q	13	DIL	plastic	SOT141R

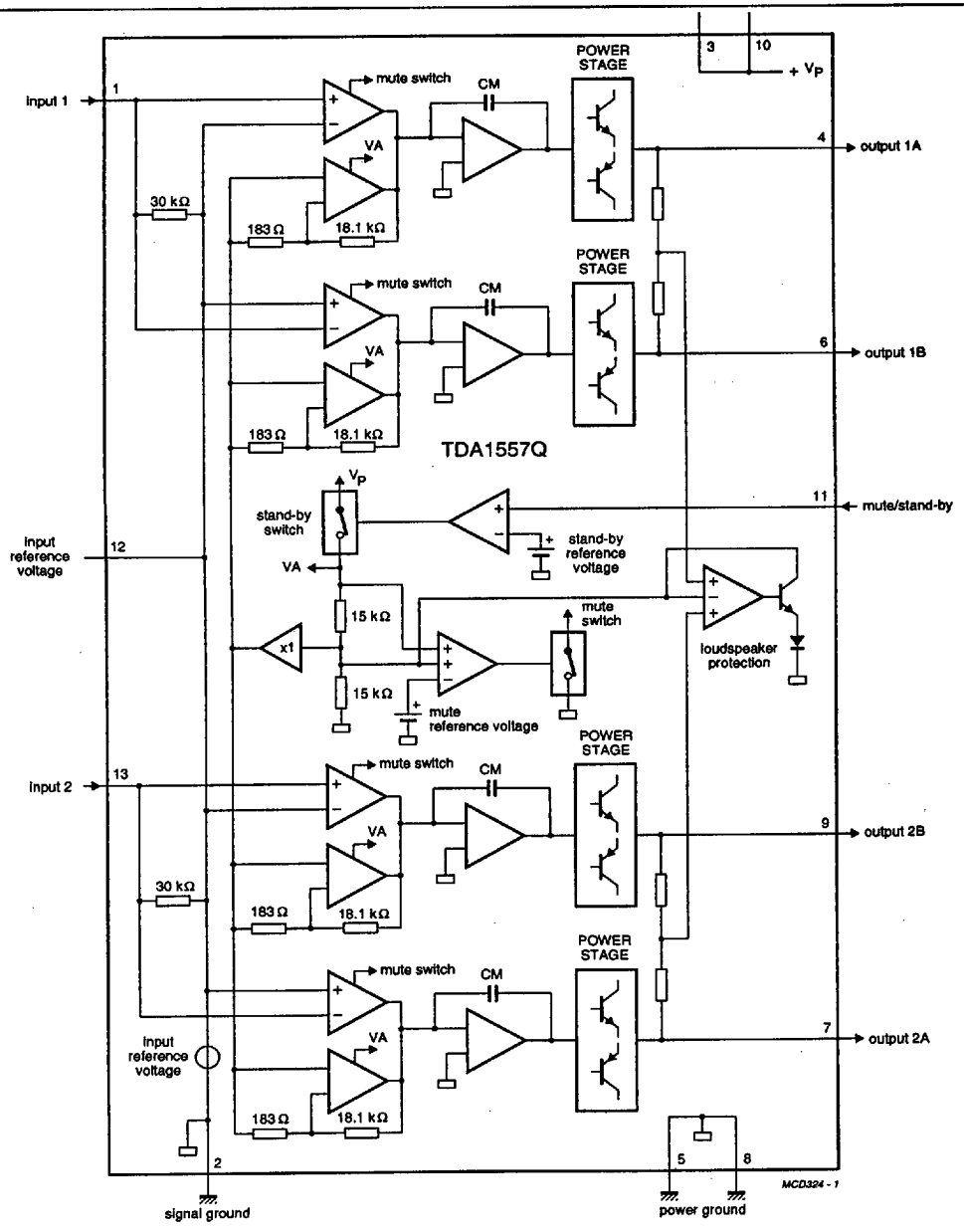

Fig.1 Block diagram.

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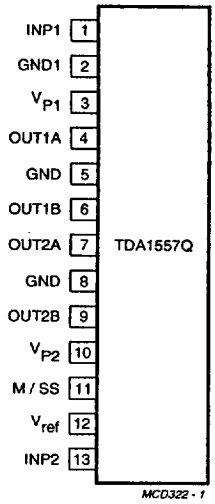

Fig.2 Pin configuration.

PINNING

SYMBOL	PIN	DESCRIPTION
INP1	1	input 1
GND1	2	ground (signal)
V_{P1}	3	supply voltage 1
OUT1A	4	output 1A
GND	5	power ground 1
OUT1B	6	output 1B
OUT2A	7	output 2A
GND	8	power ground 2
OUT2B	9	output 2B
V_{P2}	10	supply voltage 2
M/SS	11	mute/stand-by switch
V_{ref}	12	input reference voltage
INP2	13	input 2

FUNCTIONAL DESCRIPTION

The TDA1557Q contains two identical amplifiers with differential input stages, and can be used for bridge applications. The gain of each amplifier is fixed at 46 dB. Special features of this device are:

a. mute/stand-by switch

low stand-by current

low mute/stand-by switching current (low cost supply switch)

mute facility

b. loudspeaker protection

when a short circuit to ground is made, which forces a DC voltage of ≥ 1 V across the loudspeaker, a built-in protection circuit becomes active and limits the DC voltage across the loudspeaker to ≤ 1 V

c. the harmonic distortion at low frequencies can be decreased by connecting two diodes to ground at pin 12.

LIMITING VALUES

In accordance with the Absolute maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_P	positive supply voltage				
		operating	–	18	V
		non-operating	–	30	V
		load dump protected; during 50 ms; rise time ≥ 2.5 ms	–	45	V
V_{PSC}	AC and DC short-circuit safe voltage		–	18	V
V_{PR}	reverse polarity		–	6.0	V
	energy handling capability at outputs	$V_P = 0$	–	200	mJ
IOSM	non-repetitive peak output current		–	6	A
IORM	repetitive peak output current		–	4	A
P_{tot}	total power dissipation		–	60	W
T_{stg}	storage temperature range		−55	+150	°C
Tj	junction temperature		–	+150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ vj\text{-}a}$	from virtual junction to ambient in free air	40 K/W
$R_{th\ vj\text{-}c}$	from virtual junction to case (see Fig.3)	1.5 K/W

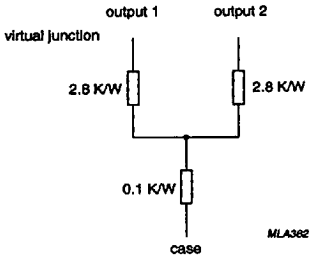

Fig.3 Equivalent thermal resistance network.

DC CHARACTERISTICS

V_P = 14.4 V, T_{amb} = 25 °C, unless otherwise specified. See note 1.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply						
V_P	positive supply voltage range	note 2	6.0	14.4	18	V
I_P	quiescent current		–	80	160	mA
V_O	DC output voltage	note 3	–	6.9	–	V
$\lvert\Delta V_{os}\rvert$	DC output offset voltage		–	–	250	mV
Mute/stand-by switch						
V_{sw}	switch-on voltage level		8.5	–	–	V
MUTE CONDITION						
V_{mute}	mute voltage		3.3	–	6.4	V
V_O	output signal in mute position	V_I = 1 V max; f = 1 kHz	–	–	20	mV
$\lvert\Delta V_{os}\rvert$	DC output offset voltage		–	–	250	mV
STAND-BY CONDITION						
V_{sb}	stand-by voltage		0	–	2.0	V
I_{sb}	DC current in stand-by condition					
		$V_{11} \leq 0.5$ V	–	–	100	µA
		$0.5 < V_{11} \leq 2$ V	–	–	500	µA
I_{sw}	switch-on current		–	30	60	µA
I_P	positive supply current	short-circuit to GND; note 4	–	5.5	–	mA
Loudspeaker protection						
$\lvert\Delta V_{4\text{-}6,\ 7\text{-}9}\rvert$	DC voltage across R_L		–	–	1.0	V

AC CHARACTERISTICS

V_P = 14.4 V; R_L = 4 Ω; f = 1 kHz; T_{amb} = 25 °C; unless otherwise specified. See note 1.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
P_O	output power					
		THD = 0.5%	15	17	–	W
		THD = 10%	20	22	–	W
		V_P = 13.2 V; THD = 0.5%	–	12	–	W
		V_P = 13.2 V; THD = 10%	–	17	–	W
THD	total harmonic distortion	P_O = 1 W	–	0.1	–	%
B	power bandwidth	THD = 0.5%; P_O = −1 dB with respect to 15 W	–	20 to 15 000	–	Hz
f_{low}	low frequency roll-off	−1 dB; note 5	–	25	–	Hz
f_{high}	high frequency roll-off	−1 dB	20	–	–	kHz
G_v	closed loop voltage gain		45	46	47	dB
SVRR	supply voltage ripple rejection					
		ON; note 6	34	–	–	dB
		ON; note 7	38	–	–	dB
		ON; note 8	45	–	–	dB
		MUTE; notes 6 and 7	45	–	–	dB
		stand-by; notes 6 and 7	80	–	–	dB
$\|Z_i\|$	input impedance		25	30	36	kΩ
V_{no}	noise output voltage					
		ON; R_S = 0; note 9	–	325	500	μV
		R_S = 10 kΩ; note 9	–	350	–	μV
		MUTE; notes 9 & 10	–	180	–	μV
α	channel separation		40	–	–	dB
$\|\Delta G_v\|$	channel unbalance		–	–	1	dB

Notes to the characteristics

1. All characteristics are measured using the circuit shown in Fig.4
2. The circuit is DC adjusted at V_P = 6 to 18 V and AC operating at V_P = 8.5 to 18 V
3. At 18 V < V_P < 30 V, the DC output voltage ≤ $V_P/2$
4. Conditions: V_{11} = 0; short-circuit output to GND; switch V_{11} to MUTE or ON condition (rise time V_{11} > 10 μs).
5. Frequency response externally fixed.
6. Ripple rejection measured at the output with a source-impedance of 0 Ω (max. ripple amplitude of 2 V) and a frequency of 100 Hz.
7. Ripple rejection measured at the output with a source-impedance of 0 Ω (max. ripple amplitude of 2 V) and a frequency between 1 and 10 kHz.
8. Ripple rejection measured at the output with a source-impedance of 0 Ω (max. ripple amplitude of 2 V) and a frequency between 100 Hz and 10 kHz. *Pin 12 is decoupled with two diodes to ground.*
9. Noise voltage measured in a bandwidth of 20 Hz to 20 kHz.
10. Noise output voltage independent of R_S (V_{in} = 0).

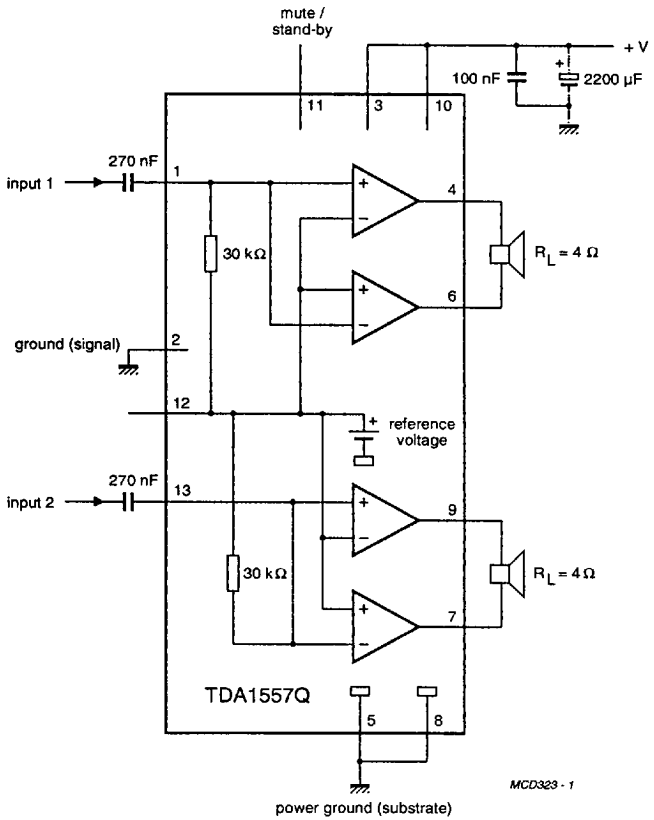

Fig.4 Stereo BTL application.