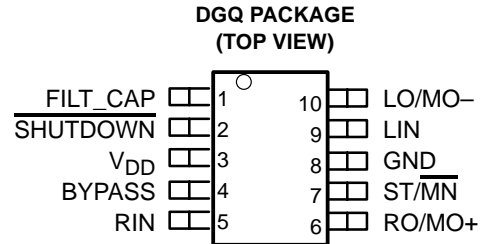


TPA0233

2-W MONO AUDIO POWER AMPLIFIER WITH HEADPHONE DRIVE

SLOS278C – JANUARY 2000 – REVISED MAY 2001

- Ideal for Notebook Computers, PDAs, and Other Small Portable Audio Devices
- 2 W Into 4 Ω From 5-V Supply
- 0.6 W Into 4 Ω From 3-V Supply
- Stereo Head Phone Drive
- Mono (BTL) Signal Created by Summing Left and Right Signals
- Wide Power Supply Compatibility
3 V to 5 V
- Meets PC99 Portable Specs (target)
- Low Supply Current
 - 4 mA Typical at 5 V
 - 3.3 mA Typical at 3 V
- Shutdown Control . . . 1 μ A Typical
- Shutdown Pin is TTL Compatible
- –40°C to 85°C Operating Temperature Range
- Space-Saving, Thermally-Enhanced MSOP Packaging



description

The TPA0233 is a 2-W mono bridge-tied-load (BTL) amplifier designed to drive speakers with as low as 4- Ω impedance. The mono signal is created by summing left and right inputs. The amplifier can be reconfigured on-the-fly to drive two stereo single-ended (SE) signals into head phones. This makes the device ideal for use in small notebook computers, PDAs, digital personal audio players, anyplace a mono speaker and stereo head phones are required. From a 5-V supply, the TPA0233 can delivery 2 W of power into a 4- Ω speaker.

The gain of the input stage is set by the user-selected input resistor and a 50-k Ω internal feedback resistor ($A_V = -R_F/R_I$). The power stage is internally configured with a gain of –1.25 V/V in SE mode, and –2.5 V/V in BTL mode. Thus, the overall gain of the amplifier is 62.5 k Ω/R_I in SE mode and 125 k Ω/R_I in BTL mode. The input terminals are high-impedance CMOS inputs, and can be used as summing nodes.

The TPA0233 is available in the 10-pin thermally-enhanced MSOP package (DGQ) and operates over an ambient temperature range of –40°C to 85°C.



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



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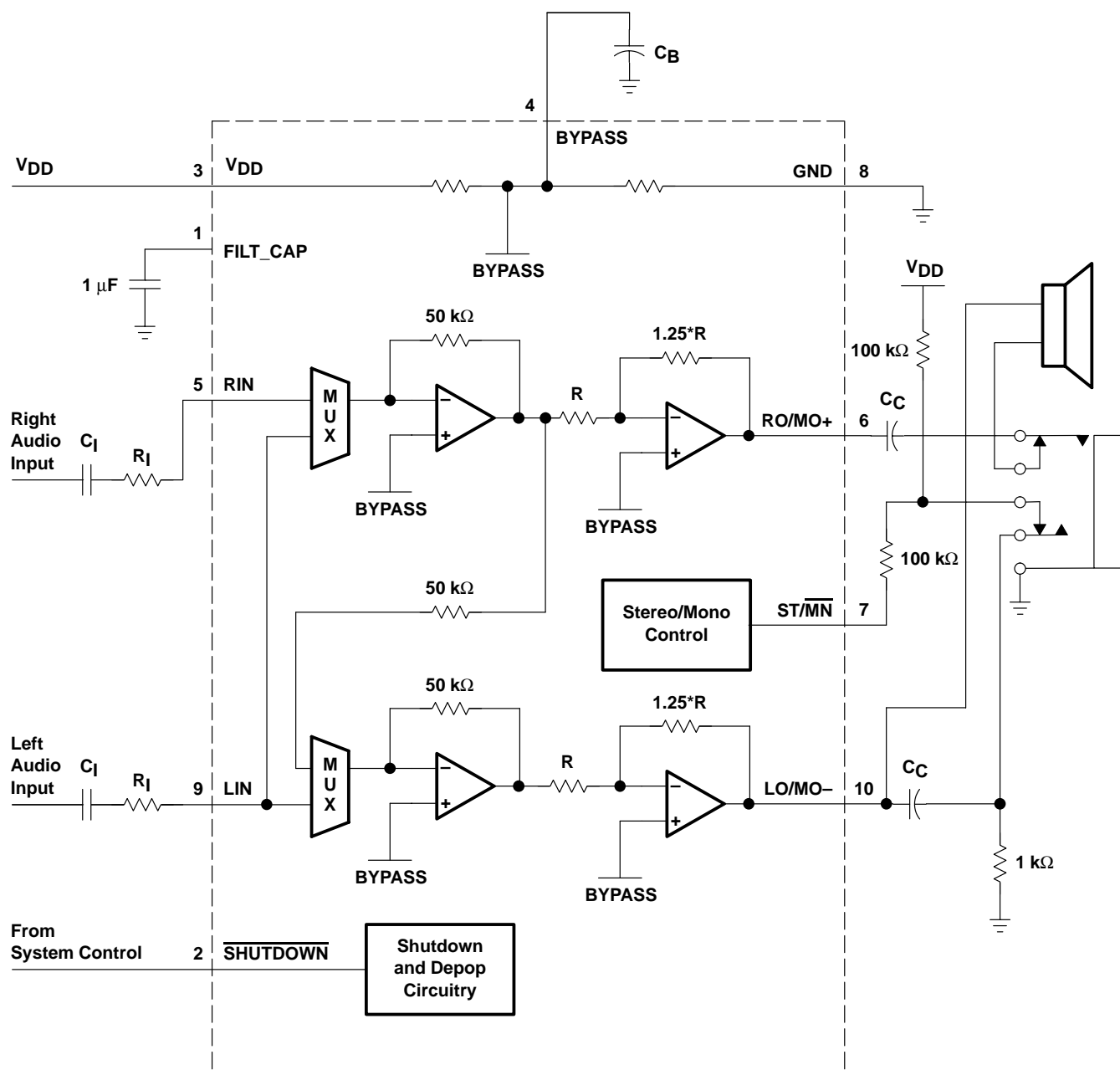
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functional block diagram



AVAILABLE OPTIONS

T _A	PACKAGED DEVICES	MSOP SYMBOLIZATION
	MSOP† (DGQ)	
–40°C to 85°C	TPA0233DGQ	AEJ

† The DGQ package are available taped and reeled. To order a taped and reeled part, add the suffix R to the part number (e.g., TPA0233DGQR).

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Terminal Functions

TERMINAL NAME	NO.	I/O	DESCRIPTION
BYPASS	4	I	BYPASS is the tap to the voltage divider for internal mid-supply bias. This terminal should be connected to a 0.1-μF to 1-μF capacitor.
FILT_CAP	1	I	Terminal is used to filter supply.
GND	8		Ground terminal
LIN	9	I	Left-channel input terminal
LO/MO–	10	O	Left-output in SE mode and mono negative output in BTL mode.
RIN	5	I	Right-channel input terminal
RO/MO+	6	O	Right-output in SE mode and mono positive output in BTL mode
SHUTDOWN	2	I	SHUTDOWN places the entire device in shutdown mode when held low. TTL compatible input.
ST/MN	7	I	Selects between stereo and mono mode. When held high, the amplifier is in SE stereo mode, while held low, the amplifier is in BTL mono mode.
V _{DD}	3	I	V _{DD} is the supply voltage terminal.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

Supply voltage, V _{DD}	6 V
Input voltage, V _I	–0.3 V to V _{DD} +0.3 V
Continuous total power dissipation	internally limited (see Dissipation Rating Table)
Operating free-air temperature range, T _A (see Table 3)	–40°C to 85°C
Operating junction temperature range, T _J	–40°C to 150°C
Storage temperature range, T _{stg}	–65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C

[†] Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

DISSIPATION RATING TABLE

PACKAGE	T _A ≤ 25°C	DERATING FACTOR	T _A = 70°C	T _A = 85°C
DGQ	2.14 W [‡]	17.1 mW/°C	1.37 W	1.11 W

[‡] See the Texas Instruments document, *PowerPAD Thermally Enhanced Package Application Report* (literature number SLMA002), for more information on the PowerPAD package. The thermal data was measured on a PCB layout based on the information in the section entitled *Texas Instruments Recommended Board for PowerPAD* on page 33 of the before mentioned document.

recommended operating conditions

			MIN	MAX	UNIT
Supply voltage, V _{DD}			2.5	5.5	V
High-level input voltage, V _{IH}	ST/ $\overline{\text{MN}}$	V _{DD} = 3 V	2.7		V
		V _{DD} = 5 V	4.5		
	SHUTDOWN		2		
Low-level input voltage, V _{IL}	ST/ $\overline{\text{MN}}$	V _{DD} = 3 V		1.65	V
		V _{DD} = 5 V		2.75	
	SHUTDOWN			0.8	
Operating free-air temperature, T _A			−40	85	°C



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electrical characteristics at specified free-air temperature, $V_{DD} = 3\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$ V_{OO} $ Output offset voltage (measured differentially)				30	mV
I_{DD} Supply current			3.3	4.5	mA
$I_{DD}(SD)$ Supply current, shutdown mode			1	10	μA

operating characteristics, $V_{DD} = 3\text{ V}$, $T_A = 25^\circ\text{C}$, $R_L = 4\ \Omega$

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
P_O Output power, See Note 1	THD = 1%, BTL mode		660		mW
	THD = 0.1%, SE mode, $R_L = 32\ \Omega$		33		
THD + N Total harmonic distortion plus noise	$P_O = 500\text{ mW}$, $f = 20\text{ Hz to } 20\text{ kHz}$		0.3%		
B_{OM} Maximum output power bandwidth	Gain = 2, THD = 2%		20		kHz

NOTE 1: Output power is measured at the output terminals of the device at $f = 1\text{ kHz}$.

electrical characteristics at specified free-air temperature, $V_{DD} = 5\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$ V_{OO} $ Output offset voltage (measured differentially)				30	mV
I_{DD} Supply current			4	5	mA
$I_{DD}(SD)$ Supply current, shutdown mode			1	10	μA

operating characteristics, $V_{DD} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, $R_L = 4\ \Omega$

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
P_O Output power, see Note 1	THD = 1%, BTL mode		2		W
	THD = 0.1%, SE mode, $R_L = 32\ \Omega$		92		mW
THD + N Total harmonic distortion plus noise	$P_O = 1\text{ W}$, $f = 20\text{ Hz to } 20\text{ kHz}$		0.2%		
B_{OM} Maximum output power bandwidth	Gain = 2.5, THD = 2%		20		kHz

NOTE 1: Output power is measured at the output terminals of the device at $f = 1\text{ kHz}$.

TYPICAL CHARACTERISTICS

Table of Graphs

		FIGURE
Supply ripple rejection ratio	vs Frequency	1, 2
I_{DD} Supply current	vs Supply voltage	3
P_O Output power	vs Supply voltage	4, 5
	vs Load resistance	6, 7
THD+N Total harmonic distortion plus noise	vs Frequency	8, 9, 10, 11
	vs Output power	12, 13, 14, 15, 16, 17
V_n Output noise voltage	vs Frequency	18, 19
Closed loop response		20, 21
Crosstalk	vs Frequency	22, 23

