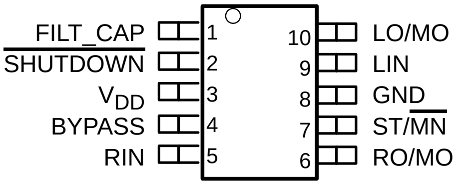
TPA0243
2-W MONO AUDIO POWER AMPLIFIER WITH HEADPHONE DRIVE

SLOS279C – JANUARY 2000 – REVISED NOVEMBER 2002

- **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 Desktop Specs (target)**
- **Low Supply Current**
  - **10 mA Typical at 5 V**
  - **9 mA Typical at 3 V**
- **Shutdown Control . . . 1 µA Typical**
- **Shutdown Pin Is TTL Compatible**
- **–40°C to 85°C Operating Temperature Range**
- **Space-Saving, Thermally-Enhanced MSOP Packaging**

DGQ PACKAGE
(TOP VIEW)



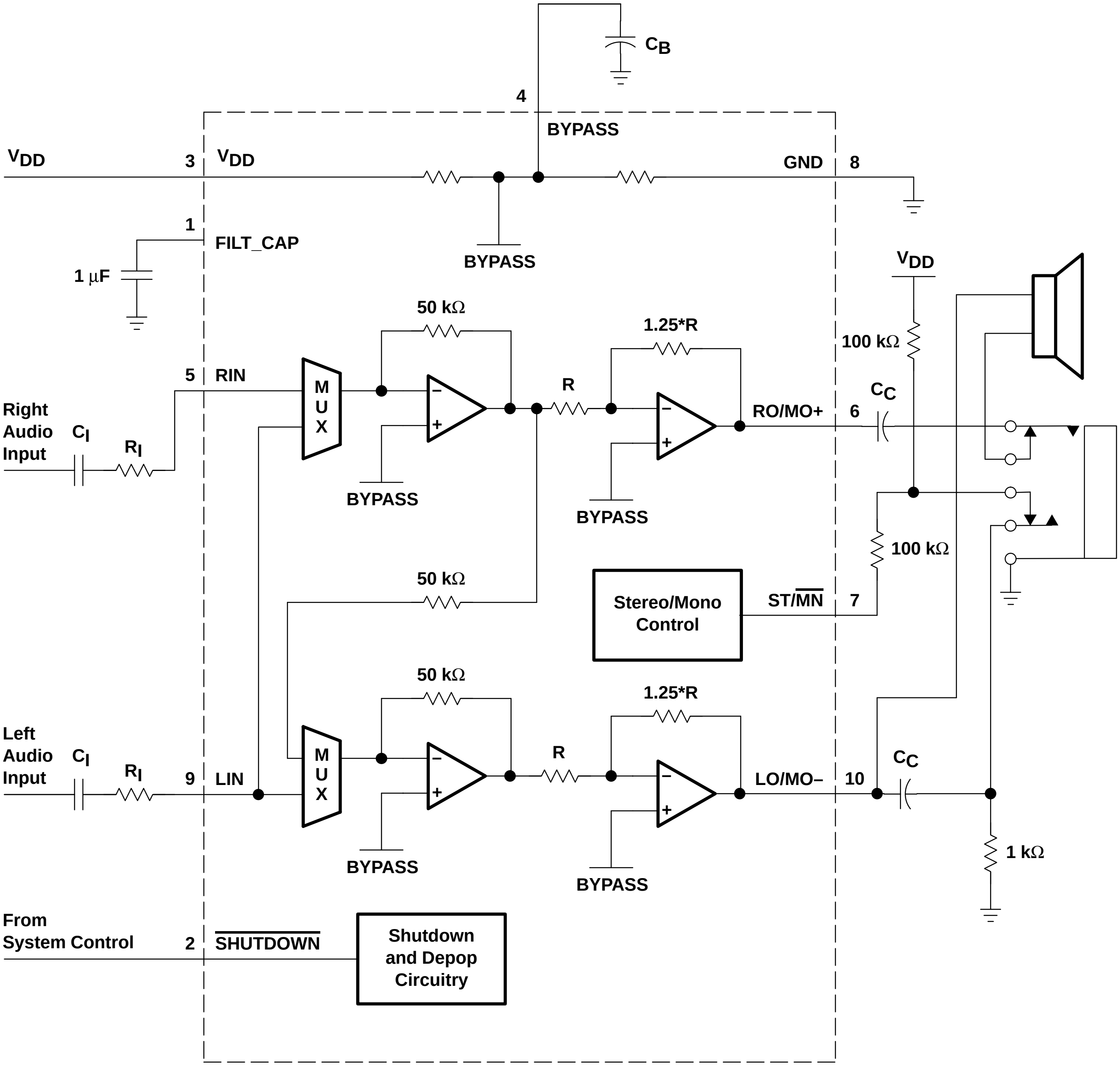
description

The TPA0243 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 headphones. This makes the device ideal for small notebook computers, PDAs, digital personal audio players, anyplace a mono speaker and stereo headphones are required. From a 5-V supply, the TPA0243 can deliver 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-kΩ 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 kΩ/ R_I in SE mode and 125 kΩ/ R_I in BTL mode. The input terminals are high-impedance CMOS inputs, and can be used as summing nodes.

The TPA0243 is available in the 10-pin thermally-enhanced MSOP package (DGQ) and operates over an ambient temperature range of –40°C to 85°C.

TEXAS INSTRUMENTS



AVAILABLE OPTIONS

T_A	PACKAGED DEVICES	MSOP SYMBOLIZATION
	MSOP[†] (DGQ)	
–40°C to 85°C	TPA0243DGQ	AEK

[†] 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., TPA0243DGQR).

Terminal Functions

TERMINAL NAME	TERMINAL 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.
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.
MONO-IN	1	I	Terminal used to filter supply
RIN	5	I	Right-channel input terminal
RO/MO	6	O	Right-output in SE mode and mono positive output in BTL mode
$\overline{\text{SHUTDOWN}}$	2	I	$\overline{\text{SHUTDOWN}}$ places the entire device in shutdown mode when held low. TTL compatible input.
ST/$\overline{\text{MN}}$	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 range, 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	$T_A \le 25°C$	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 *PowerPAD Thermally Enhanced Package Application Report* (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 that 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		
	$\overline{\text{SHUTDOWN}}$		2		
Low-level input voltage, V_{IL}	ST/$\overline{\text{MN}}$	V_{DD} = 3 V		1.65	V
		V_{DD} = 5 V		2.75	
	$\overline{\text{SHUTDOWN}}$			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 V, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$\lvert V_{OO}\rvert$	Output offset voltage (measured differentially)	$\overline{\text{SHUTDOWN}}$ = 2 V, ST/$\overline{\text{MN}}$ = 0, R_L = 4 Ω			30	mV
I_{DD}	Supply current	V_{DD} = 2.5 V, $\overline{\text{SHUTDOWN}}$ = 2 V		9	14	mA
$I_{DD(SD)}$	Supply current, shutdown mode	$\overline{\text{SHUTDOWN}}$ = 0 V		1	10	µA
$\lvert I_{IH}\rvert$	High-level input current	$\overline{\text{SHUTDOWN}}$, V_{DD} = 3.3 V, $V_I = V_{DD}$			1	µA
		ST/$\overline{\text{MN}}$, V_{DD} = 3.3 V, $V_I = V_{DD}$			1	
$\lvert I_{IL}\rvert$	Low-level input current	$\overline{\text{SHUTDOWN}}$, V_{DD} = 3.3 V, V_I = 0 V			1	µA
		ST/$\overline{\text{MN}}$, V_{DD} = 3.3 V, V_I = 0 V			1	
R_F	Feedback resistor	V_{DD} = 2.5 V, R_L = 4 Ω, ST/$\overline{\text{MN}}$ = 1.375 V, $\overline{\text{SHUTDOWN}}$ = 2 V	47	50	57	kΩ

operating characteristics, V_{DD} = 3 V, T_A = 25°C, R_L = 4 Ω

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 Ω		34		
THD + N	Total harmonic distortion plus noise	P_O = 500 mW, f = 20 Hz to 20 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 kHz.

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$\lvert V_{OO}\rvert$	Output offset voltage (measured differentially)	$\overline{\text{SHUTDOWN}}$ = 2 V, ST/$\overline{\text{MN}}$ = 0, R_L = 4 Ω			30	mV
I_{DD}	Supply current	$\overline{\text{SHUTDOWN}}$ = 2 V		10	15	mA
$I_{DD(SD)}$	Supply current, shutdown mode	$\overline{\text{SHUTDOWN}}$ = 0 V		1	10	µA
$\lvert I_{IH}\rvert$	High-level input current	$\overline{\text{SHUTDOWN}}$, V_{DD} = 5.5 V, $V_I = V_{DD}$			1	µA
		ST/$\overline{\text{MN}}$, V_{DD} = 5.5 V, $V_I = V_{DD}$			1	
$\lvert I_{IL}\rvert$	Low-level input current	$\overline{\text{SHUTDOWN}}$, V_{DD} = 5.5 V, V_I = 0 V			1	µA
		ST/$\overline{\text{MN}}$, V_{DD} = 5.5 V, V_I = 0 V			1	

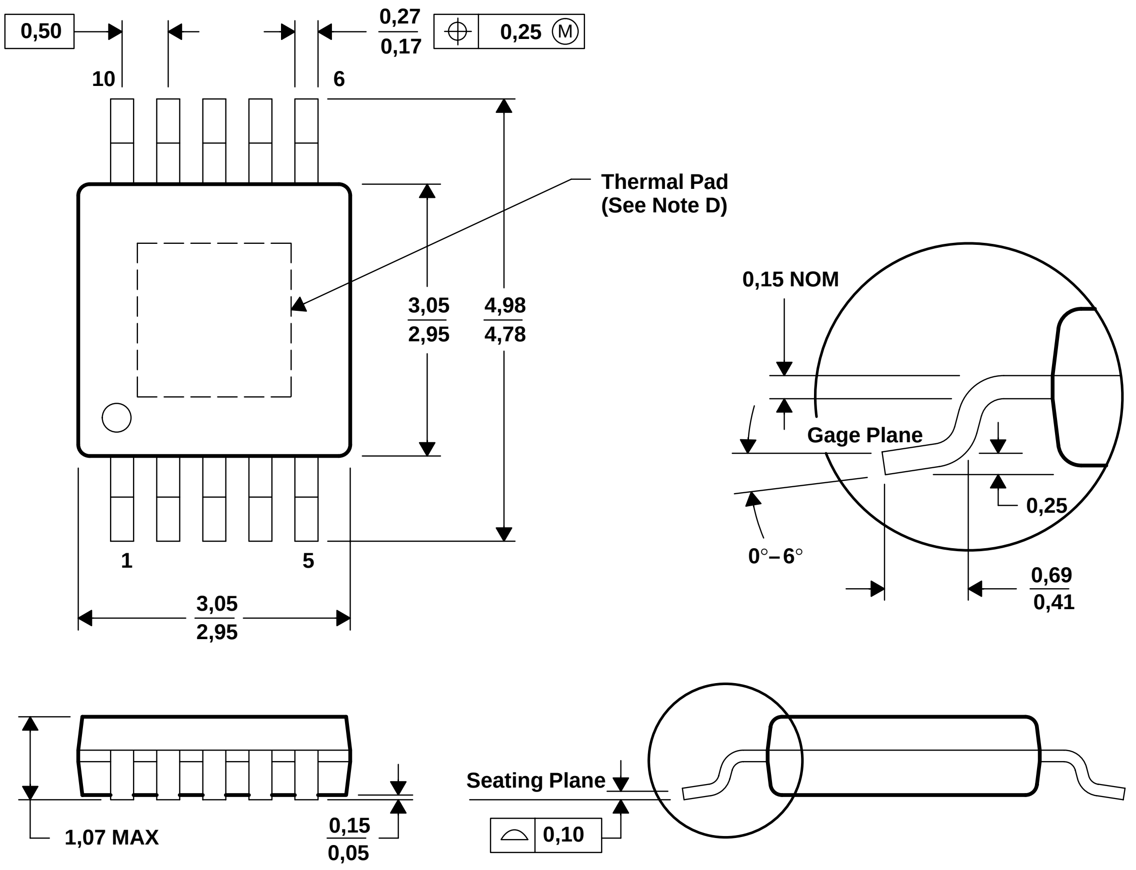
operating characteristics, V_{DD} = 5 V, T_A = 25°C, R_L = 4 Ω

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 Ω		95		mW
THD + N	Total harmonic distortion plus noise	P_O = 1 W, f = 20 Hz to 20 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 kHz.

MECHANICAL DATA

DGQ (S-PDSO-G10) **PowerPAD™ PLASTIC SMALL-OUTLINE PACKAGE**



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NOTES:
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion.
- D. The package thermal performance may be enhanced by bonding the thermal pad to an external thermal plane. This pad is electrically and thermally connected to the backside of the die and possibly selected leads.

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