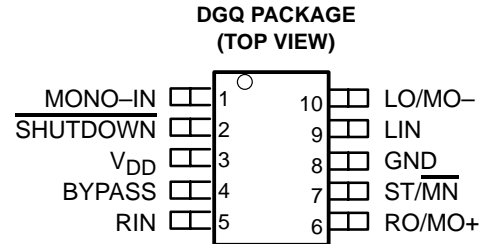


TPA0213

2-W MONO AUDIO POWER AMPLIFIER WITH HEADPHONE DRIVE

SLOS276C – JANUARY 2000 – REVISED APRIL 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 Headphone Drive
- Separate Inputs for the Mono (BTL) Signal, and Stereo (SE) Left/Right Signals
- Wide Power Supply Compatibility 2.5 V to 5.5 V
- Low Supply Current
 - 4.2 mA Typical at 5 V
 - 3.6 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 TPA0213 is a 2-W mono bridge-tied-load (BTL) amplifier designed to drive speakers with as low as 4- Ω impedance. The amplifier can be reconfigured on-the-fly to drive two stereo single-ended (SE) signals into headphones. This makes the device ideal for use in small notebook computers, PDAs, personal digital audio players, anywhere a mono speaker and stereo headphones are required. From a 5-V supply, the TPA0213 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-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 TPA0213 is available in the 10-pin thermally-enhanced MSOP package (DGQ) and operates over an ambient temperature range of -40°C to 85°C .

AVAILABLE OPTIONS

T _A	PACKAGED DEVICES	MSOP SYMBOLIZATION
	MSOP† (DGQ)	
-40°C to 85°C	TPA0213DGQ	AEH

† 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., TPA0213DGQR).



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PowerPAD is a trademark of Texas Instruments

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.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

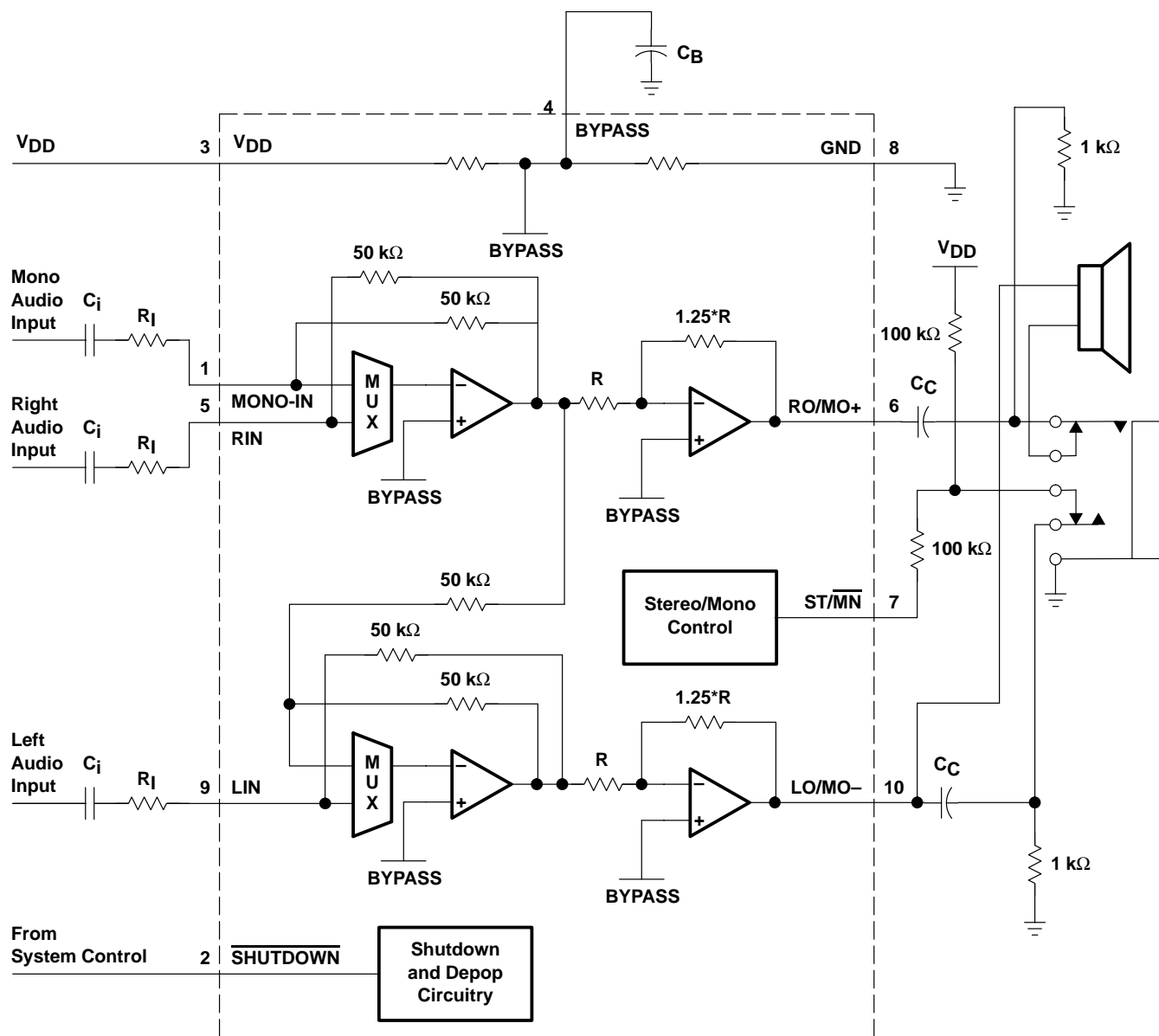
Copyright © 2001, Texas Instruments Incorporated

TPA0213

2-W MONO AUDIO POWER AMPLIFIER WITH HEADPHONE DRIVE

SLOS276C – JANUARY 2000 – REVISED APRIL 2001

functional block diagram



TPA0213
2-W MONO AUDIO POWER AMPLIFIER
WITH HEADPHONE DRIVE

SLOS276C – JANUARY 2000 – REVISED APRIL 2001

Terminal Functions

TERMINAL NAME	NO.	I/O	DESCRIPTION
MONO-IN	1	I	Mono input terminal
SHUTDOWN	2	I	SHUTDOWN places the entire device in shutdown mode when held low. TTL compatible input.
V _{DD}	3	I	V _{DD} is the supply voltage terminal.
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.
RIN	5	I	Right-channel input terminal
RO/MO+	6	O	Right-output in SE mode and mono positive output in BTL mode
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.
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.

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

[¶] Please 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.



TPA0213
2-W MONO AUDIO POWER AMPLIFIER
WITH HEADPHONE DRIVE

SLOS276C – JANUARY 2000 – REVISED APRIL 2001

recommended operating conditions

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

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)	$V_{IO} = 0$, Gain = 8 dB			30	mV
PSRR	Power supply rejection ratio	$V_{DD} = 2.9\text{ V}$ to 3.1 V , BTL mode		65		dB
$ I_{IH} $	High-level input current	$V_{DD} = 3.3\text{ V}$, $V_I = V_{DD}$			1	μA
$ I_{IL} $	Low-level input current	$V_{DD} = 3.3\text{ V}$, $V_I = 0$			1	μA
z_i	Input impedance			50		k Ω
I_{DD}	Supply current			3.6	5.5	mA
$I_{DD(SD)}$	Supply current, shutdown mode			1	10	μA

operating characteristics, $V_{DD} = 3\text{ V}$, $T_A = 25^\circ\text{C}$, $R_L = 4\text{ }\Omega$, $f = 1\text{ kHz}$ (unless otherwise noted)

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, $R_L = 32\text{ }\Omega$		33		
THD + N	Total harmonic distortion plus noise	$P_O = 500\text{ mW}$, $f = 20\text{ Hz}$ to 20 kHz		0.2%		
BOM	Maximum output power bandwidth	Gain = 8 dB, THD = 2%		20		kHz
Supply ripple rejection ratio		$f = 1\text{ kHz}$, $CB = 0.47\text{ }\mu\text{F}$	BTL mode	52		dB
			SE mode	62		
V_n	Noise output voltage	$CB = 0.47\text{ }\mu\text{F}$, $f = 20\text{ Hz}$ to 20 kHz	BTL mode	42		μVRMS
			SE mode	21		

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



TPA0213
2-W MONO AUDIO POWER AMPLIFIER
WITH HEADPHONE DRIVE

SLOS276C – JANUARY 2000 – REVISED APRIL 2001

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)	$V_{IO} = 0$, Gain = 8 dB			30	mV
PSRR	Power supply rejection ratio	$V_{DD} = 4.9\text{ V to } 5.1\text{ V}$, BTL mode		62		dB
$ I_{IH} $	High-level input current	$V_{DD} = 5.5\text{ V}$, $V_I = V_{DD}$			1	μA
$ I_{IL} $	Low-level input current	$V_{DD} = 5.5\text{ V}$, $V_I = 0$			1	μA
z_i	Input impedance			50		$\text{k}\Omega$
I_{DD}	Supply current			4.2	6.3	mA
$I_{DD}(\text{SD})$	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 = 0.3%, BTL mode		2		W
		THD = 0.1%, SE mode, $R_L = 32\ \Omega$		90		mW
THD + N	Total harmonic distortion plus noise	$P_O = 1.5\text{ W}$, $f = 20\text{ Hz to } 20\text{ kHz}$		0.2%		
B_{OM}	Maximum output power bandwidth	Gain = 6 dB, THD = 2%		20		kHz
	Supply ripple rejection ratio	$f = 1\text{ kHz}$, $CB = 0.47\ \mu\text{F}$	BTL mode	52		dB
			SE mode	62		
V_n	Noise output voltage	$CB = 0.47\ \mu\text{F}$, $f = 20\text{ Hz to } 20\text{ kHz}$	BTL mode	42		μV_{RMS}
			SE mode	21		

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

TYPICAL CHARACTERISTICS

Table of Graphs

		FIGURE
THD+N	Total harmonic distortion plus noise	vs Output power
		1, 3, 5, 6, 8, 10
V_n	Output noise voltage	vs Frequency
		2, 4, 7, 9
	Power supply rejection ratio	vs Frequency
		11
		12, 13



TPA0213

2-W MONO AUDIO POWER AMPLIFIER WITH HEADPHONE DRIVE

SLOS276C – JANUARY 2000 – REVISED APRIL 2001

APPLICATION INFORMATION

ST/MN (stereo/mono) operation (continued)

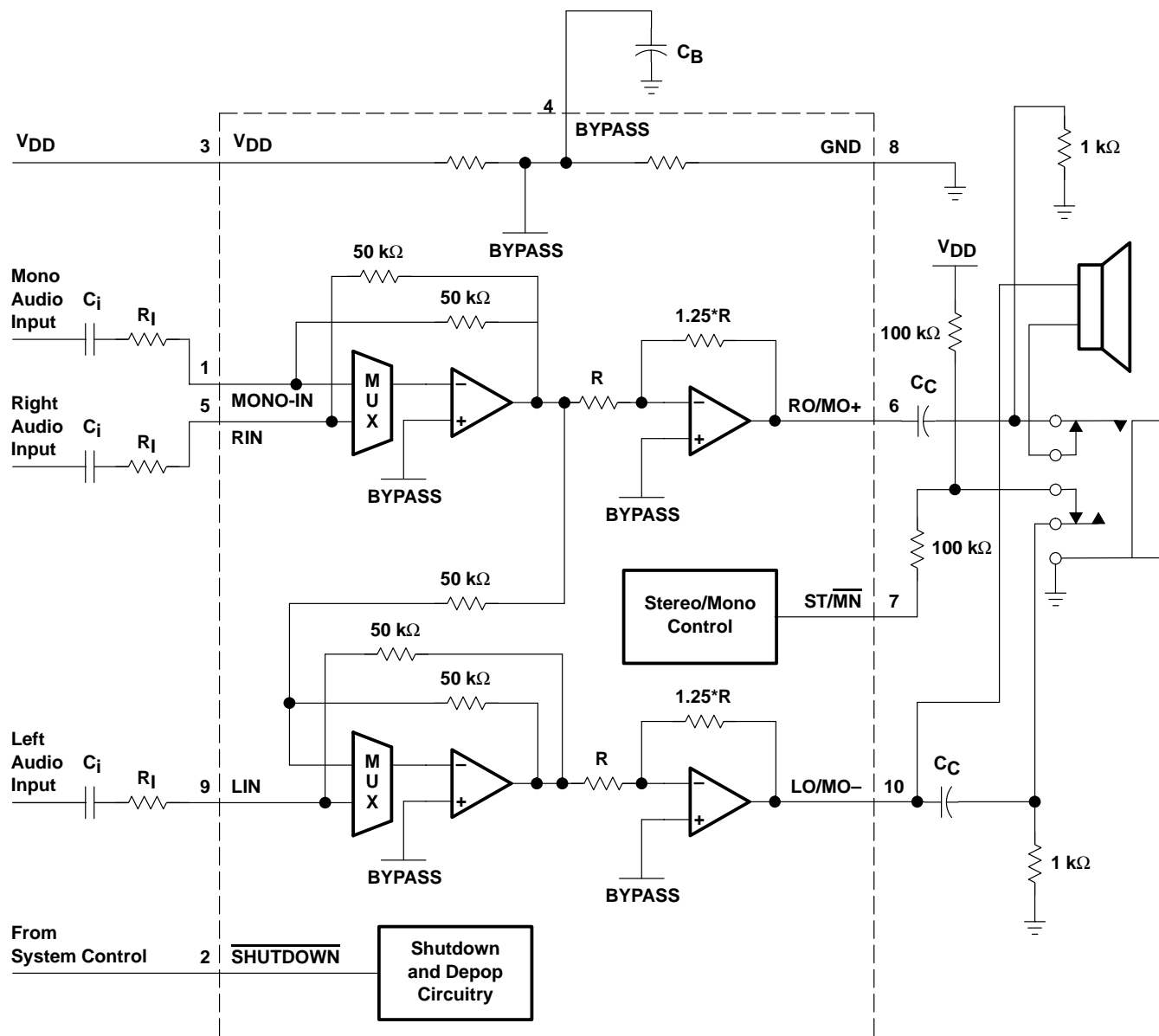


Figure 17. TPA0213 Resistor Divider Network Circuit

Using a readily available 1/8-in. (3.5 mm) stereo headphone jack, the control switch is closed when no plug is inserted. When closed, the 100-kΩ/1-kΩ divider pulls the ST/MN input low. When a plug is inserted, the 1-kΩ resistor is disconnected and the ST/MN input is pulled high. The mono speaker is also physically disconnected from the RO/MO+ output so that no sound is heard from the speaker while the headphones are inserted.