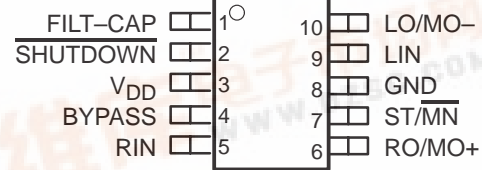


# 1-W MONO AUDIO POWER AMPLIFIER WITH HEADPHONE DRIVE

SLOS280B – JANUARY 2000 – REVISED MARCH 2000

- Ideal for Notebook Computers, PDAs, and Other Small Portable Audio Devices
- 1 W Into 8-Ω From 5-V Supply
- 0.3 W Into 8-Ω From 3-V Supply
- Stereo Head Phone Drive
- Mono (BTL) Signal Created by Summing Left and Right Signals Internally
- Wide Power Supply Compatibility  
2.5 V to 5.5 V
- Low Supply Current
  - 3.2 mA Typical at 5 V
  - 2.7 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 TPA0253 is a 1-W mono bridge-tied-load (BTL) amplifier designed to drive speakers with as low as 8-Ω impedance. The mono signal is created by summing left and right inputs internally. 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 TPA0253 can delivery 1-W of power into a 8-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 TPA0253 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.

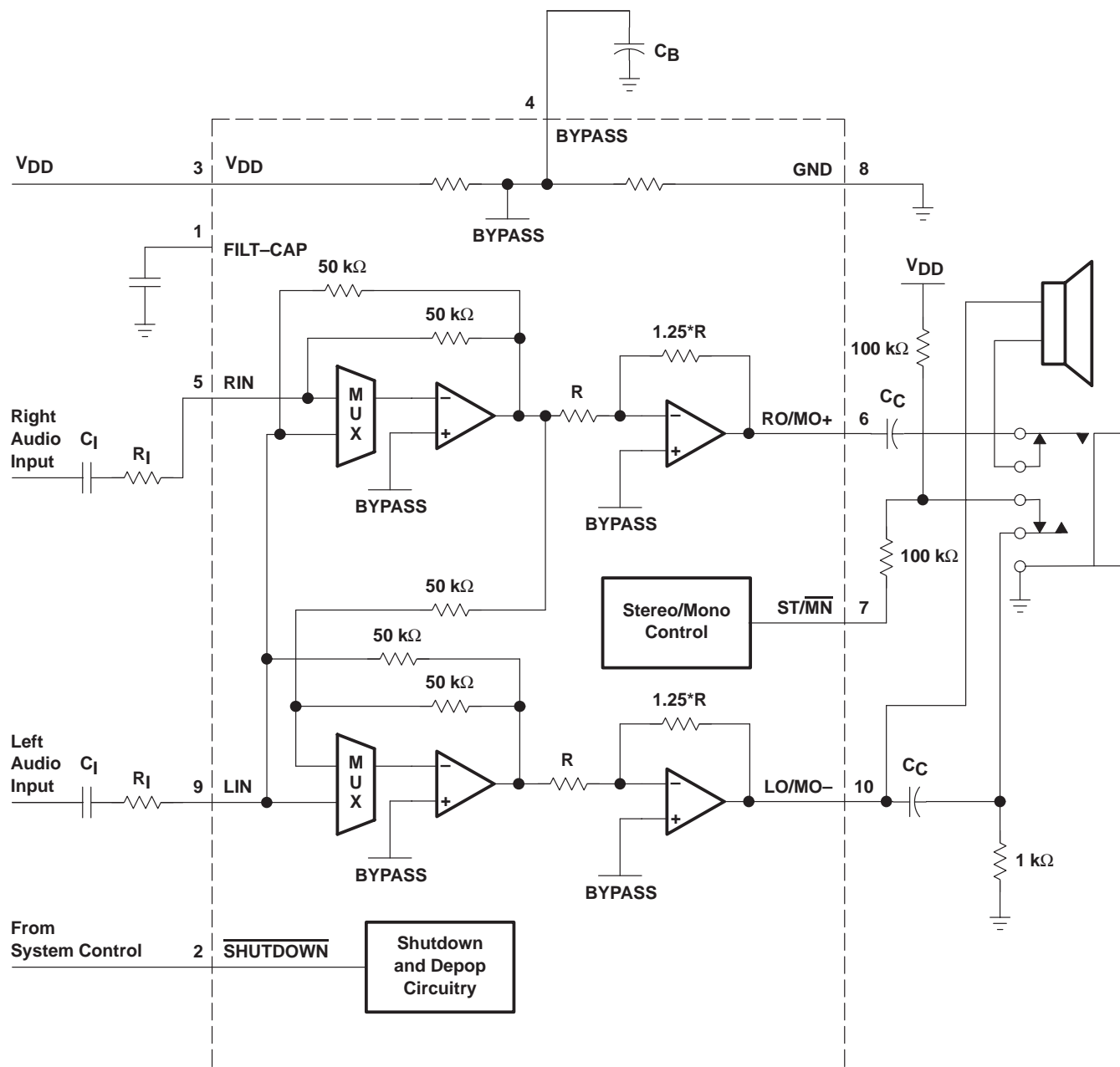


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# TPA0253

## 1-W MONO AUDIO POWER AMPLIFIER WITH HEADPHONE DRIVE

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# TPA0253

## 1-W MONO AUDIO POWER AMPLIFIER WITH HEADPHONE DRIVE

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### AVAILABLE OPTIONS

T <sub>A</sub>	PACKAGED DEVICES	MSOP SYMBOLIZATION
	MSOP† (DGQ)	
–40°C to 85°C	TPA0253DGQ	AEL

† 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., TPA0253DGQR).

### Terminal Functions

TERMINAL NAME	NO.	I/O	DESCRIPTION
FILT–CAP	1		Terminal used to filter power supply
SHUTDOWN	2	I	TTL-compatible shutdown terminal
VDD	3	I	Positive power supply
BYPASS	4	I	Mid-rail bias voltage
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 <sub>DD</sub>	6 V
Input voltage, V <sub>I</sub>	–0.3 V to V <sub>DD</sub> +0.3 V
Continuous total power dissipation	internally limited (see Dissipation Rating Table)
Operating free-air temperature range, T <sub>A</sub> (see Table 3)	–40°C to 85°C
Operating junction temperature range, T <sub>J</sub>	–40°C to 150°C
Storage temperature range, T <sub>stg</sub>	–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 <sub>A</sub> ≤ 25°C	DERATING FACTOR	T <sub>A</sub> = 70°C	T <sub>A</sub> = 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.

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### 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)	$V_{IO} = 0.1\%$ , Gain = 8 dB			30	mV
PSRR Power supply rejection ratio	$V_{DD} = 2.9\text{ V}$ to $3.1\text{ V}$ , BTL mode		65		dB
$ I_{IH} $ High-level input current	$V_{DD} = 3.3\text{ V}$ , $V_I = V_{DD}$			1	$\mu\text{A}$
$ I_{IL} $ Low-level input current	$V_{DD} = 3.3\text{ V}$ , $V_I = 0$			1	$\mu\text{A}$
$Z_I$ Input impedance			50		k $\Omega$
$I_{DD}$ Supply current			2.7	4	mA
$I_{DD(SD)}$ Supply current, shutdown mode			1	10	$\mu\text{A}$

### 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 = 0.1%, BTL mode, Gain = 14 dB		300		mW
	THD = 0.1% SE mode, Gain = 1.9 dB, $R_L = 32\text{ }\Omega$		30		
THD + N Total harmonic distortion plus noise	$P_O = 250\text{ mW}$ , $f = 20\text{ Hz}$ to $20\text{ kHz}$		0.2%		
BOM Maximum output power bandwidth	Gain = 1.9 dB, THD = 2%		20		kHz
Supply ripple rejection ratio	$f = 1\text{ kHz}$ , $CB = 0.47\text{ }\mu\text{F}$	BTL mode	46		dB
		SE mode	68		
$V_n$ Noise output voltage	$CB = 0.47\text{ }\mu\text{F}$ , $f = 20\text{ Hz}$ to $20\text{ kHz}$	BTL mode	83		$\mu\text{VRMS}$
		SE mode	33		

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

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**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	$\mu\text{A}$
$ I_{IL} $ Low-level input current	$V_{DD} = 5.5\text{ V}$ , $V_I = 0$			1	$\mu\text{A}$
$Z_I$ Input impedance			50		$\text{k}\Omega$
$I_{DD}$ Supply current			3.2	4.8	mA
$I_{DD}(\text{SD})$ Supply current, shutdown mode			1	10	$\mu\text{A}$

**operating characteristics,  $V_{DD} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ ,  $R_L = 4\ \Omega$ ,  $f = 1\text{ kHz}$  (unless otherwise noted)**

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$P_O$ Output power, see Note 1	THD = 0.1%, BTL mode		1		W
	THD = 0.1%, SE mode, $R_L = 32\ \Omega$		85		mW
THD + N Total harmonic distortion plus noise	$P_O = 1\text{ W}$ , $f = 20\text{ Hz}$ to $20\text{ kHz}$		0.33%		
$B_{OM}$ Maximum output power bandwidth	Gain = 8 dB, THD = 2%		20		kHz
Supple ripple rejection ratio	$f = 1\text{ kHz}$ , $CB = 0.47\ \mu\text{F}$	BTL mode	46		dB
		SE mode	60		
$V_n$ Noise output voltage	$CB = 0.47\ \mu\text{F}$ , $f = 20\text{ Hz}$ to $20\text{ kHz}$	BTL mode	85		$\mu\text{V}_{\text{RMS}}$
		SE mode	34		

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

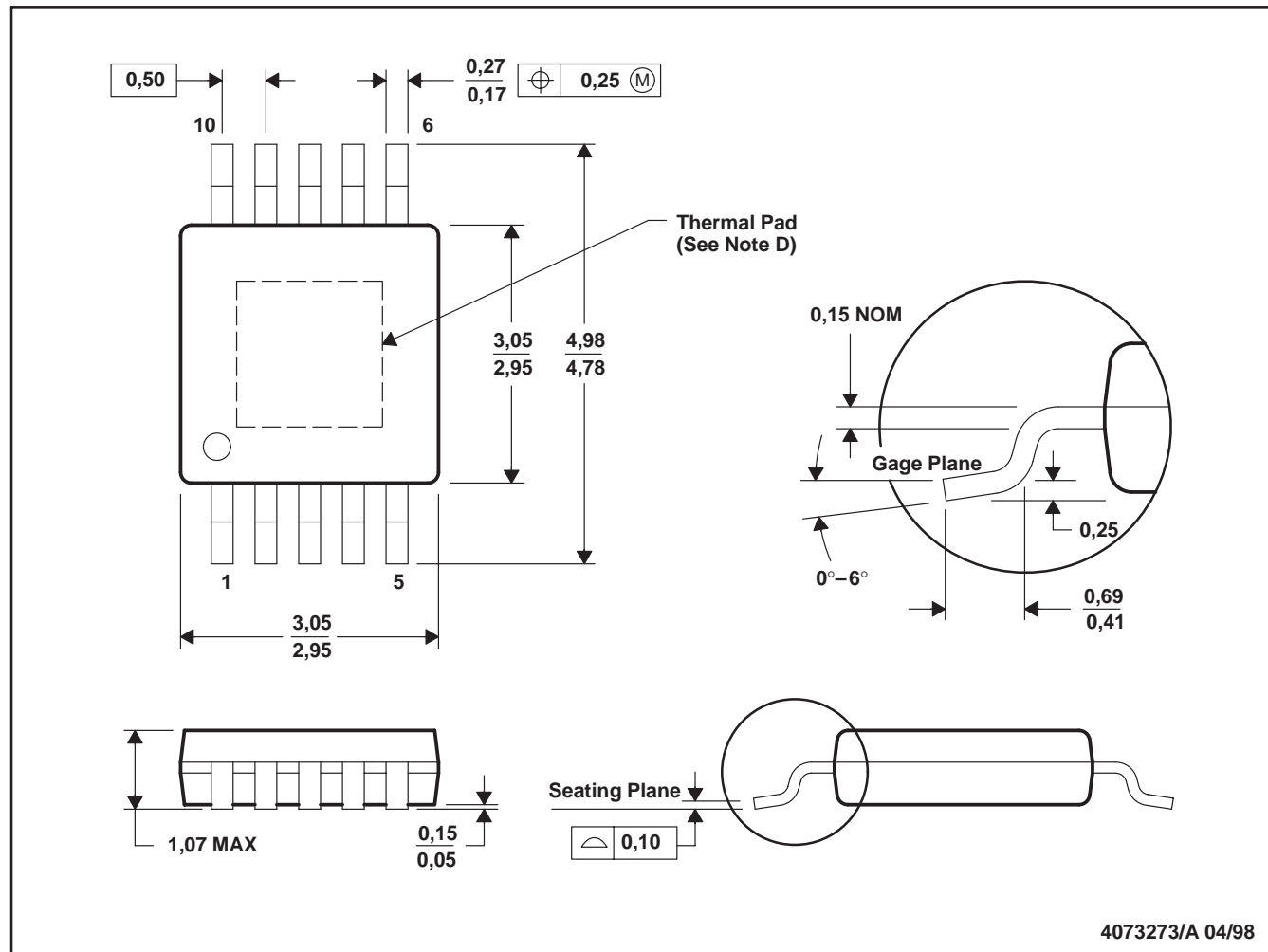
**TPA0253**  
**1-W MONO AUDIO POWER AMPLIFIER**  
**WITH HEADPHONE DRIVE**

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**MECHANICAL DATA**

**DGQ (S-PDSO-G10)**

**PowerPAD™ PLASTIC SMALL-OUTLINE PACKAGE**



- 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. The dimension of the thermal pad is 1.40 mm (height as illustrated) × 1.80 (width as illustrated) mm (maximum). The pad is centered on the bottom of the package.

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