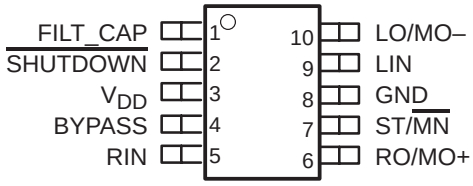
- **Ideal for Notebook Computers, PDAs, and Other Small Portable Audio Devices**
- **1 W Into 8-Ω From 5-V Supply**
- **0.3 W Into 8-Ω From 3-V Supply**
- **Stereo Head Phone Drive**
- **Mono (BTL) Signal Created by Summing Left and Right Signals Internally**
- **Wide Power Supply Compatibility 2.5 V 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.

AVAILABLE OPTIONS

T_A	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).

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.

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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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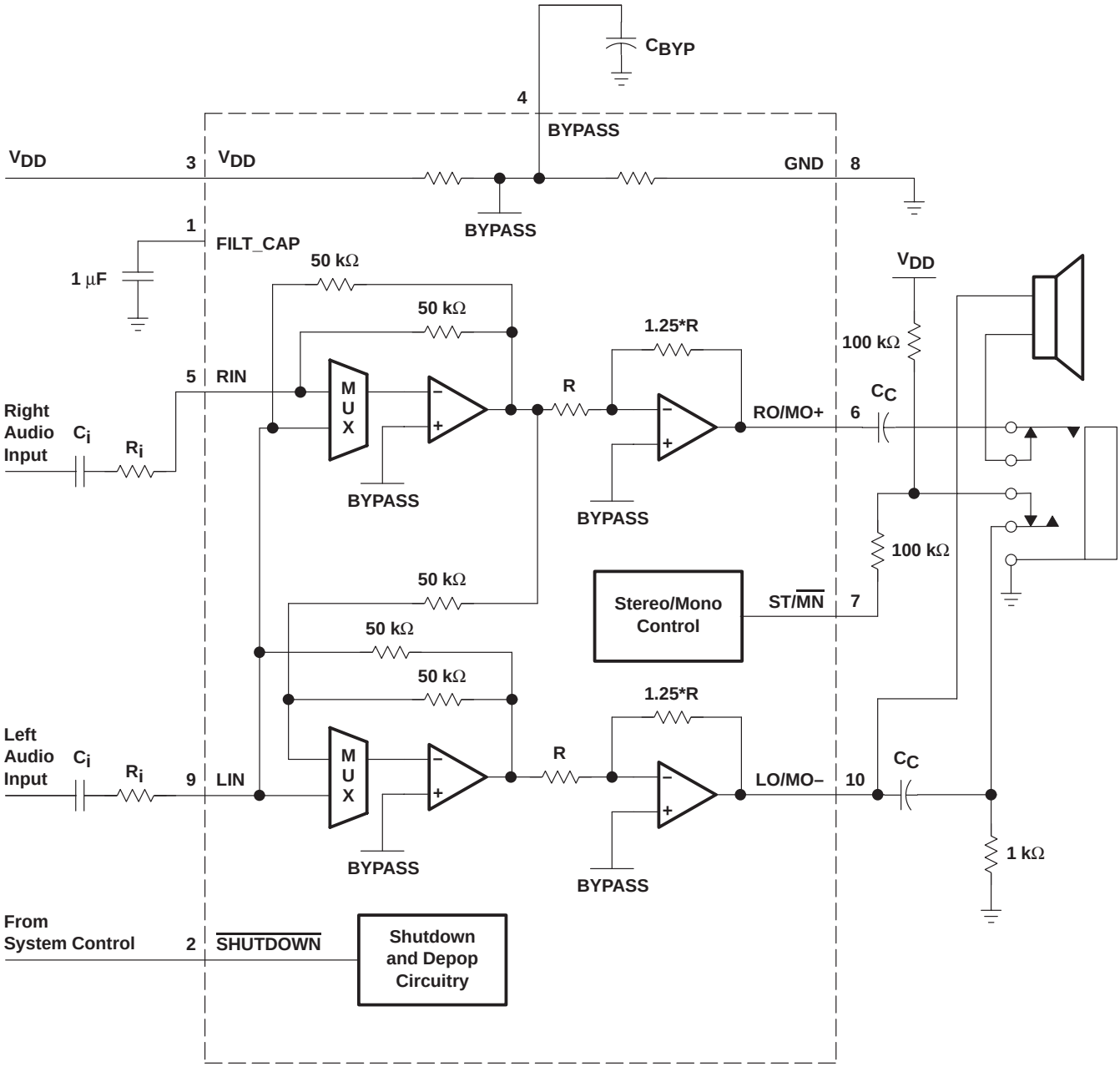
schematic


CBYP
4
BYPASS
VDD
3
VDD
GND
8
BYPASS
1
FILT_CAP
1 µF
50 kΩ
50 kΩ
1.25*R
VDD
100 kΩ
5
RIN
R
CC
Right
Audio
Input
Ci
Ri
RO/MO+
6
MUX
BYPASS
BYPASS
100 kΩ
50 kΩ
Stereo/Mono
Control
ST/MN
7
50 kΩ
50 kΩ
1.25*R
Left
Audio
Input
Ci
Ri
9
LIN
R
CC
LO/MO–
10
MUX
BYPASS
BYPASS
1 kΩ
From
System Control
2
SHUTDOWN
Shutdown
and Depop
Circuitry

Terminal Functions

TERMINAL NAME	TERMINAL 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	Midrail 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/$\overline{\text{MN}}$	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.
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	$T_A \leq 25°C$	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.

recommended operating conditions

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

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
$\|V_{OO}\|$	Output offset voltage (measured differentially)	V_{IO} = 0.1%,	Gain = 8 dB			30	mV
PSRR	Power supply rejection ratio	V_{DD} = 2.9 V to 3.1 V,	BTL mode		65		dB
$\|I_{IH}\|$	High-level input current	V_{DD} = 3.3 V,	$V_I = V_{DD}$			1	µA
$\|I_{IL}\|$	Low-level input current	V_{DD} = 3.3 V,	V_I = 0			1	µA
Z_I	Input impedance				50		kΩ
I_{DD}	Supply current				2.7	4	mA
$I_{DD(SD)}$	Supply current, shutdown mode				1	10	µA

operating characteristics, V_{DD} = 3 V, T_A = 25°C, R_L = 8 Ω, f = 1 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% Gain = 1.9 dB	SE mode,	R_L = 32 Ω		30		
THD + N	Total harmonic distortion plus noise	P_O = 250 mW,	f = 20 Hz to 20 kHz			0.2%		
B_{OM}	Maximum output power bandwidth	Gain = 1.9 dB,	THD = 2%			20		kHz
	Supple ripple rejection ratio	f = 1 kHz,	$C_{(BYP)}$ = 0.47 µF	BTL mode		46		dB
				SE mode		68		
V_n	Noise output voltage	$C_{(BYP)}$ = 0.47 µF,	f = 20 Hz to 20 kHz	BTL mode		83		μV_{RMS}
				SE mode		33		

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
$\|V_{OO}\|$	Output offset voltage (measured differentially)	V_{IO} = 0,	Gain = 8 dB			30	mV
PSRR	Power supply rejection ratio	V_{DD} = 4.9 V to 5.1 V,	BTL mode		62		dB
$\|I_{IH}\|$	High-level input current	V_{DD} = 5.5 V,	$V_I = V_{DD}$			1	μA
$\|I_{IL}\|$	Low-level input current	V_{DD} = 5.5 V,	V_I = 0			1	μA
Z_I	Input impedance				50		kΩ
I_{DD}	Supply current				3.2	4.8	mA
$I_{DD(SD)}$	Supply current, shutdown mode				1	10	μA

operating characteristics, V_{DD} = 5 V, T_A = 25°C, R_L = 8 Ω, f = 1 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 Ω		85		mW
THD + N	Total harmonic distortion plus noise	P_O = 1 W,	f = 20 Hz to 20 kHz			0.33%		
B_{OM}	Maximum output power bandwidth	Gain = 8 dB,	THD = 2%			20		kHz
	Supple ripple rejection ratio	f = 1 kHz,	$C_{(BYP)}$ = 0.47 μF	BTL mode		46		dB
				SE mode		60		
V_n	Noise output voltage	$C_{(BYP)}$ = 0.47 μF,	f = 20 Hz to 20 kHz	BTL mode		85		μV_{RMS}
				SE mode		34		

NOTE 1: Output power is measured at the output terminals of the device at f = 1 kHz.