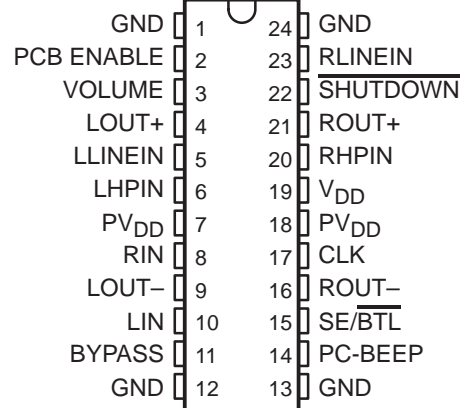


# TPA0132 STEREO 2-W AUDIO POWER AMPLIFIER WITH DC VOLUME CONTROL

SLOS223A – MAY 1999 – REVISED MAY 1999

- Compatible With PC 99 Desktop Line-Out Into 10-k $\Omega$  Load
- Compatible With PC 99 Portable Into 8- $\Omega$  Load
- Internal Gain Control, Which Eliminates External Gain-Setting Resistors
- DC Volume Control From +20 dB to –40 dB
- 2-W/Ch Output Power Into 3- $\Omega$  Load
- PC-Beep Input
- Depop Circuitry
- Stereo Input MUX
- Fully Differential Input
- Low Supply Current and Shutdown Current
- Surface-Mount Power Packaging  
24-Pin TSSOP PowerPAD™

PWP PACKAGE  
(TOP VIEW)



## description

The TPA0132 is a stereo audio power amplifier in a 24-pin TSSOP thermally enhanced package capable of delivering 2 W of continuous RMS power per channel into 3- $\Omega$  loads. This device minimizes the number of external components needed, which simplifies the design and frees up board space for other features. When driving 1 W into 8- $\Omega$  speakers, the TPA0132 has less than 0.4% THD+N across its specified frequency range.

Included within this device is integrated depop circuitry that virtually eliminates transients that cause noise in the speakers.

Amplifier gain is controlled by means of a dc voltage input on the VOLUME terminal. There are 31 discrete steps covering the range of +20 dB (maximum volume setting) to –40 dB (minimum volume setting) in 2 dB steps. When the VOLUME terminal exceeds 3.54 V, the device is muted. An internal input MUX allows two sets of stereo inputs to the amplifier. In notebook applications, where internal speakers are driven as BTL and the line outputs (often headphone drive) are required to be SE, the TPA0132 automatically switches into SE mode when the SE/BTL input is activated, and this effectively reduces the gain by 6 dB.

The TPA0132 consumes only 10 mA of supply current during normal operation. A miserly shutdown mode is included that reduces the supply current to less than 150  $\mu$ A.

The PowerPAD package (PWP) delivers a level of thermal performance that was previously achievable only in TO-220-type packages. Thermal impedances of approximately 35°C/W are readily realized in multilayer PCB applications. This allows the TPA0132 to operate at full power into 8- $\Omega$  loads at ambient temperatures of 85°C.



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 Incorporated.

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.

 **TEXAS  
INSTRUMENTS**

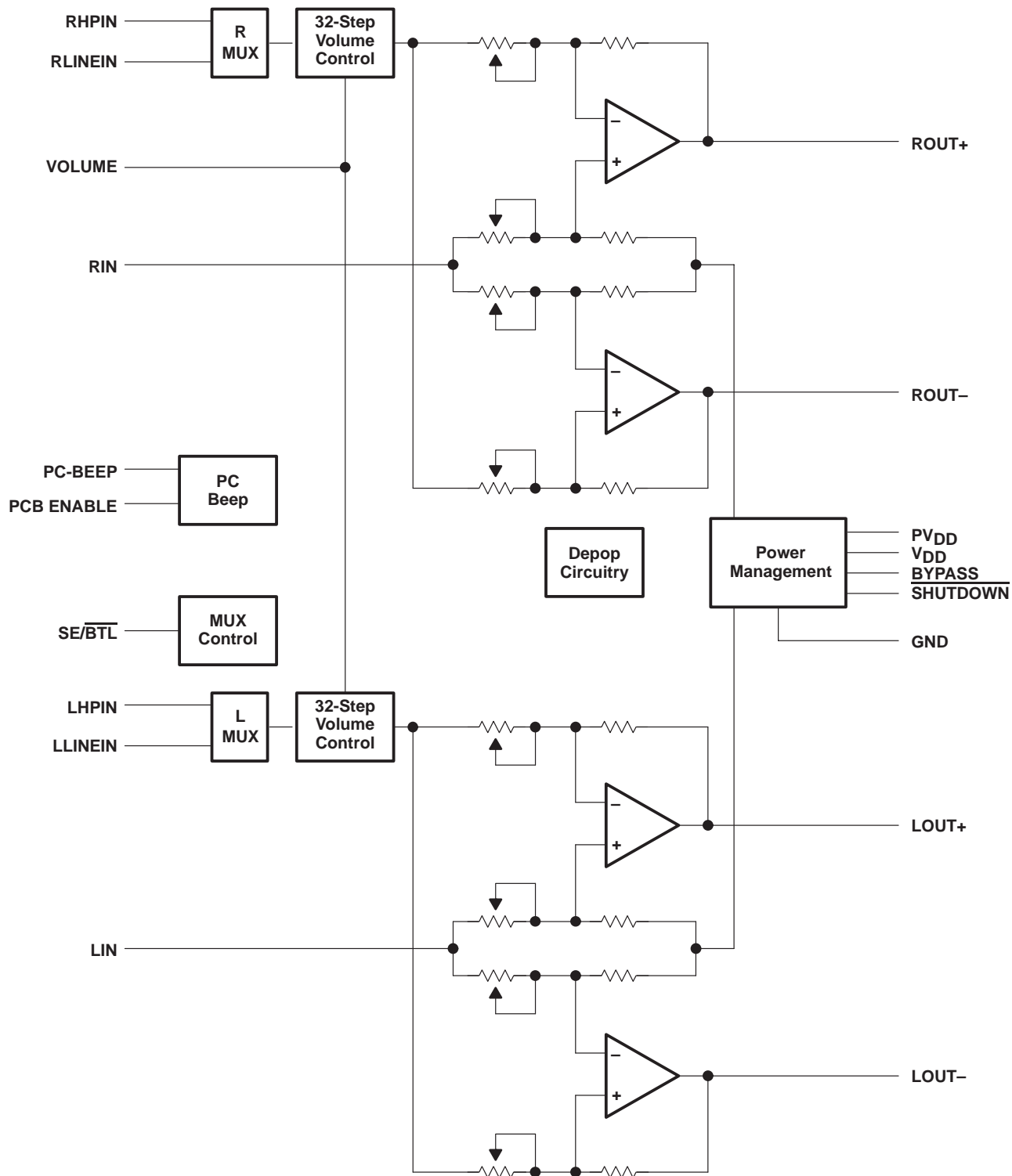
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 1999, Texas Instruments Incorporated

# TPA0132 STEREO 2-W AUDIO POWER AMPLIFIER WITH DC VOLUME CONTROL

SLOS223A – MAY 1999 – REVISED MAY 1999

## functional block diagram



**TPA0132**  
**STEREO 2-W AUDIO POWER AMPLIFIER**  
**WITH DC VOLUME CONTROL**

SLOS223A – MAY 1999 – REVISED MAY 1999

**AVAILABLE OPTIONS**

T <sub>A</sub>	PACKAGED DEVICE
	–40°C to 85°C

† The PWP package is available taped and reeled. To order a taped and reeled part, add the suffix R to the part number (e.g., TPA0132PWPR).

**Terminal Functions**

TERMINAL NAME	NO.	I/O	DESCRIPTION
BYPASS	11		Tap to voltage divider for internal mid-supply bias generator
CLK	17	I	If a 47-nF capacitor is attached, the TPA0132 generates an internal clock. An external clock can override the internal clock input to this terminal.
GND	1, 12 13, 24		Ground connection for circuitry. Connected to thermal pad.
LHPIN	6	I	Left channel headphone input, selected when $\overline{\text{SE/BTL}}$ is held high
LIN	10	I	Common left input for fully differential input. AC ground for single-ended inputs.
LLINEIN	5	I	Left channel line negative input, selected when $\overline{\text{SE/BTL}}$ is held low
LOUT+	4	O	Left channel positive output in $\overline{\text{BTL}}$ mode and positive output in SE mode
LOUT–	9	O	Left channel negative output in $\overline{\text{BTL}}$ mode and high-impedance in SE mode
PCB ENABLE	2	I	If this terminal is high, the detection circuitry for PC-BEEP is overridden and passes PC-BEEP through the amplifier, regardless of its amplitude. If PCB ENABLE is floating or low, the amplifier continues to operate normally.
PC-BEEP	14	I	The input for PC Beep mode. PC-BEEP is enabled when a > 1-V (peak-to-peak) square wave is input to PC-BEEP or PCB ENABLE is high.
PV <sub>DD</sub>	7, 18	I	Power supply for output stage
RHPIN	20	I	Right channel headphone input, selected when $\overline{\text{SE/BTL}}$ is held high
RIN	8	I	Common right input for fully differential input. AC ground for single-ended inputs.
RLINEIN	23	I	Right channel line input, selected when $\overline{\text{SE/BTL}}$ is held low
ROUT+	21	O	Right channel positive output in $\overline{\text{BTL}}$ mode and positive output in SE mode
ROUT–	16	O	Right channel negative output in $\overline{\text{BTL}}$ mode and high-impedance in SE mode
$\overline{\text{SE/BTL}}$	15	I	Input MUX control input. When this terminal is held high, the LHPIN or RHPIN and SE output is selected. When this terminal is held low, the LLINEIN or RLINEIN and BTL output are selected.
$\overline{\text{SHUTDOWN}}$	22	I	When held low, this terminal places the entire device, except PC-BEEP detect circuitry, in shutdown mode.
V <sub>DD</sub>	19	I	Analog V <sub>DD</sub> input supply. This terminal needs to be isolated from PV <sub>DD</sub> to achieve highest performance.
VOLUME	3	I	VOLUME detects the dc level at the terminal and sets the gain for 31 discrete steps covering a range of 20 dB to –40 dB for dc levels of 0.15 V to 3.54 V. When the dc level is over 3.54 V, the device is muted.



**TPA0132**  
**STEREO 2-W AUDIO POWER AMPLIFIER**  
**WITH DC VOLUME CONTROL**

SLOS223A – MAY 1999 – REVISED MAY 1999

**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, $T_A$	-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	$T_A \leq 25^\circ\text{C}$	DERATING FACTOR	$T_A = 70^\circ\text{C}$	$T_A = 85^\circ\text{C}$
PWP	2.7 W§	21.8 mW/°C	1.7 W	1.4 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, $V_{DD}$		4.5	5.5	V
High-level input voltage, $V_{IH}$	SE/BTL	4		V
	SHUTDOWN	2		
Low-level input voltage, $V_{IL}$	SE/BTL	3		V
	SHUTDOWN	0.8		
Operating free-air temperature, $T_A$		-40	85	°C



**TPA0132**  
**STEREO 2-W AUDIO POWER AMPLIFIER**  
**WITH DC VOLUME CONTROL**

SLOS223A – MAY 1999 – REVISED MAY 1999

**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 <sub>OD</sub>	Differential output voltage				25	mV
PSRR	Power supply rejection ratio	$V_{DD} = 4\text{ V to }5\text{ V}$		67		dB
I <sub>IH</sub>	High-level input current	$V_{DD} = 5.5\text{ V}$ , $V_I = V_{DD}$			900	nA
I <sub>IL</sub>	Low-level input current	$V_{DD} = 5.5\text{ V}$ , $V_I = 0\text{ V}$			900	nA
I <sub>DD</sub>	Supply current	BTL mode		10	15	mA
		SE mode		5	7.5	
I <sub>DD(sd)</sub>	Supply current, shutdown mode			150	300	μA

**operating characteristics,  $V_{DD} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ ,  $R_L = 4\ \Omega$ , Gain = 2 V/V, BTL mode (unless otherwise noted)**

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
P <sub>O</sub>	Output power	THD = 1%,	f = 1 kHz		2		W
THD + N	Total harmonic distortion plus noise	P <sub>O</sub> = 1 W,	f = 20 Hz to 15 kHz		0.4%		
B <sub>OM</sub>	Maximum output power bandwidth	THD = 5%			>15		kHz
k <sub>SVR</sub>	Supply ripple rejection ratio	f = 1 kHz, C <sub>B</sub> = 0.47 μF	BTL mode		65		dB
			SE mode		60		
V <sub>n</sub>	Noise output voltage	C <sub>B</sub> = 0.47 μF, f = 20 Hz to 20 kHz	BTL mode		34		μV <sub>RMS</sub>
			SE mode		44		

**TPA0132**  
**STEREO 2-W AUDIO POWER AMPLIFIER**  
**WITH DC VOLUME CONTROL**

SLOS223A – MAY 1999 – REVISED MAY 1999

**APPLICATION INFORMATION**

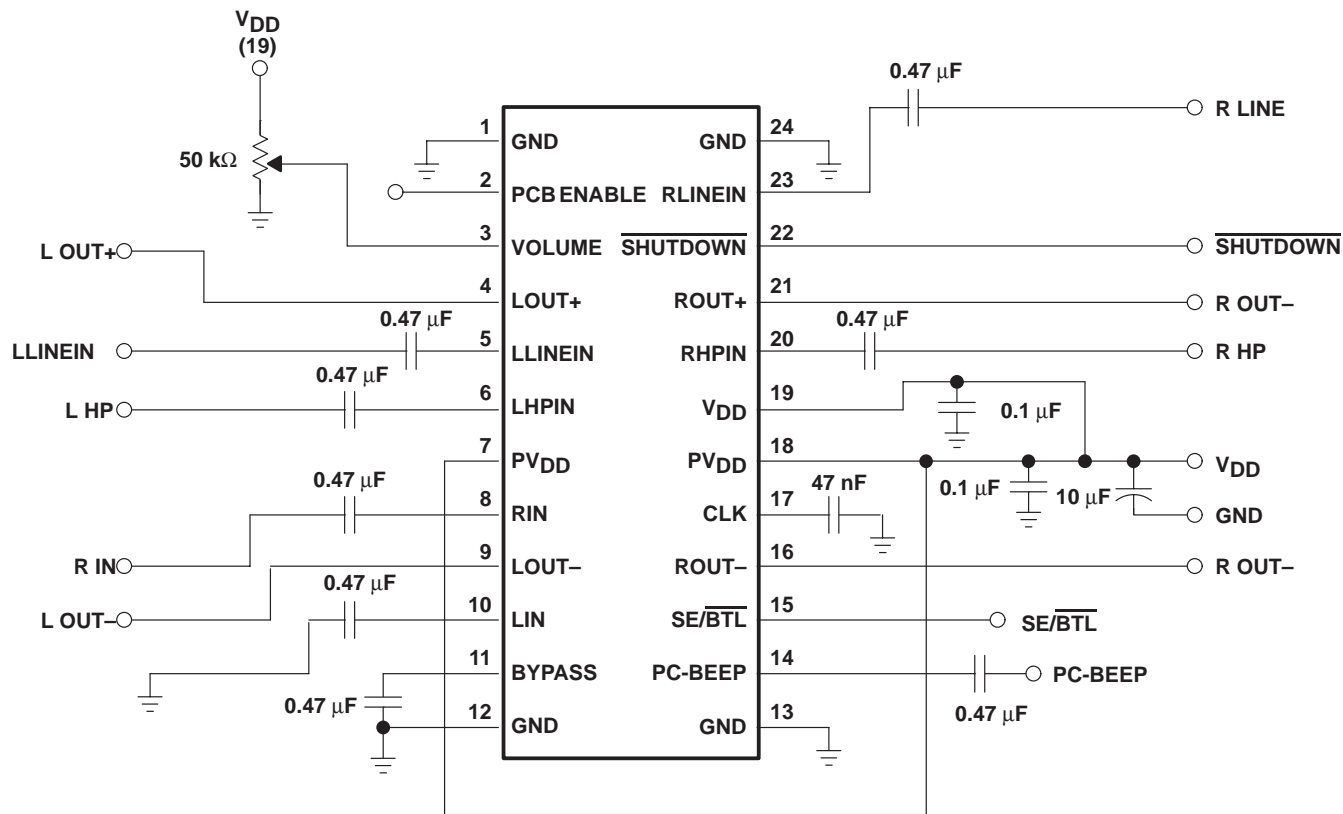


Figure 1. Typical TPA0132 Application Circuit

**APPLICATION INFORMATION**

**Table 1. DC Volume Control**

VOLUME (Terminal 3)		GAIN of AMPLIFIER (dB)
FROM (V)	TO (V)	
0	0.15	20
0.15	0.28	18
0.28	0.39	16
0.39	0.5	14
0.5	0.61	12
0.61	0.73	10
0.73	0.84	8
0.84	0.95	6
0.95	1.06	4
1.06	1.17	2
1.17	1.28	0
1.28	1.39	-2
1.39	1.5	-4
1.5	1.62	-6
1.62	1.73	-8
1.73	1.84	-10
1.84	1.95	-12
1.95	2.07	-14
2.07	2.18	-16
2.18	2.29	-18
2.29	2.41	-20
2.41	2.52	-22
2.52	2.63	-24
2.63	2.74	-26
2.74	2.86	-28
2.86	2.97	-30
2.97	3.08	-32
3.08	3.2	-34
3.2	3.31	-36
3.31	3.42	-38
3.42	3.54	-40
3.54	5	-85

**TPA0132**  
**STEREO 2-W AUDIO POWER AMPLIFIER**  
**WITH DC VOLUME CONTROL**

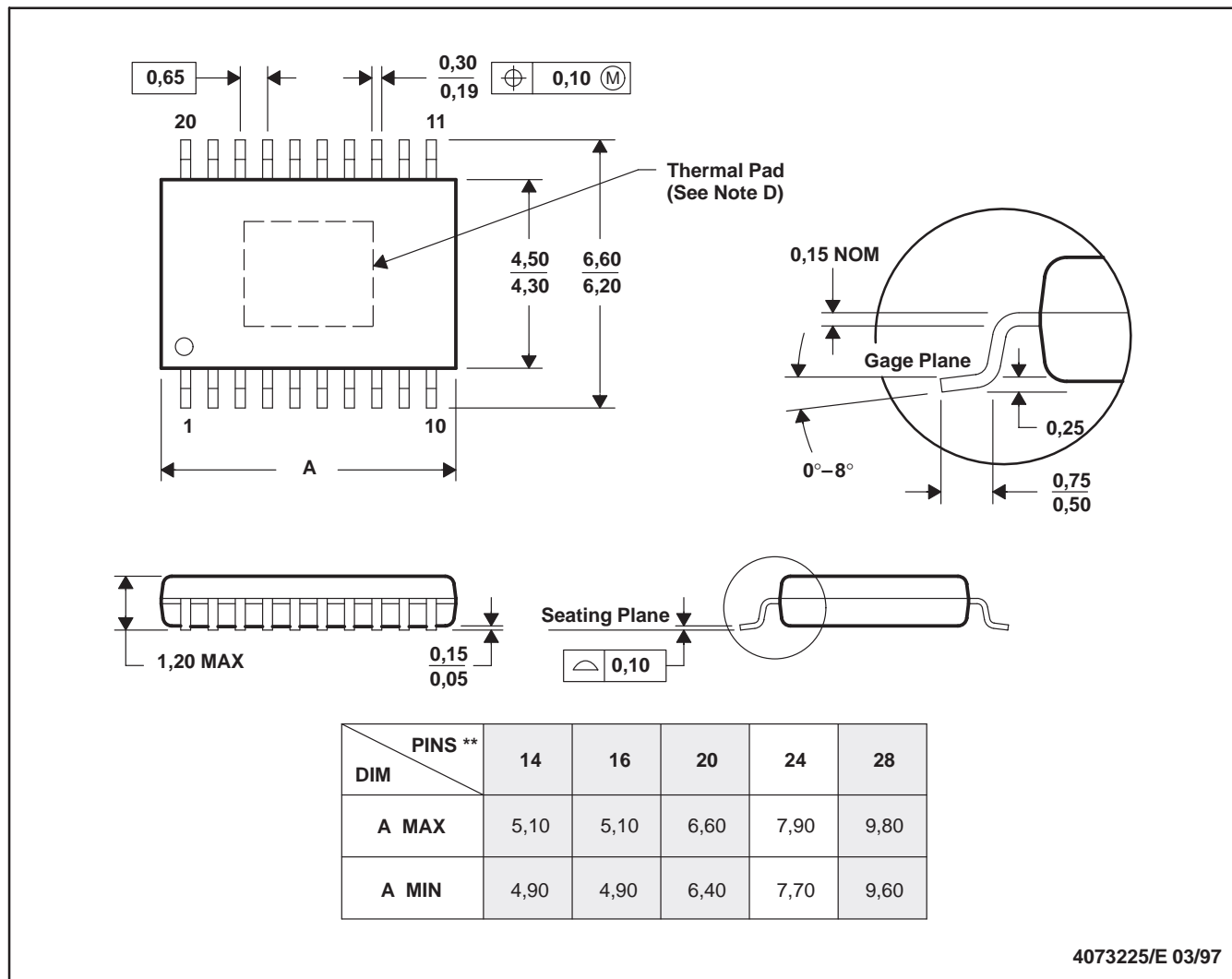
SLOS223A – MAY 1999 – REVISED MAY 1999

**MECHANICAL DATA**

**PWP (R-PDSO-G\*\*)**

**PowerPAD™ PLASTIC SMALL-OUTLINE PACKAGE**

20-PIN SHOWN



4073225/E 03/97

- 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 protrusions.
  - 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.
  - E. Falls within JEDEC MO-153

PowerPAD is a trademark of Texas Instruments Incorporated.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265



## IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.