TEXAS INSTRUMENTS

TPA751 MSOP
Audio Power Amplifier
Evaluation Module

User's Guide

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 acknowledgment, 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.

Customers are responsible for their applications using TI components.

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.

Mailing Address:

Texas Instruments
Post Office Box 655303
Dallas, Texas 75265

Preface

Related Documentation From Texas Instruments

- **TI Plug-N-Play Audio Amplifier Evaluation Platform** (literature number SLOU011) provides detailed information on the evaluation platform and its use with TI audio evaluation modules.

- **TPA751 700-mW Low-Voltage Audio Power Amplifier** (literature number SLOS336) This is the data sheet for the TPA751 audio amplifier integrated circuit.

FCC Warning

This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

Contents

Figures

Tables

Chapter 1

Introduction

This chapter provides an overview of the Texas Instruments (TI) TPA751 MSOP Audio Power Amplifier Evaluation Module (SLOP357). It includes a list of EVM features, a brief description of the module illustrated with a pictorial diagram, and a list of EVM specifications.

1.1 Feature Highlights

The TI TPA751 MSOP Audio Power Amplifier Evaluation Module and the TI Plug-n-Play Audio Amplifier Evaluation Platform include the following features:

❑ TPA751 low-voltage audio power amplifier evaluation module

 ■ Single-channel, bridge-tied load (BTL)

 ■ 2.5-V and 5.5-V operation

 ■ 700-mW output power into 8 Ω at 5 V, BTL

 ■ Ultra-low current consumption in shutdown mode

 ■ Internal thermal and short-circuit protection

 ■ Module gain is set at –4 V/V in BTL mode, –2 V/V in SE mode

❑ Quick and Easy Configuration With The TI Plug-N-Play Audio Amplifier Evaluation Platform

 ■ Evaluation module is designed to simply plug into the platform, automatically making all signal, control, and power connections

 ■ Platform provides flexible power options

 ■ Jumpers on the platform select power and module control options

 ■ Switches on the platform route signals

 ■ Platform provides quick and easy audio input and output connections

❑ Platform Power Options

 ■ Onboard 9-V battery

 ■ External 5-V to 15-V (V_{CC}) supply inputs

 ■ External regulated V_{DD} supply input

 ■ Socket for on-board 5-V/3.3-V V_{DD} voltage regulator EVM

 ■ Onboard overvoltage and reverse polarity power protection

❑ Platform Audio Input and Output Connections

 ■ Left and right RCA phono jack inputs

 ■ Miniature stereo phone jack input

 ■ Left and right RCA phono jack outputs

 ■ Left and right compression speaker terminal outputs

 ■ Miniature stereo headphone jack output

Introduction

1.2 Description

The TPA751 MSOP Audio Power Amplifier Evaluation Module is a complete, low-power single-channel audio power amplifier. It consists of the TI TPA751 700-mW low-voltage audio power amplifier IC in a very small MSOP package, along with a small number of other parts mounted on a circuit board that is approximately one and a quarter inches square (see Figure 1–1).

Figure 1–1. The TI TPA751 Audio Amplifier Evaluation Module
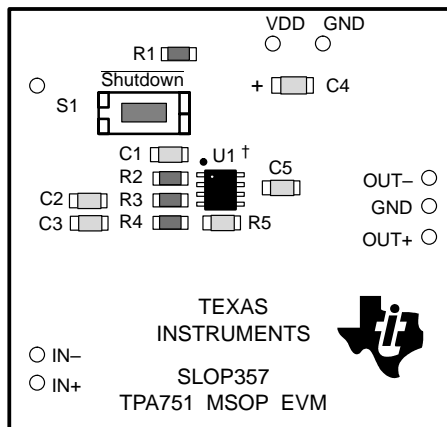
[†] Due to the very small size of the MSOP IC package, the standard part number TPA751 is replaced with the code TIATC.

Single in-line header pins are mounted to the underside of the module circuit board. These pins allow the EVM to be plugged into the TI plug-n-play audio amplifier evaluation platform or to be wired directly into existing circuits and equipment when used stand-alone.

The platform, with room for a pair of TPA751 evaluation modules, is a convenient vehicle for demonstrating TI's audio power amplifier and related evaluation modules. The EVMs simply plug into the platform, which automatically provides power to the modules, interconnects them correctly, and connects them to a versatile array of standard audio input and output jacks and connectors. Easy-to-use configuration controls allow the platform and EVMs to quickly model many possible end-equipment configurations.

There is nothing to build, nothing to solder, and nothing but the speakers included with the platform to hook up.

1.3 TPA751 EVM Specifications

Supply voltage range, V_{DD} .... 2.5 V to 5.5 V
Supply current, I_{DD} .... 450 mA, max
Continuous output power, P_O: 8-Ω BTL, V_{DD} = 5 V .... 700 mW
Audio input voltage, V_I .... 2 Vpp, max
Minimum load impedance, R_L .... 8 Ω

Chapter 2

Operation

Quick start lists in this chapter contain steps that can be followed to quickly prepare the TI plug-n-play audio amplifier evaluation platform for use with the TPA751 MSOP Audio Power Amplifier Evaluation Module, or to connect the TPA751 EVM for stand-alone operation.

Using the TPA751 EVM with the TI evaluation platform is a quick and easy way to connect power, signal and control inputs, and signal outputs to the EVM, using standard connectors.

The TPA751 EVM can also be used stand-alone by making connections directly to the module pins, and it can be wired directly into existing circuits or equipment. A stand-alone connection diagram appears below.

A schematic, parts list, and PCB and layer illustrations for the EVM are included in the Reference section of this chapter.

2.1 Precautions

Power Supply Input Polarity and Maximum Voltage

Always ensure that the polarity and voltage of the external power connected to V_{CC} power input connector J1, J2, and/or V_{DD} power input connector J6 are correct. Overvoltage or reverse-polarity power applied to these terminals can open onboard soldered-in fuses and cause other damage to the platform, installed evaluation modules, and/or the power source.

Inserting or Removing EVM Boards

Do not insert or remove EVM boards with power applied – damage to the EVM board, the platform, or both may result.

Figure 2–1. Quick Start Platform Map

Operation
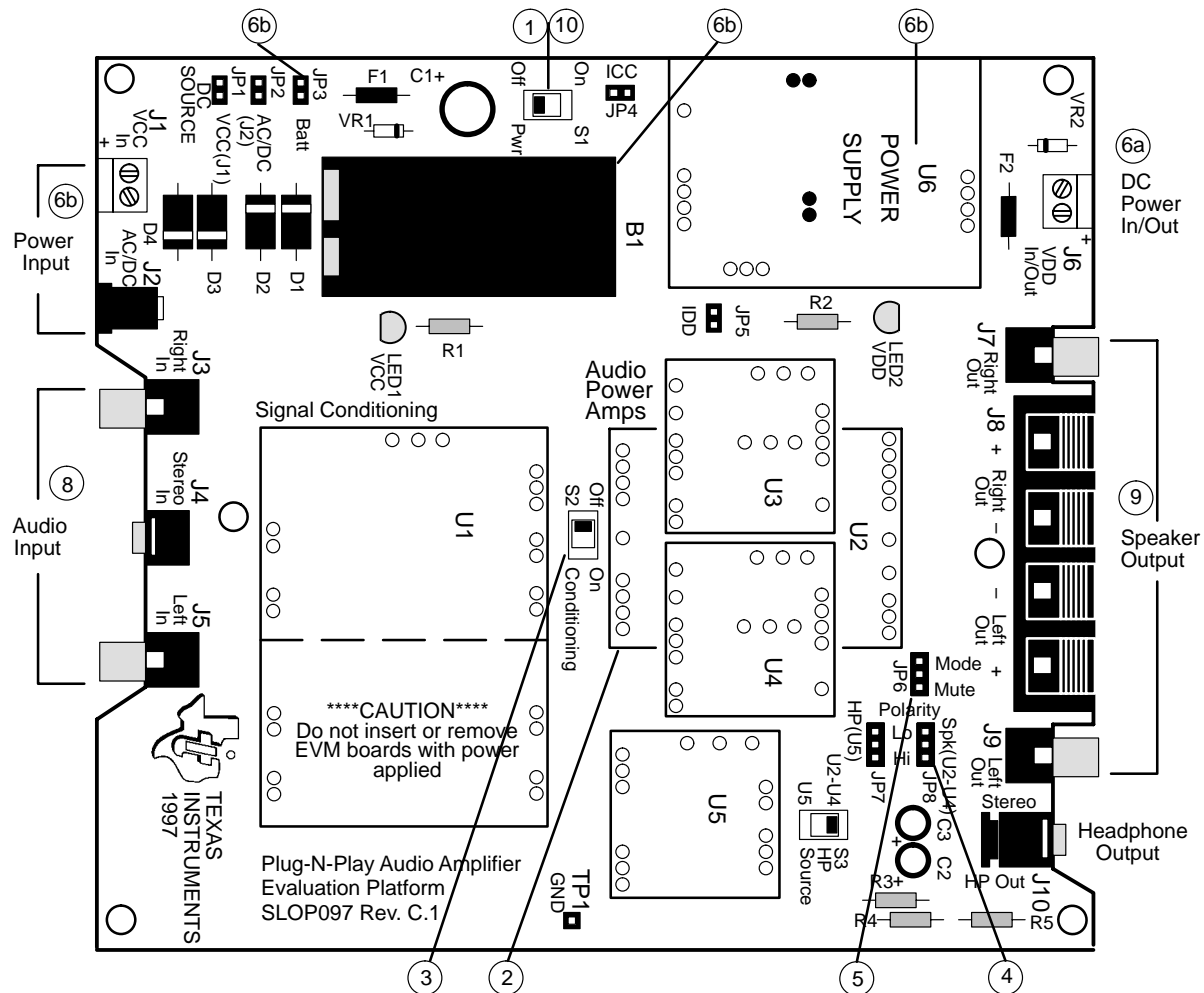
2.2 Quick Start List for Platform

Follow these steps when using the TPA751 EVM with the TI Plug-N-Play Audio Amplifier Evaluation Platform (see the platform user's guide, SLOU011, for additional details). Typical EVM settings are shown in Table 2–1. Numbered callouts for selected steps are shown in Figure 2–1.

❑ **Platform preparations**

1) Ensure that all external power sources are set to off and that the platform power switch S1 is set to off.

2) Install a TPA751 MSOP module in platform sockets U3 and U4 for stereo operation (or a module in either U3 *or* U4 for single channel operation), taking care to align the module pins correctly.

3) Use switch S2 to select or bypass the signal conditioning EVM (U1).

4) Set control signal Polarity jumper JP8 to Hi.

5) Set jumper JP6 to select the Mute control input (causes the TPA751 to shutdown if a plug is inserted into platform headphone jack J10).

Table 2–1. Platform Jumper and Switch Settings for the TPA751 EVM

EVM	JP6	JP7	JP8	S2	S3
TPA751	Mute	X	Hi	See Note 2	X

Notes: 1) X = Don't care

2) Set S2 to ON when signal conditioning board is installed in U1; set S2 to OFF when no signal conditioning board is installed.

❑ **Power supply**

6) Select and connect the power supply:

a) Connect an external regulated power supply set to a voltage between 2.5 V and 5.5 V to platform V_{DD} power input connector J6, taking care to observe marked polarity, or

b) Install a voltage regulator EVM (SLVP097 or equiv.) in platform socket U6. Install a 9-V battery in B1 or connect a 7 V – 12 V power source to a platform V_{CC} power input J1 or J2 and jumper the appropriate power input (see platform user's guide).

❑ **Inputs and outputs**

7) Ensure that signal source level is set to minimum.

8) Connect the audio source to left and right RCA phono jacks J3 and J5 or stereo miniature phone jack J4.

9) Connect 8-Ω–32-Ω speakers to left and right RCA jacks J7 and J9 or to stripped wire connectors J8.

❑ **Power-up**

10) Verify correct voltage and input polarity and set the external power supply to ON. If V_{CC} and an on-board regulator EVM are used to provide V_{DD}, set platform power switch S1 to on.

Platform LED2 lights indicating the presence of V_{DD}, and the evaluation modules installed on the platform begin operation.

11) Adjust the signal source level as needed.

2.3 Quick Start List for Stand-Alone

Follow these steps to use the TPA751 EVM stand-alone or when connecting it into existing circuits or equipment. Connections to the TPA751 module header pins can be made via individual sockets, wire-wrapping, or soldering to the pins, either on the top or the bottom of the module circuit board. Numbered callouts for selected steps are shown in Figure 2–2.

Figure 2–2. Quick Start Module Map
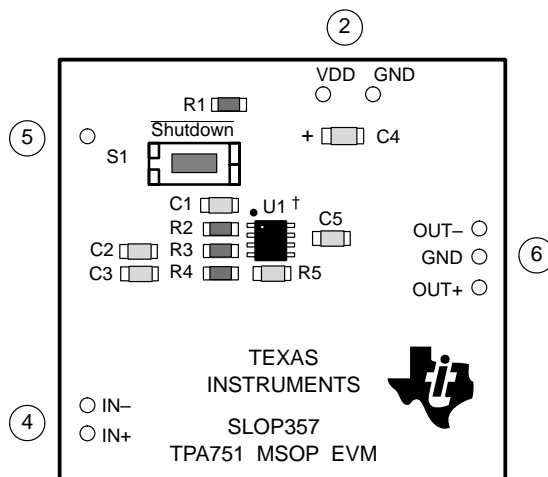
† Due to the very small size of the MSOP IC package, the standard part number TPA751 is replaced with the code TIATC.

❑ **Power supply**

1) Ensure that all external power sources are set to off.

2) Connect an external regulated power supply set to 5 V to the module V_{DD} and GND pins, taking care to observe marked polarity.

❑ **Inputs and outputs**

3) Ensure that the signal source level is set to minimum.

4) Connect the audio source to the module IN– and IN+ pins, taking care to observe marked polarity.

5) Connect the shutdown (S1) pin to GND through a normally open switch.

6) Connect an 8-Ω–32-Ω speaker to the module OUT+ and OUT– pins.

❑ **Power-up**

7) Verify correct voltage and input polarity and set the external power supply to on.

The EVM should begin operation.

8) Adjust the signal source level as needed.

2.4 Stand-Alone Connection Diagram

The power supply range is 2.5 V to 5.5 V and isolated OUT+ and OUT− lines for BTL operation are required.

Note that the source of any shutdown signal applied to the EVM $\overline{\text{SHUTDOWN}}$ pin must be able to sink the current flowing through the pullup resistor on the module (20 kΩ) when the pin is held low.

Figure 2–3 shows a TPA751 EVM connected for stereo BTL operation.

Figure 2–3. TPA751 EVMs Connected for Stereo BTL Output
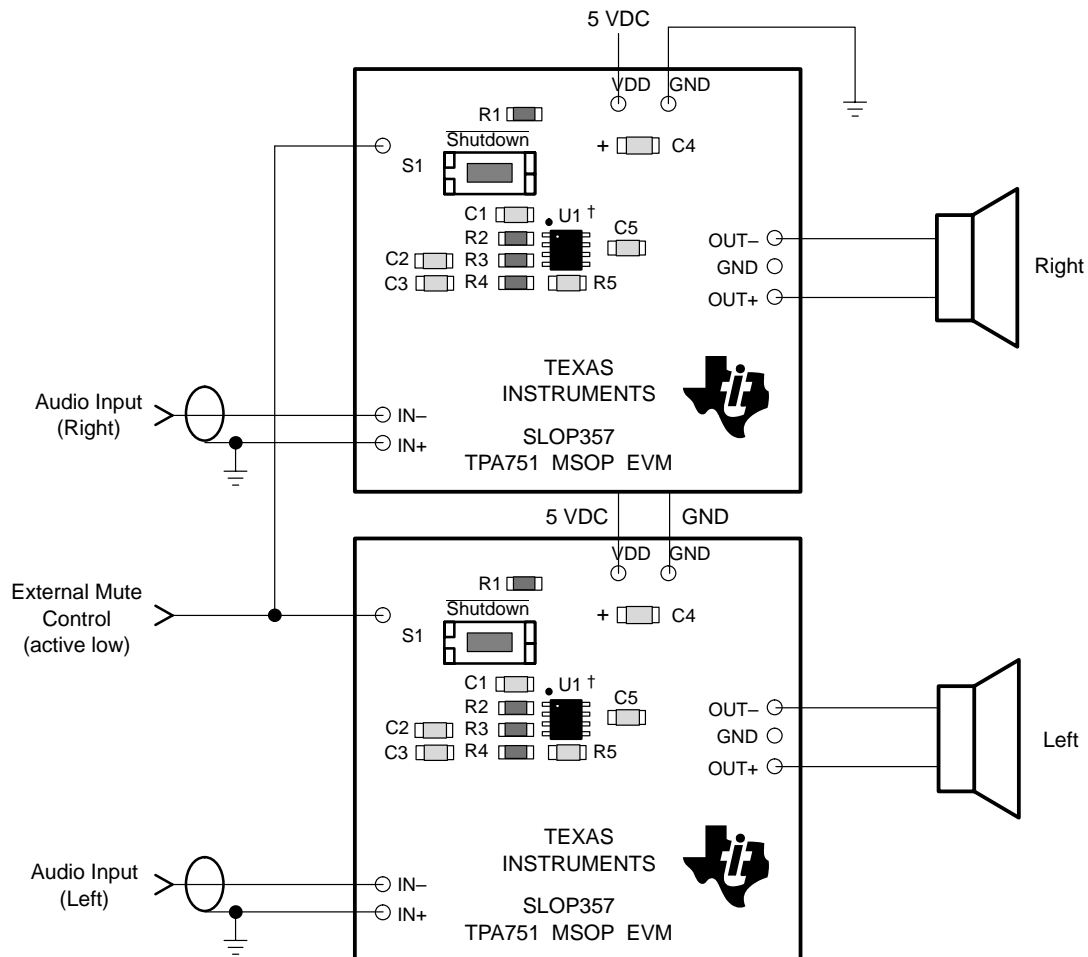
† Due to the very small size of the MSOP IC package, the standard part number TPA751 is replaced with the code TIATC.
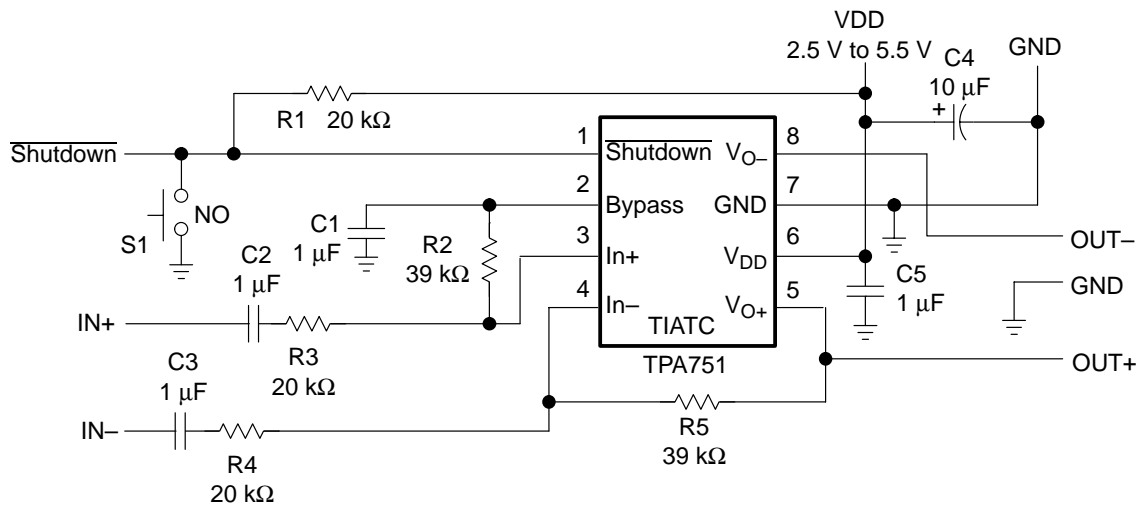
2.5 Reference

This section includes the TPA751 EVM schematic, the EVM parts list, and the module PCB layers.

2.5.1 TPA751 EVM Schematic Diagram

Figure 2–4 shows the TPA751 EVM schematic.

Figure 2–4. TPA751 EVM Schematic Diagram

Operation

2.5.2 TPA751 MSOP Audio Power Amplifier Evaluation Module Parts List

Table 2–2 shows the TPA751 EVM parts list.

Table 2–2. TPA751 EVM Parts List

Reference	Description	Size	EVM Qty.	Manufacturer/ Part Number	Vendor Number
C4	Capacitor, 10 μF, 6.3 V	A	1	Panasonic ECS-TOJY106R	Digi-Key PCS1106CT-ND
C1, C2, C3, C5	Capacitor, 1 μF, 80%/–20%, nonpolarized	0603	4	Murata GRM39-Y5V105Z10PT	Newark
R1, R3, R4	Resistor, 20 kΩ, 1/16 W, 5%	0603	3	Panasonic ERJ-3GSYJ203	Digi-Key P20KGCT-ND
R2, R5	Resistor, 39 kΩ, 1/16 W, 5%	0603	2	Panasonic ERJ-3GSYJ393	Digi-Key P39KGCT-ND
S1	Switch, momentary		1	Panasonic P8048SCT-ND	Digi-Key P8048SCT-ND
	Terminal Post Headers		9	Sullins PTC36SABN	Digi-Key S1022-36-ND
U1	IC, TPA751DGN[†], audio amplifier, 700 mW, mono	MSOP-8	1	TI TPA751DGN	
PCB1	PCB, TPA751 MSOP EVM		1		

[†] Due to the very small size of the MSOP IC package, the standard part number TPA751 is replaced with the code TIATC.

Note: All items are SMD except as noted.

2.5.3 TPA751 EVM PCB Layers

The following illustrations depict the TPA751 EVM PCB layers and silkscreen. These drawings are not to scale. Gerber plots can be obtained from any TI sales office.
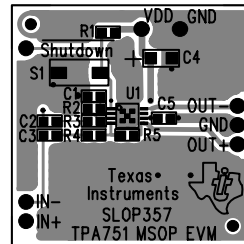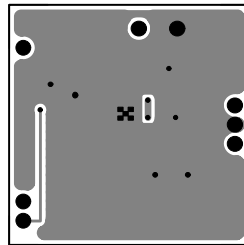
Figure 2–5. TPA751 EVM PCB

Figure 2–6. TPA751 EVM Bottom Layer

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 acknowledgment, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its 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.

Customers are responsible for their applications using TI components.

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 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, license, warranty or endorsement thereof.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations and notices. Representation or reproduction of this information with alteration voids all warranties provided for an associated TI product or service, is an unfair and deceptive business practice, and TI is not responsible nor liable for any such use.

Resale of TI's products or services with *statements different from or beyond the parameters* stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service, is an unfair and deceptive business practice, and TI is not responsible nor liable for any such use.

Also see: Standard Terms and Conditions of Sale for Semiconductor Products. www.ti.com/sc/docs/stdterms.htm

Mailing Address:

Texas Instruments
Post Office Box 655303
Dallas, Texas 75265

Copyright © 2001, Texas Instruments Incorporated

Printed in U.S.A by
Harte–Hanks, Inc.
Valencia, California

TI Worldwide Technical Support

Internet

TI Semiconductor Product Information Center Home Page
www.ti.com/sc/support

TI Semiconductor KnowledgeBase Home Page
www.ti.com/sc/knowledgebase

Product Information Centers

Americas
Phone	+1(972) 644-5580
Fax	+1(214) 480-7800
Internet	www.ti.com/sc/ampic

Europe, Middle East, and Africa
Phone
Belgium (English)	+32 (0) 27 45 55 32
France	+33 (0) 1 30 70 11 64
Germany	+49 (0) 8161 80 33 11
Israel (English)	1800 949 0107
Italy	800 79 11 37
Netherlands (English)	+31 (0) 546 87 95 45
Spain	+34 902 35 40 28
Sweden (English)	+46 (0) 8587 555 22
United Kingdom	+44 (0) 1604 66 33 99
Fax	+44 (0) 1604 66 33 34
Email	epic@ti.com
Internet	www.ti.com/sc/epic

Japan
Phone
International	+81-3-3344-5311
Domestic	0120-81-0026

Fax
International	+81-3-3344-5317
Domestic	0120-81-0036

Internet
International	www.ti.com/sc/jpic
Domestic	www.tij.co.jp/pic

Asia
Phone

	Local Access Code	TI Number
International	+886-2-23786800	
Domestic	Local Access Code	TI Number
Australia	1-800-881-011	-800-800-1450
China	1-0810	-800-800-1450
Hong Kong	800-96-1111	-800-800-1450
India	000-117	-800-800-1450
Indonesia	001-801-10	-800-800-1450
Korea	080-551-2804	-
Malaysia	1-800-800-011	-800-800-1450
New Zealand	000-911	-800-800-1450
Philippines	105-11	-800-800-1450
Singapore	800-0111-111	-800-800-1450
Taiwan	080-006800	-
Thailand	0019-991-1111	-800-800-1450
Fax	886-2-2378-6808	
Email	tiasia@ti.com	
Internet	www.ti.com/sc/apic	

TEXAS INSTRUMENTS

A121400