

TPA3100D2 Audio Power Amplifier Evaluation Module With LC Filter

Contents

1	Introduction	2
2	Operation	3
3	TPA3100D2 EVM Schematic	5
4	TPA3100D2 EVM PCB Layers	6
5	TPA3100D2 EVM Parts List.....	8

List of Figures

1	TI TPA3100D2 Audio Power Amplifier EVM – Top View.....	2
2	TI TPA3100D2 Audio Power Amplifier EVM – Bottom View.....	2
3	TPA3100D2 EVM Schematic	5
4	TPA3100D2 EVM – Top Layer	6
5	TPA3100D2 EVM – Bottom Layer.....	7

List of Tables

1	Gain Settings.....	4
2	TPA3100D2 EVM Parts List.....	8

1 Introduction

1.1 Description

The TPA3100D2 evaluation module consists of a single 20-W, class-D, stereo audio power amplifier complete with a small number of external components mounted on a circuit board that can be used to directly drive a speaker with an external analog audio source as the input.

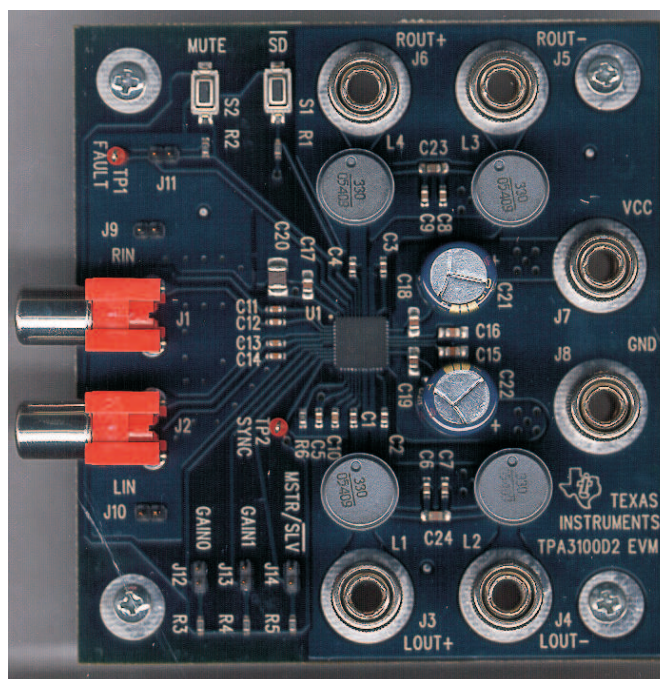


Figure 1. TI TPA3100D2 Audio Power Amplifier EVM – Top View

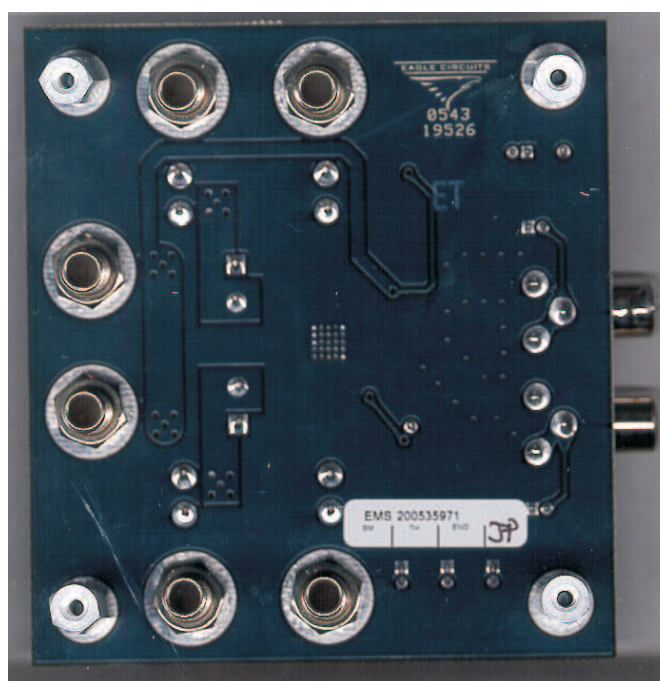


Figure 2. TI TPA3100D2 Audio Power Amplifier EVM – Bottom View

1.2 TPA3100D2 EVM Specifications

V _{CC}	Supply voltage range	10 V to 26 V
I _{CC}	Supply current	4 A max
P _O	Continuous output power per channel, 8 Ω, V _{CC} = 18 V, THD + N = 3.5%	20 W
R _L	Minimum load impedance	3.2 Ω

2 Operation

2.1 Quick Start List for Stand-Alone Operation

Follow these steps to use the TPA3100D2 EVM stand-alone or when connecting it into existing circuits or equipment. Connections to the EVM module can be made using banana plugs for the power supply and output connections. The inputs accept standard RCA plugs.

2.1.1 Power Supply

1. Ensure that all external power sources are set to OFF.
2. Connect an external regulated power supply adjusted from 10 V – 26 V to the module V_{CC} (**J7**) and GND (**J8**) banana jacks taking care to observe marked polarity.

2.1.2 Evaluation Module Preparations

2.1.2.1 Inputs and Outputs

1. If connecting to a fully differential input or a grounded input (the shield of the RCA jack is GND), remove jumpers **J9** and **J10** from the EVM board. These are located next to the input jacks **J1** and **J2**. If connecting to a floating source, like a portable CD player, install **J9** and **J10**. After setting the **J9** and **J10** jumpers appropriately, connect the audio source to **J1** (RIGHT) and **J2** (LEFT).
2. Connect a speaker across ROUT+ (**J6**) and ROUT- (**J5**). Connect another speaker across LOUT+ (**J3**) and LOUT- (**J4**).
3. Install both gain jumpers GAIN0 (**J12**) and GAIN1 (**J13**). This sets the gain of the amplifier to the lowest level, 20 dB.
4. Remove the jumper at MSTR/ $\overline{\text{SLV}}$ (**J14**). If only one TPA3100D2 is evaluated, it must be configured as the master. If multiple EVMs are connected together using the SYNC output (TP2), the additional EVMs must be configured in the slave mode by installing the **J14** jumper.
5. Remove the jumper (**J11**). This places the device in a latched mode when a short-circuit event occurs.

2.1.2.2 Control Inputs

1. $\overline{\text{SD}}$: This terminal is active low. A low signal on the device terminal (< 0.8 V) shuts down the amplifier; a high signal (> 2 V) on the device terminal places the amplifier in the active state. Holding down switch **S1** places the amplifier in the SHUTDOWN state. Releasing **S1** returns the amplifier to the active state.
2. **MUTE**: This terminal is active high. A high signal (> 2 V) on this terminal immediately terminates audio playback through the speakers and the outputs stop switching; a low signal (< 0.8 V) enables the device. **S2** on the EVM controls the state of the MUTE terminal. Holding down switch **S2** places the amplifier in the MUTE state. Releasing **S2** returns the amplifier to the active state.
3. **GAIN0/GAIN1**: Together, these terminals determine the gain of the amplifier. Refer to [Table 1](#). Installing a jumper in **J12** or **J13** sets the respective terminal to GND. Removing the jumper sets the respective terminals to VREG (~4 V). Removing jumpers **INCREASES** the gain while installing jumpers **DECREASES** the gain. Logic levels are TTL compatible.
4. **MSTR/ $\overline{\text{SLV}}$** : This terminal is used with the SYNC (**TP2**) output to synchronize the switching frequencies of multiple TPA3100D2 devices. For example, with 2 devices, one would be configured as the MASTER by removing the **J14** jumper. The other EVM would be configured as the SLAVE device by installing a jumper in the **J14** location. Logic levels are TTL compatible.

Table 1. Gain Settings

GAIN1 (J13)⁽¹⁾	GAIN0 (J12)⁽¹⁾	Amplifier Gain (dB)
ON	ON	20
ON	OFF	26
OFF	ON	32
OFF	OFF	36

⁽¹⁾ OFF = Jumper removed; ON = Jumper installed

2.1.2.3 Control Outputs

1. **FAULT:** This pin is a TTL compatible output for reporting a short-circuit fault on the output. If the outputs are shorted to GND, V_{CC} , or to each other, this terminal goes high and remains high until one of the following operations is performed: power is cycled, SHUTDOWN is cycled, or MUTE is cycled. If jumper **J11** is installed, the MUTE terminal is connected directly to the FAULT terminal and a short-circuit fault is automatically cleared when it occurs.

2.1.3 Power Up

1. Verify correct voltage and input polarity and turn the external power supplies on. The EVM should begin operation.
2. Adjust the input signal.
3. Adjust the control inputs to the desired settings.
4. If no sound is audible, check the position of the $\overline{\text{MSTR/SLV}}$ (**J14**) jumper. It should be removed if evaluating a single EVM.
5. Adjust the amplifier gain by installing/removing the gain jumpers, **J12** and **J13**.

3 TPA3100D2 EVM Schematic

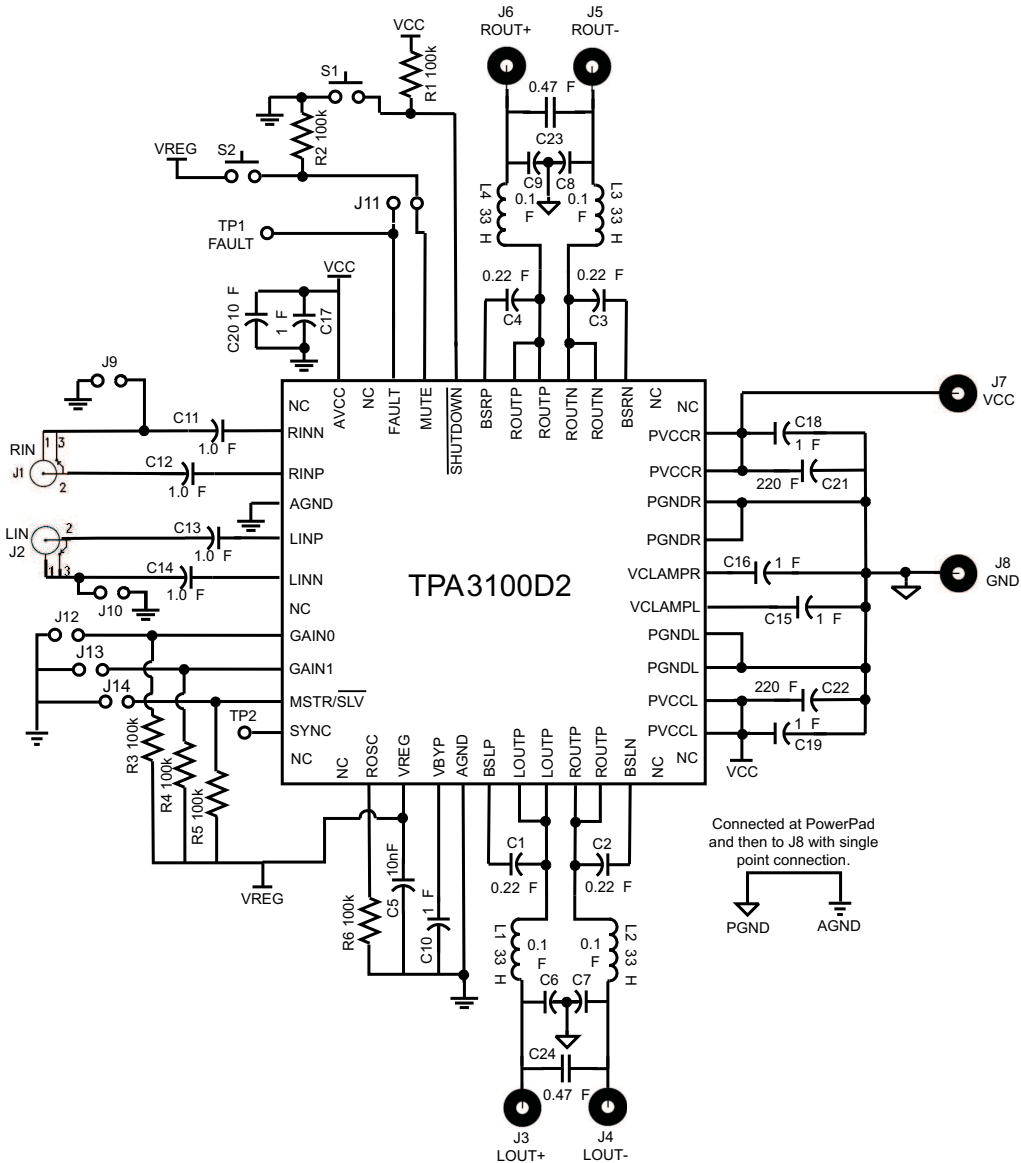


Figure 3. TPA3100D2 EVM Schematic

4 TPA3100D2 EVM PCB Layers

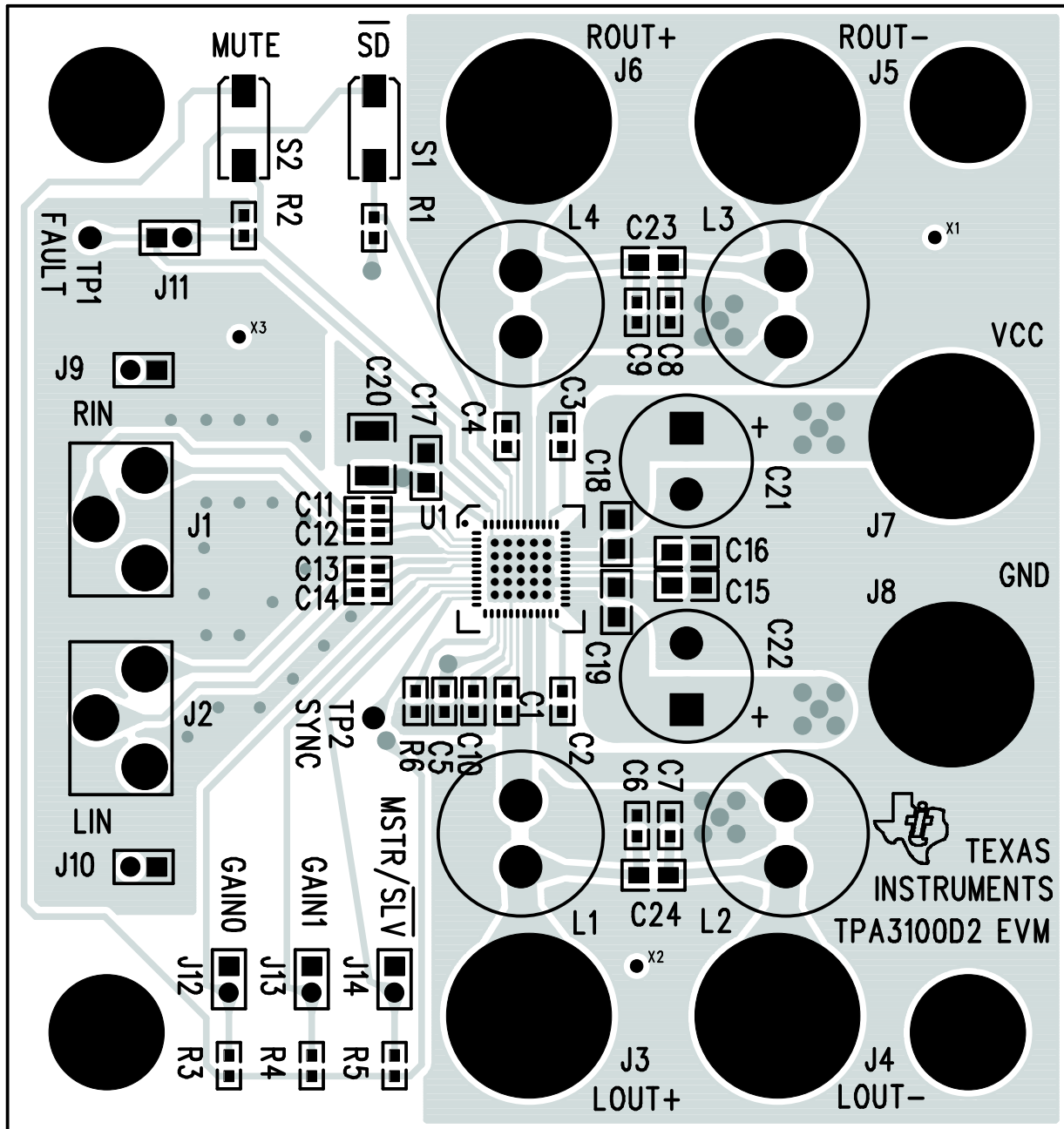


Figure 4. TPA3100D2 EVM – Top Layer

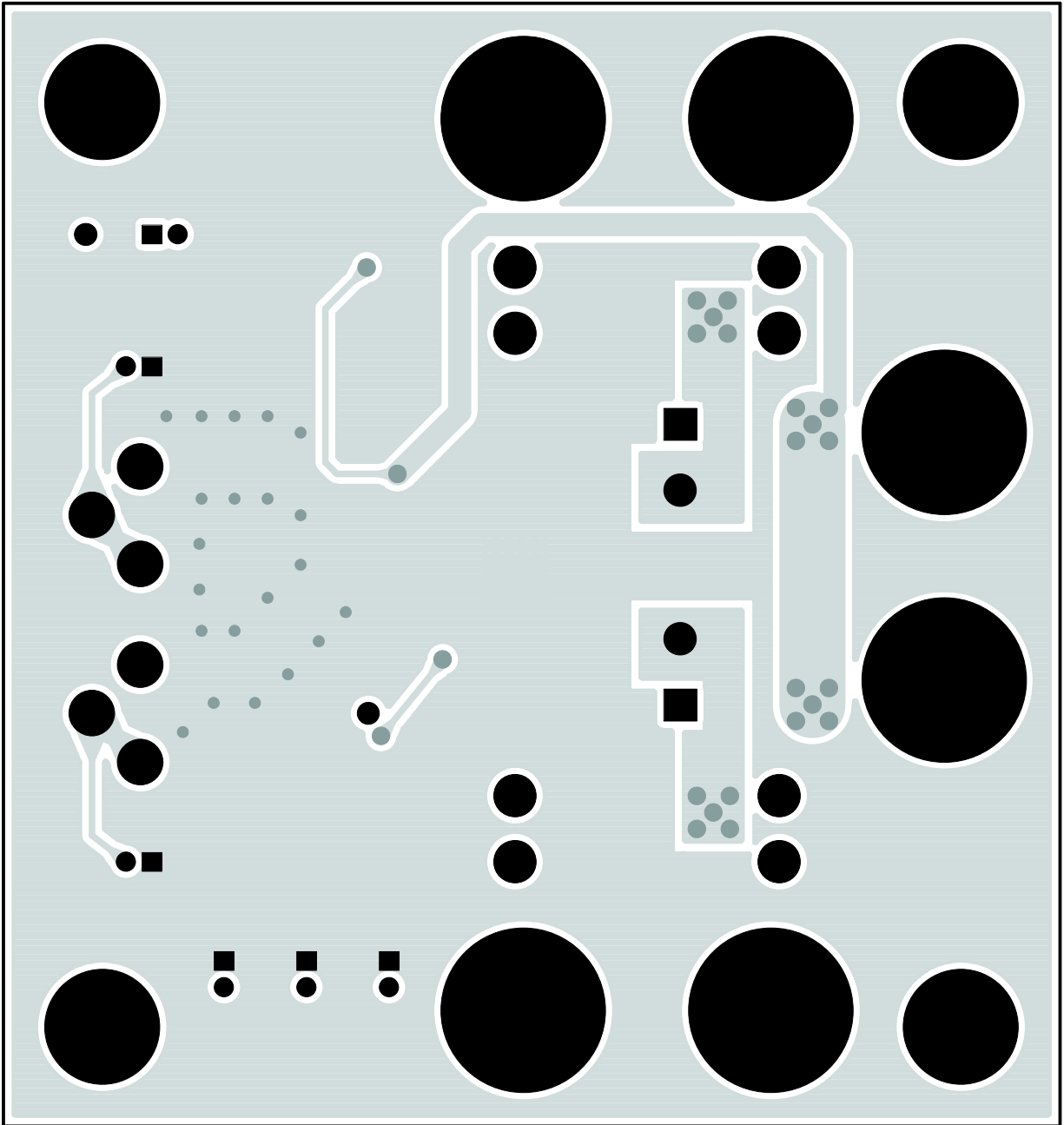


Figure 5. TPA3100D2 EVM – Bottom Layer

5 TPA3100D2 EVM Parts List
Table 2. TPA3100D2 EVM Parts List

Ref.	Description	Size	Qty	Mfg	Part #	Vendor #
C1 – C4	Capacitor, ceramic, 0.22- μ F, \pm 10%, X7R, 25-V	0603	4	TDK	C1608X7R1C224KT	Digi-key/445-1318-2
C5	Capacitor, ceramic, 0.01- μ F, \pm 10%, X7R, 50-V	0603	1	TDK	C1608X7R1H103KT	Digi-key/445-1311-2
C6 – C9	Capacitor, ceramic, 0.1- μ F, \pm 10%, X7R, 50-V	0603	4	TDK	C1608X7R1H104KT	Digi-key/445-1314-2
C10 – C14	Capacitor, ceramic, 1.0- μ F, \pm 10%, X5R, 10-V	0603	5	TDK	C1608X5R1A105KT	Digi-key/445-1321-2
C17 – C19	Capacitor, ceramic, 1.0- μ F, +80%/–20%, Y5V, 50-V	0805	3	TDK	C2012Y5V1H105Z	Digi-key/445-1364-2
C15, C16	Capacitor, ceramic, 1.0- μ F, +80%/–20%, Y5V, 16-V	0805	2	TDK	C2012Y5V1C105Z	Digi-key/445-1367-2
C20	Capacitor, ceramic, 10- μ F, +80%/–20%, Y5V, 50-V	1210	1	Murata	GRM32DF51H106ZA01L	Digi-key/490-1891-2
C21, C22	Capacitor, electrolytic, 220- μ F, low impedance	Radial	2	Panasonic	EEU-FC1V221	Digi-key/P10297
L1–L4	Inductor, 33- μ H, radial lead, ferrite material, shielded	Radial	4	Toko	A7503AY-330M	
C23, C24	Capacitor, ceramic, 0.47- μ F, \pm 10%, X5R, 35-V	0805	2	Taiyo-Yuden	GMK212BJ474KG	
R1 – R6	Resistor, chip, 100 k Ω , 1/16 W, 5%	0603	6	Panasonic	ERJ-3GEYJ104V	Digi-Key/P100KG
J1, J2	Phono jack, PC mount, switched		2	Switchcraft	PJРАН1X1U03	Newark/16C1860
J3 – J8	Banana jack w/knurled thumbnut (nickel plate)		6	Johnson	111-2223-001	Digi-Key/J587
J9 – J14	Header, 2 position, male	2 mm	6	Norcomp	2163-36-01-P2	Digi-Key / 2163S-36
J9 – J14(shunts)	Shunt, 2 mm	2 mm	6	Specialty	2JM-G	
TP1, TP2	Test points, 0.040" mounting hole		1	Farnell	240-345	
S1, S2	Switch, momentary, SMD, low profile		2	Panasonic	EVQ-PPBA25	Digi-Key/P8086S
	Standoffs, 5/8" length, 4-40 thread		4	Keystone	1808	(Newark) 89F1934
	Screws, 4-40, .375		4			(Digi-Key) H781-ND
U1	TPA3100D2RGZ	48-pin QFN	1	TI	TPA3100D2RGZ	

FCC Warnings

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.

EVM TERMS AND CONDITIONS

Texas Instruments (TI) provides the enclosed Evaluation Module and related material (EVM) to you, the user, (you or user) **SUBJECT TO** the terms and conditions set forth below. By accepting and using the EVM, you are indicating that you have read, understand and agree to be bound by these terms and conditions. **IF YOU DO NOT AGREE TO BE BOUND BY THESE TERMS AND CONDITIONS, YOU MUST RETURN THE EVM AND NOT USE IT.**

This EVM is provided to you by TI and is intended for your **INTERNAL ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY**. It is provided "AS IS" and "WITH ALL FAULTS." It is not considered by TI to be fit for commercial use. As such, the EVM may be incomplete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety measures typically found in the end product. As a prototype, the EVM does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may not meet the technical requirements of the directive.

Should this EVM not meet the specifications indicated in the EVM User's Guide, it may be returned within 30 days from the date of delivery for a full refund of any amount paid by user for the EVM, which user agrees shall be user's sole and exclusive remedy. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY TI TO USER, AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE OR NON-INFRINGEMENT.**

TI shall have no obligation to defend any claim arising from the EVM, including but not limited to claims that the EVM infringes third party intellectual property. Further, TI shall have no liability to user for any costs, losses or damages resulting from any such claims. User shall indemnify and hold TI harmless against any damages, liabilities or costs resulting from any claim, suit or proceeding arising from user's handling or use of the EVM, including but not limited to, (i) claims that the EVM infringes a third party's intellectual property, and (ii) claims arising from the user's use or handling of the EVM. TI shall have no responsibility to defend any such claim, suit or proceeding.

User assumes all responsibility and liability for proper and safe handling and use of the EVM and the evaluation of the EVM. TI shall have no liability for any costs, losses or damages resulting from the use or handling of the EVM. User acknowledges that the EVM may not be regulatory compliant or agency certified (FCC, UL, CE, etc.). Due to the open construction of the EVM it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

EXCEPT TO THE EXTENT OF THE USER'S INDEMNITY OBLIGATIONS SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES WHETHER TI IS NOTIFIED OF THE POSSIBILITY OR NOT.

TI currently deals with a variety of customers for products, and therefore our arrangement with the user **is not exclusive**.

TI assumes **no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein.**

User agrees to read the EVM User's Guide and, specifically, the EVM warnings and Restrictions notice in the EVM User's Guide prior to handling the EVM and the product. This notice contains important safety information about temperatures and voltages.

It is user's responsibility to ensure that persons handling the EVM and the product have electronics training and observe good laboratory practice standards.

By providing user with this EVM, product and services, TI is **NOT** granting user any license in any patent or other intellectual property right.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2005, Texas Instruments Incorporated

EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the supply voltage range of -0.3 V to 30 V and input voltage range of -0.3 V to 4.5 V .

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

EVM WARNINGS AND RESTRICTIONS (continued)

During normal operation, some circuit components may have case temperatures greater than 85°C. The EVM is designed to operate properly with certain components above 85°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright 2005, Texas Instruments Incorporated

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

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. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI 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 and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265