

TPA2100P1

Contents

1	Introduction	1
2	Operation	2
3	TPA2100P1 Schematic	3
4	TPA2100P1 PCB Layers	5
5	TPA2100P1 Bill of Materials	7
6	Addendum	8

List of Figures

1	TPA2100P1 – YZH Package – Schematic Revision A.....	3
2	TPA2100P1 – YZH Package – Schematic Revision B.....	4
3	TPA2100P1 – YZH Package – Top Layer Revision A	5
4	TPA2100P1 – YZH Package – Top Layer Revision B	5
5	TPA2100P1 – YZH Package – Bottom Layer Revision A	6
6	TPA2100P1 – YZH Package – Bottom Layer Revision B	6

List of Tables

1	BILL OF MATERIALS for TPA2100P1YZH_EVM	7
---	--	---

1 Introduction

This section provides a description and summary specifications for the TI TPA2100P1 audio amplifier.

1.1 Description

The TPA2100P1 is a mono Class-D amplifier with built-in 10 V boost converter designed for piezo and ceramic speakers. The TPA2100P1 drives up to 19 V_{pp} mono bridge-tied-load (BTL) from a 2.5-V power supply at less 1% total harmonic distortion plus noise (THD+N). The TPA2100P1 is available in a WCSP package. All components are lead-free.

1.2 Summary Specifications

V _{DD}	Supply voltage range	–0.3 V to 5.5 V
I _{DD}	Supply current	3 A Maximum
V _{Omax}	Output voltage	19 V _{pp}
V _I	Audio Input Voltage	–0.3 V to V _{DD} + 0.3 V

2 Operation

This section describes how to operate the TPA2100P1.

2.1 Quick Start List for Stand-Alone Operation

Use these procedures when operating the TPA2100P1 as a stand-alone or when connecting it to existing circuits or equipment.

2.1.1 Power and Ground

1. Make sure the external power sources are set to OFF.
2. Set the power supply voltage between 2.5 V and 5.5 V. When connecting the power supply to the EVM, make sure to attach the ground connection to the GND banana jack, **GND**, first and then connect the positive supply to the V_{DD} banana jack, **V_{DD}** . Verify that the connections are made to the correct banana jacks.

NOTE: Do not connect V_{DD} to the V_{CC} header pin. This can damage the device.

2.1.2 Audio

1. Make sure that the audio source is set to the minimum level.
2. Connect the audio source to the input RCA jack **IN**. Shunt JP1 for single-ended audio source.
3. Connect speaker to the output banana jacks **OUT+** and **OUT-**.
4. Locations are provided for an on board RC low-pass filter for audio measurement. Use test points TP1, TP2 and GND. The user must add the filter components R3, R4; typical value is 1 k Ω .
5. Locations are provided for EMC filter capacitors, C13 and C14. The values are between 330 pF and 1 nF.

2.1.3 Gain Control

The TPA2100P1 has three gain settings:

1. Use jumper **GAIN** to set the gain. To achieve 24 dB, place the jumper between pin 1 and pin 2; for 12 dB, shunt head 2 and head 3; for 16 dB, remove the jumper and let the gain pin float.

2.1.4 Shutdown Controls

1. The TPA2100P1 provides independent shutdown controls for the Class-D amplifier and the boost converter. Pins $\overline{SD}$ and $\overline{SDa}$ shut down the boost converter and Class-D amplifier, respectively. They are active low. Press and hold pushbutton **S1** to place the boost converter in shutdown. Release pushbutton **S1** to activate the boost converter.
2. Press and hold pushbutton **S2** to shutdown the Class-D amplifier. Release pushbutton **S2** to activate the Class-D amplifier.

NOTE: The boost converter provides power to the Class-D amplifier. When the boost converter is shut down, no voltage is supplied to the Class-D amplifier causing the Class-D amplifier to power off.

2.2 Boost Settings

See the data sheet ([SLOS595](#)) for choosing the boost converter inductor and capacitors.

3 TPA2100P1 Schematic

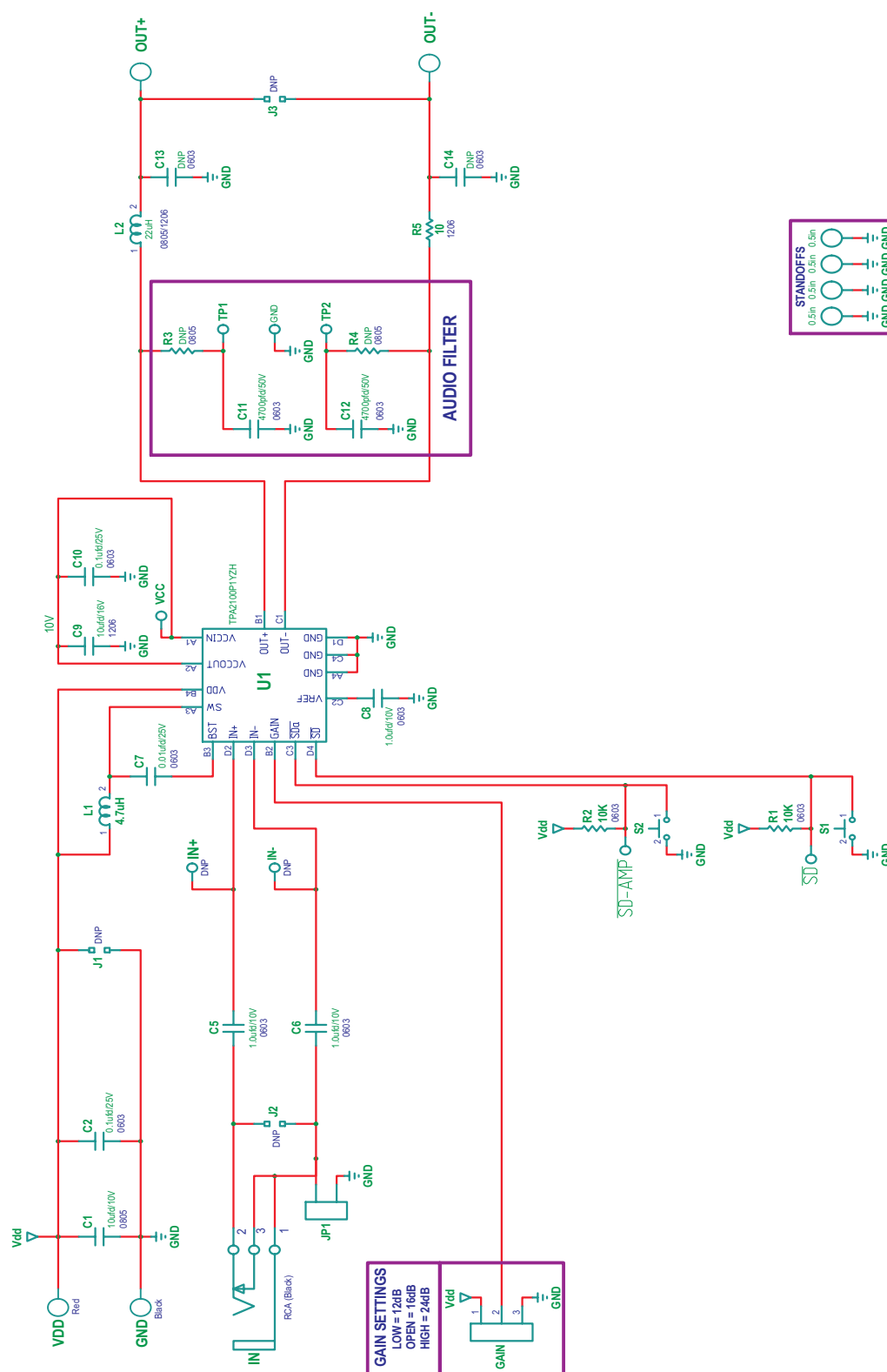


Figure 1. TPA2100P1 – YZH Package – Schematic Revision A

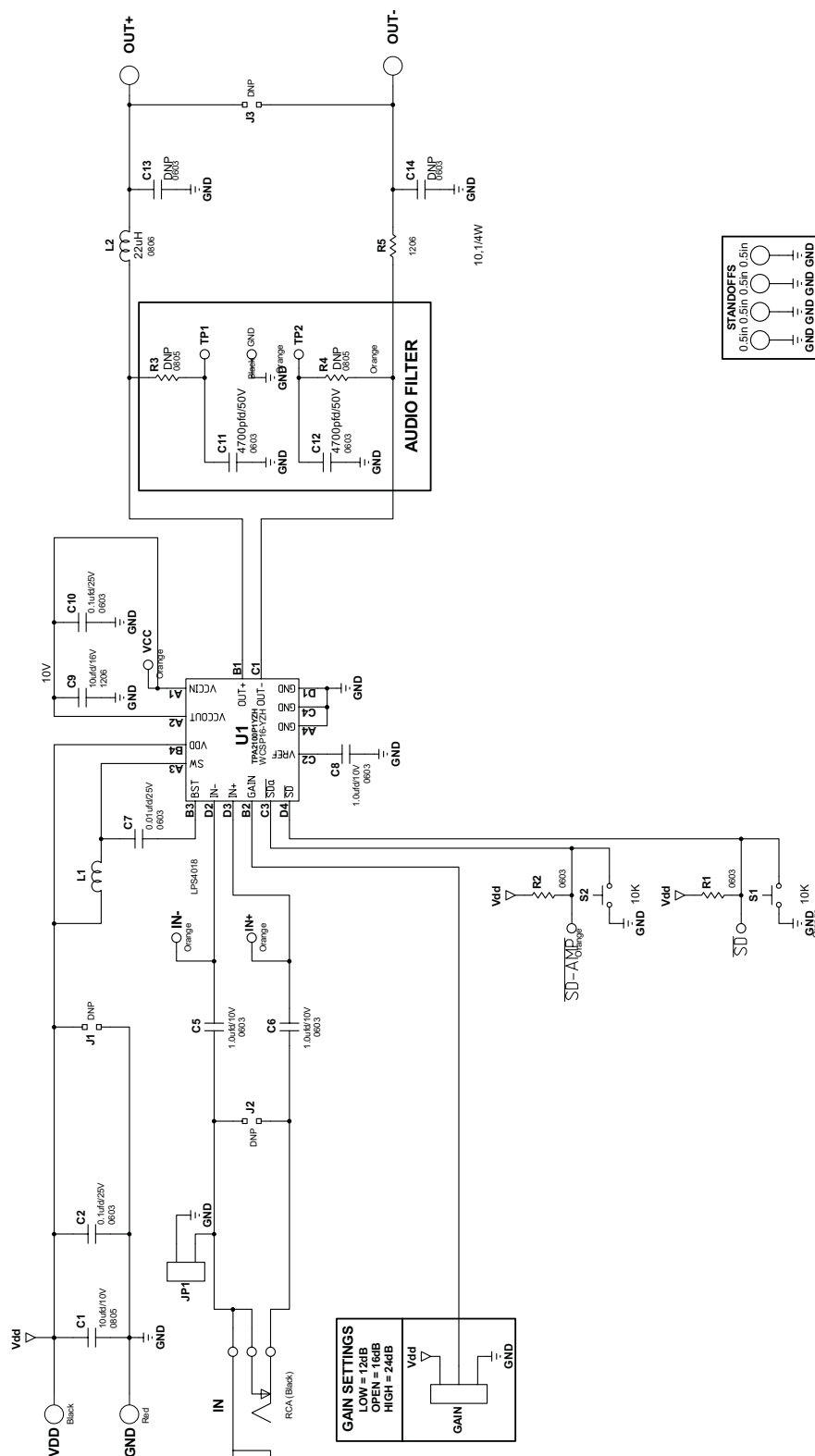


Figure 2. TPA2100P1 – YZH Package – Schematic Revision B

4 TPA2100P1 PCB Layers

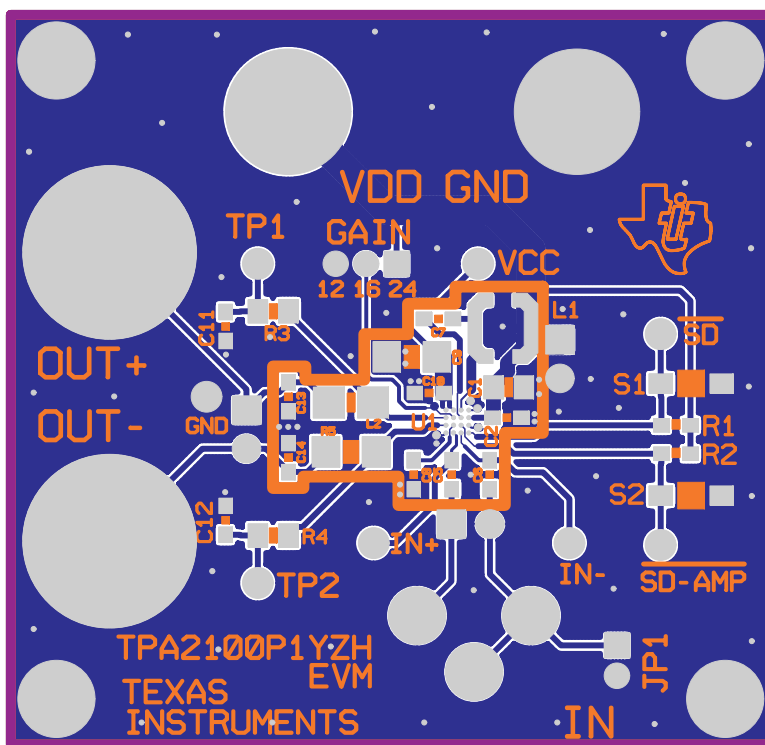


Figure 3. TPA2100P1 – YZH Package – Top Layer Revision A

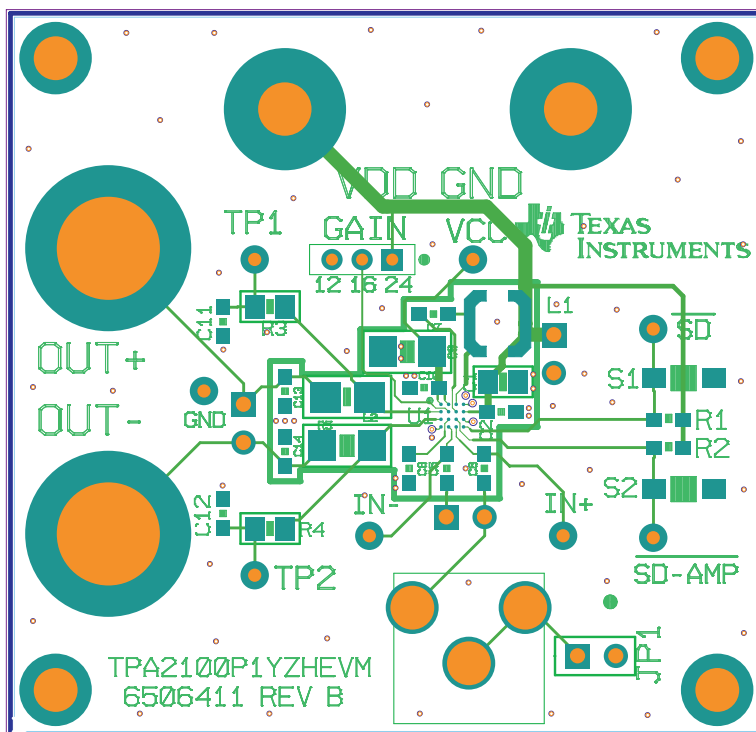


Figure 4. TPA2100P1 – YZH Package – Top Layer Revision B

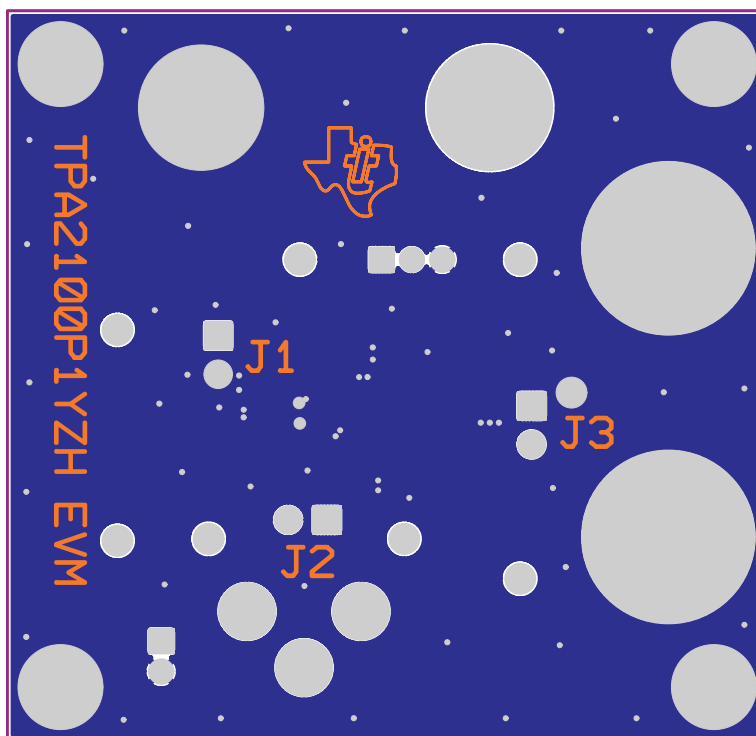


Figure 5. TPA2100P1 – YZH Package – Bottom Layer Revision A

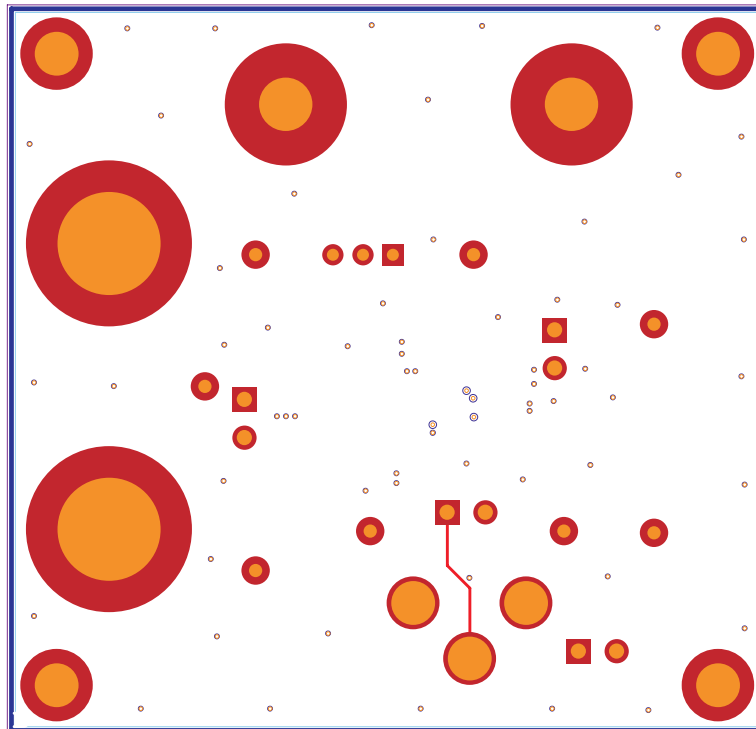


Figure 6. TPA2100P1 – YZH Package – Bottom Layer Revision B

5 TPA2100P1 Bill of Materials

Table 1. BILL OF MATERIALS for TPA2100P1YZH_EVM

ITEM	MANUFACTURER PART NUM	QTY	REF DES	VENDOR PART NUM	DESCRIPTION	VENDOR	MANUFACTURER
TI-SEMICONDUCTORS							
1	TPA2100P1YZH	1	U1	TPA2100P1 YZH	MONO SPEAKER AMP W/BOOST CONVERTER WCSP16-YZH ROHS	Texas Instruments	Texas Instruments
CAPACITORS							
2	C1608X5R1A105K	3	C5, C6, C8	445-1321-1	CAP SMD0603 CERM 1.0ufd 10V 10% X5R ROHS	DIGI-KEY	TDK
3	06031C103JAT2A	1	C7	478-3700-1	CAP SMD0603 CERM 0.01ufd 25V,5% X7R ROHS	DIGI-KEY	AVX
4	06033D104KAT2A	2	C2, C10	478-1244-1	CAP SMD0603 CERM 0.1UFD 25V X5R ROHS	DIGI-KEY	AVX
5	C1206C106K4PACT U	1	C9	399-5091-1	CAP SMD1206 CERM 10UFD 16V 10% X5R ROHS	DIGI-KEY	KEMET
6	GRM21BR71A106K E51L	1	C1	490-3905-1	CAP SMD0805 CERM 10ufd 10V 10% X7R ROHS	DIGI-KEY	MURATA
7	ECJ-1VB1H102K	DNP	C13, C14	PCC1772CT	CAP SMD0603 CERM 1000PFD 50V 10% X7R ROHS	DIGI-KEY	PANASONIC
8	ECJ-1VB1H472K	2	C11, C12	PCC1780CT	CAP SMD0603 CERM 4700PFD 50V X7R ROHS	DIGI-KEY	PANASONIC
RESISTORS							
9	ERJ-6GEYJ102V	DNP	R3, R4	P1.0KACT	RESISTOR SMD0805 1.0K 5% 1/8W ROHS	DIGI-KEY	PANASONIC
10	ERJ-3GEYJ103V	2	R1, R2	P10KGCT	RESISTOR SMD0603 10K 5% 1/10W ROHS	DIGI-KEY	PANASONIC
11	ERJ-8ENF10R0	1	R5	P10.0FCT	RESISTOR SMD1206 10.0 OHM 1% 1/4W ROHS	DIGI-KEY	PANASONIC
INDUCTORS							
12	LPS4018-472MLB	1	L1	LPS4018- 472MLB	SHIELDED POWER INDUCTOR 4.7uH,ROHS	COIL CRAFT	COIL CRAFT
13	LQH2MCN220K02L	1	L2	490-4048-1	INDUCTOR SMD0806 22uH 10% 185MA 30MHZ ROHS	DIGI-KEY	MURATA
HEADERS AND JACKS							
14	26630201RP2	1	JP1	2663S-02	HEADER 2 PIN, PCB 2.0MM ROHS	DIGI-KEY	NORCOMP
15	26630301RP2	1	GAIN	2663S-03	HEADER 3 PIN, PCB 2.0MM ROHS	DIGI-KEY	NORCOMP
16	PBC02SAAN	3	J1, J2, J3	S1011E-02	HEADER 2 PIN MALE, 0.100LS, PCB GOLD ROHS	DIGI-KEY	SULLINS
17	PJРАН1X1U01X	1	IN	65K7770	JACK, RCA 3-PIN PCB-RA BLACK ROHS	NEWARK	SWITCHCRAFT
TESTPOINTS AND SWITCHES							
18	5003	DNP	IN+, IN-, SD, SD-AMP, TP1, TP2, VCC	5003K	PC TESTPOINT, ORANGE, ROHS	DIGI-KEY	KEYSTONE
19	5001	1	GND	5001K	PC TESTPOINT, BLACK, ROHS	DIGI-KEY	KEYSTONE
20	TL1015AF160QG	2	S1, S2	EG4344CT	SWITCH, MOM, 160G SMT 4X3MM ROHS	DIGI-KEY	E-SWITCH

Table 1. BILL OF MATERIALS for TPA2100P1YZH_EVM (continued)

ITEM	MANUFACTURER PART NUM	QTY	REF DES	VENDOR PART NUM	DESCRIPTION	VENDOR	MANUFACTURER
BINDING POSTS							
21	111-2223-001	2	OUT+, OUT-	J587	BINDING- POST,NONINS,THRU,ROHS	DIGI-KEY	EMERSON NPCS
22	7007	1	VDD	7006K	BINDING POST, RED, 15A ECONO ROHS	DIGI-KEY	KEYSTONE
23	7006	1	GND	7007K	BINDING POST, BLACK, 15A ECONO ROHS	DIGI-KEY	KEYSTONE
SHUNTS							
24	800-002-SP2-001	2	JP1, GAIN	SP2-001	SHUNT, BLACK AU FLASH 2 MM	DIGI-KEY	NORCOMP INC.
STANDOFFS AND HARDWARE							
25	PMS 440 0025 PH	4	SO1-SO4	H342	4-40 SCREW, STEEL 0.250 IN	DIGI-KEY	BUILDING FASTENERS
26	2027	4	SO1-SO4	2027K	STANDOF ,4-40 0.5IN 3/16IN DIA ALUM RND F-F	DIGI-KEY	KEYSTONE

6 Addendum

This is a list of modification made to the TPA2100P1 EVM Rev. A and appearing on Rev. B. The modifications do not affect the performance of the board.

Modification	Description
RCA (Black)	Flipped vertically
D2	Relabeled IN-
D3	Relabeled IN+
IN+ Pad	Relabeled IN-
IN- Pad	Relabeled IN+

NOTE: This user's guide contains schematics and layouts for both Revision A and Revision B, so please use the document accordingly.

EVALUATION BOARD/KIT IMPORTANT NOTICE

Texas Instruments (TI) provides the enclosed product(s) under the following conditions:

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. Persons handling the product(s) must have electronics training and observe good engineering practice standards. As such, the goods being provided are not intended to be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and therefore may not meet the technical requirements of these directives or other related directives.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

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**.

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please contact the TI application engineer or visit www.ti.com/esh.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used.

FCC Warning

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to 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.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2009, Texas Instruments Incorporated

EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of -0.3 V to 6 V and the output voltage range of -0.3 V to $V_{\text{DD}}+3\text{ V}$.

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.

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 © 2009, 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 TI 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. Information of third parties may be subject to additional restrictions.

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.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

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

Products

Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
RF/IF and ZigBee® Solutions	www.ti.com/lprf

Applications

Audio	www.ti.com/audio
Automotive	www.ti.com/automotive
Broadband	www.ti.com/broadband
Digital Control	www.ti.com/digitalcontrol
Medical	www.ti.com/medical
Military	www.ti.com/military
Optical Networking	www.ti.com/opticalnetwork
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
Copyright © 2009, Texas Instruments Incorporated