TPA3118D2EVM Evaluation Module

This User's Guide describes the operation of the evaluation module for the TPA3118D2. The manual also provides measurement data and design information including the schematic, the Bill of Materials (BOM), and a printed circuit board (PCB) layout.

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1 Overview

The TPA3118D2 evaluation module (EVM) demonstrates the TPA3118D2 integrated circuit from Texas Instruments (TI).

The TPA3118D2 is a 30 W per channel, efficient stereo digital amplifier power stage for driving 2 bridge-tied speakers or a single parallel bridge-tied load (PBTL). The TPA3118D2 can drive a speaker with an impedance as low as 3.2 Ω (8 Ω typical).

The TPA3118D2 is available in a 32-pin TSSOP.

Table 1. TPA3118D2EVM Specification

Key Parameters	
Power supply voltage	4.5 V to 26 V
Number of channels	2 bridge-tied load (BTL) Stereo
Load impedance	3.2 Ω to 8 Ω
Output power BTL	30 W per channel

2 Operation

This section describes the EVM board's power supply and system interfaces. Information includes handling and unpacking, absolute operating conditions and a description of the factory default switch and jumper configuration.

The following is a step-by-step guide to configure the EVM for evaluation.

2.1 Electrostatic Discharge Warning

Many of the components on the EVM are susceptible to damage by electrostatic discharge (ESD). Customers are advised to observe proper ESD handling precautions when unpacking and handling the EVM, including the use of a grounded wrist strap at an approved ESD workstation.

CAUTION

Failure to observe ESD handling procedures may result in damage to EVM components.

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2.2 Unpacking the EVM

Ensure the following item is included in the EVM package:

- 1 piece - TPA3118D2EVM board using one TPA3118D2 (illustrated in Figure 1 and Figure 2).

If this item is missing, please contact the Texas Instruments Product Information Center nearest you to inquire about a replacement.

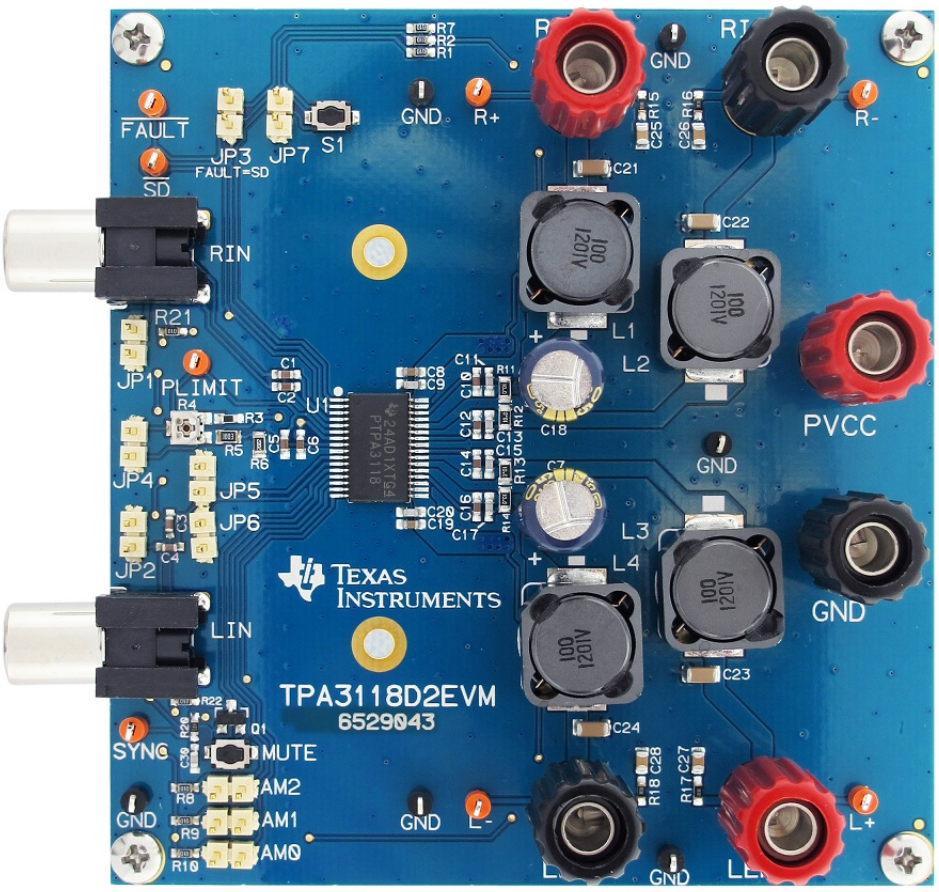


Figure 1. TPA3118D2EVM Photo, Top View

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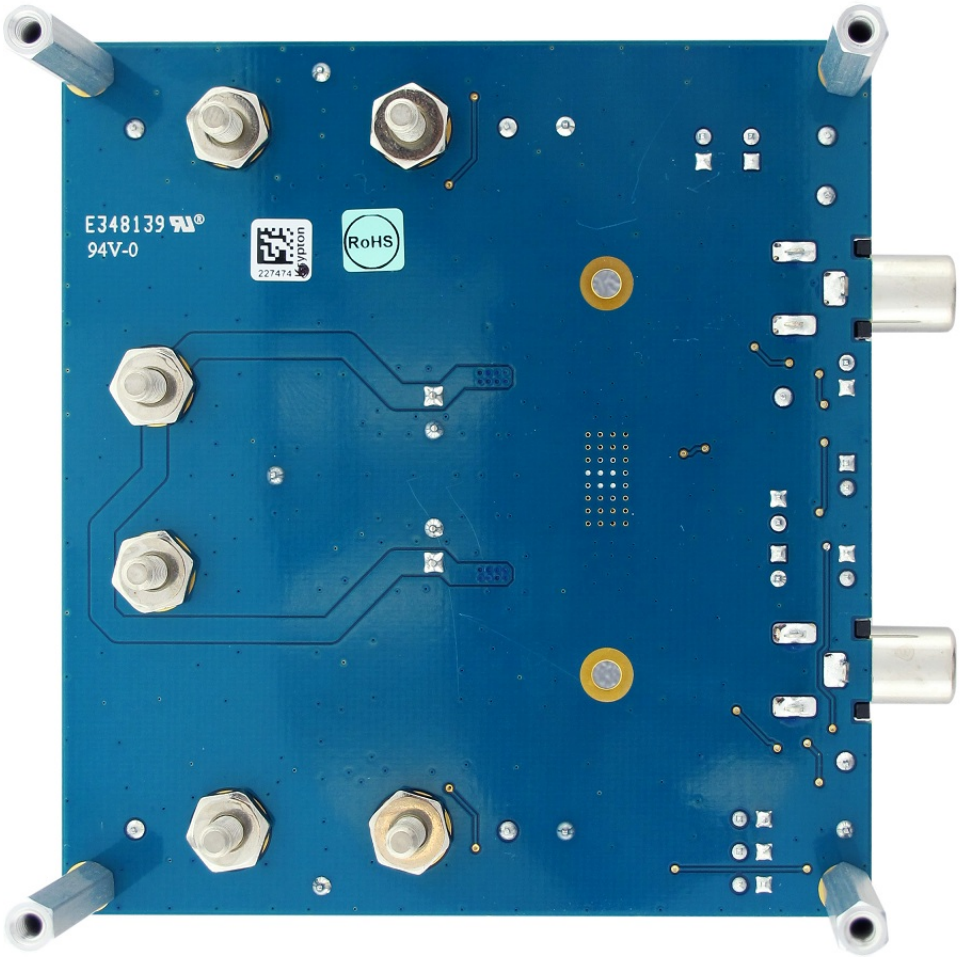


Figure 2. TPA3118D2EVM Photo, Bottom View

2.3 Power Supply Setup

A single power supply is required to power the EVM. Since most of the pins are PVCC compliant, the PVCC supply is used to power the analog supply (AVCC) and can pull up the logic pins for shutdown (SD) control, and fault detection (FAULT). GVDD is an internally generated supply for the output FETs and is also used to power the PLIMIT voltage divider circuit on the EVM. PLIMIT is GVDD compliant, but not PVCC compliant. PLIMIT can also be powered by an external supply connected to the PLIMIT pin.

Description	Voltage Range	Current Requirement	Minimum Wire Size
PVCC	4.5 V to 26 V	8 A	24 AWG

CAUTION

Applying voltages above the limitations listed in table above may cause permanent damage to your hardware.

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2.4 Evaluation Module Preparations

1. Set the external power source to OFF.
2. Connect the external regulated power supply, adjusted from 4.5 V to 26 V, to the module PVCC and GND banana jacks. Observe the marked polarity.

2.5 Inputs and Outputs

1. For a BTL Configuration, connect a load across the outputs (LEFT+ and LEFT–) and (RIGHT+ and RIGHT–). For PBTL configuration, connect a single load from one of the left speaker jacks to one of the right speaker jacks, depending on how the filters are loaded.
2. Connect the audio inputs, either differential or single-ended, to the LIN and RIN RCA phono plugs for BTL operation. For PBTL operation, apply a single input, differential or single-ended, to the RIN RCA phono plug and tie INPL and INNL directly to GND (without capacitors).

2.6 Control Inputs

1. Ensure the mode jumpers, AM0, AM1, AM2, R5 and R6 are set correctly, depending on the desired operating state. If PBTL operation is desired, connect JP5 and JP6 to GND.

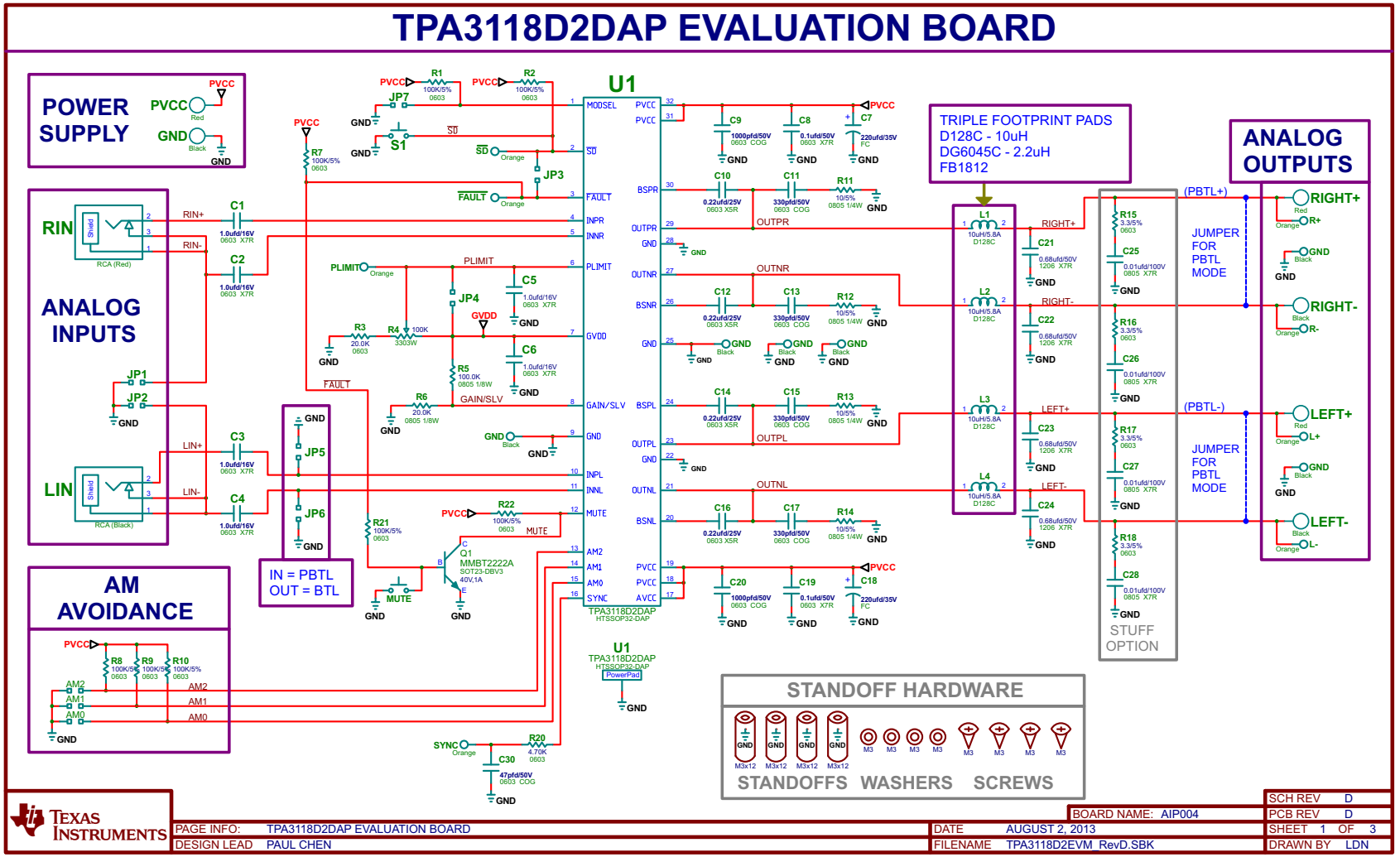
2.7 Power Up

1. Verify the correct voltage and input polarity are set and turn the external power supplies ON. The EVM should begin operation.
2. Adjust the audio source for the correct volume.

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3 Design Documentation

3.1 TPA3118D2EVM Schematic



Note: The output short to PVCC test is available in the TPA31xxD2 data sheet.

Figure 3. TPA3118D2EVM Schematic

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3.2 TPA3118D2EVM PCB Layers

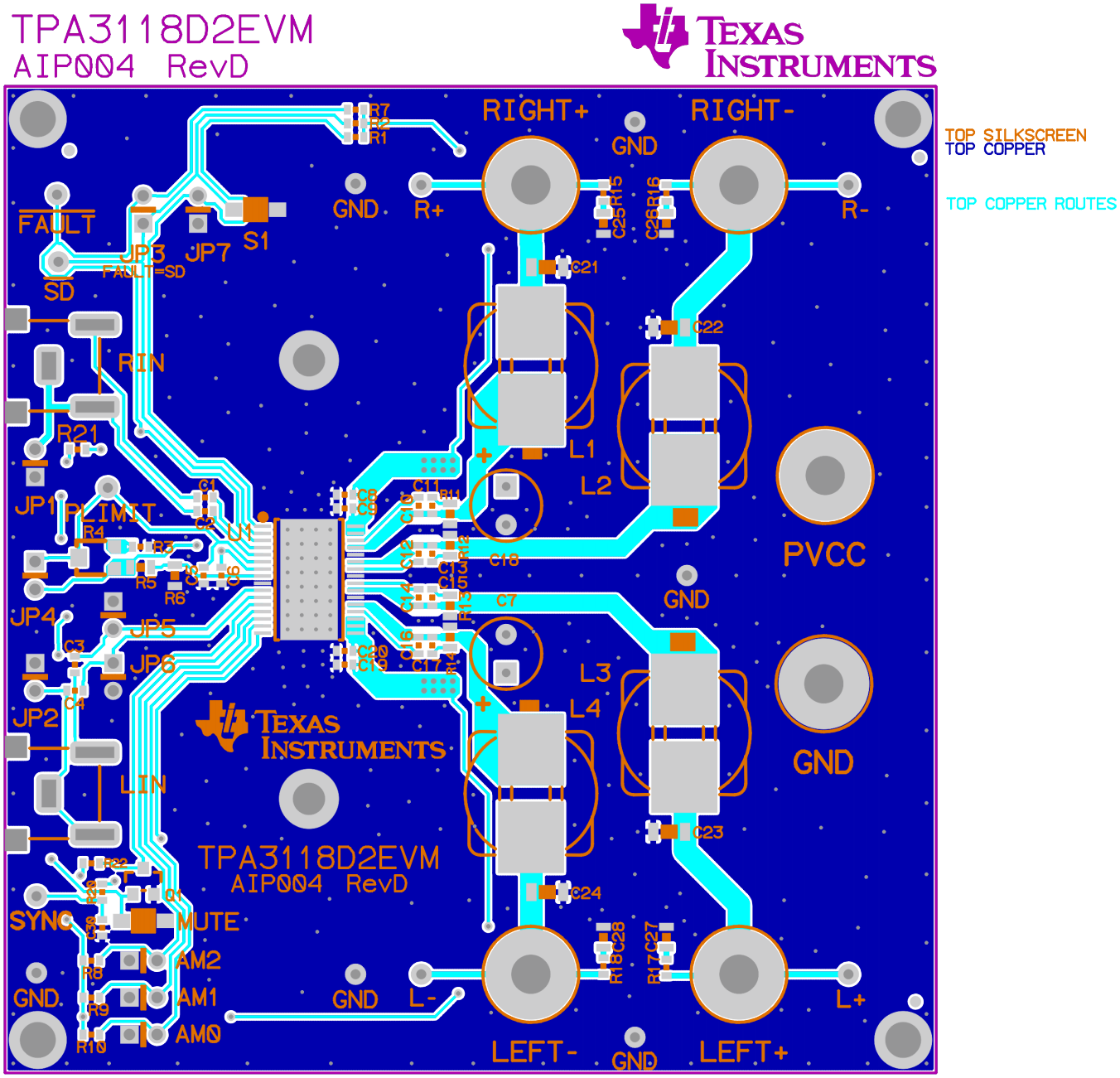


Figure 4. TPA3118D2EVM Top Side Layout

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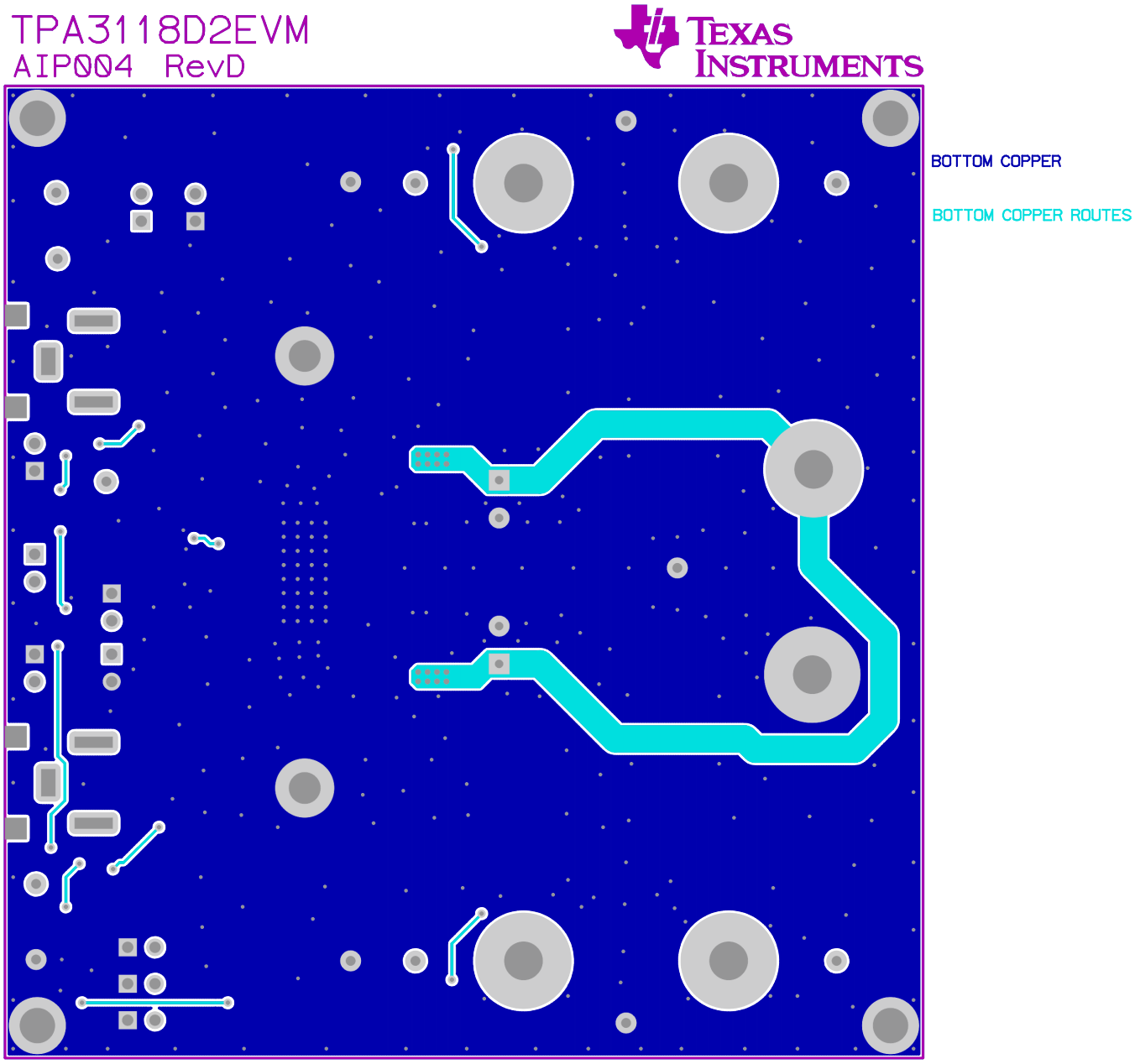


Figure 5. TPA3118D2EVM Bottom Side Layout

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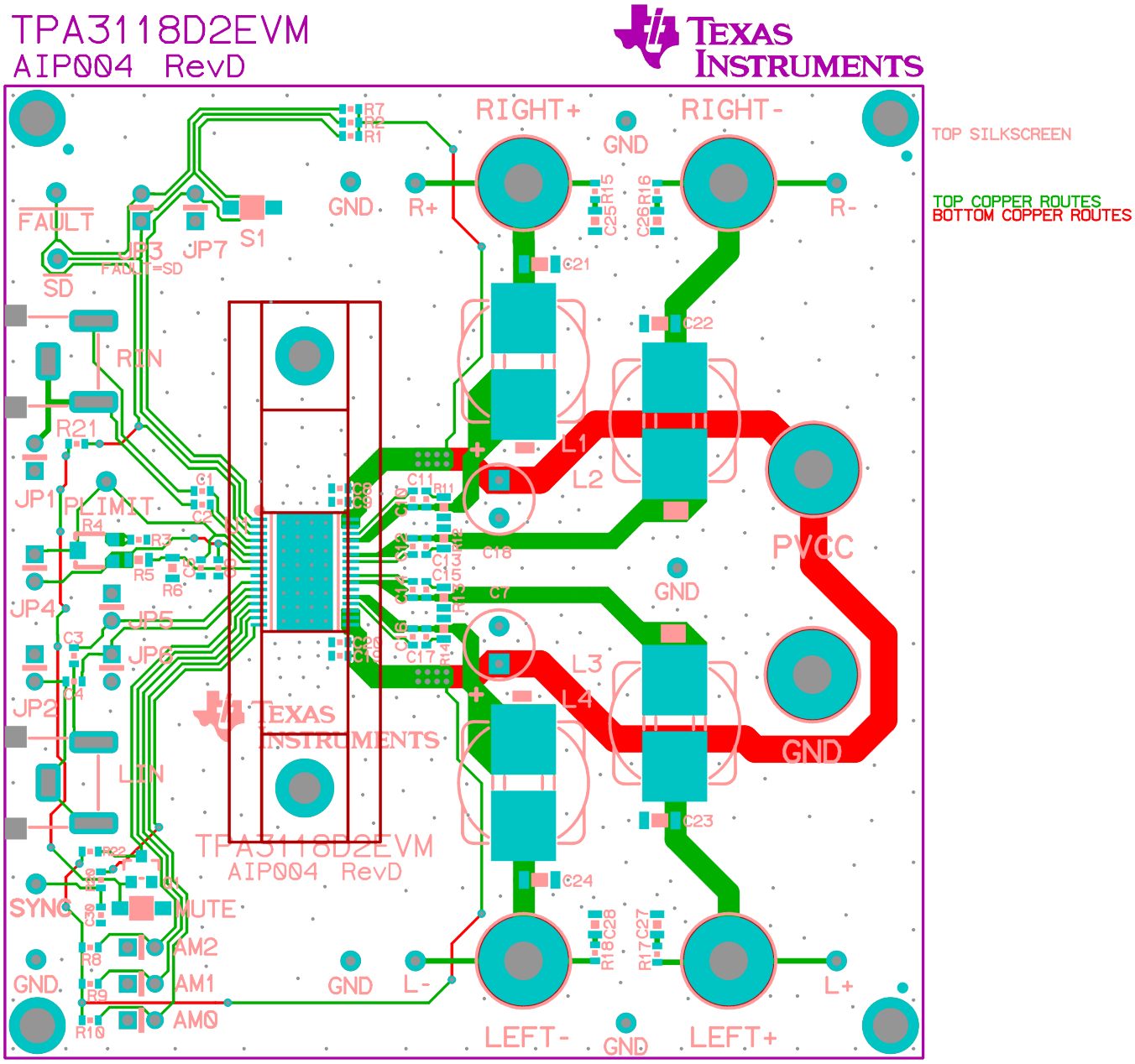


Figure 6. TPA3118D2EVM Top X-ray View

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3.3 TPA3118D2EVM Bill of Materials

Table 2. TPA3118D2EVM Bill of Materials

Item	MANU Part Number	MANU	Qty	Ref Designators	Description
1	TPA3118D2DAP	TEXAS INSTRUMENTS	1	U1	2x30W CLASS D STEREO AMP HTSSOP32-DAP ROHS
2	MMBT2222A-7-F	DIODES INC.	1	Q1	TRANSISTOR NPN GENERAL PURPOSE 40V 1A SOT23 DBV3 ROHS
3	C1608X7R1C105K	TDK	6	C1, C2, C3, C4, C5, C6	CAP SMD0603 CERM 1.0UFD 16V 10% X7R ROHS
4	EEU-FC1V221L	PANASONIC	2	C7, C18	CAP THRU ALUM-ELECT FC SERIES 220ufd 35V 20% 8x3.5x15mm ROHS
5	GRM188R71H104KA93D	MURATA	2	C8, C19	CAP SMD0603 CERM 0.1UFD 50V 10% X7R ROHS
6	C1608C0G1H102J	TDK CORP.	2	C9, C20	CAP SMD0603 CERM 1000PFD 50V 5% COG ROHS
7	06033D224KAT2A	AVX	4	C10, C12, C14, C16	CAP SMD0603 CERM 0.22UFD 25V 10% X5R ROHS
8	GRM1885C1H331JA01D	MURATA	4	C11, C13, C15, C17	CAP SMD0603 CERM 330PFD 50V 5% COG ROHS
9	C1206C684K5RACTU	KEMET	4	C21, C22, C23, C24	CAP SMD1206 CERM 0.68UFD 50V 10% X7R ROHS
10	GRM21BR72A103KA01L	MURATA	4	C25, C26, C27, C28	CAP SMD0805 CERM 0.01UFD 100V 10% X7R ROHS
11	GRM1885C1H470JA01D	MURATA	1	C30	CAP SMD0603 CERM 47PFD 50V 5% COG ROHS
12	RMCF0603JT100K	STACKPOLE ELECTRONICS	8	R1, R2, R7, R8, R9, R10, R21, R22	RESISTOR SMD0603 100K OHMS 5% 1/10W ROHS
13	ERJ-3EKF2002V	PANASONIC	1	R3	RESISTOR SDM0603 20.0K OHM 1% THICK FILM 1/16W ROHS
14	3303W-3-104E	BOURNS	1	R4	POT SMD CERMET 100K OHMS 25% SINGLE TURN TOP ADJ ROHS
15	MCR10EZHF1003	ROHM	1	R5	RESISTOR SMD0805 100.0 KOHMs 1% 1/8W ROHS
16	MCR10EZHF2002	ROHM	1	R6	RESISTOR SMD0805 20.0 KOHMs 1% 1/8W ROHS
17	ESR10EZPJ100	ROHM	4	R11, R12, R13, R14	RESISTOR SMD0805 10 OHM 5% 1/4W ROHS
18	ERJ-3GEYJ3R3V	PANASONIC	4	R15, R16, R17, R18	RESISTOR SMD0603 3.3 OHMS 5% 1/10W ROHS
19	RC0603FR-074K7L	PANASONIC	1	R20	RESISTOR SMD0603 4.70K OHMS 1% 1/10W ROHS
20	931BS-100M	TOKO	4	L1, L2, L3, L4	INDUCTOR 10uH 5.8A TYPE D128C ROHS
21	PBC02SAAN	SULLINS	10	AM0, AM1, AM2, JP1, JP2, JP3, JP4, JP5, JP6, JP7	HEADER THRU MALE 2 PIN 100LS GOLD ROHS
22	PJRAN1X1U013	SWITCHCRAFT	1	RIN	JACK, RCA 3-PIN PCB-RA RED ROHS
23	PJRAN1X1U01X	SWITCHCRAFT	1	LIN	JACK, RCA 3-PIN PCB-RA BLACK ROHS
24	5001	KEYSTONE ELECTRONICS	6	GNDx6	PC TESTPOINT, BLACK, ROHS
25	5003	KEYSTONE ELECTRONICS	8	L+, L-, R+, R-, SD, SYNC, FAULT, PLIMIT	PC TESTPOINT, ORANGE, ROHS
26	TL1015AF160QG	E-SWITCH	2	S1, MUTE	SWITCH, MOM, 160G SMT 4X3MM ROHS
27	7006	KEYSTONE ELECTRONICS	3	PVCC, LEFT+, RIGHT+	BINDING POST, RED, 15A ECONO ROHS
28	7007	KEYSTONE ELECTRONICS	3	GND, LEFT-, RIGHT-	BINDING POST, BLACK, 15A ECONO ROHS
29	969102-0000-DA	3M	8	AM0, AM1, AM2, JP1, JP2, JP3, JP4, JP7	SHUNT BLACK AU FLASH 0.100LS OPEN TOP ROHS
30	95947A121	MCMASTER-CARR	4	STANDOFFS	STANDOFF M3x12mm 4.5mm DIA HEX ALUM F-F ROHS
31	92148A150	MCMASTER-CARR	4	STANDOFF WASHERS	WASHER SPLIT-LOCK M3 6.2mm OD 0.7mm THICK STAINLESS STEEL ROHS
32	92000A118	MCMASTER-CARR	4	STANDOFF SCREWS	SCREW M3x8 PHILIPS PANHEAD STAINLESS STEEL ROHS

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Revision History

Changes from Original (March 2012) to A Revision **Page**

- Changed board image to revision C. 3
- Added bottom board image. 4
- Changed schematic image to revision D. 6
- Changed PCB top side layout image to revision D. 7
- Changed PCB top bottom layout image to revision D. 8
- Changed PCB top x-ray layout image to revision D. 9
- Changed bill of materials to revision D. 10

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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For EVMs **not** subject to the above rules, this evaluation board/kit/module 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 or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment 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.

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant

Caution

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concerning EVMs including detachable antennas

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

Concernant les EVMs avec appareils radio

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

【Important Notice for Users of EVMs for RF Products in Japan】

This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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EVALUATION BOARD/KIT/MODULE (EVM)
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2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard.
3. Since the EVM is not a completed product, it may not meet all applicable regulatory and safety compliance standards (such as UL, CSA, VDE, CE, RoHS and WEEE) which may normally be associated with similar items. You assume full responsibility to determine and/or assure compliance with any such standards and related certifications as may be applicable. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM’s electronic components and packing materials.

Certain Instructions. It is important to operate this EVM within TI’s recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. 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 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

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Safety-Critical or Life-Critical Applications. If you intend to evaluate the components for possible 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, such as devices which are classified as FDA Class III or similar classification, then you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

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