TPA3117D2EVM Audio Amplifier Evaluation Module

This evaluation module allows users to evaluate the Texas Instruments TPA3117D2 audio amplifier. This user's guide contains an operations description, schematic, printed-circuit board layout, and the bill of materials.

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1 Introduction

The TPA3117D2EVM customer evaluation module demonstrates the integrated circuit TPA3117D2 from Texas Instruments.
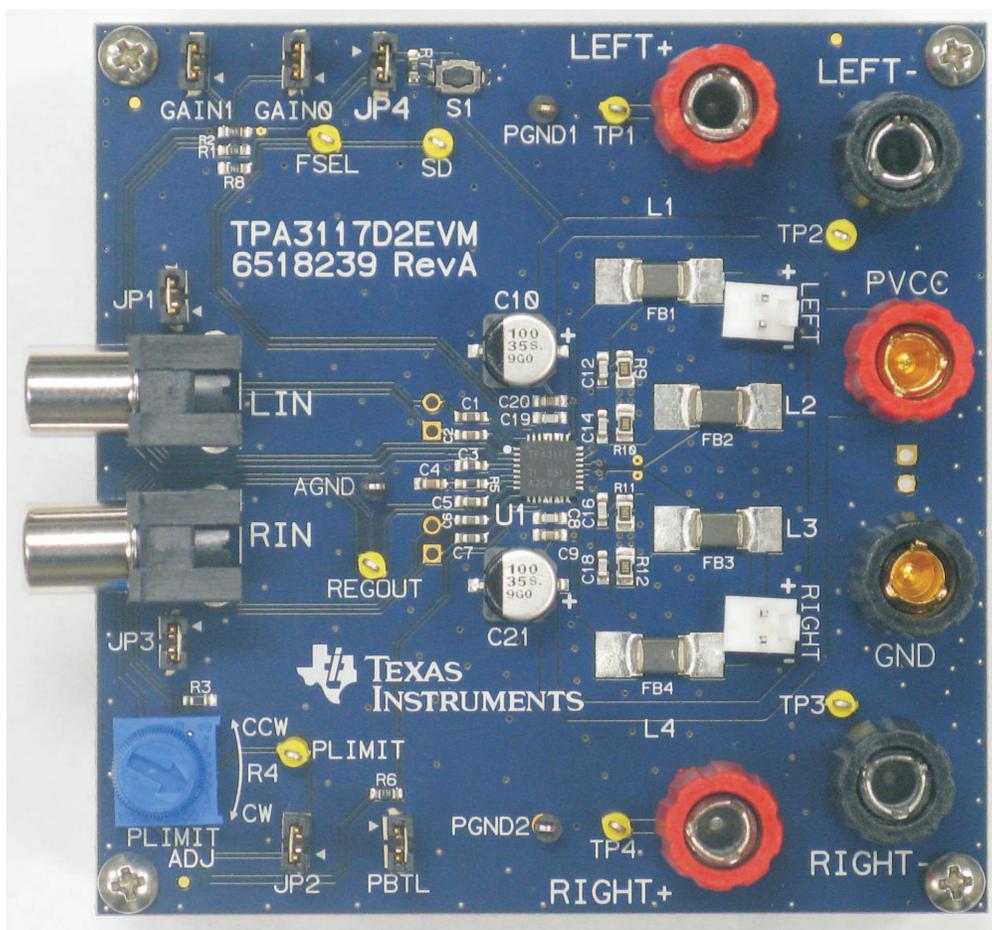
Figure 1. TPA3117D2EVM Audio Power Amplifier – Top View
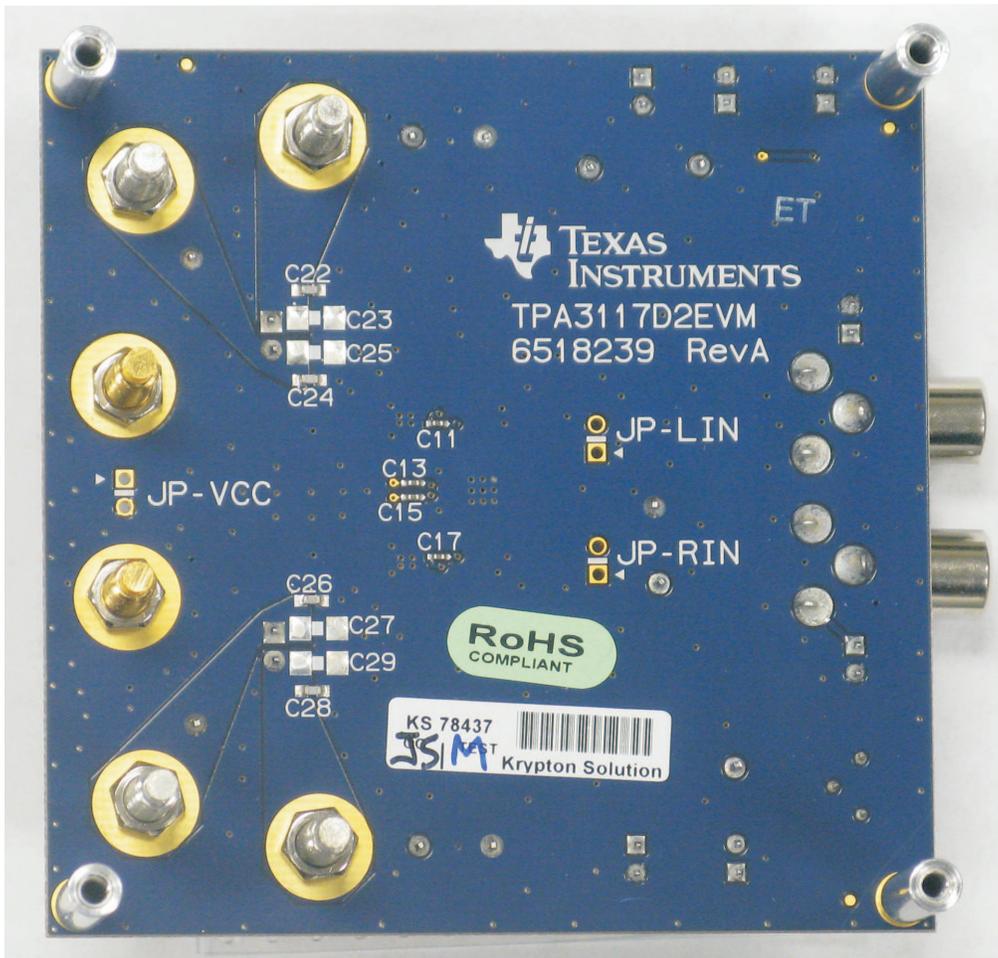
Figure 2. TPA3117D2EVM Audio Power Amplifier – Bottom View

1.1 TPA3117D2EVM Specifications

Table 1. Key Parameters

Key Parameters	
Power Supply Voltage	8 V to 26 V
Number of Channels	Two Bridge-Tied Load (BTL) Stereo or One Parallel BTL (PBTL) Mono
Load Impedance Stereo BTL	4 Ω to 8 Ω (If using ferrite bead filters and resistive loads, connect 33 µH in series with a 4-Ω load or 68 µH in series with an 8-Ω load.)
Load Impedance Mono PBTL	2 Ω to 8 Ω (If using ferrite bead filters and resistive loads, connect inductors noted above.)
	To change to LC filters instead of ferrite bead filters, remove ferrite beads FB1-4, and install 22 µH at L1-4 and 0.68 µF 5% X7R 50 V at C23, C25, C27, and C29
Output Power BTL	15 W per channel
Output Power PBTL	30 W

2 Operation

2.1 *Quick-Start List for Stand-Alone Operation*

Follow these steps to use the TPA3117D2EVM for stand-alone operation or when connecting it into existing circuits or equipment. Connections to the EVM power supply and output connectors can be made by inserting stripped wire. The input connectors are RCA phono jacks.

2.1.1 Power Supply

A single power supply is required to power the evaluation module (EVM). Because most of the pins are PVCC compliant, the PVCC supply can also be used to power the analog supply (AVcc) and to pull up the logic pins for shutdown (SD) control, switching frequency (FSEL), gain (GAIN0 and GAIN1), and PBTL. REG_OUT is an internally generated supply for the output FETs and is also used to power the PLIMIT voltage divider in the EVM. PLIMIT is REG_OUT compliant but not PVCC compliant. PLIMIT can also be powered by an external supply connected to the PLIMIT pin. Do not power the PLIMIT pin or connect power to the REG_OUT pin through the PLIMIT network when the PVCC supply is turned off. This can damage the integrated circuit (IC).

Table 2. Power Supply Requirements

Description	Voltage Range	Current Requirements	Wire Size
PVCC	8 V to 26 V	3 A	24 AWG

1. Ensure that the external regulated power supply is turned OFF.
2. Connect the external regulated power supply adjusted from 8 V to 26 V to the EVM PVCC and GND banana jacks taking care to observe marked polarity.

2.1.2 EVM Preparations

Inputs and Outputs

1. For a BTL configuration, connect loads 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. For PBTL operation, also connect the left outputs together and the right outputs together at the LEFT and RIGHT molex connectors.
2. Connect audio inputs, either differential or single-ended, to the LIN and RIN RCA phono plugs for BTL operation. For PBTL operation, connect a single input, differential or single-ended, to the RIN RCA phono plug.

Control Inputs

1. Ensure that the mode jumpers, PBTL, GAIN0, and GAIN1, are set correctly to achieve the desired operating state.

Power Up

1. Verify correct power supply voltage and polarity, and turn the external power supply ON. The EVM begins to operate.
2. Adjust the audio source for the correct volume.

Table 3. TPA3117D2 Control Guide

Control	Function	Options	Notes
GAIN1/GAIN0	Controls amplifier gain	Insert jumper for zero state (low); remove for one state (high)	00 = 9.0 dB (GAIN1, GAIN0) 01 = 12.1 dB 10 = 15.2 dB 11 = 18.2 dB
JP2	Defeats PLIMIT function and allows amplifier to run at full power.	Insert jumper for PLIMIT defeat	
R4	Adjusts PLIMIT (an external voltage can be applied to the PLIMIT test point)	Set full clockwise to defeat PLIMIT and allow amplifier to run at full power	The output voltage rails are limited to approximately four times the voltage at the PLIMIT pin

Table 3. TPA3117D2 Control Guide (continued)

Control	Function	Options	Notes
PBTL	Sets the amplifier in mono PBTL mode when removed	Insert jumper to defeat PBTL mode and run in normal stereo BTL mode	If PBTL jumper is removed (PBTL mode), the left outputs (OUTPL and OUTNL) as well as the right outputs (OUTPR and OUTNR) are synchronized and in phase. This allows them to be connected together before the reconstruction filter for PBTL operation.
JP4	Sets switching frequency to 400kHz.	Remove jumper to set switching frequency to 300kHz.	

3   Schematic, Layout, and Bill of Materials

3.1   TPA3117D2EVM Schematic
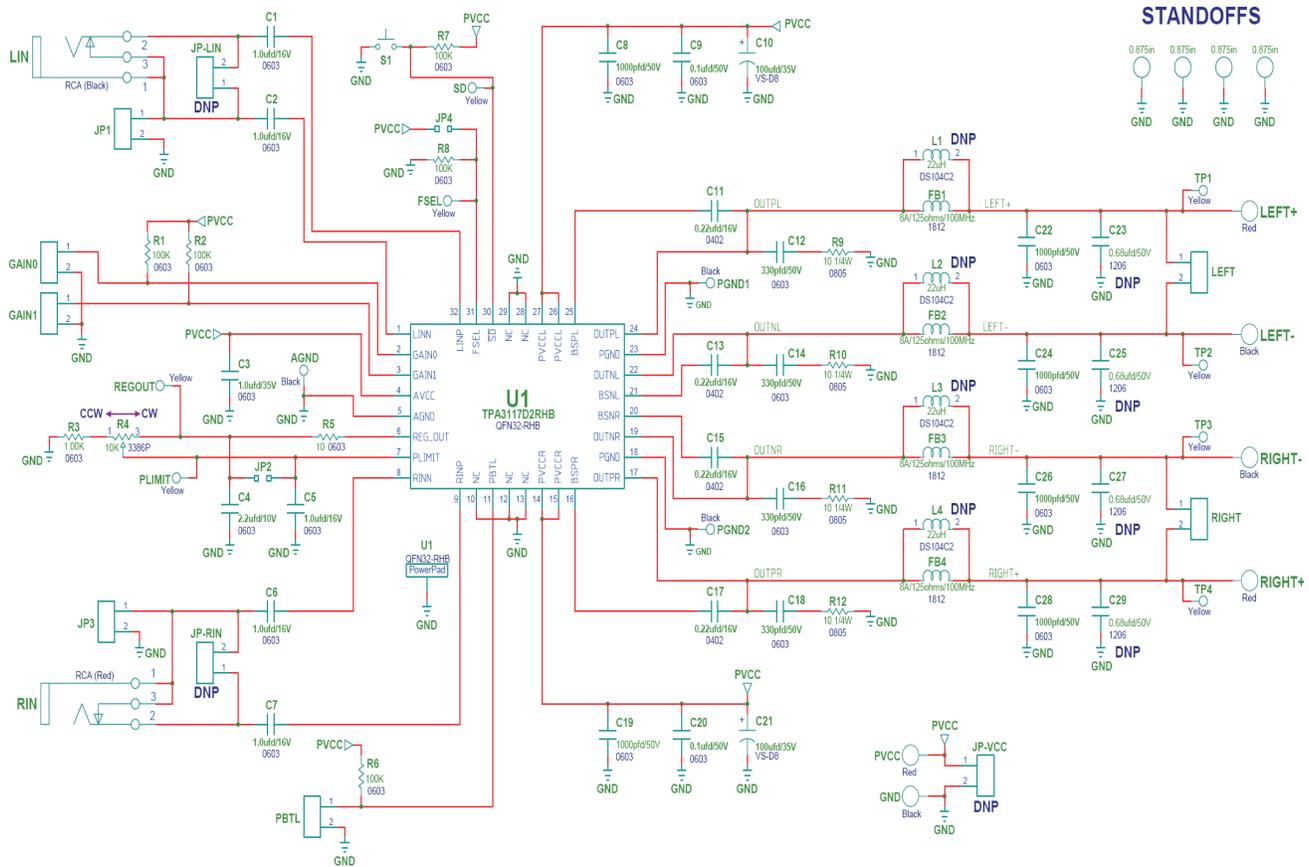
Figure 3. TPA3117D2EVM Schematic

3.2 TPA3117D2EVM Printed-Circuit Board Layers
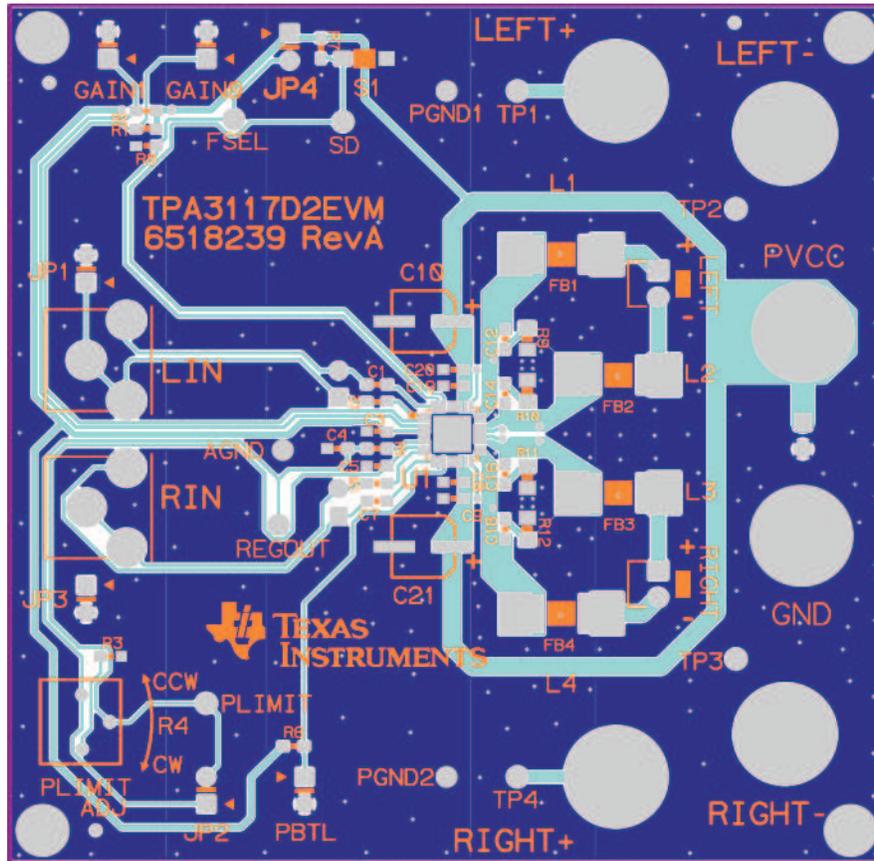
Figure 4. TPA3117D2EVM – Top-Side Layout
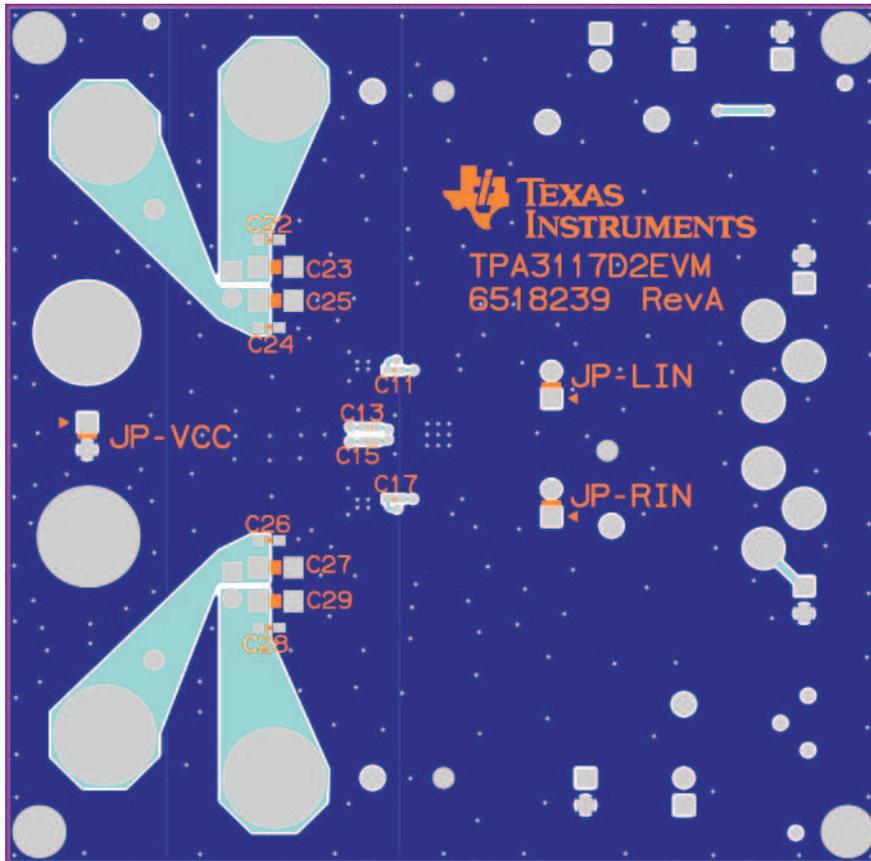
Figure 5. TPA3117D2EVM – Bottom-Side Layout

3.3 Bill of Materials for TPA31172EVM

Table 4. Bill of Materials for TPA3117D2EVM

Item	Manu Part No.	QTY	Ref Designators	Vendor Part No.	Description	Vendor	Manu
TI-SEMICONDUCTORS							
1	TPA3117D2RHB	1	U1	TPA3117D2RHB	15W FILTER FREE STEREO CLASS-D AUDIO PWR AMP W/SPEAKERGUARD QFN32-RHB ROHS	TEXAS INSTRUMENTS	TEXAS INSTRUMENTS
CAPACITORS							
2	ECJ-1VC1H331J	4	C12, C14, C16, C18	PCC331ACVCT	CAP SMD0603 CERM 330PFD 50V 5% COG ROHS	DIGI-KEY	PANASONIC
3	C1608C0G1H102J	6	C8, C19, C22, C24, C26, C28	445-1293-1	CAP SMD0603 CERM 1000PFD 50V 5% COG ROHS	DIGI-KEY	TDK CORP.
4	C1608X7R1H104K	2	C9, C20	445-1314-1	CAP SMD0603 CERM 0.1UFD 50V 10% X7R ROHS	DIGI-KEY	TDK
5	EMK105BJ224KV-F	4	C11, C13, C15, C17	587-1452-1	CAP SMD0402 CERM 0.22UFD 16V 10% X5R ROHS	DIGI-KEY	TAIYO YUDEN
6	C1206C684K5RACTU	4	C23, C25, C27, C29	399-3500-1	CAP SMD1206 CERM 0.68UFD 50V 10% X7R ROHS	DIGI-KEY	KEMET
7	C0603C105K4PACTU	5	C1, C2, C5, C6, C7	399-5090-1	CAP SMD0603 CERM 1.0ufd 16V 10% X5R ROHS	DIGI-KEY	KEMET
8	GMK107BJ105KA-T	1	C3	587-1437-1	CAP SMD0603 CERM 1.0ufd 35V 10% X5R ROHS	DIGI-KEY	TAIYO YUDEN
9	GRM188R71A225KE15D	1	C4	490-4520-1	CAP SMD0603 CERM 2.2UFD 10V 10% X7R ROHS	DIGI-KEY	MURATA
10	EEE-1VA101XP	2	C10, C21	PCE3951CT	CAP SMD ELECT 100ufd 35V 20% VS-D8 ROHS	DIGI-KEY	PANASONIC
RESISTORS							
11	RC0603JR-0710RL	1	R5	311-10GRCT	RESISTOR SMD0603 THICK FILM 10 OHM 5% 1/10W ROHS	DIGI-KEY	YAGEO
12	ESR10EZPJ100	4	R9, R10, R11, R12	RHM10KCT	RESISTOR SMD0805 10 OHM 1% 1/4W ROHS	DIGI-KEY	ROHM
13	RC0603FR-071KL	1	R3	311-1.00KHRCT	RESISTOR SMD0603 THICK FILM 1.00K OHM 1% 1/10W ROHS	DIGI-KEY	YAGEO
14	3386P-1-103TLF	1	R4	3386P-103TLF	TRIMPOT THRU 10K OHMS TOP ADJ W/KNOB 1 TURN 10% ROHS	DIGI-KEY	BOURNS
15	ERJ-3EKF1003V	5	R1, R2, R6, R7, R8	P100KHCT	RESISTOR SMD0603 100K OHM 1% THICK FILM 1/10W ROHS	DIGI-KEY	PANASONIC
INDUCTORS AND FERRITES							
16	B952AS-220M	4	L1, L2, L3, L4	B952AS-220M	INDUCTOR SMT 22uH 2.4A 87 OHMS 20% DS104C2 ROHS	TOKO JAPAN	TOKO JAPAN

Table 4. Bill of Materials for TPA3117D2EVM (continued)

Item	Manu Part No.	QTY	Ref Designators	Vendor Part No.	Description	Vendor	Manu
17	HI1812V101R-10	4	FB1, FB2, FB3, FB4	240-2543-1	FERRITE BEAD SMD1812 80 OHM@100MHz 6A ROHS	DIGI-KEY	STEWARD
				HEADERS AND JACKS			
18	PBC02SAAN	7	JP1, JP2, JP3, JP4, PBTL, GAIN0, GAIN1	S1011E-02	HEADER THRU MALE 2 PIN 100LS GOLD ROHS	DIGI-KEY	SULLINS
19	22-23-2021	2	LEFT, RIGHT	WM4200	HEADER MALE 2PIN 100LS W/ FRICTION LOCK ROHS	DIGI-KEY	MOLEX
20	PJRAN1X1U01X	1	LIN	65K7770	JACK, RCA 3-PIN PCB-RA BLACK ROHS	NEWARK	SWITCHCRAFT
21	PJRAN1X1U03X	1	RIN	89K7617	JACK, RCA 3-PIN PCB-RA RED ROHS	NEWARK	SWITCHCRAFT
				TESTPOINTS AND SWITCHES			
22	5004	8	SD, TP1, TP2, TP3, TP4, FSEL, PLIMIT, REGOUT	5004K	PC TESTPOINT, YELLOW, ROHS	DIGI-KEY	KEYSTONE ELECTRONICS
23	5001	3	AGND, PGND1, PGND2	5001K	PC TESTPOINT, BLACK, ROHS	DIGI-KEY	KEYSTONE ELECTRONICS
24	TL1015AF160QG	1	S1	EG4344CT	SWITCH, MOM, 160G SMT 4X3MM ROHS	DIGI-KEY	E-SWITCH
				BINDING POSTS			
25	3750-0	1	GND	565-3750-0	BINDING POST, BLACK 60V/15A GOLD ROHS	MOUSER	POMONA
26	3750-2	1	PVCC	565-3750-2	BINDING POST, RED 60V/15A GOLD ROHS	MOUSER	POMONA
27	3760-0	2	LEFT-, RIGHT-	565-3760-0	BINDING POST, BLACK 60V/15A TIN ROHS	MOUSER	POMONA
28	3760-2	2	LEFT+, RIGHT+	565-3760-2	BINDING POST, RED 60V/15A TIN ROHS	MOUSER	POMONA
				SHUNTS			
29	SPC02SYAN	7	JP1, JP2, JP3, JP4, GAIN0, GAIN1, PBTL	S9001	SHUNT, BLACK AU FLASH 0.100LS	DIGI-KEY	SULLINS
				STANDOFFS AND HARDWARE			
30	PMS 440 0025 PH	4	NA	H342	4-40 SCREW, STEEL 0.250 IN	DIGI-KEY	BUILDING FASTENERS
31	2030	4	NA	2030K	STANDOFF ,4-40 0.875IN 3/16IN DIA ALUM RND F-F	DIGI-KEY	KEYSTONE
	Component Count:	94					
				COMPONENTS NOT ASSEMBLED			
C23, C25, C27, C29, L1, L2, L3, L4, JP-LIN, JP-RIN, JP-VCC							

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EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of -0.3 V to 6.3 V and the output voltage range of -0.3 V to VCC + 0.3 V with respect to EVM ground.

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 125° C. The EVM is designed to operate properly with certain components above 125° 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.

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RFID	www.ti-rfid.com	Space, Avionics & Defense	www.ti.com/space-avionics-defense
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video and Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless-apps