TPA3113D2 EVM Audio Amplifier Evaluation Board

This user's guide provides the TPA3113D2 evaluation board specifications and a quick start list for stand-alone operations. Also included are the schematic, printed-circuit board layout, and bill of materials.

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1 Introduction

The TPA3113D2 EVM customer evaluation module demonstrates the integrated circuit TPA3113D2 from Texas Instruments.

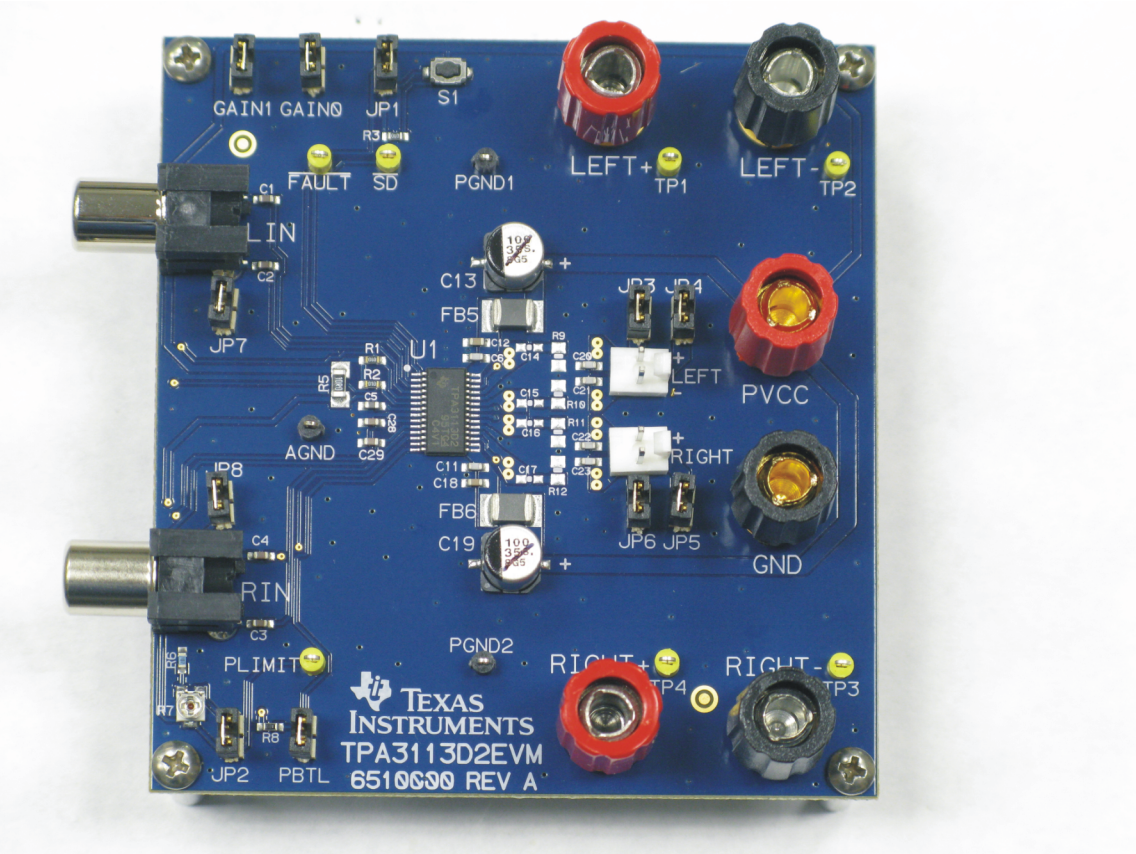

Figure 1. TI TPA3113D2 EVM Audio Power Amplifier – Top View

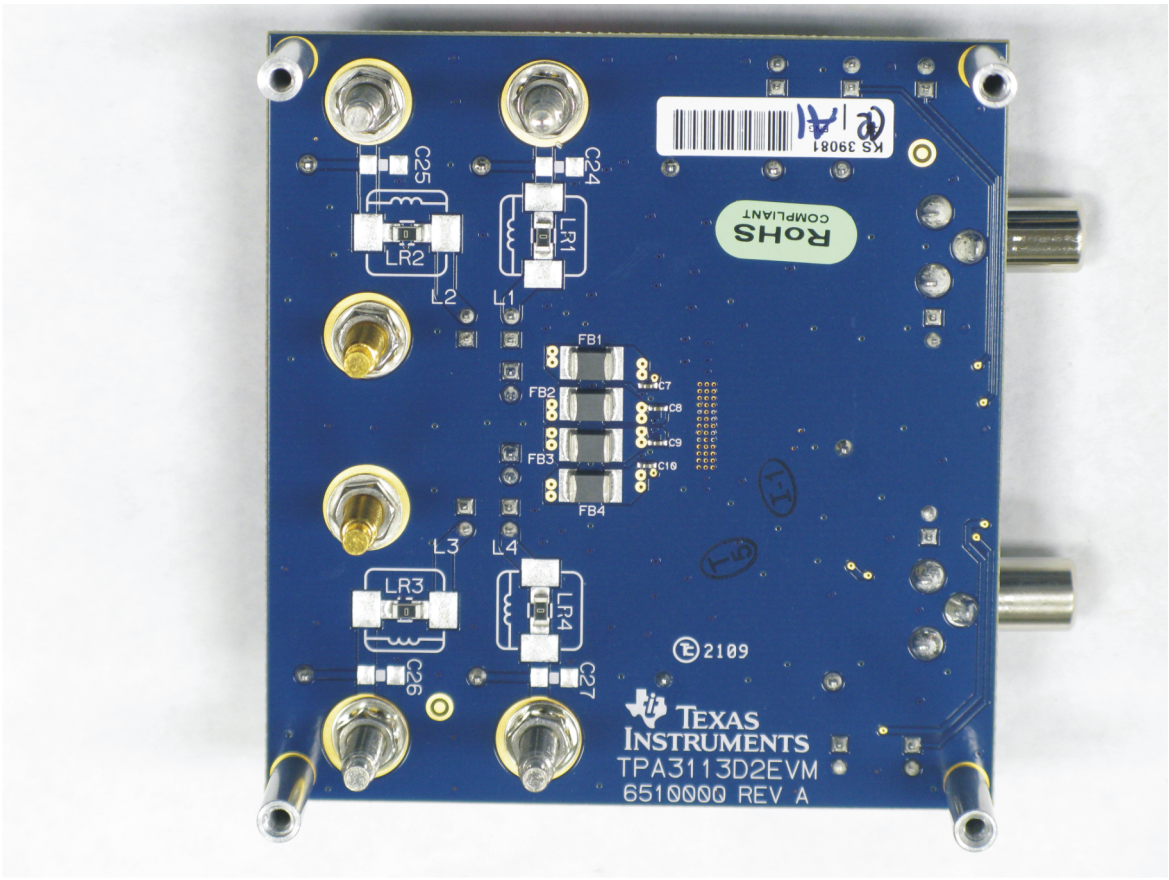

Figure 2. TI TPA3113D2 EVM Audio Power Amplifier – Bottom View

1.1 TPA3113D2 EVM Specifications

Table 1. Key Parameters

Key Parameters	
Power Supply Voltage	8 to 26 Volts
Number of Channels	2 Bridge Tied Load (BTL) Stereo
Load Impedance Stereo BTL	4 to 8 Ω (connect 33μH series inductor for 4 Ω or 68 μH inductor for 8 Ω if using the ferrite bead filters)
Load Impedance Mono PBTL	2 to 8 Ω (connect series inductors if using with ferrite bead filters)
Output Power BTL	6 W per channel
Output Power PBTL	12 W

2 Operation

2.1 Quick Start List for Stand-Alone Operation

Follow these steps to use the TPA3113D2 EVM stand-alone or when connecting it into existing circuits or equipment. Connections to the EVM module can be made by inserting stripped wire or banana plugs for the power supply and output connections. The input connectors are RCA phono jacks.

Power Supply

A single power supply is required to power up the EVM. Since most of the pins are PVCC compliant, the PVCC supply can also be used to power the analog supply (AV_{CC}) and can be used to pull up the logic pins for shutdown (SD) control, fault detection (FAULT), gain (GAIN0 and GAIN1), and PBTL as long as the voltage slew rate is limited to 10 V/ms. 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. Take care not to power the PLIMIT pin (or connect power to the GVDD pin inadvertently through the PLIMIT network) when the PVCC supply is turned off. This can cause damage to the IC.

Table 2. Power Supply Requirements

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

Evaluation Module Preparations

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

Inputs and Outputs

1. For a BTL Configuration, connect a Load(s) 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 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.

Control Inputs

1. Ensure the mode jumpers, PBTL, GAIN0, GAIN1, are set correctly depending on the desired operating state. Also, make sure to connect the left outputs together and the right outputs together at the LEFT and RIGHT molex connectors if PBTL operation is desired.

Power Up

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

Table 3. TPA3113D2 Control Guide

Control	Function	Options	Notes
JP1	Allow amp to self reset after short-circuit protection event	Insert jumper for self reset. Leave off for latched SC fault	For latched SC fault, cycle power to reset the fault latch.
GAIN1/GAIN0	Controls amp gain	Insert jumper for zero state (low), Leave off for one state (high)	00 = 20 dB (GAIN1, GAIN0) 01 = 26 dB 10 = 32 dB 11 = 36 dB
JP2	Defeats PLIMIT function and allows amp to run at full power.	Insert jumper for PLIMIT defeat	JP2 connects PLIMIT directly to GVDD
R7	Adjust PLIMIT (an external voltage can also be applied to the PLIMIT test point)	Remove JP2 to allow PLIMIT operation	The output voltage rails will be limited to approximately 4X the voltage at the PLIMIT pin. Take care not to apply power to PLIMIT when the PVCC source is off.

Table 3. TPA3113D2 Control Guide (continued)

Control	Function	Options	Notes
PBTL	Sets the amplifier in PBTL mode	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 operations. For PBTL operation, connect the OUTPL and OUTNL to each other and connect the OUTPR and OUTNR to each other. This can be done by shorting the two pins of the molex connectors labeled LEFT and RIGHT.
JP3, JP4, JP5, and JP6	Connects LC filters to outputs.		The LC filters are not installed in this version of the EVM. However, the inductors are shipped with the EVM package. They can be installed and used as normal reconstruction filters or to smooth the audio waveforms for measurement. They can also be used when driving resistive loads to simulate a speaker load. This EVM is meant to demonstrate filter-free operation with just a ferrite bead and small capacitor for good EMI performance.

3 Schematic, Layout, and Bill of Materials

3.1 TPA3113D2 EVM Schematic

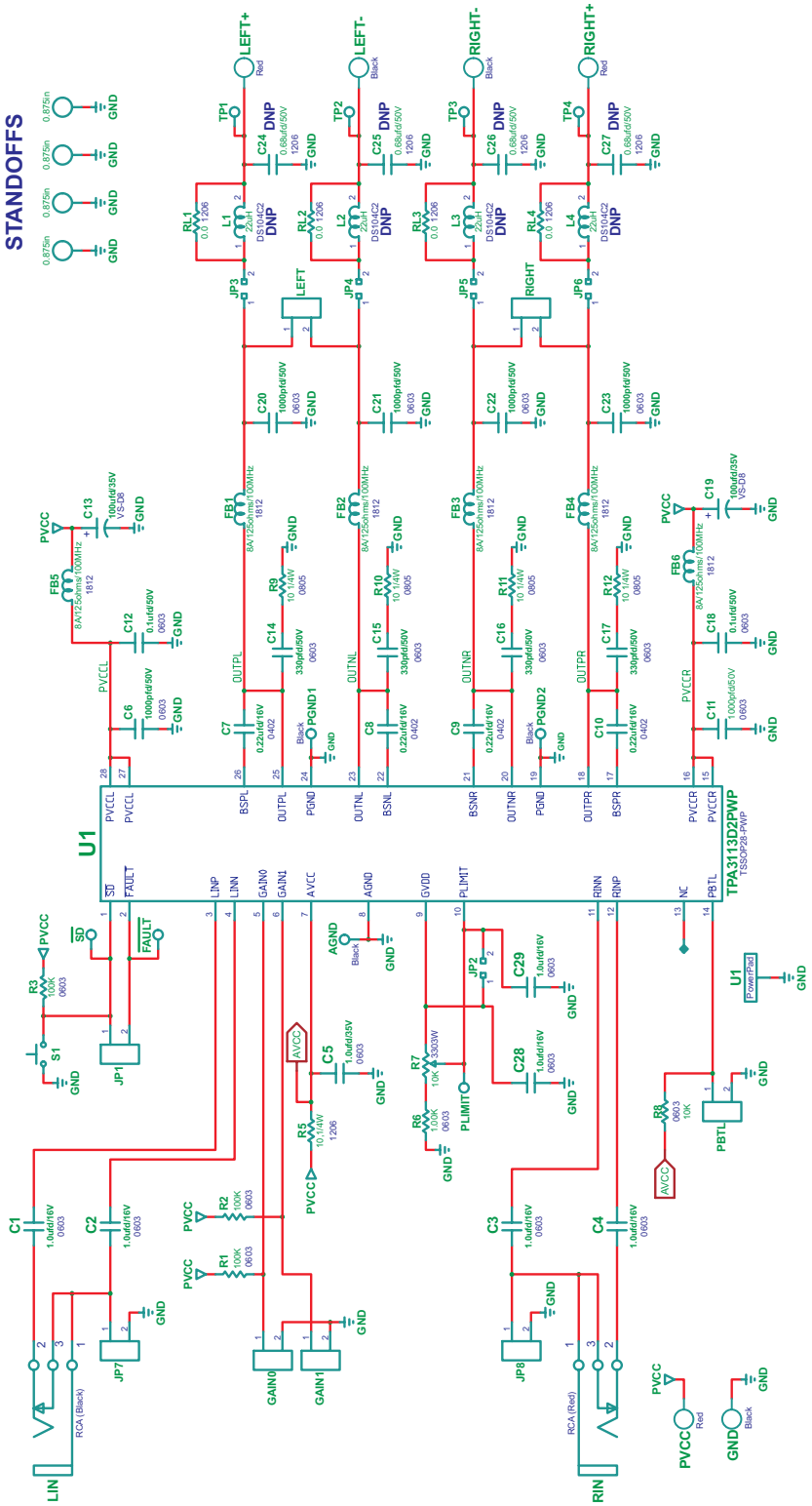

Figure 3. TPA3113D2 EVM Schematic

3.2 TPA3113D2 EVM PCB Layers

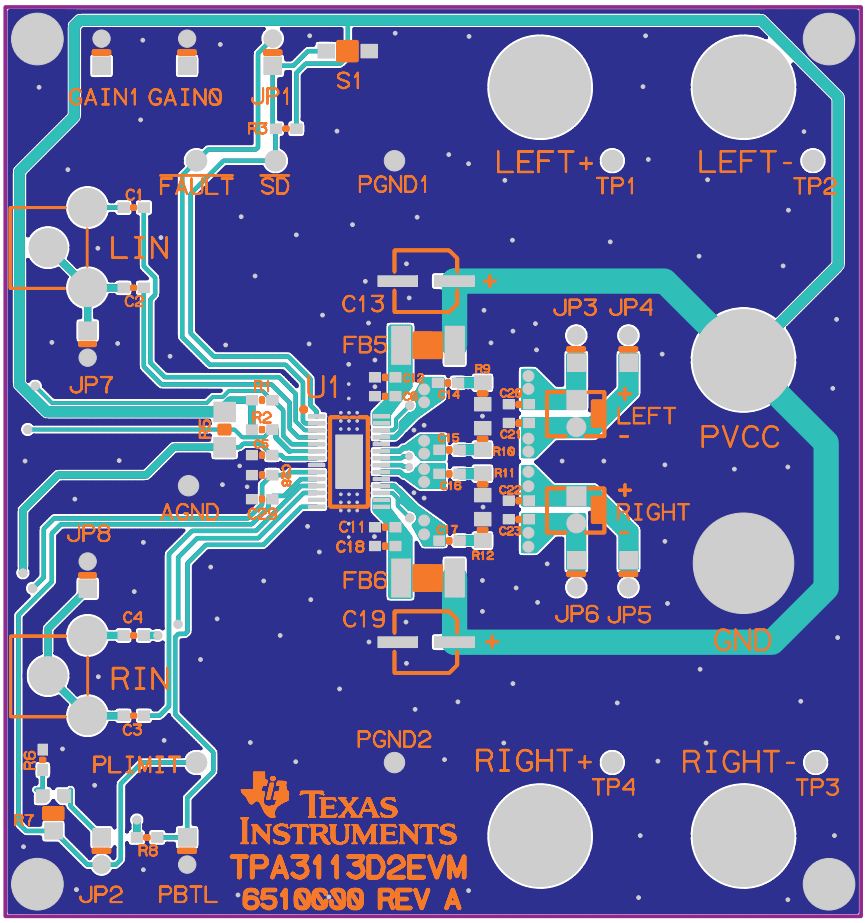

Figure 4. TPA3113D2 EVM – Top Side Layout

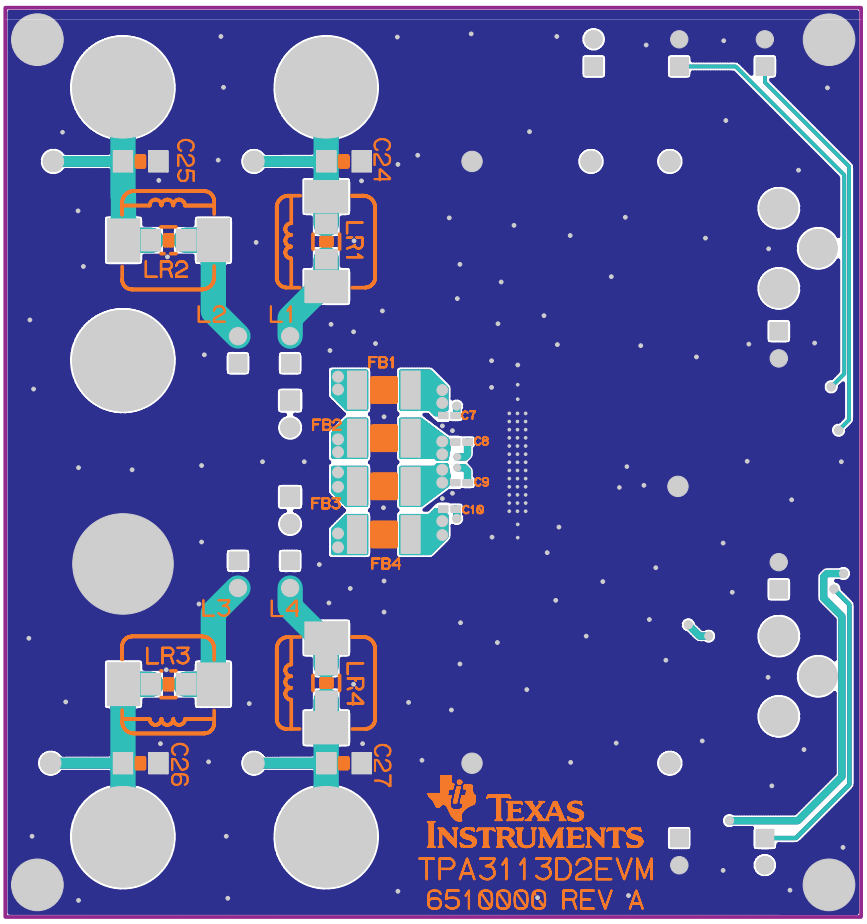

Figure 5. TPA3113D2 EVM – Bottom Side Layout

3.3 TPA3113D2 Bill of Materials

Table 4. Bill of Materials for TPA3113D2EVM

Item	MANU Part no.	QTY	REF DESIGNATORS	Vendor Part No	Description	Vendor	MANU
			TI-SEMICONDUCTORS				
1	TPA3113D2PWP	1	U1	TPA3113D2PWP	15-W STEREO CLASS-D AUDIO POWER AMP, TSSOP28-PWP ROIHS	TEXAS INSTRUMENTS	TEXAS INSTRUMENTS
			CAPACITORS				
2	ECJ-1VC1H331J	4	C14, C15, C16, C17	PCC331ACVCT	CAP SMD0603 CERM 330PFD 50V 5% COG ROHS	DIGI-KEY	PANASONIC
3	C1608C0G1H102J	6	C6, C11, C20, C21, C22, C23	445-1293-1	CAP SMD0603 CERM 1000PFD 50V 5%COG ROHS	DIGI-KEY	TDK CORP.
4	C1608X7R1H104K	2	C12,C18	445-1314-1	CAP SMD0603 CERM 0.1UFD 50V X7R ROHS	DIGI-KEY	TDK
5	EMK105BJ224KV-F	4	C7,C8,C9,C10	587-1452-1	CAP SMD0402 CERM 0.22ufd 16V X5R ROHS	DIGI-KEY	TAIYO YUDEN
6	C0603C105K4PACTU	6	C1,C2,C3,C4,C28,C29	399-5090-1	CAP SMD0603 CERM 1.0ufd 16V 10% X5R ROHS	DIGI-KEY	KEMET
7	GMK107BJ105KA-T	1	C5	587-1437-1	CAP SMD0603 CERM 1.0ufd 35V 10% X5R ROHS	DIGI-KEY	TAIYO YUDEN
8	EEE-1VA101XP	2	C13,C19	PCE3951CT	CAP SMD ELECT 100ufd 35V 20% VS-D8 ROHS	DIGI-KEY	PANASONIC
			RESISTORS				
9	ERJ-8GEY0R00V	4	RL1, RL2, RL3, RL4	P0.0ECT	RESISTOR SMD1206 0.0 OHM 5% 1/4W ROHS	DIGI-KEY	PANASONIC
10	ESR10EZPJ100	4	R9,R10,R11,R12	RHM10KCT	RESISTOR SMD0805 10 OHM 1% 1/4W ROHS	DIGI-KEY	ROHM
11	ERJ-8ENF10R0	1	R5	P10.0FCT	RESISTOR SMD1206 10.0 OHM 1% 1/4W ROHS	DIGI-KEY	PANASONIC
12	RC0603FR-071KL	1	R6	311-1.00KHRCT	RESISTOR SMD0603 1.00K OHM 1% 1/10W ROHS	DIGI-KEY	YAGEO
13	ERJ-3GEYJ103V	1	R8	P10KGCT	RESISTOR SMD0603 10K 5% 1/10W ROHS	DIGI-KEY	PANASONIC
14	3303W-3-103E	1	R7	3303W-103ECT	POT 10K SMD SINGLE TURN CERMET ROHS	DIGI-KEY	BOURNS
15	ERJ-3EKF1003V	3	R1,R2,R3	P100KHCT	RESISTOR SM0603 100K OHM 1% 1/16W ROHS	DIGI-KEY	PANASONIC
			FERRITE BEADS				
16	HI1812V101R-10	6	FB1, FB2, FB3, FB4, FB5, FB6	240-2543-1	FERRITE BEAD SMD1812 125 OHM@100MHz 8A ROHS	DIGI-KEY	STEWARD
			HEADERS AND JACKS				
17	PBC02SAAN	11	JP1, JP2, JP3, JP4, JP5, JP6, JP7, JP8, PBTL, GAIN0, GAIN1	S1011E-02	HEADER 2 PIN MALE, PCB STRAIGHT GOLD ROHS	DIGI-KEY	SULLINS

Table 4. Bill of Materials for TPA3113D2EVM (continued)

Item	MANU Part no.	QTY	REF DESIGNATORS	Vendor Part No	Description	Vendor	MANU
18	22-23-2021	2	LEFT, RIGHT	WM4200	HEADER MALE 2PIN 100LS W/ FRICTION LOCK ROHS	DIGI-KEY	MOLEX
19	PJRAN1X1U01X	1	LIN	65K7770	JACK, RCA 3-PIN PCB-RA BLACK ROHS	NEWARK	SWITCHCRAFT
20	PJRAN1X1U03X	1	RIN	89K7617	JACK, RCA 3-PIN PCB-RA RED ROHS	NEWARK	SWITCHCRAFT
TESTPOINTS AND SWITCHES							
21	5004	7	SD, TP1, TP2, TP3, TP4, FAULT, PLIMIT	5004K	PC TESTPOINT, YELLOW, ROHS	DIGI-KEY	KEYSTONE ELECTRONICS
22	5001	3	AGND, PGND1, PGND2	5001K	PC TESTPOINT, BLACK, ROHS	DIGI-KEY	KEYSTONE ELECTRONICS
23	TL1015AF160QG	1	S1	EG4344CT	SWITCH, MOM, 160G SMT 4X3MM ROHS	DIGI-KEY	E-SWITCH
BINDING POSTS							
24	3760-2	2	LEFT+, RIGHT+	565-3760-2	BINDING POST, RED 60V/15A TIN ROHS	MOUSER	POMONA
25	3760-0	2	LEFT-, RIGHT-	565-3760-0	BINDING POST, BLACK 60V/15A TIN ROHS	MOUSER	POMONA
26	3750-2	1	PVCC	565-3750-2	BINDING POST, RED 60V/15A GOLD ROHS	MOUSER	POMONA
27	3750-0	1	GND	565-3750-0	BINDING POST, BLACK 60V/15A GOLD ROHS	MOUSER	POMONA
SHUNTS							
28	SPC02SYAN	11	JP1, JP2, JP3, JP4, JP5, JP6, JP7, JP8, PBTL, GAIN0, GAIN1	S9001	SHUNT, BLACK AU FLASH 0.100LS	DIGI-KEY	SULLINS
STANDOFFS AND HARDWARE							
29	PMS 440 0025 PH	4	SO1-S04	H342	4-40 SCREW, STEEL 0.250 IN	DIGI-KEY	BUILDING FASTENERS
30	2030	4	SO1-S04	2030K	STANDOFF,4-40,0.875INx3/16IN,ALUM RND F-F	DIGI-KEY	KEYSTONE ELECTRONICS
Component Count:		98					
COMPONENTS NOT ASSEMBLED							
C24, C25, C26, C27, L1, L2, L3, L4							

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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 30 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.

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		Wireless	www.ti.com/wireless-apps

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