# TPA3112D1EVM Audio Amplifier Evaluation Board

This user's guide provides the specifications, quick-start list for stand-alone operation, the schematic, bill of materials, and the board layout for the TPA3112D1EVM evaluation module.

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# 1 Introduction

The TPA3112D1EVM customer evaluation module (EVM) demonstrates the integrated circuit TPA3112D1 from Texas Instruments.

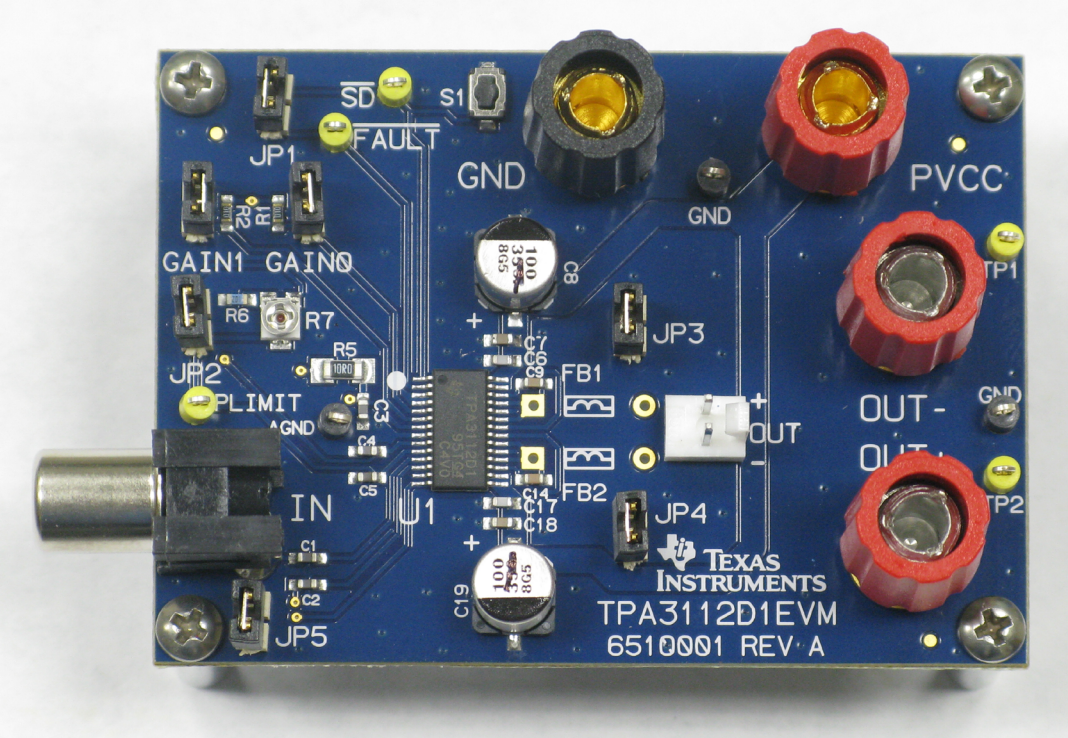



**Figure 1. TI TPA3112D1EVM Audio Power Amplifier – Top View**

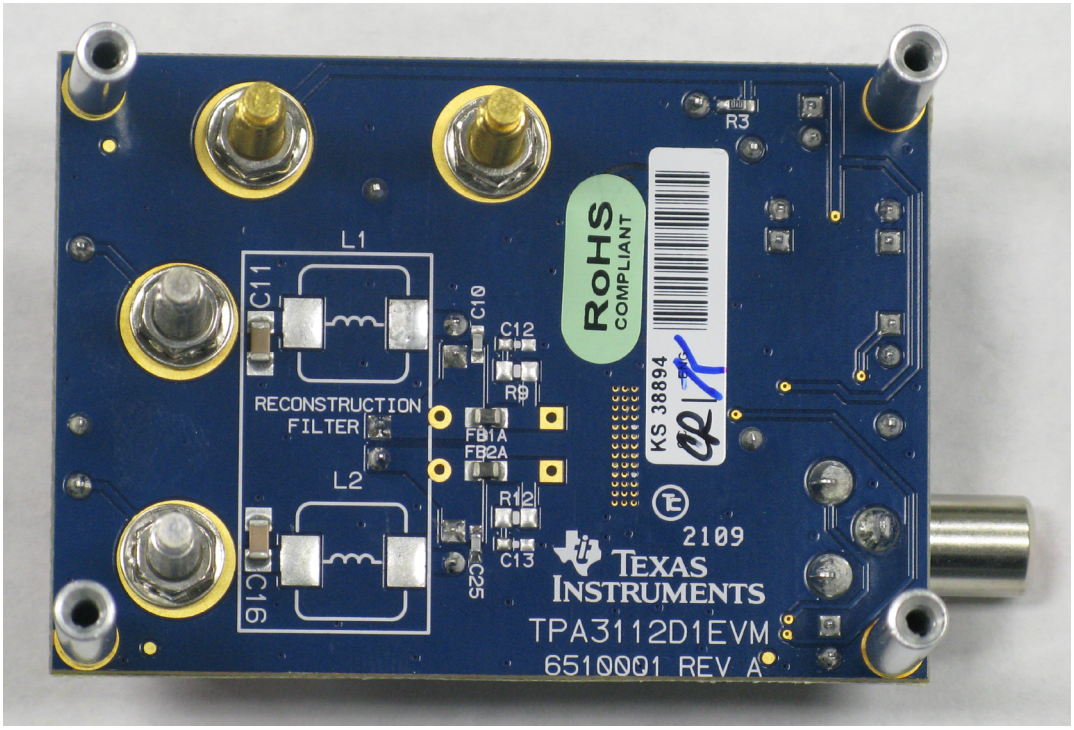



**Figure 2. TI TPA3112D1EVM Audio Power Amplifier – Bottom View**



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### 1.1 TPA3112D1EVM Specifications

**Table 1. Key Parameters**

| Key Parameters | |
|---|---|
| Power Supply Voltage | 8 V to 26 V |
| Number of Channels | 1 - Bridge-Tied Load (BTL) Mono |
| Load Impedance Mono BTL | 4 Ω to 8 Ω (connect 33-μH series inductor for 4 Ω or 68-μH inductor for 8 Ω if using the ferrite bead filters) |
| Output Power | 25 W |

## 2 Operation

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

Follow these steps to use the TPA3112D1EVM 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 outputs also can be connected via Molex connectors. The input connectors are RCA phono jacks.



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### Power Supply

A single power supply is required to power up the EVM. Most of the pins are PVCC compliant. The PVCC supply also can 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), and gain (GAIN0 and GAIN1) as long as the voltage slew rate is limited to 10 V/ms. GVDD is an internally generated supply for the output FETs and also can be used to power the PLIMIT circuit. PLIMIT is GVDD compliant, but not PVCC compliant. PLIMIT also can 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 integrated circuit.

**Table 2. Power Supply Requirements**

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

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

### Evaluation Module Preparations

#### Inputs and Outputs

1. For a BTL configuration, connect a load across the outputs (OUT+ and OUT-).
2. Connect the audio input, either differential or single-ended, to the IN RCA phono plugs for BTL operation.

#### Control Inputs

1. Ensure that the mode jumpers, JP1, JP2, GAIN0, and GAIN1, are set correctly depending on the desired operating state (Table 3).

#### Power Up

1. Verify correct voltage and input polarity and turn the external power supplies ON
   The EVM begins operation.
2. Adjust the audio source for the desired volume.

**Table 3. TPA3112D1 Control Guide**

| Control | Function | Options | Notes |
|---|---|---|---|
| JP1 | Allows amplifier 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. DC Detect does not recover with SDZ cycle. PVCC must be cycled to reset DC Detect. |
| GAIN1/GAIN0 | Controls amplifier gain | Insert jumper for zero state (low). Leave off for one state (high). | 00 = 20 dB (GAIN1, GAIN0)<br>01 = 26 dB<br>10 = 32 dB<br>11 = 36 dB |
| JP2 | Defeats PLIMIT function and allows amplifier to run at full power | Insert jumper for PLIMIT defeat | JP2 connects PLIMIT directly to GVDD |
| R7 | Adjust PLIMIT (an external voltage also can be applied to the PLIMIT test point) | Remove JP2 to allow PLIMIT operation. | The output voltage rails are limited to approximately 4X the voltage at the PLIMIT pin. Take care not to apply power to PLIMIT when the PVCC source is off. |
| JP3, JP4 | Connects LC filters to outputs. | | |



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# 3 Schematic, Layout, and Bill of Materials

## 3.1 TPA3112D1EVM Schematic

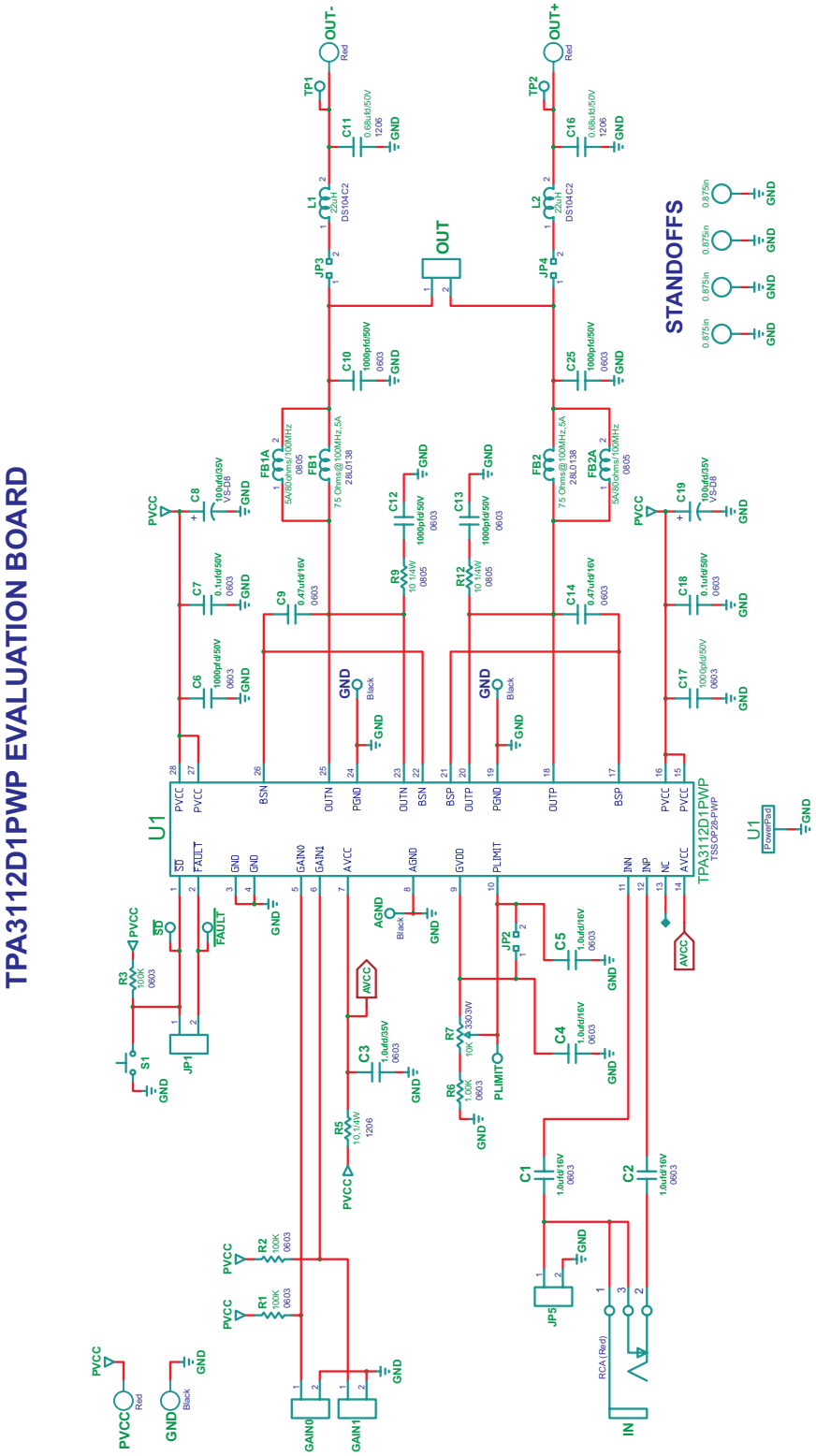



**Figure 3. TPA3112D1EVM Schematic**



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### 3.2 TPA3112D1EVM PCB Layers

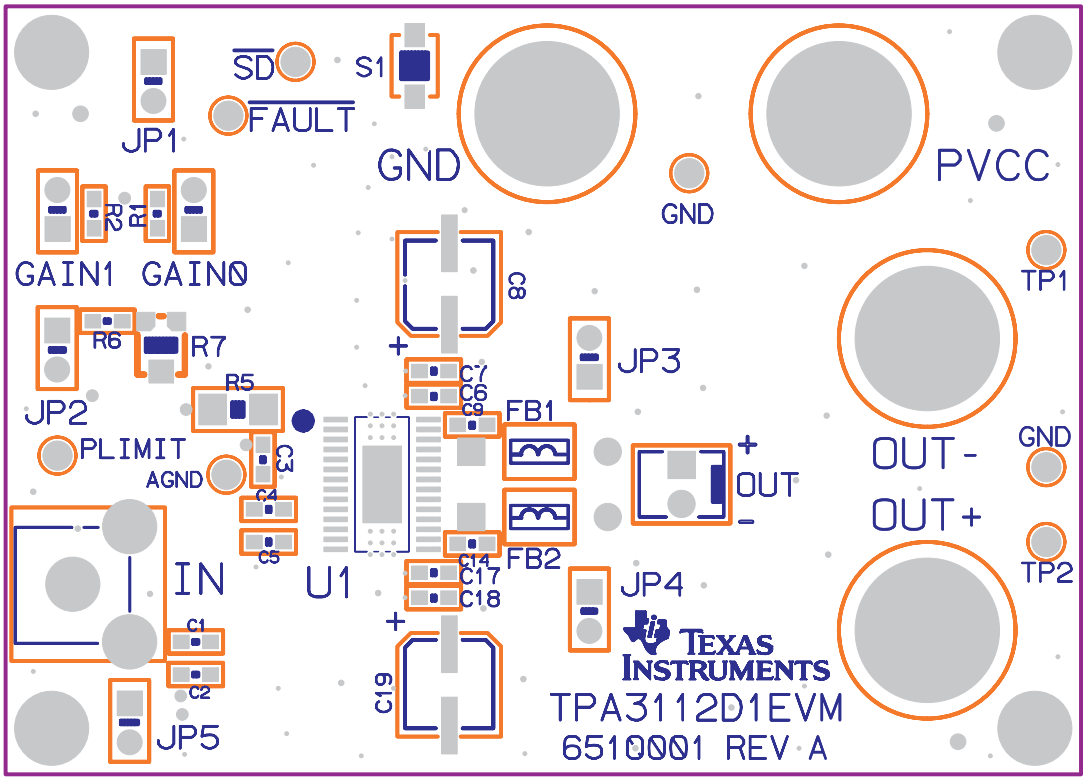



**Figure 4. TPA3112D1EVM – Top Side Layout**

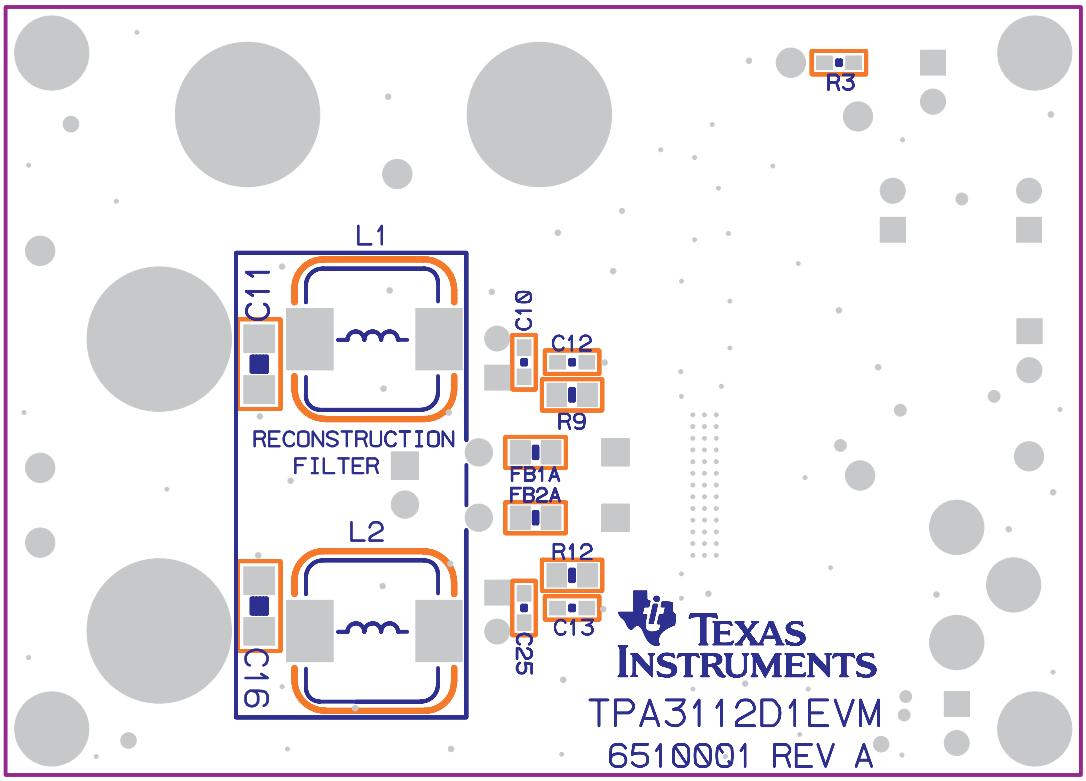



**Figure 5. TPA3112D1EVM – Bottom Side Layout**



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## 3.3 TPA3112D1EVM Bill of Materials

**Table 4. Bill of Materials for TPA3112D1EVM**

| Item | MANU Part no. | QTY | Ref Designators | Vendor Part No | Description | Vendor | MANU |
|---|---|---|---|---|---|---|---|
| **TI-SEMICONDUCTORS** | | | | | | | |
| 1 | TPA3112D1PWP | 1 | U1 | TPA3112D1PWP | 10-W MONO CLASS-D AUDIO POWER AMP, TSSOP28-PWP ROIHS | TEXAS INSTRUMENTS | TEXAS INSTRUMENTS |
| **CAPACITORS** | | | | | | | |
| 2 | C1608C0G1H102J | 6 | C6,C10,C12,C13,C17,C25 | 445-1293-1 | CAP SMD0603 CERM 1000 pF 50V 5% COG ROHS | DIGI-KEY | TDK CORP. |
| 3 | C1608X7R1H104K | 2 | C7,C18 | 445-1314-1 | CAP SMD0603 CERM 0.1 μF 50V X7R ROHS | DIGI-KEY | TDK |
| 4 | 0603YD474KAT2A | 2 | C9,C14 | 478-1248-1 | CAP SMD0603 CERM 0.47 μF 16V 10% X5R ROHS | DIGI-KEY | AVX |
| 5 | C1206C684K5RACTU | 2 | C11,C16 | 399-3500-1 | CAP SMD1206 CERM 0.68 μF 50V 10% X7R ROHS | DIGI-KEY | KEMET |
| 6 | C0603C105K4PACTU | 4 | C1,C2,C4,C5 | 399-5090-1 | CAP SMD0603 CERM 1.0 μF 16V 10% X5R ROHS | DIGI-KEY | KEMET |
| 7 | GMK107BJ105KA-T | 1 | C3 | 587-1437-1 | CAP SMD0603 CERM 1.0 μF 35V 10% X5R ROHS | DIGI-KEY | TAIYO YUDEN |
| 8 | EEE-1VA101XP | 2 | C8,C19 | PCE3951CT | CAP SMD ELECT 100 μF 35V 20% VS-D8 ROHS | DIGI-KEY | PANASONIC |
| **RESISTORS** | | | | | | | |
| 9 | ESR10EZPJ100 | 2 | R9,R12 | RHM10KCT | RESISTOR SMD0805 10Ω 1% 1/4W ROHS | DIGI-KEY | ROHM |
| 10 | ERJ-8ENF10R0 | 1 | R5 | P10.0FCT | RESISTOR SMD1206 10.0Ω 1% 1/4W ROHS | DIGI-KEY | PANASONIC |
| 11 | RC0603FR-071KL | 1 | R6 | 311-1.00KHRCT | RESISTOR SMD0603 1.00KΩ 1% 1/10W ROHS | DIGI-KEY | YAGEO |
| 12 | 3303W-3-103E | 1 | R7 | 3303W-103ECT | POT SMD SINGLE TURN CERMET10K ROHS | DIGI-KEY | BOURNS |
| 13 | ERJ-3EKF1003V | 3 | R1,R2,R3 | P100KHCT | RESISTOR SMD0603 100KΩ 1% 1/16W ROHS | DIGI-KEY | PANASONIC |
| **FERRITE BEADS AND INDUCTORS** | | | | | | | |
| 14 | HI0805R800R-10 | 2 | FB1A,FB2A | 240-2395-1 | FERRITE BEAD SMD0805 80Ω@100MHz 5A ROHS | DIGI-KEY | STEWARD |
| 15 | 28L0138-10R-10 | 2 | FB1,FB2 | 240-2438-1 | FERRITE BEAD THRU RN50 75Ω@100MHz 5A ROHS | DIGI-KEY | STEWARD |
| 16 | B952AS-220M | 2 | L1,L2 | B952AS-220M | INDUCTOR SMT 22μH 2.4A 87Ω 20% DS104C2 ROHS | TOKO JAPAN | TOKO JAPAN |
| **HEADERS AND JACKS** | | | | | | | |
| 17 | PBC02SAAN | 7 | JP1, JP2, JP3, JP4, JP5, GAIN0, GAIN1 | S1011E-02 | HEADER 2 PIN MALE, PCB STRAIGHT GOLD ROHS | DIGI-KEY | SULLINS |



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**Table 4. Bill of Materials for TPA3112D1EVM (continued)**

| Item | MANU Part no. | QTY | Ref Designators | Vendor Part No | Description | Vendor | MANU |
|---|---|---|---|---|---|---|---|
| 18 | 22-23-2021 | 1 | OUT | WM4200 | HEADER MALE 2PIN 100LS W/ FRICTION LOCK ROHS | DIGI-KEY | MOLEX |
| 19 | PJRAN1X1U03X | 1 | IN | 89K7617 | JACK, RCA 3-PIN PCB-RA RED ROHS | NEWARK | SWITCHCRAFT |
| **TESTPOINTS AND SWITCHES** | | | | | | | |
| 20 | 5004 | 5 | SD, FAULT, PLIMIT, TP1 TP2 | 5004K | PC TESTPOINT, YELLOW, ROHS | DIGI-KEY | KEYSTONE ELECTRONICS |
| 21 | 5001 | 3 | AGND, GND, GND | 5001K | PC TESTPOINT, BLACK, ROHS | DIGI-KEY | KEYSTONE ELECTRONICS |
| 22 | TL1015AF160QG | 1 | S1 | EG4344CT | SWITCH, MOM, 160G SMT 4X3MM ROHS | DIGI-KEY | E-SWITCH |
| **BINDING POSTS** | | | | | | | |
| 23 | 3760-2 | 2 | OUT+, OUT- | 565-3760-2 | BINDING POST, RED 60V/15A TIN ROHS | MOUSER | POMONA |
| 24 | 3750-2 | 1 | PVCC | 565-3750-2 | BINDING POST, RED 60V/15A GOLD ROHS | MOUSER | POMONA |
| 25 | 3750-0 | 1 | GND | 565-3750-0 | BINDING POST, BLACK 60V/15A GOLD ROHS | MOUSER | POMONA |
| **SHUNTS** | | | | | | | |
| 26 | SPC02SYAN | 7 | JP1, JP2, JP3, JP4, JP5, GAIN0, GAIN1 | S9001 | SHUNT, BLACK AU FLASH 0.100LS | DIGI-KEY | SULLINS |
| **STANDOFFS AND HARDWARE** | | | | | | | |
| 27 | PMS 440 0025 PH | 4 | SO1,SO2,SO3,SO4 | H342 | 4-40 SCREW, STEEL 0.250 IN | DIGI-KEY | BUILDING FASTENERS |
| 28 | 2030 | 4 | SO1,SO2,SO3,SO4 | 2030K | STANDOFF, 4-40, 0.875IN x 3/16IN, ALUM RND F-F | DIGI-KEY | KEYSTONE |
| **COMPONENTS NOT ASSEMBLED** | | | | | | | |
| **FB1, FB2** | | | | | | | |
| **COMPONENTS MISSING FROM SEQUENCE** | | | | | | | |
| **C15, C20-C24, R4, R8, R10, R11** | | | | | | | |



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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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