# Using the TPS2500/1 EVM

# User's Guide

Literature Number: SLUU363
June 2009

# TPS2500/1, Power-Distribution Switch With Low Voltage Input EVM

This user's guide describes the TPS2500/1DRCEVM evaluation modules (EVM). This guide contains the EVM schematic, bill of materials, assembly drawing, and top and bottom board layouts.

## 1 Introduction

The TPS2500/1DRCEVM is an evaluation module (EVM) for Texas Instruments' family of power-distribution switches with adjustable current-limit. These EVMs operate over a 1.8-V to 5.25-V range providing 5-V output for USB devices. An onboard jumper sets the output current-limit to either 0.5 A or 1 A. Test points provide convenient access to all critical node voltages.

The silkscreen outline on the PCB top-side encloses components found in a typical USB application.

The TPS2500/1 is in an SON package with a thermal pad. These switches have an enable input, an overcurrent status output, and overtemperature shutdown.

### 1.1 Related Documentation from Texas Instruments

TPS2500/1 data sheet (TI Literature Number SLVS886)

## 2 Electrical Specifications

The EVM meets the electrical specifications in Table 1 over the recommended operating junction-temperature range of -40°C ≤ $T_J$ ≤ 125°C for the DRV (SON) package.

**Table 1. EVM Electrical Specifications**

| PARAMETER | CONDITION | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Input voltage, $V_{IN}$ | J1 | 1.8 | – | 6.5 | V |
| Short-circuit output current-limit, $I_{LIMIT}$ | J2 shorting-jumper is absent, J3 is short circuited, TPS2500/1 is enabled | 0.600 | 0.652 | 0.710 | A |
| | J2 shorting-jumper is present, J3 is short circuited, TPS2500/1 is enabled | 1.215 | 1.283 | 1.362 | |

### 2.1 Electrostatic Discharge

The EVM has been tested to IEC 61000-4-2. The level used was 8-kV contact discharge and 15-kV air discharge. Surges were applied to the EVM input and output. No damage to the TPS2500/1 was observed.

# 3 Schematic

## 3.1 EVM Options

**Table 2. EVM Options**

| HPA337 | DEVICE | DEVICE PACKAGE | ECO MODE |
|---|---|---|---|
| -1 | TPS2500DRC | SON | Enabled |
| -2 | TPS2501DRC | SON | Disabled |

## 3.2 Schematic

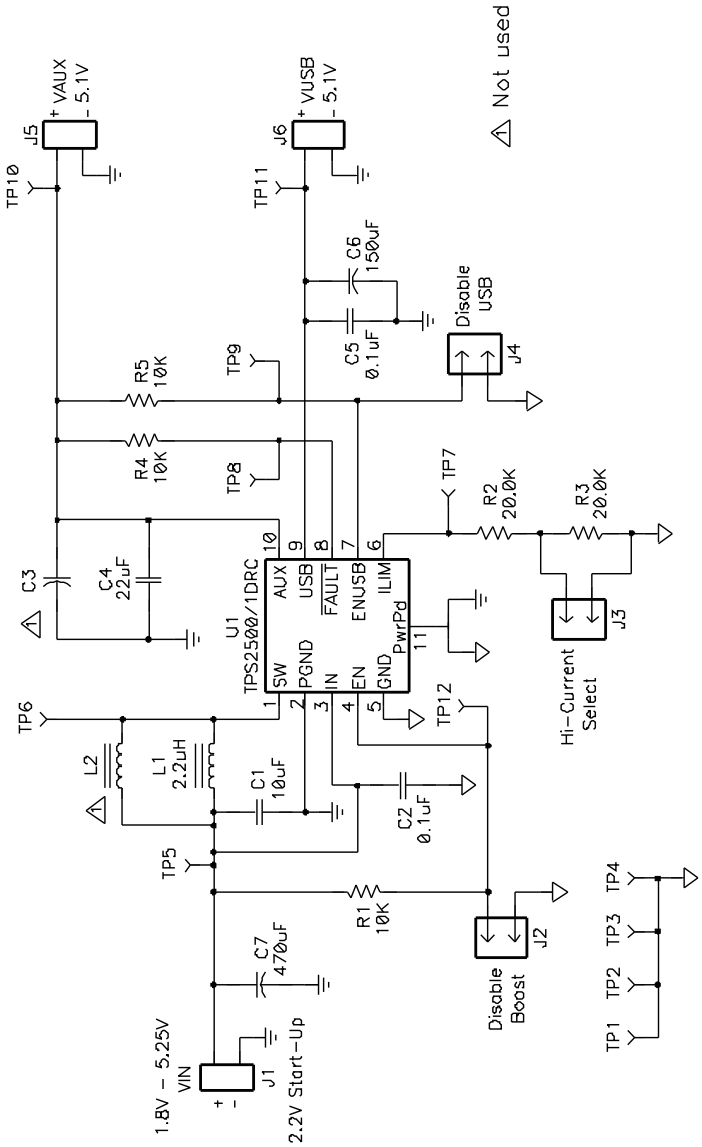


**Figure 1. EVM Schematic**

# 4 EVM Setup

## 4.1 Recommended Test Equipment

The following test equipment is recommended:

- Two-channel storage oscilloscope
- Current probe
- Voltage probe
- An adjustable power supply with a 1.75-V to 6.5-V output and a 10-A output current-limit
- Volt-ohm meter
- A passive or active load capable of handling 3 A.

## 4.2 Measuring the Short-Circuit Output Current-Limit

The user should read the TPS2500/1 data sheet before using the EVM.

Figure 2 shows the EVM test setup for measuring current-limit. Switch S1 enables the power-distribution switch into a short circuit for this measurement. Figure 3 shows the current waveform for the TPS2500/1 EVM with a shorting jumper populating header J3; Figure 4 shows the current waveform with header J3 unpopulated.

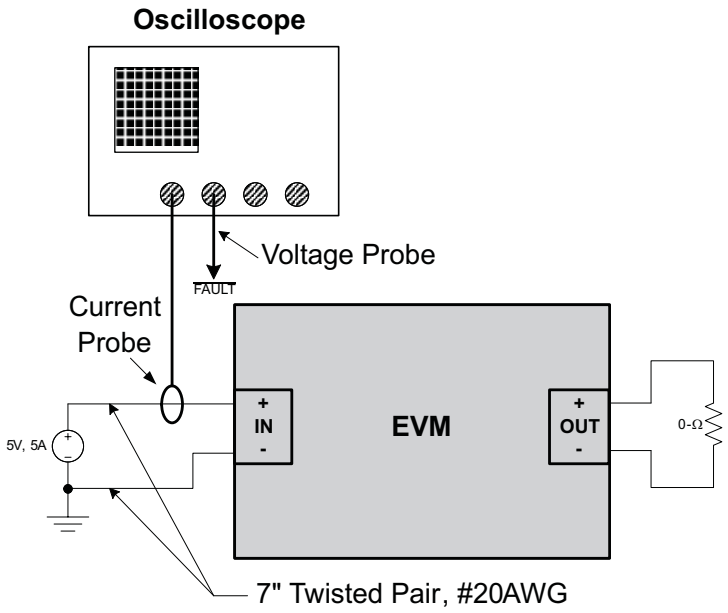


**Figure 2. EVM Setup For Measuring Current-Limit**

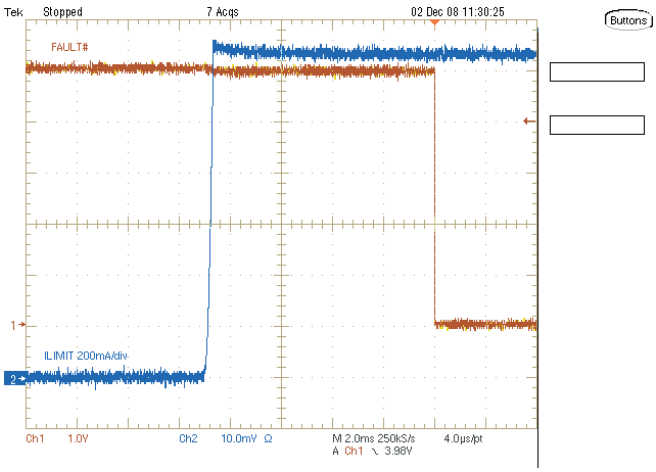


**Figure 3. TPS2500EVM Short-Circuit Output Current and $\overline{\text{FAULT}}$ Status With J3 Shorting Jumper Present.**

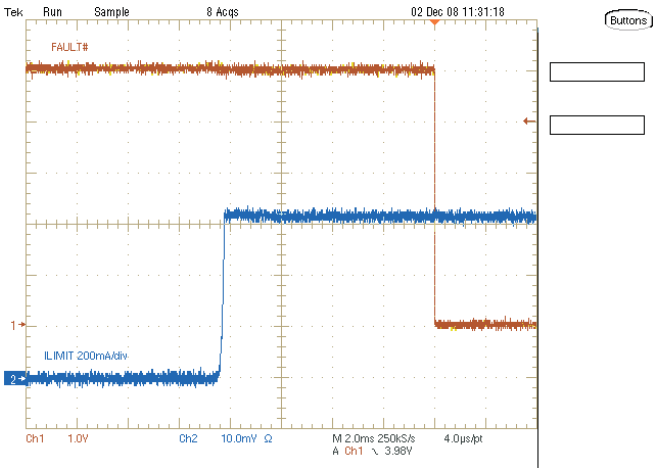


**Figure 4. TPS2500EVM Short-Circuit Output Current and $\overline{\text{FAULT}}$ Status With J3 Shorting Jumper Absent.**

## 4.3 Adjusting the Short-Circuit Output Current-Limit

The EVM provides two current-limit settings. If a different setting is required, then populate header J3 with a shorting jumper and modify resistor R3 using the current limit resistor calculator, TI Literature Number SLVC163.

See the TPS2500/1 data sheet for the worst-case current-limit variation.

## 5 Board Layout

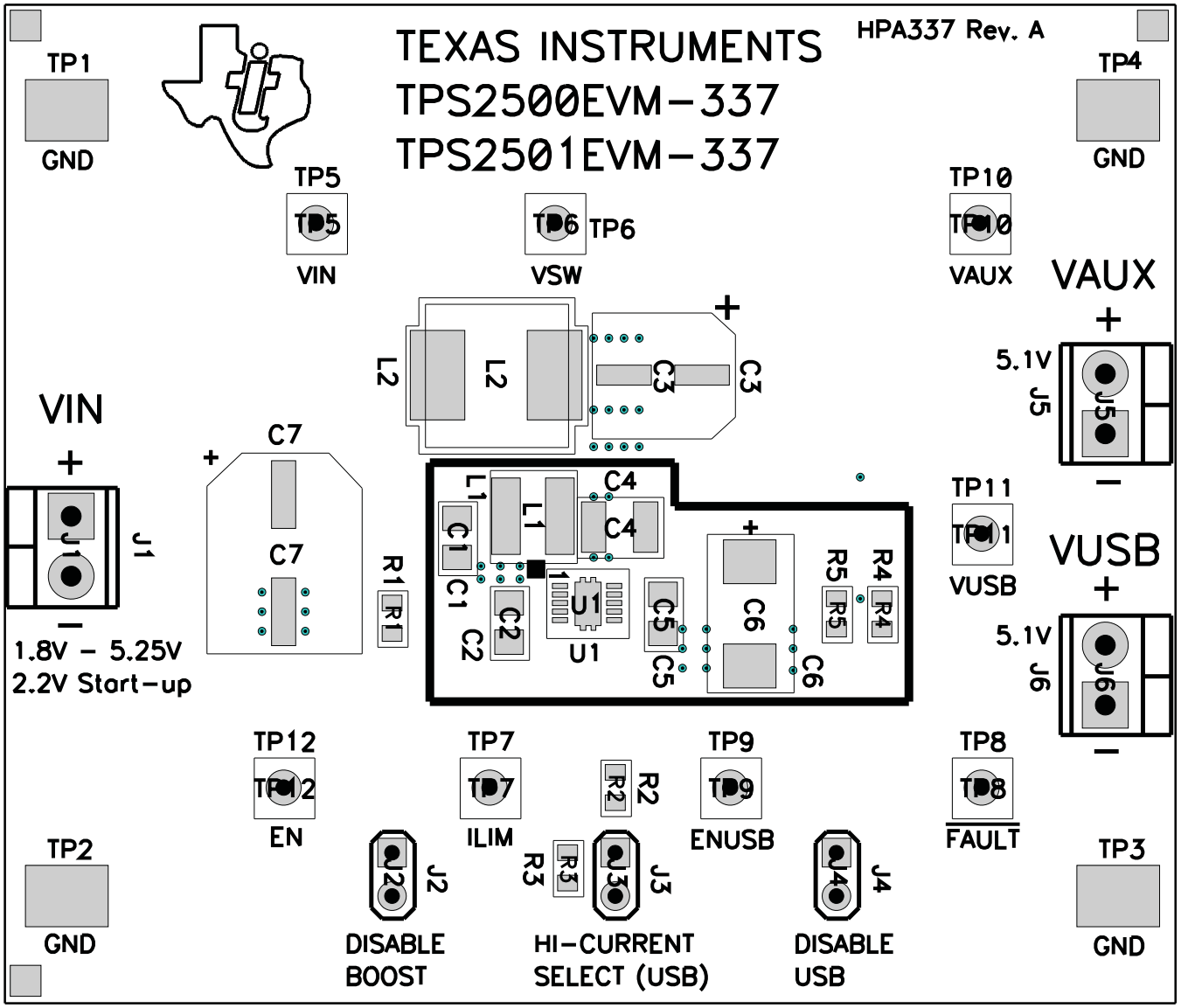


**Figure 5. EVM Top Assembly**

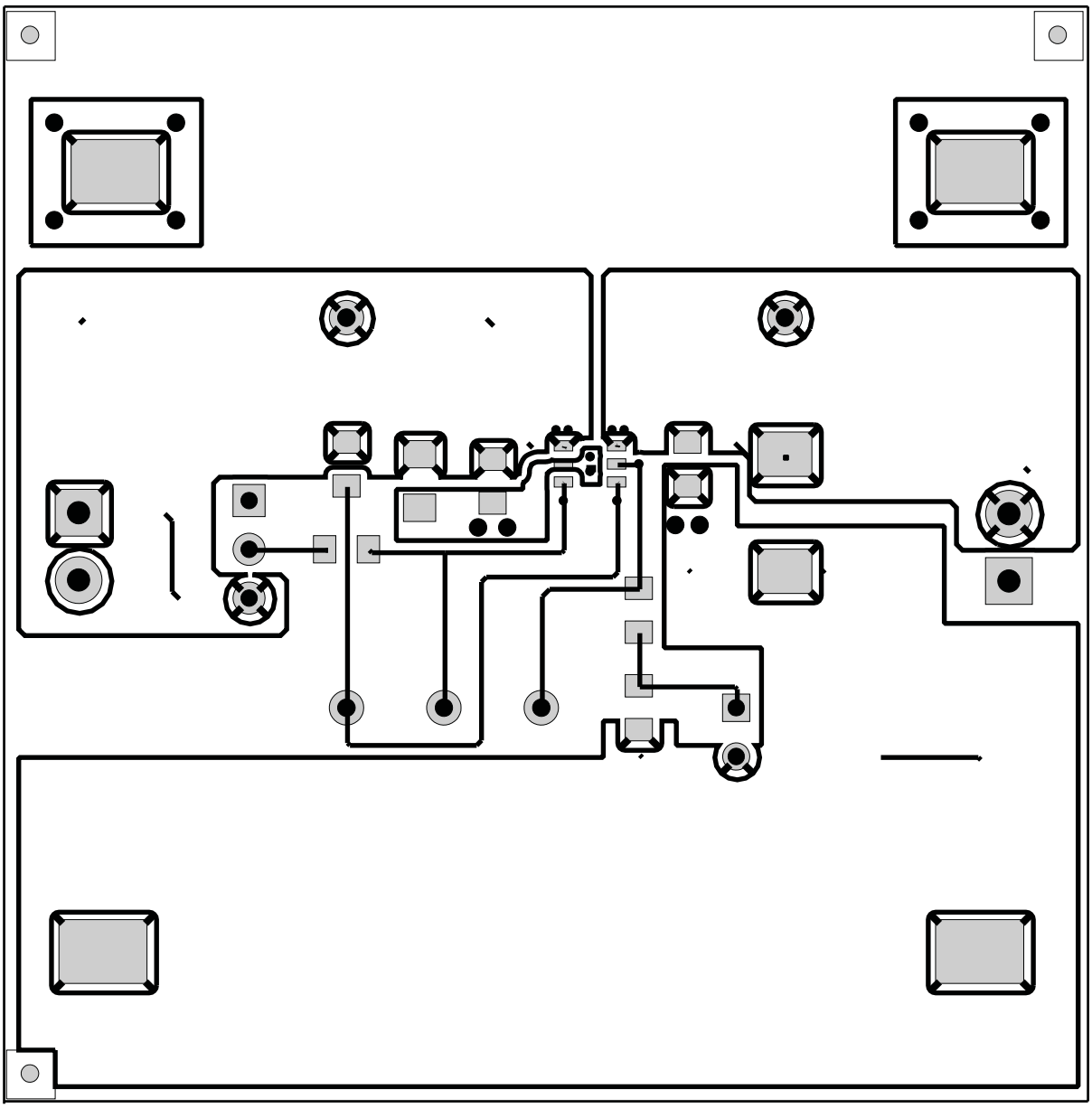

**Figure 6. EVM Top-Side Layout**

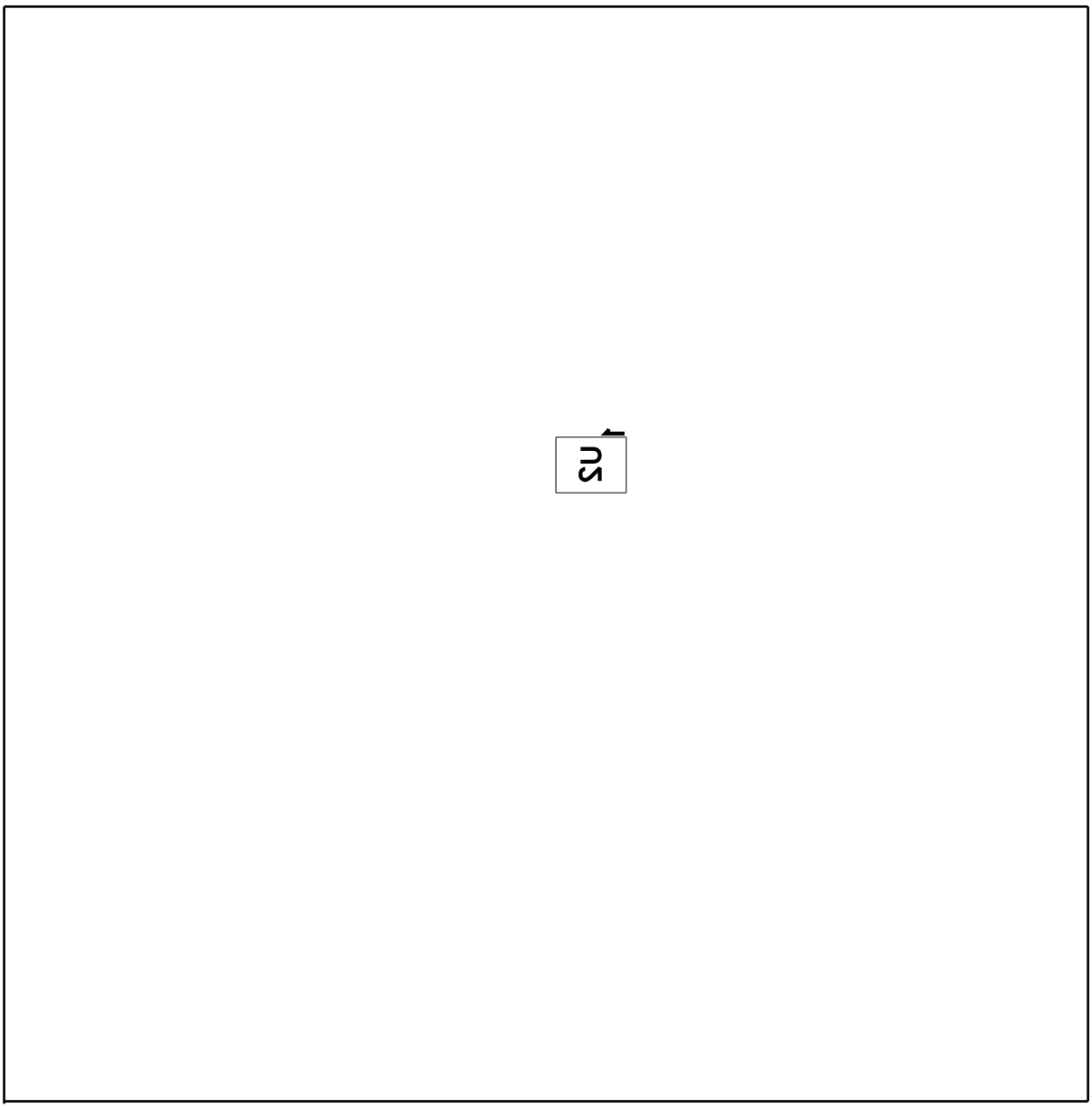

**Figure 7. EVM Bottom Assembly**

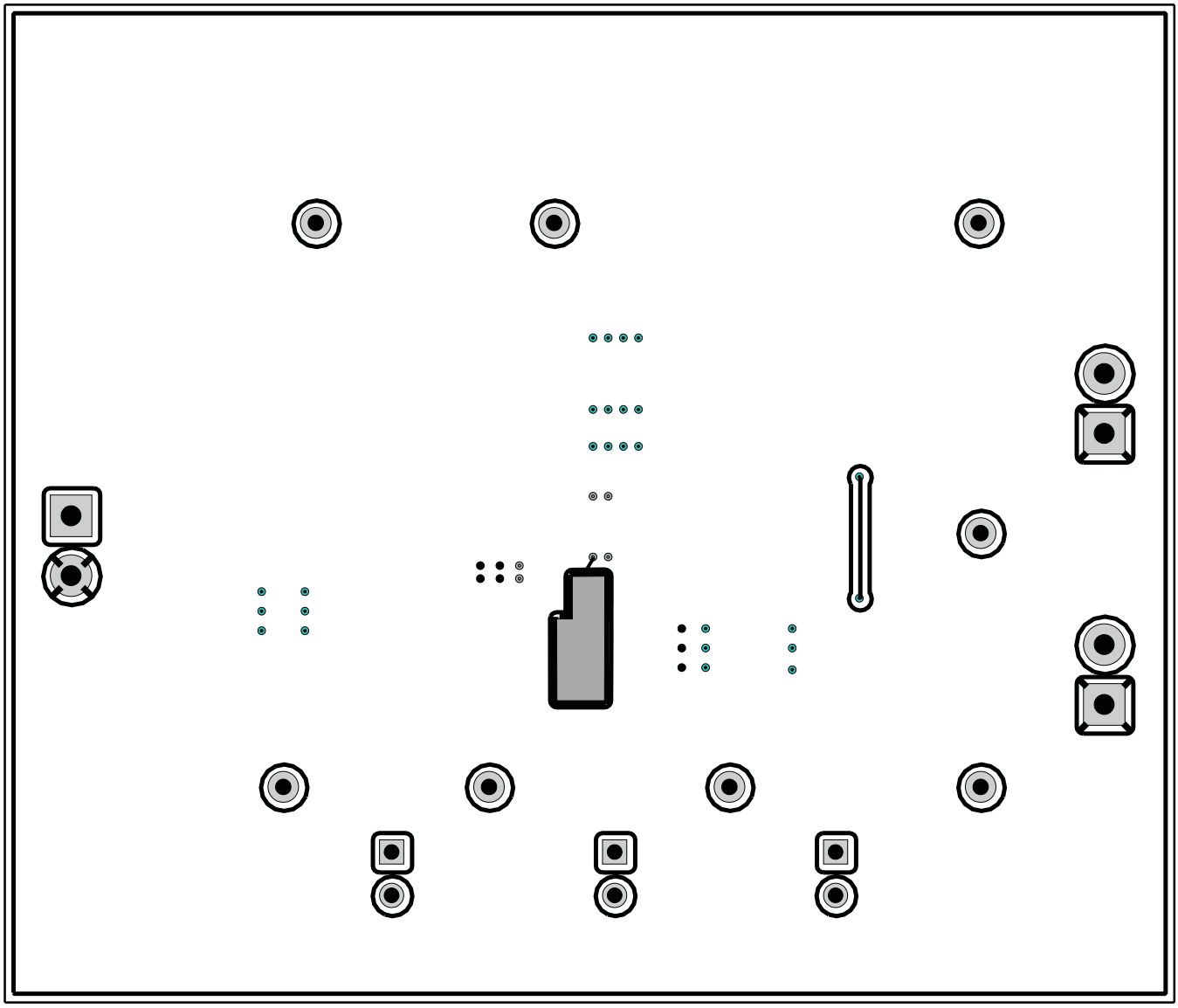

**Figure 8. EVM Bottom-Side Layout**

# 6 List of Materials

**Table 3. TPS2500/1 List of Materials(1)(2)(3)(4)**

| TPS2501 | TPS2500 | REF DES | DESCRIPTION | PART NUMBER | MFR |
|---|---|---|---|---|---|
| 1 | 1 | C1 | Capacitor, ceramic, 10 V, X5R, 10%, 10 µF, 0805 | C2012X5R1A106K | TDK |
| 2 | 2 | C2, C5 | Capacitor, ceramic, 16 V, X7R, 10%, 0.1 µF, 0805 | STD | STD |
| 1 | 1 | C3 | Capacitor, aluminum, SM, 20%, 6.3 V , 100 µF, D Code | EEVFK0J101P | Panasonic |
| 1 | 1 | C4 | Capacitor, ceramic, 10 V, X5R, 10%, 22 µF, 1210 | C3225X5R1A226M | TDK |
| 1 | 1 | C6 | Capacitor, tantalum, 150 µF, 10 V, 100 mΩ, 10%, 150 µF, 7343 (D) | B45197A2157K409 | KEMET |
| 1 | 1 | C7 | Capacitor, aluminum, 6.3 V, 20%, 470 µF, 0.328 x 0.390 inch | EEVFK0J471P | Panasonic |
| 3 | 3 | J1, J5, J6 | Terminal block, 2 pin, 6 A, 3.5 mm, 0.27 x 0.25 inch | ED1514 | OST |
| 3 | 3 | J2, J3, J4 | Header, male 2 pin, 100-mil spacing, (36-pin strip), 0.100 inch x 2 | PTC36SAAN | Sullins |
| 1 | 1 | L1 | Inductor, SMT, 2.3 A, 70 mΩ, 2.2 µH, 0.153 x 0.153 inch | LPS4018-222ML | Coilcraft |
| 0 | 0 | L2 | Inductor, SMT, 4.2 A, 16.5 mΩ, 2.2 µH, 0.300 sq" | DR73-2R2-R | Coiltronics |
| 3 | 3 | R1, R4, R5 | Resistor, chip, 1/16 W, 5%, 10 kΩ, 0603 | CRCW0603-103-J | Vishay |
| 2 | 2 | R2, R3 | Resistor, chip, 1/16 W, 1%, 20.0 kΩ, 0603 | CRCW0603-2002-F | Vishay |
| 0 | 0 | SH1 | Ground symbol | | |
| 4 | 4 | TP1, TP2, TP3, TP4 | Test point, SM, 0.150 x 0.090, 5016, 0.185 x 0.135 inch | 5016 | Keystone |
| 8 | 8 | TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12 | Test point, white, thru hole color keyed, 5002, 0.100 x 0.100 inch | 5002 | Keystone |
| 0 | 1 | U1 | Integrated USB Switch w/ Boost Converter, DRC10 | TPS2500DRC | TI |
| 1 | 0 | U1 | Integrated USB Switch w/ Boost Converter, DRC10 | TPS2500DRC | TI |
| 1 | 1 | -- | PCB, 2.3 In x 2.7 In x 0.062 In | HPA337 | Any |
| 3 | 3 | -- | Shunt, 100 mil, black, 0.100 | 929950-00 | 3M |

(1) 1. These assemblies are ESD sensitive, ESD precautions shall be observed.
(2) 2. These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.
(3) These assemblies must comply with workmanship standards IPC-A-610 Class 2.
(4) Ref designators marked with an asterisk ('**') cannot be substituted. All other components can be substituted with equivalent MFG's components.

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## EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 1.8 V to 5.5 V and the output voltage range of 1.8 V to 5.5 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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