TPS62122EVM

This user's guide describes the characteristics, operation, and use of the TPS62122 evaluation module (EVM). The TPS62122EVM-586 is a fully assembled and tested circuit for evaluating the performance of the TPS62122 high-input voltage step-down converter. This document includes schematic diagrams, a printed circuit board (PCB) layout, bill of materials, and test data. Throughout this document, the abbreviation *EVM* and the term *evaluation module* are synonymous with the TPS62122EVM-586 unless otherwise noted.

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1 Introduction

The TPS62122 is a high-efficiency, synchronous step-down, dc-dc converter optimized for low-power applications. The wide operating input voltage range of 2 V to 15 V supports energy harvesting and battery-powered as well 9-V or 12-V line-powered applications.

The TPS62122EVM-586 is a fully assembled and tested platform for evaluating the operation and performance of the TPS62122 converter. The TPS62122EVM-586 has an input voltage range from 2.0 V up to 15 V, and the output voltage is adjustable with an external feedback divider network in the range of 1.2 V to 5.5 V. The maximum output current of the EVM circuit is 75 mA.

1.1 Features

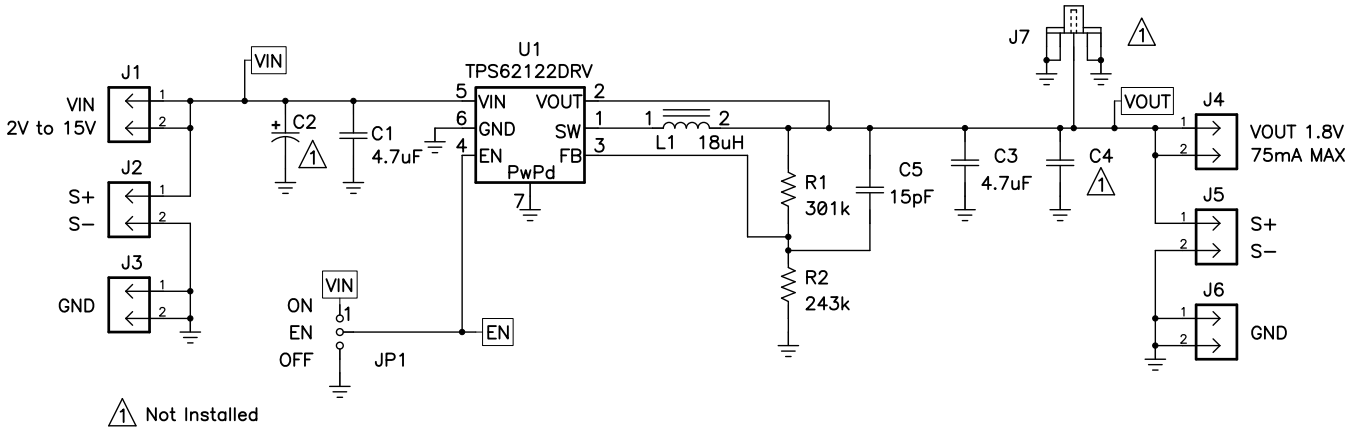
- High input voltage range: 2.0 V up to 15 V
- Adjustable output voltage: 1.2 V up to 5.5 V
- Up to 75-mA output current
- Up to 800-kHz switching frequency

1.2 Applications

- Ultralow-power microcontroller supply
- Energy harvesting
- Industrial measurement

2 TPS62122EVM Schematic

Figure 1 illustrates the TPS62122EVM-586 schematic.



NOTE: For reference only; see Table 1 for specific values.

Figure 1. TPS62122EVM Schematic

3 Connector and Test Point Descriptions

3.1 Enable Jumpers/Switches (RefDes) TPS62122

3.1.1 J1 VIN

This header is the positive connection to the input power supply. The power supply must be connected between J1 and J3 (GND). The leads to the input supply should be twisted and kept as short as possible. The input voltage must be between 2.0 V and 15.0 V.

3.1.2 J2 S+/S–

J2 S+/S– are the sense connection for the input of the converter. Connect a voltmeter, sense connection of a power supply, or oscilloscope to this header.

3.1.3 J3 GND

This header is the return connection to the input power supply. Connect the power supply between J3 and J11 (VIN). The leads to the input supply should be twisted and kept as short as possible. The input voltage must be between 2.0 V and 15.0 V.

3.1.4 J4 VOUT

This header is the positive output of the step-down converter. The output voltage of the TPS62122 is adjustable, with the feedback resistors R1 and R2. On the EVM, the output voltage can be adjusted in the range of 1.2 V to 5.5 V.

Note: A feed-forward capacitor is required. Refer to the TPS62122 data sheet (SLVSAD5) for detailed information.

3.1.5 J5 S+/S–

J5 S+/S– are the sense connection for the output of the converter. Connect a voltmeter, sense connection of an electronic load, or oscilloscope to this header.

3.1.6 J6 GND

J6 is the return connection of the converter. A load can be connected between J4and J6 (VOUT). The converter is able to support a load current of up to 75 mA.

3.1.7 JP1 EN

This jumper enables/disables the TPS62122 on the EVM. The shorting jumper JP1 between the center pin and ON turns on the unit. Shorting the jumper between the center pin and OFF turns the unit off.

3.1.8 J7 VOUT (SMA)

The J7 SMA connector is connected to the output voltage of the TPS62122. The noise spectrum of the output voltage can be easily analyzed with a spectrum analyzer.

By default, J7 is not assembled on the EVM.

4 Test Configuration

4.1 Hardware Setup

Figure 2 illustrates a typical hardware test configuration.

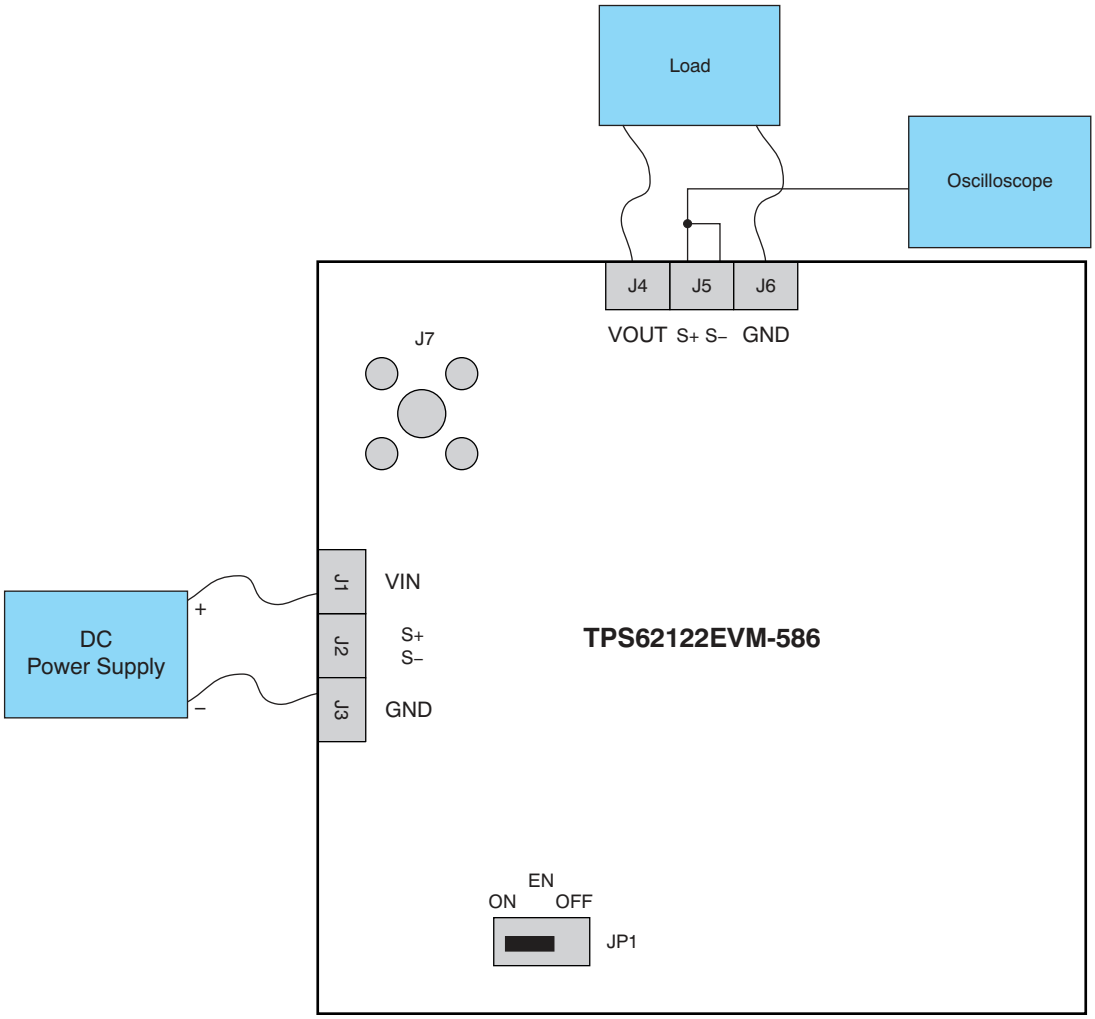


Figure 2. Hardware Board Connection

4.2 Procedure

Follow these procedures when configuring the EVM for testing.

CAUTION

Many of the components on the TPS62122EVM-586 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, bootstraps, or mats at an approved ESD workstation. An electrostatic smock and safety glasses should also be worn.

1. Work at an ESD workstation. Make sure that any wrist straps, bootstraps, or mats are connected and reference the user to earth ground before power is applied to the EVM. Electrostatic smock and safety glasses should also be worn.
2. Connect a dc power supply between J1 and J3 on the TPS62122EVM. Note that the input voltage should range from 2.0 V to 15 V. Keep the wires from the input power supply to EVM as short as possible and twisted.
3. Connect a dc voltmeter or oscilloscope to the output sense connection (J5) of the EVM.
4. A load of up to 75 mA can be connected between J4 and J6 on the TPS62122EVM.
5. To enable the converter, connect the shorting bar on JP1 between EN and ON on the TPS62122EVM.

5 TPS62122EVM Test Data

Figure 4 through Figure 10 present typical performance graphs for the TPS62122EVM. Actual performance data can be affected by measurement techniques and environmental variables; therefore, these curves are presented for reference and may differ from actual results obtained by some users.

5.1 Efficiency

Figure 4 shows the typical efficiency performance for the TPS62122EVM.

Figure 3. EFFICIENCY vs INPUT VOLTAGE V_{IN} (V_{OUT} = 3.0V)

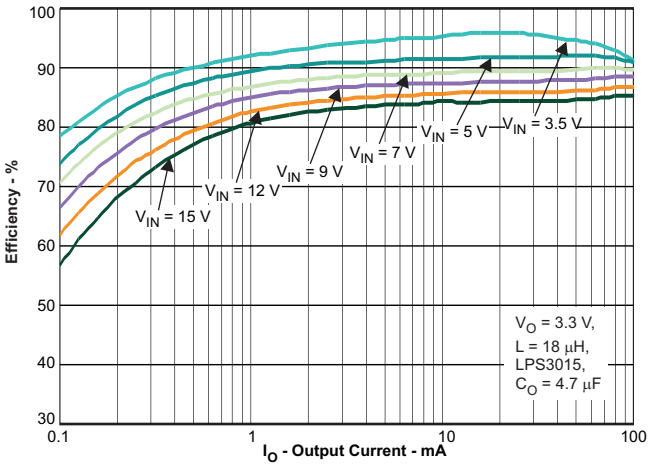


Figure 4. TPS62122EVM Efficiency versus Load Current

5.2 Start-Up

Figure 5 and Figure 6 show the typical start-up performance for different TPS62122EVM boards.

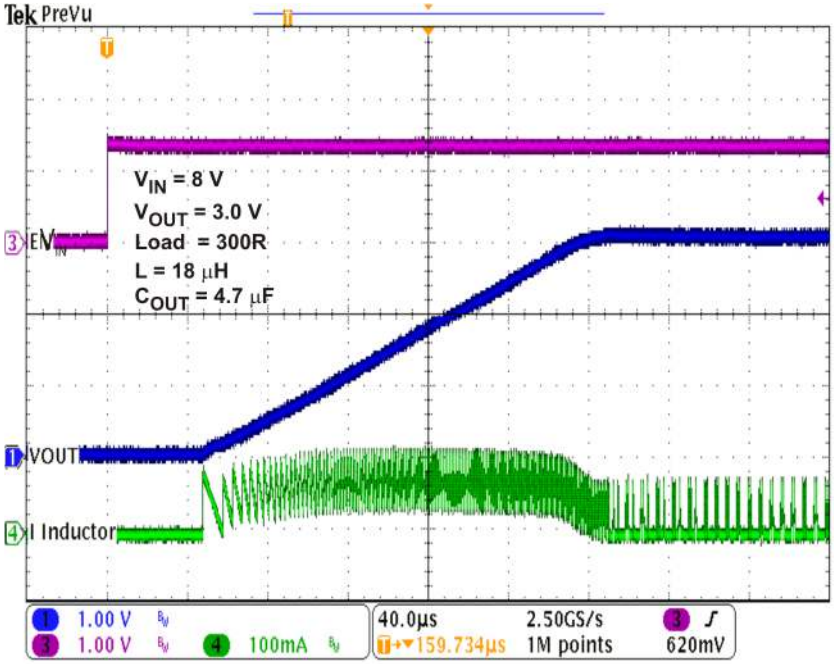


Figure 5. TPS62122EVM Startup into 300-Ω Load (V_{IN} = 8.0 V, V_{OUT} = 3.0 V)

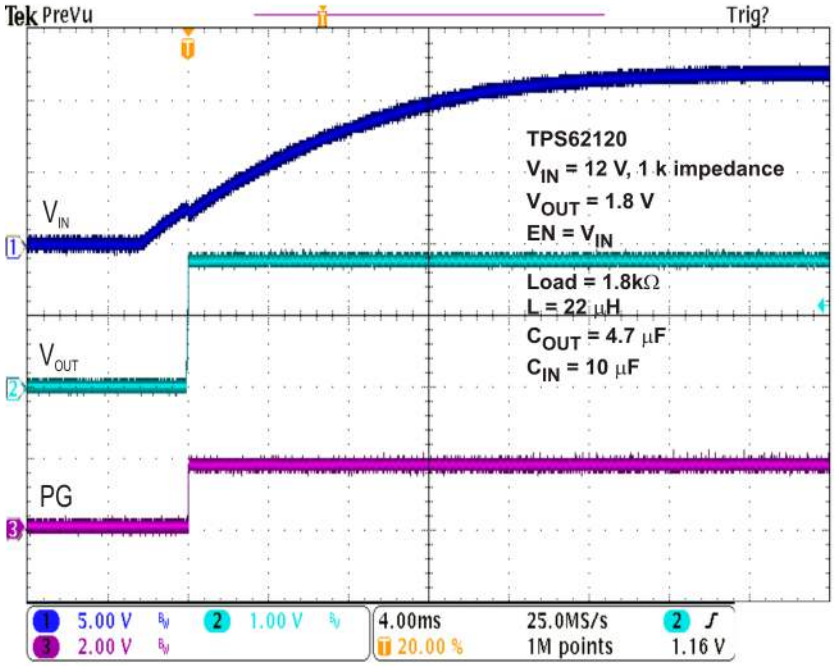


Figure 6. TPS62122EVM Start-Up from a High-Impedance Source (V_{IN} = 12.0 V, V_{OUT} = 3.0 V)

5.3 Load Transient Response

Figure 7 illustrates the load transient response for the TPS62122.

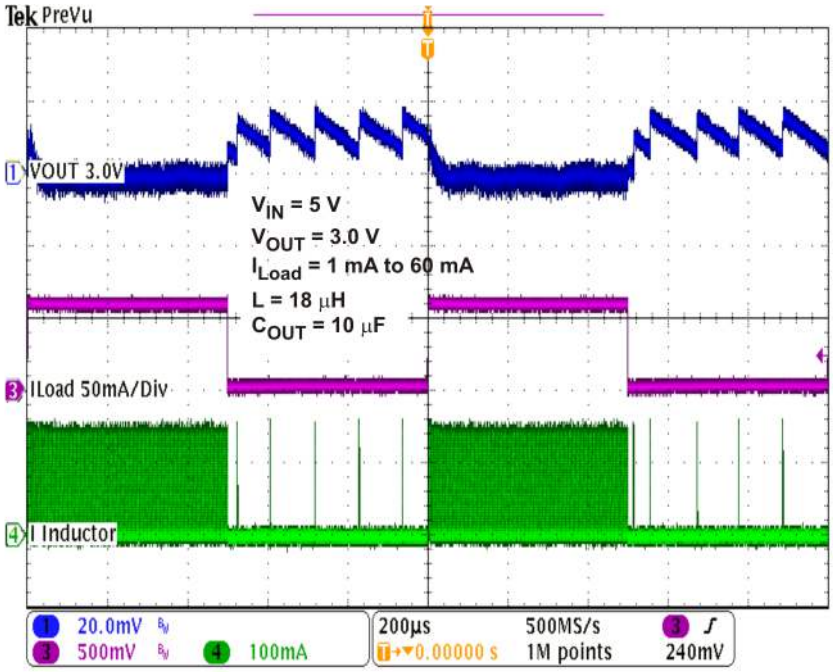


Figure 7. TPS62122 Load Transient Response (V_{IN} = 8.0 V, V_{OUT} = 1.8 V)

5.4 Typical Operation, 60 mA

Figure 8 illustrates the typical output voltage ripple for the TPS62122 with a 60-mA load.

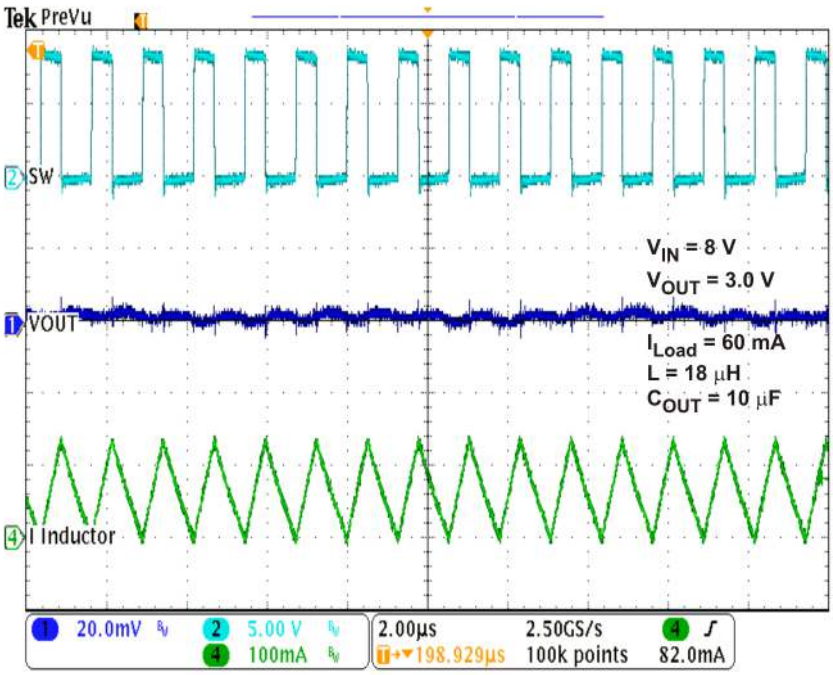


Figure 8. TPS62122EVM Output Ripple, 60-mA Load (V_{IN} = 8.0 V, V_{OUT} = 3.0 V)

5.5 Typical Operation, 10 mA

Figure 9 illustrates the typical output voltage ripple for the TPS62122 with a 10-mA load.

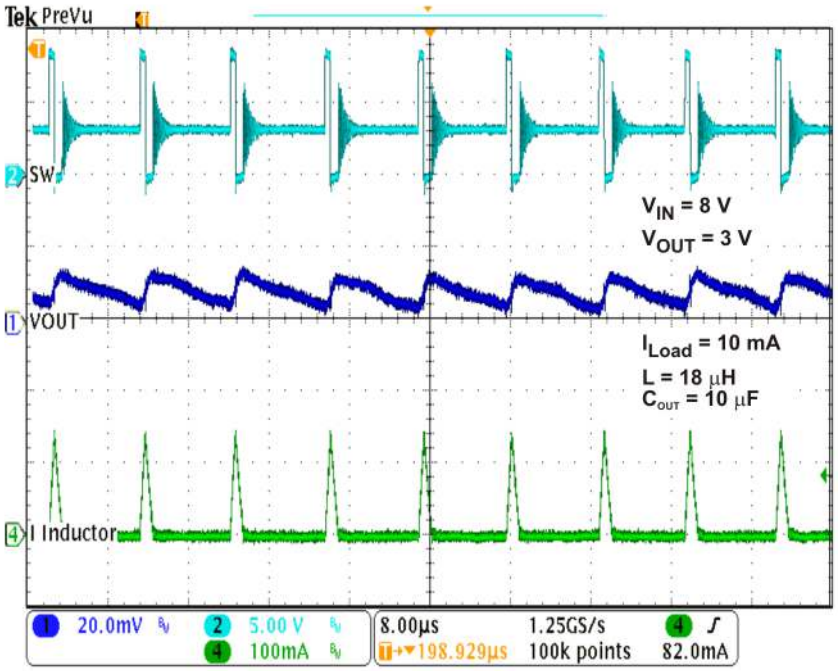


Figure 9. TPS62122EVM Output Ripple, 10-mA Load (V_{IN} = 8.0 V, V_{OUT} = 3.0 V)

5.6 Current Limit Operation

Figure 10 shows the current limit operation of the TPS62122.

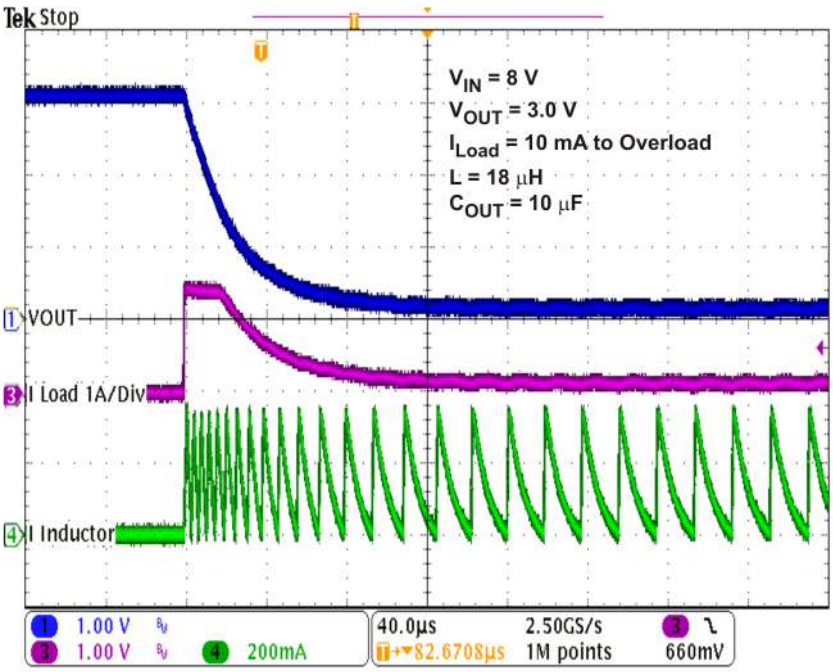


Figure 10. Current Limit Operation

6 TPS62122EVM Assembly Drawings and Layout

Figure 11 through Figure 13 show the design of the show the design of the TPS62122EVM-586 printed circuit board. The EVM has been designed using a four-layer, 1-ounce copper-clad PCB.

NOTE: Board layouts are not to scale. These figures are intended to show how the board is laid out; they are not intended to be used for manufacturing TPS62122EVM-586 PCBs.

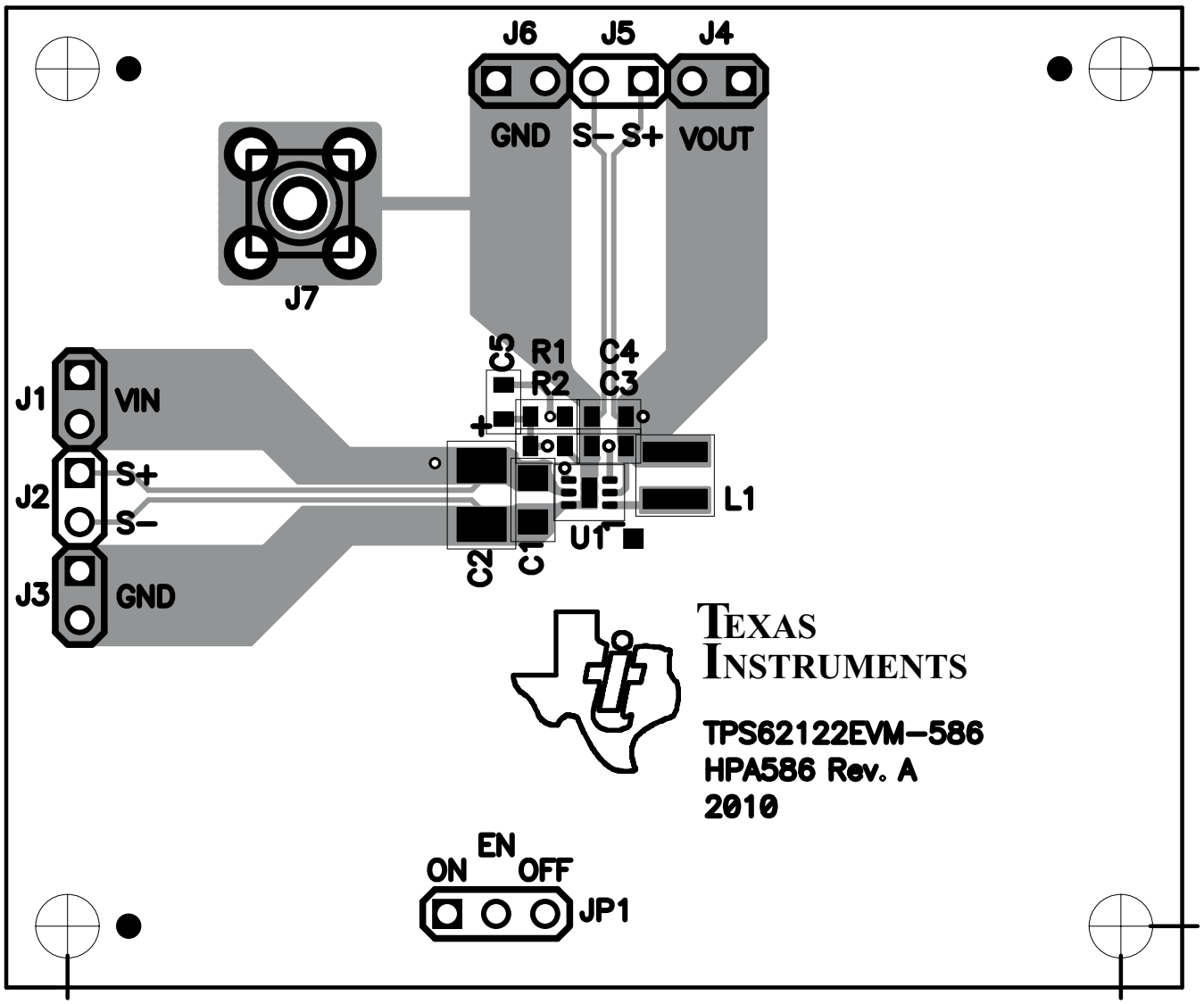


Figure 11. TPS62122EVM Component Placement (Top View)

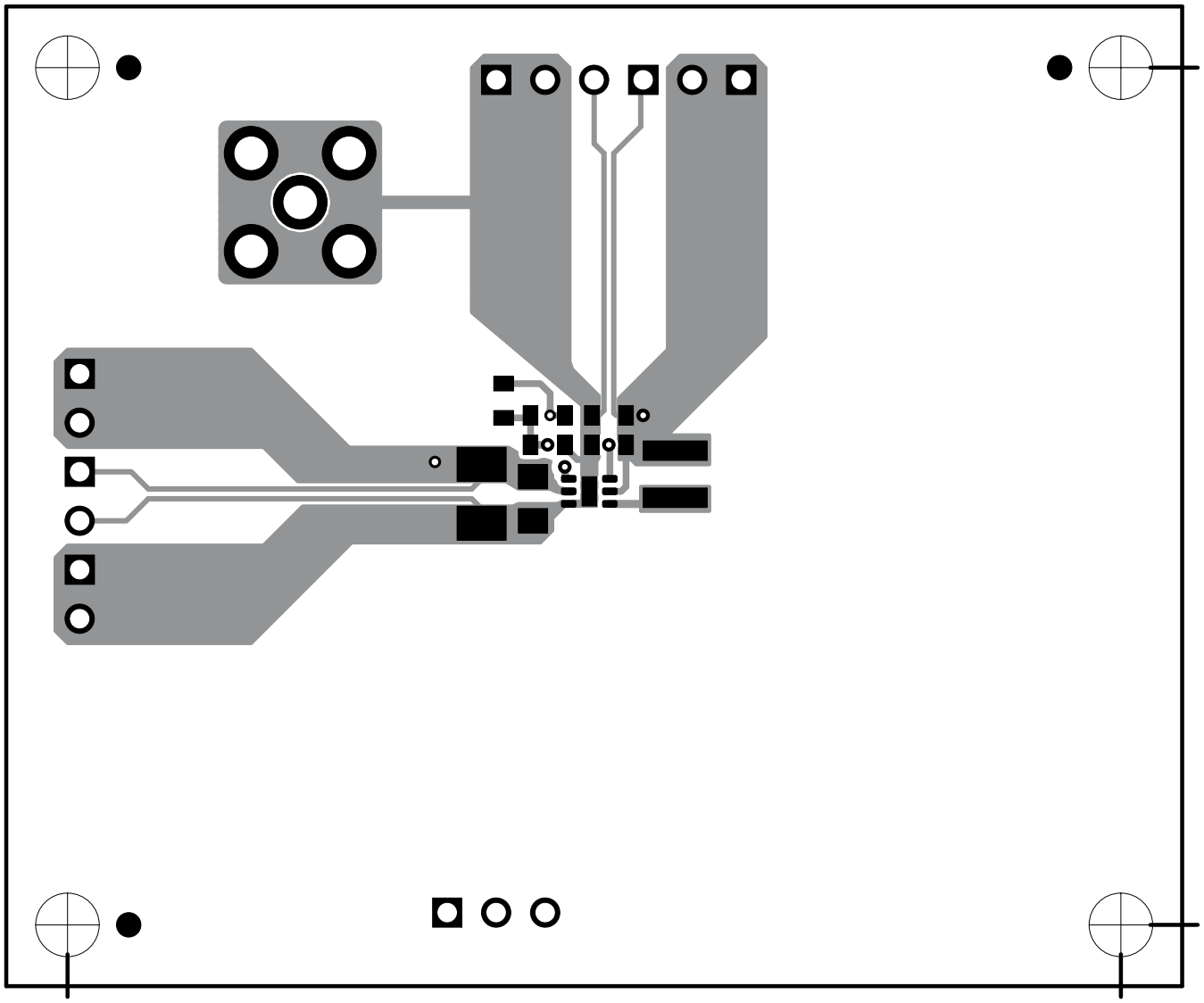


Figure 12. TPS62122EVM Top-Side Copper (Top View)

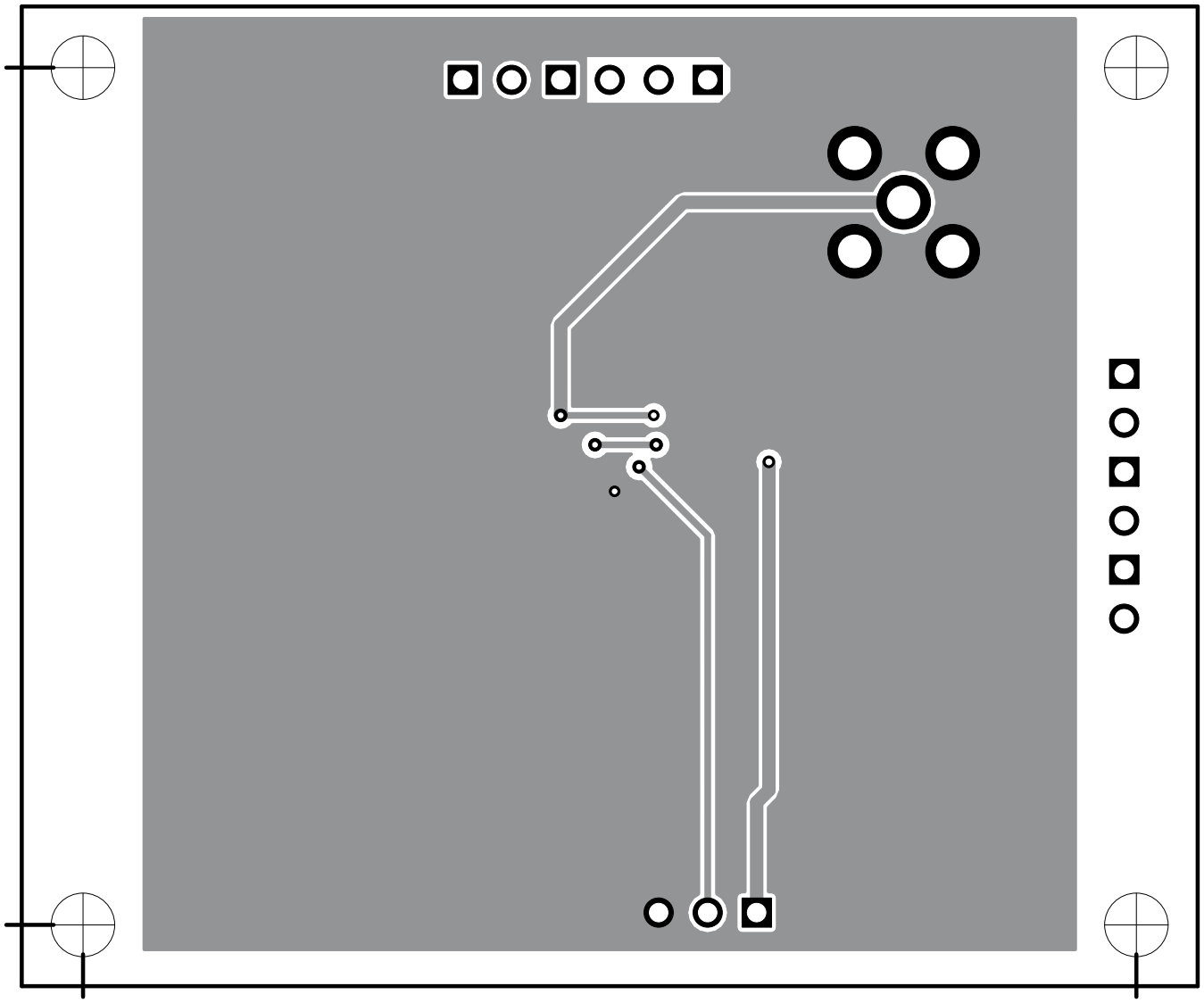


Figure 13. TPS62122EVM Bottom-Side Copper (Bottom View)

7 Bill of Materials

Table 1 lists the bill of materials for the TPS62122EVM.

Table 1. TPS62122EVM-586 Bill of Materials

Count	RefDes	Value	Description	Size	Part Number	MFR
1	C1	4.7 µF	Capacitor, Ceramic, 25 V, X5R, 20%	0805	GRM21BR61E475MA12L	muRata
0	C2	Open	Capacitor, Polymer Type, 20 V, ±20%	3528(B)	20TQC8R2M	Sanyo
1	C3	4.7 µF	Capacitor, Ceramic, Low Inductance, 6.3 V, X5R, 20%	0603	GRM188R60J475ME19D	muRata
0	C4	Open	Capacitor, Ceramic, Low Inductance, 6.3 V, X5R, 20%	0603	GRM188R60J106ME47D	muRata
1	C5	15 pF	Capacitor, Ceramic, 50 V, C0G-NP0, 5%	0603	Std	Std
1	L1	18 µH	Inductor, SMT, 0.56 A, 750milliohm	0.118 x 0.118 inch	LPS3015-183ML	Coilcraft
1	R1	301k	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	R2	243k	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	U1	TPS62122DRV	IC, 15V, 75mA High-Efficiency Buck Converter with Snooze Mode	SON-6 [DRV]	TPS62122DRV	TI

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It is important to operate this EVM within the input voltage range of 2 V to 15 V and the output voltage range of 1.2 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 +60°C. The EVM is designed to operate properly with certain components above +60°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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