User's Guide

TPS62175 Buck Converter Evaluation Module User's Guide

ABSTRACT

This user's guide describes the characteristics, operation, and use of the Texas Instruments TPS62175 evaluation module (EVM). This EVM is designed to help the user easily evaluate and test the operation and functionality of the TPS62175. The EVM converts a 4.75-V to 28-V input voltage to a regulated 3.3-V output voltage that delivers 500 mA. This user's guide includes setup instructions for the hardware, a printed-circuit board layout for the EVM, a schematic diagram, a bill of materials, and test results for the EVM.

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1 Introduction

The TPS62175 is a 500-mA, synchronous, step-down converter in a 2x3-mm, 10-pin WSON package. Both fixed and adjustable output voltage units are available.

1.1 Background

The TPS62175EVM-098 (PWR098-001) uses the TPS62175 adjustable version and is set to a 3.3-V output. The EVM operates with full-rated performance with an input voltage between 4.75 V and 28 V.

1.2 Performance Specification

Table 1-1 provides a summary of the TPS62175EVM-098 performance specifications. All specifications are given for an ambient temperature of 25°C.

Table 1-1. Performance Specification Summary

Specification	Test Conditions	Min	Typ	Max	Unit
Input Voltage		4.75		28	V
Output Voltage	DC setpoint; does not include voltage ripple	3.27	3.33	3.39	V
Output Current	SLEEP = HIGH (OFF)	0		500	mA
Peak Efficiency	VIN = 4.75 V		92.2%		
Soft-Start Time	Ramp Time of VOUT		330		µs
Soft-Start Delay Time	Time from HIGH EN to Start of VOUT Ramp		1		ms

1.3 Modifications

The printed-circuit board (PCB) for this EVM is designed to accommodate both the fixed and adjustable voltage versions of this integrated circuit (IC). Additional input and output capacitors can also be added. Finally, the loop response of the IC can be measured.

1.3.1 Fixed Output Voltage Operation

U1 can be replaced with the fixed-voltage version of the IC for evaluation. For fixed-voltage version operation, replace R2 with a 0-Ω resistor and remove R1.

1.3.2 Input and Output Capacitors

C3 is provided for an additional input capacitor. This capacitor is not required for proper operation but can be used to reduce the input voltage ripple.

C4 and C6 are provided for additional output capacitors. These capacitors are not required for proper operation but can be used to reduce the output voltage ripple and to improve the load transient response. The total output capacitance must remain within the recommended range in the data sheet for proper operation.

1.3.3 Loop Response Measurement

The loop response of the TPS62175EVM-098 can be measured with two simple changes to the circuitry. First, install a 10-Ω resistor across the pads in the middle of the back of the PCB. The pads are spaced to allow installation of 0805- or 0603-sized resistors. Second, cut the short section of trace between the via on the VOS pin and the output capacitor C2. This change is shown in Figure 1-1. With these changes, an ac signal (10-mV, peak-to-peak amplitude recommended) can be injected into the control loop across the added resistor.

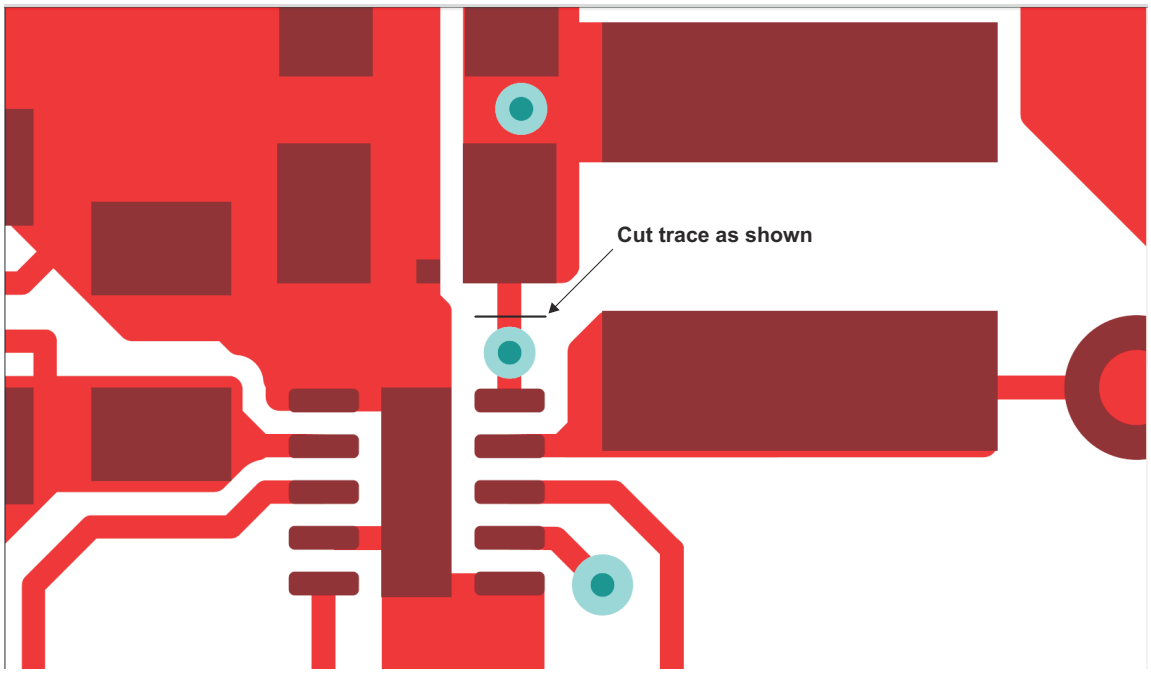

Figure 1-1. Loop Response Measurement Modification

2 Setup

This section describes how to properly use the TPS62175EVM-098.

2.1 Input/Output Connector Descriptions

J1 – VIN	Positive input connection from the input supply for the EVM.
J2 – S+/S-	Input voltage sense connections. Measure the input voltage at this point.
J3 – GND	Return connection from the input supply for the EVM.
J4 – VOUT	Output voltage connection.
J5 – S+/S-	Output voltage sense connections. Measure the output voltage at this point.
J6 – GND	Output return connection.
J7 – PG/GND	The PG output appears on pin 1 of this header with a convenient ground on pin 2.
JP1 – EN	EN pin input jumper. Place the supplied jumper across ON and EN to turn on the IC. Place the jumper across OFF and EN to turn off the IC.
JP2 – SLEEP	SLEEP pin input jumper. Place the supplied jumper across ON and SLEEP to activate SLEEP mode. Place the jumper across OFF and SLEEP to activate normal mode.
JP3 – PG Pullup Voltage	PG pin pullup voltage jumper. Place the supplied jumper on JP3 to connect the PG pin pullup resistor to Vout. Alternatively, the jumper can be removed and a different voltage can be supplied on pin 1 to pull up the PG pin to a different level. This externally applied voltage must remain below 7 V.

2.2 Setup

To operate the EVM, set jumpers JP1 through JP3 to the desired positions per Section 2.1. Connect the input supply to J1 and J3 and connect the load to J4 and J6.

3 TPS62175EVM-098 Test Results

The TPS62175EVM-098 was used to take the data in the TPS62175 data sheet, SLVSB35. See the device data sheet for the performance of this EVM.

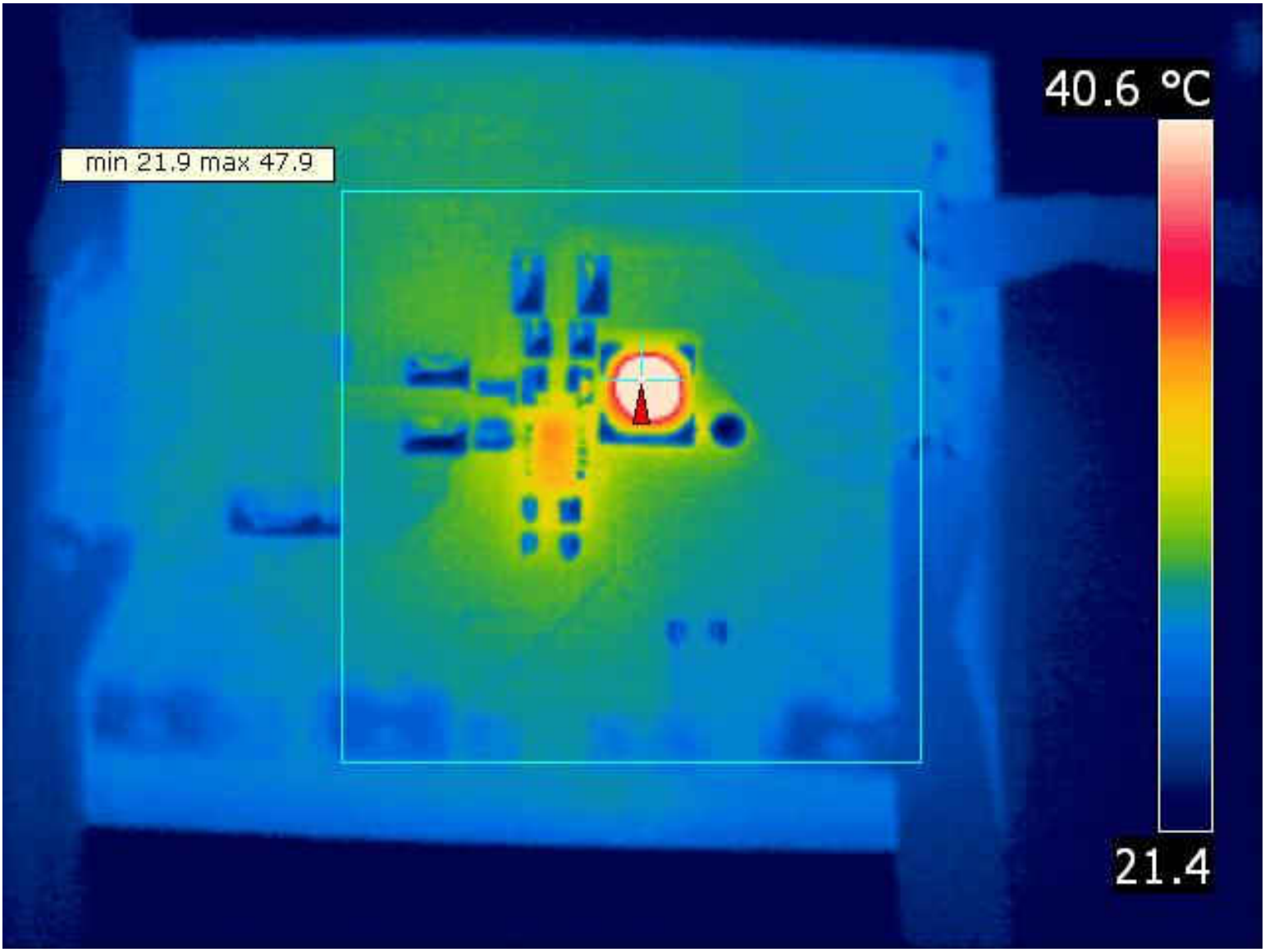

Figure 3-1. Thermal Performance (V_{IN} = 12 V, Load = 500 mA)

4 Board Layout

This section provides the TPS62175EVM-098 board layout and illustrations. The gerbers are available on the EVM product page: TPS62175EVM-098

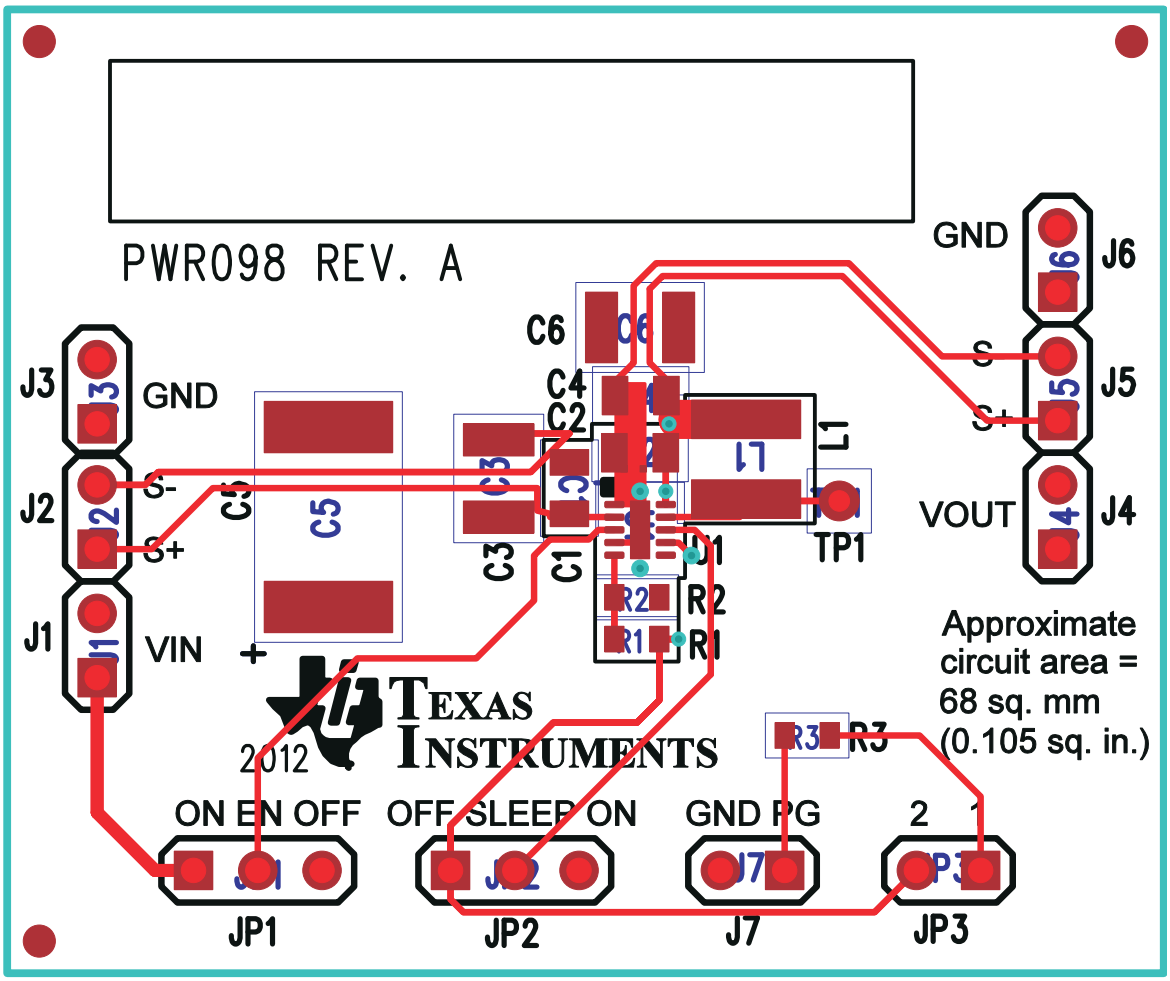

Figure 4-1. Assembly Layer

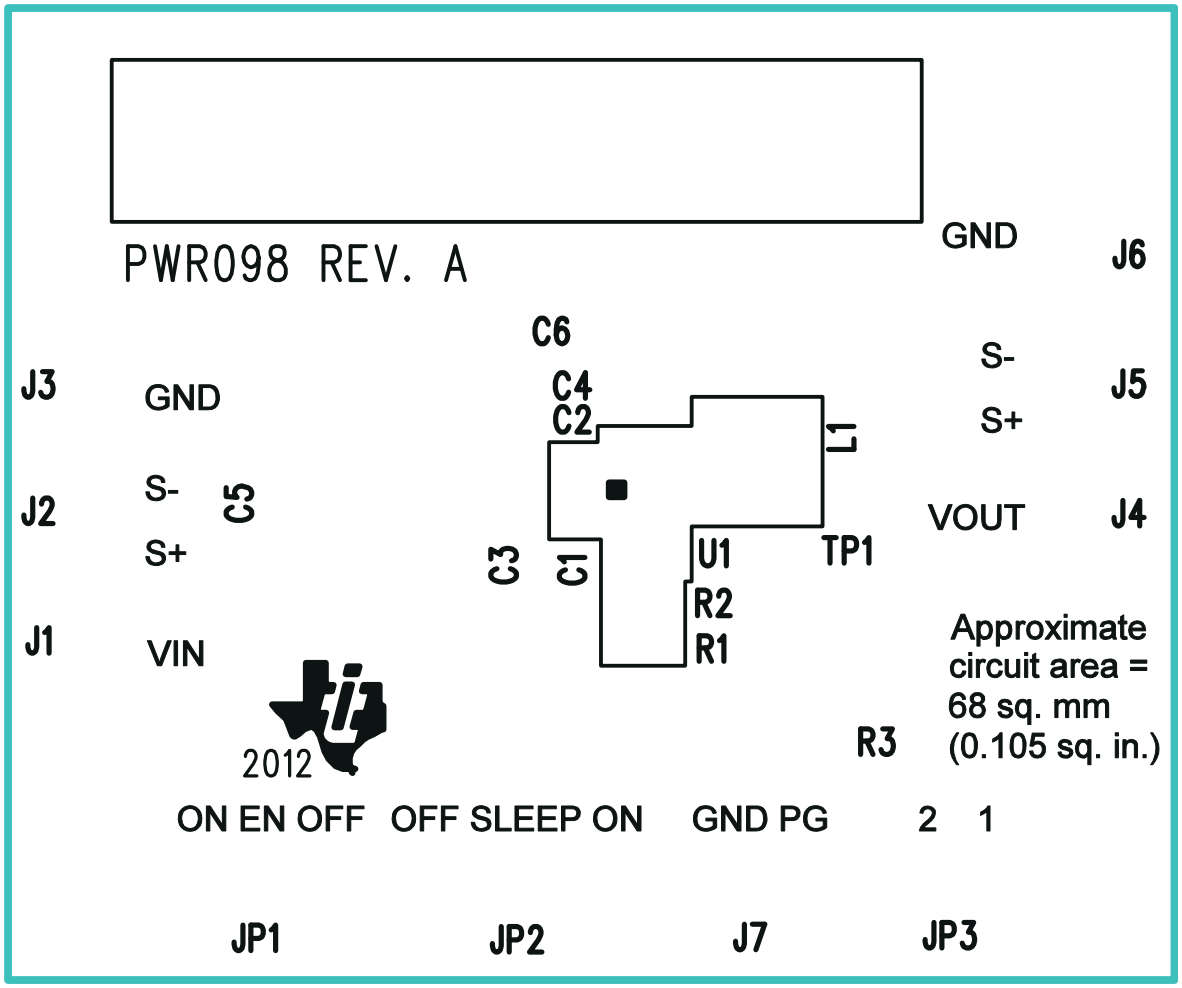

Figure 4-2. Top Silk Layer

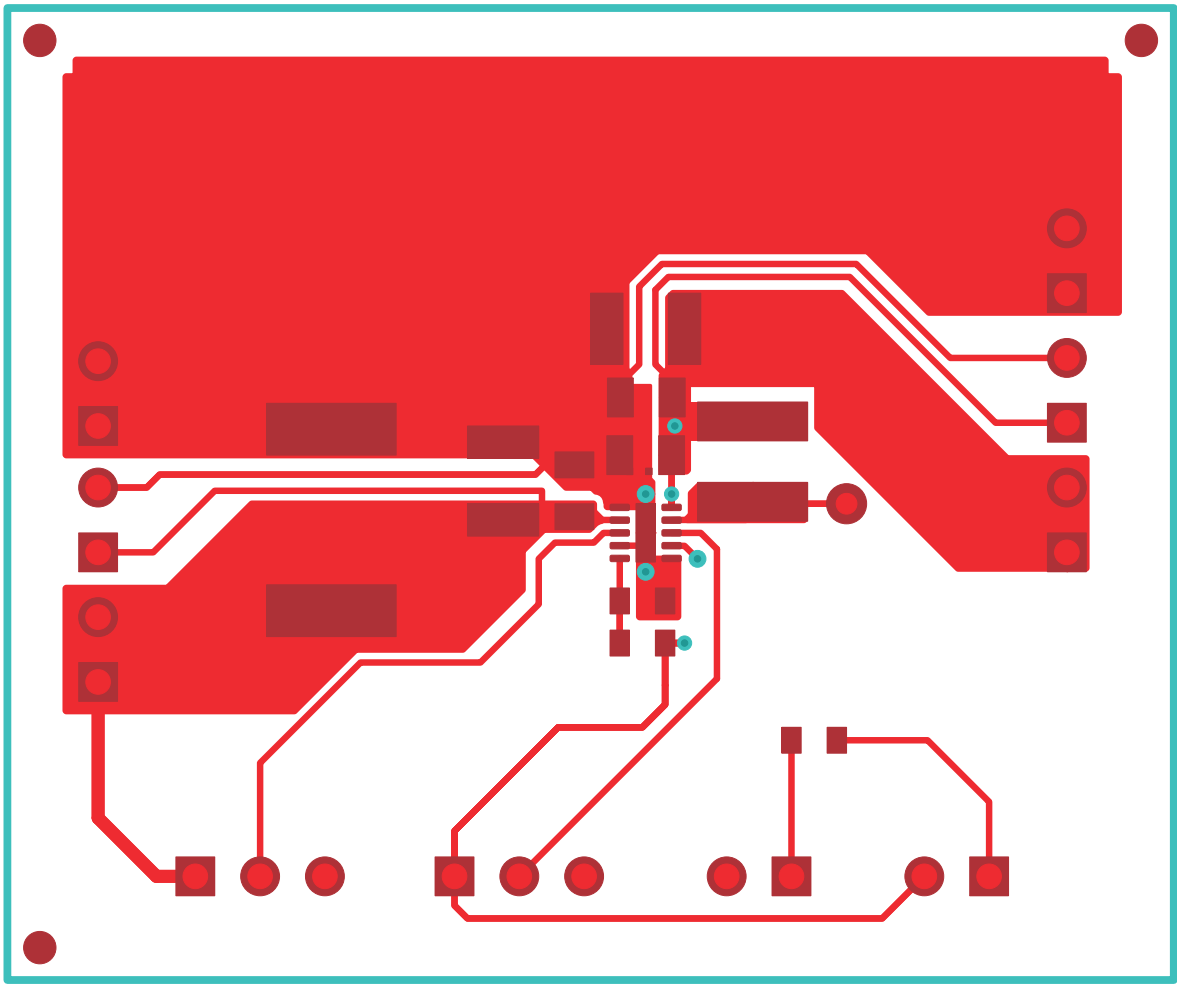

Figure 4-3. Top Layer

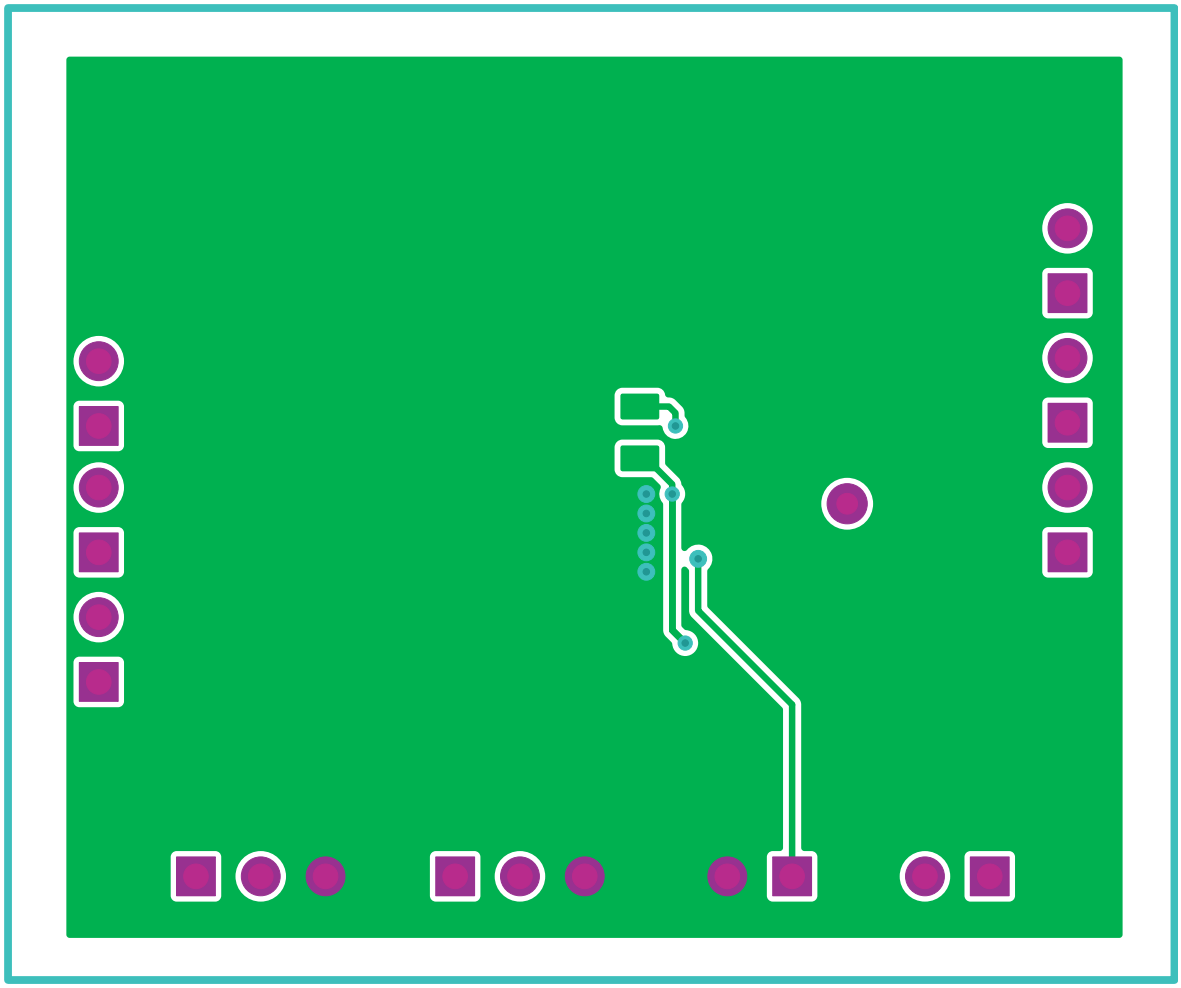

Figure 4-4. Bottom Layer

5 Schematic and Bill of Materials

This section provides the TPS62175EVM-098 schematic and bill of materials.

5.1 Schematic

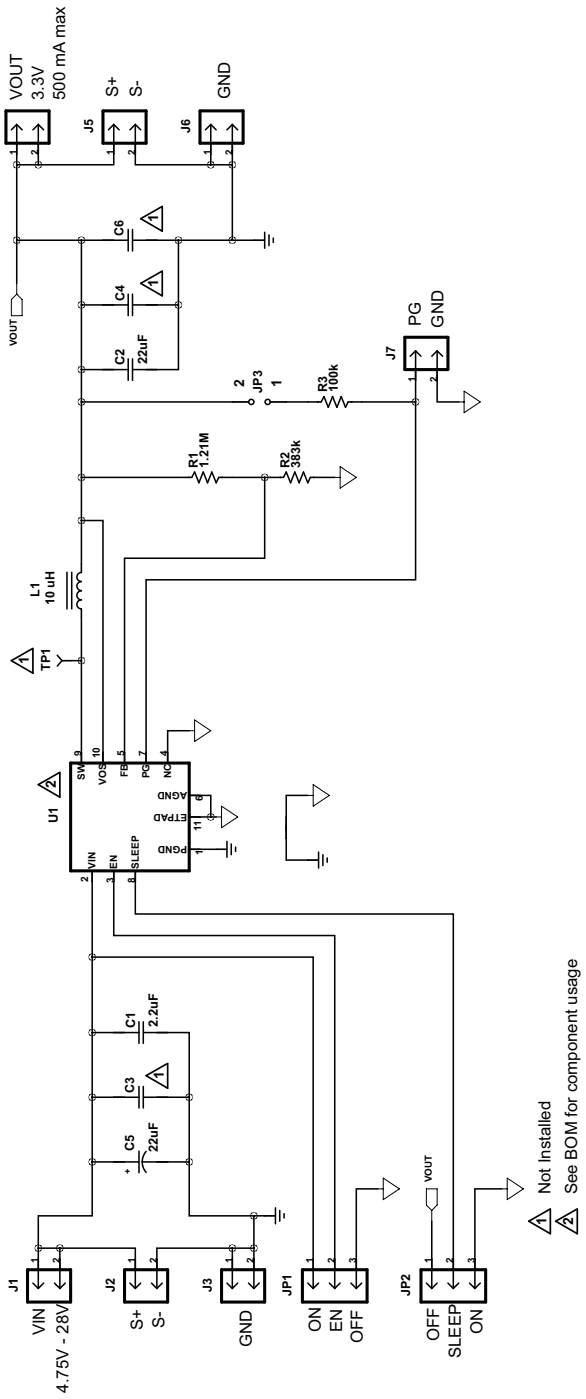

Figure 5-1. TPS62175EVM-098 Schematic

5.2 Bill of Materials

Table 5-1. TPS62175EVM-098 Bill of Materials

COUNT	RefDes	Value	Description	Size	Part Number	MFR
-001						
1	C1	2.2uF	Capacitor, Ceramic, 50V, X5R, 20%	0805	STD	STD
1	C2	22uF	Capacitor, Ceramic, 6.3V, X5R, 20%	0805	STD	STD
1	C5	22uF	Capacitor, Tantalum, 50V, ±20%	7343 (D)	TPME226M050R100	AVX
1	L1	10uH	Inductor, Power, 1.1 A, 350 mOhm	4 mm x 4 mm	LPS4012-103ML	Coilcraft
1	R1	1.21M	Resistor, Chip, 1/16W, 1%	0603	STD	STD
1	R2	383k	Resistor, Chip, 1/16W, 1%	0603	STD	STD
1	R3	100k	Resistor, Chip, 1/16W, 1%	0603	STD	STD
1	U1	TPS62175	IC, 28V 0.5A Step-Down Converter with Sleep Mode	2 mm x 3 mm	TPS62175DQC	TI

The TPS62175EVM-098 may be populated with TPS62175 (U1) devices that do not contain the correct top side markings on the top of the device itself. These devices are still fully tested TPS62175 devices and meet the specified electrical characteristics of the data sheet.

6 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision * (September 2012) to Revision A (June 2021)	Page
• Updated the numbering format for tables, figures, and cross-references throughout the document.	2
• Updated user's guide title	2

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