

**ABSTRACT**

The TPS62841-2EVM123 (BSR123) facilitates the evaluation of the TPS6284xDGR family of 750-mA, step-down converters with 60-nA I_Q in thermally-enhanced HVSSOP packages. The EVM contains two separate circuits to create output voltages between 0.8 V and 3.6 V from higher input voltages between 1.8 V and 6.5 V. Due to its extremely low I_Q , the TPS6284x provides a long battery lifetime for systems that have very low current consumption states such as building automation, metering, and the Internet of Things (IoT).

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1 Introduction

The TPS6284x is a family of synchronous, step-down converters in a 3-mm × 5-mm HVSSOP package. The BSR123 EVM contains two completely independent circuits, each for a different IC version. See [Table 1-1](#) for a summary of the BSR123 EVMs.

The reference designator order is grouped together by sub-circuit. Reference designators beginning with '1' (for example, R1x, J1x, C1x) are part of one sub-circuit. The second digit of each reference designator is the same for the same component in different sub-circuits. R11 and R21, for example, refer to the same resistor in each sub-circuit.

Table 1-1. BSR123 Circuit Options

EVM VERSION	IC INSTALLED	OUTPUT VOLTAGE	OUTPUT VOLTAGE RANGE	OUTPUT CURRENT
TPS62841-2EVM123 (BSR123)	TPS62842 (U11)	3.3 V	1.8 - 3.6 V (selectable)	750 mA
	TPS62841 (U21)	1.2 V	0.8 - 1.55 V (selectable)	750 mA

1.1 Performance Specification

[Table 1-2](#) provides a summary of the TPS62841-2EVM123 performance specifications.

Table 1-2. Performance Specification Summary

SPECIFICATION	MIN	TYP	MAX	UNIT
Input voltage	1.8	3.6	6.5	V
Output voltage	See Table 1-1			V
Output current	0		See Table 1-1	mA

1.2 Modifications

The printed-circuit board (PCB) for this EVM uses the adjustable output 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.

1.2.1 Adjusting the Output Voltage

The output voltage is adjusted through the choice of Rx1 and Rx4 resistors. Since Rx1 and Rx4 are in parallel, only Rx1 or Rx4 can be installed at the same time. Rx1 and Rx4 are 0603 sizes to make it easy to change the output voltage by replacing them. However, 0201 size resistors can also be used to reduce the total solution size.

1.2.2 Input and Output Capacitors

Cx4 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.

Cx5, Cx6, and Cx7 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.

1.2.3 Loop Response Measurement

The loop response of the EVM can be measured with two simple changes to the circuitry. First, cut the trace between the VOS pin and the output capacitor on the top layer. This change is shown in [Figure 1-1](#). Second, install a 10-Ω resistor across the resistor pads on the back of the PCB at Rx2. The pads are spaced to allow installation of an 0603-sized resistor. With these changes, an ac signal (10-mV, peak-to-peak amplitude is recommended) can be injected into the control loop across the added resistor. Details of measuring the control loop of DCS-Control devices are found in the [How to Measure the Control Loop of DCS-Control™ Devices](#) application report.

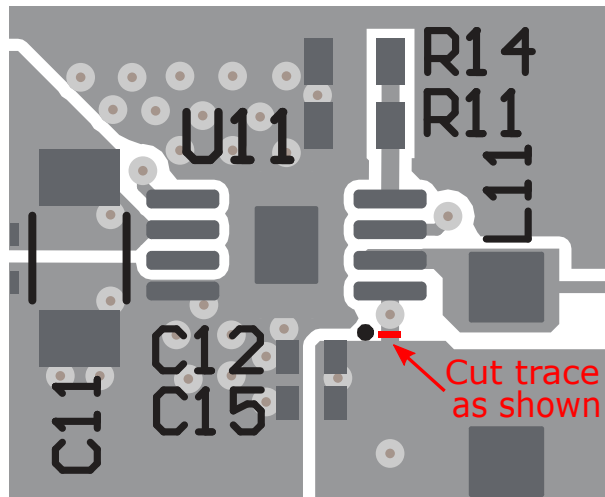


Figure 1-1. Loop Response Measurement Modification

2 Setup

This section describes how to properly use the TPS62841-2EVM123.

2.1 Input/Output Connector Descriptions

Jx1, Pin 1 and 2 – VIN	Positive input connection from the input supply for the EVM
Jx1, Pin 3 and 4 – S+/S-	Input voltage sense connections. Measure the input voltage at this point.
Jx1, Pin 5 and 6 – GND	Input return connection from the input supply for the EVM
Jx2, Pin 1 and 2 – VOUT	Output voltage connection
Jx2, Pin 3 and 4 – S+/S-	Output voltage sense connections. Measure the output voltage at this point.
Jx2, Pin 5 and 6 – GND	Output return connection
JPx1 – 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.
JPx2 – MODE	MODE pin input jumper. Place the supplied jumper across PWM and MODE to operate in forced PWM mode. Place the jumper across PFM/PWM and MODE to operate in power save mode with an automatic transition to PWM mode at higher load currents.

2.2 Setup

To operate the EVM, set jumpers JPx1 and JPx2 to the desired position per [Section 2.1](#). Connect the input supply to Jx1 and connect the load to Jx2.

3 TPS62841-2EVM123 Test Results

The TPS62841-2EVM123 was used to take all the data in the [1.8V-6.5V, 750mA, 60nA I_Q Step-Down Converter](#) data sheet. See the device data sheet for the performance of this EVM.

Figure 3-1 shows the thermal performance of the EVM.

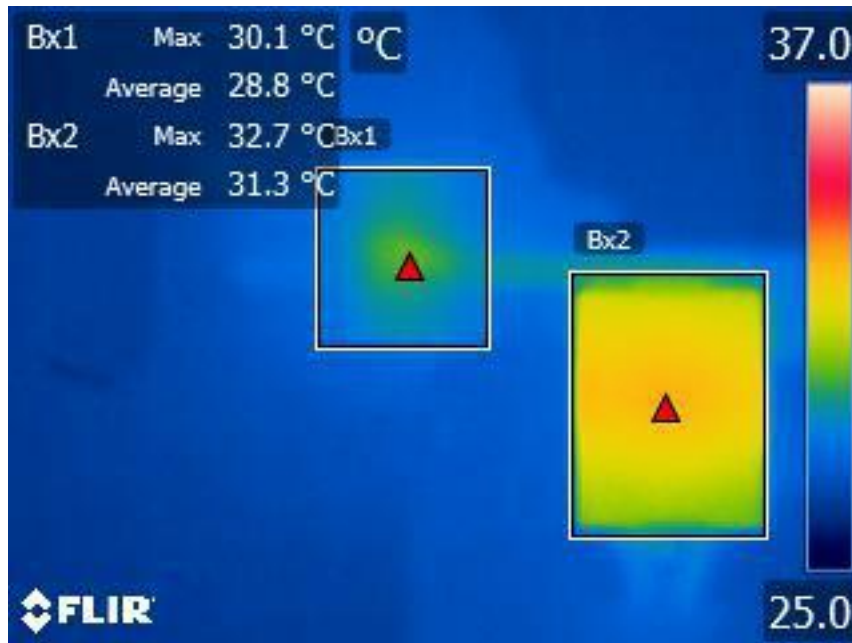


Figure 3-1. TPS62842DGR Thermal Performance ($V_{IN} = 6.5 \text{ V}$, $V_{OUT} = 3.6 \text{ V}$, $I_{OUT} = 750 \text{ mA}$)

4 Board Layout

Figure 4-1 through Figure 4-5 provide the TPS62841-2EVM123 board layout and illustrations. The Gerbers are available on the EVM product page: [TPS62841-2EVM123](#).

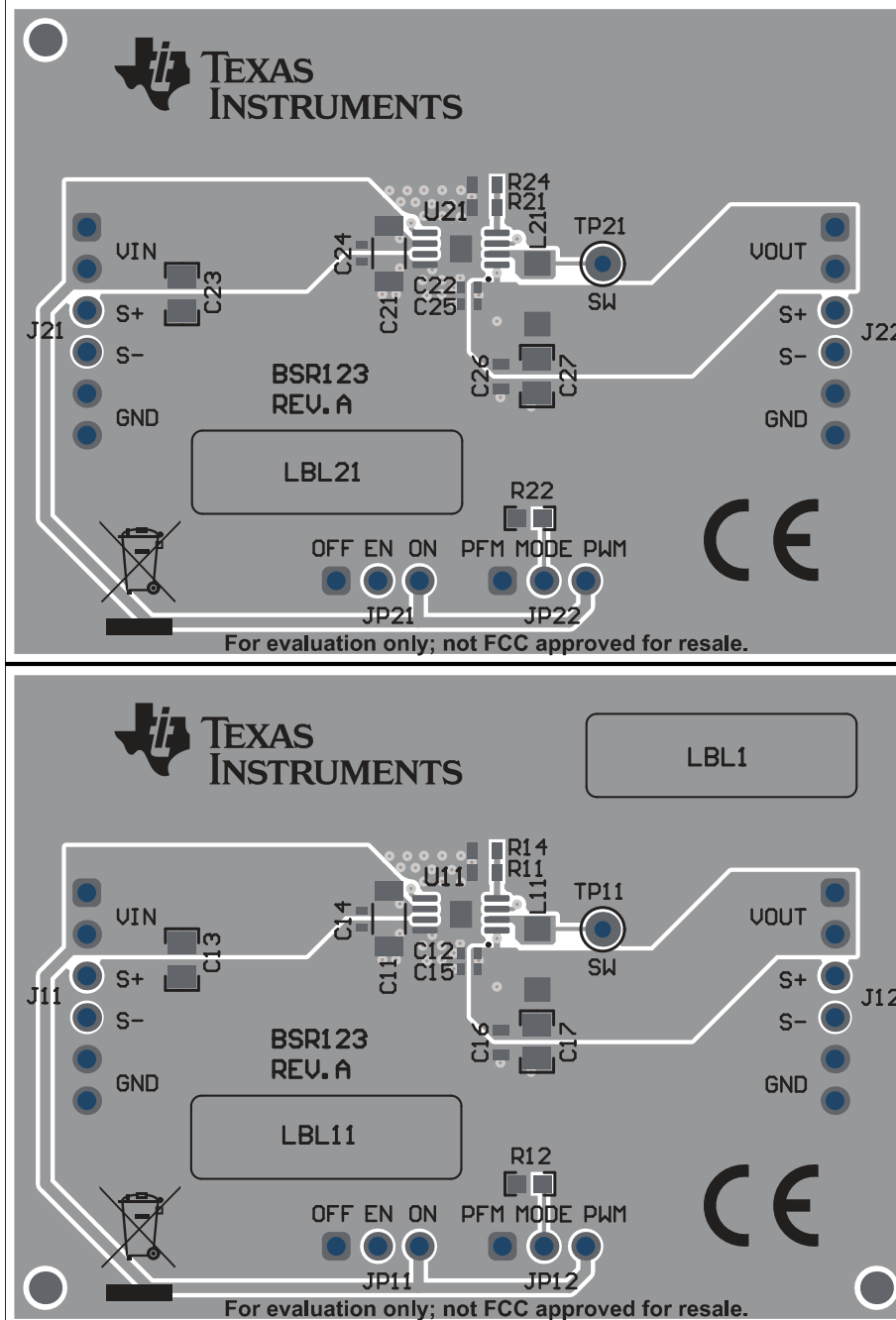


Figure 4-1. Top Assembly

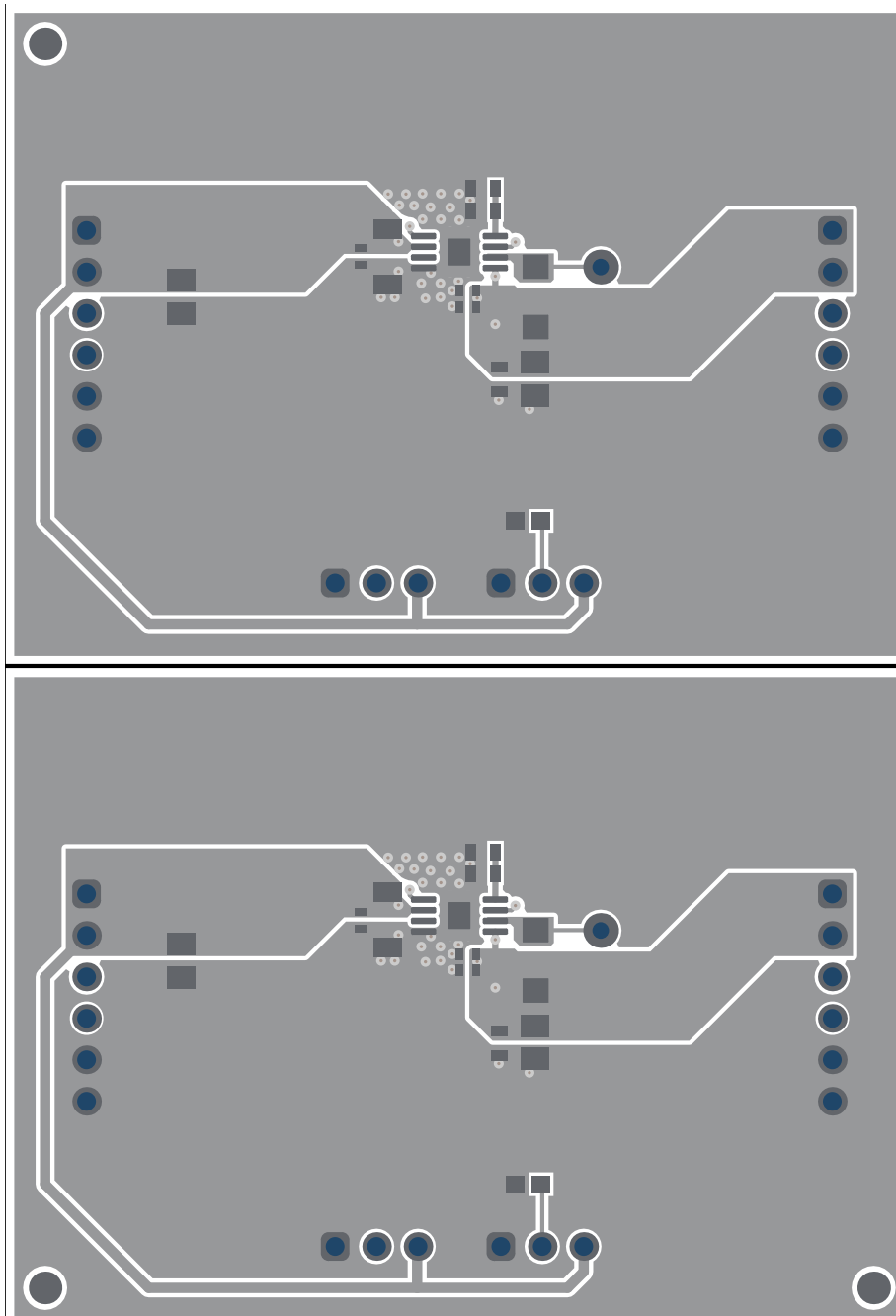


Figure 4-2. Top Layer

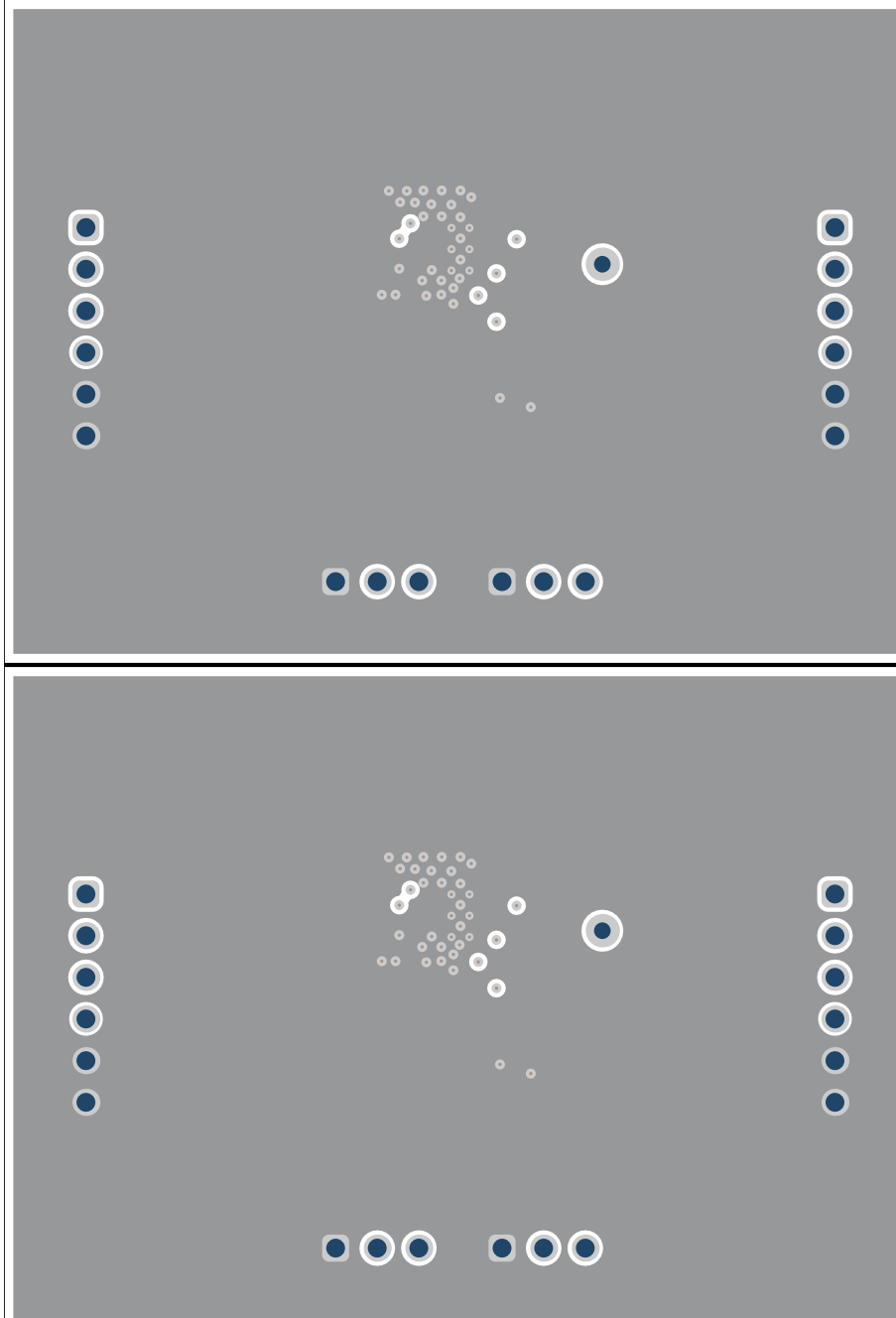


Figure 4-3. Internal Layer 1

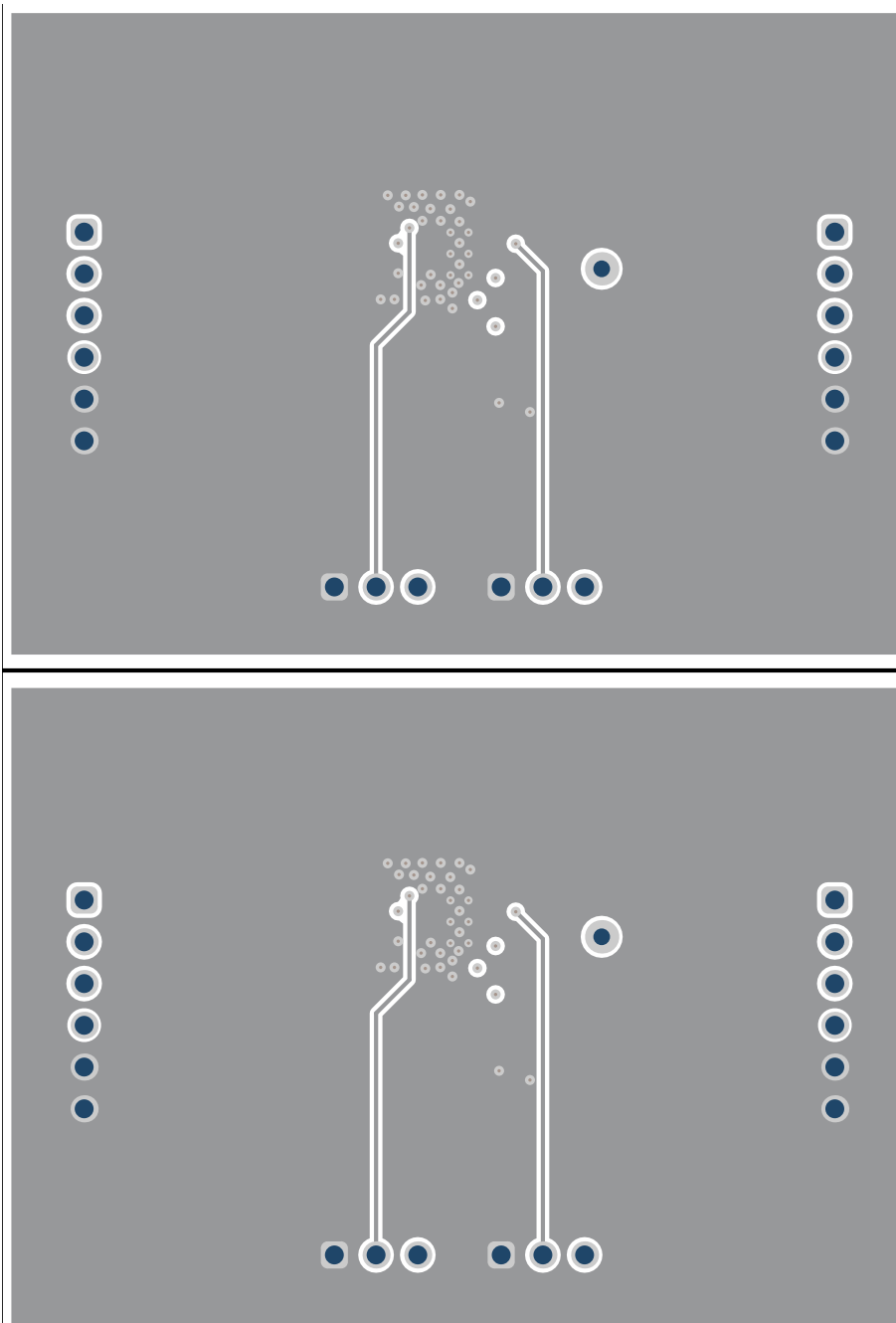


Figure 4-4. Internal Layer 2

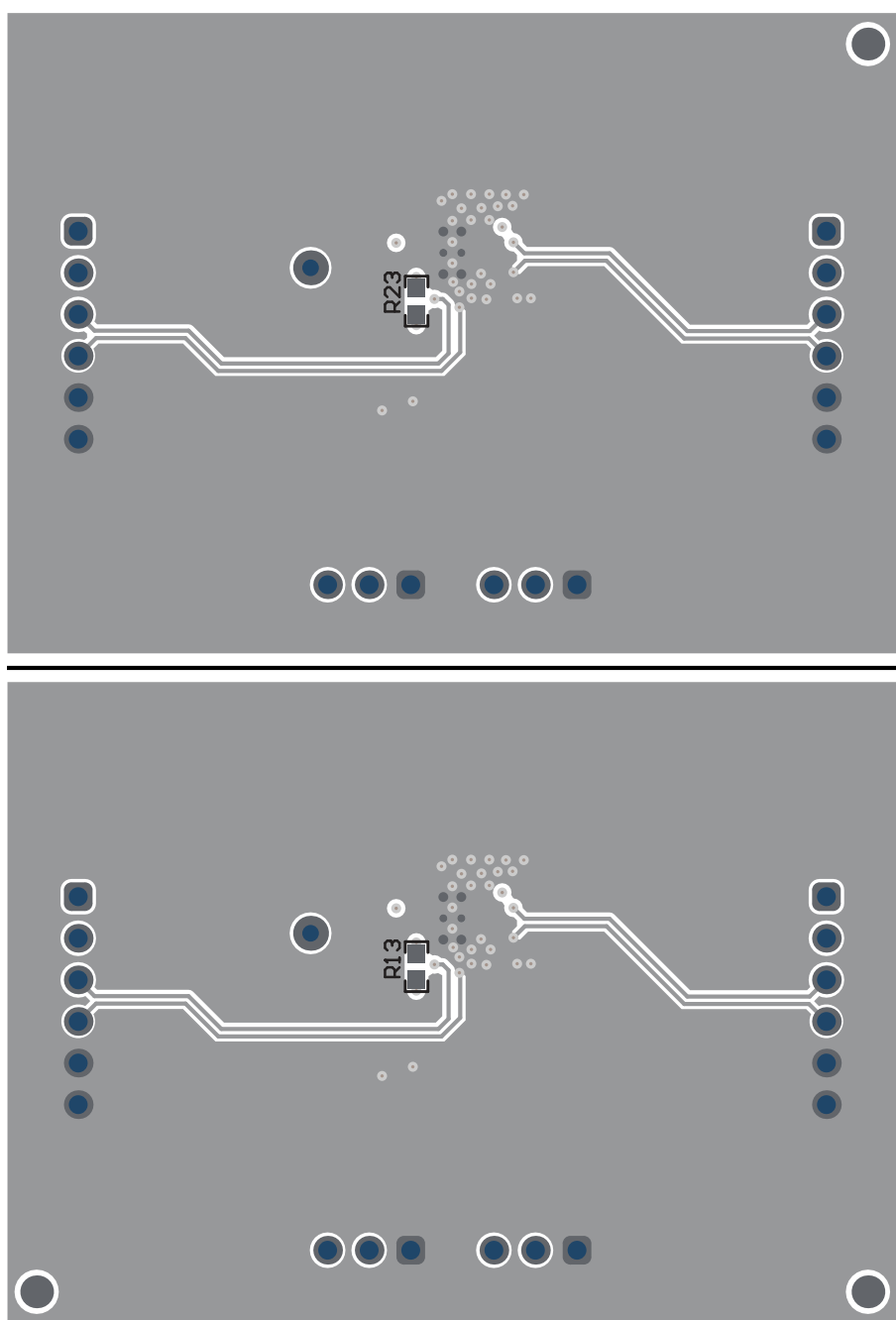


Figure 4-5. Bottom Layer

5 Schematic and Bill of Materials (BOM)

This section provides the TPS62841-2EVM123 schematic and bill of materials.

5.1 Schematic

Figure 5-1 illustrates the TPS62841DGR EVM schematic.

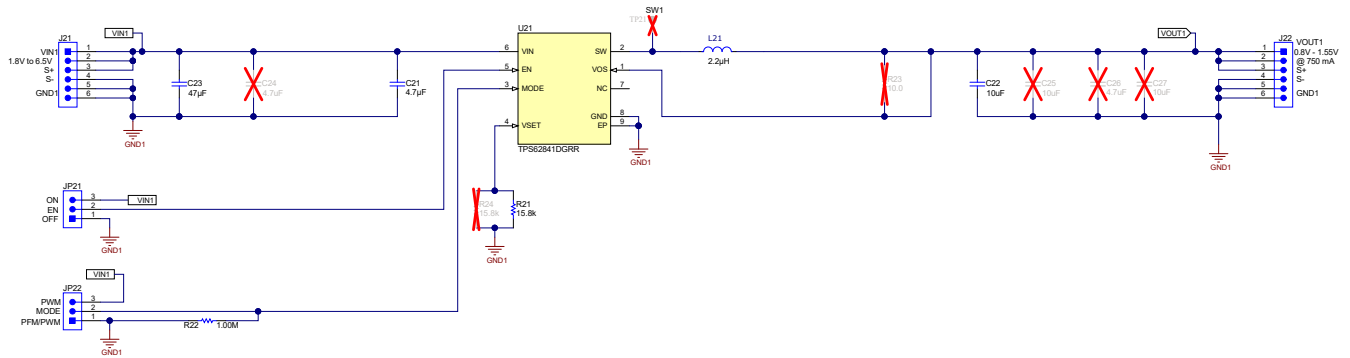


Figure 5-1. TPS62841DGR Schematic

Figure 5-2 illustrates the TPS62842DGR EVM schematic.

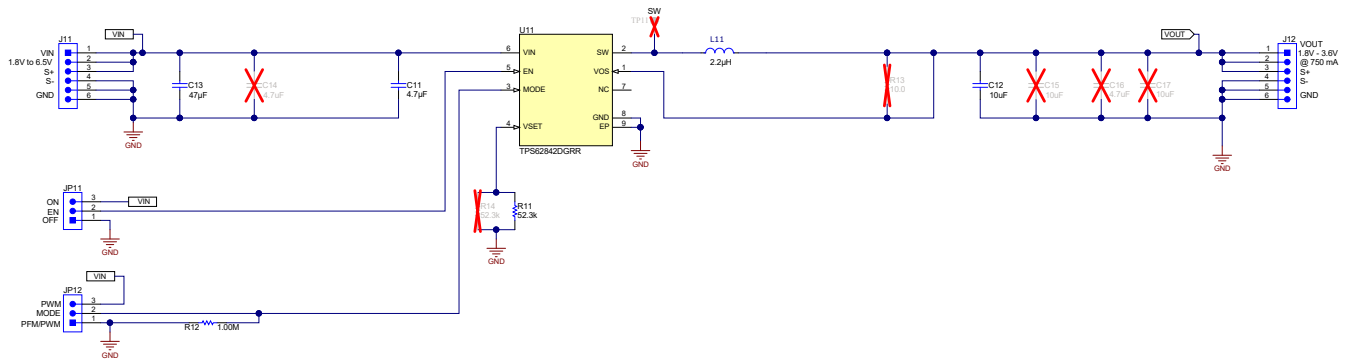


Figure 5-2. TPS62842DGR Schematic

5.2 Bill of Materials

Table 5-1 lists the TPS62841 EVM BOM.

Table 5-1. TPS62841 Bill of Materials

REF DES	QTY	DESCRIPTION	PART NUMBER	MANUFACTURER
C21	1	Capacitor, ceramic, 4.7 μ F, 50 V, \pm 20%, X7R, 1206	GRM31CR71H475MA12L	Murata
C22	1	Capacitor, ceramic, 10 μ F, 6.3 V, \pm 20%, X5R, 0402	GRM155R60J106ME15D	Murata
C23	1	Capacitor, ceramic, 47 μ F, 10 V, \pm 20%, X5R, 0805	GRM21BR61A476ME15L	Murata
L21	1	Inductor, Unshielded, metal composite, 2.2 μ H, 850 mA, 180 m Ω , SMD	CC453232-2R2KL	Murata
R21	1	RES, 15.8 k Ω , 1%, 0.1 W, 0603	Std	Std
R23	1	RES, 1.00 M Ω , 1%, 0.1 W, 0603	Std	Std
U21	1	1.8-V to 6.5-V, 750-mA, 60-nA I_Q Step Down Converter in DGR Package	TPS62841DGR	Texas Instruments

Table 5-2 lists the TPS62842 EVM BOM.

Table 5-2. TPS62842 Bill of Materials

REF DES	QTY	DESCRIPTION	PART NUMBER	MANUFACTURER
C11	1	Capacitor, ceramic, 4.7 μ F, 50 V, \pm 20%, X7R, 1206	GRM31CR71H475MA12L	Murata
C12	1	Capacitor, ceramic, 10 μ F, 6.3 V, \pm 20%, X5R, 0402	GRM155R60G106ME44D	Murata
C13	1	Capacitor, ceramic, 47 μ F, 10 V, \pm 20%, X5R, 0805	GRM21BR61A476ME15L	Murata
L11	1	Inductor, Unshielded, metal composite, 2.2 μ H, 850 mA, 180 m Ω , SMD	CC453232-2R2KL	Murata
R11	1	RES, 52.3 k Ω , 1%, 0.1 W, 0603	Std	Std
R13	1	RES, 1.00 M Ω , 1%, 0.1 W, 0603	Std	Std
U11	1	1.8-V to 6.5-V, 750-mA, 60-nA I_Q Step Down Converter in DGR Package	TPS62842DGR	Texas Instruments

6 Revision History

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

Changes from Revision * (April 2020) to Revision A (June 2021)	Page
• Updated the numbering format for tables, figures and cross-references throughout the document.....	2

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