

TPS62840-1DLCEVM55 User's Guide

The TPS62840-1DLCEVM55 (BSR055-001) facilitates the evaluation of the TPS6284x-DLC family of 750-mA, step-down converters with 60-nA I_Q in small 1.5-mm by 2-mm QFN packages. The EVM contains 2 separate circuits to create output voltages between 0.8 V and 3.3 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 which 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 1.5-mm × 2-mm QFN package. The BSR055 EVM contains 2 completely independent circuits, each for a different IC version. See [Table 1](#) for a summary of the BSR055 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. BSR055 Circuit Options

EVM Version	IC Installed	Output Voltage	Output Voltage Range	Output Current
TPS62840-1DLCEVM55 (BSR055-001)	TPS62840 (U11)	1.8 V	1.8 - 3.3 V (selectable)	750 mA
	TPS62841 (U21)	1.2 V	0.8 - 1.55 V (selectable)	750 mA

1.1 Performance Specification

[Table 2](#) provides a summary of the TPS62840-1DLCEVM55 performance specifications.

Table 2. Performance Specification Summary

SPECIFICATION	MIN	TYP	MAX	UNIT
Input voltage	1.8	3.6	6.5	V
Output voltage	See Table 1			V
Output current	0	See Table 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 should be installed at the same time. Rx1 is an 0201 size to represent a typical final solution. However, such a small size is difficult to manually replace. Therefore, Rx4 is provided in an 0603 size to easily change the output voltage. Simply remove Rx1 and install Rx4 in the desired value.

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](#). 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 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 [How to Measure the Control Loop of DCS-Control™ Devices](#). The results of this test are shown in [Figure 3](#).

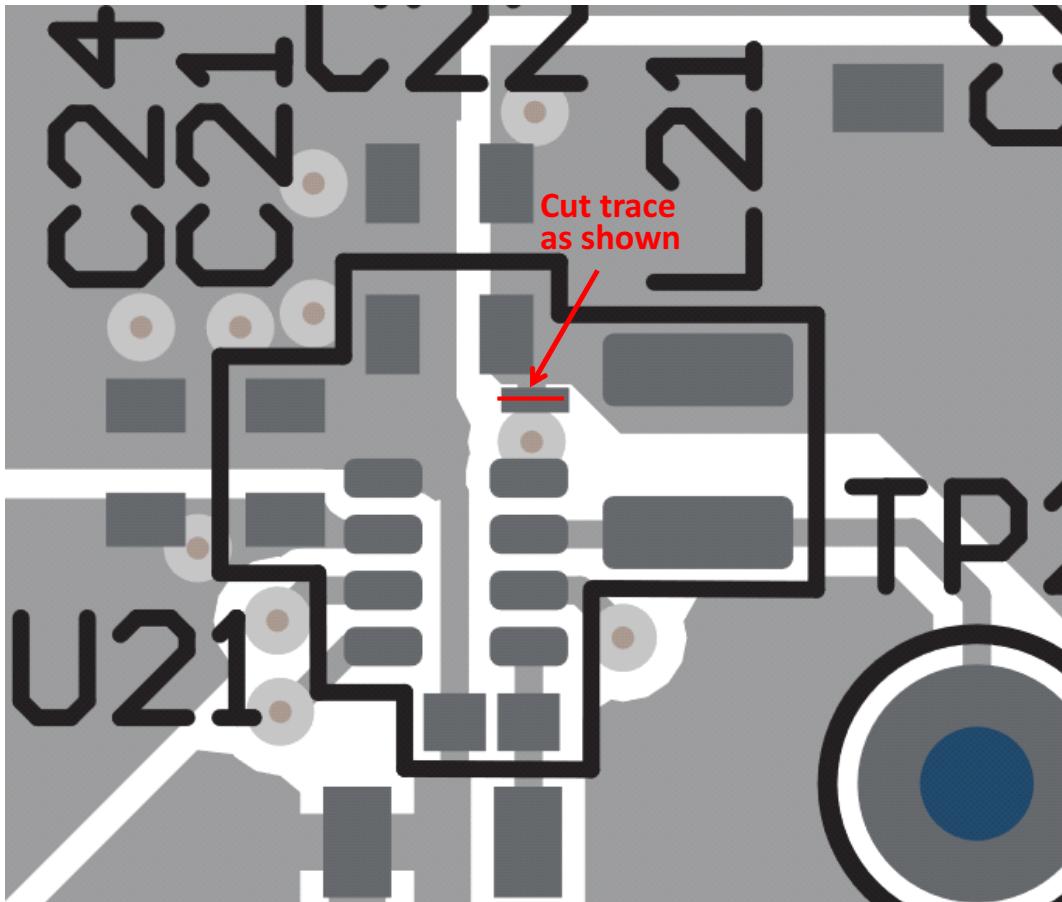


Figure 1. Loop Response Measurement Modification

2 Setup

This section describes how to properly use the TPS62840-1DLCEVM55.

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.
JPx3 – STOP	STOP pin input jumper. Place the supplied jumper across PAUSE and STOP to put the IC in the STOP state, which stops switching. Place the jumper across RUN and STOP to put the IC in its normal operating mode.

2.2 *Setup*

To operate the EVM, set jumpers JPx1 through JPx3 to the desired position per [Section 2.1](#). Connect the input supply to Jx1 and connect the load to Jx2.

3 TPS62840-1DLCEVM55 Test Results

The TPS62840-1DLCEVM55 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 2](#) shows the thermal performance of the EVM.



Figure 2. TPS62840 Thermal Performance ($V_{IN} = 3.6$ V, $V_{OUT} = 1.8$ V, $I_{OUT} = 750$ mA)

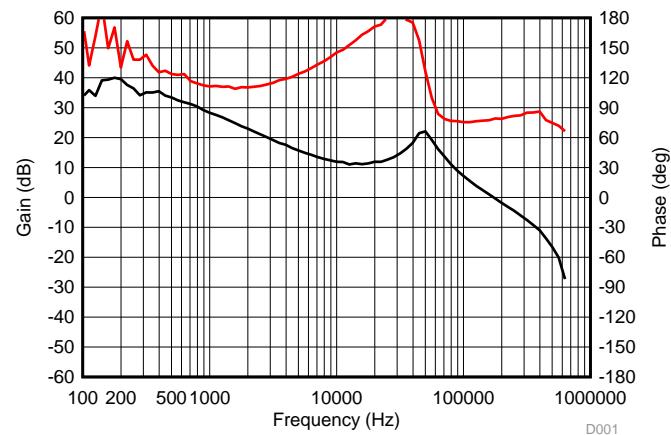


Figure 3. Loop Response ($V_{IN} = 3.6$ V, $V_{OUT} = 1.8$ V, $I_{OUT} = 750$ mA)

4 Board Layout

This section provides the TPS62840-1DLCEVM55 board layout and illustrations in [Figure 4](#) through [Figure 8](#). The Gerbers are available on the EVM product page: [TPS62840-1DLCEVM55](#).

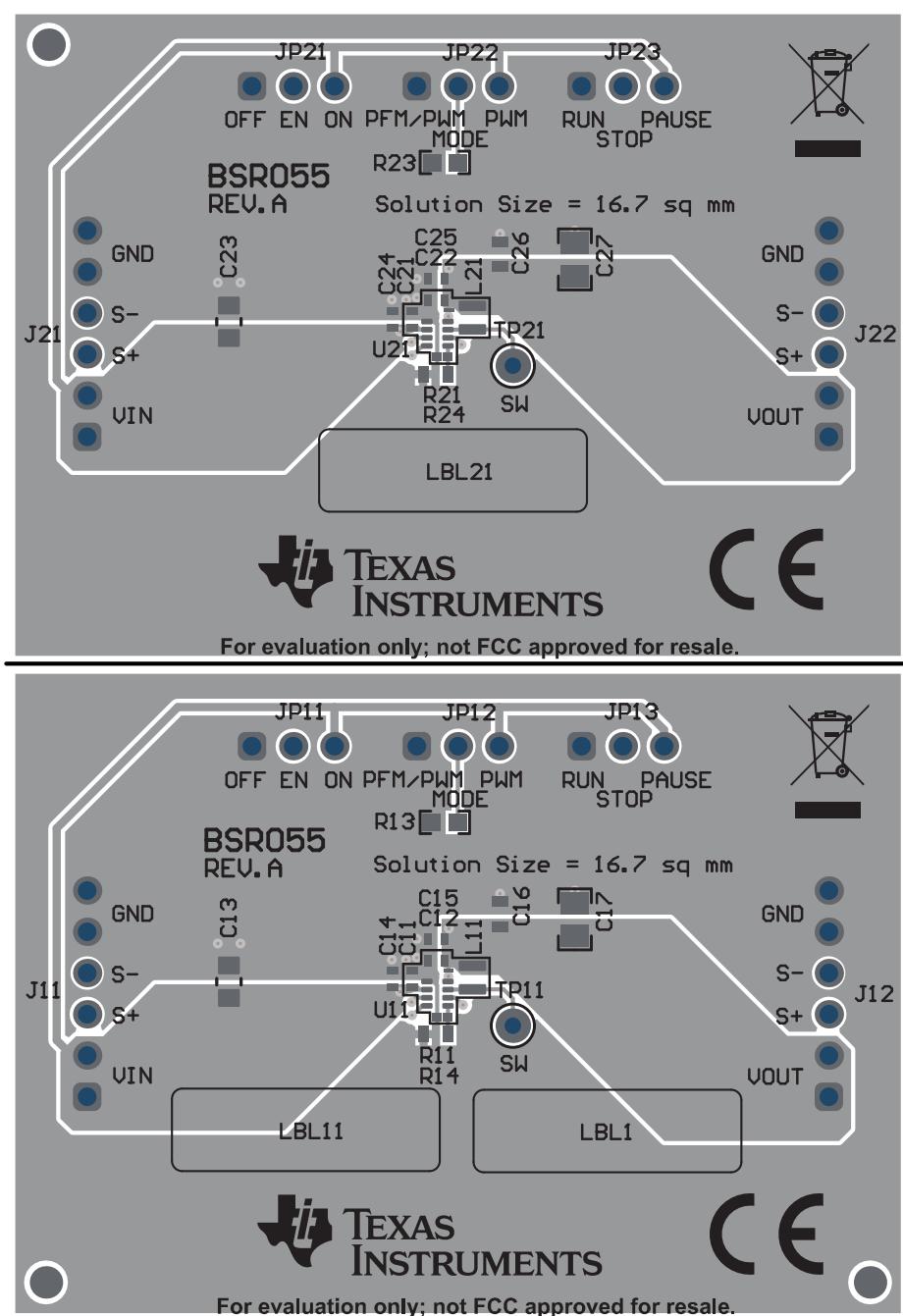


Figure 4. Top Assembly

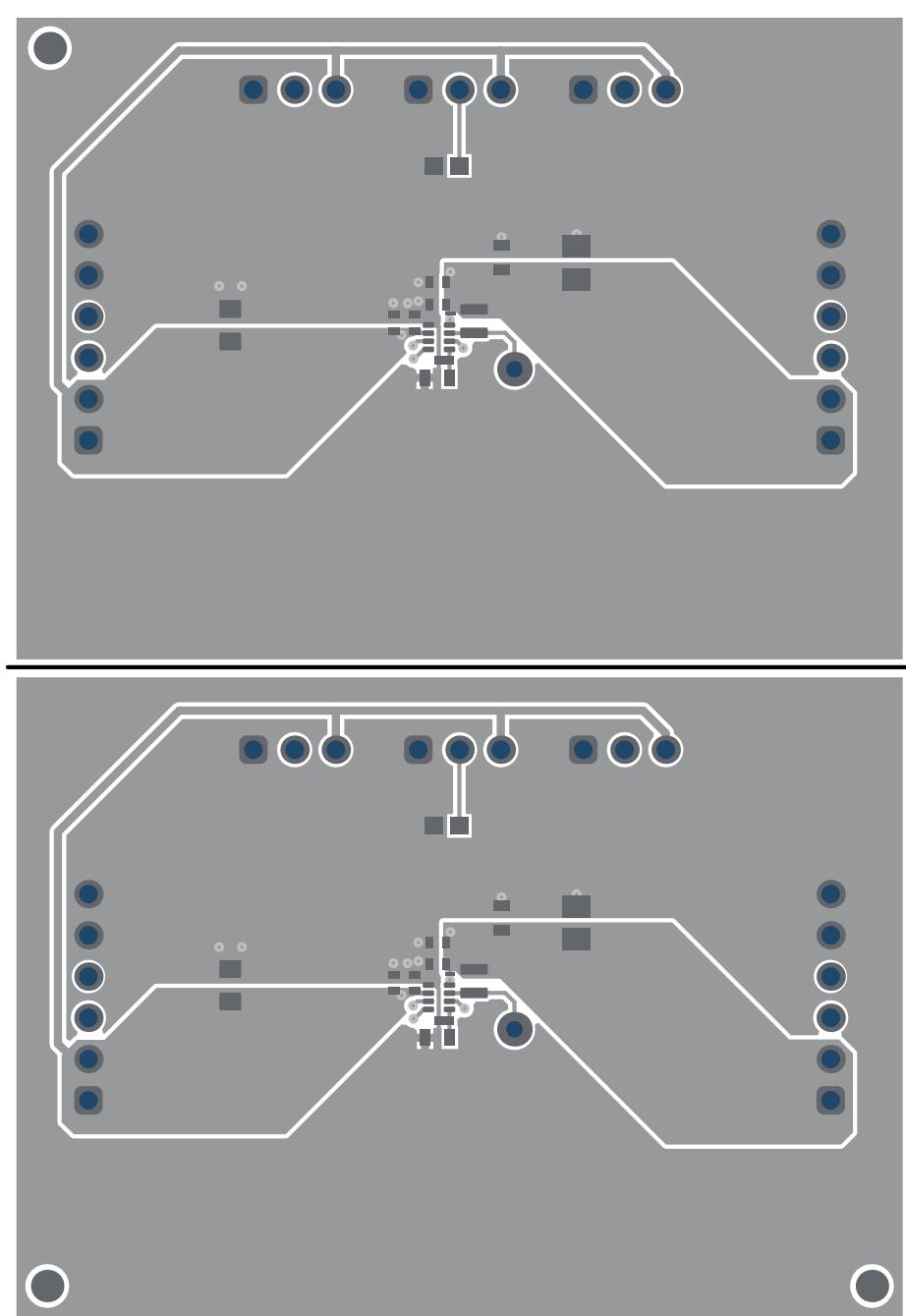


Figure 5. Top Layer

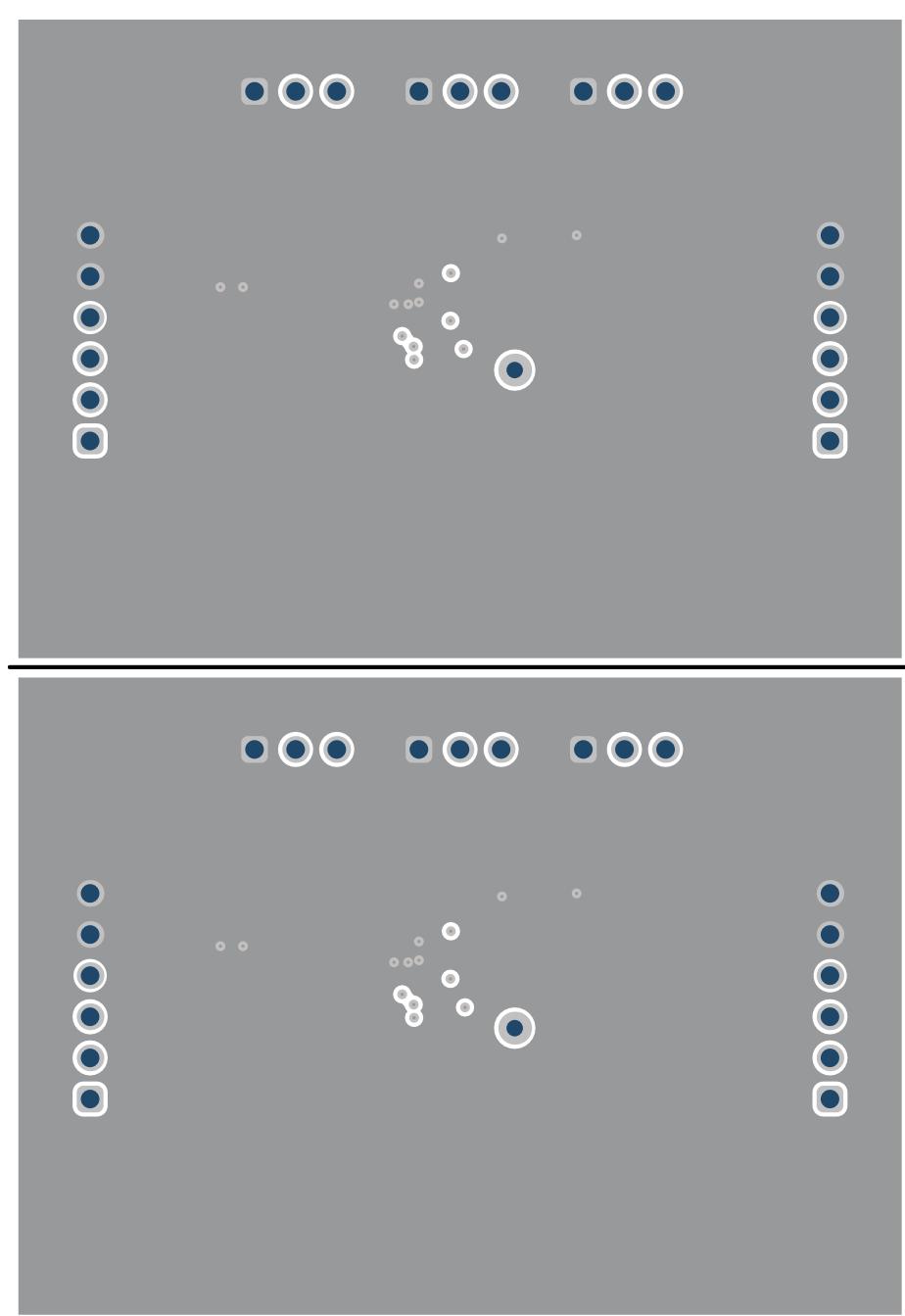


Figure 6. Internal Layer 1

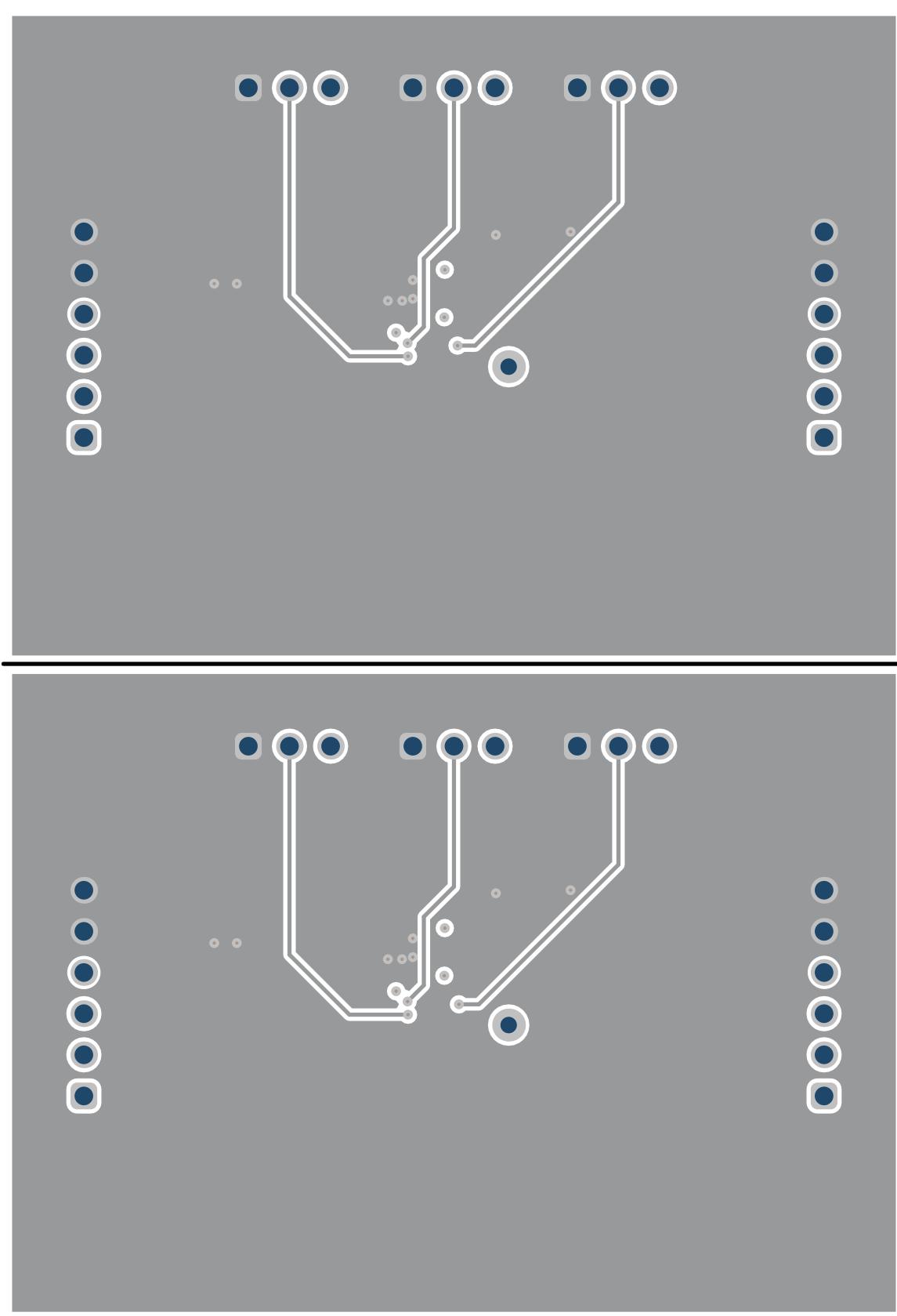
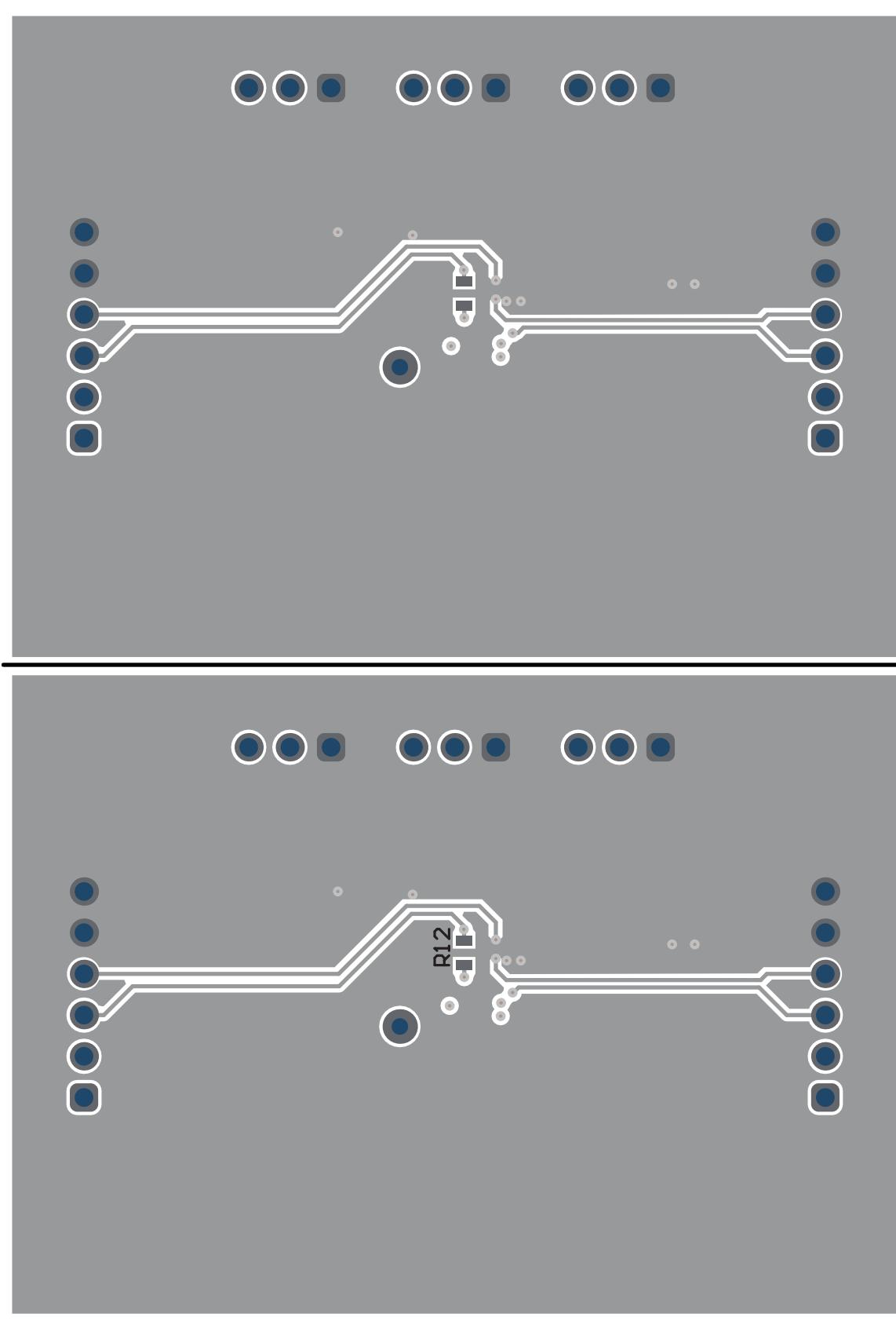


Figure 7. Internal Layer 2

**Figure 8. Bottom Layer**

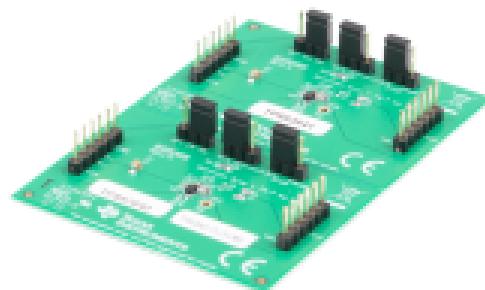


Figure 9. TPS62840-1DLCEVM55 Angled View

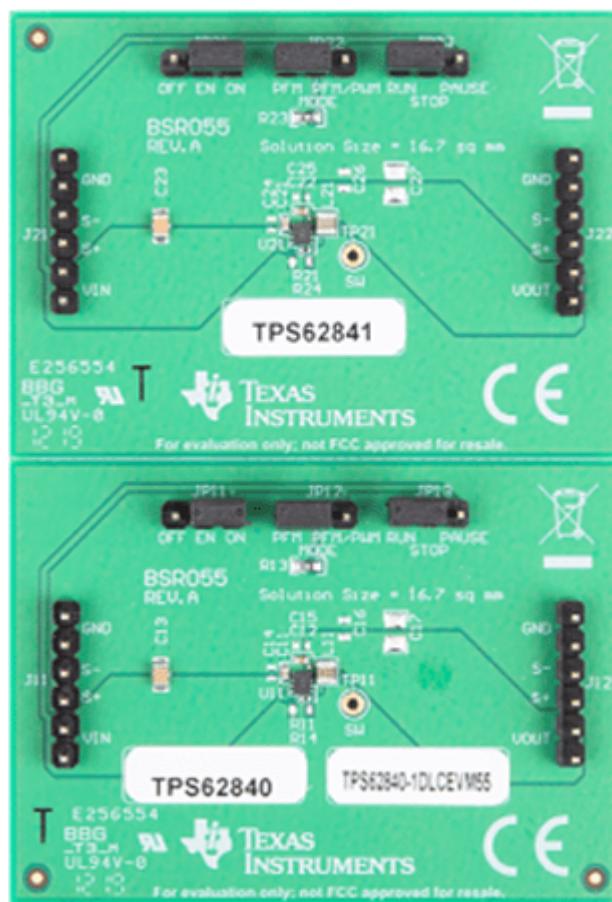


Figure 10. TPS62840-1DLCEVM55 Overhead View

5 Schematic and Bill of Materials (BOM)

This section provides the TPS62840-1DLCEVM55 schematic and bill of materials.

5.1 *Schematic*

Figure 11 illustrates the TPS62840 EVM schematic.

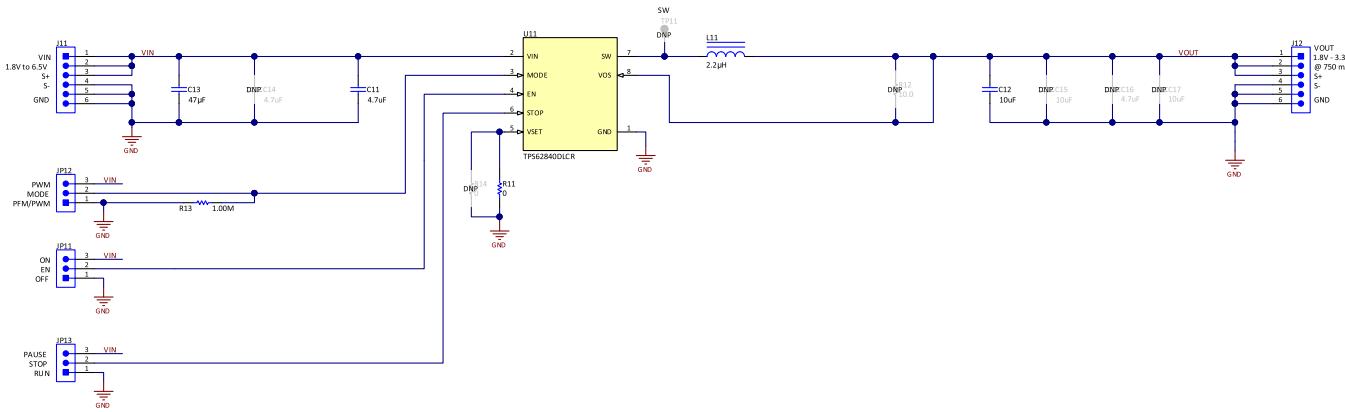


Figure 11. TPS62840 Schematic

Figure 12 illustrates the TPS62841 EVM schematic.

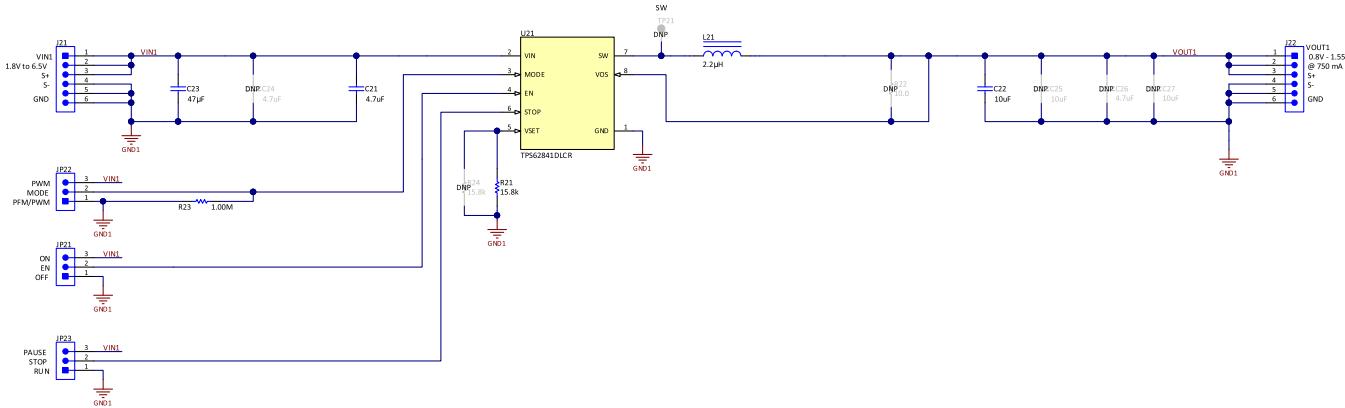


Figure 12. TPS62841 Schematic

5.2 Bill of Materials

[Table 3](#) lists the TPS62840 EVM BOM.

Table 3. TPS62840 Bill of Materials

REF DES	QTY	DESCRIPTION	PART NUMBER	MANUFACTURER
C11	1	CAP, CERM, 4.7 μ F, 10 V, $\pm 20\%$, X5R, 0402	GRM155R61A475MEAAD	Murata
C12	1	CAP, CERM, 10 μ F, 4 V, $\pm 20\%$, X5R, 0402	GRM155R60G106ME44D	Murata
C13	1	CAP, CERM, 47 μ F, 10 V, $\pm 20\%$, X5R, 0805	GRM21BR61A476ME15L	Murata
L11	1	Inductor, Shielded, Metal Composite, 2.2 μ H, 1.8 A, 97 m Ω , SMD	DFE201612E-2R2M=P2	Murata
R11	1	RES, 0 Ω , 1%, 0.05 W, 0201	Std	Std
R13	1	RES, 1.00 M Ω , 1%, 0.1 W, 0603	Std	Std
U11	1	1.8V to 6.5V, 750mA, 60nA I _Q Step Down Converter in QFN Package, 1.5 mm x 2.0 mm	TPS62840DLC	Texas Instruments

[Table 4](#) lists the TPS62841 EVM BOM.

Table 4. TPS62841 Bill of Materials

REF DES	QTY	DESCRIPTION	PART NUMBER	MANUFACTURER
C21	1	CAP, CERM, 4.7 μ F, 10 V, $\pm 20\%$, X5R, 0402	GRM155R61A475MEAAD	Murata
C22	1	CAP, CERM, 10 μ F, 4 V, $\pm 20\%$, X5R, 0402	GRM155R60G106ME44D	Murata
C23	1	CAP, CERM, 47 μ F, 10 V, $\pm 20\%$, X5R, 0805	GRM21BR61A476ME15L	Murata
L21	1	Inductor, Shielded, Metal Composite, 2.2 μ H, 1.8 A, 97 m Ω , SMD	DFE201612E-2R2M=P2	Murata
R21	1	RES, 15.8 k Ω , 1%, 0.05 W, 0201	Std	Std
R23	1	RES, 1.00 M Ω , 1%, 0.1 W, 0603	Std	Std
U21	1	1.8V to 6.5V, 750mA, 60nA I _Q Step Down Converter in QFN Package, 1.5 mm x 2.0 mm	TPS62841DLC	Texas Instruments

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