User's Guide

TPS628436-7-8EVM-167 Evaluation Module

ABSTRACT

The TPS628436-7-8EVM-167 (BSR167) facilitates the evaluation of the TPS62843 family of 600-mA, step-down converters with 300-nA I_Q in tiny 0.8-mm by 1.05-mm WCSP packages with 0.4-mm pitch. The EVM contains 3 separate circuits to create output voltages between 0.4 V and 3.6 V from higher input voltages between 1.8 V and 5.5 V. All circuits have a maximum height of 1.0-mm. The TPS62843x is a highly efficient and tiny solution for point-of-load (POL) converters for space-constrained applications, such as wearables and smartphones.

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Trademarks

1 Introduction

The TPS62843x is a family of synchronous, step-down converters in a 0.8-mm × 1.05-mm wafer chip-scale package (WCSP) with a 0.4-mm pitch. The BSR167 EVM contains three completely independent circuits, each for a different IC version. See Table 1-1 for a summary of the BSR167 EVMs.

The reference designator order is grouped 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, R21, and R31, for example, refer to the same resistor in each sub-circuit.

Table 1-1. BSR167 Circuit Options

EVM Version	IC Installed	Output Voltage Setpoint	Output Voltage Setpoint Range	Output Current
TPS628436-7-8EVM167 (BSR167-001)	TPS628436 (U11)	0.6 V	0.4-0.8 V (adjustable)	600 mA
	TPS628437 (U21)	0.9 V	0.8-1.8 V (adjustable)	600 mA
	TPS628438 (U31)	1.8 V	1.8-3.6 V (adjustable)	600 mA

1.1 Performance Specification

Table 1-2 provides a summary of the TPS628436-7-8EVM-167 performance specifications.

Table 1-2. Performance Specification Summary

SPECIFICATION	MIN	TYP	MAX	UNIT
Input voltage	1.8	3.6	5.5	V
Output voltage setpoint	See Table 1-1			V
Output current	0		See Table 1-1	mA

1.2 Modifications

The printed circuit board (PCB) for this EVM is designed to accommodate all the output voltage versions of this integrated circuit (IC). Extra input and output capacitors can also be added. Finally, the loop response of the IC can be measured by configuring the board.

1.2.1 Adjusting the Output Voltage

The output voltage can be adjusted through the choice of Rx1 and Rx2 resistors. Since Rx1 and Rx2 are in parallel, only Rx1 or Rx2 should be installed one at a time. Rx1 is an 0201 size to represent a typical solution in actual application. However, such a small size is difficult to replace. Therefore, Rx2 is provided in an 0603 size to change the output voltage easily. Simply remove Rx1 and place the desired value to Rx2.

1.2.2 Input and Output Capacitors

Cx2 provides 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 options for additional output capacitors. These capacitors are not mandatory for the device's proper operation. But it can be used to reduce the output voltage ripple and 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, place a 10-Ω resistor across the resistor pads on the back of the PCB at Rx3. The pads are spaced to allow installation of an 0603-sized resistor. With these changes, an ac signal (100-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*.

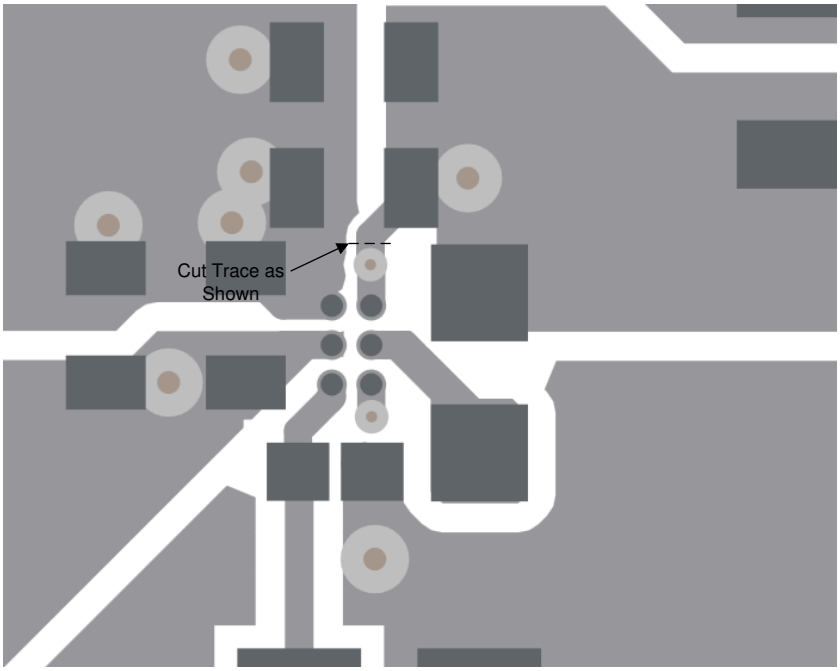

Figure 1-1. Loop Response Measurement Modification

2 Setup

This section describes how to properly use the TPS628436-7-8EVM-167.

2.1 Input/Output Connector Descriptions

Table 2-1. Input/Output Connectors

Input/Output	Description
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.

Note

To achieve a different output voltage, disconnect the power supply of the EVM. Replace the R11/R21/R31 accordingly (refer to Sec. 6.1 of the data sheet), then power up the device again.

2.2 Setup

To operate the EVM, set jumpers JPx1 to the desired position per Section 2.1. Connect the input supply to Jx1 and connect the load to Jx2.

3 Board Layout

This section provides the TPS62843678EVM-167 board layout and illustrations in Figure 3-1 through Figure 3-3.

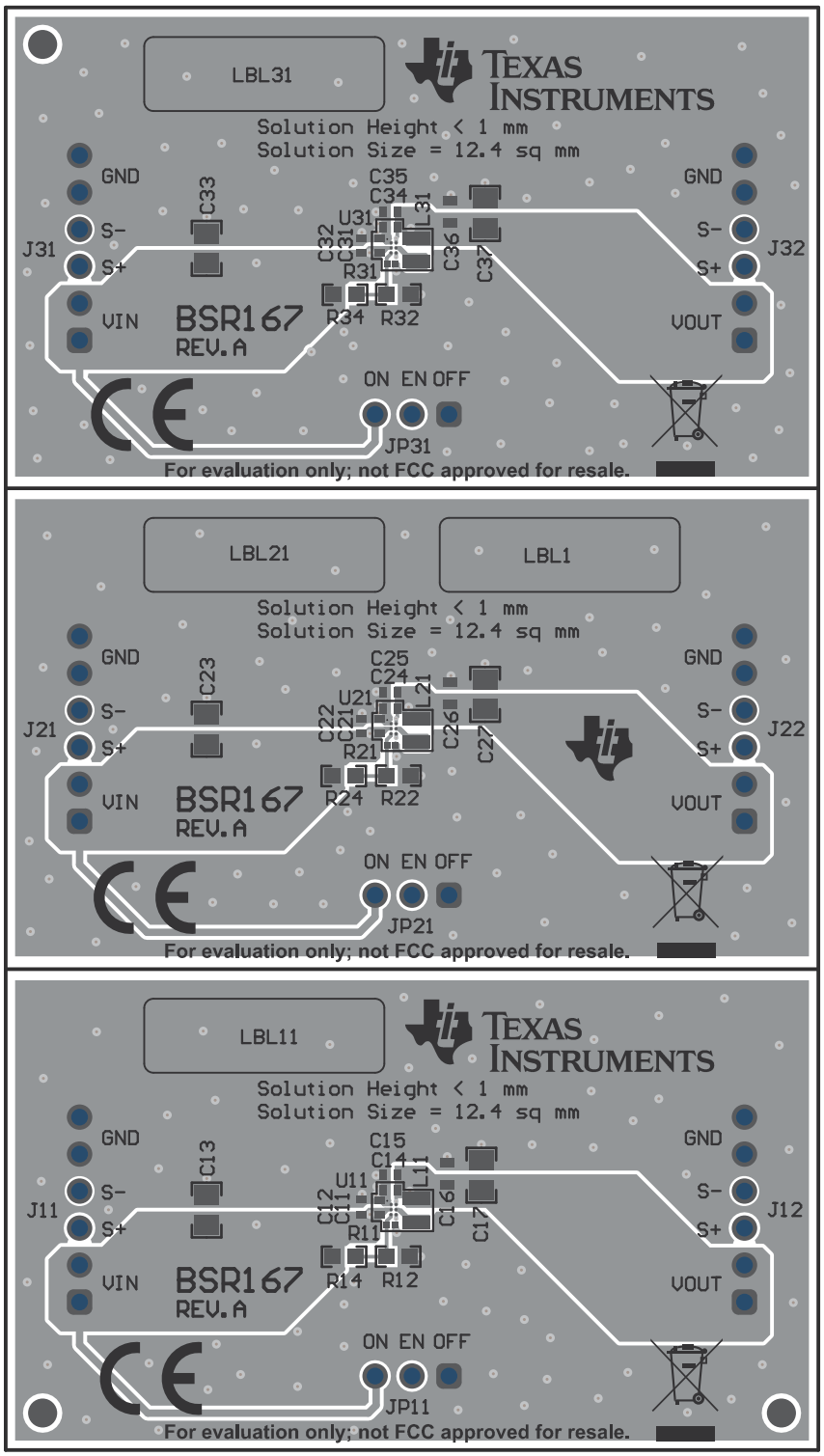

Figure 3-1. Top Assembly

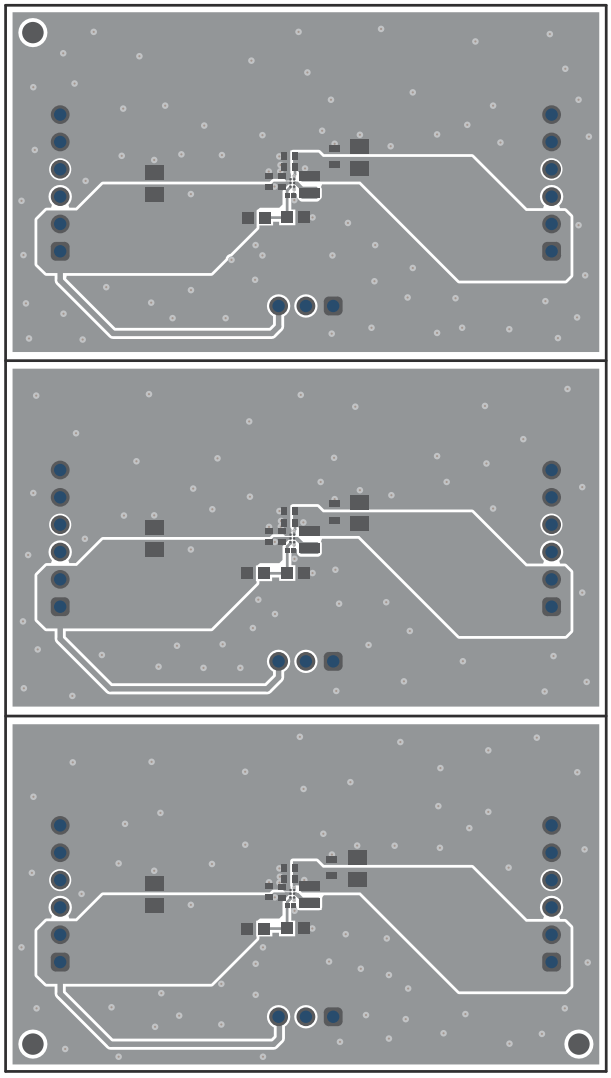

Figure 3-2. Top Layer

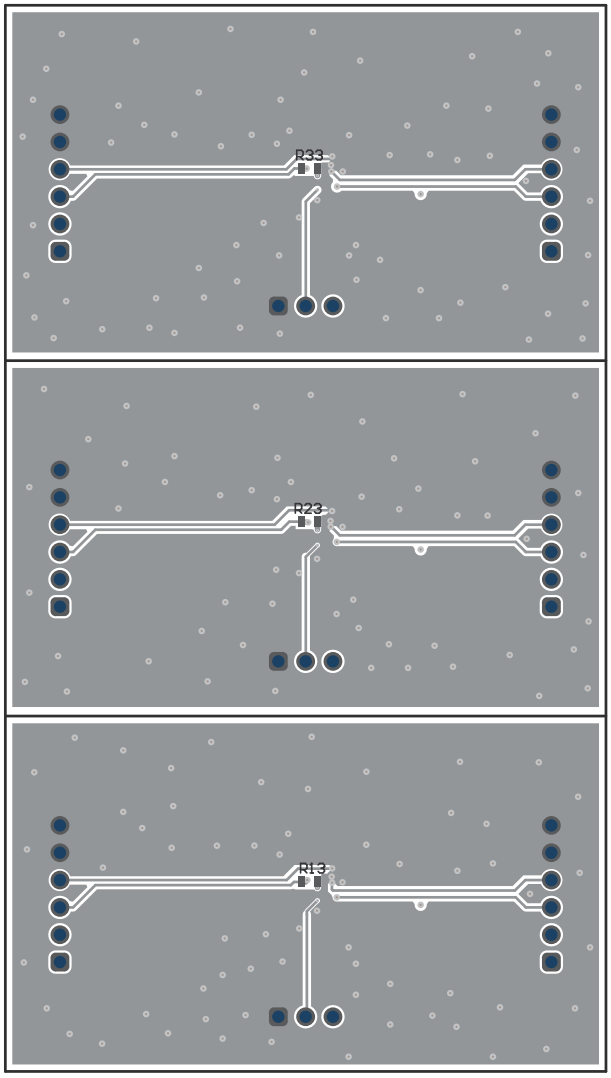

Figure 3-3. Bottom Layer

4 Schematic

Figure 4-1 illustrates the TPS628436 EVM schematic.

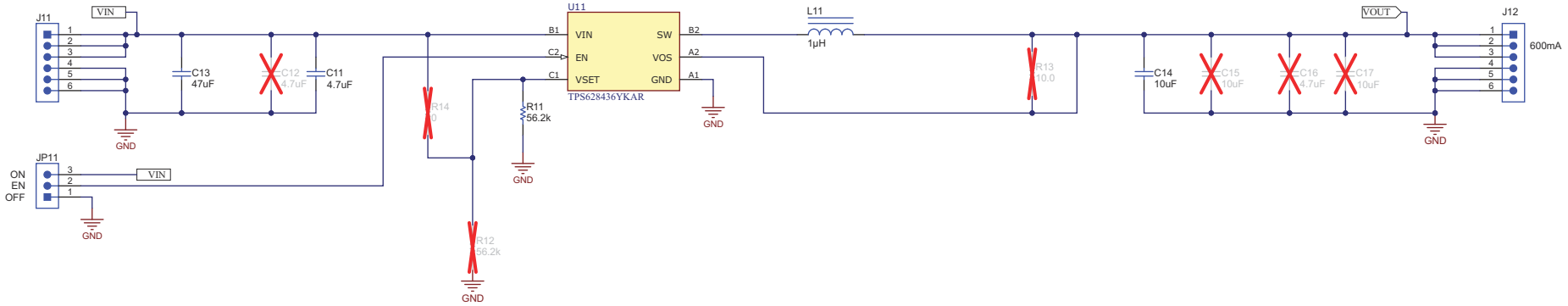

Figure 4-1. TPS628436 Schematic

Figure 4-2 illustrates the TPS628437 EVM schematic.

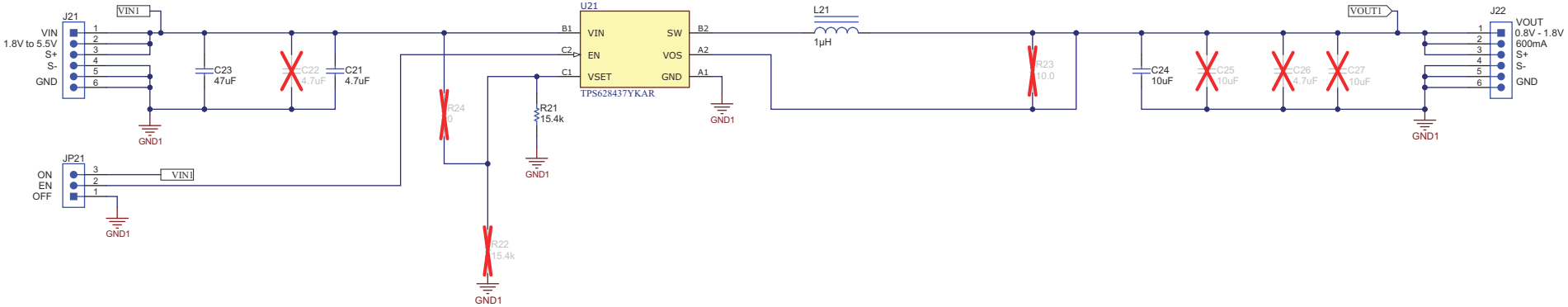

Figure 4-2. TPS628437 Schematic

Figure 4-3 illustrates the TPS628438 EVM schematic.

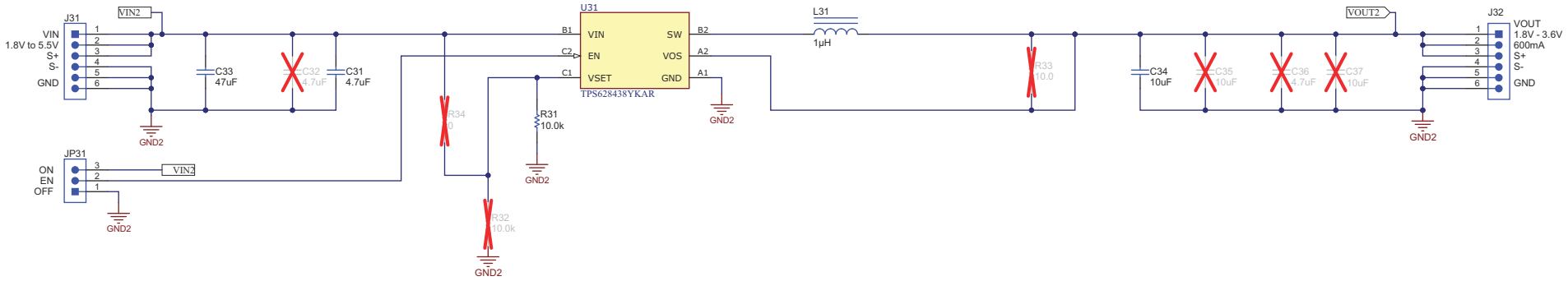

Figure 4-3. TPS628438 Schematic

5 List of Materials

Table 5-1 lists the TPS628436 EVM list of materials.

Table 5-1. TPS628436 List of Materials

DES	QTY	DESCRIPTION	PART NUMBER	MANUFACTURER
C11	1	CAP, CERM, 4.7 µF, 6.3 V, ±20%, X5R, 0402	GRM155R60J475ME47D	Murata
C13	1	CAP, CERM, 47 µF, 6.3 V, ±20%, X5R, 0805	GRM21BR60J476ME15L	Murata
C14	1	CAP, CERM, 10 µF, 6.3 V, ±20%, X5R, 0402	GRM155R60J106ME15D	Murata
L11	1	Inductor, Shielded, Metal Composite, 1 µH, 2.7 A, 0.057 ohm, SMD	DFE201610E-1R0M=P2	Cyntec
R11	1	RES, 56.2 kΩ, 1%, 0.05 W, 0201	Std	Std
U11	1	1.8-V to 5.5-V, 600mA 0.4-0.775V, 300-nA IQ Step Down Converter, DSBGA6	TPS628436YKAR	Texas Instruments

Table 5-2 lists the TPS628437 EVM BOM.

Table 5-2. TPS628437 List of Materials

DES	QTY	DESCRIPTION	PART NUMBER	MANUFACTURER
C21	1	CAP, CERM, 4.7 µF, 6.3 V, ±20%, X5R, 0402	GRM155R60J475ME47D	Murata
C23	1	CAP, CERM, 47 µF, 6.3 V, ±20%, X5R, 0805	GRM21BR60J476ME15L	Murata
C24	1	CAP, CERM, 10 µF, 6.3 V, ±20%, X5R, 0402	GRM155R60J106ME15D	Murata
L21	1	Inductor, Shielded, Metal Composite, 1 µH, 2.7 A, 0.057 ohm, SMD	DFE201610E-1R0M=P2	Murata
R21	1	RES, 15.4 kΩ, 1%, 0.05 W, 0201	Std	Std
U21	1	1.8-V to 5.5-V, 600mA 0.4-0.775V, 300-nA IQ Step Down Converter, DSBGA6	TPS628437YKAR	Texas Instruments

Table 5-3 lists the TPS628438 EVM BOM.

Table 5-3. TPS628438 List of Materials

DES	QTY	DESCRIPTION	PART NUMBER	MANUFACTURER
C31	1	CAP, CERM, 4.7 µF, 6.3 V, ±20%, X5R, 0402	GRM155R60J475ME47D	Murata
C33	1	CAP, CERM, 47 µF, 6.3 V, ±20%, X5R, 0805	GRM21BR60J476ME15L	Murata
C34	1	CAP, CERM, 10 µF, 6.3 V, ±20%, X5R, 0402	GRM155R60J106ME15D	Murata
L31	1	Inductor, Shielded, Metal Composite, 1 µH, 2.7 A, 0.057 ohm, SMD	DFE201610E-1R0M=P2	Murata
R31	1	RES, 10.0 k, 1%, 0.05 W, 0201	Std	Std
U31	1	1.8-V to 5.5-V, 600mA 0.4-0.775V, 300-nA IQ Step Down Converter, DSBGA6	TPS628438YKAR	Texas Instruments

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