User's Guide
SLVU156–March 2006

TPS63000EVM-148

This User's Guide describes the characteristics, operation, and use of the TPS63000EVM evaluation module (EVM). This EVM is designed to help the user easily evaluate and test the operation and functionality of the TPS63000. This User's Guide includes setup instructions for the hardware, a schematic diagram, a bill of materials (BOM), and PCB layout drawings for the evaluation module.

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1 Introduction

The Texas Instruments TPS63000 is a high efficient single inductor buck-boost converter in a 10-pin, 3-mm × 3-mm QFN package. Both fixed and adjustable output voltage units are available.

1.1 Background

The TPS63000EVM-148 uses the TPS63000 adjustable version, and is set to 3.3-V output. The EVM operates with full-rated performance with an input voltage between 3.0 V and 5.5 V.

1.2 Performance Specification

Table 1 provides a summary of the TPS63000EVM-148 performance specifications. All specifications are given for an ambient temperature of 25°C.

Table 1. Performance Specification Summary

Specification	Test Conditions	Min	Typ	Max	Unit
Input voltage	Iout = 500 mA	3.0	3.6	5.5	V
Output voltage	Iout = 0 mA to 500 mA	3.2	3.3	3.4	V
Output current	3.6 V in	0	500	1000	mA
Operating frequency			1000		kHz
Efficiency	3.6 V in at 500 mA load		90%		
Output ripple	3.6 V in at 500 mA load		25		mV

1.3 Modifications

The PWB for this EVM is designed to accommodate both the fixed and adjustable versions of this IC. If the fixed version is installed, R1 is replaced with a 0-Ω resistor and R2 will be open.

1.3.1 Adjustable Output IC U1 Operation

U1 is configured for evaluation of the adjustable output version. This unit is configured for 3.3 V. Resistors R1 and R2 are used to set the output voltage between 1.2 V and 5.5 V. See data sheet for recommended values.

1.3.2 Fixed Output Operation

U1 can be replaced with the fixed version for evaluation. R1 would need to be replaced with a 0-Ω resistor; R2 position would be open.

2 Setup and Results

This chapter describes how to properly use the TPS63000EVM-148.

2.1 Input / Output Connector and Header Descriptions

2.1.1 J1 – VIN

Positive input connection from the input supply for U1.

2.1.2 J2 – GND

Return connection from the input supply for U1, common with J4.

2.1.3 J3 – VOUT

Output voltage connection.

2.1.4 J4 – GND

Output return connection, common with J2.

2.1.5 JP1 – EN

Enable pin; 1=enabled and 0=disabled. Shorting jumper JP1 between the center pin and VIN turns on the unit. Shorting the jumper between center pin and GND turns the unit off.

2.1.6 JP2 –SYNC/PS

Center pin is SYNC input, and is used to synchronize the unit with an external clock. Also, in power-saving mode, 1=disabled and 0=enabled. Shorting jumper JP2 between the center pin and VIN disables power-saving mode; jumper between center pin and GND enables power-saving mode.

2.2 Setup

To operate the EVM, simply connect an input supply to the appropriate pins, connect a load to the appropriate pins. Maximum recommended load is 600 mA or 5.5 Ω. Input supply voltage of 3.0 V to 5.5 V is recommended.

2.3 Power Up

The soft-start circuit is controlled by a ramp to the current limit comparator that starts the switch current limit low and increases it to 1.7 A. Output voltage is monitored during this time and must increase for switch current to increase.

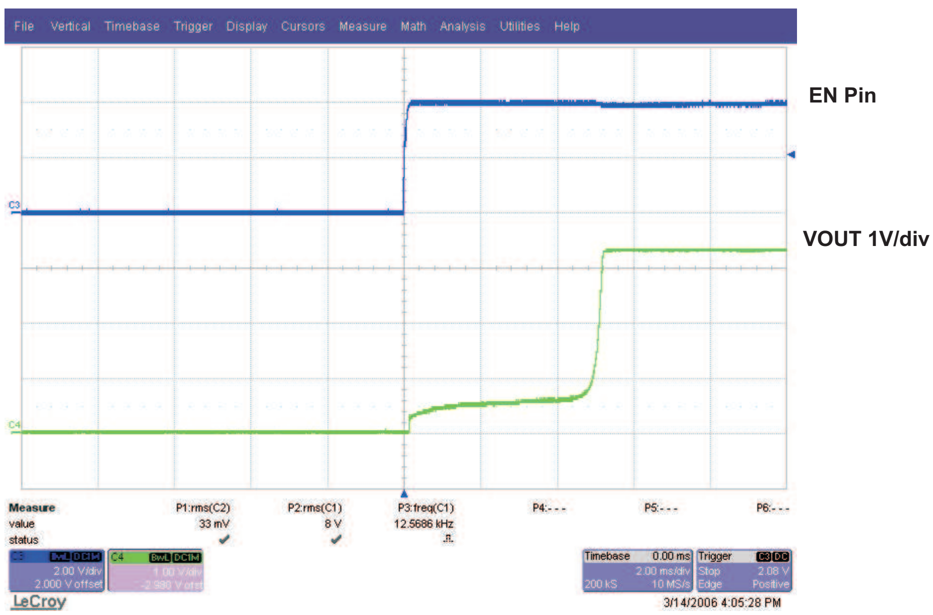

Figure 1. Turn ON into Electronic Load

2.4 Output Ripple

Output ripple occurs at the switching frequency of 1 MHz, and with the recommended L and output C, is low. Amplitude of the ripple varies, depending on load current and input voltage. Ensure the oscilloscope probe is connected as close as possible to the output capacitor, with a very short ground lead, for accurate measurements. Resistance in trace and leads adds to output ripple, and ground lead length increases the amplitude of switching spikes.

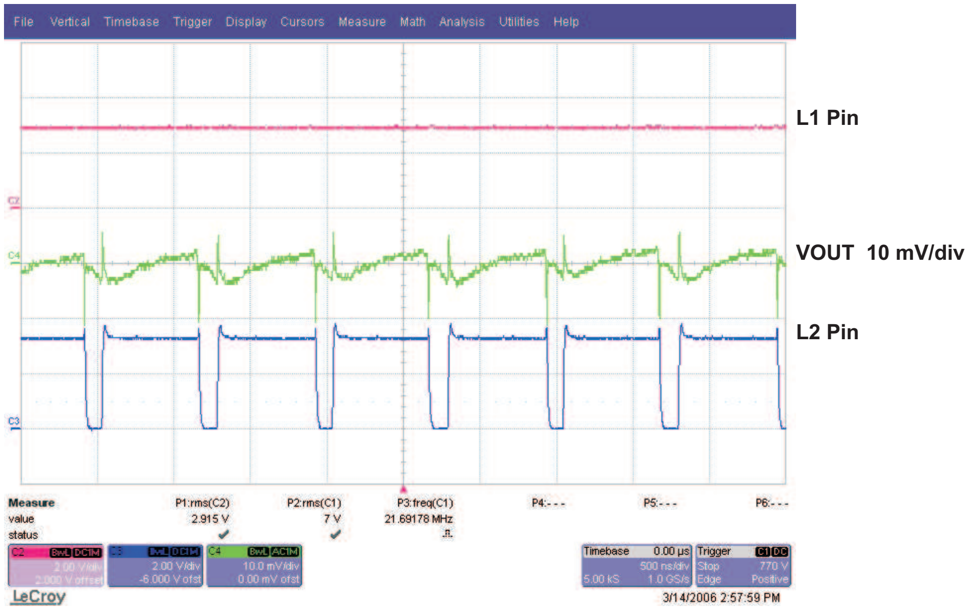

Figure 2. Output Ripple Vin 3.0 V

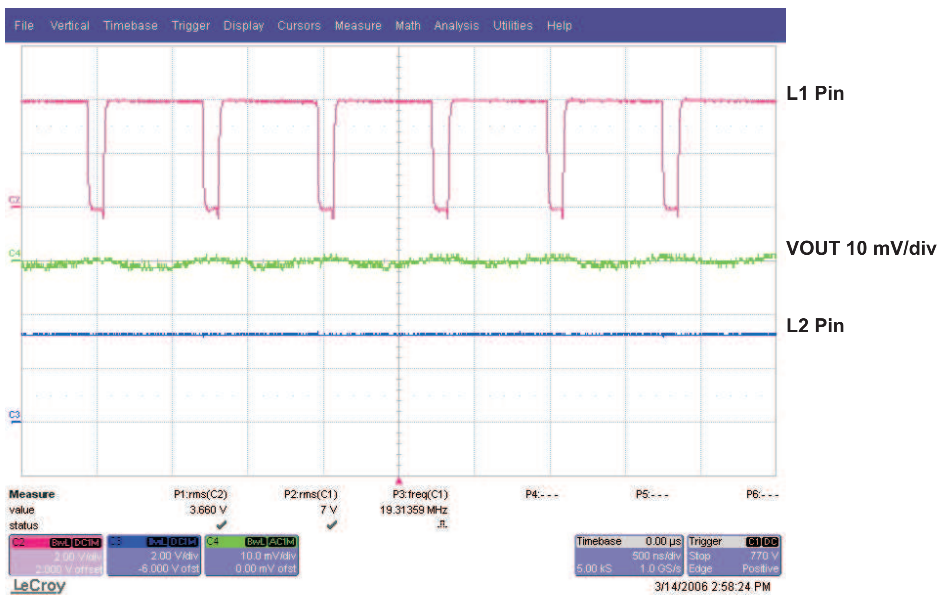

Figure 3. Output Ripple Vin 4.0 V

2.5 Efficiency

Efficiency of over 90% is common at mid-to-high loads. With power-save mode enabled, efficiency is greater than 80% at light loads of 1 mA to 100 mA.

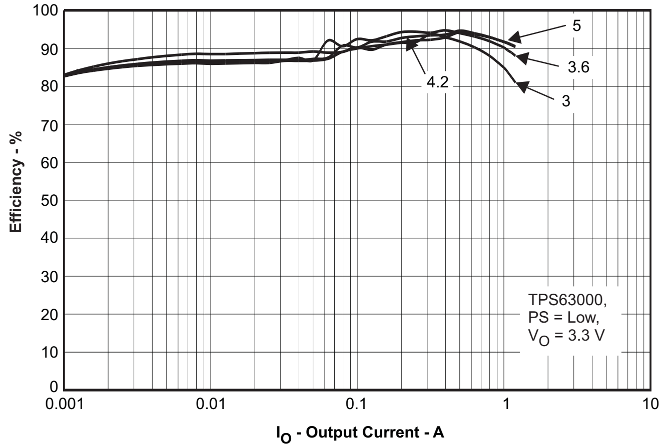

Figure 4. Efficiency Over Li-Ion Cell Range

2.6 Power Dissipation

With high efficiency, the power to be dissipated is low. Also, the QFN package with a solder pad is very efficient at removing heat. In this case, with unit delivering 3.3 V at 550 mA and 90% efficiency, power dissipation will be 180 mW. The package thermal resistance is about 50°C/W, therefore the case-to-junction temperature rise would be 9°C. This would allow an ambient temperatire of 116°C, and still hold the junction temperature below 125°C.

2.7 Load Transients

Load transient response is well regulated. Additional output capacitance reduces voltage over- and under-shoot.

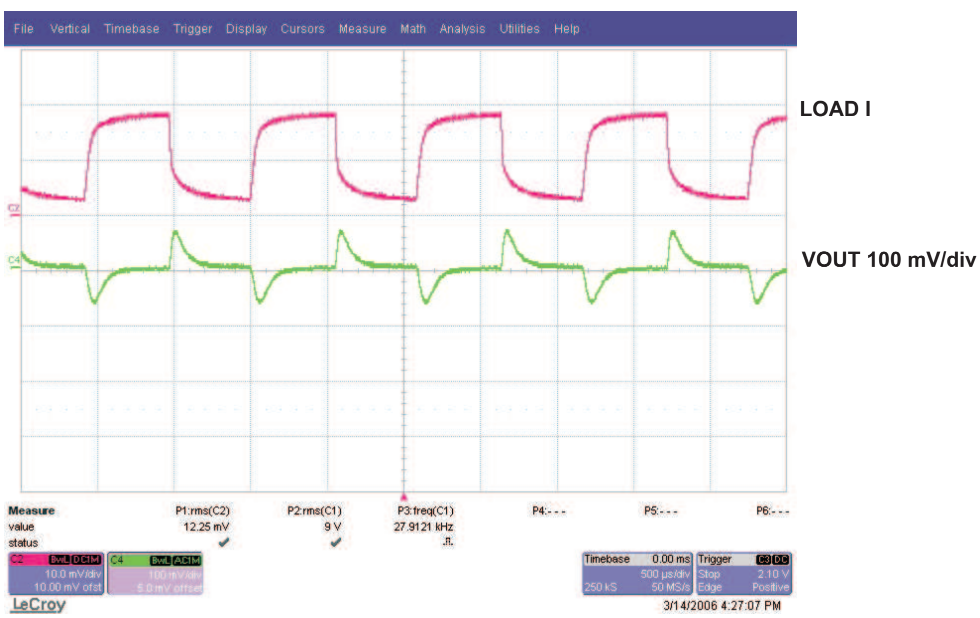

Figure 5. Load Step 100 mA to 500 mA

3 Board Layout

This chapter provides the TPS63000EVM-148 board layout and illustrations.

3.1 Layout

Figure 6 through Figure 8 show the board layout for the TPS63000EVM-148 PWB.

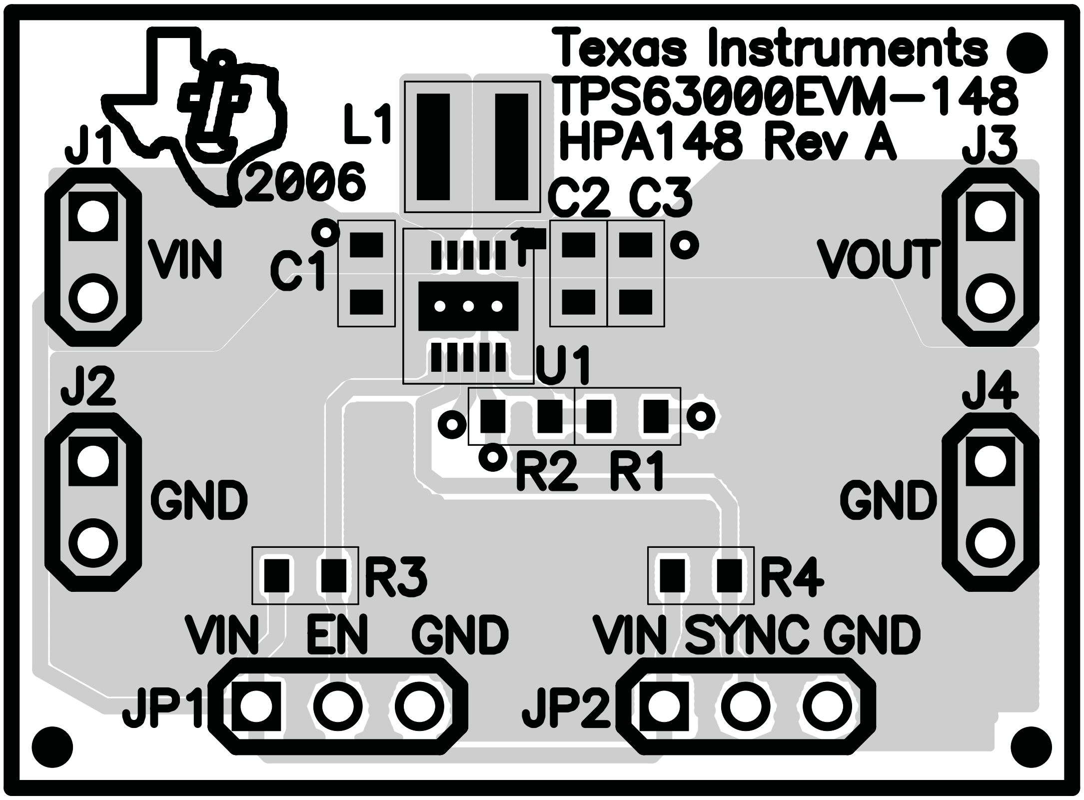

Figure 6. Assembly Layer

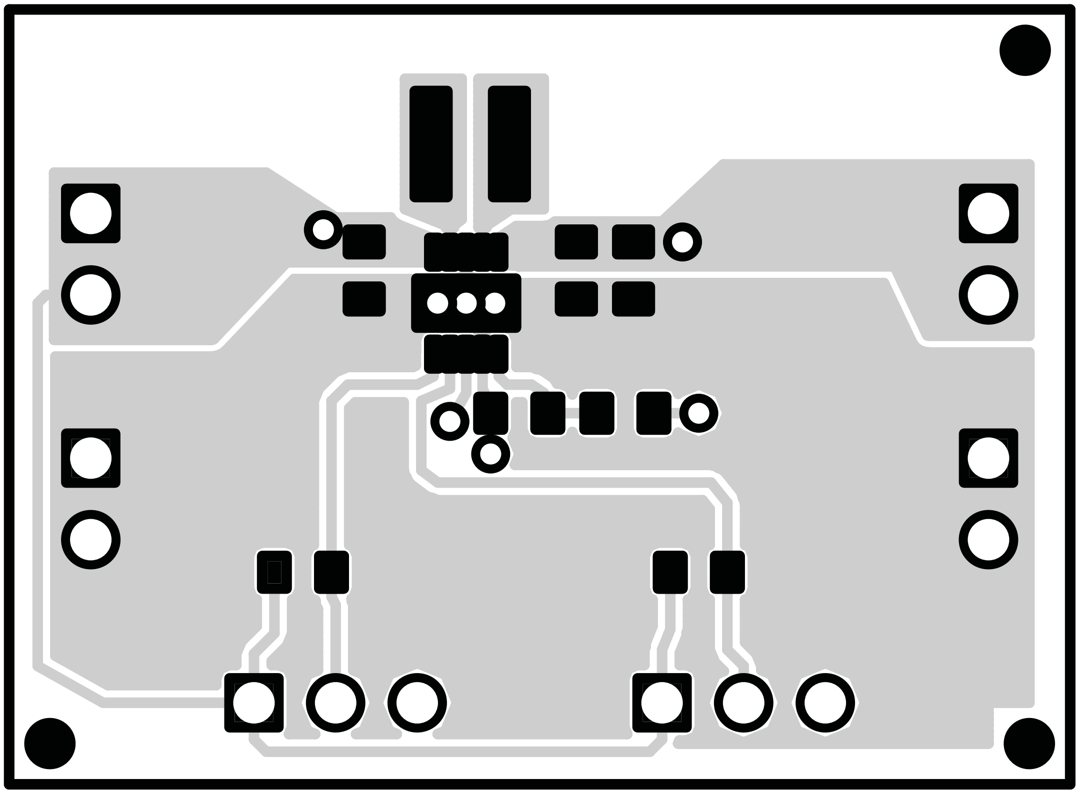

Figure 7. Top Layer Routing

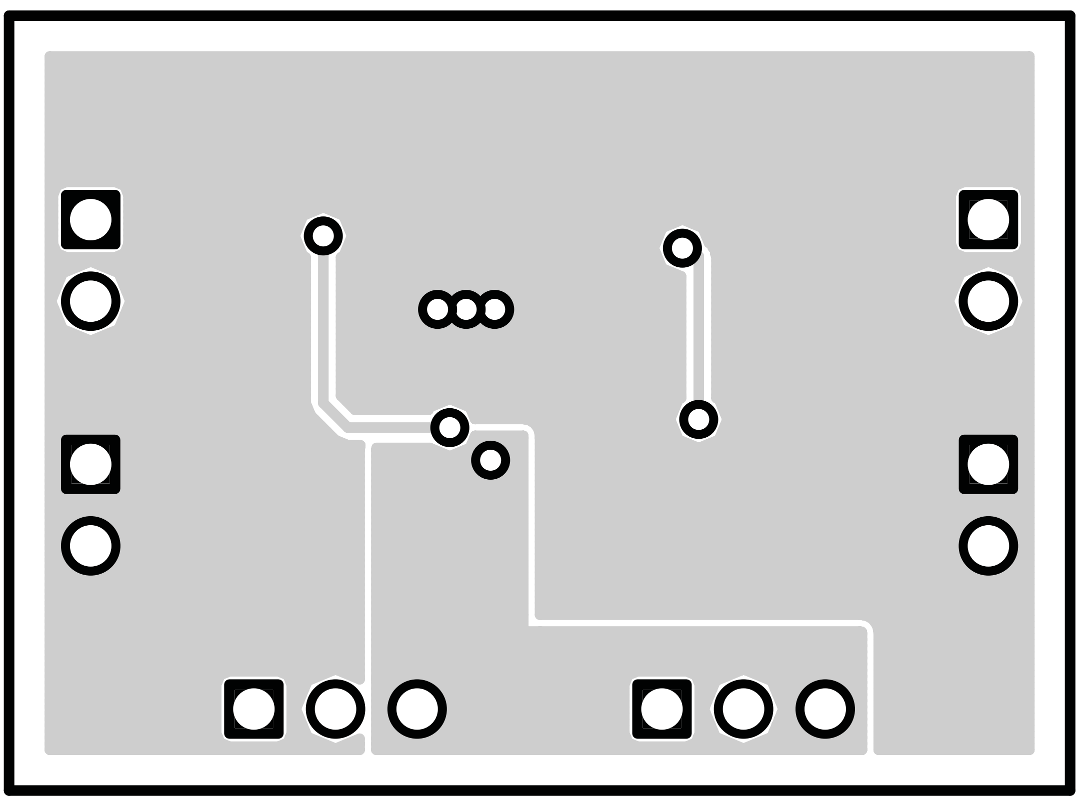

Figure 8. Bottom Layer Routing

4 Schematic and Bill of Materials

This chapter provides the TPS63000EVM-148 schematic and bill of materials.

4.1 Schematic

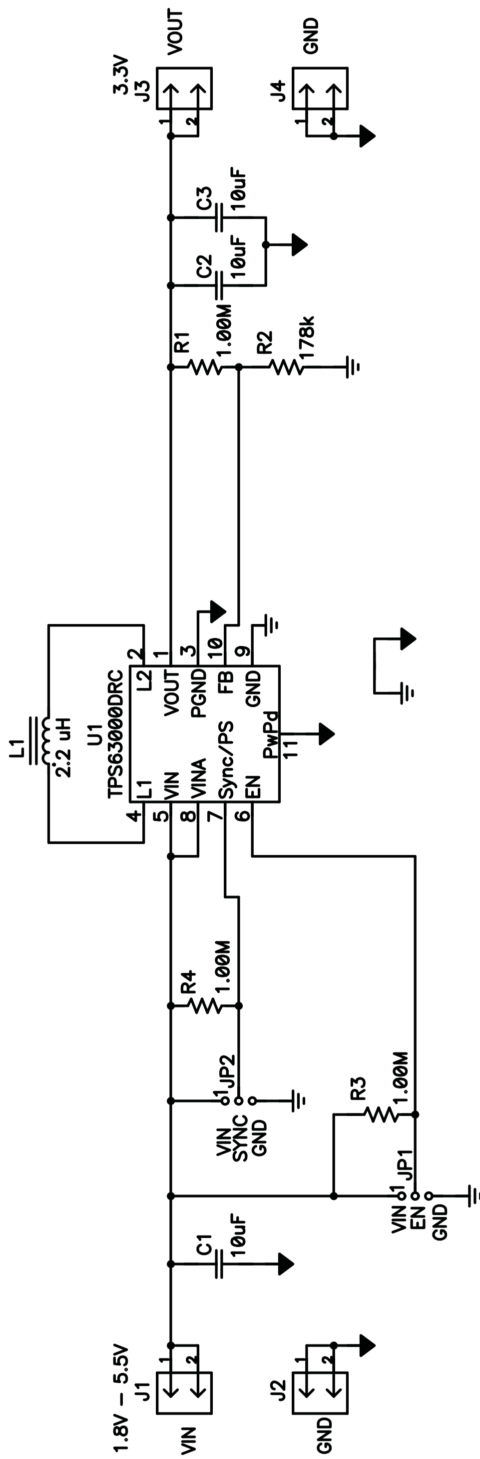

Figure 9. TPS63000EVM-148 Schematic

4.2 Bill of Materials

Table 2. TPS63000EVM-148 Bill of Materials

Count	RefDes	Value	Description	Size	Part Number	MFR
3	C1, C2, C3	10 µF	Capacitor, ceramic, 6.3-V, X5R, 20%	0603	C1608X5R0J106M	TDK
4	J1–J4		Header, 2-pin, 100-mil spacing, (36-pin strip)	0.100 × 2	PTC36SAAN	Sullins
2	JP1, JP2		Header, 3-pin, 100-mil spacing, (36-pin strip)	0.100 × 3	PTC36SAAN	Sullins
1	L1	2.2 µH	Inductor, SMT, 1.5-A, 110-mΩ	0.118 × 0.118	LPS3015-222ML	Coilcraft
3	R1, R3, R4	1.00M	Resistor, chip, 1/16-W, 1%	0603	Std	Std
1	R2	178k	Resistor, chip, 1/16-W, 1%	0603	Std	Std
1	U1		IC, High Efficiency, single-inductor buck-boost converter with 1.2-A switches	QFN10	TPS63000DRC	TI
1	—		PCB, 1.3-In × 0.95-In × 0.062-In		HPA148	Any
2	—		Shunt, 100-mil, black	0.100	929950-00	3M

4.3 Related Documentation From Texas Instruments

TPS63000 data sheet (SLVS520)

4.4 If You Need Assistance

Contact your local TI sales representative.

FCC Warnings

This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

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EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 3.0 V to 5.5 V. Maximum recommended output current is 1000 mA with 3.6 V input.

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.

During normal operation, some circuit components may have case temperatures greater than 50°C . The EVM is designed to operate properly with certain components above 50°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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