

User's Guide SLVU275–December 2008

TPS63030EVM-417

This user's guide describes the characteristics, operation, and use of the TPS63030EVM evaluation module (EVM). This EVM is designed to help the user easily evaluate and test the operation and functionality of the TPS63030. The document includes setup instructions for the hardware, a schematic diagram, a bill of materials, and printed-circuit board layout drawings for the evaluation module.

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1 Introduction

The Texas Instruments TPS63030 is a highly efficient, single-inductor, buck-boost converter in a 10-pin, 2,5-mm \times 2,5-mm QFN package. Both fixed and adjustable output voltage units are available.

1.1 Background

The TPS63030EVM-417 uses the TPS63030 adjustable version that is programmed with an external feedback divider to an output voltage of 3.3-V. The EVM operates with an input voltage between 1.8-V and 5.5-V.



Setup and Results

1.2 Performance Specification

Table 1 provides a summary of the TPS63030EVM-417 performance specifications. All specifications are given for an ambient temperature of 25°C.

	-	-			
Specification	Test Conditions	Min	Тур	Max	Unit
Input voltage	lout = 500 mA	1.8		5.5	V
Output voltage	Vin = 4.2 V, lout = 500 mA	3.2	3.3	3.4	V
Output current	Vin = 3.6 V	0		800	mA
Operating frequency			2250		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 printed-circuit board (PCB) for this EVM is designed to accommodate both the fixed and adjustable versions of this integrated circuit (IC). If the fixed version is installed, R1 is replaced with a $0-\Omega$ resistor and R2 is 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 the TPS63030 data sheet (<u>SLVS696</u>) for recommended values.

1.3.2 Fixed Output Operation

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

2 Setup and Results

This section describes how to properly use the TPS63030EVM-417.

2.1 Input / Output Connector and Header Descriptions

2.1.1 J1 – VIN

This header is the positive connection to the input power supply. The power supply must be connected between J1 and J6 (GND). The leads to the input supply should be twisted and kept as short as possible. The input voltage has to be between 1.8-V and 5.5-V.

2.1.2 J2 – VIN Sense/GND Sense

Header J2 can be used to measure the input voltage directly on the input capacitor. Therefore a 4-wire power & sense supply can be connected. The leads to the sensing connector should also be twisted.

2.1.3 J3 – GND

This header is the return connection of the output voltage. Connect the load between J3 and J4 (VOUT).



2.1.4 J4 – VOUT

This header is the positive connection of the output voltage. The load has to be connected between J4 and J3 (GND).

2.1.5 J5 – VOUT Sense / GND Sense

Header J5 can be used to measure the output voltage directly on the output capacitor.

2.1.6 J6 – GND

This header is the return connection to the input power supply. Connect the power supply between J6 and J1 (VIN). The leads to the input supply should be twisted and kept as short as possible. The input voltage has to be between 1.8-V and 5.5-V.

2.1.7 JP1 – EN

This jumpers enables/disables the TPS63030 on the EVM. The shorting jumper JP1 between the center pin and ON turns on the unit. Shorting the jumper between center pin and OFF turns the unit off. A 1-M Ω pullup resistor is connected between VIN and EN. Removing the jumper JP1 turns on the converter.

2.1.8 JP2 –SYNC/PS

The center pin of this jumpers is connected to the SYNC pin of the TPS63030 and is used to synchronize the unit with an external clock. This jumper also enables/disables the power-saving mode at light loads. Shorting jumper JP2 between the center pin and PWM disables the power-saving mode; the jumper between the center pin and PWM/PSM enables the power-saving mode. The device operates in power-saving mode at light-load conditions. See the TPS63030 data sheet (<u>SLVS696</u>) for detailed description.

A 1-M Ω pulldown resistor is connected between GND and SYNC/PS. By removing JP2, the converter operates on power-saving mode at light-load conditions.

2.2 Setup

To operate the EVM, simply connect an input supply between J1 and J6. Connect a load between J4 and J3. Input supply voltage of 1.8-V to 5.5-V is recommended.

2.3 Power Up

After the device is enabled and starts operating the average switch current limit is ramped up from initial 400-mA following the output voltage increasing.

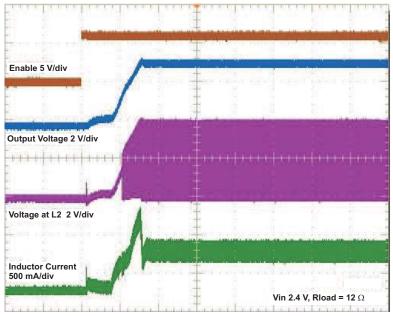
At an output voltage of 1.2-V, the switch current limit is at its nominal value of 1000-mA.

If the output voltage does not increase, the switch current limit does not increase. Figure 1 shows the typical start from Vin = 2.4-V into a load of $12-\Omega$.



Setup and Results

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t - Time - 400 μs/div

Figure 1. Turn ON into Load, Vin = 2.4 V

Figure 2 shows typical start from Vin = 4.2-V into a load of $12-\Omega$.

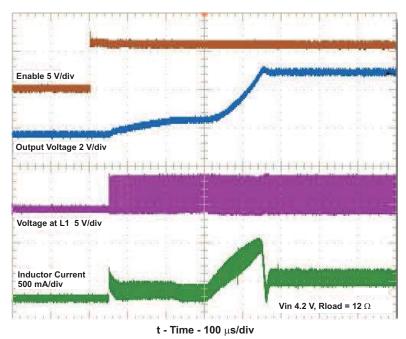
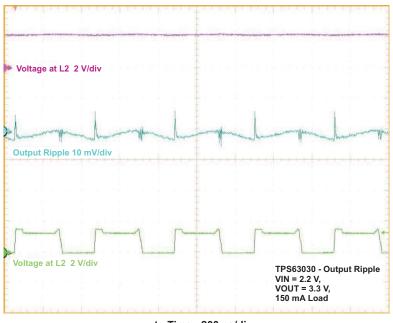


Figure 2. Turn ON into Load, Vin = 4.2 V



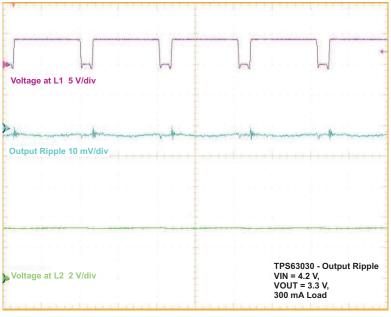
2.4 Output Ripple

Output ripple occurs at the switching frequency of 2.25 -MHz, and with the recommended L and output C, is low. Amplitude of the ripple varies, depending on load current and input voltage. Ensure that the oscilloscope probe is connected as close as possible to the output capacitor, with a 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.



t - Time - 200 ns/div

Figure 3. Output Ripple Vin 2.2 V



t - Time - 200 ns/div

Figure 4. Output Ripple Vin 4.2 V

Setup and Results



2.5 Load Transients

Figure 5 shows the load transient response behaviur at a load step from 100-mA to 500-mA. Additional output capacitance reduces voltage overshoot and undershoot.

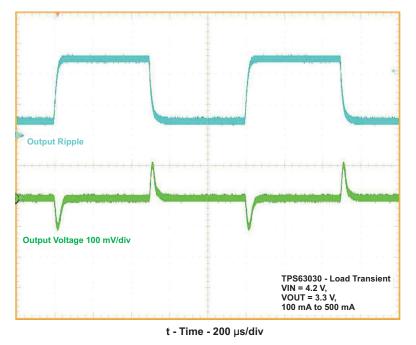


Figure 5. Load Step 100 mA to 500 mA

3 Board Layout

This section provides the TPS63030EVM-417 board layout and illustrations.



3.1 Layout

Figure 6 through Figure 8 show the board layout for the TPS63030EVM-417 PCB.

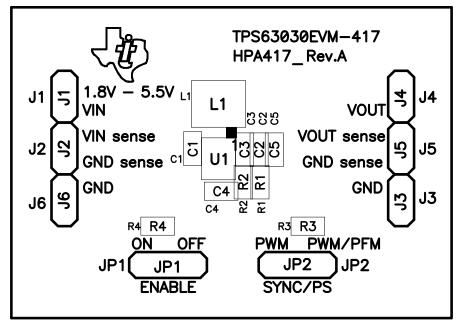


Figure 6. Assembly Layer

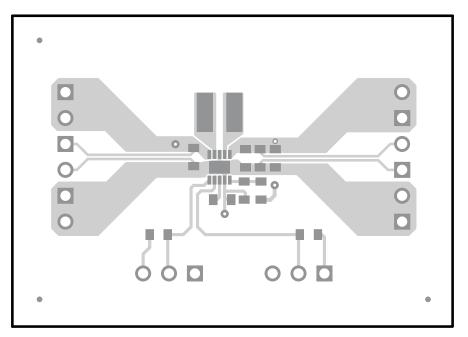


Figure 7. Top Layer Routing



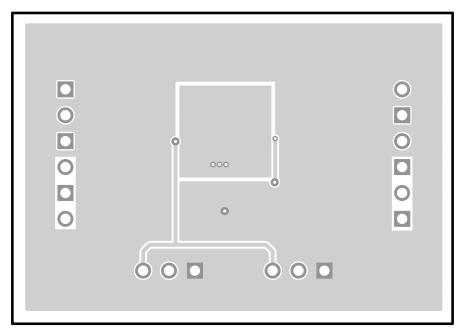
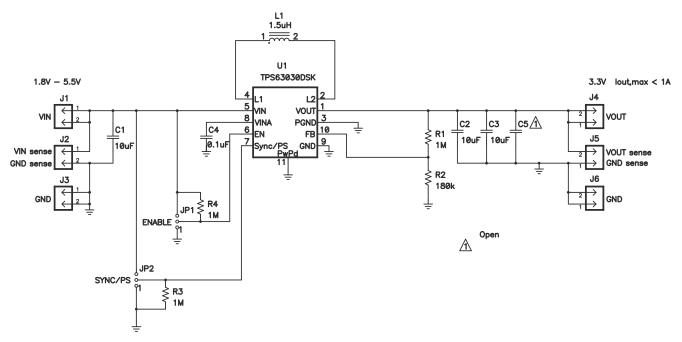


Figure 8. Bottom Layer Routing

4 Schematic and Bill of Materials

This section provides the TPS63030EVM-417 schematic and bill of materials.

4.1 Schematic







4.2 Bill of Materials

Count	RefDes	Value	Description	Size	Part Number	MFR
3	C1, C2, C3	10 μF	Capacitor, ceramic, 6.3-V, X7R, 10%	0603	GRM188R60J106ME84D	Murata
1	C4	0.1 μF	Capacitor, ceramic, 6.3-V, X7R, 10%	0603	GRM188R70J104KA01B	Murata
0	C5	Open	Capacitor, ceramic, 6.3-V, X7R, 10%	0603	GRM188R60J106ME84D	Murata
6	J1–J6		Header, Male 2-pin, 100-mil spacing	$0.100 \text{ inch} \times 2$		Any
2	JP1, JP2		Header, 3-pin, 100-mil spacing	$0.100 \text{ inch} \times 3$		Any
1	L1	1.5 μΗ	Inductor, SMT, 1.3-A, 110-mΩ	0.118 × 0.118	LPS3015-152MLB	Coilcraft
3	R1, R3, R4	1M	Resistor, chip, 1/16-W, 1%	0603	Std	Std
1	R2	180k	Resistor, chip, 1/16-W, 1%	0603	Std	Std
1	U1	TPS63030DSK	IC, DC-DC Converter	DSK	TPS63030DSK	TI
1	—		PCB, 1.7 In × 1.2 In × 0.062-In		HPA417	Any
2	_		Shunt, 100-mil, black	0.100		Any

Table 2. TPS63030EVM-417 Bill of Materials

4.3 Related Documentation From Texas Instruments

TPS63030, High Efficiency Single Inductor Buck-Boost Converter With 1-A Switches data sheet (<u>SLVS696</u>)

4.4 If You Need Assistance

Contact your local TI sales representative.

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EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 3.6 V to 5.5 V and the output voltage range of 1000 mA.

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.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

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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