

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.

Contents

1	Introduction	1
2	Setup and Results	2
3	Board Layout	6
4	Schematic and Bill of Materials	8

List of Figures

1	Turn ON into Load, $V_{in} = 2.4\text{ V}$	4
2	Turn ON into Load, $V_{in} = 4.2\text{ V}$	4
3	Output Ripple $V_{in} 2.2\text{ V}$	5
4	Output Ripple $V_{in} 4.2\text{ V}$	5
5	Load Step 100 mA to 500 mA.....	6
6	Assembly Layer	7
7	Top Layer Routing	7
8	Bottom Layer Routing	8
9	TPS63030EVM-417 Schematic.....	8

List of Tables

1	Performance Specification Summary	2
2	TPS63030EVM-417 Bill of Materials	9

1 Introduction

The Texas Instruments TPS63030 is a highly efficient, single-inductor, buck-boost converter in a 10-pin, 2,5-mm × 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.

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.

Table 1. Performance Specification Summary

Specification	Test Conditions	Min	Typ	Max	Unit
Input voltage	I _{out} = 500 mA	1.8		5.5	V
Output voltage	V _{in} = 4.2 V, I _{out} = 500 mA	3.2	3.3	3.4	V
Output current	V _{in} = 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-Ω 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 ([SLVS696](#)) 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 ([SLVS696](#)) 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 $V_{in} = 2.4\text{-V}$ into a load of 12- Ω .

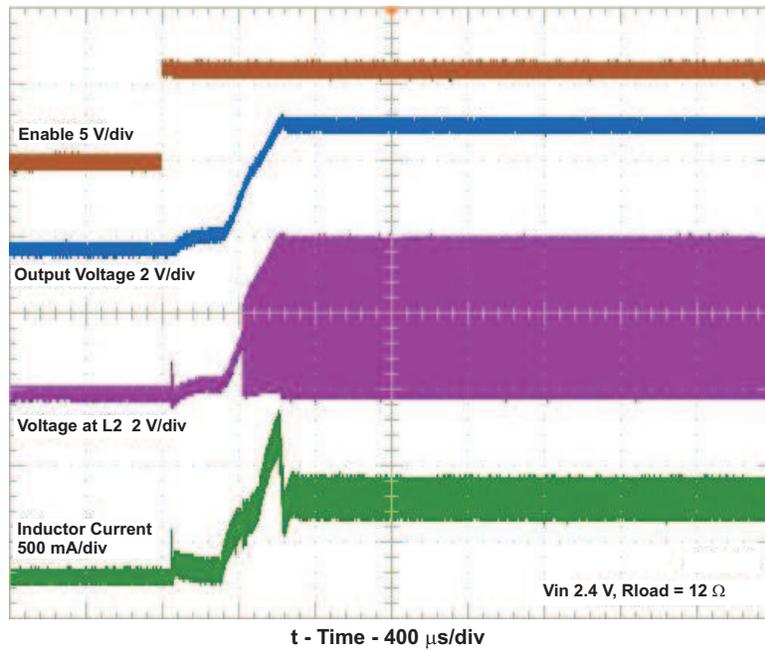


Figure 1. Turn ON into Load, Vin = 2.4 V

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

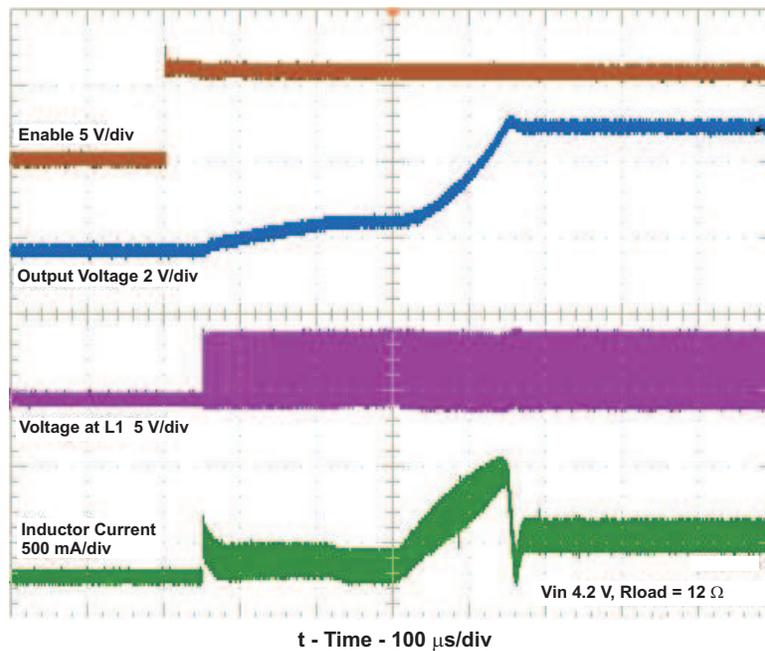
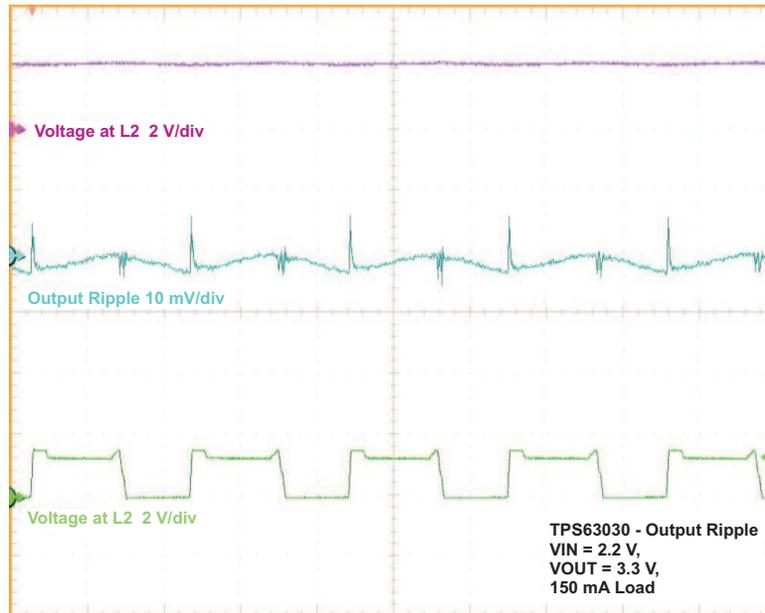


Figure 2. Turn ON into Load, Vin = 4.2 V

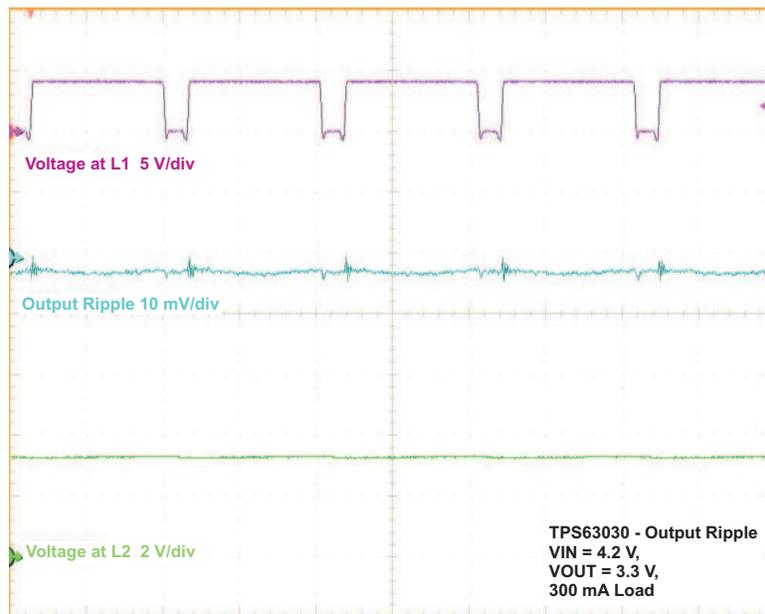
2.4 Output Ripple

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

2.5 Load Transients

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

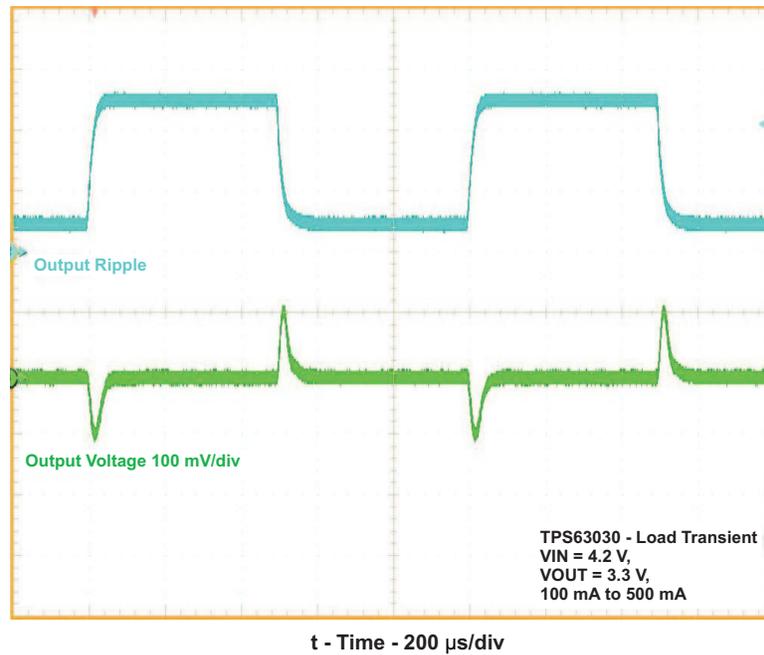


Figure 5. Load Step 100 mA to 500 mA

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.

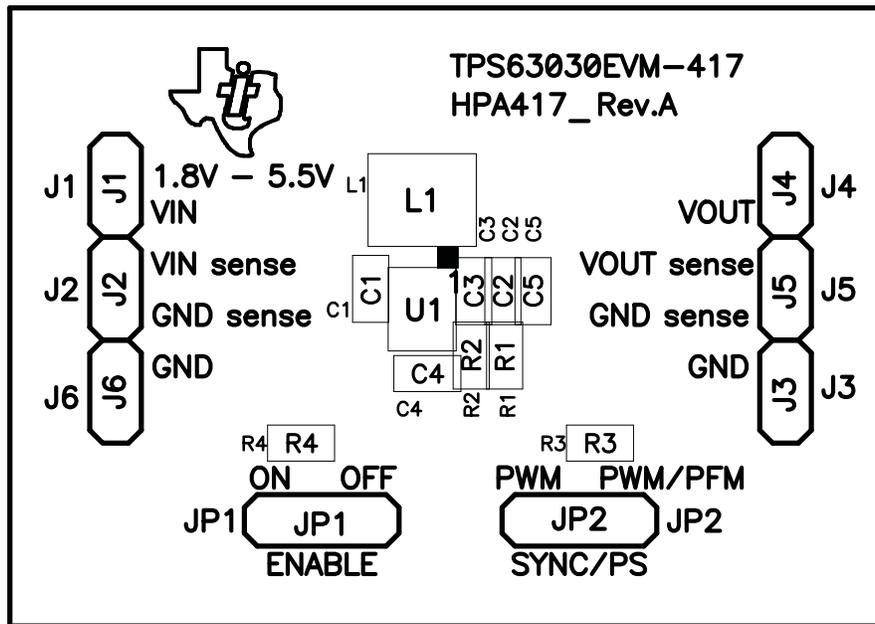


Figure 6. Assembly Layer

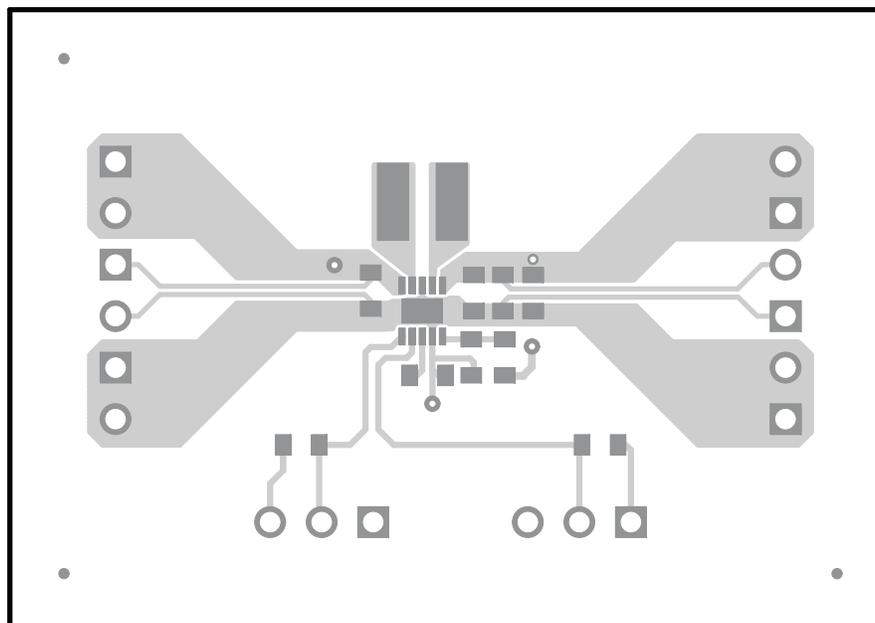


Figure 7. Top Layer Routing

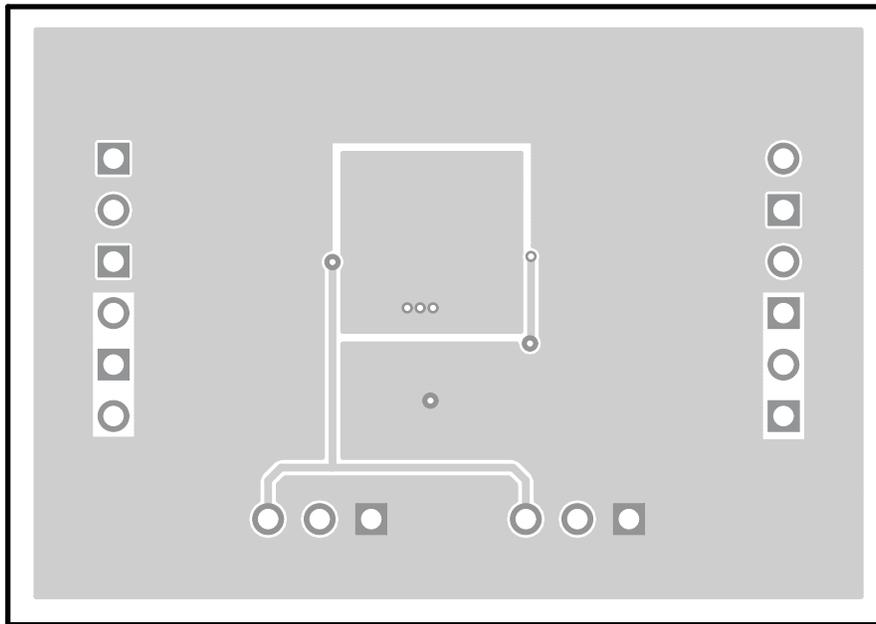


Figure 8. Bottom Layer Routing

4 Schematic and Bill of Materials

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

4.1 Schematic

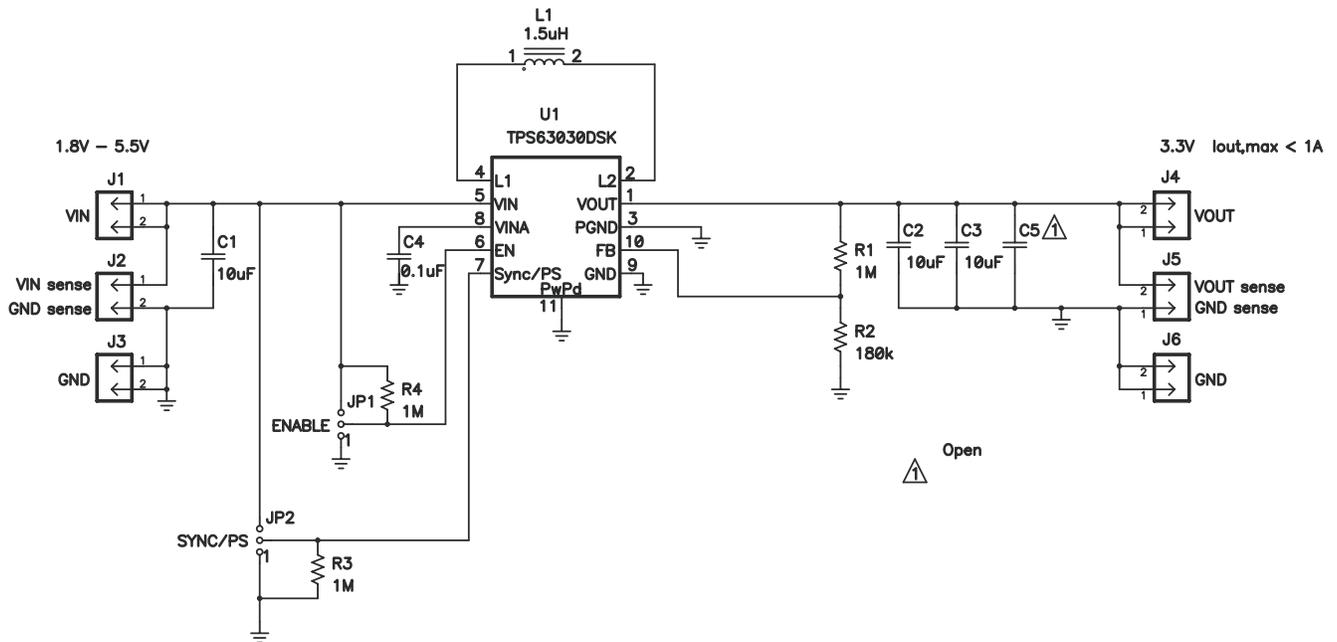


Figure 9. TPS63030EVM-417 Schematic

4.2 Bill of Materials

Table 2. TPS63030EVM-417 Bill of Materials

Count	RefDes	Value	Description	Size	Part Number	MFR
3	C1, C2, C3	10 μ F	Capacitor, ceramic, 6.3-V, X7R, 10%	0603	GRM188R60J106ME84D	Murata
1	C4	0.1 μ F	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 inch \times 2		Any
2	JP1, JP2		Header, 3-pin, 100-mil spacing	0.100 inch \times 3		Any
1	L1	1.5 μ H	Inductor, SMT, 1.3-A, 110-m Ω	0.118 \times 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 \times 1.2 In \times 0.062-In		HPA417	Any
2	—		Shunt, 100-mil, black	0.100		Any

4.3 Related Documentation From Texas Instruments

TPS63030, High Efficiency Single Inductor Buck-Boost Converter With 1-A Switches data sheet ([SLVS696](#))

4.4 If You Need Assistance

Contact your local TI sales representative.

EVALUATION BOARD/KIT IMPORTANT NOTICE

Texas Instruments (TI) provides the enclosed product(s) under the following conditions:

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. Persons handling the product(s) must have electronics training and observe good engineering practice standards. As such, the goods being provided are not intended to be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and therefore may not meet the technical requirements of these directives or other related directives.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.**

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

TI currently deals with a variety of customers for products, and therefore our arrangement with the user **is not exclusive.**

TI assumes **no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein.**

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please contact the TI application engineer or visit www.ti.com/esh.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used.

FCC Warning

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to 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.

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.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2008, Texas Instruments Incorporated

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
RF/IF and ZigBee® Solutions	www.ti.com/lprf

Applications

Audio	www.ti.com/audio
Automotive	www.ti.com/automotive
Broadband	www.ti.com/broadband
Digital Control	www.ti.com/digitalcontrol
Medical	www.ti.com/medical
Military	www.ti.com/military
Optical Networking	www.ti.com/opticalnetwork
Security	www.ti.com/security
Telephony	www.ti.com/telephony
Video & Imaging	www.ti.com/video
Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2008, Texas Instruments Incorporated