Texas Instruments

TPS61090EVM-029

Evaluation Module

User's Guide

October 2003

SBVU003

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

Products		**Applications**	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	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

EVM IMPORTANT NOTICE

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

This evaluation kit being sold by TI is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not considered by TI to be fit for commercial use. As such, the goods being provided may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety measures typically found in the end product incorporating the goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may not meet the technical requirements of the directive.

Should this evaluation kit not meet the specifications indicated in the EVM User's Guide, the 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. Please be aware that the products received may not be regulatory compliant or agency certified (FCC, UL, CE, etc.). 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 EVM User's Guide and, specifically, the EVM Warnings and Restrictions notice in the EVM User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact the TI application engineer.

Persons handling the product must have electronics training and observe good laboratory practice standards.

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.

Mailing Address:

Texas Instruments
Post Office Box 655303
Dallas, Texas 75265

EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the specified input and output ranges described in the EVM User's Guide.

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 60°C. The EVM is designed to operate properly with certain components above 60°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

Preface

Read This First

About This Manual

This user's guide describes the characteristics, operation, and use of the TPS61090EVM-029 synchronous boost converter evaluation module (EVM). This EVM features a Texas Instruments high-efficiency, single-cell Li-Ion, dual-cell battery boost converter that is configured to deliver 5.0V at 500mA with an input voltage of 1.8V. This user's guide includes setup instructions, a schematic diagram, a bill of materials (BOM), characterization results, and printed circuit board (PCB) layout drawings for the evaluation module.

How to Use This Manual

This document contains the following chapters:

- Chapter 1—Introduction
- Chapter 2—Setup
- Chapter 3—Board Layout
- Chapter 4—Schematic and Bill of Materials

Related Documentation From Texas Instruments

The following document provides information regarding Texas Instruments integrated circuits used in the assembly of the TPS61090EVM-029. This document is available from the TI web site. The last character of the literature number corresponds to the document revision, which is current at the time of the writing of this User's Guide. To obtain a copy of the following TI document, visit our website at http://www.ti.com/ or call the Texas Instruments Literature Response Center at (800) 477−8924 or the Product Information Center at (972) 644−5580. When ordering, identify the document by both title and literature number.

Data sheet	**Literature number**
TPS61090 Data Sheet	SLVS484

If You Need Assistance

If you have questions regarding either the use of this evaluation module or the information contained in the accompanying documentation, please contact the Texas Instruments Product Information Center at (972) 644−5580, visit the TI web site at www.ti.com, or contact your local TI sales representative.

FCC Warning

This equipment is intended for use in a laboratory test environment only. It generates, uses, and can readiate 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 interface 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.

Contents

Figures

Tables

Chapter 1

Introduction

The Texas Instruments TPS61090EVM evaluation board helps designers evaluate the operation and performance of the TPS61090 family of high-frequency synchronous boost DC/DC converters.

This EVM is specifically designed and optimized to operate with 2-cell NiCad, Ni-MH, or alkaline battery input. The default output voltage of this EVM is 5.0V. If desired, this EVM can easily be modified to supply higher or lower output voltages by adjusting the appropriate feedback resistor dividers. Also, other fixed-output voltage versions of the devices can be easily evaluated using this EVM. Refer to the product data sheet (SLVS484) for the various fixed-output voltage options available in the TPS6109x device family as well as for more information on adjusting the output voltage.

Chapter 2

Setup

This chapter describes the jumpers and connectors on the EVM as well as how to properly configure, set up, and use the TPS61090EM-029.

Topic **Page**

2.1 Input/Output Connector Descriptions

2.1.1 J1—VBAT

This is the positive connection to the input power supply. The leads to the input supply should be twisted and kept as short as possible to minimize EMI transmission.

2.1.2 J2—GND

This is the return connection for the input power supply.

2.1.3 J3—VOUT

This is the positive connection from the output of the power supply. Connect this pin to the positive input of the load.

2.1.4 J4—GND

This is the negative connection from the output of the power supply. Connect this pin to the negative input of the load.

2.1.5 J5—LBO

The LBO pin is an open-drain output configured with a 1M pull-up resistor.

2.1.6 J6—GND

This is the ground connection for the LBO pin.

2.1.7 JP1—SYNC

This jumper enables or disables the power save mode at light loads. If SYNC is connected to VBAT, the power save mode is disabled. Connecting SYNC to GND enables the power save mode. When the SYNC pin is not connected to VBAT or GND, the switch of the frequency of the device will synchronize to a user-provided signal of 500kHz to 700kHz.

2.1.8 JP2—EN

This jumper enables and disables the TPS61090 on the EVM.

2.2 Setup

Connect an input supply between J1 and J2. The voltage range on this supply should stay between 1.8V and 5.0V. Connect a load between J3 and J4. Enable the output by positioning a jumper to connect the EN and ON pins. Configure the SYNC jumper to the desired setting.

2.3 Operation

The EVM has been optimized to operate from a 2-cell NiCad, NiMH, and alkaline battery with input voltage range down to 1.8V. The output voltage is set to 5.0V and is capable of supplying 500mA. After connecting the input and output connections, and setting the SYNC jumper (JP1) to the desired setting, turn on the input supply and then enable the output as desired with JP2.

The resistor divider on the LBI pin is designed to trip the LBO output when the input supply voltage drops below 1.8V.

To reduce the total PCB design area, the inductor used on the EVM is smaller than the inductor used in characterization curves in the data sheet. Generally, smaller size inductors decrease the efficiency in the design. Figure 2−1 shows the efficiency vs I_{OUT} curve for the TPS61090EVM.

Figure 2−1. Efficiency vs I_{OUT} for the TPS61090EVM

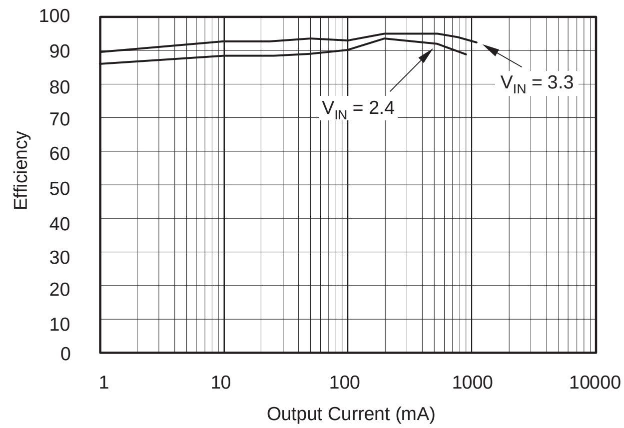
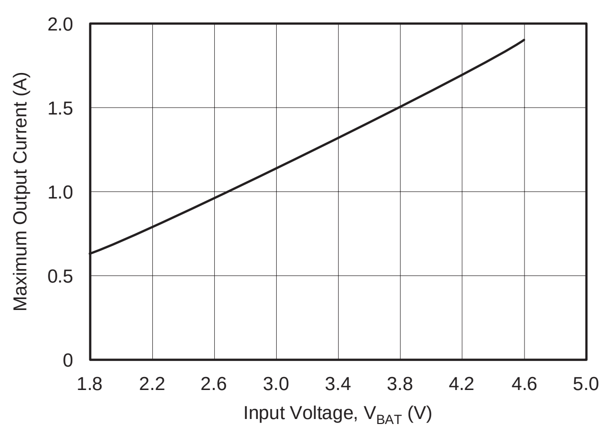


Figure 2−2 shows the typical maximum output current vs input voltage for this EVM. The maximum output current of the EVM is slightly less than what is shown in the data sheet. This difference is because the EVM uses a smaller value inductor with a smaller footprint to save board area.

Figure 2−2. Maximum Output Current vs V_{BAT}



Chapter 3

Board Layout

This chapter provides the TPS61090EVM-029 board layout and illustrations.

Topic **Page**

3.1 Layout

Board Layout is critical for all switch mode power supplies. Figure 3−1, Figure 3−2, and Figure 3−3 show the board layout for the TPS61090EVM-029 PCB. The nodes with high switching frequencies and currents are short and isolated from the noise sensitive feedback circuitry. Careful attention has been given to the routing of high-frequency current loops. Refer to the data sheet for specific layout guidelines.

Figure 3−1. Assembly Layer

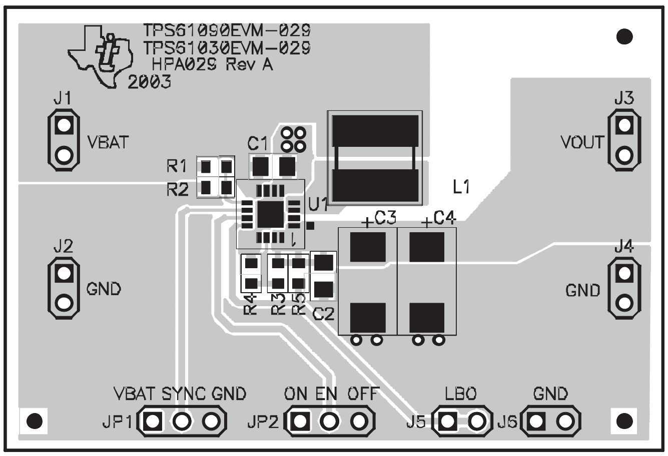


Figure 3−2. Top Layer Routing

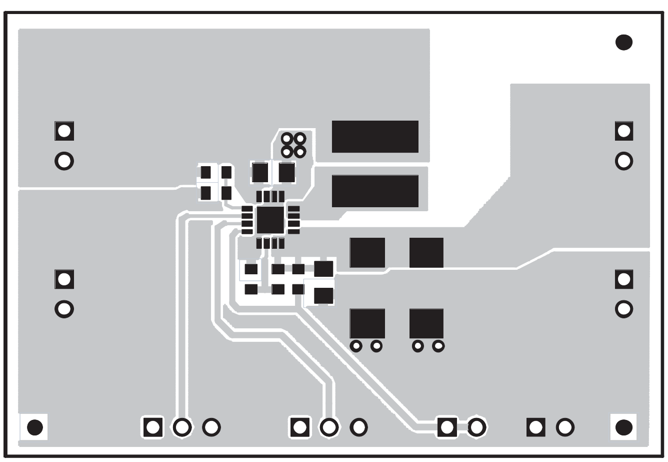
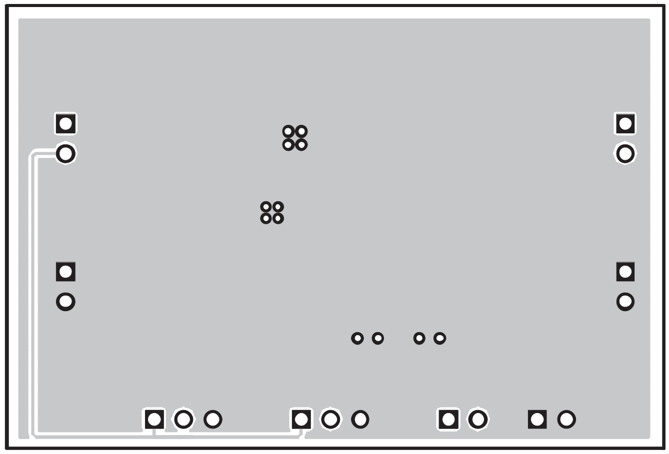


Figure 3−3. Bottom Layer Routing



Chapter 4

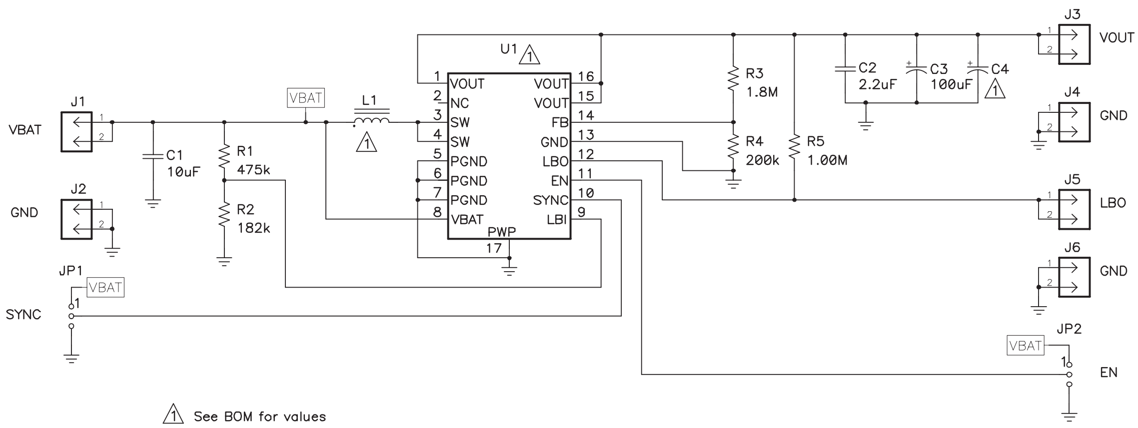
Schematic and Bill of Materials

This chapter provides the TPS61090EVM-029 schematic and bill of materials.

Topic **Page**

4.1 Schematic

Figure 4−1. TPS61090EVM-029 Schematic



4.2 Bill of Materials

Table 4−1. TPS61090EVM-029 Bill of Materials

Count	Reference Designator	Description	Size	Manufacturer	Mfg Part Number
1	C1	Capacitor, Ceramic, 10µF, 6.3V, X5R, ±10%	805	TDK	C1608X5R1A105KT
1	C2	Capacitor, Ceramic, 2.2µF, 10V, X5R, ±20%	805	TDK	C1005X7R1H472KT
1	C3	Capacitor, Low ESR Tantalum, 100µF, 16V, 270mΩ, 10%	7343 (D)	Vishay	595D107X0016C2T
0	C4	Capacitor, Low ESR Tantalum, xxµF, vvV	7343 (D)	Vishay	595D107X0016C2T
6	J1 − J6	Header, 2-pin, 100 mil spacing (36-pin strip)	0.100 x 2	Sullins	PTC36SAAN
2	JP1, JP2	Header, 3-pin, 100 mil spacing (36-pin strip)	0.100 x 3	Sullins	PTC36SAAN
1	L1	Inductor, SMT, 6.2µH, 2.5A, 27mΩ	0.264 sq	Sumida	CDRH6D38-6R2
1	R1	Resistor, Chip, 475kΩ, 1/16W, 1%	603	Std	Std
1	R2	Resistor, Chip, 182kΩ, 1/16W, 1%	603	Std	Std
1	R3	Resistor, Chip, 1.8MΩ, 1/16W, 1%	603	Std	Std
1	R4	Resistor, Chip, 200kΩ, 1/16W, 1%	603	Std	Std
1	R6	Resistor, Chip, 1.0MΩ, 1/16W, 1%	603	Std	Std
1	U1	IC, Synchronous Boost Converter with 2A Switch	QFN−16	Texas Instruments	TPS61090RSA
1	−−	PCB, 2.23in x 1.5in x .062in		Any	HPA029
2	−−	Shunt, 100 mil (black)	0.100	3M	929950−00