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# **TPS61090EVM-029**

## ***Evaluation Module***



**User's Guide**

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## **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.

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## Preface

# Read This First

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### ***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.

|                     |                          |
|---------------------|--------------------------|
| <b>Data sheet</b>   | <b>Literature number</b> |
| 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](http://www.ti.com), or contact your local TI sales representative.

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# Contents

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|  |     |
|--|-----|
| <b>Introduction</b> .....                          | iii |
| About This Manual .....                            | iii |
| How to Use This Manual .....                       | iii |
| Related Documentation From Texas Instruments ..... | iii |
| If You Need Assistance .....                       | iv  |
| FCC Warning .....                                  | iv  |
| <b>Contents</b> .....                              | v   |
| <b>Figures</b> .....                               | vi  |
| <b>Tables</b> .....                                | vi  |
| <b>Introduction</b> .....                          | 1-1 |
| <b>Setup</b> .....                                 | 2-1 |
| 2.1    Input/Output Connector Descriptions .....   | 2-2 |
| 2.2    Setup .....                                 | 2-2 |
| 2.3    Operation .....                             | 2-3 |
| <b>Board Layout</b> .....                          | 3-1 |
| 3.1    Layout .....                                | 3-2 |
| <b>Schematic and Bill of Materials</b> .....       | 4-1 |
| 4.1    Schematic .....                             | 4-2 |
| 4.2    Bill of Materials .....                     | 4-3 |

# **Figures**

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---

|   |     |
|---|-----|
| Figure 1. Efficiency vs $I_{OUT}$ for the TPS61090EVM ..... | 2-3 |
| Figure 2. Maximum Output Current vs $V_{BAT}$ .....         | 2-3 |
| Figure 3. Assembly Layer .....                              | 3-2 |
| Figure 4. Top Layer Routing .....                           | 3-2 |
| Figure 5. Bottom Layer Routing .....                        | 3-3 |
| Figure 6. TPS61090EVM-029 Schematic .....                   | 4-2 |

# **Tables**

---

---

---

|  |     |
|--|-----|
| Table 1. TPS61090EVM-029 Bill of Materials ..... | 4-3 |
|--|-----|

## 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 ..... | 2-2  |
| 2.2 Setup .....                               | 2-2  |
| 2.3 Operation .....                           | 2-3  |

## **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*

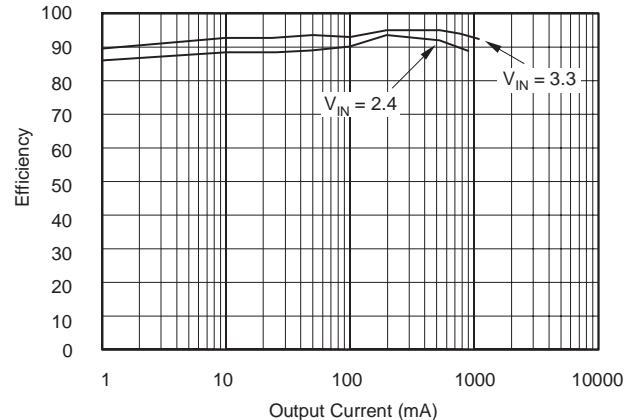
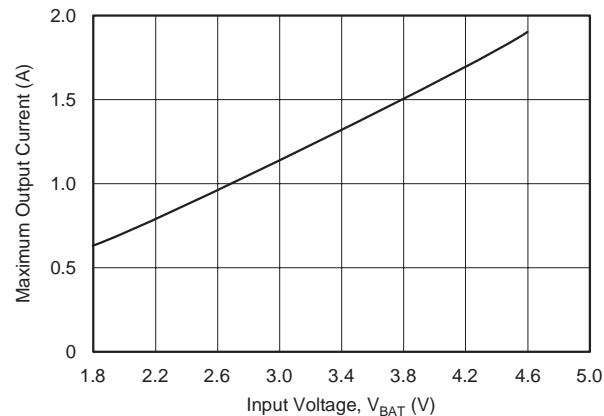


Figure 2–2 shows the typical maximum output current vs input voltage for this EVM. The maximum output current of the EVM is slightly less than what is shown in the data sheet. This difference is because the EVM uses a smaller value inductor with a smaller footprint to save board area.

*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 ..... | 3-2  |

### 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

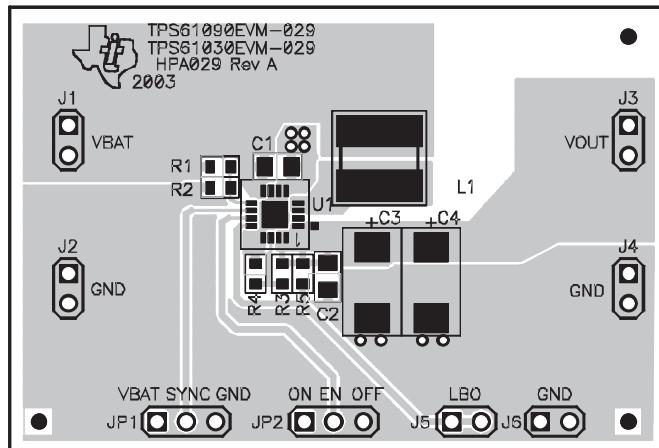
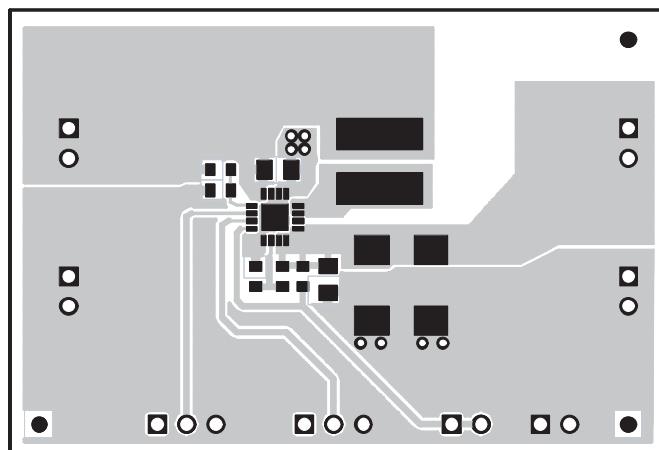
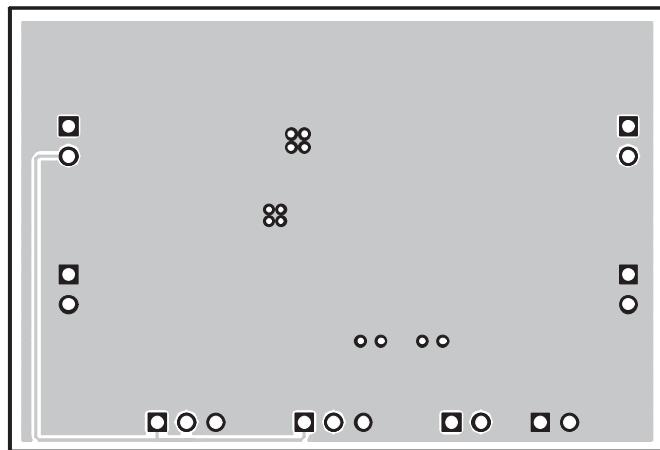


Figure 3–2. Top Layer Routing



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*Figure 3–3. Bottom Layer Routing*



## Chapter 4

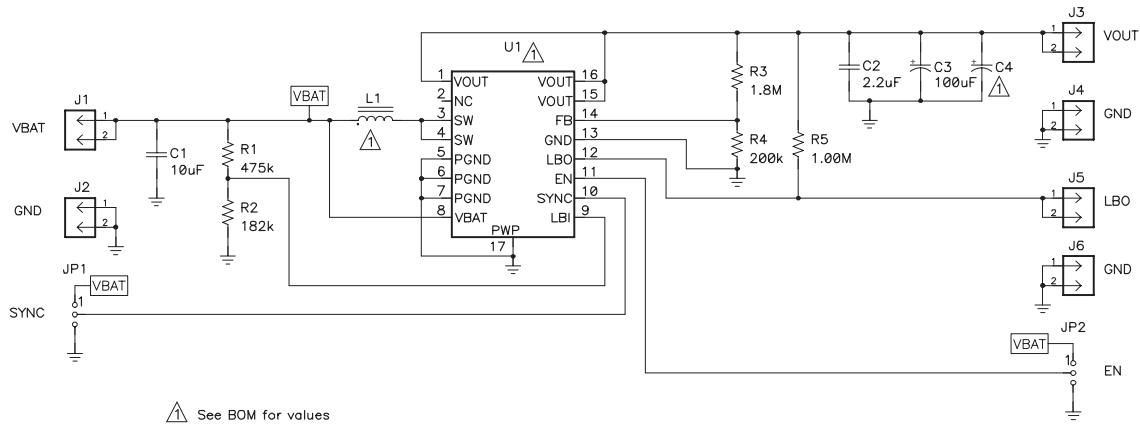
# Schematic and Bill of Materials

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

| Topic                       | Page |
|-----------------------------|------|
| 4.1 Schematic .....         | 4-2  |
| 4.2 Bill of Materials ..... | 4-3  |

## 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       |