User's Guide
SLVU080B–January 2003–Revised September 2016

TPS6103x EVM-208 For High Efficient Output Current Boost Converter

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1 Introduction

The Texas Instruments TPS61030, TPS61031, and TPS61032 evaluation modules (EVM) for high-efficiency boost converters help designers evaluate the different operating modes and the performance of the device. See Table 1 for the various EVMs available in this family.

If any other output voltage configuration is to be evaluated, the TPS61030 adjustable output voltage version can be set up to provide an output voltage between 2.5 V and 5.5 V at the output of the boost converter. Only the appropriate feedback resistor divider has to be adjusted. Also, other fixed output voltage device versions can be easily evaluated using the EVM. Refer to the SLUS534 data sheet for the fixed output voltage options available in the TPS6103x device family. The TPS6103x has an input voltage range between 1.8 V and 5.5 V. For proper operation the maximum input voltage should not exceed the output voltage.

Table 1. EVMs You Can Order

EVM Number	Description
TPS61030EVM-208	Adjustable boost output voltage, set to 5 V
TPS61031EVM-208	Boost output voltage fixed at 3.3 V
TPS61032EVM-208	Boost output voltage fixed at 5 V

2 Setting Up the EVMs

It is important to establish all connections for the EVM before power is applied to the EVM.

- ❑ Connect a power supply (1.8 V to VOUT, depending on the output voltage of the EVM) to the INPUT header.
- ❑ Connect a voltmeter to the OUTPUT header.
- ❑ Verify that all jumpers are set to the correct value (EN, SYNC). Default value for EN for V_{BAT} and SYNC for GND.
- ❑ Turn on the power supply and verify the output voltage is within limits described in the **EVM Warnings and Restrictions** section. It is important to operate this EVM within the input voltage range of 1.8 V to 5.0 V and the output voltage range of 2.5 V to 5.5 V at the dc-dc output.

2.1 Introduction—Evaluation with the TPS6103x EVM

This section details the evaluation process and features of the EVM. For detailed evaluation, a load must be connected to the output terminal in order to adjust the load current between 0 mA and 1600 mA.

CAUTION

For accurate output voltage and input voltage measurements, it is important to measure the voltage on the input and output voltage terminals with Kelvin contacts or with a voltmeter connected directly to the input voltage or output voltage terminals. This eliminates any measurement errors related to voltage drops along the input and output terminal wires connected to the power supply or load.

2.2 Enable (EN) Jumper

This jumper is used to enable the device. Connecting the enable pin (EN) to V_{BAT} enables the part. The device is disabled when EN is set to GND. For more details about the Enable Jumper, refer to the SLUS534 data sheet.

2.3 Power Save Mode Enable and Synchronization (SYNC) Jumper

This jumper enables the device to enter into power save mode at light load, when it is set to GND. The device automatically stops switching when the output voltage reached its upper threshold, and starts switching again, when the lower threshold of the output voltage is reached.

When disabling the power save function by setting the jumper to VBAT, the device stays operating in fixed frequency mode, regardless of the load current value. In this mode, however reverse current flows back to the input during light load operation, increasing power losses. The operating frequency stays constant, which implies low output voltage ripple.

To synchronize the operating frequency to an external frequency, a clock signal can be applied to the SYNC pin. The device then operates at the applied operating frequency, with no Power Save Mode. For more details about the applied frequency and synchronization frequency range, refer to the SLUS534 data sheet.

2.4 LBI/LBO Comparator

The LBO terminal is an open drain output and has a pullup resistor, R6, connected to the output. The signal on this pins goes low as soon as the input voltage at LBI falls below the threshold of 500 mV. Refer to the more detailed description in the SLUS534 data sheet.

The LBO output stays at high-impedance when the input voltage at LBI is above the appropriate threshold. A resistor divider (R1, R2) is used on the EVM to monitor the supply voltage. More details about setting the low battery threshold voltage can be found in the SLUS534 data sheet.

3 Bill of Materials, PCB Layout, and Schematic

Section contents:

- Section 3.1 Bill of Materials
- Section 3.2 PCB Layout
- Section 3.3 Schematic

3.1 Bill of Materials

The TPS6103x EVM Bill of Materials is shown in Table 2 with adjustable and fixed output voltage versions.

More details about the design and component selection for the dc-dc converter can be found in the SLUS534 data sheet.

Table 2. TPS6103x EVM Bill of Materials

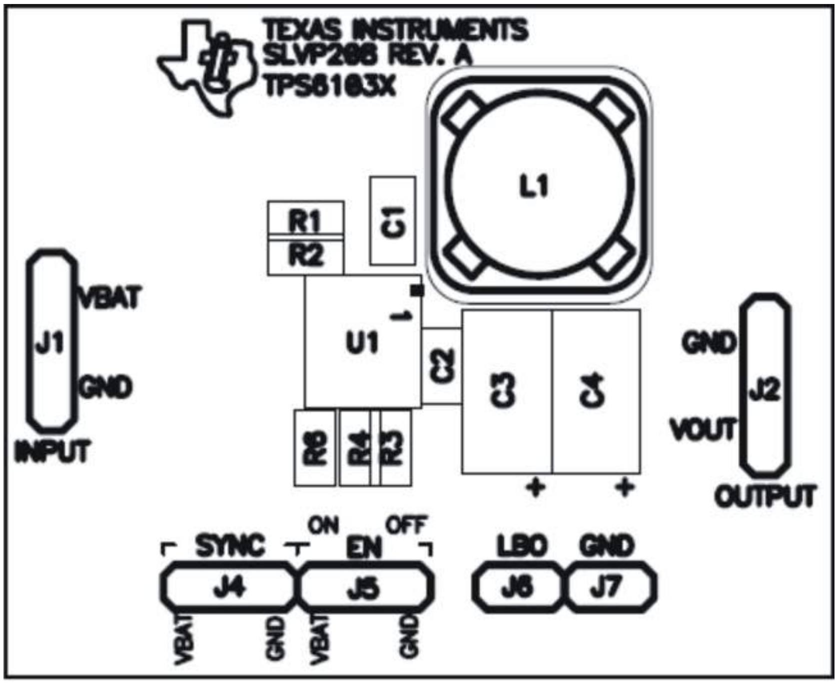
Reference	Description	Manufacturer	Comments
C3, C4	100 μF 10 V, Low ESR tantalum size D	Vishay	594D–107X0016C2T or 594D–107X0010C2T
C1	10 μF X5R 6.3 V, capacitor SMD1206	TDK	C3216X5R0J106M
C2	2.2 μF X5R 10 V, capacitor SMD0805	TDK	C2012X5R1A225M
L1	6.8 μH, CDRH124-6R8	Sumida	SUMIDA CDRH104R–7R0, CDRH104R–100, or EPCOS B82464–G4682-M
R4	200 kΩ,1%, resistor SMD0805		TPS61030EVM, not used on the fixed output voltage versions
R3	1.8 MΩ,1%, resistor SMD0805		TPS61030EVM, not used on the fixed output voltage versions
R6	1 MΩ, 1%, resistor SMD0805		
R1	560 kΩ, 1%, resistor SMD0805		
R2	180 kΩ, 1%, resistor SMD0805		
J1, J2	Header 1×4, 0.1" pitch		
J6, J7	Header 1×2, 0.1" pitch		
J5	Header 1×3, 0.1" pitch		With jumper set to V_{BAT}
J4	Header 1×3, 0.1" pitch		With jumper set to GND
U1	TPS61030PW, TSSOP16 PowerPAD	TI	TPS61030EVM–208
	TPS61031PW, TSSOP16 PowerPAD		TPS61031EVM–208
	TPS61032PW, TSSOP16 PowerPAD		TPS61032EVM–208

3.2 PCB Layout

For all switch mode power supplies the PCB layout is a critical step in the power supply design process. Figure 1, Figure 2, Figure 3, and Figure 4 show the layout for the adjustable and fixed output voltage EVMs. Please refer to the SLUS534 data sheet for further layout guidelines.

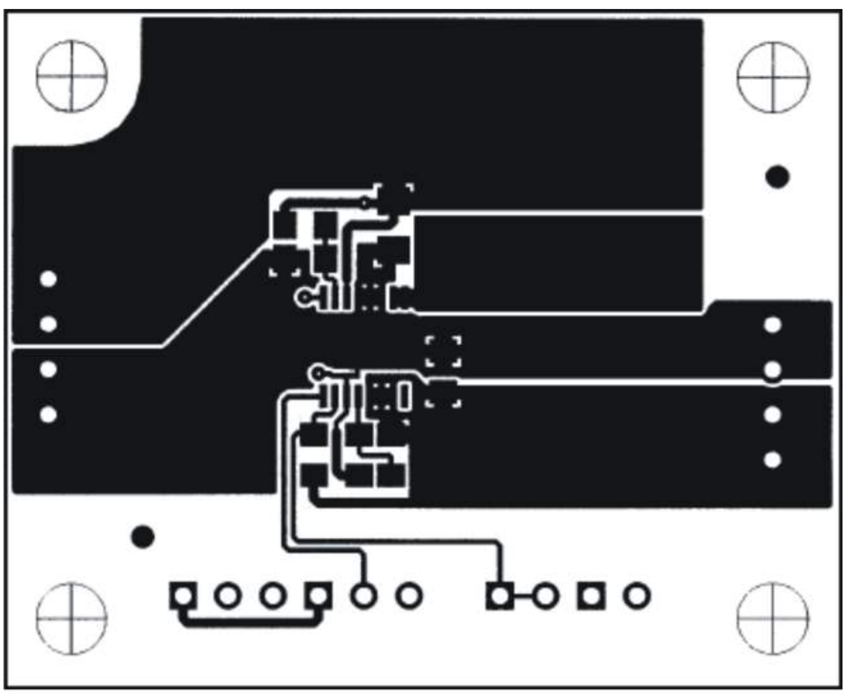
The required board area for the complete dc-to-dc converter solution takes up less than 494 mm^2 (19 mm × 26 mm) on a double-sided PCB, as it is indicated by the Figure 1 component placement.

Figure 1. Component Placement



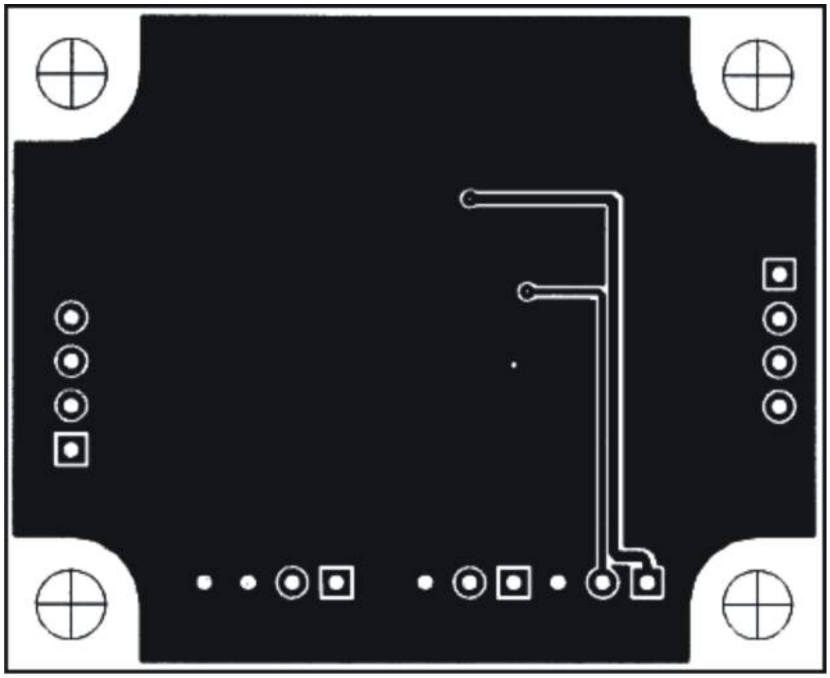
C001

Figure 2. PCB Top Layer



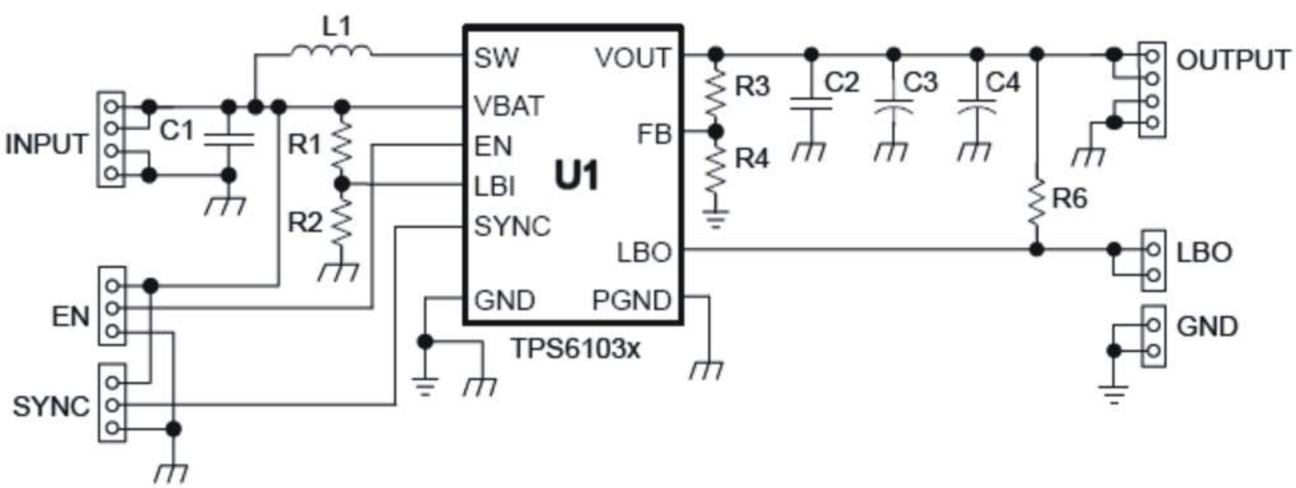
C002

Figure 3. PCB Bottom Layer



3.3 Schematic

Figure 4. TPS6103x EVM Circuit Diagram



Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from A Revision (October 2007) to B Revision	Page
• Deleted 1000 mA maximum output current statement in *Introduction*	1

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      3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

      CAUTION

      This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

      Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

      FCC Interference Statement for Class A EVM devices

      NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

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- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

3.2 *Canada*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d’usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

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http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

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1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry’s Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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