Using the TPS61097AEVM-073

User's Guide

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TPS61097A-33 Low Input Voltage Synchronous Boost Converter With Low Quiescent Current

This user's guide describes the characteristics, operation, and use of the TPS61097AEVM-073 evaluation module (EVM). This EVM demonstrates the Texas Instruments TPS61097A-33 synchronous boost converter. The input voltage range of the TPS61097A-33 is 0.9 to 5.5 V, which allows the device to operate from one-cell to three-cell battery configurations in addition to a single-cell Li-ion battery.

1 Introduction

The TPS61097AEVM-073 EVM helps designers evaluate the operation and performance of the TPS61097A-33 boost converter. The board features the small 5-pin SOT-23 package for a small solution size.

2 Set-Up

This section describes the jumpers and connectors on the EVM and how to properly connect, setup, and use the TPS61097AEVM-073.

2.1 J1 and J3 – Input Connections

This is the connection for the leads from the input source. Connect the positive connection to the VIN J1. Connect the negative connection to the GND J3.

2.2 J4 and J6 – Output Connections

This is the connection for the output of the TPS61097A EVM. Connect the positive connection of the load to the VOUT J4. Connect the negative connection to the GND J6.

2.3 JP1 – EN

This is the enable input for the device. Place a shorting jumper across the ON and EN pins of JP1 to enable the integrated circuit (IC). Place a shorting jumper across the OFF and EN pins of JP1 to disable the IC. A shorting jumper must be installed on JP1 in either the on or off positions, and EN must not be left unconnected.

When the EN pin is placed in the off position, the device's internal bypass switch is enabled, providing a direct low-impedance connection from the input voltage (at the L pin) to the load (VOUT). The EN pin can be set for low-voltage control of this bypass switch. First add jumpers on pin 1 to pin 2 and pin 3 to pin 4. By setting the desired ratio of R1 and R2, the TPS61097A device can be set to switch on the bypass at a defined voltage level on VIN. See the *Adjustable Bypass Switching* section of the TPS61097A data sheet for more details.

The board's adjustable switching configuration (R1 and R2) is set to switch the device off and thus, enable the internal bypass switch when VIN ≤ 0.7 V.

2.4 J2 and J5 – VIN Sense and VOUT Sense

The two connectors are not installed, but if very accurate measurements of input or output voltage are required, J2 or J4 can be installed for the measurements. Traces on the PCB connect to the input or output capacitor and run independent of the output and ground lines to the two connectors.

3 Operation

Connect the positive input power supply to the VIN J1 and GND J3. Typical input voltage is 0.9 to 3 V for 3.3-V configuration of the output voltage. The TPS61097AEVM-073 has a maximum input voltage of 5.5 V.

Connect the desired load between the VOUT J4 and GND J6. The TPS61097A device maximum output current depends on the conversion ratio between input and output along with VOUT; see the device data sheet, SLVSCF2, for additional information.

Configure jumper JP1 as required; the EN pin is not pulled-up or pulled-down inside the device or on the EVM. JP1 must be installed for proper operation. On is normal operation. In the off position, the device is shut down and switching stopped.

When the IC is disabled by putting JP1 in the off position, the internal bypass switch is turned on. This provides a direct low-impedance connection from the input voltage (at the L pin) to the load (VOUT). The voltage level at VIN is seen at VOUT, minus the voltage drop across the internal switch, whose on-resistance is 3.4 Ω (typical).

4 Test Results

See the *Typical Characteristics* section of the TPS61097A data sheet. This EVM uses the same inductors and capacitors as those used for characterization in the data sheet. Performance is consistent with the data sheet specifications.

5 Board Layout, Schematic, and Bill of Materials

This section provides the TPS61097AEVM-073 board layout, schematic, and bill of materials.

5.1 Board Layout

Board layout is critical for all high-frequency, switch-mode power supplies. If the layout is not done carefully, the regulator can show stability problems as well as EMI problems. Therefore, use wide and short traces for the main current path and for the power ground tracks. The input and output capacitor, as well as the inductor, must be placed as close as possible to the IC. Use a common ground node for power ground to minimize the effects of ground noise. Figure 1 through Figure 3 show the board layout for the TPS61097AEVM-073 PCB.

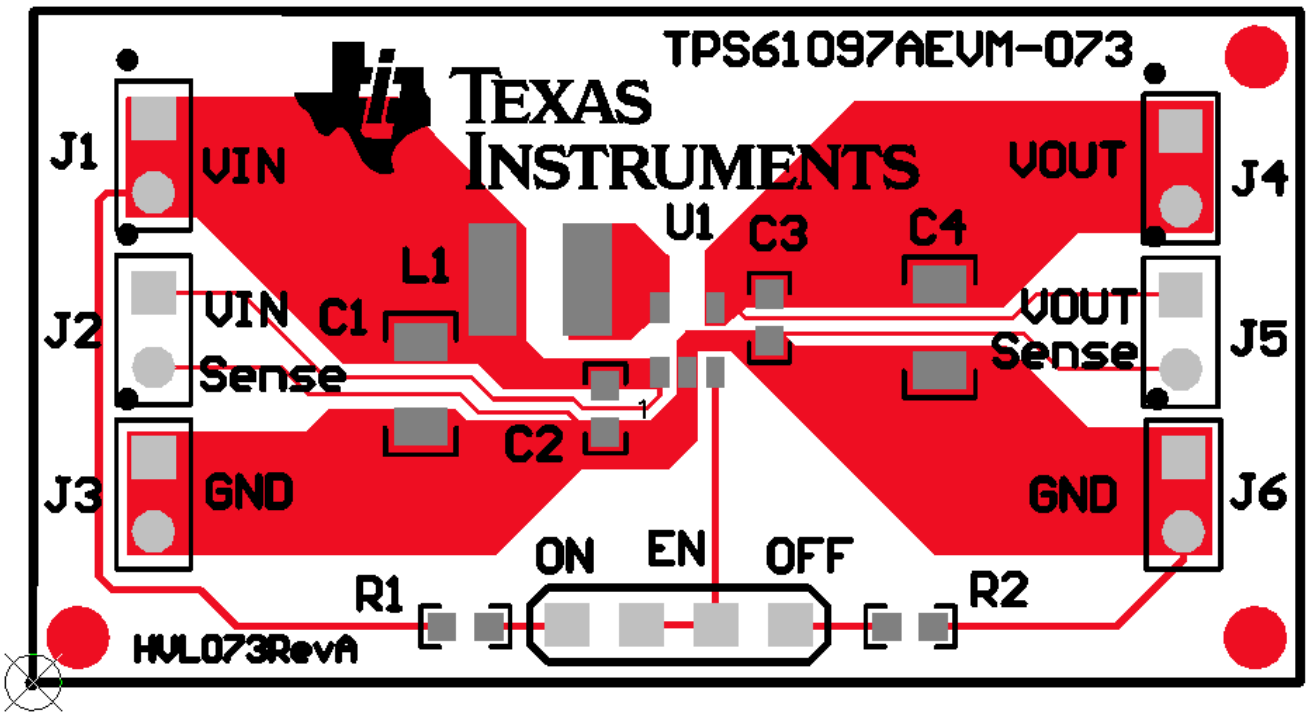

Figure 1. Top Assembly Layer

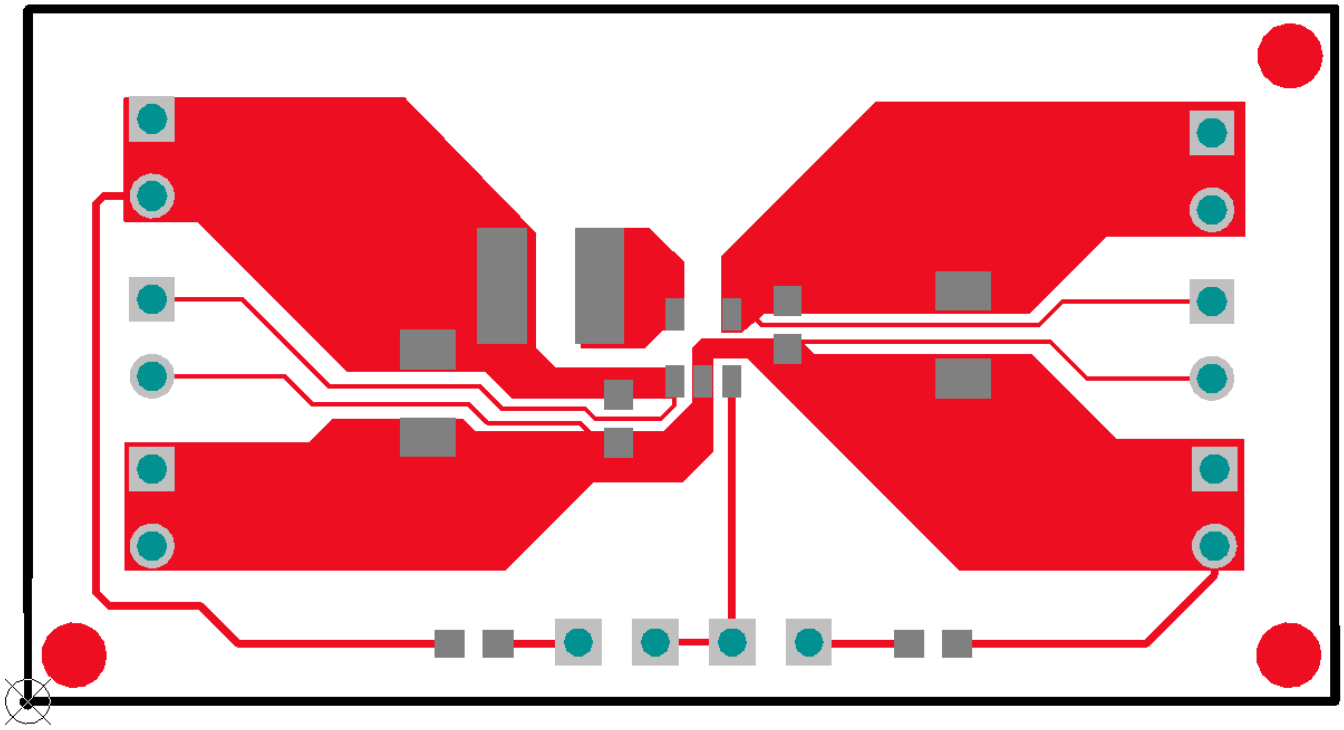

Figure 2. Top Layer

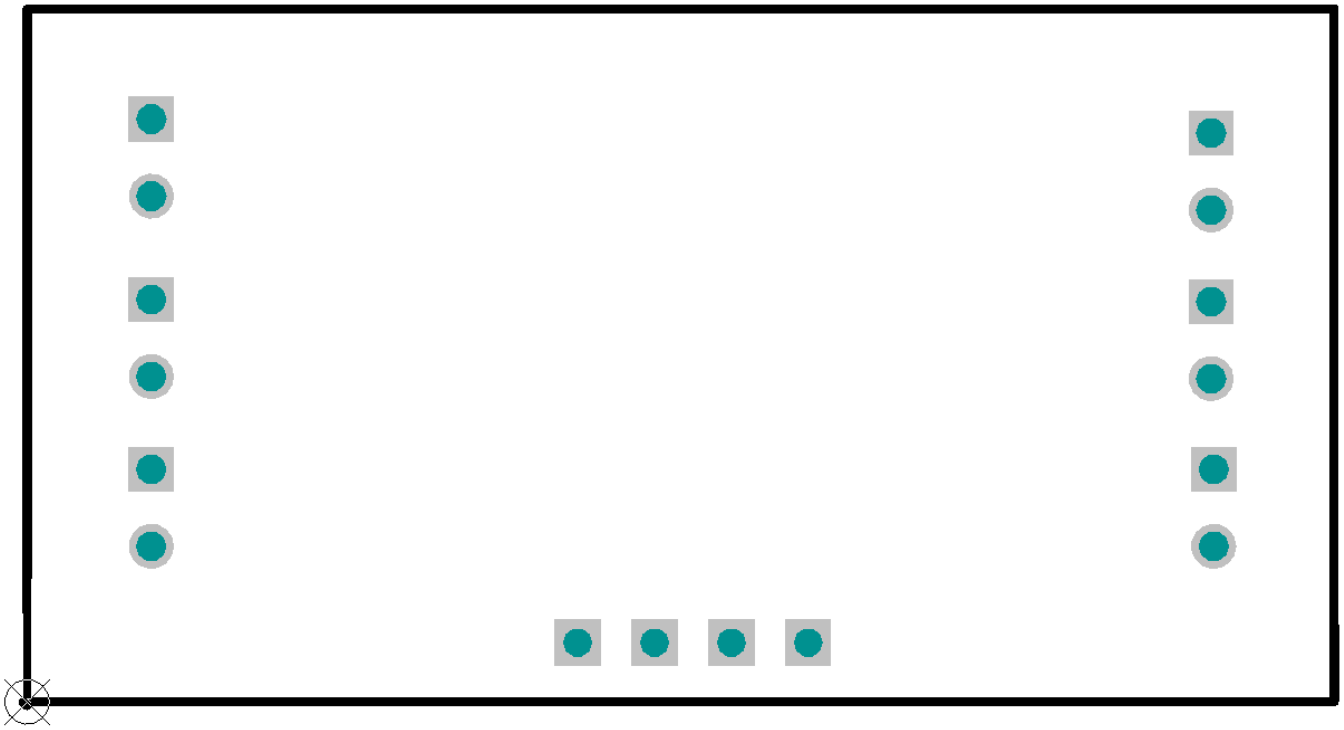

Figure 3. Bottom Layer

5.2 Schematic

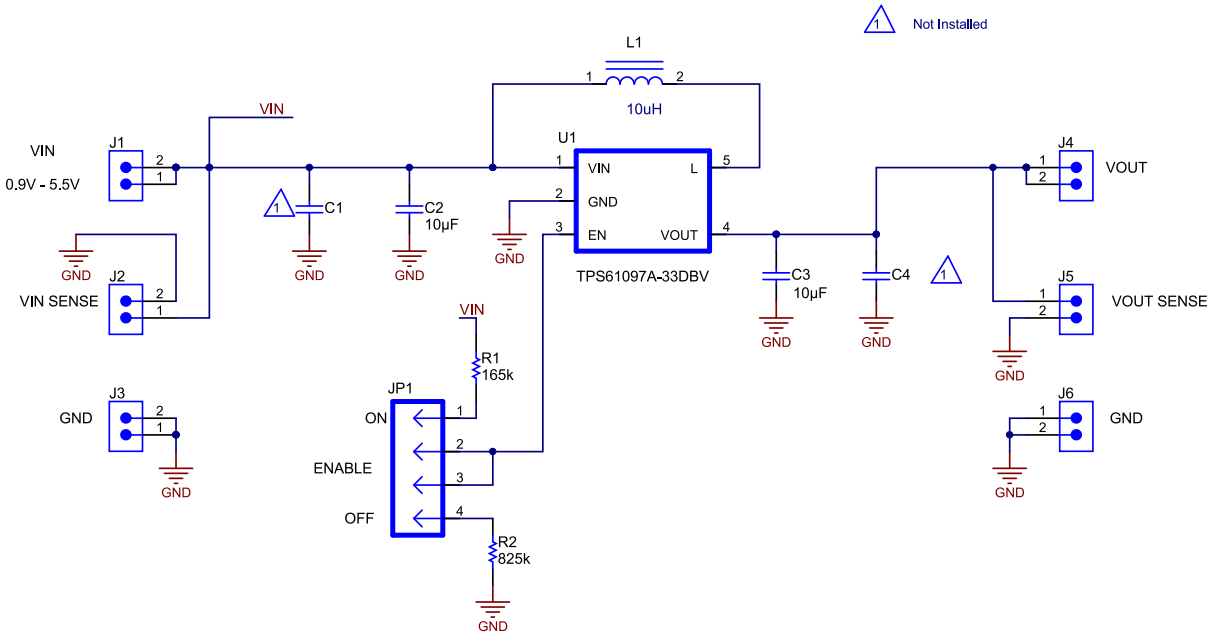

Figure 4. TPS61097AEVM-073 Schematic

5.3 Bill of Materials

Bill of Materials (1)(2)(3)(4)(5)

Count	RefDes	Value	Description	Size	Part Number	Manufacturer
0	C1, C4	Open	Capacitor, ceramic, 6.3 V, X5R, 20%	1206	Std	Std
2	C2, C3	10 µF	Capacitor, ceramic, 10 µF, 6.3 V, X5R, 20%	603	GRM188R60J106ME47D	Murata
0	J2, J5	Open	Header, 2 pin, 100-mil spacing	0.100 in x 2	PEC02SAAN	Sullins
4	J1, J3, J4, J6	PEC02SAAN	Header, 2 pin, 100-mil spacing	0.100 in x 2	PEC02SAAN	Sullins
1	JP1	PEC04SAAN	Header, 4 pin, 100-mil spacing	0.100 in x 4	PEC04SAAN	Sullins
1	L1	10 µH	Inductor, SMT, 0.75A, 520 mΩ	0.138 x 0.138 in	DO3314-103MLC	Coilcraft
1	R1	165K	Resistor, chip, value, 1/10 W, 1%	603	Std	Std
1	R2	825K	Resistor, chip, value, 1/10 W, 1%	603	Std	Std
1	U1	TPS61097A-33DBV	IC, low input voltage synchronous boost converter	5-pin SOT23 DBV	TPS61097A-33DBV	TI
1			Shunt, 100-mil, black	0.100	929950-00	3M
4			Bumpon, hemisphere, .44 x .20, clear	.44 x .20 in	SJ-5303	3M
1		HVL073	PCB	0.9 x 1.7 x 0.062 in	HVL073	Any

(1) These assemblies are ESD-sensitive. ESD precautions shall be observed.
(2) These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.
(3) These assemblies must comply with workmanship standards IPC-A-610 Class 2.
(4) These ref designators cannot be substituted.
(5) All other components can be substituted with equivalent components, unless otherwise noted.

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General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

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

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

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- 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.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

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

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-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.

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.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

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.

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.

【Important Notice for Users of EVMs for RF Products in Japan】

This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product 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 this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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