User's Guide

TPS61033EVM-105 Evaluation Module

ABSTRACT

The TPS61033EVM-105 evaluates the performance of the TPS61033, which is a 5-A valley switching current limit boost converter. This user's guide describes the input and output ranges, EVM setup, bill of materials (BOM), schematic, and the PCB layout.

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Trademarks

1 Introduction

1.1 Performance Specification

Table 1-1 provides a summary of the TPS61033EVM performance characteristics, tested at 25°C ambient temperature.

Table 1-1. Performance Specification

	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input voltage			3.6		V
Output voltage	TPS61033EVM, V_{IN} = 3.6 V, I_O ≤ 2.5A		5.0		V
Output current	V_{IN} = 2.7 V			2	A
	V_{IN} = 1.8 V			1	

1.2 Modification

The EVM is designed to support some modifications by the user. The external component can be changed according to the real application.

1.3 Input Capacitor

A 150-µF tantalum capacitor C3, is added as the input capacitor in the EVM, The ESR of the tantalum capacitor is 0.1Ω, to damp the ringing of the input voltage when the EVM is powered by a power supply with a long cable. The capacitor is not required for proper operation and can be removed in a real application.

1.4 Feedforward Capacitor

A feed-forward capacitor C10 can help to improve the response performance and the phase margin if the value is properly selected. Refer to this application note to select the feed-forward capacitor if required.*Feedforward Capacitor Makes Boost Converter Fast and Stable*

2 Setup

This section describes how to properly connect, set up, and use the TPS61033EVM-105.

2.1 Input/Output Connector Descriptions

Reference Designator	Description
J1-VIN	Positive input connection from the input supply for the EVM.
J2-VOUT	Positive connection for the output voltage.
J3-GND	Return connection from the input supply for the EVM.
J4-GND	Return connection for the output voltage.
J5-VIN	Input voltage sensing for measuring efficiency. VIN_S+ is for positive input and VIN_S- is for negative input.
J6-VOUT	Output voltage sensing for measuring efficiency. VOUT_S+ is for output positive node and VOUT_S- is for output negative node.
J7-PG	Test point to measure PG pin waveform.
JP1-MODE	MODE pin input jumper. Place a jumper across MODE and VIN to set the device in forced PWM mode. Place a jumper across MODE and GND to set the device in auto PFM mode.
JP2-EN	EN pin input jumper. Place a jumper across EN and VIN to turn on the IC. Place a jumper across EN and GND to turn off the IC.
TP1-SW	Test point to measure SW pin waveform.

3 Schematic and Bill of Materials

This section provides the TPS61033EVM-105 schematic, bill of materials (BOM), and board layout.

3.1 Schematic

Figure 3-1 is the EVM schematic.

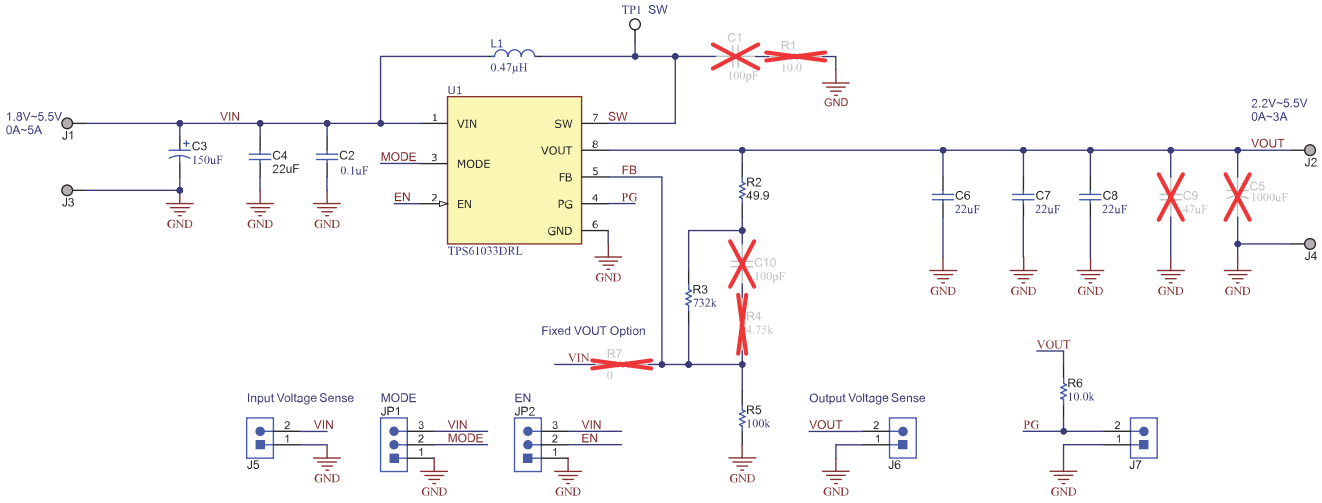

Figure 3-1. Schematic

3.2 Bill of Materials

Table 3-1 displays the EVM bill of materials.

Table 3-1. Bill of Materials

Designator	Qty	Value	Description	PackageReference	PartNumber	Manufacturer
C2	1	0.1uF	CAP, CERM, 0.1 uF, 10 V, +/- 10%, X5R, 0402	0402	GRM155R61A104KA01D	MuRata
C3	1	150uF	CAP, TA, 150 uF, 10 V, +/- 10%, 0.1 ohm, SMD	7343-31	T495D157K010ATE100	Kemet
C4	1	22uF	CAP, CERM, 22 uF, 25 V, +/- 20%, X5R, 0805	0805	GRM21BR61E226ME44L	MuRata
C6, C7, C8	3	22uF	CAP, CERM, 22 uF, 10 V, +/- 20%, X5R, 0603	0603	GRM188R61A226ME15D	MuRata
J1, J2, J3, J4	4		Terminal, Turret, TH, Double	Keystone1502-2	1502-2	Keystone
J5, J6, J7	3		Header, 2.54 mm, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	61300211121	Wurth Elektronik
JP1, JP2	2		Header, 2.54 mm, 3x1, Gold, TH	Header, 2.54mm, 3x1, TH	61300311121	Wurth Elektronik
L1	1	0.47uH	Shielded Power Inductors	SMT_4MM0_4MM0	XGL4020-471MEC	Coilcraft
R2	1	49.9	RES, 49.9, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060349R9FKEA	Vishay-Dale
R3	1	732k	RES, 732 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW0603732KFKEA	Vishay-Dale
R5	1	100k	RES, 100 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW0603100KFKEA	Vishay-Dale
R6	1	10.0k	RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060310K0FKEA	Vishay-Dale
TP1	1		Test Point, Multipurpose, White, TH	White Multipurpose Testpoint	5012	Keystone Electronics
U1	1		5.0-A 2.4-MHz High Efficiency Boost Converter	SOT-5X3	TPS61033DRL	Texas Instruments
C1, C10	0	100pF	CAP, CERM, 100 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	GRM1885C1H101JA01D	MuRata
C5	0	1000uF	CAP, AL, 1000 uF, 10 V, +/- 20%, 0.15 ohm, SMD	SMT Radial G	EEE-FC1A102P	Panasonic
C9	0	47uF	CAP, CERM, 47 uF, 10 V, +/- 10%, X5R, 1206	1206	GRM31CR61A476KE15L	MuRata
R1	0	10	RES, 10.0, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060310R0FKEA	Vishay-Dale
R4	0	4.75k	RES, 4.75 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06034K75FKEA	Vishay-Dale
R7	0	0	RES, 0, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	RMCF0603ZT0R00	Stackpole Electronics Inc

4 Board Layout

The PCB of the TPS61033EVM has four layers. Figure 4-1 and Figure 4-2 show the top side and bottom side of the PCB layout, respectively. Figure 4-3 and Figure 4-4 show the inner layer 1 and inner layer 2, respectively.

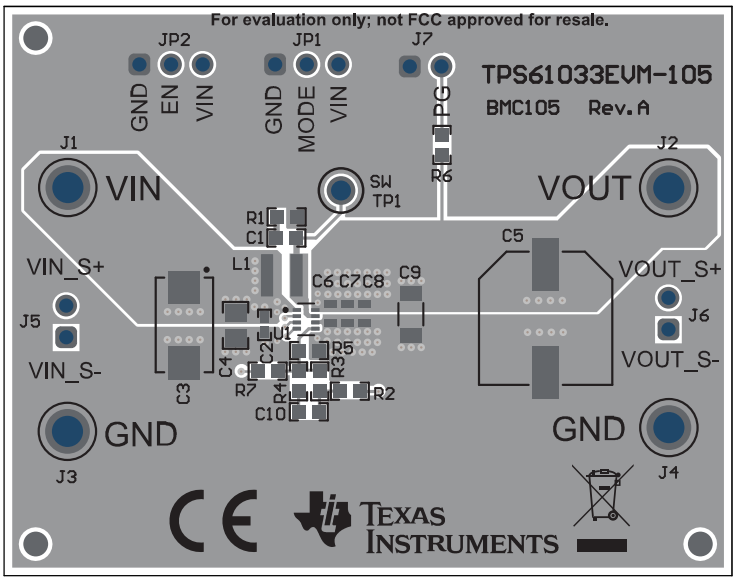

Figure 4-1. Top-Side Layout

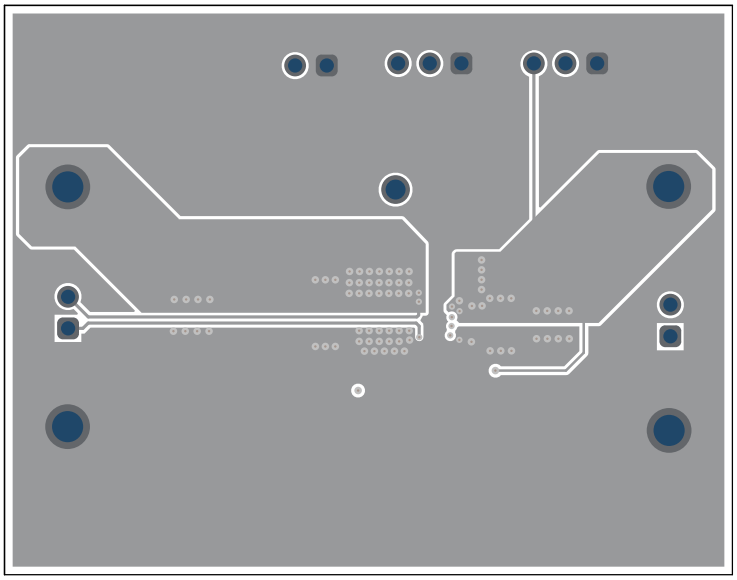

Figure 4-2. Bottom-Side Layout

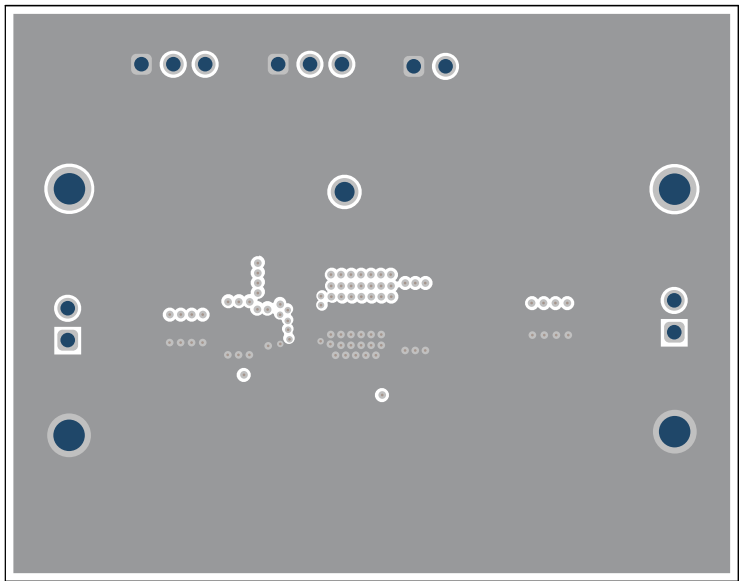

Figure 4-3. Inner Layer 1 Layout

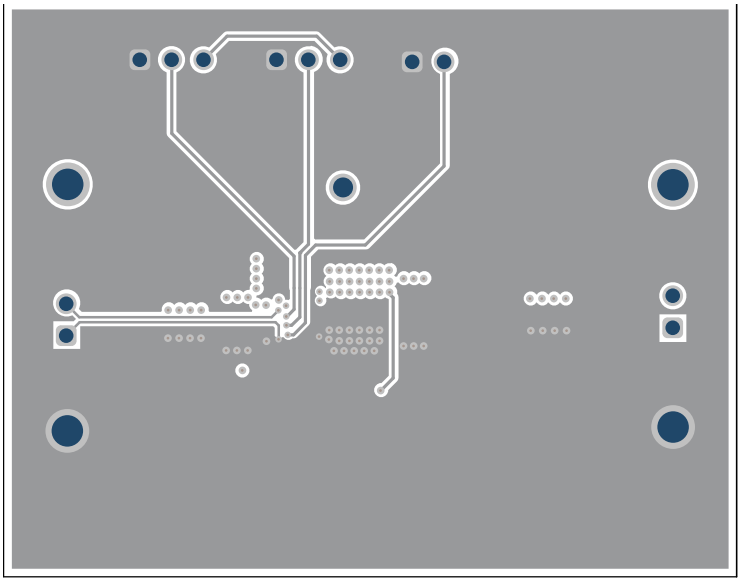

Figure 4-4. Inner Layer 2 Layout

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NOTE:

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FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

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

NOTE: 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.*

3.2 *Canada*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. 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

3.3 *Japan*

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

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If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

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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3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive)*:

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

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4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

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9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

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