TPS61253A-PWR803 Evaluation Module

This user's guide describes the characteristics, operation, and the use of the TPS61253AEVM-803 evaluation module (EVM). The EVM contains the TPS61253A, which is a 4A boost converter with 3.8MHz switching frequency. The user's guide includes EVM specifications, recommended test setup, test result, schematic diagram, bill of materials, and the board layout.

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1 Introduction

1.1 Performance Specification

Table 1 provides a summary of the TPS61253A EVM performance specifications. All specifications are given for an ambient temperature of 25°C.

Table 1. Performance Specification Summary

Specification	Test Conditions	MIN	TYP	MAX	UNIT
V_{IN}			3.6		V
V_{OUT}	TPS61253A EVM, V_{IN} = 3.6 V, I_o ≤ 1.5 A		5		V

1.2 Modification

The printed-circuit board (PCB) for this EVM is designed to accommodate 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 C5 is added as the input capacitor in the EVM. The ESR of the tantalum capacitor is 0.1 Ω which helps 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 Output Capacitor Selection

A 10-µF ceramic capacitor C2 and two 4.7-µF ceramic capacitors C3 and C4 are added as the output capacitors. These capacitors can ensure the low output ripple at heavy load condition. When the maximum output current is lower than 1 A, only a 10-µF ceramic capacitor C2 is needed.

2 Setup

This section describes how to properly connect, set up, and use the TPS61253AEVM-803.

2.1 Input/Output Connector Descriptions

The following:

J1-VIN	Positive input connection from the input supply for the EVM
J3-GND	Return connection from the input supply for the EVM
J4-VOUT	Positive connection for the output voltage
J6-GND	Return connection for the output voltage
J7-EN	EN pin input jumper. Place a jumper across EN and pin1 to turn on the IC, place a jumper across EN and pin3 to turn off the IC
J8-MODE	MODE pin input jumper. Place a jumper across MODE and pin1, the device works in Force PWM mode; Place a jumper across MODE and pin3, the device works in PFM mode with good light load efficiency; Float the MODE pin, the device works in ultra-sonic mode.

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3 Test Results

3.1 Startup Waveform

The startup waveform is shown in Figure 1.

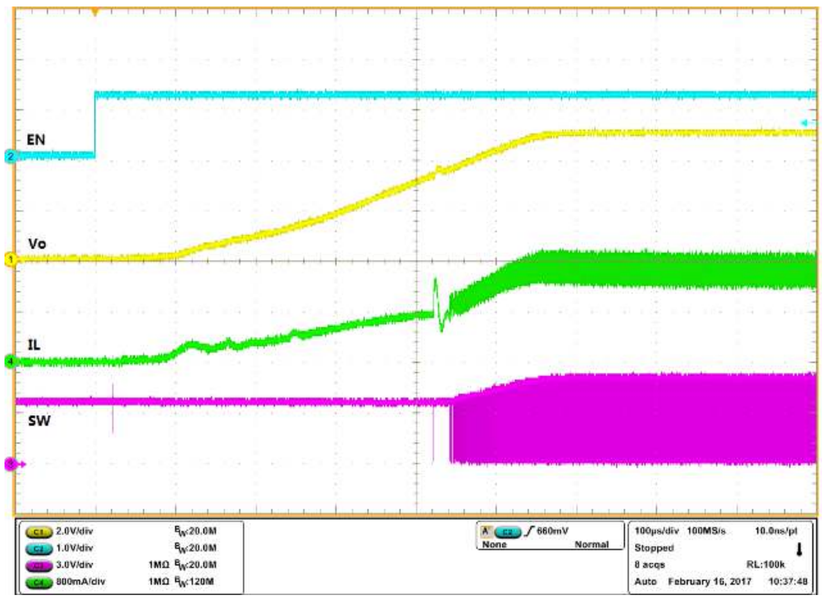

Figure 1. Startup Waveforms (R_{load} = 5 Ω)

3.2 Efficiency

The conversion efficiency is shown in Figure 2.

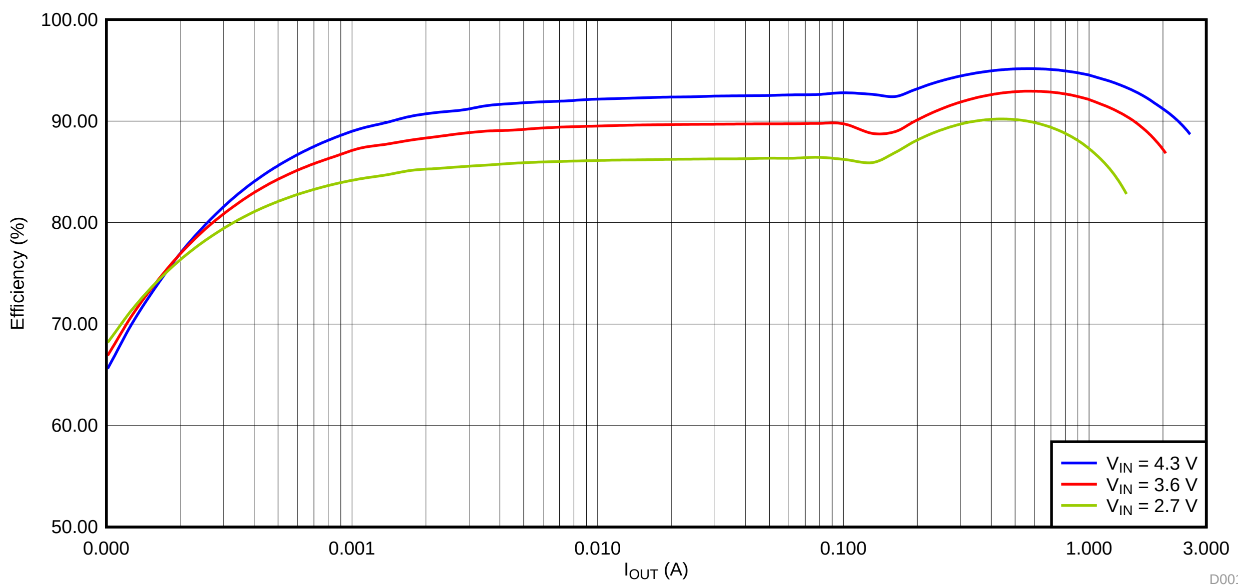

Figure 2. TPS61253A EVM Efficiency vs Load Current (PFM Mode)

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3.3 Load Transient

The load transient waveform is shown in Figure 3. Please note that the effective output capacitance is about 7 µF under V_O = 5 V DC bias, although one 10-µF ceramic capacitor and two 4.7-µF ceramic capacitors are used in the EVM. Larger effective capacitance will help to improve the load transient.

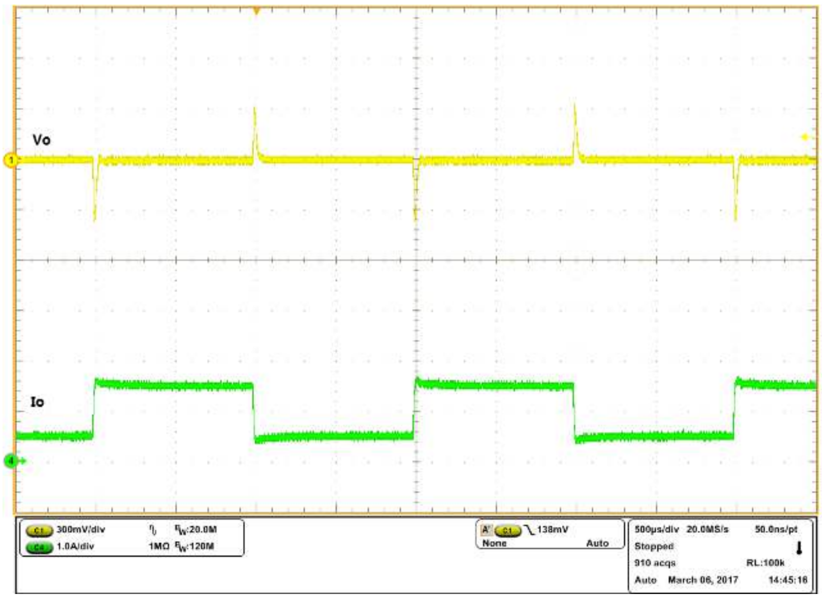

Figure 3. Load Transient (V_O = 3.6 V, I_O = 0.5 A to 1.5 A)

3.4 Output Voltage Ripple

Figure 4 shows the output voltage ripple , switching waveforms and the inductor current ripple in PFM mode at I_O = 50 mA.

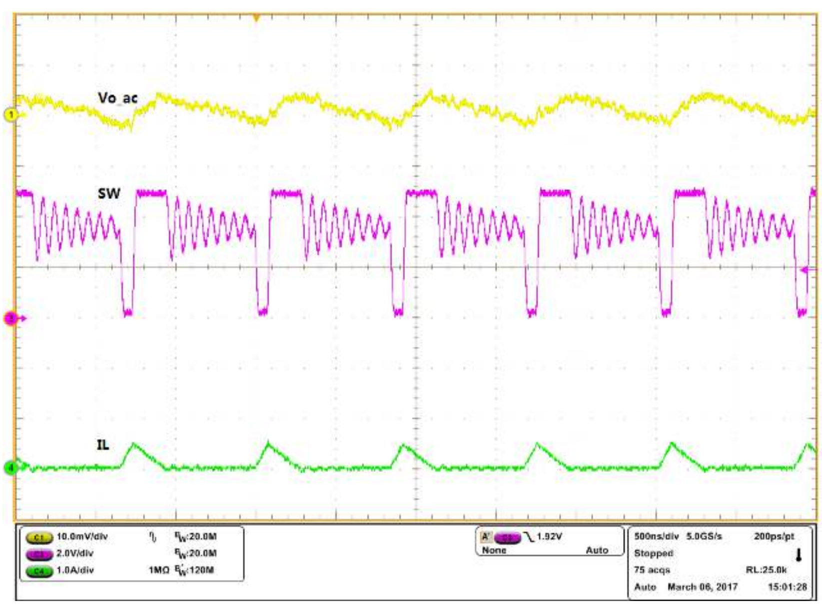

Figure 4. Output Ripple in PFM Mode (V_{IN} = 3.6 V, I_O = 50 mA)

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Figure 5 shows the output voltage ripple , switching waveforms and the inductor current ripple in PFM mode at Io = 1.5 A.

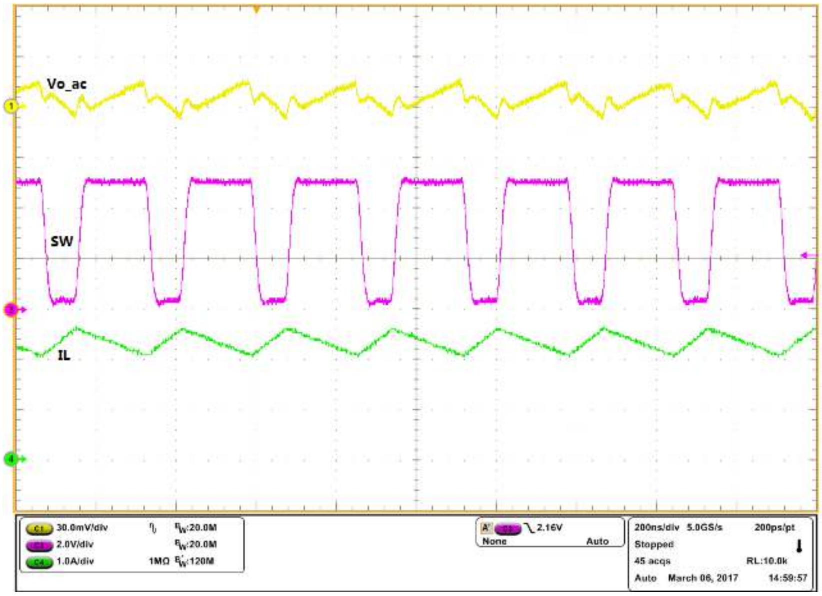

Figure 5. Output Ripple in PFM Mode (V_{IN} = 3.6 V, I_O = 1.5 A)

Figure 6 shows the output voltage ripple , switching waveforms and the inductor current ripple in FPWM mode at I_O = 50 mA.

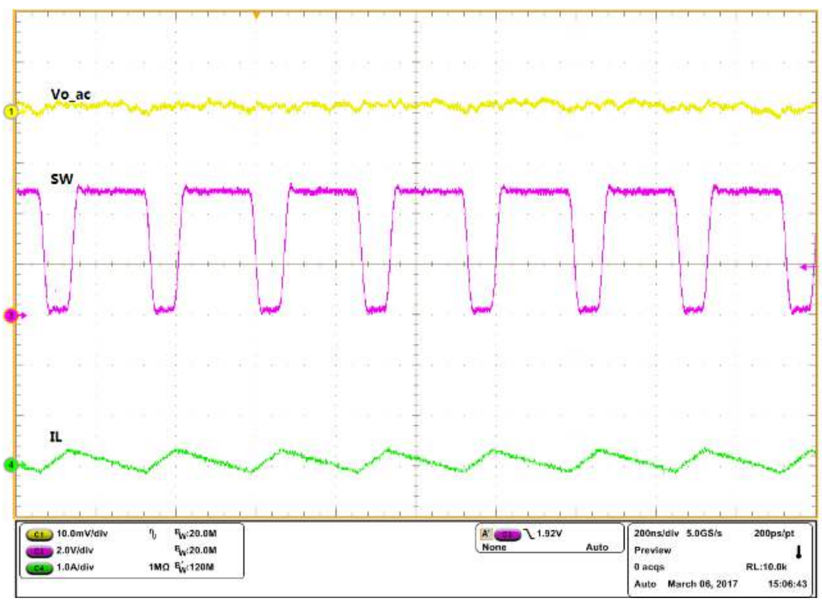

Figure 6. Output Ripple in FPWM (V_{IN} = 3.6 V, I_O = 50 mA)

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Figure 7 shows the output voltage ripple , switching waveforms and the inductor current ripple in ultra-sonic mode at no load condition.

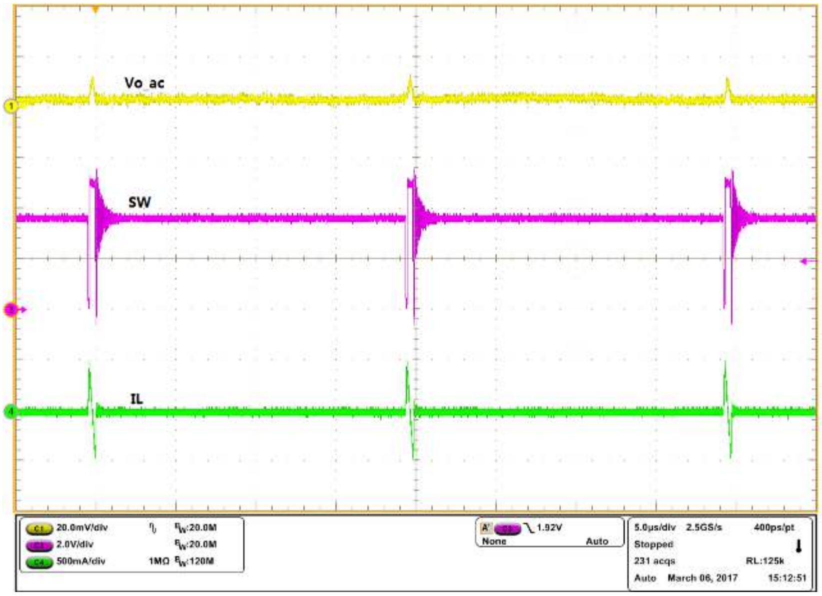

Figure 7. Output Ripple in Ultra-Sonic Mode (V_{IN} = 3.6 V, no load)

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4 Schematic, Bill of Materials, and Board Layout

This section provides the TPS61253AEVM-803 schematic, bill of materials (BOM), and board layout.

4.1 Schematic

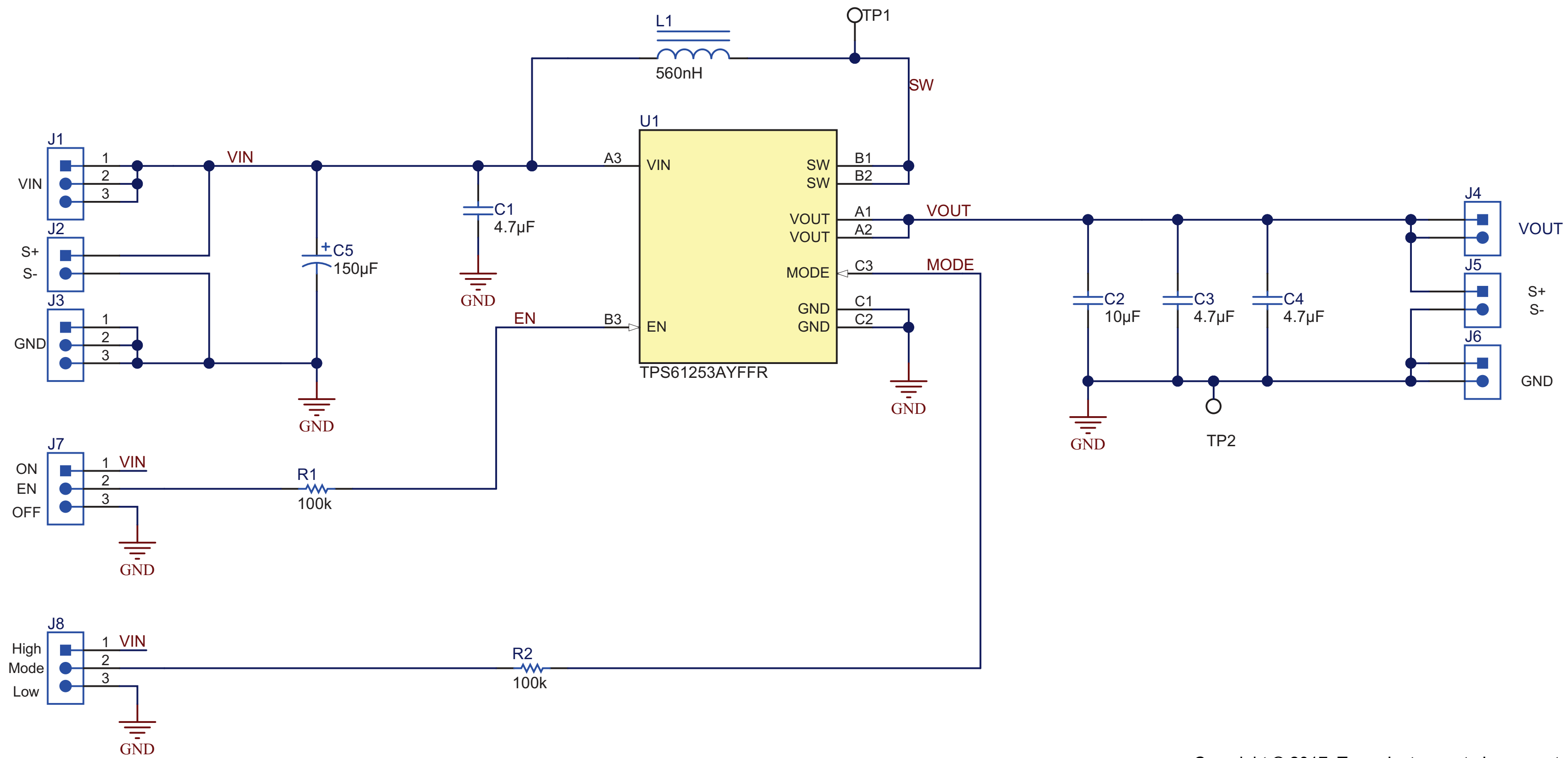

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Figure 8. TPS61253AEVM-803 Schematic

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4.2 Bill of Materials

Table 2 lists the EVM BOM.

Table 2. TPS61253AEVM-803 Bill of Materials

Designator	Qty	Value	Description	Package	Part Number	MFG
C1, C3, C4	3	4.7uF	CAP, CERM, 4.7 µF, 10 V, +/- 20%, X5R, 0402	0402	GRM155R61A475MEAAD	Murata
C2	1	10uF	CAP, CERM, 10 µF, 10 V, +/- 20%, X5R, 0603	0603	GRM188R61A106ME69D	Murata
C5	1	150uF	CAP, TA, 150 µF, 6.3 V, +/- 20%, 0.07 ohm, SMD	3528-21	T520B157M006ATE070	Kemet
J1, J3, J7, J8	4		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec
J2, J4, J5, J6	4		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec
L1	1	560nH	Inductor, Shielded, Composite, 560 nH, 6.5 A, 0.0237 ohm, AEC-Q200 Grade 1, SMD	Inductor	XEL3515-561MEB	Coilcraft
R1, R2	2	100k	RES, 100 k, 1%, 0.063 W, 0402	0402	CRCW0402100KFKED	Vishay-Dale
SH-JP1, SH-JP2	2	1x2	Shunt, 100mil, Gold plated, Black	Shunt	969102-0000-DA	3M
TP1, TP2	2	SMT	Test Point, Miniature, SMT	Testpoint_Keystone_Miniature	5015	Keystone
U1	1		3.5-MHz, 5Vout High Efficiency Step-Up Converter In Chip Scale Packaging, YFF0009ACAG	YFF0009ACAG	TPS61253AYFFR	Texas Instruments

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4.3 Board Layout

Figure 9 through Figure 12 illustrate the EVM board layouts.

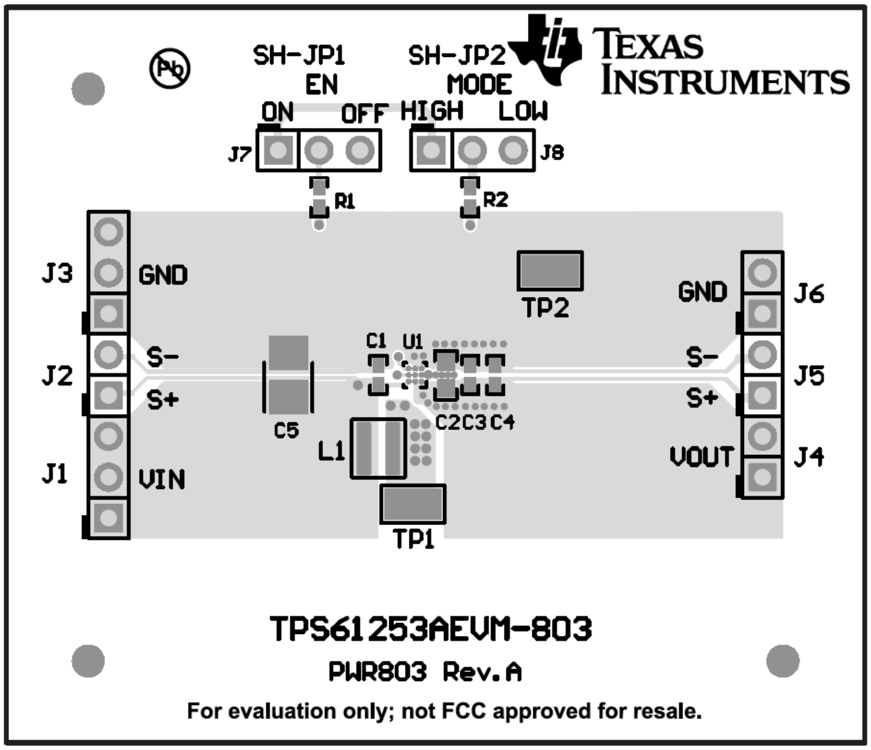

Figure 9. TPS61253AEVM-803 Top-Side Layout

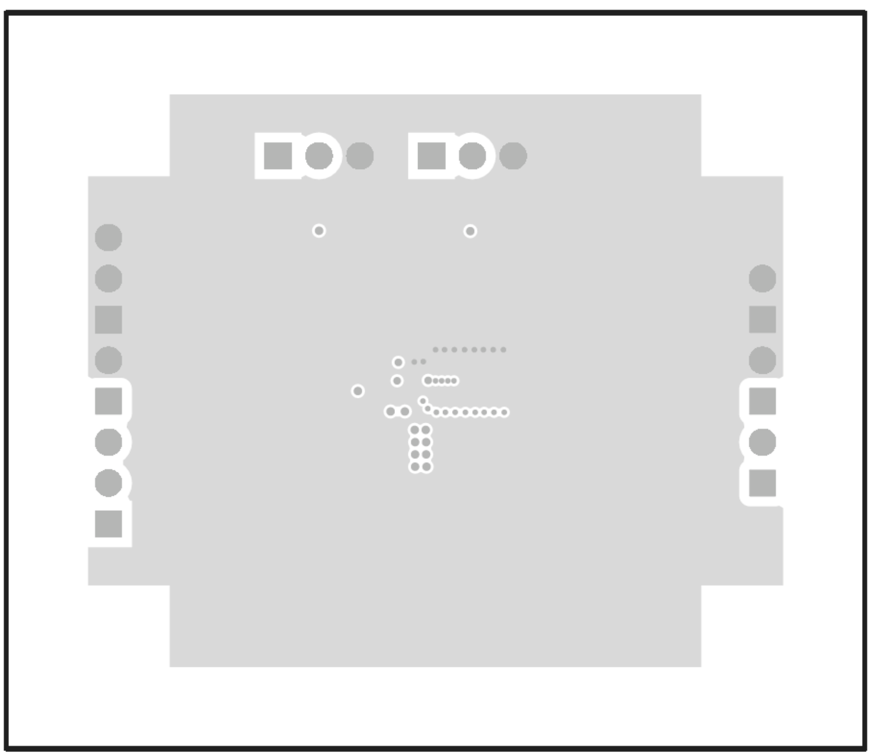

Figure 10. TPS61253AEVM-803 Inner Layout1

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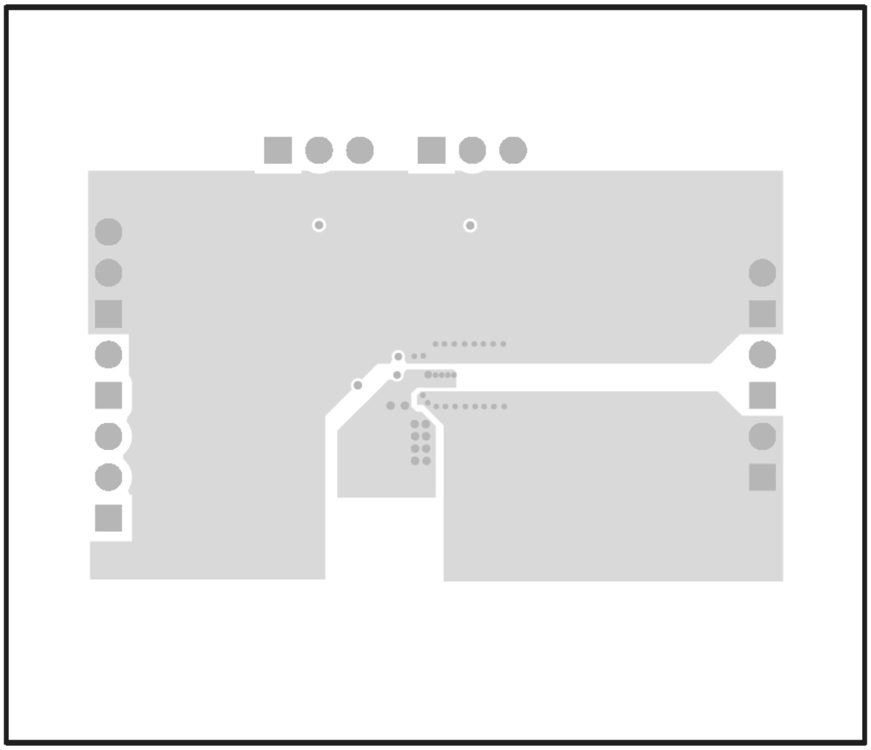

Figure 11. TPS61253AEVM-803 Inner Layout2

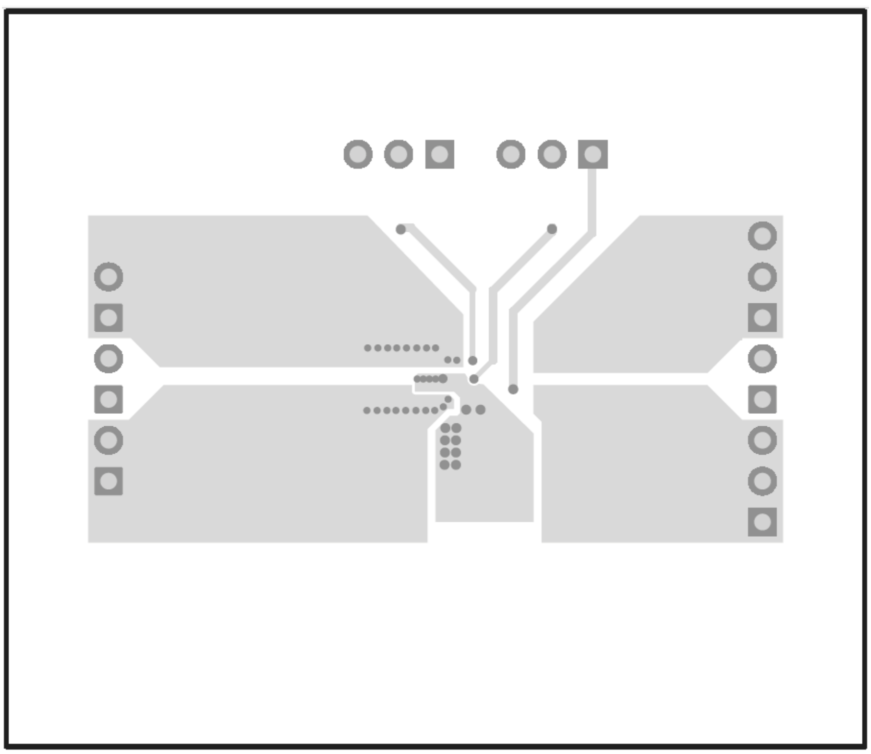

Figure 12. TPS61253AEVM-803 Bottom-Side Layout

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   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.

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   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 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.

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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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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):

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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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