User's Guide

TPS6208xA Step-Down Converter Evaluation Module User's Guide

ABSTRACT

The TPS6208xA is a synchronous, step-down converter in a 1.2-mm × 0.8-mm × 0.5-mm wafer chip-scale package (WCSP) with 0.4-mm pitch. The EVM outputs a 1.8-V output voltage with 1% accuracy from input voltages between 2.4 V and 5.5 V with a maximum solution height of 1 mm. The TPS6208xA is a highly efficient and tiny solution for point-of-load (POL) converters for space-constrained applications, such as solid state drives (SSDs), wearables, and smart phones.

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1 Introduction

The TPS6208xA is a synchronous, step-down converter in a 1.2-mm × 0.8-mm × 0.5-mm wafer chip-scale package (WCSP) with 0.4-mm pitch. The BSR187 EVM supports different IC versions of the TPS62088A and TPS62089A.

1.1 Performance Specification

Table 1-1 provides a summary of the TPS6208xAEVM-187 performance specifications.

Table 1-1. Performance Specification Summary

Specification	Test Conditions	Min	Typ	Max	Unit
Input voltage		2.4	5	5.5	V
Output voltage setpoint			1.8		V
Output current	TPS62088A	0		3000	mA
	TPS62089A	0		2000	mA

1.2 Modifications

The printed-circuit board (PCB) for this EVM is designed to accommodate both the fixed and adjustable output voltage versions of this integrated circuit (IC). Additional input and output capacitors can also be added. Finally, the loop response of the IC can be measured.

1.2.1 Fixed Output Voltage Operation

U1 can be replaced with the fixed output voltage version of the IC for evaluation. For fixed output voltage version operation, replace R1 with a 0-Ω resistor and remove R2 and C4.

1.2.2 Input and Output Capacitors

C9 is provided for an additional input capacitor. This capacitor is not required for proper operation but can be used to reduce the input voltage ripple.

C6, C7, and C8 are provided for additional output capacitors. These capacitors are not required for proper operation but can be used to reduce the output voltage ripple and to improve the load transient response. The total output capacitance must remain within the recommended range in the data sheet for proper operation.

2 Setup

This section describes how to properly use the TPS6208xEVM-187.

2.1 Input and Output Connector Descriptions

J1, Pin 1 and 2 – VIN	Positive input connection from the input supply for the EVM
J1, Pin 3 and 4 – S+/S–	Input voltage sense connections. Measure the input voltage at this point.
J1, Pin 5 and 6 – GND	Input return connection from the input supply for the EVM
J2, Pin 1 and 2 – VOUT	Output voltage connection
J2, Pin 3 and 4 – S+/S–	Output voltage sense connections. Measure the output voltage at this point.
J2, Pin 5 and 6 – GND	Output return connection
J3 – PG/GND	The PG output appears on pin 1 of this header with ground on pin 2.
JP1 – EN	EN pin input jumper. Place the supplied jumper across ON and EN to turn on the IC. Place the jumper across OFF and EN to turn off the IC.
JP2 – PG Pullup Voltage	PG pin pullup voltage jumper. Place the supplied jumper on JP2 to connect the PG pin pullup resistor to V_{IN}. Alternatively, the jumper can be removed and a different voltage can be supplied on pin 1 to pull up the PG pin to a different level. This externally applied voltage must remain below 5.5 V.

2.2 Setup

To operate the EVM, set jumpers JP1 and JP2 to the desired position per Section 2.1. Connect the input supply to J1 and connect the load to J2.

3 Board Layout

This section provides the TPS6208xEVM-187 board layout and illustrations in Figure 3-1 through Figure 3-5. The Gerbers are available on the TPS6208xEVM-187 EVM product page.

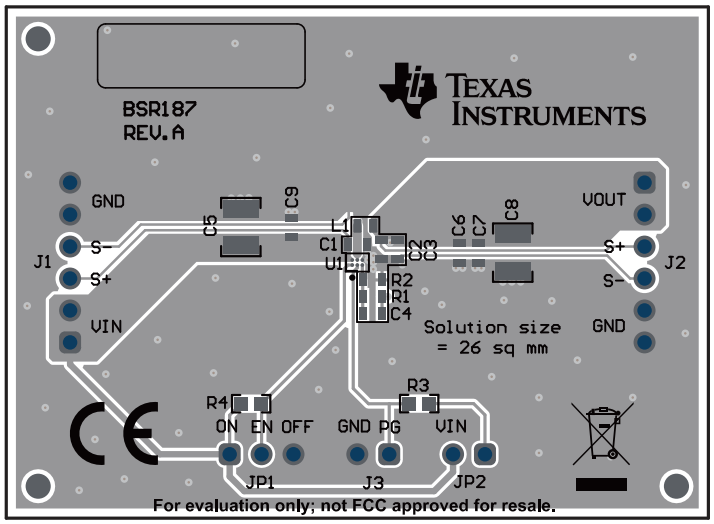

Figure 3-1. Top Assembly

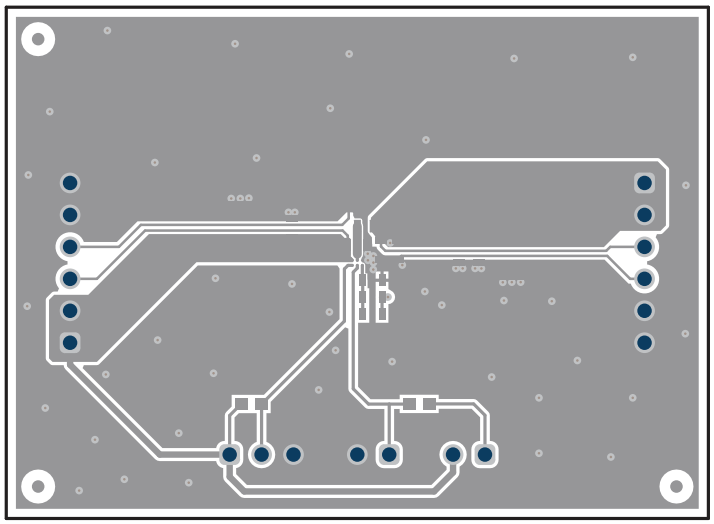

Figure 3-2. Top Layer

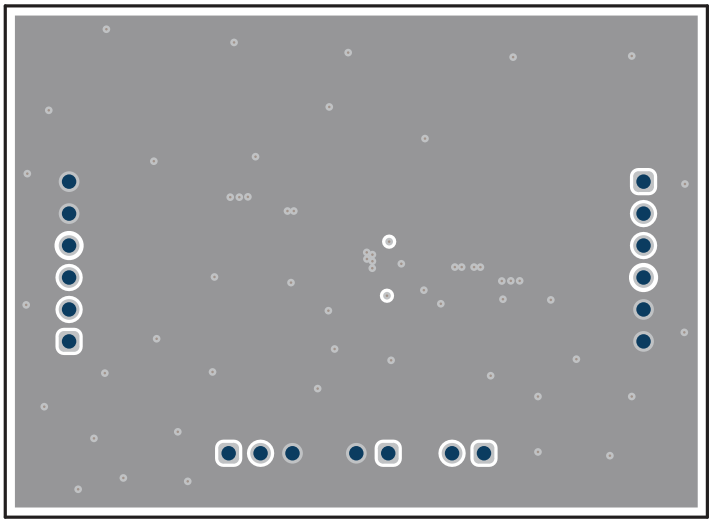

Figure 3-3. Signal Layer 1

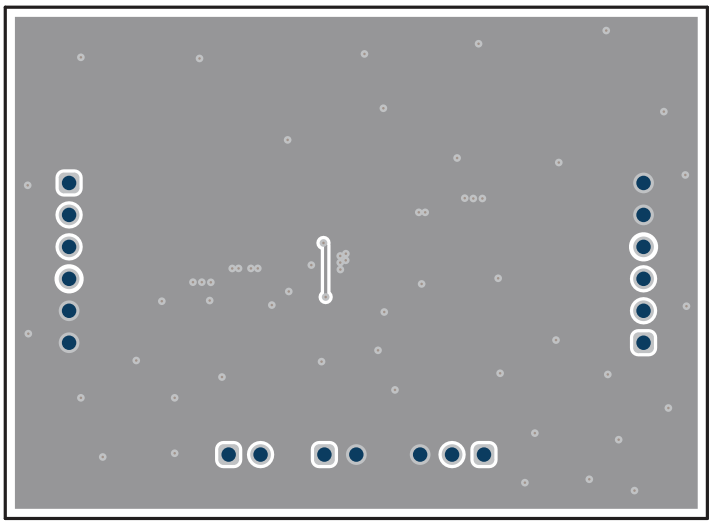

Figure 3-4. Signal Layer 2

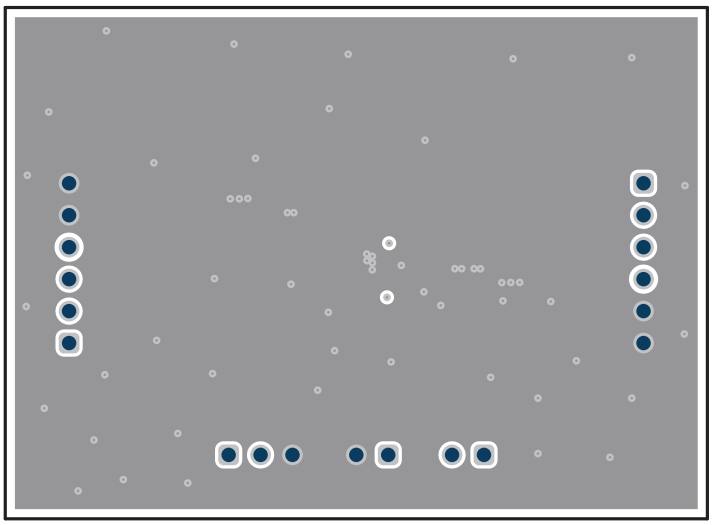

Figure 3-5. Bottom Layer

4 Schematic and Bill of Materials

This section provides the TPS6208xEVM-187 schematic and bill of materials (BOM).

4.1 Schematic

Figure 4-1 and Figure 4-2 illustrate the TPS62088A and TPS62089A EVM schematic, respectively.

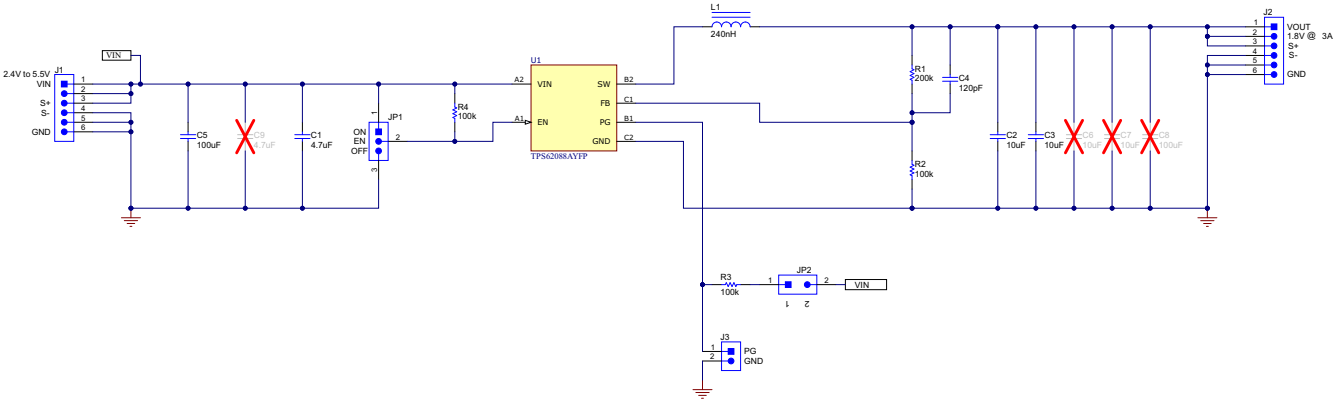

Figure 4-1. TPS62088A EVM Schematic

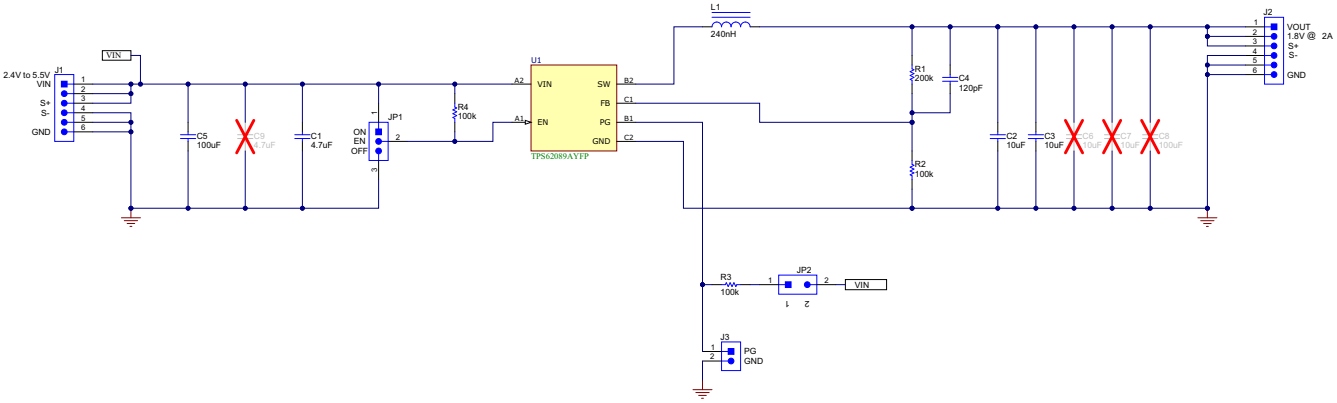

Figure 4-2. TPS62089A EVM Schematic

4.2 Bill of Materials

Table 4-1 and Table 4-2 list the BOM for TPS62088A and TPS62089A, respectively.

Table 4-1. TPS62088AEVM-187 Bill of Materials

Designator	QTY	Value	Description	Package Reference	Part Number	Manufacturer
C1	1	4.7 µF	CAP, CERM, 4.7 µF, 6.3 V, ±10%, X7R, 0603	0603	JMK107BB7475MA-T	Taiyo Yuden
C2, C3	2	10 µF	CAP, CERM, 10 µF, 10 V, ±20%, X7R, 0603	0603	GRM188Z71A106MA73D	Murata
C4	1	120 pF	CAP, CERM, 120 pF, 50 V, ±5%, C0G/NP0, 0603	0603	Std	Std
C5	1	100 µF	CAP, CERM, 100 µF, 6.3 V, ±20%, X5R, 1210	1210	GRM32ER60J107ME20L	Murata
L1	1	240 nH	Inductor, 240 nH, 3.5 A, 0.03 Ω, SMD	1608	DFE18SANR24MG0L	Murata
R1	1	200 kΩ	RES, 200 k, 1%, 0.1 W, 0603	0603	Std	Std
R2, R3, R4	3	100 kΩ	RES, 100 k, 1%, 0.1 W, 0603	0603	Std	Std
U1	1		Tiny 3-A High Efficiency Synchronous Buck Converter in Chip Scale Package	1.2 × 0.8 mm	TPS62088AYFP	Texas Instruments

Table 4-2. TPS62089AEVM-187 Bill of Materials

Designator	QTY	Value	Description	Package Reference	Part Number	Manufacturer
C1	1	4.7 µF	CAP, CERM, 4.7 µF, 6.3 V, ±10%, X7R, 0603	0603	JMK107BB7475MA-T	Taiyo Yuden
C2, C3	2	10 µF	CAP, CERM, 10 µF, 10 V, ±20%, X7R, 0603	0603	GRM188Z71A106MA73D	Murata
C4	1	120 pF	CAP, CERM, 120 pF, 50 V, ±5%, C0G/NP0, 0603	0603	Std	Std
C5	1	100 µF	CAP, CERM, 100 µF, 6.3 V, ±20%, X5R, 1210	1210	GRM32ER60J107ME20L	Murata
L1	1	240 nH	Inductor, 240 nH, 3.5 A, 0.03 Ω, SMD	1608	DFE18SANR24MG0L	Murata
R1	1	200 kΩ	RES, 200 k, 1%, 0.1 W, 0603	0603	Std	Std
R2, R3, R4	3	100 kΩ	RES, 100 k, 1%, 0.1 W, 0603	0603	Std	Std
U1	1		Tiny 3-A High Efficiency Synchronous Buck Converter in Chip Scale Package	1.2 × 0.8 mm	TPS62089AYFP	Texas Instruments

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NOTE:

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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

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

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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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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.

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