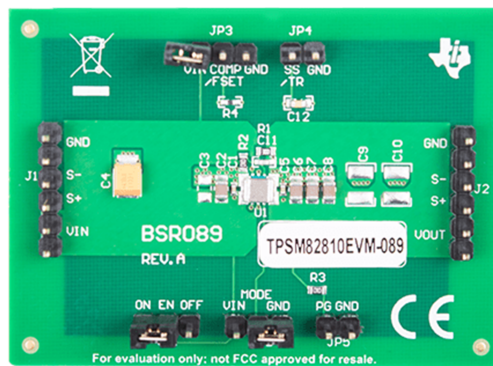


TPSM82810EVM Evaluation Module

This user's guide describes the characteristics, operation, and use of TI's TPSM82810 evaluation module (EVM). The TPSM82810EVM-089 is designed to help you easily evaluate and test the operation and functionality of the TPSM82810 buck converter power module. The EVM converts a 2.75-V to 6.0-V input voltage to a regulated 1.8-V output voltage that delivers up to 4 A. This user's guide includes setup instructions for the hardware, a printed-circuit board (PCB) layout, a schematic diagram, and a bill of materials (BOM).



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1 Introduction

The TPSM8281x device is a high-frequency, synchronous, step-down converter power module optimized for a small solution size and high efficiency. The devices focus on high-efficiency, step-down conversion over a wide output current range. When the MODE/SYNC pin is pulled low, the power module operates in PWM mode at medium to heavy loads and automatically enters *Power Save Mode* operation at light loads to maintain high efficiency over the entire load-current range. The internal compensation circuit allows a compact solution and small external components. The power module is available in a 3.0-mm x 4.0-mm x 2.4-mm, uSiLL package.

1.1 Performance Specification

Table 1 provides a summary of the TPSM82810EVM-089 performance specifications.

Table 1. Performance Specification Summary

SPECIFICATION		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input voltage			2.75		6.0	V
Output voltage setpoint				1.8		V
Output current	TPSM82810EVM-089		0		4.0	A

1.2 Modifications

The printed-circuit board (PCB) for this EVM is designed to accommodate the different adjustable output voltage versions of this integrated circuit (IC). On the EVM, additional input and output capacitors can be added, the soft-start time can be changed, and the switching frequency can be modified.

1.2.1 Input and Output Capacitors

Footprints for an additional input capacitor (C3) as well as for additional output capacitors (C9, C10) are provided. These capacitors are not required for proper operation but can be used to reduce the input and output voltage ripple and to improve the load transient response. For proper operation, the total output capacitance must remain within the recommended range described in the [TPSM8281x 2.75-V to 6-V Adjustable-frequency Step-down Converter with Integrated Inductor Data Sheet](#).

1.2.2 Adjustable-Output IC U1 Operation

U1 is configured for evaluation of the adjustable-output version. This unit is set to 1.8 V. Resistors R1 and R2 can be used to set the output voltage between 0.6 V and 5.5 V. See the [TPSM82810 Low Input Voltage, Fixed Frequency Step-down Converter Module Data Sheet](#) for recommended values.

1.2.3 Feedforward Capacitor

C11 is the feedforward capacitor. If the feedback divider (R1 and R2) has been modified, you may have to adjust the value of the feedforward capacitor as well. See the [TPSM82810 Low Input Voltage, Fixed Frequency Step-down Converter Module Data Sheet](#) for the recommended values.

1.2.4 Soft-Start Time

C12 controls the soft-start time of the output voltage. It can be changed for a faster or slower ramp-up of the output voltage. See the [TPSM82810 Low Input Voltage, Fixed Frequency Step-down Converter Module Data Sheet](#) for recommended capacitor values..

1.2.5 Tracking

A control voltage connected to JP4 can be used to control the output voltage. See the [TPSM82810 Low Input Voltage, Fixed Frequency Step-down Converter Module Data Sheet](#) for more details.

1.2.6 Switching Frequency and Control Loop Compensation

R4 controls the switching frequency of the converter. It is also used to select a predefined control loop compensation setting. See the [TPSM82810 Low Input Voltage, Fixed Frequency Step-down Converter Module Data Sheet](#) for recommended values.

2 Setup

This section describes how to correctly use the TPSM82810EVM-089.

2.1 Connector Descriptions

J1, Pin 1 and 2 – VIN—Positive input voltage 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—Positive 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

JP1 – EN—EN pin 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 – MODE/SYNC—MODE/SYNC pin jumper. Place the supplied jumper across VIN and MODE/SYNC to force the device in fixed frequency PWM operation at all load currents. Place the jumper across MODE/SYNC and GND to enable power save mode. Connect a clock signal to MODE/SYNC referenced to GND to synchronize the switching frequency to the clock signal.

JP3 – COMP/FSET—Device compensation and frequency set input. When the jumper is open, the resistor R4 from this pin to ground defines the compensation of the control loop as well as the switching frequency if it is not externally synchronized. The COMP/FSET pin connects pin 1 and 2 and is tied to VIN. Comp setting 1 (for smallest output capacitance) is set and the switching frequency is internally fixed at 2.25 MHz. The COMP/FSET pin connects pin 2 and 3 and is tied to GND. Comp setting 3 (for large output capacitance) is set and the switching frequency is internally fixed at 2.25 MHz.

JP4 – SS/TR—SS/TR input. A voltage connected on pin 1 of this header referenced to GND on pin 2 can be used to control the output voltage (tracking). Change the capacitor from SS/TR pin to GND to adjust the soft-start ramp time.

JP5 – PG—The PG output appears on pin 1 of this header with a convenient ground on pin 2.

2.2 Hardware Setup

To operate the EVM, set jumpers J3 and J4 to the desired positions per [Section 2.1](#). Connect the input supply to J1, between VIN and GND, and connect the load to J2 between VOUT and GND.

3 TPSM82810EVM-089 Test Results

The TPSM82810EVM-089 was used to take the typical characteristics data in the [TPSM82810 Low Input Voltage, Fixed Frequency Step-down Converter Module Data Sheet](#). See the [TPS6281x-Q1 Low Input Voltage, Fixed-Frequency Step-Down Converter Data Sheet](#) for the performance of this EVM.

4 Board Layout

This section provides the TPSM82810EVM-089 board layout. The Gerber files are available on the [TPSM82810EVM-089](#) tool page.

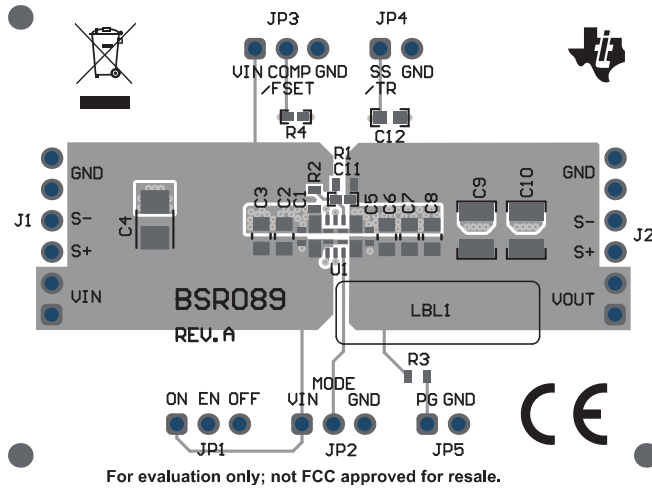


Figure 1. Top Silk

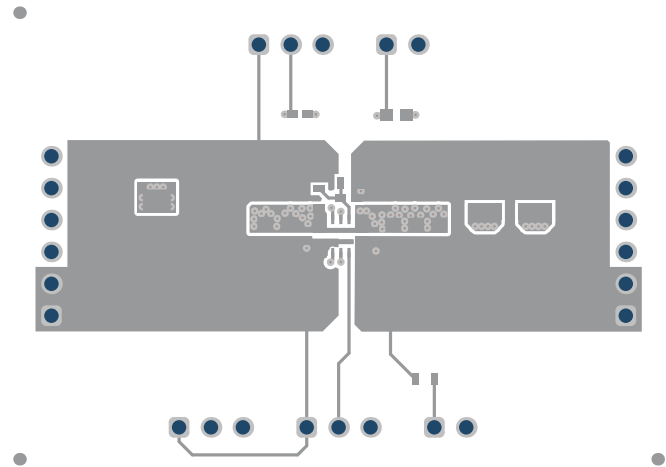


Figure 2. Top Layer

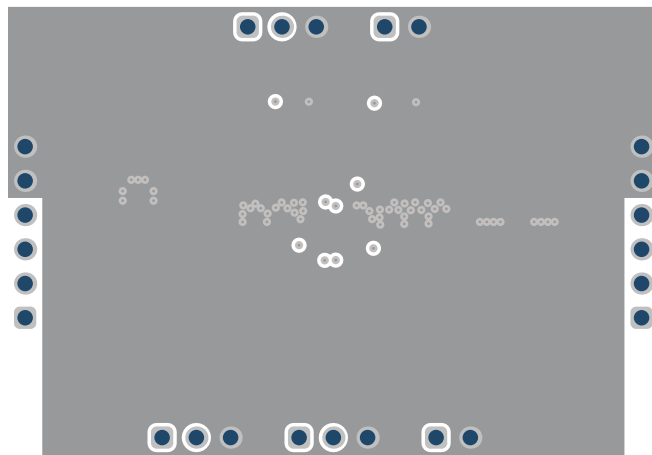


Figure 3. Layer 1

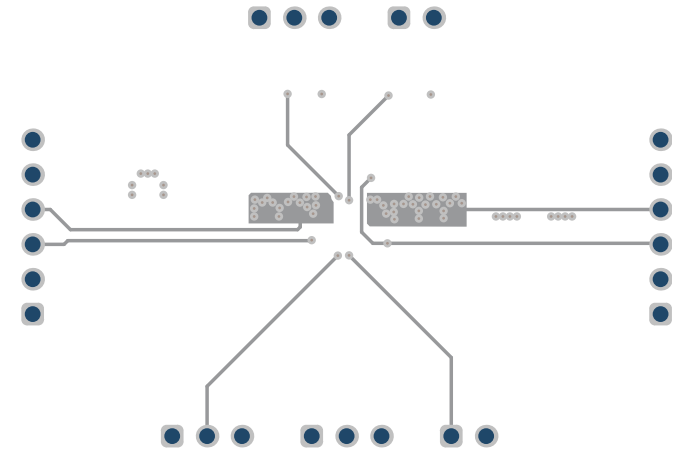


Figure 4. Layer 2

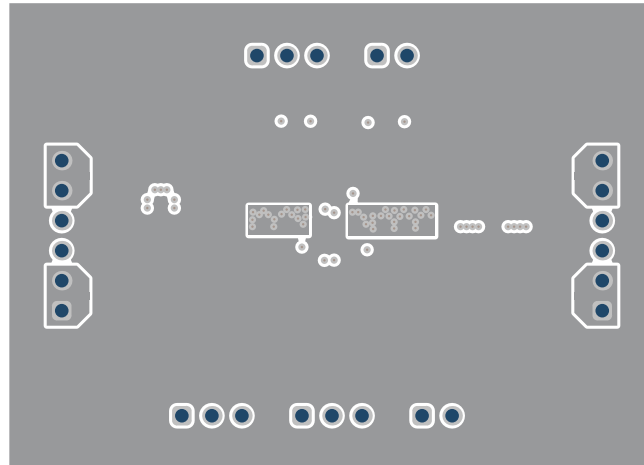


Figure 5. Bottom Layer

5 Schematic and Bill of Materials

This section includes the TPS62810EVM-015 schematic and bill of materials.

5.1 Schematic

Figure 6 shows the EVM schematic.

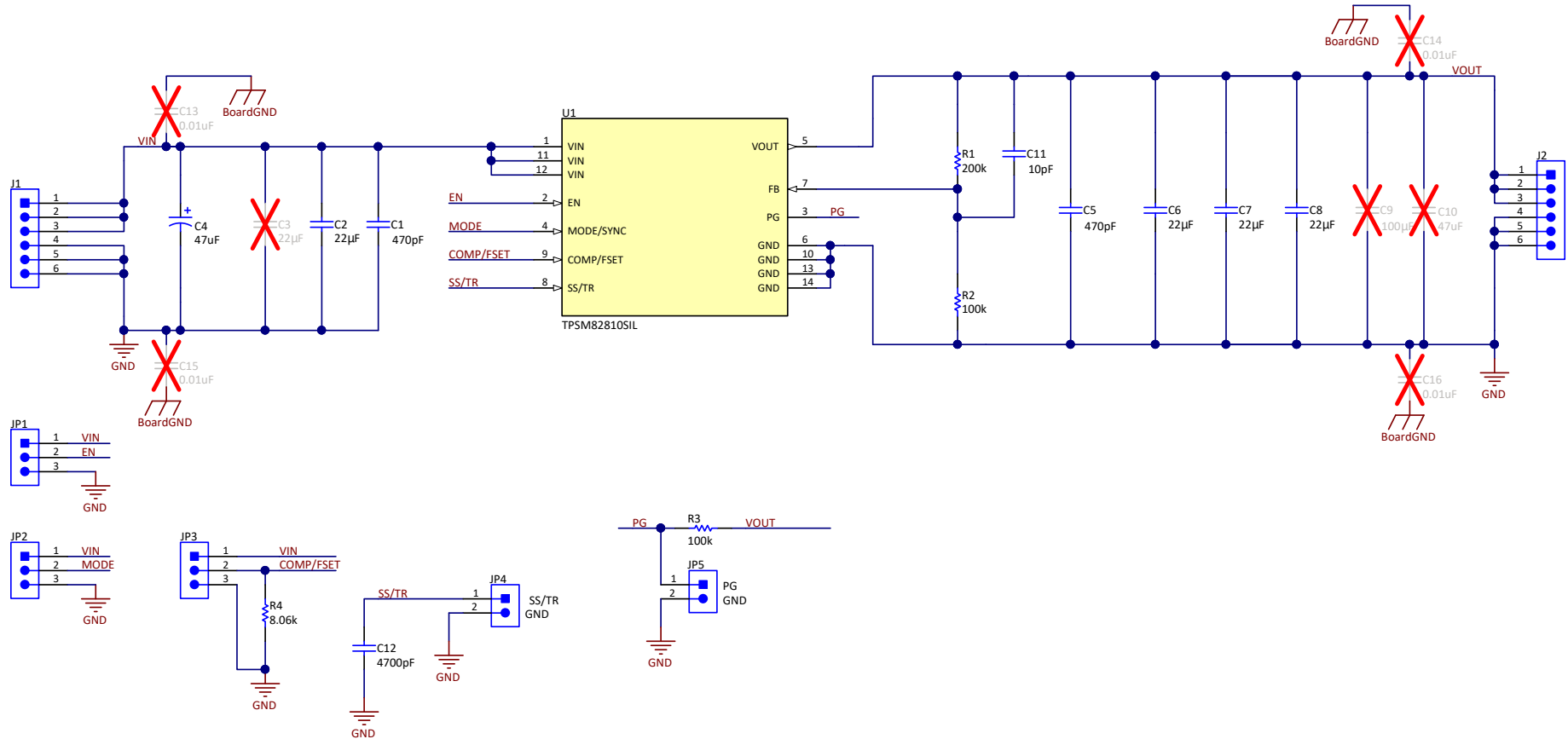


Figure 6. TPSM82810EVM-089 Schematic

5.2 Bill of Materials

Table 2 lists the BOM for this EVM.

Table 2. TPSM82810EVM-089 BOM

QUAN TITY	REF DES	VALUE	DESCRIPTION	SIZE	PART NUMBER	MFR
1	C1, C5	470 pF	Ceramic Capacitor, 50 V, X7R	0402	GCM155R71H471KA37D	Murata
1	C2, C6, C7, C8	2.2 μ F	Ceramic Capacitor, 10 V, X7T	0805	GRM21BD71A226ME44L	Murata
1	C4	47 μ F	Tantalum Capacitor, 10 V, X7R	3528-21	TPSB476K010R0250	AVX
1	C12	4700 pF	Ceramic Capacitor, 50 V, X7R	0603	GCM188R71H472KA37D	Murata
1	R1	200 k Ω	Resistor 1%, 0.1 W	0603		Any
1	R2	100 k Ω	Resistor 1%, 0.1 W	0603		Any
1	R3	100 k Ω	Resistor 1%, 0.1 W	0603		Any
1	R4	8.06 k Ω	Resistor 1%, 0.1 W	0402		Any
1	U1		Low-Input Voltage, Adjustable-Frequency Step-down Converter Power Module	SIL0014	TPSM82810SIL	Texas Instruments

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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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3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lstds/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/lstds/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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-
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