

TPS628502EVM-092 Evaluation Module

This user's guide describes the characteristics, operation, and use of TI's evaluation module (EVM) for the TPS62850x-Q1, TPS628501-Q1, and TPS628502-Q1 devices. The TPS628502EVM-092 is designed to help the user easily evaluate and test the operation and functionality of the TPS62850x buck converters. The EVM converts a 2.7-V to 6.0-V input voltage to a regulated 1.8-V output voltage that delivers up to 2 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 TPS62850x device is a high-frequency, synchronous, step-down converter optimized for a small solution size and high efficiency. The devices focus on high-efficiency, step-down conversion over a wide output current range. The internal compensation circuit allows a compact solution and small external components. The device is available in a 2.1-mm × 1.6-mm, incl pins in SOT583 package.

1.1 Performance Specification

Table 1 provides a summary of the TPS628502EVM-092 performance specifications.

Table 1. Performance Specification Summary

SPECIFICATION		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input voltage			2.7		6.0	V
Output voltage setpoint				1.8		V
Output current	TPS628502EVM-092		0		2.0	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 and the switching frequency can be modified.

1.2.1 Input and Output Capacitors

Footprints for an additional input capacitor (C11) and output capacitors (C9 and 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 [TPS62850x-Q1 2.7-V to 6-V Adjustable-Frequency Step-Down Converter in SOT583 Package 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. For recommended values, see the [TPS62850x-Q1 2.7-V to 6-V Adjustable-Frequency Step-Down Converter in SOT583 Package data sheet](#).

1.2.3 Fix-Output IC U1 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. For recommended values, see the [TPS62850x-Q1 2.7-V to 6-V Adjustable-Frequency Step-Down Converter in SOT583 Package data sheet](#).

1.2.4 Feedforward Capacitor

C8 is the feedforward capacitor. For recommended values, see the [TPS62850x-Q1 2.7-V to 6-V Adjustable-Frequency Step-Down Converter in SOT583 Package data sheet](#).

1.2.5 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. For recommended values, see the [TPS62850x-Q1 2.7-V to 6-V Adjustable-Frequency Step-Down Converter in SOT583 Package data sheet](#).

2 Setup

This section describes how to correctly use the TPS628502EVM-092.

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 – 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 JP1 and JP2 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 TPS628502EVM-092 Test Results

The TPS628502EVM-092 was used to take the typical characteristics data in the TPS62850x-Q1 data sheet. See the [TPS62850-Q1 2.7-V to 6-V Adjustable-Frequency Step-Down Converter in SOT583 Package data sheet](#) for the performance of this EVM.

4 Board Layout

This section provides the TPS628502EVM-092 board layout. The Gerber files are available on the [TPS628502EVM-092](#) tool page.

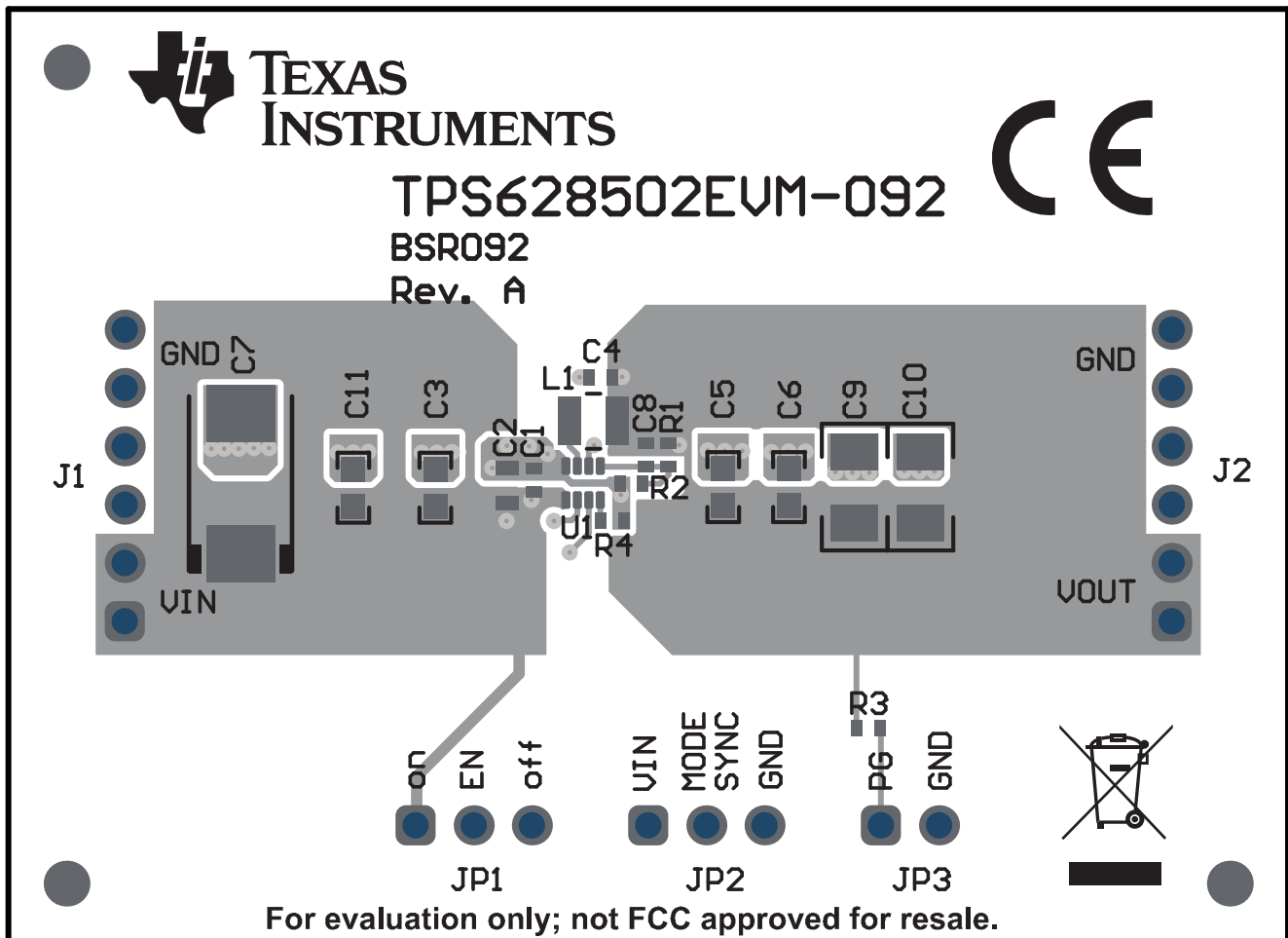


Figure 1. Top Silk

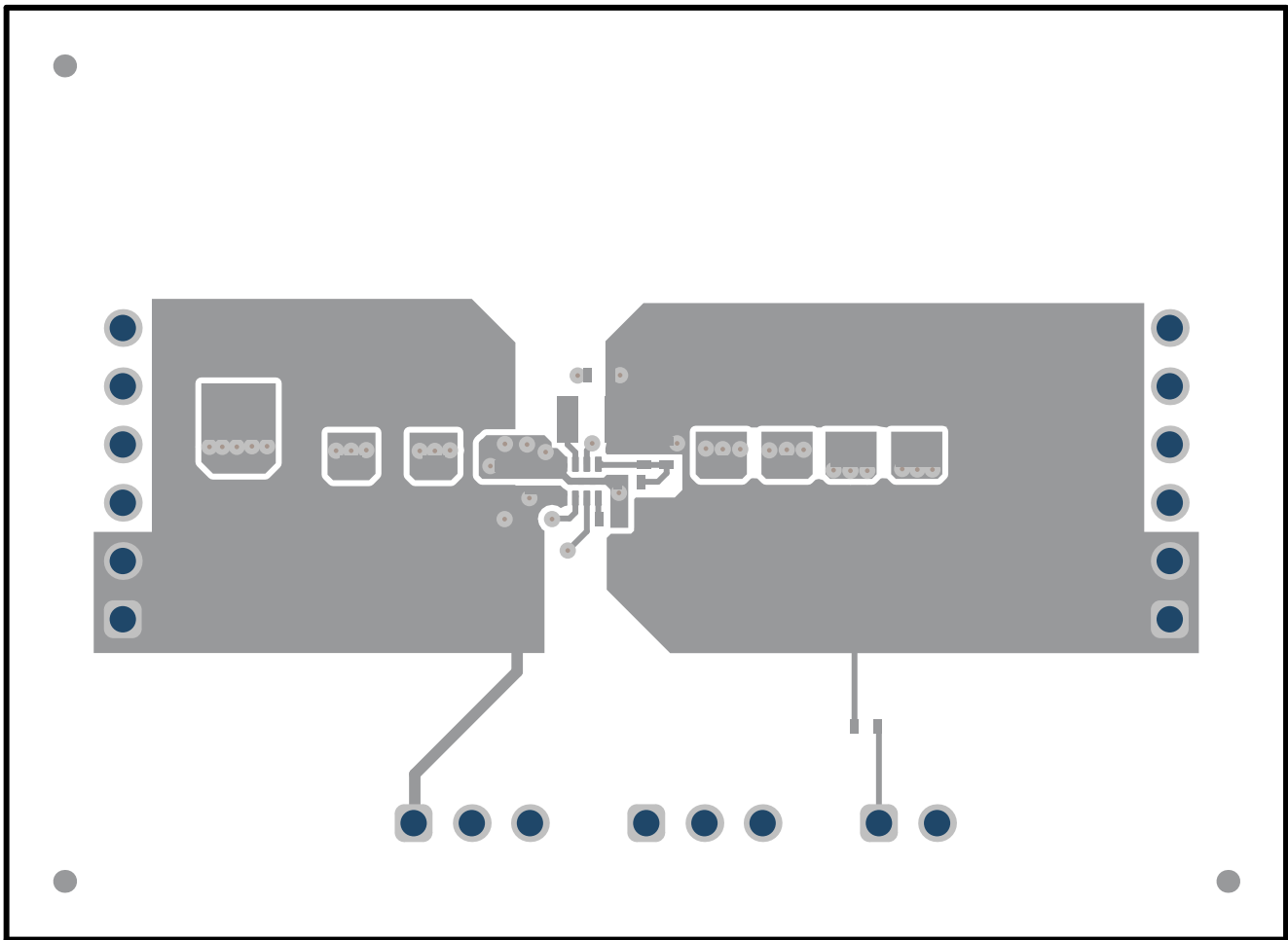


Figure 2. Top Layer

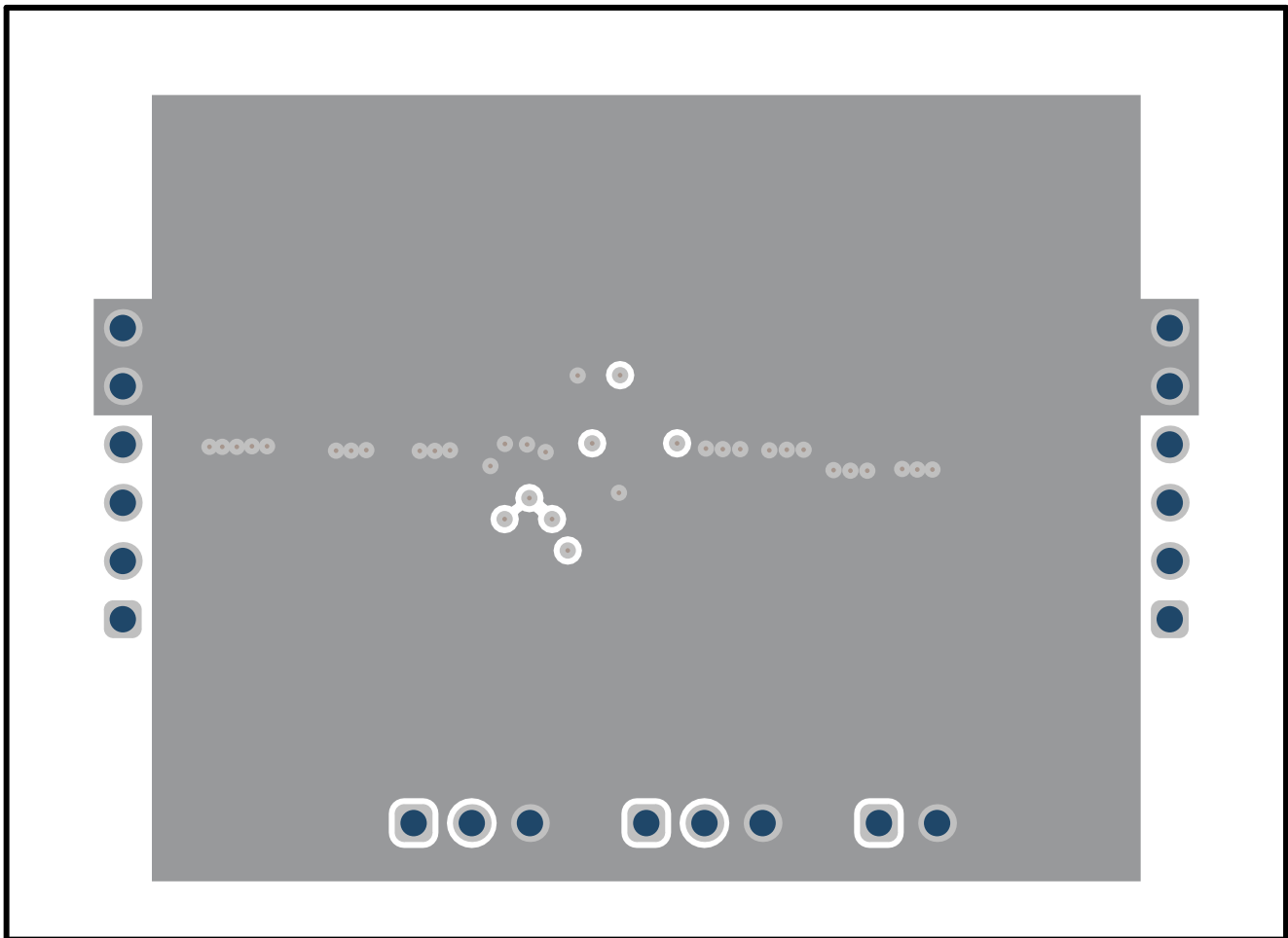


Figure 3. Layer 2

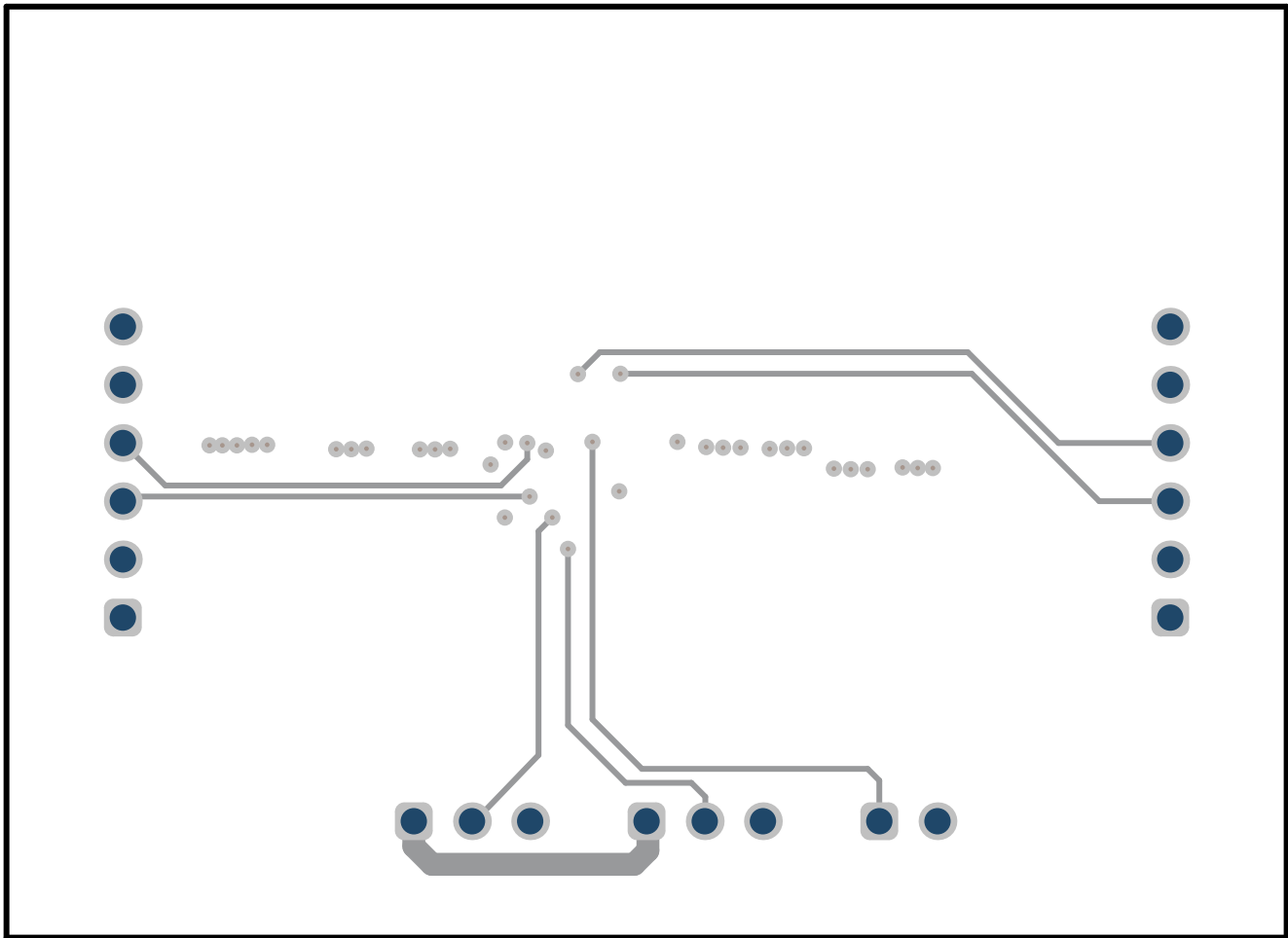


Figure 4. Layer 3

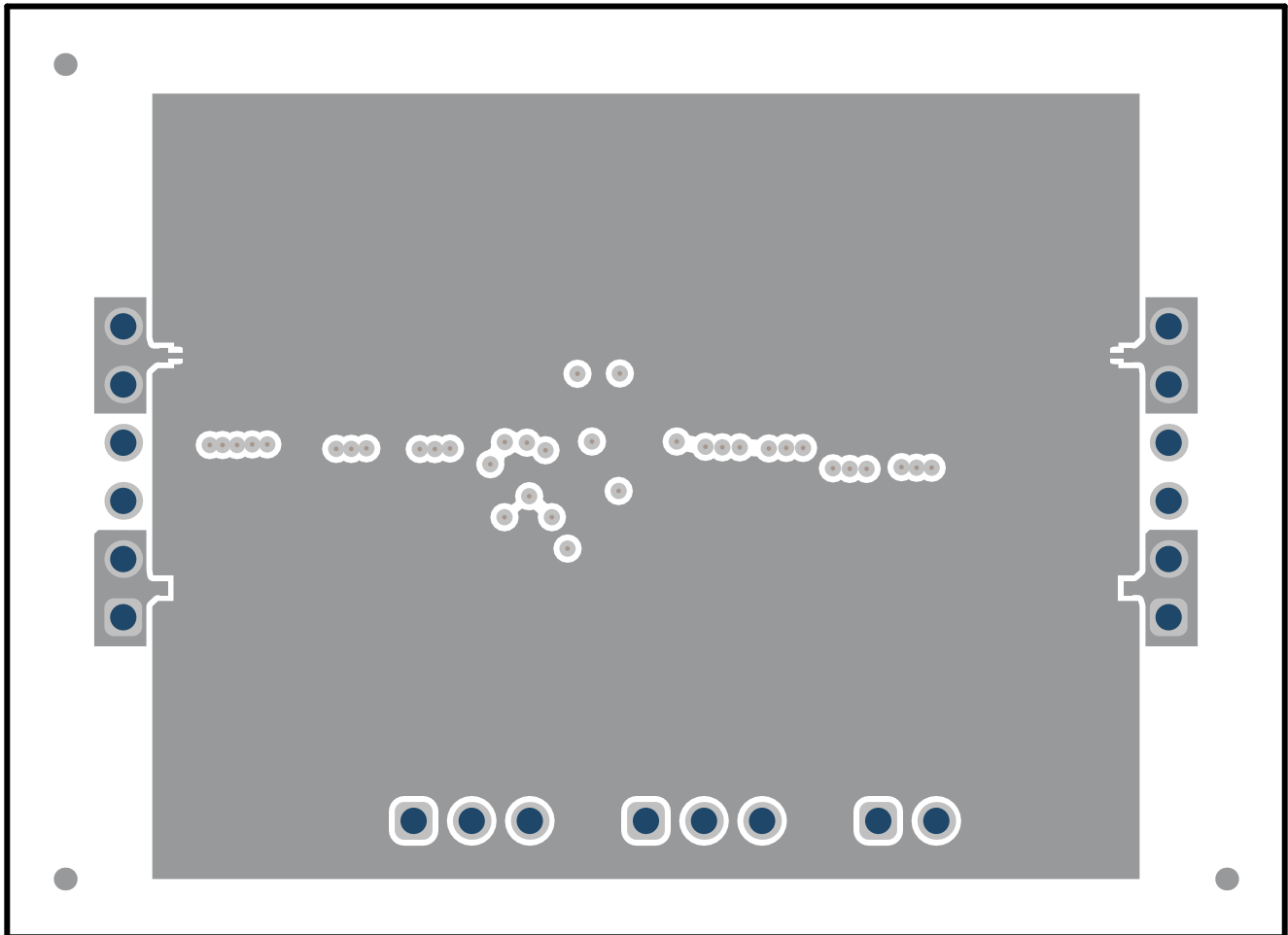


Figure 5. Bottom Layer

5 Schematic and Bill of Materials

This section includes the TPS628502EVM-092 schematic and bill of materials.

5.1 Schematic

Figure 6 shows the EVM schematic.

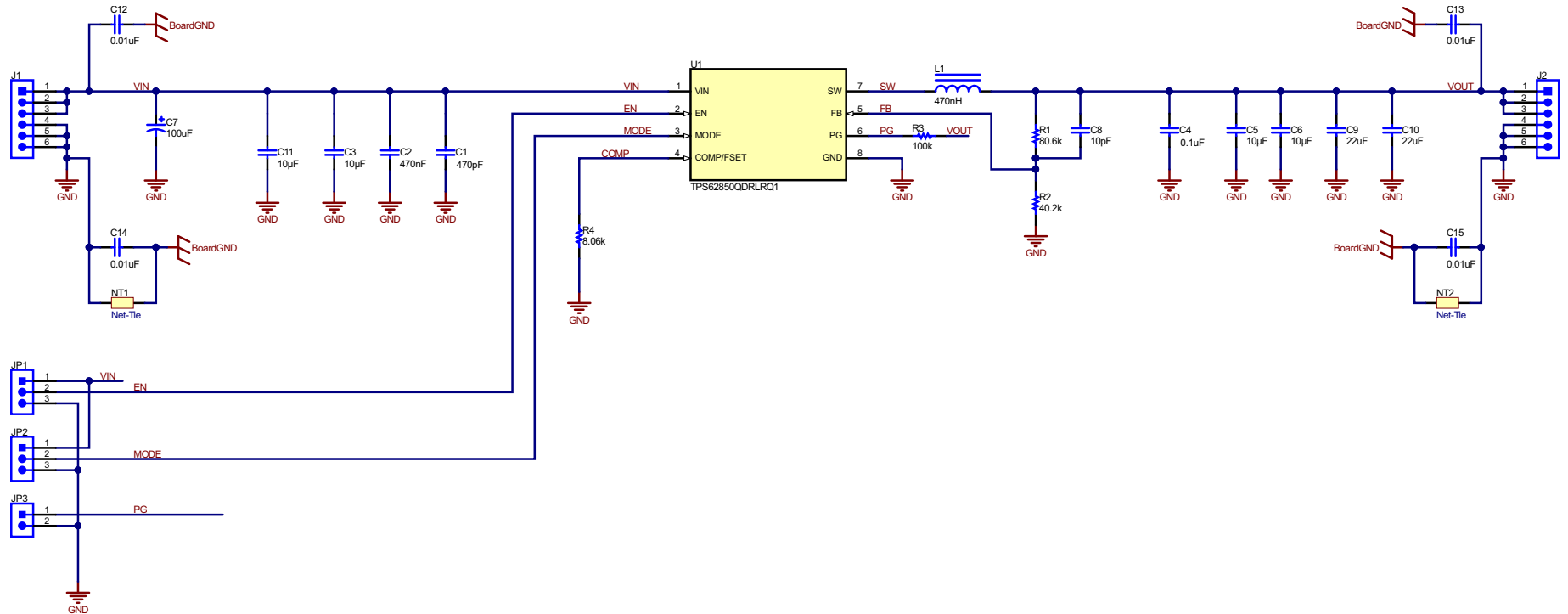


Figure 6. TPS628502EVM-092 Schematic

5.2 Bill of Materials

Table 2 lists the BOM for this EVM.

Table 2. TPS628502EVM-092 BOM

QTY	REF DES	VALUE	DESCRIPTION	SIZE	PART NUMBER	MFR
1	C1	470 pF	Ceramic Capacitor, 50 V, X7R	0402		any
1	C2	0.47 μ F	Ceramic Capacitor, 16 V, X7R	0603	GRM188R71C474KA88D	MuRata
3	C3, C5, C6,C11	10 μ F	Ceramic Capacitor, 10 V, X7R	0603	GRM188Z71A106MA73D	MuRata
1	C4	0.1 μ F	Ceramic Capacitor, 16 V, X7R	0402		any
1	C7	100 μ F	Polymer Capacitor, 20 V	7.3x4.3 mm	20TQC100MYF	Panasonic
1	C8	10 pF	Ceramic Capacitor, 50 V, COG/NPO	0402	GCM1555C1H100JA16D	MuRata
2	C9, C10	22 μ F	Ceramic Capacitor, 10 V, X7R	1206	GCM31CR71A226KE02	MuRata
1	L1	470 nH	Inductor	1008	DFE252012PD-R47M	MuRata Toko
1	R1	80.6 k Ω	Resistor 1%, 0.1 W	0402		any
1	R2	40.2 k Ω	Resistor 1%, 0.1 W	0402		any
1	R3	100 k Ω	Resistor 1%, 0.1 W	0402		any
1	R4	8.06 k Ω	Resistor 1%, 0.1 W	0402		any
1	U1		2.7-V to 6-V Adjustable-Frequency Step-Down Converter	SOT583	TPS628502QDRLRQ1	Texas Instruments

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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.

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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<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

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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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-
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