# TPS630702EVM User's Guide

This user's guide describes the characteristics, operation, and use of the TPS630702EVM evaluation module (EVM). The TPS630702EVM is designed to help the users easily evaluate and test the operation and functionality of the TPS630702 Buck-Boost Converter. The TPS630702EVM uses the TPS630702 adjustable version with output discharge function. The output voltage is set to 3.3 V to 5 V. The user can select the output voltage with the VSEL pin. The EVM operates from 2 V to 16 V input voltage. Output currents can go up to 2 A in buck mode and boost mode. This document includes setup instructions for the hardware, a schematic diagram, a bill of materials (BOM), and printed-circuit board (PCB) layout drawings for the evaluation module. Throughout this document, the abbreviations EVM, TPS630702EVM, and the term evaluation module are synonymous with the TPS630702, unless otherwise noted.

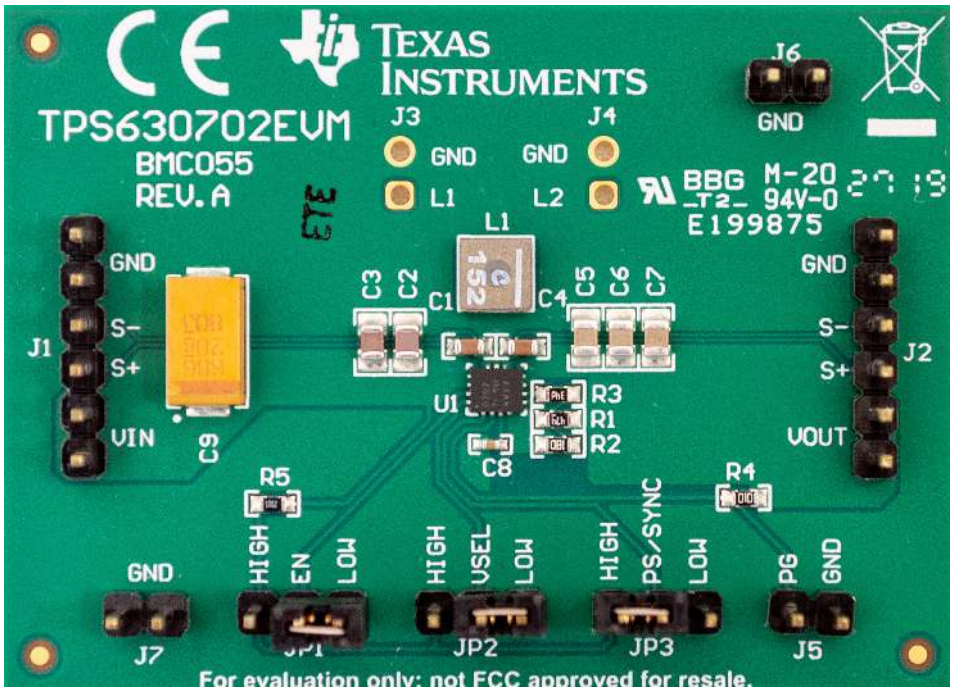


**Figure 1. TPS63802 EVM Picture**

**Contents**

## Trademarks

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# 1 Introduction

The Texas Instruments TPS630702 is a highly efficient, single-inductor, internally compensated, buck-boost converter in a 15-pin, 2.5-mm × 3-mm HotRod package. Both fixed and adjustable output voltage units are available.

## *1.1 Background*

The TPS630702EVM uses the TPS630702 adjustable-output voltage and output discharge version of the integrated circuit (IC) and is set to a 3.3 V to 5 V output. The fixed-output version(s) can be evaluated on this EVM with minor modification as stated in section titled, *Fixed Output Operation*. The EVM operates with an input voltage between 2  V and 16 V.

## 1.2 Performance Specification

Table 1 provides a summary of the TPS630702EVM 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 |
|---|---|---|---|---|---|
| Input voltage | | 2 | | 16 | V |
| Output voltage | | 2.5 | 5 | 9 | V |
| Output current | during operation $V_{IN}$ ≥ 4.5 V | 0 | | 2000 | mA |
| | during operation $V_{OUT}$ ≥ 4.5 and boost factor ($V_{OUT}/V_{IN}$) ≤ 1 | 0 | | 2000 | mA |
| Operating frequency | | | 2400 | | kHz |

## 1.3 Modifications

The printed-circuit board (PCB) for this EVM is designed to accommodate both the fixed and adjustable versions of this IC. If the fixed version is installed, R1 and R3 are replaced with a 0-Ω resistor and R2 is open. Extra positions are available for additional input and output capacitors.

### 1.3.1 Adjustable-Output IC U1 Operation

U1 is configured for evaluation of the adjustable-output version. This unit is set to 5 V. Resistors R1, R2 and R3 can be used to set the output voltage between 2 V and 9 V. See the data sheet for recommended values.

### 1.3.2 Fixed-Output Operation

U1 can be replaced with the fixed version for evaluation. With the fixed version, R1 and R3 need to be replaced with a 0-Ω resistor; R2 position is open.

# 2 Setup

This section describes how to properly use the TPS630702EVM.

## 2.1 Input/Output Connector and Header Descriptions

### 2.1.1 J1, Pin 1 and 2 – VIN

Positive input connection from the input supply for the EVM.

### 2.1.2 J1, Pin 3 and 4 – S+/S-

Input voltage sense connections. Measure the input voltage at this point.

### 2.1.3 J1, Pin 5 and 6 – GND

$V_{IN}$ GND return connection from the input supply for the EVM, common with J2, pin 5 and 6.

### 2.1.4 J2, Pin 1 and 2 – VOUT

Output voltage connection.

### 2.1.5 J2, Pin 3 and 4 – S+/S-

$V_{OUT}$ Sense and GND Sense low-current sense lines for sampling the output voltage at the output capacitor.

#### 2.1.6 J2, Pin 5 and 6 – GND

$V_{OUT}$ GND return connection for the output voltage, common with J1 pin 5 and 6.

#### 2.1.7 J5 – PG GND

Power Good (PG) test point and GND connection.

#### 2.1.8 JP1 – ENABLE

Shorting jumper between the center pin EN and HIGH turns on the unit. Shorting jumper between the center pin EN and LOW turns the unit off.

#### 2.1.9 JP2 – VSEL

Shorting jumper between the center pin VSEL and HIGH sets the output voltage to 5 V. Shorting jumper between the center pin VSEL and LOW sets the output voltage to 3.3 V.

#### 2.1.10 JP3 – PWR Save

Shorting jumper between the center pin PS/SYNC and HIGH enables automatic transition to power-saving mode at light-load currents as described in the data sheet; shorting jumper between the center pin PS/SYNC and LOW enables forced PWM mode.

### *2.2 Setup*

To operate the EVM, connect an input supply with the positive lead to J1, pins 1 and 2 and negative lead to J1, pins 5 and 6; connect a load with the positive lead to J2, pins 1 and 2 and the negative lead to J2, pins 5 and 6; short EN and HIGH (pins 2 and 3) of JP1 with a shorting jumper.

# 3 Board Layout

This section provides the TPS630702EVM board layout and illustrations.

## 3.1 TPS630702EVM Layout

Figure 2 through Figure 4 show the board layout for the TPS630702EVM PCB.

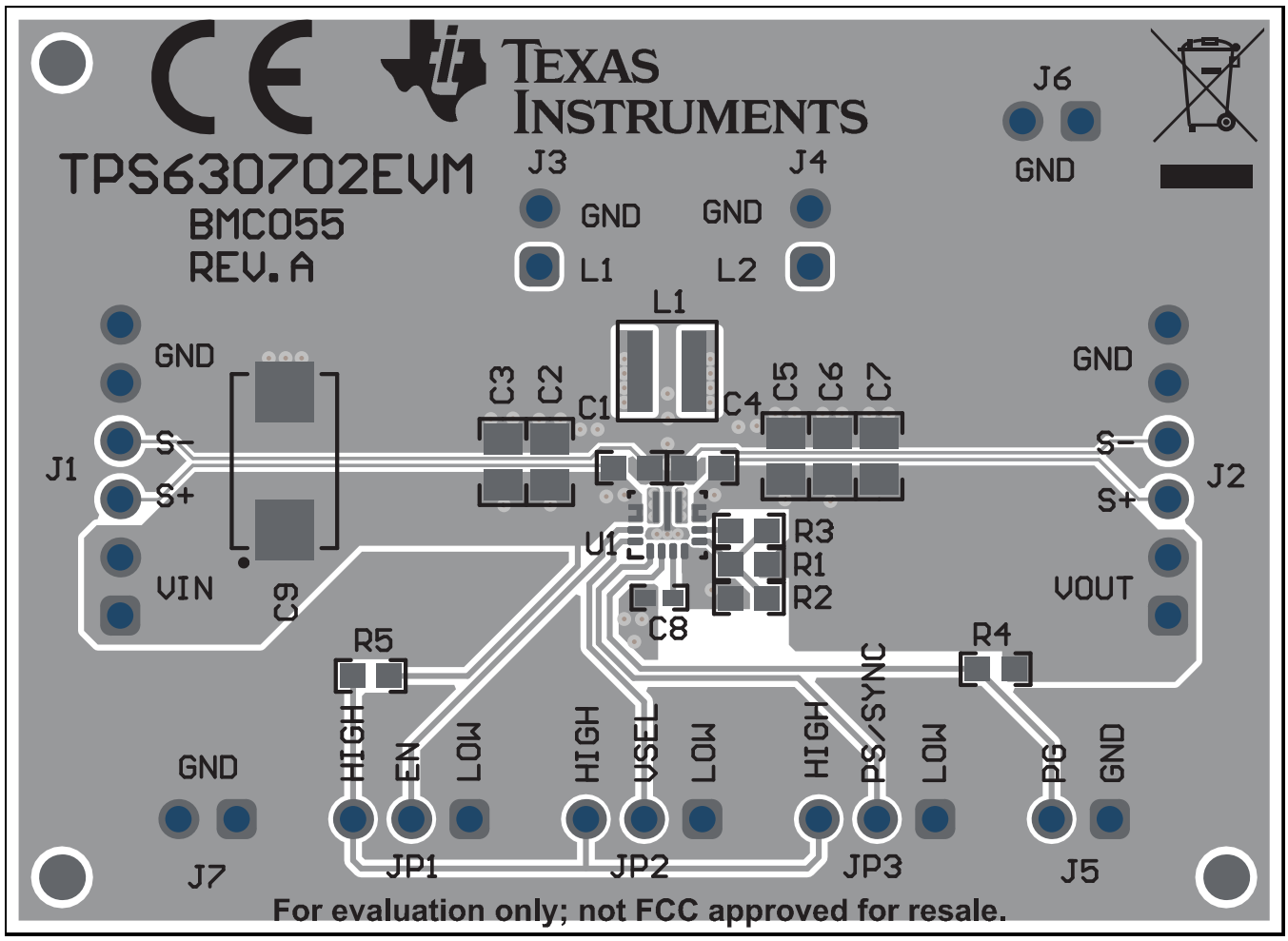


**Figure 2. Assembly Layer of TPS630702EVM**

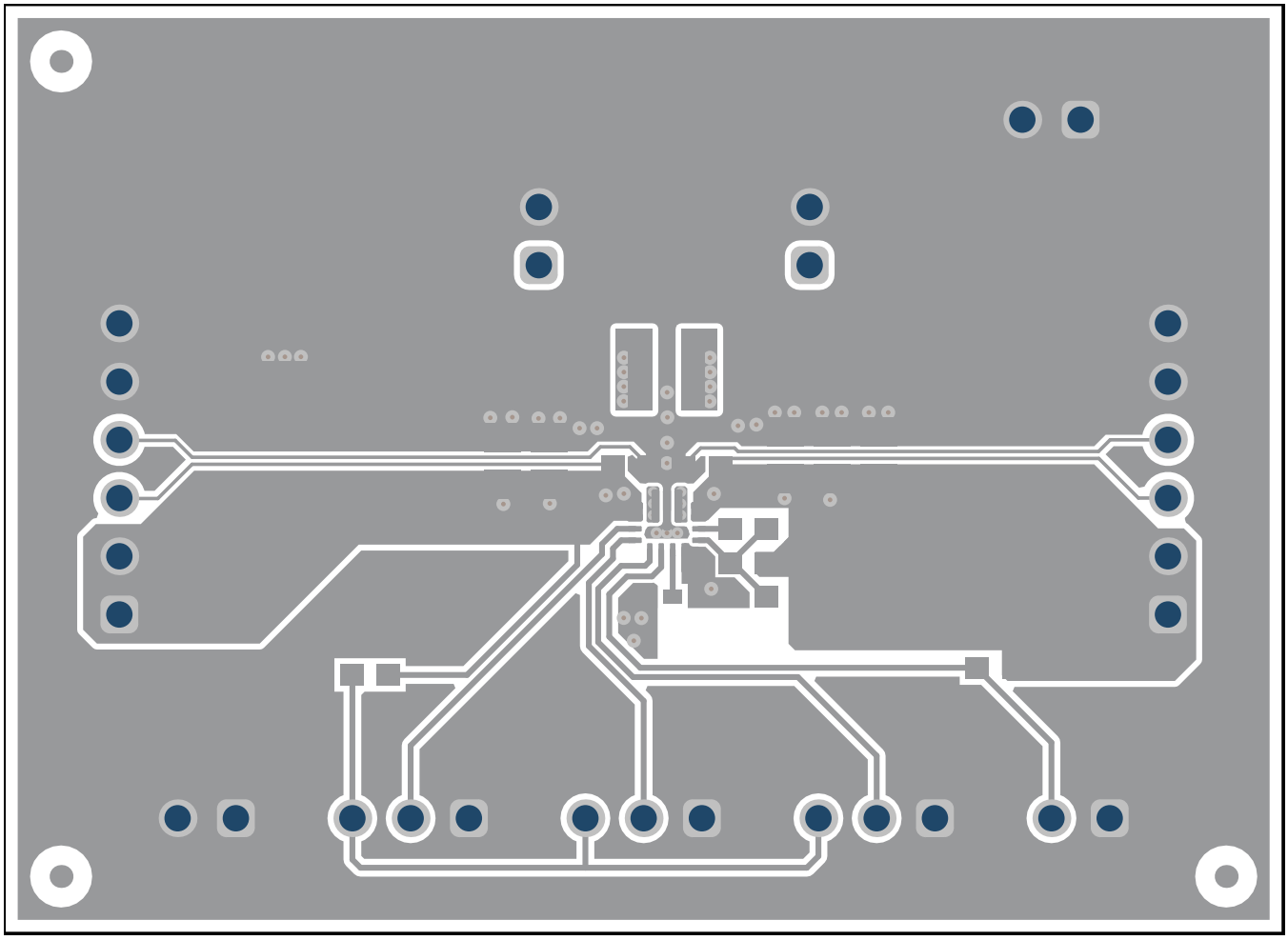

**Figure 3. Top Layer Routing of TPS630702EVM**

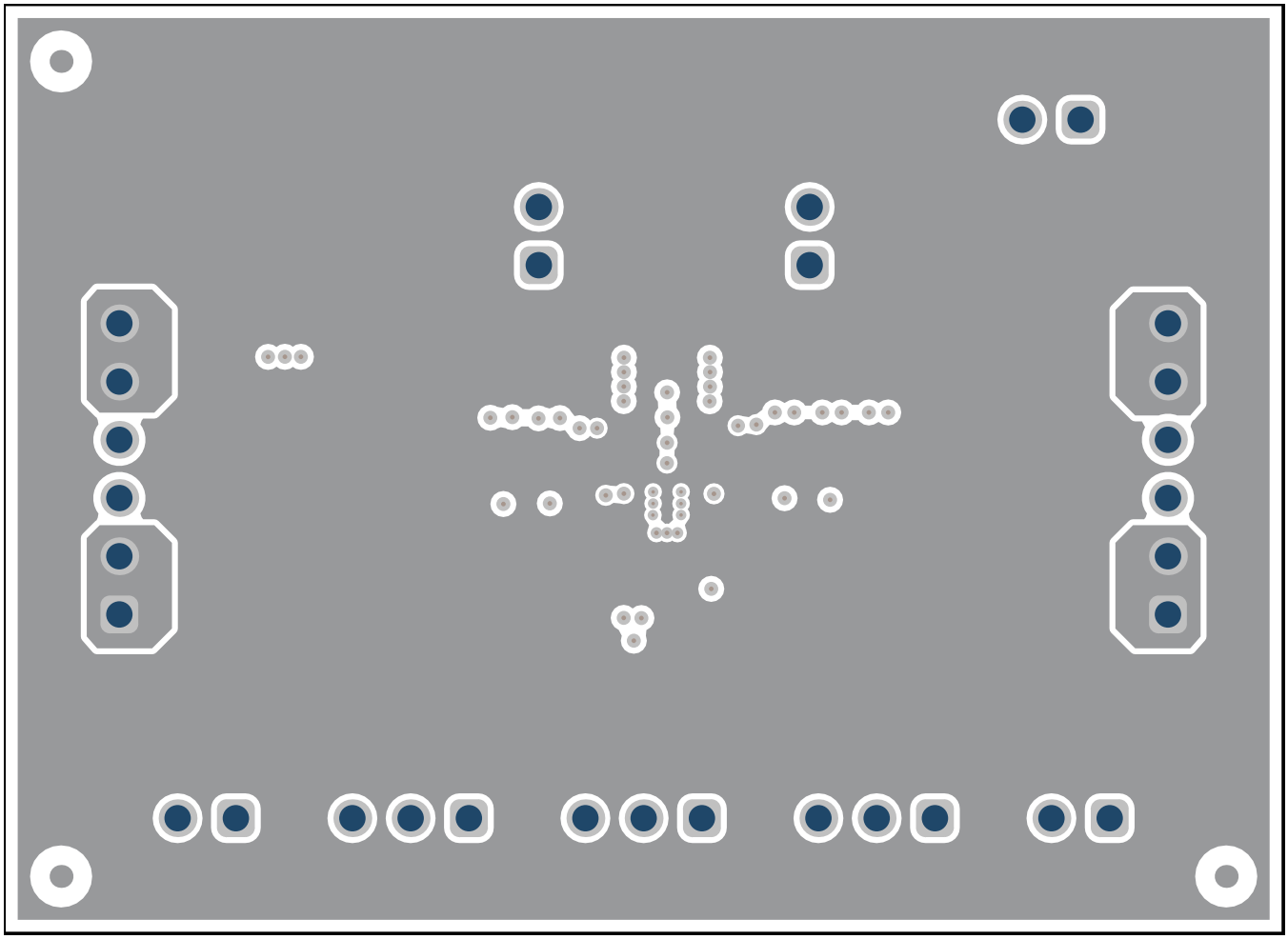

**Figure 4. Bottom Layer Routing of TPS630702EVM**

# 4 Schematic and Bill of Materials

This section provides the TPS630702EVM schematic and bill of materials.

## 4.1 TPS630702EVM Schematic

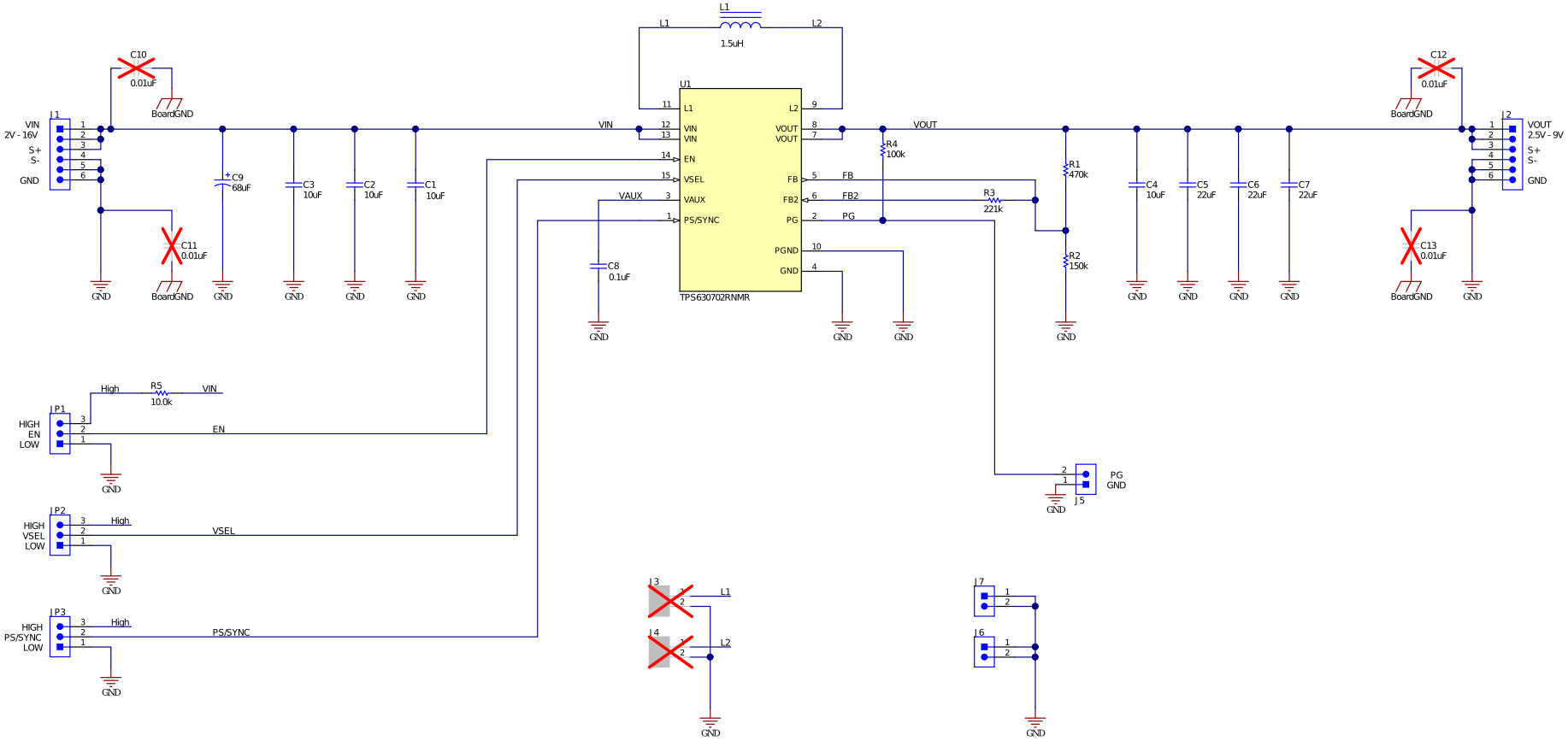


**Figure 5. TPS630702EVM Schematic**

## 4.2 Bill of Materials

**Table 2. TPS630702EVM Bill of Materials**

| Count | RefDes | Value | Description | Size | Part Number | MFR |
|---|---|---|---|---|---|---|
| 2 | C1,C4 | 10uF | CAP, CERM, 10 µF, 25 V, +/- 20%, X5R, 0603 | 0603 | GRM188R61E106MA73 | Murata |
| 2 | C2,C3 | 10uF | CAP, CERM, 10 µF, 25 V, +/- 20%, X7S, 0805 | 0805 | GRM21BC71E106ME11L | Murata |
| 3 | C5, C6, C7 | 22uF | CAP, CERM, 22 µF, 16 V, +/- 20%, X6S, 0805 | 0805 | GRM21BC81C226ME44L | Murata |
| 1 | C8 | 0.1uF | CAP, CERM, 0.1 µF, 25 V, +/- 10%, X7R, 0402 | 0402 | GRM155R71C104KA55 | Murata |
| 1 | C9 | 68uF | CAP, TA, 68 µF, 20 V, +/- 10%, 0.15 ohm, SMD | 7343-31 | T495D686K020ATE150 | Kemet |
| 1 | L1 | 1.5uF | Inductor, Shielded, Composite, 1.5 µH, 4.6 A, 0.01ohm, SMD | 4x2x4mm | XFL4020-152MEB | Coilcraft |
| 1 | R1 | 470k | RES, 470 k, 1%, 0.1 W, 0603 | 0603 | RC0603FR-07470KL | Yageo |
| 1 | R2 | 150k | RES, 150 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603 | 0603 | CRCW0603150KFKEA | Vishay-Dale |
| 1 | R3 | 221k | RES, 221 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603 | 0603 | CRCW0603221KFKEA | Vishay-Dale |
| 1 | R4 | 100k | RES, 100 k, 1%, 0.1 W, 0603 | 0603 | RC0603FR-07100KL | Yageo |
| 1 | R5 | 10.0k | RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603 | 0603 | CRCW060310K0FKEA | Vishay-Dale |
| 1 | U1 | | Wide input voltage (2V-16V) buck-boost converter, RNM0015A (VQFN-HR-15) | RNM0015A | TPS630702RNMR | TI |

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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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