SN6501EVM Evaluation Module

This document describes the SN6501EVM evaluation module (EVM). It allows designers to analyze and evaluate the SN6501 oscillator/power driver from Texas Instruments.

In addition to the SN6501, the EVM contains a small form-factor transformer, simple rectifier circuit, and voltage regulator. This combination simulates a complete isolated power supply system suitable for many different applications.

Contents

List of Figures

List of Tables

1 Introduction

1.1 Overview

This SN6501EVM evaluation module allows the user to evaluate the performance and features of the SN6501 in an actual isolated power application. This includes the transformer, rectifier, and low-dropout (LDO) voltage regulator shown in Figure 1.

The complementary output signals (D1 and D2) from the SN6501 are ground referenced, N-channel, power switches that drive the primary side of the center-tapped transformer. The secondary of the transformer has its center-tap referenced to an isolated ground, and the complementary outputs are rectified through a simple two-diode bridge. The make-before-break feature of the two driver outputs from the SN6501 ensures that only one side of the transformer is driven at a time. After being rectified, the dc voltage is smoothed and routed to the TPS76250 voltage regulator. The regulator outputs a stable, regulated +5-Vdc output that can be used to drive downstream circuitry.

Note that the EVM is configured for +3.3-Vdc input and a +5-Vdc output (+3.3/5 Vdc). It also can be configured for +3.3-Vdc input and +3.3-Vdc output (+3.3/3.3 Vdc), +5-Vdc input and +5-Vdc output (+5/5 Vdc) and finally a +5-V input and +3.3-Vdc output (+5/3.3 Vdc). Contact the Texas Instruments Product Information Center if you require one of these other configurations.

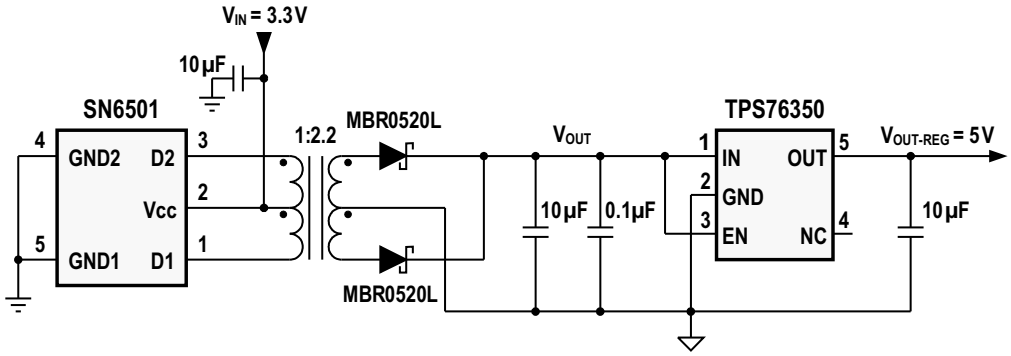

Figure 1. SN6501EVM Pinout and Functional Block Diagram

1.2 ISO5501EVM Kit Contents

- SN6501EVM Printed-Circuit Board (P/N 6540596)
- SN6501EVM Evaluation Module user's guide (SLLU156)
- SN6501 data sheet

2 Printed-Circuit Board

The SN6501EVM printed-circuit board (PCB) contains an SN6501, transformer, and voltage regulator. The board has separate and isolated grounds across the isolation transformer that allow the user to evaluate operation of the isolated power supply system contained on the EVM. Although the transformer secondary can be wound to provide any isolated voltage, the SN6501EVM uses a transformer with a 1:2.2 turns ratio, ideal for generating the rectified voltage required by the TPS76350 regulator.

Refer to the SN6501EVM schematic and bill of materials (BOM) and become familiar with the PCB components and layout. The PCB files (Gerber/ODB) are available from Texas Instruments on request.

2.1 SN6501EVM Operation

2.1.1 Left-Side Operation: SN6501 and Transformer Primary

DC Power – The SN6501 (installed on the left-side of the isolation transformer) can be operated using either a single +3.3-V (±10%), or single +5-V (±10%) dc power supply. On this EVM, the turns-ratio of the transformer is 1:2.2, which essentially provides a *step-up* voltage function. This allows the user to evaluate

system performance using a supply voltage anywhere within the range of +3 Vdc to 5.5 Vdc. The small amount of dc current required also allows the user the option to operate the EVM from a battery. The input dc power supply must be connected to the TB1 terminal block on the left side of the EVM. No other controls are required to operate the SN6501EVM. The SN6501 oscillates and drives the transformer when dc voltage is applied.

2.1.2 Right-Side Operation

2.1.2.1 DC Output Power

The right side of the isolation transformer contains a two-diode rectifier, filter capacitors, and a voltage regulator. Because the purpose of the EVM is to generate isolated power across the transformer, a separate power supply on the right side of the EVM is unnecessary. The rectified, unregulated output voltage can be observed at TP1. The user can monitor this output from the transformer while varying the input voltage to the SN6501. The regulated output is available at TB2. The user may connect external circuitry and/or loading to evaluate the operating range, line regulation, load regulation, and efficiency of the EVM. Note that the ground reference on the right side of the transformer (GND2) is not connected to the ground of the SN6501 (GND1). This demonstrates the isolation feature of the EVM.

CAUTION

Although the transformer has an isolation rating of 2 kV_{rms}, the PCB provides only 50 V of isolation between GND1 and GND2 to prevent electrical shock or injury. Do not attempt to apply high voltage between GND1 and GND2.

2.2 Bill of Materials and Schematic

2.2.1 Bill of Materials

The bill of materials for the SN6501EVM is shown in Table 1.

Table 1. Bill of Materials for SN6501EVM

Item	QTY	Reference	Part	Footprint	Manufacturer
1	1	C1	1µF, CAP CER 1.0µF 16V X5R	402	Any
2	1	C2	10µF, CAP CER 10µF 10V X5R 20%	603	Any
3	1	C3	22µF, CAP CER 22µF 16V 20% X5R	805	Any
4	1	C4	0.1µF, CAP CER .10µF 10V X5R	402	Any
5	1	C5	10µF, CAP CER 10µF 10V X5R 20%	1210	Any
6	2	D1,D2	DIODE SCHOTTKY 0.5A 20V SOD-123	SOD123	Fairchild
7	2	F1	ISO-T EMI SHIELD	EMI_CAN_LP-TFMRSHF-05	Fotofab or Latha Plastronics
8	1	JMP1	Header 2x1	HDR_THVT_1X2_100	Any
9	2	TB1,TB2	Terminal Block 2x1	TB_THRTSCR_1x2_100	Buchanan
10	1	T1	DA2304-AL	CoilCraft_DA23xx_AL	Coilcraft or Murata
11	1	U1	SN6501	SOT_5DBV	TI
12	1	U2	TPS76350	SOT_5DBV	TI

2.2.2 Schematic

Figure 2 shows the electrical schematic for the SN6501EVM.

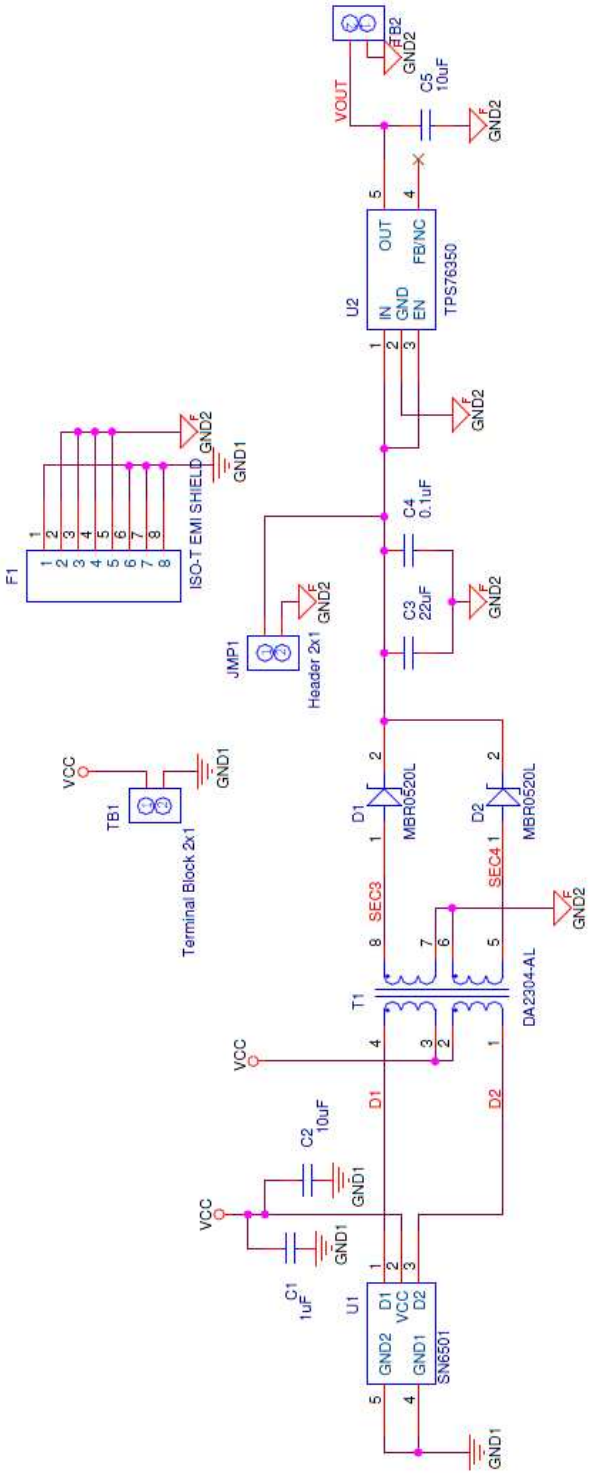

Figure 2. SN6501EVM Schematic

3 PCB Layout Information

Figure 3 through Figure 6 contain the PCB layout views.

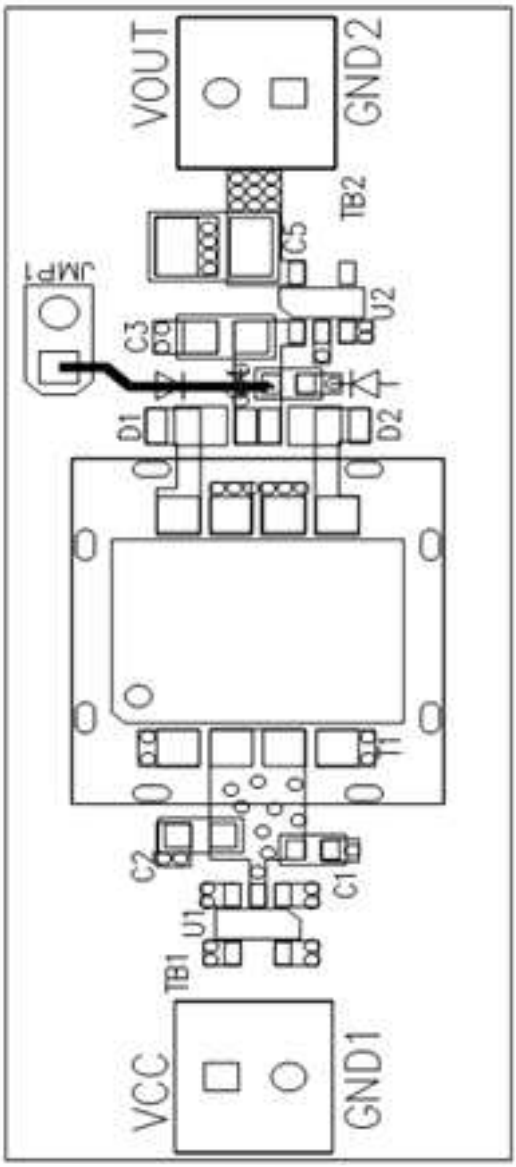

Figure 3. SN6501EVM Top Layer View

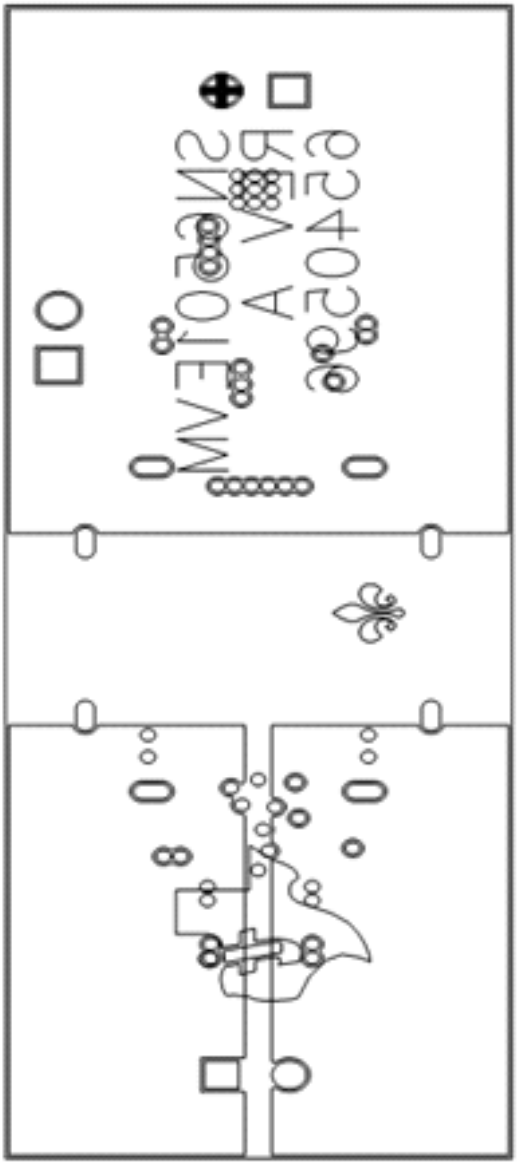

Figure 4. SN6501EVM Bottom Layer View

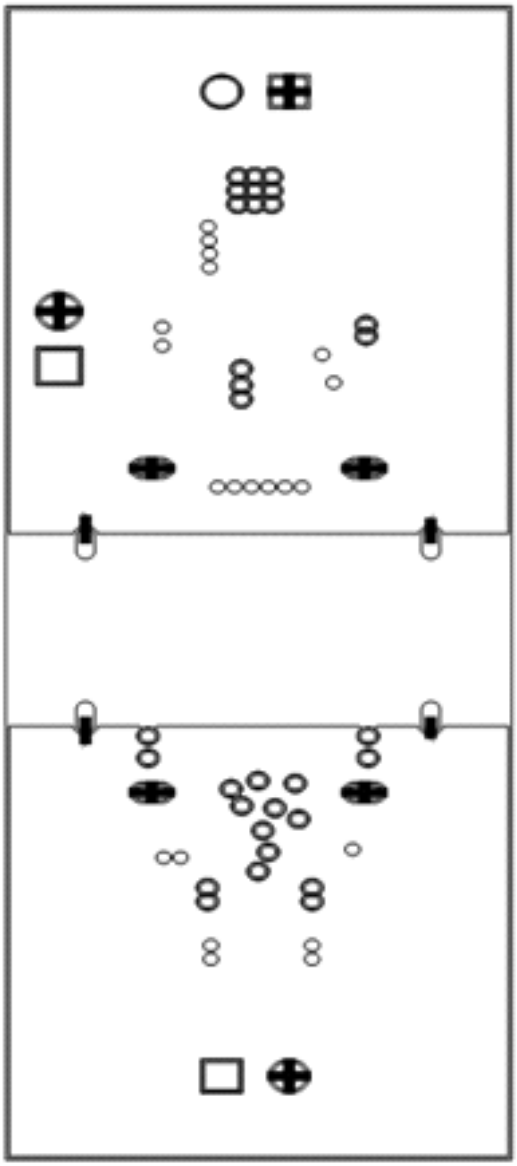

Figure 5. SN6501EVM Ground Plane View

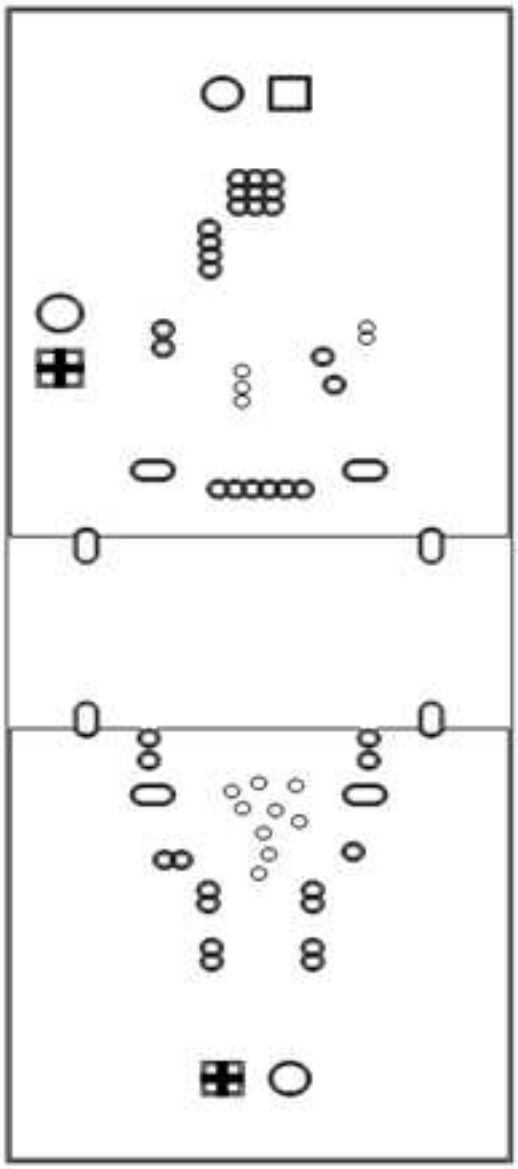

Figure 6. SN6501EVM Power Plane View

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As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this is strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

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

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.

REGULATORY COMPLIANCE INFORMATION (continued)

FCC Interference Statement for Class B EVM devices

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.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). 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.

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.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

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.

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.

【Important Notice for Users of this Product in Japan】

This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product 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 this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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EVALUATION BOARD/KIT/MODULE (EVM)
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3. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

Certain Instructions. It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

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