TPS65218EVM

This user's guide describes the characteristics, operation, and use of the TPS65218 evaluation module (EVM). The TPS65218EVM is a fully assembled platform for evaluating the performance of the TPS65218 power management device. This document includes schematic diagrams, a printed-circuit-board (PCB) layout, and bill of materials (BOM).

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1 Introduction

The TPS65218 is a highly-integrated power management solution for ARM® Cortex™ Microprocessors. Features of the TPS65218 include:

- 2 battery backup supplies
- 3 Buck converters
- 1 Buck-Boost converter
- USB load switch
- General purpose LDO
- Low-voltage load switch
- High-voltage load switch

2 Requirements

2.1 Software

The EVM will power-up and operate without use of software. However, I^2C commands must be made through the GUI.

2.2 Host Computer

A computer with an available USB port is required to make use of the EVM software. The EVM software runs on the computer and communicates with the EVM via the USB2ANY interface.

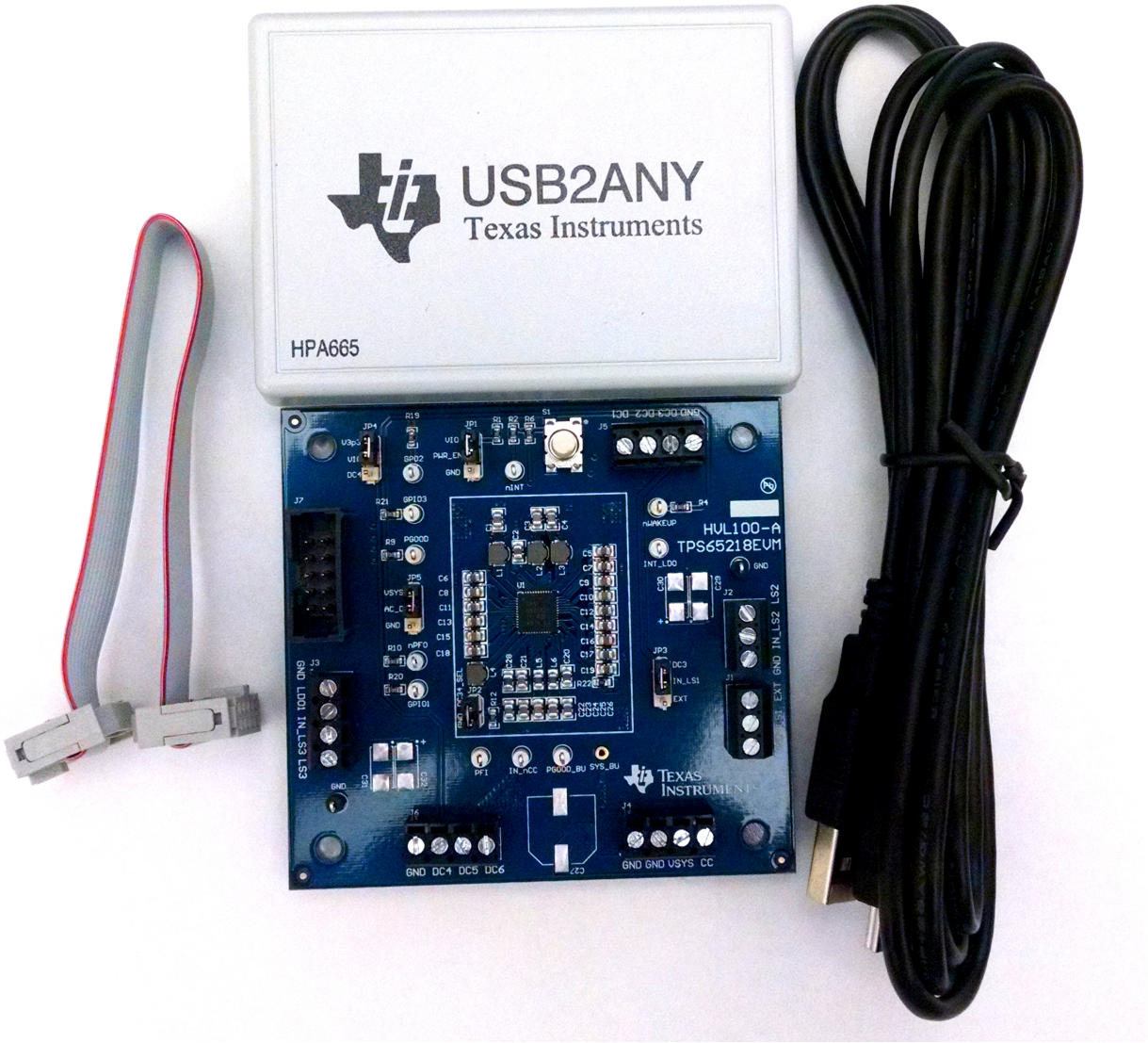
2.3 Power Supply

A DC power supply capable of delivering up to 5 V and 3 A, and a coin cell battery or separate 3-V power supply for the backup supplies.

3 EVM Kit

The EVM kit (Figure 1) contains the following items:

- TPS65218 evaluation board
- USB2ANY adapter
- USB to USB micro cable
- 10-pin ribbon cable
- 30-pin ribbon cable



Note: The 30-pin ribbon cable is not required for the TPS65218EVM.

Figure 1. TPS65218 EVM Kit

4 Schematic

Figure 2 illustrates the schematic for this EVM.

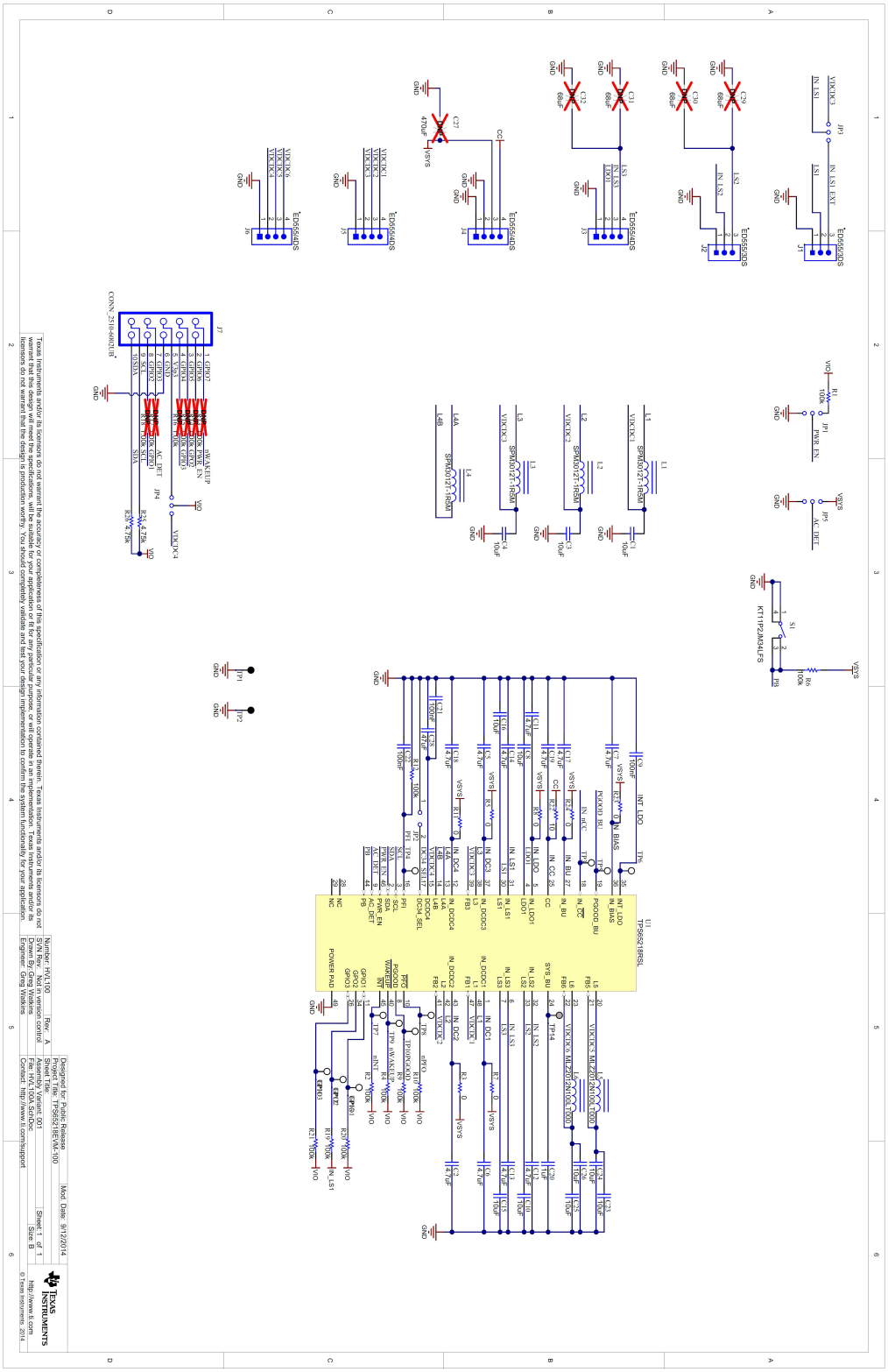


Figure 2. TPS65218 EVM Schematic

5 Terminal Block, Test Point, and Jumper Descriptions

Table 1. Terminal Block Descriptions

Connector	Pin	Description	Note
J1	GND	Ground	—
	LS1	LS1 Output	—
	EXT	External supply to LS1	Power Input (1.2 V – 3.3 V)
J2	GND	Ground	—
	IN_LS2	LS2 Input	Power Input (3.0 V – 5.5 V)
	LS2	LS2 Output	—
J3	GND	Ground	—
	LDO1	LDO1 Output	Default 1.8 V
	IN_LS3	LS3 Input	Power Input (1.8 V – 9.9 V)
	LS3	LS3 Output	—
J4	GND	Ground	—
	GND	Ground	—
	VSYS	DC Input	Power Input (2.7 V – 5.5 V)
	CC	Coin Cell Battery Input	Power Input (2.2 V – 3.3 V)
J5	GND	Ground	—
	DC3	Buck 3 Output (DCDC3)	Default 1.2 V Output
	DC2	Buck 2 Output (DCDC2)	Default 1.1 V Output
	DC1	Buck 1 Output (DCDC1)	Default 1.1 V Output
J6	GND	Ground	—
	DC4	Buck-Boost Output (DCDC4)	Default 3.3 V Output
	DC5	Battery Backup Supply Output (DCDC5)	1.0 V Output
	DC6	Battery Backup Supply Output (DCDC6)	1.8 V Output
J7	10-pin EVM connector for USB2ANY cable (I^2C communication)		

Table 2. Test Point Descriptions[(1)]

Test Point	Description
GND	Ground
INT_LDO	Internal bias voltage
nWAKEUP	Wakeup output signal
nINT	Interrupt output
nPFO	Power-fail comparator output
GPO2	General purpose output 2 or DDR reset output
GPIO3	General purpose output 3 or warm reset input
PGOOD	Power good
GPIO1	General purpose output 1
SYS_BU	Battery back-up power path output
PFI	Power-fail comparator input
IN_nCC	Output indicating power source for battery backup supplies
PGOOD_BU	Power good for backup supplies

(1) Test points are not designed to carry current, they are intended for measuring voltage.

Table 3. Jumper Descriptions

Jumper	Description	Default Position
JP1	Ties PWR_EN to VIO or GND	PWR_EN tied to VIO
JP2	Ties DC34_SEL pin to ground. Remove and jump with resistor for alternate voltage selections.	DC34_SEL tied to GND
JP3	Selects LS1 input between DCDC3 output and external supply from J1	IN_LS1 tied to DC3
JP4	Ties VIO to either DCDC4 output or 3.3-V supply from USB2ANY adaptor (J9). VIO supplies the pull-up voltage for the device I/Os.	VIO tied to V3p3
JP5	Ties AC_DET pin to either VSYS or GND. Tying to GND causes the device to start upon VSYS application.	AC_DET tied to VSYS

6 Setup

Figure 3 displays an example setup for using the TPS65218 EVM.

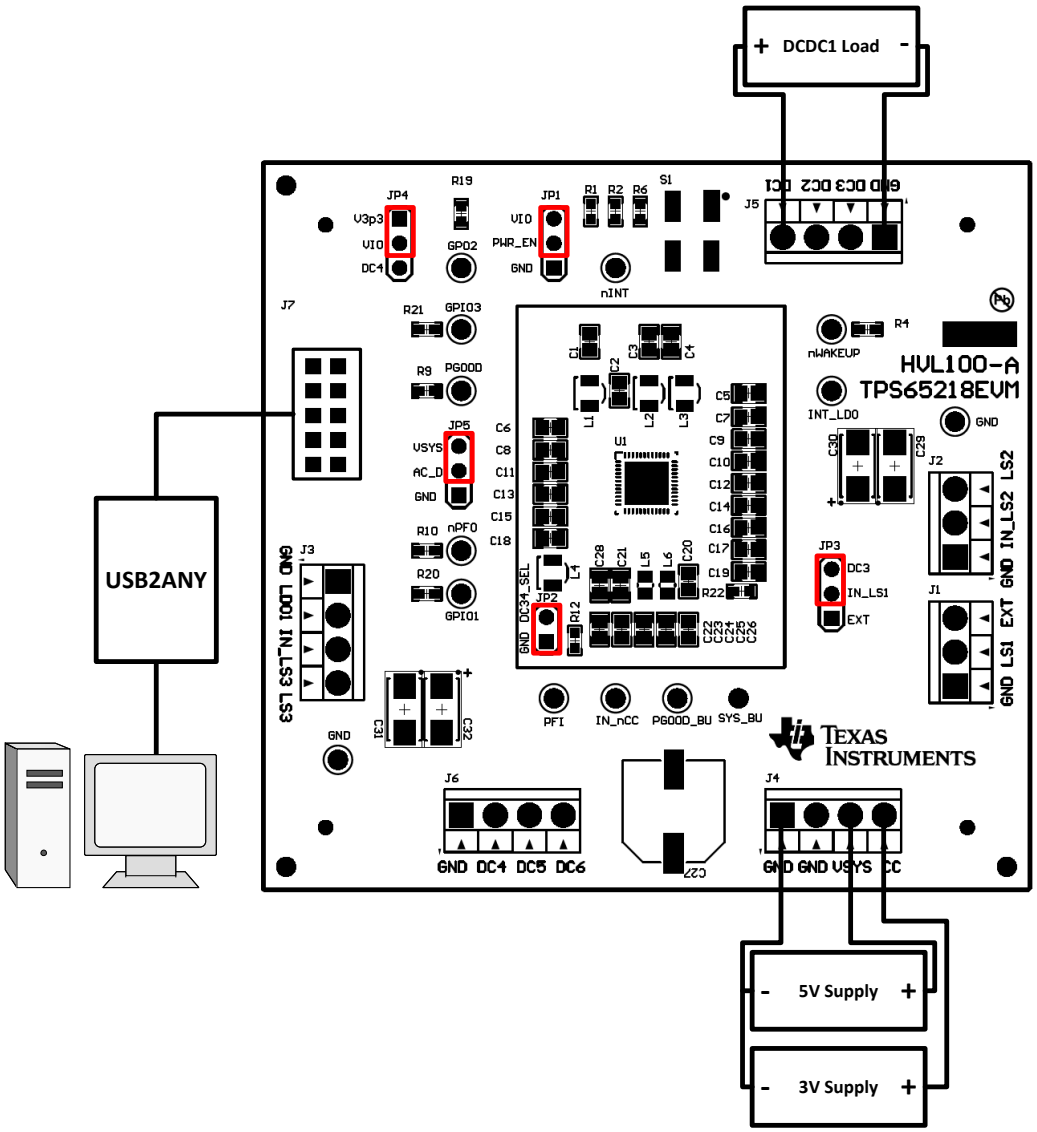


Figure 3. TPS65218 EVM Setup

7 Software

7.1 Software Installation Instruction

The following section explains the procedure for installing the Graphical User Interface (GUI) onto a Microsoft® Windows® based PC. A USB interface adapter is required to connect the EVM to a PC and is provided with the EVM.

Use the following steps to install the EVM software:

- Copy the TPS65218_GUI.zip to your computer and extract all files
- Double-click on the setup.exe file in the TPS65218 GUI directory
- Follow the prompts to finish the installation
- At the end of the installation, a reboot of your computer may be required

7.2 Using the TPS65218 GUI

I^2C read/write commands may be made using the provided software.

Reading a Register: Click on the desired register name within the *Register Map*, then click the "Read Register" button. Alternatively, all registers can be read simultaneously by clicking the "Read All" button.

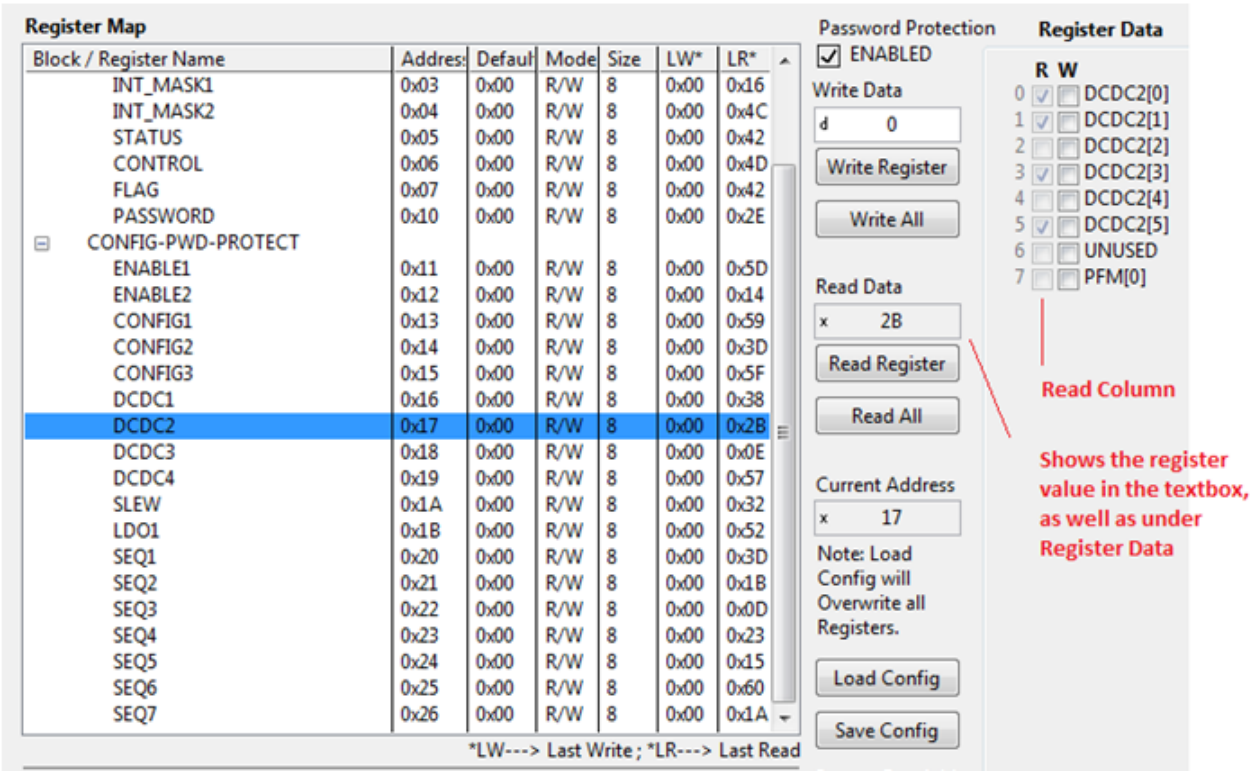


Figure 4. Reading a Register

Writing to a Register: Click on the desired register. Under *Register Data*, check the boxes under “W” to write the desired binary value to that register. Alternatively, input the desired value into the text field under *Write Data* then click the button “Write Register”.

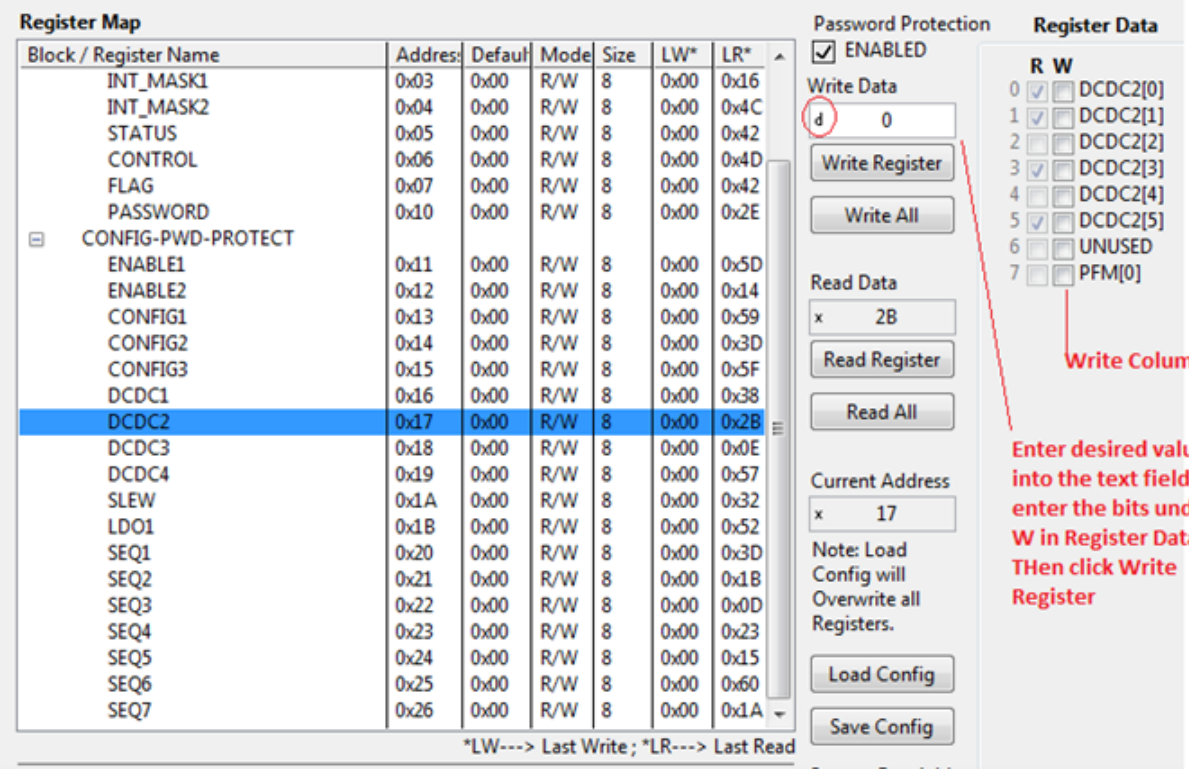


Figure 5. Writing a Register

Simulate Communication: Simulate active communication with the TPS65218 EVM by clicking the "Simulate Communcation" checkbox in the top right corner of the window. This feature allows the full functionality of the GUI, without the USB interface being connected to a board. **When connecting to an EVM, be sure the "Simulate Communication" box is left unchecked.**

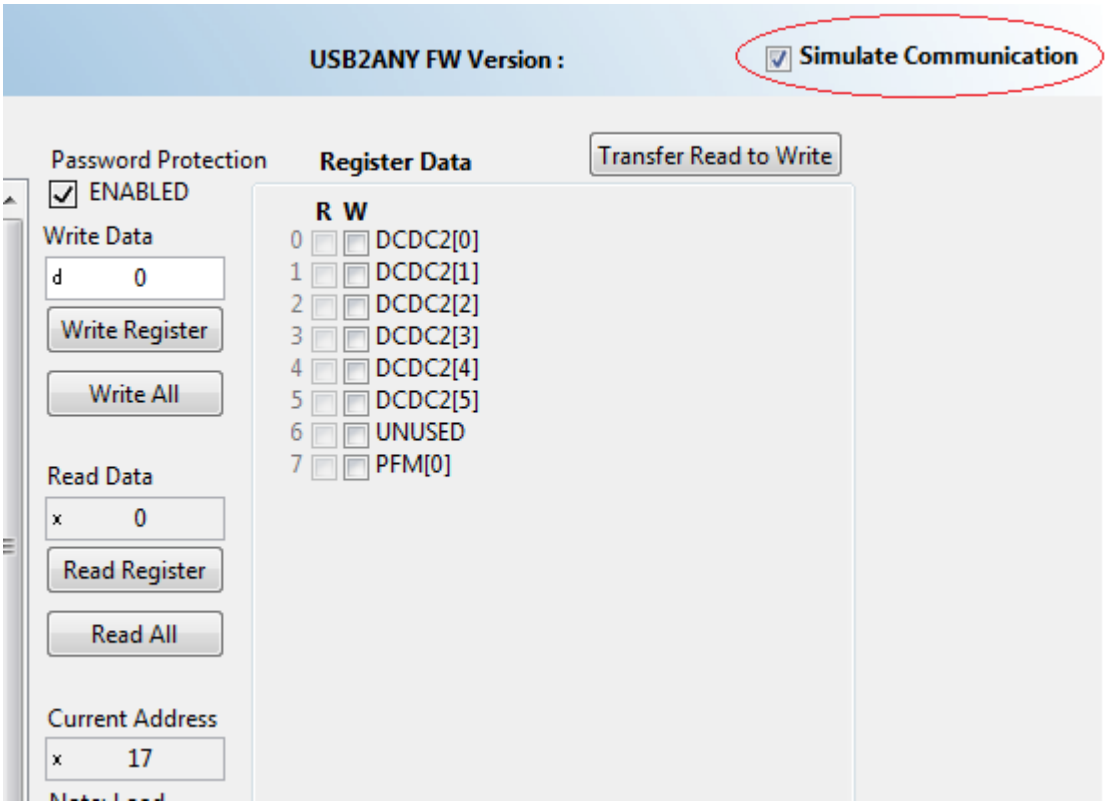


Figure 6. Simulate Communication

Password protection: Automatically enters password when writing to password-protected registers.

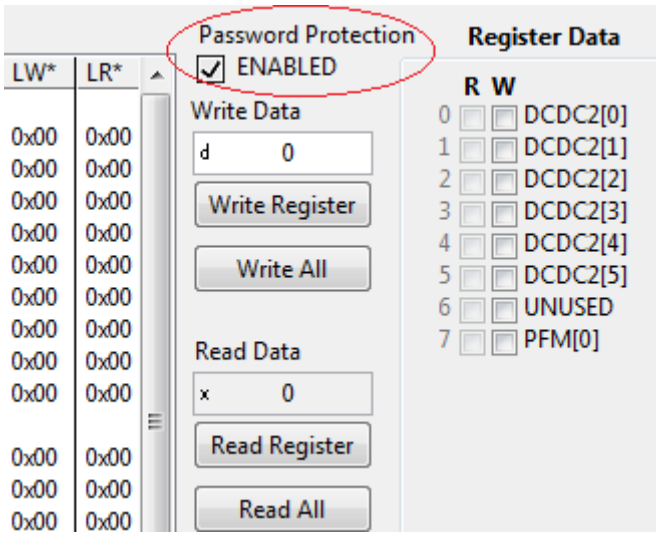


Figure 7. Password protection

“Load Config.” and “Save Config” Buttons: The register settings can be saved and loaded at a later time.

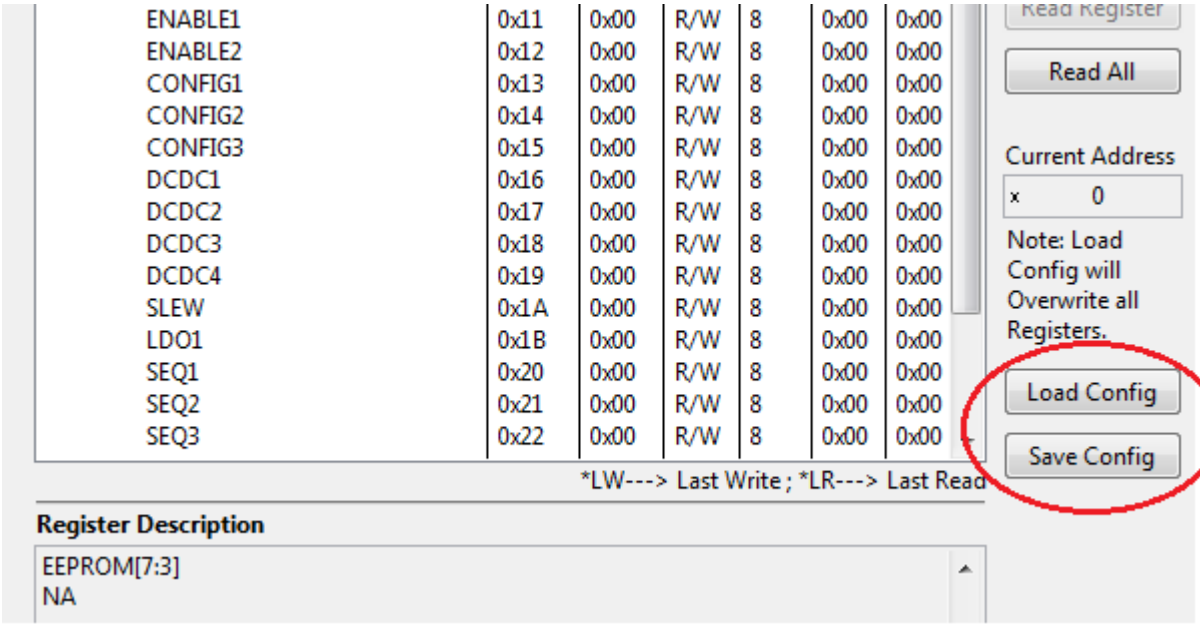


Figure 8. Saving Register Configurations

8 Bill of Materials

Table 4 lists the BOM for this EVM.

Table 4. Bill of Materials

Designator	Description	Value	Voltage Rating	Dielectric	Footprint	Qty.	Manufacturer	Manufacturer PN
C1, C3, C4, C8	Capacitor	10µ	6.3 V	X7R	805	4	TDK	C2012X7R0J106K125AB
C2, C5–C7, C11, C12, C14, C17–C19	Capacitor	4.7µ	10V	X7R	805	10	TDK	C2012X7R1A475K125AC
C10, C16, C23–C26	Capacitor	10µ	10V	X7R	805	6	TDK	C2012X7R1A106K125AC
C9, C21, C22	Capacitor	100n	10V	X7R	805	3	Kemet	C0805C104K8RACTU
C13	Capacitor	4.7µ	16V	X7R	805	1	TDK	C2012X7R1C475K125AE
C15	Capacitor	10µ	16V	X7R	805	1	Samsung	CL21B106KOQNNNE
C28	Capacitor	47µ	10V	X5R	805	1	TDK	C2012X5R1A476M125AC
C20	Capacitor	1µ	10V	X7R	805	1	TDK	C2012X7R1A105K
C27	Capacitor	470µ	25V		CAP_EEE Size G	0	Panasonic	EEE1EA471UAP
C29, C30, C31, C32	Capacitor	68µ	16V		6032	0	Kemet	B45197A3686+30
L1, L2, L3, L4	Inductor	1.5µ			IND_SPM3012	4	TDK	SPM3012T-1R5M
L5, L6	Inductor	10µ			805	2	TDK	MLZ2012N100LT
R1, R2, R4, R6, R9, R10, R12, R19, R20, R21	Resistor	100K			603	9		
R3, R5, R7, R8, R11, R23, R24	Resistor	0			805	7		
R13–R18	Resistor	1K			603	0		
R22	Resistor	10			603	1		
R25, R26	Resistor	4.7K			603	2		
U1	PMIC				RSL (S-PQFP-N48) 0.4 pitch	1	Texas Instruments	TPS65218

9 Layout

Figure 9 through Figure 14 illustrate the PCB layouts for the evaluation module.

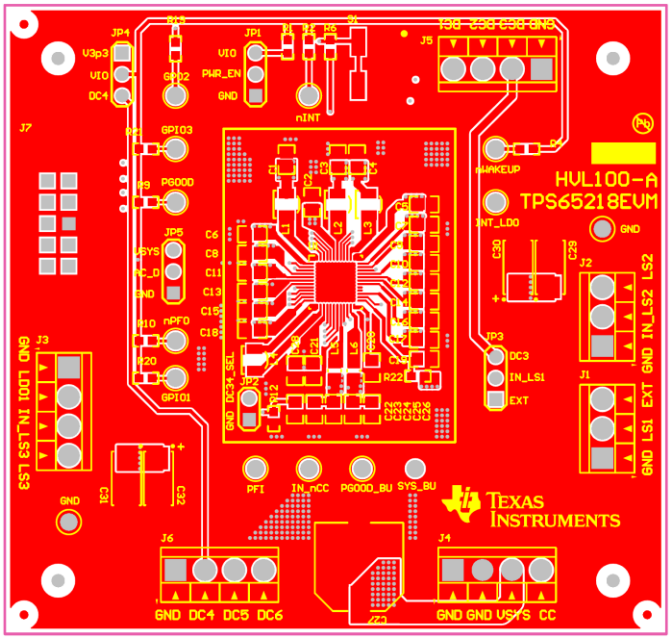


Figure 9. Top Layer Silkscreen

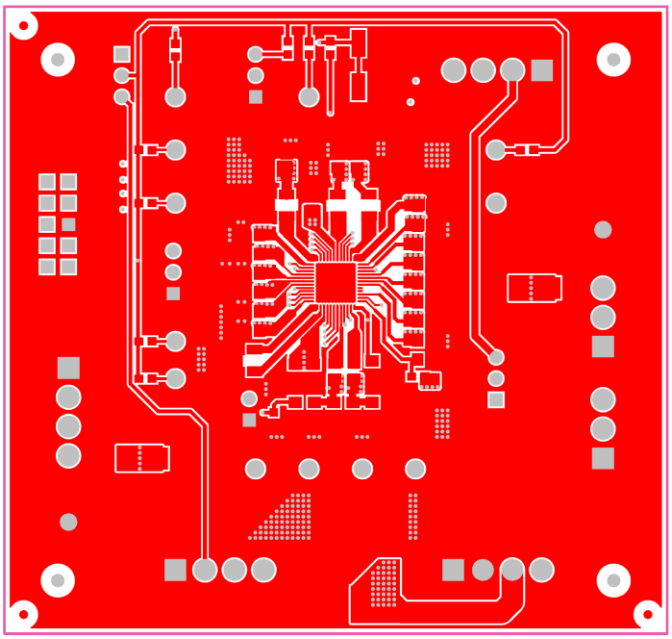


Figure 10. Top Layer

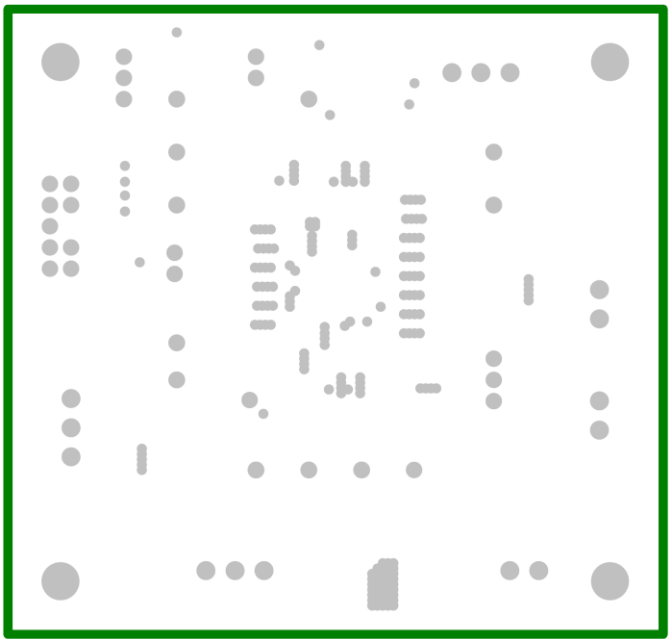


Figure 11. Ground Plane

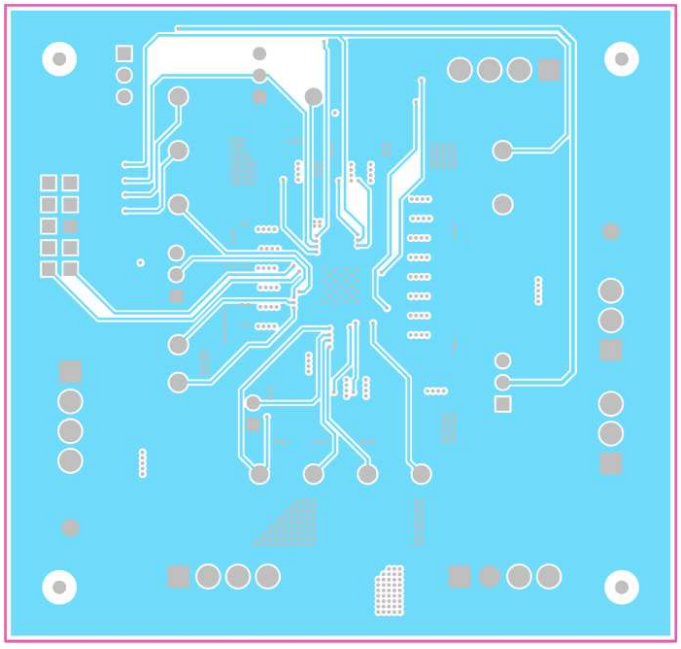


Figure 12. Mid Layer

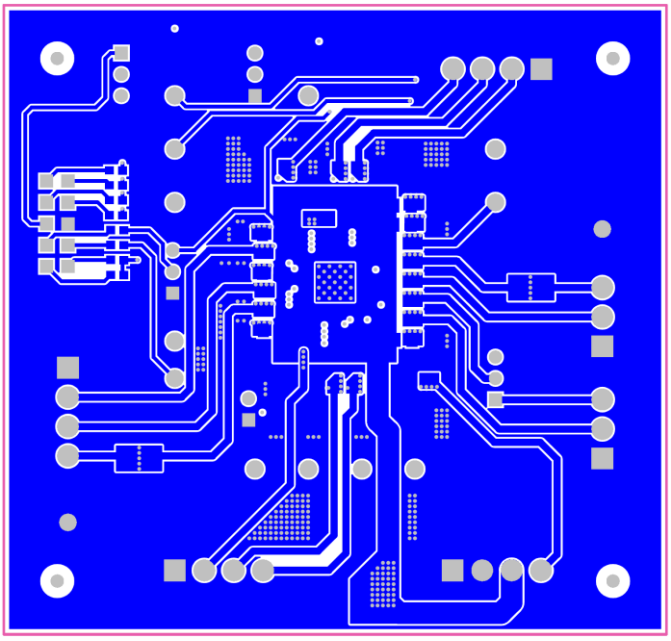


Figure 13. Bottom Layer

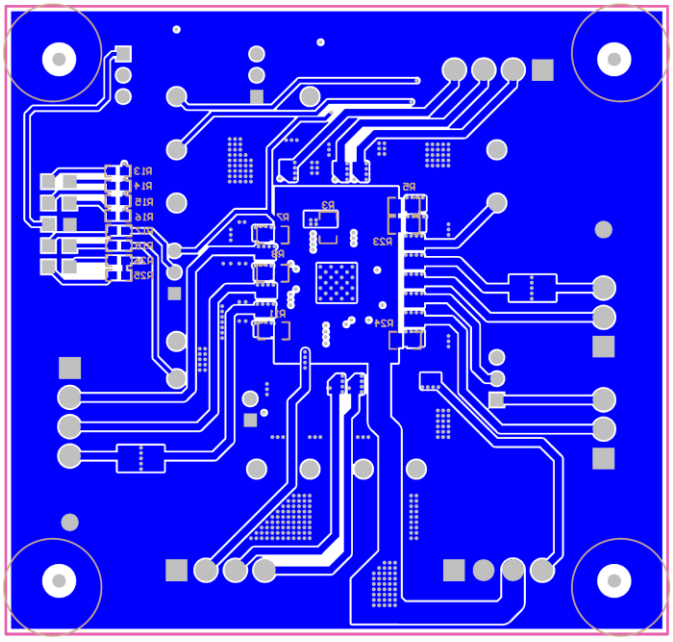


Figure 14. Bottom Layer Silkscreen

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   2.3 If any EVM fails to conform to the warranty set forth above, TI's sole liability shall be at its option to repair or replace such EVM, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

3 *Regulatory Notices:*

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      3.1.1 *Notice applicable to EVMs not FCC-Approved:*

      This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

      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*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-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.

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/lsds/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/lsds/ti_ja/general/eStore/notice_01.page

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If User uses EVMs in Japan, User is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

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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4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should 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 also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user 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, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

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.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

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