User's Guide

UA78LEVM-075 Evaluation Module

ABSTRACT

This user's guide describes the operational use of the UA78LEVM-075 evaluation module (EVM) as a reference design for engineering demonstration and evaluation of the UA78L05CPK, low-dropout linear regulator (LDO). Included in this user's guide are setup and operating instructions, layout guidelines, a printed circuit board (PCB) layout, a schematic diagram, and a bill of materials (BOM). Throughout this document, the terms *demonstration kit*, *evaluation board*, *evaluation module*, and *EVM* are synonymous with the UA78LEVM-075.

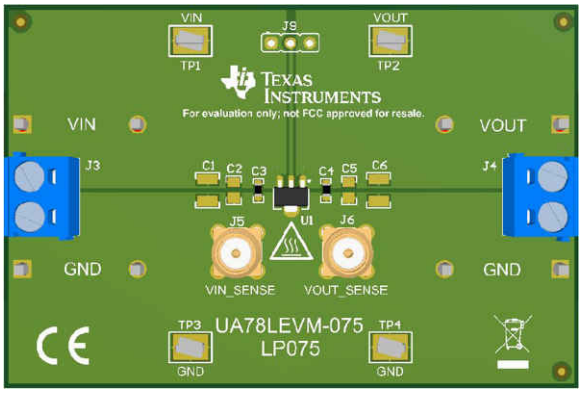

Figure 1-1. UA78LEVM-075 Evaluation Module

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Trademarks

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1 Introduction

Texas Instruments' UA78LEVM-075 EVM helps design engineers evaluate the operation and performance of the UA78L05CPK linear regulator for possible use in their own circuit application. This particular EVM configuration contains a single 100-mA, 3-terminal, low-dropout regulator for general applications. The regulator is capable of delivering up to 100 mA and has a VIN range of up to 20 V. Although not required for stability for the UA78L05CPK, use a 0.1µF (or larger) bypass capacitor on the output, Cout.

1.1 Before You Begin

This evaluation module is not encapsulated and has exposed terminals with voltages that are connected to the main power supply. The following warnings are noted for the safety of anyone using or working close to the UA78LEVM-075. Observe all safety precautions.

WARNING

Failure to adhere to these steps or to not heed the safety requirements at each step may lead to shock, injury, and damage to the hardware. Texas Instruments is not responsible or liable in any way for shock, injury, or damage caused by negligence or failure to heed advice. If you are not trained in the proper safety of handling and testing power electronics please do not test this evaluation module.

WARNING

Danger: HIGH VOLTAGE! This evaluation board is intended for professional use only. This board has exposed high voltages. Do not operate this board without proper high-voltage and high-current safety practices. Read this user guide carefully before testing with UA78LEVM-075. Use floating measurement equipment such as high-voltage differential scope probes and see Section 3 and Section 4 for proper EVM setup and test equipment connection.

CAUTION:

Caution! Do not leave the EVM powered when unattended.

HOT SURFACE:

Caution Hot Surface! Contact can cause burns. Do not touch. Please take the proper precautions when operating.

HIGH VOLTAGE:

Danger High Voltage! Electric shock is possible when connecting the board to live wire. The board must be handled with care by a professional. For safety, using isolated test equipment with overvoltage and overcurrent protection is highly recommended.

2 Schematic

Figure 2-1 shows the schematic for the UA78LEVM-075.

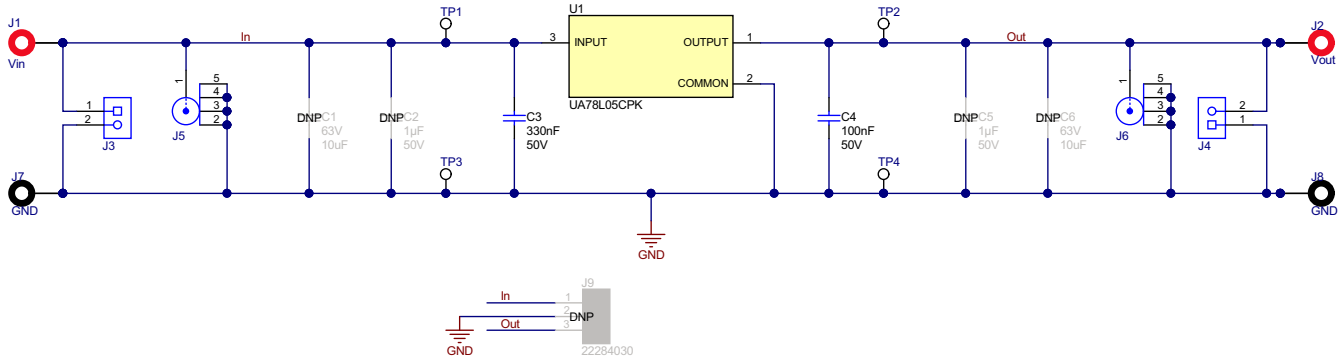

Figure 2-1. UA78LEVM-075 Schematic

3 EVM Setup

This section describes how to properly connect and setup the UA78LEVM-075, including the jumpers and connectors on the EVM board. See Section 4 for the proper connections of test equipment.

3.1 Jumper Connections

3.1.1 J1

J1 is an input jumper.

3.1.2 J2

J2 is an output jumper.

3.1.3 J3

J3 is a VIN/GND input screw terminal.

3.1.4 J4

J4 is a VOUT/GND output screw terminal.

3.1.5 J5

J5 is an SMA VIN_Sense connector.

3.1.6 J6

J6 is an SMA VOUT_Sense connector.

3.1.7 J7

J7 is a GND jumper.

3.1.8 J8

J8 is a GND jumper.

3.1.9 J9

J9 is a test point jumper. Pin 1 is tied to VIN, pin 2 is tied to GND, and pin 3 is tied to VOUT.

3.2 Test Points

Table 3-1 lists the test points for the UA78LEVM-075.

Table 3-1. Test Point Functions

TEST POINT	NAME	DESCRIPTION
TP1	VIN	Unregulated DC input
TP2	VOUT	Regulated DC output
TP3	GND	Device GND
TP4		

3.3 Soldering Guidelines

To avoid damaging the LDO, use a hot-air system for any solder rework to modify the EVM for the purpose of repair or other application reasons.

4 Equipment Connection and Operation

Connect test equipment as described in this section and follow the listed steps to properly take measurements.

1. Verify that the input voltage power supply is set from 4.75 V to 20 V
2. Connect the anode of the power supply to J1 (VIN) and the cathode to J7 (GND)
3. Connect the anode of the load to J2 (VOUT) and the cathode to J8 (GND)
4. Turn on the power supply
5. Vary VIN and the load as necessary for testing purposes

5 PCB Layout

Figure 5-1 through Figure 5-4 illustrate the layout for the UA78LEVM-075.

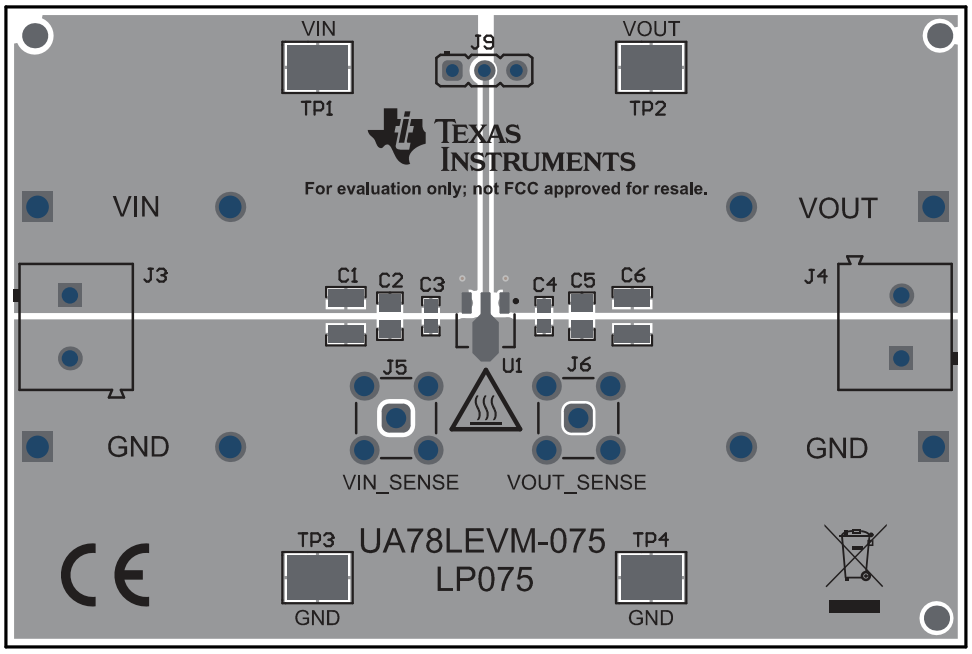

Figure 5-1. UA78LEVM-075 Top Assembly Layer and Silkscreen

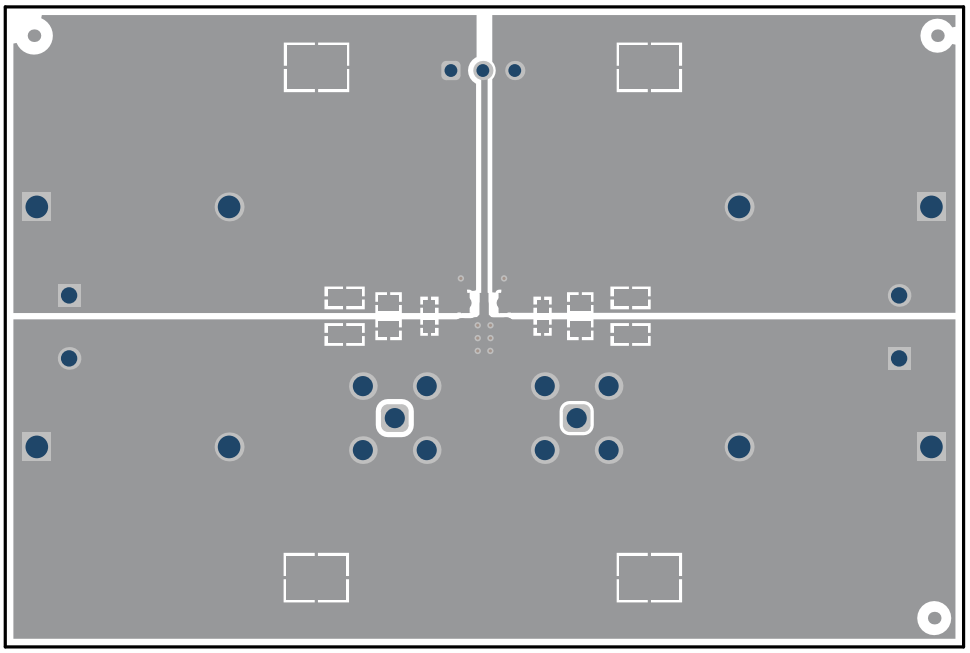

Figure 5-2. UA78LEVM-075 Top Layer Routing

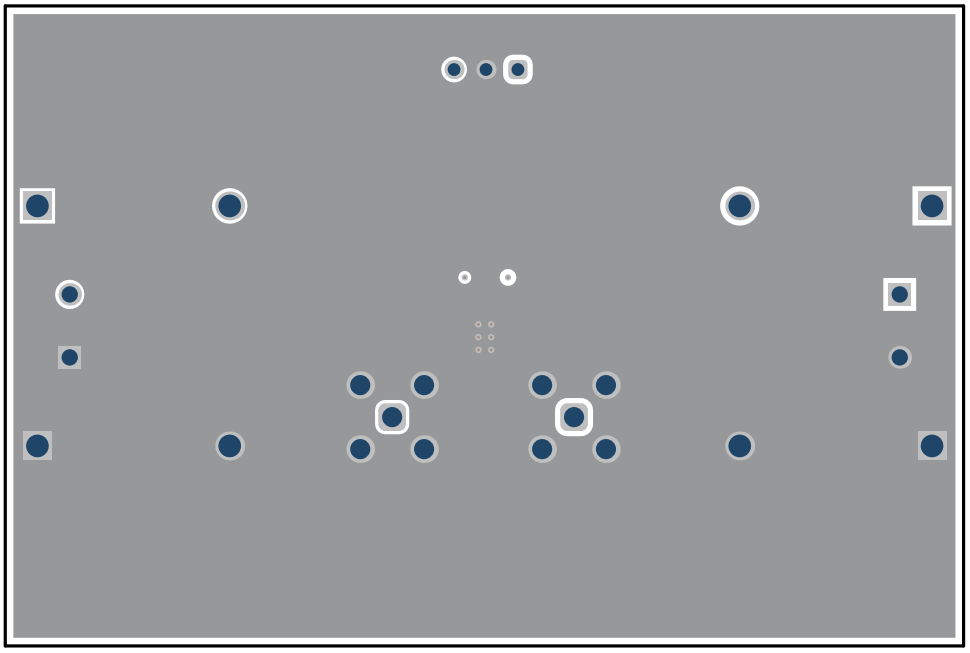

Figure 5-3. UA78LEVM-075 Bottom Layer Routing

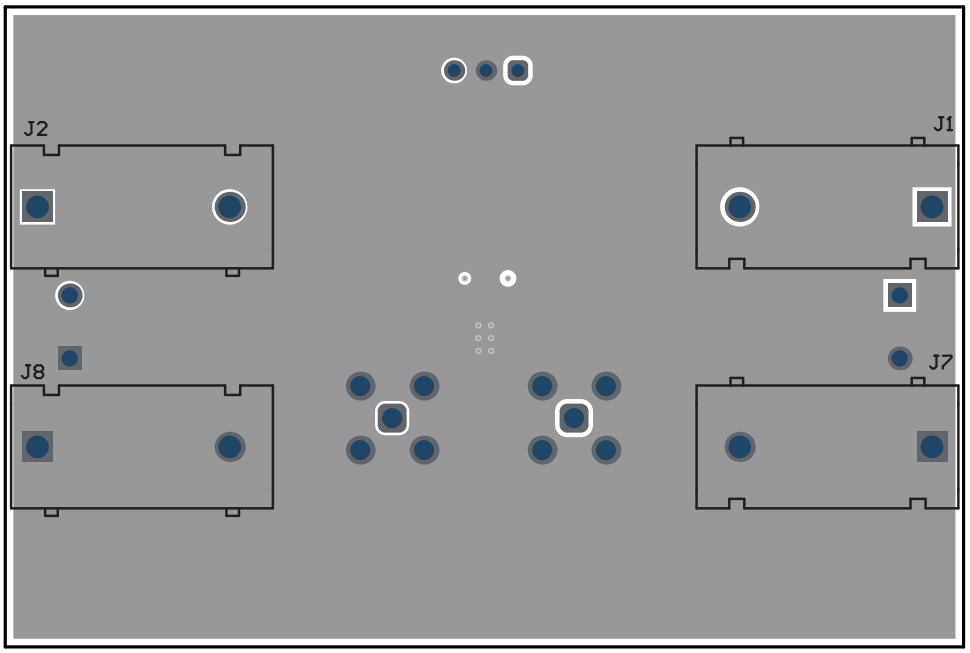

Figure 5-4. UA78LEVM-075 Bottom Assembly Layer and Silkscreen

6 Bill of Materials (BOM)

Table 6-1 shows the BOM for this EVM.

Table 6-1. UA78LEVM-075 BOM

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
!PCB1	1		Printed Circuit Board		LP075	Any		
C3	1	0.33uF	CAP, CERM, 0.33 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E3X7R1H334K080AB	TDK		
C4	1	0.1uF	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E2X7R1H104K080AA	TDK		
J1, J2	2		Standard Banana Jack, insulated, 10A, red	571-0500	571-0500	DEM Manufacturing		
J3, J4	2		Terminal Block, 5 mm, 2x1, Tin, TH	Terminal Block, 5 mm, 2x1, TH	691 101 710 002	Wurth Elektronik		
J7, J8	2		Standard Banana Jack, insulated, 10A, black	571-0100	571-0100	DEM Manufacturing		
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650 x 0.200 inch	THT-14-423-10	Brady		
TP1, TP2, TP3, TP4	4		Test Point, Compact, SMT	Testpoint_Keystone_Compact	5016	Keystone Electronics		
U1	1		3 Pin 100mA Fixed 5V Positive Voltage Regulator, PK0003A (SOT-3)	PK0003A	UA78L05CPK	Texas Instruments		Texas Instruments
C1, C6	0	10uF	CAP, CERM, 10 uF, 63 V, +/- 10%, X7R, 1210	1210	GRM32ER71J106KA12L	MuRata		
C2, C5	0	1uF	CAP, CERM, 1 µF, 50 V,+/- 10%, X7R, AEC-Q200 Grade 1, 0805	0805	08055C105K4Z2A	AVX		
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A		
J5, J6	0		SMA, 50 Ohm, Gold, TH	SMA, TH	32K101-400L5	Rosenberger		
J9	0		Header, 2.54mm, 3x1, Tin, TH	Header, 2.54mm, 3x1, Tin, TH	22284030	Molex		

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   2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, 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.

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NOTE:

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

FCC NOTICE: 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 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/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。
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3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

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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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4.2 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.

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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.

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10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

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