HDC1000EVM User’s Guide

User's Guide

Literature Number: SNAU162
July 2014

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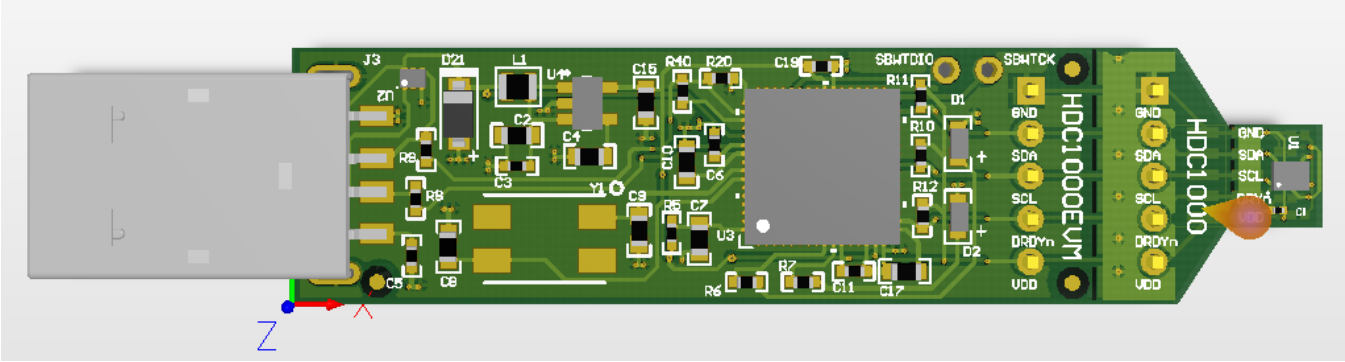
1 Introduction



The HDC1000EVM (EVM) evaluation kit is a plug and play system to test and evaluate the HDC1000 humidity and temperature sensor. The EVM is a breakable PCB which consists of 3 sections. The first section is a USB to I2C converter based on MSP430F5528 micro-controller, the second section is a conversion board (to SIL 100mil pitch) with the HDC1000 and the third section is a narrow 5mm x 5.5mm PCB with the HDC1000 (to SIL 50mil pitch) which allows to reduce the thermal mass of the system (sensor + PCB). Both second and third section can be used for remote measurements. The EVM does not need additional hardware, calibration, nor does it require any software programming - only the HDC1000EVM GUI has to be installed. The software is able to configure the HDC1000's registers, display temperature and relative humidity in two graphs and export data in CSV format.

The EVM contains one HDC1000 (See Table 1).

Table 1. Device and Package Configurations

DEVICE	IC	PACKAGE
U1	HDC1000YPAR	DSBGA - 8 pin (YPA0008)

2 Setup

This section describes the connectors on the EVM as well and how to properly connect, setup and use the HDC1000EVM.

2.1 Input/Output Connector Description

J1 – 5x1 Header it is not populated and can be populated in case the EVM is broken in 2 modules: PC interface and Sensor. This connector with its counterpart J2 allows the communication of the two modules through a 5-wire cable.

J1.1	GND
J1.2	SDA
J1.3	SCL
J1.4	DRDYn
J1.5	VDD

J2 – 5x1 Header it is not populated and can be populated in case the EVM is broken in 2 modules: PC interface and Sensor. This connector with its counterpart J1 allows the communication of the two modules through a 5-wire cable.

J1.1	GND
J1.2	SDA
J1.3	SCL
J1.4	DRDYn
J1.5	VDD

J3 – USB Type A Connector, it is the mechanical interface between the PC and the EVM, through this connector the EVM communicate to the PC and receive the power.

2.2 HW Setup

The HDC1000 on the EVM is supplied at 3.3 V through an LDO (U2), which is supplied from the USB. The I2C address of the HDC1000 is set at EVM level at 1000000xb on the EVM.

The I2C address has been set replacing the resistors R3 and R1 with a short (refer to Figure 1).

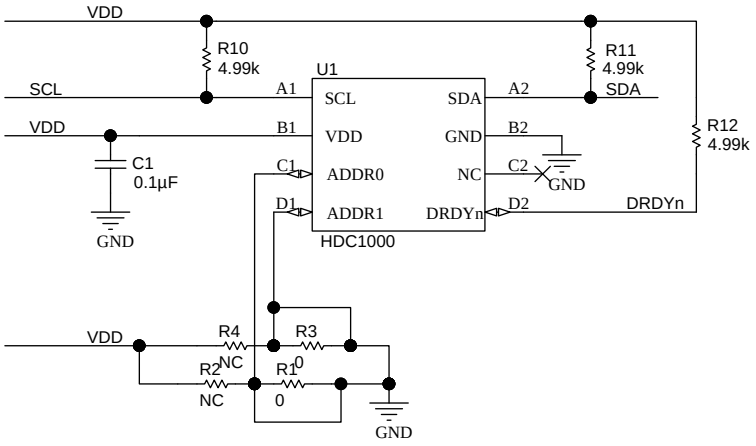


Figure 1. HDC1000EVM : Sensor module

In order to change the I2C address, cut the short (with a cutter) and populate the R2 and R4 with 0 Ω resistors (refer to Figure 2)

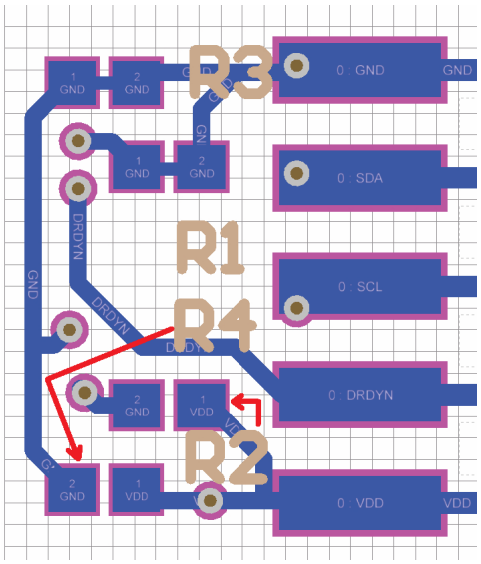


Figure 2. HDC1000EVM: Layout Resistors for I2C Address Setting

Table 2. I2C Address

ADR1	ADR0	R1	R2	R3	R4	HDC1000 ADDRESS
0	**0**	**Short**	**Open**	**Short**	**Open**	**1000000**
0	1	Open	Short	Short	Open	1000001
1	0	Short	Open	Open	Short	1000010
1	1	Open	Short	Open	Short	1000011

In the table above, the EVM default configuration is in **bold**.

2.3 SW Setup

Make sure that the HDC1000 GUI and the drivers have been installed on the host. Connect the USB of the EVM to the host.

2.4 Operation

Plug the EVM into an available USB port on the host computer. The host computer should automatically detect the device as HDC1000EVM. Launch the GUI. Push the "START" button to acquire and stream relative humidity and temperature.

2.5 Reduce the Thermal Mass of the EVM

The HDC1000EVM can be break in 2 main modules: PC interface and Sensor (Refer to Figure 3).

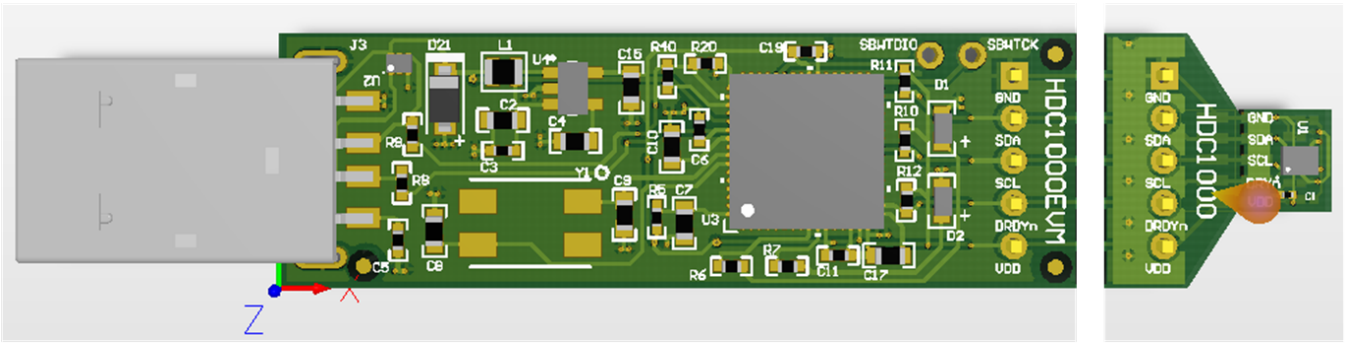


Figure 3. HDC1000EVM : PC Interface and Sensor Module

The communication between the two modules is ensured through the connector J1 and J2 and a 5-wire cable. In this configuration the thermal mass of the EVM is dramatically reduced, improving the temperature measurements performances of the HDC1000.

When the EVM is broken in 2 sections it is still possible to use the GUI to configure the HDC1000 (ensuring the connections between the modules) or alternatively it is possible to connect the sensor module to a custom micro-controller.

In case the thermal mass is still too large the Sensor module can be broken into two sections, in this condition the HDC1000 PCB section is only 5.5mm x 5mm (Refer to Figure 4).

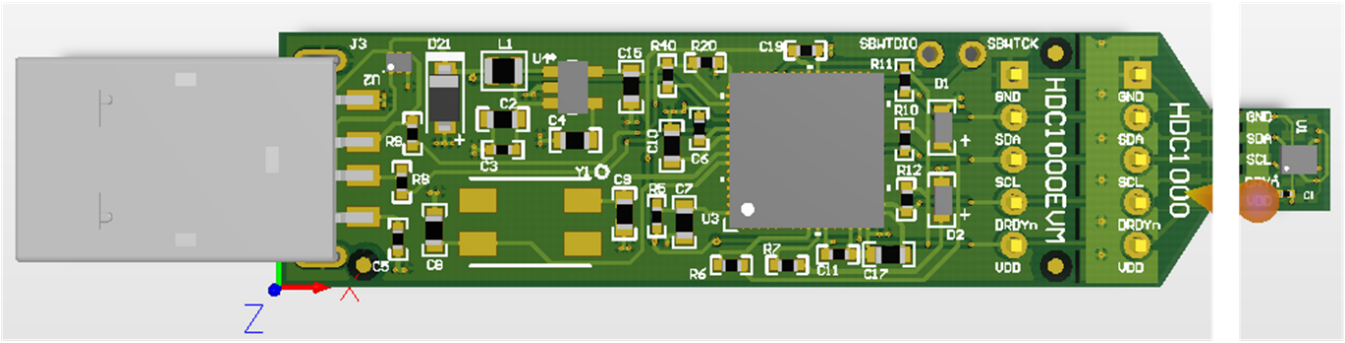


Figure 4. HDC1000EVM : PC Interface and Smaller Sensor Module

Also in the case where the EVM is broken in 2 sections it is still possible to use the GUI (ensuring the connections between the modules) or alternatively it is possible to connect the sensor module to a custom micro-controller. (Refer to Figure 5).

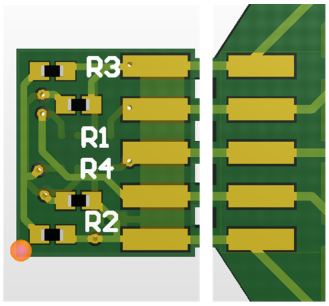


Figure 5. HDC1000EVM : Pads for I2C and Supply of the Smaller Sensor Module

3 Board Layout

Figure 6 and Figure 7 show the board layout for the HDC1000EVM.

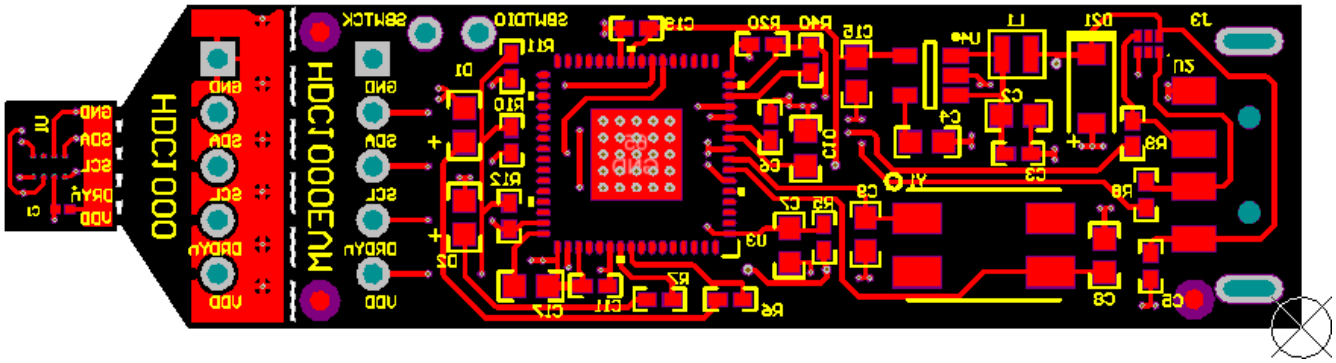


Figure 6. Top Layer Routing

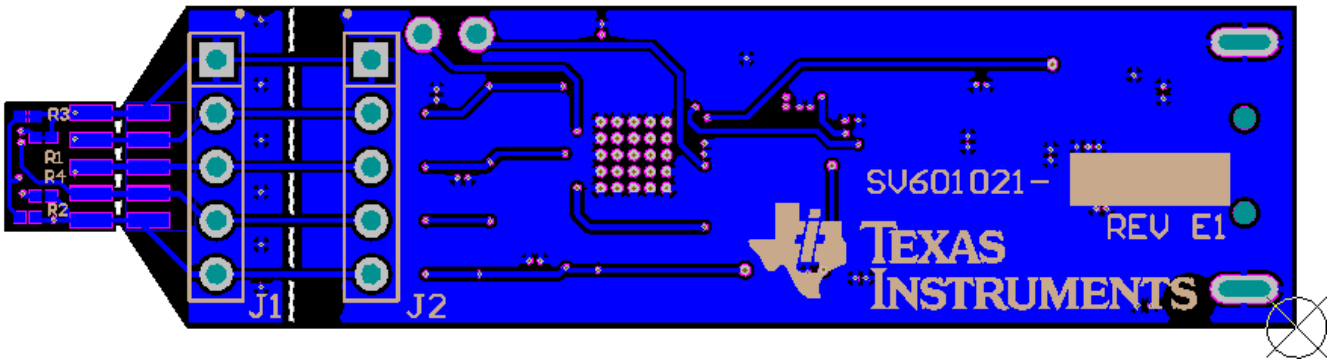


Figure 7. Bottom Layer Routing

4 Schematic

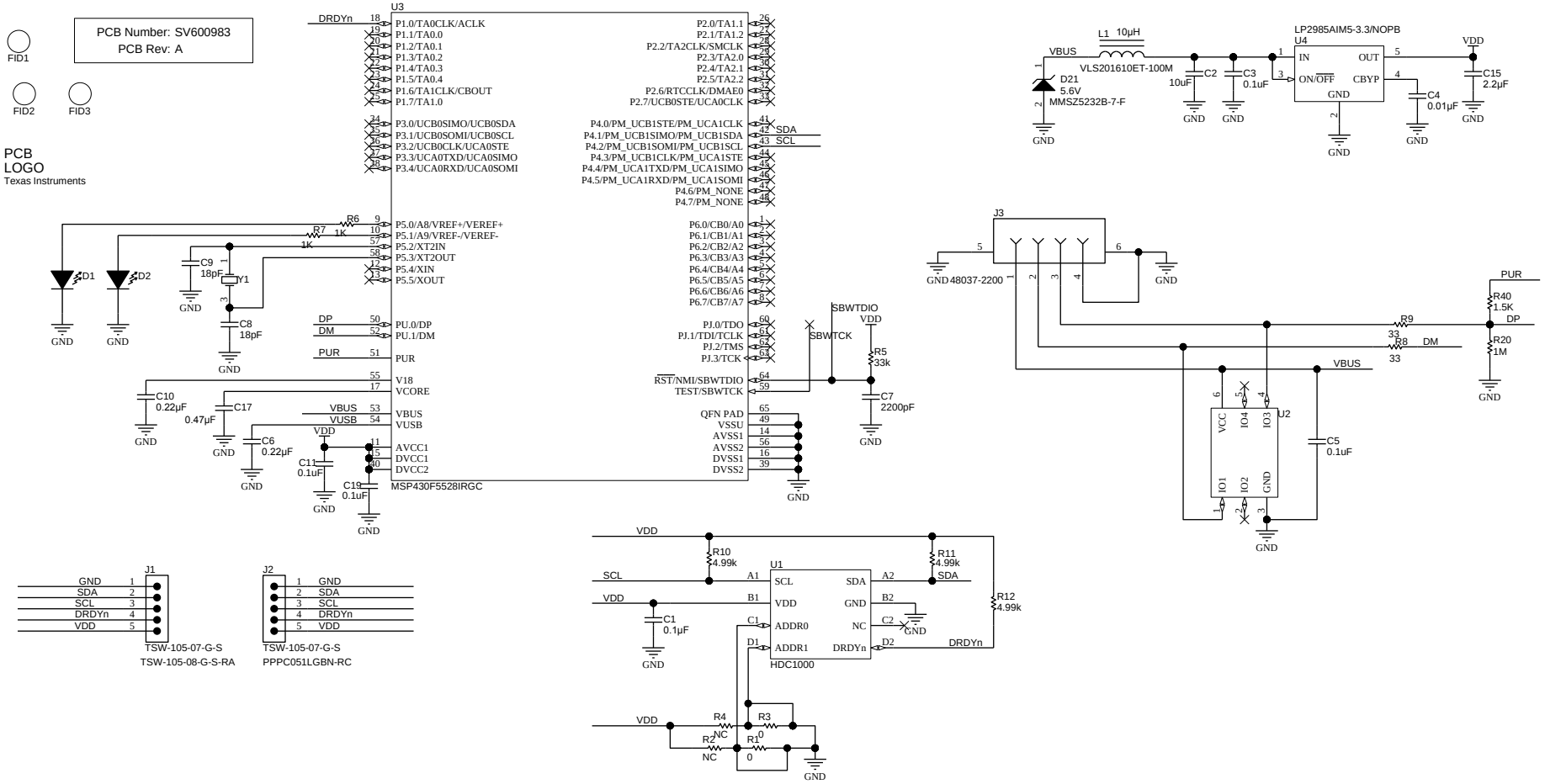


Figure 8. HDC1000EVM Schematic

5 Bill of Materials

COUNT	REF DES	DESCRIPTION	FOOTPRINT	PART NUMBER
1	C1	CAP, CERM, 0.1uF, 10V, +/-10%, X5R, 0201	0201	CL03A104KP3NNNC
1	C2	CAP CER 10UF 10V 10% X5R 0603	0603	C1608X5R1A106K080AC
4	C3, C5, C11, C19	CAP CER 0.1UF 16V 5% X7R 0402	0402	GRM155R71C104JA88D
1	C4	CAP, CERM, 0.01uF, 25V, +/-5%, C0G/NP0, 0603	0603	C1608C0G1E103J
1	C6	CAP, CERM, 0.22uF, 16V, +/-10%, X7R, 0402	0402	GRM155R71C224KA12D
1	C7	CAP, CERM, 2200pF, 50V, +/-10%, X7R, 0603	0603	C0603X222K5RACTU
2	C8, C9	CAP CER 18PF 100V 5% NP0 0603	0603	GRM1885C2A180JA01D
1	C10	CAP, CERM, 0.22uF, 25V, +/-10%, X5R, 0603	0603	C0603C225K8PACTU
1	C15	CAP, CERM, 2.2uF, 10V, +/-10%, X5R, 0603	0603	C0603C225K8PACTU
1	C17	CAP, CERM, 0.47uF, 10V, +/-10%, X7R, 0603	0603	C0603C474K8RACTU
1	D1	GREEN LED, 1.7x0.65x0.8mm	0603	LG L29K-G2J1-24-Z
1	D2	RED LED DIFF, 1.6x0.60x0.8mm	0603	SML-LX0603SRW-TR
1	D21	Diode, Zener, 5.6V, 500mW, SOD-123	SOD-123	MMSZ5232B-7-F
2	J1, J2	Header, TH, 100mil, 5x1, Gold plated, 230 mil above insulator	-	TSW-105-07-G-S
1	J3	Connector, USB Type A, 4POS R/A, SMD	-	48037-2200
1	L1	INDUCTOR POWER 10UH .45A SMD	VLS201610	VLS201610ET-100M
4	R1, R2, R3, R4	RES, 0 Ω, 5%, 0.05W, 0201	0201M	ERJ-1GE0R00C
1	R5	RES, 33k Ω, 5%, 0.063W, 0402	0402	CRCW040233K0JNED
2	R6, R7	RES 1K Ω 1/10W 5% 0402 SMD	0402	CRCW04021K00JNED
2	R8, R9	RES, 33 Ω, 5%, 0.063W, 0402	0402	CRCW040233R0JNED
3	R10, R11, R12	RES, 4.99k ohm, 1%, 0.063W, 0402	0402	CRCW04024K99FKE
1	R20	RES,1M ohm, 5%, 0.063W, 0402	0402	CRCW040233K0JNED
1	R40	RES, 1.50k ohm, 1%, 0.063W, 0402	0402	CRCW04021K50FKED
1	U1	HDC1000 – Relative Humidity and Temperature sensor	YPA0008	HDC1000
1	U2	4-CHANNEL ESD-PROTECTION ARRAY FOR HIGH-SPEED DATA INTERFACES, DRY006A	DRY0006A	TPD4E004DRY
1	U3	Mixed Signal micro-controller, RGC0064B	RGC0064B	MSP430F5528IRGC
1	U4	Micropower 150 mA Low-Noise Ultra Low-Dropout Regulator, 5-pin SOT-23, Pb-Free	MF05A_N	LP2985AIM5-3.3/NOPB
1	Y1	CRYSTAL 24.000MHZ 18PF SMD	ABMM	ABMM-24.000MHZ-B2-T

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   1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.

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   2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for any defects that are caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI. Moreover, TI shall not be liable for any defects that result from User's design, specifications or instructions for such EVMs. Testing and other quality control techniques are used to the extent TI deems necessary or as mandated by government requirements. TI does not test all parameters of each EVM.

   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.

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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。
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If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of 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:*

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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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