EVM User's Guide: DS90LVRA2

DS90LVRA2 EVM User's Guide

ABSTRACT

The DS90LVRA2 EVM is an evaluation module designed for performance and functional evaluation of the Texas Instruments DS90LVRA2 LVDS dual differential line receiver. With this kit, users can quickly evaluate the output waveform characteristics and signal integrity supported by the DS90LVRA2. SMA allows access to the DS90LVRA2 inputs and outputs, and also facillitate connection to the lab equipement or user systems for performance evaluation.

Table of Contents

List of Figures

List of Tables

Trademarks

Features

DS90LVRA2

- 600 Mbps (300 MHz) switching rates
- 50 ps differential skew (typical)
- 0.1 ns channel-to-channel skew (typical)
- 1.8 V, 2.5 V, or 3.3 V power supply
- CMOS output voltage based on the power supply voltage
- Flow-through pinout simplified PCB layout
- Power down high impedance on LVDS inputs
- Output slew rate control

Applications

- Board-to-board communication
- Multifunction printers
- Ultrasound scanners
- Lab instrumentation
- Data center interconnect
- Test and measurement

1 Hardware

Figure 1-1 shows a 3D model of the DS90LVRA2VM.

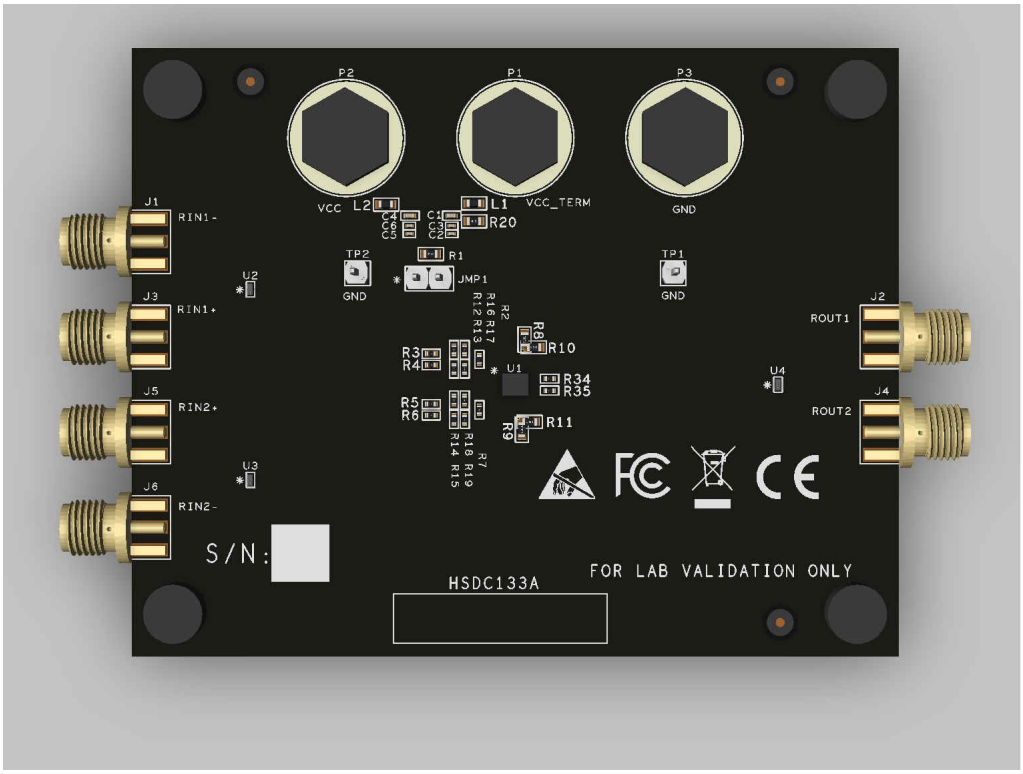

Figure 1-1. DS90LVRA2 EVM Printed Circuit Board

1.1 Setup

1. Connect a 1.8 V, 2.5 V, or 3.3 V DC power supply to the banana jack P2 and P3. Since the CMOS output voltage is based on the power supply voltage, please make sure the power supply voltage matches with the CMOS output voltage requirement.

2. Provide LVDS differential signal to the DS90LVA2 inputs, J1/J3 (channel 1) or J5/J6 (channel 2). For channel 1, J1 is the inverting input while J3 is the non-inverting input. For channel 2, J6 is the inverting input while J5 is the non-inverting input. The DS90LVRA2 differential line receiver is capable of detecting signals as low as 100 mV, over a commonmode range of 0 to 2.4 V. This is related to the driver offset voltage which is typically +1.2 V. The driven signal is centered around this voltage and may shift ±1.2 V around this center point.

3. The CMOS output signals can be measured on an oscilloscope by connecting a SMA cable to J2 (channel 1) or J4 (channel 2).

1.2 Jumpers Information

A jumper (JMP1) has been provided on the board if the transmitter common mode voltage does not meet the DS90LVRA2 receiver common mode voltage requirement. In this case, do the following:

- Replace R3, R4, R5, and R6 with AC coupling capacitors. The value of AC coupling capacitors depends on the operating frequency, as it needs to block the DC component, but look like a short circuit for the AC component
- Populate L1
- Populate R12, R13, R14, R15, R16, R17, R18, and R19
- Remove JMp1
- Provide the appropriate VCC_TERM such that it restores the DS90LVRA2 receiver DC common mode voltage to 1.2 V which is in the middle of the input common mode range for a standard LVDS receiver.

For more detailed information about DC and AC coupling LVDS receivers, refer to the *How to Terminate LVDS Connections wth DC and AC Coupling* application note.

2 Hardware Design Files

2.1 Schematics

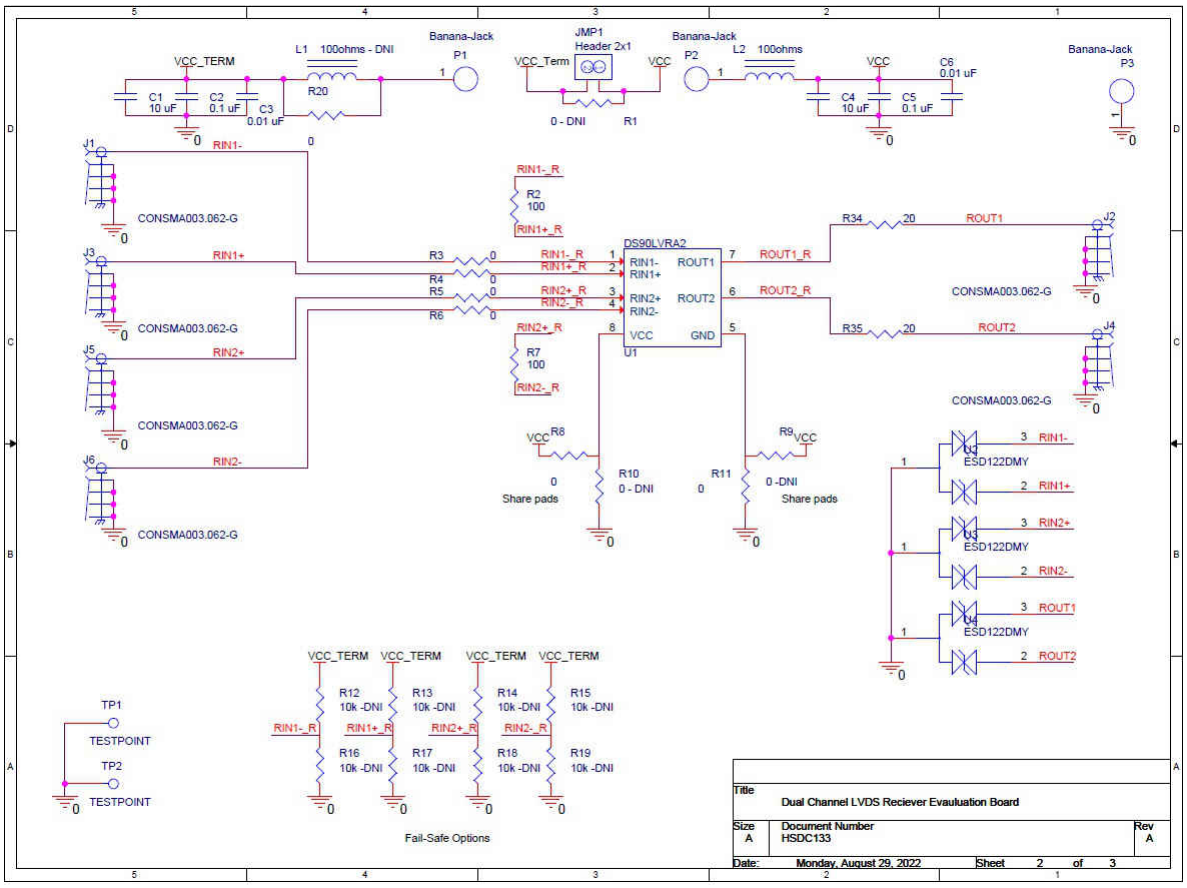

Figure 2-1. DS90LVRA2 EVM Schematic Diagram – DS90LVRA2

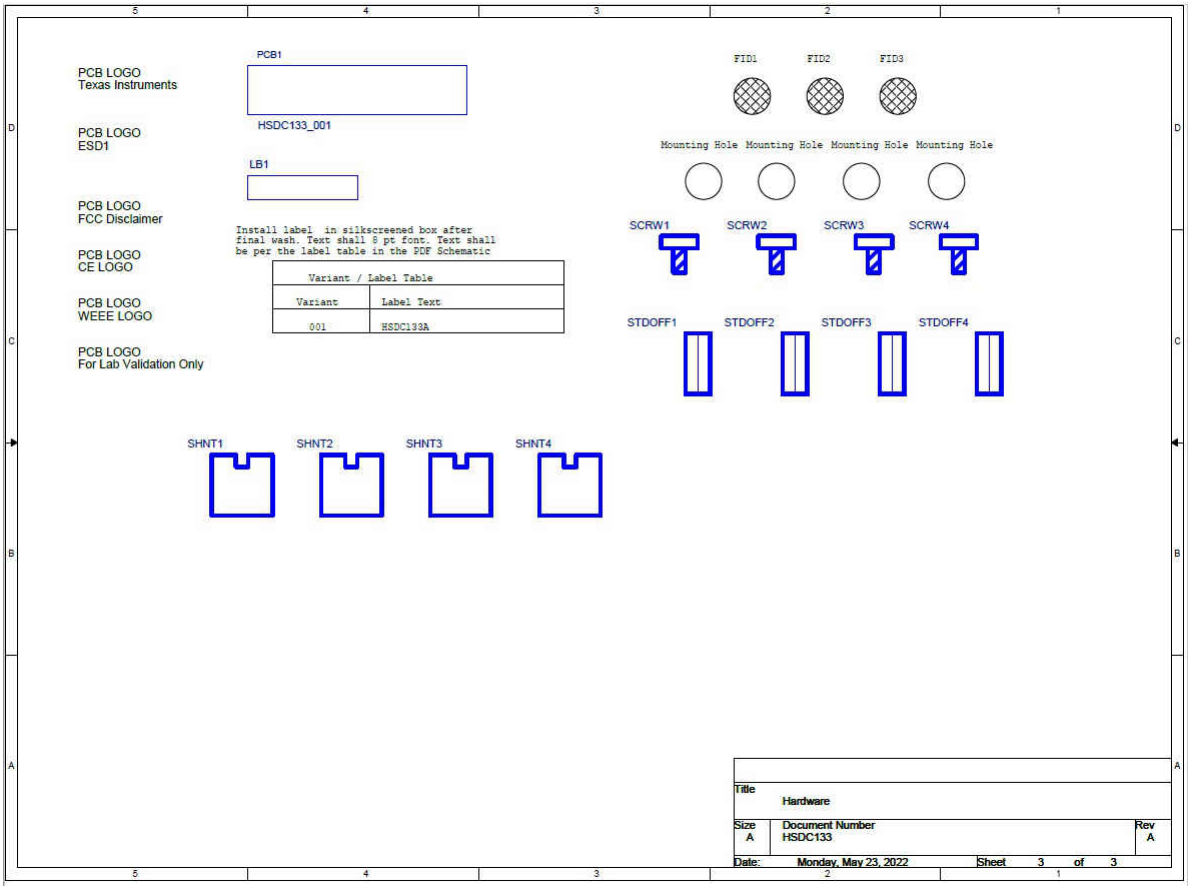

Figure 2-2. DS90LVRA2 EVM Schematic Diagram – Hardware

2.2 PCB Layouts

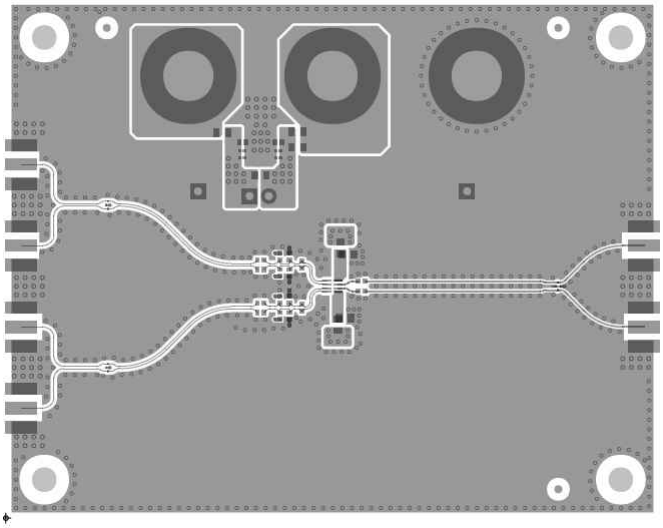

Figure 2-3. DS90LVRA2 EVM PCB Layout – Layer 1 (Top Side)

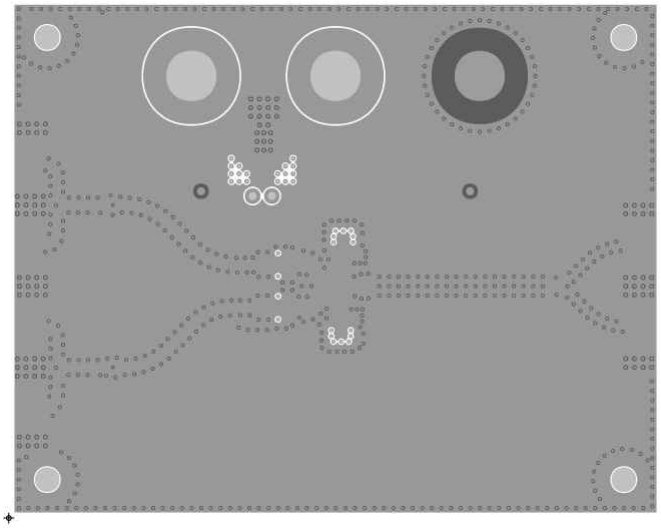

Figure 2-4. DS90LVRA2 EVM PCB Layout – Layer 2 (Ground Plane)

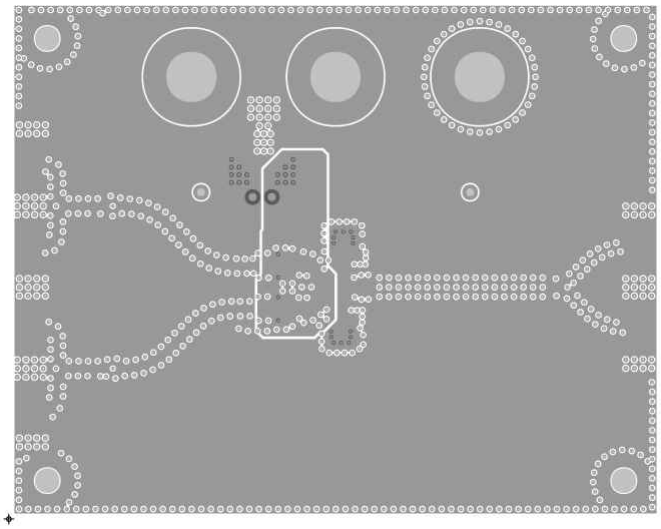

Figure 2-5. DS90LVRA2 EVM PCB Layout – Layer 3 (Power Plane)

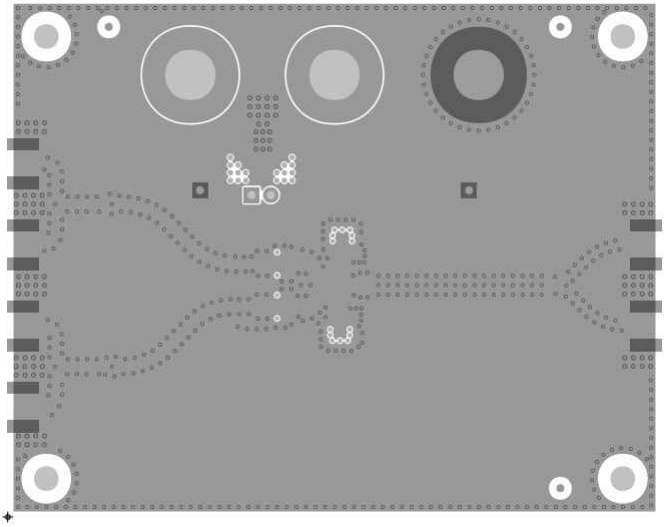

Figure 2-6. DS90LVRA2 EVM PCB Layout – Layer 4 (Bottom Side)

2.3 Bill of Materials (BOM)

Item	Quantity	Reference	Value	Manufacturer	Manufacturer Part Number	PCB Footprint
1	2	C1,C4	10 µF	Murata Electronics	GRM155R60G106ME44D	CAP_0402
2	2	C2,C5	0.1 µF	Murata Electronics	GRM033C71A104KE14D	CAP_0201
3	2	C3,C6	0.01 µF	Murata Electronics	GRM033R71A103KA01J	CAP_0201
4	1	JMP1	Header 2x1	Amphenol ICC (FCI)	68001-402HLF	HDR_THVT_1x2_254_1097
5	6	J1,J2,J3,J4,J5,J6	CONSMA003.062-G	Linx Technologies Inc.	CONSMA003.062-G	JACK_SMRT_CONSMA003_062_G
6	1	LB1	THD-47-478-10	Brady	THT-14-423-10	rectangle
7	1	L1	100 Ω - DNI	TDK Corporation	MPZ1608Y101BTA00	FB_0603
8	1	L2	100 Ω	TDK Corporation	MPZ1608Y101BTA00	FB_0603
9	1	PCB1	HSDC133_001	Any	HSDCxxx	n/a
10	2	P1,P2	Banana-Jack	Pomona	1581-2	BJ_THVT_3267
11	1	P3	Banana-Jack	Pomona	1581-0	BJ_THVT_3267
12	2	R1,R10	0 - DNI	Panasonic Electronic Components	ERJ-U030R00V	RES_0603
13	2	R2,R7	100	Panasonic Electronic Components	ERJ-PA2J101X	RES_0402
14	4	R3,R4,R5,R6	0	Panasonic Electronic Components	ERJ-2GE0R00X	RES_0402
15	3	R8,R11,R20	0	Panasonic Electronic Components	ERJ-U030R00V	RES_0603
16	1	R9	0 -DNI	Panasonic Electronic Components	ERJ-U030R00V	RES_0603
17	8	R12,R13,R14,R15,R16,R17,R18,R19	10 k -DNI	Panasonic Electronic Components	ERJ-PA2J103X	RES_0402
18	2	R34,R35	20	Panasonic Electronic Components	ERJ-U02F20R0X	RES_0402
19	4	SCRW1,SCRW2,SCRW3,SCRW4	NY PMS 440 005 PH	B & F Fastener	NY PMS 440 0050 PH	screw
20	4	SHNT1,SHNT2,SHNT3,SHNT4	QPC02SXGN-RC	Sullins Connector Solutions	QPC02SXGN-RC	0.1
21	4	STDOFF1,STDOFF2,STDOFF3,STDOFF4	1902E	Keystone	1902E	Standoff
22	2	TP1,TP2	TESTPOINT	Amphenol ICC (FCI)	75160-101-01LF	HDR_THVT_1x1_1097
23	1	U1	DS90LVRA2	Texas Instruments	DS90LVRA2DEM	DEM0008AA
24	3	U2,U3,U4	ESD122DMY	Texas Instruments	ESD122DMYR	DMY0003AA

3 References

The following is a list of documents about LVDS devices and related applications materials that will assist in the design and development of LVDS interfaces.

- *How to Terminate LVDS Connections wth DC and AC Coupling* application note
- *LVDS Designer's Notes* application note
- *Reducing EMI With Low Voltage Differential Signaling* application note
- *A statistical Survey of Common-Mode Noise* application note
- *Measuring Crosstalk in LVDS Systems* application note
- *Interface Circuits for TIA/EIA–644 (LVDS)* design considerations
- *Performance of LVDS With Different Cables* application note

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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 a nonconforming EVM if (a) the nonconformity was 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, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.

   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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Evaluation Kits 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 shall operate the Evaluation Kit within TI’s recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI’s recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI’s instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGREDATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 *Regulatory Notices:*

3.1 *United States*

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。
http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

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.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

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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This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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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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