User's Guide
SNVU614–July 2018

TPS3431EVM Standard Programmable Watchdog Timer with Enable

This user's guide describes the TPS3431EVM evaluation module (EVM). This guide contains the EVM schematic, bill of materials (BOM), assembly drawing, and top and bottom board layouts.

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1 Introduction

The TPS3431EVM is an evaluation module (EVM) for the TPS3431 standard watchdog timer. The EVM has a supply voltage range of 1.8V to 6.5V, and offers connection headers for all device input and output pins. Test points are provided to give the user additional connection points if needed for oscilloscope or multimeter measurements.

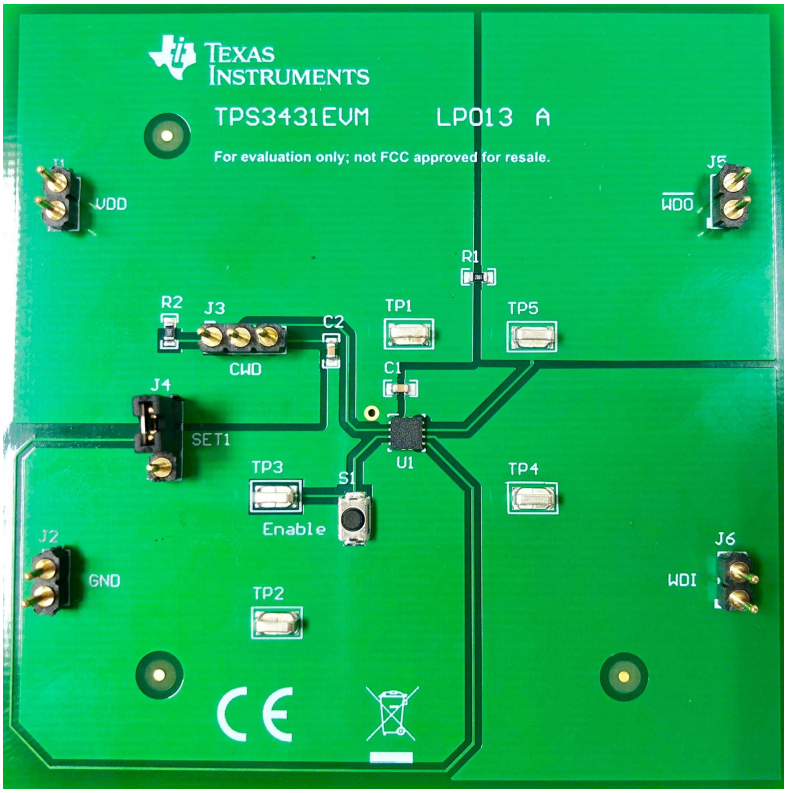


Figure 1. TPS3431EVM Board - Top

1.1 Related Documentation

TPS3431 Standard Watchdog Timer with Enable data sheet, SBVSB66

TPS3431Q1 Standard Watchdog Timer with Enable data sheet, SBVSB67

Please see the TPS3431 and TPS3431Q1 datasheets for more detailed specifications, pin descriptions, applications, and other information related to the devices. This user guide provides information related to using the EVM.

2 Schematic, Bill of Materials, and Layout

This section provides a detailed description of the TPS3431EVM schematic, bill of materials (BOM), and layout.

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2.1 TPS3431EVM Schematic

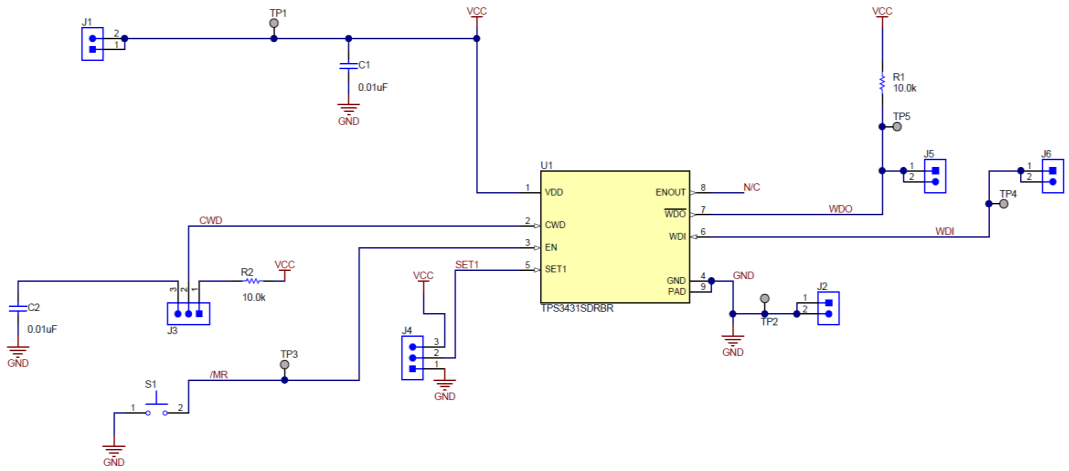


Figure 2. TPS3431EVM Schematic

2.2 TPS3431EVM Bill of Materials

Table 1. BOM

DESIGNATOR	QUANTITY	VALUE	DESCRIPTION	PACKAGE REFERENCE	PART NUMBER	MANUFACTURER
!PCB	1		Printed Circuit Board		LP013	Any
C1, C2	2	0.01 µF	CAP, CERM, 0.01 µF, 6.3 V, ± 10%, X7R, 0603	0603	GRM188R70J103KA01D	MuRata
H1, H2, H3, H4	4		Bumpon, Hemisphere, 0.44 X 0.20, Clear	Transparent Bumpon	SJ-5303 (CLEAR)	3M
J1, J2, J5, J6	4		Header, 100mil, 2x1, TH	Header, 2x1, 100mil, TH	800-10-002-10-001000	Mill-Max
J3, J4	2		Header, 100mil, 3x1, TH	Header, 3x1, 100mil, TH	800-10-003-10-001000	Mill-Max
R1, R2	2	10.0k	RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060310K0FKEA	Vishay-Dale
S1	1		Switch, Push Button, SMD	2.9x2x3.9mm SMD	SKRKAEE010	Alps
TP1, TP2, TP3, TP4, TP5	5		Test Point, Miniature, SMT	Test Point, Miniature, SMT	5019	Keystone
U1	1		Stand Alone Watchdog with programmable timeout period, DRC0010J (VSON-10)	'DRC0010J	TPS3431WDRCR	Texas Instruments
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A

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2.3 Layout and Component Placement

Figure 3 and Figure 4 are the top overlay and bottom overlay of the printed circuit board (PCB) and shows the component placement on the EVM.

Figure 5 shows the top layout, Figure 6 and Figure 7 show the top and bottom layers, and Figure 8 and Figure 9 show the top and bottom solder masks of the EVM.

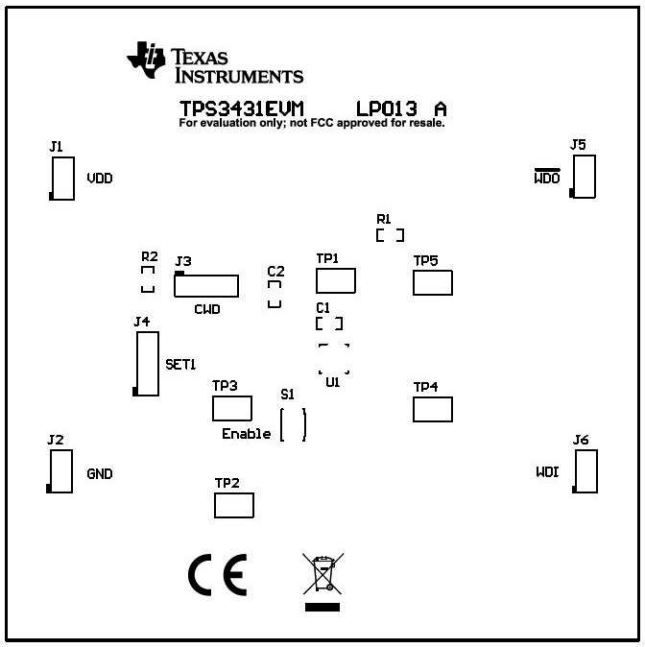


Figure 3. Component Placement—Top Overlay

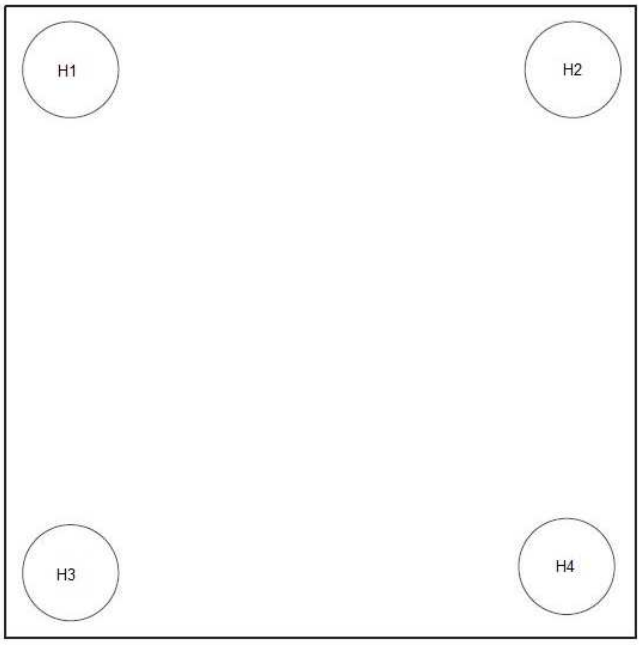


Figure 4. Component Placement—Bottom Overlay

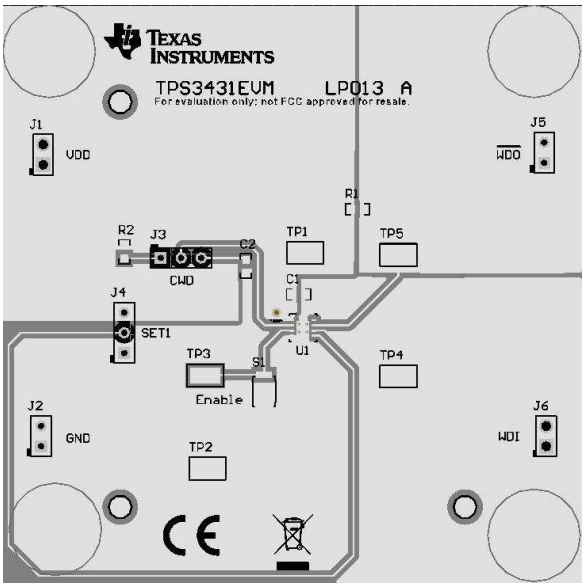


Figure 5. Layout—Top

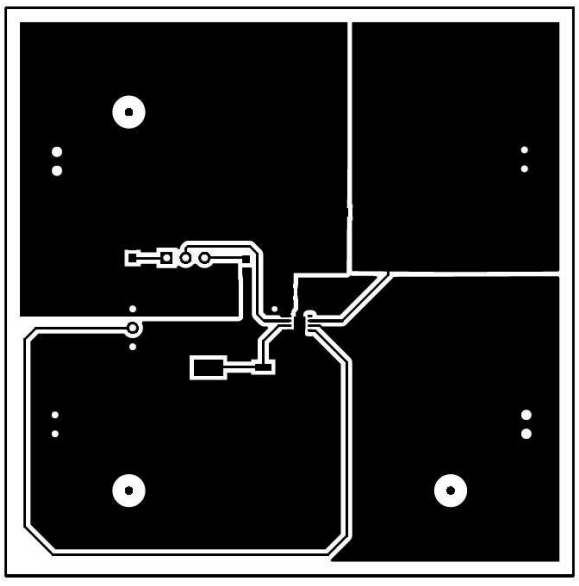


Figure 6. Top Layer

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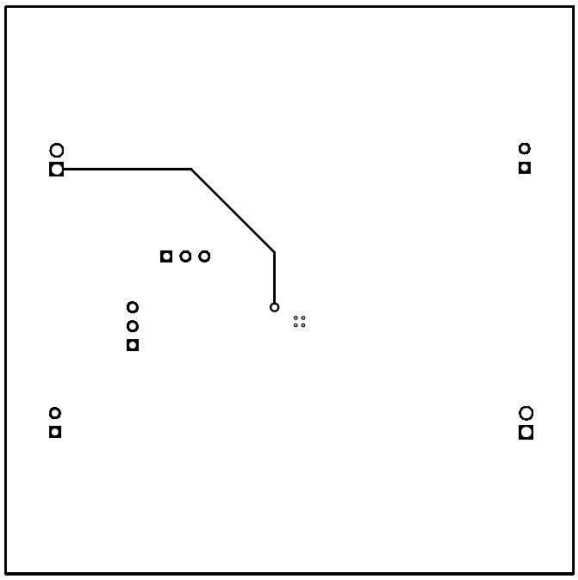


Figure 7. Bottom Layer

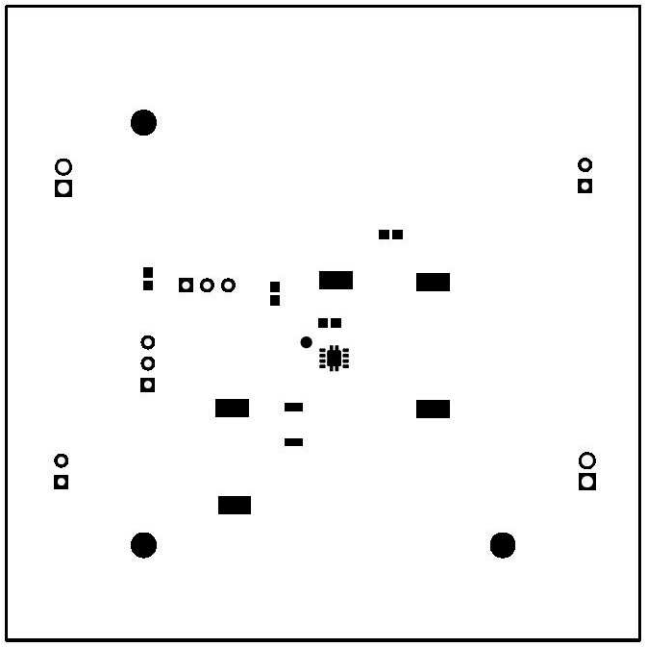


Figure 8. Top Solder Mask

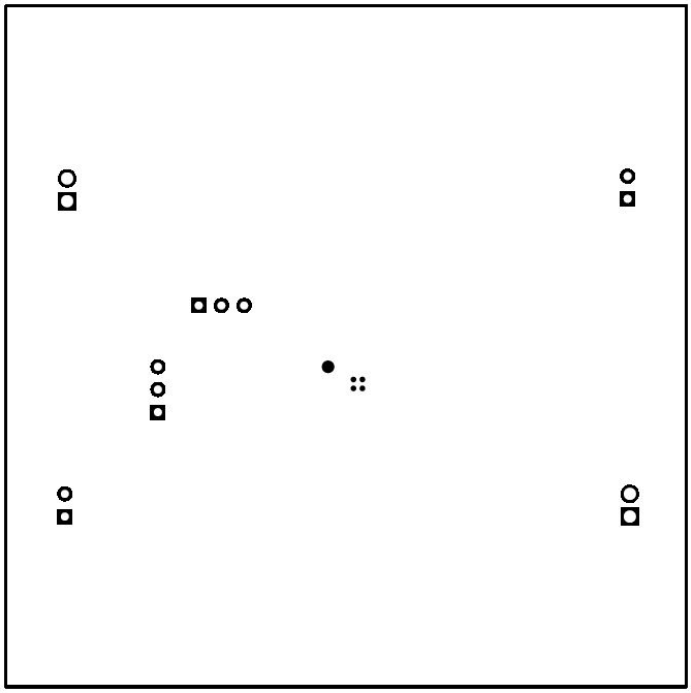


Figure 9. Bottom Solder Mask

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3 EVM Connectors

This section describes the connectors, jumpers, and test points on the EVM as well as how to connect, set up, and properly use the EVM. Each device has an independent supply connection, but all grounds are connected on the board.

3.1 EVM Test Points

Table 2 lists the test points and functional descriptions. All pins of the device are broken out to test points on the EVM.

Table 2. Test Points

Test Point Number	Test Point Silkscreen Label	Function	Description
TP1	VCC	Connection to VDD1 and VDD2 pins.	Allows user to measure the VDD power pin.
TP2	GND	Connection to GND pin.	Allows user to connect to ground close to the GND pin.
TP3	EN	Connection to Enable input.	Allows user to measure Enable input signal or connect a signal to the Enable pin.
TP4	WDI	Connection to Watchdog input.	Allows user to measure WDI input signal or connect a signal to the WDI pin.
TP5	$\overline{\text{WDO}}$	Connection to Watchdog output.	Allows user to measure $\overline{\text{WDO}}$ for watchdog output monitoring.

3.2 EVM Jumpers

Table 3 lists the jumpers on the TPS3431EVM. As ordered, the EVM will have five jumpers installed.

Table 3. List of Onboard Jumpers

Jumper	Default Connection	Description
J1	Open	VCC power jumper. Both pins of J1 are connected together. Apply power to either J1 pin to deliver power to the VDD pin.
J2	Open	GND jumper. Both pins of J2 are connected together. Apply ground to either J2 pin to provide a ground reference to GND pin.
J3	Open - CWD is floating	CWD configuration pin. J5 allows user to connect CWD to a pull-up resistor, an external capacitor, or leave CWD floating for different watchdog timeout options.
J4	Closed - SET1 connects to VCC	SET1 configuration pin. J4 allows user to short SET1 to either VCC or ground. This configuration alters the watchdog function.
J5	Open	$\overline{\text{WDO}}$ output pin. Both pins of J7 are connected together. This jumper allows users to measure watchdog output by connecting to either pin of J7.
J6	Open	WDI input pin. Both pins of J8 are connected together. This jumper allows users to measure WDI or apply a watchdog input by connecting to either pin of J8.

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4 EVM Setup and Operation

This section describes the functionality and operation of the TPS3431EVM. The user should read the TPS3431 datasheet for electrical characteristics of the device.

4.1 Input Power (VDD)

The VDD supply is connected through the J1 header on board and can be applied to either jumper pin as they are connected together in the layout. J1 is connected to the VDD pin of the TPS3431 device and J2 is connected to the board common GND. The supply voltage range is 1.8V to 6.5V and a 0.1µF decoupling capacitor is recommended at the input for reducing noise that can propagate through the device. Table 4 details the nominal supply voltage and typical input decoupling capacitor.

Table 4. Nominal Supply Parameters

Device	Nominal Supply Voltage (V)	Typical Decoupling Capacitor at Input
TPS3431	1.8V to 6.5V	0.1 µF

4.1.1 Watchdog Input (WDI)

The TPS3431 devices offer a standard watchdog with programmable watchdog timing also called watchdog timeout. The watchdog timeout (t_{WD}) is configured using the SET1 and CWD pins. The user has two factory-programmed timing options by either leaving CWD floating or by pulling CWD high with a pull-up resistor. The user can also create user-programmed timing options by connecting CWD to a capacitor connected to GND. To program the watchdog timeout, the user simply replaces the CWD capacitor C2. Please see CWD Adjustable Capacitor Watchdog Timeout section in the TPS3431 datasheet for more detailed information on user programming. The watchdog input (WDI) is ignored for the watchdog reset delay (t_{RST}) upon start-up which is fixed to 200ms typical. After start-up, the watchdog input signal must arrive before the watchdog timeout to prevent a watchdog reset. When a watchdog fault occurs due to a late timed watchdog input signal or missing watchdog input signal, the watchdog output ($\overline{WDO}$) activates and transitions to logic low for the watchdog reset delay (t_{RST}). When t_{RST} expires, $\overline{WDO}$ deactivates and returns to logic high. When the watchdog is disabled by either forcing EN logic low or SET1 to logic low, the watchdog input is ignored and $\overline{WDO}$ is high impedance and remains logic high due to the external pull-up resistor.

4.2 Watchdog Output ($\overline{WDO}$)

The watchdog output ($\overline{WDO}$) is an open-drain active-low output that activates when a watchdog fault occurs. A watchdog fault occurs when the falling edge of the watchdog input signal fails to arrive within the watchdog timeout. When a watchdog fault occurs, the internal MOSFET, as shown in Figure 10, turns ON and $\overline{WDO}$ pulls low to GND for t_{RST}. When t_{RST} expires, the internal MOSFET turns OFF and $\overline{WDO}$ pulls high due to the external pull-up resistor. The pull-up resistor is calculated from dividing the pull-up voltage by the absolute maximum watchdog reset output current. The pull-up resistor should be chosen so that the watchdog reset current never exceeds the absolute maximum allowed under all operations.

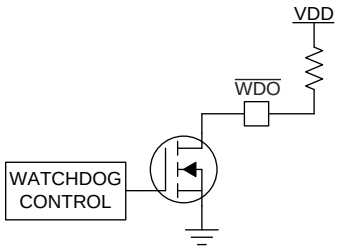


Figure 10. Open-Drain $\overline{WDO}$ Configuration

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4.3 Watchdog Disable

The watchdog is disabled by forcing EN pin to logic low or by forcing SET1 to logic low. When the watchdog is disabled the watchdog input is ignored and $\overline{WDO}$ is high impedance and remains logic high due to the external pull-up resistor. When using EN pin to disable, the watchdog input is ignored for t_{RST} when EN is released back to logic high. When using SET1 pin to disable, the watchdog input is ignored for a watchdog setup time of 150µF when the watchdog is enabled by forcing SET1 back to logic high.

4.4 Configuring Watchdog Timeout (CWD, SET1)

The watchdog timeout is configured using the CWD and SET1 pins. The CWD pin allows for two factory-programmed timing options by leaving CWD floating or pulling CWD to logic high using a pull-up resistor. The CWD pin also allows for user programming by connecting CWD pin to a capacitor connected to GND. To program the watchdog timeout, simply replace the CWD capacitor C2. Please see CWD Adjustable Capacitor Watchdog Timeout section in the TPS3431 datasheet for more detailed information on user programming.

Revision History

DATE	REVISION	NOTES
July 2018	*	Initial Release

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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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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.

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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