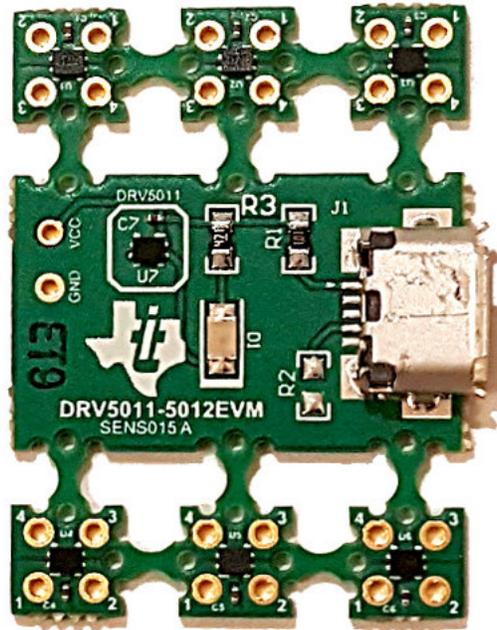


## **DRV5011-5012EVM**



This user's guide describes the characteristics, operation, and use of the DRV5011-5012EVM evaluation module (EVM). This EVM is designed to evaluate the performance of the [DRV5011](#) and [DRV5012](#) ultra-low power digital-latch Hall effect sensors. Throughout this document, the terms evaluation board, evaluation module, and EVM are synonymous with the DRV5011-5012EVM. This document includes a schematic, reference printed-circuit board (PCB) layouts, and a complete bill of materials.

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## Trademarks

All trademarks are the property of their respective owners.

## 1 Overview

The DRV5011 and DRV5012 devices are ultra-low-power digital latch Hall effect sensors. When a south magnetic pole is near the top of the package and the  $B_{OP}$  threshold is exceeded, the devices drive a low voltage. The output stays low until a north pole is applied and the  $B_{RP}$  threshold is crossed, which causes the output to drive a high voltage. Alternating north and south poles are required to toggle the output, and integrated hysteresis separates  $B_{OP}$  and  $B_{RP}$  to provide robust switching.

The DRV5011 is available in SOT23 (3) and tiny X2SON (4) packages, and the DRV5012 is available in the tiny X2SON (4) package.

### 1.1 Kit Contents

[Table 1](#) lists the contents of the DRV5011-5012EVM kit. Contact the nearest [Texas Instruments Product Information Center](#) if any component is missing. TI highly recommends checking the DRV5011 and DRV5012 product folders on the TI website at [www.ti.com](http://www.ti.com) for further information regarding this product.

**Table 1. DRV5011-5012EVM Kit Contents**

Item	Quantity
DRV5011-5012EVM Test Board	1
8182 Cylindrical NdFeB Axial Magnet	1
USB Cable, Micro	1

### 1.2 Related Documentation From Texas Instruments

The following document provides information regarding Texas Instruments' integrated circuits used in the assembly of the DRV5011-5012EVM. This user's guide is available from the TI web site under literature number SLYU045. Any letter appended to the literature number corresponds to the document revision that is current at the time of the writing of this document. Newer revisions may be available from the [TI website](#), or call the Texas Instruments' Literature Response Center at (800) 477-8924 or the Product Information Center at (972) 644-5580. When ordering, identify the document by both title and literature number.

**Table 2. Related Documentation**

Document	Literature Number
<a href="#">DRV5011</a> product data sheet	<a href="#">SLVSCY6</a>
<a href="#">DRV5012</a> product data sheet	<a href="#">SLVSDD5</a>

## 2 Hardware

The DRV5011 and DRV5012 are digital-latch Hall effect sensors that provides ease of use with low power consumption and small size. The DRV5011 operates at 30 kHz, whereas the DRV5012 has an additional SEL pin that selects either a 2.5-kHz or 20-Hz sampling speed to conserve power. The fixture layout is not intended to be a model for the target circuit, nor is it laid out for electromagnetic compatibility (EMC) testing. The DRV5011-5012EVM consists of one PCB with an option to cut out seven individual PCBs: three coupon boards with the DRV5011 soldered down, three coupon boards with the DRV5012 soldered down, and a final board that accepts a micro-USB cable to power a DRV5011 and an LED for easy demonstration and evaluation.

### 2.1 Features

The layout of the DRV5011-5012EVM printed-circuit board (PCB) is designed to provide the following features:

- Easy demonstration and evaluation of the DRV5011
- Ease of access to DRV5011 and DRV5012 device pins with test point vias
- Capability to remove small coupon boards and wire them directly into space constrained applications for prototype evaluation

See the [DRV5011](#) and [DRV5012](#) data sheets for comprehensive information about the DRV5011 and DRV5012 devices, respectively.

## 3 Quick Start Setup and Use

The following are instructions to set up and use the DRV5011-5012EVM.

- Step 1. Connect the included USB cable to a powered, 5V USB source (like a computer or wall charger).
- Step 2. Hold the included magnet near the DRV5011 device on the central board. Alternate the polarity of the magnet by turning it around 180°.
- Step 3. Observe the LED turn on and off as the polarity of the magnet reverses.

### 3.1 Measurements

With the DRV5011-5012EVM, the user can either quickly test the functionality of a DRV5011 circuit with a 5-V USB power supply, or remove and install up to three DRV5011 and DRV5012 devices on coupon boards into a prototype system.

The following procedures are used to connect the coupon boards for evaluation.

- *DRV5011:*
  - Step 1. Connect a supply of 2.5-V to 5.5-V to pin 1 of the coupon board labeled DRV5011, and connect the ground reference of that supply to pin 2.
  - Step 2. Monitor the output of the DRV5011 by connecting a multimeter to pin 4 of the coupon board.
- *DRV5012:*
  - Step 1. Connect a supply of 1.65-V to 5.5-V to pin 1 of the coupon board labeled DRV5012, and connect the ground reference of that supply to pin 2.
  - Step 2. Connect either supply or ground to pin 4 of the coupon board labeled DRV5012. This connection selects the speed of conversion.
  - Step 3. Monitor the output of the DRV5012 by connecting a multimeter to pin 3 of the coupon board.

## 4 EVM Components

This section summarizes the DRV5011-5012EVM components.

### 4.1 C1-C7

C1-C7 are 0.1- $\mu$ F bypass capacitors included for every DRV5011 and DRV5012 installed on the EVM board.

### 4.2 U1-U3

U1, U2 and U3 are DRV5012 devices, installed on removable coupon boards.

### 4.3 U4-U7

U4, U5, U6 and U7 are DRV5011 devices. U4, U5, and U6 are installed on removable coupon boards. U7 is installed on the central board and attached to the USB connector and LED.

### 4.4 R1, R2

R1 is a current-limiting resistor, provided to help keep a USB power supply from getting damaged if  $V_{CC}$  shorts to GND. R2 ties the unused pin 4 of the micro-USB connector to GND, and therefore, is not installed by default.

### 4.5 R3, D1

R3 is a current-setting resistor that provides the appropriate amount of current to light LED D1 and not damage U7.

### 4.6 J1

J1 is the micro-USB connector installed on the DRV5011-5012EVM that allows a USB power source to provide power to U7 and D1.

## 5 Schematic, PCB Layout, and BOM

**NOTE:** Board layouts are not to scale. These figures are intended to show how the board is laid out. The figures are not intended to be used for manufacturing DRV5011-5012EVM PCBs.

### 5.1 Schematic

Figure 1 through Figure 3 show the schematic for the DRV5011-5012EVM PCB.

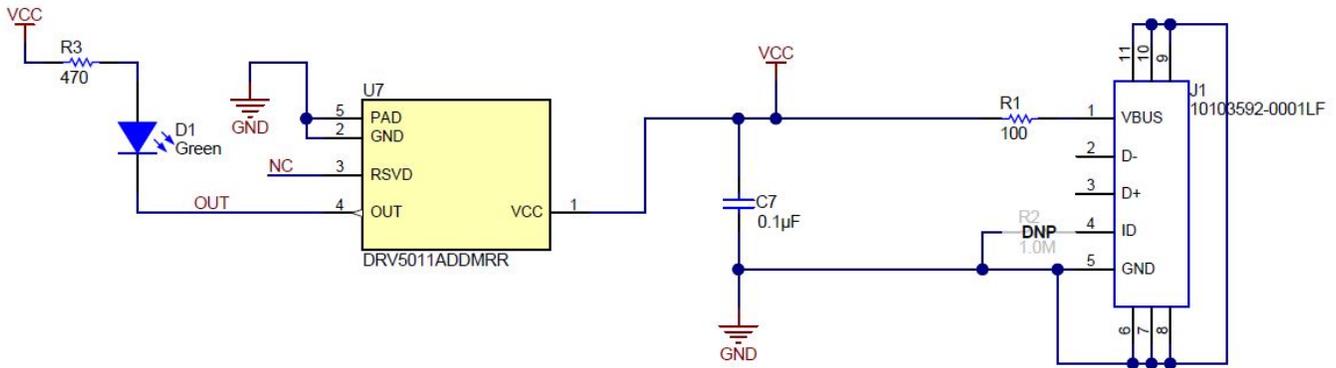


Figure 1. DRV5011 Center Board Schematic

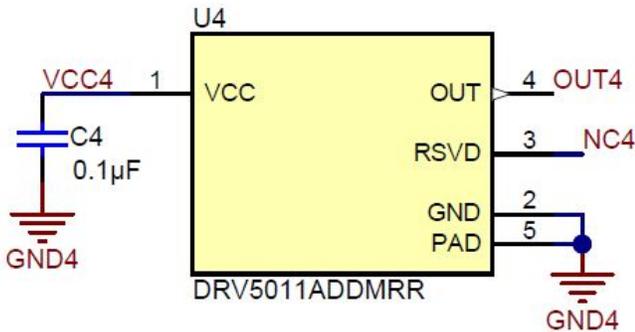


Figure 2. DRV5011 Coupon Board Schematic

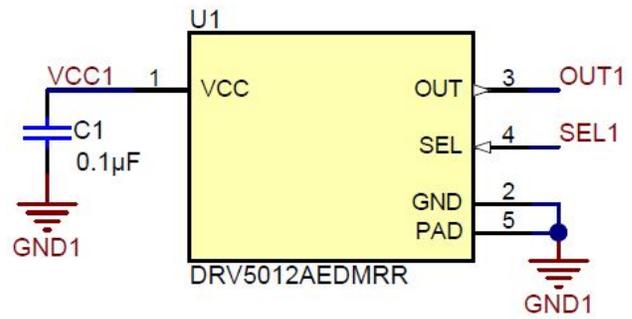


Figure 3. DRV5012 Coupon Board Schematic

## 5.2 PCB Layout

Figure 4 through Figure 9 illustrate the PCB layout for the DRV5011-5012EVM.

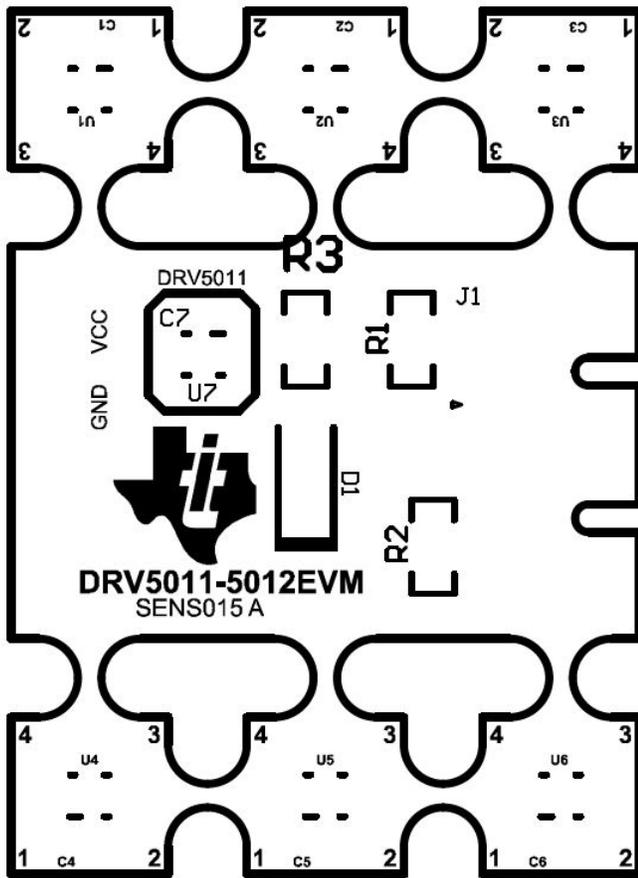


Figure 4. Top Overlay

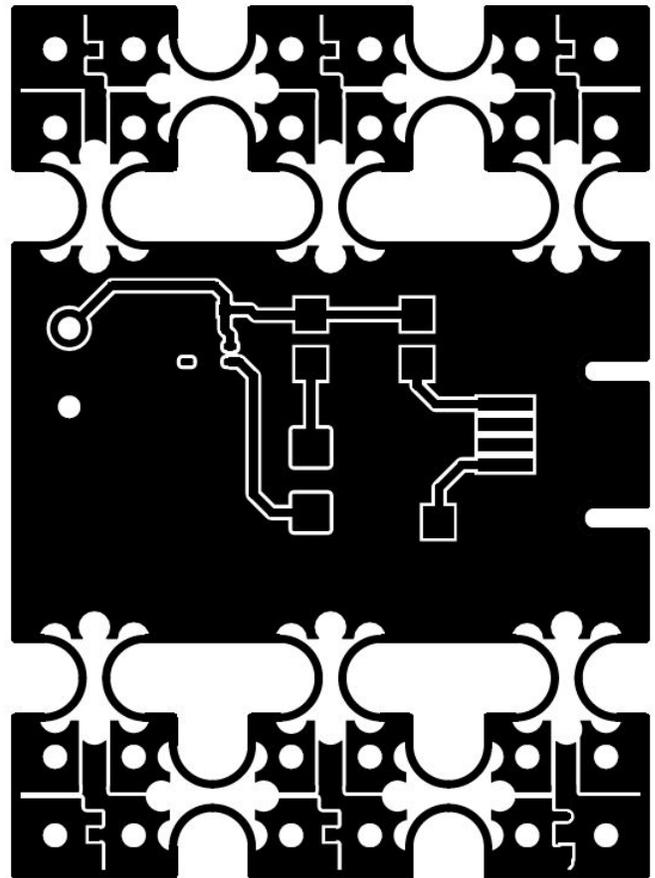


Figure 5. Top Layer

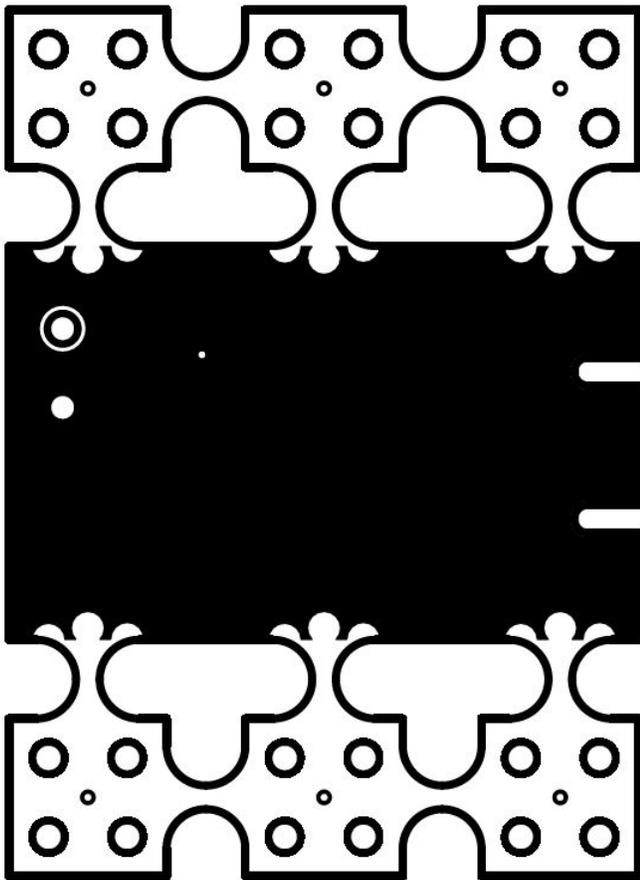


Figure 6. Bottom Layer

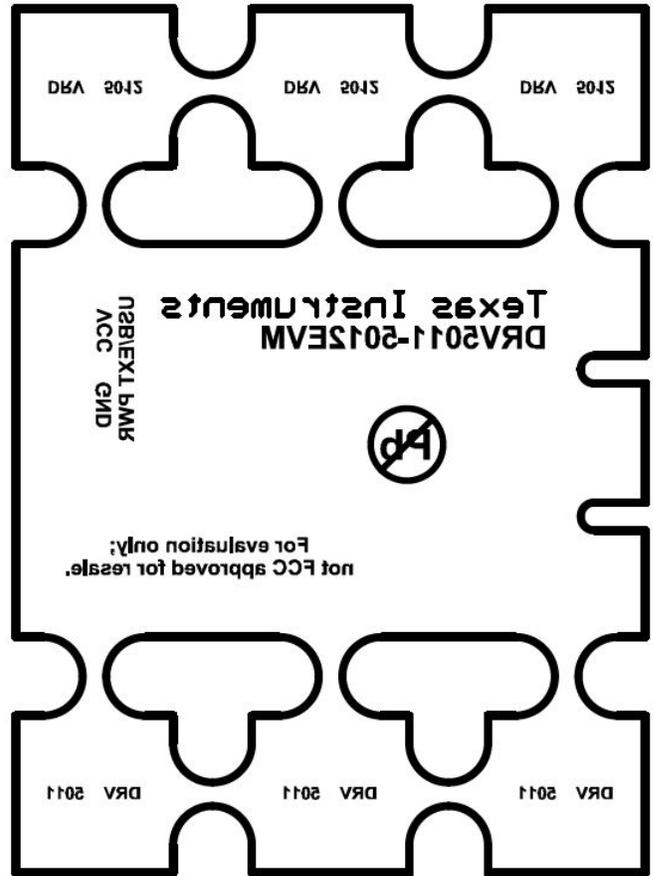
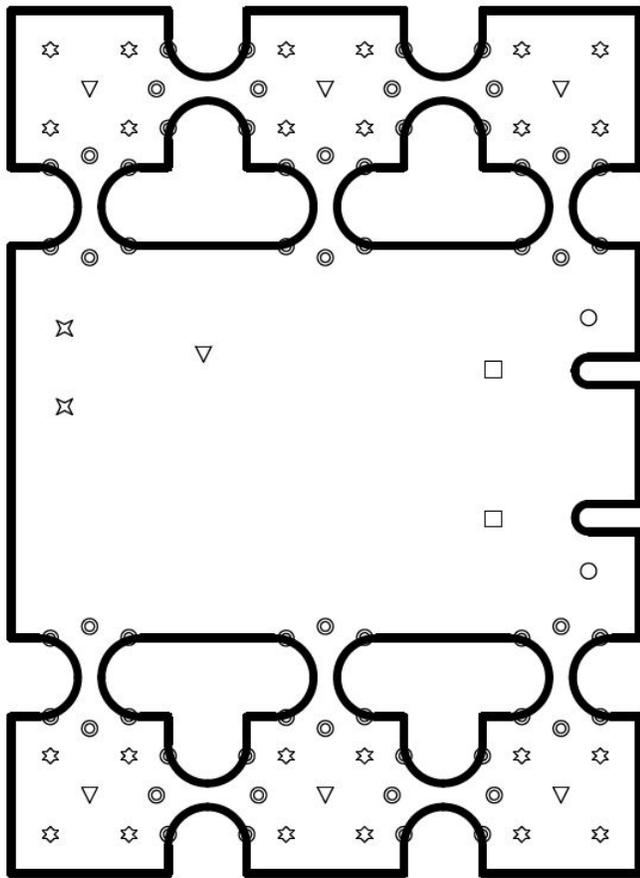
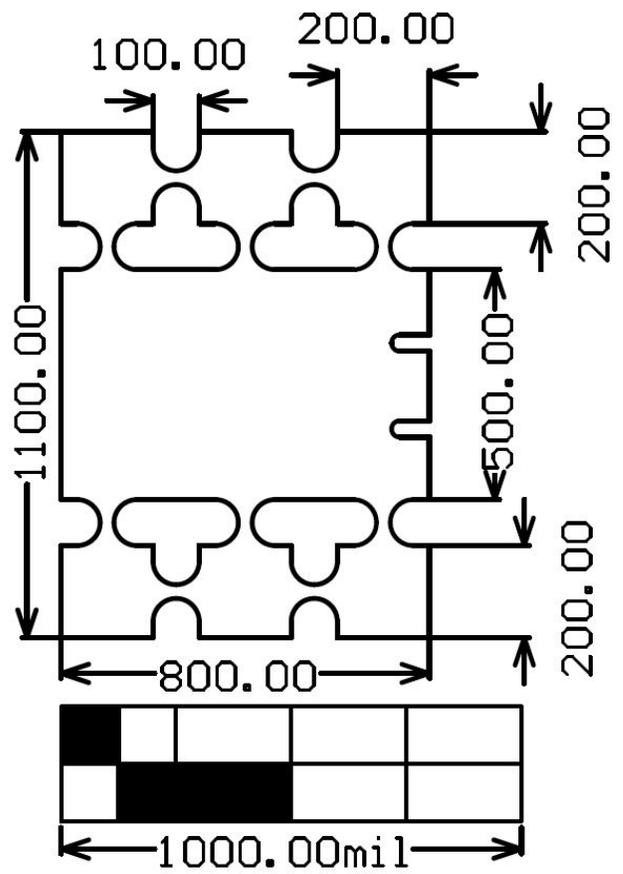


Figure 7. Bottom Overlay



**Figure 8. Drill Drawing**



**Figure 9. Dimensions**

### 5.3 Bill of Materials

Table 3 provides the parts list for the DRV5011-5012EVM.

**Table 3. Bill of Materials**

Designator	Qty	Value	Description	Package Reference	PartNumber	Manufacturer
C1-C7	7	0.1 $\mu$ F	CAP, CERM, 0.1 $\mu$ F, 6.3 V, +/- 10%, X5R, 0201	0201	C0603X5R1C104K030BC	TDK
D1	1		LED, Green, SMD	0805	SML-LXT0805GW-TR	Lumex
H1	1		MAGNET CYLINDRICAL NDFEB AXIAL		8182	Radial Magnets
H2	1		USB Cable, Micro		3025010-03	Qualtek
J1	1		Receptacle, USB 2.0, Micro B, 5 Position, R/A, SMT		10103592-0001LF	FCI
R1	1	100	RES, 100, 5%, 0.25 W, AEC-Q200 Grade 0, 0603	0603	ESR03EZPJ101	Rohm
R2	0	1M	RES, 1.0 M, 5%, 0.1 W, 0603	0603	CRCW06031M00JN EA	Vishay-Dale
R3	1	470	RES, 470, 5%, 0.1 W, 0603	0603	RMCF0603JT470R	Stackpole
U1-U3	3		Low-Power Digital-Latch Hall Effect Sensor, DMR0004A (X2SON-4)		DRV5012AEDMRR	Texas Instruments
U4-U7	4		Low-Voltage Digital-Latch Hall Effect Sensor, DMR0004A (X2SON-4)		DRV5011ADDMRR	Texas Instruments

### Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

#### Changes from Original (December 2017) to A Revision

Page

- |   |                   |
|---|-------------------|
| <ul style="list-style-type: none"> <li>Changed 'pin 3' to 'pin 4' in step 2 of the DRV5011 <a href="#">Measurements</a> procedures. ....</li> <li>Changed 'pin 3' to 'pin 4' in step 2 of the DRV5012 <a href="#">Measurements</a> procedures and changed 'pin 4' to 'pin 3' in step 3 of the same procedures list. ....</li> </ul> | <p>4</p> <p>4</p> |
|---|-------------------|

## STANDARD TERMS FOR EVALUATION MODULES

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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.
2. *Limited Warranty and Related Remedies/Disclaimers:*
  - 2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
  - 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 DEGRADATION 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.

#### 3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see [http://www.tij.co.jp/lstds/ti\\_ja/general/eStore/notice\\_01.page](http://www.tij.co.jp/lstds/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/lstds/ti\\_ja/general/eStore/notice\\_01.page](http://www.tij.co.jp/lstds/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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電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。[http://www.tij.co.jp/lstds/ti\\_ja/general/eStore/notice\\_02.page](http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page)

#### 3.4 European Union

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

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.

- 
4. *EVM Use Restrictions and Warnings:*
    - 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.
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