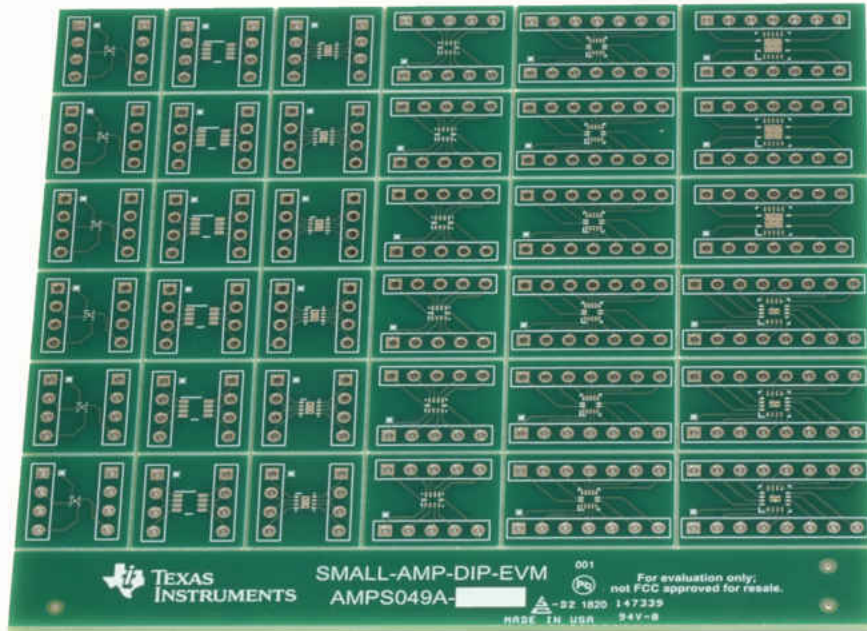


# SMALL-AMP-DIP Evaluation Module (EVM)



## ABSTRACT



This user's guide contains support documentation for the SMALL-AMP-DIP evaluation module (EVM). Included is a step-by-step guide on setting up and configuring the EVM, bill of materials (BOM), and printed circuit board (PCB) layout.

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### Trademarks

All trademarks are the property of their respective owners.

## 1 Introduction

The SMALL-AMP-DIP-EVM is designed to facilitate evaluation of op amps offered in small packages. This EVM gives users an easy tool to test the following op amp packages: DPW, DCN, DDF, DSG, RUG, RUC, RGY, and RTE. This EVM routes each pin of the device to a header pin and can be used as a basic building block for circuit design and device testing purposes.

### 1.1 List of Packages

The SMALL-AMP-DIP-EVM contains the following packages:

- DPW-5
- DCN-8
- DDF-8
- DSG-8
- RUG-10
- RUC-14
- RGY-14
- RTE-16

## 2 Hardware Setup

The SMALL-AMP-DIP-EVM setup requires identifying and breaking out the desired PCB from the EVM and then soldering the IC and terminal strips onto the EVM. This section presents the details of these procedures.

### 2.1 EVM Package Locations

Figure 2-1 and Table 2-1 map the location of each package on the EVM. Figure 2-1 labels each package drawing with a letter ranging from A to G. Table 2-1 matches the package drawing to a letter in Figure 2-1.

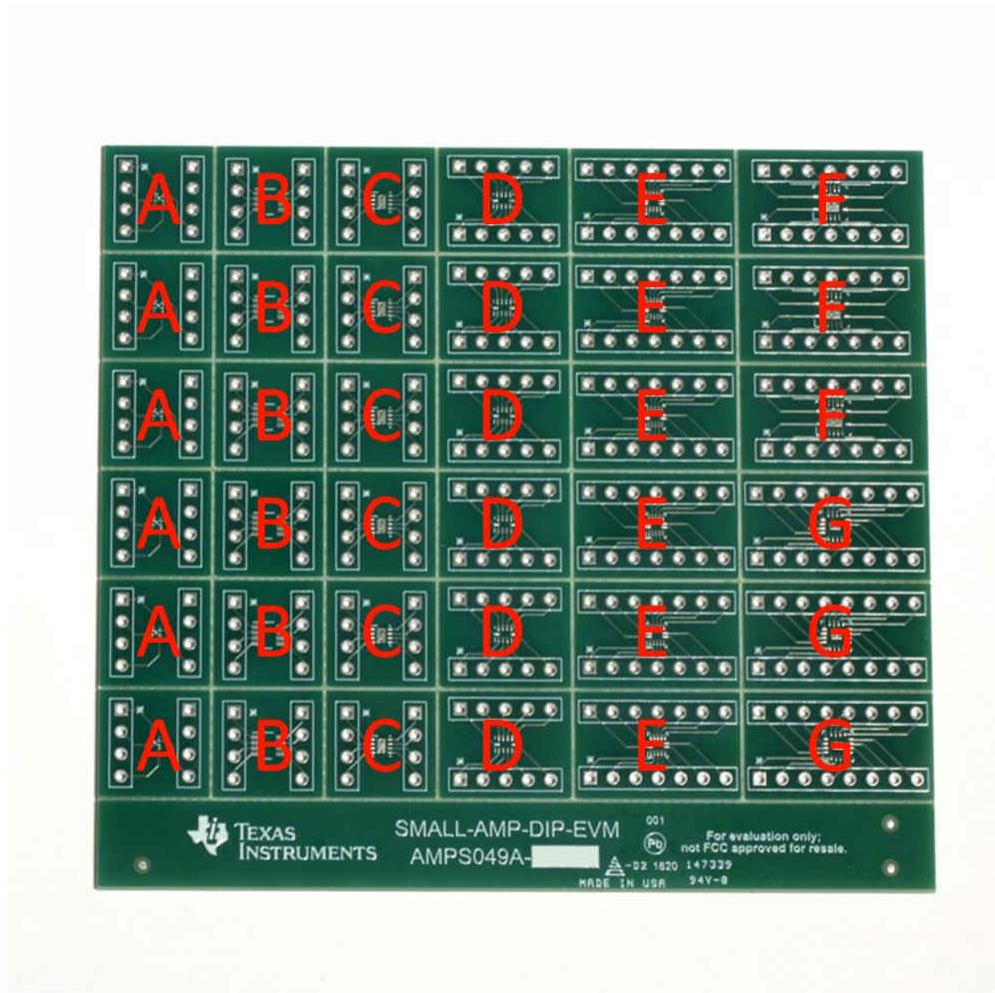


Figure 2-1. Location of packages on EVM

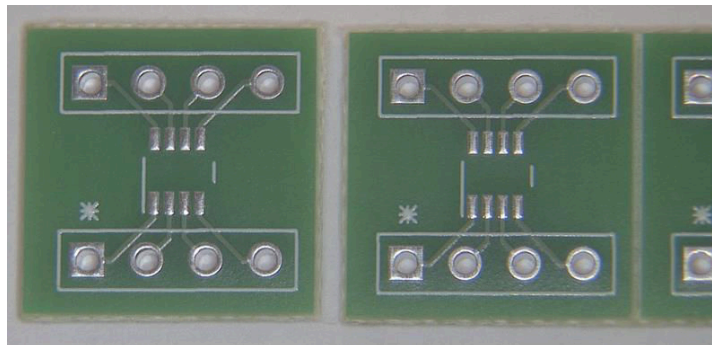
Table 2-1. Package type mapped to EVM

Package Name	Letter in Figure 2-1
DPW-5	A
DCN-8	B
DDF-8	B
DSG-8	C
RUG-10	D
RUC-14	E
RGY-14	F
RTE-16	G

## 2.2 EVM Assembly Instructions

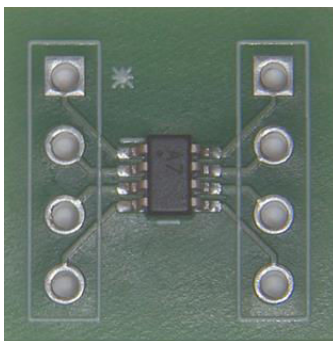
This section provides step-by-step instructions on how to assemble the EVM.

1. Choose the desired package. See [Section 2.1](#) for the location of each package type.
2. Gently flex the PCB panel at the score lines to separate the desired package from the EVM.



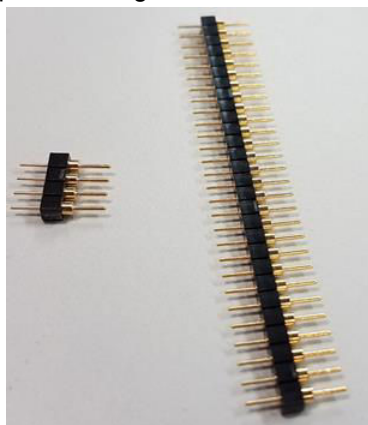
**Figure 2-2. Detach desired PCB**

3. Solder the device onto the separated PCB.



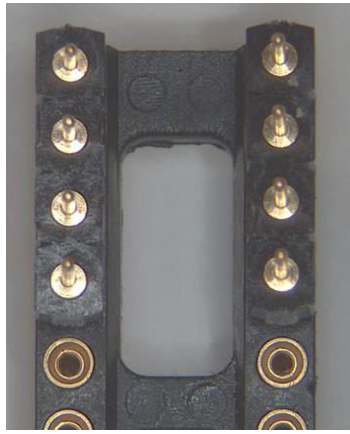
**Figure 2-3. Detached PCB with soldered IC**

4. Use long-nose pliers to snap terminal header strips into the desired position lengths.
  - For the DPW, DCN, DDF and DSG packages, the terminal strips need to be snapped into 4 position lengths, as shown in [Figure 2-4](#).
  - For the RUG package, use 5 position lengths.
  - For the RUC and RGY packages, use 7 position lengths.
  - And for the RTE package, use 8 position lengths.



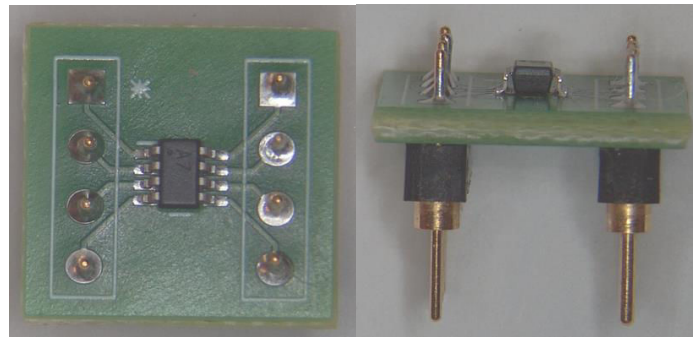
**Figure 2-4. Terminal strip (TS-132-G-AA) broken into 4 position length**

5. Insert the header strips into a spare DIP socket or breadboard as shown in [Figure 2-5](#).



**Figure 2-5. Terminal strip (TS-132-G-AA) inserted into spare DIP socket**

6. Position the separated PCB with the soldered IC over the terminal strips and solder each pin in place. Carefully remove the PCB from the DIP socket. [Figure 2-6](#) displays a fully assembled PCB.



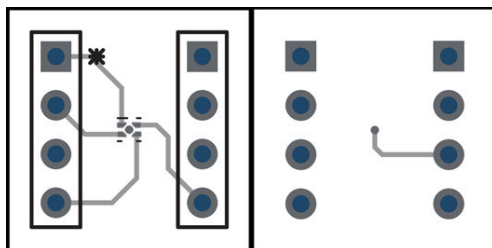
**Figure 2-6. Fully assembled PCB**

### 3 EVM Description and PCB Layout

This section shows the PCB layout of each circuit configuration provided on the EVM.

#### 3.1 DPW Package

Figure 3-1 displays the PCB layout of the top (left) and bottom layers (right) for the DPW package.

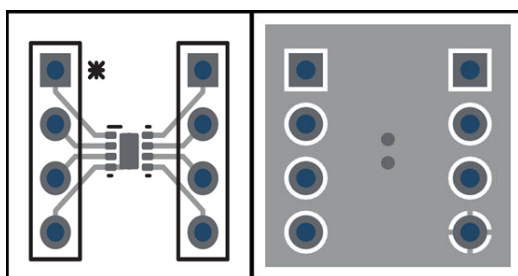


**Figure 3-1. DPW package top layer (left) and bottom layer (right) PCB layout**

The X2SON (DPW) package has the following dimensions: 0.48-mm pitch, 0.37-mm maximum height, 0.8-mm length, and 0.8-mm width.

#### 3.2 DSG Package

Figure 3-2 displays the PCB layout of the top (left) and bottom layers (right) for the DSG package.

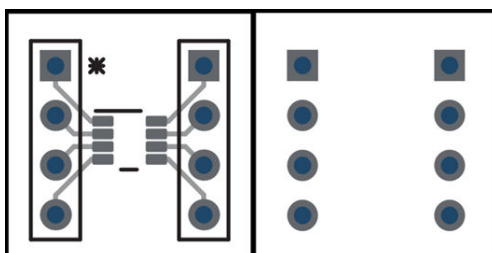


**Figure 3-2. DSG package top layer (left) and bottom layer (right) PCB layout**

The WSON (DSG) package has the following dimensions: 0.5-mm pin pitch, 0.75-mm maximum height, 2.0-mm length, and 2.0-mm width.

#### 3.3 DCN and DDF Packages

Figure 3-3 displays the PCB layout of the top (left) and bottom layers (right) for the DCN and DDF packages.

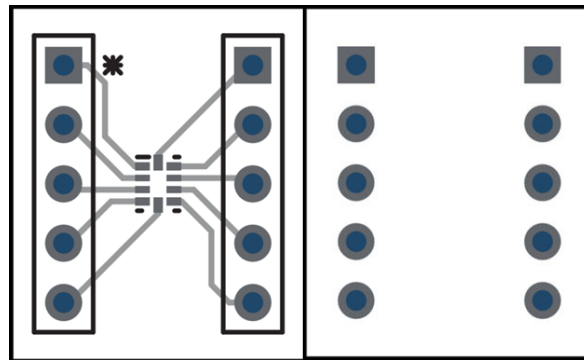


**Figure 3-3. DCN and DDF packages top layer (left) and bottom layer (right) PCB layout**

The SOT-23 (DCN and DDF) package has the following dimensions: 0.65-mm pin pitch, 1.1-mm maximum height, 2.9-mm length, and 1.63-mm width.

#### 3.4 RUG Package

Figure 3-4 displays the PCB layout of the top (left) and bottom layers (right) for the RUG package.

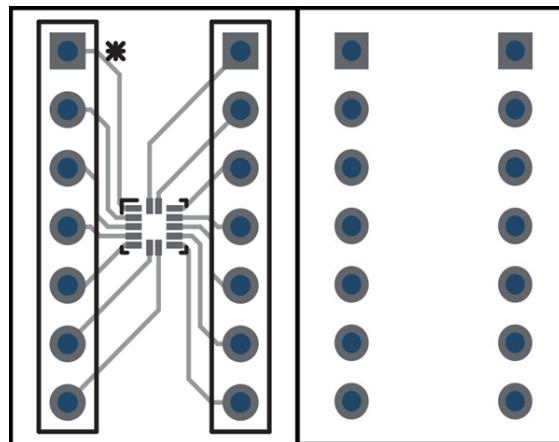


**Figure 3-4. RUG package top layer (left) and bottom layer (right) PCB layout**

The X2QFN (RUG) package has the following dimensions: 0.5-mm pin pitch, 0.37-mm maximum height, 1.5-mm length, and 2.0-mm width.

### 3.5 RUC Package

Figure 3-5 displays the PCB layout of the top (left) and bottom layers (right) for the RUC package.



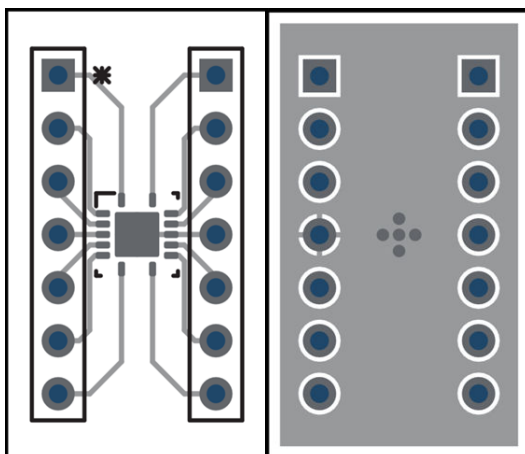
**Figure 3-5. RUC package top layer (left) and bottom layer (right) PCB layout**

The X2QFN (RUC) package has the following dimensions: 0.4-mm pin pitch, 0.35-mm maximum height, 2.0-mm length, and 2.0-mm width



### 3.6 RGY Package

Figure 3-6 displays the PCB layout of the top (left) and bottom layers (right) for the RGY package.

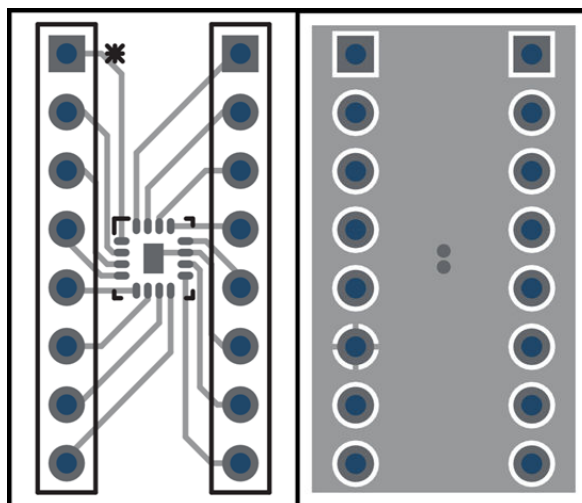


**Figure 3-6. RGY package top layer (left) and bottom layer (right) PCB layout**

The VQFN (RGY) package has the following dimensions: 0.5-mm pin pitch, 0.9-mm maximum height, 3.5-mm length, and 3.5-mm width.

### 3.7 RTE Package

Figure 3-7 displays the PCB layout of the top (left) and bottom layers (right) for the RTE package.



**Figure 3-7. RTE package top layer (left) and bottom layer (right) PCB layout**

The WQFN (RTE) package has the following dimensions: 0.5-mm pin pitch, 0.75-mm maximum height, 3.0-mm length, and 3.0-mm width.

## 4 Bill of Materials and References

### 4.1 Bill of Materials

Designator	QTY	Description	Part Number
PCB	1	Printed-Circuit-Board	SMALL-AMP-DIP-EVM
Header Strips	2	Header, 2.54 mm, 32 × 1, Gold, TH	TS-132-G-AA

### 4.2 References

1. [DIYAMP-EVM Tool Folder](#)
2. [DUAL-DIYAMP-EVM Tool Folder](#)
3. [DIP Adapter EVM Tool Folder](#)
4. [TI Precision Labs Training](#)

## 5 Revision History

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

Changes from Revision * (January 2019) to Revision A (July 2021)	Page
• Updated the numbering format for tables, figures and cross-references throughout the document.....	3

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**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:

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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.

#### 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。

<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

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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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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:*
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