

# TPS62A2I4-Q1 降压转换器评估模块



## 说明

TPS62A2I4QEVM-156 是 TPS62A2IXQ 系列 I<sup>2</sup>C 汽车同步降压转换器的评估模块，经过优化可实现高效率和紧凑型设计尺寸。TPS62A2I4QEVM-156 提供高达 4A 的输出电流。

## 开始使用

1. 在 [ti.com](https://ti.com) 上订购 EVM。
2. 在 [ti.com](https://ti.com) 上下载数据表。
3. 使用数据表调整器件的 BOM，以获得所需的输出电压。

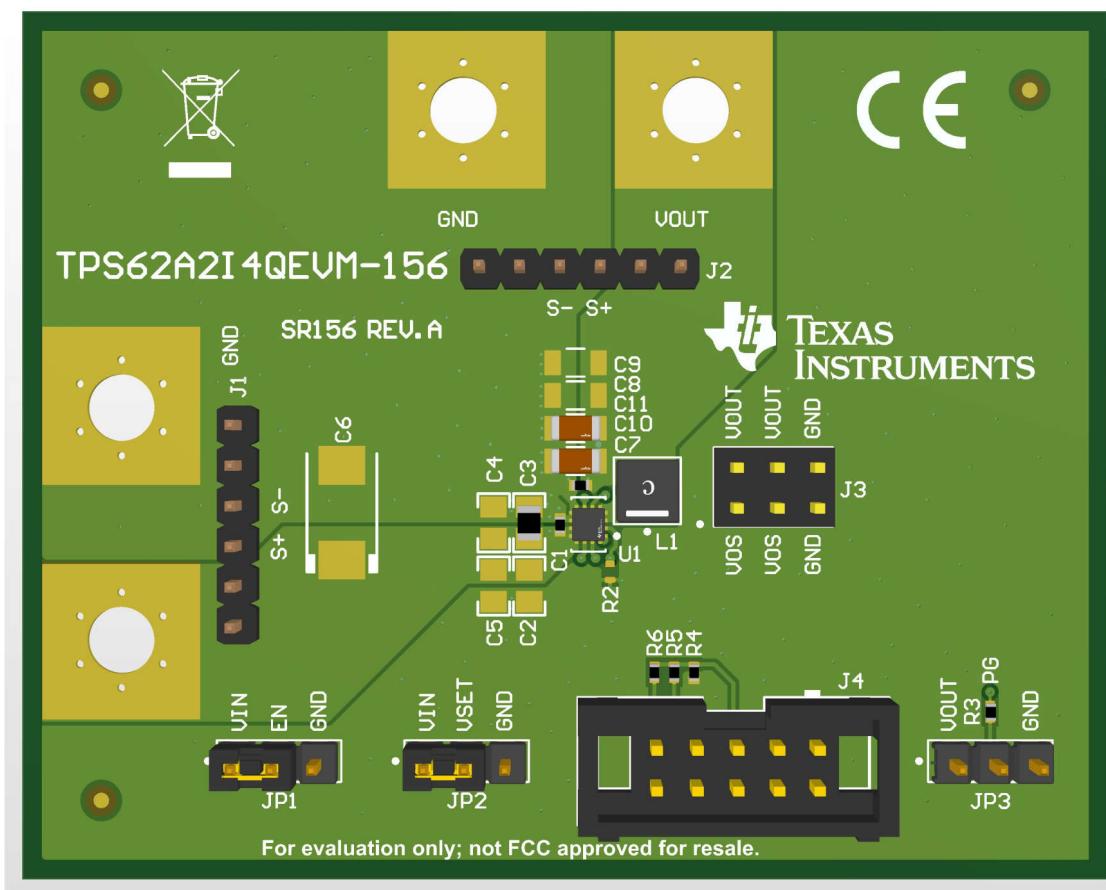
## 特性

- 输入电压范围为 2.75V 至 6V

- 可调节输出电压范围为 0.4V 至 3.6V
- 静态电流 < 33 $\mu$ A
- 输出电压精度为 0.8% (-40°C 至 150°C 温度范围内)
- 开关频率为 1.5MHz 至 4MHz
- 支持节电模式或 PWM 选项
- 与 I<sup>2</sup>C 兼容的接口，频率高达 1MHz

## 应用

- 前置摄像头
- 环视系统 ECU
- 汽车仪表组显示器



TPS62A2I4QEVM-156

## 1 评估模块概述

### 1.1 简介

这些 EVM 用于帮助用户轻松评估和测试 TPS62A2I1-Q1、TPS62A2I2-Q1、TPS62A2I3-Q1 和 TPS62A2I4-Q1 降压转换器的运行情况及功能。这些 EVM 可将 2.75V 至 6V 的输入电压转换为 0.75V 的稳压输出电压，并提供最高 4A 的电流。本用户指南介绍了 TI TPS62A2I1-Q1、TPS62A2I2-Q1、TPS62A2I3-Q1 和 TPS62A2I4-Q1 评估模块 (EVM) 的特性、运行和使用情况。本文档包含以下方面的设置说明：

- 硬件
- 印刷电路板 (PCB) 布局
- 原理图
- 物料清单 (BOM)

TPS62A2I4QEVM-156 具有板载 TPS62A2I4AQWRZXRQ1 IC，此 EVM 也适用于 1A、2A 和 3A 型号。仅需更改板载 IC。

### 1.2 套件内容

表 1-1. TPS62A2I4QEVM-156 套件内容

条目	说明	数量
TPS62A2I4QEVM-156	PCB	1

### 1.3 规格

表 1-2. 性能规格汇总

规格	测试条件	最小值	典型值	最大值	单位
输入电压		2.75		6	V
输出电压			0.75		V
输出电流	TPS62A2I4QEVM-156	0		4	A

### 1.4 器件信息

此 EVM 的 PCB 旨在容纳 IC TPS62A204Q 的 I2C 版本。

- 板载 IC 的默认输出电压为 0.75V。可以使用 I2C 接口设置其他电压。
- 可以在 C4、C5、C8 或 C9 上添加额外的输入和输出电容器。
- 在该 EVM 上，可通过 I2C 接口与器件进行通信来调节所需的输出电压、模式、软启动时间、展频和开关频率。
- 此器件 TPS62A2I4Q 有 16 种补偿设置。任何可用的补偿都可以通过 I2C 接口进行选择。

## 2 硬件

### 2.1 设置

本节介绍如何正确使用 TPS62A2I4QEVM-156。

#### 2.1.1 连接器说明

<b>J1、引脚 1 和引脚 2 - VIN</b>	从 EVM 输入电源的正输入电压连接
<b>J1、引脚 3 和引脚 4 - S+/S -</b>	输入电压检测连接，测量此处的输入电压
<b>J1，引脚 5 和引脚 6 - GND</b>	从 EVM 输入电源的输入返回连接
<b>J2、引脚 1 和引脚 2 - VOUT</b>	正输出电压连接
<b>J2、引脚 3 和引脚 4 - S+/S -</b>	输出电压检测连接、测量此处的输出电压
<b>J2，引脚 5 和引脚 6 - GND</b>	输出返回连接
<b>JP2 - VSET</b>	该引脚上连接到 GND 的电阻器定义了转换器的目标输出电压值。该引脚也可直接连接至 AGND 或 VIN。引脚不使用时连接至 AGND
<b>JP1 - EN</b>	EN 引脚跳线。使提供的跳线跨接 ON 和 EN 以开启 IC。使跳线跨接 OFF 和 EN 以关断 IC。
<b>JP3 - PG 上拉电压</b>	PG 引脚上拉电压跳线。将所提供的跳线置于 JP2 上，从而将 PG 引脚上拉电阻器连接到输出电压。或者，可移除跳线，并在引脚 5 上施加不同电压，从而将 PG 引脚上拉到不同电平。外部施加电压必须低于 5.5V。

#### 2.1.2 硬件设置

要运行该 EVM，请按照[连接器说明](#)中所述将跳线 JP1 设置到所需位置。将输入电源连接到 J1，将负载连接到 J2。

### 2.2 更改

此 EVM 的印刷电路板 (PCB) 设计用于适应用户所做的一些更改。可以根据输出电压添加额外的输入和输出电容器。此外，输出电压可以通过 I<sup>2</sup>C 接口进行调整。对于所有可用的 I<sup>2</sup>C 设置，请遵循数据表。

#### 2.2.1 输入和输出电容器

为附加输入电容器提供了 C4 和 C5。该电容器不是正常运行所必需的，但可用于减少输入电压纹波。

提供 C8 和 C9 以用作附加输出电容器。这些电容器可能不是正常运行所必需的，但有助于减少输出电压纹波和改进负载瞬态响应。输出电容必须保持在器件数据表中推荐的范围内才能确保正常运行。

### 3 硬件设计文件

#### 3.1 原理图

图 3-1 展示了 TPS62A2I4QEVM-156 的 EVM 原理图，这也适用于 TPS62A2I1-Q1、TPS62A2I2-Q1 和 TPS62A2I3-Q1 型号。

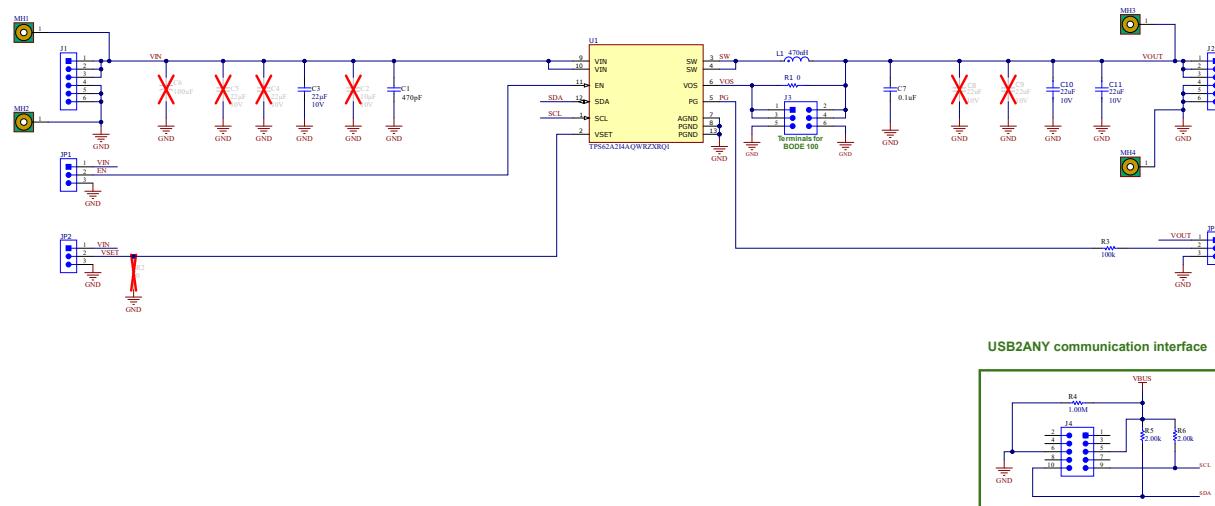


图 3-1. TPS62A2I4QEVM-156 原理图

### 3.2 PCB 布局

本节提供 TPS62A2I4QEVM-156 的电路板布局布线和图示，这也适用于 TPS62A2I1-Q1、TPS62A2I2-Q1 和 TPS62A2I3-Q1 型号。TPS62A2I4QEVM 为四层 PCB。

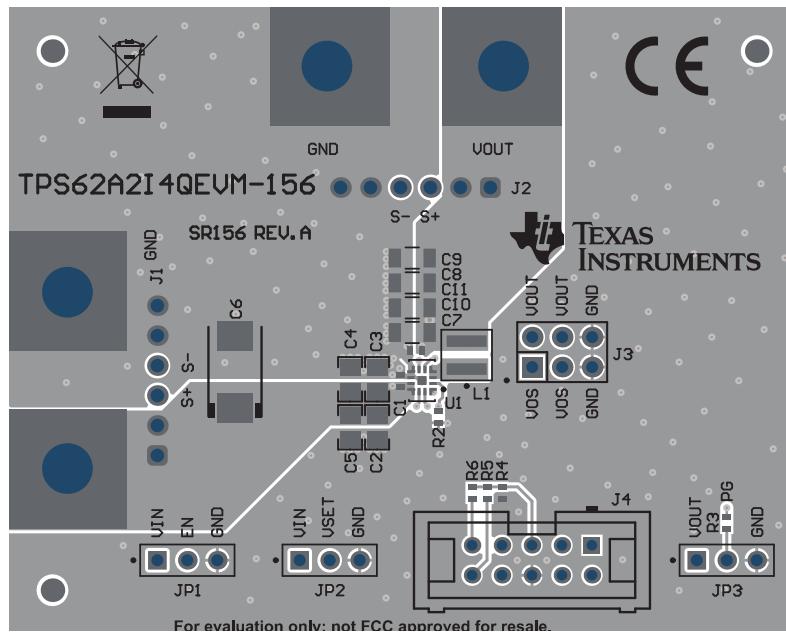


图 3-2. 顶视图阻焊层

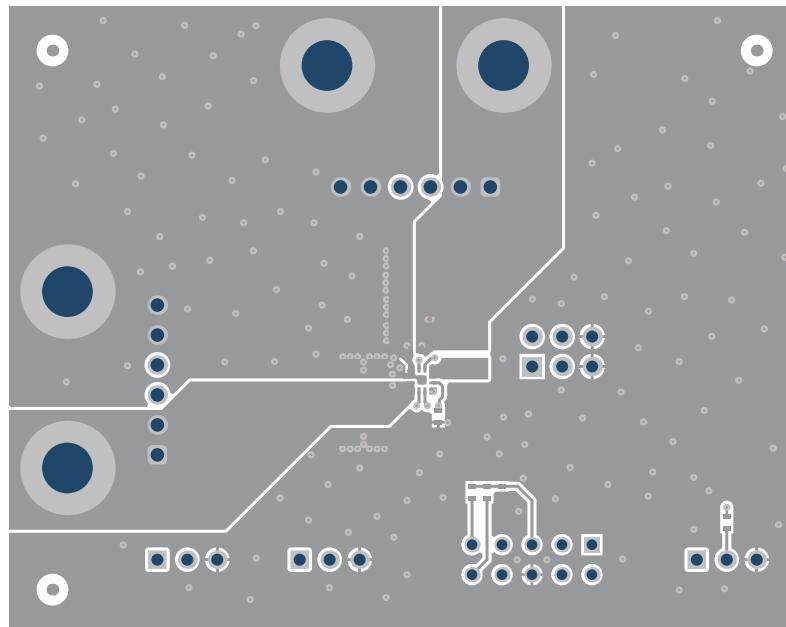


图 3-3. 顶层

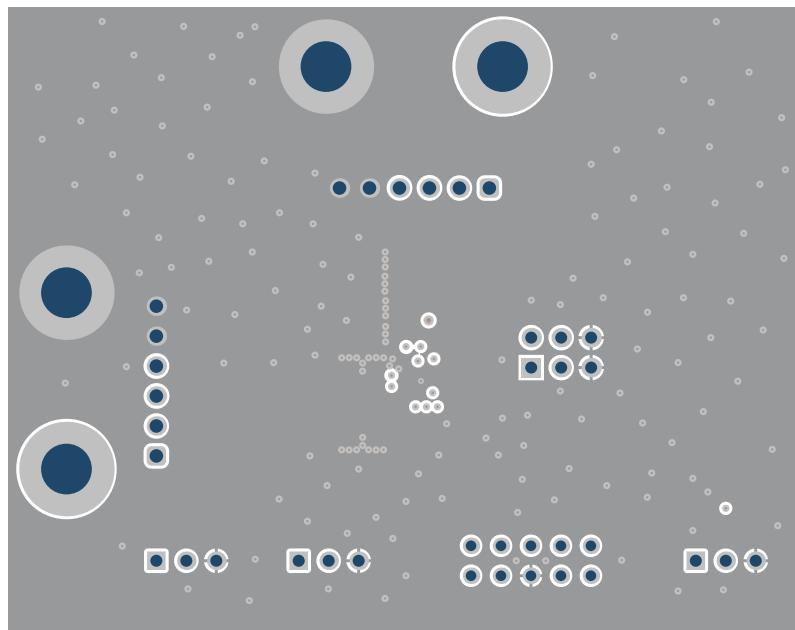


图 3-4. 信号层 1

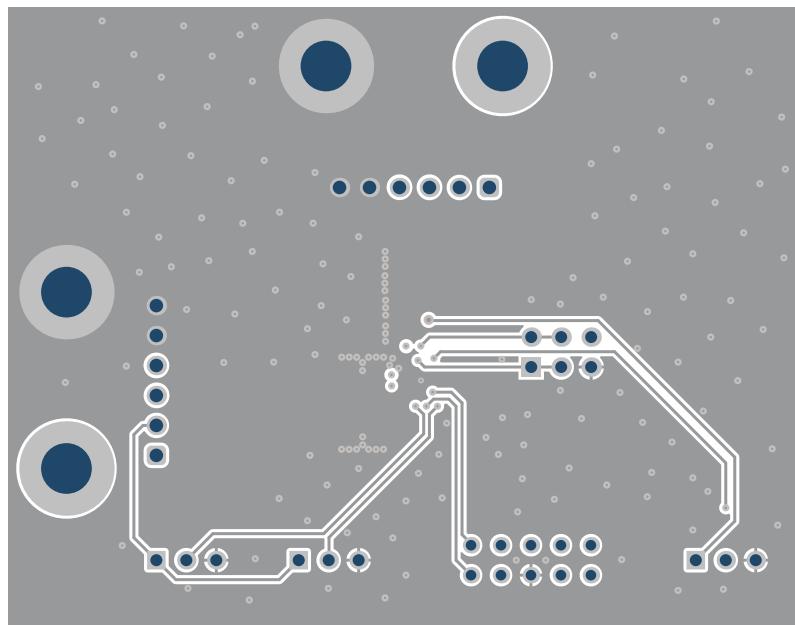


图 3-5. 信号层 2

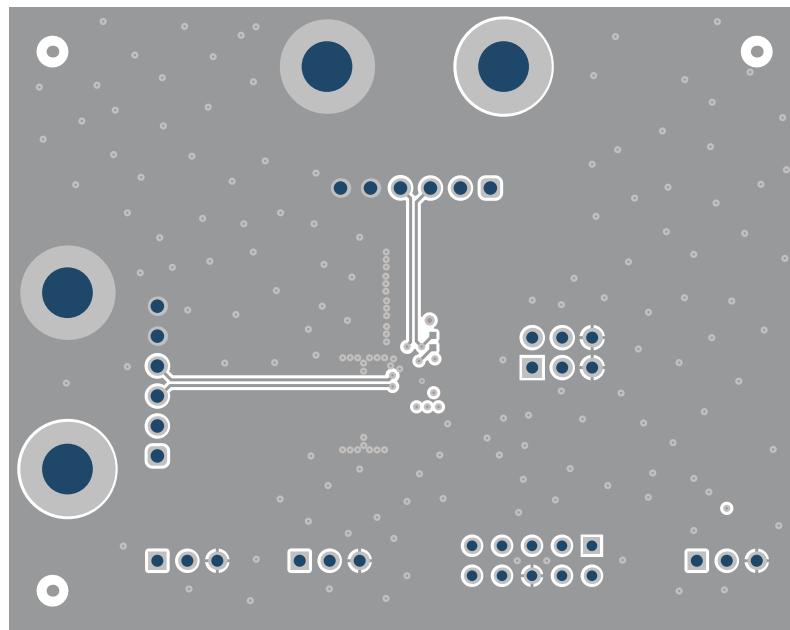


图 3-6. 底层

### 3.3 物料清单 (BOM)

表 3-1 列出了此 EVM 的物料清单。

表 3-1. TPS62A2I4QEVM-156 物料清单

数量	参考位号	值	说明	尺寸	器件型号	制造商
<b>TPS62A2I4QEVM-156</b>						
1	C3	22uF	电容, 陶瓷, 10V, X7R, ±20%	0805	GRM21BZ71A226ME15L	Murata
1	C10、C11	22uF	电容, 陶瓷, 10V, X7R, ±20%	1206	GCM31CR71A226KE02L	Murata
0	C6	100uF	电容, 钽聚合物, 20V, ±20%	7.3×4.3mm	C0402C104K4RACAUTO	Kemet
1	C7	0.1uF	电容, 陶瓷, 16V, X7R, ±10%	0402	C0402C104K4RACAUTO	Kemet
1	C1	470pF	电容, 陶瓷, 50V, ±10%	0402	CGA2B2X7R1H471K050BA	TDK
1	L1	0.47uH	电感, 屏蔽, 14.2A, 0.0039Ω	4040 公制	XGL4030-471MEC	Coilcraft
1	R5、R6	2k	电阻, 贴片, 0.1W, 1%	0402	Std	Std
1	R4	1Meg	电阻, 贴片, 0.063W, 1%	0402	Std	Std
1	R3	100k	电阻, 贴片, 0.0625W, 1%	0402	Std	Std
1	R1	0	电阻器, 贴片	0402	Std	Std
1	U1	TPS62A2I4AQWRZ XRQ1	具有快速瞬态响应的 IC、6V、4A I2C 降压转换器	2.1 × 2.1mm	TPS62A2I4AQWRZXRXQ1	TI

## 4 其他信息

### 4.1 商标

所有商标均为其各自所有者的财产。

## 5 相关文档

[TPS62A2I4-Q1](#) 的产品文件夹中提供了器件的数据表和其他文档。

## STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.
  - 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software
  - 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.

### **WARNING**

**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.

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### 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 isotope 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/lsts/ti\\_ja/general/eStore/notice\\_01.page](http://www.tij.co.jp/lsts/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>

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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2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

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3.3.3 *Notice for EVMs for Power Line Communication:* Please see [http://www.tij.co.jp/lsts/ti\\_ja/general/eStore/notice\\_02.page](http://www.tij.co.jp/lsts/ti_ja/general/eStore/notice_02.page)  
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。<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html>

#### 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.

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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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最后更新日期：2025 年 10 月