EVM User's Guide: TPSM82A824EVM-162 TPSM82A824AEVM-162

TPSM82A824 和 TPSM82A824A 评估模块

说明

TPSM82A824 和 TPSM82A824A 评估模块 (EVM) 旨在帮助用户轻松评估和测试 TPSM82A824 与 TPSM82A824A 降压转换器模块的运行情况和功能。这些 EVM 可将 2.5V 至 5.5V 的输入电压转换为 1.8V 的稳压输出电压，输出电流最高为 4A。

开始使用

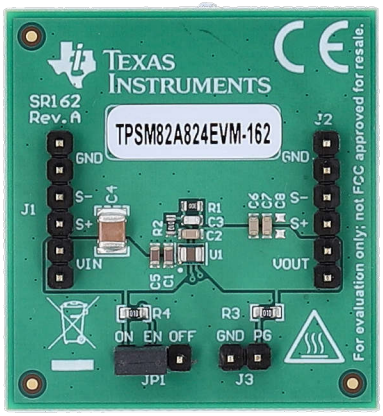
1. 在 ti.com 上订购 EVM
2. 下载数据表
3. 使用数据表调整器件的 BOM，以获得所需的输出电压。

特性

- 效率超过 92%
- 输入电压范围为 2.5V 至 5.5V
- 0.6V 至 VIN 可调节输出电压
- 运行静态电流 26 µA
- 提供强制 PWM 及 PSM 版本
- 100% 占空比，可实现超低压降
- 输出放电
- 电源正常状态输出
- 集成软启动
- 过热保护
- 断续短路保护
- 与 TPSM82821、TPSM82822 和 TPSM82823 引脚及尺寸兼容
- 10 引脚 µSIP，最大高度为 1.2mm

应用

- 光学模块
- 机器视觉
- 工业 PC
- PLC
- 有线网络



1 评估模块概述

1.1 简介

TPSM82A82x 和 TPSM82A82xA 是采用 2mm×2.5mm μSIP 封装的高效同步降压转换器电源模块。该器件系列包含 3A 或 4A 输出电流模块，提供自动省电模式和强制 PWM 模式版本。本用户指南包含以下信息：

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

在本文档中，某些情况下 TPSM82A824EVM-162 是 TPSM82A824EVM-162 (003) 和 TPSM82A824AEVM-162 (004) 的缩写。

1.2 套件内容

表 1-1. TPSM82A824EVM-162 套件内容

条目	说明	数量
TPSM82A824EVM-162	PCB	1

表 1-2. TPSM82A824AEVM-162 套件内容

条目	说明	数量
TPSM82A824AEVM-162	PCB	1

1.3 规格

表 1-3 提供了 TPSM82A824EVM-162 和 TPSM82A824AEVM-162 性能规格的汇总。

表 1-3. 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		2.5	5	5.5	V
输出电压设定点			1.8		V
输出电流	TPSM82A82EVM-162	0		4	A
	TPSM82A824AEVM-162	0		4	A

1.4 器件信息

此 EVM 的 PCB 旨在容纳该集成电路 (IC) 的可调电压版本。在 EVM 上，可以通过使用反馈引脚调整电阻分压器支路来设置所需的输出电压。还可以添加额外的输出电容器。TPSM82A824 在自动 PFM/PWM 模式下运行。在中等负载至重负载电流下，该器件通常以 2.2MHz 频率脉宽调制 (PWM) 模式运行。轻负载条件下，开关频率会降低。TPSM82A824A 以 FPWM 模式运行。在 FPWM 模式下，器件的开关频率通常为 2.2MHz。

2 硬件

本节介绍了如何正确使用 TPSM82A824EVM-162 和 TPSM82A824AEVM-162。

2.1 外部电源或电源配件要求

标称输出电压：2.5 至 5.5 VDC

最大输出电流：4A

效率等级 V

备注

TI 建议使用符合适用地区安全标准（如 UL、CSA、VDE、CCC 和 PSE 等）的外部电源或电源配件。

2.2 设置

要操作 EVM，请在 ON 和 EN 之间设置跳线 JP1 以打开器件，如节 2.3 中所示。将电源连接到输入 J1，将负载连接到 J2。

2.3 输入/输出连接器说明

J1、引脚 1 和引脚 2 – VIN	EVM 输入电源的正输入连接。
J1、引脚 3 和引脚 4 – S+/S –	输入电压感测连接。测量此处的输入电压。
J1，引脚 5 和引脚 6 – GND	从 EVM 输入电源输入返回连接。
J2、引脚 1 和引脚 2 – VOUT	输出电压连接
J2、引脚 3 和引脚 4 – S+/S –	输出电压感测连接。测量此处的输出电压。
J2，引脚 5 和引脚 6 – GND	输出返回连接
J3 – PG/GND	该接头的引脚 1 为 PG 输出，引脚 2 接地。
JP1 – EN	EN 引脚输入跳线。使提供的跳线跨接 ON 和 EN 以开启模块。使跳线跨接 OFF 和 EN 以关断 IC。

2.4 更改

此 EVM 的印刷电路板 (PCB) 旨在适应此器件系列的可调输出电压版本。可通过更换元件来调整输入电容器及前馈电容器。还可以添加额外的输出电容器。TPSM82A824EVM-162 和 TPSM82A824AEVM-162 的电路板布局布线、原理图、物料清单以及设置保持不变。因此，通过更换 IC，任一 EVM 都可用于评估此系列中的任何器件型号。

2.4.1 输入和输出电容器

图 3-1 中的 C4 组装在电路板上，可以降低电路板的输入阻抗并避免在高输出电流条件下出现振荡，但最终应用可能不需要此电容器。

C8 作为输出电容器提供。此电容器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。总输出电容必须保持在数据表中推荐的范围内才能正常运行。

2.4.2 前馈电容器

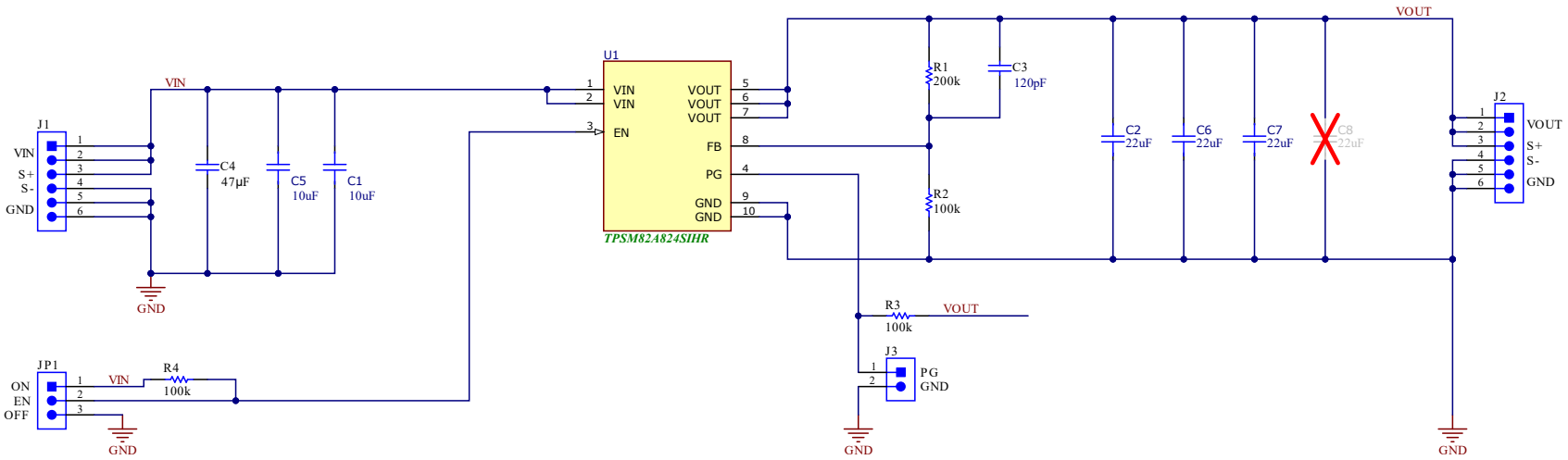
C3 为前馈电容器。该电容器不是正常运行所必需的，但有助于提高负载瞬态性能。该 EVM 组装了一个 120pF 的前馈电容器。TI 建议根据调整后的输出电压检查器件数据表中前馈电容器的要求。

3 硬件设计文件

3.1 原理图

图 3-1 所示为 EVM 原理图。在该子部分中，以 TPSM82A824EVM-162 为例。

- TPSM82A824EVM-162 使用 TPSM82A824 IC。
- TPSM82A824AEVM-162 使用 TPSM82A824A IC。



3.2 PCB 布局

本节的图 3-2 至 图 3-6 提供了 TPSM82A824EVM-162 和 TPSM82A824AEVM-162 电路板布局布线和图示。Gerbers 可在 TPSM82A824EVM-162 产品页面上找到。在该部分中，以 TPSM82A824EVM-162 为例。TPSM82A824AEVM-162 的电路板布局保持不变。TPSM82A824AEVM-162 的 Gerbers 也可在各自的产品页面上找到。

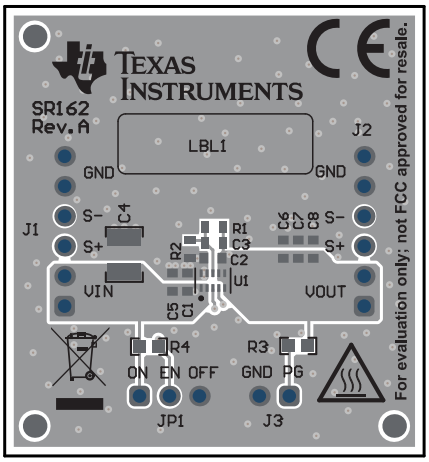


图 3-2. 顶层装配图

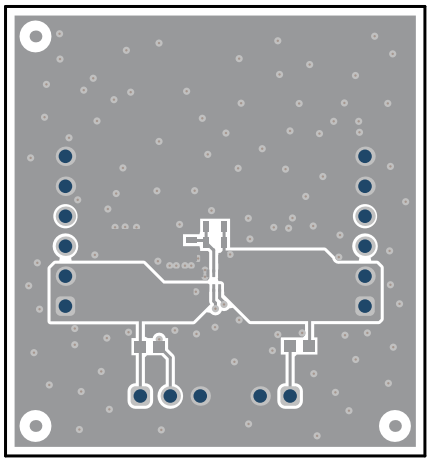


图 3-3. 顶层

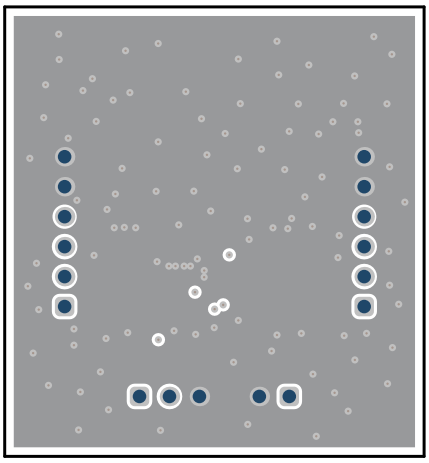


图 3-4. 信号层 1

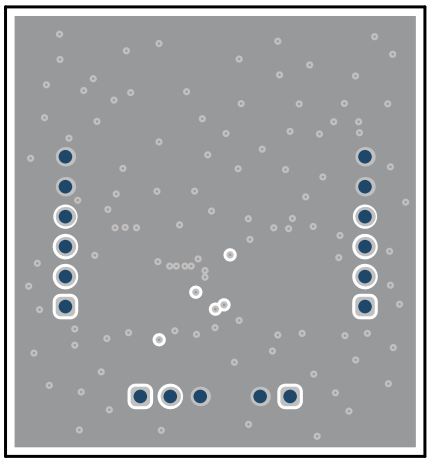


图 3-5. 信号层 2

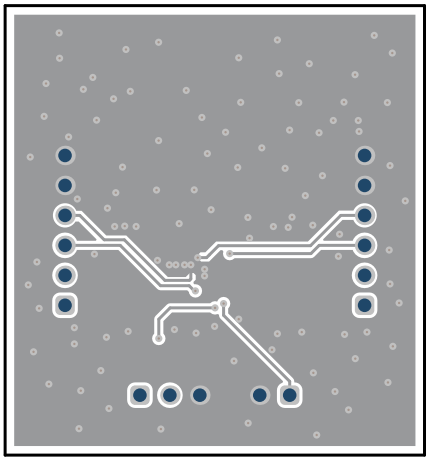


图 3-6. 底层

3.3 物料清单

节 3.3 列出了该 EVM 的物料清单 (BOM)。

表 3-1. TPSM82A824EVM-162 和 TPSM82A824AEVM-162 物料清单

数量		指示符	值	说明	尺寸	器件型号	制造商
-003	-004						
2	2	C1、C5	10μF	电容，陶瓷，10μF，10V，±10%，X7R，0603	0603	GRM188Z71A106KA73D	Murata
3	3	C2、C6、C7	22μF	电容，陶瓷，22μF，6.3V，±20%，X7T，0603	0603	GRM188D70J226ME01D	Murata
1	1	C3	120pF	电容，陶瓷，120pF，50V，±5%，C0G/NP0，0603	0603	06035A121JAT2A	AVX
1	1	C4	47μF	电容，陶瓷，47μF，10V，±20%，X7R，1210	1210	LMK325B7476MM-PR	Taiyo Yuden
1	1	R1	200k	电阻，200k，1%，0.1W，0603	0603	RC0603FR-07200KL	Yageo
3	3	R2、R3、R4	100k	电阻，100k，1%，0.1W，0603	0603	RC0603FR-07100KL	Yageo
1	0	U1		采用 2mm× 2.5mm μSIP 封装且具有自动电源安全模式的 4A 高效降压模块	2mm × 2.5mm	TPSM82A824SIHR	德州仪器 (TI)
0	1	U1		采用 2mm× 2.5mm μSIP 并具有强制 PWM 的 4A 高效降压模块	2mm × 2.5mm	TPSM82A824ASIHR	德州仪器 (TI)

4 安全说明

警告

表面高温。接触可致烫伤。请勿触摸。

5 修订历史记录

注：以前版本的页码可能与当前版本的页码不同

日期	修订版本	注释
2026 年 5 月	*	初始发行版

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 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

3.3 *Japan*

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。

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.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。 技術適合証明を受けていないもののご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
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。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。 日本テキサス・インスツルメンツ株式会社

東京都新宿区西新宿 6 丁目 2 4 番 1 号

西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lsds/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.

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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