

EVM User's Guide: TLIN1124AEVM

TLIN1124A 评估模块



说明

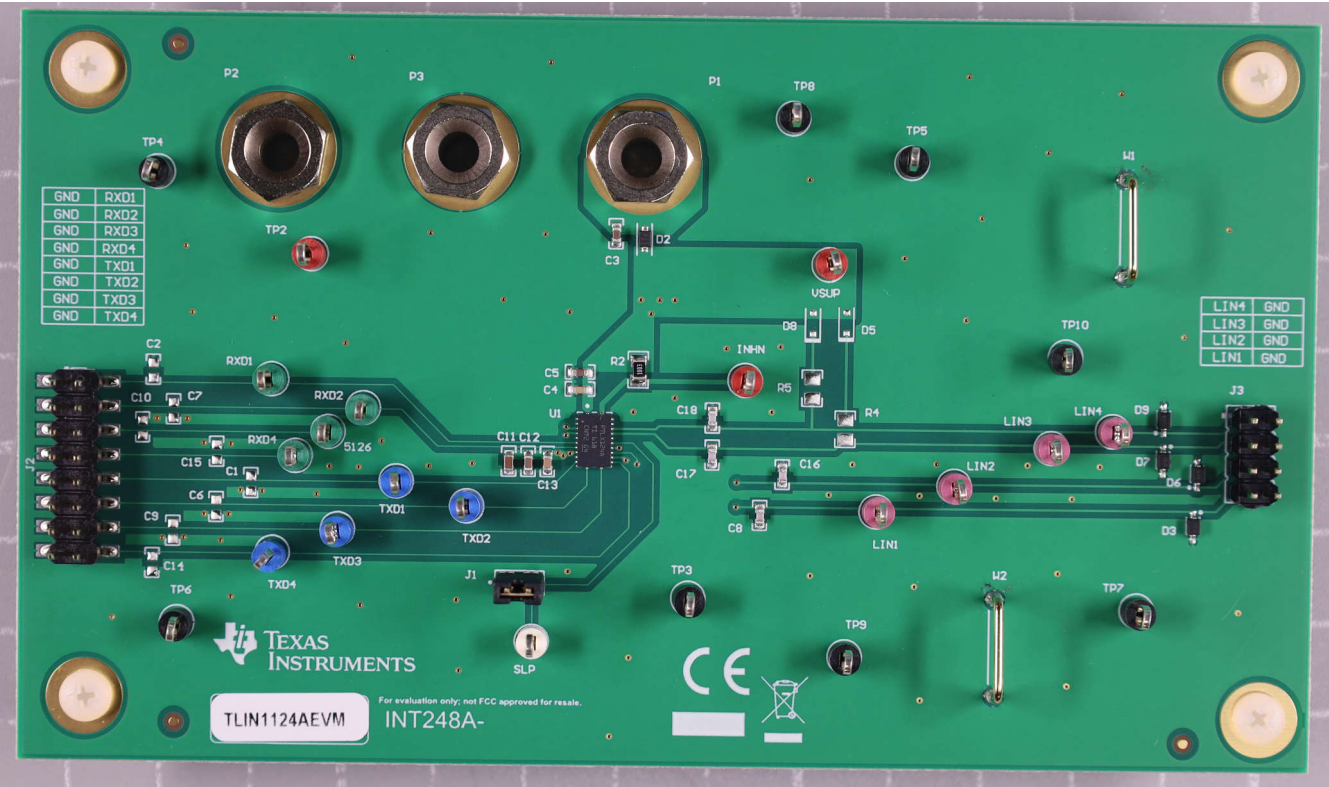
TLIN1124AEVM 为用户提供评估 TI TLIN1124A-Q1 器件的能力。TLIN1124AEVM 配备已组装的 TLIN1124A-Q1 器件，以及连接器和测试点，用于监控和评估与收发器往来的所有引脚和信号。该 EVM 还为四个 LIN 通道的指挥节点上拉提供了引脚布局，同时设有电容滤波和通过保护二极管实现瞬变电压保护的位置。

特性

- 四路 LIN 通道
- 集成端接
- 宽电压工作
- 全面保护
- 轻松连接
- 测试点

应用

- 车身电子装置和照明
- 汽车信息娱乐系统与仪表组
- 混合动力电动汽车和 PowerTrain™ 系统
- 工业运输



TLIN1124AEVM-Q1 PCB

1 评估模块概述

1.1 简介

TLIN1124A-EVM 旨在帮助用户评估 TLIN1124A-Q1 汽车四路本地互连网络 (LIN) 物理层收发器。该 EVM 可轻松访问所有器件引脚，还包含用于全面评估器件特性和性能的必要支持电路。

下文包含有关 EVM 特性的更多信息：

- 四路 LIN 通道 - 评估所有四个独立的 LIN 收发器通道
- 集成终端 - TLIN1124A-Q1 器件上的内置命令器和响应器上拉电阻器，以及每个 LIN 引脚上用于外部上拉网络的封装
- 宽电压工作 - 为每个电压电源提供香蕉插孔连接器
 - VSUP - 5V 至 28V
 - VIO - 2.97V 至 5.5V
- 全面保护 - 所有 LIN 引脚均集成 ESD 保护，并提供用于外部保护二极管和滤波电容的封装
- 轻松连接 - 用于 MCU 接口和 LIN 总线连接的接头
- 测试点 - 适用于所有器件引脚的便捷接入点（可用于测量和调试），以及电路板上的多个接地选项

1.2 套件内容

用于 TLIN1124A-Q1 器件的评估模块

1.3 规格

TI 提供各种 LIN 收发器（单路、双路和四路器件）。这些收发器都能为 VSUP 电源提供宽输入电压范围，该产品组合可提供各种不同的功能，例如本地唤醒、睡眠、待机和正常模式运行、用于系统级电源外部启用的抑制功能、看门狗功能以及中断通知。

该 EVM 支持对 TLIN1124A-Q1 器件的评估。该器件支持用户访问四个不同的 LIN 通道，且由于这些上拉网络已集成到收发器中，因此无需为命令器模式使用外部上拉电路。该器件中包含 INH，用于启用外部电源。与所有其他 TI TLIN 收发器一样，该器件可以使用多种运行模式，包括睡眠模式、待机模式和正常模式。

1.4 器件信息

TLIN1124-Q1 是一款四通道 LIN 收发器，每条通道均具有内置命令器模式上拉网络。有一个模式控制引脚 SLP，该引脚为高电平有效，并会在处于逻辑低电压电平时将器件置于正常模式。提供了两个电源引脚 VSUP 和 VIO，用于启用器件上的所有功能和特性。VSUP 是电池电源电压，而 VIO 是所有逻辑引脚的逻辑电平电压基准：TXD、RXD 和 SLP。

有关 TLIN1124A-Q1 的更多信息，请参阅 [TLIN1124A-Q1 具有集成命令器上拉电阻器和抑制功能的汽车类四路本地互连网络 \(LIN\) 收发器数据表](#)。

2 硬件

2.1 电源要求

TLIN1124A-Q1 上有两个电源：VIO 和 VSUP。

2.1.1 VIO

VIO 是用于转换器件上所有逻辑信号的逻辑电平基准电压。这些信号为 SLP、TXD 和 RXD。建议 VIO 电压范围为 3.0V 至 5.0V

2.1.2 VSUP

VSUP 是 TLIN1124A-Q1 处理器的主电源。使用 VSUP 作为汽车应用的电池电源。如果 VSUP 的供电范围不正确，器件将无法正常工作。建议 VSUP 电压范围为 5.0V 至 28.0V。

2.2 设置

TLIN1124AEVM 开箱即用，但需要一些工具和电源来为 PCB 供电和进行评估。

2.2.1 电源和接地

通过香蕉插孔连接电路板顶部的电源、VIO 和 VSUP 以及 PCB 接地。使用三根香蕉插孔电缆为电路板正确供电：一根用于 VIO，一根用于 VSUP，一根用于接地。有关 VIO 和 VSUP 的建议电压范围，请参阅 [节 2.1](#)。

2.2.2 LIN 通信

四个 LIN 通道中的每一个通道都为所有 TXD、RXD 和 LIN 引脚分配了接头和测试点。有关接头和测试点的具体详细信息，请参阅 [节 2.3](#)。PCB 丝印上也标记了所有测试点。

为了充分使用和评估 LIN 通道，请使用至少 100kHz 和 0V 至 5V 方波的函数发生器。将其连接到四个 TXD 引脚之一。观察相应 LIN 引脚上的输出，确保电压电平在接地和 VSUP 之间摆动。此外，请参阅相应 RXD 引脚上的输出，电压电平在接地端和 VIO 之间摆动。使用一个每分段至少 10V 电压和每分段 50μs 的示波器。

在尝试评估 LIN 通信之前，请验证 SLP 引脚是否处于逻辑低电平状态。这会将收发器置于启用 LIN 通信的正常模式。如果一个波形在 TXD 上置位且相应的 LIN 引脚未响应或处于接地电平，则器件未处于正常模式。这意味着 SLP 引脚置为高电平；在运行任何 LIN 通道之前，请验证 SLP 引脚的状态。

2.3 接头和跳线信息

[表 2-1](#) 展示了 EVM 上的所有连接器、测试点和夹子，并附有功能说明。

表 2-1. 接头和跳线硬件信息

连接	类型	说明
J1	2 引脚插头	与 SLP 引脚的连接 已组装分流器：器件处于正常模式 未组装分流器：器件处于睡眠模式
J2	2 个 8 引脚接头	所有奇数引脚都接地，偶数引脚为 RXD 和 TXD 连接： 2 - RXD1，4 - RXD2，6 - RXD3，8 - RXD4，10 - TXD1，12 - TXD2，14 - TXD3，16 - TXD4
J3	2 个 4 引脚接头	所有偶数引脚都接地，奇数引脚都是 LIN 总线连接： 1 - LIN4，2 - LIN3，3 - LIN2，4 - LIN1
P1	香蕉插孔	VSUP 电源
P2	香蕉插孔	VIO 电源
P3	香蕉插孔	EVM 的接地连接
TP1	测试点	VSUP 测试点
TP2	测试点	VIO 测试点
TP3 - TP10	测试点	接地连接测试点
TP11	测试点	SLP 测试点
TP12	测试点	INHN 测试点

表 2-1. 接头和跳线硬件信息 (续)

连接	类型	说明
TP13 - TP16	测试点	TXD 测试点：TP13 - TXD1，TP14 - TXD2，TP15 - TXD3，TP16 - TXD4
TP17 - TP20	测试点	RXD 测试点：TP17 - RXD1，TP18 - RXD2，TP19 - RXD3，TP20 - RXD4
TP21 - TP24	测试点	LIN 测试点：TP21 - LIN1，TP22 - LIN2，TP23 - LIN3，TP24 - LIN4
W1 和 W2	接地线夹	用于额外接地连接的夹子

3 硬件设计文件

3.1 原理图

图 3-1 显示了 EVM 原理图。

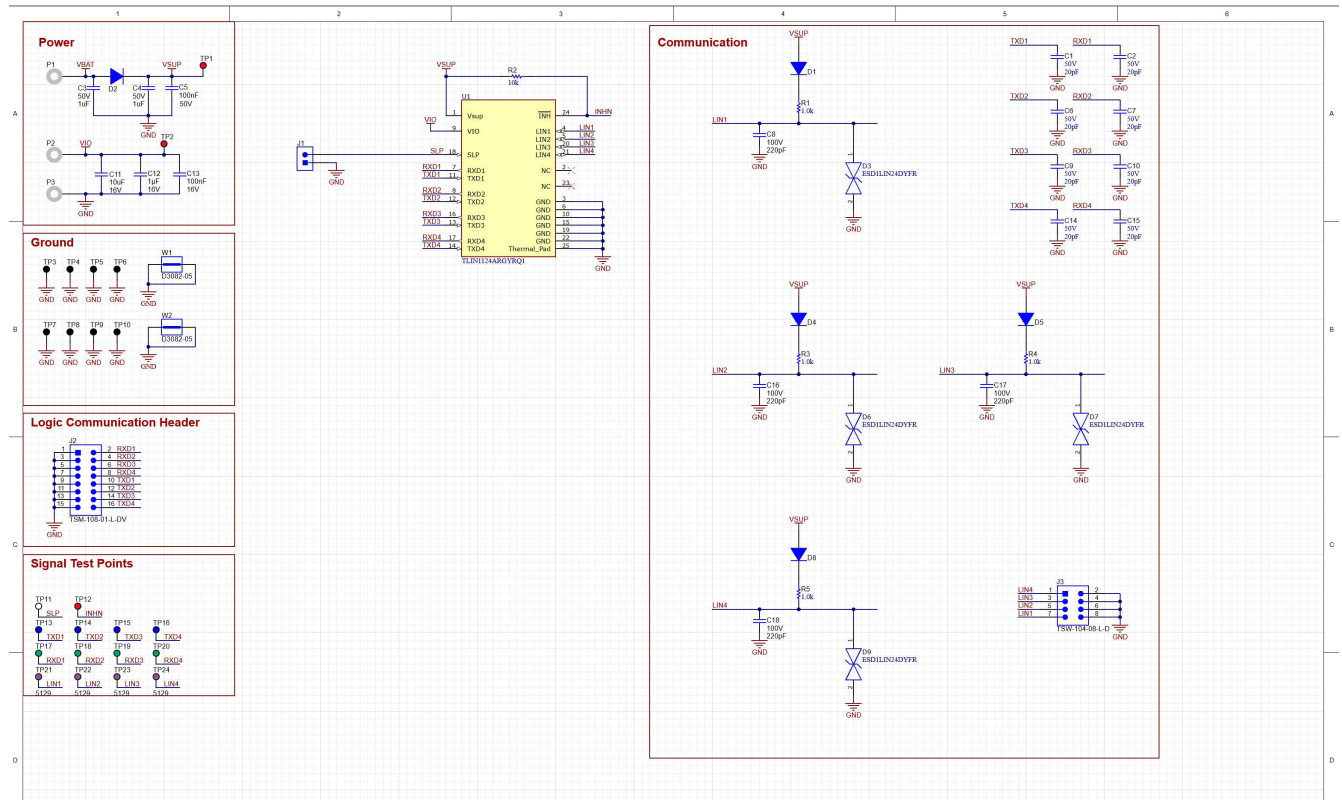


图 3-1. TLIN1124AEVM 原理图

3.2 PCB 布局

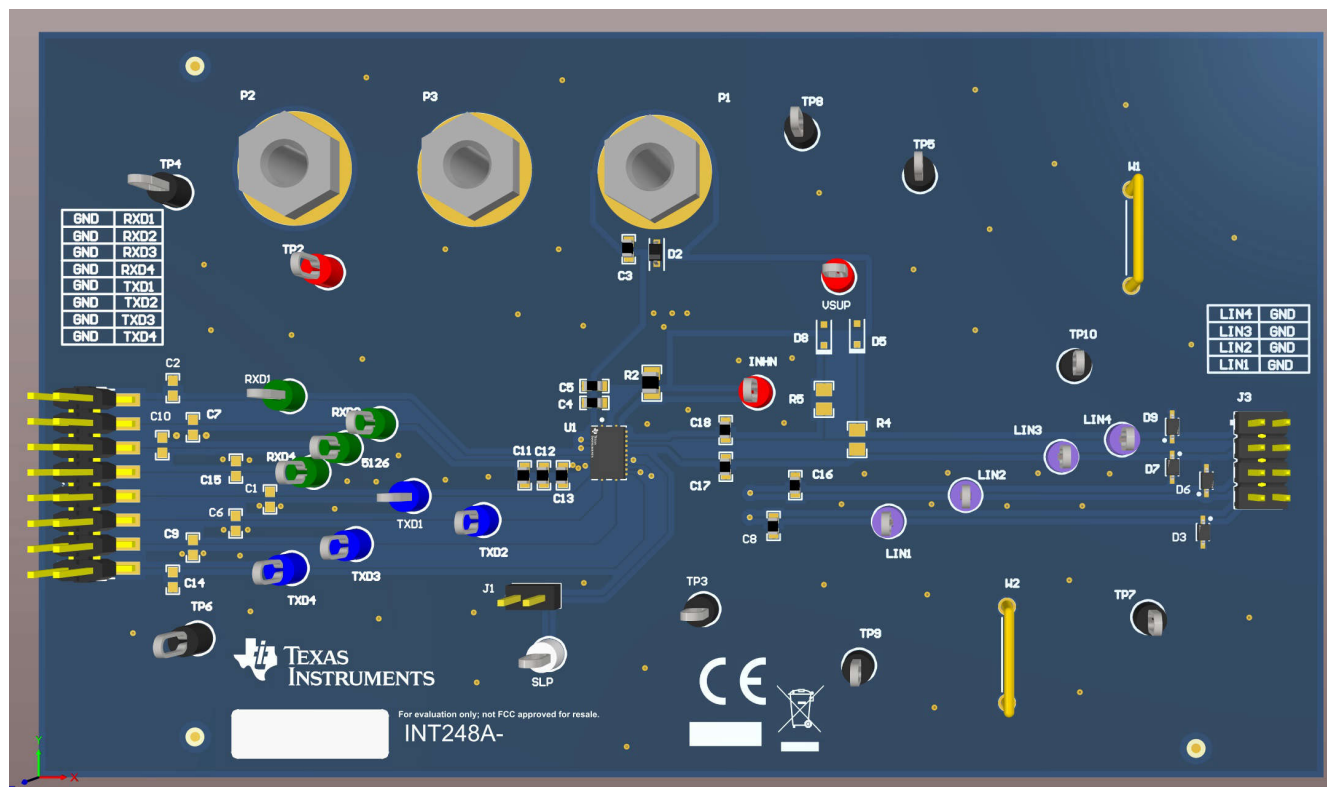


图 3-2. TLIN1124AEVM 布局 (顶部)

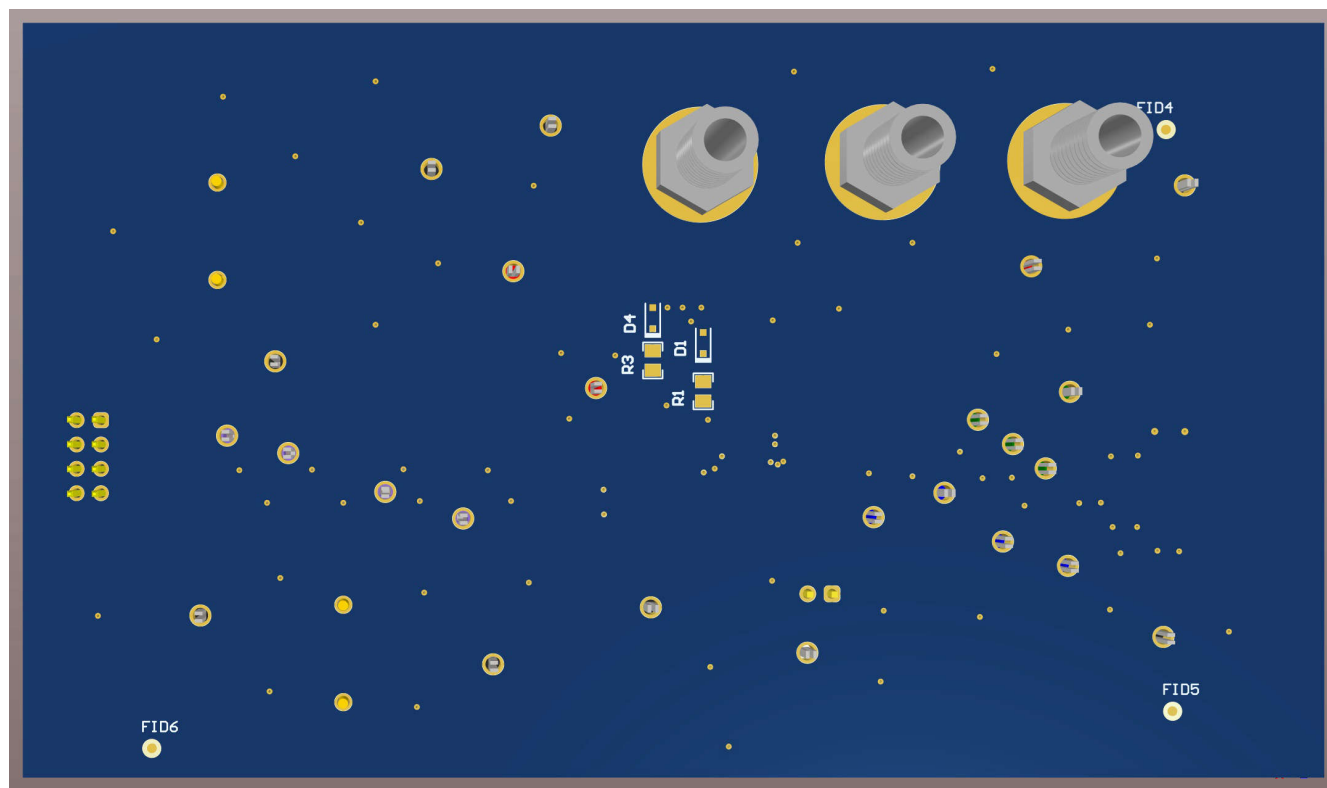


图 3-3. TLIN1124AEVM 布局 (底部)

3.3 物料清单 (BOM)

位号	数量	值	说明	封装参考	器件型号	制造商
C3、C4	2	1uF	电容, 陶瓷, 1μF, 50V, +/-10%, X7R, 0603	603	UMK107AB7105K A-T	Taiyo Yuden
C5	1	0.1uF	电容, 陶瓷, 0.1μF, 50V, +/-10%, X7R, 0603	603	GRM188R71H104 KA93D	MuRata
C8、C16、C17、 C18	4	220pF	电容, 陶瓷, 220pF, 100V, +/-10%, X7R, 0603	603	06031C221KAT2A	AVX
C11	1	10uF	电容, 陶瓷, 10μF, 16V, +/-20%, X5R, 0603	603	GRM188R61C106 MAALD	MuRata
C12	1	1uF	电容, 陶瓷, 1μF, 16V, +/-10%, X7R, 0603	603	C1608X7R1C105 K080AC	TDK
C13	1	0.1uF	电容, 陶瓷, 1μF, 16V, +/-10%, X7R, AEC-Q200 0.1 级, 0603	603	0603YC104K4T4A	AVX
D2	1	75V	二极管, 开关, 75V, 0.15A, AEC-Q101, SOD-323	SOD-323	1N4148WS-7-F	Diodes Inc.
D3、D6、D7、D9	4		24V 单通道 ESD 保护二极管	SOD323	ESD1LIN24DYFR	德州仪器 (TI)
H1、H2、H3、H4	4		机械螺钉, 圆头, #4-40 x 1/4, 尼 龙, 飞利浦盘形头	螺钉	NY PMS 440 0025 PH	B&F Fastener Supply
H5、H6、H7、H8	4		六角螺柱, 0.5"L #4-40, 尼龙	螺柱	1902C	Keystone
J1	1		接头, 100mil, 2x1, 金, TH	2x1 接头	TSW-102-07-G-S	Samtec
J2	1		接头, 2.54mm, 8x2, 金, SMT	接头, 2.54mm, 8x2, SMT	TSM-108-01-L-DV	Samtec
J3	1		接头, 2.54mm, 4x2, 金, TH	接头, 2.54mm, 4x2, TH	TSW-104-08-L-D	Samtec
P1、P2、P3	3		标准香蕉插孔, 非 绝缘, 15A	香蕉插孔	108-0740-001	Cinch Connectivity

位号	数量	值	说明	封装参考	器件型号	制造商
R2	1	100k	电阻, 100k, 1%, 0.125W, AEC-Q200 0 级, 0805	805	CRCW0805100KF KEA	Vishay-Dale
TP1、TP2、TP12	3		测试点, 多用途, 红色, TH	红色通用测试点	5010	Keystone
TP3、TP4、TP5、TP6、TP7、TP8、TP9、TP10	8		测试点, 多用途, 黑色, TH	黑色通用测试点	5011	Keystone
TP11	1		测试点, 通用, 白色, TH	白色通用测试点	5012	Keystone
TP13、TP14、TP15、TP16	4		测试点, 通用, 蓝色, TH	蓝色多用途测试点	5127	Keystone
TP17、TP18、TP19、TP20	4		测试点, 通用, 绿色, TH	绿色通用测试点	5126	Keystone
TP21、TP22、TP23、TP24	4		测试点, 通用, 紫色, TH	紫色通用测试点	5129	Keystone Electronics
U1	1		汽车四路本地互联网络 (LIN) 收发器, 集成了命令器上拉电阻器和禁止功能	VQFN24	TLIN1124ARGYR Q1	德州仪器 (TI)
W1、W2	2		1mm 非绝缘短路插头, 10.16mm 间距, TH	短路插头, 10.16mm 间距, TH	D3082-05	Harwin

4 其他信息

4.1 商标

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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.

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/sds/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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西新宿三井ビル

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

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.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

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