

EVM User's Guide: AMC-AMP-200APK-EVM

AMC-AMP-200APK-EVM



1 说明

AMC-AMP-200A-EVM 是一款用于 $\pm 200\text{A}$ 分流式电流检测的隔离式电流检测评估模块。该 EVM 可让用户通过外部分流电阻器检测不超过 $\pm 500\text{A}$ 的峰值电流，同时可通过 AMC3302 隔离屏障测量隔离输出。

AMC3302 是一款精密的隔离式放大器，针对基于分流器的电流测量进行优化，能够与 $100\mu\Omega$ 分流电阻器配合使用。该 EVM 采用过孔拼接工艺，有助于在大电流条件下散热，能够在 $\pm 1\%$ （典型值）的精度范围内执行检测。

开始使用

1. 从 ti.com 订购 AMC-AMP-200APK-EVM
2. 在工作台上评估 AMC3302 性能。

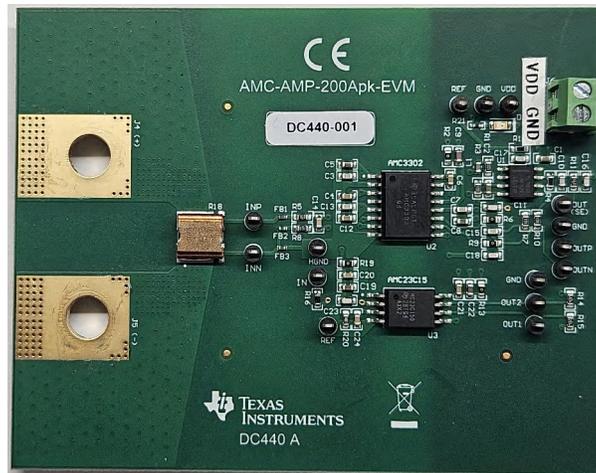
2 特性

- $\pm 200\text{A}$ 隔离式电流检测

- $100\mu\Omega$ 分流电阻器
- 接线片连接兼容性
- 散热设计为可在自由空气环境下承受最高 120°C 的温度，持续 20 分钟
- 便于评估的测试点
- 差分到单端信号链

3 应用

- 电机驱动器
- 电力输送
- 车载充电器 (OBC)
- 牵引逆变器
- 直流/直流转换器
- 能量存储系统 (ESS)
- 电动汽车充电
- 光伏逆变器



4 评估模块概述

4.1 简介

本文档中的缩写词 **EVM** 和术语评估模块与 **AMC-AMP-200APK-EVM** 具有相同的含义。本文档介绍了 **EVM** 的设置和评估方法、印刷电路板 (PCB) 布局、原理图以及物料清单 (BOM)。

4.2 套件内容

EVM 套件包含一个印刷电路板，并安装了评估 **AMC3302** 和 **AMC23C15** 所需的所有元件。

4.3 规格

AMC-AMP-200APK-EVM 能够评估高达 $\pm 200\text{A}$ 的连续高电流或 $\pm 500\text{A}$ 脉冲电流。有关详细的器件规格，请参阅 **AMC3302**、**AMC23C15** 和 **TLV9002IDR** 的数据表。

4.4 器件信息

AMC-AMP-200APK-EVM 旨在为大型电流应用场景实现易用性和高精度方面的需求。电流检测器件 **AMC3302** 是一款隔离式放大器，用于具有增强型隔离和集成式直流/直流转换器的分流式电流检测。过流检测可使用 **AMC23C15** (增强型可调阈值隔离式比较器) 进行配置。两种隔离式电流检测产品都可以在两个并联安装的 $200\mu\Omega$ 分流电阻器上进行检测。

5 硬件

本节总结了 AMC-AMP-200APK-EVM 元件、组装说明、接口、电源要求和测试点信息。

5.1 电源要求

AMC-AMP-200APK-EVM 需要在 3.3V 至 5V 电源下运行。提供了 J6，以允许用户将外部工作台电源连接到 EVM，从而为 AMC3302 和 AMC23C15 的低侧供电。AMC3302 具有高侧 LDO 输出，用于为 AMC23C15 双路窗口比较器的高侧供电。

5.2 设置

EVM 的初始设置很简单，只需将 3.3V 至 5V 工作台电源连接到 J6，即可为 EVM 供电。有两个大焊盘 J4 和 J5，用于将用户提供的电流源连接到 EVM。该 EVM 具有 6 层 4 盎司铜，这有助于在不使用散热器的情况下耗散并联分流电阻器产生的功率。

将电流源端子连接到 J4 及 J5 焊盘时使用共感应。压接或机械接线片可以与评估板配合使用。PCB 使用 ¼ 英寸通孔，设计用于与 ¼ “-20 螺栓和六角螺母配合使用。典型的 200A 连接使用 2/0 AWG 导线，需要 16 至 23 英尺磅的扭矩。使用 EVM 时监测 PCB 温度，不要让温度长时间超过 170°C。

5.3 测试点

以下部分详细介绍了 AMC-AMP-200APK-EVM 上各种测试点。

5.3.1 模拟输入

可以通过标记为“INP”和“INN”的测试点在 EVM 的高侧监测 AMC3302 的模拟输入。这两个测试点直接连接到来自分流电阻器 R17 及 R18 的开尔文检测线路。模拟输入随后会经过由 R5、R8 和 C14 构成的差分低通滤波器，然后馈送到 AMC3302 的引脚 6 和 7。

AMC23C15 双窗口比较器的模拟输入可以测试点“REF”为基准的测试点“IN”处进行监控，该测试点位于 R16（用于设置可变输入电流的电阻器）下方。

输入电源电压可在位于 J6 左侧的测试点“VDD”和“GND”处进行监测。

5.3.2 模拟输出

可以使用标记为“OUTP”和“OUTN”的测试点直接监控 AMC3302 的模拟输出，这些测试点通过零欧姆电阻器 R6 和 R9 直接连接到 AMC3302 的引脚 11 和 10。在使用 U1（TLV9002 双通道放大器）进行差分至单端转换之前，电阻器 R6 和 R9 以及可选电容器 C15 在 AMC3302 的输出端形成一个低通差分滤波器。

当以“GND”测试点为基准时，可以直接在标记为“OUT1”和“OUT2”的测试点监测 AMC23C15 比较器的输出。

5.4 注意事项和警告

如果 AMC-AMP-200APK-EVM 连接到交流电源，则存在暴露于高电压的风险。执行通电测试时，建议使用个人防护装备 (PPE)，如橡胶绝缘手套、电气危害防护鞋和护目镜。TI 建议使用带有保护安全外壳的 EVM，以在外壳打开时禁用高压电位。

警告



表面高温！接触会导致烫伤。请勿触摸。操作时请采取适当的预防措施。

小心



高压！将电路板连接到带电的导线时可能会发生电击。电路板应由专业人员小心处理。为安全起见，强烈建议使用具有过压或过流保护功能的隔离式测试设备。

6 实现结果

6.1 评估设置

AMC-AMP-200APK-EVM 旨在长时间连续处理 200A 电流，而不会超过 PCB 上所装分流电阻器的额定温度。图 6-1 示出了运行 20 分钟、200A 连续电流流经分流器时 115°C 的峰值温度。



图 6-1. AMC-AMP-200APK-EVM 的热像图

6.2 性能数据和结果

下图示出了 0A 至 200A 范围内的百分比误差。红色迹线表示未校准结果。黄色迹线表示偏移校准结果。绿色迹线表示增益及失调电压校准后的结果。

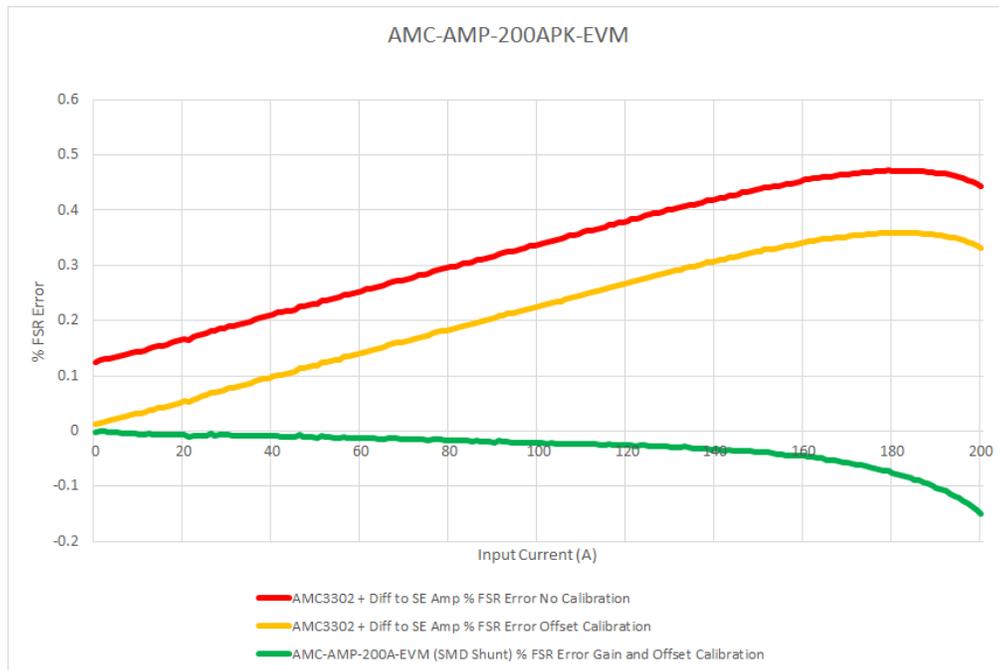
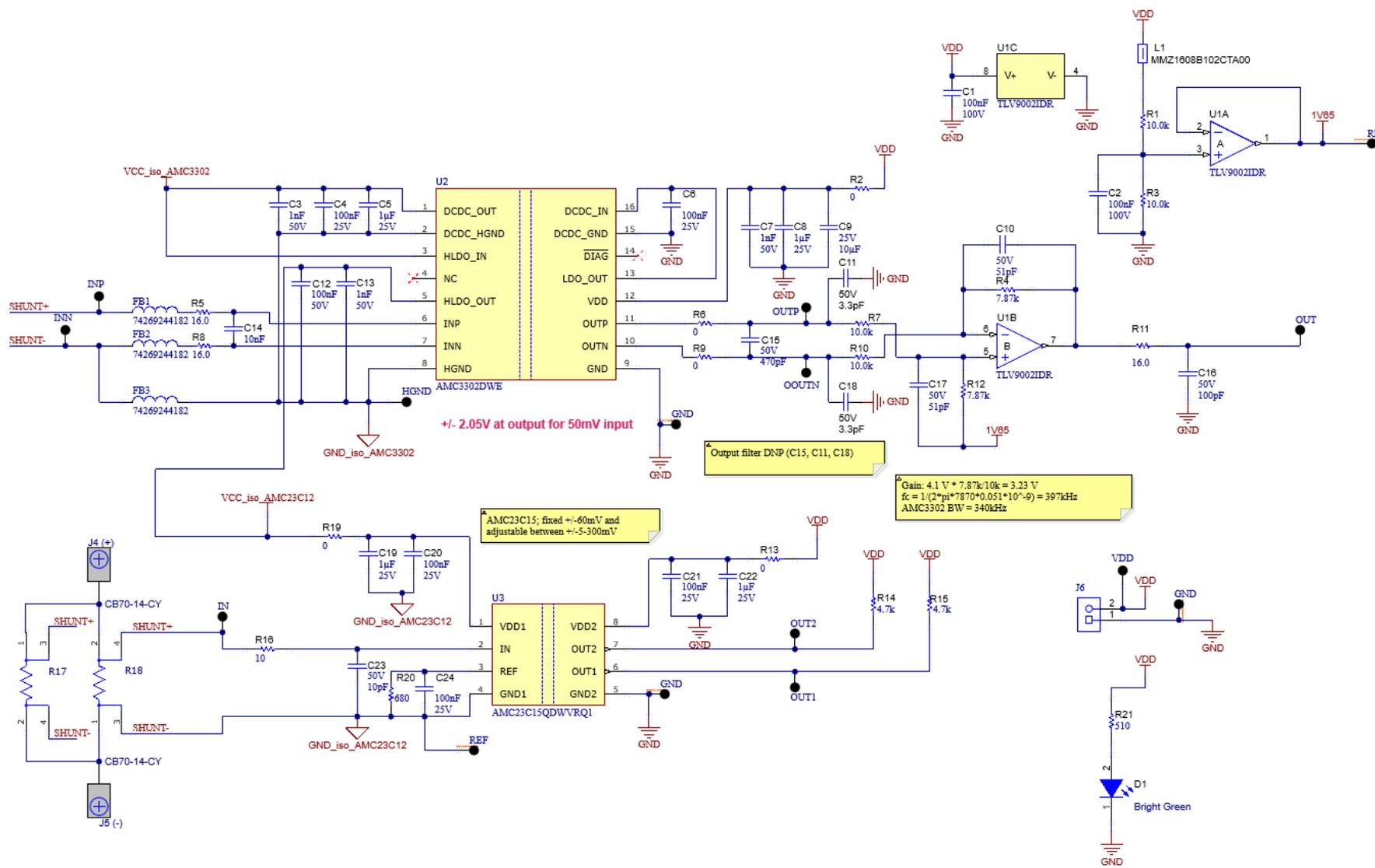


图 6-2. 百分比误差

7 硬件设计文件

7.1 原理图

下图为 AMC-AMP-200APK-EVM 的整体电路原理图。



7.2 PCB 布局

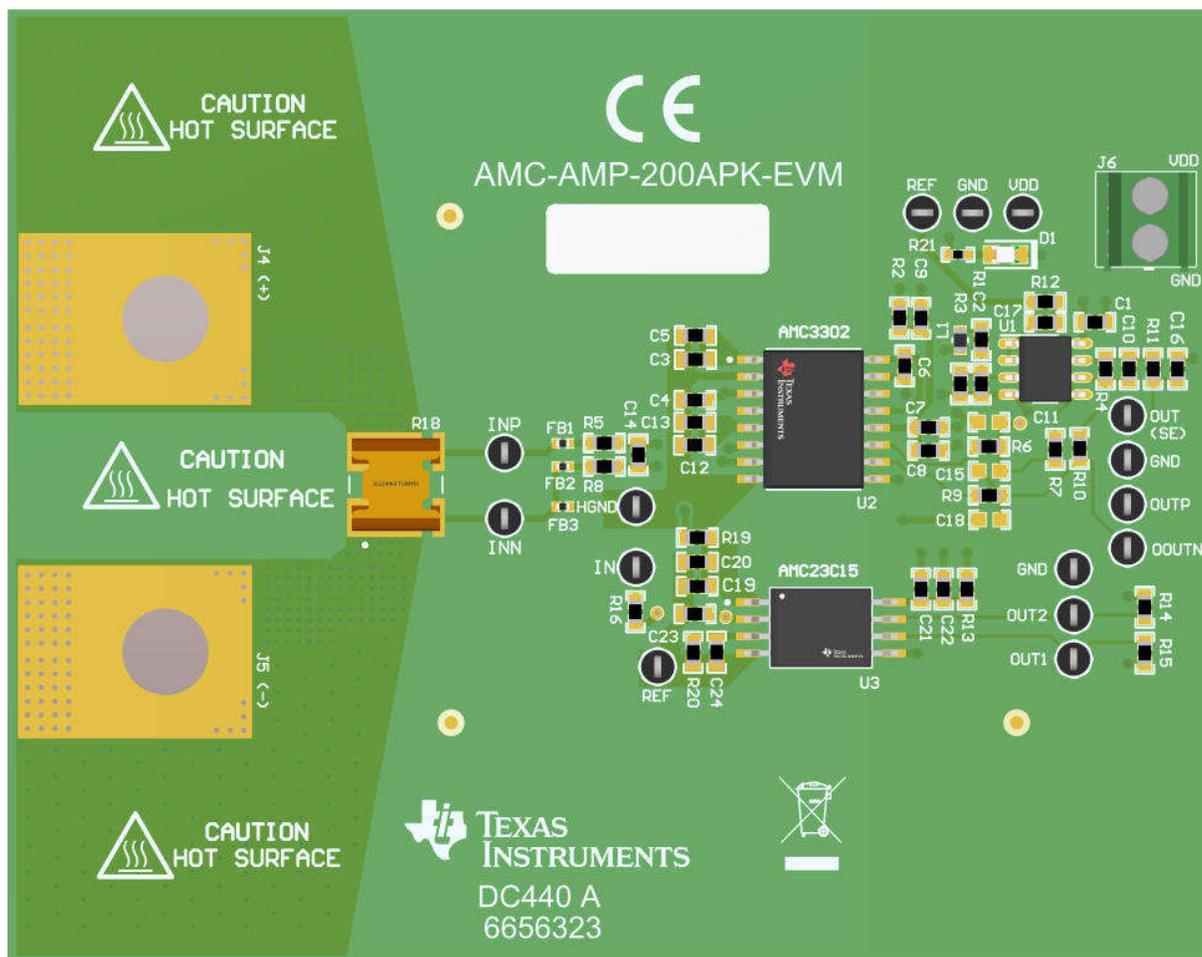


图 7-1. 顶部 EVM 布局

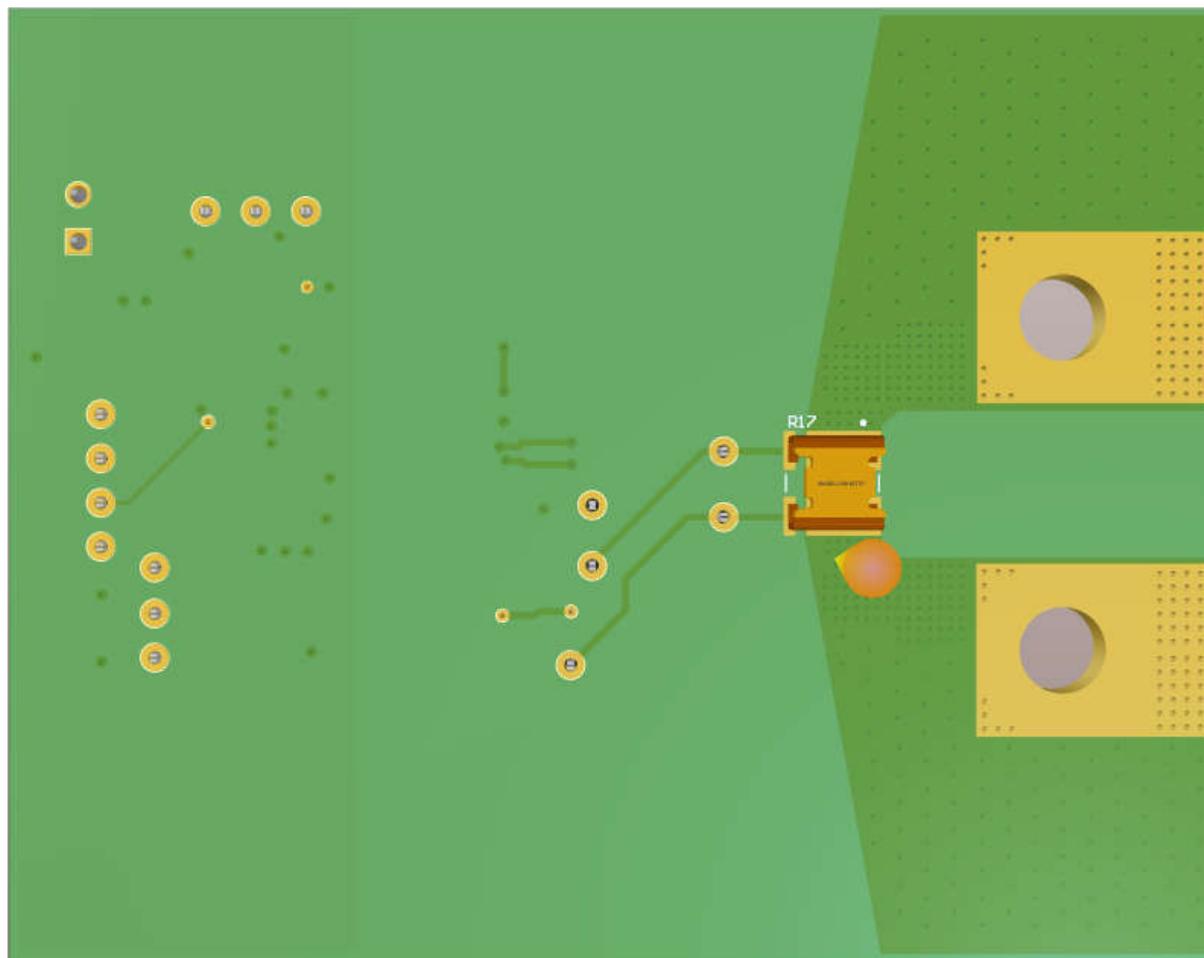


图 7-2. 底层布局

7.3 物料清单 (BOM)

下表显示了完整物料清单。

指示符	说明	制造商	器件型号
FB1、FB2、FB3	WE-TMSB 微型多层抑制磁珠，尺寸 0402，1800Ohm，0.21A	Würth Elektronik	74269244182
C1、C2	电容，陶瓷，0.1μF，100V，+/-10%，X7R，0603	MuRata	GRM188R72A104KA35J
C3、C7、C13	电容，陶瓷，1000pF，50V，+/-10%，X7R，0603	Kemet	C0603C102K5RACTU
C4、C6、C20、C21、C24	电容，陶瓷，0.1μF，25V，+/-10%，X7R，0603	AVX	06033C104KAT2A
C5、C8	电容，陶瓷，1μF，25V，+/-10%，X7R，AEC-Q200 1级，0603	TDK	CGA3E1X7R1E105K080A C
C9	电容，陶瓷，10μF，25V，+/- 10%，X5R，0603	MuRata	GRM188R61E106KA73D
C10、C17	电容，陶瓷，51pF，50V，+/-5%，C0G/NP0，AEC-Q200 1级，0603	MuRata	GCM1885C1H510JA16D
C11、C18	电容，陶瓷，3.3pF，50V，+/- 8%，C0G/NP0，0603	AVX	06035A3R3CAT2A
C12	电容，陶瓷，1μF，50V，+/-10%，X7R，AEC-Q200 0.1级，0603	Kemet	C0603C104K5RACAUTO
C14	电容，陶瓷，0.01μF，16V，+/- 10%，X7R，0603	Kemet	C0603C103K4RACTU
C15	电容，陶瓷，470pF，50V，+/-5%，C0G/NP0，0603	MuRata	GRM1885C1H471JA01D
C16	电容，陶瓷，100pF，50V，+/-1%，C0G/NP0，0603	Kemet	C0603C101F5GACTU
C19、C22	电容，陶瓷，1μF，25V，+/-10%，X7R，0603	AVX	06033C105KAT2A
C23	电容，陶瓷，10pF，50V，+/-5%，C0G/NP0，0603	Kemet	C0603C100J5GACTU
D1	LED，亮绿色，SMD	Würth Elektronik	150080VS75000
GND、HGND、IN、INN、INP、OUT、OUT1、OUT2、OUTN、OUTP、REF、VDD	测试点，微型，黑色，TH	Keystone Electronics	5001
J6	端子块，3.5mm，2x1，锡，TH	Würth Elektronik	691214110002
L1	铁氧体磁珠，1000ohm（在 100MHz 时），0.3A，0603	TDK	MMZ1608B102CTA00
R1、R3、R7、R10	电阻，10.0k，0.1%，0.1W，0603	Yageo America	RT0603BRD0710KL
R2、R6、R9、R13、R19	电阻，0，5%，0.1W，0603	Yageo	RC0603JR-070RL
R4、R12	电阻，7.87k，0.1%，0.1W，0603	Yageo America	RT0603BRD077K87L
R5、R8、R11	电阻，16.0，0.5%，0.1W，0603	Yageo America	RT0603DRE0716RL
R14、R15	电阻，4.7k，5%，0.1W，0603	Yageo	RC0603JR-074K7L
R16	电阻，10，5%，0.1W，AEC-Q200 0级，0603	Vishay-Dale	CRCW060310R0JNEA
R17、R18	适用于混合动力应用的 ISA-WELD 精密电阻器电流传感器	Isabellenhütte	BVB-Z-R0002-1.0
R20	电阻，680，1%，0.1W，0603	Yageo	RC0603FR-07680RL
R21	电阻，510，5%，0.1W，AEC-Q200 0级，0402	Panasonic	ERJ-2GEJ511X
U1	适用于成本优化型系统的 2 通道、1MHz、RRIO、1.8V 至 5.5V 运算放大器，D0008A (SOIC-8)	德州仪器 (TI)	TLV9002IDR
U2	具有集成式直流/直流转换器的 ±50mV 输入、增强型隔离式高精度放大器	德州仪器 (TI)	AMC3302DWE
U3	具有可调节阈值的双路、快速响应、增强型隔离式窗口比较器，SOICW8	德州仪器 (TI)	AMC23C15QDWVRQ1

8 其他信息

8.1 商标

所有商标均为其各自所有者的财产。

9 参考资料

若需 EMI 性能、执行差分至单端转换的其他信息，或要详细了解 TI 隔离放大器相关精度的信息，请查看以下应用手册。

1. 德州仪器 (TI), [衰减 AMC3301 系列辐射发射 EMI 的优秀实践](#)
2. 德州仪器 (TI), [将差分输出 \(隔离式\) 放大器连接到单端输入 ADC 应用简报](#)
3. 德州仪器 (TI), [隔离放大器电压检测 Excel 计算器](#) 工具

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/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>

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/lstds/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.
 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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8. *Limitations on Damages and Liability:*

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9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

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