

EVM User's Guide: TPS62A2I4QEVM-156

TPS62A2I4-Q1 降圧コンバータの評価基板



説明

TPS62A2I4QEVM-156 は、高効率と小型の設計サイズ向けに最適化された I2C 車載対応、同期降圧 (バック) コンバータの TPS62A2IXQ デバイス ファミリー向けの評価ボードです。TPS62A2I4QEVM-156 は、最大 4A の出力電流を供給します。

- 0.4V~3.6V の可変出力電圧範囲
- 静止電流: 33 μ A (最大値)
- 出力電圧精度 0.8% (-40°C~150°C)
- スイッチング周波数: 1.5MHz~4MHz
- パワー セーブ モードまたは PWM オプションが利用可能
- I2C 互換インターフェイス: 最高 1MHz

設計を開始

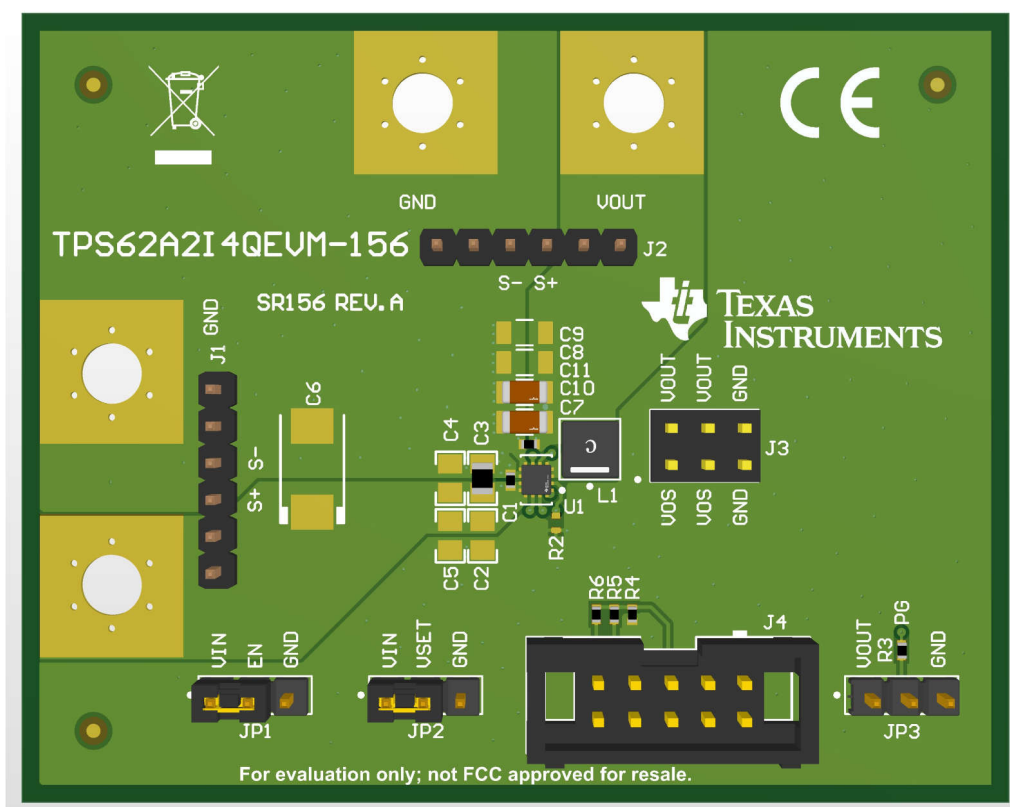
1. [ti.com](https://www.ti.com) で評価基板を注文します。
2. [ti.com](https://www.ti.com) 上のデータシートをダウンロードします。
3. データシートを使用して、目的とする出力電圧に応じてデバイスの部品表 (BOM) を調整してください。

アプリケーション

- フロント カメラ
- サラウンド ビュー システムの ECU
- 車載対応、クラスA ディスプレイ

特長

- 入力電圧範囲: 2.75V ~ 6V



TPS62A2I4QEVM-156

1 評価基板の概要

1.1 はじめに

これらの評価基板は、TPS62A2I1-Q1、TPS62A2I2-Q1、TPS62A2I3-Q1、および TPS62A2I4-Q1 という降圧コンバータの動作と機能を、ユーザーが容易に評価およびテストできる設計を採用しています。評価基板は、2.75V ~ 6V の入力電圧を 0.75V のレギュレーション済み出力電圧に変換し、最大 4A の出力電流を供給します。このユーザー ガイドでは、TI の TPS62A2I1-Q1、TPS62A2I2-Q1、TPS62A2I3-Q1、および TPS62A2I4-Q1 評価基板 (EVM) の特性、動作、使用方法について説明しています。このドキュメントには、以下のセットアップ手順が含まれています。

- ハードウェア
- プリント基板 (PCB) レイアウト
- 回路図
- 部品表 (BOM)

TPS62A2I4QEVM-156 は、TPS62A2I4AQWRZXRQ1 IC をオンボード搭載しています。この評価基板は、1A、2A、3A の各バリエーションでも有効です。IC を変更する必要があるのは、オンボードのみです。

1.2 キットの内容

表 1-1. TPS62A2I4QEVM-156 キットの内容

項目	説明	数量
TPS62A2I4QEVM-156	PCB	1

1.3 仕様

表 1-2. 性能仕様の概要

仕様	テスト条件	最小値	標準値	最大値	単位
入力電圧		2.75		6	V
出力電圧			0.75		V
出力電流	TPS62A2I4QEVM-156	0		4	A

1.4 製品情報

この評価基板の PCB は、IC TPS62A204Q の I2C バージョンに対応するよう設計されています。

- オンボードの IC のデフォルトの出力電圧は、0.75V です。I2C インターフェイスを使用して、他の電圧を設定することができます。
- C4、C5、C8、または C9 に入力および出力コンデンサを追加できます。
- この評価基板上で、I2C インターフェイス経由によるデバイスとの通信で、目的とする出力電圧、モード、ソフトスタート時間、スペクトラム拡散、およびスイッチング周波数を調整することができます。
- この TPS62A2I4Q というデバイスには、16 の補償設定があります。利用可能な補償は、I2C インターフェイスを使用して選択できます。

2 ハードウェア

2.1 構成

このセクションでは、TPS62A2I4QEVMM-156 の適切な使用方法について説明します。

2.1.1 コネクタの説明

J1、ピン 1 および 2 – VIN	評価基板の入力電源からの正の入力電圧接続
J1、ピン 3 および 4 – S+/S–	入力電圧センス接続。このポイントの入力電圧を測定します
J1、ピン 5 および 6 – GND	評価基板の入力電源からの入力リターン接続
J2、ピン 1 および 2 – VOUT	正の出力電圧接続
J2、ピン 3 および 4 – S+/S–	出力電圧センス接続。このポイントで出力電圧を測定します
J2、ピン 5 および 6 – GND	出力リターン接続
JP2 – VSET	このピンから GND への抵抗によって、コンバータの目標出力電圧値が決まります。このピンは AGND または VIN に直接接続できます。このピンを使用しないときは、AGND に接続します。
JP1 – EN	EN ピン ジャンパ。ON と EN の間に付属のジャンパを配置すると、IC をオンにします。OFF と EN の間にジャンパを配置すると、IC がオフになります。
JP3 – PG プルアップ電圧	PG ピン プルアップ電圧ジャンパ。付属のジャンパを JP2 に配置し、PG ピン プルアップ抵抗を出力電圧に接続します。また、ジャンパを取り外し、ピン 5 に別の電圧を供給することで、PG ピンを異なるレベルにプルアップできます。この外部印加電圧は 5.5V 未満である必要があります。

2.1.2 ハードウェア設定

この評価基板を動作させるには、[コネクタの説明](#)に従ってジャンパ JP1 を目的の位置に設定してください。入力電源を J1 に接続し、負荷を J2 に接続します。

2.2 変更点

この評価基板 (EVM) のプリント基板 (PCB) は、ユーザによる一部の変更に対応できるよう設計されています。出力電圧に応じて、他の入力コンデンサ、および出力コンデンサを追加できます。また、出力電圧は I2C インターフェイスで変更できます。利用可能なすべての I2C 設定については、データシートを参照してください。

2.2.1 入力と出力の各コンデンサ

C4、C5 は、追加の入力コンデンサとして提供されています。このコンデンサは適切な動作に必須ではありませんが、入力電圧リップルを低減するために使用できます。

C8、C9 は、追加の出力コンデンサとして提供されています。これらのコンデンサは適切な動作に必須ではない可能性があります。出力電圧リップルの低減および負荷過渡応答の改善に使用できます。適切に動作させるため、出力キャパシタンスをデバイスのデータシートの推奨範囲内にする必要があります。

3 ハードウェア設計ファイル

3.1 回路図

図 3-1 に、TPS62A2I4QEVM-156 の評価基板の回路図を示します。これは、TPS62A2I1-Q1、TPS62A2I2-Q1、および TPS62A2I3-Q1 バリエーションでも有効です。

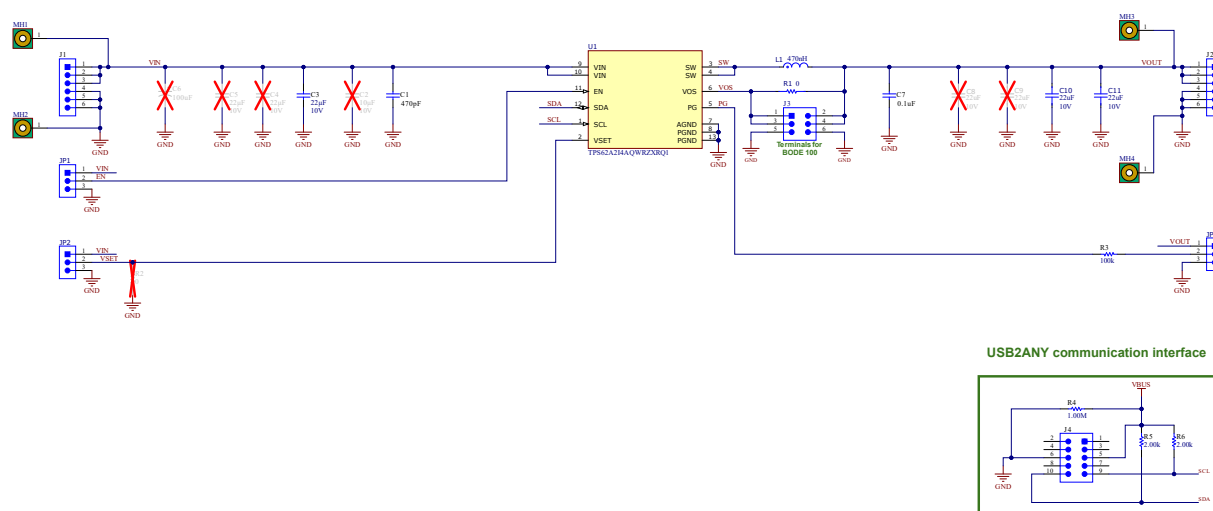


図 3-1. TPS62A2I4QEVM-156 の回路図

3.2 PCB のレイアウト

このセクションでは、TPS62A2I4QEV-156 の基板レイアウトと図を示します。これは、TPS62A2I1-Q1、TPS62A2I2-Q1、TPS62A2I3-Q1 バリエーションでも有効です。TPS62A2I4QEV は 4 層 PCB です。

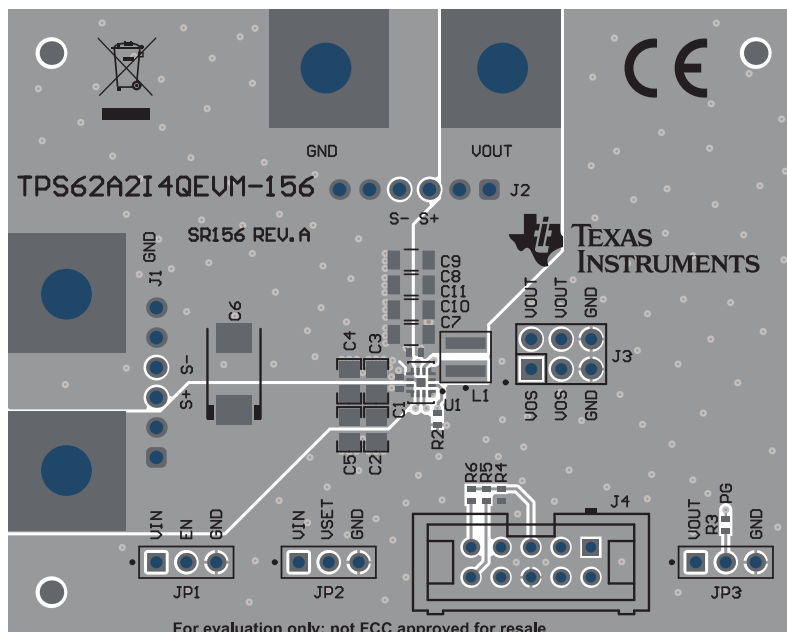


図 3-2. 上面図マスク

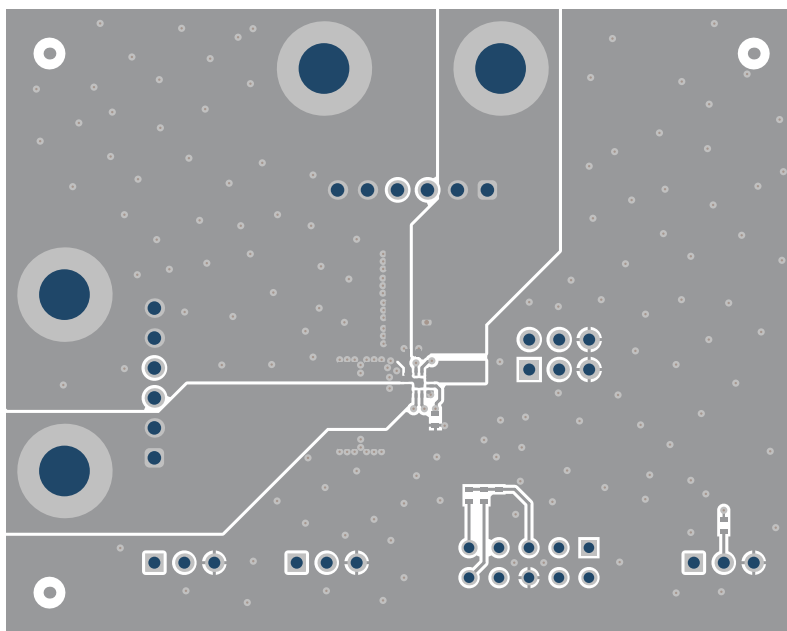


図 3-3. 上層

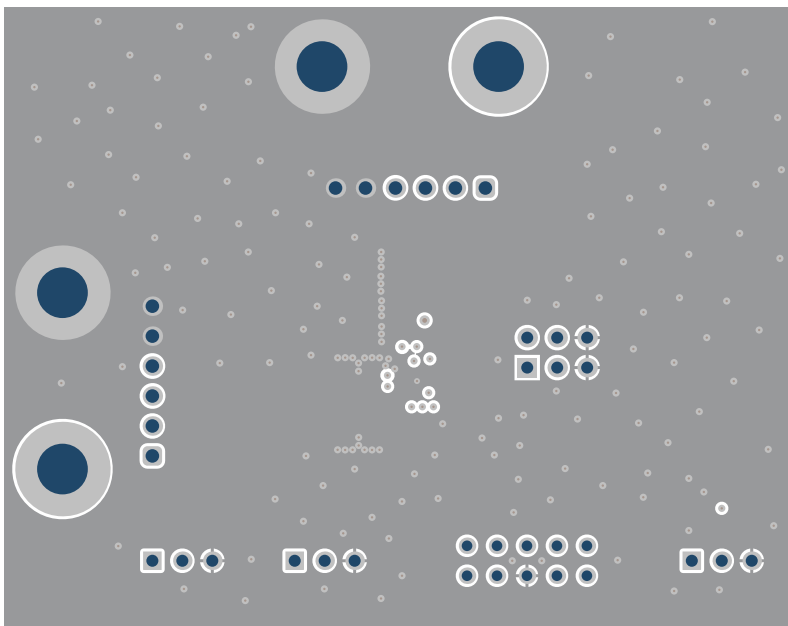


図 3-4. 信号層 1

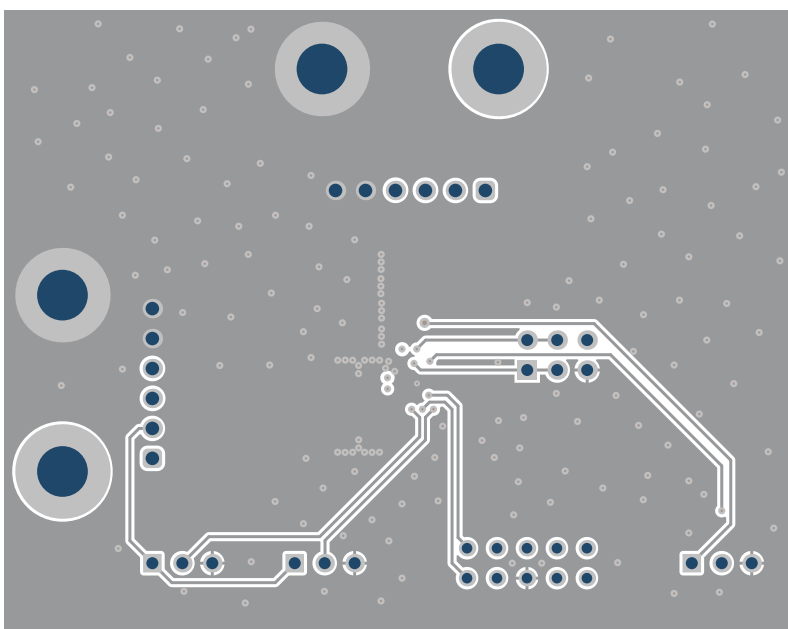


図 3-5. 信号層 2

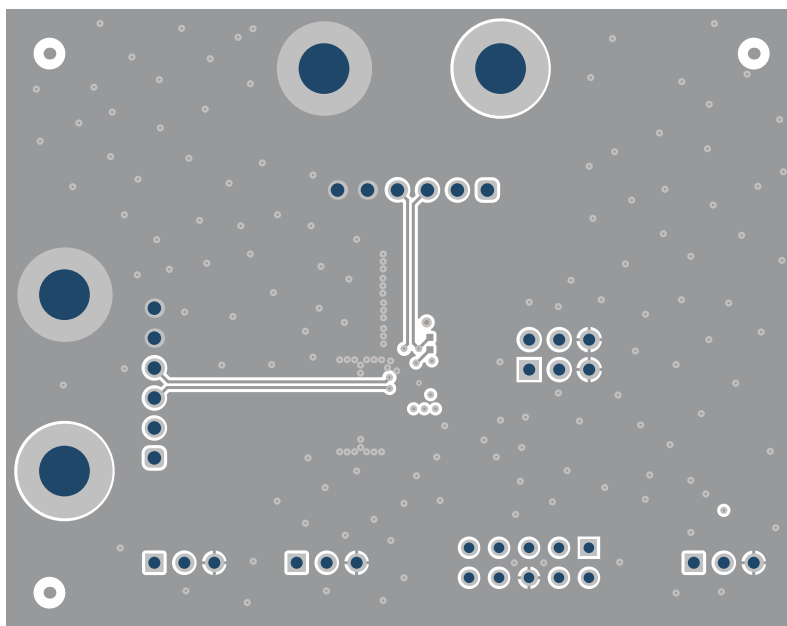


図 3-6. 下層

3.3 部品表 (BOM)

この EVM の部品表を [表 3-1](#) に示します。

表 3-1. TPS62A2I4QEVM-156 部品表

数量	参照の記号	値	説明	サイズ	部品番号	メーカー
TPS62A2I4QEVM-156						
1	C3	22uF	コンデンサ、セラミック、10V、X7R、±20%	0805	GRM21BZ71A226ME15L	Murata (村田製作所)
1	C10、C11	22uF	コンデンサ、セラミック、10V、X7R、±20%	1206	GCM31CR71A226KE02L	Murata (村田製作所)
0	C6	100uF	コンデンサ、タンタル ポリマー、20V、±20%	7.3 × 4.3mm	C0402C104K4RACAUTO	Kemet
1	C7	0.1uF	コンデンサ、セラミック、16V、X7R、±10%	0402	C0402C104K4RACAUTO	Kemet
1	C1	470pF	コンデンサ、セラミック、50V、±10%	0402	CGA2B2X7R1H471K050BA	TDK
1	L1	0.47uH	インダクタ、シールド付き、14.2A、0.0039Ω	4040 メートル	XGL4030-471MEC	Coilcraft
1	R5、R6	2k	抵抗、チップ、0.1W、1%	0402	標準	標準
1	R4	1Meg	抵抗、チップ、0.063W、1%	0402	標準	標準
1	R3	100k	抵抗、チップ、0.0625W、1%	0402	標準	標準
1	R1	0	抵抗、チップ	0402	標準	標準
1	U1	TPS62A2I4AQWRZXRQ1	IC、6-V、4-A、高速過渡応答 I2C 降圧コンバータ	2.1 × 2.1mm	TPS62A2I4AQWRZXRQ1	TI

4 追加情報

4.1 商標

すべての商標は、それぞれの所有者に帰属します。

5 関連資料

デバイスのデータシートおよびその他のドキュメントは、[TPS62A2I4-Q1](#) のプロダクトフォルダで入手できます。

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.

【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/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.

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