

EVM User's Guide: TLV61040-Q1

TLV61040QEVM-166 評価基板

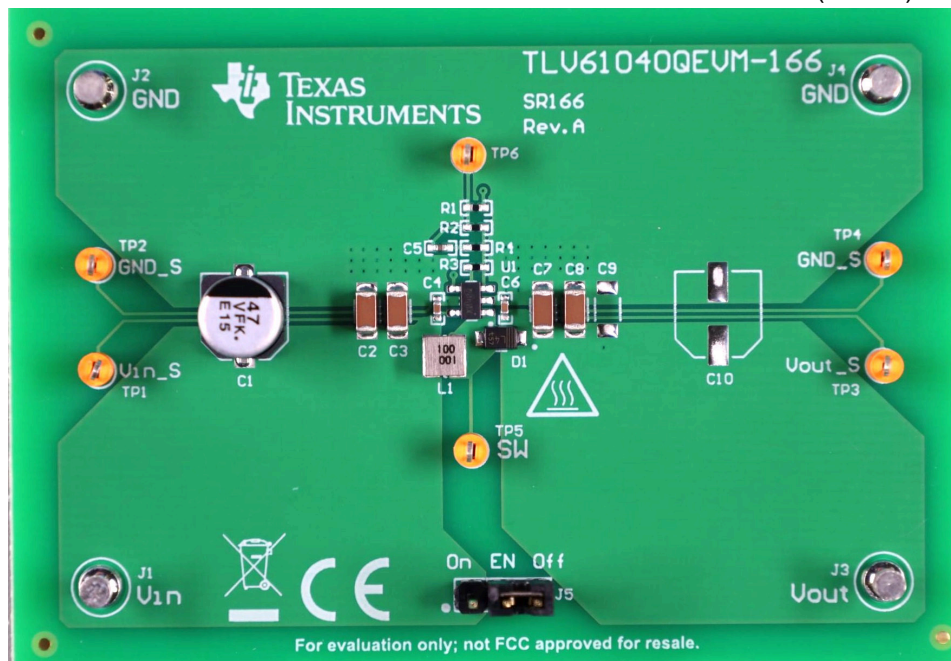


説明

TLV61040-Q1 は、1.8V ~ 20V の広範な入力電圧レンジを持つ、非同期昇圧コンバータです。出力電圧は最大 28V に対応し、400mA のピーク スイッチング電流能力を備えています。この評価基板は、2V ~ 14V の入力電圧で動作し、18V の出力電圧を供給するアプリケーション向けの設計を採用しています。

特長

- 出力電流 20mA ($V_{IN} \geq 5V \sim V_{OUT} = 18V$)
- $V_{IN} = 5V$ 、 $V_{OUT} = 18V$ 、 $I_{OUT} = 20mA$ で最大 90% の効率
- 400mA の固定ピーク スイッチング電流制限 (標準値)
- 標準値 25 μ A の静止電流
- オフ時間変調動作モード
- 400ns の最小オフ時間 (標準値)



TLV61040QEVM-166

1 評価基板の概要

1.1 概要

このユーザーガイドでは、TLV61040-Q1 の評価基板 (EVM) のセットアップ、回路図およびレイアウトについて説明します。この評価基板は、さまざまな入力電圧、出力電圧、負荷条件におけるデバイスの動作と性能を評価するのに役立ちます。

この評価基板は、2V ~ 14V の入力電圧で動作し、18V の出力電圧を供給するアプリケーション向けの設計を採用しています。EN ジャンパー (J5) はデバイスのオンおよびオフを制御します。この評価基板には、それぞれ SW 電圧とループ測定を行う TP5 と TP6 のテストポイントがあります。フィードバック分周器は、データシートに従い、他のアプリケーション条件に合わせて変更することができます。

1.2 キットの内容

表 1-1. キットリスト

記号	数量	説明	素材資料のタイプ	パッケージ
PCB1	1	TLV61040QEVM-166、回路基板	EEE	袋、ESD
BOX1	1	箱、段ボール	段ボール	箱
FM1	2	フォーム、帯電防止	プラスチック	フォーム
LBL1	2	ラベル、小型および大型の標準ラベル	紙/カード ストック	紙
LIT1	1	資料、EVM の免責事項と手順書 (はじめにお読みください)	紙/カード ストック	紙

1.3 仕様

表 1-2 は TLV61040QEVM-166 の性能仕様の概要を提供します。すべての仕様は、25°C の周囲温度に対するものです。

表 1-2. 性能仕様

パラメータ	値	単位
入力電圧	2 ~ 14	V
出力電圧	18	V
固定ピーク電流制限 (標準値)	400	mA
出力電流	0 ~ 7 (Vin > = 2V の場合) 0 ~ 20 (Vin > = 5V の場合)	mA

1.4 製品情報

TLV61040-Q1 は、200mΩ ローサイド パワー スイッチを内蔵した高電圧の非同期昇圧コンバータで、効率が高く小型サイズ オプションを提供します。TLV61040-Q1 は、入力電圧範囲が 1.8V ~ 20V と広く、出力電圧は最大 28V に対応し、通常のピーク電流制限は 400mA です。TLV61040-Q1 は、補償、2.5ms ソフトスタート時間、およびサーマル シャットダウン保護を内蔵しています。

2 ハードウェア

2.1 テスト設定

ジャンパ	説明
J1	入力電圧の正の接続
J2	入力電圧のリターン接続
J3	出力電圧の正の接続
J4	出力電圧のリターン接続
J5	EN ピン入力ジャンパ。EN とオンの上にジャンパを配置すると、IC がオンになります。EN とオフの上にジャンパを配置すると、IC がオフになります。
TP1	効率を測定するための入力電圧の正のセンシング ノード
TP2	効率を測定するための入力電圧の負のセンシング ノード
TP3	効率を測定するための出力電圧の正のセンシング ノード
TP4	効率を測定するための出力電圧の負のセンシング ノード
TP5 (SW)	SW ピンの波形を測定するためのテストポイント
TP6	ボードプロットを測定するためのテストポイント


2.2 変更

TLV61040-Q1 デバイスの外部部品は、実際のアプリケーションの出力電圧を調整するために変更できます。

2.3 入力コンデンサ C1

47 μ F、35V のアルミニウム コンデンサ **C1** を 評価基板の入力コンデンサとして追加しています。コンデンサは不要で、実際のアプリケーションでは取り外すことができます。

2.4 事前の注意事項

	<p>注意</p> <p>表面は高温になります。 触れるとやけどの原因になることがあります。 触らないでください！</p>
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3 ハードウェア設計ファイル

3.1 回路図

図 3-1 に、TLV61040QEVМ-166 の回路図を示します。

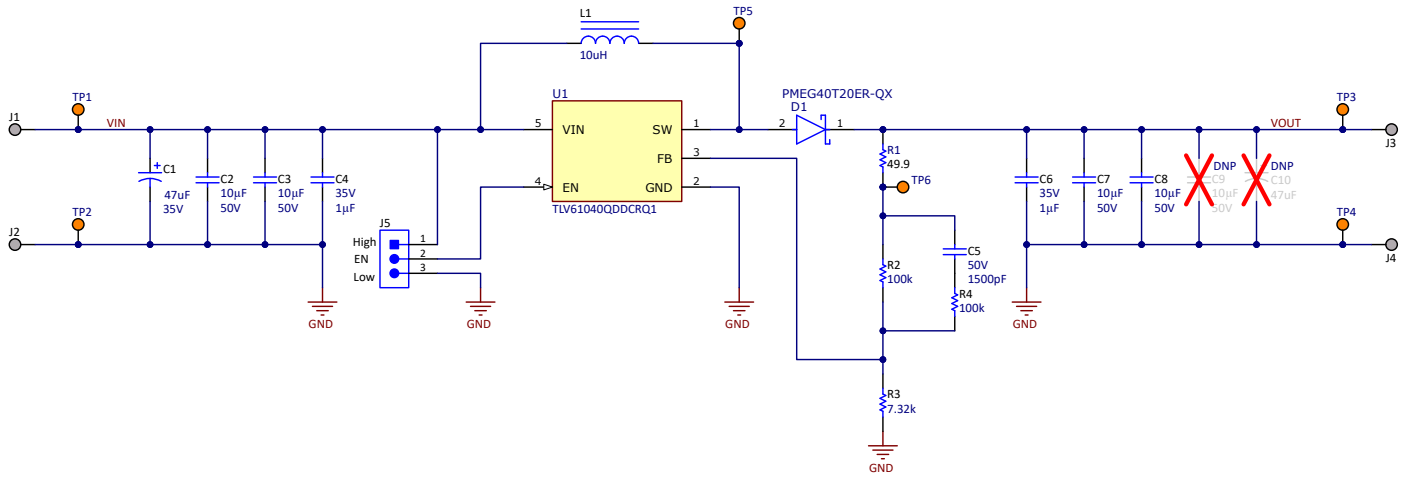


図 3-1. 回路図

3.2 PCB レイアウト

TLV61040QEVM-166 基板は 2 層、1oz 厚の銅 PCB です。すべての部品を上面に配置しています。図 3-2 および 図 3-3 は上面図と底面図を示します。

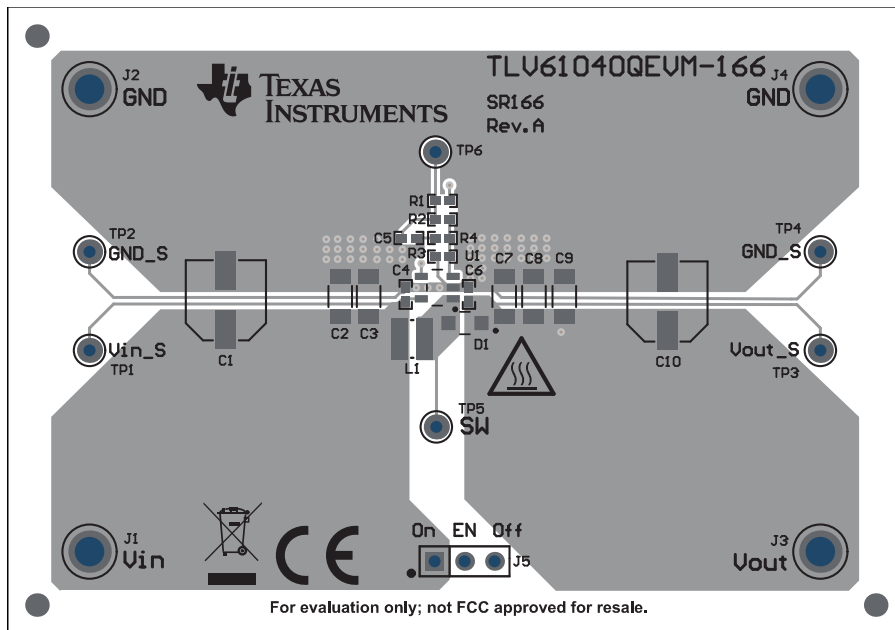


図 3-2. 上面レイアウト

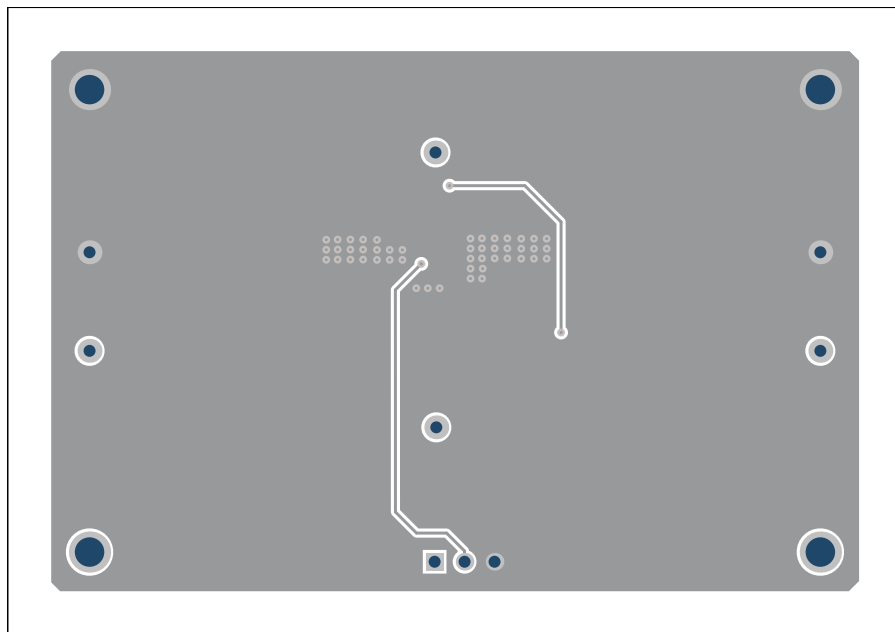


図 3-3. 底面レイアウト

3.3 部品表

表 3-1 は TLV61040QEV-166 の BOM をリストします。

表 3-1. TLV61040QEV-166 部品表

記号	数量	値	説明	PackageReference	部品番号	メーカー
C1	1	47 μ F	コンデンサ、AL、47 μ F、35V、 \pm 20%、0.36ohm、AEC-Q200 グレード 2、SMD	SMT ラジアル D	EEE-FK1V470P	Panasonic
C2、C3、C7、C8	4	10 μ F	コンデンサ、セラミック、10 μ F、50V、 \pm 10%、X7R、AEC-Q200 グレード 1、1206	1206	CGA5L1X7R1H106K160AC	TDK
C4、C6	2	1 μ F	コンデンサ、セラミック、1 μ F、35V、 \pm 10%、X5R、AEC-Q200 グレード 3、0402	0402	GRT155R6YA105KE13D	MuRata
C5	1	1.5nF	コンデンサ、セラミック、1500pF、50V、 \pm 5%、X7R、0402	0402	GRM155R71H152JA01D	MuRata
D1	1		40V、2A 低 VF トレンチ メガ ショットキー バリア整流器、SOD123W	SOD123W	PMEG40T20ER-QX	Nexperia
J1、J2、J3、J4	4		端子、タレット、TH、ダブル	Keystone1502-2	1502-2	Keystone
J5	1		ヘッド、100mil、3x1、Tin、TH	ヘッド、3 ピン、100mil、Tin	PEC03SAAN	Sullins Connector Solutions
L1	1	10 μ H	インダクタ、シールド付き、10 μ H、1.2A、0.023 Ω 、SMD	SMD、2 リード、本体 3.2x3.2mm	74438336100	Würth Elektronik
R1	1	49.9	RES、49.9、1%、0.063W、AEC-Q200 グレード 0、0402	0402	CRCW040249R9FKED	Vishay-Dale
R2、R4	2	100k	抵抗、100k、0.5%、0.063W、AEC-Q200 グレード 0、0402	0402	CRCW0402100KDHP	Vishay-Dale
R3	1	7.32k	抵抗、7.32k、1%、0.063W、AEC-Q200 グレード 0、0402	0402	CRCW04027K32FKED	Vishay-Dale
SH-J1	1		シャント、2.54mm、金、黒	シャント、2.54mm、黒	60900213421	Würth Elektronik
TP1、TP2、TP3、TP4、TP5、TP6	6		テスト ポイント、ミニチュア、オレンジ白色、TH	オレンジ ミニチュア テストポイント	5003	Keystone Electronics
U1	1		20VIN、28VOUT、400mA の非同期 ブーストコンバータ	SOT-23-5	TLV61040QDDCRQ1	テキサス・インスツルメンツ

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。

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.
 6. *Disclaimers:*
 - 6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.
 - 6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT, REGARDLESS OF WHEN MADE, CONCEIVED OR ACQUIRED.
 7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

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.

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