

EVM User's Guide: ADS9324EVM

ADS9324 BoosterPack™ プラグイン評価基板



説明

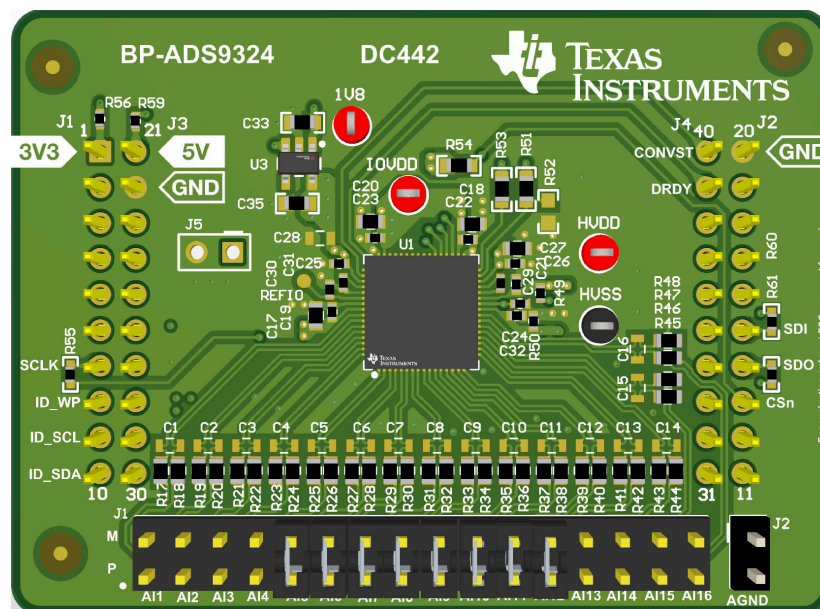
ADS9324 BoosterPack™ プラグイン モジュール (BP-ADS9324) は、ADS9324 を使用したアプリケーションを開発するための、コスト効率に優れた使いやすいプラットフォームを提供します。このモジュールは、LAUNCHXL-F28P65X LaunchPad™ 評価キットとの互換性があり、他のコントローラとの併用をサポートするヘッダーを搭載しています。基本的なデバイス機能を示すサンプルコードが提供されており、アプリケーション開発のためのオープンな出発点として利用できます。

特長

- アナログ フロント エンド内蔵、16 チャンネル、16 ビット ADC
- チャンネル独立型プログラマブル入力: ±12.5V、±10V、±6.25V、±5V、±2.5V
- アナログ帯域幅オプション: 25kHz と 325kHz
- LaunchPad 互換のヘッダー ピン
- フレキシブルなコントローラ インターフェイス機能
- 他の ADS9324 ファミリー デバイスや ADS9308V81、および他のバリエーションとの互換性

設計を開始

- BP-ADS9324 のご注文。
 - ADS9324 のソフトウェア サンプルをダウンロードしてください (ADS9324-BOOSTERPACK-C2000-CODE)。
- LaunchPad で評価を行う場合は、LAUNCHXL-F28P65X を注文してください。LaunchPad で評価を行う場合は、「ハードウェアとソフトウェア」のセクションを参照してください。
 - 既存のコントローラで評価を行う場合、BoosterPack に接続するためのガイドとして [図 1-1](#) を使用し、必要に応じてサンプルコードを参照してください。



1 評価基板の概要

1.1 概要

ADS9324 BoosterPack プラグイン モジュールを使用すると、テキサス インストルメンツの ADS9324 (最大 $\pm 12.5V$ の入力範囲で、16 ビット、16 チャンネル、1MSPS ADC) を評価できます。この BoosterPack は、ADS9324 を使用した評価およびアプリケーション開発を迅速に開始するための、ハードウェア プラットフォームを提供します。

この資料では、モジュール設計について説明しており、回路図、プリント基板 (PCB) レイアウト、部品表 (BOM) を掲載しています。

BP-ADS9324 BoosterPack は、LAUNCHXL-F28P65X LaunchPad で評価できます。『C2000™ F28P65X LaunchPad 開発キット ユーザー ガイド』には、LaunchPad プラットフォームに関する詳細情報が記載されています。

ADS9324-BOOSTERPACK-C2000-CODE は、基本的な ADC レジスタの読み取り、レジスタの書き込み、変換データの読み取り動作を示すもので、完全なアプリケーション開発の出発点として機能すること目的としています。

1.2 キットの内容

ADS9324 BoosterPack プラグイン モジュールには、TI LaunchPad 開発キットと容易に統合できるようにする 2 個の LaunchPad 互換ヘッダー (J3 および J4) と、8 個の入力チャンネルに直接アクセスできる追加のヘッダーが搭載されています。この構成によって、より広範なコントローラやユーザー設計の信号チェーンとの柔軟なインターフェイスが可能になります。

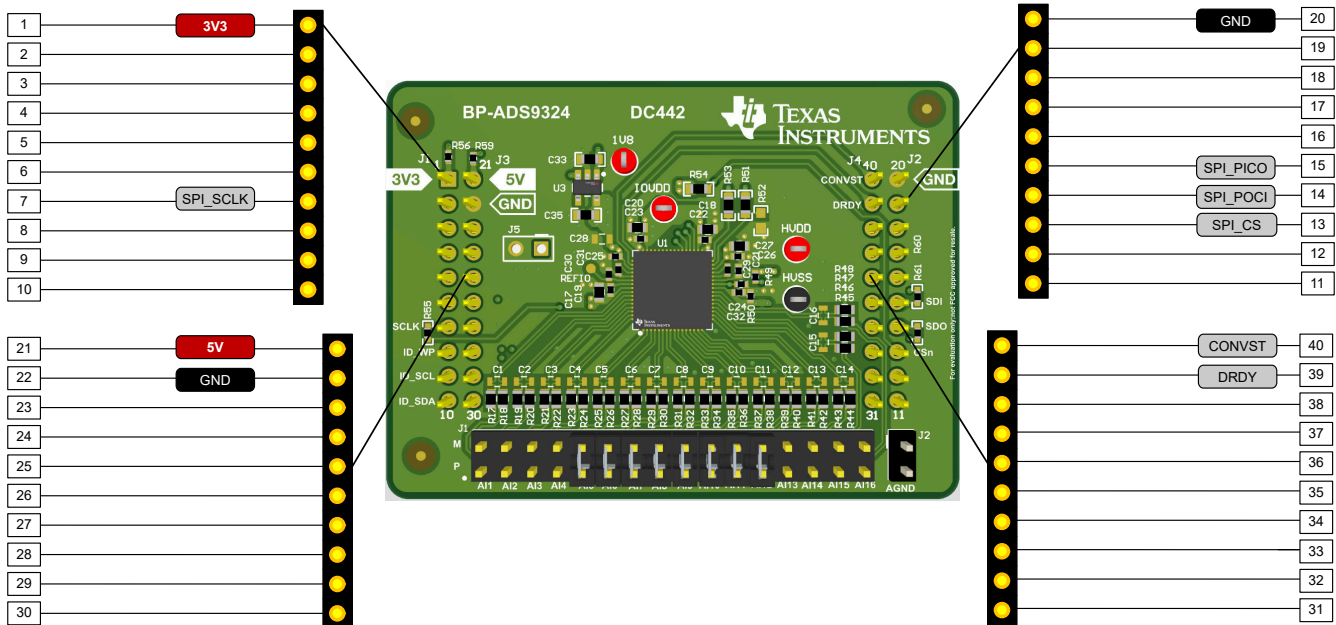


図 1-1. インターフェイスのピン配置

表 1-1. キットの内容

| 項目 | 数量 |
|------------------------|----|
| BP-ADS9324 BoosterPack | 1 |

表 1-2. キットには含まれない部品

| 項目 | 数量 |
|----------------------------|----|
| LAUNCHXL-F28P65X LaunchPad | 1 |

LAUNCHXL-F28P65X LaunchPad は www.ti.com から購入してください。

1.3 仕様

このモジュールは、ADS9324 デバイスへの直接的なハードウェア アクセスを可能にし、ユーザー定義のシグナル コンディショニング、制御、システム統合をサポートします。このボードには ADS9324 が搭載されており、電源デカップリングおよび LaunchPad 互換ヘッダーへの配線が備わっています。固定のシグナル コンディショニング回路は実装されていないため、特定用途向けのフロント エンド設計が可能です。統合されたテスト ポイントと構成可能な部品フットプリントにより、コンパクトなフォーム ファクタ内での評価、変更、デバッグが容易になります。

1.4 製品情報

ADS9324 は、16 ビット、16 チャネル、1MSPS の ADC で、最大 $\pm 12.5V$ の入力電圧範囲に対応しています。このデバイスは、各入力チャネルに統合型アナログ フロント エンド回路を搭載し、内蔵 PGA、ローパス フィルタ、低温度ドリフトのオンチップ 4.096V リファレンス電圧を備えています。

2 ハードウェア

2.1 ボードの設定

BP-ADS9324 BoosterPack を使用すれば、デバイスの電源ピンへの電氣的接続が可能です。

入力構成:

- 必要に応じて R1R16 を実装し、AINxM を GND に短絡します。
- AINxP と AINxM を短絡接続するには、必要に応じて J1 にジャンパを配置します。

2.2 構成

- BoosterPack を LaunchPad ヘッダー J1、J3、J4、J2 に合わせて配置します。BoosterPack 上の 3V3、5V、GND のシルクスクリーンを、以下に示すように、LaunchPad と視覚的に揃えます。
- USB ケーブルを接続して LaunchPad をパワーアップします。

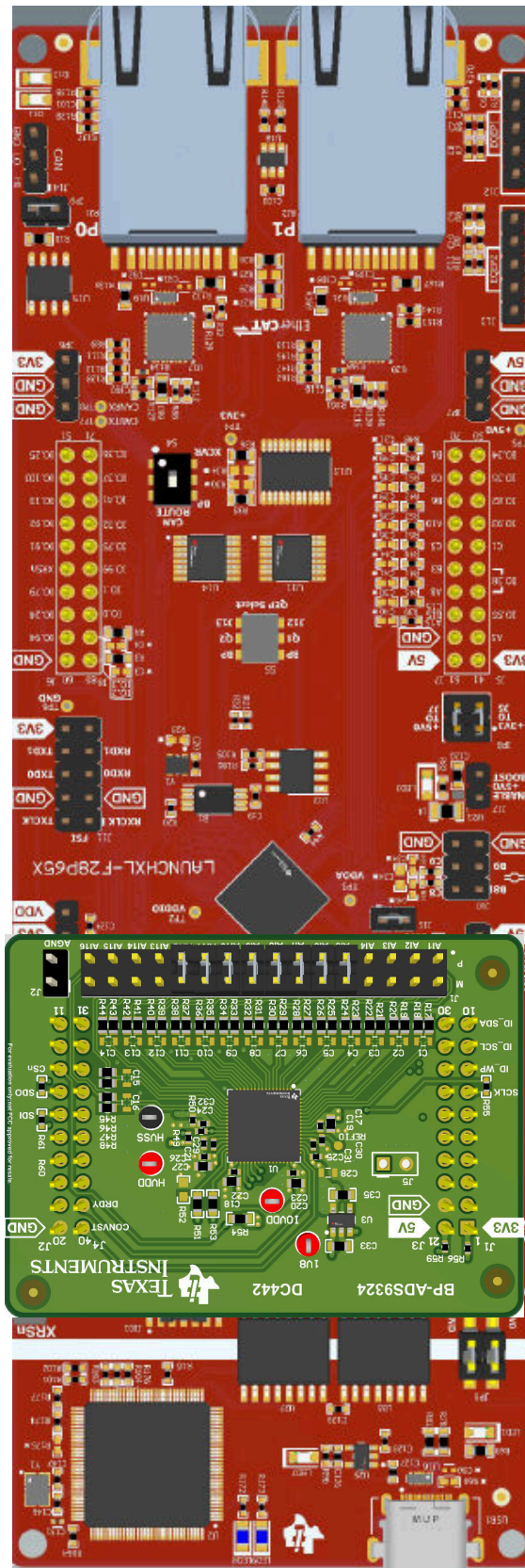


図 2-1. ハードウェア設定

3 ソフトウェア

3.1 ソフトウェアのインストール

- [Code Composer Studio™](#) の統合開発環境を使用する、[ADS9324-BOOSTERPACK-C2000-CODE](#) を出発点として LaunchPad をプログラムします。

詳細については、付属の README ファイルを参照してください。

注

Code Composer Studio や LaunchPad の使用に関するヘルプが必要な場合は、C2000 ソフトウェア開発キット (SDK) に含まれる利用可能なリソースを確認するか、[TI Cloud Developer Zone](#) にアクセスしてください。C2000 マイコンには、広範囲にわたるオンライン資料、C2000 Academy によるトレーニング、[TI E2E™ サポートフォーラム](#)のオンラインサポートも用意されています。

4 ハードウェア設計ファイル

4.1 回路図

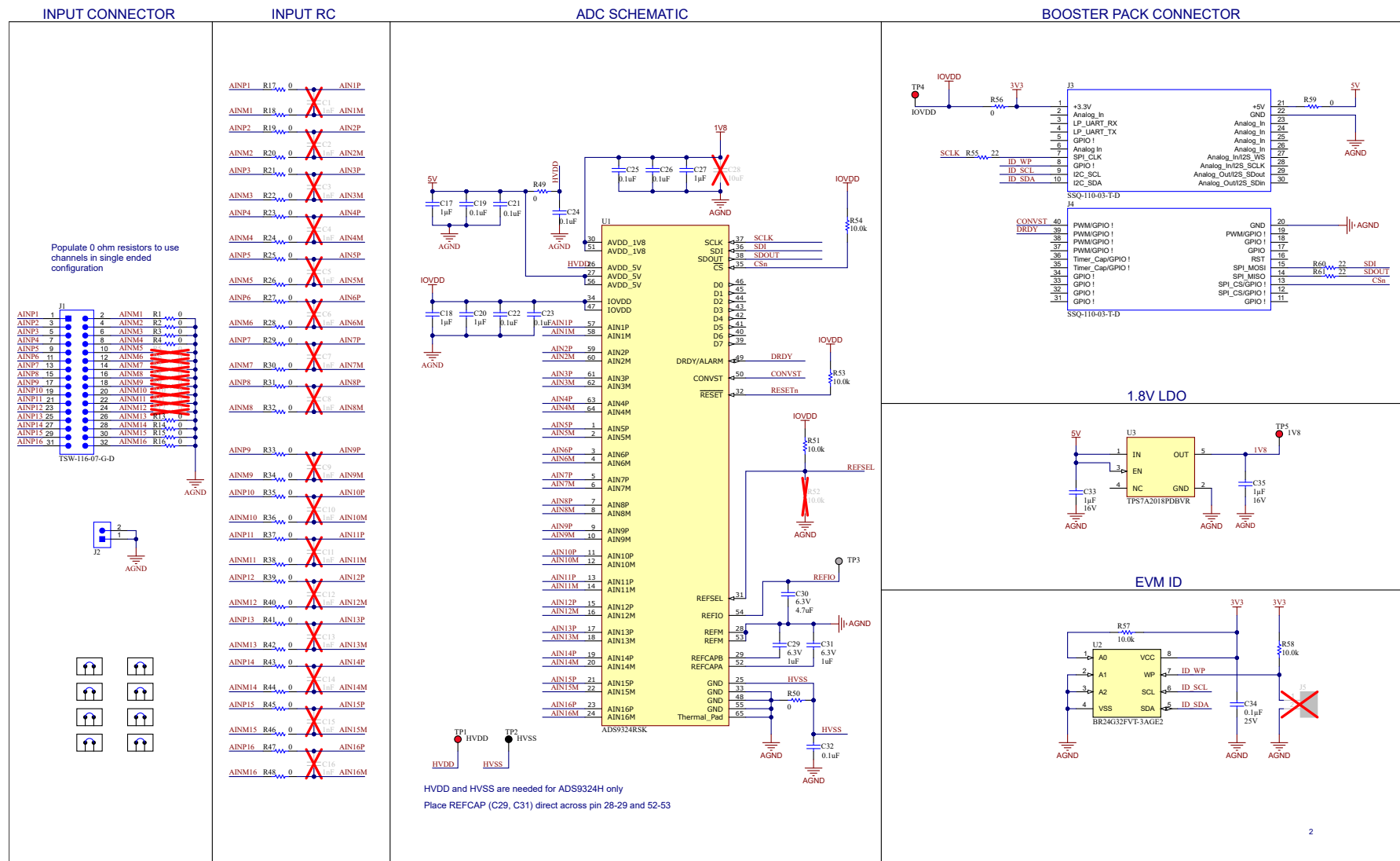


図 4-1. 回路図

4.2 PCB のレイアウト

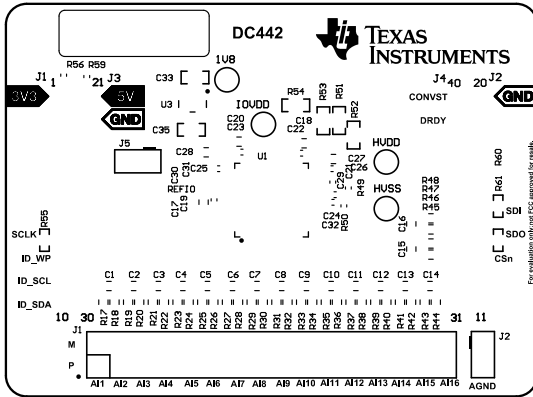


図 4-2. PCB 最上層、オーバーレイ

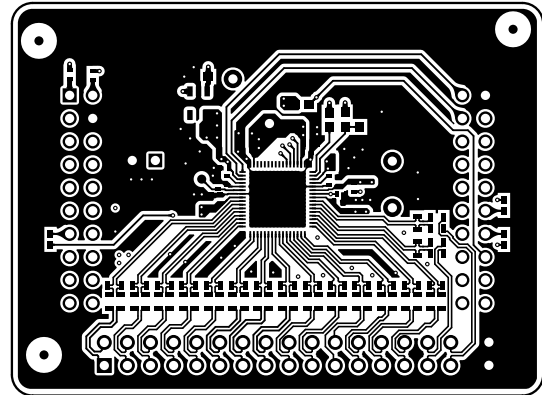


図 4-3. PCB の最上層

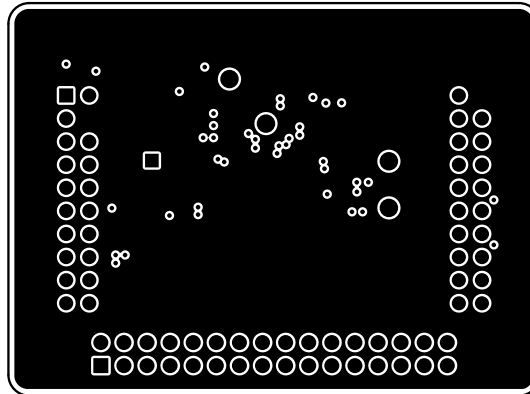


図 4-4. PCB 信号レイヤ 1

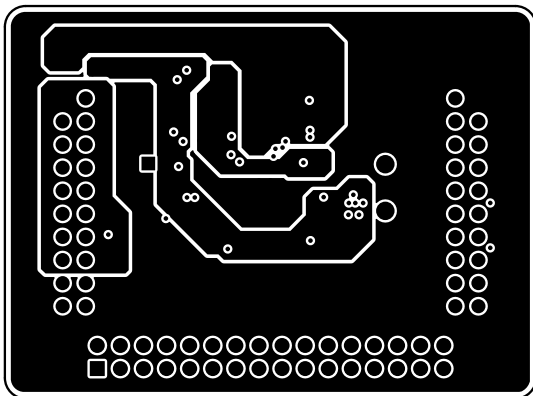


図 4-5. PCB 信号レイヤ 2

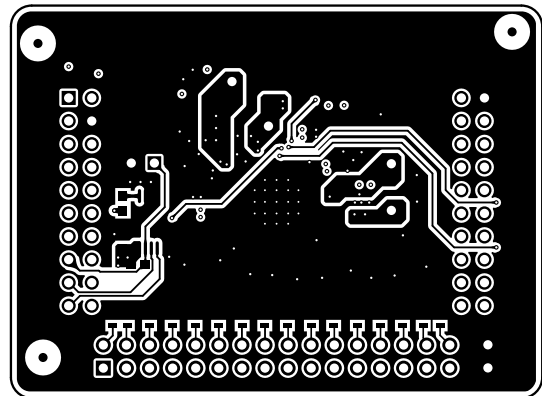


図 4-6. PCB 底面図

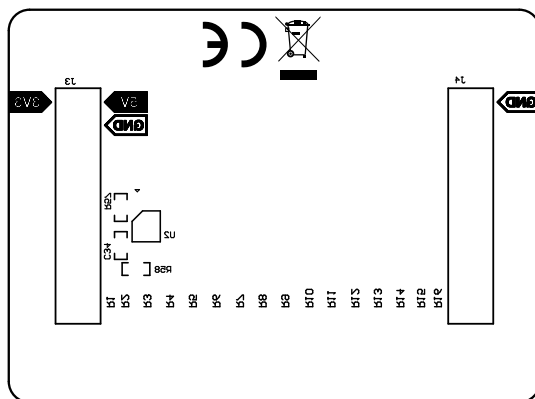


図 4-7. PCB 底面層、オーバーレイ

4.3 部品表 (BOM)

| 記号 | 部品番号 | 値 | 数量 | 説明 | メーカー | パッケージ記号 |
|---|----------------------|-------|----|---|-----------------------------|--------------------|
| C17、C18、C20、C27 | CGA3E1X7R1E105K080AC | 1uF | 4 | コンデンサ、セラミック、1μF、25V、±10%、X7R、AEC-Q200 グレード 1、0603 | TDK | 0603 |
| C19、C21、C22、C23、C24、C25、C26、C32 | GRM155R61C104KA88D | 0.1uF | 8 | コンデンサ、セラミック、0.1μF、16V、±10%、X5R、0402 | MuRata | 0402 |
| C29、C31 | GRM155R70J105KA12D | 1uF | 2 | コンデンサ、セラミック、1uF、6.3V、±10%、X7R、0402 | MuRata | 0402 |
| C30 | GRM155R60J475ME87D | 4.7uF | 1 | CAP、CERM、4.7uF、6.3V、±20%、X5R、0402 | MuRata | 0402 |
| C33、C35 | C1608X7R1C105K080AC | 1uF | 2 | コンデンサ、セラミック、1uF、16V、±10%、X7R、0603 | TDK | 0603 |
| C34 | CL10A104KA8NNNC | 0.1uF | 1 | コンデンサ、セラミック、0.1μF、25V、±10%、X5R、0603 | Samsung Electro-Mechanics | 0603 |
| J1 | TSW-116-07G-D | | 1 | ヘッダ、100mil、16x2、金、TH | Samtec | 16x2 ヘッダー |
| J2 | PEC02SAAN | | 1 | ヘッダ、100mil、2x1、Tin、TH | Sullins Connector Solutions | ヘッダ、2ピン、100mil、Tin |
| J3、J4 | SSQ-110-03T-D | | 2 | レセプタクル、2.54mm、10x2、錫、TH | Samtec | 10x2 レセプタクル |
| R1、R2、R3、R4、R13、R14、R15、R16、R17、R18、R19、R20、R21、R22、R23、R24、R25、R26、R27、R28、R29、R30、R31、R32、R33、R34、R35、R36、R37、R38、R39、R40、R41、R42、R43、R44、R45、R46、R47、R48 | ERJ-3GEY0R00V | 0 | 40 | 抵抗、0、5%、0.1W、AEC-Q200 グレード 0、0603 | Panasonic | 0603 |
| R49、R50、R56、R59 | CRCW04020000Z0ED | 0 | 4 | 抵抗、0、5%、0.063W、AEC-Q200 グレード 0、0402 | Vishay-Dale | 0402 |
| R51、R53、R54、R57、R58 | CRCW060310K0FKEA | 10.0k | 5 | RES、10.0k、1%、0.1W、AEC-Q200 グレード 0、0603 | Vishay-Dale | 0603 |
| R55、R60、R61 | CRCW040222R0JNED | 22 | 3 | 抵抗、22、5%、0.063W、AEC-Q200 グレード 0、0402 | Vishay-Dale | 0402 |

| 記号 | 部品番号 | 値 | 数量 | 説明 | メーカー | パッケージ記号 |
|--|--------------------|--------|----|---|-----------------------------|---------------------|
| TP1、TP4、TP5 | 5000 | | 3 | テストポイント、ミニチュア、赤色、TH | Keystone Electronics | 赤色ミニチュア テストポイント |
| TP2 | 5001 | | 1 | テストポイント、ミニチュア、黒色、TH | Keystone Electronics | 黒色ミニチュア テストポイント |
| U1 | ADS9324RSK | | 1 | 16 チャンネル、16 ビット、1MSPS、アナログ フロントエンド内蔵の同時サンプリング SAR ADC | テキサス・インスツルメンツ | QFN64 |
| U2 | BR24G32FVT-3AGE2 | | 1 | I2C BUS EEPROM (2 線式)、TSSOP-B8 | Rohm | TSSOP-8 |
| U3 | TPS7A2018PDBVR | | 1 | リニア電圧レギュレータ IC 正電圧固定 1 出力 300mA SOT-23-5 | テキサス・インスツルメンツ | SOT23-5 |
| C1、C2、C3、C4、C5、C6、C7、C8、C9、C10、C11、C12、C13、C14、C15、C16 | GRM188R72A102KA01D | 1000pF | 0 | コンデンサ、セラミック、1000pF、100V、±10%、X7R、0603 | MuRata | 0603 |
| C28 | GRM188R61E106MA73D | 10uF | 0 | コンデンサ、セラミック、10uF、25V、±20%、X5R、0603 | MuRata | 0603 |
| J5 | PEC02SAAN | | 0 | ヘッダ、100mil、2x1、Tin、TH | Sullins Connector Solutions | ヘッダ、2 ピン、100mil、Tin |
| R5、R6、R7、R8、R9、R10、R11、R12 | ERJ-3GEY0R00V | 0 | 0 | 抵抗、0、5%、0.1W、AEC-Q200 グレード 0、0603 | Panasonic | 0603 |
| R52 | CRCW060310K0FKEA | 10.0k | 0 | RES、10.0k、1%、0.1W、AEC-Q200 グレード 0、0603 | Vishay-Dale | 0603 |

5 追加情報

5.1 商標

BoosterPack™, LaunchPad™, Code Composer Studio™, and E2E™ are trademarks of Texas Instruments.
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

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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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