参考資料

EVM User's Guide: TMUXHS5212-EVM

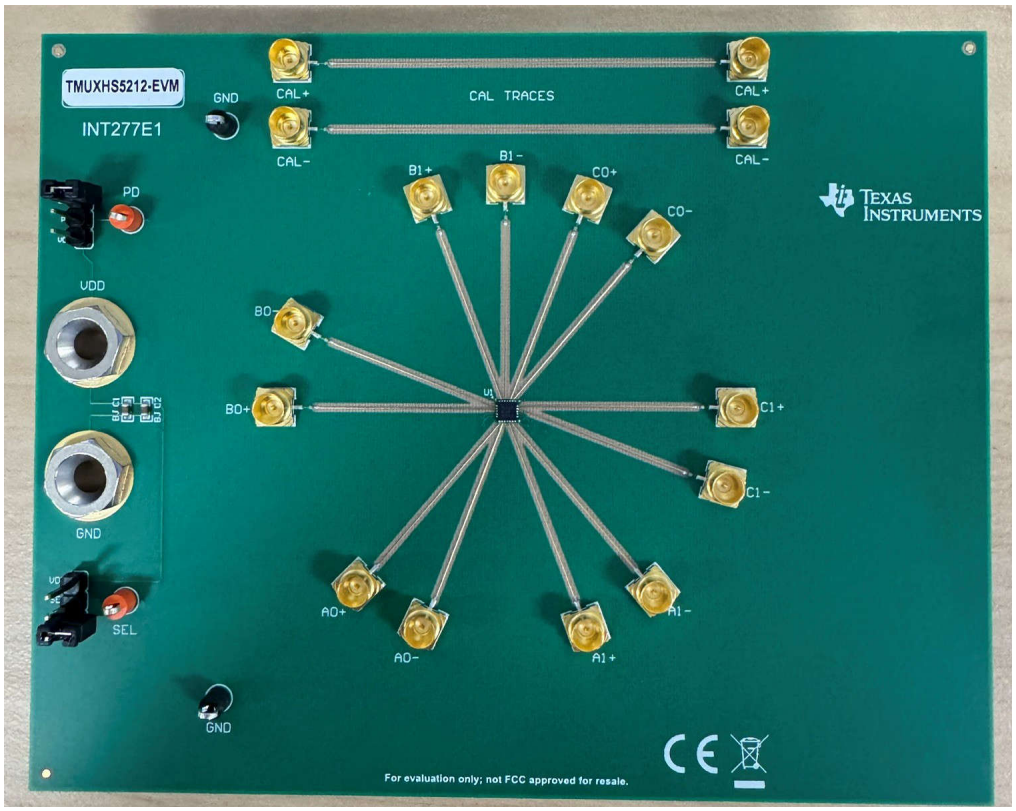
TMUXHS5212 評価基板

説明

TMUXHS5212-EVM は、TMUXHS5212 の高速信号の性能評価に使用されます。この評価基板 (EVM) には、半田付けしたユニットが付属しています。この評価基板を使用すると、マルチプレクサを通過する信号性能を単純なパターンと比較して評価できます。I/O は SMP コネクタを経由して接続され、デバイスのロジックに対応するテスト ポイントまたはヘッダ経由で制御できます。

特長

- 電源接続オプション用 VDD および GND バナナ ジャック プラグイン、デカップリング コンデンサ (1µF 0603、10µF 0603)。
- DUT 近傍のデカップリング コンデンサ (0.01µF 0402、0.1µF 0402)。
- I/O シグナリング用の 12 個の SMP コネクタ。
- デバイスなしで信号性能を評価するための 4 個の追加 SMP コネクタ。
- ロジック制御向けの PD と SEL のテスト ポイント。
- 接続を容易にするための 2 個の GND テスト ポイント。
- ロジックを簡単に選択できるジャンパを備えた 2 個のヘッダ。



TMUXHS5212-EVM (上面図)

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1 評価基板の概要

1.1 はじめに

この評価基板では、TMUXHS5212-EVM 評価基板 (EVM) とその想定用途の概要を説明します。このボードを使用すると、TI の TMUXHS5212 高速マルチプレクサの迅速なプロトタイプ製作と特性評価を実施できます。

評価基板の追加の特長を以下に示します。

- デバイスを起動するためのバナナ ジャック プラグイン。
- 高速信号伝送に使用する I/O の複数の SMP コネクタ。
- ロジック制御とチャネル トグル向けの 2 個の 3 ピン ヘッダ。
- デバイスを制御するための追加的な方法に役立つ、ロジックと GND の各テスト ポイント。

1.2 キットの内容

この 評価基板には以下が含まれます:

- (1) TMUXHS5212-EVM

1.3 仕様

TMUXHS5212-EVM は TMUXHS5212 の評価に使用されます。この評価基板を使用すると、バナナ ジャック プラグイン経由で DUT への電力供給とグランド接続が可能です。デバイスのロジック設定とチャネルの切り替えのための 2 個のヘッダと、I/O 信号のキャリブレーション用の SMP コネクタを搭載しています。

また、この評価基板は DUT を制御するためのロジックとグランドのテスト ポイントも実装しており、基板上で接続のフレキシビリティをより高めることができます。

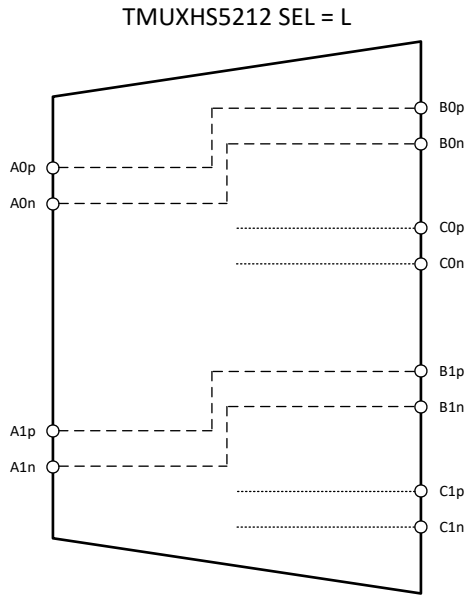

図 1-1. TMUXHS5212 SEL = L 概略回路図

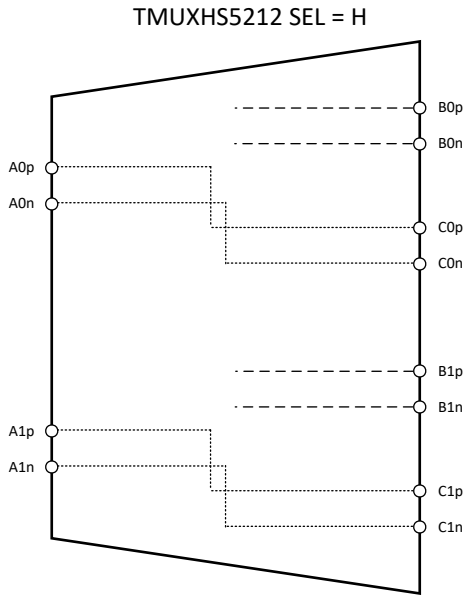

図 1-2. TMUXHS5212 SEL = H 概略回路図

1.4 製品情報

TMUXHS5212 は、パッシブ差動 2 チャネル 2:1 高速マルチプレクサです。ロジック制御は、アクティブ "Low" の PD ピンを使用してチャネルを選択することで GPIO を介して行われ、SEL ピンでチャネル B と C 間を切り替えられます。

TMUXHS5212 は、1.65V ～ 1.95V の電源電圧で動作し、PCIe Gen 5 信号に合格するように設計されています。

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2 ハードウェア

2.1 電源要件

TMUXHS5212-EVM には、バナナ ジャック プラグイン経由で 1.65V ～ 1.95V の電源電圧が必要です。デバイスの動作中、電圧電源をフローティングやグランドのままにしないでください。

2.2 ヘッダおよび SMP コネクタ情報

TMUXHS5212-EVM は、ロジック制御を設定して高速信号を渡すために、2 個の 3 ピン ヘッダと 16 個の SMP コネクタを搭載しています。また、この評価基板を使用すると、シグナル キャリブレーションや、このデバイスとシンプルなパターンの間でのシグナル インテグリティ性能の比較が可能です。各ヘッダと SMP コネクタの説明は以下のとおりです。

1. **PD J ヘッダ**

   ヘッダ PD J は、ジャンパを介して PD ピンを電源電圧またはグランドに接続します。図 2-1 に、ヘッダ PD J を示します。

   a. VDD に接続するには、ヘッダ上の J2-3 の位置を短絡させます。この時点で、VDD バナナ ジャック プラグインが PD ピンをプルアップしています。
   b. グランドに接続するには、ヘッダ上の J2-1 の位置を短絡させます。GND バナナ ジャック プラグインが PD ピンをプルダウンして、デバイスのロジック制御をアクティブにします。

2. **SEL J ヘッダ**

   ヘッダ SEL J は、ジャンパを介して SEL ピンを電源電圧またはグランドに接続します。図 2-1 に、ヘッダ SEL J を示します。

   a. VDD に接続するには、ヘッダ上の J2-1 の位置を短絡させます。VDD バナナ ジャック プラグインは、チャネル A をチャネル C に接続する SEL ピンをプルアップしています。
   b. グランドに接続するには、ヘッダ上の J2-3 の位置を短絡させます。GND バナナ ジャック プラグインは、チャネル A をチャネル B に接続する SEL ピンをプルダウンしています。

3. キャリブレーション用パターン

   完全な差動ペアをシミュレーションできるように、SMP コネクタを配置します。これらのデバイスを使用して、本デバイスと理想的な条件との間で高速信号性能を比較できます。これは、TMUXHS5212 をお客様が評価するためのもので、この製品が信号の性能と減衰に及ぼす影響を確認するためのものです。

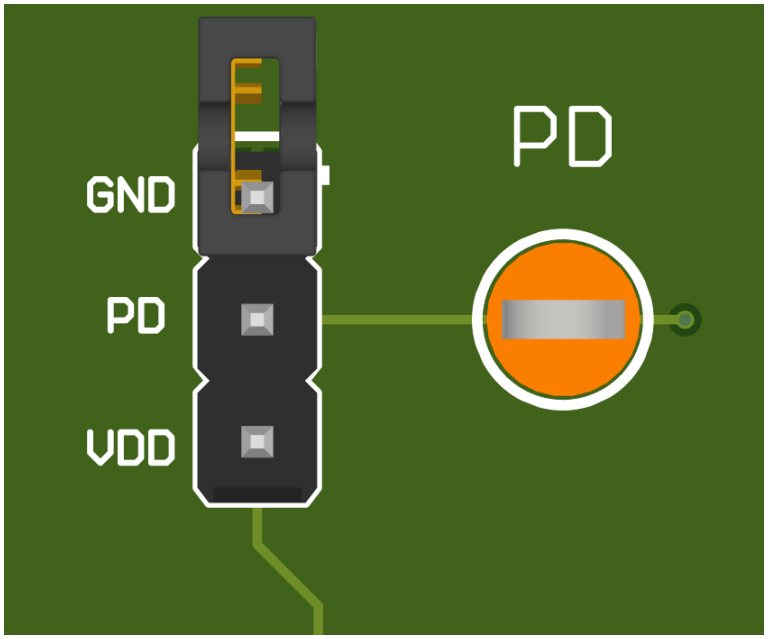

図 2-1. ヘッダ PD J：J-1 (GND)、J-2 (デバイス PD への接続)、J-3 (VDD)

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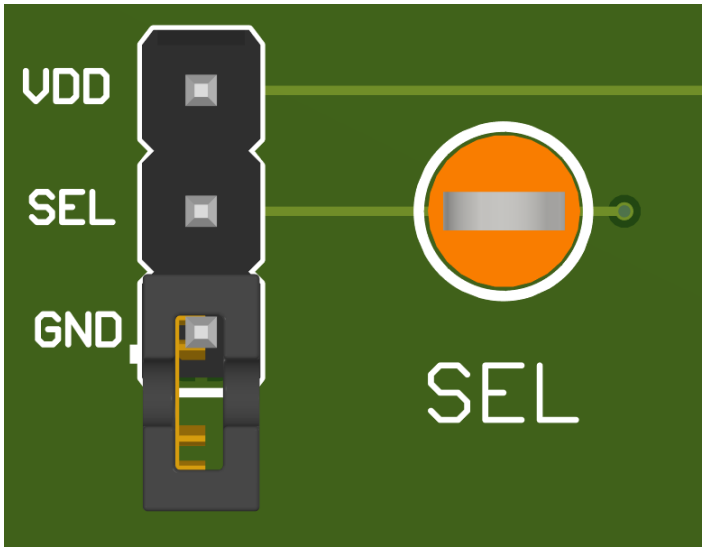

図 2-2. ヘッダ SEL J:J-1 (VDD)、J-2 (デバイス SEL への接続)、J-3 (GND)

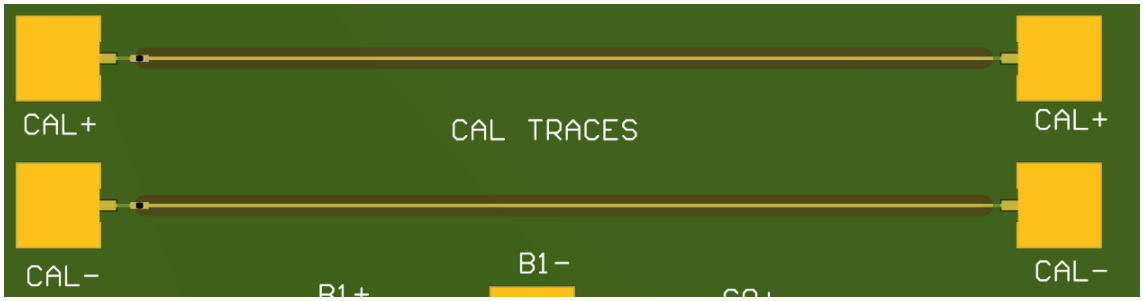

図 2-3. キャリブレーション用パターン

2.3 テスト ポイント

このボードには、合計 4 テスト ポイント、2 GND、2 ロジック制御が搭載されています。

テスト ポイント ID	説明	信号
PD	オレンジの TP	PD
SEL	オレンジの TP	SEL
GND	黒の TP	GND
GND	黒の TP	GND

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3 ハードウェア設計ファイル

以下のセクションには、TMUXHS5212-EVM のハードウェア設計ファイルを示します。このセクションでは、基板レベルの回路図、PCB レイアウト、部品表 (BOM) を示します。

3.1 回路図

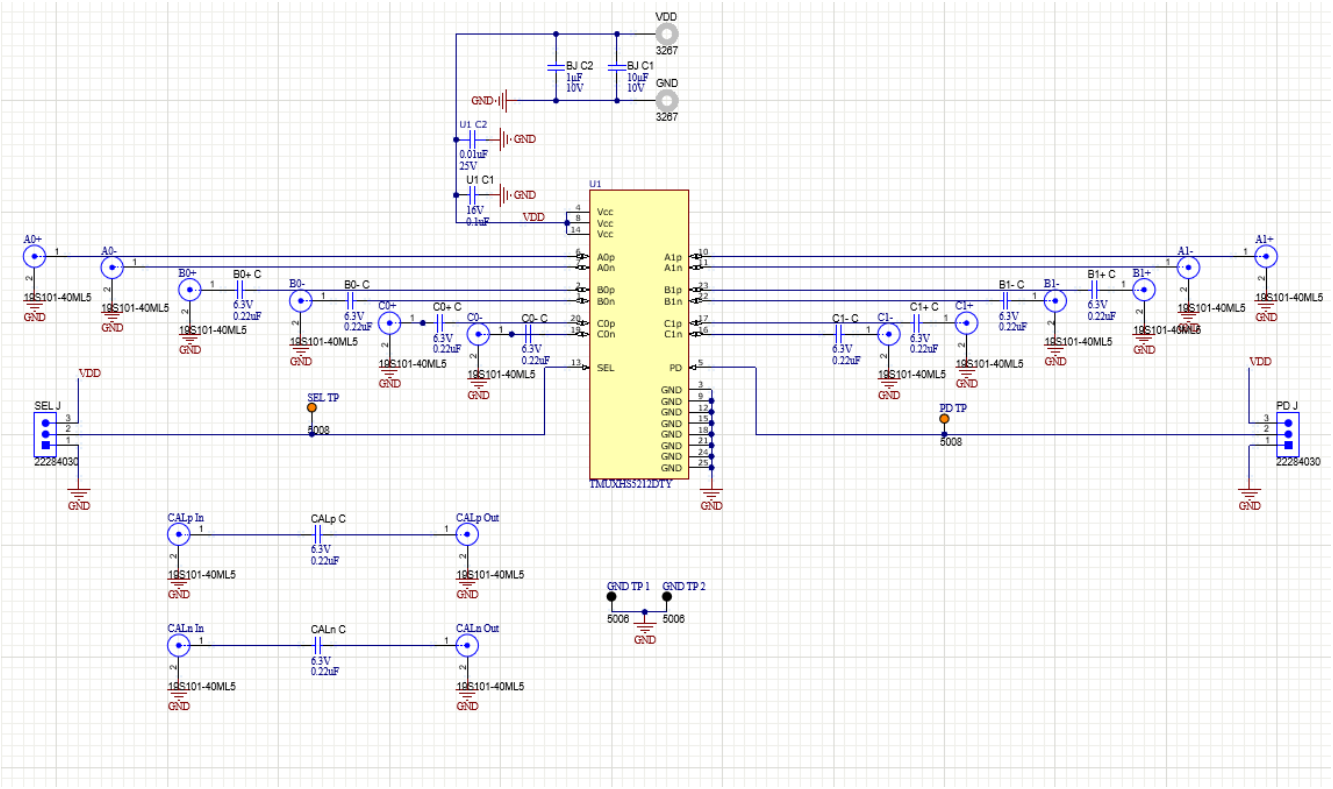

図 3-1. TMUXHS5212-EVM の回路図

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3.2 PCB のレイアウト

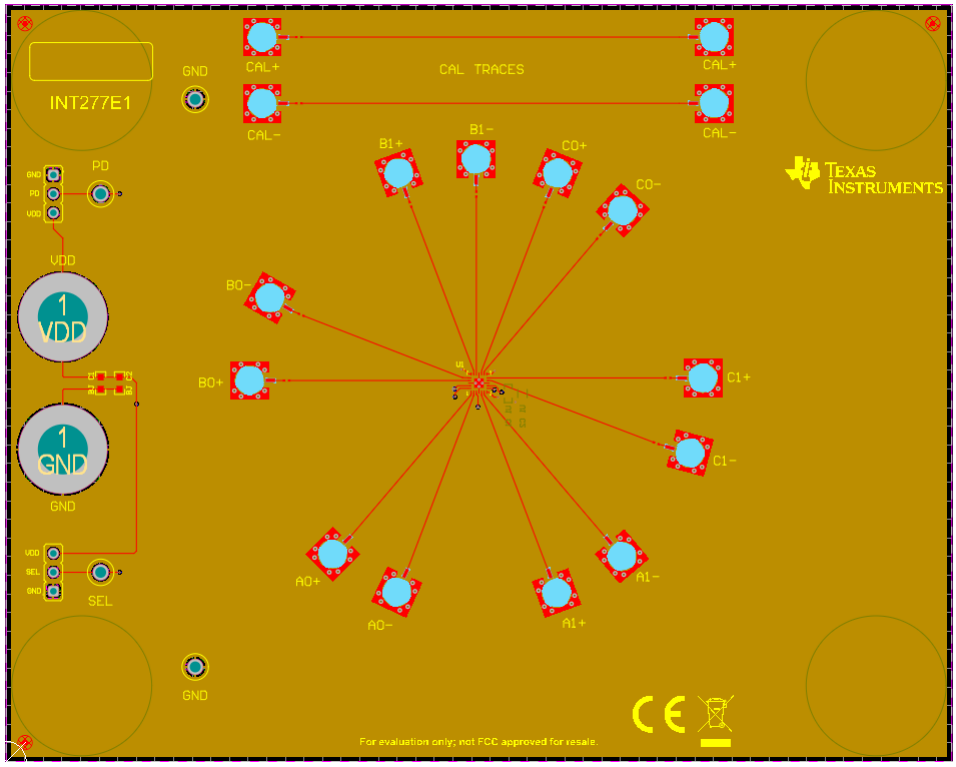

図 3-2. TMUXHS5212-EVM の上層レイアウト

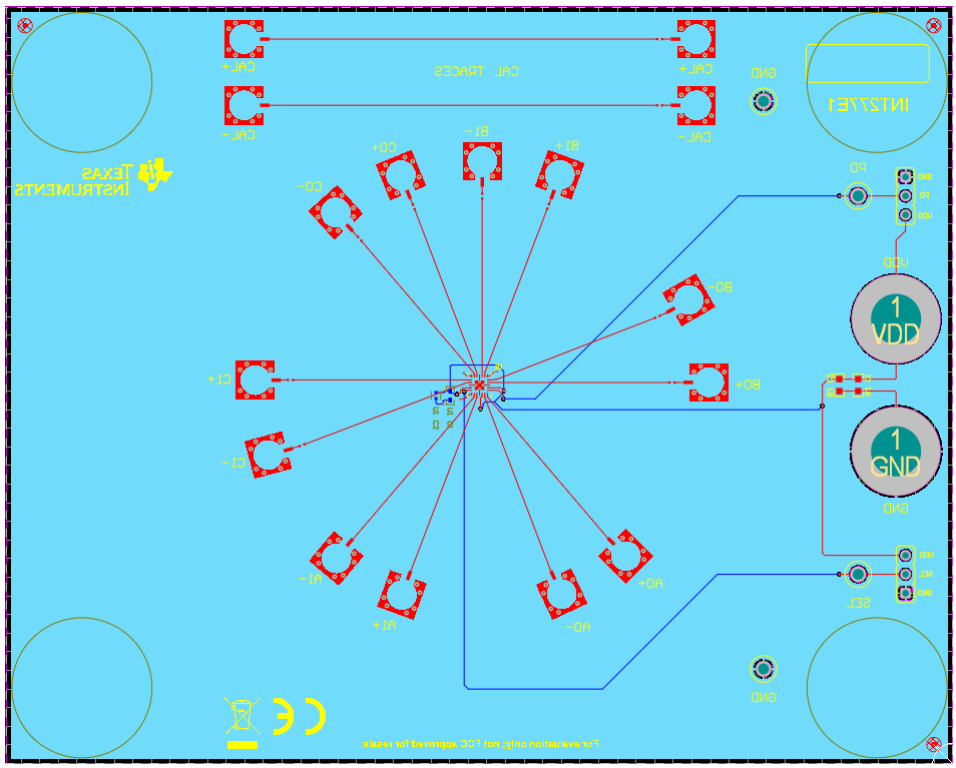

図 3-3. TMUXHS5212-EVM の最下部レイアウト

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3.3 部品表 (BOM)

表 3-1. 部品表

記号	数量	値	説明	メーカー	部品番号
A0-、A0+、A1-、A1+、B0-、B0+、B1-、B1+、C0-、C0+、C1-、C1+、CALn 入力、CALn 出力、CALp 入力、CALp 出力	16		コネクタ、RF 50Ω、SMT	Rosenberger	19S101-40ML5
B0- C、B0+ C、B1- C、B1+ C、C0- C、C0+ C、C1- C、C1+ C、CALn C、CALp C	10	0.22µF	コンデンサ、セラミック、0.22uF、6.3V、±20%、X5R、0201	MuRata	GRM033R60J224ME90
B1、B2、B3、B4	4		バンパー円筒形、ドーム径 0.720 インチ (18.30mm) ポリウレタン ブラック	Essentra コンポーネント	RBS-37BK
BJ C1	1	10µF	CAP、CERM、10µF、10V、±10%、X5R、0603	MuRata	GRM188R61A106KE69D
BJ C2	1	1µF	コンデンサ、セラミック、1µF、10V、±10%、X7R、0603	Taiyo Yuden	LMK107B7105KA-T
GND TP 1、GND TP 2	2		テスト ポイント、コンパクト、ブラック、TH	Keystone Electronics	5006
GND、VDD	2		標準バナナ ジャック、非絶縁	Pomona Electronics	3267
J1、J2	2		コネクタ ジャンパー S2 (1 × 2) ポジション シャント コネクタ ブラック オープン トップ 0.100 インチ (2.54mm) GoldHORTING .100 インチ ゴールド	Sullins	QPC02SXGN-RC
PD J、SEL J	2		ヘッダ、2.54mm、3x1、錫、TH	Molex	22284030
PD TP、SEL TP	2		テスト ポイント、コンパクト、オレンジ、TH	Keystone Electronics	5008
TMUXHS5212-EVM	1		熱転写プリンタブル ラベル、幅 0.650 インチ x 高さ 0.200 インチ、ロールあたり 10,000	Brady	THT-14-423-10
U1	1		2 チャネル差動 2:1 マルチプレクサ / 1:2 デマルチプレクサ	テキサス インスツルメンツ	TMUXHS5212DTY
U1 C1	1	0.1µF	コンデンサ、セラミック、0.1uF、16V、±10%、X7R、AEC-Q200 グレード 1、0402	Kemet	C0402C104K4RACAUTO
U1 C2	1	10nF	セラミック コンデンサ 0.01µF 25V X7R 10% SMD 1.0 × 0.5mm 125℃ 紙 T/R	KEMET	C0402C103K3RACTU

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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。

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STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.

   1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software

   1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.

2 *Limited Warranty and Related Remedies/Disclaimers*:

   2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.

   2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.

   2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.

User shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGREDATION 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/lsds/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。

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

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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.

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