EVM User's Guide: TCA984748-EVM

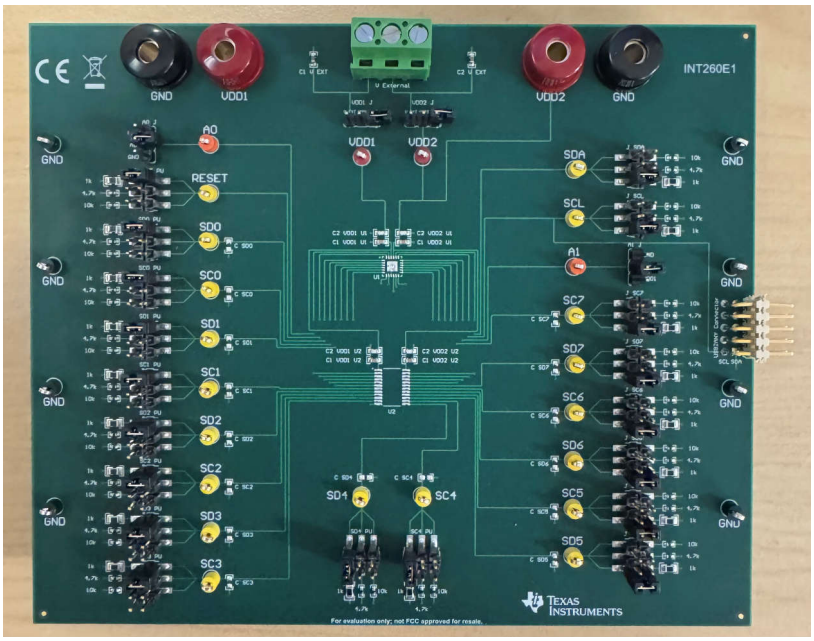
TCA984748 Evaluation Module

Description

The TCA984748-EVM is used to evaluate the performance of the TCA9847 and TCA9848. The evaluation module (EVM) does not come with a soldered unit. A sample can be ordered online at the bottom of the product page. The EVM allows for engineers to evaluate the TCA9847 and TCA9848 I2C signaling capabilities. The EVM has a USB2ANY male connecter to send I2C signals through the DUT. The USB2ANY microcontroller has to be acquired separately and does not come with this EVM. If a USB2ANY is used for the communication, then the cable must be connected with the notch facing up. A test point for each pin is present with many ground points for ease of use. Other features like load capacitor footprints and pull up resistors are for simplifying evaluation and testing.

Features

- External power supply with decoupling capacitors from V_External to ground (2x 1µF 0603)
- VDD1 and VDD2 test points for a second power supply connection option with decoupling capacitors (4x 100nF 0603, 4x 100pF 0603)
- VDD1 and VDD2 banana jack plug ins for a third power supply connection option with the same decoupling capacitors (4x 100nF 0603, 4x 100pF 0603)
- Two GND banana jack plug ins
- Eighteen test points for the I/Os
- A RESET test point and two additional ones for the addresses
- Eight GND test points for probing
- USB2ANY male connector for I2C signaling source from a microcontroller



TCA984748-EVM (Top View)

1 Evaluation Module Overview

1.1 Introduction

This EVM describes the TCA984748-EVM evaluation module (EVM) and the intended use. The board allows for quick prototyping and characterization of TI's TCA9847 and TCA9848 switch/multiplexer in PW and QFN packages.

The EVM includes the following additional features:

- Two 3-pin headers for connecting or disconnecting device from external power.
- Two 3-pin headers for setting the addresses of the device.
- Nineteen 3-lane 3-pin headers to pull up the bus through the desired resistor value.
- Multiple unpopulated load capacitor footprints for potential additional bus capacitance.

1.2 Kit Contents

The EVM kit includes the following :

- (1)TCA984748-EVM

1.3 Specification

The TCA984748-EVM is used for evaluating TCA9847 and TCA9848. The EVM has four 3-pin headers and two headers for VDD1 and VDD2 supplies that can be connected to an external source or to the board ground. Two headers for setting the addresses A0 and A1 pins high or low. An additional nineteen 3-lane 3-pin headers for the option to pull up the bus to VDD1 through a 1k, 4.7k, or 10k resistor using a jumper.

The EVM has test points on each I/O (for a total of eighteen), and two test points for both supplies and two test points for the two address pins. Eight ground test points allow for more connection flexibility on the board.

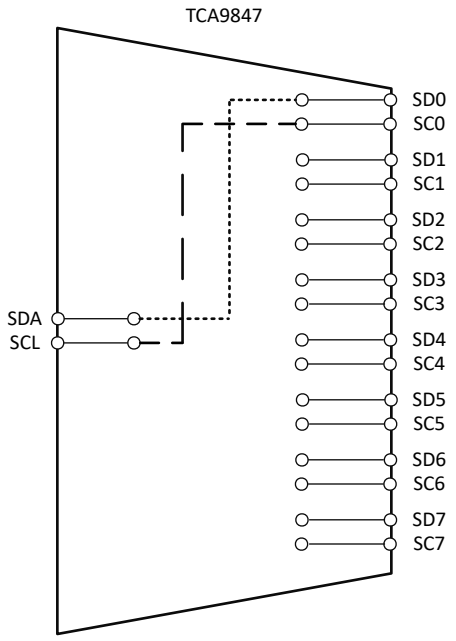


Figure 1-1. TCA9847 Simplified Circuit

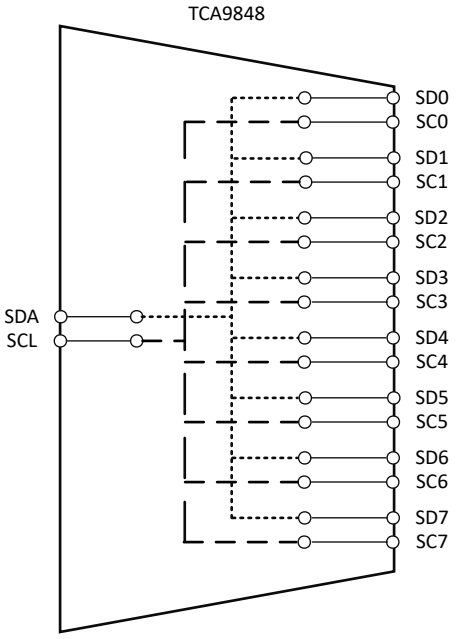


Figure 1-2. TCA9848 Simplified Circuit

1.4 Device Information

The TCA9847 and TCA9848 are in-band I2C controlled multiplexer and switch. The channel switching and toggling is controlled by the I2C bus that is also passed through the I/Os. Both TCA9847 and TCA9848 have 8-channels, but with mux and switch configurations. They work with a single supply of 1.65V to 3.6V and have voltage translating capabilities from 0.65V to 3.3V.

The TCA9847 and TCA9848 are also capable of operating at I2C Fast Mode Plus, which have a rated operating bandwidth of 1MHz to support higher speed signaling in I2C applications.

2 Hardware

2.1 Power Requirements

TCA984748-EVM requires a 1.65V to 3.6V supply provided through the External Supply, Banana Jack Plugins, or directly hooked to the red VDD test points. The voltage supply of the device must not be left floating.

2.2 Header and Jumper Information

The TCA984748-EVM has four 3-pin headers and nineteen 3x2 headers to set up the power supply connection, addresses and pull up resistors. The following is a description of each header.

1. **VDD1 J Header**

   Header VDD1 J connects the VDD1 pin to either the external power or to ground via a jumper. If that header is not connected, then the device's supply is left floating. Figure 2-1 shows header VDD1 J.

   a. To connect to the external supply, short the J1-2 location on the header. The External Supply terminal is now supplying the device power.
   b. To connect to ground, short the J2-3 location on the header. The device VDD1 supply pin is now grounded.

2. **VDD2 J Header**

   Header VDD2 J connects the VDD2 pin to either the external power or to ground via a jumper. If that header is not connected, then the device's supply is left floating.

   a. To connect to the external supply, short the J2-3 location on the header. The External Supply terminal is now supplying the device power.
   b. To connect to ground, short the J1-2 location on the header. The device VDD2 supply pin is now grounded.

3. **A0 J Header**

   Header A0 J connects the address pin A0 to either VDD1 or ground via a jumper. This pin must not be left floating.

   a. To connect to VDD1, short the J2-3 location on the header. A0 is connected to VDD1.
   b. To connect to GND, short the J2-1 location on the header. The A0 pin is now grounded.

4. **A1 J Header**

   Header A1 J connects the address pin A1 to either VDD1 or ground via a jumper. This pin must not be left floating.

   a. To connect to VDD1, short the J2-3 location on the header. A1 is connected to VDD1.
   b. To connect to GND, short the J2-1 location on the header. The A1 pin is now grounded.

5. **3x2 Header "Pin Name" PU**

   The 3x2 headers are connected to each I/O of the device. Each one can pull up the line with three different resistor options: 1k, 4.7k, and 10k. It is highly recommended to pull up the line with one of these values since the I2C bus cannot be left floating.

   a. To connect to a 1k pull up, populate the top row of the header with a jumper. If the header is placed on the right side of the board, populate the bottom row.
   b. To connect to a 4.7k pull up, populate the middle row of the header with a jumper.
   c. To connect to a 10k pull up, populate the bottom row of the header with a jumper. If the header is placed on the right side of the board, then populate the top row.

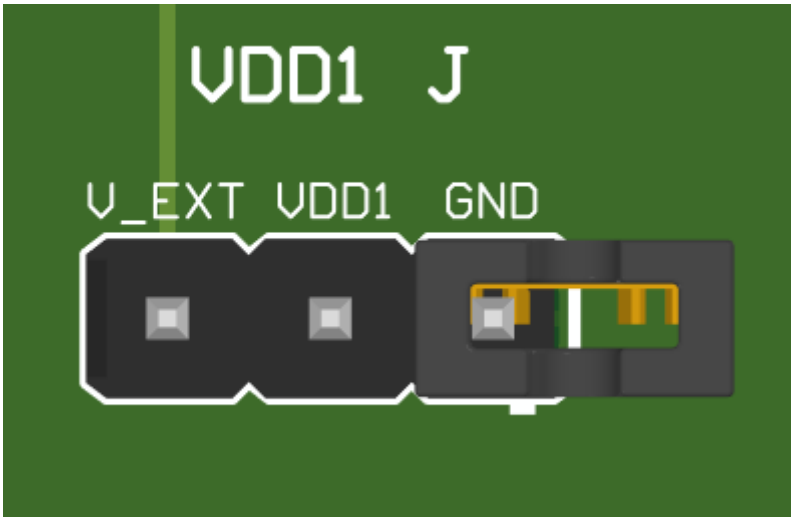


Figure 2-1. Header VDD1 J : J-1(External Supply), J-2(Connection to device VDD1), J-3 (GND)

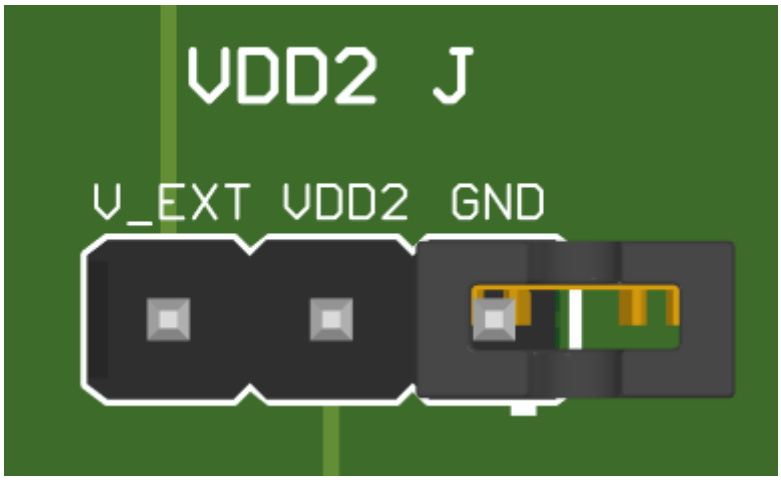


Figure 2-2. Header VDD2 J : J-1(External Supply), J-2(Connection to device VDD2), J-3 (GND)

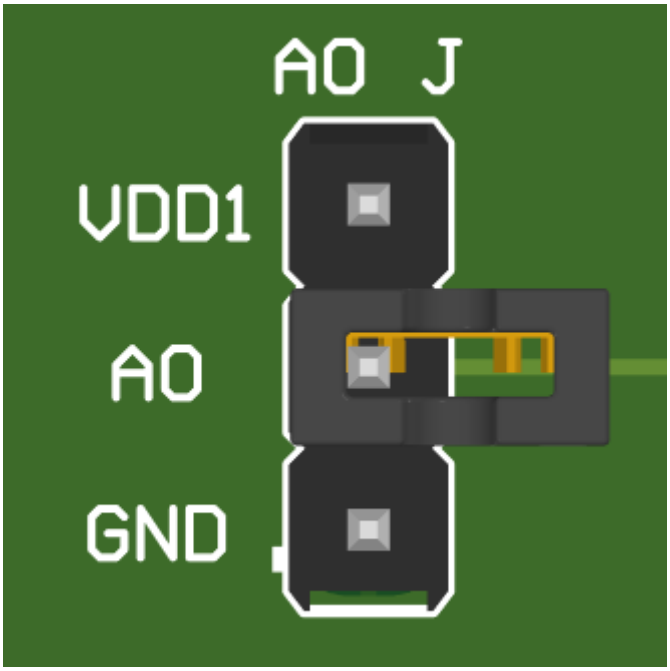


Figure 2-3. Header A0 J : J-1(VDD1), J-2(Connection to device A0), J-3 (GND)

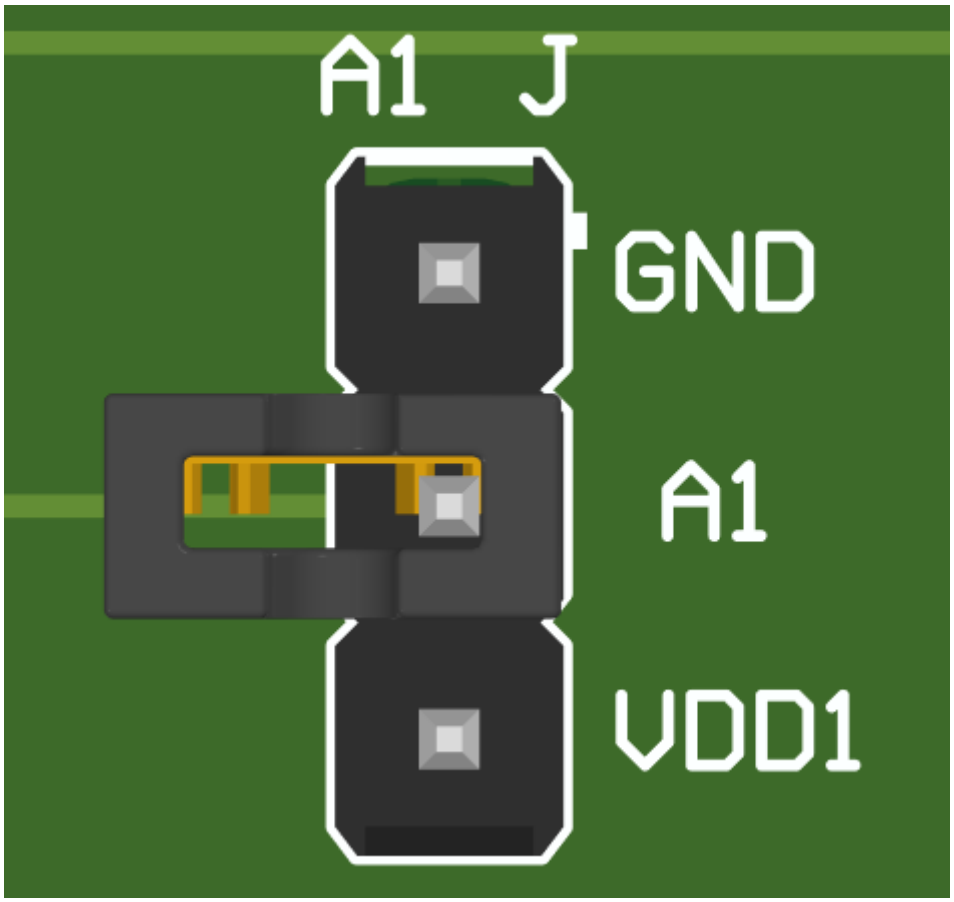


Figure 2-4. Header A1 J : J-1(GND), J-2(Connection to device A1), J-3 (VDD1)

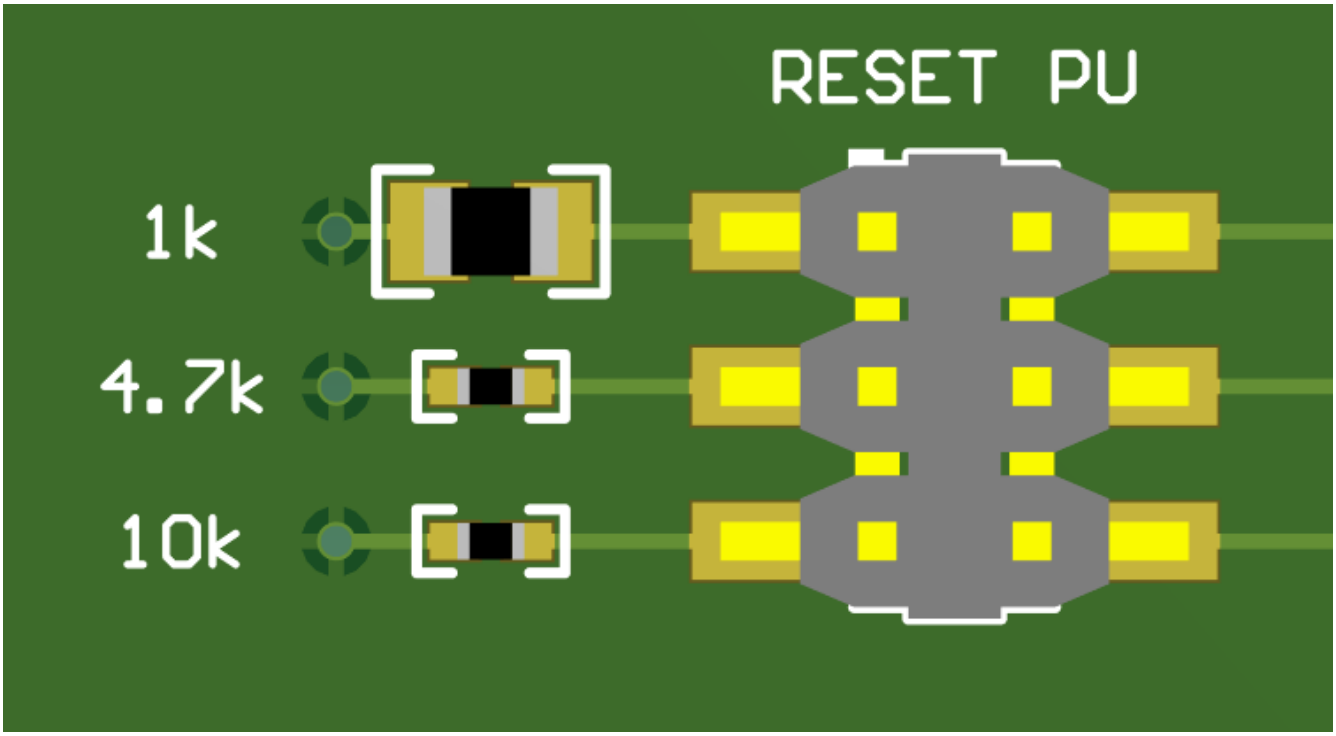


Figure 2-5. Header 3x2 RESET PU : Top(RESET-1k), Middle(RESET-4.7k), Bottom (RESET-10k)

2.3 Test Points

The board has a total of 31 test points. 8 GND, 2 SEL, 2 VDD, and 19 I/O.

Test Point ID	Description	Signal
RESET	Yellow TP	RESET
SD0	Yellow TP	SD0
SC0	Yellow TP	SC0
SD1	Yellow TP	SD1
SC1	Yellow TP	SC1
SD2	Yellow TP	SD2
SC2	Yellow TP	SC2
SD3	Yellow TP	SD3
SC3	Yellow TP	SC3
SD4	Yellow TP	SD4
SC4	Yellow TP	SC4
SD5	Yellow TP	SD5
SC5	Yellow TP	SC5
SD6	Yellow TP	SD6
SC6	Yellow TP	SC6
SD7	Yellow TP	SD7
SC7	Yellow TP	SC7
SDA	Yellow TP	SDA
SCL	Yellow TP	SCL
VDD1	Red TP	VDD1
VDD2	Red TP	VDD2
A0	Orange TP	A0
A1	Orange TP	A1
GND	Black TP	GND
GND	Black TP	GND
GND	Black TP	GND
GND	Black TP	GND
GND	Black TP	GND
GND	Black TP	GND
GND	Black TP	GND
GND	Black TP	GND

3 Hardware Design Files

The following section includes hardware design files for TCA984748-EVM . This section includes the board level schematic, PCB layout, and Bill of materials (BOM).

3.1 Schematics

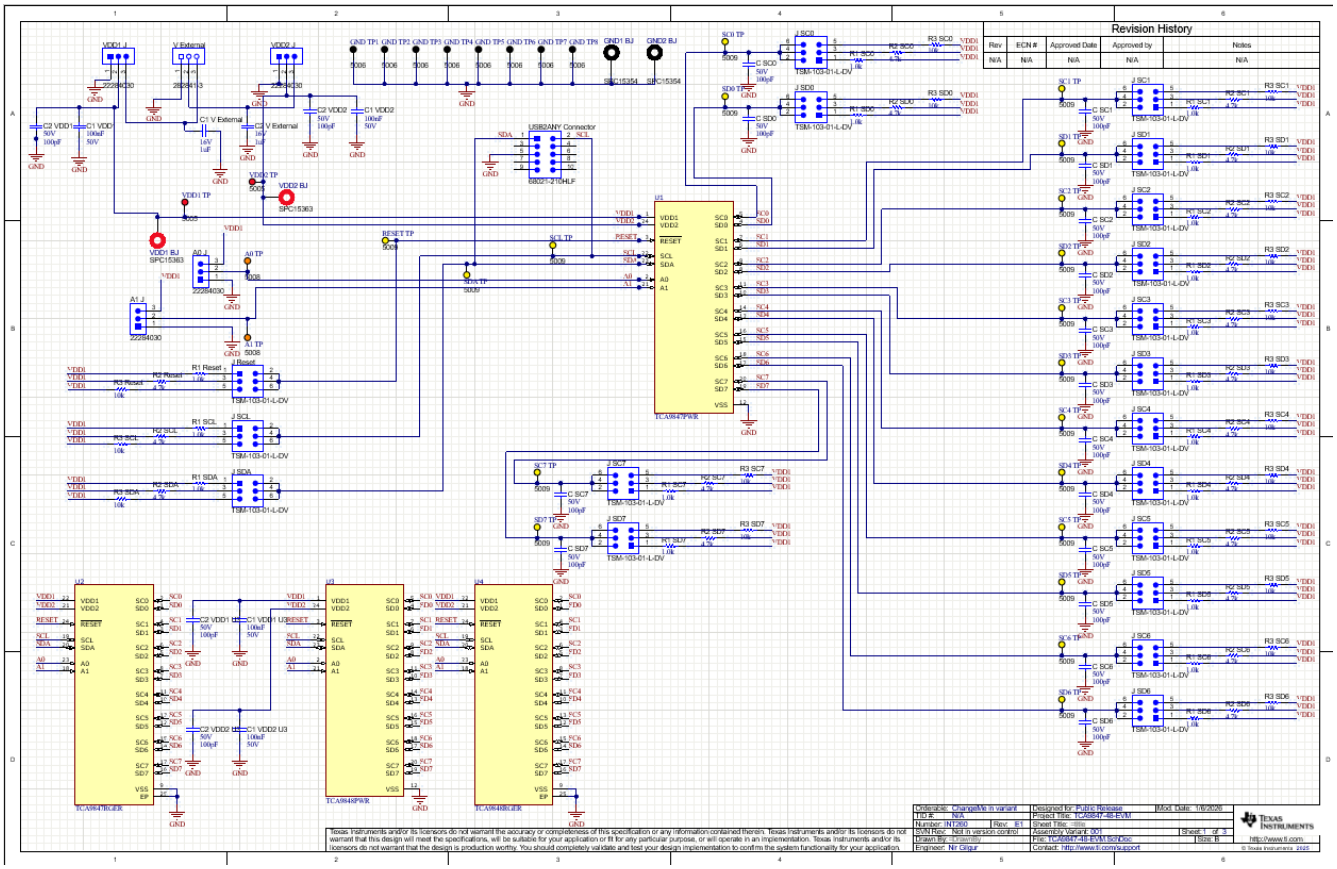


Figure 3-1. TCA984748-EVM Schematic

3.2 PCB Layouts

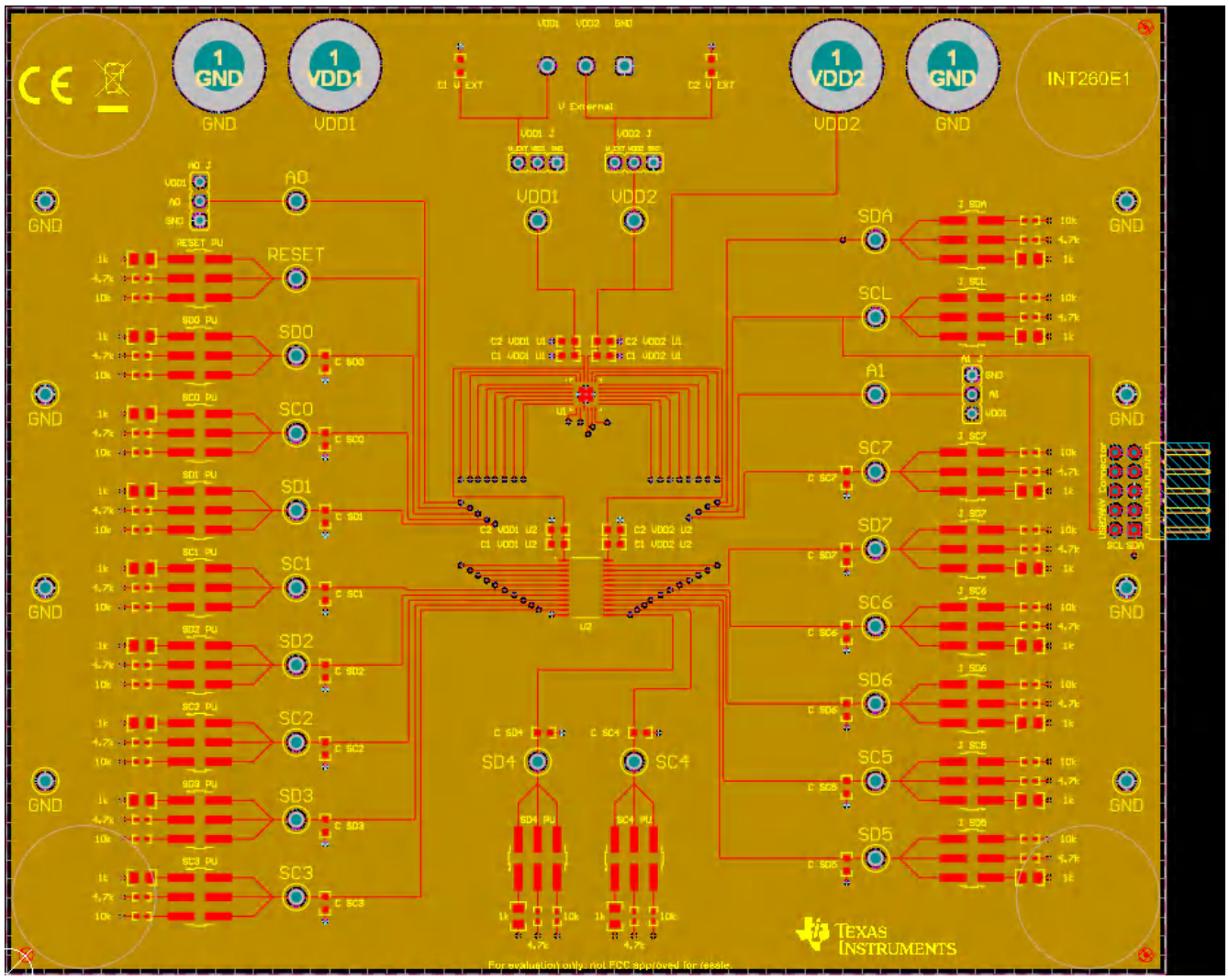


Figure 3-2. TCA984748-EVM Top Layer Layout

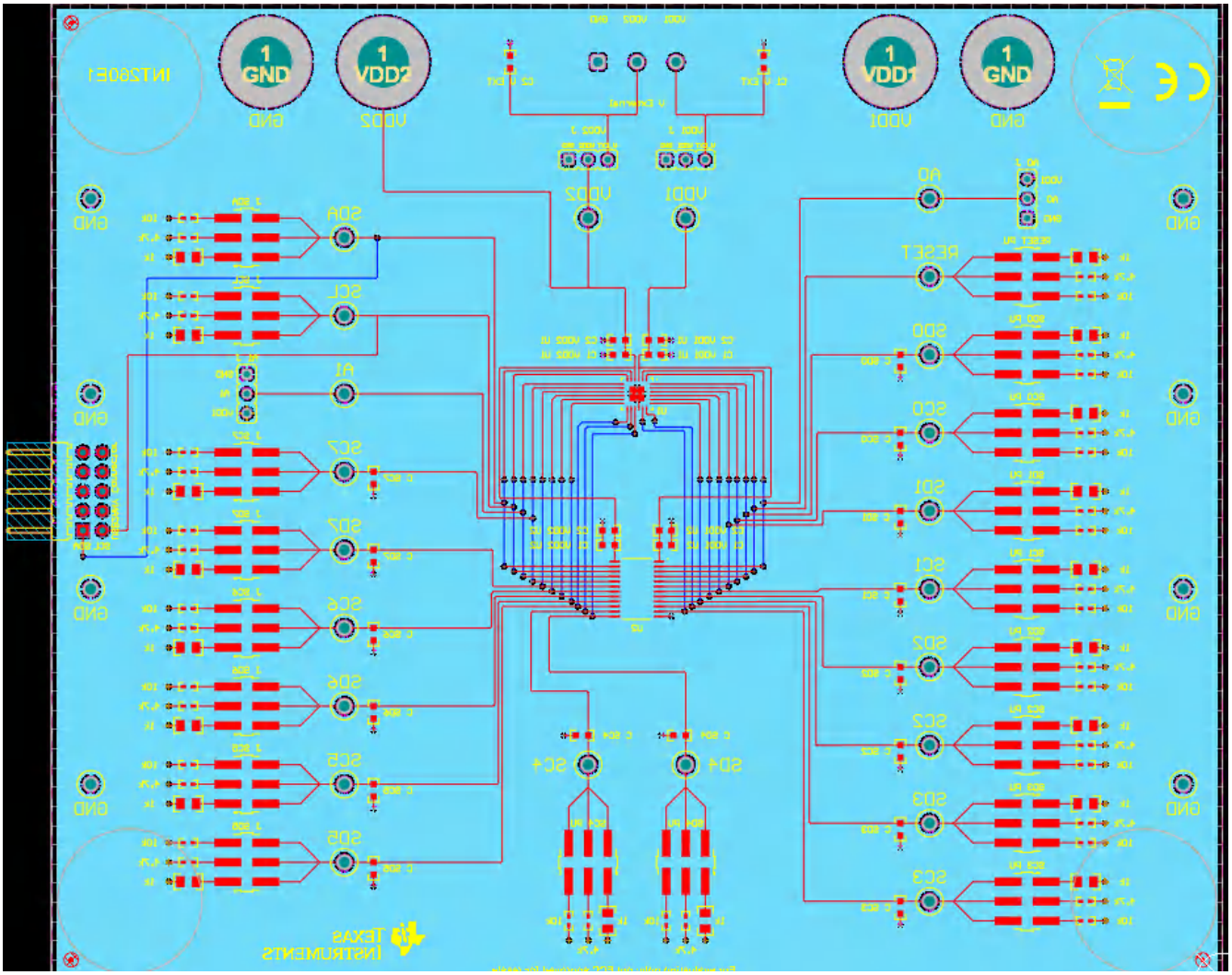


Figure 3-3. TCA984748-EVM Bottom Layer Layout

3.3 Bill of Materials (BOM)

Table 3-1. Bill of Materials

Designator	Qty	Value	Description	Manufacturer	Part Number
J1, J2, J3, J4, J5, J6, J7, J8, J9, J11, J12, J13, J14, J15, J16, J17, J18, J19, J20, J21, J22, J23	23		CONN JUMPER S2 (1 × 2) Position Shunt Connector Black Open Top 0.100" (2.54mm) GoldHORTING .100" GOLD	Sullins	QPC02SXGN-RC
A0 J, A1 J, VDD1 J, VDD2 J	4		Header, 2.54mm, 3x1, Tin, TH	Molex	22284030
A0 TP, A1 TP	2		Test Point, Compact, Orange, TH	Keystone Electronics	5008
B1, B2, B3, B4	4		Bumper Cylindrical, Dome 0.720" Dia (18.30mm) Polyurethane Black	Essentra Components	RBS-37BK
C1 V External, C2 V External	2	1uF	CAP, CERM, 1uF, 16V, +/- 10%, X5R, 0603	Kemet	C0603C105K4PACTU
C1 VDD1, C1 VDD1 U3, C1 VDD2, C1 VDD2 U3	4	0.1uF	CAP, CERM, 0.1µF, 50V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	Kemet	C0603C104K5RACAUTO
C2 VDD1, C2 VDD1 U3, C2 VDD2, C2 VDD2 U3	4	100pF	CAP, CERM, 100pF, 50V, +/- 1%, C0G/NP0, 0603	AVX	06035A101FAT2A
GND1 BJ, GND2 BJ	2		BANANA JACK, SOLDER LUG, BLACK, TH	Tenma	SPC15354
GND TP1, GND TP2, GND TP3, GND TP4, GND TP5, GND TP6, GND TP7, GND TP8	8		Test Point, Compact, Black, TH	Keystone Electronics	5006
J Reset, J SC0, J SC1, J SC2, J SC3, J SC4, J SC5, J SC6, J SC7, J SCL, J SD0, J SD1, J SD2, J SD3, J SD4, J SD5, J SD6, J SD7, J SDA	19		Header, 2.54mm, 3x2, Gold, SMT	Samtec	TSM-103-01-L-DV
R1 Reset, R1 SC0, R1 SC1, R1 SC2, R1 SC3, R1 SC4, R1 SC5, R1 SC6, R1 SC7, R1 SCL, R1 SD0, R1 SD1, R1 SD2, R1 SD3, R1 SD4, R1 SD5, R1 SD6, R1 SD7, R1 SDA	19	1.0kΩ	RES, 1.0k, 5%, 0.125W, AEC-Q200 Grade 0, 0805	Panasonic	ERJ-6GEYJ102V
R2 Reset, R2 SC0, R2 SC1, R2 SC2, R2 SC3, R2 SC4, R2 SC5, R2 SC6, R2 SC7, R2 SCL, R2 SD0, R2 SD1, R2 SD2, R2 SD3, R2 SD4, R2 SD5, R2 SD6, R2 SD7, R2 SDA	19	4.7kΩ	RES, 4.7k, 5%, 0.063W, AEC-Q200 Grade 0, 0402	Vishay-Dale	CRCW04024K70JNED

Table 3-1. Bill of Materials (continued)

Designator	Qty	Value	Description	Manufacturer	Part Number
R3 Reset, R3 SC0, R3 SC1, R3 SC2, R3 SC3, R3 SC4, R3 SC5, R3 SC6, R3 SC7, R3 SCL, R3 SD0, R3 SD1, R3 SD2, R3 SD3, R3 SD4, R3 SD5, R3 SD6, R3 SD7, R3 SDA	19	10kΩ	RES, 10k, 5%, 0.063W, AEC-Q200 Grade 0, 0402	Vishay-Dale	CRCW040210K0JNED
RESET TP, SC0 TP, SC1 TP, SC2 TP, SC3 TP, SC4 TP, SC5 TP, SC6 TP, SC7 TP, SCL TP, SD0 TP, SD1 TP, SD2 TP, SD3 TP, SD4 TP, SD5 TP, SD6 TP, SD7 TP, SDA TP	19		Test Point, Compact, Yellow, TH	Keystone Electronics	5009
USB2ANY Connector	1		Header, 100mil, 5x2, R/A, Gold, TH	FCI	68021-210HLF
V External	1		Terminal Block, 5.08mm, 3x1, Tin, TH	TE Connectivity	282841-3
VDD1 BJ, VDD2 BJ	2		BANANA JACK, SOLDER LUG, RED, TH	Tenma	SPC15363
VDD1 TP, VDD2 TP	2		Test Point, Compact, Red, TH	Keystone Electronics	5005
C SC0, C SC1, C SC2, C SC3, C SC4, C SC5, C SC6, C SC7, C SD0, C SD1, C SD2, C SD3, C SD4, C SD5, C SD6, C SD7	0	100pF	CAP, CERM, 100pF, 50V, +/- 1%, C0G/NP0, 0603	AVX	06035A101FAT2A
U1	0		TCA9847PWR	Texas Instruments	TCA9847PWR
U2	0		TCA9847RGER	Texas Instruments	TCA9847RGER
U3	0		TCA9848PWR	Texas Instruments	TCA9848PWR
U4	0		TCA9848RGER	Texas Instruments	TCA9848RGER

4 Additional Information

4.1 Trademarks

All trademarks are the property of their respective owners.

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.

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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

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西新宿三井ビル

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:*

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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