

ABSTRACT

This user's guide describes the characteristics, operation, and use of the TMP1827EVM evaluation board. This user's guide discusses how to set up and configure the software, lists the hardware, and reviews various aspects of the software operation. Throughout this document, the terms evaluation board, evaluation module, and EVM are synonymous with the TMP1827EVM. This user's guide also provides information on the operating procedure, input and output connections, an electrical schematic, printed circuit board (PCB) layout drawings, and a parts list for the EVM.

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Trademarks

All trademarks are the property of their respective owners.

1 Introduction

The TMP1827EVM allows users to evaluate the performance of the TMP1827 digital temperature sensor. The EVM comes in a USB stick form factor, with an onboard MSP430F5528 microcontroller that interfaces with both the host computer and the TMP1827 device using a Single Wire interface. The module is designed with perforations between the sensor and host controller on the EVM board. The perforation allows the user flexibility in their evaluation:

- The user can connect the TMP1827 to the user's system/host.
- The user can connect the EVM host and software to the user's system with TMP1827 devices.
- Small individual boards allow the user to place sensors in the user's system.
- Hole spacing is compatible with common 0.1" prototyping breadboards

1.1 EVM Kit Contents

[Table 1-1](#) lists the contents of the EVM kit. Contact the Texas Instruments Product Information Center nearest you if any components are missing. TI highly recommends that users check the TI website at <https://www.ti.com> to verify that they have the latest versions of the related software.

Table 1-1. Kit Contents

Item	Quantity
TMP1827EVM	1

2 EVM Hardware

2.1 Perforations

The perforation between the USB controller board and TMP1827 sensor board is designed to allow separation of the sensor and controller. The holes support standard 0.1" pitch headers. The pins are labeled with their functions on both sides. The small sensor board can be placed in-system, or the controller can be used to test a sensor which is part of another system.

2.2 Subregulator

The switch S1 enables and disables the onboard 3.3-V regulator: U8. When the subregulator is enabled, the green LED D3 illuminates. The subregulator must be enabled for normal operation of TMP1827EVM. It is possible to supply other voltages at the 3P3V pin when the subregulator is disabled.

2.3 Logic Level Translator

The translators U3 and U6 separates the MSP430 UART host from the TMP1827 device. This is not required for end applications, but the translator is provided on the EVM as a courtesy. When the subregulator is disabled, a voltage between 1.7 V and 5.5 V can be applied at the 3P3V net, which is the 3.3-V pin on the perforation. This external voltage will illuminate the green LED D3 and power the TMP1827 device.

2.4 Programming Header

The TMP1827EVM comes pre-loaded with firmware that is necessary for the correct operation of the USB interface and PC GUI software. The unpopulated header, J2, is provided for Spy-Bi-Wire access to the MSP430F5528. TI does not recommend that users access this header or reprogram the device.

2.5 BSL Button

The TMP1827EVM features push-button SW1 for entering USB BSL mode. This can be used for firmware updates. The button must be held down while the user plugs in the USB and can be released afterwards.

2.6 Status LED

The red LED (D4) indicates status in the USB2ANY firmware. A blinking LED indicates the MSP430F5528 is waiting for USB connection from the GUI application. At initial power on, or when connected to the GUI, the LED turns off.

3 Software Download

The PC GUI Software for TMP1827EVM runs on TI's GUI Composer framework. The software is available as a live version which runs in your browser, and it is available as a download for offline use. The software is compatible with Windows, Mac, and Linux operating systems.

3.1 Live Software on dev.ti.com

The live software currently works on Chrome, Firefox, and Safari browsers. Internet Explorer is not supported. Users can access the live version through one of the following actions:

- Follow [this link](#).
- Go to the EVM tool page and click the *View* button.
- Go to [dev.ti.com/gallery](#), login with your myTI account credentials, and search for TMP1827.

Click the application icon within the gallery to launch the software. You must agree to the prompts to install or update the TI Cloud Agent Bridge browser plugin. The plugin is necessary for connection to the USB hardware.

3.2 Download from dev.ti.com

Users can access the latest version of the offline software by navigating to the live version as noted above. Look for the download icon  and download both the application and runtime for the operating system as shown in [Figure 3-1](#).

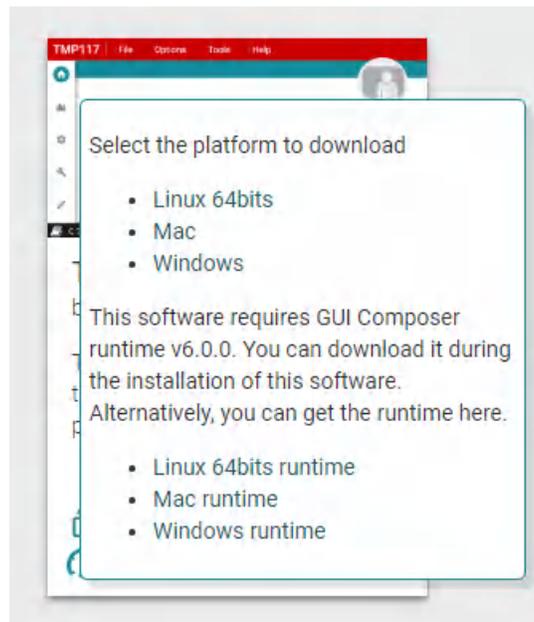


Figure 3-1. Download Pop-Up

4 Software

4.1 Home Tab

The *Home* tab is shown at software launch. The icons on the bottom of this tab are shortcuts to the other functional tabs of the GUI, and correspond to the icons on the left-hand-side of the GUI.

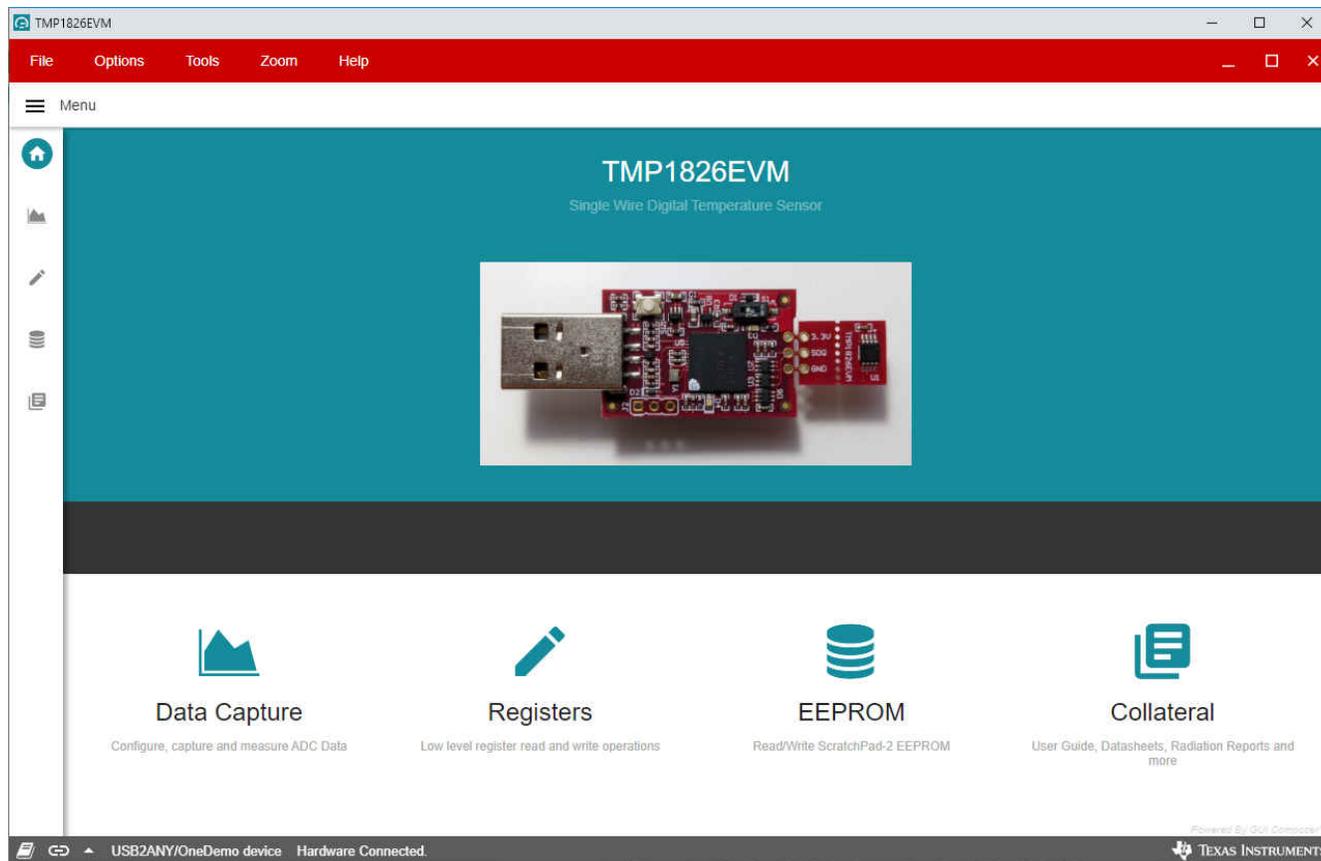


Figure 4-1. Home

4.2 Data Capture Tab

The *Data Capture* tab reports the temperature from the TMP1827 device included on the TMP1827EVM.

- Temperature data will be polled and displayed by default. To disable polling or change the polling rate, use the *Polling Rate* drop-down menu under the *Chart Controls* tile on the right. The CONVERT TEMP command (0x44) is sent automatically while polling. The polling rate setting on the *Data Capture* tab is synchronized with the polling rate setting on the *Registers* tab.
- Temperature data can be saved to file as it is received using the *Save Start* and *Save Stop* buttons. Note that when the online version of the GUI is used, a download will begin in your browser. This download will be lost if the GUI is closed. When the offline version of the GUI is used, the file will be appended as data is received. In this case, appended data will not be lost if the GUI is closed.

- The *Offset* and *Alert* settings are synchronized to the *Registers* tab. A temperature in Celsius may be entered and view the corresponding hex value or vice versa.

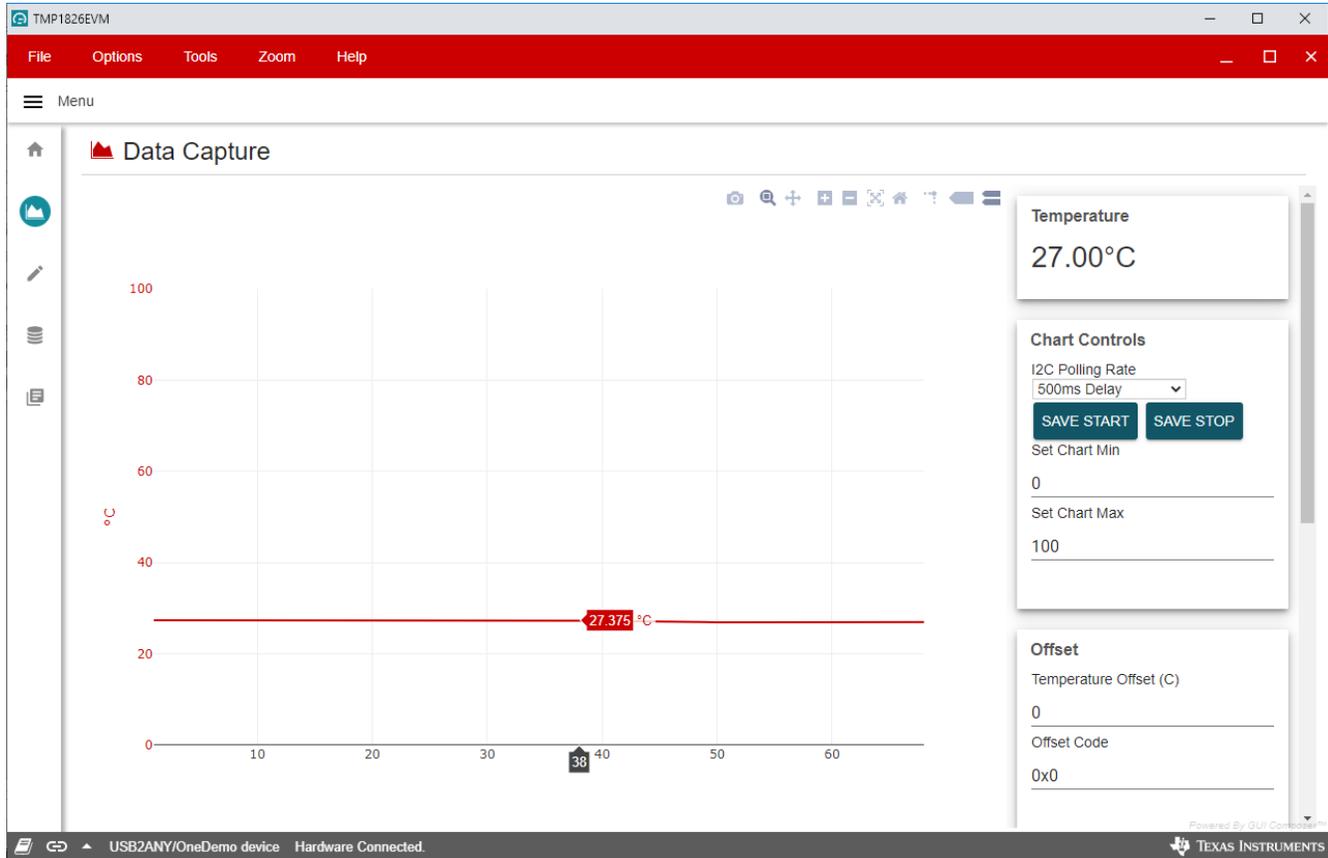


Figure 4-2. Data Capture

4.3 Registers Tab

The *Registers* tab interacts with the ScratchPad-1 registers within the TMP1827 device.

The *Auto Read* drop-down menu configures polling of register contents. When *Auto Read* is off, it is necessary to click *Read Register* to fetch the contents of the current register. The *Read All Registers* button can be used to fetch the contents of all registers at once. The *Write Register* button is greyed and disabled when the drop-down menu next to the button is set to *Immediate*. *Immediate* mode triggers a write operation each time a register is modified. When *Deferred mode* is selected, the *Write Register* button is enabled, and write operations will not be performed unless the *Write Register* button is clicked. These settings give the user total control over bus activity,

and enable individual transactions to be easily observed with an oscilloscope, logic analyzer, or bus-sniffing device.

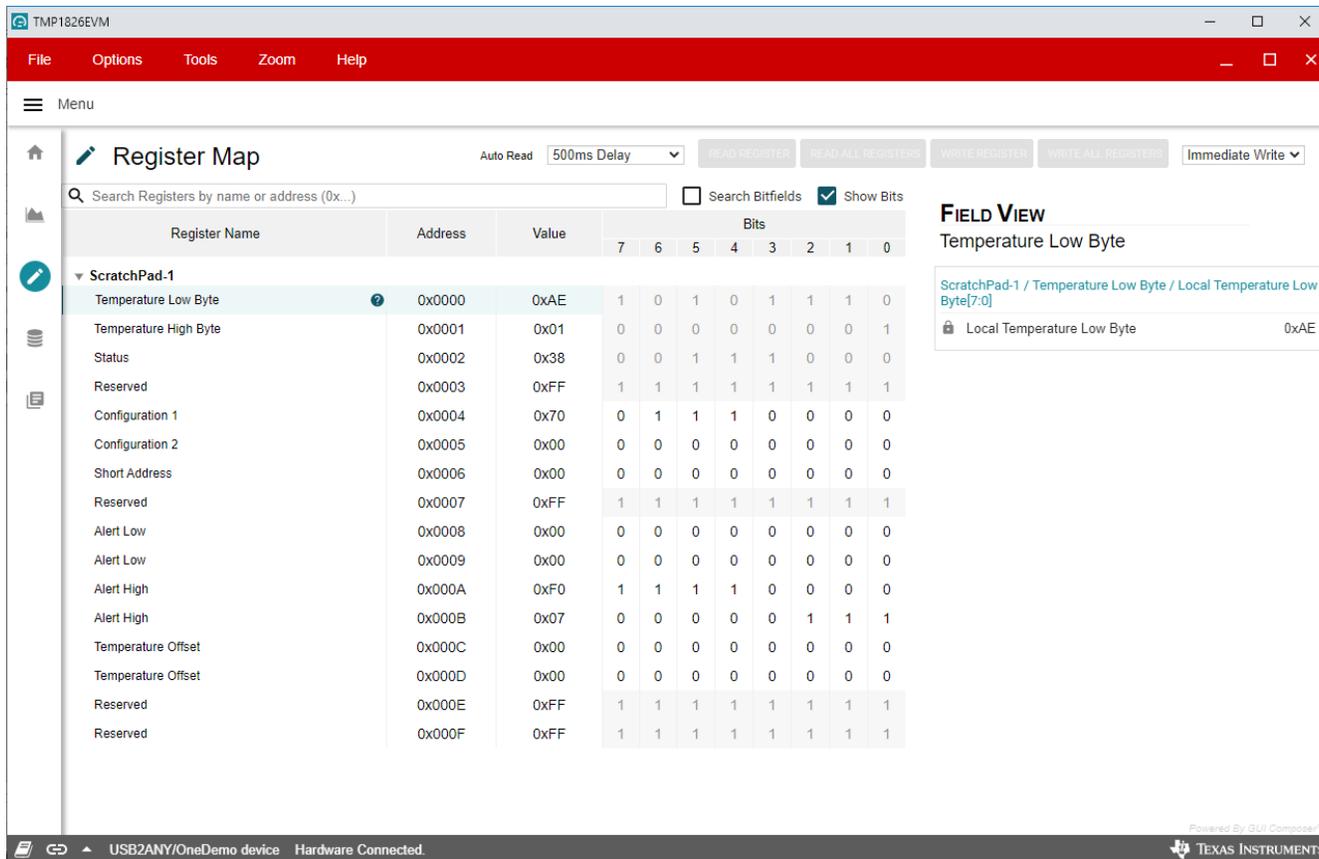


Figure 4-3. Registers

4.4 EEPROM Tab

The *EEPROM* tab interacts with the user EEPROM through the ScratchPad-2 register within the TMP1827 device.

- **Read Blocks:** To query the contents of EEPROM, enter an address range and click *Read EEPROM*. The data is displayed at the right in the preview area as it is retrieved. Note that ScratchPad-2 is a buffer for data being committed to EEPROM, so only the last write to ScratchPad-2 can be read back. Other addresses will respond with 0xFF when the Read ScratchPad-2 command is used.
- **Write Blocks:** A single block of 8 bytes can be written to ScratchPad-2, or written and immediately committed to EEPROM.
- **File Operations:**
 - *Read File* loads a CSV file into the preview area at the right. TI recommends to verify read back of edited files before clicking the *Write EEPROM From File* button.
 - *Save File* saves the current preview, shown at the right, to a CSV file. TI recommends to save a preview and edit the resulting file.

- Write *EEPROM From File* loads a CSV file into preview as it performs the necessary Write ScratchPad-2 and EEPROM Copy (Commit) commands.

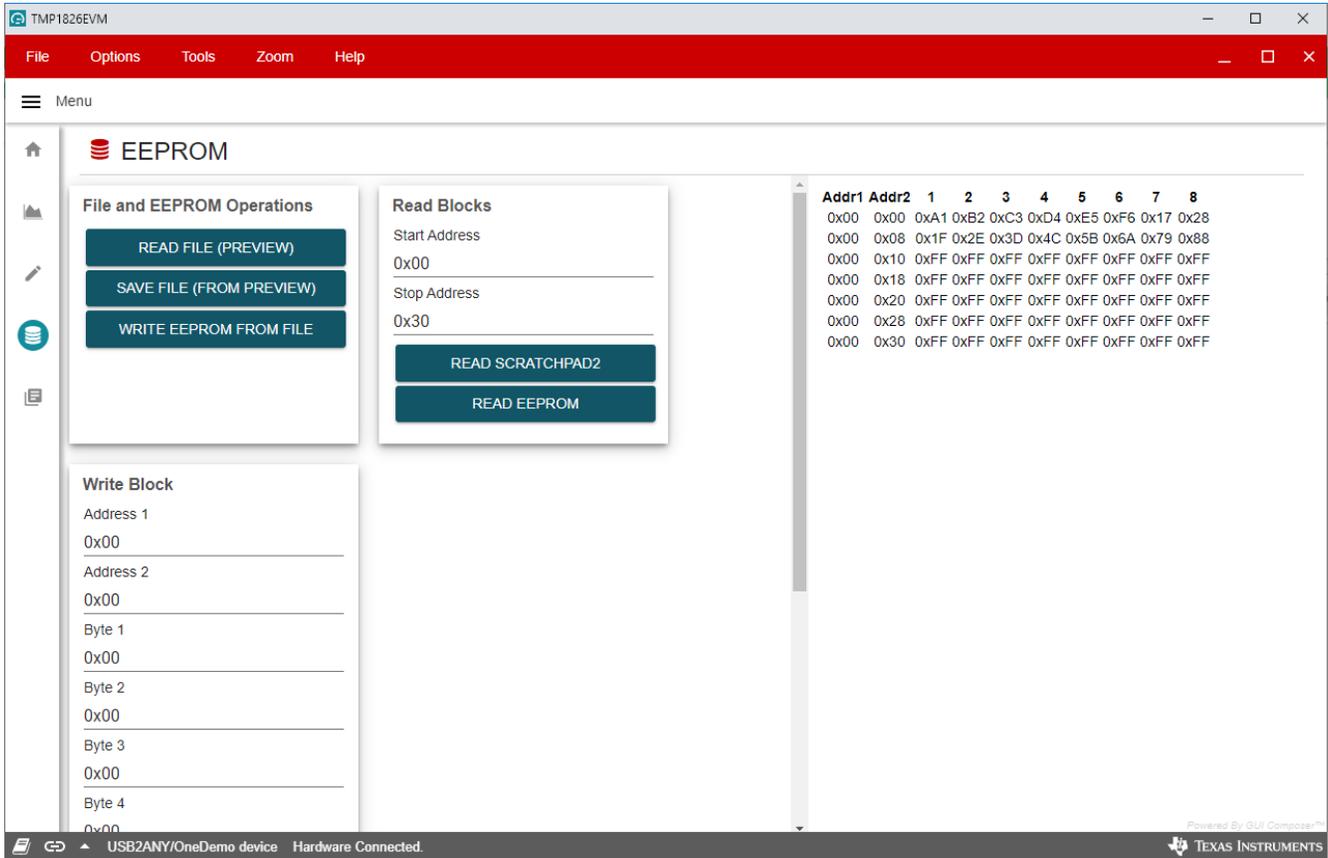


Figure 4-4. EEPROM

5 Schematic, Board Layout and Bill of Materials

5.1 Schematic

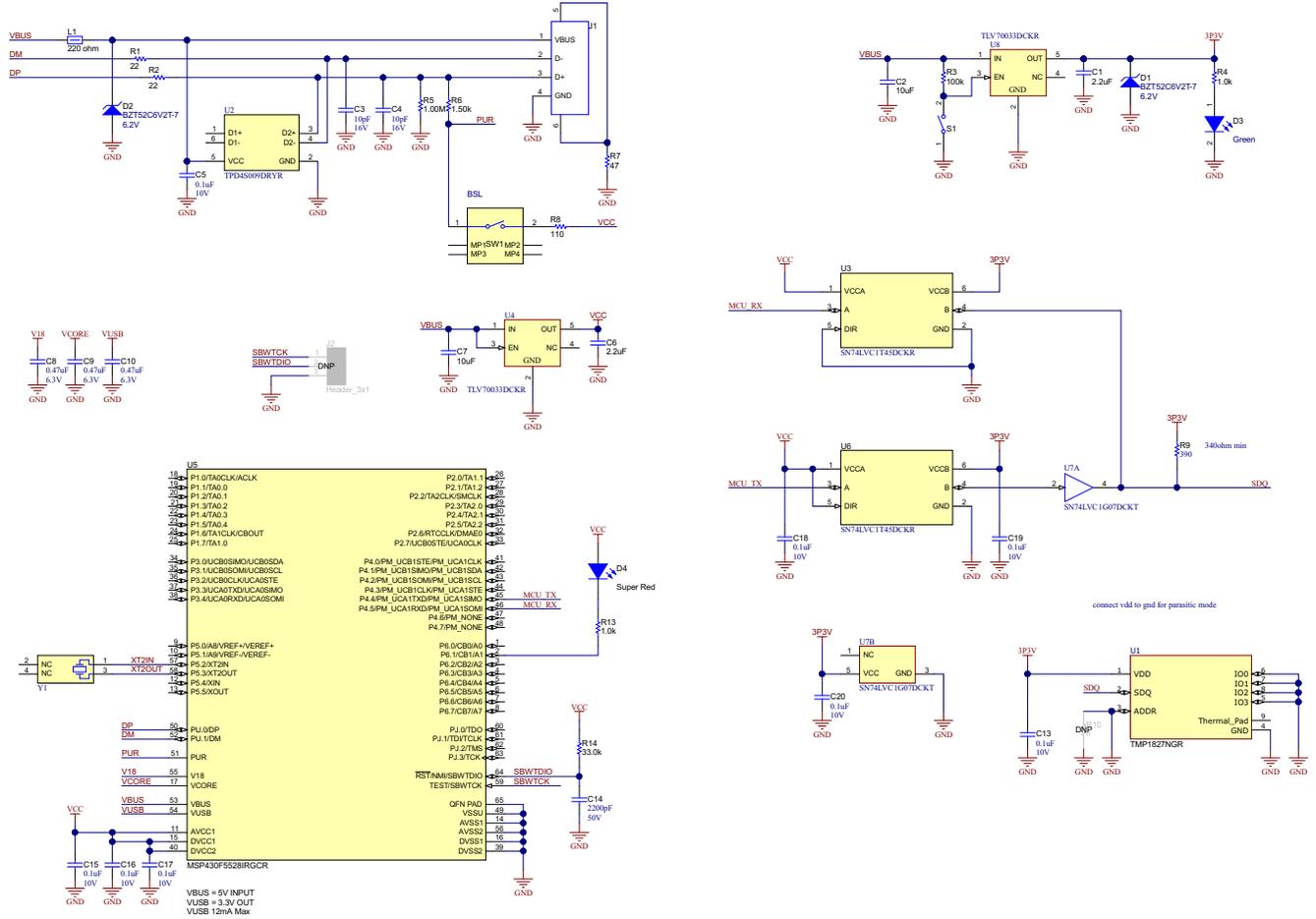


Figure 5-1. Schematic

5.2 Printed Circuit Board (PCB)

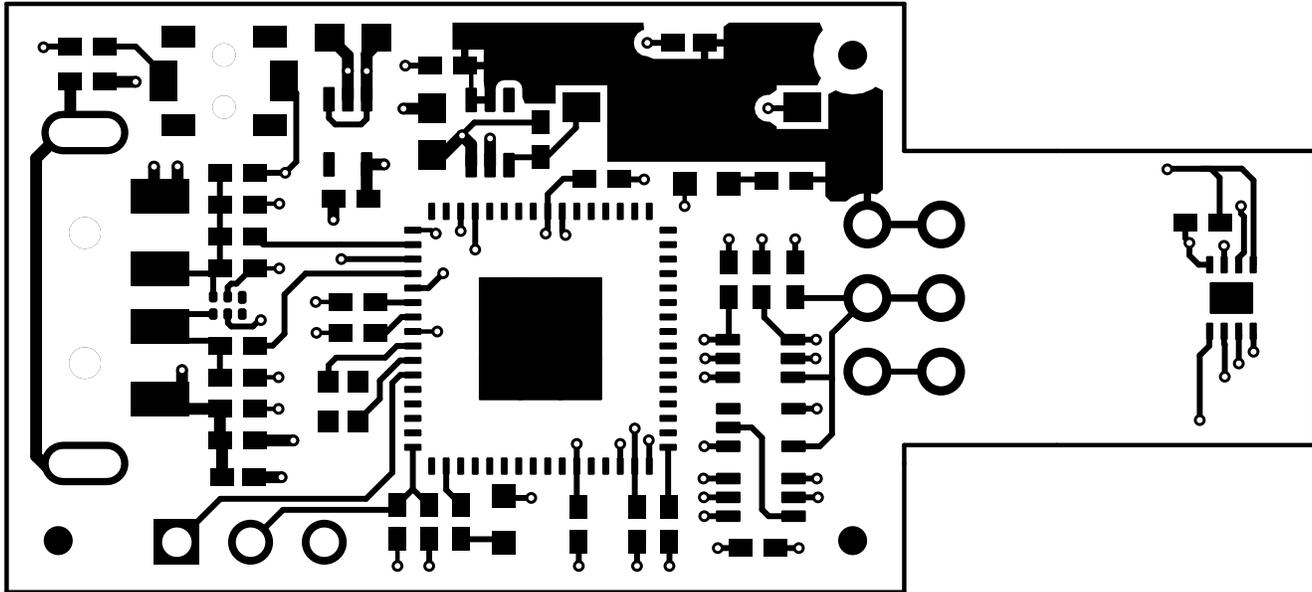


Figure 5-2. PCB Top

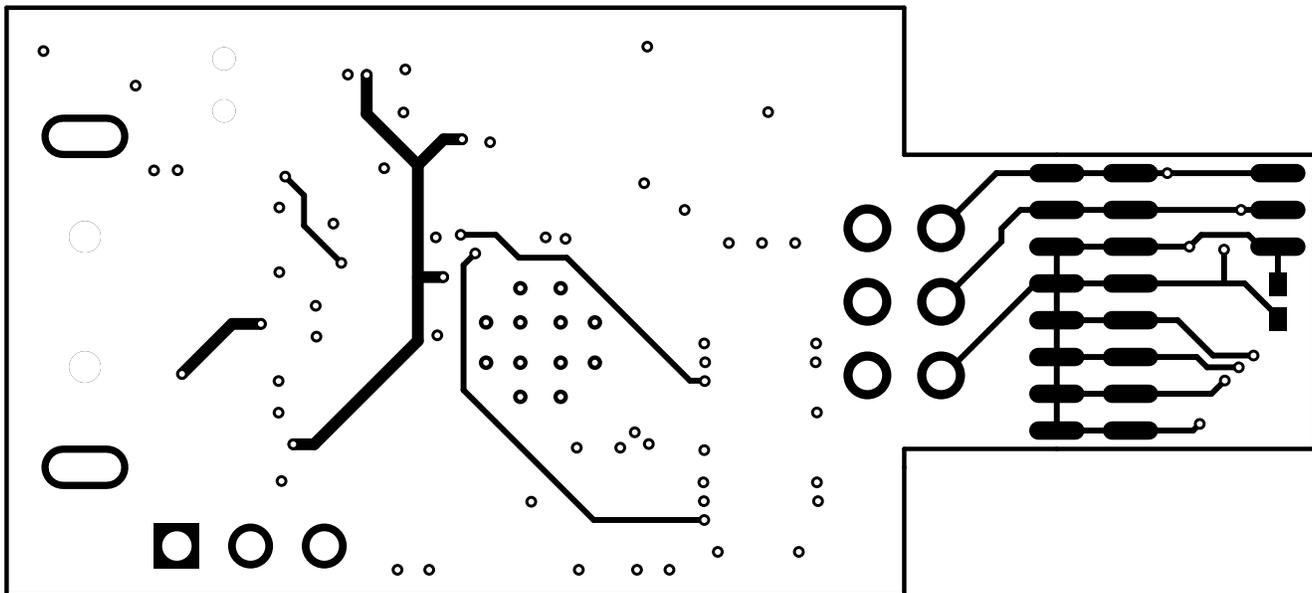


Figure 5-3. PCB Bottom

5.3 Bill of Materials

Table 5-1. Bill of Materials

Description	Designator	PartNumber	Quantity	Manufacturer	PackageReference	Value
Printed Circuit Board	IPCB1	SENS091	1	Any		
CAP, CERM, 2.2 uF, 16 V, +/- 10%, X5R, 0402	C1, C6	GRM155R61C225KE11D	2	MuRata	0402	2.2uF
CAP, CERM, 2200 pF, 50 V, +/- 5%, X7R, 0402	C14	CL05B222JB5NNNC	1	Samsung Electro-Mechanics	0402	2200pF
CAP, CERM, 10 uF, 10 V, +/- 20%, X5R, 0603	C2, C7	C1608X5R1A106M080A C	2	TDK	0603	10uF
CAP, CERM, 10 pF, 16 V, +/- 10%, C0G, 0402	C3, C4	C0402C100K4GACTU	2	Kemet	0402	10pF
CAP, CERM, 0.1 uF, 10 V, +/- 10%, X5R, 0402	C5, C13, C15, C16, C17, C18, C19, C20	LMK105BJ104KV-F	8	Taiyo Yuden	0402	0.1uF
CAP, CERM, 0.47 uF, 6.3 V, +/- 10%, X7R, 0402	C8, C9, C10	JMK105B7474KVHF	3	Taiyo Yuden	0402	0.47uF
Diode, Zener, 6.2 V, 300 mW, SOD-523	D1, D2	BZT52C6V2T-7	2	Diodes Inc.	SOD-523	6.2V
LED, Green, SMD	D3	SML-LX0603GW-TR	1	Lumex	LED, GREEN, 0603	Green
LED, Super Red, SMD	D4	150060SS75000	1	Wurth Elektronik	LED_0603	Super Red
Connector, Plug, USB Type A, R/A, Top Mount SMT	J1	48037-1000	1	Molex	USB Type A right angle	
Header, 2.54 mm, 3x1, Gold, TH	J2	GBC03SAAN	0	Sullins Connector Solutions	Header, 2.54 mm, 3x1, TH	
Ferrite Bead, 220 ohm @ 100 MHz, 0.45 A, 0402	L1	BLM15AG221SN1D	1	MuRata	0402	220 ohm
RES, 22, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	R1, R2	ERJ-2GEJ220X	2	Panasonic	0402	22
RES, 0, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	R10	CRCW04020000Z0ED	0	Vishay-Dale	0402	0
RES, 33.0 k, 1%, 0.063 W, 0402	R14	RC0402FR-0733KL	1	Yageo America	0402	33.0k

Table 5-1. Bill of Materials (continued)

Description	Designator	PartNumber	Quantity	Manufacturer	PackageReference	Value
RES, 100 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	R3	ERJ-2GEJ104X	1	Panasonic	0402	100k
RES, 1.0 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	R4, R13	ERJ-2GEJ102X	2	Panasonic	0402	1.0k
RES, 1.00 M, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	R5	RMCF0402FT1M00	1	Stackpole Electronics Inc	0402	1.00Meg
RES, 1.50 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	R6	RMCF0402FT1K50	1	Stackpole Electronics Inc	0402	1.50k
RES, 47, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	R7	ERJ-2GEJ470X	1	Panasonic	0402	47
RES, 110, 1%, 0.1 W, AEC-Q200 Grade 0, 0402	R8	ERJ-2RKF1100X	1	Panasonic	0402	110
RES, 390, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	R9	CRCW0402390RJNED	1	Vishay-Dale	0402	390
Switch, Slide, SPST, Top Slide, SMT	S1	CHS-01TB	1	Copal Electronics	Switch, Single Top Slide, 2.5x8x2.5mm	
Switch, SPST-NO, Off-Mom, 0.05A, 12VDC, SMD	SW1	PTS820 J20M SMTR LFS	1	C&K Components	3.9x2.9mm	
Single Wire, ± 0.3 °C Accurate Digital Temperature Sensor With Integrated 2-Kbit EEPROM, VSSOP8	U1	TMP1827NGR	1	Texas Instruments	VSSOP8	
4-Channel ESD Solution for High-Speed Differential Interface, DRY0006A (USON-6)	U2	TPD4S009DRYR	1	Texas Instruments	DRY0006A	

Table 5-1. Bill of Materials (continued)

Description	Designator	PartNumber	Quantity	Manufacturer	PackageReference	Value
Single-Bit Dual-Supply Bus Transceiver with Configurable Voltage Translation and 3-State Outputs, DCK0006A, LARGE T&R	U3, U6	SN74LVC1T45DCKR	2	Texas Instruments	DCK0006A	
Single Output LDO, 200 mA, Fixed 3.3 V Output, 2 to 5.5 V Input, with Low IQ, 5-pin SC70 (DCK), -40 to 125 degC, Green (RoHS & no Sb/Br)	U4, U8	TLV70033DCKR	2	Texas Instruments	DCK0005A	
16-Bit Ultra-Low-Power Microcontroller, 128KB Flash, 8KB RAM, USB, 12Bit ADC, 2 USCIs, 32Bit HW MPY, RGC0064B (VQFN-64)	U5	MSP430F5528IRGCR	1	Texas Instruments	RGC0064B	
Single Buffer/Driver With Open-Drain Output, DCK0005A, SMALL T&R	U7	SN74LVC1G07DCKT	1	Texas Instruments	DCK0005A	
Crystal, 24 MHz, SMD	Y1	XRCGB24M000F2P00R0	1	MuRata	2x1.6mm	

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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。
http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page

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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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。
http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page

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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 - 4.4 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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