

TMP75BEVM

User's Guide



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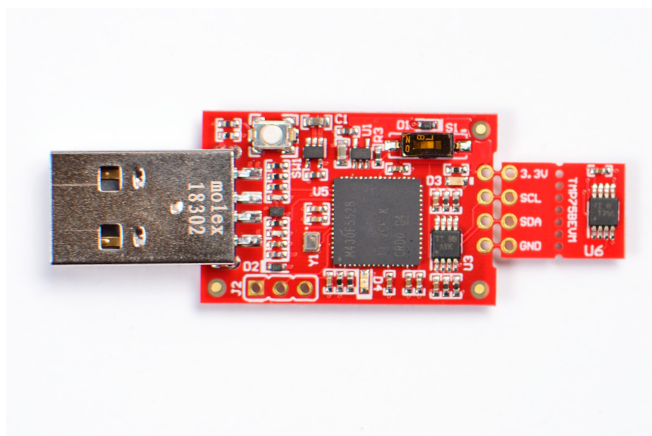
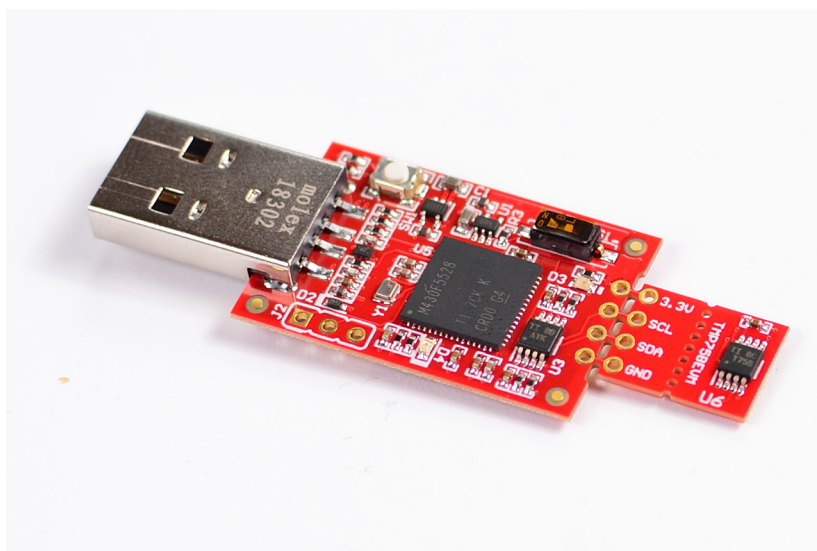
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TMP75BEVM User's Guide

This user's guide describes the characteristics, operation, and use of the TMP75BEVM evaluation board. This user's guide discusses how to set up and configure the software, discusses 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 TMP75BEVM. 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.



1 Trademarks

All trademarks are the property of their respective owners.

2 Overview

The TMP75BEVM allows users to evaluate the performance of the TMP75B 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 TMP75B device using an I2C 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 TMP75B to the user's system/host.
- The user can connect the EVM host and software to the user's system with TMP75B 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.

2.1 EVM Kit Contents

Table 1 details 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 <http://www.ti.com> to verify that they have the latest versions of the related software.

Table 1. EVM Kit Contents

Item	Quantity
TMP75BEVM	1

3 EVM Hardware

3.1 Perforations

The perforation between the USB controller and TMP75B sensor is labeled on both sides for pin connections.

3.2 Subregulator

The switch S1 enables and disables the on-board 1.8-V regulator: U1. When the subregulator is enabled, the green LED D3 illuminates. The subregulator must be enabled for normal operation of TMP75BEVM.

3.3 Logic Level Translator

The translator U3 separates the MSP430 I2C host from the TMP75B 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 1.4 V and 3.6 V can be applied at the 1P8V net, which is the 1.8-V pin on the perforation. This external voltage will illuminate the green LED D3 and power the TMP75B device.

3.4 Programming Header

The TMP75BEVM 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.

3.5 BSL Button

The TMP75BEVM features push-button SW1 for entering USB BSL mode. This can be used for firmware updates.

4 Software Download

The PC GUI Software for TMP75BEVM 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.

4.1 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:

- Go to the EVM tool page and click on the View button
- Go to dev.ti.com/gallery and search for TMP75BEVM

Click on the application icon within the gallery to launch the software. Click on the prompt to install the TI Cloud Agent Bridge browser plugin.

4.2 Offline Software

4.2.1 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 the Gallery Download.

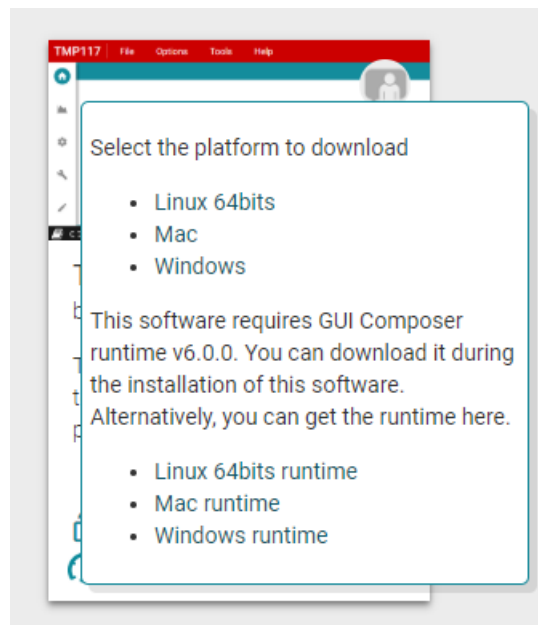


Figure 1. Download Pop-Up

5 Software

5.1 Home Tab

The Home Tab is shown at software launch. The Learn More link displays Features and Functional Diagram for the TMP75B device. The icons are shortcuts to the tabs shown on the left side of the screen.

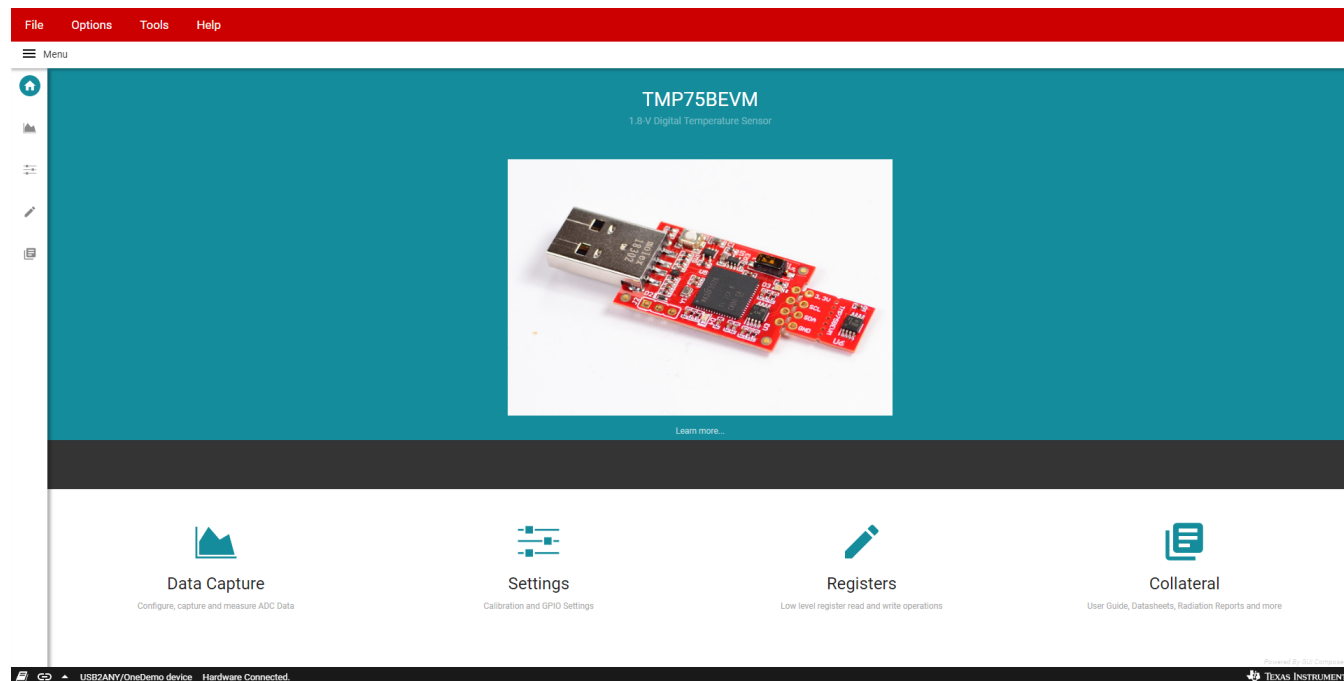


Figure 2. Home

5.2 Data Capture Tab

The Data Capture tab reports the temperature from the TMP75B device included on the TMP75BEVM. To enable Data Capture, select an Auto Read setting at the top of the Registers tab.

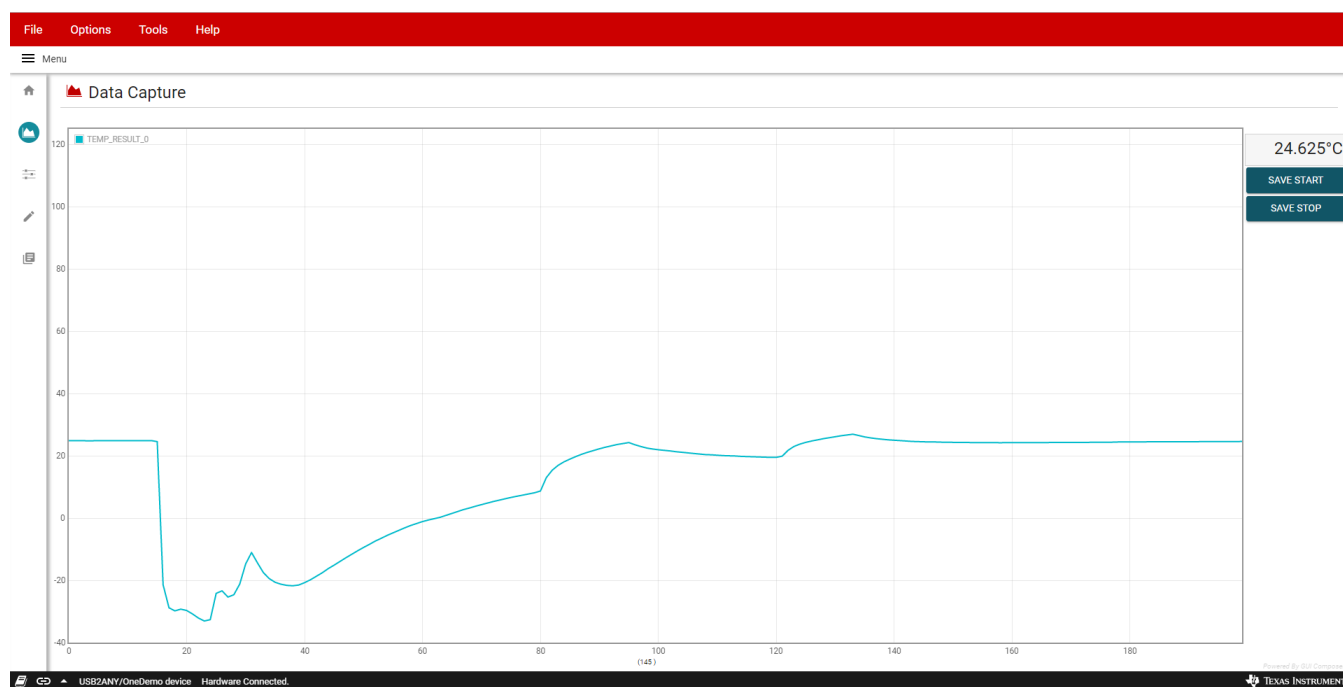


Figure 3. Data Capture

5.3 Settings Tab

The Settings tab provides the hardware configuration for the USB to I2C bridge and device features for the TMP75B device.

Selecting the wrong Device I2C Address will cause the GUI to disconnect from the USB device. The hardware must be modified at the TMP75B device to change the TMP75B's address. The link icon in the bottom left corner indicates the current connection status, and the user can click on the area to change the connection status.

If the user makes changes to the High Limit and Low Limit fields, this will trigger an immediate write to the TMP75B's limit register if Immediate mode is enabled on the Registers tab.

The Send One Shot button will force a I2C write to the TMP75B's Configuration register with the OS bit set to 1.

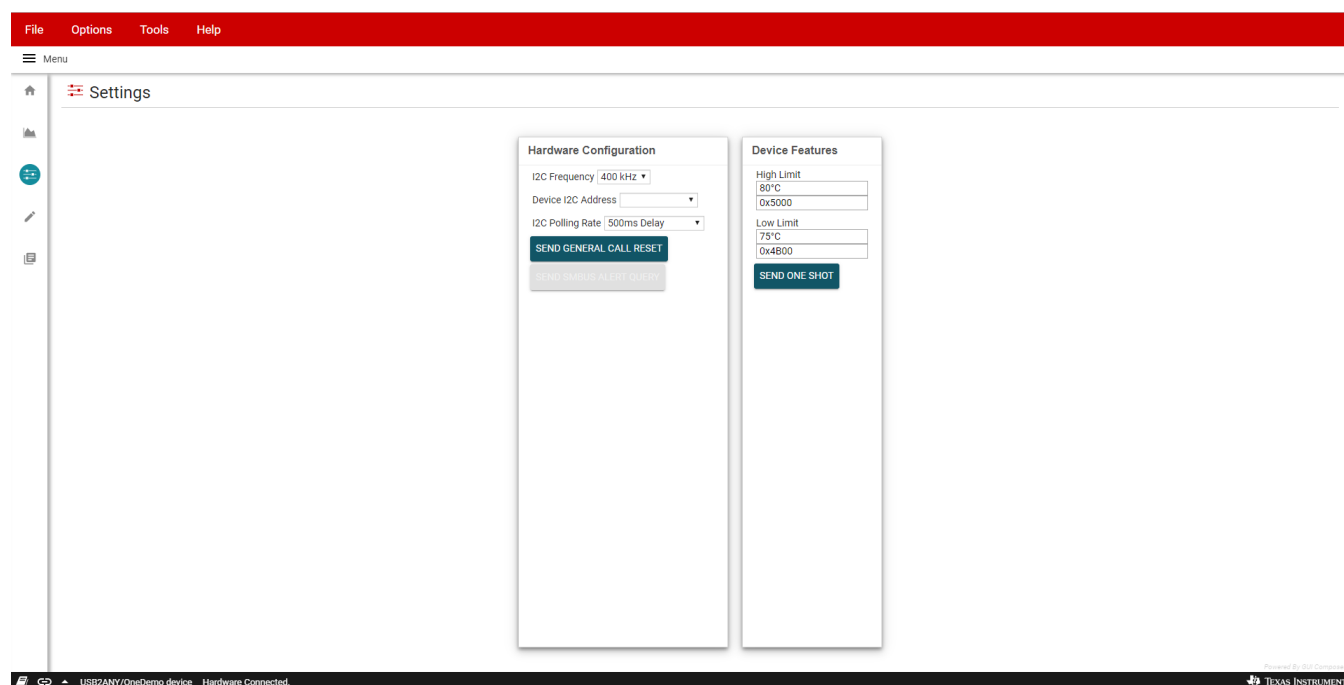
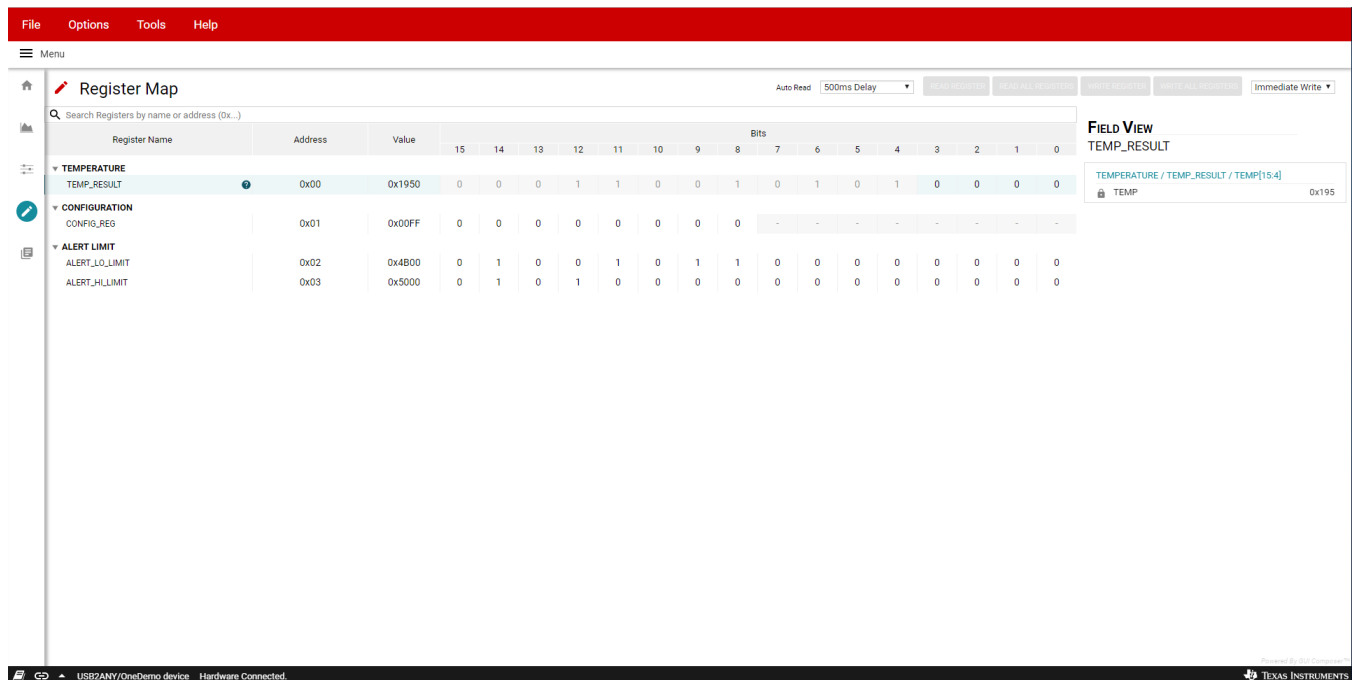


Figure 4. Settings

5.4 Registers Tab

The Registers tab interacts with the registers and bits within the TMP75B device.

The Auto Read drop-down box 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. Read All Registers can be used to fetch the contents of all registers at once. The Write Register button is greyed and disabled when the drop-down 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 I2C Bus activity, and enable individual transactions to be easily observed with an oscilloscope, logic analyzer, or bus-sniffing device.



The screenshot shows the Register Map interface. The top bar includes File, Options, Tools, and Help. Below the bar, there is a search bar and a table of registers. The table has columns for Register Name, Address, Value, and Bits (15 to 0). The registers listed are:

Register Name	Address	Value	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
TEMP_RESULT	0x00	0x1950	0	0	0	1	1	0	0	1	0	1	0	1	0	0	0	0
CONFIG_REG	0x01	0x00FF	0	0	0	0	0	0	0	0	-	-	-	-	-	-	-	
ALERT_LIMIT	0x02	0x4800	0	1	0	0	1	0	1	1	0	0	0	0	0	0	0	
ALERT_HLIMIT	0x03	0x5000	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	

On the right, the Field View for TEMP_RESULT is shown, displaying the bit pattern 0x195 and the value 0x195.

Figure 5. Registers

5.5 Collateral Tab

The Collateral tab contains links to the EVM user's guide, the tool page on ti.com, as well as links to the product data sheet and other relevant links.

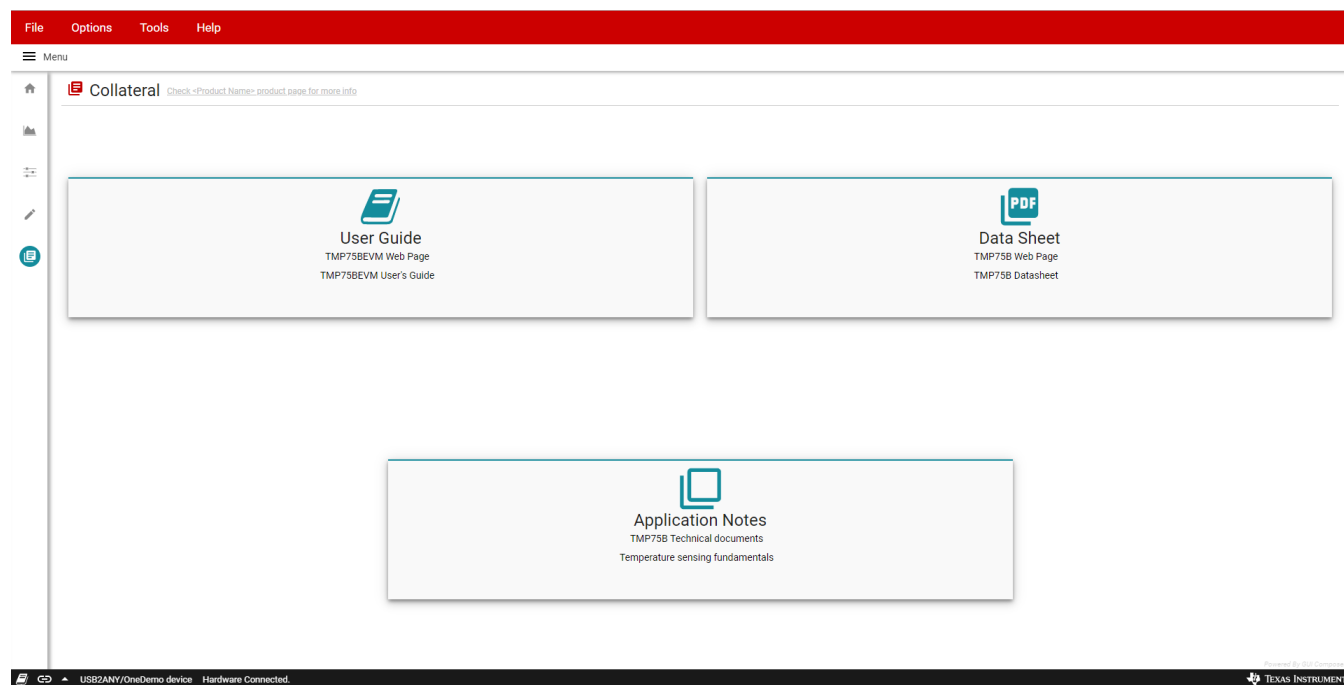


Figure 6. Collateral

6.1 Schematic



6.2 Printed-Circuit Board

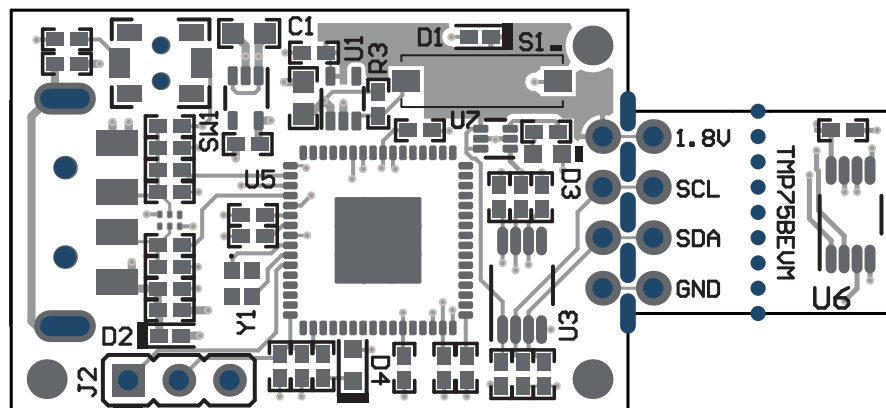


Figure 8. Top View

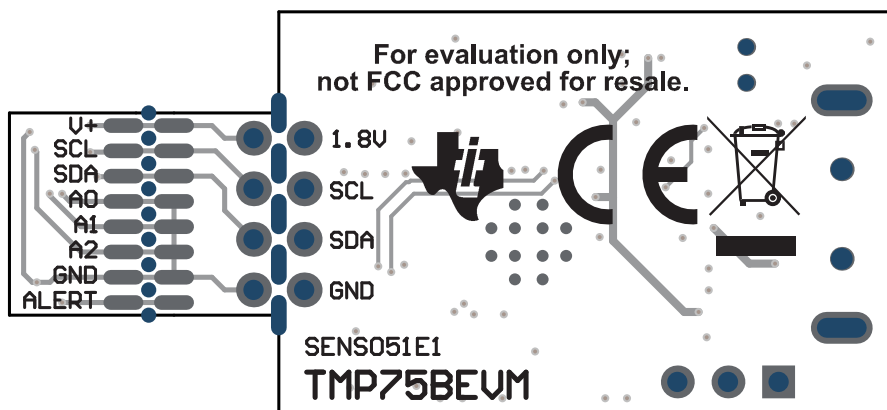


Figure 9. Bottom View

6.3 Bill of Materials

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		SENS051	Any
C1, C6	2	2.2uF	CAP, CERM, 2.2 uF, 16 V, +/- 10%, X5R, 0402	0402	GRM155R61C22 5KE11D	MuRata

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
C2, C7	2	10uF	CAP, CERM, 10 uF, 10 V, +/- 20%, X5R, 0603	0603	C1608X5R1A10 6M080AC	TDK
C3, C4	2	10pF	CAP, CERM, 10 pF, 16 V, +/- 10%, C0G, 0402	0402	C0402C100K4G ACTU	Kemet
C5, C11, C12, C13, C15, C16, C17	7	0.1uF	CAP, CERM, 0.1 uF, 10 V, +/- 10%, X5R, 0402	0402	LMK105BJ104K V-F	Taiyo Yuden
C8, C9, C10	3	0.47uF	CAP, CERM, 0.47 uF, 6.3 V, +/- 10%, X7R, 0402	0402	JMK105B7474K VHF	Taiyo Yuden
C14	1	2200pF	CAP, CERM, 2200 pF, 50 V, +/- 5%, X7R, 0402	0402	CL05B222JB5N NNC	Samsung Electro-Mechanics
D1	1	4.3V	Diode, Zener, 4.3 V, 300 mW, SOD-523	SOD-523	BZT52C4V3T-7	Diodes Inc.
D2	1	6.2V	Diode, Zener, 6.2 V, 300 mW, SOD-523	SOD-523	BZT52C6V2T-7	Diodes Inc.
D3	1	Green	LED, Green, SMD	LED, GREEN, 0603	SML-LX0603GW-TR	Lumex
D4	1	Super Red	LED, Super Red, SMD	LED_0603	150060SS75000	Würth Elektronik
J1	1		Connector, Plug, USB Type A, R/A, Top Mount SMT	USB Type A right angle	48037-1000	Molex
L1	1	220 ohm	Ferrite Bead, 220 ohm @ 100 MHz, 0.45 A, 0402	0402	BLM15AG221SN 1D	MuRata
R1, R2	2	22	RES, 22, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2GEJ220X	Panasonic
R3	1	100k	RES, 100 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2GEJ104X	Panasonic
R4, R13	2	1.0k	RES, 1.0 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2GEJ102X	Panasonic
R5	1	1.00Meg	RES, 1.00 M, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	RMCF0402FT1 M00	Stackpole Electronics Inc
R6	1	1.50k	RES, 1.50 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	RMCF0402FT1K 50	Stackpole Electronics Inc
R7	1	47	RES, 47, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2GEJ470X	Panasonic
R8	1	110	RES, 110, 1%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2RKF1100X	Panasonic

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
R9, R10, R11, R12	4	10k	RES, 10 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2GEJ103X	Panasonic
R14	1	33.0k	RES, 33.0 k, 1%, 0.063 W, 0402	0402	RC0402FR-0733KL	Yageo America
S1	1		Switch, Slide, SPST, Top Slide, SMT	Switch, Single Top Slide, 2.5x8x2.5mm	CHS-01TB	Copal Electronics
SW1	1		Switch, SPST-NO, Off-Mom, 0.05A, 12VDC, SMD	3.9x2.9mm	PTS820 J20M SMTR LFS	C&K Components
U1	1		Single Output LDO, 200 mA, Fixed 1.8 V Output, 2 to 5.5 V Input, with Low IQ, 5-pin SC70 (DCK), -40 to 125 degC, Green (RoHS & no Sb/Br)	DCK0005A	TLV70018DCKR	Texas Instruments
U2	1		4-Channel ESD Protection Array for High-Speed Data Interfaces, DRY0006A (USON-6)	DRY0006A	TPD4E004DRY R	Texas Instruments
U3	1		Level-Shifting I2C Bus Repeater, DGK0008A (VSSOP-8)	DGK0008A	TCA9517DGKR	Texas Instruments
U4	1		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)	DCK0005A	TLV70033DCKR	Texas Instruments
U5	1		16-Bit Ultra-Low-Power Microcontroller, 128KB Flash, 8KB RAM, USB, 12Bit ADC, 2 USCIs, 32Bit HW MPY, RGC0064B (VQFN-64)	RGC0064B	MSP430F5528IR GCR	Texas Instruments
U6	1		1.4V-Capable Temperature Sensor with I2C/SMBus Interface in LM75 Form Factor & Pinout, DGK0008A (VSSOP-8)	DGK0008A	TMP75BIDGKR	Texas Instruments

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
U7	1		Single-Bit Dual-Supply Bus Transceiver with Configurable Voltage Translation and 3-State Outputs, DRL0006A, LARGE T&R	DRL0006A	SN74AVC1T45D RLR	Texas Instruments
Y1	1		Crystal, 24 MHz, SMD	2x1.6mm	XRCGB24M000 F2P00R0	MuRata
J2	0		Header, 2.54 mm, 3x1, Gold, TH	Header, 2.54 mm, 3x1, TH	GBC03SAAN	Sullins Connector Solutions

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.
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 - 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/lscs/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/lscs/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/lscs/ti_ja/general/eStore/notice_02.page
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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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