

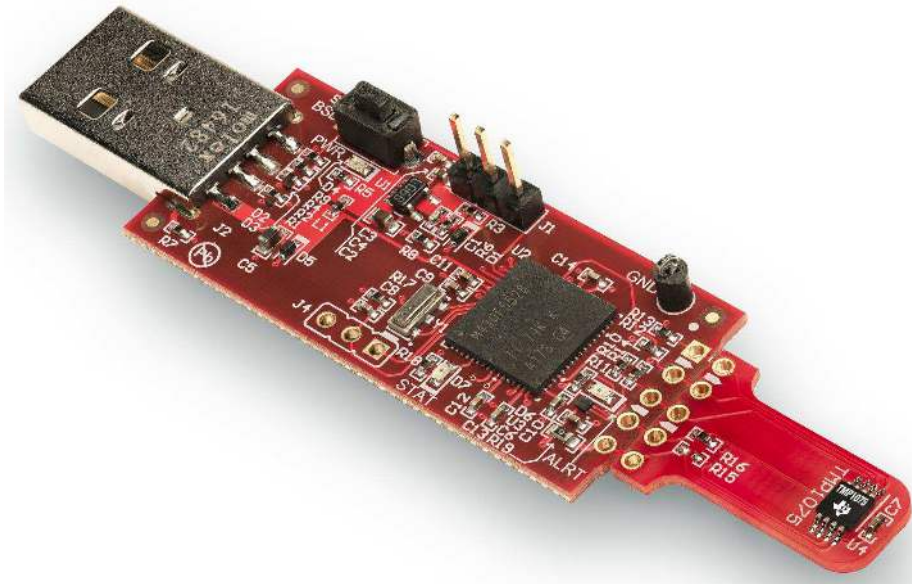
## **TMP1075EVM User's Guide**

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The industry standard LM75/TMP75 is now available with high accuracy and a wider temperature range. The TMP1075 is a drop-in replacement for the most prevalent digital temperature sensors with enhanced features. The TMP1075 provides up to  $\pm 0.5^{\circ}\text{C}$  typical accuracy over the  $-25^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  range, and  $\pm 1^{\circ}\text{C}$  typical accuracy over the  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  range with 12-bit resolution, giving a temperature resolution of  $0.0625^{\circ}\text{C}$ . The Texas Instruments TMP1075EVM (Evaluation Module) provides the user a simple way to get started with TMP1075. The module and GUI are designed to provide the user a quick setup to evaluate the system and register map. The EVM features a perforation that allows the temperature sensor to be placed away from the MSP430 for remote temperature measurements and a header to connect multiple TMP1075's to the controller. This document provides detailed information about the hardware design and software installation.



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## 1 Overview

The TMP1075EVM allows users to evaluate the performance of the best digital temperature sensor available in the VSSOP8 (MSOP8) package. The EVM comes in a USB stick form factor with an onboard MSP430F5528 microcontroller that interfaces with both the host computer and up to two TMP1075 devices using I2C interface. The module is designed to provide user flexibility separating the TMP1075 and MSP430 at the perforation location on the EVM board. The perforation allows the user to connect wires, cable, or header to both ends for remote temperature measurements or connects to desired system as well as connecting additional TMP1075s.

## 2 EVM Kit Contents

[Table 1](#) details the contents of the EVM kit. Contact the Texas Instruments Product Information Center nearest you if any component is missing. TI highly recommends checking the TI website at <http://www.ti.com> to verify that you have the latest versions of the related software.

**Table 1. EVM Kit Contents**

ITEM	QUANTITY
PCB test board: TMP1075EVM	1
USB cable extender	1

### 3 Board Connectors and Components

The jumpers and connectors on the EVM, along with how to properly connect, set up, and use the TMP1075 Bench Board, are described here.

#### 3.1 Input/Output Connector Description and Components

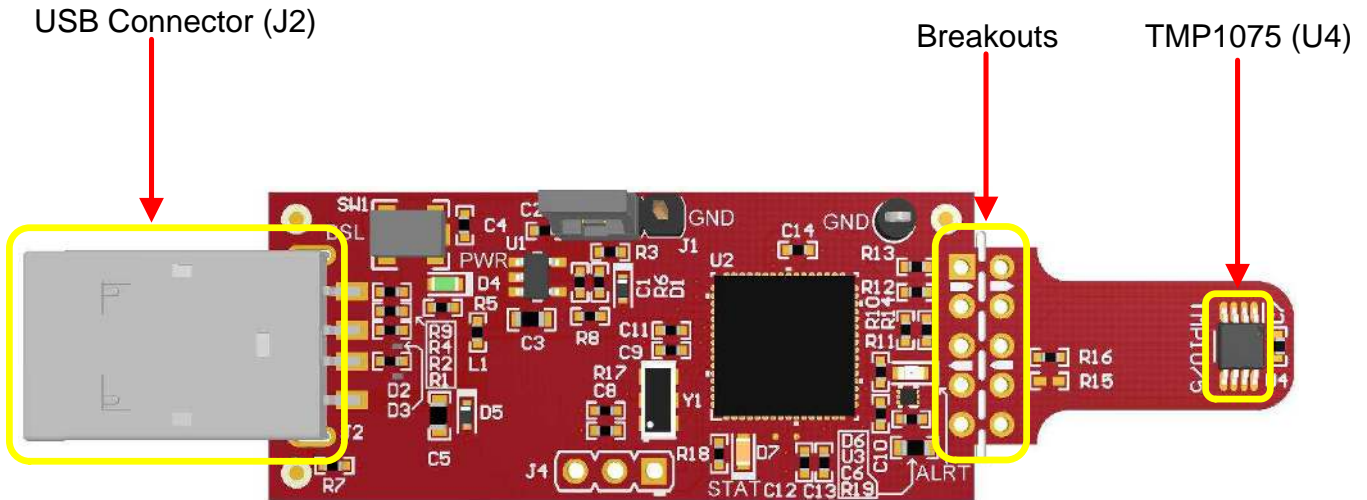


Figure 1. TMP1075 Evaluation Board Top Side

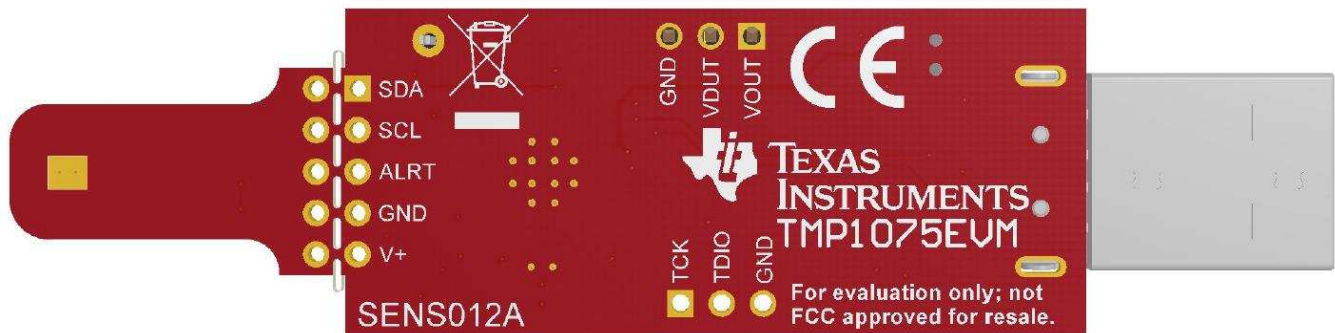


Figure 2. TMP1075 Evaluation Board Bottom Side

Table 2. Device and Package Configurations

DEVICE	IC	PACKAGE
U4	TMP1075AIDRVR	VSSOP (8)

### 3.2 EVM Power Supply Input – J1

TMP1075EVM uses the +5-V input power supply of the USB connector to power the EVM. The EVM does not require an external power supply. The board is powered by the USB port and switches to +3.3 V. It can be powered by shorting the J1 jumper with a regulated voltage with desired programmable voltage such as 1.8 V, 3.3 V, and 3.6 V based on Equation 1. The EVM power supply input can be changed to any input power supply range of the TMP1075 1.7 V to 5.5 V; however, note that the MSP430 can only support a power supply range of 1.8 V to 3.6 V with the recommended  $V_{OH}$  and  $V_{OL}$  conditions listed in the TMP1075 data sheet specifications.

The resistor adjust  $R_{ADJ}$  can be calculated using Equation 1 with the desired voltage of  $V_{OUT}$  and where  $V_{REF} = 1.23$  V,  $R_{ADJ} = R6$ , and  $R8 = 51.1$  k $\Omega$ .

$$V_{OUT} = V_{REF} + \left[ V_{REF} \times \left( \frac{R_{ADJ}}{51.1 \text{ k}\Omega} \right) \right] \quad (1)$$

$$R_{ADJ} = 51.1 \text{ k}\Omega \times \left[ \left( \frac{V_{OUT}}{V_{REF}} \right) - 1 \right] \quad (2)$$

### 3.3 Interface Connector – J2

J2 is the USB connector, and used to connect the PC. The interface is used to access the device's registers and read the conversion data from the TMP1075 through I2C communication protocol.

### 3.4 Debug Jumper – J4

J4 is the connector that allows debugging the firmware using three wires instead of the standard 14-pin header. This connector is not populated.

### 3.5 Pushbutton Switch – SW1

Basically, the SW1 is to bring the MSP430 into a BSL mode for upgrading the firmware with combination of the USB connector manually referring to the picture in Figure 1 BSL button (SW1 switch). Press and hold the switch SW1 next to the USB connector while plugging the USB cable from the board to the PC. This will allow bringing the MSP430 into BSL mode.

### 3.6 Header Connector – J3

The purpose of the header connector is to isolate the heat source and prevent it from heat incoming directly into contact with the TMP1075, and the perforation allows users to snap at the breakout tab. When the TMP1075 is separated from the MSP430, it can be connected through wires or header to both ends for remote temperature measurements.

### 3.7 LED – (D4, D6, D7)

There are a total of three LEDs on the board: green (D4), red (D6), and orange (D7). The green LED is the power supply indicator, and it should be turned ON. The orange LED should not blink when the EVM is initially plugged into the PC. The orange LED will blink if the power-on-reset (POR) tests on the MSP430 microcontroller fails on start-up or if the Test LED button is toggled. It will blink when the Start Graph button is pressed. The red LED is the Alert pin indicator when the Alert pin is pulling LOW.

### 3.8 I2C Slave Addresses – (R15, R16)

TMP1075 is capable of supporting up to 32 I2C 7-bit addresses. The TMP1075 is connected to the bus by a unique slave address to operate data transfer from the master-transmitter to the slave-receiver or the slave-transmitter to the master-receiver. The TMP1075 can be configured desired two serial bus addresses depending on the state of the A0, A1, and A2 as [Table 3](#). The EVM can be configured up to two addresses. At default, the resistor R16 is soldered, and configured for 0x48h address. For more details information, refer to the *Address Pins and Slave Addresses for the TMP1075* table in the [TMP1075 Temp Sensor With I2C and SMBus Interface in Industry Standard LM75](#) data sheet (SBOS854).

**Table 3. I2C Slave Addresses**

CORRESPONDING EVM RESISTOR	ADDRESS PIN CONNECTION			SLAVE ADDRESS	
	A2	A1	A0	BINARY	HEX
R15	GND	GND	GND	1001000	0x48
R16	GND	GND	V+	1001001	0x49

## 4 System Setup

The TMP1075EVM hardware consists of the USB2ANY Platform and the TMP1075EVM altogether in one single board. The unit is easily connected through USB connector into the computer as shown in [Figure 3](#).



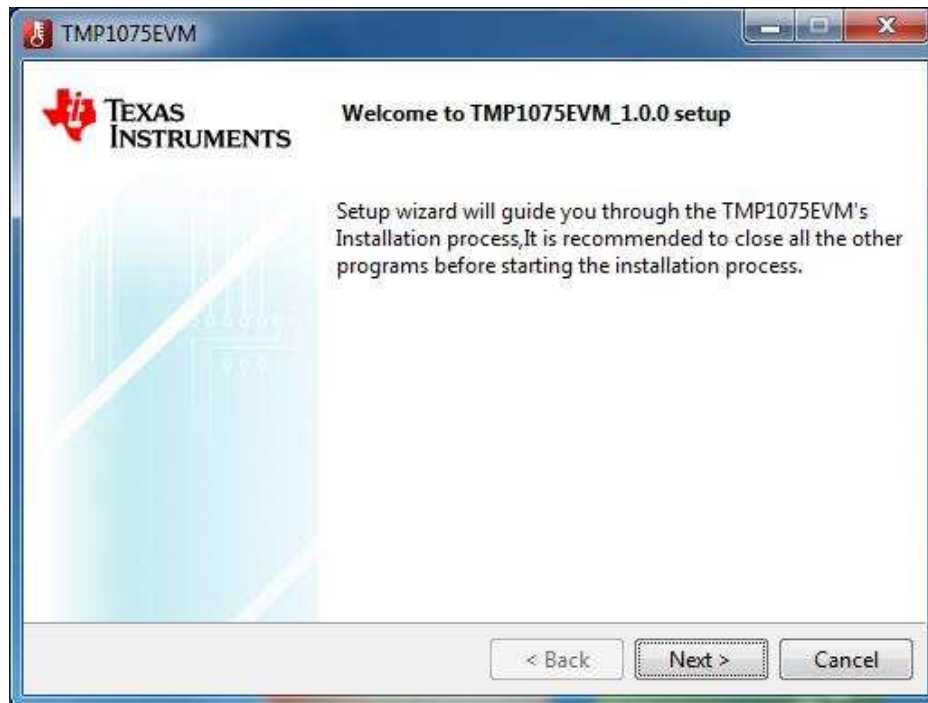
**Figure 3. TMP1075EVM Hardware Setup**

## 5 Software Installation

### 5.1 Graphical User Interface (GUI)

The EVM software is tested on the Microsoft Windows 7 and 10 operating system (OS). The software also functions on other Windows operating systems. The EVM software is available through the EVM product folder on the TI website. To download the software to your system, simply follows the instructions below.

1. Go to the TMP1075EVM web page on the TI website: <http://www.ti.com/tool/TMP1075EVM>. Scroll down to the *Software* section and download the latest evaluation software.
2. Unzip the downloaded file into a known directory. Once the files are extracted, navigate and run the *Setup\_TMP1075EVM\_GUI.exe* file located in [Unzip location]. The EVM software installer then begins the installation process as shown in [Figure 4](#).



**Figure 4. TMP1075EVM Welcome**

3. Follow the on-screen instructions by clicking the *Next* button to install the software. The following this option, two license agreements are presented as shown in [Figure 5](#) and [Figure 6](#) that must be accepted. After accepting both the Texas Instruments and National Instruments license agreements, the user is given the choice of selecting the directory to install the program; usually, TI recommends choosing the default setting stored in the *C:\Program Files (x86)\Texas Instruments\TMP1075EVM* path as shown in [Figure 7](#).

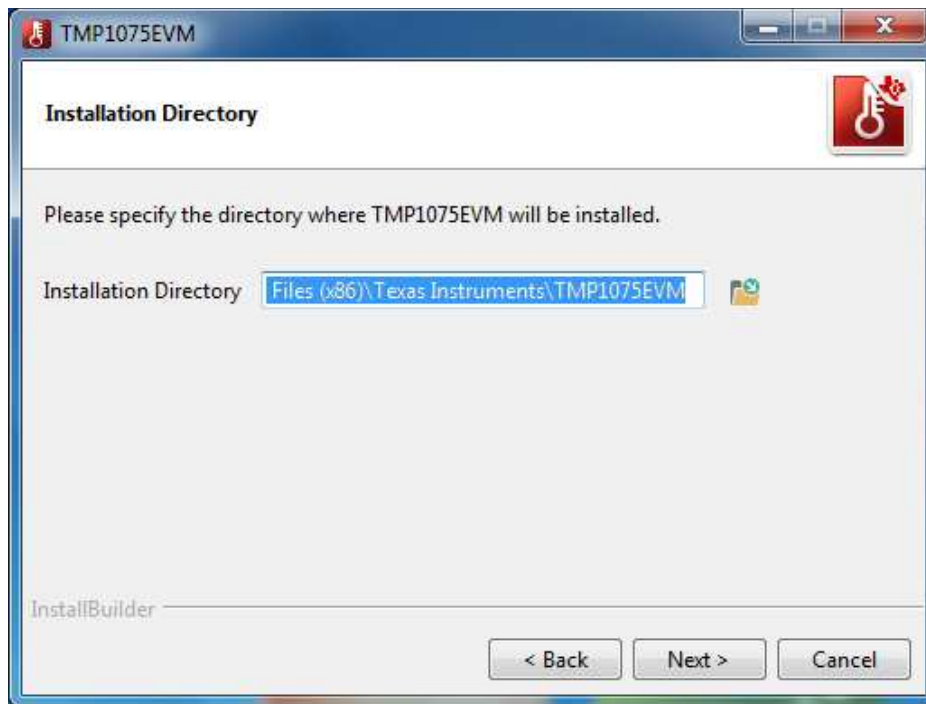


Figure 5. TMP1075EVM License Agreement



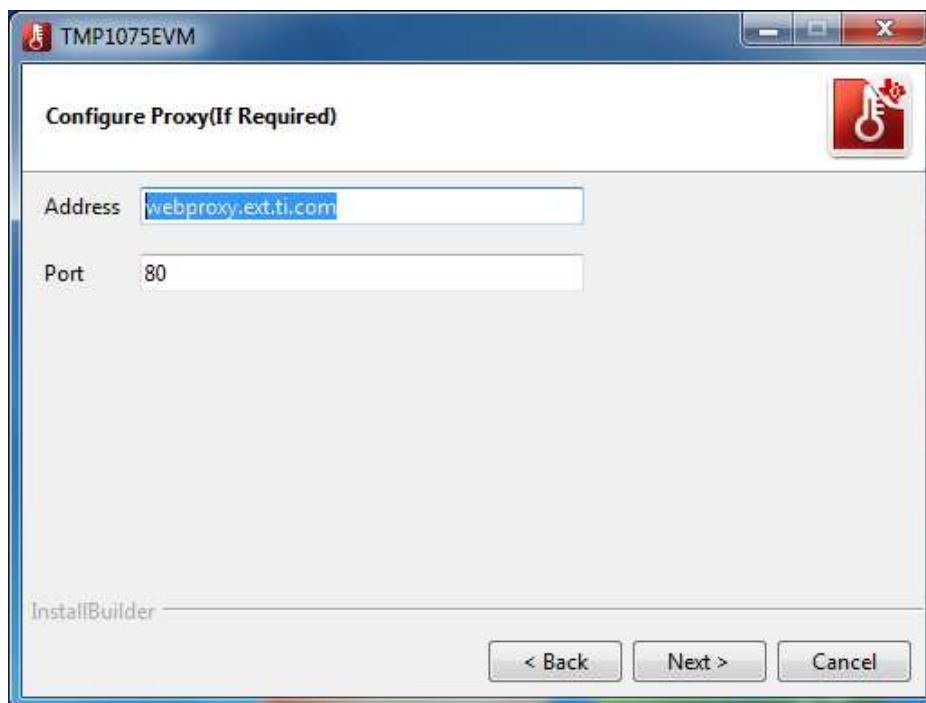
Figure 6. NI License Agreements





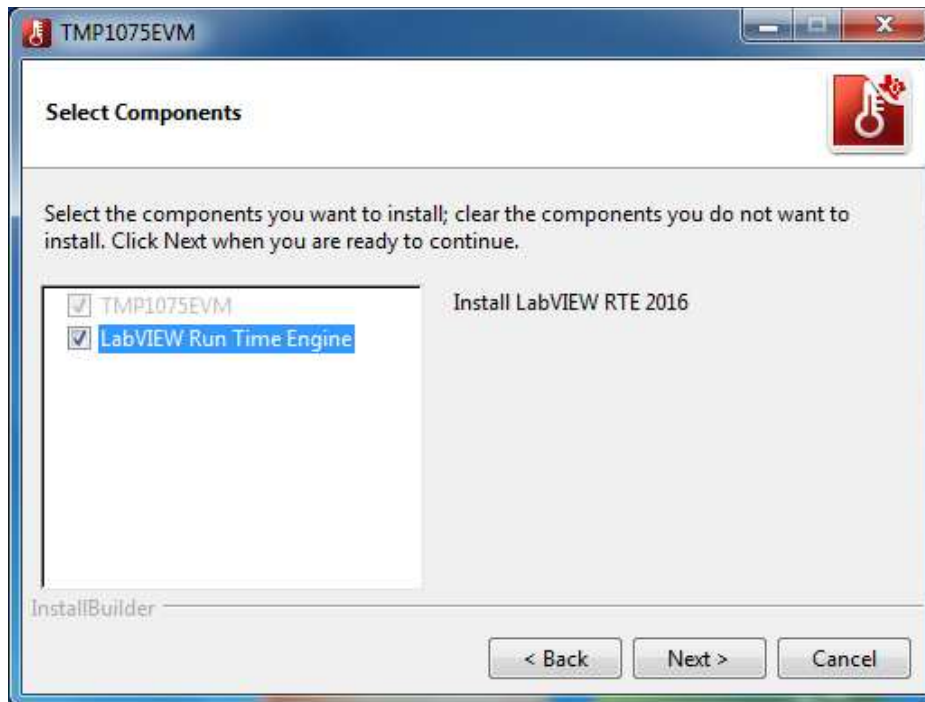
**Figure 7. TMP1075EVM Installation Directory**

4. Some servers must configure the proxy before authorizing users gains access outside of the internal network, and they act like an intermediary between the user's computer and the internet. In this case, provide the correct server address and port number. If the server does not require the proxy server, just simply delete the default address and port number in [Figure 8](#) by leaving the input box blank and click *Next*.



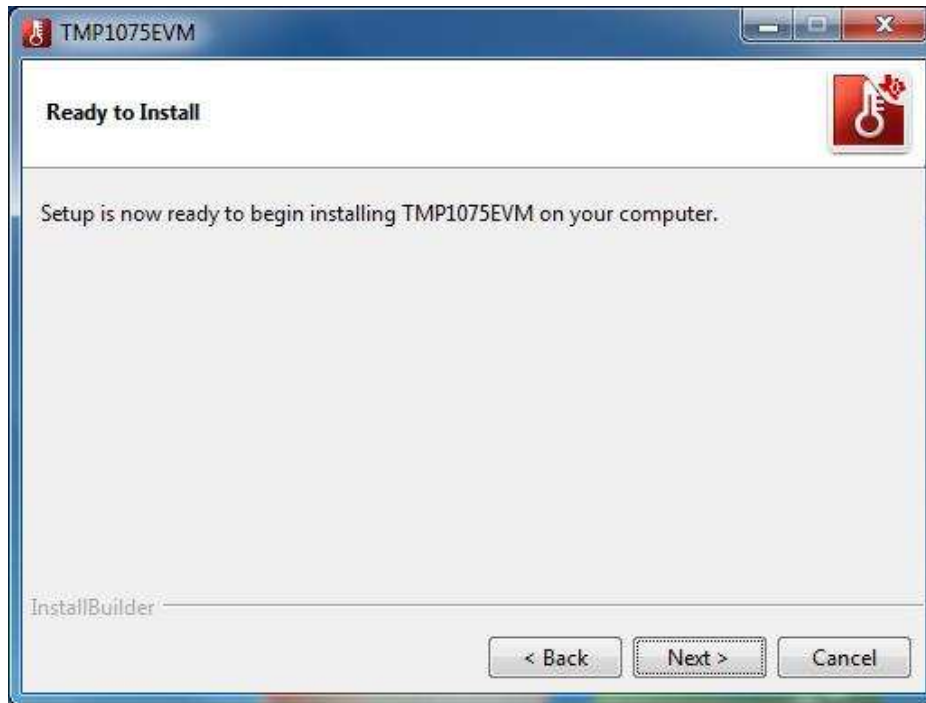
**Figure 8. Network Proxy Server**

- For first-time installation, ensure the *LabVIEW Run Time Engine* is listed in the following summary as shown in [Figure 9](#). TMP1075EVM GUI is required LabVIEW 2016 f5 runtime engine for proper operation. Once the *Next* button is clicked, the progress bar opens and shows the installation of the software. It may take some time to download the LabVIEW Run Time Engine on the first installation. Users may be prompted to download the file when installing the software for the first time, especially if the *LabVIEW Run Time Engine* checkbox is checked.



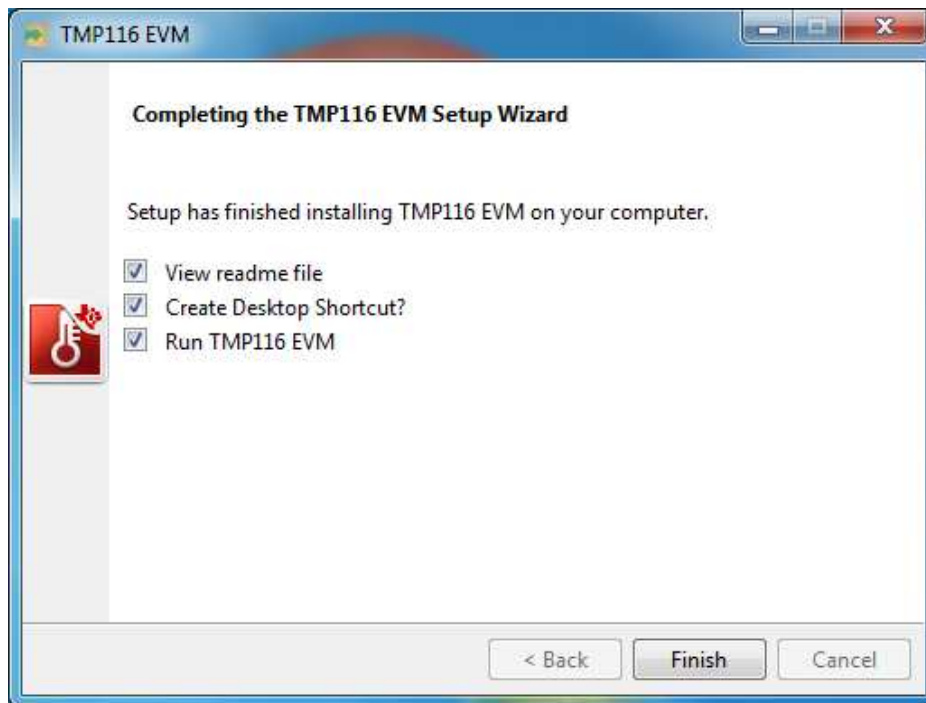
**Figure 9. TMP1075EVM Select Components Installation**

- Click the *Next* button in [Figure 10](#) to proceed the installation processes.



**Figure 10. Ready to Install**

- Once the installation process is complete, uncheck the *View readme file* and click *Finish*.



**Figure 11. TMP1075EVM Installation Finish**

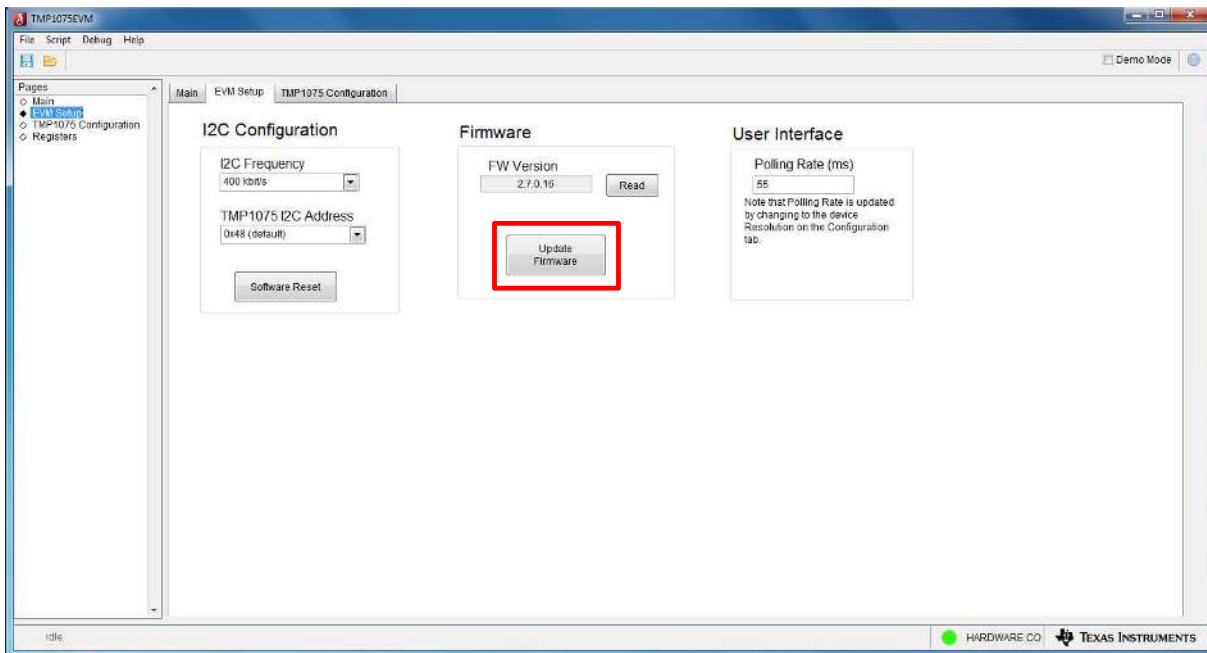
## 6 Upgrading the Firmware

There are two ways to upgrade or program the firmware of the TMP1075EVM board. The first method is to click on the *Upgrade Firmware* through the TMP1075 GUI or go directly to the directory of the TMP1075EVM folder.

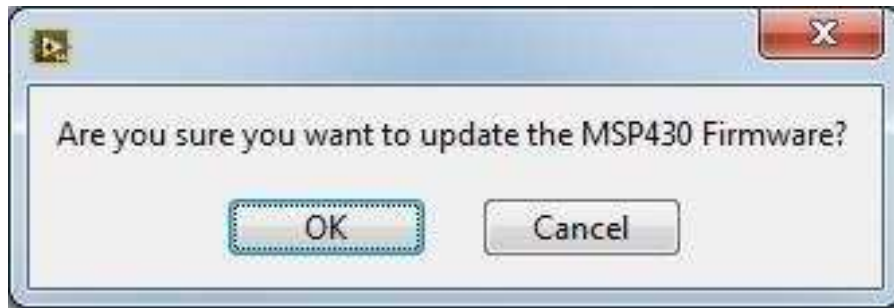
**CAUTION**  
 TMP1075EVM software must be installed before performing any tasks.

In [Figure 12](#), the *Upgrade Firmware* button will call the *MSP430 USB Firmware Upgrade Example* application in the TMP1075EVM folder *C:\Program Files (x86)\Texas Instruments\TMP1075EVM\MSP430 USB Firmware Upgrade\BSL\_USB\_GUI.exe*. So, another method is to go directly to the folder instead of running from the GUI. For programming multiple EVMs, the second method is the best option.

- An error window will appear if the computer cannot communicate with the EVM. This is due to the driver not recognized by the computer yet because the firmware is not programmed. On top right of the GUI, ensure the *Demo Mode* checkbox is checked.
- Click on *Update Firmware* button. This will launch the *MSP430 USB Firmware Upgrade Example* program.
- The confirmation pop-up dialog appears in [Figure 13](#). Click on *OK* button to precede the firmware update.



**Figure 12. TMP1075 GUI Firmware Upgrade**



**Figure 13. Firmware Update Confirmation**



**Figure 14. TMP1075EVM Connection Diagram**

To update the firmware of the TMP1075EVM, please following the procedure below.

1. Start the *MSP430 USB Firmware Upgrade Example* program as shown in [Figure 15](#) , and click on *Next* to proceed the update and accept the license agreement. Note that in [Figure 16](#), it shows *No device connected* at this time.
2. Before starting the upgrade, the BSL mode must be invoked by disconnecting the TMP1075EVM from the USB cable.
3. Press and hold the SW1 switch button down while connecting the USB cable.
4. Once the BSL mode is now invoked, the *MSP430 USB Firmware Upgrade Example* shows *Found 1 device* in [Figure 17](#).
5. Select the *Select Firmware* radio button and click on *Browse* button to navigate the firmware file in this folder *C:\Program Files (x86)\Texas Instruments\TMP1075EVM\Firmware*. The firmware file name is *USB2ANY\_F5528.txt* version v2.7.16.
6. The firmware image is programmed, and the TMP1075EVM restarts automatically. The new firmware is now ready to use as shown in [Figure 18](#).



Figure 15. MSP430 USB Firmware Upgrade Program

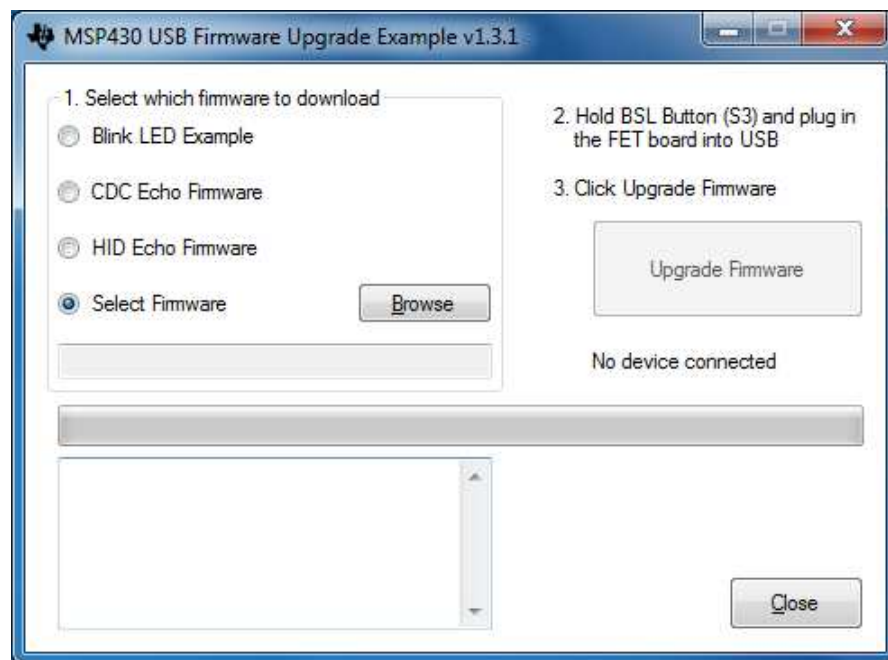


Figure 16. MSP430 USB Firmware Upgrade Program With No Device Connected

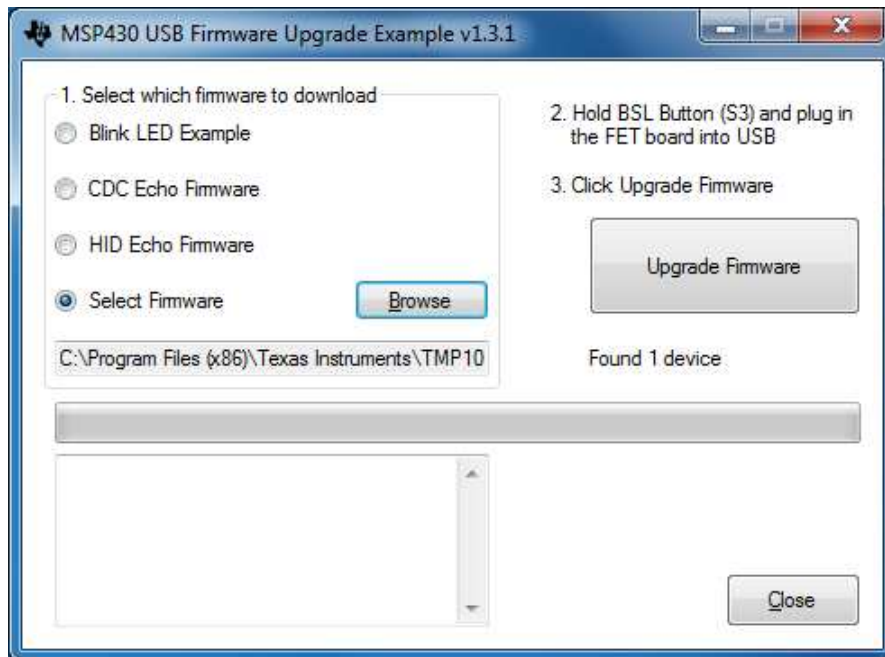


Figure 17. MSP430 USB Firmware Upgrade Program With Device Found

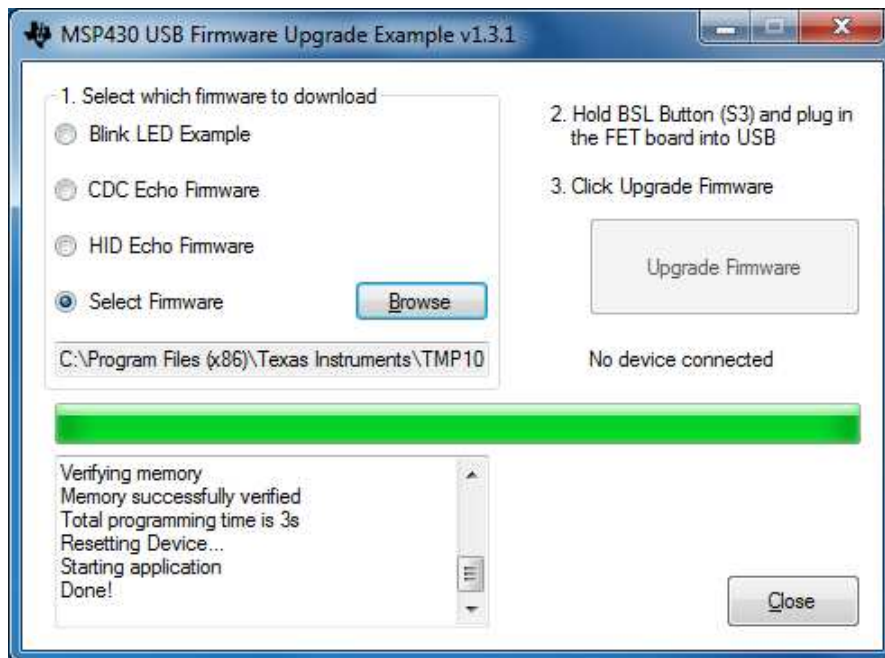


Figure 18. MSP430 USB Firmware Upgrade Program Showing Successful Firmware Update

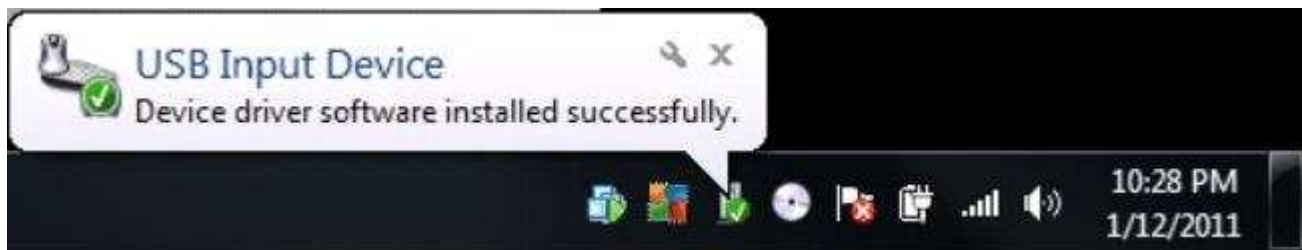
## 7 TMP1075EVM Setup and Operation

### CAUTION

Do not exceed the power supply rating of the MSP430.

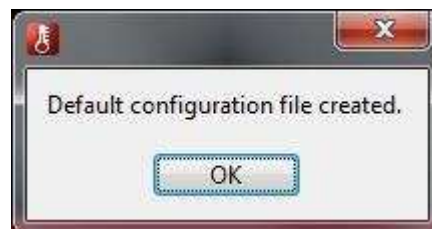
### 7.1 Launching and Running the Software

The TMP1075EVM is recognized by the host as a generic human interface device (HID); therefore, there is no required proprietary driver to install on the user's PC. It shows the typical response to connecting the USB-to-I2C converter board to a PC USB port for the first time. Typically, the computer responds with a Found New Hardware: USB device pop-up dialog. The pop-up window then typically changes to Found New Hardware: USB Human Interface Device. This pop-up indicates that the device is ready to be used. The USB-to-I2C Converter uses the human interface device drivers that are part of the Microsoft Windows® operating system.



**Figure 19. Confirmation of USB-to-I2C Converter Driver Installation**

The TMP1075EVM GUI can be run from the Start Menu or from Windows desktop. It is located in a folder Start -> Programs -> Texas Instruments -> TMP1075EVM -> TMP1075EVM.exe. Clicking the OK button will take the user to the main window of the GUI.



**Figure 20. Default Configuration**

1. Connect the TMP1075EVM to a USB port on a PC as shown in [Figure 20](#).
2. Launch the TMP1075EVM software by clicking on Start >> All Program >> Texas Instruments >> TMP1075 EVM >> TMP1075EVM.exe. The TMP1075 EVM GUI should automatically initialize and connect to the HID port. A successful connection will show *HARDWARE CONNECTED* highlighted in green color on the bottom of the GUI status indicator. If there is a connection problem please verify if the TMP1075EVM has an established connection with the PC. A fail connection if the status indicator shows as *DEMO MODE*.



## 7.2 Tab Pages Selection

The tab pages selection consists of three tabs: Main (Temperature Graph), EVM Set-Up, and TMP1075 Configuration. Launching the software will take you to the main window GUI (Main tab) display. By clicking on the page tab allows switching between pages of the tab control.

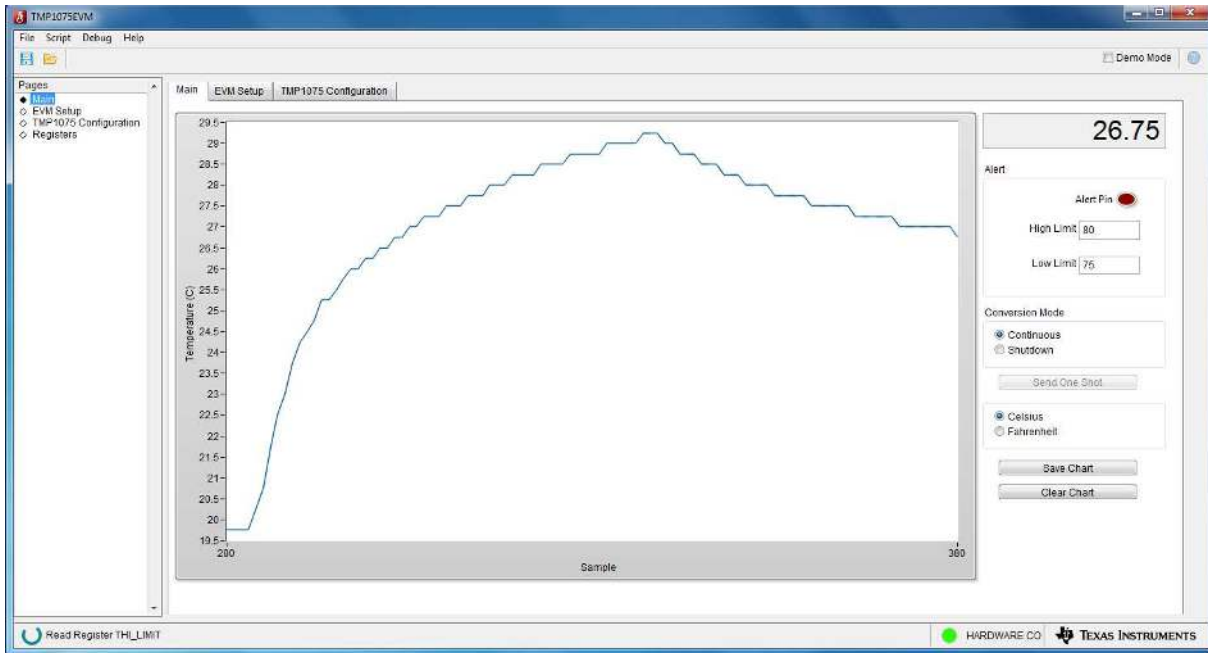


Figure 21. TMP1075EVM Default Tab

### 7.3 Main Tab

The *Main* tab provides graphing the temperature result as well as other features:

**Clear Chart** erases the contents of the Temperature Chart box or click right button of the mouse on the display screen then select *Clear chart*.

**Save Chart** prompts for a file name, and then saves the contents of the current Temperature graph box to \*.csv file. Note that the **Clear Chart** button must be performed first before log the data; otherwise, it will also save from the previous data in the memory.

**Current Value** shows the current temperature of the TMP1075.

**Celsius or Fahrenheit** is to toggle the temperature conversion Celsius to Fahrenheit.

**One Shot** is available on the Temperature Chart tab. The One Shot button writes to the TMP1075 configuration register with the one-shot in conversion mode. This setting initiates a temperature conversion within the TMP1075 device that updates the temperature result registers. After the one-shot conversion finishes, the device goes into shutdown until the next trigger of one-shot again.

**Continuous** performs the temperature conversion continuously when the shutdown mode bits is configured in the configuration register to continuously. Each temperature conversion consists of an active conversion period followed by a standby period based on the time of the conversion cycle configuration.

**Alert high and low limit register** can be set by entering the value in °C or °F based on °C/°F control on Main tab that stores the high and low limit for comparison with the temperature result.

### 7.4 Register Tab

The *Registers* tab provides access to the registers of the TMP1075, performing read and writes commands. Changes to the configuration page are mirrored here, and vice versa. For more details about each register, refer to the latest TMP1075 ([SBOS854](#)) data sheet.

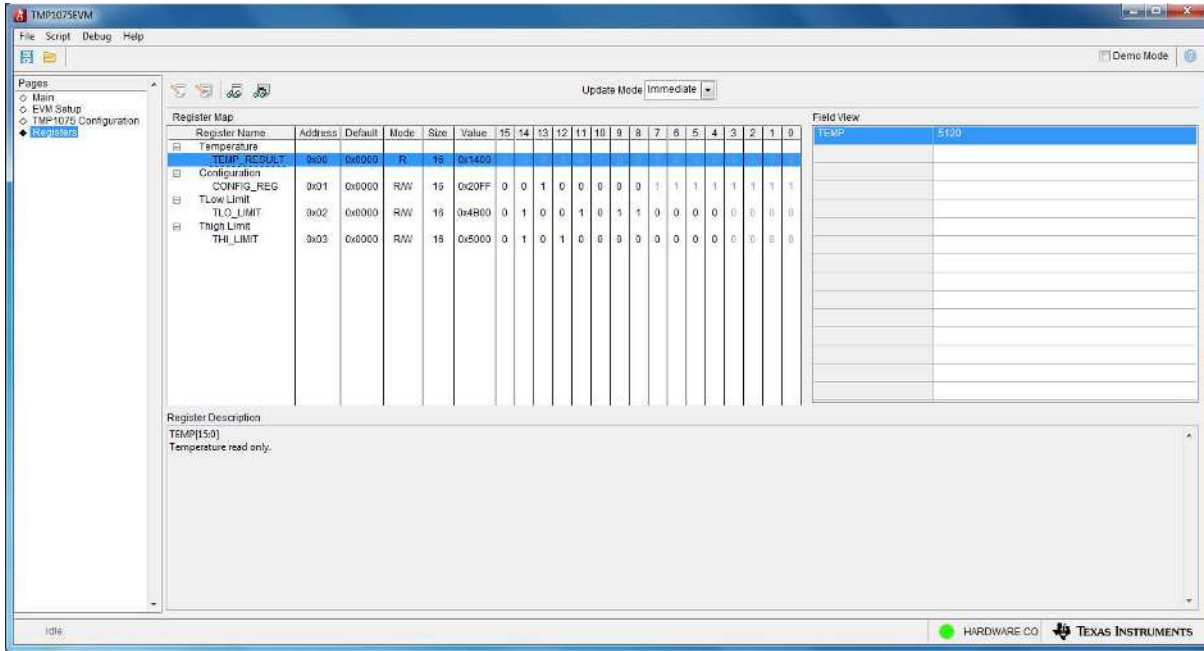
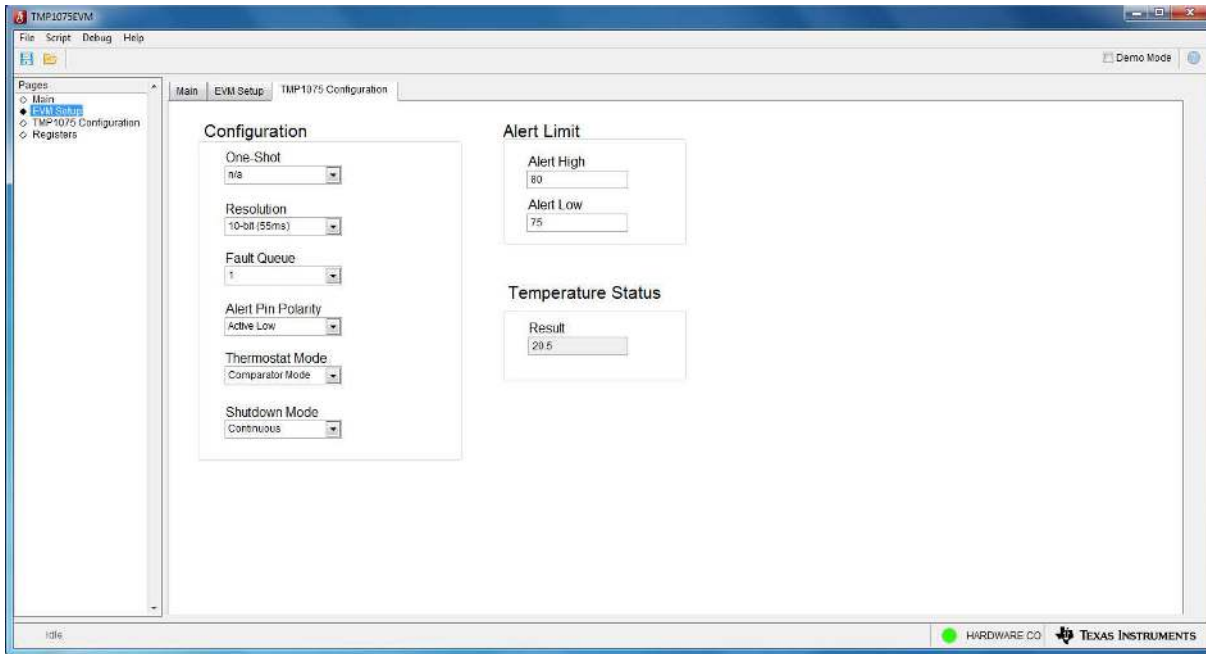


Figure 22. Registers Tab

## 7.5 Configuration Tab



**Figure 23. Configuration Tab**

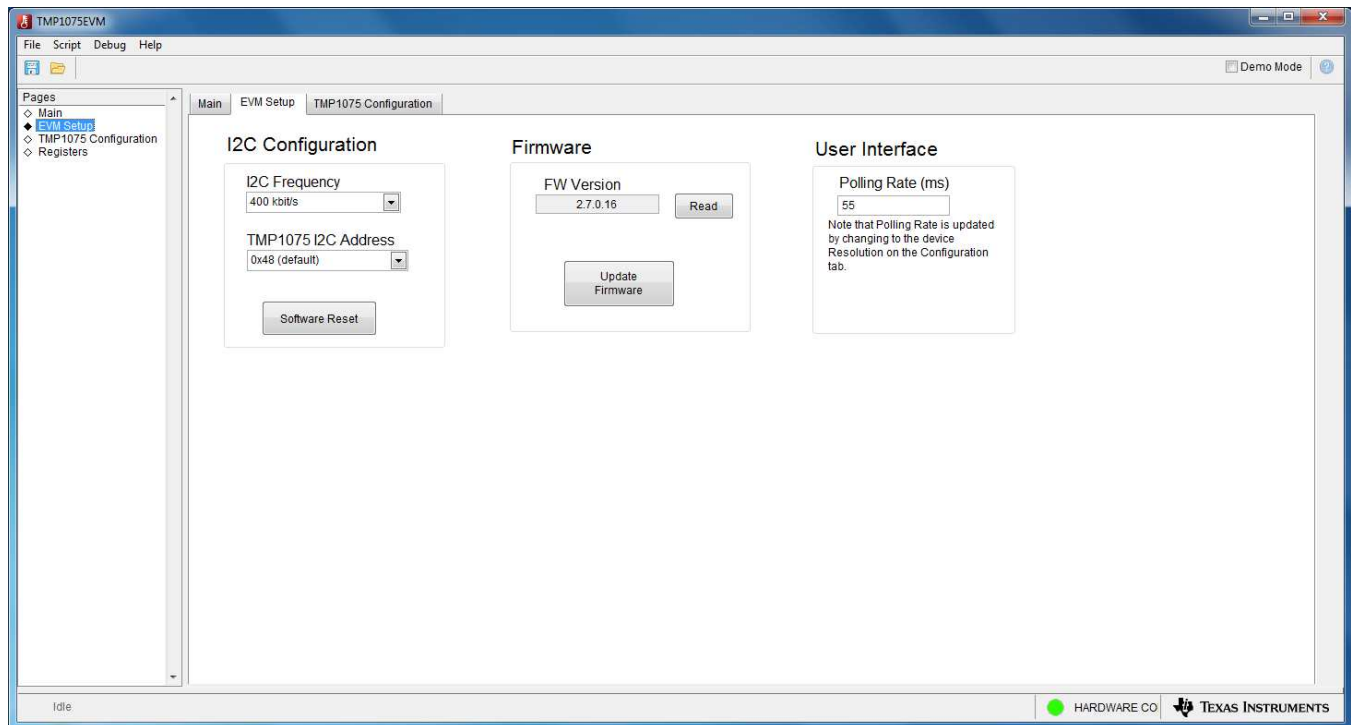
**Configuration register** can be set to desired value by selecting the drop-down menu.

**Alert high and low limit register** can be set by entering the value in °C/°F based on setting of the Main tab.

**Temperature** displays the current temperature of the TMP1075.

## 7.6 EVM Set-Up Tab

It is necessary to configure the TMP1075 slave address as 0x48 for communication with the EVM-GUI. This is the default slave address.



**Figure 24. TMP1075 Set-Up**

**Firmware** is allowed to check the firmware revision on the MSP430F5528 microcontroller by clicking the *Read* button or *Update The Firmware Revision*.

**I2C Configuration** is to change the bus frequency and slave address.

**Software Reset** performs software reset on the TMP1075 device by issuing a general call. After software reset, the values displayed in the EVM software may be out of sync with the device register contents. To sync register contents after software reset, click Read All in the Registers tab page.

**Demo Mode** allows to operate the GUI without a hardware connected. In this mode, the handle is closed. Clicking on any buttons or drop-down menu will be automatically closed the software GUI.

**User Interface** polling rate refers to the time interval at which the GUI software queries the TMP1075 device. It can be configured here, but it will be changed automatically when changes are made to resolution bit.

## 8 Board Layout

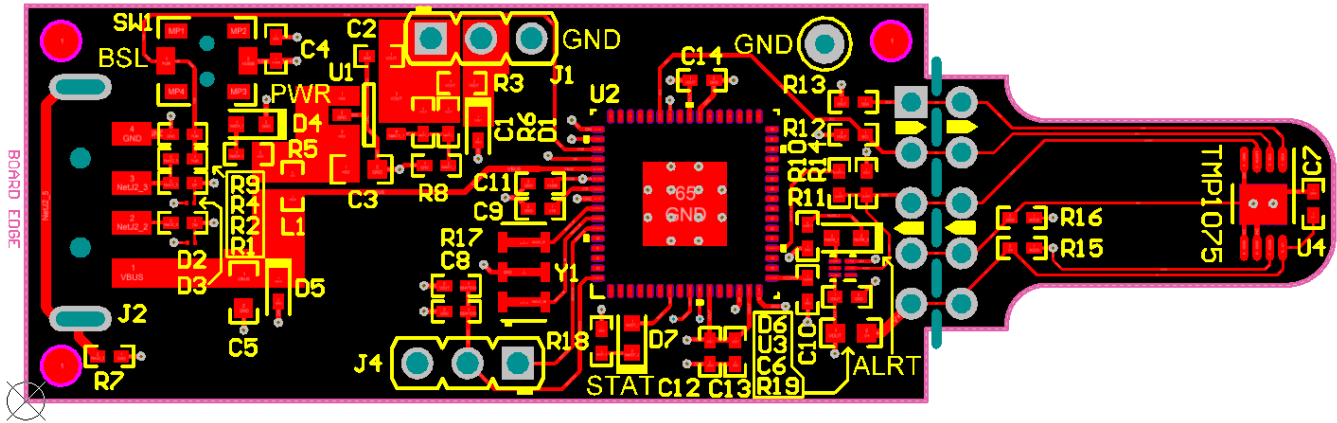


Figure 25. Top Assembly Layer

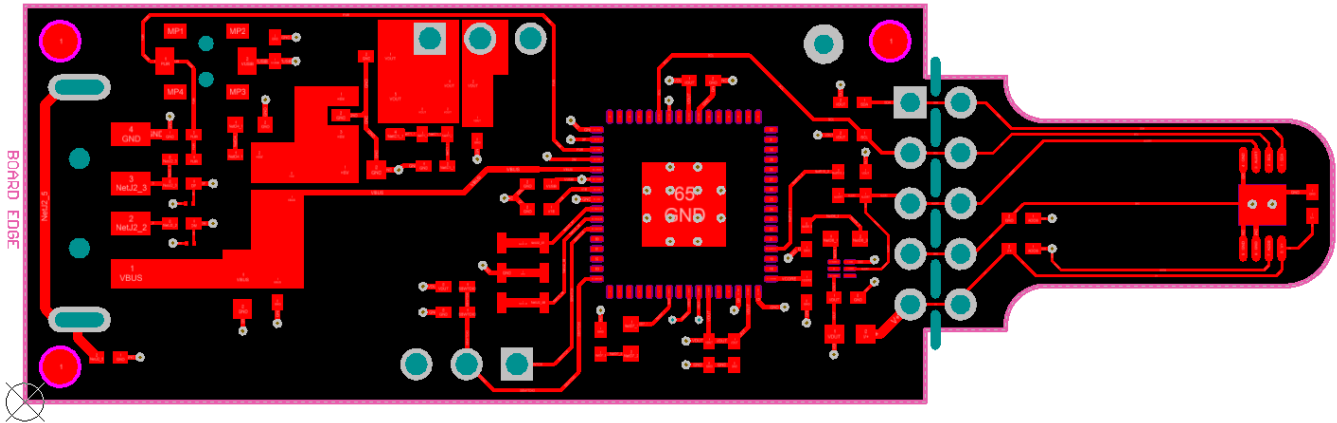


Figure 26. Top Layer Routing

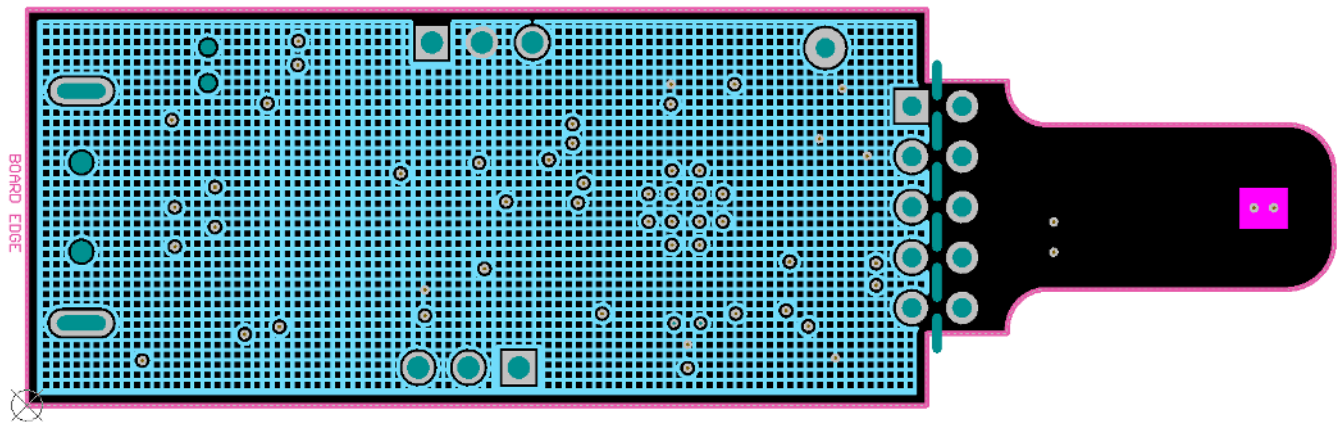


Figure 27. Power Layer Routing

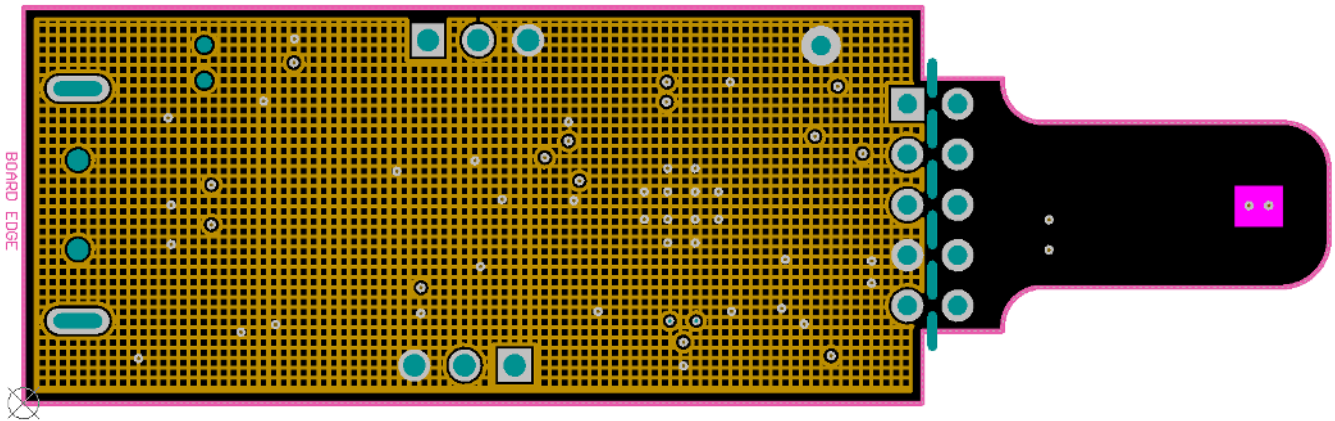


Figure 28. Ground Layer Routing

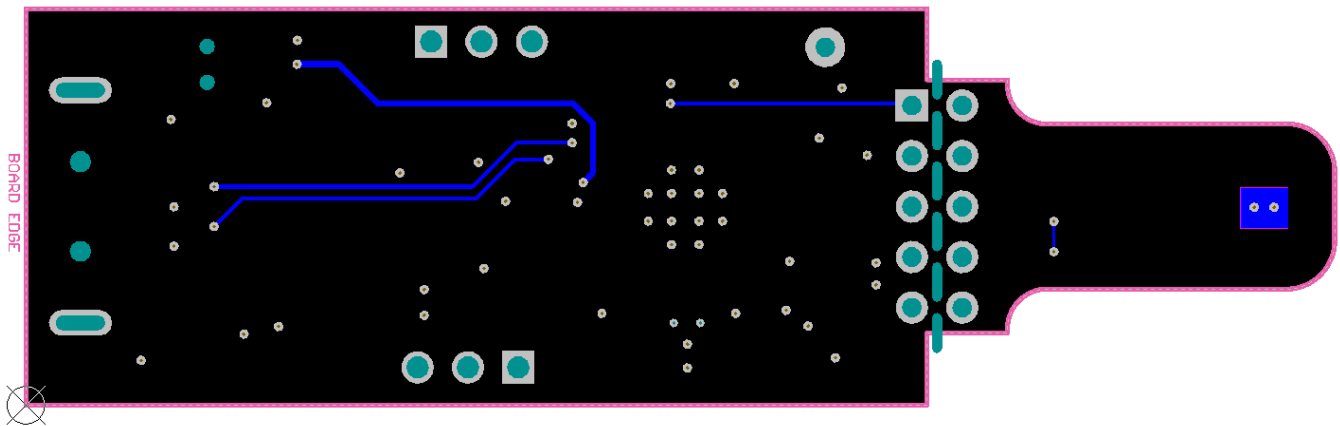


Figure 29. Bottom Layer Routing

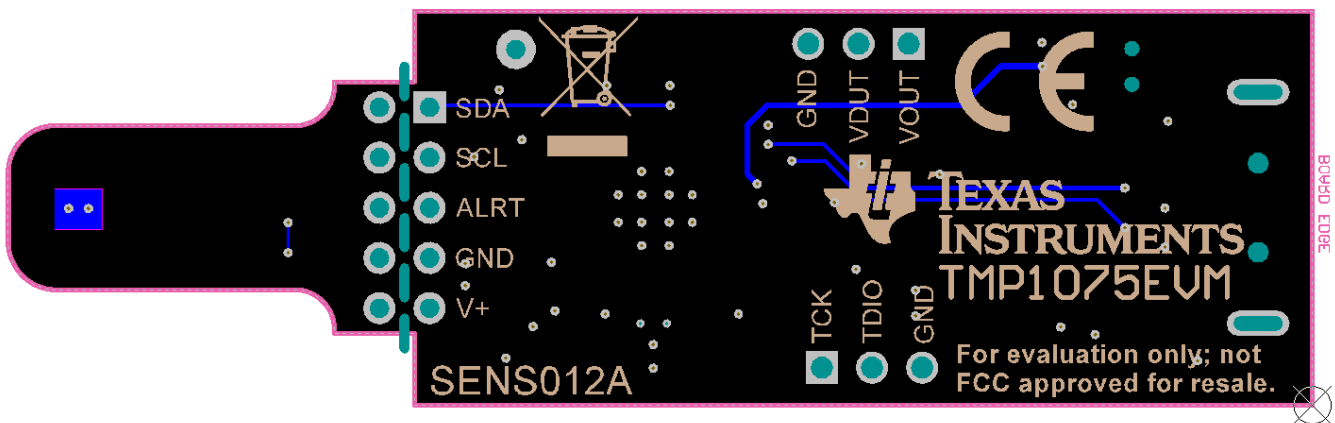
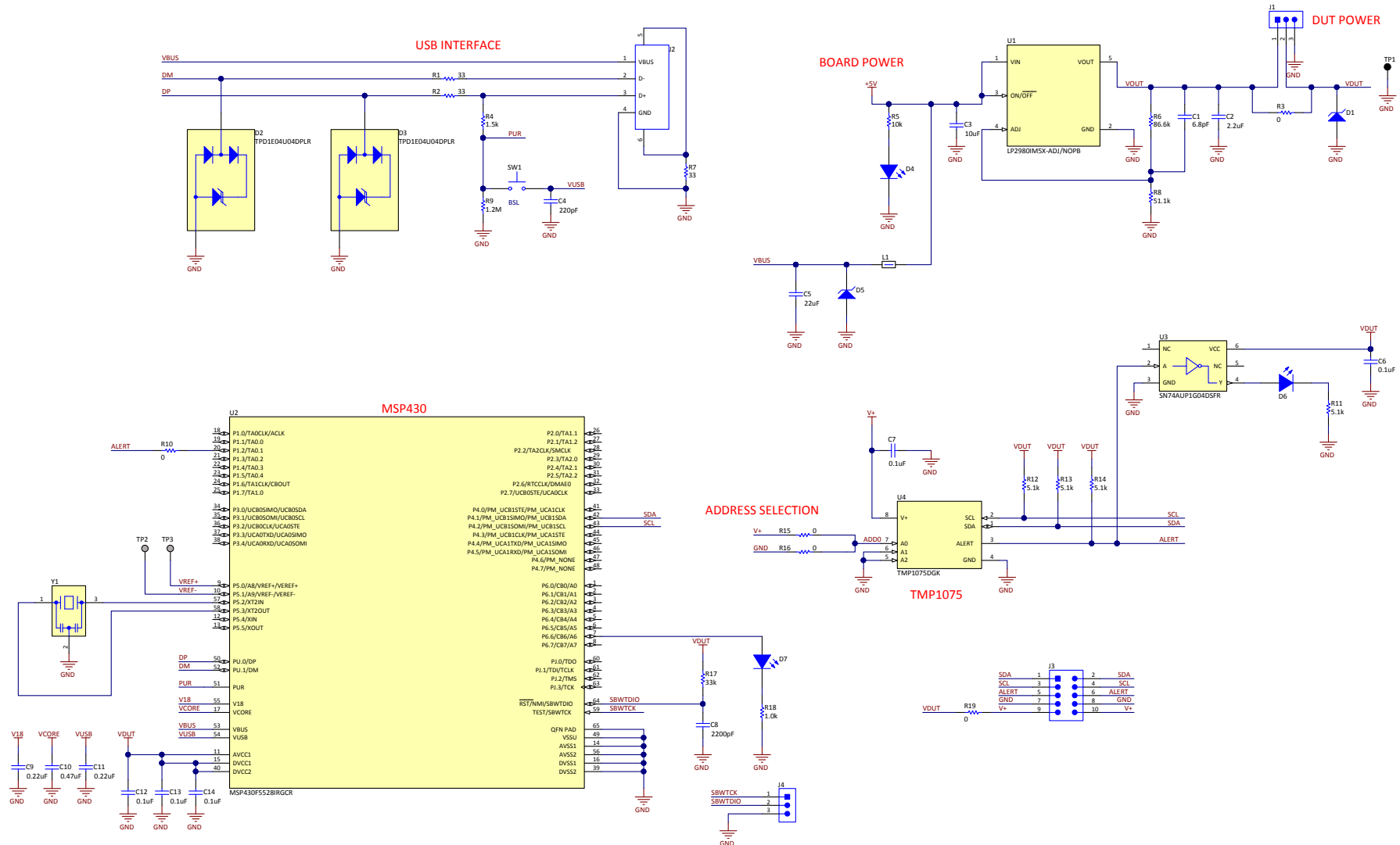


Figure 30. Bottom Assembly Layer

## 9 Schematic



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Figure 31. TMP1075EVM Schematic



## 10 Bill of Materials

**Table 4. TMP1075EVM Bill of Materials**

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		SENS012	Any
C1	1	6.8pF	CAP, CERM, 6.8 pF, 25 V, +/- 5%, C0G/NP0, 0402	0402	GRM1555C1E6R8CA01D	MuRata
C2	1	2.2uF	CAP, CERM, 2.2 uF, 16 V, +/- 10%, X5R, 0402	0402	GRM155R61C225KE11D	MuRata
C3	1	10uF	CAP, CERM, 10 uF, 10 V, +/- 20%, X5R, 0603	0603	C1608X5R1A106M080AC	TDK
C4	1	220pF	CAP, CERM, 220 pF, 50 V, +/- 10%, X7R, 0402	0402	GRM155R71H221KA01D	MuRata
C5	1	22uF	CAP, CERM, 22 uF, 10 V, +/- 20%, X5R, 0603	0603	C1608X5R1A226M080AC	TDK
C6, C7	2	0.1uF	CAP, CERM, 0.1 uF, 16 V, +/- 5%, X7R, 0402	0402	GRM155R71C104JA88D	MuRata
C8	1	2200pF	CAP, CERM, 2200 pF, 100 V, +/- 10%, X7S, AEC-Q200 Grade 1, 0402	0402	CGA2B3X7S2A222K050BB	TDK
C9, C11	2	0.22uF	CAP, CERM, 0.22 uF, 16 V, +/- 10%, X5R, 0402	0402	C1005X5R1C224K050BB	TDK
C10	1	0.47uF	CAP, CERM, 0.47 uF, 10 V, +/- 10%, X5R, 0402	0402	GRM155R61A474KE15D	MuRata
C12, C13, C14	3	0.1uF	CAP, CERM, 0.1 uF, 10 V, +/- 10%, X5R, 0402	0402	C1005X5R1A104K050BA	TDK
D1	1	4.3V	Diode, Zener, 4.3 V, 300 mW, SOD-523	SOD-523	BZT52C4V3T-7	Diodes Inc.
D2, D3	2		1-Channel ESD Protection Diode With Low Dynamic Resistance for HDMI 2.0 and USB 3.0, DPL0002A (X2SON-2)	DPL0002A	TPD1E04U04DPLR	Texas Instruments
D4	1	Green	LED, Green, SMD	LED_0603	LTST-C191TGKT	Lite-On
D5	1	6.2V	Diode, Zener, 6.2 V, 300 mW, SOD-523	SOD-523	BZT52C6V2T-7	Diodes Inc.
D6	1	Red	LED, Red, SMD	LED_0603	LTST-C191KRKT	Lite-On
D7	1	Orange	LED, Orange, SMD	LED_0603	LTST-C191KFKT	Lite-On
J1	1		Header, 2.54 mm, 3x1, Gold, TH	Header, 2.54mm, 3x1, TH	61300311121	Würth Elektronik
J2	1		Connector, Plug, USB Type A, R/A, Top Mount SMT	Edge mount USB A CONN	48037-2200	Molex
L1	1	120 ohm	Ferrite Bead, 120 ohm @ 100 MHz, 0.55 A, 0402	0402	BLM15AG121SN1D	MuRata
R1, R2, R7	3	33	RES, 33, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040233R0JNE D	Vishay-Dale
R3, R10, R16	3	0	RES, 0, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04020000Z0E D	Vishay-Dale
R4	1	1.5k	RES, 1.5 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04021K50JNE D	Vishay-Dale
R5	1	10k	RES, 10 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2GEJ103X	Panasonic
R6	1	86.6k	RES, 86.6 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040286K6FKE D	Vishay-Dale
R8	1	51.1k	RES, 51.1 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040251K1FKE D	Vishay-Dale
R9	1	1.2Meg	RES, 1.2 M, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04021M20JNE D	Vishay-Dale
R11, R12, R13, R14	4	5.1k	RES, 5.1 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04025K10JNE D	Vishay-Dale
R17	1	33k	RES, 33 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040233K0JNE D	Vishay-Dale
R18	1	1.0k	RES, 1.0 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04021K00JNE D	Vishay-Dale
R19	1	0	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06030000Z0E A	Vishay-Dale

**Table 4. TMP1075EVM Bill of Materials (continued)**

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
SH-J1	1		Shunt, 100mil, Tin plated, Black	Shunt Connector Black Open Top, 2x1	SNT-100-BK-T-H	Samtec
SW1	1		Switch, SPST-NO, Off-Mom, 0.05A, 12VDC, SMD	3.9x2.9mm	PTS820 J20M SMTR LFS	CK Components
TP1	1		Test Point, Miniature, Black, TH	Black Miniature Testpoint	5001	Keystone
U1	1		Micropower 50 mA Ultra Low-Dropout Adjustable Voltage Regulator in SOT-23, DBV0005A (SOT-23-5)	DBV0005A	LP2980IM5X-ADJ/NOPB	Texas Instruments
U2	1		25 MHz Mixed Signal Microcontroller with 128 KB Flash, 8192 B SRAM and 47 GPIOs, -40 to 85 degC, 64-pin QFN (RGC), Green (RoHS and no Sb/Br)	RGC0064B	MSP430F5528IRGCR	Texas Instruments
U3	1		Low-Power Single Inverter Gate, DSF0006A, LARGE TandR	DSF0006A	SN74AUP1G04DSFR	Texas Instruments
U4	1		Temperature Sensor With I2C and SMBus Interface, DGK0008A (VSSOP-8)	DGK0008A	TMP1075DGK	Texas Instruments
Y1	1		Resonator, 4 MHz, 5000 ppm, AEC-Q200 Grade 1, SMD	4.5x2mm	PBRV4.00MR50Y000	AVX
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A
J3	0		Header, 100mil, 5x2, Tin, TH	Header, 5x2, 100mil, Tin	PEC05DAAN	Sullins Connector Solutions
J4	0		Header, 2.54 mm, 3x1, Gold, TH	Header, 2.54mm, 3x1, TH	61300311121	Würth Elektronik
R15	0	0	RES, 0, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04020000Z0E D	Vishay-Dale

## Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

<b>Changes from Original (March 2018) to A Revision</b>	<b>Page</b>
• Changed key graphic .....	1
• Changed <i>TMP1075EVM Hardware Setup</i> graphic .....	6
• Changed <i>TMP1075EVM Connection Diagram</i> graphic .....	13

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  - 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.
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

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[http://www.tij.co.jp/lstds/ti\\_ja/general/eStore/notice\\_01.page](http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page)

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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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#### 3.4 *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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