

# LM75AEVM Evaluation Module (EVM)

## User's Guide



Literature Number: SNVU209  
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## Introduction

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The Texas Instruments LM75AEVM evaluation module (EVM) helps designers evaluate the operation and performance of the LM75A. The LM75A is an industry-standard digital temperature sensor with an integrated Sigma-Delta analog-to-digital converter with a digital I<sup>2</sup>C interface. The LM75A provides 9-bit digital temperature readings with an accuracy of  $\pm 2^{\circ}\text{C}$  from  $-25^{\circ}\text{C}$  to  $100^{\circ}\text{C}$  and  $\pm 3^{\circ}\text{C}$  from  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . It has an Over-temperature Shutdown (O.S.) pin that can be used in Comparator or Interrupt mode.

The EVM contains one LM75A digital temperature sensor. It comes pre-assembled with the LM75A, and the jumper header allows the end user to select the desired slave ID address on board. The EVM kit includes a USB2ANY interface board. The evaluation board communicates through the MSP430 microcontroller using the USB2ANY interface board to provide I<sup>2</sup>C bus. The USB2ANY interface board is used to relay the information from the EVM to USB2ANY via the PC running the LabVIEW evaluation software.

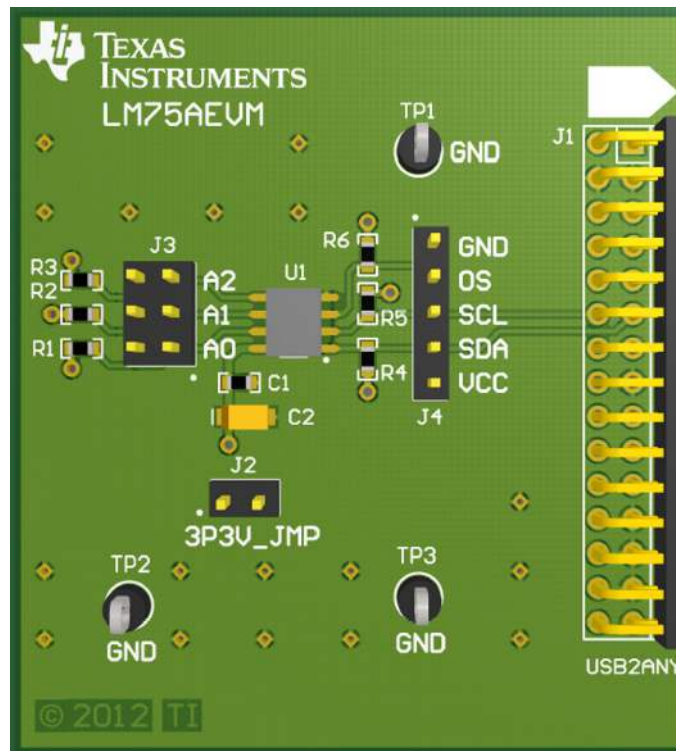
**Table 1-1. Device and Package Configurations**

SENSOR	IC	PACKAGE
U1	LM75AIM	8VSSOP

## Board Connectors and Components

This section describes the jumpers and connectors on the LM75AEVM, and how to properly connect, set up and use the LM75AEVM.

### 2.1 Input/Output Connector Description and Components



**Figure 2-1. LM75A Evaluation Board**

#### 2.1.1 Power Supply Input – VDD and GND

The power supply pin of the device is connected to the 3P3V jumper. The EVM does not require an external power supply. It can be powered by shorting the J2 connector from the USB2ANY interface board with a regulated voltage. There are two bypass capacitors: 10 $\mu$ F tantalum and 0.1 $\mu$ F ceramic.

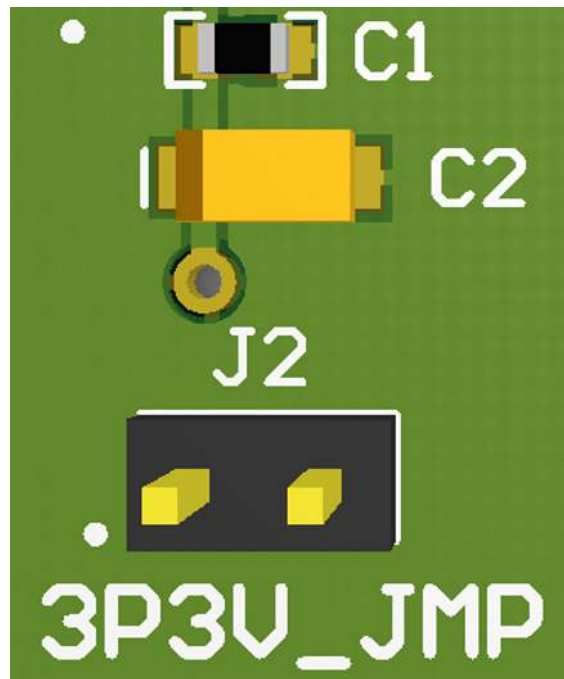


Figure 2-2. VCC Jumper

### 2.1.2 Inter-IC (I<sup>2</sup>C) Bus Test Point

The standard 100 mils header allows probing of the I<sup>2</sup>C bus. The I<sup>2</sup>C bus requires two bus lines to communicate with the device: a serial data line (SDA) and a serial clock line (SCL). There is an additional OS, VCC, and GND that is not part of the I<sup>2</sup>C interface.

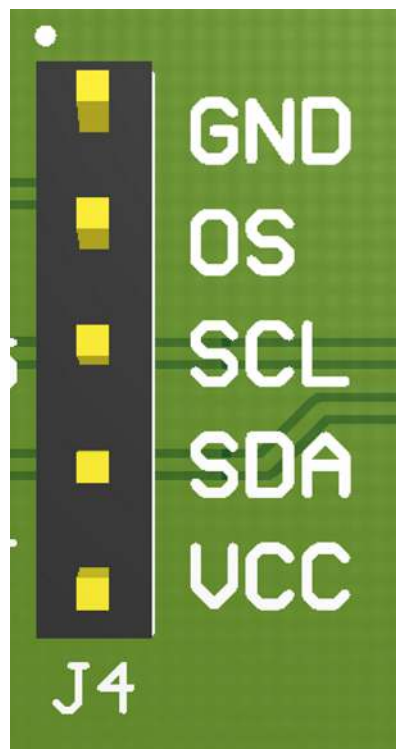


Figure 2-3. Probing Test Point

### 2.1.3 Interface Connector - J1

J1 is used to connect the LM75AEVM to the USB2ANY board. USB2ANY is the I<sup>2</sup>C protocol master control by the PC via LabVIEW software. The bundle setup is allowed accessing to the device registers and temperature data.

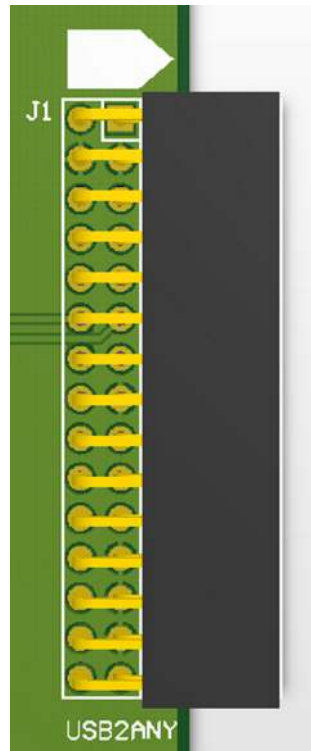


Figure 2-4. USB2ANY Interface Connector

### 2.1.4 Slave Address

The LM75A is connected to the bus by a unique slave address, to operate data transfer from the master-transmitter to the slave-receiver or slave-transmitter to the master-receiver. At default, this jumper is pulling high, and shorting the two terminals allow setting to a "LOW". Refer to the [LM75A datasheet](#) for more details.

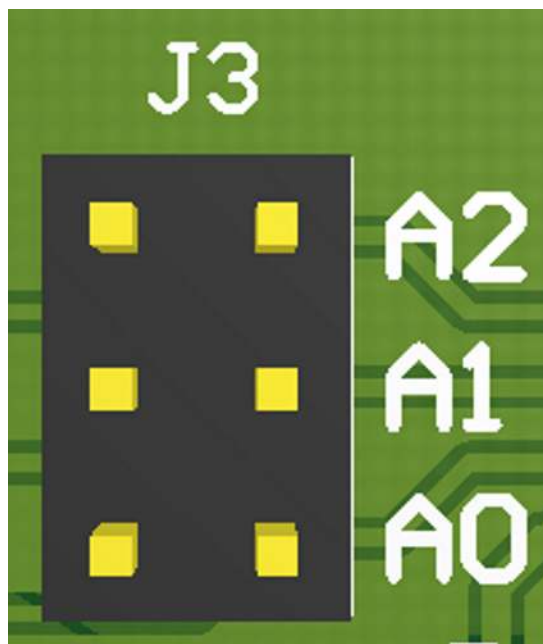


Figure 2-5. I<sup>2</sup>C Slave Select Jumper

Table 2-1. 7-bit Slave Address

1	0	0	1	A2	A1	A0
MSB			LSB			

Table 2-2. I<sup>2</sup>C Address User Setting Input

A2	A1	A0	Slave Address
0	0	0	0x48
0	0	1	0x49
0	1	0	0x4A
0	1	1	0x4B
1	0	0	0x4C
1	0	1	0x4D
1	1	0	0x4E
1	1	1	0x4F

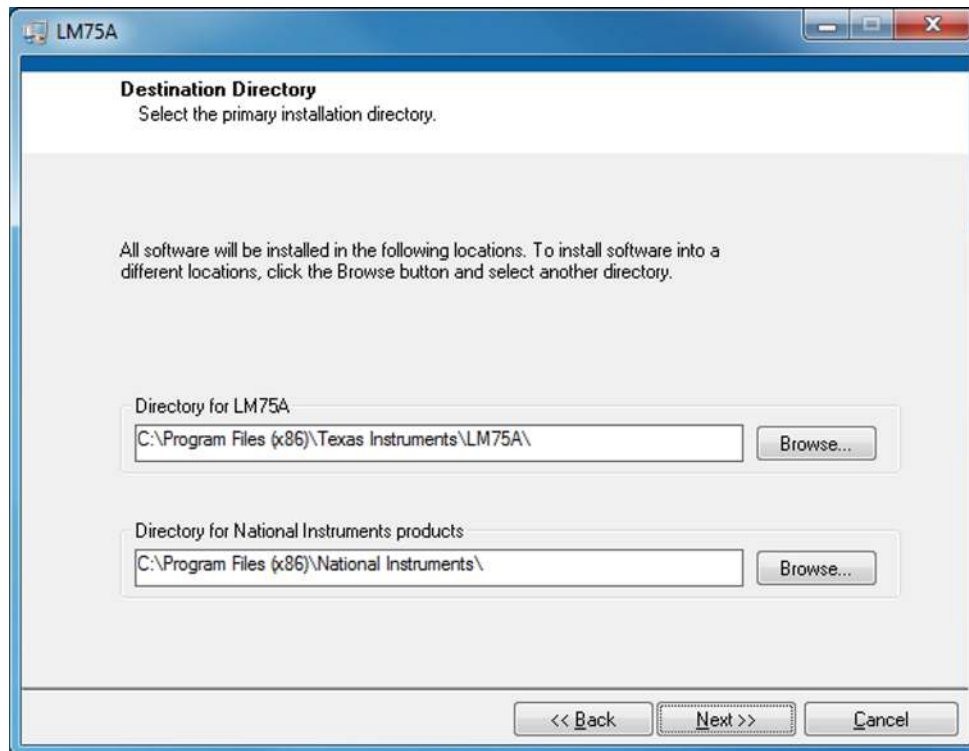


## Software Installation

The latest version of the LM75A software can be downloaded from: <http://www.ti.com/product/lm75a>. The LM75A software must be installed before connecting LM75AEVM to your PC.

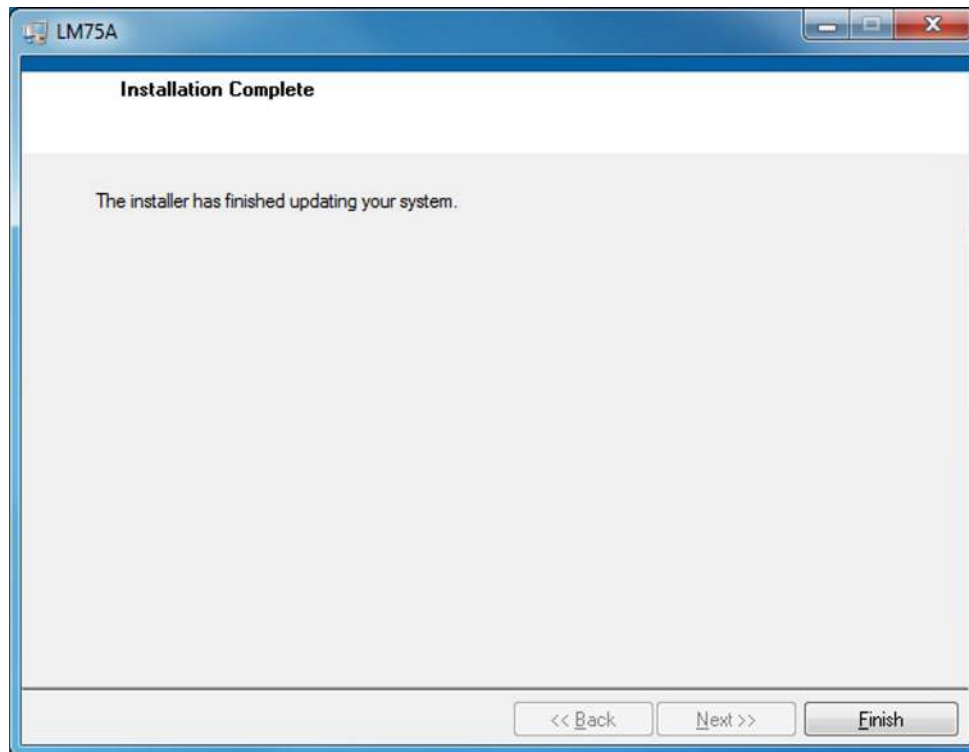
To install the LM75A Software:

1. Click this link: <http://www.ti.com/product/lm75a>, scroll down to the “software” section, and download the latest LM75A evaluation software.
2. Unzip the downloaded file into a known directory, and run the “setup.exe” file located in the previously created folder. Follow the instructions on the pop-up window, and click “Next” to install the software.



**Figure 3-1. Select the Primary Installation Directory**

3. When the installation is finished, please click the “Finish” button.



**Figure 3-2. Installation Complete**

4. Before launching the LM75A software, connect USB2ANY board to a USB port of your PC. The USB2ANY interface board is recognized by the host as a generic human interface device (HID); therefore, there is no proprietary driver required to install on your PC.

## Board Setup and Operation

1. For proper operation of the LM75AEVM, J2 should be jumped. This will allow the LM75A's VDD to be sourced from an on-board 3.3V regulator.
2. Jumping J3 will allow configuration of the I<sup>2</sup>C slave address to a desired address.

The figures below show the connection between the LM75AEVM and the USB2ANY interface board module.

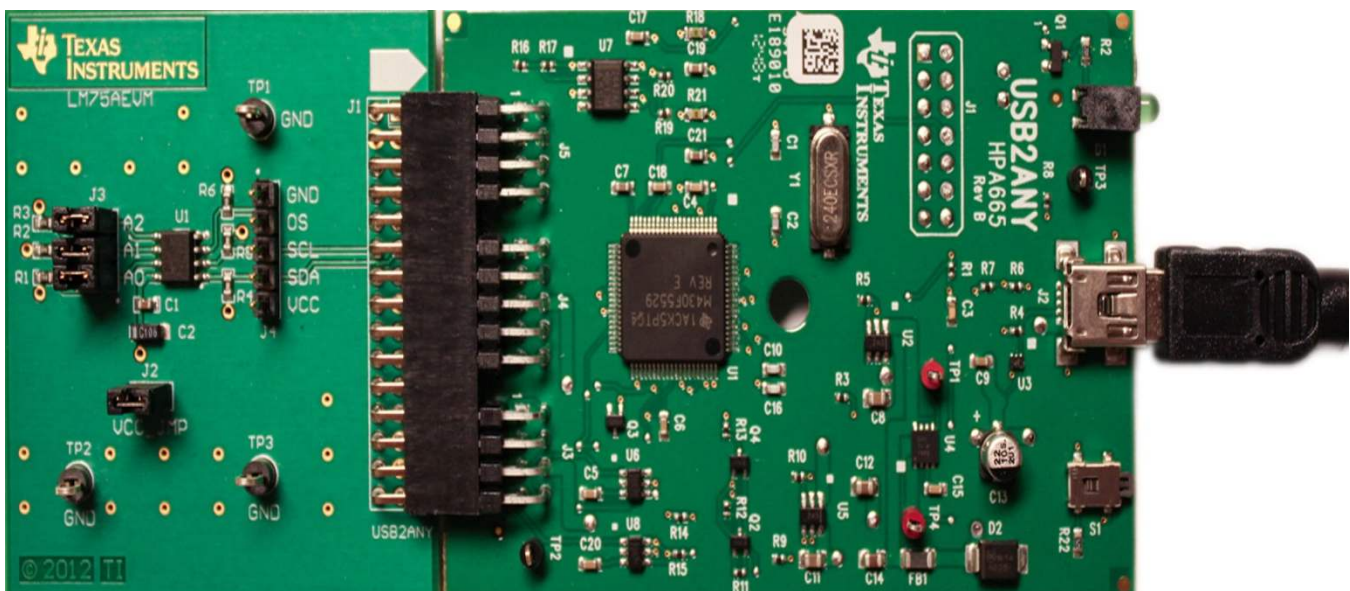


Figure 4-1. LM75AEVM Hardware Connection

### 4.1 Launching the Software

1. The LM75A GUI software can be run by clicking Start | All Program | Texas Instruments | LM75A. Launching the software will take you directly to the main GUI (Registers tab). The “Registers” tab contains a list of LM75A registers. It provides access to the registers of the LM75A by performing read and write commands.

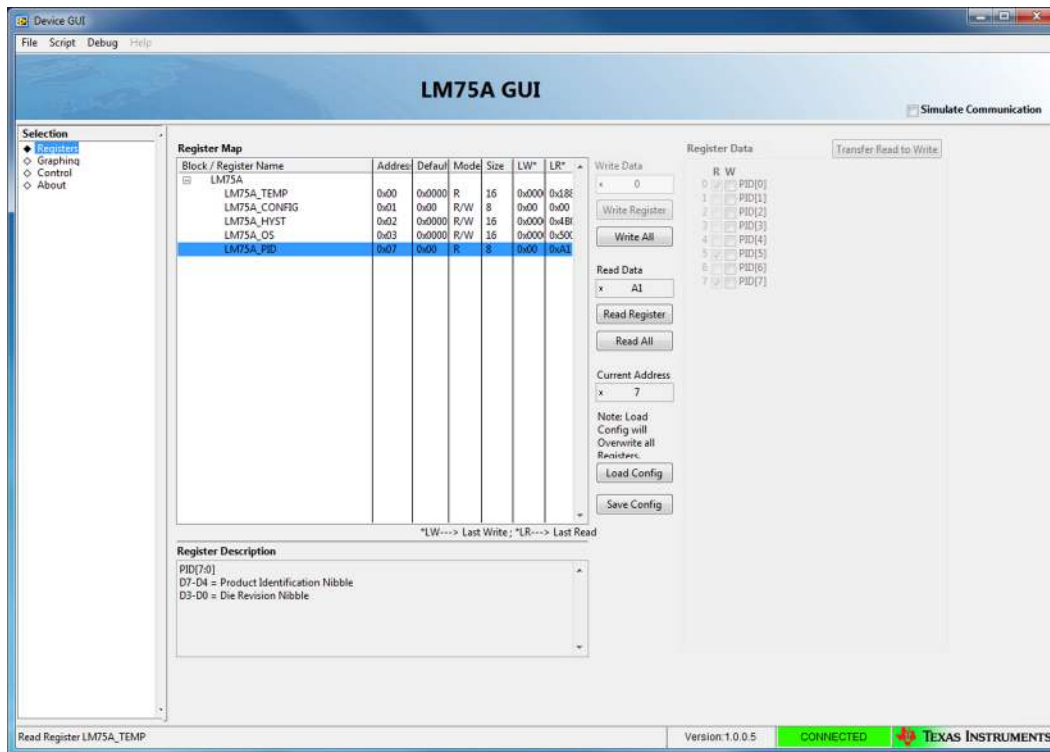


Figure 4-2. Registers Tab

- The “Graphing” tab allows capturing and displaying of the temperature data. By default, the plotting will not start until the “Start” button is pressed. Click on the “Stop” button to stop the plotting. The temperature data can be saved as an excel file by right-clicking, and selecting the Export | Export Data To Excel.

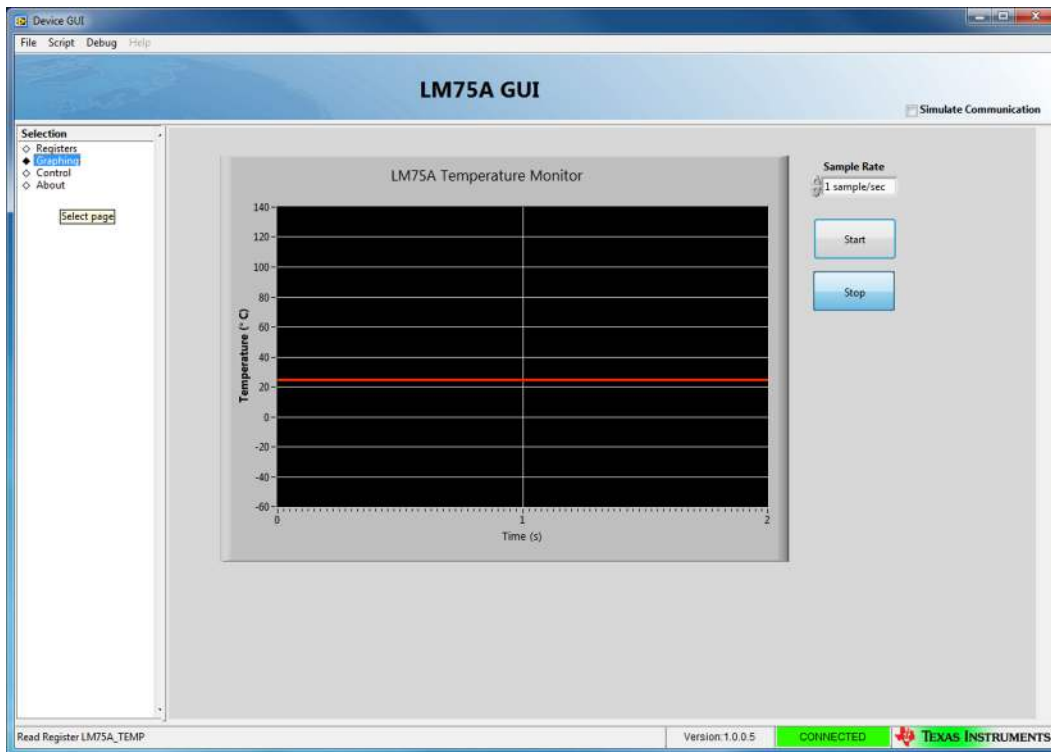


Figure 4-3. Graphing Tab

- The “Control” tab provides the user with instant monitoring capabilities and control of the device from the screen. This tab is very similar to the “Registers” tab.

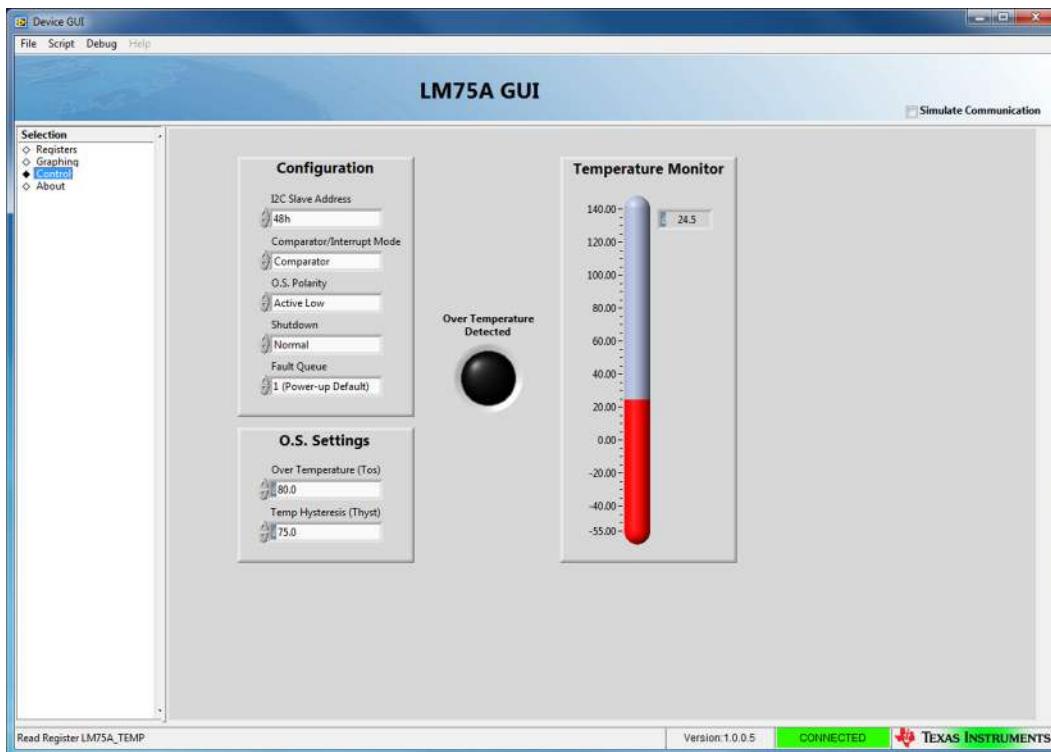


Figure 4-4. Control Tab

## Board Layout

Figure 2-4, Figure 2-5, and Table 2-1 show the board layout for the LM75AEVM. The EVM offers jumpers to set the three least significant bits of the I<sup>2</sup>C slave address, in order to run the LM75AIM temperature sensor.

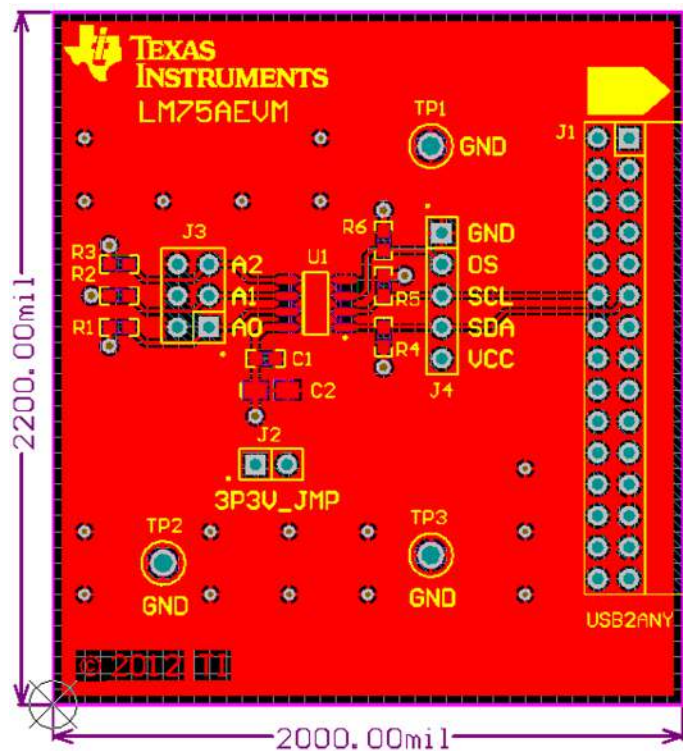


Figure 5-1. Top Assembly Layer

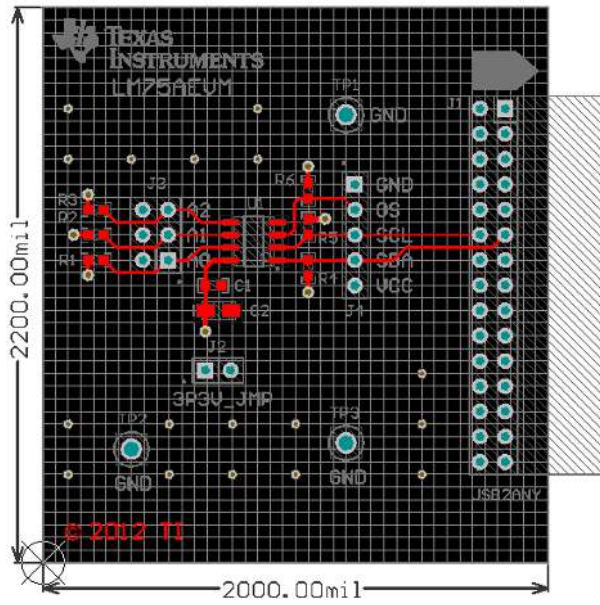


Figure 5-2. Top Layer Routing

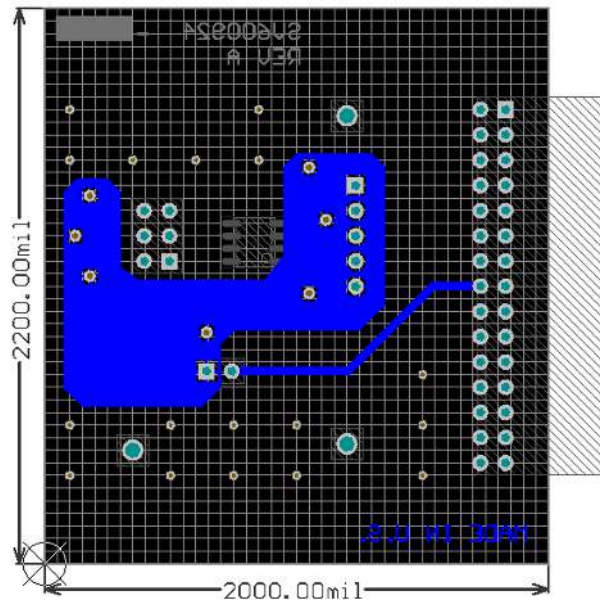


Figure 5-3. Bottom Layer Routing

# Schematic

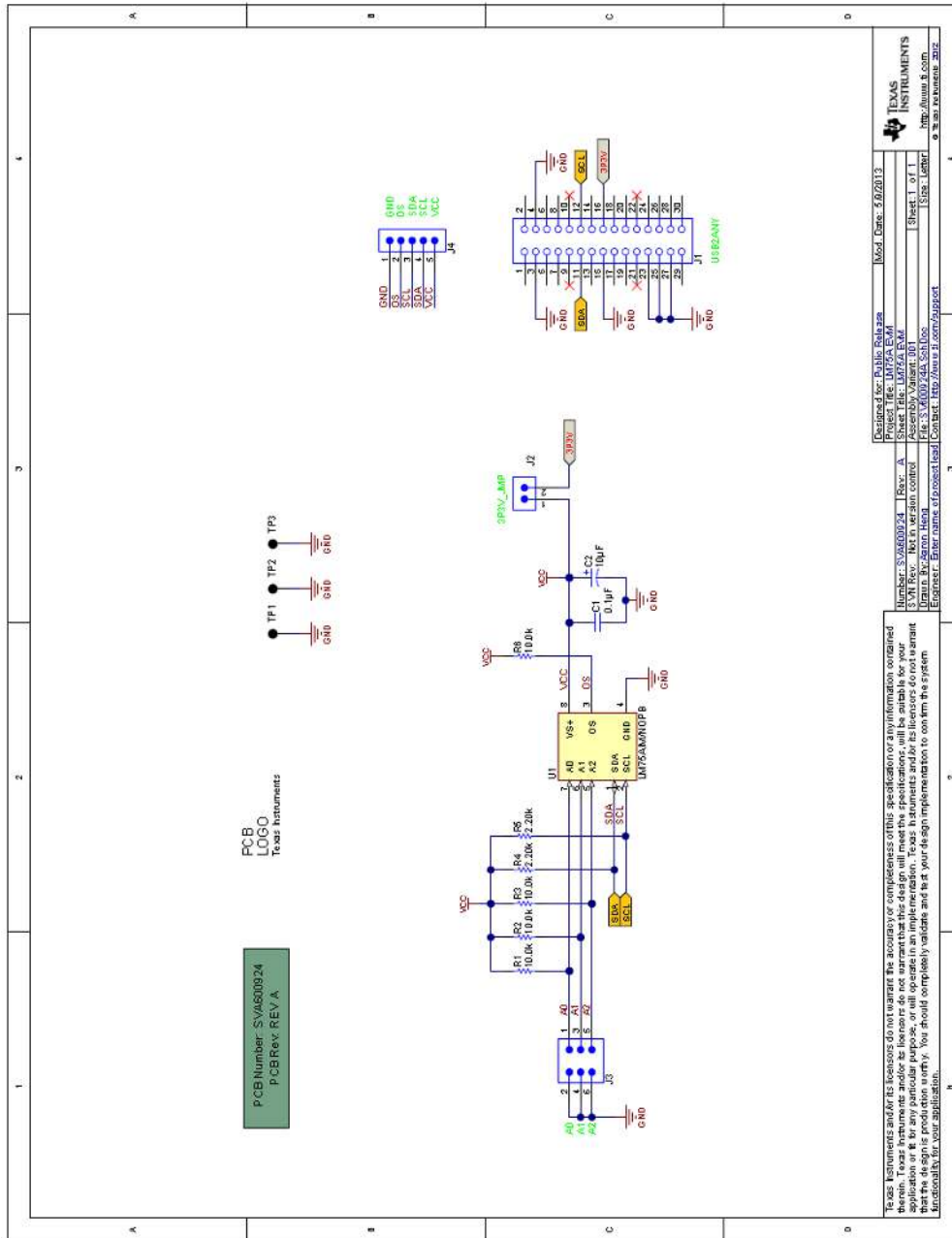


Figure 6-1. LM75AEVM Schematic



## Bill Of Materials

**Table 7-1. LM75AEVM Bill of Materials**

Designator	Description	Manufacturer	Part Number
EVM	LM75A Evaluation Board	Texas Instruments	SVA600924
C1	CAP, CERM, 0.1uF, 25V, +/- 10%, X5R, 0603	AVX	06033D104KAT2A
C2	CAP, TANT, 10uF, 10V, +/-20%, 1.8 ohm, 3216-18 SMD	AVX	TPSA106M010R1800
J1	Receptacle, 100mil, 15x2, Right Angle, Gold plated, TH	Sullins Connector Solutions	PPPC152LJBN-RC
J2	Header, TH, 100mil, 2x1, Gold plated, 230 mil above insulator	Samtec, Inc.	TSW-102-07-G-S
J3	Header, TH, 100mil, 3x2, Gold plated, 230 mil above insulator	Samtec, Inc.	TSW-103-07-G-D
J4	Header, TH, 100mil, 5x1, Gold plated, 230 mil above insulator	Samtec, Inc.	TSW-105-07-G-S
LBL1	Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	Brady	THT-14-423-10
R1, R2, R3, R6	RES, 10.0k ohm, 1%, 0.1W, 0603	Vishay-Dale	CRCW060310K0FKEA
R4, R5	RES, 2.20k ohm, 1%, 0.1W, 0603	Yageo America	RC0603FR-072K2L
TP1, TP2, TP3	Test Point, TH, Multipurpose, Black	Keystone	5011
U1	Digital Temperature Sensor and Thermal Watchdog with Two-Wire Interface, 8-pin Narrow SOIC, Pb-Free	Texas Instruments	LM75AIM/NOPB

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As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

### General Statement for EVMs including a radio

*User Power/Frequency Use Obligations:* This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

### 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

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**

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.

### **For EVMs annotated as IC – INDUSTRY CANADA Compliant**

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### **Concerning EVMs including radio transmitters**

This device complies with Industry Canada licence-exempt RSS standard(s). 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.

### **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.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

### **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.

### **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.

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**This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan**

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product 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 this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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**For Feasibility Evaluation Only, in Laboratory/Development Environments.** Unless otherwise indicated, this EVM is not a finished electrical equipment and not intended for consumer use. It is intended solely for use for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all or part of a finished end product.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure 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.
3. Since the EVM is not a completed product, it may not meet all applicable regulatory and safety compliance standards (such as UL, CSA, VDE, CE, RoHS and WEEE) which may normally be associated with similar items. You assume full responsibility to determine and/or assure compliance with any such standards and related certifications as may be applicable. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

**Certain Instructions.** It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please 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 result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's 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, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

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