



## **LM75AEB Evaluation Board User's Guide**

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## LM75A Evaluation Board User's Guide

### References

1. LM75 Digital Temperature Sensor and Thermal Watchdog with Two-Wire Interface datasheet.

The latest copy of the LM75 datasheet can be obtained by going to the National Semiconductor website [www.national.com](http://www.national.com), by searching on "LM75", and then downloading the LM75.pdf file.

2. SensorEval Version 1.1.0s or later Evaluation Board CD containing:
  - a. The SensorEval.exe executable program used to run the LM75A Evaluation Board.
  - b. A softcopy of this User's Guide
  - c. A readme.txt file with useful information about the program.
  - d. A softcopy of the SensorEval Software manual.

## 1.0 Introduction

The LM75AEB/NOPB Evaluation Board is used together with the National Semiconductor SensorEval software (provided in the kit), and with a USB cable, (not provided in the kit), and with an external personal computer (PC). Power to the LM75AEB/NOPB Evaluation Board is provided by the +5 VDC line of the USB connection. No external power supply or signal sources are required for operation of the LM75AEB/NOPB evaluation board.

Before connecting the LM75AEB/NOPB evaluation board to the PC through the USB cable, the PC is first turned on and allowed to go through its boot-up procedure. The user installs and initiates the SensorEval software.

After the SensorEval software is running, the user can connect the USB cable first to the computer and then to the LM75A Evaluation Board.

The PC should be able to recognize the board and the user simply selects the LM75AEB/NOPB Eval Board radio button. By selecting the "Read Cont"

(Read Continuously) box the temperature reading will update the temperature readings continuously.

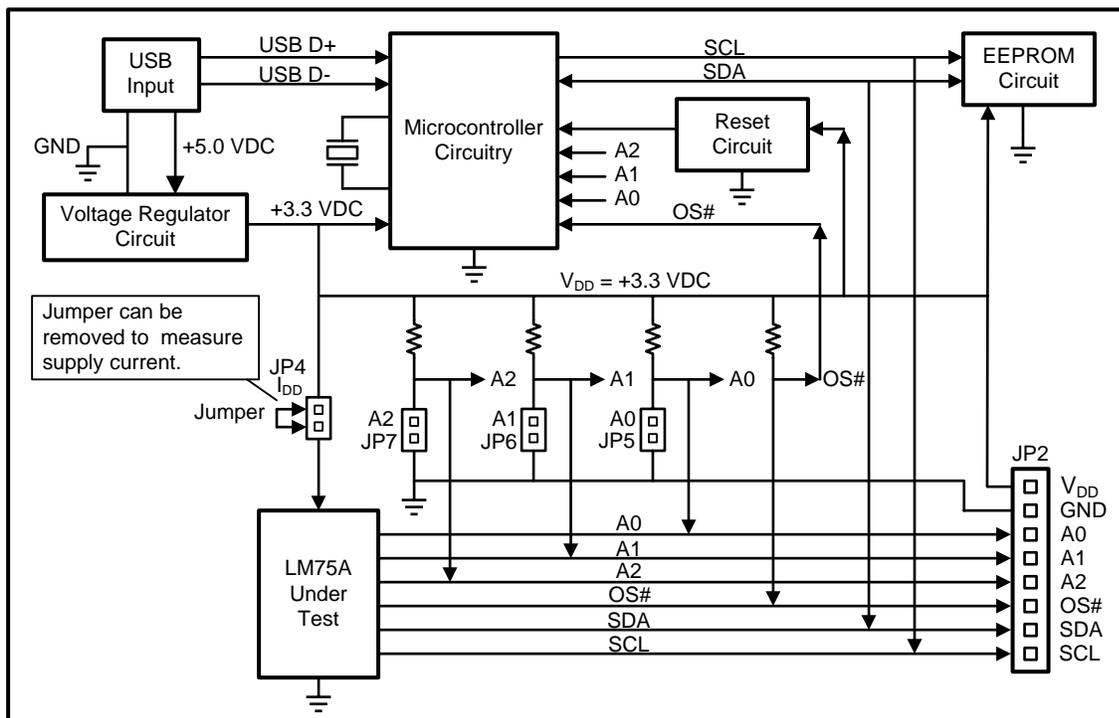
The user may also select the plot program and the temperature will be plotted for each reading made by the LM75A temperature sensor. See Section 4.0 for more details.

The block diagram below describes the LM75AEB/NOPB Evaluation Board itself. The USB input provides the +5.0 VDC power to the board, which is regulated down to 3.3 VDC to power the ICs. The EEPROM is programmed at the factory with a unique ID code for this particular board. When the USB cable is plugged in, the PC interrogates the USB devices and can identify this device as the LM75A Evaluation Board.

The microcontroller on the board provides the SDA, and SCL signals and relays the information from the LM75A to the PC via the USB lines.

The header JP2 of the Block Diagram shows the signals that are available to probe by the user.

## 1.1 Block Diagram



## 2.0 Quick Start

1. Install the CD into the CD drive of the computer and install the SensorEval software (see Section 4.0).
2. Make sure that the jumper at JP4 is installed on the LM75AEB/NOPB Evaluation Board as shown in the Quick Start Diagram below.
3. Hook up the USB cable between the PC or notebook computer as shown in Quick Start Diagram below.

**Important!** NO EXTERNAL POWER SUPPLY OR SIGNAL INPUTS ARE REQUIRED!

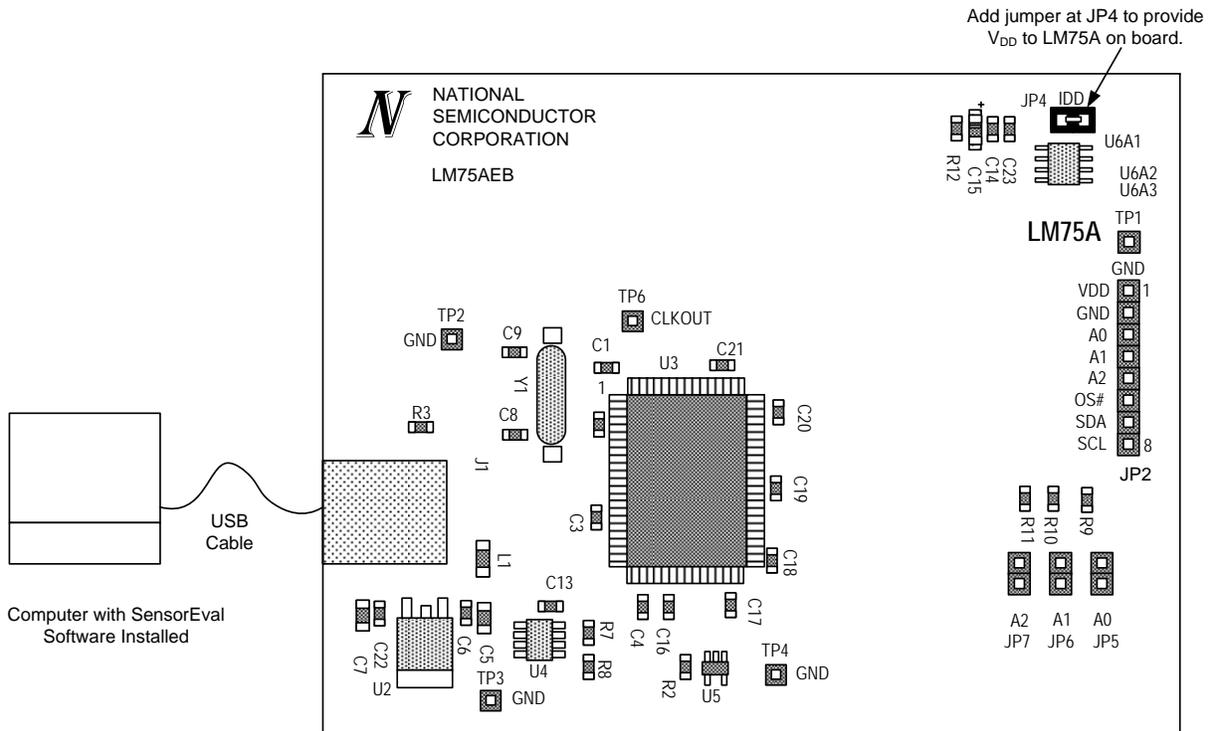


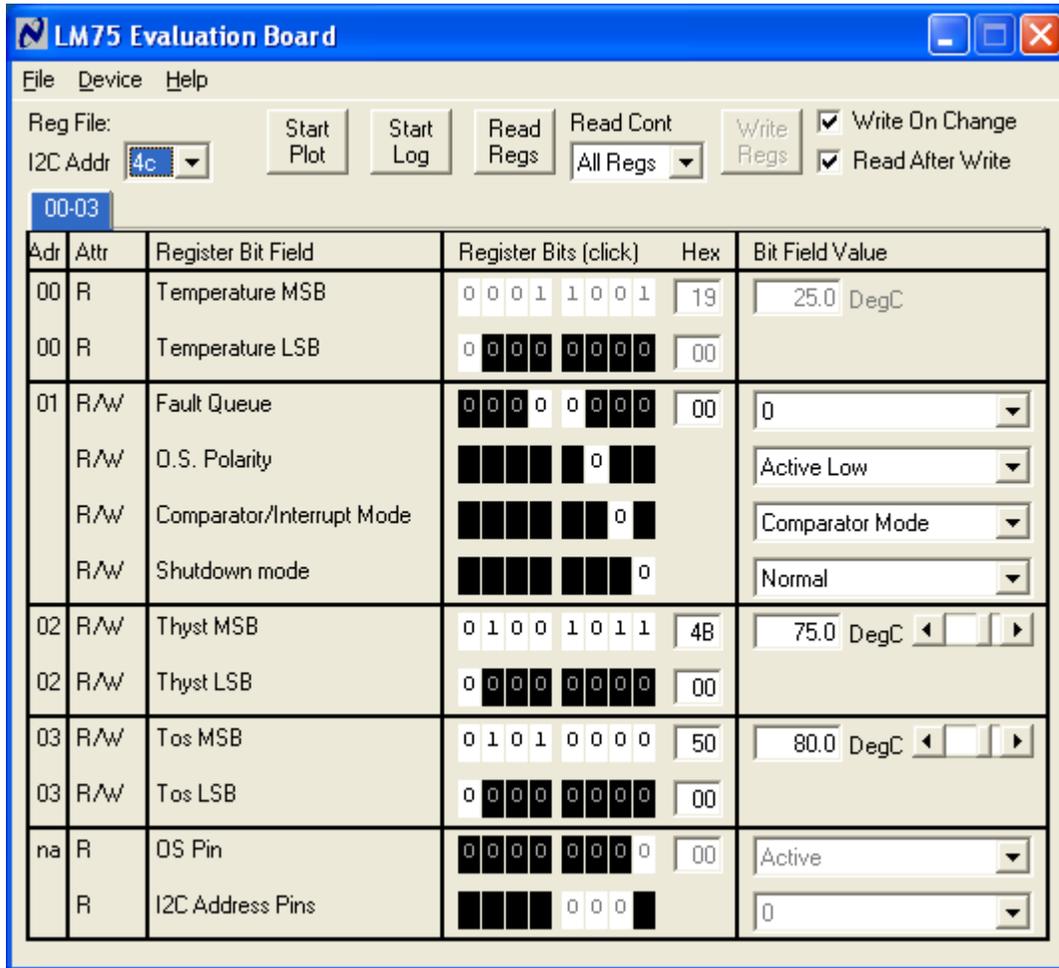
Figure 2.1 Quick Start Diagram

4. Run the SensorEval software clicking the icon on the desktop. The first screen will look like this:



Select the LM75 Evaluation Board.  
Click OK.

5. The next screen will look like this:



This screen shows the default values or settings for registers 00 through 03. If the user clicks on the Read Cont box down arrow and selects "All Regs" then the temperature will read continuously. The user may then modify Registers 01, 02, and/or 03 in order to change their values from the default value.

6. If the user clicks on the Start Plot button a graph box will appear and will graph the temperature. An example is shown below. The x-axis is the number of the sample taken.



### 3.0 Functional Description

The LM75AEB/NOPB Evaluation Board, along with the SensorEval Software, provides the system designer with a convenient way to learn about the operation of the LM75A Temperature Sensor chip. The user simply has to install the SensorEval software on his PC, run it, connect the USB cable from the PC to the Evaluation Board, and the user can read temperatures. It's that simple! The user doesn't have to provide any power or external signals to the evaluation board.

Power to the LM75AEB/NOPB Evaluation Board is taken from the USB 5-Volt line. This +5VDC is the input to the on-board LM2950 low dropout voltage regulator, which regulates the output voltage to +3.3 VDC. This output voltage powers the LM75A, the on-board microcontroller, and the EEPROM chip, which stores the board ID information.

The microcontroller provides the SMBus signals SCL and SDA to the LM75A chip. The Serial communications between the LM75A and the PC USB data lines is controlled by the microcontroller. For all of the details of this communication protocol see the latest LM75A datasheet, available at [www.national.com](http://www.national.com).

#### 3.1 LM75AEB/NOPB Evaluation Board Connection Table

Connector Label	Pin Number	Description
J1	N/A	USB Cable Input. Connect the USB cable to this jack <i>after</i> the SensorEval software has been loaded on the PC.
JP2 Output header provides user with signals for test purposes only.  <i>Do not apply any external power or signals to any of the pins on this header!</i>	1	V <sub>DD</sub> (V+) The +3.3 VDC voltage supplied by the on-board voltage regulator to the evaluation board circuitry. <b>Note: JP4 must be jumpered to apply power to the LM75A.</b>
	2	Ground.
	3	A0 is the LSB of the 7-bit digital I <sup>2</sup> C Address input. See the table in Section 3.2 for the possible combinations.
	4	A1 is the next higher bit of the 7-bit digital I <sup>2</sup> C Address input. See the table in Section 3.2 for the possible combinations.
	5	A2 is the next bit after A1 of the 7-bit digital I <sup>2</sup> C Address input. See the table in Section 3.2 for the possible combinations.
	6	OS# Over-temperature Shutdown is the open-drain digital output of the LM75A when The temperature exceeds the programmed limit.
	7	SDA is the bi-directional signal for communications between the LM75A and the microcontroller.
	8	SCL Serial Clock signal from the microcontroller to the LM75A SCL input.
JP4	1,2	Default = jumpered to power the LM75A. May be removed in order to insert a milliammeter to measure the current to the LM75A.
TPx	N/A	These test points (1x1 headers) are provided for convenient Ground or Power access to the board.

### 3.2 LM75AEB/NOPB 7-bit digital I<sup>2</sup>C Address and 3-bit jumper input

The table below explains the 8 possible combinations for the I<sup>2</sup>C addresses given the condition of the jumpers at A2, A1, and A0. Note that these 3-bits are the least significant bits in the 7-bit I<sup>2</sup>C address and are the only bits that are changeable. The default position of the jumpers are: A2 = not jumpered = “1”, A1 and A0 = jumpered = “0”. From the table 100 = 4Ch. This is what the SensorEval software recognizes when the LM75AEB board is powered-up with the software active. The user may change the jumpers and change the address in the software accordingly to investigate the use of another I<sup>2</sup>C address selection.

MSB							LSB	HEX
1	0	0	1	A2	A1	A0		
1	0	0	1	0	0	0	48	
1	0	0	1	0	0	1	49	
1	0	0	1	0	1	0	4A	
1	0	0	1	0	1	1	4B	
1	0	0	1	1	0	0	4C	
1	0	0	1	1	0	1	4D	
1	0	0	1	1	1	0	4E	
1	0	0	1	1	1	1	4F	

## 4.0 Software Installation and Operation

### 4.1 Installation

The CD provided in the LM75AEB/NOPB Evaluation Board Kit contains the SensorEval software used to make the LM75A Evaluation Board operate with the user's PC. It is assumed that the user will be using a PC with a Pentium® III or higher processor and a Microsoft Windows® XP/2000/98/ME operating system.

The software is installed as follows:

1. Insert the LM75AEB/NOPB Evaluation Board CD into the CD drive of the PC. See details in the readme.txt file.
2. The software manual, provided on the CD, may be useful to the user during this process.
3. The installation process will put an icon on the PC desktop so that the SensorEval program will run when the icon is double-clicked.

### 4.2 Operation

Follow the following procedure for operation of the LM75AEB/NOPB Evaluation Board using the SensorEval software:

1. Run the SensorEval program by either double-clicking on the icon on the desktop or by selecting Start, Run, and browse to find the SensorEval.exe file.
2. Plug in the USB cable on both the PC and the LM75AEB/NOPB Evaluation Board. The first screen will look like this:

Follow the register setups in section 2.0 Quick Start in the User's Guide. Make sure that you are following the given procedure for the specific evaluation board you are working with.

Refer to the schematic, layout and connector diagrams for the connections to remote diodes for the temperature readings.

# 5.0 Electrical and Mechanical Specifications

## 5.1 Electrical Specifications

Power Requirements	
The Board uses the +5.0 VDC and GND lines from the USB connection. This +5.0 VDC voltage is regulated down to +3.3 VDC for board power. * <b>NO EXTERNAL POWER SUPPLY INPUTS ARE REQUIRED</b> *	+5.0 ± 0.1 V, 100 mA max.

## 5.2 Electrical Schematic

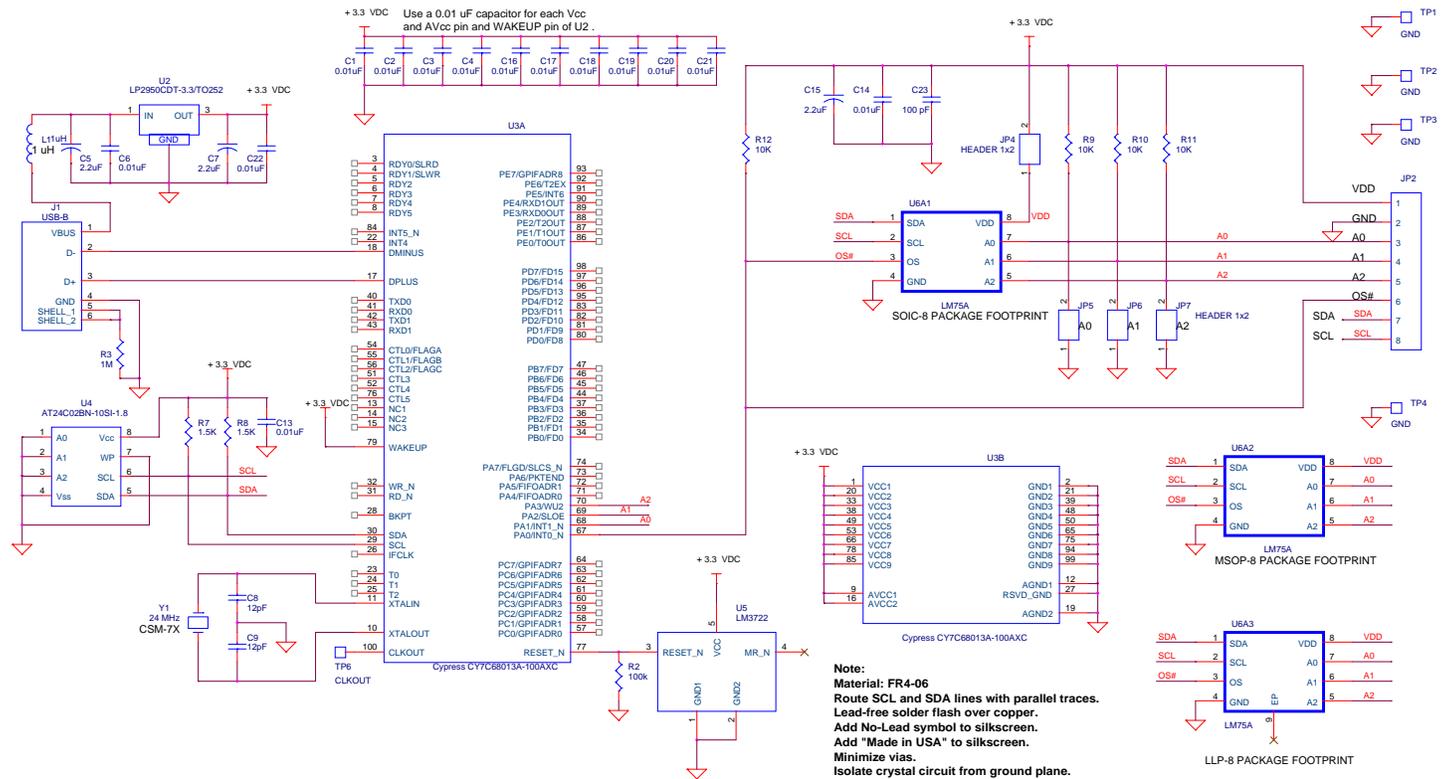


Figure 5.2 Schematic Diagram of the LM75AEB/NOPB Evaluation Board

### 5.3 Evaluation Board Layout

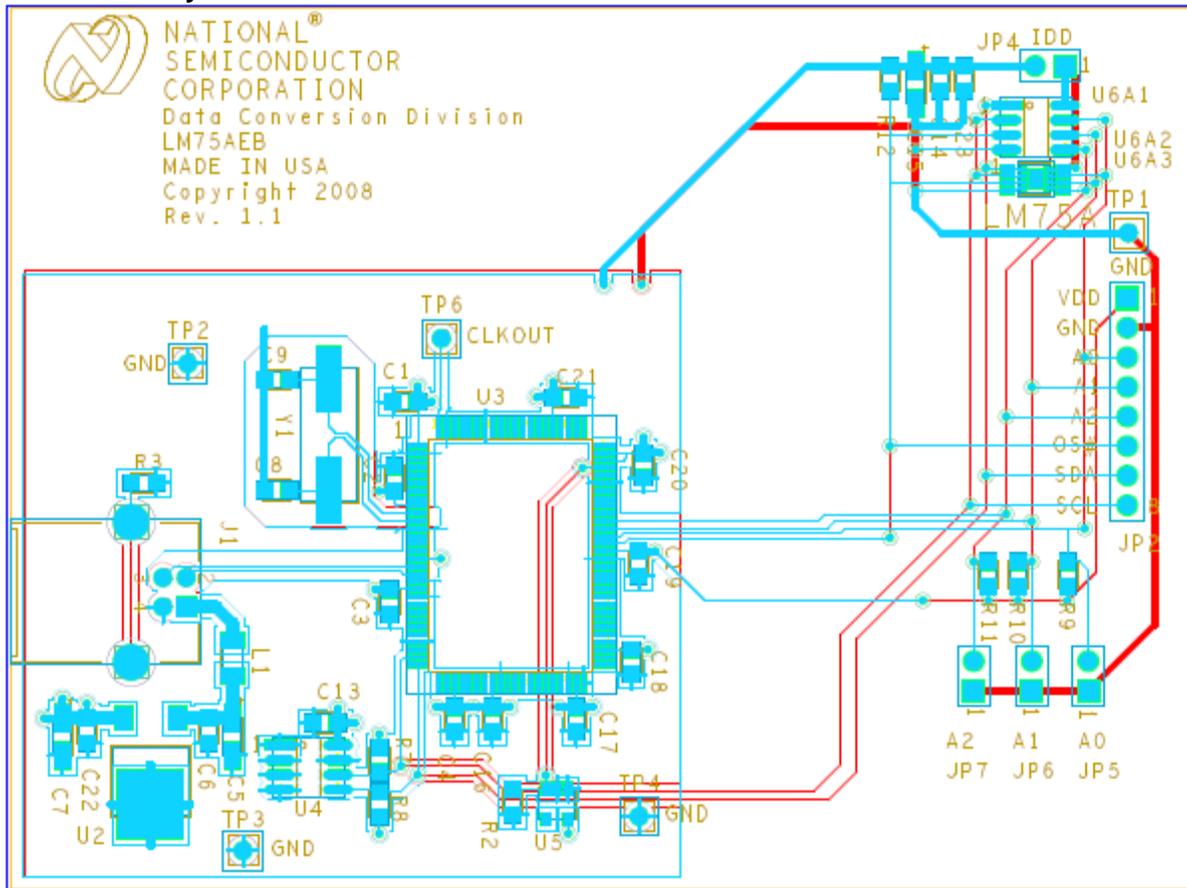


Figure 5.3 Layout diagram of the LM75AEB/NOPB Evaluation Board

### 5.4 Bill of Materials for LM75AEB/NOPB Evaluation Board

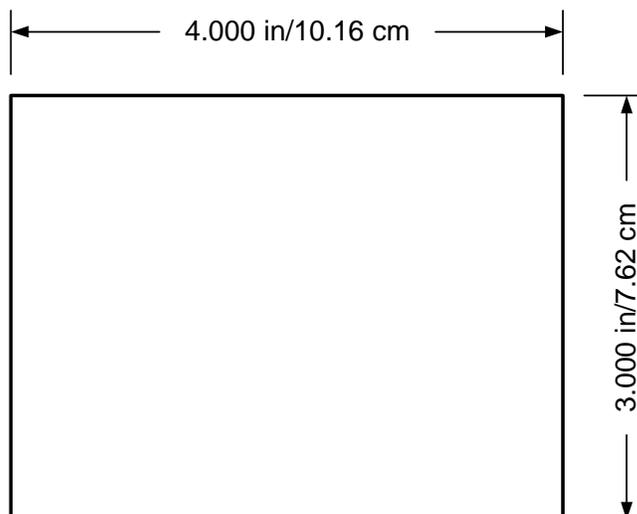
Item	Qty	Part Reference	Value	Manufacturer	Manufacturer Part Number
1	3	C7,C15, C5	2.2 uF	Kemet	T491A225K010AT
2	14	C1,C2,C3,C4,C6,C13,C14,C16 C17,C18,C19,C20,C21,C22	10 nF	Panasonic	ECJ-1VB1C103K
3	1	C23	100 pF		
4	2	C8,C9	12 pF		
5	1	J3	Connector, USB-B	Mill-Max	897-43-004-90-00000
6	4	JP4,JP5,JP6,JP7	CONN, 1X2 Headers, 0.1 in centers	Sullins	PTC36SAAN
7	1	JP2	CONN, 1X6 Headers, 0.1 in centers	Sullins	PTC36SAAN
8	4	TP1, TP2, TP3, TP4, TP6	CONN, 1X1 Headers, 0.1 in centers	Sullins	
9	1	L1	CM CHOKE	Steward	M11206K900R-10
10	3	R2,R15,R17	100K	Panasonic	ERJ-6ENF1003V
11	1	R9,R10,R11,R12	10K	Panasonic	ERJ-6ENF1002V
12	1	R12	1 Meg	Panasonic	ERJ-6ENF1004V
13	2	R7,R8	1.5K	Panasonic	ERJ-6ENF1504V
14	1	U2	LP2950CDT-3.3/TO252	National Semiconductor	LM2676S-ADJ
15	1	U3	Cypress CY7C68013A-100AXC	Cypress	CY7C68013A-100AXC
16	1	U6	Device Under Test (DUT)	National Semiconductor	LM75A or LM75B or LM75C
17	1	U4	24C02	Atmel	AT24C02BN-10SU-1.8
18	1	U5	LM3722	National Semiconductor	LM3722EM5-3.08
19	1	BOARD	LM75AEB	Advanced Circuits	LM75AEB Eval Board, Rev 1.1
20	1	Y1	24 MHz	ECS Inc.	ECS-240-12-5PX-TR

## 5.5 Mechanical Specifications

### 5.5.1 Operating Mechanical and Environmental Specifications

	Minimum	Typical	Maximum
Temperature	0°C	25°C	70°C

### 5.5.2 Evaluation Board Basic Dimensions



### 5.5.3 Electrostatic Discharge (ESD) Precautions

The user shall use ESD precautions as specified in National Semiconductor ESD control document (SC)CSI-3-038 available through [www.national.com](http://www.national.com).

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