National Semiconductor

LM73 Evaluation Board User's Guide

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References

1. LM73 2.7V, SOT23 Digital Temperature Sensor with Two-Wire Interface datasheet.

The latest copy of the LM73 datasheet can be obtained by going to the National Semiconductor website www.national.com, by searching on "LM73", and then downloading the LM73.pdf file.

2. SensorEval Version 1.0.9 or later Evaluation Board CD containing:
   a. The SensorEval.exe executable program used to run the LM73 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 LM73 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 LM73 Evaluation Board is provide by the +5VDC line of the USB connection. No external power supply or signal sources are required for operation of the LM73 evaluation board.

Before connecting the LM73 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 LM73 Evaluation Board.

The PC should be able to recognize the board and the user simply selects the LM73 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 LM73 temperature sensor. See Section 4.0 for more details.

The block diagram below describes the LM73 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 LM73 Evaluation Board.

The microcontroller on the board provides the SMBDAT, SMBCLK, and SMBALERT signals and relays the information from the LM73 to the PC via the USB lines.

The block in the lower right of the Block Diagram shows the signals that are available to probe by the user.

1.1 Block Diagram
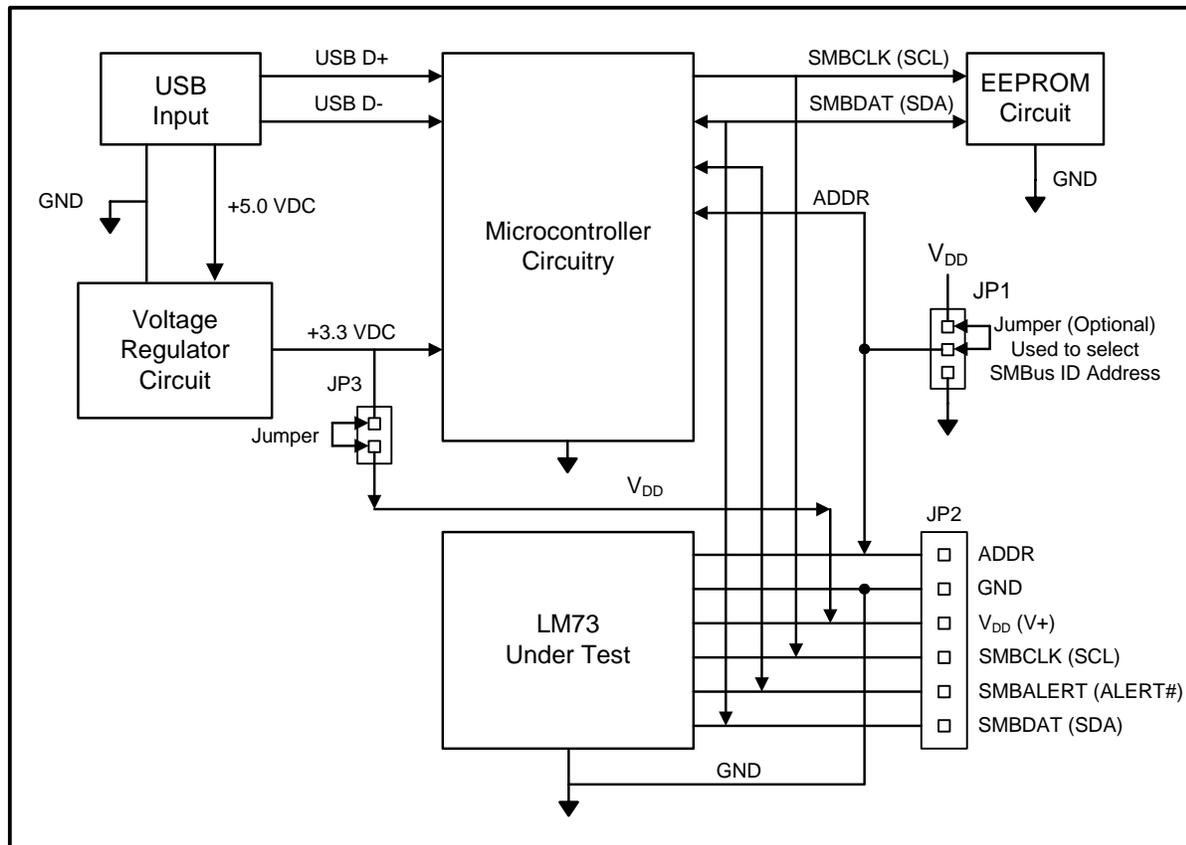
2.0 Quick Start

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 JP3 is installed on the LM73 Evaluation Board as shown in the Quick Start Diagram below.
3. Hookup the USB cable between the PC or notebook computer as shown in Quick Start Diagram below.

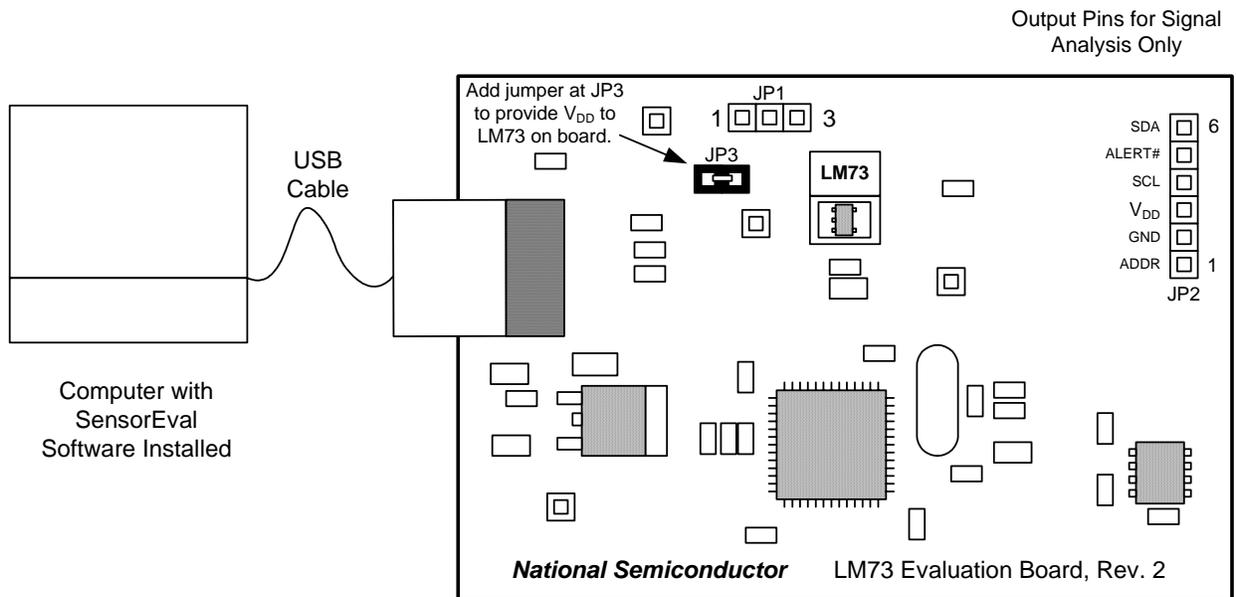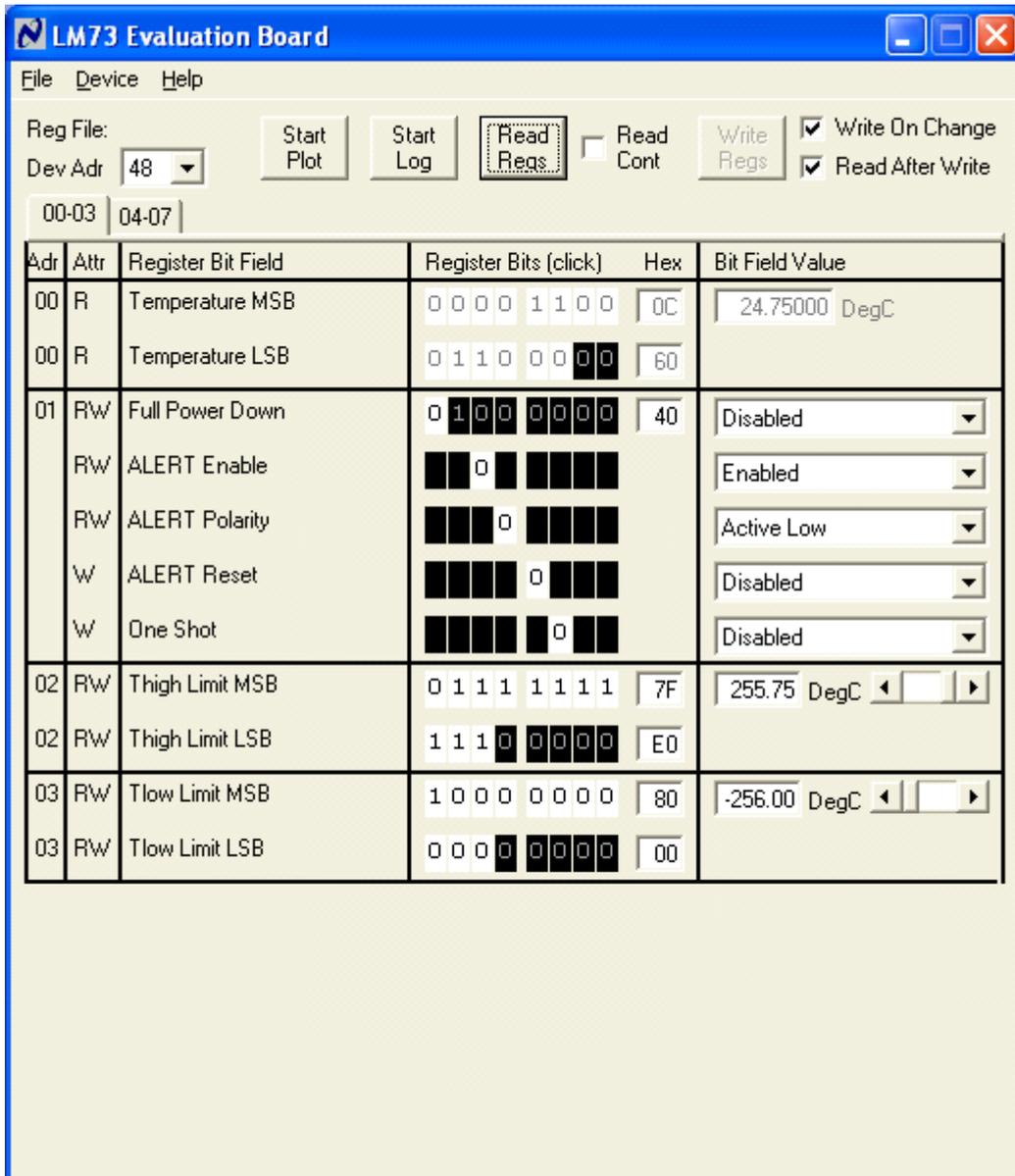**Important!** *NO EXTERNAL POWER SUPPLY OR SIGNAL INPUTS ARE REQUIRED!*

Figure 2.1 Quick Start Diagram

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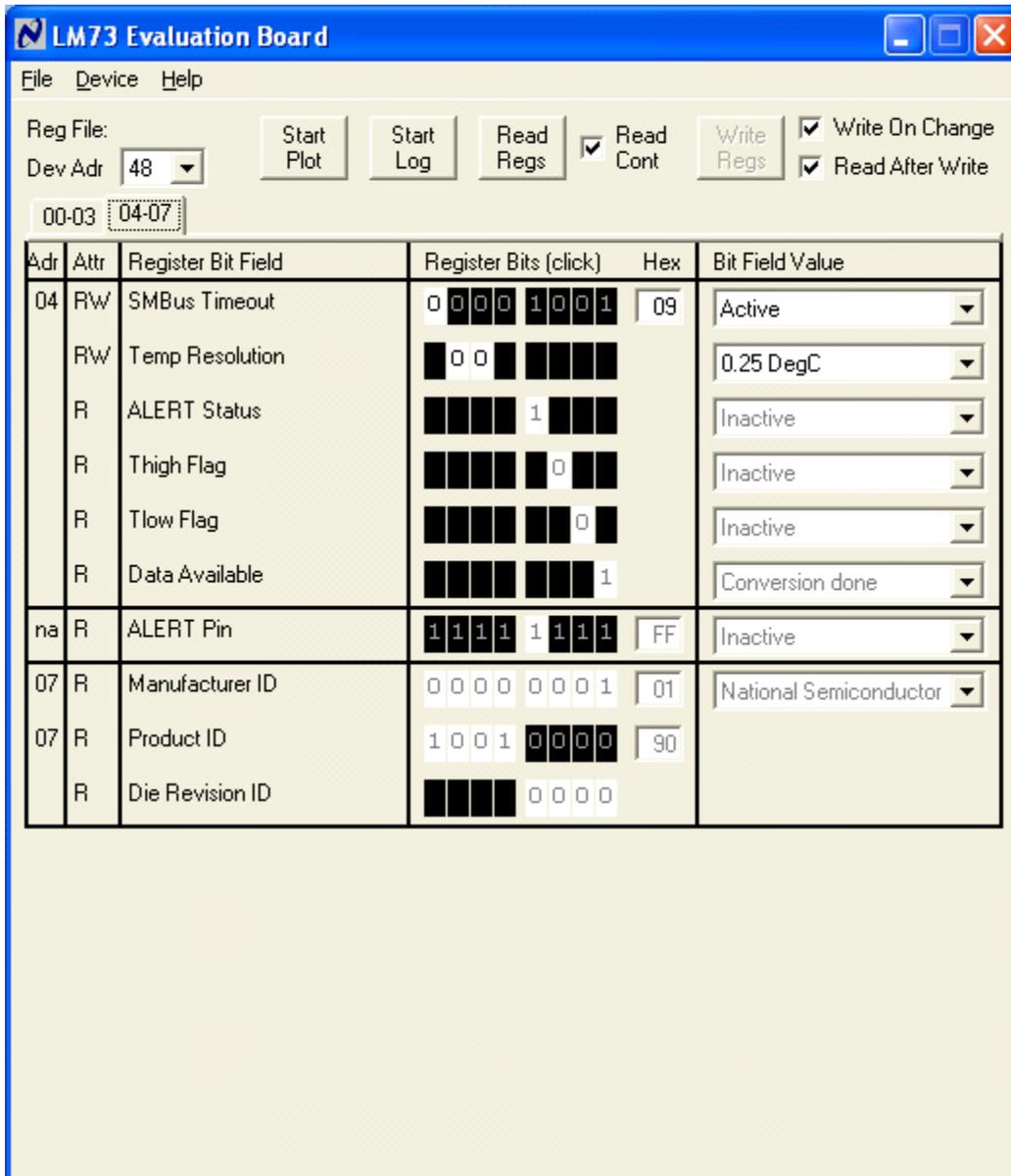

Select the LM73 Evaluation Board.
Click OK.

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 the temperature will read continuously.

6. If the user clicks on the "04-07" tab then the following screen will appear:

This screen shows the default values or settings for registers 04 through 07.

7. 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.
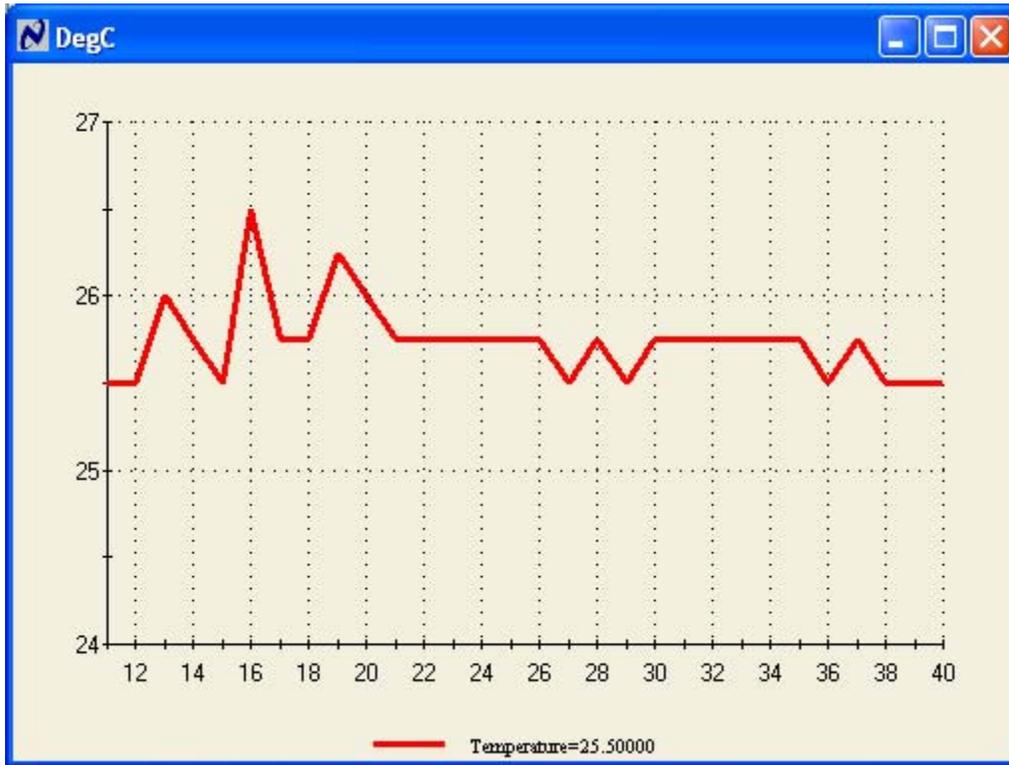
3.0 Functional Description

The LM73 Evaluation Board, along with the SensorEval Software, provides the system designer with a convenient way to learn about the operation of the LM73 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 LM73 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 LM73, the on-board microcontroller, and the EEPROM chip, which stores the board ID information.

The microcontroller provides the SMBus signals SMBCLK, SMBALERT, and SMBDAT to the LM73 chip. The Serial communications between the LM73 and the PC USB data lines is controlled by the microcontroller. For all of the details of this communication protocol see the latest LM73 datasheet, available at www.national.com.

3.1 LM73 Evaluation Board Connection Table

Connector Label	Pin Number	Description
J1	N/A	USB Cable Input. Connect the USB cable to this jack *after* the SensorEval software has been loaded on the PC.

JP1	1-2	Bus Address Select. Pin 2 is connected to the ADDR pin of the LM73. The Bus address that corresponds to these settings can be found in the LM73 datasheet. The 3 options are:
		
		"Float" = No jumpers
		"GND" = Jumpering Pin 2 to Pin 3
		    This will pull the ADDR pin low.
		"V_{DD}" = Jumpering Pin 2 to Pin 1
		    This will pull the ADDR pin high.

JP2 Output header provides user with signals for test purposes only. *Do not apply any external power or signals to any of the pins on this header!*	1	ADDR. This connects directly to the ADDR pin. A voltmeter probe may be connected to this pin.
	2	Ground.
	3	V_{DD} (V+) The +3.3 VDC voltage supplied by the on-board voltage regulator to the evaluation board devices. **Note: JP3 must be jumpered to apply power to the LM73.**
	4	SMBCLK (SCL). Serial SMBus Clock signal from the microcontroller to the LM73 SMBCLK input.
	5	SMBALERT# (ALERT#) is the SMBus ALERT signal generated from pin 5 of the LM73 to the microcontroller.
	6	SMBDAT (SDA) is the bi-directional signal for communications between the LM73 and the microcontroller.
JP3	1-2	Jumper the two pins on the header for regular operation. A milliammeter may be connected here to measure the input current to the LM73.
TPx	N/A	These test points (1x1 headers) are provided for convenient Ground or Power access to the board.

4.0 Software Installation and Operation

4.1 Installation

The CD provided in the LM73 Evaluation Board Kit contains the SensorEval software used to make the LM73 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 LM73 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 the LM73 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 LM73 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.
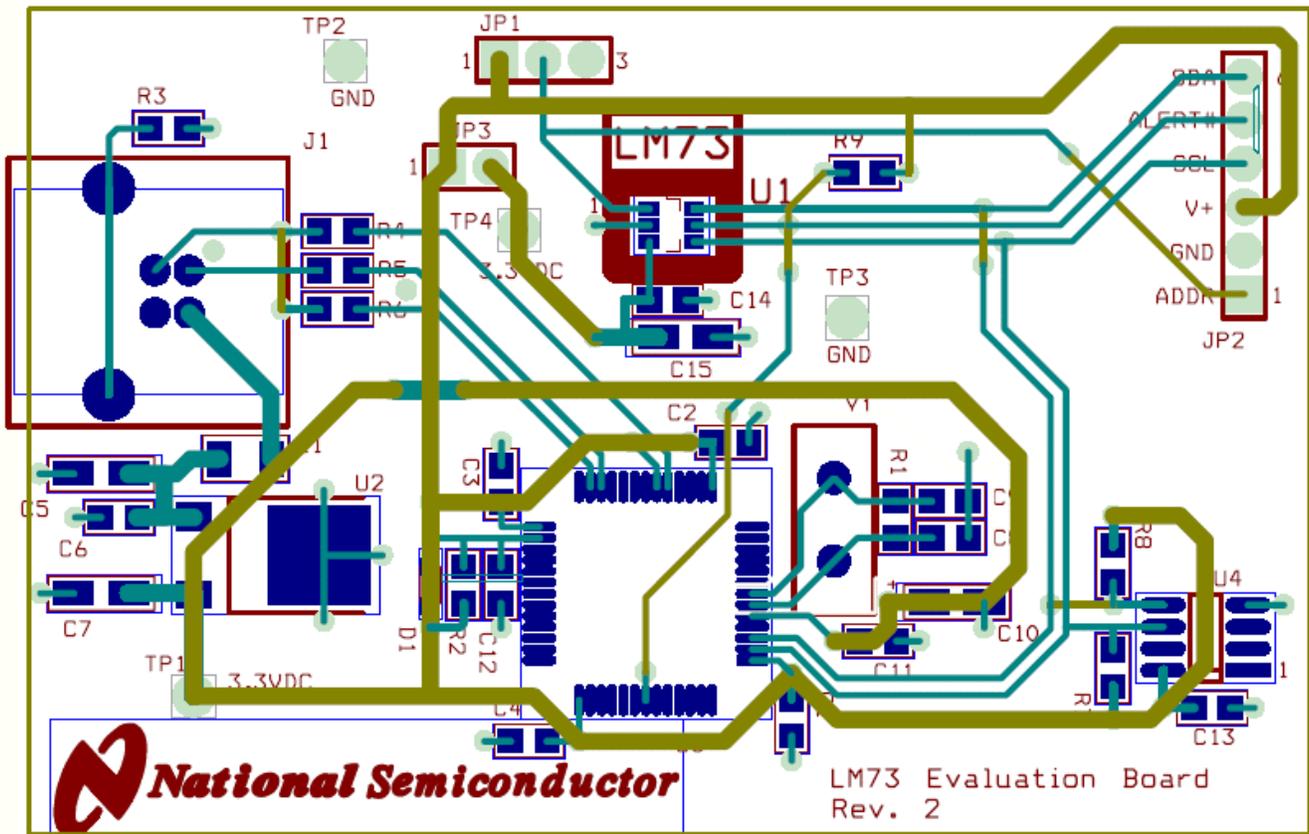
5.0 Electrical and Mechanical Specifications

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. * **NO EXTERNAL POWER SUPPLY INPUTS ARE REQUIRED** *	$+5.0 \pm 0.1$ V, 100 mA max.

5.2 Electrical Schematic

Figure 5.2 Schematic Diagram of the LM73 Evaluation Board

5.3 Evaluation Board Layout

Figure 5.3 Layout diagram of the LM73 Evaluation Board

5.4 Bill of Materials for LM73 Evaluation Board

Item	Quantity	Reference	Part
1	9	C1, C2, C3, C4, C6, C11, C12, C13, C14	Capacitor, ceramic, 0.1uF
2	2	C8, C9	Capacitor, ceramic, 33 pF
3	4	C5, C7, C10, C15	Capacitor, ceramic, 2.2 uF
4	1	D1	Diode, Silicon, 1N4148
5	1	JP1	Header, 1X3, 0.1 in centers
6	1	JP2	Header, 1X6, 0.1 in centers
7	1	JP3	Header, 1X2, 0.1 in centers
8	1	J1	Connector, USB-B
9	1	L1	Filter, 1 uH, Stewart MI1206K900R-00
10	2	R1, R3	Resistor, SMT, 1M, 0805
11	1	R2	Resistor, SMT, 100 k, 0805
12	1	R4	Resistor, SMT, 1.5 k, 0805
13	2	R5, R6	Resistor, SMT, 22 Ohm, 0805
14	2	R7, R8	Resistor, SMT, 2.43k, 0805
15	1	R9	Resistor, SMT, 3 k, 0805
16	4	TP1-TP4	Test Points (1X1 Headers)
17	1	U1	LM73CIMK-0 Device Under Test (DUT)
18	1	U2	IC, Voltage Regulator, National LP2950CDT-3.3
19	1	U3	IC, Microcontroller, Cypress CY7C64613-52NC
20	1	U4	IC, EEPROM, Atmel AT24C02-10SI-2.7
21	1	Y1	Crystal, 12 MHz, Pletronics 2S1200G140
22	1	--	Circuit Board, Fabricated, LM73 Evaluation Board, Rev. 2

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
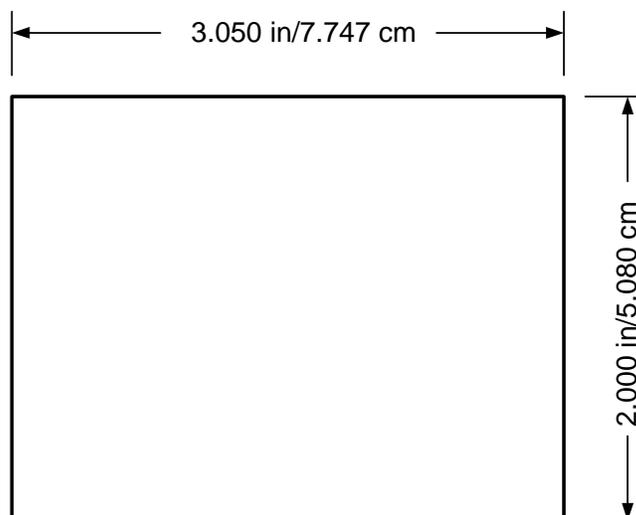
5.5.3 Electrostatic Discharge (ESD) Precautions

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

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