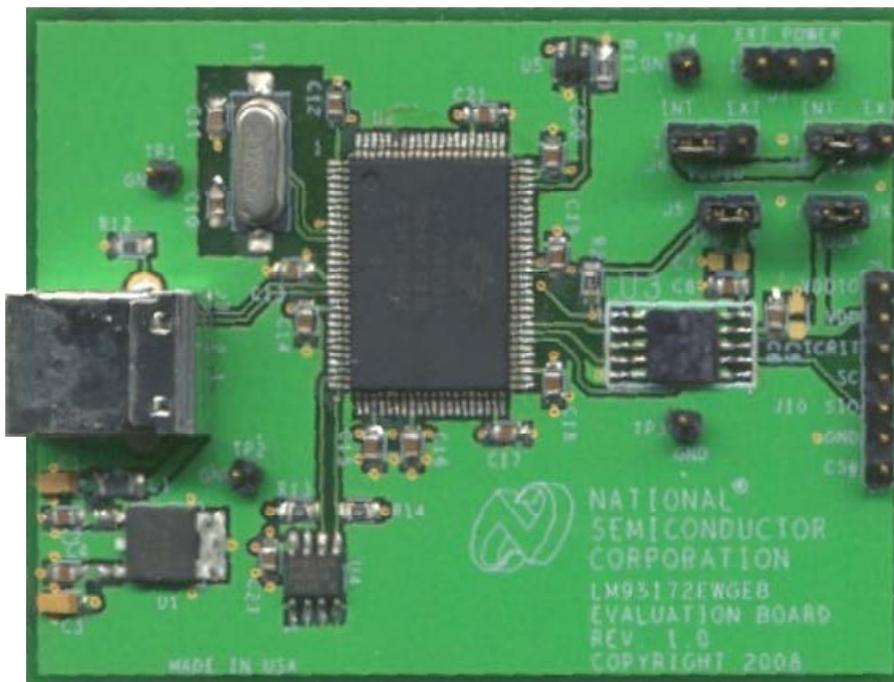


## LM95172EWGEB/NOPB Evaluation Board User's Guide



# LM95172EWGEB/NOPB Evaluation Board User's Guide

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## LM95172EWGEB/NOPB Evaluation Board User's Guide

### References

1. LM95172EWG 13-Bit to 16-Bit Digital Temp Sensor with Dual Supply and 3-Wire Interface datasheet.

The latest copy of the LM95172EWG datasheet can be obtained by going to the National Semiconductor website [www.national.com](http://www.national.com), by searching on "LM95172EWG", and then downloading the LM95172EWG.pdf file.

2. SensorEval Version 1.1.0r or later Evaluation Board CD containing:
  - a. The SensorEval.exe executable program used to run the LM95172EWGEB/NOPB 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 LM95172EWGEB/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 LM95172EWGEB/NOPB Evaluation Board is provided by the +5VDC line of the USB connection. No external power supply or signal sources are required for operation of the LM95172EWGEB/NOPB evaluation board although there is an option allowing the use of an external power supply. .

Before connecting the LM95172EWGEB/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 LM95172EWGEB/NOPB Evaluation Board.

The PC should be able to recognize the board and the user simply selects the LM95172EWGEB/NOPB Eval Board radio button. By selecting the “Read Cont” (Read Continuously) box the temperature reading will update the temperature readings continuously. The

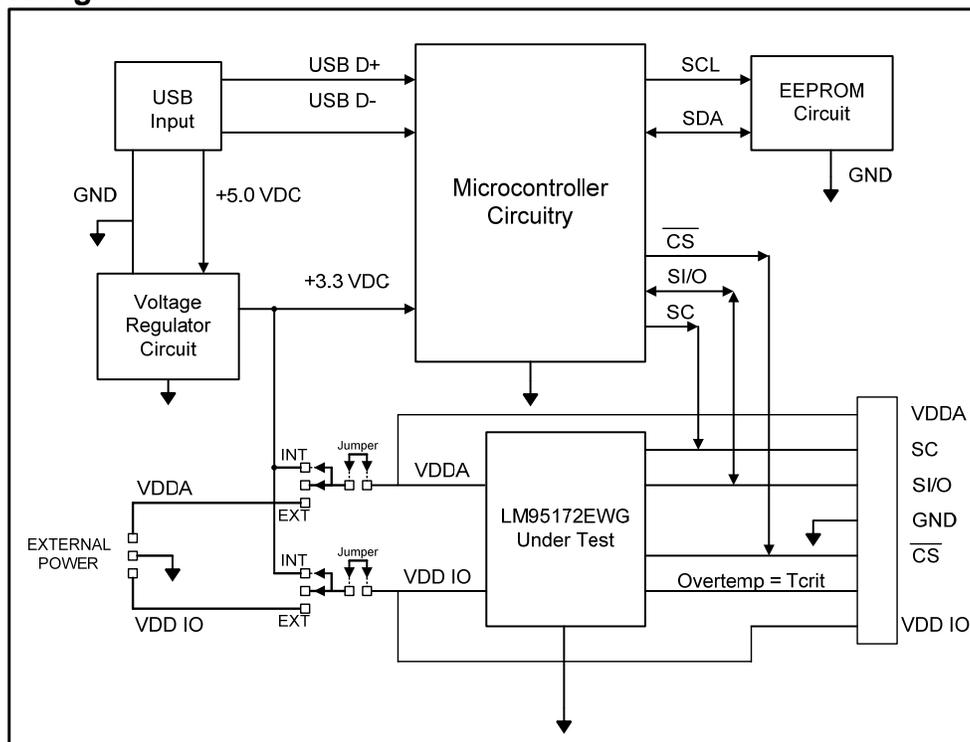
user may also select the plot program and the temperature will be plotted for each reading made by the LM95172EWG temperature sensor. See Section 4.0 for more details.

The block diagram below describes the LM95172EWGEB/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 LM95172EWGEB/NOPB Evaluation Board.

The microcontroller on the board provides the chip select (CS), the serial clock (SC), and the serial I/O (SI/O) signals and relays the information from the LM95172EWGEB/NOPB to the PC via the USB bus.

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

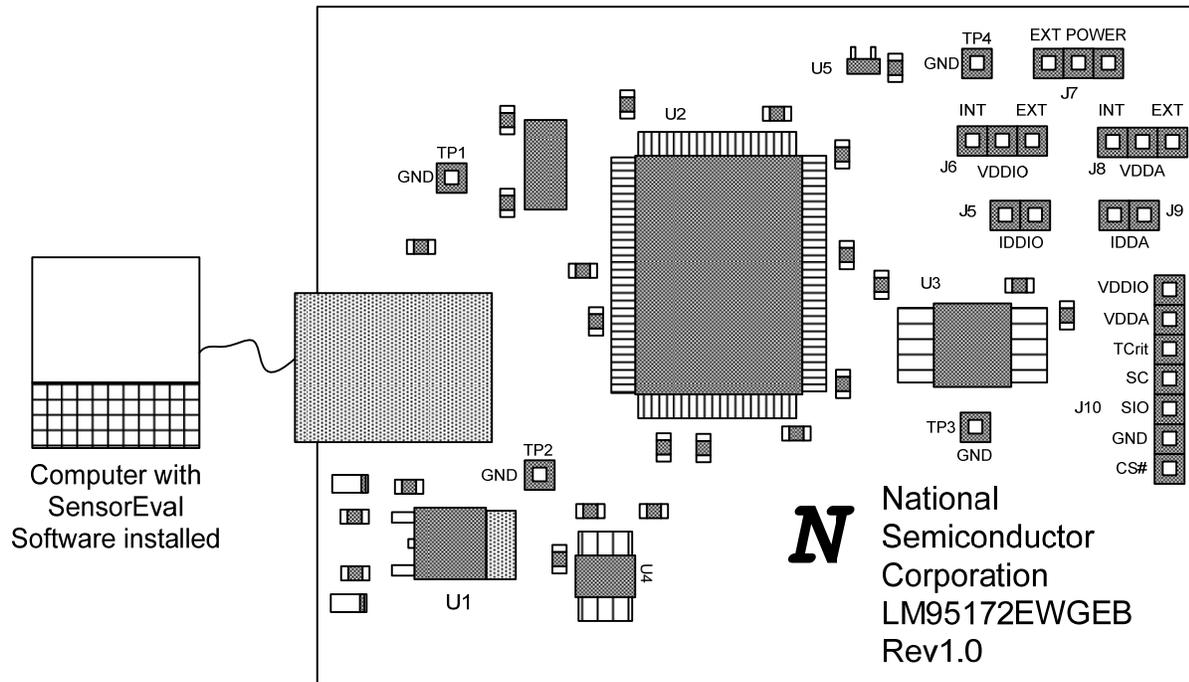


## 2.0 Quick Start

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 jumpers are installed on the LM95172EWGEB/NOPB 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.

### Quick Start Diagram

**Important!** Pay attention to jumper positions for internal or external power. See Section 3.1.



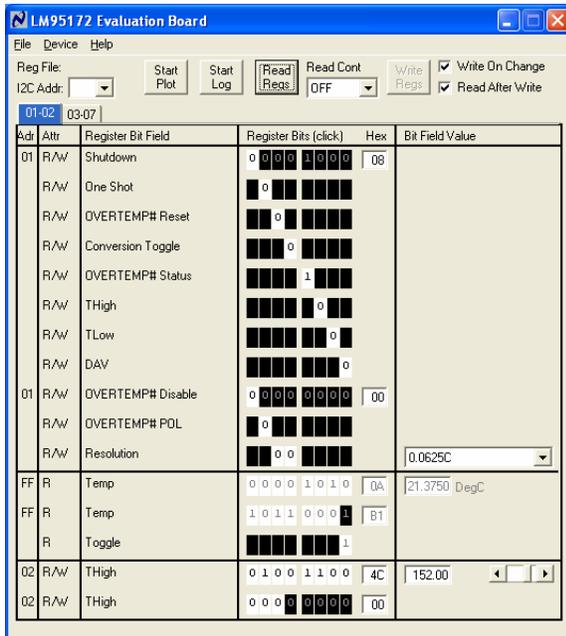
## 2.0 Quick Start (Continued)

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

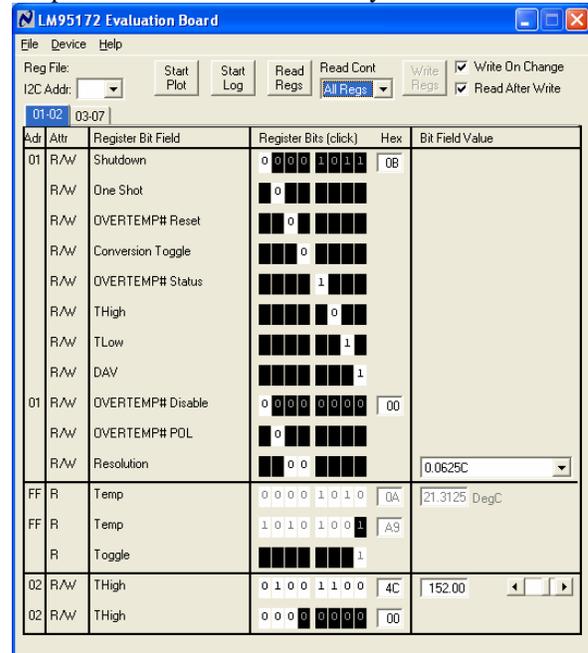


Select the LM95172 Evaluation Board.  
Click OK.

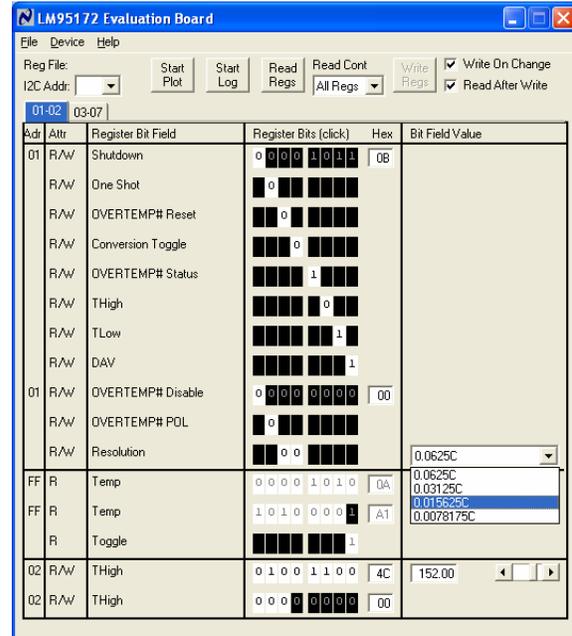
- The next screen will look like this:



- If the user clicks on the Read Cont box the temperature will read continuously.

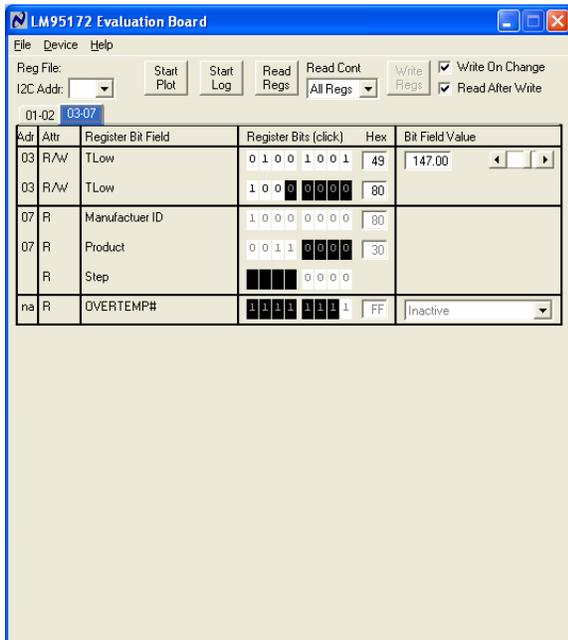


- If the user selects the Resolution box the selections are shown.



The T<sub>HIGH</sub> Register can be programmed with the T<sub>HIGH</sub> limit. See the datasheet.

8. If the User selects the Register 03-07 Tab then the screen appears as below. The  $T_{LOW}$  limit can then be programmed. See the datasheet for details.

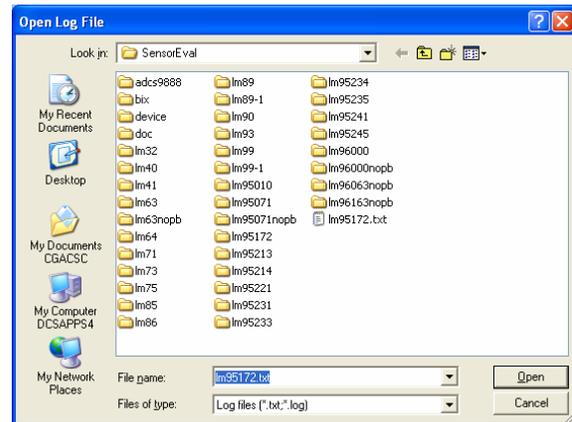


The Manufacturer's and Product ID Registers are read and displayed. These registers are read-only.

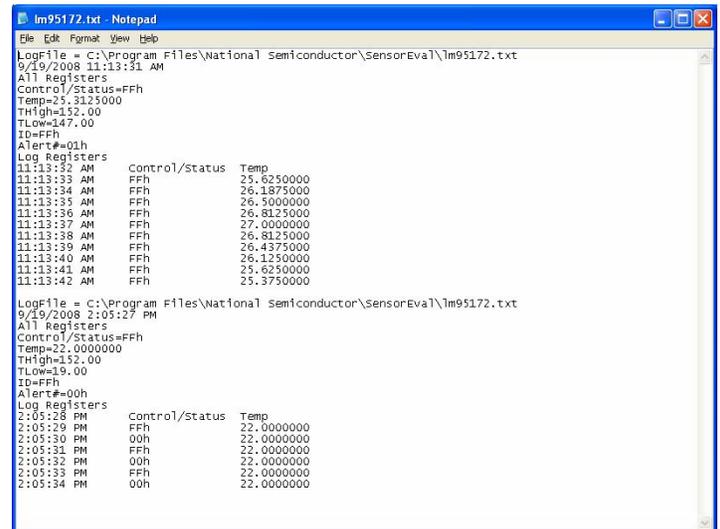
7. If the user clicks on the Start Plot button a graph box will appear and will graph the temperature. An example is shown below.



8. If the user clicks on the on the Start Log button a window, as shown below, will appear.



Enter the filename.txt and select the directory where you want the data file to go. The contents, after the log function has been stopped, looks like the following format:



### 3.0 Functional Description

The LM95172EWGEB/NOPB Evaluation Board, along with the SensorEval Software, provides the system designer with a convenient way to learn about the operation of the LM95172EWG 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 may select the internal supply for either VDDA VDDIO or both (Default). The user may also select an external power supply to use.

Power to the LM95172EWGEB/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 on-board microcontroller, and the EEPROM chip, which stores the board ID information, and, if the INT is selected, the VDDA and/or VDDIO inputs to the LM95172EWG device.

The microcontroller provides the active low Chip Select (CS) signal and the Serial Clock (SC) signal to the LM95172EWG chip. The Serial Input/Output (SI/O) communications between the LM95172EWG and the PC USB data lines is controlled by the microcontroller. For all of the details of this communication protocol see the latest LM95172EWG datasheet, available at [www.national.com](http://www.national.com).

### 3.1 LM95172EWGEB/NOPB Evaluation Board Connection Table

Connector Label	Pin Number	Description
J3	N/A	USB Cable Input. Connect the USB cable to this jack <i>after</i> the SensorEval software has been loaded on the PC.
J5	1-2	IDD IO Can insert a milliammeter to measure current into VDD IO pin or else jumper these pins.
J6	1-2	VDD IO Source. External Supply is selected by jumpering these pins.
	2-3	VDD IO Source. Internal Supply (+3.3VDC) is selected by jumpering these pins.
J7	1 VDDA 2 GND 3 VDD IO	External Power Supply input. Connect the common ground to middle pin (pin 2). Connect external VDDA source to Pin 1 and/or external VDD IO source to pin 3.
J8	1-2	VDDA Source. External Supply is selected by jumpering these pins.
	2-3	VDDA Source. Internal Supply (+3.3VDC) is selected by jumpering these pins.
J9	1-2	IDDA Can insert a milliammeter to measure current into VDDA pin or else jumper these pins.
J10 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	Chip Select. Signal from microcontroller to the LM95172EWG chip select input.
	2	Ground
	3	SI/O. Serial I/O signal from the microcontroller to the LM95172EWG SI/O pin.
	4	SC. Serial Clock signal from the microcontroller to the LM95172EWG SC input.
	5	OVERTEMP# (Formerly T <sub>CRIT</sub> ) pin
	6	VDDA Analog Voltage appearing at LM95172EWGEB
	7	VDDIO Analog Voltage appearing at LM95172EWGEB

# Software Installation and Operation

## Installation

The CD provided in the LM95172EWGEB/NOPB Evaluation Board Kit contains the SensorEval software used to make the LM95172EWGEB/NOPB 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 Microsoft Windows® XP/2000/98/ME operation system.

The software is installed as follows:

1. Insert the SensorEval CD, provided in the kit, 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 LM95172EWGEB/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 LM95172EWGEB/NOPB Evaluation Board. The first screen will look like this:



If the computer cannot find the eval board run the “Add Hardware” wizard in the Control Panel.

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. If the Internal +3.3 Volt is selected for both supply voltages then No External power supplies are required. The User may select the EXT external power inputs then supply the external power at the appropriate input pins.	+5.0 ± 0.1 V, 100 mA max. For internal power. For external device power see the datasheet for Operating Voltages.

## 5.2 Electrical Schematic

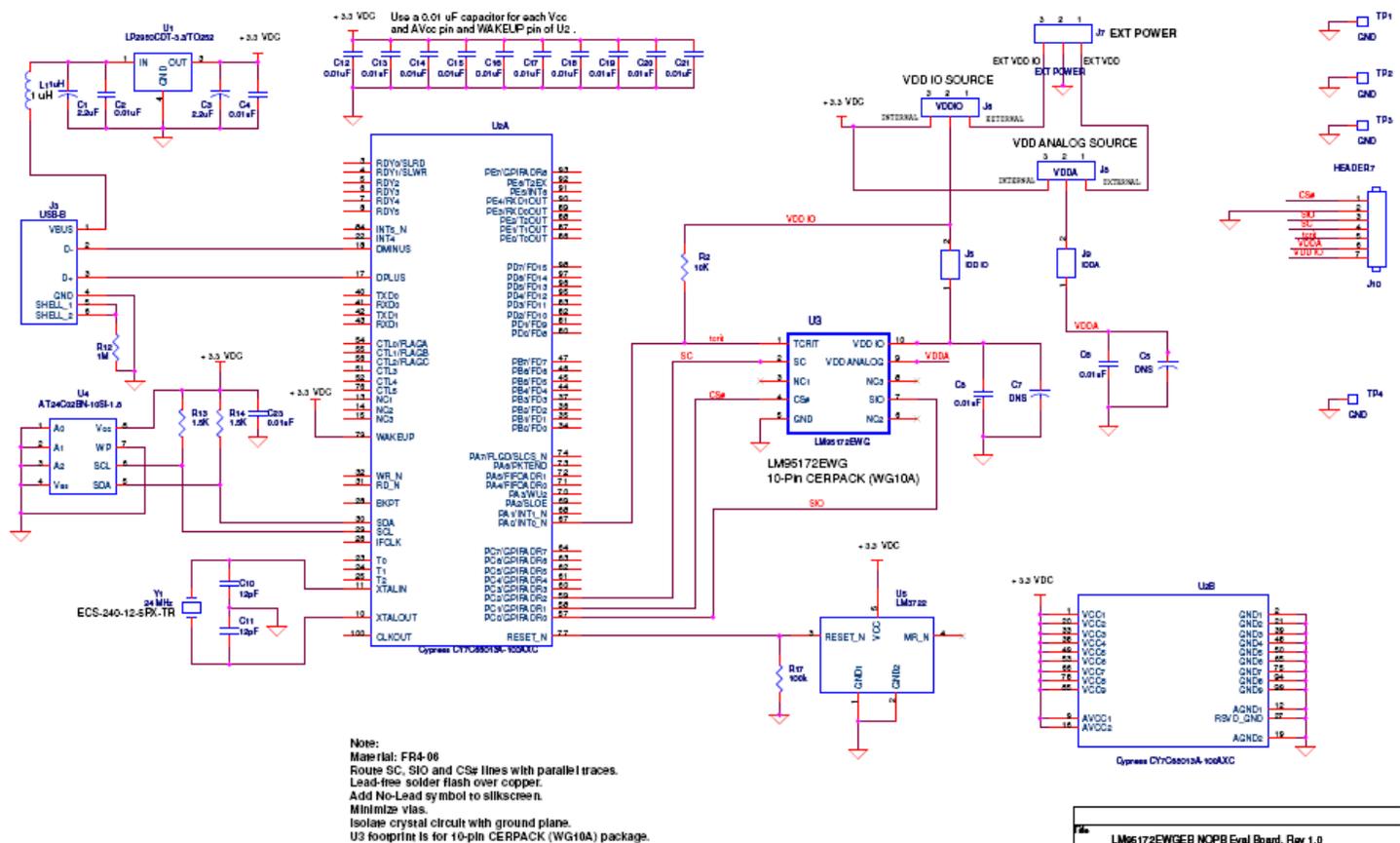


Figure 5.2 Schematic Diagram of the LM95172EWGEB/NOPB Evaluation Board

### 5.3 Evaluation Board Layout

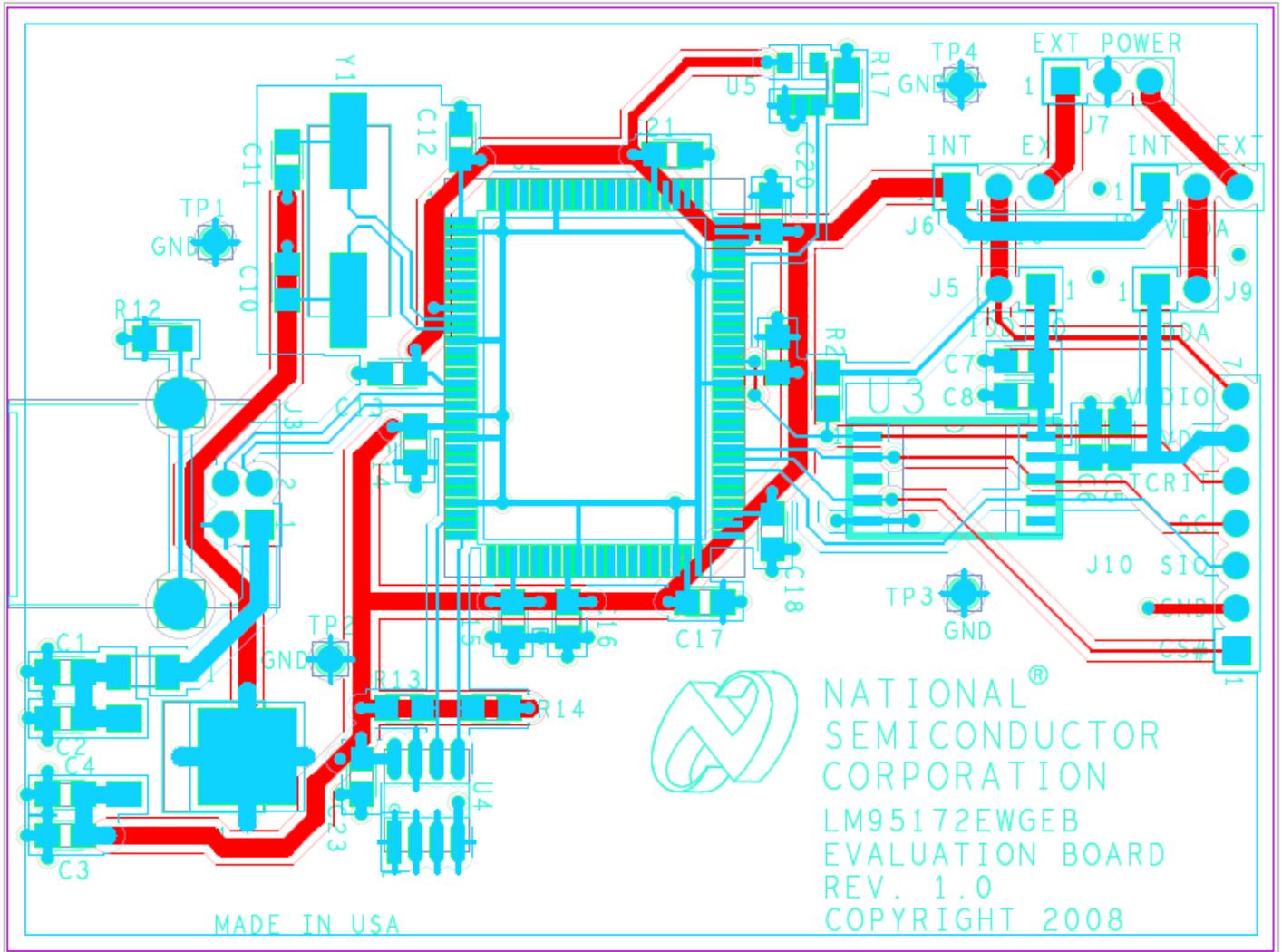


Figure 5.3 Layout diagram of the LM95172EWGEB NOPB Evaluation Board

## 5.4 Bill of Materials for LM95172EWGEB/NOPB Evaluation Board

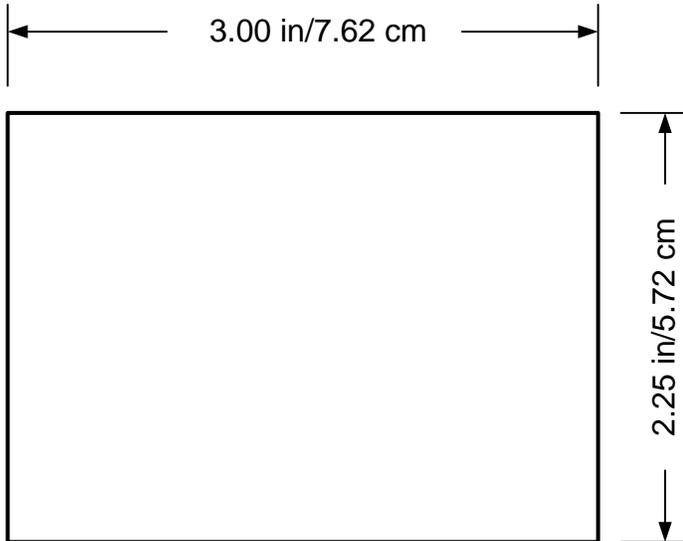
LM95172EWGEB/NOPB Temperature Sensor Eval Board			Created: August 21, 2008		Board Layout Revision: 2.0 Schematic Revision: 2.0		
Item	Qty	Part Reference	Value	Footprint	Manufacturer	Manufacturer Part Number	
<b>SMT Capacitors</b>							
1	15	C2,C4,C6,C13,C14,C15,C16,C17,C18,C19, C20,C21,C22,C23	10 nF	c0603	Panasonic	ECJ-2VB1H103K	
2	2	C1, C3	2.2 uF	c3216	Kemet	T491A225K010AT	
3	2	C10, C11	12 pF	c0805	Panasonic	ECJ-2VC1H120J	
<b>Connectors</b>							
5	1	J3	Connector, USB-B	usb-jack-b	Mill-Max	897-43-004-90-000000	
6	3	J5, J7, J9	CONN, 1X2Header, 0.1 in centers	TP40	Sullins	PTC36SAAN	
7	1	J6,J8	CONN, 1X3 Header, 0.1 in centers	TP40	Sullins	PTC36SAAN	
8	4	TP1,TP2,TP3,TP4	CONN, 1X1 Header, 0.1 in centers	TP40	Sullins	PTC36SAAN	
9	1	J10	CONN, 1X7 Header, 0.1 in centers	TP41	Sullins	PTC36SAAN	
<b>Ferrites</b>							
8	1	L1	CM CHOKE		Steward	MI1206K900R-10	
<b>Resistors</b>							
9	1	R2	10k	r0805	Panasonic	ERJ-6ENF1002V	
9	1	R12	1 Meg	r0805	Panasonic	ERJ-6ENF1004V	
10	2	R13,R14	1.5K	r0805	Panasonic	ERJ-6ENF1501V	
11	1	R17	100K	r0805	Panasonic	ERJ-6ENF1003V	
<b>IC's</b>							
12	1	U3	Device Under Test (DUT)	10-pin CERPAC	National Semiconductor	LM95172EWG NOPB	
13	1	U1	LP2950CDT-3.3/TO252	TO263_7P	National Semiconductor	LM2950CDT-3.3	
14	1	U2	Cypress CY7C68013A-100AXC	100tqfp	Cypress	CY7C68013A-100AXC	
15	1	U4	24C02	soic8	Atmel	AT24C02BN-10SU-1.8	
16	1	U5	LM3722	SOT23-stx	National Semiconductor	LM3722EM5-3.08	
<b>Misc</b>							
17	1	BOARD	LM95172EWGEB, Rev 1.0		Advanced Circuits	LM95172EWGEB, Rev 1.0	
18	1	Y1	24 MHz	hc49us	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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