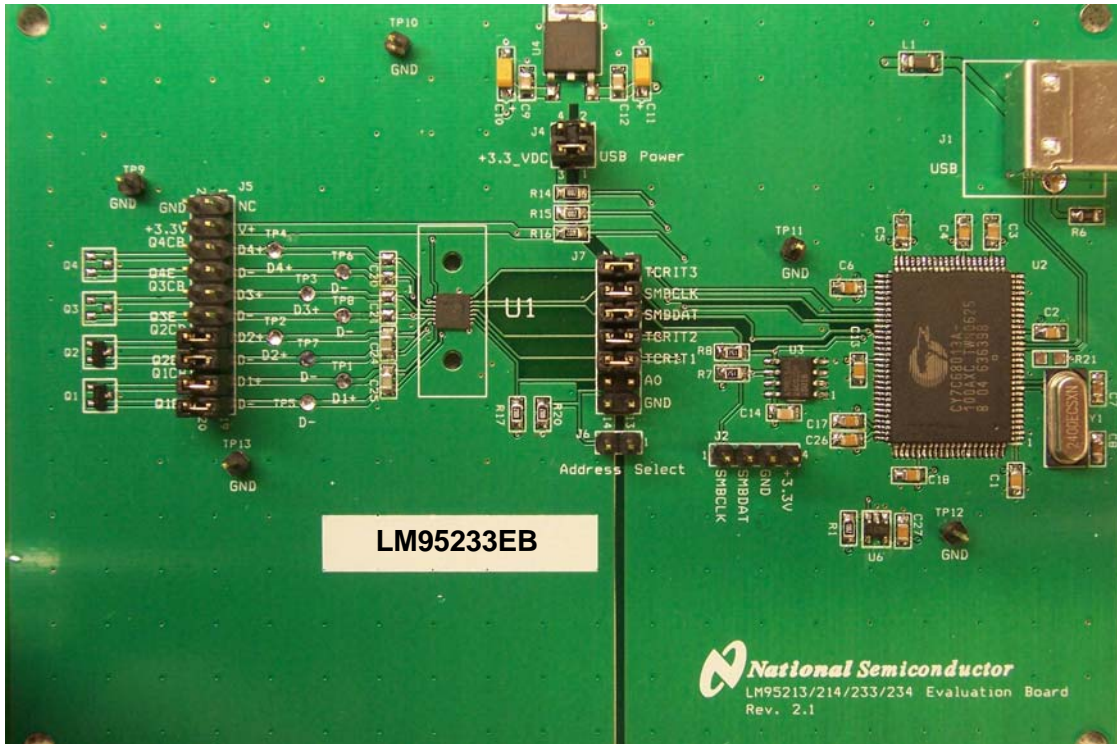


LM95213/14/33/34 Evaluation Board User's Guide



LM95213/14/33/34 Evaluation Board User's Guide
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LM95213/14/33/34 Evaluation Board User's Guide

References

“LM95213/14/33/34 TruTherm™ Precision Dual Remote Diode Temperature Sensor With SMBus Interface” datasheet.

The latest copy of the LM95213/14/33/34 datasheet can be obtained by going to the National Semiconductor website www.national.com, by searching on “LM95213/14/33/34”, and then downloading the LM95213/14/33/34.pdf file.

1. SensorEval Version 1.0.6b or later, Evaluation Board CD containing:
 - a. The SensorEval.exe executable program used to run the LM95213/14/33/34 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 LM95213/14/33/34 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 LM95213/14/33/34 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 LM95213/14/33/34 evaluation board.

Before connecting the PC to the LM95213/14/33/34 evaluation board 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. See Section 4.0 for details.

After the SensorEval software is running, the user can connect the USB cable first to the computer and then to the LM95213/14/33/34 Evaluation Board.

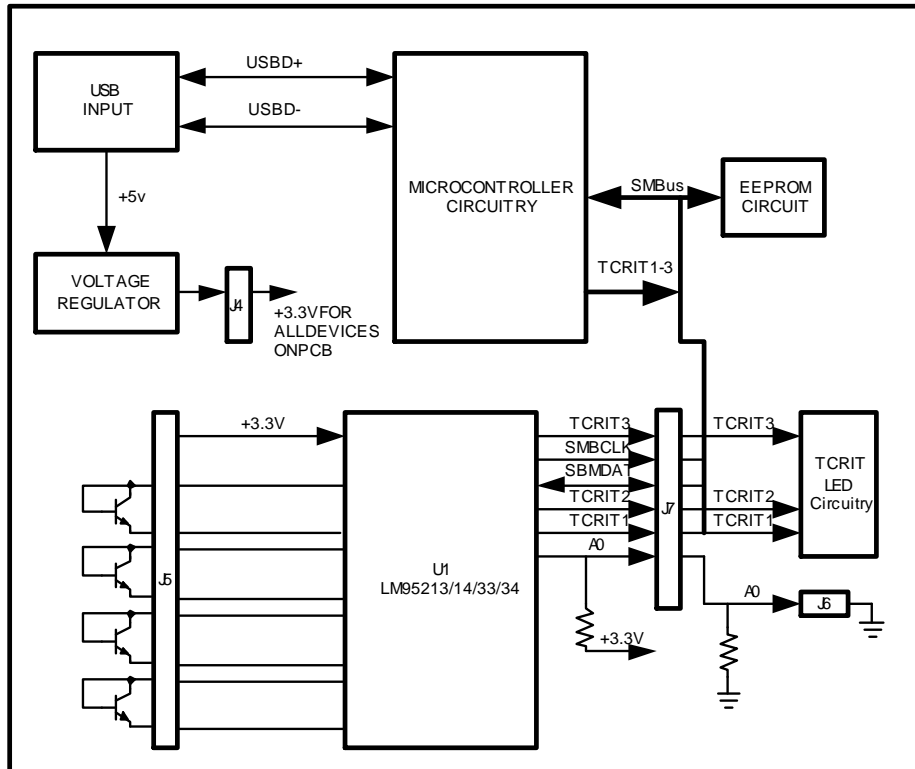
The PC should be able to recognize the board and the user simply selects the LM95213/14/33/34 Eval Board radio button.

The block diagram below describes the LM95213/14/33/34 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 IC's. 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 LM95213/14/33/34 Evaluation Board.

The microcontroller on the board provides the serial SMBus clock (SMBCLK), provides the SMBus data (SMBDAT) signal, and relays the information from the LM95213/14/33/34 to the PC via the USB lines.

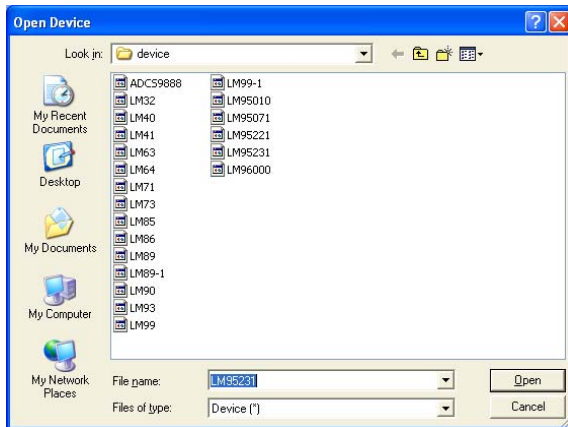
The block in the lower right of the Block Diagram shows the signals that are available to probe by the user for either of the LM95213/14/33/34 devices on the board.

1.1 Block Diagram



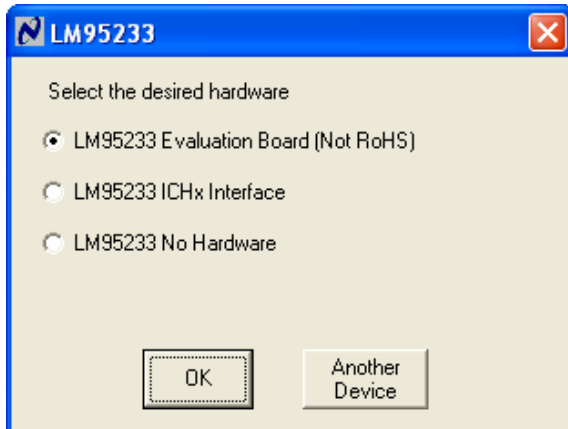
2.0 Quick Start

1. Install the CD into the CD drive of the computer and install the SensorEval software (see Section 4.0).
2. Hookup the USB cable between the PC or notebook computer and the LM95213/14/33/34EVAL board as shown in Quick Start Diagram below.
3. Run the SensorEval software clicking the icon on the desktop. The first screen after the installation will look like this:



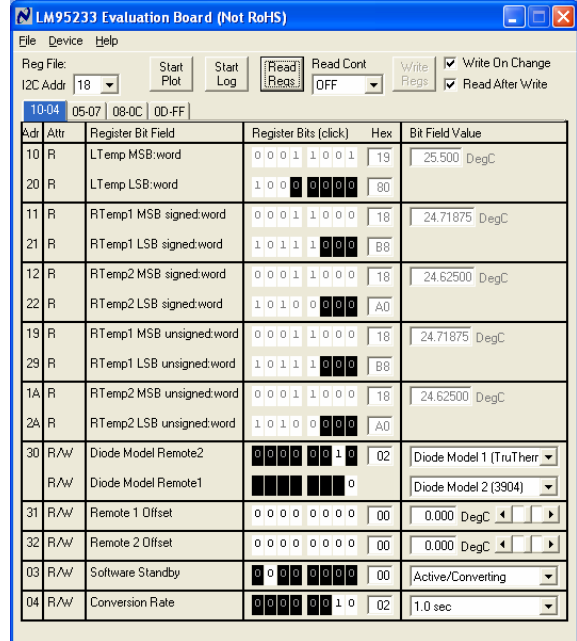
Select LM95213/14/33/34 and click on Open button.

4. The next screen (first screen after the first run of the program) will look like this:



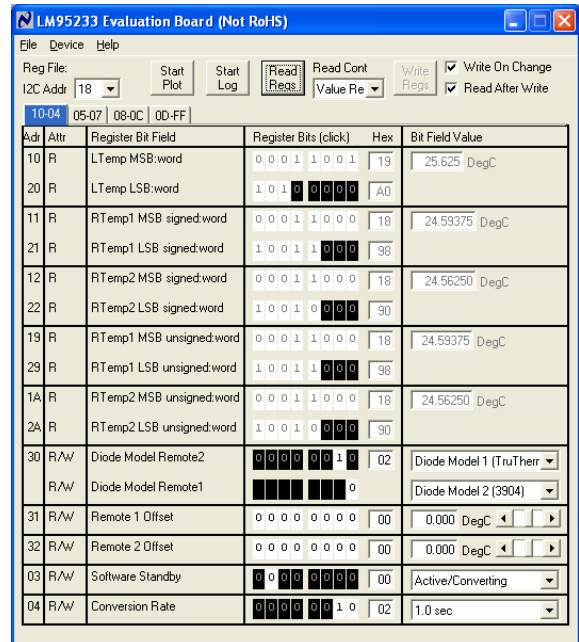
Select the LM95213/14/33/34 Evaluation Board.
Click OK.

5. The next screen will look like this:



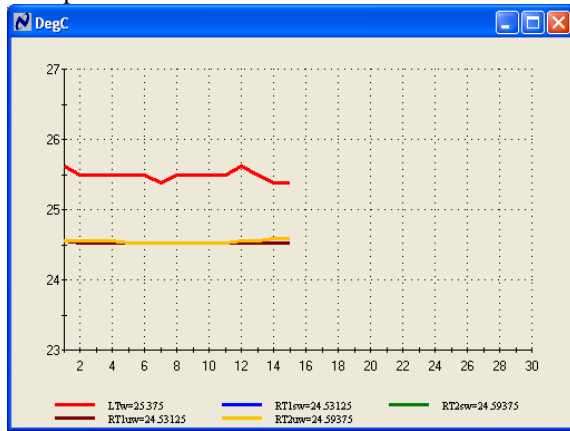
Select "Read Cont" to read the temperature registers continuously.

6. The Screen should look like this:



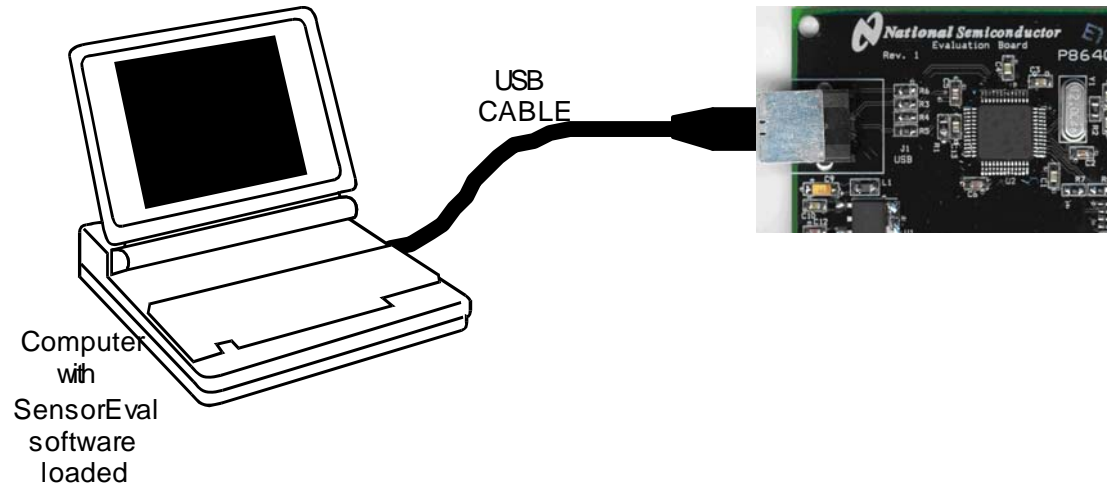
Local (on-chip), remote 1 (Q1), and remote 2 (Q3), etc. temperatures will be updated continuously.

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



2.1 Quick Start Diagram

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



3.0 Functional Description

The LM95213/14/33/34 Evaluation Board, along with the SensorEval Software, provides the system designer with a convenient way to learn about the operation of the LM95213/14/33/34 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 the temperatures. It's that simple! The user doesn't have to provide any power or external signals to the evaluation board.

Power to the LM95213/14/33/34 Evaluation Board is taken from the USB 5-Volt line. This +5 VDC 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 LM95213/14/33/34, the on-board microcontroller, and the EEPROM chip where the board ID information is stored.

The microcontroller provides the SMBus Clock (SMBCLK) signal and the SMBus Data (SMBDAT) signal to the LM95213/14/33/34 chip. This communication between the LM95213/14/33/34 and the PC USB data lines is controlled by the microcontroller. For all of the details of this communication protocol see the latest LM95213/14/33/34 datasheet, available at www.national.com.

3.1 LM95213/14/33/34 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.
J2 Output header provides user with signals for test purposes only. (may not be stuffed) <i>Do not apply any external power or signals to any of the pins on these headers!</i>	1	SMBCLK. Clock signal for SMBus.
	2	SMBDAT. Data signal for the SMBus.
	3	GND. System ground.
	4	V _{DD} . The +3.3 VDC voltage supplied by the on-board voltage regulator to the LM95213/14/33/34 V _{DD} input pin. Do not connect an external power supply to this pin!
J4 USB Power	1, 3	Short to connect 3.3V regulator output to LM95213/14/33/35 Power pin
	2, 4	GND connection
J5 Connection to temperature diodes <i>Do not apply any external power or signals to any of the pins on these headers!</i>	1	Pin 1 of DUT (NC)
	2	GND
	3, 4	+3.3V_DC
	5, 6	Short for D4+ connection to board MMBT 3904 (not available for the LM95213/LM95233)
	7, 8	Short for D4- connection to board MMBT 3904 (not available for the LM95213/LM95233)
	9, 10	Short for D3+ connection to board MMBT 3904 (not available for the LM95213/LM95233)
11, 12	Short for D3- connection to board MMBT 3904 (not available for the LM95213/LM95233)	

	13, 14	Short for D2+ connection to board MMBT 3904
	15, 16	Short for D2- connection to board MMBT3904
	17, 18	Short for D1+ connection to board MMBT3904
	19, 20	Short for D1- connection to board MMBT3904
J6 Address Select	1, 2	Short to connect A0 to GND (note, J7 pins 11 and 12 must also be shorted)
J7 Output header provides user with device digital signals for test purposes only. <i>Do not apply any external power or signals to any of the pins on these headers!</i>	1, 2	Short to connect TCRT3 pin to LED driver circuitry
	3, 4	Short to connect SMBCLK device signal, clock signal for SMBus, to microcontroller
	5, 6	Short to connect SMBDAT device signal, data signal for SMBus, to microcontroller
	7, 8	Short to connect TCRT2 pin to LED driver circuitry
	9, 10	Short to connect TCRT1 pin to LED driver circuitry
	11, 12	Short to connect A0 pin to mid supply. Note if this pin is open A0 is tied to 3.3V through a pullup resistor.
	13, 14	GND. System ground.

4.0 Software Installation and Operation

4.1 Installation

The CD provided in the LM95213/14/33/34 Evaluation Board Kit contains the SensorEval software used to make the LM95213/14/33/34 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 Microsoft Windows® XP/2000/98/ME operating system.

The software is installed as follows:

Insert the SensorEval CD into the CD drive of the PC. See details in the readme.txt file.

The software manual, provided on the CD, may be useful to the user during this process.

Follow all of the Installation instructions in the windows as the SensorEval software is installing.

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 LM95213/14/33/34 Evaluation Board using the SensorEval software:

Run the SensorEval program by either double-clicking on the icon on the desktop or by selecting Start, Program Files, National Semiconductor, National SensorEval.

- Plug in the USB cable on both the PC and the LM95213/14/33/34 Evaluation Board.

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

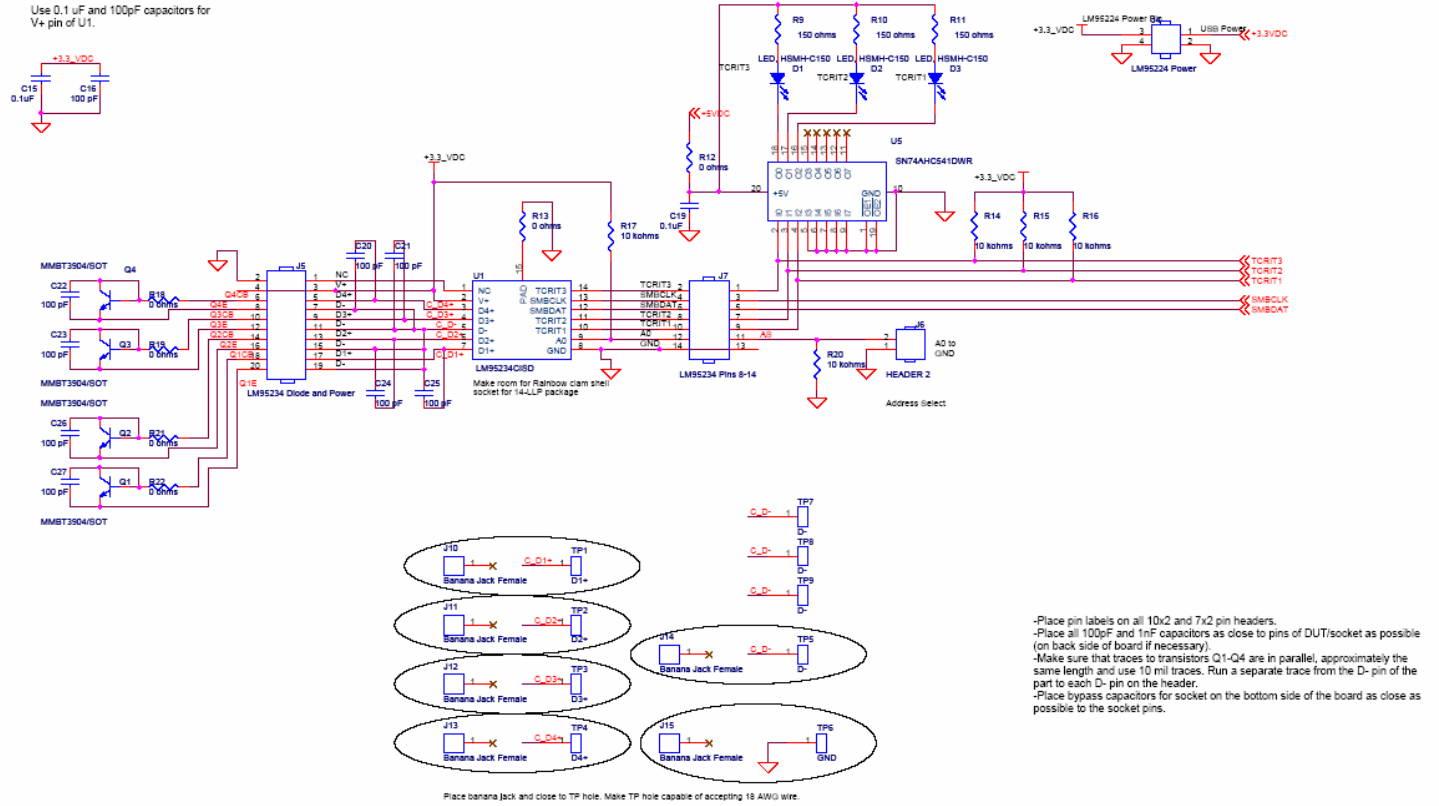
Refer to the electrical schematic, layout and connector diagrams for proper connections to external remote thermal diodes.

5.0 Electrical and Mechanical Specifications

5.1 Electrical Specifications

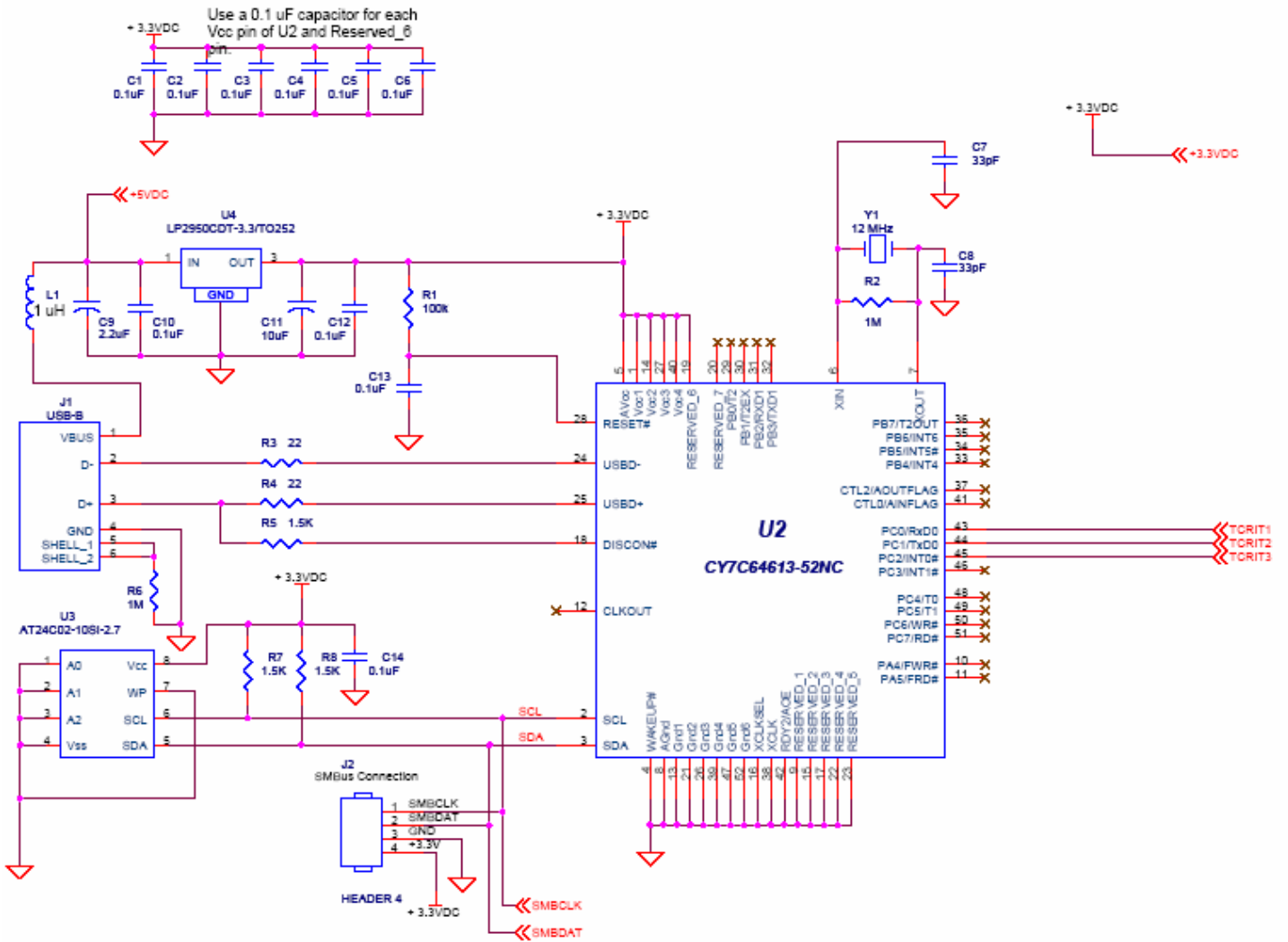
Power Requirements	
The Board uses the +5.0 VDC and GND lines from the USB connection. This +5.0 VDC voltage is regulated down to +3.3 VDC for board power. * NO EXTERNAL POWER SUPPLY INPUTS ARE REQUIRED *	+5.0 ± 0.1 V, 100 mA max.

5.2 Electrical Schematic



Page 1 of 2 Pages of the Schematic of the LM95213/14/33/34 Evaluation Board

5.2 Electrical Schematic (continued)



5.3 Evaluation Board Layout

TBD

Figure 5.3 Layout diagram of the LM95213/14/33/34 Evaluation Board

5.4 Bill of Materials for LM95213/14/33/34 Evaluation Board

Item	Quantity	Reference	Part
1	13	C1,C2,C3,C4,C5,C6,C13, C17,C18,C22,C23,C26,C27	0.01uF
2	2	C8,C7	12pF
3	1	C9	2.2uF
4	4	C10,C12,C14,C15	0.1uF
5	1	C11	10uF
6	5	C16,C20,C21,C24,C25	100 pF
7	1	J1	USB-B
8	1	J2	HEADER 4
9	1	J4	LM95213/14/33/34 Power
10	1	J5	LM952XX Diode and Power
11	1	J6	HEADER 2
12	1	J7	LM952XX Pins 8-14
13	1	L1	1uH
14	4	Q1,Q2,Q3,Q4	MMBT3904/SOT
15	1	R1	10k
16	2	R4,R3	22
17	1	R6	1M
18	2	R8,R7	1.5K
19	5	R14,R15,R16,R17,R20	10 kohms
20	1	TP1	D1+
21	1	TP2	D2+
22	1	TP3	D3+
23	1	TP4	D4+
24	4	TP5,TP6,TP7,TP8	D-
25	2	TP10,TP9	GND
26	1	U1	LM95234CISD, LM95233CISD, LM95214CISD, LM95213CISD
27	1	U2	Cypress CY7C68013A-100AXC
28	1	U3	AT24C02-10SI-2.7
29	1	U4	LP2950CDT-3.3/TO252
30	1	U6	LM3722
31	1	Y1	24 MHz Crystal

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

5.2" x 3.7"

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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