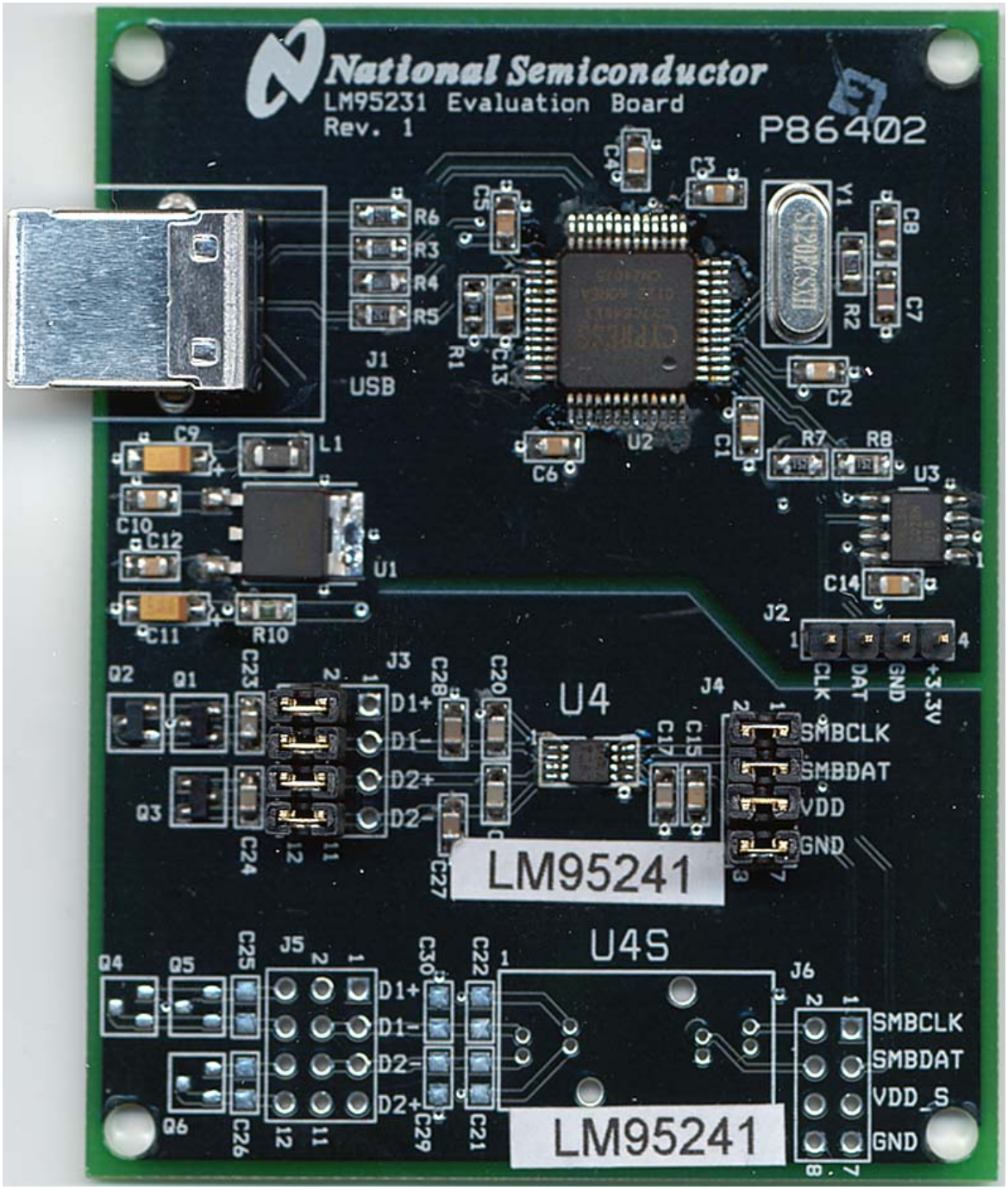
National Semiconductor

Revision B
January 16, 2007

LM95241 Evaluation Board User's Guide



LM95241 Evaluation Board User's Guide

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References

1. "LM95241 TruTherm™ Precision Dual Remote Diode Temperature Sensor With SMBus Interface" datasheet.

The latest copy of the LM95241 datasheet can be obtained by going to the National Semiconductor website www.national.com, by searching on "LM95241", and then downloading the LM95241.pdf file.

2. SensorEval Version 1.1.0 or later, Evaluation Board CD containing:
    a. The SensorEval.exe executable program used to run the LM95241 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 LM95241 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 LM95241 Evaluation Board is provide by the +5 VDC line of the USB connection. No external power supply or signal sources are required for operation of the LM95241 evaluation board.

Before connecting the PC to the LM95241 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 LM95241 Evaluation Board.

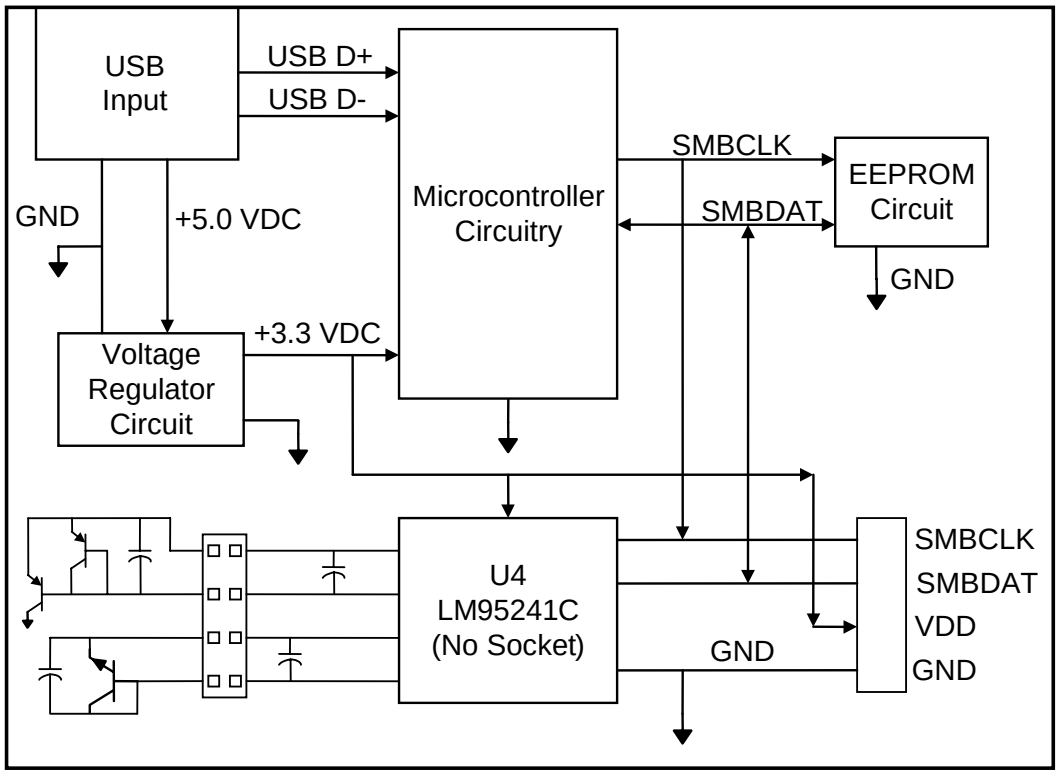
The PC should be able to recognize the board and the user simply selects the LM95241 Eval Board radio button.

The block diagram below describes the LM95241 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 LM95241 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 LM95241 to the PC via the USB lines.

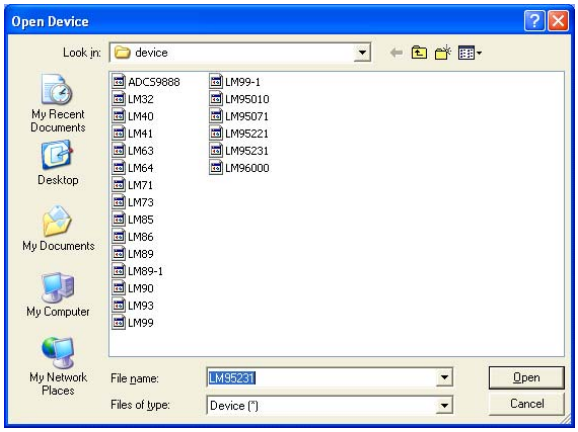
The block in the lower right of the Block Diagram shows the signals that are available to probe by the user for either of the LM95241 devices on the board.

1.1 Block Diagram



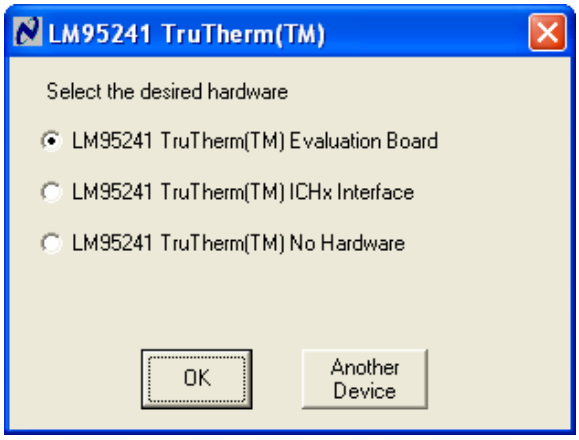
2.0 Quick Start

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 LM95241EVAL 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:



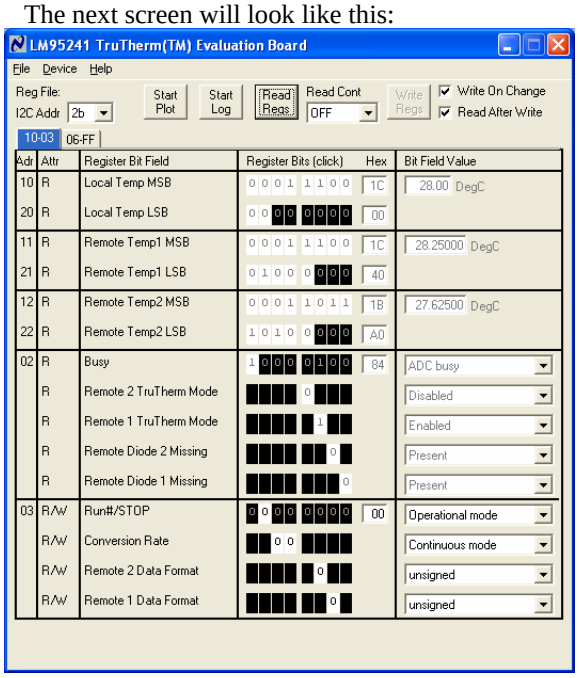
Select LM95241 and click on Open button.

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



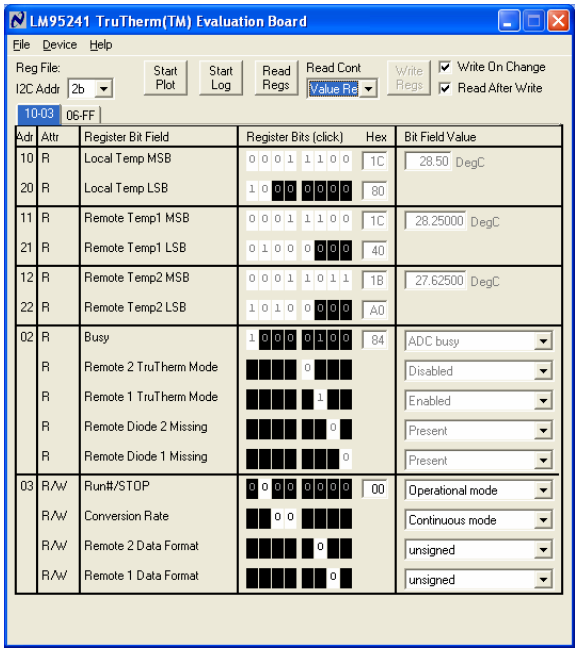
Select the LM95241 Evaluation Board. Click OK.

5. The next screen will look like this:



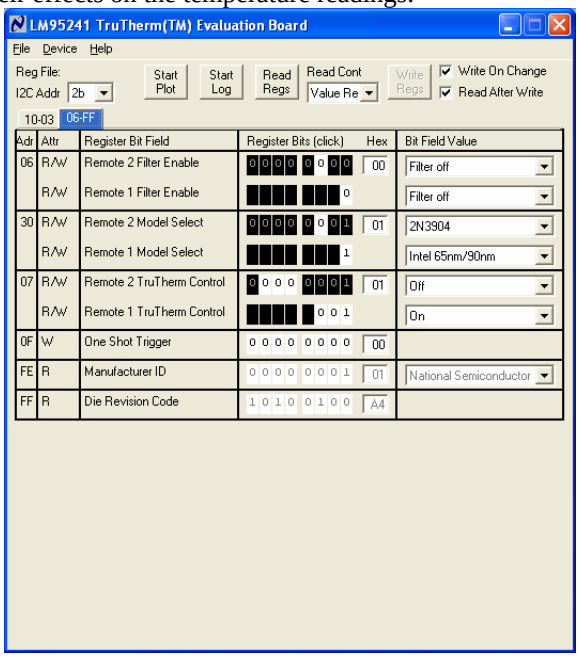
Select “Read Cont” to read the temperature continuously.

6. The Screen should look like this:



Local (on-chip), remote 1 (Q1 and Q2), and remote 2 (Q3), temperatures should read continuously.

7. If the user clicks the 06-FF tab the next screen will look like this: By turning on or off the filters, and/or changing the models, and/or changing the TruTherm controls the user can experiment with their effects on the temperature readings.



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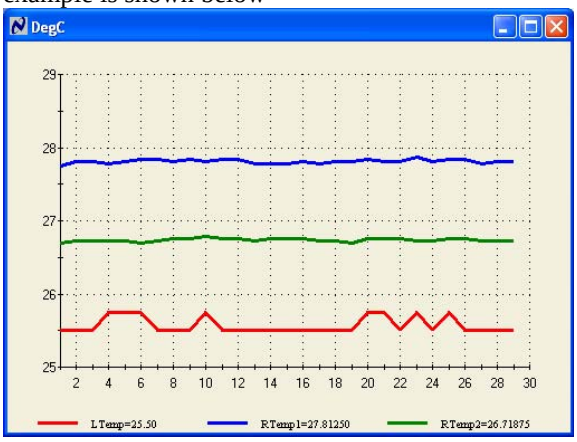
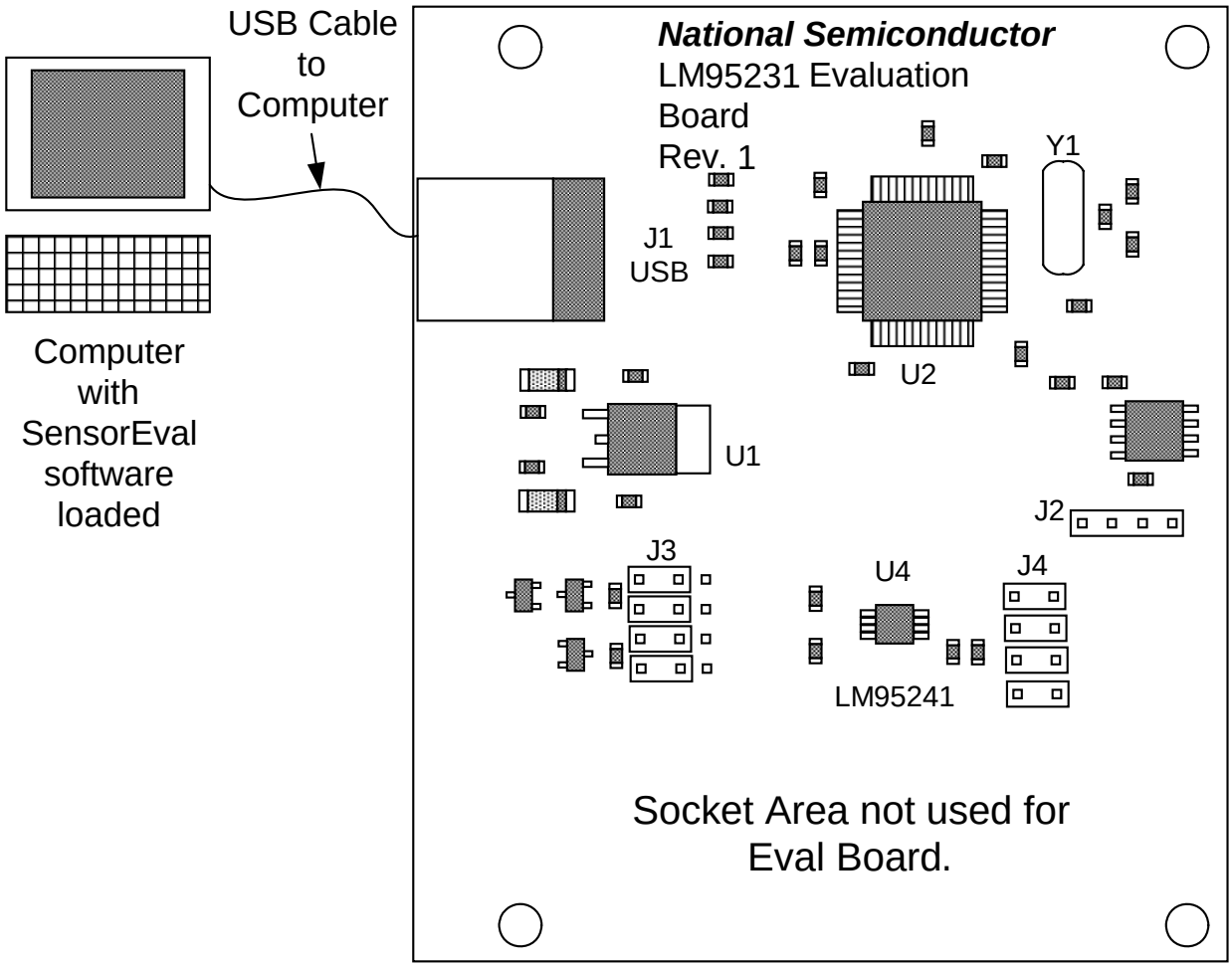
8. If the user clicks on the Start Plot button a graph box will appear and will graph the temperature. An example is shown below



2.1 Quick Start Diagram

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



3.0 Functional Description

The LM95241 Evaluation Board, along with the SensorEval Software, provides the system designer with a convenient way to learn about the operation of the LM95241 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 LM95241 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 LM95241, 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 LM95241 chip. This communication between the LM95241 and the PC USB data lines is controlled by the microcontroller. For all of the details of this communication protocol see the latest LM95241 datasheet, available at www.national.com.

3.1 LM95241 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.
J2 Output header provides user with signals for test purposes only. ***Do not apply any external power or signals to any of the pins on these headers!***	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 LM95241 V_{DD} input pin. **Do not connect an external power supply to this pin!**
J3 Connection to temperature diodes ***Do not apply any external power or signals to any of the pins on these headers!***	1, 4, 7, 10	Do not connect to these pins.
	2, 3	Connect for D1+ connection
	5, 6	Connect for D1- connection
	8, 9	Connect for D2+ connection
	11, 12	Connect for D2- connection
J4 Output header provides user with signals for test purposes only. ***Do not apply any external power or signals to any of the pins on these headers!***	1, 2	SMBCLK. Clock signal for SMBus.
	3, 4	SMBDAT. Data signal for the SMBus.
	5, 6	V_{DD}. The +3.3 VDC voltage supplied by the on-board voltage regulator to the LM95241 V_{DD} input pin. **Do not connect an external power supply to this pin!**
	7, 8	GND. System ground.

4.0 Software Installation and Operation

4.1 Installation

The CD provided in the LM95241 Evaluation Board Kit contains the SensorEval software used to make the LM95241 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:

1. Insert the SensorEval 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. Follow all of the Installation instructions in the windows as the SensorEval software is installing.
4. 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 LM95241 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, Program Files, National Semiconductor, National SensorEval.
2. Plug in the USB cable on both the PC and the LM95241 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.

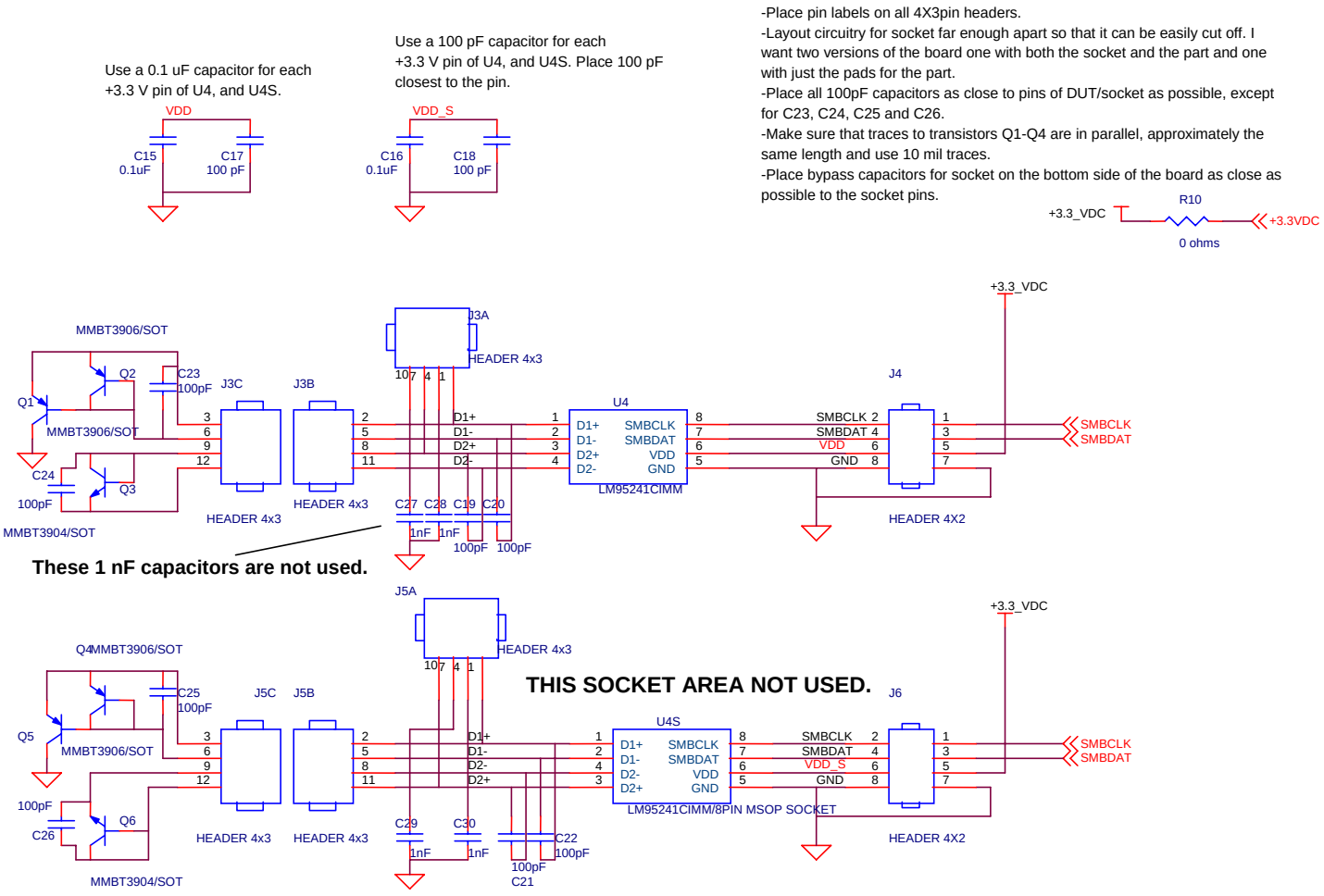
Refer to the electrical schematic, layout and connector diagrams for proper connections to external remote thermal diodes.

5.0 Electrical and Mechanical Specifications

5.1 Electrical Specifications

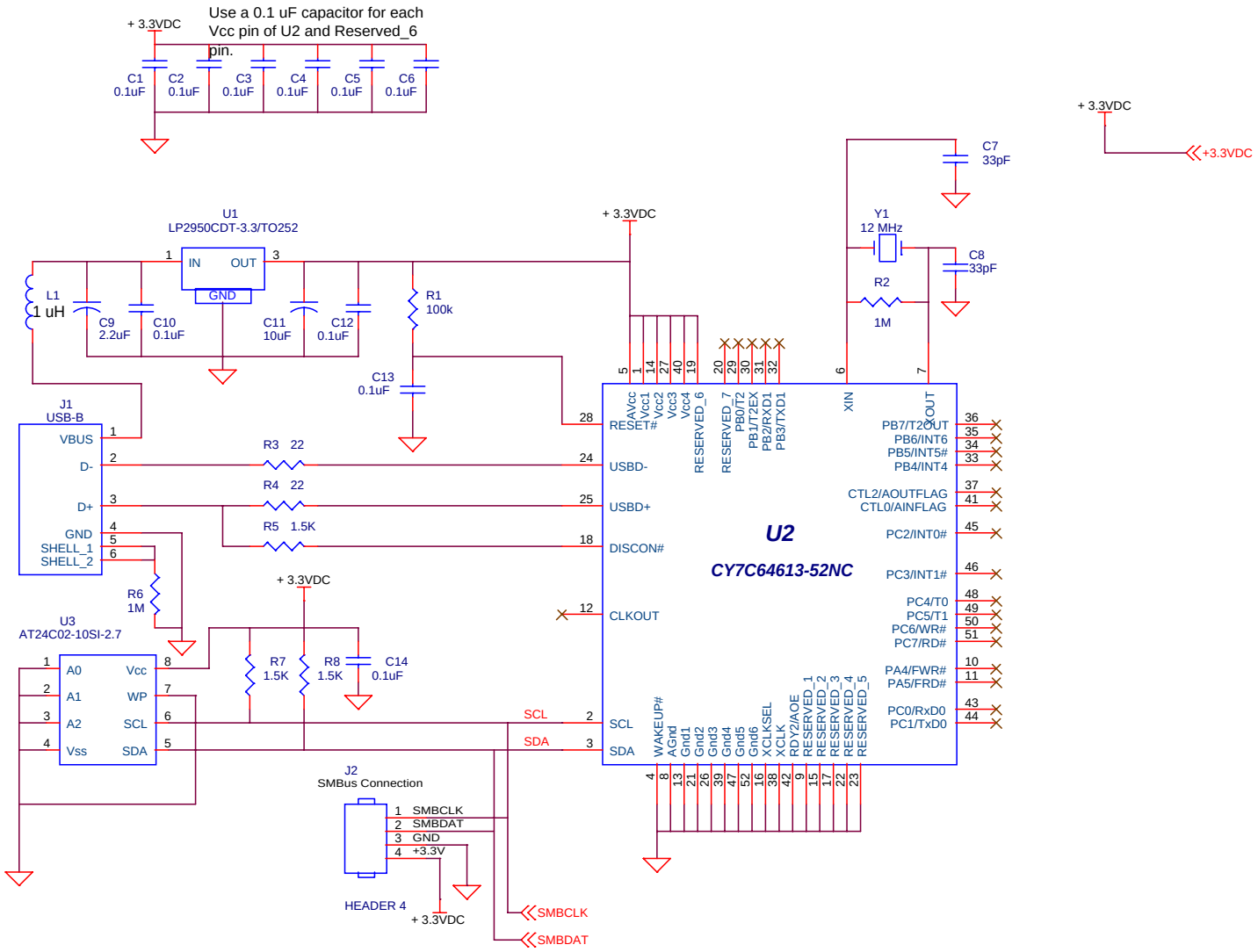
Power Requirements	
The Board uses the +5.0 VDC and GND lines from the USB connection. This +5.0 VDC voltage is regulated down to +3.3 VDC for board power. *** NO EXTERNAL POWER SUPPLY INPUTS ARE REQUIRED ***	+5.0 ± 0.1 V, 100 mA max.

5.2 Electrical Schematic



Page 1 of 2 Pages of the Schematic of the LM95241 Evaluation Board

5.2 Electrical Schematic (continued)



Page 2 of 2 Pages of the Schematic of the LM95241 Evaluation Board

5.3 Evaluation Board Layout

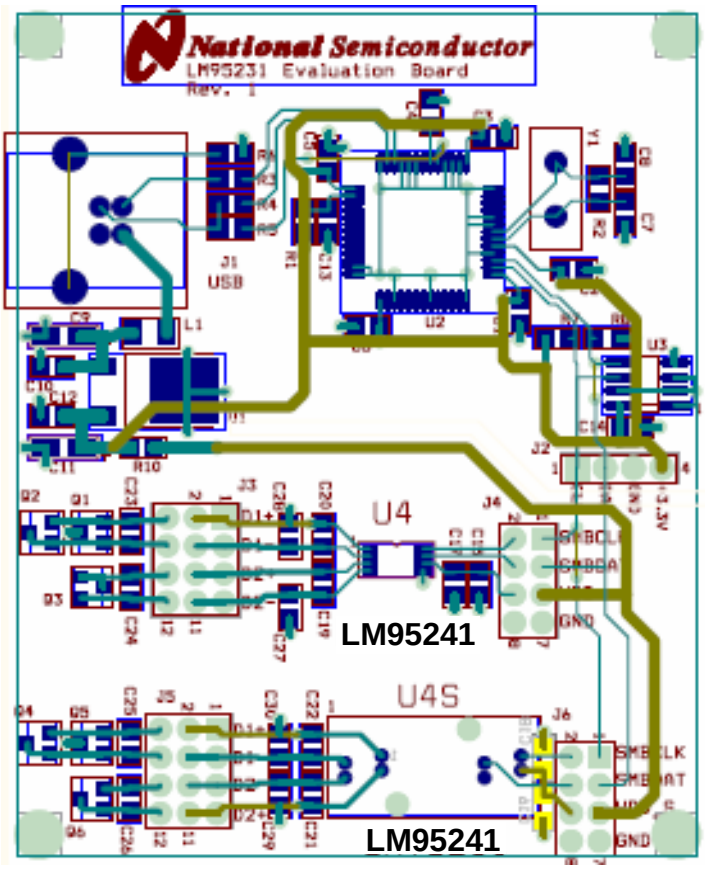


Figure 5.3 Layout diagram of the LM95241 Evaluation Board
(Note: socket and socket area not stuffed.)

5.4 Bill of Materials for LM95241 Evaluation Board

Item	Qty	Reference	Part	PCB Footprint
1	12	C1,C2,C3,C4,C5,C6,C10, C12,C13,C14,C15	Capacitor, SMD, ceramic, 0.1uF	sm/c_0805
2	2	C7, C8	Capacitor, SMD, ceramic, 33 pF	sm/c_0805
3	1	C9	Capacitor, SMD, ceramic, 2.2 uF	sm/ct_3216_12
4	1	C11	Capacitor, SMD, ceramic, 10 uF	sm/ct_3216_12
5	2	C17,C18	Capacitor, SMD, ceramic, 100 pF	sm/c_0805
6	4	C19,C20,C23,C24,	Capacitor, SMD, ceramic, 100 pF	sm/c_0805
7	1	J1	Connector, USB-B	tm/usb_typeb
8	1	J2	HEADER 4x1	blkcon.100/vh/tm1sqs/w.100/4
9	1	J3	HEADER 4x3	blkcon.100/vh/tm3/w.300/12/std
10	1	J4	HEADER 4X2	blkcon.100/vh/tm2oe/w.200/8/std
11	1	L1	Filter, 1uH, Stewart MI1206K900R-00	sm/l_1206
12	2	Q1,Q2	Transistor, SMD, MMBT3906/SOT	sm/mmbt3906a
13	1	Q3	Transistor, SMD, MMBT3904/SOT	sm/mmbt3904a
14	1	R1	Resistor, SMD, 100k	sm/r_0805
15	2	R6,R2	Resistor, SMD, 1M	sm/r_0805
16	2	R4,R3	Resistor, SMD, 22 Ohms	sm/r_0805
17	3	R5,R7,R8	Resistor, SMD, 1.5K	sm/r_0805
18	1	R10	Resistor, SMD, 0 Ohms	sm/r_0805
19	1	U1	IC, National LP2950CDT-3.3/TO252	to252ab/dpak
20	1	U2	IC, Cypress CY7C64613-52NC	sm/PQFP-52
21	1	U3	IC, EPROM, Atmel AT24C02-10SI-2.7	sog.050/8/wg.244/l.200
22	1	U4	LM95241CIMM	sm/msop-8
22	1	Y1	Crystal, 12 MHz, Pletronics 2S1200G140	tm/hc-49

DO NOT STUFF

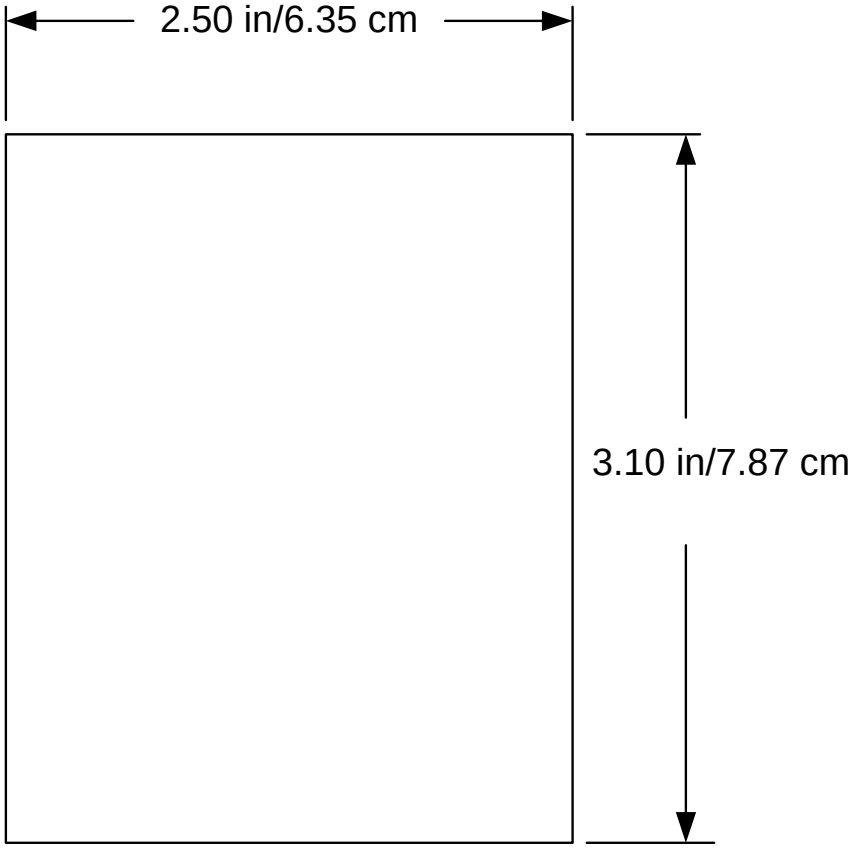
C21, C22, C25, C26, C27, C28, C29, C30, J5, J6, Q4, Q5, Q6, C16, C18

5.4 Mechanical Specifications

5.4.1 Operating Mechanical and Environmental Specifications

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

5.4.2 Evaluation Board Basic Dimensions



5.4.3 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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