







EVB-EMC1001 User Manual



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SMSC EMC1001 Revision 1.1 (12-14-06)



1 Overview

The EMC1001 is an SMBus temperature sensing IC with an internal sensor in a SOT23-6 package. The EMC1001 has 2 outputs, Alert/Therm2 and Addr/Therm, that can be configured to signal when temperatures exceed programmed limits. These outputs may be used to generate system alerts, control a fan or force system shutdown without host intervention.

The EVB-EMC1001 is a USB-based platform for evaluating the EMC1001. A block diagram of the EVB is shown in Figure 1.1 below.

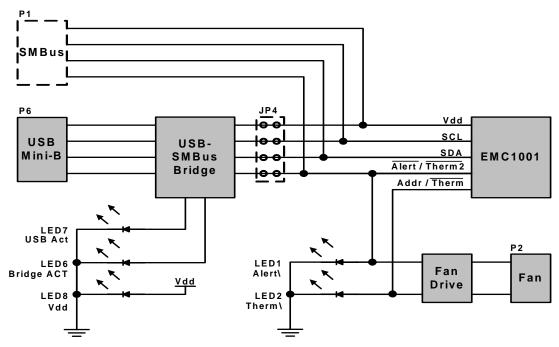


Figure 1.1 EMC1001 EVB Block Diagram

1.1 Related Documents

The CD included with the evaluation board contains the following documents:

- Evaluation Board Checklist
- Bill Of Materials
- Schematic
- Jumper Settings and Connector List
- EMC1001 Datasheet
- n Register Manager Application
- n Register Manager Readme.txt
- EMC1001.ini Register Definition Files

Revision 1.1 (12-14-06) SMSC EMC1001



2 Getting Started

2.1 System Requirements

To use the EVB you will need:

- A PC running Windows 2000 or XP
- Display resolution 800x600 (or larger to view several windows simultaneously)
- An available USB port

2.1.1 Feature Summary

- Mindows Register Manager application allows viewing and changing register values as well as graphing temperature history
- uSB communication to evaluation board
- LEDs for Alert/Therm2 and Addr/Therm indication as well as USB bridge activity
- Low cost fan control driven by Alert/Therm2 and Addr/Therm outputs
- n An external SMBus master may also be used (circuit modifications required)

2.1.2 Board Layout

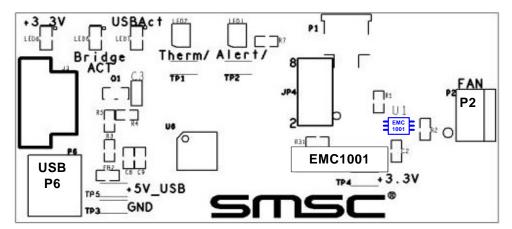


Figure 2.1 EMC1001 Board Outline and Silkscreen

2.1.3 Installing the EVB

- Install the RegMan application and device driver on a PC by running Setup.exe from the RegMan distribution CD. A revision history and install/uninstall notes may be found in the readme.txt file on the disk.
- 2. Connect the supplied USB cable to an available USB port on the PC. Plug the "mini-B" end of the USB cable into EVB connector P6. The +3.3V, Bridge ACT, Alert/ and Therm/ LEDs should illuminate. After the EVB is connected to the PC the "Find New Hardware" wizard will pop up for USB driver installation. Follow the instructions in the readme.txt file to complete the installation process.
- Start the EVB Software by selecting the Register Manager application from the SMSC folder from the Programs Windows Start menu. The EVB will initialize and the Register Manager Help screen will appear as in Figure 2.2. The USBAct LED should be blinking when the Register Manager is running.

Note: The Windows Register Manager application allows viewing and changing register values for a variety of EVBs including the EMC1001, EMC1002, EMC1023 and EMC1033. The Register



Manager software only needs to be installed once to support all of these EVBs. The list of supported EVBs may be found in the readme.txt file included on the distribution CD.

Register Manager File Plot Help ▼ SwitchTo 10 | 1 ┰║ ▾ Register Manager (click here for detail information) This utility is to allow the user to view and edit SMSC device registers in the Windows environment. It also supports the register reading history plotting in order to debug the device(see detail page). "Switch To" combo box on the tool bar lists all the SMSC devices on the motherboard, the user could switch to any of them. Note: <Started> on the toolbar maps the register [0x40] start bit, it has to be set to activate the history plotting. Some chips might use different address as a start register. To view a group of registers, select the appropriate group in the left pane. To edit the value of a register, double click the value in the "Reading(Hex)" column or "Reading(Dec)" in the right upper pane. Type in the desired value. The register will be updated with the new value once the cursor leaves the edit window. Read only registers are denoted by "R" in the "R/W" column and editing of these register values is disallowed. Some registers have bit field definitions. They are displayed in the lower right pane. If the register is not read only (i.e. read/write) the value of each bit can be edited by double clicking on the bit value in the "Last Value" column of this pane. Type "0" or "1" to change the value, follow by Enter. The register will be written to with the new value once the edit window closes. Use this feature to modify a register one bit at a time. If more than one bit must be changed at the same time, edit the register value directly from the upper right pane. The current values of the registers can be saved to an external text file by using the Export feature. The saved text file can also be read back to the device by using the Import feature. Import only affects read/write registers.

Figure 2.2 Register Manager Help Screen

Revision 1.1 (12-14-06) SMSC EMC1001



3 Circuit Description

3.1 Introduction

The EMC1001 EVB provides the means to demonstrate EMC1001 features and to view and modify registers. LED Indicators and test points are included to show status information and a fan driver circuit linearly drives a 5V fan to 3 different speeds based on programmable temperature limits.

3.2 EMC1001

The EMC1001 is an SMBus temperature sensor in a 6 pin SOT23 package. The EMC1001 has 2 programmable outputs, Alert/Therm2 and Addr/Therm, which may be configured to assert when temperatures exceed programmed limits.

3.3 USB to SMBus Bridge

The USB to SMBus bridge is based on an 8051 microcontroller with integrated USB and SMBus interfaces as well as internal flash and RAM. During EVB manufacture, firmware is loaded into the bridge that provides the interface between the SMBus and the USB driver. Power is sourced to the MCU from the USB interface.

3.4 Power Source

This demo board derives +5V power from the USB port. The bridge microcontroller has an internal voltage regulator that supplies +3.3V to the EMC1001 and other EVB circuits.

3.5 Fan Drive Circuit

The fan drive circuit linearly drives a 5V, 2-wire fan. Three different drive voltages are possible with the resistor values used on this EVB, 0, 2.4 and 4.1V. If R6 is populated with an 820 ohm resistor, the fan drive voltages will be approximately 2.4, 3.2. and 4.1V. Other fan drive voltage combinations can be achieved by varying R3, R4 and R6. R3 and R4 are located on the top side of the PCB next to transistor Q1. R6 is on the bottom side of the PCB directly opposite Q1.

Note: Full fan ON cannot be achieved with this circuit due to transistor voltage drop.

The fan drive voltage is set by controlling Q1's base and emitter voltages. When neither the Alert/Therm2 or Addr/Therm outputs are asserted low, no current flows through Q1's base terminal so the base and emitter voltages are high and the fan will be OFF. When the Alert/Therm2 output is asserted low, the base voltage is set by the resistor divider R3/R4. Asserting the Addr/Therm output low will turn the transistor fully ON, resulting in the maximum fan drive voltage for this circuit, which is approximately 4.1V.

3.6 System Interrupts / LEDs

The Alert/Therm2 and Therm outputs each have a dual-color LED to indicate the Normal (green) and Alert (red) status The Alert/Therm2 line is also routed to the USB bridge to provide Alert status to the RegMan application.

3.7 Direct SMBus Connect Option

It is also possible to connect an external SMBus master to the EMC1001 EVB. A few modifications to the circuit are required:

Cut 3 traces connecting JP4 pins 3-4, 5-6 and 7-8 on the bottom side of the PCB. This will disconnect the USB bridge from the SMBus. The pullup resistors for the SMBus SDA, SCL and Alert/Therm2 signals are also disconnected so external pullups will need to be supplied by the SMBus Master.



- n Install P1 or JP4 to provide an SMBus connector. See the Jumper Settings and Connection List for details.
- Optionally remove zero ohm resistor R31. When removed, the USB to SMBus bridge will not supply +3.3V to the circuitry so power will need to be provided from an external source. If R31 is left installed, power will be supplied from the USB connector when connected to a computer or USB hub.

3.8 Test Points

Test points are provided for:

- n Alert/Therm2 output, EMC1001 pin 6
- n Addr/Therm output, EMC1001 pin 4
- n Ground
- n +3.3V power
- n +5V_USB power

3.9 LED Indicators

LEDs indicate the status of the following signals:

- n Alert/Therm2, EMC1001 pin 6
- Addr/Therm, EMC1001 pin 4
- n +3.3V
- uSB Activity blinking indicates USB traffic
- n Bridge Activity, when ON indicates the Bridge is functioning



4 Demo Description

4.1 Register Manager Overview

The Register Manager application (RegMan) initially displays the main Help screen, where detailed description of the application's features may be found. The Help screens can be displayed at any time by selecting Help from the menubar or pressing the? button on the toolbar. RegMan enables the user to display temperature readings, set temperature limits and read/write configuration register values.

4.2 Temperature History Graph

To open a Temperature History Graph window, select Plot -> Temperature History Plot from the menubar. The history plot continuously updates the temperature reported by the EMC1001. The high and low limits associated with the Adert/Therm2 output and the Therm high limit associated with the Addr/Therm output are displayed with dashed lines. These limits may be dragged up or down to cause or clear over-limit conditions. See a typical Temperature History Graph in Figure 4.1 below:

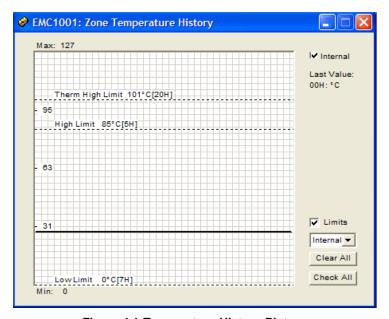


Figure 4.1 Temperature History Plot

4.3 Temperature Limits and Alert/Therm2, Addr/Therm Outputs

The high and low limits are displayed as dashed lines, initially with values set in the EMC1001.ini file. These limits may be changed either in the register manager or by dragging the line on the history plot. If any of the Temp High or Temp Low Limits are exceeded, the Alert/Therm2 output will assert. If the Ext THERM Limit or the Local THERM Limit are exceeded, the Addr/Therm output will be asserted.

The Alert/Therm2 and Addr/Therm outputs are asserted active Low when a temperature exceeds the programmed limits. The state of these outputs can be monitored by the associated bi-color LEDs or test points on the PCB.

The Alert/Therm2 output pin can be configured to function as either an SMBus Alert output or as a Therm2 output. When configured as an SMBus Alert pin it will follow the SMBus Alert Response protocol to clear the assert state. When configured as a Therm2 output it will not require the SMBus Alert Response Protocol to clear the pin's status. This pin is initialized as a Therm2 output by the EMC1001.ini file. Change register 0x09 bit #5 to "0" to configure the pin function to Alert mode.

Note: Asserting the Addr/Therm output low will also turn on the ARA LED on this EVB. This is because the fan driver circuit will pull down the Alert/Therm2 output when Addr/Therm is low. The SMBus ARA Protocol will not function in this case.



4.4 Fan Driver

The fan driver utilizes the Alert/Therm2 and Addr/Therm outputs to drive a +5V fan to 3 different fan speeds. See the Circuit Description above for information about the fan driver. Plug the 3 pin connector for the supplied fan assmembly into P2 on the EVB.

Normally, the fan driver is OFF. To turn the fan ON at low speed, the Alert/Therm2 output must be asserted low. This can be caused by dragging the High Temp Limit line below the current temperature on the Zone Temperature History graph, using the Register Manager to set the High Temp Limit value lower than the current temperature or heating the temp sensor to exceed the limit.

To turn the fan ON to high speed, the Addr/Therm output must be asserted low. This will occur when the current temperature exceeds the associated THERM limit.

Note: When Alert/Therm2 is configured as a Therm2 output, temperatures exceeding the High Temp Limit will cause it to assert, however the Low Temp Limit is ignored.

4.5 SMBus Alert Protocol (ARA) Support

When the Alert/Therm2 output is asserted an SMBus Alert interrupt is generated and an indicator light will turn RED on the Register Manager panel. Press the Response button to cause RegMan to send the SMBus Alert Address to the EMC1001. The EMC1001 will respond with it's SMBus address which is displayed in a text box next to the Response button on the RegMan interface. If the temperature is still above the limit, the indicator will remain lit and the Alert/Therm2 output will stay asserted. If the temperature is below the limit the indicator will turn OFF and the Alert/Therm2 output will de-assert.

4.6 Other EMC1001 Features

Other features such as Conversion Rate, Standby Mode, Interrupt Mask and Therm Hysteresis can be controlled with EMC1001 registers. See the EMC1001 datasheet register description for details.

Revision 1.1 (12-14-06) SMSC EMC1001