



# MAX6698 Evaluation Kit/Evaluation System

## General Description

The MAX6698 evaluation kit (EV kit) and evaluation system is an assembled and tested PC board with a mounted MAX6698. The EV kit allows full evaluation of the MAX6698 seven-channel temperature sensor. The MAX6698 monitors its own die temperature, the junction temperatures of three external diode-connected transistors, and the temperatures of three thermistors. It converts the temperature to 8-bit (or 11-bit for remote channel 1) 2-wire serial data that can be accessed over a 2-wire serial bus. Refer to the MAX6698 data sheet for additional information.

The MAX6698 EV kit includes external diode-connected transistors and thermistors soldered to the board, which can be removed. The board can then be connected through a twisted pair to remote diodes and thermistors close to your system.

The MAX6698 evaluation system consists of a Maxim command module (CMOD232) and a MAX6698 EV kit. The CMOD232 board connects to a computer's RS-232 serial port to provide a computer controlled SMBus™/I<sup>2</sup>C bus. Windows® 95/98/2000/XP-compatible software provides a user-friendly interface to exercise the features of the MAX6698. The program is menu driven and offers a graphic interface with control buttons and status display.

Order the MAX6698EVCMOD2 for complete PC-based evaluation of the MAX6698. Order the MAX6698EVKIT if you already have a CMOD232 SMBus interface.

## MAX6698EVCMOD2 (MAX6698 EV System) Component List

DESIGNATION	QTY	DESCRIPTION
MAX6698EVKIT	1	MAX6698 evaluation kit
CMOD232	1	SMBus/I <sup>2</sup> C interface board
AC adapter	1	9VDC at 200mA (powers the CMOD232 board)

SMBus is a trademark of Intel Corp.

Windows is a registered trademark of Microsoft Corp.

## Features

- ◆ Three Thermal Diode Inputs and Three Thermistor Inputs
- ◆ Local Temperature Sensor
- ◆ Programmable Temperature Alarms
- ◆ SMBus/I<sup>2</sup>C Compatible
- ◆ Easy-to-Use Menu-Driven Software
- ◆ Fully Assembled and Tested
- ◆ Includes Windows 95/98/2000/XP-Compatible Software and Demo PC Board

## Ordering Information

PART	TEMP RANGE	SMBus INTERFACE TYPE
MAX6698EVKIT	0°C to +70°C	Not included
MAX6698EVCMOD2	0°C to +70°C	CMOD232

**Note:** The MAX6698 EV kit software is provided with the MAX6698EVKIT. However, the CMOD232 board is required to interface the EV kit to the computer when using the software.

## MAX6698EVKIT Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	0.1μF ±10%, 16V X7R ceramic capacitor (0603) Murata GRM188R71C104KA01 TDK C1608X7R1C104K
C2, C3, C4	3	2200pF ±10%, 50V X7R ceramic capacitors (0603) Murata GRM188R71H222K TDK C1608X7R1H222K
C5, C6, C7	3	100pF ±50V, C0G, 0603 ceramic capacitors Murata GRM1885C1H101J TDK C1608CH1H101J
J1	1	2 x 10 right-angle female receptacle
JU1-JU7	0	Not installed
Q1, Q2, Q3	3	2N3906-type pnp transistors, SOT23 Central Semiconductor CMPT3906 Diodes Incorporated MMBT3906 Vishay Semiconductors MMBT3906
R1, R2, R4	3	10kΩ ±5% resistors (0603)
R3, R5	0	Not installed, resistors (0603)

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## MAX6698EVKIT Component List (continued)

DESIGNATION	QTY	DESCRIPTION
REXT1, REXT2, REXT3	3	1.60k $\Omega$ $\pm$ 1% resistors (0805)
R THER1, R THER2, R THER3	3	10k $\Omega$ $\pm$ 1% through-hole, 0.095in diameter thermistors BetaTHERM Sensors 10K3A1C
U1	1	MAX6698EE99 (16-pin QSOP)
—	1	MAX6698 EV kit PC board

### Quick Start

#### Recommended Equipment

Before you begin, the following equipment is needed. **Do not turn on the power until all connections are made:**

- One computer running Windows 95, 98, 2000, or XP
- One RS-232 serial port (this is a 9-pin socket on the back of the computer)
- One standard 9-pin, straight-through, male-to-female cable to connect the computer's serial port to the Maxim CMOD232 board
- One 3.3V, 100mA DC power supply

#### Procedures

- 1) Carefully connect the boards by aligning the 20-pin connector of the MAX6698 EV kit with the 20-pin header of the CMOD232 board. Gently press them together.
- 2) Disable the pullup resistors on the CMOD232 board by moving switch SW1 to the OFF position.
- 3) Connect a cable from the computer's serial port to the CMOD232 board. Use a straight-through, 9-pin, male-to-female cable.

- 4) Install the software by running the INSTALL.EXE program. The install program copies the files and creates icons for them in the Windows 95/98/2000/XP Start menu. (To remove the software at any time, click on the UNINSTALL icon.)
- 5) Connect the 9V adapter to the CMOD232 board.
- 6) Connect the +3.3V supply to the pads labeled VIN and GND on the MAX6698 EV kit.
- 7) Turn on the power supply.
- 8) Start the MAX6698 program by opening its icon in the Start menu.
- 9) Wait until the program automatically detects the address of the MAX6698 and displays the user-interface panel (Figure 1).

### Detailed Description

#### User-Interface Panel

The user interface is easy to operate; use the mouse, or press the Tab and arrow keys to navigate. The checkboxes, edit fields, and radio buttons correspond to bits in the MAX6698 registers. Clicking on them generates the correct SMBus command and updates the registers.

**Note:** Words in boldface are user-selectable features in the software.

#### Temperature

The MAX6698 monitors its own die temperature, the junction temperatures of three external diode-connected transistors, and the temperatures of three thermistors. The temperature measurements are capable of either 8-bit (or 11-bit for remote channel 1) resolution; 8-bit resolution results in temperature resolution of 1°C/LSB and 11-bit resolution results in temperature resolution of 0.125°C/LSB. Enable 11-bit resolution by selecting the **Extended Resolution** checkbox.

Read the temperatures by clicking on the **Read Temp** buttons. The temperature is shown to the right of the buttons.

### Component Suppliers

SUPPLIER	PHONE	FAX	WEBSITE
BetaTHERM	508-842-0516	508-842-0748	www.betatherm.com
Central Semiconductor	631-435-1110	631-435-1824	www.centrasemi.com
Diodes Incorporated	805-446-4800	805-446-4850	www.diodes.com
Murata	770-436-1300	770-436-3030	www.murata.com
TDK	847-803-6100	847-390-4405	www.component.tdk.com
Vishay Semiconductors	402-564-3131	402-563-6296	www.vishay.com

**Note:** Indicate you are using the MAX6698 when contacting these manufacturers.

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## External Diodes

The MAX6698 remote temperature sensor is optimized for use with a diode-connected transistor whose ideality factor is equal to 1.008. Transistors with different ideality factors produce different remote temperature readings. Some typical discrete transistors may produce readings that vary up to 3°C from the correct value. Refer to the Maxim website (maxim-ic.com) Application Note: *Compensating for Ideality Factor and Series Resistance Differences Between Thermal Sense Diodes* for additional information.

## Thermistors

The MAX6698 reads up to three external thermistors. Each thermistor is combined with an external resistor to form a voltage-divider that is connected to a reference voltage (VREF). Thermistor readings are voltage values and are directly related to temperature. However, because thermistors are very nonlinear, these values are not calibrated to temperature in degrees C. Refer to the MAX6698 data sheet for more information.

## ALERT and OVERT Temperature Limits

The MAX6698 has ALERT and OVERT (overtemperature) limit registers. Temperature exceeding the ALERT limit register generates an alert interrupt. Exceeding the OVERT limit sets the overtemperature bit in the status

register and asserts the OVERT output pin. **Note:** OVERT limit only applies to remote channel 1, thermistor 1, thermistor 2, and thermistor 3.

Read the limits by clicking on the **Read** buttons. The value is shown to the right of the button. Change the limits by entering the value into the appropriate edit field and clicking on the **Write** button. Note that OVERT has 4°C of hysteresis. The temperature must decrease 4°C below the value set in the OVERT limit register to deassert the OVERT output.

## Configurations 1, 2, and 3

The configuration 1 register controls the STOP bit, the power-on-reset (POR ) bit, the SMB timeout disabled bit, the remote 1 fast conversion bit, and the resistance cancellation bit. Configuration 2 enables or disables the ALERT interrupt. Configuration 3 enables or disables the OVERT outputs.

Figure 2 shows the checkboxes for the configuration 1 register. Each checkbox corresponds to a bit in the register. Tables 1, 2, and 3 describe the function for each checkbox in configurations 1, 2, and 3.

Read the register by clicking on the **Read** button. Change the register by selecting or deselecting the desired functions and clicking on the **Write** button.

**Table 1. Configuration 1 Register Checkboxes**

BIT	NAME	STATE	DESCRIPTION
7	STOP	Checked	Places the MAX6698 in software standby mode.
		Unchecked*	Places the MAX6698 in operational mode.
6	POR	Checked	Resets all registers to their default values including the configuration 1 register. After selecting the POR checkbox, the checkbox returns to the unchecked state.
		Unchecked*	Normal operation.
5	SMB Timeout Disabled	Checked	Disables the SMBus timeout, as well as alert response, thus providing true I <sup>2</sup> C compatibility.
		Unchecked*	Enables the SMBus timeout.
4	Remote 1 Fast Conversion	Checked	Enables more frequent conversions on remote channel 1.
		Unchecked*	Disables fast conversion.
3	Resistance Cancellation	Checked	The MAX6698 cancels series resistance in the remote channel 1 diode.
		Unchecked*	Disables resistance cancellation.
2	Reserved	—	Not used.
1	Reserved	—	Not used.
0	Reserved	—	Not used.

\*POR state.

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**Table 2. Configuration 2 Register Checkboxes**

BIT	NAME	STATE	DESCRIPTION
7	Reserved	—	Not used.
6	Mask Local ALERT	Checked	Disables the local ALERT interrupt.
		Unchecked*	Enables the local ALERT interrupt.
5	Mask Thermistor 3 ALERT	Checked	Disables the thermistor 3 ALERT interrupt.
		Unchecked*	Enables the thermistor 3 ALERT interrupt.
4	Mask Thermistor 2 ALERT	Checked	Disables the thermistor 2 ALERT interrupt.
		Unchecked*	Enables the thermistor 2 ALERT interrupt.
3	Mask Thermistor 1 ALERT	Checked	Disables the thermistor 1 ALERT interrupt.
		Unchecked*	Enables the thermistor 1 ALERT interrupt.
2	Mask Remote-Diode 3 ALERT	Checked	Disables the remote-diode 3 ALERT interrupt.
		Unchecked*	Enables the remote-diode 3 ALERT interrupt.
1	Mask Remote-Diode 2 ALERT	Checked	Disables the remote-diode 2 ALERT interrupt.
		Unchecked*	Enables the remote-diode 2 ALERT interrupt.
0	Mask Remote-Diode 1 ALERT	Checked	Disables the remote-diode 1 ALERT interrupt.
		Unchecked*	Enables the remote-diode 1 ALERT interrupt.

\*POR state.

**Table 3. Configuration 3 Register Checkboxes**

BIT	NAME	STATE	DESCRIPTION
7	Reserved	—	Not used.
6	Reserved	—	Not used.
5	Mask Thermistor 3 Overtemp	Checked	Prevents OVERT from being asserted by a thermistor 3 fault.
		Unchecked*	Allows OVERT to be asserted by a thermistor 3 fault.
4	Mask Thermistor 2 Overtemp	Checked	Prevents OVERT from being asserted by a thermistor 2 fault.
		Unchecked*	Allows OVERT to be asserted by a thermistor 1 fault.
3	Mask Thermistor 1 Overtemp	Checked	Prevents OVERT from being asserted by a thermistor 1 fault.
		Unchecked*	Allows OVERT to be asserted by a thermistor 1 fault.
2	Reserved	—	Not used.
1	Reserved	—	Not used.
0	Mask Remote-Diode 1 Overtemp	Checked	Prevents OVERT from being asserted by a remote-diode 1 fault.
		Unchecked*	Allows OVERT to be asserted by a remote-diode 1 fault.

\*POR state.

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## **Status 1, 2, and 3**

The status 1, 2, and 3 boxes display the critical and fault conditions that occur. Each line corresponds to a

bit in the registers. See Tables 4, 5, and 6 for a list of the status conditions.

Read the status by clicking on the **Read Status** button.

**Table 4. Status 1 Register**

BIT	NAME	DESCRIPTION
7	Reserved	Not used.
6	Local ALERT	The temperature of the MAX6698 is above the value set in the local ALERT limit register.
5	Thermistor 3 ALERT	The voltage of thermistor 3 is above the value set in the thermistor 3 ALERT limit register.
4	Thermistor 2 ALERT	The voltage of thermistor 2 is above the value set in the thermistor 2 ALERT limit register.
3	Thermistor 1 ALERT	The voltage of thermistor 1 is above the value set in the thermistor 1 ALERT limit register.
2	Remote-Diode 3 ALERT	The temperature of remote-diode 3 is above the value set in the remote-diode 3 ALERT limit register.
1	Remote-Diode 2 ALERT	The temperature of remote-diode 2 is above the value set in the remote-diode 2 ALERT limit register.
0	Remote-Diode 1 ALERT	The temperature of remote-diode 1 is above the value set in the remote-diode 1 ALERT limit register.

**Table 5. Status 2 Register**

BIT	NAME	DESCRIPTION
7	Reserved	Not used.
6	Reserved	Not used.
5	Thermistor 3 Overtemp	The voltage of thermistor 3 is above the value set in the thermistor 3 overtemperature limit register.
4	Thermistor 2 Overtemp	The voltage of thermistor 2 is above the value set in the thermistor 2 overtemperature limit register.
3	Thermistor 1 Overtemp	The voltage of thermistor 1 is above the value set in the thermistor 1 overtemperature limit register.
2	Reserved	Not used.
1	Reserved	Not used.
0	Remote-Diode 1 Overtemp	The temperature of remote-diode 1 is above the value set in the remote-diode 1 overtemperature limit register.

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Table 6. Status 3 Register

BIT	NAME	DESCRIPTION
7	Reserved	Not used.
6	Reserved	Not used.
5	Reserved	Not used.
4	Reserved	Not used.
3	Reserved	Not used.
2	Remote-Diode 3 Fault	DXP3 and DXN3 are either shorted or open circuit.
1	Remote-Diode 2 Fault	DXP2 and DXN2 are either shorted or open circuit.
0	Remote-Diode 1 Fault	DXP1 and DXN1 are either shorted or open circuit.

### Alert

The message ALERT appears in the Alert box when an interrupt condition occurs unless the configuration register is set to mask the alert. The cause of the interrupt is shown in the status boxes. To clear the interrupt, first eliminate the condition that caused it and click on **Read Alert**.

### Automatic Read

The program polls the device for new temperature and status data a maximum of two times a second (2Hz). To disable the polling of data, deselect **Automatic Read** on the **Action** menu.

### Data Logging

Select **Data Logging** on the **Action** menu to activate data logging. Data logging saves temperature, voltage, and status data to a text file that includes a time/date stamp next to each data point. If automatic read is enabled, data is sampled at 2Hz; however, the data is logged to the file only if the temperature or status has changed. This slows the growth of the data-logging file. When automatic read is disabled, the data is logged each time **Read All** is selected on the **Action** menu. To stop data logging, deselect **Data Logging** on the **Action** menu.

### Simple SMBus Commands

There are two methods for communicating with the MAX6698—through the normal user-interface panel or through the SMBus commands available by selecting

**Interface** on the **Debug** menu. A display pops up that allows the SMBus protocols, such as read byte and write byte to be executed. To stop normal user-interface execution so that it does not override the manually set values, turn off the update timer by deselecting **Automatic Read** on the **Action** menu.

The SMBus dialog boxes accept numeric data in binary, decimal, or hexadecimal. Hexadecimal numbers should be prefixed by \$ or 0x. Binary numbers must be exactly eight digits. **Note:** In places where the slave address asks for an 8-bit value, it must be the 7-bit slave address of the MAX6698 with the last bit set to 1 for a read operation and zero for a write.

### Jumpers JU1, JU2, JU3

Jumpers JU1, JU2, and JU3 connect the onboard 2N3906 transistors as the external diodes. To use different diodes, cut the trace shorting the two pins of each jumper and connect the diodes (through twisted-pair wire) to the MAX6698 EV kit.

### Jumpers JU4, JU5, JU6

Jumpers JU4, JU5, and JU6 connect the onboard thermistors to the MAX6698. To use different thermistors, cut the trace shorting the two pins of each jumper and connect the thermistors (through twisted-pair wire) to the MAX6698 EV kit.

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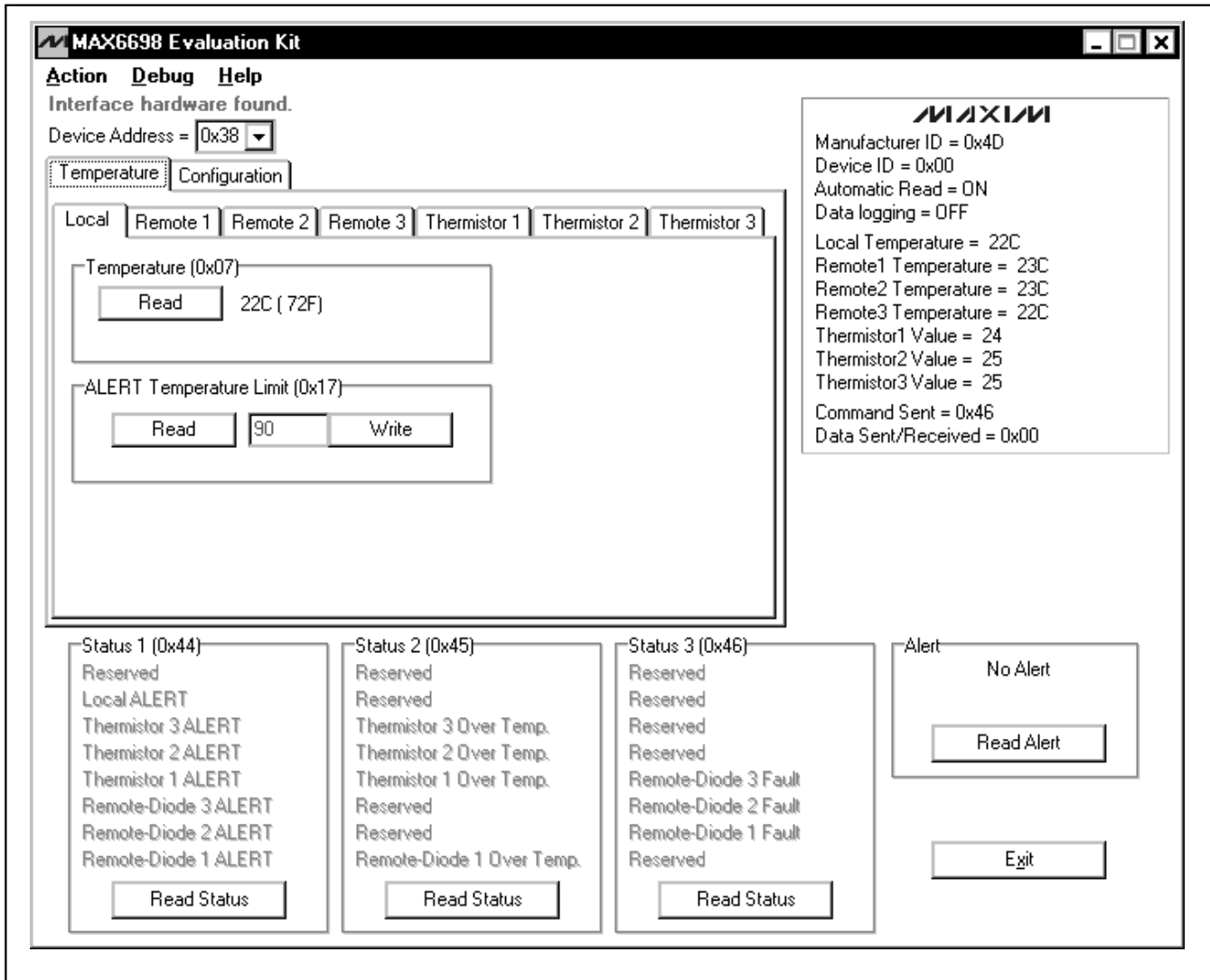


Figure 1. Main Window for the MAX6698 EV Kit Software

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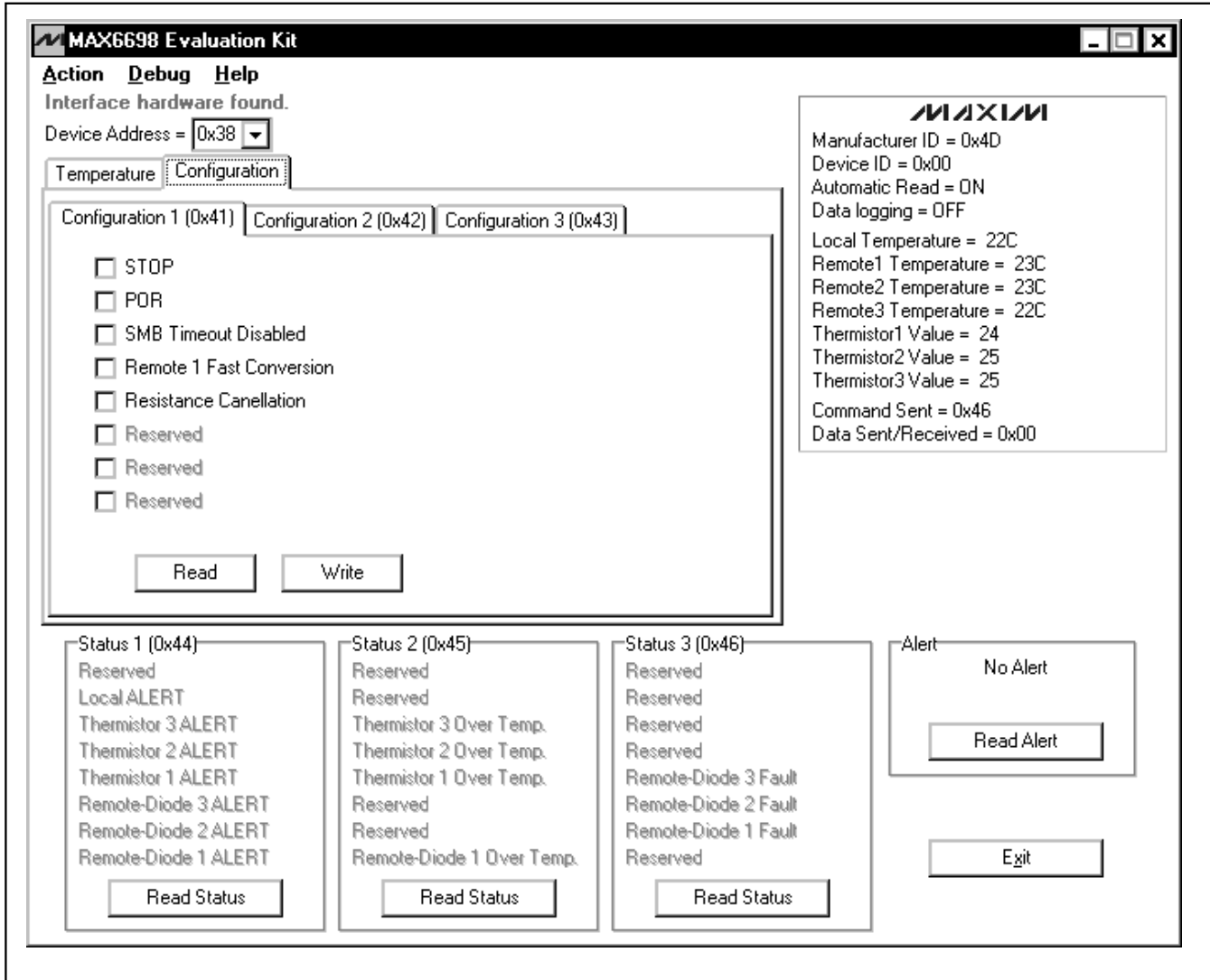


Figure 2. MAX6698 EV Kit Software Showing the Configuration Panel



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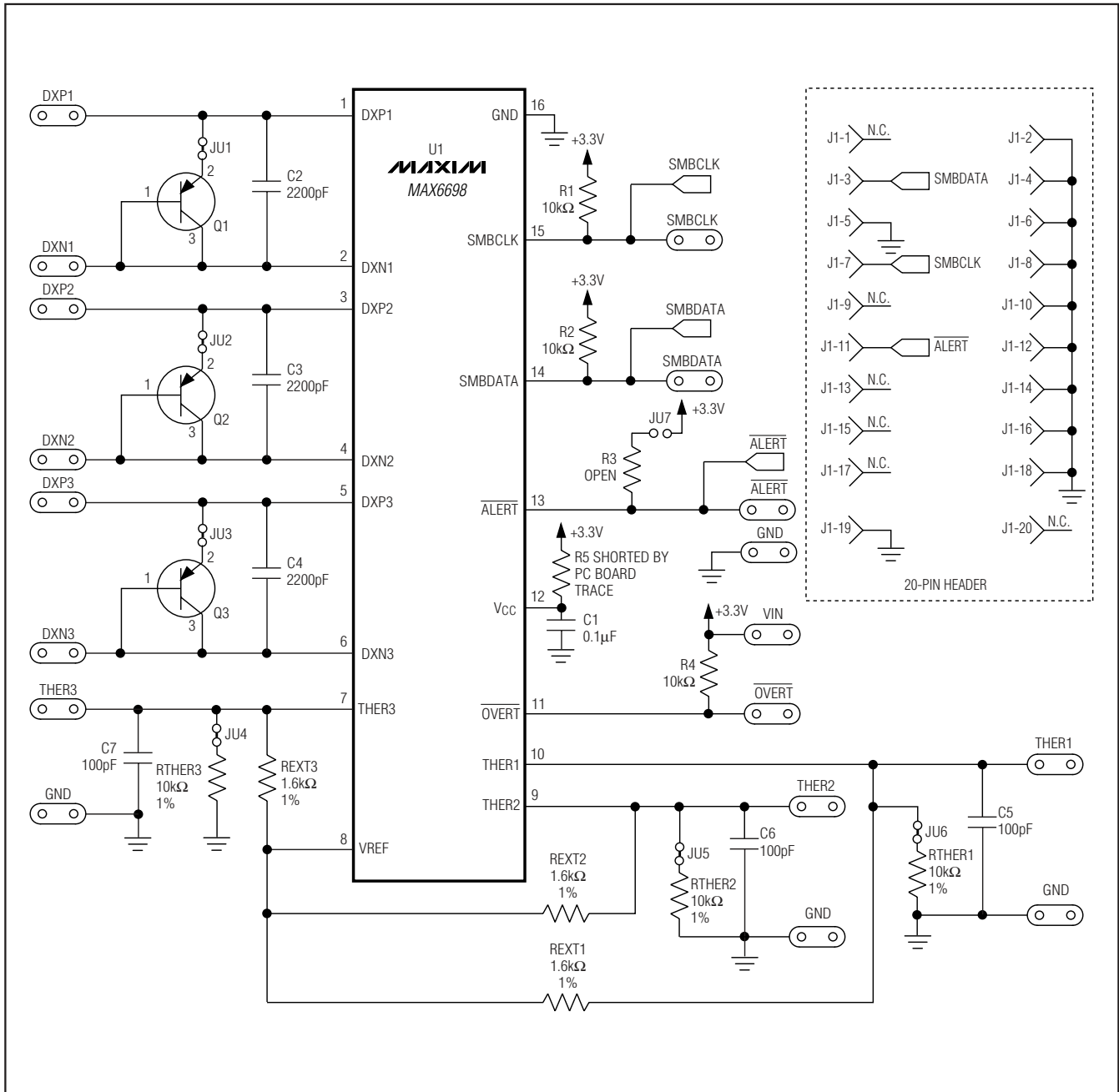


Figure 3. MAX6698 EV Kit Schematic

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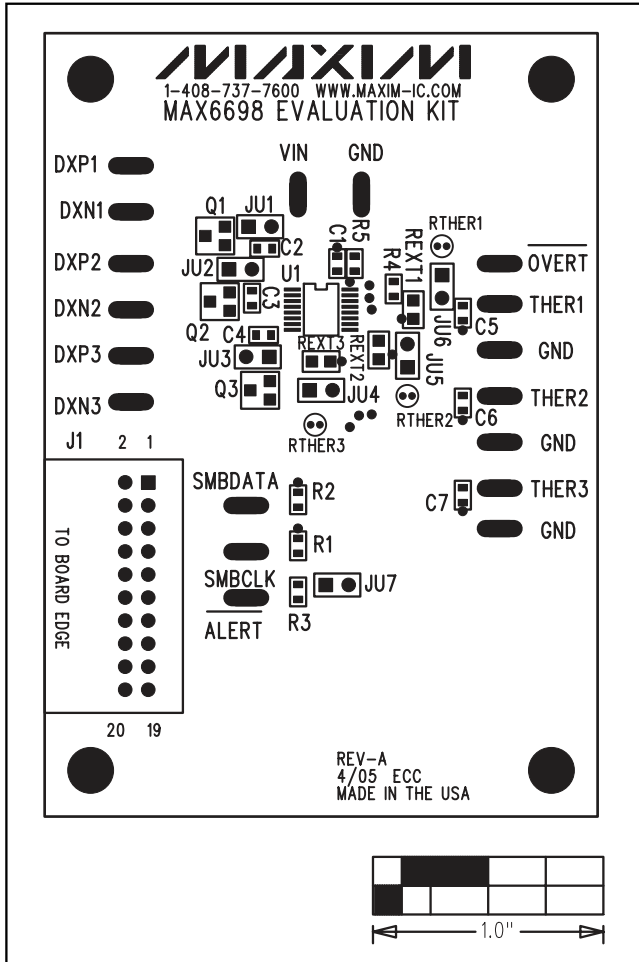


Figure 4. MAX6698 EV Kit Component Placement Guide—Component Side

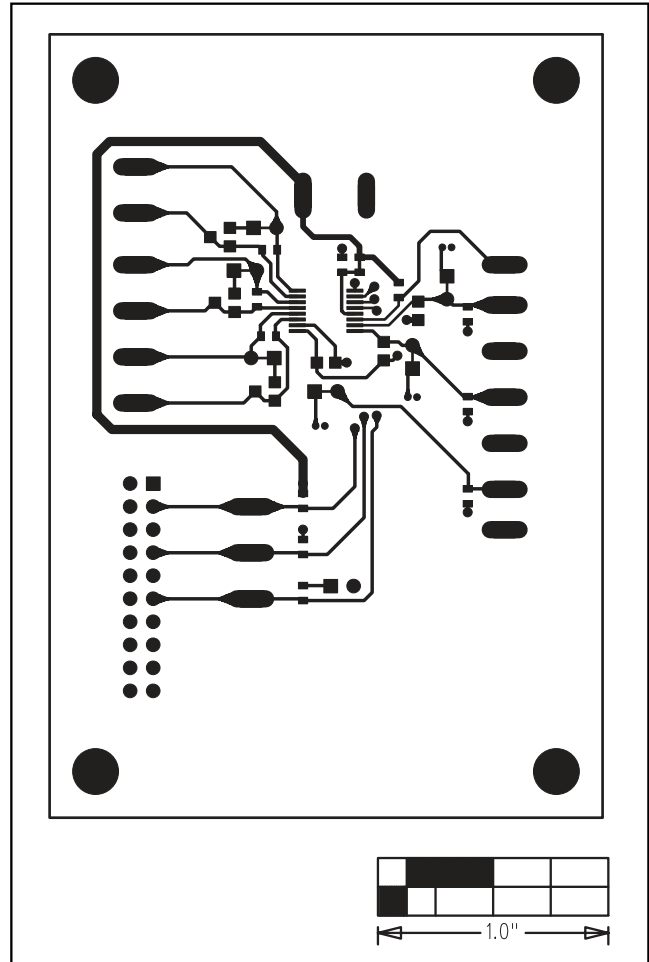


Figure 5. MAX6698 EV Kit PC Board Layout—Component Side

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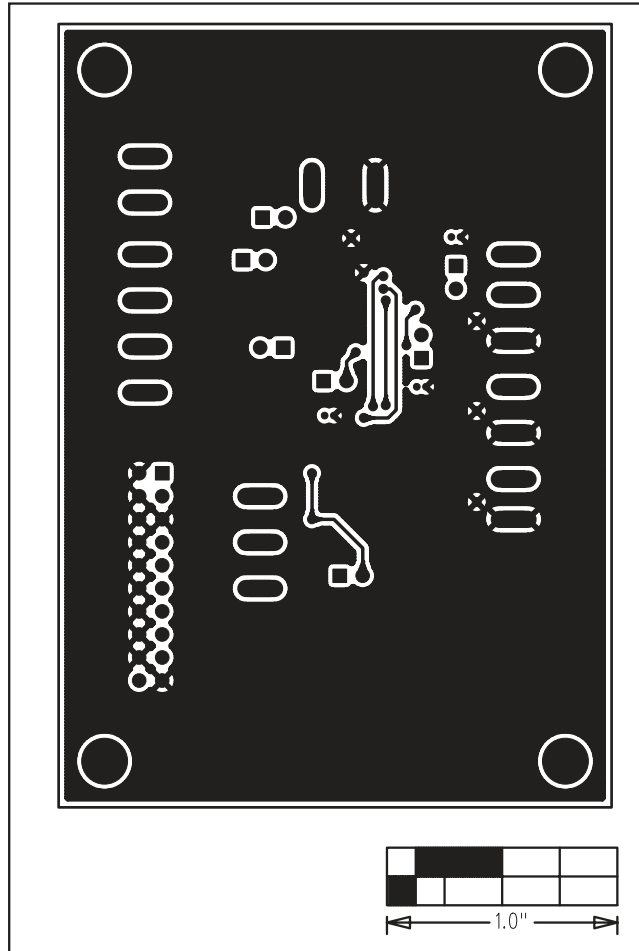


Figure 6. MAX6698 EV Kit PC Board Layout—Solder Side

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