# MAX31730 Evaluation Kit

# Evaluates: MAX31730

## General Description

The MAX31730 evaluation kit (EV kit) provides the hardware and software graphical user interface (GUI) necessary to evaluate the MAX31730 3-channel remote temperature sensor in a µMAX® or TDFN package. The EV kit includes a MAX31730 installed, as well as three external diode-connected transistors and a USB-to-SMBus/I2C interface.

## EV Kit Contents

- Assembled circuit board including MAX31730
- Mini USB cable

## Features

- Easy Evaluation of the MAX31730
- Three External Diode-Connected Transistors
- EV Kit Hardware is USB Powered (USB Cable Included)
- USB HID Interface
- Windows XP®- and Windows® 7-Compatible Software
- RoHS Compliant
- Proven PCB Layout
- Fully Assembled and Tested

***Ordering Information* appears at end of data sheet.**

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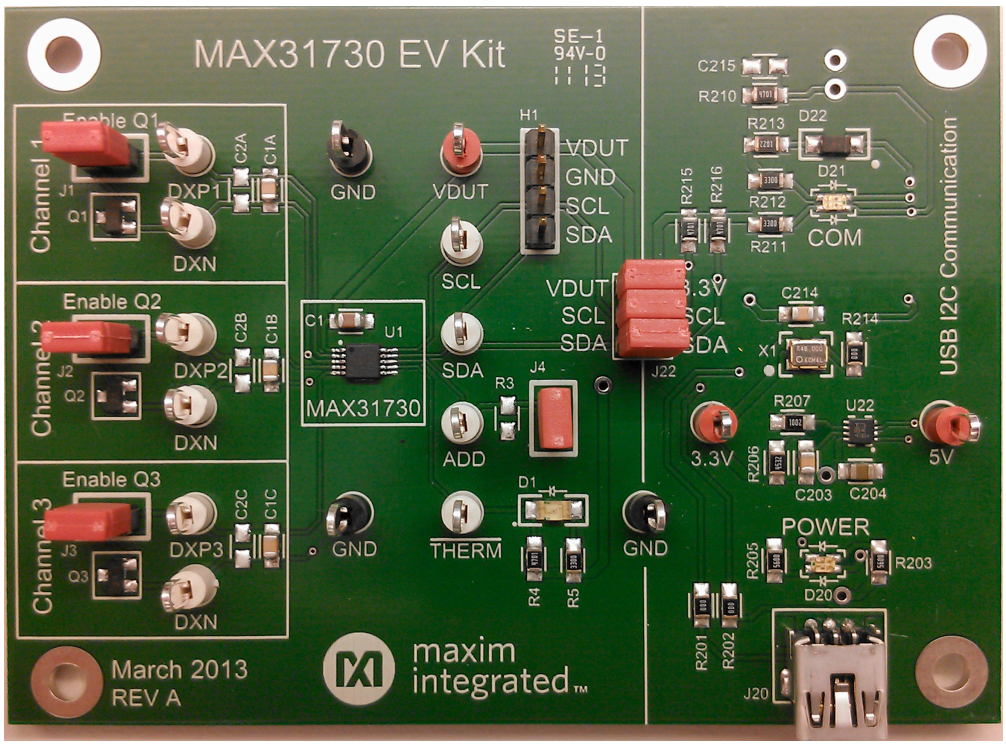
*Windows and Windows XP are registered trademarks and registered service marks of Microsoft Corporation.*

## MAX31730U EV Kit Photo



## EV Kit Files

| FILE | DESCRIPTION |
|---|---|
| MAX31730EVKitSetup.EXE | Application Program |

**Note***: The .EXE is downloaded as a .ZIP file.*

## Quick Start

### Required Equipment

- MAX31730 EV Kit Hardware
- Windows XP or Windows 7 PC
- Spare USB port
- Mini USB cable (included)

**Note:** In the following sections, software-related items are identified by bolding. Text in **bold** refers to items directly from the install or EV kit software. Text in **bold and underlined** refers to items from the Windows operating system.

### Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation:

1) Ensure that jumpers/shunts (J22, J1–J3) are installed.
2) Set the EV kit hardware on a nonconductive surface to ensure that nothing on the PCB gets shorted together.
3) Prior to starting the GUI, connect the EV kit hardware to a PC using the supplied Mini-USB cable, or equivalent. The power LED (D20) should be green and the com LED (D21) should be red and slowly flash orange.
4) Windows should automatically begin installing the necessary device driver. The USB interface of the EV kit hardware is configured as an HID device and therefore does not require a unique/custom device driver. Once the driver installation is complete, a Windows message appears near the **System Icon** menu indicating that the hardware is ready to use. Do not attempt to run the GUI prior to this message. If you do, you must close the application and restart it once the driver installation is complete. On some versions of Windows, administrator privileges may be required to install the USB device.
5) Once the device driver installation is complete. Visit www.maximintegrated.com/evkitsoftware to download the latest version of the EV kit software, MAX31730EVKitSetup.ZIP. Save the EV kit software to a temporary folder.
6) Unzip the .ZIP file and double-click the .EXE file to run the installer. A message box stating: **The publisher could not be verified. Are you sure you want to run this software?** may appear. If so, click **Yes**.
7) Follow the instructions on the installer and once complete, click **Finish**. The default location of the GUI is in the program files directory.
8) When the GUI appears, the text in the bottom right-hand corner should display **EV Kit Hardware Connected**. The com LED (D21) on the EV kit board should turn green.

## Detailed Description of Software

### Software Startup

If the MAX31730 EV kit is connected when the software is opened, the software first initializes the hardware to communicate. The software then searches for all slave addresses on the I2C bus and connects to the first valid slave address. The GUI displays **EV Kit Hardware Connected** in the bottom right-hand corner. If the EV kit is not connected on software startup, the GUI populates with default EV kit values. Once the EV kit is connected, the GUI executes the sequence above.

### Menu and Status Bar

The **File** menu item contains save and load options. To save the current GUI configuration, select **Save Config** or **Save Config As**. This saves all the configuration registers to an XML file. If a device is connected, this reads and saves data directly from the device; otherwise, it saves the configuration that is currently displayed on the GUI. **Load Config** writes all the configuration data stored in the XML file to the device and then performs a read to update the GUI with the new values. If a device is not connected, **Load Config** writes to a virtual device and displays the data on the GUI. The **Device** menu item allows the user to connect to a desired device. **Find Slave Addresses** searches for all slave addresses connected to the I2C bus. To select a device, click **Select Slave Address** and all the slave addresses found are shown and are selectable. The **Options** menu contains the **Polling Rate** option and the **Log Polling Data to File** option. The **Polling Rate** sets the delay between reads. To save the polling data to a CSV file, check the **Log Polling Data to File** option and then click **Start Polling** to select a name for the file and begin reading.

## Status Log

The status log below the tabs displays all the actions the GUI performs. Whenever an SMBus command is read or written, the action is confirmed by the log. The log can be cleared by pressing the **Clear** button.

## Status Tab

The **Status** tab sheet (Figure 1) displays all the current temperatures and the fault status. All values in the **Temperature Status** group box are read when the tab is selected. To read the values again, press the **Read Temp Status** button.The **One Shot Read** button is only enabled when the device is in standby mode by checking the **Stop** option on the **Config** tab (Figure 2). The **Over Temp** and **Under Temp** status is read from Thermal Status, High Temperature (32h) and Thermal Status, Low Temperature (33h) registers. The **Diode Fault** status is read from Diode Fault Status (36h) register. The **Temperature** column is read from the temperature registers (00h to 07h) and the **Highest Temperature** is read from registers 10h to 11h. To graph the temperatures, start polling by clicking the **Start Polling** button in the menu bar. To stop polling, press the **Stop Polling** button. Polling automatically stops if items in the **File** or **Connection** menu are selected, or if the **POR** button is pressed. To save the polling data to a CSV file, check **Log Polling Data to File** in the **Options** menu before polling is started.

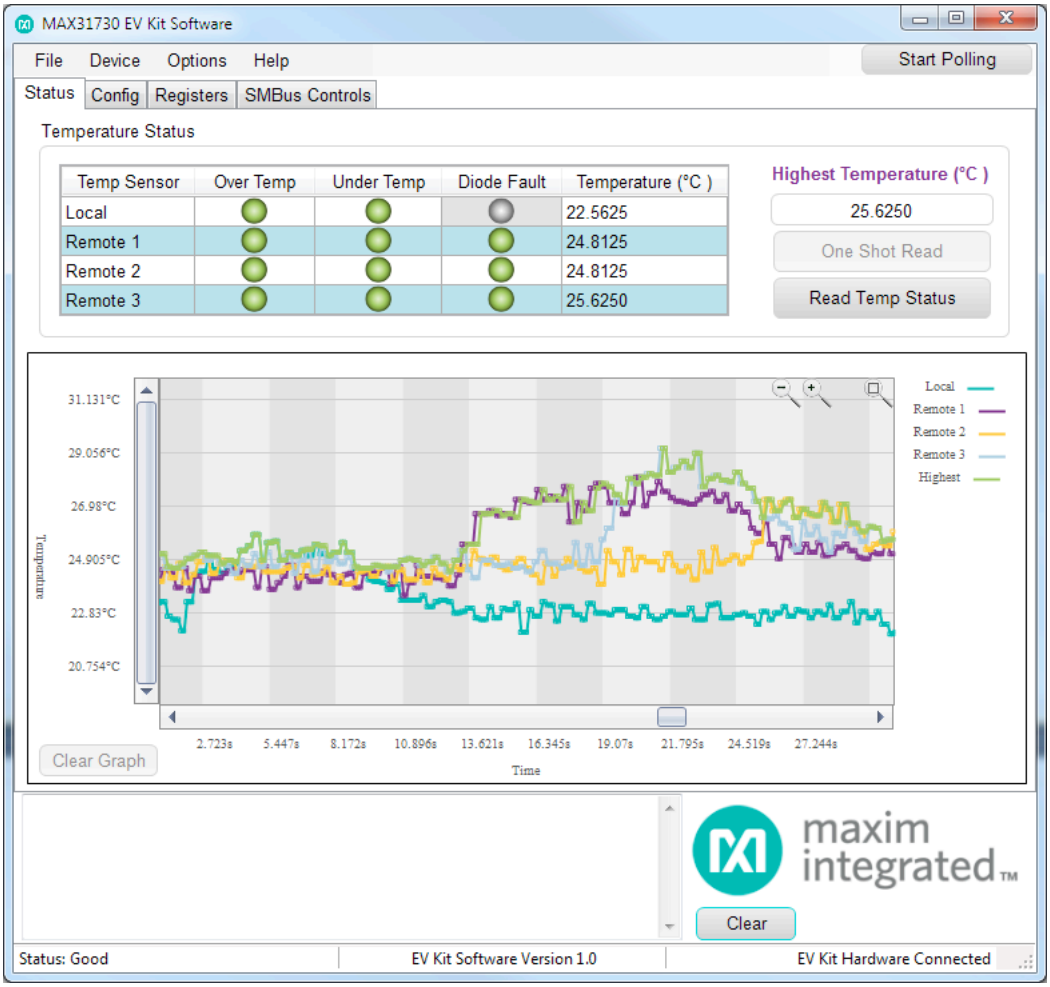



*Figure 1. MAX31730 EV Kit Software GUI (Status Tab)*

## Configuation Tab

The **Config** tab sheet (Figure 2) contains all the configuration registers. All values are read when the tab is selected. In the tables, hold the mouse over the column header to see which register(s) the cells in the column read/write to. The **Beta Value** column is the only column where all the cells are read-only. If the **Extended Range** checkbox in the **Configuration Register (13h)** group box is checked, all the temperature values on the **Config** and **Status** tab are updated to reflect the extended range format. The hex values stored in these registers are not changed.

## Registers Tab

The **Registers** tab sheet (Figure 3) displays all the registers and their current data. To read the registers, press the **Read All** button. To write to a register, enter the hex value in the cell and click another cell or press Enter on the keyboard.

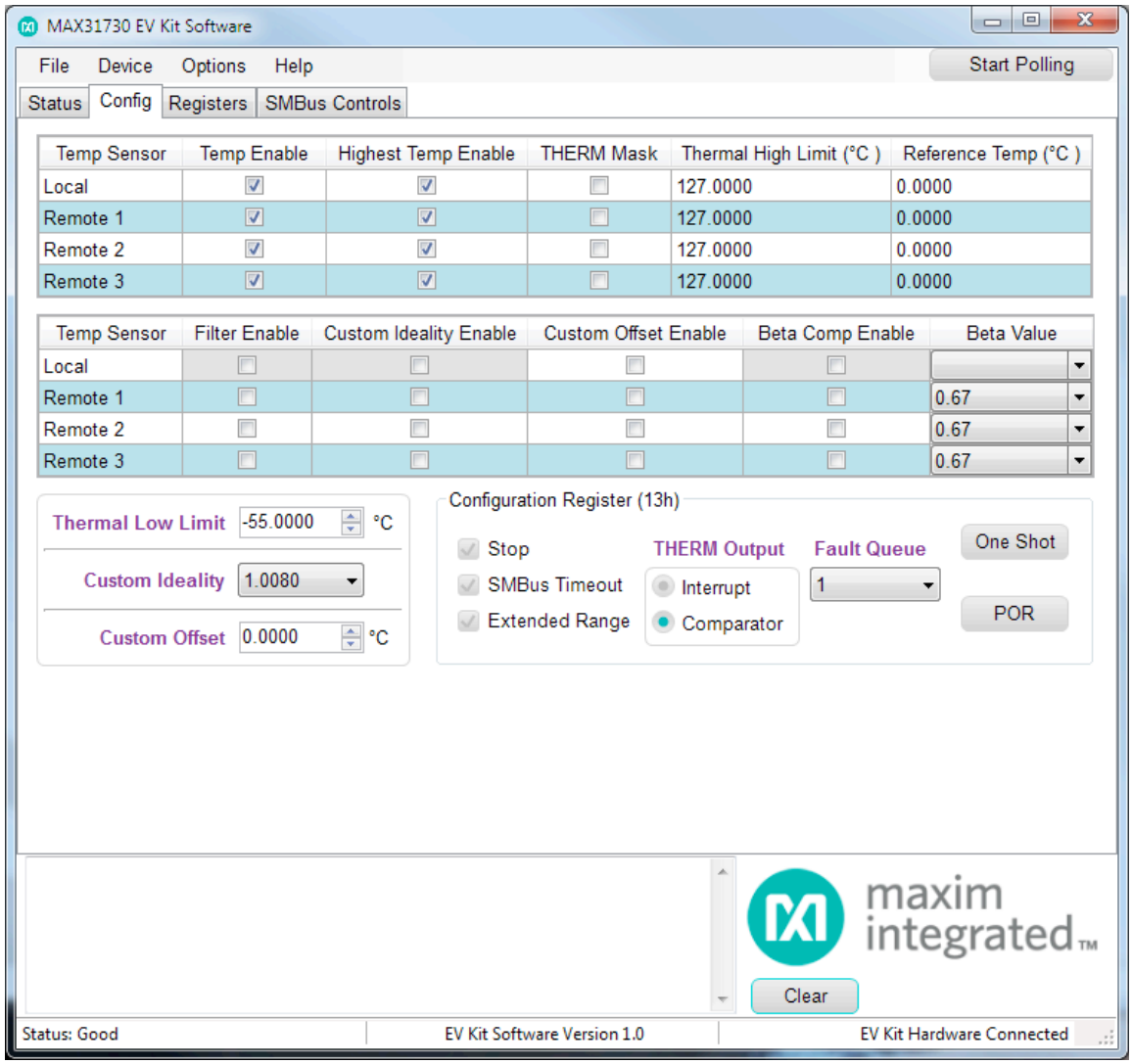



*Figure 2. MAX31730 EV Kit Software GUI (Config Tab)*

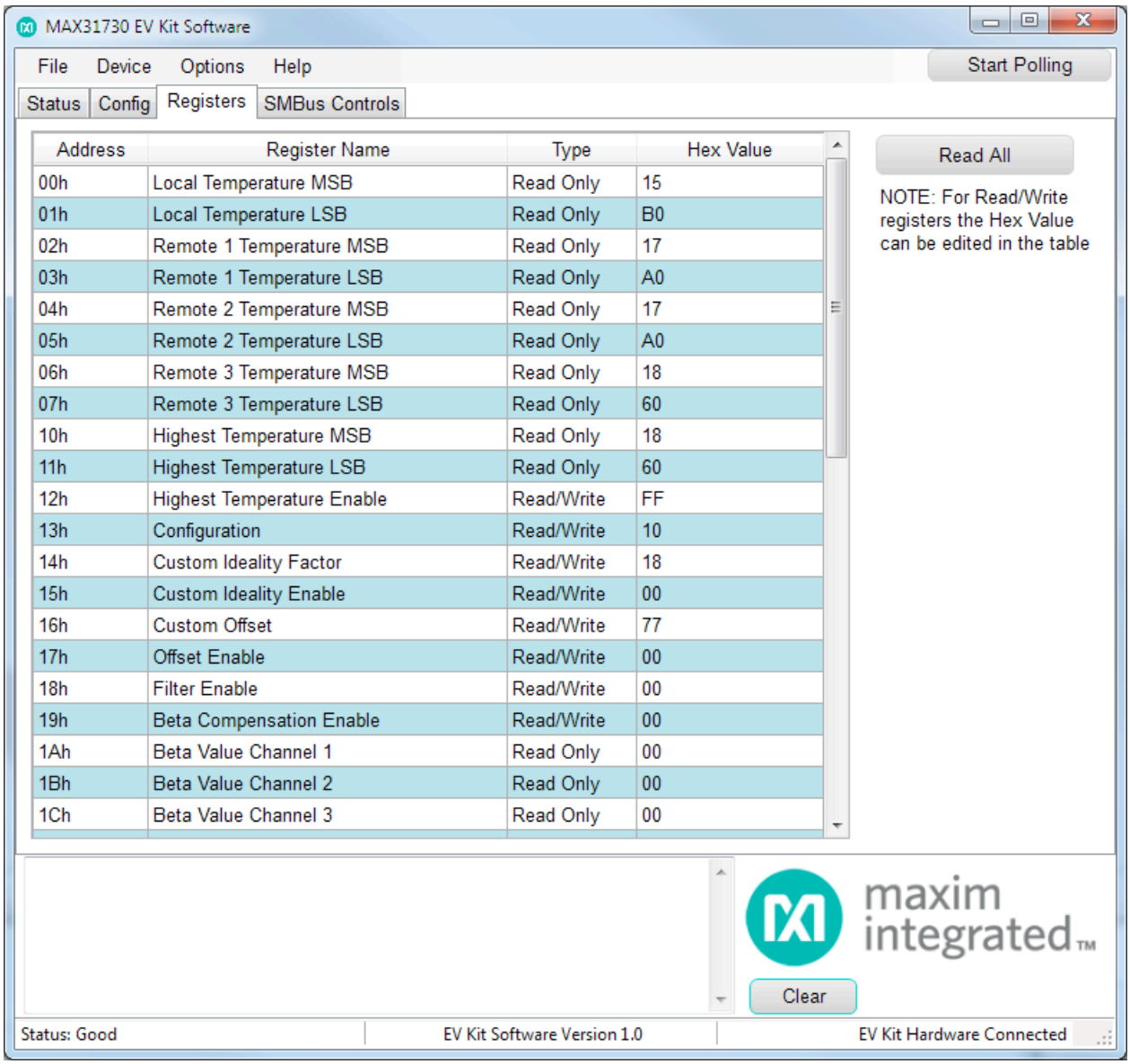



*Figure 3. MAX31730 EV Kit Software GUI (Registers Tab)*

## SMBus Controls Tab

The **SMBus Controls** tab sheet (Figure 4) allows the user to read and write to registers using hex values. The **One and Two Byte Operations (all HEX values)** group box contains controls to read/write 1 or 2 bytes at a time. To read or write a register, enter the register address desired in the **Addr** or **Start Addr** edit box and press the **Read** or **Write** button. The **Bitwise Read/Write** group box allows the user to read/write the data in binary format. To read or write a register, enter the register address in the **Address** edit box and press the **Read** or **Write** button. The data bits can be flipped by pressing the bit buttons. The **All 0's**, **All 1's**, and **Invert** buttons are useful shortcuts to change all the bits at one time. The **Page Mode (all HEX values)** group box reads/writes one page (8 bytes) at a time. To read or write a page of memory, enter the starting register address in the **Starting Address** edit box and press the **Read** or **Write** button.

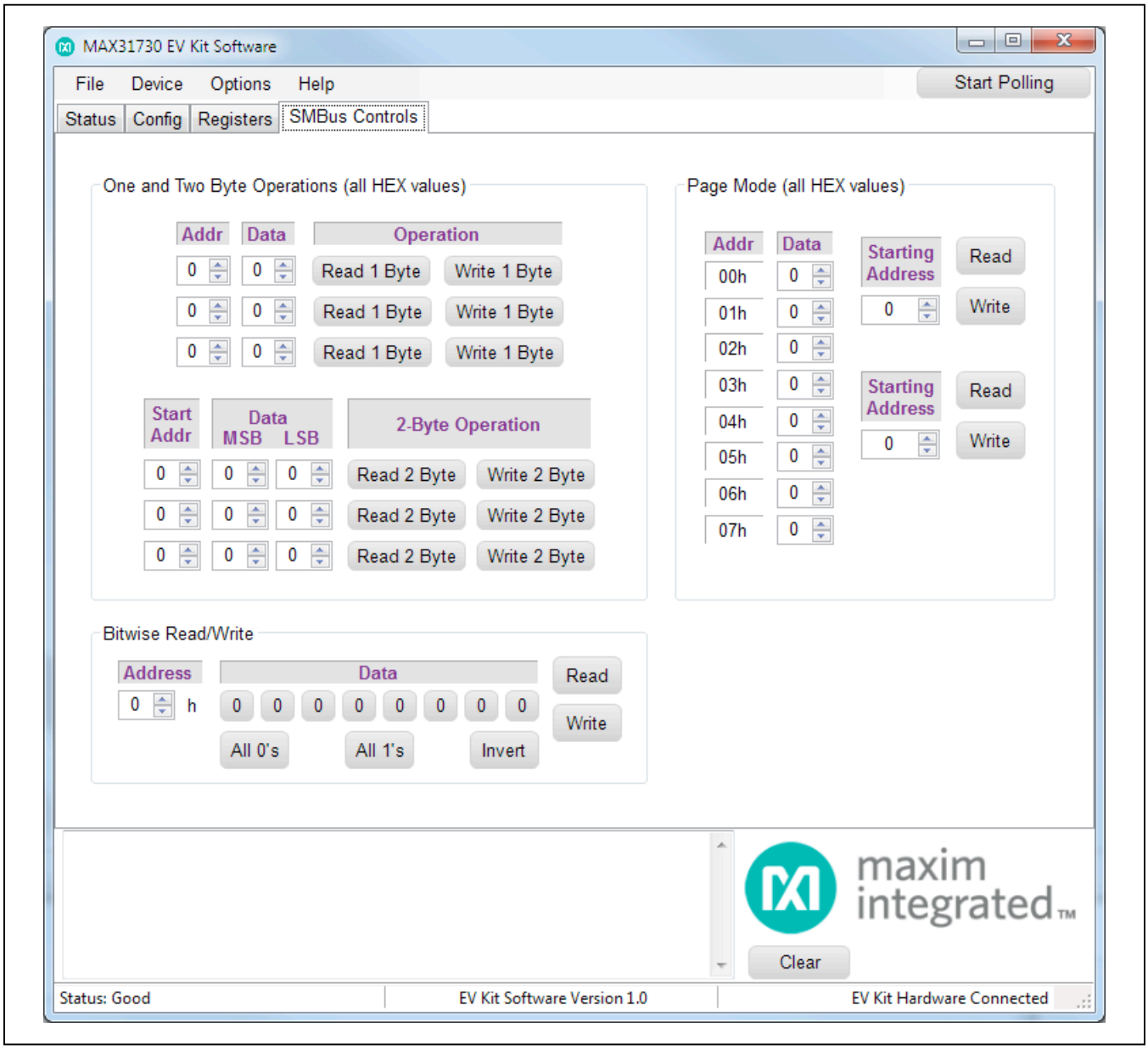



*Figure 4. MAX31730 EV Kit Software GUI (SMBus Controls Tab)*

## Detailed Description of Hardware

### User-Supplied I²C Interface

To communicate with the MAX31730 using a user-supplied I²C interface, first remove all J22 jumpers to disconnect the on-board USB I²C interface. Connect all pins on header H1 to the off-board I²C interface.

### Changing the Slave Address

The default slave address for the IC is 38h. This address can be changed to an address listed in Table 1 by removing jumper J4 and populating resistor R3.

### User-Supplied Remote Diode

To connect a user-supplied external remote diode, first remove the channel jumper (J1, J2, or J3) to disconnect the on-board diode. Then connect DXP1, DXP2, or DXP3 and DXN to the external diode. For the TDFN package, each diode has a separate DXN for each channel.

## Troubleshooting

The EV kit should work on the first try directly out of the box. In the rare occasion that a problem is suspected, see Table 4 to help troubleshoot the issue.

## Table 1. Slave Addresses

| SLAVE ADDRESS | R3(Ω) |
|---|---|
| 9Eh | Open (> 12kΩ) |
| 9Ch | 9.31kΩ |
| 9Ah | 6.81kΩ |
| 98h | 4.75kΩ |
| 3Eh | 3.01kΩ |
| 3Ch | 1.69kΩ |
| 3Ah | 750Ω |
| 38h | 0 (short to GND with J4 installed) |

## Table 2. Description of LEDs

| LED | COLOR | DESCRIPTION |
|---|---|---|
| D1 | Red | $\overline{\text{THERM}}$: A thermal fault has occured. |
| D20 (Power) | Red | USB Power Fault: A fault occurred due to overvoltage limit, current limit, or thermal limit. |
| | Green | USB Power: USB power supply is on. |
| D21 (Com) | Red | Communication: After the software has initialized the hardware, the LED flashes red when an I²C command is received. |
| | Green | Initialized: Hardware has been initialized by software. |

## Table 3. Description of Jumpers (J1–J4, J22)

| JUMPER | JUMPER NAME | DESCRIPTION |
|---|---|---|
| J1 | Enable Q1 | Connects the remote diode-connected transistor Q1 to DXP1. |
| J2 | Enable Q2 | Connects the remote diode-connected transistor Q2 to DXP2. |
| J3 | Enable Q3 | Connects the remote diode-connected transistor Q3 to DXP3. |
| J4 | ADD | Connects pin ADD to GND. |
| J22 | VDUT-3.3V | Supplies 3.3V from the USB I²C dongle to the EV kit board. |
| | SCL-SCL | Connects SCL from the USB I²C dongle to the IC's SCL. |
| | SDA-SDA | Connects SDA from the USB I²C dongle to the IC's SDA. |

## Table 4. Troubleshooting

| SYMPTOM | CHECK | SOLUTION |
|---|---|---|
| GUI says hardware not found | Is the LED labeled D20 red? | If yes, then the electronic fuse is in a fault state. Inspect for electrical shorts on the PCB and make sure that the PCB is not sitting on a conductive surface. |
| | Does the LED labeled D21 turn green when the GUI is running? | If not, then exit the GUI and try running it again. If D20 still does not turn green, then exit the GUI and try connecting the USB cable to a different USB port on the PC and wait for a Windows message that states the hardware is ready to use. Run the GUI again. |
| | Are any of the LEDs illuminated? | If not, then the PCB may not be getting power from USB. Try a different USB cable or a different USB port. |
| No slave address found and read/writes fail | Jumper J22 | Make sure three jumpers on J22 are installed. |
| GUI always displays a diode fault on the **Status** tab | J1, J2, or J3 | For the on-board diodes, jumpers J1–J3 must be installed to connect the diode to DXP. |

## Component List

| DESIGNATION | QTY | DESCRIPTION |
|---|---|---|
| C1, C212 | 2 | 0.1µF, X7R ceramic capacitors (0805) |
| C1A–C1C | 3 | 100pF, X7R ceramic capacitors (0805) |
| C2A–C2C, C215 | 0 | Do not populate, ceramic capacitors (0805) |
| C201, C202, C204 | 3 | 10µF, X5R ceramic capacitors (0805) |
| C203, C214 | 2 | 0.01µF, X7R ceramic capacitors (0805) |
| C211 | 1 | 1µF, X7R ceramic capacitor (0805) |
| C213 | 1 | 0.22µF, X7R ceramic capacitor (0805) |
| D1 | 1 | Red LED (1206) |
| D20, D21 | 2 | Red/green dual LEDs |
| D22 | 1 | 30V, 3A Schottky diode (MINI2) |
| H1 | 1 | 4-pin header, 2.54mm pitch |
| J1–J4 | 4 | 2-pin headers, 2.54mm pitch |
| J20 | 1 | 5-pin female Mini-USB |
| J21 | 0 | Do not populate, header |
| J22 | 1 | 6-pin (2 x 3) header, 2.54mm pitch |
| Q1–Q3 | 3 | Bipolar BJT PNP (SOT23) Fairchild MMBT3906 |
| R3 | 0 | Do not populate, resistor (0805) |
| R4, R210, R215, R216 | 4 | 4.7kΩ ±1% resistors (0805) |
| R5, R211, R212 | 3 | 330Ω ±1% resistors (0805) |
| R201, R202, R214 | 3 | 0Ω ±1% resistors (0805) |
| R203, R205 | 2 | 560Ω ±1% resistors (0805) |
| R204 | 1 | 100kΩ ±1% resistor (0805) |
| R206 | 1 | 45.3kΩ ±1% resistor (0805) |
| R207 | 1 | 10kΩ ±1% resistor (0805) |
| R213 | 1 | 2.2kΩ ±1% resistor (0805) |
| TP1, TP9, TP10 | 3 | Red test points |
| TP1A–TP1C, TP2, TP2A–TP2C, TP3–TP5 | 10 | White test points |
| TP6–TP8 | 3 | Black test points |
| U1 | 1 | 3-channel remote temperature sensor Maxim MAX31730AUB+ (10 µMAX) or MAX31730ATC+ (12 TDFN) |
| U20 | 1 | Microcontroller (28 SO) Microchip PIC18LF2550-I/SO |
| U21 | 1 | 50mA to 600mA current-limit switch (6 SOT23) Maxim MAX4995AAUT+ |
| U22 | 7 | 500mA LDO regulator (8 TDFN-EP*) Maxim MAX8902BATA+ |
| X1 | 1 | 48MHz, 3.3V oscillator (SMD) |
| — | 7 | Jumpers/shunts |
| — | 1 | Mini-USB cable |
| — | 1 | PCB: MAX31730 EV Kit |

**EP = Exposed pad.*

## Component Supplier

| SUPPLIER | PHONE | WEBSITE |
|---|---|---|
| Fairchild Semiconductor | 408-822-2000 | www.fairchildsemi.com |

***Note:*** *Indicate that you are using the MAX31730 when contacting this component supplier.*

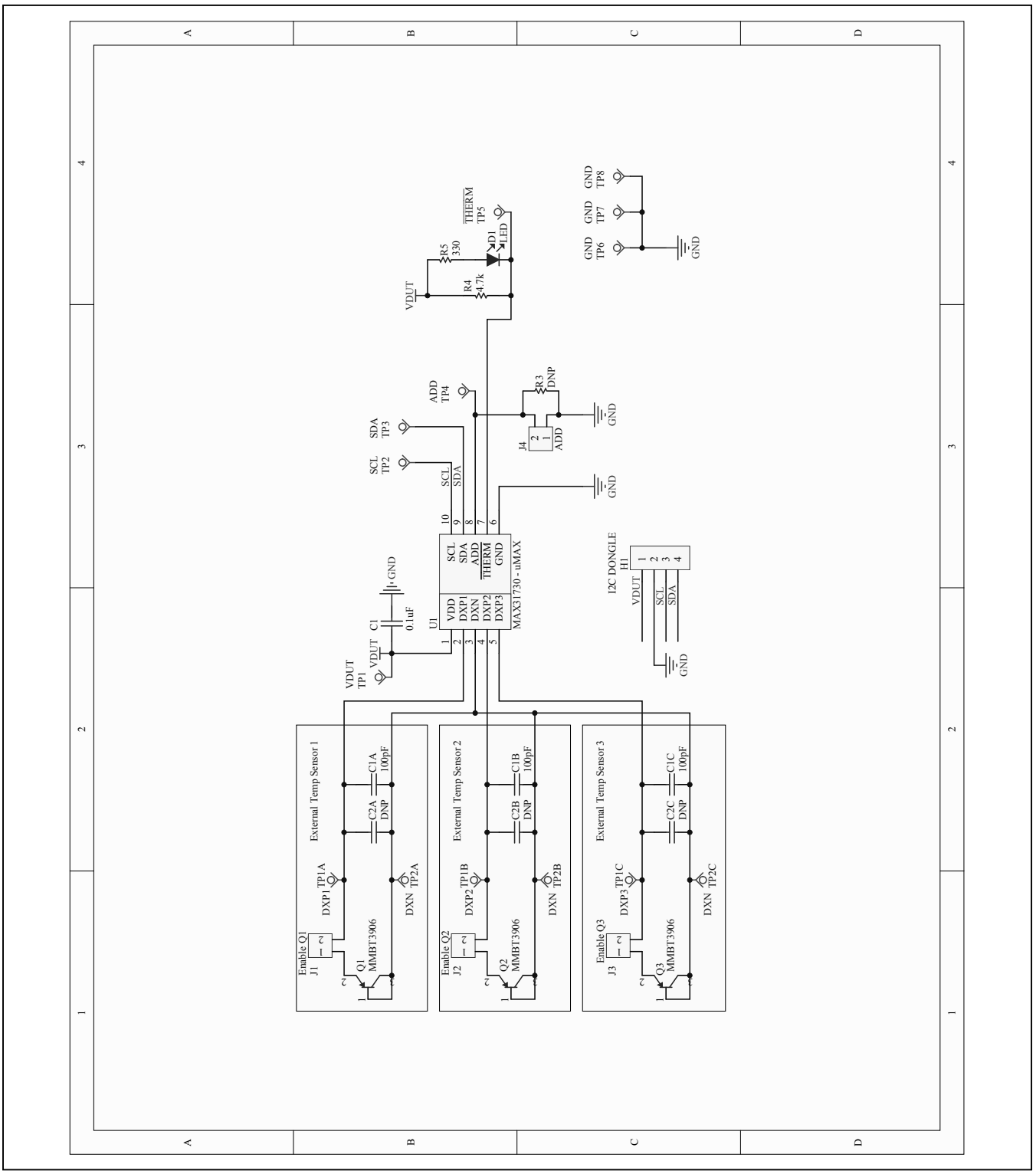



*Figure 5a. MAX31730U EV Kit Schematic (µMAX) (Sheet 1 of 2)*

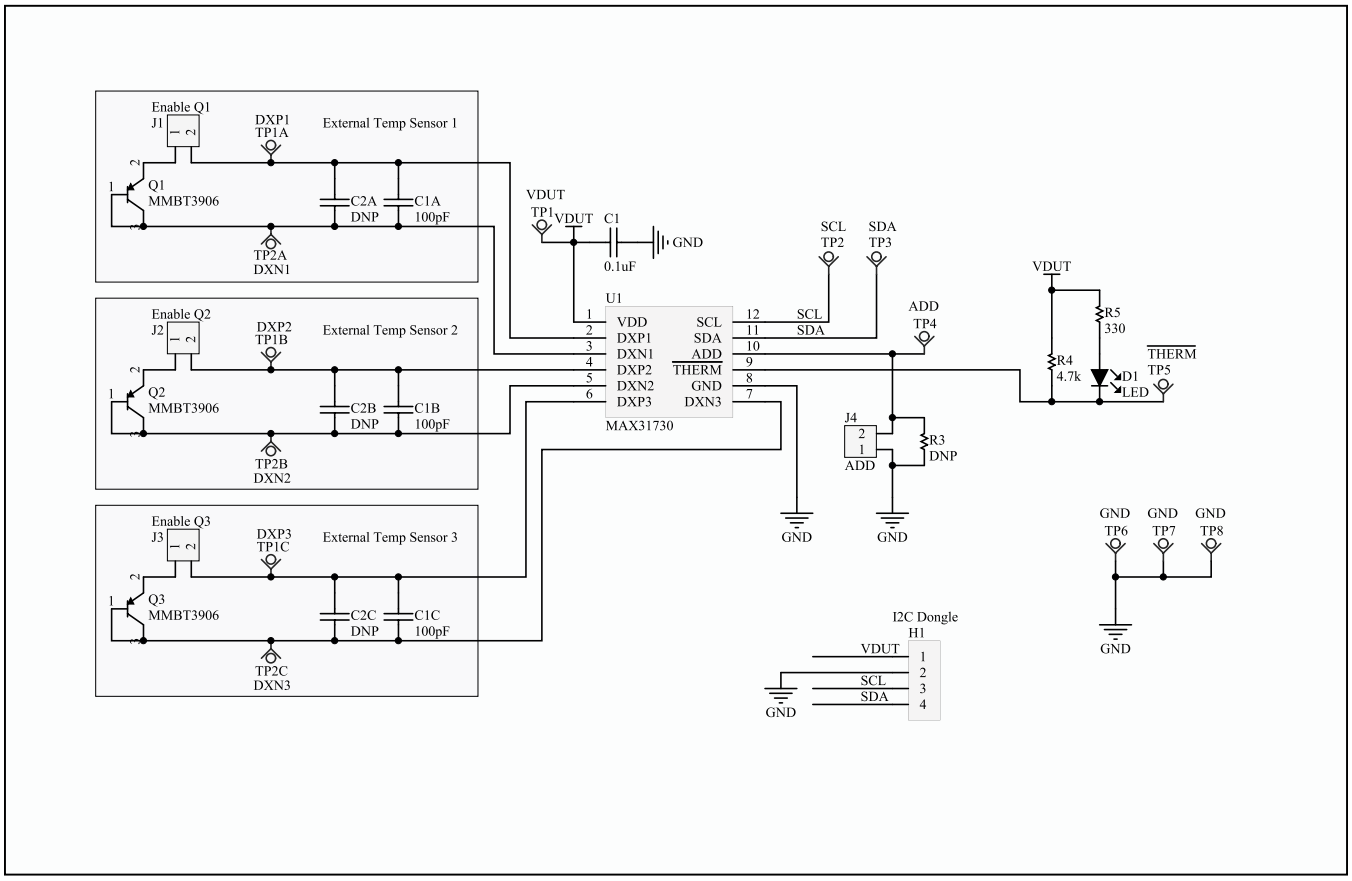



*Figure 5b. MAX31730T EV Kit Schematic (TDFN) (Sheet 1 of 2)*

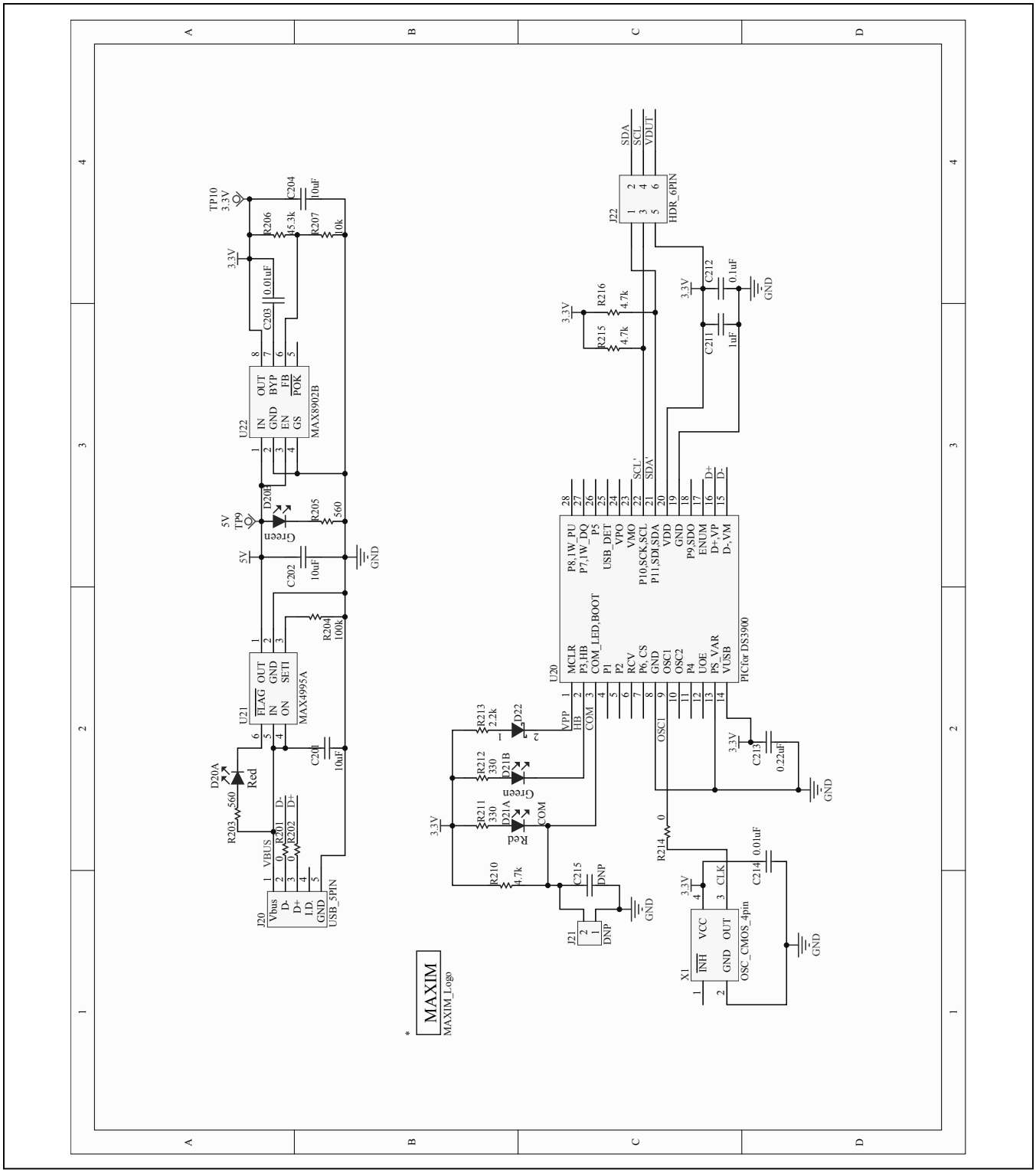



*Figure 5c. MAX31730 EV Kit Schematic (µMAX or TDFN) (Sheet 2 of 2)*

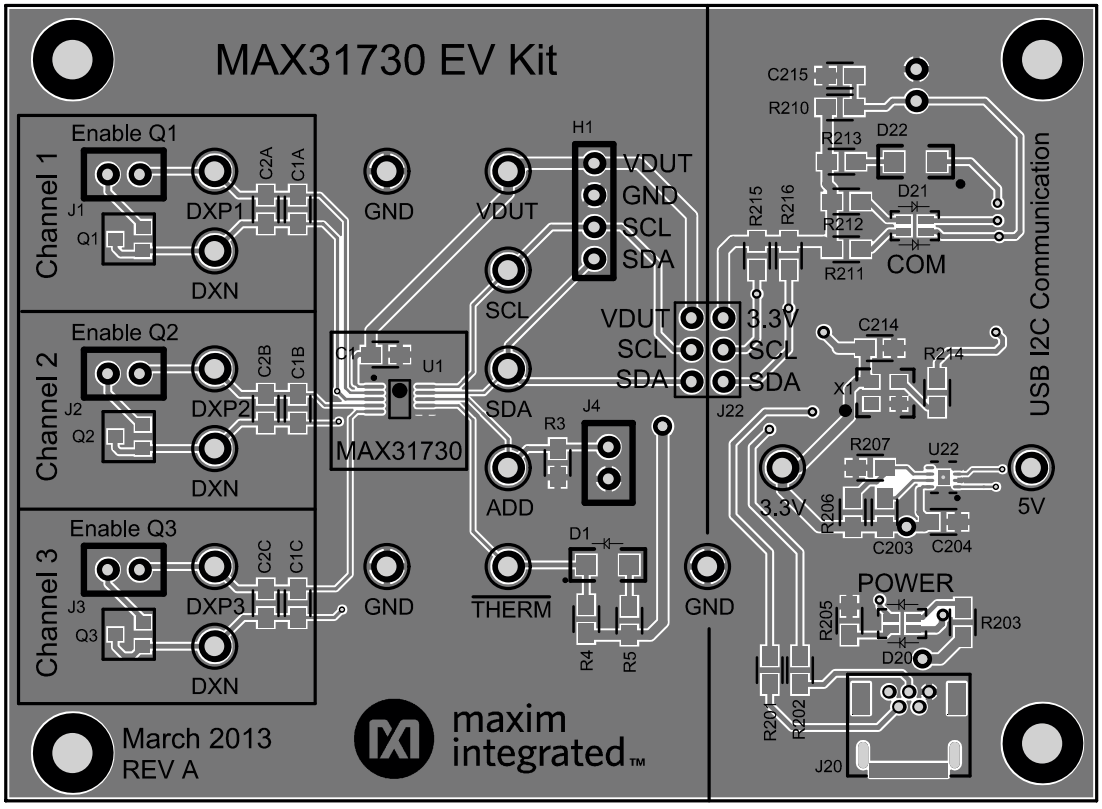



*Figure 6. MAX31730U EV Kit PCB Layout—Top (µMAX)*

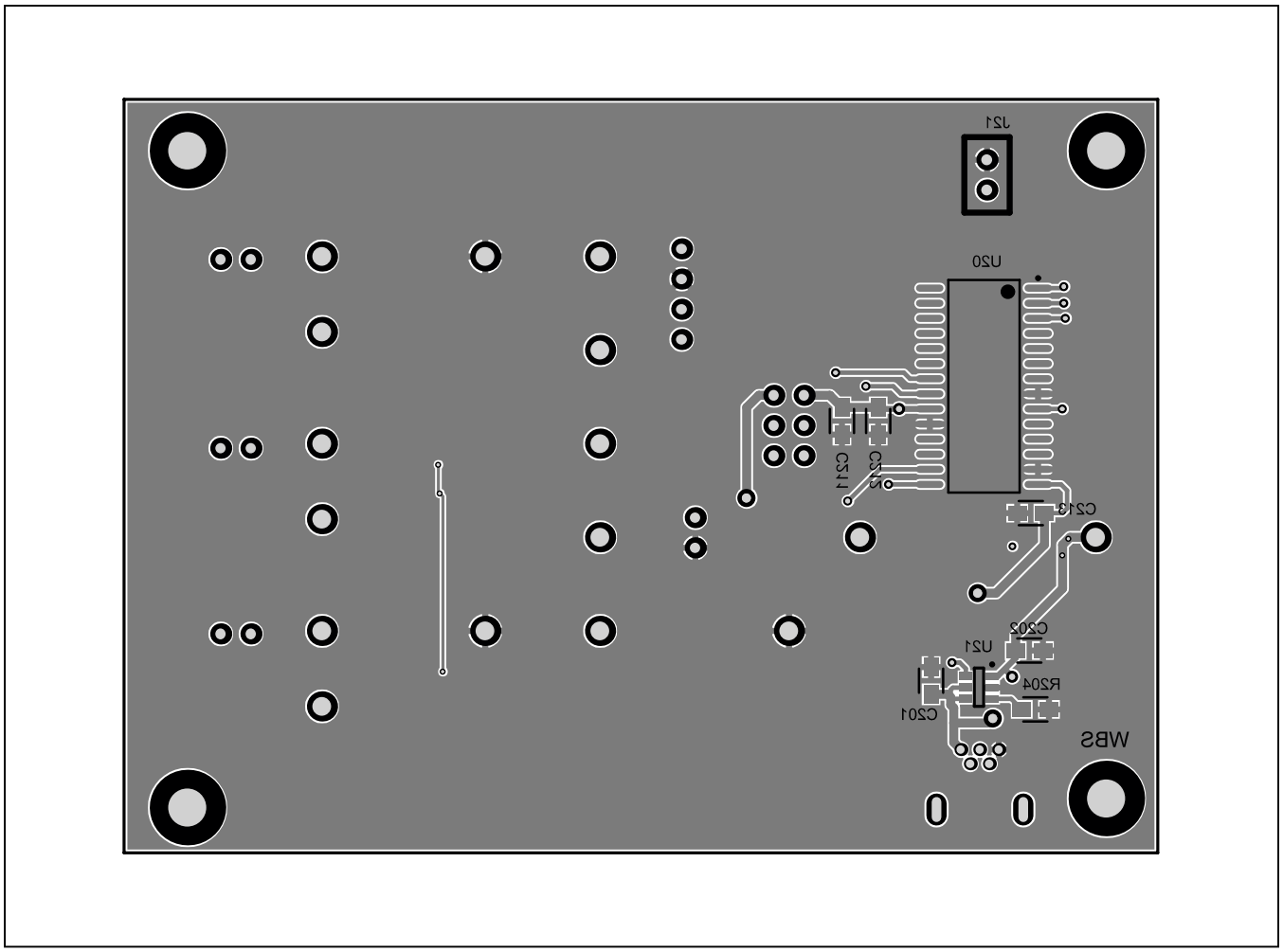



*Figure 7. MAX31730U EV Kit PCB Layout—Bottom (µMAX)*

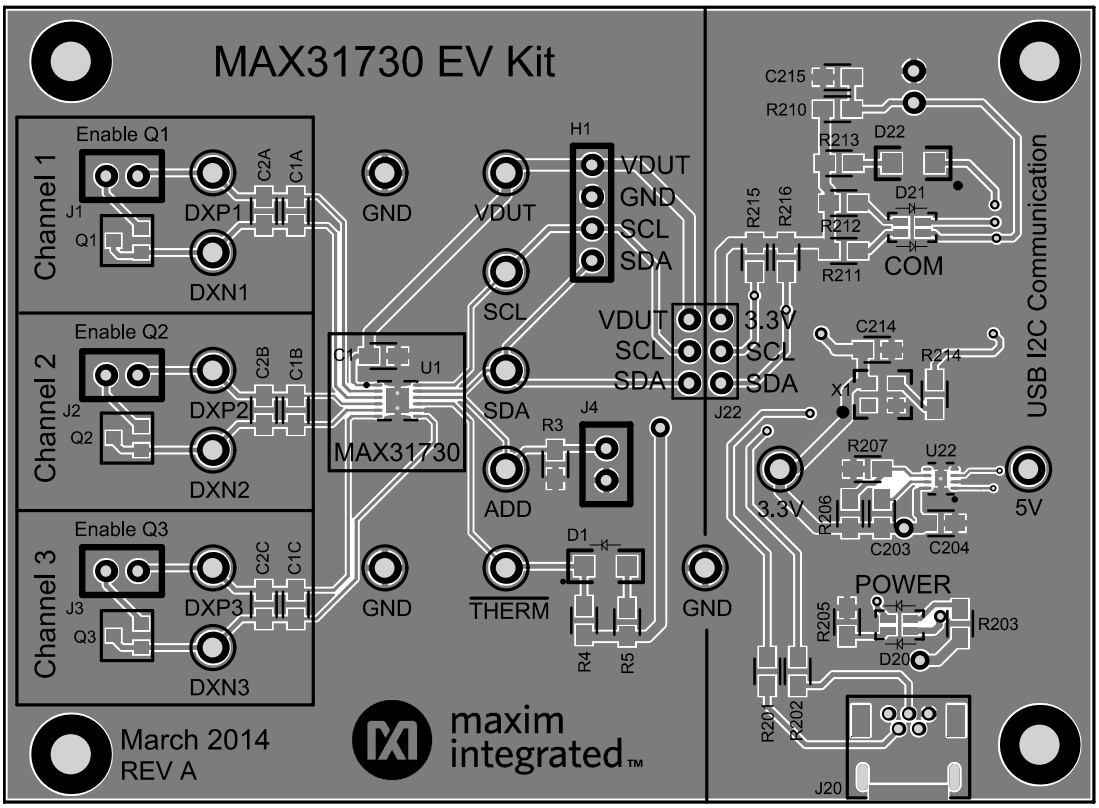



*Figure 8. MAX31730T EV Kit PCB Layout—Top (TDFN)*

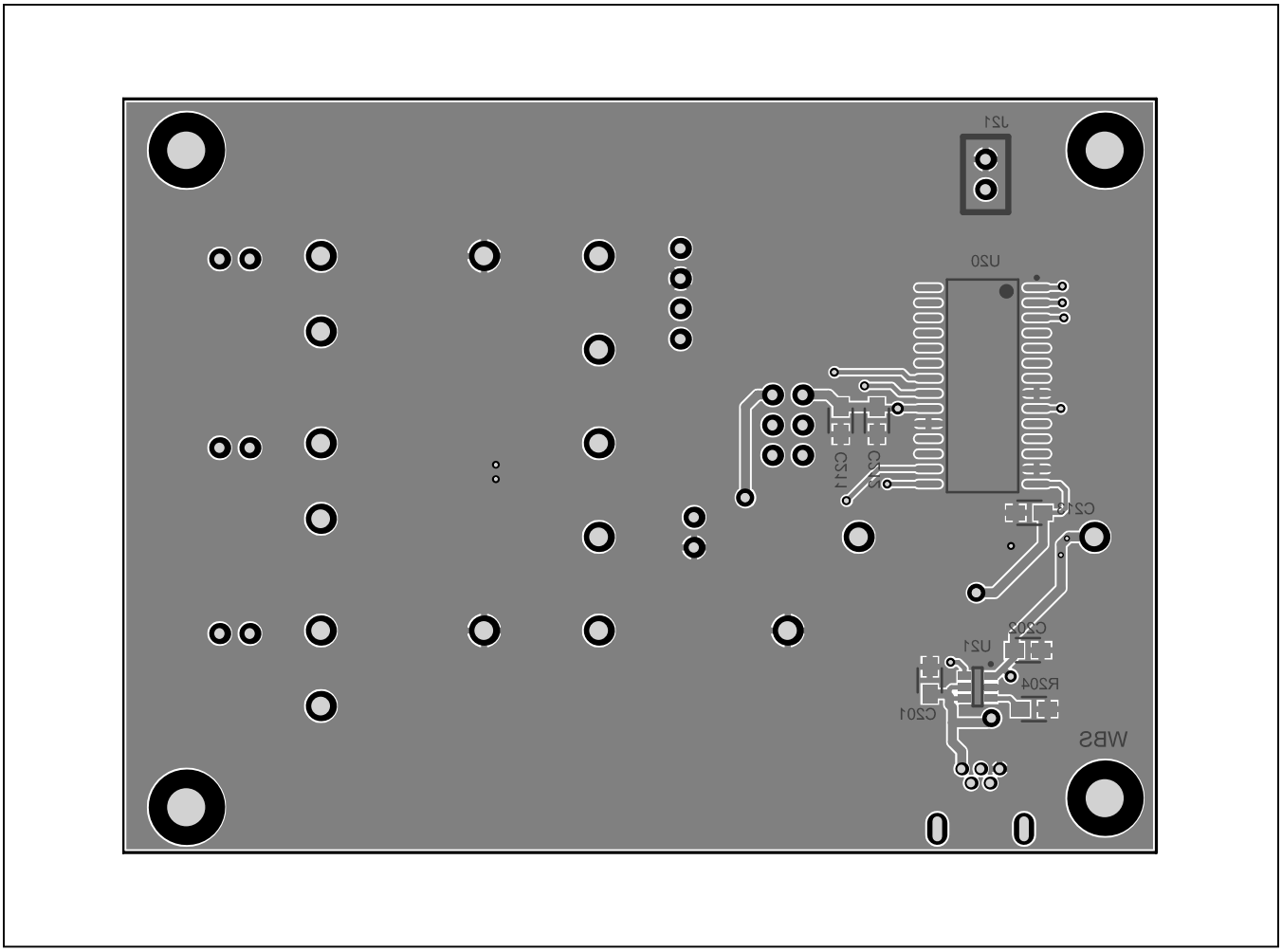



*Figure 9. MAX31730T EV Kit PCB Layout—Bottom (TDFN)*

## Ordering Information

| PART | IC PACKAGE | TYPE |
|---|---|---|
| MAX31730UEVKIT# | 10 µMAX | EV Kit |
| MAX31730TEVKIT# | 12 TDFN | EV Kit |

*#Denotes RoHS compliant.*

## Revision History

| REVISION NUMBER | REVISION DATE | DESCRIPTION | PAGES CHANGED |
|---|---|---|---|
| 0 | 8/13 | Initial release | — |
| 1 | 6/15 | Added TDFN package version of the EV Kit and revised *User-Supplied Remote Diode* section and Component List. | 1, 2, 7, 9, 11, 15, 16 |

For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim Integrated's website at www.maximintegrated.com.

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Телефон: 8 (812) 309-75-97 (многоканальный)
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Электронная почта: ocean@oceanchips.ru
Web: http://oceanchips.ru/
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А