MAX31855 Evaluation Kit
Evaluates: MAX31855

General Description

The MAX31855 evaluation kit (EV kit) provides the hardware and software (GUI) necessary to evaluate the MAX31855 cold-junction compensated thermocouple-to-digital converter.

The MAX31855 EV kit comes with a MAX31855KASA+ soldered to the PCB. This is the K-type thermocouple version of the MAX31855. Other thermocouple types can be evaluated by procuring the desired thermocouple, thermocouple socket, and corresponding MAX31855. Contact the factory for free samples of the MAX31855 to match your desired thermocouple type. See the *Evaluating Other Thermocouple Types* section for part numbers and additional information regarding other thermocouple types.

EV Kit Contents

- **Assembled Circuit Board Including MAX31855KASA+**
- **Mini-USB Cable**
- **K-Type Thermocouple**

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

Features

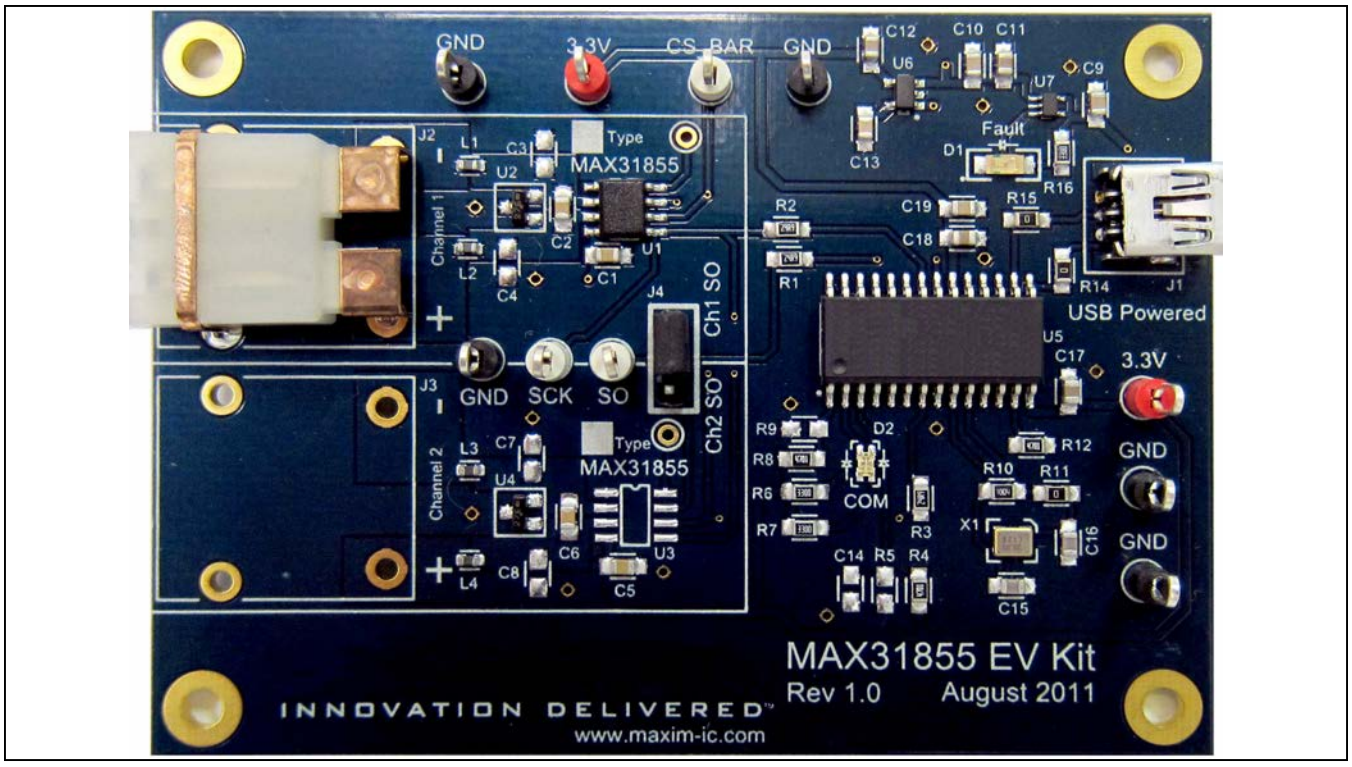
- **Includes Everything Needed to Evaluate a K-Type Thermocouple**
- **EV Kit Hardware is USB Powered (USB Cable Included)**
- **Windows XP®, Windows Vista®, and Windows® 7 Operating Systems-Compatible Software**
- **USB HID Interface**
- **Graphical User Interface (GUI) Consists of a Single .EXE File**
- **Second Channel Allows Easy Evaluation of Other Thermocouple Types**
- **RoHS Compliant**

MAX31855 EV Kit Files

FILE	DESCRIPTION
MAX31855EVkit.EXE	Application program

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

MAX31855 EV Kit Board



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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.

19-6072; Rev 0; 10/11

Quick Start

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

Required Equipment

- PC with Windows XP, Windows Vista, or Windows 7 OS with a spare USB port
- K-type thermocouple (included)
- Mini-USB cable (included)
- EV kit hardware

Procedure

Follow the steps below to get started measuring temperature using the MAX31855 interfaced to a K-type thermocouple.

1) Connect the included K-type thermocouple to J2 (thermocouple socket) of the EV kit hardware. One terminal of the thermocouple is wider than the other, ensuring proper polarity.
2) Ensure that jumper/shunt J4 is installed and is selecting Channel 1.
3) Set the EV kit hardware on a nonconductive surface that ensures nothing on the PCB gets shorted together.
4) Prior to starting the GUI, connect the EV kit hardware to a PC using the supplied mini-USB cable, or equivalent. The COM LED (D2) should flash between red and orange.
5) 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.
6) Go to **www.maximintegrated.com/MAX31855EVKIT** to download the latest version of the EV kit software, titled MAX31855EVkit.ZIP. Save the EV kit software to a temporary folder.
7) Open the .ZIP file and extract the .EXE file to your desired location. The .EXE file is the actual EV kit GUI and not an install program. You can store the .EXE wherever you like and then uninstall it later by simply deleting the .EXE file.
8) Once the device driver installation is complete (from an earlier step), double-click the .EXE file to run the GUI. A message box stating **The publisher could not be verified. Are you sure you want to run this software?** may appear. If so, click **Run**.
9) When the GUI appears, the **EV Kit Status** group box should indicate that the EV kit hardware is ready. Also, the COM LED (D2) should turn green.
10) Click the **Single Read** button to read the temperature. A valid temperature should be displayed along with all four **Alarm Status** indicators remaining green. At this point, the EV kit and setup is fully functional and ready to begin evaluating the MAX31855. If any issues arise, see the *Troubleshooting* section.

Detailed Description of Software

Figure 1 shows a screenshot of the MAX31855 GUI.

EV Kit Status Section

On the right-hand side of the GUI is a section titled **EV Kit Status**. It is used to indicate the status of the communication between the GUI and the EV kit hardware. If everything is working properly, a message indicates that the hardware is present and/or ready. Otherwise, **EV Kit not found.** is displayed.

Thermocouple Type Section

The drop-down box in this section is used to select the thermocouple type installed on the EV kit hardware. See Table 1 for the list of possible settings. Out-of-the-box, the hardware contains a K-type version of the MAX31855 along with a K-type thermocouple and socket. Therefore, the drop-down box defaults to the K-type setting. The thermocouple type selection is used by the GUI to calculate the linearized temperature values.

Table 1. Thermocouple Types and Sensitivities

TYPE	SENSITIVITY (µV/°C)
K*	41.276
J	57.953
N	36.256
S	9.587
T	52.18
E	76.373
R	10.506

**Default setting.*

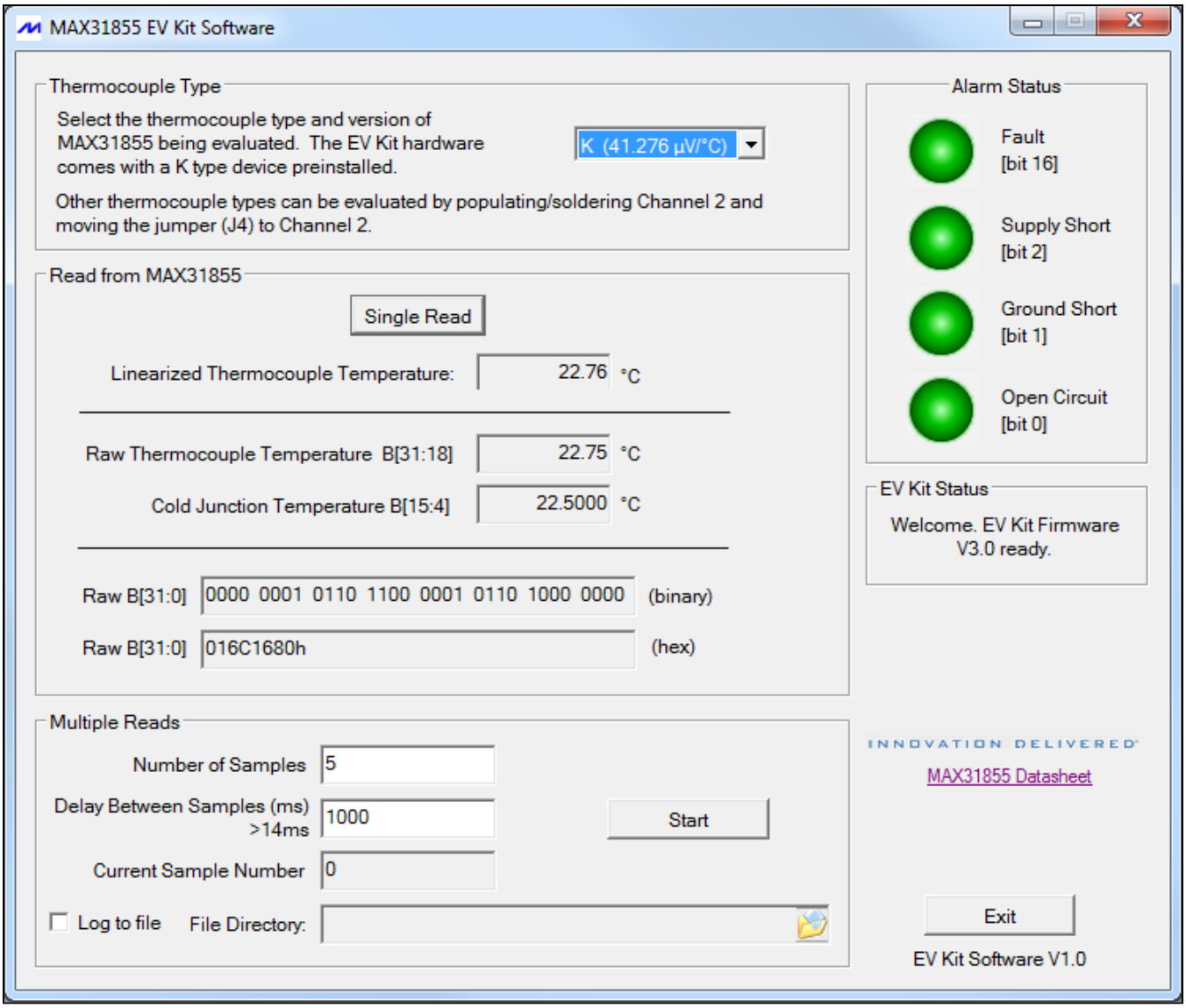

Figure 1. MAX31855 EV Kit GUI

Read from the MAX31855 Section

Interfacing to the MAX31855 is simple. The interface is read-only and consists of one 32-bit shift register. When the **Single Read** button is pressed, all 32 bits are read, parsed, and then displayed. The raw data read from the device is shown in both binary and hexadecimal format in the edit boxes labeled **Raw B[31:0]**. Furthermore, the four fault bits are analyzed and then their states are indicated in the **Alarm Status** section. The **Raw Thermocouple Temperature** and **Cold Junction Temperature** edit boxes are calculated. And finally, the **Linearized Thermocouple Temperature** edit box is calculated using the sensitivity value and NIST coefficients to compensate for thermocouple nonlinearities. Refer to the MAX31855 IC data sheet for additional information.

Multiple Reads Section

This section allows the user to enter a desired number of samples (temperature readings) as well as the delay between the samples (in milliseconds) in order to automate temperature readings. It is also possible to write the results to a file by clicking the **Log to file** checkbox and providing a folder and filename for the comma separated value (.CSV) file to be stored.

Detailed Description of Hardware

The MAX31855 EV kit hardware provides everything needed to evaluate a K-type thermocouple. In addition to a thermocouple and MAX31855, the hardware includes a USB interface that is used to communicate with the PC-based software. An added feature is that the hardware is USB powered, meaning that **no power supplies are needed**.

Thermocouple Channels

The EV kit hardware features two thermocouple channels. Channel 1 comes preconfigured with a MAX31855KASA+, K-type thermocouple, and thermocouple socket. A second channel is provided to make it easy to evaluate other thermocouple types. Channel 2 is almost fully populated, missing only the desired MAX31855 version, corresponding thermocouple, and thermocouple socket. A jumper (J4) is used to select the desired channel. The following section describes how to modify the hardware in order to evaluate other thermocouple types.

Evaluating Other Thermocouple Types

To use Channel 2, see Table 2 for the part numbers of the three items required for the desired thermocouple type.

Once the three items have been procured, carefully solder the Maxim device to the footprint labeled U3 and the thermocouple socket to the footprint labeled J3. Obviously, make sure this is done with the board unpowered. Move the jumper, J4, to the Channel 2 position. Finally, connect the thermocouple to the socket.

Reconnect the USB cable to the PC and then run the GUI. Select the correct **Thermocouple Type** from the drop-down box. The hardware and software are now ready to begin evaluation.

Description of Channel Selection Jumper

The jumper, J4, is used to select the desired channel. See Table 3 for additional details.

Table 2. Items Required to Evaluate Other Thermocouple Types

TYPE	MAXIM PART	THERMOCOUPLE*	SOCKET*
K	MAX31855KASA+	5SRTC-GG-K-24-36	PCC-SMP-K-5
J	MAX31855JASA+	5SRTC-GG-J-24-36	PCC-SMP-J-5
N	MAX31855NASA+	NMQIN-010E-6 (unverified)	PCC-SMP-N-5
S	MAX31855SASA+	—	—
T	MAX31855TASA+	5SRTC-GG-T-24-36	PCC-SMP-T-5
E	MAX31855EASA+	5SRTC-GG-E-24-36	PCC-SMP-E-5
R	MAX31855RASA+	—	—

**Thermocouple and socket part numbers are Omega part numbers (www.omega.com). Contact Omega for RoHS part numbers.*

Table 3. MAX31855 EV Kit Jumper Description (J4)

JUMPER	JUMPER POSITION	DESCRIPTION
J4	1-2*	**Selects Channel 1.** The SO (serial out) pin of the Channel 1 MAX31855 is connected to the USB PC Interface
	2-3	**Selects Channel 2.** The SO (serial out) pin of the Channel 2 MAX31855 is connected to the USB PC Interface

**Default position.*

Troubleshooting

All effort was made to ensure that each EV kit works on the first try directly out of the box. In the rare occasion that a problem is suspected, see the table below to help troubleshoot the issue.

SYMPTOM	CHECK	SOLUTION
GUI says hardware not found.	Is the LED labeled D1 on?	If yes, then the electronic fuse, U7, 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 D2 turn green when the GUI is running?	If not, then exit the GUI and try running it again. If D2 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.
GUI appears to work, but the raw data is all zeros.	Jumper (J4)	Make sure jumper, J4, is installed and connected to the correct channel.
The “Fault” and “Open Circuit” indicators are red in the **Alarm Status** section of the GUI.	Is the thermocouple connected?	Verify that the thermocouple is connected (to the correct channel).

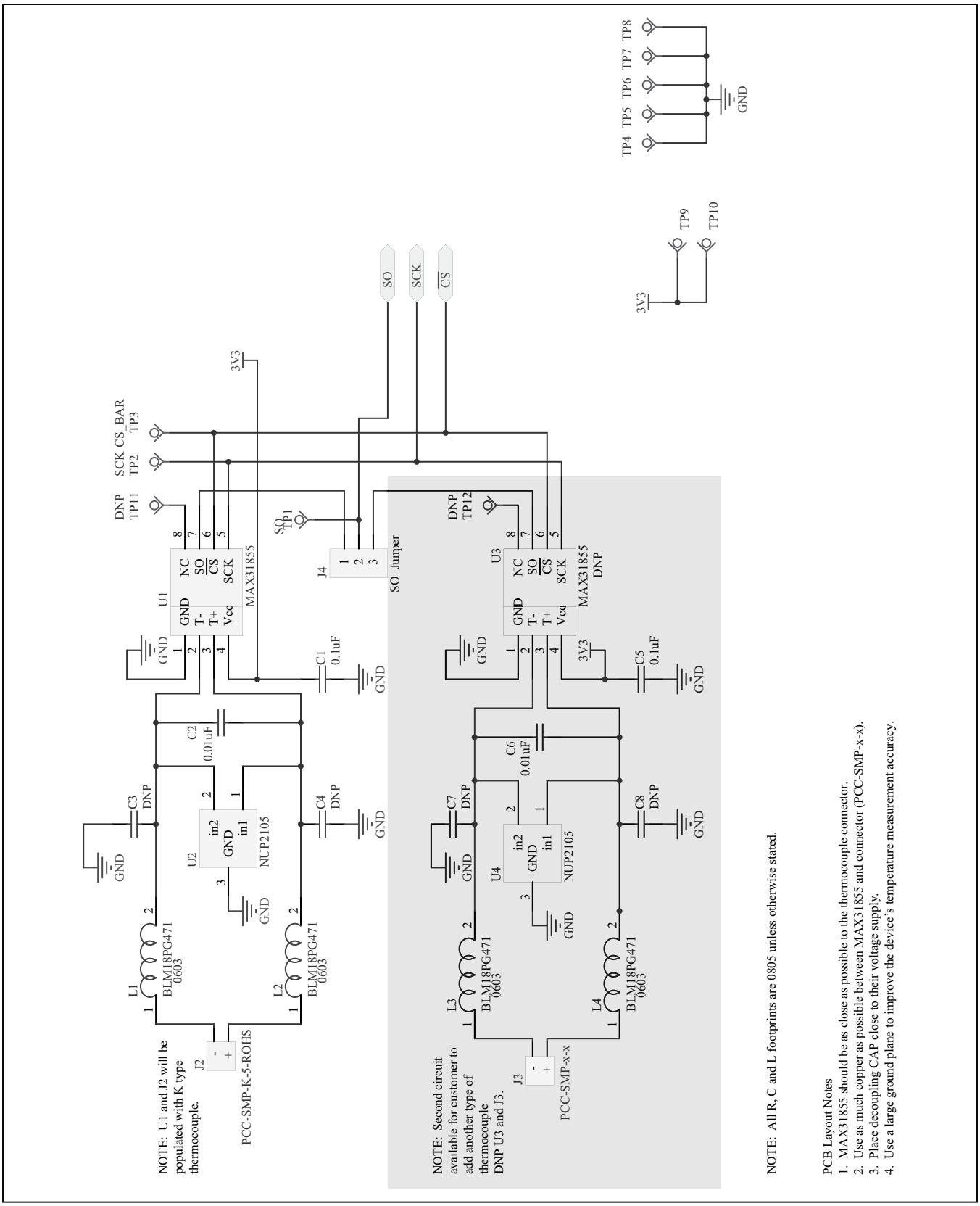

Figure 2. MAX31855 EV Kit Schematic (Sheet 1 of 2)

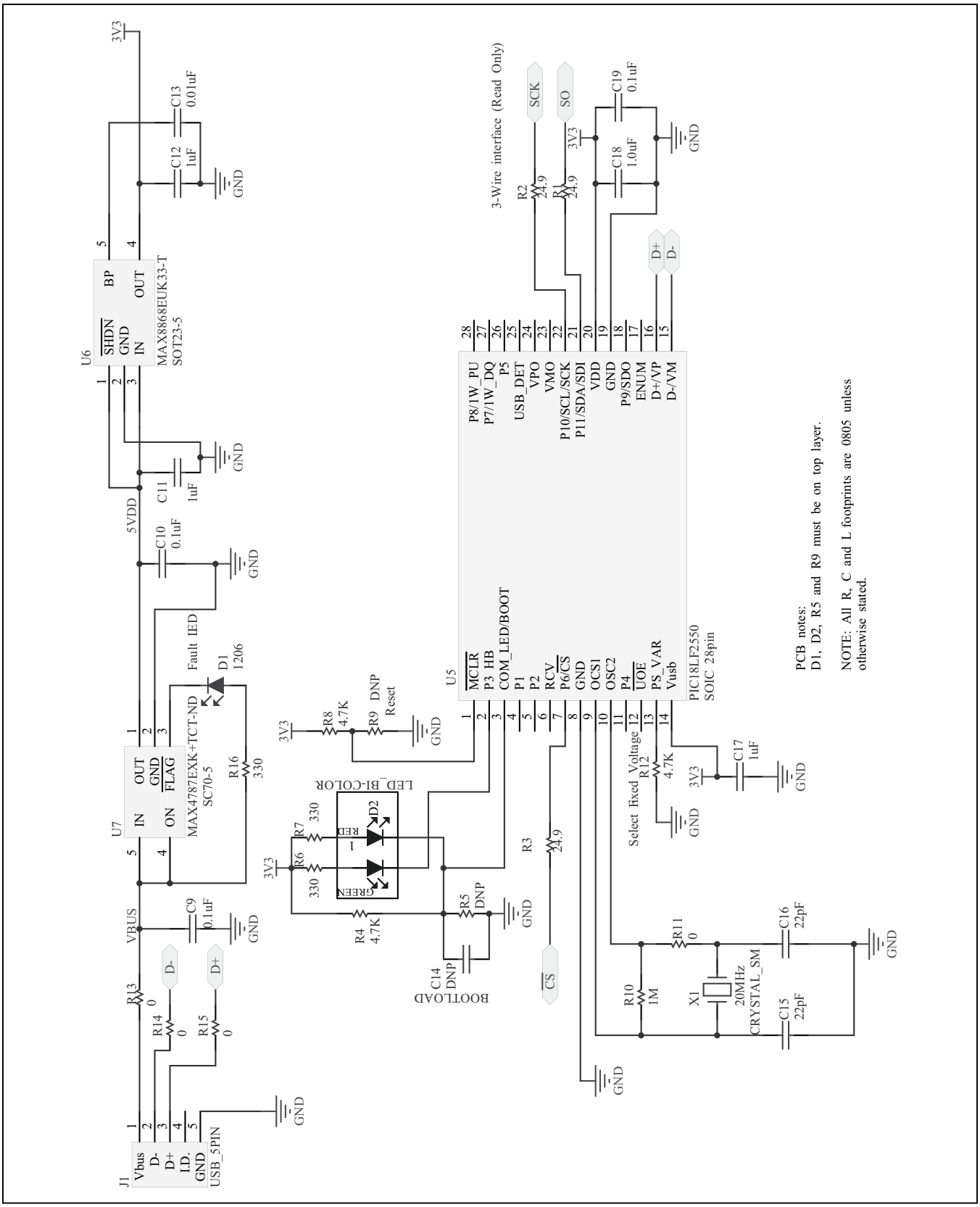

Figure 3. MAX31855 EV Kit Schematic (Sheet 2 of 2)

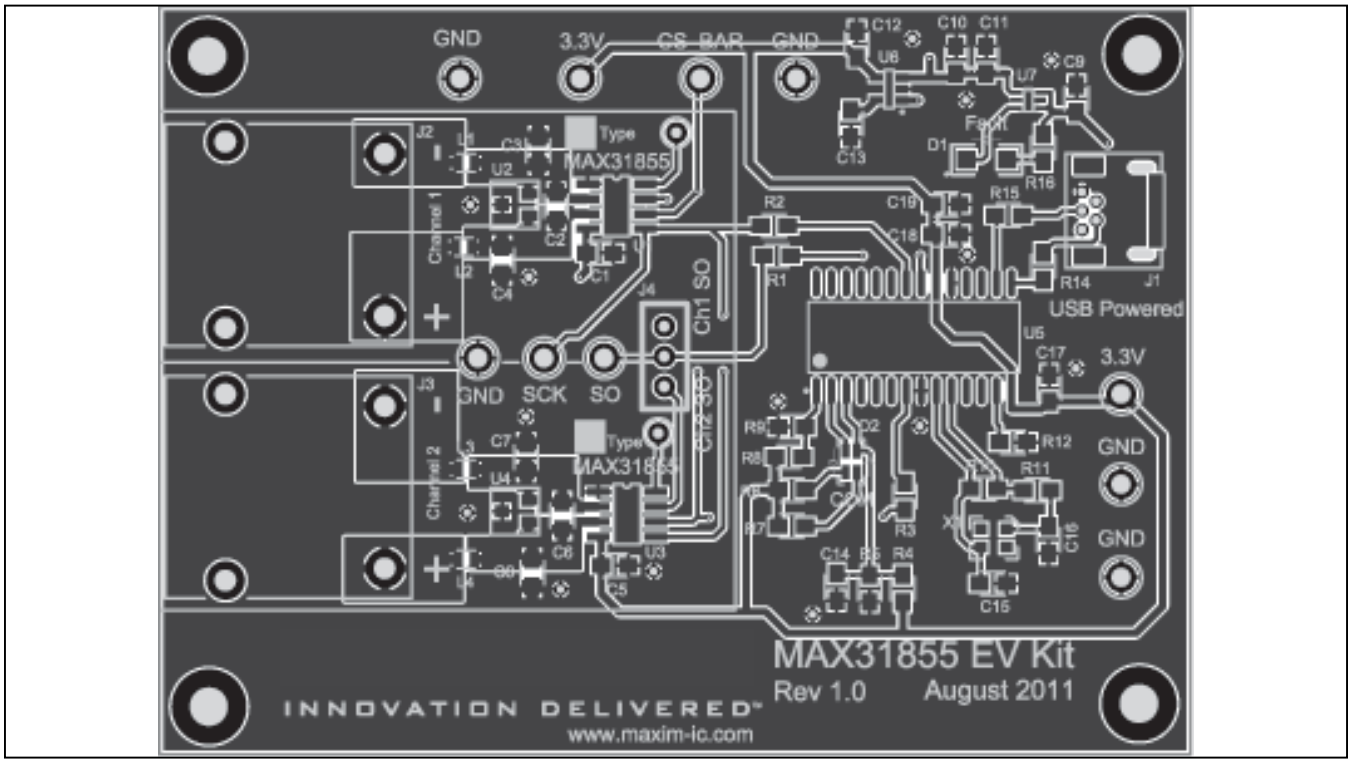

Figure 4. MAX31855 EV Kit PCB Layout—Top

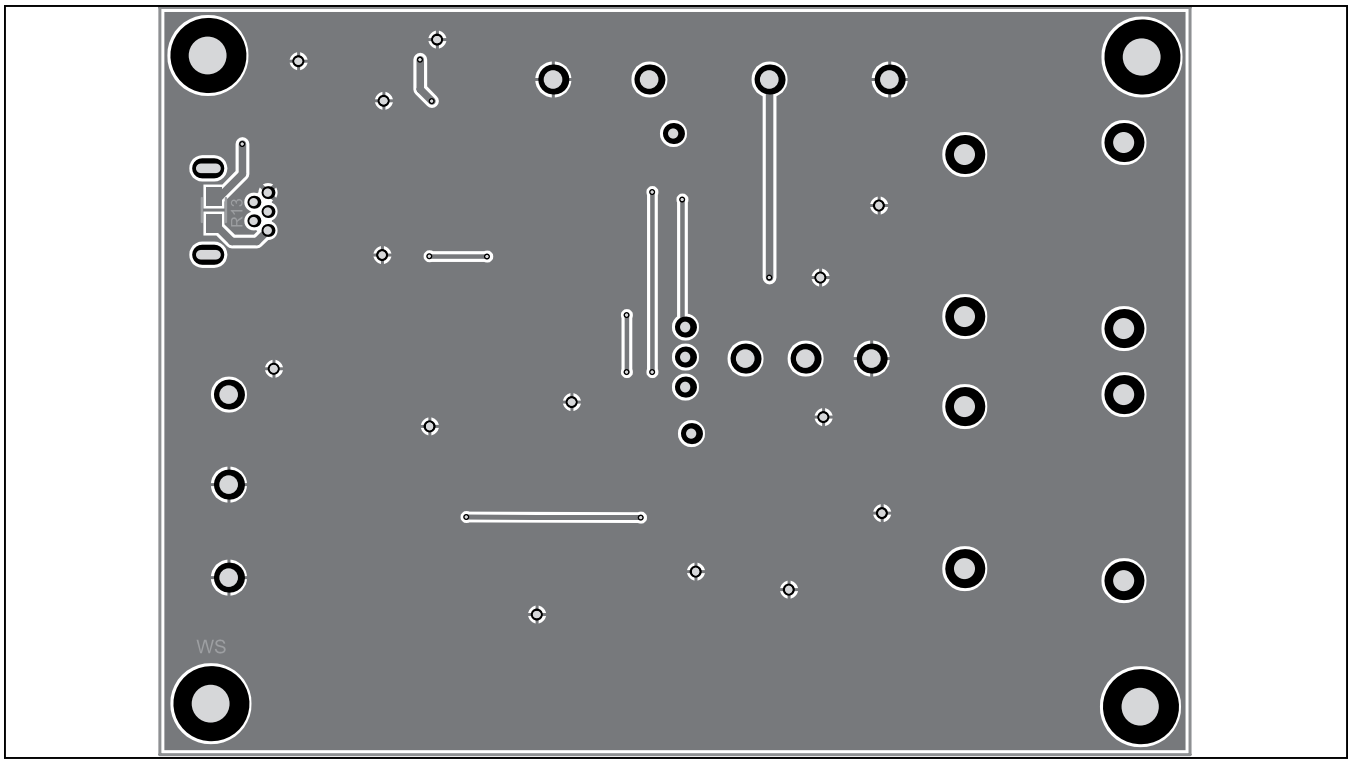

Figure 5. MAX31855 EV Kit PCB Layout—Bottom

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C5, C9, C10, C19	5	0.1µF X7R ceramic capacitors (0805) Venkel C0805X7R160-104KNE
C2, C6, C13	3	0.01µF X7R ceramic capacitors (0805) Venkel C0805X7R250-103KNE
C3, C4, C7, C8, C14	0	Do not populate (0805)
C11, C12, C17, C18	4	1µF X7R ceramic capacitors (0805) Venkel C0805X7R250-105KNE
C15, C16	2	22pF ceramic capacitors (0805) Venkel C0805COG101-220KNP
D1	1	Red LED (1206) Kingbright APT3216SURCK
D2	1	Red/green dual LED Kingbright BM2012SURKCGKC
J1	1	5-pin, female Mini-USB 54819-0519
J2	1	K-type thermocouple socket Omega PCC-SMP-K-5-ROHS
J3	0	Thermocouple socket Do not populate
J4	1	1 x 2 header, 2.54mm pitch 22-28-4360
L1–L4	4	470Ω ferrite beads (0603) BLM18PG471SN1D
R1, R2, R3	3	24.9Ω ±1% resistors (0805) Venkel CR0805-10W-24R9FT
R4, R8, R12	3	4.7kΩ ±1% resistors (0805) Venkel CR0805-10W-4701FT
R6, R7, R16	3	330Ω ±1% resistors (0805) Venkel CR0805-10W-3300FT
R10	1	1MΩ ±1% resistor (0805) Venkel CR0805-10W-1004FT
R11, R13, R14, R15	4	0Ω ±1% resistor (0805) Venkel CR0805-10W-000FT
R5, R9	0	Do not populate (0805)
TP1, TP2, TP3	3	White test points Keystone 5012
TP4–TP8	5	Black test points Keystone 5011
TP9, TP10	2	Red test points Keystone 5010
TP11, TP12	—	Do not populate
U1	1	Thermocouple-to-digital converter (8 SO) Maxim MAX31855KASA+
U2, U4	2	TVS diode (SOT-3) NUP2105TL1G
U3	0	MAX31855 Do not populate
U5	1	PIC18LF2550-I/SO (28 SO)
U6	1	Linear regulator (5 SOT23) Maxim MAX8868EUK33+
U7	1	Current-limit switch (5 SC70) Maxim MAX4787EXK+
X1	1	20MHz, 20pF SMT crystal 403I35E20M00000
—	1	Jumper/shunt
—	1	Mini-USB cable
—	1	K-type thermocouple Omega 5SRTC-GG-K-24-36-ROHS
—	1	PCB: MAX31855 EV Kit

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Omega Engineering, Inc.	888-826-6342	www.omega.com
Venkel Ltd.	800-950-8365	www.venkel.com

Note: *Indicate that you are using the MAX31855 when contacting these component suppliers.*

Ordering Information

PART	TYPE
MAX31855EVKIT#	EV Kit

#Denotes a RoHS-compliant device that may include lead that is exempt under the RoHS requirements.

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	10/11	Initial release	—

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