MAX31760 Evaluation Kit

Evaluates: MAX31760

General Description

The MAX31760 evaluation kit (EV kit) provides the hardware and software graphical user interface (GUI) necessary to evaluate the MAX31760 precision fan-speed controller with nonvolatile lookup table.

The EV kit comes with a MAX31760AEE+ installed, as well as mounting holes and headers for 4-wire, 3-wire, and 2-wire fans. The kit also includes a USB-to-I²C interface for easy communication with a PC.

EV Kit Contents

- Assembled circuit board including MAX31760
- Mini-USB cable

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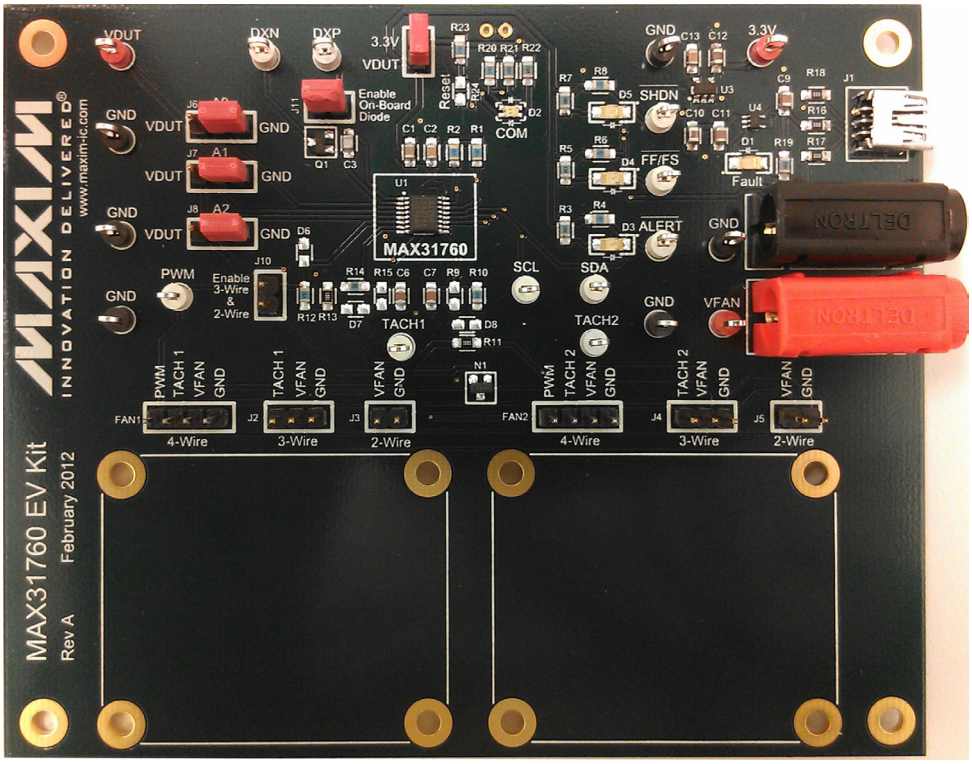
Features

- Controls and Monitors Up to Two Fans
- 2-Wire, 3-Wire, and 4-Wire Fan Configurations
- 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.**

MAX31760 EV Kit Photo



MAX31760 EV Kit Files

FILE	DESCRIPTION
MAX31760EVKitSetup.EXE	Application Program

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

Quick Start

Required Equipment

- MAX31760 EV kit hardware
- Windows XP or Windows 7 PC
- Spare USB port
- Mini USB cable (included)
- Power supply to power the fans (the voltage and current requirements depend on the fans used)
- One or two 2-wire, 3-wire or 4-wire fans (not 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 J9 and J11 are installed.
2) Connect fan(s) to FAN1 or FAN2 for 4-wire fans, J2 or J4 for 3-wire fans, or J3 or J5 for 2-wire fans.
3) If using 3-Wire or 2-Wire fans, ensure that jumper/shunt J10 is installed.
4) Set the EV kit hardware on a nonconductive surface to ensure that nothing on the PCB gets shorted together.
5) 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.
6) 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.
7) Once the device driver installation is complete, visit **www.maximintegrated.com/evkitsoftware** to download the latest version of the EV kit software, MAX31760EVKitSetup.zip. Save the EV kit software to a temporary folder.
8) 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**.
9) Follow the instructions on the installer and once complete, click **Finish**. The default location of the GUI is in the program files directory.
10) When the GUI appears, the **EV Kit Status** box in the **Status** section should indicate that the EV kit hardware is connected. The COM LED (D2) on the EV kit board should turn green.
11) Connect the fan power supply to VFAN and GND banana connectors and turn on.
12) Click the **Read All** or **Read** buttons to read the contents on the associated tab.

Detailed Description of Software

Status

In the **Status** group box (shown in Figure 1), the **EV Kit Status** displays **Connected** if the EV kit hardware is detected. The **Auto Read** edit box updates to **ON** when the **Start** button in the **Multiple Reads** group box is clicked. The **Data Log** edit box displays **ON** when the **Log to File** checkbox is checked in the **Multiple Reads** group box. The **Slave Address** edit box defaults to A0h and can be changed using the **Software Slave Address** edit box on the **User EEPROM and I2C Commands** tab. The **ALERT**, **SHDN**, and **Fan Fail** statuses are read from the device pins. The rest of the items in the **Status** group box are read from registers of the device.

Multiple Reads

This group box allows the user to enter a desired number of samples, as well as the delay between the samples (in milliseconds), to automate readings. The sample read includes the local temperature, remote temperature, TACH 1 count, TACH 2 count, current duty cycle, Alert, SHDN, Fan Fail, Status register, and the other registers in the **Status** group box. 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. The **Auto Read** and **Data Log** edit boxes in the **Status** group box update to **ON** when the **Start** button is clicked or when **Log to File** is checked.

Control Registers Tab

The **Control Registers** tab sheet (Figure 1) allows the user to configure the control and duty-cycle registers on the device. To change the configuration, select the desired options by clicking on the radio buttons, checkboxes, drop-down list, or slider. Click the **Write** button to write the current selections to their registers. The **Binary** and **Hexadecimal** edit boxes update with the desired settings. To read the registers on this tab, click on the **Read** button. The status of the last command is displayed in the box under the **Read** and **Write** buttons. To manually select the PWM duty cycle, the **PWM Direct Duty Cycle% (50h)** slider must be enabled by checking the **Direct Fan Control Enable** checkbox in the **Control Register 2** group box. Once enabled, select the desired PWM duty cycle and click on the **Write** button. The **POR** button sets the POR bit in Control Register 1. The **Clear FF** button sets the clear fan fail bit in Control Register 3.

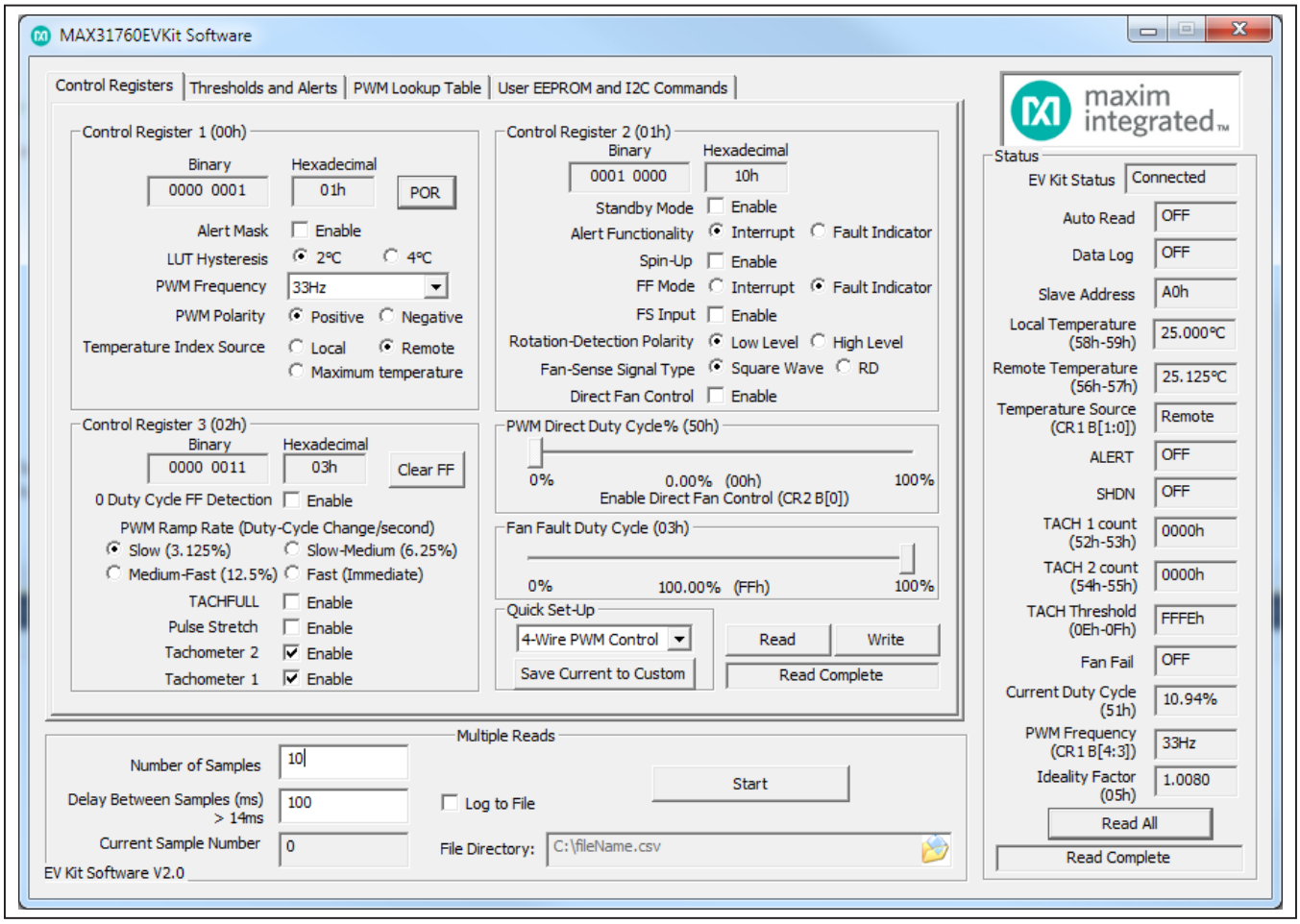


Figure 1. MAX31760 EV Kit Software (Control Registers Tab)

Quick Set-Up

The **Quick Set-Up** group box automatically adjusts the settings for 4-wire, 3-wire and 2-wire fans. The 4-wire setup changes the **PWM Frequency** to 25kHz and enables **Tachometer 1** and **Tachometer 2** monitoring. The 3-wire setup changes the **PWM Frequency** to 33Hz, enables **Direct Fan Control**, sets the **PWM Direct Duty Cycle** to 100%, and enables **Tachometer 1** and **Tachometer 2** monitoring. The 2-wire setup changes the **PWM Frequency** to 33Hz and disables **Tachometer 1** and **Tachometer 2** monitoring. The **Save Current to Custom** button allows the user to save all the current settings on the **Control Registers** tab. The custom settings can be accessed by selecting the **Custom** option in the drop-down list. To activate any of these settings, the **Write** button must be clicked to write to the registers on the device.

Thresholds and Alerts Tab

The **Thresholds and Alerts** tab sheet (Figure 2) allows the user to read/write to the temperature thresholds, TACH count threshold, Alert Mask register, and Ideality Factor register. The Status register is also read and its alarms are indicated with a red/green circle. To read these registers, click the **Read** button. To change a value, set the value desired using the edit boxes, checkboxes, or drop-down list, and then click **Write**.

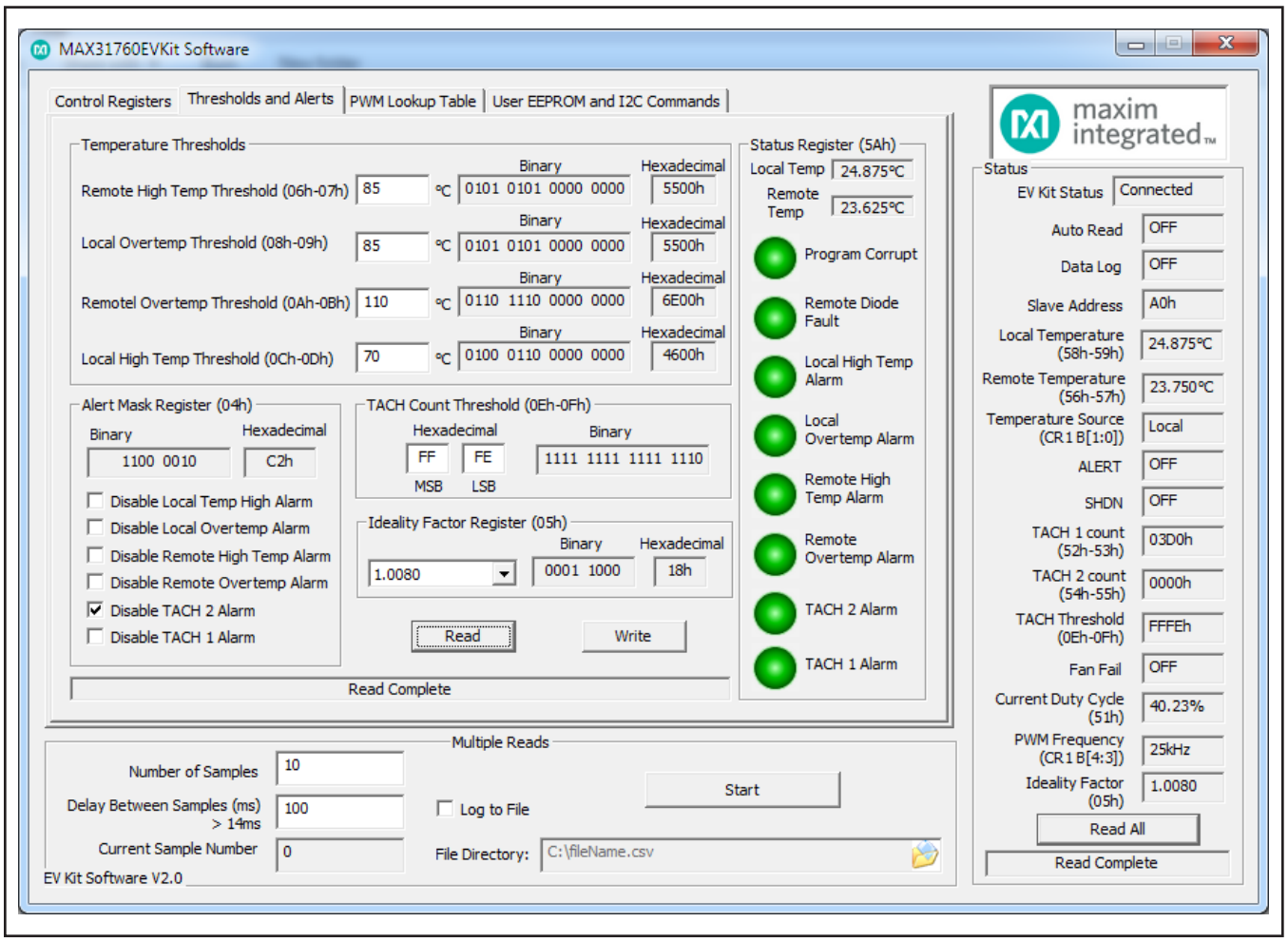


Figure 2. MAX31760 EV Kit Software (Thresholds and Alerts Tab)

PWM Lookup Table Tab

The **PWM Lookup Table** tab sheet (Figure 3) allows the user to set the duty cycle for a particular temperature range. To enable the PWM values in the lookup table, the **Direct Fan Control** in the **Control Register 2 (01h)** group box must be disabled (unchecked). To change the duty cycle, select a value from the drop-down list and click on **Write**. To see the other values in the lookup table, click on the **Next** or **Previous** button. This tab also has a **Fill Lookup Table** group box that allows the user to set several bytes in the lookup table to the same value. To fill the table, type in hex values in the **Start Address** and **End Address** edit boxes, select a duty cycle, and click on the **Fill** button.

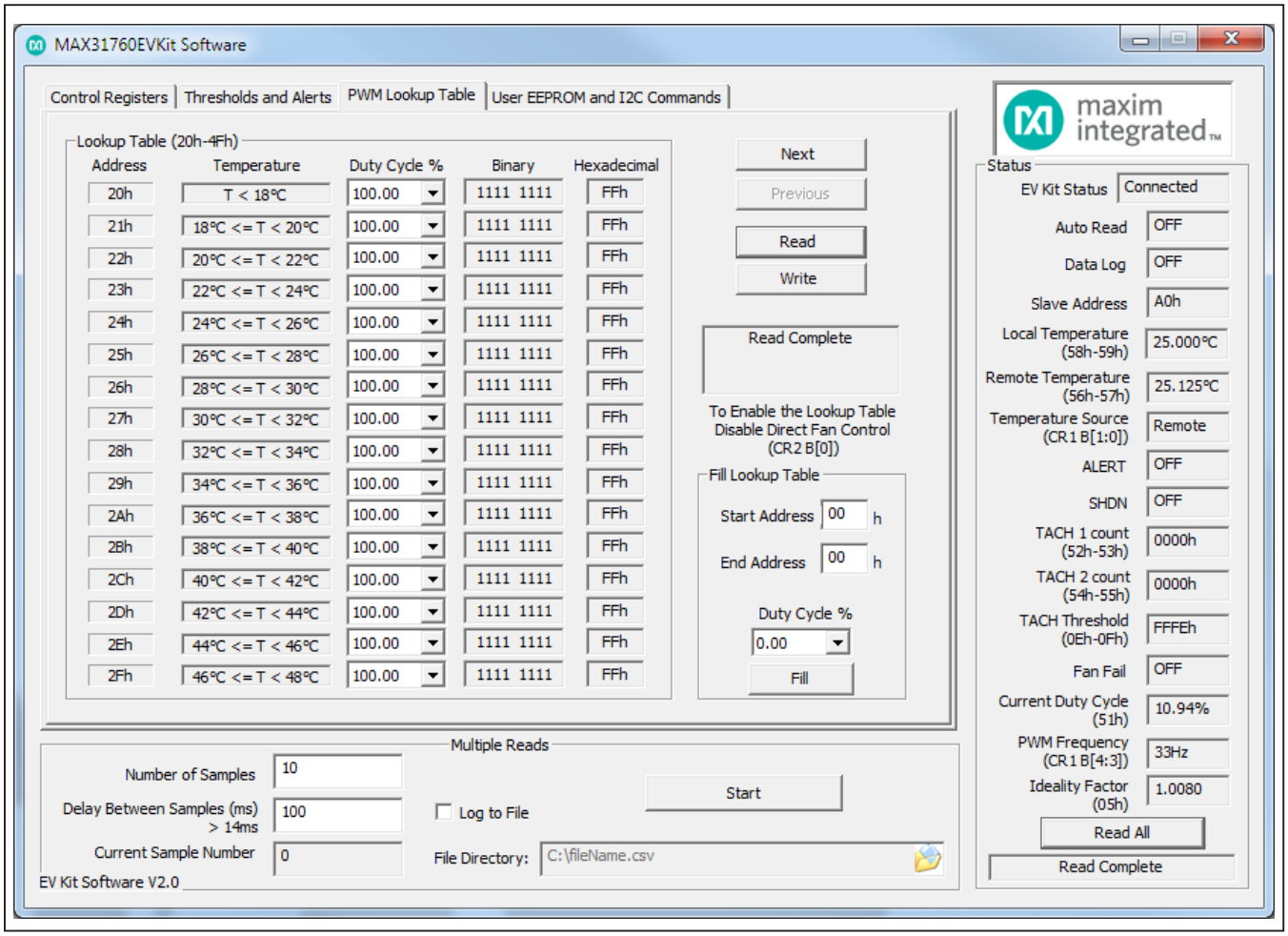


Figure 3. MAX31760 EV Kit Software (PWM Lookup Table Tab)

User EEPROM and I²C Commands Tab

The **User EEPROM and I2C Commands** tab sheet (Figure 4) allows the user to read the user EEPROM and also perform I²C commands. The **Find I2C Slave Addresses** group box searches for all the slave addresses on the I²C bus and displays them in the status box above. The **Set I2C Software Slave Address** group box changes the slave address that the software reads and writes to. The slave address must be an even hex value. The **Single Byte Read/Write (All HEX values)** group box reads or writes to any memory address available in the slave.

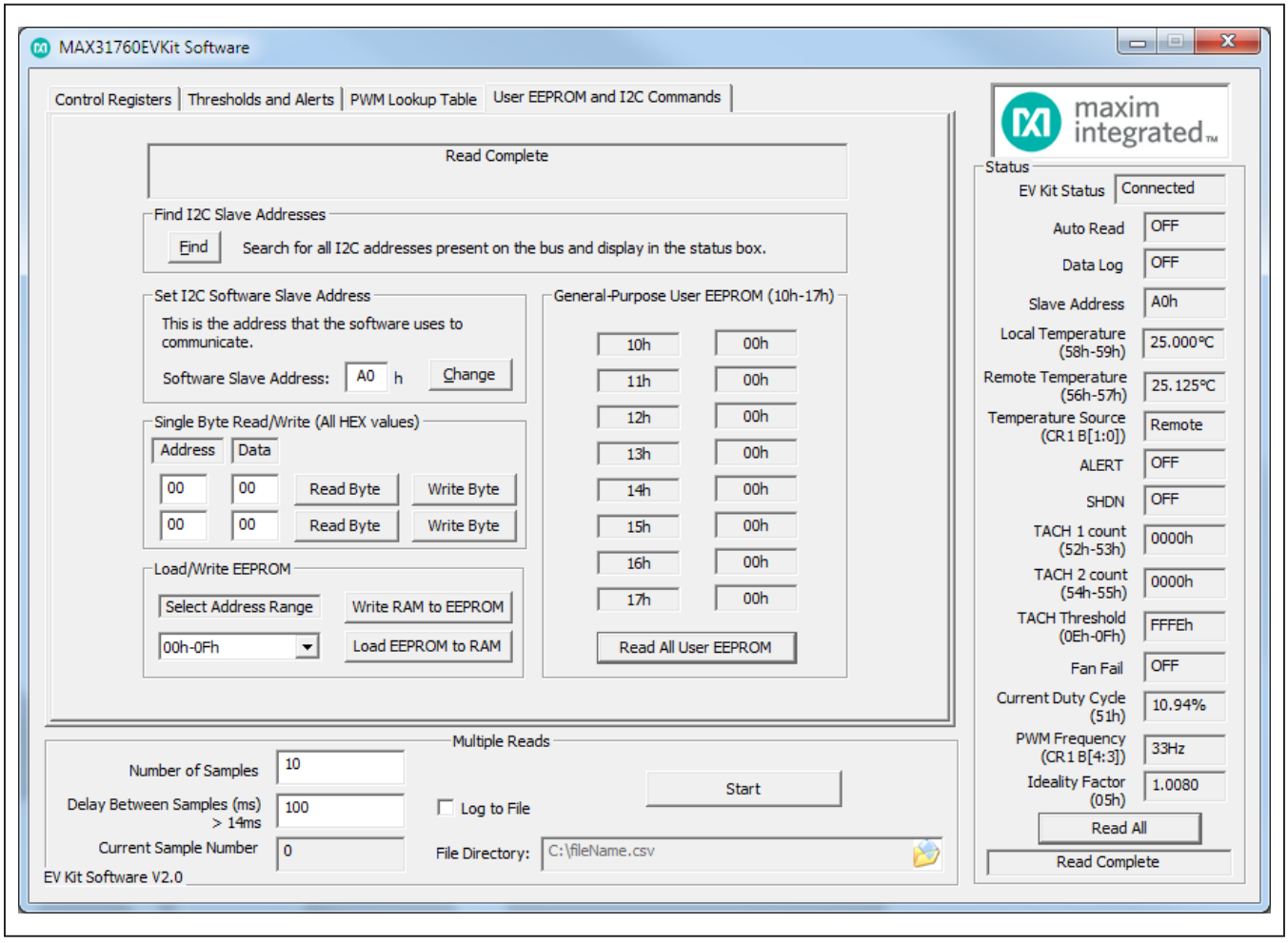


Figure 4. MAX31760 EV Kit Software (User EEPROM and I²C CommandsTab)

Detailed Description of Hardware

Connecting a Fan

Remove all power to the PCB by disconnecting the USB and VFAN power. Mount the fan to the PCB with the provided mounting holes to prevent the fan from moving while spinning. To connect 4-wire fans, use the headers FAN1/2. Connect the fan to J2 or J4 for 3-wire fans or J3 or J5 for 2-wire fans. If 3-wire or 2-wire fans are being used, make sure to populate jumper J10. Once all connections are complete, plug in the USB and VFAN power.

Table 1. Slave Address Selection

J8 (A2)	J7 (A1)	J6 (A0)	SLAVE ADDRESS (HEX)
GND	GND	GND	A0h*
GND	GND	VDUT	A2h
GND	VDUT	GND	A4h
GND	VDUT	VDUT	A6h
VDUT	GND	GND	A8h
VDUT	GND	VDUT	AAh
VDUT	VDUT	GND	ACh
VDUT	VDUT	VDUT	AEh

**Default slave address.*

Changing the Slave Address

The default slave address for the device is A0h. This address can be changed to an address in Table 1 by moving J8–J6 to the desired VDUT or GND position. The slave address that the GUI communicates with must be updated by entering the new address in the **Software Slave Address** edit box on the **User EEPROM and I2C Commands** tab.

User-Supplied Remote Diode

To connect a user-supplied external remote diode, remove jumper J11 and connect the diode to test points DXP and DXN.

User-Supplied I²C Interface

To use the device with a user-supplied I²C interface, disconnect all power to the PCB and remove resistors R26 and R27. Then connect SDA and SCL of the microcontroller to the test points provided on the EV kit board.

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 2. Description of Jumpers (J6–J11)

JUMPER	SHUNT POSITION	DESCRIPTION
J6	1-2	Connects address pin A0 to VDUT.
	2-3*	Connects address pin A0 to GND.
J7	1-2	Connects address pin A1 to VDUT.
	2-3*	Connects address pin A1 to GND.
J8	1-2	Connects address pin A2 to VDUT.
	2-3*	Connects address pin A2 to GND.
J9	1-2*	Connects the device's VDUT to the on-board 3.3V supply.
J10	1-2*	Connects the device's PWM pin to the NMOS (N1) for 3-wire and 2-wire fans.
J11	1-2*	Connects the device's DXP pin to the on-board remote diode (Q1).

**Default position.*

Table 3. Description of LEDs (D1–D5)

LED	COLOR	DESCRIPTION
D1	Red	Fault: A USB power fault occurred due to an undervoltage limit, a current limit, or a thermal limit.
D2	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 the software.
D3	Red	$\overline{\text{Alert}}$: The $\overline{\text{Alert}}$ pin is asserted low due to a local or remote high-temperature threshold being exceeded.
D4	Red	$\overline{\text{FF/FS}}$: The $\overline{\text{FF/FS}}$ pin is asserted low due to a fan failure or to the full-speed fan drive input being pulled low.
D5	Red	$\overline{\text{SHDN}}$: The $\overline{\text{SHDN}}$ pin is asserted low due to the local or remote OT threshold being exceeded.

Table 4. Troubleshooting

SYMPTOM	CHECK	SOLUTION
GUI says hardware not found	Is the fault LED (D1) on?	If yes, the current-limit switch is in a fault state. Inspect for electrical shorts on the PCB and make sure the PCB is not sitting on a conductive surface.
	Does the COM LED (D2) turn green when the GUI is running?	If not, exit the GUI and try running it again. If the COM LED 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 indicates that the hardware is ready to use. Run the GUI again.
	Are any LEDs on?	If not, the PCB may not be getting power from USB. Try a different USB cable or a different USB port.
All reads are failing	J9	Make sure jumper J9 is installed for the device to be powered.
	J6–J8	Make sure the slave address selected with jumpers J6-J8 matches the GUI slave address on the **User EEPROM and I2C Commands** tab. See Table 1.
Remote diode fault is always on	J11	Make sure jumper J11 is installed for the on-board remote diode to be connected.
Fan is not working properly	J10	For 3-wire and 2-wire fans, make sure jumper J10 is installed.
	Fan header	Make sure the pins on the fan header are connected properly to the fan.

Component List

DESIGNATION	QTY	DESCRIPTION
B1	1	Red banana jack (VFAN)
B2	1	Black banana jack (GND)
C1, C17	2	1.0µF, X7R ceramic capacitors (0805)
C2, C13, C15	3	0.01µF, X7R ceramic capacitors (0805)
C3	1	2200pF, X7R ceramic capacitor (0805)
C4	1	10µF, X7R ceramic capacitor (0805)
C5–C7, C9, C11, C18	6	0.1µF, X7R ceramic capacitors (0805)
C10, C12	2	4.7µF, X7R ceramic capacitors (0805)
C16	1	220nF, X7R ceramic capacitor (0805)
D1, D3–D5	4	Red LEDs (1206)
D2	1	Red/green dual LED
D6–D8	0	Do not populate, zener diodes
F1, F2	2	4-pin headers, 2.54mm pitch
J1	1	5-pin female Mini-USB connector
J2, J4, J6–J8	5	3-pin headers, 2.54mm pitch
J3, J5, J9–J11	5	2-pin headers, 2.54mm pitch
J12	0	Do not populate, header
N1	1	N-channel MOSFET (SOT23) Fairchild NDS351AN
Q1	1	Bipolar BJT PNP (SOT23) Fairchild MMBT3906

DESIGNATION	QTY	DESCRIPTION
R1, R2, R4, R6, R8, R12, R20, R23	8	4.7kΩ ±1% resistors (0805)
R3, R5, R7, R19, R21, R22	6	330Ω ±1% resistors (0805)
R9, R15, R24	0	Do not populate, resistors (0805)
R10, R14	2	10Ω ±1% resistors (0805)
R11, R13	2	1kΩ ±1% resistors (0805)
R16–R18, R25, R26, R27	6	0Ω ±1% resistors (0805)
TP1–TP5, TP9–TP11, TP13,TP14	10	White test points
TP6, TP8, TP12	3	Red test points
TP15–TP20	6	Black test points
U1	1	Precision fan-speed controller (16 QSOP) Maxim MAX31760AEE+
U2	1	Microcontroller (28 SO) Microchip PIC18LF2550-I/SO
U3	1	150mA, 3.3V linear regulator (5 SOT23) Maxim MAX8868EUK33+
U4	1	100mA current-limit switch (5 SC70) Maxim MAX4787EXK+
X1	1	48MHz, 3.3V oscillator (SMD)
—	6	Jumper/shunt
—	1	Mini-USB cable
—	1	PCB: MAX31760 EV Kit

Component Supplier

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

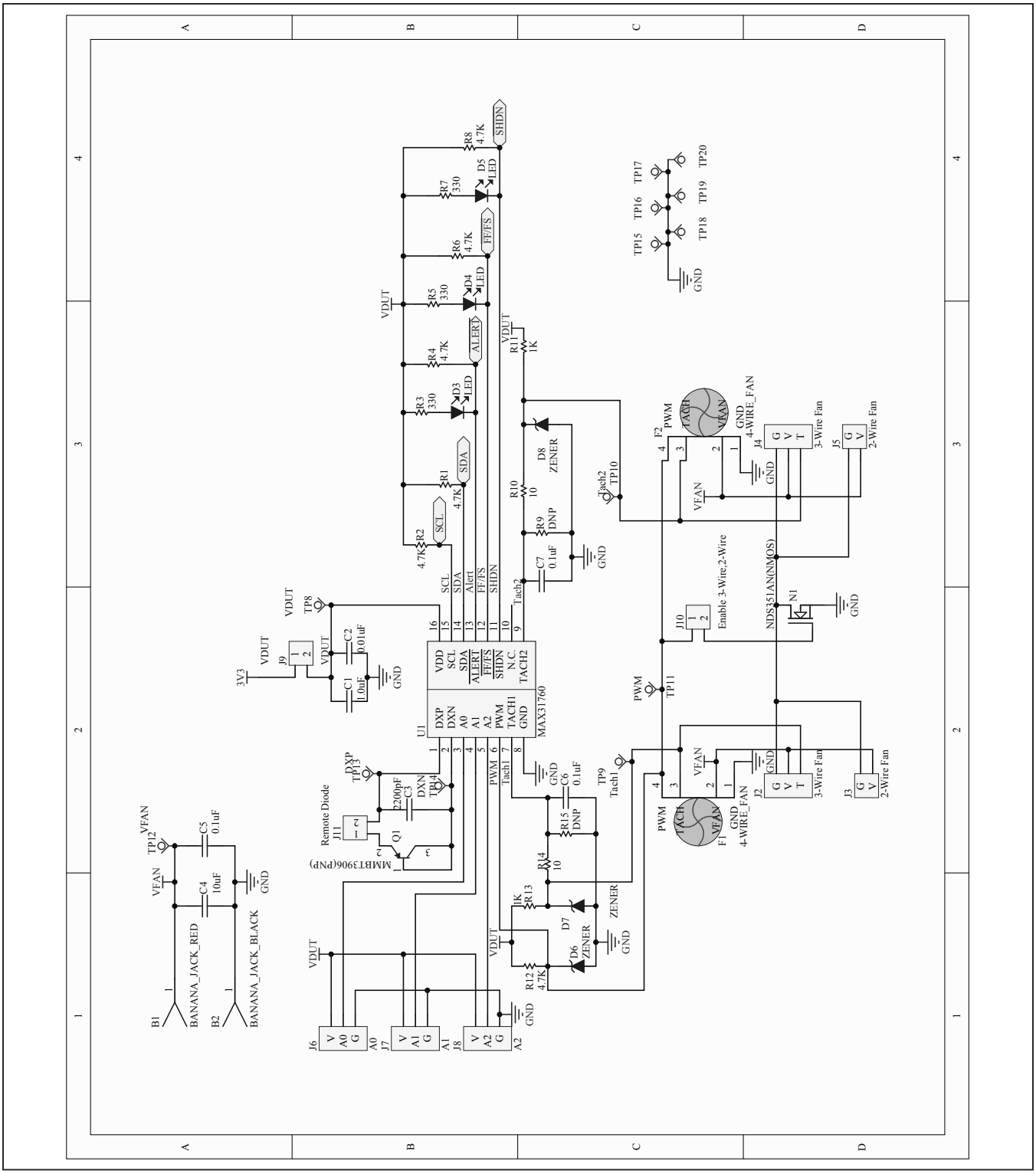


Figure 5a. MAX31760 EV Kit Schematic (Sheet 1 of 2)

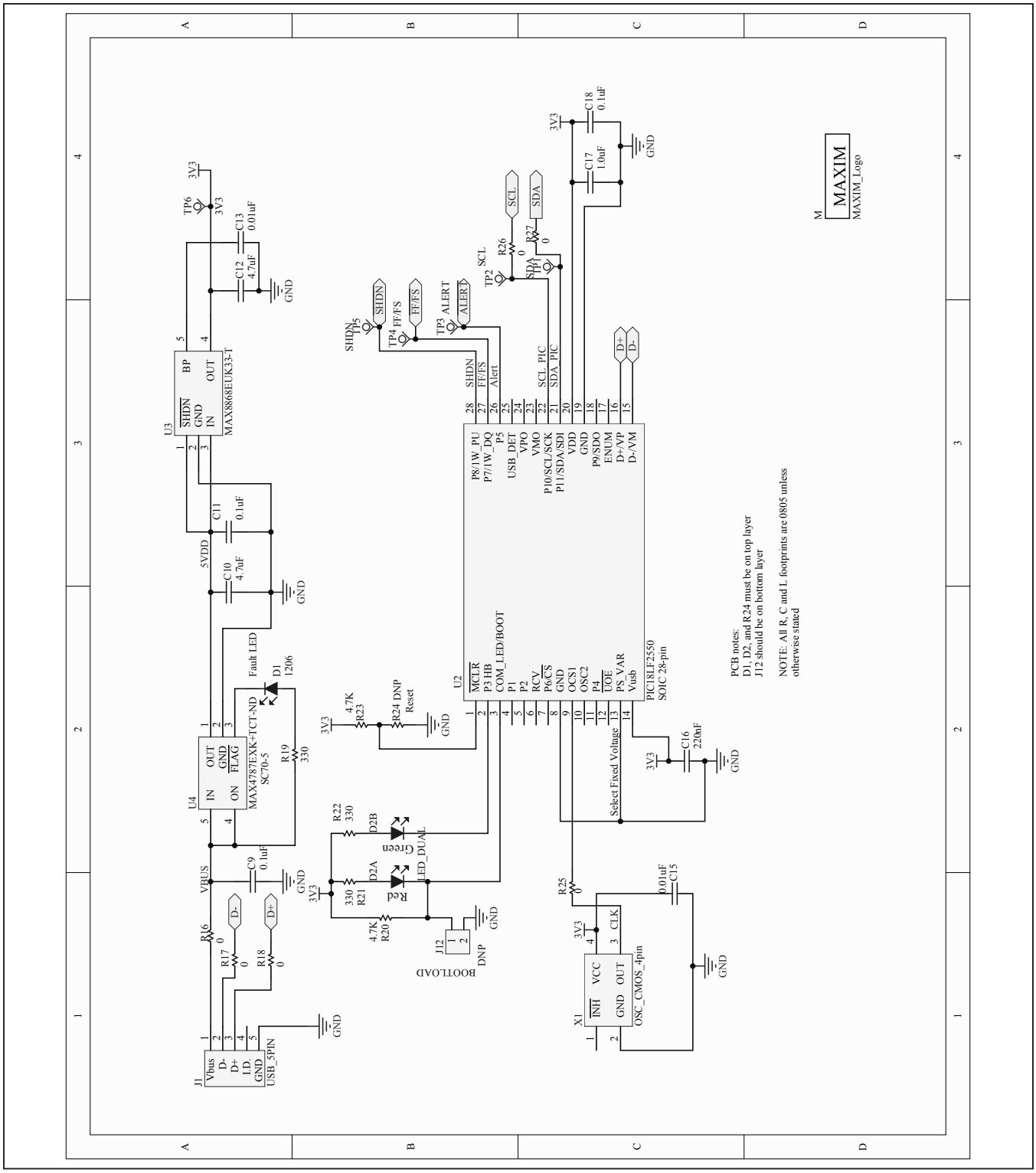


Figure 5b. MAX31760 EV Kit Schematic (Sheet 2 of 2)

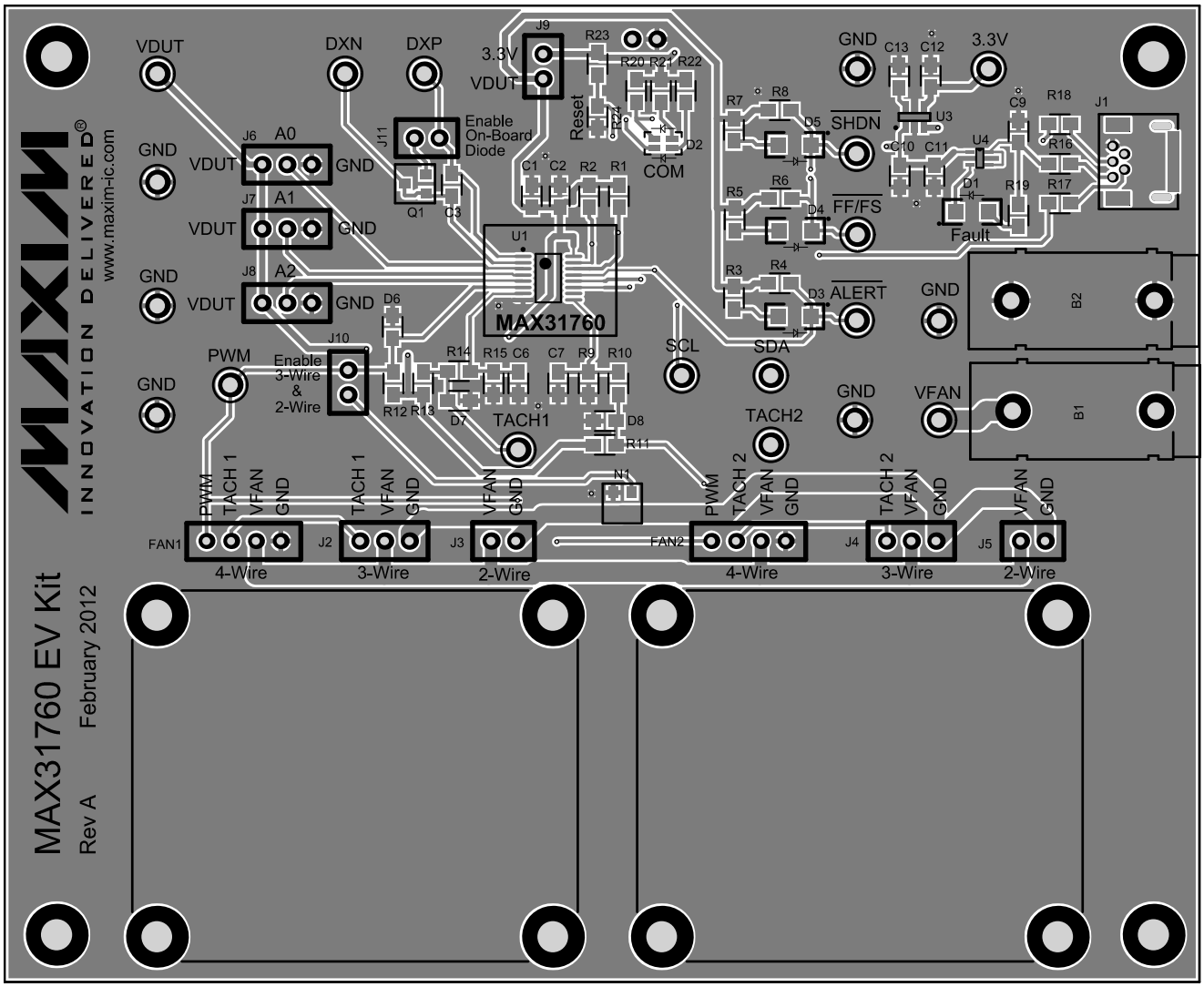


Figure 6. MAX31760 EV Kit PCB Layout—Top

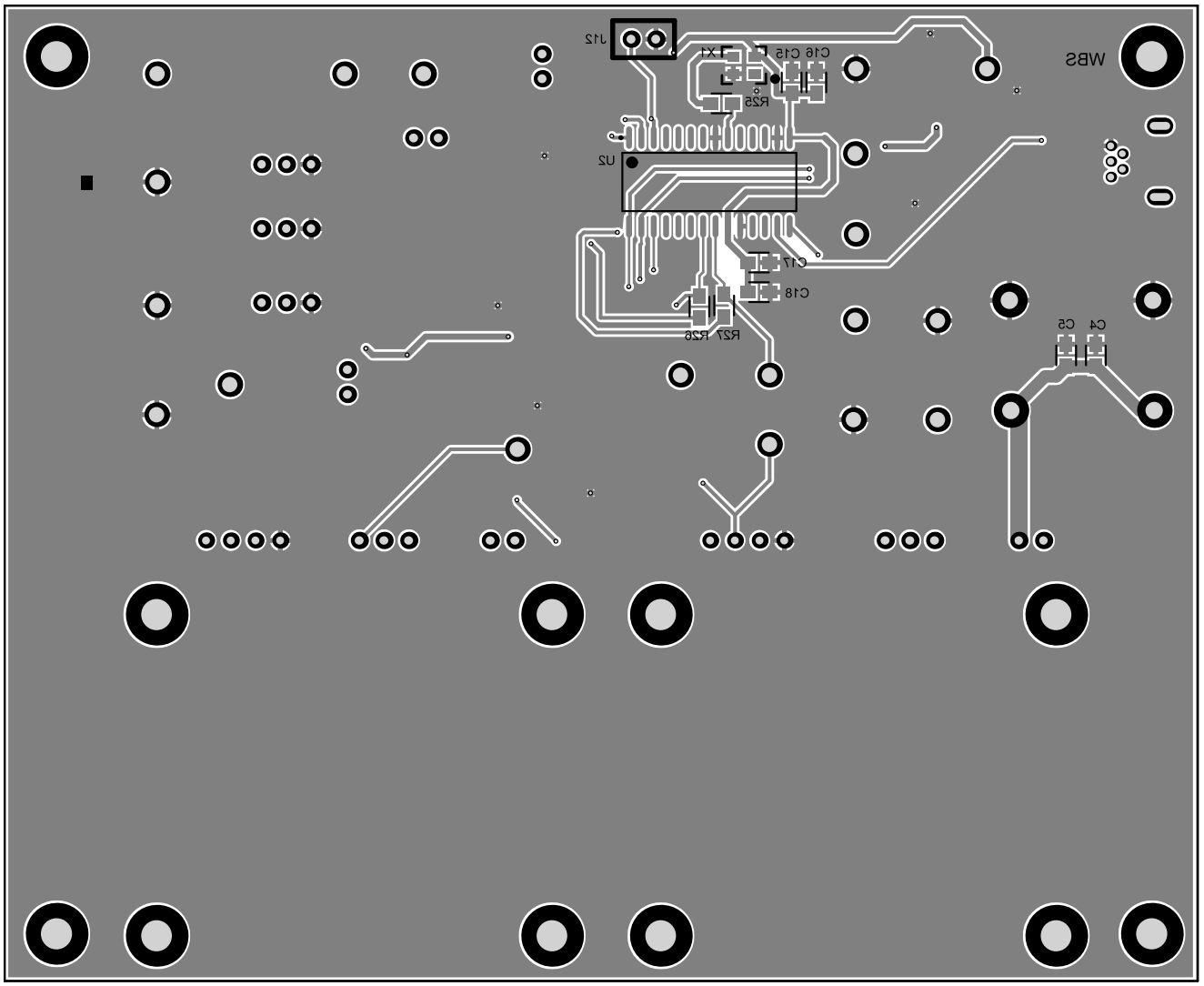


Figure 7. MAX31760 EV Kit PCB Layout—Bottom

Ordering Information

PART	TYPE
MAX31760EVKIT#	EV Kit

#Denotes RoHS compliant.

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	4/14	Initial release	—

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