

## General Description

The MAX31785 evaluation kit (EV kit) provides the hardware and software graphical user interface (GUI) necessary to evaluate the MAX31785 6-channel intelligent fan controller. The EV kit includes a MAX31785ETL+ installed, as well as a 12V fan and USB-to-I<sup>2</sup>C module to communicate with the PC.

## EV Kit Contents

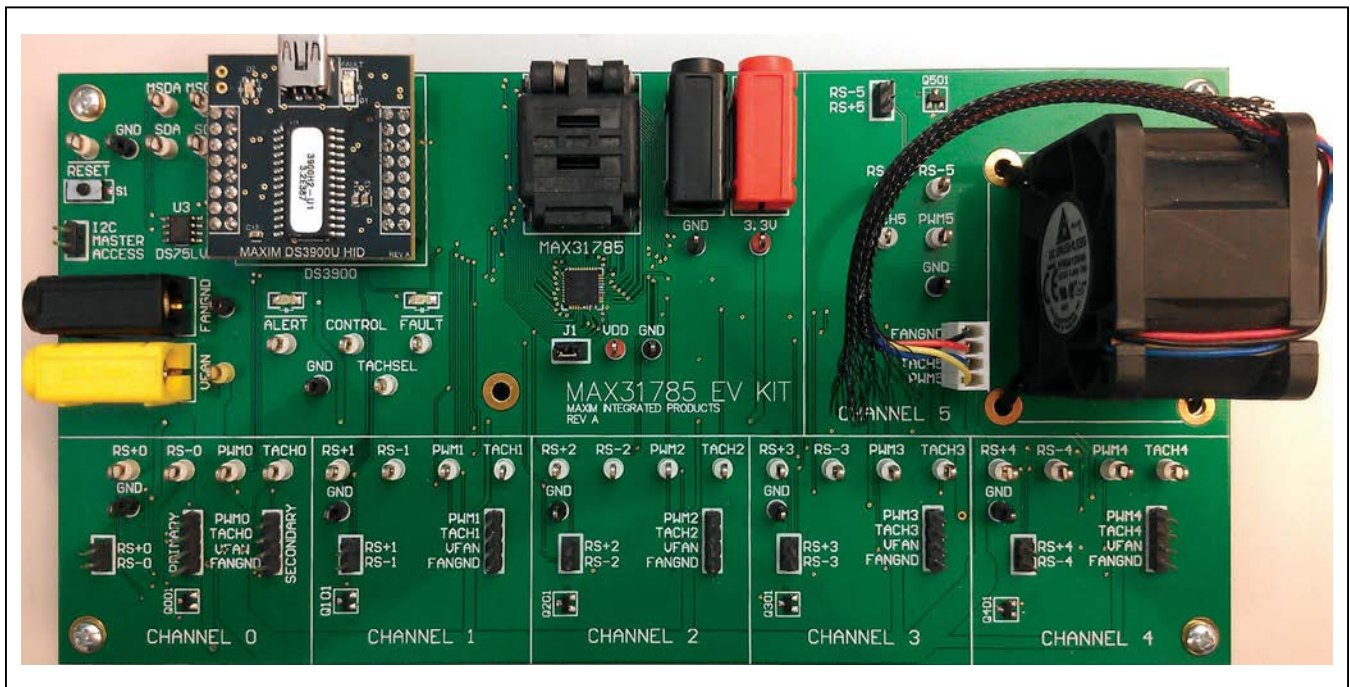
- Assembled circuit board including MAX31785ETL+
- DS3900 module
- 12V fan
- Mini-USB cable

## Features

- Easy Evaluation of the MAX31785
- 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.*

## EV Kit Photo



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

## Component List

DESIGNATION	QTY	DESCRIPTION
B1	1	Yellow banana jack
B2, B4	2	Black banana jacks
B3	1	Red banana jack
C001, C101, C201, C301, C401, C501	6	2.2nF, X7R ceramic capacitors (0805)
C004, C1, C2, C8, C11, C12, C15, C21	c8	100nF, X7R ceramic capacitors (0805)
C002, C003, C102, C103, C202, C203, C302, C303, C402, C403, C502, C503	0	Do not populate, ceramic capacitors (0805)
C3, C5, C10, C16, C18, C20	6	10nF, X7R ceramic capacitors (0805)
C4, C6, C17, C19	4	1 $\mu$ F, X7R ceramic capacitors (0805)
C7, C13	2	10 $\mu$ F, X7R ceramic capacitors (0805)
C9	1	47 $\mu$ F tantalum capacitor (Case C)
C14	0	Do not populate, tantalum capacitor (Case C)
D1, D2	2	Red LEDs (1206)
J1, P001, P1, P101, P201, P301, P401, P501	8	2-pin headers, 2.54mm pitch
P002C, P002O, P102, P202, P302, P402, P502	7	4-pin headers, 2.54mm pitch
Q001, Q101, Q201, Q301, Q401, Q501	6	npn transistors (3 SOT23) Fairchild MMBT3904
R001, R002, R16–R21, R101, R102, R201, R202, R301, R302, R401, R402, R501, R502	18	0 $\Omega$ $\pm$ 1% resistors (0805)
R003, R006, R103, R106, R203, R206, R303, R306, R403, R406, R503, R506	12	10 $\Omega$ $\pm$ 1% resistors (0805)
R004, R6, R7, R22, R104, R204, R304, R404, R504	0	Do not populate, resistors (0805)

DESIGNATION	QTY	DESCRIPTION
R005C, R005O, R105, R205, R305, R405, R505	7	1k $\Omega$ $\pm$ 1% resistors (0805)
R007, R4, R5, R8, R11–R15, R107, R207, R307, R407, R507	14	4.7k $\Omega$ $\pm$ 1% resistors (0805)
R1–R3, R23, R24	5	100k $\Omega$ $\pm$ 1% resistors (0805)
R9, R10	2	1.2k $\Omega$ $\pm$ 1% resistors (0805)
S1	1	Single-pole pushbutton switch
TP001–TP004, TP1–TP9, TP101–TP104, TP201–TP204, TP301–TP304, TP401–TP404, TP501–TP504	33	White test points
TP13, TP27	2	Red test points
TP14–TP21, TP23, TP24, TP26	11	Black test points
TP25	1	Yellow test point
U1A	1	6-channel intelligent fan controller (40 TQFN-EP*) Maxim MAX31785ETL+
U1B	0	Not installed, 6-channel intelligent fan controller (40 TQFN-EP*) Maxim MAX31785ETL+
U001	1	Low-voltage, single-supply, SPDT switch (6 SC706) Maxim MAX4599EXT-T
U2	1	USB communications module Maxim DS3900
U3	1	Digital temperature sensor (8 SO, 150 mil) Maxim DS75LV5+
—	1	PCB: MAX31785 EV KIT

\*EP = Exposed pad.

**MAX31785 EV Kit Files**

FILE	DESCRIPTION
MAX31785EVKSoftware.EXE	Application program

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

**Quick Start**

**Required Equipment**

- MAX31785 EV kit
- Windows XP or Windows 7 PC
- USB port
- Mini-USB cable (included)
- EV kit hardware (included)
- 12V fan (included)
- 3.3V (100mA) DC power supply
- 12V (500mA) DC power supply (if only operating the one provided fan)

**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 jumper J1 is populated and the DS3900 module (U2) is connected.
- 2) Connect a 12V fan to one of the six channel fan headers. For the fan supplied, make sure to connect FANGND to the black wire and VFAN to the red wire.
- 3) Set the EV kit hardware on a nonconductive surface to ensure that nothing on the PCB is shorted to the workspace.
- 4) Attach the GND first (black connector) to the ground jack of the 3.3V supply and connect the FANGND (black connector) to the ground jack of the +12V supply.

- 5) Connect the FANGND and GND nodes together. There is not a connection between these nodes on the PCB.
- 6) Connect the +3.3V (red connector) and +12V (yellow connector) power supplies and turn the power on. Either supply can be turned on first (no sequencing is required).
- 7) 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) on the DS3900 should be red and slowly flash orange.
- 8) 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, then 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.
- 9) Once the device driver installation is complete, visit [www.maximintegrated.com/evkitsoftware](http://www.maximintegrated.com/evkitsoftware) to download the latest version of the EV kit software, MAX31785EVKitSoftware.zip. Save the EV kit software to a temporary folder.
- 10) After the .EXE file has been extracted from the ZIP, double-click to launch 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 **Yes**.
- 11) When the GUI appears, the text at the bottom of the window should indicate that the USB is connected. The COM LED (D2) on the DS3900 changes to green. The GUI initially sets the CONTROL pin low to disable the fan.
- 12) The GUI can now be used to evaluate the MAX31785.

## Detailed Description of Software

### General Tab

The **General** tab sheet (Figure 1) displays the status of all pages and can be read by pressing the **Read Once** button in the **Monitor** group box. **Start Monitor** continuously reads until **Stop Monitor** is pressed. The values can be displayed in **Hex** or **DIRECT** format by selecting the appropriate radio button in the **Select display** section. The **Commands** group box allows users to read/write to registers that are 0–2 bytes long. First, select an item in the **Select a Page** drop-down list to write to PAGE (00h). Then, under the **Select or Enter Command** drop-down list, either select the command in the drop-down list or enter the command byte and press the **Read** button. To write to a register, enter the data byte in the **Data** edit box and press **Write**. In the **Global Commands** group box, pressing the **Soft Reset** button resets the device by setting a bit in MFR\_MODE (D1h) to 1, 0, and then 1 again within 8ms. The **Hard Reset** button resets the device by pulling the  $\overline{\text{RST}}$  pin low for 10ms. The **FanRunTime Reset**, **FanPwmAvg Reset**, and **MFRTimeCnt Reset** buttons reset their values by writing a sequence of all zeros, all ones, and all zeros within 8ms. The **FanRunTime Reset** and **FanPwmAvg Reset** only reset the MFR\_FAN\_RUN\_TIME (7Fh) and MFR\_FAN\_PWM\_AVG (F8h) values for the page selected from the **Select a Page** drop-down list. The **Clear Faults** button sends the CLEAR\_FAULTS (03h) command and the **Read Fault Log** button writes the fault log to a .TXT file. If the  $\overline{\text{ALERT}}$  pin is asserted, an alert indicator appears next to the **Alert Response** button and no longer responds to its fixed slave address. The **Alert Response** button sends the ARA (19h), waits for the device to ACK, and then reads the fixed slave address. The **Set Control** radio buttons pull the CONTROL pin either high or low. Setting the CONTROL pin low globally turns all fans off.

### PMBus™ Tab

The **PMBus™** tab sheet (Figure 2) allows the user to change the slave address and read/write to all PMBus commands. To change the software slave address, enter the slave address in the **Software Slave Address** edit box and press the **Change** button. This only changes the slave address that the software uses to communicate and does not change the hardware's slave address. To search for all slave addresses available on the I<sup>2</sup>C bus, press **Find**. **Note:** Slave address 34h is the factory-programmed address and should not be selected for communication. To read/write to a PMBus command, first select a page in the **Select a Page** drop-down list, which writes to PAGE (00h). Then enter the command address in the **Command** spin box and select the number of bytes to read/write from the **Number of Data** drop-down list. Press **Read** or enter data in the edit boxes and press **Write**. To read/write more than 16 bytes, click on the **Word** radio button in the **Mode** group box, which places two bytes in each data box for a maximum of 32 bytes.

### File Tab

The **File** tab sheet (Figure 3) can save the PMBus setting to a file and program the MAX31785 with settings saved in a file. The flashed-stored PMBus settings can be saved to a file in three different formats. The **Dump** button saves the settings to a .TXT file in a tab-delimited table format. The **Machine Code Dump** button saves the commands to a .TXT file in a machine-code format. The **Intel Hex Dump** button generates a .HEX file with the STORE\_DEFAULT\_ALL (11h) command placed at the end of the file. To program the device with values saved in a file, press the **Fill Device** button and select a .TXT file that was generated using the **Dump** button.

*PMBus is a trademark of SMIF, Inc.*

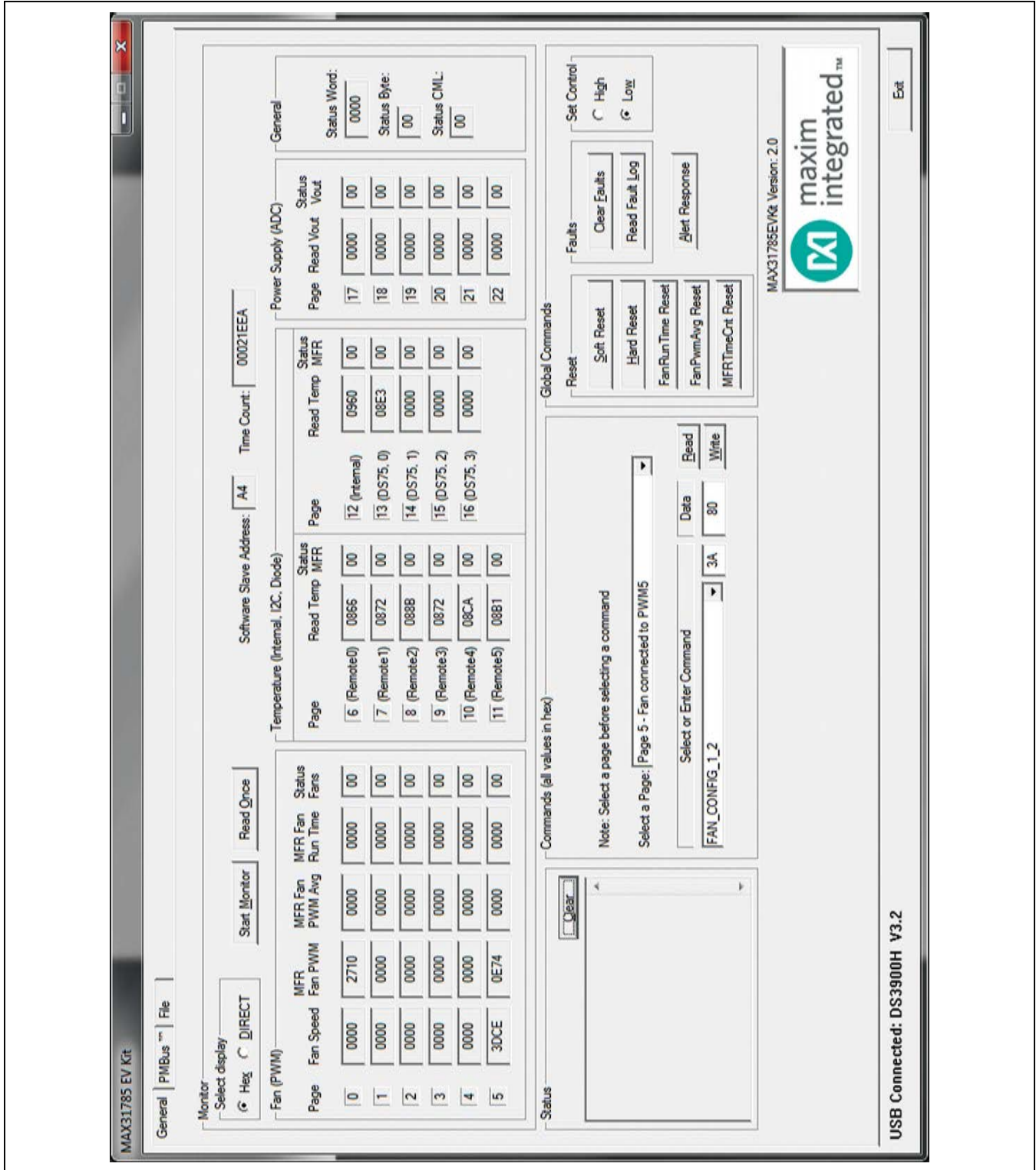


Figure 1. MAX31785 EV Kit GUI (General Tab)

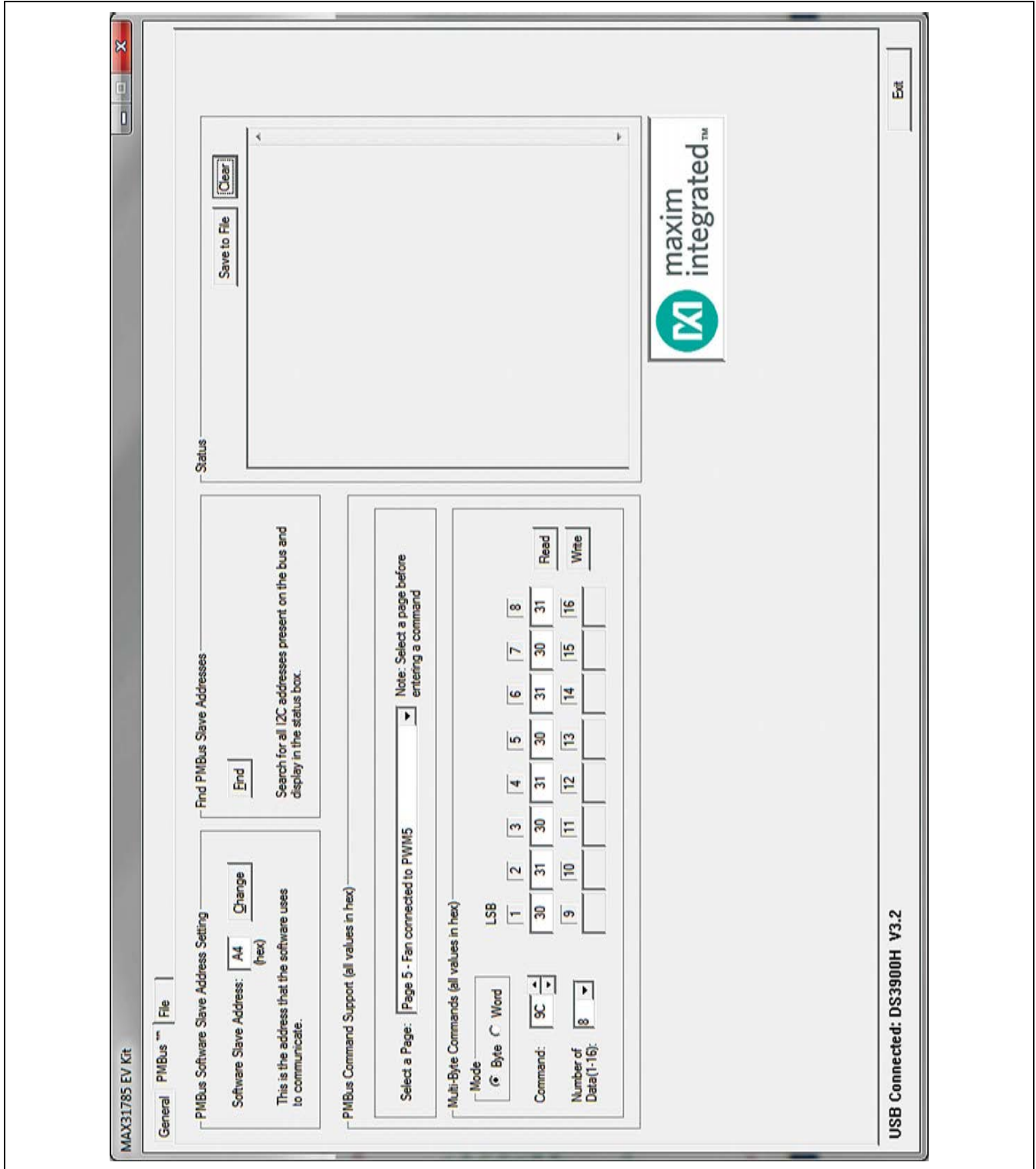


Figure 2. MAX31785 EV Kit GUI (PMBus Tab)

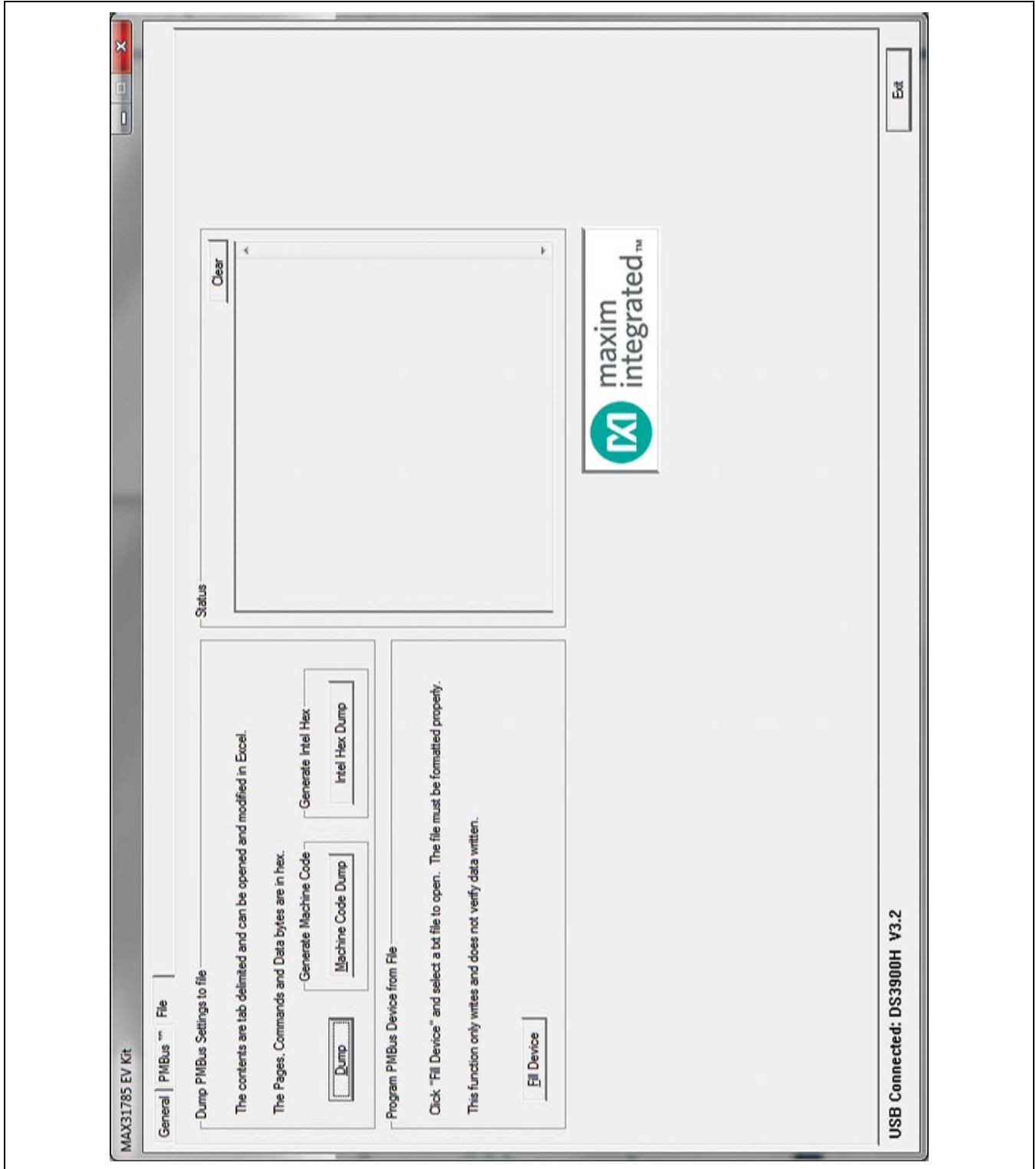


Figure 3. MAX31785 EV Kit GUI (File Tab)

## Detailed Description of Hardware

### Connecting a Fan

Mount the fan to the PCB with the provided mounting holes to prevent the fan from moving while spinning. To connect 4-wire fans, connect to FANGND, VFAN, TACHX, and PWMX. For 3-wire fans, leave PWMX unconnected. FANGND is a typical black wire and VFAN is usually a red wire on a fan.

### User-Supplied Remote Diode or Remote Voltage

To connect a user-supplied external remote diode or remote voltage, remove resistors RX01 and RX02, where X is the channel number. Then connect the diode or voltage to the header labeled with RS+X and RS-X.

### User-Supplied DS75LV

To use an off-board digital temperature sensor, connect the DS75LV device (U3) to the MSDA, MSCL, and GND test points or use the I<sup>2</sup>C master access header. The user-supplied DS75LV address pins should be configured for temp sensor I<sup>2</sup>C 1, 2, or 3. The on-board DS75LV is configured to be temp sensor I<sup>2</sup>C 0.

### User-Supplied I<sup>2</sup>C Interface

To use the device with a user-supplied I<sup>2</sup>C interface, remove the DS3900 module from the EV kit. Then connect SDA, SCL, and GND of the microcontroller to the test points provided on the EV kit board.

### Troubleshooting

All efforts were made to ensure that each EV kit works on the first try, right out-of-the-box. In the rare occasion that a problem is suspected, see Table 2 to help troubleshoot the issue.

### Determine DS3900 Module Type

The DS3900 module has been updated to the DS3900 HID (Figure 4). If the DS3900 COM (Figure 5) is attached to the EV kit, download the MAX31785EVKitCOM.ZIP file available at [www.maximintegrated.com/evkitsoftware](http://www.maximintegrated.com/evkitsoftware) and follow the *Quick Start Guide* included in the ZIP file.

**Table 1. Description of LEDs**

LED	COLOR	DESCRIPTION
D1	Red	<b>ALERT:</b> A fault occurred. The device no longer responds to its fixed slave address. See the <b>General</b> tab (Figure 1) to clear.
D2	Red	<b>FAULT:</b> A fault occurred. See the <b>General</b> tab to clear.
DS3900 D1	Red	<b>USB Power Fault:</b> A fault occurred due to overvoltage limit, current limit, or thermal limit.
DS3900 D2	Red	<b>Communication:</b> After the software has initialized the hardware, the LED flashes red when a command from the PC is received.
	Green	<b>Initialized:</b> Hardware has been initialized by software.



Table 2. Troubleshooting

SYMPTOM	CHECK	SOLUTION
GUI indicates <b>USB not Connected</b>	DS3900 HID module	The DS3900 module has been updated. Go to <b>Determine DS3900 module Type</b> to see if the correct one is connected.
	Is the LED labeled D1 on the DS3900 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 D2 on the DS3900 turn green when the GUI is running?	If not, then exit the GUI and try running it again. If the 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 of the LEDs illuminated?	If not, then the PCB may not be getting power. Make sure 3.3V is connected to the red banana jack and the USB cable is connected to a PC.
GUI indicates <b>Could not communicate with PMBus. Slave address not recognized.</b>	J1	Make sure J1 is populated with a jumper.
	MAX31785	Make sure there is a MAX31785 in the socket or solder to the board.
Fan will not turn on	VFAN	Make sure there is 12V connected to the yellow banana jack if using the supplied fan.
	Fan header	Make sure the fan is properly connected to the fan header. FANGND is a black wire and VFAN is a red wire on the fan supplied.
	CONTROL pin	Make sure the CONTROL pin is high by clicking on the <b>High</b> radio button on the <b>General</b> tab.
	FAN_CONFIG_1_2 (3Ah)	Check that the Fan Enable bit (bit 7) in FAN_CONFIG_1_2 is set to 1.

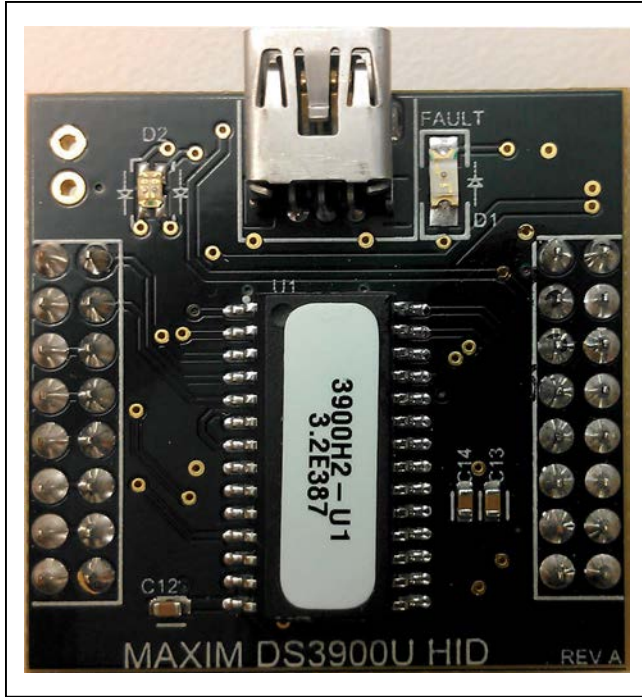


Figure 4. DS3900 HID Module

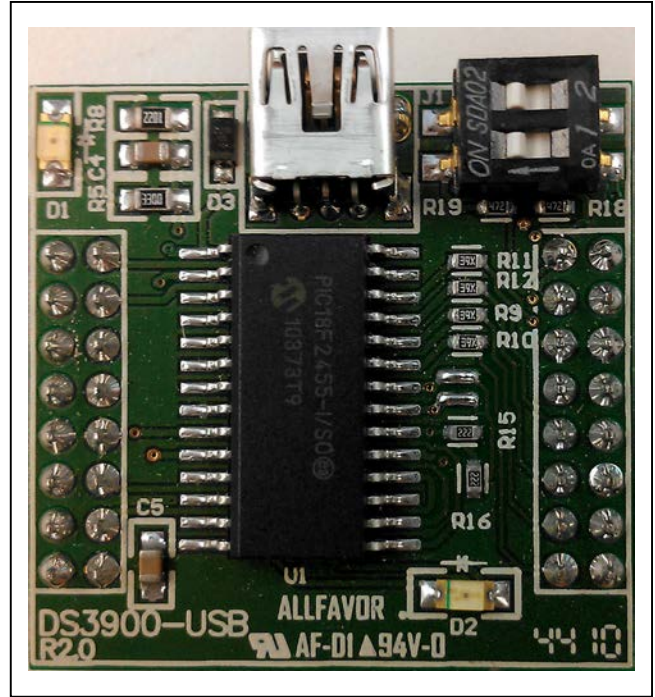


Figure 5. DS3900 COM Module

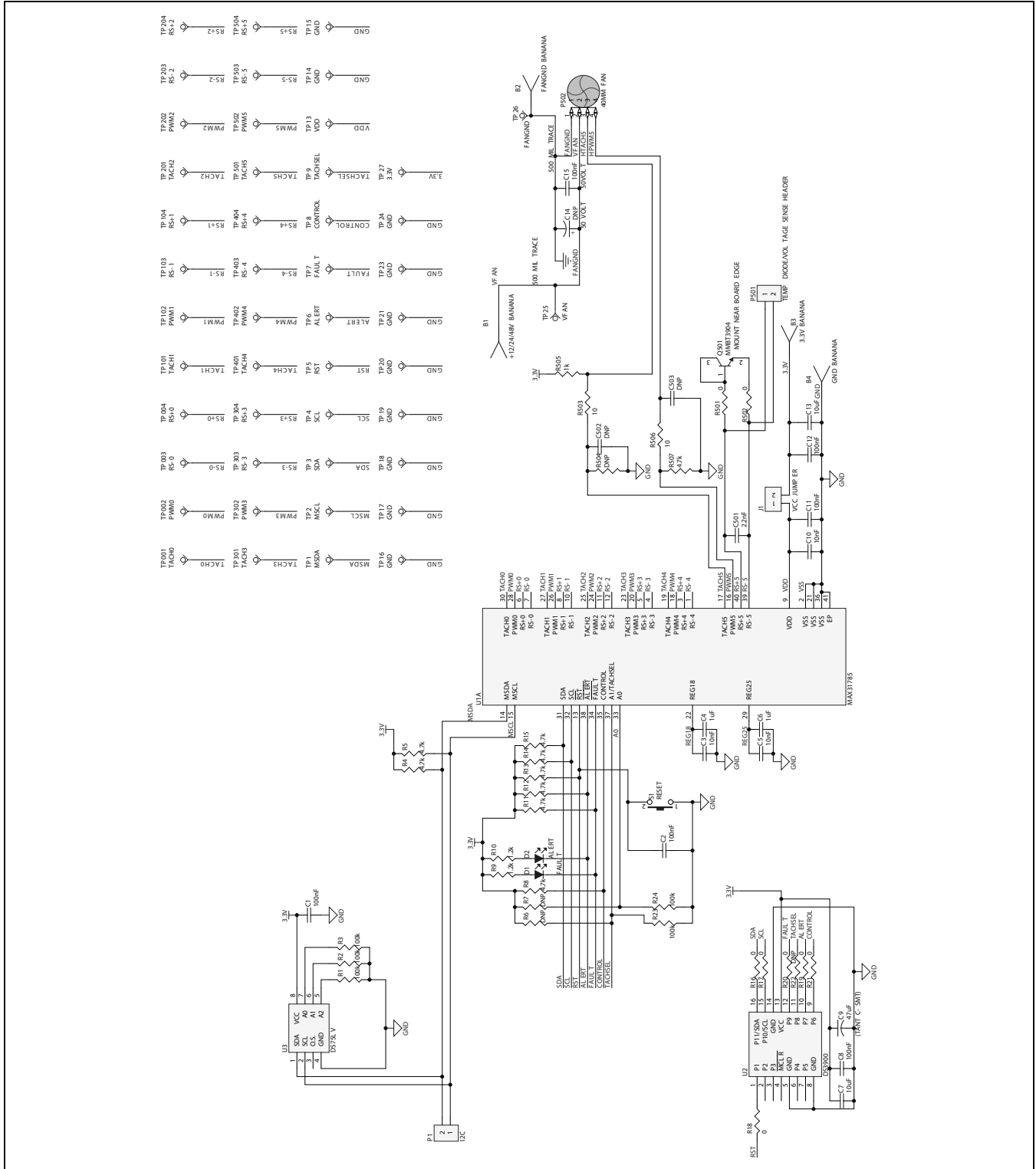


Figure 6a. MAX31785 EV Kit Schematic (Sheet 1 of 3)



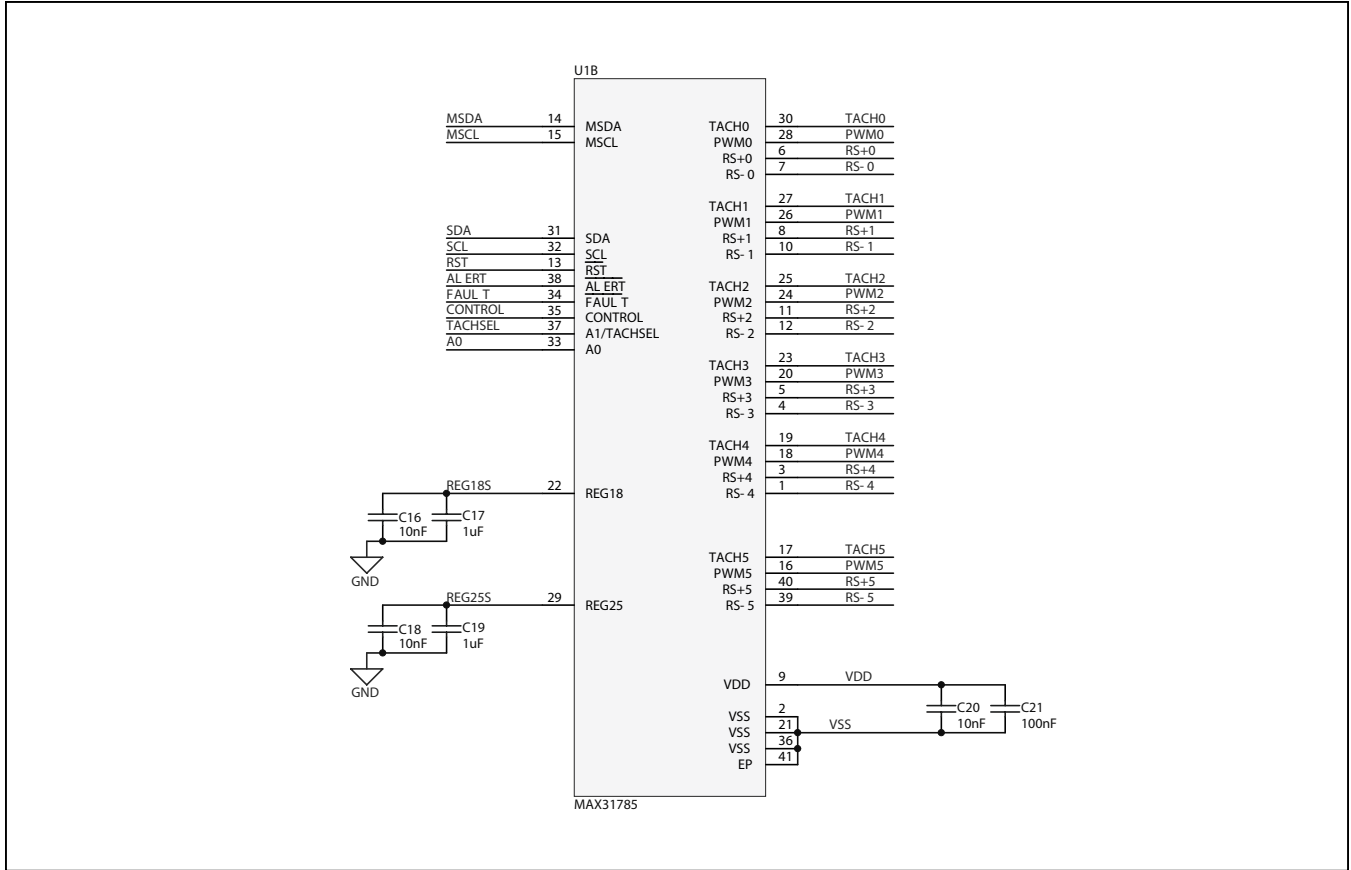


Figure 6c. MAX31785 EV Kit Schematic (Sheet 3 of 3)

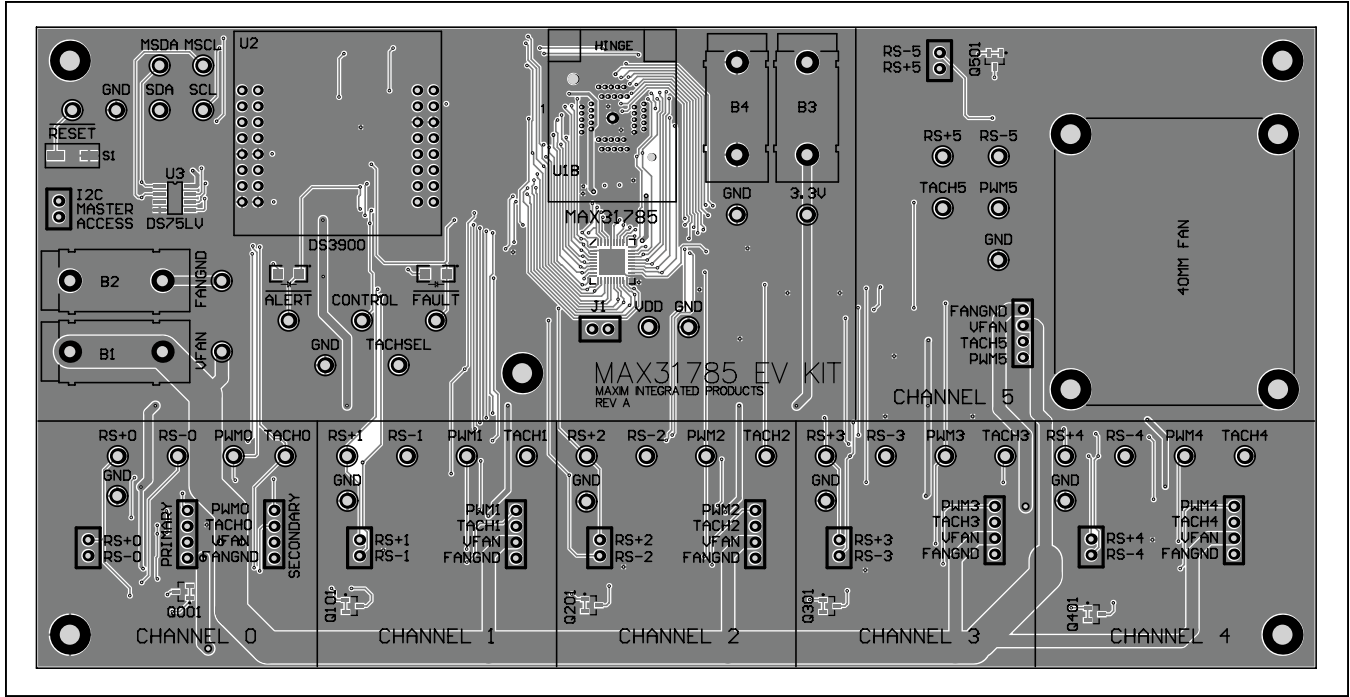


Figure 7. MAX31785 EV Kit PCB Layout—Top

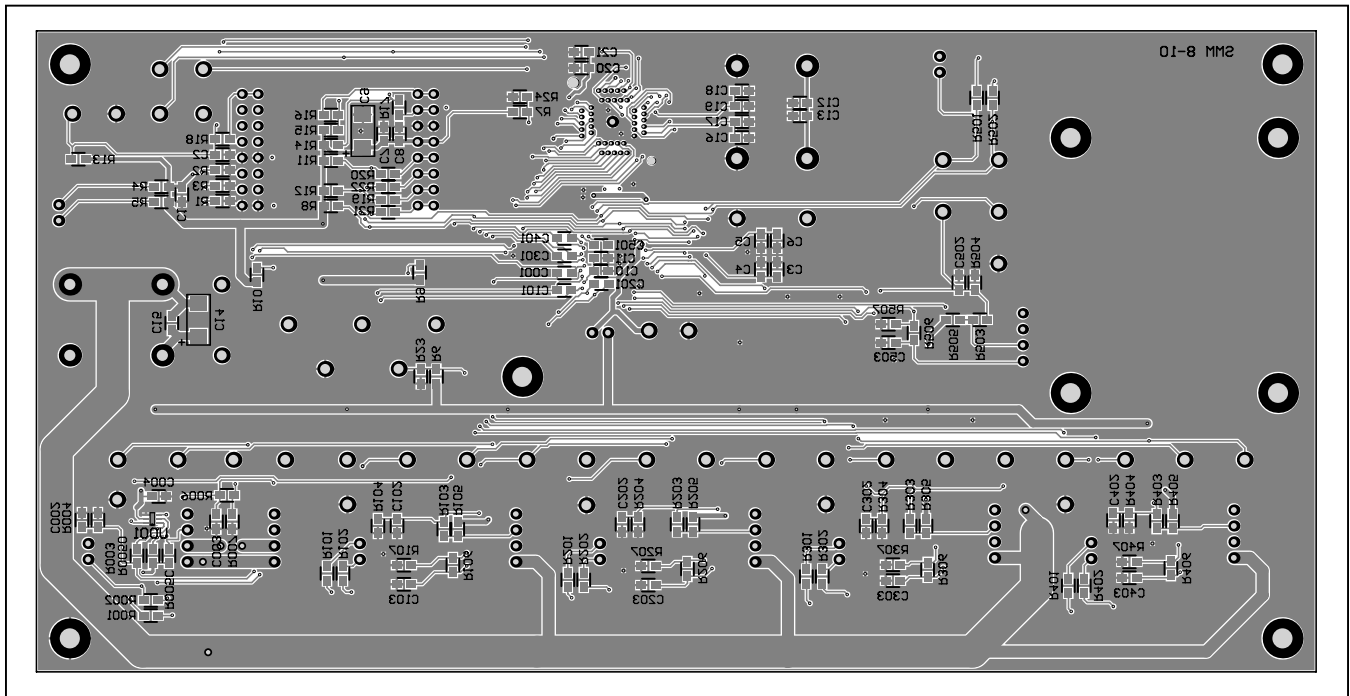


Figure 8. MAX31785 EV Kit PCB Layout—Bottom

### Ordering Information

PART	TYPE
MAX31785K#	EV Kit

*#Denotes an RoHS-compliant device that may include lead(Pb), which is exempt under the RoHS requirements.*

## Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	12/12	Initial release	—

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](http://www.maximintegrated.com).

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