19-4060; Rev 0; 2/08

MAX5312 Evaluation Kit

Evaluates: MAX5312

General Description

The MAX5312 evaluation kit (EV kit) provides a proven design to evaluate the MAX5312 ±10V, 12-bit, serial voltage-output digital-to-analog converter (DAC). The EV kit also includes Windows 2000/XP/Vista® (32-bit)-compatible software that provides a simple graphical user interface (GUI) for exercising the features of the MAX5312. The MAX5312 EV kit printed-circuit board (PCB) comes with a MAX5312EAE+ installed.

Ordering Information

PART	TYPE
MAX5312EVKIT+	EV Kit

+Denotes lead-free and RoHS-compliant.

Features

- **Evaluates ±10V or 0 to +10V Full-Scale Output-Voltage Swing**
- **On-Board USB Interface Circuit for SPI™-Compatible Signals**
- **USB-PC Connection (Cable Included)**
- **On-Board Pads for User-Supplied SPI-Compatible Signals**
- **Proven PCB Layout**
- **Evaluates the MAX5312EAE+ in a 16-Pin SSOP Package**
- **Windows 2000/XP/Vista (32-Bit)-Compatible Software**
- **Fully Assembled and Tested**
- **Lead-Free and RoHS-Compliant**

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C12, C14, C25	4	10µF ±20%, 16V X5R ceramic capacitors (1206) Murata GRM31CR61C106M
C2, C3	2	22pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H220J
C4	1	0.033µF ±10%, 16V X5R ceramic capacitor (0603) Taiyo Yuden EMK107BJ333KA
C5–C10, C17, C18, C19, C21, C24, C26, C28, C29, C31	15	0.1µF ±10%, 16V X7R ceramic capacitors (0603) TDK C1608X7R1C104K
C11, C13, C22, C23, C27, C30	6	1µF ±10%, 16V X5R ceramic capacitors (0603) TDK C1608X5R1C105K
C15, C16	2	10pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H100J
C20	0	Not installed, capacitor (0603)
J1	1	USB series-B right-angle PC-mount receptacle
JU1–JU8, JU10	9	3-pin headers

DESIGNATION	QTY	DESCRIPTION
L1	1	Ferrite bead
R1, R2	2	27Ω ±5% resistors (0603)
R3	1	1.5kΩ ±5% resistor (0603)
R4	1	470Ω ±5% resistor (0603)
R5	1	2.2kΩ ±5% resistor (0603)
R6	1	10kΩ ±5% resistor (0603)
R10	1	169kΩ ±1% resistor (0603)
R11	1	100kΩ ±1% resistor (0603)
R12–R16, R19	0	Not installed, resistors—short (PC trace) (0603)
U1	1	±10V, 12-bit, serial voltage-output DAC (16-pin SSOP) Maxim MAX5312EAE+
U2	1	Adjustable output LDO regulator (5-pin SC70) Maxim MAX8512EXK+T
U3	1	LDO regulator (5-pin SC70) Maxim MAX8511EXK25+T
U4	1	USB UART (32-pin TQFP, 7mm x 7mm) FTDI FT232BL

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SPI is a trademark of Motorola, Inc.

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

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Component List (continued)

DESIGNATION	QTY	DESCRIPTION
U5	1	93C46 type 3-wire EEPROM (8-pin SO) Atmel AT93C46A-10SU-2.7
U6	1	Microcontroller (68-pin QFN EP*, 10mm x 10mm) Maxim MAXQ2000-RAX+
U7	1	5.0V voltage reference (8-pin SO) Maxim MAX6126BASA50+

**EP = Exposed pad.*

DESIGNATION	QTY	DESCRIPTION
Y1	1	16MHz crystal
Y2	1	6MHz crystal
Y3	0	Not installed, crystal
—	9	Shunts
—	1	USB high-speed A-to-B cables, 6ft
—	1	PCB: MAX5312 Evaluation Kit+

Component Suppliers

SUPPLIER	PHONE	WEB SITE
Murata Mfg. Co., Ltd.	770-436-1300	www.murata.com
Taiyo Yuden	800-348-2496	www.t-yuden.com
TDK Corp.	847-803-6100	www.component.tdk.com

Note: *Indicate that you are using the MAX5312 when contacting these component suppliers.*

MAX5312 EV Kit Files

FILE	DESCRIPTION
INSTALL.EXE	Installs the EV kit files on your computer
MAX5312.EXE	Application program
FTD2XX.INF	USB device driver file
UNINST.INI	Uninstalls the EV kit software
USB_Driver_Help.PDF	USB driver installation help file

Quick Start

Recommended Equipment

Before beginning, the following equipment is needed:

- MAX5312 EV kit (USB cable included)
- ±15V power supply
- +6V power supply
- Voltmeter
- A user-supplied Windows 2000/XP/Vista (32-bit)-compatible PC with a spare USB port

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.

Procedure

The MAX5312 EV kit is fully assembled and tested. Follow the steps below to verify board operation. **Caution: Do not turn on power supplies until all connections are completed.**

1) Visit www.maxim-ic.com/evkitsoftware to download the latest version of the EV kit software, 5312Rxx.ZIP. Save the EV kit software to a temporary folder and uncompress the ZIP file.
2) Install the EV kit software on your computer by running the INSTALL.EXE program inside the temporary folder. The program files are copied and icons are created in the Windows **Start | Programs** menu.
3) Verify that all jumpers are in their default positions, as shown in Table 1.
4) Ensure that the power supplies are off.
5) Connect the positive terminal of the ±15V power supply to the pad labeled VDD.
6) Connect the negative terminal of the ±15V power supply to the pad labeled VSS.
7) Connect the ground terminal of the ±15V power supply to the pad labeled AGND.
8) Connect the positive terminal of the +6V power supply to the pad labeled REFVDD.
9) Connect the ground terminal of the +6V power supply to the pad labeled AGND.
10) Turn on the +6V power supply and the ±15V power supply.
11) Connect the USB cable from the PC to the EV kit board. A **New Hardware Found** window pops up when installing the USB driver for the first time. If you do not see a window that is similar to the one described above after 30s, remove the USB cable from the board and reconnect it. Administrator privileges are required to install the USB device driver on Windows.

12) Follow the directions of the **Add New Hardware Wizard** to install the USB device driver. Choose the **Search for the best driver for your device** option. Specify the location of the device driver to be **C:\Program Files\MAX5312** (default installation directory) using the **Browse** button. During device driver installation, Windows may show a warning message indicating that the device driver Maxim uses does not contain a digital signature. This is not an error condition and it is safe to proceed with installation. Refer to the USB_Driver_Help.PDF document included with the software for additional information.

13) Start the MAX5312 EV kit software by opening its icon in the **Start | Programs** menu. The EV kit software main window appears, as shown in Figure 1.

14) Wait approximately 5s for the program to connect to the hardware.

15) Drag the DAC scrollbar all the way to the right.

16) Press the **Load input and DAC registers** button.

17) Use the voltmeter to verify that the voltage across the OUT pad and the SGND pad is approximately +10V.

Detailed Description of Software

To start the MAX5312 EV kit software, double-click the MAX5312 EV kit icon that is created during installation. The GUI main window appears as shown in Figure 1. The **Software Control** group box located at the left of the window controls the DAC registers through the SPI interface. The **Hardware Control** group box located at the right of the window controls the $\overline{CLR}$, $\overline{LDAC}$, UNI/$\overline{BIP}$, and $\overline{SHDN}$ pins of the MAX5312 by the GPIOs of the microcontroller. The **SPI Interface** group box at the top right allows the user to transfer SPI commands by entering the commands in the edit box.

Software Control

Use the **Software Control** group box to set the output-voltage values for the DAC. Measure the actual reference voltage on the REF pin of the MAX5312 and enter the values into the **Voltage Reference** edit box. These values will be used to calculate the expected output-voltage values of the DAC.

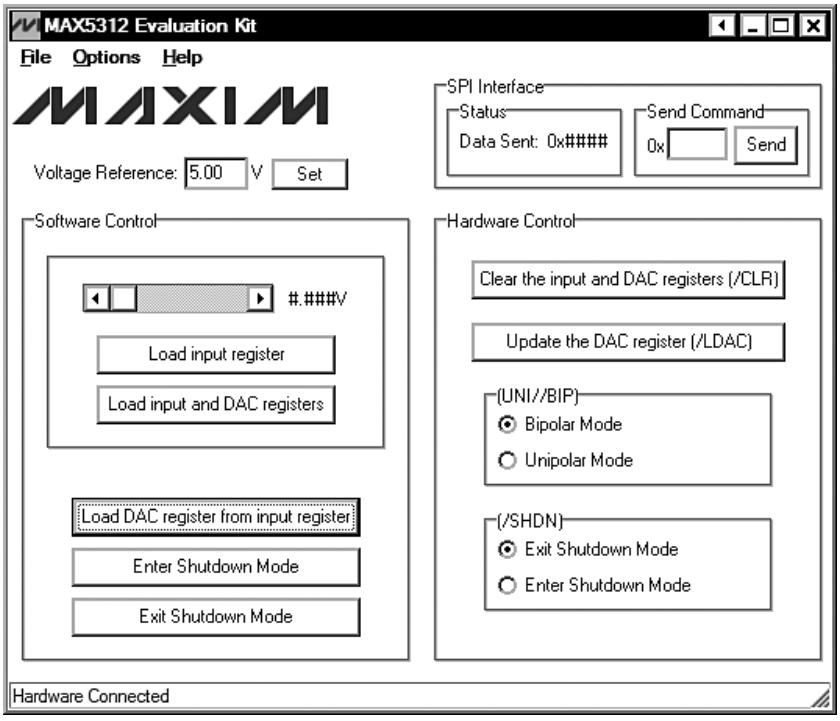


Figure 1. MAX5312 EV Kit Software Main Window

Use the **DAC** scrollbar to set the 12-bit DAC data. The adjacent label at the right of the scrollbar displays the equivalent expected output-voltage values of the DAC. Press the **Load input register** button to load the DAC data into the input register of the MAX5312 (DAC output unchanged). To load the input and DAC registers, press the **Load input and DAC registers** button (DAC output updated). To load the DAC register from the input register, press the **Load DAC register from input register** button (DAC output updated). Press the **Enter Shutdown Mode** button to put the MAX5312 into shutdown mode. To exit shutdown mode, press the **Exit Shutdown Mode** button.

Hardware Control

The **Hardware Control** group box controls the signals on the $\overline{CLR}$, $\overline{LDAC}$, UNI/$\overline{BIP}$, and the $\overline{SHDN}$ pins through the GPIO pins of the microcontroller. By default, the signals on $\overline{CLR}$, $\overline{LDAC}$, and $\overline{SHDN}$ are high and the signal on UNI/$\overline{BIP}$ is low.

Press the **Clear the input and DAC registers (/CLR)** button to generate a negative pulse on the $\overline{CLR}$ pin and asynchronously clear the input and DAC registers. The DAC output is set to 0V in unipolar or bipolar mode.

Press the **Update the DAC register (/LDAC)** button to generate a negative pulse on the $\overline{LDAC}$ pin and asynchronously load the DAC register from the input register. The DAC output immediately updates with the data from the input register.

In the **UNI//BIP** group box, select the **Bipolar Mode** radio button to evaluate bipolar mode. Select the **Unipolar Mode** radio button to evaluate unipolar mode.

In the **/SHDN** group box, select the **Enter Shutdown Mode** radio button to set the $\overline{SHDN}$ pin low to evaluate the shutdown mode and reduce the current consumption. Select the **Exit Shutdown Mode** radio button to set the $\overline{SHDN}$ pin high and resume normal operation. Hardware control takes precedence over software control.

SPI Interface

Within the **SPI Interface** group box, the **Status** group box displays the last command that is sent to the MAX5312.

Use the **Send Command** group box to manually enter the SPI command in hex format in the edit box and send the command to the MAX5312 by pressing the **Send** button.

Detailed Description of Hardware

The MAX5312 EV kit board provides a proven layout for evaluating the MAX5312. The EV kit comes with the MAX5312EAE+ installed.

Voltage Reference

By default, the on-board MAX6126 +5V external reference is connected to the REF pin of the MAX5312. To use an external voltage reference, place the shunts of JU10 to the 2-3 position. Attach the external reference between +2V and +5.25V to the REF pad. Adjust the **Voltage Reference** values in the program.

User-Supplied Signals

To use the MAX5312 EV kit with an external SPI interface, install the shunts of JU1, JU4, JU5, and JU6 to the 2-3 position. Connect the SCLK, DIN, $\overline{CS}$, DOUT, VCC, and GND lines from the external SPI interface to the corresponding pads on the MAX5312 EV kit.

To apply the external signals to the $\overline{SHDN}$ and UNI/$\overline{BIP}$ pins of the MAX5312, install the shunts of JU2 and JU3 to the 2-3 position. Connect the external signals to the $\overline{SHDN}$ and UNI/$\overline{BIP}$ pads on the MAX5312 EV kit.

Optimal Measurement

To have the optimal measurements of the DAC output voltage, use an external power supply. After programming the output voltage for the DAC, disconnect the USB cable from the EV kit to eliminate any noise coming from the USB, and measure the output.

Table 1. MAX5312 EV Kit Jumper Descriptions (JU1–JU8, JU10)

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	1-2*	VCC connected to on-board digital supply
	2-3	Connects the external VCC to the VCC pad
JU2	1-2*	$\overline{SHDN}$ signal connected to on-board microcontroller
	2-3	Connect external $\overline{SHDN}$ signal to the on-board $\overline{SHDN}$ pad
JU3	1-2*	UNI/$\overline{BIP}$ signal connected to on-board microcontroller
	2-3	Connect external UNI/$\overline{BIP}$ signal to the on-board UNI/$\overline{BIP}$ pad
JU4	1-2*	SCLK signal connected to on-board microcontroller
	2-3	Connect external SCLK signal to the on-board SCLK pad
JU5	1-2*	DIN signal connected to on-board microcontroller
	2-3	Connect external DIN signal to the on-board DIN pad
JU6	1-2*	$\overline{CS}$ signal connected to on-board microcontroller
	2-3	Connect external $\overline{CS}$ signal to the on-board $\overline{CS}$ pad
JU7	1-2*	$\overline{CLR}$ signal connected to on-board microcontroller
	2-3	Connect external $\overline{CLR}$ signal to the on-board $\overline{CLR}$
JU8	1-2*	$\overline{LDAC}$ signal connected to on-board microcontroller
	2-3	Connect external $\overline{LDAC}$ signal to the on-board $\overline{LDAC}$ pad
JU10	1-2*	REF connected to on-board +5V reference
	2-3	Connect external reference to the on-board REF pad

**Default position.*

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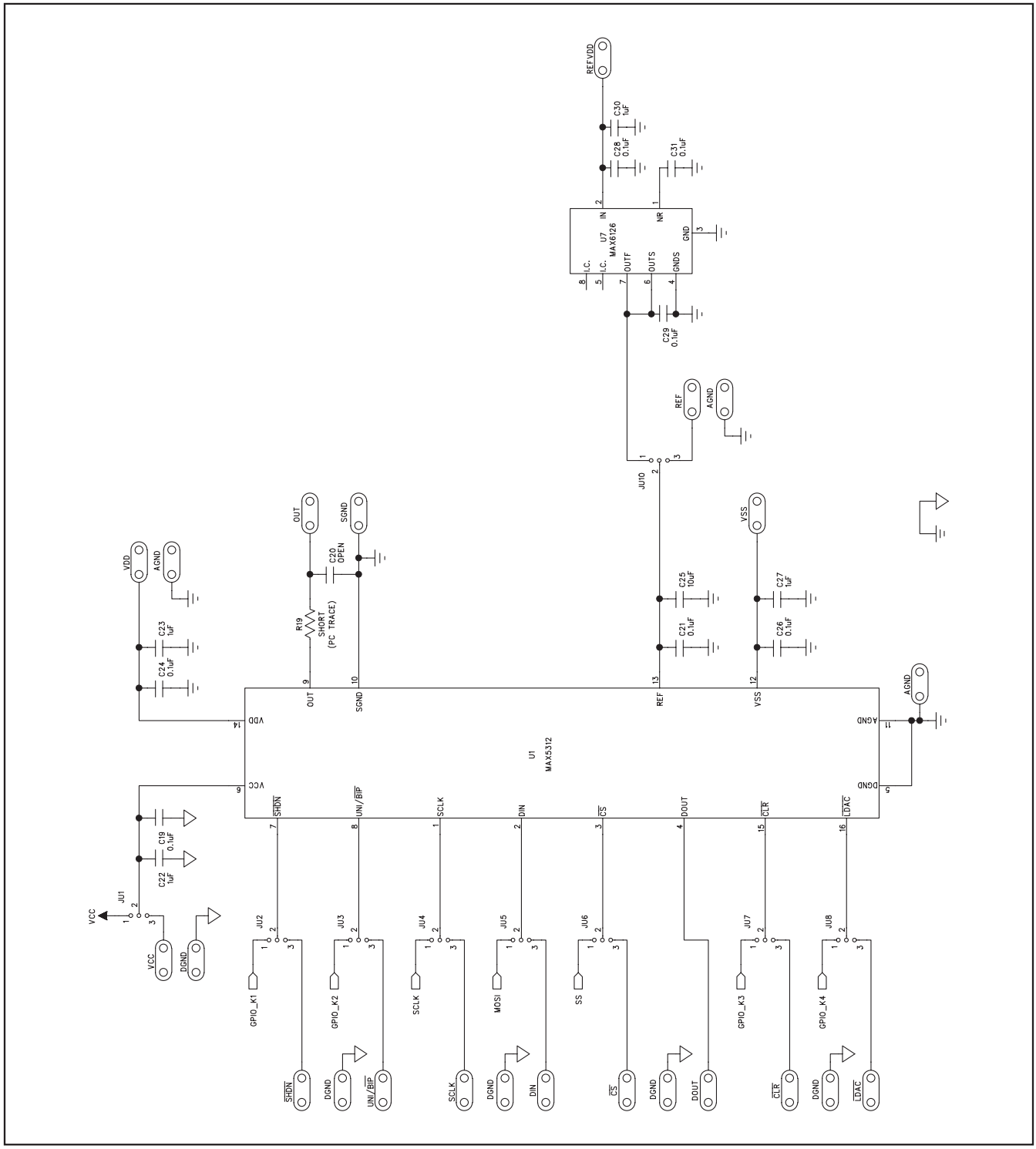


Figure 2a. MAX5312 EV Kit Schematic (Sheet 1 of 2)

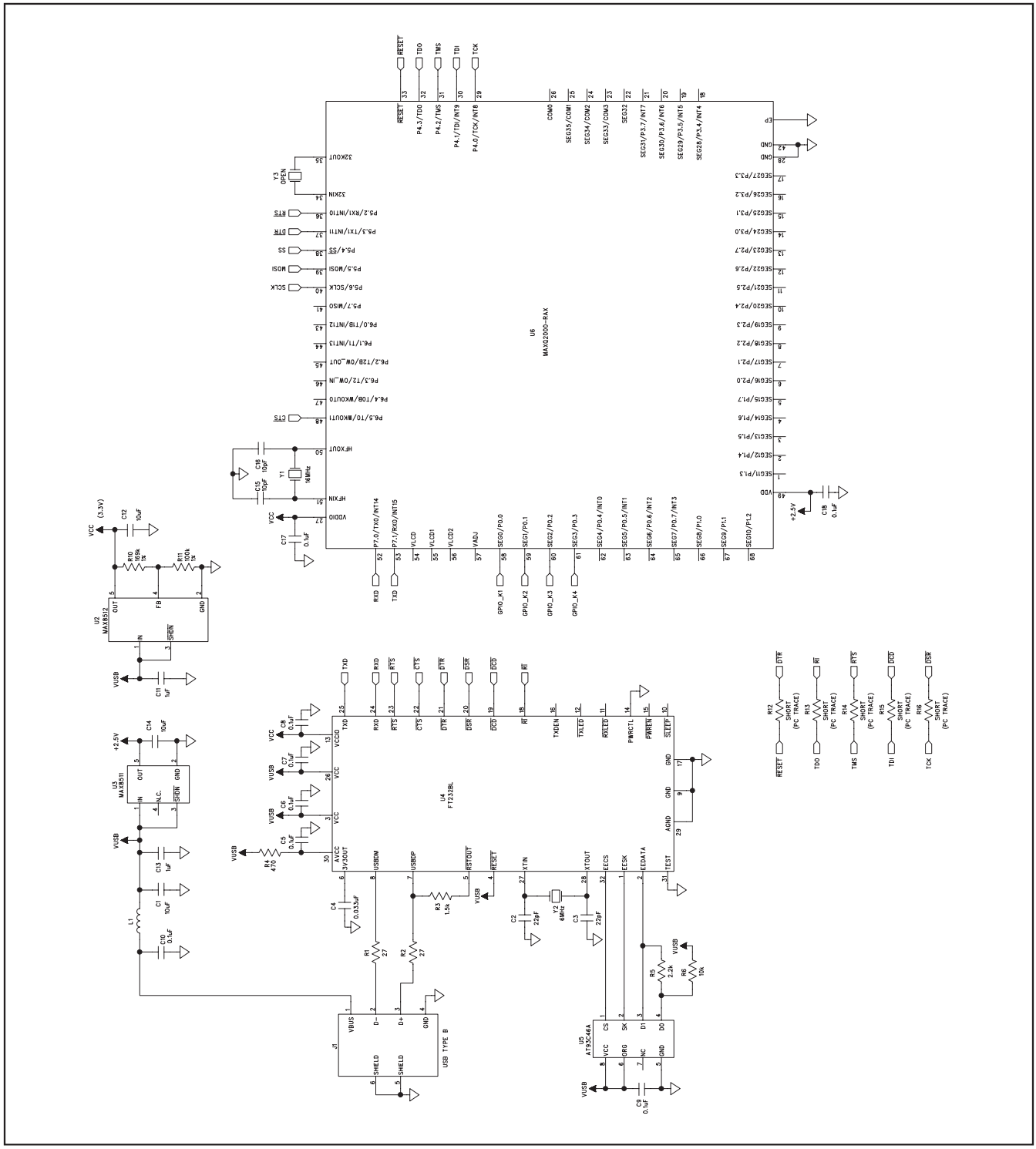


Figure 2b. MAX5312 EV Kit Schematic (Sheet 2 of 2)

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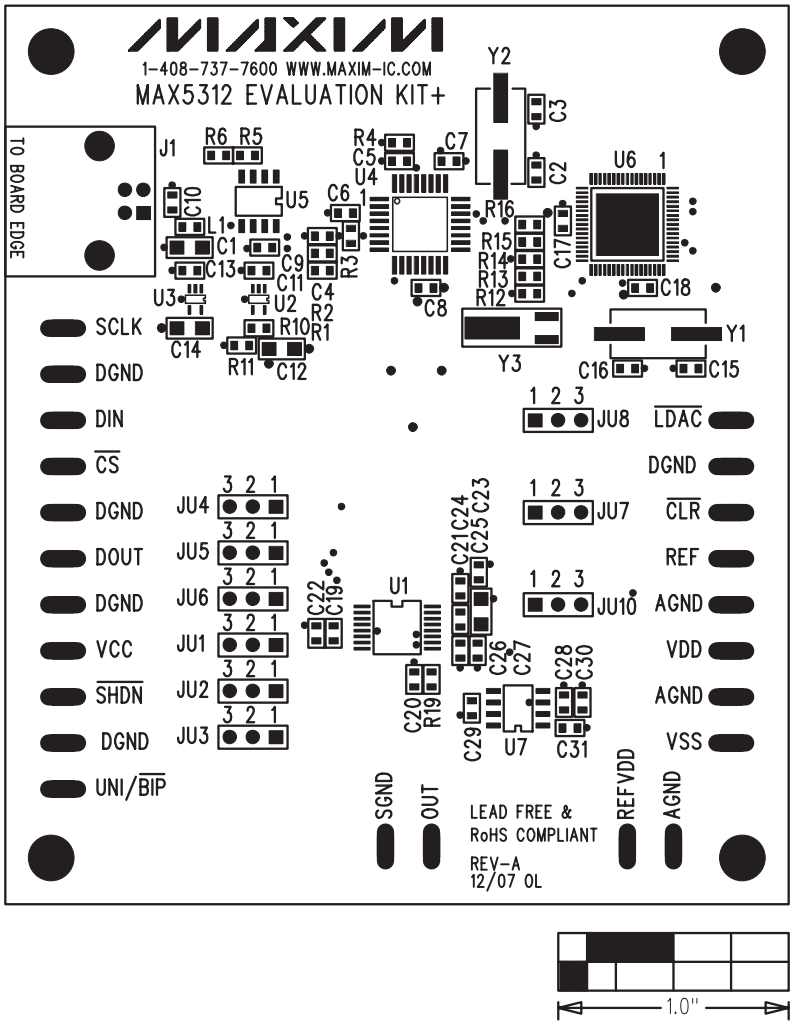


Figure 3. MAX5312 EV Kit Component Placement Guide—Component Side

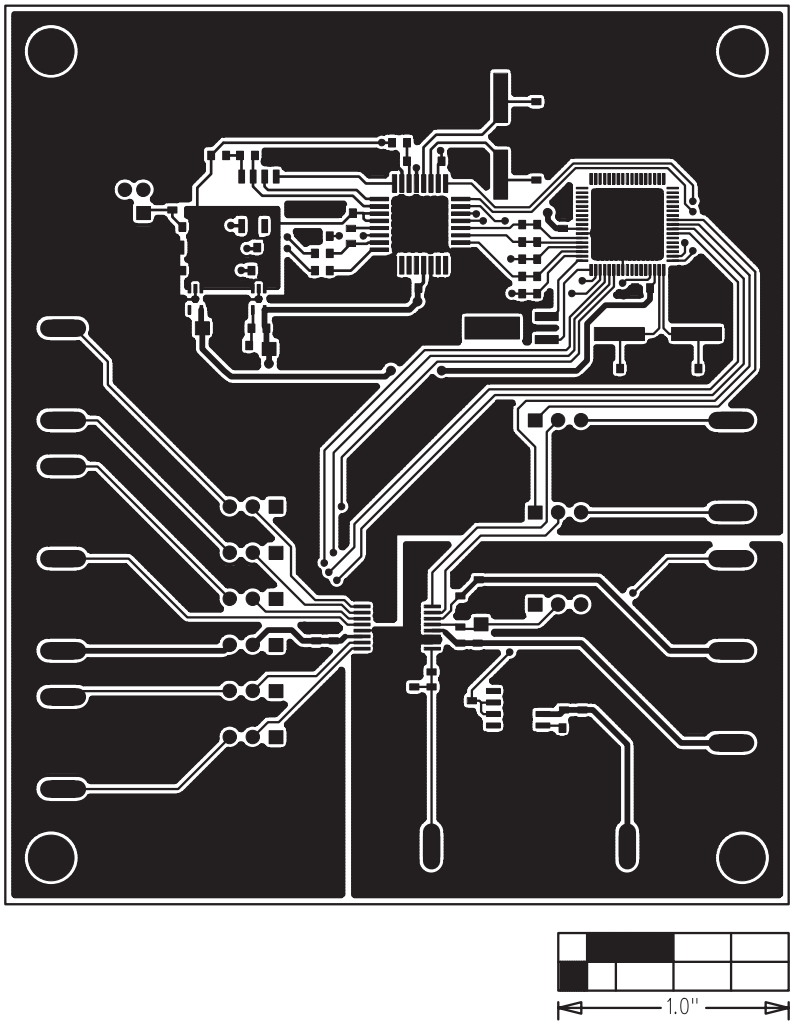


Figure 4. MAX5312 EV Kit PCB Layout—Component Side

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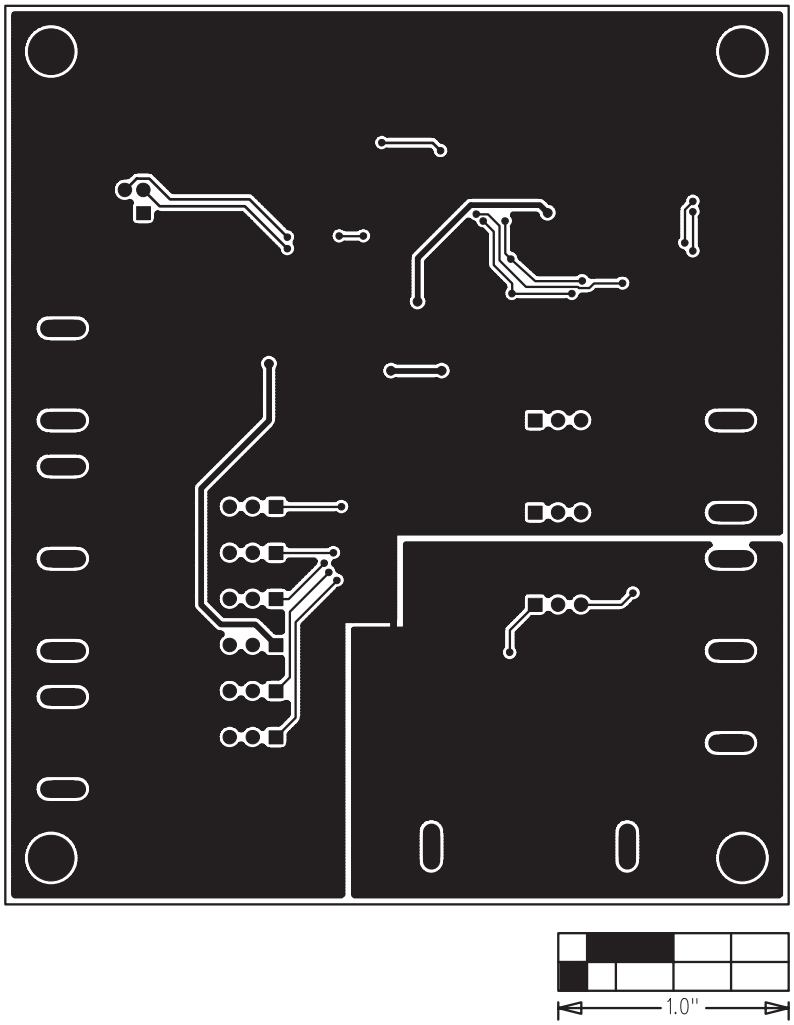


Figure 5. MAX5312 EV Kit PCB Layout—Solder Side

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