



MAX5116 Evaluation Kit

General Description

The MAX5116 evaluation kit (EV kit) provides a proven design to evaluate the MAX5116 nonvolatile, quad, 8-bit DAC with 2-wire serial interface. The EV kit also includes Windows® 2000/XP/Vista®-compatible software that provides a simple graphical user interface (GUI) for exercising the features of the MAX5116.

The MAX5116 EV kit printed-circuit board (PCB) comes with the MAX5116EEE+ installed. The MAX5116 EV kit can also be used to evaluate the MAX5109. Contact the factory for free samples of the MAX5109EEE+ device.

Ordering Information

PART	TYPE
MAX5116EVKIT+	EV Kit

+Denotes lead-free and RoHS compliant.

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DESIGNATION	QTY	DESCRIPTION
C1, C12, C14, C33, C37	5	10 μ F \pm 20%, 16V X5R ceramic capacitors (1206) Murata GRM31CR61C106M
C2, C3	2	22pF \pm 5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H220J
C4	1	0.033 μ F \pm 10%, 16V X5R ceramic capacitor (0603) Taiyo Yuden EMK107BJ333KA
C5–C10, C17, C18, C19, C22, C24, C25, C27–C32, C36	19	0.1 μ F \pm 10%, 16V X7R ceramic capacitors (0603) TDK C1608X7R1C104K
C11, C13, C23, C26, C41, C42, C43	7	1 μ F \pm 10%, 16V X5R ceramic capacitors (0603) TDK C1608X5R1C105K
C15, C16	2	10pF \pm 5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H100J
C20, C21, C34, C35, C38, C39, C40	0	Not installed, ceramic capacitors (0603)
J1	1	USB series type-B right-angle PC-mount receptacle
JU1, JU9, JU11	3	4-pin headers

Features

- ◆ Power-On Recall from Nonvolatile Registers
- ◆ 2.7V to 5.25V Operation
- ◆ Configurable Device Address
- ◆ On-Board USB Interface Circuit for I²C-Compatible Signals
- ◆ USB-PC Connection (Cable Included)
- ◆ USB Powered
- ◆ PCB Pads for User-Supplied I²C-Compatible Signals
- ◆ Proven PCB Layout
- ◆ Evaluates the MAX5116EEE+ and MAX5109EEE+ 16-Pin QSOP
- ◆ Windows 2000/XP/Vista (32-Bit)-Compatible Software
- ◆ Fully Assembled and Tested
- ◆ Lead-Free and RoHS Compliant

Component List

DESIGNATION	QTY	DESCRIPTION
JU2–JU8, JU10, JU12	9	3-pin headers
L1	1	Ferrite bead
R1, R2	2	27 Ω \pm 5% resistors (0603)
R3	1	1.5k Ω \pm 5% resistor (0603)
R4	1	470 Ω \pm 5% resistor (0603)
R5	1	2.2k Ω \pm 5% resistor (0603)
R6	1	10k Ω \pm 5% resistor (0603)
R10	1	169k Ω \pm 1% resistor (0603)
R11	1	100k Ω \pm 1% resistor (0603)
R12–R16, R19, R20, R23, R24	0	Not installed, resistors—short (PC trace) (0603)
R17, R18, R21, R22	4	2.4k Ω \pm 5% resistors (0603)
U1	1	Nonvolatile, quad, 8-bit DAC with 2-wire serial interface (16 QSOP) Maxim MAX5116EEE+
U2	1	Adjustable output LDO regulator (5 SC70) Maxim MAX8512EXK+T
U3	1	LDO regulator (5 SC70) Maxim MAX8511EXK25+T

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Component List (continued)

DESIGNATION	QTY	DESCRIPTION
U4	1	UART-to-USB converter (32 TQFP) FTDI FT232BL
U5	1	93C46 type 3-wire EEPROM (8 SO) Atmel AT93C46A-10SU-2.7
U6	1	Microcontroller (68 QFN-EP*) Maxim MAXQ2000-RAX+
U7, U8	2	Bidirectional level translators (8 TDFN) Maxim MAX3394EETA+
U9, U10	2	2.5V voltage references (8 SO) Maxim MAX6126BASA25+
Y1	1	16MHz crystal
Y2	1	6MHz crystal
Y3	0	Not installed
—	1	USB high-speed A-to-B cables, 5ft (1.5m)
—	12	Shunts
—	1	PCB: MAX5116 Evaluation Kit+

*EP = Exposed pad.

Quick Start

Recommended Equipment

Before beginning, the following equipment is needed:

- MAX5116 EV kit (USB cable included)
- Voltmeter
- A user-supplied Windows 2000/XP/Vista-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 MAX5116 EV Kit is fully assembled and tested. Follow the steps below to verify board operation:

- 1) Visit www.maxim-ic.com/evkitsoftware to download the latest version of the EV kit software, 5116Rxx.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.

Component Suppliers

SUPPLIER	PHONE	WEBSITE
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 MAX5116 or MAX5109 when contacting these component suppliers.

MAX5116 EV Kit Files

FILE	DESCRIPTION
INSTALL.EXE	Installs the EV kit files on your computer
MAX5116.EXE	Application program
FTDIBUS.INF	USB device driver file
UNINST.INI	Uninstalls the EV kit software
USB_Driver_Help.PDF	USB driver installation help file

- 3) Verify that all jumpers (JU1–JU12) are in their default positions, as shown in Table 1.
- 4) Connect the USB cable from the PC to the EV kit board. A **Building Driver Database** window pops up in addition to a **New Hardware Found** message 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 2000/XP/Vista. Refer to the USB_Driver_Help.PDF document included with the software if you have any problems during this step.
- 5) 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\MAX5116** (default installation directory) using the **Browse** button. During device driver installation, Windows might 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.
- 6) Start the MAX5116 EV kit software by opening its icon in the **Start | Programs** menu. The EV kit software main window appears, as shown in Figure 1.

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- 7) Wait approximately 5s for the program to automatically detect the slave address (0x5E) of the MAX5116 in the **Address** drop-down list.
- 8) Drag the DAC0 track bar in the **Volatile Register** group box all the way to the right.
- 9) Use the voltmeter to verify that the voltage on the OUT0 pad is approximately 2.5V.

Table 1. MAX5116 EV Kit Jumper Descriptions (JU1–JU12)

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	1-2	Connects the VDD to VUSB (5V)
	1-3*	Connects the VDD to VCC (3.3V)
	1-4	Connect external power supply to the VDD pad
JU2	1-2*	MUTE signal connected to on-board microcontroller
	2-3	Connect external MUTE signal to the on-board MUTE pad
JU3	1-2*	MAX5116 SCL signal connected to on-board microcontroller
	2-3	Connect external SCL signal to the on-board SCL pad
JU4	1-2*	MAX5116 SDA signal connected to on-board microcontroller
	2-3	Connect external SDA signal to the on-board SDA pad
JU5–JU8	1-2*	Connects the address pin to VDD
	2-3	Connects the address pin to GND
JU9	1-2	Connects REFH (REFH0**) to VDD
	1-3*	Connects REFH (REFH0**) to the on-board MAX6126 voltage reference
	1-4	Connect external voltage reference to the REFH (REFH0**) pad
JU10	1-2*	Connects REFL (REFL0**) to GND
	2-3	Connect external voltage reference to the REFL (REFL0**) pad
JU11	1-2	Connects REFH1 to VDD when evaluating the MAX5109
	1-3	Connects REFH1 to the on-board MAX6126 voltage reference when evaluating the MAX5109
	1-4*	1) Disconnects the N.C. pin when evaluating the MAX5116 2) Connect user-supplied voltage reference to the N.C. (REFH1**) pad when evaluating the MAX5109.
JU12	1-2	Connects REFL1 to GND when evaluating the MAX5109
	2-3*	1) Connects the OUT pin to the OUT (REFL1**) pad when evaluating the MAX5116 2) Connect user-supplied voltage reference to the OUT (REFL1**) pad when evaluating the MAX5109.

*Default position.

**Refers to the MAX5109.

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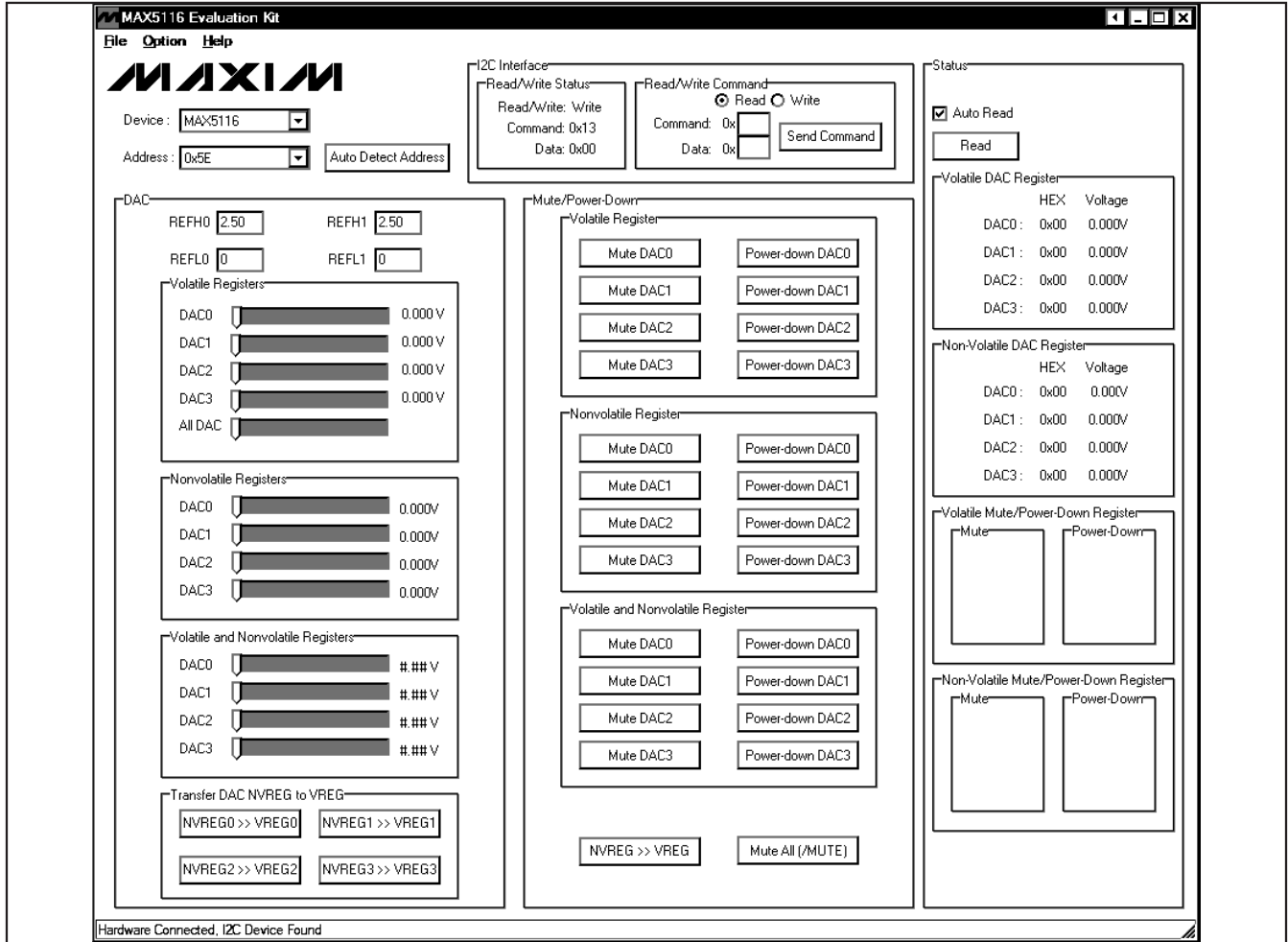


Figure 1. MAX5116 EV Kit Software Main Window

__Detailed Description of Software

To start the MAX5116 EV kit software, double-click the MAX5116 EV kit icon that is created during installation. The GUI main window appears, as shown in Figure 1. The **DAC** group box located at the left of the window controls the output-voltage settings for the DACs. Mute and power-down functions are in the **Mute/Power-Down** group box located in the middle section. The **Status** group box at the right displays the voltage values of the DACs. The **I2C Interface** group box at the top allows the user to transfer I2C commands by entering the commands in the edit boxes.

By default, the MAX5116 is selected in the **Device** drop-down list. Select MAX5109 in the **Device** drop-down list when evaluating the MAX5109 using the MAX5116 EV kit.

The I2C slave address of the MAX5116 depends on the jumper settings of JU5–JU8. The **Address** drop-down list automatically detects the MAX5116's I2C slave address when the GUI software starts. When the EV kit is shipped, the default I2C slave address is 0x5E. If the jumper settings of JU5–JU8 change, press the **Auto Detect Address** button to automatically detect the new I2C slave address of the MAX5116.

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DAC

In the **DAC** group box, the user can set the output-voltage values for the DACs. Measure the actual reference voltage on the REFH and REFL pins of the MAX5116 and enter the values into the corresponding **REFH_** and **REFL_** edit boxes. Those values are used to calculate the expected output-voltage values of the DACs.

In the **Volatile Registers** group box, **DAC0–DAC3** track bars are used to change the voltage values in the volatile DAC register of the DACs. The adjacent labels at the right of the track bars display the equivalent output-voltage values of the DACs. Use the **All DAC** track bar to send the “Write All VREG” operation that configures DAC0–DAC3 all at the same time.

In the **Nonvolatile Registers** group box, use the **DAC0–DAC3** track bars to change the values in the nonvolatile register of the DACs.

Similarly, in the **Volatile and Nonvolatile Registers** group box, use the **DAC0–DAC3** track bars to change the values in both of the volatile and nonvolatile registers.

Press the buttons in the **Transfer DAC NVREG to VREG** group box to transfer values from the nonvolatile DAC registers to volatile DAC registers.

Mute/Power-Down

The **Mute/Power-Down** group box has the mute and power down controls for the DACs. The **Mute DAC_** buttons are used to mute the DACs. The **Power-down DAC_** buttons are used to set the DACs in power-down mode.

In the **Volatile Register** group box, each button corresponds to a bit in the volatile mute/power-down register. Press the button to toggle the bit.

In the **Nonvolatile Register** group box, each button corresponds to a bit in the nonvolatile mute/power-down register. Press the applicable button to toggle the bit.

Pressing the buttons in the **Volatile and Nonvolatile Register** group box toggles the bits in both volatile and nonvolatile registers.

Press the **NVREG >> VREG** button at the bottom of the **Mute/Power-Down** group box to transfer values from the nonvolatile mute/power-down register to volatile register.

Press the **Mute All (/MUTE)** button to toggle the signal on the **MUTE** pin of the MAX5116.

Status

In the **Status** group box, press the **Read** button to read the values from all the volatile and nonvolatile registers. Values from the volatile and nonvolatile DAC registers are displayed in the **Volatile DAC Register** and **Non-Volatile DAC Register** group boxes. Values from the volatile and nonvolatile mute/power-down registers are displayed in the **Volatile Mute/Power-Down Register** and **Non-Volatile Mute/Power-Down Register** group boxes. Check the **Auto Read** checkbox at the top of the **Status** group box to automatically read the current values from all registers.

I²C Interface

In the **I²C Interface** group box, the **Read/Write Status** group box displays the last command and data that are sent or received from the MAX5116.

The **Read/Write Command** group box allows the user to manually enter the I²C read/write command and data in the edit boxes and sends them to the MAX5116 by pressing the **Send Command** button.

Detailed Description of Hardware

The MAX5116 EV kit board provides a proven layout for evaluating the MAX5116 and MAX5109 ICs. The EV kit comes with the MAX5116EEE+ installed. The MAX5116 EV kit can also be used to evaluate the MAX5109. Contact the factory for free samples of the MAX5109EEE+ device.

I²C Address Configuration

The combinations of shunt positions for jumpers JU5–JU8 determine the I²C slave address of the MAX5116 EV kit. Refer to the MAX5116 IC data sheet for appropriate settings.

Voltage Reference

By default, the on-board MAX6126 2.5V external reference is connected to the REFH (REFH0**) pin of the MAX5116, and the REFL (REFL0**) is connected to ground. Place the shunt of JU9 to the 1-2 position to connect the VDD to the REFH (REFH0**) pin. To use an external voltage reference, place the shunts of JU9 to the 1-4 position and the shunts of JU8 to the 2-3 position. Attach the high- and low-voltage references to the REFH (REFH0**) and REFL (REFL0**) pads. Adjust the REFH (REFH0**) and REFL (REFL0**) values in the program.

When evaluating the MAX5109, a second pair of voltage references (REFH1 and REFL1) is needed. The jumper settings for the REFH1 and REFL1 are similar to the settings for the REFH (REFH0**) and REFL (REFL0**), as previously mentioned.

**Refers to the MAX5109.

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User-Supplied Power Supply

By default, the MAX5116 EV kit is powered by USB. To apply a user-supplied power supply, place the shunt of JU1 to the 1-4 position, and connect a 2.7V to 5.25V power supply to the VDD pad.

User-Supplied I²C Interface

To use the MAX5116 EV kit with an external I²C interface, install the shunts of JU3 and JU4 to the 2-3 position. Connect the SDA, SCL, and GND lines from the external I²C interface to the SDA, SCL, and GND pads on the MAX5116 EV kit.

Optimal Measurement

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

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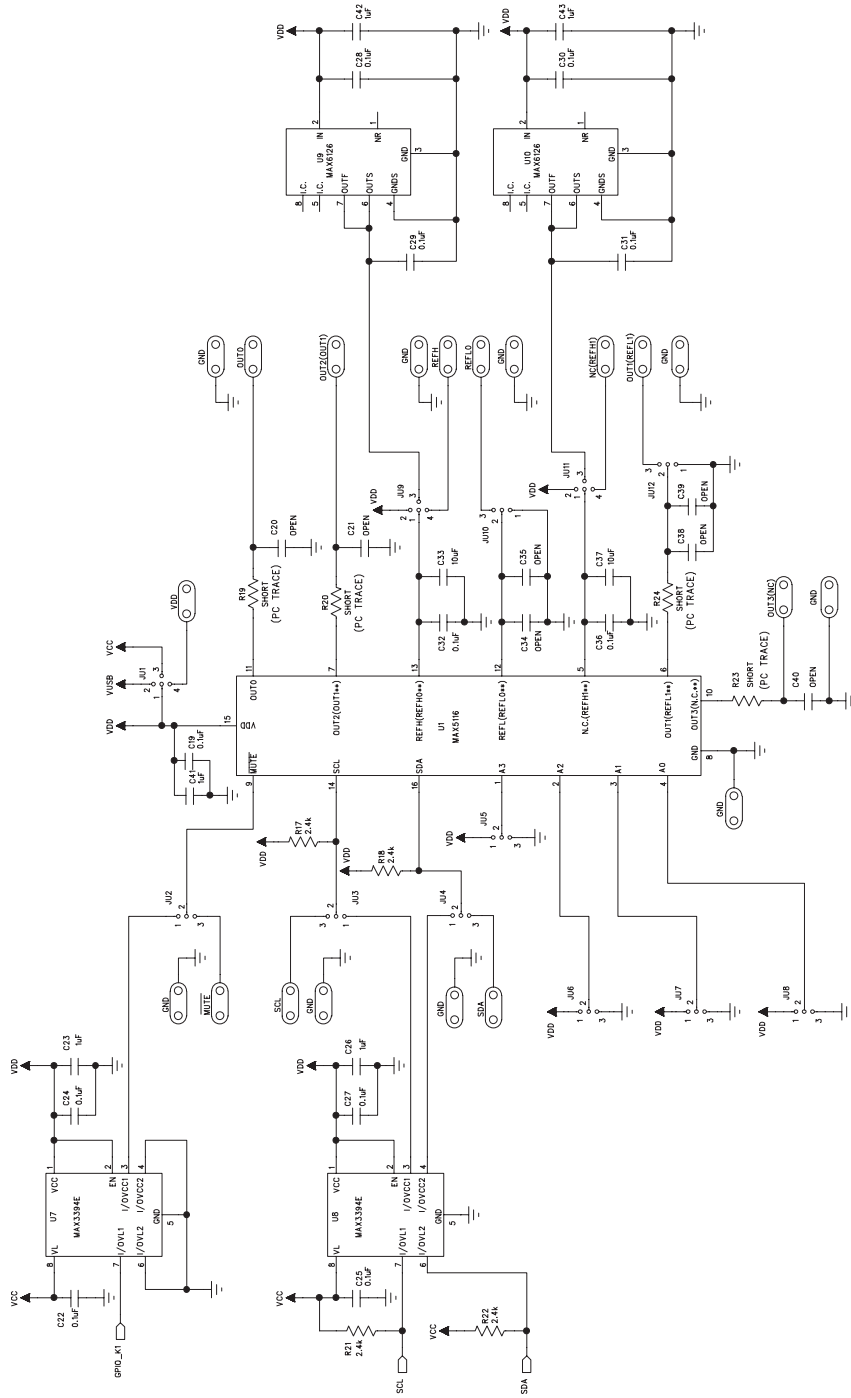


Figure 2a. MAX5116 EV Kit Schematic (Sheet 1 of 2)

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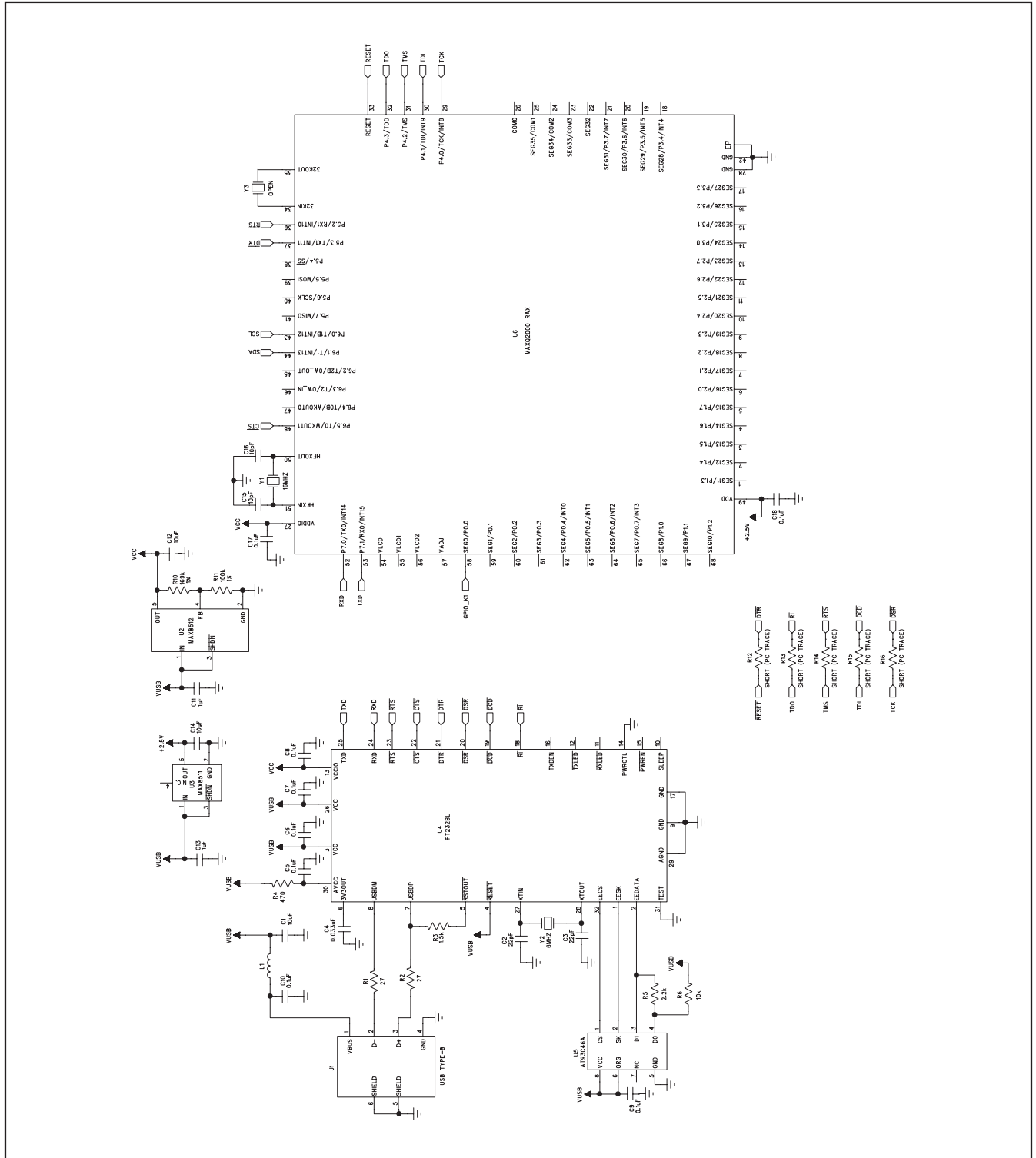


Figure 2b. MAX5116 EV Kit Schematic (Sheet 2 of 2)

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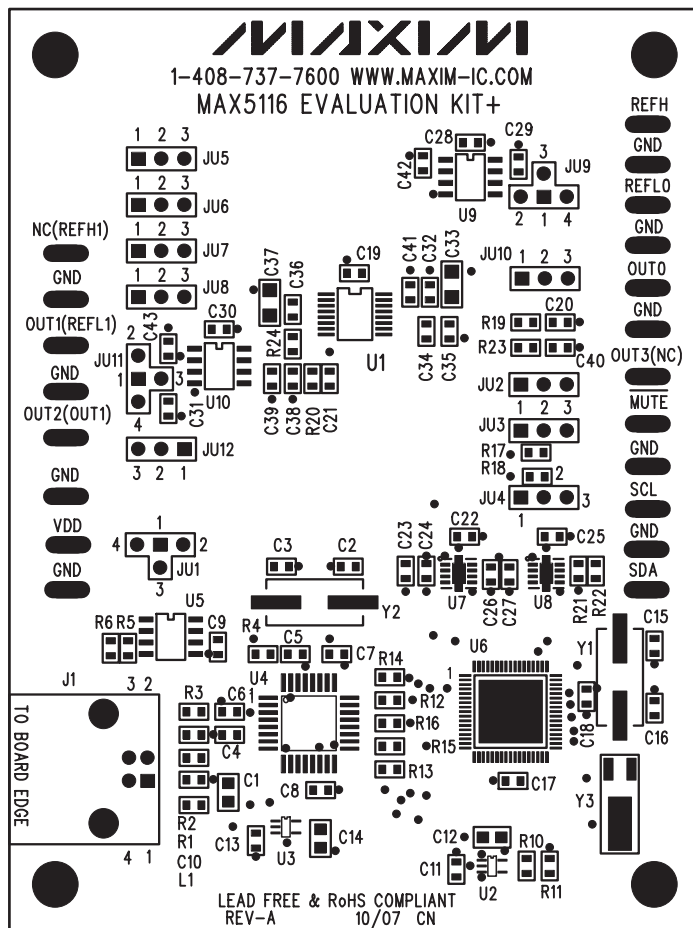


Figure 3. MAX5116 EV Kit Component Placement Guide—Component Side

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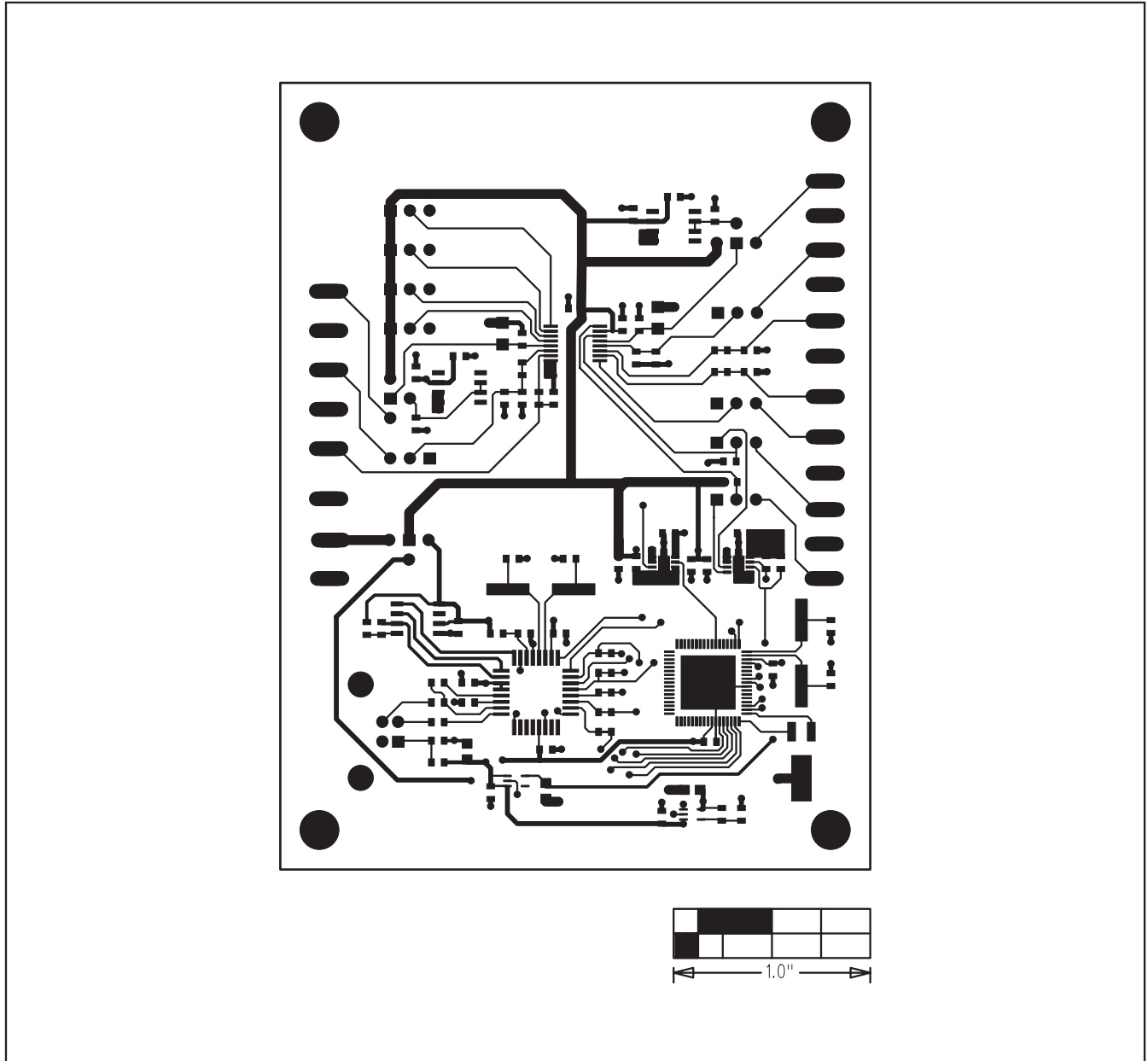


Figure 4. MAX5116 EV Kit PCB Layout—Component Side

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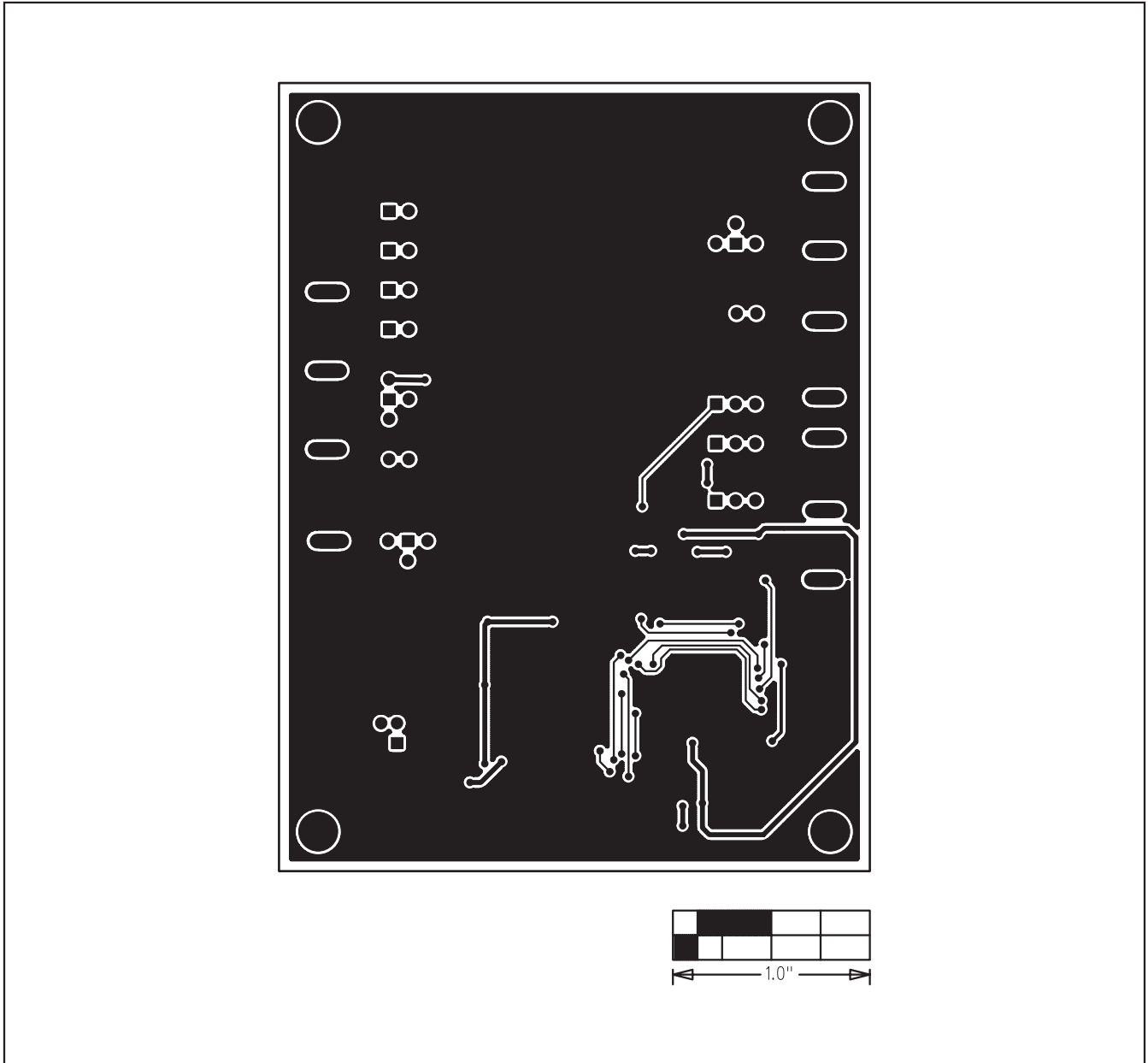


Figure 5. MAX5116 EV Kit PCB Layout—Solder Side

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