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MAX5498 Evaluation Kit

Evaluates: MAX5494–MAX5499

General Description

The MAX5498 evaluation kit (EV kit) is an assembled and tested PCB that demonstrates the MAX5498 10-bit (1024-tap), dual, nonvolatile, SPI™-interface, linear-taper digital potentiometer. Windows® 2000/XP- and Windows Vista®-compatible software provides a handy user interface to exercise the features of the MAX5498.

The EV kit can also be used to evaluate the MAX5494, MAX5495, MAX5496, MAX5497, or MAX5499. The MAX5494/MAX5495 provide two programmable voltage-dividers, the MAX5496/MAX5497 provide two variable resistors, and the MAX5498/MAX5499 provide one programmable voltage-divider and one variable resistor. The MAX5494/MAX5496/MAX5498 devices have 10kΩ end-to-end resistance and the MAX5495/MAX5497/MAX5499 devices have 50kΩ end-to-end resistance. To evaluate the MAX5494–MAX5497 or MAX5499, request a free sample (ETE+ suffix) along with the MAX5498 EV kit.

SPI is a trademark of Motorola, Inc.

Windows and Windows Vista are registered trademarks of Microsoft Corp.

Features

♦ **2.7V to 5.25V Single-Supply Operation**
♦ **Power-On Recall of Wiper Position from Nonvolatile Memory**
♦ **On-Board USB Interface Circuit**
♦ **USB Powered**
♦ **USB-PC Connection (Cable Included)**
♦ **PCB Pads for User-Supplied Microcontroller Interface Signals**
♦ **Labeled Test Points for Potentiometer Signals (L, W, and H)**
♦ **Proven USB-Compatible PCB Layout**
♦ **Evaluates MAX5494–MAX5499**
♦ **Windows 2000/XP- and Windows Vista (32-Bit)-Compatible Software**
♦ **Lead(Pb)-Free and RoHS Compliant**
♦ **Fully Assembled and Tested**

Ordering Information

PART	TYPE
MAX5498EVKIT+	EV Kit

+*Denotes lead(Pb)-free and RoHS compliant.*

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C4–C8, C12, C17, C19	9	0.1µF ±10%, 16V X7R ceramic capacitors (0603) TDK C1608X7R1C104K Murata GRM188R71C104K
C2, C13, C15	3	10µF ±20%, 16V X5R ceramic capacitors (1206) Murata GRM31CR61C106M or TDK C3216X5R1C106M
C3	0	Not installed, ceramic capacitor (0603)
C9	1	0.033µF ±10%, 16V (min) X5R ceramic capacitor (0603) Murata GRM188R71E333K TDK C1608X7R1E333K
C10, C11	2	22pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H220J or TDK C1608C0G1H220J

DESIGNATION	QTY	DESCRIPTION
C14	1	1µF ±10%, 16V X5R ceramic capacitor (0603) TDK C1608X5R1C105K Murata GRM188R61C105K
C16, C18	2	10pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H100J or TDK C1608C0G1H100J
D1	1	Green LED (0805)
FB1	1	70Ω, 4A ferrite bead (0603) TDK MMZ1608R301A Murata BLM18SG700 TN1
J1, J2	2	4-pin headers, 0.1in centers
J3	0	Not installed, dual-row (2 x 6) 12-pin header, 0.1in centers
J4	0	Not installed, dual-row (2 x 5) 10-pin JTAG header, 0.1in centers

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Component List (continued)

DESIGNATION	QTY	DESCRIPTION
JU1, JU2	2	3-pin headers, 0.1in centers
P1	1	USB series-B right-angle PC-mount receptacle
R1, R2	2	27Ω ±5% resistors (0603)
R3	1	1.5kΩ ±5% resistor (0603)
R4, R7	2	470Ω ±5% resistors (0603)
R5	1	2.2kΩ ±5% resistor (0603)
R6	1	10kΩ ±5% resistor (0603)
R8, R17	2	0Ω resistors (0603)
R9, R10, R11	0	Not installed, resistors (0603)
R12–R16	0	Not installed, resistors—short (PC trace) (0402)
U1	1	10-bit (1024-tap), dual linear-taper digital potentiometer (16 TQFN-EP*) Maxim MAX5498ETE+
U2	1	Low-voltage level translator (14 TSSOP) Maxim MAX3390EEUD+

DESIGNATION	QTY	DESCRIPTION
U3	1	Microcontroller (68 QFN-EP*) Maxim MAXQ2000-RAX+
U4	1	LDO regulator (5 SC70) Maxim MAX8511EXK25+
U5	1	USB-to-UART converter (32 TQFP) FTDI FT232BL
U6	1	93C46 type 3-wire EEPROM (8 SO) Atmel AT93C46A-10SU-2.7
Y1	1	16MHz crystal
Y2	0	Not installed, 32.768kHz crystal
Y3	1	6MHz crystal
—	4	Shunts
—	1	PCB: MAX5498 Evaluation Kit+

*EP = Exposed pad.

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com
TDK Corp.	847-803-6100	www.component.tdk.com

Note: Indicate that you are using the MAX5498, MAX5494–MAX5497, or MAX5499 when contacting these component suppliers.

MAX5498 EV Kit Files

FILE	DESCRIPTION
INSTALL.EXE	Installs the EV kit files on your computer
MAX5498.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:

- MAX5498 EV kit (USB cable included)
- A user-supplied Windows 2000/XP- or Windows Vista-compatible PC with a spare USB port
- Two ohmmeters

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.

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Procedure

The MAX5498 EV kit is fully assembled and tested. Follow the steps below to verify board operation. **Caution: Do not turn on the power (insert USB cable into computer) until all connections are completed.**

1) Visit **www.maxim-ic.com/evkitsoftware** to download the latest version of the EV kit software, 5498Rxx.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) Ensure that the MAX5498 EV kit board's jumper settings are correct (see Table 1 for jumper settings).

4) Connect one of the ohmmeters across the W1 and L1 pads.

5) Connect the other ohmmeter across the W2 and L2 pads.

6) Connect the USB cable from the PC to the EV kit. 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 a window that is similar to the one described above is not seen 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 and XP. Refer to Application Note 3601: *Troubleshooting Windows Plug-and-Play and USB for Maxim Evaluation Kits* if any problems arise during this step.

7) 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\MAX5498** (default installation directory) using the **Browse** button. During device driver installation, Windows XP shows 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 the installation.

8) Start the EV kit software by clicking its icon in the Windows **Start** menu.

9) The software automatically searches for the MAX5498. After successful connection, **MAX5498 EV Kit connected** is displayed in the lower-left corner of the EV kit main window, as shown in Figure 1. Move the **Channel 1** or **Channel 2** track bars and press the **Write** button to set the wiper position.

Table 1. Default Jumper Settings

JUMPER	SHUNT POSITION	DESCRIPTION
J1, J2	3-4	Provides a ground reference for resistor mode measurements
JU1	1-2	EV kit powered from USB bus voltage (5V)
JU2	2-3	VSS tied to GND (single-supply operation)

Detailed Description of Software

The MAX5498 EV kit software graphical user interface (GUI) is a Windows program that provides a convenient means to control the MAX5498 (Figure 1).

Factory Reset

Pressing the **Factory Reset** button returns wipers 1 and 2 (and the nonvolatile memory) to the midscale tap position.

Wipers 1 and 2 Position

In the **Channel 1** group box, set the tap value (either by typing the decimal tap number into one of the edit boxes or by moving the track bar), and then press the **Write** button.

In the **Channel 2** group box, set the tap value (either by typing the decimal tap number into one of the edit boxes or by moving the track bar), and then press the **Write** button.

As confirmation, the **Command History** window shows the executed SPI sequence. The first hex value is the command byte sent to the device and the next two hex values correspond to the W-L tap value (e.g., SPI: 0x01, 0x80, 0x00).

Nonvolatile Programming

In the **Channel 1** group box, set the tap value (either by typing the decimal tap number into one of the edit boxes or by moving the track bar), and then press the **Write NV** button.

In the **Channel 2** group box, set the tap value (either by typing the decimal tap number into one of the edit boxes or by moving the track bar), and then press the **Write NV** button.

As confirmation, the **Command History** group box diaplays the executed SPI sequence. The first hex value is the command byte sent to the device and the next two hex values correspond to the W-L tap value (e.g., SPI: 0x11, 0x80, 0x00).

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Volatile/Nonvolatile Data Transfer

In the **Channel 1** group box, copy the active tap value to nonvolatile memory by pressing the **Save active ➔ NV** button. As confirmation, the **Command History** group box displays SPI sequence 0x21.

In the **Channel 2** group box, copy the active tap value to nonvolatile memory by pressing the **Save active ➔ NV** button. As confirmation, the **Command History** group box displays SPI sequence 0x22.

To copy both of the active tap values to nonvolatile memory, press the **Copy Both Wiper Registers to NV Registers** button. As confirmation, the **Command History** group box displays SPI sequence 0x23.

In the **Channel 1** group box, copy the active tap value to nonvolatile memory by pressing the **Load NV ➔ active** button. As confirmation, the **Command History** group box displays SPI sequence 0x31.

In the **Channel 2** group box, copy the active tap value to nonvolatile memory by pressing the **Load NV ➔ active** button. As confirmation, the **Command History** group box displays SPI sequence 0x32.

To copy both the active tap values to nonvolatile memory, press the **Copy Both NV Registers to Wiper Registers** button. As confirmation, the **Command History** group box displays SPI sequence 0x33.
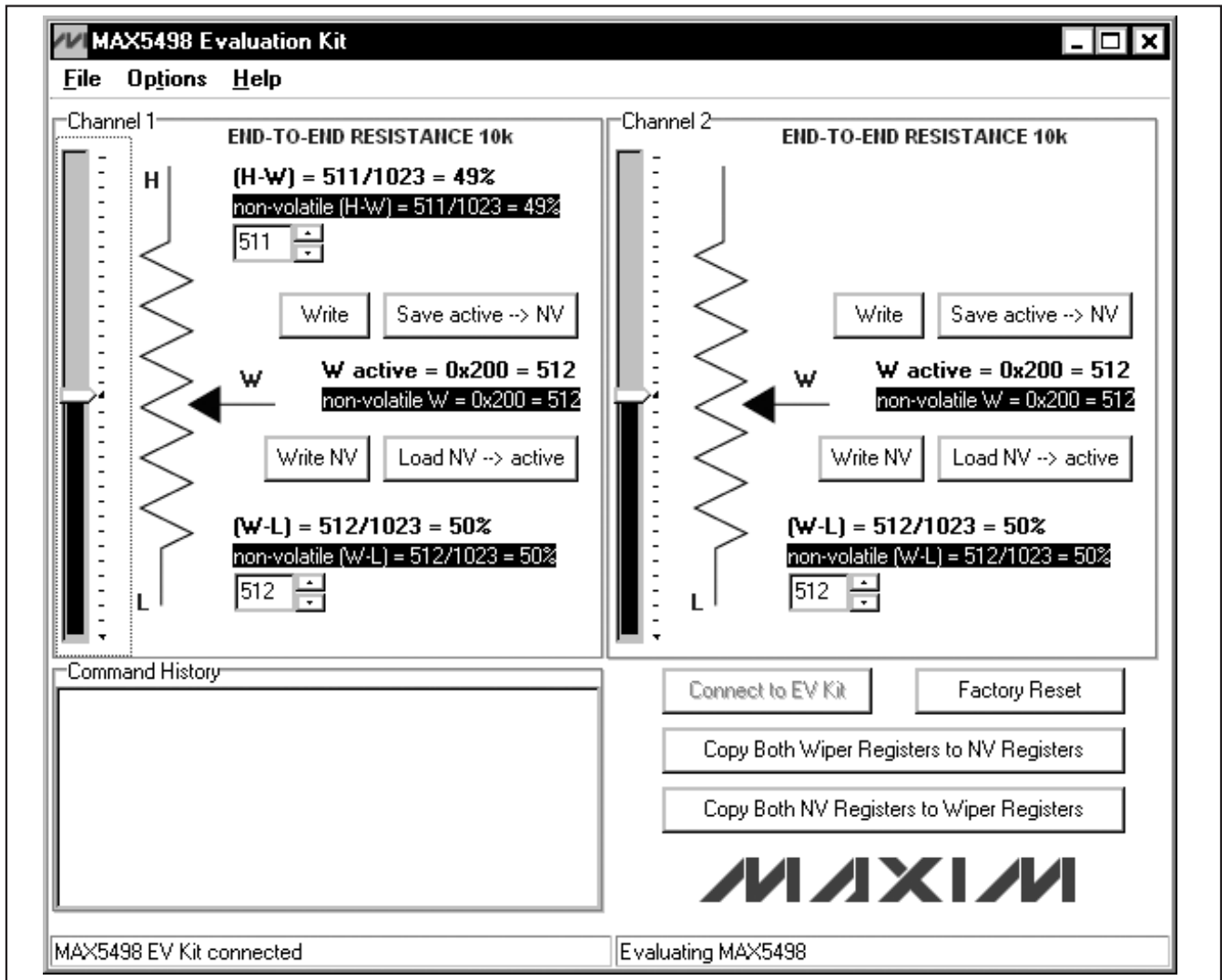

Figure 1. MAX5498 EV Kit Main Window

Command History

The **Command History** group box displays the sequence of bytes sent to the device for each of the GUI's button controls. For the write controls (**Write** and **Write NV**), the group box displays the command byte followed by the 2 data bytes (wiper setting). The 2 data bytes correspond to the W-L tap value. For the save, load, and copy controls the group box displays the associated command byte. All values are displayed in hex.

Evaluating Other Devices

The MAX5498 EV kit software can also be used to evaluate any of the other devices in the MAX5494–MAX5499 family. The software is reconfigured for each device by choosing the device number from the **Options | Device** menu bar. To ensure proper operation, install the alternate device on the EV kit before reconfiguring the software.

Keyboard Navigation

When you type on the keyboard, the system must know which control should receive the keys. Press the Tab key to move the keyboard's focus from one control to the next. The focused control is indicated by a dotted outline. Shift + Tab moves the focus to the previously focused control. Buttons respond to the keyboard's space bar. Some controls respond to the keyboard's up and down arrow keys. Activate the program's menu bar by pressing the F10 key, and then press the letter of the menu item you want. Most menu items have one letter underlined, indicating their shortcut key.

_Detailed Description of Hardware

As configured, the MAX5498 EV kit evaluates the MAX5498 dual, linear-taper potentiometer with one programmable voltage-divider and one variable resistor. The potentiometer terminals are accessible from headers H1 and H2. The MAX5498 EV kit hardware and software can also be used to evaluate the MAX5494–MAX5497 or MAX5499. The installed device is controlled using a graphical user interface (GUI) that can be downloaded by visiting www.maxim-ic.com/evkitsoftware and clicking on the MAX5498 EVKIT software link.

Ground Referencing Test Equipment

The L terminals of each digital pot are linked to ground by placing a shunt on pins 3-4 of headers J1 and J2 (see Table 2). This provides a ground reference when using nonground referenced test equipment (e.g., handheld digital multimeter).

Table 2. J1 and J2 Shunt Configuration

SHUNT POSITION	PIN	DESCRIPTION
3-4*	L1, L2	L terminals connected to GND (use when measuring digital pot resistance)
Not installed	L1, L2	L terminals unconnected

*Default position.

Evaluating the MAX5494–MAX5497 or MAX5499

To evaluate the MAX5494–MAX5497 or MAX5499, contact the factory for a free sample of the MAX5494ETE+, MAX5495ETE+, MAX5496ETE+, MAX5497ETE+, or MAX5499ETE+. Refer to the MAX5494–MAX5499 IC data sheet for additional device information.

External User-Supplied SPI Interface

The MAX5498 EV kit can be modified for use with an external user-supplied SPI interface. First, with power off and USB disconnected, turn the board over and cut the four traces that are on the back of the board, underneath location J3. Install a standard dual-row header and connect an external SPI interface. See Figure 2a for the J3 schematic and Figure 4 for J3 trace locations on the bottom side of the PCB.

Single-Supply Operation (VDD)

The MAX5498 EV kit's default configuration is for single-supply operation. The USB interface and microcontroller are powered from the USB bus voltage (5V). The device under test can be powered from an external power supply (2.7V to 5.25V) connected between VDD and GND (see Table 3). When operating with a single supply, the VSS input should be connected to GND (Table 4).

Table 3. JU1 Jumper Functions

SIGNAL	SHUNT POSITION	EV KIT FUNCTION
VDD	1-2*	Power device from USB 5V supply.
	Open	Do not use—device will not be powered.
	2-3	Power device from external power supply (2.7V to 5.25V) connected between VDD and GND pads.

*Default position.

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Dual-Supply Operation (VDD, VSS)

To evaluate the MAX5498 EV kit with dual supplies, disconnect the USB cable from the EV kit and configure JU1 for external power-supply operation (Table 3) and JU2 for dual-supply operation (Table 4). Connect the positive supply between the VDD and GND pads and the negative supply between the VSS and GND pads. When evaluating the EV kit with dual supplies, ensure that (VDD - VSS) ≤ 5.25V.

Table 4. JU2 Jumper Functions

SIGNAL	SHUNT POSITION	EV KIT FUNCTION
VSS	1-2	Dual-supply operation. Connect external supply (-2.5V to -0.2V) between VSS and GND pads. Ensure (VDD - VSS) ≤ 5.25V.
	Open	Do not use—device will not be powered.
	2-3*	Single-supply operation. VSS = GND.

Default position.

/VI/XI/VI

Evaluates: MAX5494–MAX5499

Figure 2a. MAX5498 EV Kit Schematic (Sheet 1 of 3)

Evaluates: MAX5494–MAX5499
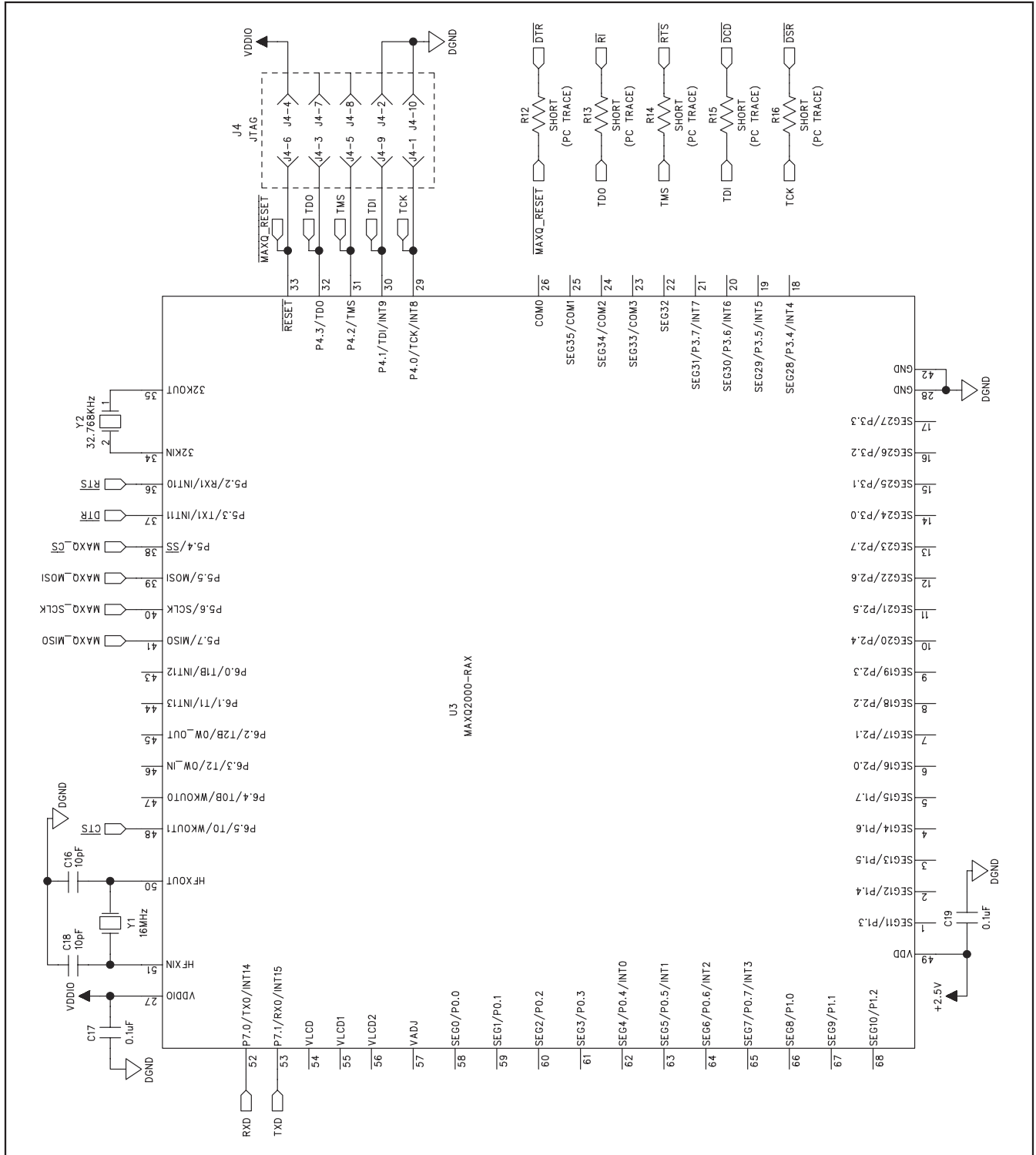
Figure 2b. MAX5498 EV Kit Schematic (Sheet 2 of 3)

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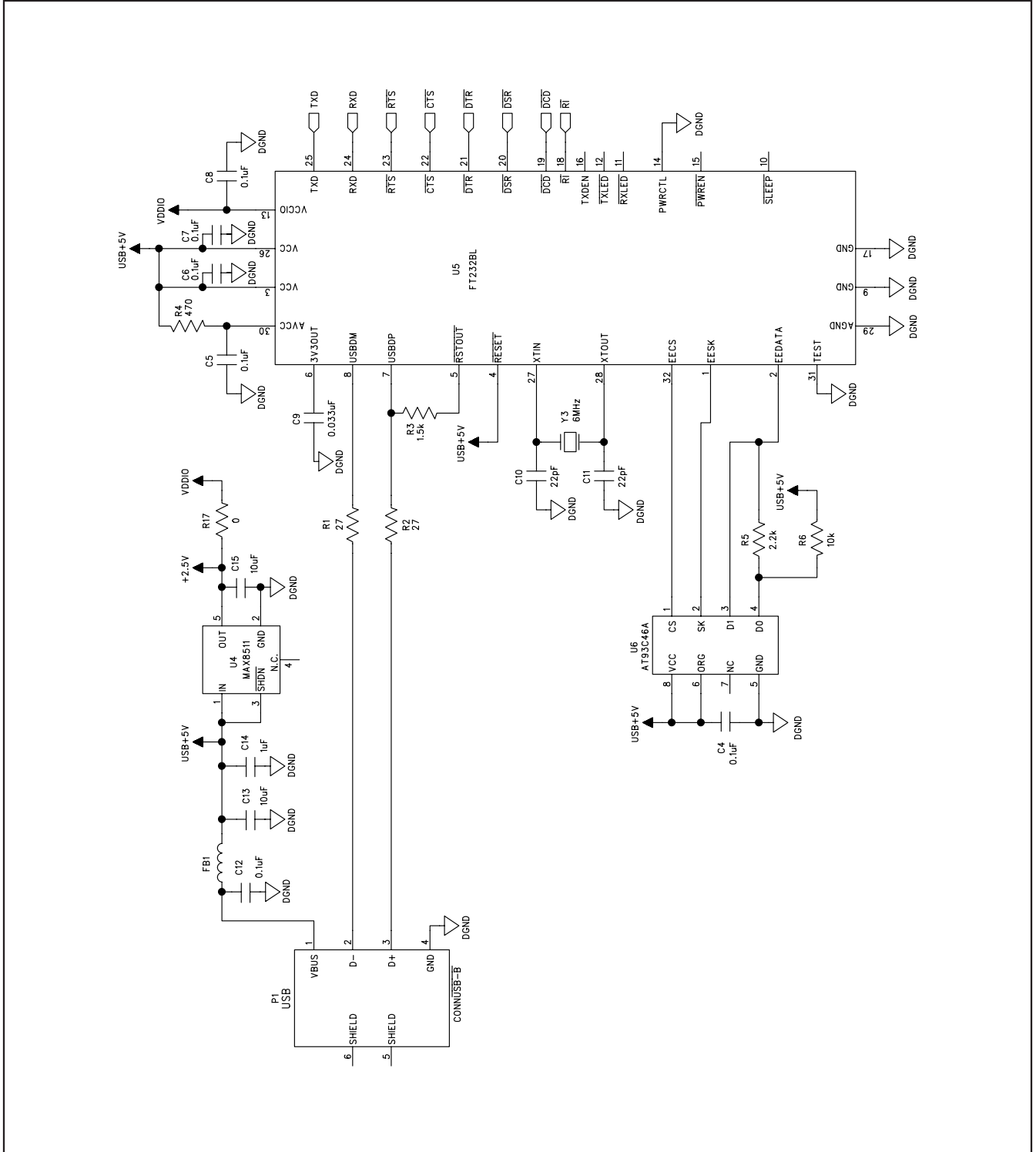*Figure 2c. MAX5498 EV Kit Schematic (Sheet 3 of 3)*

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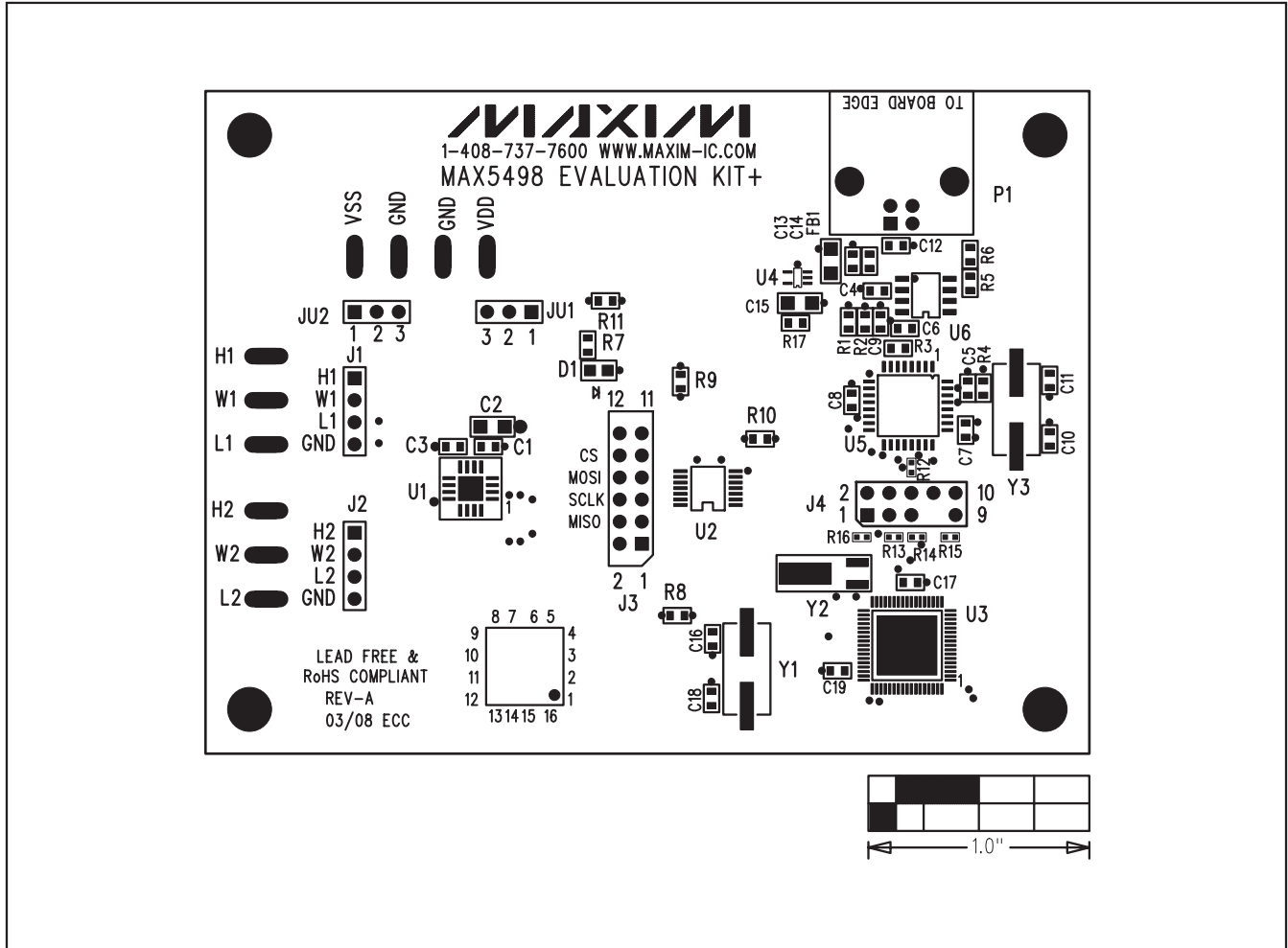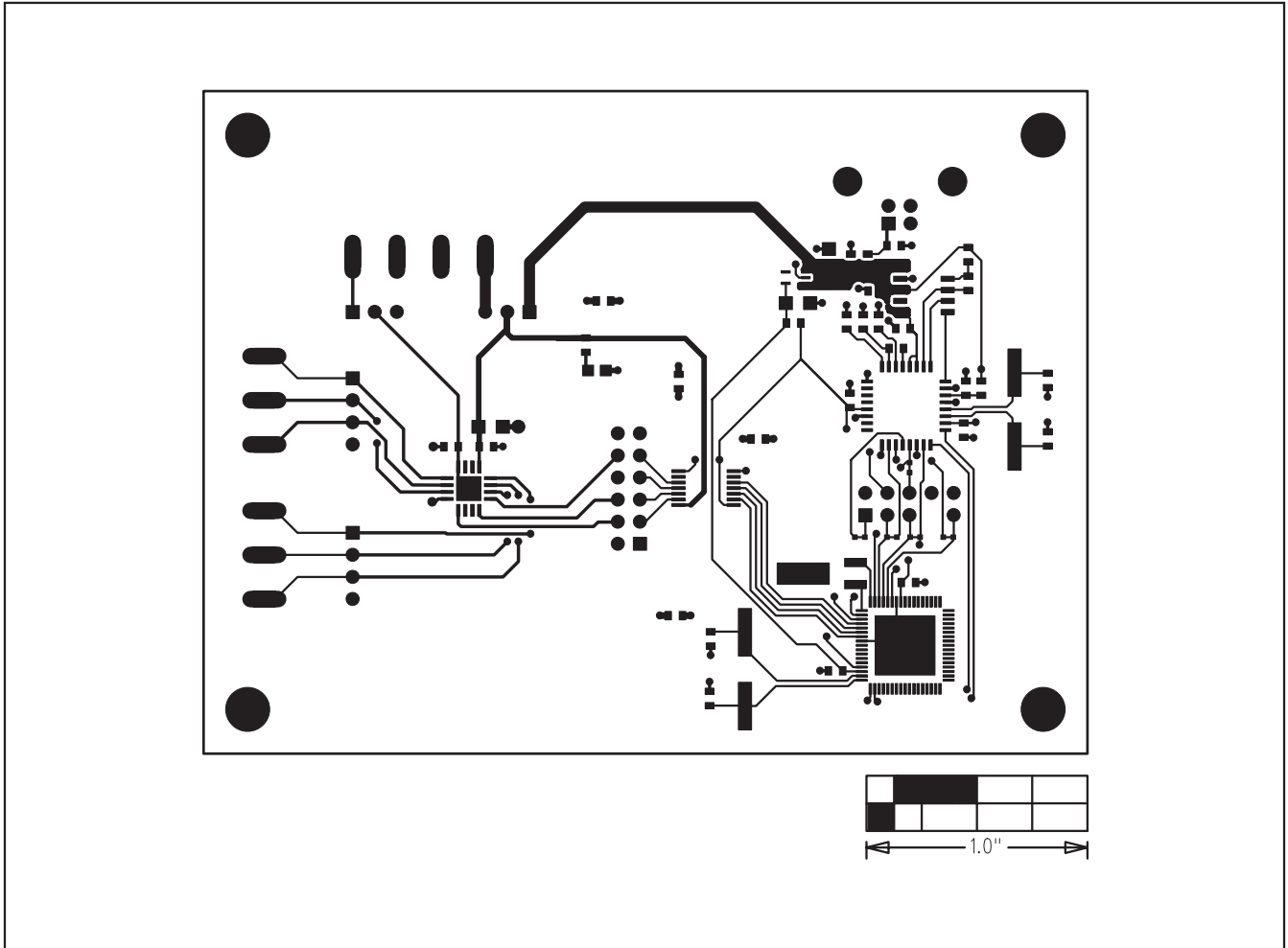
Figure 3. MAX5498 EV Kit Component Placement Guide—Component Side

Figure 4. MAX5498 EV Kit PCB Layout—Component Side

Evaluates: MAX5494–MAX5499
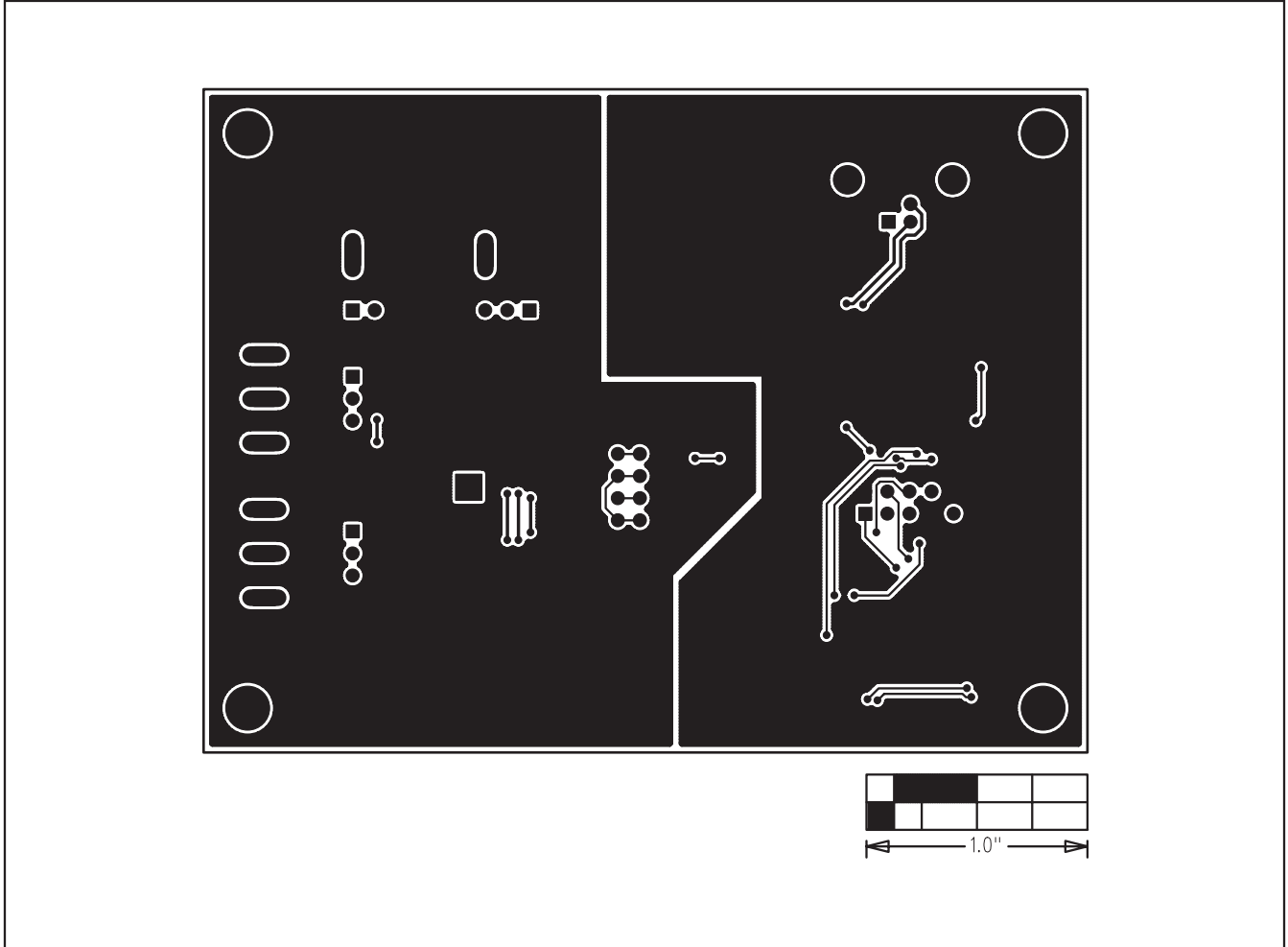
Figure 5. MAX5498 EV Kit PCB Layout—Solder Side

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_____***Revision History***

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	5/08	Initial release	—
1	12/08	Updated _External User-Supplied SPI Interface_ section, deleted Figure 2, and renumbered remaining figures.	5, 6–12

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