



# MAX5488 Evaluation Kit

## General Description

The MAX5488 evaluation kit (EV kit) is an assembled and tested printed-circuit board (PCB) that demonstrates the functionality of the MAX5488 dual, 256-tap, nonvolatile, SPI-interface, linear-taper digital potentiometer. Windows® 98SE/2000/XP-compatible software provides a handy user interface to exercise the features of the MAX5488.

The tiny 16-pin, 3mm x 3mm, thin QFN-packaged device is socketed, allowing for easy evaluation of the MAX5487 (10kΩ end-to-end resistance), MAX5488 (50kΩ end-to-end resistance), or MAX5489 (100kΩ end-to-end resistance) ICs. To evaluate the MAX5487 or the MAX5489, request a free sample (ETE suffix) along with the MAX5488 EV kit.

## Features

- ◆ Power-On Recall of Wiper Position from Nonvolatile Memory
- ◆ 2.7V to 5.25V Single-Supply Operation
- ◆ SPI-Compatible Serial Interface
- ◆ Convenient GUI Software
- ◆ Labeled Test Points for H\_, W\_, and L\_
- ◆ Assembled and Tested USB-Compatible PCB Layout
- ◆ Socketed 16-Pin Thin QFN-EP (3mm x 3mm)
- ◆ Evaluates MAX5487/MAX5488/MAX5489

## Ordering Information

PART	TYPE	PC INTERFACE
MAX5488EVKIT#	EV kit	USB

#Denotes an RoHS-compliant EV kit.

## Component List

DESIGNATION	QTY	DESCRIPTION
C1, C5–C9, C17, C18, C37	9	0.1μF ±10%, 16V X7R ceramic capacitors (0603) TDK C1608X7R1C104K Taiyo Yuden EMK107BJ104KA Murata GRM188R71C104K
C2	0	Not installed, capacitor (1206)
C4	1	0.033μF ±10%, 16V (min) X5R ceramic capacitor (0603) Taiyo Yuden EMK107BJ333KA Murata GRM188R71E333K TDK C1608X7R1E333K
C15, C16	2	10pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H100J TDK C1608C0G1H100J Taiyo Yuden UMK107CG100DZ
C30, C31	2	22pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H220J TDK C1608C0G1H220J Taiyo Yuden UMK107CG220KZ
C38, C40	2	10μF ±20%, 16V X5R ceramic capacitors (1206) Murata GRM31CR61C106M TDK C3216X5R1C106M Panasonic ECJ3YB1C106M KEMET C1206C106M4PAC

DESIGNATION	QTY	DESCRIPTION
C39	1	1μF ±10%, 16V X5R ceramic capacitors (0603) TDK C1608X5R1C105K Murata GRM188R61C105K AVX 0603YD105MAT KEMET C0603C105K4PAC
D1	1	Red LED (0805) Lumex Opto SML-LX0805SIC-TR
H1, H2	2	4-pin headers
J1	1	USB series B right-angle PC-mount receptacle Assmann Electric AU-Y1007-R
J2	0	Not installed, header
J3	0	Not installed, 2 x 5-pin JTAG header
JU1	1	3-pin header
L6	1	70Ω, 4A ferrite bead (0603) TDK MMZ1608R301A Murata BLM18SG700 TN1
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, R26	2	0Ω resistors (0603)

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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](http://www.maxim-ic.com).

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## Component List (continued)

DESIGNATION	QTY	DESCRIPTION
R9, R10, R11	0	Not installed, resistors (0603)
R12–R16	0	Not installed, resistors—short by PC trace (0402)
U1	1	MAX5488SOCKET (16-pin thin QFN-EP, 3mm x 3mm) Plastronics 16QN50K23030
U2	1	MAX3390EEUD+ (14-pin TSSOP)
U4	1	MAXQ2000-RAX+ (68-pin QFN-EP, 10mm x 10mm)
U5	1	USB UART FTDI FT232BL (32-pin TQFP, 7mm x 7mm)
U6	1	93C46 type 3-wire EEPROM Atmel AT93C46A-10SU-2.7 (8-pin SO)
U7	1	MAX8511EXK25+ LDO regulator (5-pin SC70)

DESIGNATION	QTY	DESCRIPTION
Y2	1	20MHz crystal SunTsu SCD20B-20.000MHZ-I Citizen HCM49-20.000MABJ-UT
Y3	0	Not installed, 32.768kHz crystal
Y4	1	6MHz crystal Citizen HCM49-6.000MABJ-UT SunTsu SCD22B-6.000MHZ-I
—	4	Bumps 3M SJ-5003BK
—	1	Shunt (JU1)
—	1	Maxim sample box containing three ICs MAX5488ETE#G16 (16-pin thin QFN-EP)
—	1	USB high-speed A-to-B cables 5ft (1.5m)
—	1	PCB: MAX5488 Evaluation Kit#

## Component Suppliers

SUPPLIER	PHONE	WEBSITE
AVX Corp.	843-946-0238	www.avxcorp.com
KEMET Corp.	864-963-6300	www.kemet.com
Murata Mfg. Co., Ltd.	770-436-1300	www.murata.com
Panasonic Corp.	800-344-2112	www.panasonic.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 MAX5488 when contacting these component suppliers.

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Evaluates: MAX5487/MAX5488/MAX5489

## Quick Start

### Recommended Equipment

Before beginning, the following equipment is needed:

- Maxim MAX5488 EV kit (includes USB type A-B cable)
- Sample MAX5488ETE#G16 device (included with MAX5488 EV kit)
- User-supplied Windows 98SE/2000/XP-compatible PC with a spare USB port
- Administrator privileges may be required when first installing the device on Windows 2000/XP
- Two ohmmeters
- Tweezers to move the MAX5488 sample into its socket

**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 98SE/2000/XP operating system.

### Procedure

The MAX5488 EV kit is fully assembled and tested. Follow the steps below to verify board operation.

**Caution: Do not turn on the power until all connections are completed.**

- 1) Visit [www.maxim-ic.com/evkitsoftware](http://www.maxim-ic.com/evkitsoftware) to download the latest version of the EV kit software, 5488Rxx.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 launching the 5488Rxx.MSI program inside the zip file. The program files are copied and icons are created in the Windows **Start | Programs** menu.

**Table 1. JU1 Jumper Functions**

SIGNAL	SHUNT POSITION	EV KIT FUNCTION
VDD	1-2*	Power device V+ from USB 5V supply
	Open	Do not use—device will not be powered
	2-3	Power device V+ from user-provided supply

\*Default position.

- 3) Ensure that the MAX5488 EV kit board's jumper settings are correct (see Table 1 for jumper settings).
- 4) Unlatch the socket and use tweezers to install one of the MAX5488 devices, exposed pad down. Note the location of pin 1 in the upper-right corner, as indicated on the PCB silkscreen. On the device, the pin 1 index is marked with a molded or marked feature, typically # or + for RoHS-compliant devices. After ensuring that the device is properly seated, latch the socket lid securely closed.
- 5) Connect one of the ohmmeters across the WA and LA terminals.
- 6) Connect the other ohmmeter across the WB and LB terminals.
- 7) Connect the USB cable from the PC to the MINIQUSB 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 and XP. Refer to *Application Note 3601: Troubleshooting Windows Plug-and-Play and USB for Maxim Evaluation Kits* if you have any problems during this step.
- 8) 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\Maxim MAX5488EVKIT** (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. It is safe to proceed with the installation.
- 9) Start the EV kit software by clicking its icon in the Windows **Start** menu.
- 10) The software automatically searches for the MAX5488. After successful connection, the EV kit firmware banner appears in the lower-left corner of the window. Move the **Channel A** or **Channel B** slider and click the **Write** button to set the wiper position, as shown in Figure 1.

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## Detailed Description of Software

The MAX5488 EV kit software graphical user interface (GUI) is a Windows program that provides a convenient means to control the MAX5488 (Figure 1).

In the **Channel B** group box, set the tap value (either by typing the decimal tap number into one of the edit boxes or by moving the slider), and then click the **Write** button. As confirmation, the **Command History** window shows SPI sequence 0x02 nn, where nn = the hexadecimal W-L tap value.

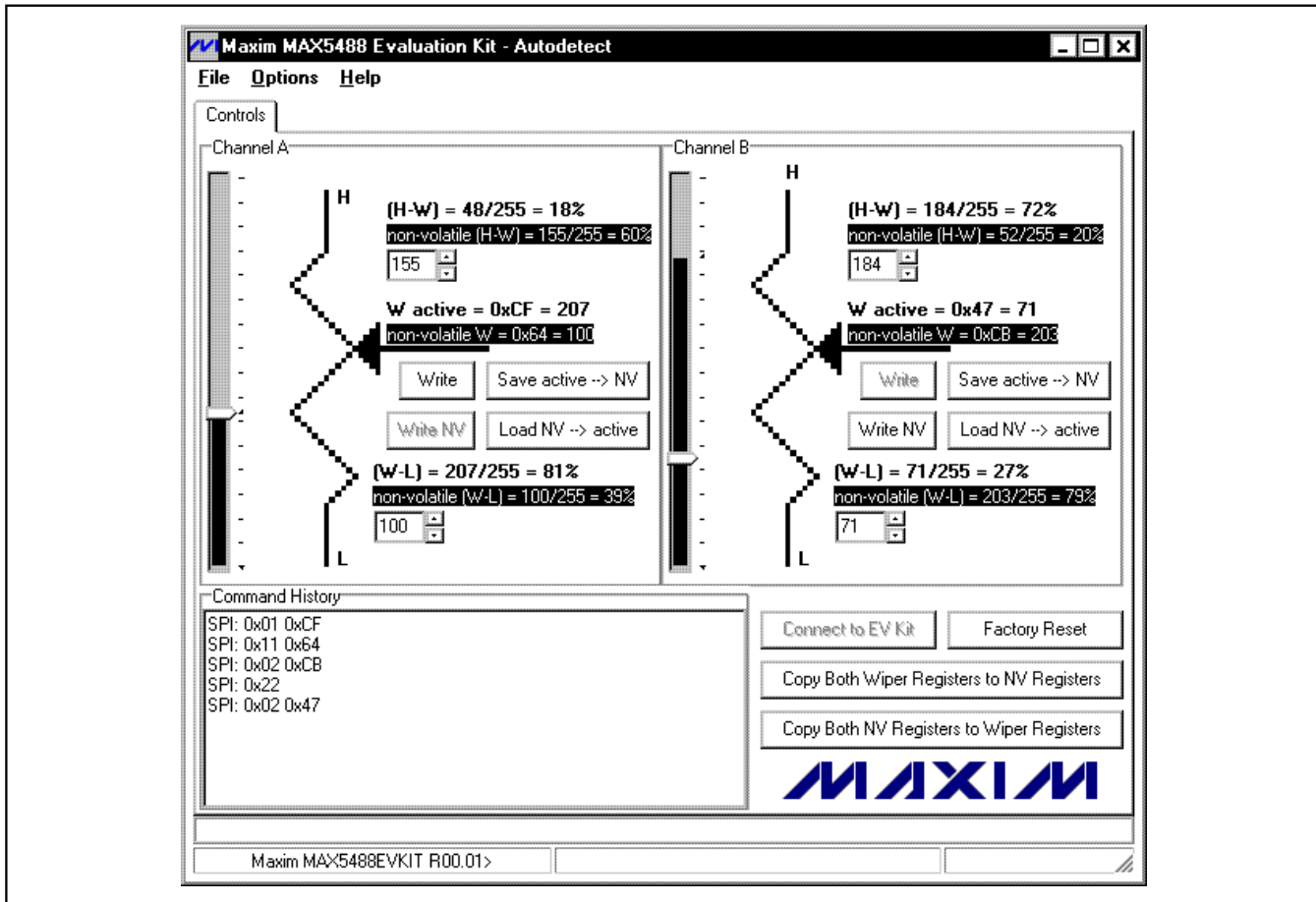


Figure 1. MAX5488 EV Kit Main Window

### Factory Reset

Clicking the **Factory Reset** button returns wiper A and wiper B (and the nonvolatile memory) to the factory-programmed midscale tap position.

### Wipers A and B Position

In the **Channel A** group box, set the tap value (either by typing the decimal tap number into one of the edit boxes or by moving the slider), and then click the **Write** button. As confirmation, the **Command History** window shows SPI sequence 0x01 nn, where nn = the hexadecimal W-L tap value.

### Nonvolatile Programming

In the **Channel A** group box, set the tap value (either by typing the decimal tap number into one of the edit boxes or by moving the slider), and then click the **Write NV** button. As confirmation, the **Command History** window shows SPI sequence 0x11 nn, where nn = the hexadecimal W-L tap value.

In the **Channel B** group box, set the tap value (either by typing the decimal tap number into one of the edit boxes or by moving the slider), and then click the **Write NV** button. As confirmation, the **Command History** window shows SPI sequence 0x12 nn, where nn = the hexadecimal W-L tap value.

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## **Volatile/Nonvolatile Data Transfer**

In the **Channel A** group box, copy the active tap value to nonvolatile memory by clicking the **Save active → NV** button. As confirmation, the **Command History** window shows SPI sequence 0x21.

In the **Channel B** group box, copy the active tap value to nonvolatile memory by clicking the **Save active → NV** button. As confirmation, the **Command History** window shows SPI sequence 0x22.

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

In the **Channel A** group box, copy the active tap value to nonvolatile memory by clicking the **Load NV→active** button. As confirmation, the **Command History** window shows SPI sequence 0x31.

In the **Channel B** group box, copy the active tap value to nonvolatile memory by clicking the **Load NV → active** button. As confirmation, the **Command History** window shows SPI sequence 0x32.

To copy both of the active tap values to nonvolatile memory, click the **Copy Both NV Registers to Wiper Registers** button. As confirmation, the **Command History** window shows SPI sequence 0x33.

## **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**

### **Evaluating the MAX5487 or MAX5489**

The MAX5487 and MAX5489 are similar to the MAX5488, but with a different end-to-end resistance. To evaluate the MAX5487 or MAX5489, order a free sample of the MAX5487ETE#G16 (refer to the MAX5487/MAX5488/MAX5489 IC data sheet).

### **External User-Supplied SPI Interface**

The EV kit may be modified for use with an external, user-supplied SPI interface. First, with power off and USB disconnected, flip the board over and cut the traces that are on the back of the board, underneath location J2. Install a standard dual-row header, and connect a ribbon cable to the user-supplied SPI.

### **Using an External Power Supply**

The EV kit may be used with an external, user-supplied 2.7V to 5.25V power supply. First, with power off and USB disconnected, move the JU1 shunt between pins 2-3.

Evaluates: MAX5487/MAX5488/MAX5489

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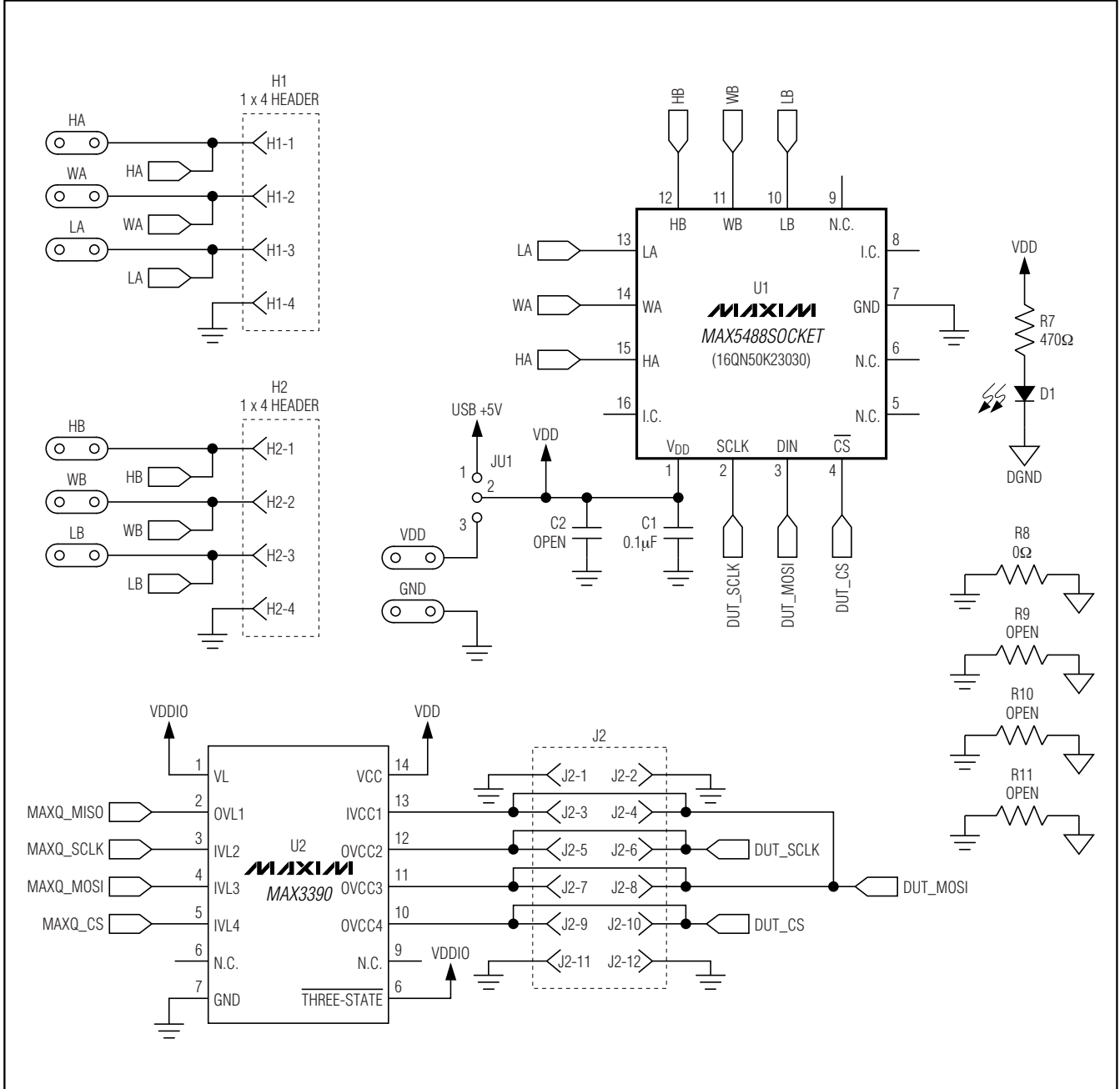


Figure 2a. MAX5488 EV Kit Schematic (Sheet 1 of 3)

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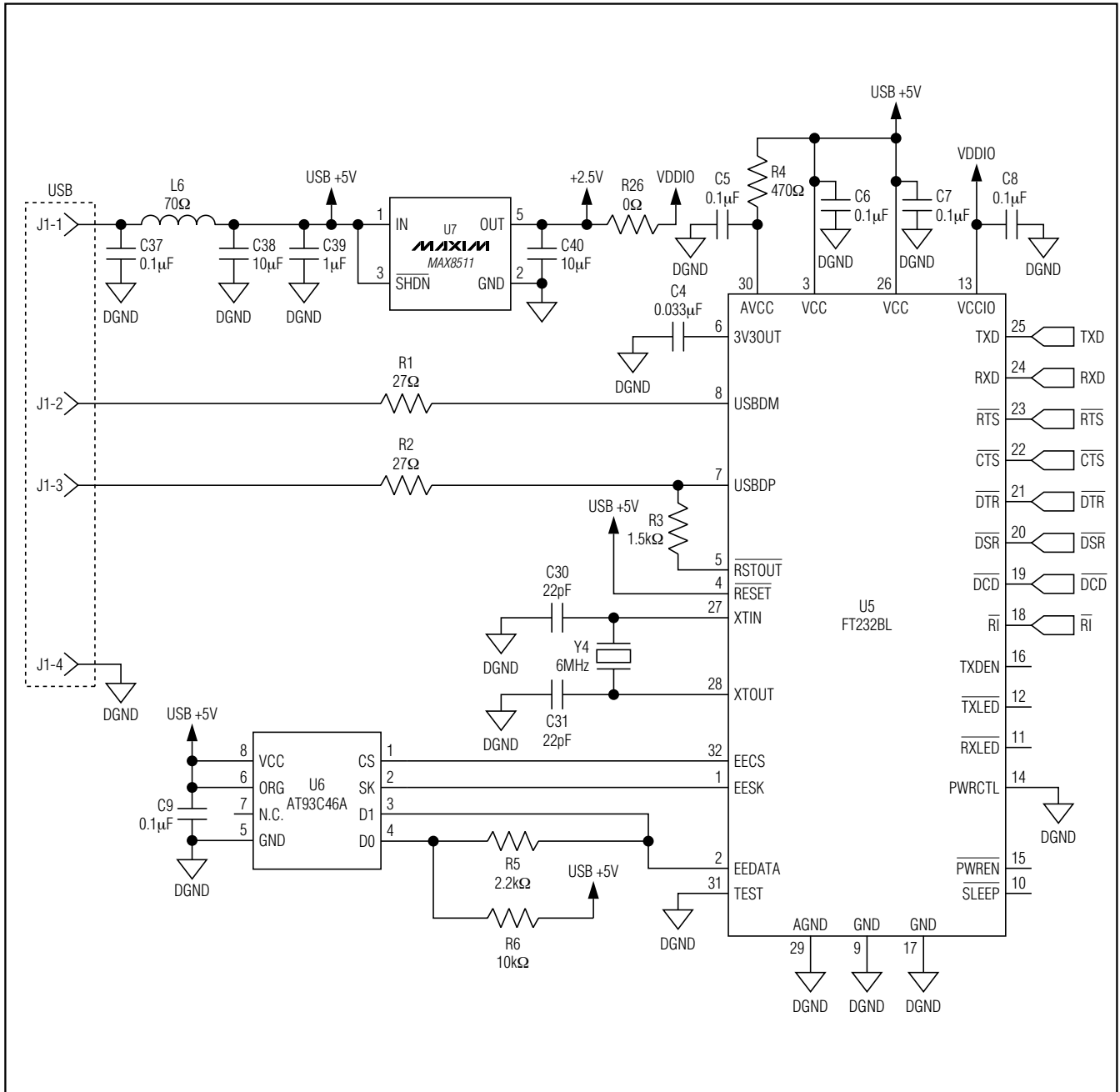


Figure 2b. MAX5488 EV Kit Schematic (Sheet 2 of 3)

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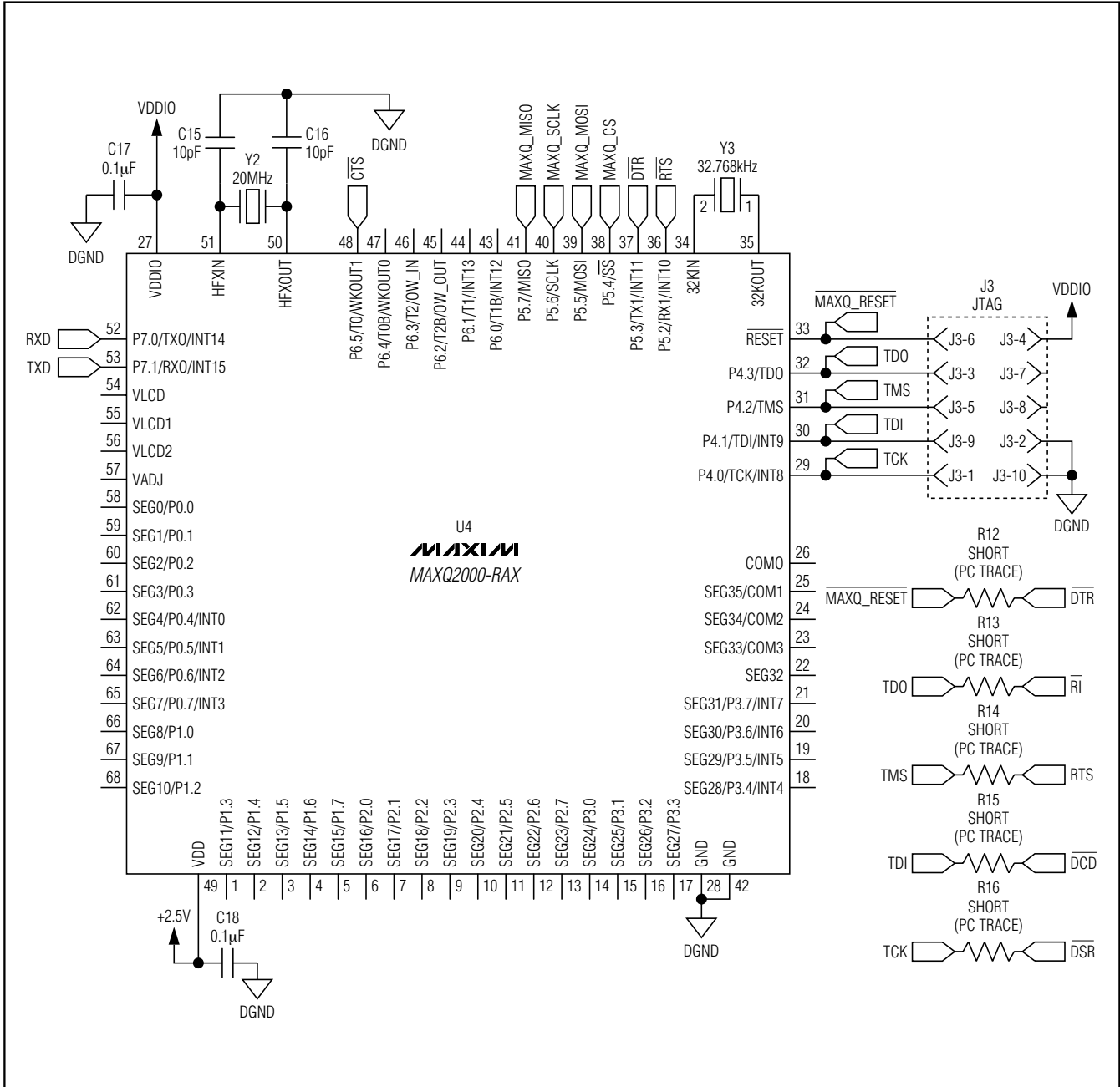


Figure 2c. MAX5488 EV Kit Schematic (Sheet 3 of 3)





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**Evaluates: MAX5487/MAX5488/MAX5489**

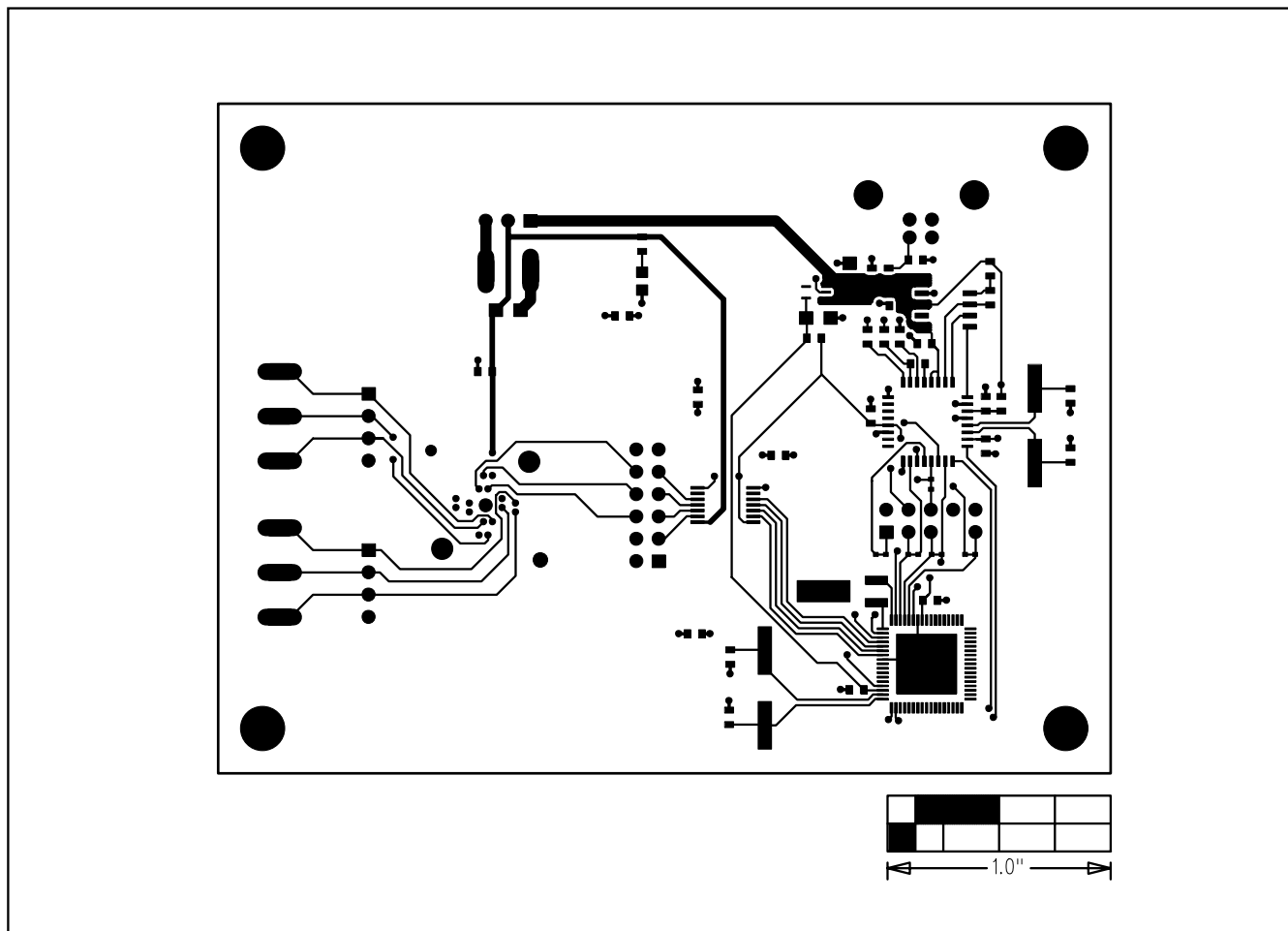


Figure 4. MAX5488 EV Kit PCB Layout—Component Side

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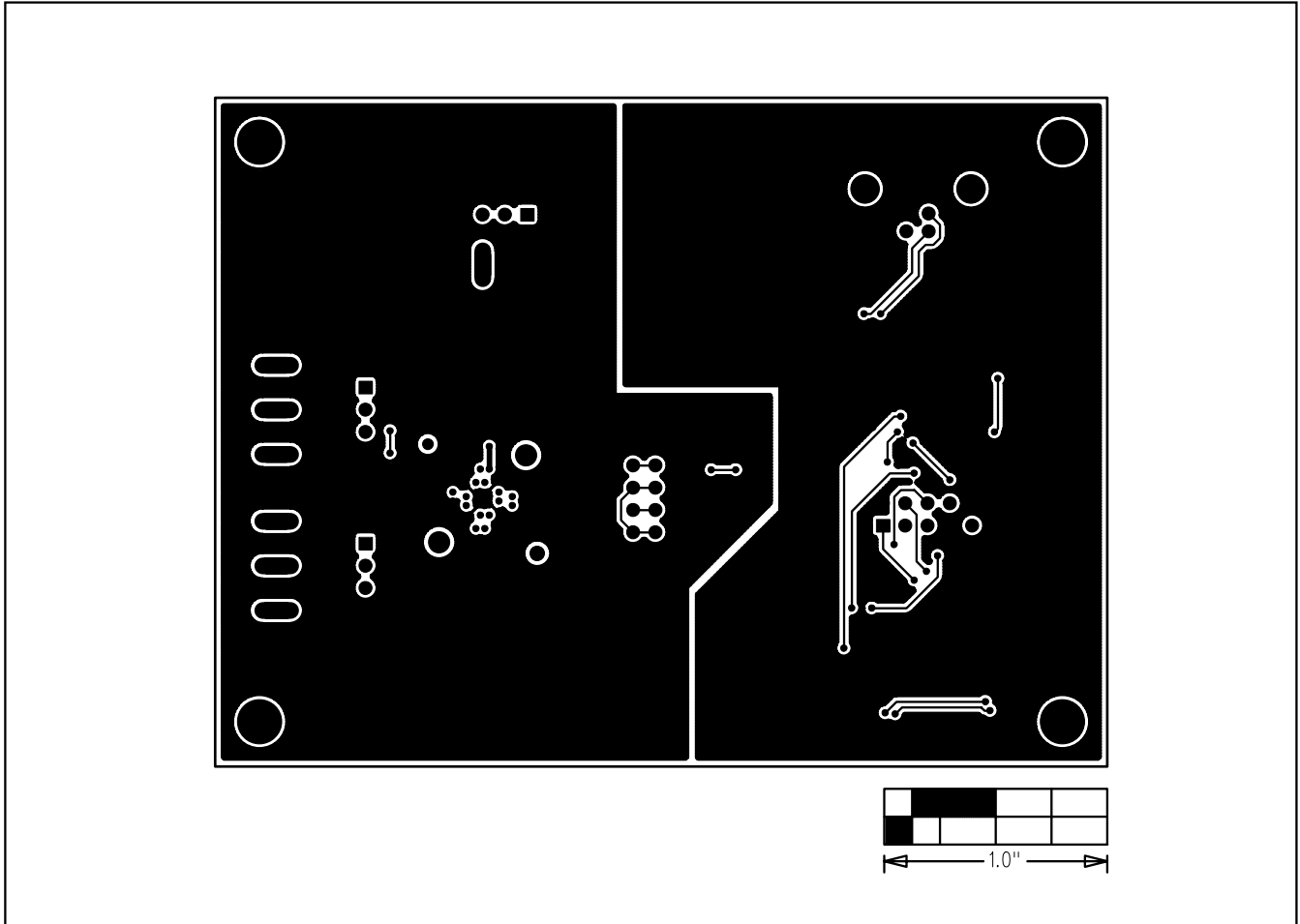


Figure 5. MAX5488 EV Kit PCB Layout—Solder Side

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