

# MAX5394M Evaluation Kit

# Evaluates: MAX5394L—MAX5394N

## General Description

The MAX5394M evaluation kit (EV kit) demonstrates the MAX5394M single, 256-tap volatile, low-voltage linear digital potentiometer. The device comes in an 8-pin TDFN-EP package. The EV kit provides controls to adjust the wiper and shutdown modes.

The digital potentiometer is controlled by an on-board MAXQ® microcontroller that provides an SPI interface. The EV kit features Windows XP®, Windows Vista®, and Windows® 7-compatible software that provides a simple graphical-user interface (GUI) for exercising the device features.

The EV kit comes with the MAX5394MATA+ (50kΩ end-to-end resistance) installed. Contact the factory for samples of the pin-compatible MAX5394LATA+ (10kΩ end-to-end resistance) and MAX5394NATA+ (100kΩ end-to-end resistance).

## Component List

DESIGNATION	QTY	DESCRIPTION
BYP, CS ADDR0 CS/L, DIN SDA UD, H, L, QPEDB ADDR1, SCLK SCL INC/L, W	8	White test points
B_INC/L	1	Pushbutton switch
C1, C3, C23	3	0.1µF ±10%, 16V X7R ceramic capacitors (0603) TDK C1608X7R1C104K
C2	1	100pF ±5%, 50V C0G ceramic capacitor (0603) Murata GQM1885C1H101J
C5–C18, C24	15	1µF ±10%, 16V X5R ceramic capacitors (0603) Murata GRM188R61C105K
C19, C20	2	18pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H180J

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## Features

- 1.7V to 5.5V Wide Input Supply Range
- Supports All SPI Family of Devices: 10kΩ, 50kΩ, and 100kΩ End-to-End Resistance
- On-Board Microcontroller to Generate SPI Commands
- Windows XP-, Windows Vista-, and Windows 7-Compatible Software
- USB-Powered (Cable Included)
- Fully Assembled and Tested with Proven PCB Layout

Ordering Information appears at end of data sheet.

DESIGNATION	QTY	DESCRIPTION
C21	1	1000pF ±10%, 50V X7R ceramic capacitor (0603) Murata GRM188R71H102K
C25	0	Not installed, ceramic capacitor (0603)
GND	1	Black test point
J1	1	USB type-B right-angle PC-mount receptacle
J2	0	Not installed, 10-pin (2 x 5) header
J3	1	4-pin header
JU1	1	3-pin header
JU2	1	5-pin header
JU3, JU4	2	10-pin (2 x 5) headers
JU5	1	4-pin header
JU6, JU7	2	2-pin headers
JU_ID0–JU_ID3	0	Not installed. 2-pin headers
L1	1	Ferrite bead (0603) TDK MMZ1608R301A
R1–R3, R5–R9	8	4.7kΩ ±5% resistors (0603)

**Component List (continued)**

DESIGNATION	QTY	DESCRIPTION
R12	1	100Ω ±5% resistor (0603)
R13	1	10kΩ ±5% resistor (0603)
SW_A0, SW_A1, SW_UD	3	DIP switches
TP1–TP3	0	Not installed, test points
U1	1	50kΩ SPI digital potentiometer (8 TDFN-EP*) Maxim MAX5394MATA+
U2	0	Not installed, digital potentiometer (10 μMAX®)
U3–U5	3	Level translators (10 μMAX) Maxim MAX1840EUB+
U7	1	Microcontroller (64 LQFP) Maxim MAXQ622G-0000+

DESIGNATION	QTY	DESCRIPTION
U8	1	3.3V LDO (5 SC70) Maxim MAX8511EXK33+
U9	1	1.8V LDO (5 SC70) Maxim MAX8511EXK18+
U10	0	Not installed, ESD protector (6 SOT23)
VDD	1	Red test point
Y1	1	12MHz crystal (HCM49)
—	1	USB high-speed A-to-B cables, 6ft
—	6	Shunts
—	1	PCB: MAX5394M EVKIT

\*EP = Exposed pad.

**Component Suppliers**

SUPPLIER	PHONE	WEBSITE
Murata Americas	800-241*6574	www.murataamericas.com
TDK Corp.	847-803-6100	www.component.tdk.com

**Note:** Indicate that you are using the MAX5394M when contacting these component suppliers.

**MAX5394M EV Kit Files**

FILES	DESCRIPTION
INSTALL.EXE	Installs the EV kit files on your computer
MAX539XVxx.EXE	Application program
USBConverterDLL.DLL	Application library
UNINSTALL.EXE	Uninstalls the EV kit software

**Quick Start**

**Required Equipment**

- MAX5394M EV kit (USB cable included)
- Windows XP, Windows Vista, or Windows 7 PC with a spare USB port
- Digital voltmeter (DVM)

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

- 1) Verify that all jumpers are in their default positions, as shown in Table 1.
- 2) Set the DVM to measure resistance. Connect the negative terminal of the DVM to the L test point and connect the positive terminal to the W test point.
- 3) Visit [www.maximintegrated.com/evkitsoftware](http://www.maximintegrated.com/evkitsoftware) to download the latest version of the EV kit software, MAX539XGUISetupVxx.ZIP. Save the EV kit software to a temporary folder and uncompress the ZIP file.
- 4) Install the EV kit software on your computer by running the INSTALL.EXE program inside the temporary folder. The program files are copied to your PC and icons are created in the Windows **Start | Programs** menu.
- 5) Connect the USB cable from the PC to the EV kit board; the USB driver is installed automatically.

- 6) Start the EV kit software by opening its icon in the **Start | Programs** menu. The EV kit software main window appears, as shown in Figure 1.
- 7) Move the wiper scrollbar up until the edit box shows **255**.
- 8) Press the **H = Open, W = Unchanged** button in the **Standby Commands** group box.
- 9) Verify that the DVM measures 50kΩ.

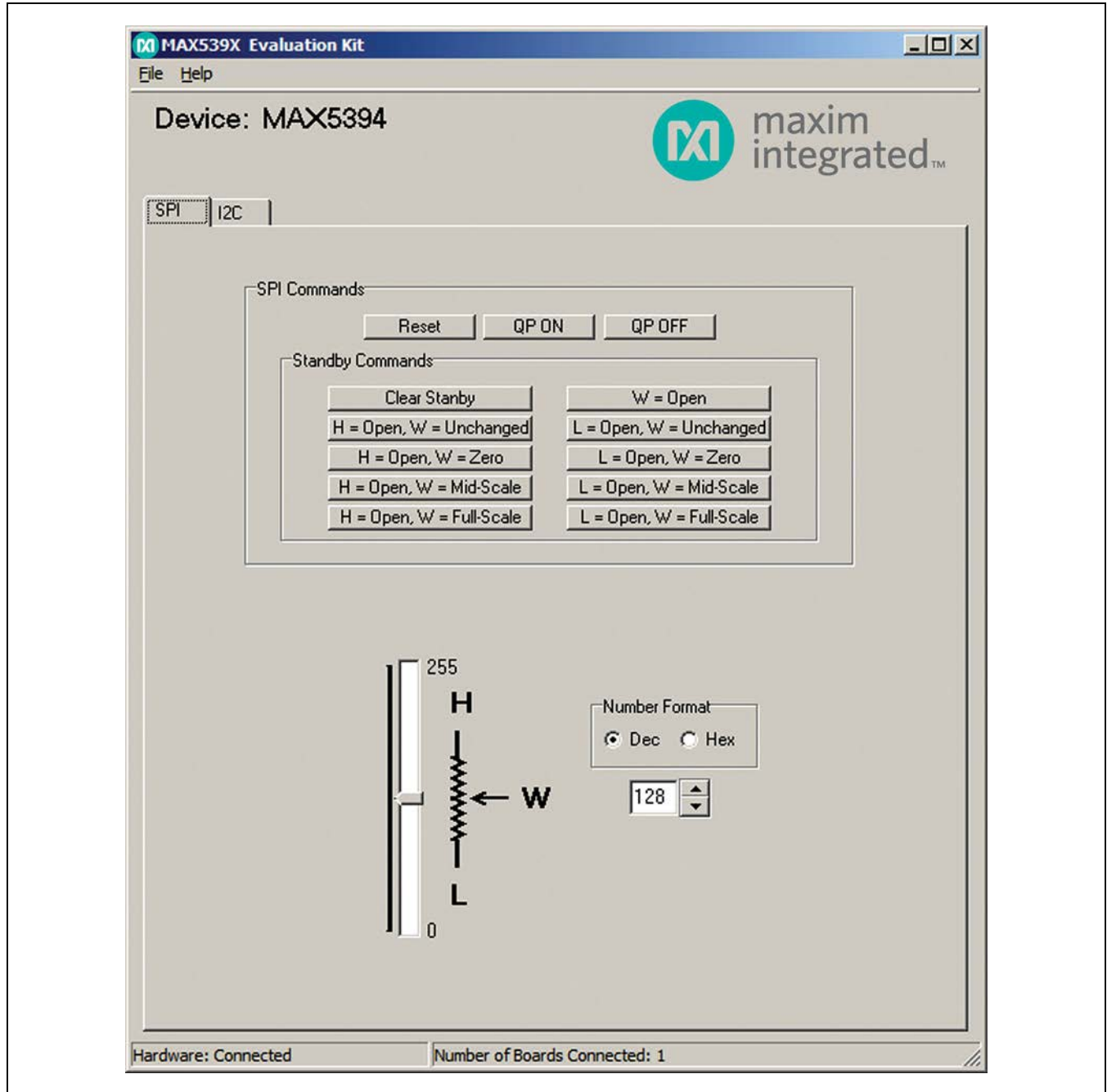


Figure 1. MAX5394M EV Kit Software Main Window

## Detailed Description of Software

The MAX5394M EV kit software provides controls to adjust the wiper and shutdown modes.

### Wiper

The wiper register stores an 8-bit data that ranges from 0–255. There are two ways of changing the wiper register. First is by using the vertical scrollbar, and the other way is through pressing the up-down arrows to the right of the edit box. Numbers in the edit box can be in decimal or hexadecimal format by selecting the corresponding radio buttons in the **Number Format** group box.

### Standby Commands

The buttons within the **Standby Commands** group box allows the user to change the H, W, or L terminals to open with the wiper position set to zero code, mid code, full code, or the value contained in the wiper register. The **Clear Standby** button is used to remove any shutdown conditions and return the wiper register to its original stored value. Refer to the MAX5394 IC data sheet for a detailed description of the standby commands.

### Reset

Press the **Reset** button to return to the POR settings. This resets the wiper register to midscale (0x80), enables the charge pump, and deasserts any shutdown modes.

### Charge Pump

Press the **QP ON** button in the **SPI Commands** group box to enable the internal charge pump that allows low-supply voltage operation. To disable the internal charge pump, press the **QP OFF** button. The device's minimum

supply voltage with charge pump disabled is limited to 2.6V and the terminal voltage cannot exceed  $-0.3V$  to  $(V_{DD} + 0.3V)$ .

## Detailed Description of Hardware

The MAX5394M EV kit provides a proven layout for the MAX5394M. An on-board MAXQ622 microcontroller and jumpers to disconnect the on-board microcontroller are included on the EV kit.

### User-Supplied Power Supply

The EV kit is powered completely from the USB port by default. To power the device with a user-supplied power supply, move the shunt on jumper JU1 to the 2-3 position and apply a 1.7V to 5.5V power supply at the VDD test point and the GND test point on the EV kit.

### User-Supplied SPI

To evaluate the EV kit with a user-supplied SPI bus, move the shunt on jumper JU2 to the 1-4 position, jumper JU3 to the 7-8 position, and jumper JU4 to the 7-8 position. Apply the user-supplied  $\overline{CS}$  to the  $\overline{CS}|ADDR0|CS/L$  test point, the user-supplied DIN to the  $DIN|SDA|UD$  test point, and the user-supplied SCLK to the  $SCLK|SCL|INC/L$  test point.

### User-Supplied H and L

Remove the shunts from jumpers JU6 and JU7 and apply a user-supplied voltage at the H and L test points. The voltage range for H and L is 0 to 5.25V and is independent of the  $V_{DD}$  operating voltage.

**Table 1. EV Kit Jumper Settings**

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	1-2*	Connects the $V_{DD}$ pin of the U1 device to the on-board 1.8V supply.
	1-3	Connects the $V_{DD}$ pin of the U1 device to a user-supplied power supply between 1.7V to 5.5V.
JU2	1-2*	Connects the $\overline{CS}$ pin of the U1 device to the $\overline{CS}$ signal of the on-board microcontroller.
	1-3	Do not install.
	1-4	Connects the $\overline{CS}$ pin of the U1 device to a user-supplied $\overline{CS}$ signal. Apply appropriate signal to the $\overline{CS} ADDR0 CS/L$ test point.
	1-5	Do not install.
JU3	1-2*	Connects the DIN pin of the U1 device to the DIN signal of the on-board microcontroller.
	3-4	Do not install.
	5-6	Do not install.
	7-8	Connects the DIN pin of the U1 device to a user-supplied DIN signal. Apply appropriate signal to the $DIN SDA UD$ test point.
	9-10	Do not install.
JU4	1-2*	Connects SCLK pin of the U1 device to the SCLK signal of the on-board microcontroller.
	3-4	Do not install.
	5-6	Do not install.
	7-8	Connects the SCLK pin of the U1 device to a user-supplied SCLK signal. Apply appropriate signal to the $SCLK SCL INC/L$ test point.
	9-10	Do not install.
JU6	Installed*	Connects the H pin to the $V_{DD}$ pin of the U1 device.
	Not installed	User-supplied H. The user must apply a voltage at the H test point. The voltage range for the H pin is 0 to 5.25V.
JU7	Installed*	Connects the L pin of the U1 device to ground.
	Not installed	User-supplied L. The user must apply a voltage at the L test point. The voltage range for the L pin is 0 to 5.25V.

\*Default position.

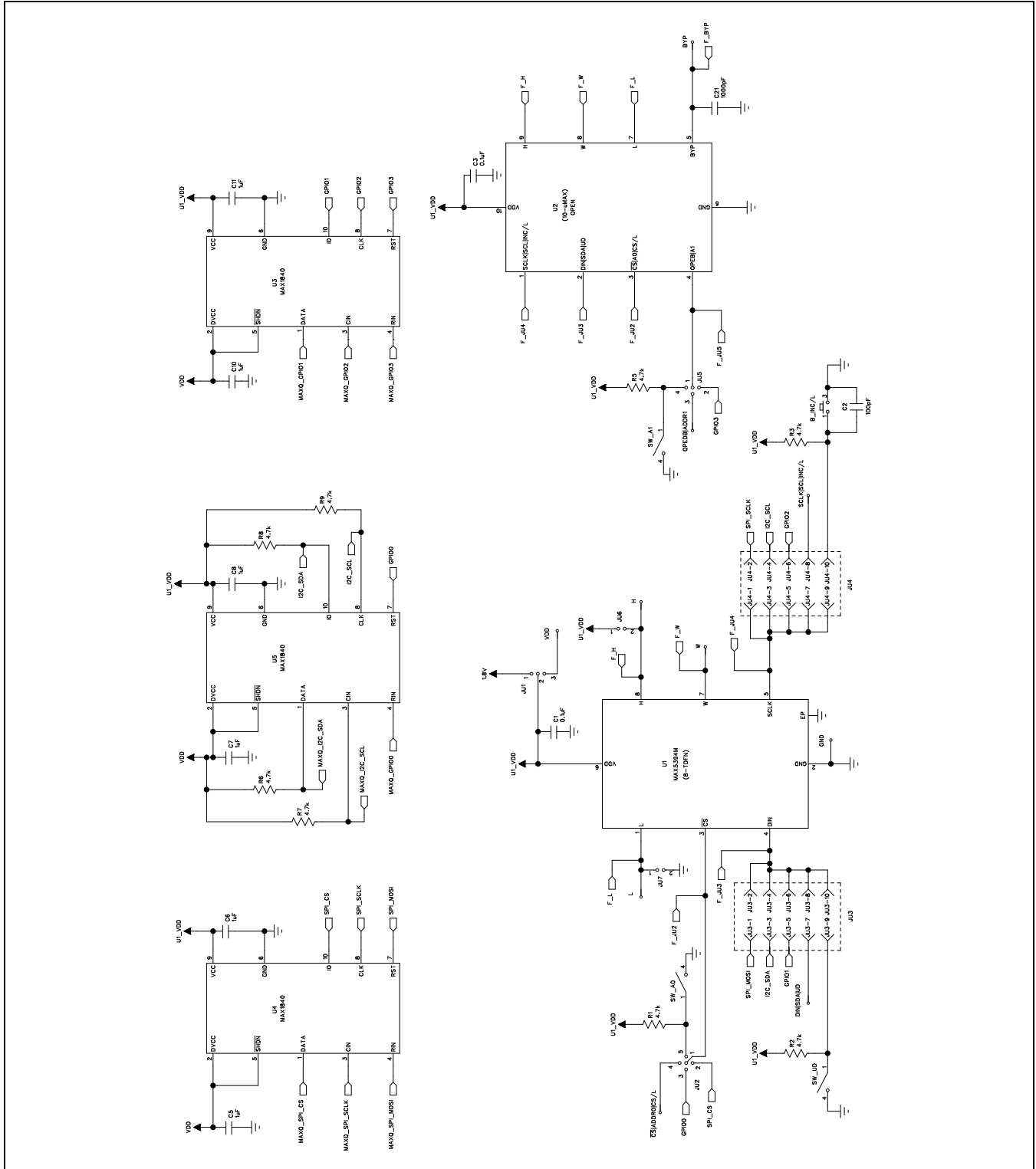
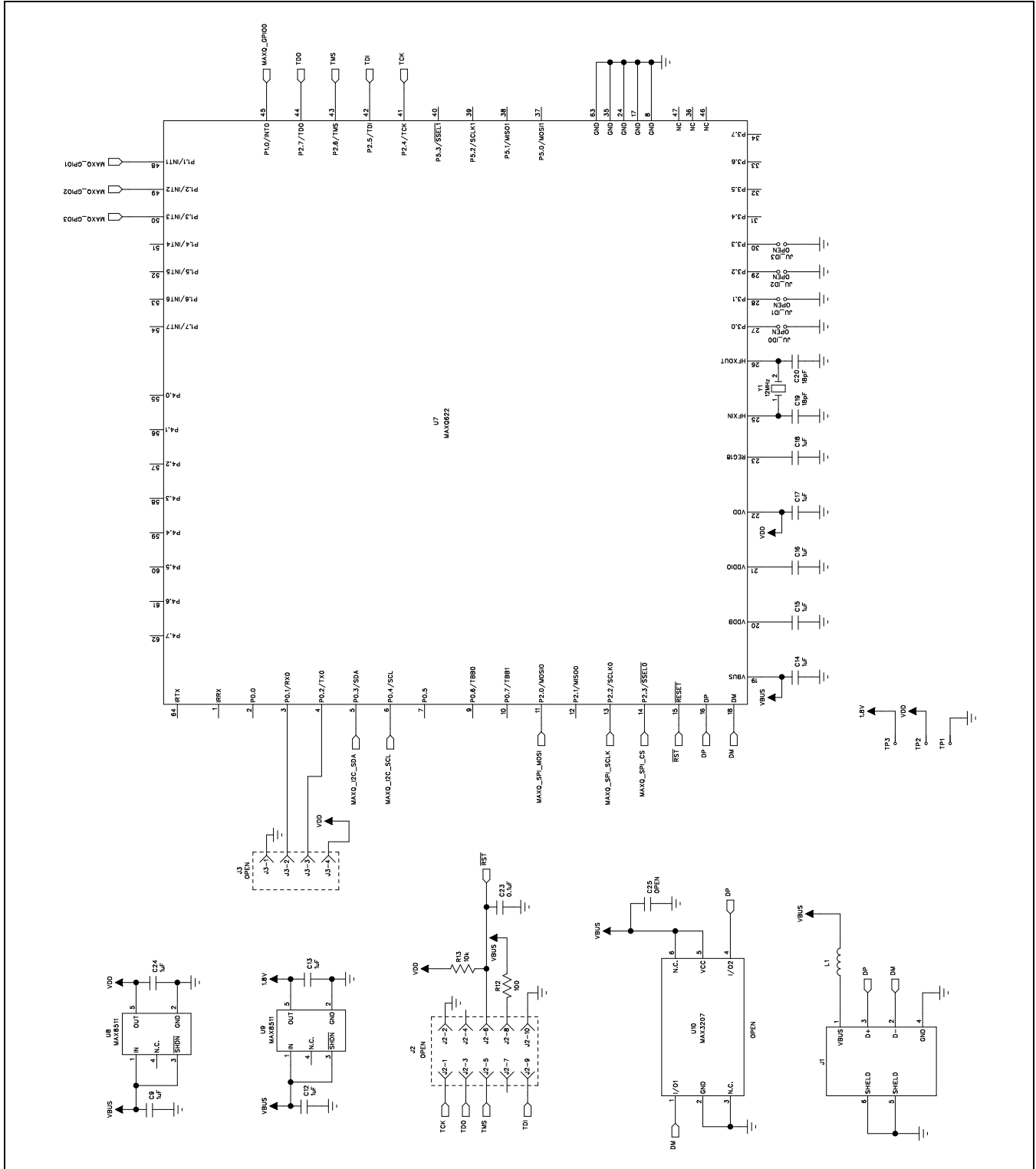


Figure 2a. MAX5394M EV Kit Schematic (Sheet 1 of 2)



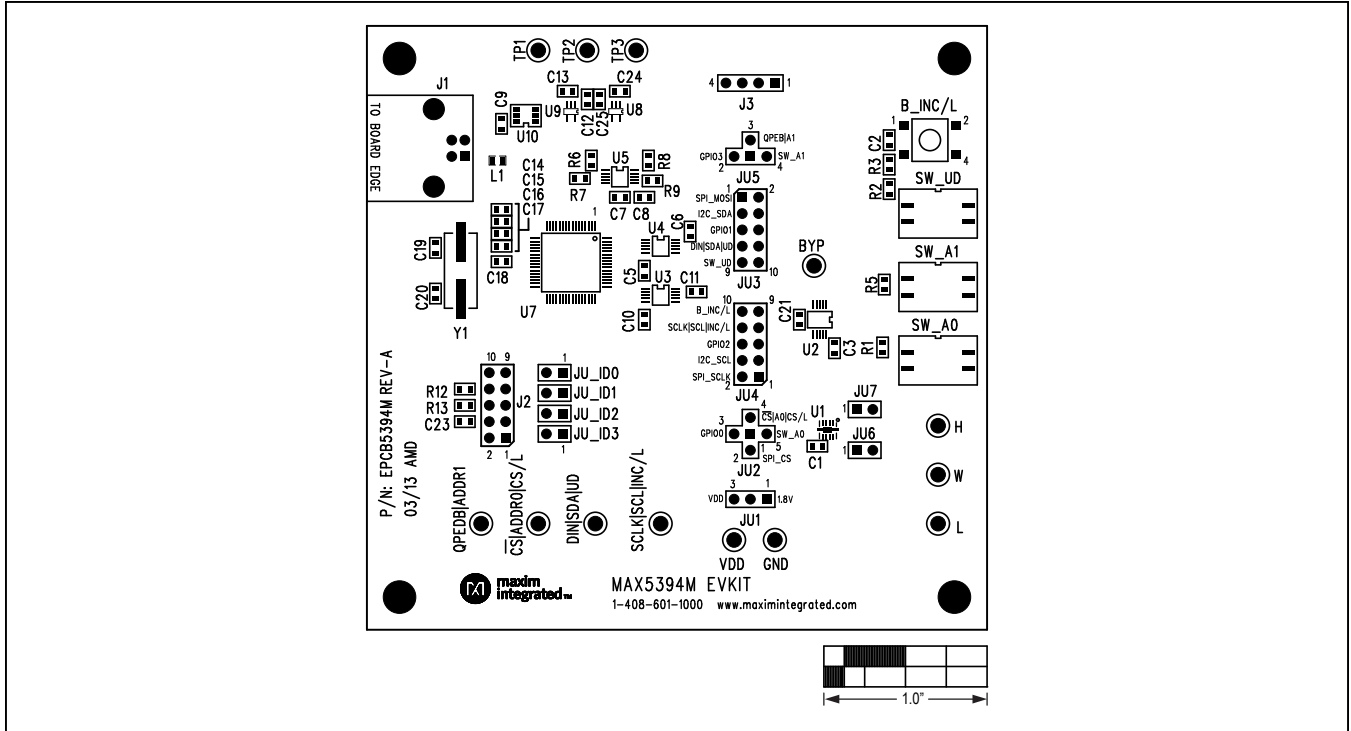


Figure 3. MAX5394M EV Kit Component Placement Guide—Component Side

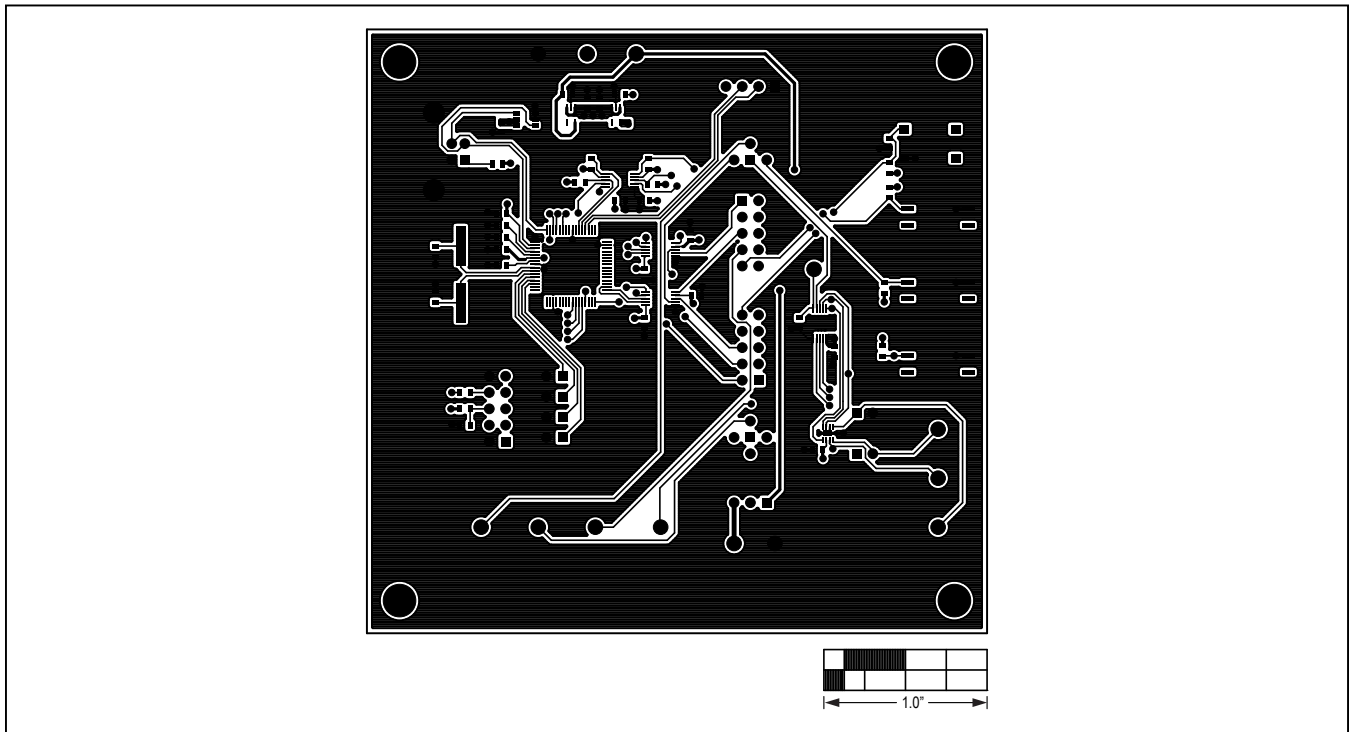


Figure 4. MAX5394M EV Kit PCB Layout—Component Side



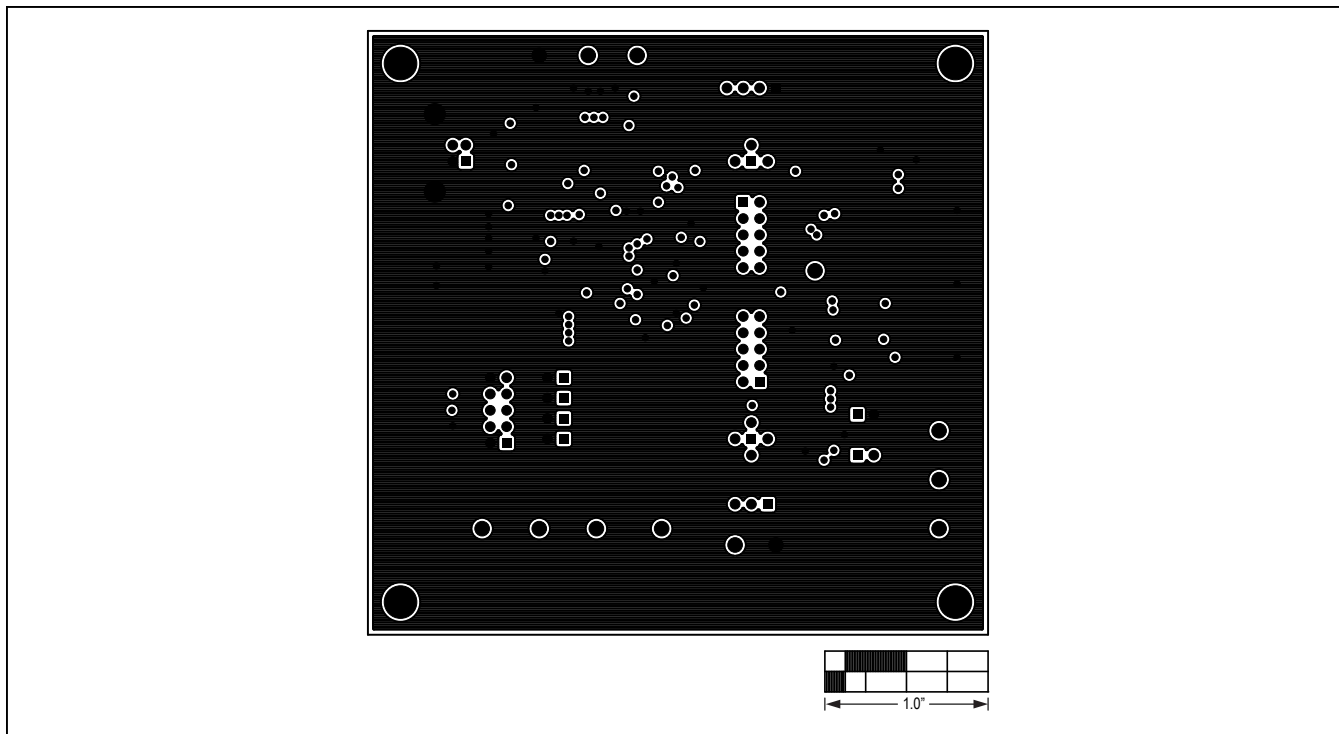


Figure 5. MAX5394M EV Kit PCB Layout—Inner Layer 2

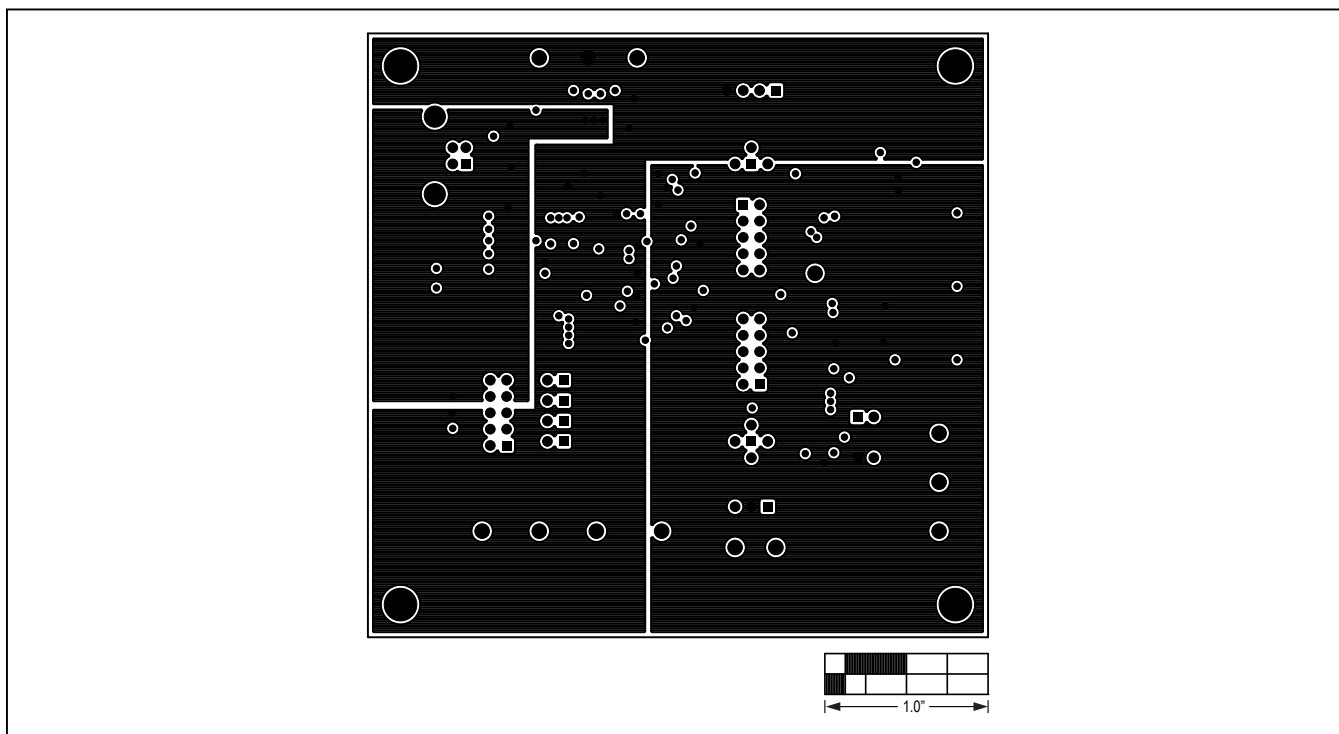


Figure 6. MAX5394M EV Kit PCB Layout—Inner Layer 3

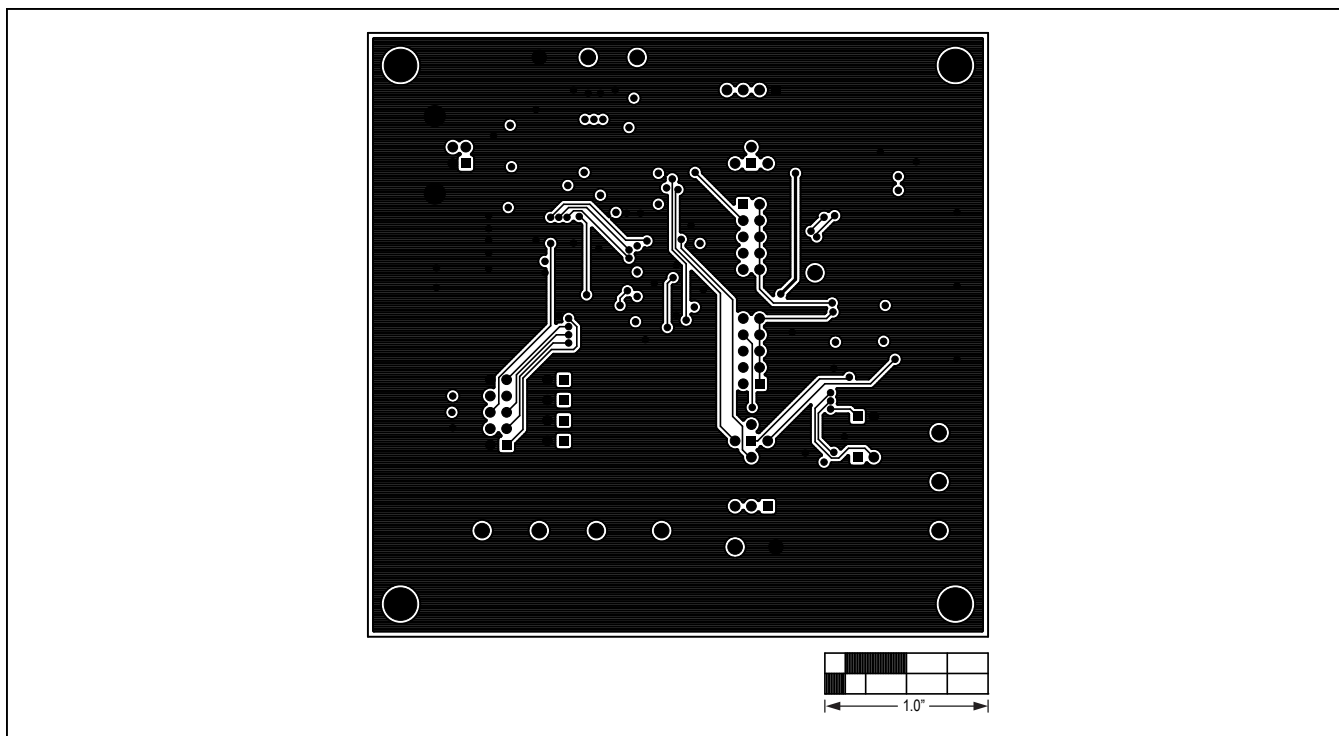


Figure 7. MAX5394M EV Kit PCB Layout—Solder Side

### Ordering Information

PART	TYPE
MAX5394MEVKIT#	EV Kit

#Denotes RoHS compliant.

## Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	5/13	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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