19-4043; Rev 0; 2/08

MAX7319 Evaluation Kit

Evaluates: MAX7319

General Description

The MAX7319 evaluation kit (EV kit) provides a proven design to evaluate the MAX7319 I²C port expander with eight Inputs and maskable transition detection. 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 MAX7319. The MAX7319 EV kit PCB comes with a MAX7319ATE+ installed.

Features

- **Wide 1.71V to 5.5V Supply Range**
- **Windows 2000/XP/Vista (32-Bit)-Compatible Software**
- **USB-PC Connection (Cable Included)**
- **USB Powered**
- **Lead-Free and RoHS-Compliant**
- **Labeled Test Points**
- **Proven PCB Layout**
- **Fully Assembled and Tested**

Ordering Information

PART	TYPE
MAX7319EVKIT+	EV Kit

+Denotes lead-free and RoHS-compliant.

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C5–C9, C17, C18, C37	9	0.1µF ±10%, 16V X7R ceramic capacitors (0603) TDK C1608X7R1C104K
C2	0	Not installed, capacitor (0603)
C4	1	0.033µF ±10%, 16V (min) X5R ceramic capacitor (0603) Taiyo Yuden EMK107BJ333KA
C10, C39	2	1µF ±10%, 16V X5R ceramic capacitors (0603) TDK C1608X5R1C105K
C11, C38, C40	3	10µF ±20%, 16V X5R ceramic capacitors (1206) Murata GRM31CR61C106M
C15, C16	2	10pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H100J
C30, C31	2	22pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H220J
H1, H2	2	8-pin headers
J1	1	USB type-B right-angle female receptacle
J3	0	Not installed
JU1, JU3	2	2 x 4 dual-row vertical headers
JU2	1	3-pin header
JU4	1	2 x 8 dual-row vertical header
JU5, JU6, JU9–JU13	0	Not installed
L1	1	Ferrite bead TDK MMZ1608R301A (0603)
LED1, LED2	2	Red LEDs (T1-3/4)
Q1, Q2	0	Not installed, 2N7002 (SOT23)
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)
R7, R8	2	4.7kΩ ±5% resistors (0603)
R9, R11	2	33kΩ ±5% resistors (0603)
R10, R17	2	330Ω ±5% resistors (0603)
R12, R14	0	Not installed, resistors (0603)
R16, R18, R24–R29	8	100kΩ ±5% resistors (0603)
R19–R23	0	Not installed, resistors (0402)
SW0–SW7	8	Momentary 6mm pushbutton switches

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Component List (continued)

DESIGNATION	QTY	DESCRIPTION
U1	1	I²C port expander (16-pin TQFN, 3mm x 3mm x 0.5mm) Maxim MAX7319ATE+ (Top Mark: ADA)
U2	1	2.5V regulator (5-pin SC70) Maxim MAX8511EXK25+ (Top Mark: ADV)
U3	1	3.3V regulator (5-pin SC70) Maxim MAX8511EXK33+ (Top Mark: AEI)
U4	1	Microcontroller (68-pin QFN-EP*, 10mm x 10mm) Maxim MAXQ2000-RAX+
U5	1	UART-to-USB converter (32-pin TQFP-L, 7mm x 7mm) FTDI FT232BL
U6	1	93C46 type 3-wire EEPROM (8-pin SO) 16-bit architecture Atmel AT93C46A-10SU-2.7
Y2	1	16MHz crystal (HCM49) Hong Kong X'tals SSM1600000E18FAF
Y3	0	Not installed, crystal
Y4	1	6MHz crystal (HCM49) Hong Kong X'tals SSL6000000E18FAF
—	11	Shunts
—	1	USB high-speed A-to-B cables, 6ft
—	1	PCB: MAX7319 Evaluation Kit+

**EP = Exposed pad.*

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Hong Kong X'tals Ltd.	+852-35112388	www.hongkongcrystal.com
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 MAX7319 when contacting these component suppliers.*

MAX7319 EV Kit Files

FILE	DESCRIPTION
MAX7319.EXE	Application program
FTD2XX.INF	USB device driver file
USB_Driver_Help.PDF	USB driver installation help file

Quick Start

Recommended Equipment

Before beginning, the following equipment is needed:

- MAX7319 EV kit (USB cable included)
- 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 MAX7319 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, 7319Rxx.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 7319Rxx.msi 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 (JU1–JU13) 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.
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\Maxim MAX7319EVKIT** (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.
6) Start the MAX7319 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) Check the **Enable F7 interrupt** checkbox and press the **Write One Byte** button.
8) Press the **Read Two Bytes** button. The **Port Status I7** edit box should be 1, indicating that switch SW7 is not pressed and the I7 pin is logic high.
9) Press and hold EV kit switch SW7. Interrupt is indicated by both **LED1** on the EV kit and by the **INT pin: 0 active** label on the software GUI.
10) Press the **Read Two Bytes** button. The interrupt is cleared, and the **Port Status I7** edit box should be zero, indicating that switch SW7 is pressed, holding the I7 pin at logic low. The **Flag Status F7** edit box should be 1, indicating that pin I7 has changed.
11) Release EV kit switch SW7. Interrupt should be active again.
12) Press the **Read Two Bytes** button. The interrupt is cleared, and the **Port Status I7** edit box should be 1, indicating that switch SW7 is released, and the I7 pin is logic high. The **Flag Status F7** edit box should be 1, indicating that pin I7 has changed.
13) Underneath the **Flag Status** edit boxes, press **AutoRead Two Bytes** so that the **Port Status** and **Flag Status** displays will be automatically read.
14) As you press and release SW0–SW7, the **Port Status** edit boxes will update to zero for buttons that are pressed and 1 for buttons that are released. The **Flag Status** edit boxes will update to 1 for each button that has changed one or more times since being read. The interrupt will assert briefly (cleared by the GUI's **AutoRead**) for SW7, because only the F7 interrupt has been enabled in this example. The other inputs can be enabled for interrupt by checking the corresponding enable checkbox and pressing **Write One Byte**.

Detailed Description of Software

The main window of the evaluation software is shown in Figure 1.

To enable interrupt when input pins I0–I7 change, check the corresponding **Enable F0 interrupt–Enable F7 interrupt** checkbox and then press the **Write One Byte** button.

Pressing **Read One Byte** updates the **Port Status** from the logic levels present at each input pin.

Pressing **Read Two Bytes** updates the **Port Status** and additionally updates the **Flag Status**, where 1 indicates that the corresponding input pin changed at least once since the last read.

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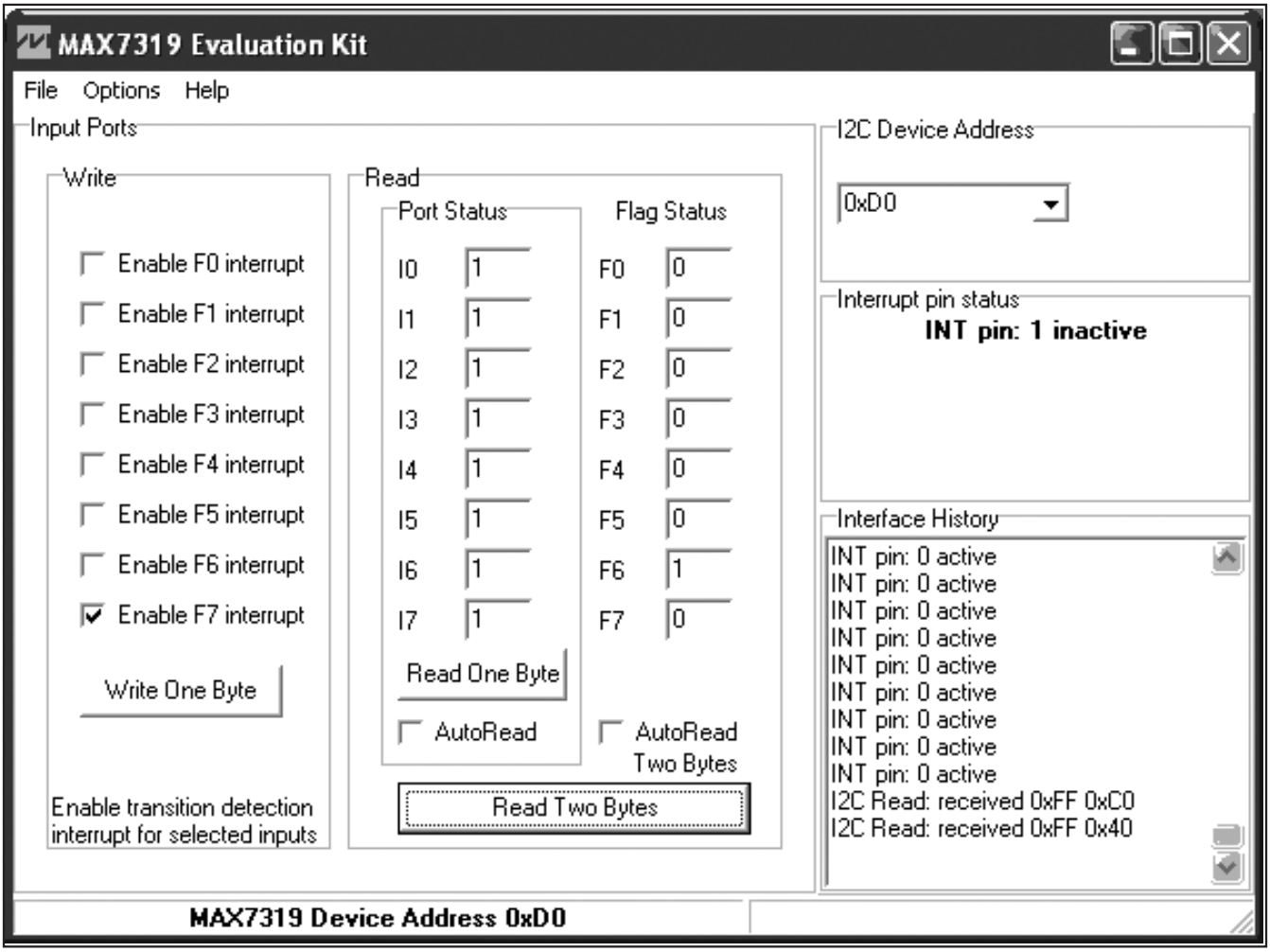

Figure 1. MAX7319 EV Kit Software Main Window

The **AutoRead** checkboxes make the GUI automatically read one or two bytes approximately every 300ms (the same rate at which the GUI polls the interrupt pin).

Detailed Description of Hardware

The MAX7319 EV kit provides a proven layout for the MAX7319. The microcontroller circuitry (U2, U3, U4, U5, and U6) is equivalent to Maxim's MAXQ2000-based MINIQUSB board. LED1 indicates when the $\overline{INT}$ interrupt signal is asserted low. Jumper blocks JU1 and JU3 select the I²C device address (see Table 2). Headers H1 and H2 provide labeled test points for all of the MAX7319 pins.

User-Supplied I²C Interface

To use the MAX7319 EV kit with a user-supplied I²C interface, first cut the JU5 and JU6 default traces, disconnecting SCL and SDA from the on-board microcontroller. If the user-supplied I²C bus provides its own SCL/SDA pullup resistors, then disable on-board pullup resistors R7 and R8 by cutting the JU12 and JU13 default traces. Next, apply your own 1.71V to 5.5V power supply between the EXT V+ and GND pads. Lastly, connect your SCL and SDA signals to the corresponding SDA and SCL test points on header H2 on the MAX7319 EV kit board.

Operation with External 1.71V to 3.6V Supply

The MAX7319 EV kit is powered completely from the USB port by default.

As shipped from the factory, the V+ supply voltage is connected to the on-board 3.3V regulator by jumper JU2.

To configure the EV kit to accept user-supplied power between 1.71V and 3.6V:

1) Remove shunts from JU4 (if present).
2) Connect external power supply between the EXT V+ oval pad and the GND oval pad.
3) Move JU2 shunt to the 2-3 position.

Operation with External 1.8V to 5.5V Supply

As shipped from the factory, the V+ supply voltage is connected to the on-board 3.3V regulator by jumper JU2.

To configure the EV kit to accept user-supplied power between 1.8V and 5.5V requires cutting traces and mounting additional components. The absolute maximum rating of the MAXQ2000 microcontroller is 3.6V—**if SCL or SDA ever exceed 3.6V, the microcontroller will be damaged**. To protect the MAXQ2000 against high voltage, a level translation circuit can be mounted on the board.

1) Obtain the following parts listed below (Maxim does not supply these components).
2) Cut the PCB trace that shorts across JU5 and JU6.
3) Mount components Q1, Q2, R12, and R14.
4) Remove shunts from JU4 (if present).
5) Connect external power supply between the EXT V+ oval pad and the GND oval pad.
6) Move JU2 shunt to the 2-3 position.

DESIGNATION	QTY	DESCRIPTION
Q1, Q2	2	2N7002 (SOT-23) Central Semiconductor 2N7002FC Diodes Inc. 2N7002-7-F Fairchild 2N7002_NL Vishay/General Semi 2N7002-E3
R12, R14	2	10kΩ ±5% resistors (0603)

To restore the EV kit, remove Q1 and Q2 and install shunts at JU5 and JU6. If Q1 and Q2 are not removed, the 2N7002's body diode will be forward-biased, which may prevent the SCL and SDA signals from meeting minimum logic-high threshold V_{IH}(min).

Table 1. MAX7319 EV Kit Jumper Descriptions (JU1–JU13)

JUMPER	SIGNAL	SHUNT POSITION	DESCRIPTION
JU1	AD0	1-2*	AD0 = GND
		3-4	AD0 = SCL
		5-6	AD0 = V+
		7-8	AD0 = SDA
JU2	V+	1-2*	U1 V+ = VDDIO (3.3V)
		2-3	U1 V+ = external user-supplied power. Remove all shunts from JU4 before applying external power.
JU3	AD2	1-2*	AD2 = GND
		3-4	AD2 = SCL
		5-6	AD2 = V+
		7-8	AD2 = SDA
JU4	Factory Test	Open*	Normal operation
		1-2	I0 connects to MAXQ2000 GPIO pin for factory test
		3-4	I1 connects to MAXQ2000 GPIO pin for factory test
		5-6	I2 connects to MAXQ2000 GPIO pin for factory test
		7-8	I3 connects to MAXQ2000 GPIO pin for factory test
		9-10	I4 connects to MAXQ2000 GPIO pin for factory test
		11-12	I5 connects to MAXQ2000 GPIO pin for factory test
		13-14	I6 connects to MAXQ2000 GPIO pin for factory test
		15-16	I7 connects to MAXQ2000 GPIO pin for factory test
JU5	Level Translator	Not installed*	SCL connects directly to MAXQ2000
		PCB trace cut open	See the *Operation with External 1.8V to 5.5V Supply* section
JU6	Level Translator	Not installed*	SDA connects directly to MAXQ2000
		PCB trace cut open	See the *Operation with External 1.8V to 5.5V Supply* section
JU9	$\overline{INT}$	Not installed*	$\overline{INT}$ pulled up to on-board VDD supply
		PCB trace cut open	$\overline{INT}$ pulled up to external INTVDD supply
JU10	SDA	Not installed*	SDA connected to on-board I^2C bus
		PCB trace cut open	SDA must be connected to an external I^2C bus
JU11	SCL	Not installed*	SCL connected to on-board I^2C bus
		PCB trace cut open	SCL must be connected to an external I^2C bus
JU12	SDA	Not installed*	SDA connected to on-board pullup resistor
		PCB trace cut open	SDA pullup resistor must be provided externally
JU13	SCL	Not installed*	SCL connected to on-board pullup resistor
		PCB trace cut open	SCL pullup resistor must be provided externally

**Default position.*

Table 2. MAX7319 Device Address Selection and Input Pullup Resistor Enable

JU3	AD2	JU1	AD0	DEVICE ADDRESS	PULLUPS ON I7–I4	PULLUPS ON I3–I0
3-4	SCL	1-2	GND	0xC0 = 1100 000 R/W	Enabled	Disabled
3-4	SCL	5-6	V+	0xC2 = 1100 001 R/W	Enabled	Enabled
3-4	SCL	3-4	SCL	0XC4 = 1100 010 R/W	Enabled	Enabled
3-4	SCL	7-8	SDA	0XC6 = 1100 011 R/W	Enabled	Enabled
7-8	SDA	1-2	GND	0xC8 = 1100 100 R/W	Enabled	Disabled
7-8	SDA	5-6	V+	0xCA = 1100 101 R/W	Enabled	Enabled
7-8	SDA	3-4	SCL	0xCC = 1100 110 R/W	Enabled	Enabled
7-8	SDA	7-8	SDA	0xCE = 1100 111 R/W	Enabled	Enabled
1-2	GND	1-2	GND	0xD0 = 1101 000 R/W	Disabled	Disabled
1-2	GND	5-6	V+	0xD2 = 1101 001 R/W	Disabled	Enabled
1-2	GND	3-4	SCL	0xD4 = 1101 010 R/W	Disabled	Enabled
1-2	GND	7-8	SDA	0xD6 = 1101 011 R/W	Disabled	Enabled
5-6	V+	1-2	GND	0xD8 = 1101 100 R/W	Enabled	Disabled
5-6	V+	5-6	V+	0xDA = 1101 101 R/W	Enabled	Enabled
5-6	V+	3-4	SCL	0xDC = 1101 110 R/W	Enabled	Enabled
5-6	V+	7-8	SDA	0xDE = 1101 111 R/W	Enabled	Enabled

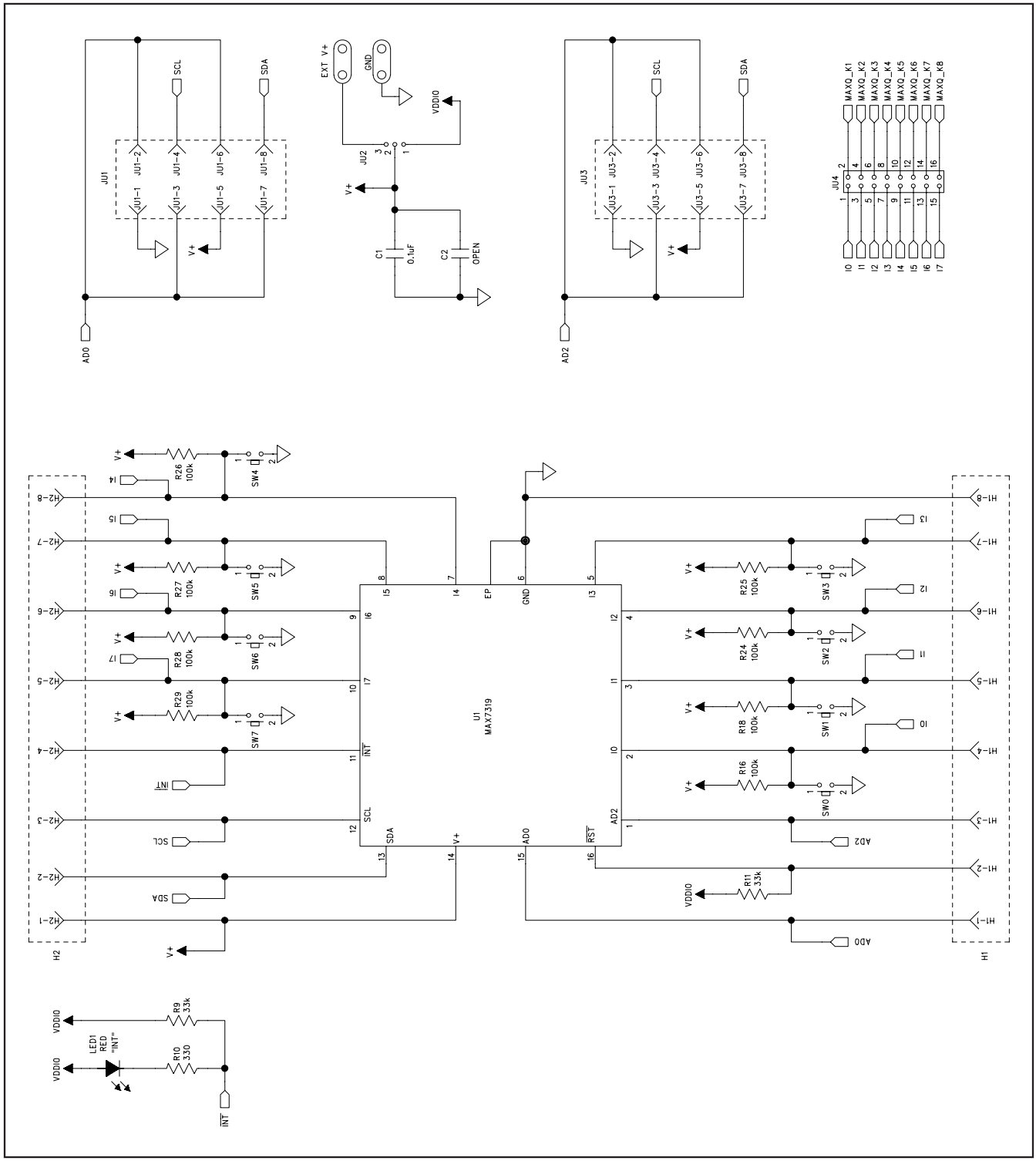

Figure 2a. MAX7319 EV Kit Schematic (Sheet 1 of 2)

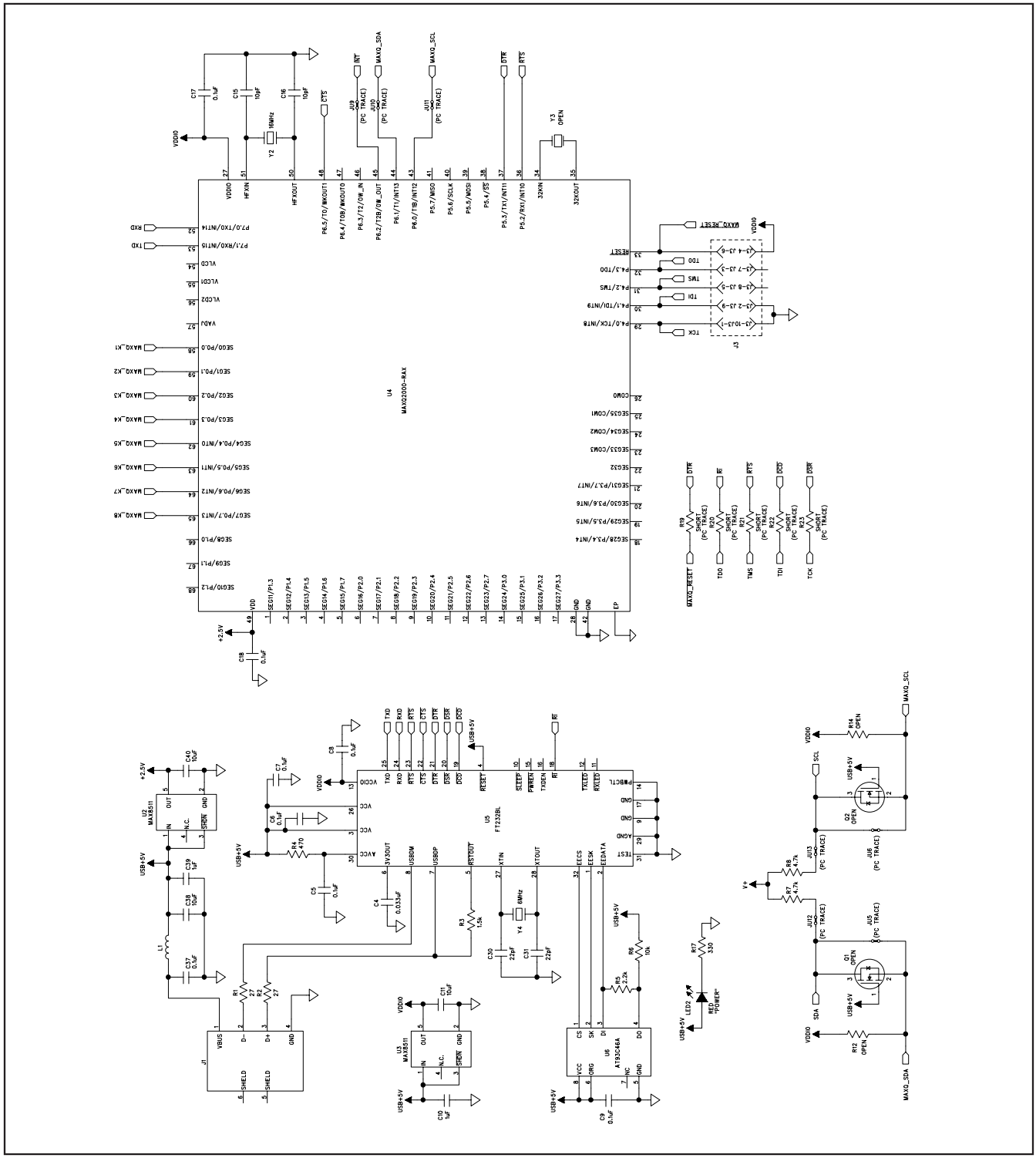

Figure 2b. MAX7319 EV Kit Schematic (Sheet 2 of 2)

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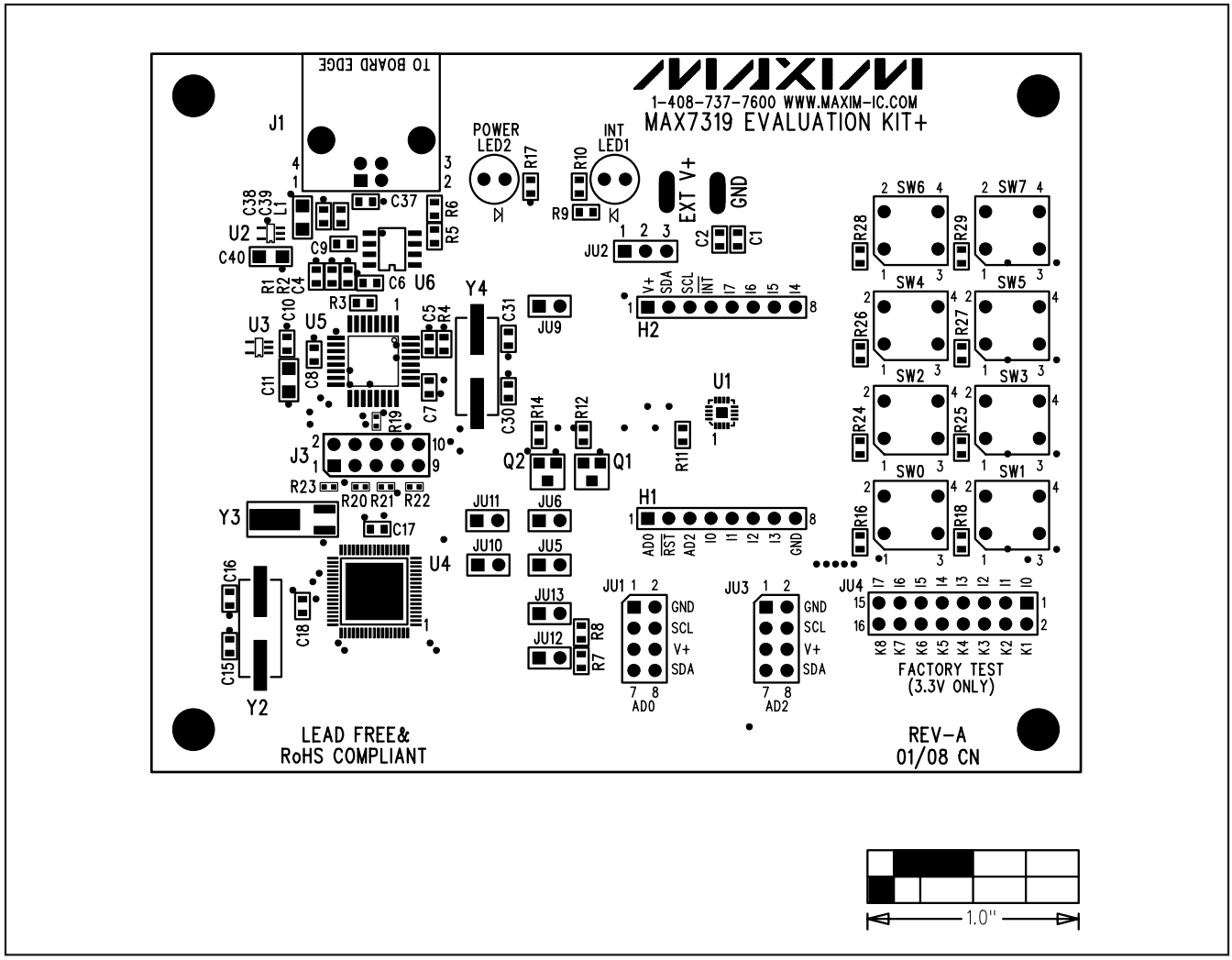

Figure 3. MAX7319 EV Kit Component Placement Guide—Component Side

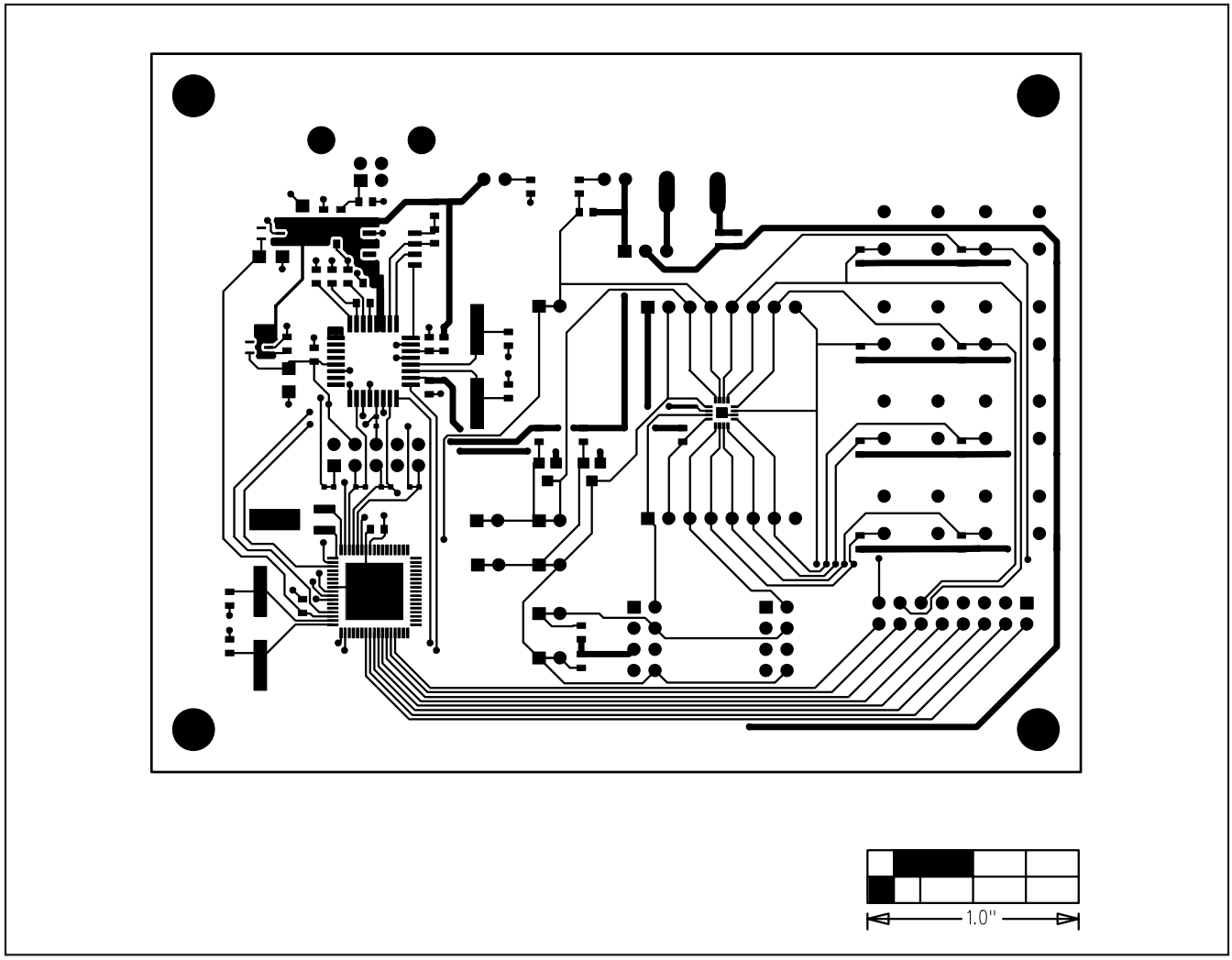

Figure 4. MAX7319 EV Kit PCB Layout—Component Side

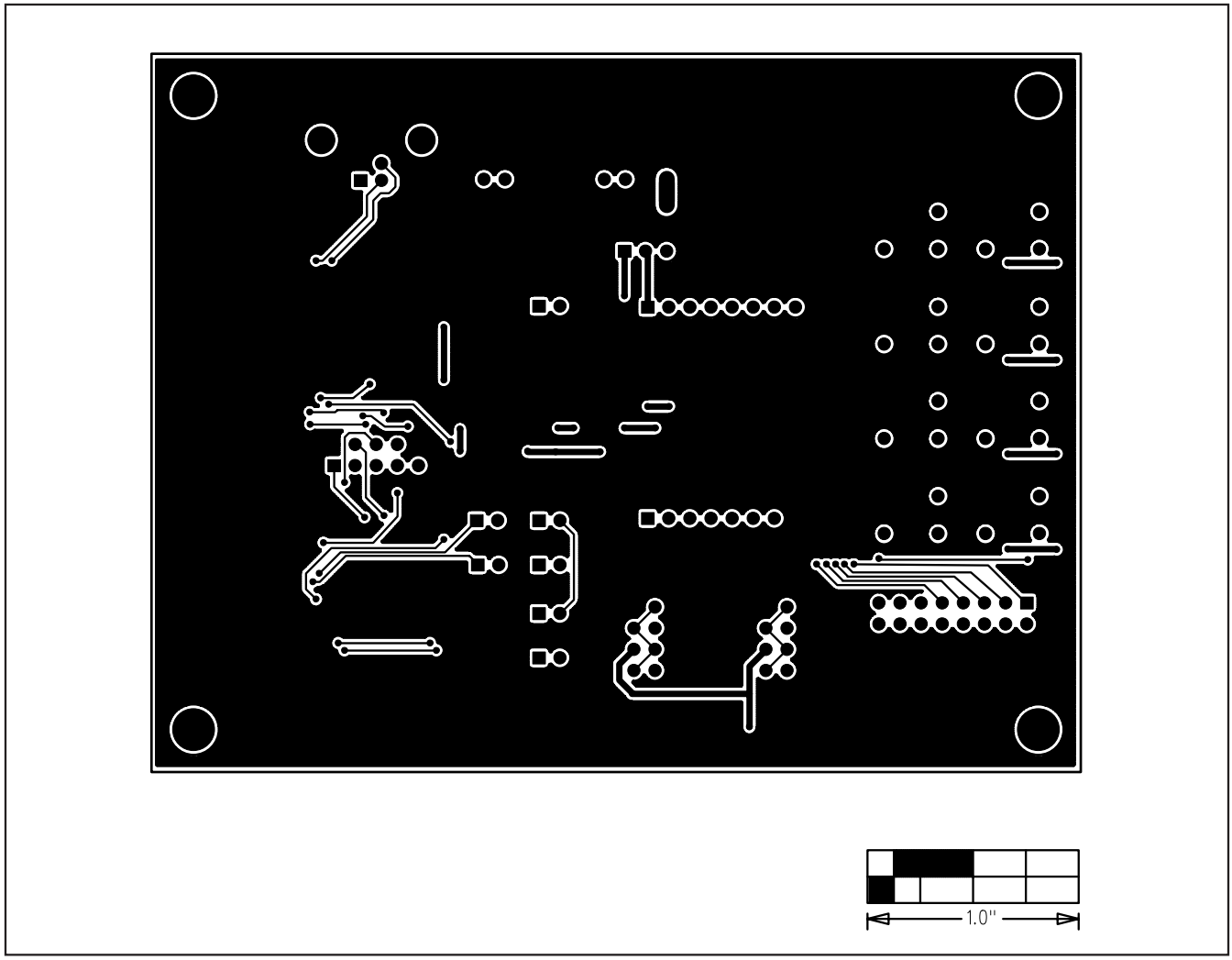

Figure 5. MAX7319 EV Kit PCB Layout—Solder Side