19-4278; Rev 0; 9/08

MAX8819A Evaluation Kit

Evaluates: MAX8819A–MAX8819D

General Description

The MAX8819A evaluation kit (EV kit) is a fully assembled and tested PCB for evaluating the MAX8819A power-management IC (PMIC). The MAX8819A PMIC is ideal for use in MP3 players and other handheld applications. In addition to the three step-down converters and WLED driver, the MAX8819A integrates a 1-cell lithium ion (Li+) or lithium polymer (Li-poly) charger and Smart Power Selector™ with a power input that accepts a USB or AC-to-DC adapter.

The MAX8819A EV kit can also be used to evaluate the MAX8819B, MAX8819C, or MAX8819D. Request a pin-compatible sample when ordering this EV kit.

Figure 1. MAX8819A EV Kit Photo

Smart Power Selector is a trademark of Maxim Integrated Products, Inc.

Features

- ♦ **USB/AC Adapter 1-Cell Li+ Charger**
- ♦ **Jumper Options Offer Four Input Current Limits**
- ♦ **Jumper Options Allow for Easy Evaluation of Five Charge-Current Settings**
- ♦ **Three 2MHz Step-Down Converters**
- ♦ **External Resistors Allow for Output-Voltage Adjustment**
- ♦ **Resistor Option Allows for Reducing Quiescent Current by Disabling Regulator 2**
- ♦ **6-Series WLEDs Showcase WLED Driver**
- ♦ **Jumper Option Allows for WLED Overvoltage Protection Evaluation**
- ♦ **On-Board Pulse Generator Allows for Pushbutton Evaluation of the WLED Dimming Feature**
- ♦ **Lead-Free and RoHS Compliant**
- ♦ **Fully Assembled and Tested**

Ordering Information

PART	TYPE
MAX8819AEVKIT+	EV Kit

+Denotes lead-free and RoHS compliant.

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	4.7µF ±10%, 10V X5R ceramic capacitor (0805) Murata GRM21BR61A475K TDK C2012X5R1A475K Taiyo Yuden LMK212BJ475MG
C2	0	Not installed, capacitor (0603)
C3	1	0.1µF ±10%, 50V X7R ceramic capacitor (0603) TDK C1608X7R1H104K
C4, C14	2	0.022µF ±10%, 10V X5R ceramic capacitors (0402) Murata GRM155R61A223K or TDK C1005X5R1E223K
C5, C8, C10, C11	4	10µF ±10%, 6.3V X5R ceramic capacitors (0805) Murata GRM21BR61A106K TDK C2012X5R0J106M
C6, C7	2	4.7µF ±10%, 6.3V X5R ceramic capacitors (0603) Murata GRM188R61A475K TDK C1608X5R0J475M

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.

MAX8819A Evaluation Kit

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
C9	1	2.2µF ±10%, 6.3V X5R ceramic capacitor TDK C1608X5R0J225K
C12, C13, C15	3	0.1µF ±10%, 10V X5R ceramic capacitors (0402) TDK C1005X5R1A104K or equivalent Murata GRM155R61A104K
C16, C17	2	1µF ±10%, 10V X5R ceramic capacitors (0603) Murata GRM188R61C105K TDK C1608X5R1C105K Taiyo Yuden EMK107BJ105KA
D1–D6	6	White LEDs Nichia NSCW215T
D7	1	500mA, 30V Schottky diode (SOD-523) NXP PMEG3005EB
J1	1	10-pin header, 1.25mm pitch, right-angle, surface-mount, lead-free Molex 53261-1071
JU1, JU2, JU10	3	3-pin headers, 0.1in Sullins PEC36SAAN or equivalent (36-pin strip, cut to size as needed)
JU3–JU9	7	2-pin headers, 0.1in Sullins PEC36SAAN or equivalent (36-pin strip, cut to size as needed)
L1, L2, L3	3	4.7µH, 0.88A, 130mΩ inductors (3.2mm x 3mm x 1.2mm) TOKO 1098AS-4R7M (DE2812C series)
L4	1	10µH, 0.77A, 290mΩ inductor (3.2mm x 3mm x 1.2mm) TOKO 1098AS-4R7M (DE2812C series)
R1	1	20Ω ±1% resistor (0402)
R2, R3, R5	3	15kΩ ±1% resistors (0402)
R4	1	7.5kΩ ±1% resistor (0402)
R6, R10	2	470kΩ ±1% resistors (0402)
R7, R11	0	Not installed, resistors (0402)
R8	1	200kΩ ±1% resistor (0402)
R9, R13, R15, R17	4	100kΩ ±1% resistors (0402)
R12	1	80.6kΩ ±1% resistor (0402)
R14	1	20kΩ ±1% resistor (0402)
R18, R19	2	10kΩ ±1% resistors (0402)
R20	1	221kΩ ±1% resistor (0402)
R21, R22	2	1MΩ ±5% resistors (0402)
S1	1	Momentary pushbutton switch Panasonic EVQ-Q2K03W
U1	1	Power-management IC (28 TQFN-EP*) Maxim MAX8819AETI+
U2	1	74HC series monostable multivibrator Texas Instruments CD74HC123PW or equivalent
U3	1	LDO linear regulator (5 SOT23) Maxim MAX8875EUK25+
—	1	PCB: MAX8819A Evaluation Kit+

**EP = Exposed pad.*

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Molex	800-768-6539	www.molex.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com
Nichia Corp.	248-352-6575	www.nichia.com
NXP Semiconductors	408-474-8142	www.nxp.com
Panasonic Corp.	800-344-2112	www.panasonic.com
Sullins Electronics Corp.	760-744-0125	www.sullinselectronics.com
Taiyo Yuden	800-348-2496	www.t-yuden.com
TDK Corp.	847-803-6100	www.component.tdk.com
Texas Instruments Inc.	972-644-5580	www.ti.com
TOKO America, Inc.	847-297-0070	www.tokoam.com

Note: *Indicate that you are using the MAX8819A, MAX8819B, MAX8819C, or MAX8819D when contacting these component suppliers.*

Quick Start

Recommended Equipment

Before beginning, the following equipment is needed:

- Battery
  1-cell Li+ or Li-poly battery (Figure 2A)
  Preloaded power supply (Figure 2B)
- Voltmeter
- Loads
- 5V > 1A power source

Procedure

The MAX8819A EV kit is fully assembled and tested. Follow the steps below to verify board operation:

1) Verify that all jumpers are in default position, as shown in Table 1.
2) Connect loads from the desired step-down outputs (V1, V2, and V3) to the nearest GND pad. The maximum load current for each output is shown in Table 2.
3) Connect a Li+ or Li-poly battery from the BAT terminal to GND, or plug battery into connector J1.

Table 1. Jumper Functions

JUMPER	NODE OR FUNCTION	SHUNT POSITION	LOGIC LEVEL	FUNCTION
JU1	DLIM2	1-2	High	If DLIM1 = high, then suspend If DLIM1 = low, then 475mA DC current limit
		2-3*	Low	If DLIM1 = high, then 95mA DC current limit If DLIM1 = low, then 1000mA DC current limit
JU2	DLIM1	1-2	High	If DLIM2 = high, then suspend If DLIM2 = low, then 95mA DC current limit
		2-3*	Low	If DLIM2 = high, then 475mA DC current limit If DLIM2 = low, then 1000mA DC current limit
JU3	CEN	Open*	—	Battery charge disabled
		Short	—	Battery charge enabled
JU4	EN123	Open	—	V1, V2, V3, and IC off, if VDC is invalid; otherwise V1, V2, V3, and IC are on.
		Short*	—	V1, V2, V3, and IC on
JU5	OVP4 (OUT4)	Open	—	LED string disconnected from REG4. If REG4 is enabled, it enters its overvoltage protection mode and latches off.
		Short*	—	LED string connected to REG4 output
JU6	CISET	Short*	—	For evaluating other charge currents, see the *Evaluating Other Charge Currents* section and Table 3.
JU7	CISET	Short*	—	
JU8	CISET	Short*	—	
JU9	EN4	Open	—	Disconnects the pulse circuit from EN4
		Short*	—	Connects the pulse circuit to EN4
JU10	IN supply for U3 (MAX8875)	1-2*	High	Enable the series pulse circuit
		2-3	Low	Disable the series pulse circuit

**Default position.*

Table 2. Default Output Voltages and Maximum Load Currents

OUTPUT	MAX8819A/MAX8819B		MAX8819C/MAX8819D	
	DEFAULT VOLTAGE (V)	MAXIMUM LOAD CURRENT (mA)	DEFAULT VOLTAGE (V)	MAXIMUM LOAD CURRENT (mA)
V1	3	400	3	550
V2	1.8	300	1.8	500
V3	1.2	300	1.2	500

4) Optionally, connect an AC-to-DC adapter to the DC pad and nearest GND pad.
5) Using a voltmeter, verify that the output voltages match the values shown in Table 2.
6) Verify that the WLEDs are brightly lit.
7) Dim the WLEDs by repeatedly pressing pushbutton S1. Verify that the WLEDs are dimming with each pulse and then return to full brightness on the 32nd button press.
8) Verify that the WLEDs turn off by removing the shunt on jumper JU9 or by moving the shunt from pins 1-2 of jumper JU10 to pins 2-3.

Detailed Description of Hardware

The MAX8819A has four outputs: three step-down DC-DC regulators (V1, V2, and V3) and one LED driver. All three step-down regulator output voltages are adjustable and set by external resistors on the EV kit. See the *Setting the Output Voltages* section for information on calculating these resistor values. The default voltage and maximum current for each output is listed in Table 2.

All regulators are powered from the system supply (SYS) by default.

Setting the Output Voltages

The step-down output voltages are adjustable from 1V to V_{SYS}. The voltage is adjusted by changing two resistors on the EV kit board. First, select the lower feedback resistor (R_{FBL}) connected from FB_ to GND. R_{FBL} is typically 100kΩ for the step-down regulator. Next, find the value of R_{FBH} (connected between FB_ and OUT_) from the following equation:

$$R_{FBH} = R_{FBL} \times \left(\frac{V_{OUT}}{V_{FB}} - 1 \right)$$

where V_{FB} is 1V.

Smart Power Selector

The MAX8819A Smart Power Selector seamlessly distributes power between the current-limited external input (DC), the battery (BAT), and the system load (SYS). For detailed information on the MAX8819A operation, refer to the MAX8819A–MAX8819D IC data sheet.

The DC input is current limited to 95mA, 475mA, 0mA (suspend), or 1000mA, depending upon the pins selected on jumper JU2 and JU1 (DILIM1 and DILIM2, respectively). See Table 1 for jumper settings.

Battery Charger

To enable the battery charger, short jumper JU3 (CEN). To disable the battery charger, open jumper JU3 (CEN). The battery regulation voltage is factory set to 4.2V (typ). The resistor/jumper network allows for easy evaluation of many charge-current settings (Table 3). The maximum charge time is factory set and detailed in the MAX8819A–MAX8819D IC data sheet.

Input Power Connections

Either a USB or AC-to-DC adapter can be connected to DC. The AC-to-DC adapter must output between 4.1V and 6V DC and be capable of providing 1A. One suitable AC-to-DC adapter is the CUI EPS050260UHH-P5P-SZ.

The Li+ or Li-poly battery connects from the BAT pad to the GND pad on the EV kit. Alternatively, a battery connector (J1) is provided. J1 is a 10-circuit, 1.25mm (0.049in) pitch surface-mount header, Molex part number 53261-1071. The recommended mating connector is Molex 51021-1000 with crimp terminals 50058-8100. To crimp the terminals, use Molex crimper 63811-0200.

$\overline{CHG}$ and $\overline{RST1}$

Output indicators are provided on the MAX8819A EV kit for charger status ($\overline{CHG}$) and REG1 converter reset output ($\overline{RST1}$). These pads connect to open-drain outputs with a pullup resistor to V1. $\overline{CHG}$ pulls low to indicate that the battery is charging. $\overline{RST1}$ pulls low to indicate that V_{FB1} is below its regulation threshold. $\overline{RST1}$ goes high 200ms after V_{FB1} reaches its regulation threshold. Refer to the MAX8819A–MAX8819D IC data sheet for more details.

LED Serial-Pulse Dimming

Pushbutton S1 and associated circuitry (Figure 4) allow for easy evaluation of the WLED dimming feature. To enable the pushbutton interface, install a shunt from pins 1-2 on jumper JU10. Install a shunt on jumper JU9 to connect the pushbutton circuit to the MAX8819A IC EN4 terminal.

When power is first applied to the REG4 (WLED driver) converter and serial-pulse dimming circuit, the WLEDs are set to maximum brightness (25mA per R1 on the EV kit). To dim the WLEDs, repeatedly press S1. Each pulse reduces the WLED current by 1/32 of maximum WLED current. On the 32nd button press, the WLEDs return to full brightness. To turn the WLEDs off, remove the shunt from jumper JU9 to pull EN4 to ground. If dimming control is not required, EN4 works as a simple on/off control. Drive EN4 high to enable the WLEDs, or drive EN4 low for shutdown.

The serial-pulse dimming-control signal can also be supplied by an external pulse generator. To configure the EV kit for external serial-pulse control, remove the shunt on jumper JU9, connect pins 2-3 on jumper JU10, and apply the external serial-pulse control signal to the EN4 pad. Refer to the MAX8819A–MAX8819D IC data sheet for timing information.

Programming the WLED Current

The MAX8819A uses sense resistor R1 to program the maximum WLED current. The MAX8819A regulates V_{FB4} to 0.5V (typ) for full-scale output current. Calculate R1 using the following equation:

$$R1 = \frac{V_{FB4}}{I_{LED(MAX)}}$$

where $I_{LED(MAX)}$ is the maximum WLED current. Maximum WLED current is programmed to 25mA using a 20Ω resistor.

Evaluating the MAX8819B/MAX8819C/MAX8819D

Order a sample of the pin-compatible MAX8819B, MAX8819C, or MAX8819D along with the MAX8819A EV kit. Replace the MAX8819A (U1) with the sampled IC. When evaluating the MAX8819C/MAX8819D, it is recommended for optimal performance to replace capacitors C8, C10, and C11 with a 22µF ceramic capacitor. The 22µF ±20%, 6.3V X5R (0805) Taiyo Yuden JMK212BJ226MD is recommended.

Evaluating Other Charge Currents

The maximum fast-charge current is selected with jumpers JU6, JU7, and JU8 (Table 3).

Disabling Regulator 2

If regulator 2 is not needed, disable it to reduce the quiescent current. To disable regulator 2, remove R11 and replace C9 with a 0Ω resistor. Although components L2, C10, R12, and R13 are not needed, they do not have to be removed for EV kit evaluation. For production circuits that do not need regulator 2, connect PV2, PG2, LX2, and FB2 to ground.

MAX8819A EV Kit Temperature Range

The PCB and components of the MAX8819A EV kit allow for operation with ambient temperatures from -20°C to +70°C. Remove S1 to increase the ambient temperature operating range from -30°C to +85°C.

Table 3. Maximum Fast-Charge Current Settings

JU6	JU7	JU8	MAXIMUM FAST-CHARGE CURRENT (mA)
Short	Short	Short	1000
Short	Short	Open	800
Short	Open	Open	400
Open	Open	Open	200
ALTERNATE SETTINGS			
Open	Open	Short	400
Open	Short	Open	600
Open	Short	Short	800
Short	Open	Short	600

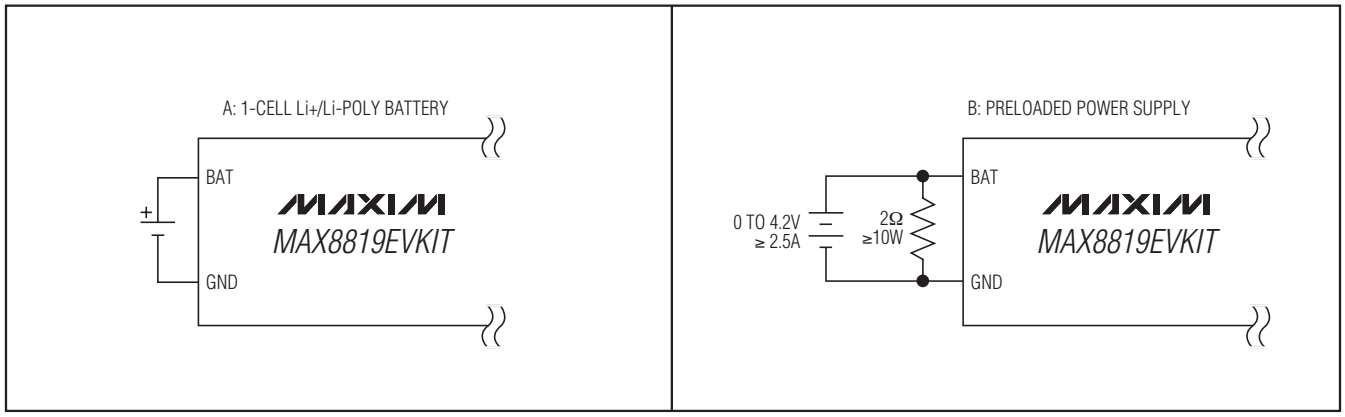

Figure 2. Battery Options for Evaluating the MAX8819 Charger

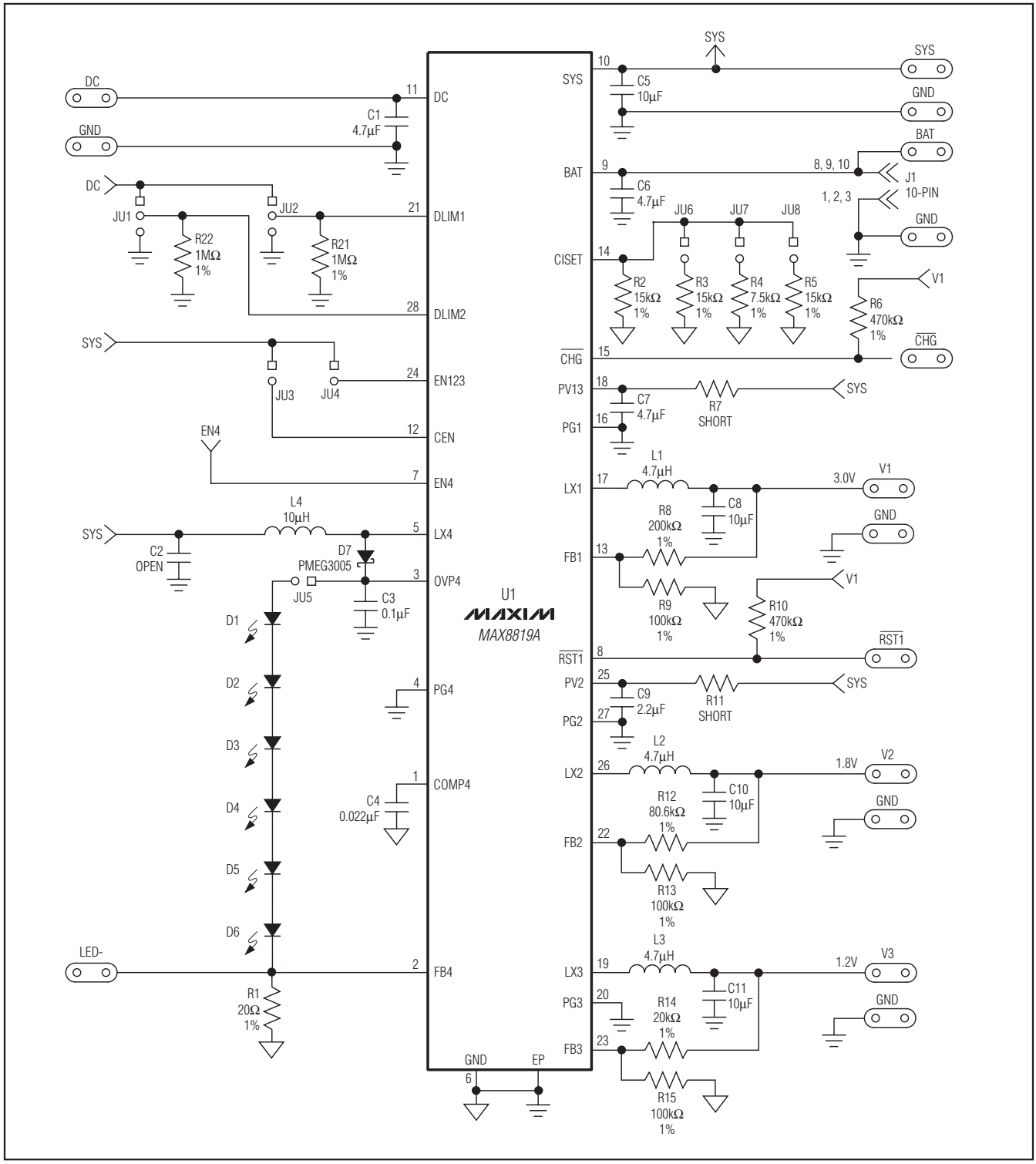

Figure 3. MAX8819A EV Kit Schematic

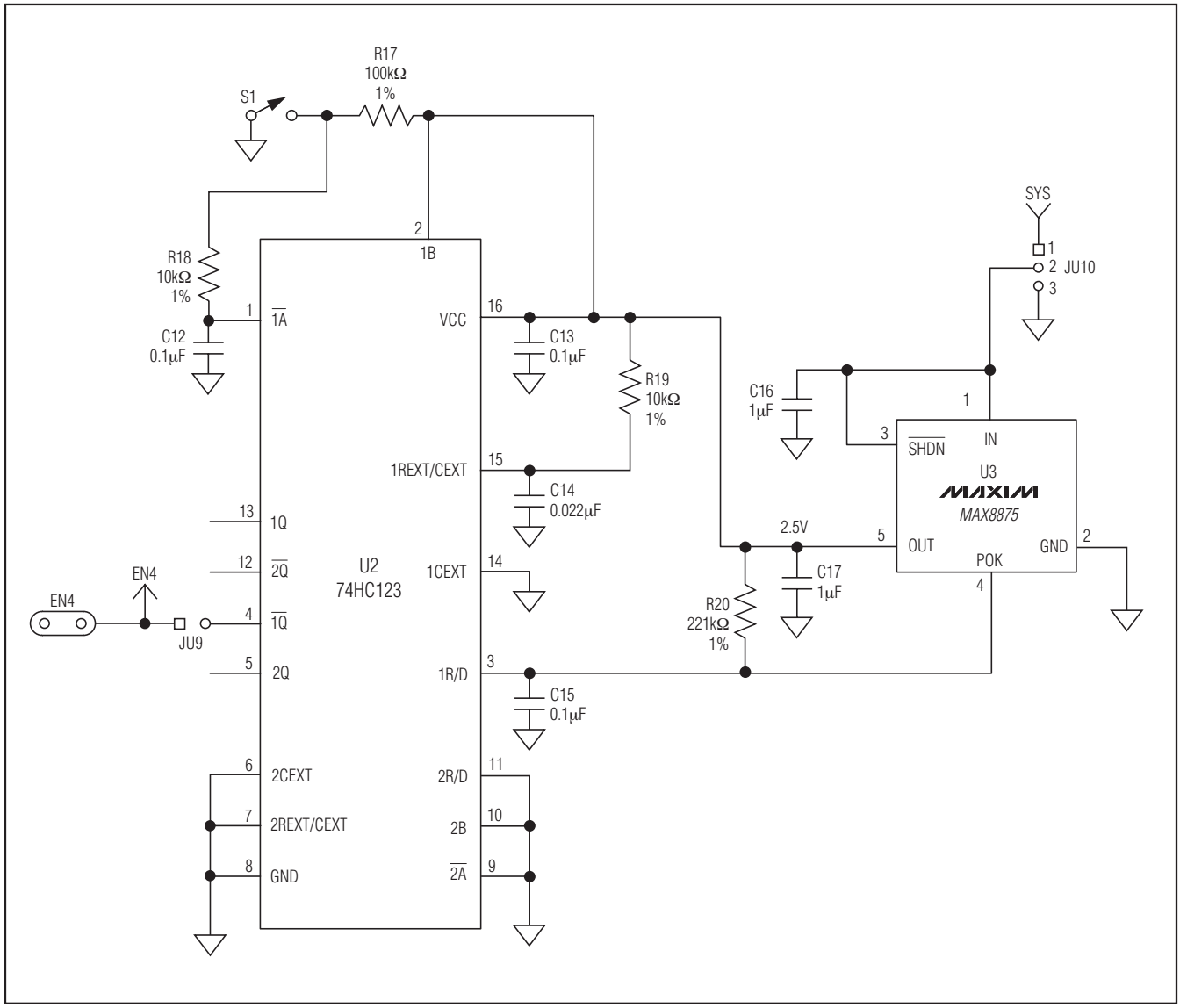

Figure 4. Pulse Circuit Schematic

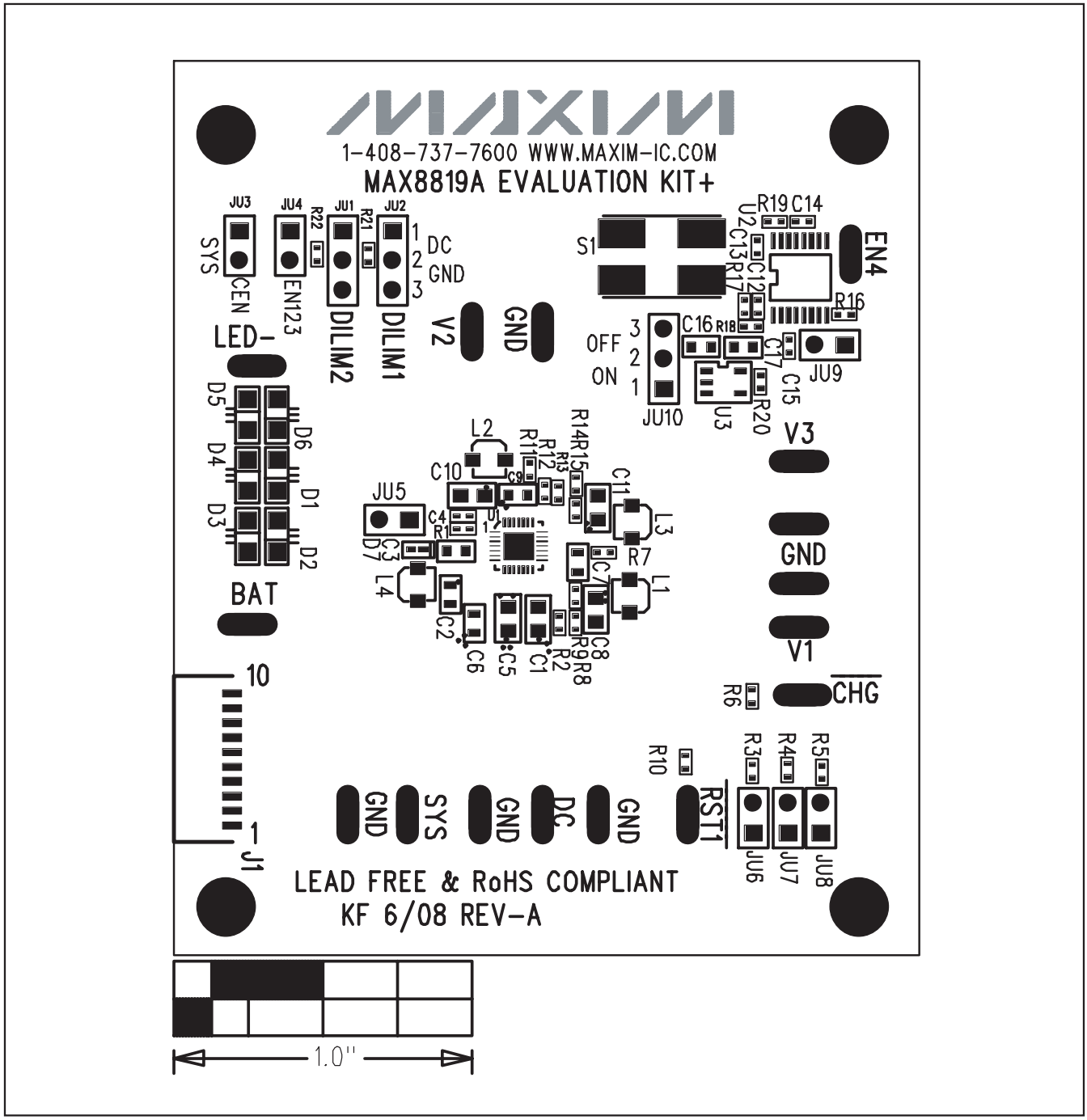

Figure 5. MAX8819A EV Kit Component Placement Guide—Component Side

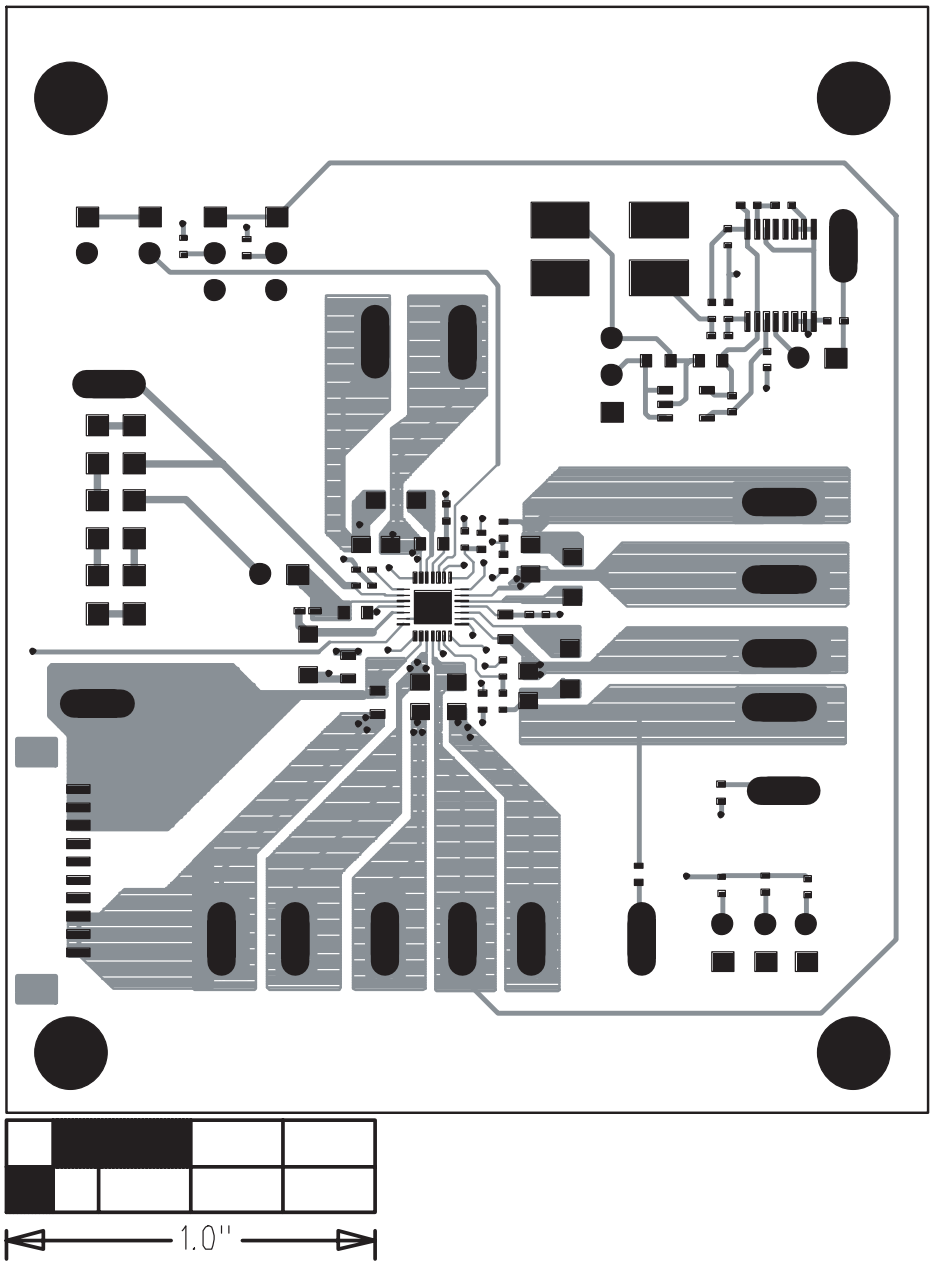

Figure 6. MAX8819A EV Kit PCB Layout—Component Side

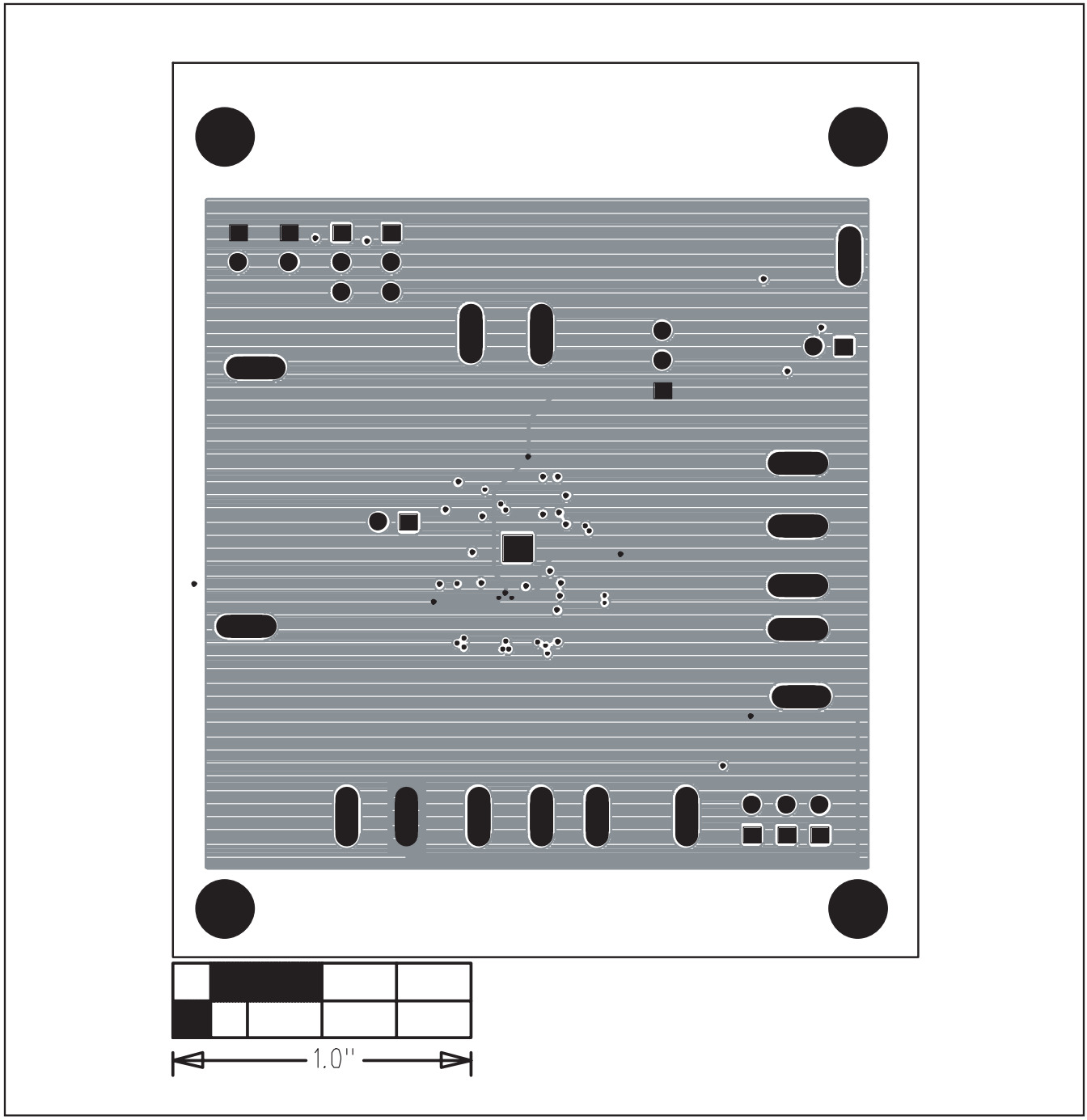

Figure 7. MAX8819A EV Kit PCB Layout—SYS Layer 2

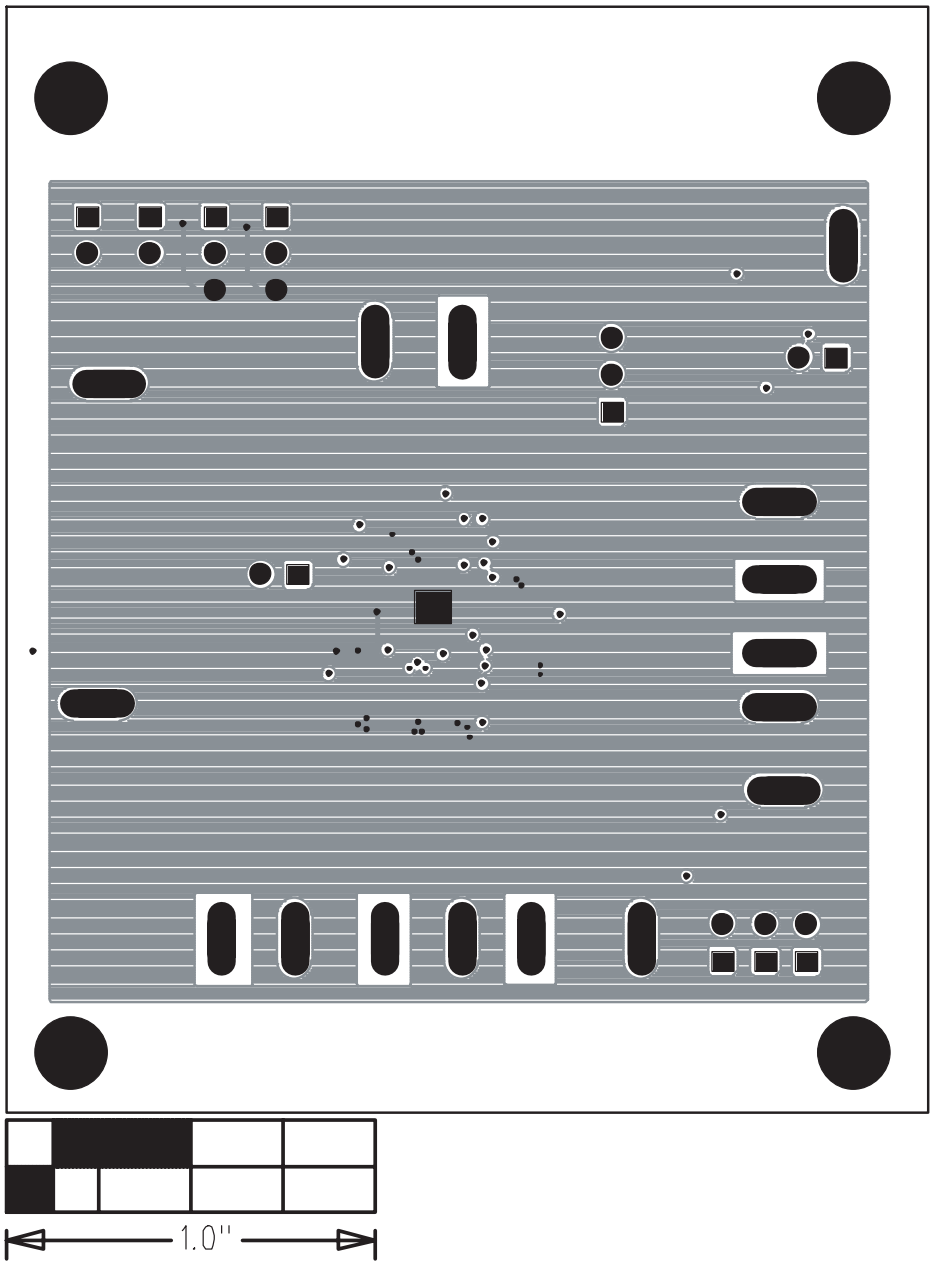

Figure 8. MAX8819A EV Kit PCB Layout—PGND Layer 3

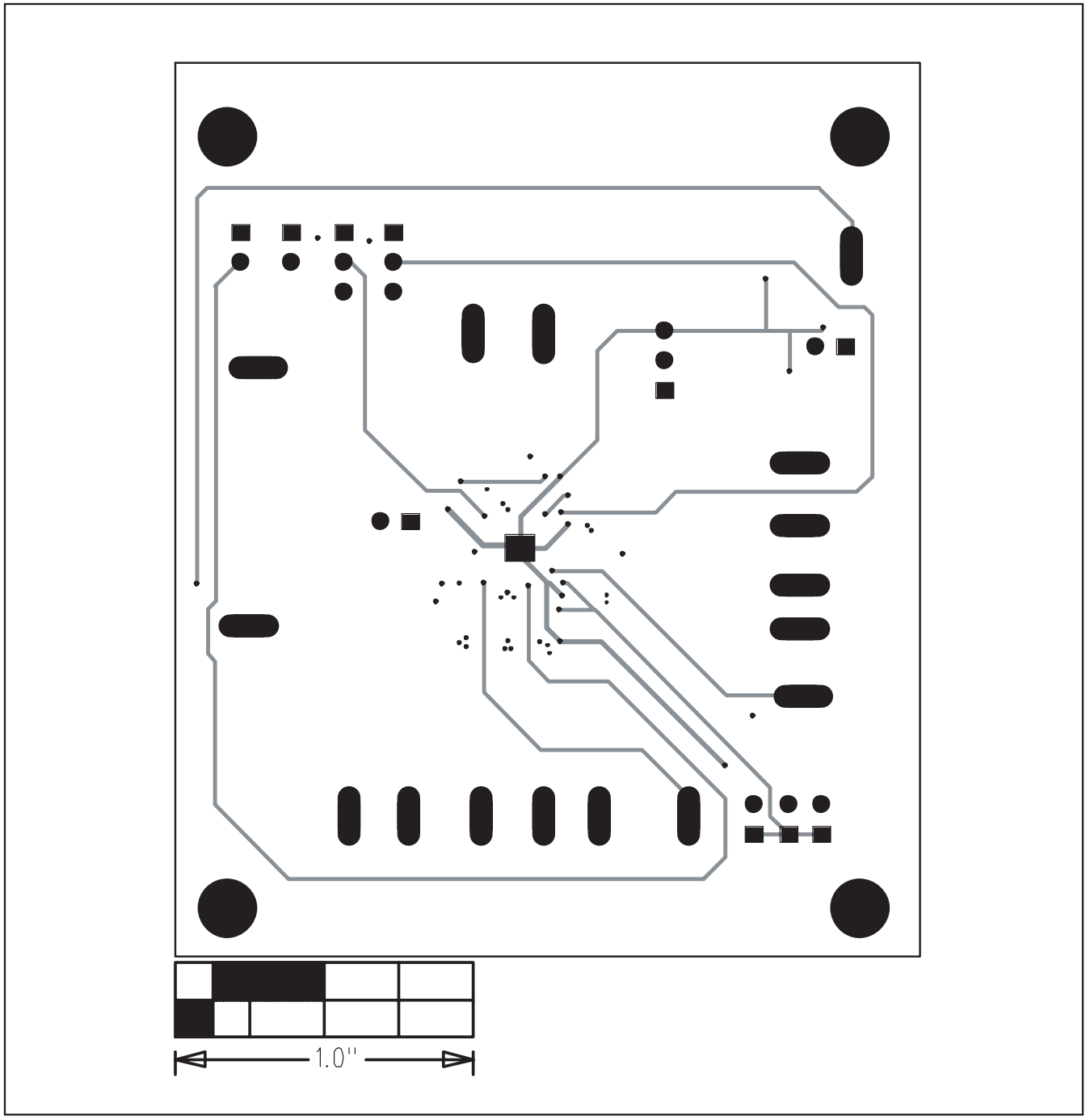

Figure 9. MAX8819A EV Kit PCB Layout—Solder Side

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