19-6277; Rev 0; 4/12

MAX4936A Evaluation Kit
Evaluates: MAX4936A/MAX4937A

General Description

The MAX4936A evaluation kit (EV kit) provides a proven design to evaluate the MAX4936A high-voltage transmit/receive (T/R) switch used in ultrasound applications.

The EV kit provides SMA connectors for interfacing to the application circuit transmitters and receivers' outputs and inputs, respectively. Test points are provided for monitoring the channels' transmit/receive signals. The EV kit circuit also provides various PCB pads for configuring the load at the transmitters' outputs and receivers' inputs.

The EV kit comes with the MAX4936ACTO+ installed, but can also be used to evaluate the MAX4937A with IC replacement of U1.

Warning: The EV kit is designed to operate with high voltages. Dangerous voltages are present on this EV kit and on equipment connected to it. Users who power up this EV kit or the power sources connected to it must be careful to follow safety procedures appropriately to work with high-voltage electrical equipment.

Features

- **SMA Connectors for Transmitter/Receiver Signals**
- **Test Points for Monitoring Transmitter/Receiver Signals**
- **Independent Enable Control for Two Banks of Four Channels**
- **RoHS Compliant**
- **Proven PCB Layout**
- **Fully Assembled and Tested**

***Ordering Information* appears at end of data sheet.**

Component List

DESIGNATION	QTY	DESCRIPTION
C1–C16	0	Not installed, ceramic capacitors (0603)
C17, C19, C21	3	10µF ±20%, 6.3V X5R ceramic capacitors (0603) Murata GRM188R60J106M
C18, C20, C22	3	1µF ±10%, 16V, X7R ceramic capacitors (0603) Murata GRM188R71C105K
D1–D8	0	Not installed, diodes (3 SOT23)
D9–D16	8	Small-signal diodes (3 SOT23) Fairchild MMBD700
GND	8	Black test points
JU1–JU8	8	2-pin headers
JU9–JU13	5	3-pin headers
L1–L8	0	Not installed, inductors (0805)

DESIGNATION	QTY	DESCRIPTION
R1–R8	0	Not installed, resistors (2512)
R9–R16	0	Not installed, resistors (0603)
SWA1–SWA8, SWB1–SWB8, SWC1–SWC8	24	SMA PC-mount connectors
TP1–TP16	16	Yellow test points
TP17–TP24, VCC, VDD	10	Red test points
U1	1	High-voltage T/R switch (42 TQFN-EP*) Maxim MAX4936ACTO+
VEE	1	White test point
—	13	Shunts
—	1	PCB: MAX4936A EVALUATION KIT

**EP = Exposed pad.*

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Fairchild Semiconductor	888-522-5372	www.fairchildsemi.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com

***Note:** Indicate that you are using the MAX4936A when contacting these component suppliers.*

Quick Start

Required Equipment

- MAX4936A EV kit
- +3.3V, 100mA power supply
- +5V, 100mA power supply
- -5V, 100mA power supply
- Four SMA cables
- 4-channel ±100V pulse generator
- 4-channel oscilloscope

Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation. **Caution: Do not turn on the power supplies until all connections are completed.**

1) Verify that jumpers are in their default positions, as shown in Table 1.
2) Connect the +3.3V power-supply positive and negative terminals to the VDD and GND test points, respectively.
3) Connect the +5V power-supply positive and negative terminals to the VCC and GND test points, respectively.
4) Connect the -5V power-supply ground and negative terminals to the GND and VEE test points, respectively.
5) Connect the oscilloscope channel 1 to test point TP1. Connect the oscilloscope ground to the GND test point.
6) Connect the oscilloscope channel 2 to test point TP2. Connect the oscilloscope ground to the GND test point.
7) Connect the oscilloscope channel 3 to test point TP3. Connect the oscilloscope ground to the GND test point.
8) Connect the oscilloscope channel 4 to test point TP4. Connect the oscilloscope ground to the GND test point.
9) Configure the pulse generator's four outputs to the following settings:
   - Set the signal period to approx 20ns with a 50% duty cycle.
   - Set the number of cycles at three. Set the bar repetition frequency at 5kHz.
   - Set the pulse amplitude to ±100V.
10) Disable the pulse-generator outputs.
11) Using the SMA cables, connect the pulse-generator outputs to the EV kit board's SWC1–SWC4 SMA connectors.
12) Turn on the power supplies.
13) Place shunts across pins 1-2 on jumpers JU9 and JU10.
14) Enable the pulse-generator outputs.
15) Verify the high-voltage signals at the oscilloscope channels 1-4.

Table 1. Jumper Descriptions (JU1–JU13)

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	Installed	SWC1 is connected to GND. Internal diodes are used for clamping.
	Not installed*	SWC1 is open. Diodes can be used as grass-clipping diodes.
JU2	Installed	SWC2 is connected to GND. Internal diodes are used for clamping.
	Not installed*	SWC2 is open. Diodes can be used as grass-clipping diodes.
JU3	Installed	SWC3 is connected to GND. Internal diodes are used for clamping.
	Not installed*	SWC3 is open. Diodes can be used as grass-clipping diodes.
JU4	Installed	SWC4 is connected to GND. Internal diodes are used for clamping.
	Not installed*	SWC4 is open. Diodes can be used as grass-clipping diodes.
JU5	Installed	SWC5 is connected to GND. Internal diodes are used for clamping.
	Not installed*	SWC5 is open. Diodes can be used as grass-clipping diodes.
JU6	Installed	SWC6 is connected to GND. Internal diodes are used for clamping.
	Not installed*	SWC6 is open. Diodes can be used as grass-clipping diodes.
JU7	Installed	SWC7 is connected to GND. Internal diodes are used for clamping.
	Not installed*	SWC7 is open. Diodes can be used as grass-clipping diodes.
JU8	Installed	SWC8 is connected to GND. Internal diodes are used for clamping.
	Not installed*	SWC8 is open. Diodes can be used as grass-clipping diodes.

Table 1. Jumper Descriptions (JU1–JU13) (continued)

JUMPER	SHUNT POSITION	DESCRIPTION
JU9	1-2	Channels I–4 (SW_1–SW_4) enabled.
	2-3*	Channels 1–4 (SW_1–SW_4) disabled.
JU10	1-2	Channels 5–8 (SW_5–SW_8) enabled.
	2-3*	Channels 5–8 (SW_5–SW_8) disabled.
JU11	1-2	See Table 4 for proper JU11, JU12, and JU13 configuration.
	2-3*	
JU12	1-2	
	2-3*	
JU13	1-2	
	2-3*	

**Default position.*

Detailed Description of Hardware

The MAX4936A EV kit evaluates the MAX4936A octal, high-voltage T/R switch used in ultrasound applications. The IC includes the T/R switch, grass-clipping diodes and is able to perform both transmit and receive operations. The IC features low on-impedance in the entire ultrasound frequency range, with an extremely low 15mW (typ) power dissipation per channel. The receive path is low impedance during low-voltage receive and high impedance during high-voltage transmit, providing protection to the receive circuitry. The low-voltage receive path is high bandwidth, low noise, low distortion, and low jitter.

The EV kit circuit passes high-voltage pulses from SMA connectors at the SWC_ pins to corresponding SMA connectors at the SWA_ pins. Extra resistors (R1–R8, 2512 PCB pads) and capacitors (C1–C8, 0603 PCB pads) set the load at the SWA_ outputs.

Low-voltage pulses are passed through from SWA_ pins to the corresponding SMA connectors at the SWB_ pins. The EV kit provides PCB pads for resistors R9–R16, capacitors C9–C16 (0603 PCBs), and inductors L1–L8 (0805 PCB pads) for setting the load at the SWB_ outputs.

The EV kit provides yellow test points TP1–TP16 and black GND test points to monitor high-voltage signals at the transmitter outputs/receiver inputs. Red test points TP17–TP24 and black GND test points are available to monitor the low-voltage signals at the SWB_ terminals.

The IC features control inputs (EN1 and EN2) to enable/disable the channels and digital inputs (S2, S1, and S0) to set the channel diode bias current. The EV kit utilizes jumpers to set these inputs. Jumpers JU9 and JU10 enable/disable channels 1–4 (SW_1–SW_4) and channels 5–8 (SW_5–SW_8), respectively. See the *Enable Inputs (EN1, EN2)* section for additional information.

Jumpers JU11, JU12, and JU13 are used to set the diode bridge bias current. See the *Setting the Diode Bridge Bias Current* section for additional information.

The EV kit can also be used to evaluate the MAX4937A IC. Refer to the *Evaluating the MAX4937A* section for additional information.

Power Supplies

The EV kit requires three power supplies for proper operation. The power supplies provide digital power to the IC's digital input (V_{DD}), and positive and negative supplies for the analog inputs (V_{CC} and V_{EE}), respectively.

The EV kit's digital supply is connected at the red VDD and black GND test points and has a +1.62V to +5.5V input voltage operating range. The EV kit's analog positive supply is connected at the red VCC and black GND test points and has a +2.5V to +5.5V input voltage operating range. The analog negative supply VEE is connected to the white VEE and black GND test points and has a -2.5V to -5.5V input voltage operating range.

Enable Inputs (EN1, EN2)

Jumpers JU9 and JU10 are provided to enable/disable the IC channels. JU9 (EN1) enables/disables channels 1–4 (SW_1–SW_4). Place a shunt across pins 1-2 to enable channels 1–4. Install a shunt across pins 2-3 to disable channels 1–4. JU10 (EN2) enables/disables channels 5–8 (SW_5–SW_8). Place a shunt across pins 1-2 to enable channels 5–8. Install a shunt across pins 2-3 to disable channels 5–8. See Tables 2 and 3 for proper jumper configurations.

To control EN1 and EN2 with external signals, remove the shunts on JU9 and JU10 and apply a control signal and its ground connections at pins 2-3 of each jumper, respectively.

Table 2. EN1 Enable Control (JU9)

SHUNT POSITION	EN1 PIN	CHANNEL 1–4 STATUS
1-2	Connected to VDD	Enabled
2-3*	Connected to GND	Disabled
Not installed	Connected to an external signal controller	Dependent on the voltage level applied at EN1

**Default position.*

Table 3. EN2 Enable Control (JU10)

SHUNT POSITION	EN2 PIN	CHANNEL 5–8 STATUS
1-2	Connected to VDD	Enabled
2-3*	Connected to GND	Disabled
Not installed	Connected to an external signal controller	Dependent on the voltage level applied at EN2

**Default position.*

Table 4. Diode Bridge Current Setting (JU11, JU12, JU13)

SHUNT POSITION			TYPICAL DIODE BRIDGE CURRENT (mA)	
JU11	JU12	JU13	V_{CC} = +3.3V	V_{CC} = +5V
2-3*	2-3*	2-3*	0	0
2-3	2-3	1-2	0.28	0.47
2-3	1-2	2-3	0.56	0.94
2-3	1-2	1-2	0.84	1.41
1-2	2-3	2-3	1.11	1.89
1-2	2-3	1-2	1.39	2.36
1-2	1-2	2-3	1.67	2.83
1-2	1-2	1-2	1.95	3.30

**Default position.*

Anti-Parallel Diodes

The flexible design of the EV kit allows the use of the internal anti-parallel diodes between SWC_ and SWA_, as either grass clippers or as voltage clamps. To use the anti-parallel diodes between SWC_ and SWA_ as grass clippers, leave jumpers JU1–JU8 open and apply a high-voltage signal to SWC_ (see Table 1). In this configuration, connect SWA_ to an appropriate load and SWB_ to a low-noise amplifier (LNA) or another low-voltage receiver. Use PCB pads D9–D16 to connect the external diodes on SWB_.

To use the anti-parallel diodes as clamps, ground the SWC_ terminal by installing shunts on jumpers JU1–JU8 (see Table 1). Drive high-voltage signals through external glass-clipping diodes connected to SWB_, and connect SWA_ to an LNA or another low-voltage receiver.

Setting the Diode Bridge Bias Current

The IC uses a diode bridge topology. On the EV kit, use jumpers JU11, JU12, and JU13 to set the amount of bias current into the diode bridge for enabled channels. See Table 4 for proper jumper settings for adjusting the diode bridge bias current.

Evaluating the MAX4937A

The EV Kit PCB can also be used to evaluate the pin-compatible MAX4937A IC. The MAX4937A includes only the T/R switch for each channel and performs the receive operation only. PCB pads D1–D8 are available for connecting external diodes for grass-clipping when evaluating the MAX4937A.

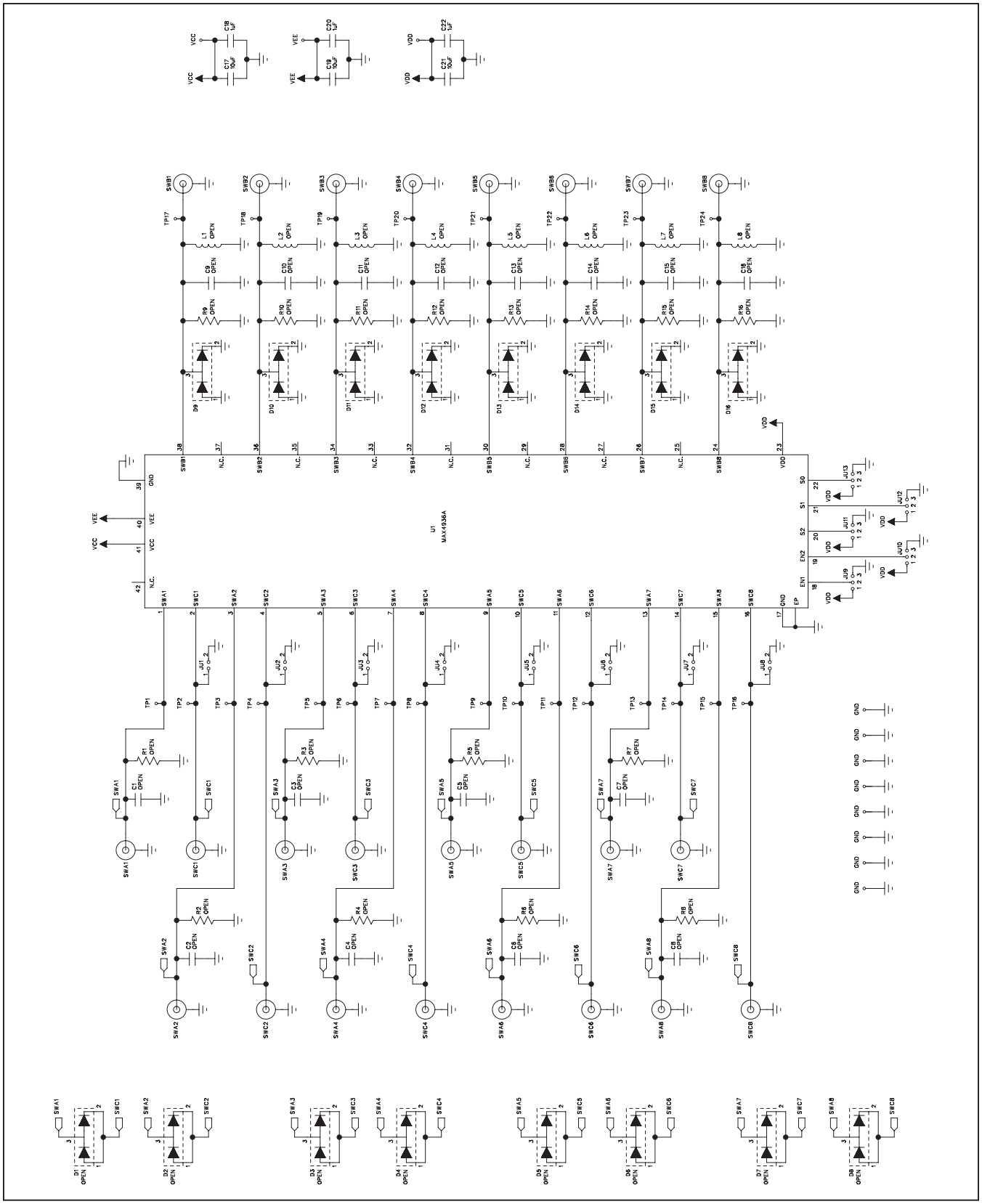

Figure 1. MAX4936A EV Kit Schematic

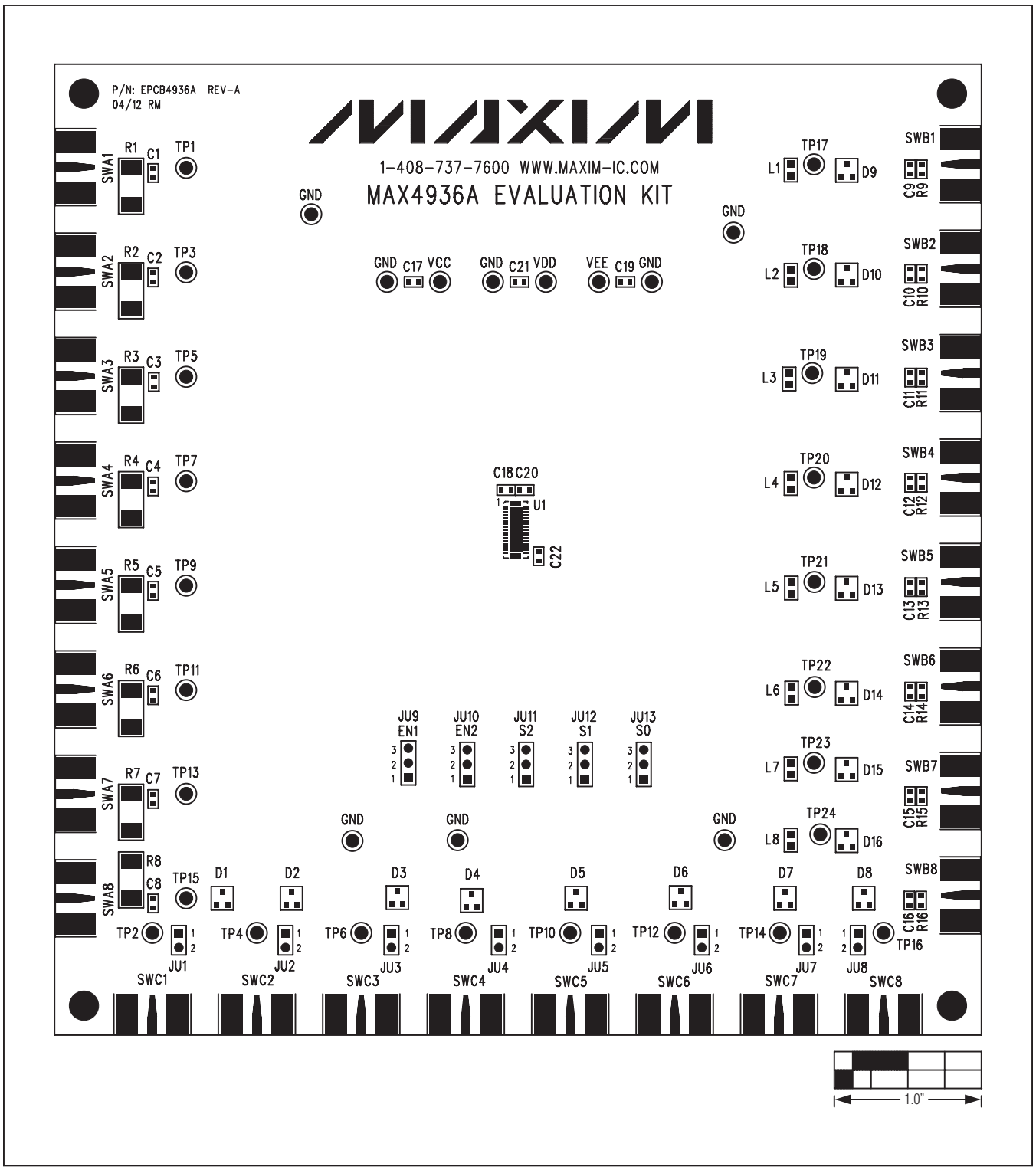

Figure 2. MAX4936A EV Kit Component Placement Guide—Component Side

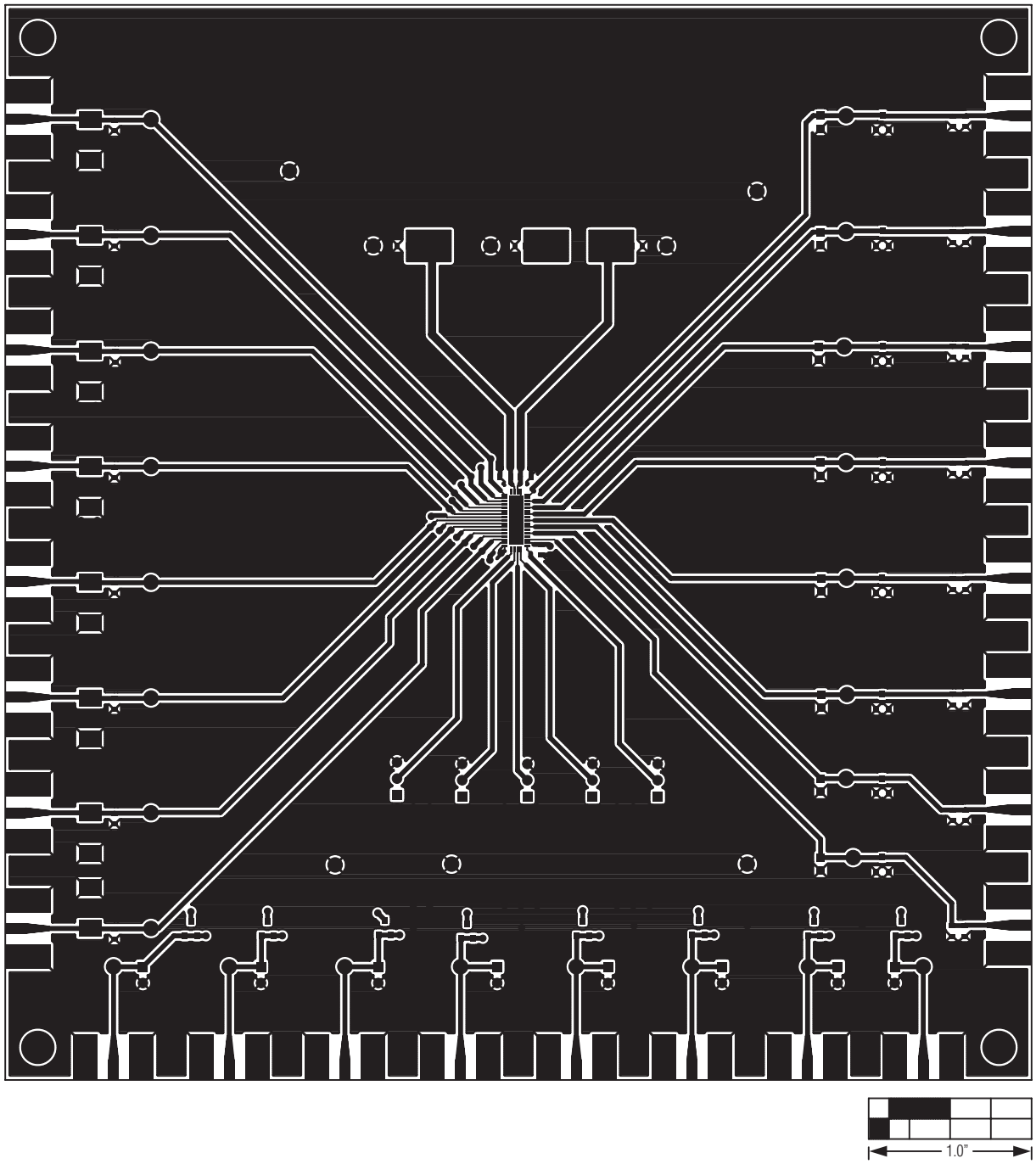

Figure 3. MAX4936A EV Kit PCB Layout—Component Side

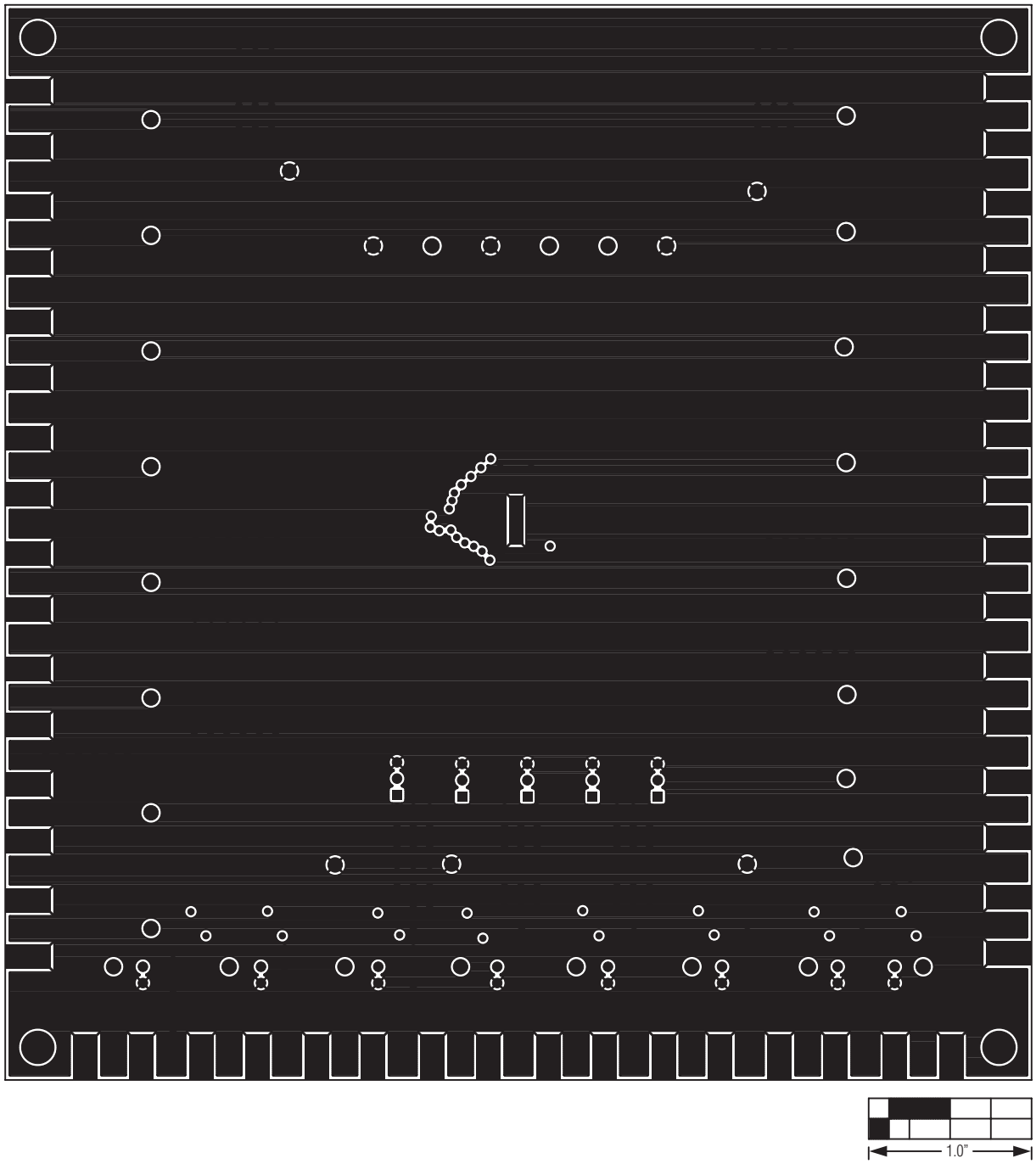

Figure 4. MAX4936A EV Kit PCB Layout—Layer 2 (GND)

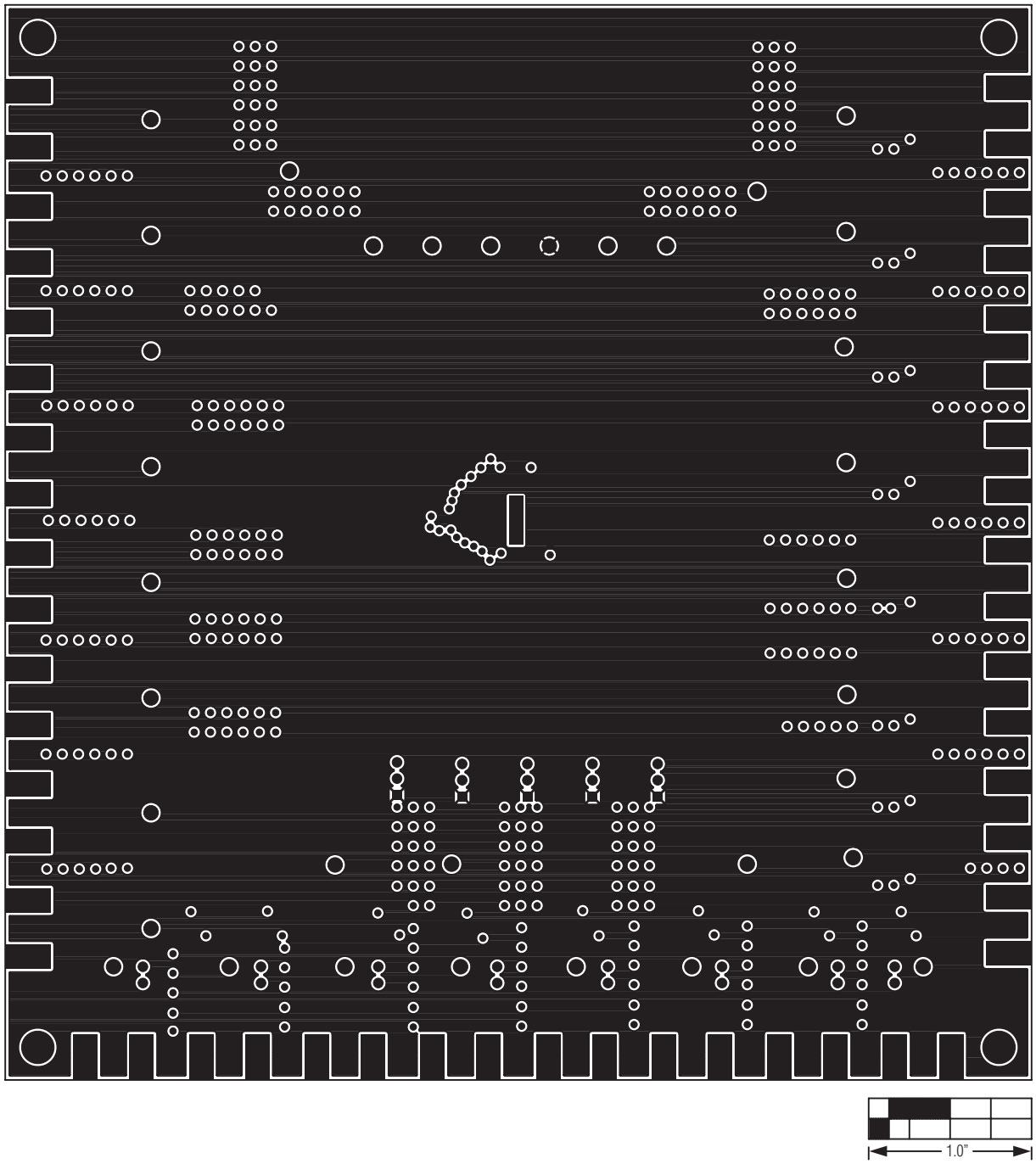

Figure 5. MAX4936A EV Kit PCB Layout—Layer 3 (Power)

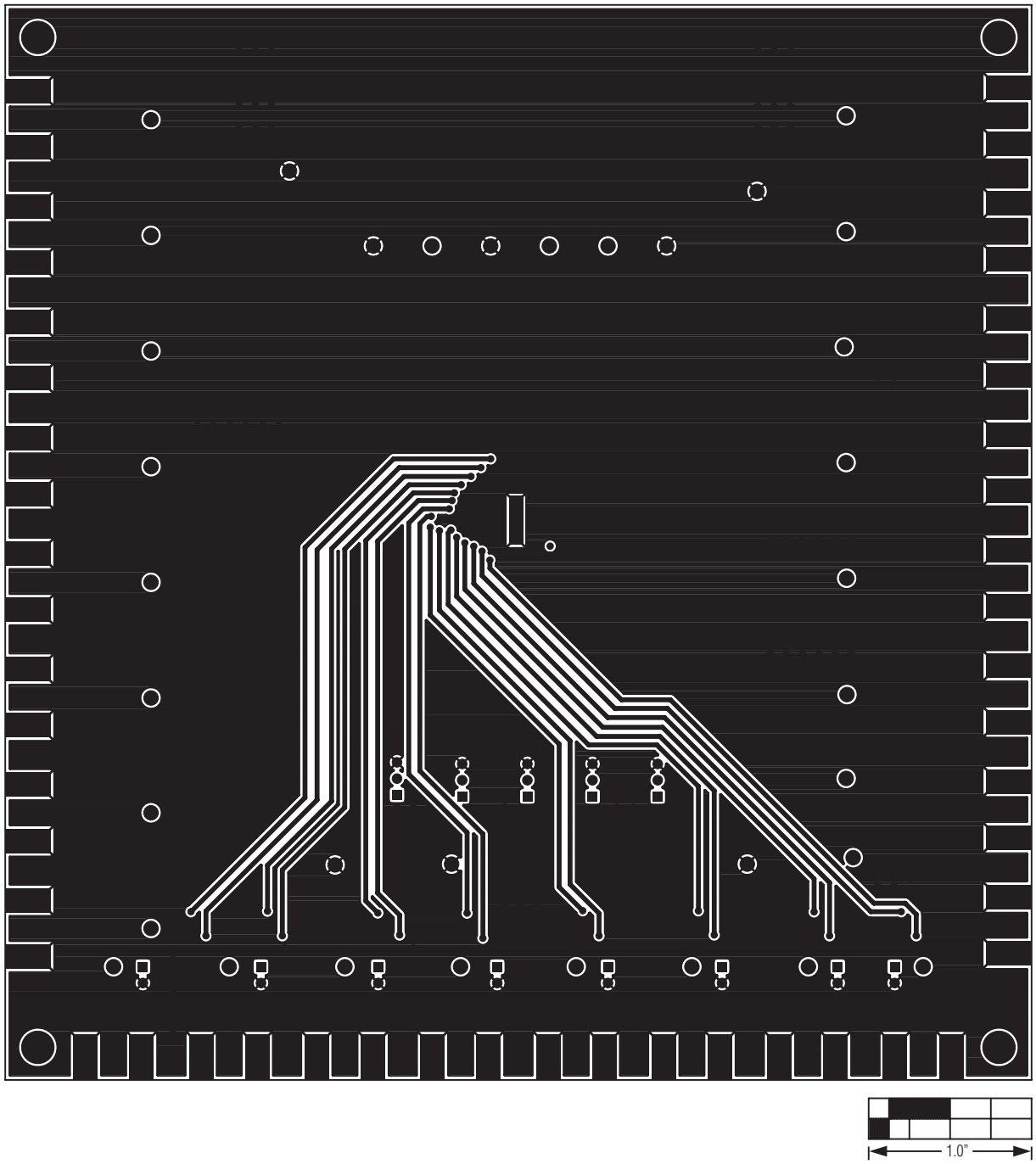

Figure 6. MAX4936A EV Kit PCB Layout—Solder Side

Ordering Information

PART	TYPE
MAX4936AEVKIT#	EV Kit

#Denotes RoHS compliant.

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	4/12	Initial release	—