19-2313; Rev 0; 1/02

MAX9400 Evaluation Kit

General Description

The MAX9400 evaluation kit (EV kit) contains the MAX9400 low-skew quad buffer. The MAX9400 EV kit runs at PECL/ECL and LVPECL/LVECL supplies at clock rates up to 3.0GHz. The EV kit can be operated synchronously with an external clock or asynchronously.

The EV kit is designed with 50Ω controlled-impedance traces in a four-layer PC board. It can also be used to evaluate the MAX9401–MAX9405.

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C2	2	10µF ±10%, 10V tantalum capacitors (case B) AVX TAJB106K010R Kemet T494B106010AS
C3–C11	9	0.1µF ±10%, 16V X7R ceramic chip capacitors (0603) Murata GRM39X7R104K016A or Taiyo Yuden EMK107BJ104KA
C12–C20	9	0.01µF ±10%, 16V X7R ceramic capacitors (0402) Taiyo Yuden EMK105BJ103KW or Murata GRM36X7R103K016AD
IN0–IN3, $\overline{IN0}$–$\overline{IN3}$, OUT0–OUT3, $\overline{OUT0}$–$\overline{OUT3}$, CLK, $\overline{CLK}$	18	SMA edge-mount connectors Johnson Components 142-0701-801
JU1–JU4	4	3-pin jumpers
R1, R2	0	Not installed resistor (0402)
R3–R8	6	49.9Ω ±1% resistors (0402)
R9–R36	28	100Ω ±1%, 1/8W resistors (1206)
U1	1	MAX9400EHJ (32-pin 5mm x 5mm TQFP)
SEL, $\overline{SEL}$, EN, $\overline{EN}$	0	Not installed, SMA edge-mount connectors
None	4	Shunts
None	1	MAX9400 PC board
None	1	MAX9400 EV kit data sheet
None	1	MAX9400 data sheet

Features

- ♦ **Controlled 50Ω Coplanar Traces**
- ♦ **Input Trace Lengths Matched to <2mils**
- ♦ **Output Trace Lengths Matched to <1mil**
- ♦ **Frequency Range**
  - **Up to 3.0GHz (MAX9400/MAX9402/MAX9403/MAX9405)**
  - **Up to 2.0GHz (MAX9401/MAX9405)**
- ♦ **PECL/ECL or LVPECL/LVECL Supply**
- ♦ **32-Pin TQFP Package**
- ♦ **Fully Assembled and Tested**

Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX9400EVKIT	0°C to +70°C	32 TQFP

Note: *To evaluate the MAX9401–MAX9405, request a MAX9401EHJ/MAX9402EHJ/MAX9403EHJ/MAX9404EHJ/MAX9405EHJ free sample with the MAX9400EVKIT.*

Quick Start

The MAX9400 EV kit is fully assembled and tested. **Do not turn on the power supplies until all connections are completed.**

Recommended Equipment

- One 3GHz (min) differential signal generator (e.g., Agilent 8133A)
- One 12GHz (min) bandwidth oscilloscope with internal 50Ω input termination (e.g., Tektronix 11801C digital sampling oscilloscope with SD-24 sampling head)
- Two power supplies:
  - a) One 2.0V with 500mA current capability
  - b) One adjustable -3.5V to -0.375V with 500mA current capability
- Matched male-SMA-to-male-SMA 50Ω coax cables:
  - a) Matched SMA 50Ω coax cables for inputs IN1 and $\overline{IN1}$
  - b) Matched SMA 50Ω coax cables for outputs OUT1 and $\overline{OUT1}$

Component Suppliers

SUPPLIER	PHONE	FAX	WEBSITE
AVX	843-946-0238	843-626-3123	www.avxcorp.com
Kemet	864-963-6300	864-963-6322	www.kemet.com
Murata	770-436-1300	770-436-3030	www.murata.com
Taiyo Yuden	800-348-2496	847-945-0899	www.t-yuden.com

Note: *Please indicate that you are using the MAX9400–MAX9405 when contacting these component suppliers.*

Asynchronous Operation

1) Verify that shunts are across pins 1 and 2 of jumpers JU1 (SEL) and JU3 (EN) and pins 2 and 3 of jumpers JU2 ($\overline{\text{SEL}}$) and JU4 ($\overline{\text{EN}}$).
2) Connect two matched coax cables to the oscilloscope. Then connect the other end of the cables to OUT1 and $\overline{\text{OUT1}}$ on the MAX9400 EV kit board.
3) Connect the 2.0V power supply to the VCC pad. Set the supply to 2.00V. Connect the supply ground to the GND pad closest to VCC.
4) Connect the -0.375V to -3.5V power supply to the VEE pad. Set the supply to -1.3V. Connect the supply ground to the GND closest to VEE.
5) Connect two matched coax cables to the differential signal generator that provides differential square waves with the following setting:
   a) Frequency = 2GHz
   b) V_{IH} = 1.5V
   c) V_{IL} = 1.0V
   d) Duty cycle = 50%
6) Connect the other end of the cables to IN1 and $\overline{\text{IN1}}$.
7) Turn on the two power supplies, enable the function generator, and verify the differential output signal (V_{OUT1} - $V_{\overline{OUT1}}$) is greater than 500mV.

To evaluate other channels, make sure the corresponding output termination resistors on the EV kit board are removed and the unused outputs are terminated.

To eliminate signal distortion, use the matched same-length input cables, and use the matched same-length output cables.

Detailed Description

The MAX9400 EV kit contains an extremely fast, low-skew quad LVECL/LVPECL or ECL/PECL buffer. The EV kit demonstrates ultra-low propagation delay and channel-to-channel skew. The four channels can be operated synchronously with an external clock, or in asynchronous mode, depending on the state of the SEL input.

Power Supply

The MAX9400/MAX9402/MAX9403/MAX9405 are specified with outputs terminated with 50Ω to V_{CC} - 2V. In order to terminate the outputs with 50Ω to V_{CC} - 2V using the 50Ω oscilloscope input termination, V_{CC} is set to 2.0V. The MAX9401/MAX9404 are specified with outputs terminated with 50Ω to V_{CC} - 3.3V, and with double swing outputs. In order to terminate the outputs with 50Ω to V_{CC} - 3.3V, V_{CC} is set to 3.3V. Table 1 lists the supply ranges for V_{CC} and V_{EE}. In an actual application, V_{CC} and V_{EE} can have different supplies (refer to the MAX9400/MAX9402/MAX9403/MAX9405 data sheet or the MAX9401/MAX9404 data sheet).

Enable and Select

EN, $\overline{\text{EN}}$, SEL, and $\overline{\text{SEL}}$ can be controlled by either jumpers or external signals. The MAX9400 EV kit can provide internal DC logic signals to EN, $\overline{\text{EN}}$, SEL, and $\overline{\text{SEL}}$ by using jumpers JU1, JU2, JU3, and JU4. Table 2 lists jumper JU3 and jumper JU4 functions. Table 3 lists jumper JU1 and jumper JU2 functions. The EV kit can also be controlled by external signals using EN, $\overline{\text{EN}}$, SEL, and $\overline{\text{SEL}}$ connectors. **Before connecting external signals to the EN, $\overline{\text{EN}}$, SEL, $\overline{\text{SEL}}$ connectors, verify there are no shunts across jumpers JU1–JU4.**

Table 1. V_{CC} and V_{EE} Range

DEVICE	V_{CC} (V)	V_{EE} RANGE (V)
MAX9400	2.0	-3.5 to -0.375
MAX9401	3.3	-2.2 to +0.3
MAX9402	2.0	-3.5 to -0.375
MAX9403	2.0	-3.5 to -0.375
MAX9404	3.3	-2.2 to +0.3
MAX9405	2.0	-3.5 to -0.375

Table 2. Jumper JU3 and JU4 Functions

JU3 LOCATION	EN PIN	JU4 LOCATION	$\overline{\text{EN}}$ PIN	OUTPUT
1 and 2	Connected to V_{CC}	2 and 3	Connected to GND	Enabled
2 and 3	Connected to GND	1 and 2	Connected to V_{CC}	Disabled
All other combinations (not driven externally)				Undefined

Table 3. Jumpers JU1 and JU2 Functions

JU1 LOCATION	SEL PIN	JU2 LOCATION	$\overline{\text{SEL}}$ PIN	OPERATING MODE
1 and 2	Connected to V_{CC}	2 and 3	Connected to GND	Asynchronous mode
2 and 3	Connected to GND	1 and 2	Connected to V_{CC}	Synchronous mode
All other combinations (not driven externally)				Undefined

Evaluating the MAX9401–MAX9405

The MAX9400 EV kit is a four-layer PC board with 50Ω controlled-impedance input traces with 50Ω termination (two parallel 100Ω resistors). All output signal traces are also 50Ω controlled-impedance traces (with 49.9Ω termination resistors).

The MAX9400 EV kit can be used to evaluate the MAX9401–MAX9405 after modification. Table 4 lists on-chip input and output termination to the corresponding Maxim IC:

- To evaluate the MAX9401, replace the MAX9400EHJ with a MAX9401EHJ.
- To evaluate the MAX9402, replace the MAX9400EHJ with a MAX9402EHJ and remove output termination resistors R1 to R8. The output is half-amplitude compared to an open output because of the voltage-divider formed by the on-chip series 50Ω and the 50Ω oscilloscope input.
- To evaluate the MAX9403/MAX9404, replace the MAX9400EHJ with a MAX9403EHJ/MAX9404EHJ and remove input termination resistors R9 to R36.
- To evaluate the MAX9405, replace the MAX9400EHJ with a MAX9405EHJ and remove input and output termination resistors R1 to R36. The output is half-amplitude compared to an open output because of the voltage-divider formed by the on-chip series 50Ω and the 50Ω oscilloscope input.

Table 4. On-Chip Input and Output Termination

NAME	INPUT TERMINATION RESISTOR	OUTPUT TERMINATION RESISTOR
MAX9400	Open	Open
MAX9401	Open	Open
MAX9402	Open	50Ω
MAX9403	100Ω	Open
MAX9404	100Ω	Open
MAX9405	100Ω	50Ω

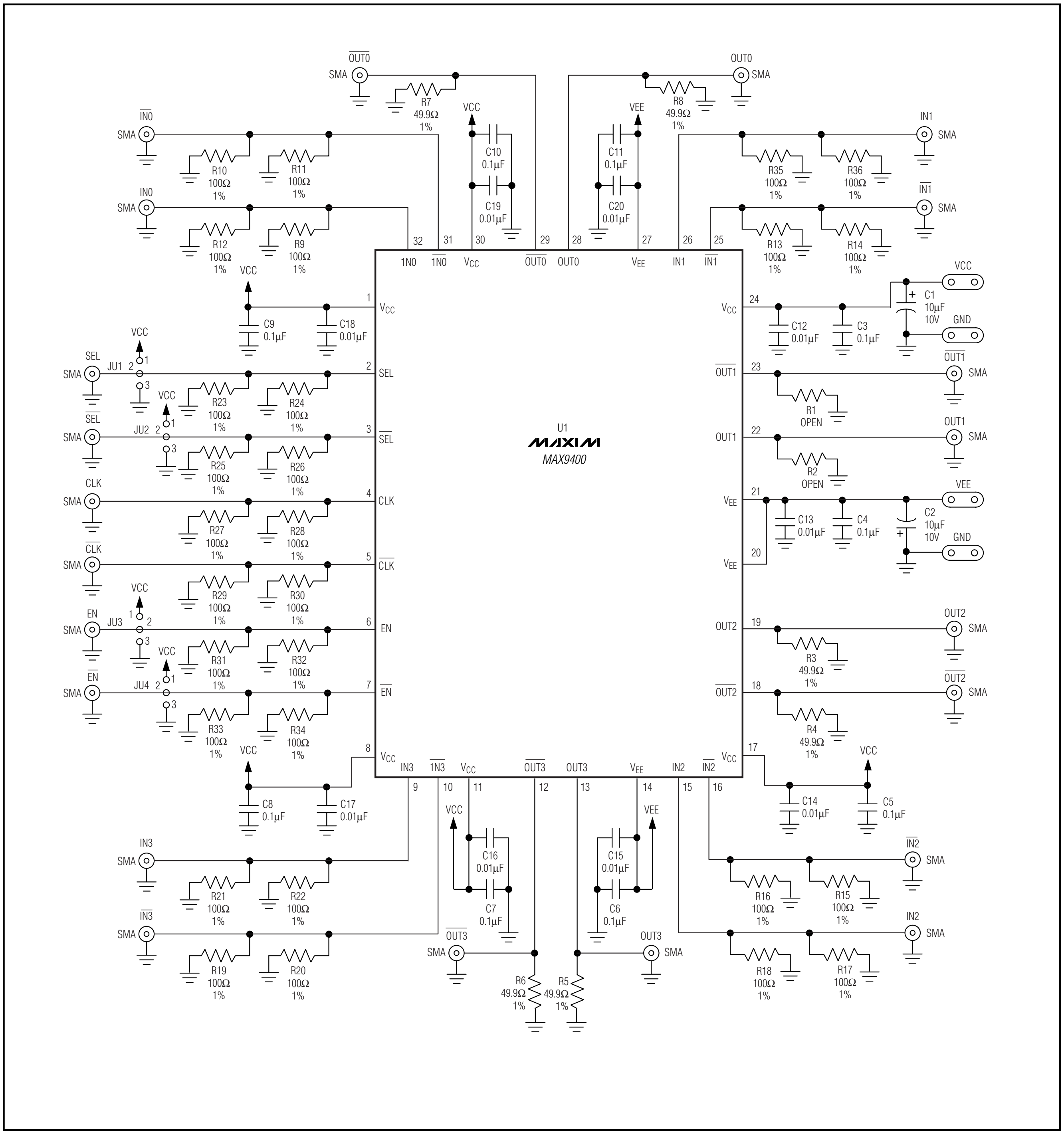

Figure 1. MAX9400 EV Kit Schematic

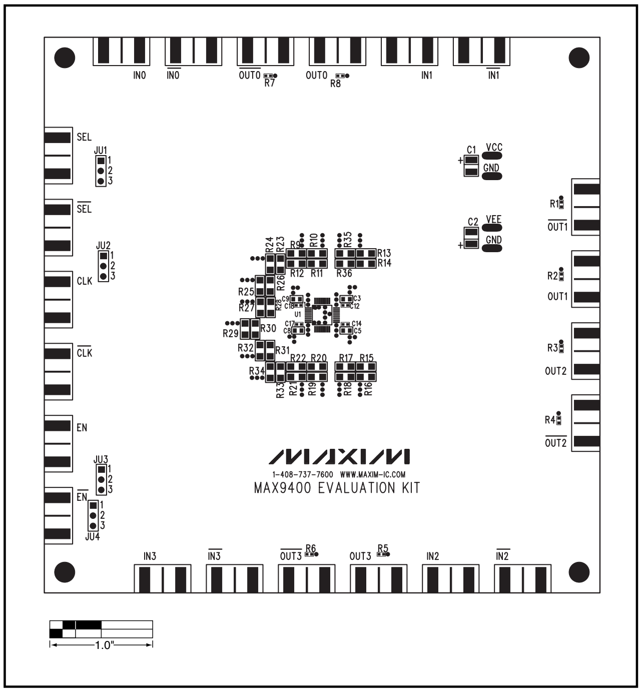

Figure 2. MAX9400 EV Kit Component Placement Guide—Component Side

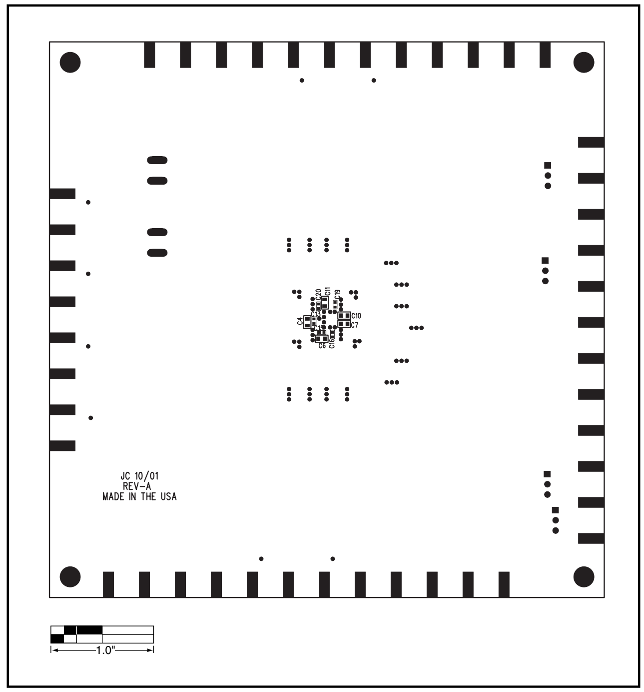

Figure 3. MAX9400 EV Kit Component Place Guide—Solder Side

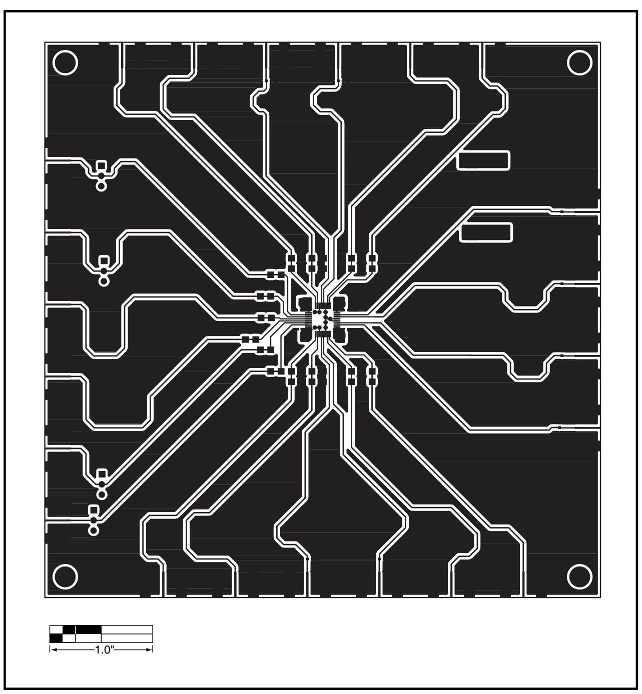

Figure 4. MAX9400 EV Kit PC Board Layout—Component Side

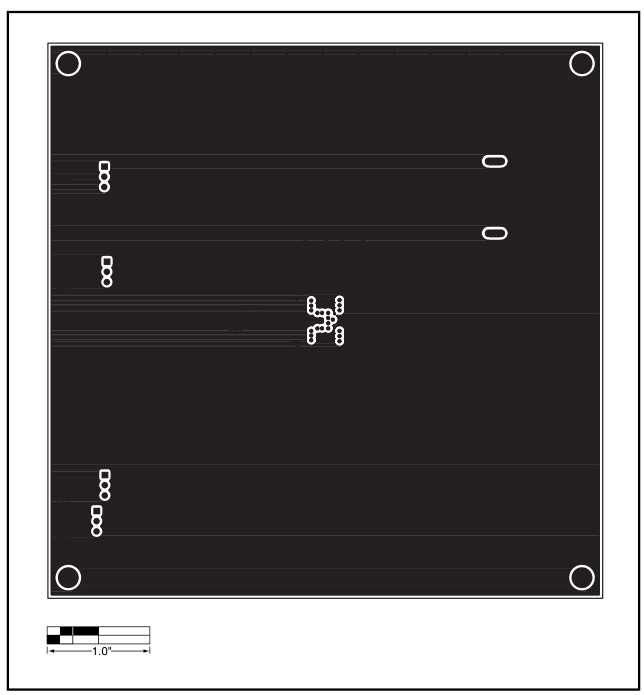

Figure 5. MAX9400 EV Kit PC Board Layout—Inner Layer 2 (GND Layer)

MAX9400 Evaluation Kit

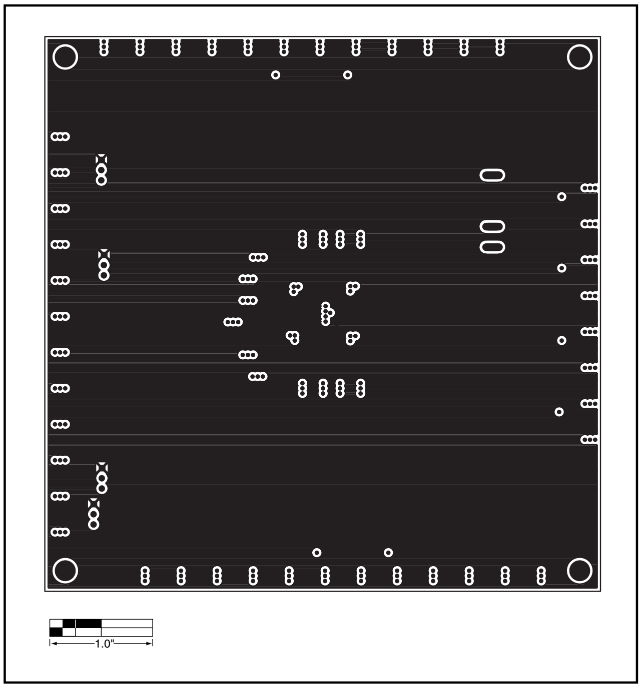

Figure 6. MAX9400 EV Kit PC Board Layout—Inner Layer 3 (VCC Layer)

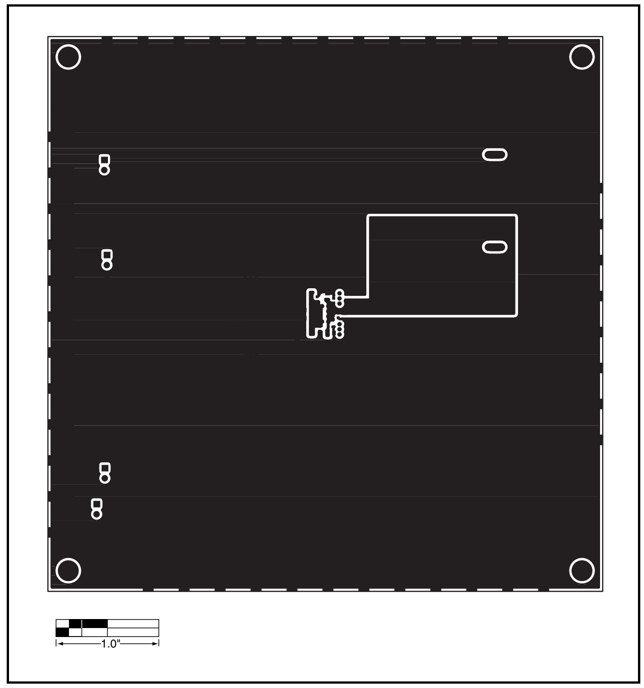

Figure 7. MAX9400 EV Kit PC Board Layout—Solder Side