MAX14950 Evaluation Kit

Evaluates: MAX14950

General Description

The MAX14950 evaluation kit (EV kit) provides a proven design to evaluate the MAX14950 quad PCI Express® (PCIe) equalizer/redriver. The device includes a four-level programmable input equalization and an eight-level programmable output deemphasis/preemphasis.

The EV kit PCB comes with a MAX14950CTO+ installed, which is available in a lead(Pb)-free (3.5mm x 9.0mm), 42-pin TQFN package with an exposed pad.

Features

- ♦ **Eye Diagram Test Circuit with SMA Input/Output**
- ♦ **Calibration Traces Provided**
- ♦ **Proven PCB Layout**
- ♦ **Fully Assembled and Tested**

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

Component List

DESIGNATION	QTY	DESCRIPTION
C1–C24	24	0.22µF ±10%, 10V X5R ceramic capacitors (0402) Murata GRM155R61A224K
C25–C32	8	2.2µF ±10%, 10V X5R ceramic capacitors (0603) Murata GRM188R61A225K
J1–J28	28	Edge-mount SMA connectors
J29	1	Red multipurpose connector
J30	1	Black multipurpose connector

DESIGNATION	QTY	DESCRIPTION
JU1–JU8	8	2-pin headers
R1–R8	8	1kΩ ±5% resistors (0603)
U1	1	Quad PCIe equalizer/redriver (42 TQFN-EP) Maxim MAX14950CTO+
—	8	Shunts (JU1–JU8)
—	1	PCB: MAX14950 EVALUATION KIT+

Component Supplier

SUPPLIER	PHONE	WEBSITE
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com

Note: *Indicate that you are using the MAX14950 when contacting this component supplier.*

Quick Start

Required Equipment

- MAX14950 EV kit
- 3.3V, 500mA DC power supply
- Pulse data generator with a minimum frequency of 8GHz (e.g., Agilent 81142A)
- Digital serial analyzer (DSA) sampling oscilloscope with a minimum frequency of 12GHz (e.g., Tektronix DSA8200)
- Two pairs of 50Ω SMA cables, length matched pairwise

Procedure

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

1) Verify that all jumpers are in their default positions (see Tables 1–4).
2) Connect the 3.3V, 500mA power supply to the VCC (J29) and GND (J30) connectors on the EV kit.
3) Place a shunt across pins 1-2 on jumper JU5 to enable the device.
4) Set up the data generator to a bit rate of 8Gbps, with a $1V_{P-P}$ differential voltage and a desired pseudorandom binary sequence (PRBS) or any arbitrary waveform.

5) Use the first pair of SMA cables to connect the differential output signals of the data generator to the IN1P (J3) and IN1N (J4) on the EV kit.
6) Use the second pair of SMA cables to connect the two sampling channels of the DSA to OUT1P (J11) and OUT1N (J12) on the EV kit.
7) Set the DSA to infinite persistence and select the math function of the signal (OUT1P - OUT1N).
8) Adjust the vertical scale to 100mV/div and the horizontal scale to 200ps/div on the DSA.
9) Turn on the DC power supply.
10) Enable the data outputs on the data generator and autoset the DSA to observe the waveform from the device.
11) Save the waveform on the DSA.
12) Disable the data outputs on the data generator.
13) Turn off the DC power supply.
14) Remove the first pair of SMA cables connected to J3 and J4 on the EV kit and connect them to J17 and J18 on the EV kit.
15) Remove the second pair of SMA cables connected to J11 and J12 on the EV kit and connect them to J19 and J20 on the EV kit.
16) Enable the data outputs on the data generator and autoset the DSA to observe the waveform from the calibration through traces.
17) Compare the waveform to the waveform that includes the device and observe the jitter/eye height of both systems. Take the difference in jitter/eye height, which is the extra jitter/eye height coming from the device.
18) Change the input equalization-control settings and the output deemphasis-control settings for further tests.

Detailed Description of Hardware

The MAX14950 EV kit provides a proven design to evaluate the MAX14950 quad PCIe equalizer/redriver. The device includes a four-level programmable input equalization and an eight-level programmable output deemphasis/preemphasis.

All signal traces coming out of the device are 100Ω differential controlled-impedance traces. Once the traces split into separate directions, the traces are 50Ω single-ended controlled impedances, which is equivalent to 100Ω differentially.

Calibration Traces

At the lower section on the EV kit board are calibration traces that are used as a reference to differentiate the performance of the device from the traces and SMA connectors, providing a complete analysis of the device. For simplicity, only channel 1 is provided with calibration traces. These traces are also intended to be used for the s-parameter extraction of the traces of the DUT for deembedding the trace effect from the performance of the device for a jitter analysis, as well as a serial link data analysis. The jitter performance of a PCIe Gen III transmitter is specified by deembedding the traces to the package pin of the device.

Through Traces

The first calibration traces are made with no load. The lengths of the traces are equal to the channel 1 circuitry minus the device. The traces starting from the SMA connectors are 50Ω single-ended controlled impedances. Once the traces run parallel to each other and are matched side by side, the traces are 100Ω differential-controlled impedances. The through traces can also be used for measuring the propagation delay and also measuring the exit and entry times of the electrical idle function of the device.

Short Traces

The second calibration traces are shorted at the device's exposed pad. These traces can be used to extract the s-parameters of the traces of the main DUT, along with the use of the open-ended traces and the through traces. They can also be used for the port extension of a vector network analyzer (VNA) (e.g., Agilent Technologies N5230A), along with the open traces.

Open Traces

The third calibration traces are open near the device's exposed pad. These traces can be used to extract the s-parameters of the traces of the main DUT, along with the use of the short-ended traces and the through traces. They can also be used for the port extension of a VNA for calibration, along with the short traces.

Jumper Selection

Tables 1–5 show the control settings for the device.

Table 1. Device Enable Setting (JU5)

EN (JU5)	DESCRIPTION
0 (Open)*	Standby mode
1 (Closed)	Normal mode

**Default position.*

Table 2. Input Equalization Setting (JU1, JU2)

INEQ1 (JU1)	INEQ0 (JU2)	INPUT EQUALIZATION (dB)
0 (Open)*	0 (Open)*	3
0 (Open)	1 (Closed)	5
1 (Closed)	0 (Open)	7
1 (Closed)	1 (Closed)	9

**Default position.*

Table 3. Output Deemphasis/Preshoot Setting (JU3, JU4, JU7)

OEQ2 (JU7)	OEQ1 (JU3)	OEQ0 (JU4)	OUTPUT DEEMPHASIS/ PRESHOOT RATIO (dB)
0 (Open)*	0 (Open)*	0 (Open)*	0
0 (Open)	0 (Open)	1 (Closed)	3.5
0 (Open)	1 (Closed)	0 (Open)	6
0 (Open)	1 (Closed)	1 (Closed)	6 (Peak-to-peak swing is 1.2V)
1 (Closed)	0 (Open)	0 (Open)	3.5
1 (Closed)	0 (Open)	1 (Closed)	6
1 (Closed)	1 (Closed)	0 (Open)	9 (Peak-to-peak swing is 0.9V)
1 (Closed)	1 (Closed)	1 (Closed)	9 (Peak-to-peak swing is 1V)

**Default position.*

Table 4. Receiver Detection Input Function Setting (JU5, JU6)

RXDET (JU6)	EN (JU5)	DESCRIPTION
X	0 (Open)*	Receiver detection is inactive.
X	1 (Closed)	Following a rising edge of the EN signal, indefinite retry until receiver detected at least one channel. Retry stops a few times after any channel receiver is detected.
Rising/falling edge	1 (Closed)	Initiate receiver detection.

X = Don't care.

**Default position.*

Table 5. Electrical Idle Detection Limits Threshold Setting (JU8)

EIVIL (JU8)	THRESHOLD LOW LIMIT (mV)	THRESHOLD HIGH LIMIT (mV)
0 (Open)*	108 (typ)	115 (typ)
1 (Closed)	81 (typ)	115 (typ)

**Default position.*

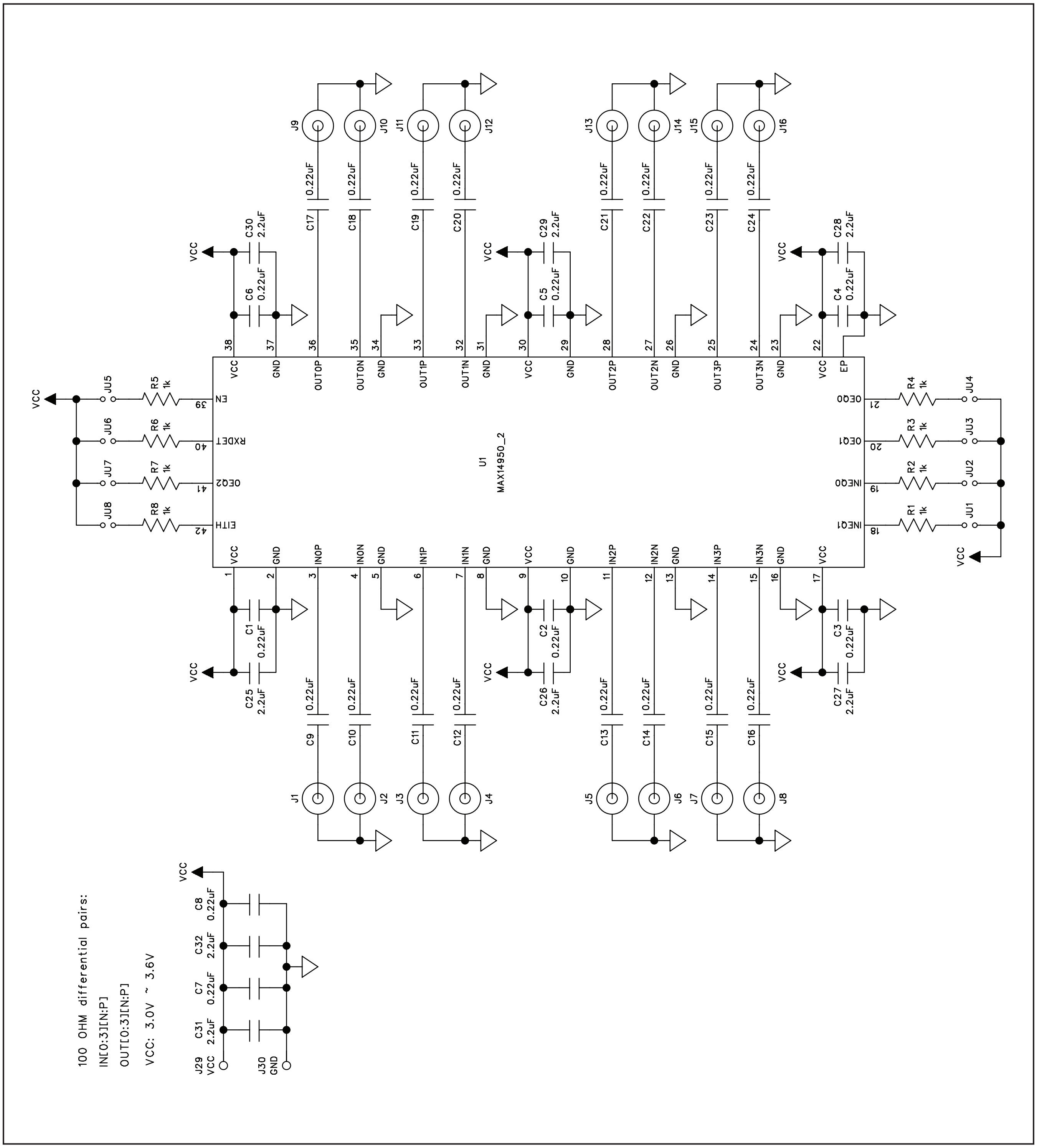

Figure 1a. MAX14950 EV Kit Schematic (Sheet 1 of 2)

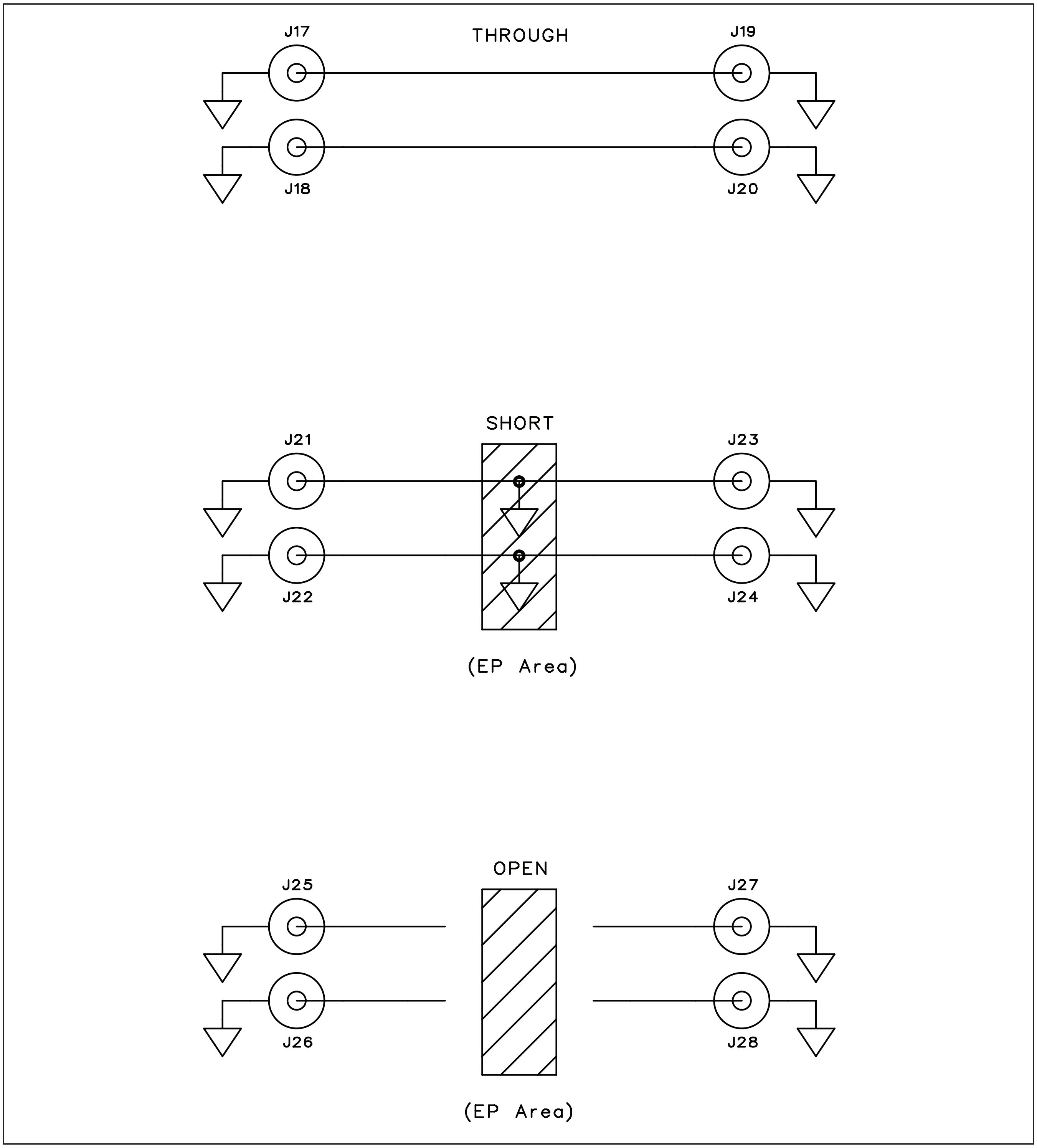

Figure 1b. MAX14950 EV Kit Schematic (Sheet 2 of 2)

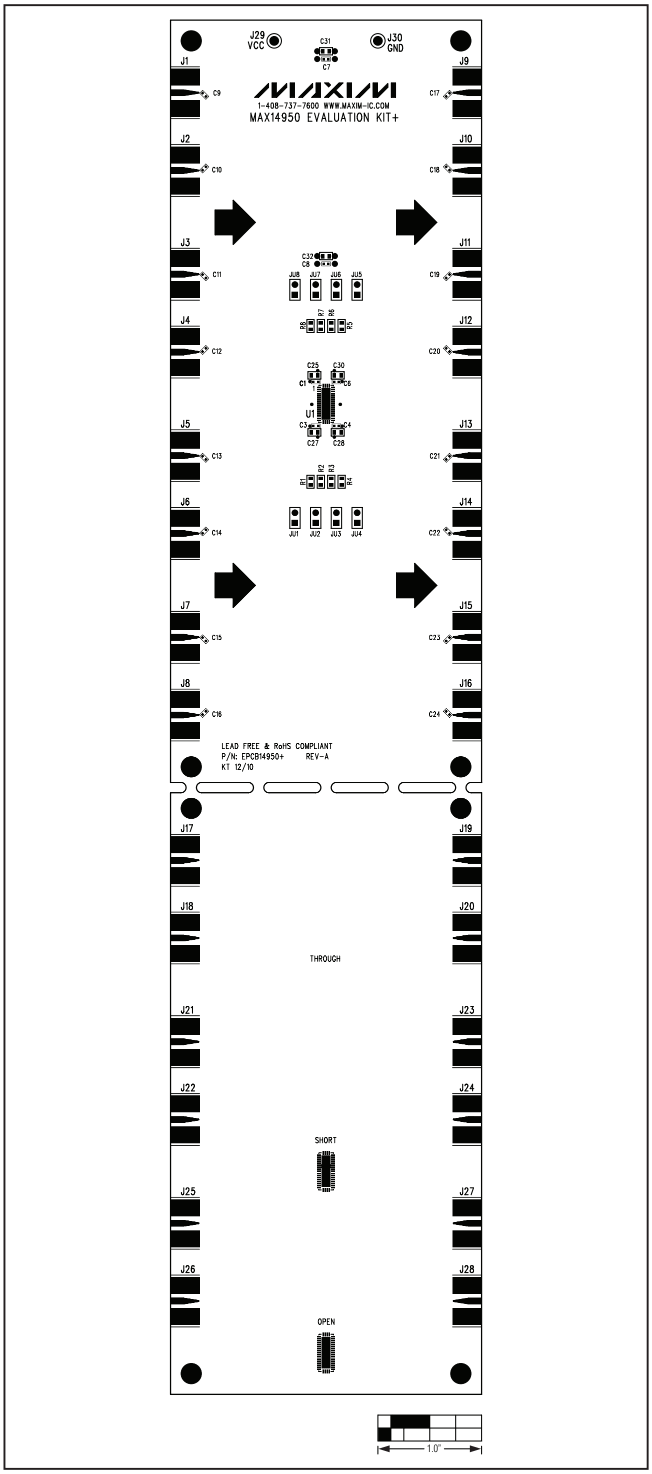

Figure 2. MAX14950 EV Kit Component Placement Guide—Component Side

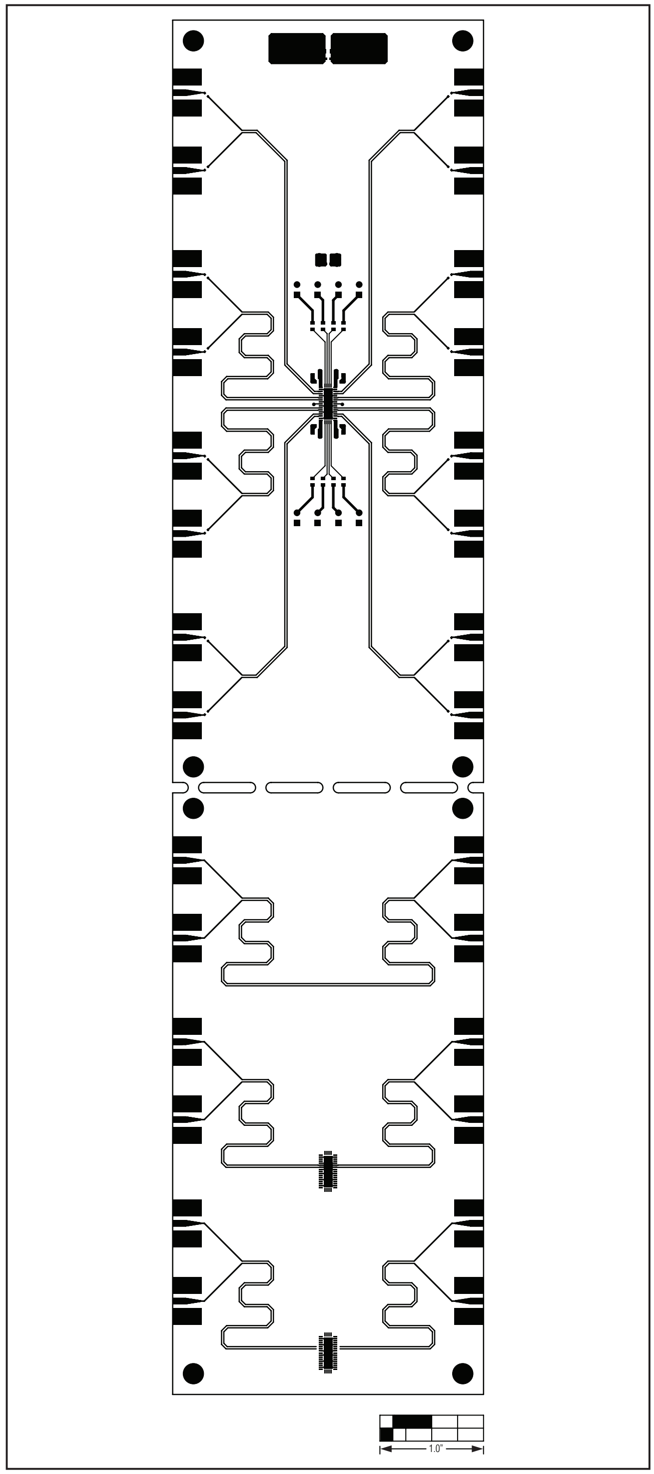

Figure 3. MAX14950 EV Kit PCB Layout—Component Side

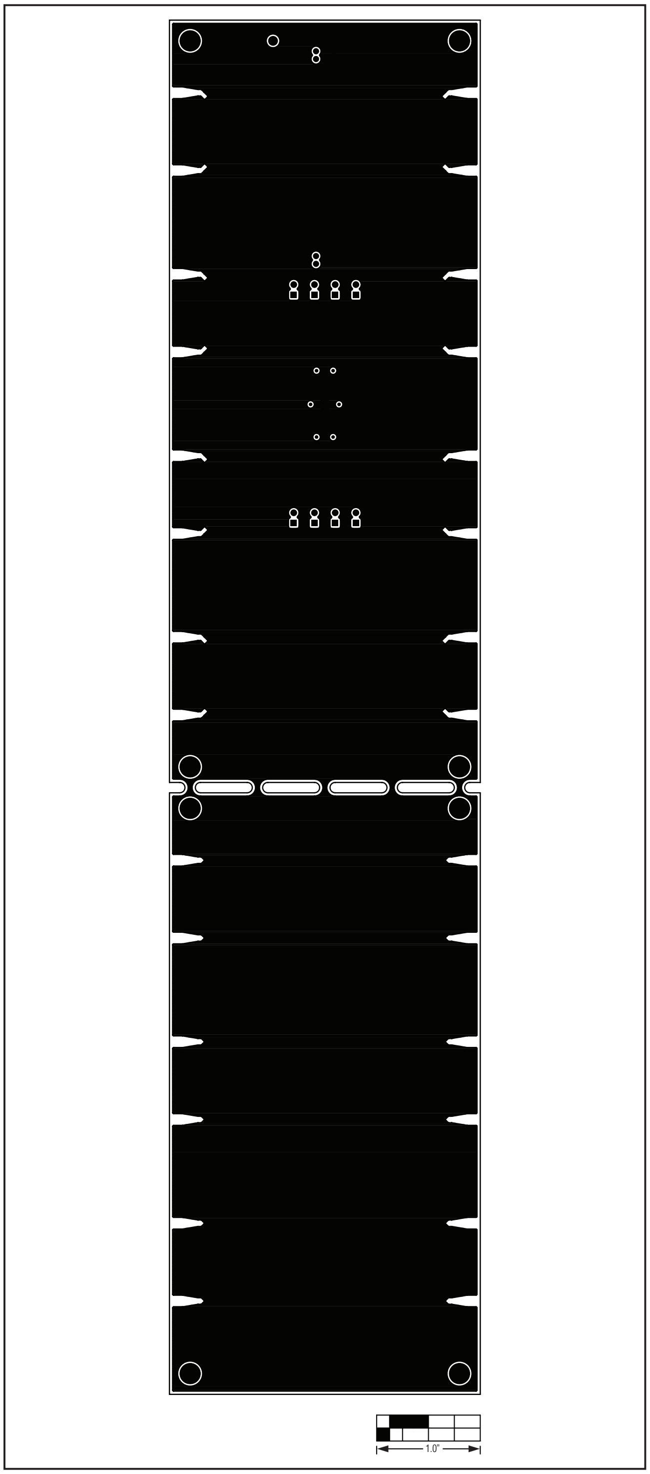

Figure 4. MAX14950 EV Kit PCB Layout— Inner Layer 2

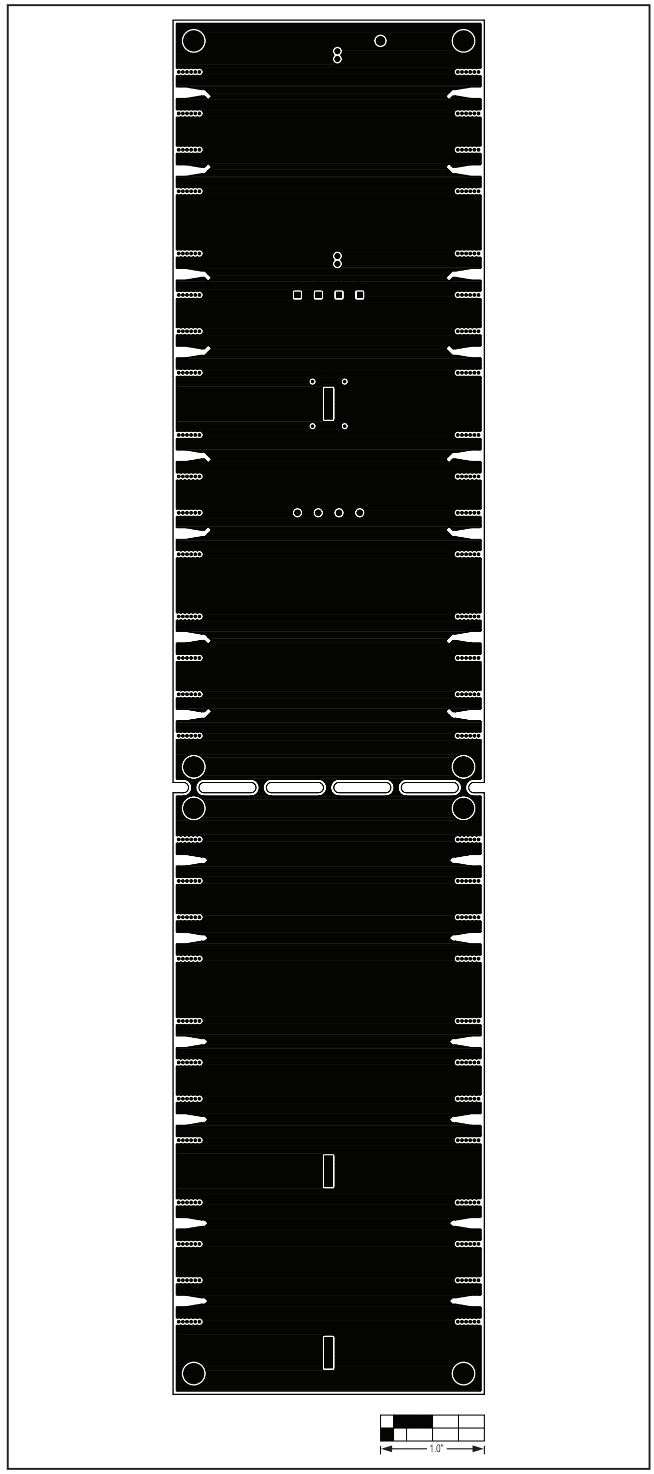

Figure 5. MAX14950 EV Kit PCB Layout— Inner Layer 3

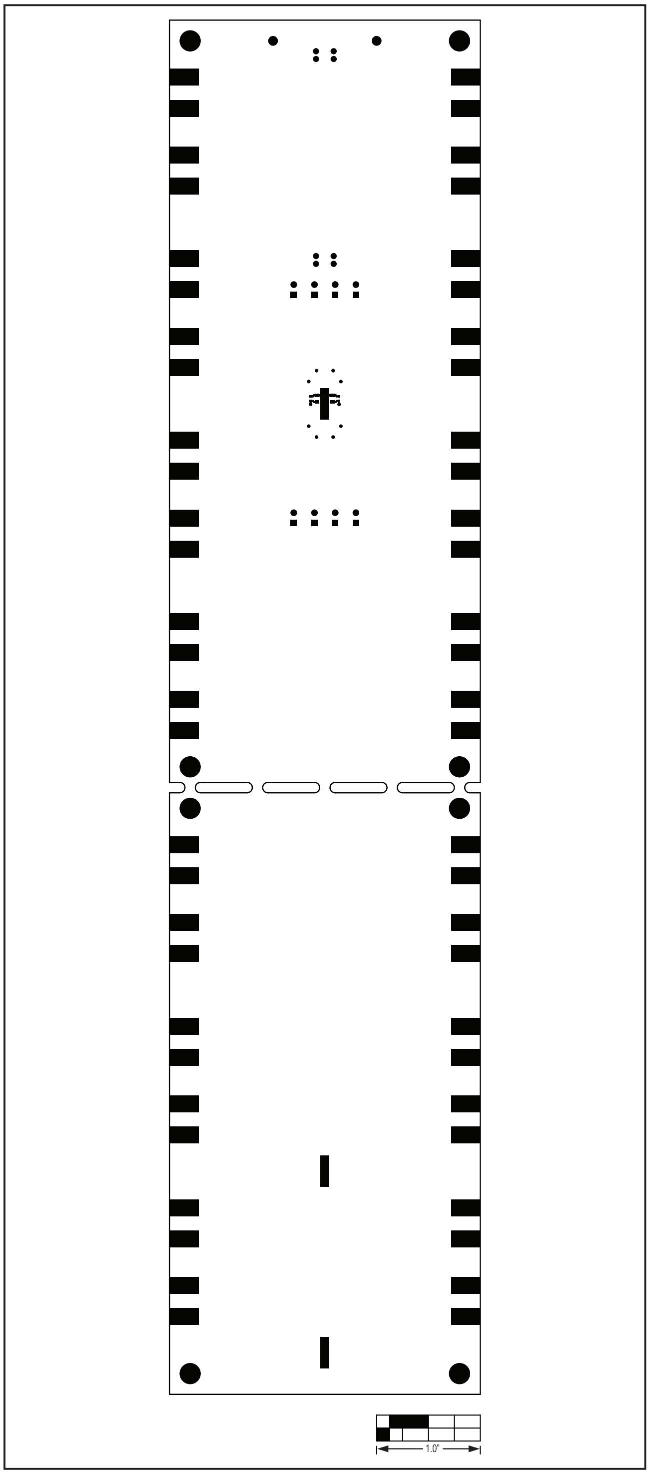

Figure 6. MAX14950 EV Kit PCB Layout—Solder Side

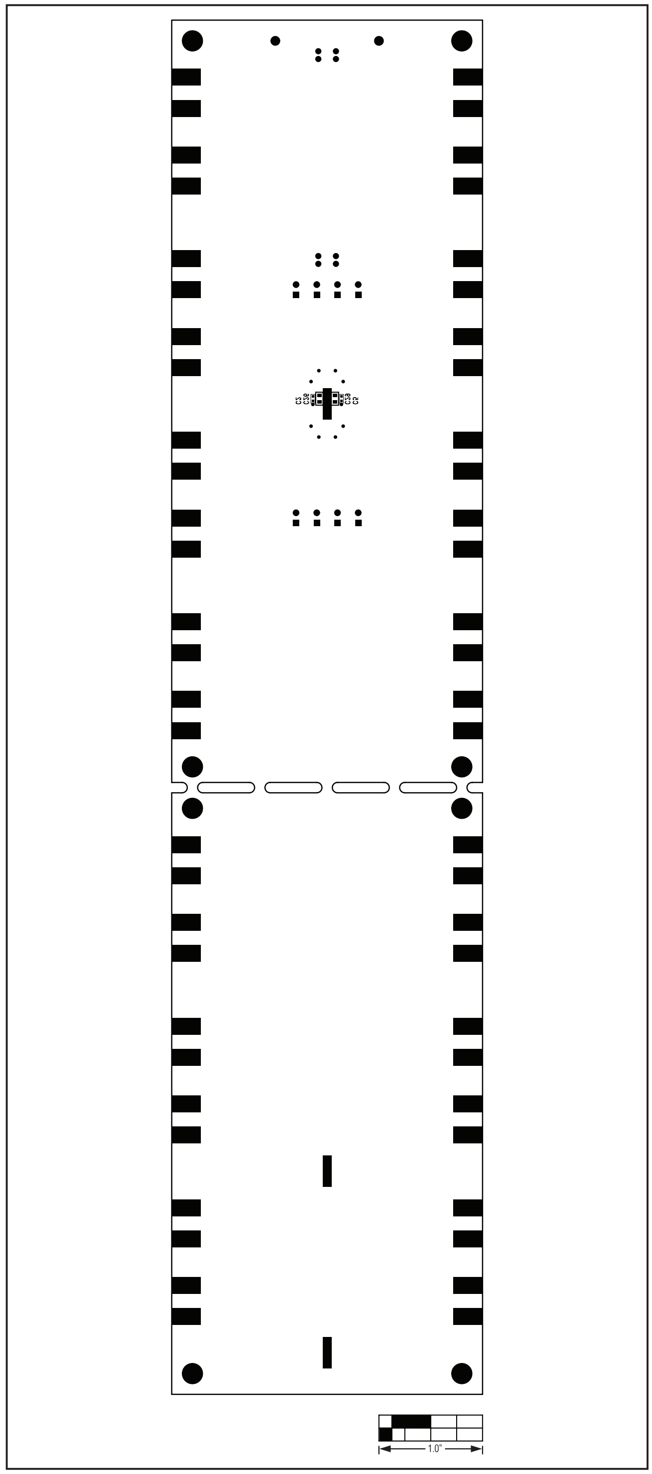

Figure 7. MAX14950 EV Kit Component Placement Guide—Solder Side

Ordering Information

PART	TYPE
MAX14950EVKIT+	EV Kit

+Denotes lead(Pb)-free and RoHS compliant.