



# MAX9209/MAX9244 Evaluation Kit

## General Description

The MAX9209/MAX9244 evaluation kit (EV kit) provides a proven design to evaluate the MAX9209 21-bit programmable DC-balanced serializer and the MAX9244 21-bit deserializer with programmable spread spectrum and DC balance. The MAX9209 serializes 21 bits of LVCMOS/LVTTL parallel input data to three LVDS outputs. The MAX9244 deserializes the three LVDS input data from the MAX9209 and transforms it back to 21-bit LVCMOS/LVTTL parallel data.

The MAX9209/MAX9244 EV kit circuits are implemented on a single PCB and come with a MAX9209EUM+ and a MAX9244EUM+ installed.

## Features

- ◆ 21-Bit Parallel LVCMOS/LVTTL Interface
- ◆ 8-Conductor Connector with Custom Cable
- ◆ Independent Evaluation of the MAX9209/MAX9244 Serializer/Deserializer (SerDes)
- ◆ Lead-Free and RoHS Compliant
- ◆ Proven PCB Layout
- ◆ Fully Assembled and Tested

## Ordering Information

PART	TYPE
MAX9209EVKIT+	EV Kit
or	
MAX9244EVKIT+	

+Denotes lead-free and RoHS compliant.

**Note:** The MAX9209/MAX9244 EV kit can be ordered using either part number.

## Component List

DESIGNATION	QTY	DESCRIPTION
C1, C2, C6, C8, C12–C21, C26, C29, C32, C34, C36, C39, C44–C51, C74–C77	32	0.1 $\mu$ F $\pm$ 10%, 16V X7R ceramic capacitors (0402) Murata GRM155R71C104K
C3, C4, C5, C7, C11, C22, C25, C28, C31, C33, C35, C38	12	0.01 $\mu$ F $\pm$ 10%, 16V X7R ceramic capacitors (0402) Murata GRM155R71C103K
C40–C43	4	1 $\mu$ F $\pm$ 10%, 6.3V X5R ceramic capacitors (0402) Murata GRM155R60J105K
C9, C10, C23, C24, C27, C30, C37	7	10 $\mu$ F $\pm$ 10%, 16V X5R ceramic capacitors (0805) Murata GRM21BR61C106K
C52–C73	0	Not installed, ceramic capacitors (0402)
H1–H4	4	2 x 10 shrouded plug connectors (0.100in centers)
H5, H6	2	2 x 20 shrouded plug connectors (0.100in centers)

DESIGNATION	QTY	DESCRIPTION
JU1–JU4, JU9, JU10, JU11	7	3-pin headers
JU5–JU8, JU12–JU20	13	2-pin headers
P1, P2	2	8-conductor PCB connectors Hirose GT17VB-8DP-DS-SB
P3–P6	4	Vertical-mount SMA connectors
R1, R3–R10	9	49.9 $\Omega$ $\pm$ 1% resistors (0402)
R2	0	Not installed, resistor (0402)
U1	1	Programmable 21-bit serializer (48 TSSOP) Maxim MAX9209EUM+
U2	1	Programmable 21-bit deserializer (48 TSSOP) Maxim MAX9244EUM+
—	12	Shunts
—	1	8-conductor cable Nissei SIODIC F-2W-4ME AWG28 Design No. 916591
—	1	PCB: MAX9209/44 Evaluation Kit+

## Component Suppliers

SUPPLIER	PHONE	WEBSITE
Hirose Electric Co., Ltd.	81-3-3491-9741	www.hirose.com
Murata Electronics North America, Inc	770-436-1300	www.murata-northamerica.com
Nissei Electric Co., Ltd.	81-53-485-4705	www.nissei-el.co.jp/english/index.htm

**Note:** Indicate that you are using the MAX9209 and the MAX9244 when contacting these component suppliers.



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](http://www.maxim-ic.com).

# MAX9209/MAX9244 Evaluation Kit

## Quick Start

### Recommended Equipment

Before beginning, the following equipment is needed:

- MAX9209/MAX9244 EV kit (8-conductor cable included)
- Two 3.3V/200mA DC power supplies
- Digital data generator (e.g., HP/Agilent 16522A)
- Low phase-noise clock generator (e.g., HP/Agilent 8133A)
- Logic analyzer or data-acquisition system (e.g., HP/Agilent 16500C)

### Procedure

The MAX9209/MAX9244 EV kit is fully assembled and tested. Follow the steps below to verify board operation. **Caution: Do not turn on the power supplies or signal sources until all connections are completed.**

- 1) Verify that all jumpers (JU1–JU20) are in their default position, as shown in Table 1.
- 2) Connect the first 3.3V power supply across the VCC1 and GND1 pads of the EV kit.

- 3) Connect the second 3.3V power supply across the VCC2 and GND2 pads of the EV kit.
- 4) Connect the 8-conductor cable from the P1 to P2 connectors of the EV kit.
- 5) Connect the data generator to the H1, H2, and H3 connectors and set it to generate 21-bit parallel data at LVCMOS/LVTTL levels. See Tables 2, 3, and 4 for input bit locations.
- 6) Connect the clock generator to the H4 connector and set its output frequency between 8MHz and 34MHz. See Table 5 for TXCLK\_IN location.
- 7) Connect the logic analyzer or data-acquisition system to connectors H5 and H6, as shown in Tables 6 and 7.
- 8) Turn on the power supplies.
- 9) Enable the clock generator.
- 10) Enable the data generator.
- 11) Enable the logic analyzer or data-acquisition system and begin sampling data.

**Table 1. MAX9209/MAX9244 EV Kit Jumper Descriptions (JU1–JU20)**

JUMPER	FUNCTION	SHUNT	DESCRIPTION
JU1	Power enable without logic analyzer	1-2	Connects to VCC1 when not using a logic analyzer
	Power enable with logic analyzer	2-3*	Connects to GND1 when using a logic analyzer
JU2	MAX9209 power-down	1-2*	Pulls $\overline{\text{PWRDWN}}$ high for full functionality and 5V tolerant LVCMOS/LVTTL operation
	MAX9209 power-down	2-3	Pulls $\overline{\text{PWRDWN}}$ low and turns off the MAX9209. In this mode, the MAX9209 outputs are high impedance. This mode is used in combination with jumper JU3 to activate the internal PRBS mode for the MAX9209.
JU3	PRBS mode disable	1-2*	Connects pin 14 of the MAX9209 to VCC1 for full operation
	PRBS mode enable	2-3	Connects pin 14 of the MAX9209 to GND1 for PRBS mode operation
JU4	MAX9209 DC-balance mode enable	1-2*	Configures the MAX9209 to operate in DC-balance mode
	MAX9209 DC-balance mode disable	2-3	Configures the MAX9209 to operate in non-DC-balance mode
JU5	TXOUT0+/-	Open*	Used for probing TXOUT0+ and TXOUT0-
JU6	TXOUT1+/-	Open*	Used for probing TXOUT1+ and TXOUT1-
JU7	TXOUT2+/-	Open*	Used for probing TXOUT2+ and TXOUT2-
JU8	TXCLK-OUT+/-	Open*	Used for probing TXCLK_OUT+ and TXCLK_OUT-
JU9	MAX9244 DC-balance mode disable	1-2	Configures the MAX9244 to operate in non-DC-balance mode
	MAX9244 DC-balance mode enable	2-3*	Configures the MAX9244 to operate in DC-balance mode

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Evaluates: MAX9209/MAX9244

**Table 1. MAX9209/MAX9244 EV Kit Jumper Descriptions (JU1–JU20) (continued)**

JUMPER	FUNCTION	SHUNT	DESCRIPTION
JU10	MAX9244 spread-spectrum enable	1-2*	Configures the RXCLKOUT frequency spread to $\pm 4\%$ relative to RXCLKIN
	MAX9244 spread-spectrum disable	2-3	Configures the RXCLKOUT frequency to no spread relative to RXCLKIN
	MAX9244 spread-spectrum enable	Open	Configures the RXCLKOUT frequency spread to $\pm 2\%$ relative to RXCLKIN
JU11	MAX9244 power-down	1-2*	Pulls $\overline{\text{PWRDWN}}$ high for full functionality and 5V tolerant LVCMOS/LVTTL operation
	MAX9244 power-down	2-3	Pulls $\overline{\text{PWRDWN}}$ low and turns off MAX9244. In this mode, the MAX9244 inputs are high impedance.
JU12	RXIN0+/-	Open*	Used for probing RXIN0+ and RXIN0-
JU13	RXIN1+/-	Open*	Used for probing RXIN1+ and RXIN1-
JU14	RXIN2+/-	Open*	Used for probing RXIN2+ and RXIN2-
JU15	RXCLKIN+/-	Open*	Used for probing RXCLKIN+ and RXCLKIN-
JU16	Board supply connectivity	1-2*	Connects VCC1 to LVDS1_VCC. This shunt reduces the number of supplies required to operate the EV kit.
	Board supply connectivity	Open	Disconnects VCC1 from LVDS1_VCC. The 2-pin header can be utilized for supply current measurements.
JU17	Board supply connectivity	1-2*	Connects LVDS1_VCC to PLL1_VCC. This shunt reduces the number of supplies required to operate the EV kit.
	Board supply connectivity	Open	Disconnects LVDS1_VCC from PLL1_VCC. The 2-pin header can be utilized for supply current measurements.
JU18	Board supply connectivity	1-2*	Connects VCC2 to LVDS2_VCC. This shunt reduces the number of supplies required to operate the EV kit.
	Board supply connectivity	Open	Disconnects VCC2 from LVDS2_VCC. The 2-pin header can be utilized for supply current measurements.
JU19	Board supply connectivity	1-2*	Connects LVDS1_VCC to PLL2_VCC. This shunt reduces the number of supplies required to operate the EV kit.
	Board supply connectivity	Open	Disconnects VCC2 from PLL2_VCC. The 2-pin header can be utilized for supply current measurements.
JU20	Board supply connectivity	1-2*	Connects PLL2_VCC to VCC0. This shunt reduces the number of supplies required to operate the EV kit.
	Board supply connectivity	Open	Disconnects PLL2_VCC from VCC0. The 2-pin header can be utilized for supply current measurements.

\*Default position.

# MAX9209/MAX9244 Evaluation Kit

## Detailed Description of Hardware

The MAX9209/MAX9244 EV kit provides a proven design to evaluate the MAX9209 21-bit programmable DC-balanced serializer and the MAX9244 21-bit deserializer with programmable spread spectrum and DC balance. The MAX9209 serializes 21 bits of LVCMOS/LVTTL parallel input data to three LVDS outputs. The MAX9244 deserializes the three LVDS input data from the MAX9209 and transforms it back to 21-bit LVCMOS/LVTTL parallel data.

### Input Signals

The MAX9209 accepts 21-bit parallel data at LVCMOS/LVTTL. The 21-bit pattern is supplied to the EV kit by connecting a data generator to the three 20-pin headers (H1, H2, and H3), or by connecting selected H1, H2, and H3 pins to high/low LVCMOS/LVTTL states. See Tables 2, 3, and 4 for input bit locations for H1, H2, and H3.

### Output Signals

The MAX9244 outputs 21-bit parallel data at LVCMOS/LVTTL levels on 40-pin headers H5 and H6. To sample the 21-bit pattern, connect a logic analyzer or data-acquisition system to H5 and H6. See Tables 6 and 7 for the output bit locations on the 40-pin headers (H5 and H6).

### DC-Balance and Non-DC-Balance Modes

The MAX9209 operates at a parallel clock frequency of 8MHz to 34MHz in DC-balance mode by moving the shunt of JU4 to the 1-2 position. The MAX9244 operates at a parallel clock frequency of 16MHz to 34MHz in DC-balance mode by moving the shunt of JU9 to the 2-3 position.

The MAX9209 operates at a parallel clock frequency of 10MHz to 40MHz in non-DC-balance mode by moving the shunt of JU4 to the 2-3 position. The MAX9244 operates at a parallel clock frequency of 10MHz to 40MHz in non-DC-balance mode by moving the shunt of JU9 to the 1-2 position.

**Table 2. Input Bit Locations for BIT0–BIT6**

SIGNAL	BIT0	BIT1	BIT2	BIT3	BIT4	BIT5	BIT6
Input (H1)	H1-1	H1-3	H1-5	H1-7	H1-9	H1-11	H1-13

**Table 3. Input Bit Locations for BIT7–BIT13**

SIGNAL	BIT7	BIT8	BIT9	BIT10	BIT11	BIT12	BIT13
Input (H2)	H2-1	H2-3	H2-5	H2-7	H2-9	H2-11	H2-13

**Table 4. Input Bit Locations for BIT14–BIT20**

SIGNAL	BIT14	BIT15	BIT16	BIT17	BIT18	BIT19	BIT20
Input (H3)	H3-1	H3-3	H3-5	H3-7	H3-9	H3-11	H3-13

**Table 5. Input/Output Clock Locations**

SIGNAL	DESIGNATION
TXCLK_IN	H4-15

**Table 6. Output Bit Locations for BIT10–BIT20**

SIGNAL	BIT10	BIT11	BIT12	BIT13	BIT14	BIT15	BIT16	BIT17	BIT18	BIT19	BIT20
Input (H5)	H5-3	H5-5	H5-7	H5-9	H5-11	H5-13	H5-15	H5-17	H5-19	H5-21	H5-23

**Table 7. Output Bit Locations for BIT0–BIT9**

SIGNAL	BIT0	BIT1	BIT2	BIT3	BIT4	BIT5	BIT6	BIT7	BIT8	BIT9
Input (H6)	H6-13	H6-15	H6-17	H6-19	H6-21	H6-23	H6-25	H6-27	H6-29	H6-31

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## **Power-Down**

The power-down mode in the MAX9209 and MAX9244 puts the outputs in high impedance, stops the PLL, and reduces supply current to 50 $\mu$ A or less by moving the shunts of JU2 and JU11 to the 2-3 position. When JU2 and JU11 are in the 1-2 position, the LVDS outputs of the MAX9209 are not driven until the PLL locks and the LVDS outputs of the MAX9244 are driven low until the PLL locks.

## **Spread-Spectrum Frequency**

The MAX9244 can set the frequency spread to  $\pm 4\%$ ,  $\pm 2\%$ , or no spread by moving JU10 to the appropriate shunt position (Table 1).

## **Pseudo-Random Bit Sequence (PRBS) Mode**

The MAX9209/MAX9244 EV kit offers the user an internal test mode to quickly verify full functionality and verification of the quality of the SerDes link. This mode is called pseudo-random bit sequence, or PRBS mode.

The MAX9209 features an on-chip PRBS generator that can be utilized to generate a pseudo-random bit stream to evaluate the quality and performance by comparing the output of the serializer (prior to the link/cable) with the input of the deserializer (after the link/cable).

To activate this feature, the MAX9209 must first enter power-down mode by moving the shunt of JU2 to the 2-3 position. Activate the internal PRBS mode by moving the shunt of JU3 to the 2-3 position.

## **Power Supplies**

The MAX9209 is powered by connecting PLL1\_VCC, LVDS1\_VCC, and VCC1 to a DC power supply at 3V to 3.6V. The MAX9209 can be configured to reduce wiring to the supply and ground pads by moving the shunts of JU16 and JU17 to the 1-2 position. The MAX9244 is powered by applying 3.3V to 3.6V to the PLL2\_VCC, LVDS2\_VCC, VCC2, and VCC0 pads. The MAX9244 can be configured to reduce wiring to the supply and ground pads by moving the shunts of JU18, JU19, and JU20 to the 1-2 position.

Evaluates: MAX9209/MAX9244

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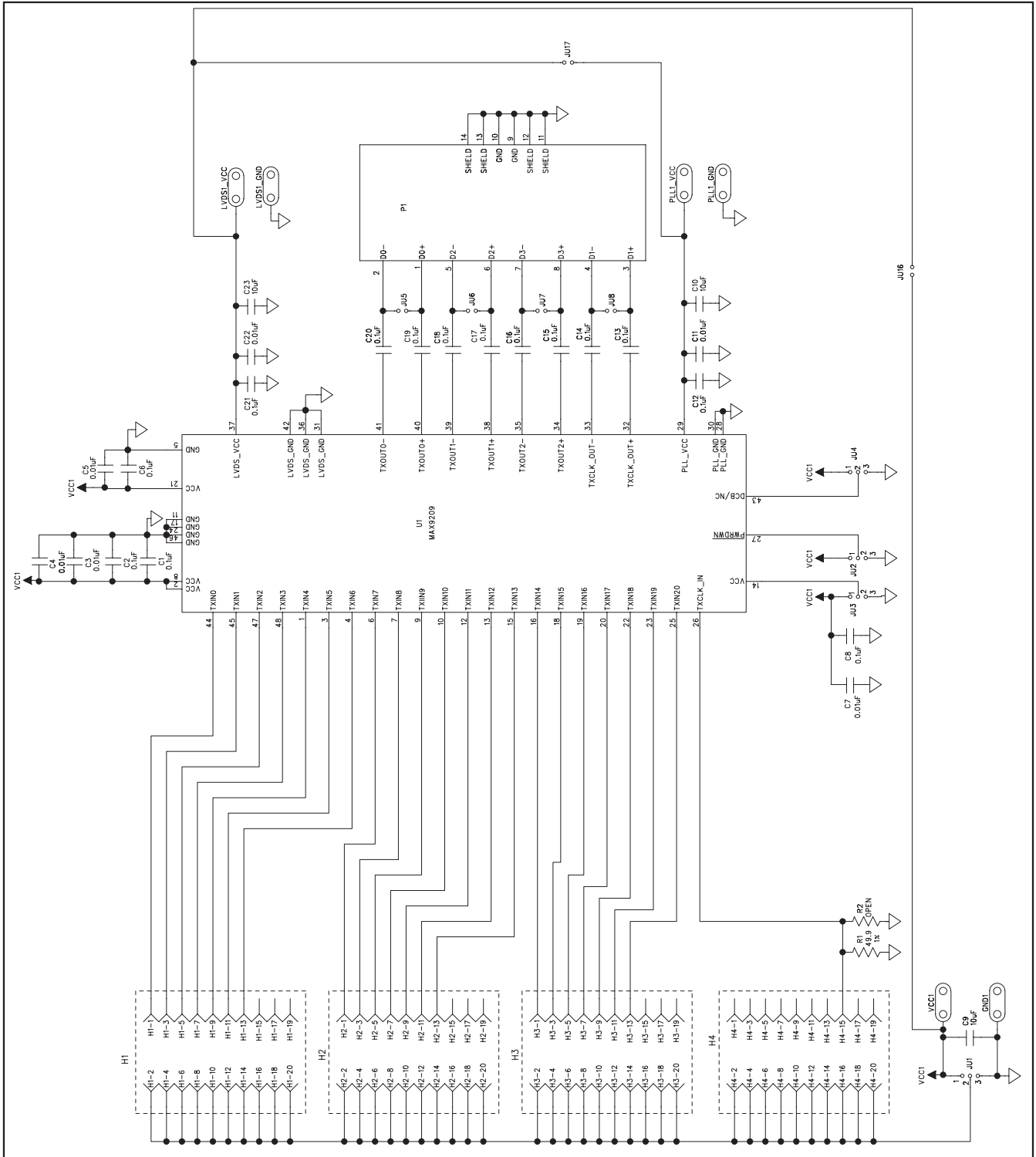


Figure 1a. MAX9209/MAX9244 EV Kit Schematic (1 of 2)

# MAX9209/MAX9244 Evaluation Kit

Evaluates: MAX9209/MAX9244

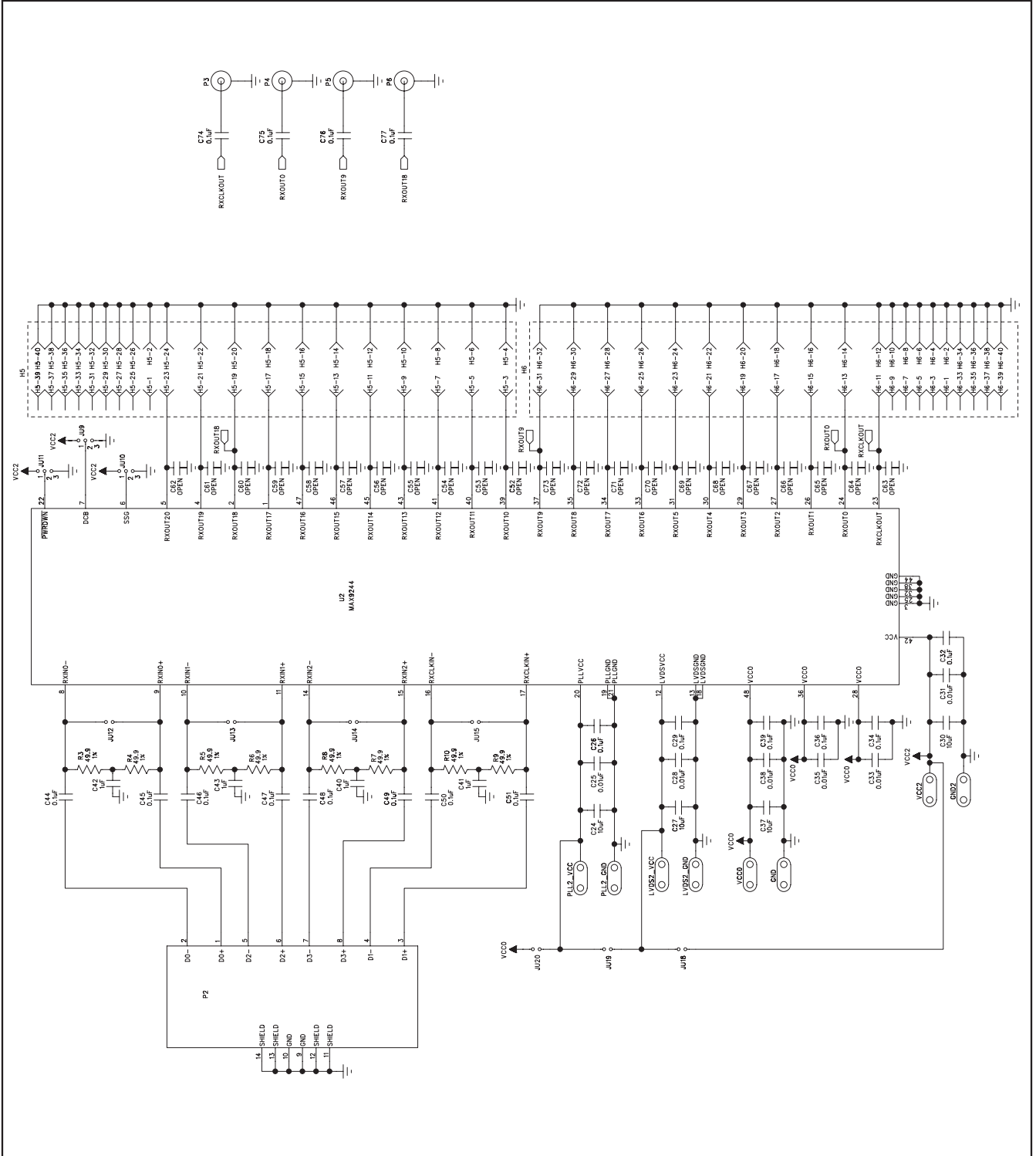


Figure 1b. MAX9209/MAX9244 EV Kit Schematic (2 of 2)

# MAX9209/MAX9244 Evaluation Kit

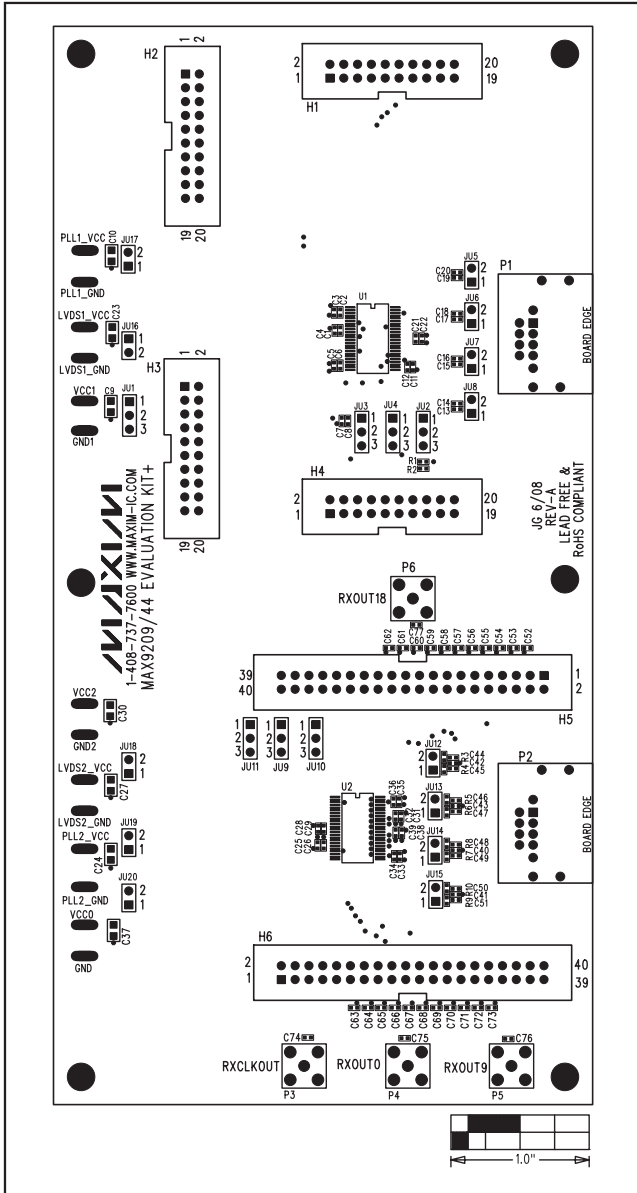


Figure 2. MAX9209/MAX9244 EV Kit Component Placement Guide—Component Side

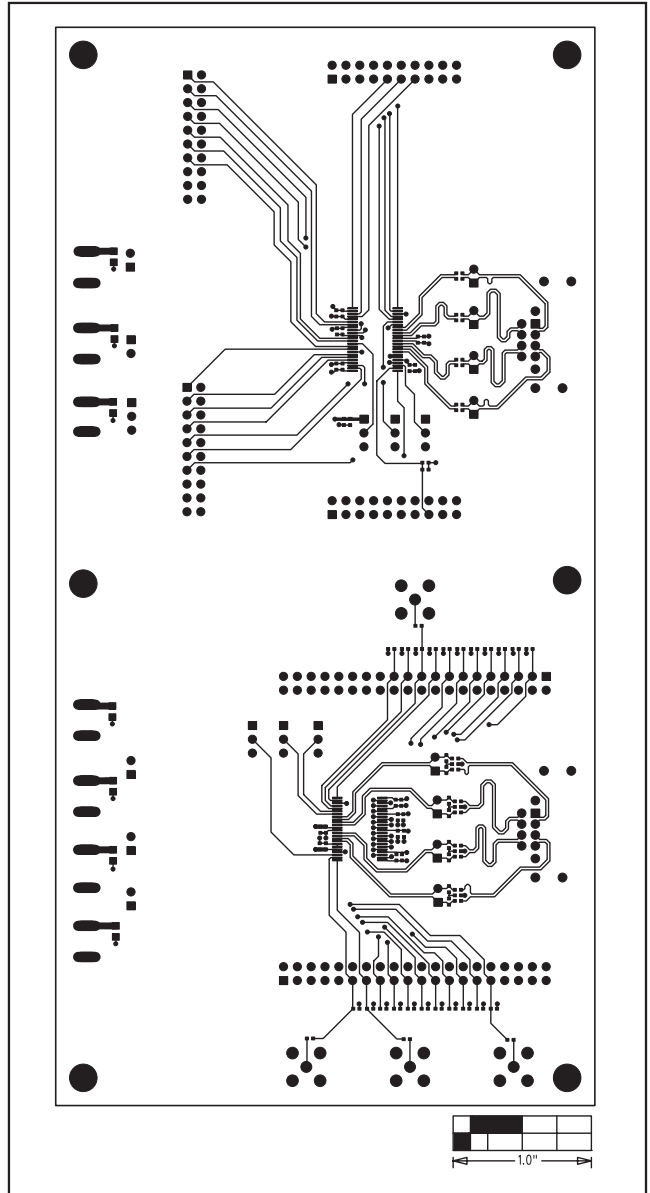


Figure 3. MAX9209/MAX9244 EV Kit PCB Layout—Component Side



# MAX9209/MAX9244 Evaluation Kit

Evaluates: MAX9209/MAX9244

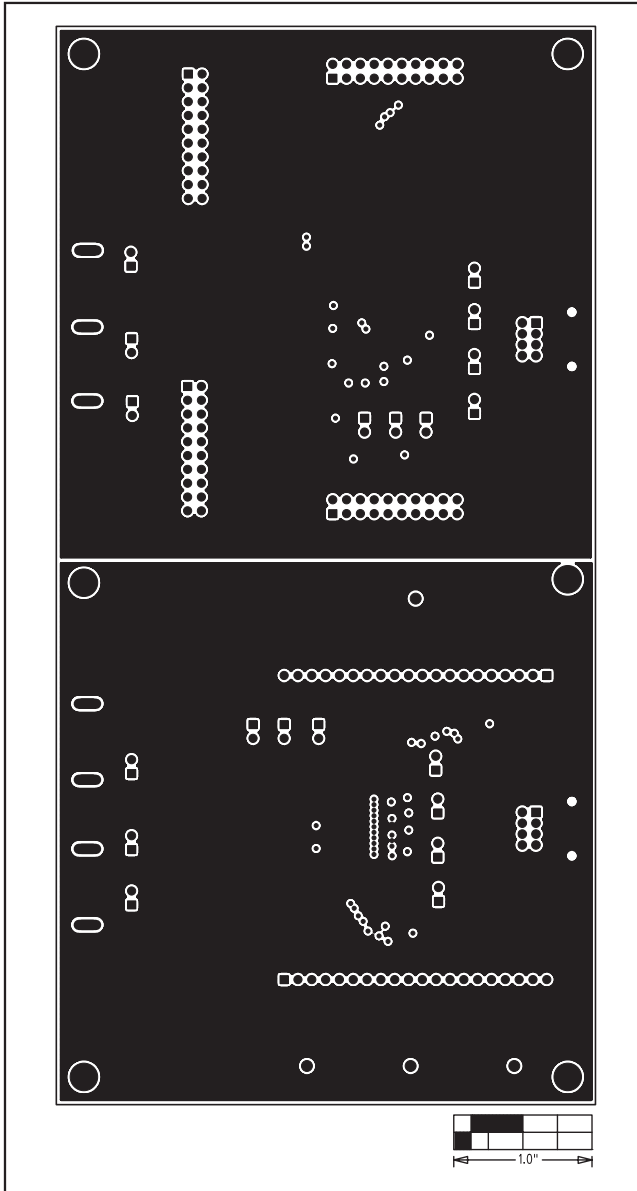


Figure 4. MAX9209/MAX9244 EV Kit PCB Layout—Inner Layer 2

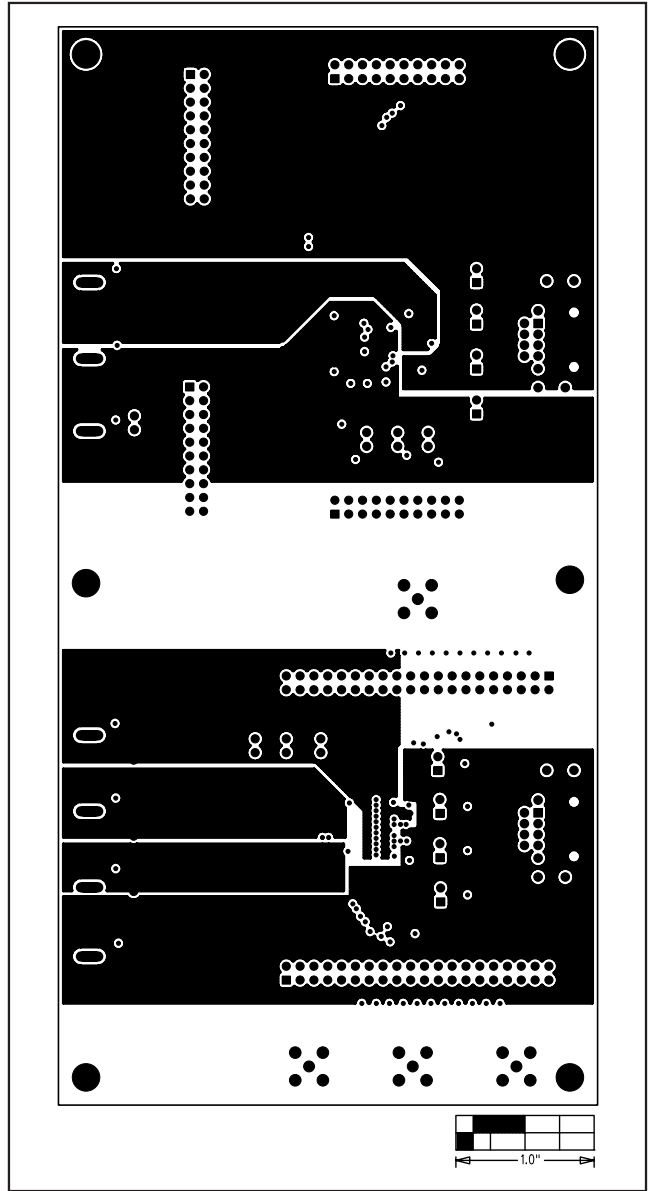


Figure 5. MAX9209/MAX9244 EV Kit PCB Layout—Inner Layer 3

# MAX9209/MAX9244 Evaluation Kit

Evaluates: MAX9209/MAX9244

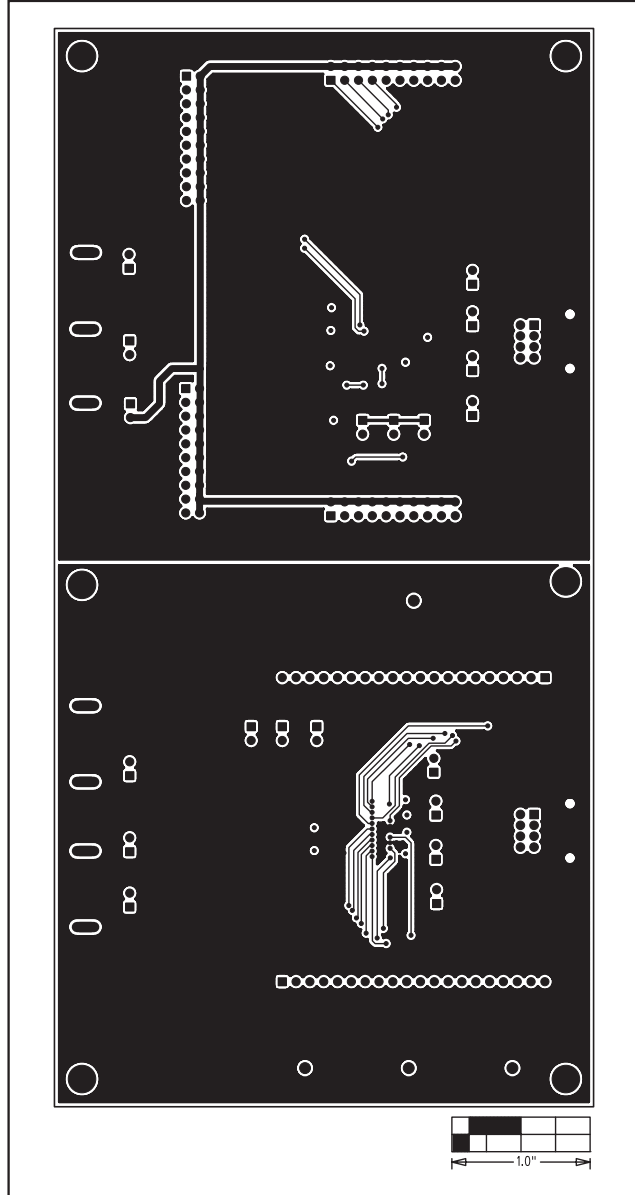


Figure 6. MAX9209/MAX9244 EV Kit PCB Layout—Solder Side

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