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MAX9911 Evaluation Kit

General Description

The MAX9911 evaluation kit (EV kit) provides a proven design to evaluate the MAX9911 low-power, MOS-input operational amplifier (op amp) in a 6-pin wafer-level package (WLP). The EV kit circuit is preconfigured as a noninverting amplifier, but can easily be adapted to other topologies by changing a few components. Low power, low-input V_{OS} , and rail-to-rail input/output stages make this device ideal for a variety of measurement applications. The component pads accommodate 0805 packages, making them easy to solder and replace. The EV kit comes with a MAX9911EWT+ installed.

Features

- ◆ 1.8V to 5.5V Supply Voltage Range
- ◆ Accommodates Multiple Op-Amp Configurations
- ◆ Component Pads Allow for Sallen-Key Filter
- ◆ Rail-to-Rail Inputs/Outputs
- ◆ Accommodates Easy-to-Use 0805 Components
- ◆ Proven PCB Layout
- ◆ Fully Assembled and Tested

Ordering Information

PART	TYPE
MAX9911EVKIT+	EV Kit

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

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	0.1 μ F \pm 10%, 16V X7R ceramic capacitor (0603) Murata GRM188R71C104K
C2	1	4.7 μ F \pm 10%, 6.3V X5R ceramic capacitor (0603) Murata GRM188R60J475K
C3, C4, C8, C9	0	Not installed, ceramic capacitors (0805)
JU1	1	2-pin header
JU2	1	3-pin header

DESIGNATION	QTY	DESCRIPTION
R1, R2	2	1k Ω \pm 1% resistors (0805)
R5	1	10k Ω \pm 1% resistor (0805)
R6, R8	2	0 Ω \pm 5% resistors (0805)
U1	1	Single low-power, rail-to-rail I/O op amp (6 WLP) Maxim MAX9911EWT+
—	2	Shunts
—	1	PCB: MAX9911 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 MAX9911 when contacting this component supplier.

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Quick Start

Required Equipment

- MAX9911 EV kit
- +5V, 10mA DC power supply (PS1)
- Precision voltage source
- Digital multimeter (DMM)

Procedure

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

- 1) Verify that jumpers are in their default positions, as shown in Table 1.
- 2) Connect the positive terminal of the +5V supply to the VDD PCB pad and the negative terminal to the GND PCB pad closest to VDD.
- 3) Connect the positive terminal of the precision voltage source to the IN+ PCB pad. Connect the negative terminal of the precision voltage source to GND (GND or IN- PCB pads).
- 4) Connect the DMM to monitor the voltage on the OUT PCB pad. With the 10kΩ feedback resistor (R5) and 1kΩ series resistor (R1), the gain is +11 (noninverting configuration).
- 5) Turn on the +5V power supply.
- 6) Apply 100mV from the precision voltage source. Observe the output at OUT on the DMM. OUT should read approximately +1.1V.
- 7) Apply 400mV from the precision voltage source. OUT should read approximately +4.4V.

Table 1. Jumper Descriptions (JU1, JU2)

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	Installed*	Connects the IN- PCB pad to GND.
	Open	Isolates the IN- PCB pad from GND.
JU2	1-2*	Connects $\overline{\text{SHDN}}$ to VDD (normal operation).
	2-3	Connects $\overline{\text{SHDN}}$ to GND (shutdown).

*Default position.

Detailed Description of Hardware

The MAX9911 EV kit provides a proven layout for the MAX9911 low-power, MOS-input op amp. The device is a single-supply op amp that is ideal for buffering sensor signals. The Sallen-Key topology is easily accomplished by changing and removing some components. The Sallen-Key topology is ideal for buffering and filtering sensor signals.

Op-Amp Configurations

The device is a single-supply op amp that is ideal for differential sensing, noninverting amplification, buffering, and filtering. A few common configurations are detailed in the next few sections.

Noninverting Configuration

The EV kit comes preconfigured as a noninverting amplifier. The gain is set by the ratio of R5/R1. The EV kit comes preconfigured for a gain of +11. For a voltage applied to the IN+ PCB pad, the output voltage for the noninverting configuration is given by the equation below:

$$V_{\text{OUT}} = \left(1 + \frac{R_5}{R_1}\right)(V_{\text{IN}+} + V_{\text{OS}})$$

where V_{OS} = input-referred offset voltage.

Differential Amplifier

To configure the EV kit as a differential amplifier, replace R1, R2, RC3, and R5 with appropriate resistors. When R1 = R2 and RC3 = R5, the CMRR of the differential amplifier is determined by the matching of the resistor ratios R1/R2 and RC3/R5:

$$V_{\text{OUT}} = \text{Gain}(V_{\text{IN}+} - V_{\text{IN}-}) + \left(1 + \frac{R_5}{R_1}\right)V_{\text{OS}}$$

where:

$$\text{Gain} = \frac{R_5}{R_1} = \frac{R_{C3}}{R_2}$$

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Sallen-Key Configuration

The Sallen-Key topology is ideal for filtering sensor signals with a 2nd-order filter and acting as a buffer. Schematic complexity is reduced by combining the filter and buffer operations. The EV kit can be configured in a Sallen-Key topology by replacing and populating a few components. The Sallen-Key topology is typically configured as a unity-gain buffer, which can be done by replacing R1 and R5 with 0Ω resistors. The signal is noninverting and applied to IN+. The filter component pads are R2, R3, R4, and R8, where some have to be populated with resistors and others with capacitors.

Lowpass Sallen-Key Filter

To configure the Sallen-Key as a lowpass filter, populate the R2 and R8 pads with resistors and the C3 and C4 pads with capacitors. The corner frequency and Q are then given by:

$$f_C = \frac{1}{2\pi\sqrt{R2 \times C3 \times R8 \times C4}}$$
$$Q = \frac{\sqrt{R2 \times C3 \times R8 \times C4}}{C4(R2 + R8)}$$

Highpass Sallen-Key Filter

To configure the Sallen-Key as a highpass filter, populate the C3 and C4 pads with resistors and the R2 and R8 pads with capacitors. The corner frequency and Q are then given by:

$$f_C = \frac{1}{2\pi\sqrt{C_{R8} \times R_{C4} \times C_{R2} \times R_{C3}}}$$
$$Q = \frac{\sqrt{C_{R8} \times R_{C4} \times C_{R2} \times R_{C3}}}{R_{R3}(C_{R2} + C_{R8})}$$

Capacitive Loads

Some applications require driving large capacitive loads. To improve the stability of the amplifier in such cases, replace R6 with a suitable resistor value to improve amplifier phase margin in the presence of the capacitive load (C9), or apply a resistive load in parallel with C9.

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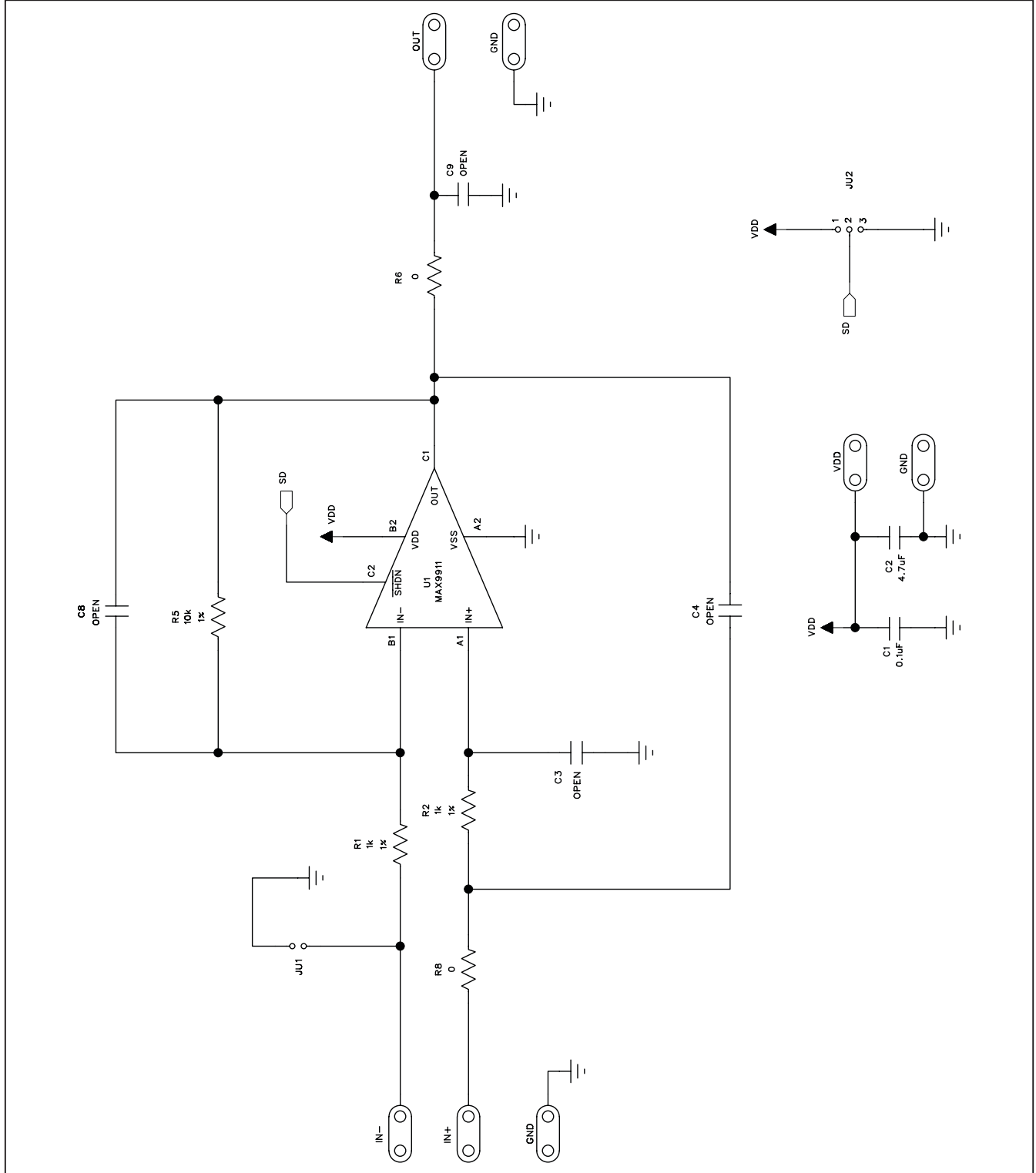


Figure 1. MAX9911 EV Kit Schematic

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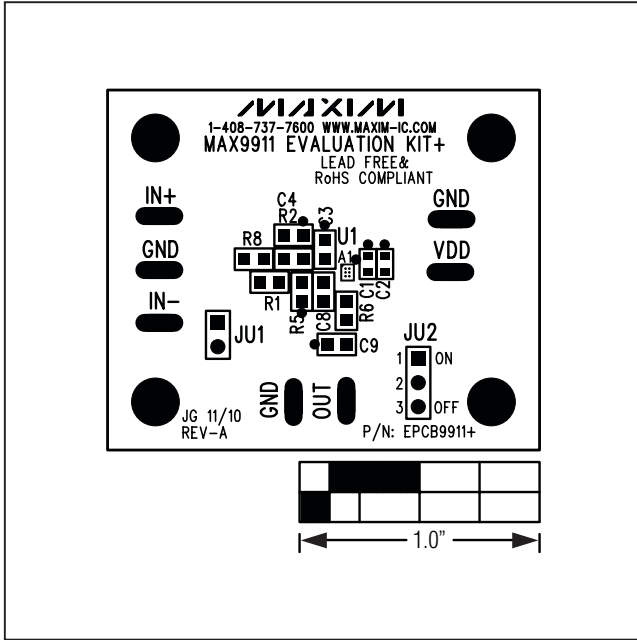


Figure 2. MAX9911 EV Kit Component Placement Guide—Component Side

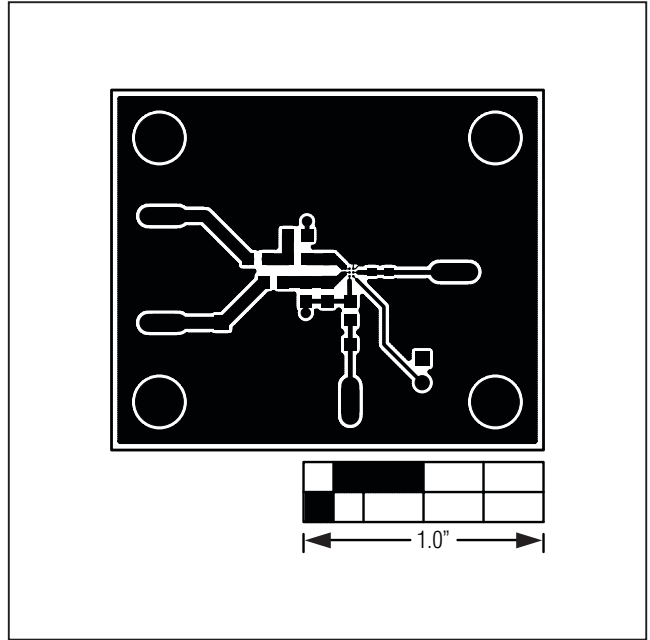


Figure 3. MAX9911 EV Kit PCB Layout—Component Side

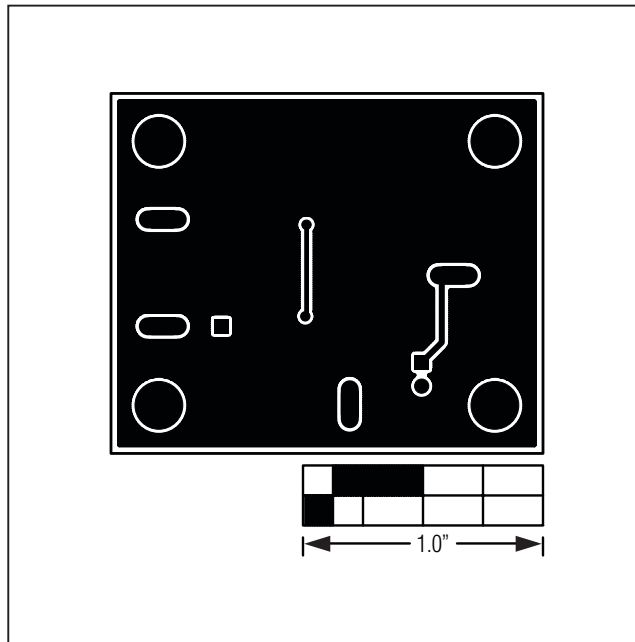


Figure 4. MAX9911 EV Kit PCB Layout—Solder Side

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Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	1/11	Initial release	—

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