19-5734; Rev 0; 1/11

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	0.1µF ±10%, 16V X7R ceramic capacitor (0603) Murata GRM188R71C104K
C2	1	4.7µF ±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
R1, R2	2	1kΩ ±1% resistors (0805)
R5	1	10kΩ ±1% resistor (0805)
R6, R8	2	0Ω ±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.*

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 $\overline{SHDN}$ to VDD (normal operation).
	2-3	Connects $\overline{SHDN}$ 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:

$$V_{OUT} = (1 + \frac{R5}{R1})(V_{IN+} V_{OS})$$

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

Differential Amplifier

To configure the EV kit as a differential amplifier, replace R1, R2, R_{C3}, and R5 with appropriate resistors. When R1 = R2 and R_{C3} = R5, the CMRR of the differential amplifier is determined by the matching of the resistor ratios R1/R2 and R_{C3}/R5:

$$V_{OUT} = Gain(V_{IN+} - V_{IN-}) + (1 + \frac{R5}{R1})V_{OS}$$

where:

$$Gain = \frac{R5}{R1} = \frac{R_{C3}}{R2}$$

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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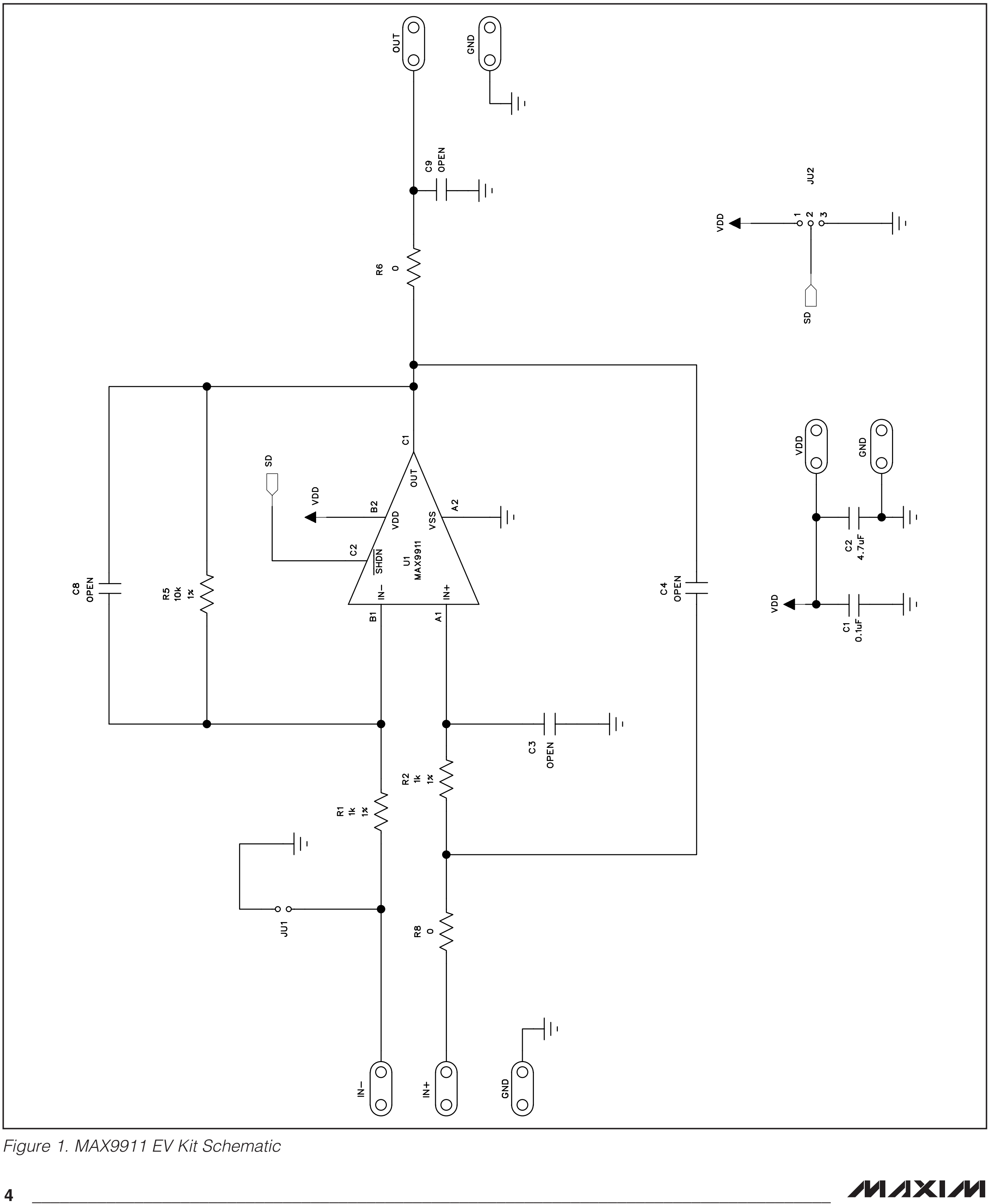

Figure 1. MAX9911 EV Kit Schematic

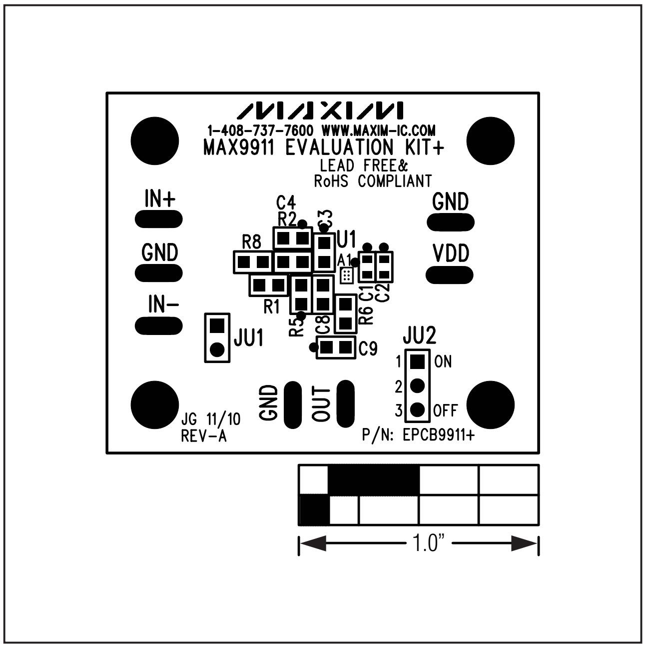

Figure 2. MAX9911 EV Kit Component Placement Guide—Component Side

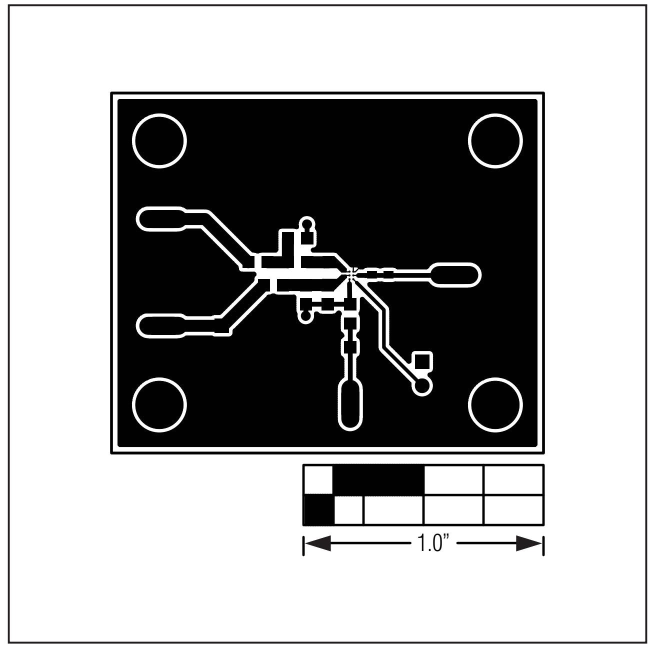

Figure 3. MAX9911 EV Kit PCB Layout—Component Side

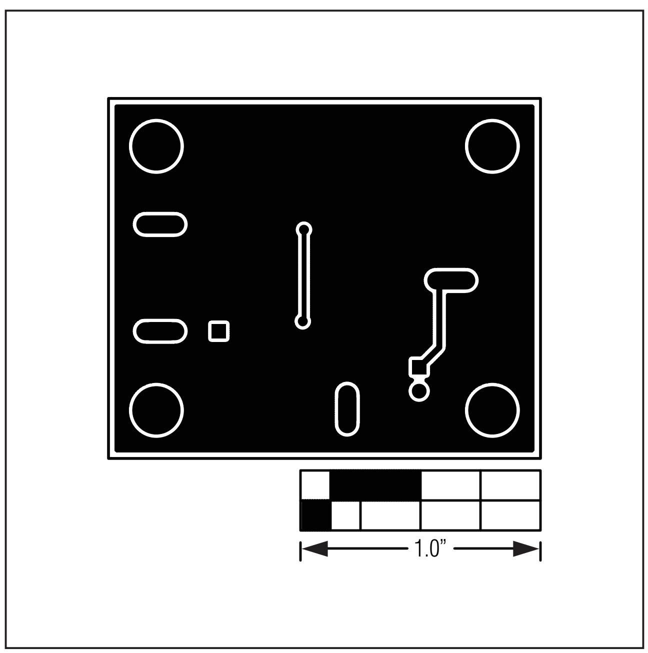

Figure 4. MAX9911 EV Kit PCB Layout—Solder Side

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Revision History

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