19-5186; Rev 0; 3/10

# MAX9618 Evaluation Kit



## General Description

The MAX9618 evaluation kit (EV kit) provides a proven design to evaluate the MAX9618 dual low-power, zero-drift operational amplifiers (op amps) in an 8-pin SC70 package. The EV kit circuit is preconfigured as noninverting amplifiers, but can be adapted to other topologies by changing a few components. Low power, zero drift, input offset voltage, and rail-to-rail input/output stages make this device ideal for a variety of low-frequency measurement applications. The component pads accommodate 0805 packages, making them easy to solder and replace. The MAX9618 EV kit comes with a MAX9618AXA+ installed.

## Features

- ♦ **Accommodates Multiple Op-Amp Configurations**
- ♦ **Component Pads Allow for Sallen-Key Filter**
- ♦ **Rail-to-Rail Inputs/Outputs**
- ♦ **Accomodates Easy-to-Use 0805 Components**
- ♦ **Proven PCB Layout**
- ♦ **Fully Assembled and Tested**

## Ordering Information

| PART | TYPE |
|---|---|
| MAX9618EVKIT+ | EV Kit |

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

## Component List

| DESIGNATION | QTY | DESCRIPTION |
|---|---|---|
| C1, C3 | 2 | 0.1µF ±10%, 25V X7R ceramic capacitors (0805) Murata GRM21BR71E104K |
| C2, C4 | 2 | 4.7µF ±10%, 25V X5R ceramic capacitors (0805) Murata GRM21BR61E475K |
| C5–C10, C15–C20 | 0 | Not installed, ceramic capacitors (0805) |
| JU1, JU2, JU4, JU11, JU12, JU14 | 6 | 2-pin headers, 0.1in centers |
| JU3, JU13 | 2 | 3-pin headers, 0.1in centers |
| R1, R2, R11, R12 | 4 | 1kΩ ±1% resistors (0805) |
| R3, R4, R7, R13, R14, R17 | 0 | Not installed, resistors (0805) |
| R5, R15 | 2 | 10kΩ ±1% resistors (0805) |
| R6, R8, R16, R18 | 4 | 0Ω ±5% resistors (0805) |
| TP1, TP2 | 0 | Not installed, miniature test points |
| U1 | 1 | Dual low-power, rail-to-rail I/O op amp (8 SC70) Maxim MAX9618AXA+ |
| — | 10 | Shunts |
| — | 1 | PCB: MAX9618 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 MAX9618 when contacting this component supplier.*

# MAX9618 Evaluation Kit

## Quick Start

### Required Equipment

- MAX9618 EV kit
- +5V, 10mA DC power supply (PS1)
- Two precision voltage sources
- Two digital multimeters (DMMs)

### Procedure

The MAX9618 EV kit is fully assembled and tested. Follow the steps below to verify board operation:

1) Verify that the jumpers are in their default position, as shown in Table 1.
2) Connect the positive terminal of the +5V supply to VDD and the negative terminal to GND and VSS.
3) Connect the positive terminal of the precision voltage source to INAP. Connect the negative terminal of the precision voltage source to GND.
4) Connect INAM to GND.
5) Connect the positive terminal of the second precision voltage source to the INBP pad. Connect the negative terminal of the precision voltage source to GND.
6) Connect INBM to GND.
5) Connect the DMMs to monitor the voltages on OUTA and OUTB. With the 10kΩ feedback resistors and 1kΩ series resistors, the gain of each noninverting amplifier is +11.
8) Turn on the +5V power supply.
9) Apply 100mV from the precision voltage sources. Observe the output at OUTA and OUTB on the DMMs. Both should read approximately +1.1V.
10) Apply 400mV from the precision voltage sources. Both OUTA and OUTB should read approximately +4.4V.

## Table 1. Jumper Descriptions

| JUMPER | SHUNT POSITION | DESCRIPTION |
|---|---|---|
| JU1 | 1-2* | Connects INAM to R1. Also shorts capacitor C5. |
| | Open | Connects INAM to R1 through capacitor C5. When AC-coupling is desired, remove the shunt and install capacitor C5. |
| JU2 | 1-2* | Connects INAP to JU3 position 1. Also shorts capacitor C6. |
| | Open | Connects INAP to JU3 position 1 through capacitor C6. When AC-coupling is desired, remove the shunt and install capacitor C6. |
| JU3 | 1-2* | Connects INAP to JU2 and C6 through R2 and R8 |
| | 2-3 | Connects INAP to GND through R2 and R8 |
| JU4 | 1-2* | Connects OUTA to OUTA |
| | Open | Connects OUTA to OUTA through capacitor C10. When AC-coupling is desired, remove the shunt and install capacitor C10. |
| JU11 | 1-2* | Connects INBM to R11. Also shorts capacitor C15. |
| | 2-3 | Connects INBM to R11 through capacitor C15. When AC-coupling is desired, remove the shunt and install capacitor C15. |
| JU12 | 1-2* | Connects INBP to JU13 position 1. Also shorts capacitor C16. |
| | Open | Connects INBP to JU13 position 1 through capacitor C16. When AC-coupling is desired, remove the shunt and install capacitor C16. |
| JU13 | 1-2* | Connects INBP to JU12 and C16 through R12 and R18 |
| | 2-3 | Connects INBP to GND through R12 and R18 |
| JU14 | 1-2* | Connects OUTB (U1, pin 1) to OUTB |
| | Open | Connects OUTB (U1, pin 1) to OUTB through capacitor C20. When AC-coupling is desired, remove the shunt and install capacitor C20. |

**Default position.*

## Detailed Description of Hardware

The MAX9618 EV kit provides a proven layout for the MAX9618 low-power, zero-drift dual operational amplifier (op amp). The MAX9618 is a single-supply dual op amp (op-amp A and op-amp B) that is ideal for buffering low-frequency sensor signals. The Sallen-Key topology is easily accomplished by changing and removing a few components. The Sallen-Key topology is ideal for buffering and filtering sensor signals. Various test points are included for easy evaluation.

The MAX9618 is a single-supply dual op amp whose primary application is operating in the noninverting configuration; however, the MAX9618 can operate with a dual supply as long as the voltage across the VDD and GND pins of the IC do not exceed the absolute maximum ratings. When operating with a single supply, short VSS to GND.

### Op-Amp Configurations

The MAX9618 is a single-supply dual op amp that is ideal for differential sensing, noninverting amplification, buffering, and filtering. A few common configurations are shown in the next few sections.

The following sections explain how to configure one of the device's op amps (op-amp A). To configure the device's second op amp (op-amp B), the same equations can be used after modifying the component reference designators. For op-amp B, the equations should be modified by adding 10 to the number portion of the reference designators (e.g., for the noninverting configuration, equation R1 becomes R11 and R5 becomes R15).

### Noninverting Configuration

The MAX9618 EV kit comes preconfigured as a noninverting amplifier. The gain is set by the ratio of R5 and R1. The MAX9618 EV kit comes preconfigured for a gain of 11. The output voltage for the noninverting configuration is given by the equation below:

$$V_{OUTA} = (1 + \frac{R5}{R1})\ V_{INAP}$$

### Differential Amplifier

To configure the MAX9618 EV kit as a differential amplifier, replace R1, R2, R3, and R5 with appropriate resistors. When R1 = R2 and R3 = R5, the CMRR of the differential amplifier is determined by the matching of the resistor ratios R1/R2 and R3/R5.

$$V_{OUTA} = GAIN\ (V_{INAP} - V_{INAM})$$

where:

$$GAIN = \frac{R5}{R1} = \frac{R3}{R2}$$

### Sallen-Key Configuration

The Sallen-Key topology is ideal for filtering sensor signals with a second-order filter and acting as a buffer. Schematic complexity is reduced by combining the filter and buffer operations. The MAX9618 EV kit can be configured in a Sallen-Key topology by replacing and populating a few components. The Sallen-Key topology can be configured as a unity-gain buffer by replacing R1 and R5 with 0Ω resistors. The signal is noninverting and applied to INAP. 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 populate the R3 and R4 pads with capacitors. The corner frequency and Q are then given by:

$$f_C = \frac{1}{2\pi\sqrt{R_{R2} R_{R8} C_{R3} C_{R4}}}$$

$$Q = \frac{\sqrt{R_{R2} R_{R8} C_{R3} C_{R4}}}{C_{R4}(R_{R2} + R_{R8})}$$

**Highpass Sallen-Key Filter:** To configure the Sallen-Key as a highpass filter, populate the R3 and R4 pads with resistors and populate the R2 and R8 pads with capacitors. The corner frequency and Q are then given by:

$$f_C = \frac{1}{2\pi\sqrt{R_{R3} R_{R4} C_{R2} C_{R8}}}$$

$$Q = \frac{\sqrt{R_{R3} R_{R4} C_{R2} C_{R8}}}{R_{R3}(C_{R2} + C_{R8})}$$

### 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.

# MAX9618 Evaluation Kit

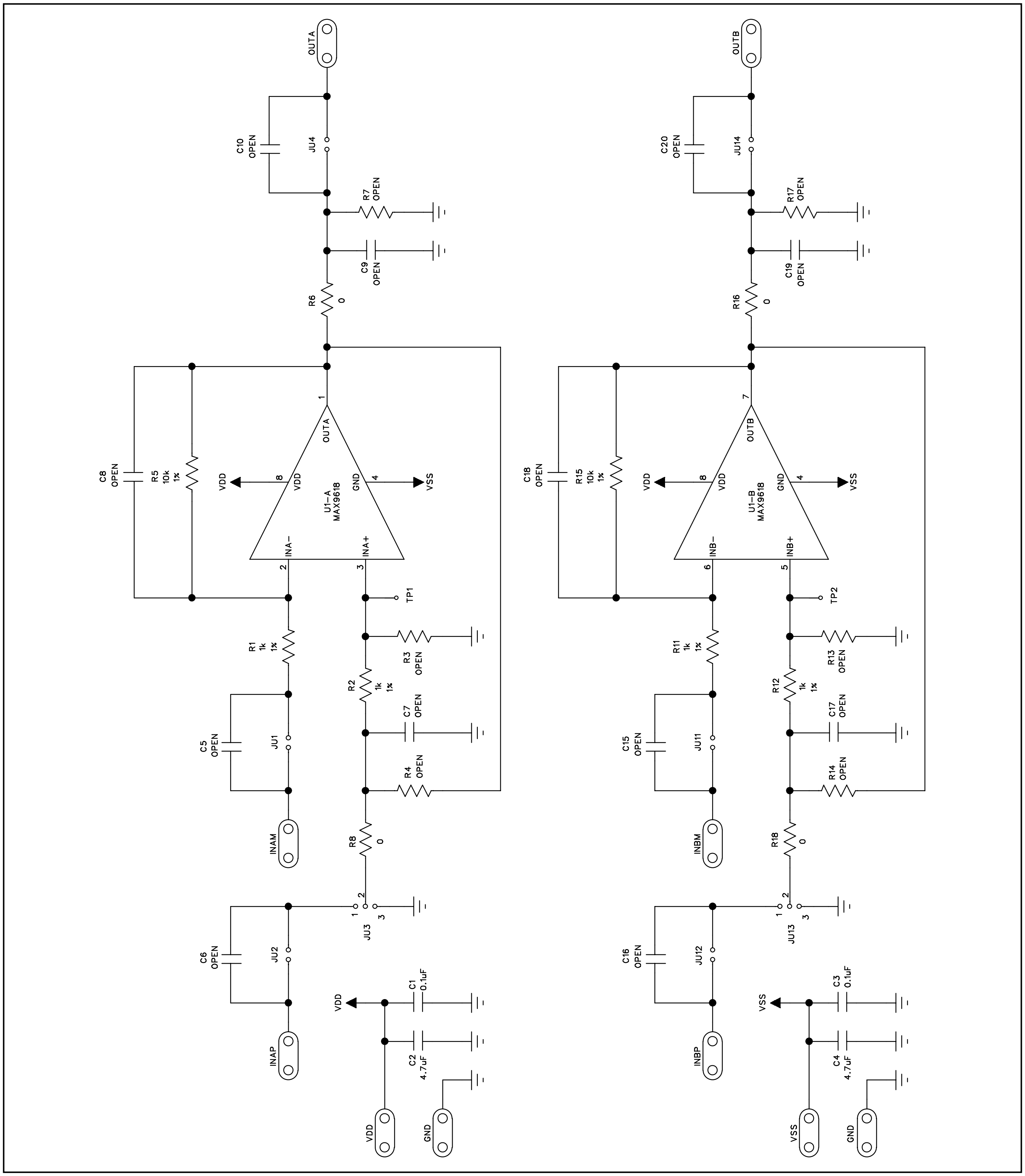


*Figure 1. MAX9618 EV Kit Schematic*

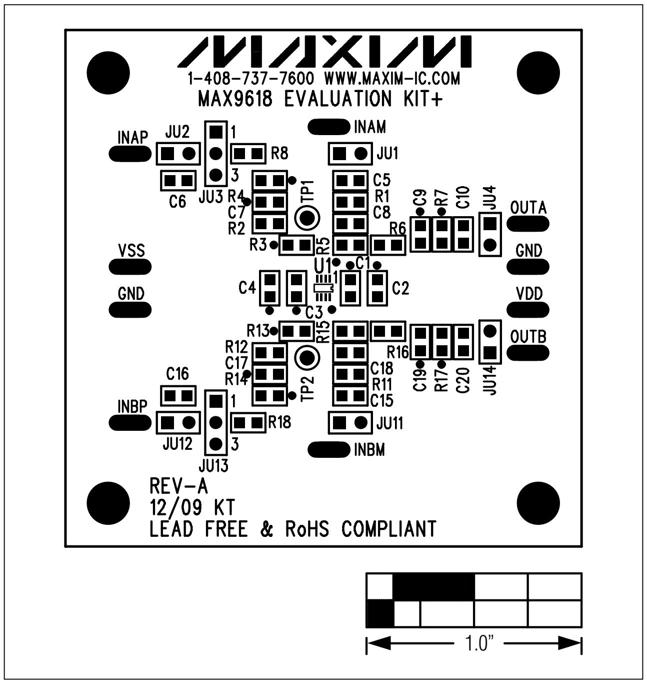


*Figure 2. MAX9618 EV Kit Component Placement Guide—Component Side*

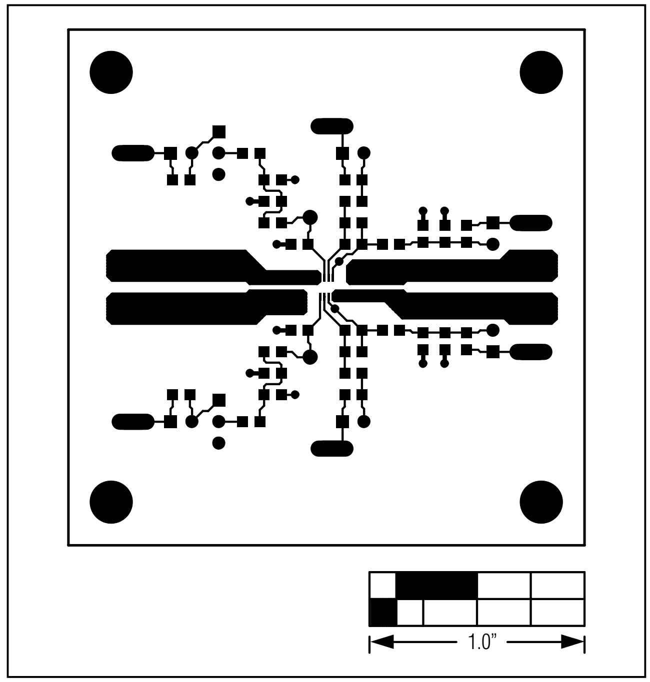


*Figure 3. MAX9618 EV Kit PCB Layout—Component Side*

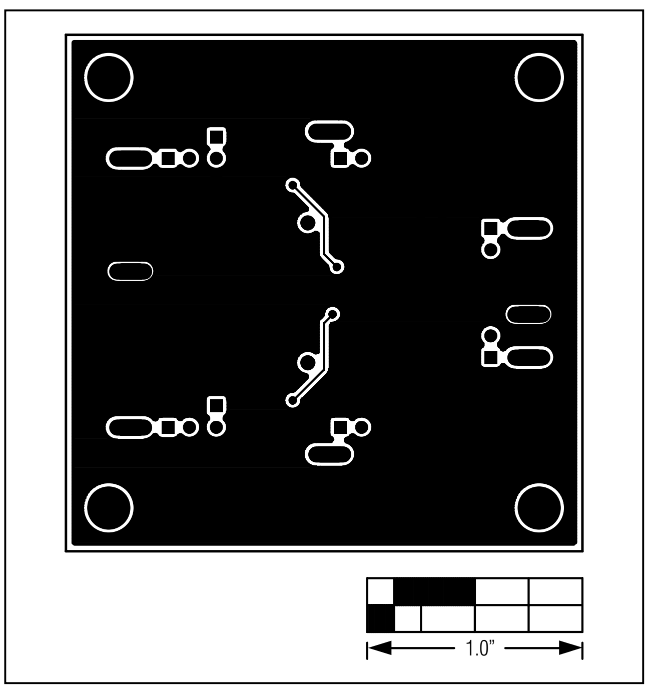


*Figure 4. MAX9618 EV Kit PCB Layout—Solder Side*