MAX44248 Evaluation Kit

Evaluates: MAX44248

General Description

The MAX44248 evaluation kit (EV kit) provides a proven design to evaluate the MAX44248 low-power, dual op amps in an 8-pin µMAX® package. The EV kit circuit is preconfigured as noninverting amplifiers, but can be adapted to other topologies by changing a few components. The component pads use a 0805 package, making them easy to solder and replace. The EV kit comes with a MAX44248AUA+ installed.

Features

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

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

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C10	2	0.1µF ±10%, 50V X7R ceramic capacitors (0805) Murata GRM21BR71H104K
C2, C20	2	4.7µF ±10%, 50V X7R ceramic capacitors (1210) Murata GRM32ER71H475K
C3–C9, C13–C19	0	Not installed, ceramic capacitors (0805) C3, C4, C9, C13, C14, C19 are short (PC trace); C5–C8, C15–C18 are open
GND	6	Black test points
INAN, INAP, INBN, INBP, OUTA, OUTB	6	White test points
JU1–JU5	5	2-pin headers
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	36V, ultra-precision, low-power, dual op amps (8 µMAX) Maxim MAX44248AUA+
VDD, VSS	2	Red test points
—	5	Shunts
—	1	PCB: MAX44248 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 MAX44248 when contacting this component supplier.*

Quick Start

Required Equipment

- MAX44248 EV kit
- +5V, 10mA DC power supply (PS1)
- Two precision voltage sources
- Two digital multimeters (DMMs)

Procedure

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

1) Verify that all jumpers (JU1–JU5) are in their default positions, as shown in Table 1.
2) Connect the positive terminal of the +5V supply to VDD and the negative terminal to GND.
3) Connect the positive terminal of the precision voltage source to INAP. Connect the negative terminal of the precision voltage source to GND. INAN is already connected to GND through jumper JU1.
4) Connect the positive terminal of the second precision voltage source to INBP. Connect the negative terminal of the precision voltage source to GND. INBN is already connected to GND through jumper JU3
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.
6) Turn on the +5V power supply.
7) Apply 100mV from the precision voltage sources. Observe the output at OUTA and OUTB on the DMMs. Both should read approximately +1.1V.
8) Apply 400mV from the precision voltage sources. Both OUTA and OUTB should read approximately +4.4V.

Note: For dual-supply operation, ±2.7V to ±18V can be applied to VDD and VSS, respectively. In this case, remove the shunt on jumper JU5. The rest of the procedure remains the same as that of the single-supply operation.

Detailed Description of Hardware

The MAX44248 EV kit provides a proven layout for the MAX44248 low-power, dual op amps. The IC is a single-/dual-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 default configuration for the IC in the EV kit is single-supply operation in a noninverting configuration; however, the IC can operate with a dual supply as long as the voltage across the VDD and VSS pins on the IC does not exceed the absolute maximum ratings. When operating with a single supply, short VSS to GND using jumper JU5.

Op-Amp Configurations

The IC is a single-/dual-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 EV kit comes preconfigured as a noninverting amplifier. The gain is set by the ratio of R5 and R1. The EV kit comes preconfigured for a gain of 11. The output voltage for the noninverting configuration is given in the following equation:

$$V_{OUTA} = \left(1 + \frac{R5}{R1}\right)\left[V_{INAP} + V_{OS}\right]$$

Table 1. Jumper Descriptions (JU1–JU5)

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	Pin 1	Disconnects INAN from GND.
	1-2*	Connects INA- to GND through R1 for noninverting configuration.
JU2	Pin 1*	Disconnects INAP from GND.
	1-2	Connects INA+ to GND through R2.
JU3	Pin 1	Disconnects INBN from GND.
	1-2*	Connects INB- to GND through R11 for noninverting configuration.
JU4	Pin 1*	Disconnects INBP from GND.
	1-2	Connects INB+ to GND through R12.
JU5	Pin 1	Disconnects VSS from GND for dual-supply operation.
	1-2*	Connects VSS to GND for single-supply operation.

*Default position.

Inverting Configuration

To configure the EV kit as an inverting amplifier, remove the short on jumper JU1 (default position), install a shunt on jumper JU2, and feed an input signal on the INAN test point.

Differential Amplifier

To configure the 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.

$$V_{OUTA} = GAIN(V_{INAP} - V_{INAN})$$

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 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 R5 with a 0Ω resistor and removing R1. The signal is noninverting and is 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, remove jumper JU1, 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:

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

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

Highpass Sallen-Key Filter: To configure the Sallen-Key as a highpass filter, remove jumper JU1, 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:

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

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

Bandpass Sallen-Key Filter: To configure the Sallen-Key as a bandpass filter, remove jumper JU1, replace R8, populate the R3 and R4 pads with resistors, and populate the C8 and R2 pads with capacitors. The corner frequency and Q are then given by:

$$f_C = \frac{1}{2\pi}\sqrt{\frac{R_{R4} + R_{R8}}{C_{C8}C_{R2}R_{R8}R_{R3}R_{R4}}}$$

$$Q = \frac{\sqrt{(R_{R4} + R_{R8})C_{C8}C_{R2}R_{R8}R_{R3}R_{R4}}}{R_{R4}R_{R8}(C_{C8} + C_{R2}) + R_{R3}C_{R2}\left(R_{R4} - \frac{R_{R5}}{R_{R1}}R_{R8}\right)}$$

Transimpedance Amplifier

To configure the EV kit as a transimpedance amplifier (TIA), short jumper JU2 and replace R1 and R2 with a 0Ω resistors. The output voltage of the TIA is the input current multiplied by the feedback resistor:

$$V_{OUT} = (I_{IN} + I_{BIAS}) \times R_{R5} + V_{OS}$$

where:

I_{IN} is the input current source applied at the INAP test point

I_{BIAS} is the input bias current

V_{OS} is the input offset voltage of the op amp

Use capacitor C6 (and C7, if applicable) to stabilize the op amp by rolling off high-frequency gain due to a large cable capacitance.

Capacitive Loads

Some applications require driving large capacitive loads. The EV kit provides C7 and R6 pads for an optional capacitive-load driving circuit. C7 simulates the capacitive load while R6 acts as an isolation resistor to improve the op amp's stability at higher capacitive loads. To improve the stability of the amplifier in such cases, replace R6 with a suitable resistor value to improve amplifier phase margin.

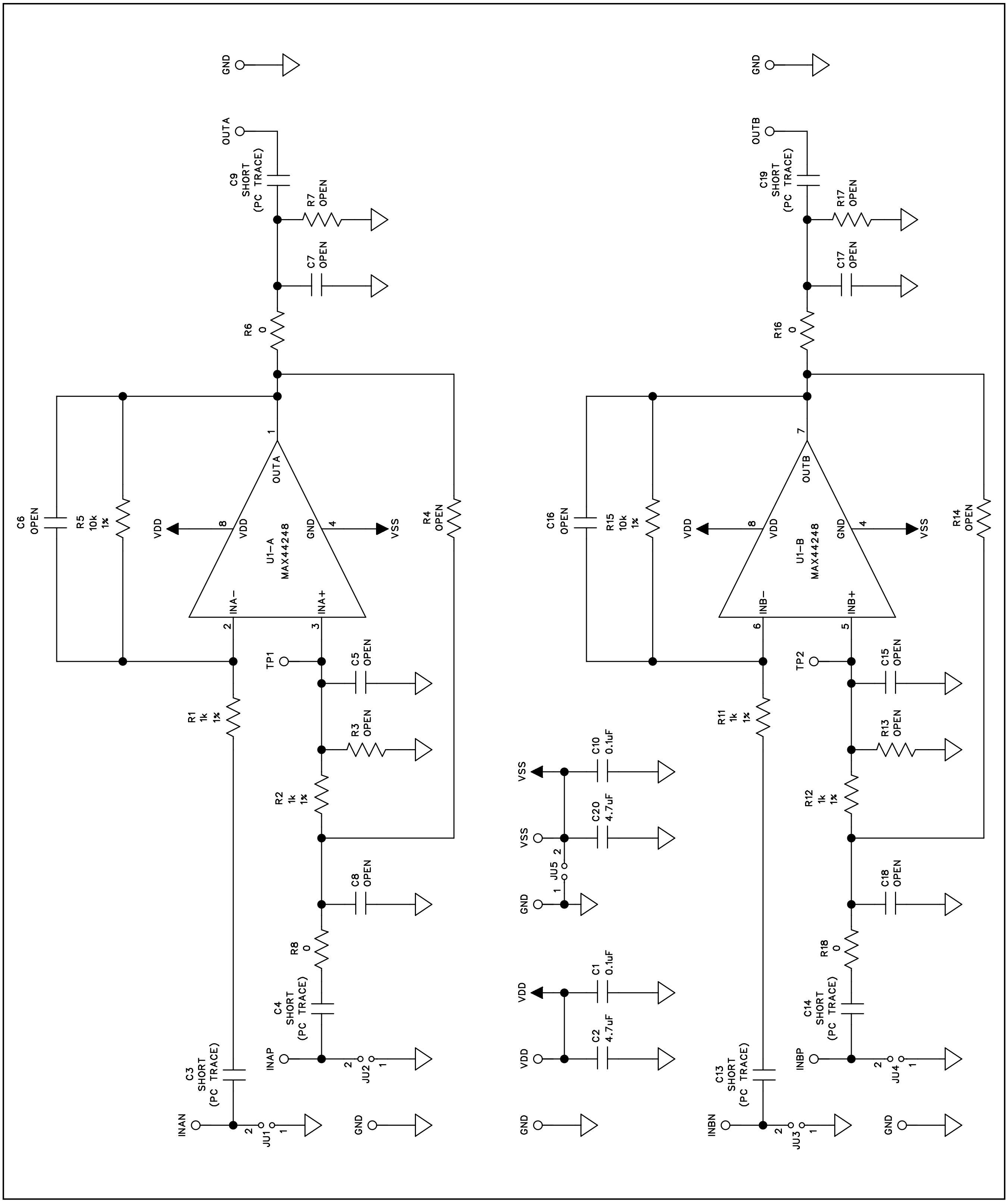

Figure 1. MAX44248 EV Kit Schematic

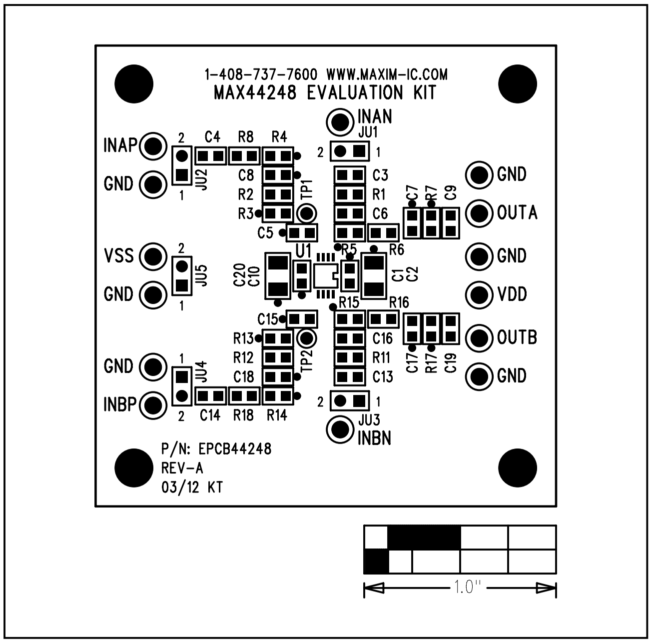

Figure 2. MAX44248 EV Kit Component Placement Guide—Component Side

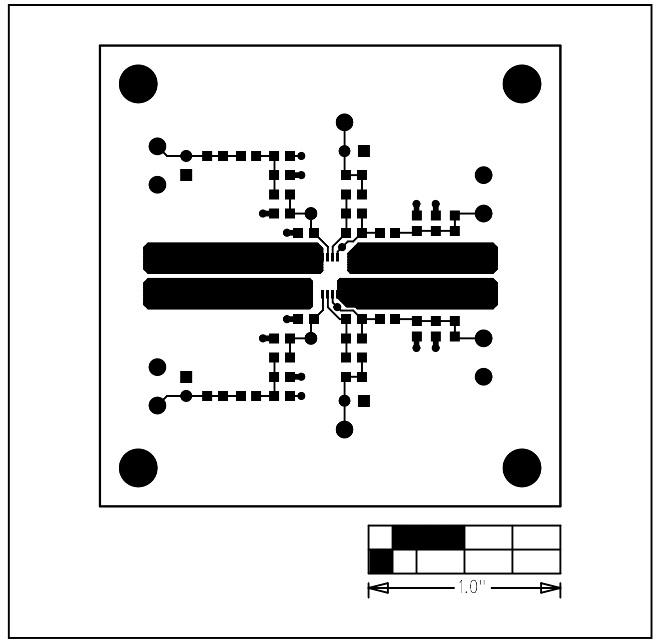

Figure 3. MAX44248 EV Kit PCB Layout—Component Side

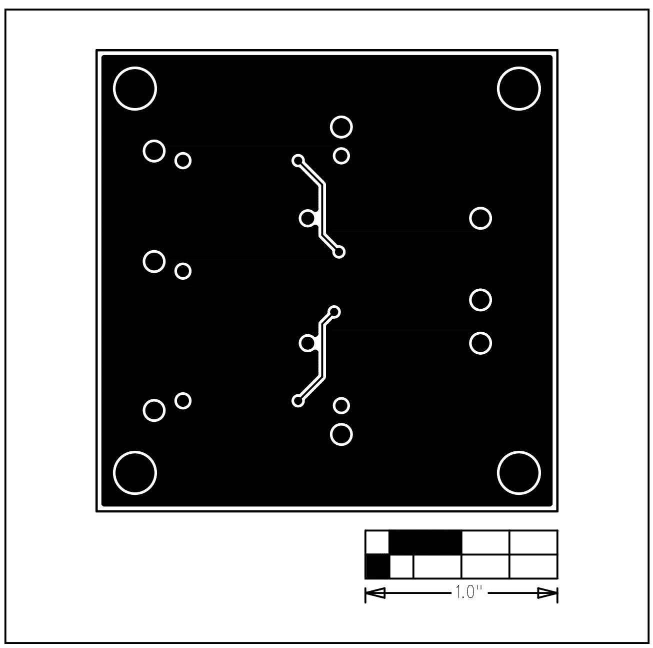

Figure 4. MAX44248 EV Kit PCB Layout—Solder Side

Ordering Information

PART	TYPE
MAX44248EVKIT#	EV Kit

#Denotes RoHS compliant.

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	8/12	Initial release	—