MAX44251 Evaluation Kit

General Description

The MAX44251 evaluation kit (EV kit) provides a proven design to evaluate the MAX44251 dual low-power, low-drift operational amplifier (op amp) in an 8-pin SOT23 package. The EV kit circuit is preconfigured as noninverting amplifiers, but can be adapted to other topologies by changing a few components. Low power, low drift, input offset voltage, and rail-to-rail input/output stages make this device ideal for applications requiring ultra-low noise and DC precision. The component pads accommodate 0805 packages, making them easy to solder and replace. The EV kit comes with a MAX44251AKA+ installed.

Features

♦ **Accommodates Multiple Op-Amp Configurations**

♦ **Rail-to-Rail Inputs/Outputs**

♦ **Accommodates Easy-to-Use 0805 Components**

♦ **2.7V to 20V Power-Supply Range**

♦ **Proven PCB Layout**

♦ **Fully Assembled and Tested**

Ordering Information

PART	TYPE
MAX44251EVKIT#	EV Kit

#Denotes 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)

DESIGNATION	QTY	DESCRIPTION
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 SOT23) Maxim MAX44251AKA+
—	8	Shunts
—	1	PCB: MAX44251 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 MAX44251 when contacting this component supplier.*

For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim's website at www.maximintegrated.com.

19-6285; Rev 0; 4/12

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Quick Start

Required Equipment

- MAX44251 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 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	Installed*	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	Installed*	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	Installed*	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	Installed*	Connects INBM to R11. Also shorts capacitor C15.
	Open	Connects INBM to R11 through capacitor C15. When AC-coupling is desired, remove the shunt and install capacitor C15.
JU12	Installed*	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	Installed*	Connects OUTB to OUTB
	Open	Connects OUTB to OUTB through capacitor C20. When AC-coupling is desired, remove the shunt and install capacitor C20.

*Default position.

_Detailed Description of Hardware

The MAX44251 EV kit provides a proven layout for the MAX44251 low-power, low-drift dual op amp. The IC is an ultra-high-precision, dual op amp with a high supply voltage range designed for load cell, medical instrumentation, and precision instrumentation applications. Various test points are included for easy evaluation.

The IC is a single-supply dual op amp whose primary application is operating in the noninverting configuration; however, the IC 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 IC 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 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 by the equation below:

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

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.

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

where:

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

Sallen-Key Filter Configuration

The Sallen-Key filter 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 is typically configured as a unity-gain buffer, which can be done by replacing R1 and R5 with 0Ω resistors and short JU2. The noninverting signal is applied to the INAP test point with JU2 short and short pins 1-2 on JU3 or do the same on the INBP PCB pad similarly. 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:

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

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

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:

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

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

Transimpedance Application

To configure op-amp U1-A as a transimpedance amplifier (TIA), replace R1 with a 0Ω resistor and install a shunt on jumper JU1 and shunt on pins 2-3 on jumper JU3. The output voltage of the TIA is the input current multiplied by the feedback resistor:

$$V_{OUT} = (I_{IN} + I_{BIAS}) \times R4 + V_{OS}$$

where R4 is installed as a 10kΩ resistor, I_{IN} is defined as the input current source applied at the INAM PCB pad, I_{BIAS} is the input bias current, and V_{OS} is the input offset voltage of the op amp. Use capacitor C8 (and C7, if applicable) to stabilize the op amp by rolling off high-frequency gain due to a large cable capacitance. Similarly, we can configure op-amp U1-B for transimpedance application.

Capacitive Loads

Some applications require driving large capacitive loads. To improve the stability of the amplifier, replace R6 (R16 for U1-B) with a suitable resistor value to improve amplifier phase margin. The R6/C9 (R16/C19 for U1-B) filter can also be used as an anti-alias filter, or to limit amplifier
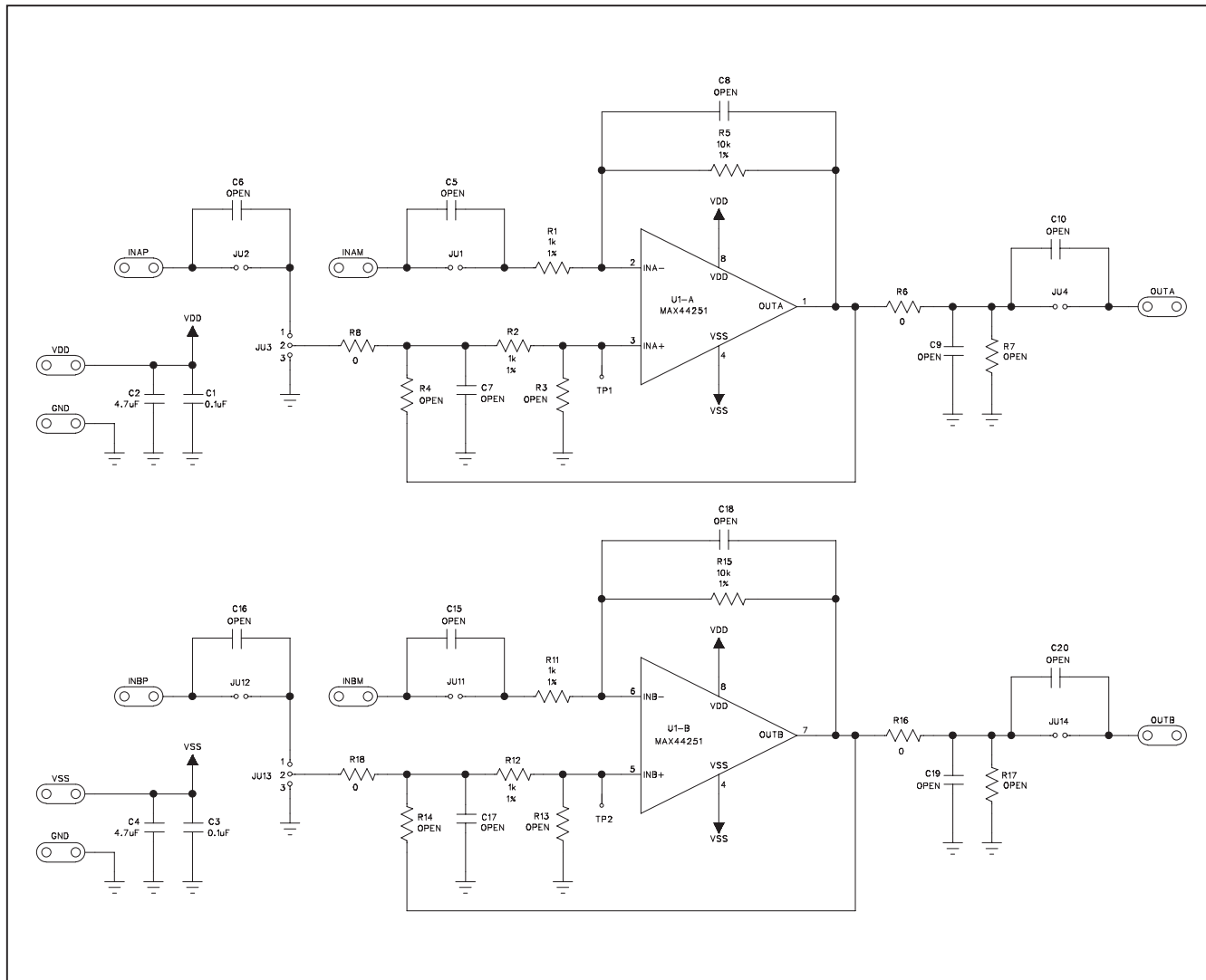
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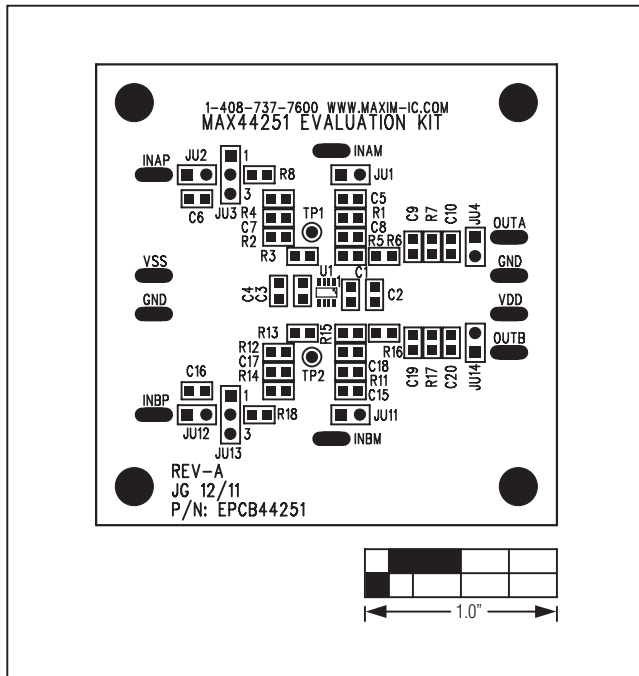Figure 1. MAX44251 EV Kit Schematic

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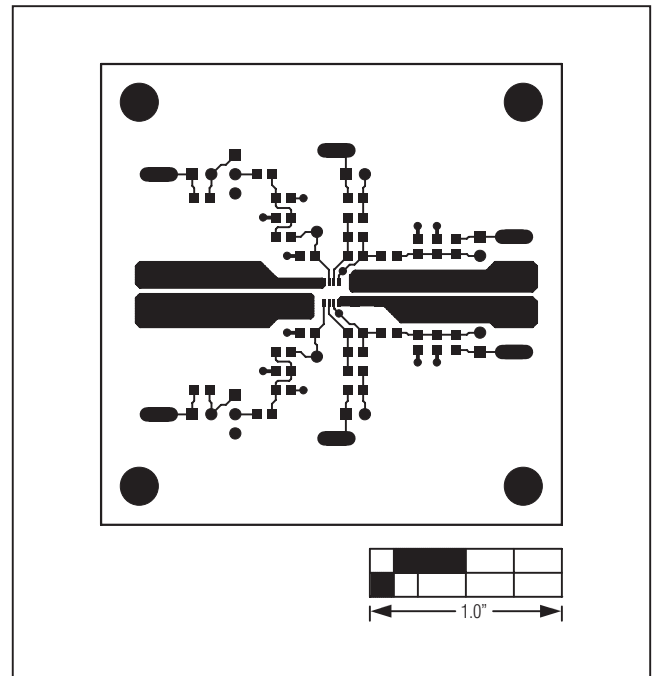Figure 2. MAX44251 EV Kit Component Placement Guide—Component Side
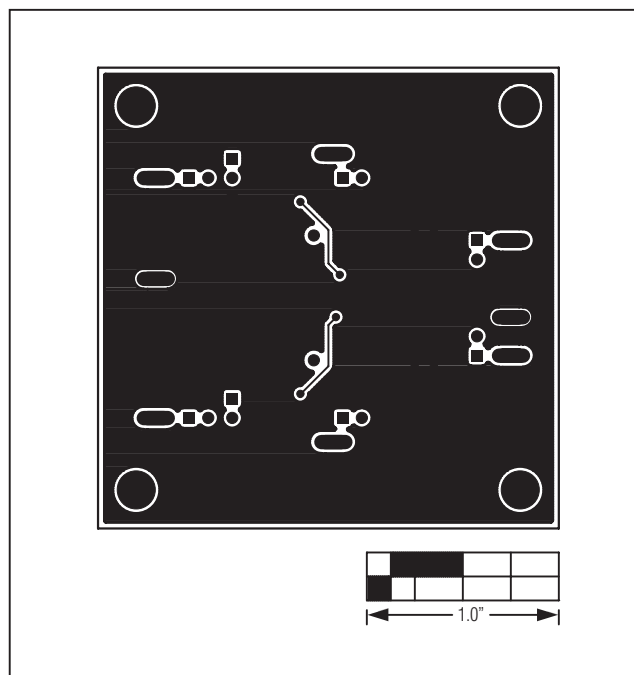

Figure 3. MAX44251 EV Kit PCB Layout—Component Side

Figure 4. MAX44251 EV Kit PCB Layout—Solder Side

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REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	4/12	Initial release	—

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