

MAX44264 Evaluation Kit **Evaluates: MAX44264**

General Description

Features

The MAX44264 evaluation kit (EV kit) is a fully assembled and tested circuit board that contains all the components necessary to evaluate the MAX44264 IC, offered in a space-saving 0.9mm x 1.3mm, 6-bump wafer-level package (WLP). The device is a rail-to-rail micropower op amp, drawing only 750nA of supply current. The EV kit operates from a single 1.8V to 5.5V DC power supply.

- **♦** 1.8V to 5.5V Single-Supply Operation
- ♦ Jumper Selectable for Inverting, Noninverting, Differential, and Buffer Op-Amp Configurations
- **♦ Demonstrates Super-Capacitor Charge Balancing Using the Op-Amp Buffer Configuration**
- ♦ Evaluates the Device in a 6-Bump WLP
- ♦ Proven PCB Layout
- ♦ Fully Assembled and Tested

Ordering Information appears at end of data sheet.

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C2	2	0.22F -20% to +80%, 3.3V super capacitors (6.8mm)
C3	1	1μF ±10%, 6.3V X5R ceramic capacitor (0603) Murata GRM188R60J105K
C4	1	0.1µF ±10%, 16V X5R ceramic capacitor (0603) Murata GRM188R61C104K
C5	1	0.01µF ±10%, 16V X7R ceramic capacitor (0603) Murata GRM188R71C103K
C6	0	Not installed, ceramic capacitor (0603)
JU1, JU3	2	2-pin headers

DESIGNATION	QTY	DESCRIPTION
JU2	1	3-pin header
R1, R6	0	Not installed, resistors (0603) R1 is short (PC trace) and R6 is open
R2	1	0Ω ±5% resistor (0603)
R3, R4	2	2MΩ ±5% resistors (0603)
R5	1	10Ω ±5% resistor (0603)
U1	1	Rail-to-rail op amp (6 WLP) Maxim MAX44264EWT+ (Top Mark: +CB)
_	3	Shunts (JU1, JU2, JU3)
_	PCB: MAX44264 EVALUAT	

Component Supplier

SUPPLIER	PHONE	WEBSITE
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com

Note: Indicate that you are using the MAX44264 when contacting this component supplier.

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Quick Start

Required Equipment

- MAX44264 EV kit
- 1.8V to 5.5V, 100mA DC power supply
- Voltmeter

Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation. Caution: Do not turn on the power supply until all connections are completed.

- 1) To configure the EV kit as an op-amp buffer to balance super capacitors C1 and C2 charge, set jumpers JU1, JU2, and JU3 in their default positions, as shown in Table 1.
- 2) Set the power supply to provide 5V and then disable the power supply.
- 3) Connect the power-supply positive terminal to the VDD PCB pad.
- 4) Connect the power-supply ground to the GND PCB pad (nearest the VDD PCB pad).
- 5) Enable the power supply.
- 6) Verify that the OUT PCB pad is at 2.5V.

Detailed Description of Hardware

The MAX44264 EV kit contains the MAX44264 IC, which is a rail-to-rail micropower op amp with an ultra-low 750nA supply current designed in a 6-bump WLP. The EV kit operates from a single 1.8V to 5.5V DC power supply.

Table 1. Default Shunt Positions

JUMPER SHUNT POSITION		DESCRIPTION
JU1	Not installed	IN- = OUT (through resistor R2)
JU2	2-3	IN+ = VDD/2
JU3	Installed	

Default Application Circuit

The EV kit comes preconfigured as a buffer used in a super-capacitor charge-balancing circuit. Super capacitors offer exceptional charge storage density and are widely used to prolong the life of weak batteries subject to high current-load pulses, or to buffer a weak energy source to a high-power load in energy-harvesting devices. In such applications, it is common to have a stack of super capacitors connected in series to achieve the desired working voltage. The EV kit demonstrates an active, super-capacitor charge-balancing circuit that distributes the charge equally across two series-connected super capacitors (C1 and C2), ensuring identical voltage across each capacitor. This circuit prevents overvoltage conditions from occurring across either of the super capacitors due to a difference in leakage currents and tolerance in the capacitor values. The IC's ultra-low power consumption of 750nA and CMOS inputs allow a powerefficient solution to the super-capacitor charge-balancing problem.

Op-Amp Configurations

While super-capacitor charge balancing is the featured application, the EV kit also provides flexibility to easily reconfigure the op amp into any of the four common circuit topologies: inverting amplifier, noninverting amplifier, differential amplifier, or buffer. Table 2 lists the JU1, JU2, and JU3 jumper settings for the various op-amp configurations. The configurations are described in the next few sections.

Important Note: Remove super capacitors C1 and C2 when not demonstrating super-capacitor charge balancing in the four configurations detailed in the Noninverting Amplifier, Inverting Amplifier, Differential Amplifier, and Buffer Amplifier sections.

Table 2. JU1, JU2, JU3 Jumper Functions (IN-, IN+, REF)

OP-AMP	SHUNT POSITION			
CONFIGURATION	JU1	JU2	JU3	
Inverting	Installed			
Differential	1-2		Not	
Noninverting	Not	1-2	installed	
Buffer	installed			
Super-capacitor buffer	Not installed	2-3	Installed	

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Noninverting Amplifier

To configure the device as a noninverting amplifier, replace R2 and R6 with suitable resistors. Replace R3 with a short and remove C5 (follow the jumper settings listed in Table 2). The output voltage (Vout) for the noninverting configuration is given by the following equation:

$$V_{OUT} = \left(1 + \frac{R2}{R6}\right) (V_{IN+} + V_{OS})$$

where:

Vos = Input-referred offset voltage.

V_{IN+} = Input voltage applied at the IN+ PCB pad.

Inverting Amplifier

To configure the device as an inverting amplifier, cut open the shorted PCB trace on R1. Replace R3 with a short and remove C5. Replace R1 and R2 with suitable gain resistors (follow the jumper settings listed in Table 2). An appropriate DC voltage (VDC) should be applied to the IN+ PCB pad to level shift the output voltage of the op amp if the applied input voltage (V_{IN-}) at the IN- PCB pad is positive:

$$V_{OUT} = -\frac{R2}{R1}V_{IN-} + \left(1 + \frac{R2}{R1}\right)(V_{OS} + V_{DC})$$

Differential Amplifier

To configure the device as a differential amplifier, cut open the shorting PCB trace on R1. Replace R1-R4 with appropriate resistors. Remove C5 (follow the jumper settings listed in Table 2). Apply a reference voltage (VREF) to the REF PCB pad to level shift the output voltage of the op amp, if required. When R1 = R3 and R2 = R4, the CMRR of the differential amplifier is determined by the matching of ratios R1/R2 and R3/R4:

$$V_{OUT} = GAIN(V_{IN+} - V_{IN-}) + \left(1 + \frac{R2}{R1}\right)V_{OS} + V_{REF}$$

where:

$$GAIN = \frac{R2}{R1} = \frac{R4}{R3}$$

Buffer Amplifier

To configure the device as a standard unity-gain buffer, replace R3 with a short and remove C5:

$$V_{OUT} = V_{IN+} + V_{OS}$$

Important Note: Remove super capacitors C1 and C2 when not demonstrating super-capacitor charge balancing for the four configurations just listed.

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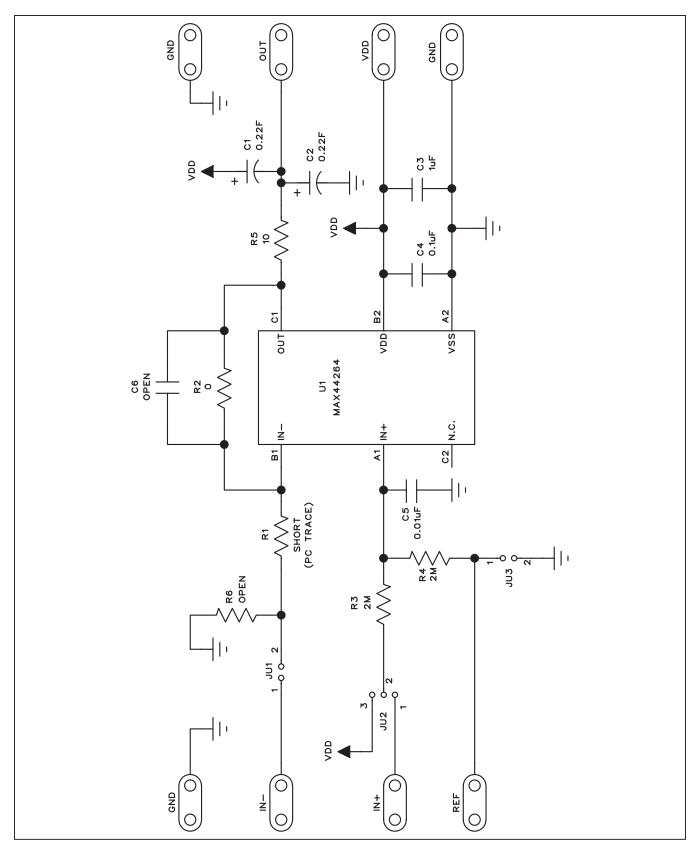


Figure 1. MAX44264 EV Kit Schematic

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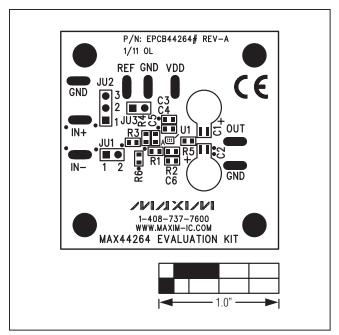


Figure 2. MAX44264 EV Kit Component Placement Guide— Component Guide

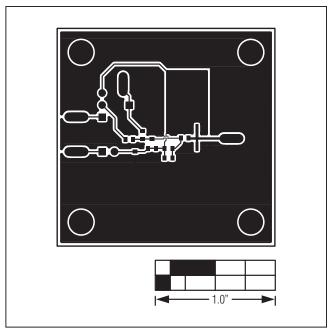


Figure 3. MAX44264 EV Kit PCB Layout—Component Side

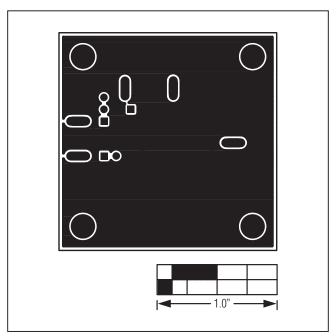


Figure 4. MAX44264 EV Kit PCB Layout—Solder Side

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Ordering Information

PART	TYPE	
MAX44264EVKIT#	EV Kit	

#Denotes RoHS compliant.

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Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	2/11	Initial release	_

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