

## General Description

The MAX9092 evaluation kit (EV kit) provides a proven design to evaluate the MAX9092 dual comparator. The EV kit circuit can be easily configured by installing shunts and changing a few components to support multiple comparator applications such as window detector and pulse-width modulation (PWM) generator. The EV kit provides 0603 component PCB pads for ease of evaluation. The EV kit operates from a +1.8V to +5.5V VDD supply.

The EV kit comes with a MAX9092AKA+ installed. Contact the factory for the pin-compatible MAX9093AKA+.

## Features

- Accommodates Multiple Comparator Configurations
- Accommodates Easy-to-Use Components
- Proven PCB Layout
- Fully Assembled and Tested

[Ordering Information](#) appears at end of data sheet.

## Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	0.1 $\mu$ F $\pm$ 10%, 16V X7R ceramic capacitor (0603) Murata GCM188R71C104K
C2	1	4.7 $\mu$ F $\pm$ 10%, 16V X7R ceramic capacitor (0805) Murata GRM21BR71C475K
JU1–JU5	5	2-pin headers
INA-, INA+, INAM, INAP, INB-, INB+, INBM, INBP, OUTA, OUTB, VDD, VPULLA, VPULLB	13	Red multipurpose test points

DESIGNATION	QTY	DESCRIPTION
VSS	4	Black multipurpose test points
R1–R4	4	0 $\Omega$ $\pm$ 5% resistors (0603)
R5, R6, R9–R11	0	Not installed, resistors (0603)
R7, R8	2	100k $\Omega$ $\pm$ 5% resistors (0603)
U1	1	Dual comparator (8 SOT23) Maxim MAX9092AKA+
—	5	Shunts
—	1	PCB: MAX9092 EVKIT

## Component Supplier

SUPPLIER	PHONE	WEBSITE
Murata Americas	800-241-6574	www.murataamericas.com

**Note:** Indicate that you are using the MAX9092 when contacting this component supplier.

## Quick Start

### Required Equipment

- MAX9092 EV kit
- Three adjustable 0 to +5V DC power supplies
- Oscilloscope

### Procedure

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

- 1) Verify that jumpers JU1-JU5 are in their default position, as shown in Table 1.
- 2) Set the first DC power supply to +3.3V and connect the positive terminal to VDD and the negative terminal to the GND PCB pads.
- 3) Set the second DC power supply to +2.5V and connect the positive terminal to VDD and the negative terminal to the GND PCB pads.
- 4) Set the third DC power supply to +2V and connect the positive terminal to VDD and the negative terminal to the GND PCB pads.
- 5) Connect an oscilloscope's channel to the OUTA test point on the EV kit.
- 6) Enable all three power supplies.
- 7) Verify that the OUTA signal is logic-high (+3.3V).
- 8) Increase the third DC power supply to +3V.
- 9) Verify that the OUTA signal is logic-low (0V).

## Detailed Description of Hardware

The MAX9092 EV kit is a fully assembled and tested PCB that evaluates the MAX9092 dual comparator. The EV kit requires a +1.8V to +5.5V input supply voltage at VDD for normal operation.

The EV kit is configurable for different applications, such as logic-level translation, window detector, and PWM generator by adjusting the jumper settings and installing appropriate resistors on the PCB.

### Comparator Application Circuits

#### Logic-Level Translation

Jumpers JU2 and JU3 are available to change the logic level of the comparators' output. Install a shunt on the jumpers to set VDD as the comparator output logic level. Remove the shunt from the jumper and apply the desired voltage at the VPULLA and/or VPULLB test points to set the comparator output logic level independent of the supply voltage. Note that the OUT\_ pins on the comparator have an absolute maximum of (VSS - 0.3V) to 6V. See Table 1 for proper jumper configurations.

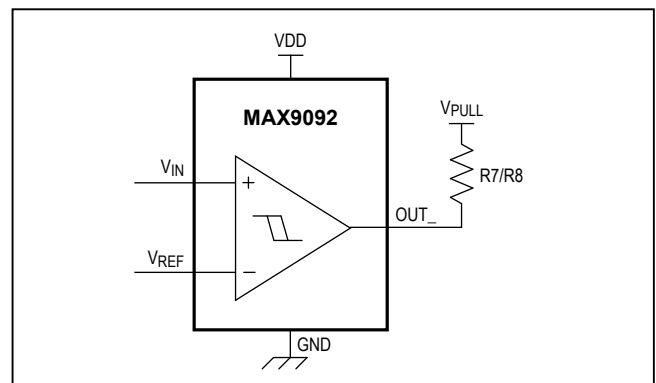


Figure 1. Logic-Level Translator Circuit

Table 1. EV Kit Jumper Settings (JU1–JU5)

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	Installed	Window detection configuration. Connects the OUTA to OUTB pin of the device.
	Not installed*	Disconnects the OUTA from OUTB pin of the device.
JU2	Installed*	Pulls up to VDD through resistor R7.
	Not installed	Pulls up to VPULLA through resistor R7. External voltage must be applied at the VPULLA test point.
JU3	Installed*	Pulls up to VDD through resistor R8.
	Not installed	Pulls up to VPULLB through resistor R8. External voltage must be applied at the VPULLB test point.
JU4	Installed	Window detection configuration. Connects the INA- to INB+ pin of the device.
	Not installed*	Disconnects the INA- from INB+ pin of the device.
JU5	Installed	PWM generator configuration. Connects the INA- to INB- pin of the device.
	Not installed*	Disconnects the INA- from INB- pin of the device.

\*Default position.

**Window Detector**

Table 2 depicts the proper jumper configuration for evaluating the EV kit window detector application circuit using comparators A and B.

Resistor R1, R5, and R6 pads are available for setting the overvoltage and undervoltage-threshold levels. OUTA provides an active-low overvoltage indication and OUTB provides an active-low undervoltage indication. The open-drain outputs of both comparators are wired in an OR configuration using jumper JU1 to give an active-high power-good signal on either OUTA or OUTB.

For accurate threshold settings, use the following equations in this section.

The input bias current into INB- is worst-case 400nA over temperature (T<sub>A</sub> = -40°C to +125°C) and approximately 250nA (max) at room temperature (T<sub>A</sub> = +25°C), so the current through R1 should exceed 40µA for the threshold to be accurate over temperature. Calculate R5 using Equation 1:

$$R5 = \frac{V_{REF}}{40\mu A} \text{ (Equation 1)}$$

where V<sub>INAP</sub> is the reference voltage applied at the IN- and R5 is in the order of kΩ.

Choose the desired overvoltage threshold and calculate resistance R<sub>T</sub> using Equation 2 for resistor R5 value:

$$R_T = R5 \left[ \frac{V_{OTH}}{V_{REF}} - 1 \right] \text{ (Equation 2)}$$

where R<sub>T</sub> = R6 + R1 in kΩ and V<sub>OTH</sub> is the desired overvoltage threshold in volts.

Calculate R6 using the Equation 3:

$$R6 = \frac{(R_T + R5)(V_{REF})}{V_{UTH}} - (R5) \text{ (Equation 3)}$$

Where V<sub>UTH</sub> is the desired undervoltage threshold. Obtain the R1 resistor value using Equation 4:

$$R1 = R_T - R5 - R6 \text{ (Equation 4)}$$

**Table 2. Window Detection Circuit Jumper Configuration**

JUMPER	SHUNT POSITION
JU1, JU2, JU4	Installed
JU3, JU5	Not installed

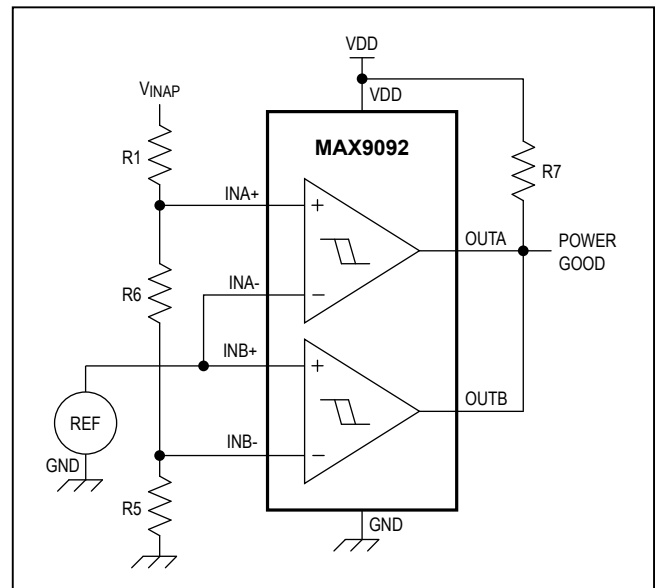


Figure 2. Window Detector Circuit

**PWM Generator**

The EV kit can be configured to generate a simple PWM signal using comparators A and B. See Table 3 for proper jumper configurations on the EV kit for a simple PWM generation circuit. Configure comparator A as a relaxation oscillator as follows:

- 1) Add a suitable resistor and capacitor at the R11 and R5 PCB pads, respectively.
- 2) Connect the INAP test point to the VDD test point.
- 3) The trip thresholds are set by applying suitable external hysteresis using resistors R1, R9, and R10.

Jumper JU5 connects the sawtooth waveform generated on comparator A's inverting input to comparator B's inverting input. The analog control voltage, applied on the noninverting input of comparator B (INB+), determines the pulse width. **Note:** Since the relaxation oscillator generates a sawtooth waveform, the duty cycle is not a linear function of the applied analog control voltage.

**Table 3. PWM Generation Circuit Jumper Configuration**

JUMPER	SHUNT POSITION
JU1, JU4	No installed
JU2, JU3, JU5	Installed

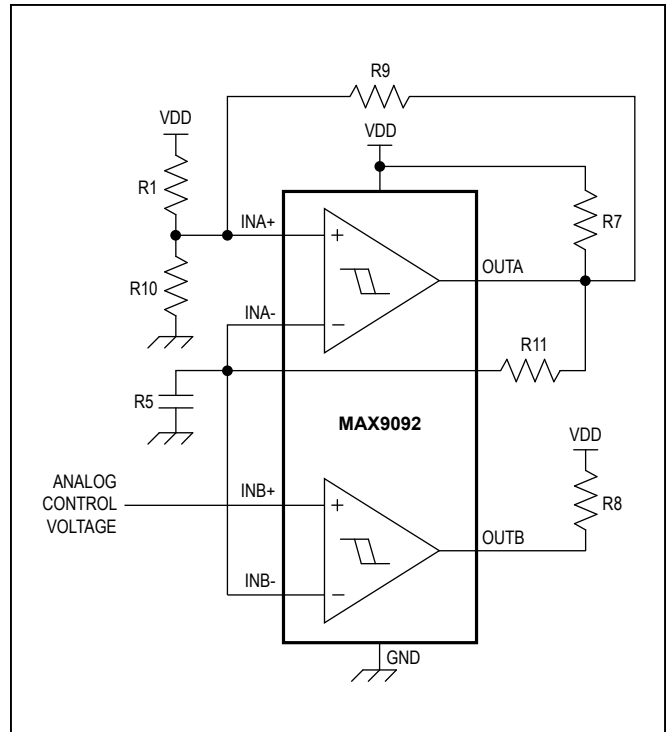


Figure 3. PWM Generator Circuit

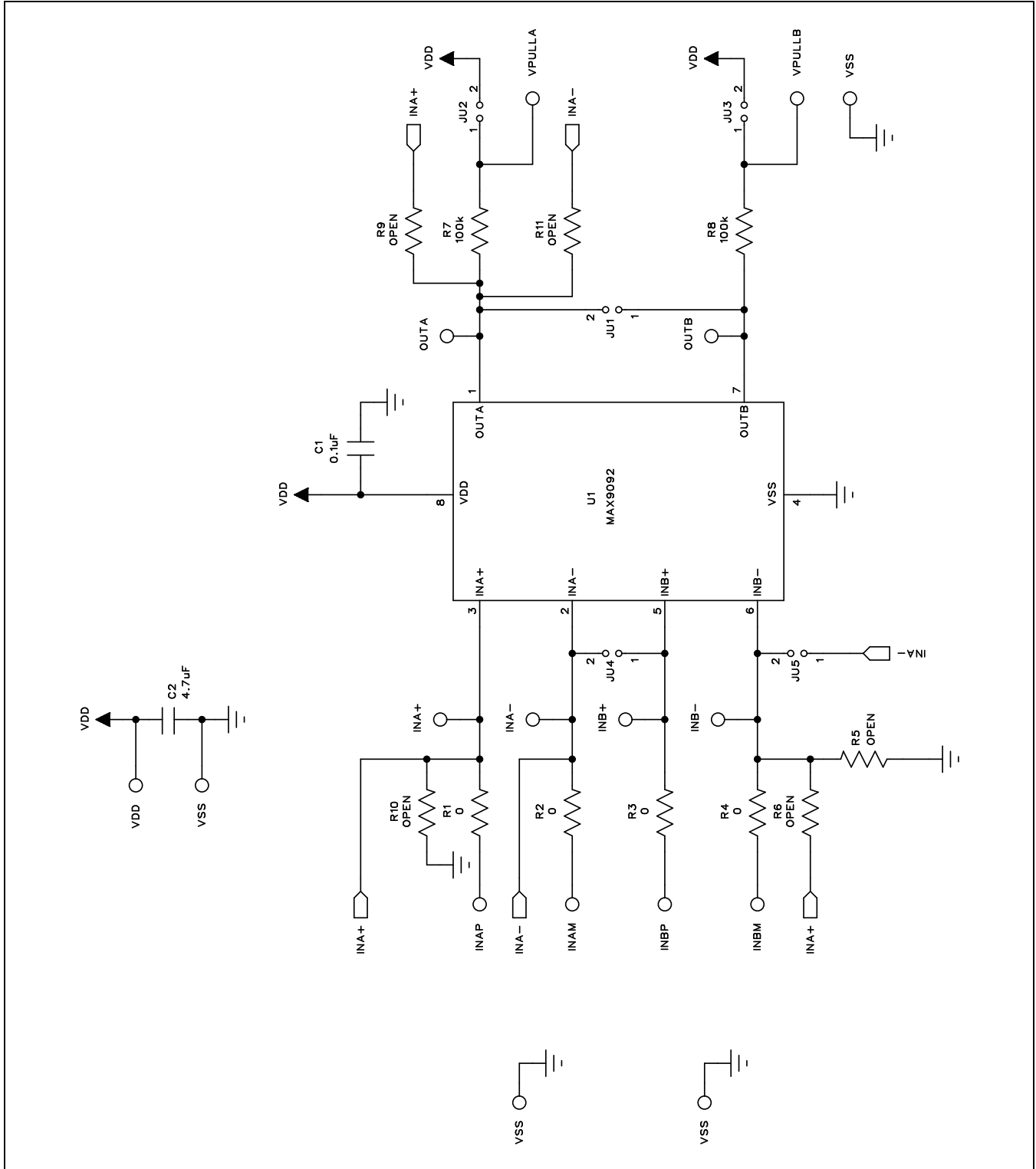


Figure 4. MAX9092 EV Kit Schematic

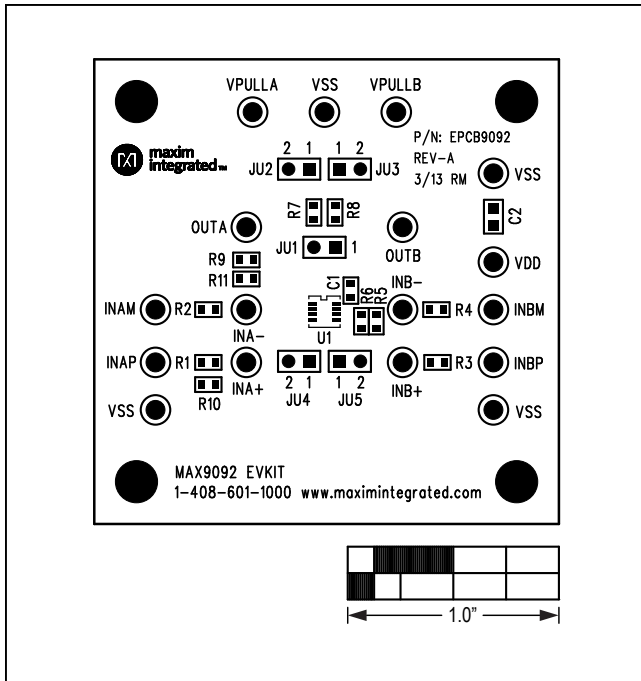


Figure 5. MAX9092 EV Kit Component Placement Guide—Component Side

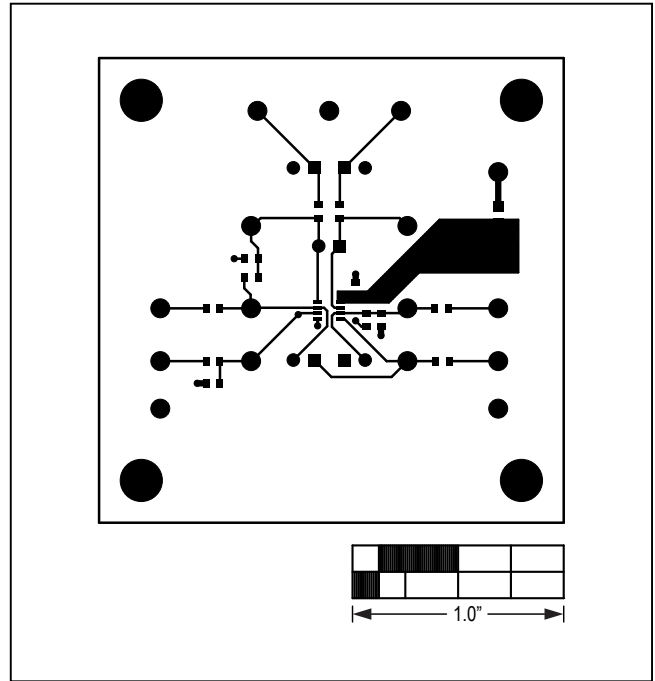


Figure 6. MAX9092 EV Kit PCB Layout—Component Side

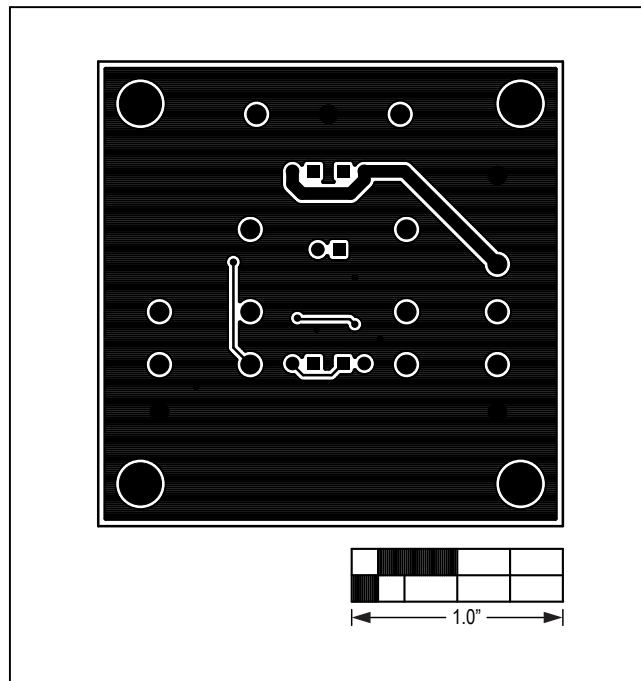


Figure 7. MAX9092 EV Kit PCB Layout—Solder Side

### Ordering Information

PART	TYPE
MAX9092EVKIT#	EV Kit

#Denotes RoHS compliant.

### Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	5/13	Initial release	—

For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim Integrated's website at [www.maximintegrated.com](http://www.maximintegrated.com).

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