General Description

The MAX44292 evaluation kit (EV kit) provides a proven design to evaluate the MAX44292 ultra-precision, low-noise, low-drift dual-operational amplifier (op amp) in an 8-pin SO package. The EV kit circuit is preconfigured as noninverting amplifiers, but can be adapted to other topologies by changing a few components.

The EV kit comes with a MAX44292ASA+ installed. The performance on this EV kit matches the single and quad channels op amps within the same family. The MAX44291AUA+ is the single version and is available in the 8-pin µMAX® package. The MAX44294ASD+ is the quad version and is available in the 14-pin SO package.

Features and Benefits

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

Quick Start

Required Equipment

- MAX44292 EV kit
- +36V, 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–JU4) are in their default positions, as shown in Table 1.
2) Connect the positive terminal of the +36V supply to VCC 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. INAM is already connected to GND through jumper JU1.
4) Connect the positive terminal of the second precision voltage source to the INBP PCB pad. Connect the negative terminal of the precision voltage source to GND. INBM 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 +36V 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, a ±2.25V to ±18V can be applied to VDD and VSS, respectively.

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

19-7649; Rev 0; 6/15

Detailed Description of Hardware

The MAX44292 EV kit provides a proven layout for the MAX44292 ultra-precision, low-noise, low-drift, dual op amp. The device is a single/dual-supply, dual op amp (op amp A and op amp B) that is ideal for sensor interfaces, loop-powered systems, and various types of medical and data-acquisition instruments.

The default configuration for the device in the EV kit is single-supply operation in noninverting configuration. However, the device can operate with a dual supply as long as the voltage across the V_{DD} and GND pins of the IC do not exceed the absolute maximum ratings. When operating with a single supply, short V_{SS} to GND.

Op-Amp Configurations

The device 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.

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:

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

Inverting Configuration

To configure the EV kit as an inverting amplifier, remove the shunt on jumper JU1 and install a shunt on jumper JU2 and feed an input signal on the INAM PCB pad.

Differential Amplifier

To configure the EV kit as a differential amplifier, replace R1–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 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 resistor R1. The signal is noninverting and applied to INAP. The filter component pads are R2–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 the shunt from 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 the shunt from 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:

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

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

Bandpass Sallen-Key Filter: To configure the Sallen-Key as a bandpass filter, remove the shunt from 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:

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

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

Transimpedance Amplifier (TIA)

To configure the EV kit as a TIA, place a shunt on jumper JU2 and replace R1 with 0Ω resistors. The output voltage of the TIA is the input current multiplied by the feedback resistor:

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

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 a capacitor and 0Ω resistor at location R10 or R17 (and C8, 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 C8 and R6 pads for an optional capacitive-load driving circuit. C8 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.

Table 1. Jumper Descriptions (JU1–JU4)

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	Pin 1	Disconnects INAM 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 INBM from GND.
	1-2*	Connects INB- to GND through R9 for noninverting configuration.
JU4	Pin 1*	Disconnects INBP from GND.
	1-2	Connects INB+ to GND through R10.

**Default position.*

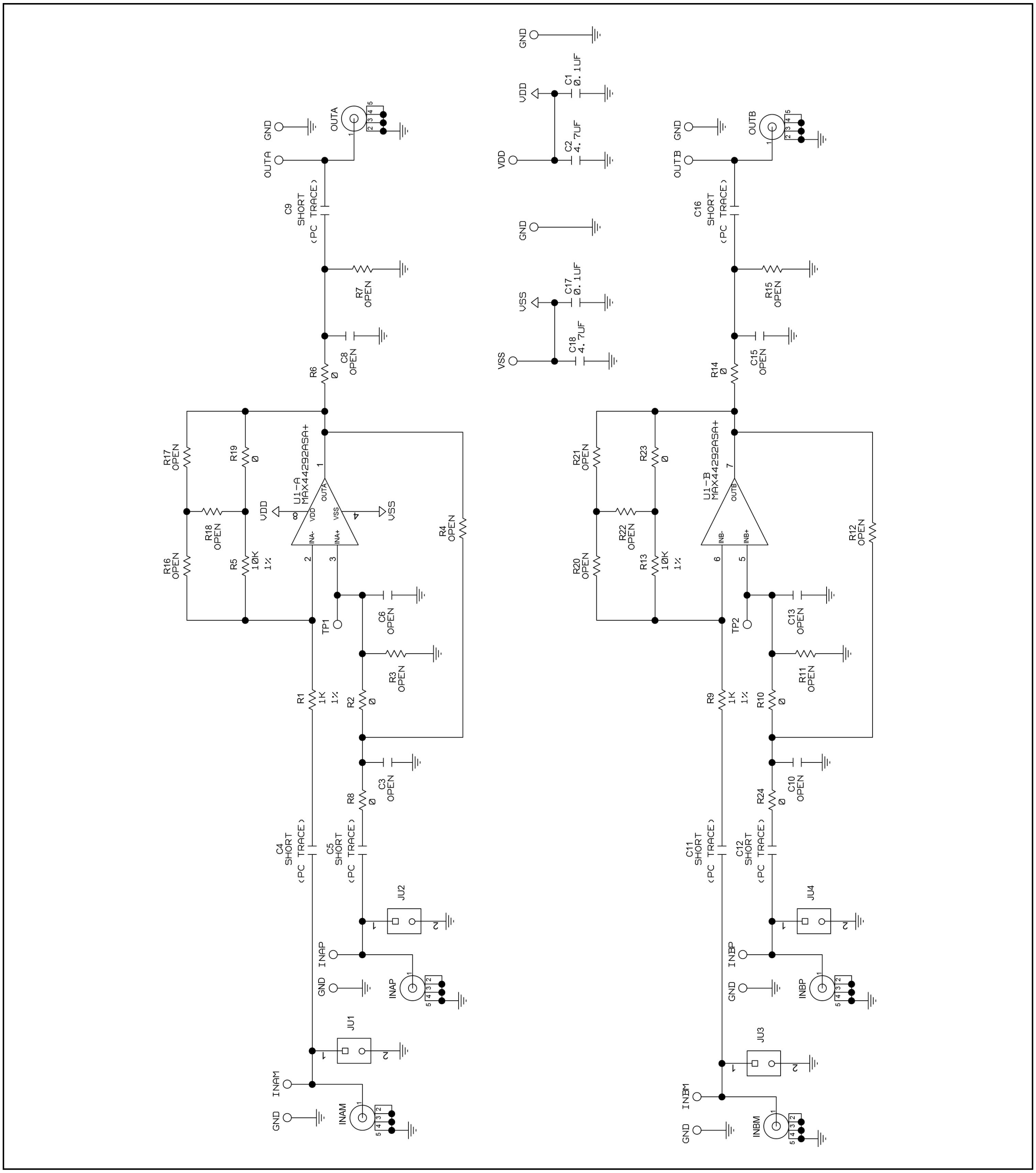

Figure 1. MAX44292 EV Kit Schematic

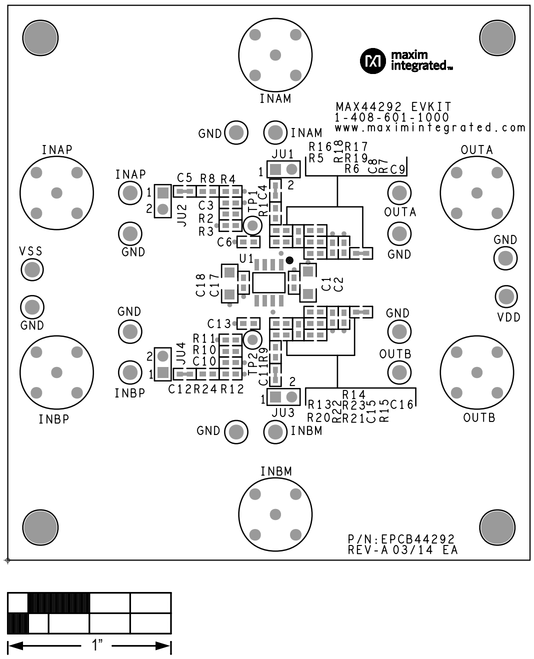

Figure 2. MAX44292 EV Kit Component Placement Guide—Component Side

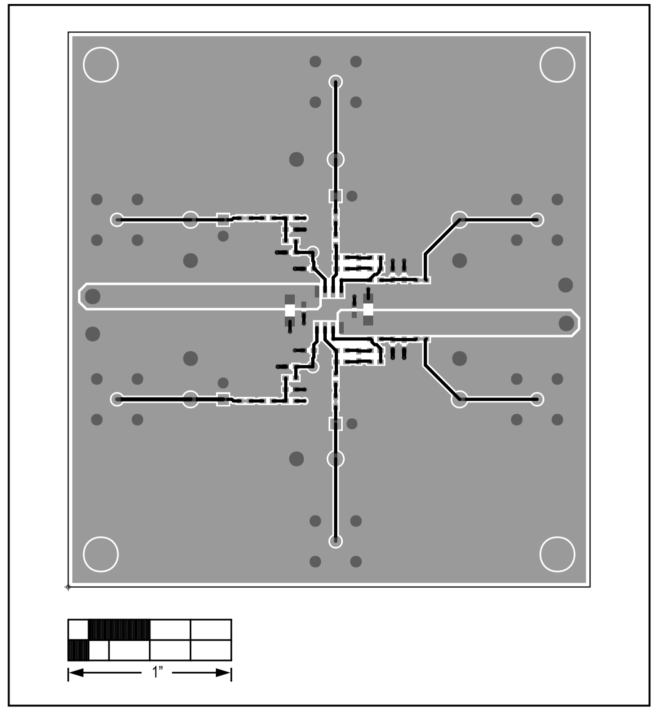

Figure 3. MAX44292 EV Kit PCB Layout—Component Side

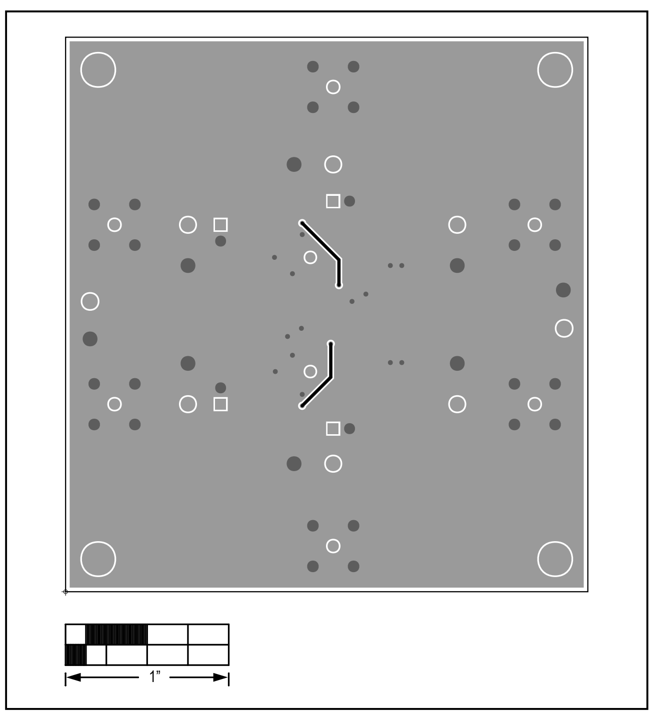

Figure 4. MAX44292 EV Kit PCB Layout—Component Side

Component List

See the following links for component information:

- **MAX44292 EV BOM**

Ordering Information

PART	TYPE
MAX44292EVKIT#	EV Kit

#Denotes RoHS compliant.

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	6/15	Initial release	—

TITLE: Bill of Materials
DATE: 03/26/2014
DESIGN: max44292_evkit_a
TEMPLATE: \\cavndsa02a.maxim-ic.com\tp_loc\hw_cardcat\allegrolib\site\cdssetup\BOM_Templates\evkit_build_template.bom
CALLOUT:
VARIANT: dnivariant

Revision_Type : PRODUCTION

ITEM	QTY	REF DES	MFG PART #	MANUFACTUR	VALUE	DESCRIPTION
1	2	C1,C17	N/A	?	0.1UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.1UF; 50V; TOL=10%; MODEL=X7R; TG=-55 DEGC TO +125 DEGC; TC=+/-; NOT RECOMMENDED FOR NEW DESIGN USE - 20-000u1-01
2	2	C2,C18	N/A	?	4.7UF	CAPACITOR; SMT (1206); CERAMIC CHIP; 4.7UF; 50V; TOL=10%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=X7R
3	8	GND,TP0_GND-TP6_GND	5011	?	5011	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH; RECOMMENDED FOR BOARD THICKNESS=0.062IN
4	4	JU1-JU4	PCC02SAAN	SULLINS	PCC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 2PINS; -65 DEGC TO +125 DEGC
5	2	R1,R9	N/A	?	1K	RESISTOR; 0603; 1K; 1%; 100PPM; 0.10W; THICK FILM
6	8	R2,R6,R8,R10,R14,R19,R23,R24	N/A	?	0	RESISTOR; 0603; 0 OHM; 5%; JUMPER; 0.10W; THICK FILM
7	2	R5,R13	N/A	?	10K	RESISTOR; 0603; 10K; 1%; 100PPM; 0.10W; THICK FILM
8	4	SU1-SU3,SU5	STC02SYAN	SULLINS ELECT	STC02SYAN	TEST POINT; JUMPER; STR; TOTAL LENGTH=0.256IN; BLACK; INSULATION=PBT CONTACT=PHOSPHOR BRONZE; COPPER PLATED TIN OVERALL
9	2	TP1,TP2	5000	?	N/A	TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; RED; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH; RECOMMENDED FOR BOARD THICKNESS=0.062IN; NOT FOR COLD TEST
10	6	TP_INAM,TP_INAP,TP_INBM,TP_INBP,TP_OUTA,TP_OUTB	5012	?	5012	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; WHITE; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH; RECOMMENDED FOR BOARD THICKNESS=0.062IN
11	1	U1	MAX44292ASA+	MAXIM	MAX44292ASA+	IC; AMP; DUAL PRECISION; LOW-NOISE AMPLIFIER; NSOIC8 150 MIL
12	2	VDD,VSS	5010	?	N/A	TESTPOINT WITH 1.80MM HOLE DIA, RED, MULTIPURPOSE; NOT FOR COLD TEST; SET TO OBSOLETE TO CORRECT PACK TYPE
13	1		EPCB44292	MAXIM	PCB	PCB: EPCB44292
TOTAL	44					

DO NOT PURCHASE

ITEM	QTY	REF DES	MFG PART #	MANUFACTUR	VALUE	DESCRIPTION
1	6	C3,C6,C8,C10,C13,C15	N/A	N/A	OPEN	PACKAGE OUTLINE 0603 NON-POLAR CAPACITOR - EVKIT
2	6	C4,C5,C9,C11,C12,C16	N/A	N/A	SHORT	PACKAGE OUTLINE 0603 NON-POLAR CAPACITOR - EVKIT
3	6	INAM,INAP,INBM,INBP,OUTA,OUTB	CN-BNC-011PG	FIRST TECH ELI	CN-BNC-011PG	CONNECTOR; FEMALE; THROUGH HOLE; BNC JACK; STRAIGHT; 5PINS
4	12	R3,R4,R7,R11,R12,R15-R18,R20-R22	N/A	N/A	OPEN	PACKAGE OUTLINE 0603 RESISTOR - EVKIT
TOTAL	30					

PACKOUT

ITEM	QTY	REF DES	MANUFACTURE	VALUE	DESCRIPTION
1	1	PACKOUT	N/A	?	BOX;SMALL BROWN 9 3/16"X7"X1 1/4" - PACKOUT
2	1	PACKOUT	N/A	?	ESD BAG;+;BAG; STATIC SHIELD ZIP 8”X10”; W/ ESD LOGO
3	1	PACKOUT	N/A	?	PINK FOAM;FOAM;ANTI-STATIC PE 12inX12inX5MM - PACKOUT
4	1	PACKOUT	N/A	?	WEB INSTRUCTIONS FOR MAXIM DATA SHEET
5	1	PACKOUT	N/A	?	LABEL(EV KIT BOX) - PACKOUT
TOTAL	5				