MAX40089 Evaluation Kit

Evaluates: MAX40077, MAX40089

General Description

The MAX40089 evaluation kit (EV kit) is a fully assembled and tested circuit board that contains all the components necessary to evaluate both MAX40077 and MAX40089 dual channel op amps.

The MAX40089 EV kit printed circuit board (PCB) comes installed with MAX40089AUT+ in an 8-µMAX package.

The device is a dual-channel, rail-to-rail output op amp offering 10MHz Gain Bandwidth product (MAX40077) and 42MHz Gain Bandwidth product (MAX40089). The EV kit operates from a single 2.7V to 5.5V DC power supply or from ±1.35V to ±2.75V split supply.

Features

- +2.7V to +5.5V Supply Voltage Range Across V_{DD} and V_{SS}
- 42MHz Gain Bandwidth Product (MAX40089)
- 10MHz Gain Bandwidth Product (MAX40077)
- Ultra-Low Distortion (0.0002% with 1kΩ load)
- Proven PCB Layout
- Fully Assembled and Tested

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

Quick Start

Required Equipment

Before beginning, the following equipment is needed:

- MAX40089 EV kit
- 2.7V to 5.5V, 100mA DC power supply
- Precision voltage calibrator
- 2 digital multimeters

Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation. **Caution: Do not turn on power supplies until all connections are completed and turn on V_{DD}, V_{SS} supplies before turning on voltage sources on the input pins.**

1) Make sure JU1 and JU4 jumpers are installed in 1-2 and 1-4 position, respectively, before applying supply voltage.
2) Have JU5 installed for single-supply operation.
3) Connect positive terminal of the +5V supply to the VDD test point and the GND terminal of supply to the VSS test point.
4) Connect the positive terminal of the precision voltage source to the INA+ and INB+ test point and negative terminal to GND test point.
5) Connect 2 Digital Multimeters(DMM) to monitor the voltage on the OUTA and OUTB test points.
6) Turn on the 5V power supply connected to VDD test point and turn on the precision voltage source on INA+, INB+ test points and set 0.1V. Observe the output at the OUTA and OUTB test points on the Multimeters. DMMs should approximately read 1V.
7) Also, now vary precision voltage source on inputs INA+, INB+ between 0V to 0.45V and see if DMMs on OUTA and OUTB test points is gained up by a factor of 10V/V to the voltage applied on input.

Once above steps are confirmed, EV kit is tested for functionality.

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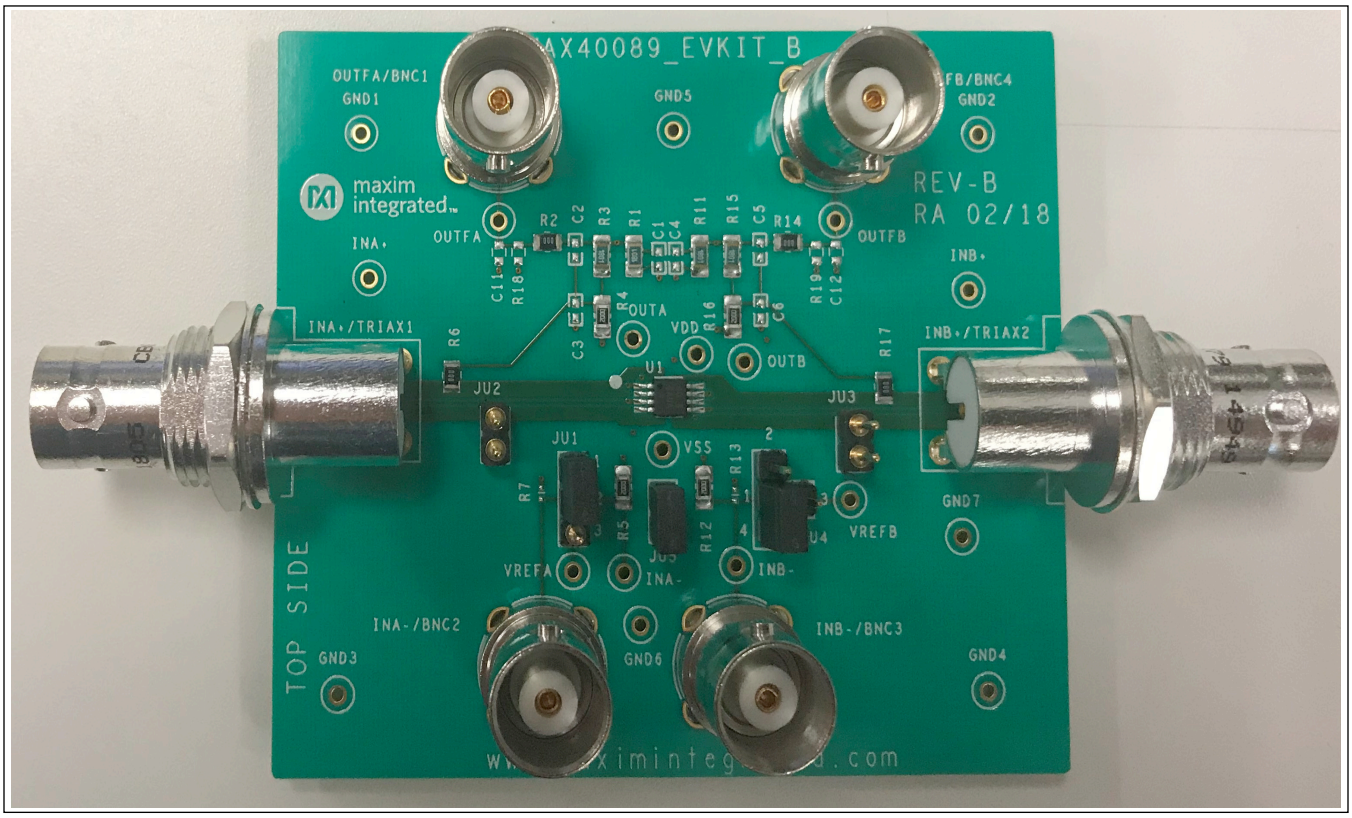
MAX40089 EV Kit Board Photo



Detailed Description of Hardware

The MAX40089 EV kit contains the MAX40089 IC, a rail-to-rail output op amp with low noise and wide bandwidth in 8-µMAX package. The EV kit operates from a single 2.7V to 5.5V DC power supply. The EV kit is meant to work using split supplies as well where the voltage between V_{DD} and V_{SS} is +2.7V to +5.5V.

Default Application Circuit

The EV kit comes preconfigured in a noninverting amplifier configuration with gain set as 10V/V on both the channels. The EV kit also comes with shielding and guarding on the INA+/INB+ pins with usage of TRIAX connectors that enable us to measure input leakage current on the order of ~30fA. Inner shield of the TRIAX is driven to the INA+/INB+ voltage to nullify leakage from input signal trace. If this low input bias current measurement is not important then R6, R17 can be opened and install JU2, JU3 to force shield of TRIAX connector to ground.

Op Amp Configurations

The EV kit provides flexibility to easily reconfigure the dual op amp into any of the three common circuit topologies: inverting amplifier, noninverting amplifier, 2 op amp instrumentation amplifier, and ADC driver.

These configurations are described in the next few sections.

Noninverting Configuration

The MAX40089 EV kit comes preconfigured as a noninverting amplifier on both the channels. The gain is set by the ratio of R1, R9 on CHA and R11, R12 on CHB. The MAX40089 EV kit comes preconfigured for a gain of 10.

The output voltage for the noninverting configuration is given by the equation below for CHA:

$$V_{OUTA} = \left(1 + \frac{R1}{R5}\right) V_{INA+}$$

Inverting Configuration

To configure the EV kit as an inverting amplifier on both the channels, remove the shunt 1-2 on JU1, remove shunt 1-4 on JU4 and tie INA+, INB+ test points to ground or any voltage.

The output voltage for the inverting configuration is given by the equation below for CHA:

$$V_{OUTA} = -\left(\frac{R1}{R5}\right) V_{INA-}$$

2 Op Amp Instrumentation Amplifier

To configure the MAX40089 EV kit as an instrumentation amplifier, choose R1, R9, R11, and R12 with appropriate resistors. When R9 = R11 and R1 = R12, the CMRR of the Instrumentation amplifier is determined by the matching of resistor ratios R11/R12 and R1/R5. R10 serves as the variable gain setting resistor on the EV kit.

The output voltage for the instrumentation amplifier for CHA is given by the equation below and it applies to CHB as well:

$$V_{OUTA} = (V_{INB+} - V_{INA+}) \times [1+(R11/R12) + (2 \times (R11/R10))]$$

where

$$GAIN = [1+(R11/R12) + (2 \times (R11/R10))]$$

Dual Op Amp Driving Fully Differential ADC Circuit (MAX40077 Only)

To configure the MAX40089 EV kit as ADC driver to drive fully differential input signal into fully differential ADC, apply each half of fully differential signal to INA+, INB+ test points. Replace MAX40089AUT+ with MAX40077AUT+ Have JU1 short at 1-2 and JU4 short at 1-4 as per default jumper configuration. R1, R11 can be chosen as 0Ω and R5, R12 can be open to make both the channels as unity gain follower configuration. The EV kit, by default, comes in with Gain = 10V/V noninverting configuration with R1, R11 = 1800Ω and R5, R15 = 200Ω.

Choose appropriate RC filter combination (R2, C11 on OUTA and R14, C12 on OUTB) on each OUTA and OUTB legs to optimize ADC performance.

Transimpedance Amplifier circuit

To configure the MAX40089 EV kit as a transimpedance amplifier (TIA), short INA+, INB+ test point to either ground or appropriate bias voltage, replace R5, R12 with a 0Ω resistor and replace R1, R11 pad with 100kΩ resistor. Also, remove short 1-2 on JU1 and short 1-4 on JU4.

The output voltage for CHA of the TIA is the input current multiplied by the feedback resistor and it applies to CHB as well:

$$V_{OUTA} = (I_{INA-} + I_{BIAS-}) \times R11 + V_{OS}$$

where I_{INA-} is the input current source applied at the INA- test point, I_{BIAS-} is the input bias current into INA- pin, and V_{OS} is the input offset voltage of the op amp. Use capacitor C1 to stabilize the op amp by rolling off high-frequency gain due to a large cable capacitance if desired.

Capacitive Loads

Some applications require driving large capacitive loads. To improve stability of the amplifier in such cases, replace R2 on OUTA and R14 on OUTB with a suitable isolation resistance to improve amplifier phase margin.

Table 1. Default Jumper Settings

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	1-2*	INA- to GND
	2-3	Apply external VREF to INA- for dc bias on output
	Not Installed	INA- terminal floating
JU2	Install	INA+ TRIAX shield to GND
	Not Installed*	INA+ TRIAX shield floating
JU3	Install	INB+ TRIAX shield to GND
	Not Installed*	INB+ TRIAX shield floating
JU4	1-2	Connects INB- to OUTA for 2 op amp instrumentation amplifier application circuit
	1-3	Apply external VREF to INB- for dc bias on output
	1-4*	INB- to GND
	Not Installed	INB- terminal floating
JU5	Install*	Single-supply operation
	Not Installed	To enable split-supply operation

**Default position*

Ordering Information

PART	TYPE
MAX40089EVKIT#	EV Kit

#RoHS-compliant

Component Suppliers

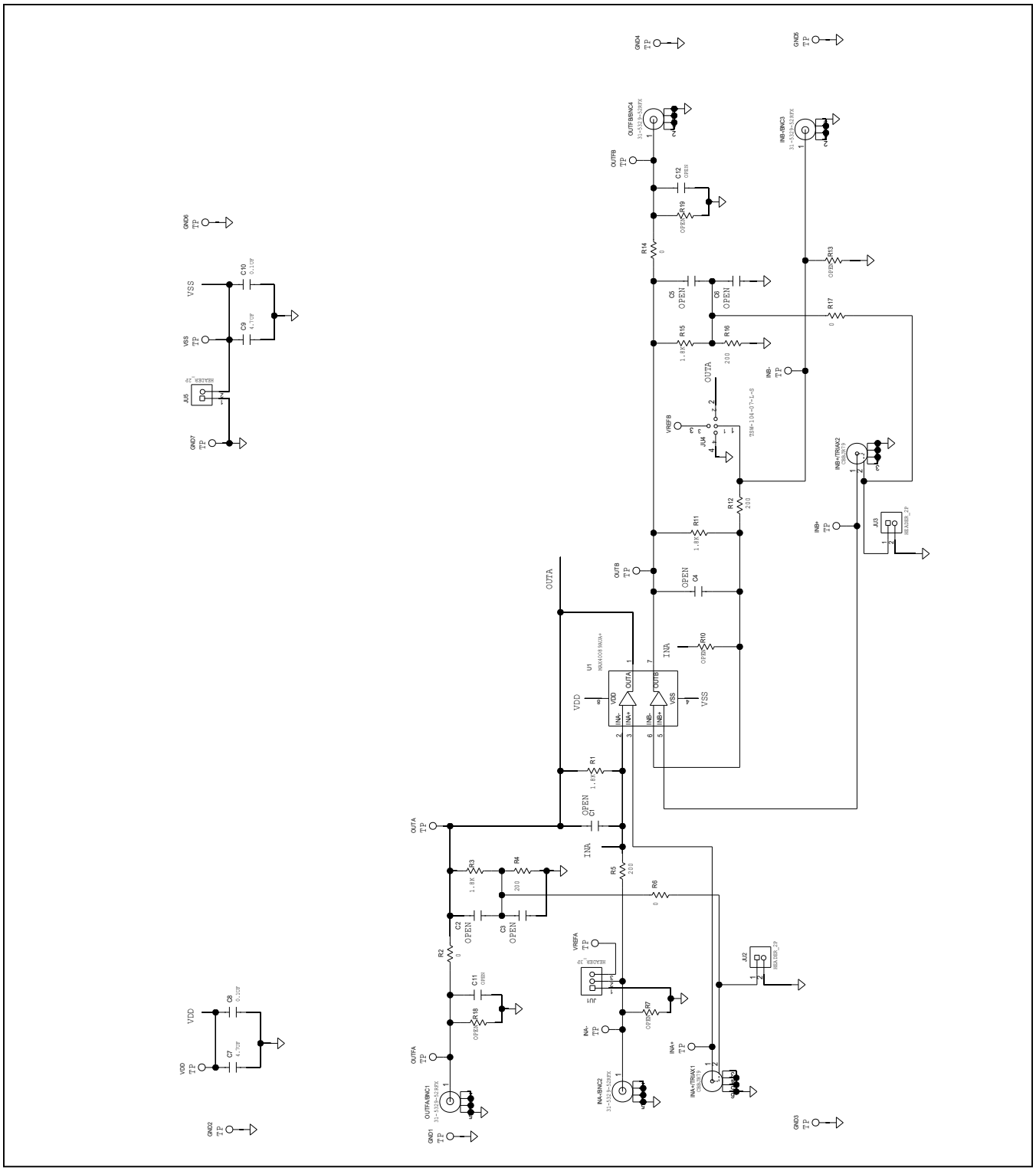
SUPPLIER	WEBSITE
Murata Electronics North America Inc.	www.murata-northamerica.com

Note: *Indicate that you are using the MAX40089 EV kit when contacting these component suppliers.*

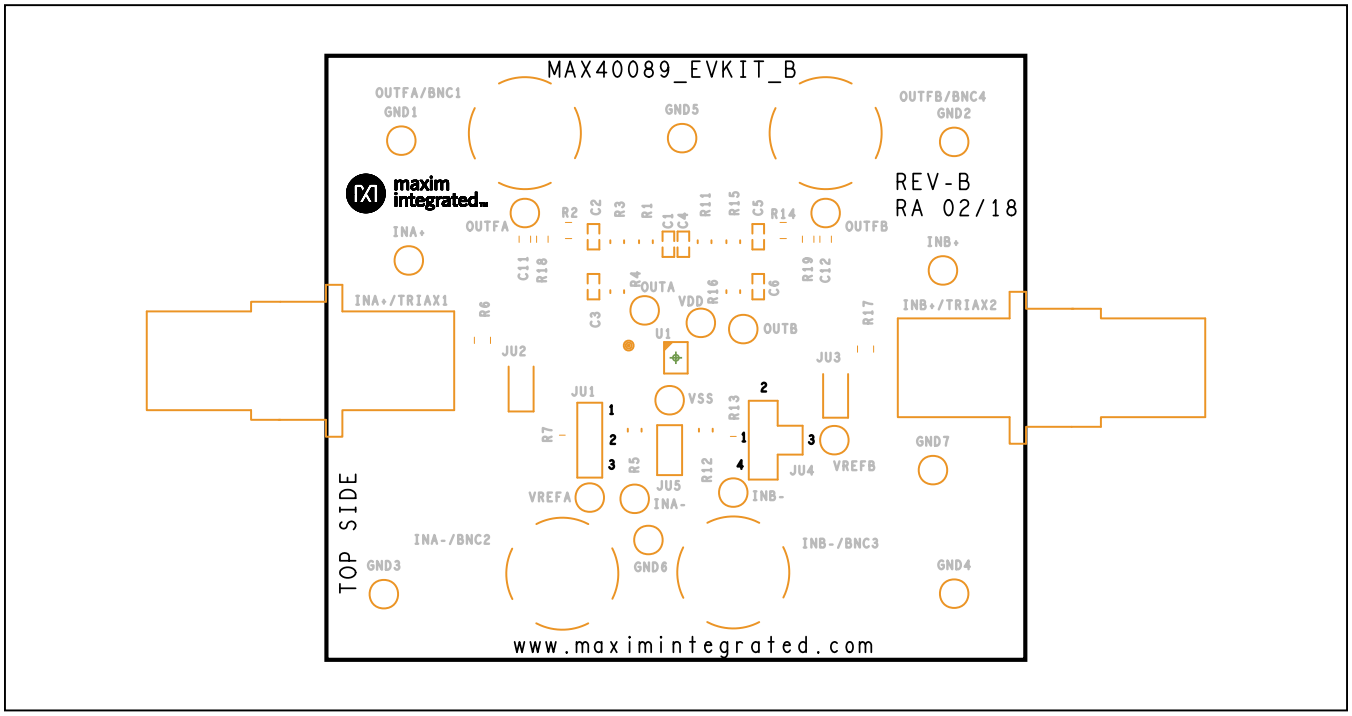
MAX40089 EV Kit Bill of Materials

ITEM	QTY	REF DES	MAXINV	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION
1	2	C7, C9	20-004U7-O9	C2012X5R1H475K125AB	TDK	4.7µF	CAPACITOR; SMT (0805); CERAMIC CHIP; 4.7µF; 50V; TOL = 10%; MODEL = ; TG = -55°C TO +85°C; TC = X5R
2	2	C8, C10	20-000U1-04A	N/A	N/A	0.1µF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.1µF; 50V; TOL = 10%; MODEL = CGA SERIES; TG = -55°C TO +125°C; TC = X7R; FORMFACTOR
3	7	GND1-GND7	02-TPMINI5001-00	5001	KEYSTONE	N/A	TEST POINT; PIN DIA = 0.1IN; TOTAL LENGTH = 0.3IN; BOARD HOLE = 0.04IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH; RECOMMENDED FOR BOARD THICKNESS = 0.062IN; NOT FOR COLD TEST
4	8	INA+, INA-, INB+, INB-, OUTA, OUTB, OUTFA, OUTFB	02-TPMINI5002-00	5002	KEYSTONE	N/A	TEST POINT; PIN DIA = 0.1IN; TOTAL LENGTH = 0.3IN; BOARD HOLE = 0.04IN; WHITE; PHOSPHOR BRONZE WIRE SILVER; NOT FOR COLD TEST
5	2	INA+/TRIAX1, INB+/TRIAX2	01-CBBJR796P-01	CBBJR79	TROMPETER ELECTRONICS INC	CBBJR79	CONNECTOR; BNC; THROUGH HOLE; FEMALE; RIGHT ANGLE; 6PINS
6	4	INA-/BNC2, INB-/BNC3, OUTFA/BNC1, OUTFB/BNC4	01-31532952RFX5P-01	31-5329-52RFX	AMPHENOL	31-5329-52RFX	CONNECTOR; FEMALE; THROUGH HOLE; BNC 50OHM PCB RECEPTACLE; STRAIGHT; 5PINS
7	1	JU1	01-800100031000100003P-21	800-10-003-10-001000	MILLMAX	HEADER_3P	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 3PINS;
8	3	JU2, JU3, JU5	01-800100021000100002P-21	800-10-002-10-001000	MILLMAX	HEADER_2P	CONNECTOR, FEMALE, TH, BREAKAWAY, STR, 2PINS
9	1	JU4	01-TSW10407LS4P-17	TSW-104-07-L-S	SAMTEC	TSW-104-07-L-S	EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; TSW SERIES; SINGLE ROW; STRAIGHT; 4PINS
10	4	R1, R3, R11, R15	80-001K8-70	TNPW08051K80BE	VISHAY DALE	1.8K	RESISTOR; 0805; 1.8KΩ; 0.1%; 25PPM; 0.125W; THICK FILM
11	4	R2, R6, R14, R17	80-0000R-28	N/A	N/A	0	RESISTOR; 0805; 0Ω; JUMPER; 0.125W; THICK FILM; FORMFACTOR
12	4	R4, R5, R12, R16	80-0200R-25	CRCW0805200RFK; 9C08052A2000FK	VISHAY DALE; YAGEO	200	RESISTOR; 0805; 200Ω; 1%; 100PPM; 0.125W; THICK FILM
13	1	U1	00-SAMPLE-01	MAX40089AUA+	MAXIM	MAX40089AUA+	EVKIT PART - IC; AMP; DUAL ULTRA-LOW INPUT BIAS CURRENT; LOW NOISE AMPLIFIER; UMAX8
14	4	VDD, VREFA, VREFB, VSS	02-TPMINI5000-00	5000	KEYSTONE	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
15	1	PCB	EPCB	MAX	MAXIM	PCB	PCB:MAX
TOTAL	48						

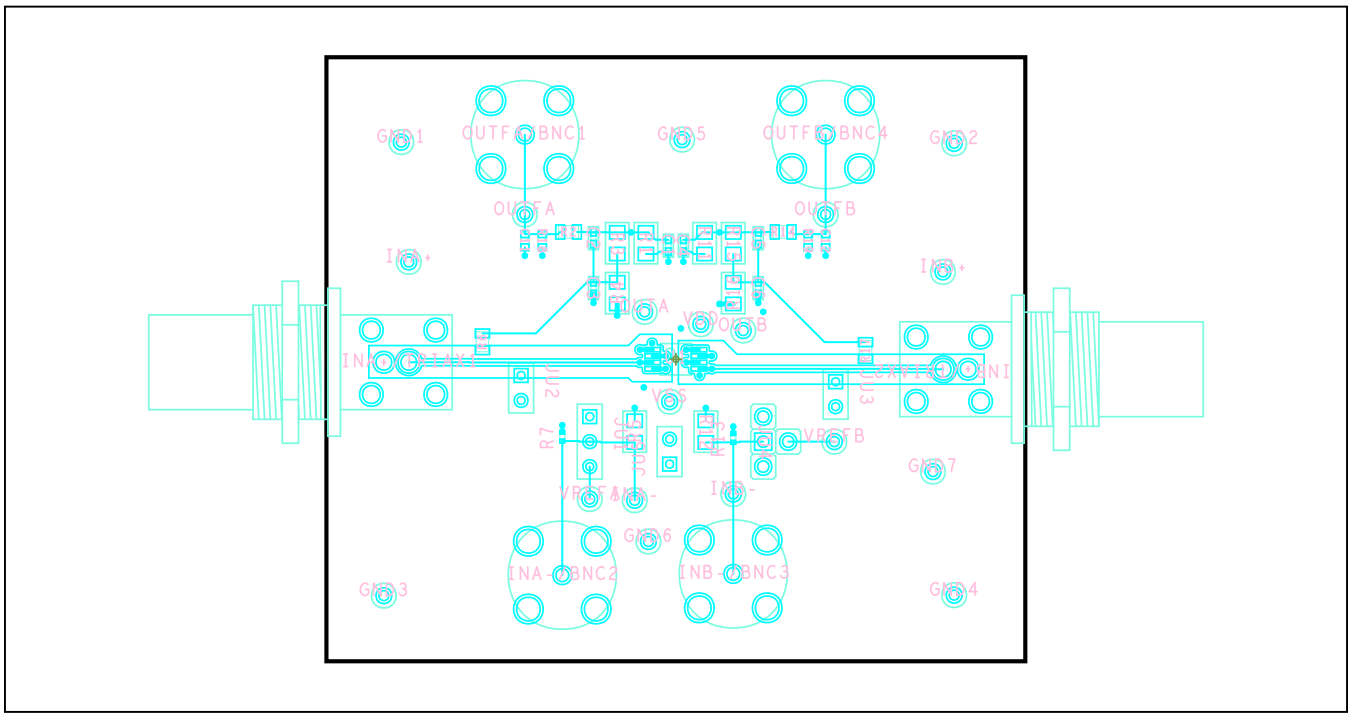
MAX40089 EV Kit Schematic



MAX40089 EV Kit PCB Layout

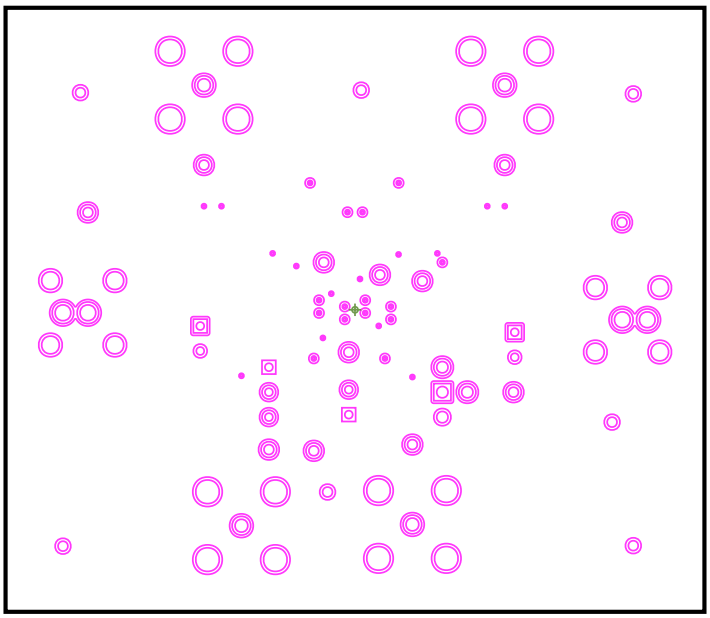


MAX40089 EV Kit—Top Silkscreen

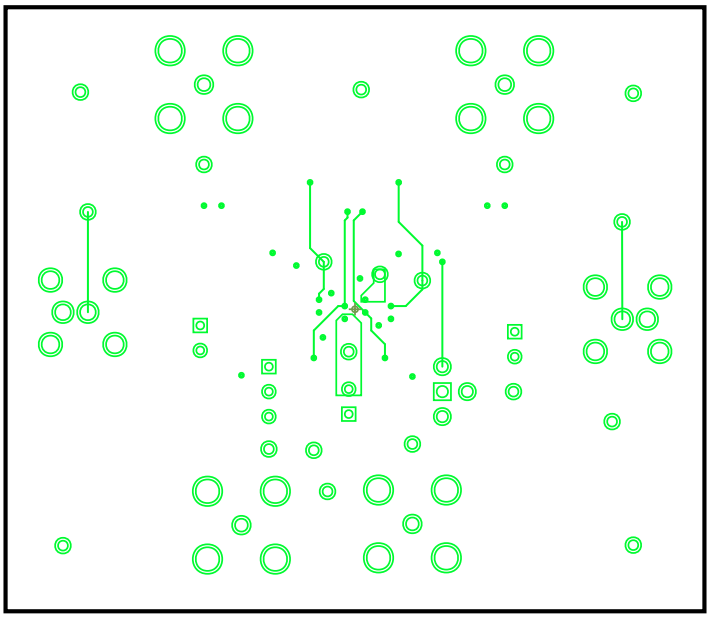


MAX40089 EV Kit—Layout Top side

MAX40089 EV Kit PCB Layout (continued)

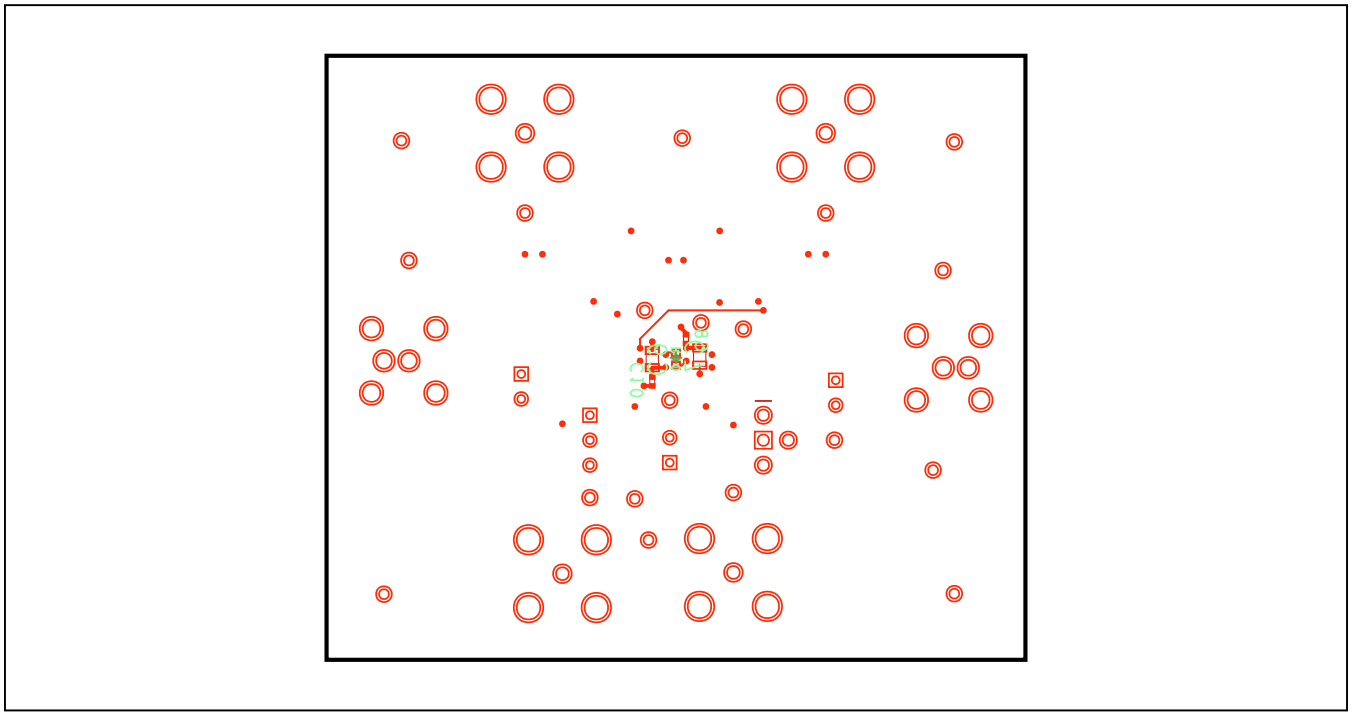


MAX40089 EV Kit—Layer 2

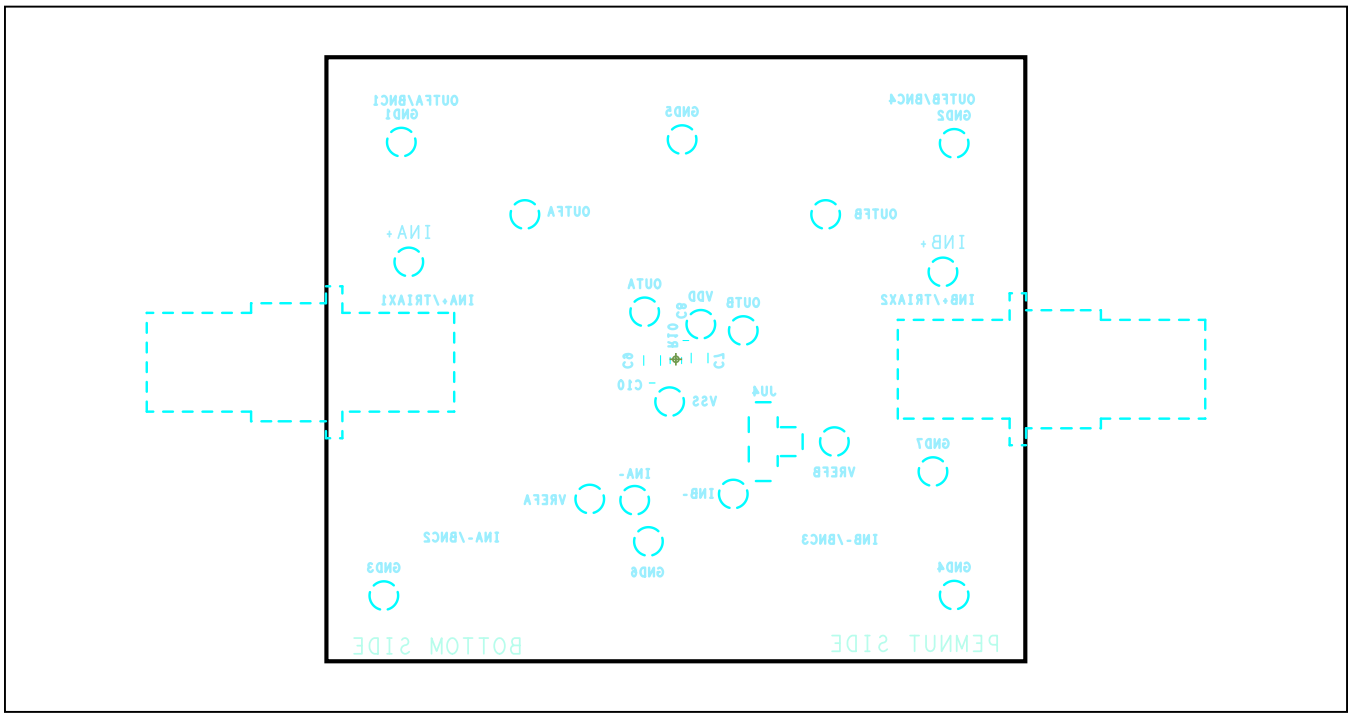


MAX40089 EV Kit—Layer 3

MAX40089 EV Kit PCB Layout (continued)



MAX40089 EV Kit—Layout Bottom side



MAX40089 EV Kit—Bottom Silkscreen