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## MAX40024 Evaluation Kit

Evaluates: MAX40024

### General Description

The MAX40024 evaluation kit (EV kit) provides a proven design to evaluate the MAX40024 low-noise, low-power, low-bias-current, rail-to-rail dual-operational amplifiers (op amps) in an 9-bump (1.23mm x 1.23mm x 0.5mm) wafer-level package (WLP). The EV kit circuit is preconfigured as noninverting amplifiers, but can be adapted to other topologies by changing a few components.

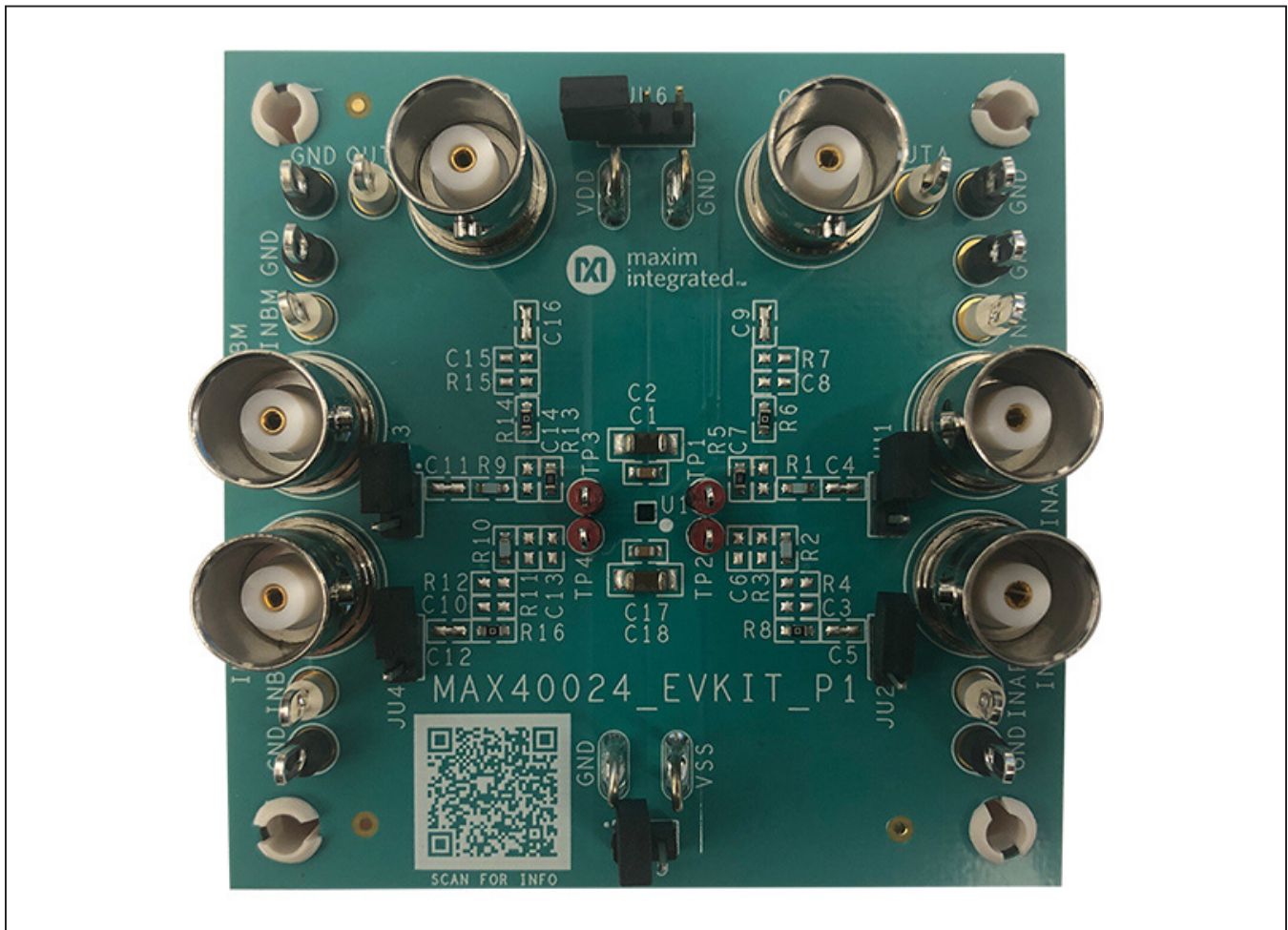
The EV kit comes with a MAX40024ANL+ installed.

### Features

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

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

### MAX40024 EV Kit Photo



## Quick Start

### Required Equipment

- MAX40024 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. Use the following steps to verify board operation:

- 1) Verify that all jumpers (JU1–JU6) are in their default positions, as shown in [Table 1](#).
- 2) Connect the positive terminal of the +1.8V supply to  $V_{DD}$  and the negative terminal to GND and  $V_{SS}$ .
- 3) Connect the positive terminal of the precision voltage source to IN1+. Connect the negative terminal of the precision voltage source to GND. IN1- is already connected to GND through jumper JU1.
- 4) Connect the positive terminal of the second precision voltage source to the IN2+ test point. Connect the negative terminal of the precision voltage source to GND. IN2- is already connected to GND through jumper JU3.
- 5) Connect the DMMs to monitor the voltages on OUT1 and OUT2. With the 10k $\Omega$  feedback resistors and 1k $\Omega$  series resistors, the gain of each noninverting amplifier is +11.
- 6) Turn on the +1.8V 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 40mV from the precision voltage sources. Both OUT1 and OUT2 should read approximately +0.44V.

**Note:** For dual-supply operation, a  $\pm 0.9V$  to  $\pm 1.8V$  can be applied to  $V_{DD}$  and  $V_{SS}$ , respectively. In this case, remove the shunt on jumper JU5. The rest of the procedure remains the same as that of the single-supply operation.

## Detailed Description of Hardware

The MAX40024 EV kit provides a proven layout for the MAX40024 low-noise, low-power, low-bias-current, dual op amp. The device is a single/dual-supply, dual op amp (op amp 1 and op amp 2) that is ideal for sensors.

The default configuration for the device in the EV kit is dual-supply operation in noninverting configuration. However, the device can operate with a single-supply as long as the voltage across the  $V_{DD}$  and  $V_{SS}$  pins of the IC do not exceed the absolute maximum ratings. When operating with a single supply, short  $V_{SS}$  to GND using jumper JU5.

### 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 1). To configure the device's second op amp (op amp 2), 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:

$$V_{OUT1} = \left(1 + \frac{R5}{R1}\right) [V_{IN1+} \pm V_{OS}]$$

#### 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 IN1- test point.

**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.

$$V_{OUT1} = GAIN \times (V_{IN1+} - V_{IN1-})$$

where:

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

**Capacitive Loads**

Some applications require driving large capacitive loads. The EV kit provides C8 and R6 pads for 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–JU5)**

| JUMPER | SHUNT POSITION | DESCRIPTION   |
|--------|----------------|---|
| JU1    | Pin 1          | Disconnects IN1- from GND.  |
|        | 1-2*           | Connects IN1- to GND through R1 for noninverting configuration.   |
| JU2    | Pin 1*         | Disconnects IN1+ from GND.  |
|        | 1-2            | Connects IN1+ to GND through R2.                                  |
| JU3    | Pin 1          | Disconnects IN2- from GND.  |
|        | 1-2*           | Connects IN2- to GND through R9 for noninverting configuration.   |
| JU4    | Pin 1*         | Disconnects IN2+ from GND.  |
|        | 1-2            | Connects IN2+ to GND through R10.                                 |
| JU5    | Pin 1*         | VSS and GND are independently supplied for dual-supply operation. |
|        | 1-2            | Connects VSS to GND for single-supply operation.                  |
| JU6    | 1-2*           | Set Op amp to normal operation mode                               |
|        | 2.3            | Set Op amp to Shutdown mode                                       |

\*Default position.

**Ordering Information**

| PART           | TYPE   |
|----------------|--------|
| MAX40024EVKIT# | EV Kit |

#Denotes RoHS compliance.

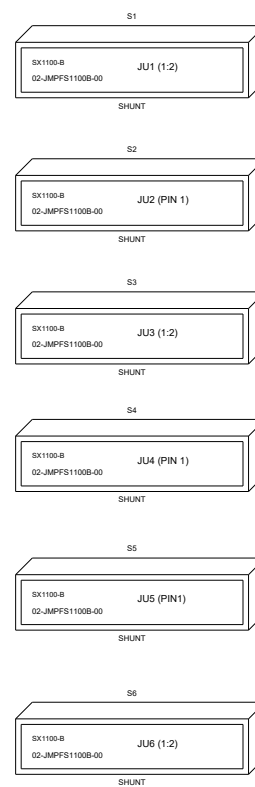
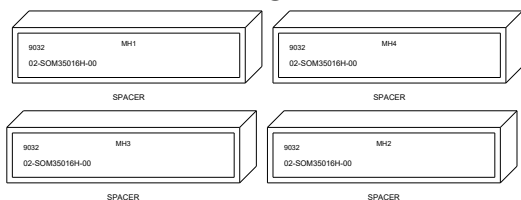
MAX40024 EV Kit Bill of Materials

| ITEM  | REF DES  | DNI/DNP | QTY | MFG PART #   | MANUFACTURER                                 | VALUE        | DESCRIPTION   |
|-------|--|---------|-----|--|--|--------------|---|
| 1     | C1, C17  | -       | 2   | C1608X5R1H104K080AA  | TDK  | 0.1UF        | CAP; SMT (0603); 0.1UF; 10%; 50V; X5R; CERAMIC  |
| 2     | C2, C18  | -       | 2   | GRM31CR71H475KA12;<br>GRJ31CR71H475KE11;<br>GXM31CR71H475KA10;<br>UMK316AB7475KL | MURATA;MURATA;<br>MURATA;TAIYO YUDEN         | 4.7UF        | CAP; SMT (1206); 4.7UF; 10%; 50V; X7R; CERAMIC  |
| 3     | GND, TP0_GND,<br>TP1_GND-TP4_GND                           | -       | 6   | 5011   | KEYSTONE                                     | N/A          | TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN;<br>BOARD HOLE=0.063IN; BLACK; PHOSPHOR BRONZE WIRE<br>SILVER PLATE FINISH; |
| 4     | JU1-JU5  | -       | 5   | PEC02SAAN  | SULLINS                                      | PEC02SAAN    | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY;<br>STRAIGHT; 2PINS  |
| 5     | JU6  | -       | 1   | PCC03SAAN  | SULLINS                                      | PCC03SAAN    | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY;<br>STRAIGHT THROUGH; 3PINS; -65 DEGC TO +125 DEGC                                   |
| 6     | MH1-MH4  | -       | 4   | 9032   | KEYSTONE                                     | 9032         | MACHINE FABRICATED; ROUND-THRU HOLE SPACER;<br>NO THREAD; M3.5; 5/8IN; NYLON  |
| 7     | R1, R2, R9, R10  | -       | 4   | MCT06030C1001F   | VISHAY BEYSCHLAG                             | 1K           | RES; SMT (0603); 1K; 1%; +/-50PPM/DEGC; 0.1250W   |
| 8     | R5, R13  | -       | 2   | CRCW060310K0FKEAHP   | VISHAY DRALORIC                              | 10K          | RES; SMT (0603); 10K; 1%; 100PPM; 0.2500W   |
| 9     | R6, R8, R14, R16   | -       | 4   | RC1608J000CS;<br>CR0603-J/-000ELF;<br>RC0603JR-070RL                             | SAMSUNG ELECTRONICS;<br>BOURNS;YAGEO PH      | 0            | RES; SMT (0603); 0; 5%; JUMPER; 0.1000W   |
| 10    | S1-S6  | -       | 6   | S1100-B;SX1100-B;<br>STC02SYAN   | KYCON;KYCON;<br>SULLINS ELECTRONICS<br>CORP. | SX1100-B     | TEST POINT; JUMPER; STR; TOTAL LENGTH=0.24IN;<br>BLACK; INSULATION=PBT;PHOSPHOR BRONZE<br>CONTACT=GOLD PLATED                 |
| 11    | TP1-TP4  | -       | 4   | 5000   | KEYSTONE                                     | N/A          | TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN;<br>BOARD HOLE=0.04IN; RED; PHOSPHOR BRONZE<br>WIRE SILVER PLATE FINISH;        |
| 12    | TP6_GND, TP7_GND,<br>VDD, VSS                              | -       | 4   | 9020 BUSS  | WEICO WIRE                                   | MAXIMPAD     | EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL; SOLID;<br>WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG                                   |
| 13    | TP_INAM, TP_INAP,<br>TP_INBM, TP_INBP,<br>TP_OUTA, TP_OUTB | -       | 6   | 5012   | KEYSTONE                                     | N/A          | TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN;<br>BOARD HOLE=0.063IN; WHITE; PHOSPHOR BRONZE<br>WIRE SILVER PLATE FINISH; |
| 14    | U1   | -       | 1   | MAX40024ANL+   | MAXIM  | MAX40024ANL+ | EVKIT PART - IC; MAX40024ANL+; PACKAGE OUTLINE<br>DRAWING: 21-100549; PACKAGE CODE: N91G1+; WLP9                              |
| 15    | PCB  | -       | 1   | MAX40024   | MAXIM  | PCB          | PCB:MAX40024  |
| 16    | INAM, INAP, INBM,<br>INBP, OUTA, OUTB                      | DNP     | 0   | CN-BNC-011PG   | FIRST TECH<br>ELECTRONICS, CO.               | CN-BNC-011PG | CONNECTOR; FEMALE; THROUGH HOLE; BNC JACK;<br>STRAIGHT; 5PINS   |
| 17    | C3, C6-C8, C10,<br>C13-C15                                 | DNP     | 0   | N/A  | N/A  | OPEN         | PACKAGE OUTLINE 0603 NON-POLAR CAPACITOR  |
| 18    | C4, C5, C9, C11,<br>C12, C16                               | DNP     | 0   | N/A  | N/A  | SHORT        | PACKAGE OUTLINE 0603 NON-POLAR CAPACITOR  |
| 19    | R3, R4, R7, R11,<br>R12, R15                               | DNP     | 0   | N/A  | N/A  | OPEN         | PACKAGE OUTLINE 0603 RESISTOR   |
| TOTAL |  |         | 52  |  |  |              |   |

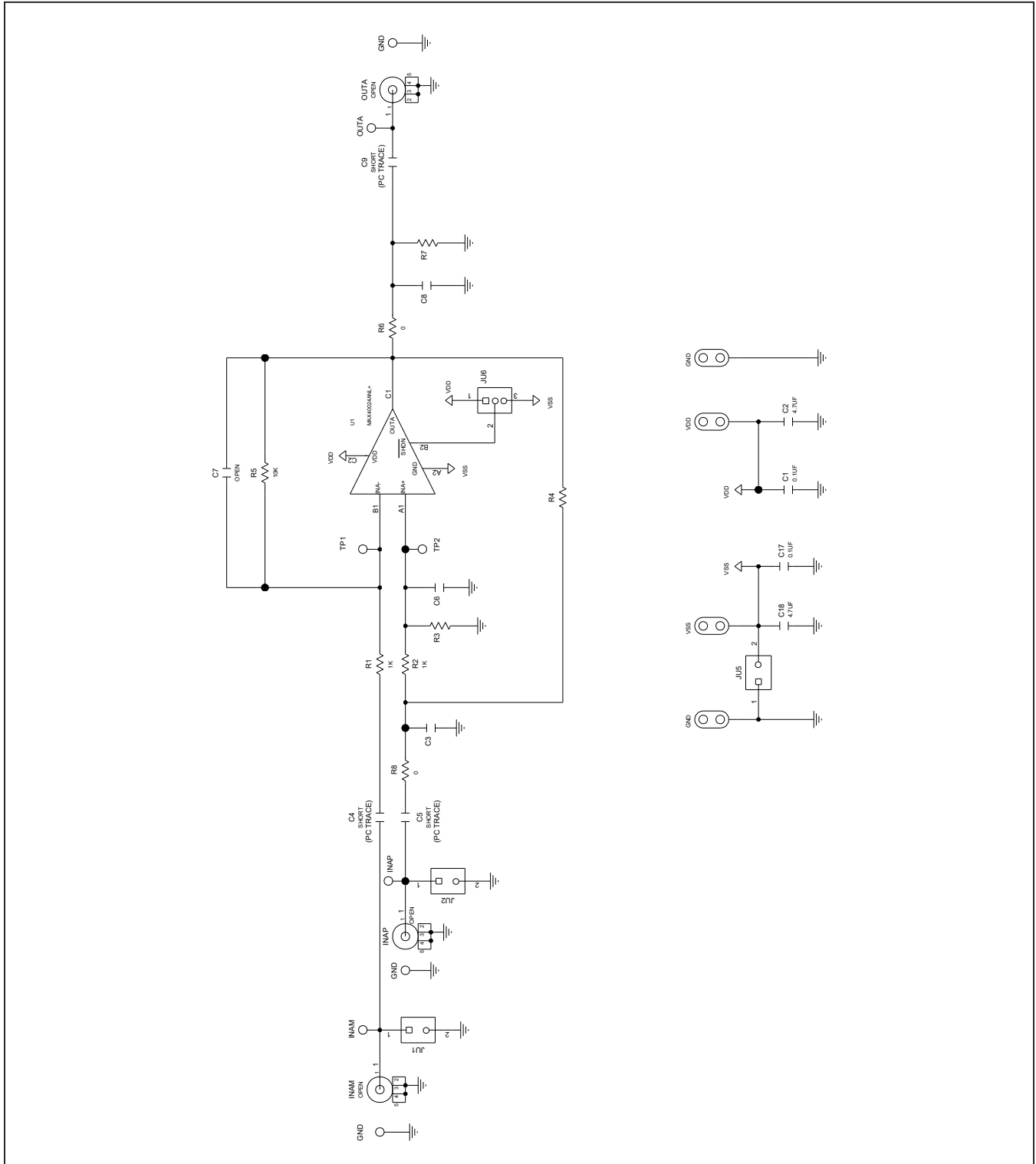
MAX40024 EV Kit Schematics

# MECHANICAL

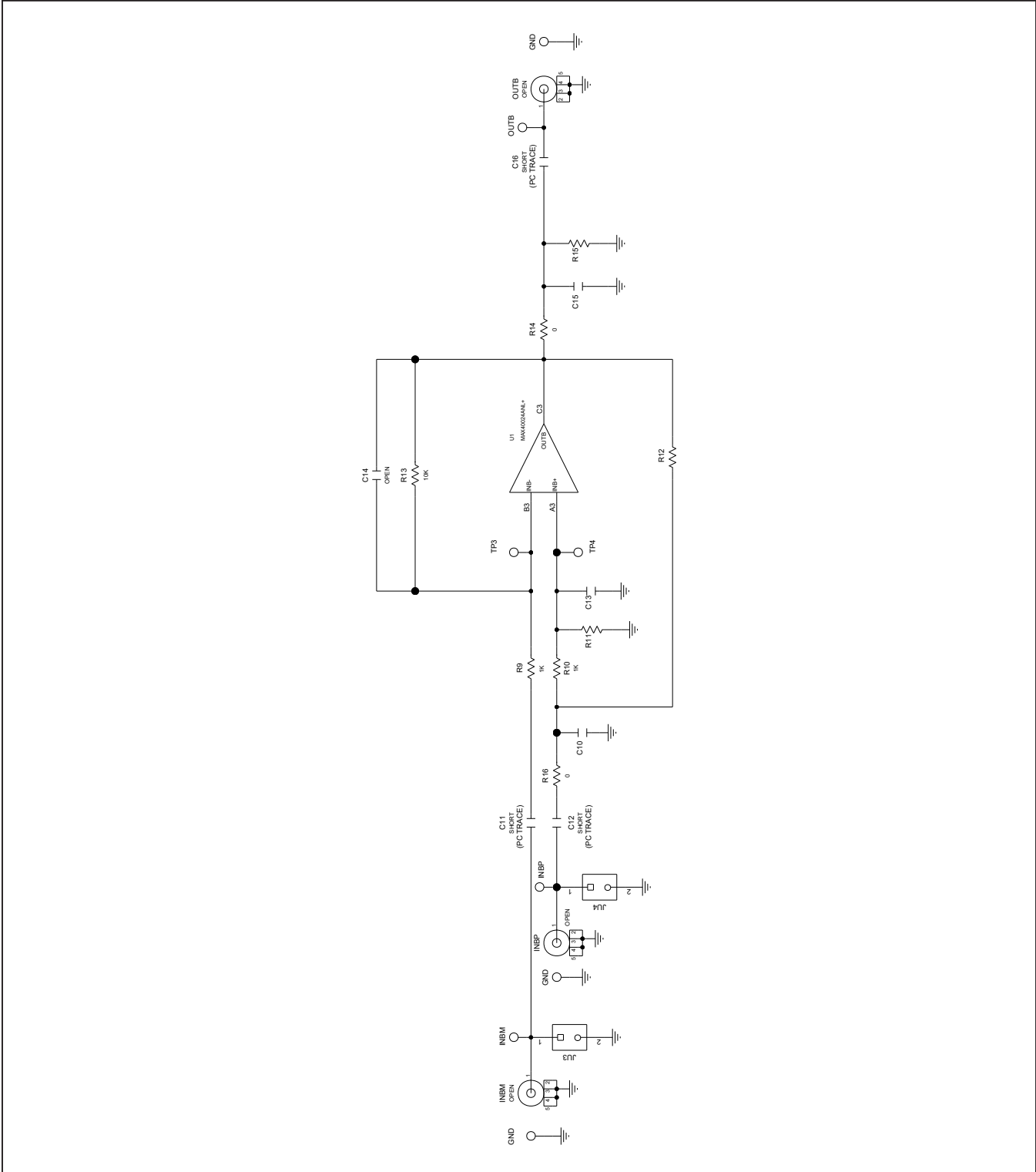
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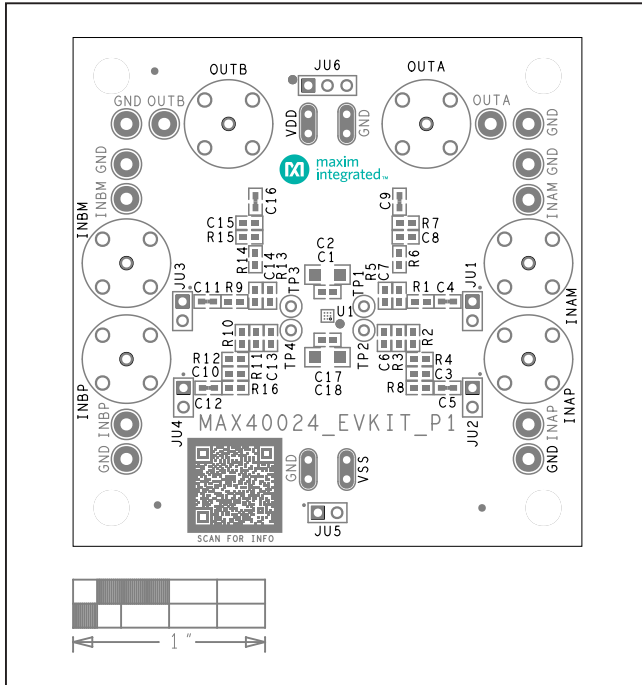
MAX40024 EV Kit Schematics (continued)



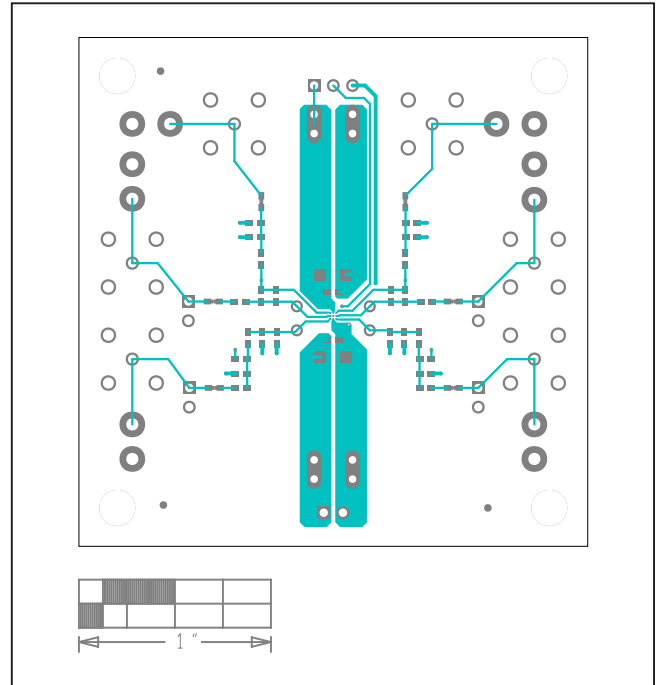
MAX40024 EV Kit Schematics (continued)



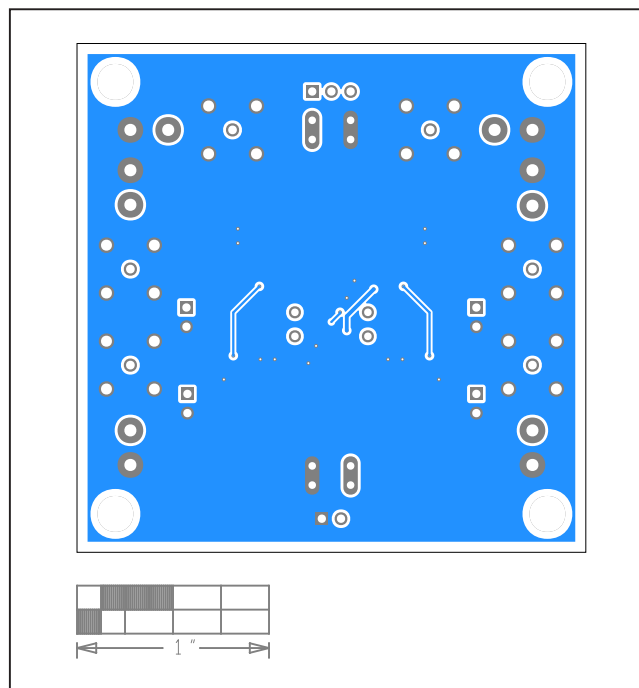
MAX40024 EV Kit PCB layouts



MAX40024 EV Kit Component Placement Guide—Top Silkscreen



MAX40024 EV Kit PCB Layout—Top



MAX40024 EV Kit PCB Layout—Bottom



## Revision History

| REVISION NUMBER | REVISION DATE | DESCRIPTION     | PAGES CHANGED |
|-----------------|---------------|-----------------|---------------|
| 0               | 5/21          | Initial release | —             |

For pricing, delivery, and ordering information, please visit Maxim Integrated's online storefront at <https://www.maximintegrated.com/en/storefront/storefront.html>.

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