

## General Description

The MAX4475 evaluation kit (EV kit) is a fully assembled and tested circuit board that contains all the components necessary to evaluate both MAX4475 and MAX4488 ICs. The MAX4475 EV kit printed circuit board (PCB) comes installed with MAX4475AUT/V+ in 6-SOT23 package.

The device is a rail-to-rail output op amp offering 10MHz Gain Bandwidth product (MAX4475) and 42MHz Gain Bandwidth product (MAX4488). The EV kit operates from a single 2.7V to 5.5V DC power supply or from  $\pm 1.35V$  to  $\pm 2.75V$  split supply.

## Features

- +2.7V to +5.5V Supply Voltage Range Across  $V_{DD}$  and  $V_{SS}$
- 42MHz Gain Bandwidth Product (MAX4488)
- 10MHz Gain Bandwidth Product (MAX4475)
- Ultra-Low Distortion (0.0002% with 1k $\Omega$  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:

- MAX4475 EV kit
- 2.7V to 5.5V, 100mA DC power supply
- Precision voltage calibrator
- Digital multimeter

### 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 calibrator on the input pins.

- 1) Make sure JU1 jumper is uninstalled and JU2 jumper is in 1-2 position before applying supply voltage.
- 2) Connect positive terminal of the +5V supply to the VDD test point and the GND terminal of supply to the GND test point. Make sure JU3 is in 1-2 position and JU4 is installed. JU4 is opened if split supply operation is desired.

## EV Kit Board Photo



- 3) Connect the positive terminal of the precision voltage calibrator to the INP/TP3 test point.
- 4) Connect the DMM to monitor the voltage on the OUTA/TP11 test point.
- 5) Turn on the 5V power supply connected to VDD test point, turn on the precision voltage calibrator on INP/TP3 test point and set 0.1V. Observe the output at the OUTA/TP11 test point on the DMM. DMM should read approximately 1V. Also, vary IN+ voltage between 0V to 0.45V and see if DMM on OUTA test point is showing a gained up voltage by 10V/V to the voltage applied on INP test point. Once above step is confirmed, EV kit is tested for functionality.

## Detailed Description of Hardware

The MAX4475 EV kit contains the MAX4475 IC, which is rail-to-rail output op amps with low noise and wide bandwidth in 6-SOT23 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 Non-Inverting amplifier configuration with Gain set as 10V/V.

### Op Amp Configurations

The EV kit provides flexibility to easily reconfigure the op amp into any of the three common circuit topologies: inverting amplifier, non-inverting amplifier, and differential amplifier.

These configurations are described in the next few sections.

#### Noninverting Configuration

The MAX4475 EV kit comes preconfigured as a non-inverting amplifier. The gain is set by the ratio of R8 and R9. The MAX4475 EV kit comes preconfigured for a gain of 10. The output voltage for the non-inverting configuration is given by the equation below:

$$V_{OUTA} = \left(1 + \frac{R8}{R9}\right) V_{INP}$$

#### Inverting Configuration

To configure the EV kit as an inverting amplifier, remove the shunt 1-2 on JU2 and install a shunt on jumper JU1 on position 1-2 and feed an input signal on the INM pad.

$$V_{OUTA} = -\left(\frac{R8}{R9}\right) V_{INM}$$

### Differential Amplifier

To configure the MAX4475 EV kit as a differential amplifier, replace R2, R3, R8, and R9 with appropriate resistors. When  $R2 = R8$  and  $R3 = R9$ , the CMRR of the differential amplifier is determined by the matching of the resistor ratios  $R2/R3$  and  $R8/R9$ .

$$V_{OUTA} = \text{GAIN} (V_{INP} - V_{INM})$$

where

$$\text{GAIN} = \frac{R8}{R9} = \frac{R2}{R3}$$

### Transimpedance Amplifier

To configure the MAX4475 EV kit as a transimpedance amplifier (TIA), short jumper JU1 on 1-2, replace R3, R9 with a 0 ohm resistor and populate R8 pad with 100kΩ resistor. The output voltage of the TIA is the input current multiplied by the feedback resistor:

$$V_{OUT} = (I_{INM} + I_{BIAS-}) \times R8 + V_{OS}$$

where  $I_{INM}$  is the input current source applied at the INM test point,  $I_{BIAS-}$  is the input bias current into IN- pin, and  $V_{OS}$  is the input offset voltage of the op amp. Use capacitor C2 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 R11 with a suitable resistor value to improve amplifier phase margin.

**Table 1. Default Jumper Settings**

| JUMPER | SHUNT POSITION | DESCRIPTION                     |
|--------|----------------|---------------------------------|
| JU1    | 1-2            | IN+ to GND                      |
|        | 2-3            | IN+ terminated by 50Ω to GND    |
|        | Not Installed* | IN+ terminal floating           |
| JU2    | 1-2*           | IN- to GND                      |
|        | 2-3            | IN- terminated by 50Ω to GND    |
|        | Not Installed  | IN- terminal floating           |
| JU3    | 1-2*           | Device in active or normal mode |
|        | 2-3            | Device in Shutdown mode         |
| JU4    | Installed*     | Single-supply operation         |
|        | Not Installed  | Split-supply operation          |

\*Default position.

## Component Suppliers

| SUPPLIER                              | WEBSITE                                                                      |
|---------------------------------------|------------------------------------------------------------------------------|
| Murata Electronics North America Inc. | <a href="http://www.murata-northamerica.com">www.murata-northamerica.com</a> |

**Note:** Indicate that you are using the MAX4475 EV kit when contacting these component suppliers.

## Ordering Information

| PART          | TYPE   |
|---------------|--------|
| MAX4475EVKIT# | EV Kit |

#RoHS compliant.

# MAX4475 Evaluation Kit

Evaluates: MAX4475, MAX4488

## MAX4475 EV Kit Bill of Materials

| ITEM  | QTY | REF DES             | VAR STATUS | MAXINV              | MFG PART #                             | MANUFACTURER              | VALUE         | DESCRIPTION                                                                                                                                                                                |
|-------|-----|---------------------|------------|---------------------|----------------------------------------|---------------------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | 2   | C4, C6              | Pref       | 20-000U1-P6B        | C1608X7R1E104K080AA                    | TDK                       | 0.1UF         | CAPACITOR; SMT (0603); CERAMIC CHIP; 0.1µF; 25V; TOL = 10%; MODEL = C SERIES; TG = -55°C TO +125°C; TC = X7R                                                                               |
| 2     | 2   | C5, C7              | Pref       | 20-004U7-L3         | C1608X5R1E475K080AC; GRM188R61E475KE11 | TDK; MURATA               | 4.7UF         | CAPACITOR; SMT (0603); CERAMIC CHIP; 4.7µF; 25V; TOL = 10%; TG = -55°C TO +85°C; TC = X5R                                                                                                  |
| 3     | 2   | GND, GND1           | Pref       | 02-TPMINIS011-00    | 5011                                   | KEYSTONE                  | N/A           | 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; NOT FOR COLD TEST   |
| 4     | 3   | INM, INP, OUTA      | Pref       | 01-31532952RFXSP-01 | 31-5329-52RFX                          | AMPHENOL                  | 31-5329-52RFX | CONNECTOR; FEMALE; THROUGH HOLE; BNC 500 PCB RECEPTACLE; STRAIGHT; 5PINS                                                                                                                   |
| 5     | 3   | JU1-JU3             | Pref       | 01-PEC03SAAN3P-21   | PEC03SAAN                              | SULLINS                   | PEC03SAAN     | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS                                                                                                                                  |
| 6     | 1   | JU4                 | Pref       | 01-PEC02SAAN2P-21   | PEC02SAAN                              | SULLINS                   | PEC02SAAN     | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS                                                                                                                                  |
| 7     | 4   | R1, R5, R7, R11     | Pref       | 80-0000R-AA6        | CRCW06030000Z0                         | VISHAY DALE               | 0             | RESISTOR; 0603; 0Ω; 0%; JUMPER; 0.1W; THICK FILM                                                                                                                                           |
| 8     | 1   | R3                  | Pref       | 80-0180R-24         | CRCW0603180RFK                         | VISHAY DALE               | 180           | RESISTOR; 0603; 180Ω; 1%; 100PPM; 0.10W; THICK FILM                                                                                                                                        |
| 9     | 2   | R6, R10             | Pref       | 80-0050R-H9         | RG1608N-500-W                          | SUSUMU CO LTD.            | 50            | RESISTOR; 0603; 50Ω; 0.05%; 10PPM; 0.10W; THIN FILM                                                                                                                                        |
| 10    | 1   | R8                  | Pref       | 80-001K8-24         | CRCW06031K80FK                         | VISHAY DALE               | 1.8K          | RESISTOR; 0603; 1.8KΩ; 1%; 100PPM; 0.10W; THICK FILM                                                                                                                                       |
| 11    | 1   | R9                  | Pref       | 80-0200R-24         | CRCW06032000FK                         | VISHAY DALE               | 200           | RESISTOR; 0603; 200Ω; 1%; 100PPM; 0.10W; THICK FILM                                                                                                                                        |
| 12    | 4   | SU1-SU4             | Pref       | 02-JMPFSTC02SYAN-00 | STC02SYAN                              | SULLINS ELECTRONICS CORP. | STC02SYAN     | TEST POINT; JUMPER; STR; TOTAL LENGTH = 0.256IN; BLACK; INSULATION = PBT CONTACT = PHOSPHOR BRONZE; COPPER PLATED TIN OVERALL                                                              |
| 13    | 4   | TP1, TP2, TP4, TP5  | Pref       | 02-TPMINIS001-00    | 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      |
| 14    | 4   | TP3, TP6, TP7, TP11 | Pref       | 02-TPMINIS012-00    | 5012                                   | KEYSTONE                  | N/A           | 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; NOT FOR COLD TEST |
| 15    | 1   | U1                  | Pref       | 00-SAMPLE-01        | MAX4475AUTV+                           | MAXIM                     | MAX4475AUTV+  | EVKIT PART-IC; PKG: OUTLINE DWG.: 21-0058; SOT23-6                                                                                                                                         |
| 16    | 1   | VDD                 | Pref       | 02-TPMINIS010-00    | 5010                                   | KEYSTONE                  | N/A           | TESTPOINT WITH 1.80MM HOLE DIA, RED, MULTIPURPOSE; NOT FOR COLD TEST                                                                                                                       |
| 17    | 1   | VSS                 | Pref       | 02-TPMINIS013-00    | 5013                                   | KEYSTONE                  | N/A           | TEST POINT; PIN DIA = 0.125IN; TOTAL LENGTH = 0.445IN; BOARD HOLE=0.063IN; ORANGE; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH; RECOMMENDED FOR BOARD THICKNESS = 0.062IN; NOT FOR COLD TEST  |
| 18    | 1   | PCB                 | -          | EPCB4475            | MAX4475                                | MAXIM                     | PCB           | PCB:MAX4475                                                                                                                                                                                |
| TOTAL | 38  |                     |            |                     |                                        |                           |               |                                                                                                                                                                                            |

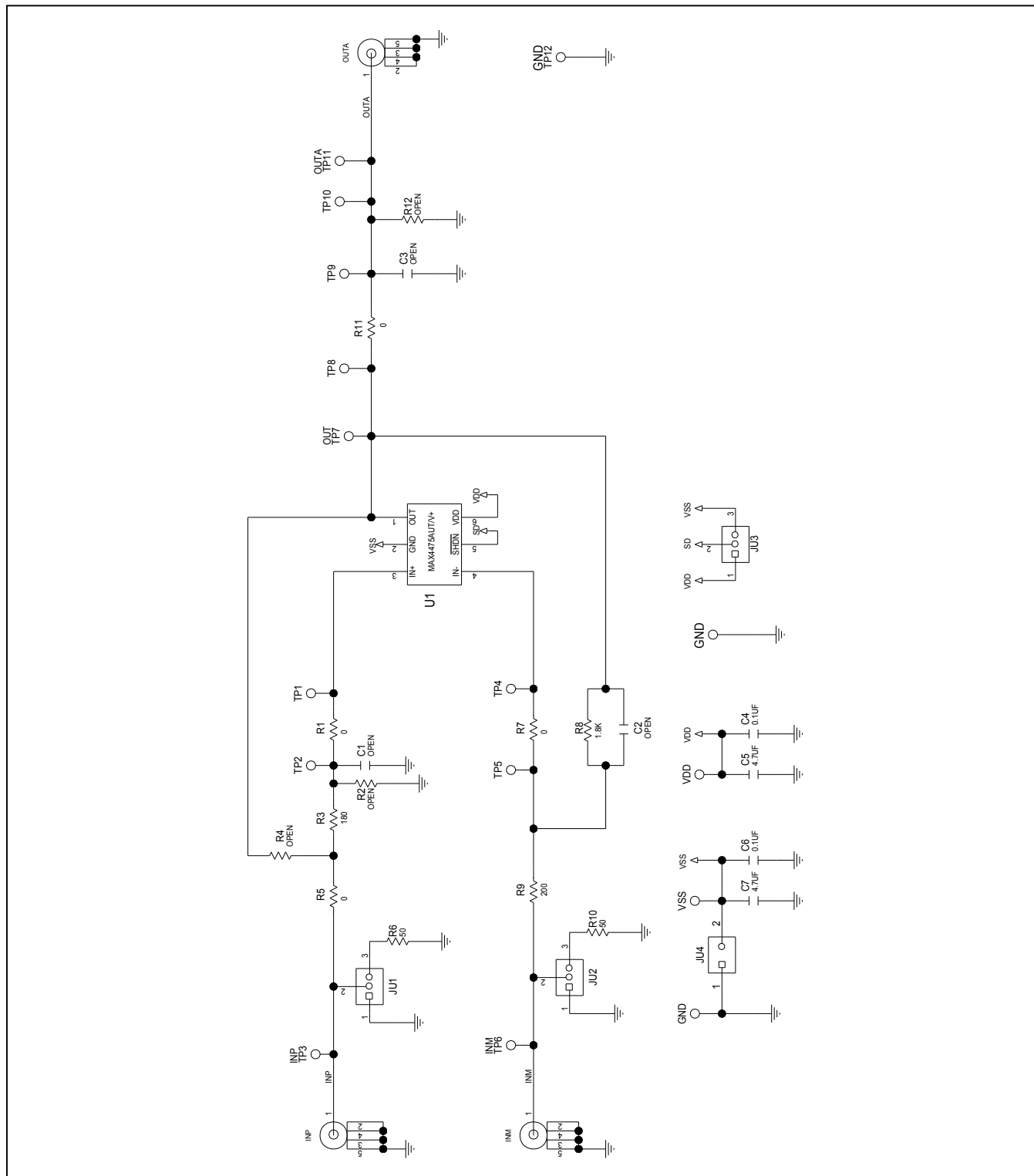
DO NOT PURCHASE(DNP)

| ITEM  | QTY | REF DES     | VAR STATUS | MAXINV | MFG PART # | MANUFACTURER | VALUE | DESCRIPTION                                      |
|-------|-----|-------------|------------|--------|------------|--------------|-------|--------------------------------------------------|
| 1     | 3   | C1-C3       | DNP        | N/A    | N/A        | N/A          | OPEN  | PACKAGE OUTLINE 0603 NON-POLAR CAPACITOR - EVKIT |
| 2     | 3   | R2, R4, R12 | DNP        | N/A    | N/A        | N/A          | OPEN  | PACKAGE OUTLINE 0603 RESISTOR - EVKIT            |
| TOTAL | 6   |             |            |        |            |              |       |                                                  |

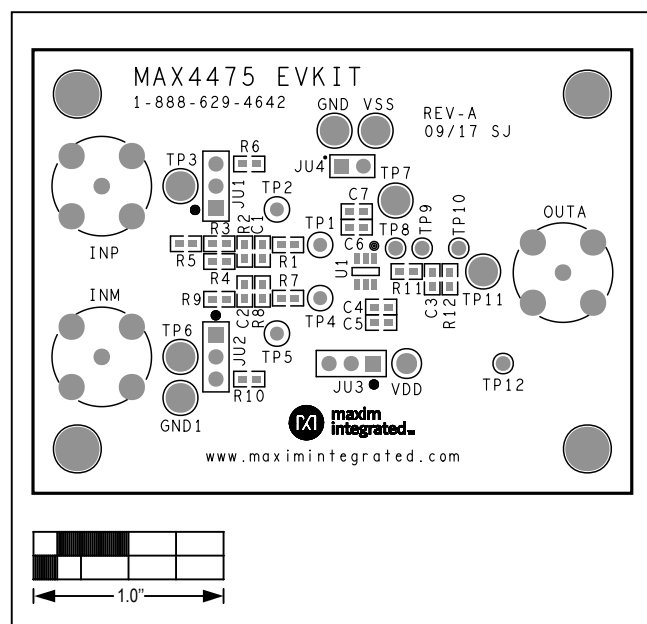
PACKOUT (These are purchased parts but not assembled on PCB and will be shipped with PCB)

| ITEM  | QTY | REF DES     | VAR STATUS | MAXINV        | MFG PART #    | MANUFACTURER | VALUE | DESCRIPTION                                           |
|-------|-----|-------------|------------|---------------|---------------|--------------|-------|-------------------------------------------------------|
| 1     | 1   | PACKOUT_BOX | DNI        | 88-00712-MDM  | 88-00712-MDM  | N/A          | ?     | BOX;+MEDIUM BROWN 9 3/8" X 7 1/4" X 2 1/2             |
| 2     | 1   | PACKOUT_BOX | DNI        | 87-02159-000  | 87-02159-000  | N/A          | ?     | ESD BAG;+BAG; STATIC SHIELD 5X8;WESD LOGO             |
| 3     | 1   | PACKOUT_BOX | DNI        | 85-MAXKIT-PNK | 85-MAXKIT-PNK | N/A          | ?     | PINK FOAM;FOAM;ANTI-STATIC PE 12inX12inX5MM - PACKOUT |
| 4     | 1   | PACKOUT_BOX | DNI        | EVINSERT      | EVINSERT      | N/A          | ?     | WEB INSTRUCTIONS FOR MAXIM DATA SHEET                 |
| 5     | 1   | PACKOUT_BOX | DNI        | 85-84003-006  | 85-84003-006  | N/A          | ?     | LABEL(EV KIT BOX) - PACKOUT                           |
| TOTAL | 5   |             |            |               |               |              |       |                                                       |

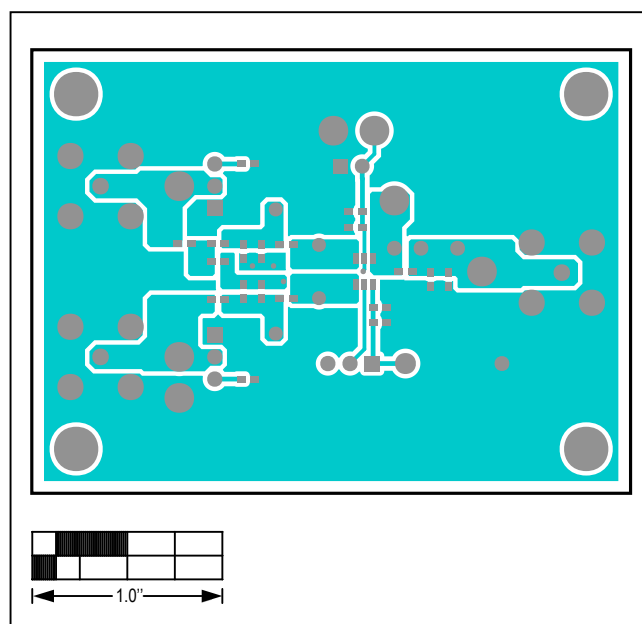
## MAX4475 EV Kit Schematic



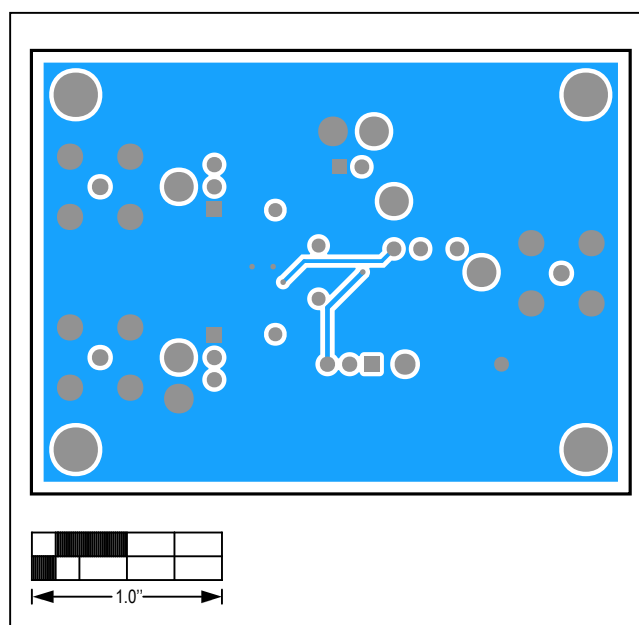
## MAX4475 EV Kit PCB Layout Diagrams



MAX4475 EV Kit—Top Silkscreen



MAX4475 EV Kit—Top



MAX4475 EV Kit—Bottom

## Revision History

| REVISION<br>NUMBER | REVISION<br>DATE | DESCRIPTION     | PAGES<br>CHANGED |
|--------------------|------------------|-----------------|------------------|
| 0                  | 1/18             | 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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