



# MAX8576 Evaluation Kit

## General Description

The MAX8576 evaluation kit (EV kit) is a fully assembled and tested circuit board that evaluates the MAX8576 and MAX8578 hysteretic, synchronous step-down DC-DC converters. The MAX8576 circuit generates a 1.8V output voltage at load currents up to 12A from a 10.8V to 13.2V input voltage range. The MAX8578 circuit uses an all-ceramic capacitor solution to generate a 1.8V output voltage at load currents up to 5A from a 10.8V to 13.2V input voltage with V<sub>CC</sub> supply from an additional 4.5V to 5.5V supply. The MAX8576 circuit switches at approximately 300kHz, and the MAX8578 circuit switches at approximately 500kHz. Both devices have up to 93% efficiency with the supplied components. The MAX8576 EV kit also evaluates the MAX8577 and MAX8579. To evaluate the MAX8577 or MAX8579, order a free sample along with this EV kit.

## Features

- ◆ 10.8V to 13.2V Supply Voltage Range with 4.5V to 5.5V V<sub>CC</sub> Supply Voltage Range
- ◆ 1.2% Accurate Over Temperature
- ◆ Adjustable Output Voltage Down to 0.6V
- ◆ 300kHz and 500kHz Switching Frequency
- ◆ Lossless Peak Current Sensing
- ◆ Monotonic Startup into Prebias Output (MAX8576/MAX8578)
- ◆ Startup Overvoltage Protection (MAX8577/MAX8579)
- ◆ Enable/Shutdown
- ◆ Fully Assembled and Tested

## Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX8576EVKIT	0°C to +70°C	10 $\mu$ MAX <sup>®</sup>

$\mu$ MAX is a registered trademark of Maxim Integrated Products, Inc.

## MAX8576 Component List

DESIGNATION	QTY	DESCRIPTION
C1, C2	2	470 $\mu$ F, 35V aluminum electrolytic capacitors Sanyo 35MV470WX
C3	1	10 $\mu$ F $\pm$ 10%, 25V X5S ceramic capacitor (1206) Taiyo Yuden TMK316C106KL
C4	1	0.01 $\mu$ F $\pm$ 20%, 10V X7R ceramic capacitor (0603) Kemet C0603C103M8RAC
C5	1	1 $\mu$ F $\pm$ 20%, 35V X7R ceramic capacitor (1206) Taiyo Yuden GMK316BJ105ML
C6	1	4.7 $\mu$ F $\pm$ 20%, 6.3V X5R ceramic capacitor (0805) Taiyo Yuden JMK212BJ475MG
C7, C12	1	0.1 $\mu$ F $\pm$ 20%, 10V X7R ceramic capacitors (0603) Kemet C0603C104M8RAC
C8	1	0.027 $\mu$ F $\pm$ 10%, 50V X7R ceramic capacitor (0603) Kemet C0603C273K5RAC
C9, C10	2	2200 $\mu$ F, 6.3V aluminum electrolytic capacitors Rubycon 6.3MBZ2200M10X20

DESIGNATION	QTY	DESCRIPTION
C11	1	0.01 $\mu$ F $\pm$ 20%, 25V X5R ceramic capacitor (0603) Kemet C0603C103M3PAC
C13	1	3300pF $\pm$ 20%, 6.3V X7R ceramic capacitor (0603) Kemet C0603C332M9RAC
D1	1	100V, 250mA high-speed diode Philips BAS316 (SOD-323)
JU1	1	3-pin header
L1	1	1.8 $\mu$ H, 14A, 3.48m $\Omega$ inductor Panasonic ETQP2H1R8BFA
N1	1	30V, 12.5m $\Omega$ (max) n-channel MOSFET (SO-8) International Rectifier IRF7821
N2	1	30V, 3.7m $\Omega$ (max) n-channel MOSFET (SO-8) International Rectifier IRF7832
N3	1	n-channel MOSFET, 2N7002 (SOT23)
R1	1	6.04k $\Omega$ $\pm$ 1% resistor (0603)
R2	1	5.11k $\Omega$ $\pm$ 1% resistor (0603)
R3	1	12.4k $\Omega$ $\pm$ 1% resistor (0603)
R4	1	1k $\Omega$ $\pm$ 5% resistor (0603)

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## MAX8576 Component List (continued)

DESIGNATION	QTY	DESCRIPTION
R5	1	20k $\Omega$ $\pm$ 5% resistor (0603)
R6	1	2 $\Omega$ $\pm$ 5% resistor (0603)
R7	1	10 $\Omega$ $\pm$ 5% resistor (0402)
R8	0	Not installed, shorted on PC board (0402)
U1	1	MAX8576EUB (10-pin $\mu$ MAX)
None	1	Shunt (position 2)

## MAX8578 Component List

DESIGNATION	QTY	DESCRIPTION
C14	1	10 $\mu$ F $\pm$ 20%, 25V X5R ceramic capacitor (1210) Taiyo Yuden TMK325BJ106MM
C15	1	1 $\mu$ F $\pm$ 20%, 25V X7R ceramic capacitor (1206) TDK C3216X7R1E105M
C16	1	4700pF $\pm$ 20%, 10V X7R ceramic capacitor (0603) Kemet C0603C472M8RAC
C17	1	4.7 $\mu$ F $\pm$ 20%, 6.3V X5R ceramic capacitor (0805) Taiyo Yuden JMK212BJ475MG
C18	1	0.1 $\mu$ F $\pm$ 20%, 10V X7R ceramic capacitor (0603) Kemet C0603C104M8RAC
C19	1	0.01 $\mu$ F $\pm$ 20%, 25V X7R ceramic capacitor (0603) Kemet C0603C103M3RAC
C20	1	47 $\mu$ F $\pm$ 20%, 6.3V, ESR = 5m $\Omega$ , X5R ceramic capacitor (1812) Taiyo Yuden JMK432BJ476MM
C21	1	0.01 $\mu$ F $\pm$ 20%, 25V X5R ceramic capacitor (0603) Kemet C0603C103M3PAC
C22	0	Not installed (optional, 47 $\mu$ F $\pm$ 20%, 6.3V, ESR = 5m $\Omega$ , X5R ceramic capacitor) (1812) Taiyo Yuden JMK432BJ476MM
C23	1	1000pF $\pm$ 20%, 25V X5R ceramic capacitor (0603) Kemet C0603C102M3PAC
D2	1	100V, 250mA high-speed diode Philips BAS316 (SOD-323)
JU2	1	3-pin header
L2	1	2.2 $\mu$ H, 7.3A, 9.8m $\Omega$ inductor Sumida CDEP104L-2R2

## MAX8578 Component List

DESIGNATION	QTY	DESCRIPTION
N4	1	30V, 18m $\Omega$ (max) n-channel MOSFET (SO-8) International Rectifier IRF7807Z
N5	1	30V, 12.5m $\Omega$ (max) n-channel MOSFET (SO-8) International Rectifier IRF7821
R9	1	6.04k $\Omega$ $\pm$ 1% resistor (0603)
R10	1	2.49k $\Omega$ $\pm$ 1% resistor (0603)
R11	1	12.4k $\Omega$ $\pm$ 1% resistor (0603)
R12	1	2 $\Omega$ $\pm$ 5% resistor (0603)
R13	0	Not installed, shorted on PC board, resistor (0402)
U2	1	MAX8578EUB (10-pin $\mu$ MAX)
None	1	Shunt (position 2)
None	1	MAX8576 EV kit PC board

## Quick Start

### Recommended Equipment

- One variable-DC power supply capable of supplying up to 13.2V at 3.5A
- One variable-DC power supply capable of supplying up to 5V at 100mA
- Digital multimeter (DMM)
- 5A load
- 12A load
- Ammeter (optional)

### Procedure (MAX8576)

The MAX8576 EV kit is fully assembled and tested. Follow the steps below to verify board operation:

- 1) Preset the variable-DC power supply to 12V. Turn off the power supply. **Do not turn on the power supply until all connections are complete.**
- 2) Connect the positive lead of the 12V power supply to the VIN pad on the EV kit and connect the negative lead of the power supply to the GND pad on the EV kit.
- 3) Connect the positive lead of the DMM to the VOUT pad on the EV kit and connect the negative lead of the DMM to the GND pad on the EV kit.
- 4) Turn on the power supply.
- 5) Verify the voltage at VOUT is 1.8V  $\pm$ 5%.
- 6) Connect a 12A load between VOUT and GND.
- 7) Verify that the voltage at VOUT is 1.8V  $\pm$ 5%.

# MAX8576 Evaluation Kit

## Component Suppliers

SUPPLIER	PHONE	WEBSITE
Central Semiconductor	631-435-1110	www.centalsemi.com
International Rectifier	800-341-0392	www.irf.com
Kemet	864-963-6300	www.kemet.com
Panasonic	402-564-3131	www.panasonic.com
Philips	800-447-1500	www.semiconductors.philips.com
Rubycon	408-467-3864	www.rubycon.com
Sanyo	619-661-6835	www.sanyo.com
Sumida	847-956-0666	www.sumida.com
Taiyo Yuden	408-573-4150	www.t-yuden.com
TDK	888-835-6646	www.component.tdk.com

**Note:** Indicate that you are using the MAX8576 when contacting these suppliers.

### Procedure (MAX8578)

Follow the steps below to verify board operation:

- 1) Preset the variable-DC power supplies to 12V and 5V. Turn off the power supplies. **Do not turn on the power supplies until all connections are complete.**
- 2) Connect the positive lead of the 5V power supply to the VCC1 pad on the EV kit, and connect the negative lead of the power supply to the GND1 pad on the EV kit.
- 3) Connect the positive lead of the 12V power supply to the VIN1 pad on the EV kit, and connect the negative lead of the power supply to the GND1 pad on the EV kit.
- 4) Connect the positive lead of the DMM to the VOUT1 pad on the EV kit, and connect the negative lead of the DMM to the GND1 pad on the EV kit.
- 5) Turn on the 12V supply.
- 6) Turn on the 5V supply.
- 7) Verify the voltage at VOUT1 is 1.8V  $\pm$ 5%.
- 8) Connect a 5A load between VOUT1 and GND1.
- 9) Verify that the voltage at VOUT1 is 1.8V  $\pm$ 5%.

### Detailed Description

#### Evaluating Other Output Voltages

Both circuits come preset to a 1.8V output voltage. The output voltage of the MAX8576 is adjustable down to 0.6V and up to  $0.9 \times V_{IN}$ . To adjust the output voltage, place a  $\pm$ 1% resistor at R3 with a value corresponding to the equation:

$$R3 = 6040 \times \left( \frac{V_{OUT} + 0.01 + (0.5 \times R_{DC} \times I_{OUTMAX})}{0.59} - 1 \right)$$

where  $R_{DC}$  is the resistance of the inductor. Refer to the MAX8576 data sheet for information on selecting the inductor, output capacitor, and feed-forward capacitor to optimize the circuit for different output voltages.

For the MAX8578 circuit, R11 can be calculated using the same method.

#### Higher Input/Output Voltages

The MAX8576 and MAX8578 circuits are targeted for 10.8V to 13.2V input voltages and 1.8V output voltages. However, the 9V to 24V input voltage range and an output voltage up to  $0.9 \times V_{IN}$  is possible for IC evaluation. 30V rated MOSFETs must be installed if the input voltage is raised above 16V. Ensure that input and output capacitor voltage ratings are sufficient for the new operating voltages.

### Jumper Settings

#### Jumper JU1 Function

The MAX8576 circuit features an output shutdown mode. To shut down the output, place a shunt between pins 2 and 3 on JU1. For normal operation remove the shunt or place it on pins 1 and 2 of JU1 (default position).

#### Jumper JU2 Function

The MAX8578 circuit features an output shutdown mode. To shut down the output, place a shunt between pins 1 and 2 on JU2. For normal operation remove the shunt or place it on pins 2 and 3 of JU2 (default position).

#### Evaluating the MAX8577/MAX8579

To evaluate the MAX8577, carefully remove the MAX8576 and install the MAX8577. To evaluate the MAX8579, carefully remove the MAX8578 and install the MAX8579. All other components can remain the same.

# MAX8576 Evaluation Kit

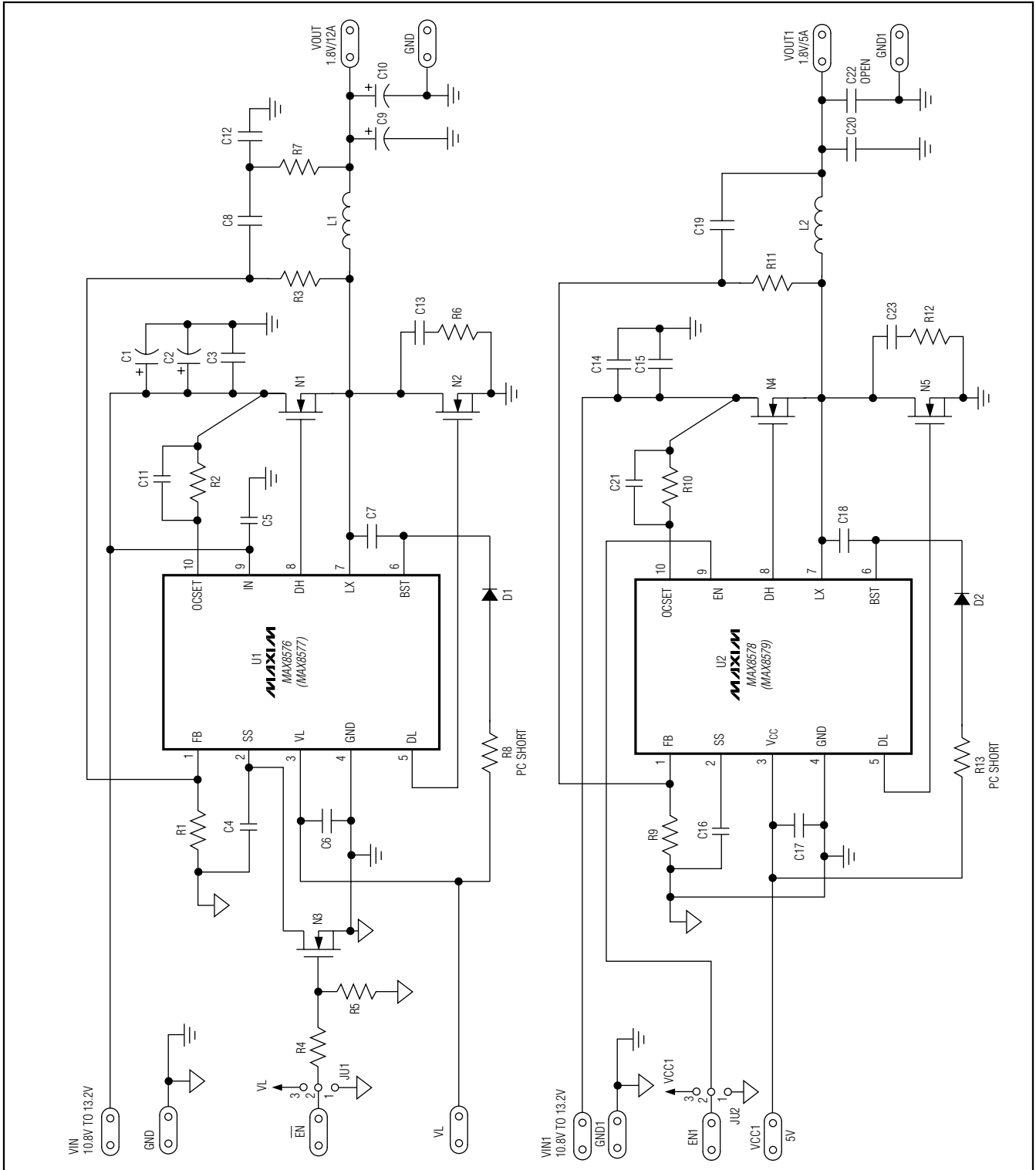


Figure 1. MAX8576 EV Kit Schematic

# MAX8576 Evaluation Kit

Evaluates: MAX8576-MAX8579

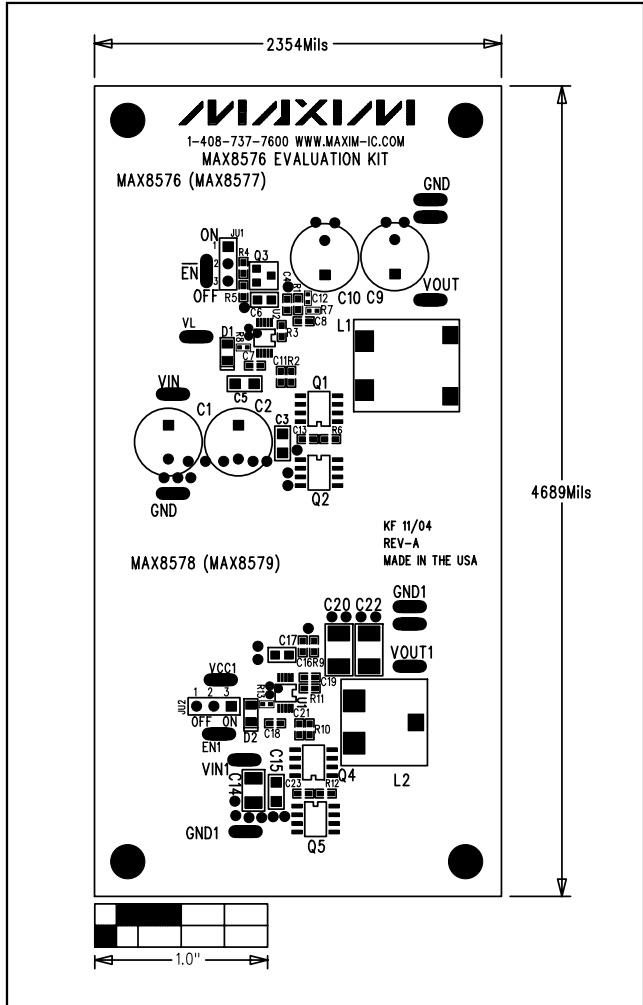


Figure 2. MAX8576 EV Kit Component Placement Guide—Component Side

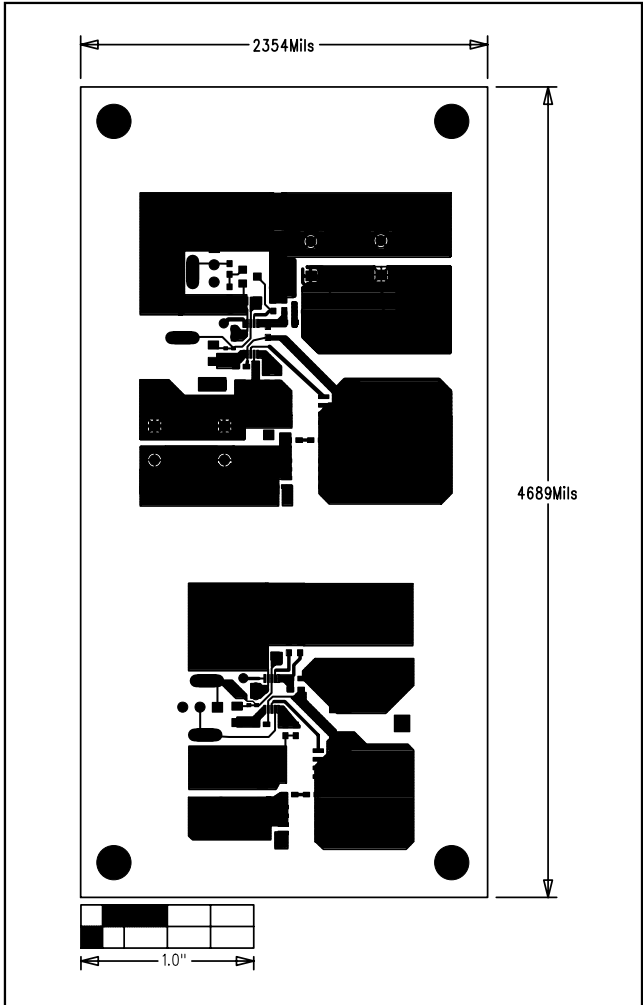


Figure 3. MAX8576 EV Kit PC Board Layout—Component Side

# MAX8576 Evaluation Kit

**Evaluates: MAX8576-MAX8579**

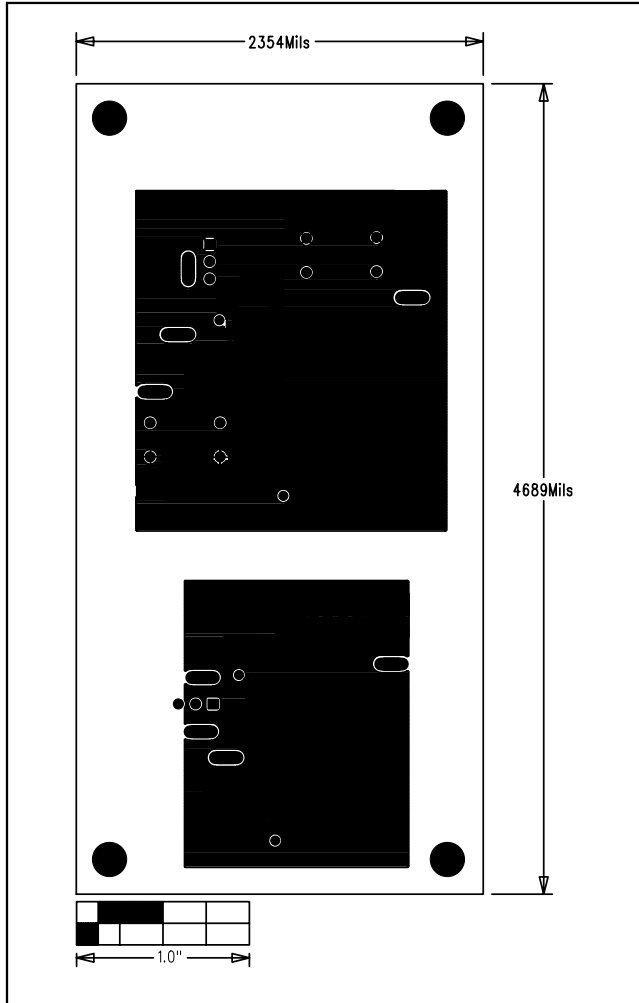


Figure 4. MAX8576 EV Kit PC Board Layout—Layer 2

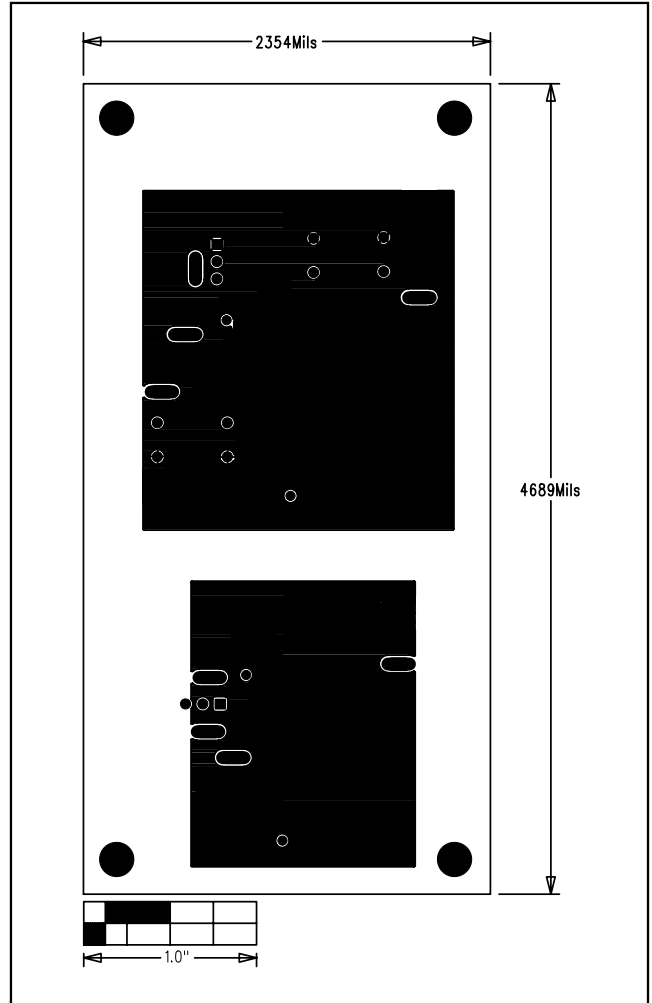


Figure 5. MAX8576 EV Kit PC Board Layout—Layer 3

# MAX8576 Evaluation Kit

Evaluates: MAX8576-MAX8579

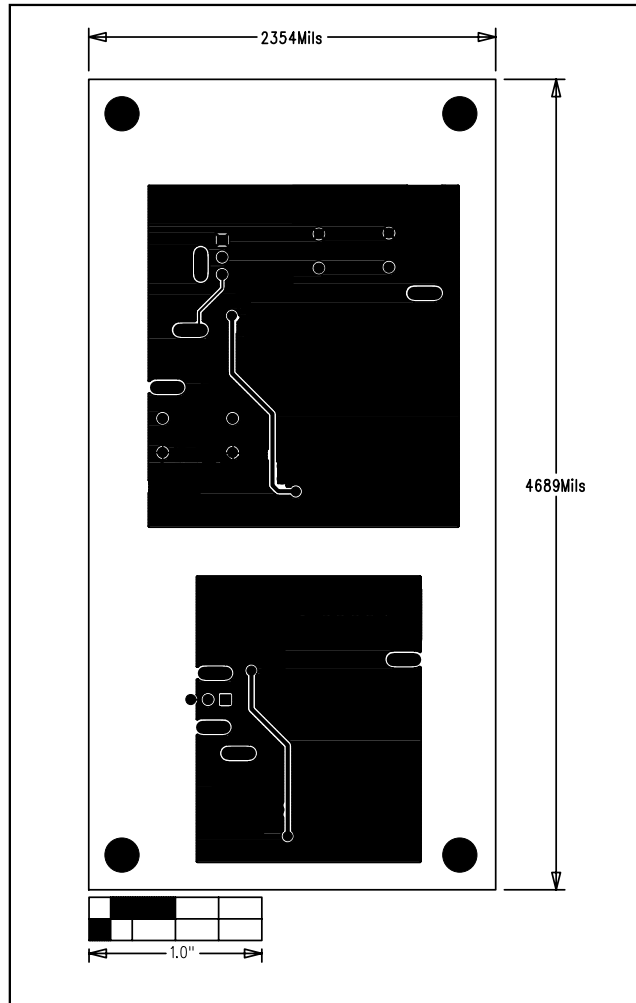


Figure 6. MAX8576 EV Kit PC Board Layout—Solder Side

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