

# MAX17609 Evaluation Kit

**Evaluates: MAX17609 – 4.5V to 60V,  
1A, OV, UV Protector with  
Forward Current Limit**

## General Description

The MAX17609 evaluation kit (EV kit) is a fully assembled and tested circuit board that demonstrates the MAX17609 4.5V to 60V, 1A, OV, UV protector with forward current-limit in a 12-pin TDFN-EP package. The EV kit can be configured to demonstrate adjustable overvoltage, under-voltage, different current-limit types, and different current-limit thresholds.

## Features

- 4.5V to 60V Operating-Voltage Range
- Features a TVS Diode across the Input and Schottky Diode across the Output Terminals
- Evaluates UVLO, OVLO, Three Current-Limit Types, and Current-Limit Threshold
- UVLO programmed to 4.5V
- OVLO programmed to 36V
- Jumper-Configurable Current-Limit (Selected as 0.1A by default)
- Current-Limit Mode Set To Autoretry by default
- Proven PCB Layout
- Fully Assembled and Tested

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

## Quick Start

### Recommended Equipment

- MAX17609 EV kit
- 60V DC power supply
- Multimeters
- Adjustable load (0A-1.5A)
- USB-A male to USB-B male cable or 5V DC power supply

### Equipment Setup and Test Procedure

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

**Caution: Do not turn on the power supply until all connections are completed.**

- 1) Verify that all jumpers are in their default positions.
- 2) Connect the USB cable to J1 from a computer or connect a 5V-DC power supply to TP3.
- 3) Verify that LED1 is on.
- 4) Set the 60V DC power supply to 5V and connect to IN (J2/TP6). Verify that OUT (J3/TP8) is 5V.
- 5) Gradually increase the DC power-supply voltage and verify that OUT voltage goes down and  $\overline{UVOV}$  goes low when input reaches approximately 36V.
- 6) Gradually decrease the DC power-supply voltage and verify that OUT comes back and  $\overline{UVOV}$  goes high when the input reaches approximately 34.8V.
- 7) Set the DC power-supply voltage to 24V and connect the adjustable load between OUT and GND terminals and a multimeter in series to measure the current. Gradually increase the load current and verify that the OUT goes down and  $\overline{FLAG}$  goes low when the load current increases above 0.1A.
- 8) The jumper JU1 can be configured to change the current limit as given in [Table 2](#). Verify various current limit operations by repeating step 7.

**CAUTION:** When applying a negative input to  $V_{IN}$ , the negative input test should be performed when the output capacitors are fully discharged and  $V_{BUS}$  is not supplied.

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## Detailed Description

The EV kit circuit can be configured to evaluate user-defined UVLO and OVLO thresholds using resistor-dividers. The overcurrent threshold is determined by external resistors connected to the SET1 pin and is jumper-configurable through jumper JU1. Using jumper JU4, the EV kit circuit can be configured to evaluate different current limit types (Autoretry, Continuous, and Latch-off). LED1 on the EV kit indicates availability of logic power for annunciation signals ( $\overline{UVOV}$  and  $\overline{FLAG}$ ) and EN.

The EV kit provides on-board output capacitors to enable a demonstration of the MAX17609 protection features.

### Input-Power Supply

The EV kit is powered by a user-supplied 4.5V to 60V power supply connected between J2/TP6 (INPUT POWER) and GND.

### Enable

To enable the device, connect a USB-A male connector from the computer to the USB-B female connector, J1, or an external 5V supply to TP3 and GND. This provides 5V to  $V_{BUS}$  and to the EN pin (JU5 connects  $V_{BUS}$  to EN by default). Choose the JU5 setting to enable or disable operation of the MAX17609 (see [Table 1](#)).

### UVLO/OVLO Threshold

Ensure jumper JU2 is installed to use the UVLO/OVLO resistive dividers.

**Table 1. Enable (JU5)**

JUMPER	SHUNT POSITION	DESCRIPTION	MAX17609 STATUS
JU5	1-2*	EN pin connected to $V_{BUS}$	ON
	2-3	EN pin connected to GND	OFF
	Open	EN pin floating	ON

\*Default position.

**Table 2. Current-Limit Threshold (JU1)**

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	1-2*	Current limit 0.1A
	3-4	Current limit 0.5A
	5-6	Current limit 1.0A
	7-8	Current limit adjustable

\*Default position.

The UVLO threshold for input voltage is set through the R9, R10 resistive divider. Use the following equation to calculate the value of R10 for a required undervoltage threshold level:

$$R10 = \frac{R9}{\left(\frac{V_{UVLO}}{V_{REF}} - 1\right)}$$

where R9 can be chosen as 2.2M $\Omega$ ,  $V_{REF}$  is 1.5V, and  $V_{UVLO}$  is the required undervoltage protection threshold.

The OVLO threshold for input voltage is set through the R11, R12 resistive divider. Use the following equation to calculate the value of R12 for a required overvoltage threshold level:

$$R12 = \frac{R11}{\left(\frac{V_{OVLO}}{V_{REF}} - 1\right)}$$

where R11 can be chosen as 2.2M $\Omega$ ,  $V_{REF}$  is 1.5V, and  $V_{OVLO}$  is the required overvoltage protection threshold.

### Current-Limit Threshold

The EV kit features a jumper (JU1) to select the current-limit threshold. Install a jumper as shown in [Table 2](#) to change the current-limit threshold.

**Current-Limit Type Select**

The EV kit features jumper JU4 to select different current-limit responses. See [Table 3](#) for jumper settings.

**Output-Load Capacitor**

Use JU6 to connect the OUT pins to the OUT test point (TP8). Use jumper JU7 to connect output to 330 $\mu$ F capacitors. See [Table 4](#) for jumper settings

**Table 3. Current-Limit Type Select (JU4)**

JUMPER	SHUNT POSITION	DESCRIPTION
JU4	1-2	Latch-off
	2-3	Continuous
	Open*	Autoretry

\*Default position.

**Table 4. Output Load Capacitor (JU7)**

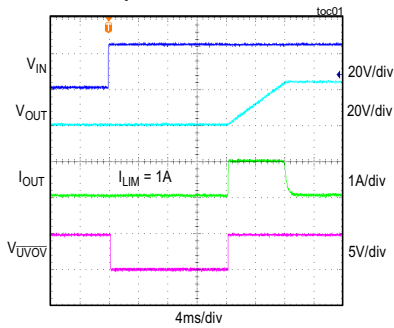
JUMPER	SHUNT POSITION	DESCRIPTION
JU7	Installed	OUT connected to C4 and C5.
	Not installed*	OUT not connected to C4 and C5.

\*Default position.

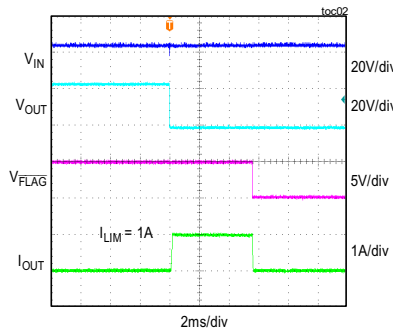
**MAX17609 EV Kit Performance Report**

( $V_{IN} = 24V$ , unless otherwise noted.)

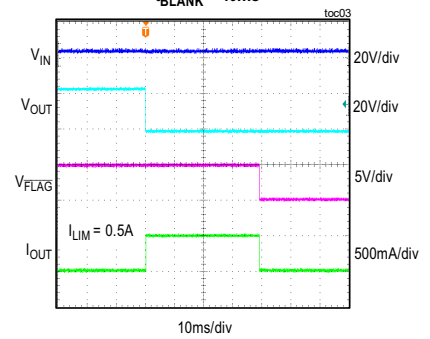
**POWER-UP RESPONSE  
WITH 330 $\mu$ F CAPACITOR AT NO LOAD**



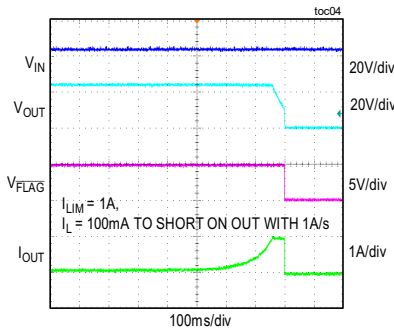
**THERMAL SHUTDOWN DUE TO  
OUTPUT SHORT-CIRCUIT**



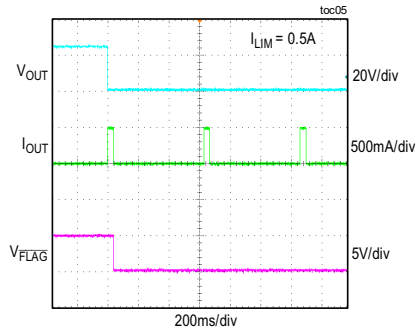
**OUTPUT SHORT-CIRCUIT RESPONSE  
 $t_{BLANK} = 40ms$**



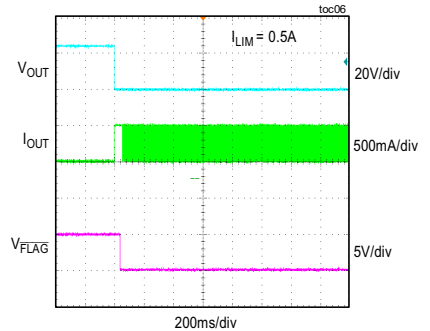
**CURRENT-LIMIT RESPONSE**



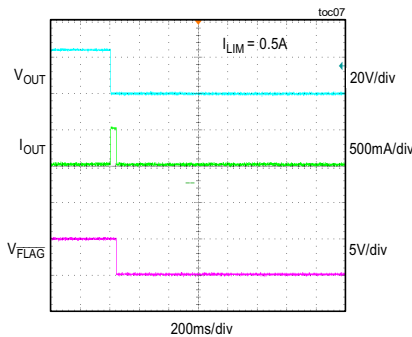
**AUTORETRY CURRENT-LIMIT RESPONSE**



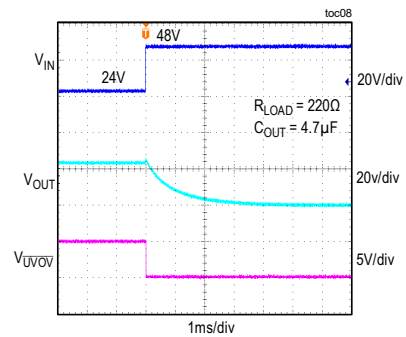
**CONTINUOUS CURRENT-LIMIT RESPONSE**



**LATCH-OFF CURRENT-LIMIT RESPONSE**



**OVERVOLTAGE-FAULT RESPONSE**



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### Component Suppliers

SUPPLIER	WEBSITE
Bourns, Inc.	<a href="http://www.bourns.com">www.bourns.com</a>
Fairchild Semiconductor	<a href="http://www.fairchildsemi.com">www.fairchildsemi.com</a>
FCI Electronics Interconnection Solutions	<a href="http://www.fciconnect.com">www.fciconnect.com</a>
Lite-On, Inc.	<a href="http://www.us.liteon.com">www.us.liteon.com</a>
Lumex Inc.	<a href="http://www.lumex.com">www.lumex.com</a>
Murata Americas	<a href="http://www.murata.com">www.murata.com</a>
Panasonic Corp.	<a href="http://www.panasonic.com">www.panasonic.com</a>
Phoenix Contact, Inc.	<a href="http://www.phoenixcontact.com">www.phoenixcontact.com</a>
STMicroelectronics	<a href="http://www.us.st.com">www.us.st.com</a>
TDK Corp.	<a href="http://www.component.tdk.com">www.component.tdk.com</a>

**Note:** Indicate that you are using the MAX17609 when contacting these component suppliers.

### Ordering Information

PART	TYPE
MAX17609EVKIT#	EV Kit

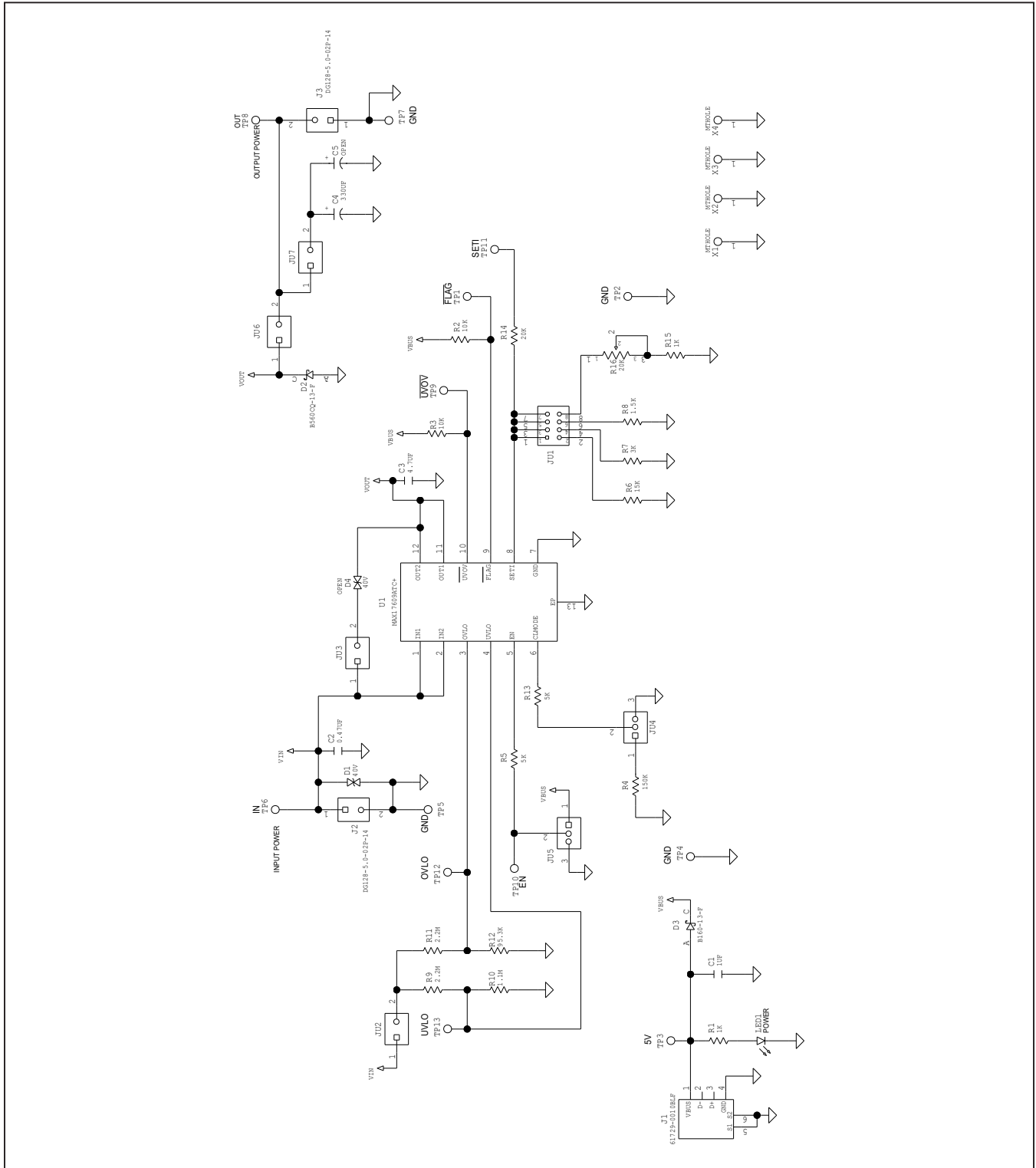
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## MAX17609 EV Kit Bill of Materials

PART REFERENCE	QTY	DESCRIPTION	MANUFACTURER PART NUMBER
C1	1	1µF 10%, 25V X7R ceramic capacitors (0603)	Murata GRM188R61E105KA12
C2	1	0.47µF 10%, 100V X7R ceramic capacitors (0805)	Murata GRM21BR72A474KA73L
C3	1	4.7µF 10%, 100V X7R ceramic capacitors (1210)	Kemet C1210C475K1R2C, Murata GRM32ER72A475KE14
C4	1	330µF 20%, 50V aluminium (10mm)	Panasonic EEU-EB1H331
D1	1	TVS Diode, 600W (SMB)	Bourns SMBJ40CA
D2	1	Power Schottky Diode, 60V, 5A (SMC)	Diodes Incorporated B560CQ-13-F
D3	1	Power Schottky Diode, 60V, 1A (SMA)	Diodes Incorporated B160-13-F
J1	1	USB B connector	FCI Connect 61729-0010BLF
J2, J3	2	2-Pin Green PC Terminal Block	Degson Electronics DG128-5.0-02P-14
JU1	1	2x4 Dual-Row Header, 0.1in centers, cut to fit	Sullins Connector PBC04DAAN
JU2, JU3, JU6, JU7	4	2-Pin Single-Row Header, 0.1in centers, cut to fit	Molex Connector 22-28-4023
JU4, JU5	2	3-Pin Single-Row Header, 0.1in centers, cut to fit	Sullins Connector PEC03SAAN
LED1	1	Green LED (1206)	Kingbright APT3216SGC
R1	1	1kΩ 1% resistors (0603)	–
R2, R3	2	10kΩ 1% resistors (0402)	–
R4	1	150kΩ 5% resistor (0402)	–
R5, R13	2	5kΩ 0.1% resistors (0402)	–
R6	1	15kΩ 1% resistors (0402)	–
R7	1	3kΩ 1% resistors (0402)	–
R8	1	1.5kΩ 1% resistors (0402)	–
R9, R11	2	2.2MΩ 5% resistors (0402)	–
R10	1	1.1MΩ 1% resistors (0402)	–
R12	1	95.3kΩ 1% resistors (0402)	–
R14	1	20kΩ 1% resistors (0402)	–
R15	1	1kΩ 1% resistors (0402)	–
R16	1	20kΩ Trimmer Potentiometers	Bourns 3296W-1-203LF
TP1, TP9, TP11-TP13	5	White Test Point	Keystone Electronics Corp 5002
TP2, TP4, TP5, TP7	4	Black Test Point	Keystone Electronics Corp 5001
TP3, TP6, TP8	3	Red Test Point	Keystone Electronics Corp 5000
TP10	1	Green Test Point	Keystone Electronics Corp 5116
U1	1	4.5V to 60V, 1A, OV, UV Protector with Forward Current Limit (12-pin TDFN-EP, 3mm x 3mm)	MAX17609ATC+
C5	0	Not Installed; 330µF 20%, 50V aluminium (10mm)	Panasonic EEU-EB1H331
D4	0	Not Installed; TVS Diode, 600W (SMB)	Bourns SMBJ40CA
PCB	1	PCB: MAX17609 Evaluation Kit	–

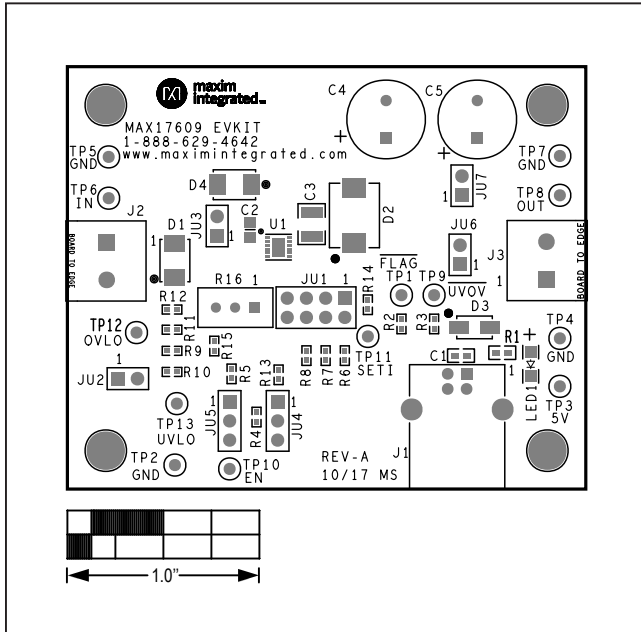
MAX17609 EV Kit Schematic



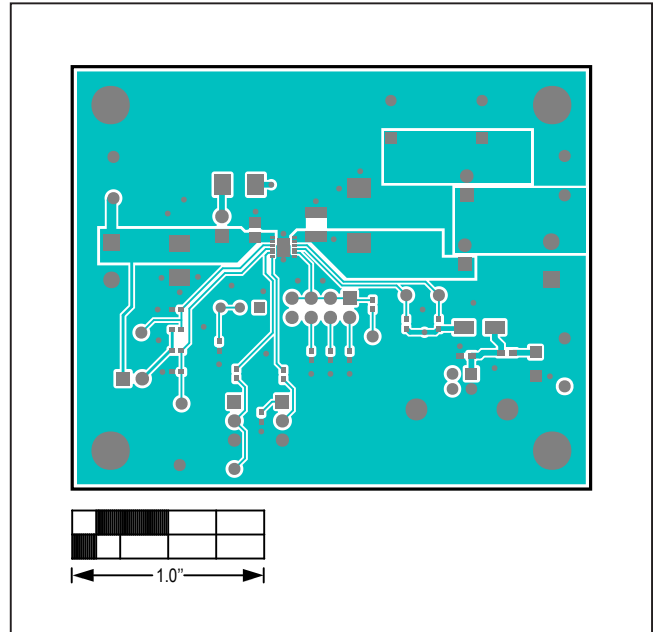
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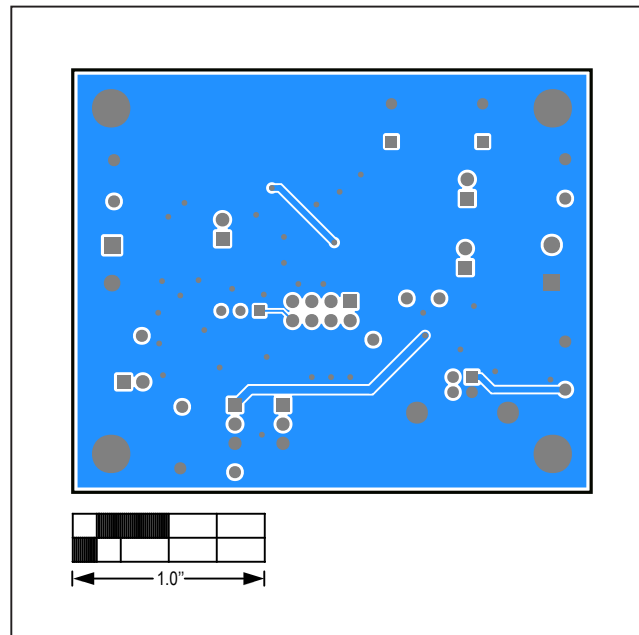
## MAX17609 EV Kit PCB Layout



MAX17609 EV Kit PCB Layout—Top Silkscreen



MAX17609 EV Kit PCB Layout—Top Layer



MAX17609 EV Kit PCB Layout—Bottom Layer



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## Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	3/18	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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