

## 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  $\overline{\text{UVOV}}$  goes low when input reaches approximately 36V.
- 6) Gradually decrease the DC power-supply voltage and verify that OUT comes back and  $\overline{\text{UVOV}}$  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  $\overline{\text{FLAG}}$  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  $V_{\text{IN}}$ , the negative input test should be performed when the output capacitors are fully discharged and  $V_{\text{BUS}}$  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 ( $\overline{\text{UVOV}}$  and  $\overline{\text{FLAG}}$ ) 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  $V_{\text{BUS}}$  and to the EN pin (JU5 connects  $V_{\text{BUS}}$  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 $V_{\text{BUS}}$ | 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:

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

where R9 can be chosen as 2.2M $\Omega$ ,  $V_{\text{REF}}$  is 1.5V, and  $V_{\text{UVLO}}$  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:

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

where R11 can be chosen as 2.2M $\Omega$ ,  $V_{\text{REF}}$  is 1.5V, and  $V_{\text{OVLO}}$  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.

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### 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 330μF capacitors. See [Table 4](#) for jumper settings

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

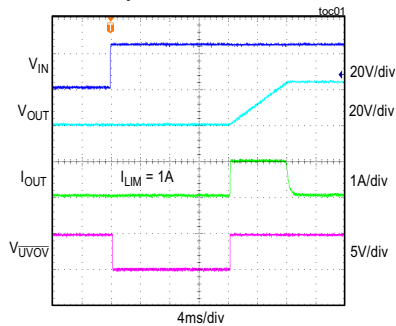
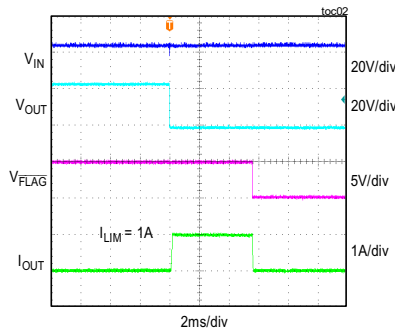
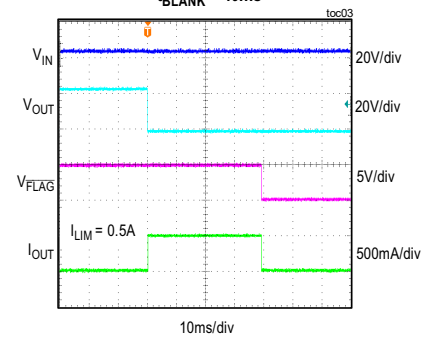
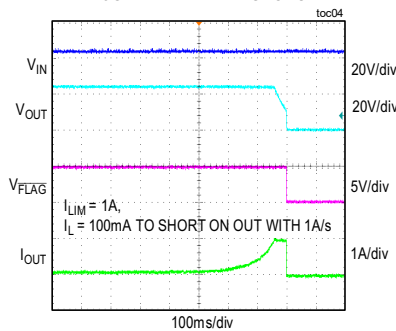
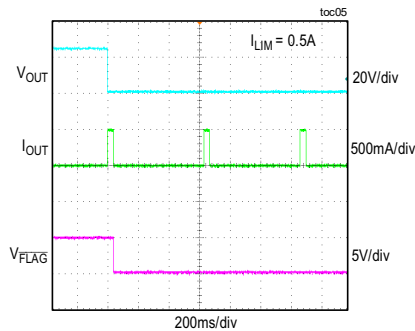
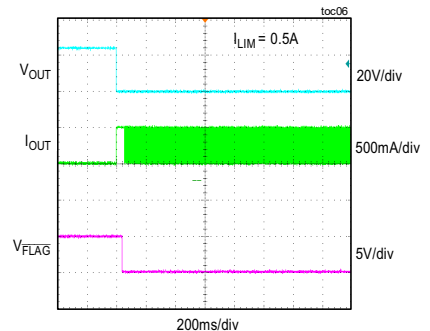
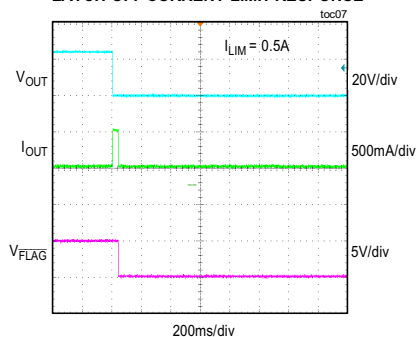
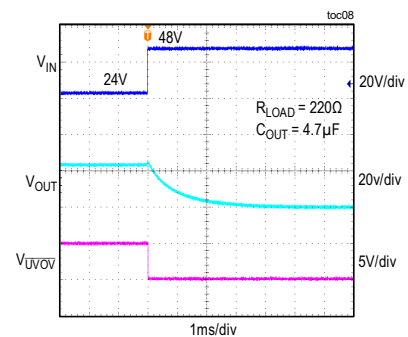
| JUMPER | SHUNT POSITION | DESCRIPTION |
|--------|----------------|-------------|
| JU4    | 1-2            | Latch-off   |
|        | 2-3            | Continuous  |
|        | Open*          | Autoretry   |

\*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<sub>IN</sub> = 24V, unless otherwise noted.)**POWER-UP RESPONSE  
WITH 330μF CAPACITOR AT NO LOAD****THERMAL SHUTDOWN DUE TO  
OUTPUT SHORT-CIRCUIT****OUTPUT SHORT-CIRCUIT RESPONSE  
t<sub>BLANK</sub> = 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

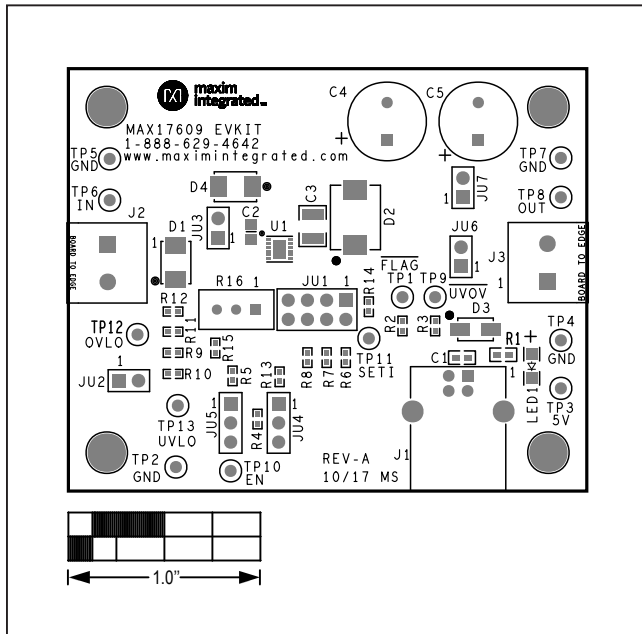
| PART<br>REFERENCE   | QTY | DESCRIPTION                                                                                 | MANUFACTURER<br>PART NUMBER                       |
|---------------------|-----|---------------------------------------------------------------------------------------------|---------------------------------------------------|
| C1                  | 1   | 1 $\mu$ F 10%, 25V X7R ceramic capacitors (0603)                                            | Murata GRM188R61E105KA12                          |
| C2                  | 1   | 0.47 $\mu$ F 10%, 100V X7R ceramic capacitors (0805)                                        | Murata GRM21BR72A474KA73L                         |
| C3                  | 1   | 4.7 $\mu$ F 10%, 100V X7R ceramic capacitors (1210)                                         | Kemet C1210C475K1R2C,<br>Murata GRM32ER72A475KE14 |
| C4                  | 1   | 330 $\mu$ F 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   | 1k $\Omega$ 1% resistors (0603)                                                             | —                                                 |
| R2, R3              | 2   | 10k $\Omega$ 1% resistors (0402)                                                            | —                                                 |
| R4                  | 1   | 150k $\Omega$ 5% resistor (0402)                                                            | —                                                 |
| R5, R13             | 2   | 5k $\Omega$ 0.1% resistors (0402)                                                           | —                                                 |
| R6                  | 1   | 15k $\Omega$ 1% resistors (0402)                                                            | —                                                 |
| R7                  | 1   | 3k $\Omega$ 1% resistors (0402)                                                             | —                                                 |
| R8                  | 1   | 1.5k $\Omega$ 1% resistors (0402)                                                           | —                                                 |
| R9, R11             | 2   | 2.2M $\Omega$ 5% resistors (0402)                                                           | —                                                 |
| R10                 | 1   | 1.1M $\Omega$ 1% resistors (0402)                                                           | —                                                 |
| R12                 | 1   | 95.3k $\Omega$ 1% resistors (0402)                                                          | —                                                 |
| R14                 | 1   | 20k $\Omega$ 1% resistors (0402)                                                            | —                                                 |
| R15                 | 1   | 1k $\Omega$ 1% resistors (0402)                                                             | —                                                 |
| R16                 | 1   | 20k $\Omega$ 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<br>Forward Current Limit (12-pin TDFN-EP, 3mm x 3mm) | MAX17609ATC+                                      |
| C5                  | 0   | Not Installed; 330 $\mu$ F 20%, 50V aluminium (10mm)                                        | Panasonic EEU-EB1H331                             |
| D4                  | 0   | Not Installed; TVS Diode, 600W (SMB)                                                        | Bourns SMBJ40CA                                   |
| PCB                 | 1   | PCB: MAX17609 Evaluation Kit                                                                | —                                                 |

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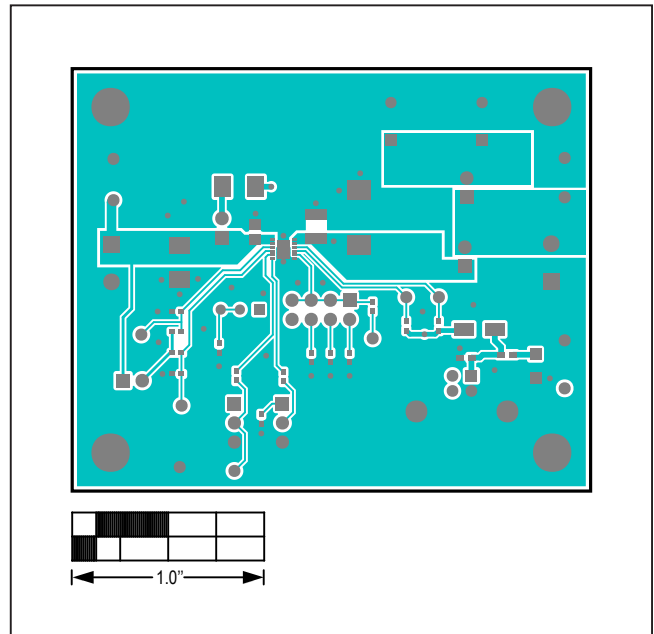
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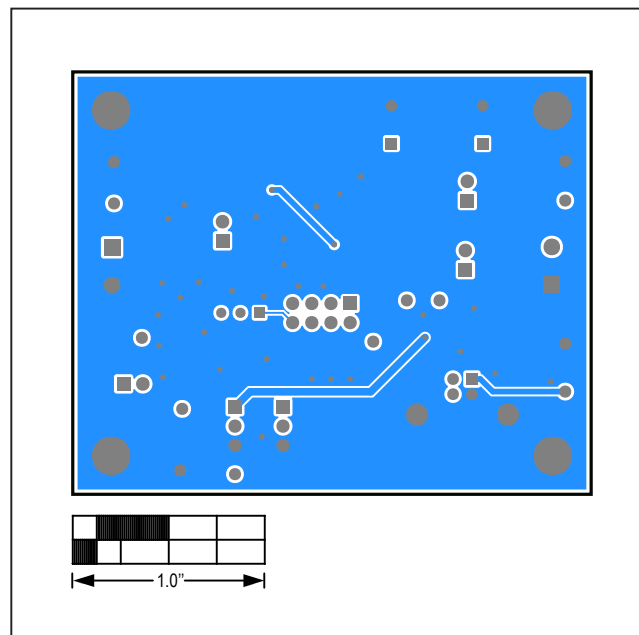
### MAX17609 EV Kit PCB Layout



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<br>NUMBER | REVISION<br>DATE | DESCRIPTION     | PAGES<br>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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