

# MAX17048/MAX17049 Evaluation Kits

## Evaluate: MAX17048/MAX17049

### General Description

The MAX17048/MAX17049 evaluation kits (EV kits) consist of the MAX17048/MAX17049 evaluation kit (EV kit) and the Maxim DS91230+ command module. A Windows XP<sup>®</sup>, Windows Vista<sup>®</sup>, and Windows<sup>®</sup> 7-compatible software is also available for use with the evaluation kits and can be downloaded from [www.maxim-ic.com/evkitsoftware](http://www.maxim-ic.com/evkitsoftware).

The EV kits are fully assembled and tested surface-mount PCBs that evaluate the MAX17048/MAX17049 host or battery-side fuel gauge for 1-cell/2-cell lithium-ion (LI+) batteries in handheld and portable equipment. The EV kits can be powered from a single battery (MAX17048) and can be configured to evaluate a single lithium cell (MAX17048) or two lithium cells in series (MAX17049).

### Features

- ◆ **Battery Input Voltage Range**  
+2.5V to +4.5V (MAX17048)  
+2.5V to +12V (MAX17049)
- ◆ **Powered from a Single Battery (MAX17048)**
- ◆ **Evaluates 1-Cell (MAX17048) or 2-Cell (MAX17049) Batteries**
- ◆ **Precision  $\pm 7.5\text{mV}$  Voltage Measurement Per Cell**
- ◆ **Current Sense Not Required**
- ◆ **On-Board LDO for 2-Cell Evaluation (MAX17049)**
- ◆ **Windows XP<sup>®</sup>, Windows Vista<sup>®</sup>, and Windows 7-Compatible Software**
- ◆ **Proven PCB Layout**
- ◆ **Fully Assembled and Tested**

*Ordering Information appears at end of data sheet.*

### Component List

| DESIGNATION | QTY | DESCRIPTION  |
|-------------|-----|--|
| C1, C2      | 2   | 1 $\mu\text{F}$ $\pm 10\%$ , 16V X7R ceramic capacitors (0603)<br>Murata GRM188R71C105K<br>TDK C1608X7R1C105K  |
| C3          | 1   | 0.1 $\mu\text{F}$ $\pm 10\%$ , 16V X7R ceramic capacitor (0402)<br>Murata GRM155R71C104K<br>TDK C1005X7R1C104K |
| C4          | 0   | Not installed, ceramic capacitor (0603)  |
| D1, D2, D3  | 3   | 5.6V zener diodes (SOD323)<br>ON Semi MM3Z5V6ST1G  |
| J1          | 1   | RJ11 6p6c right-angle, through-hole jack   |
| J2          | 1   | 6-pin straight-row header  |
| JU1         | 1   | 3-pin header, 0.1in centers  |
| JU2         | 1   | 2-pin header, 0.1in centers  |

| DESIGNATION | QTY | DESCRIPTION                                      |
|-------------|-----|--|
| R1, R4, R5  | 3   | 150 $\Omega$ $\pm 5\%$ resistors (0603)          |
| R3          | 0   | Not installed, resistors—short (PC trace) (0603) |
| R6          | 1   | 10k $\Omega$ $\pm 5\%$ resistor (0603)           |
| R7          | 1   | 1M $\Omega$ $\pm 5\%$ resistor (0603)            |
| U1          | 1   | See the <i>EV Kit-Specific Component List</i>    |
| U2          | 1   | 3.3V LDO (5 SOT23)<br>Maxim MAX1726EUK33-T       |
| —           | 1   | USB-to-RJ11 PicBrick board<br>Maxim DS91230+     |
| —           | 1   | RJ12 6pos-6pos reverse modular cord, 7in         |
| —           | 2   | Shunts   |
| —           | 1   | PCB: MAX17048/MAX17049 EVALUATION KIT            |

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### EV Kit-Specific Component List

| PART           | DESIGNATION | DESCRIPTION   |
|----------------|-------------|---|
| MAX17048EVKIT# | U1          | Micropower 1-cell Li+ ModelGauge™ IC (8 TDFN, 2mm x 2mm)<br>Maxim MAX17048G+T10 |
| MAX17049EVKIT# |             | Micropower 2-cell Li+ ModelGauge IC (8 TDFN, 2mm x 2mm)<br>Maxim MAX17049G+T10  |

### Component Suppliers

| SUPPLIER                               | PHONE        | WEBSITE                     |
|--|--------------|-----------------------------|
| Murata Electronics North America, Inc. | 770-436-1300 | www.murata-northamerica.com |
| ON Semiconductor                       | 602-244-6600 | www.onsemi.com              |
| TDK Corp.                              | 847-803-6100 | www.component.tdk.com       |

**Note:** Indicate that you are using the MAX17048/MAX17049 when contacting these component suppliers.

### MAX17048 EV Kit Files

| FILE          | DESCRIPTION                                |
|---------------|--|
| SETUP.EXE     | Installs the EV kit files on your computer |
| MAX17048k.EXE | Application program                        |
| README.HTML   | Help File                                  |

### MAX17049 EV Kit Files

| FILE          | DESCRIPTION                                |
|---------------|--|
| SETUP.EXE     | Installs the EV kit files on your computer |
| MAX17049k.EXE | Application program                        |
| README.HTML   | Help File                                  |

### Quick Start

#### Required Equipment

- MAX17048/MAX17049 EV kits
- +2.5V to +4.5V DC power supply or single cell battery
- DS91230+ PicBrick board
- RJ12 6pos-6pos reverse modular cord
- Windows XP, Windows Vista, or Windows 7 PC
- USB port

**Note:** In the following sections, software-related items are identified by bolding. Text in **bold** refers to items directly from the EV kit software. Text in **bold and underlined** refers to items from the Windows operating system.

#### Procedure

The EV kits are 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) Connect the DS91230+ board to a spare USB port on the PC.
- 2) Connect the RJ12 cord between J2 on the DS91230 board and J1 on the EV kit.
- 3) Verify that shunts are installed according to the defaults listed in Table 1.
- 4) Connect the positive terminal of the power supply or battery to the BAT+ PCB pad on the EV kit. Connect

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Table 1. Default Jumper Positions

| JUMPER | DEFAULT SHUNT POSITION |           |
|--------|------------------------|-----------|
|        | MAX17048               | MAX17049  |
| JU1    | 1-2                    | 2-3       |
| JU2    | Open                   | Installed |

the negative terminal of the power supply to the BAT- PCB pad on the EV kit.

- 5) Visit [www.maxim-ic.com/evkitsoftware](http://www.maxim-ic.com/evkitsoftware) to download the latest version of the MAX17048 or MAX17049 EV kit software, MAX17048Rxx.ZIP/MAX17049Rxx.ZIP. Save the EV kit software to a temporary folder and uncompress the ZIP file.
- 6) Install the EV kit software on your computer by running the SETUP.EXE program inside the temporary folder. The program files are copied and icons are created in the Windows **Start | Programs** menu. The software requires the .NET Framework 4. If you are connected to the Internet, Windows automatically locates the correct files and walks you through the process. You can also download the **Microsoft .NET Framework 4 Client Profile (Standalone Installer)** and run that on your PC.
- 7) Start the EV kit software by opening its icon in the **Start | Programs** menu.
- 8) Load the default or custom battery model.

# MAX17048/MAX17049 Evaluation Kits

## Evaluate: MAX17048/MAX17049

### Detailed Description of Hardware

The MAX17048/MAX17049 EV kits are fully assembled and tested surface-mount PCBs that evaluate the MAX17048/MAX17049 host or battery-side fuel gauge for 1-cell/2-cell Li+ batteries in handheld and portable equipment. The EV kits can be powered from a single supply or battery with an input range of +2.5V to +4.5V. The EV kits can be configured to evaluate a single lithium cell (MAX17048) or two lithium cells in series (MAX17049). Optional LDO U2 is provided to power VIN when using a higher voltage 2-cell Li+ battery to evaluate the MAX17049.

#### Default Jumper Settings

The MAX17048 EV kit is set by default to evaluate 1-cell Li+ batteries, while the MAX17049 EV kit is set by default to evaluate 2-cell Li+ batteries. LDO U2 is provided so that only a single supply is needed to power the EV kit in the case a 2-cell battery is used.

When evaluating the MAX17048, set jumper JU1 to pins 1-2 and remove any shunt installed on JU2 to bypass the LDO. When evaluating the MAX17049, set jumper JU1 to pins 2-3 and install a shunt on JU2 to power VIN from the LDO. See Tables 2 and 3 for jumper JU1 and JU2 settings. Note that when using a separate supply for VIN for evaluating the MAX17048, JU2 should be uninstalled to prevent additional current drawn from the battery.

**Table 2. Power-Supply Input (JU1)**

| SHUNT POSITION | VDD PIN   | EV KIT CONFIGURATION |
|----------------|---|----------------------|
| 1-2*           | Powered from a battery applied between the BAT+ and BAT- PCB pads | MAX17048             |
| 2-3            | Powered from the +5V output of LDO U2                             | MAX17049             |

\*Default position (MAX17048).

**Table 3. LDO U2 Input Settings (JU2)**

| SHUNT POSITION | U2 INPUT                  | U2 OUTPUT | EV KIT CONFIGURATION |
|----------------|---------------------------|-----------|----------------------|
| Installed      | Connected to BAT+ PCB pad | Enabled   | MAX17048             |
| Not installed* | Unconnected               | Disabled  | MAX17049             |

\*Default position (MAX17049).

### Detailed Description of Software

#### Splash Screen

The splash screen (Figure 1) allows you to choose one of three distinct modes:

- 1) Custom model with physical MAX17048/MAX17049. Custom models for MAX17040–MAX17044 can be used in this software provided you change the line **Device = MAX1704x to Device = MAX17048**.
- 2) Default model with physical MAX17048. **Warning:** Using the default model normally results in poor fuel-gauge performance. For good fuel-gauge performance it is recommended to always use a model that is matched to the battery according to battery characterization.
- 3) Demo mode with a MAX17048 log file.

**Note:** The MAX17049 EV kit software is also available for download at [www.maxim-ic.com/evkitsoftware](http://www.maxim-ic.com/evkitsoftware).

#### Main Window

You can resize the left-right split in the window. Most major functionality is available from the menu, but some of these items should be observed early (see Figure 2).

# MAX17048/MAX17049 Evaluation Kits

## Evaluate: MAX17048/MAX17049

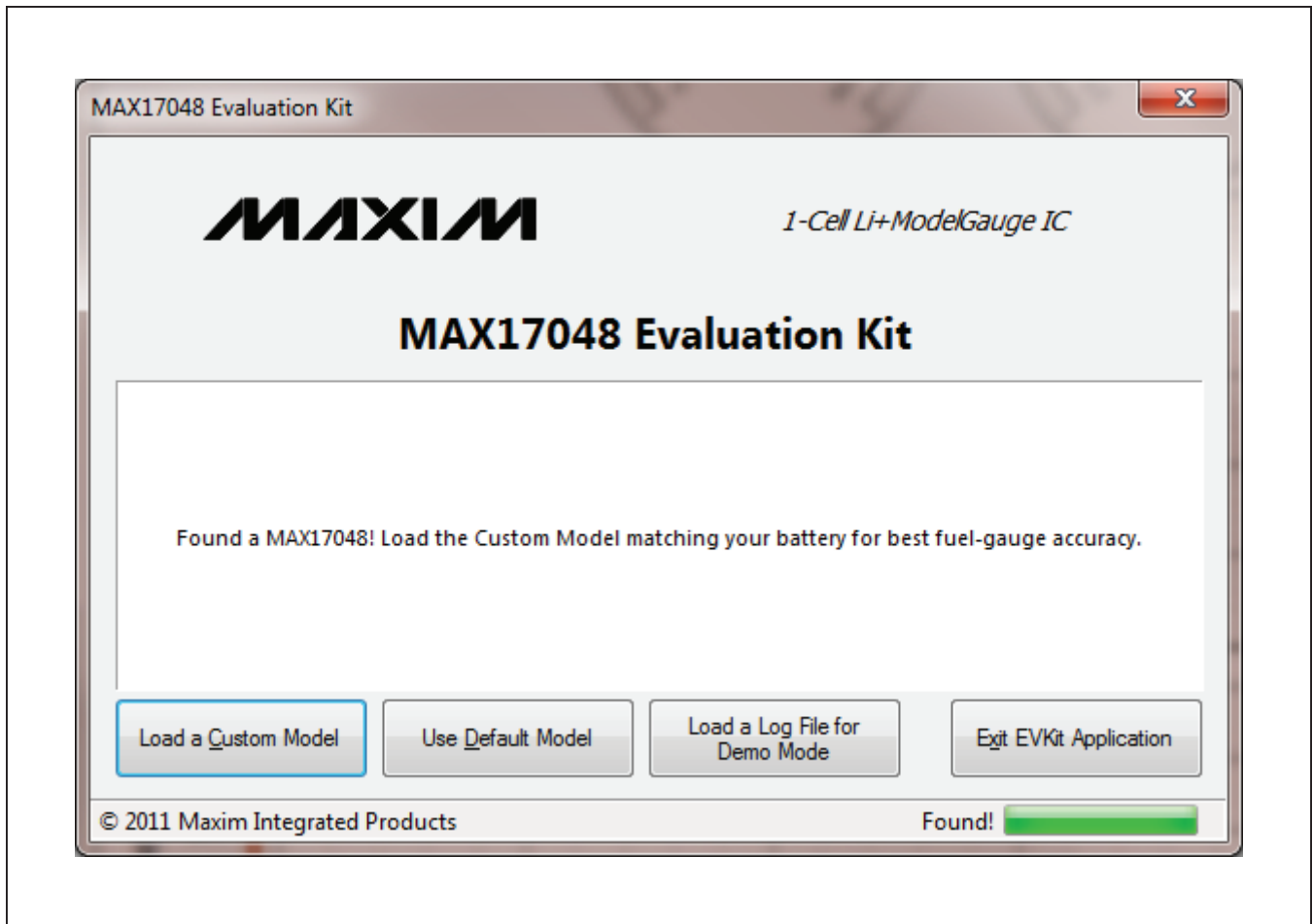


Figure 1. MAX17048 EV Kit Software (Splash Screen)

# MAX17048/MAX17049 Evaluation Kits

## Evaluate: MAX17048/MAX17049

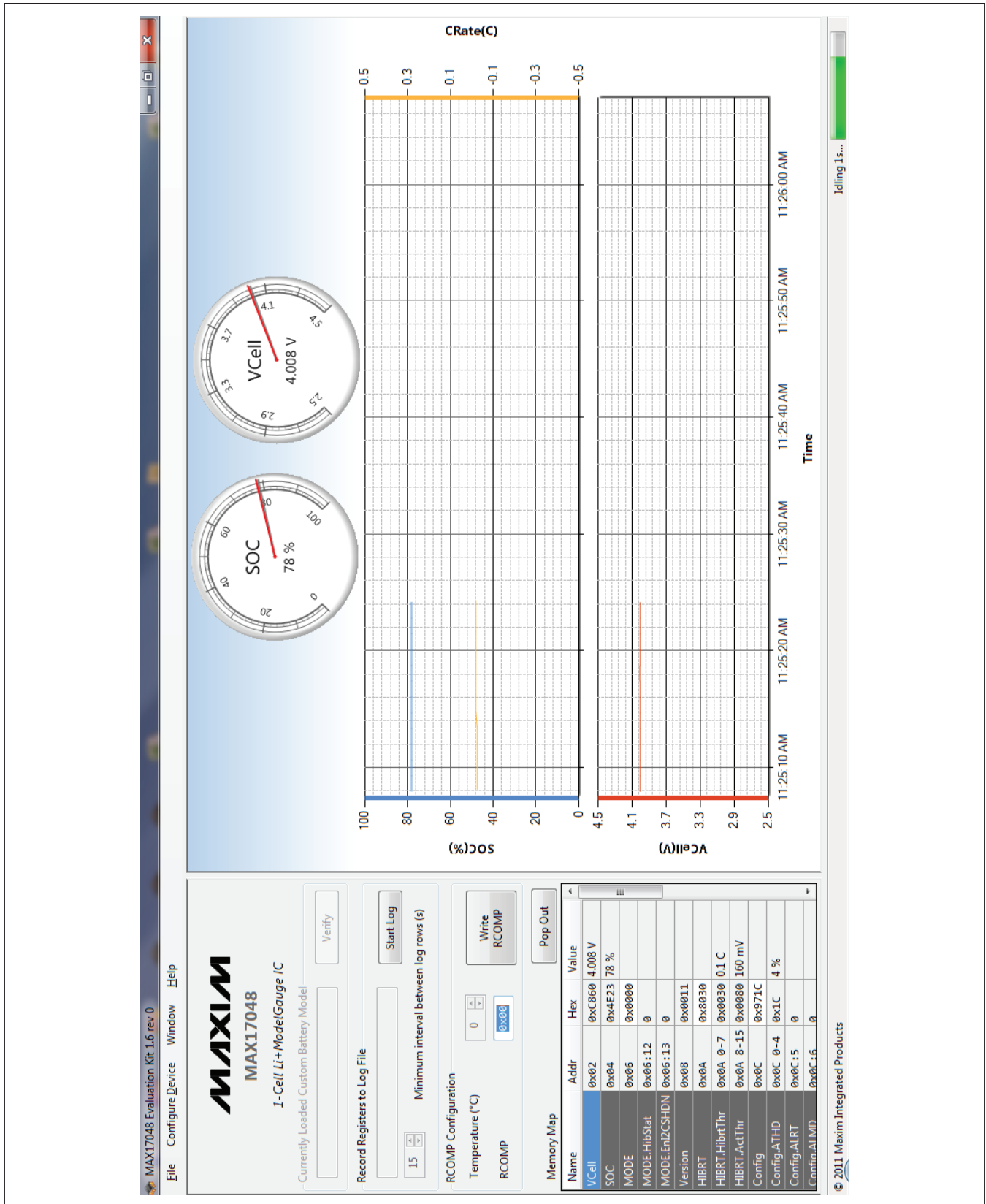


Figure 2. MAX17048 EV Kit Software (Main Window)

# MAX17048/MAX17049 Evaluation Kits

## Evaluate: MAX17048/MAX17049

### **Currently Loaded Custom Model**

This group displays any custom model that has been loaded onto the part by the software. If the device resets, this model is automatically reloaded. If you are using the default model, nothing is displayed here. Any changes to the configuration file are not reloaded automatically.

### **Record Registers to Log File**

This group displays the file path to which the software is recording the registers. If this box is blank, no file is being saved.

### **RCOMP Configuration**

You can enter a byte here and press the **Write** button to write it to the device. This is not the same as writing the value into the memory map, because RCOMP is part of a larger 2-byte register.

If you have a custom model, you can also change the temperature, which adjusts the MAX17048 for proper temperature performance. Changing this value immediately calculates a new value of RCOMP and displays it in the box. This value is not written to the device until you press the **Write** button. A change to RCOMP is not reflected in the temperature.

### **Memory Map**

Notation used for name and address should be familiar to C programmers with one small change. The memory map lists:

- **Register Name:** A dot indicates that a single address has multiple meanings. This is similar to how the C firmware might access the bits.
- **Memory Address:** A colon indicates the 0-indexed location, not the size of the bit field. A dash indicates a range of values (e.g., 0x0C:0-4 is a 5-bit value, offset 0 bits at address 0x0C).
- **Hex:** The raw value as read directly from the device.
- **Value:** A conversion of the raw hex value, usually with units. Alert bit flags are blank when inactive, or show text when they are alerting.
- **Description:** Reminders of the functionality. For full details, refer to the MAX17048/MAX17049 IC data sheet.

The user can write values to the device directly through the memory map. To write a raw hex value, select the cell in the hex column, overwrite the value, and press the Enter or Tab key. You will be prompted to write to the device. Normal communication will pause, and you will see a corresponding blank spot in the graph.

For registers with a conversion factor (e.g., Hibernate Threshold or VAlertMax, you can also modify the Value column. The software converts the value back to the raw hex, and prompts to verify that you are writing what you expect. Remember that not all registers are writable.

### **Plot**

The plot can be configured using the **Preferences** window.

The plot is interactive: You can zoom into the time axis by left-clicking and dragging anywhere in the plot area. You will see the region highlighted as you drag. You can zoom out either by clicking the small button in the bottom left, or by right-clicking in the plot area.

Plotted information not in a log file cannot be recovered once the application closes.

The top and bottom plots are synchronized in time, so zooming one zooms the other. The y axes are fixed scale, and you cannot modify which registers are plotted, or where.

### **Standalone Windows**

#### **Preferences**

Here you can see options for how frequently you wish to read the device and how to plot points. If you are trying to observe transient events, you need to increase the read speed, as well as how frequently the points are actually plotted.

The plots can use a lot of system memory if you read frequently for a long time, so be aware of these settings. After the maximum number of points is reached, points are trimmed from the beginning. The discarded points cannot be recovered on the plot.

#### **I<sup>2</sup>C Traffic Log Window**

Here you can see a log of traffic that you initiate, as well as any time the device is programmed. It describes each step in detail, including the particular values read or written. This can help remove uncertainty about how to communicate with the device. This log does not show the standard reading events.

#### **Memory Map Pop-Up Window**

This displays the same information as the memory map on the main application, except you cannot modify values in this map. This is the easiest place to read descriptions of the registers.

# MAX17048/MAX17049 Evaluation Kits

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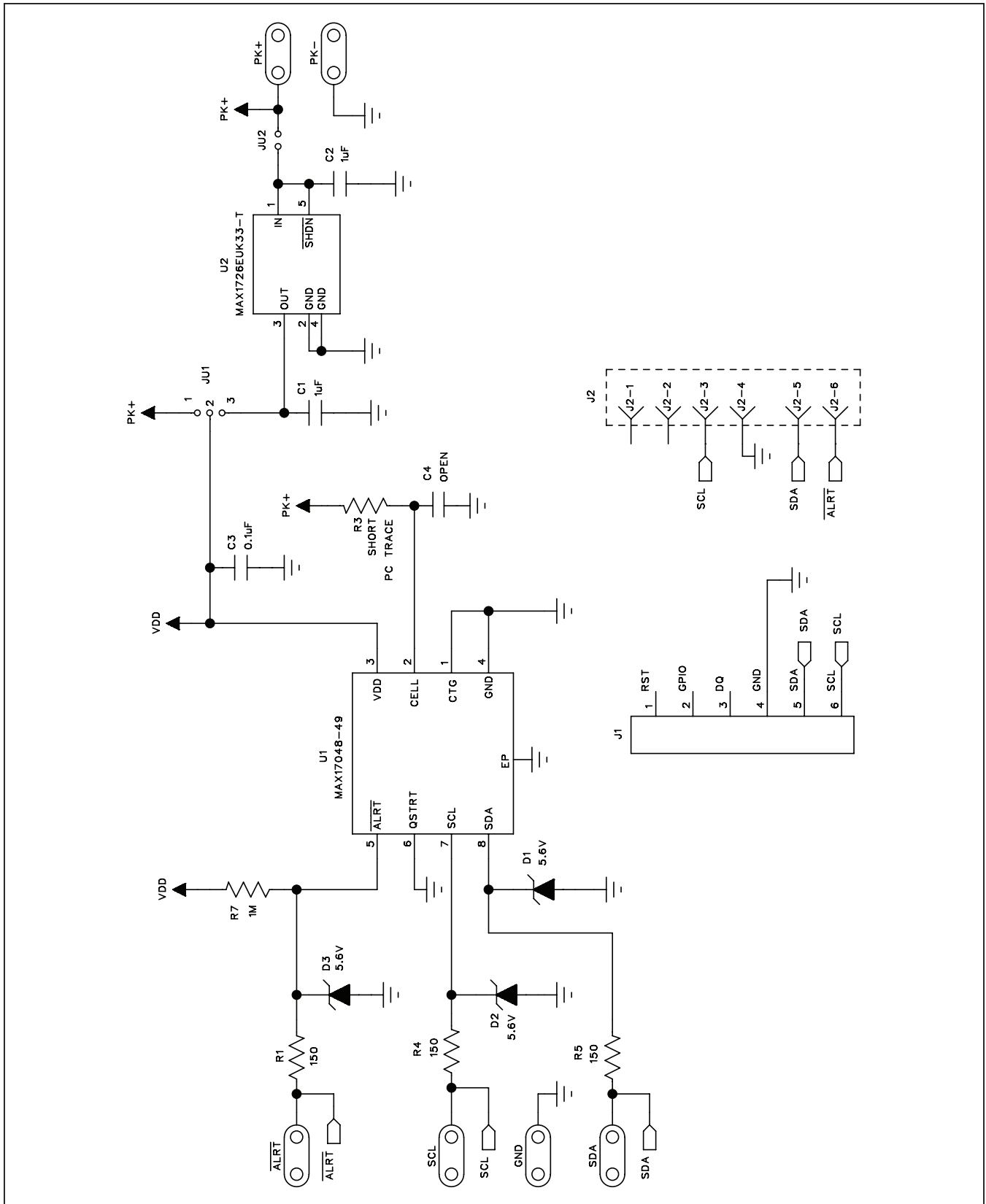


Figure 3. MAX17048/MAX17049 EV Kit Schematic

# MAX17048/MAX17049 Evaluation Kits

## Evaluate: MAX17048/MAX17049

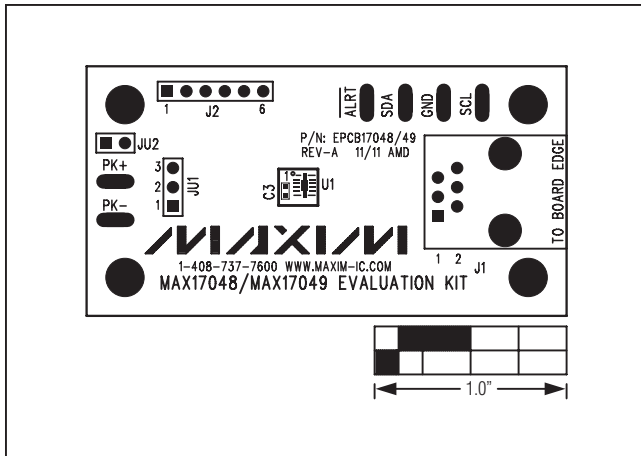


Figure 4. MAX17048/MAX17049 EV Kit Component Placement Guide—Component Side

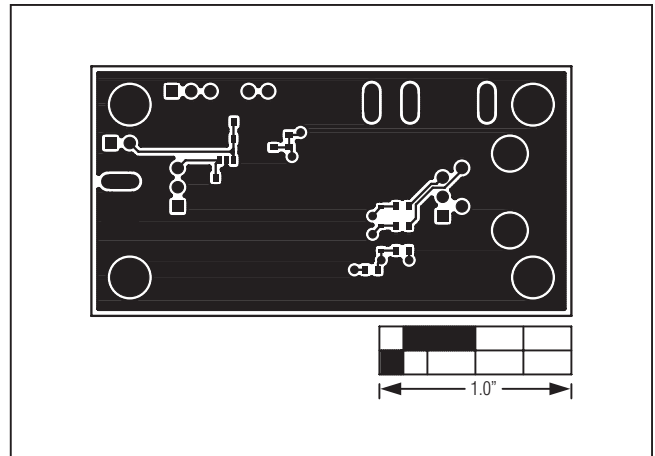


Figure 6. MAX17048/MAX17049 EV Kit PCB Layout—Solder Side

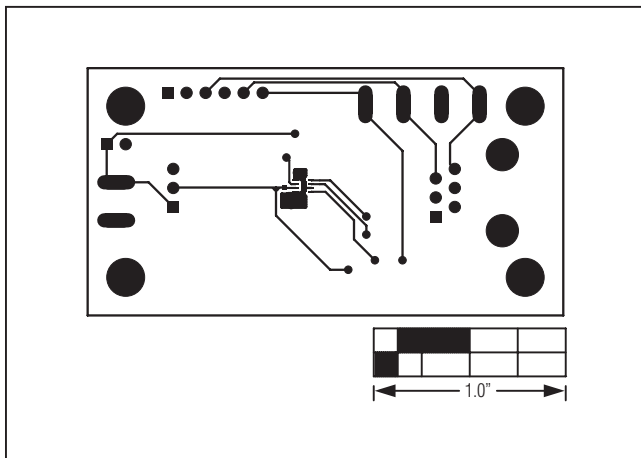


Figure 5. MAX17048/MAX17049 EV Kit PCB Layout—Component Side

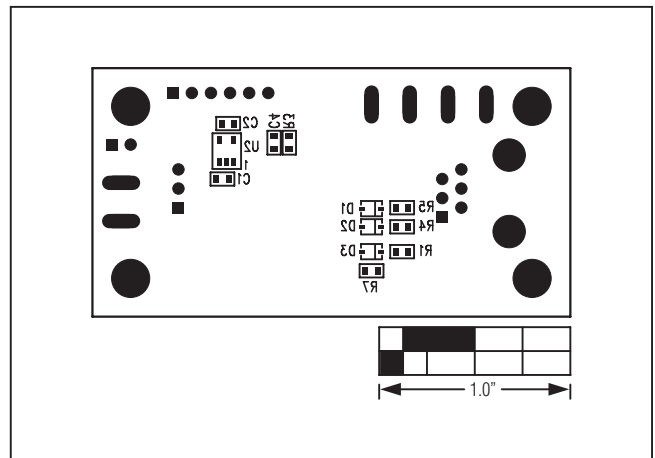


Figure 7. MAX17048/MAX17049 EV Kit Component Placement Guide—Solder Side



# MAX17048/MAX17049 Evaluation Kits

## Evaluate: MAX17048/MAX17049

### ***Ordering Information***

| PART           | TYPE   |
|----------------|--------|
| MAX17048EVKIT# | EV Kit |
| MAX17049EVKIT# | EV Kit |

#Denotes RoHS compliant.

# MAX17048/MAX17049 Evaluation Kits

## Evaluate: MAX17048/MAX17049

### Revision History

| REVISION NUMBER | REVISION DATE | DESCRIPTION     | PAGES CHANGED |
|-----------------|---------------|-----------------|---------------|
| 0               | 3/12          | Initial release | —             |

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