MAX17050 Evaluation Kit
Evaluates: MAX17050

General Description

The MAX17050 evaluation kit (EV kit) includes the USB adapter and cord. Windows XP®-, Windows Vista®-, and Windows® 7-compatible software is also available for use with the EV kit and can be downloaded from Maxim's website (www.maximintegrated.com/evkitsoftware).

The EV kit is a fully assembled and tested surface-mount PCB that evaluates the MAX17050 advanced stand-alone fuel-gauge IC for single-cell lithium-ion (LI+) batteries in handheld and portable equipment.

Features

- **Battery Input Voltage Range: +2.5V to +4.5V**
- **Thermal Measurement Network**
- **Optional On-Board PC Trace Sense Resistor**
- **Windows XP-, Windows Vista-, 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	1	0.01µF ±10%, 50V X7R ceramic capacitor (0402) Murata GRM155R71H103K
C2, C3	2	0.1µF ±10%, 16V X7R ceramic capacitors (0402) Murata GRM155R71C104K TDK C1005X7R1C104K
D1, D2, D3	3	5.6V zener diodes (SOD323) ON Semi MM3Z5V6ST1G
D4	1	Red LED (0603)
J1	1	RJ11 6p6c right-angle, through-hole jack
JU1, JU4	2	2-pin headers
JU2, JU3	0	Not installed, 3-pin headers (PC short pins 1-2)
R1	1	10kΩ ±1% NTC resistor (0402) Murata NCP15XH103F03 TDK NTCG103JF103FT1
R3	1	1kΩ ±5% resistor (0402)
R4	1	10kΩ ±5% resistor (0402)
R5, R6, R7	3	150Ω ±5% resistors (0402)
R8	0	Not installed, 10mΩ sense resistor (0805) Vishay-Dale WSL0805R0100FEA
R9	0	Not installed, resistors—short (PC trace) Vishay-Dale WSL0805R0100FEA
U1	1	Li+ compact fuel gauge (9 WLP) Maxim MAX17050X+
V1	0	Not installed, varistor (0603)
—	2	Shunts
—	1	PCB: MAX17050 EVALUATION KIT

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
Vishay	402-563-6866	www.vishay.com

Note: *Indicate that you are using the MAX17050 when contacting these component suppliers.*

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.

19-7394; Rev 0; 4/14

MAX17050 EV Kit Files

FILE	DESCRIPTION
SETUP.EXE	Installs the EV kit files on your computer
MAX17050k.EXE	Application program
README.HTML	Help file

Quick Start

Required Equipment

- MAX17050 EV kit
- +2.5V to +4.5V DC power supply or single-cell battery
- USB adapter and cord
- 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 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) Connect the USB adapter to a spare USB port on the PC.
2) Connect the RJ12 cord between J2 on the USB adapter and J1 on the EV kit.
3) Verify that jumpers are installed in their default positions, as shown in Table 1.
4) Connect the positive terminal of the power supply or battery to the PK+ PCB pad on the EV kit. Connect the negative terminal of the power supply to the PK- PCB pad on the EV kit.
5) Visit **www.maximintegrated.com/evkitsoftware** to download the latest version of the EV kit software, MAX17050Rxx.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. Start the EV kit software by opening its icon in the **Start | Programs** menu.
7) Load the default or custom battery model.

Detailed Description of Hardware

Auxiliary Voltage Input

The MAX17050 AIN pin allows temperature measurement of the cell pack when connected to an external resistor-divider network, R4 and NTC R1. To enable this resistor-divider, simply install a shunt across jumper JU1. When temperature is not being measured, remove the shunt from JU1 and the AIN pin on the IC is pulled to the voltage at the THRM pin and temperature measurement disabled.

Optional PC Trace Sense Resistor R9

The IC measures current through an external sense resistor placed between the CSP and CSN pins. The EV kit provides resistor R8 installed by default, but also offers the option to configure for a PC trace sense resistor (R9).

To utilize PC trace sense resistor R9, follow the steps below:

1) Remove resistor R8.
2) Cut the PC short on pins 1-2 on jumpers JU2 and JU3.
3) Install JU2 and JU3.
4) Connect a shunt between pins 2-3 on JU2 and JU3.

Table 1. Default Jumper Settings (JU1, JU4)

JUMPER	SHUNT POSITION
JU1	1-2
JU4	Pin 1 only

Table 2. Auxillary Voltage Input (JU1)

SHUNT POSITION	AIN PIN	CELL TEMPERATURE MONITORING
1-2*	Connected to external thermal measurement network resistors R4 and R1	Enabled
Pin 1 only	Pulled to THRM pin through R4	Disabled

**Default position.*

5) Install a shunt on jumper JU4.

Detailed Description of Software

The MAX17050K evaluation kit software gives the user complete control of all functions of the MAX17050, as well as the ability to load a custom model into the Model Gauge™. Separate control tabs allow the user access to view real-time updates of all monitored parameters. The software also incorporates a data-logging feature to monitor a cell over time.

Software Installation

To install the evaluation software, exit all programs currently running and unzip the provided MAX17050K Installation Package zipped file. Double click on the SETUP.EXE icon and the installation process begins. Follow the prompts to complete the installation. The evaluation software can be uninstalled in the Add/Remove Programs tool in the Control Panel. After the installation is complete, open the MAX17050K folder and run MAX17050k.EXE or select MAX17050K from the program menu. A splash screen containing information about the evaluation kit appears as the program is being loaded.

Selecting the Communication Port

If the USB adapter is connected when the EV kit is started, the software starts up automatically. If it is not connected, the **Select Preferences** window opens (Figure 1).

In this window select either serial port or USB communication from the **Port Type** drop-down list and the port number, then press the **OK** button. The evaluation software saves this port selection and automatically uses the selection each time the program starts. To attempt to automatically locate the USB adapter, press the **Poll Ports** button.

Program Tabs

All functions of the program are divided under three tabs in the main program window. Click on the appropriate tab to move to the desired function page. Located on the **RealTime** tab (Figure 8) is the primary user information measured and calculated by the IC. The **Memory** tab (Figure 9) allows the user to modify the registers one at a time. The **Log Data** tab (Figure 10) allows the user to store all real-time information to a file and view the data in a graphical form.

Initializing the Device

When the evaluation software starts, the software detects whether the device is in its power-up state and then asks if the user would like to initialize the device into its recommended state (Figure 2). This includes updating a few registers to the most standard user configuration. Press the **Yes** button to initialize the device into its recommended state.

Configuring the Device

The user is prompted to **Select a Configuration** (Figure 3). Press the **Yes** button and then point the browser to the INI file provided by Maxim to load the configuration. For best performance, the cell under test should be characterized by Maxim under the application conditions prior to beginning the customer evaluation. Maxim will provide a custom INI file following the complete characterization of the cell.

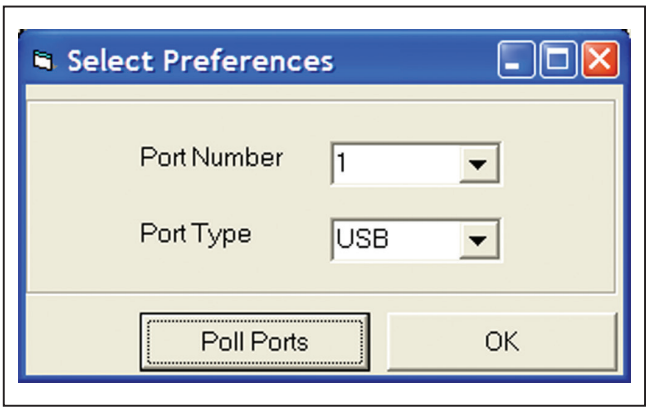

Figure 1. Communication Port

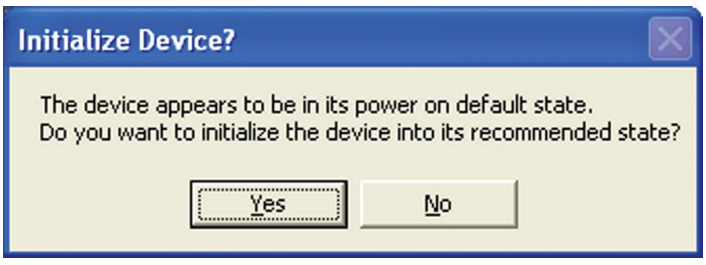

Figure 2. Initializing the Device

ModelGauge is a trademark of Maxim Integrated Products, Inc.

The software provides options of all the registers that are typically configured. By default, all the registers are selected. If the user wants to only change a few registers, uncheck the registers that should not be updated (Figure 4).

If the cell capacity in the device is different than what is in the INI file, the user is prompted to either preserve the capacity information that is in the device (by pressing **Yes**) or load new capacity values from the INI file into the device (by pressing **No**). The user can ignore any capacity-related values by pressing **Cancel** (Figure 5).

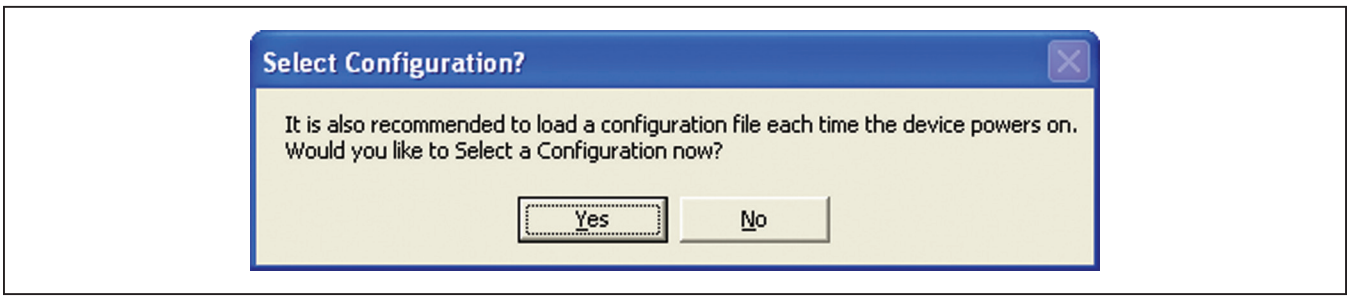

Figure 3. Configuring the Device

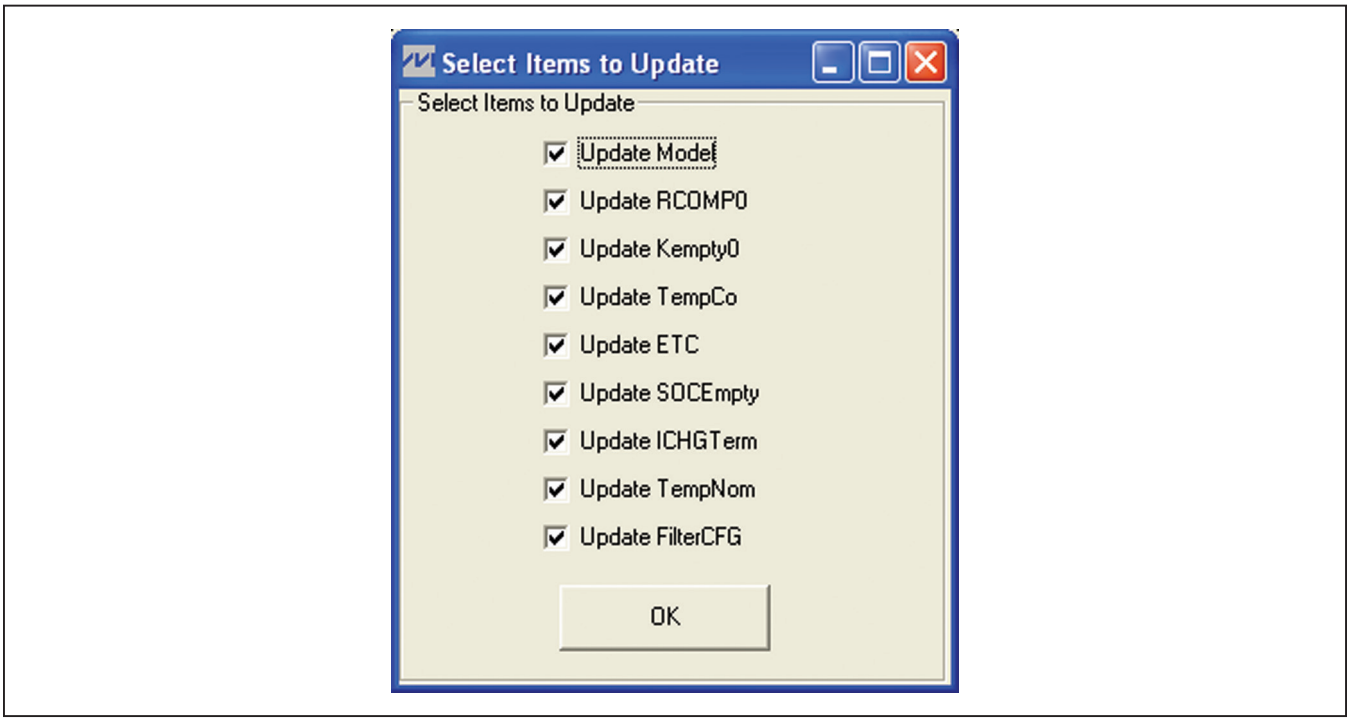

Figure 4. Register Selection

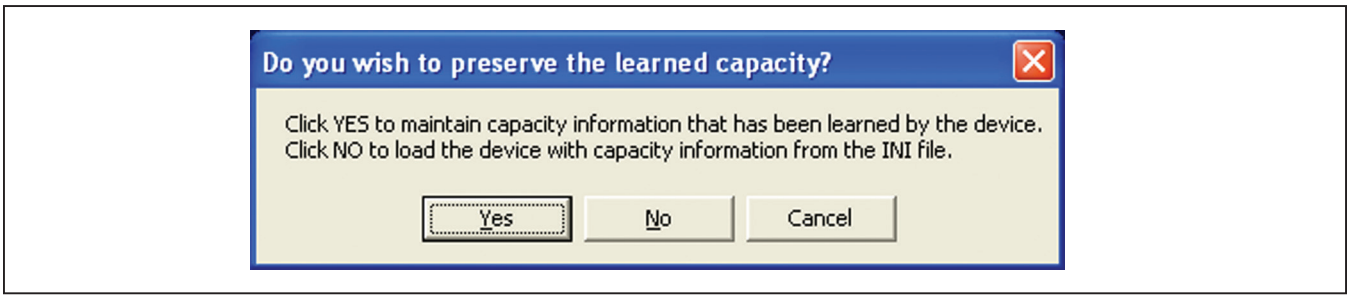

Figure 5. Cell Capacity

Advance to Coulomb-Counter Mode

The software gives the user the chance to advance the device to coulomb-counter mode (Figure 6). Normally the device starts with a heavy weighting of the voltage fuel gauge and as it learns the capacity of the cell during the next few cycles it adds more weight to the coulomb counter. During these cycles, the device becomes more confident in the capacity of the battery, which improves the accuracy of the IC.

If the user is already confident that the capacity of the battery is known to within 5%, the user can skip to coulomb-counter mode and immediately begin observing the performance of the fuel gauge. However, if the capacity is not accurately known within 5%, it takes significantly longer for the IC to adapt to the capacity if the device is skipped to coulomb-counter mode. Take special care when deciding if the device should be advanced.

When the following message box appears, press **Yes** to advance to coulomb-counter mode or press **No** to resume normal operation.

If the user decides to advance to coulomb-counter mode, then the user can decide to keep the capacity that is currently known by the device, which is displayed next to the **Preserve Capacity** radio button. The user also has the option to enter a **New Capacity** value in terms of mAH in the edit box. The user also has a third option to abandon the coulomb-counter mode advance by clicking on the **Begin to Learn new capacity?** radio button (Figure 7).

Once the INI file is completely loaded to the device, the user is notified of the success and then the title bar of the application contains the title included in the INI file.

The configuration can also be loaded by pressing the **Select Configuration** button on the **ReadTime** tab (Figure 8) and then following the same steps.

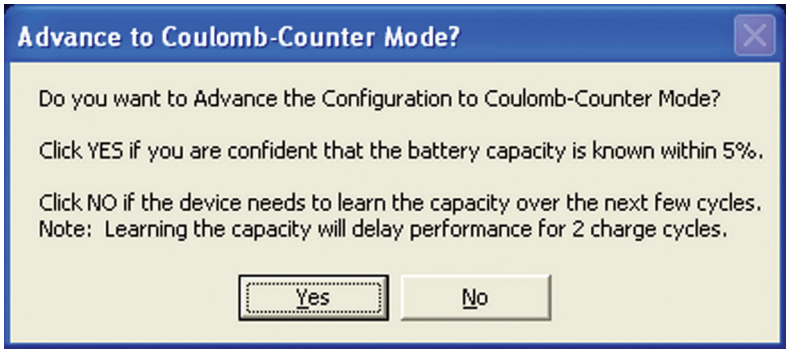

Figure 6. Coulomb-Counter Mode

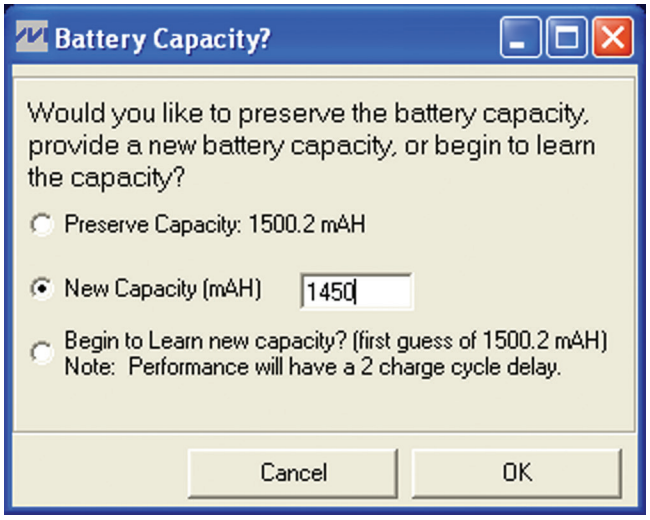

Figure 7. Battery Capacity

RealTime Tab

The **RealTime** tab sheet (Figure 8) displays the latest real-time measurements of cell **Voltage**, **Current**, **Temperature**, and **State of Charge** (in terms of percent and mAH remaining), with both analog meter readouts and digital values. The various configuration registers and alert thresholds are also displayed.

Save Capacity/Restore Capacity

The **Save Capacity** and **Restore Capacity** buttons allow the evaluation software to maintain accuracy of the algorithm after the IC has been power cycled. If a battery is going to be removed from the IC, the user should save the capacity information prior to removing the battery. Also, the user should periodically save the capacity information so it can be restored to the device in the event of a power loss.

Pressing the **Save Capacity** button prompts the user to select a filename in which to store the critical registers required to maintain the accuracy of the algorithm, as described in the MAX17047/MAX17050 IC data sheet. It is recommended to use a very specific naming convention so the file can later be connected to the battery under test. After power is restored to the device, initialize the device and select the appropriate configuration. The user should then press the **Restore Capacity** button and point the browser to the file with the saved parameters for this battery.

Configuration Registers

The user can access the **Status**, **Config**, **FilterCFG**, **RelaxCFG**, and **MiscCFG** registers by pressing the associated button, or from the **Configuration Registers** menu item. Clicking on the associated label opens a window with a bit-by-bit explanation of the register and allows the user to make changes and **Write** the value to the register.

All other registers can be viewed and modified on the **Memory** tab.

Memory Tab

The **Memory** tab sheet (Figure 9) allows the user to modify any of the registers from address 0x00h to 0x4Fh. Any changes to the registers should be made cautiously. To change a value, first press the **Pause** button. This stops any new readings from occurring. Modify the text box of the register that needs updating and then press the button containing the register's name. The register is written and read back to verify it was updated correctly. Make sure to press the **Resume** button so that the software resumes reading the IC.

Log Data Tab

The **Log Data** tab sheet (Figure 10) allows the user to see the IC's real-time measurements graphed over time. There are separate sub tabs for **Voltage**, **Current**, **Temperature**, and **SOC Rep**. Each graph displays the last 500 data points collected by the evaluation software. The **sampling interval** can be adjusted from as fast as possible to 15 minutes and can be adjusted from the **Sampling Interval** drop-down list at the bottom of the window. The **Clear Graphs** button clears all data from all four graphs, but does not reset the log-to-file function. When the fastest sampling interval is selected, the graphs are not updated, only the data logging is enabled.

The **Log to File** sub tab contains control information for storing all data to an ASCII file. The default filename is c:\MAX17050_datalog.txt, but can be modified in the **Filename** edit box. The **Stop Logging** button toggles data logging off and on. For easy import into a spreadsheet, data is stored at the same interval selected for updating the graphs in the following tab-delimited format:

Time<tab>Status(0h)<tab>VALRT_Th(1h)<tab>…..
<tab>Reserved(FEh)<tab>Reserved(FFh)

The 50 most-recent samples are displayed in the window for observation. **Warning:** The **Log Data** function overwrites previous file information. Data previously stored in the file will be lost.

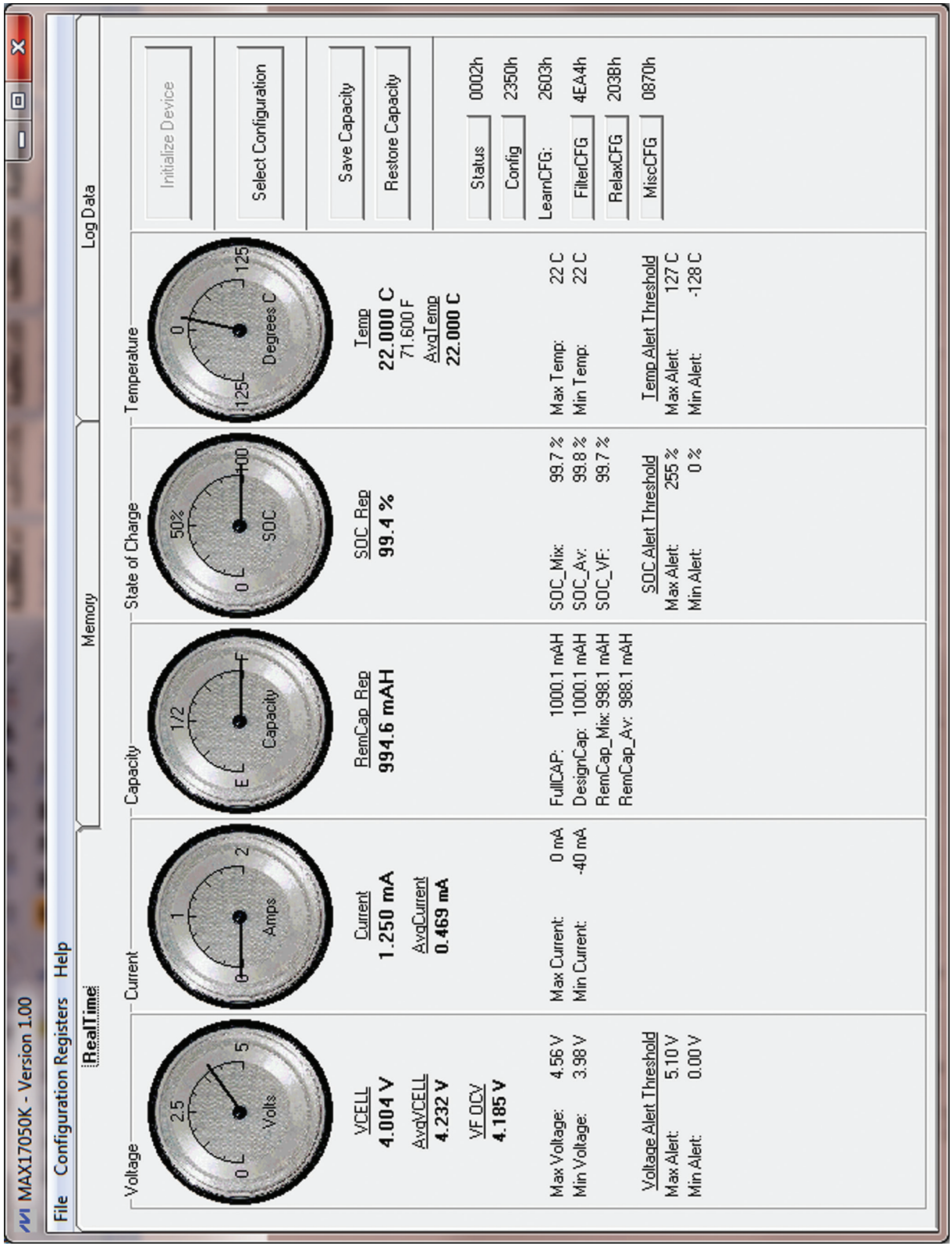

Figure 8. RealTime Tab

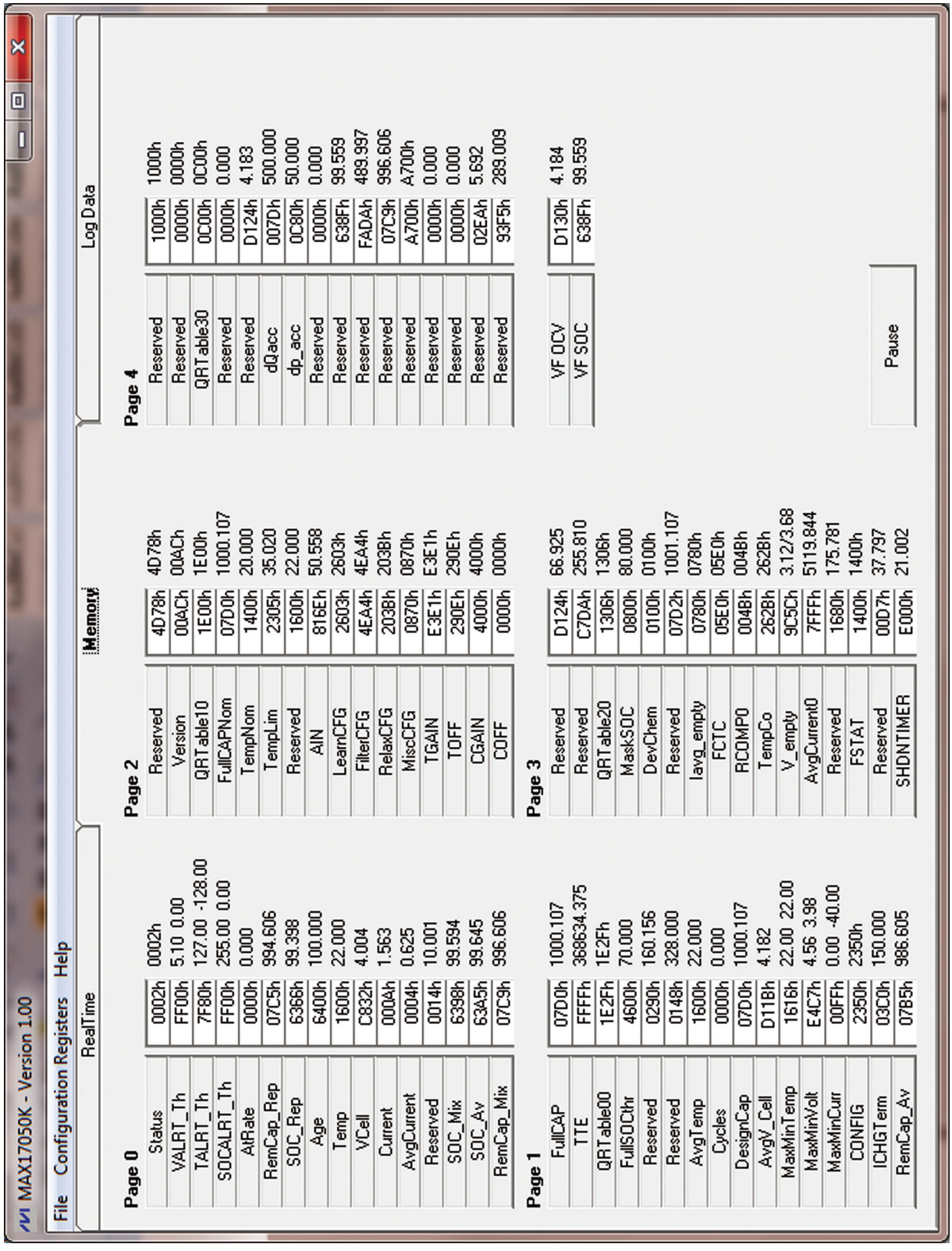

Figure 9. Memory Tab

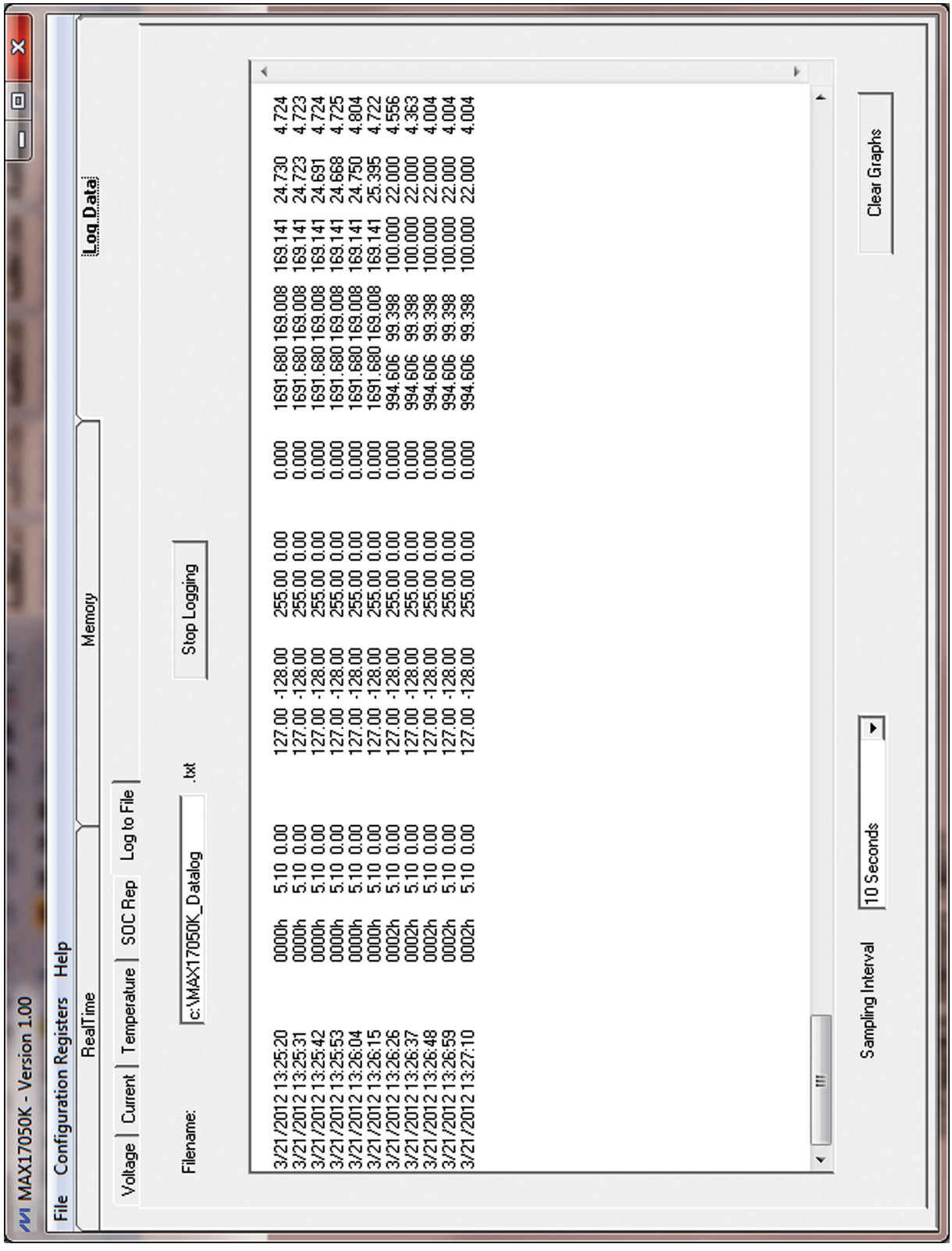

Figure 10. Log Data Tab

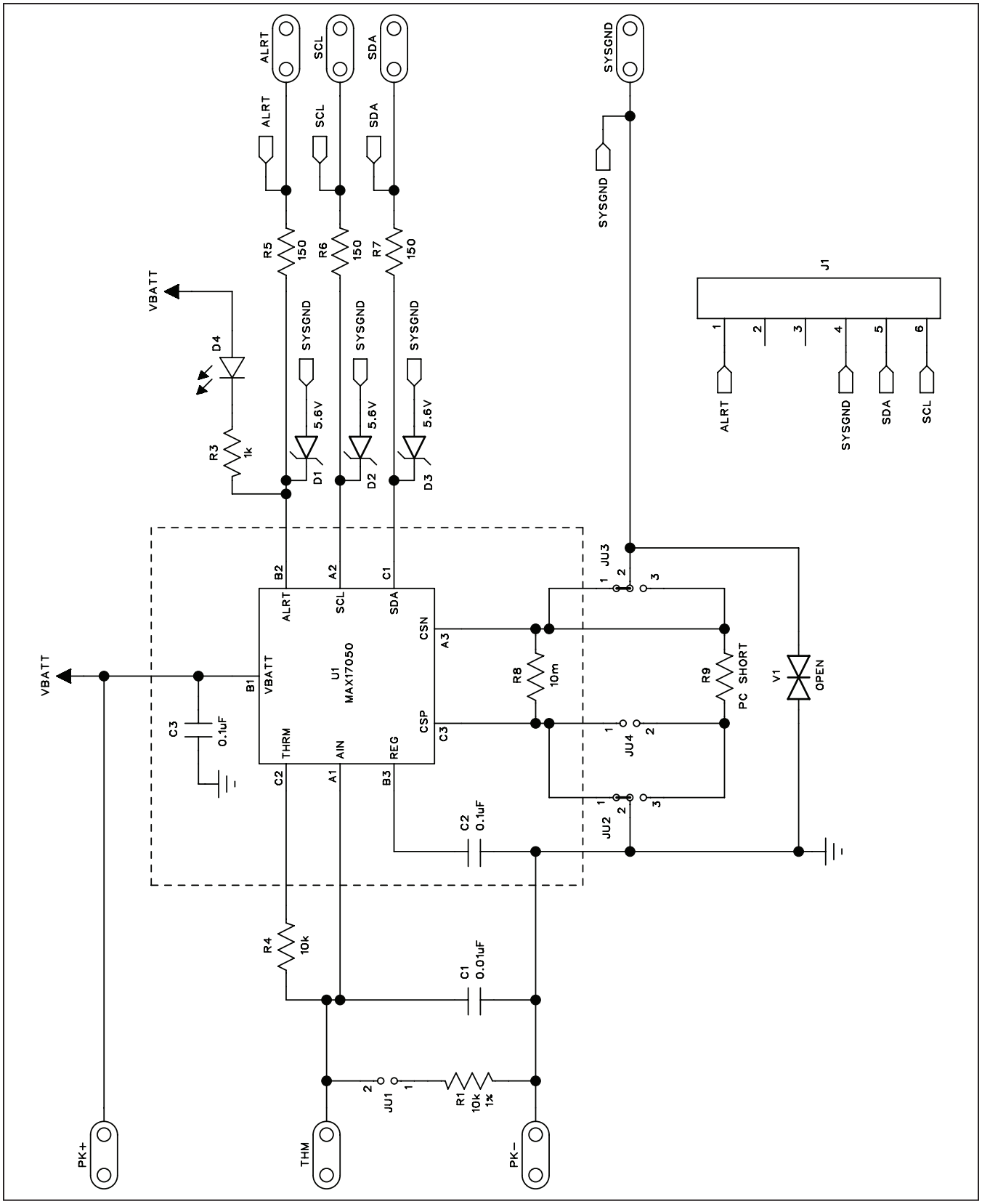

Figure 11. MAX17050 EV Kit Schematic

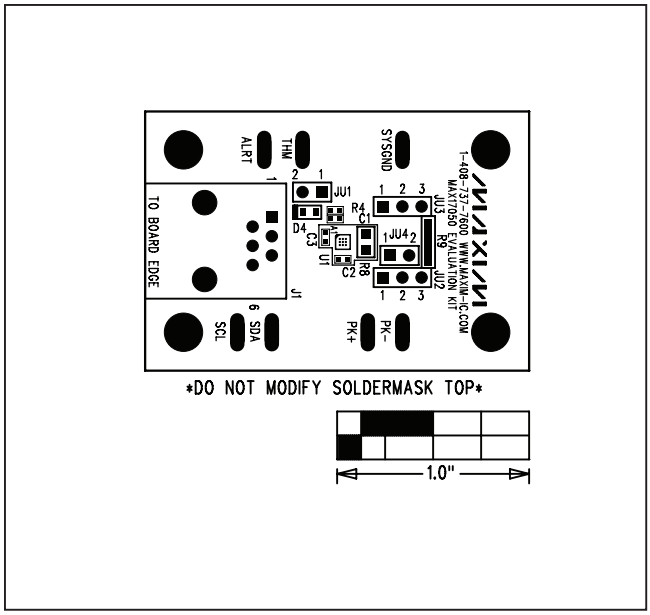

Figure 12. MAX17050 EV Kit Component Placement Guide—Component Side

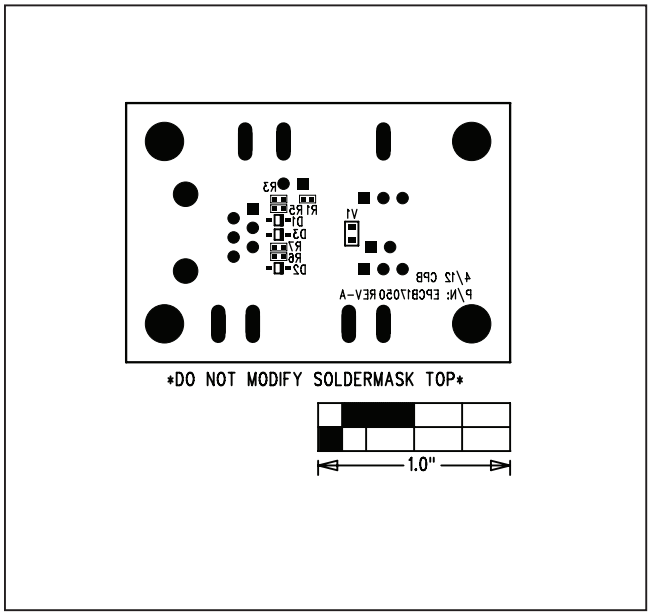

Figure 13. MAX17050 EV Kit PCB Layout—Component Side

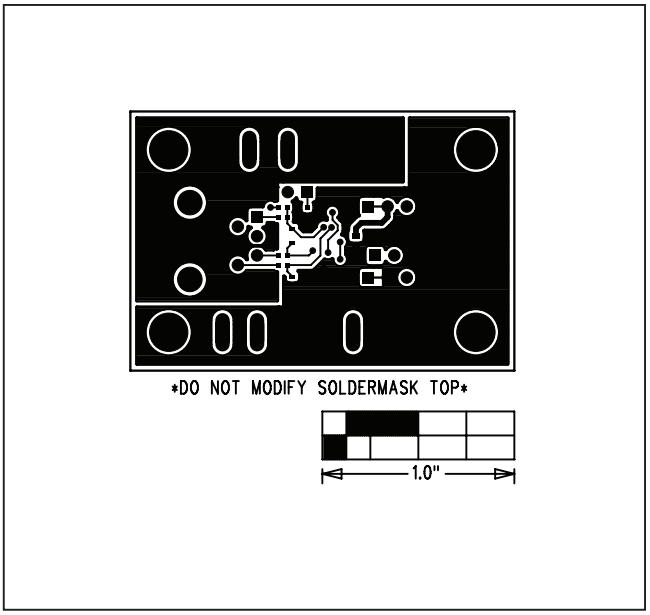

Figure 14. MAX17050 EV Kit PCB Layout—Solder Side

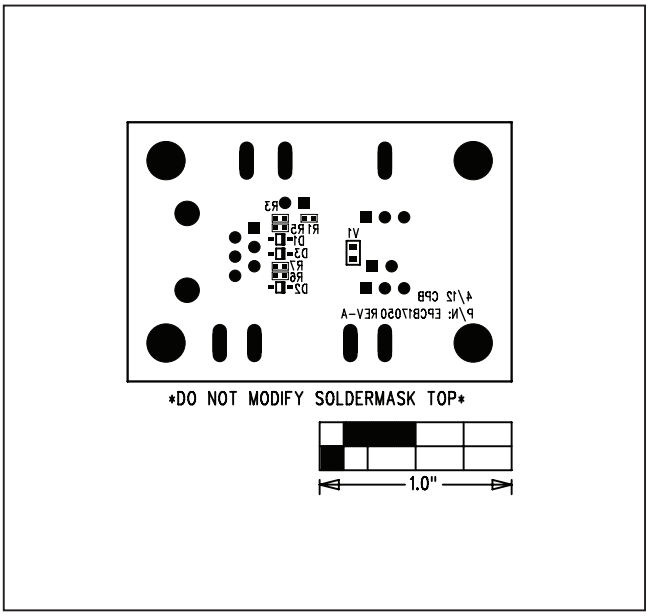

Figure 15. MAX17050 EV Kit Component Placement Guide—Solder Side

Ordering Information

PART	TYPE
MAX17050EVKIT#	EV Kit

#Denotes RoHS compliant.