MAX17260G/MAX17260X Evaluation Kits

Evaluates: MAX17260

General Description

The MAX17260G/MAX17260X evaluation kits (EV kits) are fully assembled and tested surface-mount PCBs that evaluate the stand-alone ModelGauge™ m5 host-side fuel-gauge ICs for lithium-ion (Li+) batteries in handheld and portable equipment.

The MAX17260G/MAX17260X EV kits include the Maxim DS91230+ USB interface, IC evaluation board, and RJ-11 connection cable. Windows®-based graphical user interface (GUI) software is available for use with the EV kits and can be downloaded from Maxim's website at **www.maximintegrated.com/en/products/power/battery-management/MAX17260.html** (under the Design Resources tab). Windows 7 or newer Windows operating system is required to use with the EV kit GUI software.

Features and Benefits

- ModelGauge m5 Algorithm
- Monitors from 1S Cell Packs
- Battery Pack Input Voltage Range of +2.3V to +4.9V
- Thermistor Measurement Network
- Optional On-Board PCB Trace Sense Resistor
- Windows 7 or Newer Compatible Software
- Proven PCB Layout
- Fully Assembled and Tested

MAX17260 EV Kit Files

FILE	DECRIPTION
MAX17260_Vx_x_x_Install.exe	Installs all EV kit files on your computer.

Ordering Information **appears at end of data sheet.**

Quick Start

Required Equipment

- MAX17260G/MAX17260X EV kit
- Lithium battery pack of desired configuration
- Battery charger or power supply
- Load circuit
- DS91230+ USB adapter
- RJ-11 6pos reverse modular cord
- PC with Windows 7 or newer Windows operating system and 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 install the EV kit software, make required hardware connections, and start operation of the kits. The EV kit software can be run without hardware attached. It automatically locates the hardware when connections are made. Note that after communication is established, the IC must still be configured correctly for the fuel gauge to be accurate.

1) Visit **www.maximintegrated.com/en/products/power/battery-management/MAX17260.html** under the Design Resources tab to download the latest version of the EV kit software. Save the EV kit software to a temporary folder and unpack the ZIP file.

2) Install the EV kit software on your computer by running the MAX17260_Vx_x_x_Install.exe program inside the temporary folder. The program files are copied, and icons are created in the Windows **Start** menu. The software requires the .NET Framework 4.5 or later. If you are connected to the Internet, Windows automatically updates .NET framework as needed.

Windows is a registered trademark and registered service mark of Microsoft Corporation.

3) The EV kit software launches automatically after install or alternatively it can be launched by clicking on its icon in the Windows **Start** menu.

4) Connect the DS91230+ adaptor to a USB port on the PC. The DS91230+ is a HID device and is located automatically by Windows without the need to install additional drivers.

5) Make connections to the EV kit board based on cell pack configuration as shown in Figure 1. The load or charger circuit can be connected at this time as well. The cell connects between the PACK- and PACK+ pads and the charger/load connects between the SYSGND and SYSPWR pads. Connect a jumper on J9 to choose between high-side and low-side current measurement. For high-side current measurement, connect pin 1 and 2 on J9. For low-side current measurement, connect pin 2 and 3.

6) Connect the RJ-11 cable between the USB adapter and the EV kit board. The GUI software establishes communication automatically.

7) At power up the IC defaults to EZ Configuration, if you have a custom .INI file for your application, it can be loaded at this time.

Detailed Description of Hardware

The MAX17260G/MAX17260X EV kit boards provide a variety of features that highlight the functionality of the IC. The following sections detail the most important aspects of the EV kit board.

Communication Connections

The RJ-11 connector provides all signal lines necessary for I^2C communication between the IC and the software GUI interface. When developing code separately, connections to the communication lines can be made directly to the board. Table 1 summarizes the connections. The user must apply the appropriate external pullup resistors to the communication lines when not using the DS91230+ communication interface.

Table 1. Communication Line Solder Points

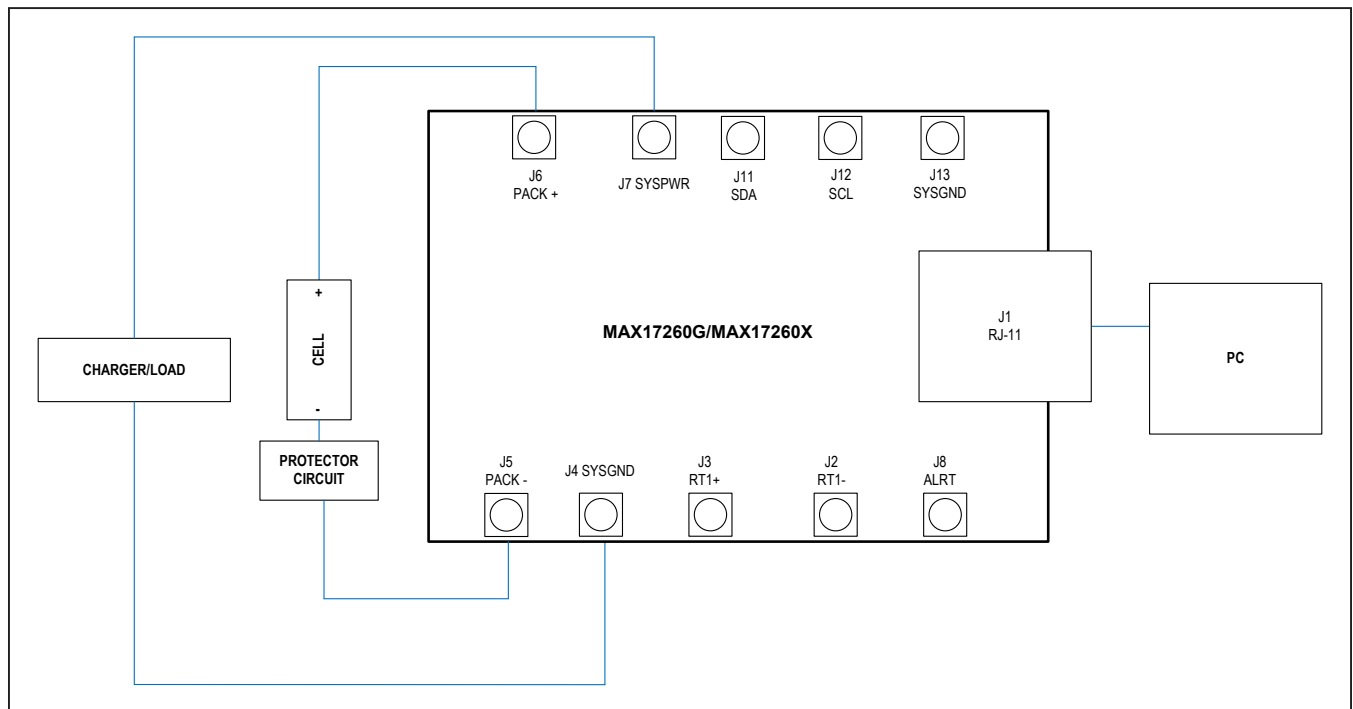| COMMUNICATION LINE	CONNECTION POINT
SDA	J11
SCL	J12
GND	J13

Figure 1. MAX17260 Board Connections

External Thermistor

The MAX17260 can be configured to use internal temperature measurements or an external thermistor. All EV kit boards come with a thermistor installed as surface mount component RT1. If the application requires direct thermal contact to the cells, RT1 can be removed and replaced with a leaded thermistor connected between the RT1+/RT1- solder pads (J2 and J3).

Sense Resistor Options

All EV kit boards are shipped with an 0805 size 0.010Ω chip sense resistor installed. Oversized land pattern pads allow for different size sense resistors to be used if desired. Also, each board contains an optional 0.003Ω copper trace sense resistor that can be enabled if desired. To do so, the chip sense resistor must be removed and 0Ω jumpers must be resoldered to change the circuit. Table 2 summarizes the changes. Note that the IC must be reconfigured to support the new resistor type. For high-side current measurement, connect J9 pin CSN_H and CSN_SW (pin 1 and 2) with a jumper. For low-side current measurement, connect CSN_L and CSN_SW pin (pin 2 and 3).

Detailed Description of Software

The MAX17260G/MAX17260X evaluation kit software gives the user complete control of all functions of the MAX17260, as well as the ability to load a custom model into the ICs. 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

The software requires Windows 7 or newer operating system. .NET version 4.5 is required for operation and is automatically installed if an older version of .NET framework is detected. To install the evaluation software, exit all programs currently running and unzip the provided MAX17260 Installation Package zipped file.

Double click the MAX17260_Vx_x_x Install.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 Maxim Integrated/MAX17260 folder and run MAX17260.exe or select it from the program menu. Figure 2 shows a splash screen containing information about the evaluation kit that appears while program is loading.

Table 2. Sense Resistor Selection for MAX17260

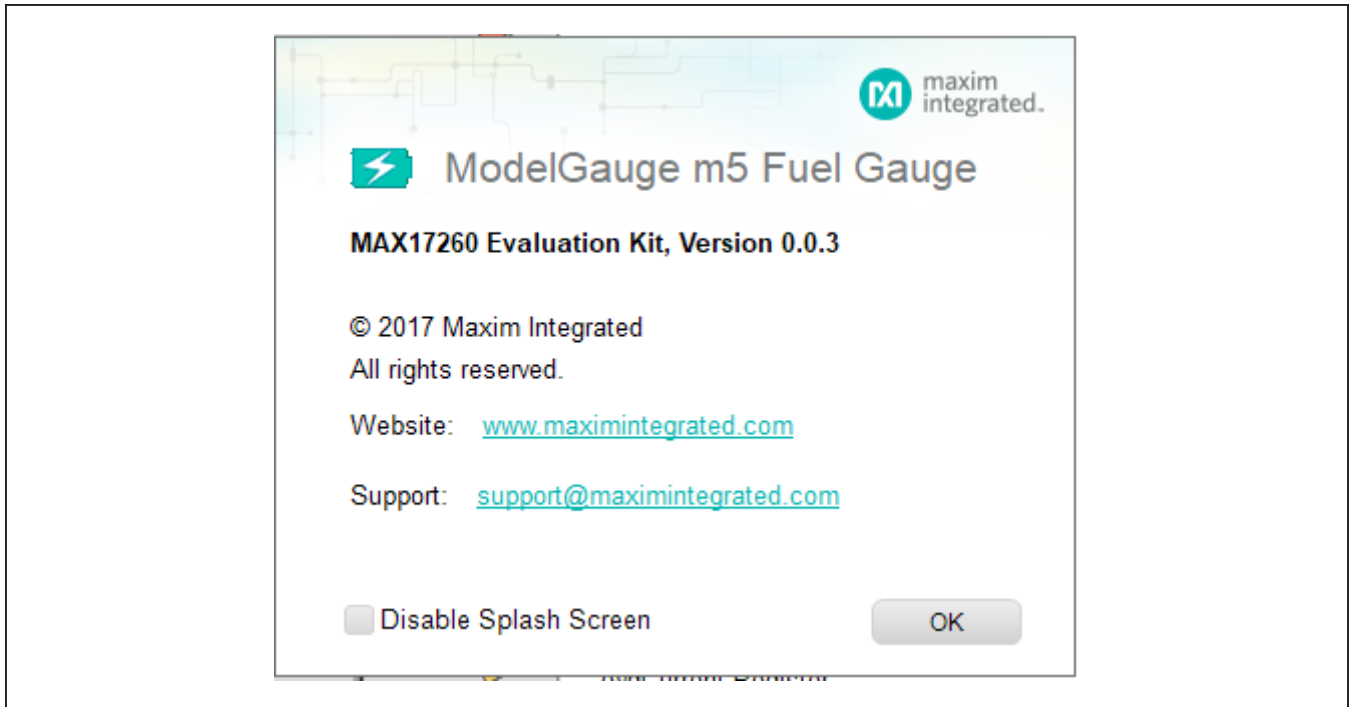| COMPONENT	VALUE FOR CHIP SENSE	VALUE FOR BOARD TRACE SENSE
R3	0Ω	Not populated
R4	Not populated	0Ω
R5	Desired sense value	Not populated
R6	Not populated	0Ω (R7 is trace resistor)

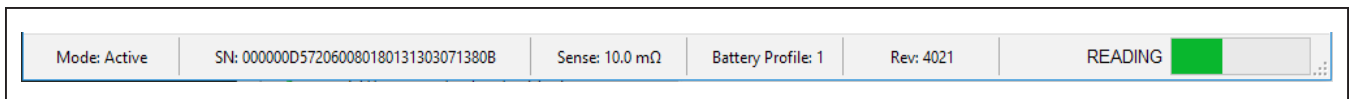Figure 2. EV Kit Splash Screen

Figure 3. EV Kit Bottom Status Bar

Communication Port

The EV kit software automatically finds the DS91230+ adapter when connected to any USB port. Communication status is shown on the right-hand side of the bottom status bar. See Figure 3. If the adapter cannot be found, a "No USB Adapter" message is displayed. If the adapter is found, but the IC daughter board cannot be found, a "No Slave Device" message is displayed. Otherwise, if communication is valid, a green bar updates as the software continuously reads the IC registers.

If the DS91230+ is connected, the status bar should be active. The bottom status bar also displays information on data logging status, the communication mode, hibernation status, selected current-sense resistor value, device serial number, and the EV kit GUIs version number.

Program Tabs

All functions of the program are divided under four tabs in the main program window. Click on the appropriate tab to move to the desired function page. Located on the **ModelGauge m5** tab is the primary user information measured and calculated by the IC. The **Graphs** tab visually displays fuel gauge register changes over time. The **Registers** tab allows the user to modify common fuel gauge registers one at a time. The **Configure** tab allows for special operations such as initializing the fuel gauge logging and performing fuel gauge reset. All tabs are described in more detail in the following sections.

ModelGauge m5 Tab

The **ModelGauge m5** tab displays the important output information read from the IC. Figure 4 shows the format of the ModelGauge m5 Tab. Information is grouped by function and each is detailed separately.

State-of-Charge

The **State-of-Charge** group box displays the main output information from the fuel gauge: state-of-charge of the cell, remaining capacity, time-to-full, and time-to-empty.

Cell Information

The **Cell Information** group box displays information related to the health of the cell such as the cell's age, internal resistance, present capacity, number of equivalent full cycles, and change in capacity from when it was new.

Measurements

The **Measurements** group box displays ADC measurements that are used by the fuel gauge to determine state-of-charge.

Alerts

The **Alerts** group box tracks all eleven possible alert trigger conditions. If any alert occurs, the corresponding checkbox is checked for the user to see. The clear alerts button resets all alert flags.

At Rate

The **At Rate** group box allows the user to input a hypothetical load current and the fuel gauge calculates the corresponding hypothetical Qresidual, TTE, AvSOC, and AvCap values.
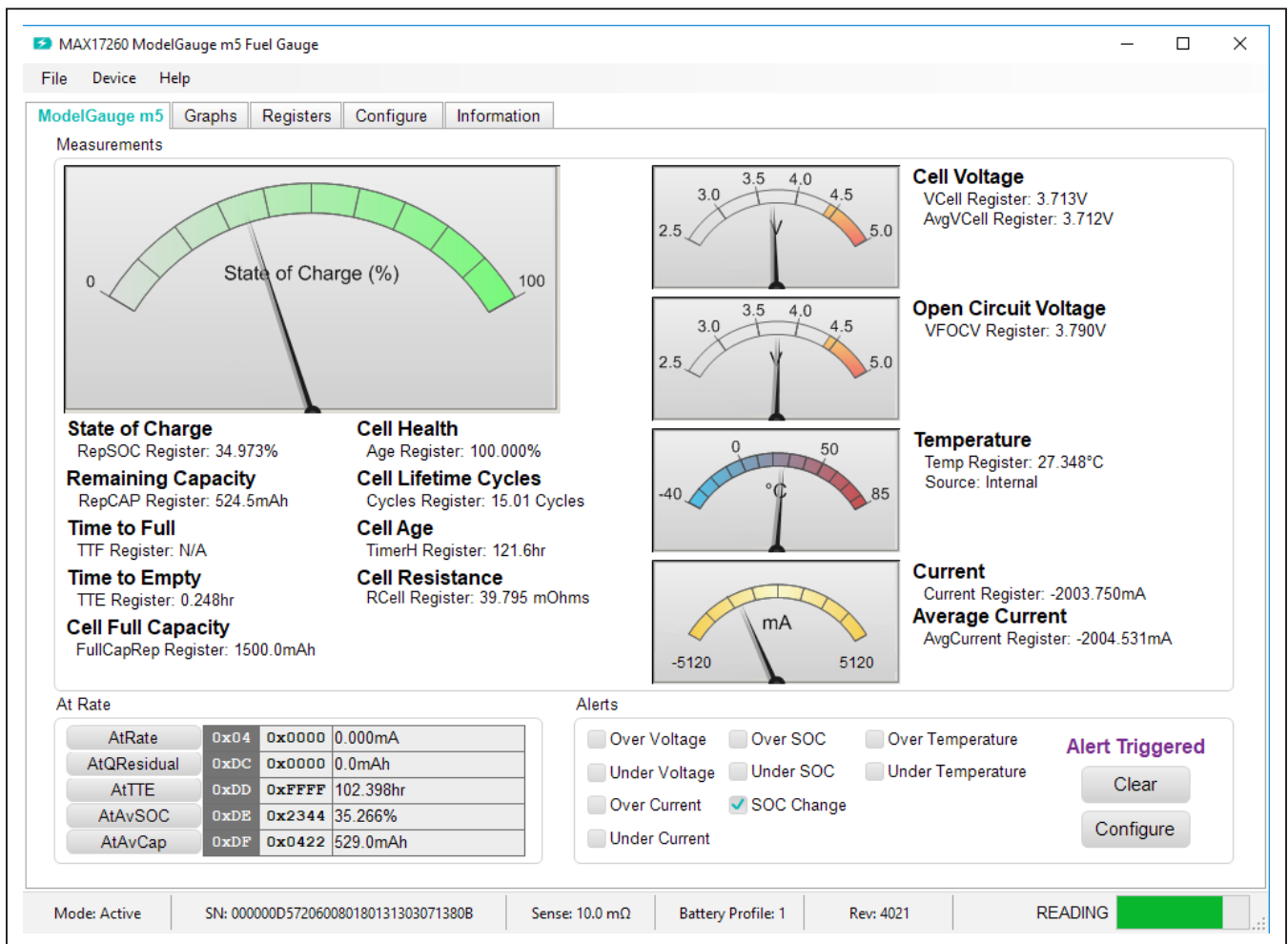

Figure 4. ModelGauge m5 Tab

Graphs Tab

Figure 5 shows the format of the **Graphs** Tab. Graph information is grouped into four categories: voltages, temperatures, capacities, and currents. The user can turn on or off any data series using the check boxes on the right-hand side of the tab. The graph visible viewing area can be adjusted from 10 minutes up to 1 week. The graphs remember up to 1 week worth of data. If the viewing area is smaller than the time range of the data already collected, the scroll bar below the graphs can be used to scroll through graph history. All graph history information is maintained by the program. Graph settings can be changed at any time without losing data.
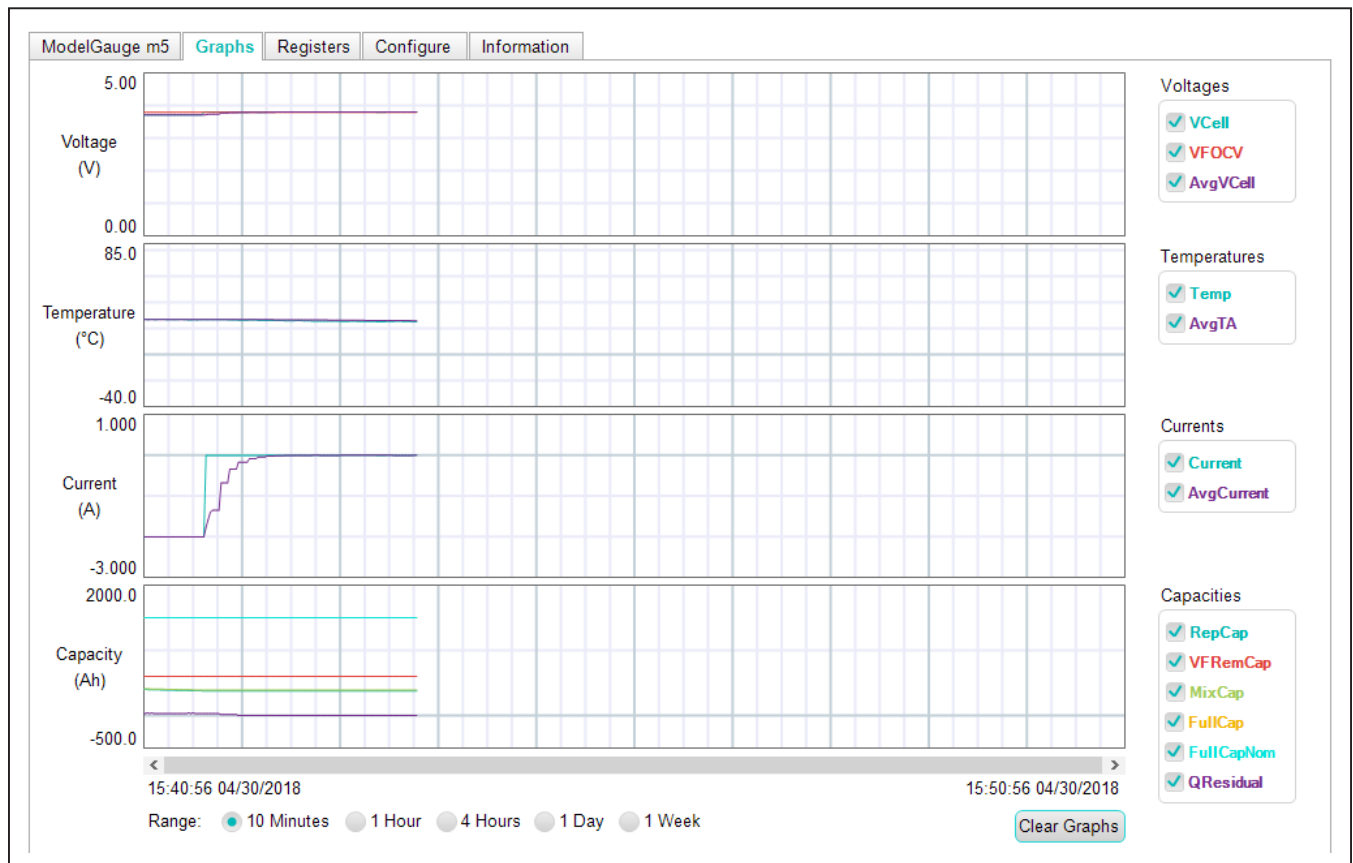

Figure 5. Graphs Tab

Registers Tab

The **Registers** tab allows the user access to all fuel gauge related registers of the IC. Figure 6 shows the format of the **Registers** tab. By using the drop down menu on the left side of the tab, the user can sort the registers either by function or by their internal address. Each line of data contains the register name, register address, hexa-decimal representation of the data stored in the register, and if applicable, a conversion to application units. To write a register location click on the button containing the register name. A pop-up window allows the user to enter a new value in either hexadecimal units or application units. The main read loop temporarily pauses while the register updates.
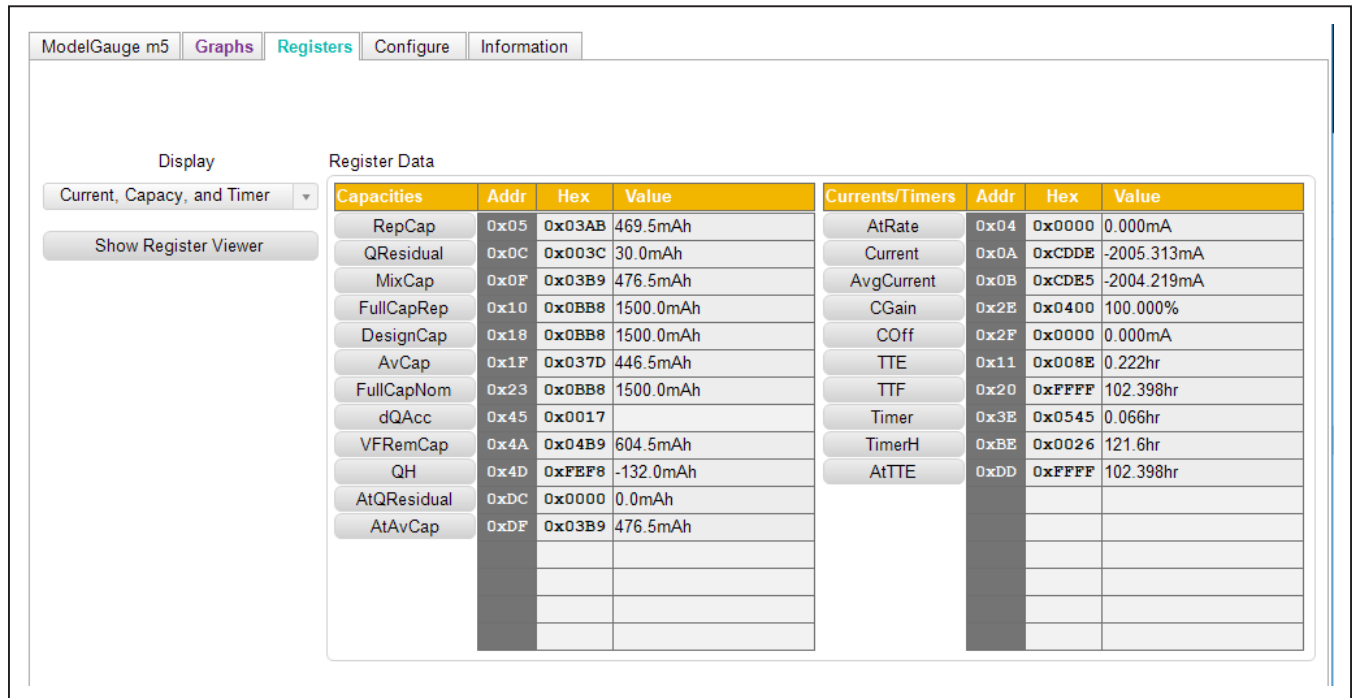

Figure 6. Registers Tab

Configure Tab

The **Configure** tab allows the user to access any general IC functions not related to normal writing and reading of register locations. Figure 7 shows the format of the **Configure** tab. Each group box of the **Configure** tab is described in detail in the following sections.

Read/Write Register

The user can read a single register location by entering the address in hex and clicking the **Read** button. The user can write a single register location by entering the address and data in hex and clicking the **Write** button. The read loop is temporarily paused each time to complete this action.

Log Data to File

Data logging is always active when the EV kit software starts. The default data log storage location is the My Documents/Maxim Integrated/MAX17260/Datalog.csv.

The user can stop data logging by clicking the **Stop** button. The user can resume logging by clicking the **Start** button. All user available IC registers are logging in a .csv formatted file. The user can adjust the logging interval at any time. The user can also enable or disable the event logging at any time. When event logging is enabled, the data log also stores any IC write or reads that are not part of the normal read data loop and indicates any time communication to the IC is lost. The GUI automatically begins writing to a new file on each launch. To manually begin logging to a new file, click the **Advance** button.

Reset IC

Clicking the **POR** button sends the software POR command to the command register to fully reset operation the same as if the IC had been power cycled. Note that resetting the IC when the cell is not relaxed causes fuel gauge error.
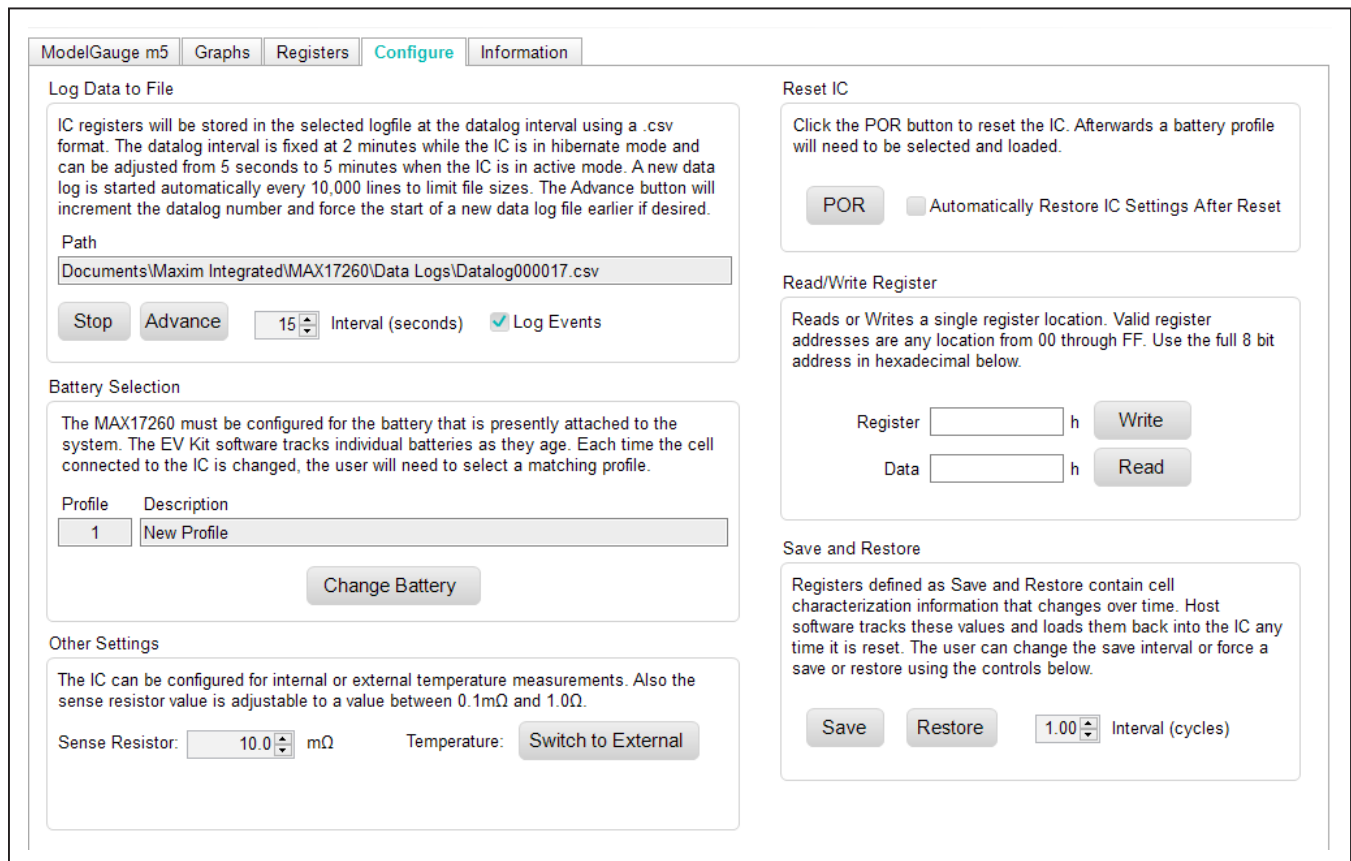

Figure 7. Commands Tab

Battery Selection

Clicking the **Change Battery** button opens the battery selector window. In this window, a battery profile is created. The battery profile stores the EZ Config model or custom INI for that battery, as well as any learned parameters, if the save and restore function is used. Ideally, a new profile is created for each battery to store these parameters. The software automatically programs the IC when the **Save Profile and Update IC** button is pressed.

Save and Restore

The EV Kit software periodically saves the values from registers related to cell characteristics that change over time. These values are then restored into an IC after reset so that the fuel gauge remains accurate as the cell ages. The software automatically performs a save operation every 10 cycles or when the software exits. The user can change the save interval or force a save operation at any time by clicking the **Force Save** button. To restore this information after the IC has been power cycled or reset through software, click the **Restore** button.

ModelGauge m5 EZ Configuration

Before the IC accurately fuel gauges the battery pack, it must be configured with characterization information. This can be accomplished two ways. The first is through a custom characterization procedure that can be performed by Maxim under certain conditions. The result is an .INI summary file that contains information that can be programmed into the IC on the **Configure** tab. Contact Maxim for details on this procedure.

The second method is ModelGauge m5 EZ configuration. This is the default characterization information shipped inside every IC. This default model produces accurate results for most applications under most operating conditions. It is the recommended method for new designs as it bypasses the custom cell characterization procedure. Some additional information is required from the user for EZ configuration initialization.

For EZ configuration, click the **Import INI File** button in the **Information** tab, or click **Change Battery** in the **Configure** tab. A **Battery Selector** panel as shown in Figure 8 pops out. In the panel, select **Use Default IC Settings (EZ Config)** option. Fill in the rated battery capacity and the charge termination current, select the battery chemistry in the **Model ID** drop down menu, and select the minimum system voltage in the **Empty Voltage** drop down menu. Check the **Charge voltage is greater than 4.275V** box if full charge voltage is higher than 4.275V. After configuring these items, click the **Save Profile and Update IC** button to load EZ configuration into the chip.

For characterized battery, choose the **Load INI File** option in the **Battery Selector** panel, and select the INI file provided from MAXIM, then click **Save Profile and Update IC** button to load configuration.
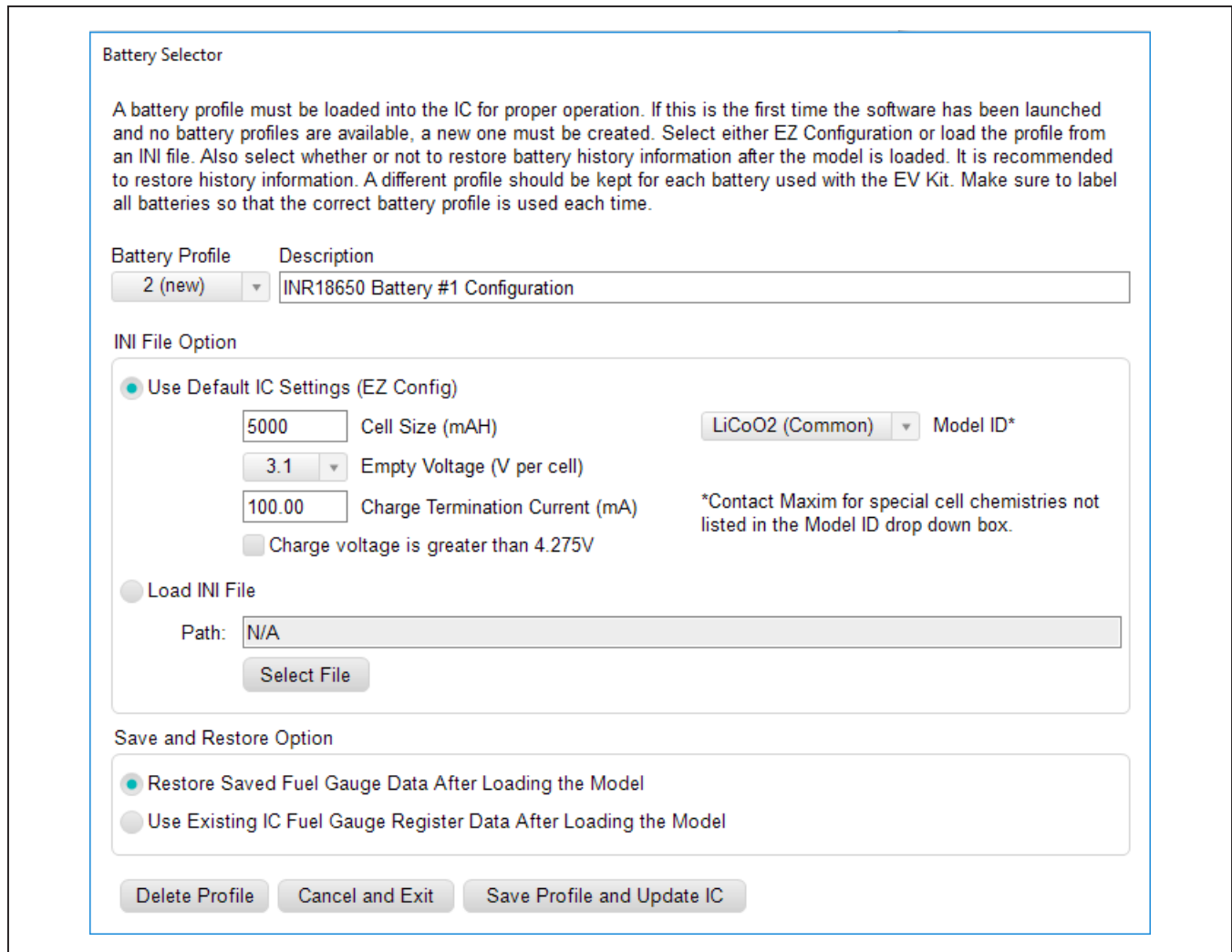
Figure 8. New Battery Selector Panel

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Murata Electronics North America, Inc.	770-436-1300	www.murata.com/en-us
TDK Corp.	847-803-6100	www.component.tdk.com
Vishay	402-563-6866	www.vishay.com

Note: *Indicate that you are using the MAX17260 when contacting these component suppliers.*

Ordering Information

PART	TYPE
MAX17260GEVKIT#	MAX17260SETD+ EV Kit
MAX17260XEVKIT#	MAX17260SEWL+ EV Kit

#Denotes RoHS compliant.

MAX17260G EV Kit Bill of Materials

REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
C1	0	1	GRM155R71A104JA01	MURATA	0.1UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.1UF; 10V; TOL=5%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
C2	-	1	GRM155R60J474KE19	MURATA	0.47UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.47UF; 6.3V; TOL=10%; TG=-55 DEGC TO +85 DEGC; TC=X5R	
D2	-	1	LTST-C190CKT	LITE-ON ELECTRONICS INC.	LTST-C190CKT	DIODE; LED; STANDARD; RED; SMT (0603); PIV=5.0V; IF=0.04A; -55 DEGC TO +85 DEGC	
D3-D5	-	3	BZX384-C5V6	NXP	5.6V	DIODE; ZNR; SMT (SOD-323); Vz=5.6V; Izm=0.000001A; -65 DEGC TO +150 DEGC	
J1	-	1	95009-7661	MOLEX	95009-7661	CONNECTOR; FEMALE; THROUGH HOLE; FLUSH MOUNT RJ-11 MODULAR JACK; RIGHT ANGLE; 6PINS	
J9	-	1	PEC03SAAN	SULLINS ELECTRONICS CORP.	PEC03SAAN	EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS; -65 DEGC TO +125 DEGC;	
R3	-	1	CRCW04020000Z0EDHP; RCS04020000Z0	VISHAY DRALORIC;VISHAY DALE	0	RESISTOR; 0402; 0 OHM; 0%; JUMPER; 0.2W; THICK FILM	
R5, R15	-	2	KRL1220E-M-R010-F	SUSUMU CO LTD.	0.01	RES; SMT (0805); 0.01; 1%; +/-50PPM/DEGC; 0.5W	
R11	-	1	CRCW04021K00FK; RC0402FR-071KL	VISHAY DALE;YAGEO PHICOMP	1K	RESISTOR; 0402; 1K; 1%; 100PPM; 0.0625W; THICK FILM	
R12, R13	-	2	CRCW0402150RFK; 9C04021A1500FL	VISHAY DALE;YAGEO	150	RESISTOR; 0402; 150 OHM; 1%; 100PPM; 0.0625W; THICK FILM	
RT1	-	1	NCP15XH103F03RC	MURATA	10K	THERMISTOR; SMT (0402); THICK FILM (NICKEL PLATED); 10K; TOL=+/-1%	
U1	-	1	MAX17260SETD+	MAXIM	MAX17260SETD+	EVKIT PART - IC; MAX17260SETD+; PACKAGE OUTLINE: 21-0137; LAND PATTERN: 90-0063	
PCB	-	1	MAX17260GTDFN	MAXIM	PCB	PCB:MAX17260GTDFN	
MOD1	DNI	1	89-91230+000	MAXIM	89-91230+000	MODULE; DS91230 CONNECTOR EVAL KIT+	COMMUNICATION INTERFACE KIT
R4	DNP	0	CRCW04020000Z0EDHP; RCS04020000Z0	VISHAY DRALORIC;VISHAY DALE	0	RESISTOR; 0402; 0 OHM; 0%; JUMPER; 0.2W; THICK FILM	
R6	DNP	0	CRCW08050000ZS; ERJ-6GEY0R00V; RC2012J000; RMCF0805ZT0R00	DIGI-KEY	0	RESISTOR; 0805; 0 OHM; JUMPER; 0.125W; THICK FILM	

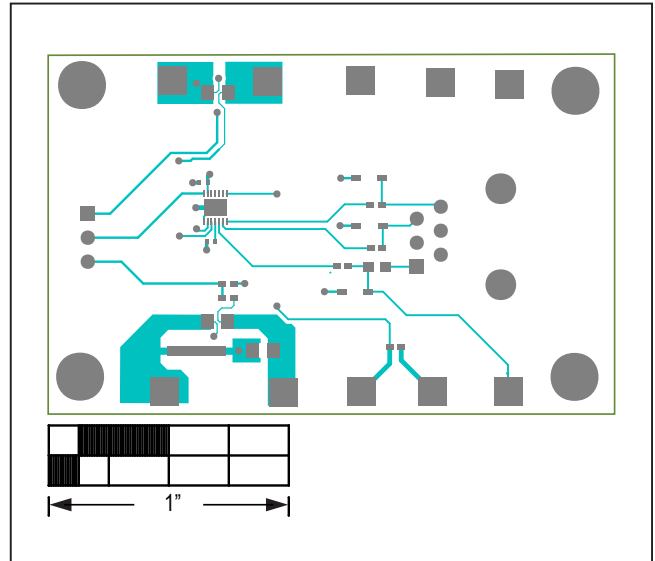NOTE: DNI--> DO NOT INSTALL (PACKOUT) ; DNP--> DO NOT POPULATE
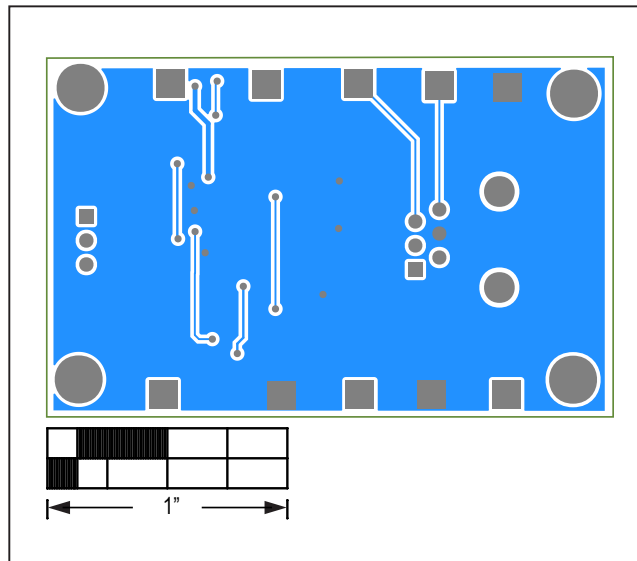
MAX17260G EV Kit Schematic
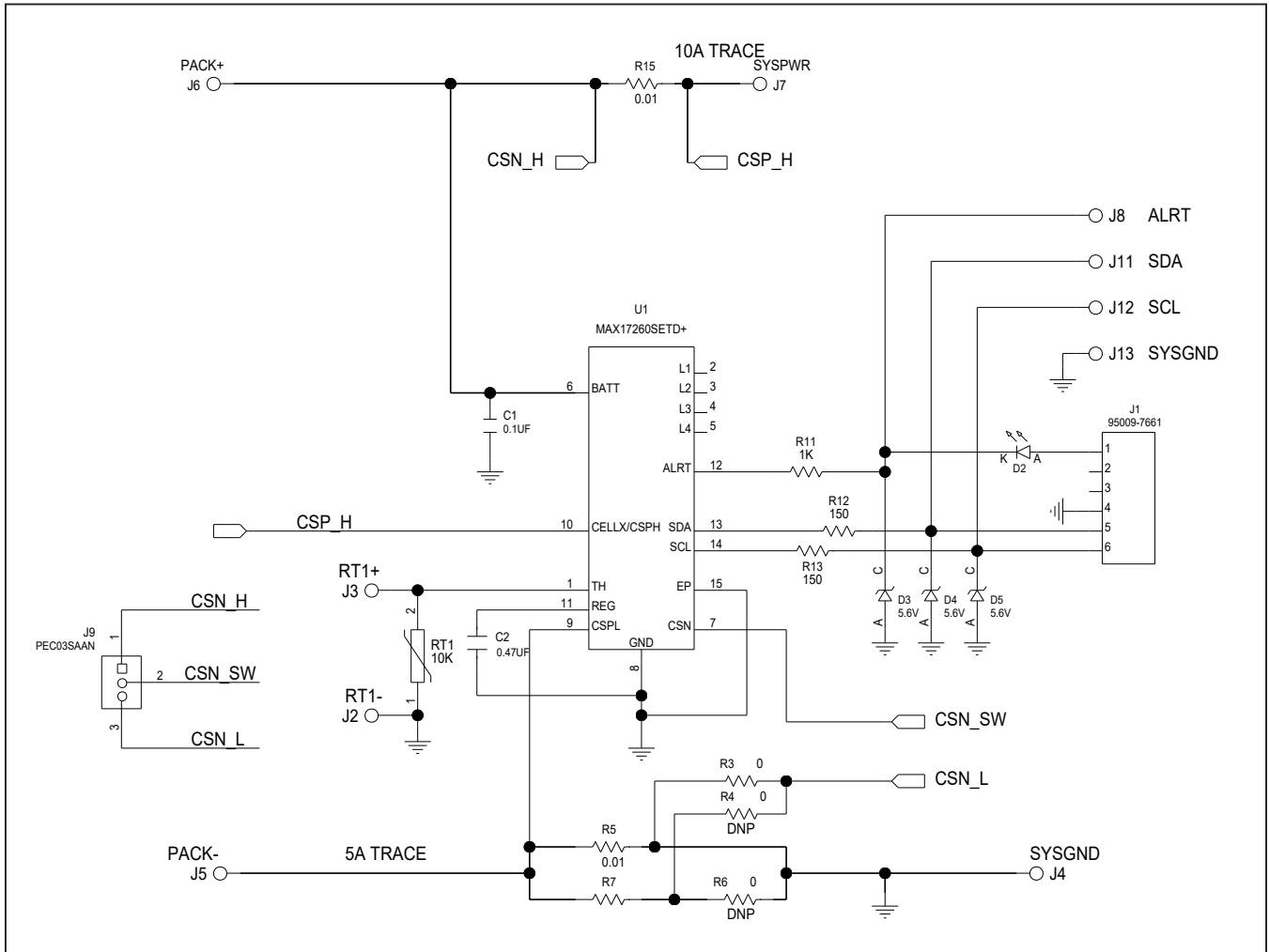
MAX17260G EV Kit PCB Layouts
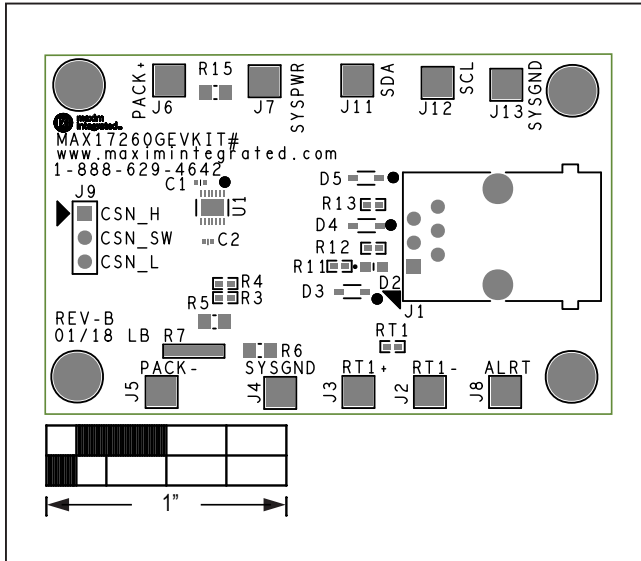
MAX17260G EV Kit Component Placement Guide—Top Silkscreen

MAX17260G EV Kit PCB Layout—Top Layer

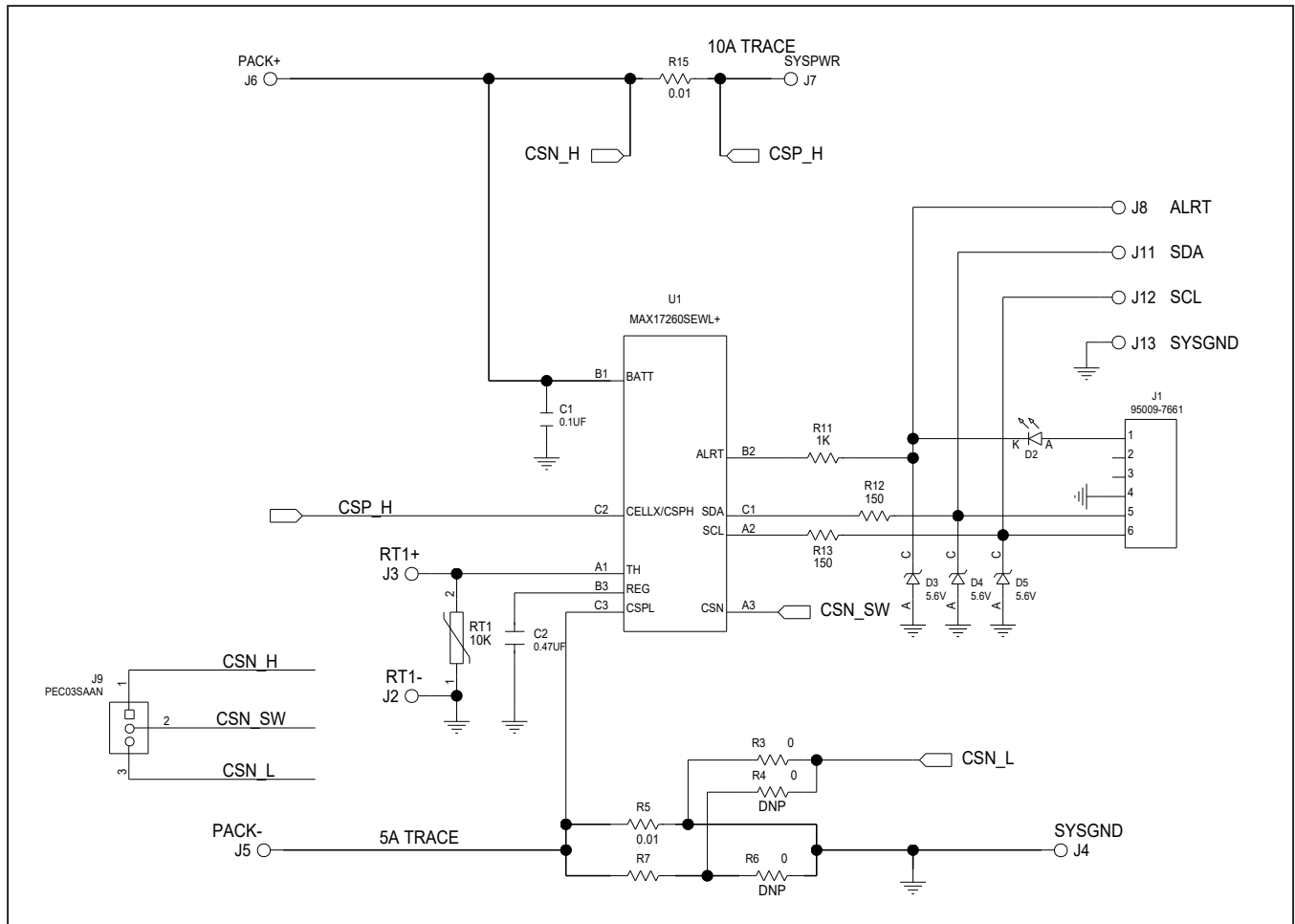*MAX17260G EV Kit PCB Layout—Bottom Layer*

MAX17260X EV Kit Bill of Materials

REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
C1	-	1	GRM155R71A104JA01	MURATA	0.1UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.1UF; 10V; TOL=5%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
C2	-	1	GRM155R60J474KE19	MURATA	0.47UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.47UF; 6.3V; TOL=10%; TG=-55 DEGC TO +85 DEGC; TC=X5R	
D2	-	1	LTST-C190CKT	LITE-ON ELECTRONICS INC.	LTST-C190CKT	DIODE; LED; STANDARD; RED; SMT (0603); PIV=5.0V; IF=0.04A; -55 DEGC TO +85 DEGC	
D3-D5	-	3	BZX384-C5V6	NXP	5.6V	DIODE; ZNR; SMT (SOD-323); Vz=5.6V; Izm=0.000001A; -65 DEGC TO +150 DEGC	
J1	-	1	95009-7661	MOLEX	95009-7661	CONNECTOR; FEMALE; THROUGH HOLE; FLUSH MOUNT RJ-11 MODULAR JACK; RIGHT ANGLE; 6PINS	
J9	-	1	PEC03SAAN	SULLINS ELECTRONICS CORP.	PEC03SAAN	EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS; -65 DEGC TO +125 DEGC;	
R3	-	1	CRCW04020000Z0EDHP; RCS04020000Z0	VISHAY DRALORIC;VISHAY DALE	0	RESISTOR; 0402; 0 OHM; 0%; JUMPER; 0.2W; THICK FILM	
R5, R15	-	2	KRL1220E-M-R010-F	SUSUMU CO LTD.	0.01	RES; SMT (0805); 0.01; 1%; +/-50PPM/DEGC; 0.5W	
R11	-	1	CRCW04021K00FK; RC0402FR-071KL	VISHAY DALE;YAGEO PHICOMP	1K	RESISTOR; 0402; 1K; 1%; 100PPM; 0.0625W; THICK FILM	
R12, R13	-	2	CRCW0402150RFK; 9C04021A1500FL	VISHAY DALE;YAGEO	150	RESISTOR; 0402; 150 OHM; 1%; 100PPM; 0.0625W; THICK FILM	
RT1	-	1	NCP15XH103F03RC	MURATA	10K	THERMISTOR; SMT (0402); THICK FILM (NICKEL PLATED); 10K; TOL=+/-1%	
U1	-	1	MAX17260SEWL+	MAXIM	MAX17260SEWL+	EVKIT PART - IC; MAX17260SEWL+; PACKAGE OUTLINE: 21-100168; PACKAGE CODE: W91G1+2	
PCB	-	1	MAX17260X_WLP_REVB	MAXIM	PCB	PCB:MAX17260X_WLP_REVB	
MOD1	DNI	1	89-91230+000	MAXIM	89-91230+000	MODULE; DS91230 CONNECTOR EVAL KIT+	COMMUNICATION INTERFACE KIT
R4	DNP	0	CRCW04020000Z0EDHP; RCS04020000Z0	VISHAY DRALORIC;VISHAY DALE	0	RESISTOR; 0402; 0 OHM; 0%; JUMPER; 0.2W; THICK FILM	
R6	DNP	0	CRCW08050000ZS; ERJ-6GEY0R00V; RC2012J000; RMCF0805ZT0R00	DIGI-KEY	0	RESISTOR; 0805; 0 OHM; JUMPER; 0.125W; THICK FILM	

NOTE: DNI--> DO NOT INSTALL (PACKOUT) ; DNP--> DO NOT POPULATE
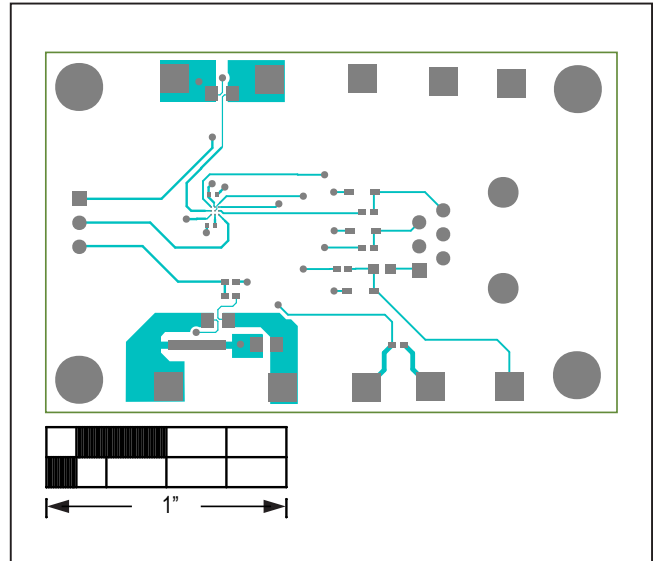
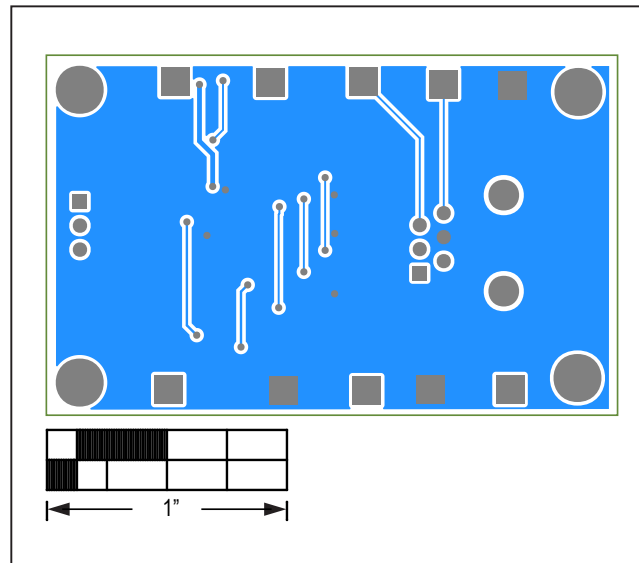## MAX17260X EV Kit Schematic

MAX17260X EV Kit PCB Layouts
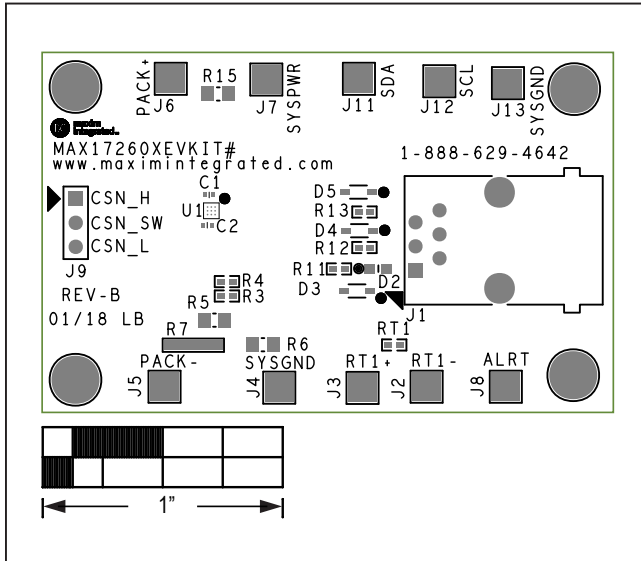
MAX17260X EV Kit Component Placement Guide—Top Silkscreen

MAX17260X EV Kit PCB Layout—Top Layer

MAX17260X EV Kit PCB Layout—Bottom Layer

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	05/18	Initial release	—