MAX17854 Evaluation Kit

General Description

The MAX17854 evaluation kit (EV kit) is used to demonstrate the features and capabilities of the MAX17854 14-channel high-voltage smart sensor data acquisition interface IC. The EV kit is coupled with a MAX17851 EV kit to establish communication with a host PC. With communication established, control of the MAX17854 EV kit is executed through the EV kit GUI on the host PC. The GUI is Windows XP®-, Windows Vista®-, Windows® 7-, and Windows 10-compatible and is available through your local Maxim Integrated sales office.

Note: References to the MAX17851 in this data sheet pertain equally to the MAX17841B as well.

The MAX17854 EV kit design provides a convenient platform for evaluating the features and functions of the IC, in addition to the IC's electrical parameters. The EV kit with vertical communication connectors (TXLP_CONN, RXLP_CON, TXUP_CONN, RXUP_CONN) and snap and lock battery pack connector enables the user to quickly build and evaluate a system with up to 32 daisy-chain devices.

Features

- Provides a Convenient Platform for Evaluating the Features and Functions of the MAX17854
- Versatile GUI Interface for Features Evaluation
- Plug-and-Play Architecture for Rapid System Prototyping
- Force and Sense Pin Headers for Precision Measurement Assessment
- Built-In Resistor Stack for Battery Emulation
- Proven PCB Layout
- Fully Assembled and Tested

MAX17854 EV Kit Files

FILE	DESCRIPTION
MAX1785X_EV kit_Installer.exe	Software: Graphical User Interface (GUI)
MAX17854_EVKIT_B.pdf	Schematic File pdf
MAX17854_EVKIT_B.pdf	PCB Layout File pdf

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

EV Kit Board: MAX17854 EV Kit System for Single UART with MAX17851EVKIT as a Bridge Device
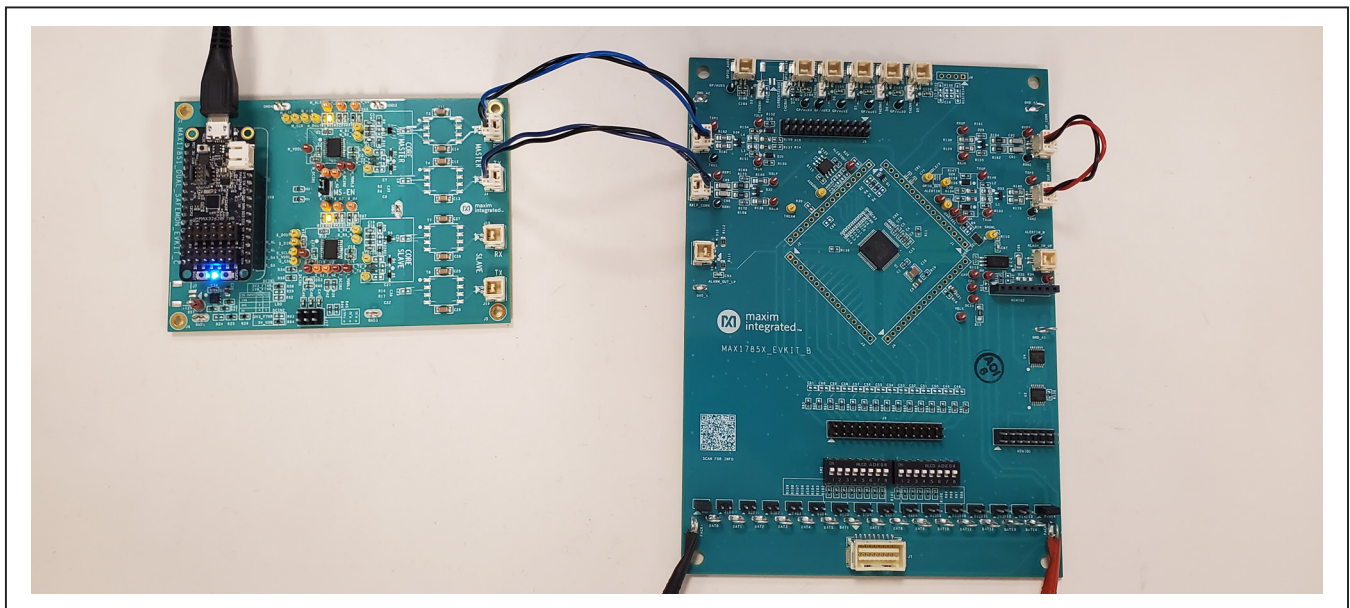
Windows, Windows XP, and Windows Vista are registered trademarks and registered service marks of Microsoft Corporation.

319-100860; Rev 0; 12/21

Quick Start (Single UART)

This procedure describes the setup and initialization of a two-module distributed daisy-chained system using the MAX17854 in a single UART with external loopback communication mode. The user may choose to expand the system with additional EV kit modules depending on their requirements and testing needs.

Required Hardware

- Minimum one MAX17854 EV kit (cables included)
- One Single UART MAX17851 EV kit or MAX17841 EV kit (includes the FTHR or MINIQ interface controller, respectively)
- 9V to 65V DC power supplies (refer to the MAX17854 IC data sheet for recommended operating range)
- User-supplied Windows XP-, Windows Vista-, Windows 7-, or Windows 10-compatible PC with a spare 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 MAX17854 EV kit is fully assembled and functionally tested prior to shipment. Follow the steps below to become acquainted with the MAX17854 EV kit and initialize the single-UART EV kit communication.

1) Install the MAX17854 EV kit software on your computer by running the MAX1785X_EV kit_Installer.exe.

2) Follow the on-screen instructions shown in the pop-up window.

3) Click the **Install** button to confirm the installation of the MAX1785X GUI.

4) After a successful installation of the MAX1785X GUI, a window is displayed for the installation of the required **MINIQUSB** and **FTHR** drivers. Administrator privileges are required to install the USB device driver on Windows XP, Windows Vista, Windows 7, and Windows 10.

5) Click **Next** in the device driver installation wizard window.

6) Once the installation of the **MINIQUSB** is completed, click Finish.

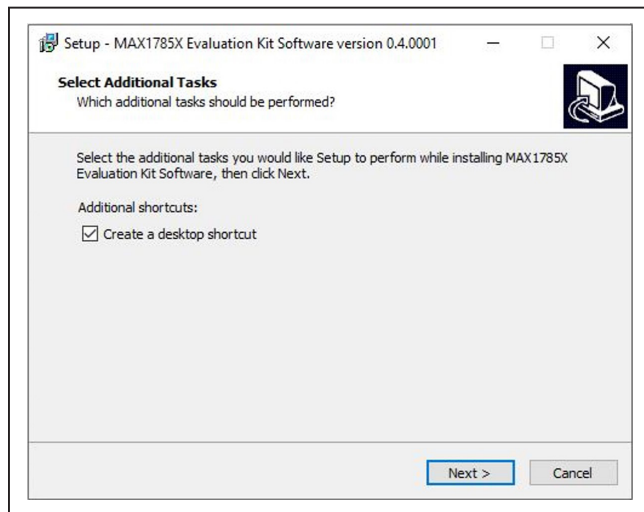7) Click **Next** to confirm the installation of the FTHR driver.

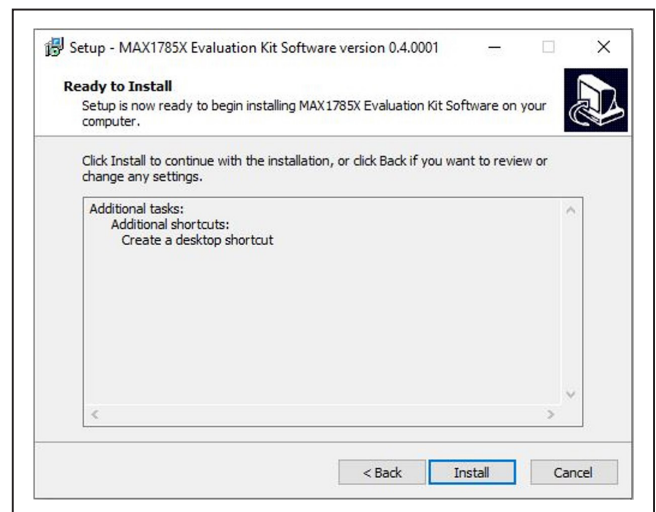Figure 1. MAX17851 Software Installation
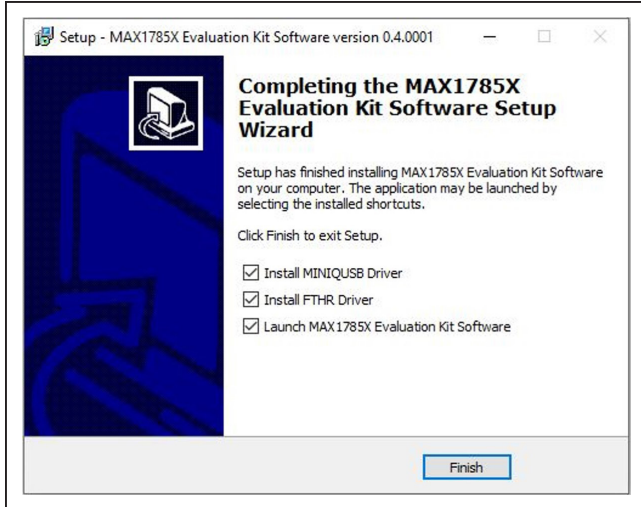

Figure 2. MAX17851 Confirm Software Installation

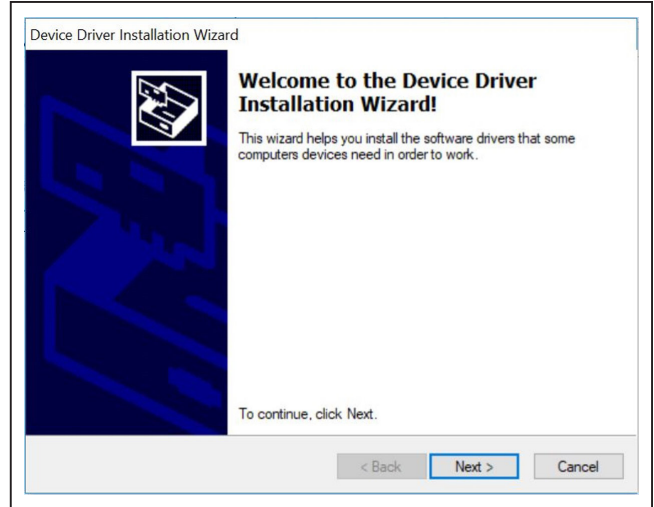Figure 3. MAX17851 Completed Software Installation
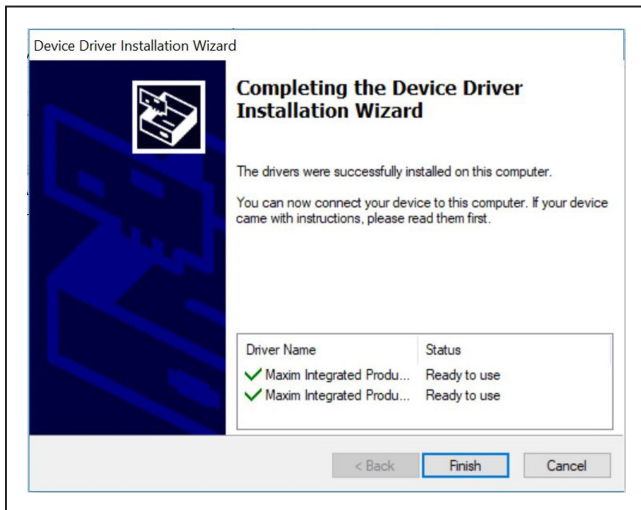

Figure 4. MAX17851 Driver Installation
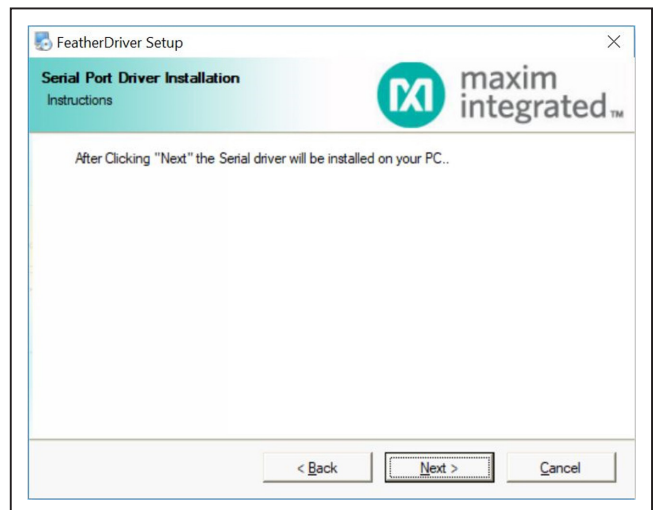

Figure 5. MAX17851 MINIQUSB Installation Completed

Figure 6. MAX17851 FTHR Driver Installation

Default Configuration

Notes: The MAX17851 EV kit draws all necessary power from the USB. For more information on how to connect it to a 12V battery source, refer to the MAX17851 EV kit data sheet.

Notes: The MAX17854 EV kit needs an external supply of minimum 12V. Switching all switches to the ON position enables a 2kΩ resistor ladder, connecting from PACK+ to PACK- and enabling a uniform voltage reading across all battery inputs.

Establishing Communication

1) Ensure that all shunts and switches are configured as listed in **Tables 1–3**.

2) Connect the 2-wire blue/black cable from MAX17851 EV Kit (J3) to MAX17854 EV Kit (TXLP_CONN)

3) Connect the 2-wire blue/black cable from MAX17851 EV Kit (J4) to MAX17854 EV Kit (RXLP_CONN)

4) Connect the 2-wire red/black cable from MAX17854 EV Kit from TXUP_CONN to RXUP_CONN
The setup should look like as shown in the board photo.

Table 1. MAX17854 EV Kit Default Jumper Settings

JUMPER	SHUNT POSITION
P+B14, B0P-	Installed
THERM1–THERM6	Open

Table 2. MAX17851 EV Kit Default Jumper Settings

JUMPER	SHUNT POSITION
J20	Installed

Table 3. MAX17854 EV Kit Default Switch Settings

SWITCH	SETTING
SW1, SW2	ON position

5) Start the MAX17854EV KIT software by opening its icon in the Start Programs menu.

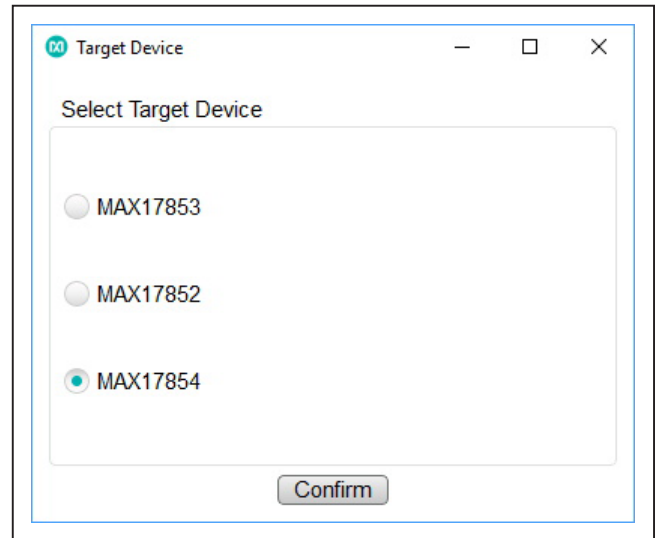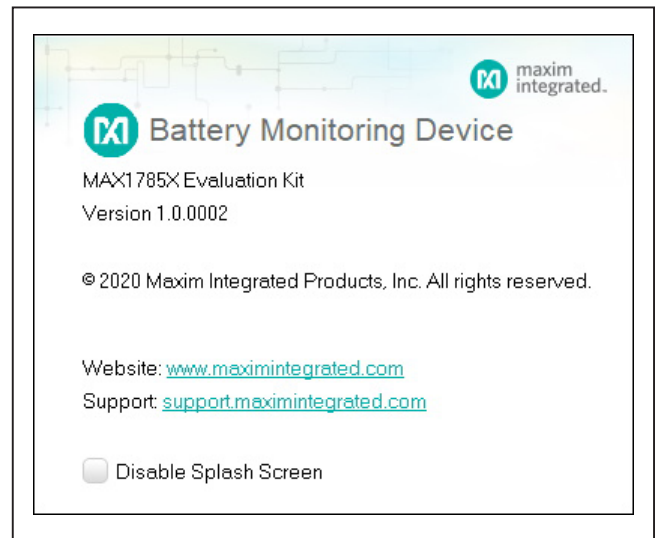6) Select the target device (MAX17854).

Figure 7. Target Device

Figure 8. Splash Screen

7) The EV kit GUI software automatically establishes communication with the MAX32620 interface. The status bar at the bottom of the GUI displays **Maxim 32620 BMS USB to serial 01.xx.xx** and **UART Not Initialized**. With the MAX32620 detected, the user can proceed to the next step.

8) In the **Communication** tab (Figure 12), select the **MAX17851** radio button.

9) Click on the **Single-UART** radio button (Figure 12).

10) Select the **Initialization** tab (Figure 14).

11) Click the **Wakeup** button.

12) Verify that the communication is established with the MAX17851. The **Event Log** will read Wakeup successful.

13) The EV kit is now ready for further evaluation. See the *Evaluation Procedures* section for a step-by-step guide to evaluate the specific IC functions.

MAX17854 EV Kit Hardware Description

The MAX17854 EV kit PCB is designed with headers, test points, and jumpers, providing convenient access to circuit nets where measurements can be made, and signals monitored.
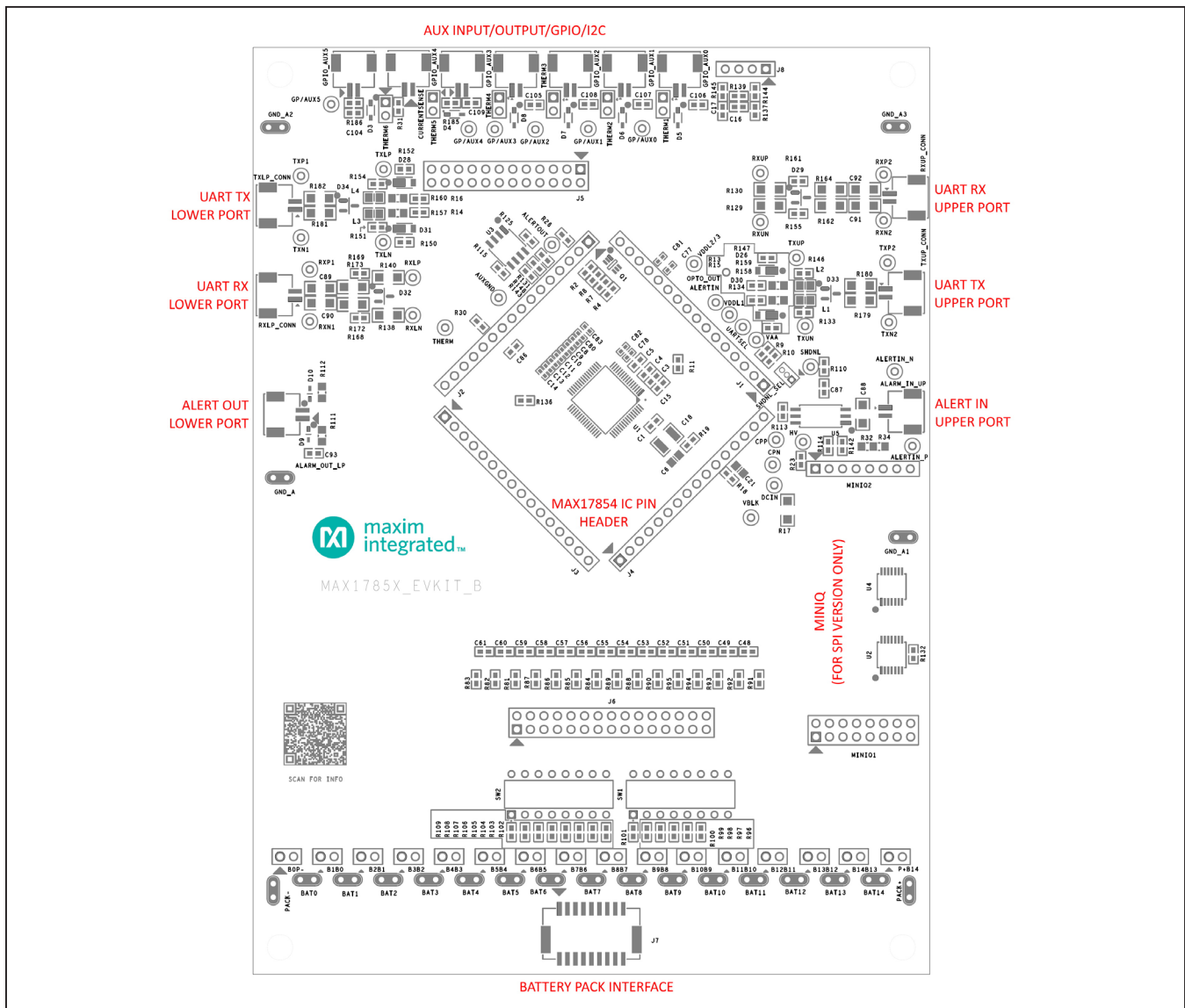

Figure 9. MAX17854 EV Kit PCB

Battery-Pack Connector (J7)

Power is applied to the MAX17854 EV kit through the J7 battery-pack connector, or the PACK+ and PACK- test points. The PACK+ and PACK- test points are provided should the user prefer to source power from a laboratory power supply. The Battery Cell Jumpers (B1B0–B14B13) can emulate a bus bar connection, shorting that input.

Caution: Do not use those jumpers when a battery is connected to that cell. There is no resistor limiting the current!

To power the MAX17854 EV kit using a bench power supply, terminate PACK+ to the positive post and PACK- to the negative post of the power supply and install the P+B14 and B0P- jumpers.

Battery-Cell Emulation

For convenience, the MAX1785X EV kit PCB is equipped with a 2kΩ resistor ladder to emulate a battery pack when using a bench power supply. To apply the emulated battery-pack resistor ladder voltages to the MAX17854 cell-voltage measurement inputs (C0–C14), place all SW1 and SW2 switches in the closed/ON position. Pack voltage from a bench power supply applied to the 2kΩ resistor ladder divides equally across the resistors and is measured by the MAX17854.

The battery interface includes a battery force and sense pin header (J6) that can be used for precision measurement testing. A forced simulated-battery voltage between adjacent pins on the J6 pin header can be measured at the pin header and compared with the data conversion values of the MAX17854 IC.

AUX Input/Output/GPIO/I2C

The auxiliary (AUX) input/output/ADC section of the EV kit PCB gives the user access to the MAX17854 AUX GPIO pins and THRM pin. Each GPIO_AUX connector is equipped to interface directly with the NTC thermistors for external temperature measurement. With the THERM jumper installed, the NTC sensor is pulled up through a 10kΩ resistor to the THRM pin on the MAX17854. This feature allows the user to turn on or off the 10kΩ pullup through the THRM pin during a measurement for energy conservation.

The GPIO_AUX is instrumented with a block header (J5) that allows the user to perform AUX_GPIO force and sense accuracy measurements. To perform accuracy measurement through the J5 header, a voltage is forced onto a pin header and can be sensed through the adjacent pin on the header. The measurement can then be compared to the conversion measurement of the MAX17854.

UART Ports

The UART communication ports are identified as the upper port (RXU/TXU) and the lower port (RXL/TXL), with reference to the MAX17854 device on the EV kit PCB. Each UART port comprises a differential transmitter and a differential receiver.

Communication data received on the lower receiver is retransmitted through the upper transmitter to the next EV kit in the daisy-chain. Communication received on the upper receiver is retransmitted through the lower transmitter and downward through the chain. Each differential pair includes four test points for observing the communication signals. It is critical to note that the upper port (RXP2, RXN2, TXP2, TXN2) test points are referenced to the next higher ground-potential EV kit.

The EV kit UART network and components are designed for the automotive environment and are capable of enduring battery-management-system compliance testing. This includes BCI, ESD, radiated emission, pulse testing, and deactivation of the service-disconnect switch. The PCB and UART components are designed and selected for 630VDC (max) isolation between each MAX17854 EV kit in the daisy-chained system; however, isolation capability has not been tested on the MAX17854 EV kit.

ALERT IN/ALERT OUT

The redundant ALERT interface provides an additional channel for notifying the host about potential hazards in the daisy chain. It can be programmed to activate on specific alerts of the IC (for example over and undervoltage conditions) and can propagate a 2MHz signal through the daisy-chain to the host where actions can be taken. The propagation is always DOWN the daisy-chain and since it is not a differential signal (unlike the UART port), additional isolation measures need to be taken on board level.

The EV kit comes with an optical isolation, thus a simple UART cable (blue/black) can be used to connect multiple devices.

MAX17854 IC Pin Headers (J1–J4)

Each pin on the MAX17854 is available for easy monitoring through the J1 IC pin header. Header J1 is terminated to pins 1–16 on the MAX17854, J2 is terminated to pins 17–32, J3 is terminated to pins 33–48, and J4 is terminated to pins 49–64.

For convenience, certain IC pins are terminated to test points for monitoring frequently observed device signals. Examples include: VBLK, DCIN, HV, CPP, CPN, SHDNL _SELSHDNL, VAA UARTSEL, VDDL1, ALERTIN, ALERTOUT, and THERM.

MAX17851 EV Kit or MAX17841 EV Kit

To complete the Maxim EV kit battery management evaluation system, it is essential to include the MAX17841EVMINIQ# or the MAX17851_DUAL_ SAFEMON_EVKIT. In this EV kit, we only refer to the MAX17851 EV kit as it can use the full potential of the MAXIM BMS system. The MAX17851 EV kit contains the MAX17851 base board and the PC USB interface board (MAX32620FTHR). Power and ground for the MAX17851 is derived through the MAX32620FTHR board and require no other power source. It is critical to note that the MAX17851 EV kit provides the battery management evaluation system with capacitive isolation on connectors J3, J4, J18, and J19.
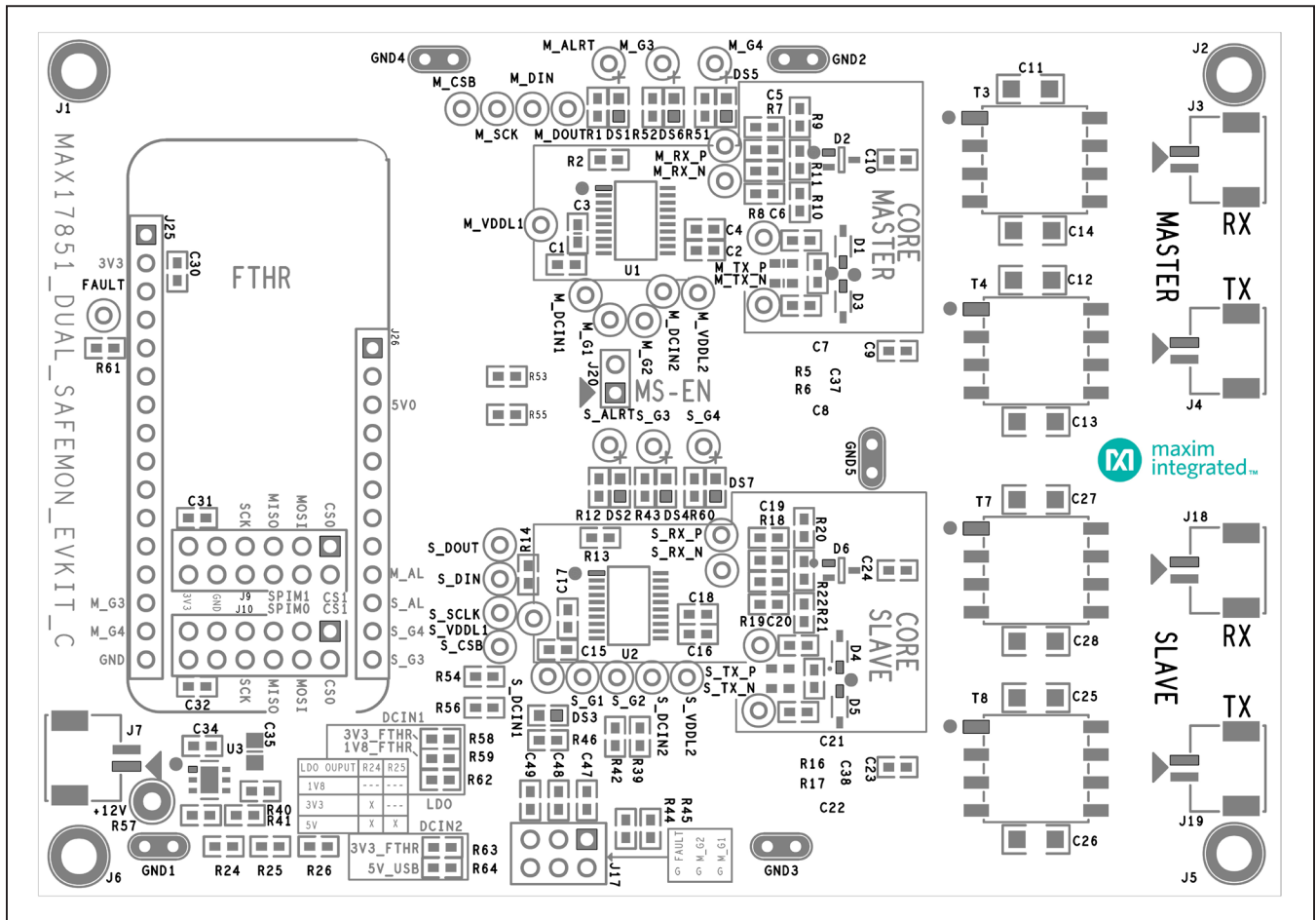

Figure 10. MAX17851 EV Kit PCB

Graphical User Interface Description

The MAX17854 EV kit is evaluated in conjunction with the MAX17854 evaluation software. The GUI provides a friendly environment for reading and writing to all device registers, as well as executing device commands.

Communication Tab

The GUI startup cockpit is designed to guide the user through hardware setup and provides overall startup system information. At startup, the GUI automatically initializes and establishes communication with the Maxim MAX32620FTHR interface board and places the user on the Communication tab. The UART status is shown in the lower-right corner of the cockpit.

The GUI is preset to UART communication with a dual UART interface (see Figure 11). When selecting the UART configuration, the hardware graphic updates to reflect the proper wiring interface for the selected UART. For communication to be established between the MAX17851 EV kit and MAX17854 EV kit, it is imperative that the system wiring matches the UART configuration selected.

The MAX17854 EV kit is designed to support Single UART Interface with External Loopback, as shown in Figure 12. Follow the UART wiring changes shown in Figure 11, Figure 12, and Figure 13 for alternative UART configurations.

Located in the Communication tab is the UART Options group box. Options set in the UART Options group box control TXL and TXU idle state impedance, adaptive transmission setting, and packet error check (PEC). The user can also enable and evaluate the alert function, double-buffer feature, UART DC diagnostic test, and control the alive-counter bit (ALIVECNTEN).
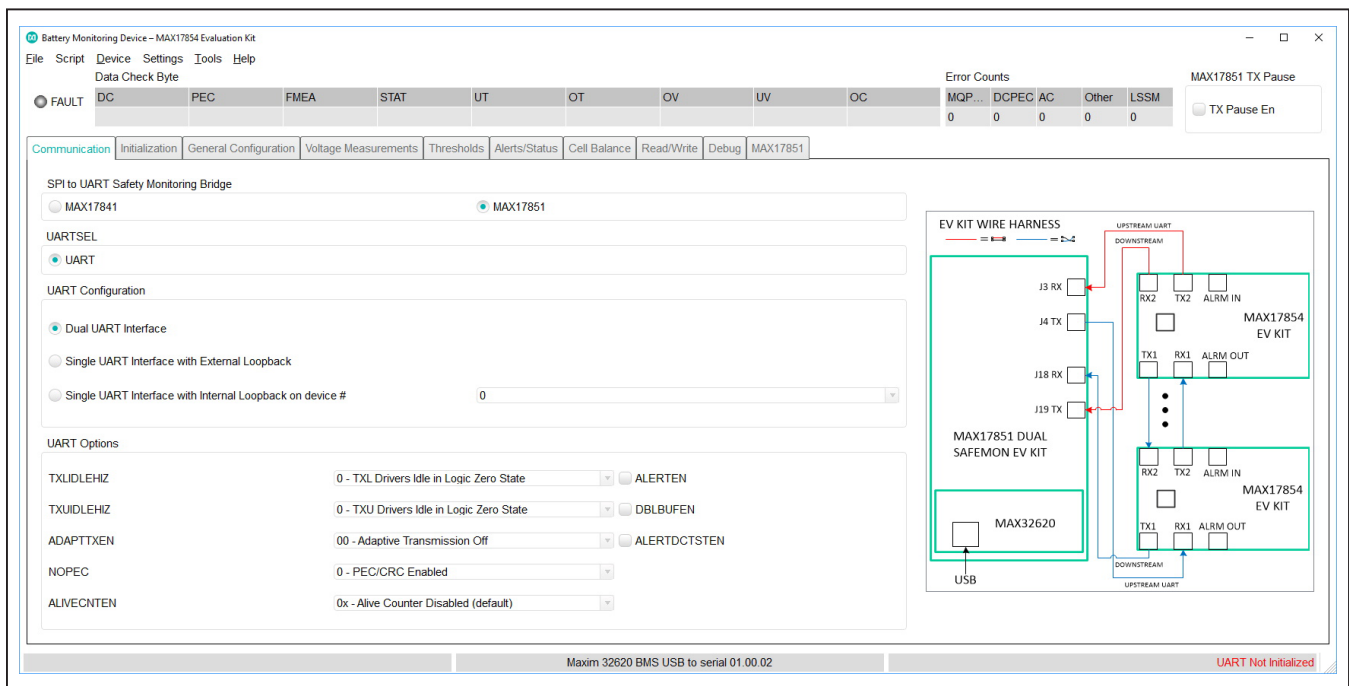

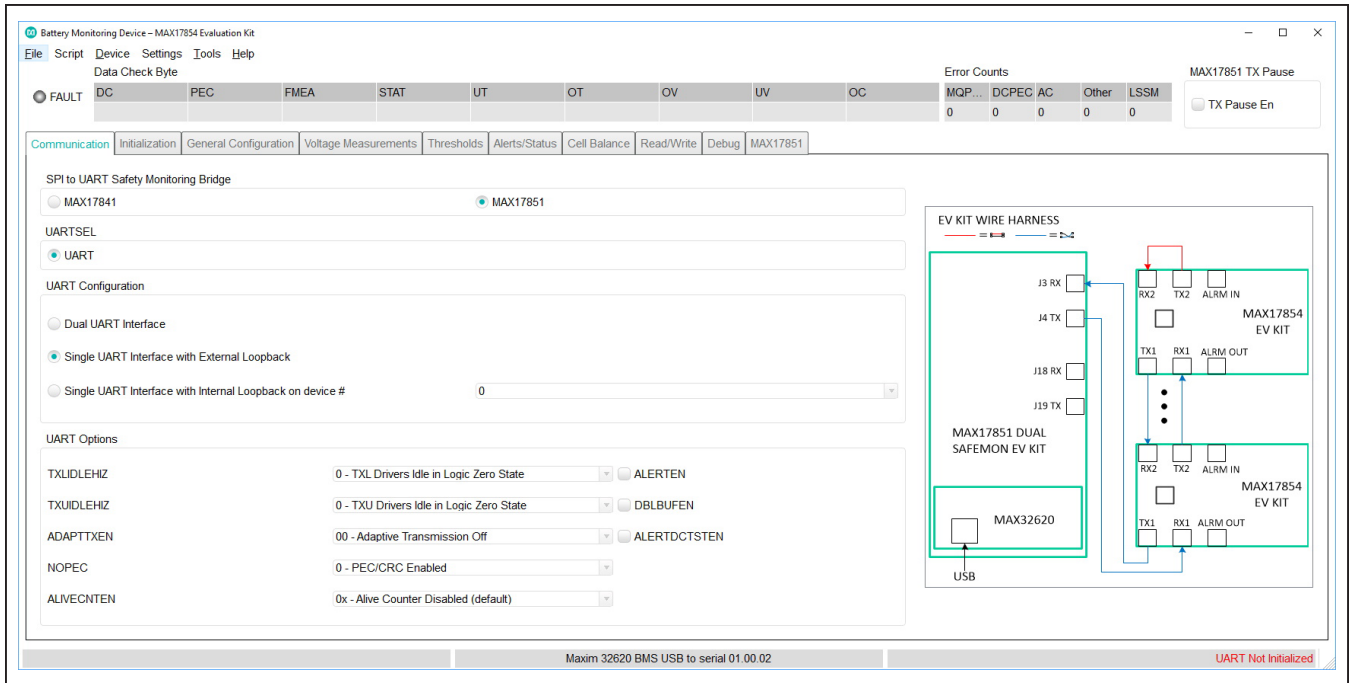Figure 11. Communication Tab—Dual UART Interface
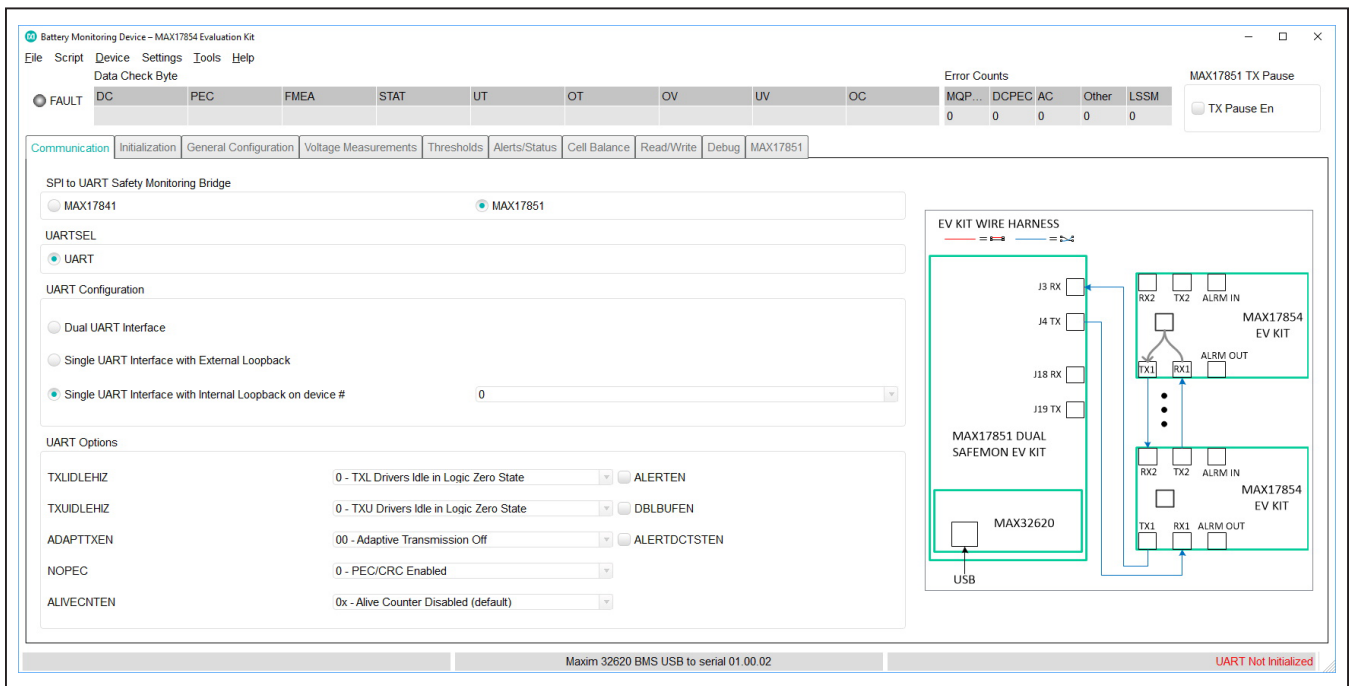
Figure 12. Single UART Interface with External Loopback

Figure 13. Single UART Interface with Internal Loopback on Device#

Initialization Tab

The **Initialization** tab is used to initialize the system and assign addresses to each device in the daisy-chain. The correct **Single UART Interface** or **Dual UART Interface** radio button must be selected for the hardwired system. Communication is only established when the wired system aligns with the interface chosen from the **UARTCFG** group box. With the **Dual UART Interface** radio button selected, the user has the option of selecting **UPHOST** or **DOWNHOST**. Further information on UPHOST and DOWNHOST communication is available in the MAX17854 IC data sheet. The **Wakeup** button initiates the communication process, and the **Hello All** button assigns the device addresses.

Along with establishing communication, the **Initialization** tab provides a method to log detailed communication events. The event and detailed logs can be enabled or disabled by clicking the checkboxes in the lower-left corner of the GUI.

After Wakeup and Hello All, there are some error messages present.

On top of the GUI, "DC" (Standing for Data Check Byte). This byte is appended to every READ-message and contains 8 bits in which each of them has a significance.

The bit "STAT" means "the status register of any MAX17854 in the daisy-chain has a problem."
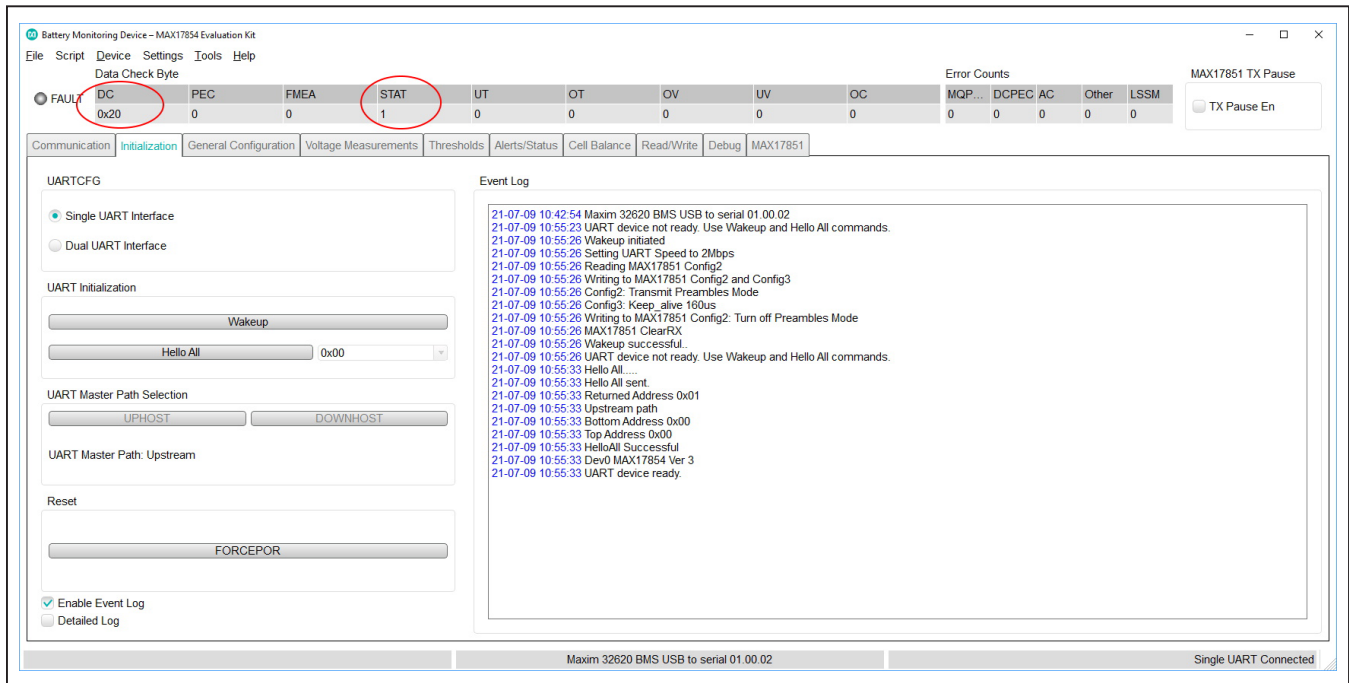
Figure 14. Initialization Tab

To look deeper into that, go to the **Alerts/Status** tab (Figure 15). Here, all possible alerts of MAX17854 are displayed and can be cleared by just clicking on them.

Note: The F**ORCEPOR** button commands a soft-reset to all MAX17854 devices in the daisy-chained system.

RST: This flag indicates that the chip experienced a reset condition which makes sense as we just connected the chip.

INTRFC: This one indicates that the interface experienced some sort of problem.

DUALUART: This bit is the more specific description of an interface error. It is set because in a Single UART configuration, the HELLOALL message travels upstream and is then passed through the downstream. In a Dual UART configuration (default), the downstream can initially only be used as a READ operation. Because HELLOALL is a write operation (it actively writes the address register of each device), we get a DUALUART alert.

Clicking RST and DUALUART resets those bits and clears the Data Check byte.
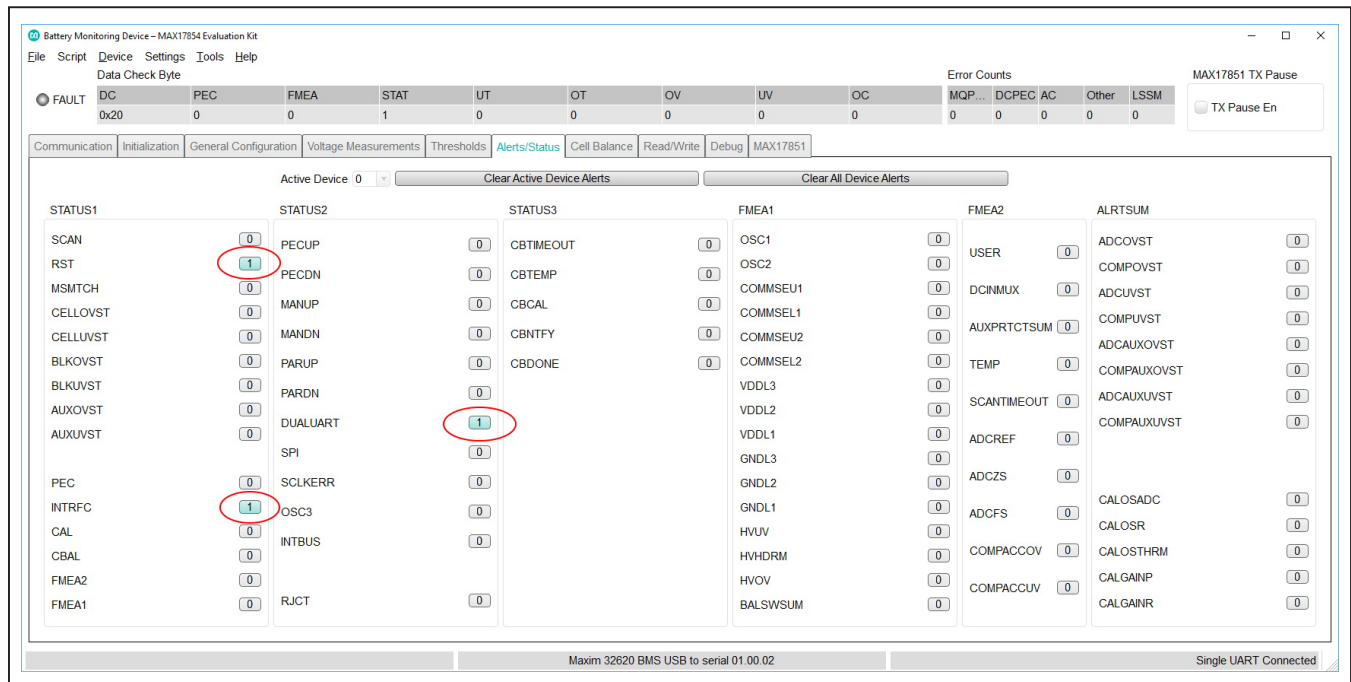
Figure 15. Initial Alerts

General Configuration Tab

The General Configuration tab is used for programming settling times for AUXTIME, CELLDLY, and SWDLY. The FlexPack feature enables, and programming is easily controlled through the drop-down menus in the General Configuration tab. Parameters such as TOPCELL and TOPBLOCK, required for FlexPack programming, can be directly entered.

Information on each of the parameters on the General Configuration tab is available in the MAX17854 IC data sheet.

Voltage Measurements Tab

The Voltage Measurements tab is the user interface for visually monitoring all cell measurement and AUX conversion values in the battery monitoring system. In addition, the Voltage Measurements tab can be constructed to display a visual indication of cell ADC OV/UV, comparator OV/UV, and communication alerts.

Figure 16. General Configuration Tab

In the Voltage Measurements tab, the Scan Settings and Diag Settings buttons in the Settings group box on the right side of the GUI open into individual settings panels (see Figures 18 and 19).

The lower right-hand corner in the Voltage Measurements tab displays a legend that indicates visually the state of each voltage measurement and comparator alert. For the visual alert to be active, the thresholds must be set and enabled in the Thresholds tab (Figure 20).
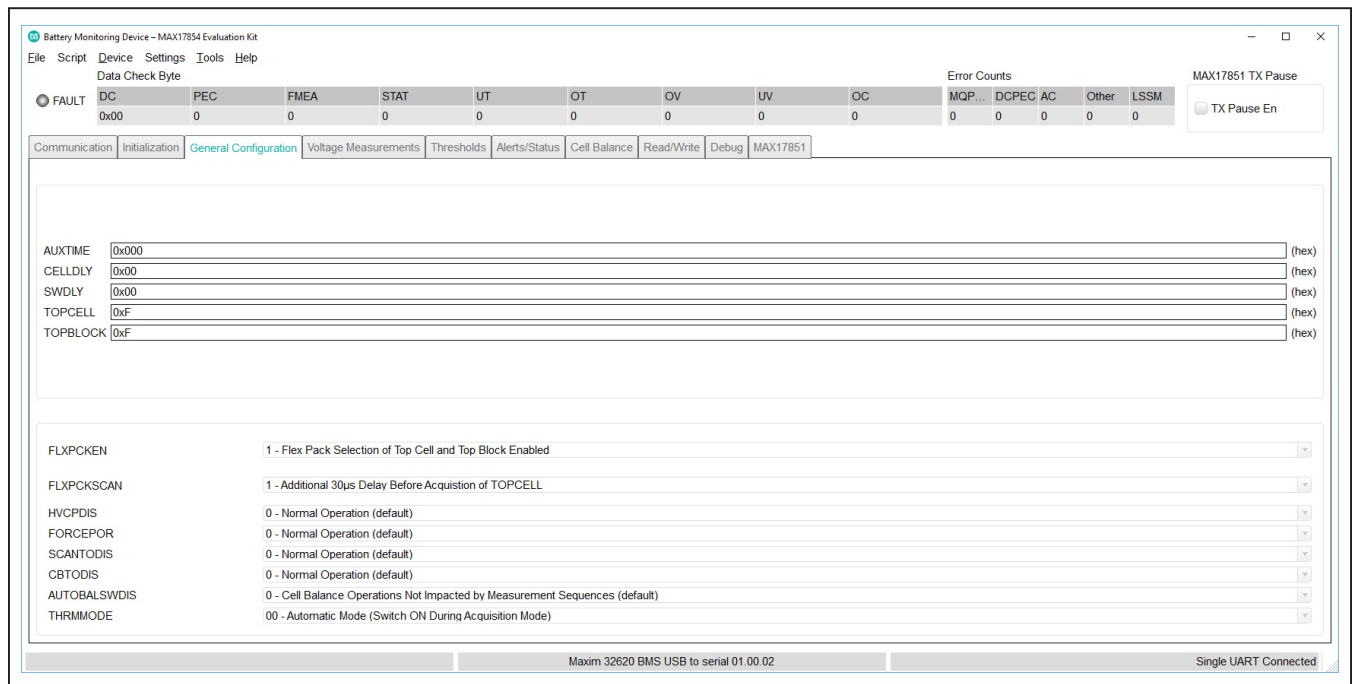
In the Scan Settings panel, the user can set monitoring and control properties for Cell and AUX inputs, in addition to ADC oversample setting/frequency and ADC scan mode.

Note: The user must click the Confirm Settings button at the bottom of the panel for the selections to take effect. Selections made in the Scan Settings panel are applied to each MAX17854 device in the system.

For cell voltages to be displayed on the Voltage Measurements tab, simply enable the cells to be monitored on the Scan Settings panel and press the Confirm Settings button. Pressing the Confirm Settings button closes the Scan Settings panel and places the user back in the Voltage Measurements tab. To have the MAX17854 perform the scan settings operation, select the Scan Type from the drop-down list and the number of scans to be performed (Single Scan, N Scans, or Scan Continuously).

The IIR Filter settings are also located in the Voltage Measurements tab and are enabled by selecting the IIR Filter Enable checkbox. The user selects the desired filter from the Coefficient Selection drop-down list. The smaller the coefficient is, the more it improves the noise rejection at a cost of increased settling time. Pressing the RDFILT checkbox commands the GUI to read the IIR filter output.

The Diag Settings button in the Voltage Measurements tab gives the user control of diagnostic current sources and diagnostic terminations within the MAX17854 device. The user can update diagnostic control for one device or for all devices in the system.

In Figure 17, 14 cell voltages, the block voltage, 6 auxiliary measurements, and 2 diagnostic channels are activated. The following figures show how they are activated by clicking "Scan Settings" and "Diag Settings."
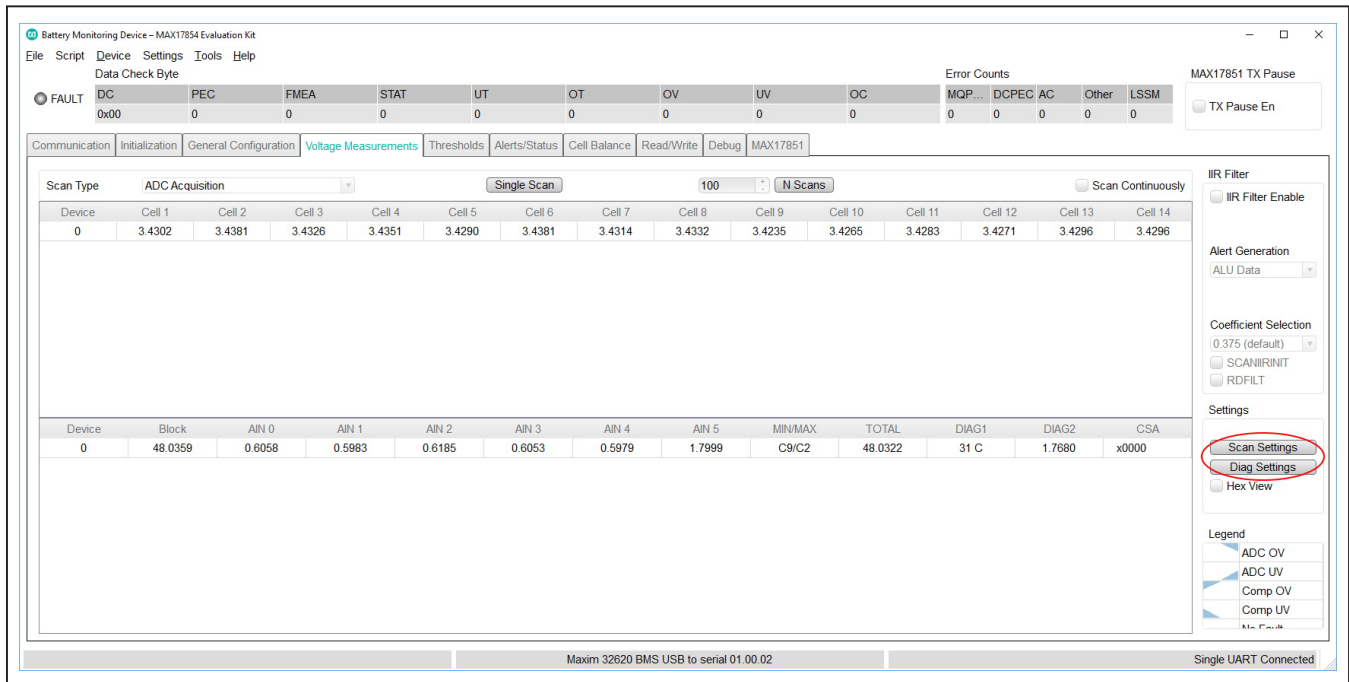
Figure 17. Voltage Measurements Tab
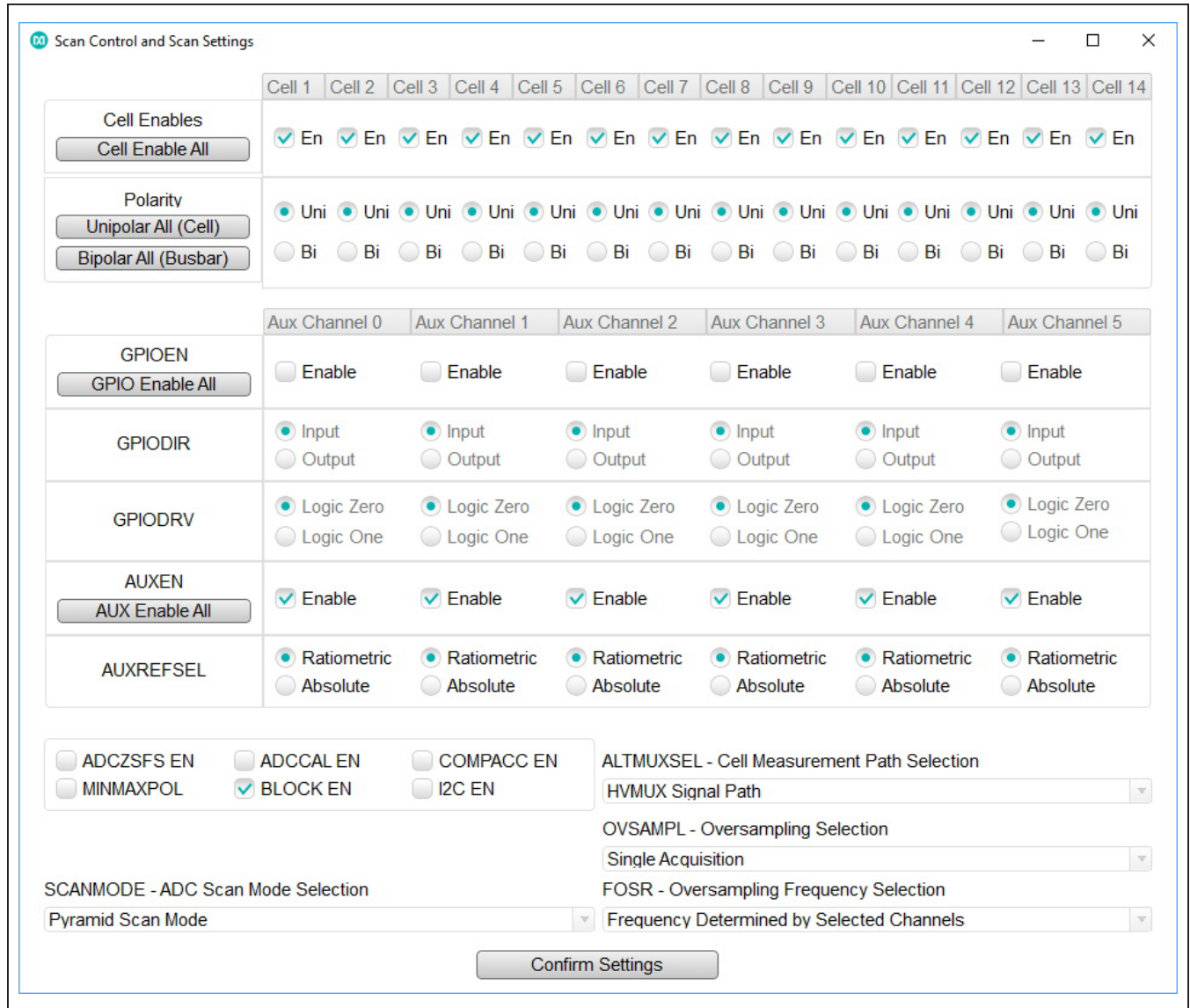
Figure 18. Scan Settings Panel
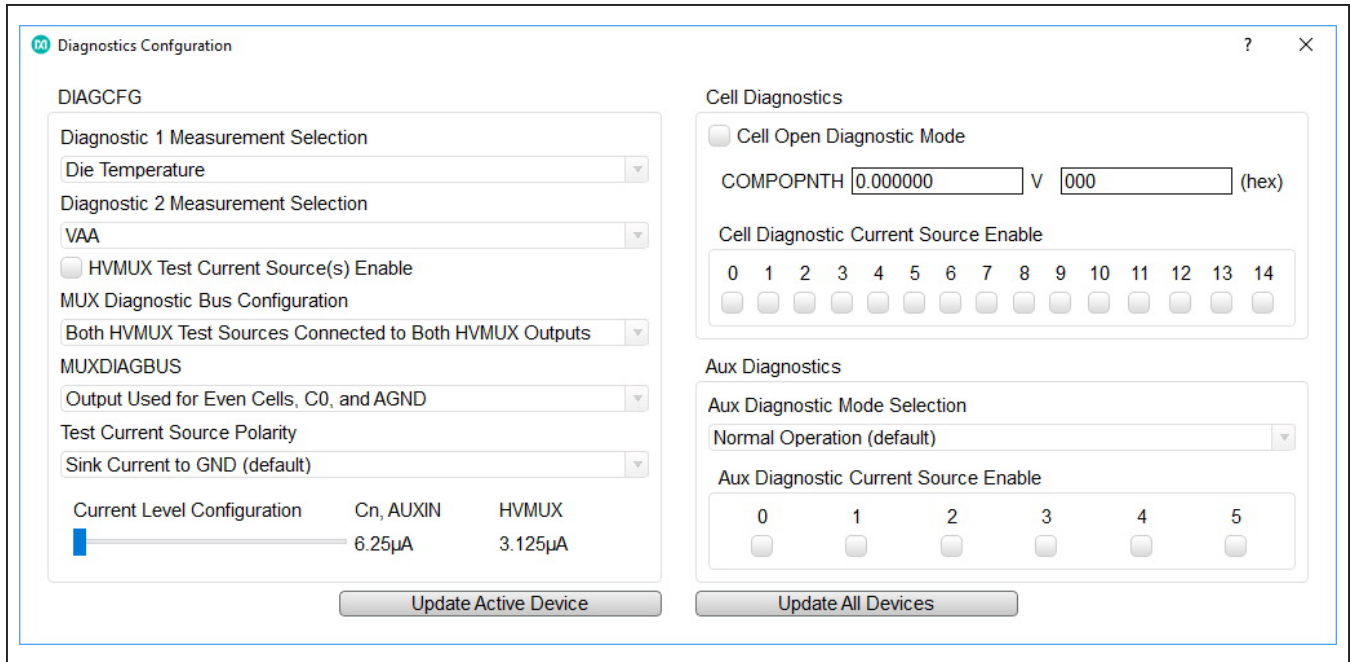
Figure 19. Diagnostic Settings Panel

Thresholds Tab

Clicking the **Thresholds** tab opens the panel where users can enter overvoltage/undervoltage (OV/UV) and fault thresholds in hex value or voltage.

Clicking the **Alert Enables** button in the top-right corner of the **Thresholds** tab opens the **Alert Enable** panel (see Figure 21).
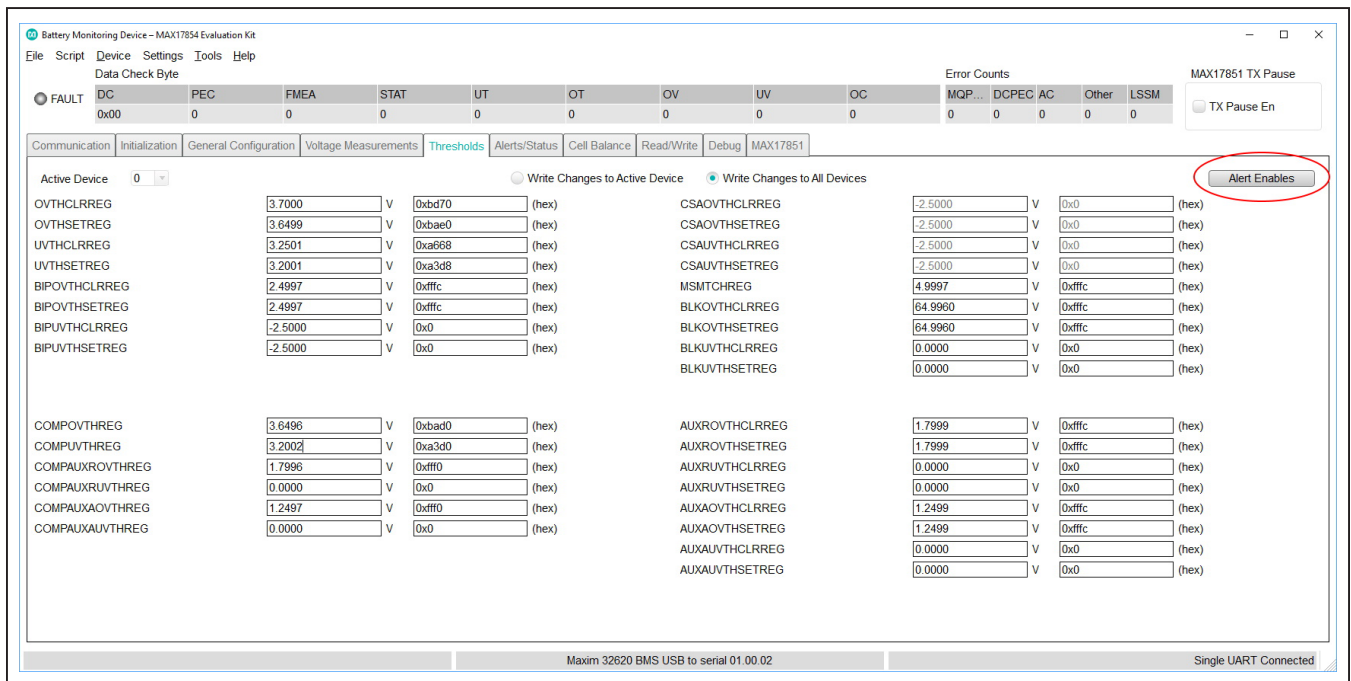
Figure 20. Thresholds Tab
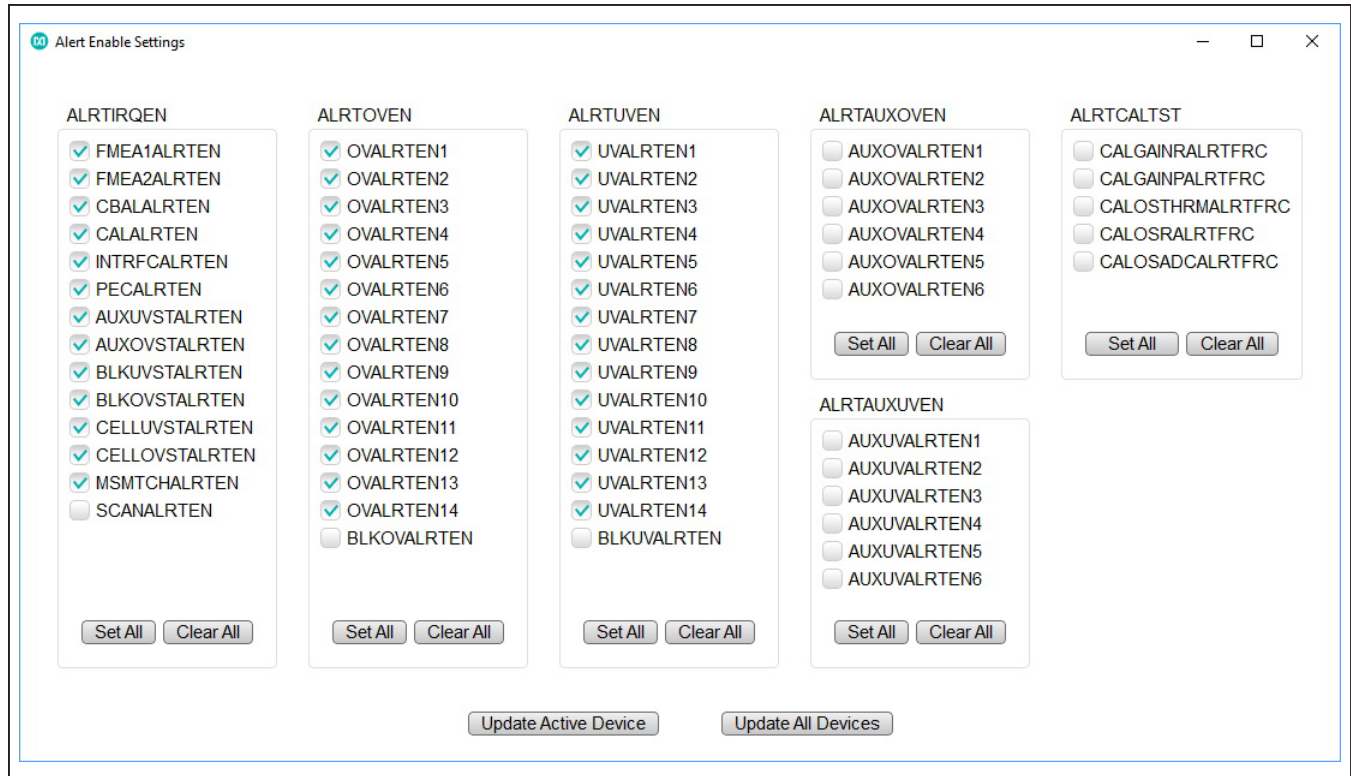
Figure 21. Alert Enable Panel

Alerts/Status

When selecting the OV and UV correctly, there is a visual indication of a failure in the GUI when doing a scan.

For functional safety purpose, the IC is also equipped with a comparator which can check the ADC readings for their validity. To activate them, simply select ADC and Comparator Acquisition. The triangle represents an OV or UV condition of the comparator.

A more detailed view of the error can be observed in the **Alert/Status** (Figure 24) tab.

By selecting the **Active Device** from the drop-down list, the **Alerts/Status** tab displays the fault status of the MAX17854 in the system.

The user can use the **Clear Device Alerts** or the **Clear All Device Alerts** to clear the faults logged in the system.

Note: Some alerts are "sticky," meaning they do not clear until the alert condition has been resolved.

Above the cockpit tabs, the GUI shows the **Data Check Byte** faults and **Error Counts**. Resetting the error count is done through the **Device** dropdown at the top left of the GUI. Click **Device** and select **Reset Error Counts**.
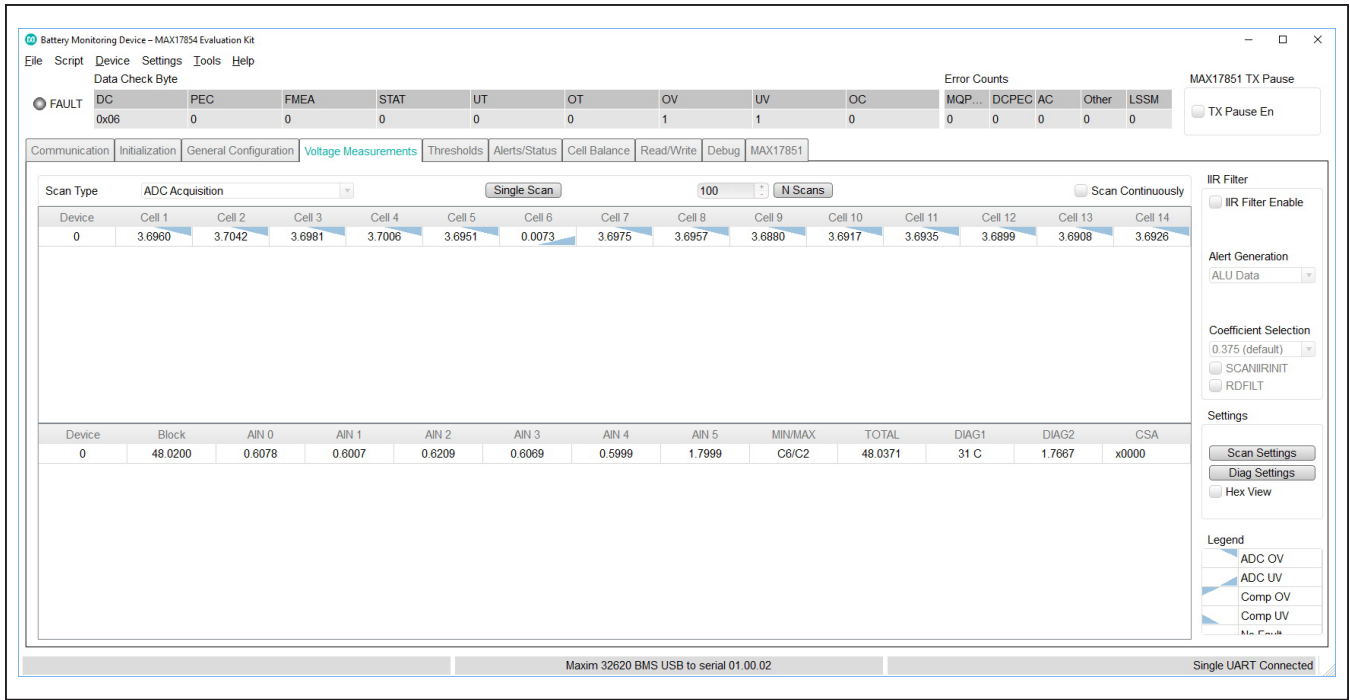
Figure 22. Voltage Alerts for ADC Acquisition
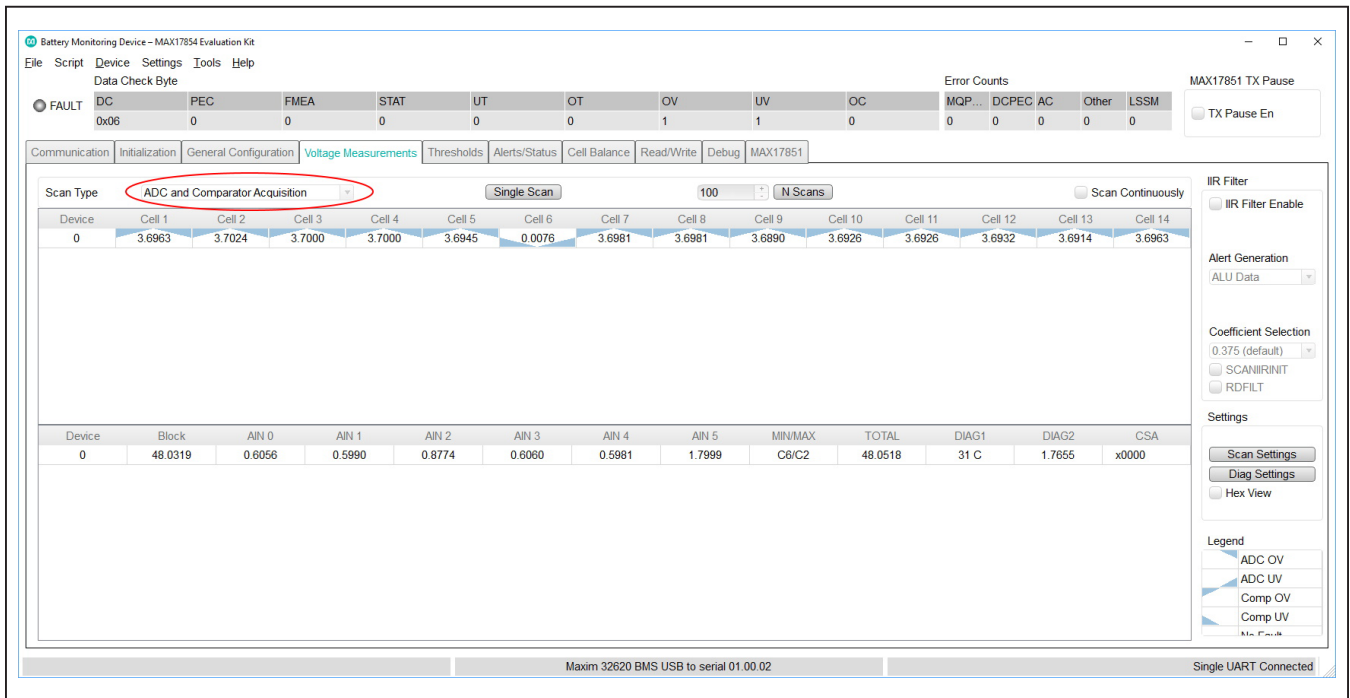
Figure 23. Voltage Alerts for ADC + Comparator Acquisition
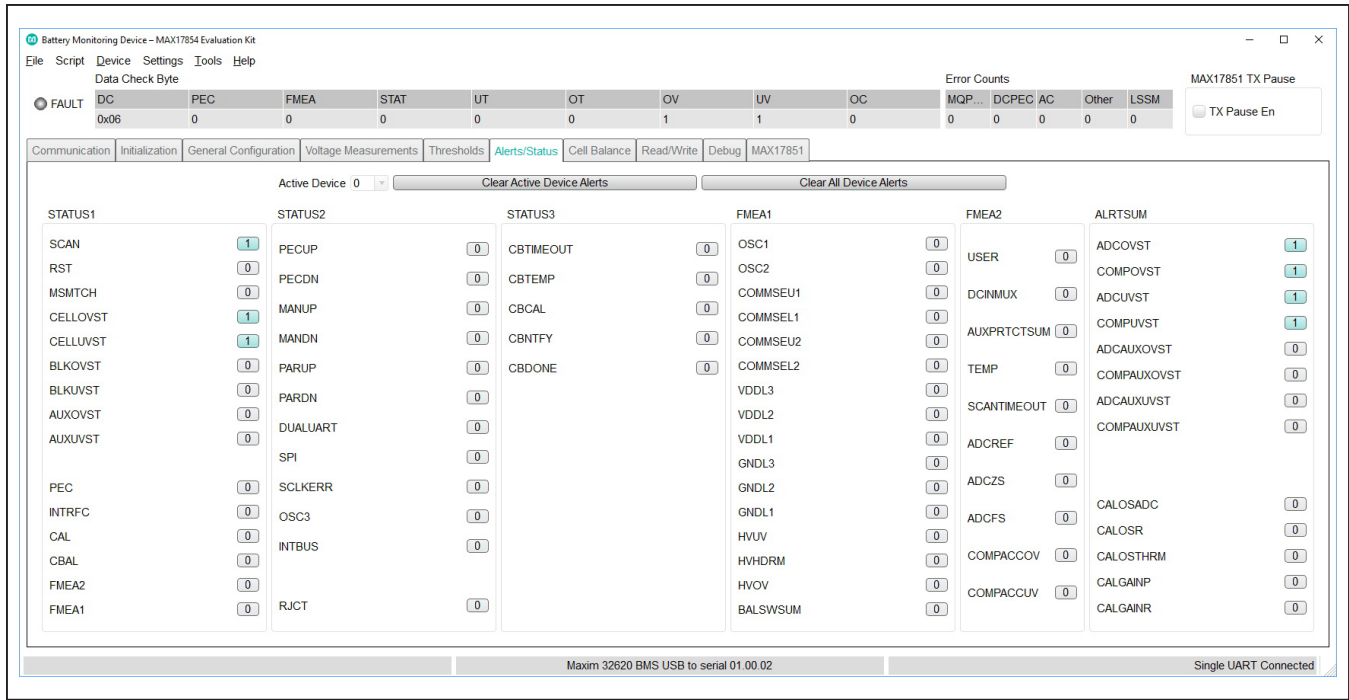
Figure 24. Alerts/Status Tab

Cell Balance Tab

The **Cell Balance** tab gives the user the flexibility for manual and automatic control of the MAX17854 cell-balance feature. The **Device Selection** drop-down list programs the balancing settings to one or more devices in the system. The **Balance Switch Control** group box includes a drop-down list for the desired operational balance mode.

Note: To update parameters in the **Cell Balance** tab, select **Cell Balancing Disabled** from the **Mode** drop-down list prior to selecting the desired balancing mode.

To activate a cell-balance switch, use the **Balance Switch Enable** group box to enable the desired balance switch and set the **Balancing Expiration Time** #1 to the number of seconds or minutes to perform the balance. In the **Alerts/Status tab** (Figure 24), be sure to click the **Clear All Device Alerts** button (the interface-specific error alert [INTRFC] must be clear). Next, select **Manual Cell Balancing by Second** from the **Mode** drop-down list in the **Balance Switch Control** group box, and the cell balance immediately becomes active and the timer is started. Manual mode allows the user total control over the cell-balance switches.

Caution: Prevent accidental activation of adjacent cell-balance switches or the activation of all cell-balance switches when using **Manual Cell Balancing Mode**.

Note: In **Manual Cell Balancing by Second** or **Minute**, only the Cell 1 timer is recognized by the system, with all switches deactivated when the Cell 1 timer expires.

For **Automatic Balance** modes, the user can enable all balance switches and allow the MAX17854 to control the activation according to the user-set parameters. From the **Cell Balance** tab, in **Automatic** mode, the user can set the cell-balance **Duty Cycle** using the slidebar and other key parameters like **UV Threshold** and **Balance Switch Diagnostic Thresholds**. The **Cell Balance** tab also includes **Balance Switch Fault Alert** and **CBUVTHR Check Status** indicators.

In the setting as shown in Figure 25, Cell 4 has been enabled to run for 5 seconds (placing the number 5 in Cell 4 and enabling the switch). When changing the Mode to "Manual Cell Balancing by Second," the balancing begins.

Note: During balancing, the IC can only write to specific register. Setting thresholds during balancing results in an ALRTINTRFC error!
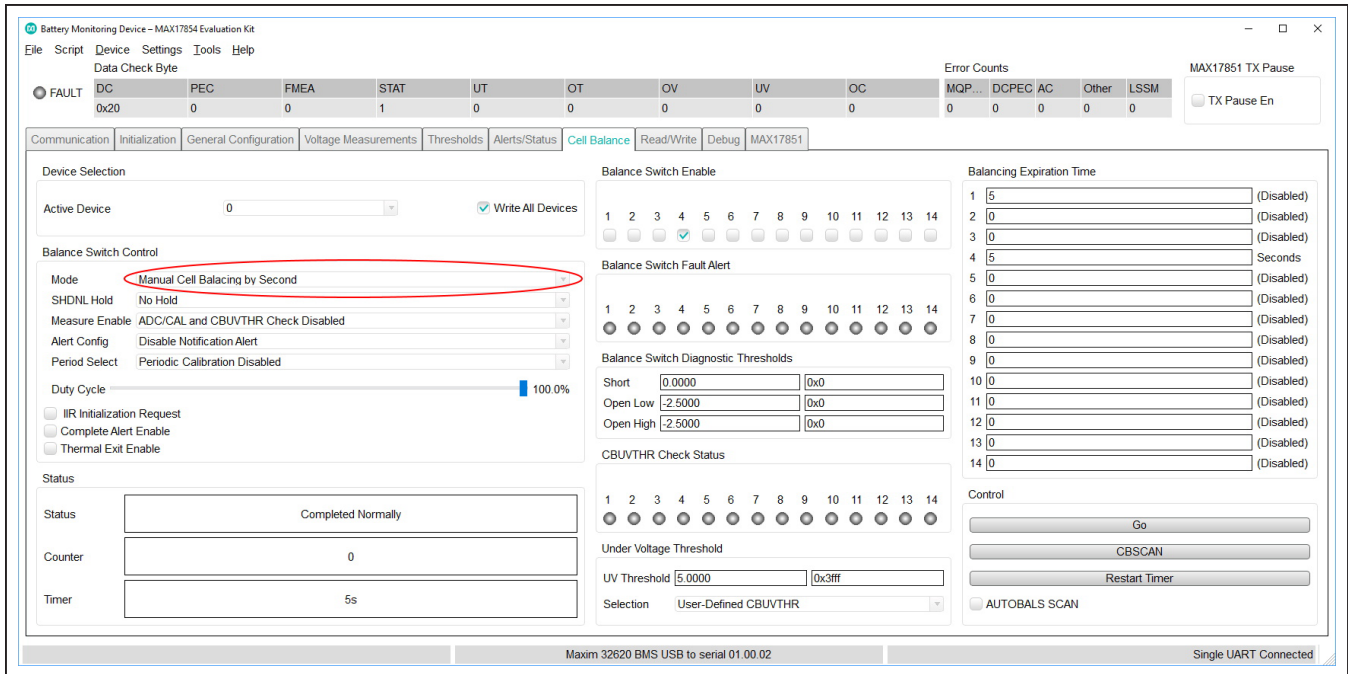
Figure 25. Cell Balance Tab Manual Balancing
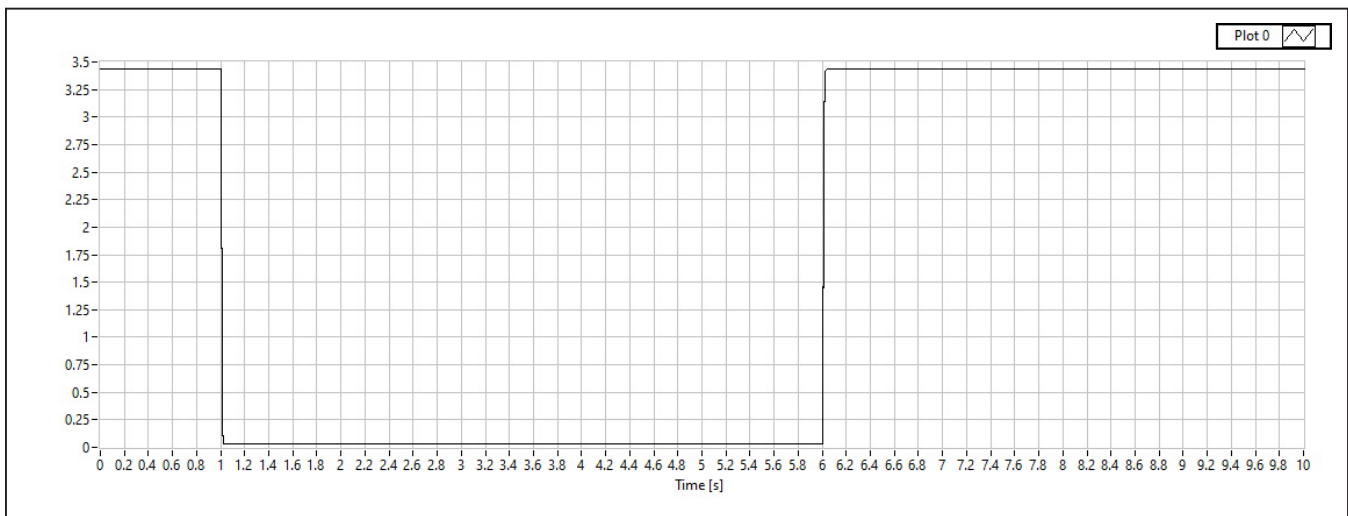
Figure 26. Cell Voltage during Balancing vs Time (Manual Balancing)

A duty cycle of 100% means that in total, each cell has been balanced for the full amount of 5 seconds. If multiple devices are enabled, the IC operates in an EVEN/ODD scheme and alternates between those two until the final balancing time has been reached. In this case, a 5-second balancing on cell 4 and cell 1 has a duration of 10 seconds. The graph below shows an activation and deactivation of the balancing FET which basically shorts the 2k input resistor of the EVKIT emulating a cell.

Cell balancing by second means that every second, there is a switch between EVEN and ODD cells and the expiration time (on the right) is representing seconds. There is also a mode for "Minute" and "Hour" which scales accordingly.
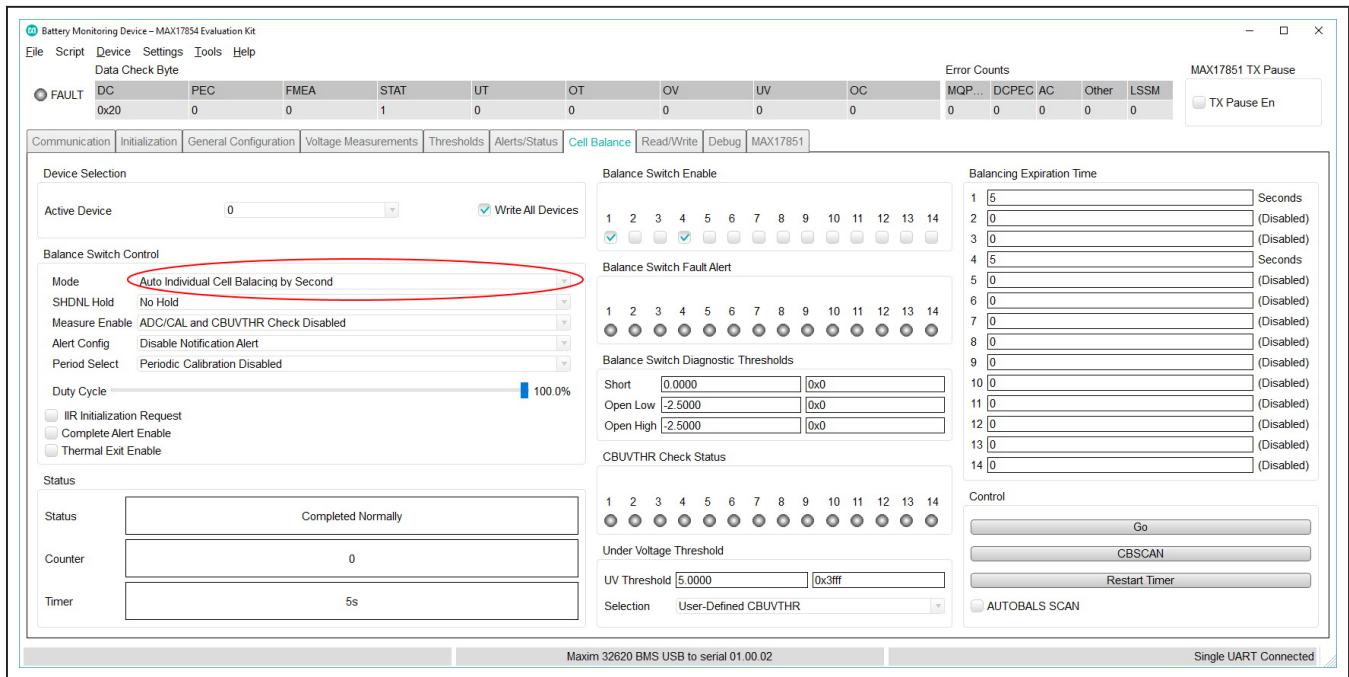
Figure 27. Cell Balance Tab Individual Balancing
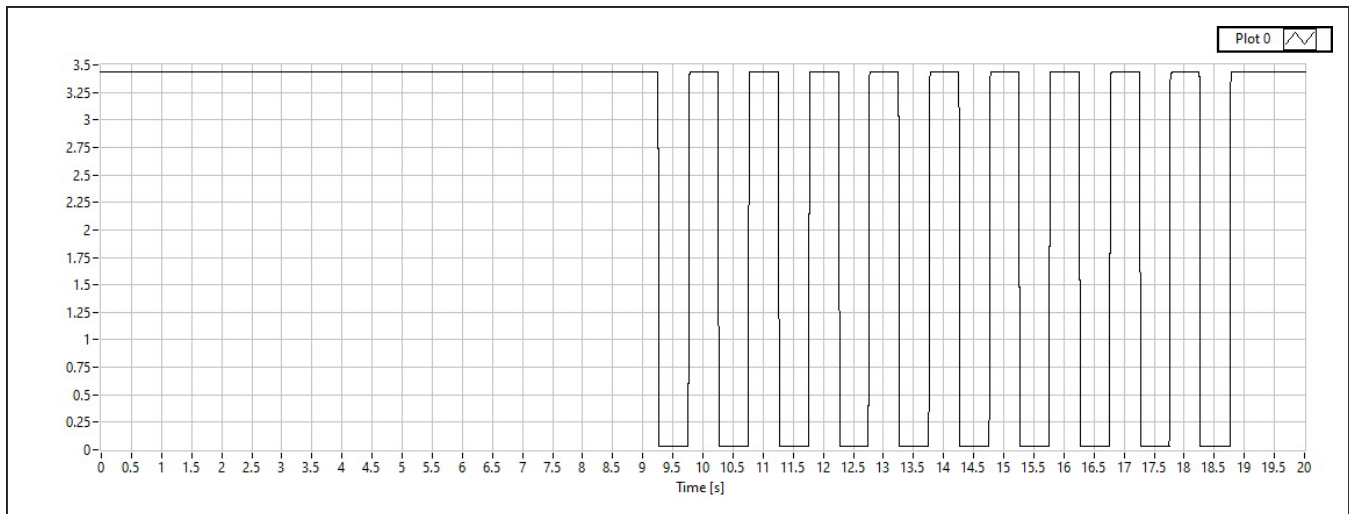
Figure 28. Cell Voltage during Balancing vs. Time (Even/Odd)

Read/Write Tab

The **Read/Write** tab provides direct access to the read and write registers of the MAX17854. In the **Read/Write** tab, the GUI offers several read/write options to the user. The **Select Register** group box allows the user to read register contents by highlighting the desired register and clicking the **Read All** button. For example, if the user wants to read the unique ID assigned to each device, scroll down the list and highlight the ID1 (0x8C) register and click the **Read All** button, then highlight the ID2 (0x8D) register and click the **Read All** button. The contents of the registers are then displayed in the **Read Output** group box.

Blocks of data in packets of ≤ 28 registers can be requested through the **Read Block** group box. Enter the **Start Address** and set the **Block Size**, then click the **Read Block** button. The **Read All** and **Write All** group box provide alternative methods to write to specific registers in specific addressed devices.
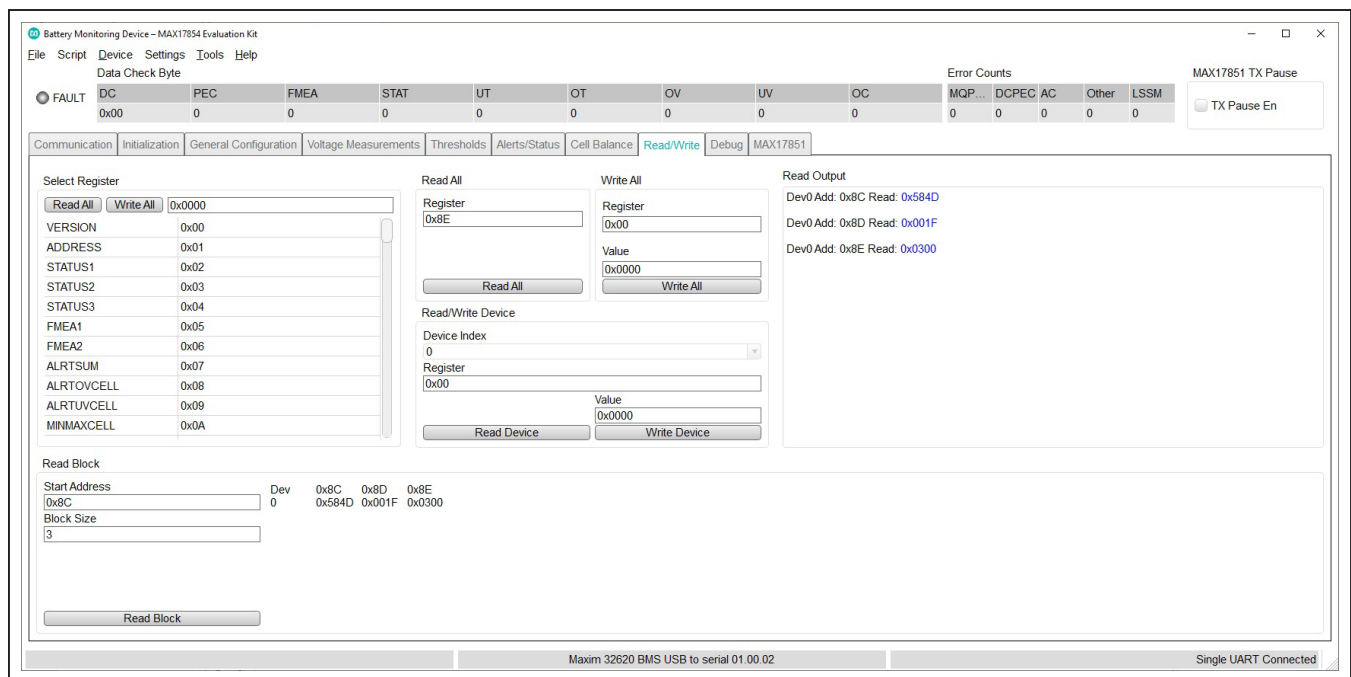
Figure 29. Read/Write Tab

MAX17851 Tab

The MAX17851 registers can be directly modified using the **MAX17851 Register Map** sub-tab. A pull-down arrow to the left of the address number allows the user to identify register content. As an example, register 0x66 content and has the **Keep-Alive [3:0]** highlighted. To alter the keep-alive timing, the user must type the desired hex value of the period directly in the **Update Field** edit box and then click the **Set** button on the right. Selecting a parameter in a register automatically highlights the bit values of the parameter and provides a description of the parameter in the **Field Description** group box.

GUI File Options

The **File** menu drop-down list on the GUI offers powerful tools such as L**og Scan Data**, **Save Register Configuration**, **Load Register Configuration**, as well as **Restart** and **Exit**.

File → Log Scan Data

For collecting conversion data for later analysis, select Log Scan Data from the File menu drop-down list. The

Log Scan Data window pops up and requests the Number of ADC Scans to Log, the Scanning Rate (ms) and the File Path and Root Name of the location where the data should be stored. Conversion data is taken according to the user-set parameters like Oversample settings and IIR Filter Enable.
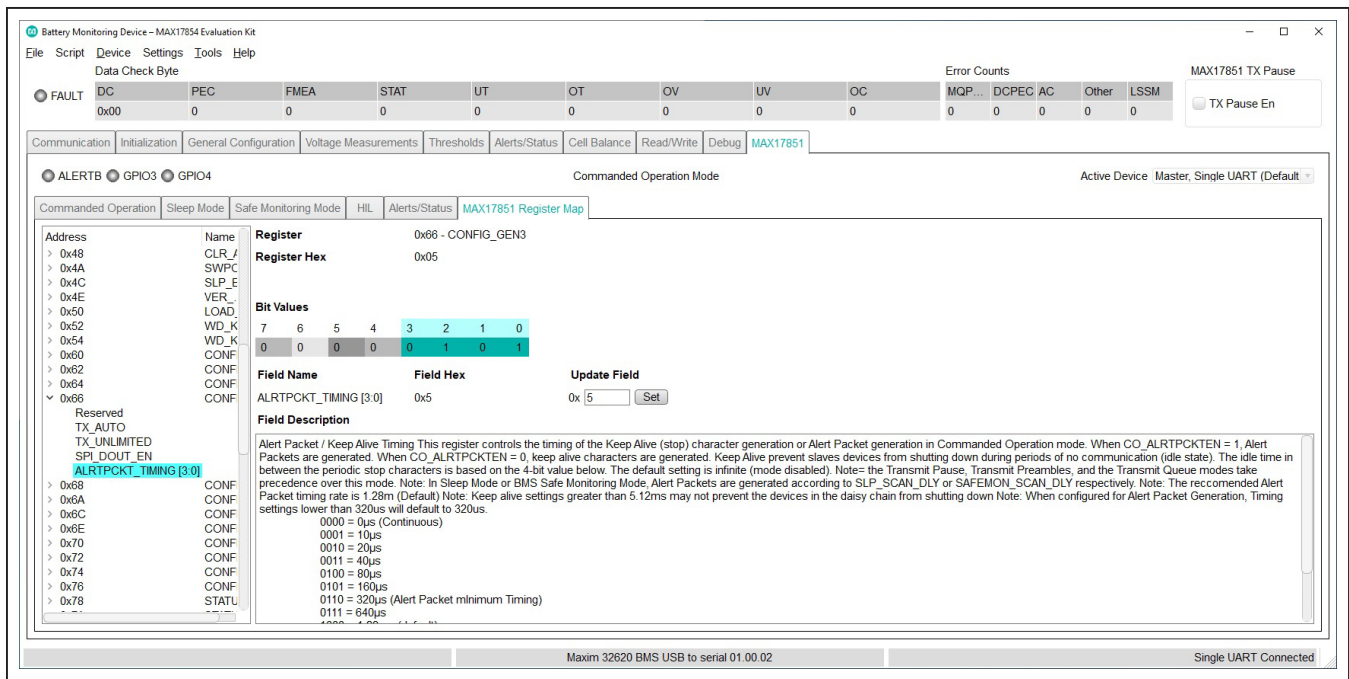
Figure 30. MAX17851 Tab (Register Map Panel)

Figure 31. Log Scan Data

Note: Be sure to set active channels and scanning options prior to the datalog functionality.

Default Scanning Mode (Number of ADC Scans to Log):

Per default, all the important registers (Cell, AUX, Diagnostics, Status, and Alert) are logged. The fastest achievable interval (depending on the PC) is around **500ms** per timestamp.

Real-Time Scanning:

Optimized scanning with help from MAX17851 and FTHR board can get a scanning rate of down to 50ms. A reduced dataset is stored in the datalog file containing only cell and auxiliary voltages.

Figure 32. Datalog File for Real-Time Scanning

Note: With increased number of devices in the daisy-chain, the 50ms cycle might not be met.

File → Device Register Configuration Files

During evaluation, the user may want to save the device register content for later use. Saving device register content is performed by selecting **Save Register Configuration** from the **File** menu drop-down list. The register file is saved in standard .csv format. Registers can be loaded from a saved register file by selecting the **Load Register Configuration** option from the list and selecting the previously saved register.csv file.

File → Scripting

A script file can be used to set up the GUI and device to operate in specific modes, or to evaluate a sequence of commands for device functionality. Commands for writing scripts can be found in the **Command Reference** menu item under the **Help** menu bar drop-down list. Detailed information on the Register Map is available in the MAX17854 IC data sheet.

Before running scripts, follow the *Quick Start (Single UART)* section. **HelloAll Successful** and **UART device ready** response must be displayed in the **Event Log** on the **Initialization** tab. This example shows a script that programs 12 cells overvoltage to 1.1V and the undervoltage to 0.9V. To test it, set up a continuous voltage reading

(ADC+ COMP) with a supply voltage of 14V → 12V with active divider.

To run a script, select **Run Script** from the **Script** menu drop-down list. The **Open Script** window pops up and requests the location where the Script file is stored. After the script is run, the OV/UV is indicated in the updated **Voltage Measurements** tab shown in Figure 33 according to the **Legend** group box in the lower-right corner.

The following sequence can be copied into a standard text editor and saved as "OVUVScript.bms".

Syntax:

CMD<space>ADDRESS[HEX]<space>REGVALUE<space>#<space>Description Text

```
writeall 1A 7FFF   #   ALRTOVEN
writeall 1B 8FFF   #   ALRTUVEN
writeall 1F 3850   #   OVTHCLRREG = 1.1V
writeall 20 3850   #   OVTHSETREG = 1.1V
writeall 21 2E14   #   UVTHCLRREG = 0.9V
writeall 22 2E14   #   UVTHSETREG = 0.9V
writeall 38 3AC0   #   COMPOVTHREG = 1.15V
writeall 39 2B80   #   COMPUVTHREG = 0.85V
```


Figure 33. Voltage Measurement with Scripted Limits

Evaluation Procedures

This section gives the user step-by-step procedures for functional evaluation of the MAX17854 using the software interface GUI.
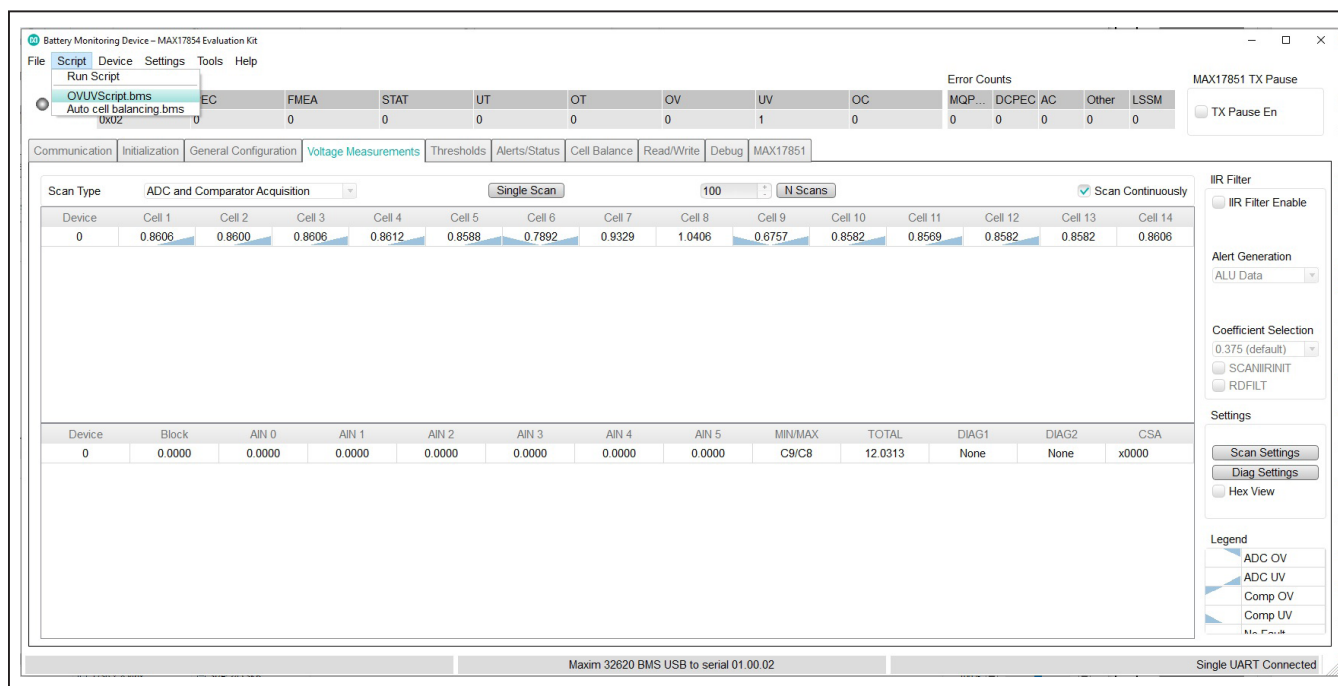
Cell Voltage and Comparator Measurements

The following procedure describes how to use the GUI and EV kit to make **Cell Voltage** measurements and observe measurement and comparator OV/UV alerts in the **Voltage Measurements** tab.

Procedure

1) Set up hardware and run GUI according to the *Quick Start (Single UART)* section. **HelloAll Successful** and **UART device ready** response must be displayed in the **Event Log** on the **Initialization** tab. Be sure to set the supply voltage to 18.0V for this procedure.

2) Set the PCB resistor ladder DIP switches (SW1, SW2) to the ON position (closed). Verify that the P+B14 and B0P- jumpers are installed.

3) Select the **Voltage Measurements** tab and click the **Scan Setting**s button in the **Settings** group box to open the **Scan Settings** panel. First, click the **Cell Enable All**, **Unipolar All (Cell)**, **BLOCK EN** check-boxes and select **64x OVSAMPL** from the OVSAMPL a drop-down list at the bottom of the panel, and then click the **Confirm Settings** button.

4) Select the **Voltage Measurements** tab and in the upper left corner, set the **Scan Type** to **ADC and Comparator Acquisition**, and then select the **Scan Continuously** checkbox. Observe that cell voltage levels are approximately equal in value. At this point, the MAX17854 is continuously reading the voltages across each of the 2kΩ resistors in the resistor ladder. Increasing the power-supply voltage increases the voltage across each of the 2kΩ resistors in the ladder.

5) Select the **Thresholds** tab and set the comparator and cell voltage threshold. Set **OVTHSETREG** to 1.41V, **UVTHSETREG** to 1.2V, **COMPOVTHREG** to 1.5V, and **COMPUVTHREG** to 1.1V (threshold values automatically adjust to the closest hex value).

6) In the **Thresholds** tab, click the **Write Changes to All Devices** radio button, and then open the **Alert Enables** panel by clicking the **Alert Enables** button. Click the **Set All** button for **ALRTOVEN** and **ALRTU-VEN** to command the MAX17854 to check the OV/UV condition. In the Alert Enables panel, the user can mask OV/UV faults. The user can also mask faults from generating an alert output activation by unchecking the appropriate checkboxes in the **ALRTIRQEN** group box. Finally, click the **Update All Devices** button at the bottom and close the panel.

7) Select the **Voltage Measurements** tab. Verify that voltage measurements are approximately 1.28V and no OV/UV voltage measurements or OV/UV comparator measurements are indicated. Slowly increase the power-supply voltage from 18.0V to 22.0V. Verify that OV and comparator measurements are detected at the user-programmed OV thresholds by comparing the triangular indicator with the **Legend** on the lower right side of the window. The UV and comparator measurements can be verified similarly by decreasing the supply voltage from 18.0V to 14.0V.

In addition to the oversampling filter, the MAX17854 has implemented an IIR noise filter to further reduce noise in the conversion result. Take the following steps in the GUI to become familiar with the IIR filter:

1) From the **Voltage Measurements** tab, in the **IIR Filter** group box, click the **IIR Filter Enable** checkbox.

2) Select the desired filter from the **Coefficient Selection** drop-down list (0.125 for maximum filter effect).

3) To see the dynamic effect of the IIR filter, set the **OVSAMPL** drop-down list in the **Scan Settings** panel to **Single Acquisition** and click the **Confirm Settings** button.

4) Back in the **Voltage Measurements** tab, in the **IIR Filter** group box, click the **RDFILT** checkbox in the **Coefficient Selection** group box to command the GUI to read the IIR filter output. Notice numerically the noise reduction in voltage readings.

Note: To test the step response, a voltage step can be applied to the supply (example 14V → 28V) while **data-logging** and **RDFILT** checkbox is active. Then, the same process can be repeated without RDFILT for an immediate response.

Auxiliary General-Purpose Input/Output Port

The following procedure demonstrates the use of the auxiliary (AUX) channels as a general-purpose input/output (GPIO) port.

Procedure

1) Set up hardware and run GUI according to the *Quick Start (Single UART)* section. **HelloAll Successful** and **UART device ready** response must be displayed in the Event Log on the Initialization tab.

2) Set the PCB resistor ladder DIP switches (SW1, SW2) to the ON position (closed). Verify that P+B14 and B0P- jumpers are installed.

3) Select the **Voltage Measurements** tab and click the **Scan Settings** button in the Settings group box to open the Scan Settings panel. Click the **GPIO Enable All** button and set the GPIODIR to Output. Set the GPIODRV to the desired high or low level.

4) Click the **Confirm Settings** button at the bottom of the panel and then verify with an oscilloscope that the digital voltage is present at the GP/AUXn test pin on the PCB.

5) To command the GPIO as an input, on the Scan Settings panel, click the **GPIO Enable All** button and set the GPIODIR as Input.

6) The EV kit contains a 10kΩ pullup resistor on each of the GP/AUXn pins. To pull up each of the GP/AUXn pins, select the **Read/Write** tab. Using the Read All group box, read register 0x62. Set THRMMODE bit 9 and bit 10 (e.g., if register 0x62 is 0x0000, use the Write All box and send 0x0600). Setting the THRMMODE bit activates the THRM pin on the device (pin no. 29). The EV kit terminates THRM to the 10kΩ pullup resistors.

7) Populate the THERMx jumpers in the AUX INPUT/OUTPUT/ADC block on the PCB (see Figure 9) and verify the logical state of the GP/AUX0–GP/AUX5 pins on the MAX17854 or GP/AUX0–GP/AUX3 pins on the MAX17854 by reading register GPIOCFG (0x17). Verify that the GPIORD bits are set to logic 1.

AUX Absolute/Ratiometric Measurement

The software GUI and the MAX17854 EV kit are developed with features that allow the user to evaluate the performance of the AUX channels when configured as analog absolute measurements or analog ratiometric measurements. The following procedure shows how to configure the AUXIN0–AUXIN5 pins on the MAX17854 for analog measurement.

Key Points to Consider

- AUX GPIO can be used in mixed-mode applications.
- Each port can be independently configured for GPIO, AUX ratiometric, or AUX absolute measurement.

Procedure

1) Set up hardware and run GUI according to the *Quick Start (Single UART)* section. **HelloAll Successful** and **UART device ready** response must be displayed in the **Event Log** on the **Initialization** tab.

2) Set the PCB resistor ladder DIP switches (SW1, SW2) to the ON position (closed). Verify that P+B14 and B0P- jumpers are installed.

3) Select the **Voltage Measurements** tab and click the **Scan Settings** button in the **Settings** group box to open the **Scan Settings** panel. Click the **AUX Enable All** button to enable the AUX channels as analog.

4) Set the **AUXREFSEL** to **Absolute** when absolute measurements are desired or set to **Ratiometric** when ratiometric measurements are to be evaluated. Temperature measurements using NTC are generally ratiometric for improved temperature accuracy.

5) Other conversion characteristics available to the user in the **Scan Settings** panel are **OVSAMPL**, **FOSR**, **SCANMODE**, and **BLOCK EN**. From the **OVSAMPL** drop-down list, select **64x Oversampling**. Click **Confirm Settings** at the bottom of the window.

6) From the hardware perspective, it is necessary to verify that the THRM switch is active during conversion (bits 9 and 10 of register 0x62). Setting the THRMMODE bit to **Automatic** activates the THRM switch only during conversion. In **Manual On** mode, the THRM switch is always active. **Manual** mode is recommended. With the THRM output active, V_{AA} reference is applied to each AUXn 10kΩ pullup resistor. Verify that the PCB THERMn jumpers are installed.

7) Back on the **Voltage Measurements** tab, click the **Scan Continuously** checkbox. Observe from the **GP/AUX0–GP/AUX5** test points on the MAX17854 (Figure 9) that AUX levels are approximately 1.8V in value. Terminate a 10kΩ NTC thermistor to each of the GPIO_AUXn connectors and the conversion values update accordingly.

Cell Balancing

Manual Cell Balancing with CBTIMER Shutoff

This procedure details a simple process for using the GUI to set up and run manual cell balancing with shutoff from the programmable CBTIMER register.

Key Points to Consider

- User must set mode to **Disable Cell Balancing** prior to updating cell-balance parameters.
- In manual mode, the user can enable and disable balance switches at any time before the timer expires.
- **AUTOBALSWDIS** affects cell-balance switch behavior in manual cell-balancing modes only.
- In manual cell-balancing mode, the user should avoid activation of adjacent cell-balance switches or activation of all switches simultaneously.
- **Duty Cycle** slide bar is not functional in manual cell-balancing mode.

Procedure

1) Set up hardware and run GUI according to the *Quick Start (Single UART)* section. **HelloAll Successful** and **UART device ready** response must be displayed in the **Event Log** on the **Initialization** tab.

2) Set the PCB resistor ladder DIP switches (SW1, SW2) to the ON position (closed). Verify that P+B14 and B0P- jumpers are installed.

3) Select the **Voltage Measurements** tab and click the **Scan Settings** button in the **Settings** group box to open the **Scan Settings** panel. Select **Cell Enable All** and click **Confirm Settings** at the bottom of the panel.

4) Back in the **Voltage Measurements** tab, click the **Scan Continuously** checkbox. Observe that cell voltage levels are approximately equal in value. At this point, the MAX17854 is continuously reading the voltage across each of the 2kΩ resistors in the resistor ladder. Increasing the power-supply voltage increases the voltage across each of the 2kΩ resistors in the ladder.

5) Select the **Alerts/Status** tab and click the **Clear All Device Alerts** button. The INTRFC alert is set when the user tries to make changes to the **Balancing**

Expiration Time when a timer is established for a cell-balance mode or other command faults. The user must select Cell Balancing Disabled in the Balance Switch Control group box to update the **Balancing Expiration Time**.

6) Select the **Cell Balance** tab and enable odd balance switches by clicking the checkboxes in the **Balance Switch Enable** group box.

7) Set the **Balancing Expiration Time** in row 1 to the desired timer value (e.g., 100 or a value up to 1023).

8) In the **Balance Switch Control** group box, select **Manual Cell Balancing by Second** from the **Mode** drop- down list. Observe in the lower left corner of the **Cell Balance** tab that the Counter box increments and the **Timer** is activated.

9) Select the **Voltage Measurements** tab again and observe the change in resistor stack cell voltage due to the activation of the odd-cell balance switches.

10) In the **Cell Balance** tab, select the **Mode** drop-down and click **Cell Balancing Disabled** to disable manual cell balancing.

The same procedure can be used to verify functionality of the even-cell balance switches. In manual cell- balancing mode, the cell-balance switch can be set to automatically disable when a conversion is executed. To enable the automatic cell-balance switch-disable feature, set AUTOBALSWDIS bit 12 in the SCANCTRL register (0x66) to logic 1. When using the auto cell-balance switch-disable feature, set the time delay before the ADC conversion value:

1) Use the **Read/Write** tab to read register 0x66.

2) Rewrite the SCANCTRL register (0x66) with bit 12 set.

3) Program the BALSWDLY register (0x63) with the necessary **CELLDLY** delay time from when a balance switch opens to when the MAX17854 performs the conversion. Setting the BALSWDLY register to 0x0F0F sets the cell and switch delay to 1.44ms. Alternatively, the parameters can be programmed using the **General Configuration** tab.

Detailed information on manual cell-balancing features is available in the MAX17854 IC data sheet.

Automated Cell Balancing with CBUVTHR and CBTIMER (Host Sleep Mode)

This procedure details a simple process for using the GUI to set up and run the Automated Cell Balance with shutoff threshold set by the programmable CBUVTHR register.

Key Points to Consider

- User must set **Mode** in the **Balance Switch Control** group box to **Cell Balancing Disabled** prior to updating the parameters in the **Cell Balance** tab.

- Enable or disable cell-balance parameters in **Auto Cell Balancing** mode triggers an INTRFC alert in the **Alerts/Status** tab.

- User must uncheck the **Scan Continuously** checkbox in the **Cell Measurement** to prevent an INTRFC alert from being set when **Auto Cell Balancing** mode is activated.

- In **Auto Cell Balancing** mode, the IC state machine prevents adjacent cell-balance switches from being activated simultaneously.

- The **Duty Cycle** slidebar is not functional in Manual Cell Balancing.

- The UV threshold can be used independently or in conjunction with cell balancing timer(s) (CBEXP1 or CBEXPn)

Procedure

1) Set up hardware and run GUI according to the *Quick Start (Single UART)* section. **HelloAll Successful** and **UART device ready** response must be displayed in the **Event Log** on the **Initialization** tab.

2) Set the PCB resistor ladder DIP switches (SW1, SW2) to the ON position (closed). Verify that P+B14 and B0P- jumpers are installed.

3) Select the **Voltage Measurements** tab and click the **Scan Settings** button in the **Settings** group box to open the **Scan Settings** panel. Select **Cell Enable All** and **Unipolar All (Cell)**. Select 32x Oversampling from the **OVSAMPL** drop down then click **Confirm Settings** at the bottom of the window.

4) In the **Voltage Measurements** tab, set the **Scan Continuously** button. Observe that cell voltage levels are approximately equal in value. At this point,

the MAX17854 is continuously reading the voltages across each of the 2kΩ resistors in the resistor ladder. Increasing the power-supply voltage increases the voltage across each of the 2kΩ resistors in the ladder. With the power supply set to 18.0V, each resistor ladder simulated cell voltage reads approximately 1.286V.

5) The INTRFC alert is generated when an improper communication action is taken. Select the **Alerts/Status** tab and click the **Clear All Device Alerts** button to clear the INTRFC alert and all other alerts in the system.

6) Select the **Cell Balance** tab and enable ALL balance switches by clicking the 14 checkboxes in the **Balance Switch Enable** group box.

7) Set the **Balancing Expiration Time** in rows 1–14 to the desired timer value for each cell balance (e.g., 100 or a value up to 1023).

8) In the **Under Voltage Threshold** group box, if using a benchtop power supply, select the **User-Defined CBUVTHR** from the drop-down list and set the **UV Threshold** to 1.5V. If using a battery pack, set the voltage to the desired undervoltage level.

9) In the **Balance Switch Control** group box, select **ADC/CAL and CBUVTHR Check Enabled** from the **Measure Enable** drop-down list.

10) In **Auto Cell Balance** mode, the state machine enables even and odd switches inversely. Using the slidebar, set the **Duty Cycle** to 100% to effectively control a 50% duty cycle for each switch.

11) Use the **Mode** drop-down and select one of the **Automated Cell Balancing** modes to activate the **Balancing Expiration Timer**. Immediately the **CBUVTHR Check Status** buttons illuminates red (CBUVTHR set to 1.5V in Step 8 is greater than cell-voltage measurement) and the driver will shut off.

12) Observe in the lower left corner of the **Cell Balance** tab, the **Counter** box increments and **Timer** box count continues until the timer is expired.

13) From the **Mode** drop-down list in the **Cell Balance** tab, click **Cell Balancing Disabled** to disable automated cell balancing.

Automated Cell Balancing with MINCELL Threshold (Host Sleep Mode)

This procedure details the process for using the GUI to set up and run the automated cell balance with shutoff threshold set by the cell with the minimum cell voltage.

Procedure

1) Set up hardware and run GUI according to the *Quick Start (Single UART)* section. **HelloAll Successful** and **UART device ready** response must be displayed in the **Event Log** on the **Initialization** tab.

2) Set the PCB resistor ladder DIP switches (SW1, SW2) to the ON position (closed). Verify that P+B14 and B0P- jumpers are installed.

3) Select the **Voltage Measurements** tab and click the **Scan Settings** button in the **Settings** group box to open the **Scan Settings** panel. Click the **Cell Enable All** and **Unipolar All (Cell)** buttons. Select 64x Oversampling from the **OVSAMPL** drop-down list, and then click the **Confirm Settings** button at the bottom of the window.

4) In the V**oltage Measurements** tab, click the **Scan Continuously** checkbox. Observe that cell-voltage levels are approximately equal in value. At this point, the MAX17854 is continuously reading the voltages across each of the 2kΩ resistors in the resistor ladder. Increasing the power-supply voltage increases the voltage across each of the 2kΩ resistors in the ladder. With the power supply set to 24.0V each resistor ladder simulated cell voltage will read approximately 1.72V.

5) The INTRFC alert is generated when an improper communication action is taken. Select the **Alerts/ Status** tab and click the **Clear All Device Alerts** button to clear the INTRFC alert and all other alerts in the system.

6) Select the **Cell Balance** tab and enable ALL balance switches by clicking the 14 checkboxes in the **Balance Switch Enable** group box. Set the **Balancing Expiration Timer** in rows 1–14 to the desired timer value for each cell balance (e.g., 100 or a value up to 1023).

7) In the **Under Voltage Threshold** group box, select **MINCELL-Defined CBUVTHR** from the drop-down list.

8) In the **Balance Switch Control** group box, set the **Measure Enable** drop-down to **ADC/CAL** and **CBU-VTHR Check Enabled**.

9) In **Auto Cell Balance Mode**, the state machine enables even and odd switches inversely. Using the **Duty Cycle** slidebar, set to 100% to effectively control a 50% duty cycle for each switch.

10) Use the **Mode** drop-down list and select any one of the **Automated Cell Balancing** modes to activate the **Balancing Expiration Time**. Immediately, the CBUVTHR register becomes loaded with the lowest cell voltage, setting the **UV Threshold**. Due to the PCB resistor ladder cell emulation, some of the CBUVTHR Status buttons will illuminate red as the cell-balance switches (SWn) are activated. Lowering the power- supply voltage illuminates all **CBUVTHR Check Status** indicators.

11) Observe in the lower left corner of the **Cell Balance** tab, that the **Counter** box increments and **Timer** box counts continue until the timer is expired.

12) Select the **Alerts/Status** tab and observe that **CB-DONE** is activated. Click the **Clear All Device Alerts** button.

13) Select the **Mode** drop-down list in the **Cell Balance** tab and click **Cell Balancing Disabled** to disable automated cell balancing.

The graph in Figure 34 displays an actual automated cell-balance cycle on a 14-cell ICR18650-26 battery pack using MINCELL as the shutoff mechanism. As seen in the graph, each cell continues to discharge through the MAX17854 cell-balance switch until the MINCELL threshold is achieved.
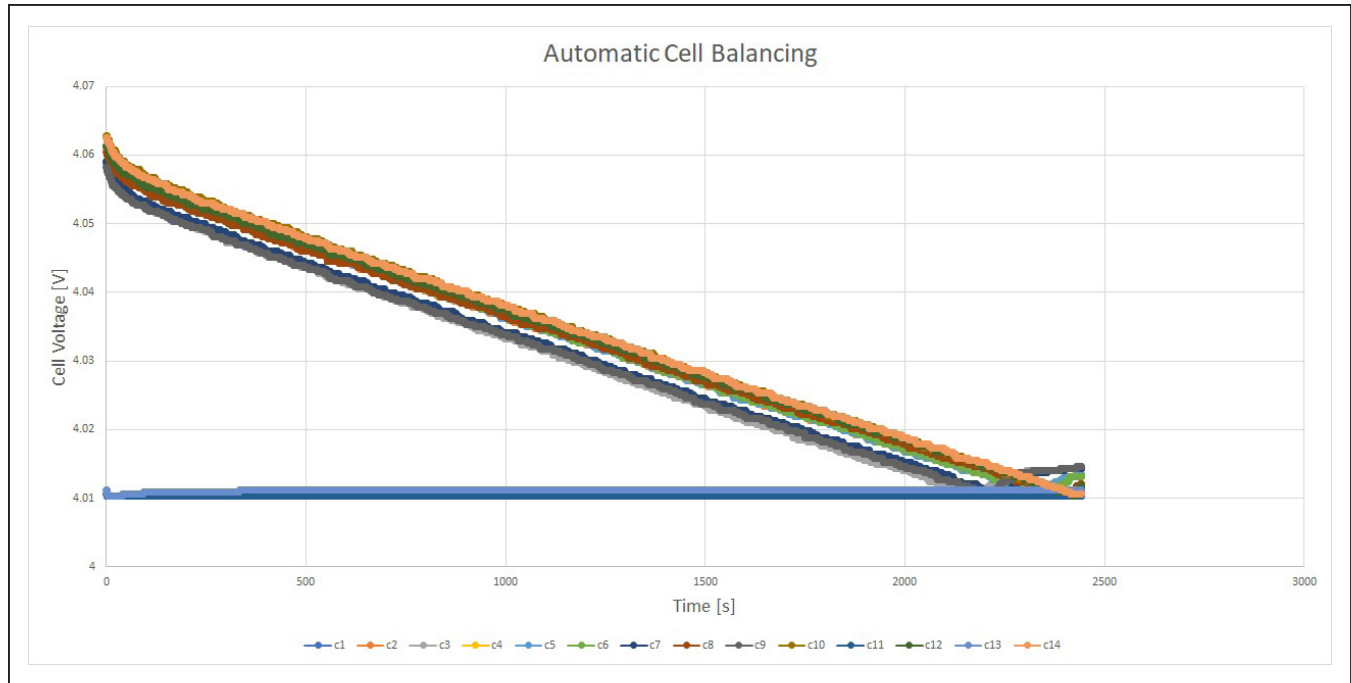
Figure 34. Automatic Cell Balancing

I2C Master

The following procedure demonstrates the use of the auxiliary channels (AUXIN0, AUXIN1) as SDA and SCL for I2C interface. Prior to the use, the I2C Master must be configured by writing data to the registers described below. Detailed descriptions of the Register Map are available in the MAX17854 IC data sheet.

In order to evaluate the I2C Master interface, the user must make the following hardware changes to the MAX17854 EV kit:

- Populate R26 (0Ω)
- Populate R143 (0Ω)
- Populate R148 (0Ω)
- Do not populate R116 (1kΩ)
- Do not populate R117 (1kΩ)

Refer to the MAX1785X EV Kit schematic for further details on the location of the resistors.

Procedure

1) Set up hardware and run GUI according to the *Quick Start (Single UART)* section. **HelloAll Successful** and **UART device ready** response must be displayed in the **Event Log** on the **Initialization** tab.

2) Set the PCB resistor ladder DIP switches (SW1, SW2) to the ON position (closed). Verify that the P+B14 and B0P- jumpers are installed.

3) Select the **Voltage Measurements** tab and click the **Scan Settings** button in the **Settings** group box to open the **Scan Settings** panel. Click the **I2C EN** button to enable the I2C Master pins (SDA, SCL).

4) Click the **Confirm Settings** button at the bottom of the panel and then verify with an oscilloscope that SDA and SCL are idle high at the AUXIN0 and AUXIN1 IC pins 21 and 22 on the EV kit.

5) Select the **Read/Write** tab. Using the Write All group box, send 0x0000 to register STATUS1 (0x02). This will reset the STATUS1 register.

6) Using the **Write All** group box, send 0x0004 to register I2CPNTR (0x84). This will write a pointer to address 0x0004.

7) Write 0xAA55 to register I2CWDATA1 (0x85). This register stores the upper data bytes for I2C Master Write Mode transaction.

8) Write 0x9669 to register I2CWDATA2 (0x86). This register stores the lower data bytes for I2C Master Write Mode transaction.

9) Configure the I2C Master mode to a simple write transaction by writing 0x2000 to register I2CCFG (0x89).

10) Clear the current status of the I2C Master by writing 0x0000 to register I2CSTAT (0x8A).

11) Initiate an I2C Master transaction by writing 0x78A8 to register I2CSEND (0x8B). User may observe the I2C communication with EV kit Flash by probing IC pins 21 and 22 during data transfer.

12) Using the **Read All** group box, read register I2C-STAT (0x8A) to access the current status of the I2C Master. An output of 0xC000 indicates that the transaction was completed with no errors.

Flexible Battery-Pack Connectivity

The flexible battery pack feature allows the user to optimize the battery pack system while maintaining hardware consistency across the pack's battery modules with variable number of cells. The following procedure demonstrates the default state of flexible battery pack and the proper activation.

Key Points to Consider

● The FlexPack feature is considered partially enabled at power-up and must be fully enabled when less than 14 cells are terminated to the MAX17854.

● When fully enabled, FlexPack uses internal MOSFETs to route power from the highest voltage switches input pin (SW8–SW14) to the DCIN pin which, in case of FlexPack, is not connected.

● Programming FlexPack **TOPCELL** to a lower number cell than terminated to the device places a low ohmic short between the higher SWn input and the lower programmed **TOPCELL** SWn input. Caution must be exercised.

Procedure

1) Set up hardware and run GUI according to the *Quick Start (Single UART)* section, with a few exceptions.
   a. Connect power to the MAX1785X EV kit through terminal BAT12 to represent a 12-cell pack.
   b. For both EV kits, set the PCB Resistor Ladder DIP Switches (SW1) to the ON position (closed). Close ladder DIP switches 1–5 on SW2 (12 cells).
   c. Verify that the B0P- jumper is installed. Remove the P+B14 jumper.

2) Apply 18.0V power from PACK- to BAT12. Initialize

with Single UART interface. Use **Wakeup** and **Hello All** to establish communication. Verify that **HelloAll Successful** and **UART device ready** response is displayed in the **Event Log** on the **Initialization** tab.

3) Select the **Voltage Measurements** tab and click the **Scan Settings** button in the **Settings** group box to open the **Scan Settings** panel. Select **Cell Enable** for Cell 1–Cell 12. Click **Confirm Settings** at the bottom of the window.

4) In the **Voltage Measurements** tab, click the **Scan Continuously** checkbox. Observe that the cell voltage levels are approximately equal in value. At this point, the MAX17854 is continuously reading the differential voltages across the Cell 1–Cell 12 2kΩ emulation resistors. Increasing the power-supply voltage increases the voltage across each of the 2kΩ resistors in the ladder.

5) To fully activate the FlexPack, select the **General Configuration** tab. Set **TOPCELL** to the corresponding hex number of cells. Set **TOPCELL** to 0xC.

6) Generally, **TOPBLOCK** is programmed the same as **TOPCELL** unless bus bar measurement is desired. Refer to the MAX17854 IC data sheet for details on **TOPBLOCK** feature and operation. For the FlexPack exercise, Set **TOPBLOCK** to 0xC.

7) Programming **TOPCELL** to battery cell 12 terminates DCIN pin to battery cell 12. To verify operation, the user can connect a voltmeter between IC pin 55 (SW12) and test point DCIN. Set **TOPCELL** to hex 0xF to deactivate and observe the forward biased diode (~820mV) between IC pin 55 (SW12) and DCIN. Set **TOPCELL** to hex 0xC to activate the internal cell 12-FlexPack MOSFET and observe the internal MOSFET forward voltage. (<100mV).

The MAX17854 EV kit provides the user with an introduction to the features and functions of the MAX17854 device. Refer to the MAX17854 IC data sheet for detailed explanations of the product features, register set, and modes of operation.

Ordering Information

PART	TYPE
MAX17854EVKIT#	EV kit
MAX17851EVKIT#	EV kit

#Denotes RoHS compliance.

MAX17854 EV Kit Bill of Materials

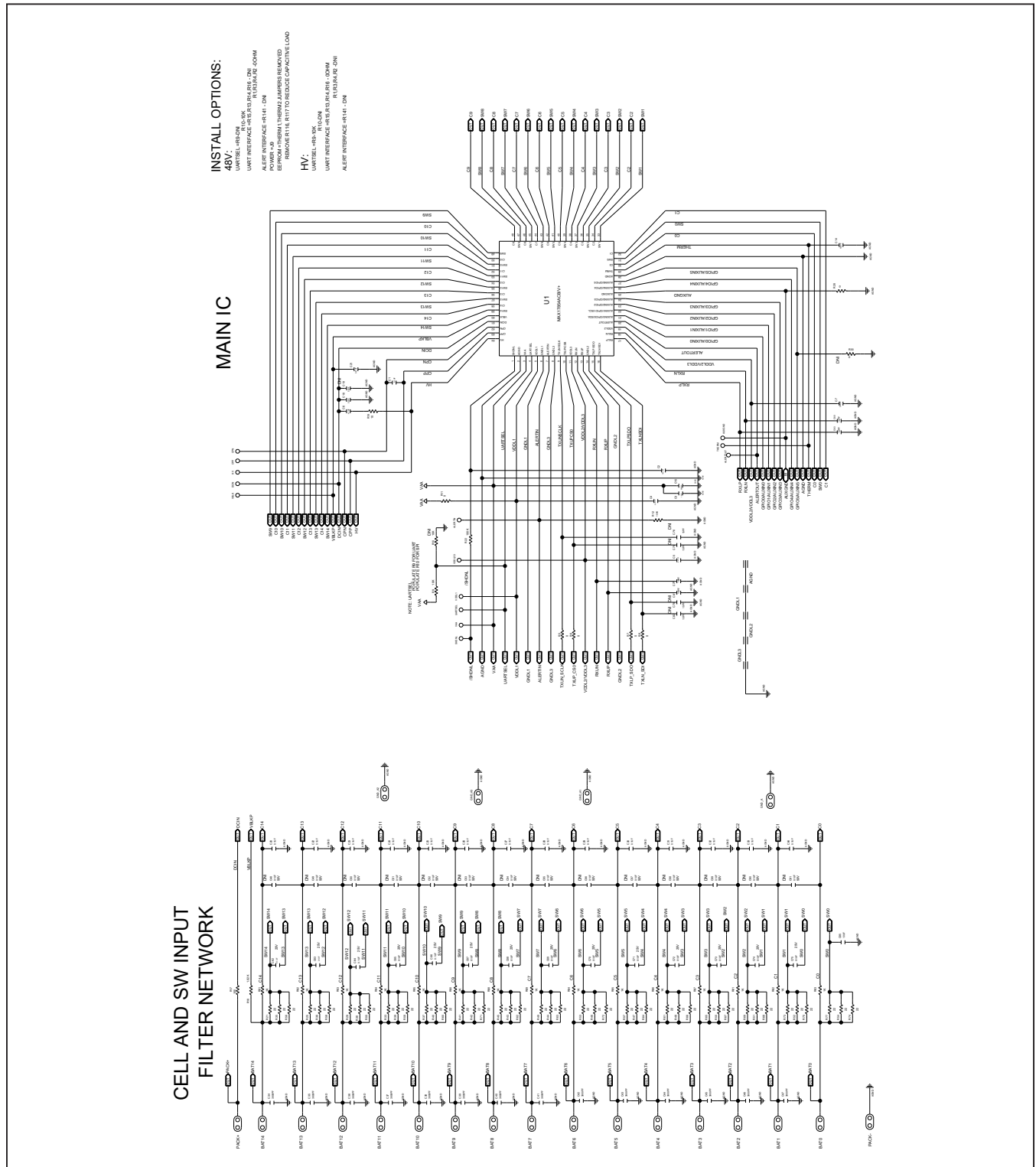| ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	ALARM_IN_UP, ALARM_OUT_LP, GPIO_AUX0-GPIO_AUX5, RXLP_CONN, RXUP_CONN, TXLP_CONN, TXUP_CONN	-	12	502584-0270	MOLEX	502584-0270	CONNECTOR; FEMALE; SMT; 502584 SERIES; STRAIGHT; 2PINS	
2	ALERTIN, ALERTIN_P, ALERTOUT, CPN, CPP, DCIN, HV, RXLN, RXLP, RXP1, RXP2, RXUN, RXUP, TXLN, TXLP, TXP1, TXP2, TXUN, TXUP, UARTSEL, VAA, VBLK	-	22	5000	KEYSTONE	N/A	TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; RED; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	
3	ALERTIN_N, GP/AUX0-GP/AUX5, RXN1, RXN2, TXN1, TXN2	-	11	5001	KEYSTONE	N/A	TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	
4	AUXGND, OPTO_OUT, SHDNL, THERM, VDDL1, VDDL2/3	-	6	5004	KEYSTONE	N/A	TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; YELLOW; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	
5	B0P-, B1B0, B2B1, B3B2, B4B3, B5B4, B6B5, B7B6, B8B7, B9B8, B10B9, B11B10, B12B11, B13B12, B14B13, P+B14	-	16	PEC02SAAN	SULLINS ELECTRONICS CORP.	PEC02SAAN	EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS;	
6	BAT0-BAT14, GND_A, GND_A1-GND_A3, PACK+, PACK-	-	21	9020 BUSS	WEICO WIRE	MAXIMPAD	EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL; SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG	
7	C1		1	CC0603KRX7R0BB104; GRM188R72A104KA35; HMK107B7104KA; 06031C104KAT2A; GRM188R72A104K	YAGEO;MURATA;TAIYO YUDEN; AVX;MURATA	0.1UF	CAP; SMT (0603); 0.1UF; 10%; 100V; X7R; CERAMIC	
8	C2	-	1	GRM155R72A102KA01; HMK105B7102KV	MURATA;TAIYO YUDEN	1000PF	CAP; SMT (0402); 1000PF; 10%; 100V; X7R; CERAMIC	
9	C3, C85	-	2	GRM188R70J105KA01; CL10B105KQ8NNNC	MURATA;SAMSUNG ELECTRONICS	1.0UF	CAP; SMT (0603); 1.0UF; 10%; 6.3V; X7R; CERAMIC;	
10	C4, C5, C7	-	3	C0603C474K4RAC; GRM188R71C474K; EMK107B7474AK; C1608X7R1C474K080AC	KEMET;MURATA;TAIYO YUDEN;TDK	0.47UF	CAP; SMT (0603); 0.47UF; 10%; 16V; X7R; CERAMIC	
11	C6	-	1	CGA4J1X7R1V475K125AE; CGA4J1X7R1V475K125AC	TDK;TDK	4.7UF	CAP; SMT (0805); 4.7UF; 10%; 35V; X7R; CERAMIC	
12	C14	-	1	GRM1555C1E101GA01	MURATA	100PF	CAP; SMT (0402); 100PF; 2%; 25V; C0G; CERAMIC	
13	C15	-	1	C1608C0G1H392K080AA	TDK	3900PF	CAP; SMT (0603); 3900PF; 10%; 50V; C0G; CERAMIC	
14	C18	-	1	GRM32ER72A225KA35; CGA6N3X7R2A225K230AB; CC1210KKX7R0BB225; HMK325B7225KM	MURATA;TDK;YAGEO; TAIYO YUDEN	2.2UF	CAP; SMT (1210); 2.2UF; 10%; 100V; X7R; CERAMIC	
15	C20, C22-C33, C84	-	14	C3216X8R2A104K115AA	TDK	0.1UF	CAP; SMT (1206); 0.1UF; 10%; 100V; X8R; CERAMIC	
16	C21	-	1	GRM21BR72A474KA73; 08051C474K4T4A	MURATA;AVX	0.47UF	CAP; SMT (0805); 0.47UF; 10%; 100V; X7R; CERAMIC	
17	C34-C47	-	14	GRM319R72A392JA01	MURATA	3900PF	CAP; SMT (1206); 3900PF; 5%; 100V; X7R; CERAMIC	
18	C62-C75	-	14	885012206071; C1608X7R1E104K080AA; C0603C104K3RAC; GRM188R71E104KA01; C1608X7R1E104K; 06033C104KAT2A	WURTH ELECTRONICS INC; TDK;KEMET;MURATA;TDK;AVX	0.1UF	CAP; SMT (0603); 0.1UF; 10%; 25V; X7R; CERAMIC	
19	C77, C80, C81, C83	-	4	C0402C180J5GAC; GRM1555C1H180JA01; C1005C0G1H180J050BA	KEMET;MURATA;TDK	18PF	CAP; SMT (0402); 18PF; 5%; 50V; C0G; CERAMIC	
20	C87	-	1	C0603C390K1GAC	KEMET	39PF	CAP; SMT (0603); 39PF; 10%; 100V; C0G; CERAMIC	
21	C88	-	1	C1206C101J1GAC	KEMET	100PF	CAP; SMT (1206); 100PF; 5%; 100V; C0G; CERAMIC	
22	C89-C92	-	4	CGA5H4C0G2J222J115AA	TDK	2200PF	CAP; SMT (1206); 2200PF; 5%; 630V; C0G; CERAMIC	
23	C93	-	1	GCM1885C2A150JA16	MURATA	15PF	CAP; SMT (0603); 15PF; 5%; 100V; C0G; CERAMIC	
24	C104-C109	-	6	GRM188R71C103KA01; ECJ-1VB1C10; CL10B103KO8NNN; GCJ188R71C103KA01	MURATA;PANASONIC; SAMSUNG;MURATA	0.01UF	CAP; SMT (0603); 0.01UF; 10%; 16V; X7R; CERAMIC	
25	D3-D8, D11-D14, D16, D18-D21, D24, D25	-	17	SP4021-01FTG	LITTELFUSE	5V	DIODE; TVS; SMT (SOD-323); VRM=5V; IPP=25A	
26	D9, D10	-	2	PESD3V3U1UB	NXP	3.3V	DIODE; TVS; SMT (SOD-523); PIV=3.3V; IF=0.1A	
27	D26, D28, D30, D31	-	4	DFLS1100-7	DIODES INCORPORATED	DFLS1100-7	DIODE; SCHOTTKY; SMT; PIV=100V; IF=1A	
28	D29, D32-D34	-	4	SESDONCAN1LT1G	ON SEMICONDUCTOR	SESDONCAN1LT1G	DIODE; TVS; SMT (SOT-23); VRM=24V; IPP=3A	
29	J5	-	1	PEC12DAAN	SULLINS ELECTRONICS CORP	PEC12DAAN	CONNECTOR; MALE; THROUGH HOLE; .1IN CC; BREAKAWAY HEADER; STRAIGHT; 24PINS	
30	J6	-	1	PBC15DAAN	SULLINS ELECTRONICS CORP.	PBC15DAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 30PINS	

MAX17854 EV Kit Bill of Materials (continued)

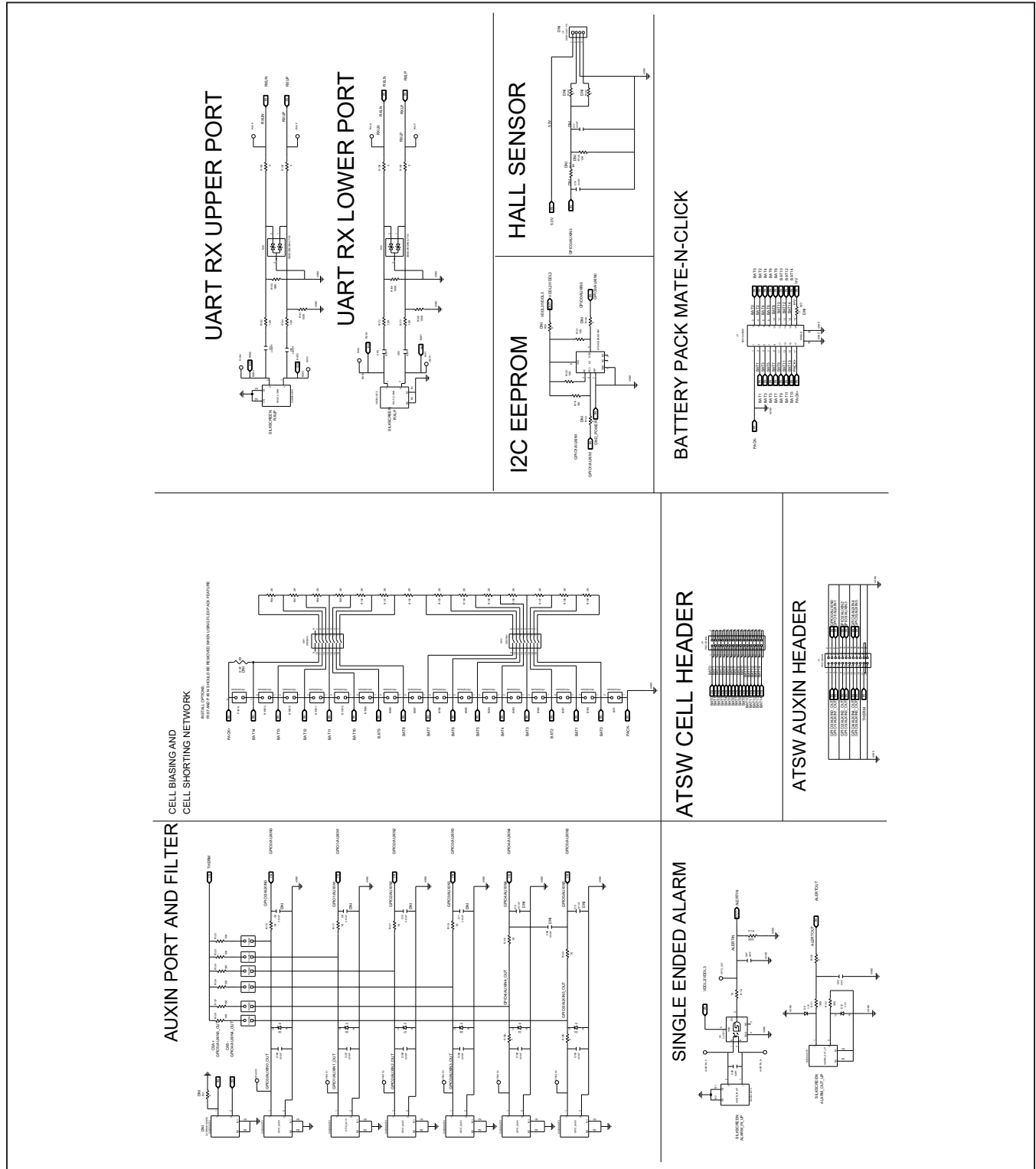| ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
31	J7	-	1	5031541890	MOLEX	5031541890	CONNECTOR; FEMALE; SMT; 1.5MM PITCH CLIK-MATE; WIRE-TO-BOARD PCB RECEPTACLE; DUAL ROW; STRAIGHT; 18PINS	
32	L1-L4	-	4	MMZ2012S601AT000	TDK	600	INDUCTOR; SMT (0805); FERRITE-BEAD; 600; TOL=+/25%; 0.5A	
33	MINIQ1	-	1	PEC08DAAN	SULLINS ELECTRONICS CORP.	PEC08DAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 16PINS; -65 DEGC TO +125 DEGC	
34	MINIQ2	-	1	SSW-108-01-T-S	SAMTEC	SSW-108-01-T-S	CONNECTOR; FEMALE; THROUGH-HOLE 0.025in POST SOCKET; STRAIGHT; 8PINS	
35	Q1, Q2	-	2	BC857BS-7-F	DIODES INCORPORATED	BC857BS-7-F	TRAN; PNP; SOT-363; PD-(0.2W); I-(-0.1A); V-(-45V)	
36	R5-R8	-	4	CRCW06030000Z0EAHP	VISHAY DRALORIC	0	RES; SMT (0603); 0; JUMPER; JUMPER; 0.2500W	
37	R9, R114, R115, R122-R128, R131-R134, R146, R147, R150-R152, R154	-	20	CRCW060310K0FK; ERJ-3EKF1002; AC0603FR-0710KL; RMCF0603FT10K0	VISHAY DALE;PANASONIC; YAGEO	10K	RES; SMT (0603); 10K; 1%; +/-100PPM/DEGC; 0.1000W	
38	R11, R13-R16, R28, R136, R185, R186	-	9	RC1608J000CS; CR0603-J/-000ELF; RC0603JR-070RL	SAMSUNG ELECTRONICS; BOURNS;YAGEO PH	0	RES; SMT (0603); 0; 5%; JUMPER; 0.1000W	
39	R12	-	1	CRCW0603100KFK; RC0603FR-07100KL; RC0603FR-13100KL; ERJ-3EKF1003; AC0603FR-07100KL	VISHAY DALE;YAGEO;YAGEO; PANASONIC	100K	RES; SMT (0603); 100K; 1%; +/-100PPM/DEGC; 0.1000W	
40	R17	-	1	RNCP1206FTD100R	STACKPOLE ELECTRONICS INC	100	RES; SMT (1206); 100; 1%; +/-100PPM/DEGC; 0.5000W	
41	R18	-	1	ERA-3AEB1021	PANASONIC	1.02K	RES; SMT (0603); 1.02K; 0.10%; +/-25PPM/DEGC; 0.1000W	
42	R19	-	1	ERJ-P03F10R0V	PANASONIC	10	RES; SMT (0603); 10; 1%; +/-200PPM/DEGC; 0.2000W	
43	R20. R27. R183. R184	-	4	RC0805JR-070RL	YAGEO PHYCOMP	0	RES: SMT (0805): 0: 5%: JUMPER: 0.1250W	
44	R21, R25, R29, R33, R35-R74, R77	-	45	ERJ-14NF22R0	PANASONIC	22	RES; SMT (1210); 22; 1%; +/-100PPM/DEGC; 0.5000W	
45	R22, R110, R155, R161, R168, R169	-	6	ERJ-3GEYJ104; CRCW0603100KJN	PANASONIC;VISHAY	100K	RES; SMT (0603); 100K; 5%; +/-200PPM/DEGC; 0.1000W	
46	R81-R95	-	15	CR0603-FX-1001ELF; RC0603FR-071KL	BOURNS;YAGEO	1K	RES; SMT (0603); 1K; 1%; +/-100PPM/DEGC; 0.1000W	
47	R96-R109	-	14	CRCW06032K0FK; ERJ-3EKF2001; RC0603FR-072KL; CRCW06032K00FK	VISHAY;PANASONIC; YAGEO;VISHAY	2K	RES; SMT (0603); 2K; 1%; +/-100PPM/DEGC; 0.1000W	
48	R111, R112	-	2	CRCW0805360RFK	VISHAY DALE	360	RES; SMT (0805); 360; 1%; +/-100PPM/DEGC; 0.1250W	
49	R113	-	1	ERJ-3GEYJ102	PANASONIC	1K	RES; SMT (0603); 1K; 5%; +/-200PPM/DEGC; 0.1000W	
50	R116-R121	-	6	CRCW06031K00FK; ERJ-3EKF1001; CR0603AFX-1001ELF	VISHAY; PANASONIC;BOURNS	1K	RES; SMT (0603); 1K; 1%; +/-100PPM/DEGC; 0.1000W	
51	R129, R130, R138, R140, R179-R182	-	8	CRCW12060000ZS	VISHAY DALE	0	RES; SMT (1206); 0; JUMPER; JUMPER; 0.2500W	
52	R157-R160	-	4	CRCW080549R9FK; ERJ-6ENF49R9; RMCF0805FT49R9	VISHAY DALE;PANASONIC; STACKPOLE	49.9	RES; SMT (0805); 49.9; 1%; +/-100PPM/DEGC; 0.1250W	
53	R162, R164, R172, R173	-	4	CRCW12061K50FK	VISHAY DALE	1.5K	RES; SMT (1206); 1.5K; 1%; +/-100PPM/DEGC; 0.2500W	
54	SHDNL_SEL	-	1	FTS-103-01-L-S	SAMTEC	FTS-103-01-L-S	CONNECTOR; MALE; THROUGH HOLE; MICRO LOW PROFILE TERMINAL STRIP; STRAIGHT; 3PINS	
55	SU1, SU2	-	2	S1100-B;SX1100-B; STC02SYAN	KYCON;KYCON;SULLINS ELECTRONICS CORP.	SX1100-B	TEST POINT; JUMPER; STR; TOTAL LENGTH=0.24IN; BLACK; INSULATION=PBT;PHOSPHOR BRONZE CONTACT=GOLD PLATED	
56	SW1, SW2	-	2	ADE0804	TE CONNECTIVITY	ADE0804	SWITCH; SPST; DIP16; 24V; 0.1A; SLIDE ACTUATED PIANO-DIP; RCOIL= OHM; RINSULATION= OHM; TYCO ELECTRO	
57	THERM1-THERM6	-	6	3-644456-2	TYCO	3-644456-2	CONNECTOR, HEADER STRIP, TH, STR, 2PINS, 1 ROW	
58	U1	-	1	MAX17854ACB/V+	MAXIM	MAX17854ACB/V+	IC; INFC; 14 CHANNEL HIGH-VOLTAGE DATA ACQUISITION SYSTEM; LQFP64	
59	U2	-	1	MAX3378EEUD+	MAXIM	MAX3378EEUD+	IC; TRANS; +/-15KV ESD-PROTECTED, 1UA, 16MBPS, QUAD LOW-VOLTAGE LEVEL TRANSLATOR; TSSOP14	
60	U3	-	1	AT24CS08-SSHM	ATMEL	AT24CS08-SSHM	IC; EPROM; I2C-COMPATIBLE TWO-WIRE SERIAL EEPROM; NSOIC8 150MIL	

MAX17854 EV Kit Bill of Materials (continued)

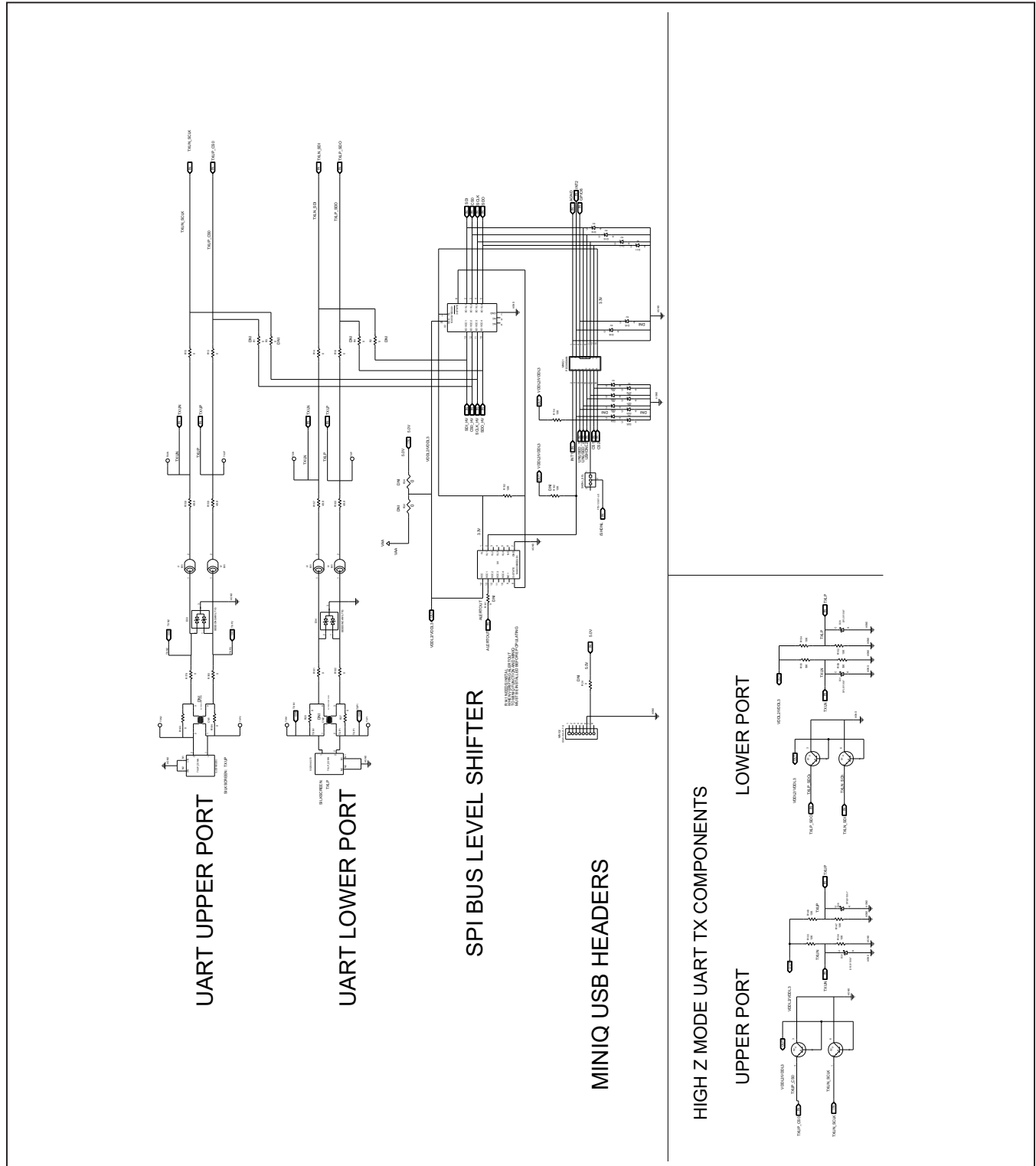| ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
61	U4	-	1	MAX3390EEUD+	MAXIM	MAX3390EEUD+	IC; TRANS; 15KV ESD-PROTECTED; 1UA; 16MBPS; QUAD LOW-VOLTAGE LEVEL TRANSLATOR; TSSOP14	
62	U5	-	1	TLP2770	TOSHIBA	TLP2770	IC; PHOTO; 20MBPS LOW POWER PHOTOCOUPLER; WSOIC6	
63	PCB	-	1	MAX1785X	MAXIM	PCB	PCB:MAX1785X	-
64	MISC1-MISC3	DNI	3	2844/19 BK001	ALPHA WIRE COMPANY	N/A	WIRE; BLACK; 19/36; ALPHA WIRE COMPANY; HOOK-UP; MIL-W-16878E (TYPE E); AWG24	
65	MISC2, MISC3	DNI	2	2844/19 BL001	ALPHA WIRE COMPANY	N/A	WIRE; BLUE; 19/36; ALPHA WIRE COMPANY; HOOK-UP; MIL-W-16878E (TYPE E); AWG24	
66	MISC1-MISC3	DNI	6	5025780200	MOLEX	N/A	CONNECTOR; FEMALE; WIREMOUNT; CLIK-MATE WIRE-TO-BOARD HOUSING; SINGLE ROW; POSITIVE LOCK 2PINS	
67	MISC1-MISC3	DNI	12	5025790000	MOLEX	N/A	CONNECTOR; FEMALE; WIRE-TO-BOARD CRIMP TERMINAL; WIREMOUNT; 1PIN	
68	MISC1	DNI	1	2844/19 RD001	ALPHA WIRE COMPANY	N/A	WIRE; RED; 19/36; ALPHA WIRE COMPANY; HOOK-UP; MIL-W-16878E (TYPE E); AWG24	
69	BUMP1-BUMP6	DNI	6	SJ-5003(BLACK)	3M ELECTRONIC SOLUTIONS DIVISION	SJ-5003(BLACK)	BUMPER; BLACK-HEMISPHERICAL SHAPE EVKIT EH0231; 0.44D/0.2BH; RESILIENT ELASTOMER POLYURETHANE	
70	MISC1	DNI	1	CLIK-MATE_2-PIN_LOOP-BACK	MAXIM	CLIK-MATE_2-PIN_LOOP-BACK	CABLE ASSEMBLY; TWO WIRE CLIK-MATE 2-WIRE LOOP CABLE; WITH WIRE STRIPPER AND CRIMP TOOL;	
71	MISC2, MISC3	DNI	2	CLIK-MATE-CABLE_2-WIRE	MAXIM	CLIK-MATE-CABLE_2-WIRE	CABLE ASSEMBLY; TWO WIRE CLIK-MATE CROSSOVER CABLE; WITH WIRE STRIPPER AND CRIMP TOOL;	
72	C8-C13	DNP	0	NMC0402X7R103K16TRP; GRM155R71C103KA01; CC0402KRX7R7BB103	NIC COMPONENTS CORP.; MURATA;YAGEO	0.01UF	CAP; SMT (0402); 0.01UF; 10%; 16V; X7R; CERAMIC	
73	C16	DNP	0	C0603C474K4RAC; GRM188R71C474K; EMK107B7474KA; C1608X7R1C474K080AC	KEMET;MURATA; TAIYO YUDEN;TDK	0.47UF	CAP; SMT (0603); 0.47UF; 10%; 16V; X7R; CERAMIC	
74	C17, C86	DNP	0	GRM188R71C103KA01; ECJ-1VB1C10; CL10B103KO8NNN; GCJ188R71C103KA01	MURATA;PANASONIC; SAMSUNG;MURATA	0.01UF	CAP; SMT (0603); 0.01UF; 10%; 16V; X7R; CERAMIC	
75	C19	DNP	0	GRM32ER72A225KA35; CGA6N3X7R2A225K230AB; CC1210KKX7R0BB225; HMK325B7225KM	MURATA;TDK;YAGEO; TAIYO YUDEN	2.2UF	CAP; SMT (1210); 2.2UF; 10%; 100V; X7R; CERAMIC	
76	C48-C61	DNP	0	GCJ188R71H104KA12; GCM188R71H104K; CGA3E2X7R1H104K080AA; CGA3E2X7R1H104K080AD; CL10B104KB8WPN	MURATA;MURATA;TDK; TDK;SAMSUNG	0.1UF	CAP; SMT (0603); 0.1UF; 10%; 50V; X7R; CERAMIC	
77	C76, C78, C79, C82	DNP	0	C0402C0G500-150JNP; GRM1555C1H150JA01	VENKEL LTD.;MURATA	15PF	CAP; SMT (0402); 15PF; 5%; 50V; C0G; CERAMIC	
78	CM1, CM2	DNP	0	ACT45B-510-2P-TL003	TDK	ACT45B-510-2P-TL003	INDUCTOR; SMT (1812); WIREWOUND CHIP; 51UH; TOL=[+50%/-30%]; 0.2A	
79	CURRENTSENSE	DNP	0	502584-0270	MOLEX	502584-0270	CONNECTOR; FEMALE; SMT; 502584 SERIES; STRAIGHT; 2PINS	
80	D15. D22. D23	DNP	0	SP4021-01FTG	LITTELFUSE	5V	DIODE: TVS; SMT (SOD-323); VRM=5V; IPP=25A	
81	J1-J4	DNP	0	TSW-116-07-G-S	SAMTEC	TSW-116-07-G-S	CONNECTOR; MALE; THROUGH HOLE; 0.25INCH SQ POST HEADER; STRAIGHT; 16PINS	
82	J8	DNP	0	SSW-104-01-T-S	SAMTEC	SSW-104-01-T-S	CONNECTOR; MALE; THROUGH HOLE; .025INCH SQ POST SOCKET; STRAIGHT; 4PINS	
83	R1-R4, R23, R24, R26, R30, R31, R141, R143-R145, R148	DNP	0	RC1608J000CS; CR0603-J/-000ELF; RC0603JR-070RL	SAMSUNG ELECTRONICS; BOURNS;YAGEO PH	0	RES; SMT (0603); 0; 5%; JUMPER; 0.1000W	
84	R10, R142	DNP	0	CRCW060310K0FK; ERJ-3EKF1002; AC0603FR-0710KL; RMCF0603FT10K0	VISHAY DALE;PANASONIC; YAGEO	10K	RES; SMT (0603); 10K; 1%; +/-100PPM/DEGC; 0.1000W	
85	R32, R34	DNP	0	CRCW08050000ZS; RC2012J000	VISHAY;SAMSUNG ELECTRONICS	0	RES; SMT (0805); 0; JUMPER; JUMPER; 0.1250W	
86	R137, R139	DNP	0	ERJ-3GEYJ153	PANASONIC	15K	RES; SMT (0603); 15K; 5%; +/-200PPM/DEGC; 0.1000W	
87	R187	DNP	0	CRCW12060000ZS	VISHAY DALE	0	RES; SMT (1206); 0; JUMPER; JUMPER; 0.2500W	
TOTAL			393					

MAX1785X EV Kit Schematics

MAX1785X EV Kit Schematics (continued)

MAX1785X EV Kit Schematics (continued)

UART UPPER PORT

UART LOWER PORT

SPI BUS LEVEL SHIFTER

MINIQ USB HEADERS

HIGH Z MODE UART TX COMPONENTS

UPPER PORT

LOWER PORT

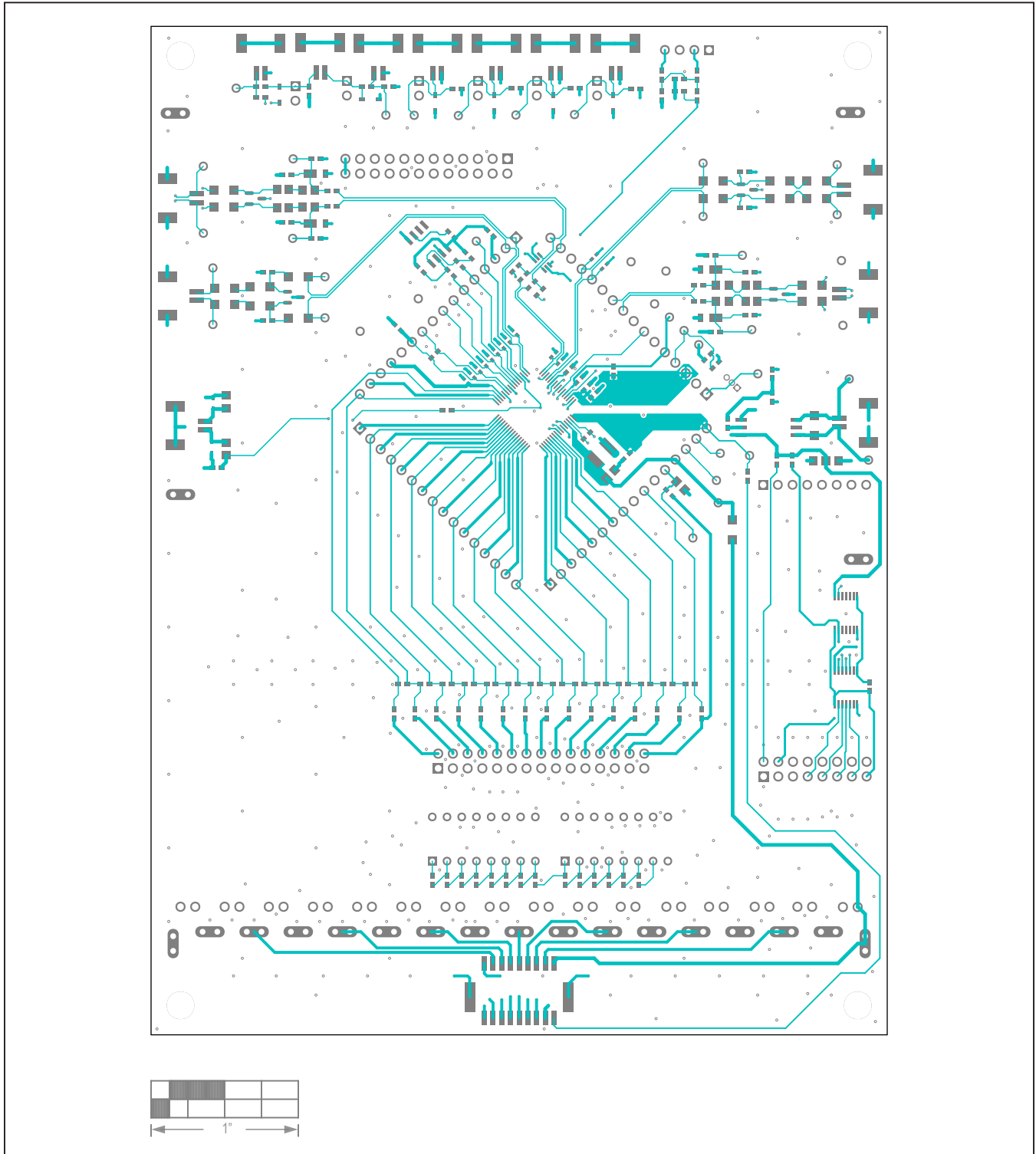## MAX1785X EV Kit Schematics (continued)
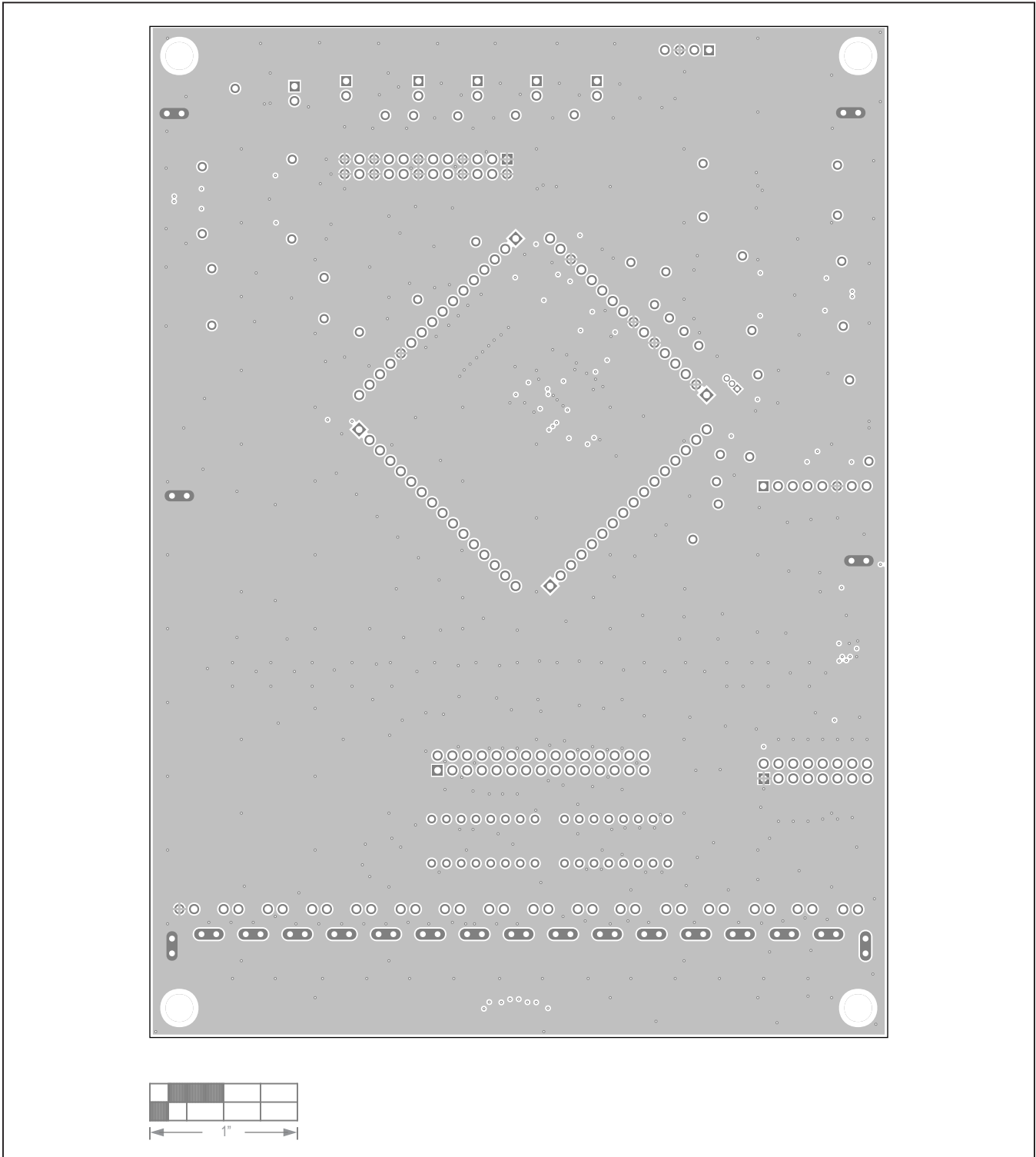
MAX1785X EV Kit PCB Layouts
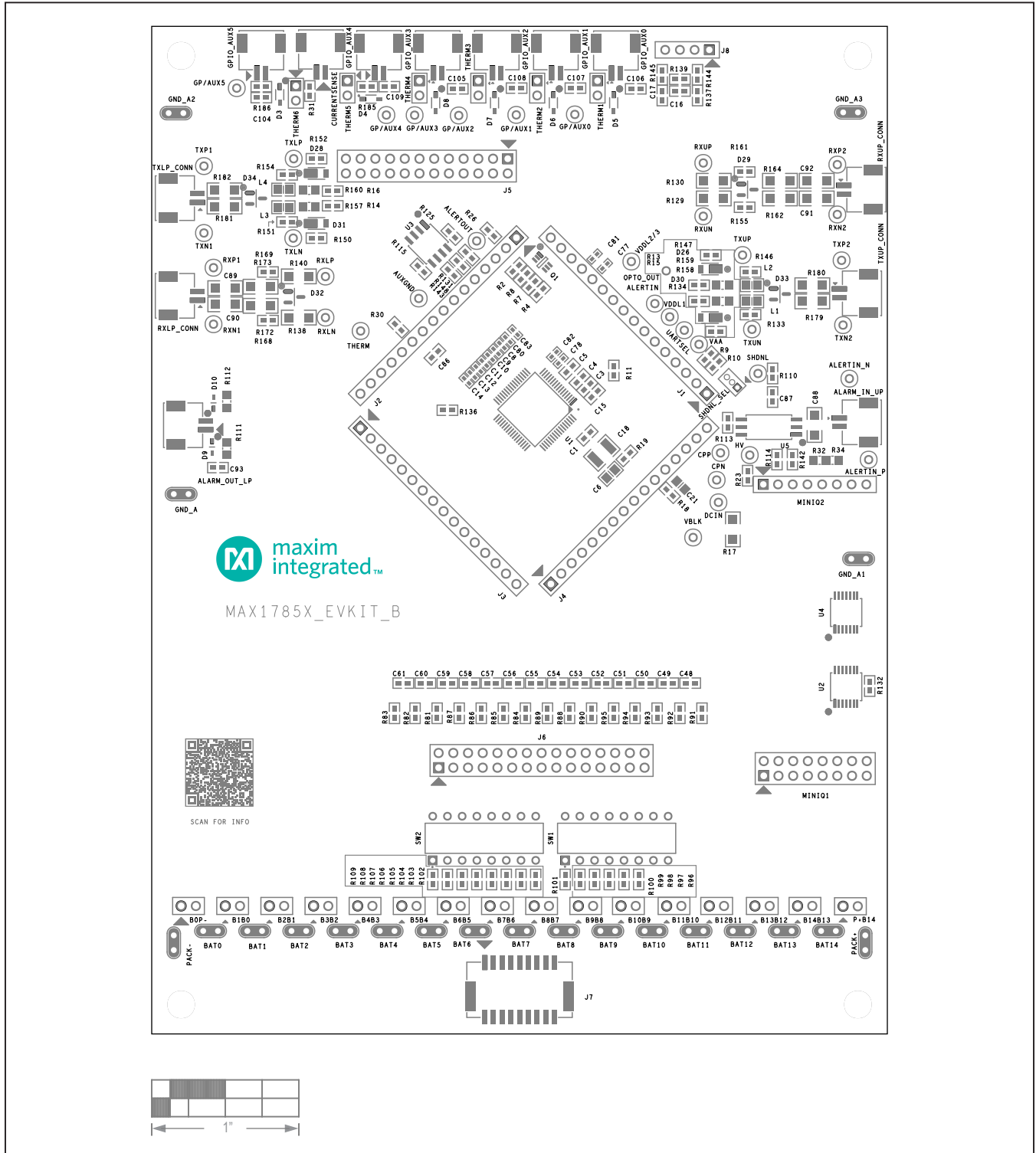
MAX1785X EV Kit PCB Layout—Silk Top

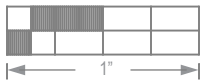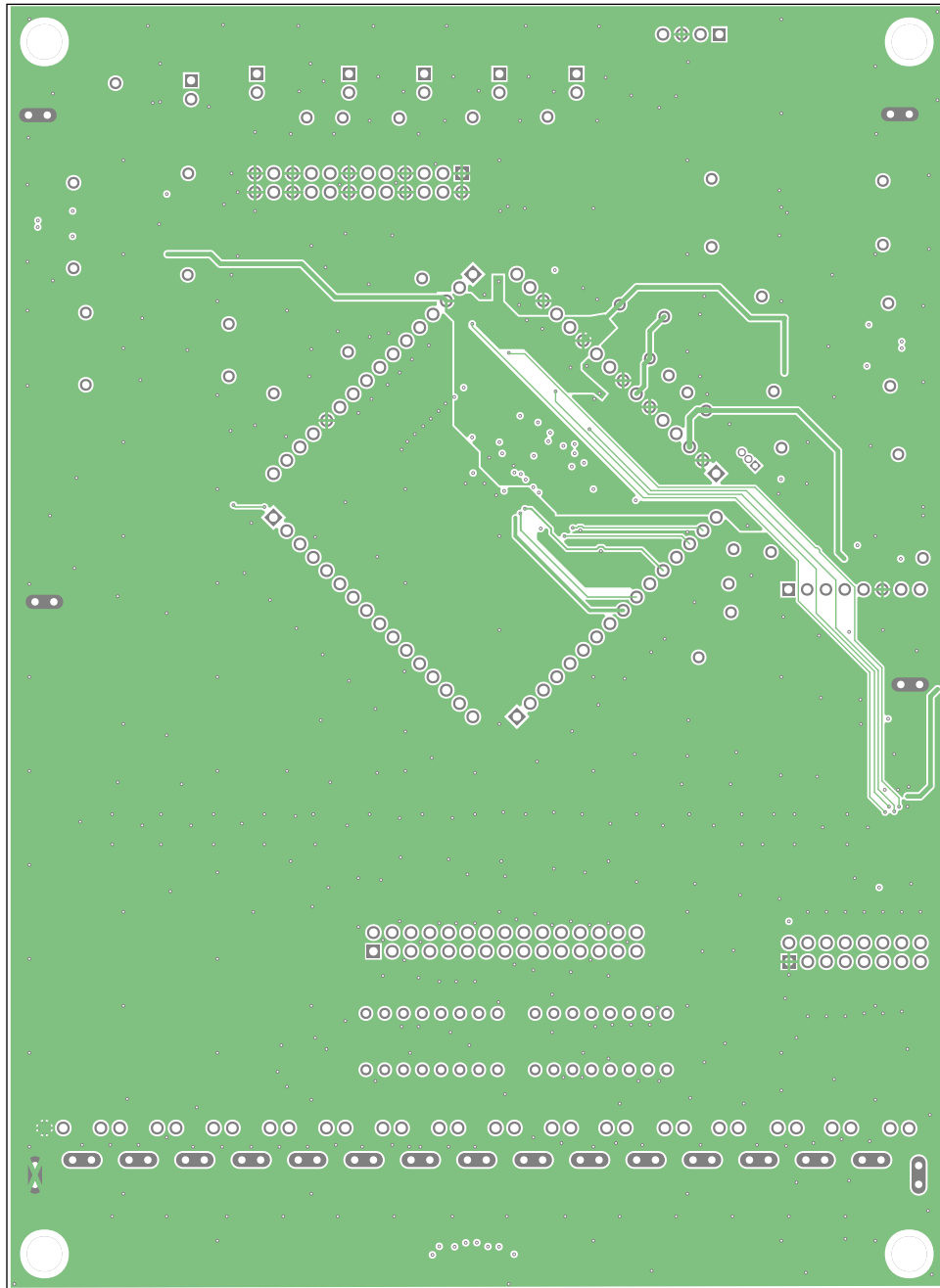## MAX1785X EV Kit PCB Layouts (continued)

MAX1785X EV Kit PCB Layout—Top

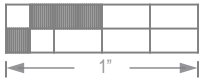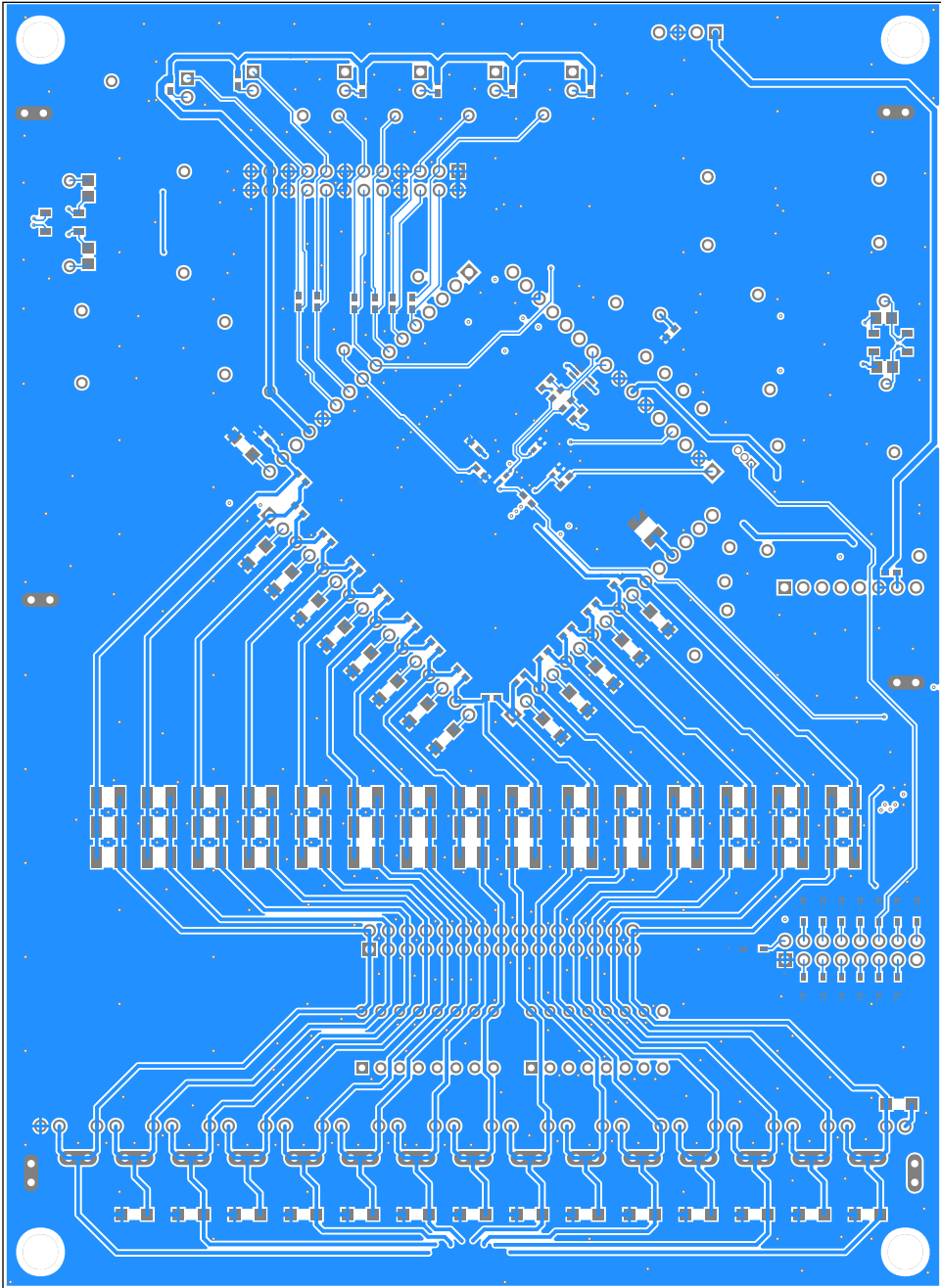## MAX1785X EV Kit PCB Layouts (continued)

MAX1785X EV Kit PCB Layout—Internal2
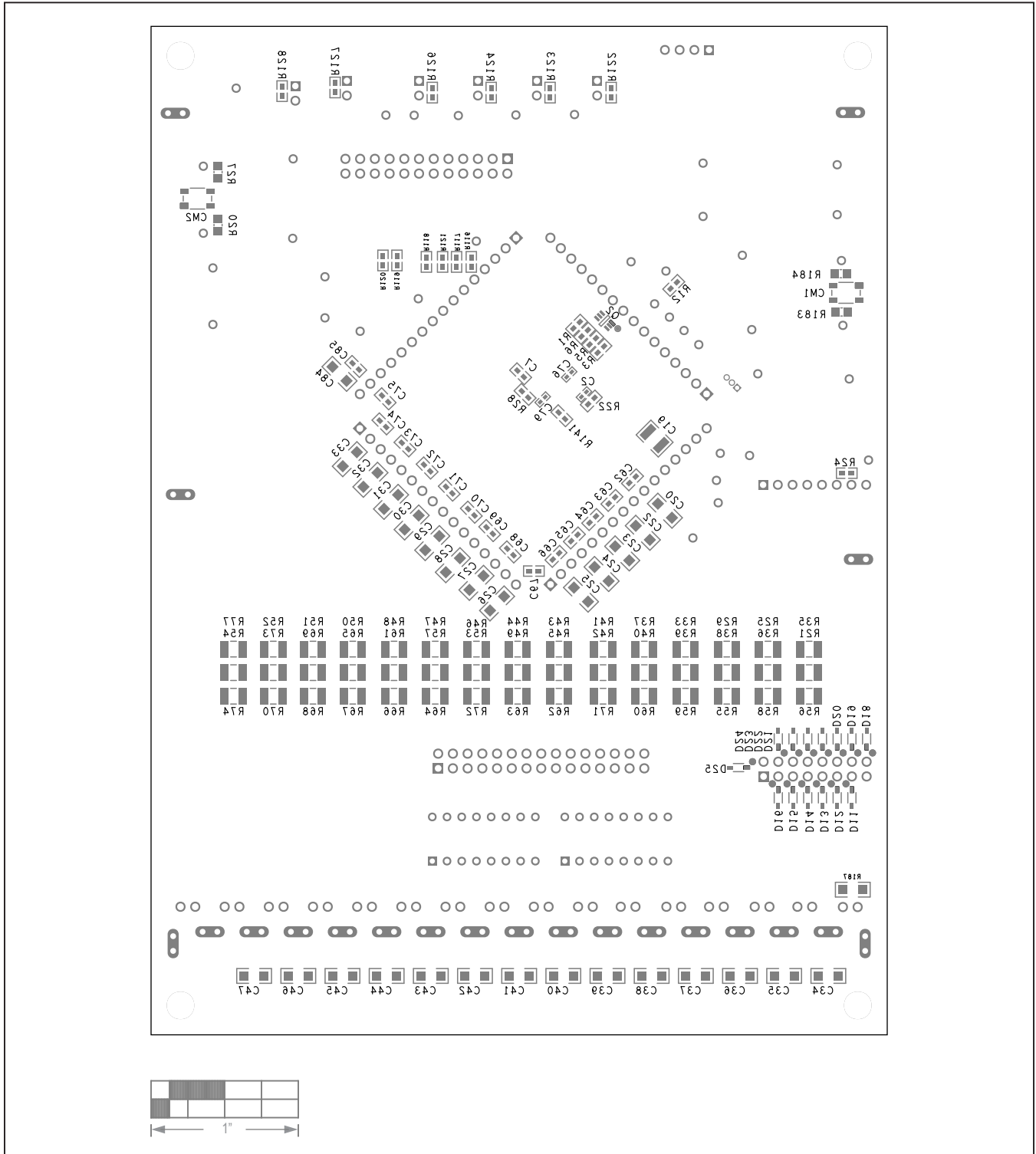
MAX1785X EV Kit PCB Layouts (continued)

MAX1785X EV Kit PCB Layout—GND3

MAX1785X EV Kit PCB Layouts (continued)

MAX1785X EV Kit PCB Layout—Bottom

MAX1785X EV Kit PCB Layouts (continued)

MAX1785X EV Kit PCB Layout—Silk Bottom

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	12/21	Initial release	—