MAX17853 Evaluation Kit

Evaluates: MAX17853

General Description

The MAX17853 evaluation kit (EV kit) is used to demonstrate the features and capabilities of the MAX17853 14-channel high-voltage smart sensor data-acquisition interface IC. The EV kit is coupled with a MAX17841B EV kit to establish communication to a host PC. With communication established, control of the MAX17853 EV kit is executed through the EV kit graphical user interface (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 MAX17841 in this data sheet pertain equally to the MAX17841B as well.

The MAX17853 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 (P2, P3, P5, and P6) and snap and lock battery pack connector enable the user to quickly build and evaluate a system with up to 32 daisy-chain devices.

Ordering Information appears at end of data sheet.

Benefits and Features

- Provides a Convenient Platform for Evaluating the Features and Functions of the MAX17853
- 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

MAX17853 EV Kit Files

FILE	DESCRIPTION
MAX17853_EV kit_Installer.exe	Software: Graphical User Interface (GUI)
MAX17853_UART_EV kit_SCH.pdf	Schematic File pdf
MAX17853_UART_EV kit_PCB.pdf	PCB Layout File pdf

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Quick Start (Single UART)

This procedure describes the setup and initialization of a two-module distributed daisy-chained system using the MAX17853 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

- Two MAX17853 EV kits (cables included)
- One Single UART MAX17841B EV kit (includes the MINIQUSB+ interface board)
- 9V to 65V DC power supplies (refer to the MAX17853 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 MAX17853 EV kit is fully assembled and functionally tested prior to shipment. Follow the steps below to become acquainted with the MAX17853 EV kit and initialize the single-UART EV kit communication. Enable power supplies only after all connections have been completed:

1) Install the MAX17853 EV kit software on your computer by running the MAX17853_EV kit_Installer.exe.

2) Connect the MINIQUSB+ to the J3 and J4 headers on the single-UART MAX17841B EV kit.

3) Connect the USB cable from the PC to the MINIQUSB+ board. A **Building Driver Database** window pops up in addition to a **New Hardware Found** message if this is the first time the EV kit board is connected to the PC. If a window is not seen like the one described above after 30s, remove the USB cable from the MINIQUSB+ and reconnect

Figure 1. MAX17853 EV Kit System for Single UART

again. Administrator privileges are required to install the USB device driver on Windows XP, Windows Vista, Windows 7, and Windows 10.

4) Follow the directions of the **Add New Hardware Wizard** to install the USB device driver. Choose the **Search for the Best Driver for Your Device** option. Specify the location of the device driver to be C:\Program Files\MAX17853 (default installation directory) using the Browse button. Refer to the USB_Driver_Help.pdf document included with the software for additional information.

5) Download and install the appropriate FTDI drivers from https://www.ftdichip.com/Drivers/D2XX.htm if required.

6) Ensure that all jumper shunts and switches are configured as listed in Table 1, Table 2, and Table 3.

7) For purposes of evaluation a single power supply can be used to power all MAX17853 EV kits in a system with a common ground. Configure the DC power supply and disable the output.

8) Connect each MAX17853 EV kit PACK+ and PACK- to the power-supply output. Terminate PACK+ to the power-supply positive output and PACK- to the power-supply negative output.

9) Connect the four 2-wire black/blue crossover cables, as described below:

a) Connect P1 on the MAX17841B EV kit to RXLP_CONN on the first MAX17853 EV kit

b) Connect P2 on the MAX17841B EV kit to TXLP_CONN on the first MAX17853 EV kit

c) Connect TXUP_CONN on the first MAX17853 EV kit to RXLP_CONN on the second MAX17853 EV kit

d) Connect RXUP_CONN on the first MAX17853 EV kit to TXLP_CONN on the second MAX17853 EV kit

Note: The connections mentioned in steps 1–4 can be generalized for any number of devices within a daisy-chain (up to 32). These connections are also illustrated within the GUI for quick reference.

10) On the second MAX17853 EV kit, connect the 2-wire red/black loopback cable from TXUP_CONN to RXUP_CONN.

11) Enable the DC power supply.

12) Start the MAX17853EV KIT software by opening its icon in the Start Programs menu. The EV kit GUI software automatically establishes communication with the Maxim MINIQUSB+ interface. The status bar at the bottom of the GUI displays **Maxim MINIQUSB+**

V02.05.xx and **UART Not Initialized** (see Figure 8). With the MINIQUSB detected, the user can proceed to the next step.

13) In the **Communication** tab (Figure 8), click on the **Single UART with External Loopback** radio button.

14) Select the **Initialization** tab (Figure 13).

15) Click the **Wakeup** button.

16) Click the **Hello ALL** button.

17) In the bottom-right side of status bar, verify communication is established with the UART. Status will read **Single UART Connected**.

In the **Event Log** group box, verify:

18-08-13 14:22:20 HelloAll Successful

18-08-13 14:22:20 Dev0 MAX17853 Ver 4

18-08-13 14:22:20 Dev1 MAX17853 Ver 4

18-08-13 14:22:20 UART device ready

18) The EV kit is ready for further evaluation.

Table 1. MAX17853 EV Kit Default Jumper Settings

JUMPER	SHUNT POSITION
P+B14, B0P-	Installed
THERM0–THERM5	On one pin only

Table 2. MAX17841B EV Kit Default Jumper Settings

JUMPER	SHUNT POSITION
JU1–JU4, JU6, JU7	On one pin only
JU5	1-2

Table 3. MAX17841B EV Kit Default Switch Settings

SWITCH	SETTING
SW1, SW2	ON position

Notes:

1) The default position of the SW1 and SW2 battery-emulation resistor ladder is OFF (actuators toward battery connector J7), and the setup is for a battery-pack supply.

2) The optional position of SW1 and SW2 is ON (actuators toward MAX17853), and the setup is for an external power-supply input between PACK+ and PACK- with the 2kΩ resistor ladder.

MAX17853 EV Kit Hardware Description

The MAX17853 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.
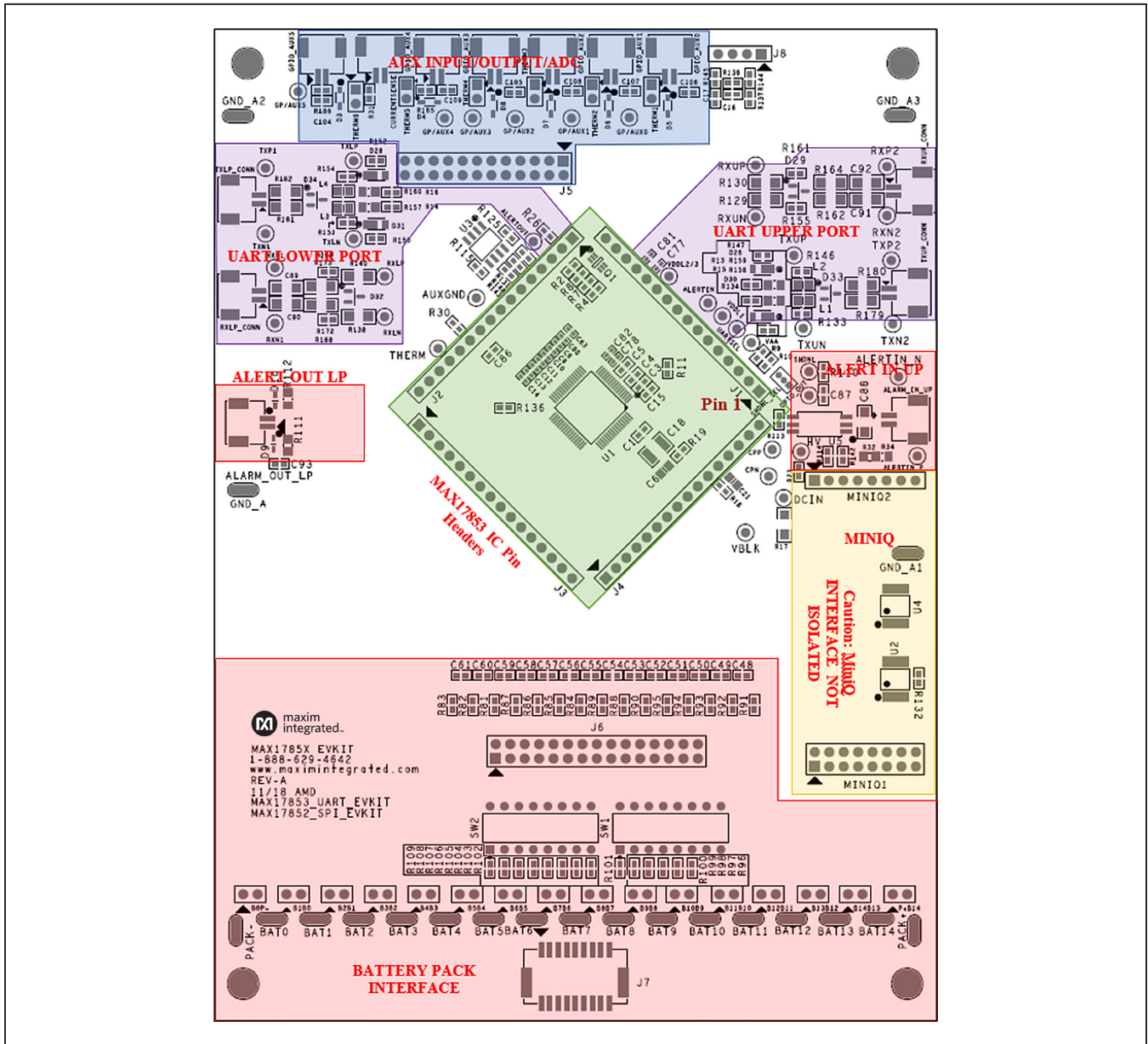

Figure 2. MAX17853 EV Kit PCB

Battery-Pack Connector (J7)

Power is applied to the MAX17853 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. **Caution:** Only apply a jumper to B0P- and P+B14 when using a battery pack. Placing a jumper on any battery pin header with a battery pack connected places a direct short on the battery-pack cell.

To power the MAX17853 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 MAX17853 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 MAX17853 cell-voltage measurement inputs (C0–C14), place all SW1 and SW2 switches in the closed or 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 MAX17853.

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 MAX17853 IC.
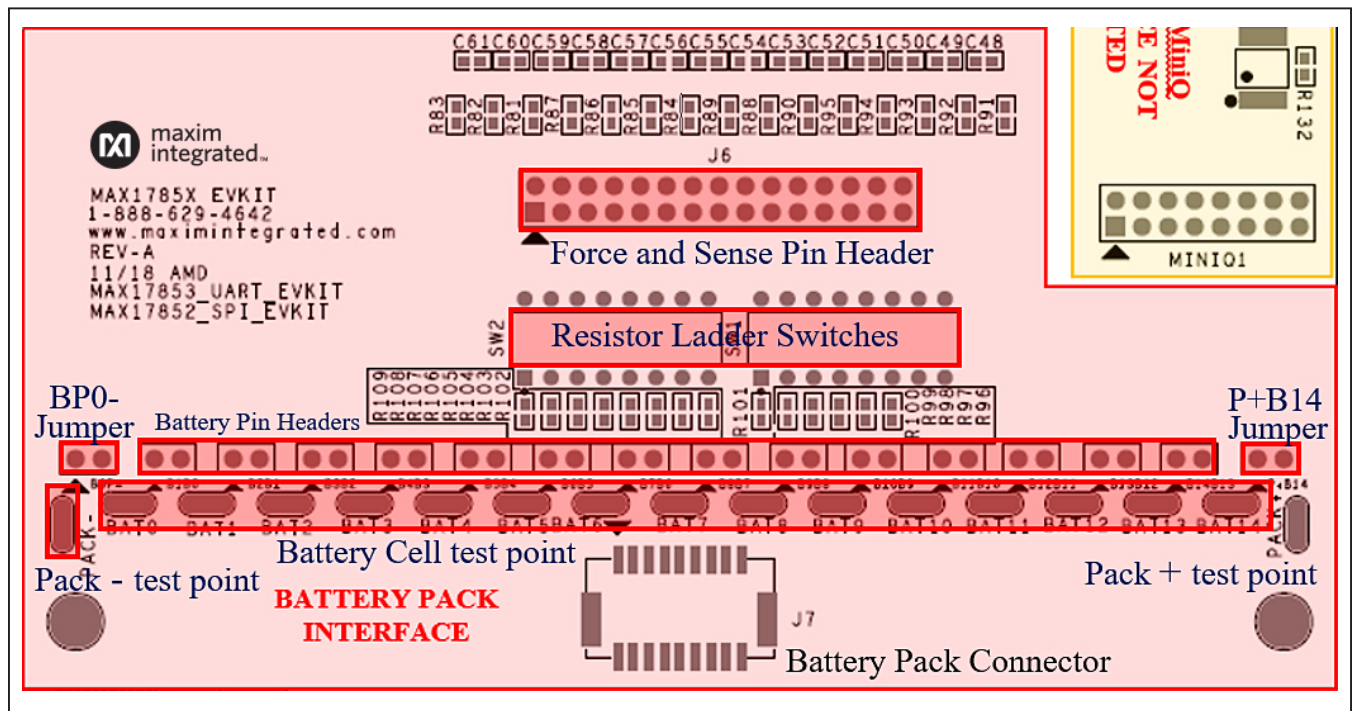

Figure 3. MAX17853 Battery Interface

AUX Input/Output/ADC

The auxiliary (AUX) input/output/ADC section of the EV kit PCB (see Figure 4) gives the user access to the MAX17853 AUX GPIO pins and THRM pin. Each GPIO_AUX connector is equipped to interface directly to NTC thermistors for external temperature measurement. With the THERMn jumper installed, the NTC sensor is pulled up through a 10kΩ resistor to the THRM pin on the MAX17853. This feature allows the user to turn on or off the 10kΩ pullup through the THRM pin for energy conservation.

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 MAX17853.

UART Ports

The UART communication ports are identified as the upper port (RXU/TXU) and the lower port (RXL/TXL), with reference to the MAX17853 device on the EV kit PCB (see Figure 5). 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 MAX17853 EV kit in the daisy-chained system; however, isolation capability has not been tested on the MAX17853 EV kit.
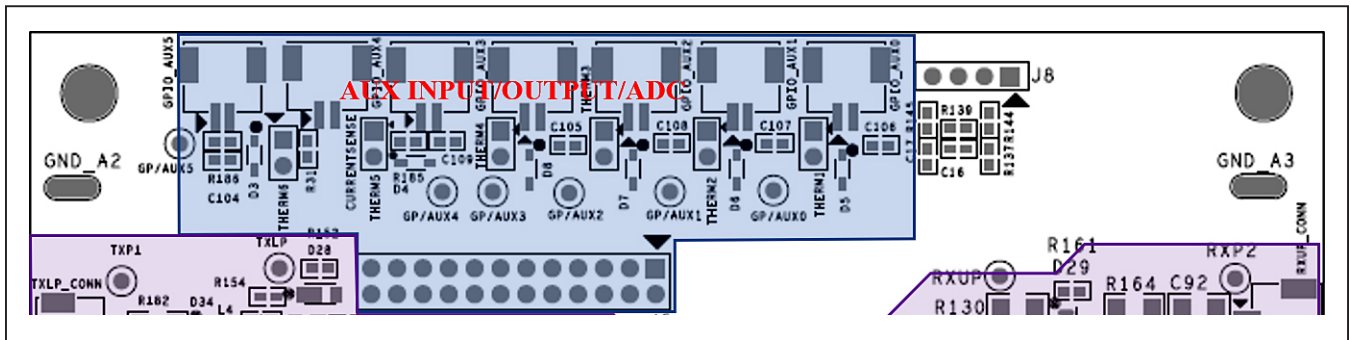

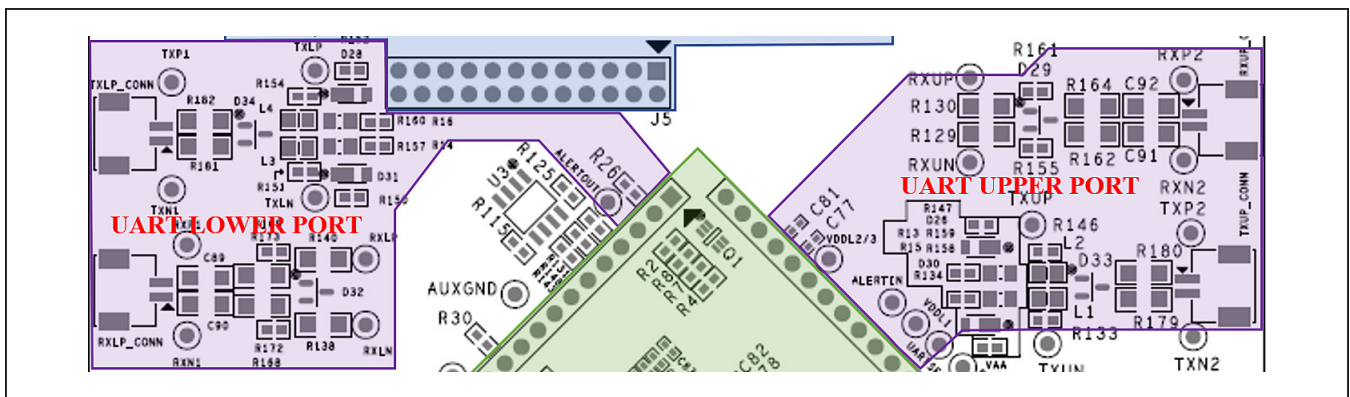
Figure 4. GPIO_AUX Port Access

Figure 5. UART Ports

MAX17853 IC Pin Headers (J1–J4)

Each pin on the MAX17853 is available for easy monitoring through the J1 IC pin header (see Figure 6). Header J1 is terminated to pins 1–16 on the MAX17853, 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.

Figure 6. MAX17853 IC Pin Header (J1)

MAX17841B EV Kit and MINIQUSB+

To complete the Maxim EV kit battery-management evaluation system, it is essential to include the MAX17841B EV kit. The MAX17841B EV kit contains the MAX17841B base board and the PC USB interface board (MINIQUSB+). Power and ground for the MAX17841B is derived through the MINIQUSB+ and require no other power source. It is critical to note that the MAX17841B EV kit provides the battery-management evaluation system with capacitive isolation on connectors P1 and P2. See Figure 7 for the MAX17841B EV kit PCB.
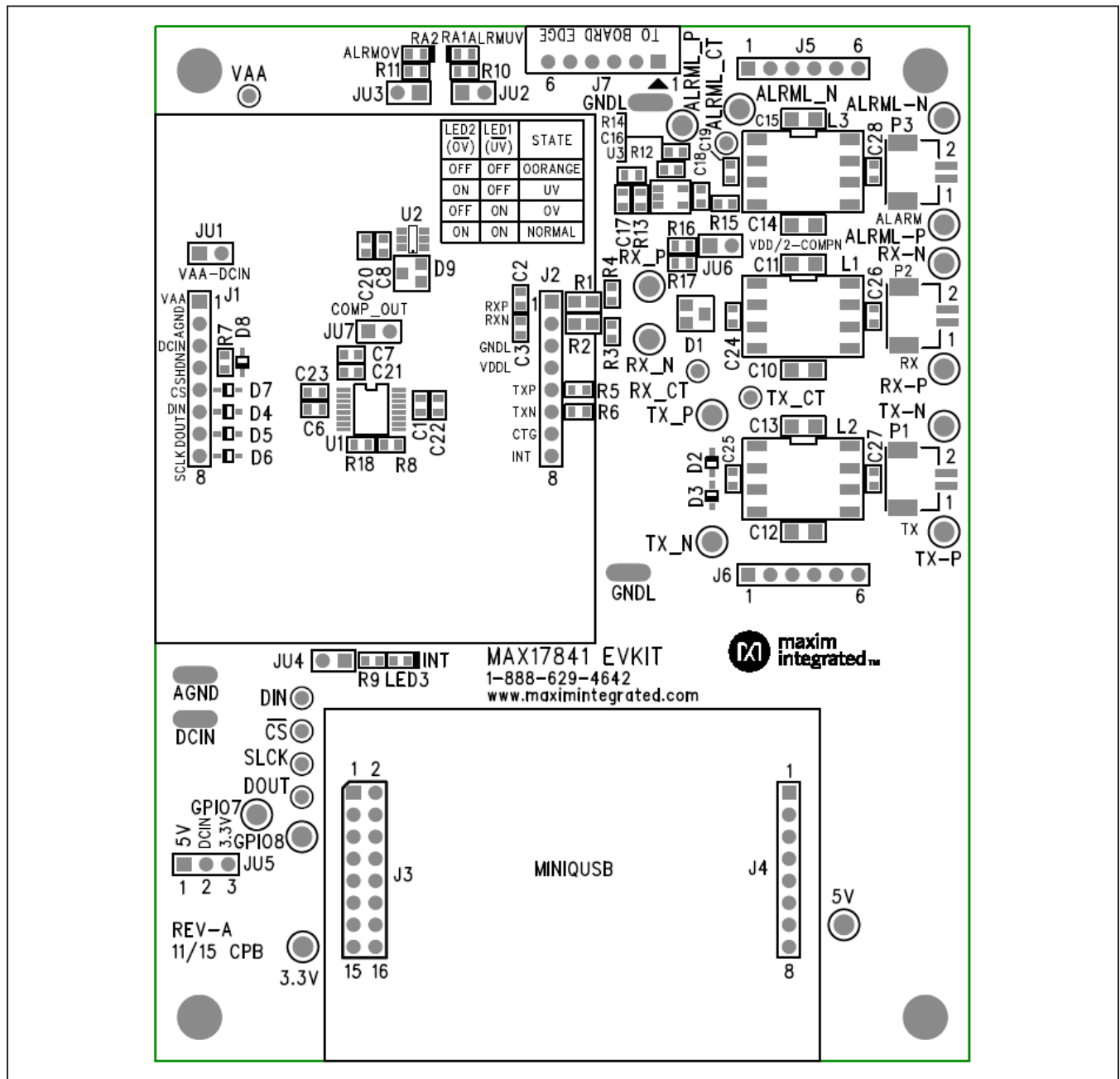
Figure 7. MAX17841B EV Kit PCB

Using the Graphical User Interface

The MAX17853 EV kit is evaluated in conjunction with the MAX17853 evaluation software. The graphical user interface (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 MINIQUSB+ interface board and places the user on the **Communication** tab (see Figure 8). 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 8). 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 MAX17841B EV kit and MAX17853 EV kit, it is imperative that system wiring match the UART configuration selected.

The MAX17853 EV kit is designed to support **Single UART Interface with External Loopback**, as shown in Figure 10. Follow the UART wiring changes shown in Figure 9, Figure 11, and Figure 12 for alternative UART configurations.

Located in the **Communication** tab (Figure 8) 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).
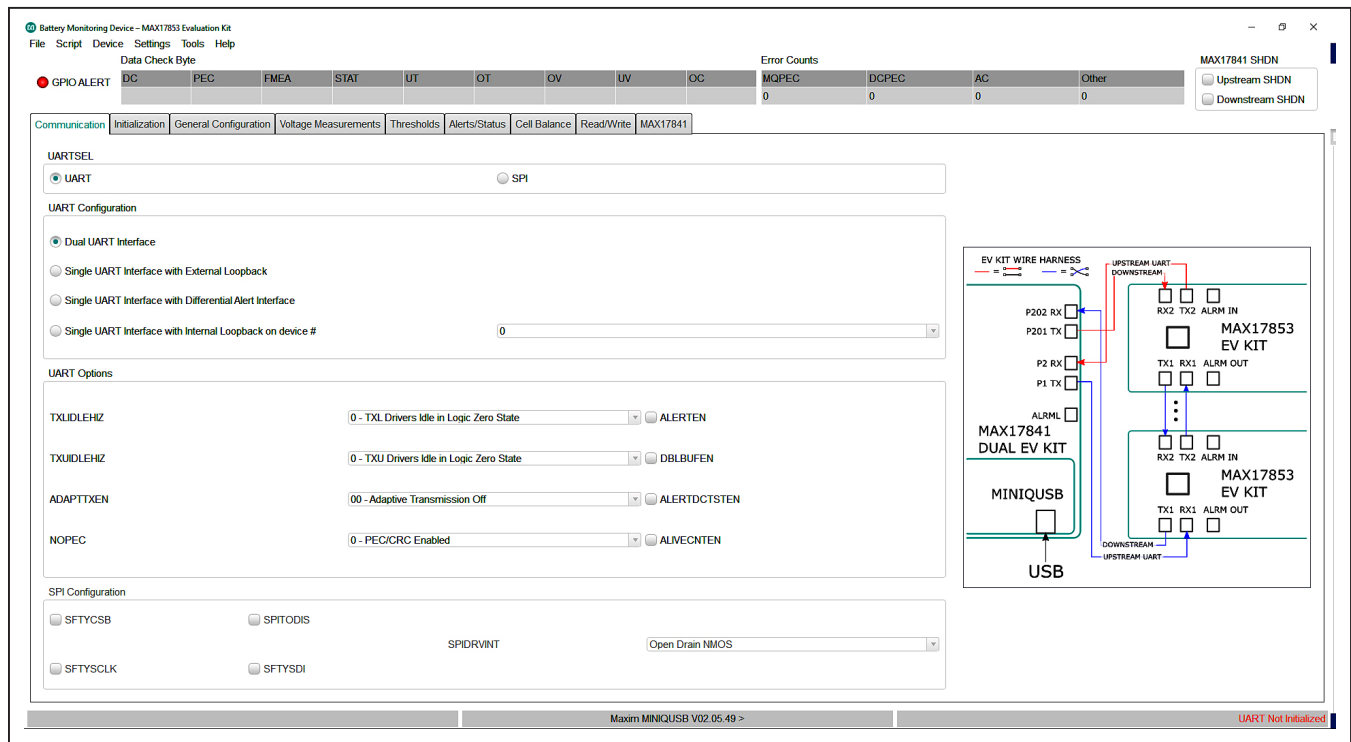

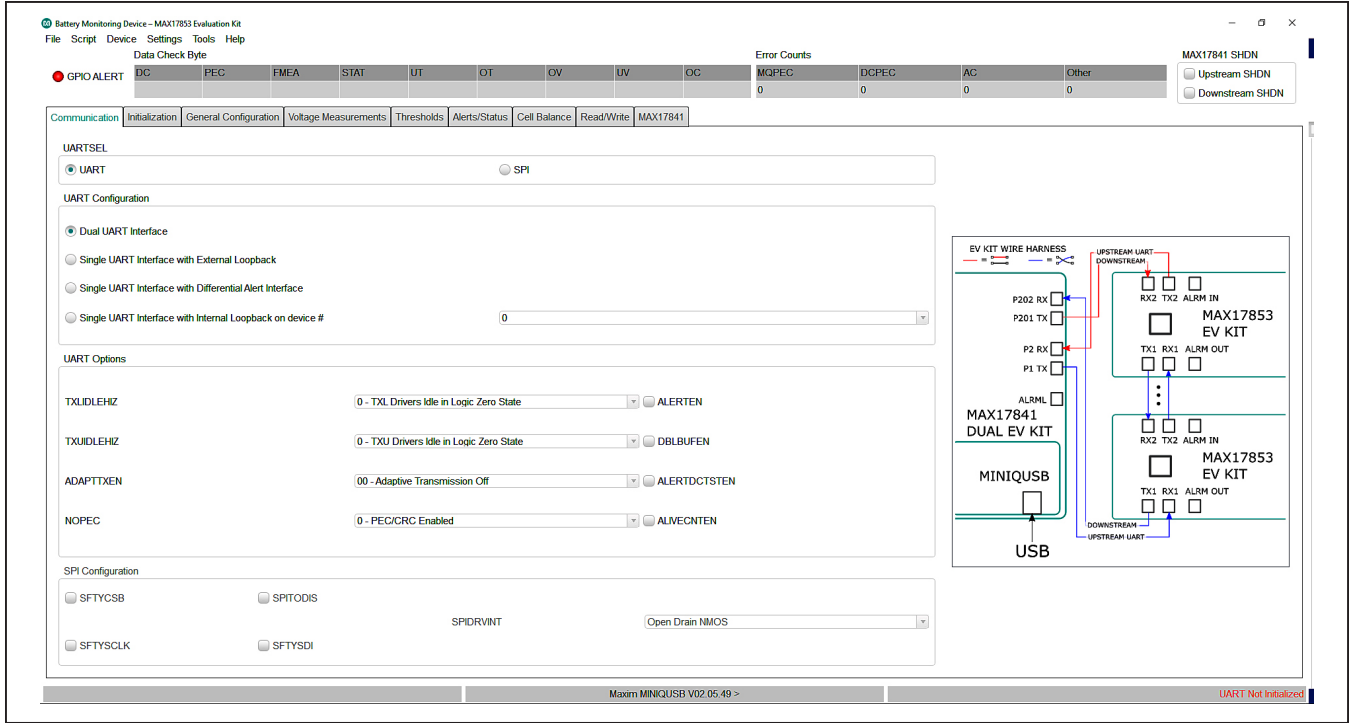Figure 8. Communication Tab

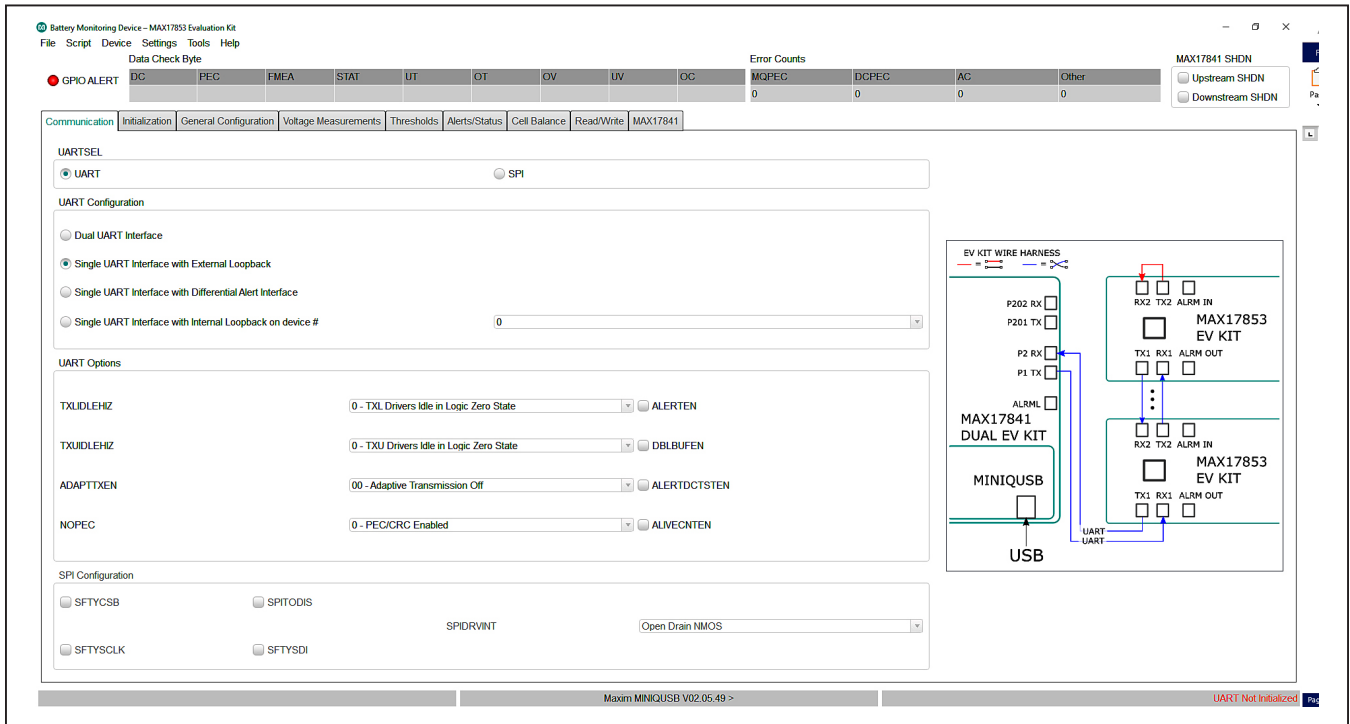Figure 9. Dual UART Interface

Figure 10. Single UART Interface with External Loopback
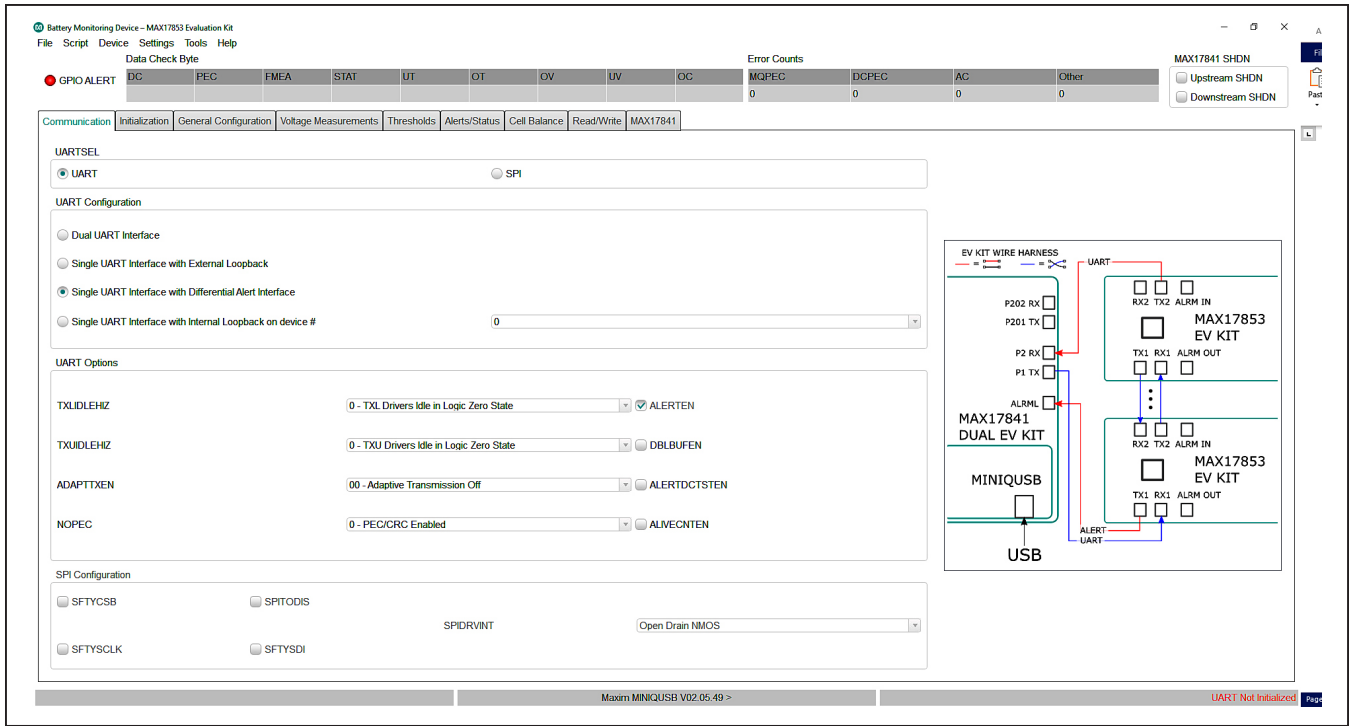
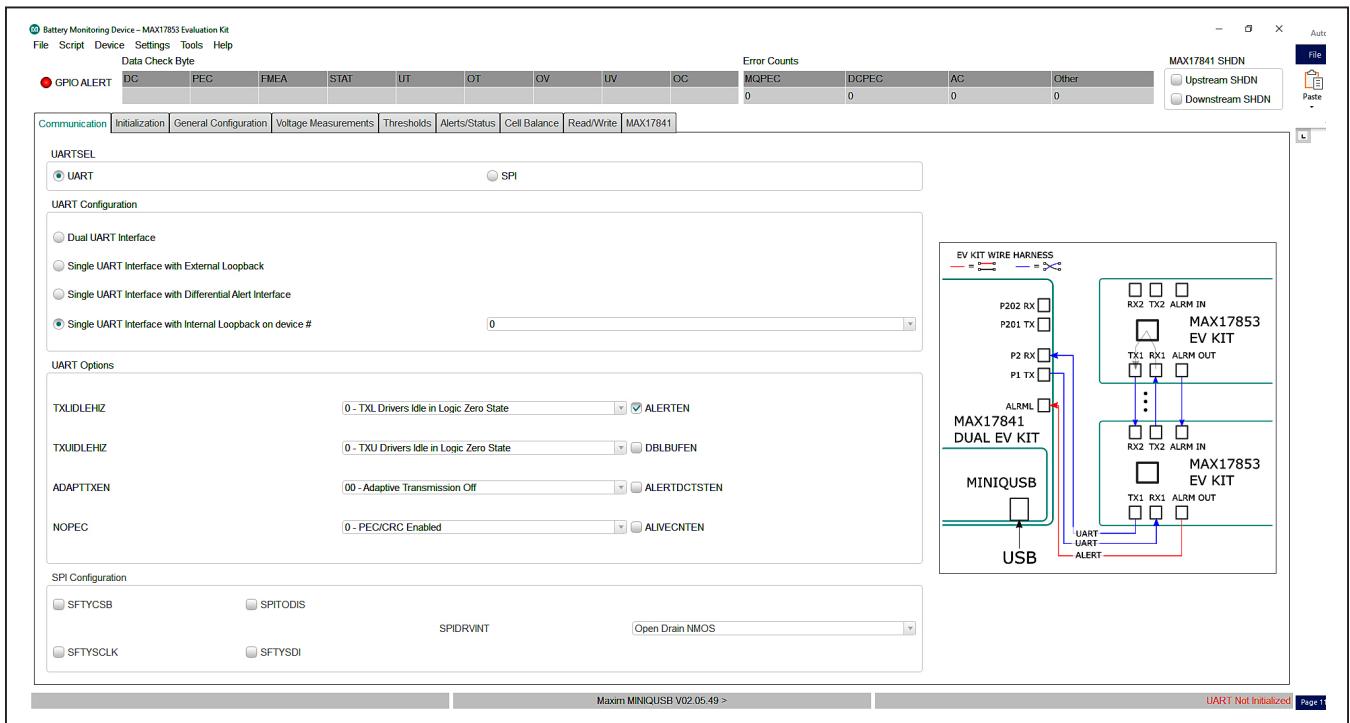Figure 11. Single UART Interface with Differential Alert Interface

Figure 12. Single UART Interface with Internal Loopback on Device#

Initialization Tab

The **Initialization** tab (see Figure 13) 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 will only be 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 *MAX17853 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.

Note: The **FORCEPOR** button commands a soft-reset to all MAX17853 devices in the daisy-chained system.

General Configuration Tab

The **General Configuration** tab (see Figure 14) is used for programming settling times for **AUXTIME**, **CELLDLY** and **SWDLY**. The FlexPack feature enable and programming is easily controlled through 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 *MAX17853 IC data sheet*.
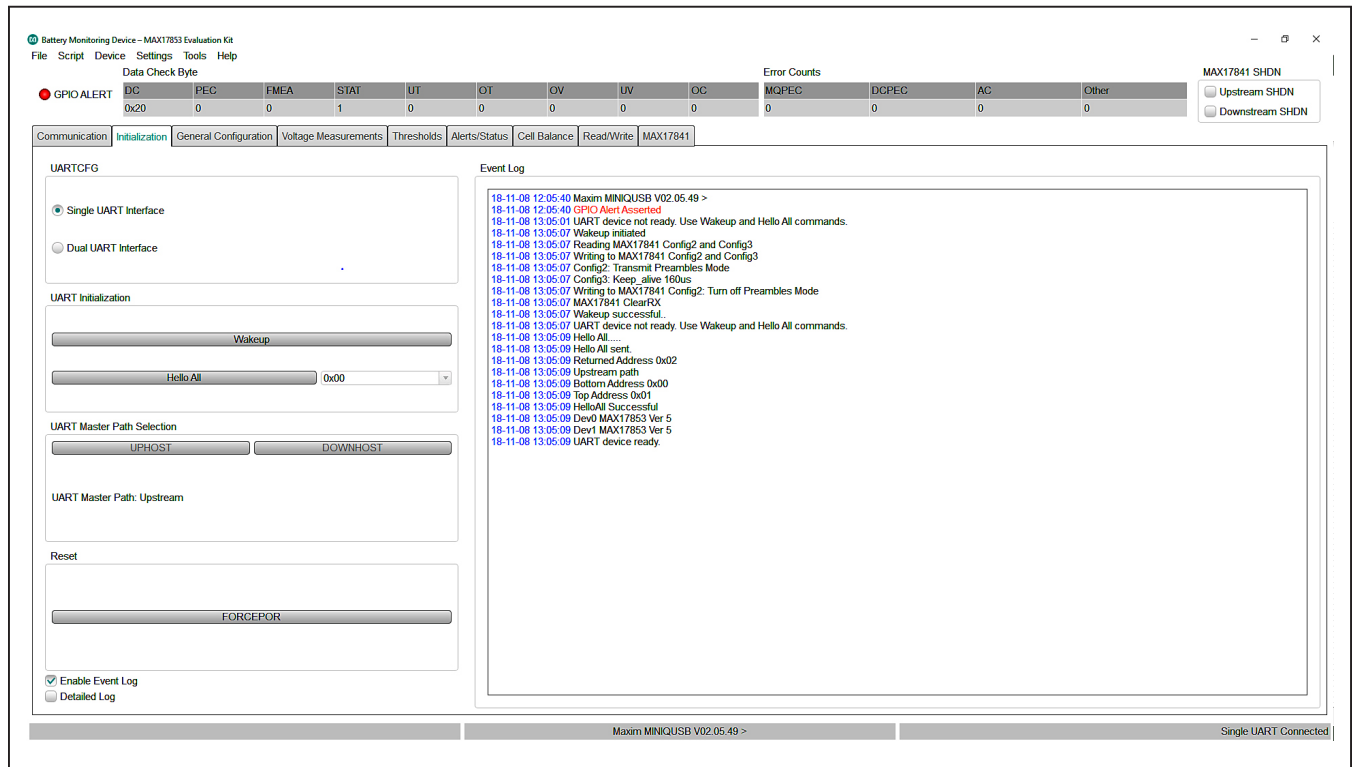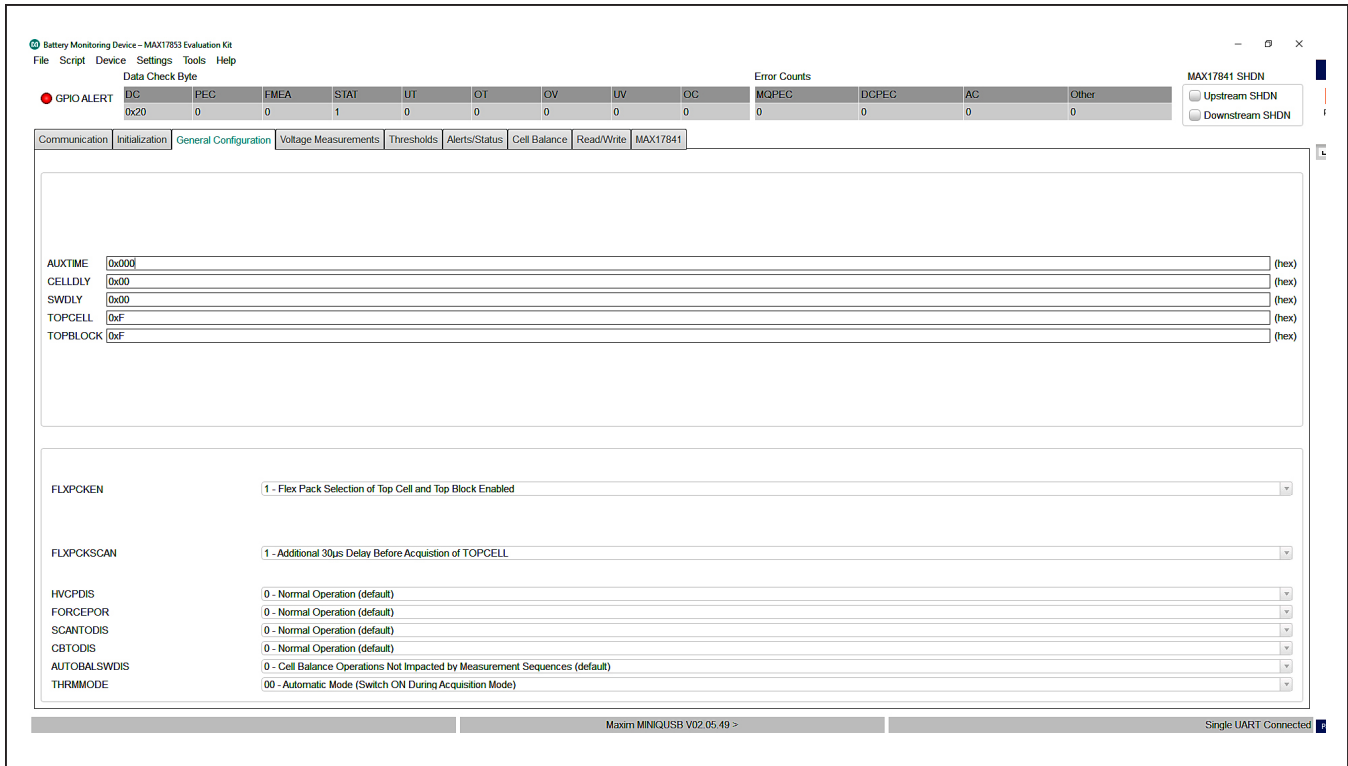

Figure 13. Initialization Tab

Figure 14. General Configuration Tab

Voltage Measurements Tab

The **Voltage Measurements** tab (see Figure 15) 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.

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 Figure 16 and Figure 17).

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 18).

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 MAX17853 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 MAX17853 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 controlled with a button click enable and a drop-down **Coefficient Selection**.

The **Diag Settings** button in the **Voltage Measurements** tab gives the user control of diagnostic current sources and diagnostic terminations within the MAX17853 device. The user can update diagnostic control for one device or for all devices in the system.
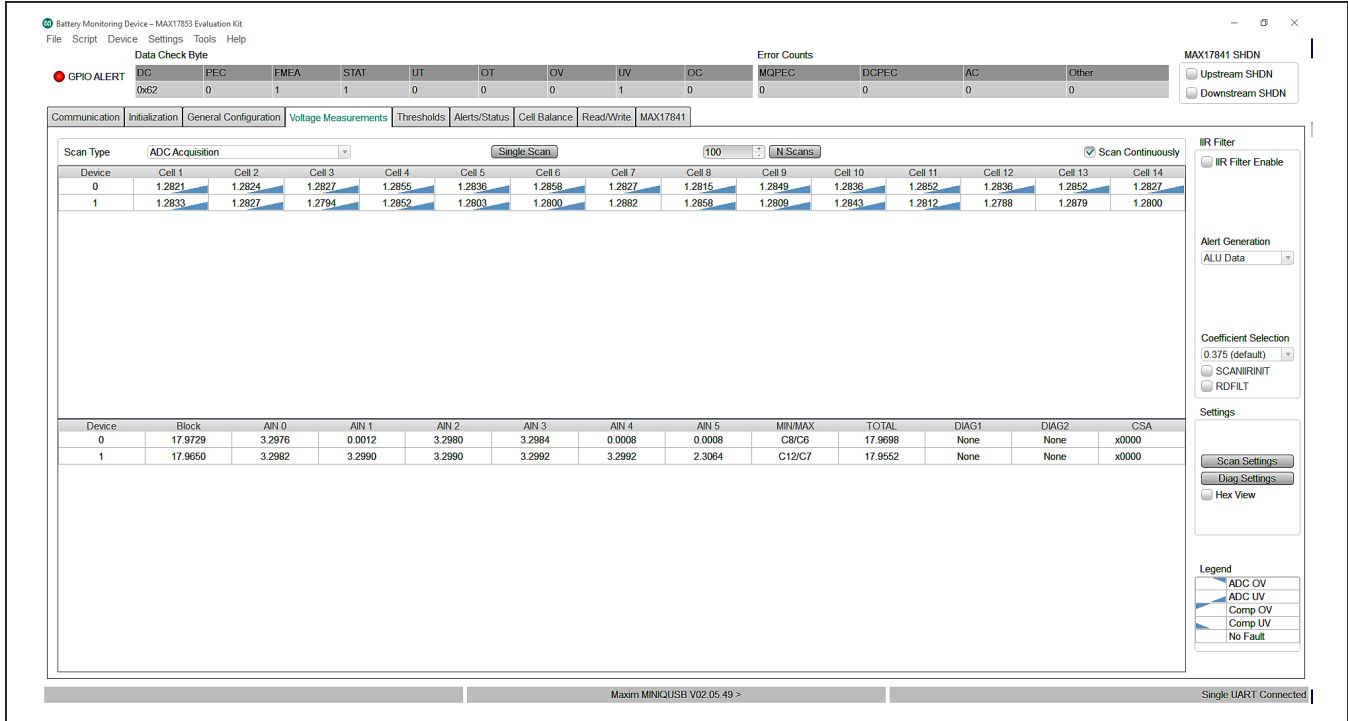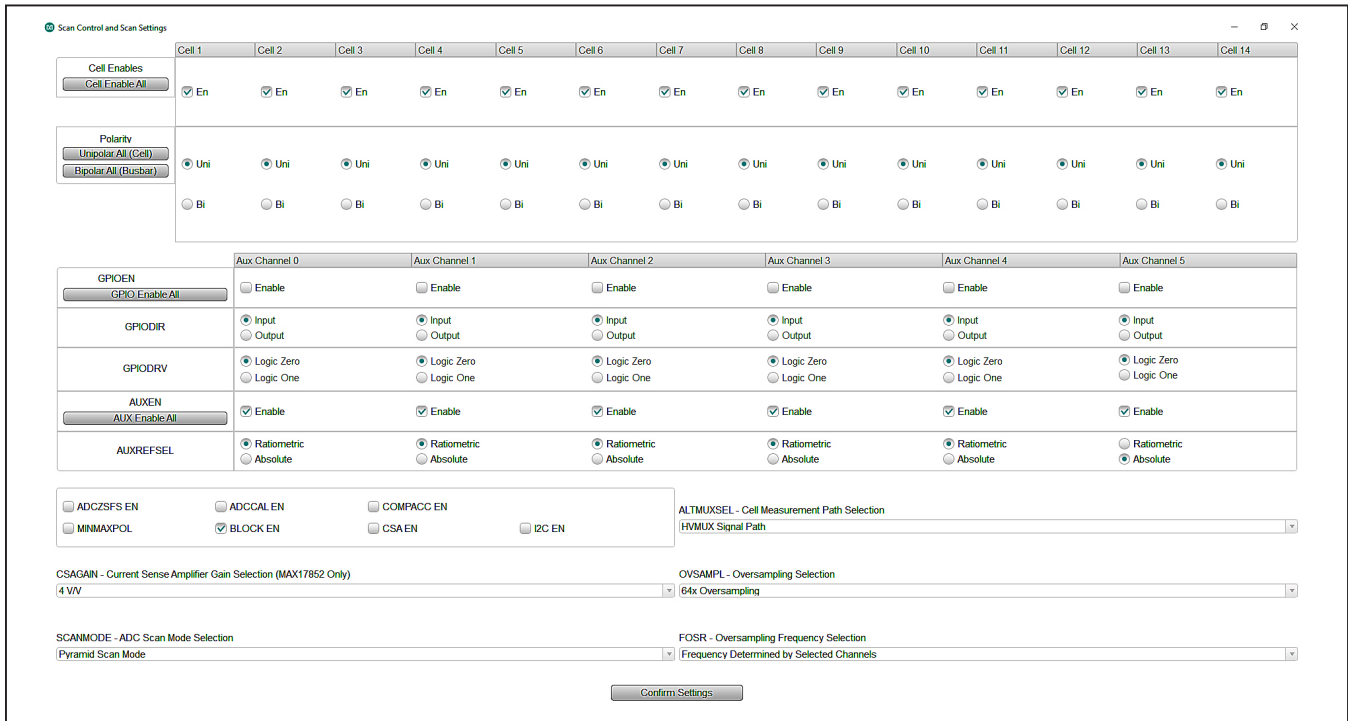
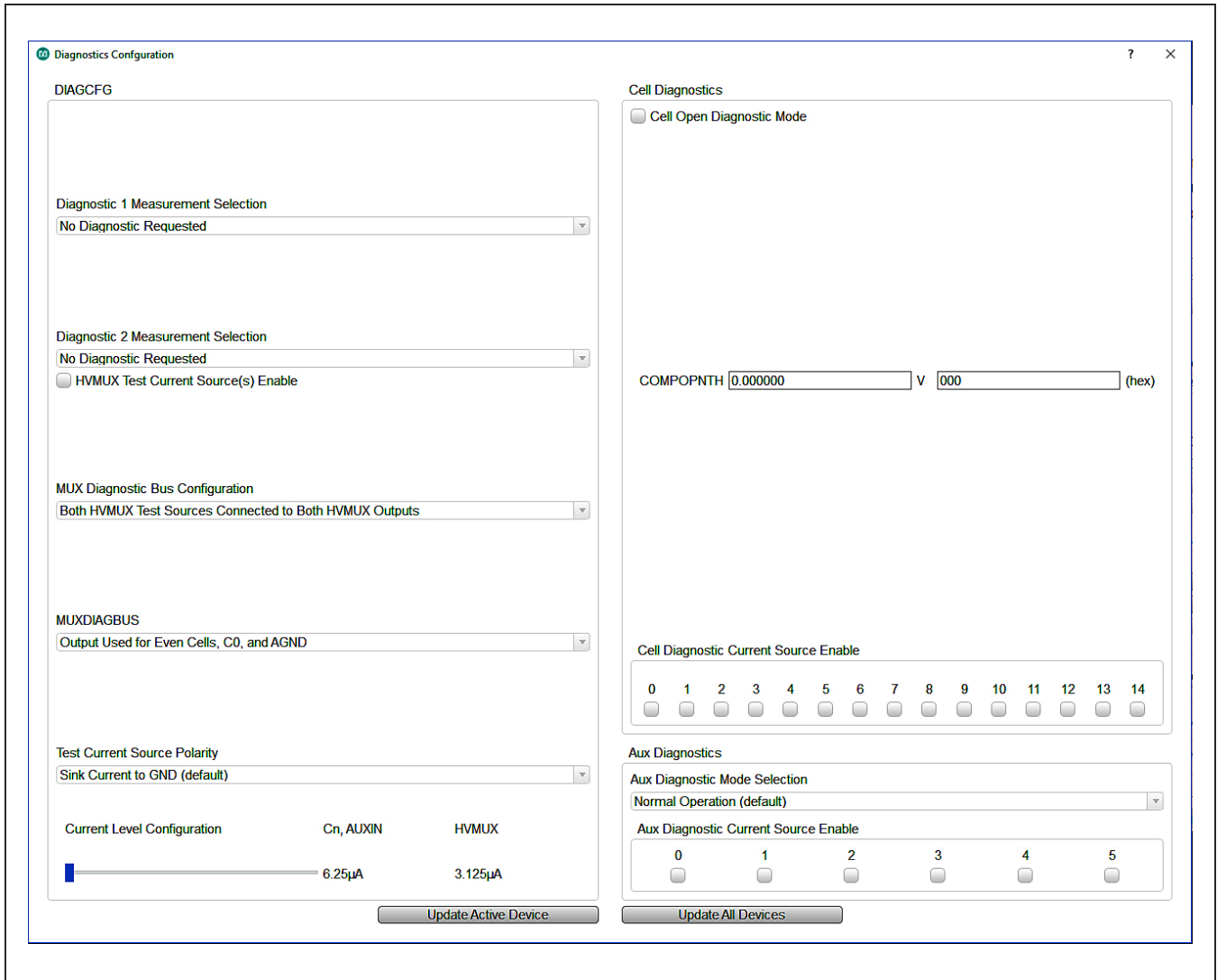Figure 15. Voltage Measurements Tab

Figure 16. Scan Settings Panel

Figure 17. Diagnostic Settings Panel

Thresholds Tab

Clicking on the **Thresholds** tab (see Figure 18) opens the panel where users can enter OV/UV and fault thresholds in hex value or voltage (see Figure 19).

Clicking the **Alert Enables** button in the top-right corner of the **Thresholds** tab opens the **Alert Enable** panel (see Figure 19).

Alerts/Status Tab

By selecting the **Active Device** from the drop-down list, the **Alerts/Status** tab (see Figure 20) displays the fault status of the MAX17853 in the system.

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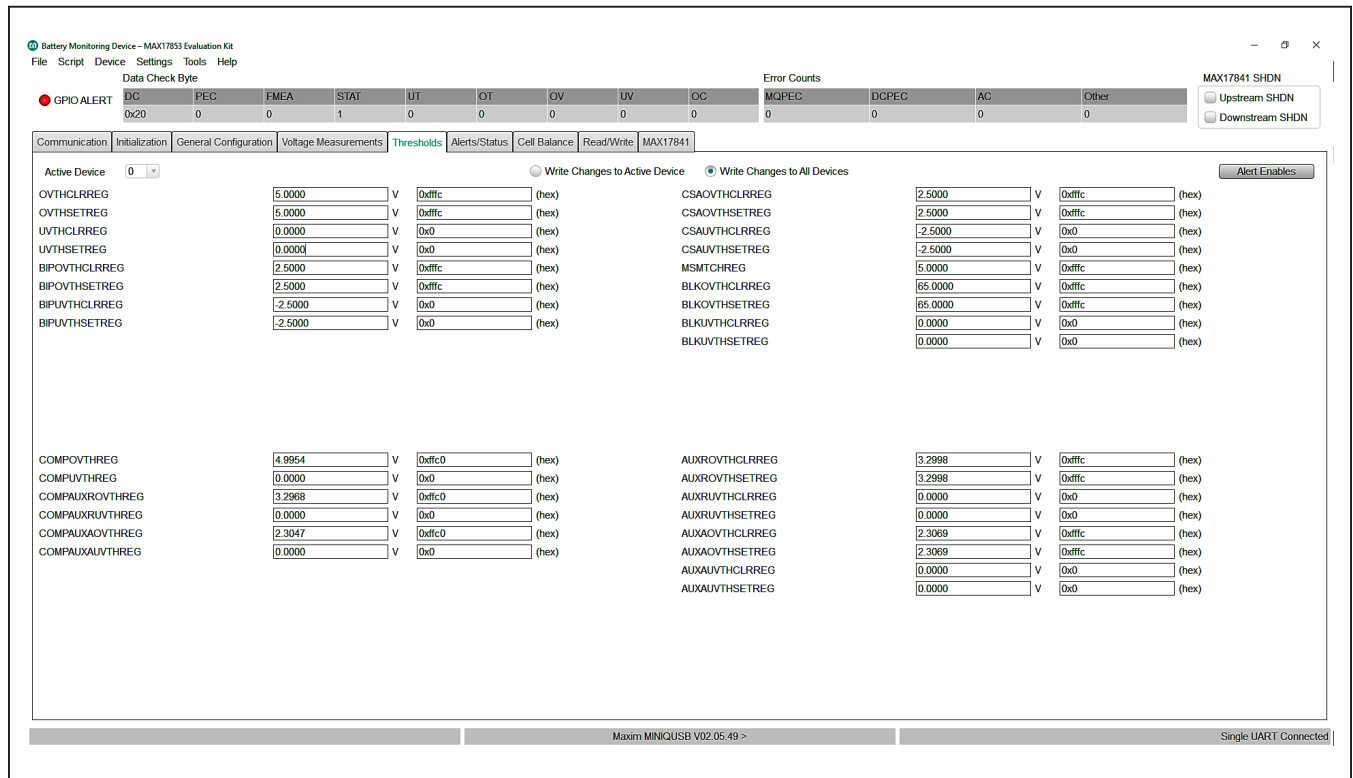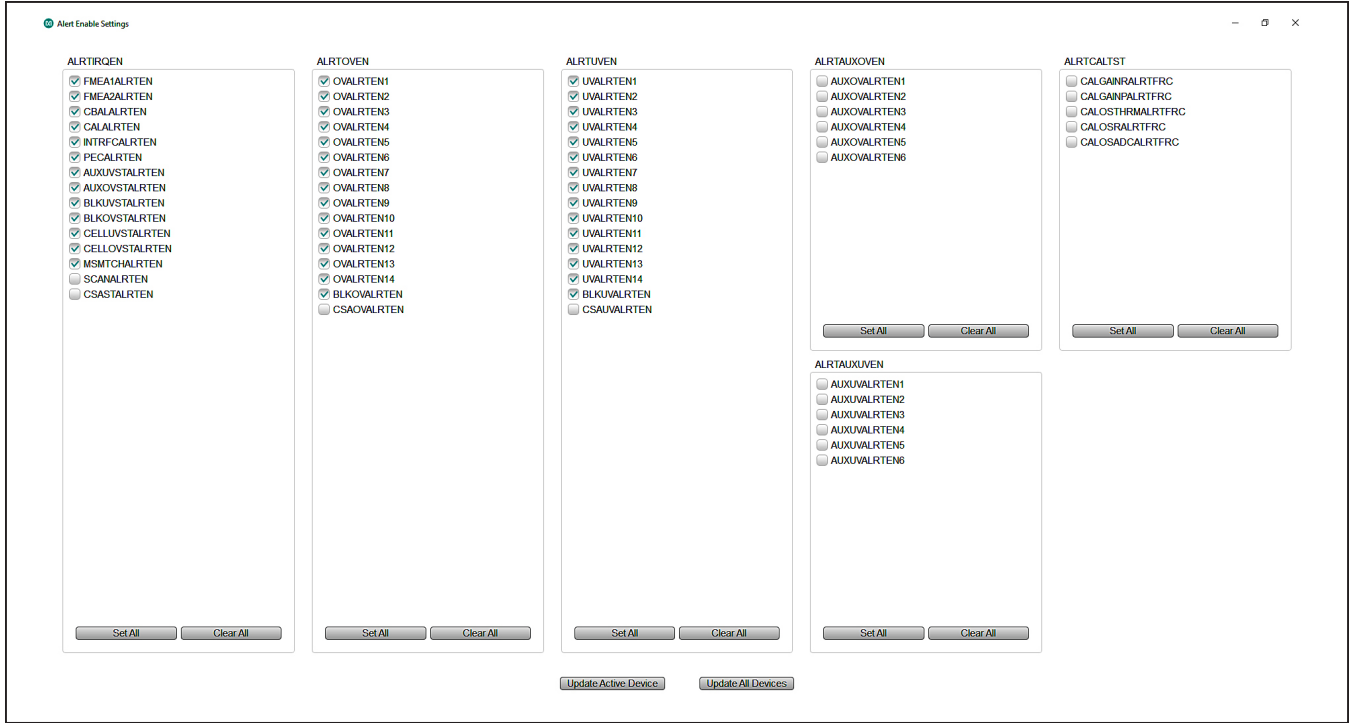

Figure 18. Thresholds Tab
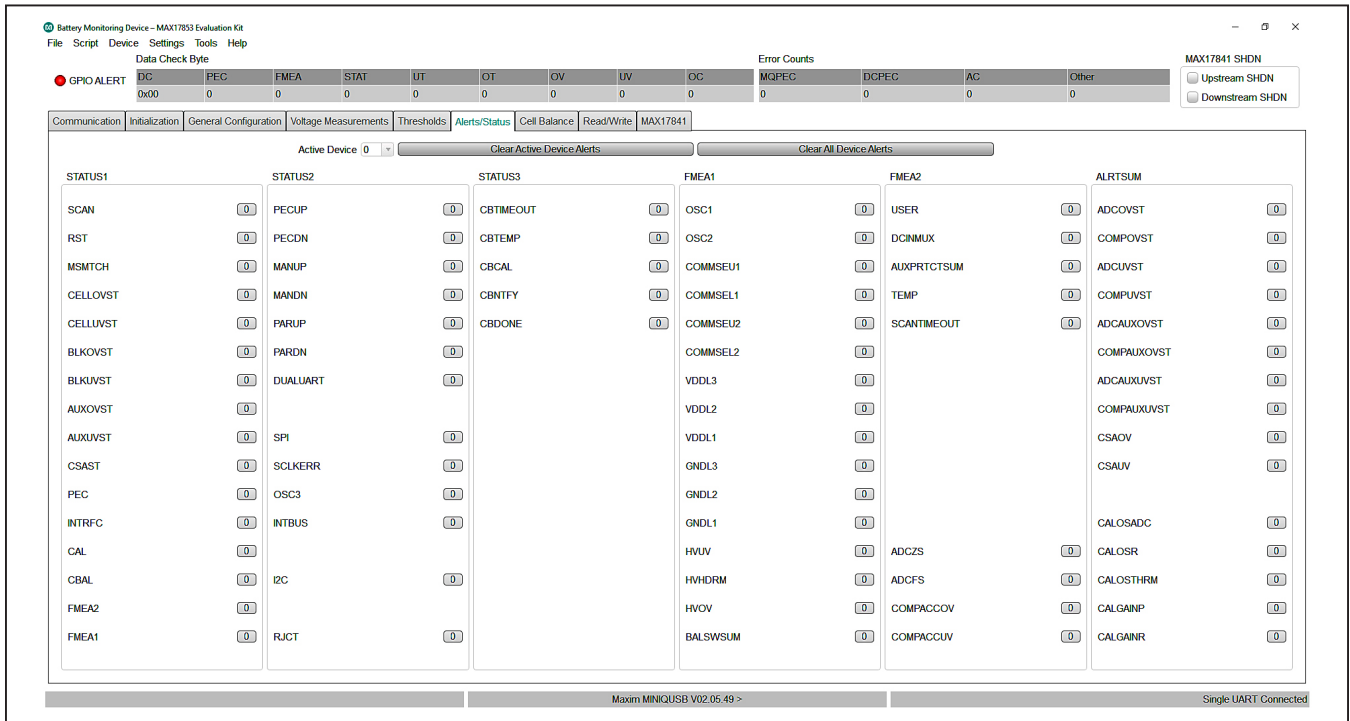
Figure 19. Alert Enable Panel

Figure 20. Alerts/Status Tab

Cell Balance Tab

The **Cell Balance** tab (see Figure 21) gives the user the flexibility for manual and automatic control of the MAX17853 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 20), 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 MAX17853 to control the activation according to the user-set parameters. From the **Cell Balance** tab (Figure 21), 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.
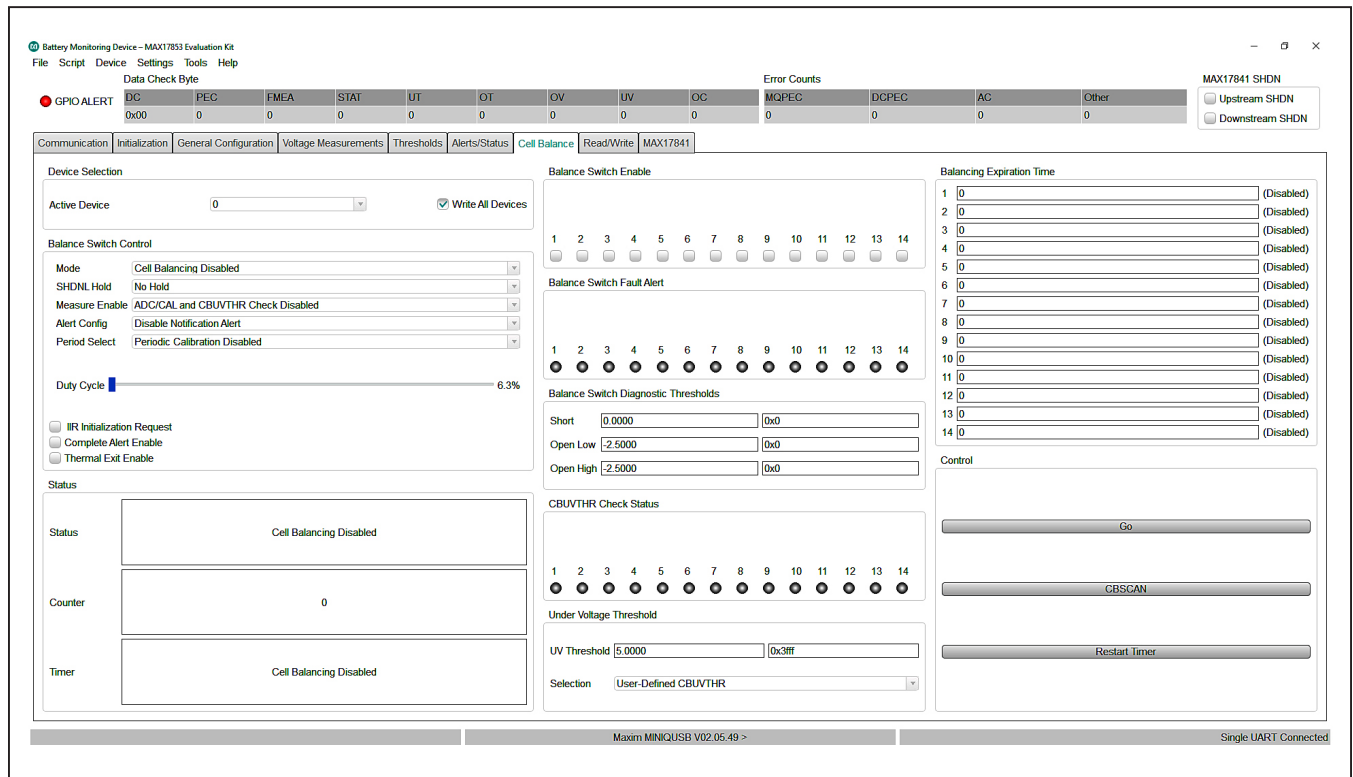

Figure 21. Cell Balance Tab

Read/Write Tab

The **Read/Write** tab ([Figure 22](#)) provides direct access to the read and write registers of the MAX17853. 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** group box, **Write All** group box provide alternative methods to write to specific registers in specific addressed devices.

MAX17841 Tab

The MAX17841B registers can be directly modified using the **MAX17841 Register Map** sub-tab (see [Figure 23](#)). A pull-down arrow to the left of the address number allows the user to identify register content. As an example, [Figure 23](#) shows register 0x11 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.

Similarly, the **SPI Commander** sub-tab shown in [Figure 24](#) can be used to send SPI commands to the MAX17841B in an SPI-controlled system.
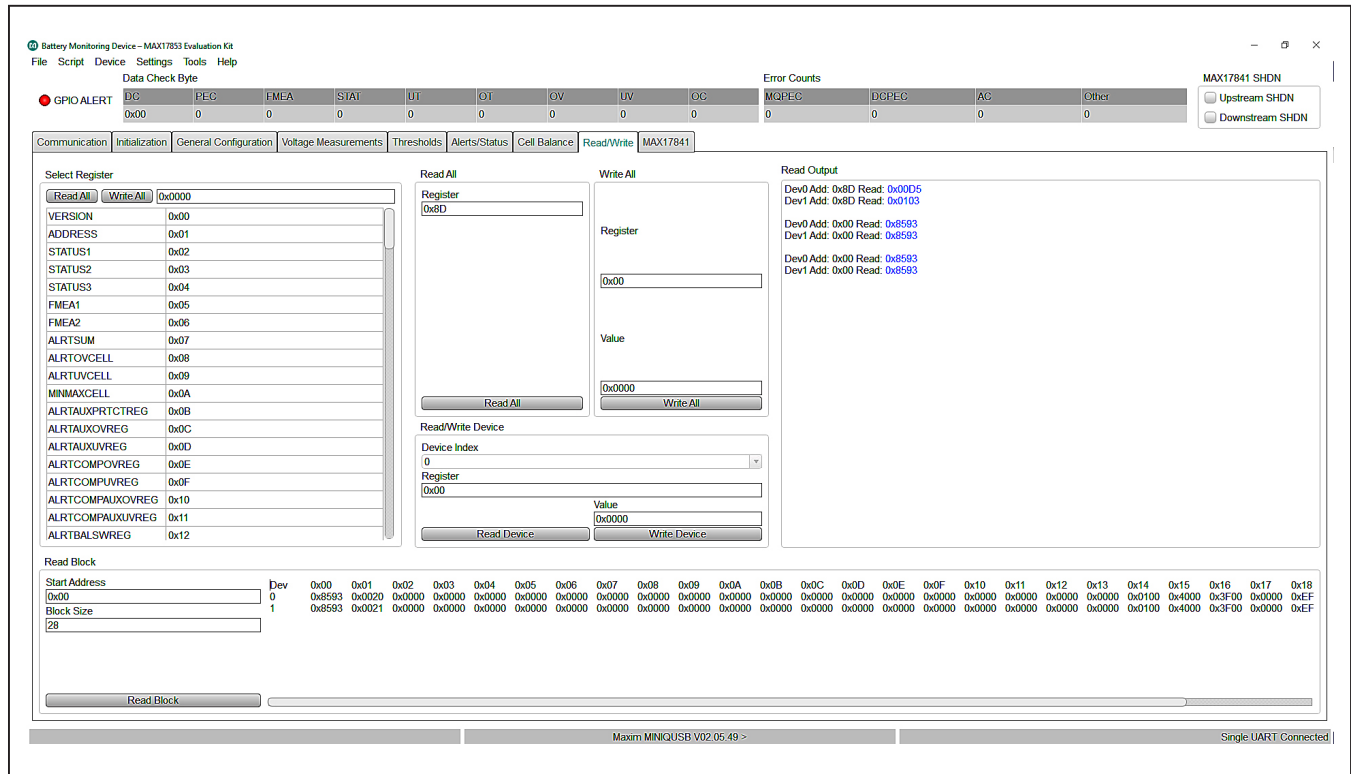
Figure 22. Read/Write Tab
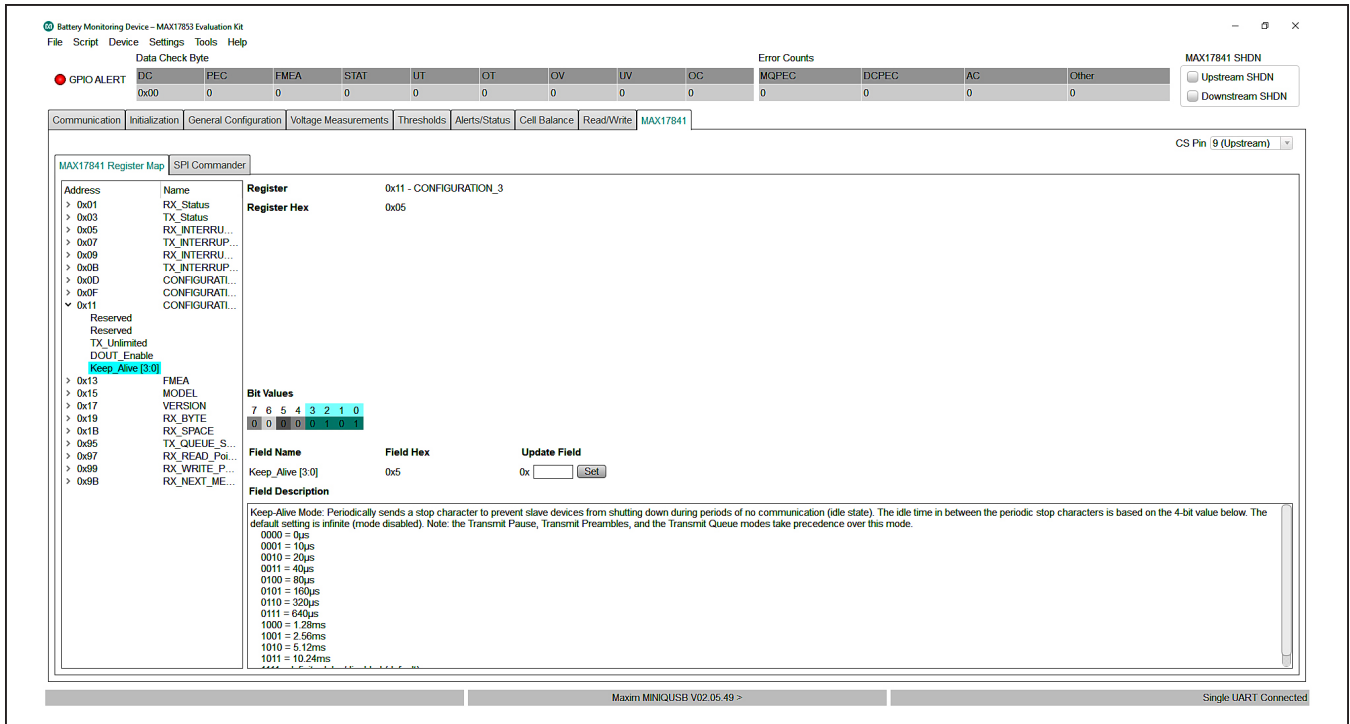
Figure 23. MAX17841 Tab (Register Map Panel)
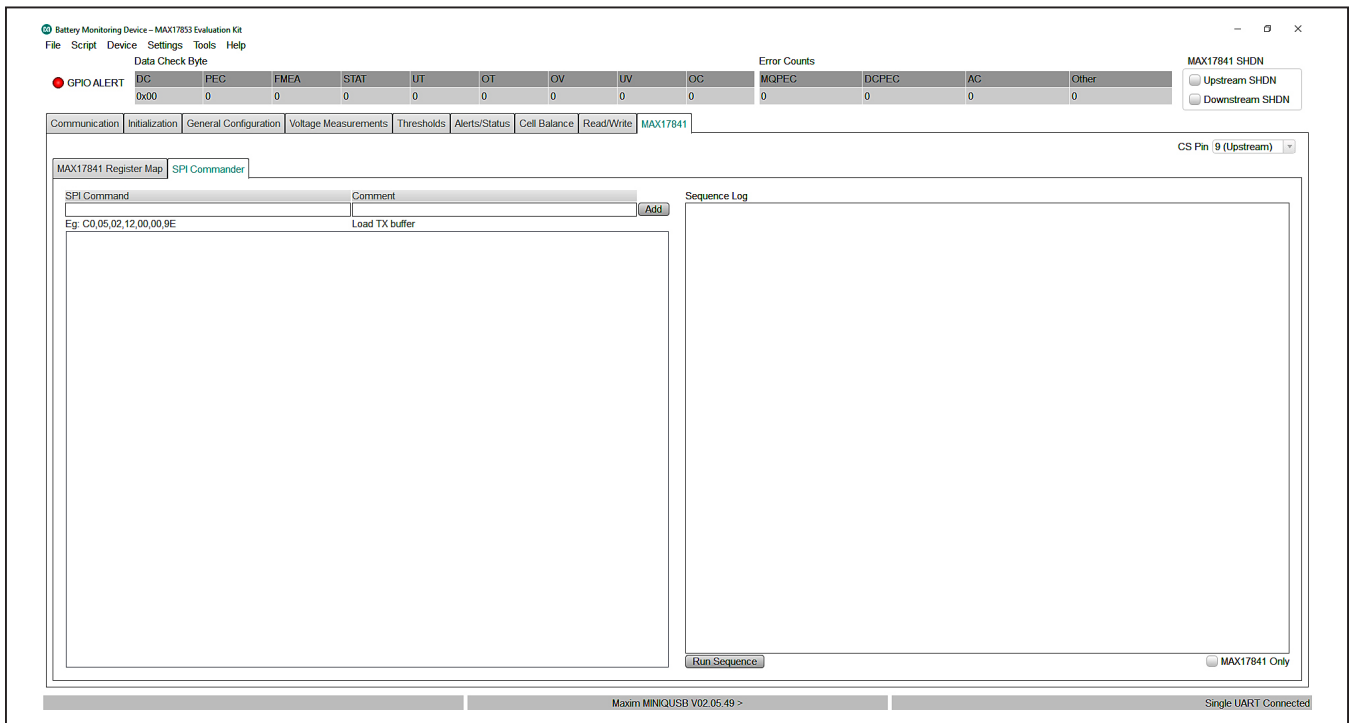
Figure 24. MAX17841 Tab (SPI Commander Panel)

GUI File Options

The **File** menu drop-down list on the GUI (see Figure 25) offers powerful tools such as **Log Scan Data**, **Save Register Configuration**, **Load Register Configuration**, as well as **Restart** and **Exit**.

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** and the **File Path and Root Name** of the location where the data should be stored. Conversion data will be taken according to user-set parameters like **Oversample** settings and **IIR Filter Enable**.
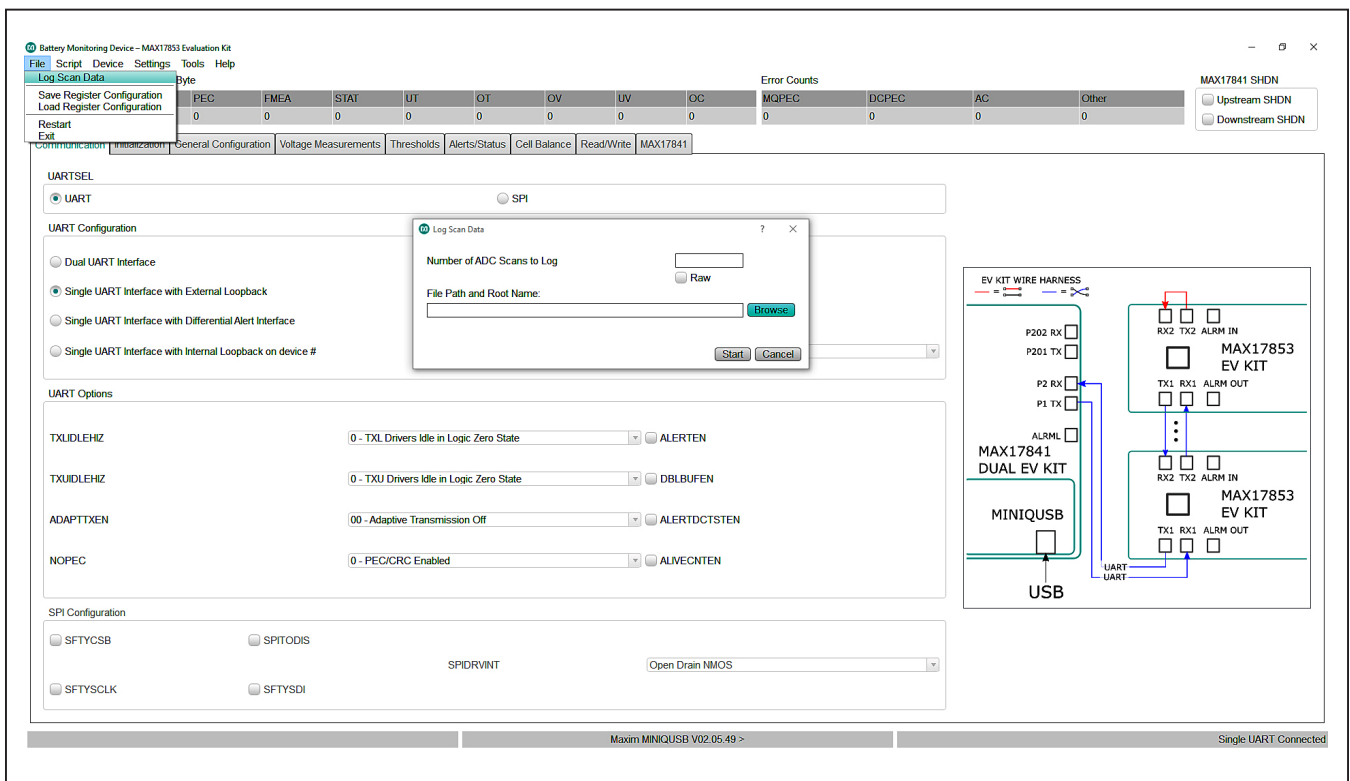
Figure 25. Log Scan Data

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, as shown in Figure 25. 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.

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.
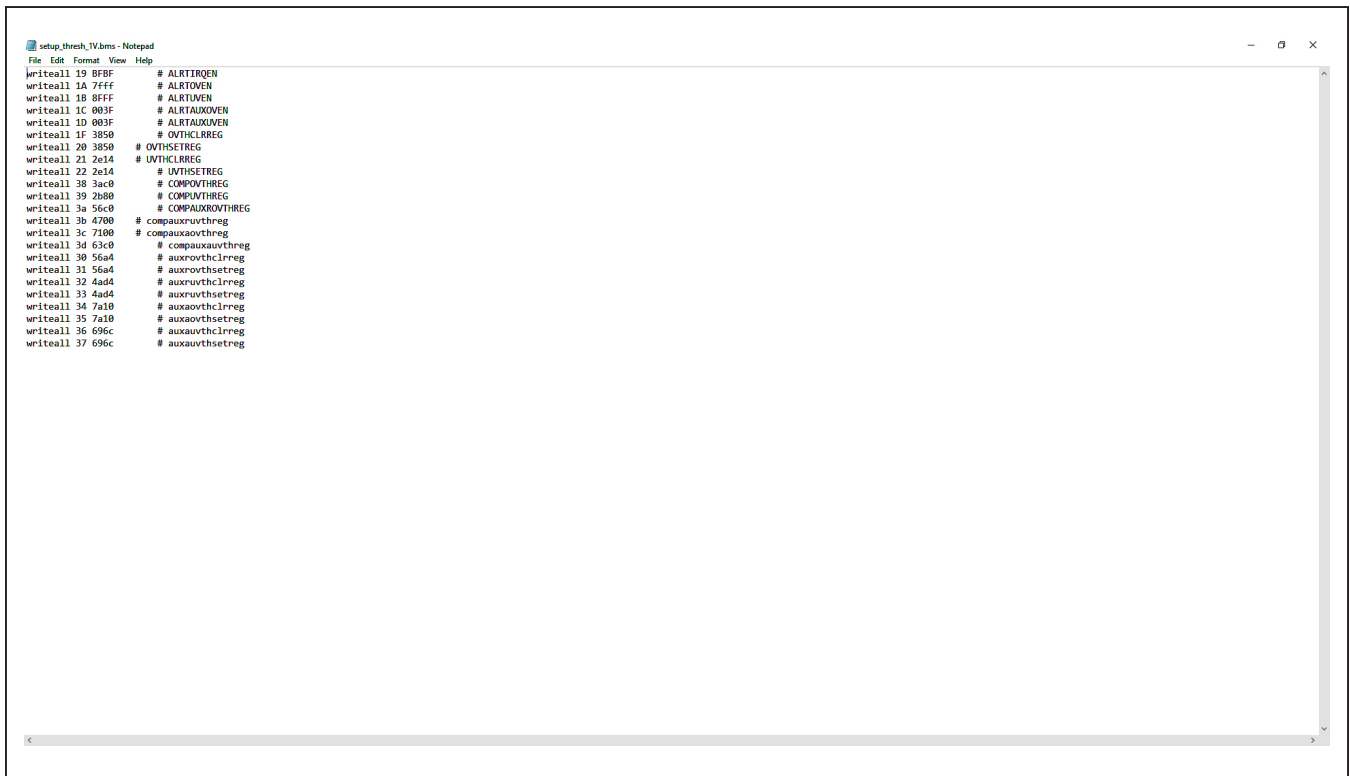
Before running scripts, follow the *Quick Start (Single UART)* section and establish system communication. Figure 26 shows a sample script that programs the cell overvoltage to 1.099V and the undervoltage to 0.9V.

After the script is run and **Cell Voltage** measurement is enabled, the OV/UV is indicated in the updated **Voltage Measurements** tab shown in Figure 27, according to the **Legend** group box in the lower-right corner.


```
setup_thresh_1V.bms - Notepad
File  Edit  Format  View  Help
writeall 19 BFBF        # ALRTIRQEN
writeall 1A 7fff        # ALRTOVEN
writeall 1B 8fff        # ALRTUVEN
writeall 1C 003F        # ALRTAUXOVEN
writeall 1D 003F        # ALRTAUXUVEN
writeall 1F 3850        # OVTHCLRREG
writeall 20 3850    # OVTHSETREG
writeall 21 2e14    # UVTHCLRREG
writeall 22 2e14        # UVTHSETREG
writeall 38 3ac0        # COMPOVTHREG
writeall 39 2b80        # COMPUVTHREG
writeall 3a 56c0        # COMPAUXROVTHREG
writeall 3b 4700    # compauxruvthreg
writeall 3c 7100    # compauxaovthreg
writeall 3d 63c0        # compauxauvthreg
writeall 30 56a4        # auxrovthclrreg
writeall 31 56a4        # auxrovthsetreg
writeall 32 4ad4        # auxruvthclrreg
writeall 33 4ad4        # auxruvthsetreg
writeall 34 7a10        # auxaovthclrreg
writeall 35 7a10        # auxaovthsetreg
writeall 36 696c        # auxauvthclrreg
writeall 37 696c        # auxauvthsetreg
```
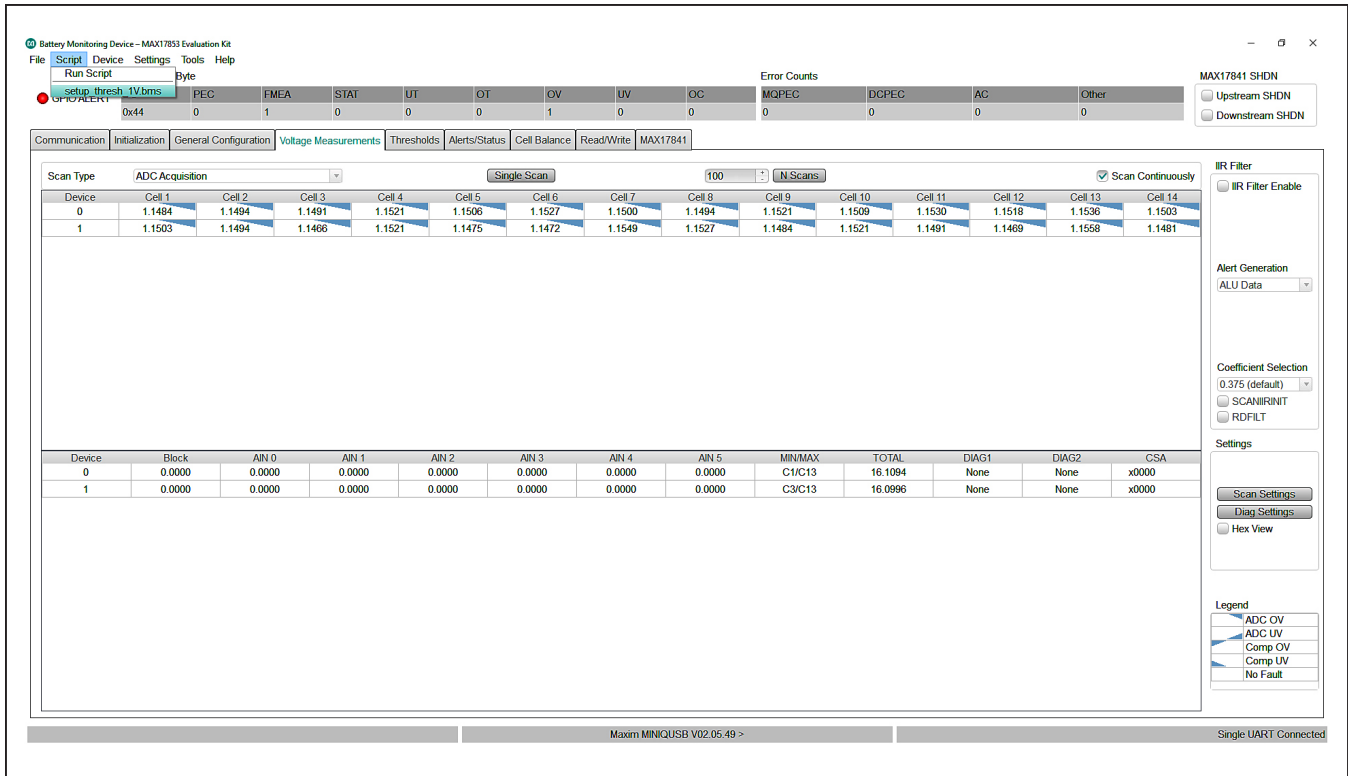
Figure 26. OV/UV Sample Script

Figure 27. Voltage Measurements Tab (Updated)

Evaluation Procedures

This section gives the user step-by-step procedures for functional evaluation of the MAX17853 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 (Figure 15).

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 (Figure 13). 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 (Figure 15) and click on the **Scan Settings** button in the **Settings** group box to open the **Scan Settings** panel (Figure 16). First click the **Cell Enable All**, **Unipolar All (Cell)**, **BLOCK EN** checkboxes, 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 (Figure 15) 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 MAX17853 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 (Figure 18) 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 (Figure 19) by clicking the **Alert Enables** button. Click the **Set All** button for **ALRTOVEN** and **ALRTUVEN** to command the MAX17853 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 (Figure 15). 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 voltage 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 voltage 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 MAX17853 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 (Figure 15), in the **IIR Filter** group box, click on 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 (Figure 16) 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.

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 (Figure 13).

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 (Figure 13) and click on the **Scan Settings** button in the **Settings** group box to open the **Scan Settings** panel (Figure 16). 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 (Figure 22). 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 4) and verify the logical state of the **CP/AUX0–CP/AUX5** pins by reading register GPIOCFG (0x17). Verify the GPIORD bits are set to logic 1.

AUX Absolute/Ratiometric Measurement

The software GUI and the MAX17853 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 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 (Figure 13).

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 (Figure 15) and click on the **Scan Settings** button in the **Settings** group box to open the **Scan Settings** panel (Figure 16). Click the **AUX Enable All** button to enable the AUX channels as analog. 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.

4) 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.

5) From the hardware perspective, it is necessary to verify 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. With the filter on, the MAX17853 EV kit AUXIN0–AUXIN5 pins, **Manual** mode is recommended. With the THRM output active, V_{AA} reference is applied to each AUXn 10kΩ pullup resistor. Verify that PCB THERMn jumpers are installed.

6) Back on the **Voltage Measurements** tab, click the **Scan Continuously** checkbox. Observe from the **GP/AUX0–GP/AUX5** test points (Figure 4) that AUX levels are approximately 3.3V 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 at the same time.

● **Duty Cycle** slidebar 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 (Figure 13).

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 (Figure 15) and click on the **Scan Settings** button in the **Settings** group box to open the **Scan Settings** panel (Figure 16). Select **Cell Enable All** and click **Confirm Settings** at the bottom of the panel.

4) Back in the **Voltage Measurements** tab, click on the **Scan Continuously** checkbox. Observe that cell voltage levels are approximately equal in value. At this point, the MAX17853 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 (Figure 20) 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 (Figure 21) to update the **Balancing Expiration Time**.

6) Select the **Cell Balance** tab (Figure 21) 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 on **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 (Figure 22) 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 MAX17853 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 (Figure 14).

Detailed information on manual cell-balancing features is available in the MAX17853 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 (Figure 21)

● Enable or disable cell-balance parameters in **Auto Cell Balancing** mode triggers an INTRFC alert in the **Alerts/Status** tab (Figure 20)

● User must uncheck the **Scan Continuously** checkbox in the **Cell Measurement** (Figure 15) to prevent an INTRFC alert from being set when **Auto Cell Balancing** mode is activated

● In **Auto Cell Balancin**g 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 P+B14 and B0P- jumpers are installed.

3) Select the **Voltage Measurements** tab (Figure 15) and click on the **Scan Settings** button in the **Settings** group box to open the **Scan Settings** panel (Figure 16). 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 MAX17853 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 (Figure 20) 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 (Figure 21) 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 on **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 (Figure 13).

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

3) Select the **Voltage Measurements** tab (Figure 15) and click on the **Scan Settings** button in the **Settings** group box to open the **Scan Settings** panel (Figure 16). 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 **Voltage Measurements** tab, click on the **Scan Continuously** checkbox. Observe that cell-voltage levels are approximately equal in value. At this point, the MAX17853 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 (Figure 20) 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 (Figure 21) 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 CBUVTHR 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 **CBDONE** is activated. Click on the **Clear All Device Alerts** button.

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

The graph in Figure 28 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 MAX17853 cell-balance switch until the MINCELL threshold is achieved.

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 the less than 14 cells are terminated to the MAX17853.

- When fully enabled, FlexPack uses internal MOSFETs to route power from the highest voltage switches input pin (SW8–SW14) to the DCIN pin.

- 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 both EV kits 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.
   c) Verify B0P- jumper is installed. Remove the P+B14 jumper.

2) Apply 18.0V power to the system, 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 (Figure 15) and click on the **Scan Settings** button in the **Settings** group box to open the **Scan Settings** panel (Figure 16). Select **Cell Enable** for Cell 1–Cell 12. Click **Confirm Settings** at the bottom of the window.

4) In the **Voltage Measurements** tab, click on the **Scan Continuously** checkbox. Observe that the cell voltage levels are approximately equal in value. At this point, the MAX17853 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.
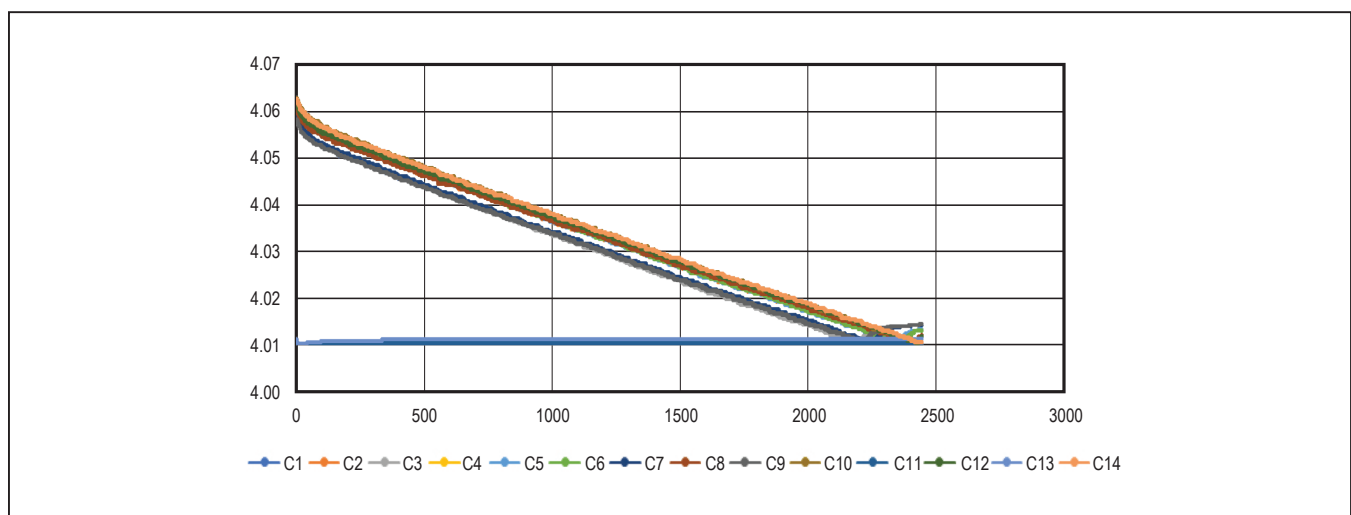

Figure 28. Automated Cell Balance

5) To fully activate the FlexPack, select the **General Configuration** tab (Figure 14). 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 MAX17853 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 MAX17853 EV kit is provides the user with an introduction to the features and functions of the MAX17853 device. Refer to the MAX17853 IC data sheet for detailed explanations of the product features, register set, and modes of operation.

MAX17853 UART-to-SPI Hardware

To communicate directly to the IC through the SPI interface, populate the components (see Table 4) and insert the MINIQUSB+ to SPI converter directly into the MAX17853 EV kit.

Table 4. UART-to-SPI Hardware Change

ITEM	REF_DES	COMPONENT	COMMENTS	POPULATE
Schottky diodes (POWER123)	D26, D28, D30, D31	DFLS1100-7	Remove UART components from SPI signals.	
10kΩ ±1% resistor (0603)	R10	CRCW060310K0FK	Populate pulldown on UARTSEL.	
0Ω resistor (0603)	R13	RC1608J000CS	Apply VAA to level shifter.	
22Ω ±5% resistors	R5–R8	CPCW060322R0FK	Terminate level-shifted MINIQUSB+ SPI signals to the MAX17853 SPI port.	
10kΩ ±1% resistors (0603)	R9	CRCW060310K0FK	Remove pullup from UARTSEL.	
0Ω resistor (0603)	R141	RC1608J000CS	Terminate ALERTOUT to level shifter.	
49.9Ω ±1% resistors (0603)	R157–R160	CRCW080549R9FK	Remove unnecessary components from SPI signals.	

Ordering Information

PART	TYPE
MAX17853EVKIT#	EV kit

#Denotes RoHS compliant.

MAX17853 EV Kit Bill of Materials

REF_DES	QTY	VALUE	DESCRIPTION	MFG PART #	MFG
ALARM_IN_UP, ALARM_OUT_LP, GPIO_AUX0-GPIO_AUX5, RXLP_CONN, RXUP_CONN, TXLP_CONN, TXUP_CONN	12	502584-0270	CONNECTOR; FEMALE; SMT; 502584 SERIES; STRAIGHT; 2PINS	502584-0270	MOLEX
ALERTIN, ALERTIN_P, ALERTOUT, CPN, CPP, DCIN, HV, RXLN, RXLP, RXP1, RXP2, RXUN, RXUP, TXLN, TXLP, TXP1, TXP2, TXUN, TXUP, UARTSEL, VAA, VBLK	22	N/A	TEST POINT; PIN DIA = 0.1IN; TOTAL LENGTH = 0.3IN; BOARD HOLE = 0.04IN; RED; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	5000	KEYSTONE
ALERTIN_N, GP/AUX0-GP/AUX5, RXN1, RXN2, TXN1, TXN2	11	N/A	TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE = 0.04IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	5001	KEYSTONE
AUXGND, OPTO_OUT, SHDNL, THERM, VDDL1, VDDL2/3	6	N/A	TEST POINT; PIN DIA = 0.1IN; TOTAL LENGTH = 0.3IN; BOARD HOLE = 0.04IN; YELLOW; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	5004	KEYSTONE
B0P-, B1B0, B2B1, B3B2, B4B3, B5B4, B6B5, B7B6, B8B7, B9B8, B10B9, B11B10, B12B11, B13B12, B14B13, P+B14	16	PEC02SAAN	EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS;	PEC02SAAN	SULLINS ELECTRONICS CORP.
BAT0-BAT14, GND_A, GND_A1-GND_A3, PACK+, PACK-	21	MAXIMPAD	EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL; SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG	9020 BUSS	WEICO WIRE
BUMP1-BUMP6	6	SJ-5003(BLACK)	BUMPER; BLACK-HEMISPHERICAL SHAPE EVKIT EH0231; 0.44D/0.2BH; RESILIENT ELASTOMER POLYURETHANE	SJ-5003(BLACK)	3M ELECTRONIC SOLUTIONS DIVISION
C1	1	0.1UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.1UF; 100V; TOL = 10%; TG = -55°C TO +125°C; TC = X7R	CC0603KRX7R0BB104	YAGEO
C2	1	1000PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 1000PF; 100V; TOL = 10%; TG = -55°C TO +125°C; TC = X7R; AUTO	GCM155R72A102KA37	MURATA
C3, C85	2	1.0UF	CAPACITOR; SMT (0603); CERAMIC; 1UF; 6.3V; TOL = 10%; MODEL = GRM SERIES; TG = -55°C TO +125°C; TC = X7R;	GRM188R70J105KA01 CL10B105KQ8NNNC	MURATA SAMSUNG ELECTRONICS
C4, C5, C7	3	0.47UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.47UF; 16V; TOL = 10%; TG = -55°C TO +125°C; TC = X7R; AUTO	GCM188R71C474KA55	TDK
C6	1	4.7UF	CAPACITOR; SMT (0805); CERAMIC CHIP; 4.7UF; 25V; TOL = 10%; TG = -55°C TO +125°C; TC = X7R; AUTO	CGA4J1X7R1E475K125AC	TDK
C8-C11 (Do Not Install)	DNI	0.01UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.01UF; 16V; TOL = 10%; MODEL =; TG = -55°C TO +125°C; TC = X7R	NMC0402X7R103K16TRP; GRM155R71C103KA01; CC0402KRX7R7BB103	NIC COMPONENTS CORP. MURATA YAGEO
C12, C13 (Do Not Install)	0	0.01UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.01UF; 16V; TOL = 10%; MODEL =; TG = -55°C TO +125°C; TC = X7R	NMC0402X7R103K16TRP GRM155R71C103KA01 CC0402KRX7R7BB103	NIC COMPONENTS CORP. MURATA YAGEO
C14	1	100PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 100PF; 25V; TOL = 2%; MODEL = GRM SERIES; TG = -55°C TO +125°C; TC = C0G	GRM1555C1E101GA01	MURATA
C15	1	3900PF	CAP;SMT (0603);3900PF;10%;50V;C0G;CERAMIC CHIP	C1608C0G1H392K080AA	TDK
C16 (Do Not Install)	DNI	0.47UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.47UF; 16V; TOL = 10%; TG = -55°C TO +125°C; TC = X7R; AUTO	GCM188R71C474KA55	TDK
C17 (Do Not Install)	DNI	0.01UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.01UF; 16V; TOL = 10%; TG = -55°C TO +125°C; TC = X7R	GRM188R71C103KA01 ECJ-1VB1C10 CL10B103KO8NNN	MURATA PANASONIC SAMSUNG
C18	1	2.2UF	CAPACITOR; SMT (1210); CERAMIC CHIP; 2.2UF; 100V; TOL = 10%; MODEL = GRM SERIES; TG = -55°C to +125°C; TC = X7R	GRM32ER72A225KA35 CGA6N3X7R2A225K230	MURATA TDK

MAX17853 EV Kit Bill of Materials (continued)

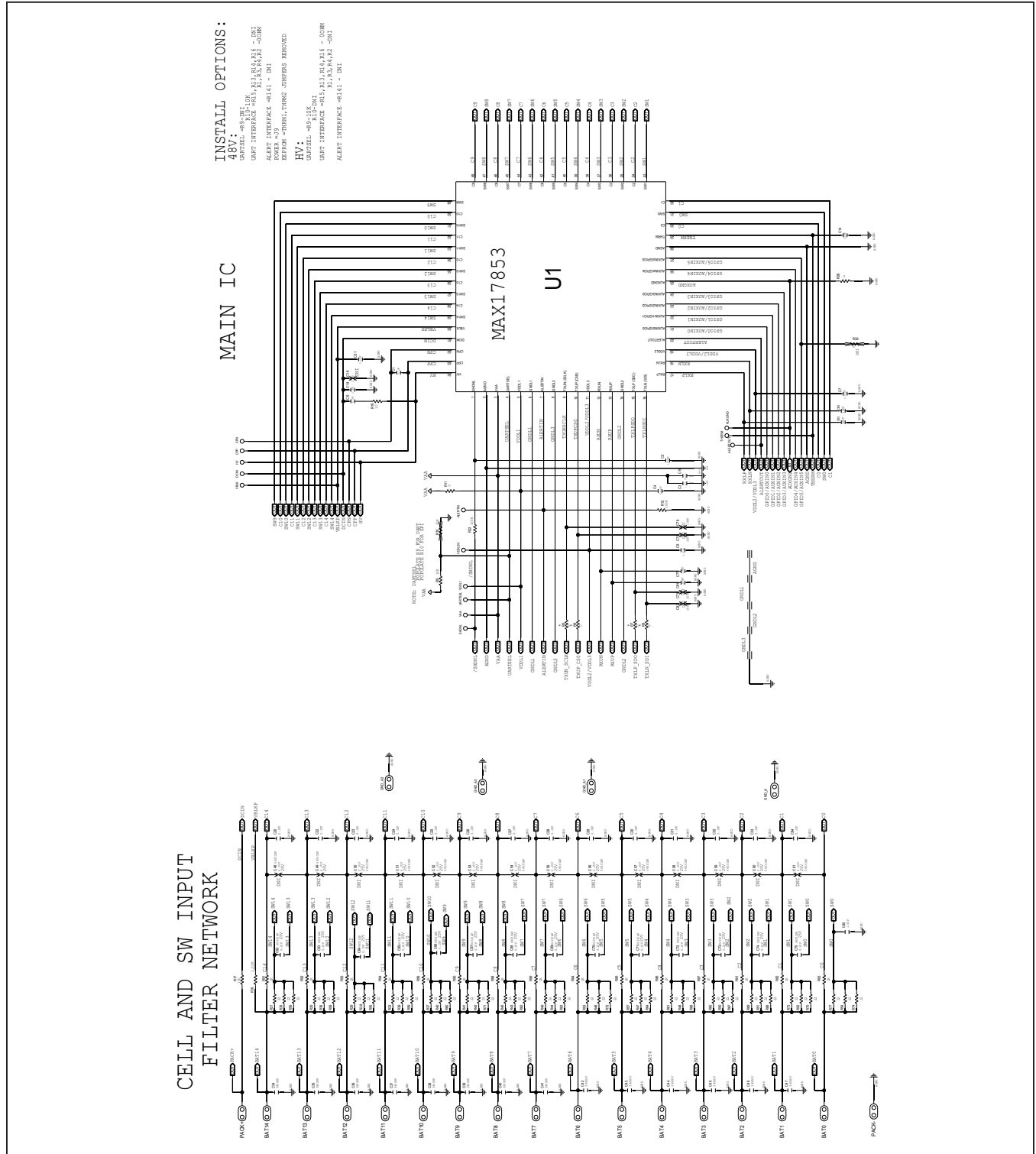| REF_DES	QTY	VALUE	DESCRIPTION	MFG PART #	MFG
C19 (**Do Not Install**)	DNI	2.2UF	CAPACITOR; SMT (1210); CERAMIC CHIP; 2.2UF; 100V; TOL = 10%; MODEL = GRM SERIES; TG = -55°C to +125°C; TC = X7R	GRM32ER72A225KA35 CGA6N3X7R2A225K230	MURATA TDK
C20, C22-C33, C84	14	0.1UF	CAPACITOR; SMT (1206); CERAMIC CHIP; 0.1UF; 100V; TOL = 10%; MODEL = CGA SERIES; TG = -55°C TO +150°C; TC = X8R AUTO	CGA5H2X8R2A104K115 C3216X8R2A104K115AA	TDK TDK
C21	1	0.47UF	CAPACITOR; SMT (0805); CERAMIC CHIP; 0.47UF; 100V; TOL = 10%; MODEL =; TG = -55°C TO +125°C; TC = X7R	GRM21BR72A474KA73	MURATA
C34-C47	14	3900PF	CAPACITOR; SMT (1206); CERAMIC CHIP; 3900PF; 100V; TOL = 5%; TG = -55°C TO +125°C; TC = X7R	GRM319R72A392JA01	MURATA
C48-C61 (**Do Not Install**)	DNI	0.1UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.1UF; 25V; TOL = 10%; MODEL = C SERIES; TG = -55°C TO +125°C; TC=X7R	C1608X7R1E104K080AA	TDK
C62-C75	14	0.1UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.1UF; 25V; TOL = 10%; MODEL = C SERIES; TG = -55°C TO +125°C; TC = X7R	C1608X7R1E104K080AA	TDK
C76, C78, C79, C82 (**Do Not Install**)	DNI	15PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 15PF; 50V; TOL = 5%; TG = -55°C TO +125°C; TC = C0G	C0402C0G500-150JNP GRM1555C1H150JA01	VENKEL LTD. MURATA
C77, C80, C81, C83	4	18PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 18PF; 50V; TOL = 5%; TG = -55°C TO +125°C; TC = C0G	C0402C180J5GAC GRM1555C1H180JA01 C1005C0G1H180J050	KEMET MURATA TDK
C86 (**Do Not Install**)	DNI	0.01UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.01UF; 16V; TOL = 10%; TG = -55°C TO +125°C; TC = X7R	GRM188R71C103KA01 ECJ-1VB1C10 CL10B103KO8NNN	MURATA PANASONIC SAMSUNG
C87	1	39PF	CAPACITOR; SMT (0603); CERAMIC CHIP; 39PF; 100V; TOL = 10%; MODEL = C0G; TG = -55°C TO +125°C; TC = +/	C0603C390K1GAC	KEMET
C88	1	100PF	CAPACITOR; SMT; 1206; CERAMIC; 100pF; 100V; 5%; C0G; -55°C to +125°C; 0 ±30PPM/°C	C1206C101J1GAC	KEMET
C89-C92	4	2200PF	CAPACITOR; SMT (1206); CERAMIC CHIP; 2200PF; 630V; TOL = 5%; MODEL =; TG = -55°C TO +125°C; TC = C0G	CGA5H4C0G2J222J	TDK
C93	1	15PF	CAPACITOR; SMT (0603); CERAMIC CHIP; 15PF; 100V; TOL = 5%; TG = -55°C TO +125°C; TC = C0G; AUTO	GCM1885C2A150JA16	MURATA
C104-C109	6	0.01UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.01UF; 16V; TOL = 10%; TG = -55°C TO +125°C; TC = X7R	GRM188R71C103KA01 ECJ-1VB1C10 CL10B103KO8NNN	MURATA PANASONIC SAMSUNG
CM1, CM2 (**Do Not Install**)	DNI	ACT45B-510-2P-TL003	INDUCTOR; SMT (1812); WIREWOUND CHIP; 51UH; TOL = [+50%/-30%]; 0.2A	ACT45B-510-2P-TL003	TDK
CURRENTSENSE (**Do Not Install**)	DNI	502584-0270	CONNECTOR; FEMALE; SMT; 502584 SERIES; STRAIGHT; 2PINS	502584-0270	MOLEX
D3-D8, D11-D14, D16, D18-D21, D24, D25	17	5V	DIODE; TVS; SMT (SOD-323); VRM = 5V; IPP = 25A	SP4021-01FTG	LITTELFUSE
D9, D10	2	3.3V	DIODE; TVS; SMT (SOD-523); PIV = 3.3V; IF = 0.1A	PESD3V3U1UB	NXP
D15, D22, D23 (**Do Not Install**)	DNI	5V	DIODE; TVS; SMT (SOD-323); VRM = 5V; IPP = 25A	SP4021-01FTG	LITTELFUSE
D26, D28, D30, D31	4	DFLS1100-7	DIODE; SCHOTTKY; SMT; PIV = 100V; IF = 1A	DFLS1100-7	DIODES INCORPORATED
D29, D32-D34	4	SESDONCAN1LT1G	DIODE; TVS; SMT (SOT-23); VRM = 24V; IPP = 3A	SESDONCAN1LT1G	ON SEMICONDUCTOR
J1-J4 (**Do Not Install**)	DNI	TSW-116-07-G-S	CONNECTOR; MALE; SMT; 0.25INCH SQ POST HEADER; STRAIGHT; 16PINS	TSW-116-07-G-S	SAMTEC
J5	1	PEC12DAAN	CONNECTOR; MALE; THROUGH HOLE; .1IN CC; BREAKAWAY HEADER; STRAIGHT; 24PINS	PEC12DAAN	SULLINS ELECTRONICS CORP

MAX17853 EV Kit Bill of Materials (continued)

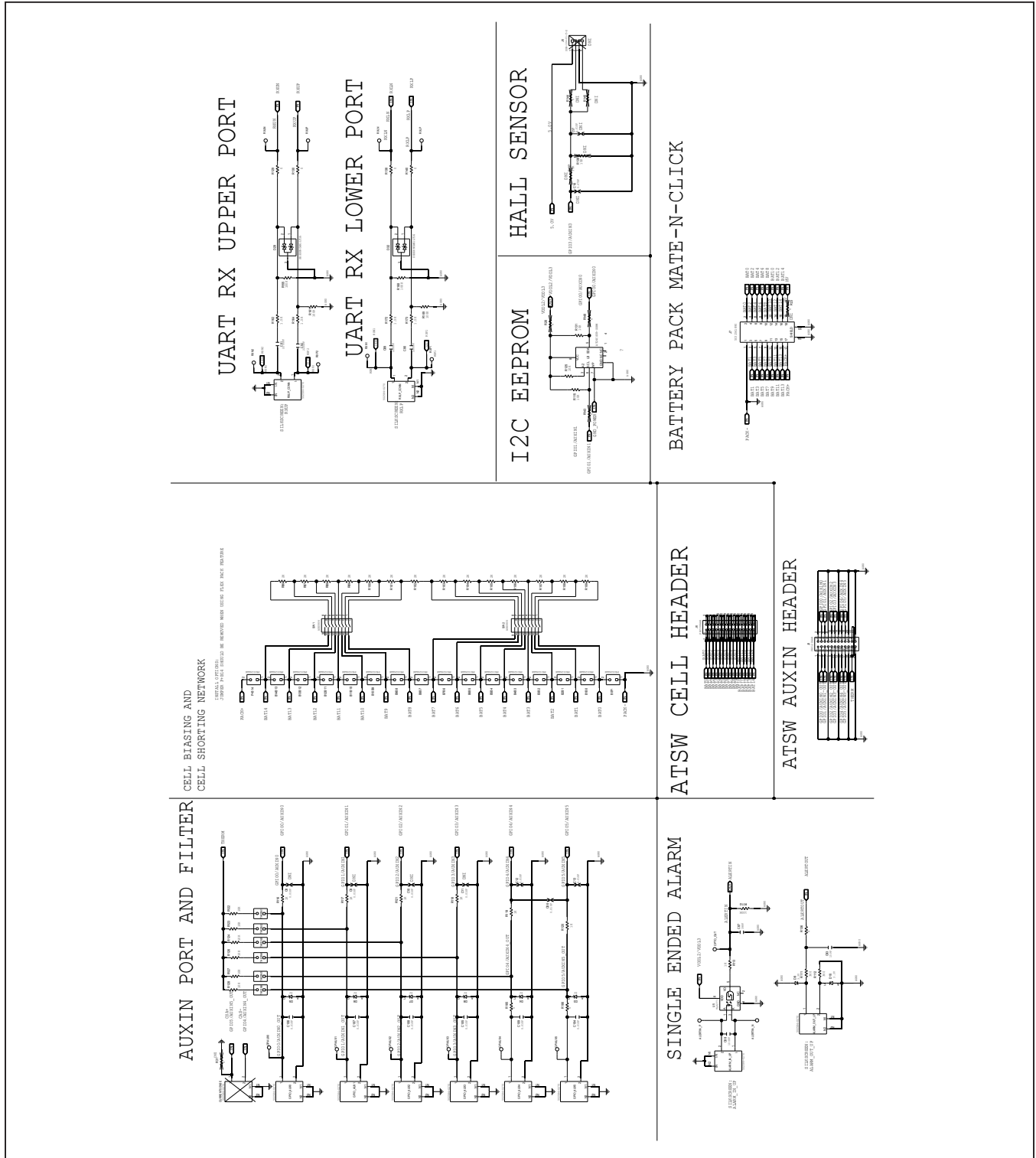| REF_DES	QTY	VALUE	DESCRIPTION	MFG PART #	MFG
J6	1	PBC15DAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 30PINS	PBC15DAAN	SULLINS ELECTRONICS CORP.
J7	1	5031541890	CONNECTOR; FEMALE; SMT; 1.5MM PITCH CLIK-MATE; WIRE-TO-BOARD PCB RECEPTACLE; DUAL ROW; STRAIGHT; 18PINS	5031541890	MOLEX
J8 (**Do Not Install**)	DNI	SSW-104-01-T-S	CONNECTOR; MALE; THROUGH HOLE; .025INCH SQ POST SOCKET; STRAIGHT; 4PINS	SSW-104-01-T-S	SAMTEC
L1-L4	4	600	INDUCTOR; SMT (0805); FERRITE-BEAD; 600; TOL = ±25%; 0.5A	MMZ2012S601A	TDK
MINIQ1	1	PEC08DAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 16PINS; -65°C TO +125°C	PEC08DAAN	SULLINS ELECTRONICS CORP.
MINIQ2	1	SSW-108-01-T-S	CONNECTOR; FEMALE; THROUGH-HOLE 0.025in POST SOCKET; STRAIGHT; 8PINS	SSW-108-01-T-S	SAMTEC
MISC1	1	N/A	WIRE; RED; 19/36; ALPHA WIRE COMPANY; HOOK-UP; MIL-W-16878E (TYPE E); AWG24	2844/19 RD001	ALPHA WIRE COMPANY
MISC1	1	CLIK-MATE_ 2-PIN LOOP-BACK	CABLE ASSEMBLY; TWO WIRE CLIK-MATE 2-WIRE LOOP CABLE; WITH WIRE STRIPPER AND CRIMP TOOL;	CLIK-MATE_ 2-PIN_LOOP-BACK	MAXIM
MISC1-MISC3	3	N/A	WIRE; BLACK; 19/36; ALPHA WIRE COMPANY; HOOK-UP; MIL-W-16878E (TYPE E); AWG24	2844/19 BK001	ALPHA WIRE COMPANY
MISC2, MISC3	2	N/A	WIRE; BLUE; 19/36; ALPHA WIRE COMPANY; HOOK-UP; MIL-W-16878E (TYPE E); AWG24	2844/19 BL001	ALPHA WIRE COMPANY
MISC2, MISC3	2	CLIK-MATE CABLE_2-WIRE	CABLE ASSEMBLY; TWO WIRE CLIK-MATE CROSSOVER CABLE; WITH WIRE STRIPPER AND CRIMP TOOL;	CLIK-MATE- CABLE_2-WIRE	MAXIM
MISC1-MISC3	6	N/A	CONNECTOR; FEMALE; WIREMOUNT; CLIK-MATE WIRE-TO-BOARD HOUSING; SINGLE ROW; POSITIVE LOCK 2PINS	5025780200	MOLEX
MISC1-MISC3	12	N/A	CONNECTOR; FEMALE; WIRE-TO-BOARD CRIMP TERMINAL; WIREMOUNT; 1PIN	5025790000	MOLEX
Q1, Q2	2	BC857BS-7-F	TRAN; PNP; SOT-363; PD-(0.2W); I-(-0.1A); V-(-45V)	BC857BS-7-F	DIODES INCORPORATED
R1-R4, R26, R143, R148 (**Do Not Install**)	DNI	0	RESISTOR; 0603; 0Ω; 5%; JUMPER; 0.10W; THICK FILM	RC1608J000CS	SAMSUNG ELECTRONICS
R9, R114, R115, R122-R128, R131-R134, R146, R147, R150-R152, R154	20	10K	RESISTOR; 0603; 10K; 1%; 100PPM; 0.10W; THICK FILM	CRCW060310K0FK ERJ-3EKF1002	VISHAY DALE PANASONIC
R5-R8 (**Do Not Install**)	DNI	22	RESISTOR; 0603; 22Ω; 1%; 100PPM; 0.10W; THICK FILM	CRCW060322R0FK	VISHAY DALE
R5-R8, R11, R13-R16, R28, R136, R185, R186	13	0	RESISTOR; 0603; 0Ω; 5%; JUMPER; 0.10W; THICK FILM	RC1608J000CS CR0603-J/-000ELF RC0603JR-070RL	SAMSUNG ELECTRONICS BOURNS YAGEO PH
R10, R142 (**Do Not Install**)	DNI	10K	RESISTOR; 0603; 10K; 1%; 100PPM; 0.10W; THICK FILM	CRCW060310K0FK ERJ-3EKF1002	VISHAY DALE PANASONIC
R12	1	100K	RESISTOR; 0603; 100KΩ; 1%; 100PPM; 0.1W; THICK FILM	ERJ-3EKF1003	PANASONIC
R17	1	100	RESISTOR; 1206; 100Ω; 1%; 100PPM; 0.5W; THIN FILM	RNCP1206FTD100R	STACKPOLE ELECTRONICS INC
R18	1	1.02K	RESISTOR; 0603; 1.02KΩ; 0.1%; 25PPM; 1W; METAL FILM	ERA-3AEB1021	PANASONIC
R19	1	10	RESISTOR; 0603; 10Ω; 1%; 200PPM; 0.20W; THICK FILM	ERJ-P03F10R0V	PANASONIC

MAX17853 EV Kit Bill of Materials (continued)

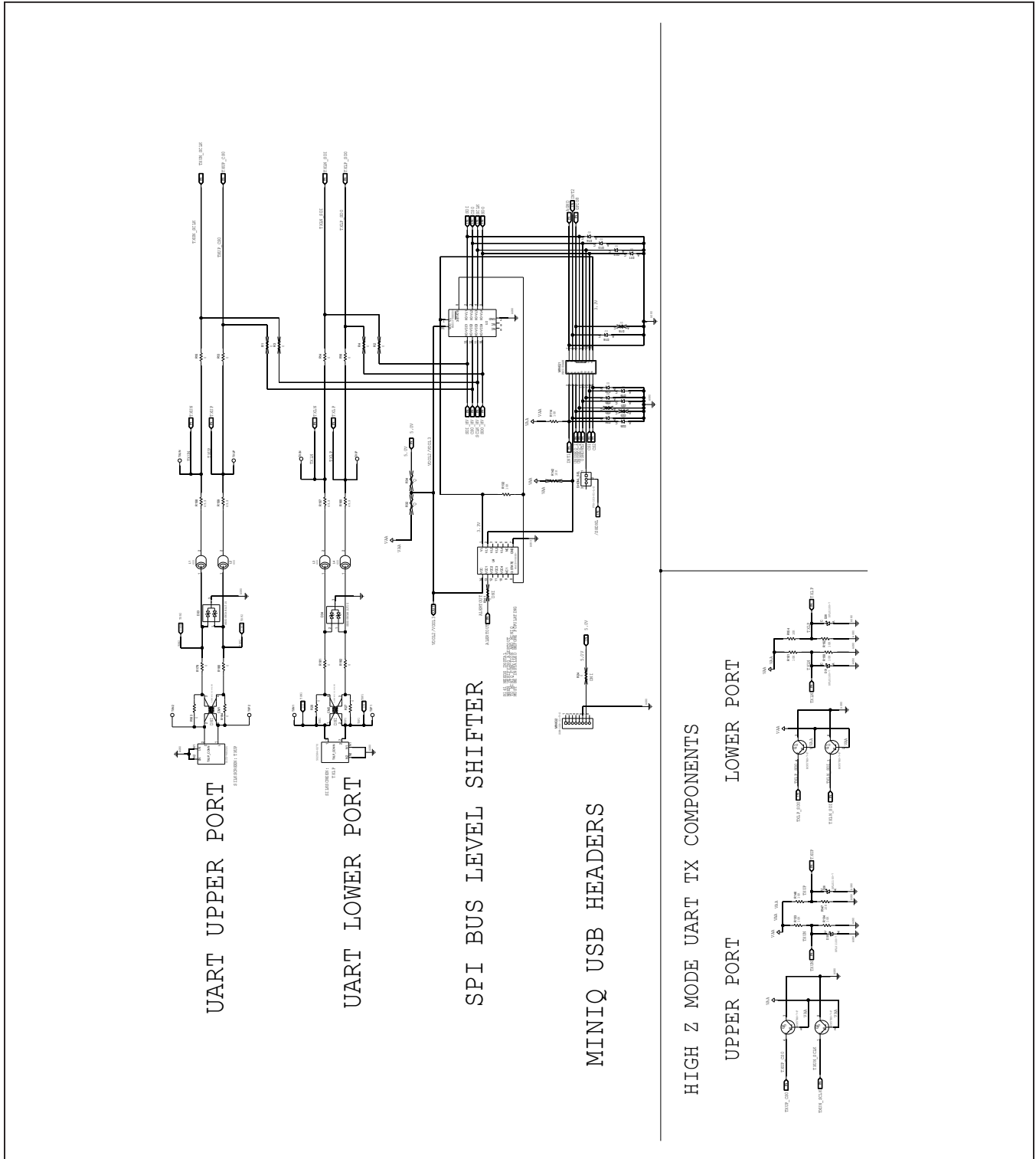| REF_DES	QTY	VALUE	DESCRIPTION	MFG PART #	MFG
R20, R27, R183, R184	4	0	RESISTOR; 0805; 0Ω; 5%; JUMPER; 0.125W; THICK FILM	RC0805JR-070RL	YAGEO PHYCOMP
R21, R25, R29, R33, R35-R74, R77	45	22	RES; SMT (1210); 22; 1%; ±100PPM/DEGC; 0.5W	ERJ-14NF22R0	PANASONIC
R22, R110, R155, R161, R168, R169	6	100K	RESISTOR; 0603; 100KΩ; 5%; 200PPM; 0.10W; THICK FILM	ERJ-3GEYJ104V	PANASONIC
R23, R24, R30, R31, R141, R144, R145 (**Do Not Install**)	DNI	0	RESISTOR; 0603; 0Ω; 5%; JUMPER; 0.10W; THICK FILM	RC1608J000CS	SAMSUNG ELECTRONICS
R32, R34 (**Do Not Install**)	DNI	0	RESISTOR; 0805; 0Ω; JUMPER; 0.125W; THICK FILM	CRCW08050000ZS	DIGI-KEY
R81-R95	15	1K	RESISTOR; 0603; 1KΩ; 1%; 100PPM; 0.10W; THICK FILM	CR0603-FX-1001ELF	BOURNS
R96-R109	14	2K	RESISTOR, 0603, 2KΩ, 1%, 100PPM, 0.10W, THICK FILM	CRCW06032K0FK ERJ-3EKF2001V	VISHAY DALE PANASONIC
R111, R112	2	360	RESISTOR; 0805; 360Ω; 1%; 100PPM; 0.125W; THICK FILM	CRCW0805360RFK	VISHAY DALE
R113	1	1K	RESISTOR; 0603; 1KΩ; 5%; 200PPM; 0.10W; THICK FILM	ERJ-3GEYJ102V	PANASONIC
R116-R121	6	1K	RESISTOR; 0603; 1K; 1%; 100PPM; 0.10W; THICK FILM	CRCW06031K00FK ERJ-3EKF1001V	VISHAY DALE PANASONIC
R129, R130, R138, R140, R179-R182	8	0	RESISTOR; 1206; 0Ω; 0%; JUMPER; 0.25W; THICK FILM	CRCW12060000ZS ERJ-8GEY0R00V	VISHAY DALE PANASONIC
R137, R139 (**Do Not Install**)	DNI	15K	RESISTOR; 0603; 15KΩ; 5%; 200PPM; 0.10W; THICK FILM	ERJ-3GEYJ153V	PANASONIC
R157-R160	4	49.9	RESISTOR; 0805; 49.9Ω; 1%; 100PPM; 0.125W; THICK FILM	CRCW080549R9FK ERJ-6ENF49R9	VISHAY DALE PANASONIC
R162, R164, R172, R173	4	1.5K	RESISTOR; 1206; 1.5KΩ; 1%; ±100PPM; 1/4W; THICK FILM	CRCW12061K50FK	VISHAY DALE
SHDNL_SEL	1	FTS-103-01-L-S	CONNECTOR; MALE; THROUGH HOLE; MICRO LOW PROFILE TERMINAL STRIP; STRAIGHT; 3PINS	FTS-103-01-L-S	SAMTEC
SW1, SW2	2	ADE0804	SWITCH; SPST; DIP16; 24V; 0.1A; SLIDE ACTUATED PIANO-DIP; RCOIL= OHM; RINSULATION = Ω; TYCO ELECTRO	ADE0804	TE CONNECTIVITY
THERM1-THERM6	6	" 3-644456-2"	CONNECTOR, HEADER STRIP, TH, STR, 2PINS, 1 ROW	" 3-644456-2"	TYCO
U1	1	MAX17853	EVKIT PART-IC; MAX17853; LQFP64; PACKAGE OUTLINE: 21-0083	MAX17853	MAXIM
U2	1	MAX3378EEUD+	IC; TRANS; ±15KV ESD-PROTECTED, 1UA, 16MBPS, QUAD LOW-VOLTAGE LEVEL TRANSLATOR; TSSOP14	MAX3378EEUD+	MAXIM
U3	1	AT24CS08-SSHM	IC; EPROM; I2C-COMPATIBLE TWO-WIRE SERIAL EEPROM; NSOIC8 150MIL	AT24CS08-SSHM	ATMEL
U4	1	MAX3390EEUD+	IC; TRANS; 15KV ESD-PROTECTED; 1UA; 16MBPS; QUAD LOW-VOLTAGE LEVEL TRANSLATOR; TSSOP14	MAX3390EEUD+	MAXIM
U5	1	TLP2770	IC; PHOTO; 20MBPS LOW POWER PHOTOCOUPLER; WSOIC6	TLP2770	TOSHIBA
—	1	—	PCB: MAX1785X EVKIT	MAX17853EVKIT#	MAXIM

MAX17853 EV Kit Schematics

MAX17853 EV Kit Schematics (continued)

MAX17853 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

MAX17853 EV Kit Schematics (continued)

MAX17853 EV Kit PCB Layouts

MAX17853 EV—PCB Top Layer Silkscreen
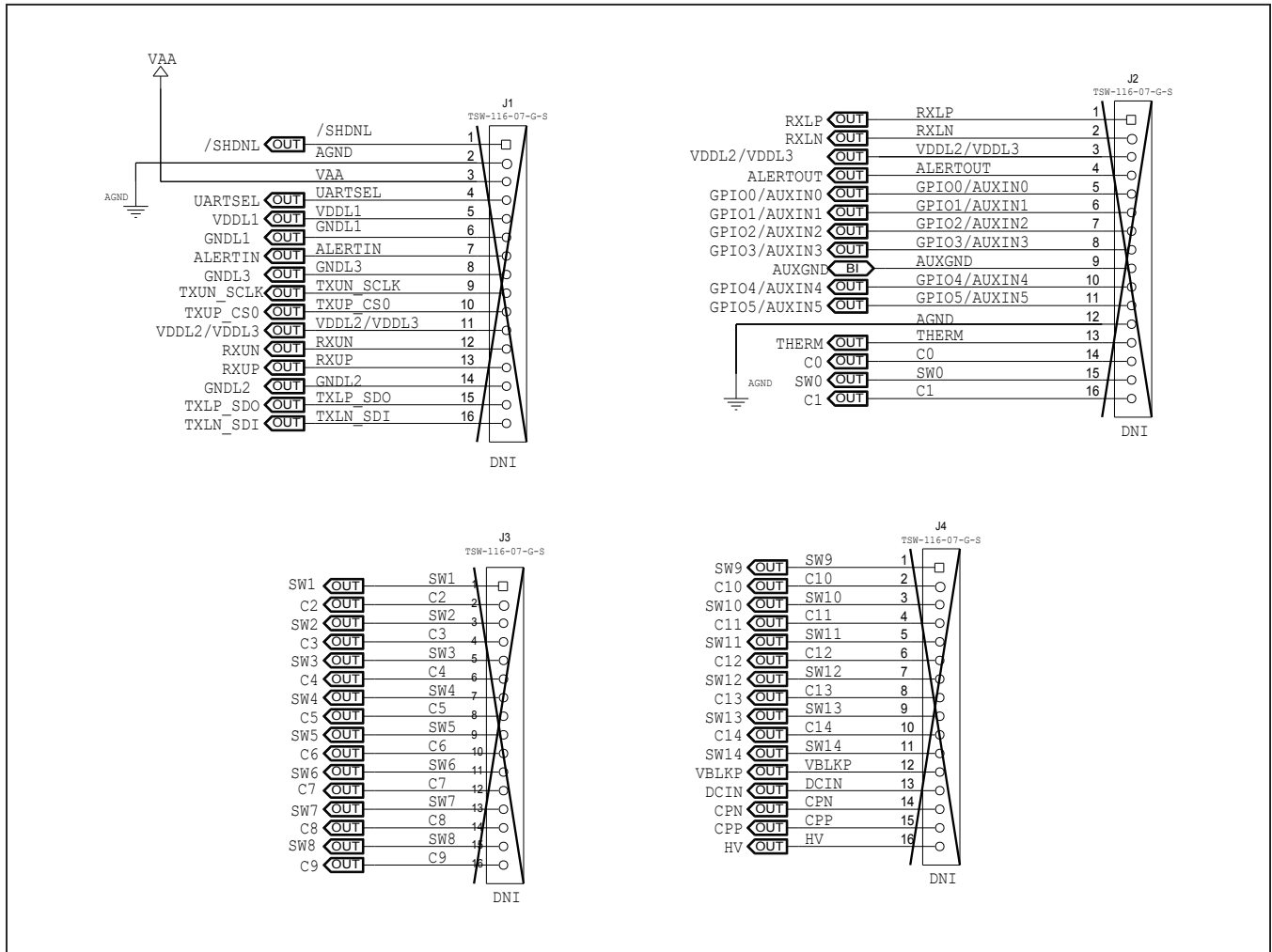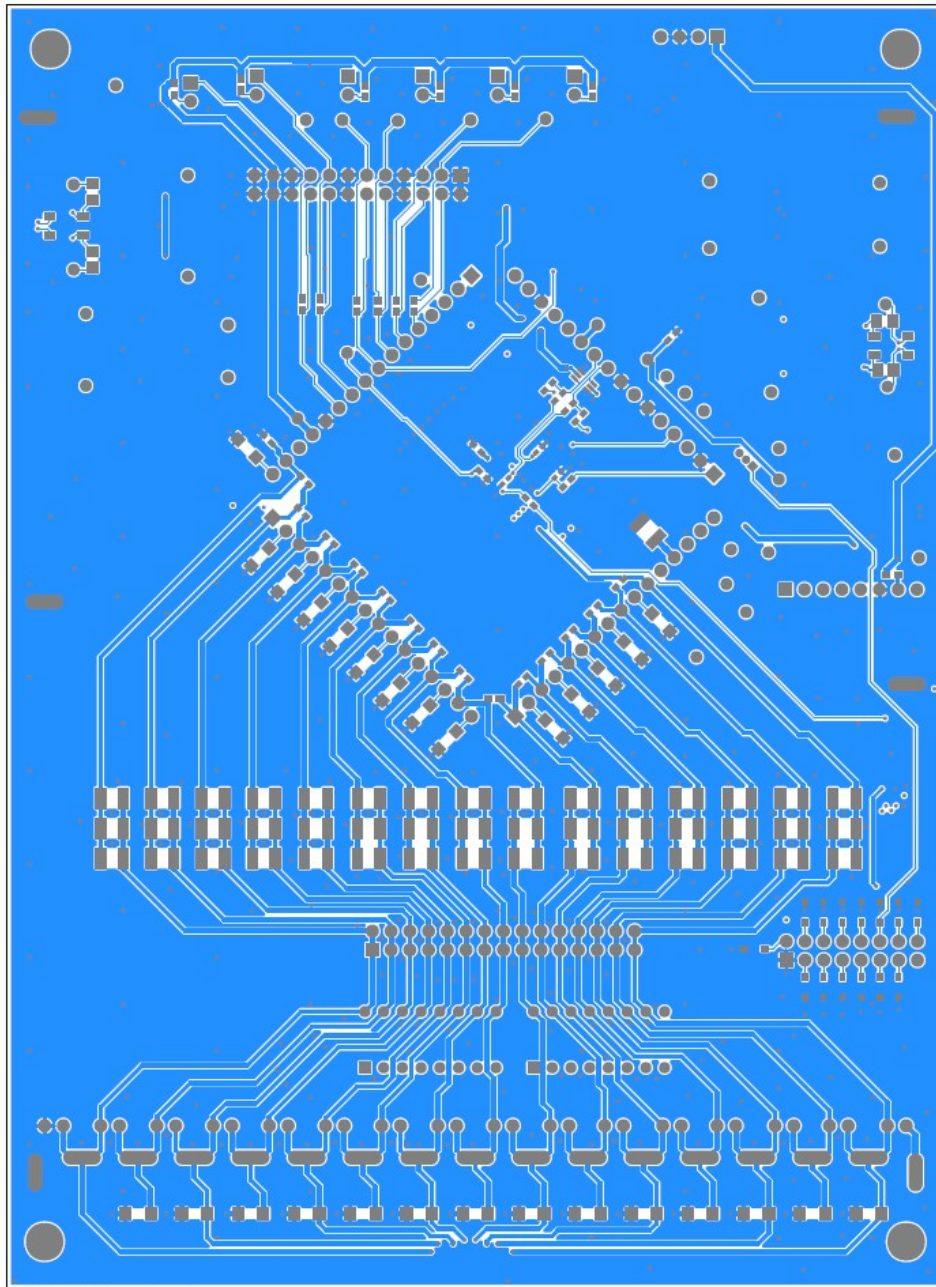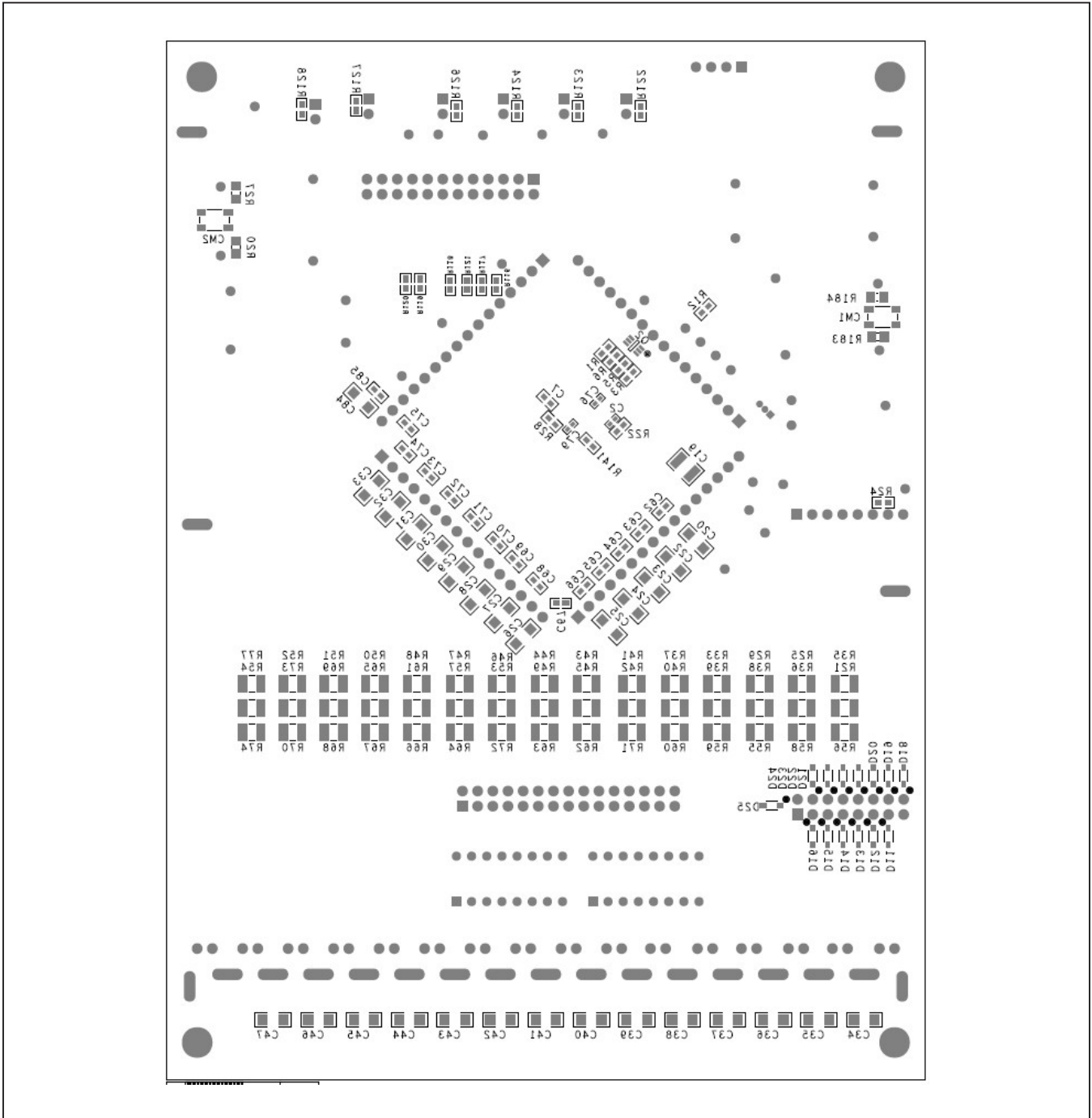
MAX17853 EV Kit PCB Layouts (continued)
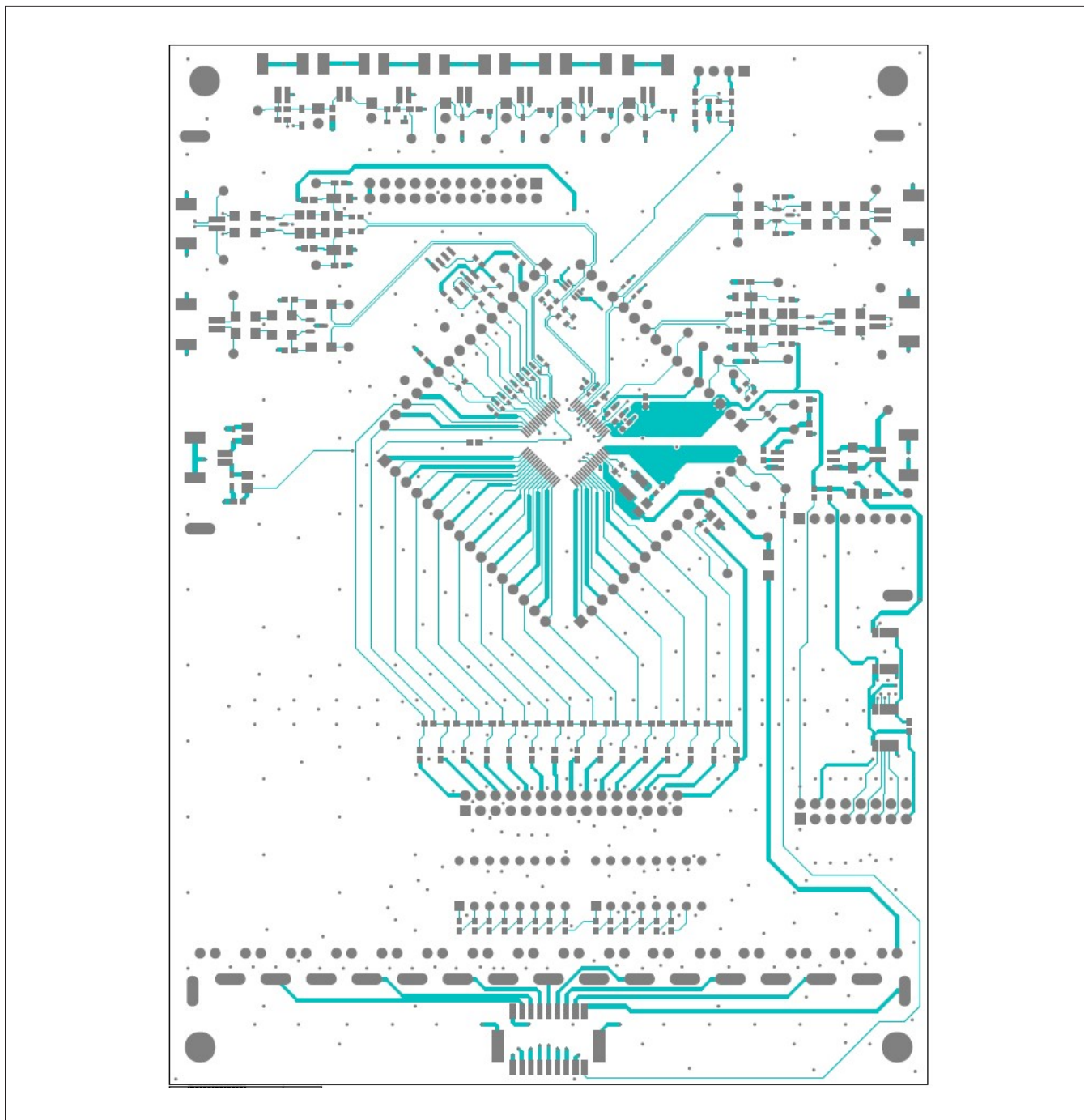
MAX17853 EV—PCB Top Layer Metal

MAX17853 EV Kit PCB Layouts (continued)
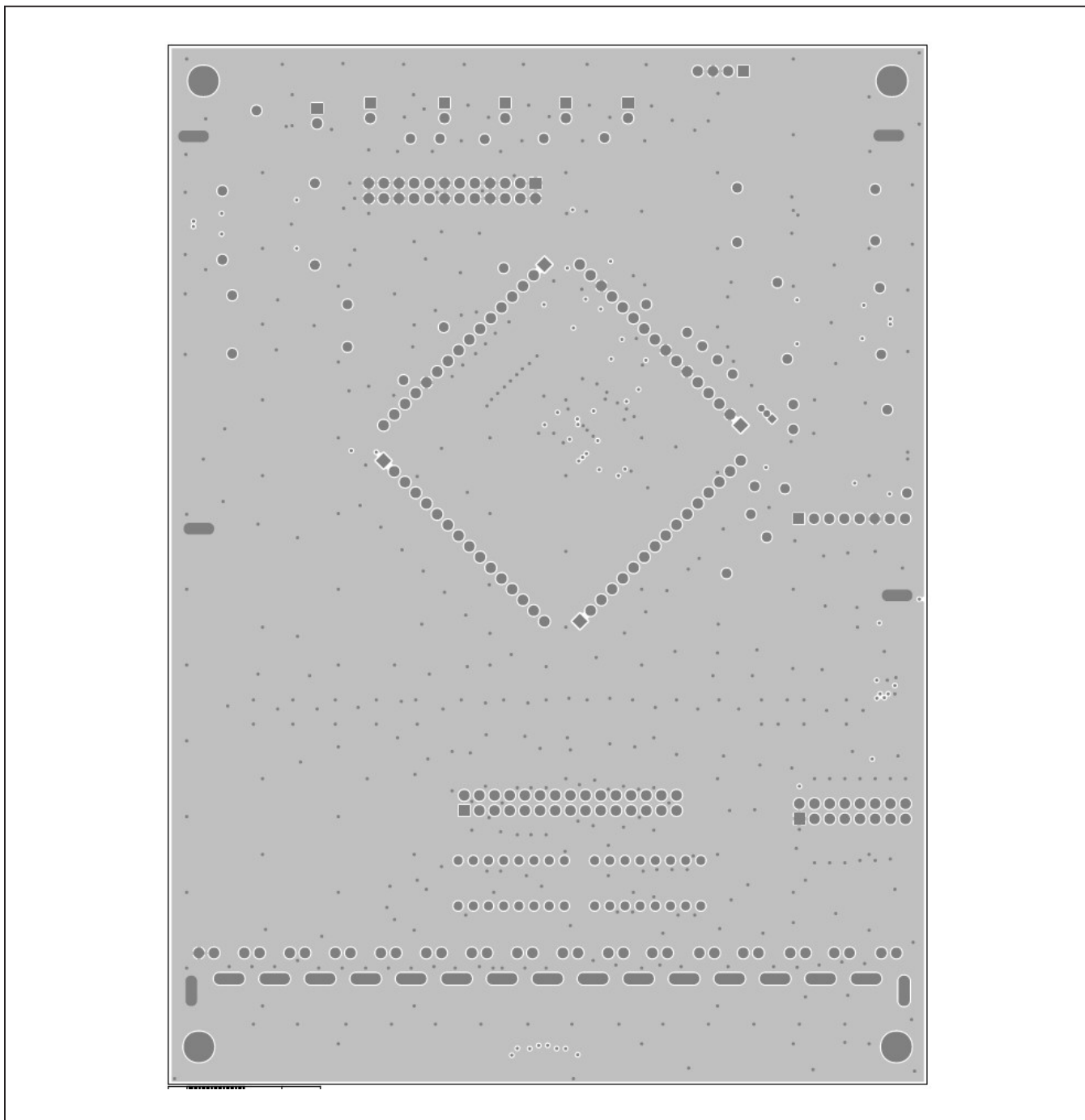
MAX17853 EV—PCB Layer Two Metal

MAX17853 EV Kit PCB Layouts (continued)
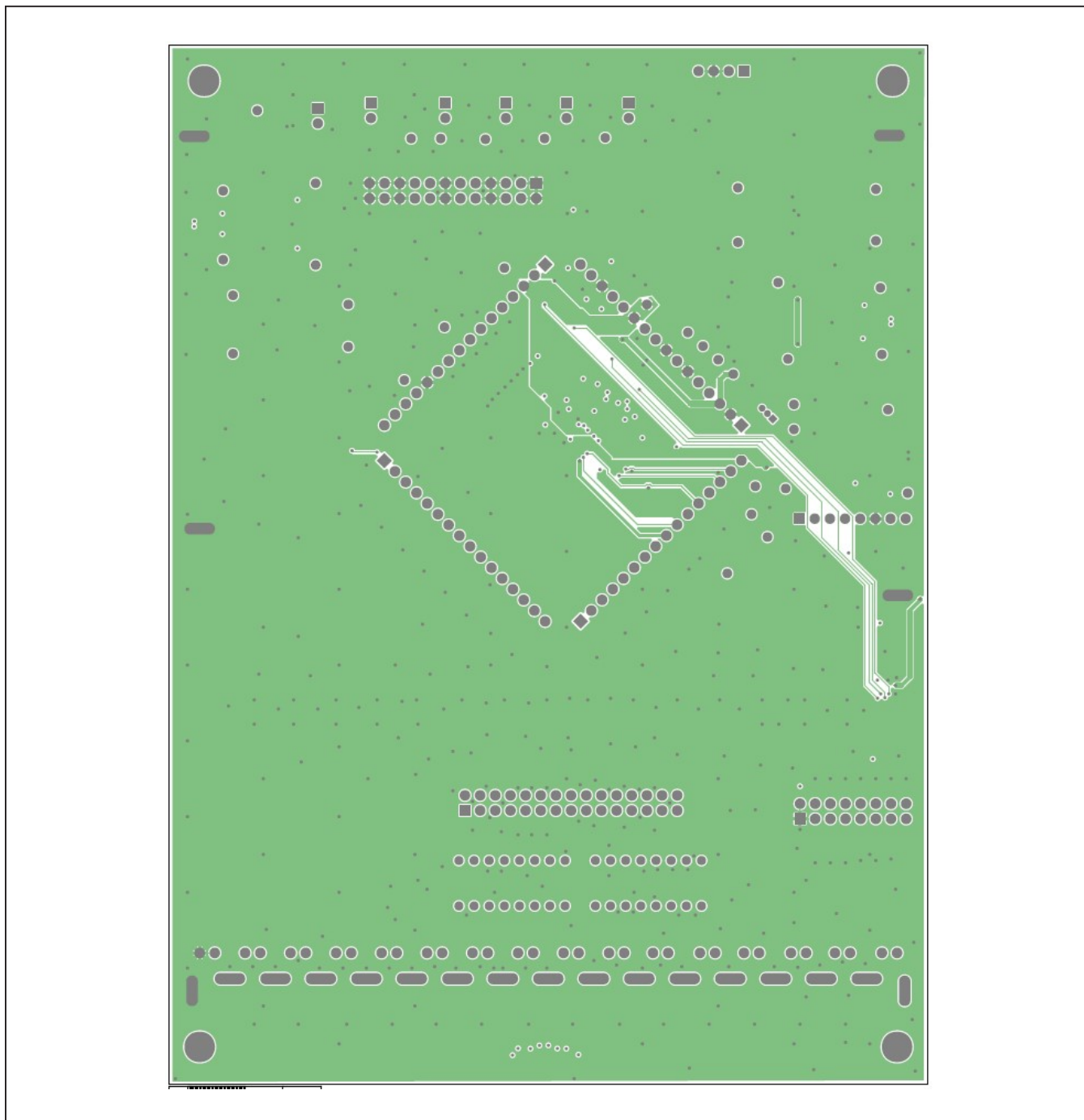
MAX17853 EV—PCB Layer Three Metal

MAX17853 EV Kit PCB Layouts (continued)

MAX17853EV—PCB Bottom Layer Metal

MAX17853 EV Kit PCB Layouts (continued)

MAX17853EV—PCB Bottom Layer Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	11/18	Initial release	—