Evaluation Board User Guide

MAX20366 Evaluation Kit

Evaluates: MAX20366

General Description

The MAX20366 evaluation kit (EV kit) is a fully assembled and tested circuit board that demonstrates the MAX20366 ultra-low power wearable power management integrated circuit (PMIC). The MAX20366 includes voltage regulators such as bucks, boost, buck-boost, and linear regulators, and a complete battery management solution with battery seal, charger, power path, and fuel gauge.

The device is configurable through an I^2C interface that allows for programming various functions and reading device status. The EV kit GUI application sends commands to the MAXPICO2PMB# adapter board to configure the device.

The MAX20366EVKIT# has no harvester feature. The MAX20366HEVKIT# has a harvester feature enabled and can be connected to MAX20361EVKIT# to evaluate the interaction between the two devices.

Features

- USB Power Option
- Flexible Configuration
- On-Board LED Current Sink and Battery Simulation
- Sense Test Point for Output-Voltage Measurement
- Filter Test Point for Haptic-Waveform Measurement
- Windows® 8/Windows 10-Compatible GUI Software
- Fully Assembled and Tested

Analog Devices is in the process of updating documentation to provide culturally appropriate terminology and language. This is a process with a wide scope and will be phased in as quickly as possible. Thank you for your patience.

EV Kit Contents

- MAX20366 EV kit
- MAXPICO2PMB# board
- Two USB A to USB micro-B cables

MAX20366 EV Kit Files

FILE	DESCRIPTION
MAX20366EVKitSetupVxxx.exe	PC GUI Program

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

One Analog Way, Wilmington, MA 01887-2356, U.S.A. | Tel: 781.329.4700

EV Kit Photo

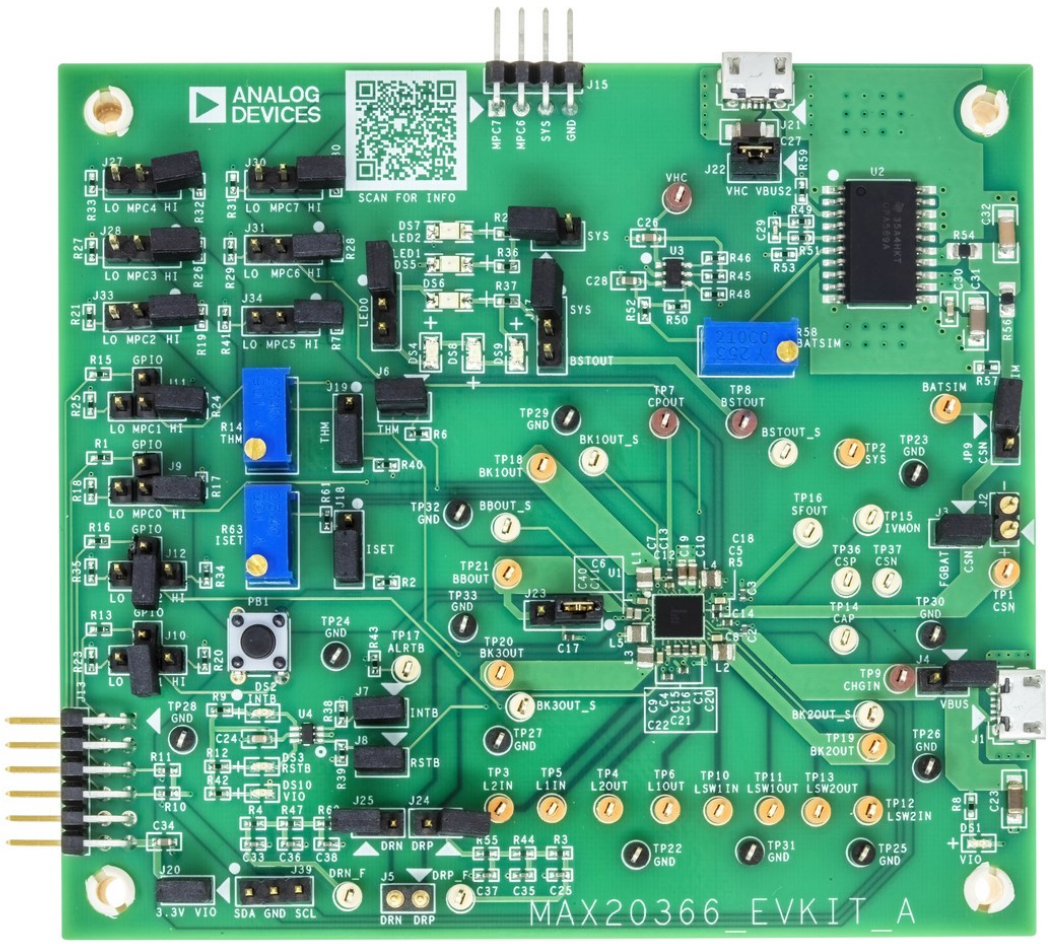


Figure 1. MAX20366 EV Kit Photo

Quick Start

Required Equipment

- MAX20366 EV kit
- Windows PC with USB ports
- One USB A to USB micro-B cable and MAXPICO2PMB# adapter board
- One USB A to USB micro-B cable or power supply (for battery simulation or battery voltage)
- Optional one USB A to USB micro-B cable or power supply (for charger input CHGIN)
- Voltmeter

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

Procedure

The EV kit is fully assembled and tested. Follow the steps to install the EV kit software, make required hardware connections, and start operation of the kit. The EV kit software can be run without hardware attached. Note that after communication is established, the IC must still be configured correctly for desired operation mode. Make sure the PC is connected to the internet throughout the process so that the USB driver can be automatically installed.

1. Visit www.analog.com/products/MAX20366 under the Evaluation Kits tab, View the detailed EV kit information.
2. On the Evaluation Kit page, under the Tools & Simulations tab, download the latest version of the MAX20366 EV kit software. Save the software to a temporary folder and unpack the zip file.
3. Install the EV kit software on the computer by running the MAX20366EVKitSetupVxxx.exe program inside the temporary folder.
4. Verify that all jumpers are in their default positions, as shown in *Table 1*.
5. Connect the type-A end of a cable to the PC and micro-USB end of a cable to MAXPICO2PMB# board, and connect the MAXPICO2PMB# to J13 located on lower left of the EV kit board.
6. Connect a USB A to micro-B cable from the computer to J21 on the upper right corner of the EV kit board to use VBUS to power the battery simulation circuits on the board, or power the battery simulation circuits from the VHC test point. (Use a Li-ion battery or power source to evaluate the device if not using the battery simulation circuits. Connect the battery or power source to J2 on the EV kit board. Skip Step 6 if not using the battery simulation.)
7. Use a voltmeter to check VHC is approximately 5V; BATSIM test point is approximately 3.7V. To adjust the BATSIM voltage, turn the R58 BATSIM potentiometer. Place shunt on JP9, then confirm that TP1 CSN is the set BATSIM voltage.
8. On the computer, open the MAX20366 GUI. For the MAX20366EVKIT#, the status bar at the bottom displays MAX20366 Not Found (*Figure 2*). The IC is in Seal Mode. For the MAX20366HEVKIT#, the status bar at the bottom displays Connected (*Figure 3*). The IC is in Battery Recovery Mode.
9. Press the PB1 (/KIN) button shortly, then the device enters ON mode. For the MAX20366EVKIT, the GUI then displays Connected, and the registers are read and displayed (*Figure 3*).
10. The EV kit is now ready for additional evaluation.
11. To evaluate the battery charger, shunt J4 and plug in the USB micro-B cable to J1 of the EV kit to use USB VBUS power, or externally supply the charging power on TP9 CHGIN.

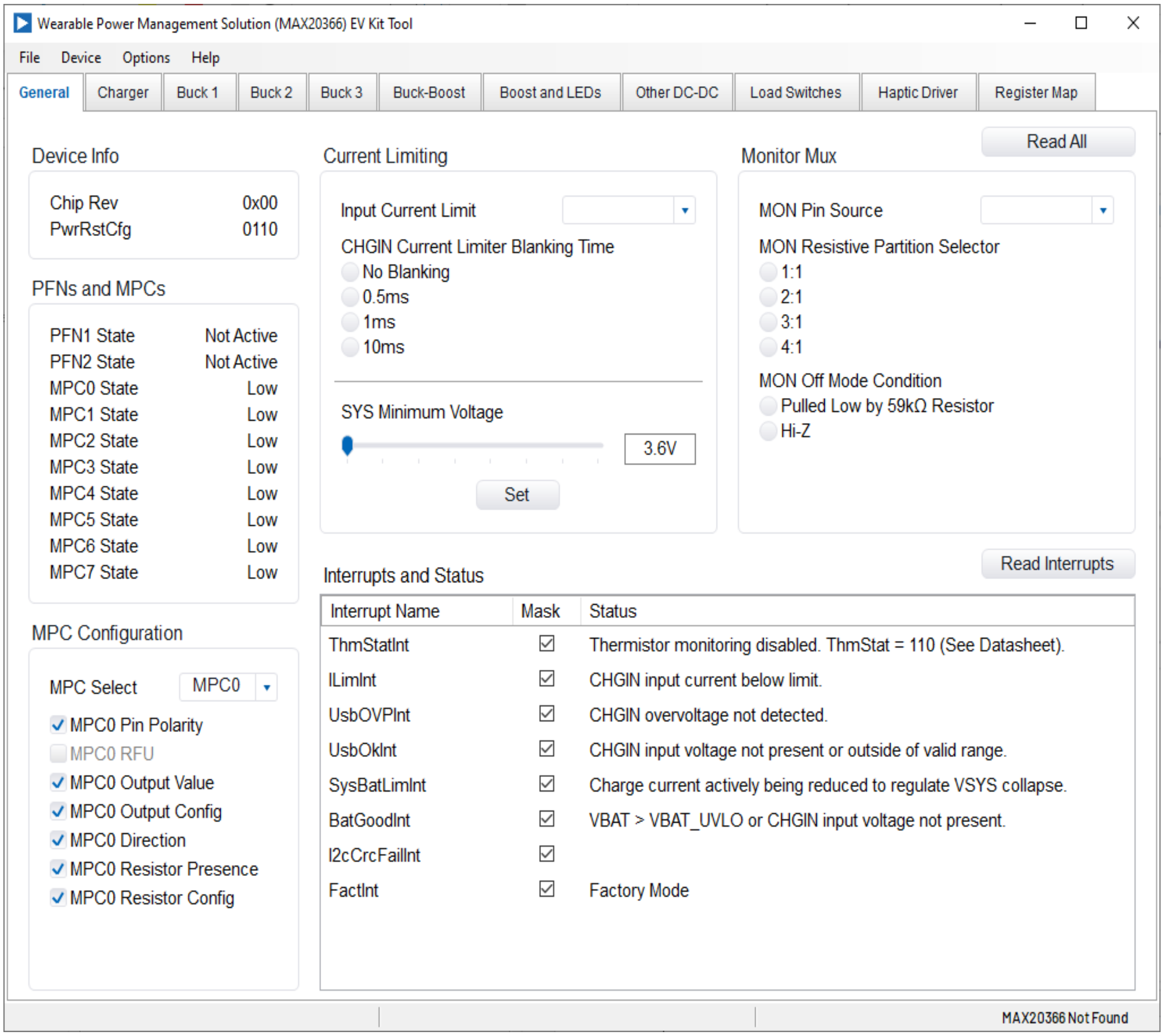


Figure 2. MAX20366 Not Found Status

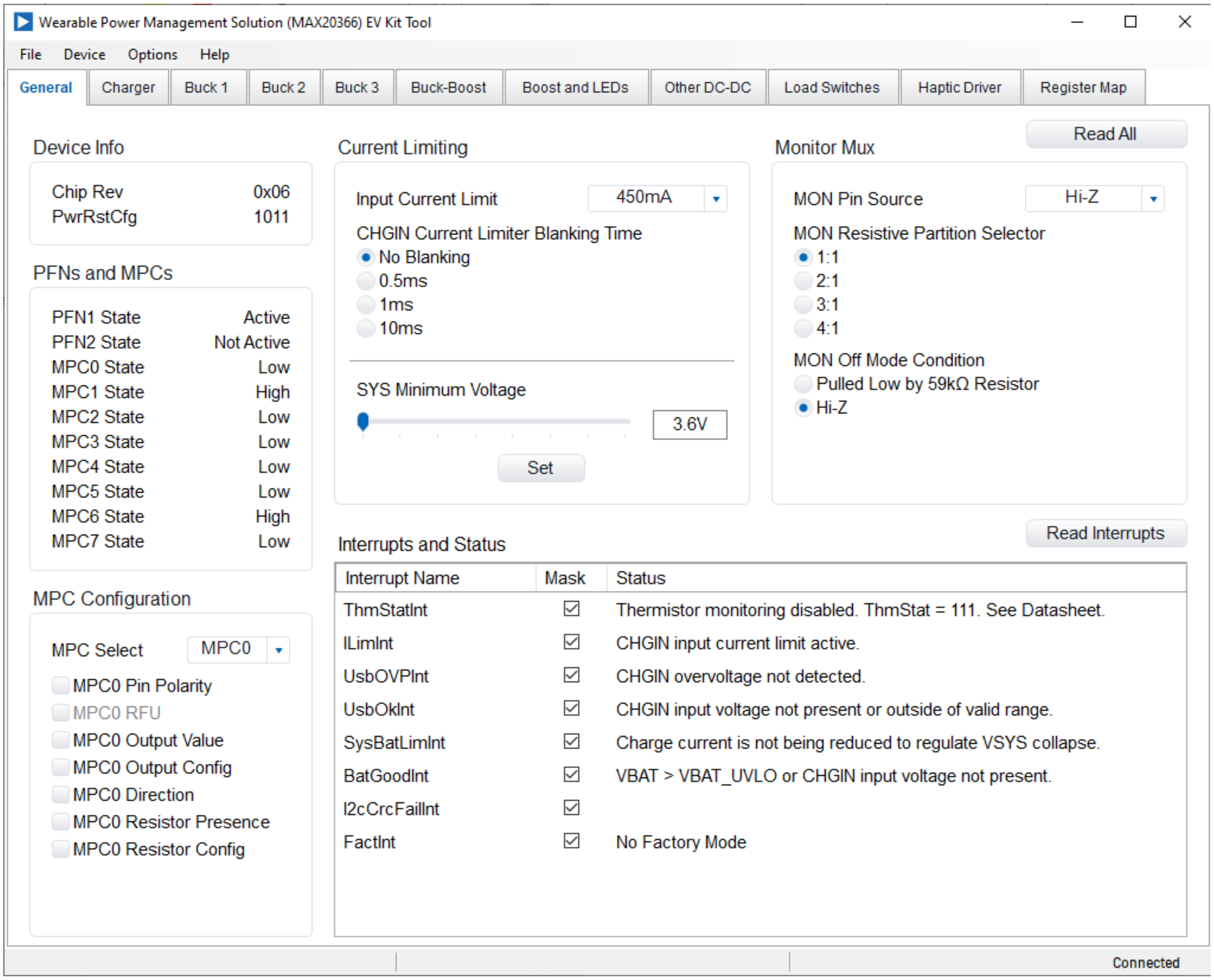


Figure 3. Connected Status

Detailed Description of Software

Software Startup

Upon starting the program, the EV kit software automatically searches for the USB interface circuit and then for the IC device addresses. The EV kit enters the normal operating mode when the connection is established and addresses are found. If the USB connection is not detected, the status bar displays **Not Connected**. If the USB connection is detected, but the MAX20366 is not found, the status bar shows **MAX20366 Not Found**.

ToolStrip Menu Bar

The ToolStrip menu bar (*Figure 4*) is located at the top of the GUI window. This bar comprises **File**, **Device**, **Options**, and **Help** menus; each function is detailed in the following sections.

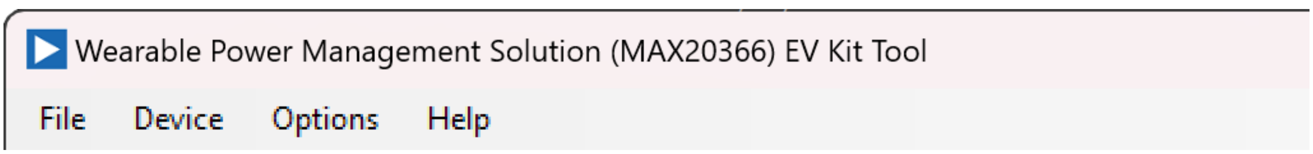


Figure 4. The ToolStrip Menu Items

File Menu

The **File** menu contains the option to exit out of the GUI program.

Device Menu

The **Device** menu provides the ability to connect or disconnect the EV kit to the GUI. The **Advanced → I^{2}C Read/Write** menu allows to read from or write to a selected register with a specified peripheral address. The **Advanced → Use USB2PMB2#** option should be checked if using with the USB2PMB2# adapter board.

Options Menu

The **Options** menu provides several settings to access additional features offered by the GUI. The **Disable Polling** option allows registers to be read manually instead of receiving automatic frequent register updates from the IC. The **Lock/Unlock** option allows for the lock or unlock of the charger, bucks, boost, buck-boost, and LDOs through I^{2}C. The **Use Fletcher-16 Checksum** is checked by default. The EV kit IC has the checksum enabled (i2c_crc_ena = enabled). Uncheck the **Use Fletcher-16 Checksum** if evaluating an IC with checksum option disabled.

Help Menu

The **Help** menu contains the **About** option, which displays the GUI splash screen indicative of the GUI version being used.

Tab Controls

The MAX20366 EV kit software GUI provides a convenient way to test the features of the MAX20366. Each tab contains controls relevant to various blocks of the device. Changing these interactive controls triggers a write operation to the MAX20366 to update the register contents. The **Read All** button reads all the configuration registers that are visible on the current tab page. The **Interrupts and Status** section in each tab shows the state of the status registers and their corresponding interrupts. Checking or unchecking the Mask option controls which interrupts cause the $\overline{\text{INT}}$ output to be pulled low when asserted.

Click the **Read Interrupts** button to read and clear the interrupts visible in the current tab. Asserted interrupts are denoted by bold text in the **Interrupt Name**. All statuses are polled continuously. The polling feature can be disabled in the **Options** section of the menu bar by selecting **Disable Polling**.

General Tab

The **General** tab (*Figure 5*) provides details on device info, PFNs, and MPCs' status and configuration. Charger input current and voltage limit setting, IVMON setting, and some general interrupts and status are also found under this tab.

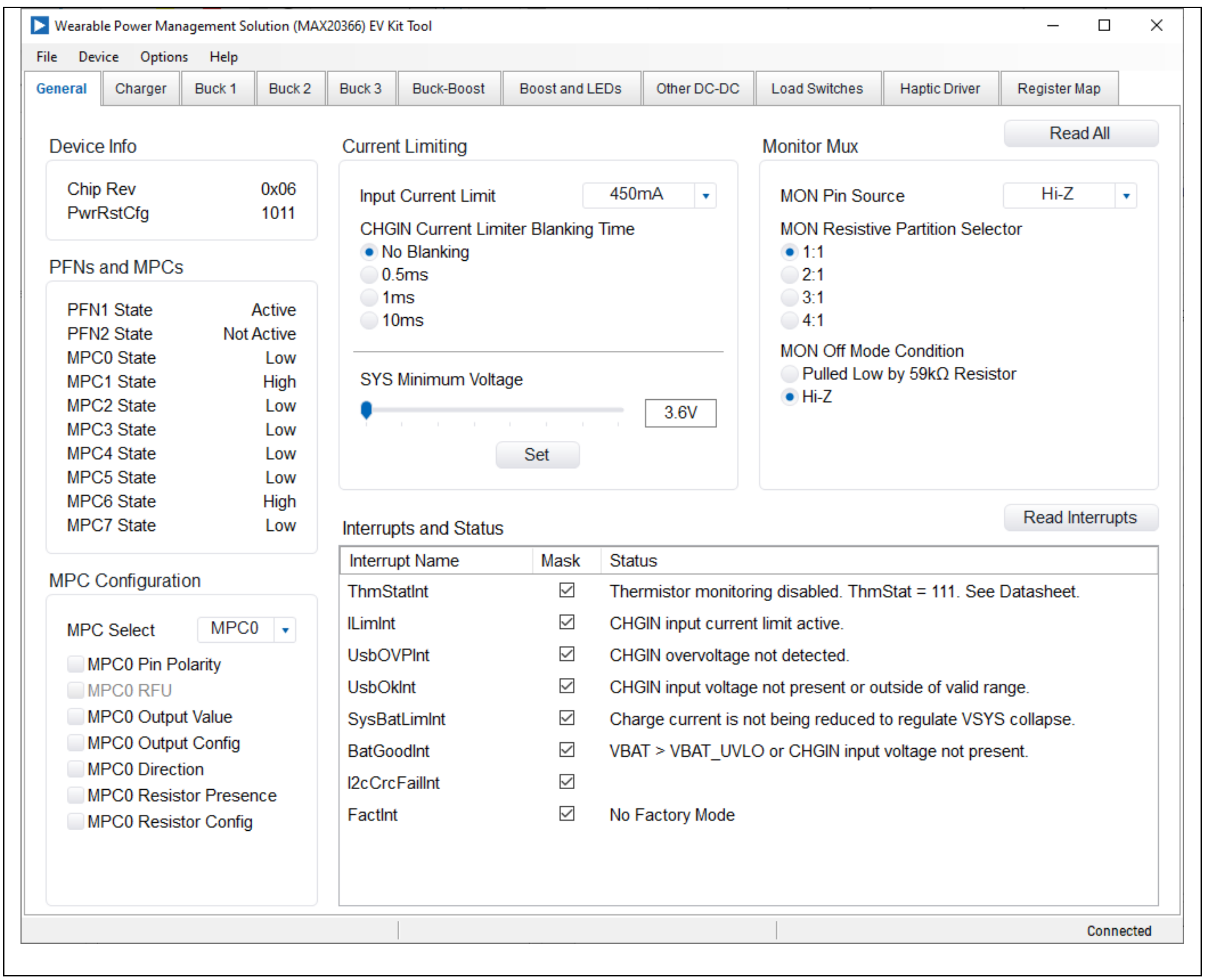


Figure 5. General Tab

Charger Tab

The **Charger** tab (*Figure 6*) provides options to set charger voltage, current, and timer in different charging states. The thermistor monitor configuration can be accessed by clicking the **Advanced** button.

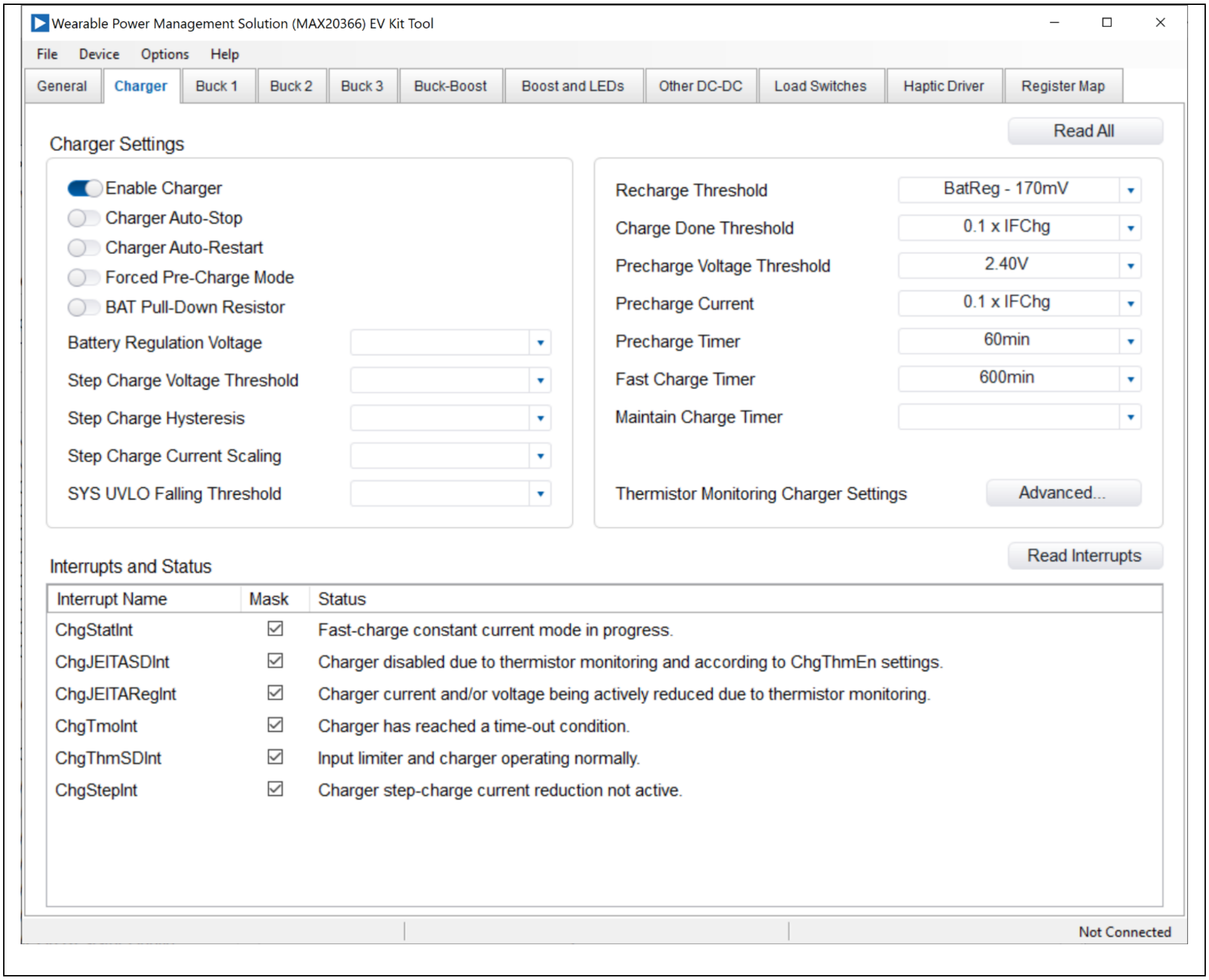


Figure 6. Charger Tab

Buck1/2/3, Buck-Boost Tab

The **Buck1**, **Buck2**, **Buck3**, and **Buck-Boost** tabs (*Figure 7*, *Figure 8*, *Figure 9*, and *Figure 10*) provide options to enable buck/buck boost, set buck/buck boost voltages, inductor current settings, DVS mode and voltage setting, and some additional settings.

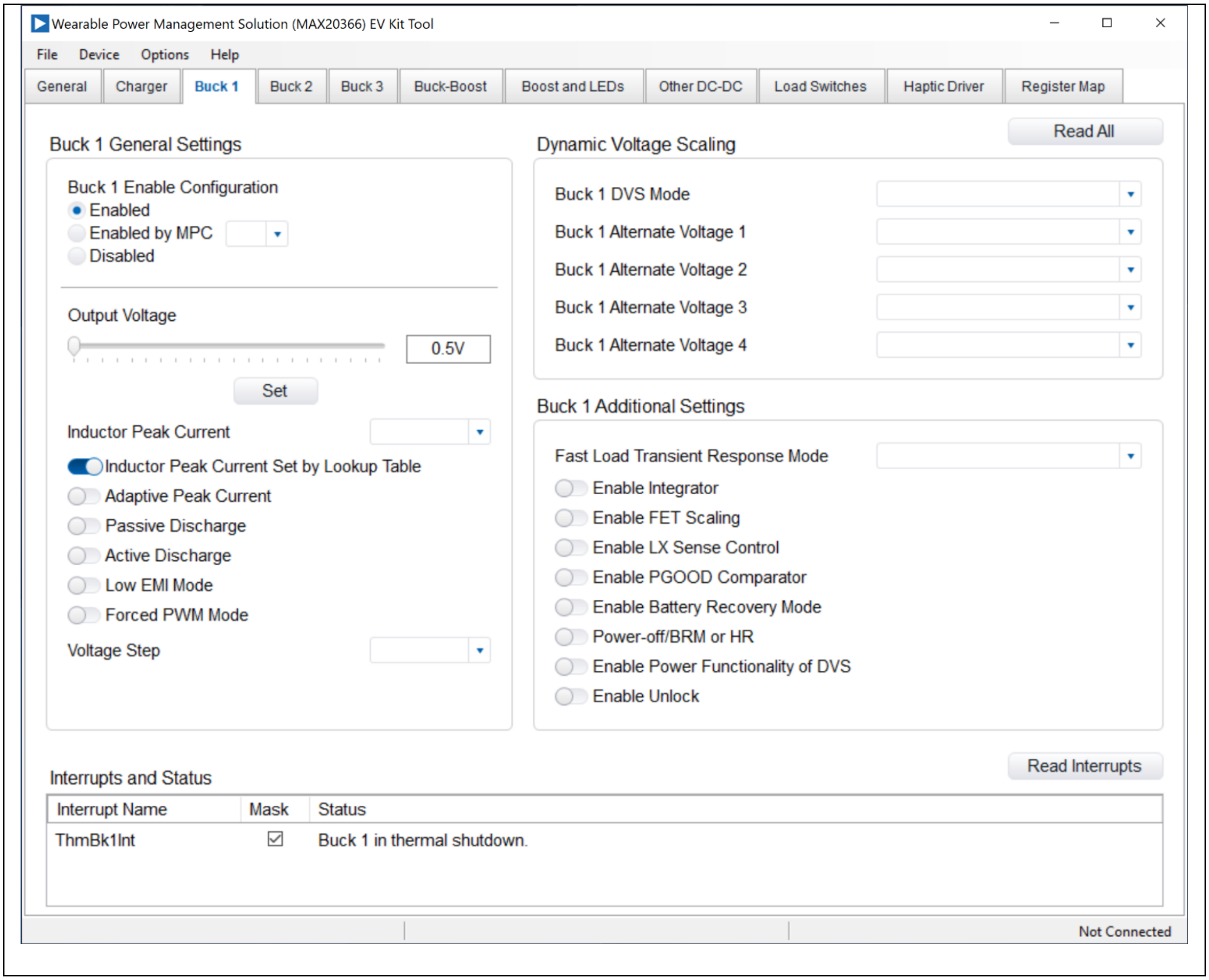


Figure 7. Buck1 Tab

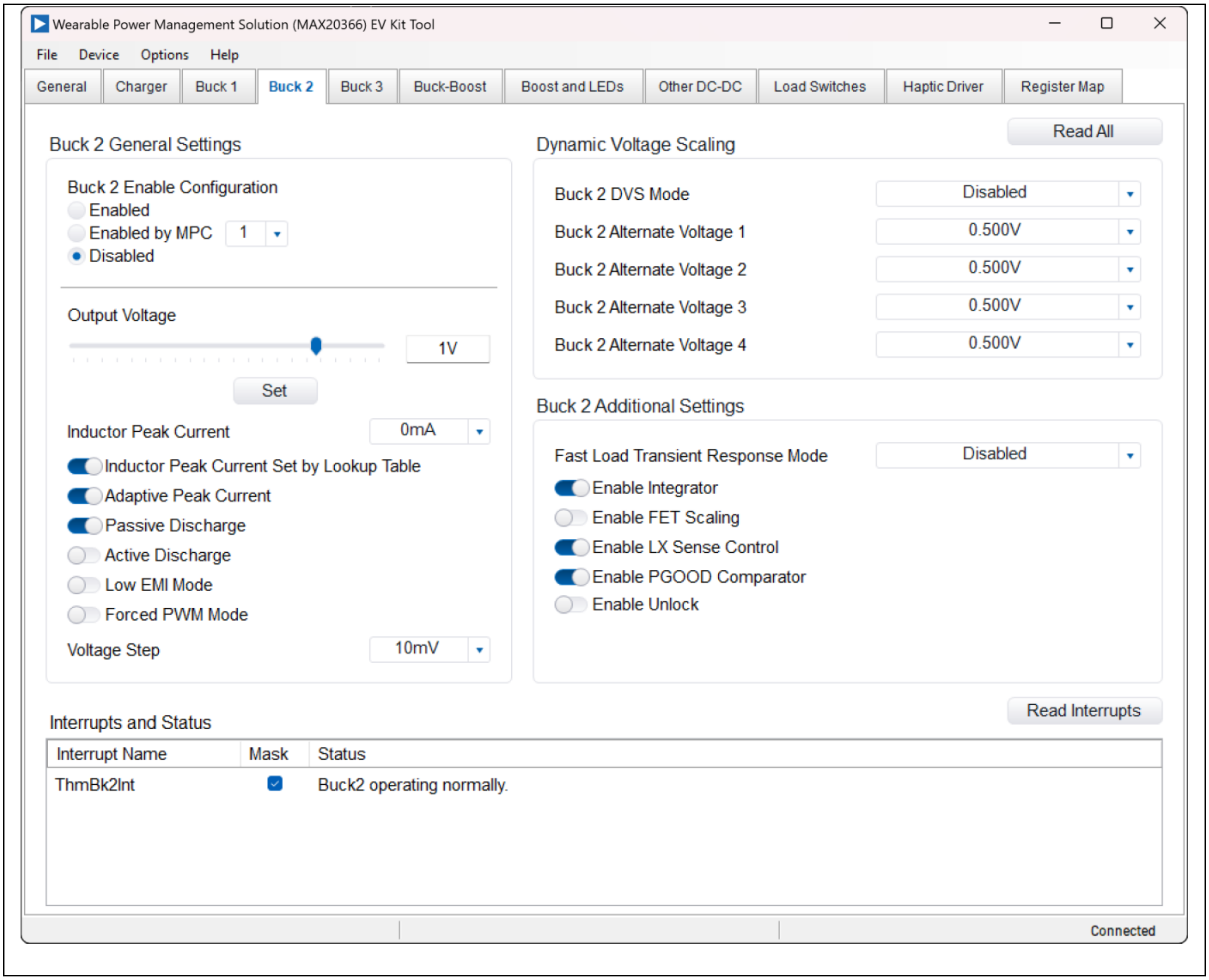


Figure 8. Buck2 Tab

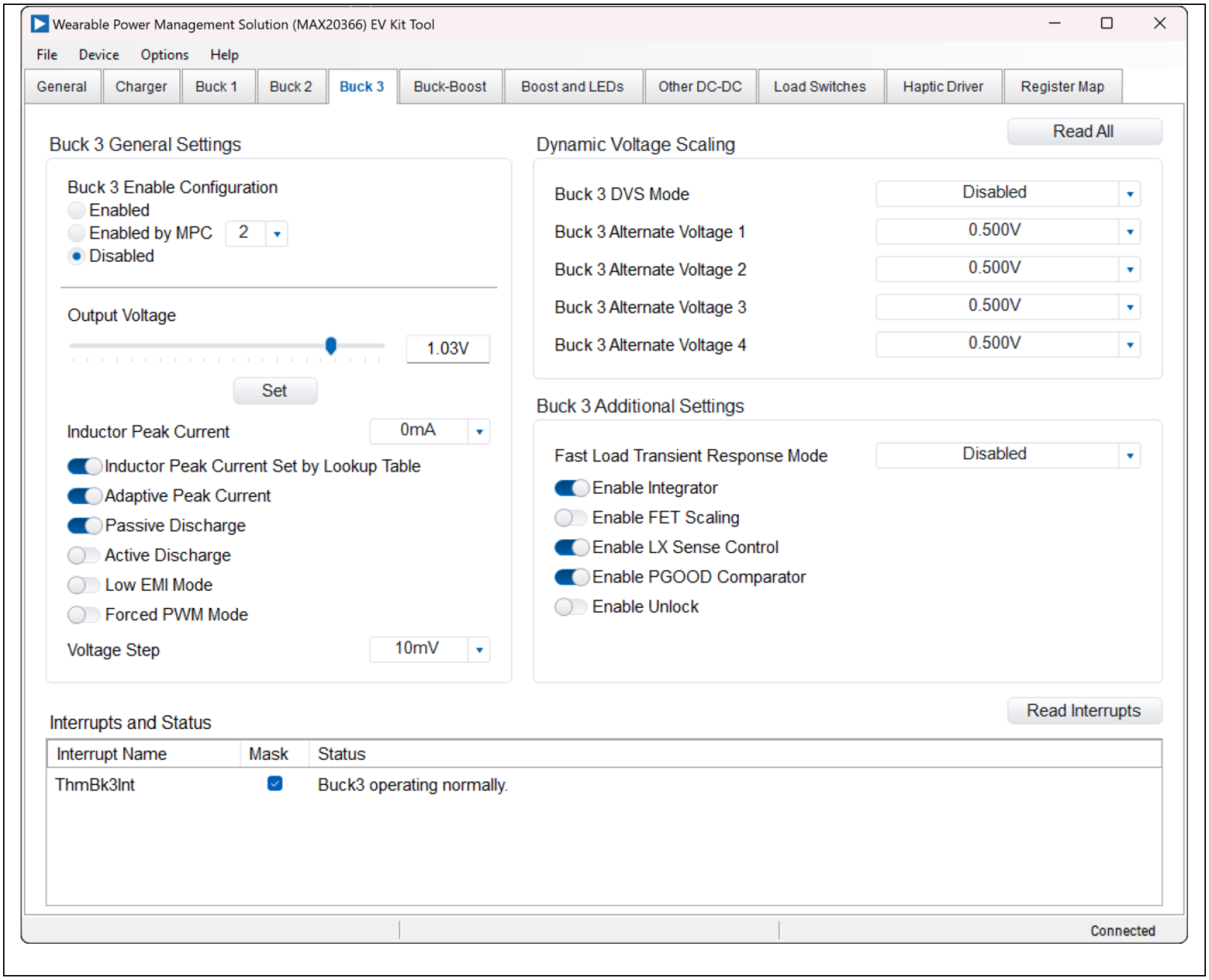


Figure 9. Buck3 Tab

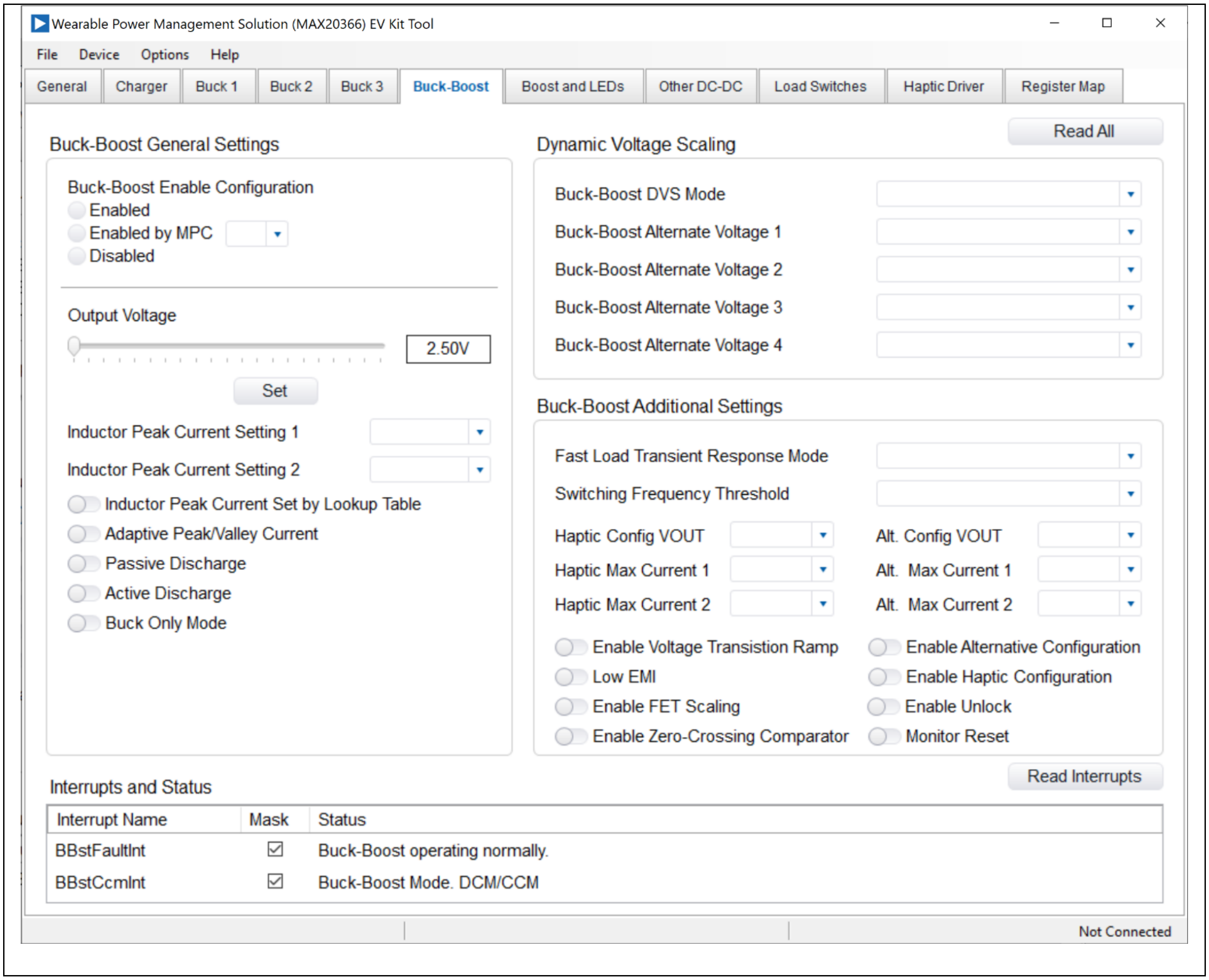


Figure 10. Buck-Boost Tab

Boost and LEDs Tab

The **Boost and LEDs** tab (*Figure 11*) provides options to enable boost, set boost voltage, inductor current settings, enable LEDs, and LED current sink setting.

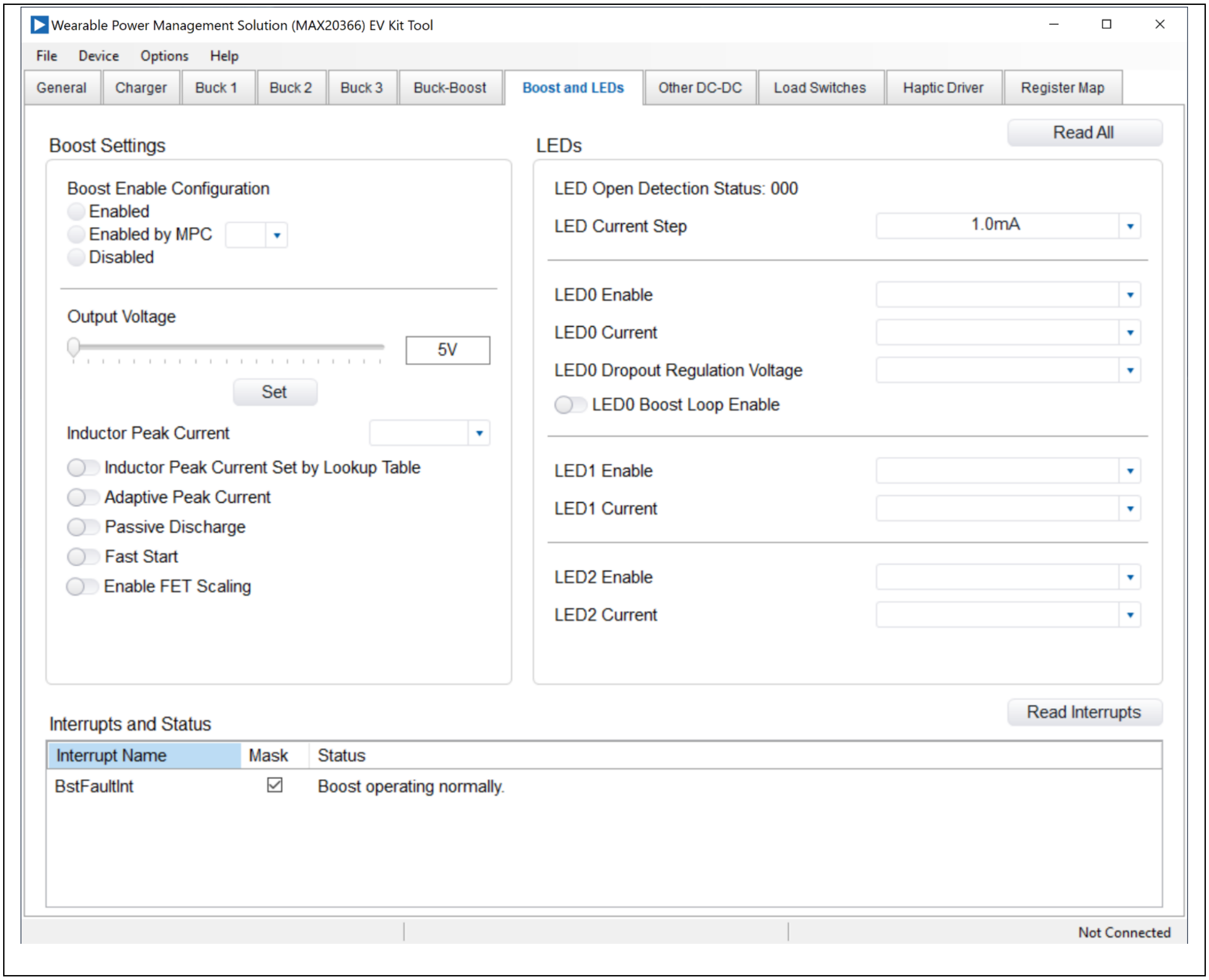


Figure 11. Boost and LEDs Tab

Other DC-DC Tab

The **Other DC-DC** tab (*Figure 12*) includes SFOUT, Charge Pump, LDO1, and LDO2 settings.

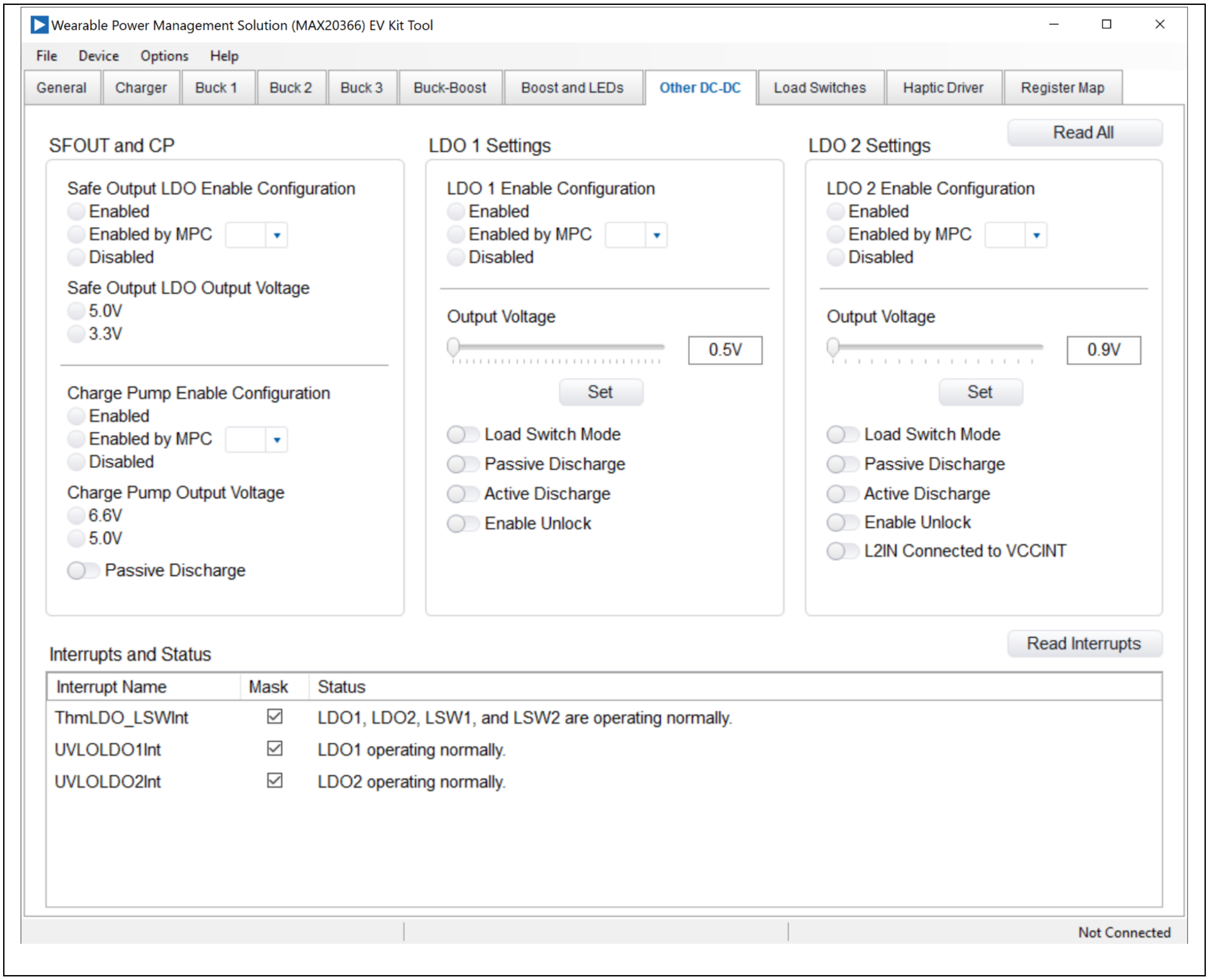


Figure 12. Other DC-DC Tab

Load Switches Tab

The **Load Switches** tab (*Figure 13*) includes Load Switch 1 and Load Switch 2 settings.

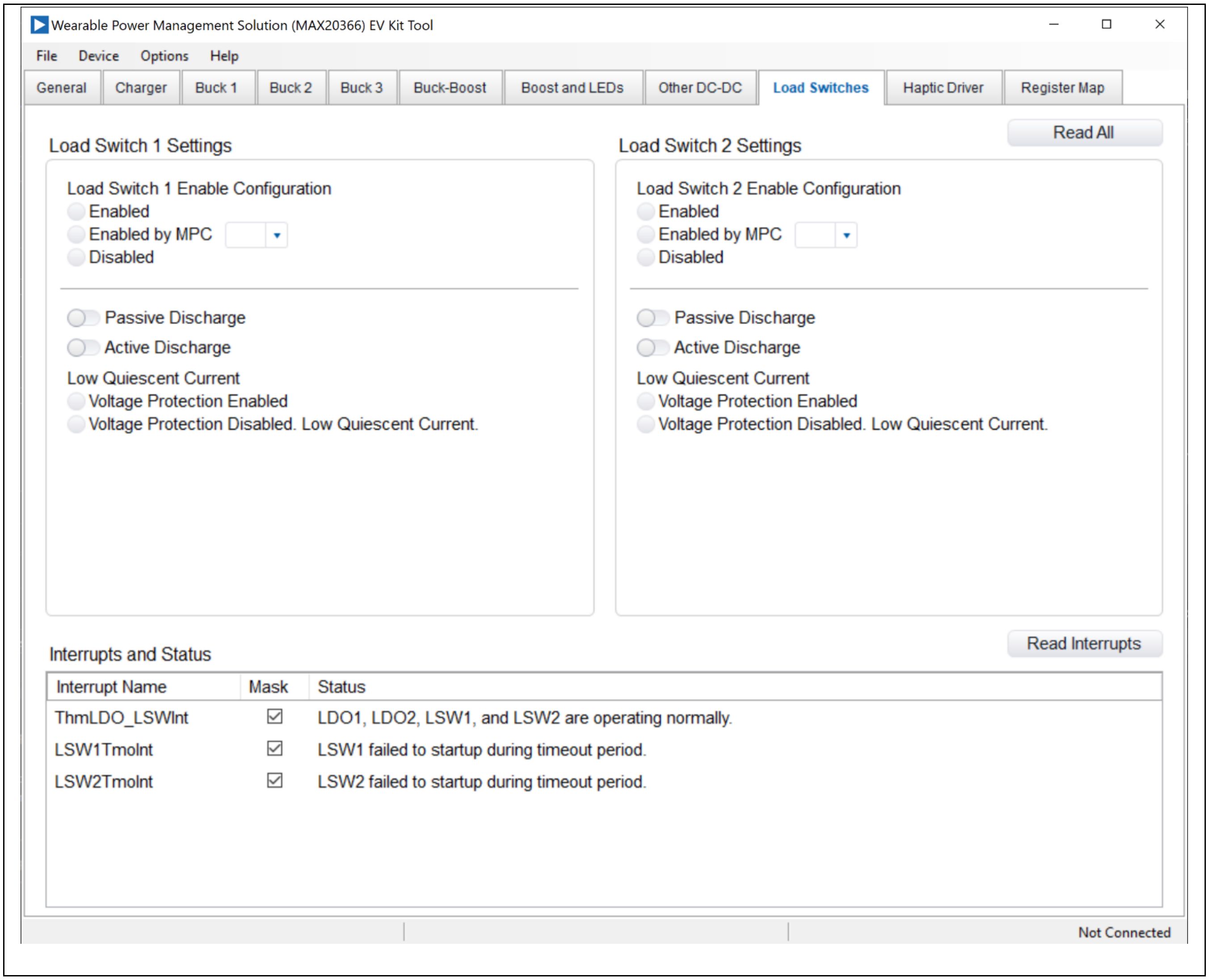


Figure 13. Load Switches Tab

Haptic Driver Tab

The **Haptic Driver** tab (*Figure 14*) provides options to choose actuator type, haptic driver mode, and different settings for each mode. To unmask the haptic interrupts, the HptStatIntM bit in 0x0D IntMask3 register also needs to be unmasked.

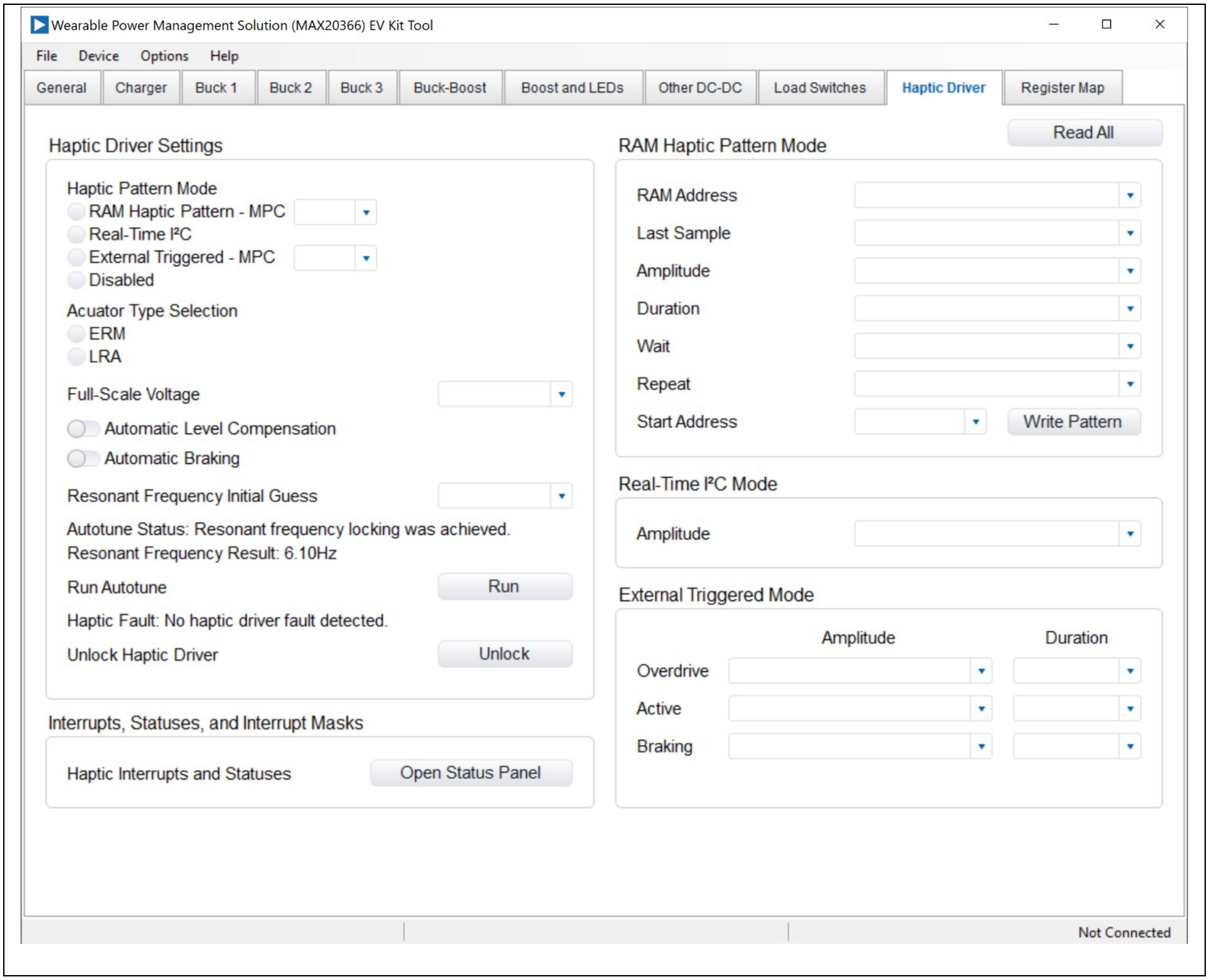


Figure 14. Haptic Driver Tab

Register Map Tab

The **Register Map** tab (*Figure 15*) provides all names and values of MAX20366 registers. Click **Read All** on the top right corner to perform a burst read of all registers.

The left table shows the register to be read from or written to. The right table contains descriptions for each register field of the selected 8-bit register. All bits, along with their field names, are displayed at the bottom of the page.

To set a bit, click the bit label. **Bold** text represents logic 1 and regular text represents logic 0. To configure the changes to the device, click the **Write** button at the bottom right.

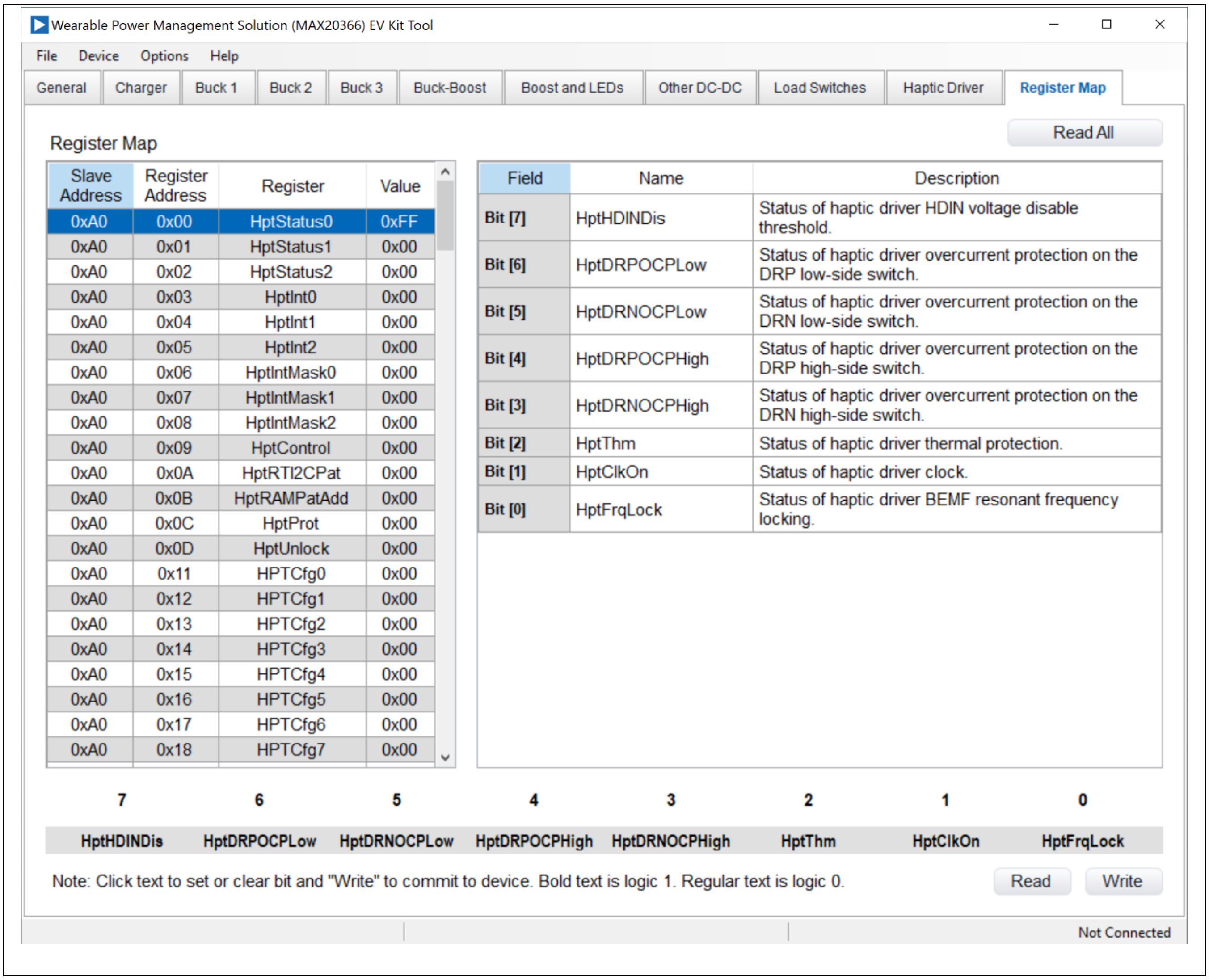


Figure 15. Register Map Tab

Detailed Description of Hardware

The MAX20366 EV kit evaluates the MAX20366 ultra-low power wearable PMIC, which communicates over the I^2C interface. The EV kit demonstrates the IC features such as bucks, buck-boost, boost, LED current sink, linear regulators, battery charger, and haptic driver. The EV kit uses the IC in a 72-bump wafer-level package on a proven, six-layer PCB design. The EV kit can use USB VBUS 5V DC for battery and charger input power source. Alternatively, the EV kit can be powered from an external power supply. *Figure 1* and *Figure 16* show the EV kit and block annotated pictures.

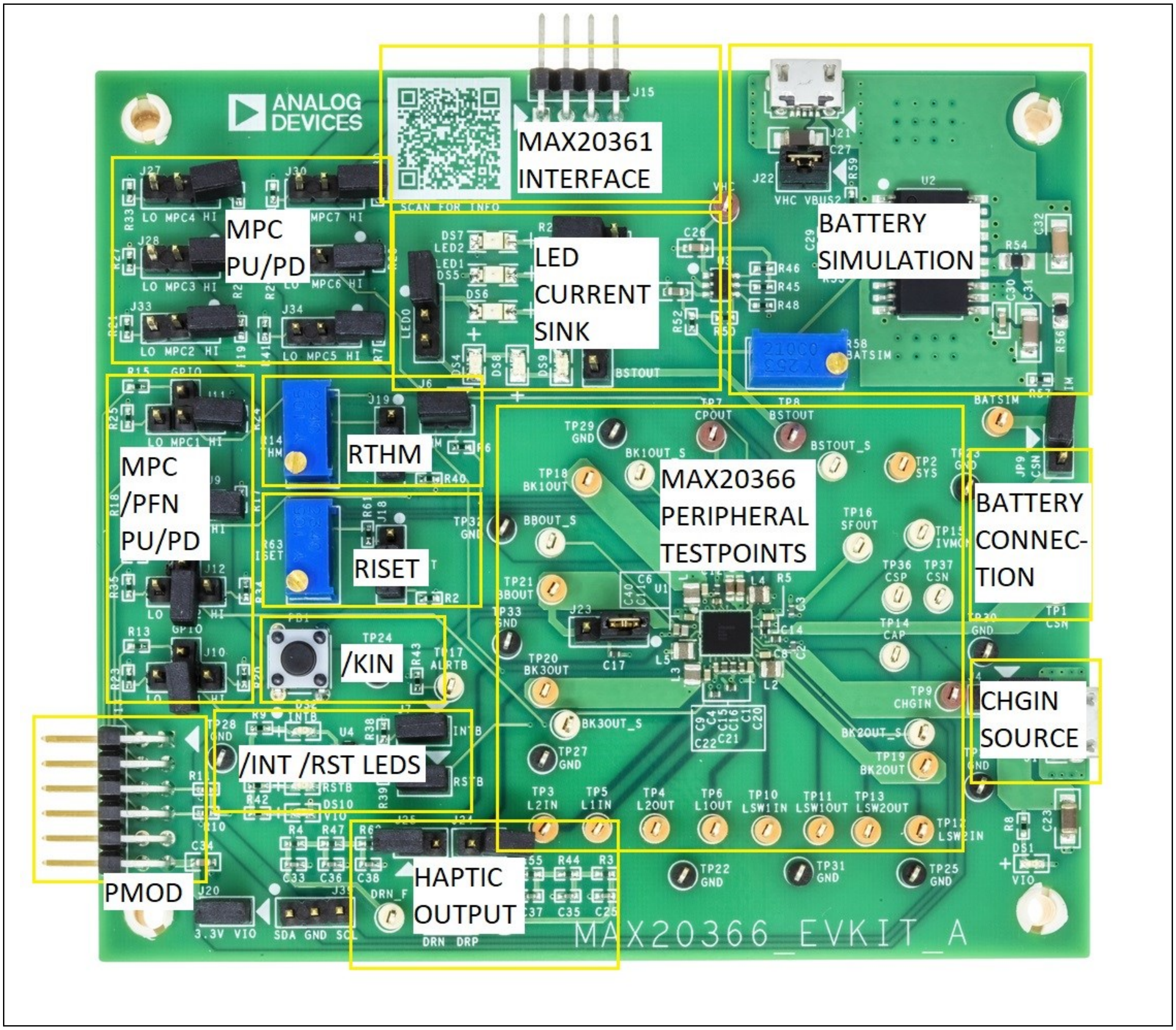


Figure 16. MAX20366 EV Kit Block Annotated Picture

Hardware Setup

To use the EV kit with the GUI, connect the MAXPICO2PMB# to the PMOD connector in the bottom left corner of the board. The MAXPICO2PMB# also provides 3.3V to the logic voltage VIO of the EV kit when shunting J20. Use the J21 USB VBUS to power the battery simulation circuits on the EV kit to supply BAT of the IC. Turning the R58 potentiometer can change the BATSIM voltage. Connect BATSIM to BAT of the IC with shunt on JP9. Alternatively, instead of using battery simulation circuits on the board, connect a Li-ion battery on J2 connector. Use the J1 USB VBUS as CHGIN source and place shunt on J4.

PFNs and MPCs States

The PFNs and MPCs can be pulled up to VIO through a 100kΩ resistor, or connected to ground through 100kΩ resistor.

Regulators and Peripherals

All regulator outputs are made available on test points. The inputs to the LDO1, LDO2, Load Switch 1, and Load Switch 2 must be supplied externally through test points. The LDO2 input can be supplied from VCCINT of the IC if set through the I^2C. Bucks, buck-boost, and boost output have sense test points which provide easy voltage measuring.

Thermistor and SET Adjustment

When the J6 shunt is installed, THM is pulled up to TPU through a 10kΩ resistor. Header J19 is used to select the pull-down resistor for THM. When pins 1 and 2 are shunted, potentiometer R14 is used to simulate a thermistor at THM. When pins 2 and 3 are shunted, a fixed 10kΩ resistor is connected between THM and ground.

Header J18 is used to select the resistor for R_{ISET} which sets the fast-charge current I_{FCHG}. Shunting pins 1 and 2 select potentiometer R63. Change R_{ISET} to change I_{FCHG}. Shunting the Pin 2 and Pin 3 selects a fixed 10kΩ resistor, which sets fast-charge current to 0.2A.

$\overline{INT}$ and $\overline{RST}$ LED Indicators

Shunts can be installed on J7 and J8 to show the status of $\overline{INT}$ and $\overline{RST}$ as LED indicators, DS2 and DS3. When the corresponding LED illuminates, it verifies that the active-low output is pulled low.

Haptic Driver

Select haptic driver supply using J23. When pins 1 and 2 are shunted, HDIN is powered from SYS. When pins 2 and 3 are shunted, HDIN is sourced from BBOUT. The haptic driver output is available on J5 where an LRA or ERM vibration motor can be connected. By shunting J24 and J25, haptic waveform can be measured with the on-board low-pass filters which convert pulse-width modulation (PWM) to sinewave.

LED Current Sink

The EV kit includes multiple LEDs to test the LED0, LED1, and LED2 current sinks. The current source for LED1 and LED2 can be connected to SYS by shunting J14. The current source for LED0 can be selected between SYS and BSTOUT by J17. Using J16, select between sinking the current from one LED or three LEDs for LED0.

Jumper Setting

Table 1 shows the detailed jumper setting, and *Table 2* shows the connector description.

Table 1. Jumper Setting

JUMPER	SHUNT POSITION	DESCRIPTION
J3	1-2*	CSN connect to FGBAT
J4	1-2	CHGIN connect to USB VBUS from J1
J6	1-2*	THM connect to TPU for thermistor monitoring
J7	1-2*	$\overline{INT}$ connect to pull up VIO and DS2.
J8	1-2*	$\overline{RST}$ connect to pull up VIO and DS3
J9	1-2	MPC0 pull down to ground
	1-3	MPC0 connect to GPIO3
	1-4	MPC0 pull up to VIO
J10	1-2	PFN1 pull down to ground
	1-3	PFN1 connect to GPIO1
	1-4	PFN1 pull up to VIO
J11	1-2	MPC1 pull down to ground
	1-3	MPC1 connect to GPIO4
	1-4	MPC1 pull up to VIO
J12	1-2	PFN2 pull down to ground
	1-3	PFN2 connect to GPIO2
	1-4	PFN2 pull up to VIO
J14	1-2	LED1/LED2 supply from SYS voltage
J16	1-2	LED0 connect to one LED

	2-3	LED0 connect to three LEDs
J17	1-2	LED0 supply from SYS
	2-3	LED0 supply from BSTOUT
J18	1-2	ISET connect to potentiometer
	2-3*	ISET connect to 10kΩ (fast-charge current 0.2A)
J19	1-2	THM connect to potentiometer
	2-3*	THM connect to 10kΩ (50%/room zone)
J20	1-2*	VIO connect to 3.3V from PMOD
J22	1-2*	VHC connect to USB VBUS from J21
J23	1-2*	HDIN connect to SYS
	2-3	HDIN connect to BBOUT
J24	1-2	DRP connect to low-pass filter which convert PWM to sinewave, measure filtered waveform at DRP_F
J25	1-2	DRN connect to low-pass filter which convert PWM to sinewave, measure filtered waveform at DRN_F
J27	1-2	MPC4 pull up to VIO
	2-3	MPC4 pull down to ground
J28	1-2	MPC3 pull up to VIO
	2-3	MPC3 pull down to ground
J30	1-2	MPC7 pull up to VIO
	2-3	MPC7 pull down to ground
J31	1-2	MPC6 pull up to VIO
	2-3	MPC6 pull down to ground
J33	1-2	MPC2 pull up to VIO
	2-3	MPC2 pull down to ground
J34	1-2	MPC5 pull up to VIO
	2-3	MPC5 pull down to ground
J39	1-2	SDA connect to ground
	2-3	SCL connect to ground
JP9	1-2	BATSIM connect to CSN

**Default position.*

Table 2. Connectors Description

CONNECTOR	DESCRIPTION
J1	Connect to USB cable for CHGIN voltage
J2	Connect to battery
J5	Connect to LRA/ERM haptic actuator
J13	Connect to MAXPICO2PMB#
J15	Connect to MAX20361 EV kit
J21	Connect to the USB cable for battery simulation

Interaction with MAX20361 EV Kit

The MAX20366 PMIC (version with harvester enabled, HrvEn = 1) can seamlessly interact with the MAX20361 solar energy harvester. Interactions between the MAX20366 charger and the MAX20361 harvester can be evaluated with the MAX20366HEVKIT# and MAX20361EVKIT#.

Hardware Settings

The following jumper settings can be used for the interaction test. The MAX20361EVKIT# jumper settings are as follows:

1) Follow the default jumper settings of the MAX20361 EV kit data sheet in *Table 1*.

2) For JU2 and JU3, connect jumper position 3–4 so $\overline{EN}$ and WAKE are connected to interaction Connector S1.

3) Connect JU9 to bring SYS to interaction Connector S1.

4) Utilize the on-board current source for a steady input current. Refer to the *On-Board Current Source* section of the MAX20361 EV kit data sheet.

5) The highest on-board input current is recommended. Connect jumper position 1–2 of JU15 to select the highest current source.

The MAX20366HEVKIT# jumper settings are as follows:

1) Follow the default jumper settings in *Table 1*.

2) Remove the jumpers on J30 and J31 so MPC6 and MPC7 are left unconnected. When the MAX20366HEVKIT# and the MAX20361EVKIT# are connected, the MAX20366 MPC6 pin is connected to the MAX20361 EN pin, and the MAX20366 MPC7 pin is connected to the MAX20361 WAKE pin.

3) Either the battery simulator (power through J21) or an actual Lithium-ion battery (connected to J2) can be used for the interaction test. Remember to disconnect JP9 when using the actual Lithium-ion battery.

Software Settings

See the following registers to configure the parameters of the interaction test.

For the MAX20361, field WakeThr[2:0] of register 0x05 WakeCfg determines the SYS/BAT voltage threshold that the WAKE output is asserted. During interaction, when WAKE is high, the MAX20366 enters ON Mode.

For the MAX20366, registers ThmCfg2, HrvCfg0, and HrvCfg1 offer some settings for how the harvester and PMIC interaction takes place. Refer to the *MAX20361 Harvester Interaction* section in the MAX20366 IC data sheet.

Interaction Process

To start the test, connect two EV kits using the S1 of the MAX20361EVKIT# and J15 of the MAX20366HEVKIT#. When the MAX20361 harvester SYS or output current is charging the BAT node of the MAX20366 PMIC, the MAX20361 harvest counter updates, which indicates the number of LX pulses transferred from SRC to SYS and correlates to the SYS charging current.

In the PMIC ON Mode, WAKE is asserted and $\overline{EN}$ is low. The SYS current keeps charging the battery until the BAT voltage reaches the harvester battery-regulation voltage set in HrvBatReg. When SYS charging halts, the harvest counter stops updating.

In PMIC Battery Recovery Mode, both WAKE and $\overline{EN}$ are low. The SYS current keeps charging the battery until the BAT voltage reaches the WAKE threshold to enter PMIC ON Mode.

Fuel Gauge Software

The MAX20366 integrates the MAX17260, an ultra-low power fuel gauge IC which implements the Analog Devices ModelGauge™ m5 algorithm with high-side current sensing. Use the MAX20360 Fuel Gauge GUI and MAXPICO2PMB to evaluate the ModelGauge m5 fuel gauge.

Sense Resistor

The default sense resistor (R5) on the MAX20366 EV kit is 0.05Ω. To obtain the most accurate testing data, replace R5 with the actual sense resistor used in the actual application.

Software Installation

Visit www.analog.com to download the latest version of the Fuel Gauge EV kit software, MAX20360 Fuel Gauge Tool, MAX17260GUISetupxxx.zip located on the MAX20360 EV Kit web page. Download the software to a temporary folder and unzip the zip file. Install the Fuel Gauge EV kit software on the computer by running the MAX17260GUISetupxxx.exe program inside the temporary folder.

Hardware Setup

The following procedure applies to the MAX20366 EV kit:

1) Connect the MAXPICO2PMB Adapter Board to J13 of the MAX20366 EV kit.

2) Connect Jumper J4 and remove Jumper JP9.

3) Connect the application's battery to Jumper J2 and ensure the battery's polarity connection.

4) Connect the MAXPICO2PMB Adapter Board to the computer USB port through USB A to USB Micro-B cable.

Communication Port

The Fuel Gauge software automatically finds the MAXPICO2PMB adapter when connected to any USB port. Communication status is shown on the right-hand side of the bottom status bar. (See *Figure 17.*) If the adapter is not found, a No USB Adapter message is displayed. If the adapter is found, but the MAX20366 EV kit board is not found, a NO SLAVE DEVICE message is displayed. If the communication is valid, a green bar updates as the software continuously reads the IC registers. If the MAXPICO2PMB is connected, the status bar should be active. The bottom status bar also displays information on data logging status, the communication mode, hibernation status, selected current-sense resistor value, device serial number, and the GUI's version number.

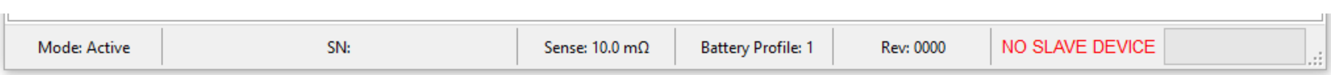


Figure 17. Bottom Status Bar

Program Tabs

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

ModelGauge m5 Tab

The **ModelGauge m5** tab displays the important output information read from the IC. *Figure 18* shows the format of the **ModelGauge m5** tab. Information is grouped by function and each is detailed separately.

State-of-Charge

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

Cell Information

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

Measurements

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

Alerts

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

At Rate

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

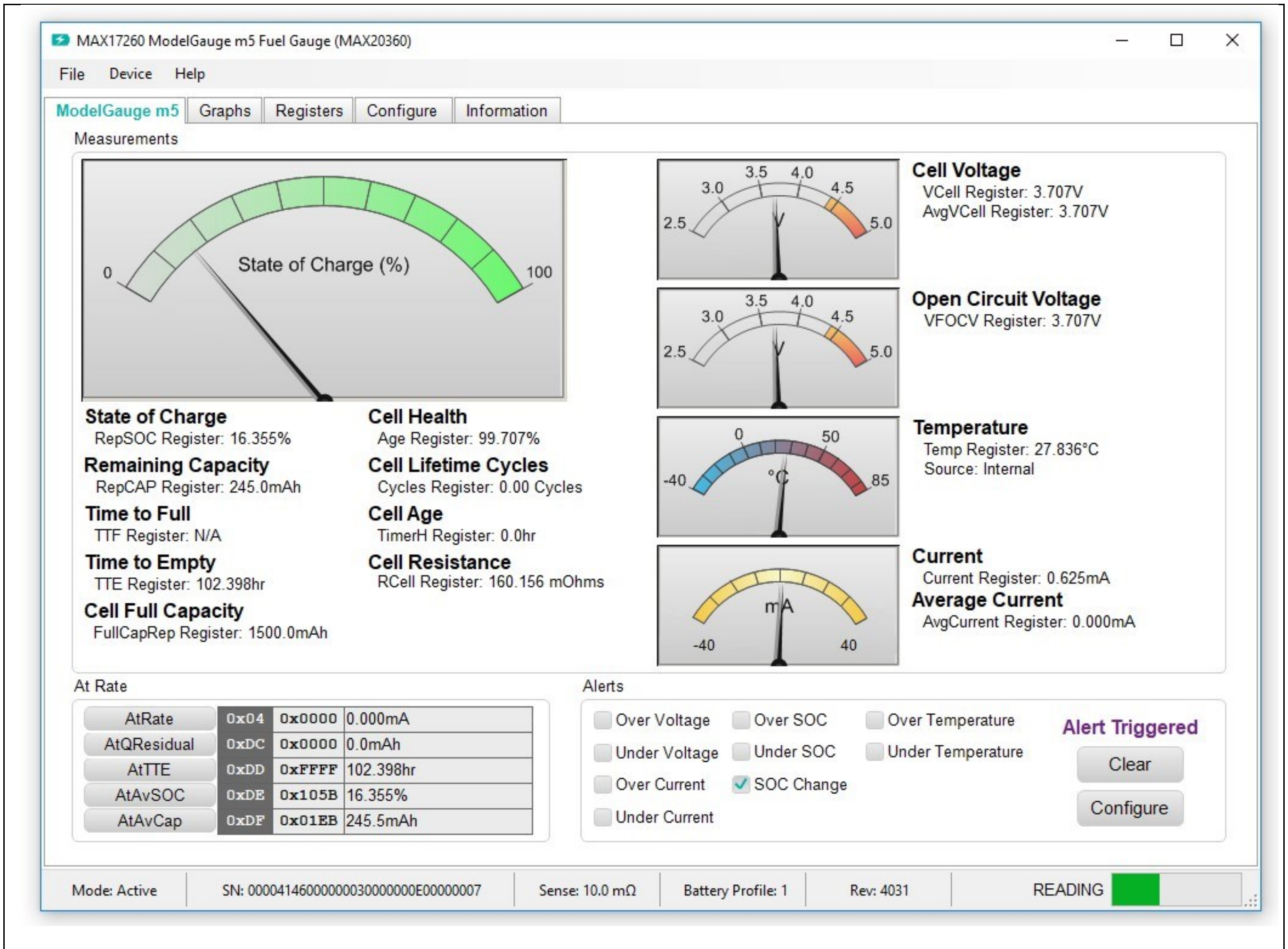


Figure 18. ModelGauge m5 Tab

Graphs Tab

Figure 19 shows the format of the **Graphs** tab. Graph information is grouped into four categories: voltages, temperatures, capacities, and currents. The user can turn on or off any data series using the checkboxes on the right-hand side of the tab. The graph visible viewing area can be adjusted from 10 minutes up to 1 week. The graphs remember up to 1 week worth of data. If the viewing area is smaller than the time range of the data already collected, the scroll bar below the graphs can be used to scroll through graph history. All graph history information is maintained by the program. Graph settings can be changed at any time without losing data.

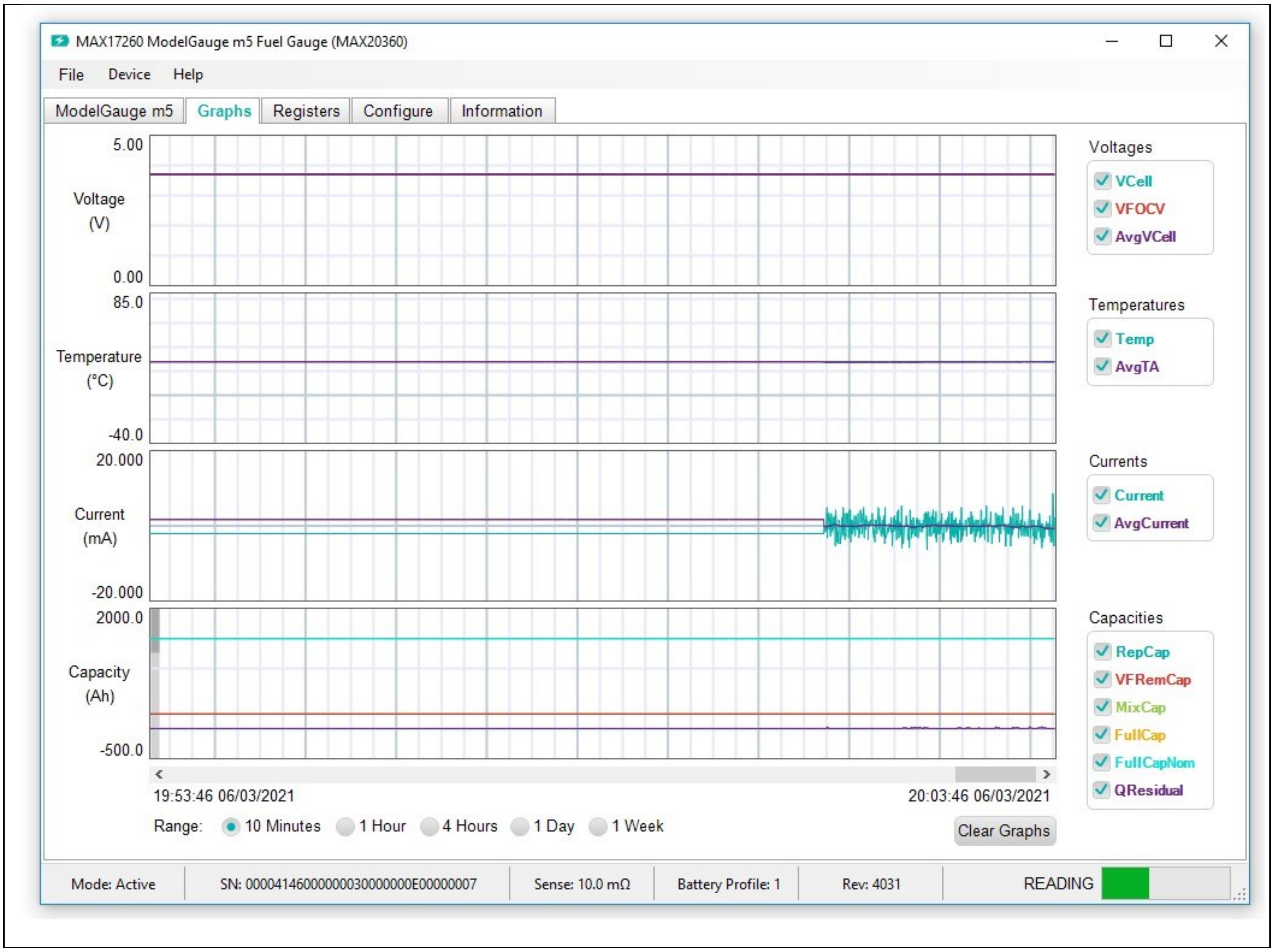


Figure 19. Graphs Tab

Registers Tab

The **Registers** tab allows the user access to all fuel gauge-related registers of the IC. *Figure 20* shows the format of the **Registers** tab. By using the drop-down menu on the left side of the tab, the user can sort the registers either by function or by their internal address. Each line of data contains the register name, register address, a hexadecimal representation of the data stored in the register, and if applicable, a conversion to application units. To write a register location, click the button containing the register name. A pop-up window allows the user to enter a new value in either hexadecimal units or application units. The main read loop temporarily pauses while the register updates.

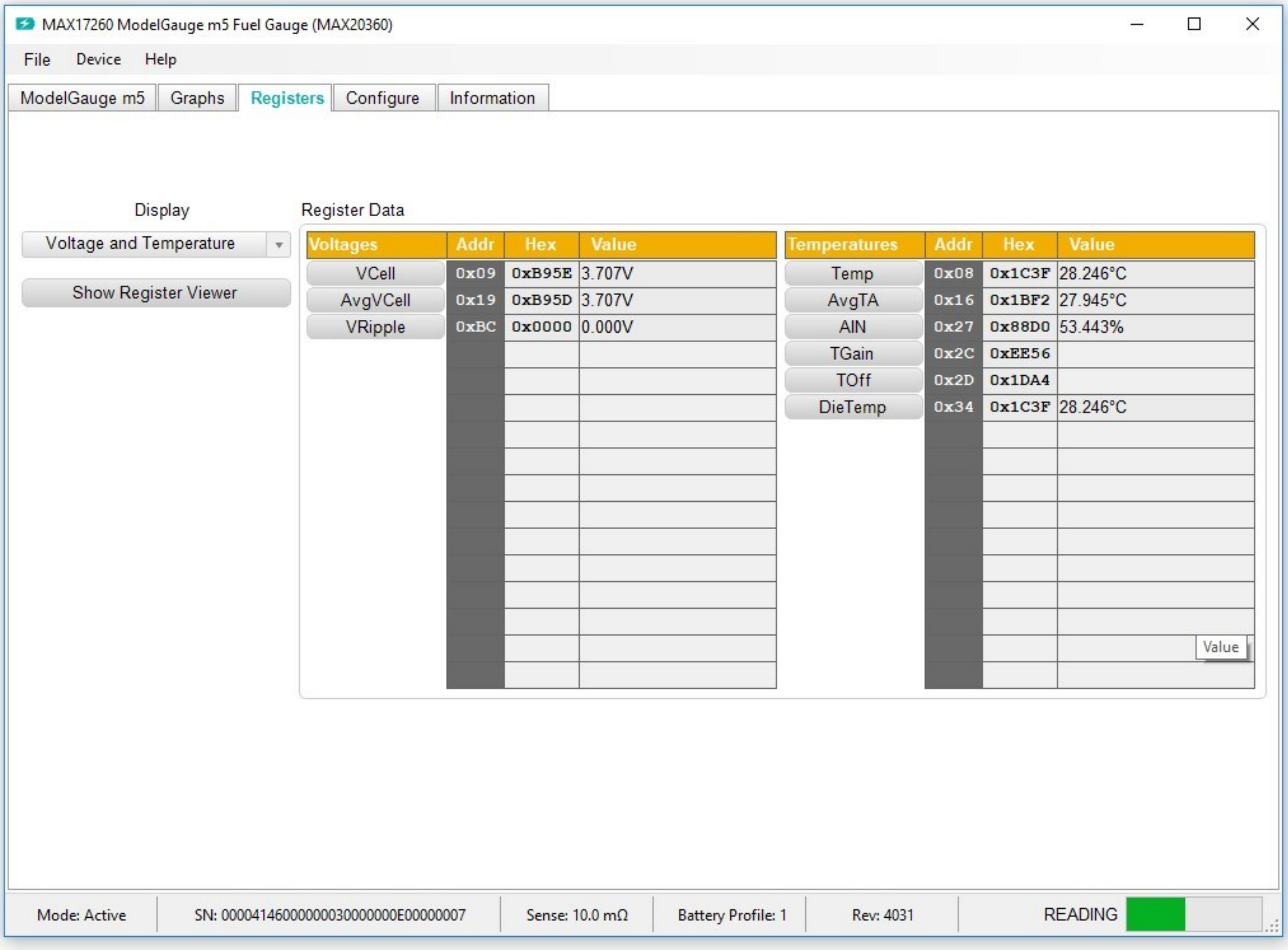


Figure 20. Registers Tab

Configure Tab

The **Configure** tab allows the user to access any general IC functions not related to normal writing and reading of register locations. *Figure 21* shows the format of the **Configure** tab. Each group box of the **Configure** tab is described in detail in the following sections.

Read/Write Register

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

Log Data to File

Data logging is always active when the EV kit software starts. The default data log storage location is the My Documents/Maxim Integrated/MAX17260/Datalog.csv. The user can stop data logging in by clicking the **Stop** button. The user can resume logging by clicking the **Start** button. All user available IC registers are logging in a .csv formatted file. The user can adjust the logging interval at any time. The user can also enable or disable the event logging at any time. When event logging is enabled, the data log also stores any IC write or reads that are not part of the normal read data loop and indicates that any time communication to the IC is lost. The GUI automatically begins writing to a new file on each launch. To manually begin logging into a new file, click the **Advance** button.

Reset IC

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

Battery Selection

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

Save and Restore

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

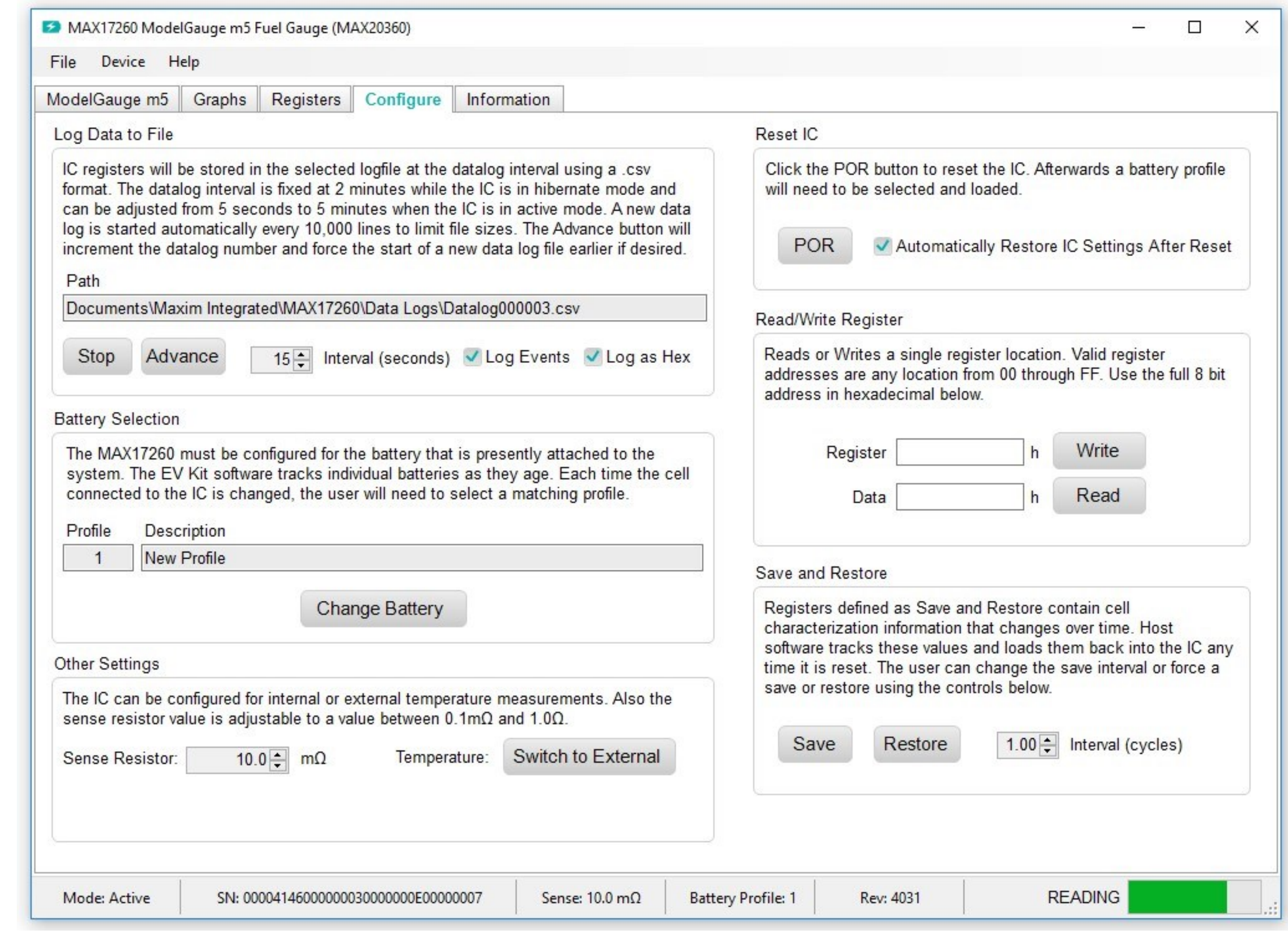


Figure 21. Configure Tab

ModelGauge m5 EZ Configuration

Before the IC accurately fuel gauges the battery pack, it must be configured with characterization information. This can be accomplished in two ways. The first is through a custom characterization procedure that can be performed by Analog

Devices under certain conditions. The result is an .INI summary file that contains information that can be programmed into the IC on the **Configure** tab. Contact Analog Devices for details on this procedure.

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

For EZ configuration, click the **Import INI File** button in the **Information** tab, or click **Change Battery** in the **Configure** tab. A **Battery Selector** panel, as shown in *Figure 22*, pops out. In the panel, select **Use Default IC Settings (EZ Config)** option. Fill in the rated battery capacity and the charge termination current, select the battery chemistry in the **Model ID** drop-down menu, and select the minimum system voltage in the **Empty Voltage** drop-down menu. Check the **Charge voltage is greater than 4.275V** box if the full charge voltage is higher than 4.275V. After configuring these items, click the **Save Profile** and update **IC button to load the EZ configuration** into the chip.

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

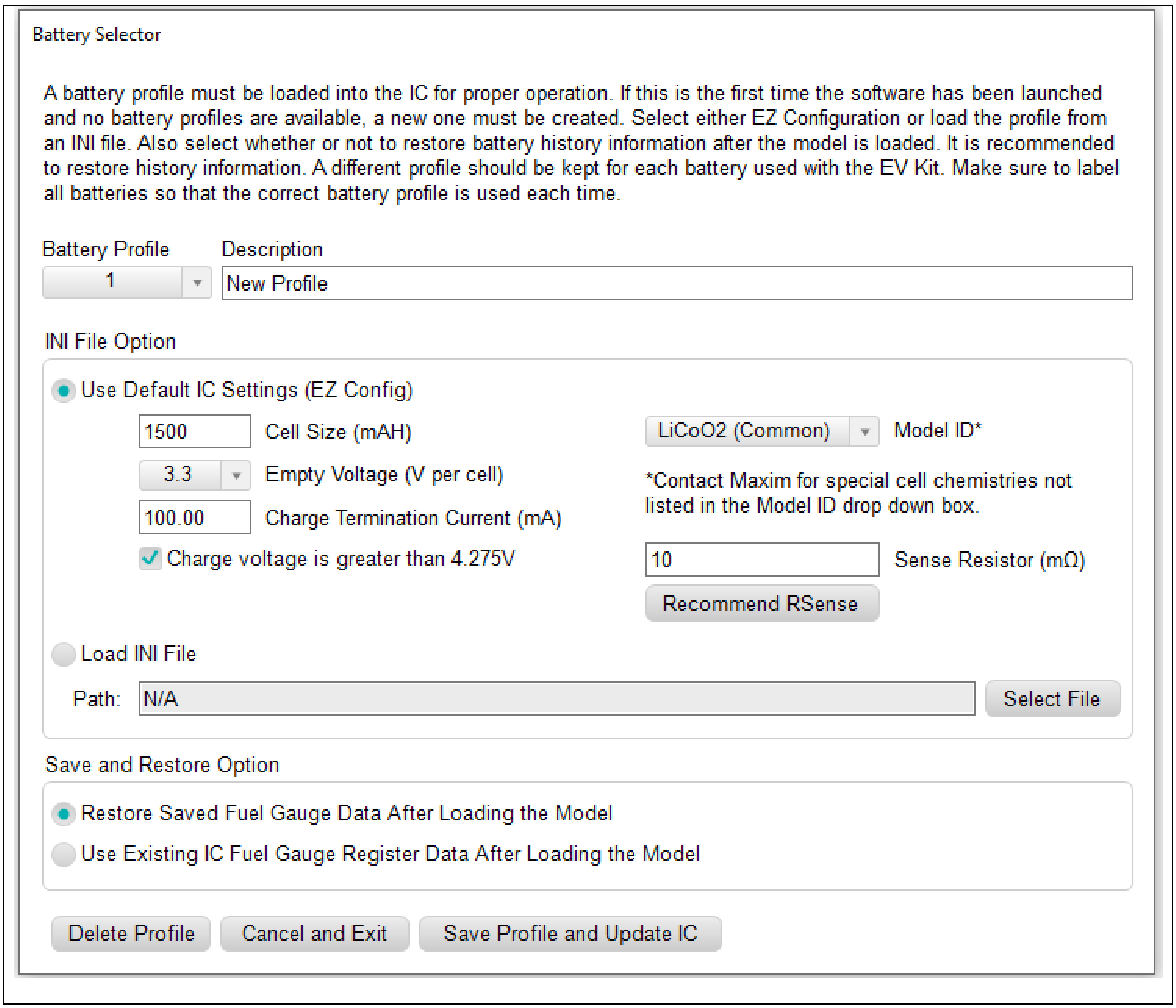


Figure 22. New Battery Selector Panel

Ordering Information

PART	HARVESTER ENABLE	TYPE
MAX20366EVKIT#	NO	EV Kit
MAX20366HEVKIT#	YES	EV Kit

#Denotes RoHS compliance.

MAX20366 EV Kit Bill of Materials

ITEM	REF_DES	DNI/ DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION
1	BATSIM, TP1-TP6, TP10-TP13, TP18-TP21	-	15	5003	KEYSTONE	N/A	TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; ORANGE; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;
2	BBOUT_S, BK1OUT_S-BK3OUT_S, BSTOUT_S, DRN_F, DRP_F, TP14-TP17, TP36, TP37	-	13	5002	KEYSTONE	N/A	TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; WHITE; PHOSPHOR BRONZE WIRE SILVER;
3	C1	-	1	C1005X7R1H104K050BB; GRM155R71H104KE14; C1005X7R1H104K050BE; UMK105B7104KV-FR; 04025C104KAT2A	TDK;MURATA;TDK;TAIYO YUDEN;AVX	0.1UF	CAP; SMT (0402); 0.1UF; 10%; 50V; X7R; CERAMIC
4	C2	-	1	C1005X5R1V225K050BC	TDK	2.2UF	CAP; SMT (0402); 2.2UF; 10%; 35V; X5R; CERAMIC
5	C3, C5, C13-C17, C21, C22	-	9	C1005X5R0J475K050BC	TDK	4.7UF	CAP; SMT (0402); 4.7UF; 10%; 6.3V; X5R; CERAMIC
6	C4	-	1	C1005X5R0J225K050BC; CL05A225KQ5NSN	TDK;SAMSUNG	2.2UF	CAP; SMT (0402); 2.2UF; 10%; 6.3V; X5R; CERAMIC
7	C6-C9, C11, C18, C20, C40	-	8	GRM155R60J226ME11	MURATA	22UF	CAP; SMT (0402); 22UF; 20%; 10V; X5R; CERAMIC ;
8	C10, C19	-	2	GRM188R6YA106MA73	MURATA	10UF	CAP; SMT (0603); 10UF; 20%; 35V; X5R; CERAMIC
9	C12	-	1	GRM155R71A273KA01; 0402ZC273KAT2A; CC0402KRX7R6BB273	MURATA;AVX; YAGEO	0.027UF	CAP; SMT (0402); 0.027UF; 10%; 10V; X7R; CERAMIC
10	C23, C27	-	2	GRM31CR71H475KA12; GRJ31CR71H475KE11;	MURATA;MURATA; MURATA;TAIYO YUDEN; MURATA;YAGEO	4.7UF	CAP; SMT (1206); 4.7UF; 10%; 50V; X7R; CERAMIC

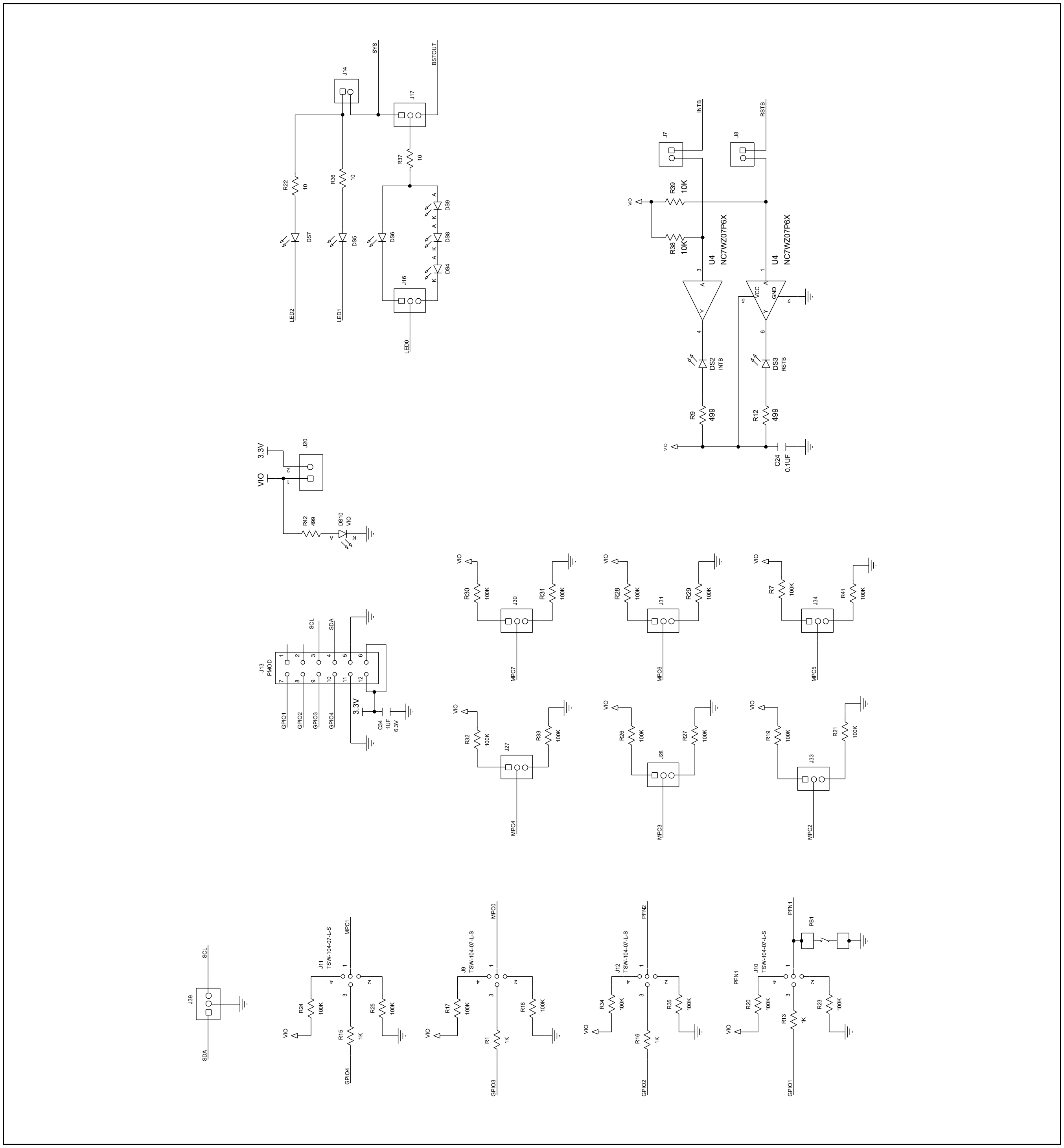
				GXM31CR71H475KA10; UMK316AB7475KL; GRM31CR71H475KA12L; CC1206KKX7R9BB475; CC1206KKX7R9BB475			
11	C24	-	1	C1608X5R1H104K080AA	TDK	0.1UF	CAP; SMT (0603); 0.1UF; 10%; 50V; X5R; CERAMIC
12	C25, C33, C35-C38	-	6	C1005X7R1C104K050BC; ATC530L104KT16; 0402YC104KAT2A; C0402X7R160-104KNE; CL05B104KO5NNNC; GRM155R71C104KA88; C1005X7R1C104K; CC0402KRX7R7BB104;EMK105B7104KV; CL05B104KO5; C0402C104K4RAC7867	TDK;AMERICAN TECHNICAL CERAMICS;AVK;VENKEL LTD.;SAMSUNG ELECTRONICS;MURATA;TDK;YAGEO PHICOMP;TAIYO YUDEN;SAMSUNG ELECTRONICS;KEMET	0.1UF	CAP; SMT (0402); 0.1UF; 10%; 16V; X7R; CERAMIC
13	C26	-	1	C0603C225K9PAC; GRM188R60J225KE01; C1608X5R0J225K080AB	KEMET;MURATA; TDK	2.2UF	CAP; SMT (0603); 2.2UF; 10%; 6.3V; X5R; CERAMIC;
14	C28	-	1	C0603C475K9PAC	KEMET	4.7UF	CAP; SMT (0603); 4.7UF; 10%; 6.3V; X5R; CERAMIC;
15	C29	-	1	C0402X7R500-222KNE; GRM155R71H222KA01; C1005X7R1H222K050BA	VENKEL LTD.; MURATA;TDK	2200PF	CAP; SMT (0402); 2200PF; 10%; 50V; X7R; CERAMIC
16	C30	-	1	C0603C104K8RAC	KEMET	0.1UF	CAP; SMT (0603); 0.1UF; 10%; 10V; X7R; CERAMIC
17	C31	-	1	C3216X5R1C476M160AB;GRM31CR61C476ME44	TDK;MURATA	47UF	CAP; SMT (1206); 47UF; 20%; 16V; X5R; CERAMIC
18	C32	-	1	C3216X5R1H106K160AB;GRM31CR61H106KA12	TDK;MURATA	10UF	CAP; SMT (1206); 10UF; 10%; 50V; X5R; CERAMIC
19	C34	-	1	GRM188R60J105KA01	MURATA	1UF	CAP; SMT (0603); 1UF; 10%; 6.3V; X5R; CERAMIC;

20	DS1-DS3, DS10	-	4	LG L29K-G2J1-24	OSRAM	LG L29K-G2J1-24	DIODE; LED; SMT (0603); Vf=1.7V; If(test)=0.002A; -40 DEGC TO +100 DEGC
21	DS4, DS8, DS9	-	3	LTST-C171TBKT	LITE-ON ELECTRONICS INC.	LTST-C171TBKT	DIODE; LED; SMD LED; BLUE; SMT (0805); PIV=5V; IF=0.020A
22	DS5-DS7	-	3	LTST-C150KRKT	LITE-ON ELECTRONICS INC.	LTST-C150KRKT	DIODE; LED; STANDARD; RED; SMT (1206); PIV=2V; IF=0.02A; -30 DEGC TO +85 DEGC
23	J1, J21	-	2	10118194-0011LF	AMPHENOL	10118194-0011LF	CONNECTOR; FEMALE; SMT; MICRO USB; INPUT OUTPUT CONNECTORS; B TYPE RECEPTACLE WITHOUT FLANGE; RIGHT ANGLE; 5PINS
24	J2, J5	-	2	800-10-002-10-001000	MILLMAX	800-10-002-10-001000	CONNECTOR; MALE; TH; SINGLE ROW; STRAIGHT; 2PINS
25	J3, J4, J6-J8, J14, J20, J22, J24, J25, JP9	-	11	PBC02SAAN	SULLINS ELECTRONICS CORP.	PBC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS
26	J9-J12	-	4	TSW-104-07-L-S	SAMTEC	TSW-104-07-L-S	EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; TSW SERIES; SINGLE ROW; STRAIGHT; 4PINS
27	J13	-	1	PBC06DBAN	SULLINS ELECTRONICS CORP.	PBC06DBAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; RIGHT ANGLE; 12PINS; 12PINS - ALTERNATE PIN NUMBERING
28	J15	-	1	PEC04SBAN	SULLINS ELECTRONICS CORP.	PEC04SBAN	CONNECTOR; MALE; THROUGH HOLE; 0.100INCH CONTACT CENTERS; MALE BREAKAWAY HEADERS; RIGHT ANGLE; NO MOUNTING; 4PINS
29	J16-J19, J23, J27, J28, J30, J31, J33, J34, J39	-	12	PBC03SAAN	SULLINS	PBC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS; -65 DEGC TO +125 DEGC
30	L1-L3, L5	-	4	DFE201612E-2R2M	MURATA	2.2UH	INDUCTOR; SMT (0806); WIREWOUND CHIP; 2.2UH; TOL=+/-20%; 1.8A
31	L4	-	1	DFE201612E-4R7M	MURATA	4.7UH	INDUCTOR; SMT (0806); METAL; 4.7UH; 20%; 1.20A
32	PB1	-	1	1825910-6	TE CONNECTIVITY	1825910-6	SWITCH; SPST; THROUGH HOLE; 24V; 0.05A; TACTILE SWITCH; RCOIL=0 OHM; RINSULATION=100M OHM; TE CONNECTIVITY
33	R1, R13, R15, R16	-	4	ERJ-2RKF1001	PANASONIC	1K	RES; SMT (0402); 1K; 1%; ±100PPM/DEGC; 0.1000W
34	R2, R10, R11, R38-	-	8	RC0402FR-0710KL;CR0402-FX-1002GLF	YAGEO;BOURNS	10K	RES; SMT (0402); 10K; 1%; ±100PPM/DEGC; 0.0630W

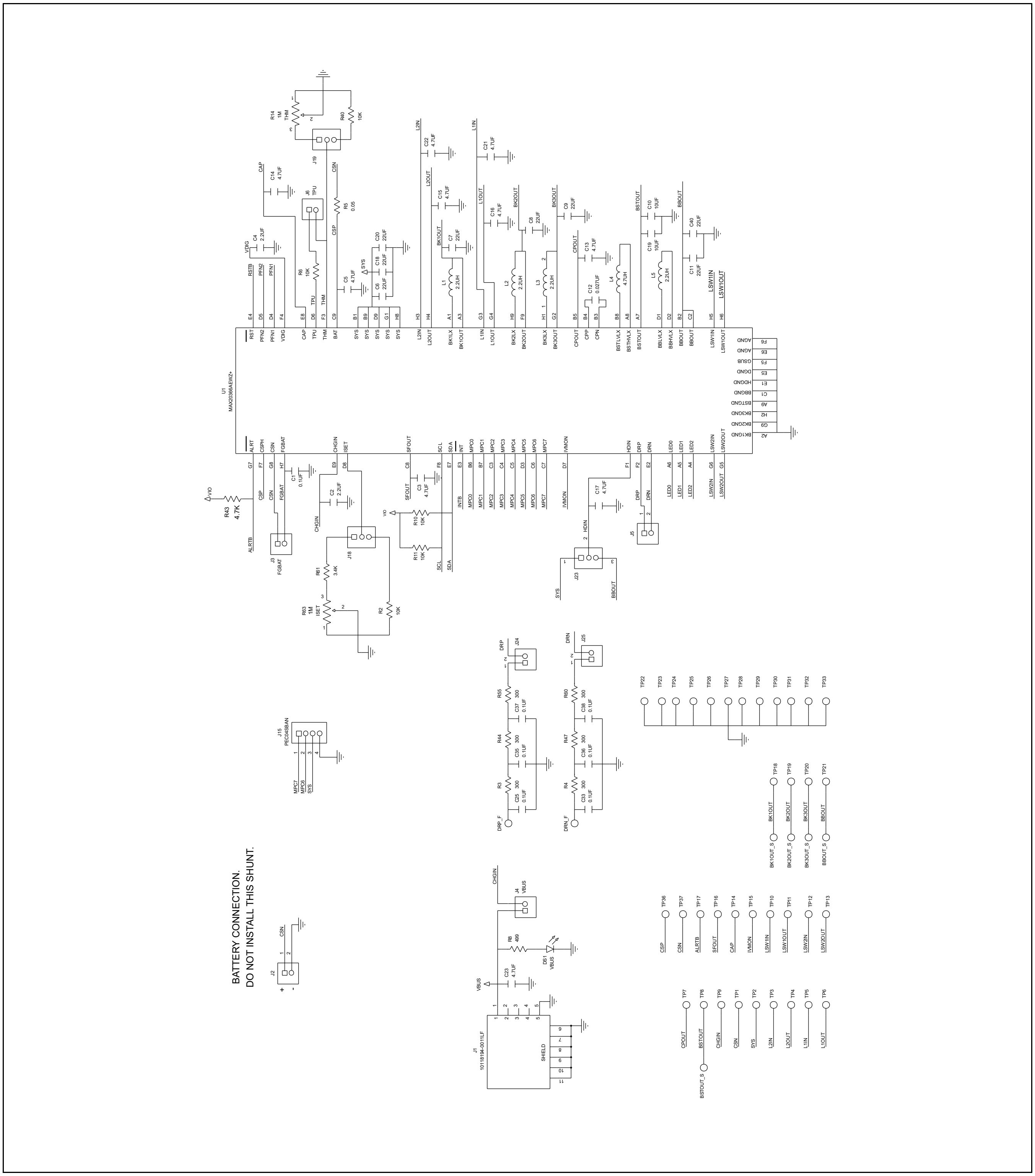
	R40, R49, R53						
35	R3, R4, R44, R47, R55, R60	-	6	ERJ-2RKF3000	PANASONIC	300	RES; SMT (0402); 300; 1%; ±100PPM/DEGC; 0.1000W
36	R5	-	1	ERJ-2BWFR050X	PANASONIC	0.05	RES; SMT (0402); 0.05; 1%; 0/+300PPM/DEGC; 0.2500W
37	R6	-	1	ERJ-2GEJ103	PANASONIC	10K	RES; SMT (0402); 10K; 5%; ±200PPM/DEGC; 0.1000W
38	R7, R17-R21, R23-R35, R41, R45, R46, R48, R50, R57	-	25	ERJ-2GEJ104	PANASONIC	100K	RES; SMT (0402); 100K; 5%; ±200PPM/DEGC; 0.1000W
39	R8, R9, R12, R42	-	4	CRCW0402499RFK	VISHAY DALE	499	RES; SMT (0402); 499; 1%; ±100PPM/DEGC; 0.0630W
40	R14, R63	-	2	PV36Y105C01B00	MURATA	1M	RESISTOR; THROUGH-HOLE-RADIAL LEAD; PV36 SERIES; 1M OHM; 10%; 100PPM; 0.5W; TRIMMER POTENTIOMETER; 25 TURNS; MOLDER CERAMIC OVER METAL FILM
41	R22, R36, R37	-	3	CRCW040210R0JNEDHP	VISHAY DRALORIC	10	RES; SMT (0402); 10; 5%; ±200PPM/DEGK; 0.2000W
42	R43	-	1	CRCW04024K70FK;MCR01MZPF4701	VISHAY DALE;ROHM SEMICONDUCTOR	4.7K	RES; SMT (0402); 4.7K; 1%; ±100PPM/DEGC; 0.0630W
43	R51	-	1	ERJ-2GE0R00	PANASONIC	0	RES; SMT (0402); 0; JUMPER; JUMPER; 0.1000W
44	R52	-	1	ERJ-2RKF5100	PANASONIC	510	RES; SMT (0402); 510; 1%; ±100PPM/DEGC; 0.1000W
45	R54, R56	-	2	WSL0805R1000FEA18	VISHAY DALE	0.1	RES; SMT (0805); 0.1; 1%; ±75PPM/DEGC; 0.1250W
46	R58	-	1	3296Y-1-253LF	BOURNS	25K	RESISTOR; THROUGH-HOLE-RADIAL LEAD; 3296 SERIES; 25K OHM; 10%; 100PPM; 0.5W; SQUARE TRIMMING POTENTIOMETER; 25 TURNS; MOLDER CERAMIC OVER METAL FILM
47	R59	-	1	ERJ-2RKF1152	PANASONIC	11.5K	RES; SMT (0402); 11.5K; 1%; ±100PPM/DEGC; 0.1000W
48	R61	-	1	CRCW04023K40FK	VISHAY DALE	3.4K	RES; SMT (0402); 3.4K; 1%; ±100PPM/DEGC; 0.0630W
49	SPACER1-SPACER4	-	4	9032	KEYSTONE	9032	MACHINE FABRICATED; ROUND-THRU HOLE SPACER; NO THREAD; M3.5; 5/8IN; NYLON
50	SU3, SU4, SU6-SU12, SU14, SU16-SU20, SU23-SU25,	-	24	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

	SU27, SU28, SU30, SU31, SU33, SU34						
51	TP7-TP9, VHC	-	4	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;
52	TP22-TP33	-	12	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;
53	U1	-	1	MAX20366EWZ+	ANALOG DEVICES	MAX20366EWZ+	EVKIT PART- IC; PMIC WITH ULTRA-LOW IQ REGULATORS; CHARGER; FUEL GAUGE; AND HAPTIC DRIVER FOR SMALL LI+ SYSTEM; PACKAGE OUTLINE DRAWING: 21-100373; PKG. CODE: W724A4+1; WLP72
54	U2	-	1	OPA569AIDWPR	TEXAS INSTRUMENTS	OPA569AIDWPR	IC; AMP; RAIL-TO-RAIL I/O; POWER AMPLIFIER; WSOIC20-EP 300MIL
55	U3	-	1	MAX8880EUT+	ANALOG DEVICES	MAX8880EUT+	IC; VREG; ULTRA-LOW-IQ LOW-DROPOUT LINEAR REGULATOR WITH POK; SOT23-6
56	U4	-	1	NC7WZ07P6X	FAIRCHILD SEMICONDUCTOR	NC7WZ07P6X	IC; BUF; TINY LOGIC ULTRA-HIGH SPEED DUAL BUFFER; SC70-6
57	PCB	-	1	MAX20366	ANALOG DEVICES	PCB	PCB:MAX20366
58	MISC1, MISC2	DNI	2	AK67421-0.5	ASSMANN	AK67421-0.5	CONNECTOR; USB CABLE; MALE-MALE; USB_2.0; 5PINS-4PINS; 500MM
59	MISC3	DNI	1	MAXPICO2PMB#	ANALOG DEVICES	MAXPICO2PMB#	ACCESSORY; BRD; PACKOUT; MAXPICO2PMB ADAPTER BOARD

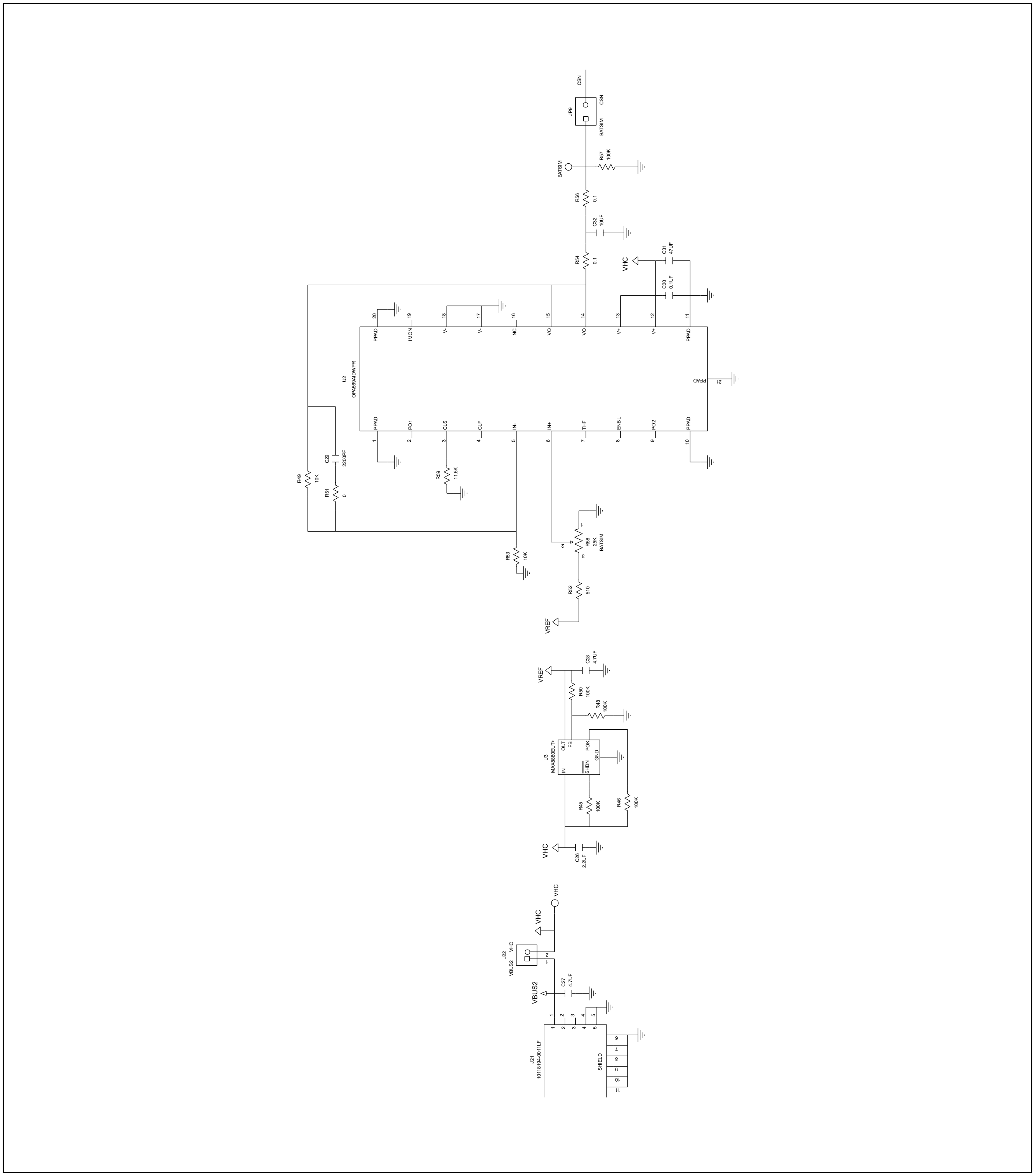
MAX20366 EV Kit Schematic



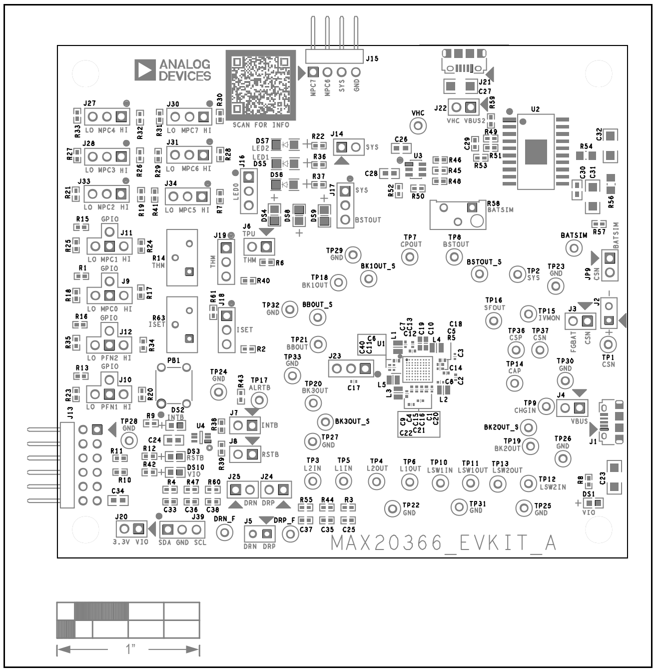
MAX20366 EV Kit Schematic (continued)



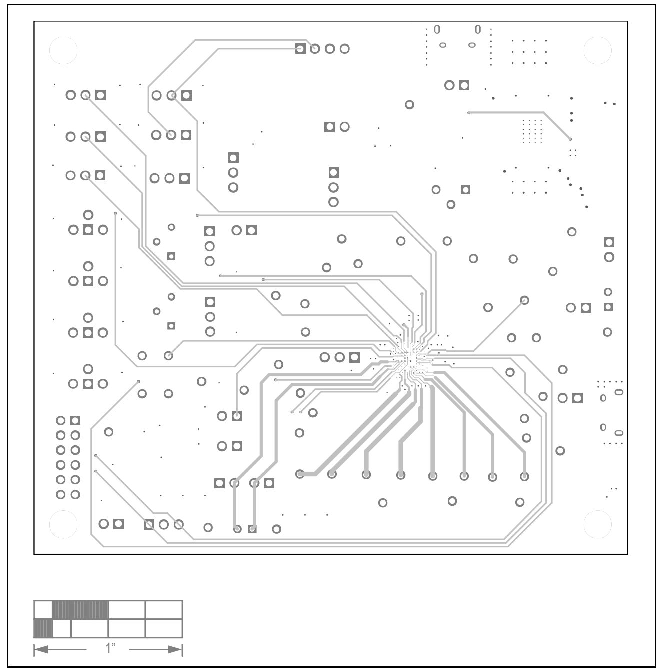
MAX20366 EV Kit Schematic (continued)



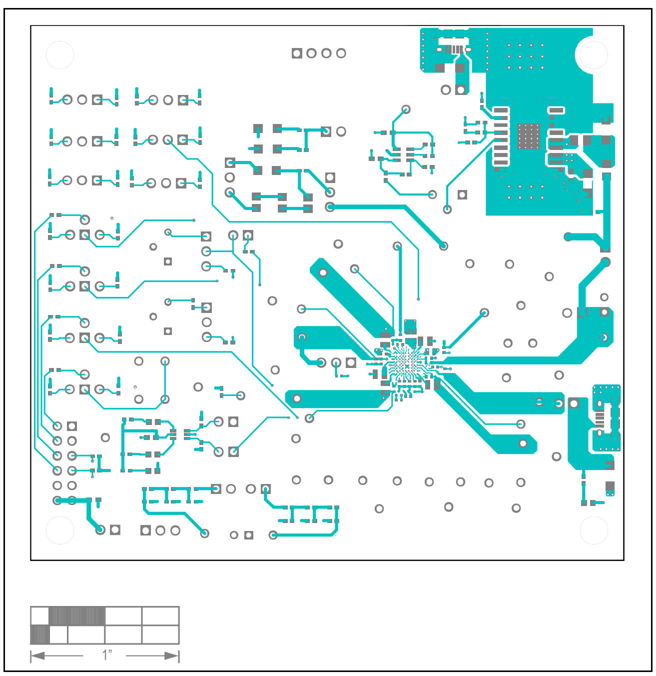
MAX20366 EV Kit PCB Layout



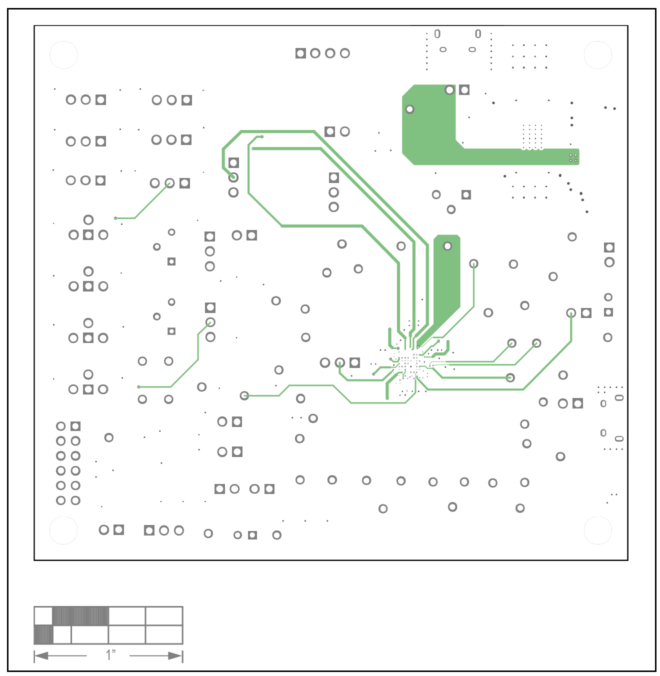
MAX20366 EV Kit Component Placement Guide—Top Silkscreen



MAX20366 EV Kit PCB Layout—Layer 2

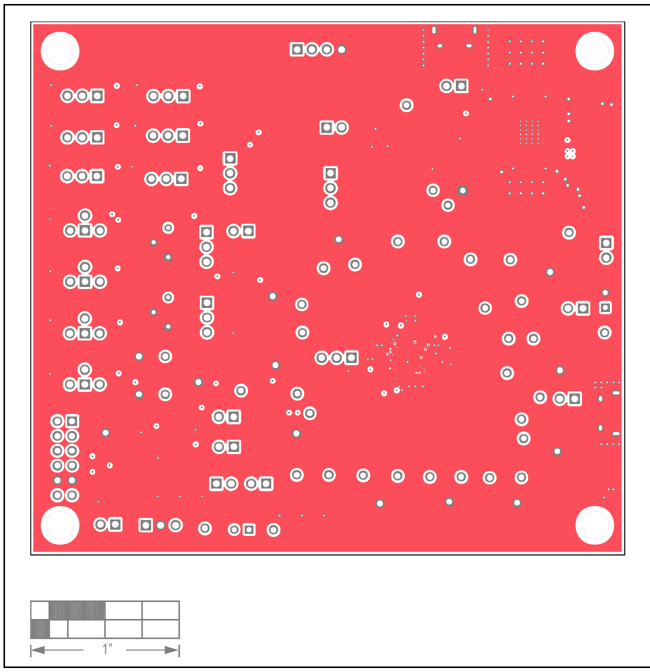


MAX20366 EV Kit PCB Layout—Top

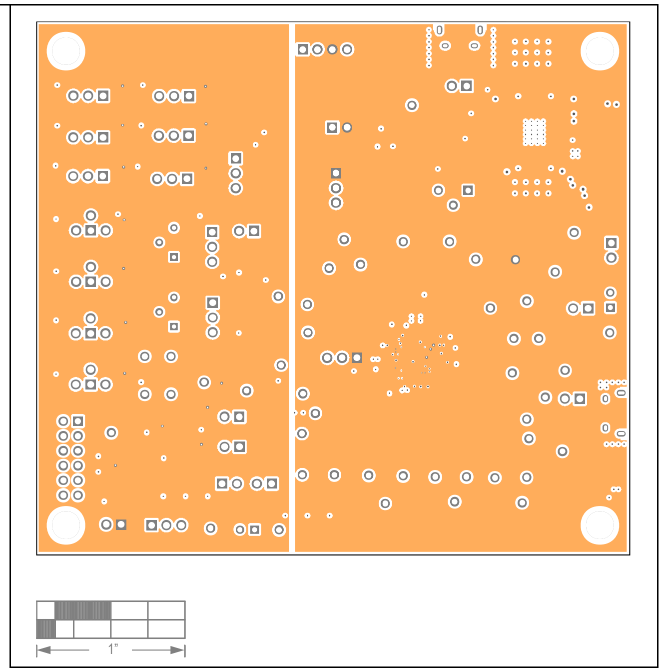


MAX20366 EV Kit PCB Layout—Layer 3

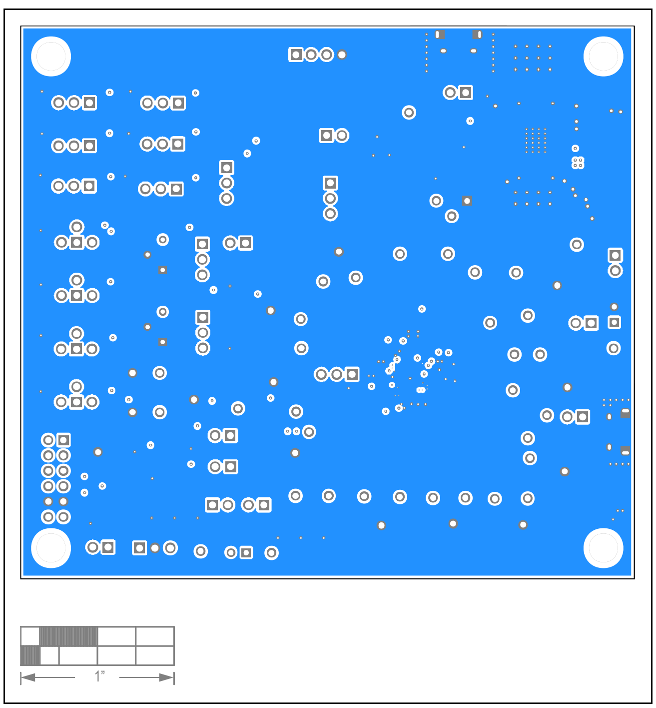
MAX20366 EV Kit PCB Layout (continued)



MAX20366 EV Kit PCB Layout—Layer 4



MAX20366 EV Kit PCB Layout—Layer 5



MAX20366 EV Kit PCB Layout—Bottom

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	01/25	Initial release	—

Notes