MAX35103 Evaluation Kit

Evaluates: MAX35103

General Description

The MAX35103 evaluation kit (EV kit) provides the hardware and graphical user interface (GUI) software necessary to evaluate the MAX35103 time-to-digital converter designed for ultrasonic heat, water, and gas meters. The EV kit includes a MAX35103EHJ+ installed, as well as the required USB-to-SPI interface needed to communicate with the IC. The USB-to-SPI master section of the EV kit, along with the EV kit software, provides a quick method to exercise the device's functionality.

The EV kit can be powered by the USB to simplify an evaluation setup, but also comes equipped with banana jacks that enable an external supply, such as a battery, to power the system. Provided BNC connectors allow for quick connection to piezoelectric transducers housed in a spool body. The provided terminal-block connectors allow for easy connection to the two remote platinum RTDs.

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

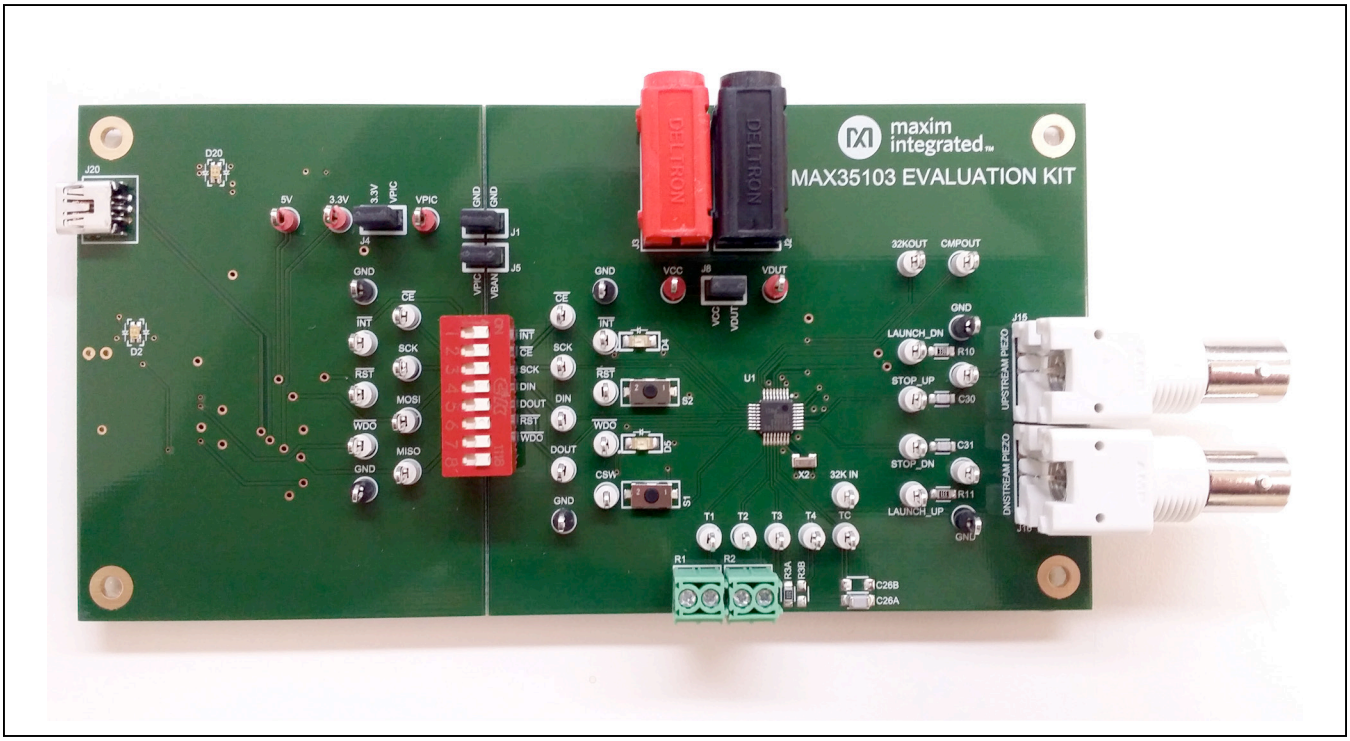
Benefits and Features

- Easy Evaluation of the MAX35103
- Two Piezoelectric Transducers and Two RTD Connections Provided
- EV Kit Hardware Optionally USB Powered (USB Cable Included)
- USB HID Interface
- Windows XP®- and Windows® 7-Compatible Software
- RoHS Compliant
- Proven PCB Layout
- Fully Assembled and Tested

EV Kit Contents

- Circuit Board Including MAX35103EHJ+ and USB-to-SPI Circuitry
- Mini-USB Cable
- Four Shunt Jumpers
- Rubber Feet

MAX35103 EV Kit Photo



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19-7530; Rev 0; 3/15

maxim integrated™

MAX35103 EV Kit Files

FILE	DECRIPTION
MAX35103EVKitSoftware.exe	Application Program

Quick Start

Required Equipment

Included:

- MAX35103 EV kit hardware
- Mini-USB cable

Not included:

- Windows XP or Windows 7 PC with USB port
- Piezoelectric transducers mounted in a spool body (BNC connections) for time-of-flight measurements
- Platinum RTDs (bare wire—terminal block connections) for temperature measurements

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

Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation running off the USB power:

1) Ensure that jumpers/shunts J4 and J8 are installed. **Note:** The GND plane and supply trace of the USB-to-SPI circuit and the IC circuit are not connected. The GND jumper on J1 must be connected for proper communication between the USB-to-SPI and the IC under all power configurations. Under the USB-only power configuration, the J5 jumper must be connected.
2) Ensure that the 8-pole DIP switch (S3) is seated properly in its socket and that all switches are in the on position.
3) Set the EV kit hardware on a nonconductive surface to ensure that nothing on the PCB gets shorted together.
4) Prior to starting the GUI, connect the EV kit hardware to a PC using the supplied mini-USB cable, or equivalent. The power LED (D20) should be green and the com LED (D2) should be red and slowly flash orange.
5) Windows should automatically begin installing the necessary device driver. The USB interface of the EV kit hardware is configured as an HID device and therefore does not require a unique/custom device driver. Once the driver installation is complete, a Windows message appears near the **System Icon** menu, indicating that the hardware is ready to use. Do not attempt to run the GUI prior to this message. If you do, then you must close the application and restart it once the driver installation is complete. On some versions of Windows, administrator privileges may be required to install the USB device.
6) Once the device driver installation is complete, download the latest version of the EV kit software, MAX35103EVKitSoftwareInstall.ZIP. Save the EV kit software to a temporary folder.
7) Open the .ZIP file and double-click the .EXE file to run the installer. A message box stating **The publisher could not be verified. Are you sure you want to run this software?** may appear. If so, click **Yes**.
8) The installer GUI appears. Click **Next** and then **Install**. Once complete, click **Close**.
9) Go to **Start | All Programs**. Look for the MAX35103EVKitSoftware folder and click on the MAX35103EVKitSoftware.EXE file inside the folder.
10) After the initial splash screen, when the GUI appears, the text in the right field of the status strip at the bottom of the GUI window should display **EV Kit Hardware Connected** and then a firmware version number. The com LED (D2) on the EV kit board should turn green.

Detailed Description of Software

Software Startup

If the MAX35103 EV kit is connected when the software is opened, the software first initializes the hardware to communicate. The software then does a read of the device and updates all the associated control fields displayed on the GUI. The GUI displays **EV Kit Hardware Connection** status in the right field of the status strip. If the EV kit is not connected on software startup, the GUI populates with default EV kit values. Once the EV kit is connected, the GUI executes the sequence above.

ToolStrip Menu Bar

The ToolStrip menu bar is located at the top of the GUI window, as shown in Figure 1.

File Menu

The **File** menu item contains save, load, and exit options. To save the current GUI configuration, click **Save Project As**. This saves all the configuration registers and RTC alarm values to an XML file. If a device is connected, this reads and saves data directly from the device; otherwise, it saves the configuration currently displayed on the GUI. **Load Project** updates the GUI with the values stored in the selected XML file, and writes the configuration and RTC alarm registers to the device.

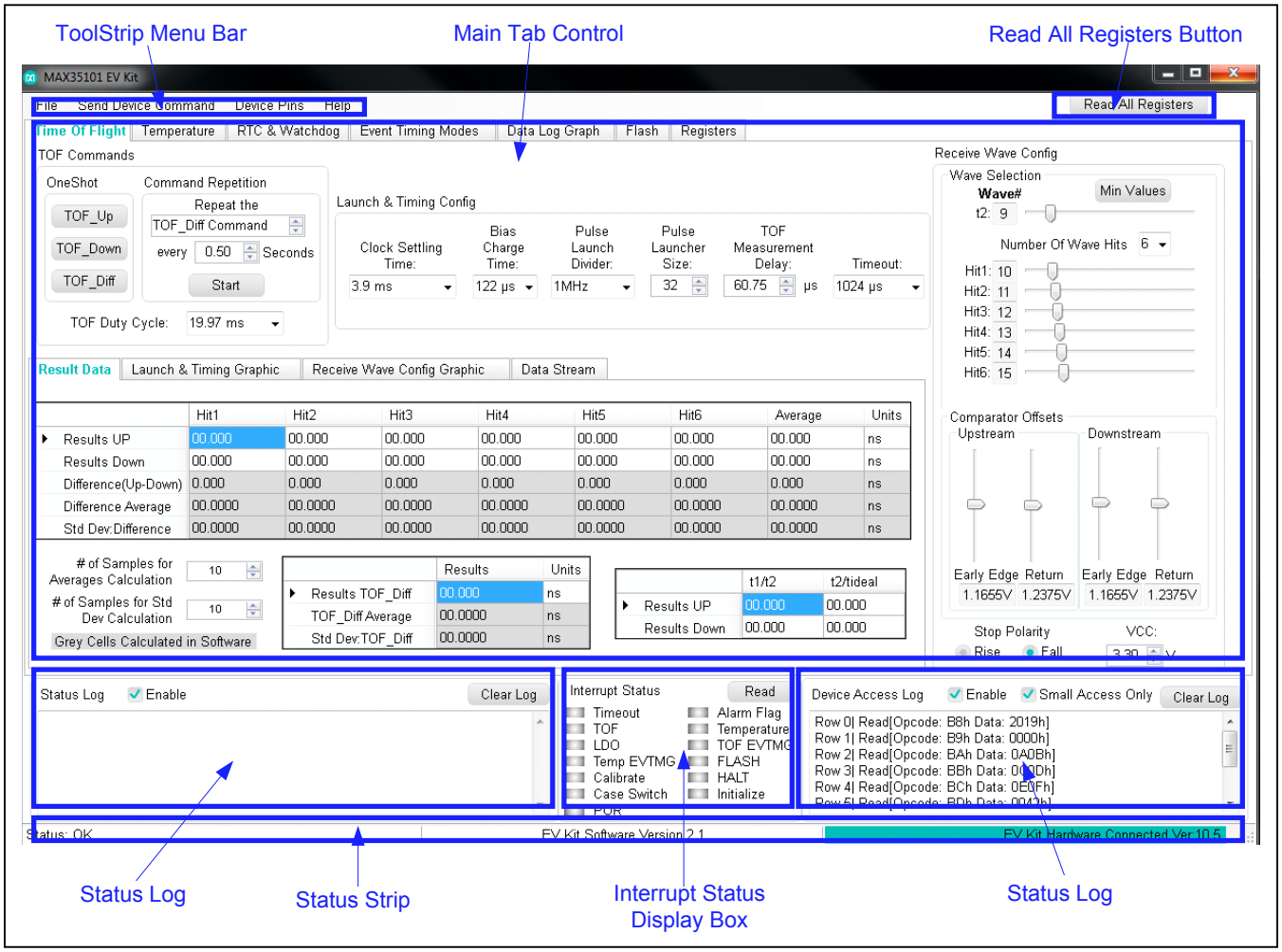

Figure 1. MAX35103 EV Kit GUI Sections (Showing Time Of Flight Tab)

Send Device Command Menu

An SPI-based interface is used to access the features and memory of the IC using an op code/command structure. Several of these commands are single-byte execution op-code commands that cause the device to execute various routines. The general execution commands are available to send to the IC from the **Send Device Command** menu. To send an **LDO Timed**, **LDO Off**, **LDO On**, **Reset**, **Initialize**, **Calibrate**, and **Transfer Config to Flash** command, simply click the appropriate selection from the drop-down menu. When the **Send Device Command** menu is selected and the drop-down menu is displayed, a read of the Calibration Results register is performed. The resulting data is displayed next to the **Calibrate Command** text in units of µs.

Device Pins Menu

Several pins of the IC are configurable or can be disabled. The **Device Pins** menu allows easy access to these configurations. A read of the appropriate registers is performed once the **Device Pins** menu is selected and the currently programmed configurations are noted with a check next to the appropriate configuration. To change the configurations, simply click the desired selection from the drop-down menu.

Read All Registers Button

The **Read All Registers** at the top right of the GUI window (Figure 1) is used to read all the required registers of the IC to update all the currently displayed controls and fields of the GUI. This action also occurs when changing tabs in the tab control. Clicking this button does not read the Interrupt Status register and therefore does not update the **Interrupt Status** group box.

Status Log

The **Status Log** at the bottom left of the GUI (Figure 1) displays all the actions the GUI performs that are relevant to the user. To disable the log, uncheck the **Enable** checkbox. To clear the **Status Log**, click on the nearby **Clear Log** button. The log is autocleared when it becomes too lengthy.

Interrupt Status Display

The **Interrupt Status** group box in the bottom center of the GUI (Figure 1) reads the Interrupt Status register and displays the results in an easy-to-decipher table. A grey circle signifies the bit is not set, while a red circle indicates that the associated bit was set when the Interrupt Status register was read. **Note:** The bits in the Interrupt Status register are self-clearing after a read. The **Interrupt Status** group box is also updated during execution of the event timing modes when the interrupt pin goes active.

Device Access Log

The **Device Access Log** group box in the bottom right of the GUI (Figure 1) displays all the actions the GUI performs in relation to the IC. All SPI transactions between the host USB-to-SPI circuit and the IC are displayed here. To speed up writes to the **Device Access Log** and make it more readable, large SPI transactions are not logged by default. However, all SPI transactions including the larger ones can be shown, if desired. This is done by unchecking the nearby **Small Access Only** checkbox. To disable the log, uncheck the **Enable** checkbox. To clear the **Device Access Log**, click on the nearby **Clear Log** button. The log is autocleared when it becomes too lengthy.

Status Strip

The **Status Strip** is located at the bottom of the GUI window (Figure 1). This strip is broken down into three sections. The first, located on the left, is an overall system status primarily used to display if the GUI is currently doing any kind of polling (automated timing) of the IC. This helps the user keep track of which polling routines have been started, allowing them to stop the running polling before moving on to evaluating other areas of the device. The middle section of the **Status Strip** displays the currently running EV kit software version. The right section of the **Status Strip** displays whether the hardware (USB-to-SPI circuitry) is currently connected to, and communicating with, the GUI.

Tab Control

The majority of the GUI consists of a tab control, where each tab contains controls relevant to various blocks of the device. The tab control is shown in Figure 1. All controls in these tabs, which can be interacted with by the user, attempt to immediately write the changed value to the IC. Likewise, these controls are updated upon a read of the device.

Time Of Flight Tab

All the configurations required to set up and execute the time-of-flight measurements can be found in the **Time Of Flight** tab (Figure 2). The **Time Of Flight** tab contains another tab control window located towards the bottom. This secondary tab control contains two informative graphics and data read from the IC.

To begin configuration of the IC, start by viewing the **Launch & Timing Graphic** tab. This is a static image of the timing associated with the **Launch & Timing Config** group box. Use this overview to assist in setting the associated controls in the **Launch & Timing Config** group box.

Next, select the **Receive Wave Config Graphic** tab. This graphic dynamically updates to provide some insight into how the configurations in the **Receive Wave Config** group box are currently set. The green line running horizontally across the graphic depicts the comparator offset trip points, but is static in amplitude, which fixes the location of the t1 wave for ease of use. The graphic contains a horizontal scrollbar located just below the graph's grid.

The **Comparator Offsets** group box is used to configure the comparator offsets in the upstream and downstream direction. The reported voltages in this group box are calculated based on the value input in the **VCC** spin box. To get accurate comparator offset voltages, the value in the **VCC** spin box must be accurate.

Once the time-of-flight configurations are complete, it is time to execute a time-of-flight command. To send a time-of-flight command, use the **OneShot** buttons located in the **TOF Commands** group box. Clicking one of these **OneShot** buttons sends the associated command to the IC and then automatically reads the results from the device. Select the **Result Data** tab from the secondary tab control. The **Result Data** tab reports the read results and calculates various other parameters. All the grey cells are values that are calculated in the GUI.

The number of samples used to calculate the averages and the standard deviation of a population can be adjusted using the input boxes provided. Once satisfied with the resulting data from a **OneShot** command, an automatic repetition feature is provided and can be enabled in the **Command Repetition** group box. Select which command to execute, the period of execution, and click **Start.** Once the **Start** button is clicked, the button's label changes to **Stop** and the **Status Strip** indicates that an automatic repetition feature is enabled. The feature runs until the **Stop** button is clicked. The command and reading of the resulting data is only executed if the currently selected main tab is either the **Time Of Flight** or the **Data Log Graph** tab.

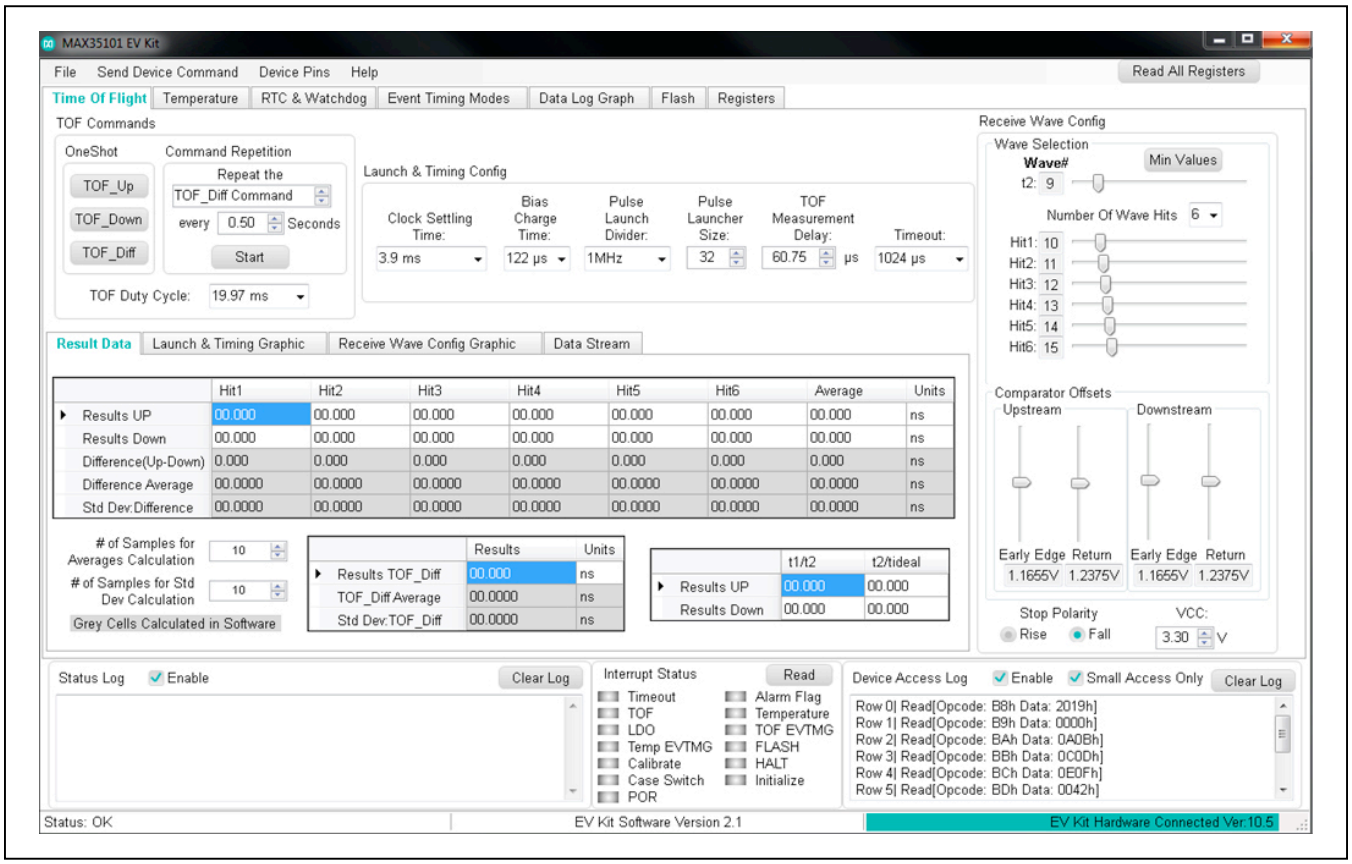

Figure 2. Time Of Flight Tab

Temperature Tab

All the configurations required to set up and execute temperature measurements are located in the **Temperature** tab (Figure 3). To begin temperature configuration of the IC, start in the **Temperature Configurations** group box. The EV kit hardware is configured to have RTDs connected to **Port T1** and **Port T2**, with a reference connected to **Port T3** and **Port T4**. All calculations in the result tables are based on this configuration. Select the desired configurations from the drop-down lists.

Once the temperature configurations are complete, it is time to execute a temperature command. To send a temperature command, use the **Temperature** button under OneShot located in the **Temperature Command** group box. Clicking the **Temperature** button sends the associated command to the IC and automatically reads the results from the device, which are displayed in the **Temperature Time Measurement on all Ports and Statistics** group box. All the grey cells are values that are calculated in the GUI.

The number of samples used to calculate the averages and the standard deviation of a population are adjustable using the input boxes provided.

Use the raw data read from the device in conjunction with the value provided for the **Reference Resistance** to determine the resistance of the associated RTD. Once the resistance is known and displayed in the **Time-to-Temperature Calculation Data** table, a temperature is derived using the Callendar-Van Dusen equation and the standard IEC 751 coefficient values. The **Temperature** tab contains two informative thermometer graphics that simply display the calculated data from the **Time-to-Temperature Calculation Data** group box.

Once satisfied with the resulting data from a **OneShot** command, an automatic repetition feature is provided and can be enabled in the **Command Repetition** group box. Select the period of execution and click **Start**. Once **Start** is clicked, the button changes to **Stop** and the **Status Strip** displays that an automatic feature is enabled. The feature runs until the **Stop** button is clicked. The command and reading of the resulting data is only executed if the currently selected main tab is either the **Temperature** or **Data Log Graph** tab.

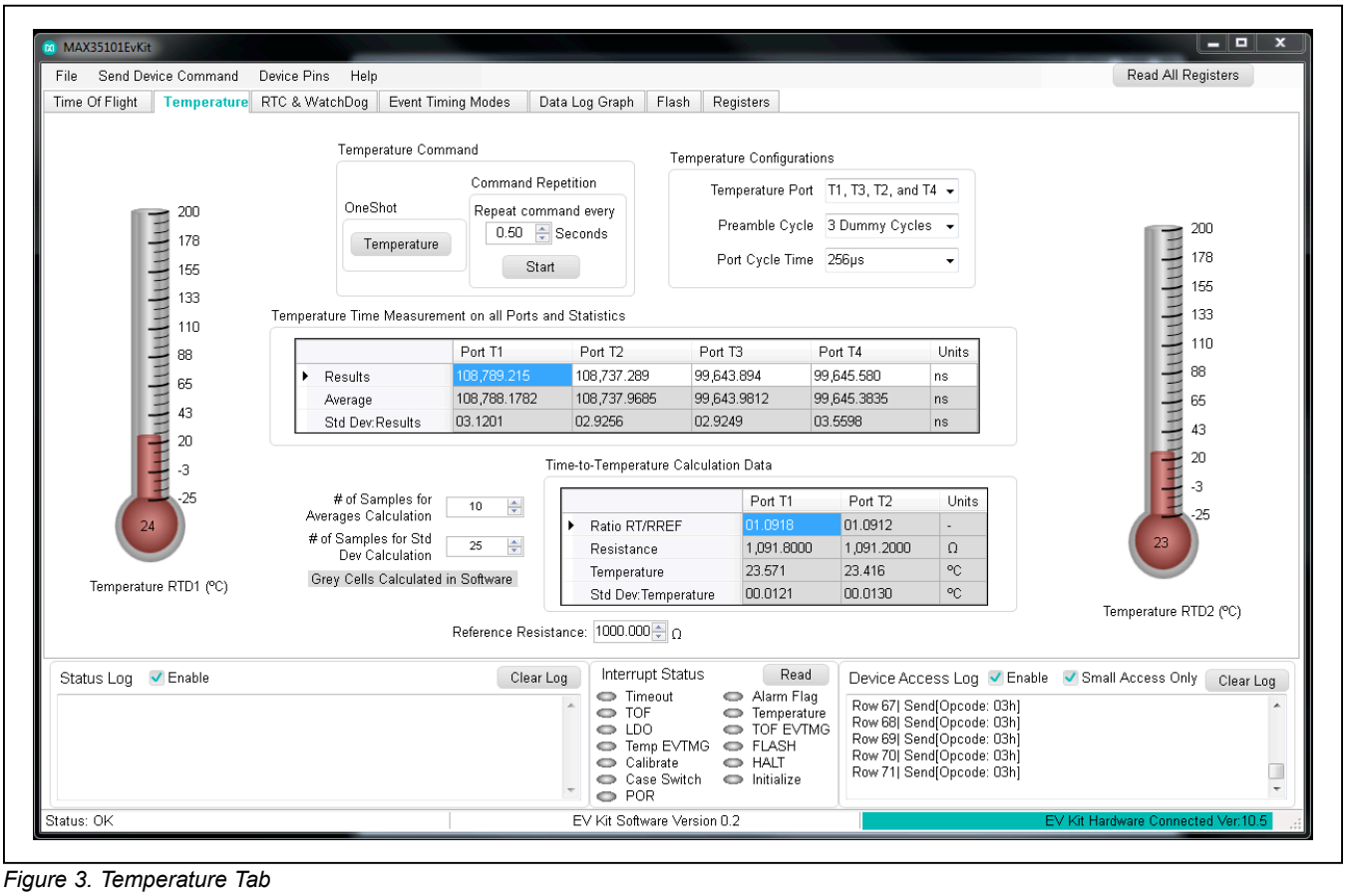

Figure 3. Temperature Tab

RTC & WatchDog Tab

All the configurations required to set up the real-time clock (RTC), watchdog, and alarm can be found in the **RTC & Watchdog** tab (Figure 4). The device powers up with the RTC set to all zeros, which is an invalid representation of date and time and therefore the date and time need to be set before a valid read can occur. To set the date and time, start with the **Set the Date** group box located in the **Set the Clock Data** group box. Clicking on a particular date from the calendar sends that value in the appropriate format to the device. The time of day can be set by adjusting the controls in the **Set the Time** group box or by clicking the nearby **Send Value** button to send the values currently represented in the associated controls.

The **Set to PC Date & Time (24hr)** button uses the internal PC clock to set the device in 24-hour mode.

The alarm and watchdog can be set in similar fashion from the **Set the Alarm** and **Set the WatchDog** group boxes, respectively.

When reading the parameters in this tab using the **Read All Registers** button, all displays on the right side in the **Read Clock Data** group box are updated. In addition, for ease of adjusting certain parameters, all values on the left side in the **Set Clock Data** group box, excluding the **Set the WatchDog** group box, are updated. An easy-to-decipher **Alarm Flag** and a **WD Flag** graphic are displayed in the **Alarm Value** and **WatchDog Value** group boxes. These graphics are updated on a read. A green circle signifies that the bit is not set, while a red circle indicates that the bit was set and an alarm match or watchdog timeout has occurred.

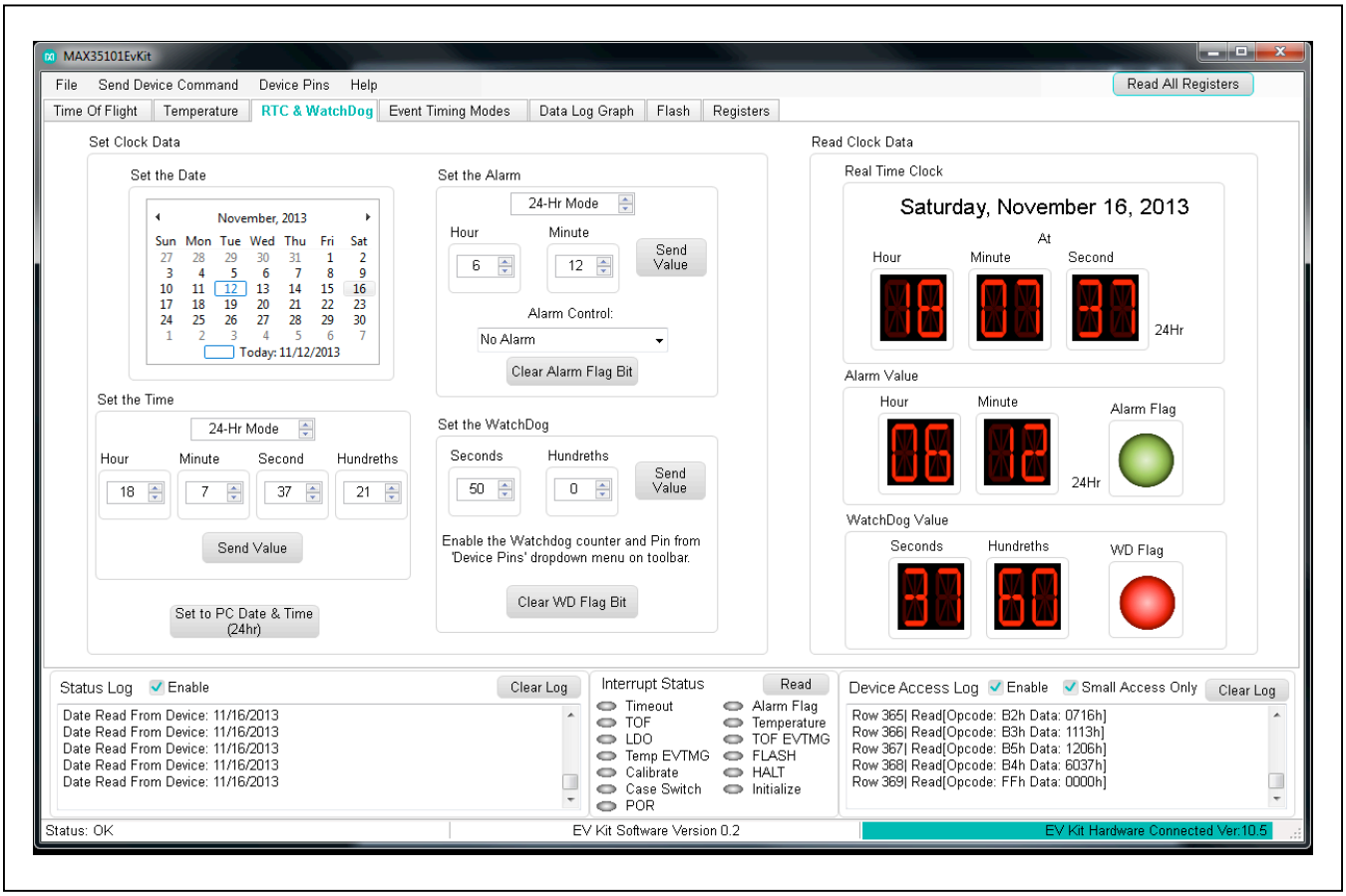

Figure 4. RTC & WatchDog Tab

Event Timing Modes Tab

The **Event Timing Modes** tab (Figure 5) allows evaluation of the advanced timing features of the IC. Prior to using this tab, the device must be fully configured, with the configurations stored to flash. Work through the configurations in the **Time Of Flight**, **Temperature**, and **RTC & WatchDog** tabs before attempting to run the **Event Timing Modes**. When ready, configure the controls in the **TOF Sequencing** and **Temp Sequencing** group boxes. Configure these in such a manner that the TOF sequence and the temperature sequence equal the same duration.

Select the desired **Calibration Configuration**. The **Timing Options** group box determines which data tables on the right side of the tab are populated with data when the event timing is run. If continuous interrupt is enabled, the IC provides data after each measurement (temperature or time of flight), which is then populated in the **Continuous Interrupt** tables. The **Continuous Operation** checkbox, when checked, causes the device to continuously run the configured event timing mode until the halt command is sent by clicking on the **HALT Command** button. If both the **Continuous Operation** and the **Continuous Interrupt** features are enabled, then a blank green row is inserted in the measurement results data when a sequence has completed. This provides an easy way to group together measurement data that is used for the sequence completion average data. To start event timing mode, click on the desired **EVTMGn** button in the **Start/Stop Timing Modes** group box. This sends the appropriate command to the IC.

The 8XS operation of the MAX35103 is not supported by the EV Kit software. This is because of a sampling rate limitation with the USB-to-SPI translation hardware.

The **Event Timing Modes** tab is intended to show the IC's interrupt pin's ($\overline{INT}$) functionality. When an event timing mode is started, the $\overline{INT}$ pin is polled every 50ms, as shown in the **INT# Pin Polling** group box. When $\overline{INT}$ is active, the Interrupt Status register is automatically read, with the results displayed in the **Interrupt Status** group box. Measurement results and sequence results data are then read based on which bits are set in the Interrupt Status register (Table 1).

If an event timing mode is running when the **Event Timing Mode** tab is exited, a halt command is sent to the device and the $\overline{INT}$ pin polling is stopped.

While the $\overline{INT}$ pin is being polled, the text on the left side of the status strip changes colors and provides a polling status until the event timing mode has run to completion, the halt command is sent, or the active tab is changed.

Table 1. Event Timing Mode (Data Reads)

INTERRUPT STATUS BIT SET	RESULTING DATA READ TABLE ENTRY
TOF	Add row to: Time of Flight - End of Measurements Data (Continuous Interrupt Mode). Read Up Average, Down Average, and TOF_Diff data from the device. Also, read RTC data from device for Time Stamp.
Temperature	Add row to: Temperature - End of Measurements Data (Continuous Interrupt Mode). Read Temperature Ports results data from the device. Also, read RTC data from the device for Time Stamp.
TOF EVTMG	Add row to: Time of Flight - End of Sequence Data. Read TOF_Diff Average and TOF Range data from the device. Also, read RTC data from the device for Time Stamp.
Temperature EVTMG	Add row to: Temperature - End of Sequence Data. Read Temperature Average Ports results data from the device. Also, read RTC data from the device for Time Stamp.

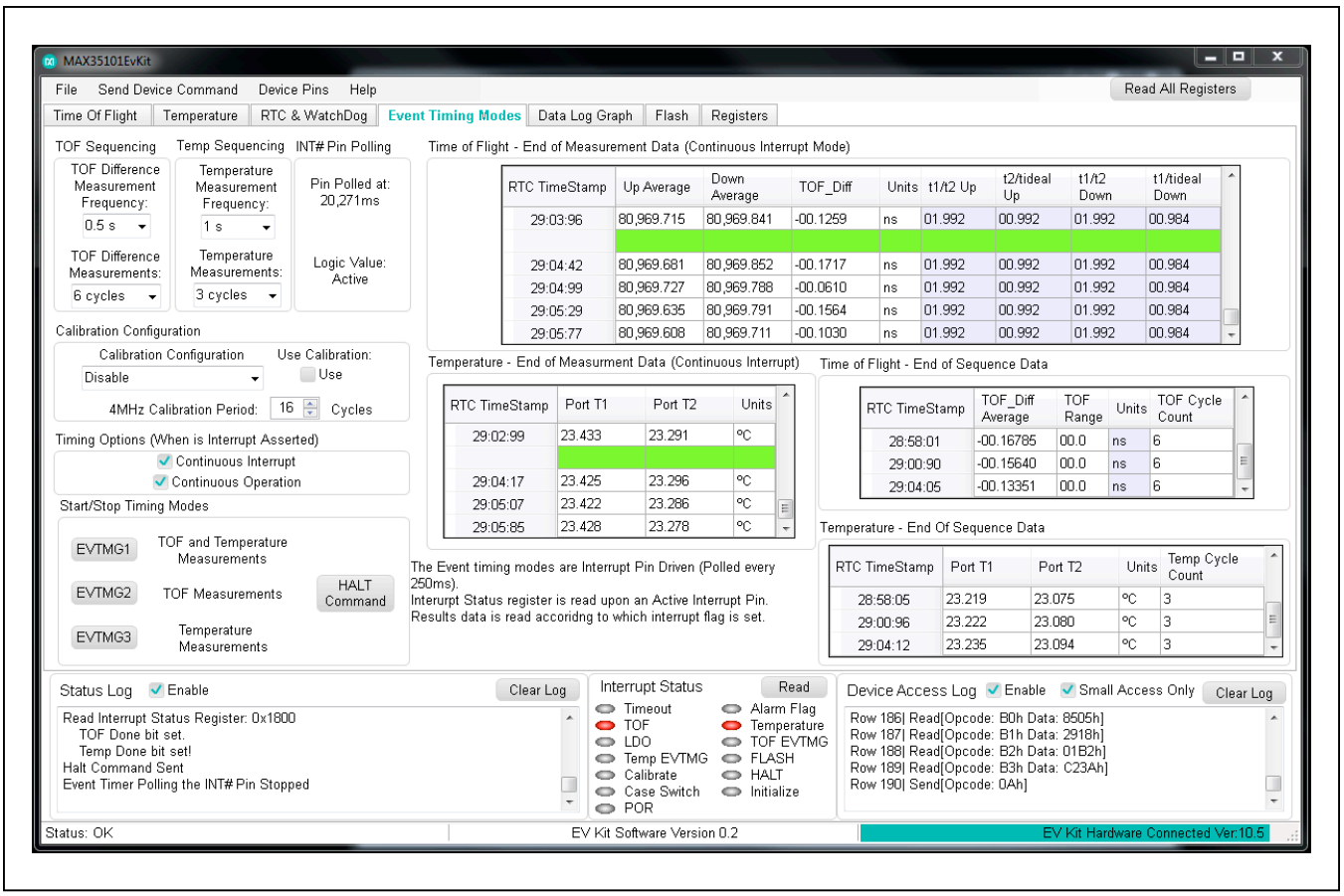

Figure 5. Event Timing Modes Tab

Data Log Graph Tab

The **Data Log Graph** tab (Figure 6) provides a basic graphing tool that can be used to view data vs. time. The data graphed in this tab are generated from the **Command Repetition** feature provided in the **Time Of Flight** and **Temperature** tabs only. Start one or both of these **Command Repetitions** and then switch to the **Data Log Graph** tab to select the data set to view. The selectable data sets are displayed in a drop-down list located in the **Data Set Select** group box. To clear the graph, click on the **Clear Data Log** button. The **Poll Count** value shows how many data points are in the series displayed on the graph. There are **Zoom in**, **Zoom out**, **and Zoom to Fit** buttons in the upper-right corner of the graph shaped like magnifying glasses. Use these tools to view the desired portion of the displayed data.

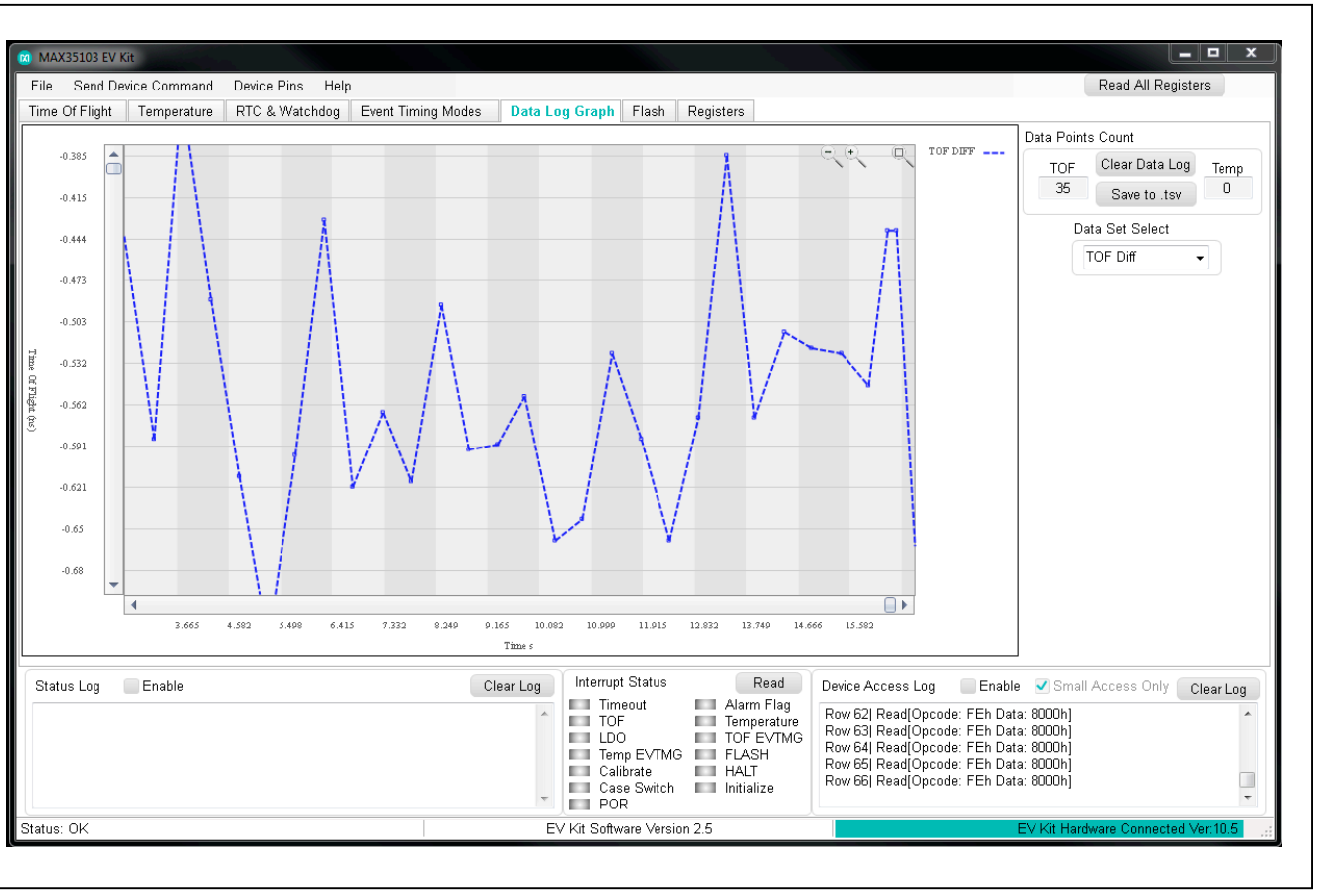

Figure 6. Data Log Graph Tab

Flash Tab

The **Flash** tab (Figure 7) provides an easy way to read and write all 8kB of user flash contained in the IC. To access flash, the LDO must first be enabled. This can be done manually with the **Send Device Command** menu. However, for simplification purposes, when the **Flash** tab is selected, the **LDO ON** command (located in the **Send Device Command** drop-down menu) is automatically sent to the device. Likewise, when leaving the **Flash** tab, the **LDO OFF** command is sent to the device.

The **Flash** tab displays all values in raw hex format. All memory is readable and when the **Read All** button in the **Flash Read** group box is clicked, the entire flash memory is read and the table is updated. All memory addresses can be written to by clicking on the desired cell and entering the hex value, then pressing Enter on the keyboard or selecting another cell. The data entered is checked for validity and if not valid is filled with zeros and a notification graphic appears in the cell. For convenience, the **Currently Selected Cell Address** is displayed on the right-hand side of the tab.

The flash is separated into 32 blocks (pages) containing 128 words each. These pages are demonstrated in the table by alternating colors of shading. To erase a particular page of flash, a memory location in that page can be selected, which updates the **Currently Selected Cell Page** value located in the **Flash Erase** group box, or the desired page can be selected manually with the provided input control. Clicking on the **Erase Page** button erases a single page of flash. Alternatively, clicking on the **Erase All** button cycles through all 32 pages and sends the **Erase Page** command. Flash must be erased before it can be written.

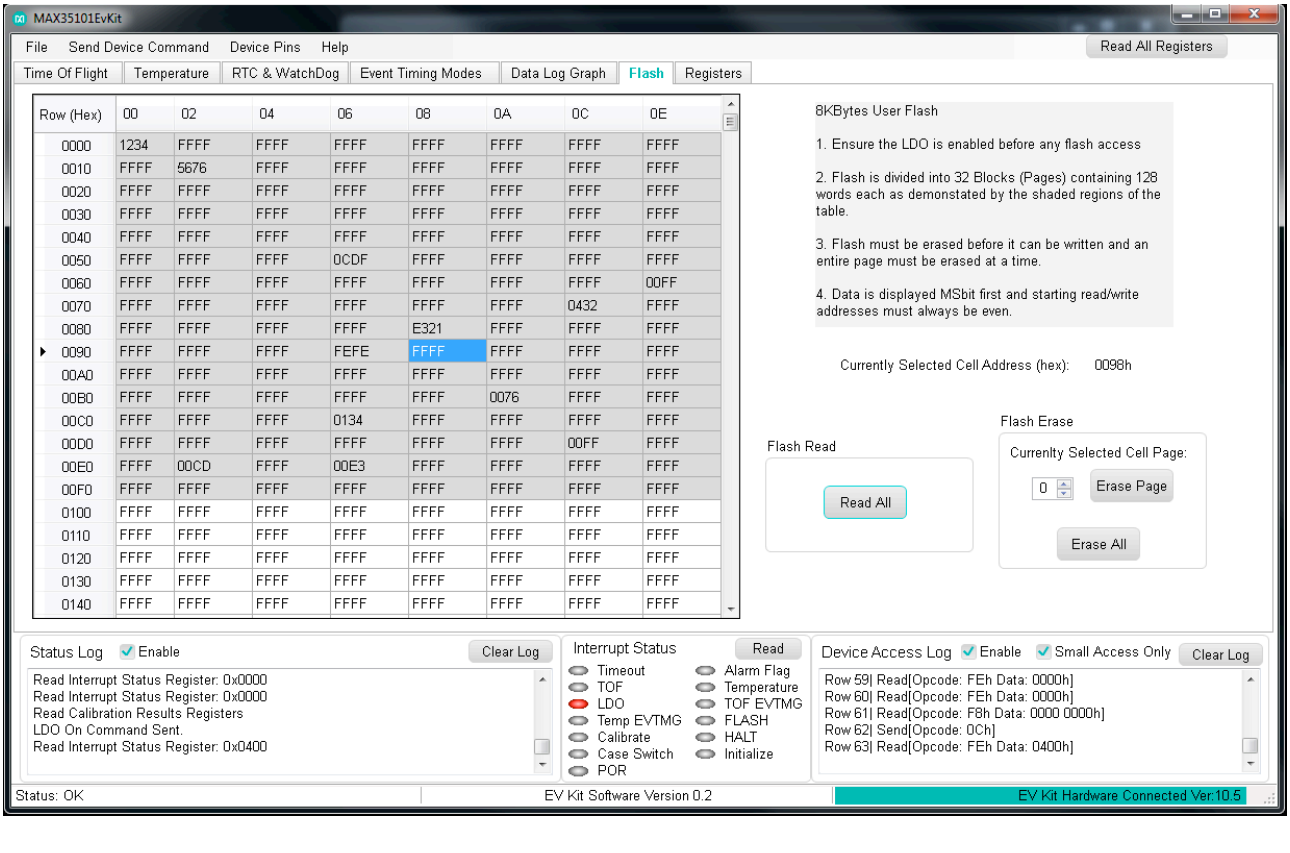

Figure 7. Flash Tab

Registers Tab

All the accessible registers in the IC can be accessed from the **Registers** tab (Figure 8). This tab displays all values in raw hex format. All registers are readable and when the **Read All** button is clicked, the entire visible register space is read and updated. The first column on the left can be written to by clicking on the desired cell and entering the hex value, then pressing Enter on the keyboard or selecting another cell. The data entered is checked for validity and if not valid is filled with zeros, with a notification graphic appearing in the cell. As indicated in the **Registers** tab, the right three columns are read-only so the cells cannot be edited.

Exporting Data from the Software

To export the data from the **Time Of Flight** tab after running repetitious TOF commands, use the **Save to .tsv** button found on the **Data Log Graph** tab. This file can then be opened as a spreadsheet.

Version 2.5 of the EV kit software does not support exporting data from the **Temperature** tab.

To export data from the **Event Timing Modes** tab, the data can simply be highlighted then copied and pasted into a spreadsheet.

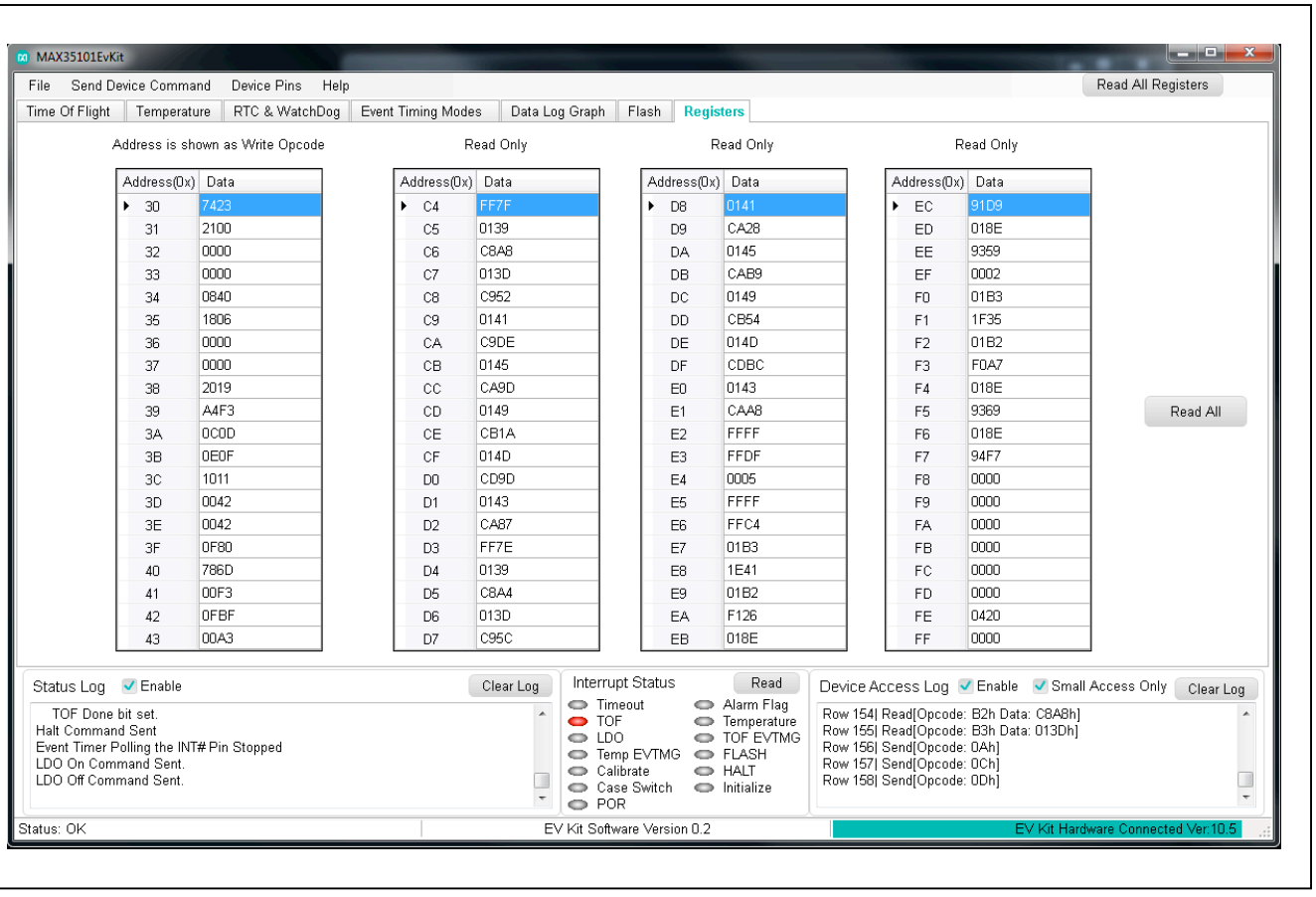

Figure 8. Registers Tab

Detailed Description of Hardware

See Figure 9 for a block diagram of the EV kit hardware and the required system-level connections. Figure 9 also highlights important hardware components such as solder bridges (Table 2), PCB connections (Table 3), jumpers (Table 4), momentary switches (Table 5), and LEDs (Table 6).

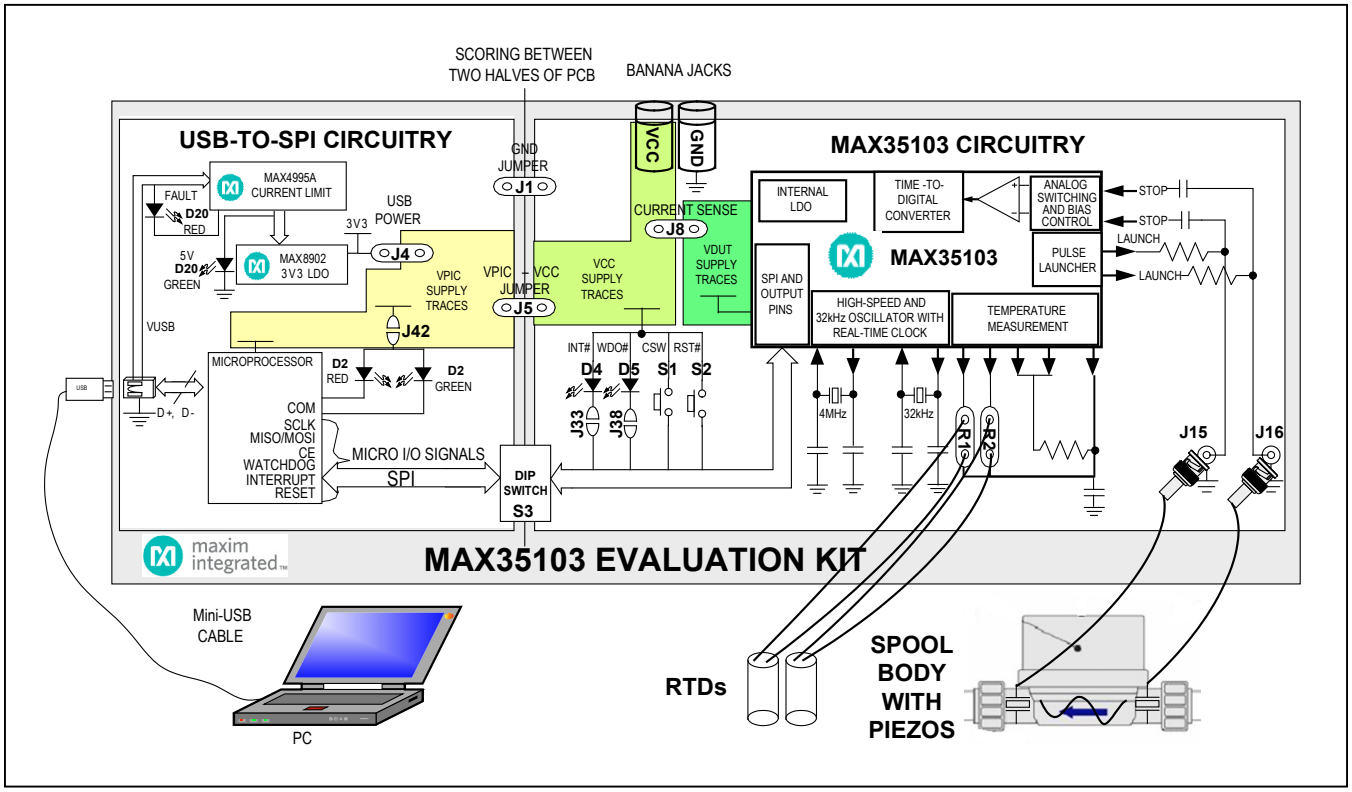

Figure 9. MAX35103 EV Kit Block Diagram

Table 2. Description of Solder Bridges

SOLDER BRIDGE	DESCRIPTION
J33	Connection between the D4 LED and ground. Removing the solder bridge disables the D4 LED.
J38	Connection between the D5 LED and ground. Removing the solder bridge disables the D5 LED.
J42	Connection between the D20 LED and supply. Removing the solder bridge disables the D20 LED.

Table 3. Description of PCB Connectors

CONNECTOR	DESCRIPTION
J2	Ground banana-jack connection. When powering the EV kit using an external supply, use this connection for ground. Connection can also be used to ground the spool body to the EV kit board.
J3	VCC banana-jack connection. When powering the EV kit using an external supply, use this connection to provide the bias for the VCC supply traces.
J15	Downstream piezoelectric transducer BNC connection.
J16	Upstream piezoelectric transducer BNC connection.
J20	Mini-USB connection. Provides communications and optional power from the PC to the IC.
R1	PORT 1 RTD terminal-block connections. Insert bare-wire connections of the RTDs into the terminal block and secure by tightening the screws with a Phillips head screwdriver.
R2	PORT 2 RTD terminal-block connections. Insert bare-wire connections of the RTDs into the terminal block and secure by tightening the screws with a Phillips head screwdriver.
S3	Socket for 8-channel DIP switch. DIP switch can be removed from the socket if the USB-to-SPI circuit is no longer desired. This allows the EV kit to be snapped along the scored line.

Above references are shown in Figure 9.

Table 4. Description of Jumpers

JUMPER	JUMPER POSITION	DESCRIPTION
J1 (GROUND)	Shorted	To use the USB-to-SPI translator circuit and the IC, they must share common ground. This jumper connects the ground planes across the scoring of the two halves of the PCB.
	Not shorted	Isolates the grounds from the USB-to-SPI translator circuit and the IC.
J4 (USB POWER)	Shorted	To run the EV kit solely on USB power, this jumper must be populated. This jumper connects the 3.3V USB regulated supply to the USB-to-SPI translator circuit (VPIC) supply.
	Not shorted	USB power is not used to generate the supplies for the USB-to-SPI translator circuit (VPIC) or the IC (VCC, VDUT). External power must be applied to the banana jacks.
J5 (VPIC SUPPLY to VCC SUPPLY)	Shorted	To run the EV kit solely on USB power, this jumper must be populated. This jumper connects the USB-to-SPI translator circuit (VPIC) supply to the IC (VCC, VDUT) supplies. This jumper connects the supplies across the scoring of the two halves of the PCB.
	Not shorted	This configuration allows the use an external SPI master or the ability to power the USB-to-SPI translator circuit (VPIC) from a different supply than the IC (VCC, VDUT).
J8 (Series Current Sense)	Shorted	Connects either the banana-jack-powered or USB-powered VCC supply to the device under test.
	Not shorted	Allows a series ammeter to be inserted into the device under test's supply for current consumption measurements

Above references are shown in Figure 9.

Table 5. Description of Momentary Switches

SWITCH	POSITION	DESCRIPTION
S1 (Case Switch)	Pressed (Active)	The CSW (case switch) input of the IC connected to the VCC supply. This input is active high.
	Not pressed (Inactive)	The CSW (case switch) input of the IC connected to ground through a 10kΩ pulldown. This input is active high.
S2 ($\overline{\text{RESET}}$)	Pressed (Active)	The $\overline{\text{RESET}}$ input of the IC connected to ground. This input is active low.
	Not pressed (Inactive)	The $\overline{\text{RESET}}$ input of the IC connected to the VCC supply through a 10kΩ pullup. This input is active low.

Above references are shown in Figure 9.

Table 6. Description of LEDs

LED	COLOR	DESCRIPTION
D2 (COM)	Green	**Noninitialized Flashing:** USB-to-SPI microcontroller active but not initialized by the software; once hardware is initialized by software, LED is disabled
	Red	**Communication:** After the software has initialized the hardware, the LED flashes red when a command from the PC is received
D4	Red	**$\overline{\text{INT}}$ PIN:** LED is illuminated when the interrupt pin is active (logic low)
D5	Red	**$\overline{\text{WDO}}$ PIN:** LED is illuminated when the watchdog device pin is active (logic low)
D20 (POWER)	Green	**USB Power:** USB 5V power supply is on
	Red	**USB Power Fault:** A fault occurred due to overvoltage limit, current limit, or thermal limit

Above references are shown in Figure 9.

Providing an External Supply

To vary the supply voltage with an external supply, or attach a battery to power the EV kit for evaluation purposes, remove jumper J4. Leave jumpers J1, J5, and J8 populated and then apply the ground and bias voltage from the external source to the banana jacks (J2 and J3).

Troubleshooting

All efforts have been made to ensure that each EV kit works on the first try, right out-of-the-box. In the rare occasion that a problem is suspected, see Table 7 to help troubleshoot the issue.

Table 7. Troubleshooting

SYMPTOM	CHECK	SOLUTION
GUI indicates: Hardware not found	Is the D20 LED red?	If yes, then the electronic fuse (U21) is in a fault state. Inspect for electrical shorts on the PCB and ensure that the PCB is not sitting on a conductive surface. The board must be power cycled once the LED is red.
	Does the D2 LED stop flashing when the GUI is running?	If not, then exit the GUI and try running it again. If D2 is still flashing, then exit the GUI and try connecting the USB cable to a different USB port on the PC and wait for a Windows message that states the hardware is ready to use. Run the GUI again. If D2 is still flashing, unplug the USB cable and reboot the PC. Connect the USB cable and open the GUI.
	Are any of the LEDs illuminated?	If not, then the PCB may not be getting power from the USB. Try a different USB cable or a different USB port.
Data is not being read properly from the device	DIP switch S3	Verify that all S3 DIP switches are in the on position. Verify that the S3 DIP switch is seated properly in its socket. Check continuity of the signals across the DIP switch. If the DIP switch is damaged, signals may need to be hard jumpered across the PCB score line.
	Common ground	Verify that there is common-ground references between the USB-to-SPI circuitry and the IC's circuitry. This is accomplished with the J1 jumper.

Component List

DESIGNATION	QTY	DESCRIPTION
3.3V, 5V, VCC, VDUT, VPIC	5	Red test points Keystone 5010
32k IN, 32KOUT, CE, CEx, CMPOUT, CSW, DIN, DNSTREAM PIEZO, DOUT, INT, INTx, LAUNCH_DN, LAUNCH_UP, MISO, MOSI, RST, RSTx, SCK (x2), STOP_DN, STOP_UP, T1–T4, TC, UPSTREAM PIEZO, WDO, WDOx	29	White test points Keystone 5012
C1, C2, C5, C7, C8, C28, C29	0	Do not populate, ceramic capacitors (0805)
C3, C6, C9, C14, C20, C58, C60	7	0.1µF, X7R ceramic capacitors (0805)
C4, C11	2	22µF, X7R ceramic capacitors (0805)
C10	1	100µF, tantalum capacitor (C-SMT) Vishay 593D107X9010C2TE3
C12, C37, C61	3	1µF, X7R ceramic capacitors (0805)
C13	1	2.2µF, X7R ceramic capacitor (0805)
C22–C25, C63, C64	6	12pF, X7R ceramic capacitors (0805)
C26A	1	0.1µF ±1%, 30ppm, C0G ceramic capacitor (1206) KEMET C1206C104F3GACTU
C26B	0	Do not populate, C0G ceramic capacitor (1206)
C30, C31	2	1nF ±1%, 30ppm, C0G ceramic capacitor (0805) Murata GRM2165C1H102FA01D
C35, C50, C52, C56	0	Do not populate, tantalum capacitors (C-SMT)
C36, C51, C53, C55, C57, C62	6	10µF, X7R ceramic capacitors (0805)
C54	1	0.01µF, X7R ceramic capacitor (0805)
D2, D20	2	Red/green dual LEDs Kingbright APHB M2012SURKCGKC
D3	1	Schottky diode ROHM Semi RB060M-30TR
D4, D5	2	Red LEDs (1206) Kingbright APTR3216EC
GND	7	Black test points Keystone 5011
J1, J4, J5, J8	4	2-pin, single-row headers 3M 961102-6404-AR
J2	1	Black banana socket Deltron 571-0100
J3	1	Red banana socket Deltron 571-0200
J6	0	Do not populate, 2-pin header
J15, J16	2	BNC connectors TE Connectivity 5227161-1
J20	1	5-pin mini-USB connector, female, Molex 54819-0519
J33, J38, J42	3	Solder bridges
L1	1	10µH ferrite inductor (0805)
R1, R2	2	2-position screw terminal Phoenix Contact 1984617
R3A	1	1kΩ, 25ppm/°C, 0.1% resistor Panasonic ERA-6YEB102V
R3B, R58	0	Do not populate, resistors (0805)
R5–R8, R56, R62	6	10kΩ ±1% resistors (0805)
R10, R11, R17, R19, R60, R61	6	330Ω ±1% resistors (0805)

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
R50, R59	2	0Ω ±1% resistors (0805)
R51, R54	2	560Ω ±1% resistors (0805)
R53	1	56kΩ ±1% resistor (0805)
R55	1	45.3kΩ ±1% resistor (0805)
R57	1	2.2kΩ ±1% resistor (0805)
S1, S2	2	Single-pole pushbutton switches C&K SR221G LFS
S3	1	100-mil socket for DIP switch 3M 929984-01-08-RK
U1	1	Time-to-digital converter (32 TQFP-EP*) Maxim MAX35103EHJ+
U2	1	Microcontroller (28 SO) Microchip PIC32MX250F128B-I/SO
U21	1	50mA to 600mA current-limit switch (6 SOT23) Maxim MAX4995AAUT+
U22	1	500mA LDO regulator (8 TDFN-EP*) Maxim MAX8902BATA+
X1, X4	2	4MHz crystals Interquip 7D04000123BTAFA2Q3
X2	1	32kHz crystal Interquip 9CAA32768122TF70CT
—	4	Jumpers/shunts
—	4	Rubber feet
—	1	Mini-USB cable
—	1	PCB: MAX35103 EVALUATION KIT

**EP = Exposed pad.*

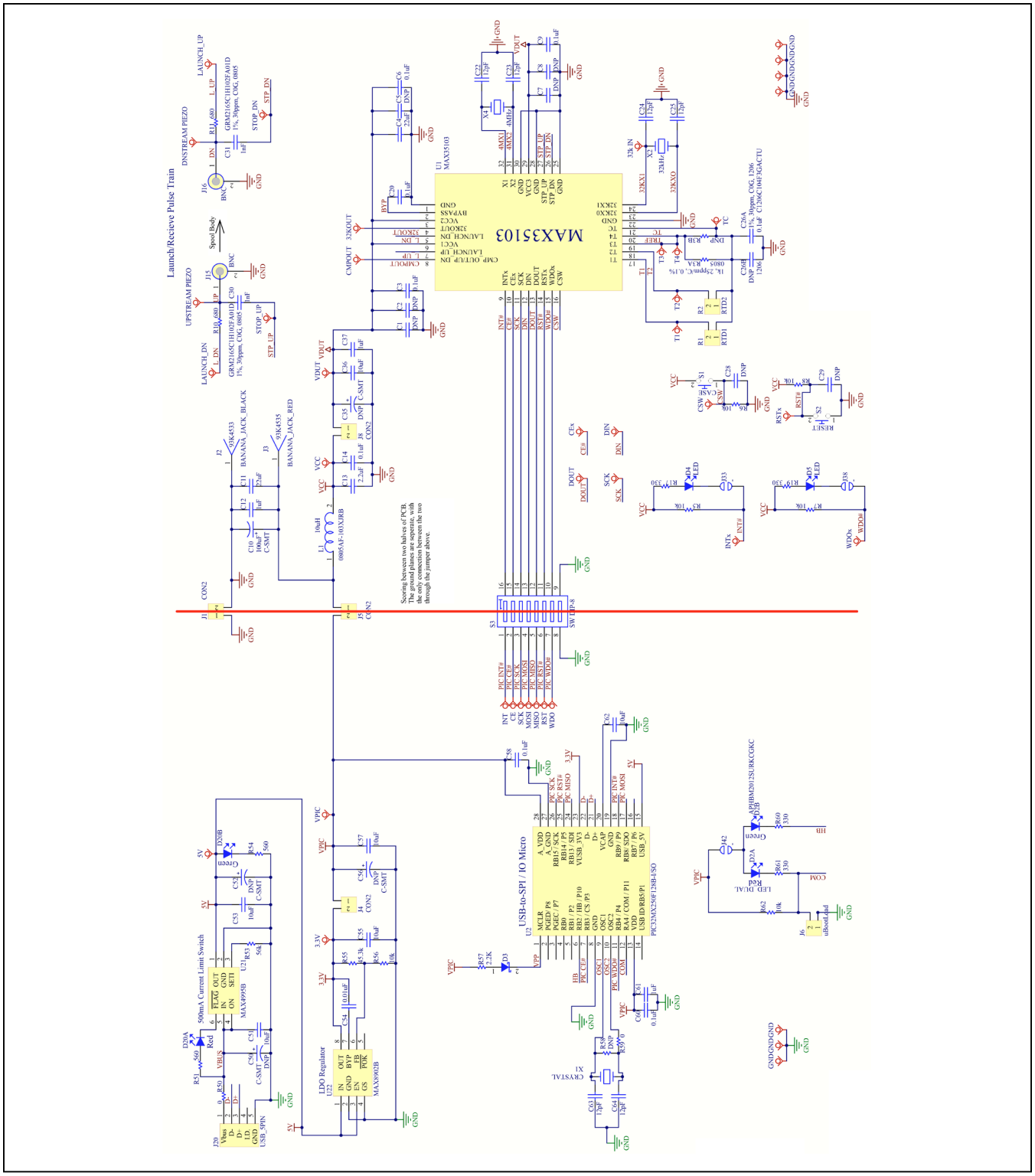

Figure 10. MAX35103 EV Kit Schematic

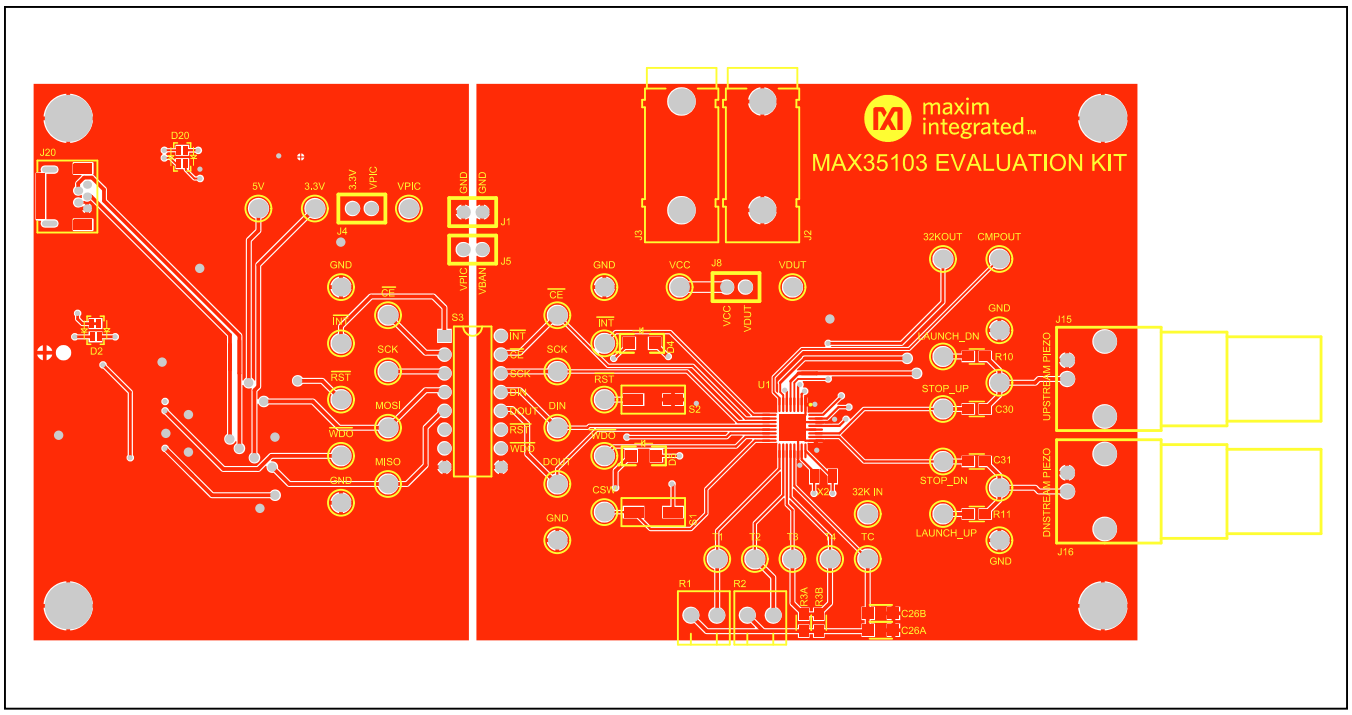

Figure 11. MAX35103 EV Kit PCB Layout—Top Layer

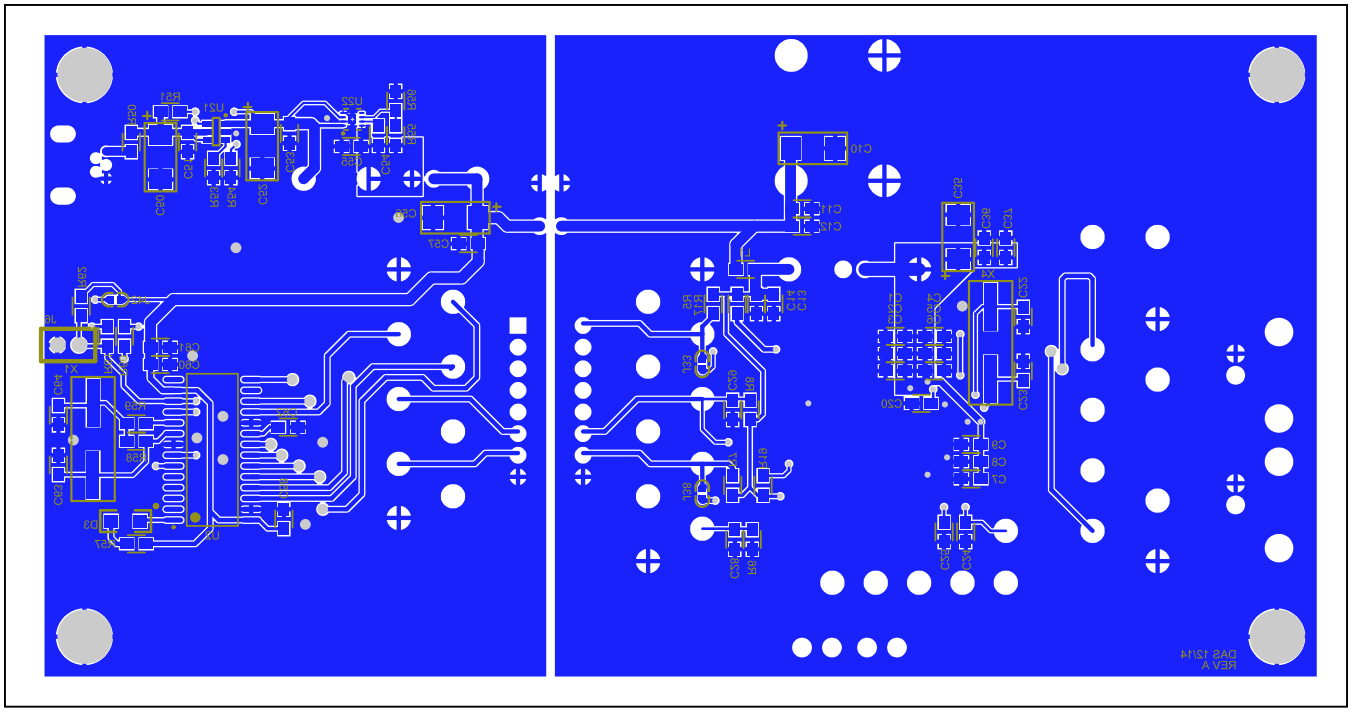

Figure 12. MAX35103 EV Kit PCB Layout—Bottom Layer

Ordering Information

PART	TYPE
MAX35103EVKIT#	EV Kit

#Denotes an RoHS-compliant device that may include lead(Pb), which is exempt under the RoHS requirements.

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	3/15	Initial release	—

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