TSC2011EVM and TSC2011EVM-PDK

This user's guide describes the characteristics, operation, and use of the TSC2011EVM, both by itself and as part of the TSC2011EVM-PDK. The TSC2011EVM and TSC2011EVM-PDK are two evaluation fixtures for the TSC2011, a nanopower resistive touch screen controller with integrated haptic feedback controller that communicates to a host processor over an I²C™ serial interface. This evaluation module (EVM) is a four-wire resistive touch screen controller EVM that also has auxiliary input and temperature measurement capabilities. The haptic feedback controller can operate automatically, using the integrated H-bridge within the TSC2011 or an external H-bridge on the EVM board. A complete circuit description, schematic diagram, printed circuit board silkscreen, and bill of materials are included.

The following related documents are available through the Texas Instruments web site at www.ti.com.

Related Documentation

Device	Literature Number
TSC2011	SBAS516
TAS1020B	SLES025
REG1117-5	SBVS001
TPS767D318	SLVS209
SN74LVC125A	SCAS290
SN74LVC1G125	SCES223
SN74LVC1G07	SCES296
5-6k Interface Board	SLAU104

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1 EVM Overview

1.1 Features

TSC2011EVM:

- Full-featured evaluation board for the TSC2011 four-wire resistive touch screen controller (TSC)
- Full-featured evaluation board for the integrated haptic feedback controller
- Modular design for use with a variety of DSP and microcontroller interface boards

TSC2011EVM-PDK:

- Easy-to-use evaluation software for Microsoft® Windows® XP
- Complete control of board settings

For use with a computer, the TSC2011EVM-PDK is a complete evaluation kit. This kit combines the TSC2011EVM with the USB-based USB-MODEVM motherboard and evaluation software for use with a personal computer.

The USB-MODEVM motherboard allows the TSC2011EVM to be connected to the computer via an available USB port. This manual shows how to use the USB-MODEVM as part of the TSC2011EVM-PDK, but does not provide technical details about the USB-MODEVM itself.

This manual covers the operation of both the TSC2011EVM and the TSC2011EVM-PDK. Throughout this document, the abbreviation *EVM* and the term *evaluation module* are synonymous with the TSC2011EVM.

1.2 Introduction

The TSC2011EVM is manufactured in Texas Instruments' modular EVM system specification. It can be connected to any modular EVM system interface card. The TSC2011EVM allows direct evaluation of the TSC2011 performance and operating characteristics, in addition to rapid software development and system prototyping. This EVM is compatible with the 5-6k Interface Board (SLAU104) from Texas Instruments and additional third-party boards such as the HPA449 demonstration board from SoftBaugh, Inc. (www.softbaugh.com) and the NI Speedy-33™ from National Instruments Corporation.

The TSC2011EVM is available as a stand-alone printed circuit board (PCB) or as part of the TSC2011EVM-PDK, which includes a USB-MODEVM motherboard and software. As a stand-alone PCB, the TSC2011EVM is useful for prototyping designs and firmware.

The TSC2011EVM-PDK is a complete evaluation and demonstration kit that includes the following items:

1. TSC2011EVM board
2. USB-MODEVM board
3. TSC2011-EVM-PDK evaluation software installer and related documentation

The EVM software is updated regularly. To check for the latest version, go to the TSC2011EVM software download page on the Texas Instruments' website.

2 Analog Interface

For maximum flexibility, the TSC2011EVM is designed for easy interfacing to multiple analog sources by means of different connection options.

The TSC2011 supports a four-wire resistive touch screen. On the board, a Young Fast Optoelectronics four-wire touch screen (part number A480Y-21-S090717-5158) is installed on the top of the TSC2011EVM board (included only with the order of the TSC2011EVM-PDK), though a Molex connector, J5 (part number 52271-0469).

Additionally, through a Samtec four-position header J4 (part number TSW-104-07-T-S), the onboard TSC2011 can be connected with an external four-wire resistive touch screen selected by users.

Note that the J4 and J5 analog interface cannot be used simultaneously. If a four-wire touch screen is connected to J4, the screen connected to J5 must be removed first, and vice-versa.

Furthermore, through a two-position terminal box, J1 (not installed), an analog input signal that ranges from 0 to VDD can be fed into the AUX pin of the TSC2011.

3 Haptic Interface

The TSC2011 haptic feedback controller produces a haptic effect using either a built-in H-bridge driver or under the control of an external H-bridge to execute tasks that require more driving capability. On the TSC2011EVM PCB, a Zetex MOSFET H-bridge, U2 (part number ZXMHC6A07T8), is installed. Also, through a Samtec four-position header, J6 (part number TSW-104-07-T-S), the TSC2011 haptic controller can be used to control another external H-bridge from the TSC2011EVM.

4 Digital Interface

The TSC2011EVM is designed to easily interface with multiple control platforms. Samtec part numbers SSW-110-22-F-D-VS-K and TSM-110-01-T-DV-P provide a convenient 10-pin, dual-row, header/socket combination at J2, described in Table 1. This header/socket provides access to the digital control and serial data pins of the TSC.

Table 1. J2: Digital Interface Pinout

Pin Number	Signal	Description
J2.12	$\overline{\text{RESET}}$	Hardware reset to TSC2011
J2.15	$\overline{\text{PINTDAV}}$	Pen interrupt and/or data available output from TSC2011
J2.16	SCL	I^2C bus serial clock
J2.20	SDA	I^2C bus serial data line
J2.1 to J2.3, J2.5 to J2.9, J2.11, J2.13, J2.14, J2.17, J2.19	Unused	—
J2.4, J2.10, J2.18	DGND	Digital ground connections

5 Power Supplies

J3 on the TSC2011EVM board provides a connection to the common power bus for the TSC2011EVM. Samtec part numbers SSW-105-22-F-D-VS-K and TSM-105-01-TDV- P provide a convenient 5-pin, dual-row, header/socket combination at J3, described in Table 2.

Table 2. J3: Power-Supply Pinout

Signal	Pin Number		Signal
Unused	J3.1	J3.2	Unused
Unused	J3.3	J3.4	Unused
DGND	J3.5	J3.6	AGND
+1.8VD	J3.7	J3.8	+VD1
+3.3VD	J3.9	J3.10	Unused

The TSC2011 requests two sets of power supplies: one is called *VDD*, and powers the touch screen controller and the digital interface. The other is denoted as *HVDD* and specifically powers the haptic controller and related circuitry.

The TSC2011 VDD power can be selected using JP4, either from the TSC2011EVMPDK motherboard (that is, the USB-MODEVM Interface Board) through the J3 connector, or from the HVDD source.

The TSC2011 HVDD power can be selected using JP3, from the TSC2011EVM-PDK motherboard through J3, or from an external 1.6-V to 3.6-V dc power supply through J7.

The TSC2011EVM-PDK motherboard (that is, the USB-MODEVM interface board) supplies power to J3 of the TSC2011EVM. Power for the motherboard is supplied through the USB port, terminal blocks, or power connectors on the motherboard.

5.1 TSC Power

Power for the TSC2011 VDD can be supplied either from the motherboard (J3-8) or from the HVDD source, selected by setting JP4. When the shunt is installed on JP4 pins 1-2, power for VDD comes from the HVDD source. For more details on the haptic power, refer to Section 5.2. When the shunt is installed on JP4 pins 2-3, power for VDD comes from J3.8 (+VD1), where +VD1 is a power source from the motherboard (the USB-MODEVM); +VD1 can be selected in the range of +1.2 VDC to +3.3 VDC by switch SW3 on the USB-MODEVM board. For further details on the USB-MODEVM power, refer to Section 5.4.

5.2 Haptic Power

Power for the TSC2011 haptic power HVDD can supplied from the TSC2011EVM-PDK motherboard (through J3), or from an external 1.6-V to 3.6-V dc power supply (through J7), selected using a jumper on JP3. The TSC2011 HVDD power comes from one of three sources:

- from J3.9 (+3.3-VD power from the motherboard) if JP3 is shunted at pins 5-6; or
- from J3.7 (+1.8-VD power from the motherboard) if JP3 is shunted at pins 3-4; or
- from J7 (a 1.2-VD to 3.6-VD external power supply) if JP3 is shunted at pins 1-2.

CAUTION

Verify that all power supplies are within the safe operating limits shown on the TSC2011 data sheet (SBAS516) before applying power to the EVM. Also, note the power polarity to J7.

5.3 Stand-Alone Operation

When used as a stand-alone EVM, the power can be applied through the J7 terminal block (not installed). Note that two additional shunts must be installed for stand-alone operation: one shunt must be installed on JP3, pins 1-2 for supplying power to the TSC2011 HVDD, and a second shunt must be installed on JP4, pins 1-2 for supplying power to the TSC2011 VDD.

CAUTION

Verify that all power supplies are within the safe operating limits shown on the TSC2011 data sheet (SBAS516) before applying power to the EVM. Also, note the power polarity to J7.

5.4 USB-MODEVM Interface Power

The USB-MODEVM Interface Board can be powered from several different sources:

- Through a USB connection
- 6-VDC to 10-VDC ac/dc external wall supply *(not included)*
- Laboratory power supply

When powered from the USB connection, JMP6 should have a shunt from pins 1-2 (the factory default configuration). However, such a configuration to supply power should not be used when the USB-MODEVM board is also used to power the HVDD supply on the TSC2011EVM board, because the haptic vibrator on the TSC2011EVM board alone can consume approximately 130 mA (under 3.3 HVDD) current.

CAUTION

It is strongly recommended to NOT use the USB connection power to supply the TSC2011EVM board.

When powered from 6 VDC to 10 VDC, either through the J8 terminal block or the J9 barrel jack, JMP6 should have a shunt installed on pins 2-3. If power is applied in either of these ways, onboard regulators generate the required supply voltages, and no further power supplies are necessary.

When powered from laboratory supplies that provide the individual voltages required by the USB-MODEVM interface board, JMP6 should have no shunt installed. Voltages are then applied to J2 (+5 VA), J3 (+5 VD), J4 (+1.8 VD), and J5 (+3.3 VD). The +1.8 VD and +3.3 VD also can be generated on the board, from the +5-VD supply, by the onboard regulators; to enable this supply, the switches on SW1 must be set to enable the regulators. Move the switches to the *ON* position (higher position, looking at the board with text reading right-side up) to enable the regulators. If +1.8 VD and +3.3 VD are supplied externally, disable the onboard regulators by placing the SW1 switches in the *OFF* position.

The last two power sources are recommended while the USB-MODEVM board is used as the motherboard for supplying power to the TSC2011EVM board, because the USB connection can support only a maximum 100 mA of current.

Each power-supply voltage has an LED (D1, D3–D8) that lights when the power supplies are active.

5.5 Reference Voltage

No additional reference is needed for the TSC2011EVM because the reference voltage used for the TSC2011 device is provided from the VDD pin of the TSC2011. A reference is needed only for single-ended input mode when measuring the AUX or temperature. TSC2011 touch screen measurements are operated under differential (ratiometric conversion) mode and therefore do not need any reference.

6 EVM Operation

This section provides information on the analog input, digital control, and general operating conditions of the TSC2011EVM, both by itself and as part of the TSC2011EVM-PDK.

6.1 Analog Input

The touch screen signal from the touch panel can be input to the TSC2011 through the J4 or J5 four-pin connector. A touch panel is attached on J5 of the TSC2011EVM board as a part of the EVM-PDK kit.

The auxiliary analog input signal can be applied directly to J1 (not installed).

CAUTION

Verify that the analog signal to the TSC2011 AUX pin is within the safe operating limits shown on the TSC2011 data sheet (SBAS516) before connecting the signal to the EVM. Also, note the signal polarity to J1.

6.2 Haptic Output

The haptic output signals from the TSC2011 are routed out through J6.

6.3 Digital Control

The digital control signals can be applied directly to J2 (top or bottom side; refer to Table 1). The modular TSC2011EVM also can be connected directly to a DSP or microcontroller interface board, such as the HPA449, or to the USB-MODEVM Interface Board if purchased as part of the TSC2011EVM-PDK. For a current list of compatible interface and/or accessory boards for the EVM or the TSC2011, see the TSC2011 product folder on the TI web site (www.ti.com).

6.4 Default Jumper Locations

Table 3 provides a list of jumpers found on the EVM and the respective factory default conditions for each.

Table 3. List of Jumpers

Jumper	Description	Default Shunt Position
JP1	TSC2011 I^2C Address Bit AD0: 1-2: AD0 = 1 2-3: AD0 = 0	2-3 (AD0 = 0)
JP2	EEPROM Address Select: Installed: Firmware for the motherboard from the onboard EEPROM on the TSC2011EVM Removed: Firmware for the motherboard from the EEPROM on motherboard	Installed (FW from the EEPROM on the TSC2011EVM board)
JP3	HVDD Power-Supply Selection: 1-2: External supply from J7 3-4: From motherboard +1.8 VD (J3.7) 5-6: From motherboard +3.3 VD (J3.9)	5-6: From motherboard +3.3 VD (J3.9)
JP4	VDD Power Supply Selection: 1-2: Use HVDD 2-3: From motherboard +VD1 (J3.8)	2-3: From motherboard +VD1 (J3.8)
JP5	Haptic Driver H+ to Onboard Vibrator: 1-2: From TSC2011 (U1) H+ pin 2-3: From onboard external H-bridge U2	1-2: From TSC2011 (U1) H+ pin
JP6	Haptic Driver H– to Onboard Vibrator: 1-2: From TSC2011 (U1) H– pin 2-3: From onboard external H-bridge U2	1-2: From TSC2011 (U1) H– pin
JP7	Haptic Driver Mode Selection: 1-2: In single-ended mode 2-3: In differential mode	2-3: In differential mode
JP8	VDD Current Measuring: Installed: VDD directly to TSC2011 VDD pin (no current measurement) Removed: VDD to TSC2011 through a current meter (must use a current meter between the two pins)	Installed: VDD directly to TSC2011 VDD pin (no current measurement)
JP9	HVDD Current Measuring: Installed: HVDD directly to TSC2011 HVDD pin (no current measurement) Removed: HVDD to TSC2011 through a current meter (must use a current meter between the two pins)	Installed: HVDD directly to TSC2011 HVDD pin (no current measurement)

7 EVM-PDK Operation

The following sections of this user guide provide information about operating the TSC2011EVM-PDK, including setup, program installation, and using the software as well as its operational description.

7.1 Block Diagram

Figure 1 shows the hardware block diagram of the TSC2011EVM-PDK. The two PCBs are connected together, and the TSC2011EVM board is seated on top of the USB-MODEVM board.

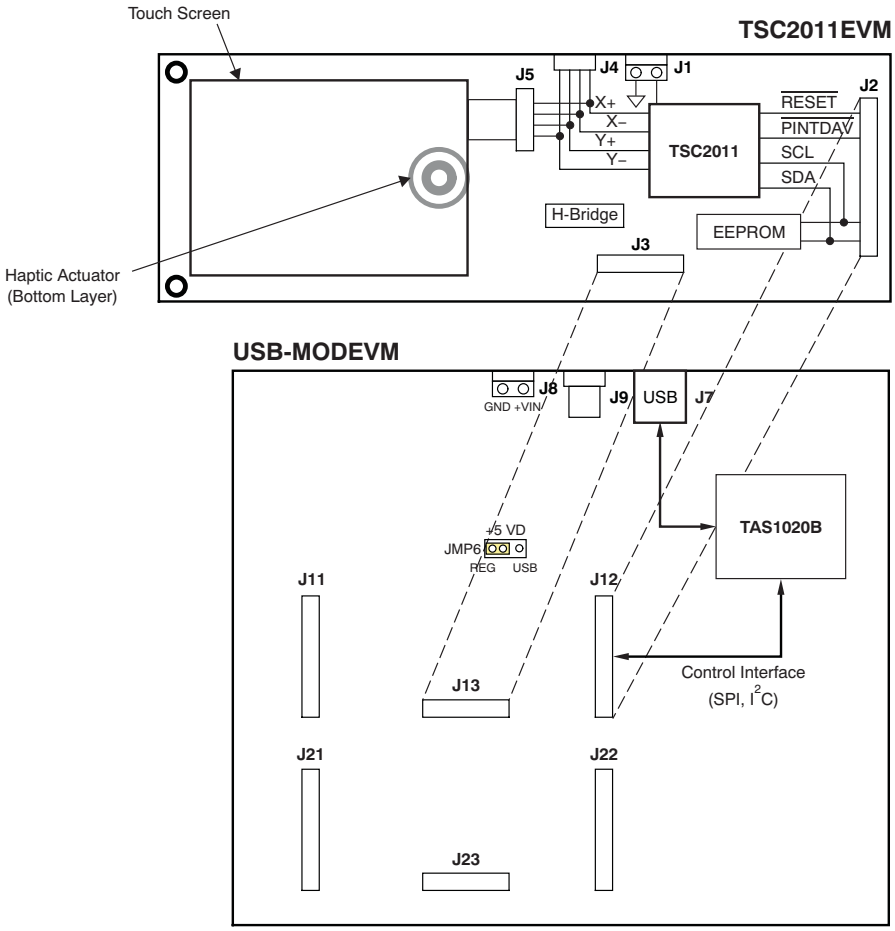


Figure 1. TSC2011EVM-PDK Hardware Block Diagram and Connection

The USB cable that connects the USB-MODEVM board to the PC is plugged in to J7. A 6-V to 10-V dc power supply that provides the power for the EVM-PDK should be connected to either J8 or J9. Note that JMP6 on the USB-MODEVM board should be set to *REG* or 2-3 (left), as shown in Figure 1.

The USB-MODEVM Interface Board is intended to be used in USB mode, where control of the installed EVM is accomplished using the onboard USB controller device. However, provision is made for driving all the buses (I^2C and/or SPI) externally. The source of these signals is controlled by switch SW2 on the USB-MODEVM. For more details, see the USB-MODEVM Interface Board schematic (appended to this document).

7.2 Quick Start

Ensure that the TSC2011EVM is installed on the USB-MODEVM Interface Board. The TSC2011EVM should be installed in the topmost position, using J12, and J13 on the USB-MODEVM, as shown in Figure 1.

CAUTION

Do not connect the EVM-PDK to your PC through a USB cable before you install the software.

Follow these procedures to install the software:

1. Download the TSC2011-EVM-PDK software from the TI website (ftp://ftp.ti.com/pub/evm-pdk/TSC2011/), and run *Setup.exe*, found in the Installer directory.
2. Accept the license agreement, and continue the installation.
3. Follow the instructions and prompts given. Then click *Finish* in the TSC2011EVM Installer window.
4. Restart your computer. (This step may not be necessary, but is recommended.)
5. When your computer has restarted, connect the TSC2011EVM to the computer via a USB cable, and connect the power to the USB-MODEVM through J8 or J9. Windows should recognize the new device, and the *Found New Hardware* wizard appears.
6. Select *Install from a list or specific location (Advanced)*, and click on **Next>**.
7. Select *Don't Search. I will choose the driver to install*, and click on **Next>**.
8. If the TSC2011EVM is in the list of available models, click on it to select it. You are done. Otherwise, if it is not shown, the *Add Hardware* wizard provides a list of *Common hardware types*; find and click on *NI-VISA USB Devices*.
9. Click on *Have Disk...*
10. Select *Browse ...*, and find the **TSC2011EVM.inf**, which is included with the installer. This file should be (by default) in the directory *C:\Program Files\Texas Instruments\TSC2011EVM\data*.
11. Select the TSC2011EVM.inf, and click on it. Then click on *OK*; your PC searches for and finds *TSC2011EVM*.
12. Select the *TSC2011EVM* in the list of models, and click on **Next>**.
13. Click **Finish** to complete the installation process.

Once the installer has completed its processes, you are done and ready to operate the TSC2011EVM software.

As noted earlier, make sure JMP6 on the USB-MODEVM board is set to 2-3, and ensure that the power supply to J8 or J9 is within the range of 6 VDC to 10 VDC. Connect the USB cable from the PC to J7, and power on the supply. The power indicator LEDs on the USB-MODEVM should light. When installation is complete, launch the TSC2011 evaluation software on your PC.

Once the USB-MODEVM powers on, the software should automatically find the TSC2011EVM, and a window similar to the one in Figure 2 should appear.

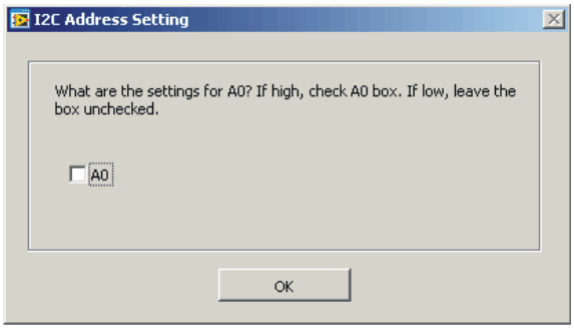


Figure 2. Prompt to Set Up TSC2011 I²C Slave Address

Check the **A0** box if the TSC2011EVM jumper JP1 is shunted on 1-2 (that is, set to the high position). By default, A0 should be unchecked with jumper JP1 shunted on 2-3 (low) (refer to Table 3). Click on the *OK* button to continue, and the software graphical user interface (GUI) appears, as shown in Figure 3.

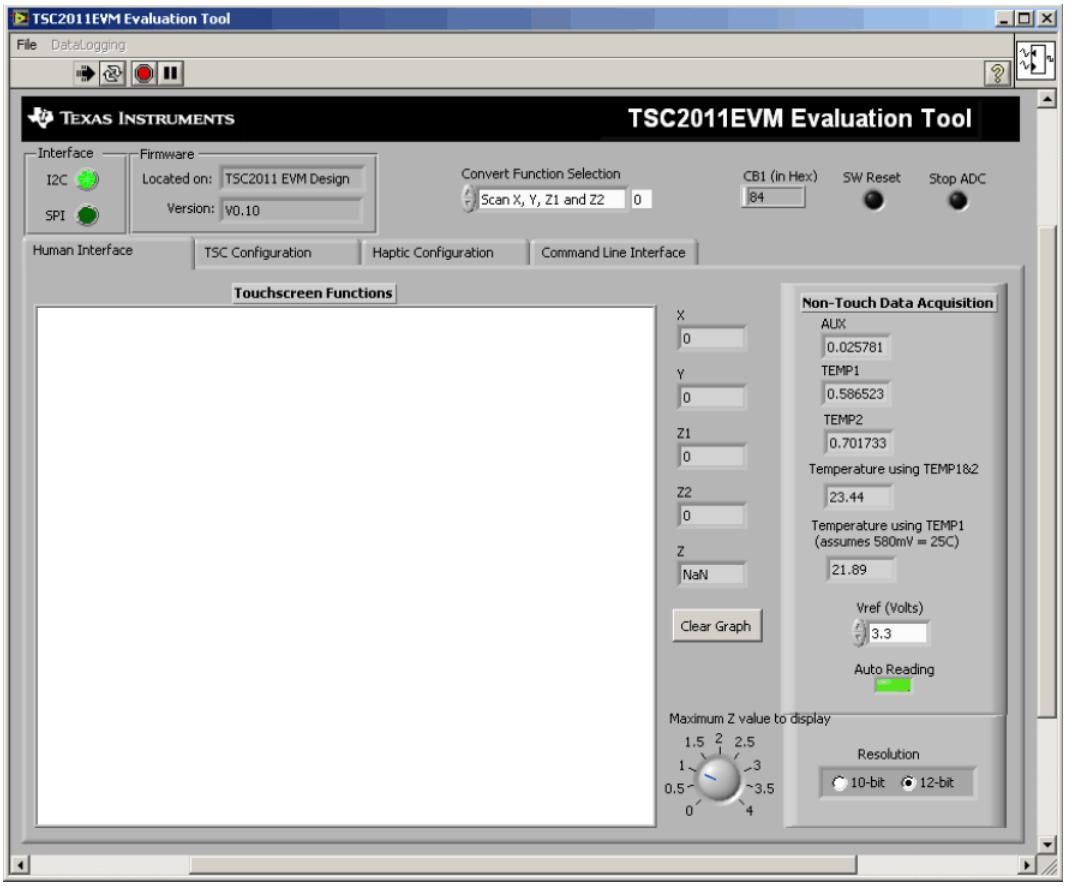


Figure 3. TSC2011EVM-PDK Software GUI: Startup Screen with Human Interface Tab

In order to use the touch screen features, a four-wire resistive touch screen must be connected to J4 or J5 of the TSC2011EVM, as discussed previously. Included with the TSC2011EVM-PDK, a touch screen is connected to J5.

7.3 USB-MODEVM Interface Board

The simple diagram shown in Figure 1 shows only the basic features of the USB-MODEVM Interface Board. The board is designed for a TAS1020B USB controller with an 8052-based core. It features two positions for modular EVMs, or one double-wide serial modular EVM can be installed.

For use with the TSC2011, the TSC2011EVM is installed in the topmost EVM slot, which connects the TSC2011 digital control interface to the I^2C port of the TAS1020B. Because the TSC2011 has no audio features, the lower EVM slot (which is connected to the TAS1020B digital audio interface) is not used.

As configured at the factory, the board is ready to use with the TSC2011EVM. However, in order to support the haptic functions of the TSC2011EVM, an external power supply (200 mA or larger) is required. Refer to Section 5.4.

If external I^2C control is desired, the signals may be applied to J6 on the USB-MODEVM board. To view all the functions and configuration options available on this board, see the USB-MODEVM Interface Board schematic appended to this document.

8 GUI Software and Operating Descriptions

8.1 Program Description

After you complete the TSC2011EVM-PDK software installation (described in Section 7.2), evaluation and development with the TSC2011 can begin.

When the TSC2011EVM-PDK software starts on your PC, the interface GUI is displayed as shown in Figure 3. On the top-left side of the GUI, a lit green LED indicates the digital serial interface type; this indicator should be *I^2C* for the TSC2011EVM-PDK. The next box to the right shows the location and version of the firmware.

The two LEDs on the top right side of the GUI can be used to perform a software reset of the TSC2011 and stop the TSC2011 analog-to-digital converter (ADC) operation.

When the Stop ADC LED is lit (red), bit 0 of CB1 is set to logic '1' and the TSC2011 ADC stops converting. When this LED is off (black), bit 0 goes to logic '0' and the TSC2011 operates normally.

When the SW Reset LED is lit (blue), bit 1 of CB1 is set to logic '1' and the TSC2011 is in software reset mode. When the LED is off (black), bit 1 is set to logic '0'; the TSC2011 is not reset and is in normal operating mode.

Note that the two LEDs reflect the corresponding bits within the CB1 box located to the left of the SW Reset LED. Data in CB1 are written to the TSC2011 when one of the following events occurs:

- Bit 0 (STS or Stop ADC) is set by clicking on the Stop ADC LED.
- Bit 1 (SWREST or SW Reset) is set by clicking on the SW Reset LED.
- Bit 2 (RM or Resolution) is set at the Human Interface tab.
- Bits 3 through 6 (Converter Function Select) can be set at the Convert Function Selection option box, near the top center of the GUI; refer to Figure 3. For a list of all possible convert functions, refer to the TSC2011 data sheet.

Most product and design evaluations can be implemented using the four primary tabs on the TSC2011EVM GUI: *Human Interface*, *TSC Configuration*, *Haptic Configuration*, and *Command Line Interface*. Clicking on a tab accesses the functions that correspond to the specific tab. This section provides a detailed discussion of the functions of these tabs.

8.2 Human Interface Tab

Refer to Figure 3 for a view of the Human Interface tab; this screen is the default (startup) tab of the GUI, and shows both touch data (such as X-, Y-, and Z-coordinates of each touch on the screen) and non-touch data (for example, AUX and temperature).

8.2.1 Touch Screen Control Function

The touch screen box in this tab updates when a touch is detected on the touch screen. As the touch screen is drawn on, the motion on the touch screen is translated into pixels in this box. The software takes X, Y, Z_1, and Z_2 readings which are shown to the right of the touch screen box. As the touch pressure increases, the pixel size increases; a lighter touch results in thinner pixel sizes, as shown in Figure 4.

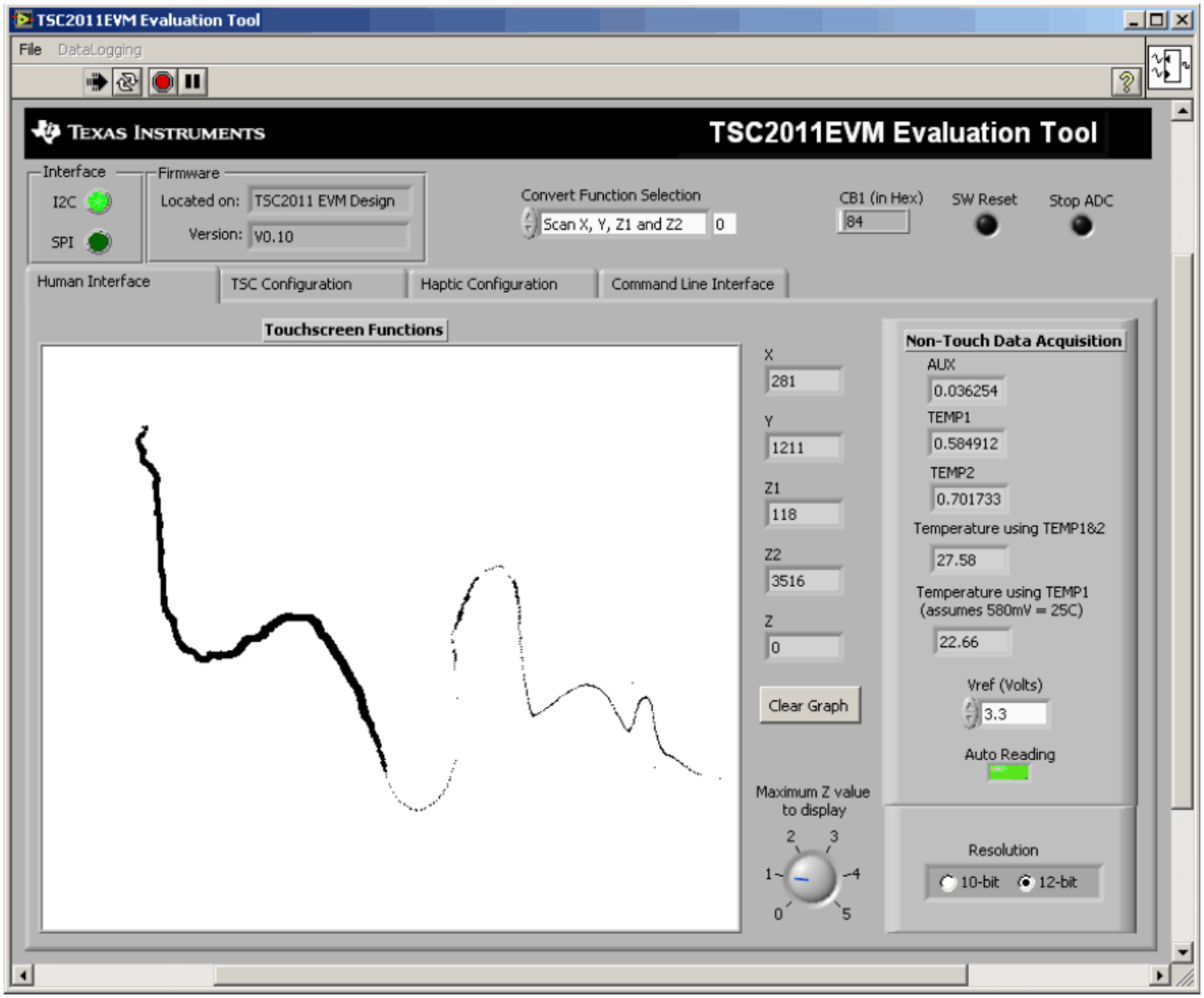


Figure 4. TSC2011EVM-PDK Software GUI: X/Y/Z Graph

The touch pressure-related value π used in the evaluation software is calculated by Equation 1 in the TSC2011 data sheet, but without multiplying the value by the Rx-plate resistance. Instead, the pixel size is determined using the (α – β × π) value, where α and β are two constant numbers. The pixel size normally ranges from 0 to 5, shown as *Z* beneath the measured touch data, X, Y, Z_1, and Z_2; larger numbers represent a more forceful press on the screen. Using the *Maximum Z Value to Display* knob, you can set a threshold so that the program does not display lightly pressed points. This threshold setting helps to eliminate the display of spurious points that may result from touch screen mechanical bouncing or physical jitter.

By default, the EVM-PDK kit collects X, Y, Z_1, and Z_2 touch coordinate data. If you only want to measure X and Y coordinate, without the third dimension or Z value, click on the *down* arrow on the Convert Function Select option box (at the top center of the software GUI) and change it to *Scan X, and Y*, as shown in Figure 5.

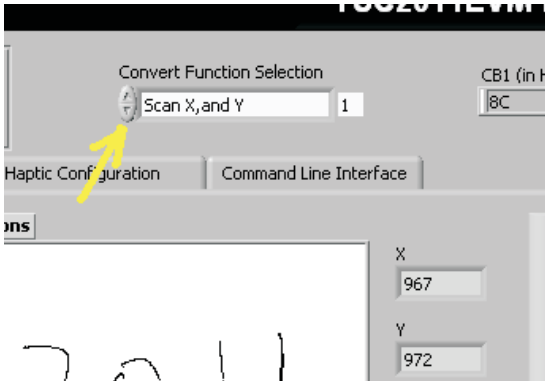


Figure 5. TSC2011EVM-PDK Software GUI: Set to X/Y (No Z) Function

In this mode, touch on the screen shows only the X and Y data with a fixed line width, as Figure 6 illustrates.

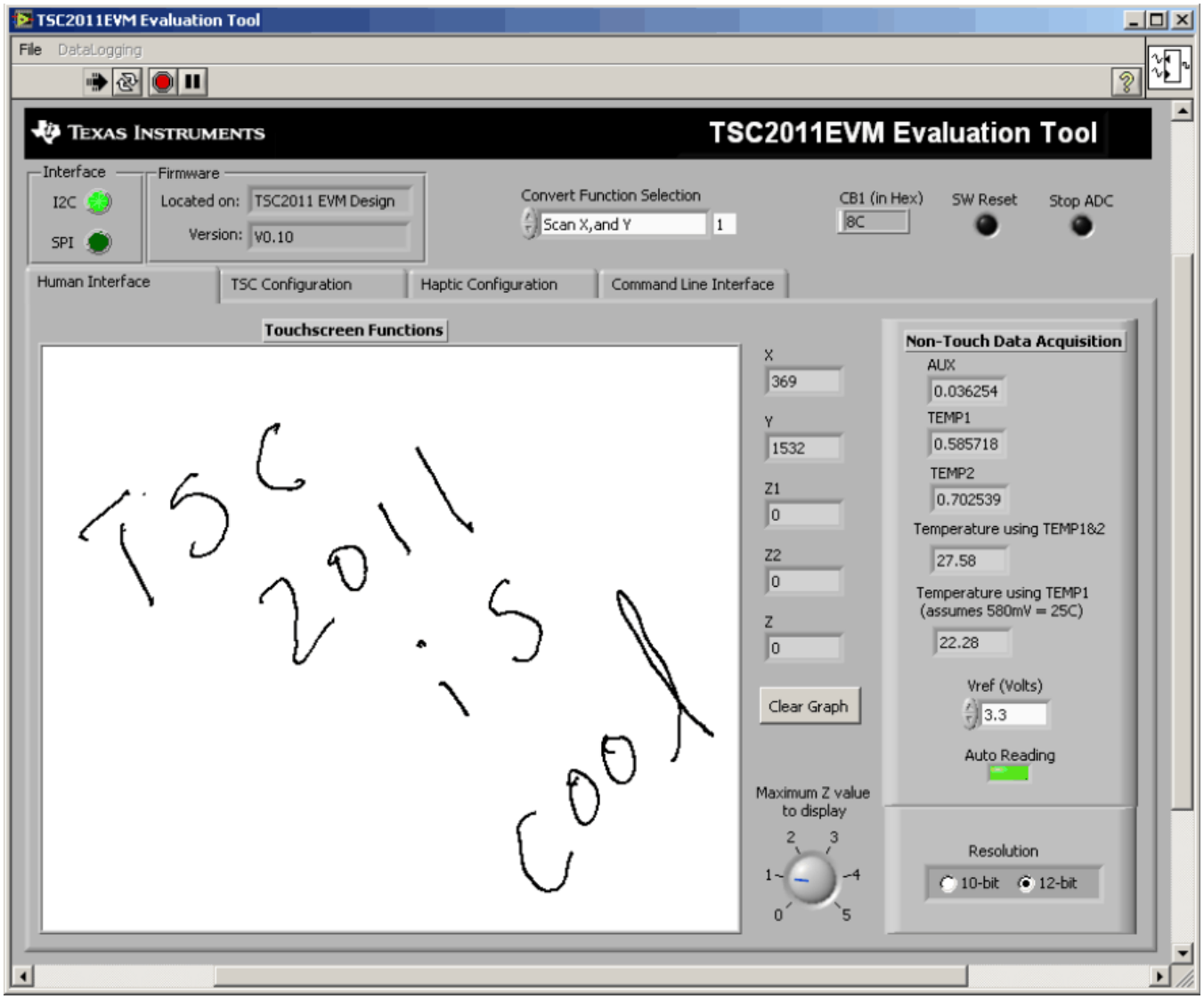


Figure 6. TSC2011EVM-PDK Software GUI: X/Y Graph

The displayed drawing in the touch screen box can be cleared by pressing the **Clear Graph** button on the screen.

8.2.2 Data Acquisition Functions

The TSC2011 provides for measuring an auxiliary input voltage (AUX) and the TSC2011 IC temperature. A data acquisition function on this tab displays the measured values for these parameters. Measurements are updated only when the touch screen is not being pressed, and the **Auto Reading** LED is on (green).

Temperature is displayed using both measurement modes described in the TSC2011 data sheet. Using the TEMP1 and TEMP2 measurements, a temperature reading with 2°C resolution and accuracy is achieved. Using only the TEMP1 measurement, a reading with 0.3°C resolution is possible, but requires that the user know the TEMP1 value at +25°C. This setting normally requests a calibration that the user performs. The evaluation software program presumes that TEMP1 = 580 mV at +25°C.

By default, the software continuously reads non-touch data, AUX, TEMP1, and TEMP2, and automatically updates these values in the *Non-Touch Data Acquisition* section of the GUI display with an interval of about 100 ms. To stop data acquisition, click on the green LED **Auto Reading** at the bottom of the *Non-Touch Data Acquisition* section.

Both AUX and temperature measurements require a reference voltage, which is provided from the TSC2011 VDD pin. The V_{REF} value (in volts) controller box can be written with the corresponding VDD voltage (from 1.2 VD to 3.6 VD).

8.2.3 Direct Configuration

Several parameters (or modes) can be accessed through direct configuration using control byte 1 (CB1), including Resolution, ADC Stop, and SW Reset. See the TSC2011 data sheet for more details.

In the Human Interface tab, Resolution can be accessed with the direct configuration operation.

The TSC2011 ADC can be configured to operate in either 10-bit or 12-bit resolution mode. This option can be directly configured using Control Byte Mode #1 (or CB1), or by writing to bit #13 of Control Register CFR0. Clicking on the resolution option in this tab changes the resolution setting in CB1. Note that the CB1 box at the top of the GUI updates when any of the control bits change. You may also need to change the resolution setting in CFR0 (which is discussed in the Configuration Tab section) to make these values consistent.

8.3 Configuration Tab

Clicking on the TSC Configuration tab brings up a screen similar to that shown in Figure 7. All of the TSC2011 touch screen-related control registers can be accessed and written to using the buttons, option select boxes, or slides available here.

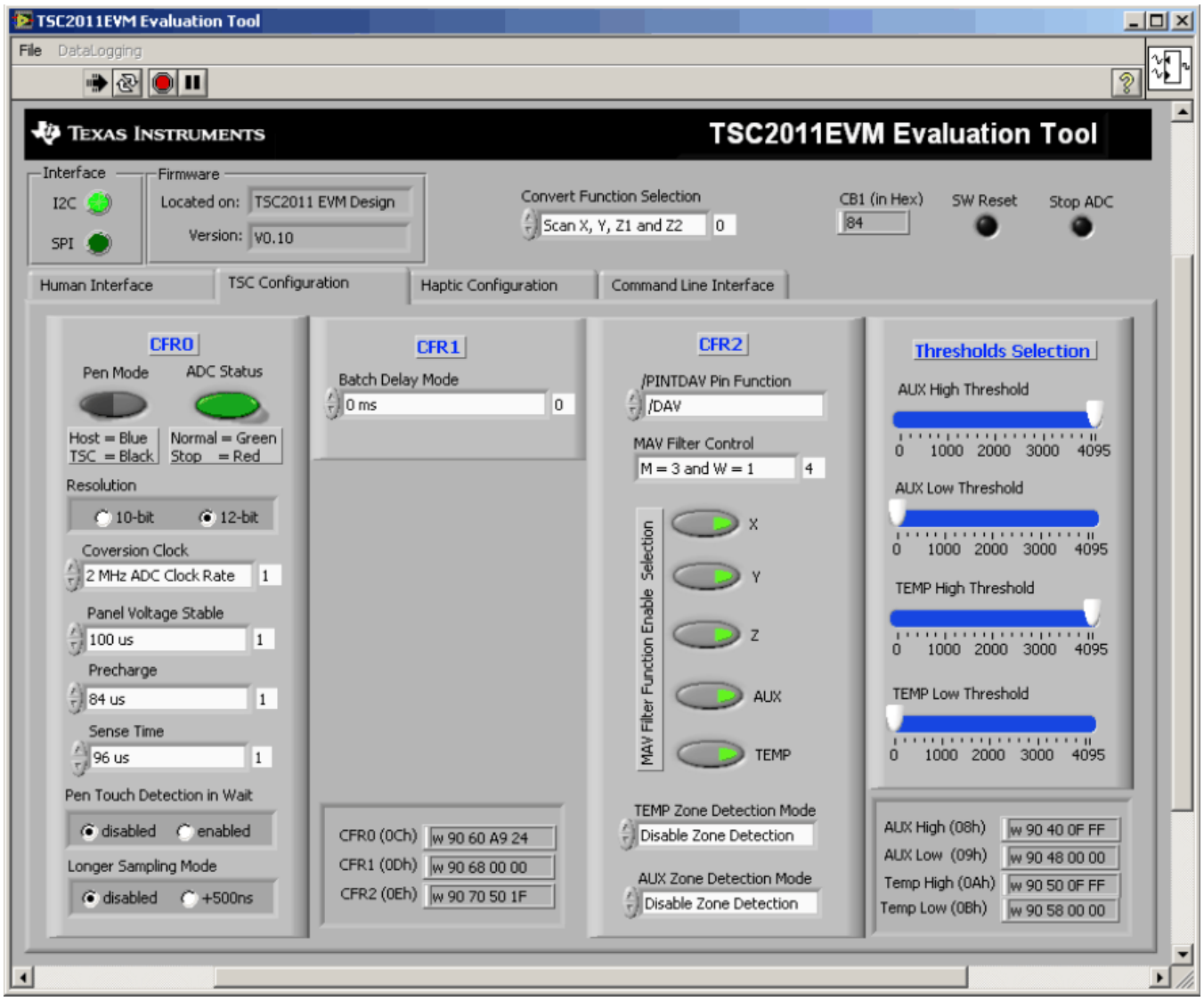


Figure 7. TSC2011EVM-PDK Software GUI: TSC Configuration Tab

The tab has four sections (or columns), corresponding to the configuration registers CRF0, CFR1, CFR2, and the four thresholds registers, respectively. The two TSC2011 TSC register status boxes, one under the *CFR1* section and the other under the *Threshold Selection* section, display the current values written to these TSC2011 touch screen control/configuration registers.

Note that a digital box is next to each of these multiple selectors; clicking on this box sends the data to the corresponding control registers. Another way to ensure that the option selection is sent to the TSC2011 device on the EVM is to click on the up or down arrow, as shown in Figure 5.

8.3.1 ADC Configuration (CFR0)

This section controls the parameters in TSC2011 configuration register CFR0. Each button or selection controls a single parameter.

- **Pen Control Mode**

  The **Pen Mode** button controls whether the touch data acquisition is started or initialized by a host processor command (manually) or by a touch on the screen (automatically). The default option is to start acquisition by touching the screen.

- **Stop ADC**

  The **ADC Status** button can stop the TSC2011 ADC, or put the ADC into normal operating mode. It has the same function as the *Stop ADC* LED (bit #1 of CB1) at the top right side of the TSC2011EVM GUI. The default is normal operating mode.

- **Resolution**

  This button selects between 10- and 12-bit resolution. It has the same function as the Resolution selector at the bottom-right corner of the *Human Interface* tab. Note that you may need to double-check the settings in both places to make sure they are consistent. The default setting is 12-bit resolution.

- **Conversion Clock**

  The internal clock that runs the ADC can run at 4 MHz, 2 MHz, or 1 MHz. Note that at 4 MHz, only 10-bit resolution is possible; 12-bit resolution is not available at this rate. Therefore, you should verify the resolution setting after selecting a 4-MHz conversion clock. By default, the clock runs at 2 MHz.

- **Panel Voltage Stabilization Time**

  This time is the period that the TSC2011 allows for the touch screen to settle after turning on the drivers and before the ADC starts to sample the signal.

- **Precharge Time**
- **Sense Time**

  These two parameters show the time allowed to precharge the touch panel capacitance and then sense to see if the screen has been touched. For more details about these parameters, see the TSC2011 data sheet.

- **Detection of Pen Touch in Wait**

  This option is valid when the ADC is put into host-controlled mode. Enabling this option puts the touch detection in the background and allows the TSC2011 to pull its $\overline{\text{PINTDAV}}$ pin high if no touch is detected while waiting for the host to issue a command, so that the host can decide whether or not a reading touch data command should be issued.

- **Longer Sample Mode**

  Enabling this option adds an extra 500 ns of sampling time to the normal sampling cycle. It is disabled by default.

8.3.2 Batch Delay Configuration (CFR1)

One of the advanced TSC2011 features is the Batch Delay Mode, as shown in the CFR1 section. Under the TSC-controlled ADC mode, this feature adds a delay between ADC samples and thus controls the time/interval between samples. The batch delay ranges from 0 ms to 100 ms. For more details about batch delay, see the TSC2011 data sheet.

8.3.3 MAVF and Zone Detection Configuration (CFR2)

The preprocessing MAV filter (MAVF) within the TSC2011 reduces sampling noise. See the TSC2011 data sheet for details of the MAVF.

The CFR2 section has five selection buttons that can be used to enable/disable the MAVF on touch data, X, Y, and Z, or nontouch data, AUX and Temperature.

Clicking on the *MAV Filter Control* option box brings up a list of settings on M and W values. Select an eligible option from the list (do not select the *Reserved* option) and the corresponding digital value appears in the next box. Click on the digital box to write the selected value to the CFR2 Register.

Zone detection is another of the new features the TSC2011 offers. The zone detection function is designed to monitor the zone/range of the nontouch inputs, including AUX and TEMP1/TEMP2.

The zone detection modes can be controlled and selected through the two option boxes, *TEMP Zone Detection Mode* and *AUX Zone Detection Mode* at the bottom of this screen. The zone thresholds can also be set up at the threshold registers; refer to Section 8.3.4.

8.3.4 Threshold Configuration

There are four control registers on the TSC2011 that configure the upper and lower thresholds of AUX and TEMP1/TEMP2, for use with the zone detection function discussed in Section 8.3.3. To access these registers, you may click and move the slides in the *Threshold Selection* section of this tab (see Figure 7).

8.4 Haptic Configuration Tab

Clicking on the *Haptic Configuration* tab brings up a screen similar to that shown in Figure 8. With the Haptic Configuration tab, all of the TSC2011 haptic-related control registers can be accessed and written to. For more details about these haptic configuration and control registers, see the TSC2011 data sheet.

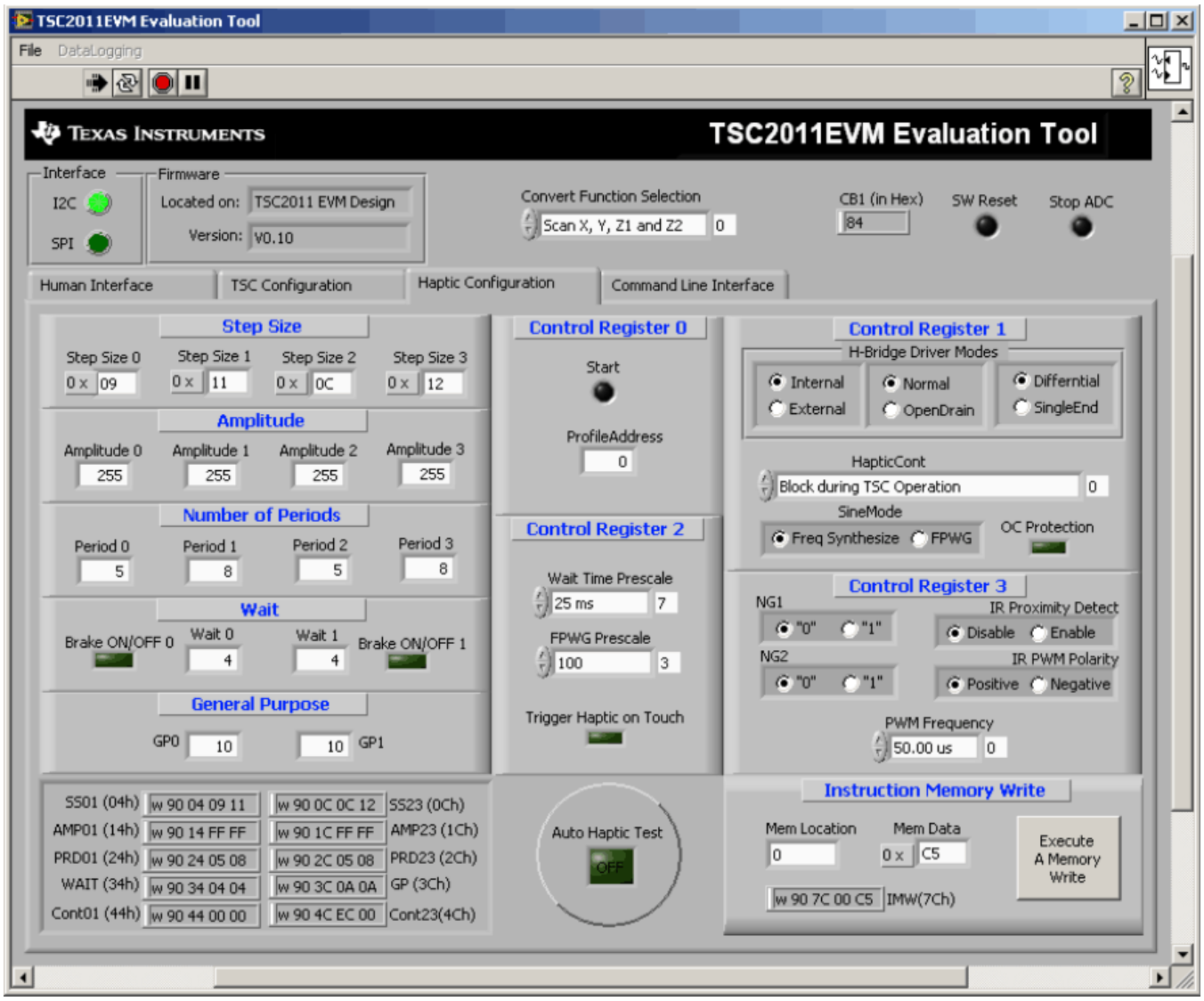


Figure 8. TSC2011EVM-PDK Software GUI: Haptic Configuration Tab

There are 10 subsections in this tab, corresponding to all bits in the TSC2011 haptic control registers:

- Step Size
- Amplitude
- Number of Periods
- Wait
- General Purpose
- Control Register 0
- Control Register 1
- Control Register 2
- Control Register 3
- Instruction Memory Write

For more details on the bit definitions and functions, refer to the TSC2011 data sheet. At the bottom-left corner of this tab, the TSC2011 haptic register status box shows the exact values written to the respective TSC2011 haptic registers.

At the bottom center of this tab, there is an **Auto Haptic Test** button. This button provides users a convenient way to test the TSC2011 haptic functions. Clicking on the button (as Figure 9 indicates) turns on the auto test loop built in the TSC2011 firmware that continuously calls one of the built-in haptic effects, at an interval of approximately 0.5 s.

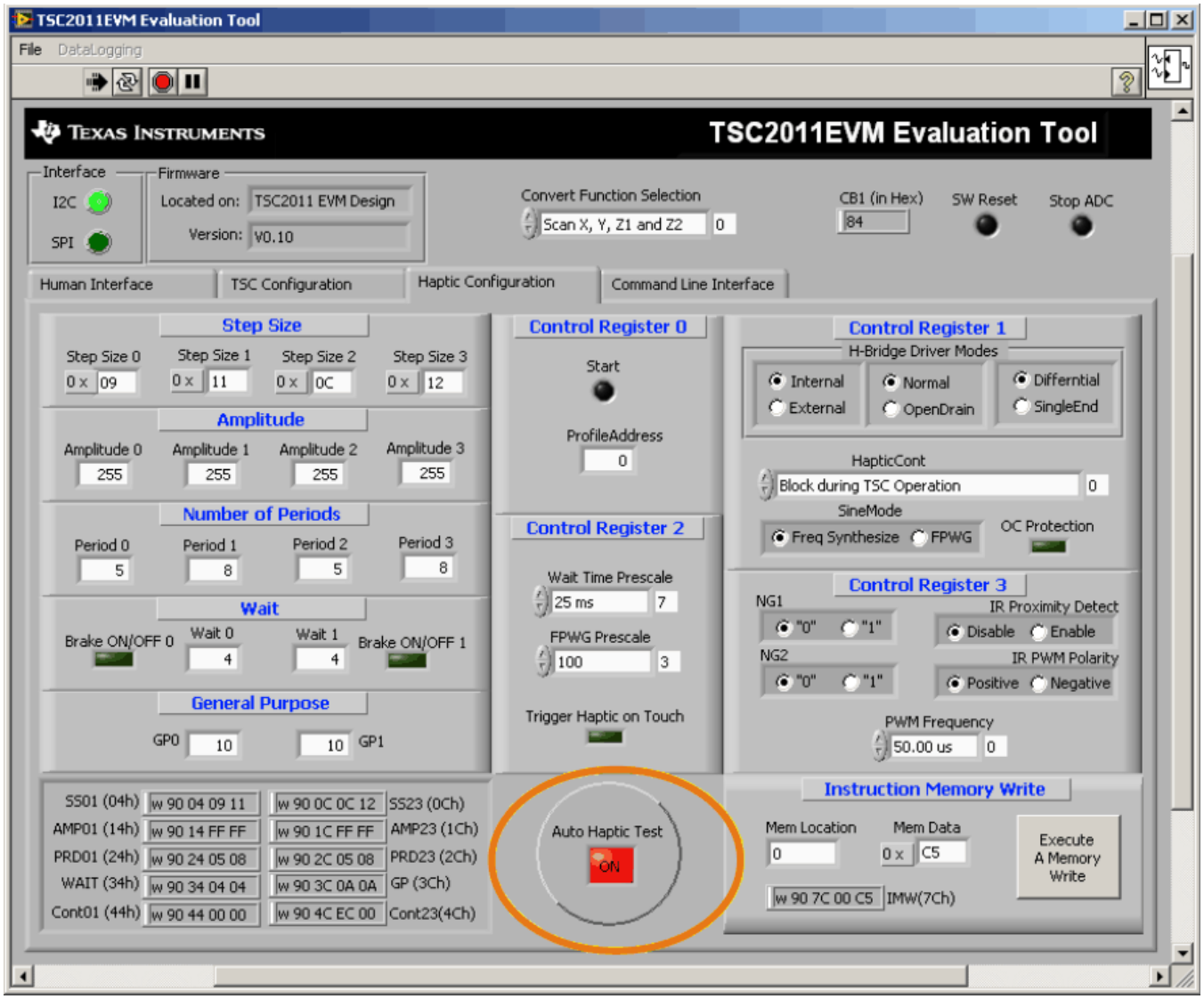


Figure 9. TSC2011EVM-PDK Software GUI: Auto Haptic Test

The TSC2011 haptic controller has four built-in haptic effects: Key Tone #1, Key Tone #2, Drag and Drop, and Slide. Refer to the TSC2011 data sheet for a detailed description of these haptic effects. To implement a built-in effect, select one of the four haptic items from the *Convert Function Select* multiple option box near the top center of the GUI, as shown in Figure 10.

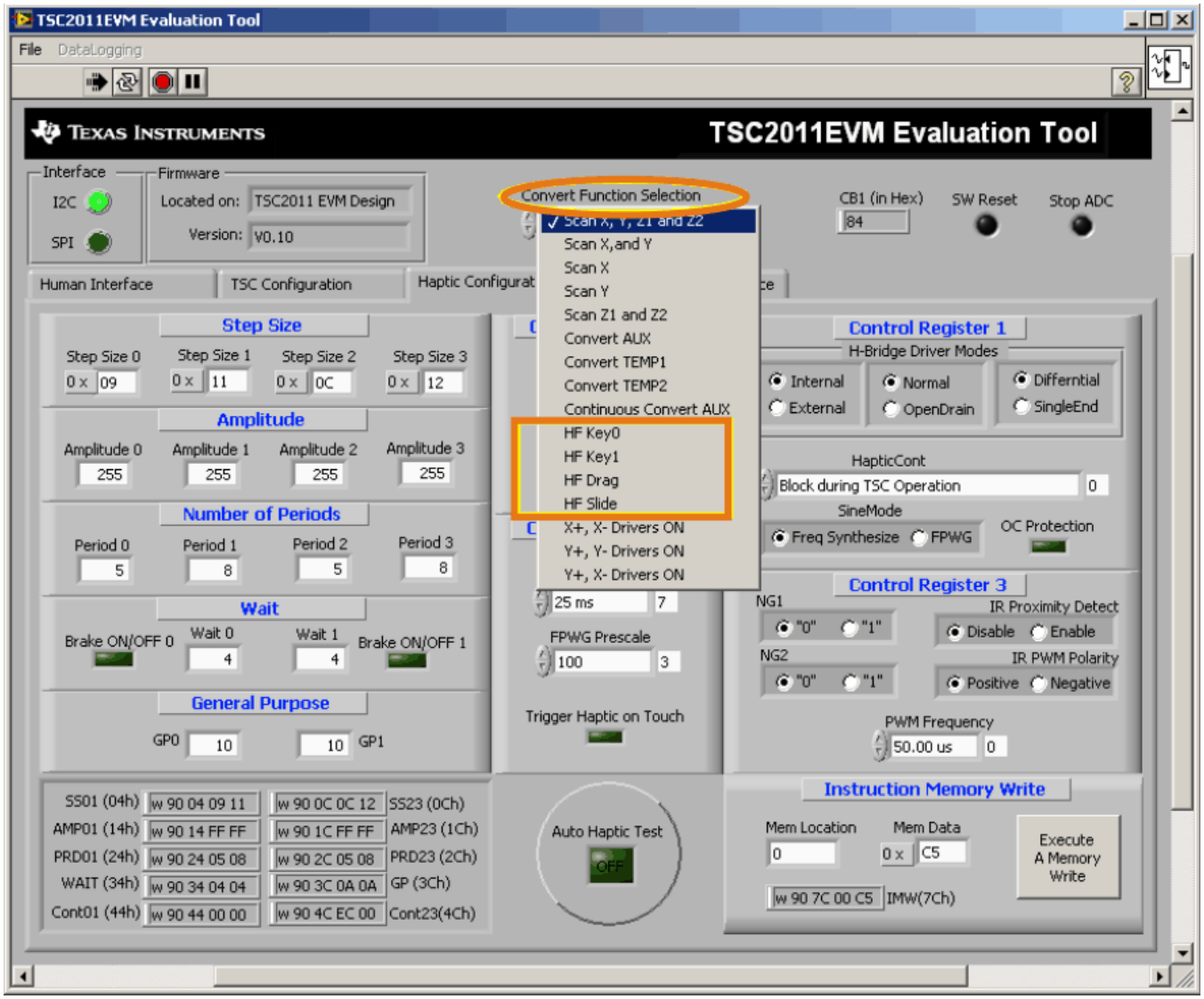


Figure 10. TSC2011EVM-PDK Software GUI: Select Built-In Haptic Effects

Note that after you select one item from the drop-down list, the small box at the right of the selector (indicated within the orange circle in Figure 11) must be clicked to send the command to the TSC2011. Each click on the small box results in sending a line of CB1 command to the TSC2011. Clicking on the up or down arrow, shown by the red arrows, also sends a CB1 command to the TSC2011.

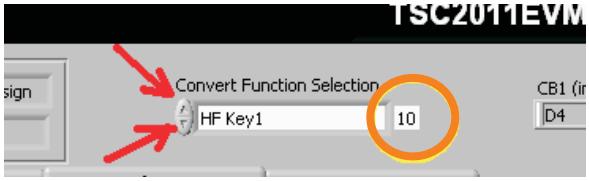


Figure 11. How to Execute a Built-In Haptic Effect

8.5 Command Line Interface Tab

Clicking on the *Command Line Interface* tab brings up a screen similar to that shown in Figure 12, which provides a flexible way to read from and write to the TSC2011EVM by the use of scripts.

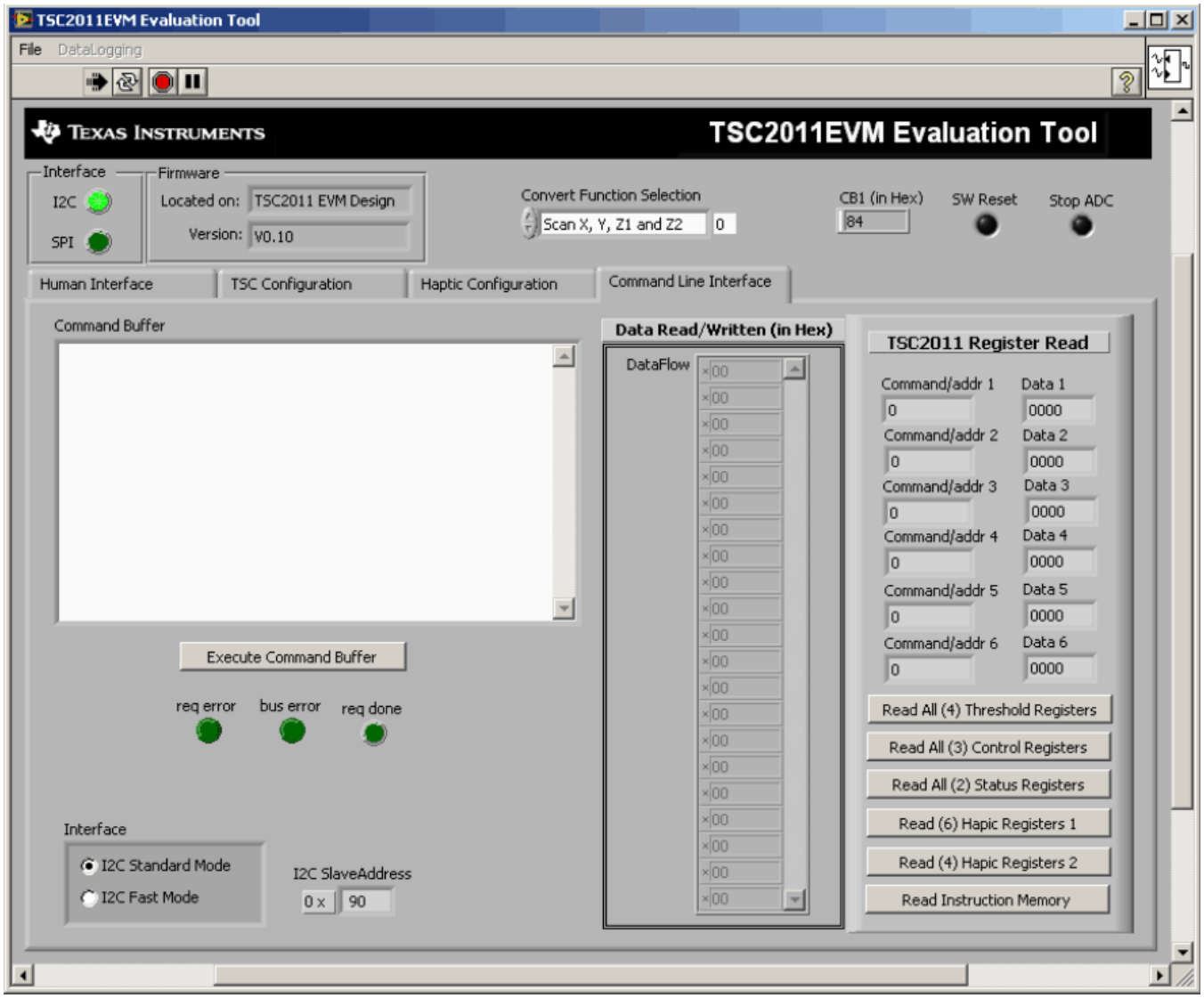


Figure 12. TSC2011EVM-PDK Software GUI: Command Line Interface Tab

The line or lines of the script are typed or loaded into the Command Buffer. Clicking on the **Execute Command Buffer** button runs the script. (The script is discussed in Section 8.5.1.)

There are three LEDs on this tab. The **req done** LED lights up (that is, it turns green) after the script execution finishes. If a line of the script is a reading command, the read data are shown at the *Data Read/Written* section; if the line of the script is a writing command, the written data bytes also are returned to the *Data Read/Written* section.

As Figure 13 shows, six read buttons reveal the contents of the Threshold, TSC Control, TSC Status, Haptic Control, and Haptic Instruction Memory Registers of the TSC2011; the contents are also displayed in the *Data Read/Written* section of the screen. The data flow is shown at the *Data Read/Written* section, and is interpreted and listed correspondingly on the *TSC2011 Registers Read* section. For example, Figure 13 shows a read result of the four TSC2011 threshold registers after clicking on the **Read All (4) Control Registers** button.

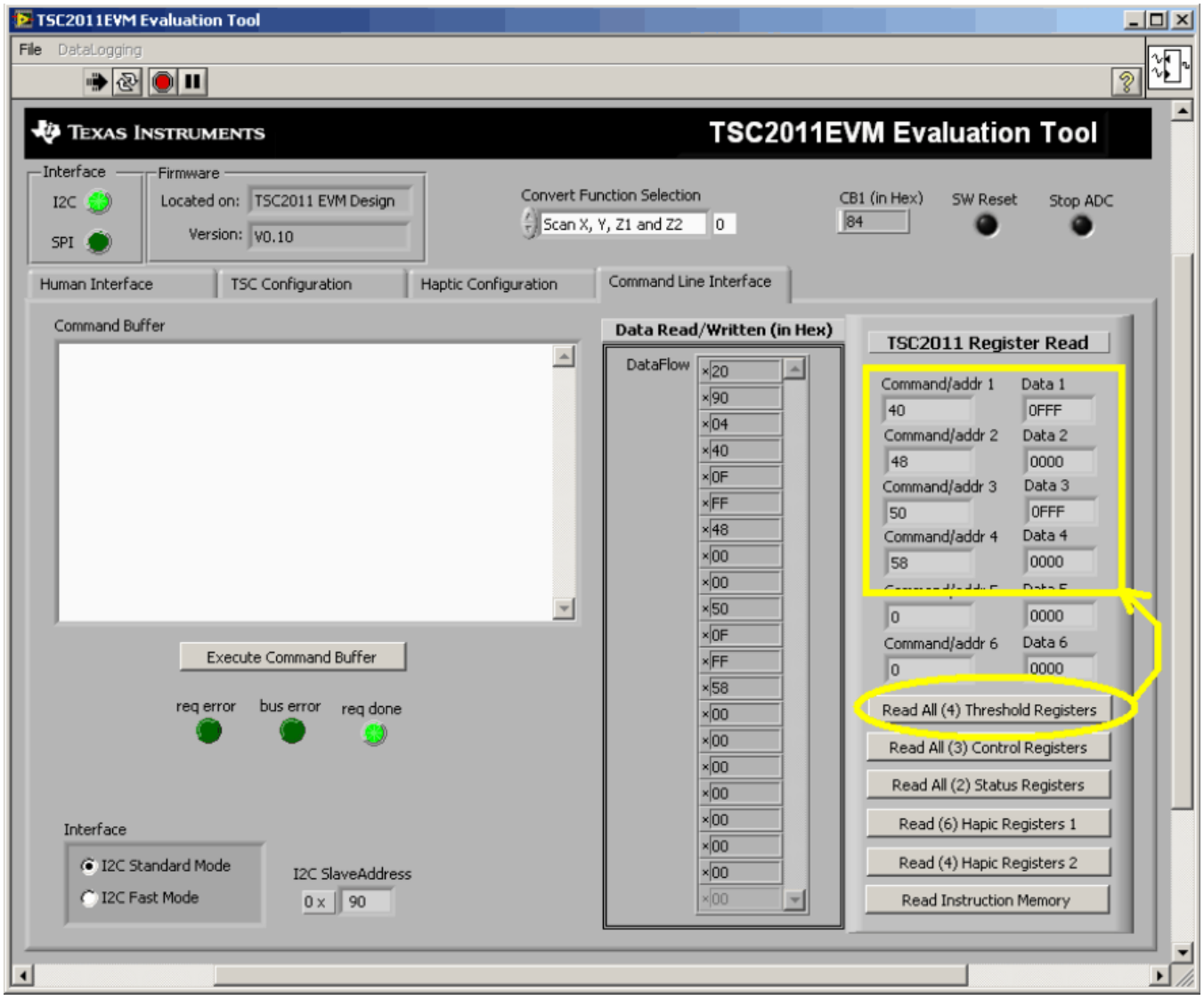


Figure 13. TSC2011EVM-PDK Software GUI: Read All Threshold Registers Option

Figure 14 shows a read result of the six haptic registers after clicking on the **Read (6) Haptic Registers 1** button.

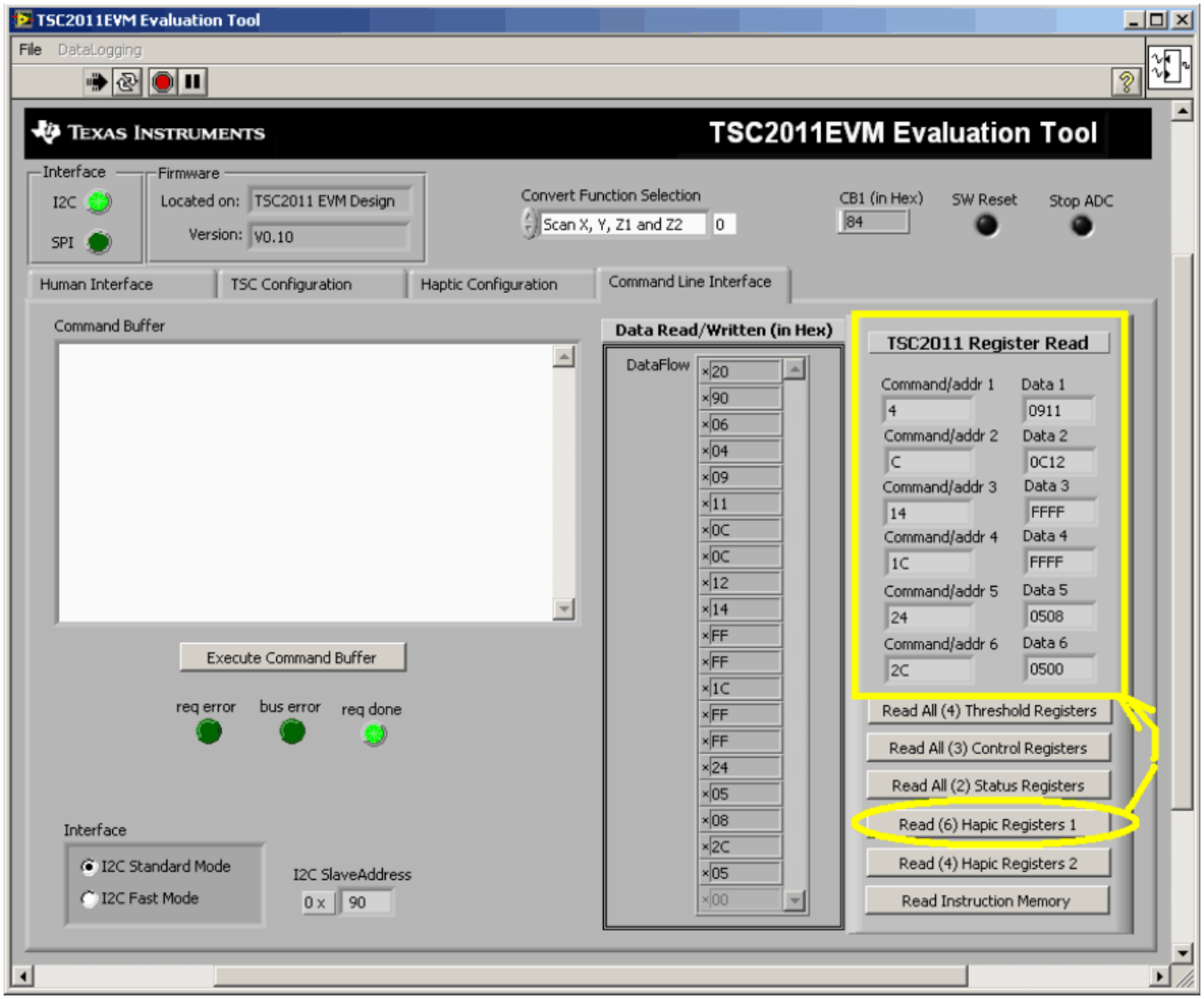


Figure 14. TSC2011EVM-PDK Software GUI: Read 6 Haptic Registers Option

8.5.1 Software Script

The TSC2011EVM-PDK software was designed to identify and decipher several scripting commands, as described in Table 4.

Table 4. Script Command Types

Command Type	Description
w	Write to TSC through the I^2C serial control bus
r	Read from TSC through the I^2C serial control bus
#	Comment line
b	Break
d	Delay

Each line in a script file is a command, and a line is terminated by a carriage return.

- The first character of a command line indicates the command type. Table 4 lists all the command types that can be recognized and implemented by the TSC2011EVM-PDK software.
- Following the command type *w* or *r*, the byte is the I^2C device address. For the TSC2011, this address is either **[1001 00A0R/W]b** where ***A0*** is 0b by default and can be changed by JP1; the LSB R/W is '1' if a read command or '0' if a write command.
- No byte follows a **#** (comment) or a ***b*** (break) command.
- The byte or bytes following a command type ***d*** is the delay time in milliseconds (ms).
- The second byte in a *w* or *r* command line is the address of the TSC2011 configuration register. Refer to the TSC2011 data sheet for details of the register address.

In an *r* command, the byte after the TSC2011 register address indicates the number of registers reading from; the next byte is ignored. If more than one register must be read, the next byte is the address and is followed by two dummy bytes that are ignored.

In a *w* command, the two bytes after the register address are the data written to the 16-bit TSC2011 registers. If more than one registers must be written, the next byte is the register address, followed by two data bytes.

For writing to CB1 of the TSC2011, this byte includes both address and content; thus, there are no further bytes after this address byte.

8.5.2 Software Script Command Line Examples

This section provides several command line script examples for use with the TSC2011EVM evaluation software.

Example 1. Writing to CB1 and Changing to 10-bit Resolution Mode

```
w 90 80
```

Example 2. Writing 0xA924 to Register CFR0

```
w 90 60 A9 24
```

Example 3. Writing the Four Threshold Registers to Set Max = 0xFF0 and Min = 0x00F

```
w 90 40 0F F0 48 00 0F 50 0F F0 58 00 0F
```

Example 4. Reading the Status Register Contents

```
r 91 38 01 00
```

Example 5. Reading Back the X, Y, Z_1, and Z_2 Data Registers

```
r 91 00 04 00 08 00 00 10 00 00 18 00 00
```

8.5.3 Downloading a Script

To download an existing script into the Control Buffer, first go to the *File* menu, then select *Open Command File...*. This menu option opens a file-select window and allows you to browse and find an existing script file. Select the desired file, click on *Open*, and the script is loaded into the command buffer.

8.5.4 Log Script and Data

The software can track and record the script or data used while the TSC2011EVM GUI is active and in use. In the *File* menu, select *Log Script and Results ...* or *Log Data to File ...* to generate the script or data log file.

8.5.4.1 Log Script and Results

Go into the *File* menu and select *Log Script and Results ...*. This option opens a file-select window and allows you to specify a log file to write the script and results to. At this point, the script to read/write and the results begin to be logged into the file. For example, a written script is logged into the file for any action performed on the Configuration Tab (see Section 8.3); a reading script and the reading results are logged into the file if one of the read buttons on the *Command Line Interface Tab* (refer to Section 8.5) is clicked.

8.5.4.2 Log Data to File

Go into the *File* menu and select *Log Data to File ...*. This option opens a file-select window and allows you to specify a log file to write the data to. At the same time, this option enables the Datalogging menu.

When you are ready to begin recording data to a file, select *Datalogging→Start Logging*. Data are written to the file until *Datalogging→Stop Logging* is selected. When the screen is not touched, the AUX, TEMP1, and TEMP2 values are written to the file; the X, Y, Z_1, and Z_2 parameters are written to the file with values of *9999*, to indicate that they are not updated. When the screen is touched, the X, Y, Z_1, and Z_2 parameters are written while the AUX, TEMP1, and TEMP2 values are written to the file as *9999*.

The format of the data file sets the first column as the time in milliseconds (this value is only a timer in the program, and can arbitrarily start at any number); then X, Y, Z_1, Z_2, AUX, TEMP1, and TEMP2 columns follow. Every new reading is a new row in the file.

After selecting the *Start Logging* option , the data are constantly updated, and the datalog file can quickly grow large. Therefore, log only necessary data.

9 EVM Bill of Materials

Table 5, Table 6, and Table 7 provide a complete bill of materials for the modular TSC2011EVM evaluation board, the TSC2011EVM-PDK, and the USB-MODEVM Interface Board (included only with the TSC2011EVM-PDK), respectively.

Table 5. TSC2011EVM Bill of Materials[1]

Item	Count	RefDes	Description	MFR [2]	Part Number [2]
1	1	NA	Printed Wiring Board	TI	6516508
2	3	C1, C3, C10	Capacitor, ceramic 0.1 µF 50V 10% X7R 0603	Murata	GRM188R71H104 KA93D
3	4	C2, C4, C11, C12	Capacitor, ceramic 10 µF 10V 10% X5R 0805	Murata	GRM219R61A106 KE44D
4	1	C5	Capacitor, ceramic 2.2 nF 50V 10% X7R 0603	Murata	GRM188R71H222 KA01D
5	0	C6, C7, C8, C9, C13, C14, C15	Not installed		
6	1	D1	4.3 V Zener Diode, SOD-123	Rohm	KDZTR4.3B
7	0	J1, J7	Not installed		
8	1	J2	10-Pin, Dual Row, SM Header (20 Pos.)	Samtec	TSM-110-01-T-DV-P
9	1	J2B[3]	10-Pin, Dual Row, SM Header (20 Pos.)	Samtec	SSW-110-22-F-D-VS-K
10	1	J3	5-Pin, Dual Row, SM Header (10 Pos.)	Samtec	TSM-105-01-T-DV-P
11	1	J3B[3]	5-Pin, Dual Row, SM Header (10 Pos.)	Samtec	SSW-105-22-F-D-VS-K
12	2	J4, J6	4-Position Header	Samtec	TSW-104-07-T-S
13	1	J5	FFC 4-Position 1 mm R/A SMD ZIF Connector	Molex	52271-0469
14	5	JP1, JP4, JP5, JP6, JP7	3-Position Header	Samtec	TSW-103-07-T-S
15	3	JP2, JP8, JP9	2-Position Header	Samtec	TSW-102-07-T-S
16	1	JP3	3-Pin, Dual Row Header (6 Pos.)	Samtec	TSW-103-07-T-D
17	1	MG1	Linear Vibrator	Sumsung	DMJBRN1036XX
18	1	R1	Resistor, 100.0 Ω 1/10W 5% 0603 SMD	Yageo	RC0603JR-07100RL
19	2	R2, R3	Resistor, 0.0 Ω 1/10W 5% 0603 SMD	Yageo	RC0603JR-070RL
20	2	R4, R7	Resistor, 20.0 kΩ 1/10W 1% 0603 SMD	Yageo	RC0603FR-0720KL
21	2	R5, R6	Resistor, 2.74 kΩ 1/10W 1% 0603 SMD	Yageo	RC0603FR-072K74L
22	0	TP1-TP7, TP10-TP17	Not installed		
23	4	TP8, TP9, TP18, TP19	Test Point PC Mini .040"D Black	Keystone	5001
24	2	TP20, TP21	Test Point PC Mini .040"D White	Keystone	5002
25	1	U1	TSC2011IRTJ, 24 QFN RGE, Capacitive Sense Scanner with I^2C Interface	TI	TSC2011IRTJ
26	1	U2	MOSFET H-Bridge, N/P-CH60 SM8	Zetex	ZXMHC6A07T8
27	1	U3	IC EEPROM 256kBit 400KHz 8TSSOP	Microchip	24AA256-I/ST
Additional Components					
28	9	N/A	Shunt Jumper .1" Black Gold	3M	969102-0000-DA
29			EPOXY double/bubble fast dry epoxy	Hardman	4001

(1) Refer to the PCA assembly instruction (6516508 ASSY_A.PDF - Assembly Drawing).
(2) Manufacturer and part numbers for items may be substituted with electrically equivalent items.
(3) J2B, J3B bottom side parts are not shown in the schematic diagram.
- J2B is installed on the bottom side of the PWB opposite J2.
- J3B is installed on the bottom side of the PWB opposite J3.

Table 6. TSC2011EVM-PDK Bill of Materials

Item	Count	RefDes	Description	MFR	Part Number
1	1	NA	TSC2011EVM	TI	6516508
2	1	NA	USB-MODEVM	TI	6443994
3	1	NA	Touch panel	Young Fast Opto	A480Y-21-S090717-5158

Table 7. USB-MODEVM Interface Board Bill of Materials

Item	Count	Value	Ref Des	Description	Mfr	Part Number
1	1	10	R4	1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ100V
2	2	27.4	R10, R11	1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF27R4V
3	1	75	R20	1/4W 1% Chip Resistor	Panasonic	ERJ-14NF75R0U
4	2	220	R19, R24	1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ221V
5	3	390	R14, R21, R22	1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ391V
6	1	649	R13	1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF6490V
7	1	1.5k	R9	1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ152V
8	4	2.7k	R1, R2, R3, R5	1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ272V
9	1	3.09k	R12	1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF3091V
10	2	10k	R15, R16	1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ103V
11	1	22.1k	R25	1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF2212V
12	1	25.5k	R27	1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF2552V
13	1	28k	R29	1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF2802V
14	1	30.1k	R18	1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF3012V
15	1	30.9k	R36	1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF3092V
16	1	32.4k	R31	1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF3242V
17	1	36.5k	R34	1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF3652V
18	1	39.2k	R33	1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF3922V
19	1	46.4k	R35	1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF4642V
20	1	48.7k	R32	1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF4872V
21	1	52.3k	R37	1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF5232V
22	1	56.2k	R30	1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF5622V
23	1	76.8k	R28	1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF7682V
24	1	100k	R17	1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ104V
25	1	137k	R26	1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF1373V
26	4	200k	R6 through R8, R23	1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ204V
27	1	10M	R38	1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ106V
28	2	10k	RA1, RA2	1/8W Octal Isolated Resistor Array	CTS Corporation	742C163103JPTR
29	2	33pF	C18, C19	50V Ceramic Chip Capacitor, ±5%, NPO	TDK	C1608C0G1H330J
30	2	47pF	C13, C14	50V Ceramic Chip Capacitor, ±5%, NPO	TDK	C1608C0G1H470J
31	1	100pF	C20	50V Ceramic Chip Capacitor, ±5%, NPO	TDK	C1608C0G1H101J
32	1	1000pF	C21	50V Ceramic Chip Capacitor, ±5%, NPO	TDK	C1608C0G1H102J
33	26	0.1µF	C9 through C12, C15, C22 through C24, C26-43	16V Ceramic Chip Capacitor, ±10%,X7R	TDK	C1608X7R1C104K
34	2	0.33µF	C16, C17	16V Ceramic Chip Capacitor, ±10%,X5R	TDK	C1608X5R1C334K
35	1	1µF	C44	6.3V Ceramic Chip Capacitor, ±10%, X5R	TDK	C1608X5R0J105K
36	9	10µF	C1 through C8, C25	6.3V Ceramic Chip Capacitor, +/ - 10%, X5R	TDK	C3216X5R0J106K
37	1		U1	64K 2-Wire Serial EEPROM I^2C	Microchip	24LC64I/SN
38	1		U11	I^2C Voltage Level Translator	Texas Instruments	PCA9306DCT
39	1		U2	5V LDO Regulator	Texas Instruments	REG1117-5

Table 7. USB-MODEVM Interface Board Bill of Materials (continued)

Item	Count	Value	Ref Des	Description	Mfr	Part Number
40	1		U17	Single 3-State Buffer	Texas Instruments	SN74AUP1G125DBV
41	3		U5, U7, U13	1-bit Dual Supply Bus Transceiver	Texas Instruments	SN74AVC1T45DBV
42	3		U3, U4, U12	4-bit Dual Supply Bus Transceiver	Texas Instruments	SN74AVC4T245PW
43	1		U16	Single Open Drain Buffer	Texas Instruments	SN74LVC1G06DBV
44	1		U10	Single 3-State Buffer	Texas Instruments	SN74LVC1G125DBV
45	1		U15	Single 3-State Buffer	Texas Instruments	SN74LVC1G126DBV
46	1		U6	10-bit Voltage Clamp	Texas Instruments	SN74TVC3010PW
47	1		U8	USB Streaming Controller	Texas Instruments	TAS1020BPFB
48	1		U14	250 mA Adjustable Output LDO Regulator	Texas Instruments	TPS73201DBV
49	1		U9	3.3V/1.8V Dual Output LDO Regulator	Texas Instruments	TPS767D318PWP
50	1		J7	USB Type B Slave Connector Thru-Hole	Mill-Max	897-43-004-90-000000
51	6		J1, J2, J3, J4, J5, J8	2 Position Terminal Block	On Shore Technology	ED555/2DS
52	1		J9	2.5mm Power Connector	CUI Stack	PJ-102BH
53	1		J10	BNC Connector, Female, PC Mount, RA	AMP/Tyco	5413631-2
54	4		J11A, J12A, J16A, J17A	20-pin SMT Plug	Samtec	TSM-110-01-L-DV-P
Not installed	4		J11B, J12B, J16B, J17B	20-pin SMT Socket	Samtec	SSW-110-22-F-D-VS-K
55	2		J13A, J18A	10-pin SMT Plug	Samtec	TSM-105-01-L-DV-P
Not installed	2		J13B, J18B	10-pin SMT Socket	Samtec	SSW-105-22-F-D-VS-K
56	1		J6	4-pin Double Row Header (2x2) .1"	Samtec	TSW-102-07-L-D
57	2		J14, J15	12-pin Double Row Header (2x6) .1"	Samtec	TSW-106-07-L-D
58	1		NA	USB-MODEVM PWB	Texas Instruments	6463995
59	1		D1	50V, 1A, Diode MELF SMD	Micro Commercial Components	DL4001-TP
60	1		D2	Yellow Light Emitting Diode	Lumex	SML-LX0603YW-TR
61	5		D3, D4, D6 to D8	Green Light Emitting Diode	Lumex	SML-LX0603GW-TR
62	1		D5	Red Light Emitting Diode	Lumex	SML-LX0603IW-TR
63	5		JMP1 to JMP4, JMP8	2 Position Jumper, 0 .1-in spacing	Samtec	TSW-102-07-L-S
64	3		JMP5 to JMP7	3 Position Jumper, 0 .1-in spacing	Samtec	TSW-103-07-L-S
65	1		SW1	SMT, Half-Pitch 2 Position Switch	C & K Division, ITT	TDA02H0SB1
66	2		SW2, SW3	SMT, Half-Pitch 8 Position Switch	C & K Division, ITT	TDA08H0SB1
Not installed	9		TP1, TP2, TP3, TP4, TP5, TP6, TP9, TP10, TP11	Miniature Test Point Terminal	Keystone Electronics	5000
67	9		TP7, TP8	Multipurpose Test Point Terminal	Keystone Electronics	5011
68	1		X1	6MHz Crystal SMD	Epson	MA-505 6.0000M-C0:ROHS
					Citizen	HCM49-6.000MABJ-UT
					CTS	ATS060SM-T
69	8		NA	Jumper Plug	Samtec	SNT-100-BK-T
70	4		NA	Rubber Feet, Adhesive Backed	3M Bumpon	SJ-5003

10 TSC2011EVM PCB

The TSC2011EVM PCB silkscreen image is shown in Figure 15.

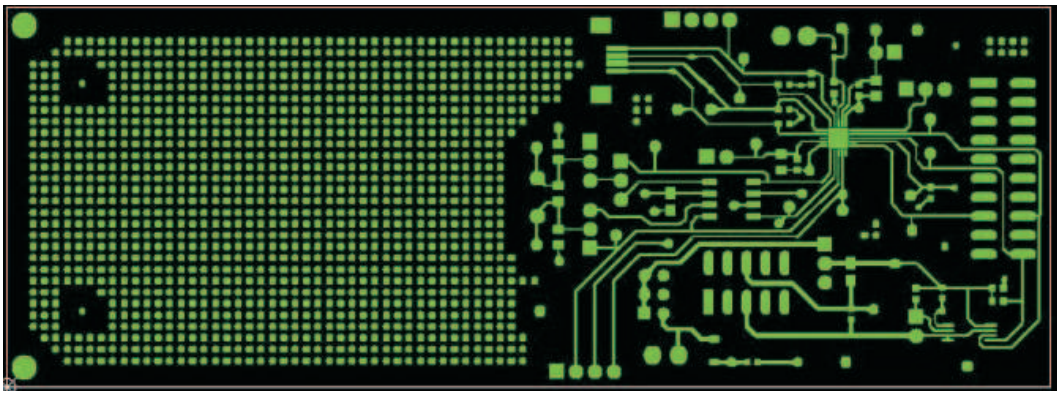
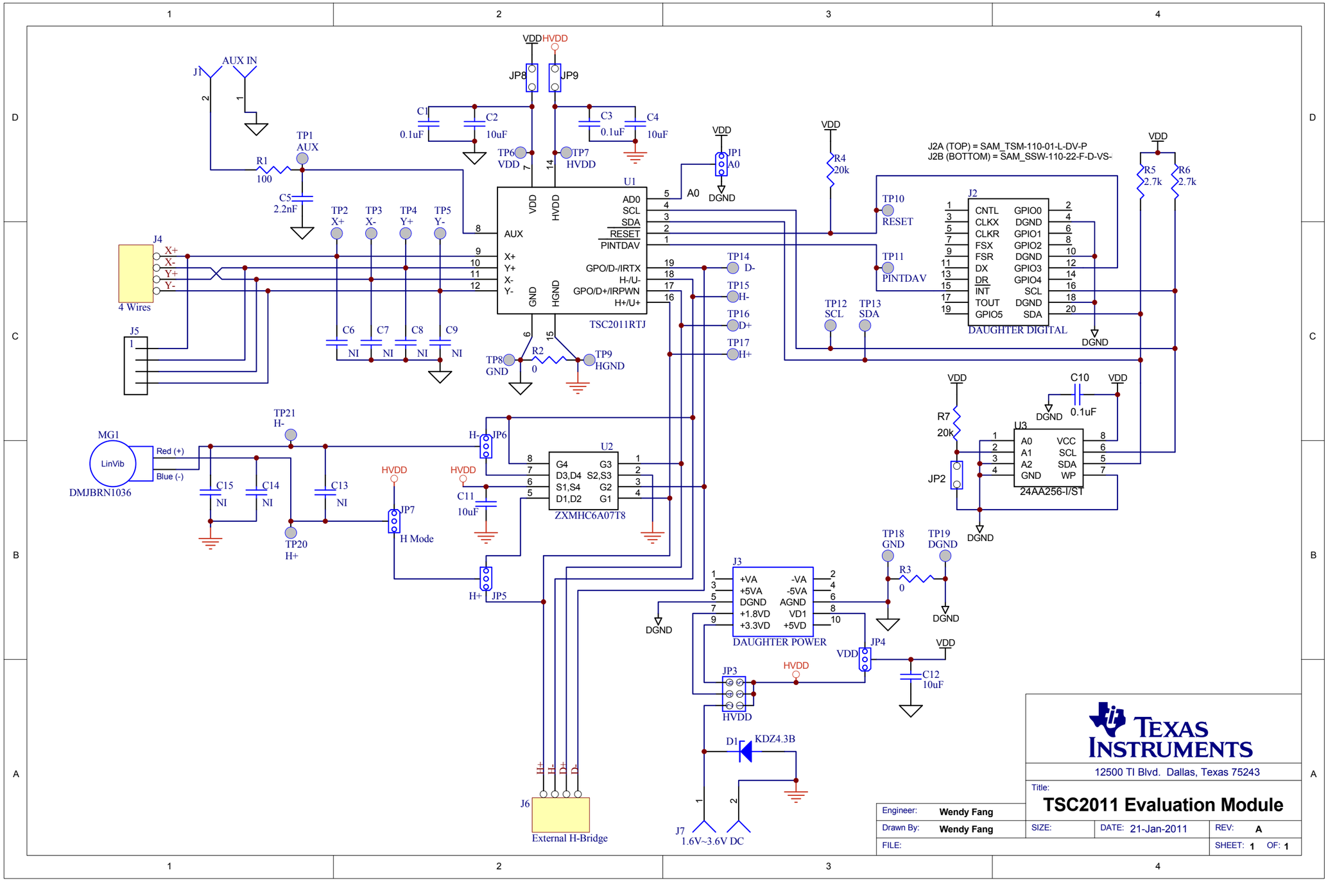


Figure 15. TSC2011EVM PCB Silkscreen (Top View)

11 TSC2011EVM Schematic

The schematic for the TSC2011EVM is appended to this user's guide.


AUX IN
J1
TP1
AUX
R1
100
C5
2.2nF
VDD
HVDD
JP8
JP9
C1
0.1uF
C2
10uF
C3
0.1uF
C4
10uF
TP6
VDD
TP7
HVDD
U1
AUX
X+
X-
Y+
Y-
AD0
SCL
SDA
RESET
PINTDAV
GPO/D-/IRTX
H-/U-
GPO/D+/IRPWN
H+/U+
GND
HGND
TSC2011RTJ
JP1
A0
DGND
A0
R4
20k
TP10
RESET
TP11
PINTDAV
TP12
SCL
TP13
SDA
J2A (TOP) = SAM_TSM-110-01-L-DV-P
J2B (BOTTOM) = SAM_SSW-110-22-F-D-VS-
J2
CNTL
CLKX
CLKR
FSX
FSR
DX
DR
INT
TOUT
GPIO5
GPIO0
DGND
GPIO1
GPIO2
DGND
GPIO3
GPIO4
SCL
DGND
SDA
DAUGHTER DIGITAL
R5
2.7k
R6
2.7k
J4
4 Wires
J5
TP2
X+
TP3
X-
TP4
Y+
TP5
Y-
C6
NI
C7
NI
C8
NI
C9
NI
TP8
GND
R2
0
TP9
HGND
TP14
D-
TP15
H-
TP16
D+
TP17
H+
C10
0.1uF
R7
20k
U3
A0
A1
A2
GND
VCC
SCL
SDA
WP
24AA256-I/ST
JP2
MG1
LinVib
Red (+)
Blue (-)
DMJBRN1036
TP21
H-
C15
NI
C14
NI
C13
NI
TP20
H+
JP7
H Mode
HVDD
C11
10uF
H-
JP6
U2
G4
D3,D4
S1,S4
D1,D2
G3
S2,S3
G2
G1
ZXMHC6A07T8
H+
JP5
J3
+VA
+5VA
DGND
+1.8VD
+3.3VD
-VA
-5VA
AGND
VD1
+5VD
DAUGHTER POWER
TP18
GND
TP19
DGND
R3
0
JP4
JP3
C12
10uF
D1
KDZ4.3B
J6
H+
H-
D+
D-
External H-Bridge
J7
1.6V~3.6V DC
TEXAS INSTRUMENTS
12500 TI Blvd. Dallas, Texas 75243
Title:
TSC2011 Evaluation Module
Engineer: Wendy Fang
Drawn By: Wendy Fang
SIZE:
DATE: 21-Jan-2011
REV: A
FILE:
SHEET: 1 OF: 1

REVISION HISTORY		
REV	ENGINEERING CHANGE NUMBER	APPROVED

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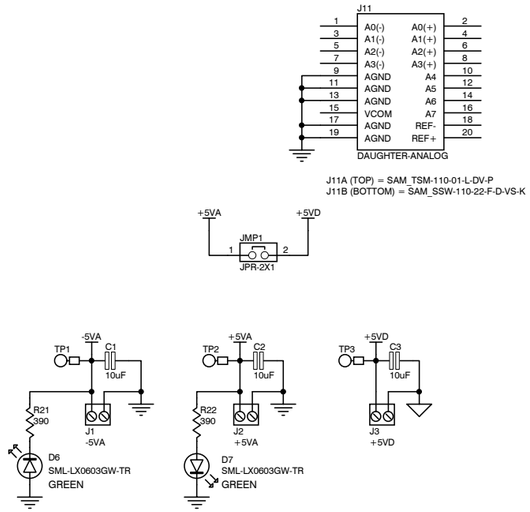
DATA ACQUISITION PRODUCTS
HIGH PERFORMANCE ANALOG DIVISION
SEMICONDUCTOR GROUP

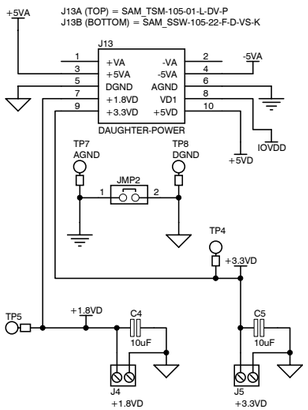
6730 SOUTH TUCSON BLVD., TUCSON, AZ 85706 USA

ENGINEER **RICK DOWNS**	TITLE **USB-MODEVM INTERFACE**		
DRAWN BY **ROBERT BENJAMIN**			
DOCUMENT CONTROL NO. **6463996**	SIZE **B**	DATE **3-Apr-2007**	REV **D**
SHEET **1** OF **2**	FILE **C:\Work\USB-MODEVM\USB Motherboard - ModEvm.ddb - Documents\SCH\USB Interface**		

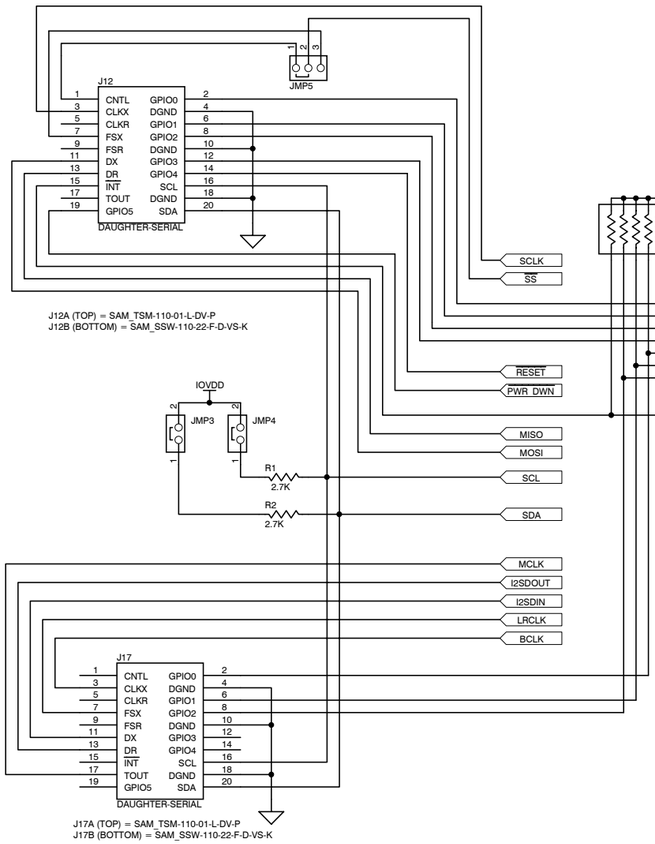
REVISION HISTORY		
REV	ENGINEERING CHANGE NUMBER	APPROVED



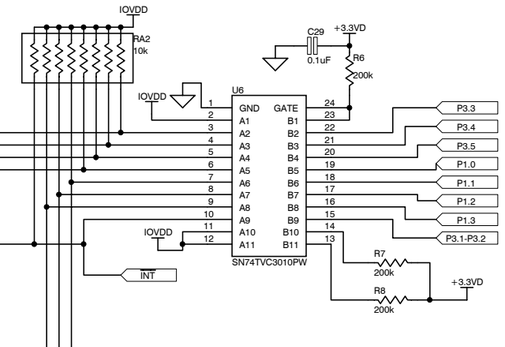
J11A (TOP) = SAM_TSM-110-01-L-DV-P
J11B (BOTTOM) = SAM_SSW-110-22-F-D-VS-K

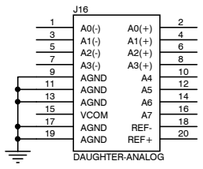


J13A (TOP) = SAM_TSM-105-01-L-DV-P
J13B (BOTTOM) = SAM_SSW-105-22-F-D-VS-K

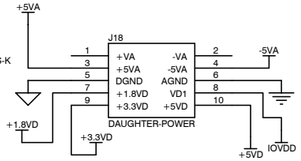


J12A (TOP) = SAM_TSM-110-01-L-DV-P
J12B (BOTTOM) = SAM_SSW-110-22-F-D-VS-K





J16A (TOP) = SAM_TSM-110-01-L-DV-P
J16B (BOTTOM) = SAM_SSW-110-22-F-D-VS-K



J18A (TOP) = SAM_TSM-105-01-L-DV-P
J18B (BOTTOM) = SAM_SSW-105-22-F-D-VS-K

J17A (TOP) = SAM_TSM-110-01-L-DV-P
J17B (BOTTOM) = SAM_SSW-110-22-F-D-VS-K

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HIGH-PERFORMANCE ANALOG DIVISION
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6730 SOUTH TUCSON BLVD., TUCSON, AZ 85706 USA

TITLE: **USB-MODEVM INTERFACE**

ENGINEER **RICK DOWNS**			
DRAWN BY **ROBERT BENJAMIN**			
DOCUMENT CONTROL NO. **6463996**	SIZE **B**	DATE **3-Apr-2007**	REV **D**
SHEET **2** OF **2**	FILE **C:\Work\USB-MODEVM\USB Motherboard - ModEvm.ddb - Documents\SCH\Daughtercard Interface**		

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Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

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