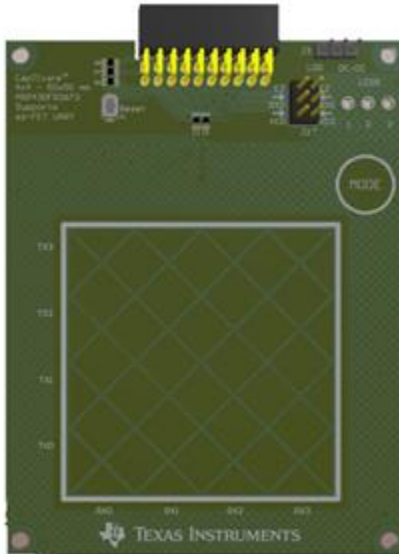


CapTivate™ Technology

TP4x4-FR2673 Demo

Quick Start User Guide



Texas Instruments

MSP430 Applications

August 17, 2020

Introduction	3
Overview	3
MSP430 FR267x CapTivate™ Technology Features	3
Touch/Gesture Pad Features	3
PCB Description	4
CapTivate Programmer/Debugger	5
Required Software Tools and Installation instructions	6
PC Software Setup	6
Touchpad Demonstrations	7
Hardware Setup	7
Starter Demo #1	8
Low Power Demo #2	17
Creating a New CapTivate™ Design Center Touchpad Project	20
Import Output Project into Code Composer Studio	24
Sensor Tuning	25
Gesture Tuning	25
Software	25
CapTivate Capacitive Touch Library Overview	25
Touchpad Software Development	25
Re-Programming the MCU using TI Uniflash	26
Schematic/PCB	28
CAPT-PGMR Connections	31

Introduction

The MSP430FR267x is a second generation family of CapTlvate™ Capacitive Touch FRAM 16-bit MCUs. CapTlvate™ Capacitive Touch Technology features flexibility that enables buttons, sliders, wheels and track/gesture pad HMI applications in any combination within the same design.

For detailed information about CapTlvate™ Technology, CapTlvate™ Design Center and capacitive sensor design guidelines, refer to CapTlvate™ documentation located in:

- CapTlvate™ Design Center GUI – select help > topics
- On-line @ www.ti.com/CapTlvateTechGuide

Overview

The MSP430FR267x MCU with CapTlvate™ Technology supports basic Touchpad sensor functionality with as few as 8 CapTlvate IO pins (4x4 configuration) and up to 16 CapTlvate™ I/O pins (8x8 configuration). Pins not assigned to Touchpad functionality can be assigned as buttons, proximity, slider and wheel sensors.

MSP430 FR267x CapTlvate™ Technology Features

- Integrated CapTlvate IP
- 5uA typical with **wake on proximity** (great for battery powered applications)
- Supports multiple combinations of sensors in the same design
- CapTlvate Library in ROM allows more user code in FRAM

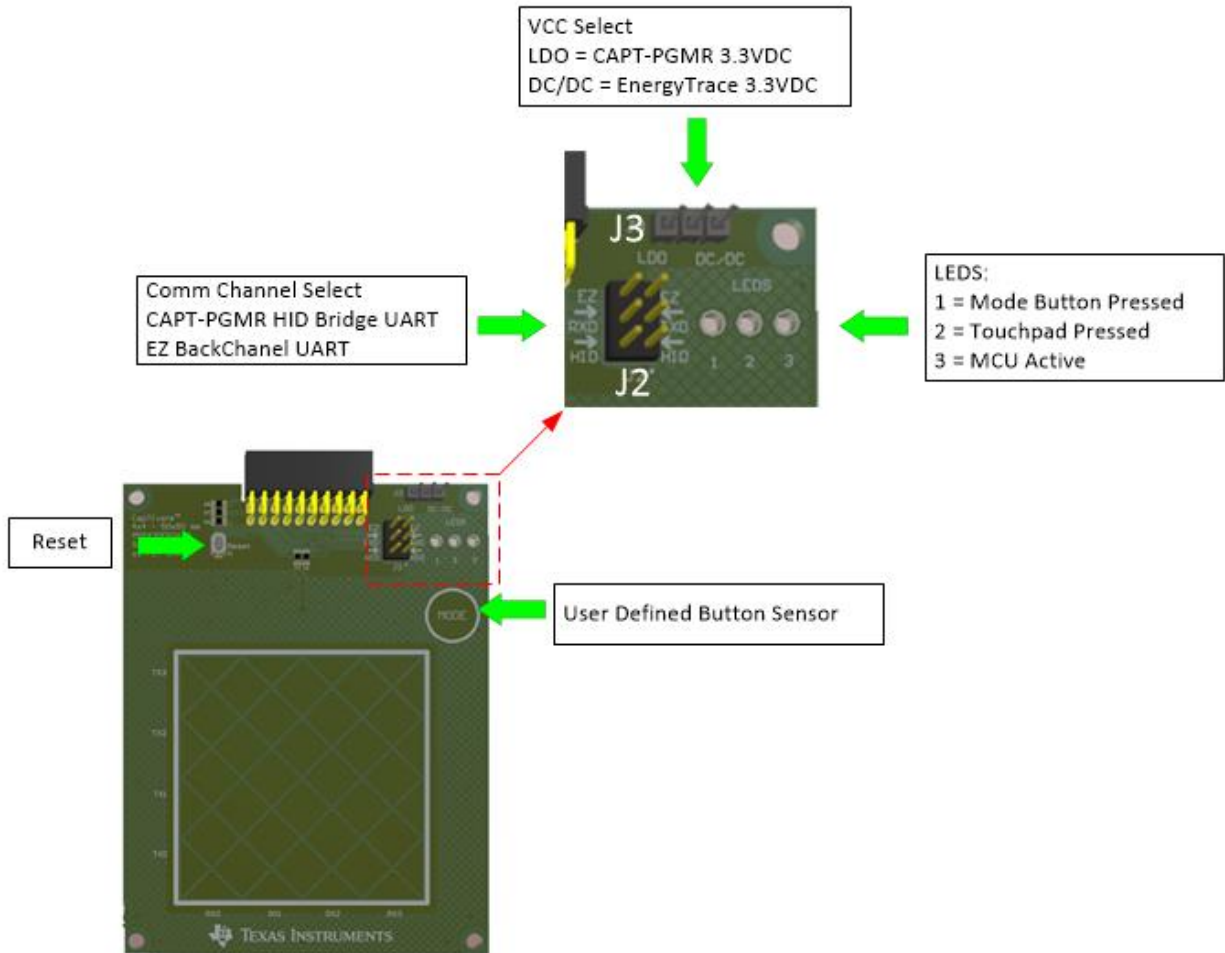


Touch/Gesture Pad Features

- Reports X,Y position and gesture
- User programmable resolution (1000 pts default)
- 1 finger gestures (Swipe up, down, left, right, Tap, double-tap, tap and hold)
- 2 finger support is coming soon
- Programmable Sensor Scan Rate 10ms (typical) , 5ms (min)
- Supports overlay thickness up to 3mm (1-2 mm is typical)
- Supports sensor configurations from 4x4 to 8x8
- More details in performance section

PCB Description

The Touchpad design is a 50x50 mm mutual capacitive sensor in a 4x4 configuration with a 1.65 mm polycarbonate overlay on a 2-layer FR-4 PCB.



Jumper (J3) is used to select the MSP430 VCC from the CAPT-PGMR PCB's 3.3V LDO or 3.3V DC/DC. For normal operation the 3.3V LDO is selected. To measure the MSP430's low power current the 3.3V DC/DC is selected.

Jumper (J2) is used to direct the MSP430 UCA0 UART RXD and TXD signals to the CAPT-PGMR's HID serial communications bridge which interfaces to the CapTivate Design Center GUI (default). Optionally, the UCA0 RXD and TXD signals can be routed to the CAPT-PGMR's backchannel UART feature on the programmer. This allows the user to create custom UART communications to send data or receive messages from a terminal application running the PC while at the same time sending sensor data and commands to the HID communications bridge using I2C.

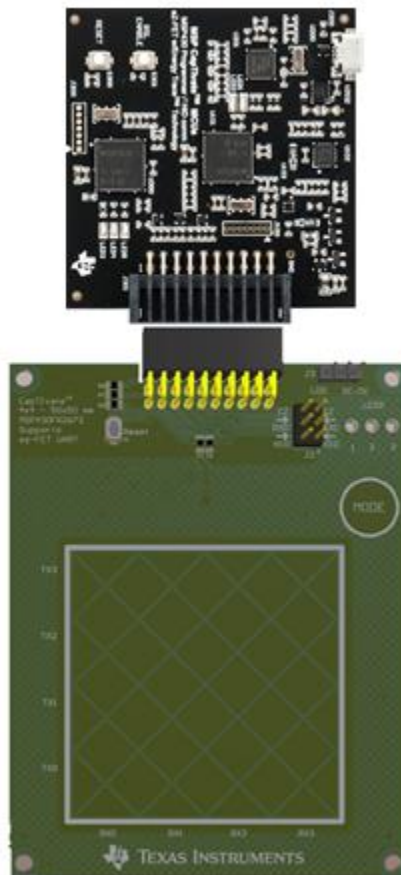
A reset button is provided to force the MSP430 into a reset state.

CapTivate Programmer/Debugger

The CAPTIVATE-PGMR PCB provides power and programming for the target MSP430. In addition, it provides a USB HID serial communications Bridge device that translates the data and commands that flow between the CapTivate Design Center GUI and the target MCU on the demo PCB, through a either the UART or I2C interface.

The CAPTIVATE-PGMR PCB provides a 3.3V LDO output and a 3.3V DC/DC output. For normal operation the 3.3V LDO can provide the target and associated circuits with up to 200mA. The DC/DC is part of the EnergyTrace measurement circuit located on the CAPT-PGMR and is designed to work with Code Composer Studio to measure and display in real time the MSP430's power and energy consumption.

For more information about using EnergyTrace, visit the [EnergyTrace landing page](#).



Required Software Tools and Installation instructions

- Java run-time engine (JRE) version 1.7 or later is required
 - To verify which version you are using, from a command line prompt, type *java -version*
 - If update is needed, download and install the latest version from www.java.com
- [CapTivate™ Design Center](#)
 - TrackPad is supported in version 1.83.00.08 and later
 - PC GUI tool used to configure and tune sensors
 - Automatically generates firmware
 - Windows 7+, Apple-OS, Linux-OS
- [TI Code Composer Studio](#)
 - IDE development platform
 - Need if modifying, programming and debugging firmware
- [Uniflash Utility \[optional\]](#)
 - Flashes firmware images on target MCU using CAPT-PGMR

PC Software Setup

Follow the steps in order.

1. Download and install TI Code Composer Studio (only select MSP430 support to minimize the download and installation time)
2. Download and install CapTivate Design Center GUI
3. [optional] download and install Uniflash programming application
4. Launch the CapTivate Design Center GUI. The very first time the GUI is launched, a CapTivate Design Center workspace directory is created in
c:\users[your name]\CaptivateDesignCenter_1_83_00_08\CaptivateDesignCenterWorkspace
5. Copy the demonstration zip file into your new CapTivate Design Center workspace directory and unzip the contents as shown below.

CapTivateDesignCenter_1_83_00_08 > CapTivateDesignCenterWorkspace

Name	Date modified	Type
 TI_Examples	8/14/2020 1:59 PM	File folder
 TP4X4-FR2673-starter-demo	8/14/2020 2:01 PM	File folder

Touchpad Demonstrations

There are two versions of pre-compiled firmware images provided in the zip file.

- TP4X4_FR2673_starter_demo.txt (Active mode)
- TP4X4_FR2673_lowpower_demo.txt (Low-Power mode demonstrates proximity feature)

Starter Demo

The Touchpad PCB is provided pre-programmed with the Starter Demo firmware to demonstrate the tracking and gesture capabilities while communicating with the CapTivate Design Center GUI.

Low Power Demo

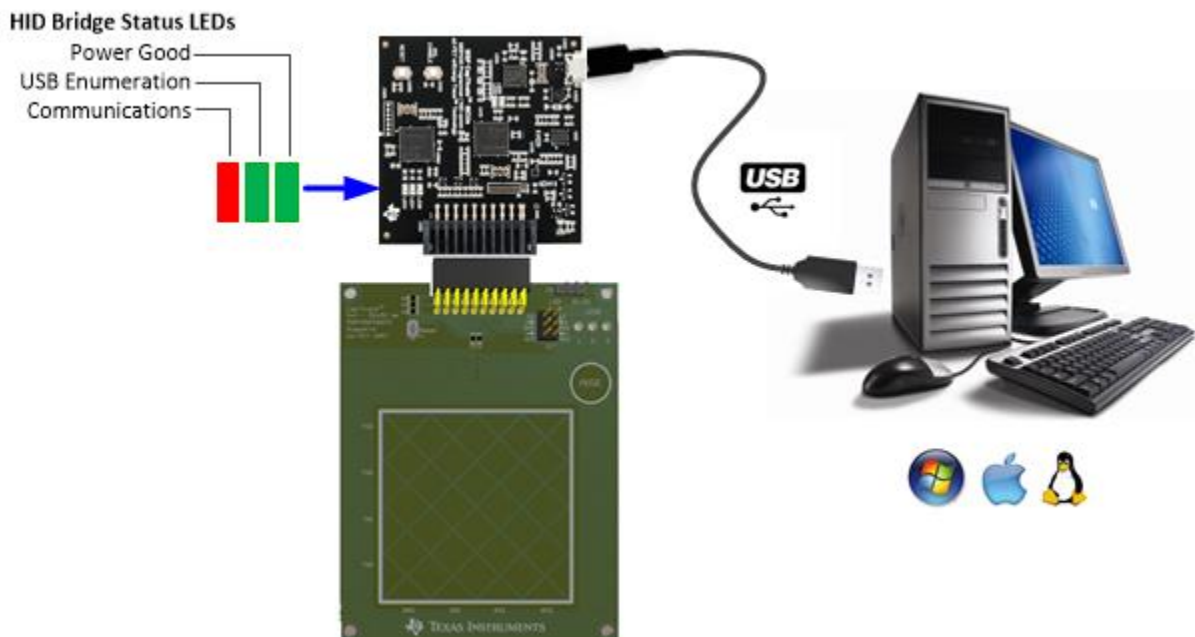
This firmware demonstrates the MSP430's low power capability. When the Touchpad is not touched after 5 seconds the MSP430 enters a low power mode. The CPU and all clocks have stopped except the CapTivate Peripheral remains active scanning the touch pad once every 100msec looking for a touch to wake the system.

Hardware Setup

Perform the following:

- Connect the Touchpad to the CAPT-PGMR
- Connect the micro-USB cable to the PC
- Verify the Power Good LED is on solid and the USB Enumeration LED blinks on/off

Note: Depending on the OS the USB enumeration LED may not stay illuminated all the time



Starter Demo #1

To demonstrate the sensor's active mode and the CapTivate Design Center GUI the MCU must be programmed with the TP4X4_FR2673_starter_demo.txt firmware image.

Operating in this mode, the MCU operates continuously, scanning the Touchpad sensor every 10ms. Sensors status and data, which includes XY position and gesture information, is transmitted to the CapTivate Design Center GUI where it can be viewed. An LED turns on when a touch is detected.



Exploring the GUI

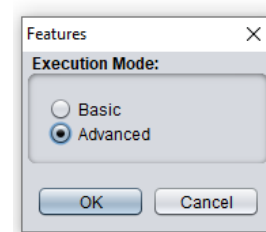
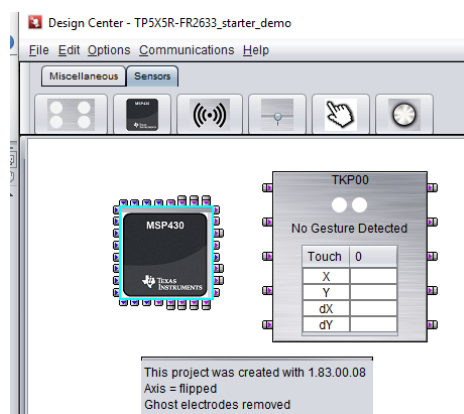
The following sections briefly describe portions of the CapTivate Design Center GUI that are related to the Touchpad sensor and its operating parameters.

Note: This document does not cover the CapTivate Design Center operation in detail. For complete information about the GUI features, refer to the CapTivate Design Center Technology Guide in the menu, File> Help>Topics or available [here](#).

Launch the CapTivate Design Center GUI. Open the TP4X4_FR2673 project by selecting from the GUI menu, File > ProjectOpen and click on TP4X4_FR2673 directory.

Note: Opening a new project will prompt you to save changes – select DISCARD.

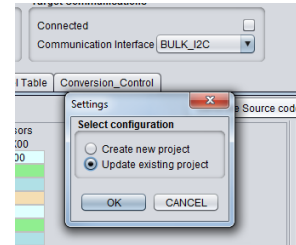
- The CapTivate Design Center Touchpad design project is shown here. The touchpad sensor and MCU icon on the canvas represents the Touchpad sensor and MSP430FR2673 device on the demo PCB.
- By default the GUI launches in “Basic” mode. To see all of the user parameters select from the main menu Options>Features>Advanced



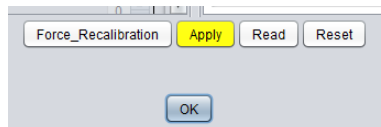
Real Time Tuning Parameters

Most CapTivate peripheral and sensor operating parameters can be updated on the target MCU in real time using the CapTivate Design Center. Most are sensor parameters, but a few are related to the controller. A user can tune a sensor's response to a touch and other system parameters without having to re-program the MCU.

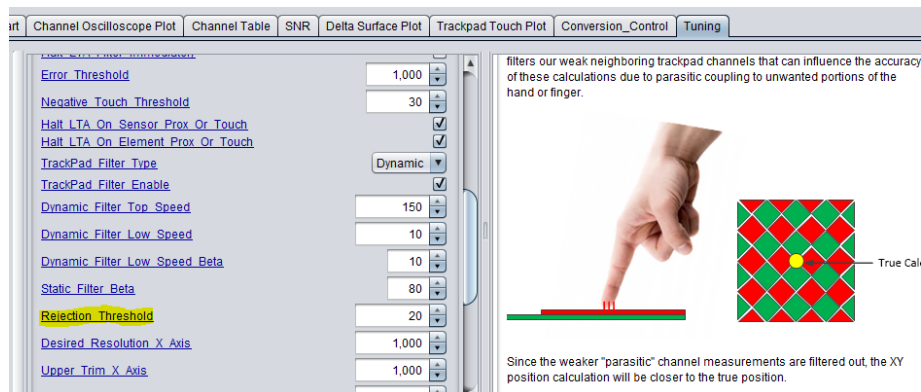
When changing these parameters while connected to the CapTivate Design Center, you will see the effects immediately. However, these parameters are volatile so if power is cycled these values are lost. To retain the updated parameters the configuration is updated and the MCU must be re-programmed.



Note: After modifying an operating parameter, the APPLY button at the bottom of the current view will turn yellow. Click the OK button to update the MCU with the new parameter value.



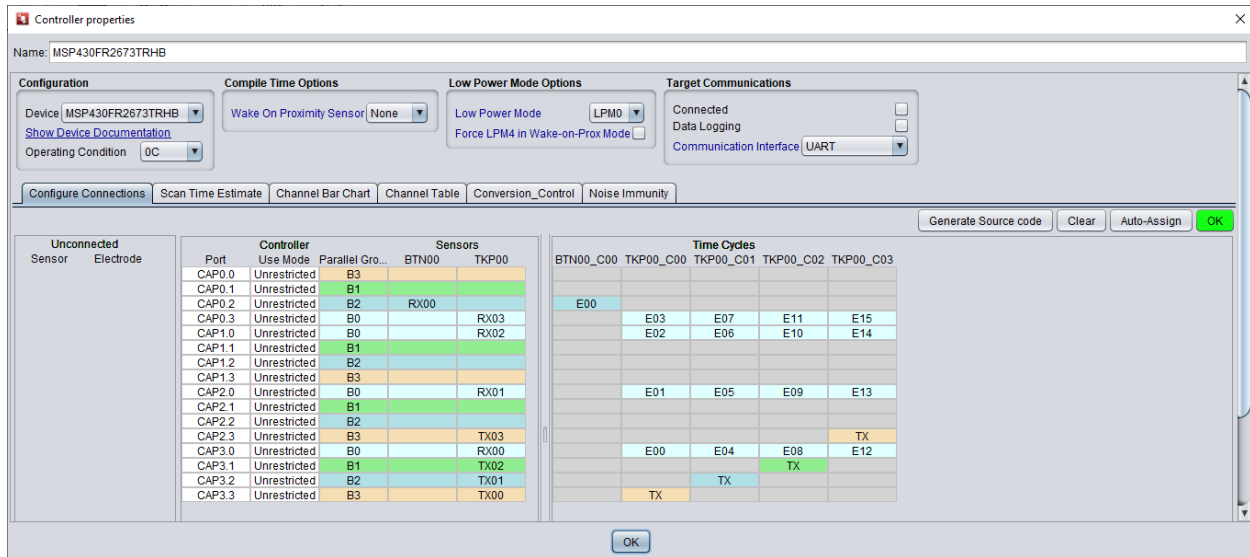
Additionally, in each sensor view, all parameters have a hyper-link that provides a description of the parameter when selected. Here is an example.



For more information about the operating parameters visit: www.ti.com/CapTivateTechGuide

MCU Controller Parameters

Let's start by exploring with the controller properties. To open the controller properties double-click on the MCU icon. The controller (MCU) properties window offers several different views and configuration tabs that control sensor channel configuration, scan rate, low power wake on proximity scan rate, target interface and more. To open the sensor properties window, double-click on the controller icon.



Controller properties
Name: MSP430FR2673TRHB

Configuration
Device: MSP430FR2673TRHB
[Show Device Documentation](#)
Operating Condition: 0C

Compile Time Options
Wake On Proximity Sensor: None

Low Power Mode Options
Low Power Mode: LPM0
Force LPM4 in Wake-on-Prox Mode: ☐

Target Communications
Connected: ☐
Data Logging: ☐
Communication Interface: UART

Configure Connections | Scan Time Estimate | Channel Bar Chart | Channel Table | Conversion_Control | Noise Immunity

Generate Source code | Clear | Auto-Assign | **OK**

Unconnected Sensor	Electrode	Port	Use Mode	Parallel Gro...	BTN00	TKP00
CAP0.0	Unrestricted	B3				
CAP0.1	Unrestricted	B1				
CAP0.2	Unrestricted	B2			RX00	
CAP0.3	Unrestricted	B0				RX03
CAP1.0	Unrestricted	B0				RX02
CAP1.1	Unrestricted	B1				
CAP1.2	Unrestricted	B2				
CAP1.3	Unrestricted	B3				
CAP2.0	Unrestricted	B0				RX01
CAP2.1	Unrestricted	B1				
CAP2.2	Unrestricted	B2				
CAP2.3	Unrestricted	B3				TX03
CAP3.0	Unrestricted	B0				RX00
CAP3.1	Unrestricted	B1				TX02
CAP3.2	Unrestricted	B2				TX01
CAP3.3	Unrestricted	B3				TX00

Time Cycles

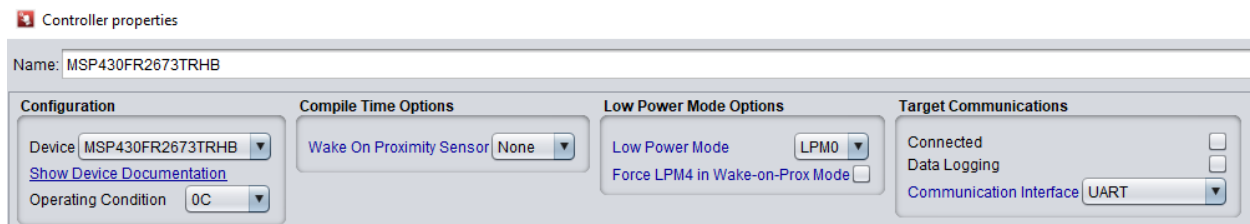
BTN00_C00	TKP00_C00	TKP00_C01	TKP00_C02	TKP00_C03
E00				
	E03	E07	E11	E15
	E02	E06	E10	E14
	E01	E05	E09	E13
				TX
	E00	E04	E08	E12
			TX	
	TX	TX		

OK

MCU - Compile Time Options

In the top portion of this view, certain compile time configurations can be selected, such as the target MCU, low power mode and communications interface between the GUI and target.

Any changes to these configurations require the MCU to be reprogrammed.



Controller properties
Name: MSP430FR2673TRHB

Configuration
Device: MSP430FR2673TRHB
[Show Device Documentation](#)
Operating Condition: 0C

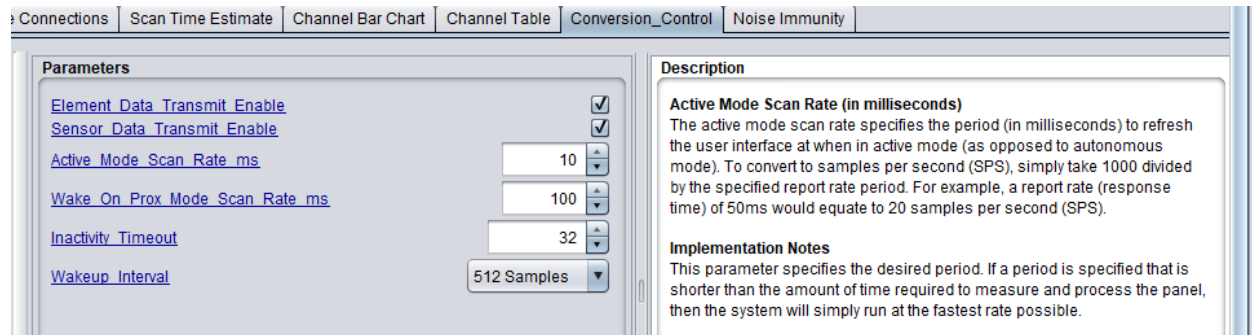
Compile Time Options
Wake On Proximity Sensor: None

Low Power Mode Options
Low Power Mode: LPM0
Force LPM4 in Wake-on-Prox Mode: ☐

Target Communications
Connected: ☐
Data Logging: ☐
Communication Interface: UART

MCU - Conversion Control Tab

The controller's Conversion_Control tab has properties that control MCU functionality that relates to the capacitive touch measurements. These parameters can be changed in real-time while communicating with the target MCU.



Parameters	Description
Element Data Transmit Enable ☒	Active Mode Scan Rate (in milliseconds) The active mode scan rate specifies the period (in milliseconds) to refresh the user interface at when in active mode (as opposed to autonomous mode). To convert to samples per second (SPS), simply take 1000 divided by the specified report rate period. For example, a report rate (response time) of 50ms would equate to 20 samples per second (SPS). Implementation Notes This parameter specifies the desired period. If a period is specified that is shorter than the amount of time required to measure and process the panel, then the system will simply run at the fastest rate possible.
Sensor Data Transmit Enable ☒	
Active Mode Scan Rate ms 10	
Wake On Prox Mode Scan Rate ms 100	
Inactivity Timeout 32	
Wakeup Interval 512 Samples	

Note: changes to these parameters are not permanent. You must update the target project and re-program the MCU with the changes (hence the term compile-time options).

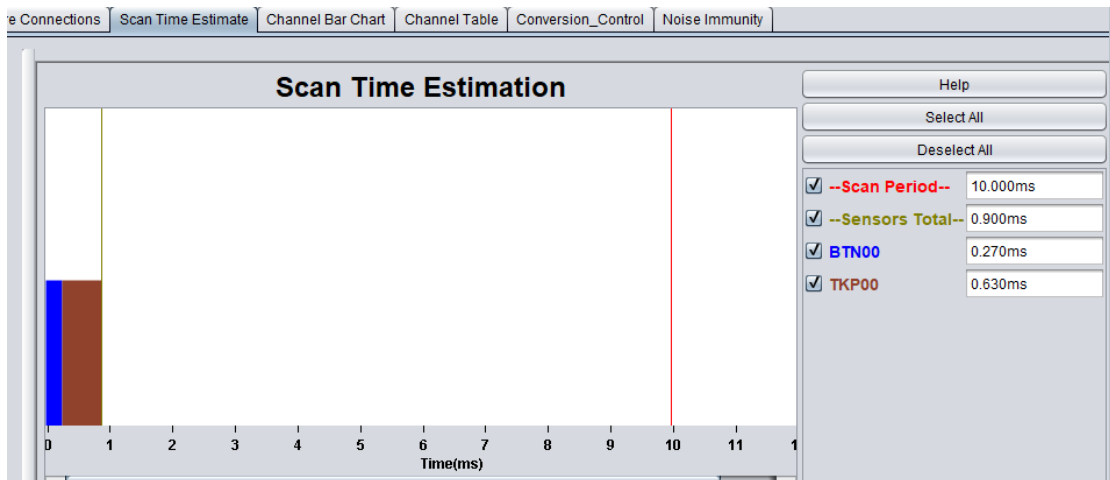
- Element Data Transmit Enable – Transmit sensor element data (count, LTA, etc.) to the GUI
- Sensor Data Transmit Enable – Transmit sensor status (Touch, no-touch, etc.) to the GUI
- Active Mode Scan Rate ms – Sensor measurement interval when MCU is in active mode
- Wake on Prox Mode Scan Rate ms – Sensor measurement interval when MCU is in low power mode
- Inactivity Timeout – After N number of samples and no touch is detected, MCU enters low power mode
- Wakeup Interval – After N number of samples, force MCU to wake from low power mode to scan sensors and check other system parameters if needed.

To see how the real-time modifications work, try changing the active scan rate from 10ms to 50ms, then click the **APPLY** button, then click OK and you will immediately see the sensor update slowdown from 100Hz to 20Hz.

MCU - Scan Time Estimate

This tab displays the total time estimated to measure the Touchpad sensor (blue bar) and the period at which the sensor is scanned (red line). In this example it takes < 1ms to scan the Touchpad and mode button, leaving 18ms for other MCU operations, such as communicating with a host MCU or sending data to the GUI.

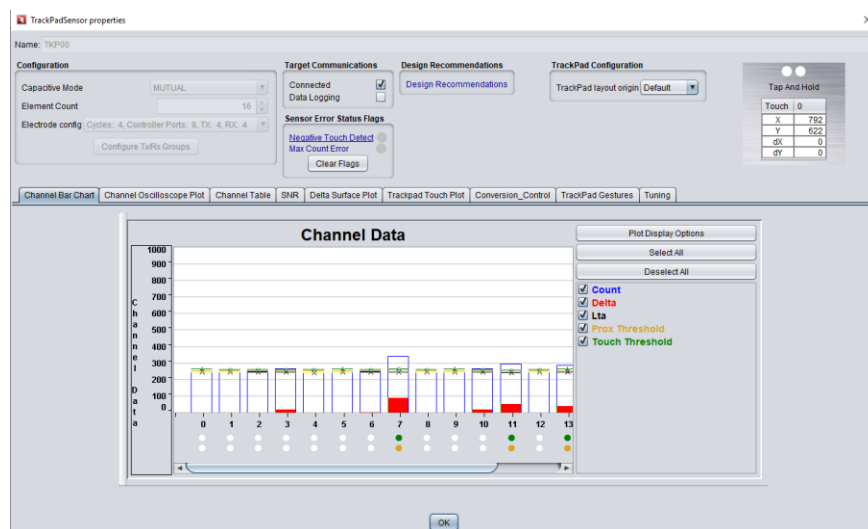
Note: the scan time estimate does not include the Touchpad sensor processing time.



Touchpad Sensor Parameters

The Touchpad Sensor properties window offers several different views to monitor real time sensor data streaming from the target MCU as well as the ability to modify run-time parameters that control sensor sensitivity, scan rates and other design parameters.

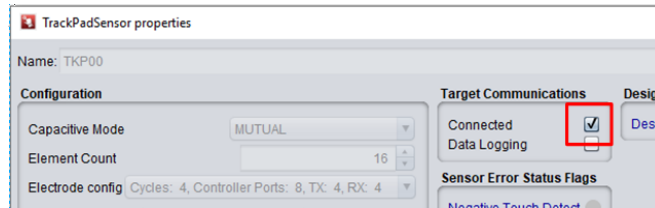
To open the sensor properties window, double-click on the touchpad sensor icon.



Sensor - Channel Bar View

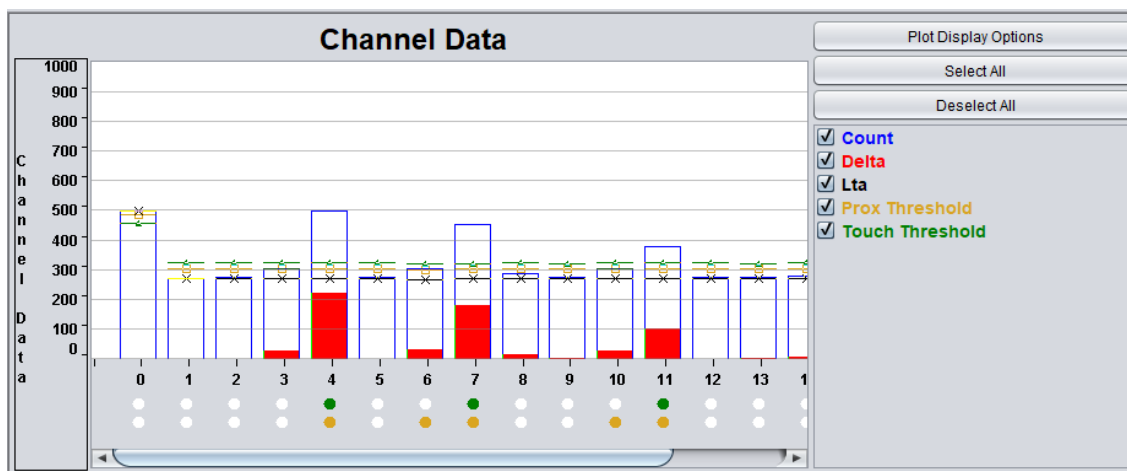
This view displays measurement information from each of the sensor's electrode channels using bars to represent the strength of the signals and lines representing the proximity and touch thresholds

- To enable communications, check the Target Communications Connected box as shown below



- Select the Channel Bar Chart View
- Move a finger around on the Touchpad sensor and the bars will change height due to the amount of change in capacitance introduced by the finger.

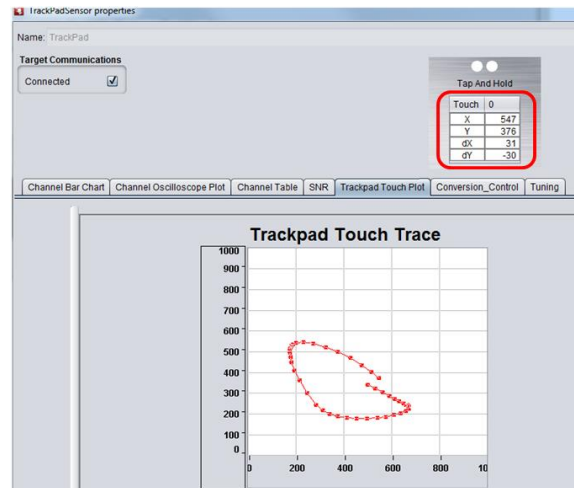
A typical Channel Data view will look like this:



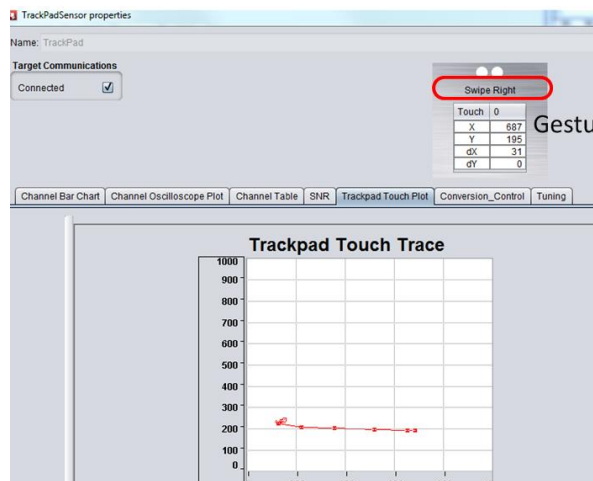
Sensor - Touchpad Touch Plot View

This view plots the XY position of the finger as it moves around the sensor. In the upper right corner the XY data values are displayed along with the detected gesture.

- Select the Touchpad Touch Plot tab
- Move a finger around the Touchpad sensor and the position is plotted
- The absolute and delta positions are displayed



The supported gestures are Tap, Double-Tap, Tap-n-Hold, Swipe Up, Swipe Down, Swipe Left, and Swipe Right and are displayed in the upper right corner.



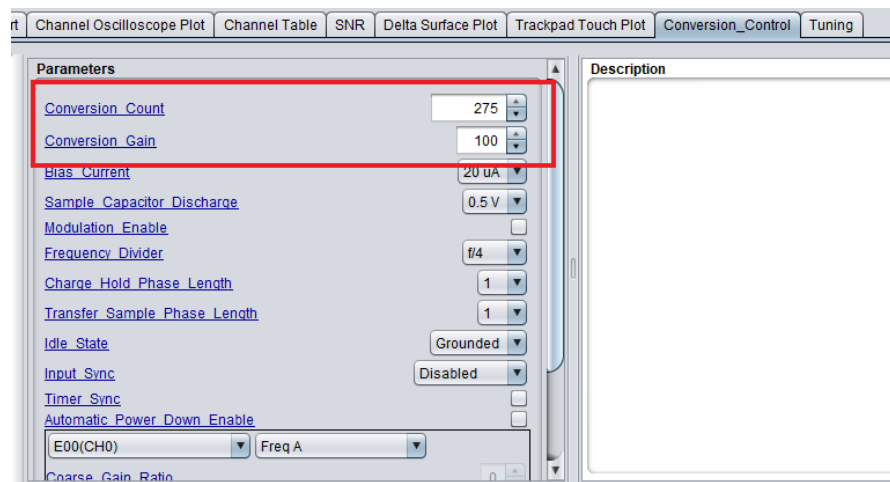
Gestures Displayed

Touchpad Sensor Tuning Parameters

The sensor properties window offers several different views and configuration tabs that control sensor operational parameters and allow the user to see real time sensor status and data coming from the target MCU. To open the sensor properties window, double-click on the controller icon.

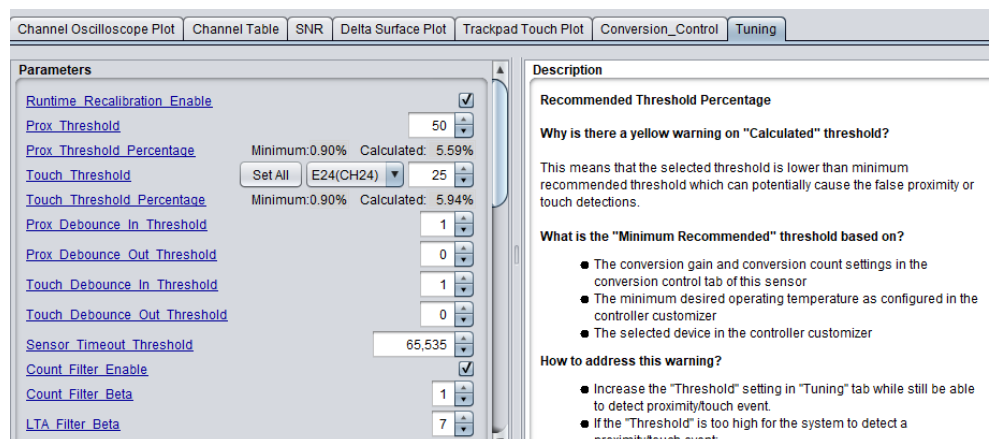
Sensor - Conversion Control Tab

The sensor's Conversion_Control tab is where the sensor's sensitivity parameters Conversion_Count and Conversion_Gain are located.



Sensor - Tuning Tab

The Tuning tab is where the majority of the sensor parameters are set. This includes thresholds, filter betas, sensor resolution and debounce values.



The Tuning tab has additional parameters for controlling the gestures.

Channel Oscilloscope Plot	Channel Table	SNR	Delta Surface Plot	Trackpad Touch Plot	Conversion_Control	Tuning
Selection Threshold			20			
Desired Resolution X Axis			1,000			
Upper Trim X Axis			1,000			
Lower Trim X Axis			0			
Desired Resolution Y Axis			1,000			
Upper Trim Y Axis			1,000			
Lower Trim Y Axis			0			
Tap Time Min Threshold			4			
Tap Time Max Threshold			10			
Double Tap Time Max Threshold			20			
Tap Hold Time Min Threshold			40			
Swipe Time Max Threshold			30			
Swipe Distance Min Threshold			150			

Description

Recommended Threshold Percentage

Why is there a yellow warning on "Calculated" threshold?

This means that the selected threshold is lower than minimum recommended threshold which can potentially cause the false proximity or touch detections.

What is the "Minimum Recommended" threshold based on?

- The conversion gain and conversion count settings in the conversion control tab of this sensor
- The minimum desired operating temperature as configured in the controller customizer
- The selected device in the controller customizer

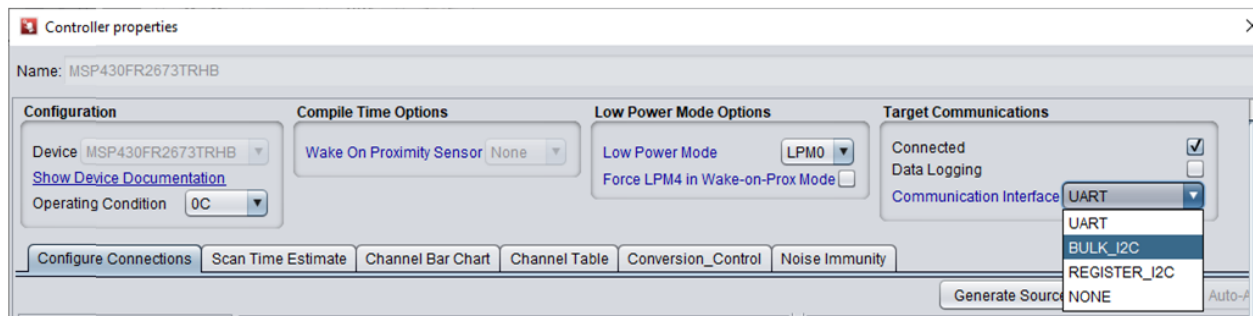
How to address this warning?

- Increase the "Threshold" setting in "Tuning" tab while still be able to detect proximity/touch event.
- If the "Threshold" is too high for the system to detect a proximity/touch event:

Low Power Demo #2

Operating in this mode, the MCU is in a low power “wake on proximity” state, leaving the CapTivate hardware to autonomously scan the sensor at a slower 100ms rate. In this mode the device consumes the least amount of power (approximate 20uA). Touching the sensor causes the MCU to exit the low power state, resuming sensor scanning and processing in the active mode at the faster 10ms rate and turning on the LED. The MCU remains in this mode until the finger is removed. The LED then turns off and the MCU re-enters the low-power state.

Note, because the Touchpad PCB was designed to communicate with the CapTivate Design Center GUI using the MSP430’s UART, operating the UART in the low power mode does not allow the MCU to achieve the lowest possible power. To demonstrate the best low power, the MCU must use I2C, not UART. The TP4X4_FR2673_LowPower_demo.txt firmware uses I2C so it is still possible to view real-time data while the sensor is touched. In order for this to work, you must select the “BULKI2C” mode in the Controller properties view.

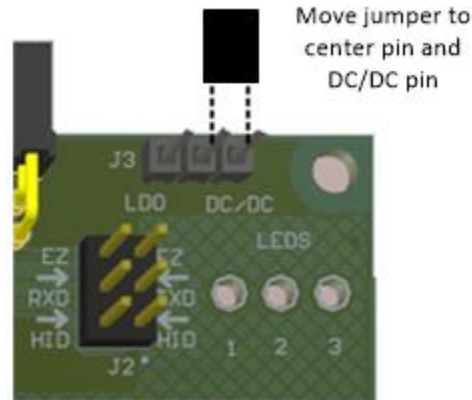


To re-program the MCU with TP4X4_FR2673_LowPower_demo.txt firmware, refer to the section “[Re-Programming the MCU.](#)”

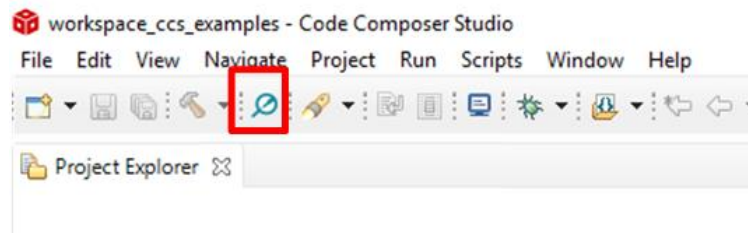
Measuring and verifying the low power current can be done easily in two different ways. The first method requires a digital voltmeter (set in mA mode). Remove the jumper on J3 and connect the meter as shown.



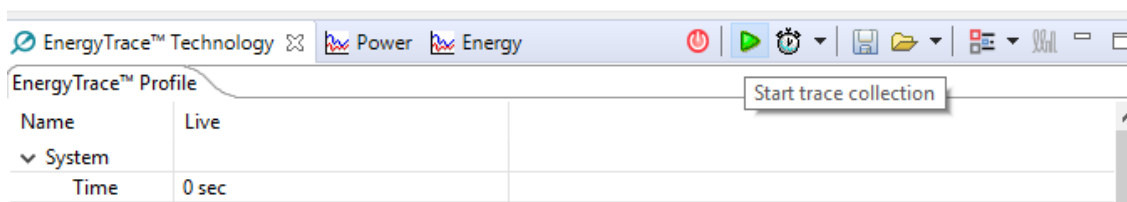
The second method uses the EnergyTrace™ feature built into the programmer and Code Composer Studio. The EnergyTrace DC-DC circuit provides a separate +3.3v that it controls and measures the flowing current. Remove the jumper from the center pin and LDO position and place it on the center pin and DC/DC pin.



Next, launch Code Composer Studio and select the Energy Trace Icon.



To start the current measurement, select the green “play” button.



The default sampling period is 10 seconds (adjustable). Current, power and energy information can be displayed.

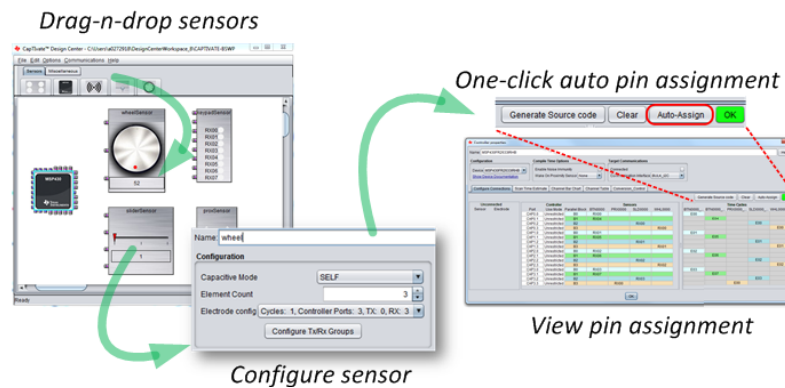
Creating a New CapTivate™ Design Center Touchpad Project

This section describes in brief detail how to create a new sensor design project. It is recommended to view the complete step by step descriptions in the CapTivate Technology Design guide workshop chapter found in the GUI menu Help>Topics information or on the [web](#).

Note: the following illustrates the steps taken to create any new sensor configuration and PCB design. Configurations and settings specific to the Touchpad demo board will be highlighted.

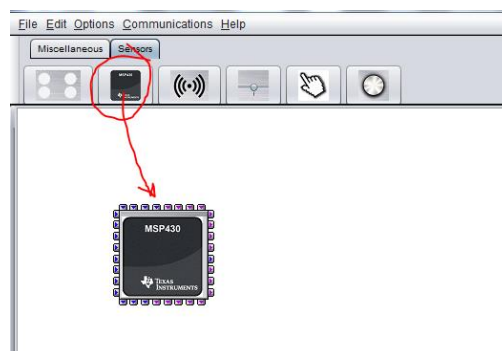
Start by creating a new project using the CapTivate™ Design Center.

Note: the normal workflow for creating and configuring sensors are illustrated by the actions shown below.

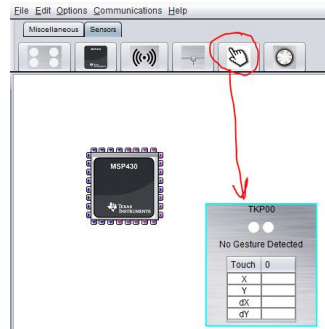


If the CapTivate Design Center is already open, select from the menu: File>NewProject. You will be prompted to save the project. Select Discard for now.

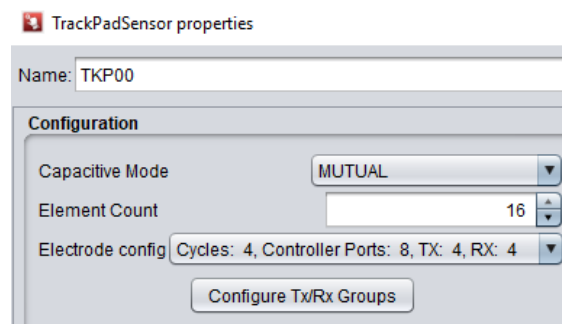
Right-click once on the MCU icon, then click on the canvas to drop it in place.



Right-click once on the Touchpad icon, then click on the canvas to drop it in place. Your canvas should look something like the following:

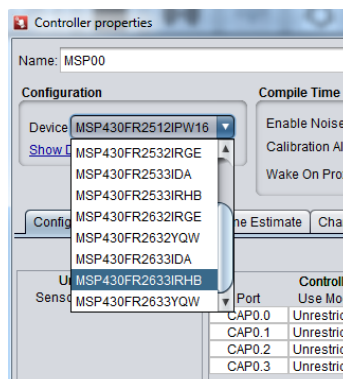


Double click on the Touchpad to view the touchpad properties. Select mutual (projected) capacitive mode. Select the element count and set = 16.



This creates a 4x4 configuration (4 RX and 4 TX). The element count represents the total measurement nodes created by the number of sensor RX channels times the number of TX channels.

Next, double click on MCU to view the controller properties. Select the MCU variant for your application by clicking in the device drop-down box. The Touchpad demo PCB uses the MSP430FR2673IRHB.



Controller properties

Name: MSP430FR2633RH4

Configuration

Device: MSP430FR2633RH4
[Show Device Documentation](#)
 Operating Condition: OC

Compile Time Options

Wake On Proximity Sensor: None

Low Power Mode Options

Low Power Mode: LPM0
 Force LPM4 in Wake-on-Prox Mode: ☐

Target Communications

Connected: ☐
 Data Logging: ☐
 Communication Interface: UART

Configure Connections

Scan Time Estimate Channel Bar Chart Channel Table Conversion_Control Noise Immunity

Generate Source code Clear Auto-Assign Errors

Unconnected		Controller		Sensors	
Sensor	Electrode	Port	Use Mode Parallel Gro...	TKP00	
TKP00	Rx00	CAP0.0	Unrestricted B3		
TKP00	Rx01	CAP0.1	Unrestricted B1		
TKP00	Rx02	CAP0.2	Unrestricted B2		
TKP00	Rx03	CAP0.3	Unrestricted B0		
TKP00	Rx04	CAP1.0	Unrestricted B0		
TKP00	Tx00	CAP1.1	Unrestricted B1		
TKP00	Tx01	CAP1.2	Unrestricted B2		
TKP00	Tx02	CAP1.3	Unrestricted B3		
TKP00	Tx03	CAP2.0	Unrestricted B1		
TKP00	Tx04	CAP2.1	Unrestricted B0		
		CAP2.2	Unrestricted B2		
		CAP2.3	Unrestricted B3		
		CAP3.0	Unrestricted B0		
		CAP3.1	Unrestricted B1		
		CAP3.2	Unrestricted B2		
		CAP3.3	Unrestricted B3		

Time Cycles

Unconnected Electrodes

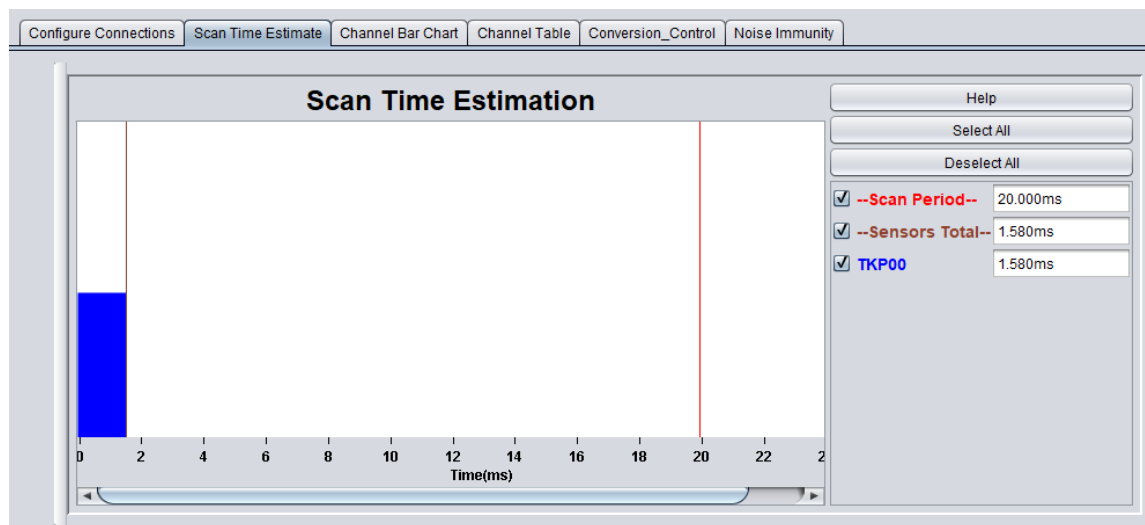
CapTivate Block/Pin

Auto-Assign Button

The Auto-Assign feature allows the CapTivate Design Center to determine the optimal connections between the sensor and the pins on the MCU. The controller view shows the measurement time cycles with the corresponding sensor elements. From this view you can see that measuring the demo Touchpad sensor takes 10 measurement cycles.

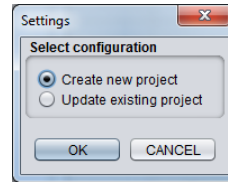
[illegible]

The Configuration Connections above show the Time Cycles columns or measurement cycles. You can see that it requires 10 measurement cycles to measure the complete touchpad. The GUI can show an estimate of how long it will take to scan all 10 cycles. Open the Scan Time Estimate tab. You see that the 10 measurement cycles take only 1.58ms, and you can see how much time remains before the next time the sensor is measured. This view gives some perspective of the percentage of the 20ms is consumed by the measurement process. Note, there is always additional MCU processing that occurs post measurement but this time will vary and is difficult to estimate so it is not included.



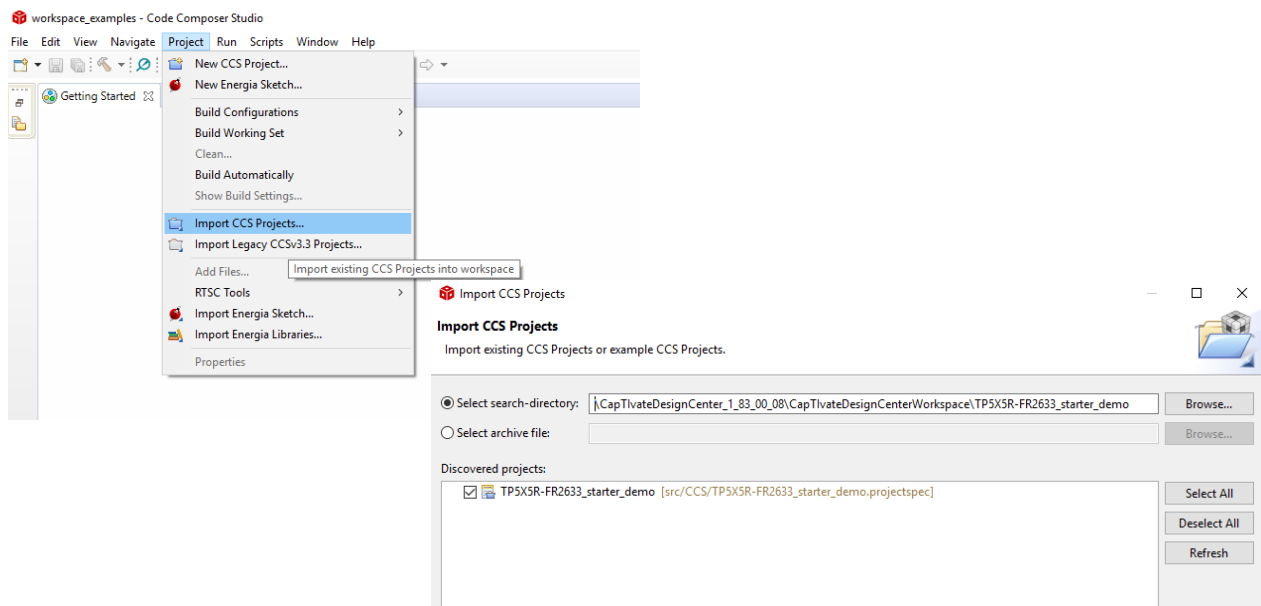
The next step is to generate a new target MCU source code project, but you want to save your project first. Next click on the “Generate Source Code” button, then select “Create New project”. Note the location where this project is saved! You will need to remember the directory name when importing the project into CCS.

c:\users[your name]\CaptivateDesignCenter_1_83_00_08\CaptivateDesignCenterWorkspace



Import Output Project into Code Composer Studio

In Code Composer Studio, import the firmware project by navigating to the directory from above, then click on the project name.



- Build and program the MCU
- To run the demo from CCS, click the RUN icon or dis-connect then re-connect the USB cable
- The MCU will start sending sensor data to the CapTivate Design Center once the MCU wakes up after a swipe across the Trackpad sensor
- Verify everything works by moving your finger around the TrackPad and try the various gestures.

Sensor Tuning

The sensor tuning procedure is described in the CapTivate_touchpad_sensor_tuning_guide.pdf.

For information on basic sensor tuning, refer to the [Workshop Getting Started](#) chapter in the CapTivate Technology Guide.

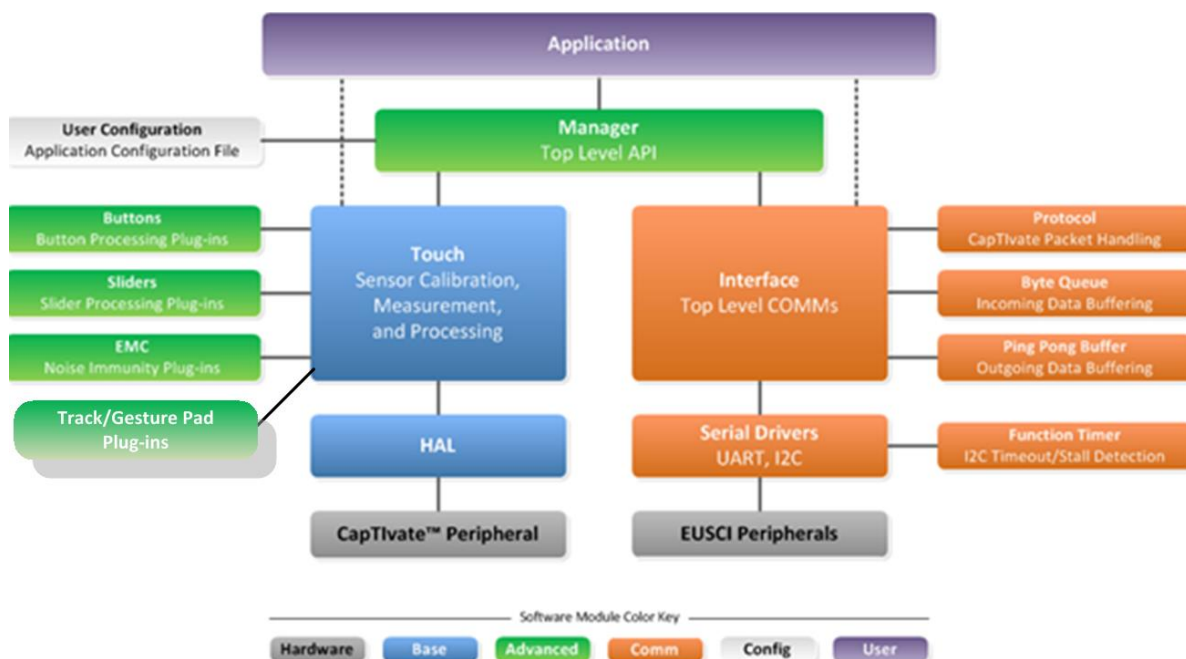
Gesture Tuning

The gesture tuning procedure is described in the CapTivate_touchpad_gesture_tuning_guide.pdf.

Software

CapTivate Capacitive Touch Library Overview

Refer to the CapTivate Design Center documentation for additional information about the CapTivate™ Touch library [\[click here\]](#).



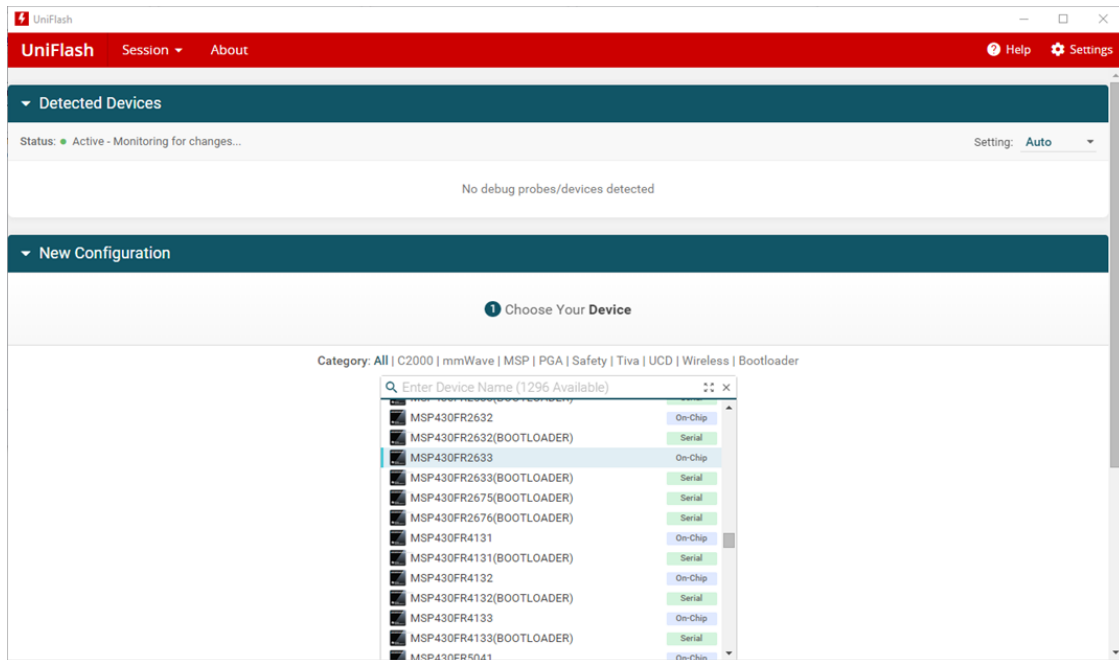
Touchpad Software Development

The sensor tuning procedure is described in the CapTivate_touchpad_software_development_guide.pdf.

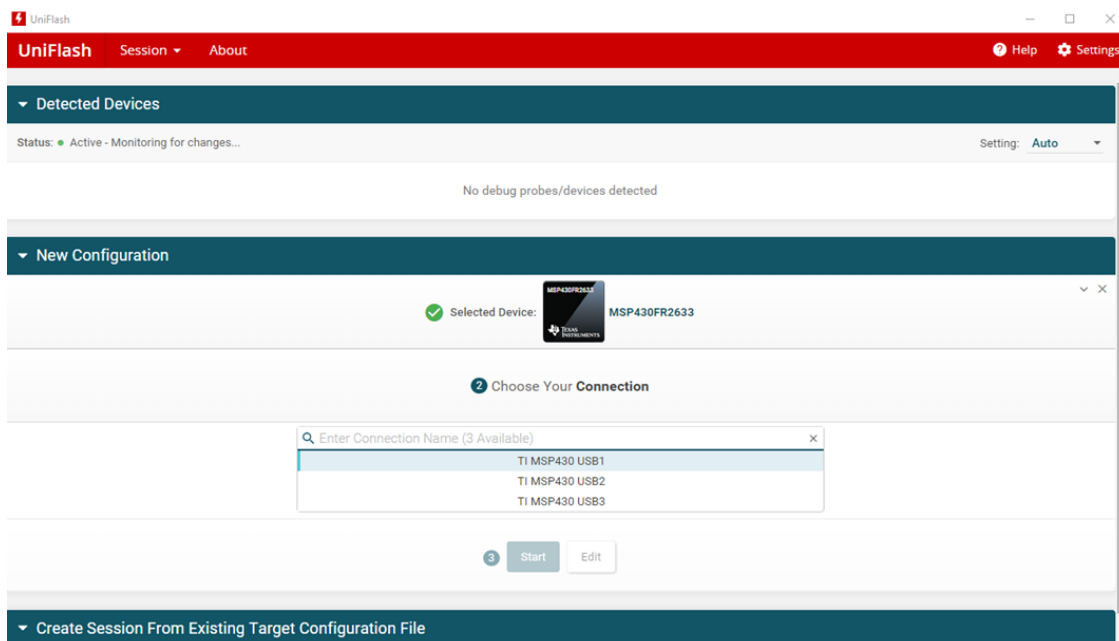
Re-Programming the MCU using TI Uniflash

To re-program the provided demo firmware images use the TI Uniflash utility.

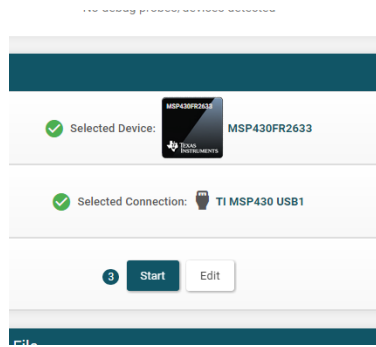
Download and launch the Uniflash utility and follow the instructions that are provided. Select the MSP430FR2673 (on-chip).



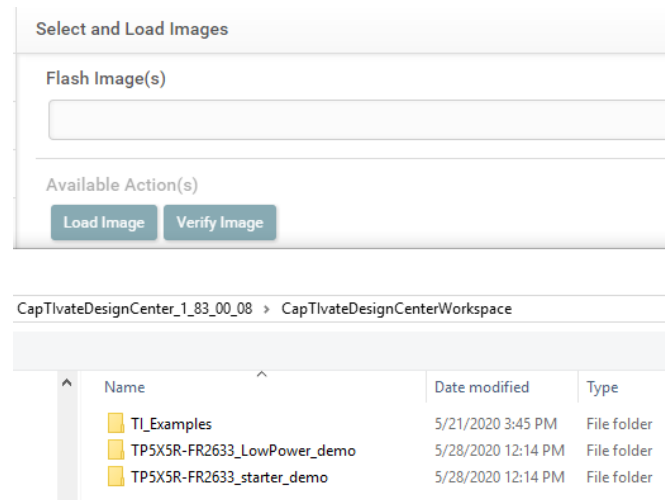
Next, select the TI MSP430 USB1 connection.



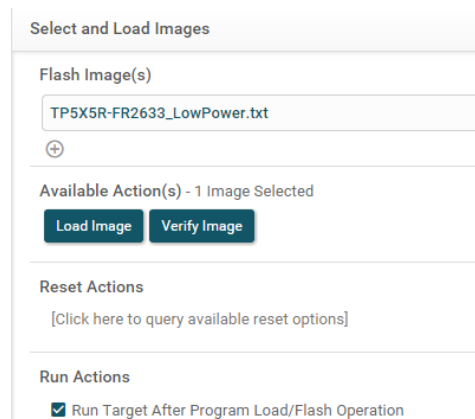
Click the Start button to establish communications with the CAPT-PGMR.



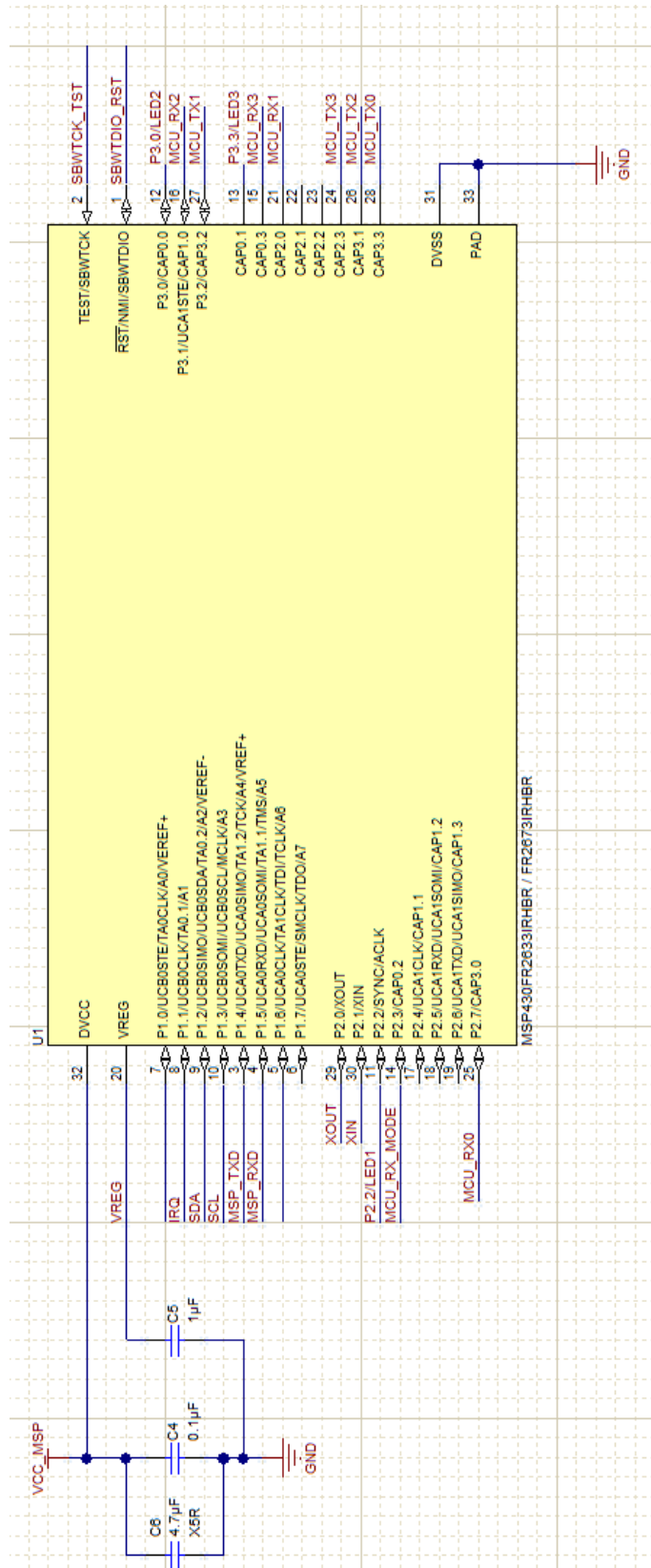
Click the Browse button and navigate to the CapTivate design workspace directory where the demonstration project zip file contents were un-zipped and select the desired demo file (*.txt) in its respective folder.

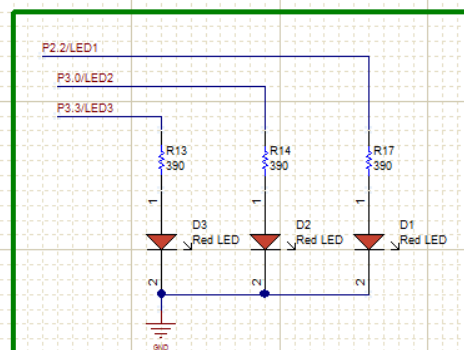
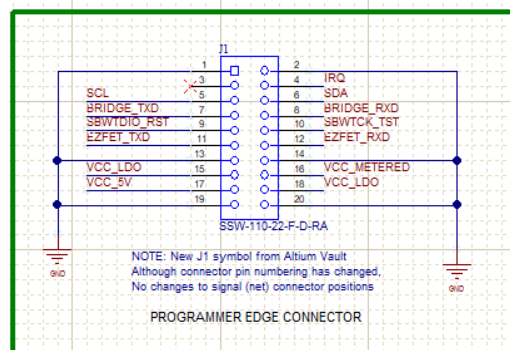
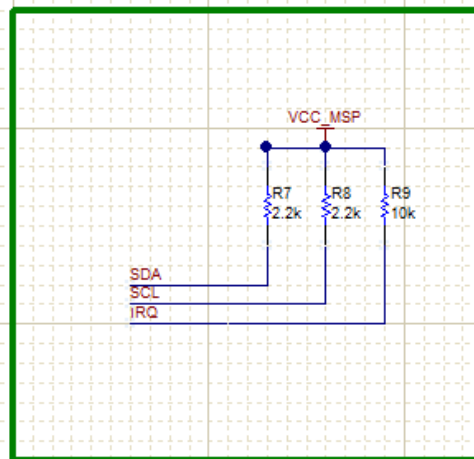
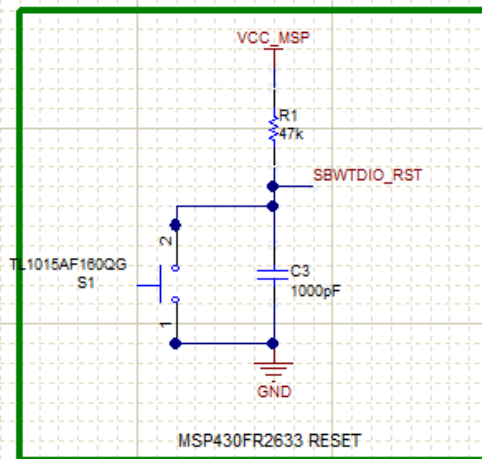
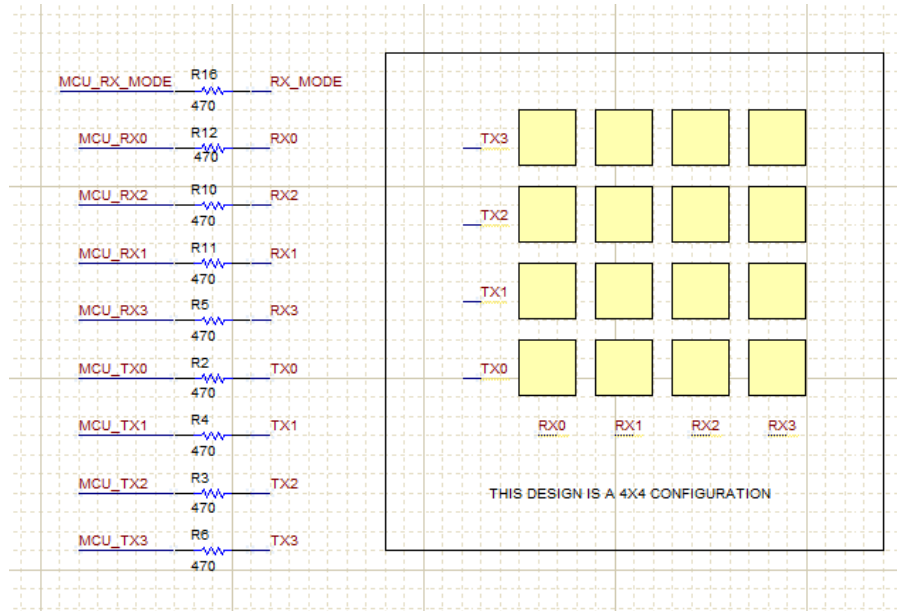


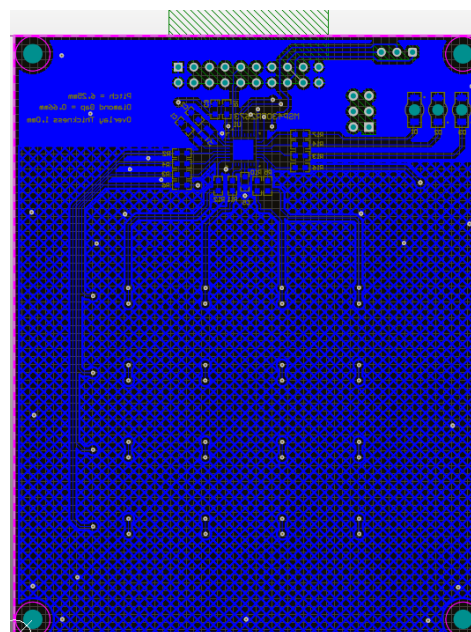
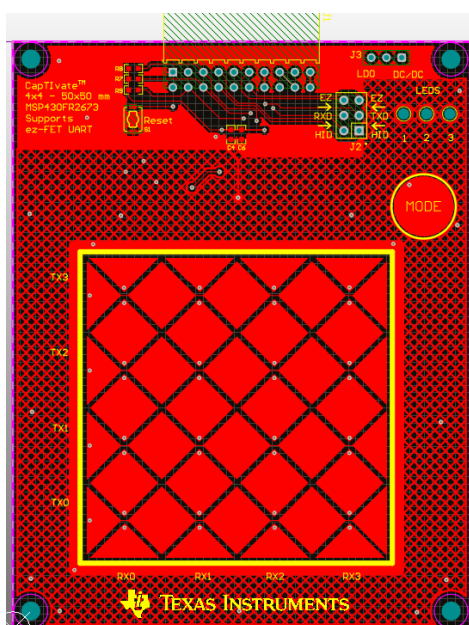
Click the Load Image button to re-flash the MCU with the new demo firmware.



Schematic/PCB







CAPT-PGMR Connections

