CY3280-24x94

Universal CapSense® Controller Kit Guide

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1. Introduction

Thank you for your interest in the CY3280-24x94 Universal CapSense® Controller (UCC) Kit. This kit is designed to easily prototype and debug the 24x94 CapSense family designs with predefined control circuitry and plug-in hardware. The kit includes programming hardware and an I2USB bridge for tuning and data acquisition. This module connects to any CY3280 Universal CapSense Module board.

This document describes the CY3280-24x94 UCC kit and demonstrates the code examples provided with the kit.

1.1 Kit Contents

The CY3280-24x94 UCC kit contains:

- CY3280-24x94 Universal CapSense Controller board
- CY3240-I2USB Bridge Board
- CY3217 PSoC MiniProg1 Programmer
- USB A to Mini-B Cable
- CY3280-24x94 Universal CapSense Controller Kit CD
  - PSoC Designer installation file
  - PSoC Programmer installation file
  - Bridge Control Panel installation file (packaged along with PSoC Programmer)
  - Code examples
  - Hardware files
  - Kit guide
  - Quick start guide
  - Release notes
- Chip Samples - CY8C24094-24LTXI

Universal CapSense Module boards are available for purchase separately or as part of the combination kits. Visit http://www.cypress.com/shop for more information. Inspect the contents of the kit. If any of the parts are missing, contact your nearest Cypress sales office for further assistance.

1.1.1 Prerequisites

The following are required for the functioning of the kit:

- CY3280 Universal CapSense Module board or user custom board similar to CY3280 module boards
- 12 V DC adapter (optional)
- CY3215-DK (optional, required for debugging the program in PSoC Designer)

1.1.2 CY3217-MiniProg1

The PSoC MiniProg 1 gives you the ability to program PSoC parts quickly and easily. It is small, compact, and connects to your PC using the provided USB A to Mini-B cable. During prototyping, the MiniProg can be used as an in-system serial programmer (ISSP) to program PSoC devices on your PCB. When the MiniProg is connected, you can use the PSoC Programmer software to program. PSoC Programmer is a free software, which can either be launched from PSoC Designer or run as a standalone program.

1.1.3 CY3240-I2USB Bridge Board

The I2USB Bridge allows testing, tuning, and debugging hardware and software of a PSoC application by bridging the USB port to I2C. Populated with the CY8C24894 PSoC device, the I2USB Bridge can be connected through the ISSP pins on the controller board.

1.1.4 CY3280 Universal CapSense Module Board

The CY3280 Universal CapSense Module board is available for purchase separately or as part of the combination kits. The CY3280-24x94 UCC can be connected to CY3280-SLM, CY3280-SRM, CY3280-BMM, and CY3280-BSM CapSense boards.

1.2 PSoC Designer

PSoC Designer<version> is the integrated development environment (IDE) used to customize your PSoC application. The latest PSoC Designer has many new features, bug fixes, and support for new PSoC devices. More information about PSoC Designer is available in the PSoC Designer IDE Guide at `<Installed_directory>\Cypress\PSoC Designer\<version>\Documentation`.

1.3 PSoC Programmer

PSoC Programmer offers you a simple GUI that connects to programming hardware to program and configure PSoC devices.

1.4 Bridge Control Panel

The Bridge Control Panel (BCP) GUI is used with CY3240-I2USB Bridge Board to enable communication with I2C slave devices; here, it is used with CY3280-24x94 UCC. This software is used to configure I2C devices and to acquire and process data received from I2C slave devices. The BCP helps to optimize, debug, and tune the target devices.

1.5 Additional Learning Resources

Visit http://www.cypress.com for additional learning resources in the form of datasheets, technical reference manual, and application notes.

- CY8C24094/794/894/994 CapSense Applications – http://www.cypress.com/?rID=3371
  This is the PSoC CY8C24094 datasheet that contains pin descriptions and other specifications of the PSoC CY8C24094
- CY3280-24x94 Universal CapSense Controller Board layouts:
  http://www.cypress.com/?rID=3481
- CY3280-24x94 Universal CapSense Controller Schematics – http://www.cypress.com/?rID=3481
- Layout Guidelines in Getting Started with CapSense (Chapter 3):
  http://www.cypress.com/?rID=48787

The layout guidelines section in Getting started with CapSense describes layout guidelines for CapSense applications with regard to PCB layout, overlay thickness, material selection and chassis design.

- CY3240 USB-I2C Bridge Guide – http://www.cypress.com/?rID=3421
- CY3280-SLM Linear Slider Module Kit – http://www.cypress.com/go/CY3280-SLM
- CY3280-SRM Radial Slider Module Kit – http://www.cypress.com/go/CY3280-SRM
- CY3280-BSM Simple Button Module Kit – http://www.cypress.com/go/CY3280-BSM
- CY3280-BMM Matrix Button Module Kit – http://www.cypress.com/go/CY3280-BMM
- MiniProg Users Guide and Code Examples – http://www.cypress.com/?rID=37459
- PSoC Designer Training – http://www.cypress.com/go/psocdesigner-training
  This is a web-based course that provides an overview of PSoC and its design tools.

1.6 Document History

Revision	PDF Creation Date	Origin of Change	Description of Change
**	06/22/2011	SSHH	Initial version of kit guide
*A	10/28/2011	SASH	Added “My First Code Example” section. Updated InstallShield Wizard step. Added note about CY8C24094 UCC board’s OCD support in the PSoC Designer section. Added note on Mini-Prog to PC connection in the PSoC Programmer section. Updated CY3280-24x94 kit CD location. Removed I2USB Bridge connection to controller image. Updated file names and locations in Bridge Control Panel section.Changed Cy8C24094-LFXI to CY8C24094-LTXI.

1.7 Document Conventions

Table 1-1. Document Conventions for Guides

Convention	Usage
Courier New	Displays file locations, User entered text, and source code: C:\ ...cd\icc\
Italics	Displays file names and reference documentation: Read about the sourcefile.hex file in the PSoC Designer User Guide.
[**Bracketed,Bold**]	Displays keyboard commands in procedures: [**Enter**] or **[Ctrl][C]**
File > Open	Represents menu paths: File > Open >New Project
Bold	Displays commands, menu paths, and icon names in procedures: Click the **File** icon and then click **Open**.
Times New Roman	Displays an equation: 2 + 2 = 4
Text in gray boxes	Describes cautions or uniwue functionality of the product.

2. Getting Started

This chapter describes the installation and configuration of the CY3280-24x94 UCC Kit.

2.1 Kit Installation

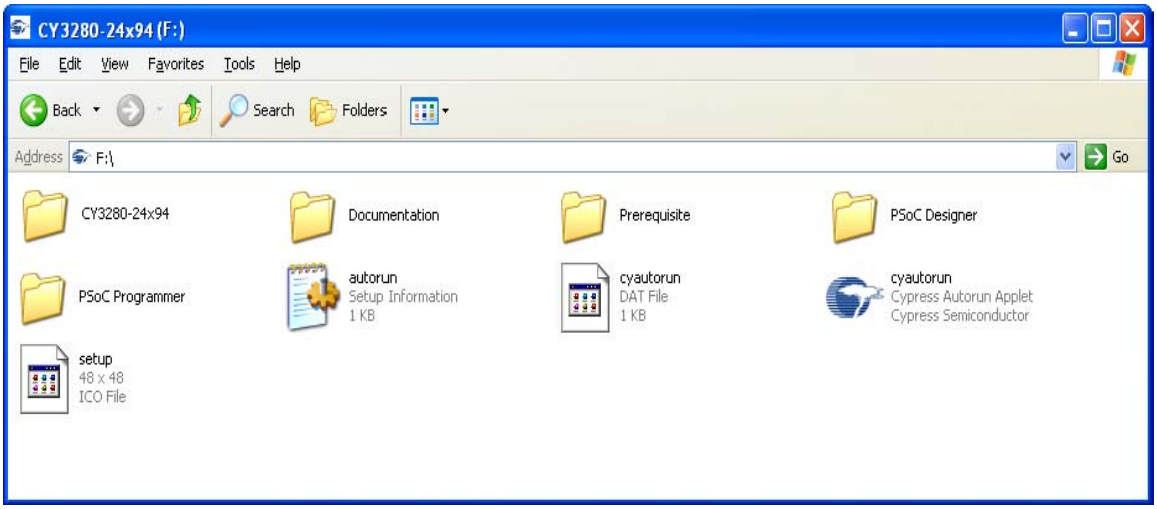
To install the kit software, follow these steps:

1. Insert the kit CD in the CD drive of your PC. The CD is designed to auto-run and the kit installer startup screen appears.
   Download the latest kit installer from http://www.cypress.com/go/CY3280-24x94. Download the kit installer ISO file and create an installer CD or extract the ISO using Ironware and install the executable.
2. Click **Install CY3280-24x94** to start the installation.

Figure 2-1. Kit Installation

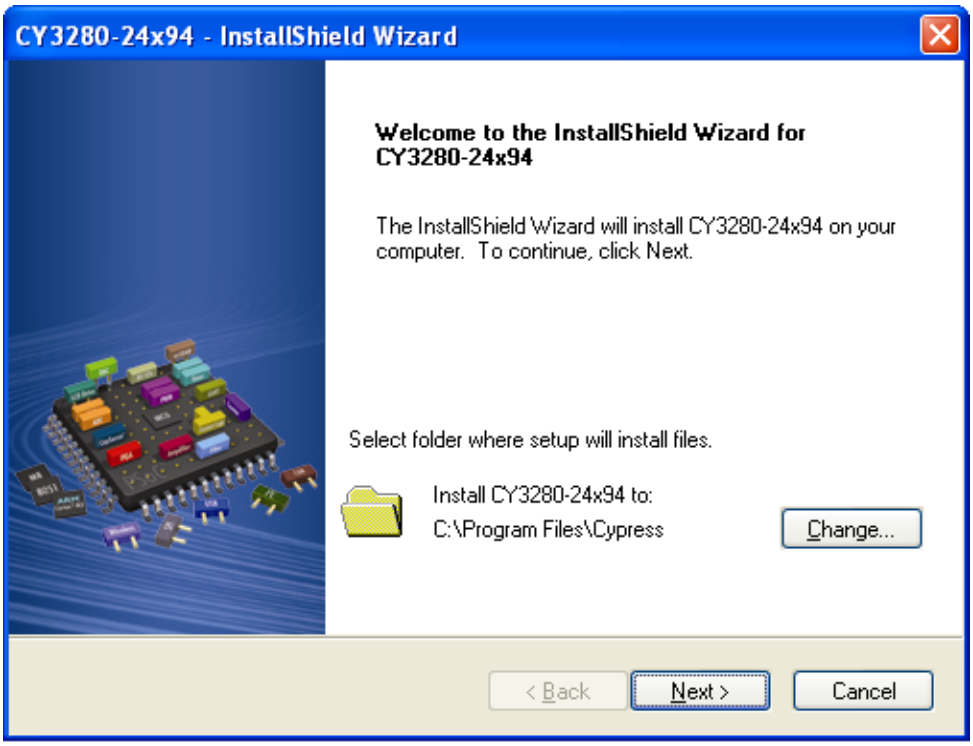
Note If auto-run does not execute, double-click *cyautorun.exe* in the root directory of the CD.

Figure 2-2. CD Root Directory.



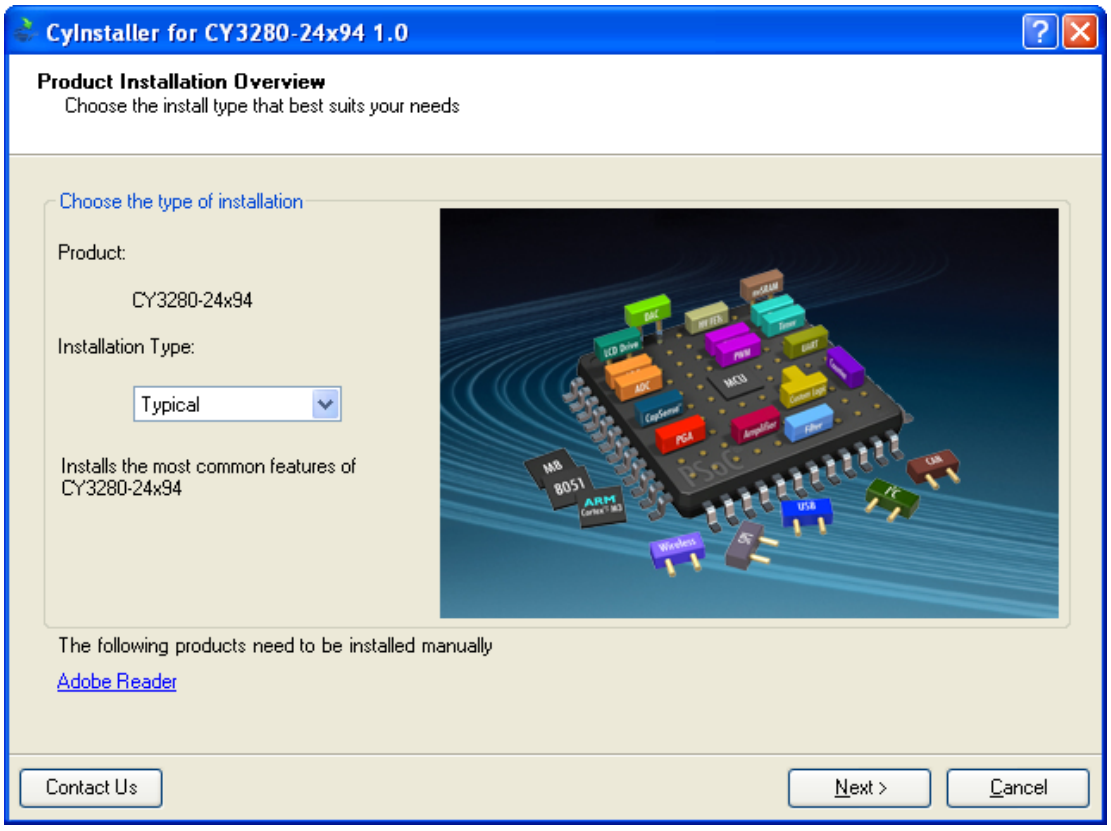
3. The InstallShield Wizard screen appears. On this screen, choose the folder location to install the setup files. You can change the location of the folder for the setup files using **Change**, as shown in Figure 2-3.
4. Click **Next** to launch the kit installer.

Figure 2-3. InstallShield Wizard



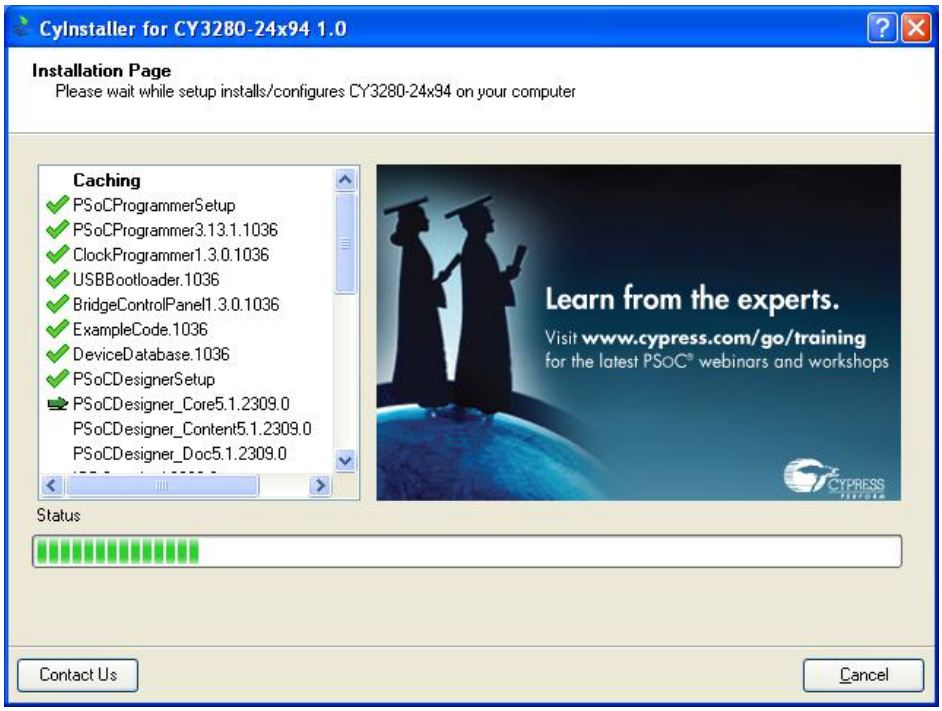
5. In the **Product Installation Overview** screen, select the installation type that best suits your requirement. The drop-down menu has three options – Typical, Complete, and Custom (see Figure 2-4).
6. Click **Next** to start the installation.

Figure 2-4. Installation Type Options



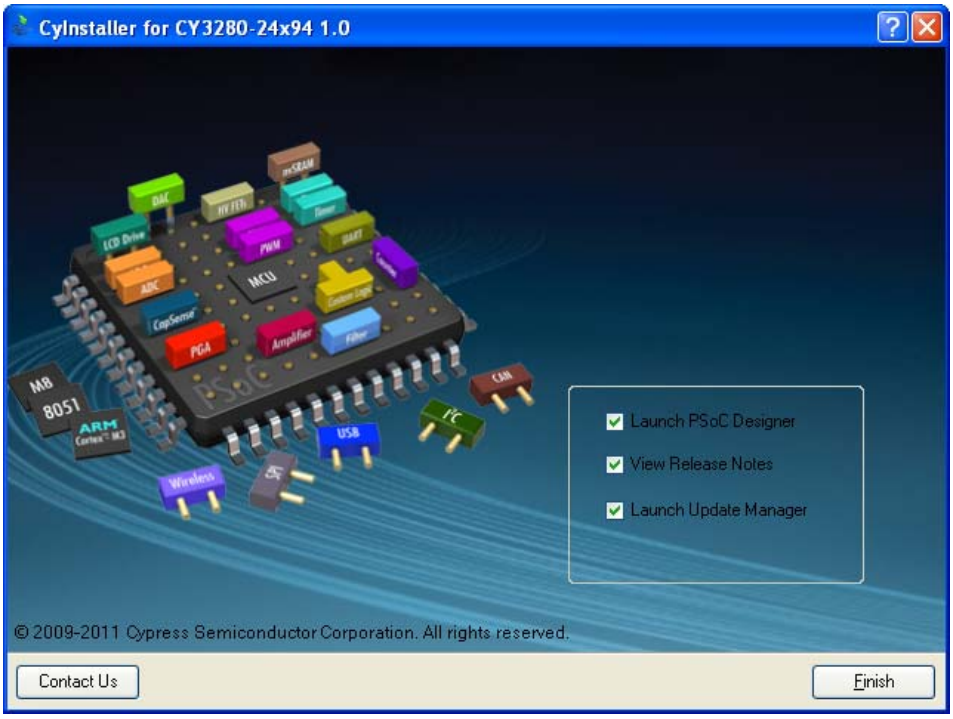
7. When the installation begins, a list of packages appear on the Installation Page. A green check mark appears next to every package that is downloaded and installed.
8. Wait until all the packages are downloaded and installed successfully.

Figure 2-5. Installation Page



9. Click **Finish** to complete the installation.

Figure 2-6. Installation Completion Page

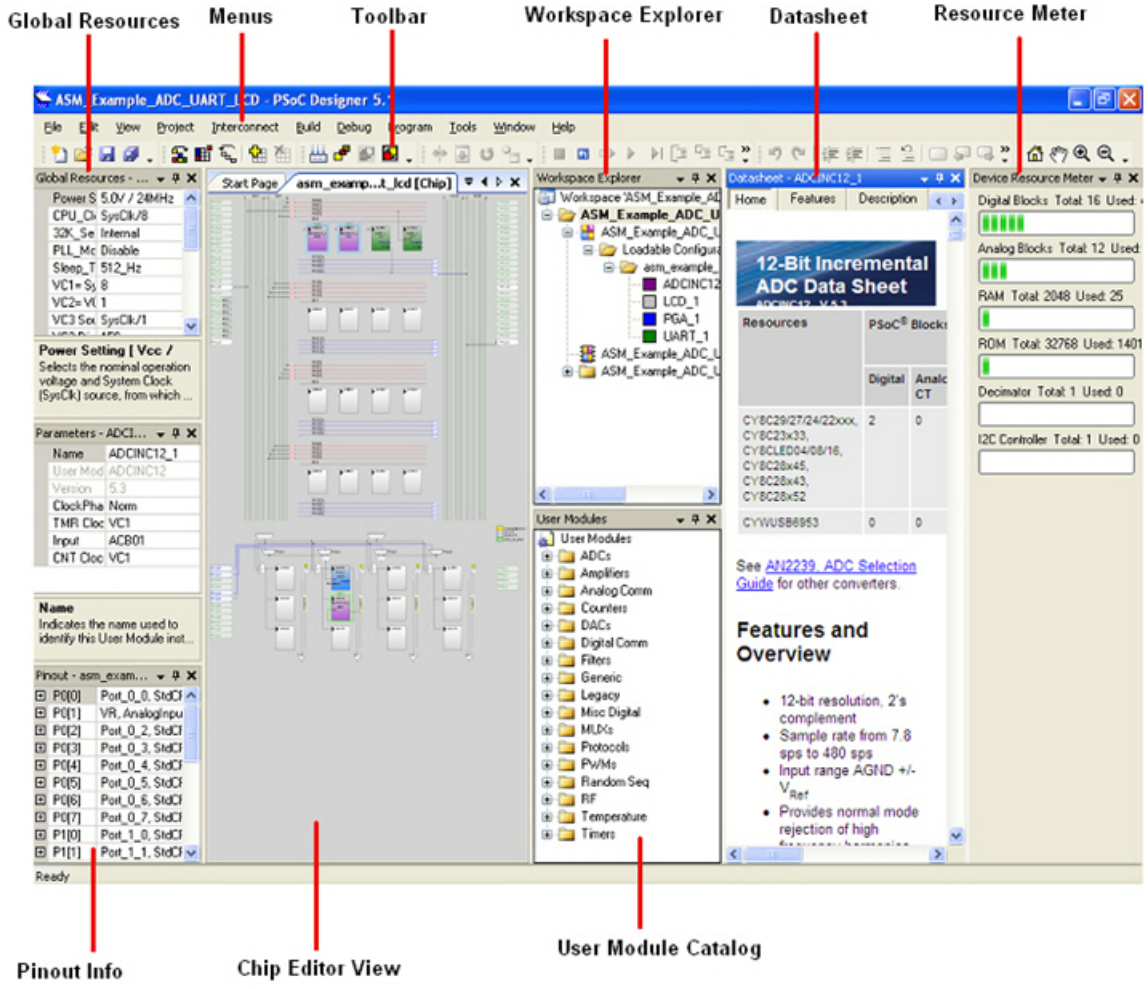


After software installation, verify your setup by opening PSoC Programmer with the MiniProg attached to PC. Open **Bridge Control Panel** with the I2USB bridge attached to the PC to verify driver installation.

2.2 PSoC Designer

1. Click **Start > All Programs > Cypress > PSoC Designer <version> > PSoC Designer <version>**.
2. Click **File > New Project** to create a new project; click **File > Open Project/Workspace** to work with an existing project.

Figure 2-7. PSoC Designer Interconnect View



3. To experiment with code examples, refer to the Code Examples chapter on page 35.

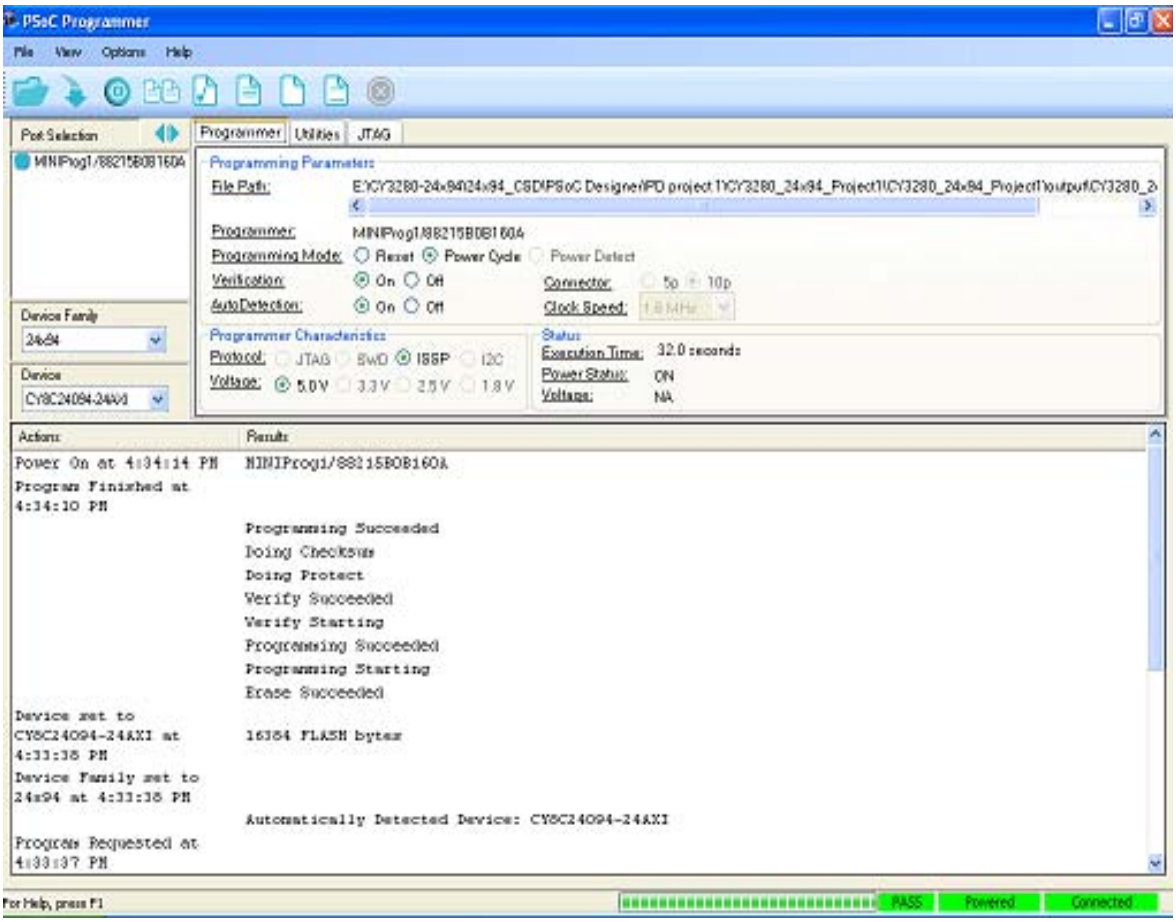
Notes

- For more details on PSoC Designer, see the PSoC Designer IDE Guide at `<Install_directory>\Cypress\PSoC Designer\<version>\Documentation.`
- The device CY8C24094 on the Universal CapSense Controller board supports On-Chip-Debug (OCD) and can emulate any device among the 24x94 family. Any device in the 24x94 family can be selected in the device selection window for new PSoC Designer projects.

2.3 PSoC Programmer

1. Click **Start > All Programs > Cypress > PSoC Programmer <version> > PSoC Programmer <version>**.
2. Connect MiniProg to the PC using a USB A to Mini-B cable.
3. Select the MiniProg from the port selection.

Figure 2-8. PSoC Programmer Window



4. Click the **File Load** button from the Programmer menu bar; navigate and select the hex file to load.
5. Use **Program** button to program the hex file on to the chip.
6. When programming is successful, **Programming Succeeded** appears in the Actions pane.
7. Close PSoC Programmer.

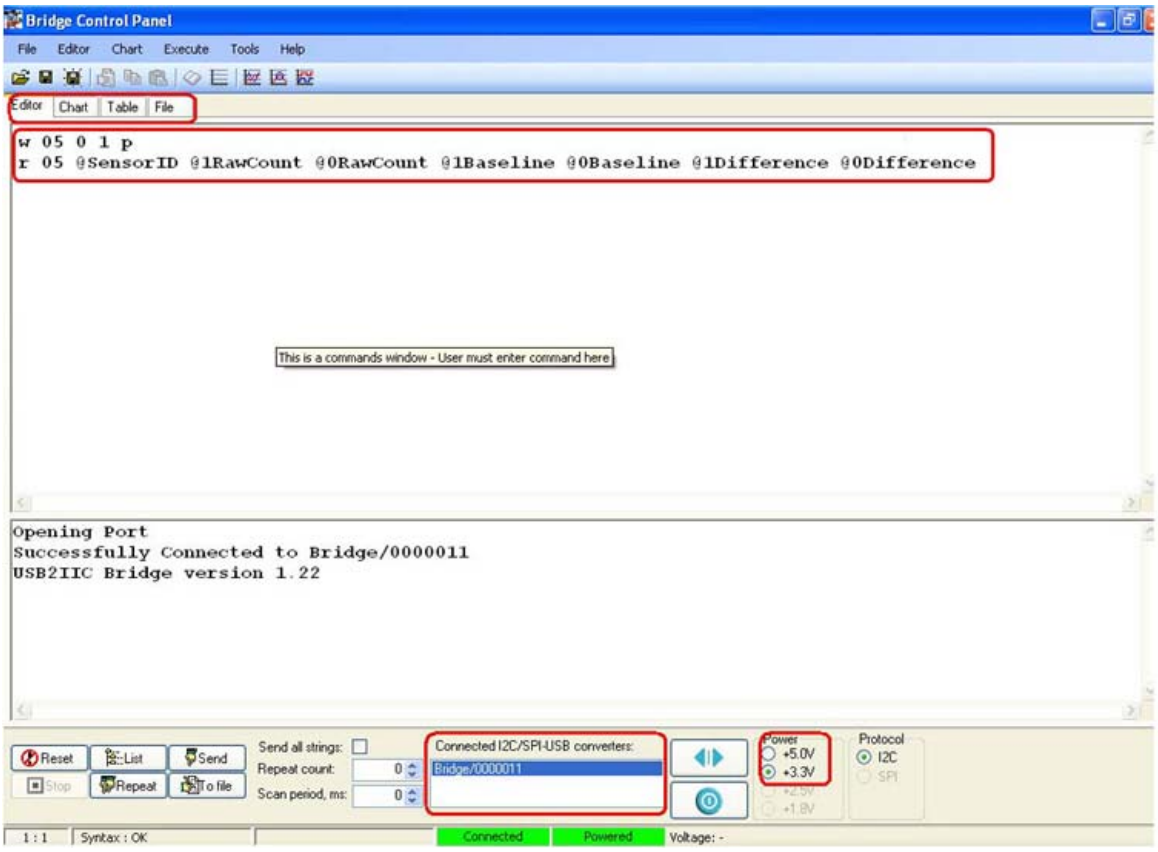
Note For more details on PSoC Programmer, go to the Programmer user guide at:

`<Install_directory>\Cypress\Programmer\<version>\Documents.`

2.4 Bridge Control Panel

1. Click **Start > All Programs > Cypress > Bridge Control Panel <version>> Bridge Control Panel <version>**
2. Select 5.0 V from the **Power Setting** box (see Figure 2-9).
3. Select the device to be connected from the port window.
4. Click the **Variable Settings** option from the Chart menu; click **Load**, and navigate to and open the **.ini* file.
5. Select **File > Open**; navigate to and open the **.iic* file. The **.iic* file contents appear on the Editor pane of the Bridge Control Panel.

Figure 2-9. Selecting the Bridge



Note For more details on the BCP, view the help topics from the Bridge Control Panel Menu bar.

2.5 Install Hardware

This kit does not require any hardware installation.

3. Kit Operation

3.1 Introduction

The CY3280-24x94 UCC connects to any CY3280 Universal CapSense Module board. This kit requires PSoC Designer for development, PSoC Programmer for programming, and Bridge Control Panel to test and tune the CapSense parameters.

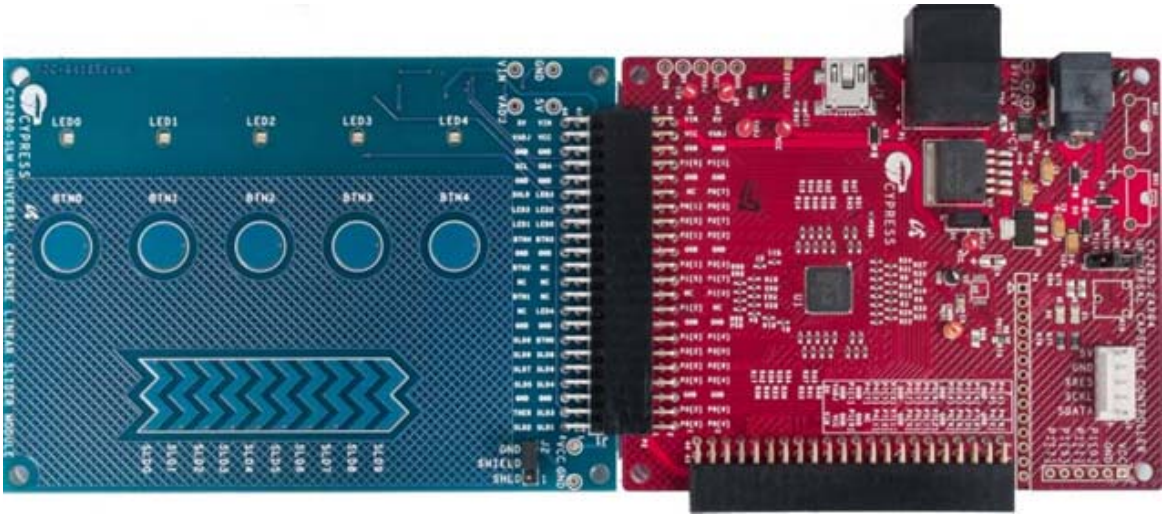
3.2 Hardware Requirement

- CY3280-24x94 UCC board (PSoC Device ID: CY8C24094-24LTXI)
- CY3280-SLM (linear slider module) board
- CY3217-MiniProg1
- CY3240-I2USB Bridge Board
- USB A to Mini-B cable

3.3 CapSense Module Board Connection

The CapSense Module Board can be connected to the controller through Port P2 of the controller and J1 of the CY3280-SLM Universal CapSense linear slider module.

Figure 3-1. Connecting CapSense Module Board to Universal CapSense Controller

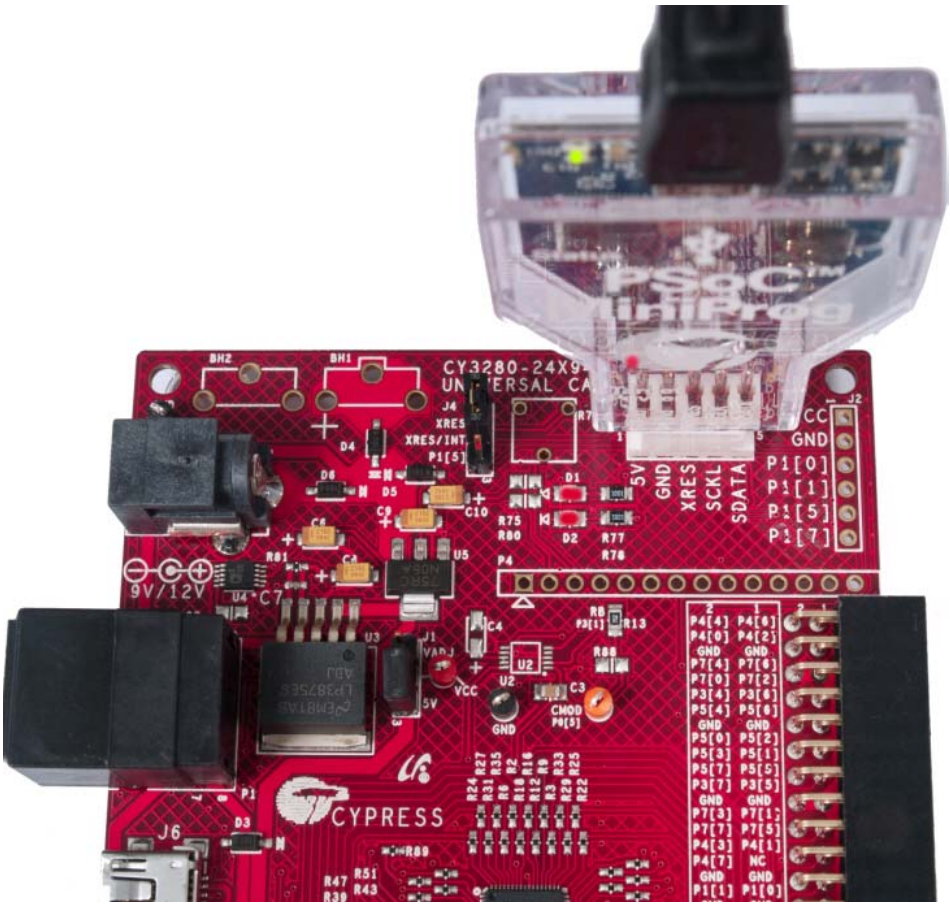


On the CY3280-24x94 UCC board, place shunts on pins 1 to 2 of J4 (XRES select). On the CY3280-SLM Universal CapSense Linear Slider Module, place a shunt on pins 2 and 3 of J2.

3.4 Programming Device

The CY3280-24x94 UCC is programmed using a MiniProg1 provided with the kit.

Figure 3-2. MiniProg 1 Connected to Controller



1. Connect the CY3280-24x94 ISSP connector (J3) to your computer using the PSoC MiniProg 1 and a USB cable (A to Mini B). Use PSoC Programmer for programming.
2. Connect pin 2 of J1 with a jumper to pin 3 to allow power to be supplied by the MiniProg1.
3. LED D1 on the CY3280-24x94 UCC is ON when the board is powered from a 12 V DC supply, USB, 9 V battery, PSoC MiniProg, I2USB Bridge, or VADJ. LED D2 lights up once the board is powered by any of the power sources (12 V DC supply, USB, 9 V battery, PSoC MiniProg, I2USBBridge, ICE Cube, or VADJ).
4. Program the *CY3280_24x94_Project1.hex* file from the kit CD or from the location `<Install_directory>\Cypress\CY3280-24x94\<version>\Firmware\CY3280_24x94_Project1\CY3280_24x94_Project1.hex` on to the CY3280-24x94 UCC board using MiniProg1 in the Power Cycle Mode. While programming is in progress, the Target Power LED on the MiniProg 1 is ON (see Figure 3-2).
5. When **Programming Succeeded** appears in the Actions pane, detach the MiniProg 1 and connect an I2USB Bridge to ISSP connector.

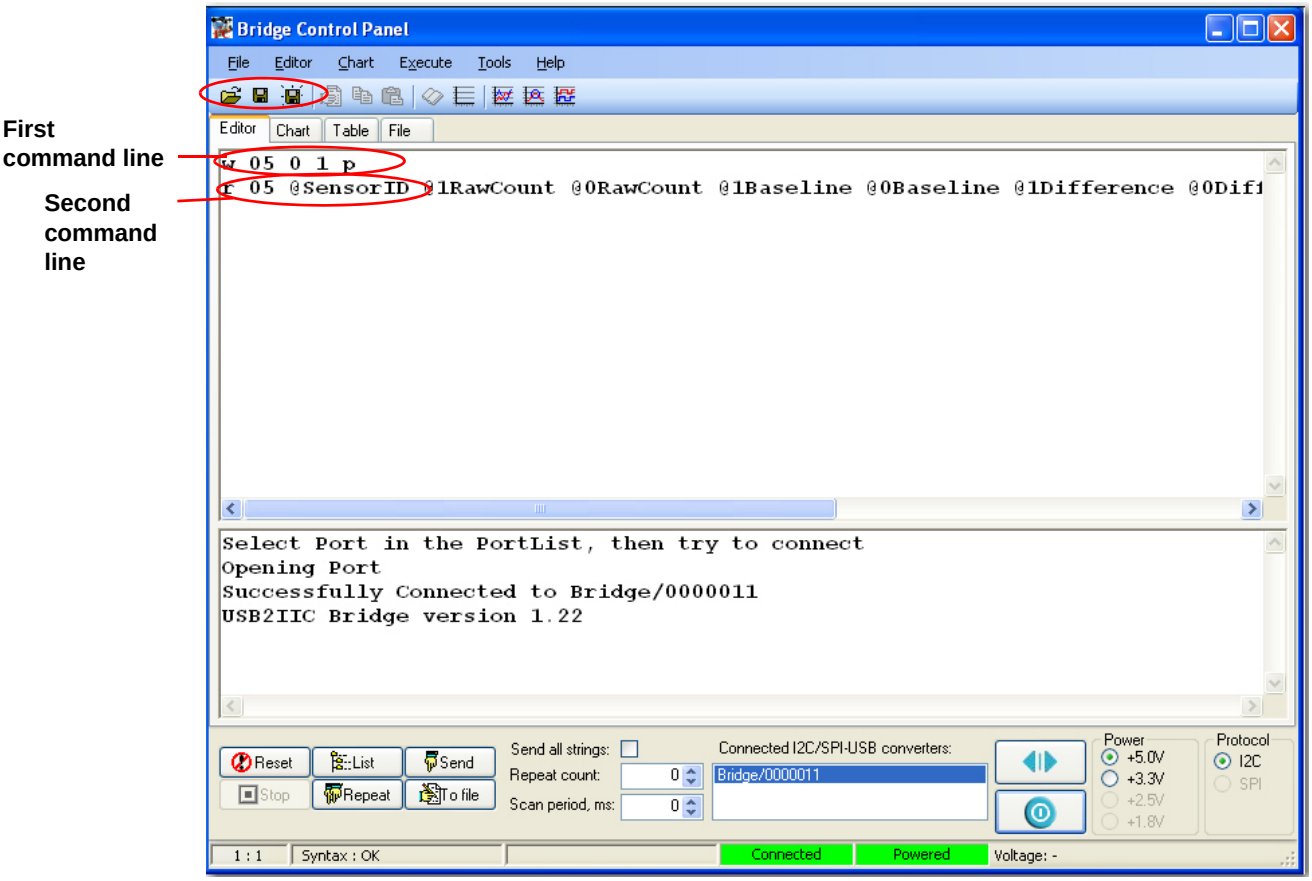
3.5 Bridge Control Panel

The I2USB Bridge is used to get the CapSense parameters from the controller board. You can view these parameters using the BCP software. Follow these steps to use BCP with the CY3280-24x94 UCC board:

1. Open Bridge Control Panel from **Start > All Programs > Cypress > Bridge Control Panel <version> > Bridge Control Panel<version>**.
2. Select the device to be connected from the port selection window.
3. Select **Variable Settings** option from the Chart menu. Load the *.ini* file, by clicking the **Load** button. The *CY3280_SLM_Project1.ini* file is the variable setting file, available in the kit CD or at the following location: `<Installed_directory>\Cypress\CY3280-24x94\<version>\Firmware\USB-I2CBridgeSoftwareConfig.`
4. Load the *CY3280_SLM_Project1.iic* file for iic commands that can be sent to the board. The *.iic* file is the configuration setting file, available in the kit CD or at the following location: `<Installed_directory>\Cypress\CY3280-24x94\<version>\Firmware\USB-I2CBridgeSoftwareConfig.`
5. Go to **File** > **Open File** > **CY3280_SLM_Project1.iic** to select the file for iic commands.
6. Select **+5 V** in the **Power Settings** box.
7. Click **Toggle Power** to power the I2USB Bridge; the red LED D1 glows.
8. Send the commands in the Editor pane to the controller board.

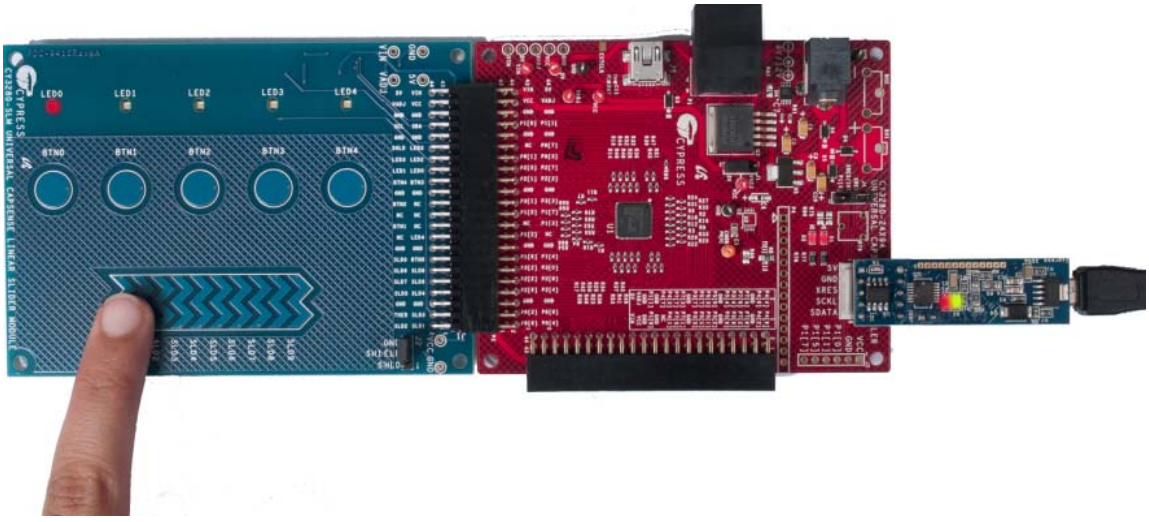
Note PSoC Designer and PSoC Programmer must be closed before opening Bridge Control Panel.

Figure 3-3. Bridge Control Panel Editor View



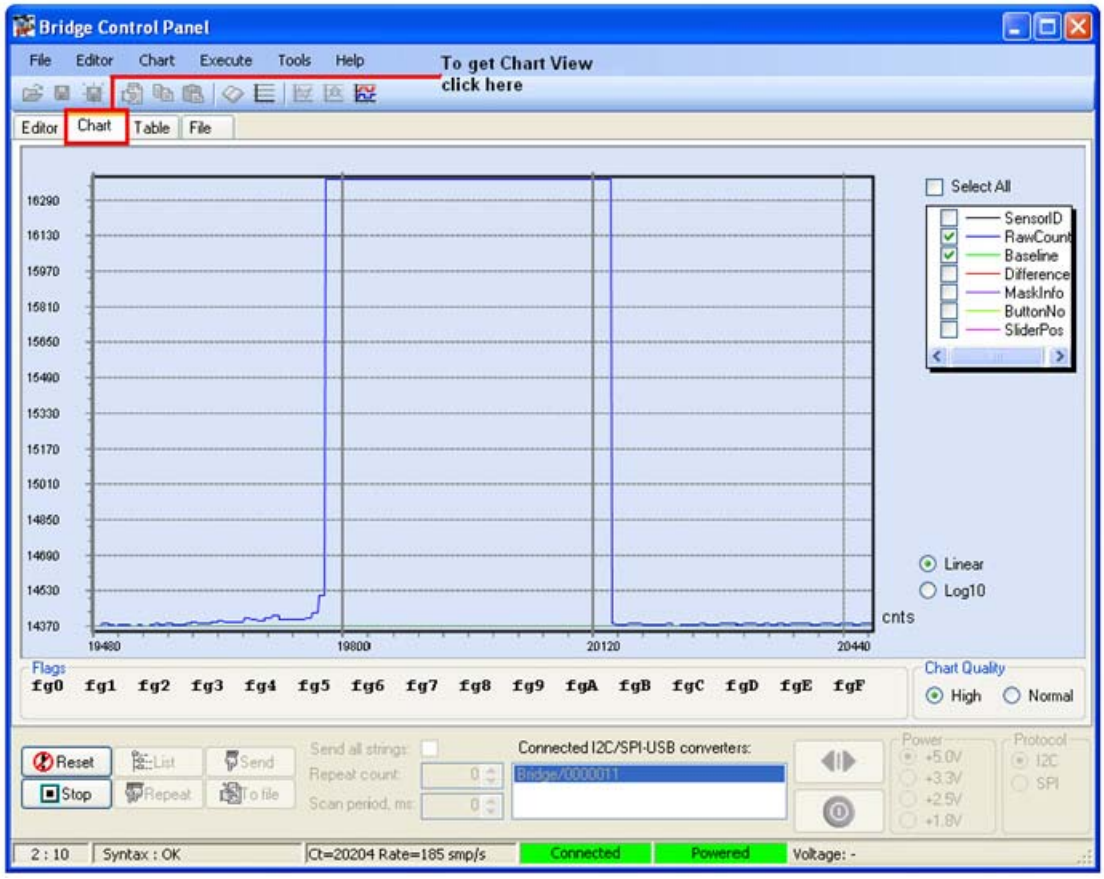
9. Click **Send** to send commands to the controller board; click **Repeat** to get parameters continuously from the controller.
10. Touch a button or slider. Each touch lights up the associated LED on the module board, representing where your finger is on the slider.

Figure 3-4. LED Glows on Touching Sensor SLD1



11. Click **Chart** to switch to Chart view and see the respective waveforms of CapSense parameters.

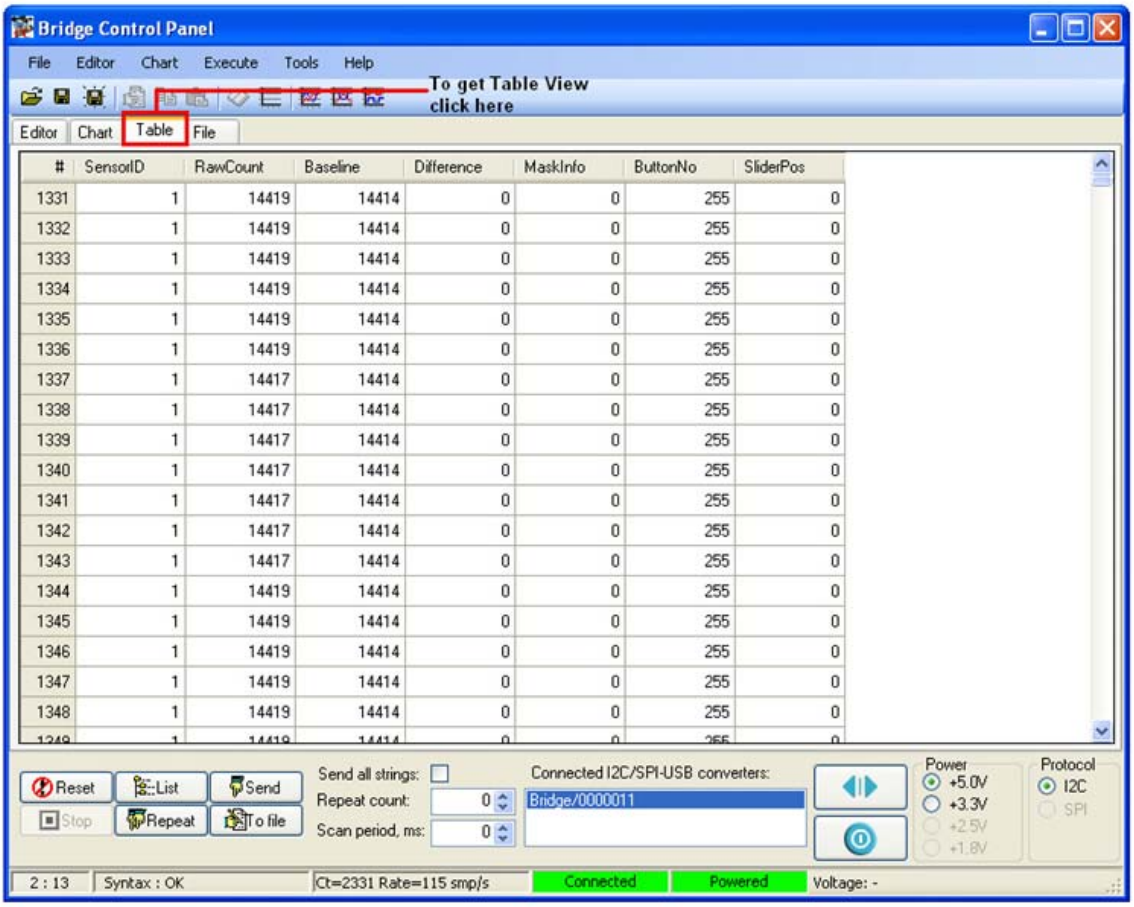
Figure 3-5. Bridge Control Panel Chart View



Note In this figure, the brown line represents the axis; the blue line indicates RawCount, and the green line indicates the Baseline.

12. View the required parameters by selecting or clearing the check boxes to the right of the Chart view.
13. Click **Stop** to stop scanning.
14. Click **Table** to view the values of the demonstration board variables.

Figure 3-6. Bridge Control Panel Table View



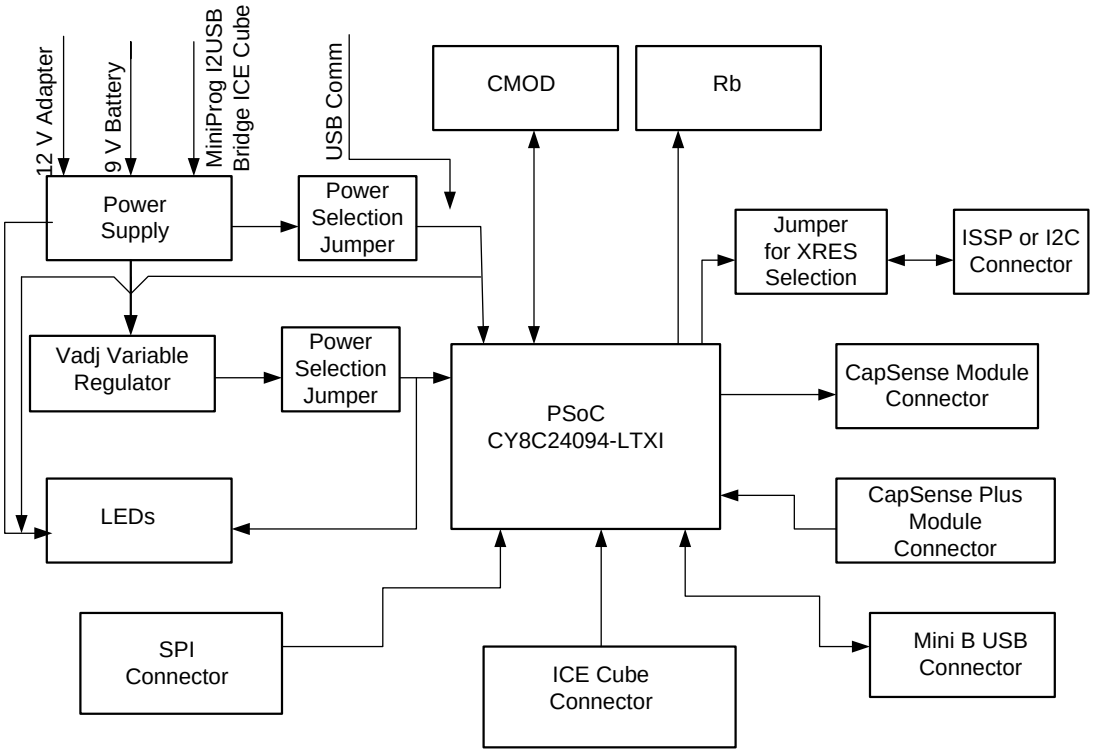
4. Hardware

4.1 System Block Diagram

The CY3280-24x94 UCC board has the following sections:

- PSoC CY8C24094-24LTXI
- Power supply system
- USB Mini B connector
- CapSense module connector
- ISSP/I2C connector
- ICE-Cube debug connector
- VADJ variable regulator control
- LEDs
- Reset switch
- CMOD

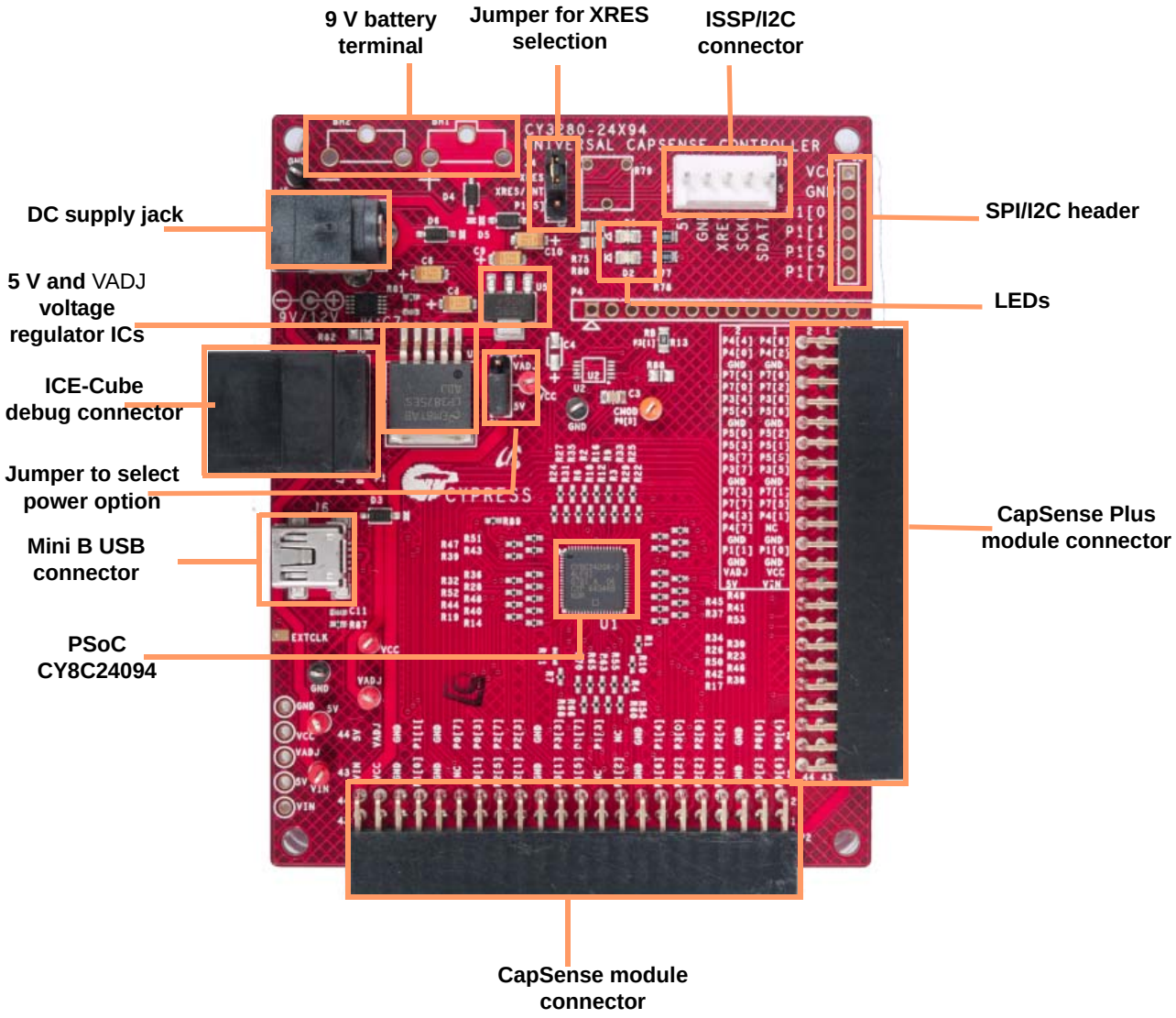
Figure 4-1. System Block Diagram



4.2 Functional Description

The CY3280-24x94 UCC includes PSoC CY8C24094-24LTXI, ISSP/I2C connector, CapSense Module connector, CapSense plus Module Connector, Mini B USB connector, DC Supply jack, and ICE-Cube debug connector. The following figure shows the different functional blocks on the CY3280-24x94 UCC board.

Figure 4-2. CY3280-24x94 UCC Functional Blocks



4.2.1 PSoC CY8C24094-24LTXI

The PSoC CY8C24094 is initially factory programmed as a CapSense controller with the control circuitry to work with the CY3280-24x94 UCC kit. The PSoC CY8C24094 along with CSD technology demonstrates the use of CapSense buttons and linear sliders. The module board connected to the CY3280-24x94 Universal CapSense Controller has sensors and LEDs.

The CapSense module board is connected to PSoC through Port P2. The list of pins connected to different ports is shown in Table 4-1.

PSoC CY8C24094 is programmed through ISSP using a MiniProg and the data acquisition and output checking is done using I2USB Bridge.

Figure 4-3. Schematic View of PSoC CY8C24094 24LTXI

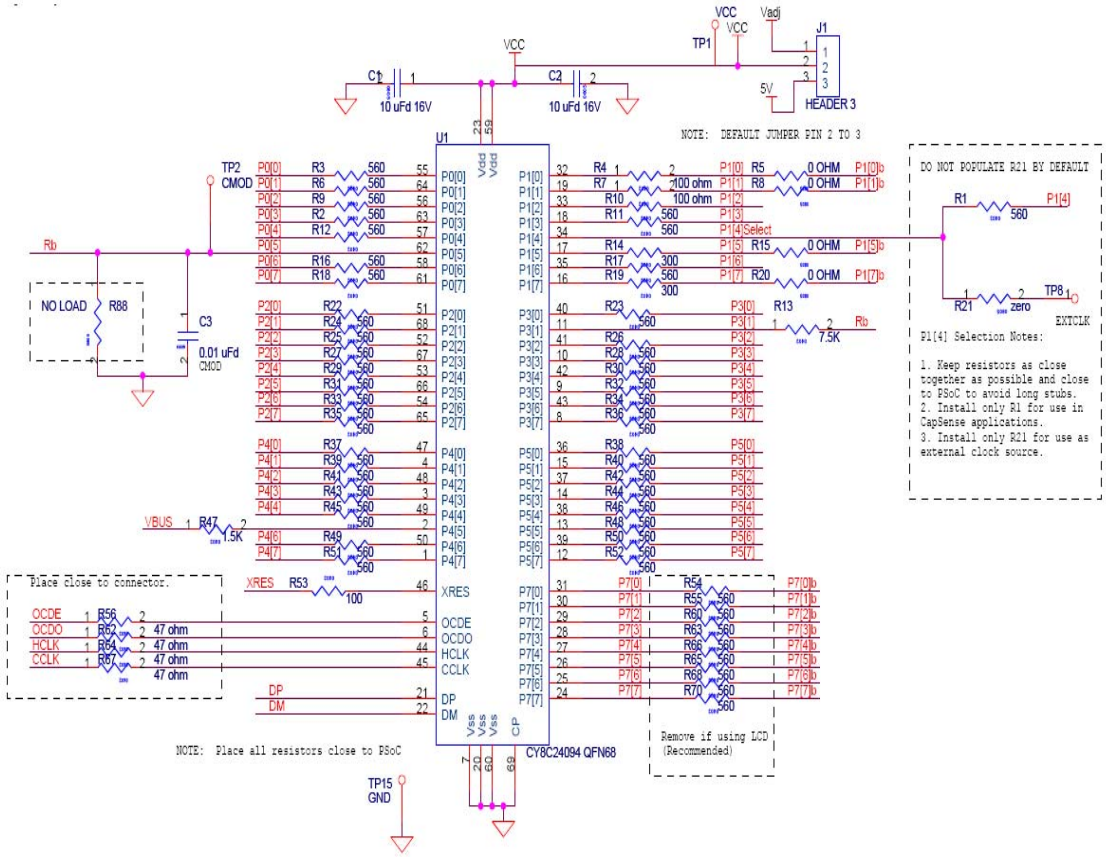


Table 4-1. Pin Description of CY8C24094-24LTXI

Pin Number	Name	Description	Connect to
1	P4[7]	GPIO	P3
2	P4[5]	Vbus in USB Connector	J6
3	P4[3]	GPIO	P3
4	P4[1]	GPIO	P3
5	OCDE	OCD mode direction pin	P1
6	OCDO	OCD mode direction pin	P1
7	Vss	Ground Connection	
8	P3[7]	GPIO	P3
9	P3[5]	GPIO	P3
10	P3[3]	CapSense	P2
11	P3[1]	Rb (bleed Resistor)	P2
12	P5[7]	GPIO	P3
13	P5[5]	GPIO	P3
14	P5[3]	GPIO	P3
15	P5[1]	GPIO	P3
16	P1[7]	I2C Serial Clock (SCL)	P2
17	P1[5]	I2C Serial Data (SDA)	P2
18	P1[3]	CapSense	P2
19	P1[1]	I2C SCL, ISSP Clock	P2,P3,J2,J3
20	Vss	Ground Connection	
21	D+	USB D+	J6
22	D-	USB D-	J6
23	Vdd	Supply Voltage	
24	P7[7]	GPIO	P3
25	P7[6]	GPIO	P3
26	P7[5]	GPIO	P3
27	P7[4]	GPIO	P3
28	P7[3]	GPIO	P3
29	P7[2]	GPIO	P3
30	P7[1]	GPIO	P3
31	P7[0]	GPIO	P3
32	P1[0]	I2C SDA, ISSP Data	P2,P3,J2,J3
33	P1[2]	GPOI,LED4	P2
34	P1[4]	CapSense	P2

Table 4-1. Pin Description of CY8C24094-24LTXI *(continued)*

Pin Number	Name	Description	Connect to
35	P1[6]	CapSense	P2
36	P5[0]	GPIO	P3
37	P5[2]	GPIO	P3
38	P5[4]	GPIO	P3
39	P5[6]	GPIO	P3
40	P3[0]	CapSense	P2
41	P3[2]	CapSense	P2
42	P3[4]	GPIO	P3
43	P3[6]	GPIO	P3
44	HCLK	OCD high speed clock output	P1
45	CCLK	OCD CPU clock output	P1
46	XRES	Active high external reset with internal pull down	J4
47	P4[0]	GPIO	P3
48	P4[2]	GPIO	P3
49	P4[4]	GPIO	P3
50	P4[6]	GPIO	P3
51	P2[0]	CapSense	P2
52	P2[2]	CapSense	P2
53	P2[4]	CapSense	P2
54	P2[6]	CapSense	P2
55	P0[0]	GPIO	P2
56	P0[2]	CapSense	P2
57	P0[4]	CapSense	P2
58	P0[6]	CapSense	P2
59	Vdd	Supply Voltage	
60	Vss	Ground Connection	
61	P0[7]	Shield Electrode	P2
62	P0[5]	Integrating Input	
63	P0[3]	GPIO,LED3	P2
64	P0[1]	GPIO,LED2	P2
65	P2[7]	GPIO,LED1	P2
66	P2[5]	GPIO,LED0	P2
67	P2[3]	CapSense	P2
68	P2[1]	CapSense	P2

4.2.2 Power Supply System

The power supply system on this board is versatile; it takes input supply from the following sources:

- 12 V DC supply using connector J5
- 9 V battery connector using connectors BH1 and BH2
- USB power (5 V) from communications section using connector J6
- Power from MiniProg and I2USB Bridge connected at J3
- Power from ICE Cube connected at P1

The board power domain is split into:

- Vin rail: This is the rail where the input of the on-board regulators is connected. This domain is powered by the power sources (12 V DC supply and 9 V battery terminal) through protection diodes.
- 5 V rail: This is the output of the 5 V regulator IC U5 and also from the devices such as MiniProg or I2USB Bridge. The rail is a fixed 5 V output regardless of any jumper settings. The voltage in this rail can be less than 5 V only when the board is powered by the USB power.
- VADJ rail: This is the output of the variable voltage regulator control. The following block diagram shows the structure of the power system on the board.
- VCC rail: This is the V_{DD} rail of CY8C24094 device. This is supplied either from a 5 V rail, VADJ rail, or ICE Cube debugger. The following block diagram shows the structure of the power system on the board.

Figure 4-4. Power Supply System Structure

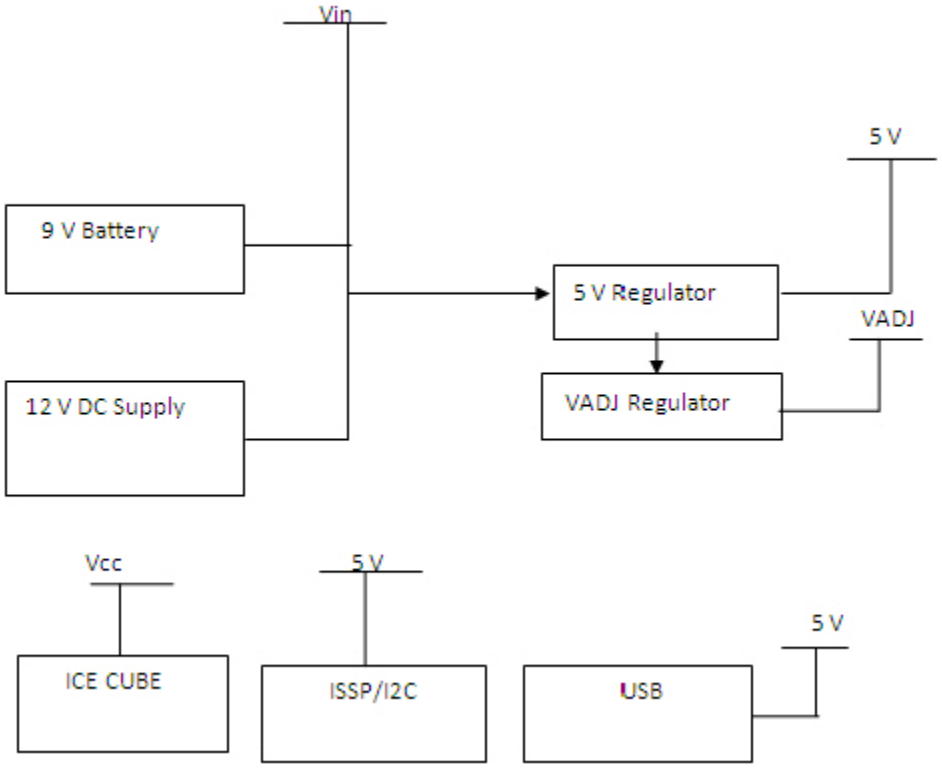
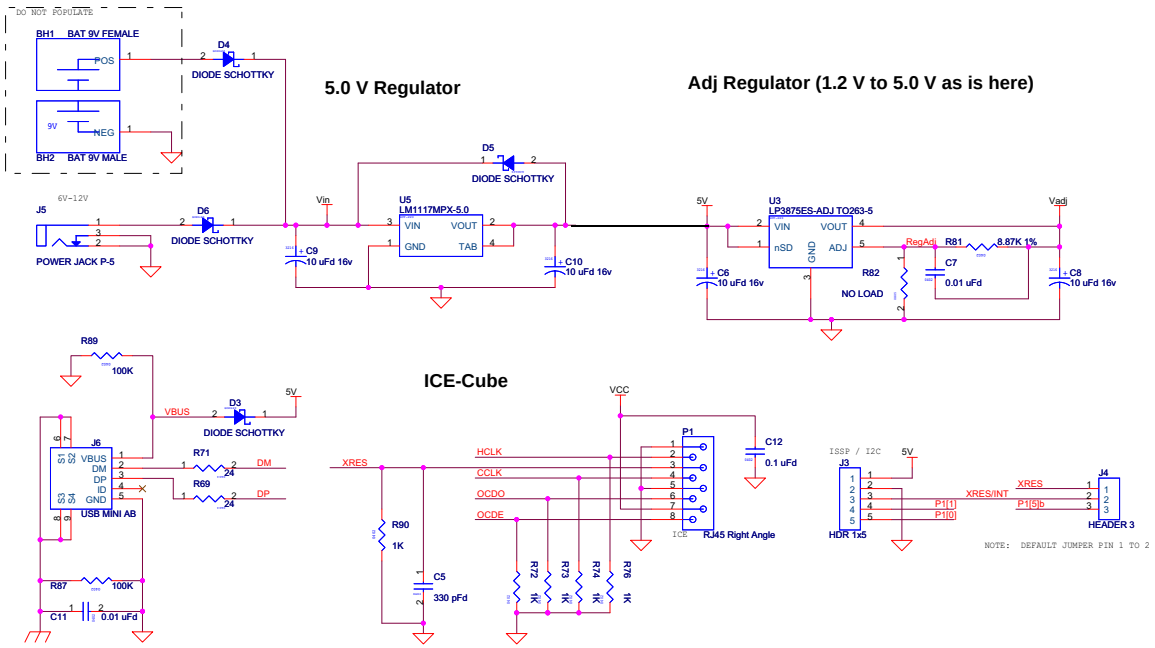


Figure 4-5. Schematic View of the Power Supply System Structure



4.2.2.1 *Power Supply Jumper Setting*

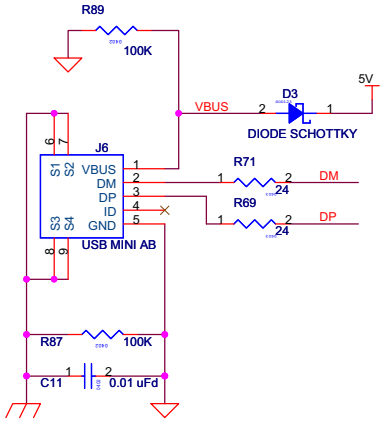
The jumper settings for each power setting are as follows:

1. To allow power to be supplied by the MiniProg, I2USB Bridge either connect pin 2 and pin 3 of J1 with a jumper or connect pin 2 and pin 1 of J1 with a jumper.
2. To allow power from the 12 V DC supply, 9 V battery terminal, or Mini B USB connector, connect pin 2 and 3 of J1 with a jumper.
3. To allow power from the variable regulator control (VADJ), connect the pin 1 and 2 of J1 with a jumper

4.2.3 USB Mini B Connector

The USB Mini B connector is a mini port used to communicate between the PC and the board and to power up the controller, supplying a voltage of 5 V. Protection diode D3 ensures that the 5 V from the board does not flow to the USB connector.

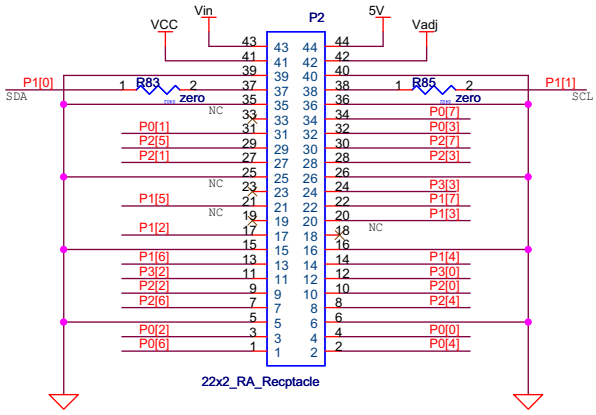
Figure 4-6. Schematic View of the USB Mini B Port



4.2.4 CapSense Module Connector

The CY3280-24x94 has an expansion port, P2. It is designed to connect CapSense module boards. The CY3280-24x94 controller board can be used with any of the Universal CapSense module boards. Universal CapSense module boards can be interfaced to the CY3280-24x94 controller through the 44-pin receptacle connector P2. The pin mapping for the port P2 is shown in the following figure.

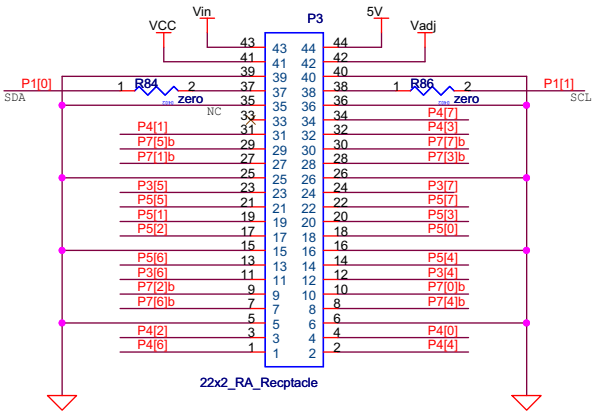
Figure 4-7. Schematic View of Port P2



4.2.5 CPM Connector (CapSense Plus Module Connector)

The CY3280-24x94 has an expansion port, P3. This port is designed to connect CY3280-CPM1 (CapSense Plus Module) to demonstrate CapSense Plus features of the CY8C24094 device. The pin mapping for the port P3 is shown in the following figure.

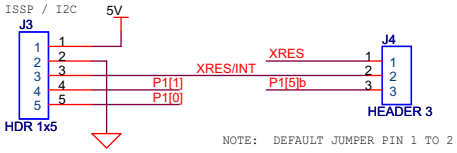
Figure 4-8. Schematic View of Port P3



4.2.6 ISSP/I2C Connector

In-System Serial Programmer (ISSP) is used to program the device using the MiniProg programmer device and the USB cable. Plug in the MiniProg device to the ISSP Header J3. The ISSP connector is also used to connect the I2USB Bridge to communicate between the PC and the controller board. XRES/INT of the ISSP/I2C header can be either connected to XRES of CY8C24094 by shorting Pin1 and Pin 2 of J4 using a jumper or it can be connected to P1[5] of CY8C24094 device by shorting Pin 2 and Pin 3 of J4 using a jumper. Refer to Power Supply Jumper Setting on page 29. The pin mapping for the ISSP connector is shown in the following figure.

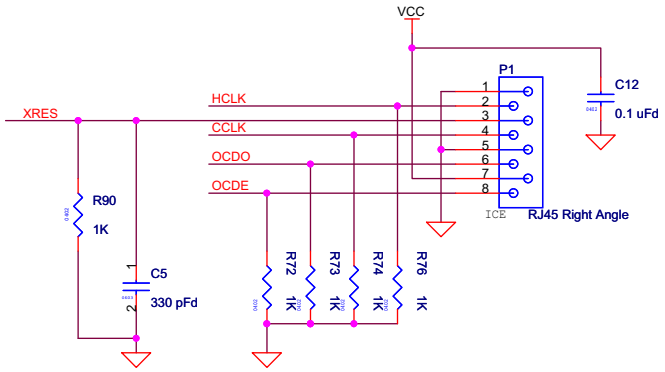
Figure 4-9. Schematic View of the ISSP Connector



4.2.7 ICE-Cube Debug Connector

The ICE-CUBE Debugger allows users to debug and view the content of specific memory locations. The ICE-Cube debugger can be connected to the CY3280-24x94 controller through port P1. The following figure shows the schematic view of the ICE-CUBE debug connector.

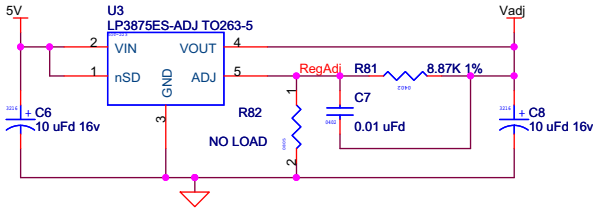
Figure 4-10. Schematic View of the ICE CUBE Connector



4.2.8 VADJ Variable Regulator Control

The CY3280-24x94 controller has a variable regulator control used to vary input voltage using the voltage regulator IC U3. The input for the variable regulator control is the output of the 5 V Regulator. VADJ is used to demonstrate CapSense at several voltages. Vout can be varied by using the digital potentiometer U3.

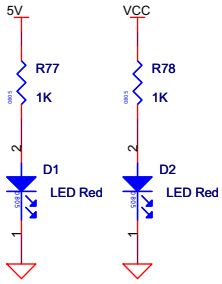
Figure 4-11. Schematic View of the VADJ Regulator



4.2.9 LEDs

The LEDs are used to show the status of the controller board. LED D1 lights up on connecting power supply from 12 V DC supply, USB, 9 V battery, PSoC MiniProg, I2USB Bridge, or VADJ. LED D2 lights up once the board is powered by any of the power sources (12 V DC supply, USB, 9 V battery, PSoC MiniProg, I2USB Bridge, ICE Cube, or VADJ).

Figure 4-12. Schematic View of the LEDs D1 and D2



4.2.10 CMOD

CMOD is the test point provided on the UCC for accessibility of charge and discharge waveforms of the measured capacitance.It is the test point for modulating capacitance C3. This test point may increase the noise sensitivity by acting as an antenna.

4.2.11 Rb

Rb is the bleed resistor connected to P3 [1] provided on UCC. This is one of the external components required for capacitive sensing on CY8C24094 24LTXI.

5. Code Examples

All code examples are available in the Firmware folder of the kit CD or at the following location:
`<Install_directory>\Cypress\CY3280-24x94\<version>\Firmware\`

5.1 My First Code Example

5.1.1 Project Description

This project demonstrates the use of the CapSense buttons and linear slider on the CY3280-SLM board using CSD technology and CY8C24x94. The EzI2C user module is used to transfer CapSense parameters related to a sensor from the board to the PC for monitoring.

This project scans five CapSense buttons and a 10-segment slider using the CSD user module. There are five LEDs on board, which illuminate when a CapSense button or slider is touched. The EzI2C user module is used to provide a register-based I2C slave communications protocol. The status of CapSense sensors (both button and slider) and their parameters are updated in the I2C register. This register can be accessed by any I2C master, similar to the I2USB Bridge.

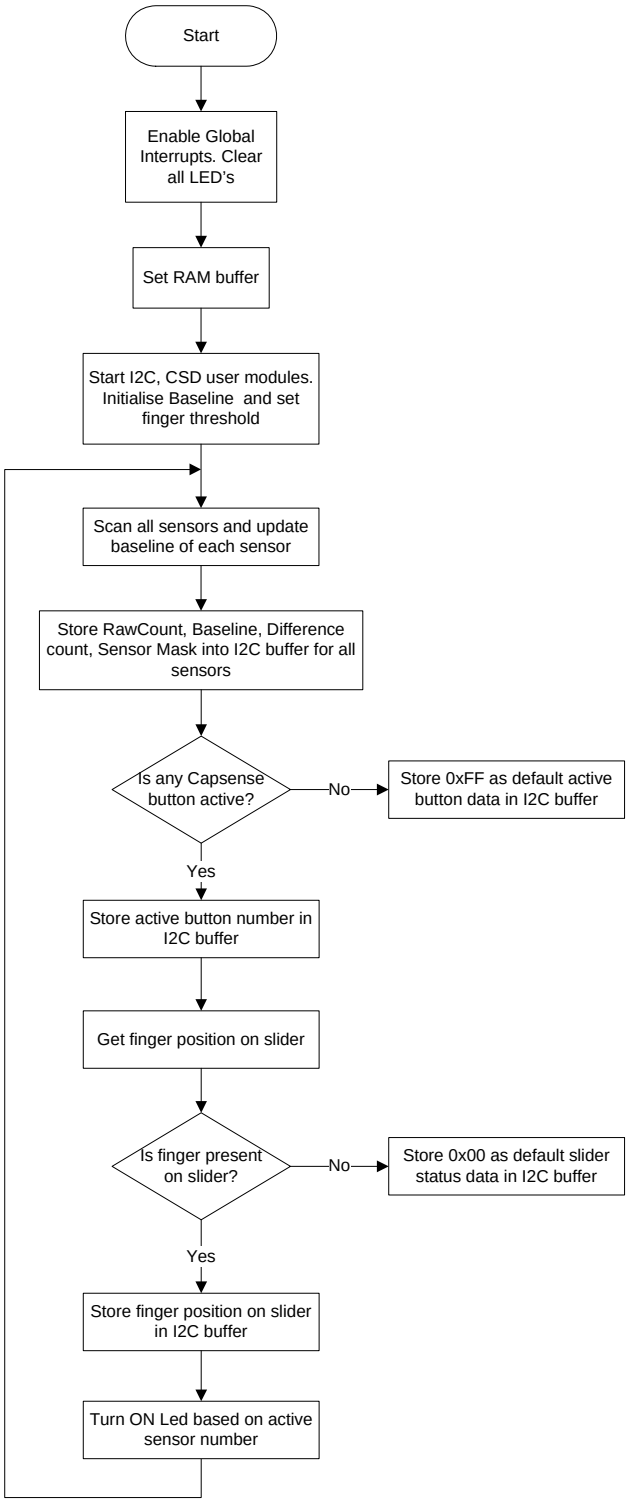
The application starts by executing *boot.asm*. The *boot.asm* does the hardware initialization and invokes the 'main' function. The main function initializes the EzI2C Slave user module and CapSense user module. After initialization, the main function enters a loop, which does the following:

- Scans all sensors
- Reads the sensor ID sent by the I2C master
- Stores CapSense data in the I2C registers
- Updates the LED status for the On/Off sensors

The following user modules are used in this project:

- **CSD**: The CSD provides capacitance sensing using the switched capacitor technique with a sigma-delta modulator to convert the sensed switching capacitor current to digital code.
- **EzI2Cs**: The EzI2Cs user module implements an I2C register-based slave device.This user module does not require any digital or analog PSoC blocks. It is used to transfer all CapSense parameters related to a sensor to the PC for monitoring.

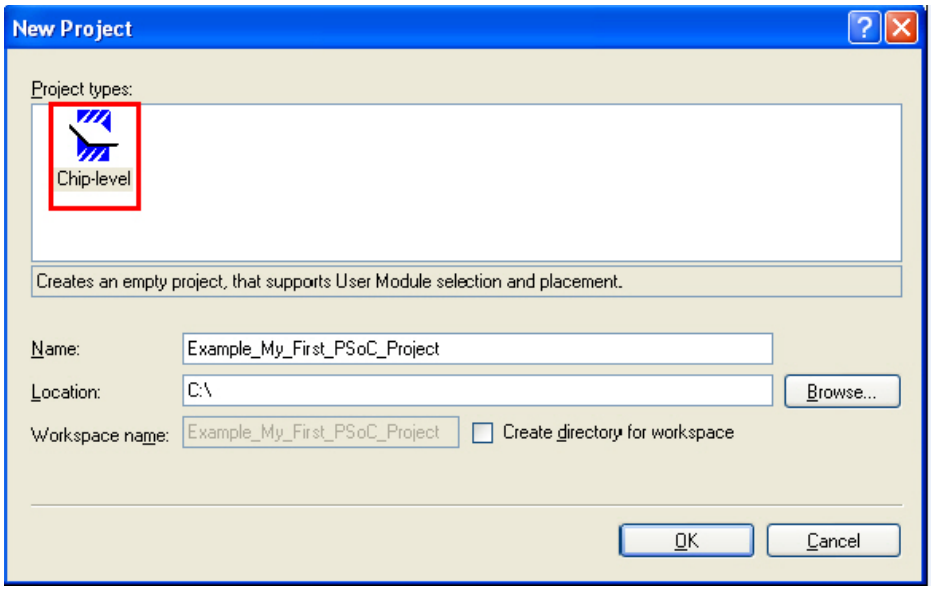
5.1.2 FlowChart



5.1.3 Creating My First PSoC 1 Project

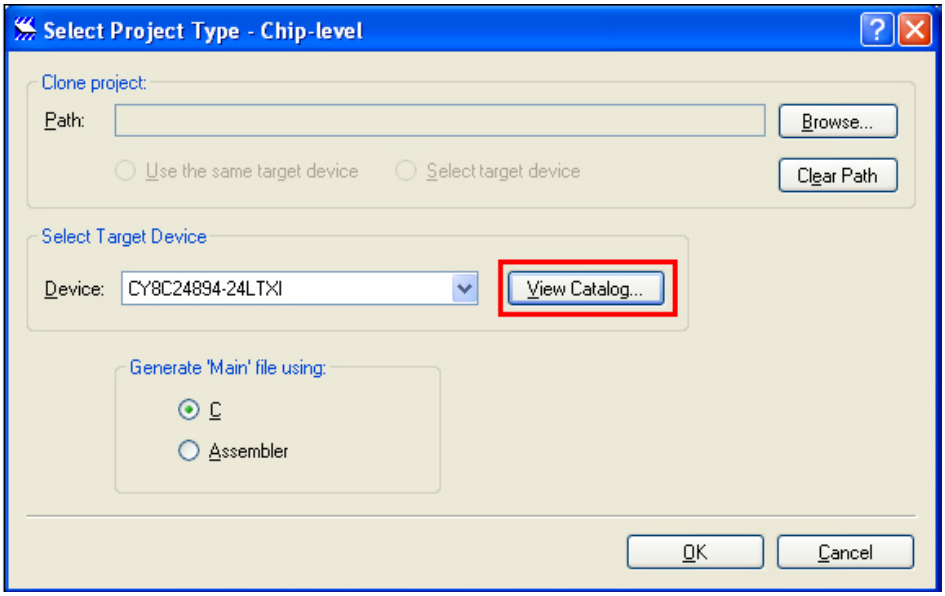
1. Open PSoC Designer.
2. To create a new project, click **File > New Projec**t. The **New Project** window opens.
3. In the **New Project** window, select the **Chip-level** icon. Name the project **Example_My_First_PSoC_Project**.
4. For **Location**, click **Browse** and navigate to the directory in which you want to create the project.

Figure 5-1. New Project Window



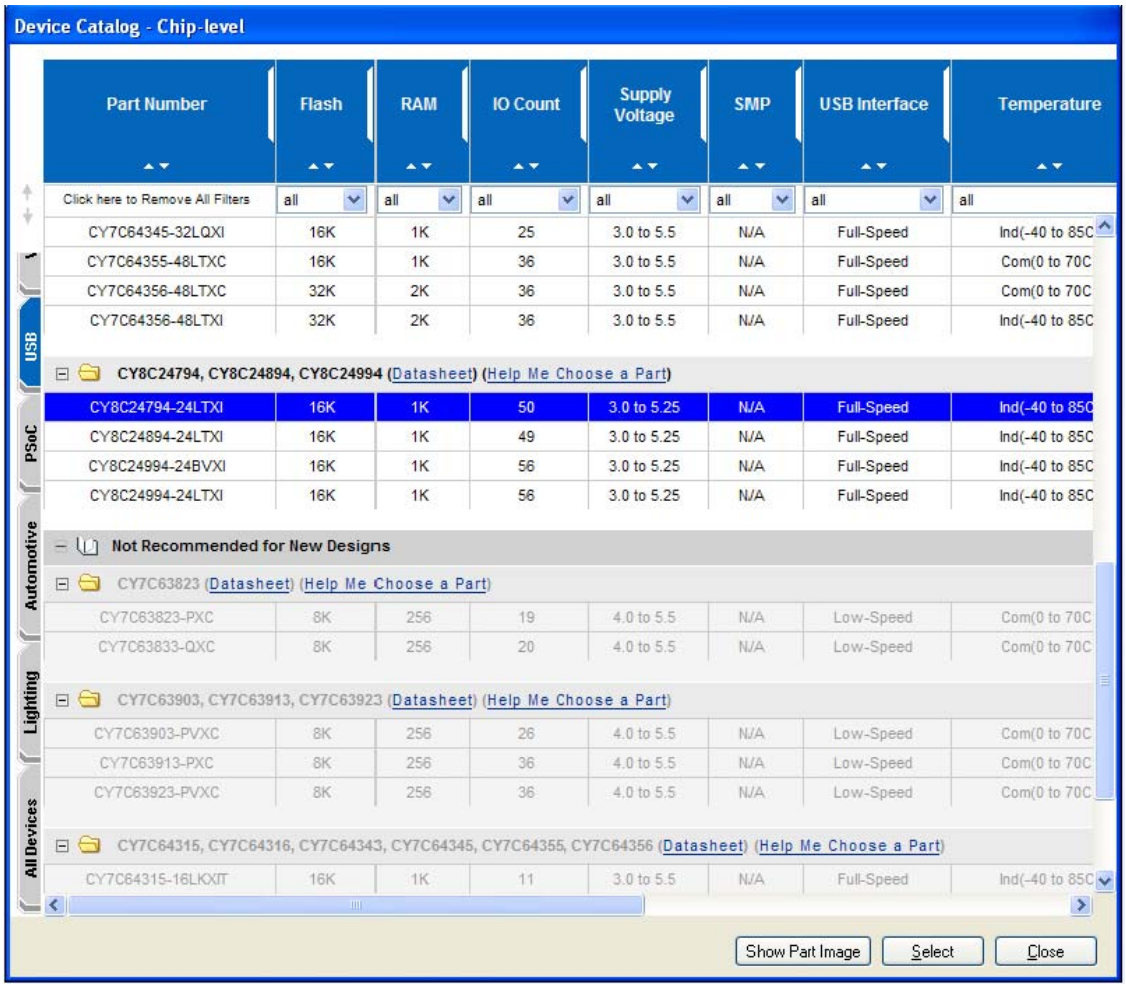
5. Click **OK**. The **Select Project Type** window opens.
6. In this window under **Select Target Device**, click **View Catalog**.

Figure 5-2. Select Project Type Window



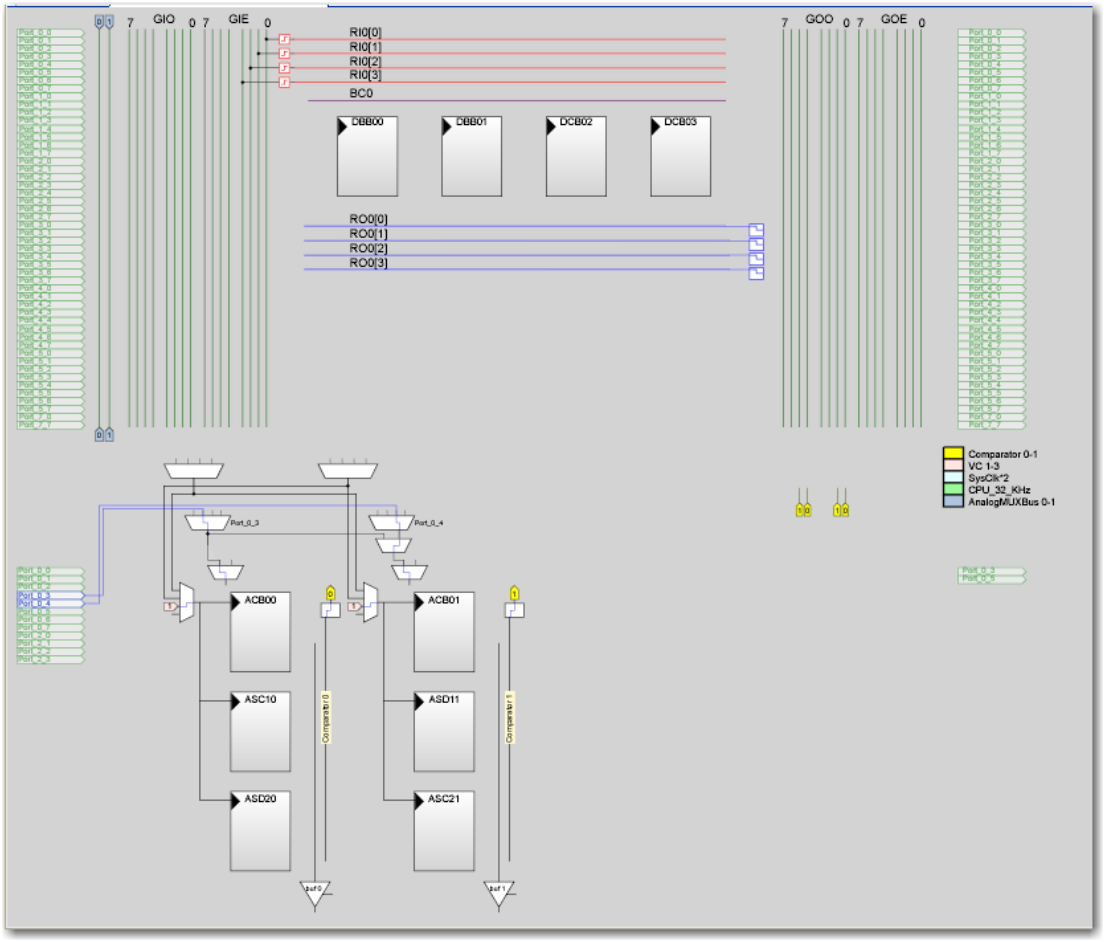
7. The **Device Catalog** window opens. Click on the **USB** tab, and scroll down to the **CY8C24794, CY8C24894, CY8C24994** section.
8. For this project click **CY8C24794-24LTXI** and then click **Select**.

Figure 5-3. Device Catalogue Window



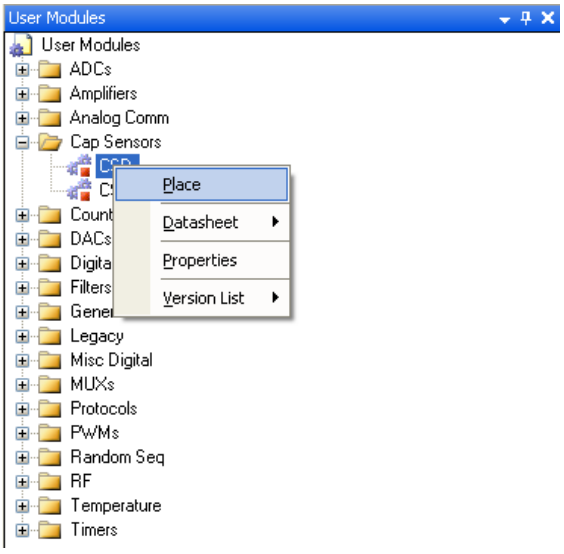
9. Under **Generate 'Main' File Using**: select **C**, and then click **OK**.
10. By default, the project opens in chip view.

Figure 5-4. Default View



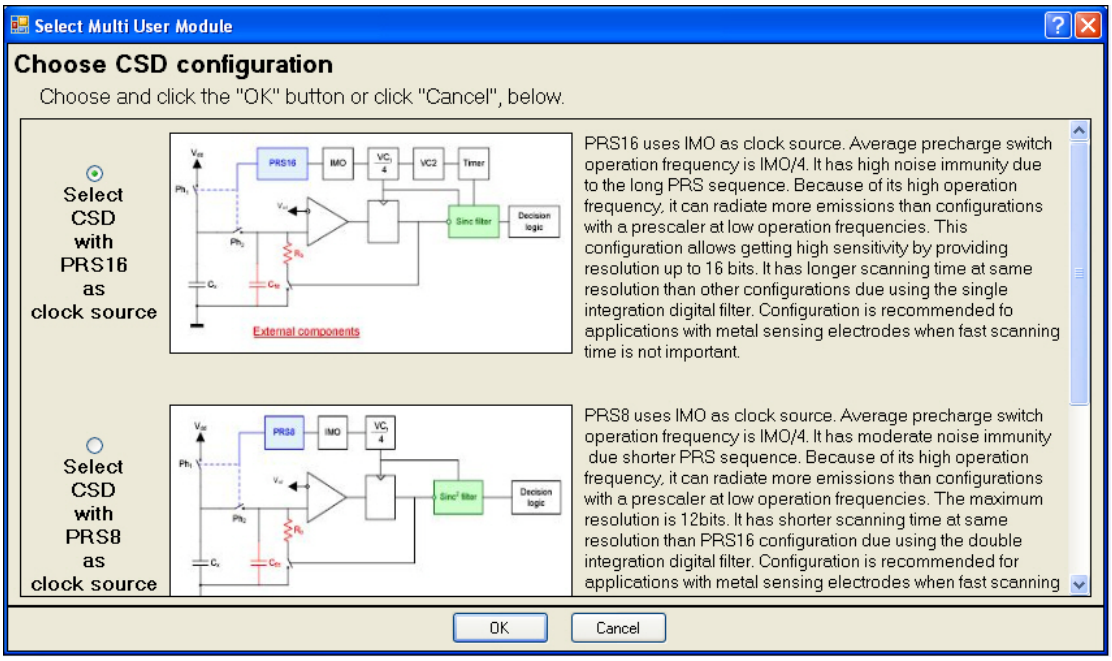
11. Now, place and configure the modules required for this design. Connect the modules together and to the pins of the PSoC. In the **User Modules** window, expand the **Cap Sensors** folder. In this folder right click on **CSD** and select **Place**.

Figure 5-5. User Modules Window - CSD Select



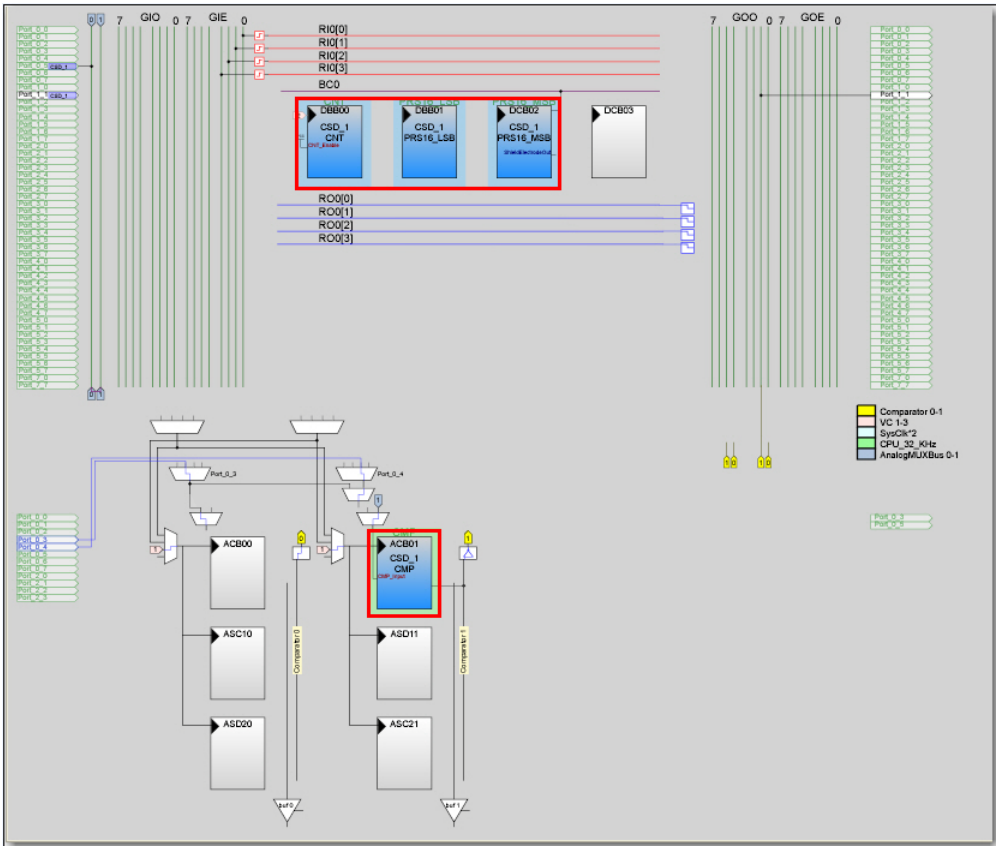
12. A window to choose the CSD configuration opens. Choose **Select CSD with PRS16 as Clock Source** configuration and click **OK**.

Figure 5-6. CSD Configuration



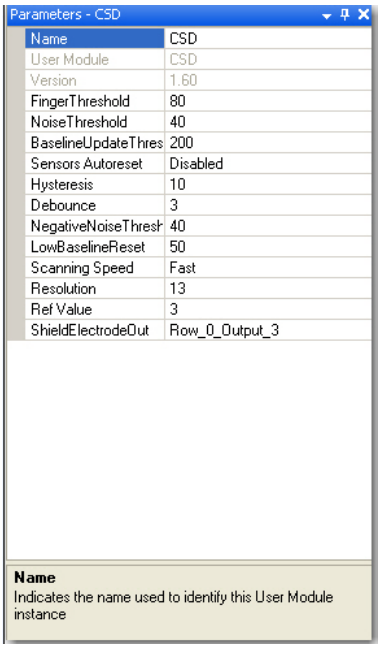
13. The CSD user module gets placed.

Figure 5-7. CSD User Module Placement



14. Configure the CSD_1 properties as shown in Figure 5-8.

Figure 5-8. CSD User Module Properties



15. To select the **CSD Wizard** option, right click on CSD user module to assign pins to the sensors.

Figure 5-9. Open CSD Wizard

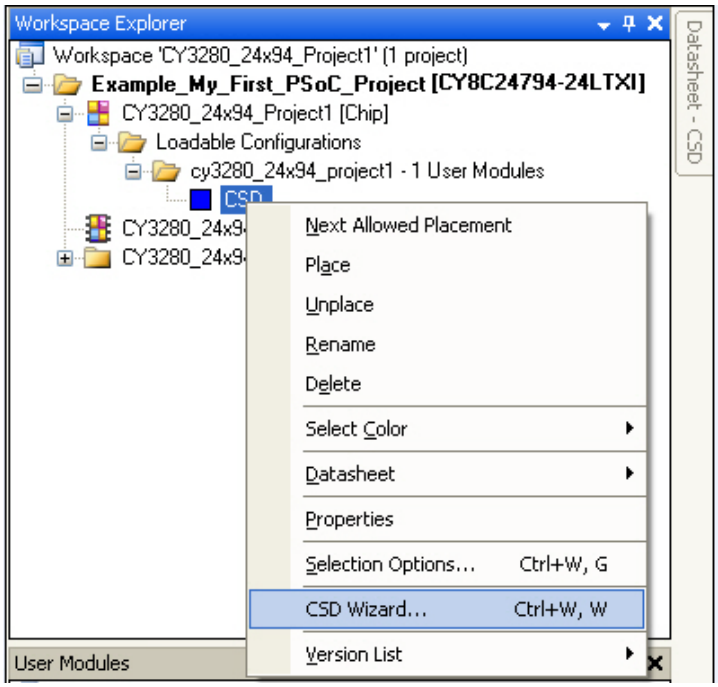
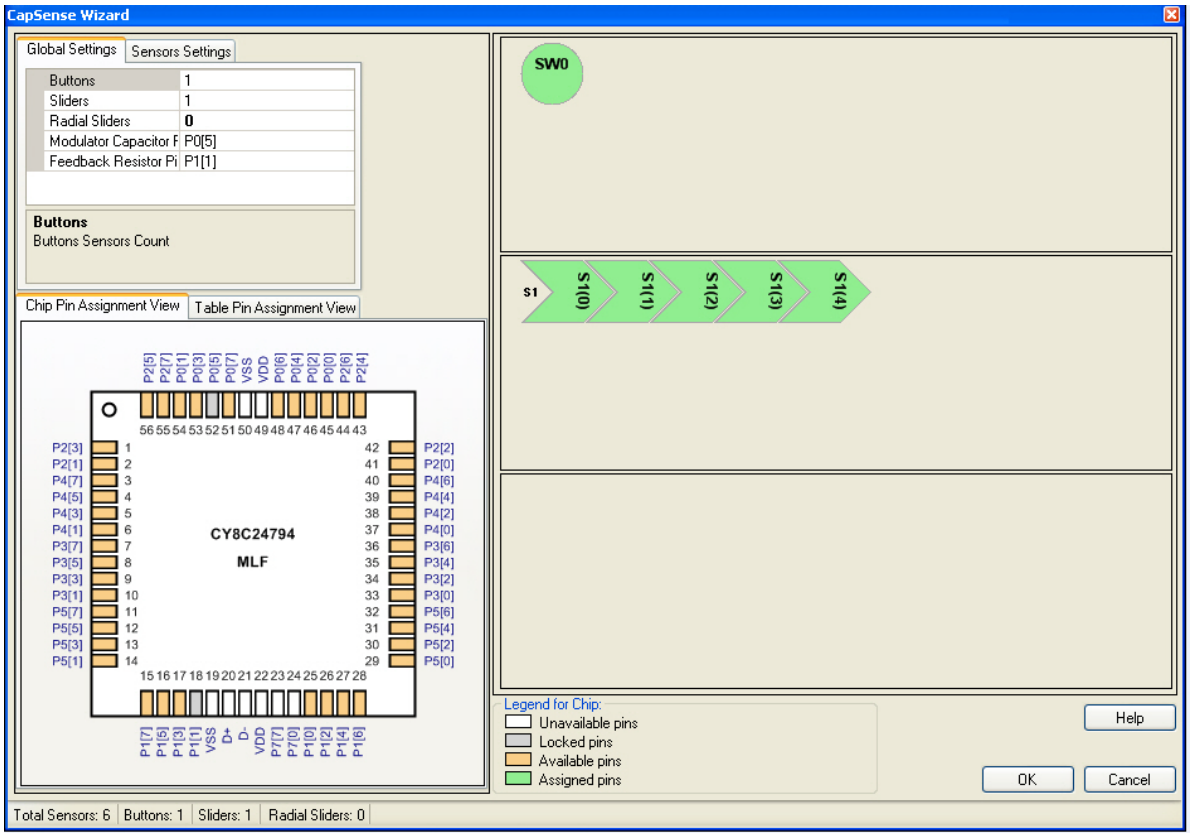
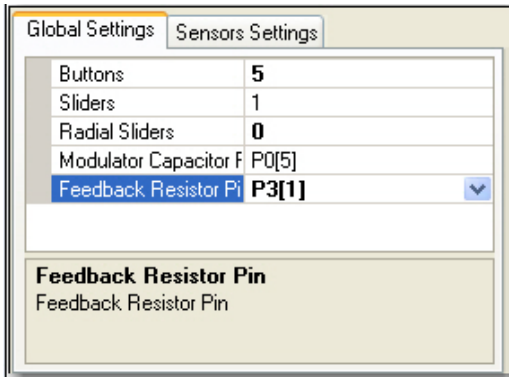


Figure 5-10. CSD Wizard Window



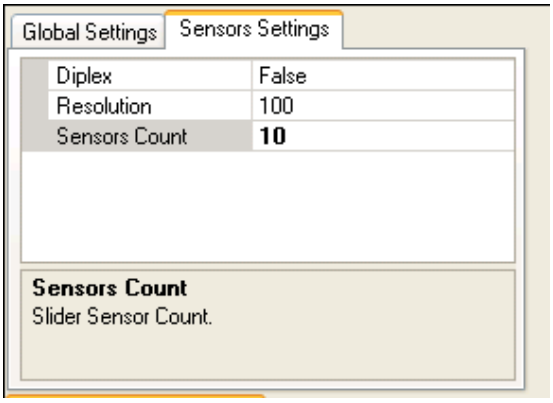
16. Configure the Global Settings in the CSD Wizard window.

Figure 5-11. Global Settings - CSD Wizard



17. Click on the slider in the CSD Wizard to view the **Sensor Settings**. Configure the sensor settings.

Figure 5-12. Sensors Settings - CSD Wizard



18. To assign the sensor on a particular pin, click and drag from the sensor block to the required pin in the **Pin Assignment** window. Drag and drop SW0 to pin P1 [6]. The assignment of the sensor pins can be done in either **Chip Pin Assignment View** (Figure 5-13) or **Table Pin Assignment View** (Figure 5-14).

Figure 5-13. Assigning Sensors to Pins - Chip Pin Assignment View

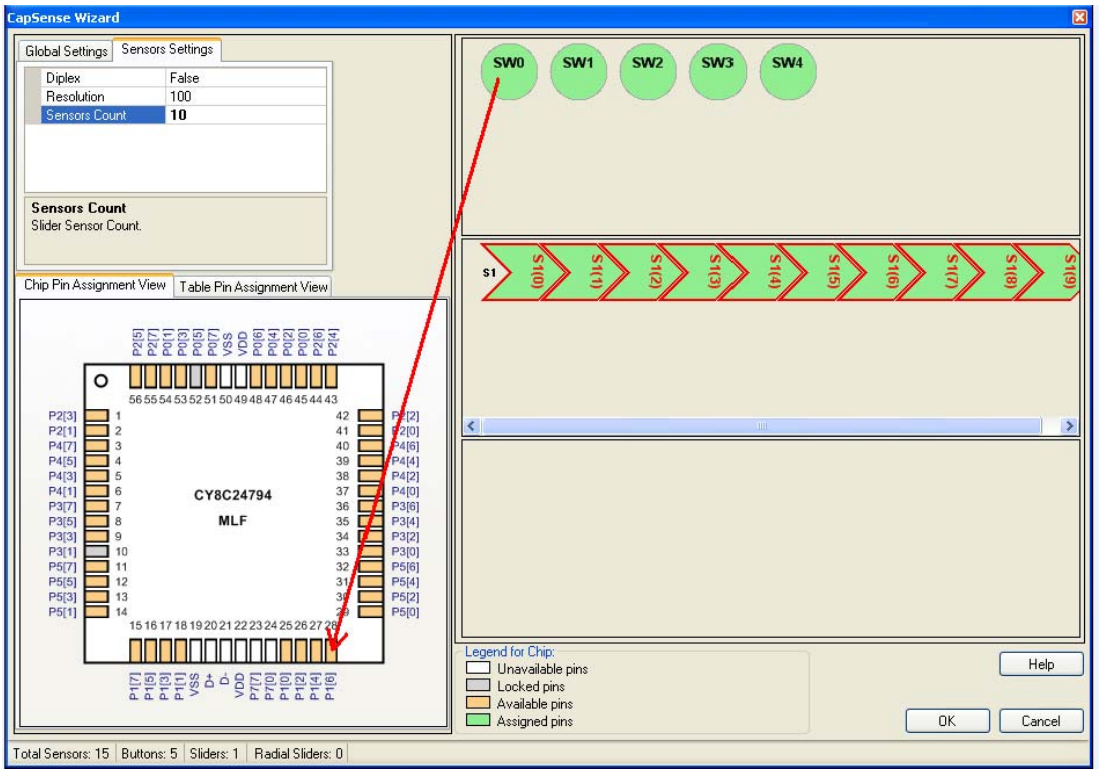
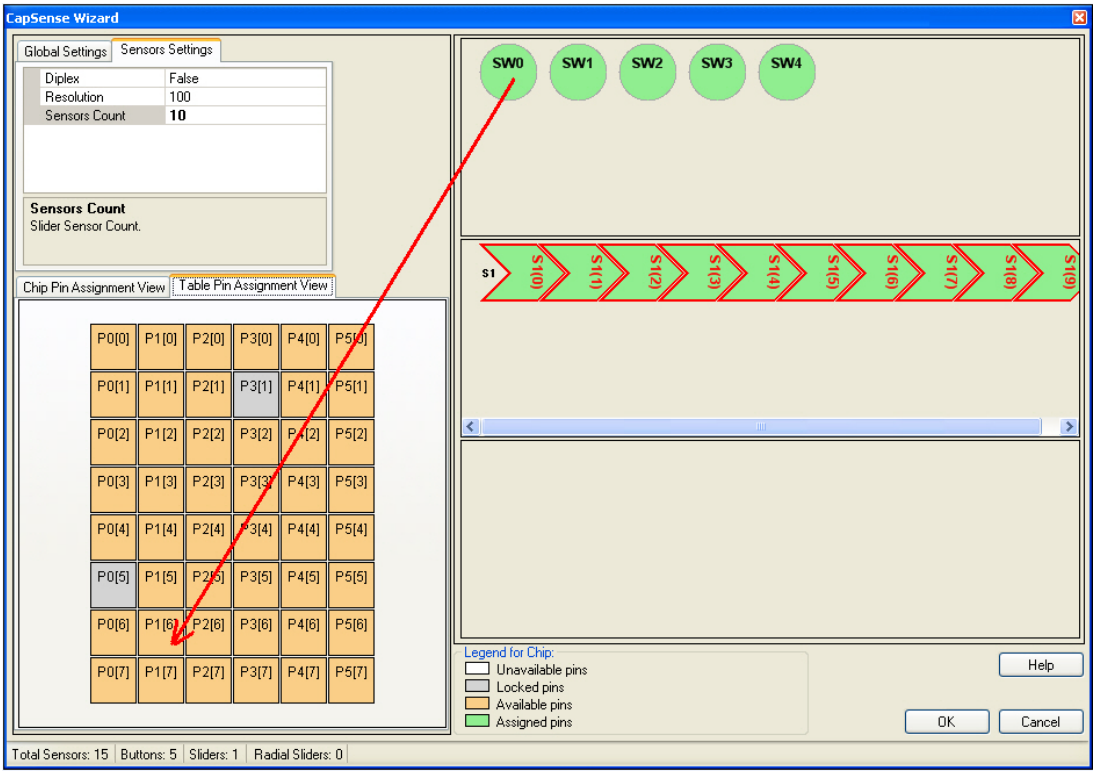
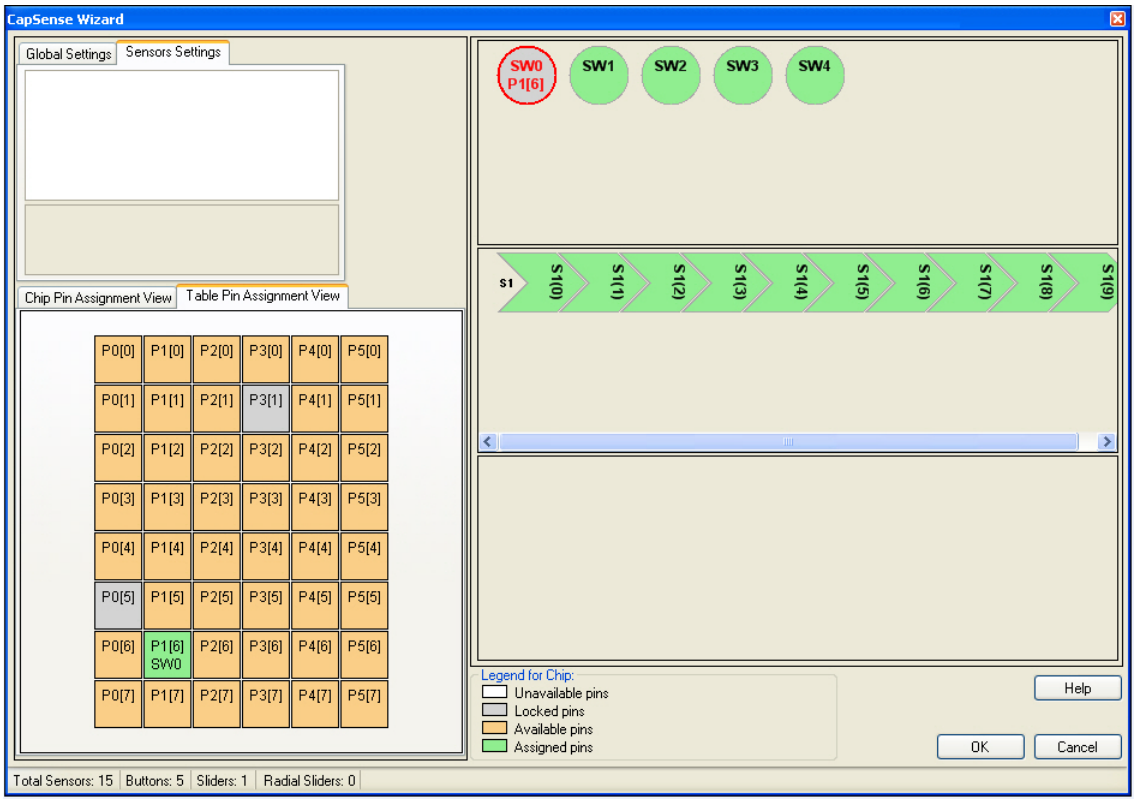


Figure 5-14. Assigning Sensors to Pins - Table Pin Assignment View



19. The following screenshot shows the CSD Wizard window after a sensor is assigned.

Figure 5-15. Sensor Assigned



20. Next, assign all the sensors according to Table 5-1.

Table 5-1. Sensor Assignment

Sensor	Port Pin
SW0	P1[6]
SW1	P1[3]
SW2	P3[3]
SW3	P2[1]
SW4	P2[3]
S1(0)	P1[4]
S1(1)	P0[6]
S1(2)	P0[4]
S1(3)	P0[2]
S1(4)	P2[6]
S1(5)	P2[4]
S1(6)	P2[2]
S1(7)	P2[0]
S1(8)	P3[2]
S1(9)	P3[0]

Figure 5-16. All Sensors Assigned - Table Pin Assignment View

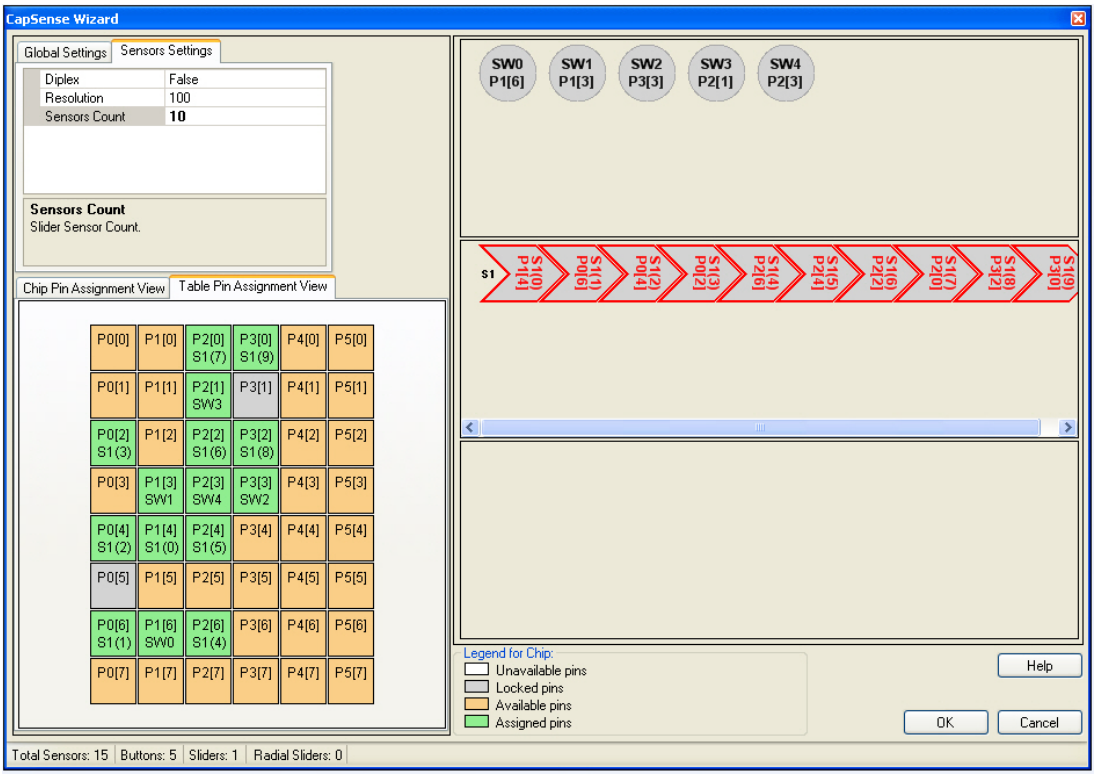
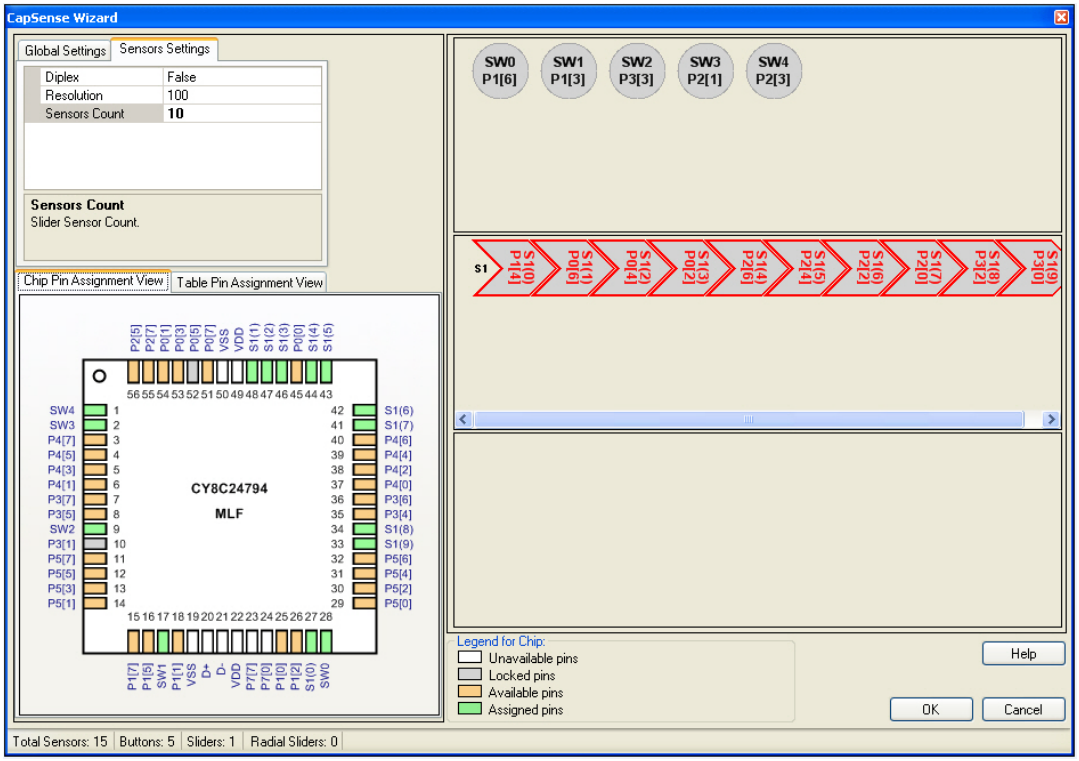
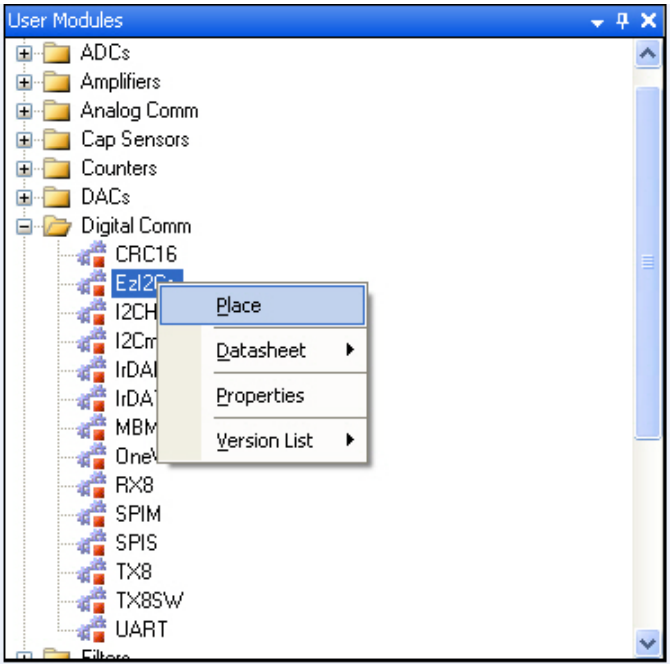


Figure 5-17. All Sensors Assigned - Chip Pin Assignment View



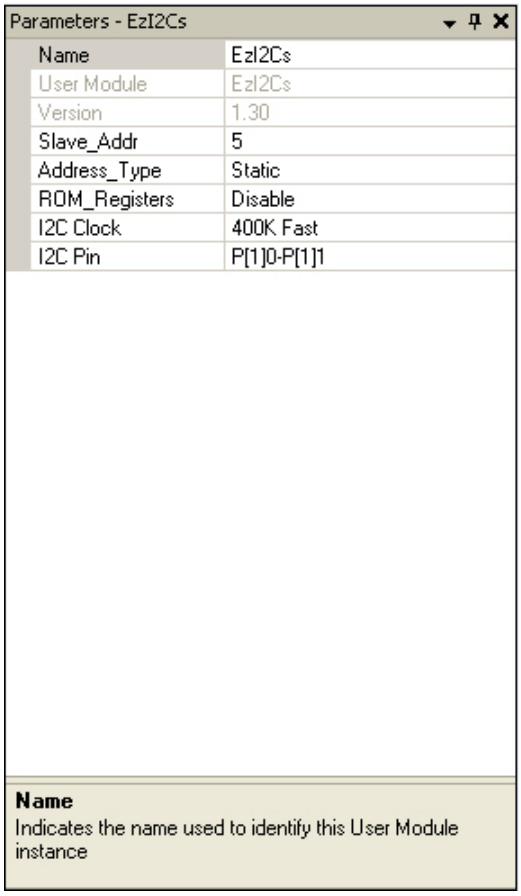
21. Click **OK** to exit the CSD wizard and return to main screen.
22. In the User Modules window, expand the **Digital Comm** folder, select EzI2Cs, right click, and place an EzI2Cs in the design.

Figure 5-18. User Module Window - EzI2Cs Select



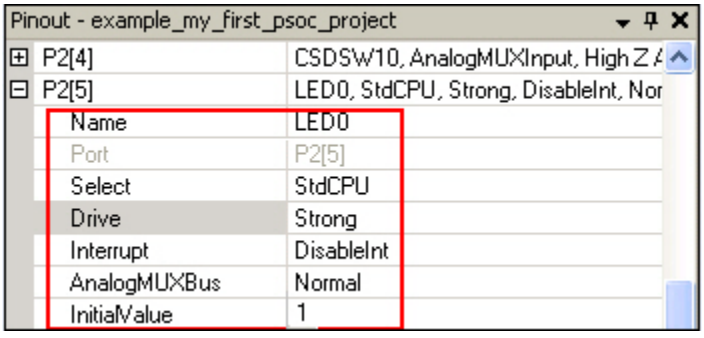
23. The EzI2Cs user module does not require a digital block for placement because it requires only two port pins (SCL and SDA), either P[1]0-P[1]1 or P[1]5-P[7]1.
24. Configure the properties of EzI2Cs_1 as shown in Figure 5-19.

Figure 5-19. EzI2Cs User Module Properties



26. Configure the port pin P2[5] in the Pinout window.

Figure 5-20. P2[5] Port Pin Properties



27. Configure the properties of P2[7], P0[1], P0[3], and P1[2] as shown in the following figures.

Figure 5-21. P2[7] Port Pin Properties

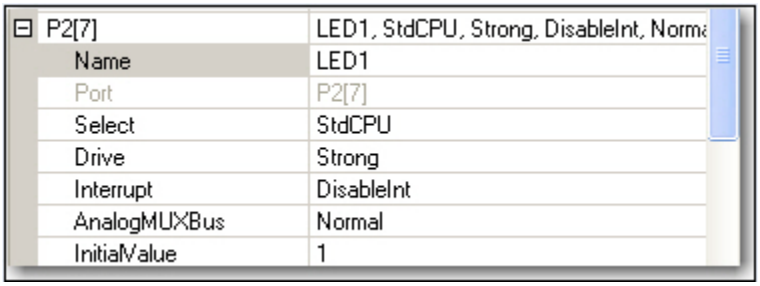


Figure 5-22. P0[1] Port Pin Properties

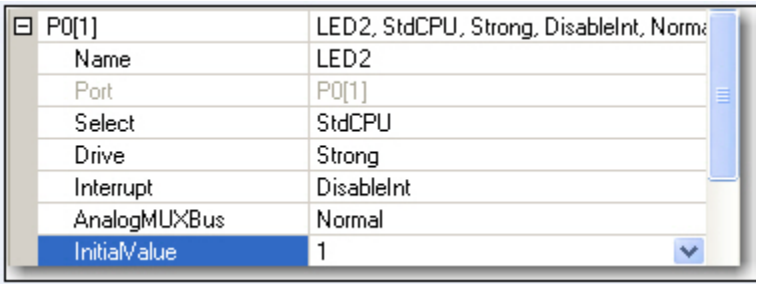


Figure 5-23. P0[3] Port Pin Properties

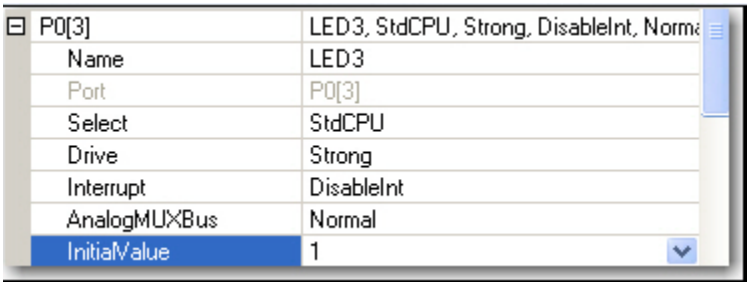
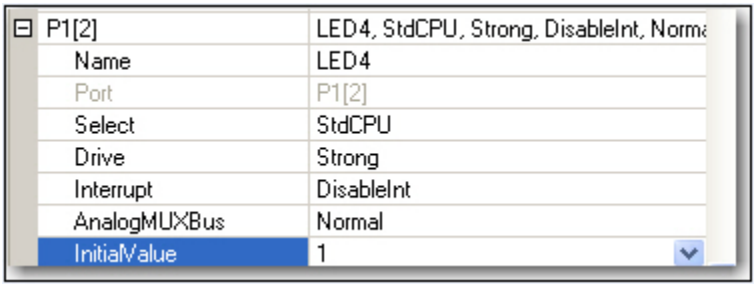
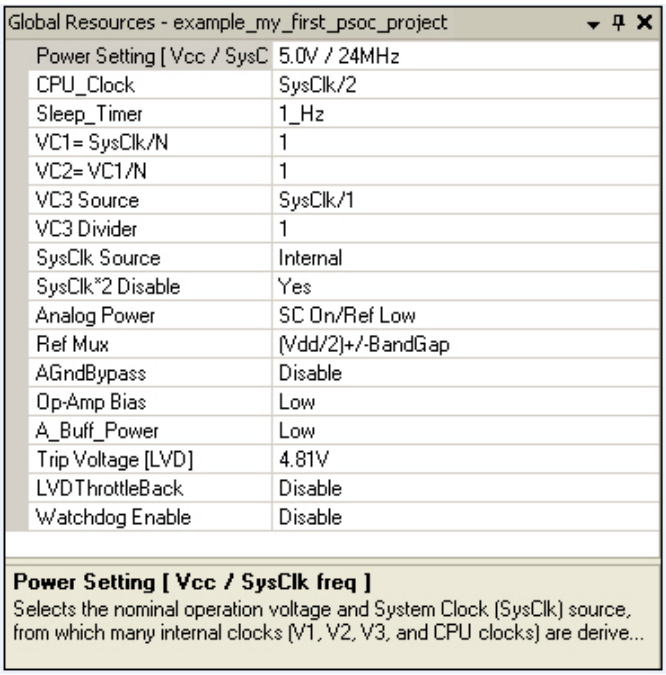


Figure 5-24. P1[2] Port Pin Properties



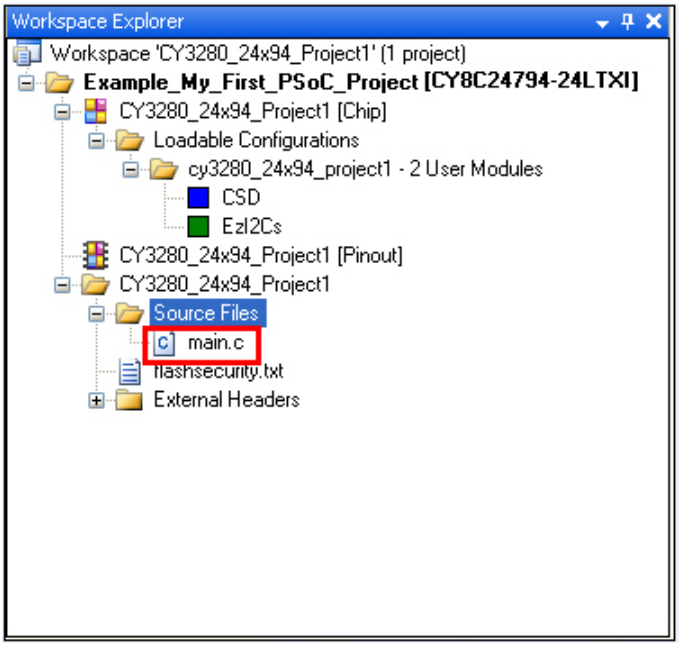
28. Configure the **Global Resources** window as shown in Figure 5-25.

Figure 5-25. Global Resources Window



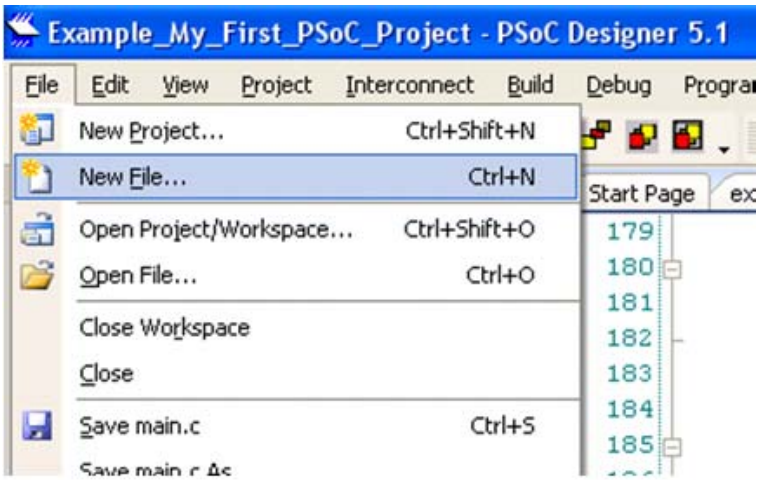
29. Open the existing *main.c* file within **Workspace Explorer**. Replace the existing *main.c* content with the content of the embedded *Example_My_First_Example_Project_Main.c* file (see Figure 5-17), which is attached in this PDF document.

Figure 5-26. Workspace Explorer Window



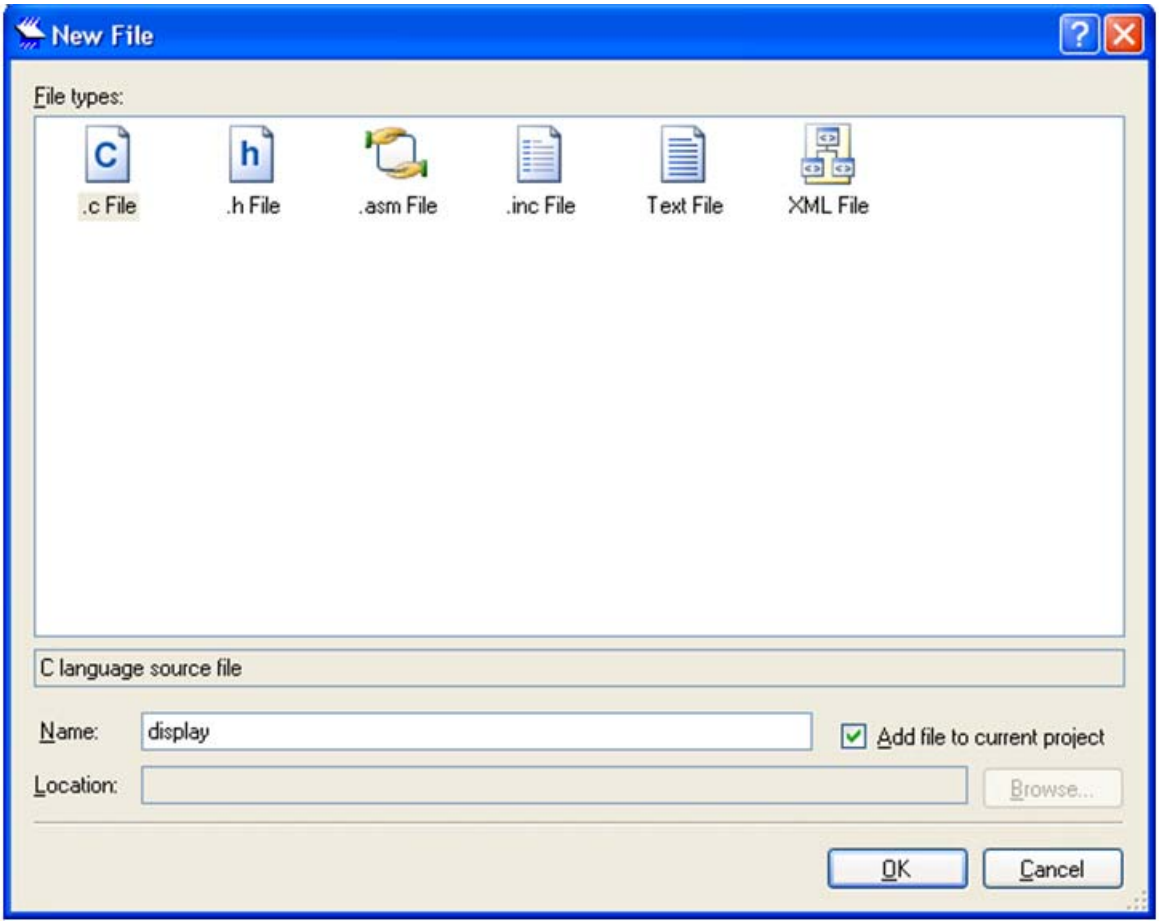
30. Add a new file to the project by clicking **File** > **New File**.

Figure 5-27. Adding a New File to Project



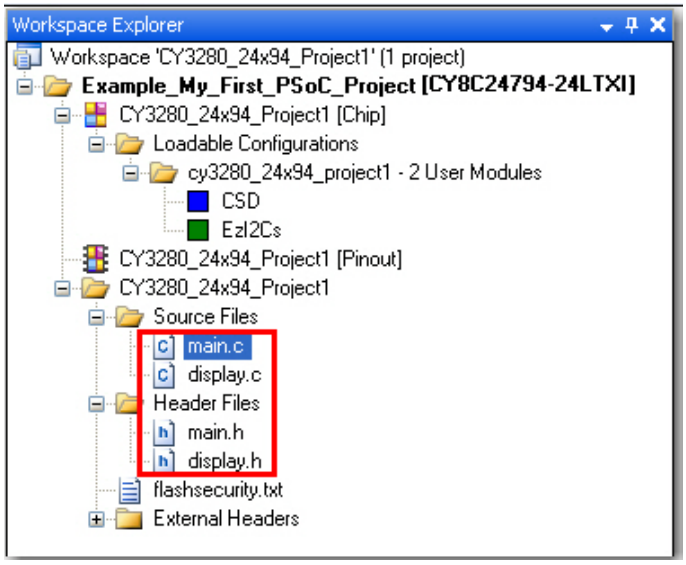
31. Select a *.C* file type and name the file ‘display’.

Figure 5-28. File Types



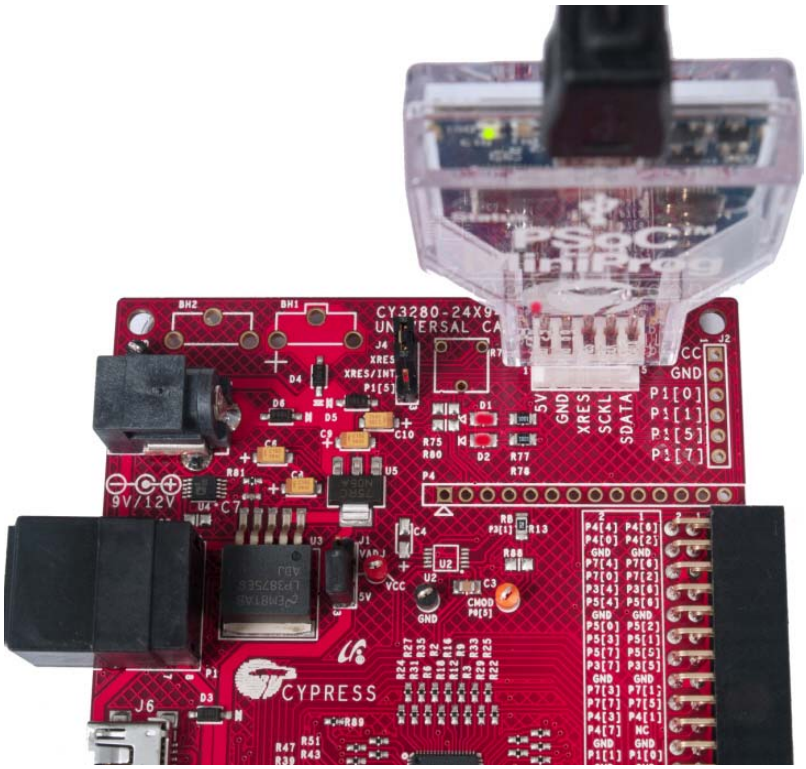
32. Create 2 *.h* file types and name them *main.h* and *display.h* respectively.

Figure 5-29. New Files in Project



33. Copy the content of the embedded *display.c*, *display.h,* and *main.h* files, that are attached with this PDF document, to the respective files in the project.
34. To build the project, go to **Build** > **Generate/Build 'Example_My_First_PSoC_Project' Projec**t.
35. Connect the CY3280-24X94 board to the PC through a MiniProg1.

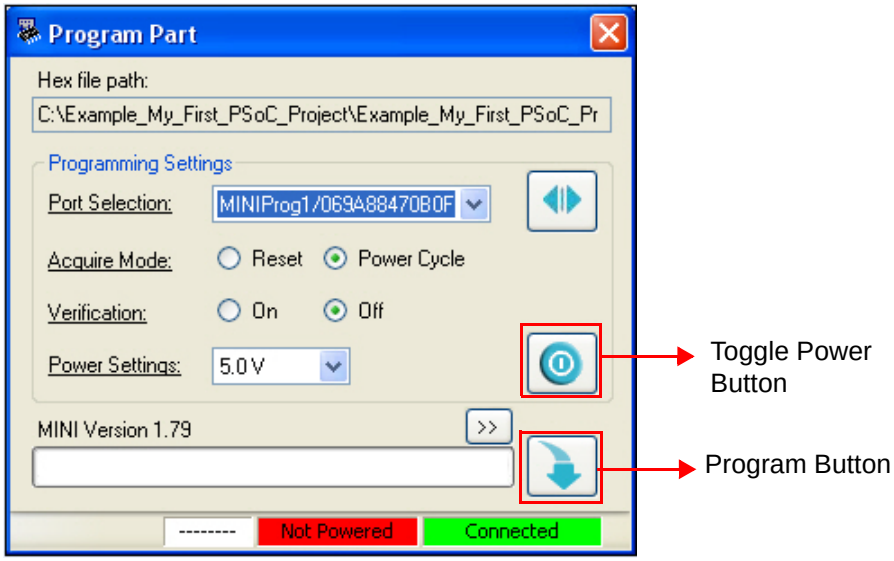
Figure 5-30. Connecting MiniProg1 to the Board



36. The board can be programmed either through the PSoC Designer IDE or by launching PSoC Programmer. To program the board using PSoC Programmer, refer to Section 3.4. To program the board through PSoC Designer follow these steps.
37. Click on **Program** > **Program Part**

Note While programming the board through PSoC Designer, close any open instance of PSoC Programmer.

Figure 5-31. Program Part Window

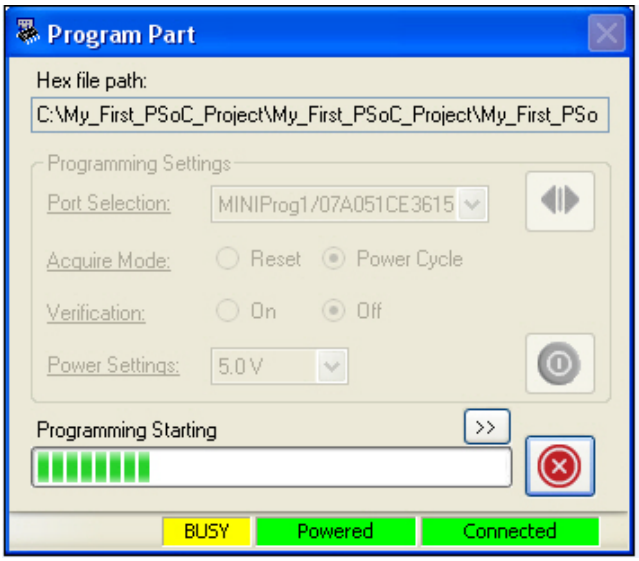


38. In the **Program Part** window, ensure the following:
    a. In the **Port Selection** drop down box, select **MiniProg1/xxxxxxxxxxx** and make certain it is 'Connected'
    b. Set **Acquire Mode** to **Power Cycle**
    c. Set **Verification** to **Off**
    d. Set **Power settings** to 5.0 V
39. Click on the **Program** button (see Figure 5-31) to start programming the board.

Note Ensure that the shorting jumper is placed on pin 2 of J1 and pin 1 of J7.

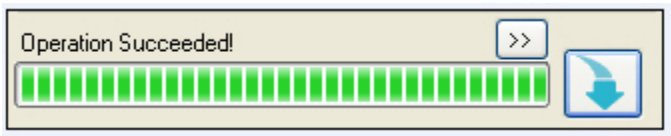
40. The board programming starts and you can observe the status on the progress bar.

Figure 5-32. Programming Status



41. When programming is successful, you get the 'Operation Succeeded!' message.

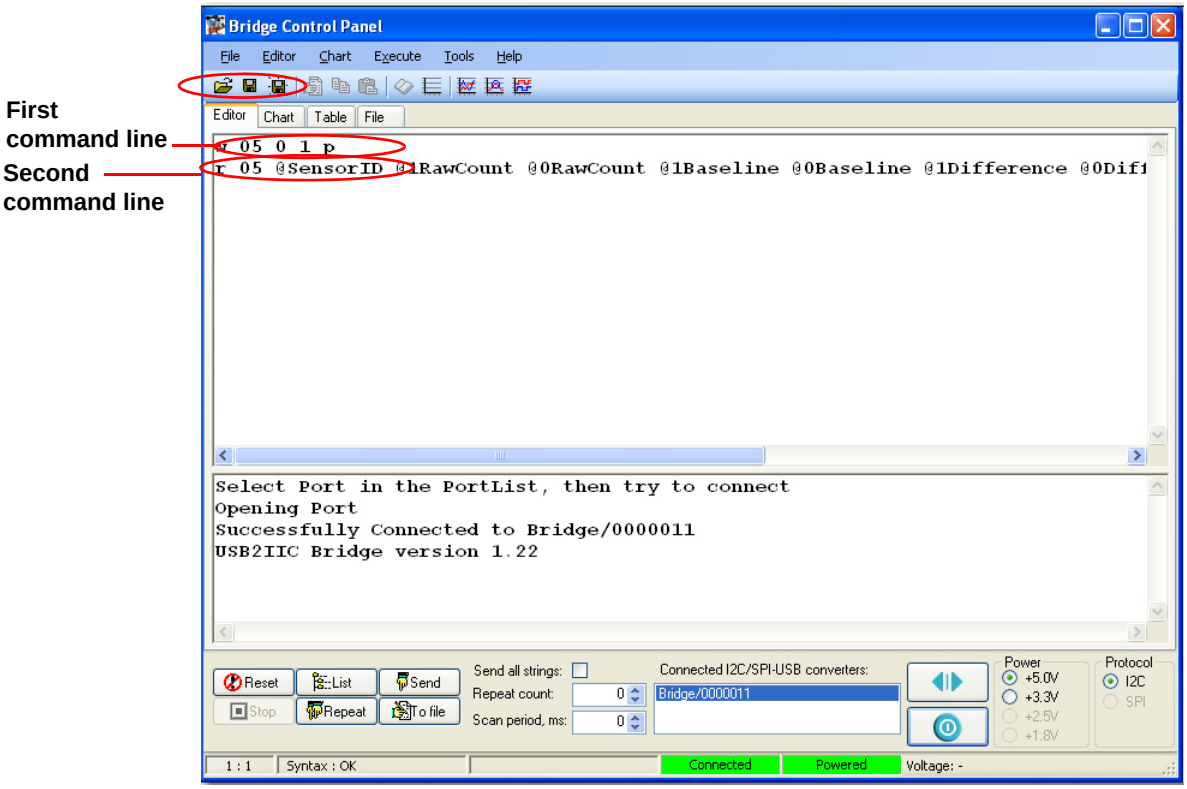
Figure 5-33. 'Operation Succeeded!' Message



5.1.4 Verify Output

1. Connect a linear slider module (SLM) on connector P2 of the board.
2. Disconnect the MiniProg1 from the header J3 and connect a USB-I2C bridge board in its place.
3. Connect a USB cable from the USB-I2C bridge board to a free USB port on a PC.
4. Open **Bridge Control Panel** by clicking on **Start > Programs > Cypress > Bridge Control Panel <version> > Bridge Control Panel <version>**. Ensure that the PSoc Designer and PSoC Programmer are closed before opening the bridge control panel.
5. Select the **Variable Settings** option from the **Chart** menu, click **Load**, navigate to open the *CY3280_SLM_Project1.ini* file from the CD or from the following kit install location: `<Install_directory>\Cypress\CY3280-24x94\<version>\Firmware\USB-I2CBridgeSoftwareConfig` and click **OK**.
6. Click **Open File** from the File menu; navigate to and open the *CY3280_SLM_Project1.iic* file from the CD or from the kit install location `<Install_directory>\Cypress\CY3280-24x94\<version>\Firmware\USB-I2CBridgeSoftwareConfig` and click **OK**.
7. Select +5 V in the power settings box. Click **Toggle Power** to power the I2USB Bridge, LED (red) D1 glows.

Figure 5-34. Linear Slider Module and USB-I2C Bridge connected to the Capsense Controller Board

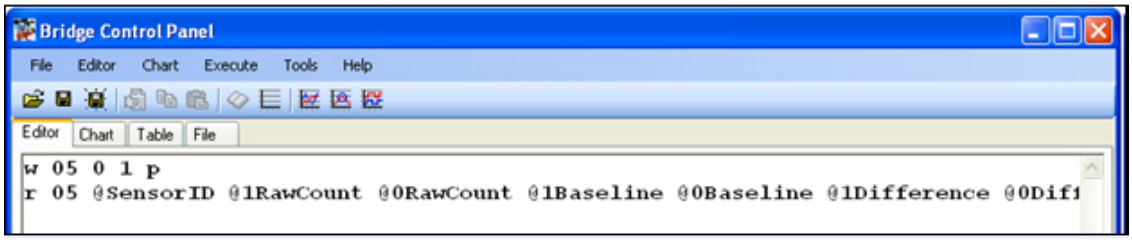


8. On the CapSense slider board, touch the button with your finger. Each button touch lights up the associated LED on the module board.
9. Touch the linear slider with your finger. The associated LED on the module board lights up, representing where you finger is on the slider.
10. The CapSense parameters such as RawCount, Baseline, Difference Count, and Mask Info (refer to the CSD User module datasheet for a more detailed explanation of each parameter) for a particular sensor can be seen on the Bridge Control Panel. The current active button number and finger position on the slider are also outputted on the Bridge Control Panel.
11. The syntax of the first command line is as follows:

W	05	0	1	p
Write command	Slave Id	Address Offset	Sensor number	Stop
	(constant)	(constant)	(In hexadecimal, Valid range: 0x1 – 0xF)	

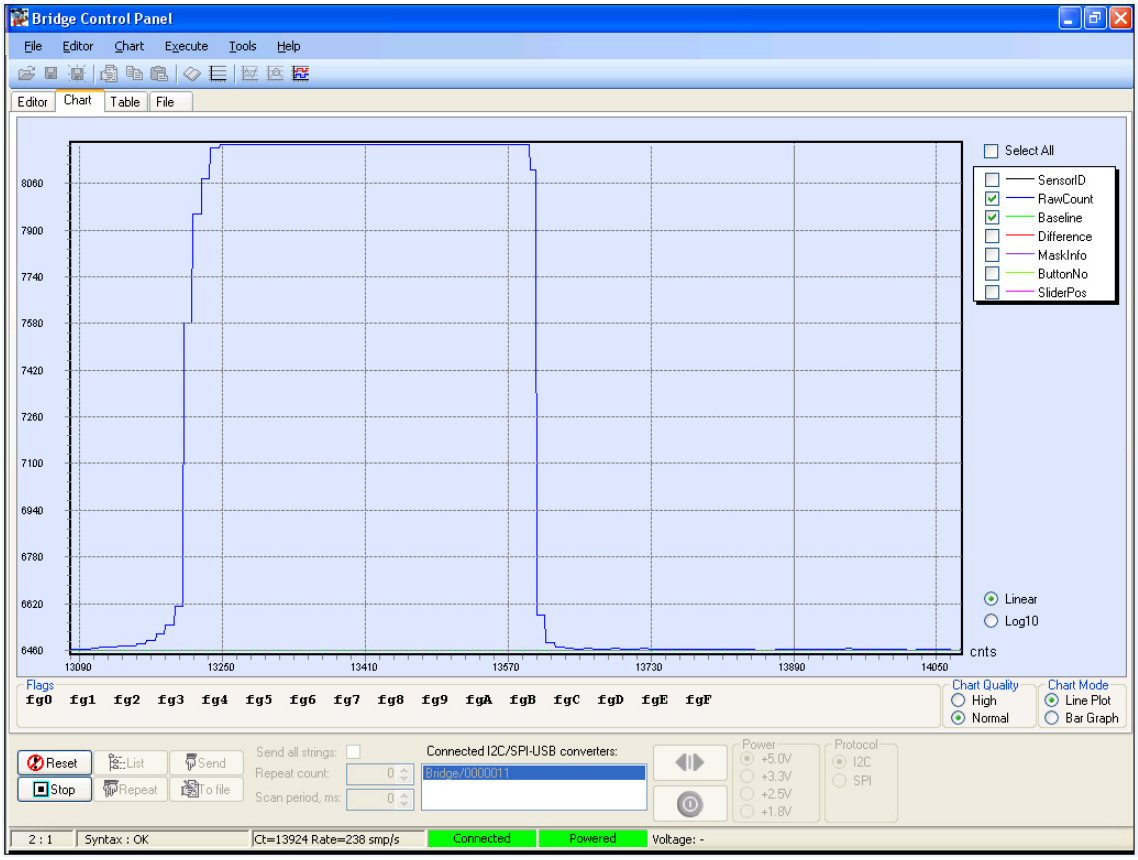
12. The first command writes to the Universal CapSense Controller (UCC) board, the sensor number for which the monitoring is required.
13. The second command line reads the CapsSense parameters from the UCC board.
14. Change the sensor ID for which parameter monitoring is required and click **Send** to write the sensor ID to the UCC board.

Figure 5-35. Command Line View



15. Click on the second command line and then click **Repeat** to read I2C data received from the UCC board.
16. Switch to the **Chart** tab to view the respective waveforms of CapSense parameters (see Figure 5-36). Click on the check box to view only the required parameters.

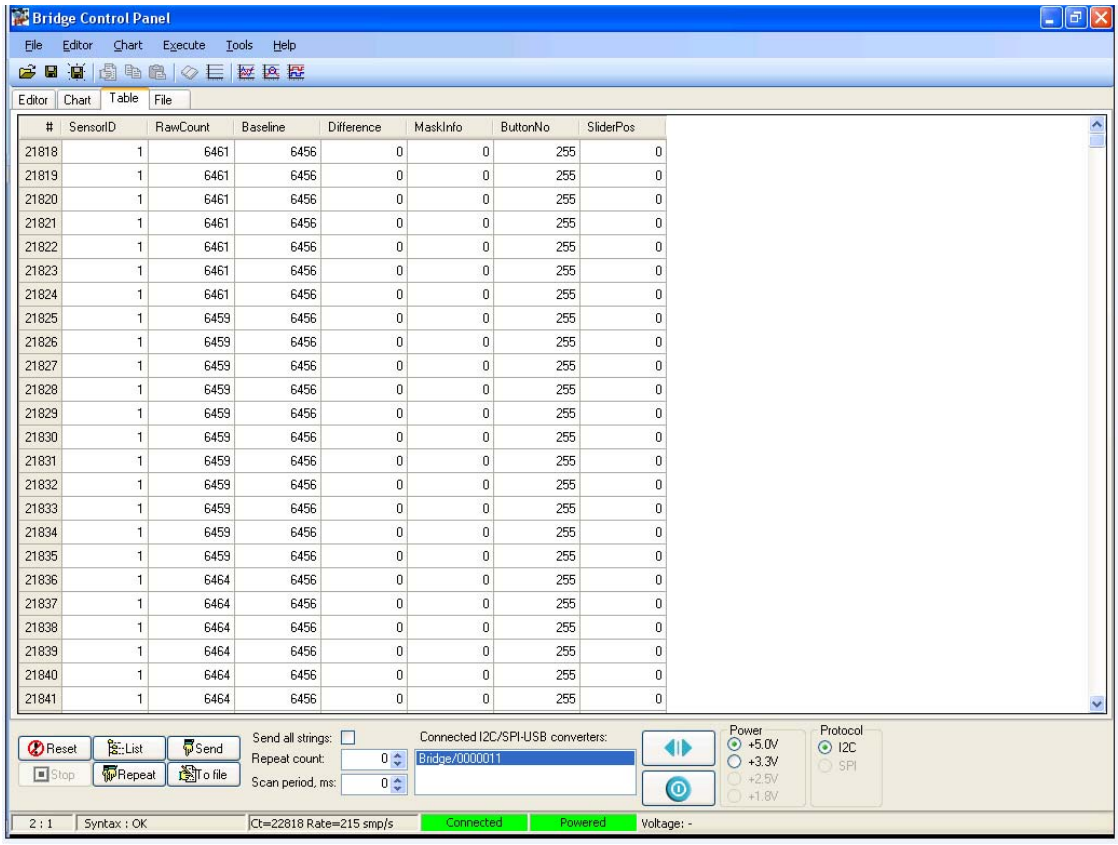
Figure 5-36. Bridge Control Panel Chart View - Only RawCount and Baseline Output during a Finger Press



17. The various parameter values being received by the UCC can be seen in the Table tab in the Bridge Control Panel.

Note The table gets populated with the received data only after the Stop  button is pressed.

Figure 5-37. Bridge Control Panel Table View



5.2 CY3280_24x94_Project1

5.2.1 Project Description

This project demonstrates the use of the CapSense buttons and linear slider on the CY3280-SLM board using CSD technology and CY8C24x94A. The EzI2Cs user module is used to transfer CapSense parameters related to a sensor to the PC for monitoring. This project is implemented in the chip level design in PSoC Designer 5.1.

This project scans five CapSense buttons and a 10-segment slider using the CSD user module. There are five LEDs on board, which illuminate when a CapSense button or slider is touched. The EzI2Cs user module is used to provide a register-based I2C slave communications protocol. The status of CapSense sensors (both button and slider) and their parameters are updated in the I2C register, which can be accessed by any I2C master, similar to the I2USB Bridge.

The application starts by executing boot.asm. The boot.asm does the hardware initialization and invokes the 'main' function. The main function initializes the EzI2Cs Slave user module and CapSense user module. After initialization, the main function enters into a loop, which does the following:

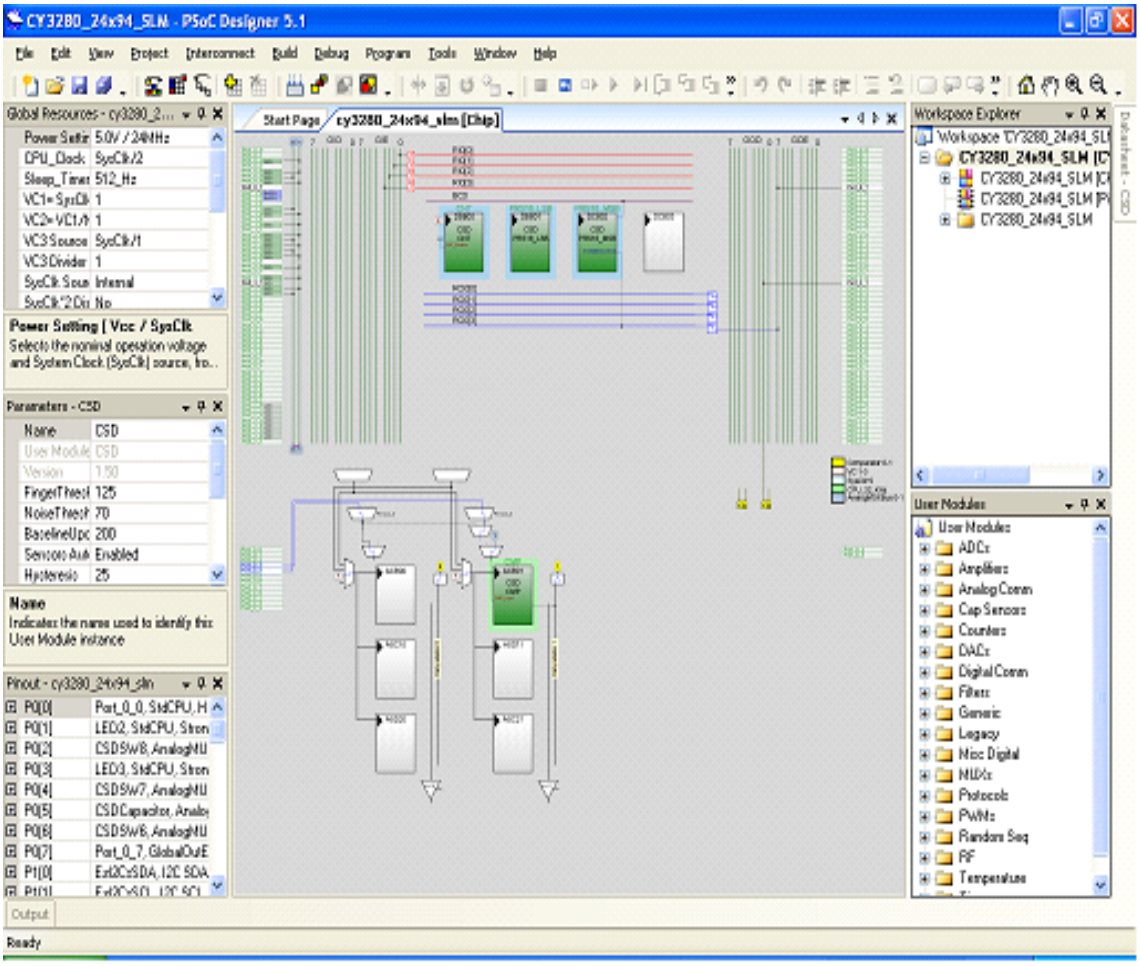
- Scans all sensors
- Reads the sensor ID sent by the I2C master
- Stores CapSense data in the I2C registers
- Updates the LED status for the On/Off sensors

The following user modules are used in this project:

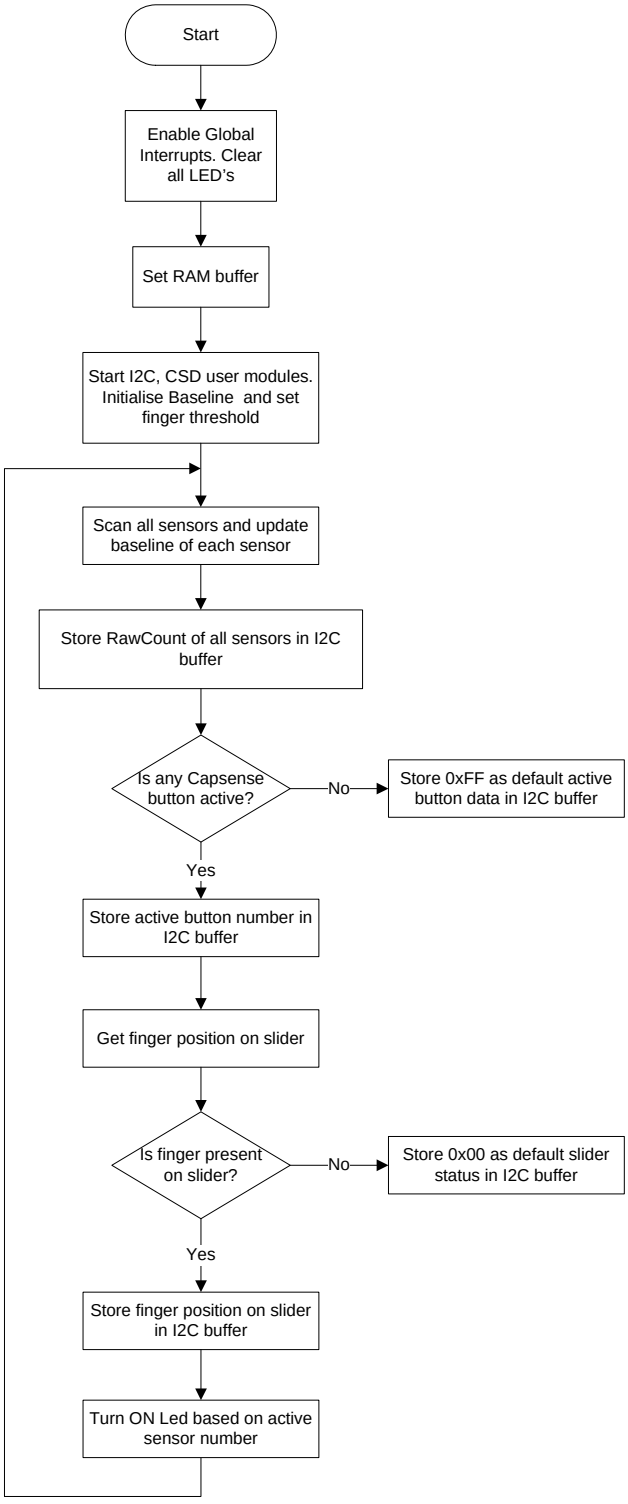
- **CSD**: The CSD provides capacitance sensing using the switched capacitor technique with a sigma delta modulator to convert the sensed switching capacitor current to digital code.
- **EzI2Cs**: The EzI2Cs user module implements an I2C register based slave device.This user module does not require any digital or analog PSoC blocks. It is used to transfer all CapSense parameters related to a sensor to the PC for monitoring.

5.2.2 Device Configurations

Figure 5-38. Device Configuration for CY3280_24x94_Project1



5.2.3 Firmware Architecture



5.2.4 Verify Output

Load CY3280_SLM_Project1.iic file from the Bridge Control Panel, as explained in Bridge Control Panel on page 17. This file is available in the following location:
`<Install_directory>\Cypress\CY3280-24x94\<version>\Firmware\USB-I2CBridgeSoftwareConfig`

1. Touch one or more buttons; the associated LEDs light up.
2. Touch the linear slider; the associated LEDs light up.
3. Touch the linear slider and buttons simultaneously. The associated LEDs light up corresponding to the buttons and the sliders being pressed.
4. In the first command line, change the sensor ID for which parameter monitoring is required and click **Send** to write the sensor ID to the Universal CapSense Controller board. See Figure 5-39 (w 05 0 1 p, where 05 is the I2C slave address, 0 is the address pointer, and 1 is the sensor ID). See Table 5-2 for a complete list of sensor IDs.
5. Click on the second command line and then click **Repeat** to read I2C data received from the Universal CapSense Controller board.
6. Switch to the Chart tab to view the respective wave forms of CapSense parameters; see Figure 5-40.

Note The character 'w' in Figure 5-2 defines the start of "write data" command. The character 'p' generates stop condition on the I2C bus and character 'r' defines the start of "read data" command.

Figure 5-39. Command Line View

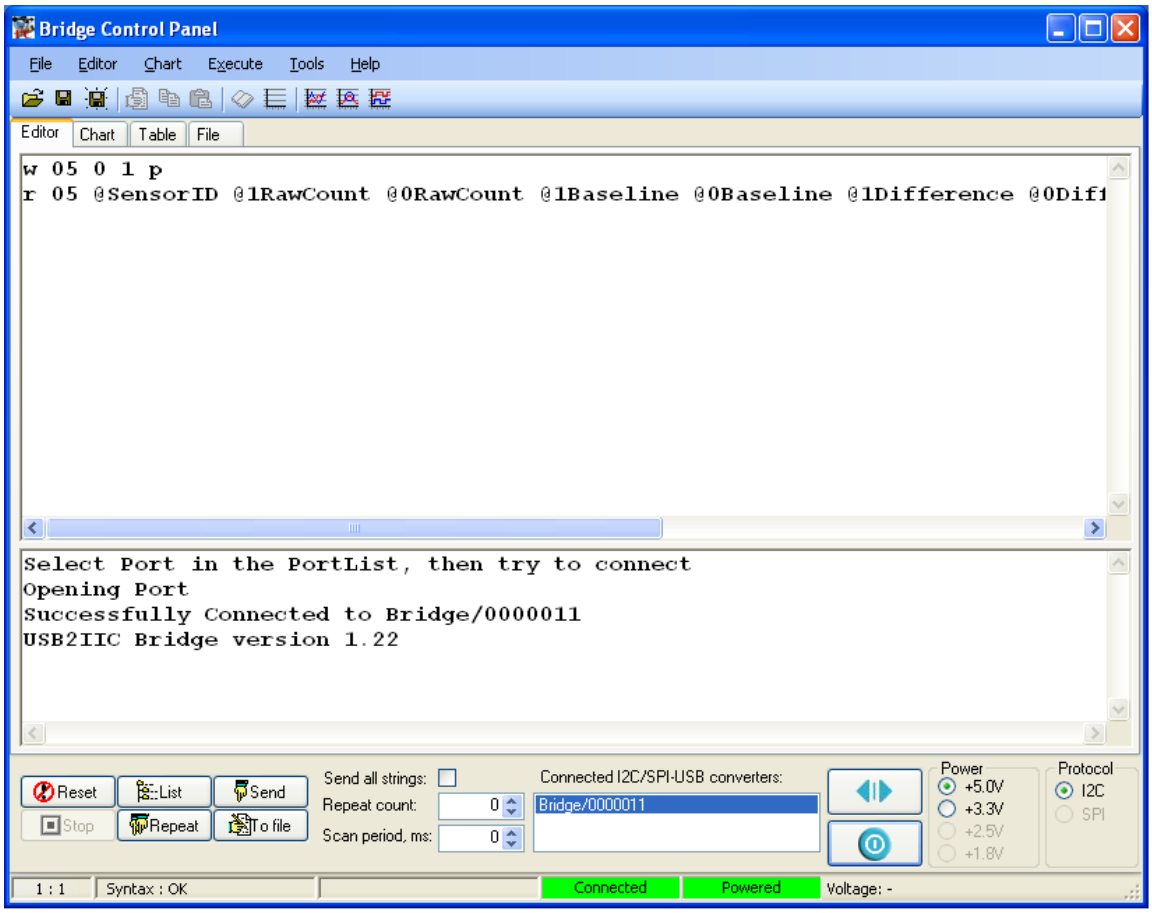
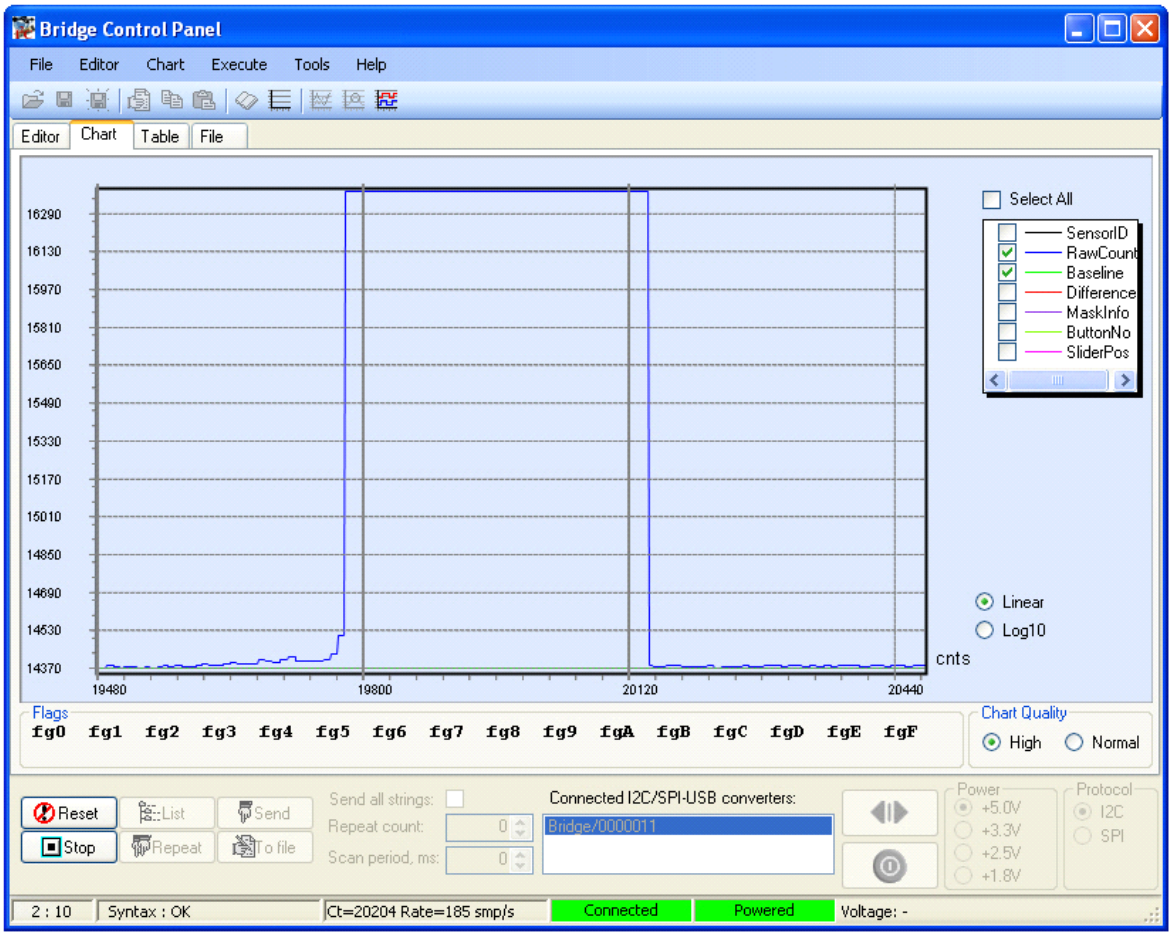


Table 5-2. Sensor Details

Firmware Labels	Sensor Name	Sensor ID(HEX)
CSDSW0	BTN0	0
CSDSW1	BTN1	1
CSDSW2	BTN2	2
CSDSW3	BTN3	3
CSDSW4	BTN4	4
CSDSW5	SLD0	5
CSDSW6	SLD1	6
CSDSW7	SLD2	7
CSDSW8	SLD3	8
CSDSW9	SLD4	9
CSDSW10	SLD5	A
CSDSW11	SLD6	B
CSDSW12	SLD7	C
CSDSW13	SLD8	D
CSDSW14	SLD9	E

Figure 5-40. Bridge Control Panel Chart View



Note In the figure, the brown line represents the axis, the blue line indicates RawCount, and the green line indicates the Baseline.

5.3 CY3280_24x94_Project2

5.3.1 Project Description

This project demonstrates the use of CapSense Buttons and linear sliders using CSD technology and CY8C24x94. The EzI2Cs user module is used to transfer the raw count of CapSense parameters related to all the sensors to PC for monitoring. This project is implemented in chip level design in PSoC Designer 5.1.

This project scans five CapSense buttons and a 10-segment slider using the CSD user module. There are five LEDs on board, which illuminate when a CapSense button or slider is touched. The EzI2Cs user module is used to provide a register-based I2C slave communications protocol. The status of CapSense sensors (both button and slider) and their parameters are updated in the I2C register, which can be accessed by any I2C master, similar to the I2USB Bridge.

The application starts by executing boot.asm. The boot.asm does the hardware initialization and invokes the 'main' function. The main function initializes the EzI2Cs slave and CapSense user modules. After initialization, the main function enters into a loop, which does the following:

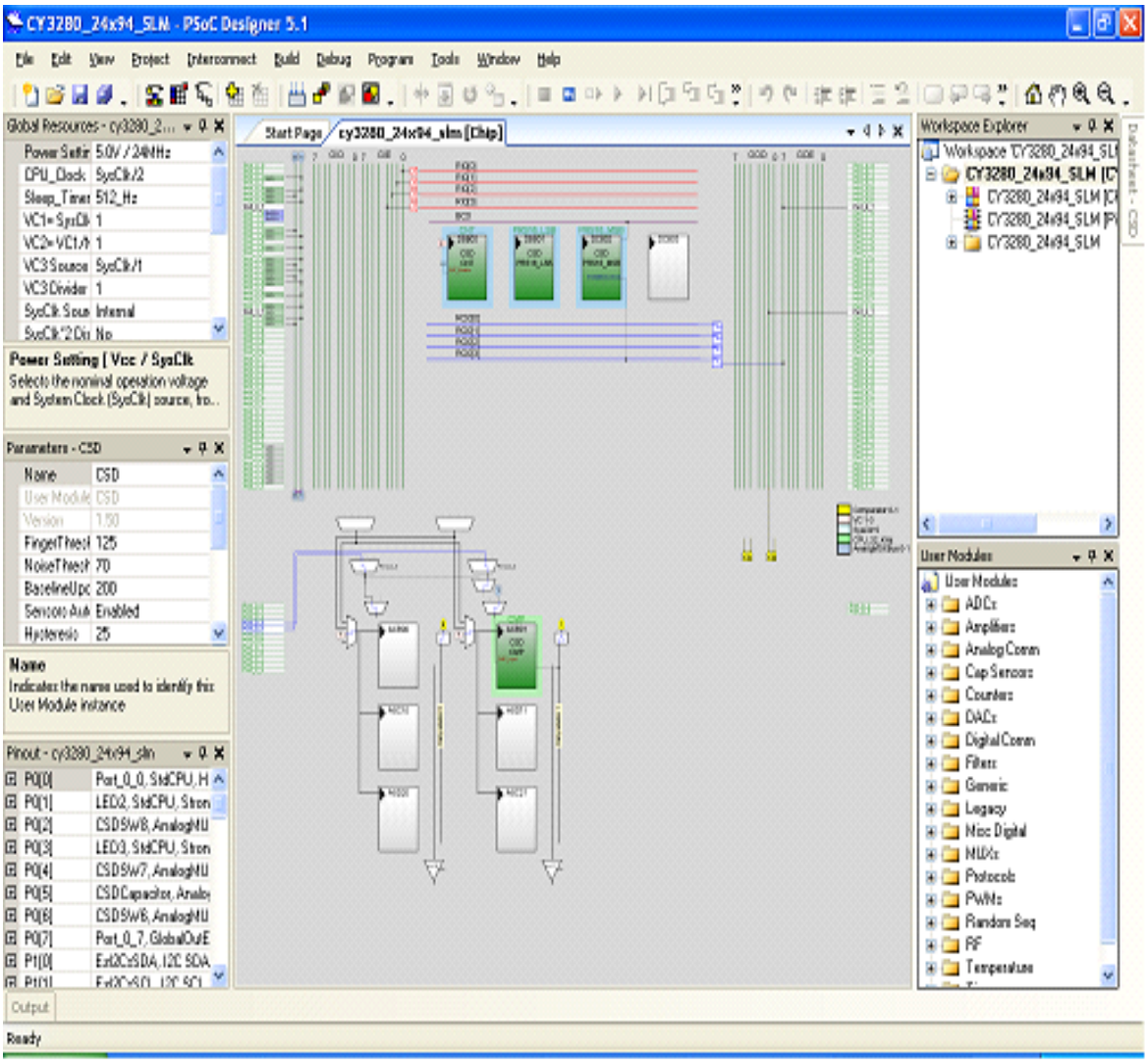
- Scans all sensors
- Reads the sensor ID sent by the I2C master
- Stores CapSense data in the I2C registers
- Updates the LED status for the On/Off sensors

The following user modules are used in this project:

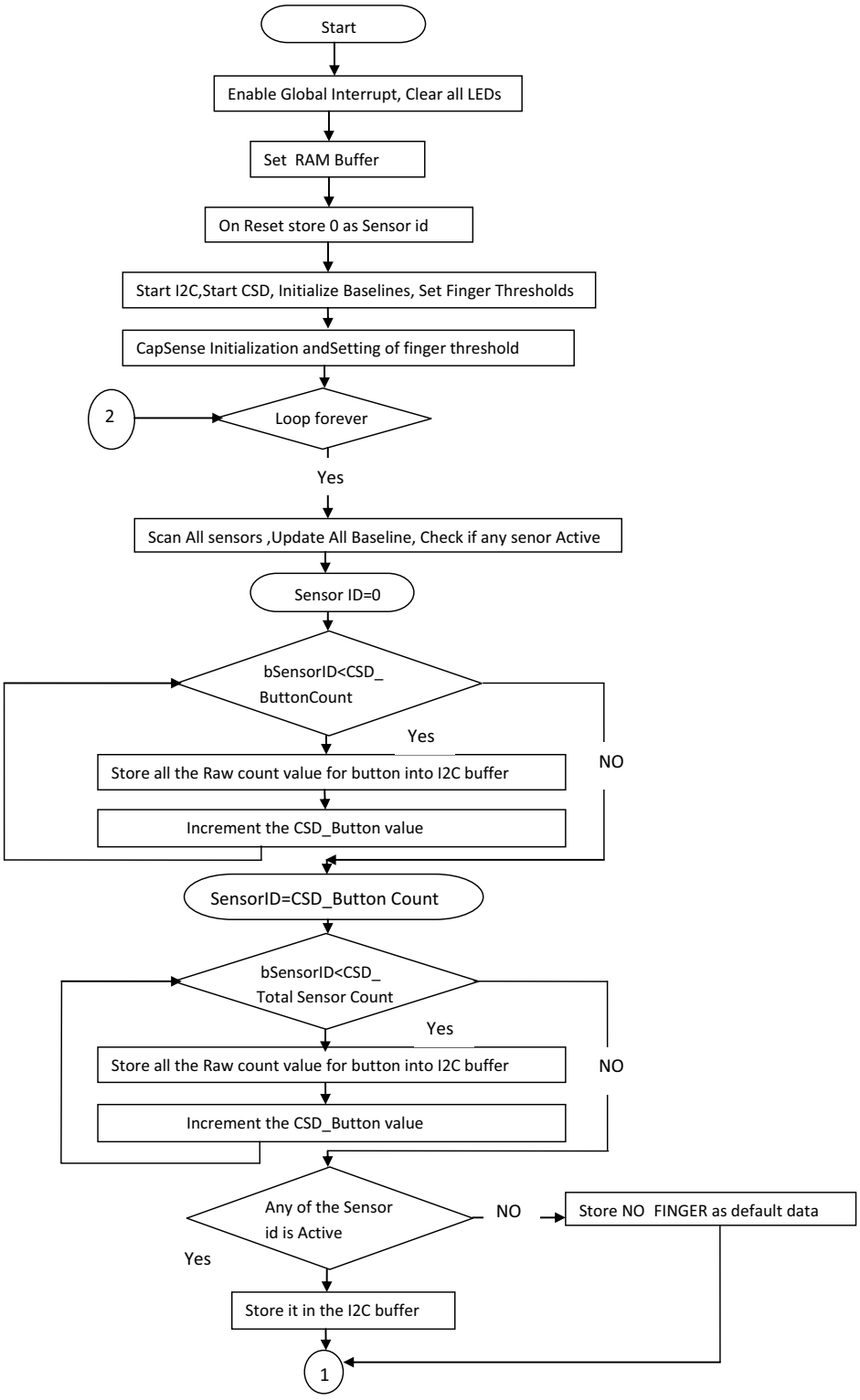
- **CSD**: The CSD provides capacitance sensing using the switched capacitor technique with a sigma delta modulator to convert the sensed switching capacitor current to digital code.
- **EzI2Cs**: The EzI2Cs user module implements an I2C register based slave device.This user module does not require any digital or analog PSoC blocks. It is used to transfer all CapSense parameters related to a sensor to the PC for monitoring.

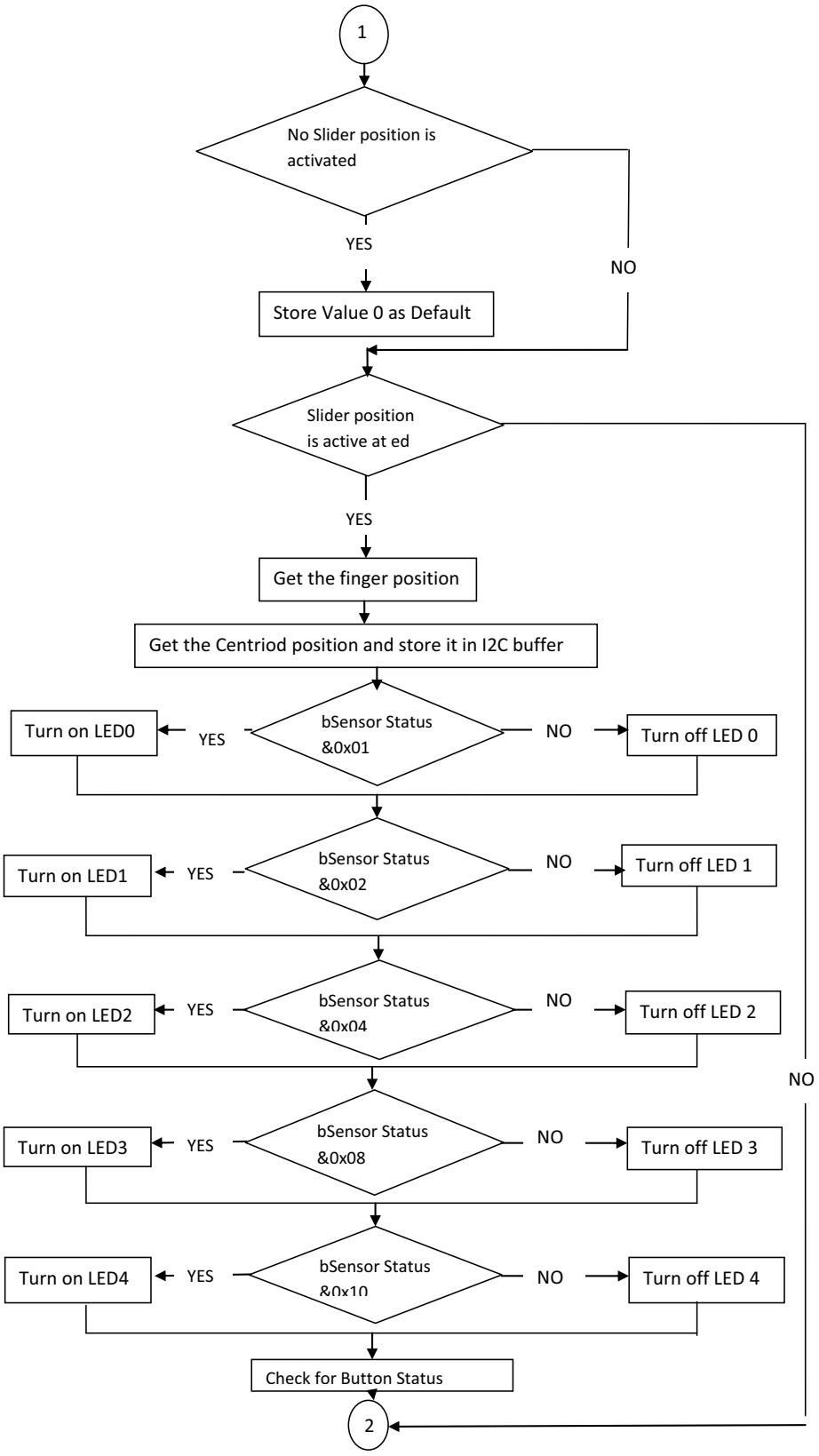
5.3.2 Device Configurations

Figure 5-41. Device Configuration for CY3280_24x94_Project2



5.3.3 Firmware Architecture




1
No Slider position is activated
YES
NO
Store Value 0 as Default
Slider position is active at ed
YES
Get the finger position
Get the Centriod position and store it in I2C buffer
Turn on LED0
YES
bSensor Status &0x01
NO
Turn off LED 0
Turn on LED1
YES
bSensor Status &0x02
NO
Turn off LED 1
Turn on LED2
YES
bSensor Status &0x04
NO
Turn off LED 2
NO
Turn on LED3
YES
bSensor Status &0x08
NO
Turn off LED 3
Turn on LED4
YES
bSensor Status &0x10
NO
Turn off LED 4
Check for Button Status
2

5.3.4 Verify Output

Load CY3280_SLM_Project2.iic file from the Bridge Control Panel as explained in Bridge Control Panel on page 17. This file is available in the following location:
`<Installed_directory>\Cypress\CY3280-24x94\<version>\Firmware\USB-I2CBridgeSoftwareConfig`

1. Touch one or more buttons; the associated LEDs light up.
2. Touch the linear slider; the associated LEDs light up.
3. Touch the linear slider and buttons simultaneously. The associated LEDs light up corresponding to the buttons and the sliders being pressed.
4. Click on the command line and then click Repeat to read I2C data received from the Universal CapSense Controller board.
5. Switch to the Chart tab to view the respective waveforms of CapSense parameters. See Figure 5-43.

Note The character 'r' in Figure 5-42 defines the start of "read data" command.

Figure 5-42. Command Line View

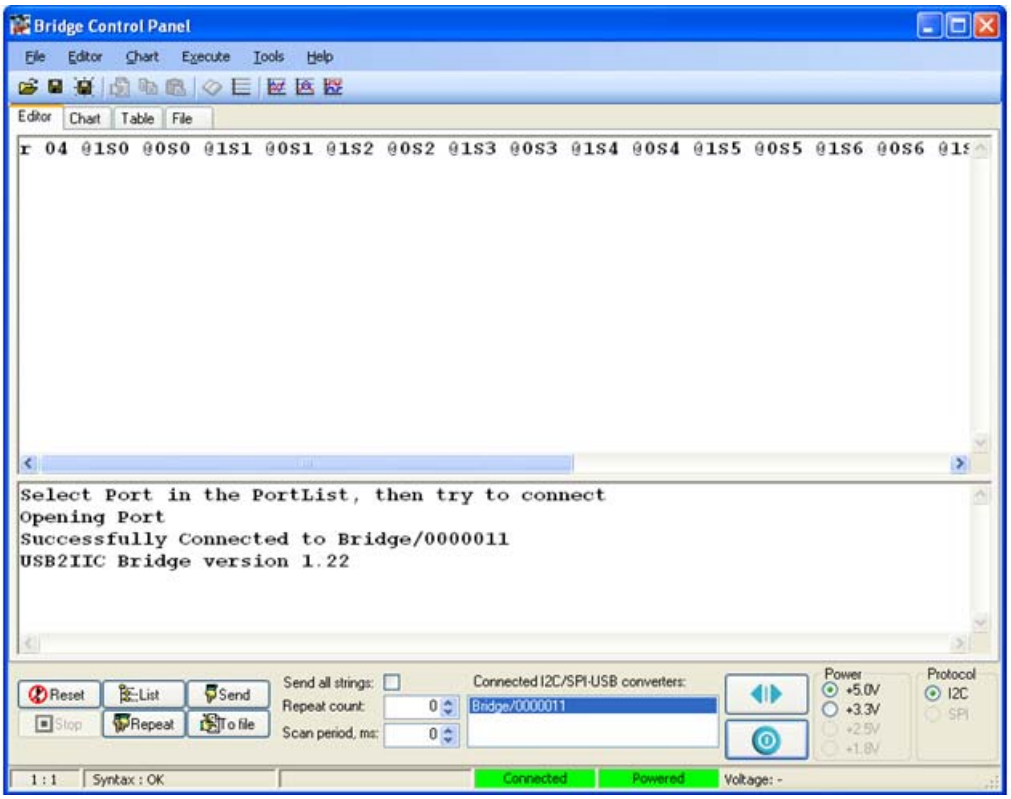
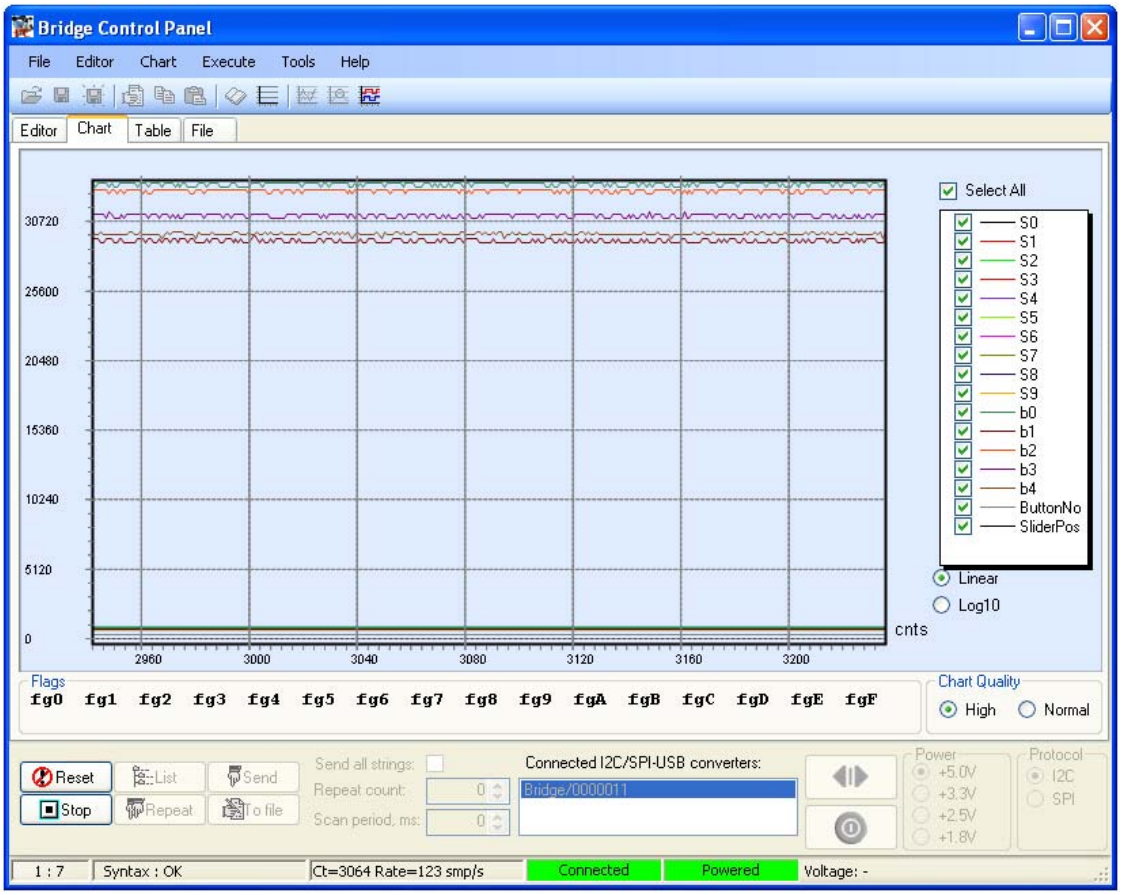


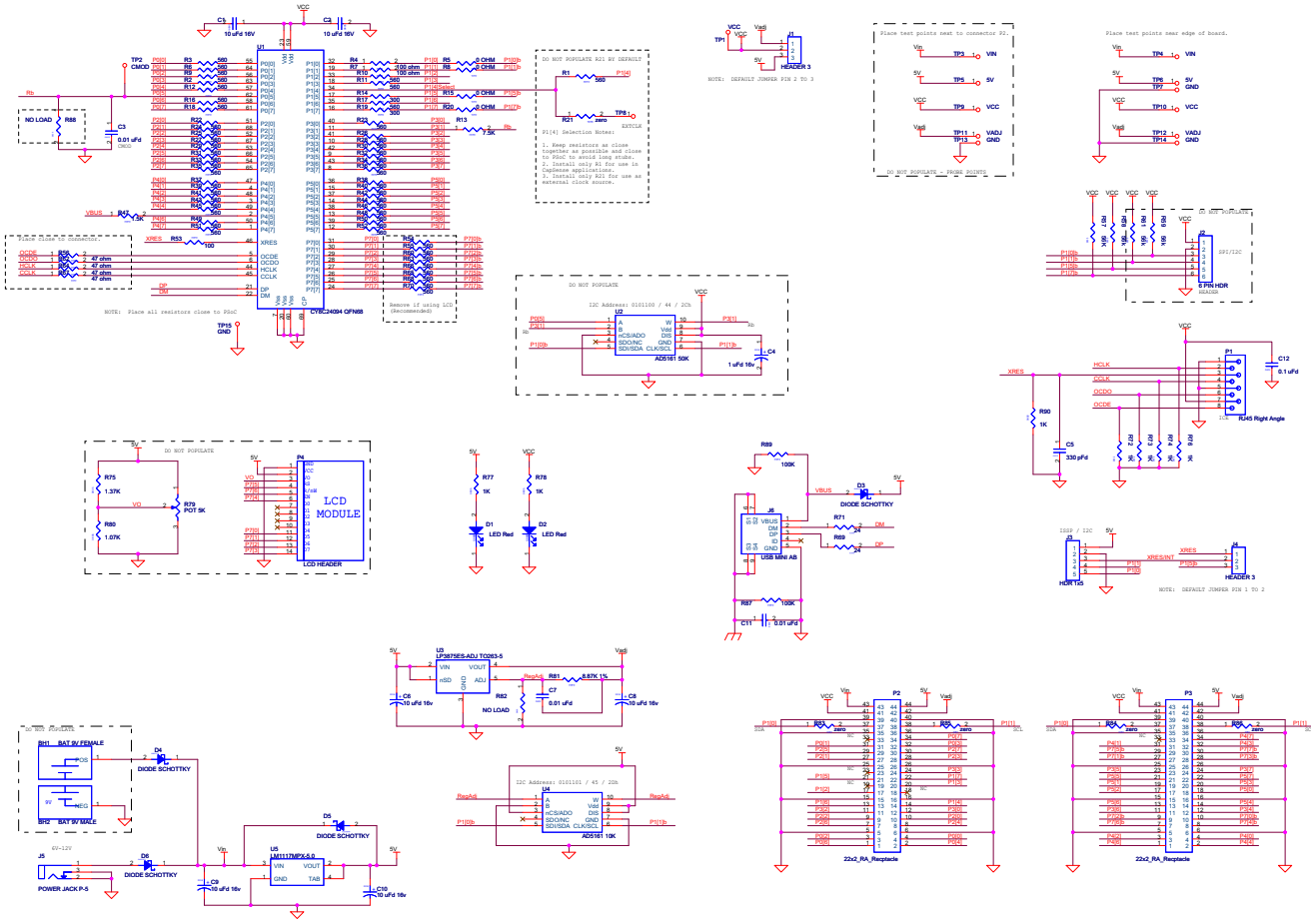
Figure 5-43. Bridge Control Panel Chart View



Note The brown line in the figure represents the axis.

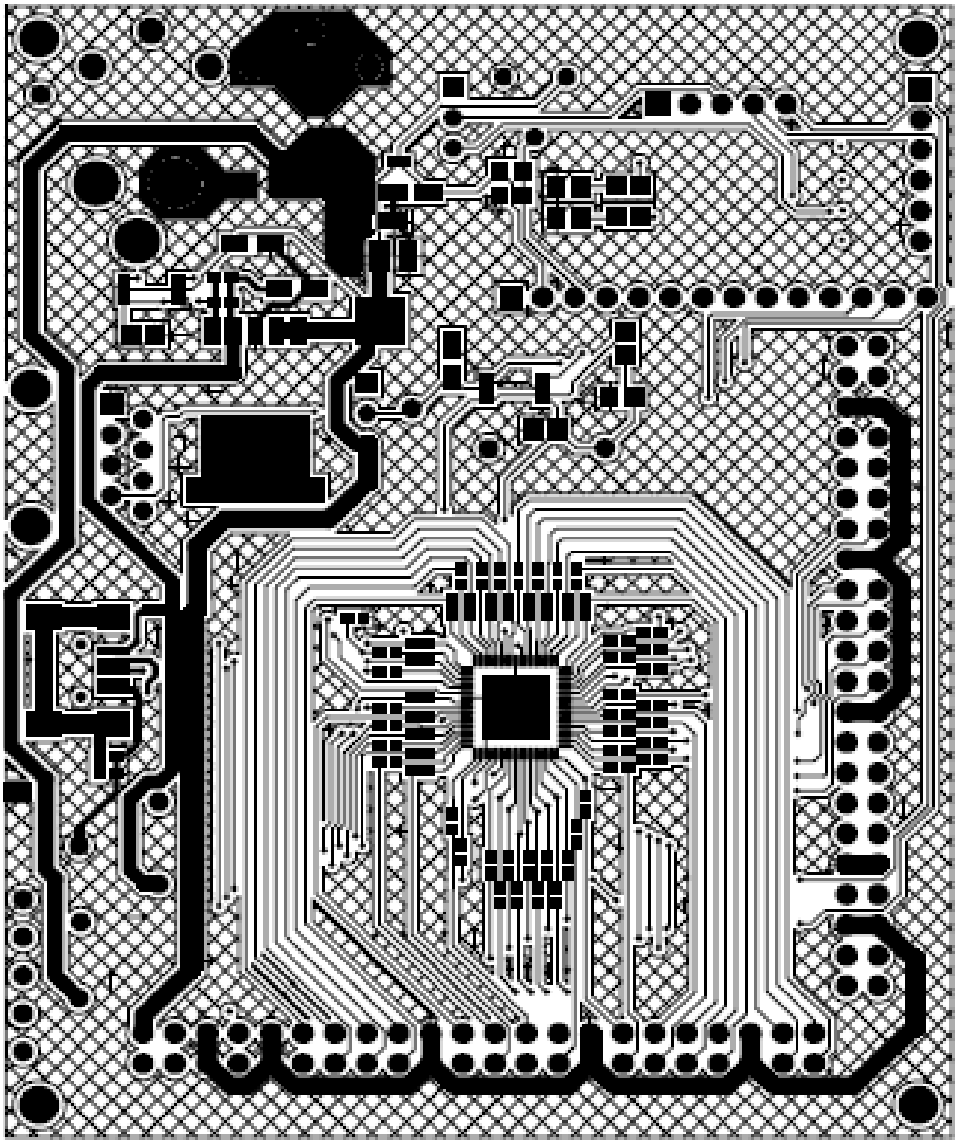
A. Appendix

A.1 Schematic

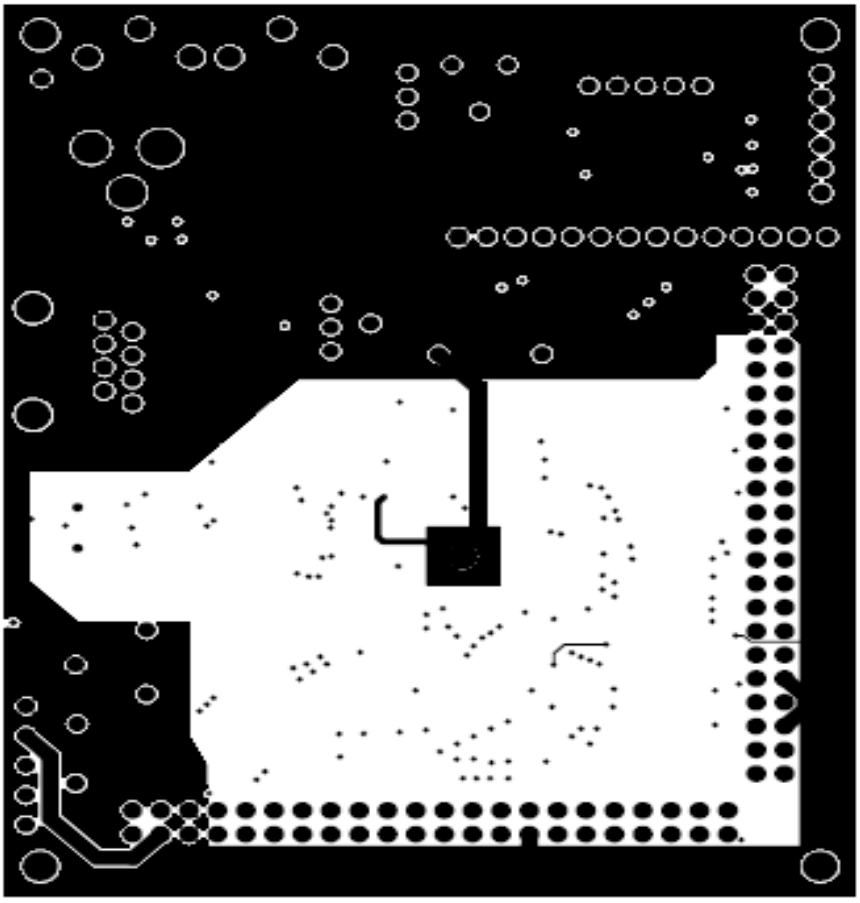


A.2 Board Layout

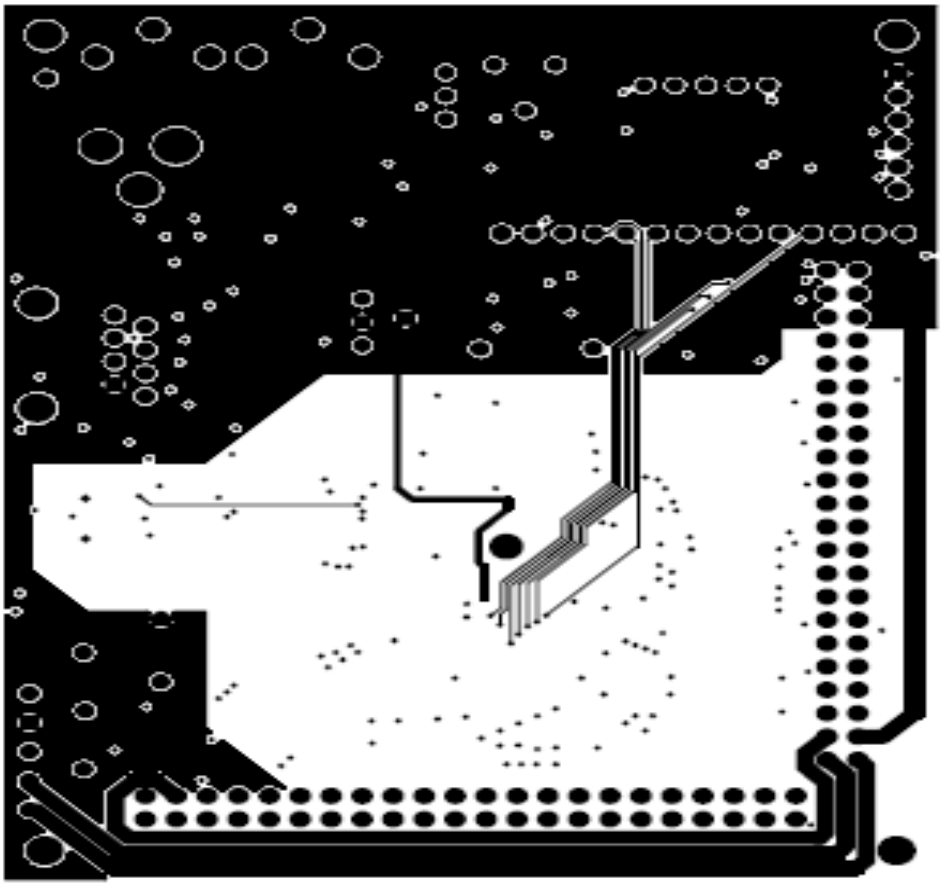
A.2.1 PDCR-9434 (Top)



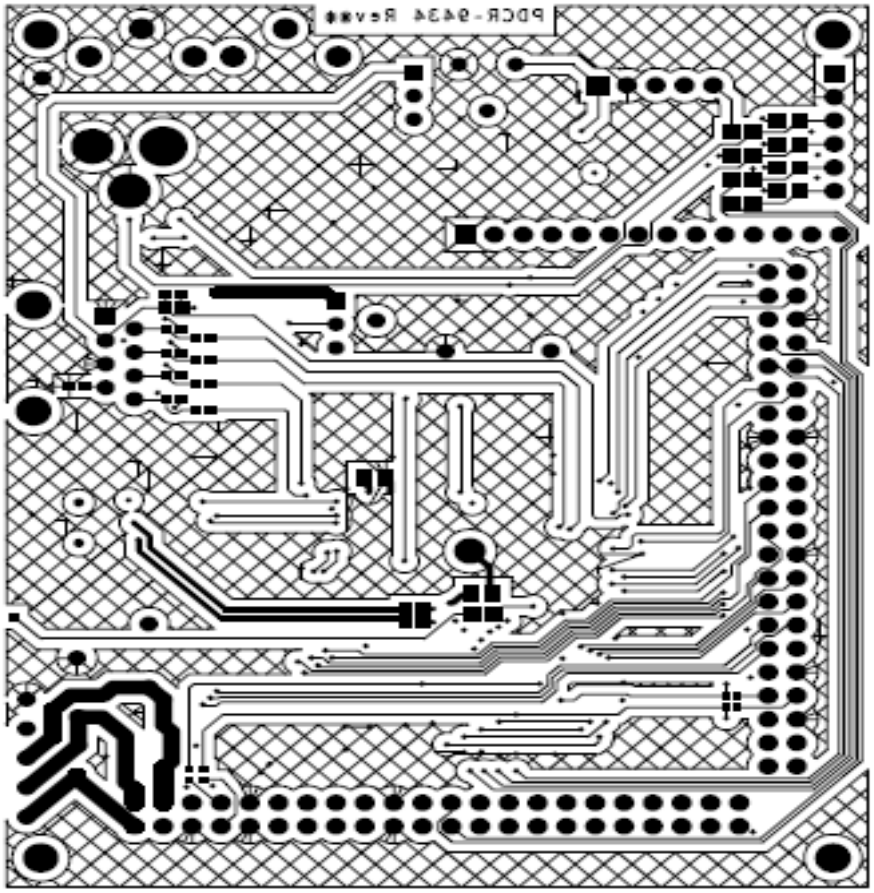
A.2.2 PDCR-9434 Layer 2



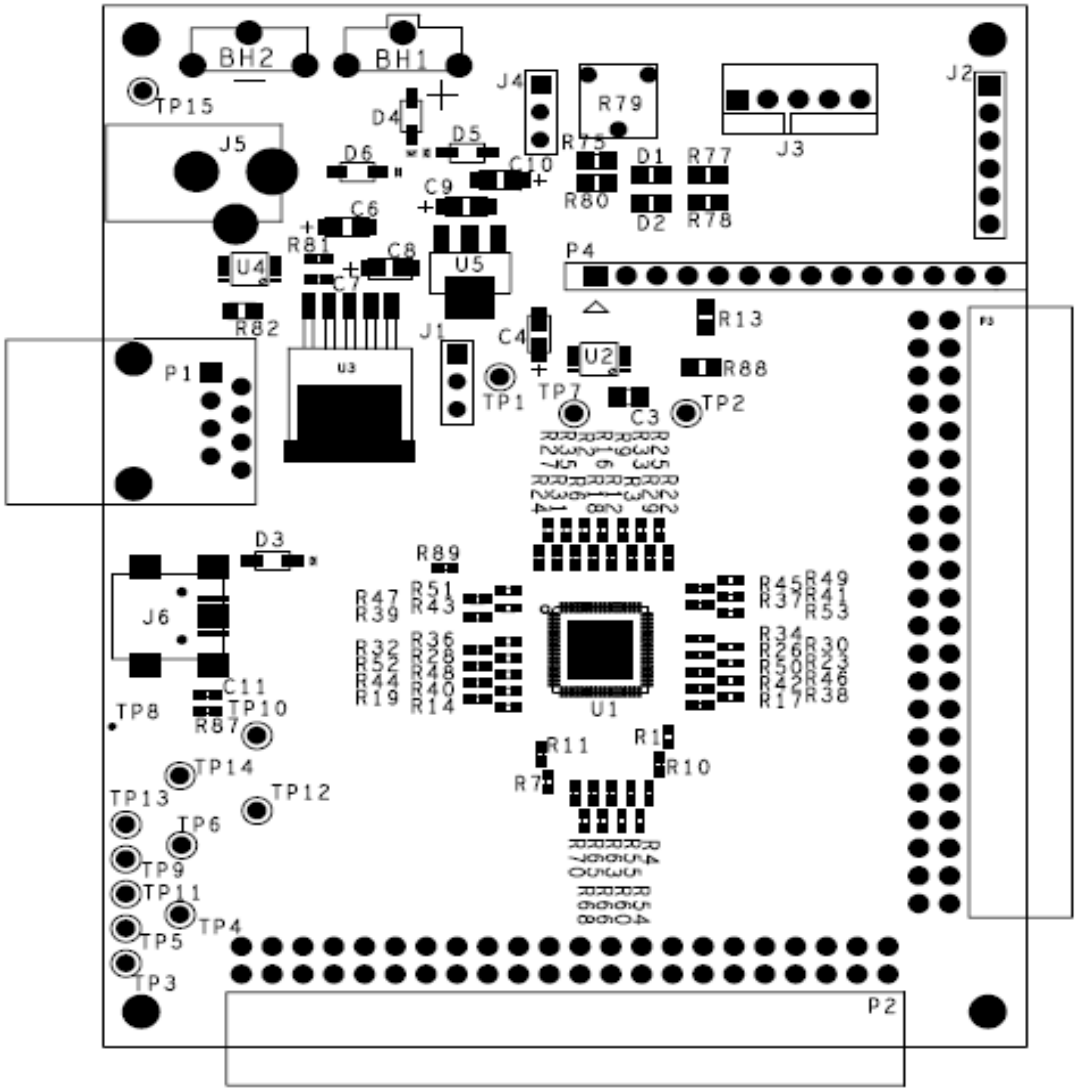
A.2.3 PDCR-9434 Layer 3



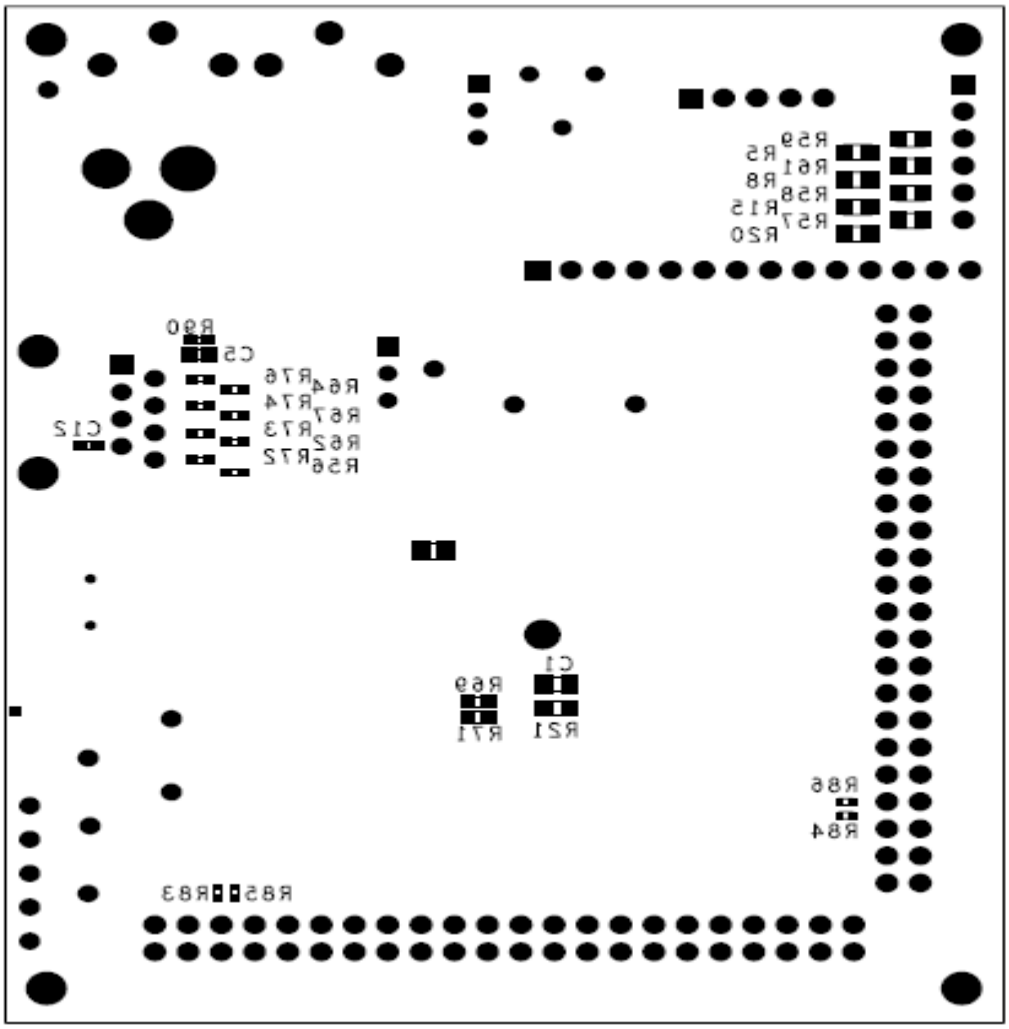
A.2.4 PDCR-9434 Bottom



A.2.5 PDCR-9434 Primary Layer



A.2.6 PDCR-9434 Secondary Layer



A.3 Bill of Materials

Item	Qty	Reference	Part	Manufacturer	Manuf. Part#	ROHS	Sub OK?
1	1		24x94 PCB Rev02	Cypress Semiconductor	PDCR-99434 Rev02	Y	N
2	2	C1,C2	CAP CER 10UF 16V X5R 0805	Murata Electronics North America	GRM21BR61C106KE15L	Y	Y
3	1	C3	CAP 0.01UF 50V CERAMIC X7R 0805	Panasonic - ECG	ECJ-2VB1H103K	Y	Y
4	1	C5	CAP 330PF 100V CERAMIC X7R 0603	Panasonic - ECG	ECJ-1VB2A331K	Y	Y
5	4	C6,C8,C9,C10	CAP 10UF 16V TANTALUM 10% 3216	AVX	TAJA106K016R	Y	Y
6	2	C7,C11	CAP 10000PF 16V CERAMIC 0402 SMD	Panasonic - ECG	ECJ-0EB1C103K	Y	Y
7	1	C12	CAP .1UF 16V CERAMIC Y5V 0402	Panasonic - ECG	ECJ-0EF1C104Z	Y	Y
8	2	D1,D2	LED RED Clear 0805 SMD	LITE-ON Inc	LTST-C170CKT	Y	Y
9	4	D3,D4,D5,D6	DIODE SCHOTTKY 0.5A 20V SOD-123	Fairchild Semiconductor	MBR0520L	Y	Y
10	2	J1,J4	CONN HEADER VERT 3POS .100 30AU	AMP Division of TYCO	87220-3	Y	Y
11	1	J3	CONN HEADER 5POS 0.1 VERT KEYED	Molex	22-23-2051	Y	Y
12	1	J5	CONN 2.1MM PWRJACK RT ANGLE PCB	Switchcraft	RAPC722X	Y	Y
13	1	J6	CONN USB MINI AB SMT RIGHT ANGLE	TYCO	1734035-2	Y	Y
14	1	P1	CONN RJ45 8-8 MOD JACK UNSHIELD RIGHT ANGLE	AMP Division of TYCO	5557785-1	Y	N
15	2	P2,P3	CONN FMALE 44POS DL .1" R/A GOLD	Sullins Electronics Corp.	PPPC222LJBN-RC	Y	N
16	51	R1,R2,R3,R6,R9,R10,R11,R12,R14,R16,R17,R18,R19,R22,R23,R24,R25,R26,R27,R28,R29,R30,R31,R32,R33,R34,R35,R36,R37,R38,R39,R40,R41,R42,R43,R44,R45,R46,R48,R49,R50,R51,R52,R54,R55,R60,R63,R65,R66,R68,R70	RES 560 OHM 1/16W 5% 0402 SMD	Yageo Corporation	RC0402JR-07560RL	Y	Y
17	4	R4,R7,R53	RES 100 OHM 1/16W 5% 0402 SMD	Rohm	MCR01MZPJ101	Y	Y
18		R47	RES 1.5k OHM 1/16W 5% 0402 SMD	Panasonic - ECG	ERJ-2GEJ152X	Y	Y
19	1	R13	RES 7.5K OHM 1/8W 5% 0805 SMD	Panasonic - ECG	ERJ-6GEYJ752V	Y	Y
20	4	R56,R62,R64,R67	RES 47 OHM 1/16W 5% 0402 SMD	Panasonic - ECG	ERJ-2GEJ470X	Y	Y
21	2	R57,R58	RES 56k OHM 1/16W 5% 0805 SMD	Panasonic - ECG	ERJ-6GEYJ563V	Y	Y
22	2	R69,R71	RES 24 OHM 1/16W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ240V	Y	Y
23	4	R72,R73,R74,R76	RES 1.0K OHM 1/16W 5% 0402 SMD	Yageo Corporation	RC0402JR-071KL	Y	Y
24	2	R77,R78	RES 1K OHM 1/10W 5% 0805 SMD	Panasonic - ECG	ERJ-6GEYJ102V	Y	Y
25	1	R81	RES 8.87K OHM 1/16W 1% 0402 SMD	Panasonic - ECG	ERJ-2RKF8871X	Y	Y
26	4	R83,R84,R85,R86	RES ZERO OHM 1/16W 0402 SMD	Panasonic - ECG	ERJ-2GE0R00X	Y	Y
27	2	R87,R89	RES 100K OHM 1/16W 5% 0402 SMD	Panasonic - ECG	ERJ-2GEJ104X	Y	Y
28	1	R90	RES 1.0K OHM 1/16W 5% 0402 SMD	Phycomp USA Inc	9C1A04021001JLHF3	Y	Y
29	1	TP2	TEST POINT 43 HOLE 65 PLATED ORANGE	Keystone Electronics	5003	Y	Y
30	5	TP1,TP4,TP6,TP10,TP12	TEST POINT 43 HOLE 65 PLATED RED	Keystone Electronics	5000	Y	Y
31	3	TP7,TP14,TP15	TEST POINT 43 HOLE 65 PLATED BLACK	Keystone Electronics	5001	Y	Y
32	1	U1	IC, 68 QFN PSoC MIXED-SIGNAL ARRAY OCD	Cypress Semiconductor	CY8C24094-24LTXI	Y	N

Item	Qty	Reference	Part	Manufacturer	Manuf. Part#	ROHS	Sub OK?
33	1	U3	IC REG LDO 1.5A ADJ VOLT TO263-5	National Semiconductor	LP3875ES-ADJ/NOPB	Y	N
34	1	U4	IC DGTL POT SPI 10K 10-MSOP	Analog Devices Inc	AD5161BRMZ10	Y	N
35	1	U5	IC REG 5.0V 800MA LDO SOT-223	National Semiconductor	LM1117MPX-5.0	Y	Y
Do Not Populate							
36	2	R82,R88	RES NO LOAD 0805 SMD	NA	NA	Y	Y
37	1	R75	RES 1.37K OHM 1/8W 5% 0805 SMD	Panasonic - ECG	ERJ-6ENF1371V	Y	Y
38	1	R79	POT 5K CARBON LAYDOWN (103)	Panasonic - ECG	EVN-D8AA03B53	Y	Y
39	1	R80	RES 1.07K OHM 1/8W 5% 0805 SMD	Panasonic - ECG	ERJ-6ENF1071V	Y	Y
40	1	R21	RES CHIP 0.0 OHM 1/10W 5% 0805 SMD	Panasonic-ECG	ERJ-6GEY0R00V	Y	Y
41	1	J2	CONN HEADER VERT 6POS .100 TIN	Molex/Waldom Electronics	22-28-4060	Y	Y
42	4	TP3,TP5,TP9,TP11	TEST POINT 43 HOLE 65 PLATED RED	Keystone Electronics	5000	Y	Y
43	1	TP13	TEST POINT 43 HOLE 65 PLATED BLACK	Keystone Electronics	5001	Y	Y
44	1	U2	IC DGTL POT SPI 50K 10-MSOP	Analog Devices Inc	AD5161BRMZ50	Y	N
45	1	C4	CAPACITOR 1.0UF/16V TEH SER SMD	Panasonic - ECG	ECS-H1CY105R	Y	Y
46	1	BH1	BATTERY HOLDER 9V Female PC MT	Keystone Electronics	594	Y	Y
47	1	BH2	BATTERY HOLDER 9V Male PC MT	Keystone Electronics	593	Y	Y
48	1	P4	CONN REC .100 14POS for LCM-S01602DTR/A-3	3M Electronics	929850-01-14-10	Y	Y
49	2	R59,R61	RES 56k OHM 1/16W 5% 0805 SMD	Panasonic - ECG	ERJ-6GEYJ563V	Y	Y
50	4	R5,R8,R15,R20	RES 560 OHM 1/16W 5% 0402 SMD	Panasonic - ECG	ERJ-2GE0R00X	Y	Y
51	1	TP8	TEST PAD 30 SMT (Copper)	NA	NA	Y	Y
Special Jumper Installation Instructions							
52	1		Install jumper across pins 2 and 3 of J1	Sullins Electronics Corp.	STC02SYAN	Y	Y
53	2		Install jumper across pins 1 and 2 of J4	Sullins Electronics Corp.	STC02SYAN	Y	Y
Install On Bottom of PCB As Close To Corners As Possible							
54	4	n/a	BUMPER CLEAR.370X.19" CYLINDER	Richco Plastic Co	RBS-35	Y	Y