CY3280-BK1 Universal CapSense Controller Basic Kit #1 Quick Start

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Contents

1. Getting Started

The examples in this Quick Start are for the CY3280-20x34 and CY3280-SLM Linear Slider Module boards only.

Kit Contents

- CY3280-20x34 Universal CapSense Controller Board
- CY3280-21x34 Universal CapSense Controller Board
- CY3280-SLM Universal CapSense Linear Slider Module
- CY3280-BBM Universal CapSense Prototyping Module
- CY3240-I2USB Board
- CY3210 MiniProg1 Programmer
- USB 2.0 Retractable Cable
- PSoC Express Installation CD
- PSoC Designer and PSoC Programmer Installation CD
- CY3280-BK1 Universal CapSense Controller Kit CD
- 1.5 mm and 3 mm Polycarbonate Overlays (with Adhesive for attachment to module board if wanted)

Installing Software

To use the examples in this quick start:

- Install PSoC Express Development Software
- Install PSoC Designer Development Software
- Review the Additional CY3280-BK1 Universal CapSense Controller CD Content

Install PSoC Express Development Software

1.1 Insert the PSoC Express Installation CD.

1.2 Install PSoC Express 3.

1.3 Install .NET Framework 2.0.

1.4 Install PSoC Programmer.

1.5 Install Express Pack 3 (found on the kit CD in the `\Software` folder).

Install PSoC Designer Development Software

1.6 Insert the PSoC Designer and PSoC Programmer Installation CD.

1.7 Browse to and launch *PD44_B119x86.exe* at `\PSoC Programmer 2.3_PSoc Designer 4.4\psoc_designer_tm__v__4_4_13\`.

1.8 Follow the installation instructions.

1.9 Install Service Pack 1 (found on the kit CD in the `\Software` folder).

1.10 A C compiler license is required to build PSoC Designer C language projects. Section 2.1 of the *C Language Compiler Users Guide.pdf* found in **Help → Documentation** explains how to enter the license.

Additional CY3280-BK1 Universal CapSense Controller CD Content

- Example projects for PSoC Express and PSoC Designer
- Hardware schematics and gerber files
- CY3240-I2USB software installer and documentation

CapSense Best Practices

The Universal CapSense Controller has been created using the best practices for CapSense lay out. To enable universality and development of the kit and its projects, certain design elements have been changed from what is recommended for final products. Below is a list of the design features in the Universal CapSense Controller and what to change for final products.

Design Feature	Reason	Impact	Recommended Change
Sensing traces routed through a connector to sensors	Buttons, sliders and LEDs placed on the module board to all for greater flexibility with custom modules for development and subsequent releases.	Connectors increase the parasitic capacitance of the sensors, effectively reducing their sensitivity. Connectors also create another path for noise to enter the system.	Sensors and control circuitry should be located on the same printed circuit board. Lower parasitic capacitance by reducing trace lengths.
Sensing traces routed to other schematic elements	Universality of the board enabled by population/depopulation of 0-ohm resistors	Solder pads of 0-ohm resistors increase parasitic capacitance.	Route traces directly to sensing elements. Use as few 0-ohm resistors as possible
Sensing traces located on the top layer	Using vias to route traces to bottom of board and back to connector increases parasitic capacitance.	Possible noise sensitivity to stimulus on top side of board. Finger presses on routing of control board can lead to sensor activation.	Route sensing traces on non-user side of printed circuit board. Route sensing traces as far from noise sources as possible.
Several regulators used, including a variable regulator	Demonstration of CapSense at several voltages.	Global and User Module parameters may need to be verified with changing power supply.	Supply one regulated voltage to PSoC.
Test point on CMOD	Accessibility of charge/discharge waveforms	A test point increases noise sensitivity by acting as an antenna.	Solder-pad test points for leads offer better noise immunity if test points are required.
GND spacing is generalized for noise immunity and sensitivity	Universality of kit required middle-ground on many parameters	Design is not optimized for high-noise or very thick overlays	Increase spacing for thicker overlays and better sensitivity. Decrease spacing for greater noise immunity
Connection to shield electrode is through a jumper (module - J2)	Flexibility of module boards for both CSD and CSA control boards	Higher resistance paths can impair performance of shield electrode in CSD projects	Dedicated trace for shield electrode. Remove jumpers wherever possible
ESD protection circuitry is not included	Development/evaluation platform without consistent overlay is inherently vulnerable to ESD events	Direct or air-separated ESD testing may impair operation or damage circuitry. +/-2kV limit on PSoC pins (see datasheet).	Include an overlay and ESD protection circuitry
UM Parameters set to supplied overlay thicknesses	Projects optimized for supplied hardware	Sensitivity may not be high enough for very thicker overlays	Thicker overlays may require verification of parameters to ensure proper operation
Unused pins are not routed directly to GND	Pins brought out to connector for subsequent modules or custom designs	Possible noise path	Tie unused sensing traces directly to ground
0-ohm Resistors populated throughout	Universality of the board enabled by population/depopulation of 0-ohm resistors	Solder pads of 0-ohm resistors increase parasitic capacitance	Route traces directly to sensing elements. Use as few 0-ohm resistors as possible

2. Use the Board as Factory Programmed

The examples in this Quick Start are for the CY3280-20x34 and CY3280-SLM Linear Slider Module boards only.

The CY3280-20x34 board is preprogrammed with demonstration firmware. When powered by a PSoC MiniProg, a CY3240-I2USB Bridge, or an optional external power supply, the LEDs light up when a finger touches one of the buttons or the slider.

These instructions assume your board has not been reprogrammed from the factory settings. If it has, and you would like to follow along with this demonstration, follow the instructions in the Resetting the Board to the Original Factory Programming section on page 5, and then start this example with the Power the Board section below.

Power the Board

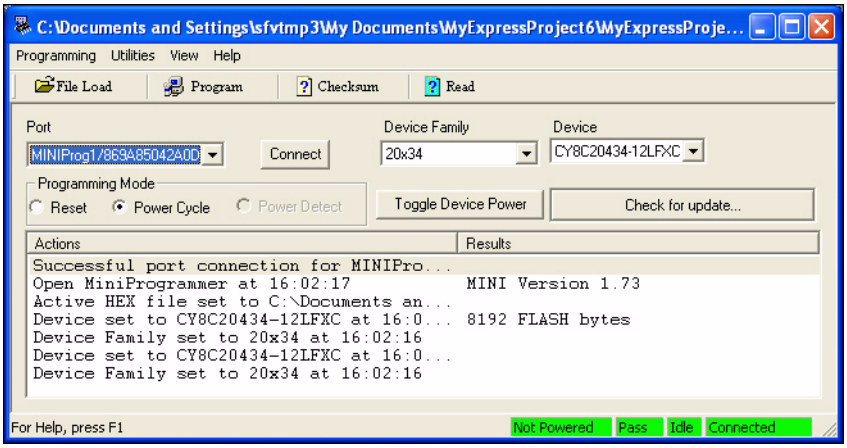
2.1 Connect your computer to the CapSense test board ISSP Connector (J3)  using the PSoC MiniProg and a USB cable. If this is your first time using the MiniProg, you will need to install the driver using these steps before proceeding:

a. When the Found New Hardware Wizard opens, select the **Install the software automatically (Recommended)** option and click **Next**.

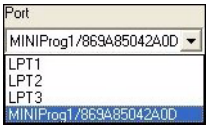
b. A warning message may tell you the software you are trying to install has not passed Windows Logo testing. Click **Continue Anyway** each time it appears.

c. When the installation is complete, click **Finish**.

2.2 Open PSoC Programmer by going to the Windows Start menu and selecting **All Programs → Cypress MicroSystems → PSoC Programming → PSoC Programmer**.



2.3 From the Port menu, select **MiniProg1/<Identification Code>**.



2.4 Click **Toggle Device Power** 

. The D1 LED on the CY3280-20x34 board lights green.

Test the Board

2.5 Touch the slider on the board with your finger. An LED will light up representing where your finger is on the slider. The LED state changes as you move your finger across the slider

2.6 Touch one or more buttons with your finger. The LEDs light up corresponding to the buttons being pressed.

Resetting the Board to the Original Factory Programming

Follow these steps if you wish to reset the board to the original factory installed programming:

2.7 Place shunts on pins 2 and 3 of J1 and pins 1 and 2 of J4.

2.8 The example projects are available on the CD and from the Cypress web site. On www.cypress.com, search for CY3280-BK1.

2.9 To reset the board to the factory conditions, connect your computer to the CY3280-20x34 board ISSP Connector (J3) using the PSoC MiniProg and a USB cable.

2.10 Open **PSoC Programmer** by going to the **Windows Start** menu → **All Programs** → **Cypress MicroSystems** → **PSoC Programming** → **PSoC Programmer**

2.11 Click **File Load**, navigate to, and open the *CY3280_20x34_slm.hex* file on the CD at:

Firmware/PSoCDesigner/CY8C20x34/CY3280_20x34_SLM/Output/CY3280_20x34_slm.hex

2.12 From the Device Family menu, select **20x34**.

2.13 From the Device menu, select **CY8C20434-12LFXC**.

2.14 Click **Program**. “Programming Succeeded...” appears in the Actions pane when programming is complete.

Note: The CY3280_20x34_slm example project is a PSoC Designer project, and will not open with PSoC Express. PSoC Programmer uses *.hex* files generated by both applications.

3. Create a PSoC Express CapSense Project

This project walks you through the steps of creating a PSoC Express project from scratch. At the end of the project, you will be able to touch a button on the board and see the corresponding LED light up.

Start a New Project

3.1 Open PSoC Express.

3.2 Select **File → New Project**.

3.3 Name the project **MyExpressProject**.

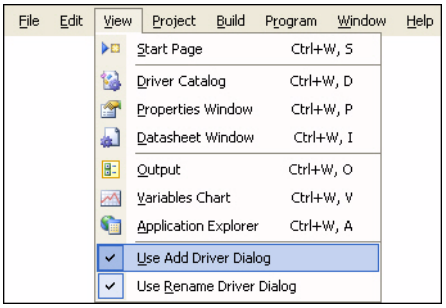
3.4 If needed, click **Browse** to save the project in a different location.

3.5 Click **OK**.

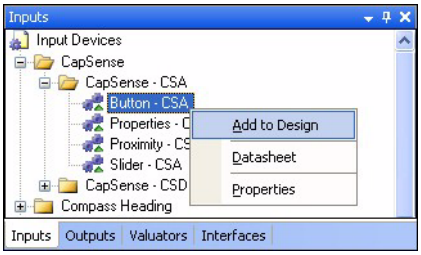
Add the First CSA Button Driver to Your Design

3.6 Ensure the Driver Catalog pane is visible by selecting **View → Driver Catalog**.

3.7 Each driver and valuator has certain properties associated with it. For the purposes of this example, ensure **View → Use Add Driver Dialog** is checked.



3.8 In the Driver Catalog pane, go to **Inputs → CapSense → CapSense - CSA**, right-click on **Button - CSA**, and select **Add to Design**. The Add Input Driver window will open.

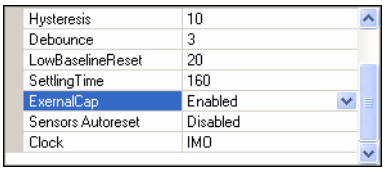


3.9 In the Add Input Driver window, name the driver **Button1**.

3.10 Click **OK** to accept the default settings. Another Add Input Driver window will open automatically.

3.11 Name this driver **CapSenseProperties**.

3.12 In the Properties pane, set ExternalCap to **Enabled**.



3.13 Click **OK**.

Add a Second CSA Button Driver to Your Design

3.14 Repeat Step 3.8 to add a second CSA Button to your design.

3.15 Name the driver **Button2**.

3.16 Click **OK**.

Add the First LED Value Driver to Your Design

3.17 In the Driver Catalog pane, go to **Outputs → Display → LED → Single Color**, and add an **On/Off** driver to your design. The Add Output Driver window will open.

3.18 In the Add Output Driver window, name the driver **LED1**.

3.19 In the Properties pane, set Current Mode to **Sinking**.

3.20 Click **OK**.

Add the Second LED Value Driver to Your Design

3.21 In the Driver Catalog pane, go to **Outputs → Display → LED → Single Color**, and add another **On/Off** driver to your design. The Add Output Driver window will open.

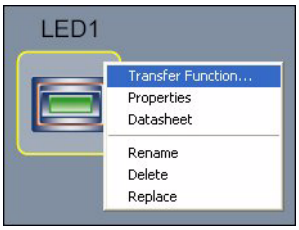
3.22 In the Add Output Driver window, name the driver **LED2**.

3.23 In the Properties pane, set Current Mode to **Sinking**.

3.24 Click **OK**.

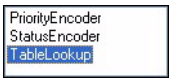
Define the LED Transfer Function

3.25 You now have five drivers on your design desktop: Button1, Button2, LED1, LED2, and CapSenseProperties. Right-click the LED1 driver and select **Transfer Function**.



Note: If your driver icons are stacked on top of each other, simply use your mouse to click and drag each driver to a new location until all five drivers are clearly visible. You may also click your mouse button while holding the [**Ctrl**] or [**Ctrl**] + [**Shift**] keys to zoom in and out respectively.

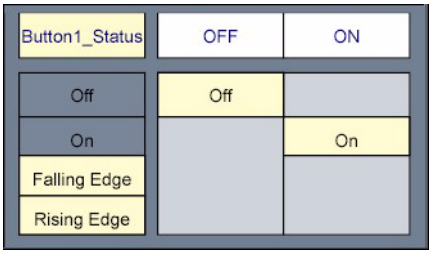
3.26 In the Select Transfer Function window, select **TableLookup** and click **OK**.



3.27 In the Select Input(s) window, select Button1_Status.

3.28 Click **Next**.

3.29 Set the Table Lookup to have the LED be off when its corresponding button is in an off state, and on when the button is in the on state.

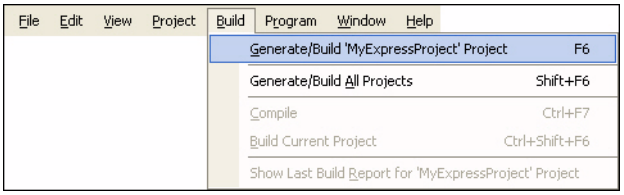


3.30 Click **OK**.

3.31 Repeat steps 3.25 to 3.30 for LED2, making sure to select Button2_Status for the Transfer Function.

Build Your Project

3.32 Select **Build → Generate/Build 'MyExpressProject' Project**



3.33 In the PSoC Device Configuration Selection window, select the **CY8C20434, 32-Pin QFN** part in the Available Device Configurations pane.

Note: The CY3280-20x34 Universal CapSense Controller includes a special on-chip debugger (OCD) part, CY8C20000, which is a 48-pin part that is not normally used for production. The corresponding production part is a CY8C20X34, and comes in 24 and 32 pin packages. For instance, a CY8C20434 is a 32 pin QFN that has many of the same pins as the CY8C20000, but is a production part without the OCD function.

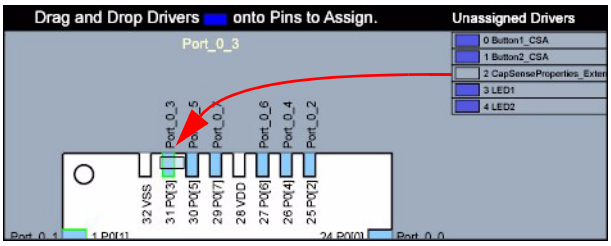
3.34 Ensure the **Assign pins automatically** check box is **NOT** selected.

3.35 Click **Next**.

Assign Drivers to Pins

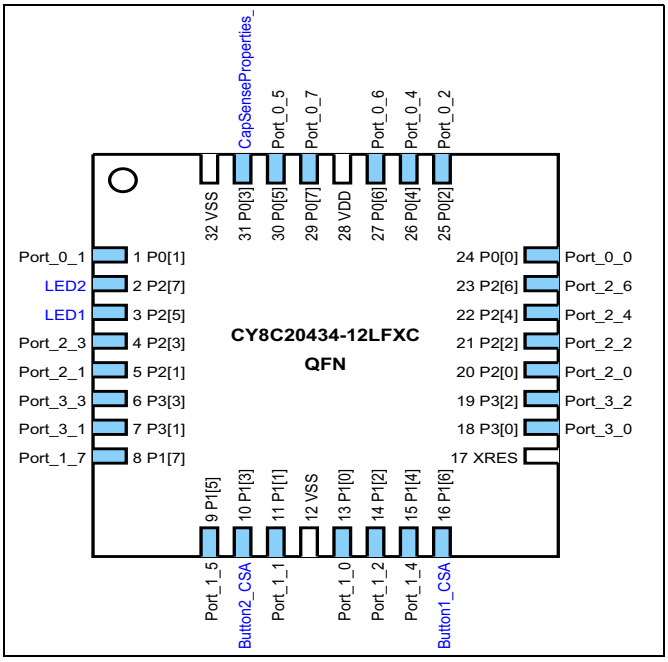
3.36 In the User Pin Assignment window, click **Unassign All Pins**. All drivers move to the Unassigned Drivers list.

3.37 To assign drivers to pins, drag and drop drivers from the Unassigned Drivers list onto a pin. Assign the CapSenseProperties_ExternalCap driver to port P0[3].



3.38 Assign the rest of the drivers according to the following table:

Button1_CSA	P1[6]
Button2_CSA	P1[3]
CapSenseProperties_ExternalCap (previously assigned in Step 3.27)	P0[3]
LED1	P2[5]
LED2	P2[7]



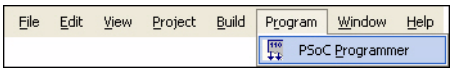
3.39 Click **Next**. PSoC Express builds your project (this may take a few minutes).

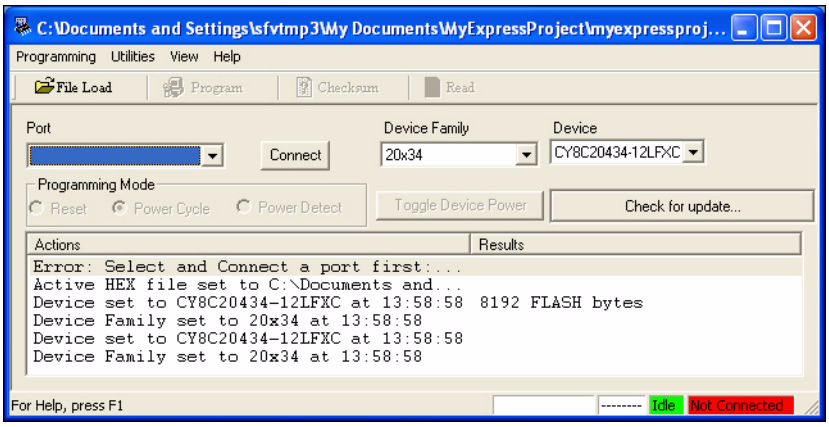
Program the CY3280-20x34 UCC Board

3.40 Connect your computer to the CapSense test board ISSP Connector (J3) using the PSoC MiniProg and a USB cable.

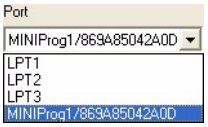
3.41 If this is your first time using the MiniProg, you will need to install the driver before proceeding. Follow the instructions in the Power the Board section on page 7.

3.42 In PSoC Express, select **Program → PSoC Programmer**. The PSoC Programmer application opens.





3.43 From the Port menu, select **MiniProg1/<Identification Code>**.



3.44 Click **Program** 

. “Programming Succeeded...” appears in the Actions pane when programming is complete.

Test the Board

3.45 Click **Toggle Device Power** 

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3.46 Touch buttons P1[6] and P1[3] on the board with your finger. The corresponding LED lights up.

3.47 When you are done experimenting, click **Toggle Device Power** 

, and close PSoC Programmer.

3.48 Return to PSoC Express and select **File → Save Application**.

What’s Next?

You have now completed the PSoC Express CapSense project. The next example walks you through adjusting the settings so the slider is not as sensitive, a process known as tuning.

4. Tune a PSoC Express CapSense Project

Note: A CY3240-I2USB Bridge is needed for CapSense tuning. If you do not have a CY3240-I2USB Bridge board, purchase one online by going to http://www.cypress.com/design/DK10063, and clicking **Buy Online**.

The goal of tuning a capacitive sensing application is to adjust the sensitivity of the buttons or slider so that they accurately detect finger presses. This involves determining which raw counts coming from the sensor are actual finger presses, or if it is some other stimuli that changes the raw count.

Detailed tuning information is available in the CapSense Guide. In PSoC Express, select **Help → Documentation**, and select **CapSense Guide**.

Open Your PSoC Express Project

4.1 In PSoC Express, if the project from the previous example is closed, select **MyExpressProject** in the Recent Project pane (or click **browse** and open the project).

4.2 If you are not in the Design view, click Design 

.

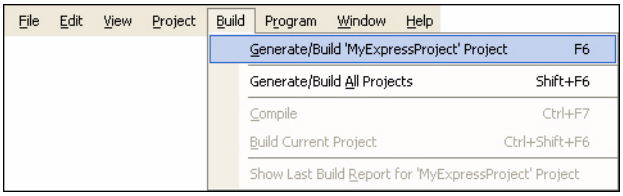
Add an I²C Slave Driver to Your Design

4.3 In the Driver Catalog pane, go to **Interfaces → Communication → I2C**, and add a **Slave** driver to your design.

4.4 In the Add Interface window, name the driver **I2CSlave** and click **OK**.

Build the Project

4.5 Select **Build → Generate/Build 'MyExpressProject' Project**



4.6 In the PSoC Device Configuration Selection window, select the **CY8C20434, 32-Pin QFN** part in the Available Device Configurations pane.

4.7 Ensure the **Assign pins automatically** check box is **NOT** selected.

4.8 Click **Next**.

Assign Drivers to Pins

4.9 In the User Pin Assignment window, click **Unassign All Pins**. All drivers move to the Unassigned Drivers list.

4.10 To assign drivers to pins, drag and drop drivers from the Unassigned Drivers list onto a pin. Assign the CapSenseProperties_ExternalCap driver to port P0[3].

Assign the rest of the drivers according to the following table.

Button1_CSA	P1[6]
Button2_CSA	P1[3]
CapSenseProperties_ExternalCap (previously assigned in Step 4.10)	P0[3]
I2CSlave I2CSCLPin	P1[1]
I2CSlave I2CSDAPin (automatically assigned when the SCL pin is assigned)	P1[0]
LED1	P2[5]
LED2	P2[7]

4.11 Click **Next**. PSoC Express builds your project (this may take a few minutes).

Program the CY3280-20x34 UCC Board

4.12 Connect your computer to the CapSense test board ISSP Connector (J3)  using the PSoC MiniProg and a USB cable.

4.13 Select **Program → Programmer**. When PSoC Programmer opens, click **Program**.

When programming has successfully completed, close PSoC Programmer and return to PSoC Express.

Tune Button1

4.14 Click the **Monitor** button  .

4.15 Connect your computer to the CapSense test board ISSP Connector (J3)  using the USB-I2C bridge and a USB cable.

4.16 From the Power Selection menu, select **5V Supplied**.

4.17 Click the **Start** button.

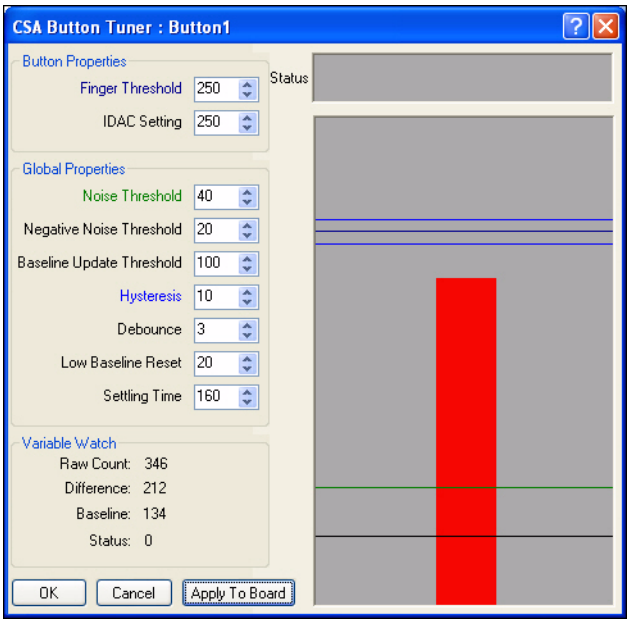
4.18 Right-click the **Button1** driver and select **Show Tuner** to open the CSA Button Tuner Window.

4.19 Touch Button1 with your finger. You can easily see the button is too sensitive because the sensor easily reports a full-finger contact.

4.20 Increase the Finger Threshold to **250** and the IDAC setting to **250**. Changing the IDAC setting is inversely related to the sensitivity of the button. Therefore, increasing the value decreases the sensitivity. Any Raw Count below the Finger Threshold does not register as a hit.

4.21 Click **Apply to Board** to write the changed parameter to Flash on the device.

4.22 Touch the button with your finger. The button is now less sensitive. When you're finished experimenting, close the CSA Button Tuner window and then click **Stop**. Monitoring a design consumes a lot of processor cycles on your PC.



Congratulations! You have successfully completed this example.To experiment with additional Universal CapSense designs, go to the `\Firmware` folder on the kit CD.

5. Create a PSoC Designer CapSense Project

This project is a brief introduction to PSoC Designer. It is recommended that you complete the PSoC Designer training offered by Cypress. At the end of the project, you will be able to touch button P2[3] on the CY3280-SLM board and see the corresponding LED light up. A C compiler license is required to build PSoC Designer C language projects. Section 2.1 of the *C Language Compiler Users Guide.pdf* found in **Help → Documentation** explains how to enter the license.

Start a New Project

5.1 Open PSoC Designer.

5.2 Click **Start New Project** button .

5.3 Name the project **MyDesignerProject**.

5.4 If needed, click **Browse** to save the project in a different location.

5.5 Click **Next**.

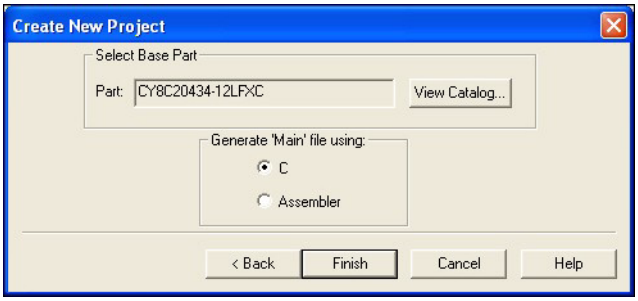
5.6 A window may pop up notifying of any directory creations. Click **Yes**.

5.7 Click **View Catalog**.

5.8 Select the **CY8C20434** part as the base part.

5.9 Select **C** for 'Main' file generation.

5.10 Click **Finish**.



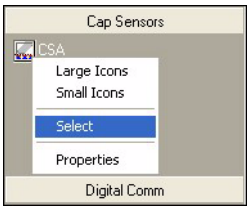
Add CSA, LED, and I2C User Modules to Your Design

5.11 If it is not already selected, click the **Device Editor** button .

5.12 Select **Config → Selection** to see the user module selection screen.

5.13 Under Cap Sensors, right-click the **CSA** user module on the left of the screen.

5.14 Click **Select**.



5.15 Under Misc Digital, right-click the **LED** user module on the left of the screen.

5.16 Click **Select**.

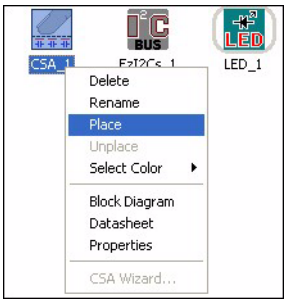
5.17 Under Digital Comm, right-click the **EzI2Cs** user module on the left of the screen.

5.18 Click **Select**.

5.19 All three selected user modules should show up in the Selected User Modules window.

5.20 Select **Config → Interconnect** to see the interconnect view.

5.21 To place the CSA and EzI2Cs user modules, right-click each user module and select **Place**. Note that the LED user module cannot be placed by the user.



Configure CSA, LED, and I2C User Modules in Your Design

5.22 Select the **CSA User Module**.

5.23 Set the External Cap to **P0[3]**, under User Module Parameters (on the left center).

5.24 Select the **LED** user module.

5.25 Set the port to **Port_1** and the pin to **Port_1_2**.

5.26 Set the drive to **active low**.

5.27 Select the **EzI2Cs** user module.

5.28 Set the I2C Clock to **400K Fast**.

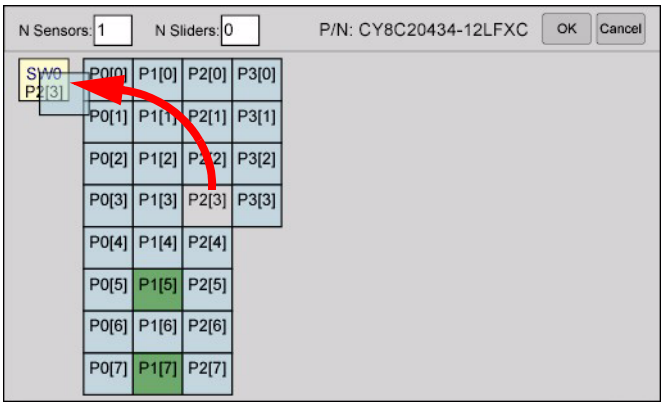
5.29 Set the I2C Pin to **P1[0]-P1[1]**.

Configure Sensor Pins Using the CSA Wizard

5.30 Right-click the **CSA** user module.

5.31 Select **CSA Wizard**.

5.32 Drag P2[3] to SW0.



5.33 Click **OK**. The Wizard will close.

5.34 Select **Config → Generate Application**.

Add Code to main.c and Build the Project

5.35 Select **View → Application Editor**.

5.36 Ensure the **Project View** button  is selected.

5.37 Double-click *main.c* under **mydesignerproject files → Source Files** on the left.

5.38 Select all text in main.c and delete it.

5.39 Add the following code:

```
#include <m8c.h>
#include "PSoCAPI.h"
typedef struct I2C_regs {
      BYTE button_state;
      WORD button_raw_counts;
      WORD button_baseline;
} I2C_REGS;
I2C_REGS reg_info;
void main()
{
      EzI2Cs_1_SetRamBuffer(sizeof(reg_info), 0, (BYTE *) &reg_info);
      M8C_EnableGInt;
      EzI2Cs_1_Start();
      CSA_1_Start();
      CSA_1_InitializeBaselines();
      CSA_1_SetDefaultFingerThresholds();
      while (1)
      {     CSA_1_ScanAllSensors();
            CSA_1_UpdateAllBaselines();
            CSA_1_bIsAnySensorActive();
            M8C_DisableGInt;
            reg_info.button_raw_counts = CSA_1_waSnsResult[0];
            reg_info.button_baseline = CSA_1_waSnsBaseline[0];
            reg_info.button_state = (CSA_1_baSnsOnMask[0] & 1);
            M8C_EnableGInt;
            if (reg_info.button_state == 1)
            LED_1_On();
            else
            LED_1_Off();
      }
}
```

5.40 Select **Build → Rebuild All** and verify the compile finishes with no errors.

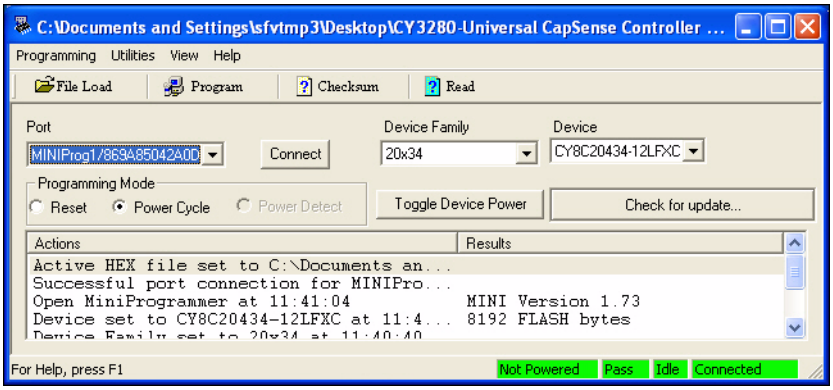
Program the CY3280 - 20x34 Board

5.41 Connect your computer to the CapSense test board ISSP Connector (J3) using the PSoC MiniProg and a USB cable. If this is your first time using the MiniProg, you will need to install the driver before proceeding. Follow the instructions in the Power the Board section on page 4.

5.42 In PSoC Designer, select **Program → Program Part**.The PSoC Programmer application opens.

5.43 From the Port menu, select **MiniProg1/<Identification Code>**.

5.44 Click **Program**. "Programming Succeeded..." appears in the Actions pane when programming is complete.



Test the Board

5.45 Click **Toggle Device Power**.

5.46 Touch the sensor P2[3] on the board with your finger. The LED P1[2] will light up.

5.47 When you are done, click **Toggle Device Power**, and close PSoC Programmer.

5.48 Return to PSoC Designer and select **File → Save Project**.

What's Next?

You have now completed the PSoC Designer CapSense project. There is a complete project that implements buttons and a slider available on the CD. To use these projects, the project folders need to be copied from the CD to a directory on a PC that has PSoC Designer installed. After copying the files, ensure that the parent folder attributes are not Read-only by following these steps:

5.49 Right-click the parent project folder.

5.50 Select **Properties**.

5.51 Ensure that the Read-only attribute is not checked.

5.52 Click **OK**.

6. Design Support and Resources

PSoC Development Software Online

All PSoC development software tools are available for download online. For PSoC Express, visit www.cypress.com/psocexpress. For PSoC Designer visit www.cypress.com/psocdesigner. For PSoC Programmer visit www.cypress.com/psocprogrammer.

PSoC Data Sheets and Application Notes

For all PSoC device data sheets and detailed application notes, many with complete starter projects, visit www.cypress.com/designresources. In the Products column, select “PSoC Mixed-Signal Controllers” and in the Resource Type column, select either “Application Notes” or “Datasheets.”

PSoC Device Selector Guide

In the PSoC Application Notes section, search for AN2209—The Device Selection Guide for PSoC. It is a useful tool for determining exactly which PSoC device you should use for a specific design project.

PSoC Development Tools Selector Guide

In the PSoC Application Notes section, search for AN2402, The PSoC Development Tools Selector Guide. This is a complete catalog and description of all the development tools that support PSoC devices and when to use them in your design cycle—from concept to production.

PSoC On-Demand Training

Visit www.cypress.com/psoctraining to engage in on-demand self-paced PSoC product and development software training. Learn to design PSoC like the pros, at the introductory, intermediate, and advanced knowledge levels!

PSoC On-Site Training

Email training@cypress.com to enquire about PSoC in-person training seminars at a location near you. Learn design basics, tips, and tricks from the pros to become a PSoC design expert!

Online Technical Support

For knowledge base articles, customer forums, and online application support, visit www.cypress.com/support.

Additional CapSense Resources

A wealth of information about PSoC Express and CapSense is available on the Cypress.com web site, and more is frequently added. The following list is just a sample of what is available.

CapSense DataSheets

- *CY8C20434 Mixed Signal Array*
- *CY8C20334 Mixed Signal Array*
- *CY8C20234 Mixed Signal Array*

CapSense Application Notes

- *AN2292, Layout Guidelines for PSoC™ CapSense*
- *AN2318, EMC Design Considerations for PSoC CapSense Applications*
- *AN2355, Calibrating CapSense with the CSR User Module*
- *AN2360, Power and Sleep Considerations*
- *AN2393, Migrating from CSR to CSA*
- *AN2394, CapSense Best Practices*
- *AN2397, CapSense Data Viewing Tool*
- *AN2398, Waterproof Capacitive Sensing*
- *AN2403, Signal-to-Noise Ratio Requirement for CapSense Applications*
- *AN2408, Migrating from CSR to CSD*
- *AN14459, CapSense Device and Method Selection Guide*

CapSense Technical Articles

- TA1186, *Designer's Guide to Rapid Prototyping of Capacitive Sensors on any Surface*
- TA1179, *Controls & Sensors Touch Sensors Spread Out*
- TA1168, *White Paper Cypress's CapSense Successive Approximation Algorithm*
- TA1193, *The Art of Capacitive Touch Sensing*

CapSense Developer Kits

- DK10068, *CapSense Successive Approximation (CSA)*
- DK10069, *CapSense Sigma-Delta (CSD)*
- DK10064, *CapSense Proximity Detection Demonstration*
- DK10059, *CapSense Demo Board*