



# CY3218-CAPEXP3 CapSense<sup>®</sup> Express<sup>™</sup> Evaluation Kit Guide

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# 1. Introduction



## 1.1 Overview

The CY3218-CAPEXP3 Evaluation Kit is used for evaluation of the CapSense Express™ device. This kit demonstrates the following features: CapSense buttons, LED drive, digital input, and I2C. The CapSense Express device is configured via a system level project in PSoC Designer™. An 8-SOIC package device is mounted on this board. The board is powered with an AAA battery. A boost converter converts the input in the range of 1.1V to 1.5V, to the device operating voltage of 3.3V. The board can also be powered using an I2C USB bridge connected to the I2C header.

## 1.2 Kit Contents

The CY3218-CAPEXP3 Evaluation Kit includes:

- CY3218-CAPEXP3 CapSense Express Evaluation Board
- Retractable USB Cable (A to Mini-B)
- CY3240-I2USB Bridge Board
- AAA Battery
- 1 mm Acrylic Overlay
- Quick Start
- A Kit CD, which includes
  - PSoC Designer IDE
  - PSoC Programmer
  - I2C USB Bridge Software
  - CapSense Express Data Sheets
  - Kit Release Notes
  - Kit User Guide
  - Software Release Notes
  - Example Project Documentation
  - Hardware Design Files

## 1.3 Default Jumper Settings

Jumper (J2) on CY3218-CAPEXP3 evaluation board configures the power setting for the board.

- Default position for J2: Jumper on pin 1 and 2; this enables powering the board via I2CUSB Bridge.
- To power the board via battery, remove the jumper at J2.

## 1.4 Document Revision History

Table 1-1. Revision History

Revision	PDF Creation Date	Origin of Change	Description of Change
**	08/07/09	RKPM	New kit guide for CapSense Express

## 1.5 Documentation Conventions

Table 1-2. Document Conventions for Guides

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

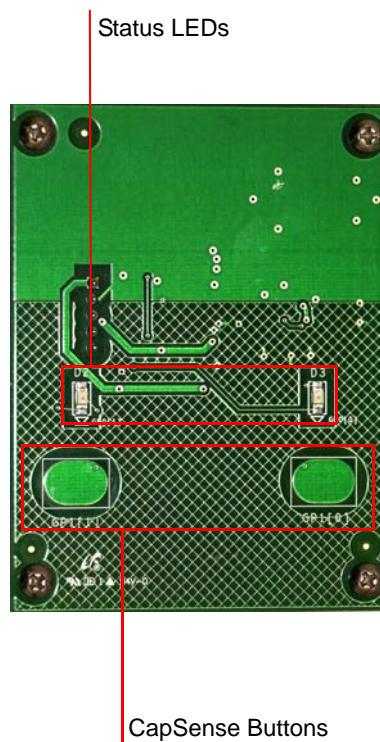
## 2. Getting Started



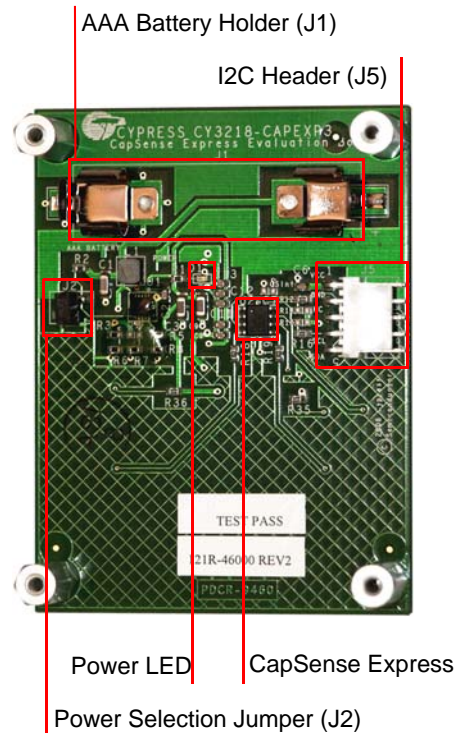
### 2.1 Hardware

The following figure illustrates the CY3218-CAPEXP3 evaluation board features.

Top View



Bottom View







## 3. Installation



### 3.1 Install Hardware

The CY3218-CAEXP3 evaluation kit is preprogrammed with demonstration firmware. These instructions assume that your board is not reconfigured from the factory settings. If it has, follow the instructions given in [Create Project with CY3218-CAEXP3 chapter on page 11](#) to configure the board.

1. Unpack the CY3218-CAEXP3 evaluation kit.
2. Insert the AAA battery into the battery holder.
3. Remove the jumper from J2 (back, left, and center of board).
4. Touch a button on the board. The respective status LED lights up.
5. Turn the board off by replacing the jumper on J2. Note that replacing the jumper disables battery operation.

**Caution** Do not touch the board anywhere other than the edges or on the buttons. Touching the board in the wrong area can lead to unintended CapSense triggers causing unexpected behaviour. If this happens, reset the power to the board. To do this, disconnect the battery supply by placing the jumper on J2. To power the board again, remove the jumper from J2.

### 3.2 Install Software

To install, insert the kit CD/DVD into your PC's CD/DVD-ROM drive. If the installer does not start automatically, start it manually by executing *cyautorun.exe* in the CD/DVD's root directory. Follow the instructions on the screen to complete the installation.

**Note** If you have a previous installation of PSoC Designer or I2C USB Bridge software (older than the version mentioned in the release notes), uninstall that version before reinstalling. To uninstall the software, go to **Start > Control Panel > Add or Remove Programs** and click the **Remove** button next to that software. Follow the instructions on the screen to complete the uninstallation.



## 4. Create Project with CY3218-CAPEXP3

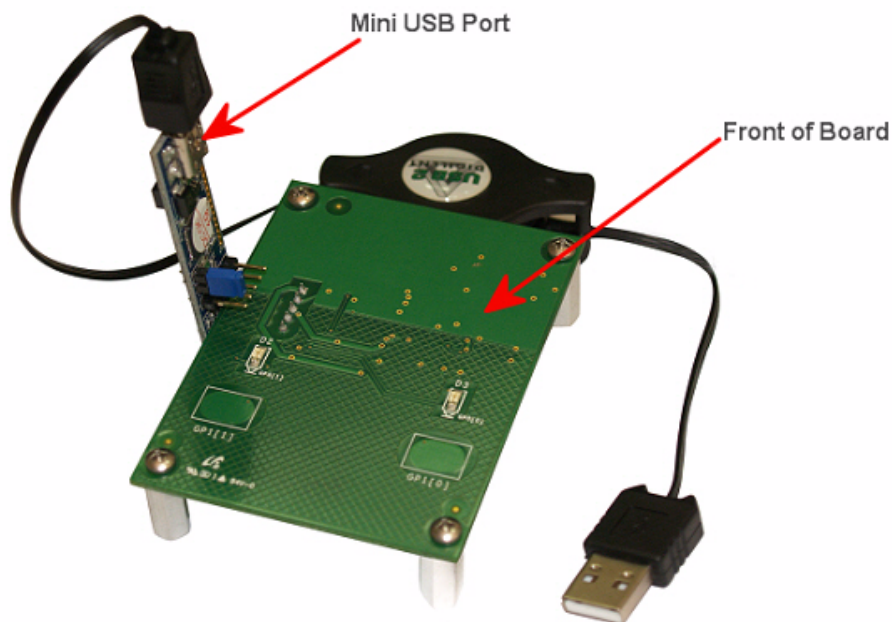


### 4.1 Functional Description

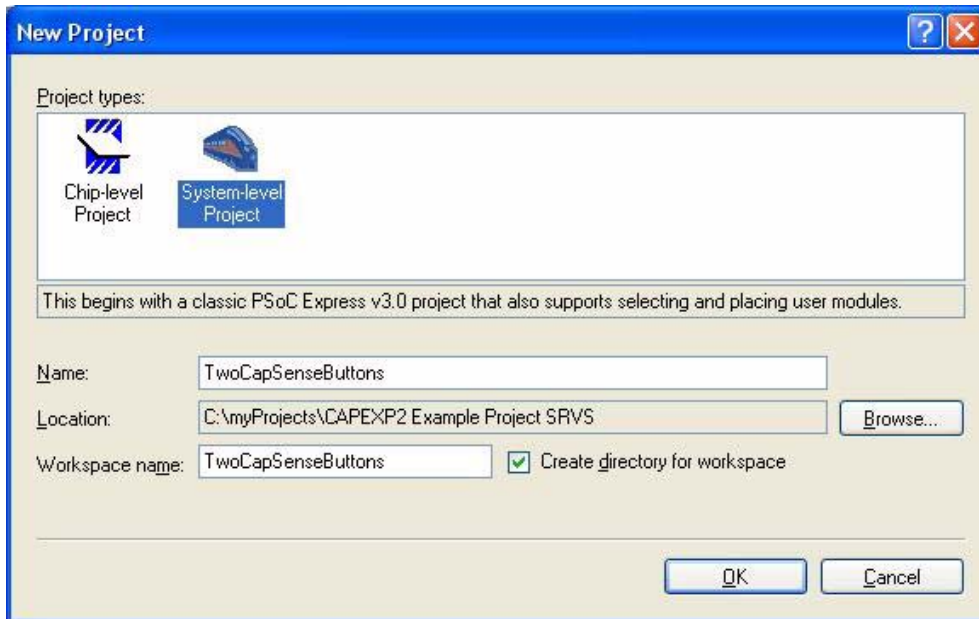
The board consists of two CapSense buttons and two status LEDs associated with these CapSense buttons. The status LEDs light up when the CapSense buttons are pressed.

### 4.2 Create New Project

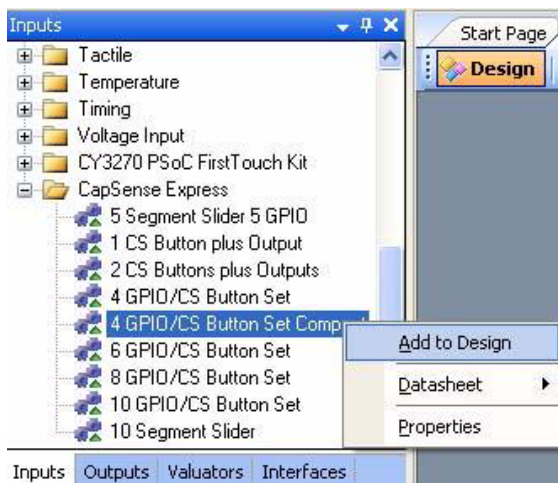
1. Connect your computer to the CapSense test board I2C Connector (J5) using the CY3240-I2USB Bridge and a USB cable as shown in this figure.



2. Launch **PSoC Designer**.
3. Create a system level project by selecting **File > New Project**; name the project 'TwoCapSense-Buttons' and save the design to a location of your choice on the computer.



4. Select **View > All Driver Catalogs** and then select the **Inputs** tab. Open the CapSense Express directory, right-click the **4 GPIO/CS Button Set Compact** driver, and select **Add to Design**. The Add Input Driver window opens.



5. Name the driver 'TwoButtons' and click **OK**. The CapSense Express 4 GPIO/CS Button Set Compact window opens.

CapSense Express 04 GPIO / CS BUTTON SET Compact : TwoButtons \* WARNING! You must apply to board to obser... ? X

### Configure Local Parameters

Pin Assignment (8-S01C)	U	U	U	U
	C0	C1	C2	C3
Pin Type	Capsens	Capsens	Capsens	Capsens
Inversion	No	No	No	No
Interrupt	OFF	OFF	OFF	OFF
Latch Direction	Rising	Rising	Rising	Rising
Drive Mode	Resistiv	Resistiv	Resistiv	Resistiv
Finger Threshold	100	100	100	100
IDAC Settings	14	14	14	14
GPIO Output	Output L	Output L	Output L	Output L

### Pin Specific Tuning

Select Pin:

### Configure Global Parameters

☒ **Firmware**  
 Firmware Revision ID: Unknown

☒ **CapSense Filtering Specific**  
 Averaging Filter: Disable  
 Averaging Samples: 2  
 I2C Drop The Sample: Enable

☒ **CapSense Specific**  
 Baseline Update Threshc: 100  
 Clock: IMO/4  
 Debounce: 3  
 External Capacitor: Disable  
 Hysteresis: 10  
 Low baseline reset: 20  
 Negative noise threshold: 20

**Averaging Filter**

Ok Apply to board Cancel

- In the system level project, each CapSense button and LED require a separate driver. The 4 GPIO/CS Button Set Compact driver is a special driver that allows you to configure all the buttons and LEDs in one interface. Each driver is listed in the Configure Local Parameters pane.

## 4.3 Configure the Driver

By default, all driver types in the Configure Local Parameters pane are set to CapSense Input. To set up the LEDs, set the Pin Type for drivers C2 and C3 to **GPOutput** and the Drive Mode to **Strong Drive**. Set the **Finger Threshold** of **C0** and **C1** CapSense Inputs to 150.

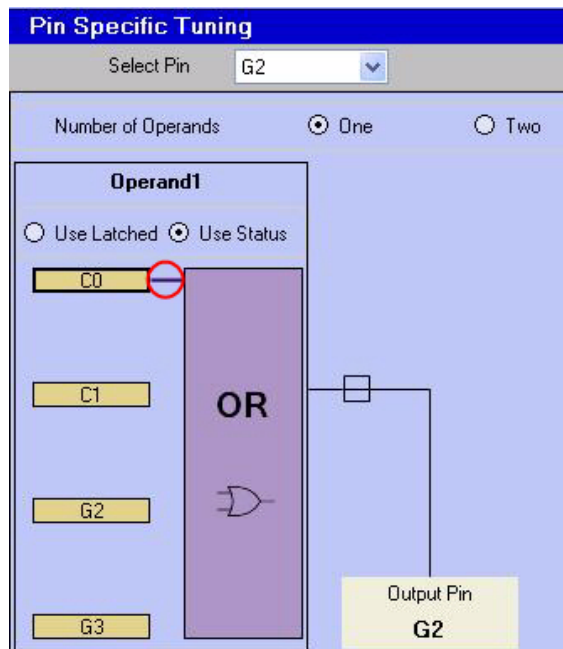
Pin Assignment (8-SOIC)	U C0	U C1	U G2	U G3
Pin Type	CapSense	CapSense	GPOutput	GPOutput
Inversion	No	No	No	No
Interrupt	OFF	OFF	OFF	OFF
Latch Direction	Rising	Rising	Rising	Rising
Drive Mode	Resistive	Resistive	Strong C	Strong C
Finger Threshold	150	150	100	100
IDAC Settings	14	14	14	14
GPIO Output	Output L	Output L	Output L	Output L

## 4.4 Configure Button and LED Behavior

1. In the Pin Specific Tuning pane, choose **G2** from the Select Pin menu.



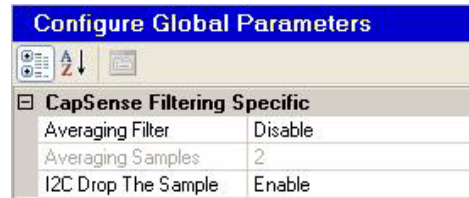
2. Click on the yellow box of the CapSense button you want to assign to LED **G2**. For LED output pin **G2**, select the CapSense button **C0**. A small line connects **C0** to the purple OR box. To have the LED turn on when the button is pressed, click the little box to the right of the purple OR box. This changes the square to an invert symbol; this is needed as the LED is connected in current sink mode



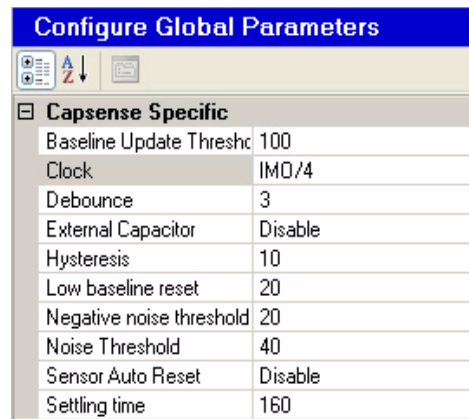
3. Repeat Step 1 and Step 2 for driver G3 according to the following table:

LED	Input
G2	C0
G3	C1

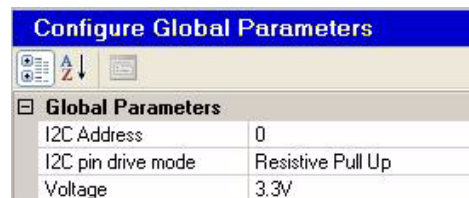
4. Enable **I2C Drop The Sample** filter in the CapSense Filtering Specific section.



5. Use the default CapSense Global Parameters for this application..

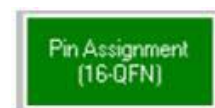


6. Configure I<sup>2</sup>C related parameters in **Global Parameters** as shown in the following figure.



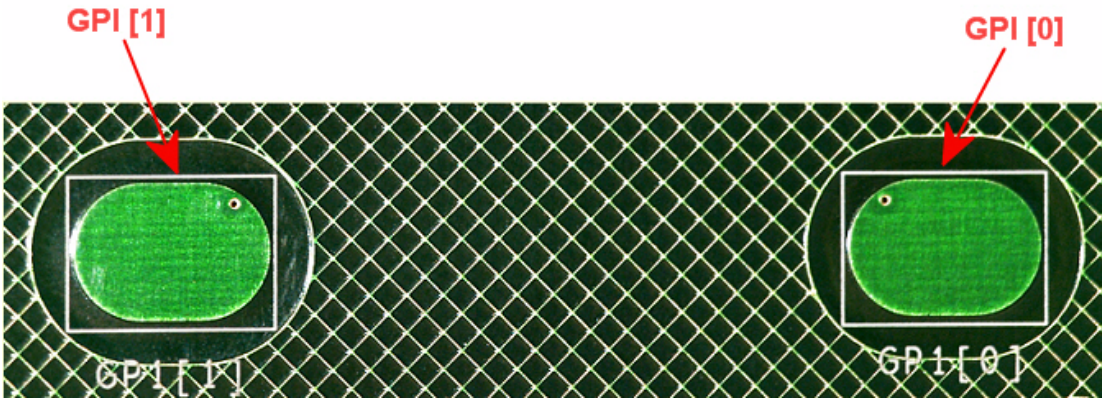
## 4.5 Pin Assignment

1. Click the **Pin Assignment (16-QFN)** button in the top left. The User Pin Assignment window opens.

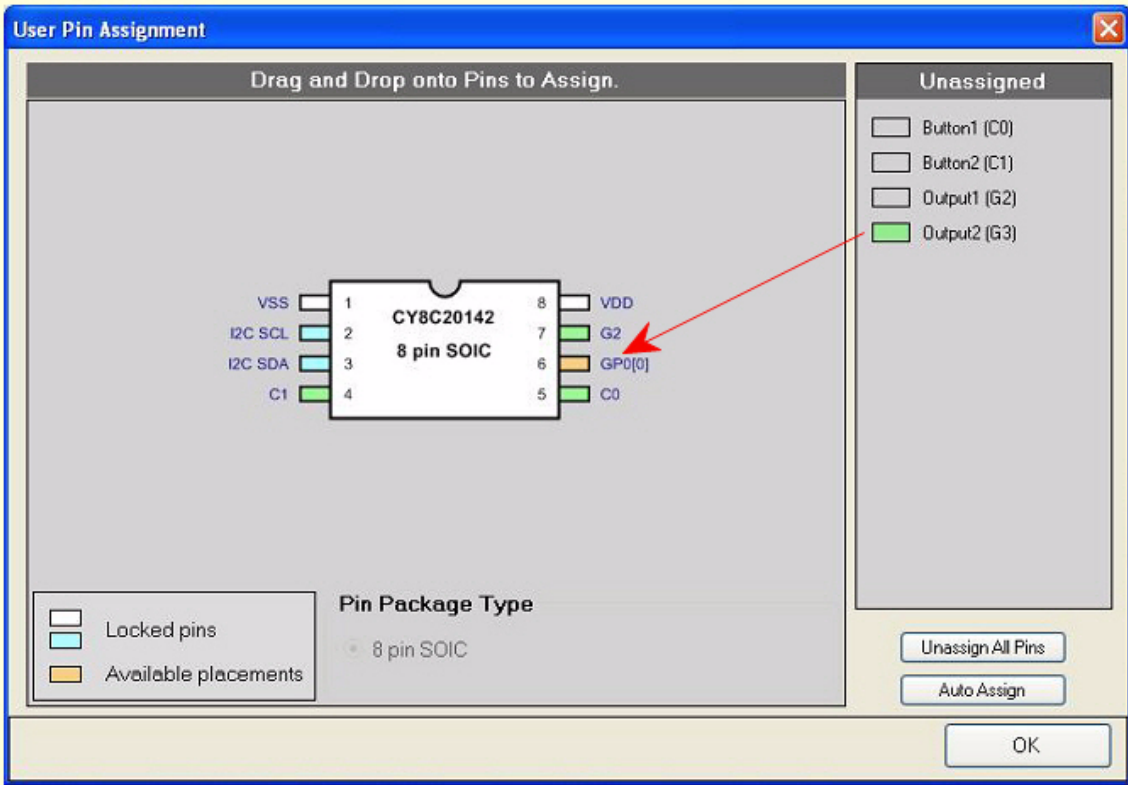




- Assign each CapSense button and LED on the board to the pin annotated on the board. For example, the CapSense sensor on the extreme left is labeled GP1[1].



- Drag each driver from the unassigned list to the appropriate pin.



Driver	Pin
Button1 (C0)	GP1[1]
Button2 (C1)	GP1[0]
Output1 (G2)	GP0[1]
Output2 (G3)	GP0[0]



4. Click **OK** to close the User Pin Assignment window.
5. Click **Apply to board**. Wait for the Configure through USB2IIC Bridge status window to appear and click **OK**.



6. Click **OK** to close the CapSense Express 4 GPIO/CS Button Set Compact: TwoButtons window.

Create Project with CY3218-CAPEXP3

## 5. Tune CY3218-CAPEXP3



### 5.1 Monitor CapSense Signal

Follow these steps to monitor the CapSense signal.

1. Click **Monitor** to open the Monitor view.



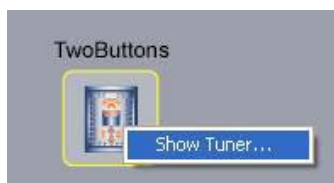
2. The Monitor Status indicator shows **Connected**.



3. Select the I2CUSB bridge power supply option.



4. Right-click **TwoButtons** and select **Show Tuner**.



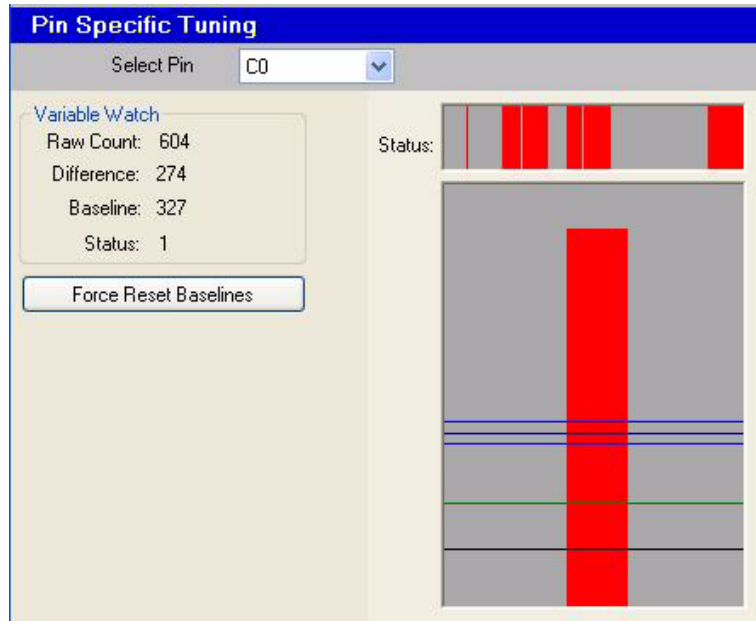
5. The Monitor Status indicator changes to **Running** and the CapSense Express window opens.
6. If your board is configured with another design, click **Apply to board** in the lower right of the CapSense Express window. When the Configure through USB2IIC Bridge status dialog appears, click **OK**. If your board is already configured with the correct design, the Apply to board button is grayed out.

## 5.2 Tune Buttons

1. From the Select Pin menu, select **C0**.

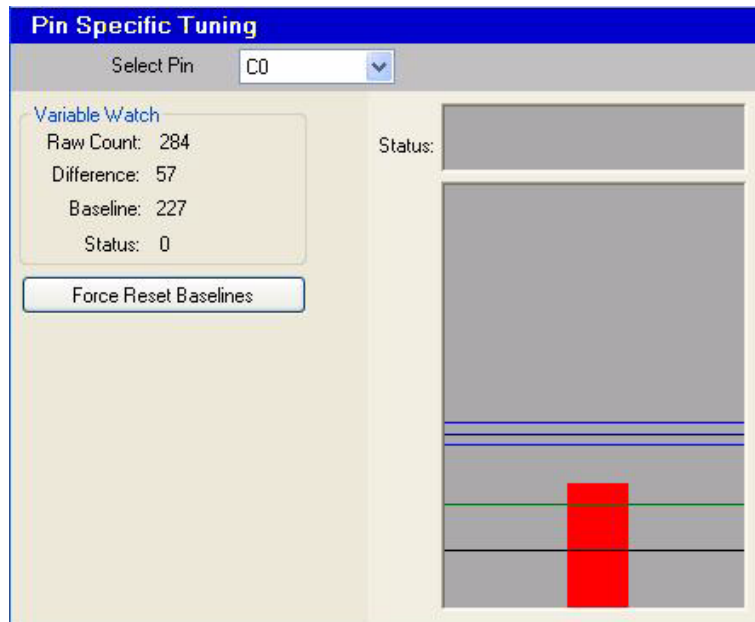


2. Touch the **C0** button (left CapSense button). When the difference variable (represented as a red vertical bar) is higher than the finger threshold (represented as a dark blue horizontal bar, set to 150), the touch registers as a hit.



3. Place the overlay provided with the kit on the board (covering both buttons).
4. Reset the device. To do this, select the powering option as **External Power** and then choose 3.3V again.

- Notice how the Difference Count value changes. The difference variable does not rise above the required finger threshold, and the button does not register a hit. The LEDs do not function as expected.



- Reducing the IDAC increases the signal strength and vice versa. To tune this button with overlay, reduce the IDAC; apply the new setting for the board by hitting the Apply to Board button, Now touch the button and check the finger response; if it does not rise above the **Finger Threshold** repeat the process.

Pin Assignment (8-S0IC)	GP1[1] C0	GP1[0] C1
Pin Type	Capsens	Capsens
Inversion	No	No
Interrupt	OFF	OFF
Latch Direction	Rising	Rising
Drive Mode	Resistive	Resistive
Finger Threshold	100	100
IDAC Settings	8	8
GPIO Output	Output L	Output L

- Repeat Step 1 to Step 6 for C1 CapSense button.

8. Test the board by touching the CapSense buttons. The LEDs on board function according to the design. Also notice how the Pin Status and Latched Value indicators change based on touch.

Pin Assignment (8-SOIC)	GP1[1] C0	GP1[0] C1	GP0[1] G2	U G3
Pin Type	Capsens	Capsens	GP0utp	GP0utp
Inversion	No	No	No	No
Interrupt	OFF	OFF	OFF	OFF
Latch Direction	Rising	Rising	Rising	Rising
Drive Mode	Resistiv	Resistiv	Strong L	Strong L
Finger Threshold	100	100	100	100
IDAC Settings	8	8	14	14
GPIO Output	Output L	Output L	Output L	Output L
Pin Status	ON	OFF	ON	OFF
Latched Value	ON	OFF	ON	OFF

9. Experiment with other materials such as plastic and wood or overlay used for your product.

## 6. Technical References



When creating a new project, always use the CY3218-CAEXP3 evaluation kit schematic and pin assignment tables as specified in this section. If you do not follow this, your project may not behave as planned.

### 6.1 CY3218-CAEXP3 Evaluation Kit Schematic

The schematic for CY3218-CAEXP3 Evaluation Kit is available on the kit CD/DVD at

- PDF file: <CD\_root>\Hardware\REF\_14697\_REVSS\_Schematic.pdf
- DSN file: <CD\_root>\Hardware\REF\_14697\_RevSS.dsn

### 6.2 CY3218-CAEXP3 Board Layout

Board files of CY3218-CAEXP3 Evaluation Kit is available on the kit CD/DVD at

- PDF file: <CD\_root>\Hardware\PDCR\_9460\_REVSS\_Layout.pdf
- Gerber file: <CD\_root>\Hardware\PDCR\_9460\_REVSS.zip

### 6.3 CY3218-CAEXP3 Bill of Material (BOM)

BOM for CY3218-CAEXP3 Evaluation Kit is available on the kit CD/DVD at

- Excel file: <CD\_root>\Hardware\121R\_46000\_REVSS\_BOM.xls

### 6.4 CY3218-CAEXP3 Pin Assignment

Pin Number	Port Number	Design Function
1	VSS	Ground connection
2	I2C SCL	I2C_Clock
3	I2C SDA	I2C_Data
4	GP1[0]	Cap_Button_2
5	GP1[1]	Cap_Button_1
6	GP0[0]	LED_2 (D3)
7	GP0[1]	LED_1 (D2)
8	VDD	Supply voltage (3.3V)





## 7. Additional Resources



### 7.1 PSoC Data Sheets, Application Notes, and Technical Articles

Cypress provides a wealth of information about CapSense Express, and more is frequently added. Many sample documents, schematics, layouts, guidelines, and other CapSense Express documents are available on the CD and at [www.cypress.com](http://www.cypress.com) (except where indicated).

To find documentation online:

- Go to [www.cypress.com](http://www.cypress.com).
- Click on the **Documentation** link.
- Select the type of documentation you are looking for from the **Resource Types** list.
- Search for the document you require.

#### 7.1.1 CapSense Express Data Sheets (available on [www.cypress.com](http://www.cypress.com))

- CY8C20110 Up to 10 IOs for touch sensing buttons, LEDs, and GPIOs
- CY8C201A0 Up to 10 IOs for touch sensing buttons/sliders, LEDs, and GPIOs
- CY8C20180 Up to 8 IOs for touch sensing buttons, LEDs, and GPIOs
- CY8C20160 Up to 6 IOs for touch sensing buttons, LEDs, and GPIOs
- CY8C20140 Up to 4 IOs for touch sensing buttons, LEDs, and GPIOs (16-Pin QFN/SOIC)
- CY8C20142 Up to 4 IOs for touch sensing buttons, LEDs, and GPIOs (8-Pin SOIC)

#### 7.1.2 CapSense Application Notes

- AN44207, CapSense Express - API's for Register Configuration
- AN44208, CapSense Express - I<sup>2</sup>C Communication Timing Information
- AN44209, CapSense Express Power and Sleep Considerations
- AN42137, CapSense Express Software Tool
- AN53490, CapSense Express™ - Design to Production
- AN2292, Layout Guidelines for PSoC™ CapSense
- AN2318, EMC Design Considerations for PSoC CapSense Applications
- AN2394, CapSense Best Practices
- AN2397, CapSense Data Viewing Tool
- AN2403, Signal-to-Noise Ratio Requirement for CapSense Applications
- AN14459, CapSense Device and Method Selection Guide
- AN48755, Designing with CapSense Express™ 8 Pin SOIC Device
- AN48430, CapSense Express™ - Noise Filtering Methods
- AN47716, CapSense Express™ - Configuring PWM for LED Intensity Control



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