

A photograph of a hand pointing towards the right, with a blue background featuring light trails that curve across the frame.

CY3218-CAPEXP3 CapSense™ Express Evaluation Kit Quick Start

Doc. # 001-44865 Rev. *A

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Getting Started

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1. Review Kit Contents

Each CY3218-CAPEXP3 CapSense Express Evaluation Kit contains:

- CY3218-CAPEXP3 CapSense Express Evaluation Board
- Kit CD, which includes:
 - PSoC Programmer
 - .NET Framework 2.0 (for Windows 2000 and Windows XP)
 - PSoC Express 3
 - CapSense Express Extension Pack
 - CapSense Express Kit Documentation
- Retractable USB Cable (A to Mini-B)
- PSoC CY3240-I2USB Bridge Board
- AAA Battery

2. Explore the Board

Caution: Do not touch the board anywhere other than the edges or the buttons. Touching the board in the wrong area could lead to a short and an unresponsive board. If this happens, follow the instructions in Section 2 to reset the power to the board.

- 2.1. Insert the AAA battery into the battery holder on the back of the board.
- 2.2. Remove the jumper from J2 (back of board, left side, center).
- 2.3. Touch a button on the board. The LED above the button turns off.
- 2.4. Turn the board off by replacing the jumper on J2. Note that replacing the jumper disables battery operation.

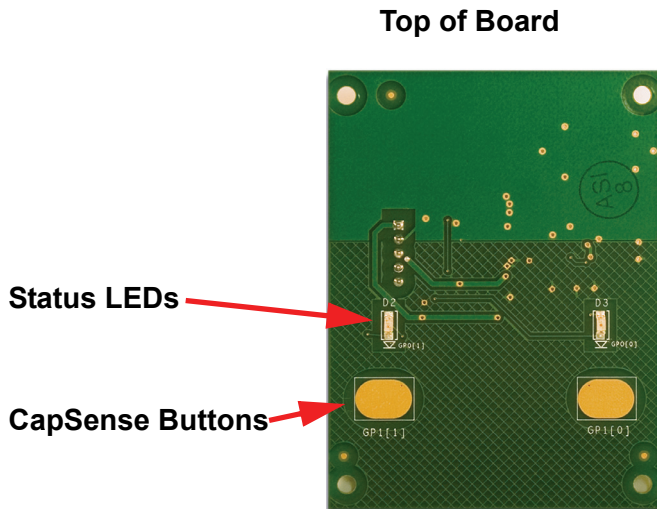
3. Install Software

Install PSoC Express Development Software

- 2.1. Insert the Kit CD, wait for the installer to start, and install the following software in the order listed:
 - a. Install PSoC Programmer.
 - b. Install .NET Framework 2.0.
 - c. Install PSoC Express 3.
 - d. Install CapSense Express Extension Pack.
 - e. Install CapSense Express Kit Documentation.

4. CY3218-CAPEXP3 Board Features

- 2 CapSense Buttons
- 2 Status LEDs (Green)
- 1 Power LED (Red)
- I²C Header (on Bottom)
- AAA Battery Holder (on Bottom)




Use the CY3218-CAPEXP3 Evaluation Kit to evaluate the CapSense Buttons, LED drive, and I²C features of the CapSense Express device. Via the CapSense Express Configuration Tool in PSoC Express, the two status LEDs can be controlled by the CapSense buttons. The CapSense Express device mounted on the board is in the 8-SOIC package. The board is powered with a AAA battery mounted in the battery holder. A boost converter converts the input voltage in the range of 0.9V-1.5V to the device operating voltage of 3.3V. The board can also be powered using an I2CtoUSB bridge connected to the I2C header.

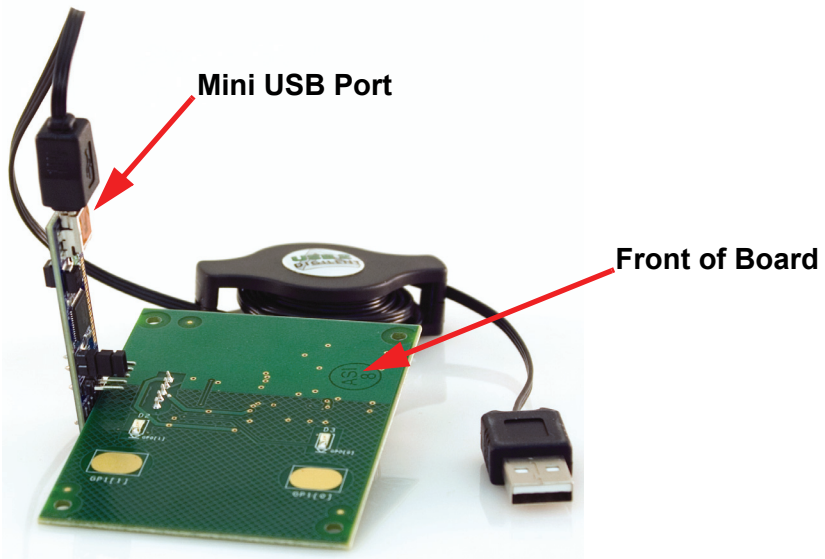
5. Tune the CY3218-CAPEXP3 CapSense Express Board

Functional Description

When either of the two capacitive sensing buttons are pressed, the corresponding LED turns off.

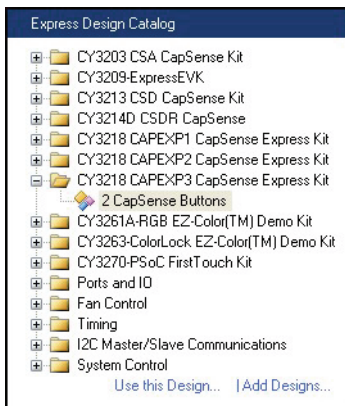
Tuning Steps

- 5.1. Connect your computer to the CapSense test board I²C Connector (J5)  using the CY3240-I2USB Bridge Board and a USB cable. When connected correctly, the USB connector on the CY3240-I2USB Bridge Board is visible when viewing the front of the CY3218-CAPEXP3 board.



- 5.2. Launch PSoc Express.

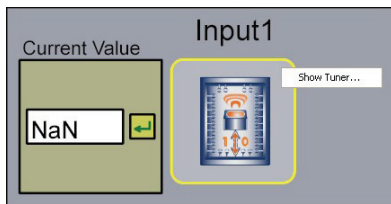
- 5.3. From the Express Design Catalog, open the **CY3218 CAEXP3 CapSense Express Kit** folder.



- 5.4. Double-click **2 CapSense Buttons** to open the design.
- 5.5. Name the design **TwoCapSenseButtons** and save the design in the location of your choice.
- 5.6. Click **Monitor** to open the Monitor view. The Monitor Status indicator shows Connected



- 5.7. Right-click **Input1** and select **Show Tuner**.



The Monitor Status indicator changes to Running **Running**, and the CapSense Express window opens.

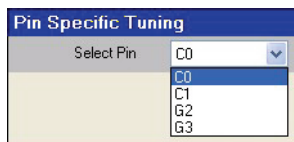
- 5.8. If your board is programmed with another design, click **Apply to board** **Apply to board** in the lower-right area of the CapSense Express window. When the Configure through USB2IIC Bridge status dialog appears, click **OK**. If your board is already programmed with the correct design, the Apply to board button is grayed out.

5.9. Test the board by touching the CapSense buttons. The LEDs above each button turn off each time the corresponding button is touched. Notice how the Pin Status and Latched Value indicators change from OFF to ON for the button and On to Off for the LED when a button is touched.

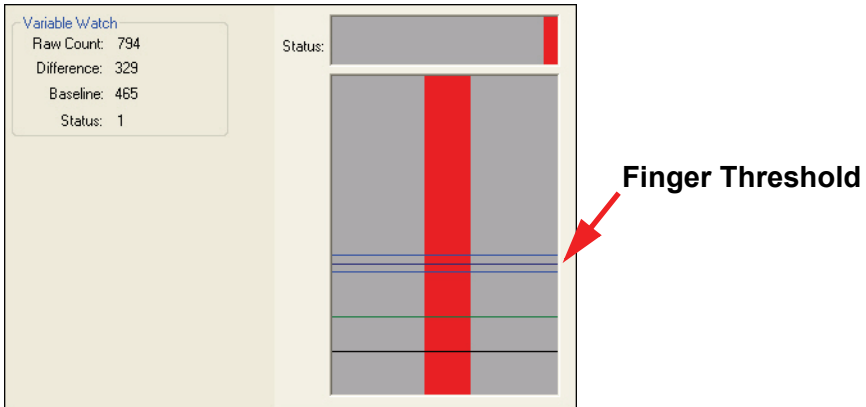
Pin Assignment (8-30 I/O)	GP1[1]	GP1[0]	GP0[1]	GP0[0]
	C0	C1	G2	G3
Pin Type	Capsens	Capsens	GPIO	GPIO
Inversion	No	No	Yes	Yes
Interrupt	OFF	OFF	OFF	OFF
Latch Direction	Rising	Rising	Rising	Rising
Drive Mode	Resistiv	Resistiv	Strong L	Strong L
Finger Threshold	100	100	100	100
IDAC Settings	14	14	14	14
GPIO Output	Output L	Output L	Output L	Output L
Pin Status	ON	OFF	OFF	ON
Latched Value	ON	OFF	OFF	ON

Tune Button C0

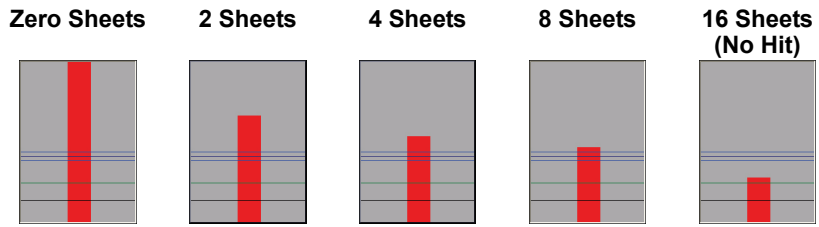
5.10. From the **Select Pin** menu, select **C0**.



5.11. Touch button C0 (leftmost CapSense button). Anytime the Difference variable (represented as a red, vertical bar) is higher than the Finger Threshold (set to 100 by default), the touch registers as a Hit.



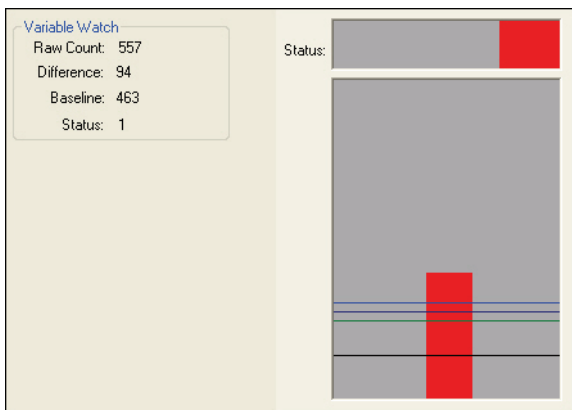
5.12. Cover the C0 button with a piece of paper and then touch the button (with the paper between our finger and the button). Notice how the Difference Count Value changes. Add additional pieces of paper to increase the thickness over the button. With enough sheets of paper, the Difference variable does not rise above the Finger Threshold, and the button does not register a hit.



5.13. Change the Finger Threshold for C0 from 100 to **50**, and click **Apply to board**.

Pin Assignment (8-S01C)	GP1[1] C0
Pin Type	CapSense
Inversion	No
Interrupt	OFF
Latch Direction	Rising
Drive Mode	Resistive
Finger Threshold	50
IDAC Settings	14
GPIO Output	Output L

5.14. Cover the button with the paper again, and touch the button. Adjust the Finger Threshold until it is low enough to register a hit with the paper over the button.




5.15. Experiment with other materials such as plastic and wood.

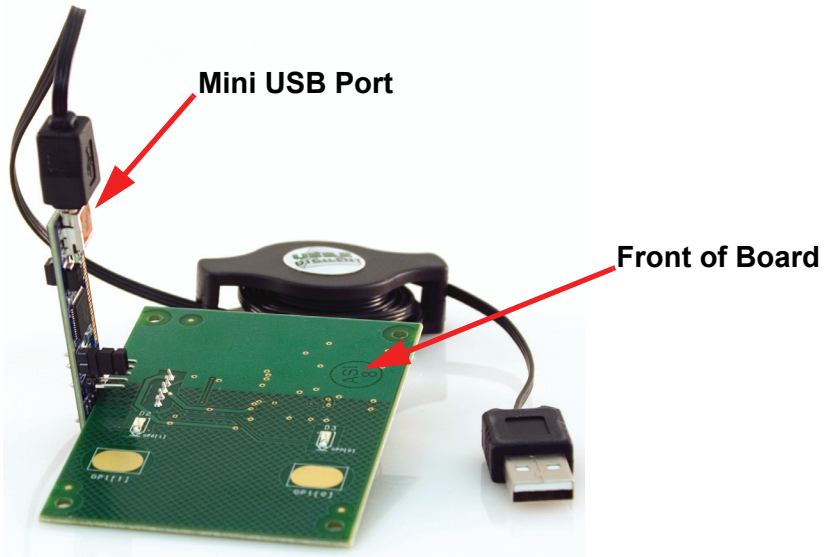
What's Next

Now that you know how easy it is to tune a CapSense button with PSoC Express, learn how to create the project from scratch in Section 6.

6. Create a CY3218-CAPEXP3 CapSense Express Project

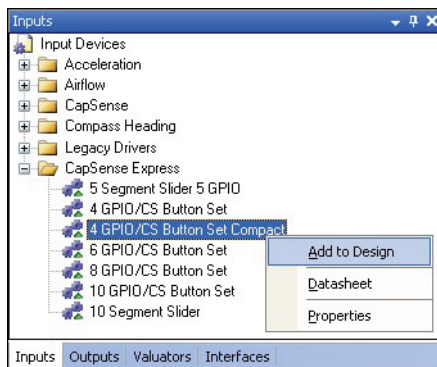
Start the Project

- 6.1. Connect your computer to the CapSense test board I²C Connector (J2)  using the CY3240-I2USB Bridge Board and a USB cable. When connected correctly, the USB connector on the CY3240-I2USB Bridge Board is visible when viewing the front of the CY3218-CAPEXP3 board.



- 6.2. Launch PSoc Express.
- 6.3. Click **New Project**, name the project **TwoButtons**, and save the design in the location of your choice.
- 6.4. Select **View > Driver Catalog**.
- 6.5. At the bottom of the Driver Catalog, select the **Inputs Tab**.

- 6.6. Open the CapSense Express directory, right-click the **4 GPIO/CS Button Set Compact** driver, and select **Add to Design**.



6.7. The Add Input Driver window opens. Name the driver **TwoButtons** and click **OK**. The CapSense Express 4 GPIO / CS BUTTON SET Compact:TwoButtons window opens.

In PSoC Express, each CapSense button and LED requires a separate driver. The 04 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.

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

- CapSense Specific**
 - Baseline Update Threshc: 100
 - Clock: IMD/4
 - Debounce: 3
 - External Capacitor: Disable
 - Hysteresis: 10
 - Low baseline reset: 20
 - Negative noise threshold: 20
 - Noise Threshold: 40
 - Sensor Auto Reset: Disable
 - Settling time: 160
- Global Parameters**
 - I2C Address: 0
 - I2C_pin_drive_mode: Open_drain_low

CapSense Specific

Ok
Apply to board
Cancel

Export Report

Configure the Drivers

- 6.8. By default, all driver types in the Configure Local Parameters pane are set to CapSense Input. To setup the LEDs, set the Pin Type for drivers C2 and C3 to **GPOutput** and the Drive Mode for each of those drivers to **Strong Drive**.

Pin Assignment (8-SDIC)	U	U	U	U
	C0	C1	G2	G3
Pin Type	Capsens	Capsens	GPOutp	GPOutp
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	14	14	14	14
GPIO Output	Output L	Output L	Output L	Output L

Configure Button and LED Behavior

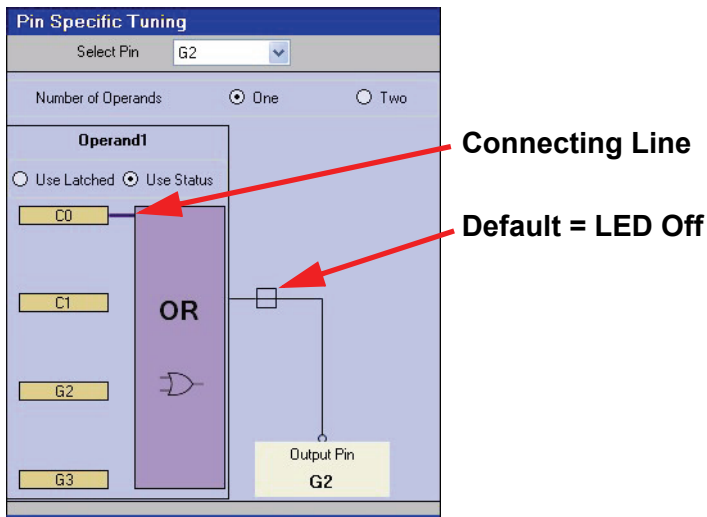
- 6.9. In the Pin Specific Tuning pane, choose **G2** from the **Select Pin** menu.

Pin Specific Tuning	
Select Pin	G2
	G2
	G3

6.10. To assign an LED to a CapSense button, simply click on the yellow box of the CapSense button you want to assign to LED G2. For LED driver G2, select the CapSense button **C0**. A small line will then connect C0 to the purple OR box.

At this point, you have two choices: 1) Set the LED to On by default and to turn off while the button is touched, or 2) Leave the LED Off by default and turn on while the button is touched. This project uses option 2, which is the default option indicated by the little square to the right of the purple OR box. If you click this box, it turns into a triangular invert symbol and would set the LED to on by default and to turn off when the button is pressed.

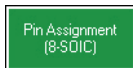
Leave the LED on by default.



6.11. Repeat [Step 6.10](#). for driver G3 connecting button C1 instead of C0.

Assign Drivers to Pins

6.12. In the upper-left of the window, click the **Pin-Assignment (8-SOIC)** button. The User Pin Assignment window opens.



6.13. Assign each CapSense button and LED to the pin annotated on the board. For example, the leftmost CapSense button is labeled GP1[1].



Drag each driver from the Unassigned list to the appropriate pin (listed in the on page 15 for convenience).

User Pin Assignment

Drag and Drop onto Pins to Assign.

CY8C20142
8 pin SOIC

VSS	1	8	VDD
I2C SCL	2	7	GP0[1]
I2C SDA	3	6	GP0[0]
GP1[0]	4	5	C0

Unassigned

- Button1 (C0)
- Button2 (C1)
- Output1 (G2)
- Output2 (G3)

Pin Package Type

8 pin SOIC

Legend:

- Locked pins
- Available placements

Buttons: Unassign All Pins, Auto Assign, OK

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

- 6.14. Click **OK** to close the User Pin Assignment window.
- 6.15. Click **Apply to board**. Wait for the Configure through USB2IIC Bridge status window appears and click **OK**.
- 6.16. Click **OK** to close the CapSense Express 04 GPIO/CS Button Set Compact: TwoButtons window.

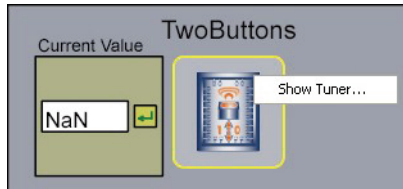
Monitor the Board

- 6.17. In the Design pane, select **Monitor**. The Monitor Status indicator shows Connected

Connected



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



The Monitor Status indicator changes to Running Running, and the CapSense Express 04 GPIO / CS BUTTON SET Compact: TwoButtons window opens.

- 6.19. Touch the leftmost CapSense button. The red bar in the Pin Specific Tuning pane responds to your touch.

What's Next

Congratulations! You have successfully recreated the 2 CapSense Buttons design (available in the Express Design Catalog, under the CY3218-CapExpress3 CapSense Express Kit). To recreate the factory installed firmware, create a new project starting at [Step 6.1.](#), but choose option 1 in [Step 6.10.](#)


To experiment with button and LED behavior, select either LED (G2 or G3) from the Select Pin menu in the Pin Specific Tuning pane and set different buttons to light different LEDs. To tune the CapSense buttons, follow the steps listed in Section 5.

7. Additional CapSense Resources

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 (except where indicated).

To find documentation online:

- a. Go to www.cypress.com.
- b. Click on the **Documentation** link.
- c. Select the type of documentation you are looking for from the **Resource Types** list.
- d. Type the part number or document number into the **Search in Design Resources** field.
- e. Click the **Search** button .

CapSense Express DataSheets (available on 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)

CapSense Application Notes

- [AN44207](#), *CapSense Express - API's for Register Configuration* (available on www.cypress.com)
- [AN44208](#), *CapSense Express - I2C Communication Timing Information* (available on www.cypress.com)
- [AN42137](#), *CapSense Express Software Tool*
- [AN44203](#), *Configuring CapSense Express in Production*
- [AN44209](#), *CapSense Express Power and Sleep Considerations*
- [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*

CapSense Technical Articles

- [Designer's Guide to Rapid Prototyping of Capacitive Sensors on any Surface](#)
- [Controls & Sensors Touch Sensors Spread Out](#)
- [White Paper Cypress's CapSense Successive Approximation Algorithm](#)
- [The Art of Capacitive Touch Sensing](#)

Design Support

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 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 Kits

Evaluation Kits

Development Kit

<p>CapSense Express: Quickest and Easiest to Use Touch Sensing</p>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>CY3218 CAPEXP1/CAPEXP3 For Buttons (Up to 10 or 4 IOs)</p>  </div> <div style="text-align: center;"> <p>CY3218 CAPEXP2 For Sliders (Up to 10 IOs)</p>  </div> </div>	<div style="text-align: center;"> <p>CY3280-BK1 Universal CapSense</p>  </div>
<p>CapSense: Programmable Touch Sensing</p>	<p style="text-align: center;">CY3203A CapSense CSA</p> 	
<p>CapSense Plus: CapSense with Non-Touch Sensing Functionality (Motor Control, Power Management, Gyro Sensing, etc.)</p>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>CY3213A CapSense CSD</p>  </div> <div style="text-align: center;"> <p>CY3214 PSoCEvalUSB</p>  </div> </div>	

For more information on these kits, please go to www.cypress.com/CapSense.

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