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CE95284 - CapSense® CSD Design with PSoC® 3 and PSoC 5LP

Objective

This code example demonstrates the usage of the CapSense® CSD component in PSoC® 3 and PSoC 5LP.

Overview

This code example shows how to implement CapSense button sensors and linear slider using the CapSense CSD Component.

In this code example, the CapSense CSD Component is configured to scan two CapSense button sensors and one linear slider with five segments. The CapSense button sensor on/off status is indicated using the LEDs and the finger position on the linear slider is indicated on a character LCD using a bar graph.

This code example can be tested on PSoC development kits such as CY8CKIT-001, CY8CKIT-030, and CY8CKIT-050.

PSoC Resources

Cypress provides a wealth of data at www.cypress.com to help you to select the right PSoC device for your design, and quickly and effectively integrate the device into your design. For a comprehensive list of resources, see KBA86521, How to Design with PSoC 3, PSoC 4, and PSoC 5LP. The following is an abbreviated list for PSoC 1, PSoC 3, and PSoC 5LP resources:

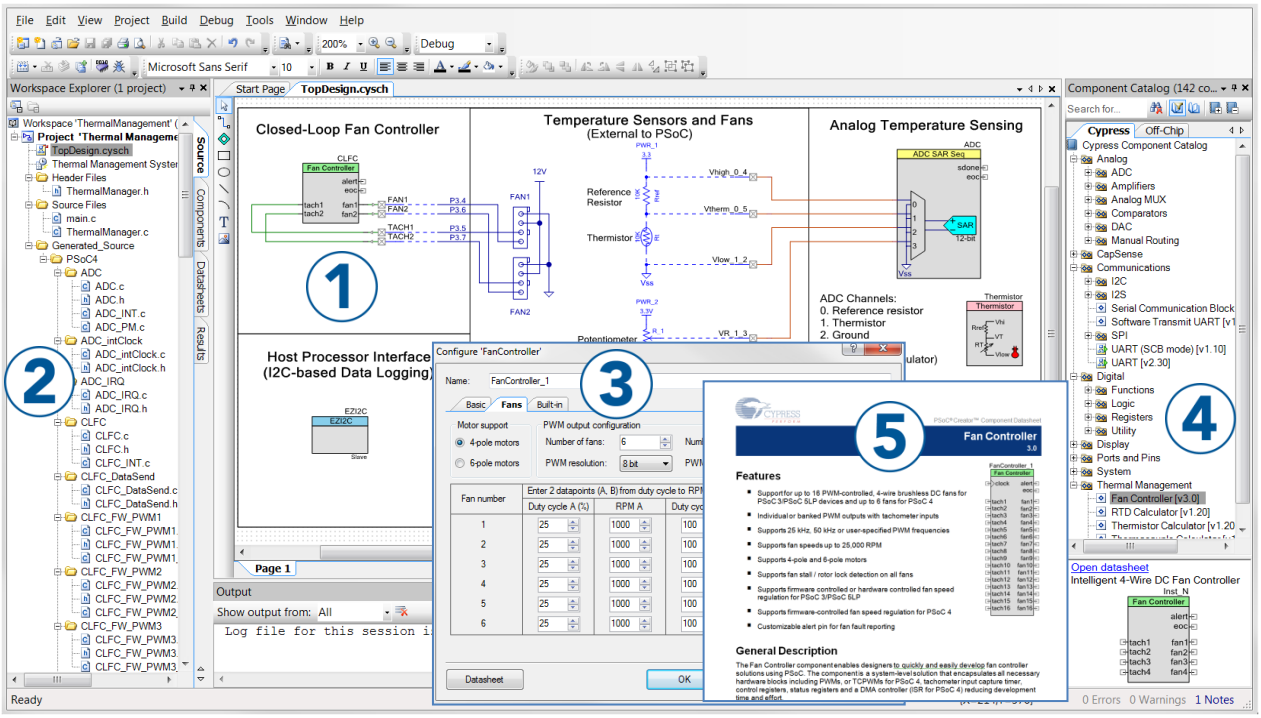
- **Overview:** PSoC Portfolio and PSoC Roadmap
- **Product Selectors:** PSoC 1, PSoC 3, PSoC 4, or PSoC 5LP. In addition, PSoC Creator™ includes a device selection tool.
- **Datasheets**: Describe and provide electrical specifications for the PSoC 3 and PSoC 5LP device families.
- **CapSense Design Guide:** Learn how to design capacitive touch-sensing applications with the PSoC 3 and PSoC 5LP families of devices.
- **Application Notes and Code Examples:** Cover a broad range of topics, from basic to advanced level. Many of the application notes include code examples.
- **Technical Reference Manuals (TRM):** Provide detailed descriptions of the architecture and registers in each of the PSoC 3 and PSoC 5LP device families.
- **Development Kits:**
  - CY8CKIT-001 is a common development platform for all PSoC family devices.
  - CY8CKIT-030 and CY8CKIT-050 are designed for analog performance. They enable you to evaluate, develop, and prototype high-precision analog, low-power, and low-voltage applications powered by PSoC 3 and PSoC 5LP, respectively.
- The MiniProg3 device provides an interface for flash programming and debug.

PSoC Creator

PSoC Creator is a free Windows-based Integrated Design Environment (IDE). It enables concurrent hardware and firmware design of systems based on PSoC 3, PSoC 4, and PSoC 5LP; see Figure 1. With PSoC Creator, you can:

1. Drag and drop Components to build your hardware system design in the main design workspace
2. Codesign your application firmware with the PSoC hardware
3. Configure Components using configuration tools
4. Explore the library of 100+ Components
5. Review Component datasheets

Figure 1. PSoC Creator Features



Requirements

Tool: PSoC Creator 3.0 SP2 See also Upgrade Information.

Programming Language: C (DP8051 Keil 9.51, ARM GCC 4.7.3, and ARM MDK compilers)

Associated Parts: All PSoC 3 and PSoC 5LP parts

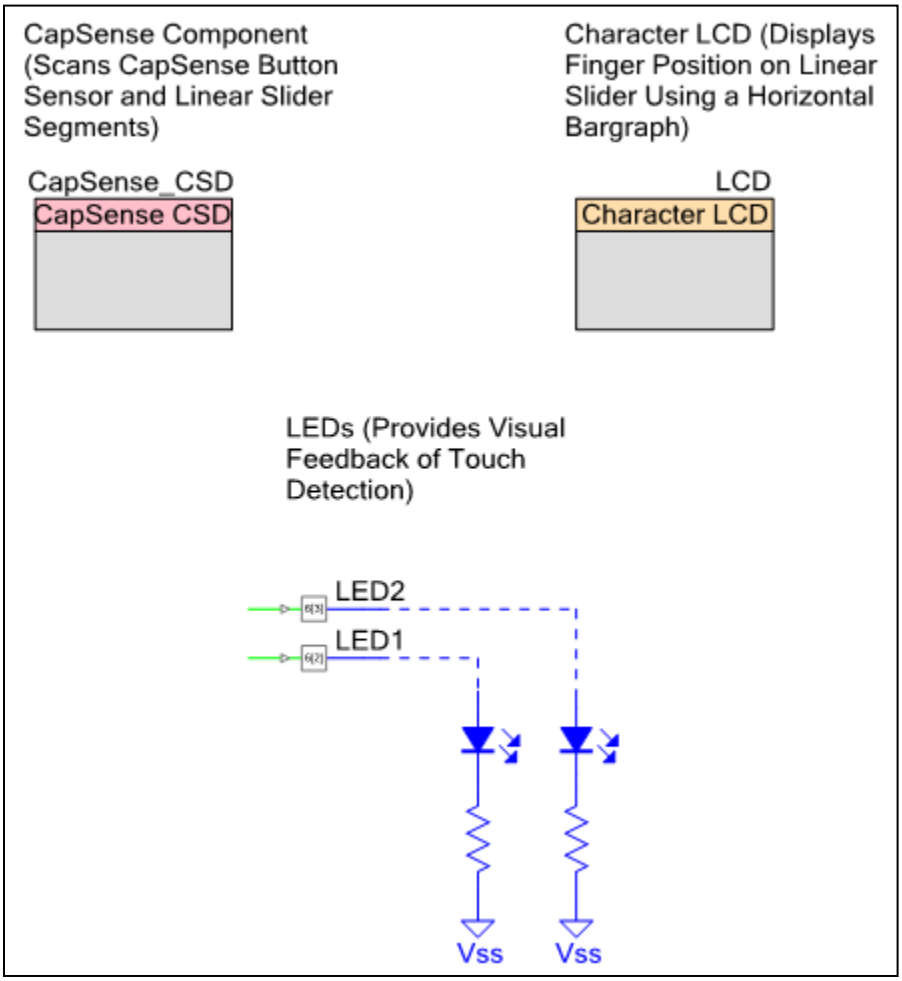
Related Hardware: CY8CKIT-001, CY8CKIT-030, and CY8CKIT-050

Design

Figure 2 shows the PSoC Creator schematic design of the code example. The code example features the following:

- CapSense CSD Component to detect finger touches on the CapSense button sensor and finger position (centroid) on the linear slider.
  - SmartSense™ auto-tuning method is used to automatically tune all the sensor tuning parameters
  - The CapSense Component is configured for two CapSense button sensors and one linear slider with five segments
  - The API resolution of the linear slider is set to 100 (0x64)
- A display Component (Character LCD or Pins driving LEDs) to show the status of CapSense sensors
  - The Pins Component is used to drive the LEDs to indicate the on/off status of CapSense button sensors
  - The Character LCD Component is used to display the finger position on the linear slider using a bar graph

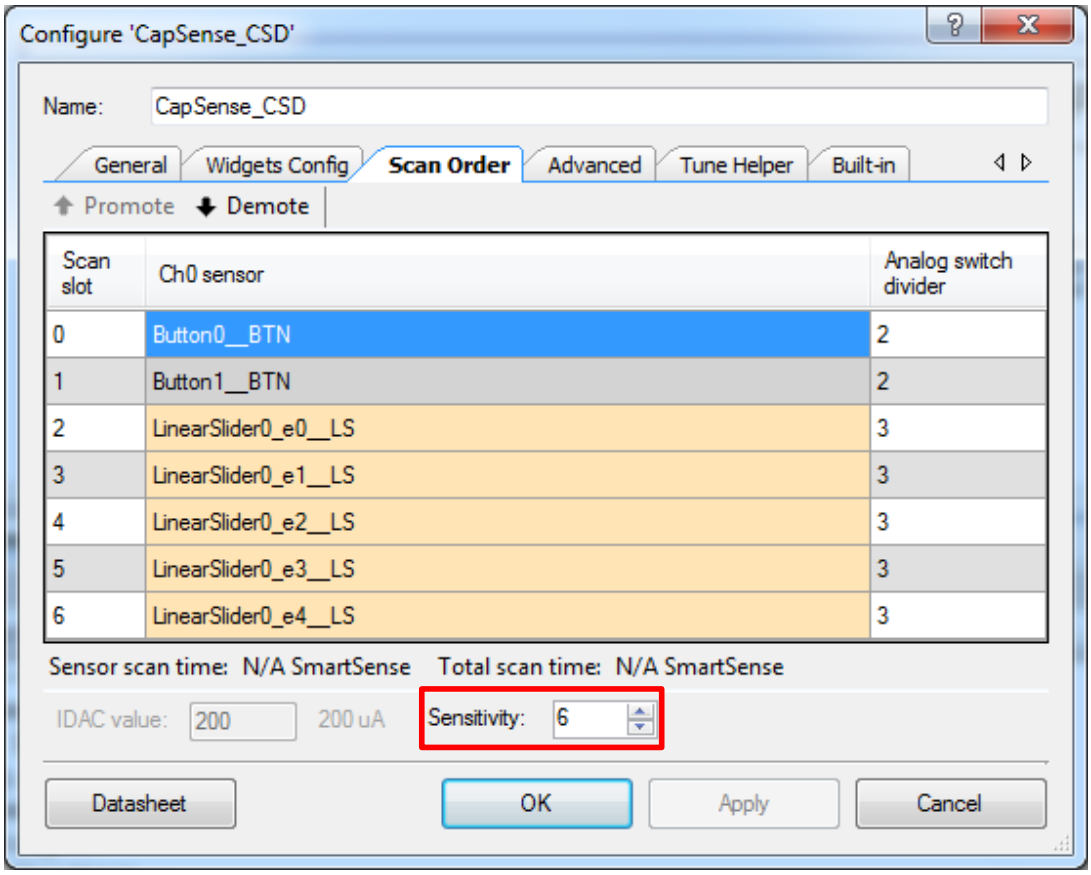
Figure 2. CapSense CSD Design with PSoC 3 and PSoC 5LP



Design Considerations

In the code example, the sensitivity parameter is set to the default value of '2'. To test the code example with an overlay on the sensor, the sensitivity parameter should be set such that touch is detected. Thicker overlays require low value of sensitivity setting. The sensitivity parameter for each sensor can be specified in the Scan Order tab of the CapSense CSD component, as shown in Figure 3.

Figure 3. CapSense CSD Component Scan Order Tab



Hardware Setup

For the basic kit board setup, see the corresponding Kit User Guide.

The code example can be tested on CY8CKIT-030 or CY8CKIT-050 without any hardware modification. To test the code example on CY8CKIT-001 follow these steps:

1. Set the LCD power jumper J12 to the ON position and leave the rest of the board at default configuration.
2. Connect pin P1[6] to LED1 and pin P1[7] to LED2 on the development board using jumper wires.
3. Ensure that the character LCD is connected to header P18 on the development board.

Software Setup

The code example works with CY8CKIT-030 without any modification. To test the code example with CY8CKIT-050, in PSoC Creator, click **Project > Device Selector**, select **CY8C5868AXI-LP035**, and click **OK**.

To test the code example with CY8CKIT-001 follow these steps:

- In PSoC Creator, click **Project > Device Selector**; select **CY8C3866AXI-040** if you are using the PSoC 3 processor module or **CY8C5868AXI-LP035** if you are using the PSoC 5 processor module and click **OK**.
- In the Pins tab of the Design-Wide Resources (.cydwr) file, reassign the sensor and LED pins by referring to Table 1.

Table 1. Pin Assignment for CapSense CSD Design Project

Function	Port Pin			
	CY8CKIT-030	CY8CKIT-050	CY8CKIT-001 (PSoC 3 Module)	CY8CKIT-001 (PSoC 5 Module)
Device	CY8C3866AXI-040	CY8C5868AXI-LP035	CY8C3866AXI-040	CY8C5868AXI-LP035
Cmod_CH0	P6[4]	P6[4]	P2[7]	P15[5]
Button0_BTN	P5[5]	P5[5]	P0[5]	P0[5]
Button1_BTN	P5[6]	P5[6]	P0[6]	P0[6]
LinearSlider0_e0_LS	P5[0]	P5[0]	P0[0]	P0[0]
LinearSlider0_e1_LS	P5[1]	P5[1]	P0[1]	P0[1]
LinearSlider0_e2_LS	P5[2]	P5[2]	P0[2]	P0[2]
LinearSlider0_e3_LS	P5[3]	P5[3]	P0[3]	P0[3]
LinearSlider0_e4_LS	P5[4]	P5[4]	P0[4]	P0[4]
LED1	P6[2]	P6[2]	P1[6]	P1[6]
LED2	P6[3]	P6[3]	P1[7]	P1[7]

Components

Table 2 lists the PSoC Creator Components used in the code example, as well as the hardware resources used by each Component.

Table 2. List of PSoC Creator Components

Component	Hardware Resources
CapSense CSD	2 UDBs, 1 interrupt, 1 clock divider,1 IDAC, 1 comparator, 1 CapSense buffer, 1 AMUXBUS
Character LCD	7 pins
Pin	2 pins for LEDs

Parameter Settings

Figure 4 to Figure 7 show the parameter settings for each of the PSoC Creator Components used in the code example. Only the parameters that vary from the default are shown.

Figure 4. CapSense CSD Component General Tab Settings

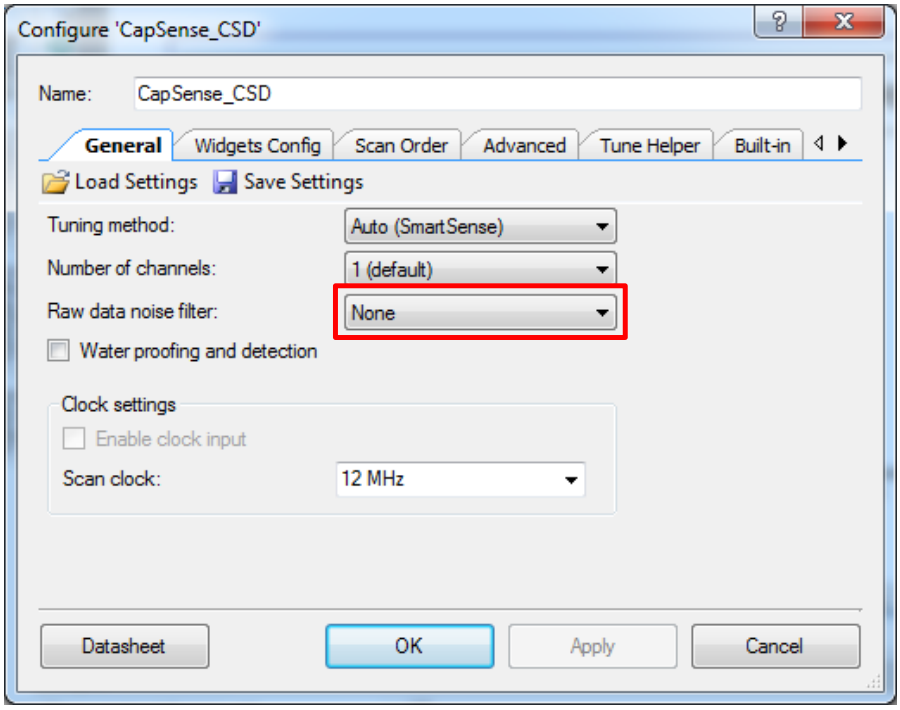


Figure 5. CapSense CSD Component Widgets Config Tab Settings

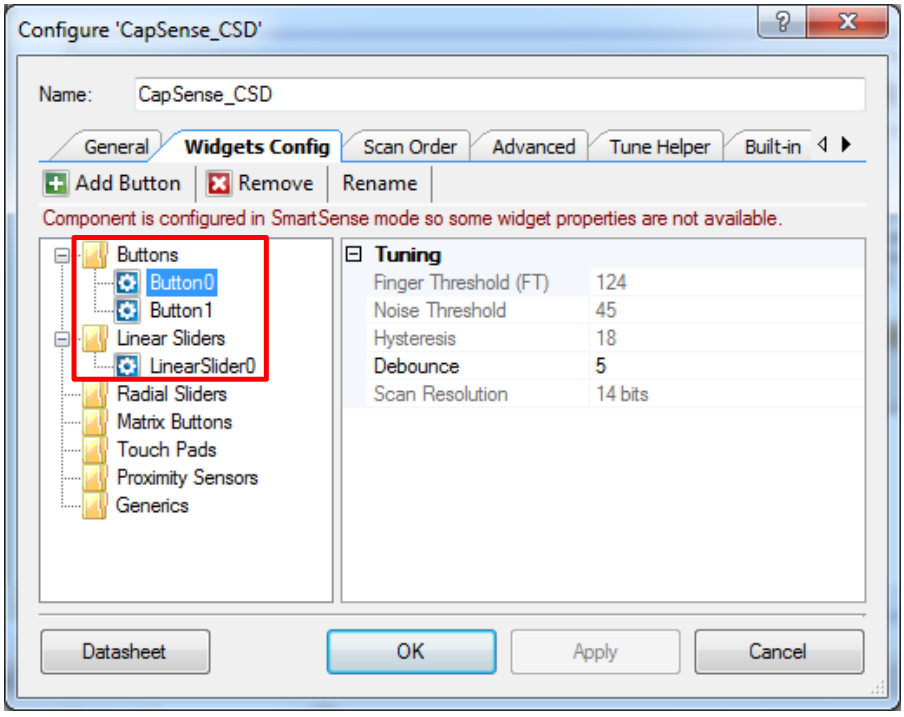


Figure 6. LCD Component General Tab Settings

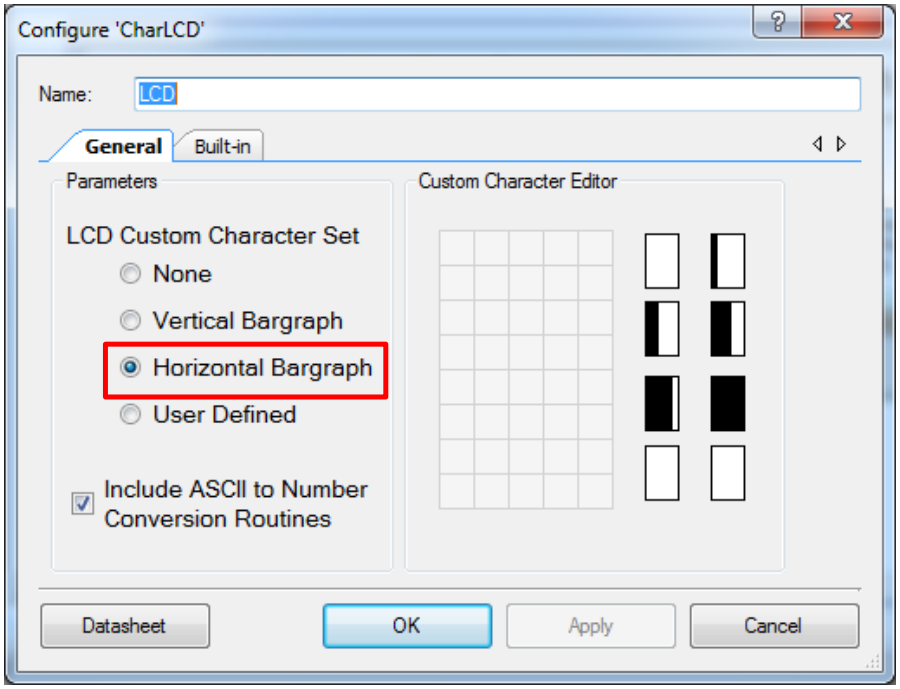
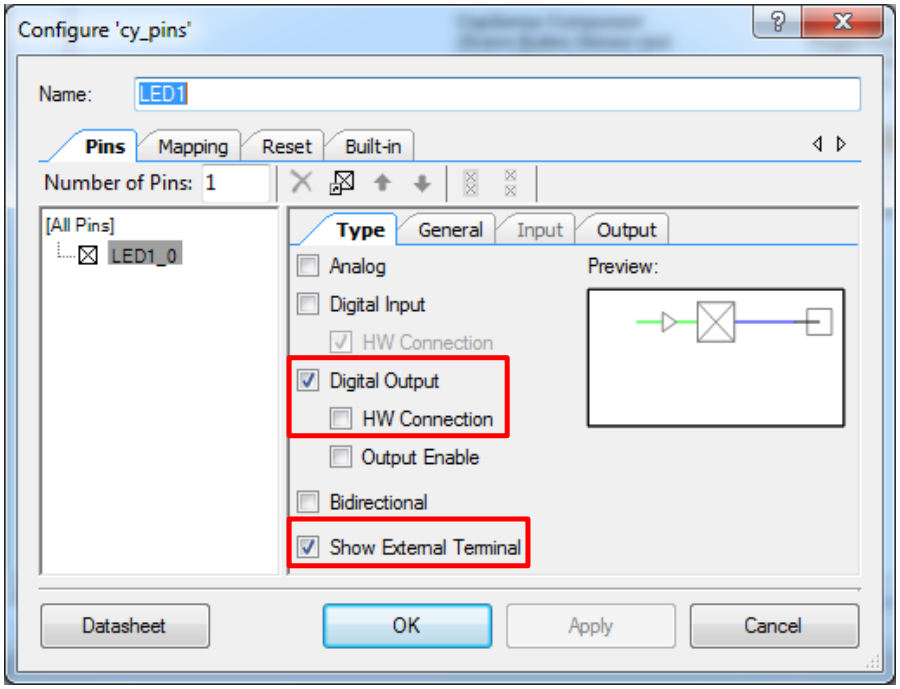


Figure 7. Digital Output Pin Pins Tab Settings



Design-Wide Resources

Figure 8 shows the pin assignments for the code example project with CY8CKIT-030 or CY8CKIT-050. No other design-wide resource needs to be changed from its default setting.

Figure 8. Pin Assignments for PSoC 3 and PSoC 5LP Example

Alias	Name	Port	Pin
Cmod_CH0	\CapSense_CSD:CmodCH0\	P6[4]	6
Button0__BTN	\CapSense_CSD:PortCH0[0]\	P5[5]	32
Button1__BTN	\CapSense_CSD:PortCH0[1]\	P5[6]	33
LinearSlider0_e0__LS	\CapSense_CSD:PortCH0[2]\	P5[0]	16
LinearSlider0_e1__LS	\CapSense_CSD:PortCH0[3]\	P5[1]	17
LinearSlider0_e2__LS	\CapSense_CSD:PortCH0[4]\	P5[2]	18
LinearSlider0_e3__LS	\CapSense_CSD:PortCH0[5]\	P5[3]	19
LinearSlider0_e4__LS	\CapSense_CSD:PortCH0[6]\	P5[4]	31
	\LCD:LCDPort[6:0]\	P2[6:0]	95..99,1..2
	LED1	P6[2]	91
	LED2	P6[3]	92

Operation

After you build and install the example in the appropriate kit, test the example by doing the following:

- Touch the CapSense buttons and verify that the LED turns ON.
- Slide your finger over the linear slider and verify that the
  - Length of the bar graph in the character LCD varies with the finger position.
  - Finger position on the linear slider is displayed on the character LCD.

Upgrade Information

This code example also works with PSoC Creator 3.1. To upgrade the code example to PSoC Creator 3.1, follow these steps:

1. Open the code example in PSoC Creator 3.1.
2. The **Component Update Tool** window (Figure 9) will pop up asking to update the components in the code example. Click **Next** > **Finish**.
3. In the **Workspace/Project Achiever** window (Figure 10), click **Archive** > **OK** to archive the files and update the components in the code example.

Figure 9. PSoC Creator Component Update Tool Window

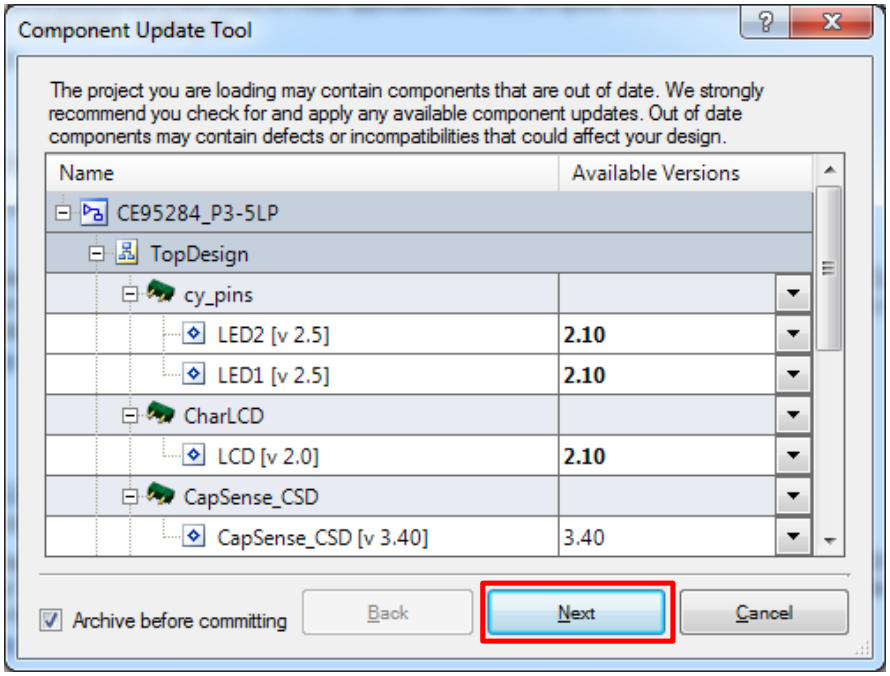
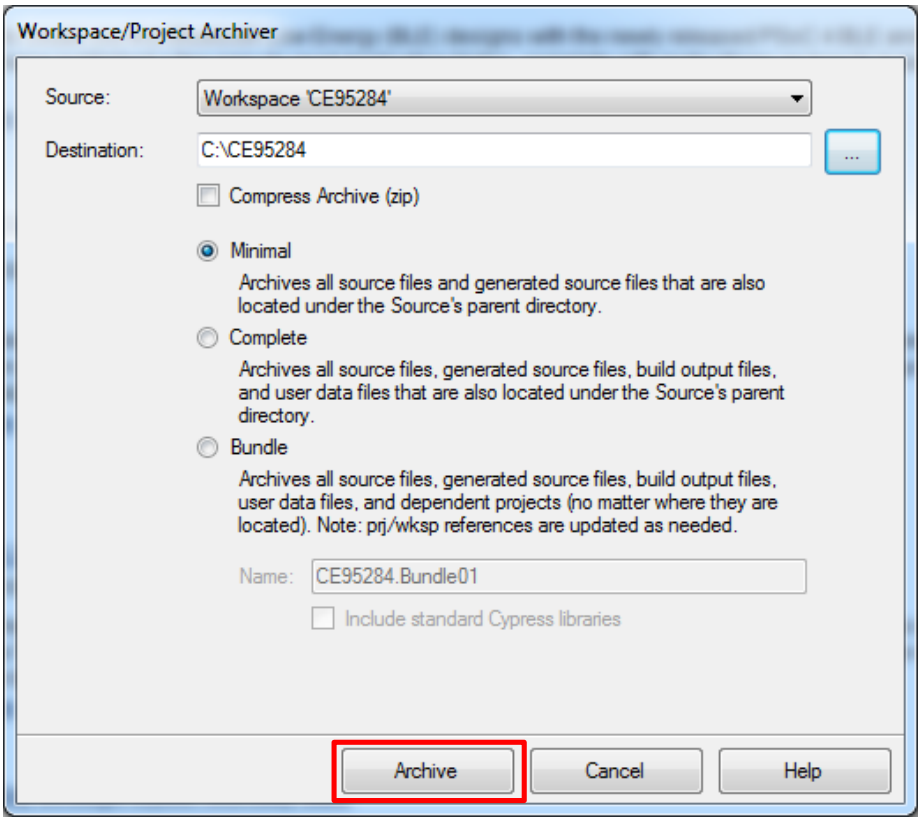


Figure 10. PSoC Creator Workspace/Project Archiver Window



Related Documents

Table 3 lists all relevant application notes, code examples, knowledge base articles, device datasheets, and component datasheets.

Table 3. Related Documents

Application Notes		
AN54181	Getting Started with PSoC 3	In this application note, you will learn about the PSoC 3 architecture and how the 8051-based MCU subsystem works closely with PSoC's programmable digital and analog fabric.
AN77759	Getting Started with PSoC 5LP	In this application note you will learn about PSoC 5LP and PSoC Creator IDE.
Design Guide		
Getting Started with CapSense		This guide is an ideal starting point if you are new to capacitive touch sensing (CapSense). It is also useful for learning key design considerations and layout best practices to ensure design success.
PSoC 3 and PSoC 5LP CapSense Design Guide		This document provides design guidance for building CapSense applications with the PSoC 3 and PSoC 5LP family of devices.
PSoC Creator Component Datasheets		
CapSense CSD		Controls CapSense CSD block and detects change in capacitance in applications such as touch sense buttons, sliders, touchpad, and proximity detection.
Character LCD (CharLCD)		Contains a set of library routines that enable simple use of one, two, or four-line LCD modules, which follow the Hitachi 44780 standard 4-bit interface.
Pins		Controls interface with physical I/O port pins.
Device Documentation		
PSoC 3 Datasheets		
PSoC 5LP Datasheets		
PSoC 3 Technical Reference Manuals		
PSoC 5LP Technical Reference Manuals		
Development Kit(DVK) Documentation		
PSoC 3 and PSoC 5LP Kits		

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Document Number: 001-95284

Revision	ECN	Orig. of Change	Submission Date	Description of Change
**	4646184	DCHE	01/30/2015	New code example.
*A	5740189	AESATP12	05/26/2017	Updated logo and copyright.

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