PSoC 4 BLE Lab #1: Blinking LED

Description

This lab introduces you to the PSoC Creator IDE for developing and programming applications on the PSoC 4 BLE chip. It also introduces you to the Bluetooth Low Energy (BLE) Pioneer Kit.

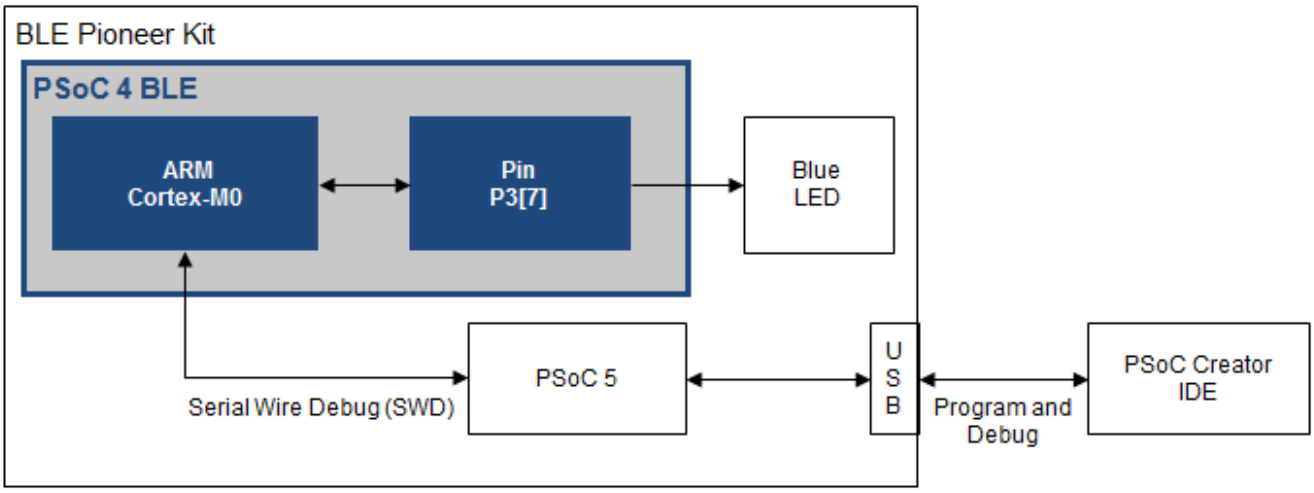
Objectives

1. Learn how to use PSoC Creator to implement and debug PSoC designs
2. Implement a simple blinking LED design

Requirements	Details
Hardware	BLE Pioneer Kit (CY8CKIT-042-BLE)
Software	PSoC Creator 3.1 (or newer)

Block Diagram

Figure 1: Lab #1 Block Diagram



Theory

The goal of this lab is to learn the basics of the PSoC Creator IDE by implementing a simple blinking LED controlled by software. A new PSoC Creator project is created, Components are placed and configured, the LED pin is assigned, and firmware is written to blink the LED. The project is then programmed onto the kit and the results are observed.

The blue LED on the kit is connected to pin P3[7] of the PSoC 4 BLE chip. The LED turns ON when the pin is driven low, and OFF when the pin is driven high. To control the pin's behavior, we will use a Pin Component, which allows control of the pin using its Component Configuration Tool and Component API.

Initial Kit Setup

The BLE Pioneer Kit connects to the PC over a USB interface. The kit enumerates as a composite device and three separate devices appear under the Device Manager window in the Windows operating system. Follow these steps to get started:

1. If you have not already installed the BLE Pioneer Kit Software, do that first.
2. Before power-on, verify that the PSoC 4 BLE module (red color) is plugged into the baseboard on your kit.
3. Plug in your BLE Pioneer Kit to your PC using the provided USB cable. You will see the Windows driver-enumeration process begin.
4. Wait for the driver installation to complete as shown in Figure 2 and Figure 3. Click on **Skip obtaining driver software from Windows Update** to speed up the process, especially if you do not have an Internet connection. The required drivers are already installed on your computer with the kit software and therefore do not need to be downloaded via the Windows Update.

Figure 2: BLE Pioneer Kit Driver Installation in Progress

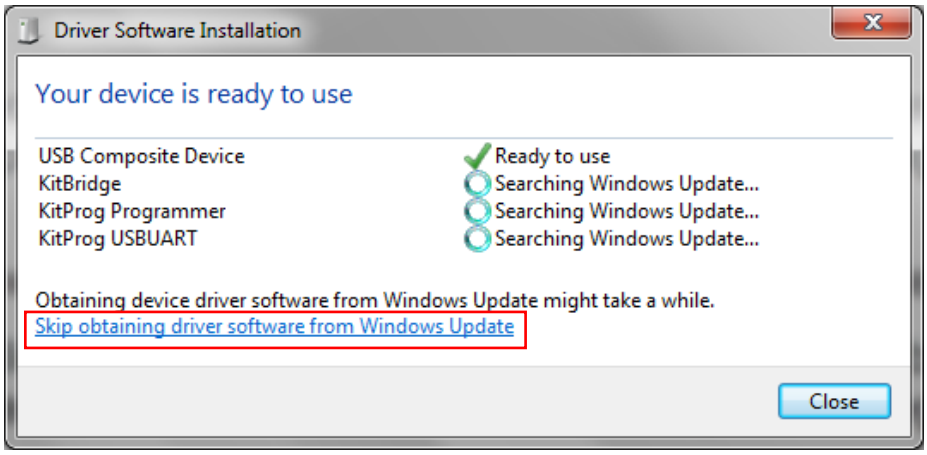
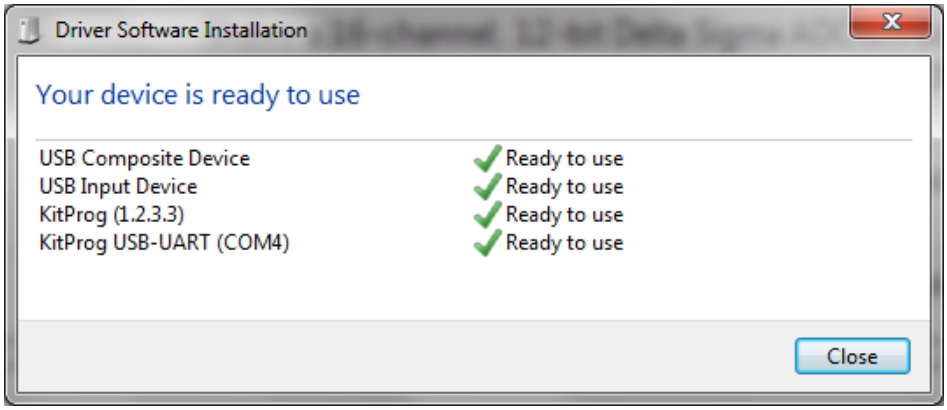


Figure 3: BLE Pioneer Kit Driver Installation Complete



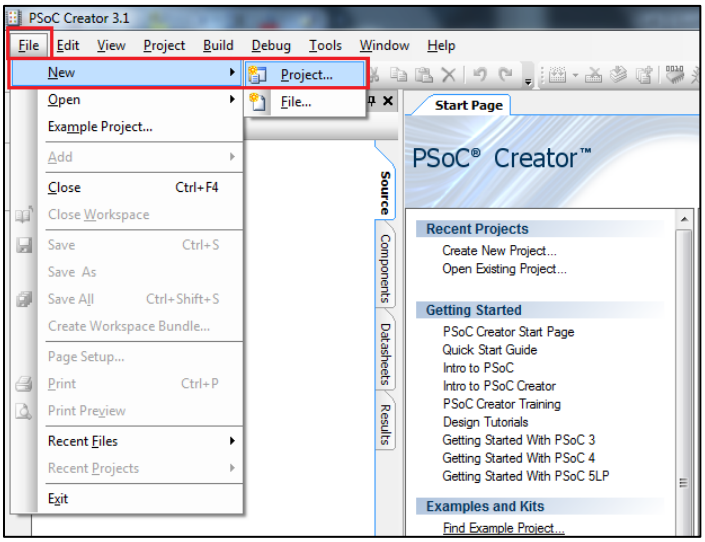
Procedure

Create a New Project

Use PSoC Creator 3.1 to create the project for the BLE Pioneer Kit. Follow these steps to create your first project:

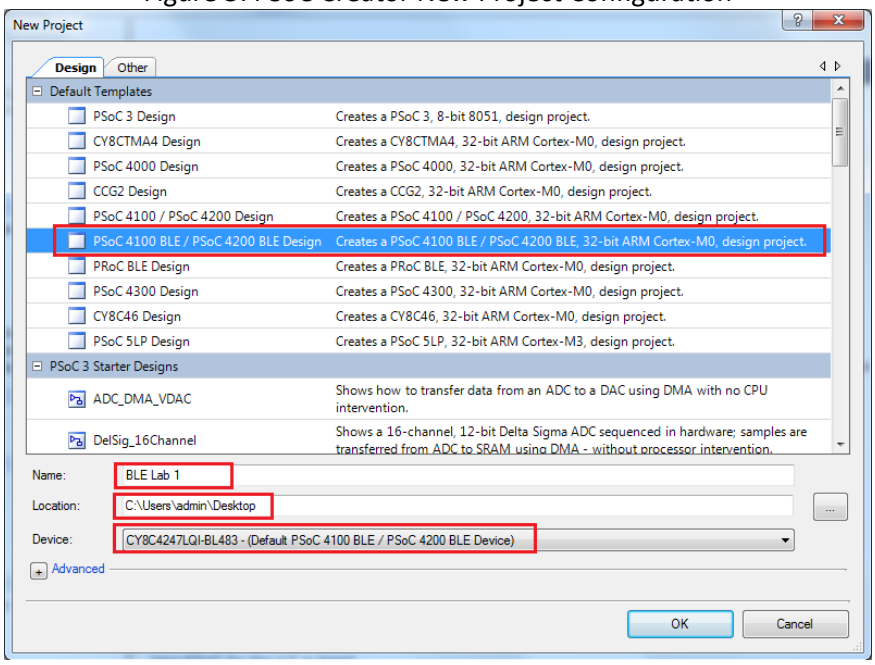
1. Open PSoC Creator 3.1. It is located in the **All Programs -> Cypress -> PSoC Creator 3.1** folder in the Windows start menu.
2. Create a new project by using the **New -> Project…** option in the **File** Menu, as shown in Figure 4.

Figure 4: PSoC Creator New Project Creation Menu



3. The **New Project** dialog appears. In the Default Templates menu, select **PSoC 4100 BLE / PSoC 4200 BLE Design**. Give a name to your project and the location where you want to store it. In the example shown in Figure 5, the project is named **BLE Lab 1** and is saved on the user's desktop. Ensure the selected **Device** is set to the default **CY8C4247LQI-BLE483**.

Figure 5: PSoC Creator New Project Configuration



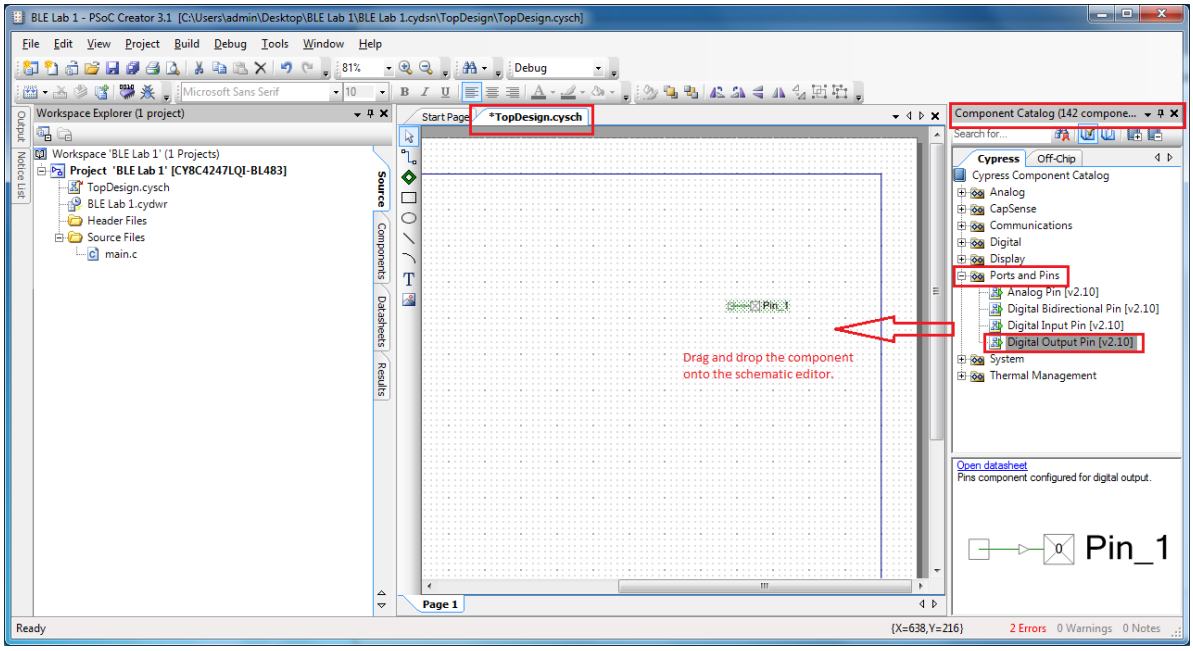
4. Click **OK** to create the blank project with your selected device.

Configure Schematic

After the project is created, the schematic editor opens. Here, you can place and configure Components. Follow these steps:

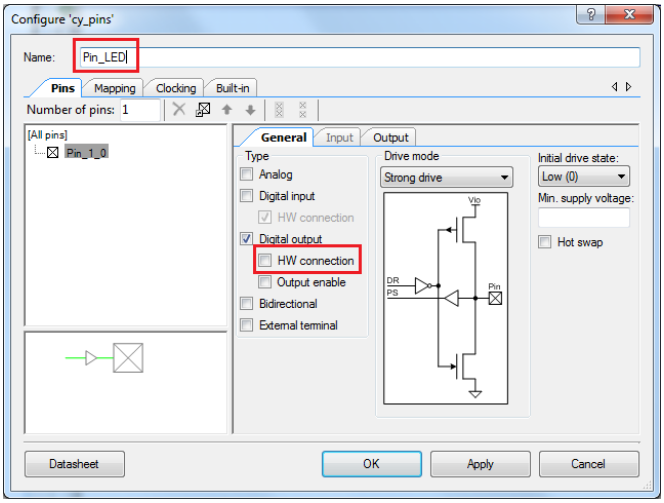
1. The **Component Catalog** window is on the right side. Locate the **Digital Output Pin** Component under the **Ports and Pins** category. Drag and drop this Component to the schematic editor (TopDesign.cysch) in the middle, as shown in Figure 6. Note that you can also find this Component by typing **Pin** in the **Search for…** box.

Figure 6: Placing the Digital Output Pin Component on the Schematic



2. Double-click the newly placed Component to open its Component Configuration Tool. Note, you can also right-click the Component and select **Configure…**. Rename the pin to **Pin_LED.** Deselect the **HW Connection** to allow firmware control as shown in Figure 7. Click **OK** to apply the changes and close the Component Configuration Tool. This completes the project schematic configuration.

Figure 7: Pin Component Configuration Tool

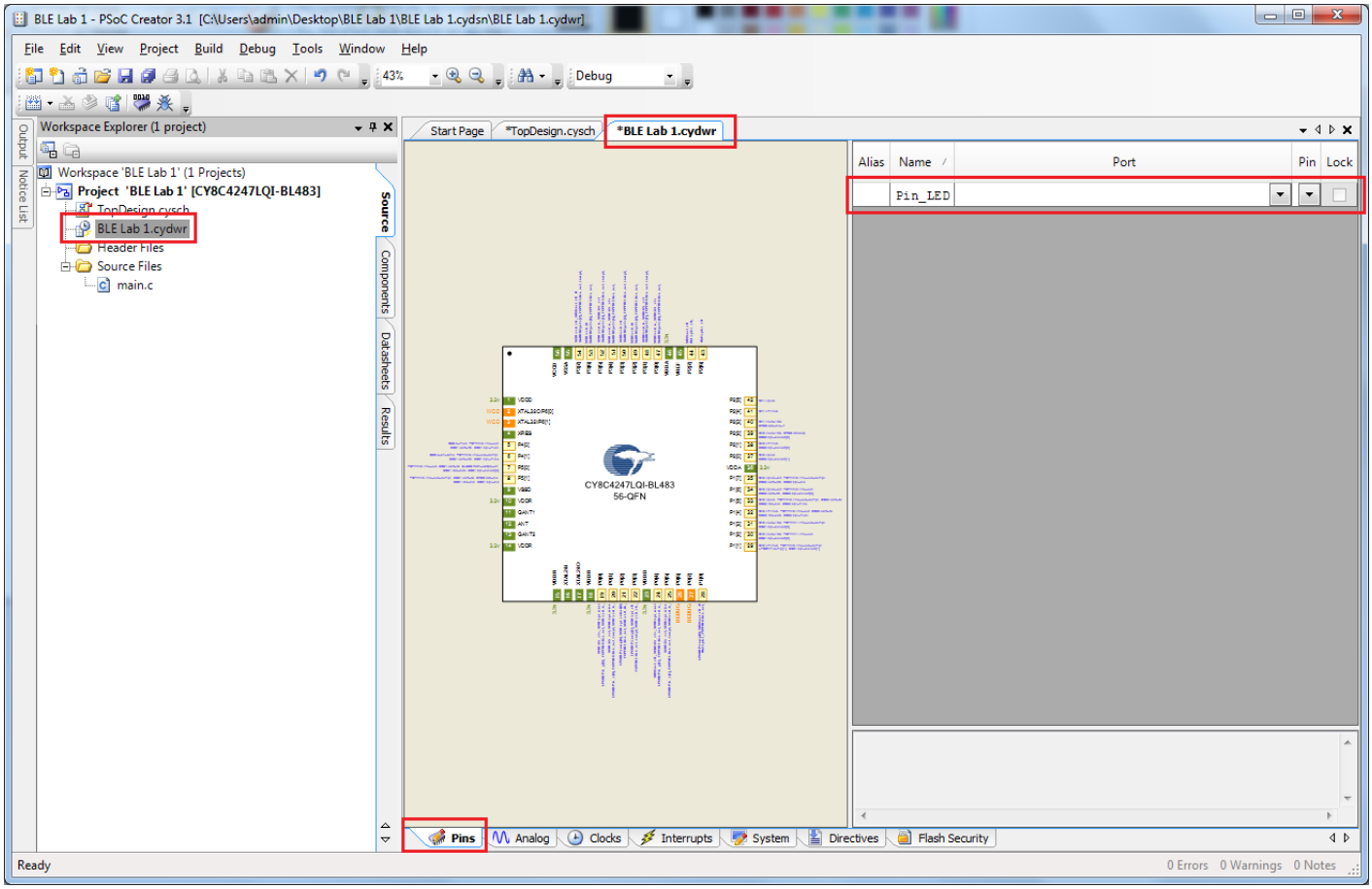


Configure Design Wide Resources

Once the schematic configuration is complete, it is time to configure the Design Wide Resources (DWR). These settings are used to configure overall chip settings, such as pin assignments, clock configurations, system debugging options etc. Do the following:

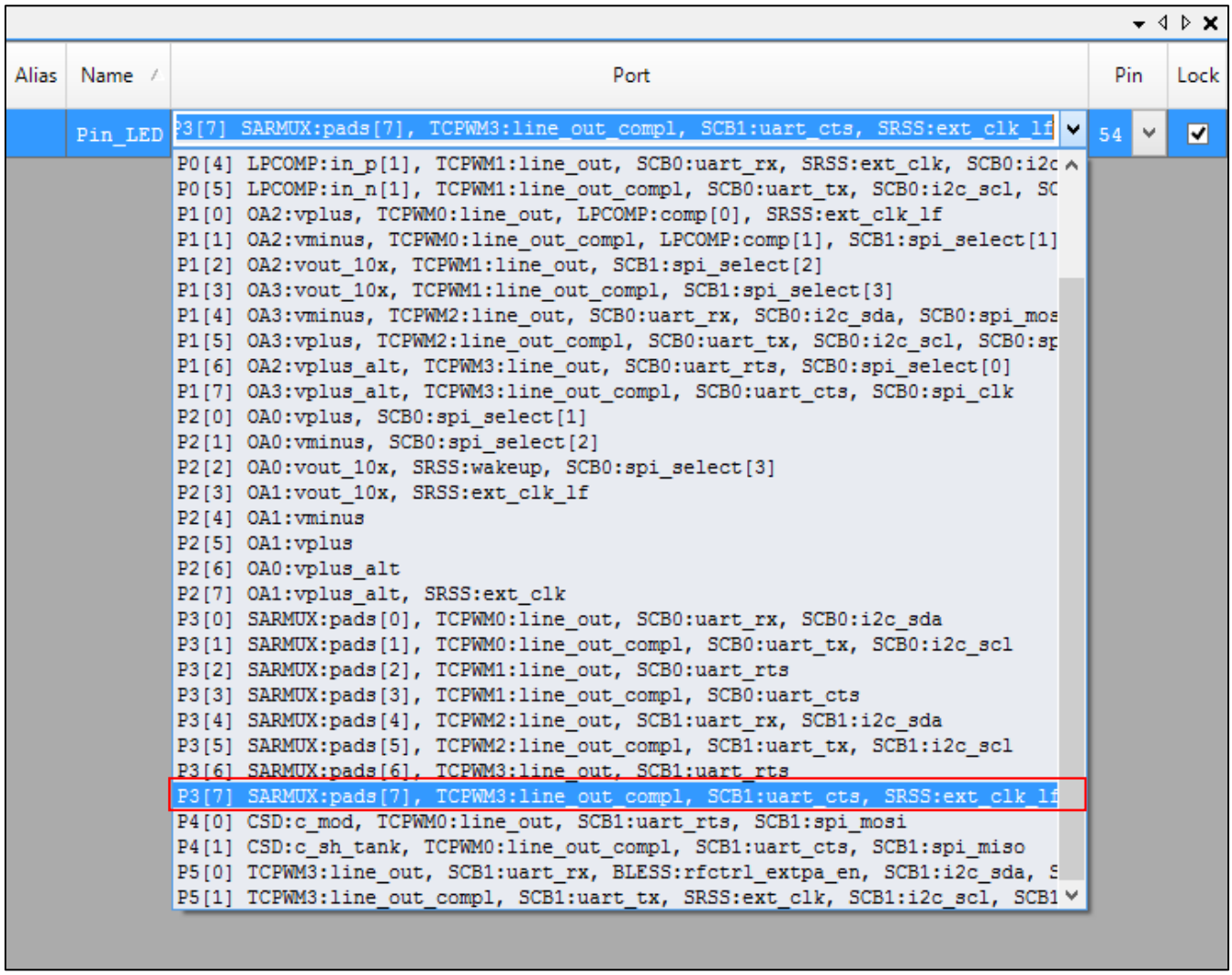
1. On the left-hand side of the PSoC Creator IDE is the **Workspace Explorer** which shows the files contained within this project. Double-click on the **BLE Lab 1.cydwr** file to open the Design Wide Resources window, as shown in Figure 8.

Figure 8: Design Wide Resources - Pins Tab



2. The **Pins** tab of the Design Wide Resources opens by default. For **Pin_LED**, click the drop-down list under the **Port** column, and assign it to **P3[7]**. You can also drag and drop the **Pin_LED** to **P3[7]** on the chip view. This step is shown in Figure 9.

Figure 9: Pin Assignment



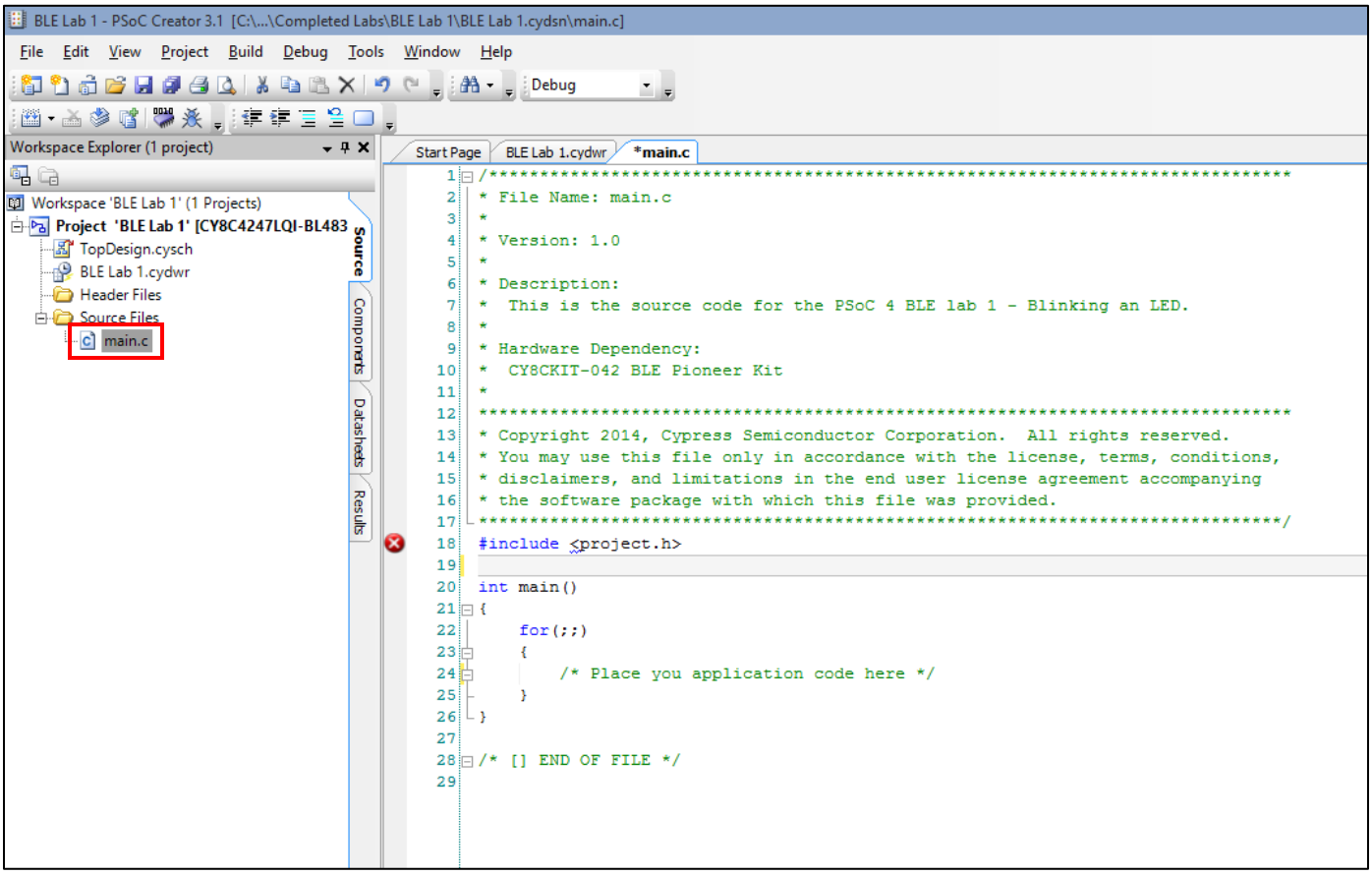
This completes DWR configuration. Before you proceed, build your project once to generate the component source files. Once these files are available, PSoC Creator auto-completes code for you when you write firmware. On the menu bar, click **Build -> Build BLE Lab 1** to build your project.

Implement Firmware

The firmware consists of just two lines of C-code to toggle the LED pin.

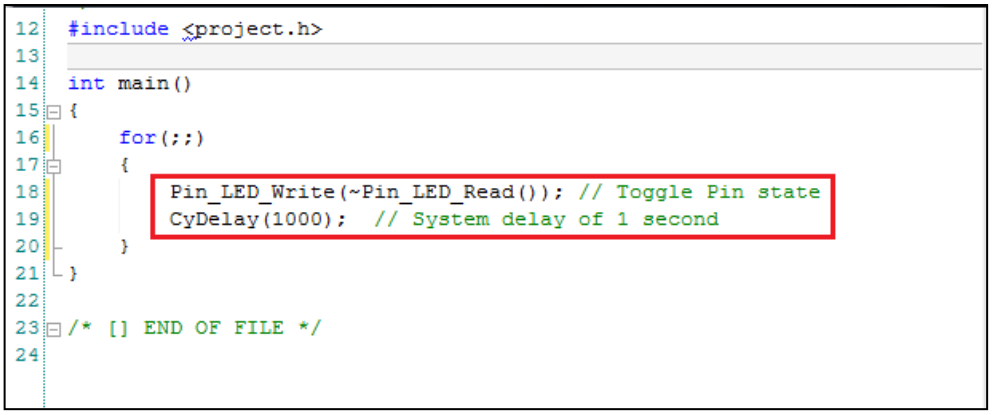
1. From the **Workspace Explorer** double-click **main.c** to open the source file in the code editor, as shown in Figure 10.

Figure 10: PSoC Creator Code Editor Showing main.c



2. Add the code shown in Figure 11 inside the **for(;;)** infinite loop to toggle the LED pin once every second. The code reads the pin's current value and writes its inverse back to the pin, followed by a one second (1000 ms) delay.

Figure 11: Snapshot of Lab 1 Pin Toggle Code

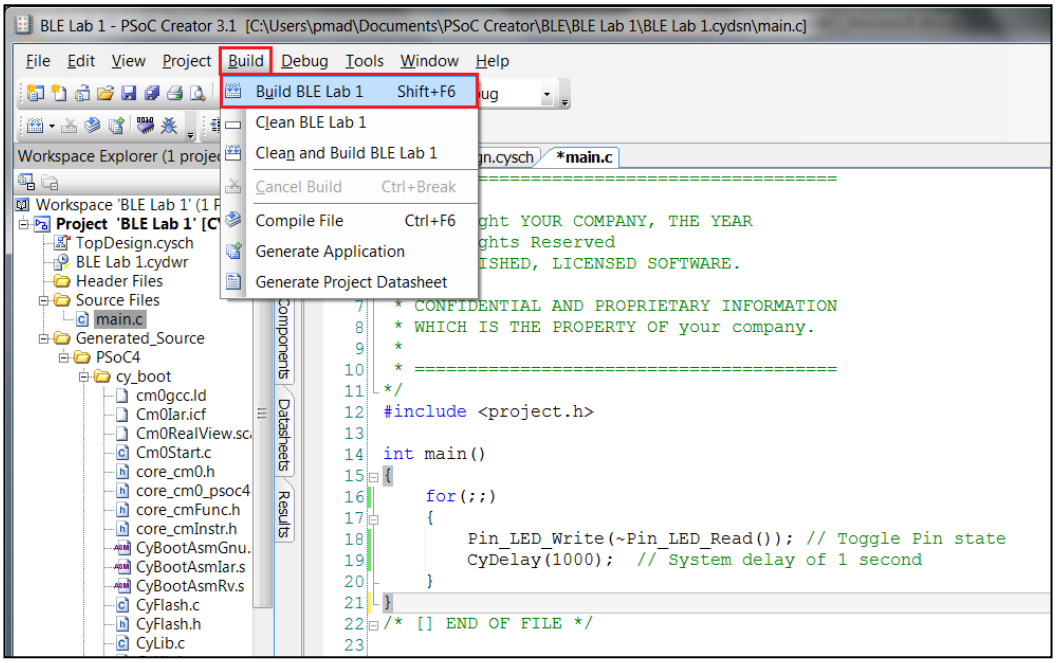


Build and Program

You are now ready to build your project and program it to the kit. Follow these steps:

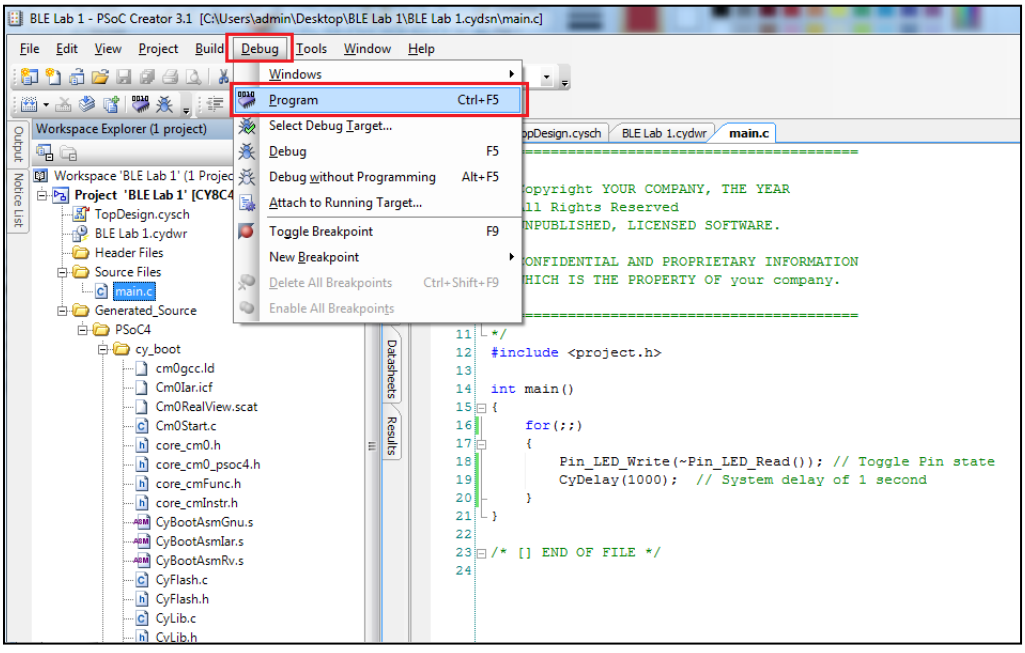
1. Click the menu item **Build -> Build BLE Lab 1** to build your project, as shown in Figure 12.

Figure 12: Building a Project



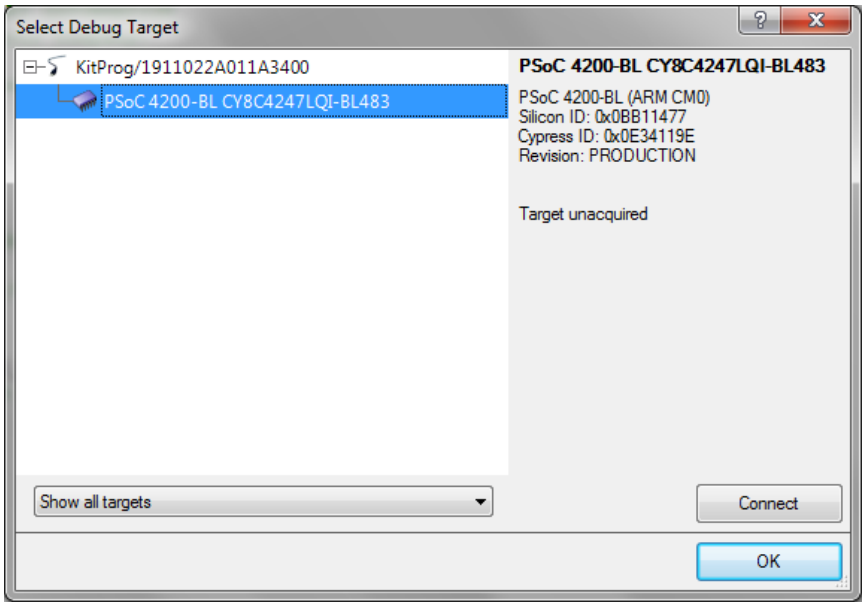
2. Click the menu item **Debug -> Program** to program your kit, as shown in Figure 13. After the programming is complete, the blue LED on the kit blinks ON and OFF every second.

Figure 13: Programming a Project



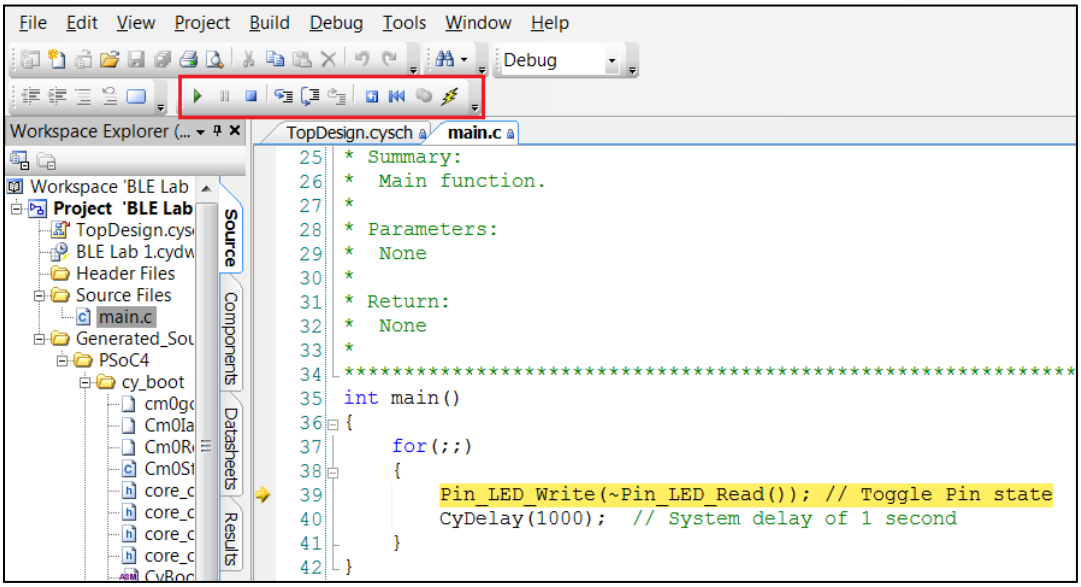
You may also see a pop-up window asking you to confirm which device to program (**Select Debug Target**, Figure 14). Simply choose the **KitProg** (the PSoC 5-based programmer and debugger on the baseboard) that is connected to **PSoC 4200-BL CY8C4247LQI-BL483** as shown below, and click **Connect** and **OK**.

Figure 14: PSoC Creator "Select Debug Target" Window



3. To debug and step through the firmware, click the menu item **Debug -> Debug**. This programs the PSoC 4 BLE device and starts the debug. Once debug is started, click the **Step Over** button in the **Debug** menu or in the control panel shown in Figure 15.

Figure 15: PSoC Creator Project - Debug



Congratulations! Your blinking LED completes the first lab with PSoC 4 BLE.

Additional Exercises

1. Instead of the Blue LED, blink the Red or Green LED.
   Hint: The LED pin-outs are printed on the board.

2. Instead of blinking the LED, generate a constant white color from the RGB LED.

3. Instead of using firmware to blink the LED, use a PWM Component (hardware) to achieve the same result. Hint: Pick a PWM Component from the Cypress Component Catalog. Read the Component datasheet for details on how to configure its parameters. Remember to start the PWM Component in main.c by using the <Component_name>_Start() API. Remember to enable the HW Connection on the Pin Component so you can control it via the PWM instead of firmware.

Document Revision History

Revision	By	Description
**	PMAD	Initial Release
*A	GUL	Edits for BLE terminology