PSoC 4 Lab 1: Blinking LED Lab Manual

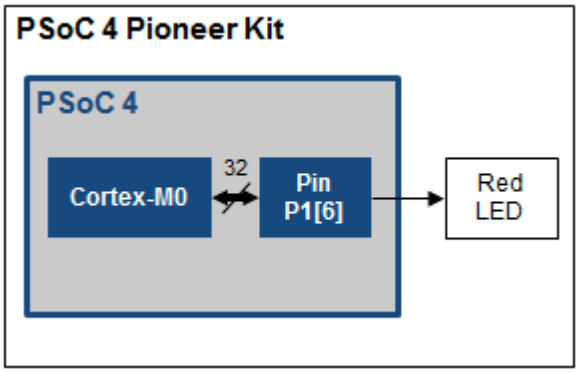
Objectives

1. Make an LED blink on your PSoC 4 Kit using only the ARM Cortex-M0 CPU
2. Use PSoC Creator to create, modify and program PSoC 4 projects

Requirements	Details
Hardware	CY8CKIT-042 PSoC 4 Pioneer Kit
Software	PSoC Creator 3.0 SP 1.0 or Higher
Firmware	None (Create your own project)
Components used	Pin Component

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, firmware controlled blinking LED. A PSoC Creator project is created, A pin component is placed and configured, the pin is assigned and firmware is written. The project is then programmed onto the development board and observed.

The LED is connected to P1[6], and is lit when the pin sinks current. This means that driving the pin output low turns the LED on. To control the pin's behavior, we will use a Pin Component, which allows control of the pin using a Component Configuration tool and high-level Component APIs.

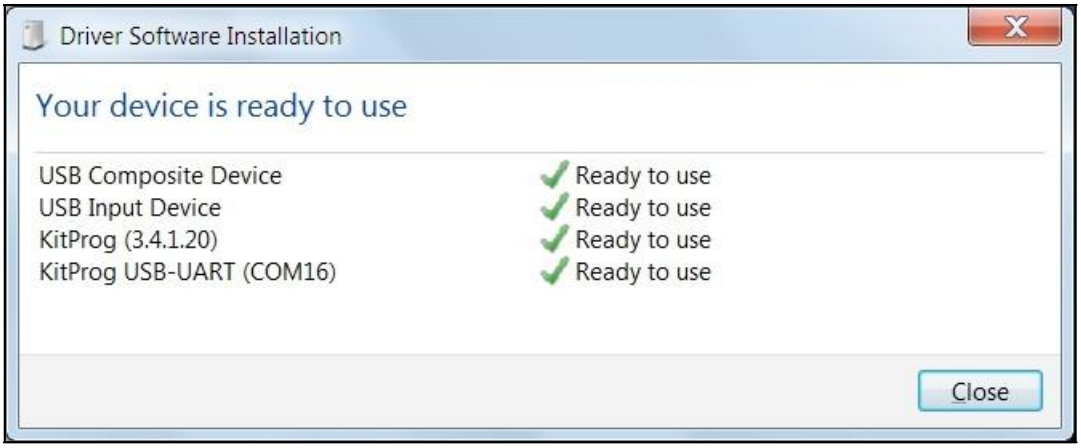
Procedure: Initial Kit Setup

The PSoC 4 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 a Windows operating system.

1. Plug in your PSoC 4 Pioneer Kit to you PC using the provided USB cable.
2. Assuming you had installed the PSoC 4 Pioneer Kit Software at the beginning of the workshop, you will now see the Windows driver-enumeration process begin.
3. Wait for the driver installation to complete as depicted in Figures 2a and 2b.

Figure 2a: PSoC 4 Pioneer Kit Driver Installation In Progress

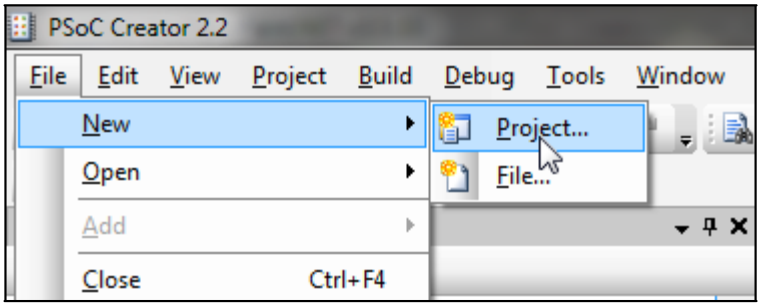
Figure 2b: PSoC 4 Pioneer Kit Driver Installation Complete



Procedure: Firmware

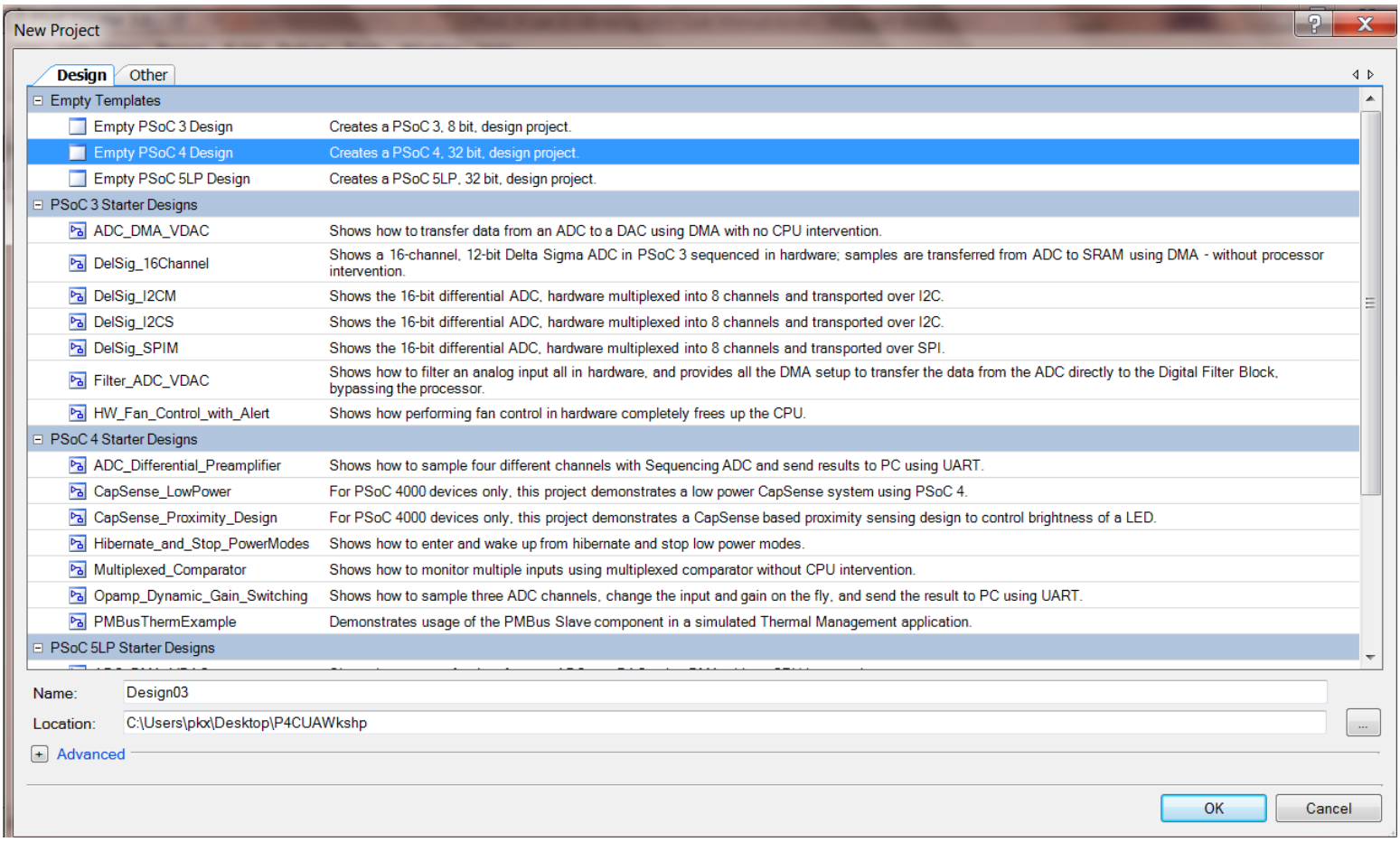
1. Open PSoC Creator. It is located in the Cypress -> PSoC Creator folder in the Windows start menu.
2. Create a new project by using the “New->Project” option in the “File” Menu. This step is shown in Figure 3.

Figure 3: PSoC Creator Project Creation



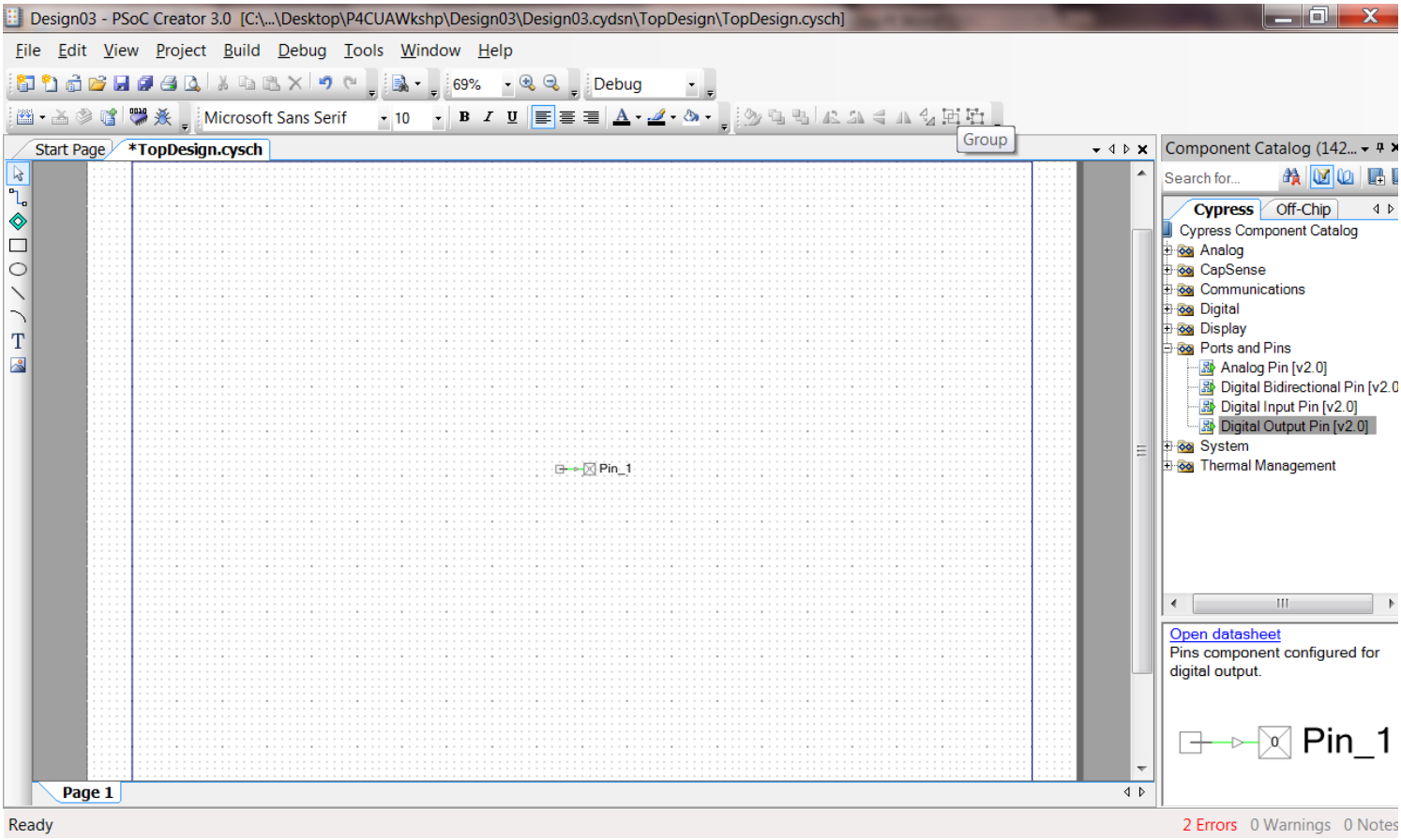
3. The “New Project” dialog will appear. Click on the “Empty PSoC 4 (CY8C42*) Design” option under “Empty Templates.” This step is shown in Figure 4.
4. Set the name of the project “Lab 1 Blink” or something similar. Click “OK” to create the project.

Figure 4: PSoC Creator “New Project” Dialog



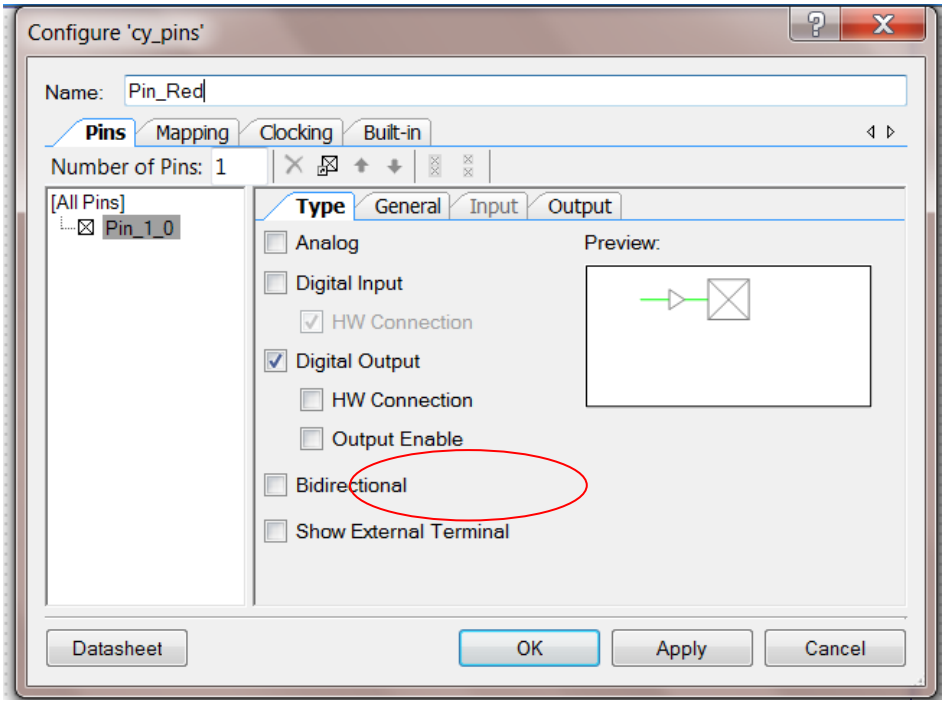
5. You will then be taken to the PSoC Creator project schematic (“TopDesign.cysch”). The right hand side of the PSoC Creator IDE will show the Component Catalog. Select the “Digital Output Pin” Component from the “Ports and Pins” category, and drag it into your schematic. This step is shown in Figure 5.

Figure 5: Adding a Digital Output Pin



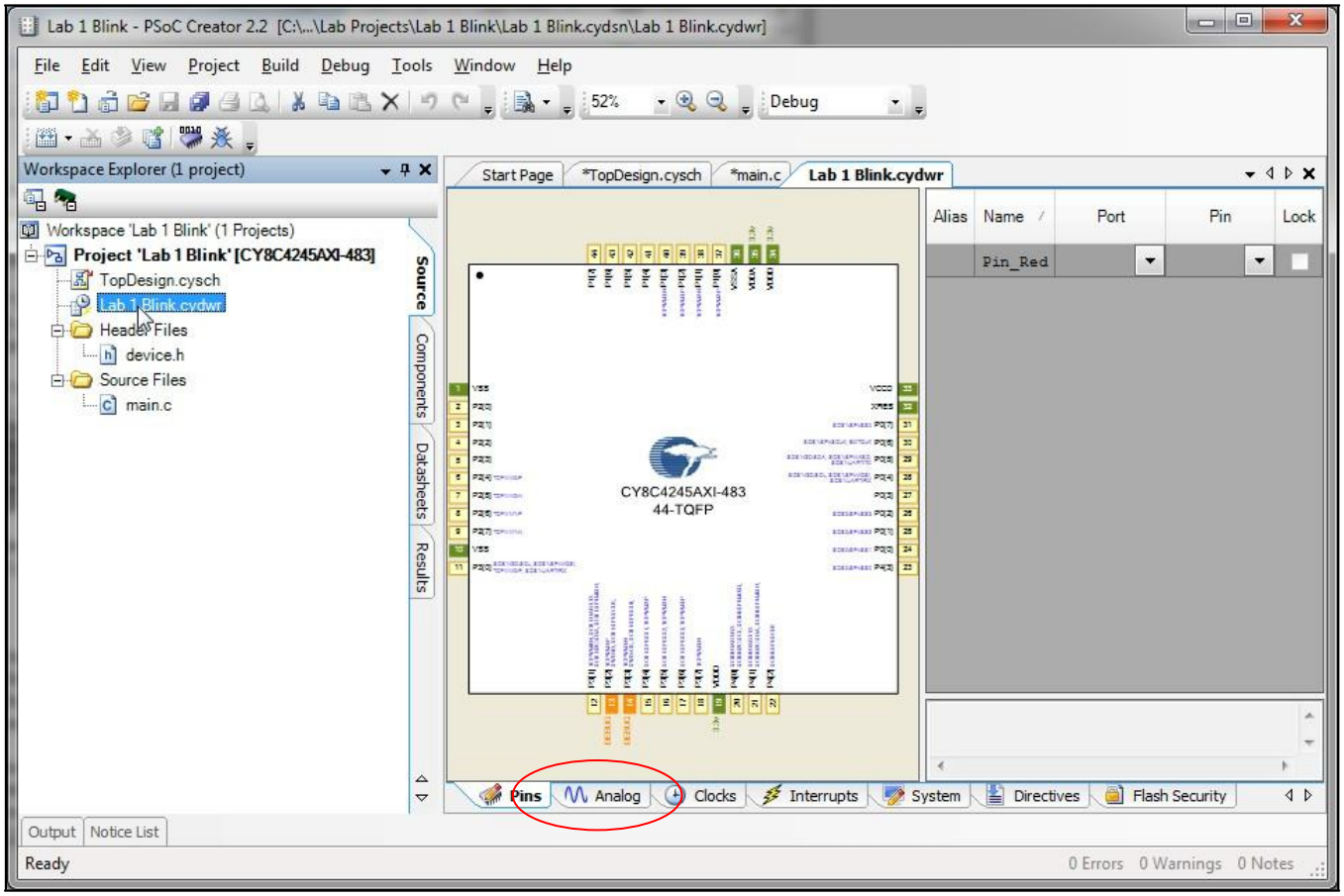
6. Double-click the Pin Component to configure it using its configuration tool. In this window, rename the pin to “Pin_Red”, and **deselect** the “HW Connection” checkbox to allow us to control it in firmware. Click OK to apply changes and close the configuration tool window. This step is shown in Figure 6.

Figure 6: Pin Component Configuration Tool



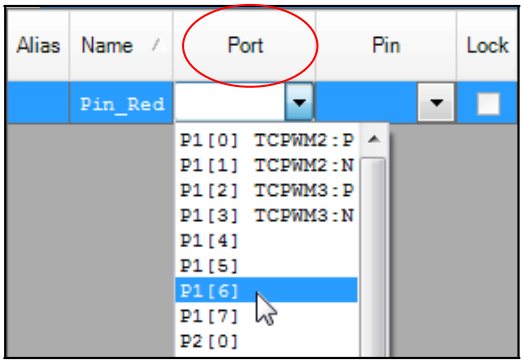
7. On the left-hand side of the PSoC Creator IDE is the “Workspace Explorer”, which shows the files contained within the PSoC Creator project. Double click on the “Lab 1 Blink.cydwr” file to open the Cypress Design Wide Resources (.cydwr) window. This configures aspects of the project that affect the entire part, such as pin mapping, clocks and interrupts. This step is shown in Figure 7.

Figure 7. Design Wide Resources – Pins



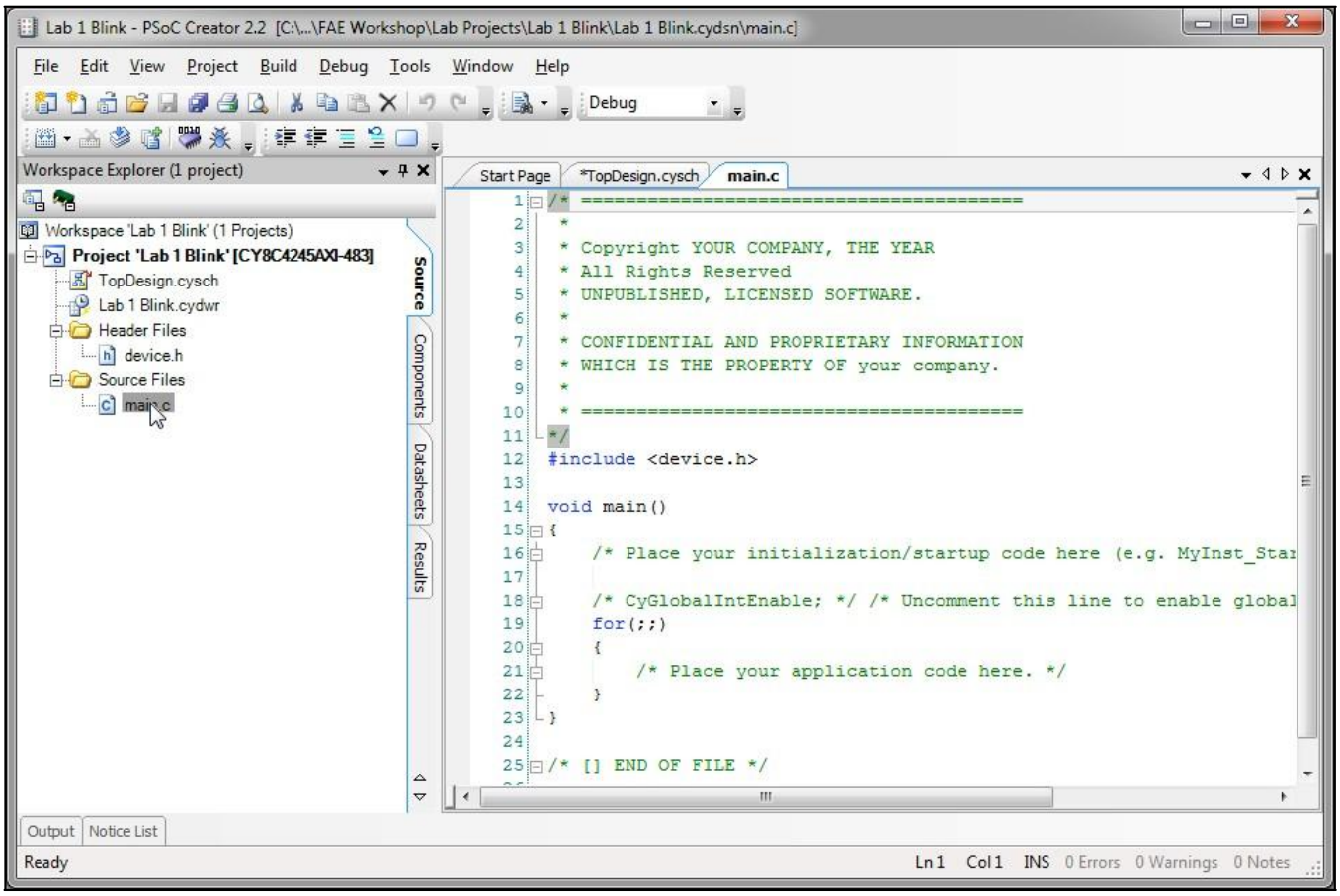
8. The “Pins” tab of the Design Wide Resources will be opened by default. Click the drop-down list under the “Port” column, and map the “Pin_Red” pin to P1[6]. This step is shown in Figure 8.

Figure 8. Pin Assignment Window



9. Now, back in the “Workspace Explorer”, double-click the “main.c” file to open it in the code editor. This step is shown in Figure 9.

Figure 9. PSoC Creator Code Editor Showing “main.c” Code



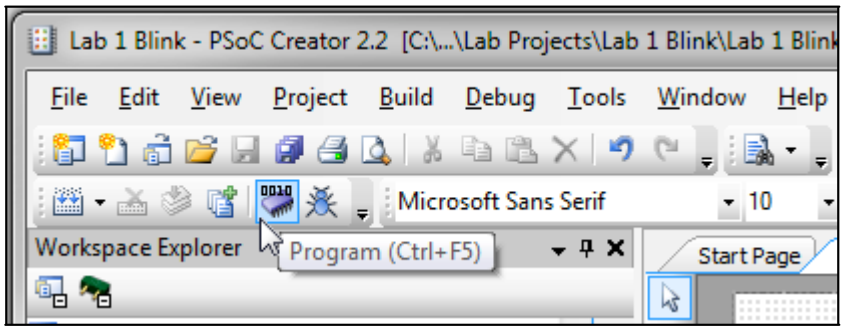
10. Add the code shown in Code 1 inside the “for(;;)” loop to toggle the LED pin once every half second. The below code reads the pin’s current value and writes its inverse back to the pin, followed by a 500ms delay.

Code 1. Lab 1 Pin Toggle Code

```
Pin_Red_Write(~Pin_Red_Read()); //toggle pin state
CyDelay(500); //system delay of 500ms
```

11. Press the “Program” button on the PSoC Creator toolbar to build the project and program your kit. This step is shown in Figures 10a. The results of the build and program operation will appear in the “Output” area at the bottom of the PSoC Creator IDE. This is shown in Figure 11. At this point, the red LED on the kit should start blinking at a 1 Hz rate, at 50% duty cycle.

Figure 10a. PSoC Creator "Program" Button



a. Note: the first time you plug in your PSoC 4 Pioneer Kit to your computer, it will enumerate over USB and link with the correct drivers that get installed with the kit installer. This enumeration and driver scanning process may take a few moments, just like with any other USB device.

b. You may also see a pop-up window inside PSoC Creator, asking you to confirm which device to program ('Select Debug Target': Figure 10b). Simply chose the "KitProg", the PSoC 4 Pioneer kit as shown below, and then press "Connect."

Figure 10b. PSoC Creator "Select Debug Target" Window

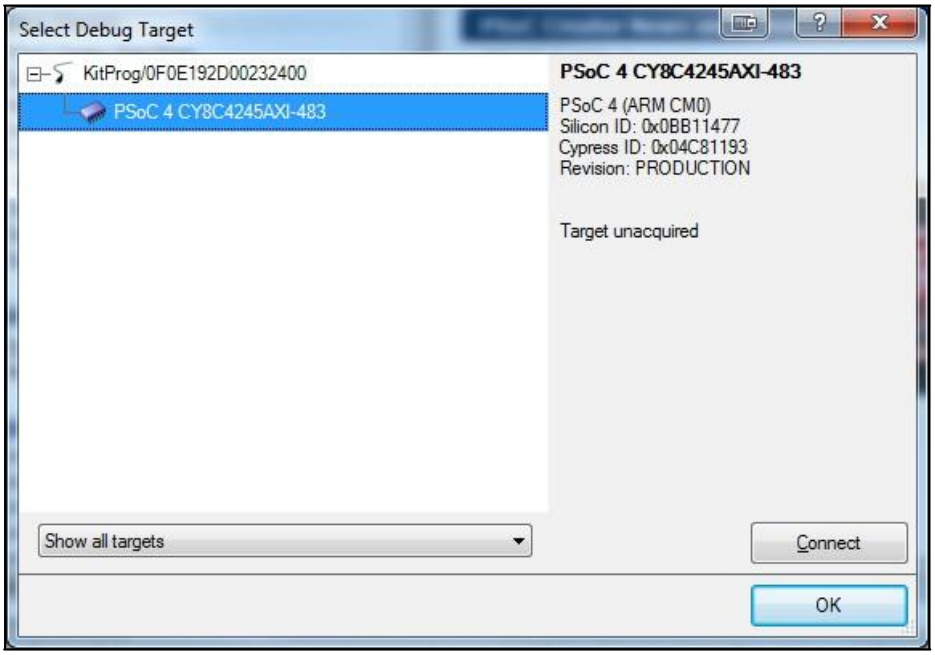
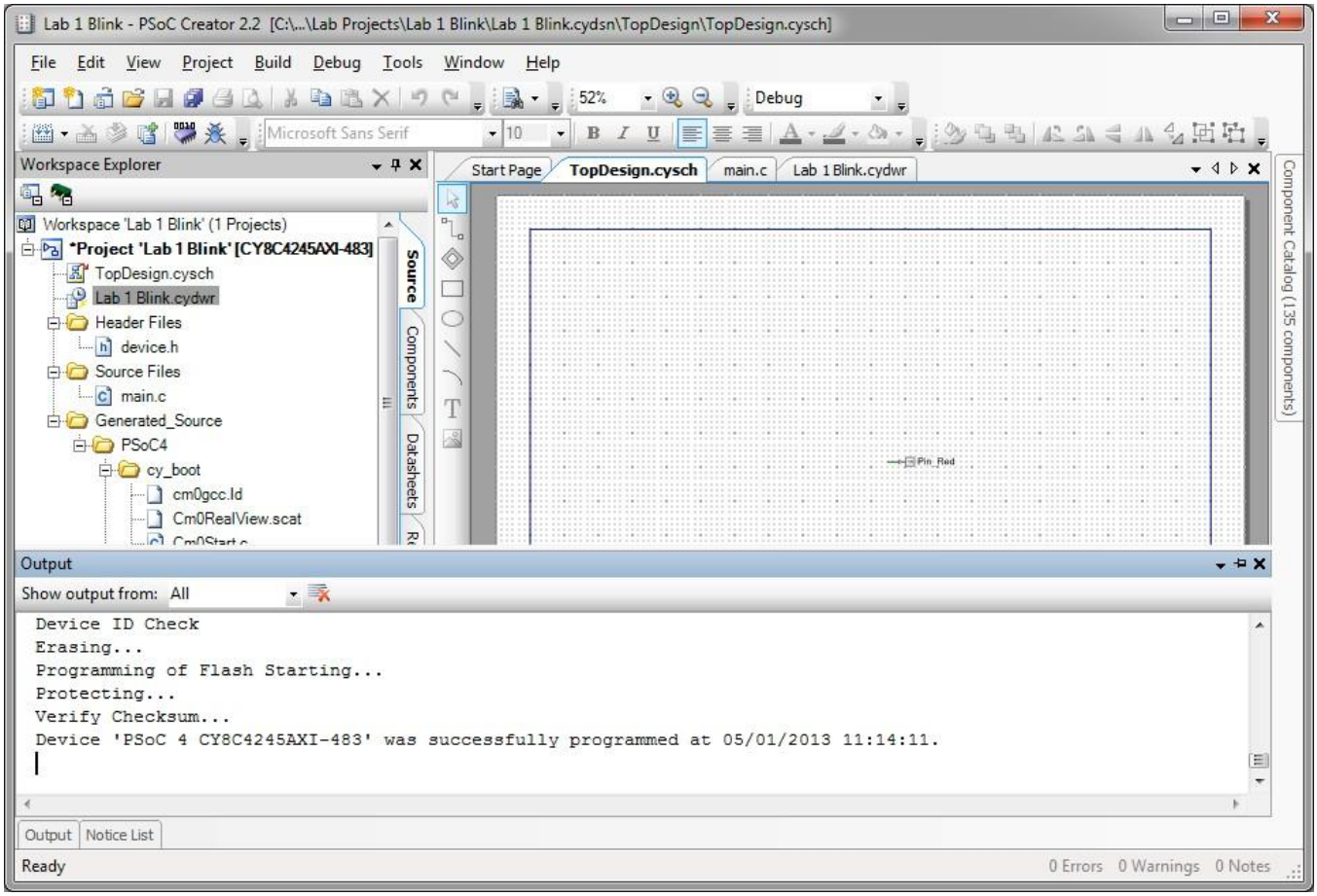


Figure 11. PSoC Creator Output Window



Procedure: PSoC 4 Pioneer Kit Hardware Setup

No hardware setup is required for this project. The red LED is connected to P1[6] with a copper trace.

Conclusion

The red LED [D9] is blinking on your PSoC 4 Pioneer Kit at a rate of 1 Hz and a duty cycle of 50%.

Stretch Goals

1. Change the delay to change the LED blink rate.
    a. We have defined the delay between writes as 500 milliseconds. This results in blinking at 1 Hz.
    b. Try increasing or decreasing the delay as a constant or variable to change the blink rate at design time or at run-time.
2. Change the LED pin to drive the other colors.
    a. We are driving the red LED out of the tri-color array using P1[6]. The green LED is attached to P0[2]. The blue LED is attached to P0[3]. Remember that all 3 LEDs are active low, and that driving the pins low will turn them on.
    b. Try driving these other LEDs instead of, or along with the red LED.
3. Use the debugger to step through code execution.
    a. PSoC Creator has a built-in debugger that works with the PSoC 4 Pioneer Kit as well as the stand-alone MiniProg3.
    b. Start debugging by pressing the “debug” icon on the PSoC Creator toolbars.
    c. Place a breakpoint on the “Pin_Red_Write…” line by clicking in the code editor to the left of the line.
    d. Step through the loop and observe the LED state changing.

Document Revision History

Revision	By	Description
**	MAXK	First Release
*A	GUL	Updated formatting. Added Initial Kit Setup section to procedure
*B	PKX	Updated for Creator 3.0 and CY8CKIT-049-42XX