CY3215A-DK

PSoC® 1 In-Circuit Emulation (ICE) Lite Development Kit Guide

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1. Introduction

Thank you for your interest in the CY3215A-DK PSoC 1 In-Circuit Emulation (ICE) Lite Development Kit (DVK) guide. You can use this kit with PSoC Designer™ or PSoC Programmer. The CY3215A-DK provides debugging functionality for PSoC 1 and manages all the emulation communication between the debugger software running on the computer (PSoC Designer) and the target PSoC chip.

PSoC Designer is PSoC 1's GUI-based Integrated Design Environment (IDE), which includes a powerful set of tools for developing code, prototyping, and debugging. The document gives an overview of the hardware configurations that can be used to set up a debugging system for PSoC 1 using this kit. The Code Examples chapter on page 27 demonstrates use of the critical software elements of the debugging system.

The CY3215A-DK kit supports the following PSoC 1 devices:

- CY8C20x34
- CY8C20xx6A
- CY8C21x23
- CY8C21x34
- CY8C22xxx/CY8C21x45
- CY8C23x33
- CY8C24x23A
- CY8C24x94
- CY8C27x43
- CY8C28xxx
- CY8C29x66
- CY8C95xx

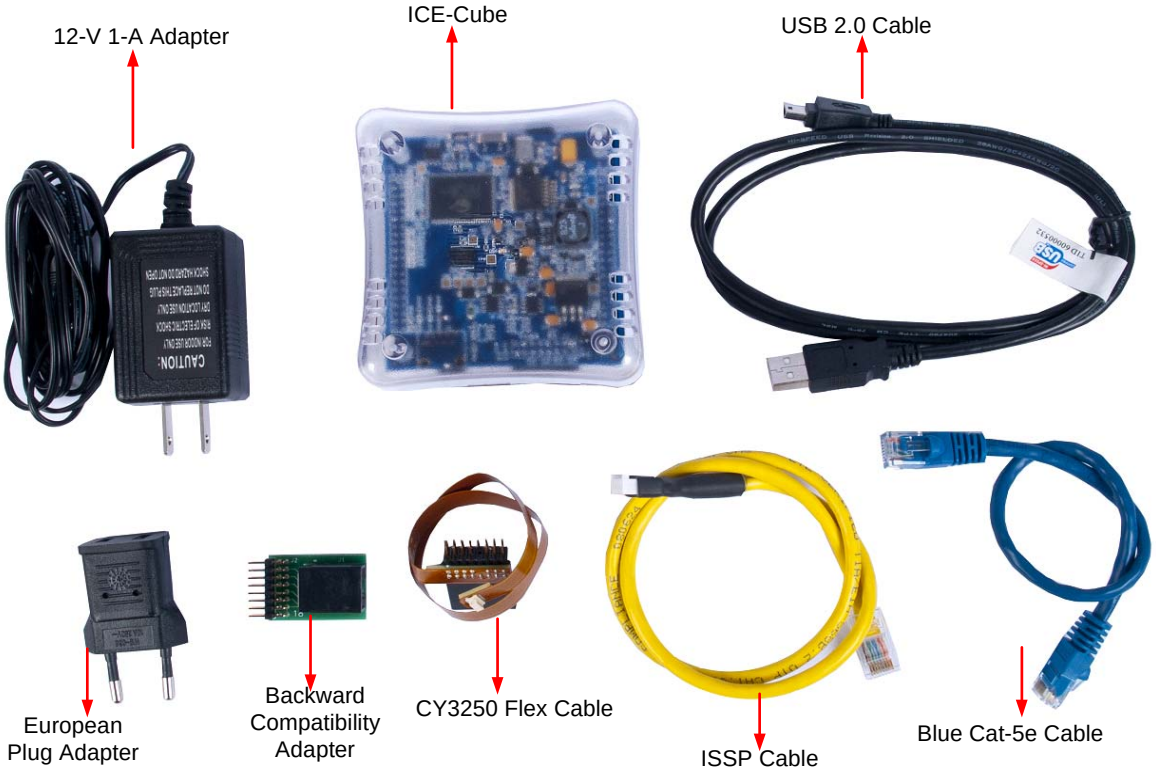
1.1 Kit Contents

The CY3215A-DK kit includes the following:

- ICE-Cube in-circuit emulator
- ISSP cable
- USB 2.0 cable
- Blue Cat-5e cable
- CY3250 flex cable
- Backward-compatibility adapter
- 12-V 1-A adapter
- CY3215A-DK kit CD
  - PSoC Designer installation file

- PSoC Programmer installation file
- Bridge Control Panel installation file (packaged along with PSoC Programmer)
- Kit guide
- Quick start guide
- Release notes

Figure 1-1. CY3215A-DK Kit Contents



Inspect the contents of the kit; if any parts are missing, contact your nearest Cypress sales office for further assistance.

Note The kit ships with only the base ICE debugger unit and its connectors. Pod kits and target boards need to be purchased separately. In-circuit emulation with the ICE is possible with target devices that have the on-chip debugger (OCD) function. Visit http://www.cypress.com/go/shop to find the latest list of pods and PSoC1 target boards.

1.2 Additional Learning Resources

Visit http://www.cypress.com for additional learning resources in the form of datasheets, technical reference manual, and application notes.

- For more information regarding PSoC Designer functionality and releases: http://www.cypress.com/go/psocdesigner
- For more information regarding PSoC Programmer, supported hardware and COM layer: http://www.cypress.com/go/psocprogrammer
- For a list of PSoC Designer-related trainings: http://www.cypress.com/go/psocdesignertraining
- For more information on CY3250-29xxxQFN ICE Pod Schematic: http://www.cypress.com/go/CY3250-29xxxQFN
- For more information on CY3250-FLEXCABLE Mechanical Layout Drawing: http://www.cypress.com/go/CY3250-29xxxQFN
- For more information on CY3250-29xxxQFN ICE Pod Mechanical Layout Drawing: http://www.cypress.com/go/CY3250-29xxxQFN

1.3 Document History

Table 1-1. Revision History

Revision	PDF Creation Date	Origin of Change	Description of Change
**	06/06/2012	RKPM	Initial version of kit guide
*A	10/22/2012	RKPM	Updated the Introduction chapter and added Figure 1-1. Reorganized chapter 3 and updated image. Added Figure 4-17.

1.4 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\`
Italics	Displays file names and reference documentation: Read about the *sourcefile.hex* file in the *PSoC Designer User Guide*.
[**Bracketed, Bold**]	Displays keyboard commands in procedures: [**Enter**] or [**Ctrl**] [**C**]
File >> Open	Represents menu paths: File >> Open >> New Project
Bold	Displays commands, menu paths, and icon names in procedures: Click the **File** icon and then click **Open**.
Times New Roman	Displays an equation: 2 + 2 = 4
Text in gray boxes	Describes cautions or unique functionality of the product.

2. Getting Started

This chapter describes how to install the CY3215A-DK PSoC 1 In-Circuit Emulation (ICE) Lite Development Kit.

2.1 Kit Installation

To install the CY3215A-DK kit, follow these steps:

1. Insert the kit CD/DVD into the CD/DVD drive of your computer. The CD/DVD is designed to autorun and the kit installer startup screen appears.

   Note You can also download the latest kit installer from http://www.cypress.com/go/CY3215A-DK. Three different types of installers are available for download.

   a. CY3215A-DK_ISO: This file (ISO image) is an archive file of the optical disc provided with the kit. You can use this to create an installer CD/DVD or extract information using WinRar or similar tools.

   b. CY3215A-DK_ Single Package: This executable file installs the contents of the kit CD/DVD, which includes PSoC Programmer, PSoC Designer, and user documents.

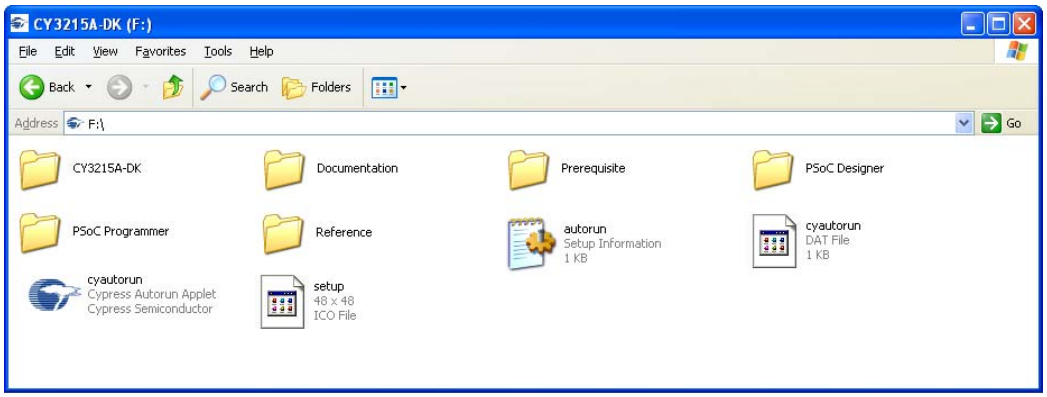
   c. CY3215A-DK_Single Package (without prerequisites): This executable file installs only the kit contents, which includes kit user documents.

2. Click **Install CY3215A-DK** to start the installation, as shown in Figure 2-1.

   Figure 2-1. Kit Installer Startup Screen

Note If auto-run does not execute, double-click the *cyautorun.exe* file on the root directory of the CD/DVD, as shown in Figure 2-2. To access the root directory, click **Start > My Computer > CY3215A-DK <drive:>**.

Figure 2-2. CD/DVD Root Directory

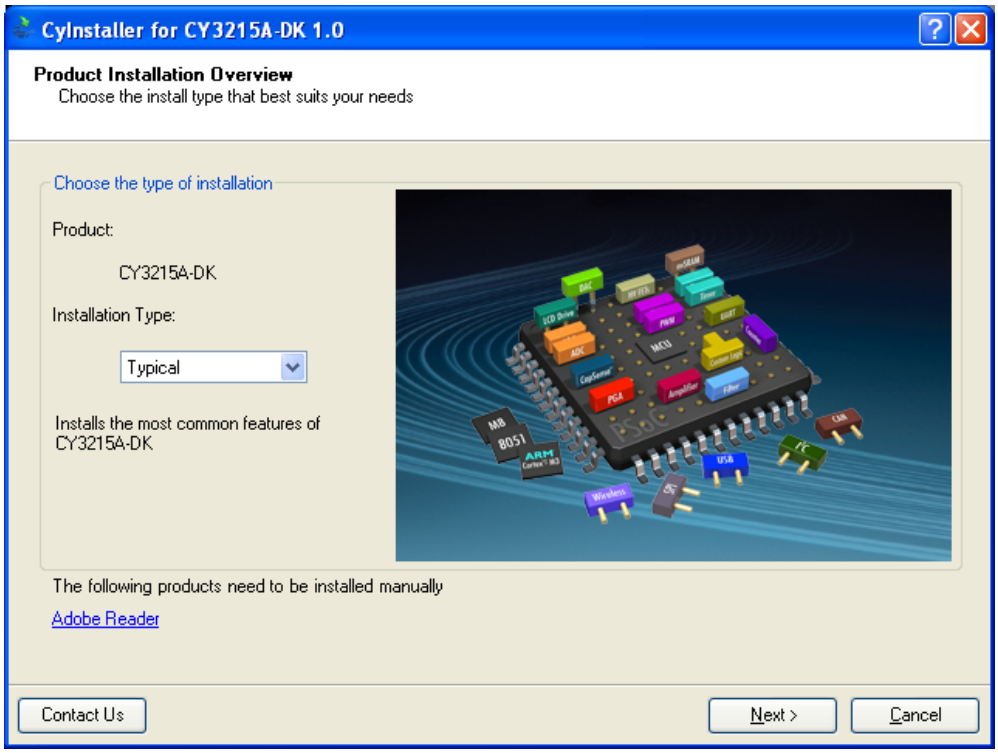


3. In the **InstallShield Wizard**, choose the folder location to install the setup files. You can change the location of the folder for the setup files using **Change**, as shown in Figure 2-3.
4. Click **Next** to launch the kit installer.

Figure 2-3. InstallShield Wizard

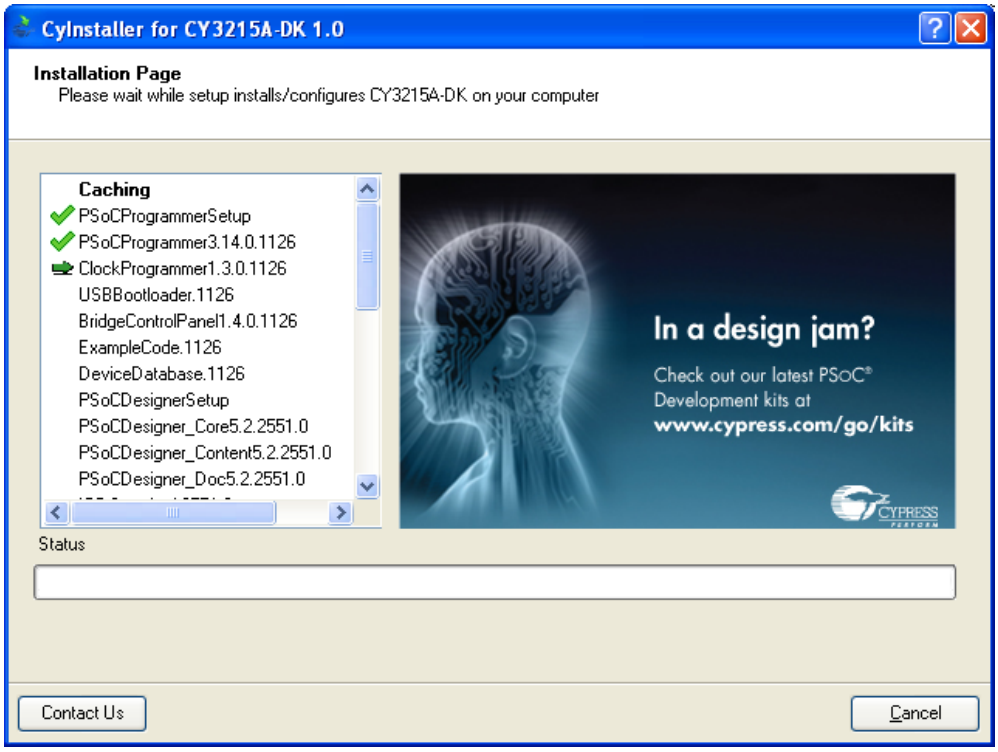
5. On the **Product Installation Overview** screen, select the installation type that best suits your requirement. The drop-down menu has three options: **Typical**, **Complete**, and **Custom**, as shown in Figure 2-4.
6. Click **Next** to start the installation.

Figure 2-4. Installation Type Options



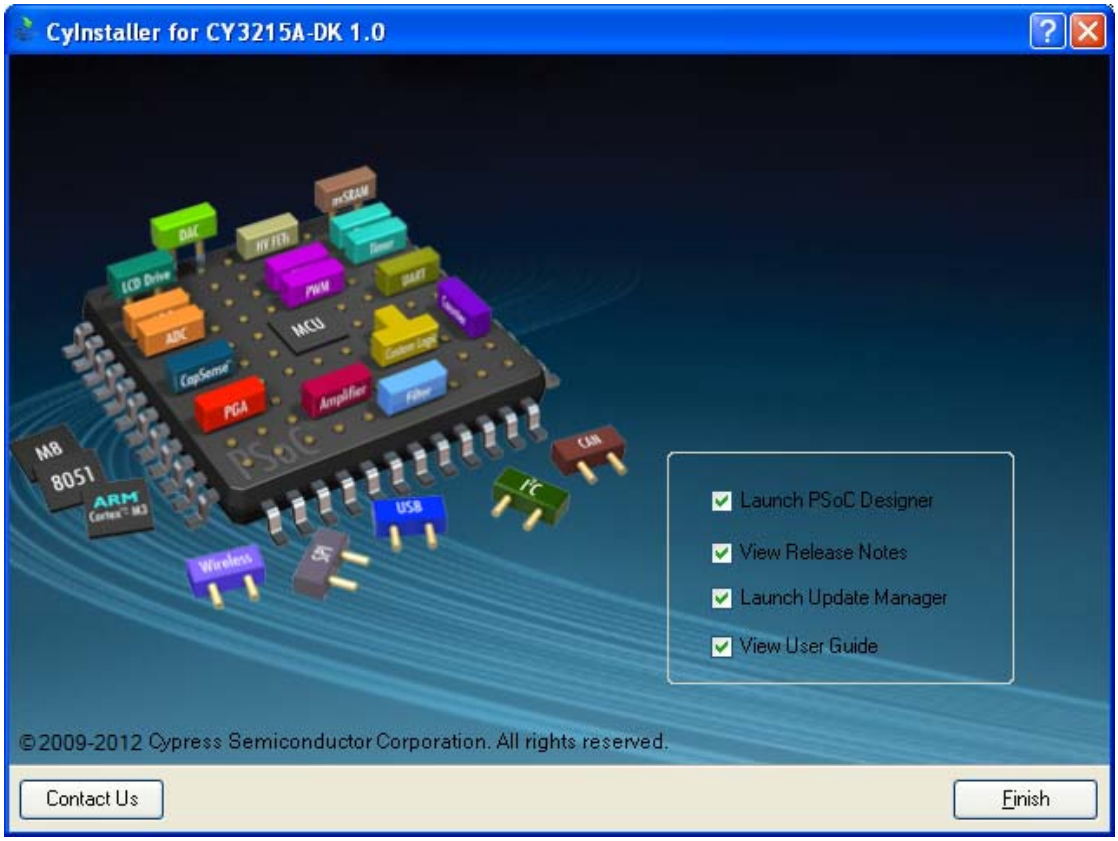
7. When the installation begins, a list of packages appears on the **Installation Page**. A green check mark appears adjacent to every package that is downloaded and installed; see Figure 2-5.

Figure 2-5. Installation Page



8. Wait until all the packages are downloaded and installed successfully.
9. Click **Finish** to complete the kit installation, as shown in Figure 2-6.

Figure 2-6. Installation Complete Page



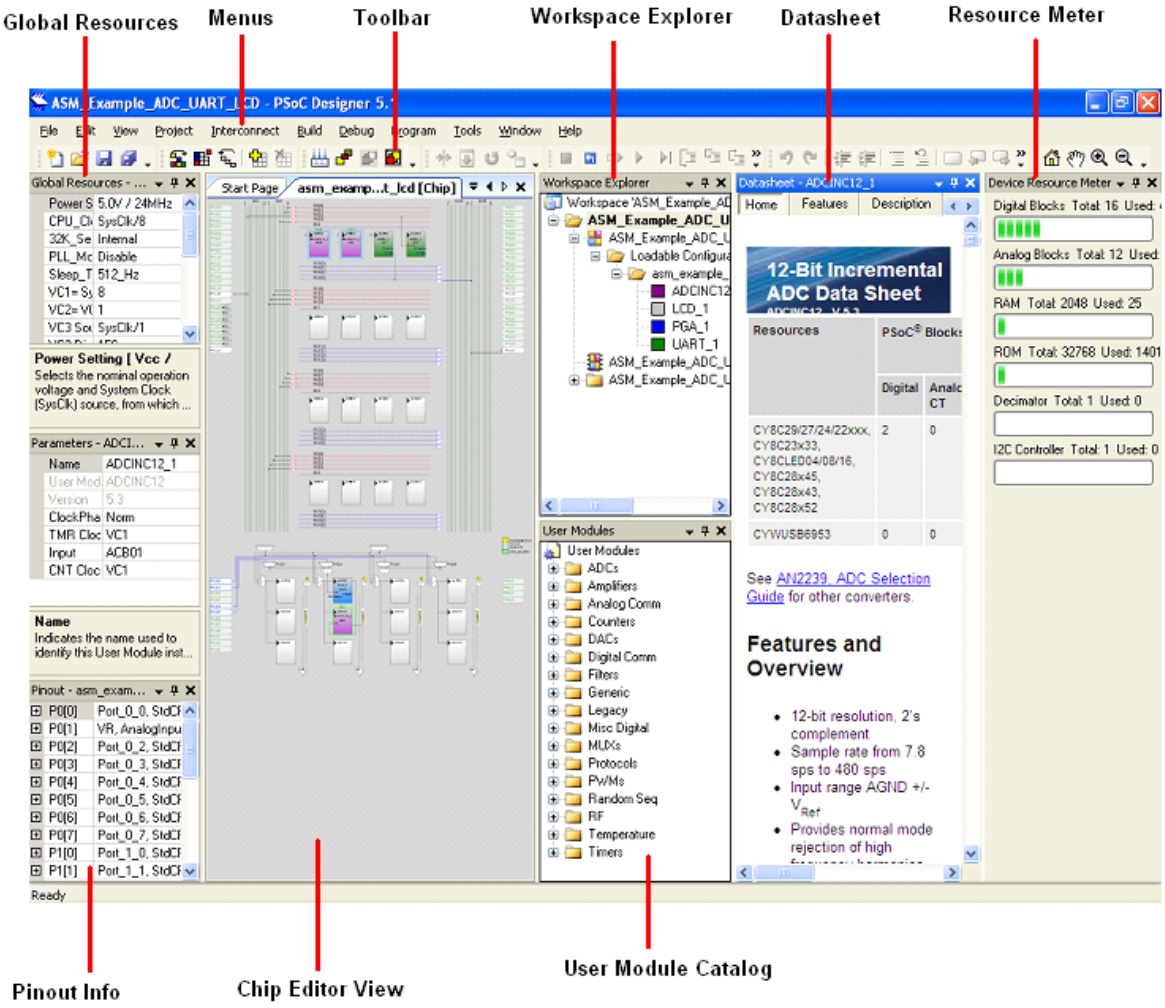
After software installation, verify that you have all hardware and drivers set up for the CY3215A-DK kit by connecting the kit to your computer via its USB interface. Because this is the first time you have connected this board to this computer, initial drivers are installed. If you encounter any prompt related to Windows Logo Testing, click the **Continue Anyway** button to allow the driver installation to finish. Follow the instructions to complete the installation process.

2.2 PSoC Designer

PSoC Designer is the revolutionary integrated design environment (IDE) that helps to customize PSoC 1 to meet specific application requirements.

1. To open PSoC Designer, click **Start** > **All Programs** > **Cypress** > **PSoC Designer <version>** > **PSoC Designer <version>**.
2. To create a new project in PSoC Designer, click **File** > **New Project**.
3. To open an existing project in PSoC Designer, click **File** > **Open**.

Figure 2-7. PSoC Designer Interconnect View



To experiment with the code examples, go to Code Examples on page 27.

Note For more details on PSoC Designer, see the PSoC Designer IDE Guide located at: `<Install_directory>:\PSoC Designer\<version>\Documentation.`

See Additional Learning Resources on page 7 for links to PSoC Designer training. The PSoC Designer quick start guide is available at: http://www.cypress.com/?rID=47954.

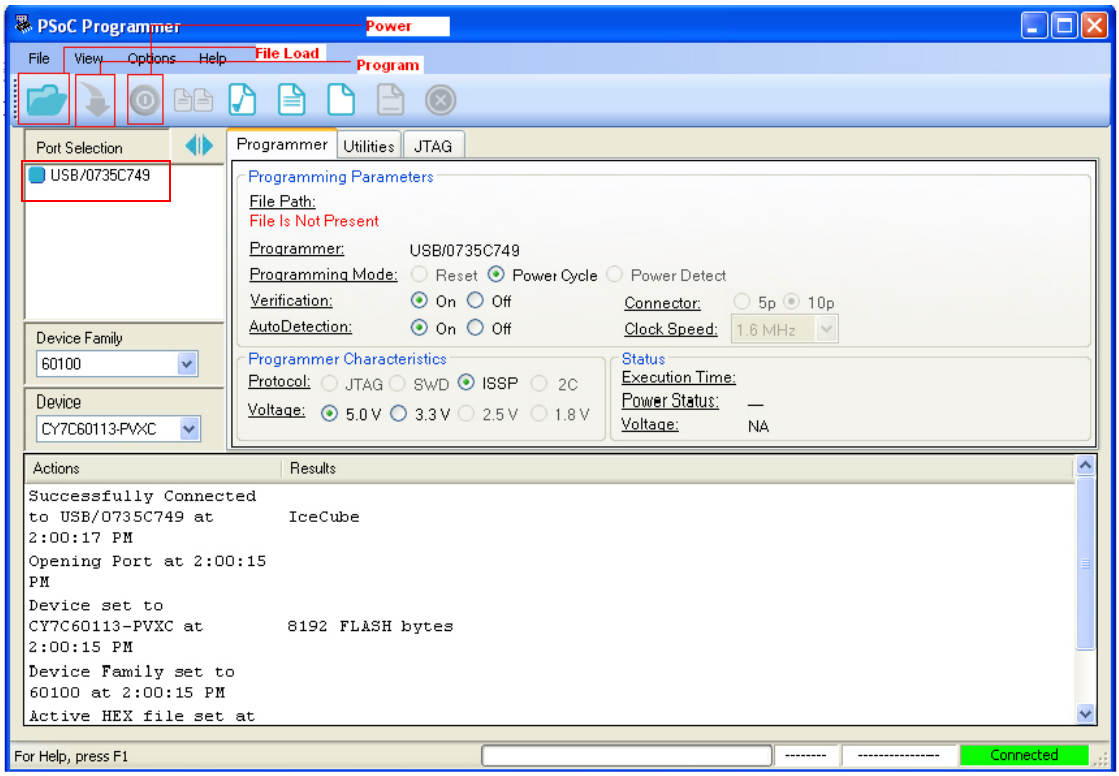
2.3 PSoC Programmer

To open PSoC Programmer, click **Start** > **All Programs** > **Cypress** > **PSoC Programmer <version>** > **PSoC Programmer <version>**.

To successfully program the device, follow these steps:

1. Select the ICE-Cube connectivity in **Port Selection**, as shown in Figure 2-8.

   Figure 2-8. PSoC Programmer Window



2. Click the **File Load** button to load the hex file.
3. Select the device and device family from the list.
4. Click the **Program** button to program the selected PSoC 1 device.
5. Close PSoC Programmer.

Note For more details on PSoC Programmer, see the user guide at the following location: `<Install_directory>\Cypress\Programmer\<version>\Documents`

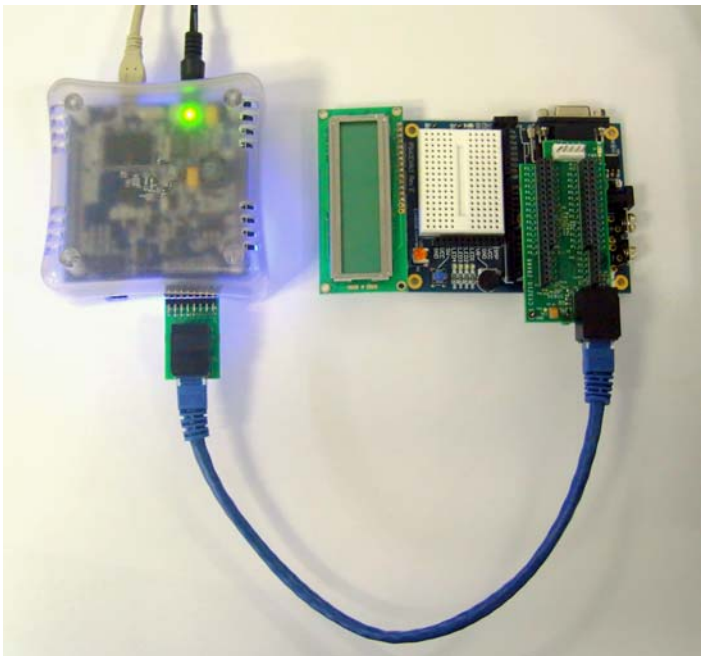
3. Using ICE-Cube Connector

The CY3215A-DK is used to prototype and develop applications with PSoC Designer IDE. This kit supports in-circuit emulation and the software interface allows access to the contents of specific memory locations.

3.1 Connecting the ICE-Cube

The new in-circuit emulator replaces the legacy ICE-4000 and USB adapter to allow seamless USB connection, debugging, and programming. CY3215A-DK is supported by the latest version of PSoC Designer, which is included with the kit.

Figure 3-1. ICE-Cube

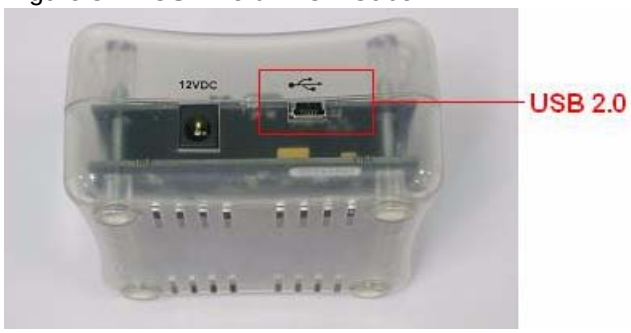


3.1.1 Connect using a USB Port

The ICE-Cube connects to any computer using a standard USB 2.0 cable, included in Cypress development kits. To connect the ICE-Cube to your computer, power it first by connecting the wall adapter to the 12-V DC port, plug the USB cable into your computer, and attach the other end to the ICE-Cube.

The ICE-Cube is a plug-and-play device and it should be recognized automatically by any computer with PSoC Designer and PSoC Programmer installed. If USB connection problems occur, refer to Microsoft Windows Help for troubleshooting Windows connectivity issues.

Figure 3-2. USB Port in ICE-Cube



3.1.2 Connect using a Backward-Compatibility Adapter

A backward-compatibility adapter can be used to debug and program PSoC 1 devices.

Figure 3-3. Backward-Compatibility Adapter

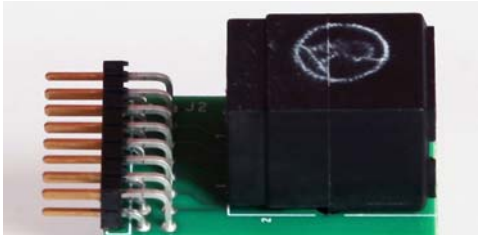
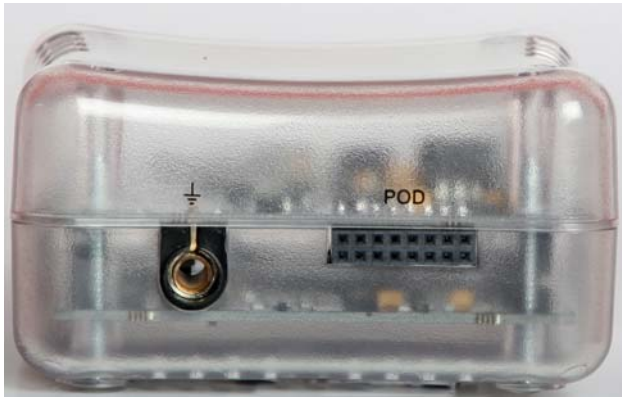


Figure 3-4. Connector in ICE-Cube



3.1.2.1 Program Device

To program the device using the backward-compatibility adapter, follow these steps:

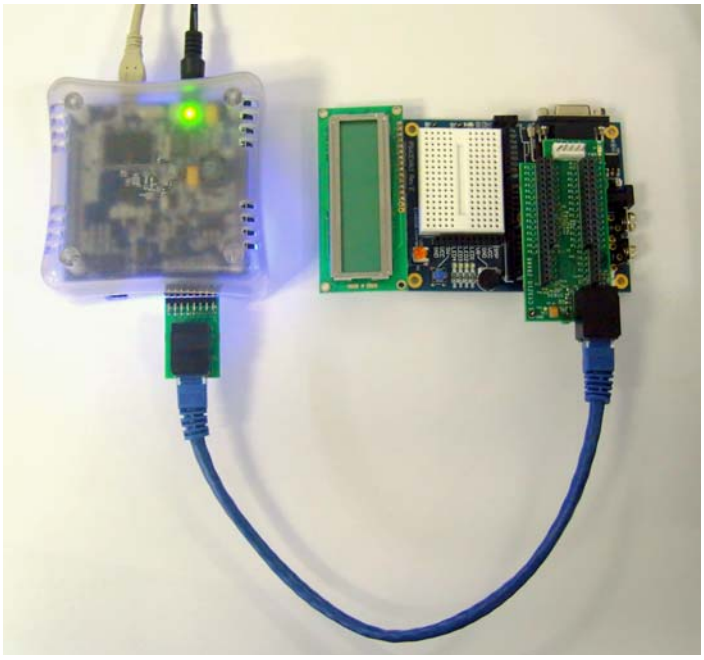
1. Power on the ICE using the 12-V adapter and connect it to your computer using the USB cable.
2. Connect the backward-compatibility adapter to the ICE using the port labelled "POD".
3. Connect the yellow ISSP cable to the ICE-Cube through the backward-compatibility adapter.
4. Place the 5-pin end of the ISSP cable on the 5-pin programming header of the target board.
5. Launch PSoC Programmer.
6. Load the hex file using the **File Load** button.
7. Program it successfully.

3.1.2.2 Debug Device

To debug the device using the backward-compatibility adapter, follow these steps:

1. Power on the ICE using the 12-V adapter and connect it to your computer using the USB cable.
2. Connect the backward-compatibility adapter to the ICE using the port labelled "POD".
3. Connect the blue CAT 5e cable to the ICE-Cube through the backward-compatibility adapter.
4. Connect the other end of the CAT cable to the RJ45 port on the target board.
5. Launch PSoC Designer and create a project for the target device to start a debugging session. The device can also be programmed in this hardware configuration.
6. Launch PSoC Programmer, load a hex file, and click on **Program** to program the device.

Figure 3-5. Backward-Compatibility Adapter Connected to ICE-Cube Pod



3.1.3 Connect using a Flex Cable

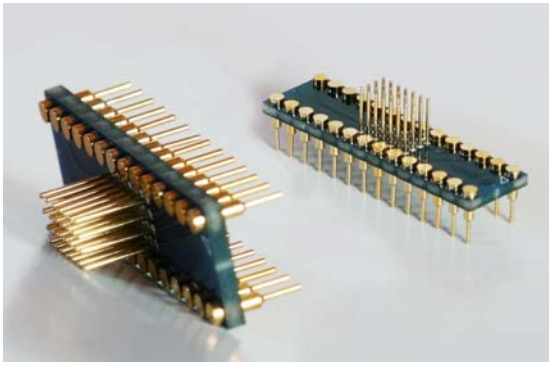
A flex cable is used to connect the ICE-Cube to the pod main board.

- **Pod:** Pods connect to target circuits via foot. As each pod contains a fully functional PSoC bond-out device, pods may be used instead of devices for test purposes. Simply plug a pod into the circuit without connecting it to an ICE base station. The pod power LED lights up when it is powered and operational.

Figure 3-6. Flex Cable and 29000-28 DIP

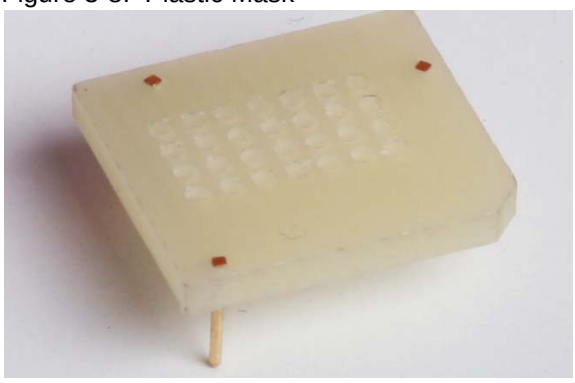
- **Foot:** A foot is used to connect the pod to the MiniEval board. Each foot has a pinout that models a PSoC – for example, a 28-pin DIP. A foot that emulates surface-mount components must be soldered to target circuits. The main board of the pod can then be attached or removed, as desired.

  Figure 3-7. 28-Pin DIP Feet



- **Plastic Mask:** The plastic mask is used to orient the foot. Plastic masks are provided to expose only the pins that connect to the foot.

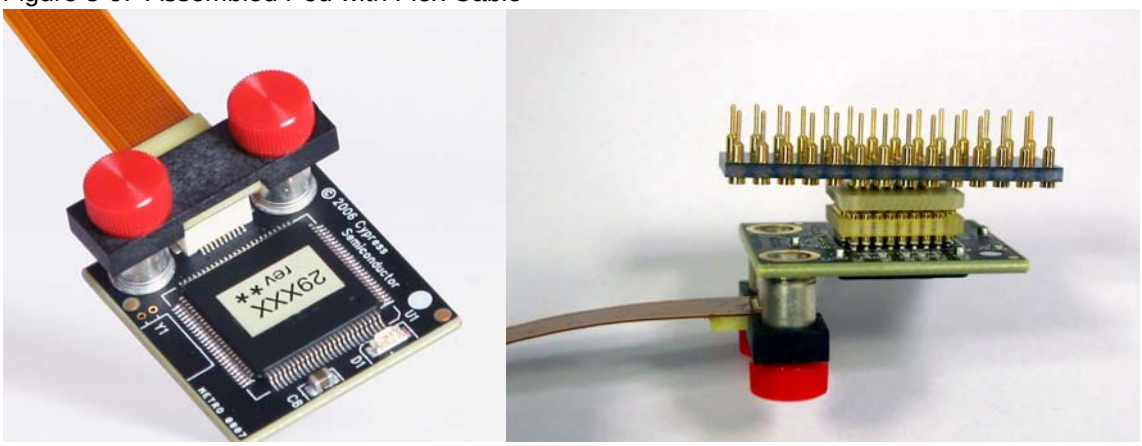
  Figure 3-8. Plastic Mask



Before connecting the flex cable to the ICE-Cube, assemble the three pieces (pod, plastic mask, and foot), as shown in Figure 3-7.

1. Select a foot. The foot should match the pinout of the PSoC 1 device used in the target circuit.
2. Next, select the mask that matches the desired foot.
3. Insert the mask into the bottom of the pod, aligning the chamfered corners of the mask to the pin-1 triangle on the pod.
4. Insert the foot through the plastic mask. Use the alignment triangles to orient the foot to the pod.
5. Plug/assemble the pod onto the target board using the relevant feet.

Figure 3-9. Assembled Pod with Flex Cable



6. Connect the other end of the flex cable to the ICE-Cube pod connector, as shown in Figure 3-7.
7. Start debugging the project, as explained in Debug a Project on page 21.

Figure 3-10. Flex Pod Connected to ICE-Cube Pod

Table 3-1. Pin Description of Pod Connector

Pin No.	Pin Name	Pin Description
1	POD EXTRA3	Future use
2	GND	Ground
3	–	–
4	POD_OCDDE	POD_OCD even data I/O
5	GND	Ground
6	POD_OCDD)	POD_OCD odd data output
7	POD EXTRA1	Future use

Table 3-1. Pin Description of Pod Connector

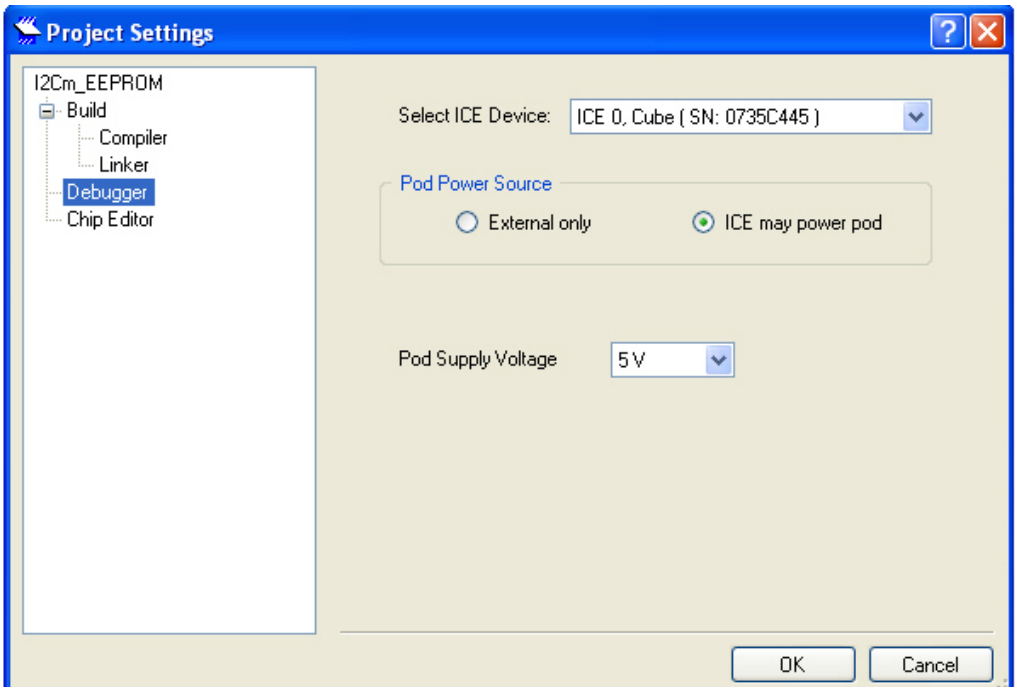
Pin No.	Pin Name	Pin Description
8	POD_XRES	Reset signal (required only for Reset programming mode)
9	GND	Ground
10	POD_OCDHC	POD_OCD high speed clock output
11	GND	Ground
12	POD_OCDCC	POD_OCD CPU clock output
13	POD EXTRA4	Future use
14	PODVCC	Supply voltage
15	–	–
16	PODVCC	Supply voltage

3.1.4 Software Installation

After the physical connection is made, you are ready to configure the internal connection from the computer to the ICE. The ICE enables communication and debugging between PSoC Designer and the pod. To connect the ICE from within PSoC Designer, perform the following steps:

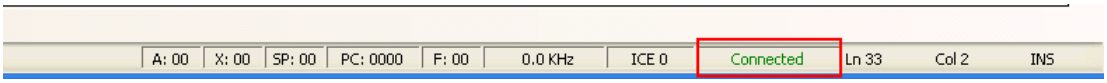
1. Confirm that the flex cable and pod are attached to the ICE-Cube.
2. Confirm that the ICE is powered from the power adapter.
3. Confirm that the USB cable is connected from the ICE-Cube to the computer.
4. Create a project using PSoC Designer. For more information, see My First Code Example on page 27.
5. To access the debugger subsystem, go to **Project > Settings > Debugger**.
6. Select the correct port from the drop-down window. The target board may either be powered by ICE-Cube or an external source. Select **5 V** as **Pod Supply Voltage** to power the board using the ICE-Cube.
7. Click **OK**.

Figure 3-11. Debugger Project Setting



8. Click **Debug > Connect/Disconnect [F9]**. On successful connection, you will receive a notification in the Output tab of the Status window; a green indicator displays **Connected** in the lower-right corner of the program.

Figure 3-12. PSoC Designer Connected with ICE-Cube



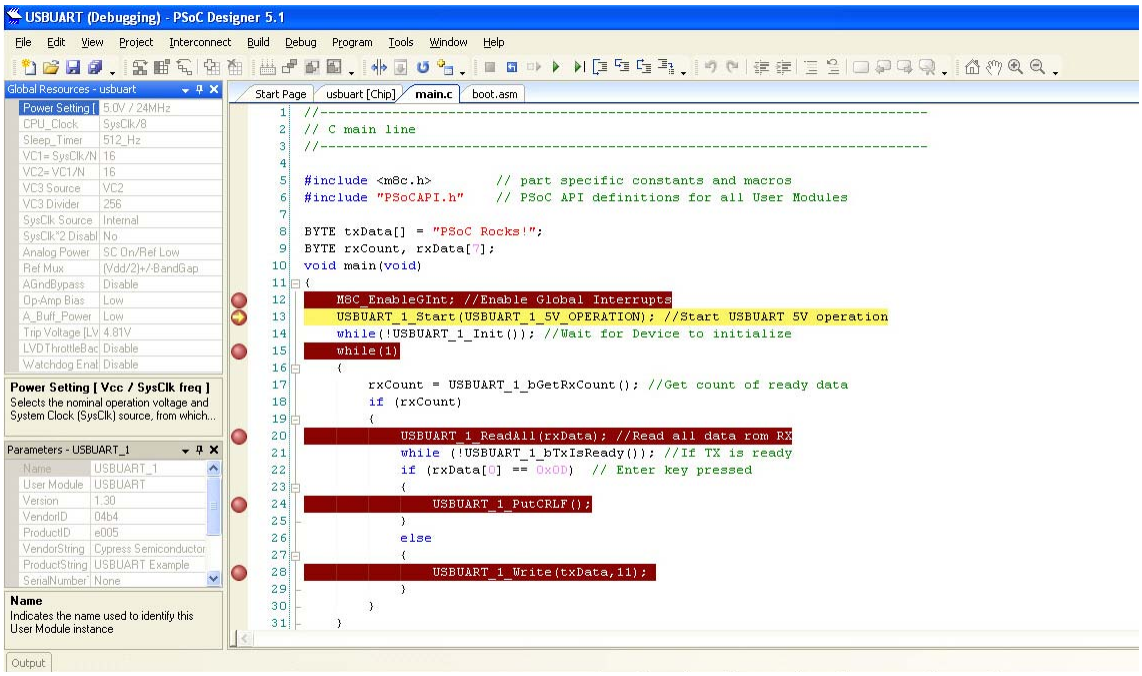
3.1.5 Debug a Project

The following section gives a brief overview of the debugging features in PSoC Designer. For more details, see Code Examples chapter on page 27. To successfully debug a project, follow these steps:

1. Connect the ICE-Cube to the PSoC 1 development board.
2. Click **Start > All Programs > Cypress > PSoC Designer <version> > PSoC Designer <version>**.
3. Create a new project in PSoC Designer by clicking **File** > **New Project**.

   Note To open an existing project, click **File** > **Open**.
4. To connect the ICE-Cube and PSoC 1 development board, go to **PSoC Designer > Debug**.
5. Click on **Connect/Disconnect** or press **F9**.
6. Right-click on a line in the project from where the debugging process should start. The **Insert/Delete Break Point** option appears.

Figure 3-13. Break Points in main.c



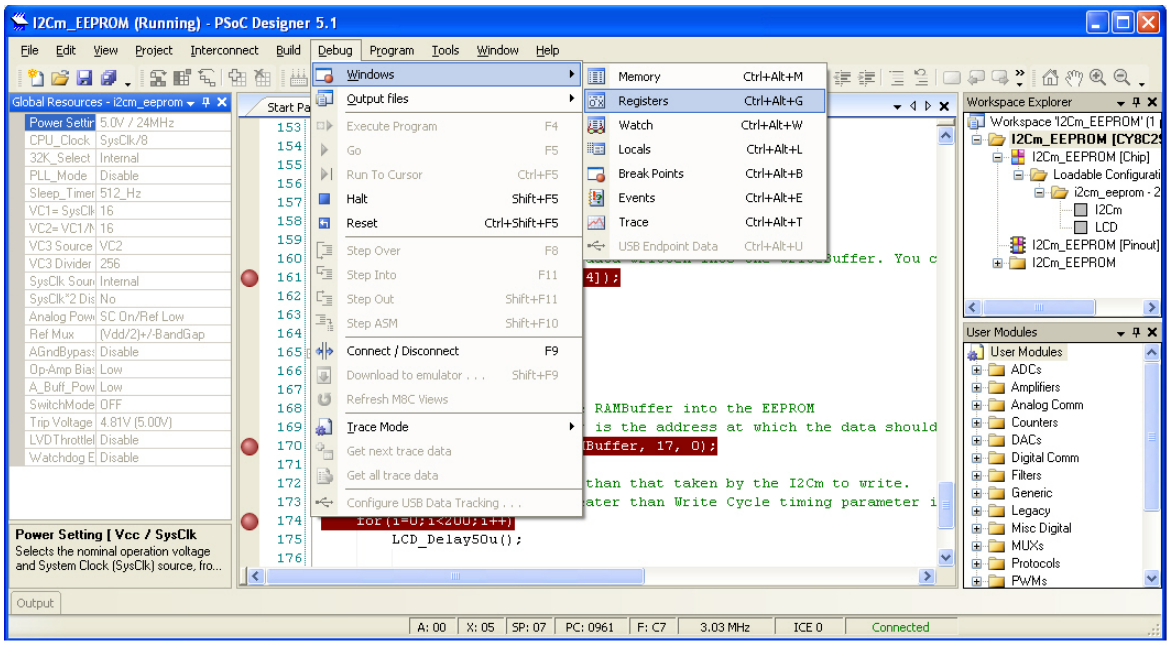
7. To view memory, registers, and watch variables at a particular location, go to **Debug > Windows**.
8. To start the debugging process, go to **Debug > Go** or press **F5**.

   Use one of the following options for the debugging process:

   a. **Debug > Step Over** (or press **F8**): Steps over next statement

b. **Debug > Step Into** (or press **F9**): Steps into next statement
c. **Debug > Step Out** (or press **Shift + F11**): Steps out of current function
d. **Debug > Step ASM** (or press **Shift + F10**): If the current line is C code, the line is located in the first file and that line is executed

Figure 3-14. Debug Options

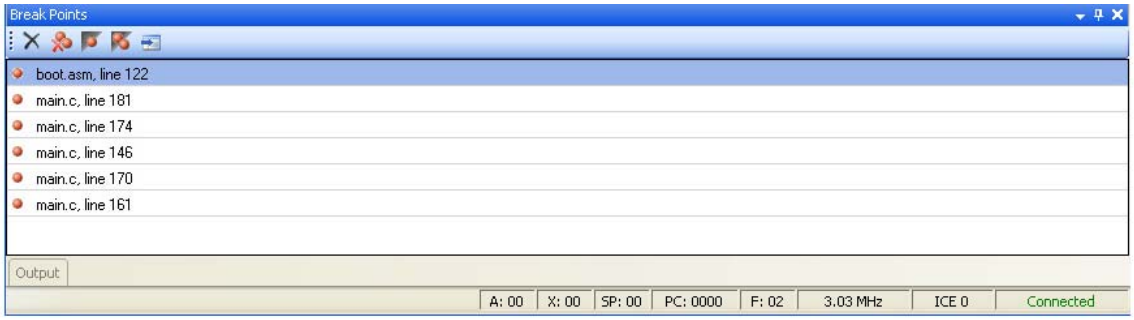


3.1.5.1 *Break Points*

The break point feature allows you to stop program execution at predetermined address locations. When a break point is encountered, the program stops at the address of the break point, without executing the address code. The program can be restarted using the available menu or icon options.

To set break points, first open the file to debug. Right-click the mouse at specific points and select **Insert Break Point**. You can view and remove active break points in the Break Points window. To open the Break Points window, select **Debug > Windows > Break Points**.

Figure 3-15. Break Points Window



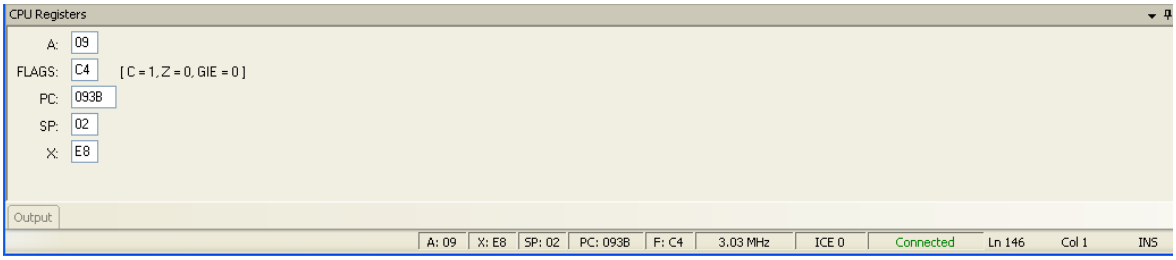
3.1.5.2 *CPU and Register Views*

During debugging, you can read and write in five areas: CPU registers, bank registers 0, bank registers 1, RAM, and flash. The CPU registers are shown in their own window (**Debug > Windows >**

Registers) and in the notification area at the bottom of PSoC Designer. The other four areas can be viewed in the Memory Window (**Debug > Windows > Memory**). Select one of the four memory areas from the **Address Space** box.

CPU Registers: This window allows you to examine and change the contents of the CPU registers. Data is entered in hexadecimal notation. CPU register values can be viewed across the bottom of PSoC Designer.

Figure 3-16. CPU Register in Memory Window

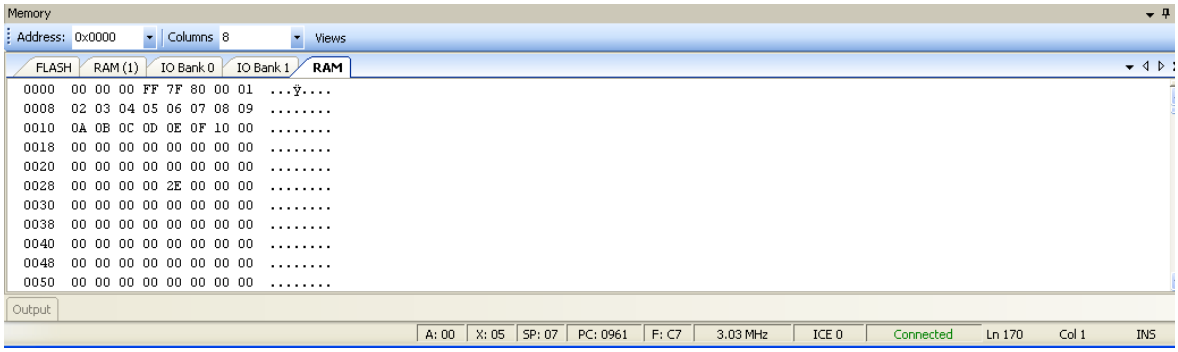


RAM: RAM locations can be modified by clicking the data at the specific location and typing in the new value. Data is entered in hexadecimal notation.

Flash: The flash window displays the data stored in flash. This is the program memory; it is read-only.

Bank Registers 0 and 1: You can scroll through the register bank to view the values in the register bank. Type a new value into the **Offset** to scroll directly to that offset. Click next to a value and type a new value for the register.

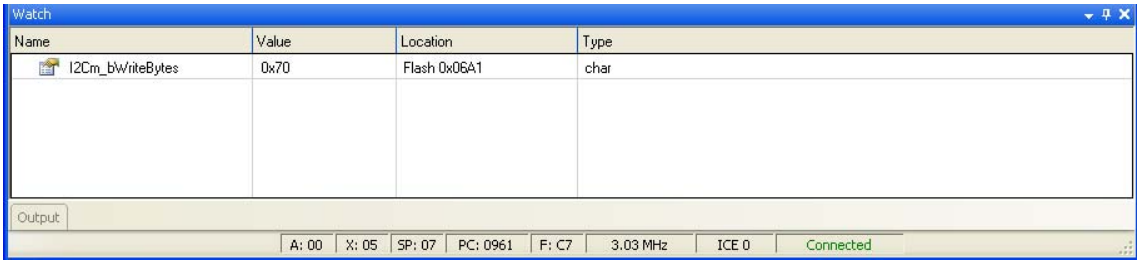
Figure 3-17. Memory Window



3.1.5.3 Watch Variables

To set watch variables, right-click a variable in a source file and select **Add Watch**. You can also select **Global Variables**. Right-click **Add**, **Delete**, or **Properties** in the Watch/Global Name window to add, delete, or modify values.

Figure 3-18. Watch Variables Window

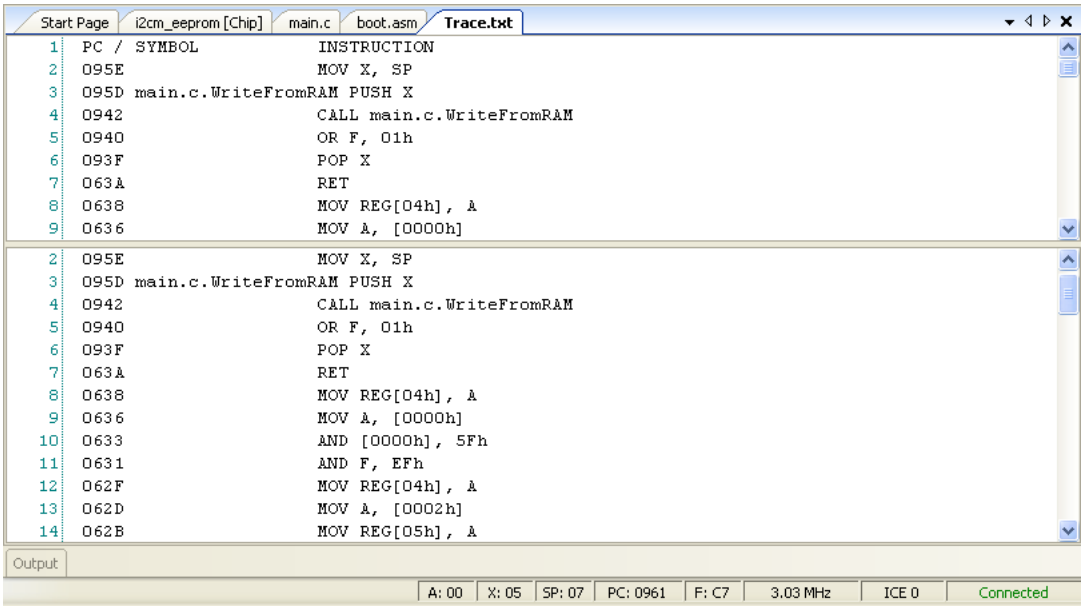


3.1.5.4 *Trace*

The Trace window is displayed when **Debug > Windows > Trace** is chosen. It displays a continuous, configurable listing of project symbols and operations from the last break point. The trace shows symbolic, rather than address data, to enhance readability.

Each time the program executes, the trace buffer is cleared. When the trace buffer becomes full, it continues to operate and overwrite old data.

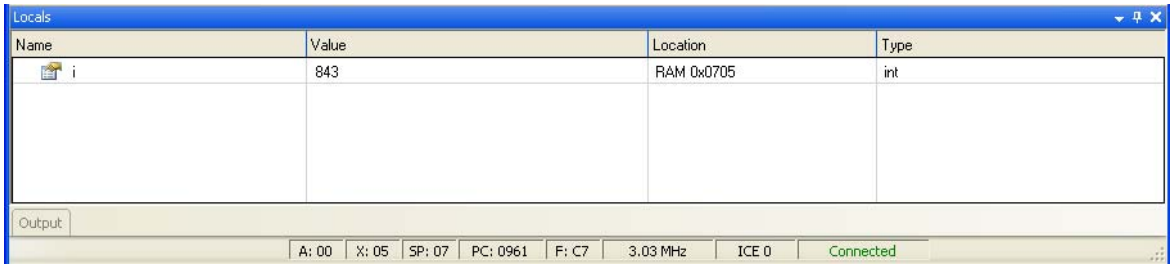
Figure 3-19. Trace Window



3.1.5.5 *Locals*

A separate window is available for local variables. Whenever execution halts, the local variables are updated to the current value.

Figure 3-20. Locals Window

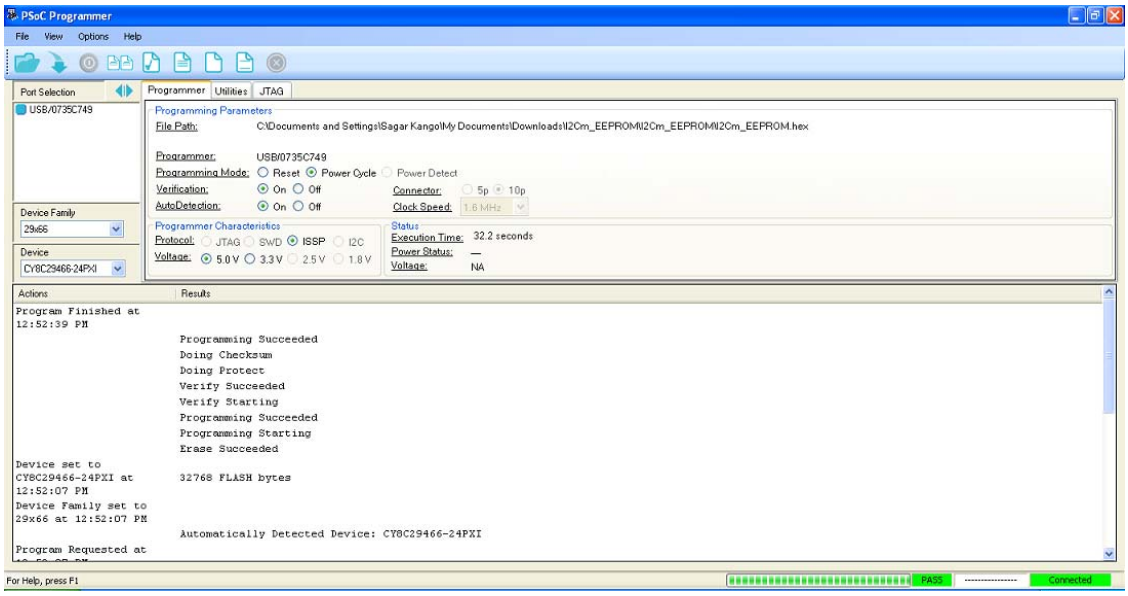


WARNING The time taken to execute a system supervisory call (SSC) such as FlashRead/Write, Table Read, and Erase Block is significantly more while emulating a code through ICE-Cube when compared to the time taken when running the code on chip.

3.2 PSoC Programmer

PSoC Programmer is used as a standalone application to program PSoC devices. It can be launched within PSoC Designer or accessed from the desktop as a standalone program.

Figure 3-21. PSoC Programmer Interface

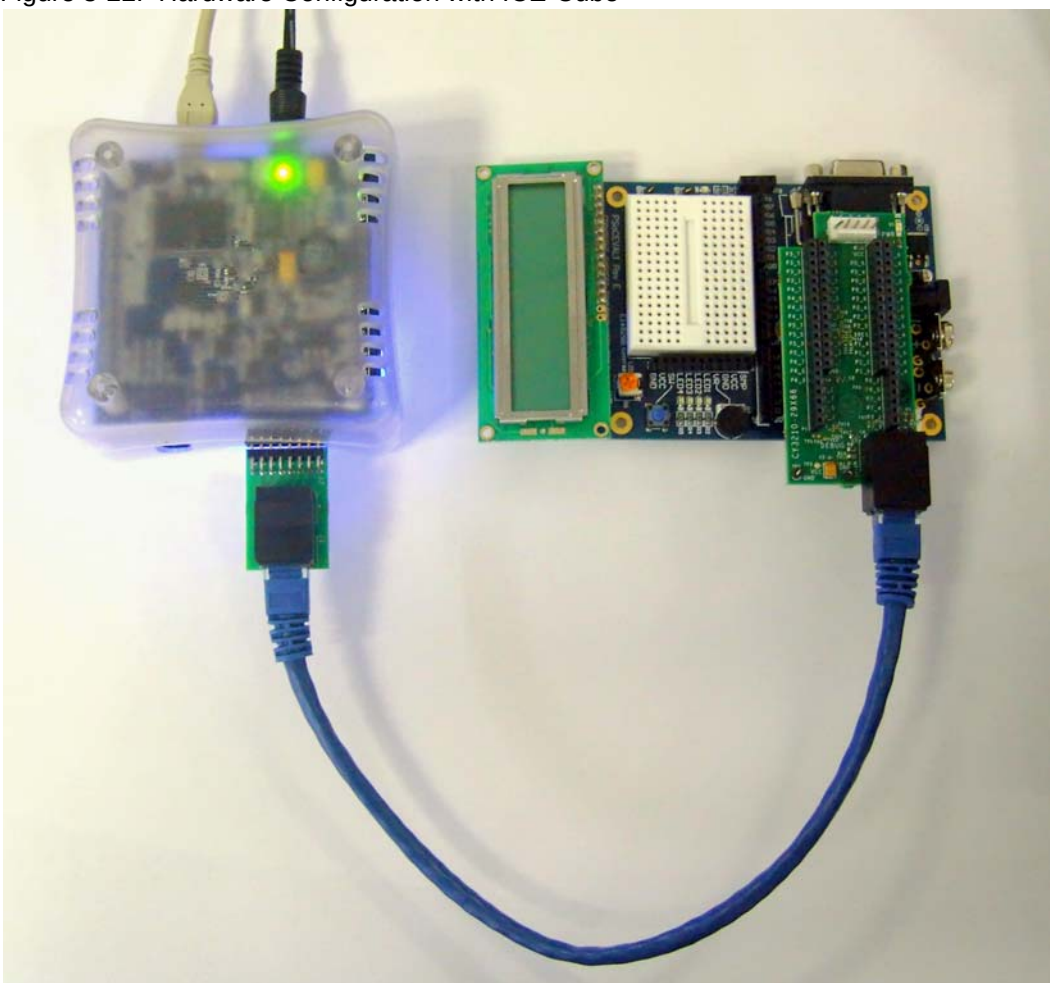


To program a target board using PSoC Programmer via ICE-Cube pod connector, follow these steps:

1. Set up all hardware, including the device to be programmed.
2. Disconnect power from the target board.
3. Launch PSoC Programmer:
   a. From the desktop, click **Start > All Programs > Cypress > PSoC Programmer**.
   b. From within PSoC Designer, click **Program > Program Part**.
4. Click **File Load** to select a file for programming.
5. Select the port used to connect the programmer.
6. Select the device family and device used to generate the hex file.
7. Select **Reset** under programming mode.

8. Apply power to the target board.
9. Click **Program** to start device programming.
10. The action window reports the status and success of programming.

Figure 3-22. Hardware Configuration with ICE-Cube



4. Code Examples

4.1 My First Code Example

4.1.1 Project Objective

This project is used to demonstrate blinking an LED at a varying duty cycle using a hardware pulse width modulator (PWM). Another LED is caused to blink using a software delay. The clock dividers VC1, VC2, and VC3 are used to divide the 24-MHz system clock by 16, 16, and 256, respectively. The resulting 366-Hz clock is used as the input to an 8-bit PWM. This in turn produces an LED blink period of 1.4 Hz. The project also demonstrates how an LED can toggle on/off with a delay of approximately 1 second.

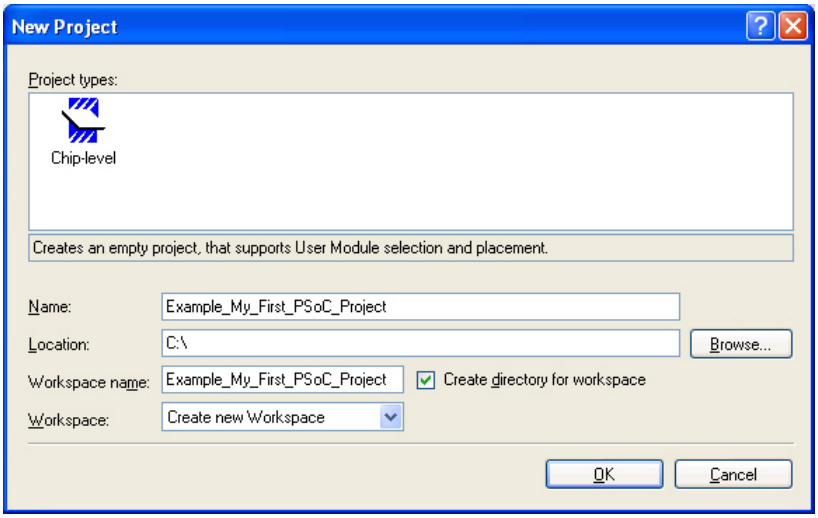
The following user modules are used in this project:

- **PWM** – An 8-bit PWM is used to generate a 366-Hz signal. An LED is connected to the PWM output. This LED blinks at 1.4 Hz.
- **LED** – This module is used to toggle an LED on/off.

4.1.2 Creating My First PSoC 1 Project

1. Open PSoC Designer 5.1.
2. To create a new project, click **File** > **New Project**. The New Project window opens.
3. In this window, select the **Chip-level** icon. Name the project **Example_My_First_PSoC_Project**, as shown in Figure 4-1.
4. Click **Browse** and navigate to the directory in which the project should be created.

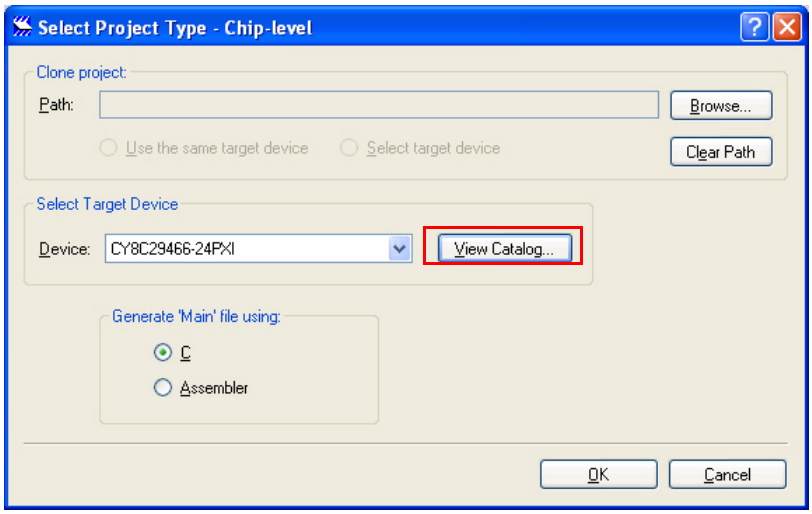
Figure 4-1. New Project Window



5. Click **OK**. The Select Project Type window opens.

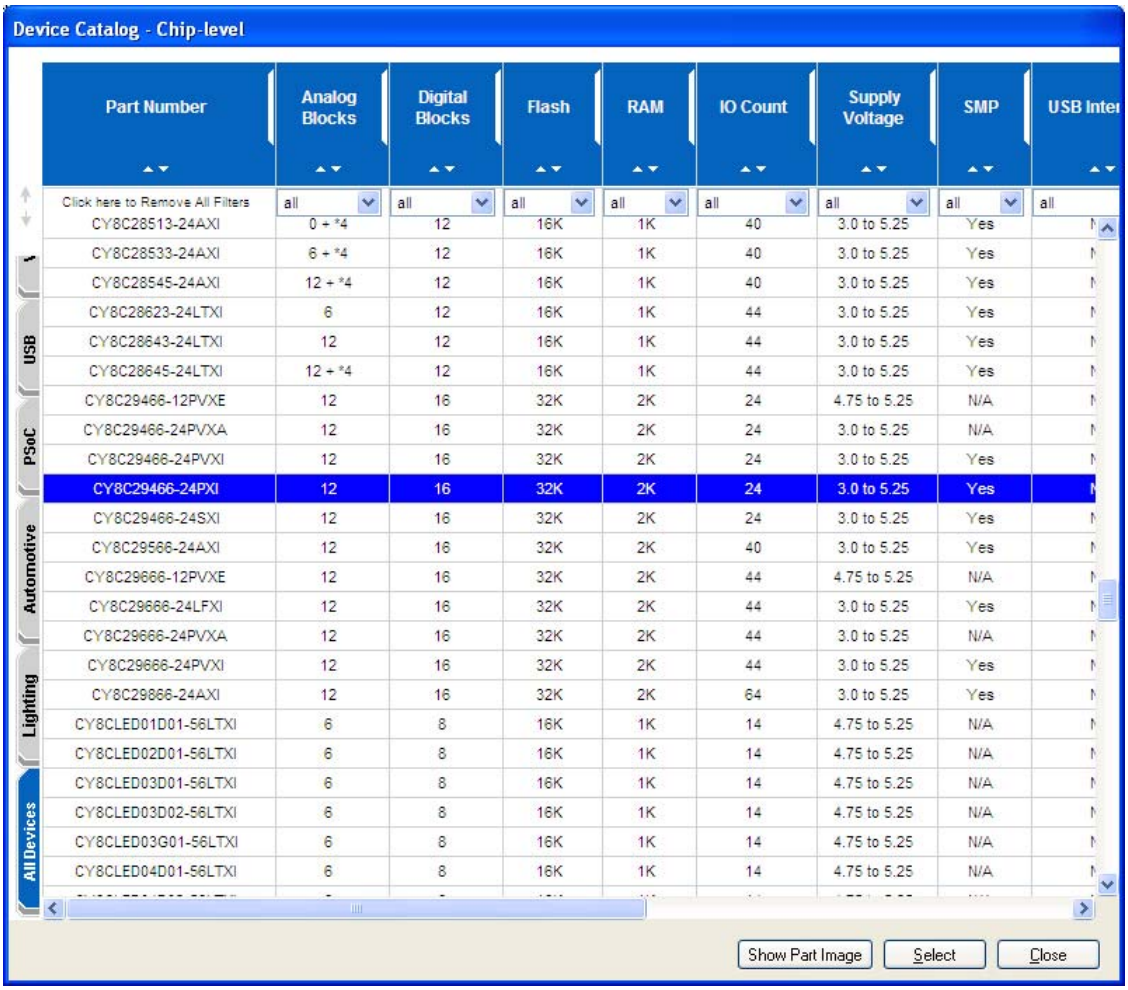
6. In this window, under Select Target Device, click **View Catalog**, as shown in Figure 4-2.

   Figure 4-2. Select Project Type Window



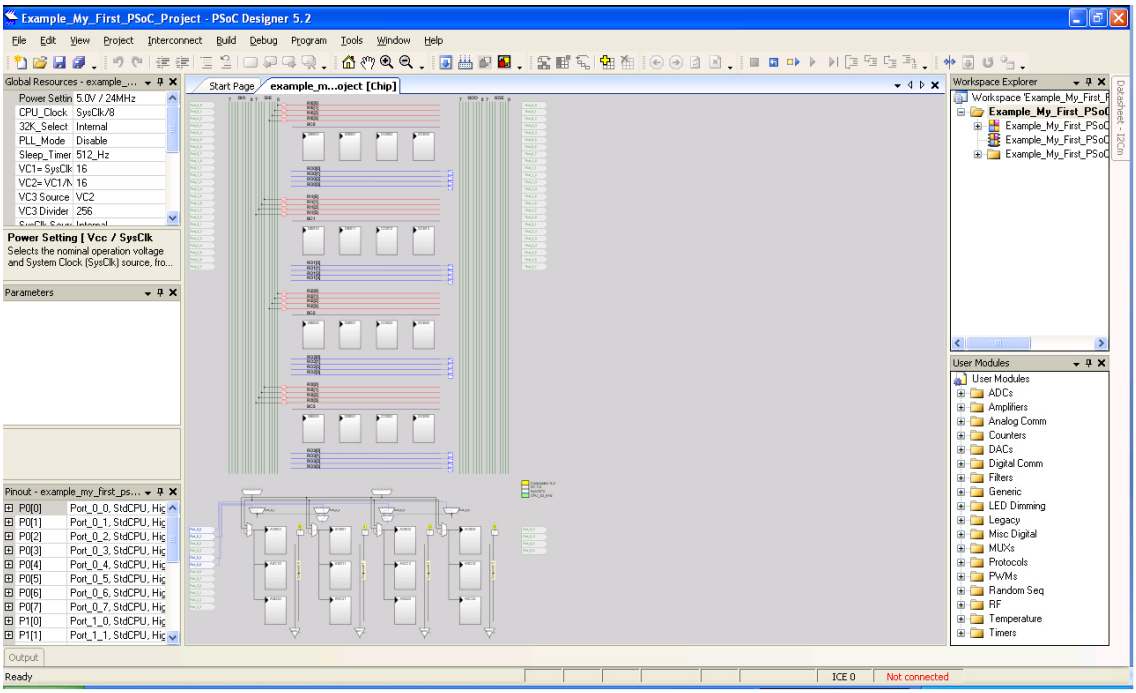
7. The Device Catalog window opens. Click the **PSoC** tab and scroll down to the **CY8C29466, CY8C29566,…** section.
8. For this project, click **CY8C29466-24PXI** and then click **Select**; see Figure 4-3.

Figure 4-3. Device Catalog Window



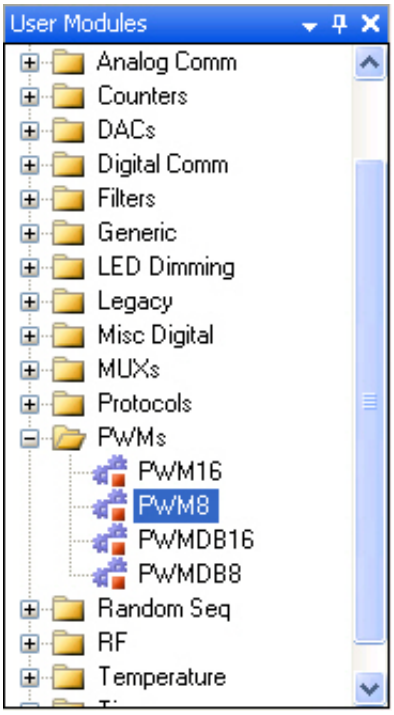
9. Under Generate 'Main' File Using:, select **C**, then click **OK**.
10. By default, the project opens in chip view, as shown in Figure 4-4.

Figure 4-4. Default View



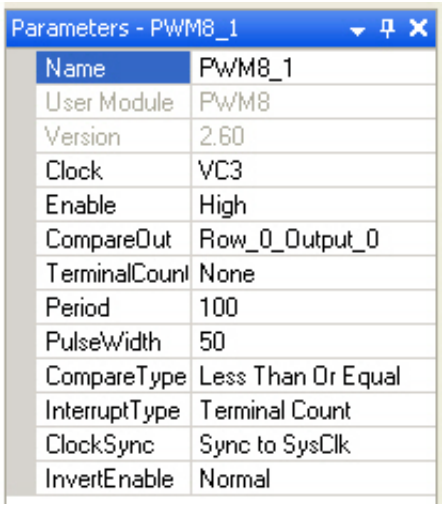
11. In the User Modules window, expand the **PWMs** folder. In this folder, right-click on **PWM8** and select **Place**. The user module (UM) is placed in the first available digital block.

Figure 4-5. User Modules Window



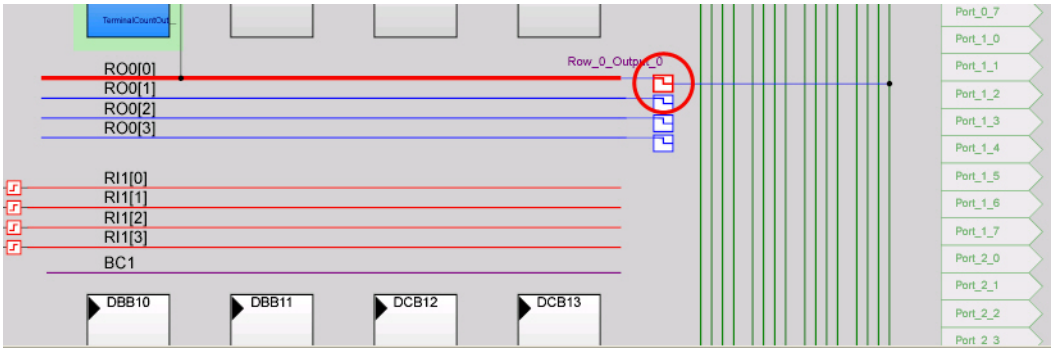
12. Configure the PWM8_1 properties, as shown in the following figure.

Figure 4-6. PWM8 User Module Properties



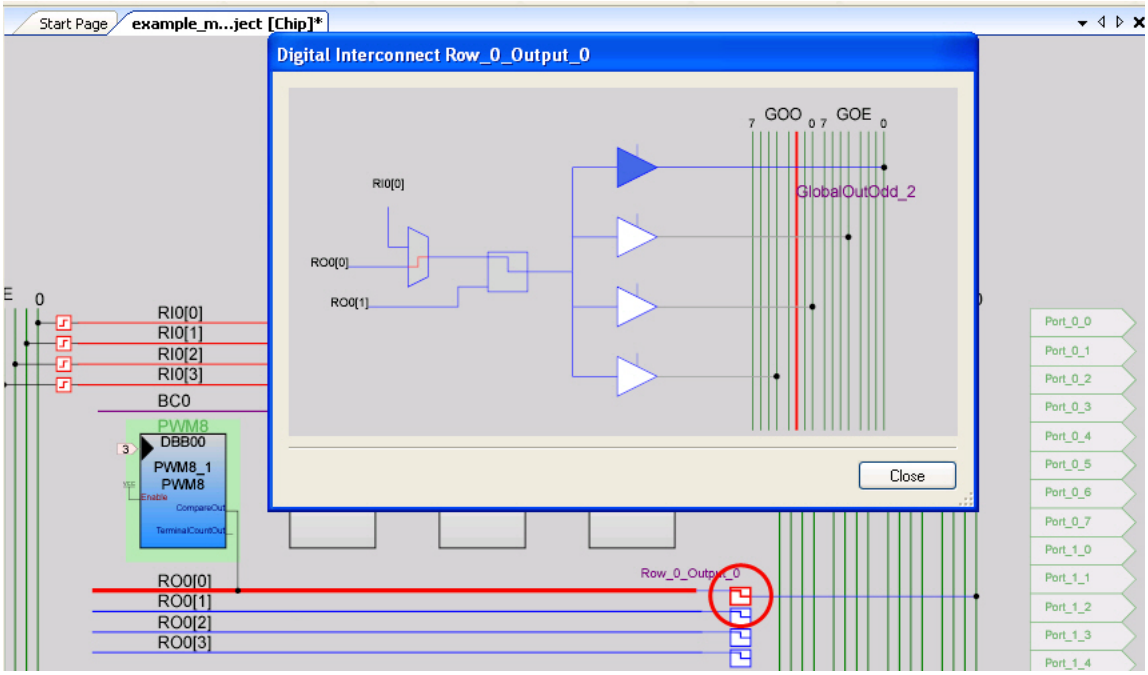
13. Next, route the PWM CompareOut signal to **P2[0]**. The first step is to configure the lookup table (LUT) on Row_0_Output0.

Figure 4-7. Route PWM CompareOut Signal to P2[0]



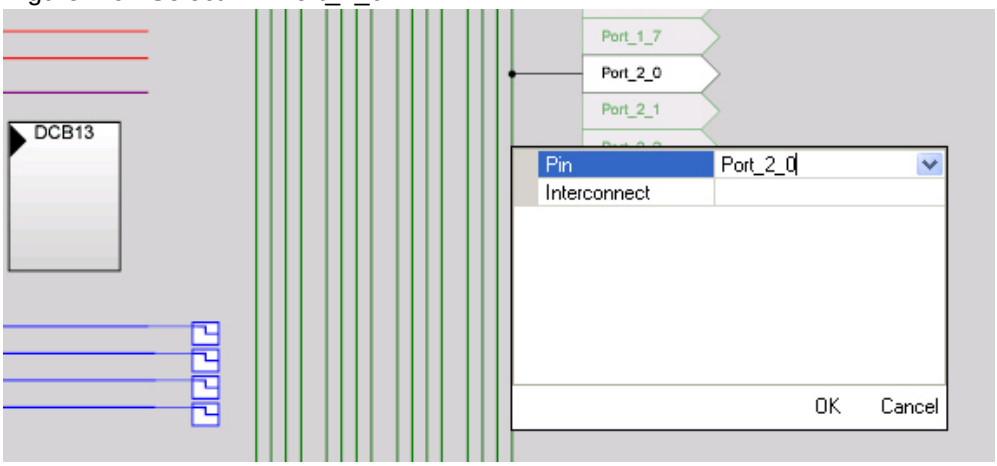
14. Click on the **LUT** node on Row_0_Output_0 to open the Digital Interconnect window.
15. In this window, configure **Row_0_Output_0_Drive_0** to connect to **GlobalOutEven_0**.

Figure 4-8. Digital Interconnect Window



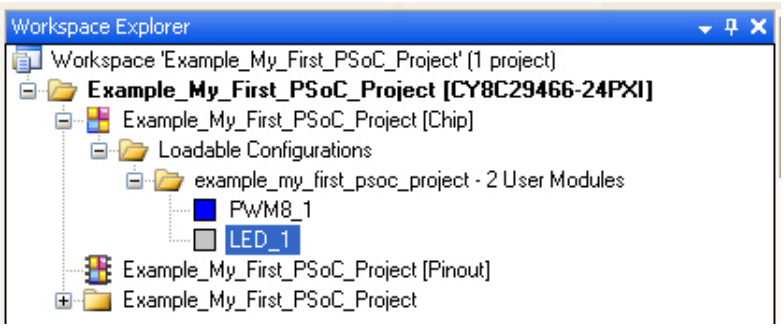
16. Click **Close**.
17. Click **GlobalOutEven_0**. In the window that appears, select the pin as **Port_2_0**.

Figure 4-9. Select Pin Port_2_0



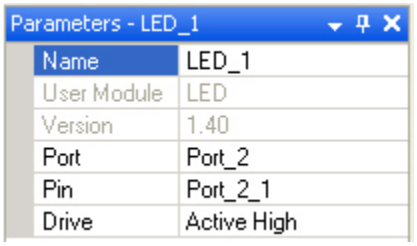
18. Click **OK** to continue.
19. In the User Modules window, expand the **Misc Digital** folder. In this folder, right-click **LED** and select **Place**; this adds the UM to the project. This UM does not use digital or analog blocks. It appears in **Workspace Explorer > Example_My_First_PSoC_Project[CY8C29466-24PXI] > Example_My_First_PSoC_Project[Chip] > Loadable Configurations > example_my_first_psoc_project - 2 User Modules**.

Figure 4-10. Workspace Explorer



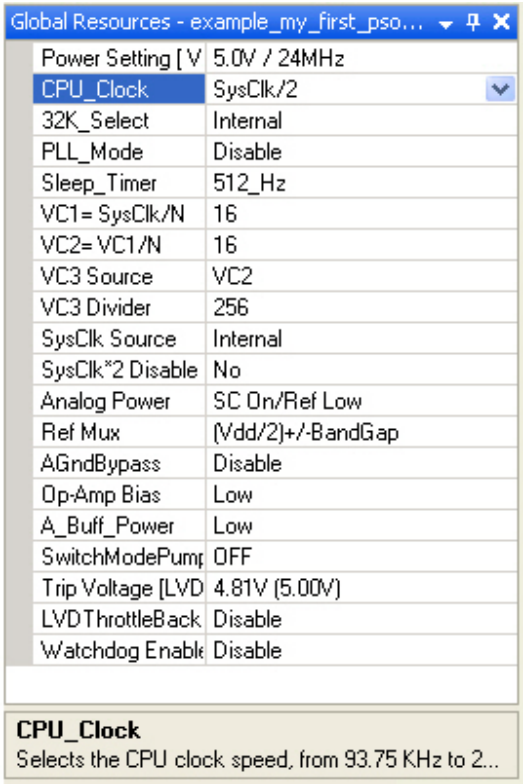
20. Configure the LED properties, as shown in the following figure.

Figure 4-11. LED User Module Properties



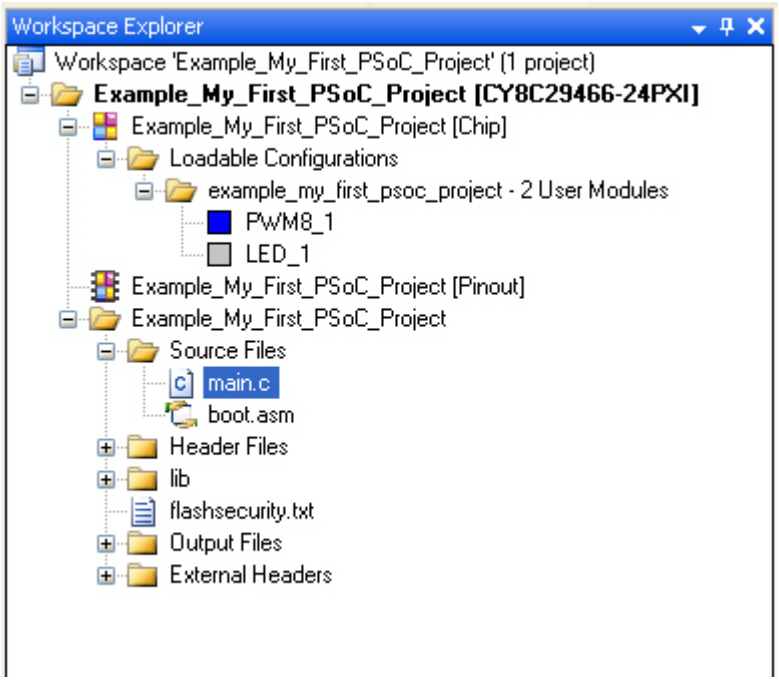
21. Configure the Global Resources window to match the following figure.

Figure 4-12. Global Resources Window



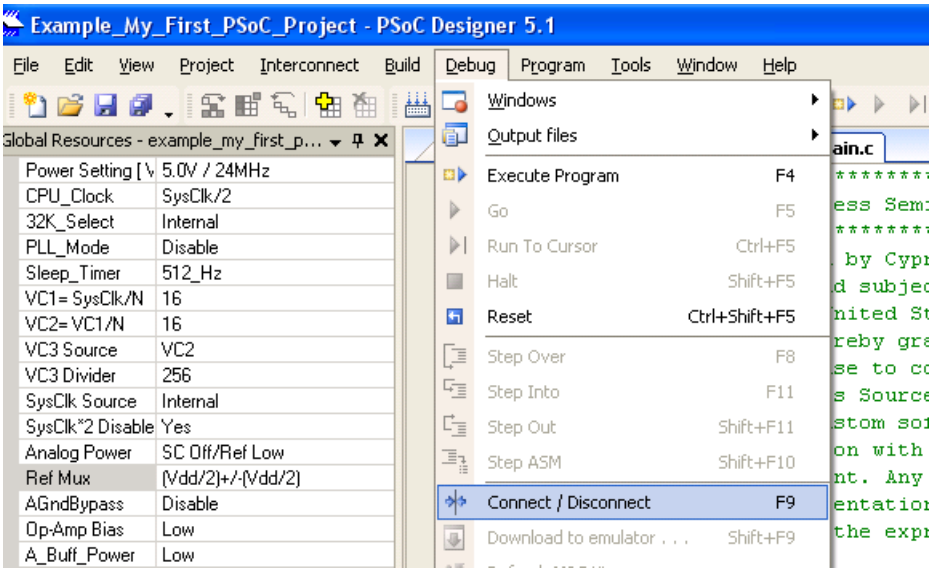
22. Open the existing *main.c* file in Workspace Explorer. Replace the existing *main.c* content with the content of the *My_First_Example_Project_Main.c* file, which is available as an attachment to this PDF document.

Figure 4-13. Workspace Explorer Window



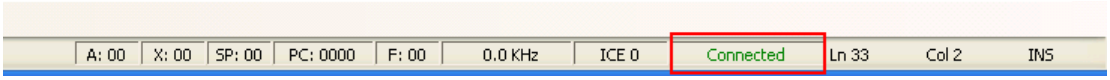
23. Save the project.
24. Click **Build > Generate/Build 'Example_My_First_PSoC_Project'**.
25. Connect the ICE-Cube to the computer. Connect the ICE-Cube to the target board (in this case CY3210-PSoCEval1 kit), as explained in Connecting the ICE-Cube on page 15.
26. In PSoC Designer, select **Debug > Connect/Disconnect** to connect the ICE to PSoC Designer.

Figure 4-14. Connecting ICE to PSoC Designer



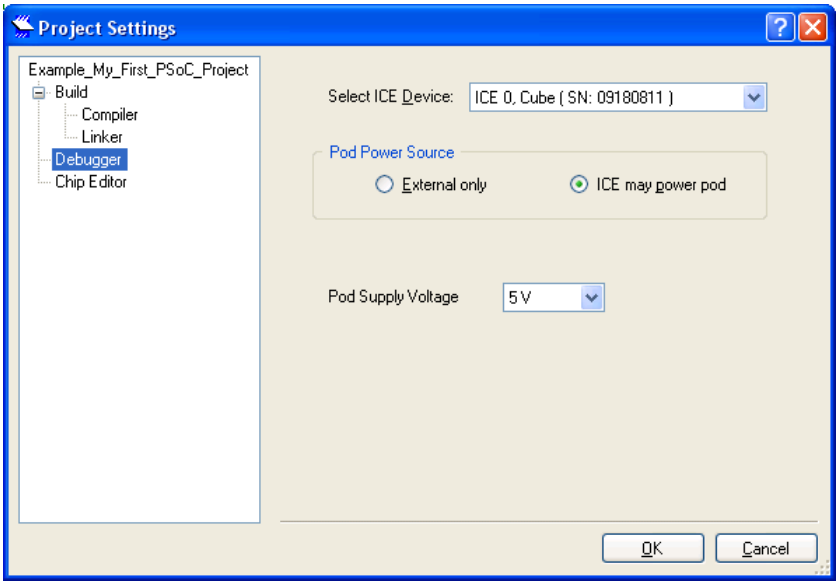
27. On successful connection, the status bar at the bottom of the PSoC Designer IDE shows the status as 'Connected'.

Figure 4-15. ICE-Cube Connected



28. If there is an error, ensure that the Debugger settings in **Project > Settings** match Figure 4-16.

Figure 4-16. Debugger Settings



Note The pod may be powered by the ICE-Cube or through external power. If external power is used, ensure that the power is on for the ICE to get connected.

29. Click on **Debug > Execute Program** or the keyboard shortcut **F4**. The project starts compiling; it is downloaded to the pod and starts running.

4.1.3 Verify Output

Verify the output as follows:

1. Two LEDs connected to P2[0] and P2[1] start blinking.
2. Open the main.c file. Right-click on any line in the while(1) loop in the code and select **Insert/Delete Break Point** to include a break point at that point. The execution of the code stops at the point where the break point is inserted – LED controlled by software (connected to P2[1]) stops blinking. The line is highlighted in yellow when the code execution stops.
3. At this point, you may either continue running the code by selecting **Debug > Run** (keyboard shortcut **F5**) or step through the code by selecting either **Debug > Step Over** (keyboard shortcut **F8**) or **Debug > Step Into** (keyboard shortcut **F11**).

   Note The Step Over command executes statement one by one and does not enter into the function calls whereas the Step Into command enters the function calls as well.

Use the debug windows (see Debug a Project on page 21) to explore other debugging features offered in PSoC Designer. For more details on debugging, debug menu options, and debug strategies, see **Help > Help Topics > Debugger**.

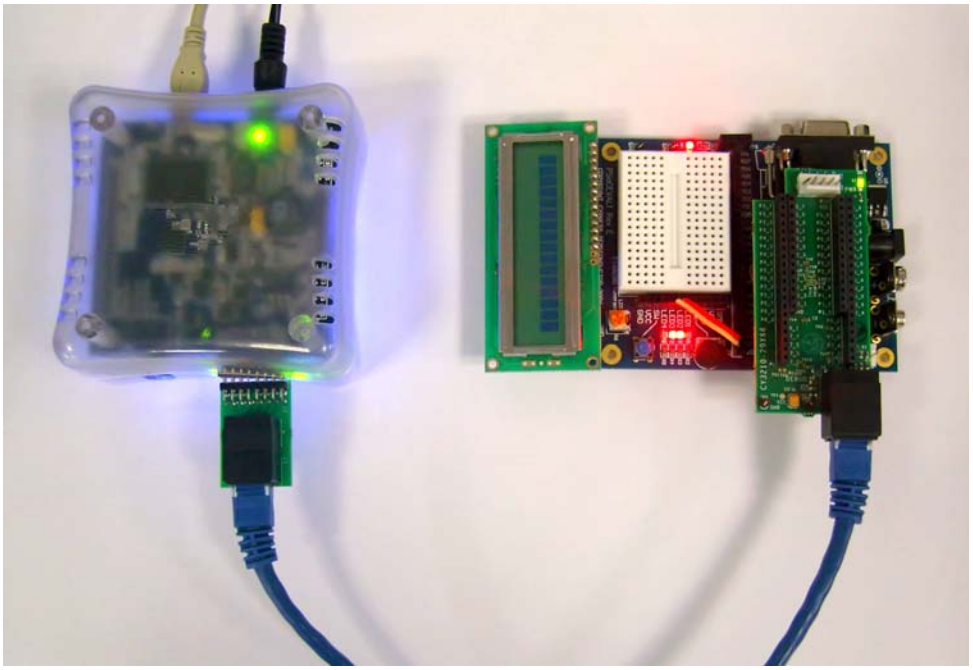



Figure 4-17. Verify Output