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CY8CKIT-001

PSoC[®] Development Kit Guide

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1. Introduction



1.1 Kit Overview

The CY8CKIT-001 PSoC[®] Development Kit provides a common development platform where you can prototype and evaluate different solutions using either the PSoC 1, PSoC 3, or PSoC 5LP architectures. See table below which highlights the main difference between the three families of PSoC. This guide gives you a practical understanding of PSoC technology. The kit also includes several code examples with step-by-step instructions to enable you to easily develop PSoC solutions. This kit includes PSoC CY8C28, CY8C38, and CY8C58LP family processor modules.

Feature	PSoC 1	PSoC 3	PSoC 5
CORE	8-bit M8C 4 MIPS	8-bit 8051 33 MIPS	ARM Cortex-M3 100 DMIPS
FLASH	4 KB – 32 KB	16 KB – 64 KB	32 KB – 256 KB
SRAM	256B – 2 KB	2 KB – 8 KB	16 KB – 64 KB
EEPROM	–	512B – 2 KB	512B – 2 KB
POWER	Active: 2 mA Sleep: 3 uA	Active: 1.2 mA Sleep: 1 uA Hibernate: 200 nA	Active: 2 mA Sleep: 2 uA Hibernate: 300 nA
ADC	6- to 14-bit $\Delta\Sigma$	12- to 20-bit $\Delta\Sigma$	12- to 20-bit $\Delta\Sigma$ 2x 12-bit SAR (1 Msps)
DAC	6- to 8-bit	8- to 12-bit	8- to 12-bit
VOLTAGE REFERENCE	$\pm 1.53\%$ Vref Accuracy	$\pm 0.1\%$ Vref Accuracy	$\pm 0.1\%$ Vref Accuracy
DIGITAL BLOCKS	Up to 16 Digital Blocks	Up to 24 UDBs PLD-based	Up to 24 UDBs PLD-based
CONNECTIVITY	UART, I2C, SPI, USB	UART, I2C, SPI, USB, CAN, LIN, I2S	UART, I2C, SPI, USB, CAN, LIN, I2S
I/Os	Up to 64	Up to 72	Up to 72

1.2 Kit Contents

The CY8CKIT-001 PSoC Development Kit includes:

- PSoC development board
- PSoC CY8C28 family processor module
- PSoC CY8C38 family processor module
- PSoC CY8C58LP family processor module
- MiniProg3 programmer and debug tool
- USB cable¹

- 12-V power supply adapter
- Wire pack
- Printed documentation
 - Quick start guide
 - Schematic and pinout of PSoC development board design
- PSoC 1 software DVD (contents are installed in \PSoC Development Kit CY8C28):
 - PSoC Designer™ IDE
 - PSoC Programmer software
 - CY8C28 datasheets
 - Kit release notes
 - Software release notes
 - Code example files, firmware, and documentation
- PSoC 3 and PSoC 5LP software DVD (contents are installed in the \CY8CKIT-009A folder for PSoC 3 module kit and \CY8C58LP Family Processor Module folder for PSoC 5LP module kit):
 - PSoC Creator™ IDE
 - PSoC Programmer software
 - CY8C38 datasheet
 - CY8C58LP datasheet
 - Kit release notes
 - Software release notes
 - Code example files, firmware, and documentation

1. Any USB certified cable up to 2 meters in length can be used with the DVK.

1.3 Installation

Everything you need to use the PSoC Development Kit is included; you only need to install the software for the processor module you plan to use.

Note CY8CKIT-008 CY8C29 family processor module is not part of this kit; you can purchase this module from <http://www.cypress.com>.

1.3.1 Before You Begin

All Cypress software installations require administrator privileges, but this is not required to run the installed software.

Shut down any currently running Cypress software.

Disconnect any ICE-Cube or MiniProg devices from your computer.

1.3.2 Prerequisites

PSoC Creator and PSoC Designer both use Microsoft .NET Framework, Adobe Acrobat Reader, and a Windows Installer. If .NET Framework and Windows Installer are not on your computer, the installation automatically installs them. If you do not have Adobe Acrobat Reader, download and install it from the Adobe website.

1.3.3 Installing PSoC 1 Development Software

To use the CY8C28 or CY8C29 family processor module (PSoC 1), you need:

- PSoC Designer 5.0 SP6 or higher
- PSoC Programmer 3.12.3 or later

If PSoC Designer 5.0 is currently installed, uninstall it. Click **Start** → **Control Panel** → **Add or Remove Programs**.

Insert the **PSoC 1 Software** DVD; using the menu, select **Install Software for PSoC 1**.

After installation, user guides and key documents are located in the \Documentation subdirectory of the PSoC Designer installation directory.

1.3.4 Installing PSoC 3 Development Software

To use the CY8C38 family processor module (PSoC 3), you need:

- PSoC Creator 1.0 Production or later
- PSoC Programmer 3.12.3 or later
- PSoC Development Kit example files

Insert the PSoC 3 or PSoC 5LP software DVD; in the menu, select **Install Software for PSoC 3**. This option installs all three required software packages. The installers for PSoC Programmer and PSoC Creator automatically start before the kit examples are installed.

For each installation, select **Typical** on the **Installation Type** page.

PSoC Creator uses the DP8051 Keil 8.16 compiler to build PSoC 3 applications. This compiler is included on the DVD; if the installer does not detect the compiler, you will be prompted to install it.

Note The Keil compiler is distributed with a free license. You must activate this license within 30 days of installation. When the Cypress software installation is complete, and you run PSoC Creator, activate the compiler license from **Help** → **Register** → **Keil**.

Important for Win7 and Vista users: Rename the *_tools.ini file in <Install_Directory>:\PSoC Creator\<version>\PSoC Creator\import\keil\pk51\<version> to "tools.ini" for the Keil registration to be successful.

After installing PSoC Creator and PSoC Programmer, refer to the documentation as needed:

- **PSoC Creator** → **Help** → **Topics** → **Getting Started**
- **Programmer** → **Documentation** → **User Guide**

Other documents included with this release are located in the \Documentation subdirectory of the PSoC Creator installation directory. The default location is:

<Install_Directory>:\PSoC Creator\<version>\PSoC Creator\Documentation

You can access this directory from within PSoC Creator under **Help** → **Documentation**. Documents include (but are not limited to):

- *PSoC Creator Component Author Guide (component_author_guide.pdf)*
- *Warp Verilog Reference Guide (warp_verilog_reference.pdf)*
- *Customization API Reference (customizer_api.chm)*

Note After the installation is complete, the kit contents are available at the following location:

<Install_Directory>:\CY8CKIT-009A\<version>

1.3.5 Installing PSoC 5LP Development Software

To use the CY8C58LP family processor module (PSoC 5LP), you need:

- PSoC Creator 2.1 or later
- PSoC Programmer 3.16 or later
- PSoC Development Kit example files

Insert the PSoC 3 or PSoC 5LP Software DVD; in the menu, select **Install Software for PSoC 5LP**. This option installs all three required software packages. The installers for PSoC Programmer and PSoC Creator automatically start before the kit examples are installed.

For each installation, select **Typical** on the **Installation Type** page.

PSoC Creator uses the GNU GCC 4.4.1 compiler to build PSoC 5LP applications.

After installing PSoC Creator and PSoC Programmer, refer to the documentation as needed:

- **PSoC Creator** → **Help** → **Topics** → **Getting Started**
- **Programmer** → **Documentation** → **User Guide**

Other documents included with this release are located in the \Documentation subdirectory of the PSoC Creator installation directory. The default location is:

<Install_Directory>:\PSoC Creator\<version>\PSoC Creator\Documentation

You can access this directory from within PSoC Creator under **Help** → **Documentation**. Documents include (but are not limited to):

- *PSoC Creator Component Author Guide (component_author_guide.pdf)*
- *Warp Verilog Reference Guide (warp_verilog_reference.pdf)*
- *Customization API Reference (customizer_api.chm)*

Note After the installation is complete, the kit contents are available at the following location:

<Install_Directory>:\CY8C58LP Family Processor Module\<version>

1.4 PSoC Development Board

The CY8CKIT-001 PSoC Development Board is designed to aid hardware, firmware, and software developers in building their own systems around Cypress's PSoC devices. The flexibility to configure the power domains is one of the foremost features of this board. Input power to the board is from one of two sources:

- 12 V 1-A power supply adapter
- 9-V alkaline battery (not included)

Note Do not apply more than 15 V as input voltage. Also, do not power the board from test points.

This full-featured board incorporates three onboard linear regulators that power peripherals and PSoC processor modules at voltages between 1.7 V and 5.0 V. These regulators include a fixed 5 V 1-A linear regulator, a fixed 3.3 V 300-mA linear regulator, and a 1.5 V to 3.3 V for 3.3-V supply and 1.5 V to 5 V for 5-V supply adjustable regulator. The board also provides the ability to separate the PSoC core VDD rail into two separate rails, analog and digital. In addition, the board is able to separate the I/O VDD rails, giving the flexibility to power the I/O ports at different voltages.

The board is equipped with a 2×16 alphanumeric LCD module capable of 1.8 V to 5.0 V I/O. In addition, there is a mini-B full-speed USB interface and a female DB9 serial communications interface. Also included is a 12-pin wireless radio module interface, which can be used to develop CyFi™ low-power RF or other embedded RF solutions with this kit. The board also has a prototyping area containing a small breadboard, complete with I/O port sockets nearby, multipurpose LEDs, mechanical push buttons, and a multipurpose variable resistor. In addition, three capacitive sensing elements (two buttons and a five segment slider) are included on the board to allow the evaluation of CapSense® applications.

The board has four general-purpose I/O (GPIO) expansion slots, allowing the I/O to expand to external boards.

The board is protected against reverse voltage and overvoltage on the 5-V and 3.3-V lines on the expansion slots. See [Protection Circuit on page 185](#) for more information.

The board is designed with modularity in mind and, as a result, supports removable processor modules. This allows you to plug different PSoC processor modules into the board based upon the desired features of both 8-bit and 32-bit PSoC devices.

Note

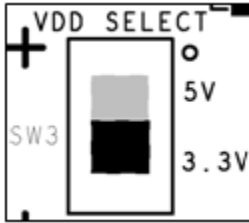
- The PSoC device may get hot or damaged if many I/O pins are configured as strong drive with initial state HIGH and grounded externally using wires.
- The PSoC device may get hot or damaged if many I/O pins are configured as strong drive with initial state LOW and connected to Vcc externally using wires.

1.4.1 Default Switch and Jumper Settings

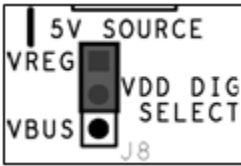
Jumpers on the CY8CKIT-001 PSoC development board have a default setting to operate at 3.3 V. For default configuration, each of the jumpers must be set according to these instructions.

Note All CY8C28 and CY8C29 family processor module code examples are configured for 5 V. Configure the board to 5 V, before creating the code examples.

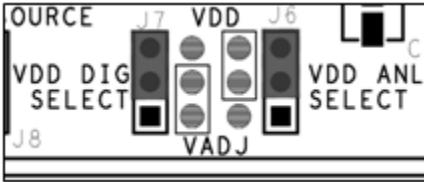
SW3 - VDD Select. Default Position: 3.3 V (down position)



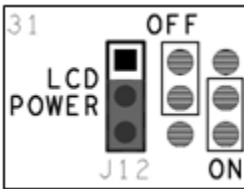
J8 - 5 V Source. Default Position: VREG (upper two pins)



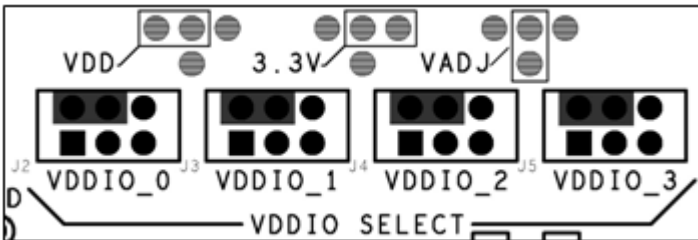
J7, J6 - VDD Digital, VDD Analog. Default Position: VDD (upper two pins, both headers)



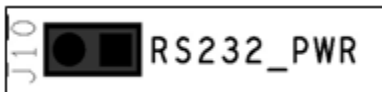
J12 - LCD Power. Default Position: ON (lower two pins)



J2-J5 - VDDIO Power Select. Default Position: VDD (upper left two pins)



J10 - RS-232 Power (Serial Communications). Default Position: Installed



J14 - Radio Power. Default Position: Installed



J11 - Variable Resistor Power. Default Position: Installed



1.4.1.1 AC/DC Adaptor Specifications

Use adaptors with the following specifications:

- Input voltage: 100 to 240 VAC, 50 Hz to 60 Hz, 1 A
- Output voltage: 12 VDC, 1 A
- Power output: 12 W
- Polarization: Positive center
- Certification: CE certified

Some recommended part numbers include EPSA120100U-P5P-EJ (CUI Inc.) and LTE12W-S2 (Li Tone Electronics Co. Ltd).

1.4.1.2 Battery Specifications

Use batteries with the following specifications:

- Battery type: 9 V
- Output voltage: 9 VDC
- Type: Non-rechargeable alkaline consumer batteries
- RoHS status: RoHS compliant
- Lead free status: Pb-free

Some recommended part numbers include 6LR61XWA/1SB (Panasonic), MN1604 (Duracell), and 6LR61 (Energizer).

1.5 Kit Revision

To know the kit revision, look for the white sticker on the bottom left on the back of the kit box. If the revision reads CY8CKIT-001C Rev **, then congratulations, you own the latest version.

To upgrade CY8CKIT-001B to CY8CKIT-001C, the main DVK and kit DVD must be updated. Purchase the latest development board and download the latest DVD ISO image at <http://www.cypress.com/go/CY8CKIT-001>.

To upgrade CY8CKIT-001A to CY8CKIT-001C, besides the upgrades stated above, you need to update the PSoC 3 processor module and kit DVD. Purchase the latest processor module at <http://www.cypress.com/go/CY8CKIT-009> and download the latest DVD ISO image at <http://www.cypress.com/go/CY8CKIT-001>.

To upgrade CY8CKIT-001 to CY8CKIT-001C, besides the upgrades stated above, you need to purchase the latest PSoC 5LP process module at <http://www.cypress.com/go/CY8CKIT-010>.

1.6 Additional Resources

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

1.6.1 Beginner Resources

[AN54181 - PSoC 3 - Getting Started with a PSoC 3 Design Project](#)

[PSoC Designer Training](#)

[PSoC Designer FAQ](#)

[PSoC Creator Training](#)

1.6.2 Engineers Looking for More

[AN54460 - PSoC 3 and PSoC 5 Interrupts](#)

[AN52705 - PSoC 3 and PSoC 5 - Getting Started with DMA](#)

[AN52701 - PSoC 3 - How to Enable CAN Bus Communication](#)

[AN54439 - PSoC 3 and PSoC 5 External Crystal Oscillators](#)

[AN52927 - PSoC 3: Segment LCD Direct Drive](#)

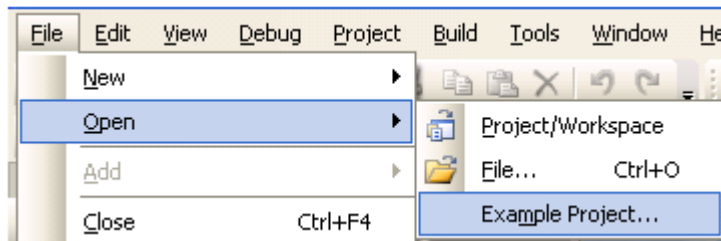
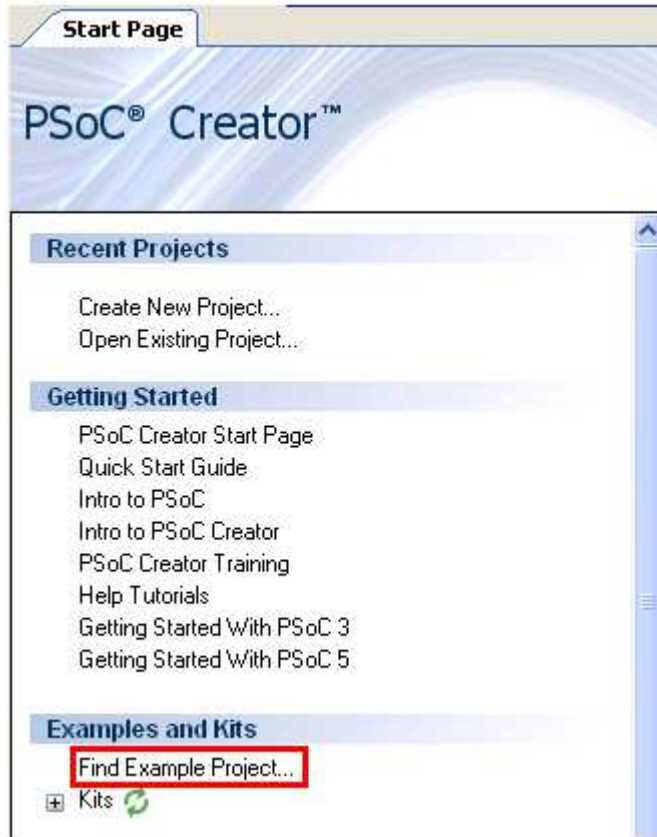
Cypress continually strives to provide the best support. Click [here](#) to view a growing list of application notes for PSoC 3 and PSoC 5LP.

1.6.3 Learning from Peers

[Cypress Developer Community Forums](#)

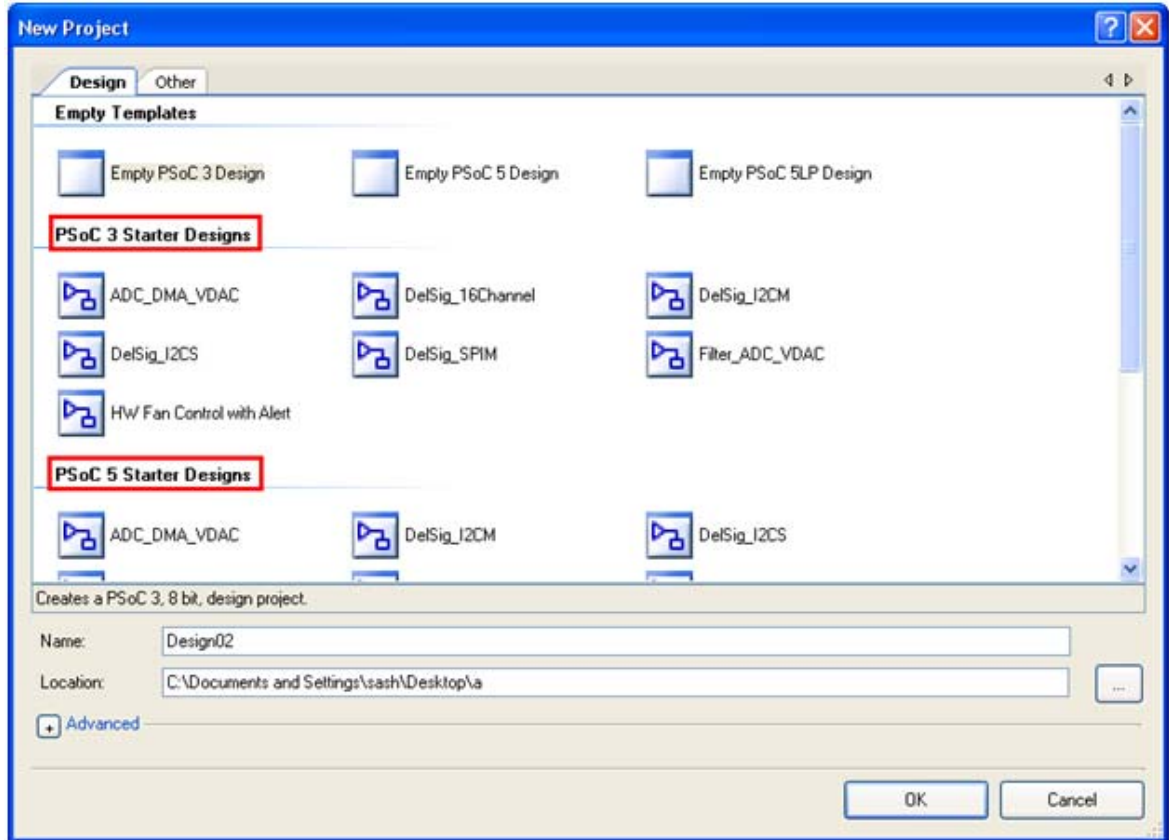
1.6.4 More Code Examples

PSoC Creator provides a host of example projects that makes the code development very fast and easy. To access these example projects, click on the **Find Example Project...** under **Example and Kits** section in **Start Page** of PSoC Creator or by navigating to **File** → **Open-Example Project...**



The Find Example project has various filters that help you locate the most relevant project you are looking for.

PSoC Creator provides several Starter Designs. These designs highlight features that are unique to PSoC devices. They allow you to create a design with various components and code is also provided, instead of creating a new empty design. To use a starter design for your project, navigate to **File** → **New** → **Project** and select the design required.



Note: The example projects and starter designs are designed for CY8CKIT-001 PSoC Development Kit. However, these projects can be converted for use with CY8CKIT-030 PSoC 3 Development Kit or CY8CKIT-050 PSoC 5 Development Kit by following the procedure in the knowledge base article [Migrating project from CY8CKIT-001 to CY8CKIT-030 or CY8CKIT-050](#).

Apart from the example projects and starter designs that are available within PSoC Creator, Cypress continuously strives to provide the best support. Click [here](#) to view a growing list of application notes for PSoC 3 and PSoC 5.

1.7 Document Conventions

These conventions are used throughout this guide.

Table 1-1. Documentation Conventions

Convention	Usage
Courier New Size 12	Displays file locations and source code: C:\ ...cd\icc\.
<i>Italics</i>	Displays file names and reference documentation: <i>sourcefile.hex</i>
[bracketed, bold]	Displays keyboard commands in procedures: [Enter] or [Ctrl] [C]

Table 1-1. Documentation Conventions (*continued*)

Convention	Usage
Bold → With → Arrows	Represents menu paths, user entered text: File → New Project → Clone
Bold	Displays commands and selections, and icon names in procedures: Click the Debugger icon, and then click Next .
Note	Displays functionality unique to PSoC Designer, PSoC Creator, or the PSoC device.
WARNING:	Displays cautions that are important to the subject.

1.8 Document Revision History

Document Title: CY8CKIT-001 PSoC® Development Kit Guide			
Document Number: 001-48651			
Revision	Issue Date	Origin of Change	Description of Change
**	6/23/09	AESA	New Guide
*A	7/22/09	AESA	CDT based updates
*B	11/19/09	AESA	CDT based updates
*C	05/21/10	AESA	Updated with PSoC 5LP.
*D	01/05/11	RKAD	Updated images. Updated PSoC Creator and PSoC Programmer versions
*E	02/10/11	RKAD	Updated images. Added Kit Revision section
*F	12/16/11	RKAD	Content updates throughout the document.
*G	12/30/11	RKAD	Updated installation directory path. Added Figure 2-4 and Figure 2-10. Added note on Keil compilers in section 1.3.4.
*H	01/13/12	RKAD	Added note on USB cable in section 1.2 - Kit Contents. Appended to note in section A.1.4 - LCD Module
*I	01/18/12	RKAD	Minor ECN to include attachments in pdf. No content updates made.
*J	05/03/12	SASH	Added the Additional Resources section
*K	07/04/12	SASH	Added Appendix D for PSoC Creator DWR. Updated images for PSoC Creator version 2.1.
*L	11/08/2012	SASH	Added A.1.7.4 Protection Circuit. Updated 1.5 Kit Revision. Updated figures in Chapter 3.

2. Loading My First PSoC Project



The CY8CKIT-001 PSoC Development Kit supports projects across the PSoC 1, PSoC 3, and PSoC 5 architectures. This section walks you through the high-level design process for opening, building, programming, and running your first PSoC project using this kit.

Before beginning, follow each of these steps to make certain that your software and hardware environments are properly configured and ready for these projects:

1. Install PSoC Designer using the steps listed in [Installing PSoC 1 Development Software on page 9](#).
2. Install PSoC Creator using the steps listed in [Installing PSoC 3 Development Software on page 9](#).
3. Connect the MiniProg3 into your PC using the supplied USB cable. When you connect the MiniProg3, Microsoft Windows® may indicate that it has found new hardware. All required drivers are installed as part of the PSoC Programmer installation process; however, if Windows opens the driver installation dialog boxes, accept the defaults and allow Windows to automatically find the appropriate driver.
4. Close any open PSoC Creator or PSoC Designer applications and projects.
5. Configure the PSoC development board (jumper settings and switches) in its default configuration, as described in [Default Switch and Jumper Settings on page 11](#).
6. Use the PSoC CY8C28 family processor module or PSoC CY8C29 family processor module for the PSoC 1 version of your first PSoC project ([My First PSoC 1 \(CY8C28\) Project on page 20](#) or [My First PSoC 1 \(CY8C29\) Project on page 25](#)).
7. Use the PSoC CY8C38 family processor module for the PSoC 3 version of your first PSoC project ([My First PSoC 3 \(CY8C38\) Project on page 30](#)).
8. Use the PSoC CY8C58LP family processor module for the PSoC 5LP version of your first PSoC project ([My First PSoC 5LP \(CY8C58LP\) Project on page 34](#)).
9. For a PSoC 1 project, use the ISSP header on the PSoC CY8C28 family processor module or PSoC CY8C29 family processor module and connect the MiniProg3 ISSP port.
10. For a PSoC 3 or PSoC 5LP project, use the JTAG ribbon cable. Connect the ribbon cable to the MiniProg3 and the CY8C38 family processor module or CY8C58LP family processor module into the header labeled PROG on the processor module.

Note The MiniProg3 should not be "hot plugged" into processor modules that are attached to the PSoC development board. In other words, do not plug the ribbon cable of the MiniProg3 into the processor module while code is actively running on the module. Doing so may cause the PSoC device to unintentionally reset. Power down the PSoC development board and module by unplugging the power supply from the development board before attaching the MiniProg3 device to the module board. When the ribbon cable is attached to the module board, power the system by plugging in the power supply to the PSoC development board. This will avoid any undesirable PSoC device resets.

11. Power the PSoC development board using the 12-V AC power supply adapter.

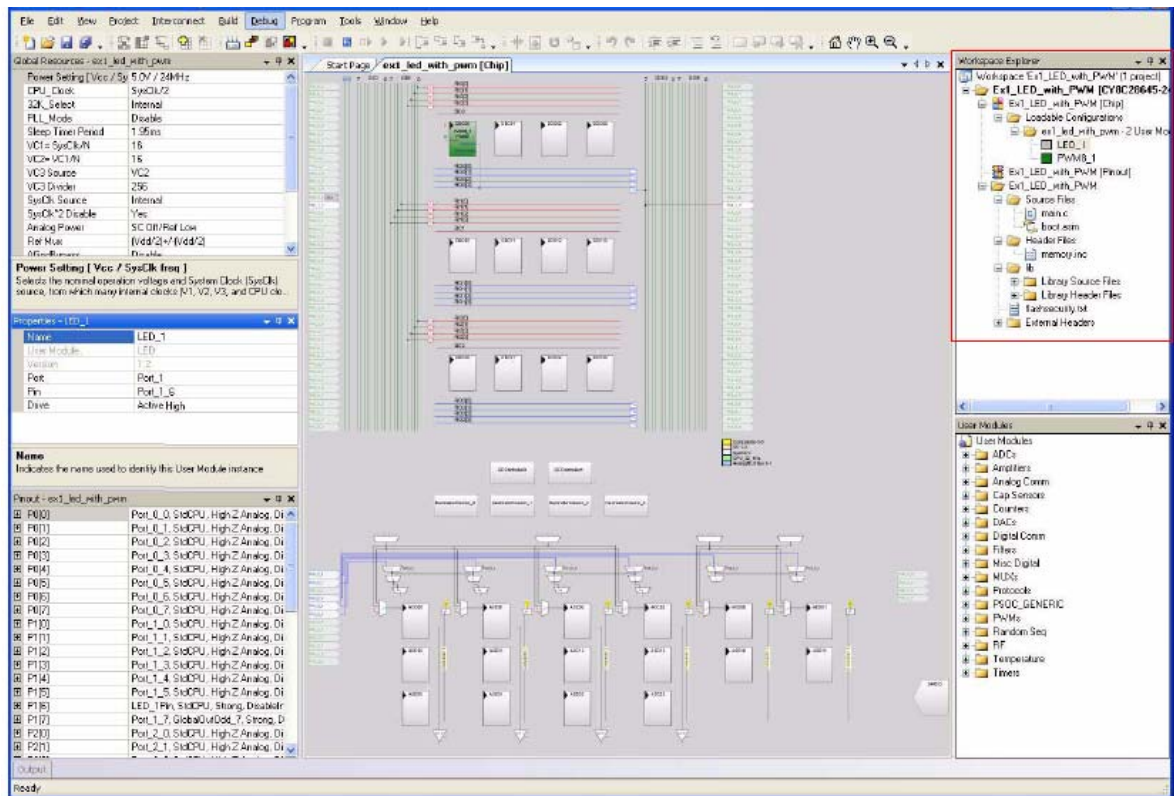
2.1 My First PSoC 1 (CY8C28) Project

This is a simple PSoC 1 project using a pulse width modulator (PWM) peripheral inside PSoC, and software to control the blinking rates of two different LED outputs. For this project, be sure you have the PSoC CY8C28 family processor module inserted into the PSoC development board and the appropriate software installed. This section walks you through the steps to open, build, and program a project.

2.1.1 Loading My First PSoC 1 Project

1. Open PSoC Designer.
2. In the **Start Page**, navigate to **File → Open Project/Workspace**
3. Navigate to the project directory: <Install_Directory>\PSoC Development Kit CY8C28\<version>\Firmware\CY8C28.
4. Open the folder Ex1_LED_with_PWM.
5. Double-click **Ex1_LED_with_PWM.app**.
6. The project opens in the Chip Editor view. All project files are in the **Workspace Explorer**.

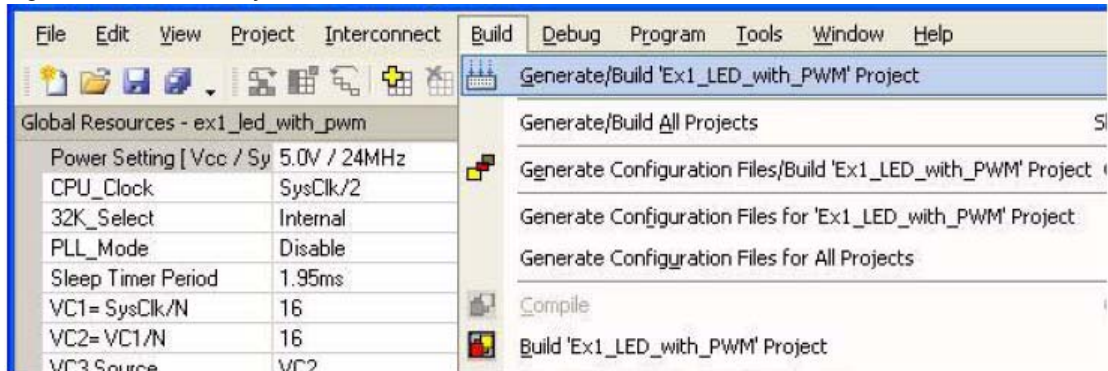
Figure 2-1. Chip Editor View



2.1.2 Building My First PSoC 1 Project

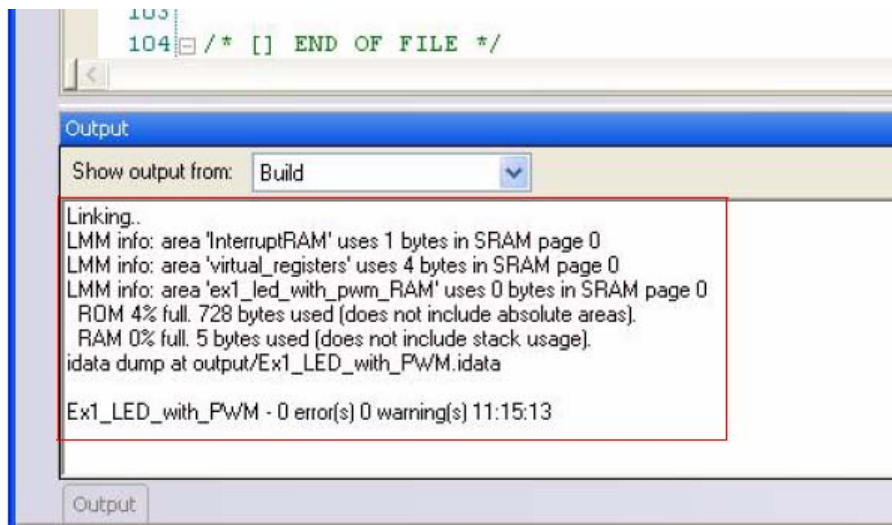
1. Select **Build** → **Generate/Build 'Ex1_LED_with_PWM' Project**.

Figure 2-2. Build Project



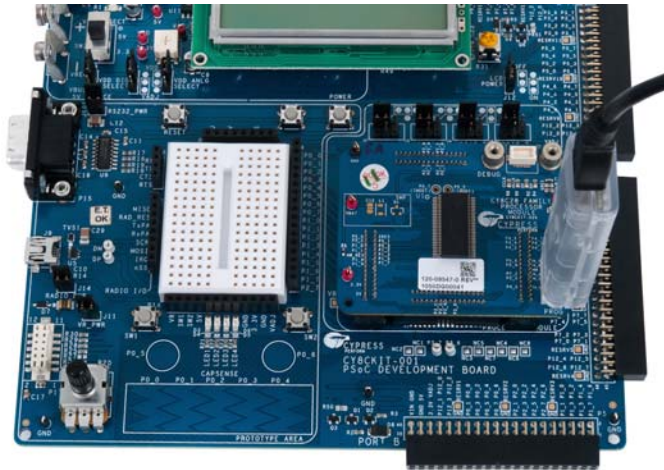
2. PSoC Designer builds the project and displays comments in the **Output** window. When you see the message that the project is built with 0 errors and 0 warnings, you are ready to program the device.

Figure 2-3. Output Window



2.1.3 Programming My First PSoC 1 Project

Figure 2-4. Connect MiniProg3 to J5 on CY8C28 Family Processor Module



Programming using PSoC Designer

1. Open **Program Part** from within PSoC Designer by selecting **Program** → **Program Part**.
2. In the **Program Part** window, ensure that **MiniProg3** is selected in the **Port Selection** box.
3. In the **Program Part** window, set **Acquire Mode** to **Reset**.
4. In the **Program Part** window, set **Verification** to **On**. This ensures that downloaded checksum matches the actual checksum.
5. In the **Program Part** window, click the program arrow to program the device.

Programming using PSoC Programmer

6. In PSoC Programmer, set **AutoDetection** to **On** to enable the software to automatically detect and configure for the target device family and device. If PSoC Programmer is properly configured, AutoDetection reports a device family of 28xxx.

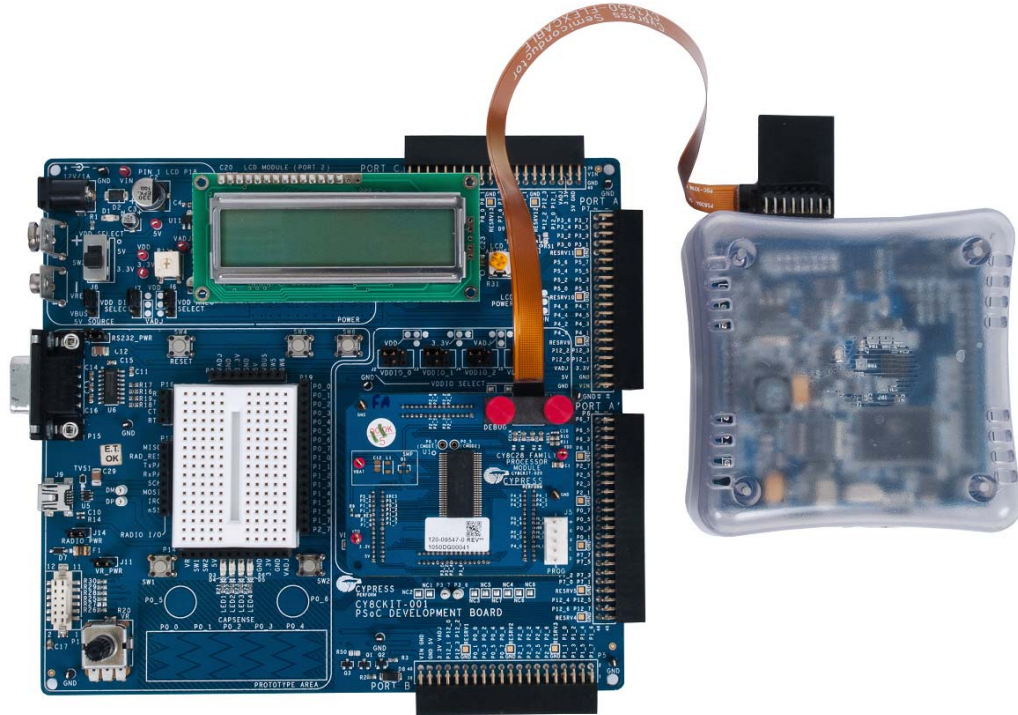
Note Make sure **ISSP protocol** is selected.

7. Wait until programming is completed, to continue.

Note For debugging purposes, the CY8C28 family processor module is designed to accommodate the use of the CY3215-DK In-Circuit Emulator (ICE-Cube). When using the ICE-Cube debugger, make certain that PSoC Designer is configured so that the ICE-Cube does not provide power to the processor module. Within the PSoC Designer application, select **Project** → **Settings** and select **Debugger** from the tree. Make sure that **External only** is selected under the **Pod Power Source** section and select **Execute Program** from the **Debug** menu to start debugging.

Connect the processor module to the CY3215-DK ICE-Cube, as shown in [Figure 2-5](#).

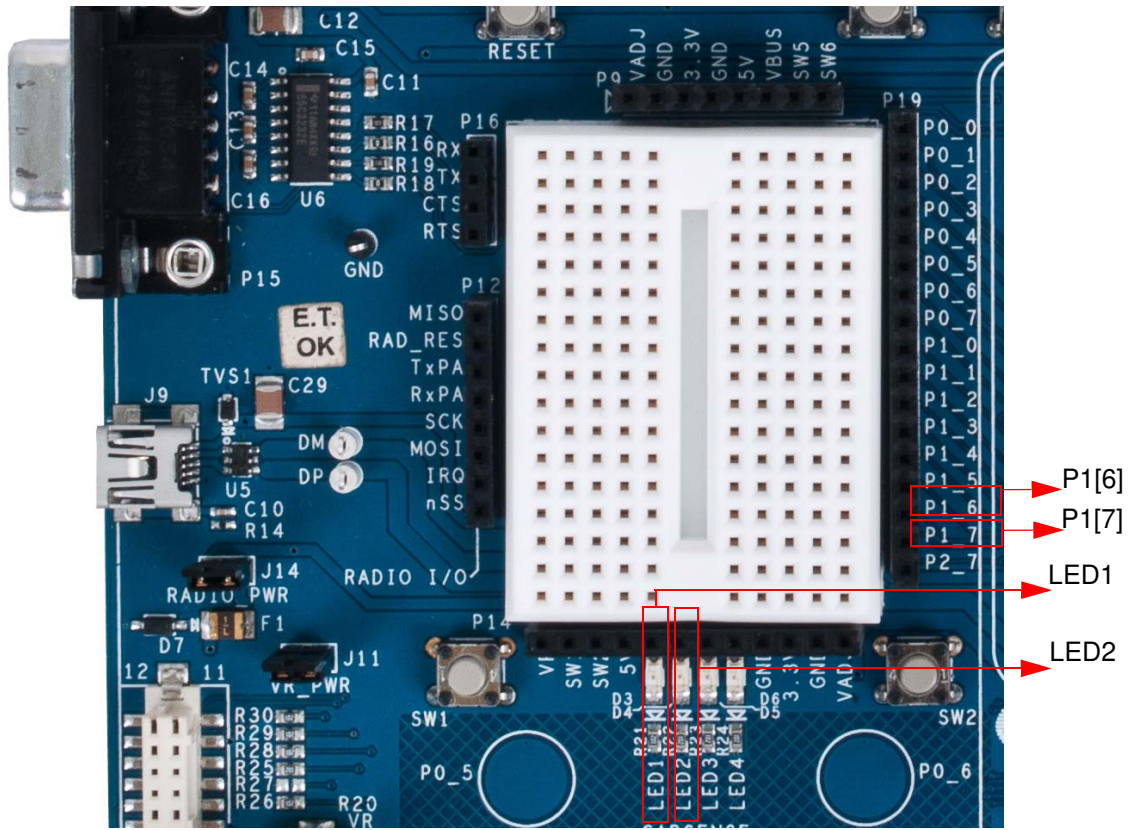
Figure 2-5. ICE-Cube Connected to CY8C28 (PSoC 1) Processor Module



2.1.4 Running My First PSoC 1 Project

1. Connect P1[6] to LED1 and P1[7] to LED2. Verify that LED1 and LED2 are blinking based on the project's use of the PWM and software. Now that the PSoC 1 device is programmed, reset the PSoC development board by pressing and releasing the reset switch (SW4).
2. LED1 blinks approximately once every second and LED2 blinks about three times a second.

Figure 2-6. Connect P1[6] to LED1 and P1[7] to LED2



3. For more details regarding this project, see the detailed project instructions in [My First PSoC 1 \(CY8C28\) Project on page 39](#).

2.2 My First PSoC 1 (CY8C29) Project

This is a simple PSoC 1 project using a PWM peripheral inside PSoC, and software to control the blinking rates two different LED outputs. For this project, be sure you have the PSoC CY8C29 family processor module inserted into the PSoC development board and the appropriate software installed. This section walks you through the steps to open, build, and program a project.

2.2.1 Loading My First PSoC 1 Project

1. Open PSoC Designer.
2. In the **Start Page**, navigate to **File** → **Open Project/Workspace**.
3. Navigate to the project directory: C:\Cypress\CY8CKIT-001\CY8C29 Projects.
4. Open the folder Example_My_First_PSoC_Project.
5. Double-click **Example_My_First_PSoC_Project.app**.
6. The project opens in the Chip Editor view. All project files are in the **Workspace Explorer**.

Figure 2-7. Chip Editor View

