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CY8CKIT-040

PSoC® 4000 Pioneer Kit Guide

Doc. # 001-91316 Rev. *C

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Cypress is willing to work with the customer who is concerned about the integrity of their code. Code protection is constantly evolving. We at Cypress are committed to continuously improving the code protection features of our products.

Contents

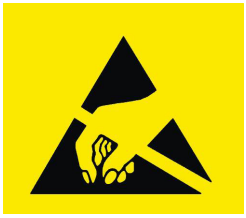
Safety Information

Regulatory Compliance

The CY8CKIT-040 PSoC® 4000 Pioneer Kit is intended for use as a development platform for hardware or software in a laboratory environment. The board is an open system design, which does not include a shielded enclosure. For this reason, the board may cause interference to other electrical or electronic devices in close proximity. In a domestic environment, this product may cause radio interference. In such cases, the user may be required to take adequate preventive measures. Also, this board should not be used near any medical equipment or RF devices.

Attaching additional wiring to this product or modifying the product operation from the factory default may affect its performance and cause interference with other apparatus in the immediate vicinity. If such interference is detected, suitable mitigating measures should be taken.

The CY8CKIT-040 as shipped from the factory has been verified to meet with requirements of CE as a Class A product.



The CY8CKIT-040 contains electrostatic discharge (ESD) sensitive devices. Electrostatic charges readily accumulate on the human body and any equipment, and can discharge without detection. Permanent damage may occur to devices subjected to high-energy discharges. Proper ESD precautions are recommended to avoid performance degradation or loss of functionality. Store unused CY8CKIT-040 boards in the protective shipping package.

End-of-Life/Product Recycling

The end of life for this kit is five years from the date of manufacture mentioned on the back of the box. Contact your nearest recycler to discard the kit.

General Safety Instructions

ESD Protection

ESD can damage boards and associated components. Cypress recommends that the user perform procedures only at an ESD workstation. If an ESD workstation is not available, use appropriate ESD protection by wearing an antistatic wrist strap attached to the chassis ground (any unpainted metal surface) on the board when handling parts.

Handling Boards

CY8CKIT-040 boards are sensitive to ESD. Hold the board only by its edges. After removing the board from its box, place it on a grounded, static free surface. Use a conductive foam pad if available. Do not slide the board over any surface.

1. Introduction

Thank you for your interest in the PSoC® 4000 Pioneer Kit. The kit is designed as an easy-to-use and inexpensive development kit, highlighting the unique flexibility of the PSoC 4000 architecture. Designed for flexibility, this kit offers footprint compatibility with several third-party Arduino™ shields. In addition, the board features an RGB LED, integrated USB programmer/debugger, a program/debug header, USB-UART/I^2C bridges, a proximity header, and an Arduino-compatible CapSense® Trackpad shield. This kit supports either 5 V or 3.3 V as power supply voltages.

The PSoC 4000 Pioneer Kit is based on the PSoC 4000 device family, delivering a programmable platform for a wide range of embedded applications. The PSoC 4000 is the smallest member of the PSoC 4 platform with support for CapSense, Timer Counter Pulse Width Modulator (TCPWM), I^2C master or slave, and up to 20 GPIOs. PSoC 4000 is a cost-optimized, entry-level PSoC 4 device targeted as socket replacements for obsolete and/or proprietary 8-bit and 16-bit MCUs. PSoC 4000 with its ARM Cortex-M0 core provides 32 programmable peripherals including CapSense.

1.1 Kit Contents

The PSoC 4000 Pioneer Kit contains the following (see Figure 1-1):

- PSoC 4000 Pioneer Kit board
- Trackpad shield board with a color palette sticker
- Quick start guide
- USB Standard A to Mini-B cable
- 6 jumper wires

Note: Trackpad and Touchpad denote the same in the context of this document and can be used interchangeably.

Figure 1-1. Kit Contents

Inspect the contents of the kit; if you find any part missing, contact your nearest Cypress sales office for help: www.cypress.com/go/support.

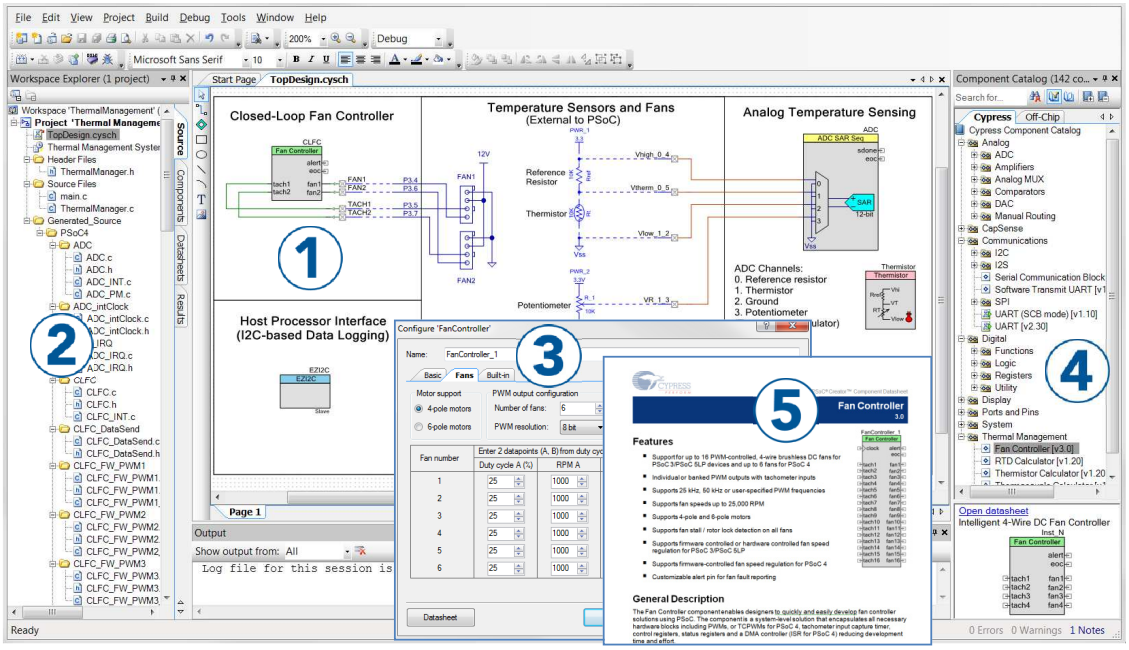
Download the latest version of the kit setup file from www.cypress.com/CY8CKIT-040.

1.2 PSoC Creator

PSoC Creator™ is a state-of-the-art, easy-to-use integrated design environment (IDE). It introduces revolutionary hardware and software co-design, powered by a library of preverified and precharacterized PSoC Components. 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 1-2. PSoC Creator Features



PSoC Creator also enables you to tap into an entire tool ecosystem with integrated compiler chains and production programming programmers for PSoC devices.

For more information, visit www.cypress.com/psoccreator. Visit PSoC Creator training page for video tutorials on learning and using PSoC Creator.

1.2.1 PSoC Creator Code Examples

PSoC Creator includes a large number of code examples. These examples are available from the PSoC Creator Start Page, as Figure 1-3 shows.

Code examples can speed up your design process by starting you off with a complete design, instead of a blank page. The code examples also show how PSoC Creator Components can be used for various applications. Code examples and documentation are included, as shown in Figure 1-4 on page 11.

In the **Find Example Project** dialog shown in Figure 1-4 on page 11, you have several options:

- Filter for examples based on architecture or device family, that is, PSoC 3, PSoC 4, or PSoC 5LP; project name; or keyword.
- Select from the menu of examples offered based on the **Filter Options**.
- Review the example project's description (on the **Documentation** tab).
- Review the code from the **Sample Code** tab. You can copy the code from this window and paste to your project, which can help speed up code development.
- Create a new project (and a new workspace if needed) based on the selection. This can speed up your design process by starting you off with a complete, basic design. You can then adapt that design to your application.

Figure 1-3. Code Examples in PSoC Creator

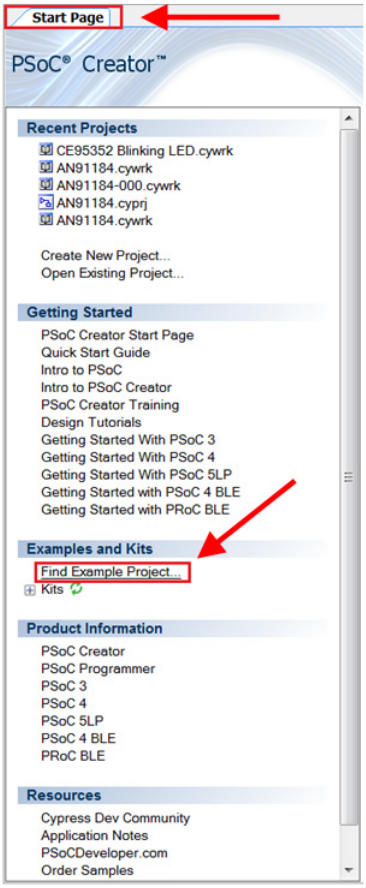
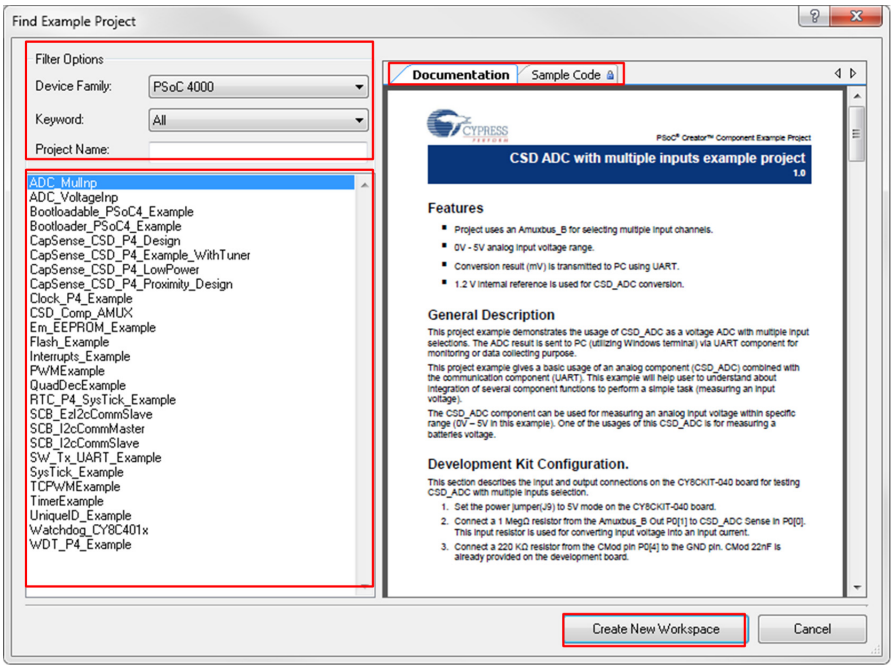


Figure 1-4. Code Example Projects with Sample Code



1.2.2 Kit Code Example

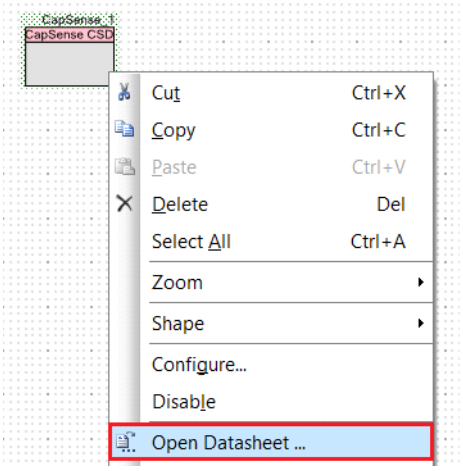
In addition to the examples built into PSoC Creator, this kit includes a simple example, which can be used to quickly evaluate the functionality of this kit. The example is described in the Code Examples chapter on page 51. In addition, the chapter also includes a section explaining how to use PSoC Creator code examples with the kit by taking one example.

1.2.3 PSoC Creator Help

Visit the PSoC Creator home page to download the latest version of PSoC Creator. Then, launch PSoC Creator and navigate to the following items:

- **Quick Start Guide**: Choose **Help** > **Documentation** > **Quick Start Guide**. This guide gives you the basics for developing PSoC Creator projects.
- **Simple Component example projects**: Choose **File** > **Example project...**. These example projects demonstrate how to configure and use PSoC Creator Components.
- **Starter designs**: Choose **File** > **New** > **Project** > **PSoC 4000 Starter Designs**. These starter designs demonstrate the unique features of PSoC 4.
- **System Reference Guide**: Choose **Help** > **System Reference Guides**. This guide lists and describes the system functions provided by PSoC Creator.
- **Component datasheets**: Right-click a Component and select **Open Datasheet**, as shown in Figure 1-5 on page 12. Visit the PSoC 4 Component Datasheets page for a list of all PSoC 4 Component datasheets.
- **Document Manager**: PSoC Creator provides a document manager to help you to easily find and review document resources. To open the document manager, choose the menu item **Help** > **Document Manager**.

Figure 1-5. Opening Component Datasheet



1.3 Getting Started

This guide helps acquaint you with the PSoC 4000 Pioneer Kit.

- The Software Installation chapter on page 15 describes the installation of the kit software.
- The Kit Operation chapter on page 19 explains how to program the PSoC 4 with a programmer and debugger, either the onboard PSoC 5LP or the external MiniProg3 (CY8CKIT-002).
- The Hardware chapter on page 31 details the hardware operation.
- The Code Examples chapter on page 51 describes the example projects that are provided with the kit.
- The Advanced Topics chapter on page 107 deals with topics such as building projects for PSoC 5LP, using onboard F-RAM, USB-UART functionality, and USB-I^{2}C functionality of PSoC 5LP.
- The Appendix on page 161 provides schematics, pin assignments, information on the use of zero-ohm resistors, troubleshooting details, and the bill of materials (BOM).

1.4 Additional Learning Resources

Cypress provides a wealth of information at www.cypress.com to help you to select the right PSoC device for your design, and to help you to 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 4:

- 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 4 device family.
- CapSense Design Guide: Learn how to design capacitive touch-sensing applications with the PSoC 4 family 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. Visit the PSoC 3/4/5 Code Examples webpage for a list of all available PSoC Creator code examples. To access code examples from within PSoC Creator, see PSoC Creator Code Examples on page 10.
- Technical Reference Manuals (TRM): Provide detailed descriptions of the architecture and registers in each PSoC 4 device family.
- Development Kits:
  - CY8CKIT-040, CY8CKIT-042, and CY8CKIT-044 are easy-to-use and inexpensive development platforms. These kits include connectors for Arduino-compatible shields and Digilent Pmod peripheral modules.
  - CY8CKIT-049 and CY8CKIT-043 are very low-cost prototyping platforms for sampling PSoC 4 devices.
  - The MiniProg3 kit provides an interface for flash programming and debug.
- Knowledge Base Articles (KBA): Provide design and application tips from experts on using the device.
- PSoC Creator Training: Visit www.cypress.com/go/creatorstart/creatortraining for a comprehensive list of video trainings on PSoC Creator.
- Learning From Peers: Visit www.cypress.com/forums to meet enthusiastic PSoC developers discussing the next generation embedded systems on Cypress Developer Community Forums.

1.5 Technical Support

If you have any questions, you can create a support request at the Cypress Technical Support page.

If you are in the United States, you can talk to our technical support team by calling our toll-free number: +1-800-541-4736. Select option 2 at the prompt. If you are outside United States, you can talk to our technical support team by calling: +1 (408) 943-2600 Ext. 2.

You can also use the following support resources if you need quick assistance.

- Self-help
- Local Sales Office Locations

1.6 Documentation Conventions

Table 1-1. 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 Creator 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 a unique functionality of the product.

2. Software Installation

This section describes the installation of the CY8CKIT-040 PSoC 4000 Pioneer Kit software and the prerequisites.

2.1 Before You Begin

All Cypress software installations require administrator privileges. However, this is not the case for installed software. Before you install the kit software, close any other Cypress software that is currently running.

2.2 Install Software

Follow these steps to install the CY8CKIT-040 PSoC 4000 Pioneer Kit software:

1. Download the CY8CKIT-040 software.

   The CY8CKIT-040 software is available in three different formats for download:

   a. **CY8CKIT-040 Kit Setup**: This installation package contains the files related to the kit. However, it does not include the Windows Installer or Microsoft .NET framework packages. If these packages are not on your computer, the installer directs you to download and install them from the Internet.

   b. **CY8CKIT-040 Kit Only**: This executable file installs only the kit contents, which include kit code examples, hardware files, and user documents. This package can be used if all the software prerequisites listed in step 5 are installed on your PC.

   c. **CY8CKIT-040 CD ISO**: This file is a complete package, stored in a CD-ROM image format that you can use to create a CD or extract using ISO extraction programs, such as WinZip or WinRAR. The file can also be mounted like a virtual CD using virtual drive programs such as Virtual CloneDrive or MagicISO. This file includes all the required software, utilities, drivers, hardware files, and user documents.

2. If you have downloaded the ISO file, mount it in a virtual drive. Extract the ISO contents if you do not have a virtual drive to mount. Double-click *cyautorun.exe* in the root directory of the extracted content or mounted ISO if 'Autorun from CD/DVD' is not enabledd in the PC. The installation window shown in Figure 2-1 will appear automatically. **Note:** If you are using the ‘Kit Setup’ or ‘Kit Only’ file, then go to step 6 for installation.
3. Click **Install CY8CKIT-040** to start the kit installation, as shown in Figure 2-1.

Figure 2-1. Kit Installer Startup Screen

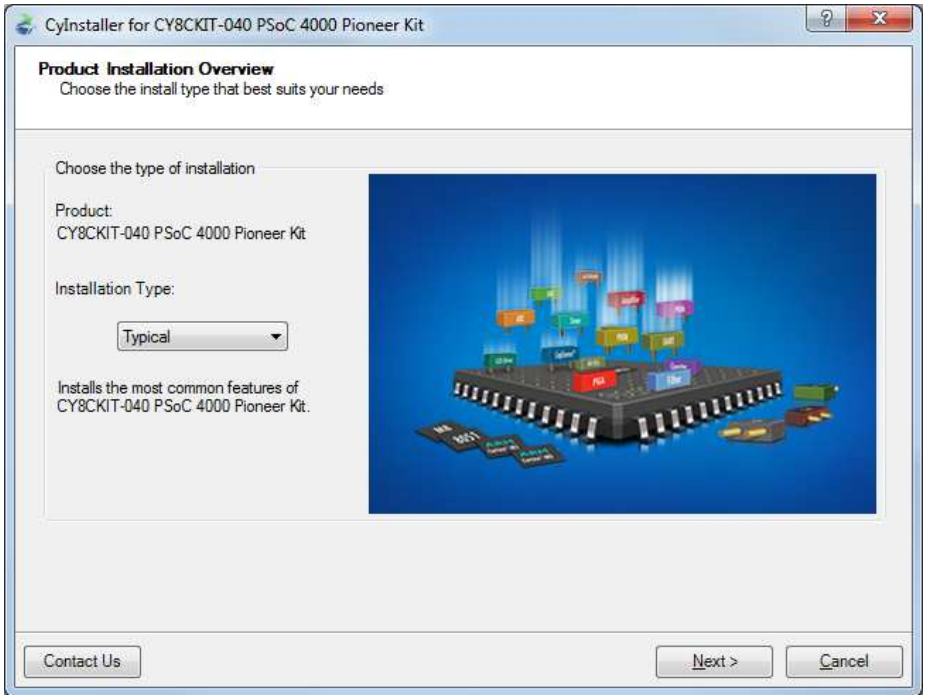
4. Select the folder in which you want to install the CY8CKIT-040 kit-related files. Choose the directory and click **Next**.
5. When you click **Next**, the CY8CKIT-040 ISO installer automatically installs the required software, if it is not present on your computer.

   Following is the required software:

   a. PSoC Creator 3.1 Service Pack 1 or later: Download the latest version from www.cypress.com/psoccreator.
   b. PSoC Programmer 3.22.2 or later: Download the latest version from www.cypress.com/programmer.

6. Choose the **Typical/Custom/Complete** installation type in the Product Installation Overview window, as shown in Figure 2-2. Click **Next** after you select the installation type.

Figure 2-2. Product Installation Overview Window



7. Read and Accept the End-User License Agreement and click **Next** to proceed with the installation.
8. When the installation begins, a list of packages appears on the installation page. A green check mark appears next to each package after successful installation.
9. Enter your contact information or select the check box **Continue Without Contact Information**. Click **Finish** to complete the CY8CKIT-040 kit installation.
10. After the installation is complete, the kit contents are available at the following location:
    `<Install_Directory>\CY8CKIT-040 PSoC 4000 Pioneer Kit\<version>`

    Default location:

    Windows 7 (64-bit):
    `C:\Program Files (x86)\Cypress\CY8CKIT-040 PSoC 4000 Pioneer Kit\<version>`

    Windows 7 (32-bit):
    `C:\Program Files\Cypress\CY8CKIT-040 PSoC 4000 Pioneer Kit\<version>`

    Note: For Windows 7/8/8.1 users, the installed files and the folder are read only. To change the property, right-click the folder and choose **Properties > Attributes**; disable the **Read-only** check box. Click **Apply** and **OK** to close the window.

2.3 Install Hardware

There is no additional hardware installation required for this kit.

2.4 Uninstall Software

You can uninstall the CY8CKIT-040 PSoC 4000 Pioneer Kit software using one of the following methods:

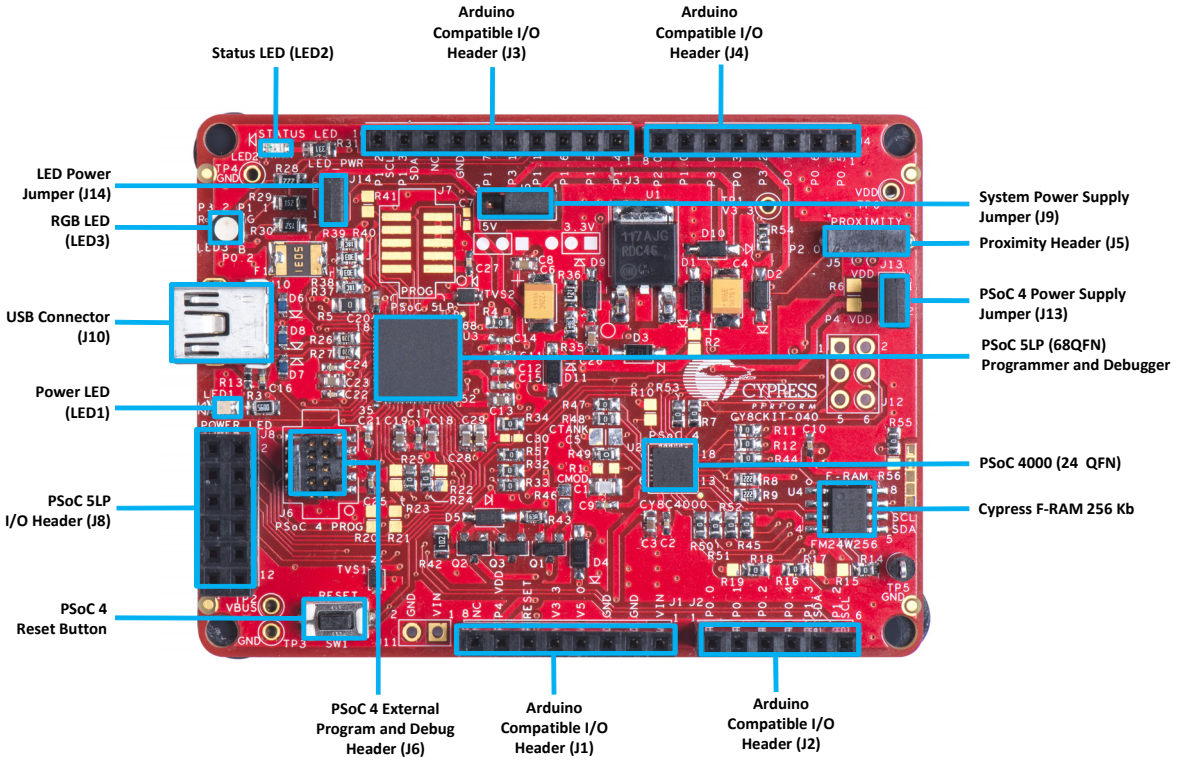
- Go to **Start** > **All Programs** > **Cypress** > **Cypress Update Manager** > **Cypress Update Manager**. Select the **Uninstall** button that corresponds to the kit software.
- Go to **Start** > **Control Panel** > **Programs and Features** (or **Add/Remove Programs** for Windows XP). Select the **Uninstall/Change** button that corresponds to the kit software.

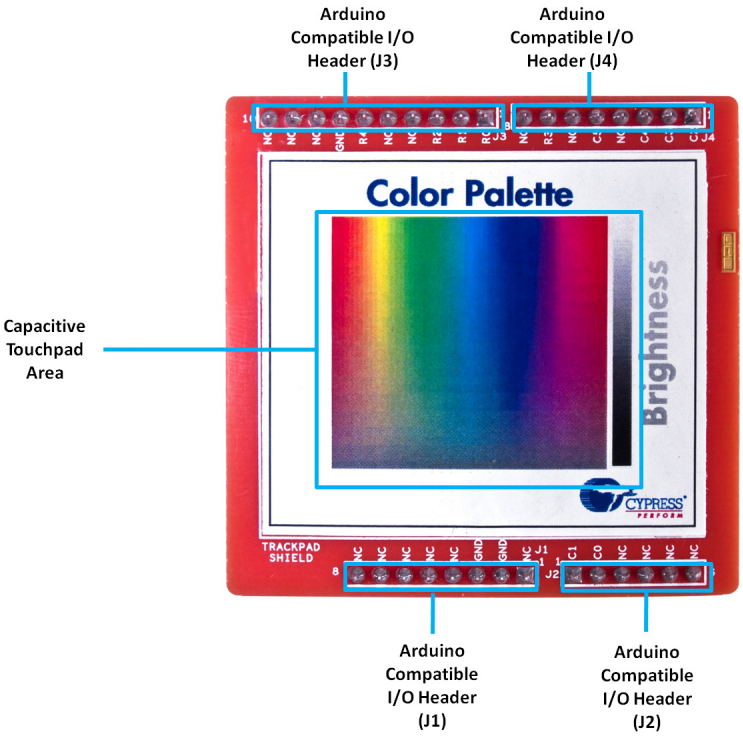
3. Kit Operation

3.1 Kit Overview

The PSoC 4000 Pioneer Kit can be used to develop applications using the PSoC 4000 family of devices. The kit includes two boards – an Arduino-compatible baseboard and a CapSense-based Trackpad shield board. Figure 3-1 is an image of the PSoC 4000 Pioneer Kit baseboard and shield board with a markup of the onboard components.

Figure 3-1. CY8CKIT-040 Kit Details




Arduino Compatible I/O Header (J3)
Arduino Compatible I/O Header (J4)
Capacitive Touchpad Area
Color Palette
Brightness
TRACKPAD SHIELD
Arduino Compatible I/O Header (J1)
Arduino Compatible I/O Header (J2)

3.2 Kit USB Connection

The PSoC 4000 Pioneer Kit connects to the PC over a USB interface (see Figure 3-2). The kit enumerates as a composite device and three separate devices appear under the **Device Manager** in the Windows operating system. See Table 3-1, and Figure 3-3.

Figure 3-2. Kit USB Connection

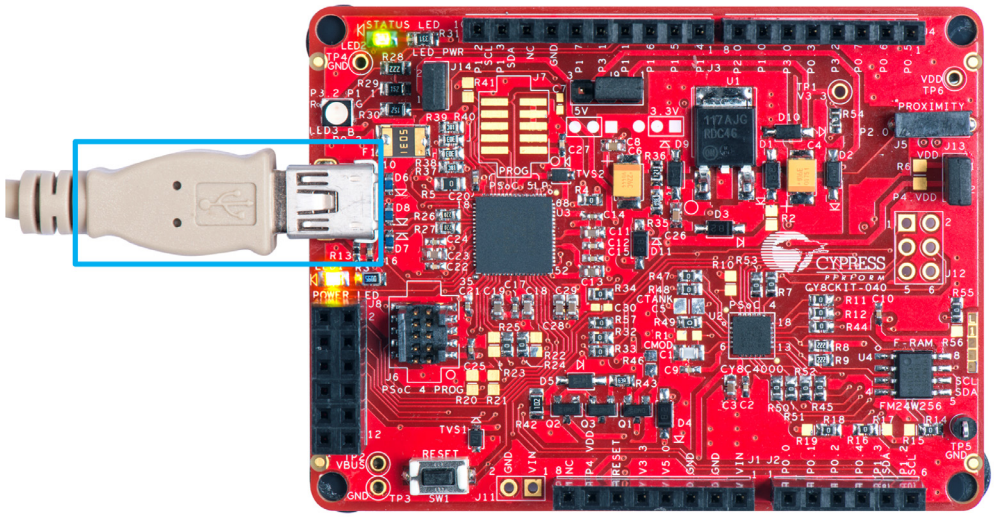
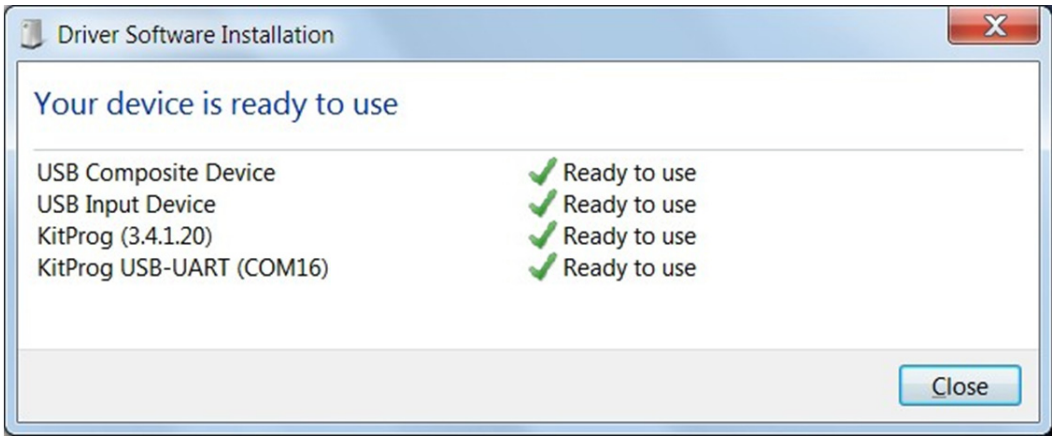


Table 3-1. PSoC 4000 Pioneer Kit in Device Manager After Enumeration

Port	Description
USB Composite Device	Composite device
USB Input Device	USB-I^{2}C bridge, KitProg command interface
KitProg	USB-I^{2}C bridge, programmer and debugger
KitProg USB-UART	USB-UART bridge, which appears as the COM# port

Figure 3-3. KitProg Driver Installation Complete



3.3 Programming and Debugging PSoC 4000

The kit allows programming and debugging of the PSoC 4 device in two modes:

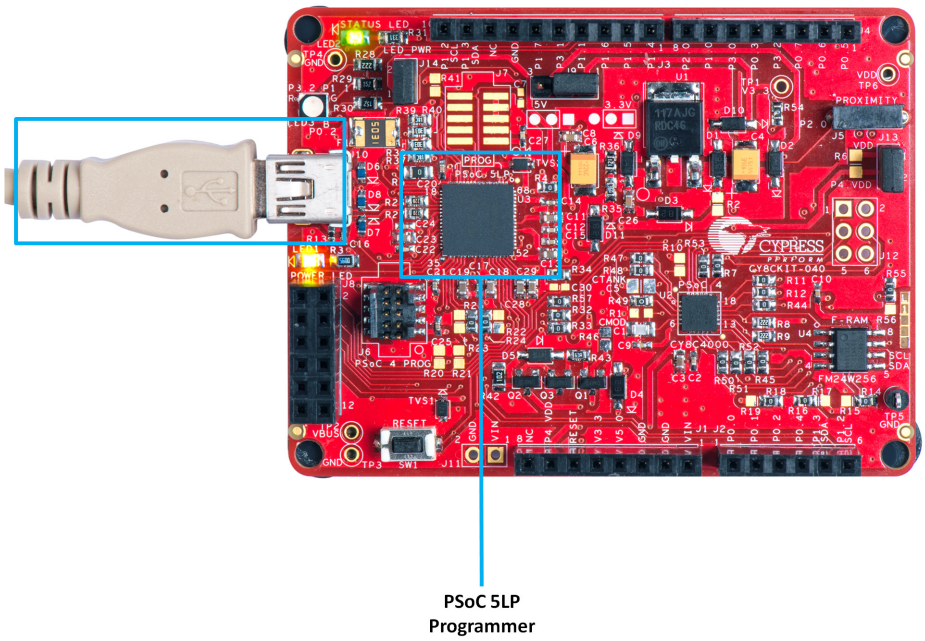
- 3.3.1 Using the Onboard PSoC 5LP Programmer and Debugger
- 3.3.2 Using the CY8CKIT-002 MiniProg3 Programmer and Debugger

3.3.1 Using the Onboard PSoC 5LP Programmer and Debugger

The default programming interface for the kit is a USB-based, onboard programming interface. Before trying to program the device, PSoC Creator and PSoC Programmer must be installed. See Install Software on page 15 for information on installing the kit software.

1. To program the device, plug the USB cable into the programming USB connector J10, as shown in Figure 3-4. The kit will enumerate as a composite device. See Kit USB Connection on page 21 for details.

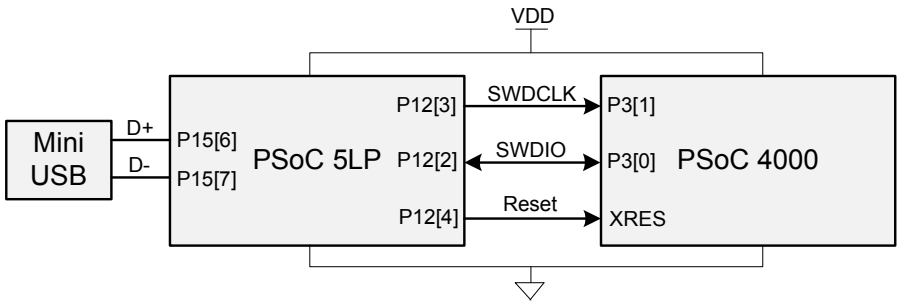
Figure 3-4. Connect USB Cable to J10



2. The onboard PSoC 5LP uses serial wire debug (SWD) to program the PSoC 4 device. See Figure 3-5.

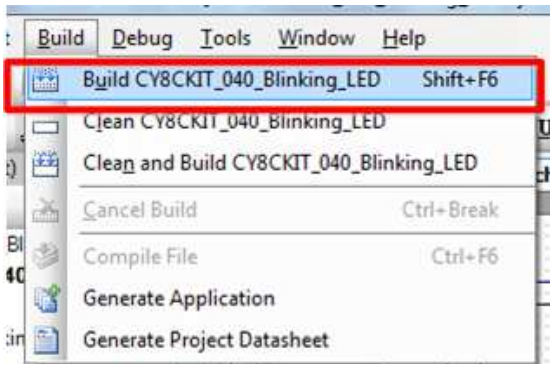
   Note: Figure 3-5 is provided only for reference, all connections are hardwired on the board itself.

Figure 3-5. SWD Programming of PSoC 4000 Using PSoC 5LP



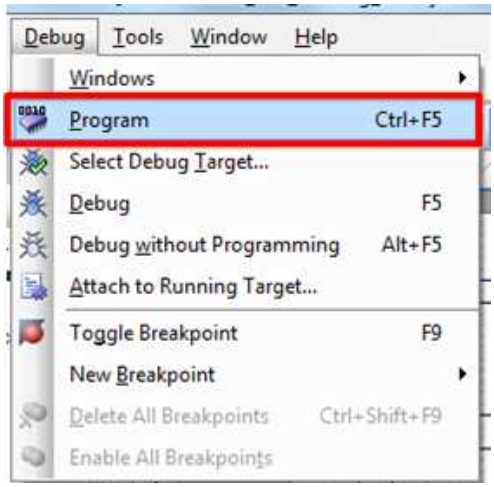
3. The kit's onboard programmer will enumerate on the PC and in the software tools as **KitProg**. Open an example project in PSoC Creator (such as Project: Blinking LED on page 56) and initiate the build by choosing **Build** > **Build Project** or pressing **[Shift] [F6]**. See Figure 3-6.

Figure 3-6. Build Project in PSoC Creator



4. After the project is built without errors and warnings, choose **Debug** > **Program** or press **[Ctrl] [F5]** to program the device. See Figure 3-7.

Figure 3-7. Program Device From PSoC Creator



The onboard programmer supports only the RESET programming mode. When using the onboard programmer, the board can either be powered by the USB (VBUS) or by an external source such as an Arduino shield (see Power Supply System on page 38). If the board is already powered from another source, plugging in the USB programmer does not damage the board.

3.3.2 Using the CY8CKIT-002 MiniProg3 Programmer and Debugger

The PSoC 4 on the kit can also be programmed using a MiniProg3 (CY8CKIT-002). To use MiniProg3 for programming, use the J6 connector on the board, as shown in Figure 3-8. With MiniProg3, programming is similar to the onboard programmer; however, it enumerates as MiniProg3 instead of KitProg.

The board can also be powered from the MiniProg3. To do so, choose **Tool** > **Options** in PSoC Creator. In the Options window, expand **Program/Debug** > **Port Configuration**; click **MiniProg3** and select the settings shown in Figure 3-9. Choose **Debug** > **Program** to program and power the board.

Note The CY8CKIT-002 MiniProg3 is not part of the PSoC 4000 Pioneer Kit contents. It can be purchased from the Cypress Online Store.

Figure 3-8. PSoC 4 Programming/Debug Using MiniProg3

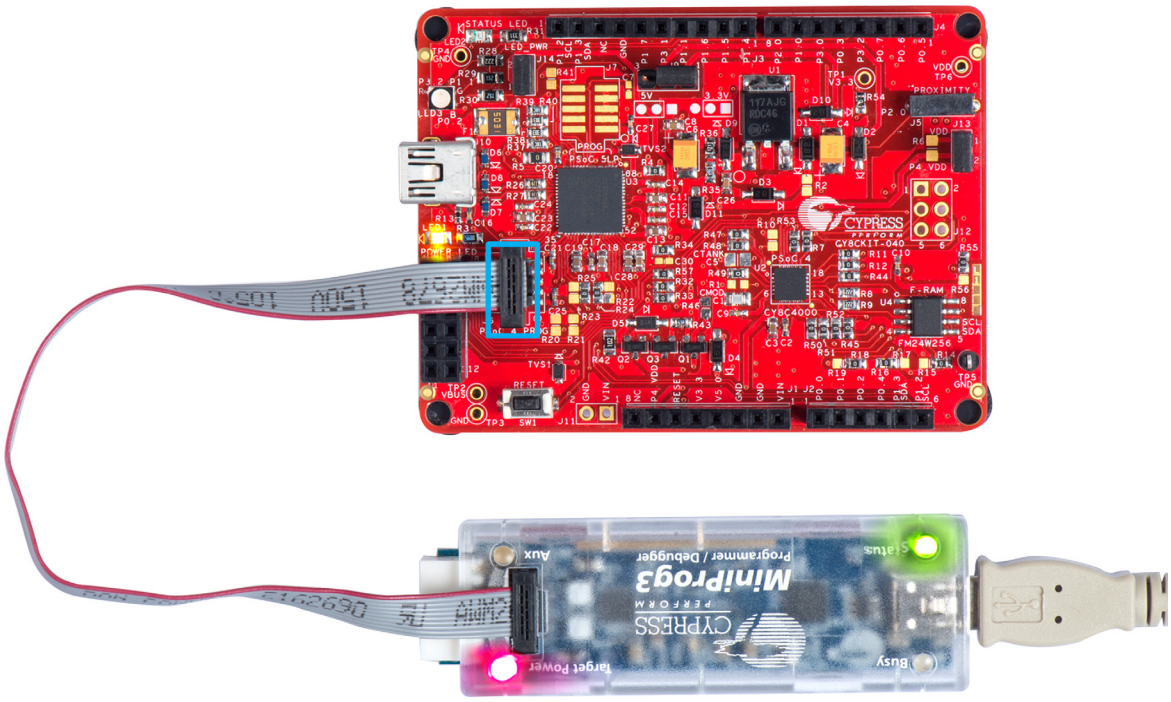
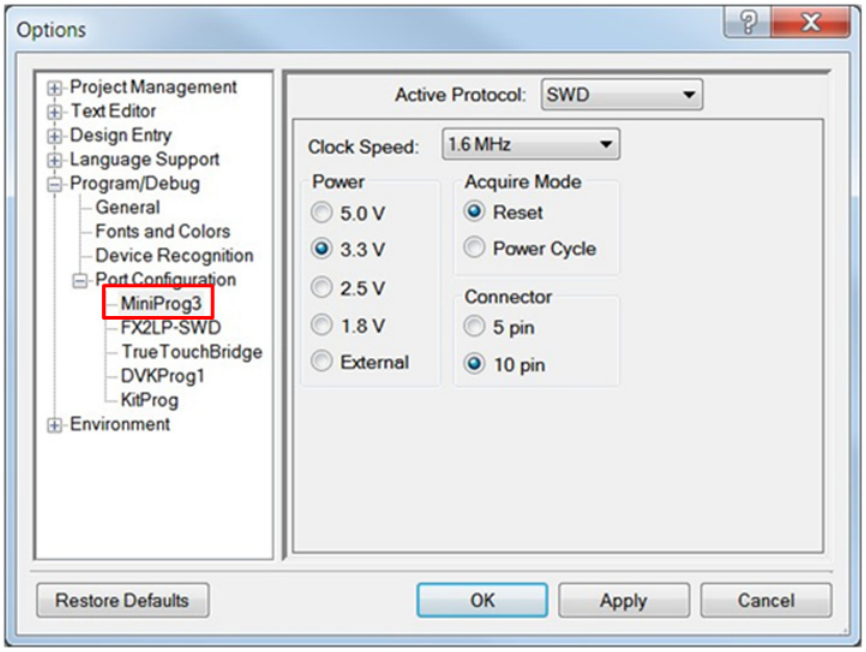


Figure 3-9. MiniProg3 Configuration in PSoC Creator



Note: Ensure that both MiniProg3 (with or without power) on header J6 and KitProg are not connected to the onboard PSoC 4 at the same time. This will result in failed device acquisition from both.