

## CY8CKIT-043

# PSoC<sup>®</sup> 4 M-Series Prototyping Kit Guide

Doc. #: 001-97606 Rev. \*\*

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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.

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## Safety Information



## **Regulatory Compliance**

The CY8CKIT-043 PSoC<sup>®</sup> 4 M-Series Prototyping 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. This 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, take adequate preventive measures. In addition, 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-043 PSoC 4 M-Series Prototyping Kit, as shipped from the factory, has been verified to meet with requirements of CE as a Class A product.





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

#### End-of-Life/Product Recycling

This kit has an end-of life five years from the date of manufacture mentioned on the back of the box. Contact your nearest recycler to dispose the kit.



## **General Safety Instructions**

#### **ESD** Protection

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

#### Handling Boards

The CY8CKIT-043 PSoC 4 M-Series Prototyping 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 board over any surface.



Thank you for your interest in the CY8CKIT-043 PSoC<sup>®</sup> 4 M-Series Prototyping Kit. This kit is designed as an easy-to-use and inexpensive prototyping platform. It supports the PSoC 4 M-Series device family, delivering a complete system solution for a wide range of embedded applications at a very low cost. The PSoC 4200M device is an expansion of the PSoC 4 device family, which offers more flash, GPIOs, and programmable analog and digital blocks. The PSoC 4200M device is a true programmable embedded system-on chip, integrating custom analog and digital peripheral functions, memory, and an ARM<sup>®</sup> Cortex<sup>®</sup>-M0 microcontroller on a single chip. The programmable analog and digital peripheral functions allow higher flexibility, in-field tuning of the design, and faster time-to-market.

The PSoC 4 M-Series Prototyping Kit offers an open footprint breakout board to maximize the endutility of the PSoC 4200M device. This kit provides a low-cost alternative to device samples while providing a platform to easily develop and integrate the PSoC 4200M device into your end-system. In addition, the board includes the following features:

- Onboard CMOD capacitors to enable CapSense<sup>®</sup> development
- Bypass capacitors to ensure high-quality ADC conversions
- An LED to provide feedback
- A push button to provide a simple user input
- Load capacitors to connect the 32-kHz external crystal oscillator
- 3.3-V to 5.5-V operation

The PSoC 4 M-Series Prototyping Kit also integrates the Cypress KitProg, which enables onboard programming, debugging, and bridging functionality, such as USB-UART and USB-I<sup>2</sup>C. The KitProg is used to program and debug the target PSoC 4200M device (see Figure 1-1). The prototyping kit allows you to separate the KitProg board from the PSoC 4 M-Series target board.

## 1.1 Kit Contents

This kit contains only the PSoC 4 M-Series Prototyping Kit board.



Figure 1-1. CY8CKIT-043 PSoC 4 M-Series Prototyping Kit



## 1.2 **PSoC Creator**

PSoC Creator<sup>™</sup> 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 10.

In the Find Example Project dialog shown in Figure 1-4, 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

Start Page	
PSoC <sup>®</sup> Creator <sup>™</sup>	
Recent Projects         Image: CE95352 Blinking LED.cywrk         Image: AN91184.cywrk         Image: AN91184.cymry         Image: AN91184.cymry	
Product Information PSoC Creator PSoC Programmer PSoC 3 PSoC 4 PSoC 5LP PSoC 4 BLE PRoC BLE	
Cypress Dev Community	
Application Notes PSoCDeveloper.com Order Samples	



<u> </u>		· · ·			
ind Example Project					? X
Filter Options			(		4.1
Device Family:	PSoC 4200M 🗸	Documentation	Sample Code 🔒		
Keyword:	All	CYPRESS			E
Project Name:		ADC	_SAR_Seq_DieT	emp_PSoC4 example project	
ADC_Differential_Pre	eamplifier / Temp PSoC4			2.0	· II
Bootloadable_PSoC4	4_Example	Features			
Bootloader_PSoC4_B	Example	<ul> <li>Project uses AD</li> </ul>	C_SAR_SEQ_P4 compon	ent	
CAN_Basic_P4_Exa	mple	<ul> <li>Indicates tempe</li> </ul>	rature and ADC channel m	easurements through UART	
CAN_Full_P4_Examp	ple Braviaita Daviera	LED brightness	depends on ADC_SAR_S8	EQ (channel0)	
Clask D4 Euspels	_Proximity_Design				
Comparator PSoC4	Evample	General Descr	iption		
Digital Pins	_cxample	This project demonstra transferring results using	tes two channels measure to an ISR to the UART and	ments by sequencing the SAR ADC and PWM.	
DMA ADC PSoC4	-	,,	,		
DMA_MEMCPY_PSo	oC4	Development	kit configuration		
DMA_SPI_PSoC4		This example project is	designed to run on the CY	8CKIT-042 kit from Cybress Semiconductor, A	
DMA_UART_PSoC4	1	description of the kit, a	long with more example pro	ograms and ordering information, can be found	í 👘
Flash_Example		at http://www.cypress.c	comigorcysckil-042.	to all an other kir from Cuptors	
Hibernate_and_Stop	PowerModes	Semiconductor. Table	1 is the list of the supported	I kits. To switch from CY8CKIT-042 to any	
Hibernate_PSoL4_E	xample PSoC4	other kit, change the pr	oject's device with the help	of Device Selector called from the project's	
Interrupts Example	-3004	Table 1. De	evelopment Kits vs Parts		
LPComparator PSoC	C4 Example	Development Ki CVRCKIT-042	t Device	3	
Multiplexed_Compara	ator	CY8CKIT-042-BI	E CY8C4247LQI-BL	183	
Opamp_Dynamic_Ga	ain_Switching	CYSCKIT-044	CY8C4247AZI-M4	as Table 2	
OpAmp_PSoC4_Exa	mple	The pin assignments to Tabl	e 2. Pin Assignment	1 dure 2.	
P4_SCB_LIN_Slave_	_Example	Pin Name	Development Kit		
P4_SCB_LIN_Slave	_Multi_Instance	Pin_LED	P0(2) P3(5)	P2[5]	
PMBusi nermExampl	le	Pin_Vin TUART_bit	P0(4) P3(0) P0(5)' P1(5)	P3(0) P7(1)	
		* Connect P0[5]	to pin P12[6] on header J8	L	
BTC P4 SusTick F	xample	The following steps sho	ould be performed to obser	ve the project operation:	-
	nampio				
			Create	e New Workspace Ca	incel

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 33. 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 4100M / PSoC 4200M Starter Designs. These starter designs demonstrate the unique features of the PSoC 4 M-Series.
- 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 11. 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.



CapSense_1 CapSense CSD				
X	Cut	Ctrl+X		
	<u>C</u> opy	Ctrl+C		
1	<u>P</u> aste	Ctrl+V		
×	<u>D</u> elete	Del		
	Select <u>A</u> ll Ctrl+A			
	Zoom •			
	Shape •			
	Configure			
	Disab <u>l</u> e			
ij	Open Datasheet .			

Figure 1-5. Opening Component Datasheet

## 1.3 Getting Started

This guide will help you get acquainted with the PSoC 4 M-Series Prototyping Kit:

- The Software Installation chapter on page 13 describes the installation of the kit software. This includes installation of PSoC Creator IDE for development and debugging the applications, and PSoC Programmer for programming hex files.
- The Kit Operation chapter on page 16 describes the major features of the PSoC 4 M-Series Prototyping Kit and functionalities such as programming, debugging, and the USB-UART and USB-I<sup>2</sup>C bridges.
- The Hardware chapter on page 20 details the hardware content of the kit and the hardware operation.
- The Code Examples chapter on page 33 describes code examples that will help you create your own PSoC 4 M-Series projects.
- The Appendix on page 42 provides schematics, details about programming the kit using MiniProg3, 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 9.



- 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, our technical support team is happy to assist you. You can create a support request on 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.

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

- Self-help
- Local Sales Office Locations

## 1.6 Document 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 <i>sourcefile.hex</i> file in the <i>PSoC Creator User Guide</i> .
[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 <b>File</b> icon and then click <b>Open</b> .
Times New Roman	Displays an equation: 2+2=4
Text in gray boxes	Describes Cautions or unique functionality of the product.



This chapter describes the steps to install the software tools and packages on a computer for using the PSoC 4 M-Series Prototyping Kit. This includes the IDE on which the projects will be built and used for programming.

## 2.1 Before You Begin

2.

Software Installation

All Cypress software installations require administrator privileges, but these are not required to run the software after it is installed. Close any other Cypress software that is currently running before installing the kit software.

**Note:** By default, the kit contents are installed in C:\Program Files\Cypress for a 32-bit machine and C:\Program Files(x86)\Cypress for a 64-bit machine. This folder will contain the kit example project. To open this example, it is recommended to use the procedure described in the Code Examples chapter on page 33. That procedure will create an editable copy of the example in a path that you chose so that the original installed example will not be modified.

## 2.2 Install Software

Follow these steps to install the PSoC 4 M-Series Prototyping kit software:

- Download the kit software from www.cypress.com/CY8CKIT-043. The kit software is available for download in three formats.
  - a. CY8CKIT-043 Kit Setup: This installation package contains the files related to the kit including PSoC Creator and PSoC Programmer. 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-043 Kit Only: This executable file installs only the kit contents, which include a kit code example, hardware files, and user documents. This package can be used if all the software prerequisites (listed in step 5) are installed on your computer.
  - c. CY8CKIT-043 DVD ISO: This file is a complete package, stored in a DVD-ROM image format, that you can use to create a DVD or extract using an ISO extraction program such as Win-RAR. The file can also be mounted similar to a virtual CD/DVD using virtual drive programs such as Virtual CloneDrive and MagicISO. This file includes all the required prerequisite software, utilities, drivers, hardware files, and user documents.
- If you have downloaded the ISO file, mount it on 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 enabled on the computer. The
  installation window will appear automatically.

Note: If you are using the "Kit Setup" or "Kit Only" file, then go to step 4 for installation.



3. Click Install CY8CKIT-043 Kit to start the kit installation, as shown in Figure 2-1.

Figure 2-1. Kit Installer Screen



- 4. Select the directory in which you want to install the PSoC 4 M-Series Prototyping kit-related files. Choose the directory and click **Next**.
- 5. When you click **Next**, the PSoC 4 M-Series Prototyping kit installer automatically installs the required software, if it is not present on your computer. Following are the required software:
  - a. PSoC Creator 3.2 or later: This software is also available at www.cypress.com/psoccreator.
  - b. PSoC Programmer 3.23 or later: This is installed as part of PSoC Creator installation (www.cypress.com/programmer).
- 6. Choose the **Typical/Custom/Complete** installation type (select 'Typical' if you do not know which one to select) in the Product Installation Overview window, as shown in Figure 2-2. Click **Next** after you select the installation type.





🕹 CyInstaller for CY8CKIT-043 PSoC 4 M-Series Prototyping Kit			
Product Installation Overview Choose the install type that best suits your needs			
Choose the type of installation Product: CY8CKIT-043 PSoC 4 M-Series Prototyping Kit Installation Type: Installs true to the type of installation type to the type of installation type to the type of type of the type of type of the type of ty			
Contact Us <u>N</u> ext > <u>C</u> ancel			

- 7. Read the License agreement and select **I accept the terms in the license agreement** to continue with the installation. Click **Next**.
- 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 kit installation.

**10.After the installation is complete, the kit contents are available at the following location:** <Install Directory>\CY8CKIT-043 PSoC 4 M-Series Prototyping Kit

Default location:

Windows OS (64-bit):

```
C:\Program Files (x86)\Cypress\CY8CKIT-043 PSoC 4 M-Series Prototyping Kit
```

Windows OS (32-bit):

C:\Program Files\Cypress\CY8CKIT-043 PSoC 4 M-Series Prototyping Kit

**Note:** For Windows 7/8/8.1 users, the installed files and the folder are read-only. To use the installer code example, follow the steps outlined in the Code Examples chapter on page 33.

## 2.3 Uninstall Software

The software can be uninstalled using one of the following methods:

- 1. Go to Start > All Programs > Cypress > Cypress Update Manager and select the Uninstall button next to the product that needs to be uninstalled.
- 2. Go to Start > Control Panel > Programs and Features for Windows 7 or Add/Remove Programs for Windows XP; choose the product and select the Uninstall/Change button.



This chapter introduces you to the features of the PSoC 4 M-Series Prototyping Kit. It describes the programming and debugging functionality, KitProg USB-UART and USB-I<sup>2</sup>C bridges, and the method to update the KitProg firmware.

## 3.1 Theory of Operation

Figure 3-1 shows the block diagram for the PSoC 4 M-Series Prototyping Kit.

Figure 3-1. Block Diagram of PSoC 4 M-Series Prototyping Kit



The PSoC 4 M-Series Prototyping Kit is simplistic in design and provides complete access to develop applications using the PSoC 4200M device family. This kit supports the following features:

- KitProg: It is an onboard programmer/debugger, which enables the user to program and debug the target PSoC 4200M device. It can also act as a USB-UART and USB-I<sup>2</sup>C bridge. When used as a standalone module, it can be used to program devices of PSoC 3, PSoC 4, or PSoC 5 families through the SWD interface. For more details on the KitProg functionality, refer to the KitProg User Guide.
- Expansion Headers: The PSoC 4 M-Series Prototyping kit brings all I/Os of the target device to the two expansion headers, enabling the user to have maximum access to the capabilities of the PSoC 4200M device.



- User LED: The onboard LED can be used to display outputs from the PSoC 4200M device. This
  includes modulating the brightness of the LED to notify different states of the device.
- Push Button (SW): The push button can be used to provide input to the PSoC 4200M device.
   Note: The switch connects the PSoC 4200M pin to ground when pressed. Therefore, you need to configure the PSoC 4200M pin as resistive pull-up for detecting the switch press.
- Reset Button: This button is used for the following purposes:
  - Reset the PSoC 4200M device: When pressed, it connects the XRES line of the PSoC 4200M to ground and resets the PSoC 4200M device.
  - Bootload the KitProg: When pressed while connecting the kit's PCB USB connector to the USB port of the PC, the KitProg enters bootloader mode. For more details on the KitProg functionality, refer to the KitProg User Guide.

**Note:** When the two boards are separated, the user can mount the SW2 button on the target board to reset the PSoC 4200M device using a switch.

- EZ-BLE: It is a fully integrated, 10×10×1.8 mm, fully certified, programmable BLE module designed for ease-of-use and reduced time-to-market. You can use the EZ-BLE module to add BLE capabilities to the board. The board only includes a footprint for the module. Refer to Section 4.2.7 EZ-BLE PRoC Module on page 30 for details.
- DPDT switch: This switch is used to select the KitProg's SWD target (PSoC 4200M or EZ-BLE). By default, this switch is not populated on-board and the PSoC 4200M SWD lines are hard-wried to the KitProg's SWD programming lines.
- 10-pin program/debug header: This header provides support for program/debug via the MiniProg3's 10-pin program/debug header. This header is not populated by default as the program/debug functionality is already provided by the on-board KitProg.

## 3.2 KitProg

The KitProg is a multi-functional system, which includes a programmer, debugger, USB-I<sup>2</sup>C bridge, and a USB-UART bridge. The Cypress PSoC 5LP device is used to implement the KitProg functionality. The KitProg is integrated in most PSoC development kits. For more details on the KitProg functionality, refer to the KitProg User Guide available on the kit web page or in the following location: <Install\_Directory>\CY8CKIT-043 PSoC 4 M-Series Prototyping Kit\ <version>\Documentation\KitProg\_User\_Guide.pdf. This is also accessible from inside PSoC Creator by clicking on the kit name on the **Start** page (left pane) and then selecting **User Guide for KitProg** from the list of available documents (right pane).

## 3.3 **Programming and Debugging the PSoC 4 Target Device**

The target PSoC 4 device can be programmed and debugged using the built-in KitProg. Before programming the device, ensure that PSoC Creator and PSoC Programmer are installed on your computer. See Install Software on page 13 for more information.

#### 3.3.1 Programming Using PSoC Creator

1. Connect the kit to the computer through the PCB USB connector, J6, as shown in Figure 3-2. The kit will enumerate as a composite device when you plug in the PSoC 4 M-Series Prototyping kit to your computer for the first time. The kit drivers should be automatically installed.





Figure 3-2. Connecting the PSoC 4 M-Series Prototyping Kit to a Computer

- Open the desired project in PSoC Creator from File > Open > Project/Workspace. This
  provides the option to browse and open a previously saved project. If you want to open the
  example project provided with the kit, follow the instructions in the Code Examples chapter on
  page 33.
- 3. Select **Build > Build Project** or press [Shift] [F6] to build the project as shown in Figure 3-3.

Figure 3-3. Build an Example Project



CE97634 PSoC 4 Breathing LED - PSoC Creator 3.2 [C:\...\CE97634 PSoC 4 Breathing LED

 If there are no errors during build, program the firmware into the kit by choosing Debug > Program or press [Ctrl] [F5], as shown in Figure 3-4. This programs the target PSoC 4200M device on the PSoC 4 M-Series Prototyping Kit; the kit is now ready for use.



#### Figure 3-4. Programming Device From PSoC Creator

EE97634 PSoC 4 Breathing LED - PSoC Creator 3.2 [C:\...\CE97634 PSoC 4 Breathing LED



### 3.3.2 Debugging Using PSoC Creator

For debugging the project using PSoC Creator, follow steps 1 to 3 from Programming Using PSoC Creator on page 17 followed by these steps:

- 1. Click the **Debug** icon 😹 or press **[F5]**. Alternatively, you can choose **Debug** > **Debug**.
- 2. When PSoC Creator opens in Debug mode, use the buttons on the toolbar to debug your application.

For more details on using the debug features, refer to section 3.2 of the KitProg User Guide.

#### 3.3.3 Programming Using PSoC Programmer

PSoC Programmer (3.23 or later) can be used to program existing *.hex* files into the PSoC 4 M-Series Prototyping Kit. Refer to section 3.3 of the KitProg User Guide for a detailed explanation on how to program using PSoC Programmer.

## 3.4 USB-UART Bridge

The KitProg can act as a USB-UART bridge. The UART lines between the KitProg and the target are hard-wired on the board, through the snappable area, with UART\_RX assigned to P7[1] and UART\_TX assigned to P7[0] on PSoC 4200M. For more details on the KitProg USB-UART functionality, refer to section 5 of the KitProg User Guide.

## 3.5 USB-I<sup>2</sup>C Bridge

The KitProg can function as a USB-I<sup>2</sup>C bridge and communicate with the Bridge Control Panel (BCP) software utility. The I<sup>2</sup>C lines on the PSoC 4200M device are P4[1] (SDA) and P4[0] (SCL), which are hardwired on the board to the I<sup>2</sup>C lines of the KitProg. The USB-I<sup>2</sup>C supports I<sup>2</sup>C speeds of 50 kHz, 100 kHz, 400 kHz, and 1 MHz. For more details on the KitProg USB-I<sup>2</sup>C functionality, refer to section 6 of the KitProg User Guide.

## 3.6 Updating the KitProg Firmware

The KitProg firmware normally does not require any update. You can use PSoC Programmer to update the KitProg firmware. Refer to section 3.5 of the KitProg User Guide for more details.

## 4. Hardware



## 4.1 Board Details

The PSoC 4 M-Series Prototyping Kit consists of the following blocks:

- PSoC 4200M device U2 (CY8C4247AZI-M485)
- PSoC 4200M headers J1 and J2
- PSoC 4200M 10-pin program/debug header J5 (footprint only)
- KitProg (PSoC 5LP) device U1 (CY8C5868LTI-LP039)
- KitProg headers J8 and J9
- SWD connection J3 and J7
- USB finger connector J6
- EZ-BLE<sup>TM</sup> PRoC<sup>TM</sup> module U4 (footprint only)
- One DPDT switch SW4 to select the SWD target device (footprint only)
- One blue LED LED1 (User)
- One amber LED LED2 (Power)
- One green LED LED3 (Status)
- User push button SW1
- Reset buttons SW2 (footprint only) and SW3
- External reference capacitor C3 (SARADC bypass)
- CapSense capacitors (CMOD C10 and CTANK C13)
- Current measurement jumper J4 (footprint only)
- Perforated 'snappable' board design





Figure 4-1. PSoC 4 M-Series Prototyping Kit Pin Details



## 4.2 Hardware Details

#### 4.2.1 Target Board

The target board uses the PSoC 4200M device. PSoC 4 is a scalable and reconfigurable platform architecture for a family of programmable embedded system controllers with an ARM Cortex-M0 CPU. It combines programmable and reconfigurable analog and digital blocks with flexible automatic routing. The PSoC 4200M device family, based on this platform architecture, is a combination of a microcontroller with digital programmable logic, programmable analog, programmable interconnect, high-performance analog-to-digital conversion, opamps with comparator mode, and standard communication and timing peripherals. The PSoC 4200M products are fully compatible with members of the PSoC 4 platform for new applications and design needs. The programmable analog and digital subsystems allow flexibility and in-field tuning of the design. For more information, refer to the PSoC 4 web page and the PSoC 4200M Family Datasheet.

Figure 4-2. Schematic of PSoC 4 (Target)





### 4.2.2 KitProg Board

PSoC 5LP on the KitProg board is used to program and debug the target PSoC 4 device. The KitProg PSoC 5LP connects to the USB port of the computer through the PCB USB connector and to the SWD interface of the target PSoC 4 device. See the KitProg User Guide for additional details and functions provided by the KitProg.

Figure 4-3. Schematic of PSoC 5LP (KitProg)





### 4.2.3 Power Supply System

The power supply system on this board is dependent on the power source. For most applications, you can use the 5-V supply from the USB connection to power the system. You can also connect an external power supply to the board for low-voltage applications. The kit supports the following connections:

- 5 V from the KitProg USB (J6)
- 3.3 V to 5.5 V from a regulated supply connected to VDD (this will not power the KitProg section of the board)

**Note:** To use an external power supply, while the KitProg is connected to the PCB USB, remove the D1 diode from the board. This ensures that VTARG supply from the KitProg is not supplied to the target device. The KitProg measures the target voltage and adjusts the logic levels on the programming pins accordingly.

Note that this prototyping kit does not have any onboard ESD protection circuitry. Therefore, the power source for the PSoC 4 M-Series Prototyping Kit must be of a high quality to ensure that the board is protected from any over-current conditions and swapped-power connections.

#### 4.2.3.1 Measure PSoC 4 Current Consumption

You can measure current consumption of the PSoC 4200M device by using one of these methods:

Method 1:

- 1. Separate the KitProg board by 'snapping' the perforated edge between the two boards.
- 2. Power the remaining prototyping board via any of the VDD or VTARG terminals.
- 3. Place an ammeter in series with the VDD or VTARG connection to measure current consumption.

Method 2:

- 1. Remove the resistor R22 and install a 2-pin jumper in the supplied holes of J4.
- 2. Connect an ammeter across the 2-pin jumper to measure the current to the PSoC 4200M device.

This method can be used either with USB power or with power supplied to one of the VTARG pins but NOT when supplying power to one of the VDD pins.

#### 4.2.4 Board Separation (Snapping)

The PSoC 4 M-Series Prototyping Kit consists of both a PSoC 4200M and a KitProg board. To separate the two boards for evaluation or development, break the two boards apart at the built-in perforated edge.

The easiest method of separating the two boards is to place the kit on the edge of a table, where the edge of the table is directly below the perforated edge and the smaller KitProg board is off the table edge. Press gently on the KitProg board and snap the two boards apart. If any material is removed from the edge of the boards, use shears to clean up the edge of the kit. Note that once the boards are separated, direct UART and I<sup>2</sup>C connections between the PSoC 4200M device and KitProg are lost. This is because the traces connecting the UART and I<sup>2</sup>C lines are cut off during the separation. However, you can access the KitProg's UART and I<sup>2</sup>C lines through headers J8 and J9.







#### 4.2.5 Header Connections

The PSoC 4 M-Series Prototyping Kit supports a number of unpopulated headers on both the KitProg and the target PSoC 4 boards.

#### 4.2.5.1 Functionality of J1 and J2 Headers (Target Board)

The target board contains two, dual-inline, headers (J1 and J2). Both are 1×29 pin headers and include all of the I/Os available on the PSoC 4200M device. These headers support all of the available ports, GND, VDD, and connections to passive elements and user-input devices. The J1 and J2 headers support 100-mil spacing, so you can solder connectors to connect the target board to any development breadboard.

Figure 4-5. J1 and J2 Headers





~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
CYPRESS
PERFORM

J1 01

J1 02

J1 03

J1 04

J1 05

J1\_06

J1 07

J1 08

J1 09

J1 10

J1\_11

J1 12

J1 13

J1 14

J1\_15

J1 16

J1\_17

J1\_18

J1 19

J1 20

J1 21

J1 22

J1 23

J1 24

J1 25

J1\_26

J1 27

J1 28

J1 29

Table 4-1. J1 Header Pin DetailsTable 4-2. J2 Header Pin Details					Header Pin Details	
PSoC 4 M-Series Prototyping Kit GPIO PSoC 4 M-Series Prototyping Kit GPI						
Pin	Signal	Description	1 1	Pin	Signal	Description
1_01	/XRES	GPIO	[	J2_01	VDDD	Power
1_02	P5[0]	GPIO		J2_02	GND	Ground
1_03	P5[1]	GPIO		J2_03	P0[7]	GPIO/SW (SW1)
1_04	P5[2]	GPIO		J2_04	P0[6]	GPIO
1_05	P5[3]	GPIO		J2_05	P0[5]	GPIO/XTAL_OUT
1_06	P5[5]	GPIO		J2_06	P0[4]	GPIO/XTAL_IN
1_07	P1[0]	GPIO		J2_07	P0[3]	GPIO
1_08	P1[1]	GPIO		J2_08	P0[2]	GPIO
1_09	P1[2]	GPIO		J2_09	P0[1]	GPIO
1_10	P1[3]	GPIO		J2_10	P0[0]	GPIO
1_11	P1[4]	GPIO		J2_11	P7[1]	GPIO/->UART_RX
1_12	P1[5]	GPIO		J2_12	P7[0]	GPIO/<-UART_TX
1_13	P1[6]	GPIO/LED (LED1)		J2_13	P4[6]	GPIO
1_14	P1[7]	GPIO/SAR BYPASS		J2_14	P4[5]	GPIO
1_15	P2[0]	GPIO		J2_15	P4[4]	GPIO
1_16	P2[1]	GPIO		J2_16	P4[3]	GPIO/CTANK
1_17	P2[2]	GPIO		J2_17	P4[2]	GPIO/CMOD
1_18	P2[3]	GPIO		J2_18	P4[1]	GPIO/I2C_SDA
1_19	P2[4]	GPIO		J2_19	P4[0]	GPIO/I2C_SCL
1_20	P2[5]	GPIO		J2_20	P3[7]	GPIO
1_21	P2[6]	GPIO		J2_21	P3[6]	GPIO
1_22	P2[7]	GPIO		J2_22	P3[5]	GPIO
1_23	P6[0]	GPIO		J2_23	P3[4]	GPIO
1_24	P6[1]	GPIO		J2_24	P3[3]	GPIO/SWDCLK
1_25	P6[2]	GPIO		J2_25	P3[2]	GPIO/SWDIO
1_26	P6[4]	GPIO		J2_26	P3[1]	GPIO/->BLE_RX
1_27	P6[5]	GPIO		J2_27	P3[0]	GPIO/<-BLE_TX
1_28	GND	Ground		J2_28	VDDA	Power
1_29	VDDIO	Power		J2_29	GND	Ground

### Table 4-1. J1 Header Pin Details

#### 4.2.5.2 Functionality of J7 and J3 Headers (PSoC 4200M to KitProg)

The KitProg and target boards each contain a 1×5-pin header. These headers provide a physical connection between the two devices. Specifically, the connection includes the SWD interface, required to program/debug the target PSoC 4200M device, power, ground, and reset.



Figure 4-6. J7 and J3 Headers



Table 4-3. Pin Details of J7 Header

PSoC 5LP KitProg Header (J7)				
Pin Signal		Description		
J7_01	VTARG	Power		
J7_02	GND	Ground		
J7_03	P12.4	PROG_XRES		
J7_04	P12.3 PROG_SWDCLK			
J7_05	P12.2 PROG_SWDIO			

Table 4-4. Pin Details of J3 Header

PSoC	PSoC 4 M-Series Prototyping Kit GPIO (J3)				
Pin	Signal	Description			
J3_01	VTARG	Power			
J3_02	GND	Ground			
J3_03	XRES	XRES			
J3_04	P3.3	SWDCLK			
J3_05	P3.2	SWDIO			

When the boards are separated, the KitProg board can be used to program any other PSoC 3, PSoC 4, or PSoC 5LP device family member via J7.

#### 4.2.5.3 Functionality of J8 and J9 Headers (KitProg)

The KitProg board contains two, dual-inline, headers (J8 and J9). Both are 1×7-pin-headers, used to provide access to several pins of the PSoC 5LP to support advanced features such as a low-speed oscilloscope and a low-speed digital logic analyzer. These headers also contain the KitProg bridge pins (USB to UART and USB to  $I^2C$ ) that can be used when the two boards are separated.

The J8 and J9 headers support 100-mil spacing, so you can solder connectors to connect the KitProg board to any development breadboard.

Figure 4-7. J8 and J9 Headers





Table 4	1-5	Pin	Details	ofIQ
	+-O.		Delans	01 78

PSoC 5LP to KitProg Header (J9)						
Pin	Description					
J9_01	VBUS	Power				
J9_02	GND	Ground				
J9_03	P12.5	GPIO				
J9_04	P12.0	GPIO/I2C_SCL				
J9_05	P12.1	GPIO/I2C_SDA				
J9_06	P12.6	GPIO/UART_RX				
J9_07	P12.7	GPIO/UART_TX				

Table 4-6. Pin Details of J8

PSoC 5LP to KitProg Header (J8)						
Pin	Signal	Description				
J8_01	GND	Ground				
J8_02	P3.0	GPIO				
J8_03	P3.4	GPIO				
J8_04	P3.5	GPIO				
J8_05	P3.6	GPIO				
J8_06	P0.0	GPIO				
J8_07	P0.1	GPIO				

#### 4.2.6 User and Passive Inputs

#### 4.2.6.1 Push Button

The target PSoC 4 board contains a single push button connected to the P0[7] pin on the PSoC 4200M device. This button can be used for general user inputs or to control different states in an application.

#### Figure 4-8. Push Button on the Board





#### 4.2.6.2 Reset/Boot Button

The KitProg board contains a push button connected to the XRES pins on the target PSoC 4200M and EZ-BLE devices. The button is also connected to P12\_4 of the KitProg device. This button serves two functions:

- Reset the PSoC 4200M and EZ-BLE devices: When this button is pressed, the XRES lines of the PSoC 4200M and EZ-BLE are connected to ground, which, in turn, resets the devices.
- Bootload the KitProg: When this button is held down while plugging the KitProg into the USB port of the PC, the KitProg enters the bootloader mode. In this mode, bootloadable applications can be downloaded on the KitProg device. The bootloader mode is indicated by the green LED (LED3) flashing.



Figure 4-9. Reset/Boot Button





#### **Reset Button**

The target board provides a footprint for a surface-mount switch, which can be used to reset the PSoC 4200M and EZ-BLE devices when the two boards are separated.



#### 4.2.6.3 LEDs

The PSoC 4 M-Series Prototyping kit contains three LEDs:

- The amber LED: Indicates that the board is powered from the PCB USB connector. This LED will not light when the board is powered from VDD or VTARG directly.
- The green LED: Indicates the KitProg status, connected to P3[1] of the KitProg PSoC 5LP device. For more details on the KitProg status LED, refer to the KitProg User Guide.
- The blue LED: This is the user LED, connected to P1[6] of the target PSoC 4200M device.

Figure 4-11. Power LED







Figure 4-13. User LED (Blue)



#### 4.2.6.4 System Capacitors

The PSoC 4 M-Series Prototyping Kit has five capacitors in addition to power supply decoupling capacitors:

- A SAR ADC bypass capacitor (C3): Required for proper ADC sampling at higher frequencies.
- Two CapSense capacitors (CMOD and CTANK): Required for proper CapSense functionality.
- Two biasing capacitors (C9 and C12): Required to interface an external 32-kHz crystal oscillator.

Note: The crystal oscillator is not placed on the board; it can be soldered on pins P0[5] and P0[4].

Figure 4-14. System Capacitors Circuit Diagram



### 4.2.7 EZ-BLE PRoC Module

The board includes a footprint for mounting an EZ-BLE PRoC Module. The EZ-BLE PRoC Module is a fully integrated, 10×10×1.8 mm, fully certified, programmable module designed for ease-of-use and reduced time-to-market. It contains Cypress's PRoC BLE chip, two crystals, chip antenna, shield, and passive components. Refer to AN96841 - Getting Started With EZ-BLE PRoC Module for more details. Visit www.cypress.com/ez-bleprocmodule/ to buy the EZ-BLE module.







The EZ-BLE module includes the following connections to the PSoC 4200M and KitProg:

- UART connections to PSoC 4200M through zero-ohm resistors R28 and R27 (see Figure 4-16 and Table 4-7).
- I<sup>2</sup>C connections to KitProg and PSoC 4200M. See Table 4-7 for details.
- SWD connections to KitProg through the DPDT switch SW4. The SWD connections are shared between the PSoC 4200M and EZ-BLE devices. By default, SW4 is not populated and the Kit-Prog SWD connections are hardwired to PSoC 4200M through zero-ohm resistors, R18 and R16.

EZ-BLE Connections							
EZ-BLE	PSoC 4	KitProg	Description				
BLE_TX, P1.5	P3.0	-	GPIO/UART_TX				
BLE_RX, P1.4	P3.1	-	GPIO/UART_RX				
BLE_SDA, P5.0	P4.1	I2C_SDA, P12.1	GPIO/I2C_SDA				
BLE_SCL, P5.1	P4.0	I2C_SCL, P12.0	GPIO/I2C_SCL				
BLE_SWDIO, P0.6	-	SWDIO, P12.2	SWD I/O				
BLE_SWDCLK, P0.7	-	SWDCLK, P12.3	SWD clock				

	Table 4-7.	EZ-BLE	Connections
--	------------	--------	-------------

To program the EZ-BLE module using Kitprog, follow these instructions:

- 1. Populate the DPDT switch, SW4. Refer to row no. 36 in Appendix A.3 Bill of Materials on page 45 for the part number of the switch to be used.
- 2. Populate the EZ-BLE PROC module, U4 (footprint on the bottom of the board)



- 3. Remove the zero-ohms resistors R18 and R16
- 4. Move the DPDT switch to position A as shown in Figure 4-16 to program PSoC 4200M and to position B as shown in Figure 4-17 to program the EZ-BLE module

Figure 4-16. SW4 Position for Programming PSoC 4200M



Figure 4-17. SW4 Position for Programming EZ-BLE







This chapter explains the code example provided along with the PSoC 4 M-Series Prototyping Kit as well as how to use the built-in PSoC Creator examples with the kit. To access the code example, download and install the CY8CKIT-043 PSoC 4 M-Series Prototyping Kit setup file from www.cypress.com/CY8CKIT-043. After installation, the code example will be available in the Firmware folder in the installation location.

For more code examples, visit the PSoC 3, PSoC 4, and PSoC 5 code examples page, which lists all PSoC Creator code examples available across application notes, kits, and PSoC Creator.

## 5.1 Using the Kit Code Example

Follow these steps to open and use the code example provided with the kit.

- Launch PSoC Creator from Start > All Programs > Cypress > PSoC Creator<version> > PSoC Creator <version>.
- On the Start Page, click CY8CKIT-043 under Examples and Kits > Kits. The code example CE97634 PSoC 4 Breathing LED, shipped with the kit, appears (see Figure 5-1).
- 3. Click on the example project and save it at a desired location.



	•
PSoC Creator 3.2	
Eile Edit View Project Build Debug	Iools Window Help
workspace Explorer (U projects)	
No workspace open	Source       Opponents         Uppen Existing Project         Opponents         Description         Uppen Existing Project         Getting Started         PSoC Creator Start Page         Quick Start Guide         Infro to PSoC         Infro to PSoC Creator         PSoC Creator Training         Design Tutorials         Getting Started With PSoC 3         Getting Started With PSoC 5LP         Getting Started with PSoC 5LP
	Examples and Kits Find Example Project ■ Kits ■ CY8CKIT-042 3.0 ■ CY8CKIT-042-8LE ■ CY8CKIT-042-8LE ■ CY8CKIT-043 ■ CY8CKIT-043 ■ CY8CKIT-044 ■ CY8CKIT-059 Product Information PSoC Creator

Figure 5-1. Open Example Project from PSoC Creator

4. Build the example project by choosing **Build** > **Build** <**Project Name>**, as shown in Figure 5-2. A *.hex* file is generated after a successful build process.

Figure 5-2. Build Example Project from PSoC Creator



- 5. Connect the PSoC 4 M-Series Prototyping kit to the PC using the KitProg PCB USB port, J6, as described in Programming Using PSoC Creator chapter on page 17 to program the kit with this code example. If this is the first time the kit is connected, wait for drivers to be installed.
- 6. Choose **Debug > Program** in PSoC Creator as shown in Figure 5-3.



#### Figure 5-3. Program Device in PSoC Creator

E97634 PSoC 4 Breathing LED - PSoC Creator 3.2 [C:\...\CE97634 PSoC 4 Breathing LED



7. PSoC Creator opens the programming window if the device is not yet acquired. Select KitProg and click the **Port Acquire** button, as shown in Figure 5-4.

Figure 5-4. Port Acquire

Select Debug Target	? 🔀
■ S KitProg/0E0F0B2A011A3400	KitProg/0E0F0B2A011A3400 POWER = 3 VOLTAGE_ADC = 4833 FREQUENCY = 2000000 PROTOCOL = SWD KitProg version Expecting 2.10, but found 2.11. Please use PSoC Programmer GUI to upgrade firmware.
Show all targets	Port Setting Port <u>A</u> cquire
	ОК

8. After the device is acquired, it is shown in a tree structure below the KitProg. Click the **Connect** button and then **OK** to exit the window and start programming, as shown in Figure 5-5.



Select Debug Target	? ×
□-5 KitProg/10180E3602213400	PSoC 4200M CY8C4247AZI-M485
PSoC 4200M CY8C4247AZI-M485	PSoC 4200M (ARM CM0) Silicon ID: 0x0BB11477 Cypress ID: 0x112D11A1 Revision: PRODUCTION
	Target unacquired
Show all targets	<u>C</u> onnect
	ОК

Figure 5-5. Connect Device From PSoC Creator and Program

 Once programming is successful, the blue LED (LED1) on the board should start displaying the breathing effect at approximately 1-Hz rate. From the Workspace Explorer in PSoC Creator, open the CE97634 PSoC 4 Breathing LED.pdf as shown in Figure 5-6. This document provides details of the code example.

Figure 5-6. Project Datasheet - CE97634 PSoC 4 Breathing LED.pdf





## 5.2 Using Built-in PSoC Creator Code Examples with the Kit

Follow these steps to open and use the built-in PSoC Creator examples.

- Launch PSoC Creator from Start > All Programs > Cypress > PSoC Creator<version> > PSoC Creator <version>.
- 2. On the Start Page, click **Find Example Project...** under **Examples and Kits**, as shown in Figure 5-7.

× Start Page PSoC<sup>®</sup> Creator<sup>™</sup> Source Recent Projects Components Create New Project ... Open Existing Project... Getting Started Datasheets PSoC Creator Start Page Quick Start Guide Intro to PSoC Intro to PSoC Creator Results PSoC Creator Training Design Tutorials Getting Started With PSoC 3 Getting Started With PSoC 4 Getting Started With PSoC 5LP Getting Started with PSoC 4 BLE Getting Started with PRoC BLE Examples and Kits Find Example Project. 🕀 Kits 💋 Product Information PSoC Creator PSoC Programmer PSoC 3 PSoC 4 PSoC 5LP PSoC 4 BLE PRoC BLE  $\nabla$ Resources

Figure 5-7. PSoC Creator Find Example Project...

3. In the Find Example Project window, set the **Device Family** to **PSoC 4200M** as shown in Figure 5-8.



a chample Project				ß
Filter Options				
Device Family:	PSoC 4200M	Documentation	Sample Code 🔒	4
Keyword: Project Name: VDC_DifferentialMode VDC_Differential_Pres VDC_DMA_VDAC VDC_Mulinp VDC_SAR_Seq_DieT VDC_SAR_Seq_DieT VDC_SAR_Seq_DieT VDC_SAR_Seq_DieT VDC_SigeEndedMo VDC_VoltageInp 3asicDesign 3LE_AlertNotification 3LE_Bettery_Level 3LE_Doving_Sensor 3LE_Device_Informat 3LE_Device_Informat 3LE_External_Memorg 3LE_FindMe 3LE_External_Memorg 3LE_FindMe 3LE_Glucose_Meter 3LE_Heart_Rate_Ser 3LE_Heart_Rate_Ser 3LE_Hone_Alert 3LE_Phone_Alert 3LE_Proximity 3LE_Proximity 3LE_Reveloce	All PSoC 3 PSoC 4000 PSoC 4100 PSoC 4200 PSoC 4200 BLE PSoC 4200 BLE PSoC 4200 BLE PSoC 4200 BLE PSoC 4200M (PSoC 5LP mple de Sensor cose_Monitoring_Sensor tion_Service Sensing y_Bootloadable y_Bootloadable y_Bootloadable y_Bootloadable	There is currently n selected from the li project.	o project selected. When an st, this tab will display inform	e example project is nation about that

Figure 5-8. Selecting PSoC 4200M Device Family in Find Examples Window

- 4. You can use any project that appears in the list with the kit. As an example, we will select the **ADC\_SAR\_Seq\_DieTemp\_PSoC4** project and see how to use it with CY8CKIT-043.
- 5. Select the ADC\_SAR\_Seq\_DieTemp\_PSoC4 project and click the Create New Workspace button. Save the workspace to a desired location. See Figure 5-9.



nd Example Project	? <mark>×</mark>
Filter Options	
Device Family: PSoC 4200M	Documentation Sample Code
Keyword: All	
Project Name:	ADC_SAR_Seq_DieTemp_PSoC4 example project
ADC_Differential_Preamplifier	20
Rote_costs_stat_ubit_instance           Pototadabit_PSot4_txample           Boottoadabit_PSot4_txample           CAN_Fail_P4_Example           CaN_Fuil_P4_Example           CaN_Fuil_P4_Example           Cohange           Cock_P4_Example           Cohange           Cock_P4_Example           Cock_P4_Example           Constant           Constant           Digital_Pins           DMA_ADC_PSoC4           DMA_MEMCPY_PSoC4           DMA_VART_PSoC4           Flash_Example           LPC_CONSTANC_PSoC4           Interrupts_Example           PCOmparator_PSoC4_Example           Hibernate_PSoC4_Example           PComparator_PSoC4_Example           Multiplexed_Comparator           OpAmp_PSoc4           PM_SOE_UN_Slave_Example           P4_SOE_UN_Slave_Example           P4_SOE_UN_Slave_Example           P4_SOE_UN_Slave_Example           PMSuThermExample           PWMSample           QuadDecExample           PC_P4_SysTick_Example	<section-header><section-header><section-header><section-header><section-header></section-header></section-header></section-header></section-header></section-header>
	Create New Workspace Cancel

Figure 5-9. ADC\_SAR\_Seq\_DieTemp\_PSoC4 Code Example

6. This example project measures an input voltage in the range 0 to 1.024 V on a pin and sends the measured voltage and device die temperature over UART. In addition, the project controls the brightness of an LED using a PWM based on the value measured by the ADC. Map the UART and LED pins as shown in Figure 5-10 to use the example with the kit. The pin used to measure an analog input voltage using the ADC can be mapped to any pin.







7. For CY8CKIT-043, make sure the device used is CY8C4247AZI-M485 as shown in Figure 5-11. Build the project and program the kit as explained in Using the Kit Code Example on page 33.

Figure 5-11. Device Selector Settings

20 Workspace 'AUC_SAR_Seq_DieTemp_PSoC403 - CY8C4247AZI-M485]														
Project 'ADC_SAR_Sec	Set As Active Project													
ADC_SAR_Seq_DieTe	Add	Add												
🕀 🗀 Header Files	Build ADC_SAR_Seq_DieTemp_PSoC403													
Source Files	Clean ADC_SAR_Seq_DieTemp_PSoC403			1										
🖵 🖸 main.c 🎬	Clean and Build ADC_SAR_Seq_DieTemp_	PSoC403												
ADC_SAR_Seq_DieTe     Generated_Source	Updat <u>e</u> Components							(MH <sub>2</sub>						
🖻 🗁 PSoC4 🛛 🗈	Copy	Ctrl+C	1	and the second				sucy			ytes			
	Paste	Ctrl+V		. S. Aller.				ənbə	Ŷ	(KB)	Ξ		nse	
ADC_SAR	Save ADC_SAR_Seq_DieTemp_PSoC403 A	5			a	- Aline		lax Fr	ash (	MM	:PRO		apSei	
-C ADC_SAR	Remove From Workspace				5	<u></u>	ã	Σ	ü	8		2	ت	<u> </u>
	Rename	F2	·/	Filters:		PSoC 4200M		_	_	_		_	_	_
ADC_SAR_SE	Unload/Reload Project			CY8C4247AZA-M483	ARM CM0	PSoC 4200M	48-LQFP	48	128	16	-	38	γ	
h ADC_SAR	Dependencies		-	CY8C4247AZA-M485	ARM CM0	PSoC 4200M	64-TQFP	48	128	16	-	51	Y	
	Build Order			CY8C4247AZI-M475	ARM CM0	PSoC 4200M	64-TQFP	48	128	16	-	51	-	
ADC_SAR	Device Selector			CY8C4247AZI-M485	ARM CM0									
E Clock	Degree Selectoria.		-	CY8C4247AZS-M475	ARM CM0	PSoC 4200M	64-TQFP	48	128	16	-	51	-	
Clock.c	Archive Workspace/Project			CY8C4247AZS-M483	ARM CM0	PSoC 4200M	48-LQFP	48	128	16	-	38	γ	
Lin Clock.h	Export to IDE (ADC_SAR_Seq_DieTemp_PS	GoC403)	- 1	CY8C4247AZS-M485	ARM CM0	PSoC 4200M	64-TQFP	48	128	16	-	51	γ	
cm0gcc.l	Project Reso <u>u</u> rces			CY8C4247LTI-M475	ARM CM0	PSoC 4200M	68-QFN	48	128	16	-	55	γ	
- 🗋 Cm0Iar.ic	Build Settings			•		III								
Cm0Real Cm0Real	Properties			29 of 391 devices found	d <u>Clear Filte</u>	rs								
C Cm05tart.c	►	∧ Analog 🔡	to	Start Auto Select										
The second			L.											

8. Open *ADC\_SAR\_Seq\_DieTemp\_PSoC4.pdf* from the Workspace Explorer to learn more about the example project and its configuration.See Figure 5-12.



Workspace Explorer (1 project)	<b>д X</b>
· · · · · · · · · · · · · · · · · · ·	
Workspace 'ADC_SAR_Seq_DieTemp_PSoC403' (1)	Prc
E Project 'ADC_SAR_Seq_DieTemp_PSoC403'	[C v]
	Ğ
ADC_SAR_Seq_DieTemp_PSoC403.cydwr	6
🖨 🧀 Header Files	0
h device.h	mp
🖨 🧀 Source Files	0ne
C main.c	nts
ADC_SAR_Seq_DieTemp_PSoC4.pdf	2
⊕- 🛅 Generated_Source	Data
	5

Figure 5-12. Project Datasheet: ADC\_SAR\_Seq\_DieTemp\_PSoC4

9. You can view the die temperature value and ADC measured voltage through any terminal emulator program like PuTTY or HyperTerminal. Refer to chapter 5 of the KitProg User Guide for details on how to configure and use the software with KitProg. The UART used in the example uses configuration provided in Table 5-1. The output with PuTTY software is shown in Figure 5-13.

Table 5-1. UART Settings

UART Parameter	Setting
Data bits	8
Stop bits	None
Parity bits	None
Baud rate	115200 bps

Figure 5-13.	ADC SAR	Seg DieTemp	PSoC4 Out	but in PuTTY
J				

P COM67 - PuTTY	J
ADC measured voltage: 64mV	]
Temperature value: 290	
ADC measured voltage: 64mV	н
Temperature value: 290	н
ADC measured voltage: 64mV	I.
Temperature value: 290	I.
ADC measured voltage: 64mV	н
Temperature value: 290	
ADC measured voltage: 64mV	
Temperature value: 29C	
ADC measured voltage: 64mV	
Temperature value: 29C	
ADC measured voltage: 66mV	
Temperature value: 29C	н
ADC measured voltage: 110mV	
Temperature value: 29C	
ADC measured voltage: 545mV	
Temperature value: 29C	
ADC measured voltage: 841mV	
Temperature value: 29C	
ADC measured voltage: 841mV	
Temperature value: 290	
ADC measured voltage: 840mV	

## A. Appendix



## A.1 PSoC 4 M-Series Prototyping Kit Schematics









## A.2 Programming the PSoC 4 M-Series Prototyping Kit Using MiniProg3/KitProg

The target board allows you to program the PSoC 4200M device using a MiniProg3 or an external KitProg via the 5-pin SWD header or the 10-pin JTAG header. To do this, connect wires or a 5-pin 100-mil spaced header to J3 or a 10-pin JTAG header to J5 on the target board. The PSoC 4 M-Series Prototyping kit supports both power cycle and reset programming modes.

Figure A-1. Connecting CY8CKIT-043 to MiniProg3



**Note:** CY8CKIT-002 MiniProg3 is not part of the PSoC 4 M-Series Prototyping kit contents and can be purchased from the Cypress Online Store.



## A.3 Bill of Materials

Item	Qty	Reference	Value	Description	Manufacturer	Mfr Part Number
1	1	600-60250-01 REV03	-	PCB, 112 mm x 24.13 mm, High Tg, ENIG fin- ish, 2 layer, Color = RED, Silk = WHITE	Cypress Semicon- ductor	600-60250-01
2	14	C1,C4,C5,C6,C8,C 11,C14,C18,C19,C 20,C22,C29,C33,C 34	0.1 uFd	CAP CER 0.1UF 10V 10% X5R 0402	TDK Corporation	C1005X5R1A104K050 BA
3	13	C3,C15,C16,C17,C 21,C23,C24,C25,C 26,C27,C28,C31,C 32	1.0 uFd	CAP CERAMIC 1.0UF 25V X5R 0603 10%	Taiyo Yuden	TMK107BJ105KA-T
4	1	C9	18 pF	CAP CER 18PF 50V 1% NP0 0402	Murata Electronics	GRM1555C1H180FA01 D
5	1	C10	2200 pFd	CAP CER 2200PF 50V 5% NP0 0805	Murata	GRM2165C1H222JA01 D
6	1	C12	36 pF	CAP CER 36PF 50V 5% NP0 0402	Murata Electronics	GRM1555C1H360JA01 D
7	1	C13	10000 pFd	CAP CER 10000PF 50V 5% NP0 0805	Murata	GRM2195C1H103JA01 D
8	1	D1	MBR0520L	DIODE SCHOTTKY 0.5A 20V SOD-123	Fairchild Semicon- ductor	MBR0520L
9	1	F1	PTC Resetta- ble Fuse	FUSE, PTC Resettable, 0.50A, 16V, 1210, SMD	Bel Fuse Inc	0ZCH0050FF2G
10	1	LED1	User LED BLUE	LED, BLUE, CLEAR, 0805, SMD	Lite-On Inc	LTST-C170TBKT
11	1	LED2	Power LED Amber	LED 595NM AMB DIFF 0805 SMD	Avago Technolo- gies	HSMA-C170
12	1	LED3	Status LED Green	LED GREEN CLEAR 0805 SMD	Chicago Miniature	CMD17-21VGC/TR8
13	3	L1,L2,L3	330 OHM @ 100MHz	FILTER CHIP 330 OHM 1.5A 0603	Murata Electronics	BLM18SG331TN1D
14	2	R2,R3	15K	RES SMD 15K OHM 5% 1/10W 0402	Panasonic - ECG	ERJ-2GEJ153X
15	2	R4,R5	22E	RES SMD 22 OHM 1% 1/ 10W 0402	Panasonic - ECG	ERJ-2RKF22R0X
16	2	R6,R8	2.2K	RES 2.2K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ222V
17	2	R7,R22	ZERO	RES 0.0 OHM 1/8W 0805 SMD	Panasonic-ECG	ERJ-6GEY0R00V
18	1	R9	560 ohm	RES 560 OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ561V
19	2	R10,R12	30K	RES SMD 30K OHM 5% 1/10W 0402	Panasonic - ECG	ERJ-2GEJ303X
20	12	R11,R13,R14,R16, R17,R18,R20,R21, R24,R26,R27,R28	ZERO	RES 0.0 OHM 1/8W 0603 SMD	Panasonic-ECG	ERJ-3GEY0R00V
21	1	R15	560 ohm	RES 560 OHM 1/8W 5% 0805 SMD	Panasonic - ECG	ERJ-6GEYJ561V



ltem	Qty	Reference	Value	Description	Manufacturer	Mfr Part Number
22	1	R19	820 ohm	RES 820 OHM 1/8W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ821V
23	2	SW1,SW3	SW PUSH- BUTTON	SWITCH TACTILE SPST- NO 0.05A 32V	C&K Components	KMR221GLFS
24	1	U1	PSoC 5LP	68QFN PSoC 5LP chip for USB debug channel and USB-Serial interface	Cypress Semicon- ductor	CY8C5868LTI-LP039
25	1	U2	PSoC 4200M	68TQFP PSoC 4M	Cypress Semicon- ductor	CY8C4247AZI-M485
26	1	U3	DUAL PMOS	MOSFET 2P-CH 20V 430MA SOT-563	ON Semiconductor	NTZD3152PT1G
Label						
27	1	N/A	N/A	LBL, PCA Label, Vendor Code, Datecode, Serial Number 121-60220-01 Rev 03 (YYWWV- VXXXXX)	Cypress Semicon- ductor	
No lo	ad coi	mponents				
28	2	C2,C30	0.1 uFd	CAP CER 0.1UF 10V 10% X5R 0402	TDK Corporation	C1005X5R1A104K050 BA
29	1	C7	1.0 uFd	CAP CERAMIC 1.0UF 25V X5R 0603 10%	Taiyo Yuden	TMK107BJ105KA-T
30	1	J4	HDR 1x2	CONN HEADR BRKWAY .100 02POS STR	TE Connectivity	9-146280-0-02
31	1	J5	50MILKEYED SMD	CONN HEADER 10 PIN 50MIL KEYED SMD	Samtec	FTSH-105-01-L-DV-K
32	1	R1	4.7K	RES SMD 4.7K OHM 5% 1/10W 0402	Panasonic - ECG	ERJ-2GEJ472X
33	1	R25	ZERO	RES 0.0 OHM 1/8W 0805 SMD	Panasonic - ECG	ERJ-6GEY0R00V
34	1	R23	4.7K	RES 4.7K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ472V
35	1	SW2	SW PUSH- BUTTON	SWITCH TACTILE SPST- NO 0.05A 32V	C&K Components	KMR221GLFS
36	1	SW4	DPDT SW	SWITCH SLIDE DPDT 200MA 12V	Copal Electronics	CL-SB-22B-02T
37	1	TP5	BLACK	TEST POINT 43 HOLE 65 PLATED BLACK	Keystone Electron- ics	5001
38	4	TP1,TP2,TP3,TP4	RED	TEST POINT 43 HOLE 65 PLATED RED	Keystone Electron- ics	5000
39	1	U4	EZ-BLE	EZ-BLE PRoC BLE Mod- ule, 10 mm X 10 mm X 1.8 mm	Cypress Semicon- ductor	CYBLE-022001-00

## **Revision History**



## CY8CKIT-043 $PSoC^{@}4$ M-Series Prototyping Kit Guide Revision History

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Document Number: 001-97606			
Revision	Issue Date	Origin of Change	Description of Change
**	06/25/2015	MSUR	New kit guide

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