CY8CKIT-149 PSOC™ 4100S Plus Prototyping Kit guide

About this document

Scope and purpose

This guide helps you get acquainted with the CY8CKIT-149 PSOC™ 4100S Plus Prototyping Kit. The document explains the kit operation, describes the out-of-the-box (OOB) example and its operation, and the hardware details of the board.

Intended audience

This kit is intended for all technical specialists familiar with the PSOC™ 4 MCU and CAPSENSE™.

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Safety precautions

***Note**: Please note the following warnings regarding the hazards associated with development systems.*

Table 1 Safety precautions

	**Caution:** *The evaluation or reference board contains parts and assemblies sensitive to electrostatic discharge (ESD). Electrostatic control precautions are required when installing, testing, servicing or repairing the assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with electrostatic control procedures, refer to the applicable ESD protection handbooks and guidelines.*

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Table of contents

About this document . . . 1
Important notice . . . 2
Safety precautions . . . 3
Table of contents . . . 4
1 Introduction . . . 6
1.1 Kit contents . . . 6
1.2 Getting started . . . 8
1.3 Board details . . . 9
1.4 Additional learning resources . . . 12
1.5 Technical support . . . 12
2 Kit operation . . . 13
2.1 Theory of operation . . . 13
2.2 Using the OOB example – CE237532 . . . 17
2.3 Creating a project and program/debug using ModusToolbox™ software . . . 18
3 Hardware . . . 23
3.1 Schematics . . . 23
3.2 Functional description . . . 23
3.2.1 PSOC™ 4100S Plus MCU features . . . 23
3.2.1.1 PSOC™ 4100S Plus device power supply system . . . 24
3.2.1.2 Measure PSOC™ 4100S Plus current consumption . . . 25
3.2.1.3 Board separation (snapping) . . . 25
3.2.1.4 Header connections . . . 26
3.2.1.5 Reset button . . . 29
3.2.2 PSOC™ 5LP-based KitProg3 programmer and debugger . . . 29
3.2.2.1 KitProg3 onboard target voltage measurement . . . 30
3.2.2.2 KitProg3 programming mode selection button and status LED . . . 31
3.2.2.3 USB-UART bridge . . . 32
3.2.2.4 USB-I2C bridge . . . 32
3.2.3 CAPSENSE™ . . . 33
3.2.3.1 Capacitive sensing . . . 34
3.2.4 System capacitors . . . 34
3.2.5 User LEDs . . . 35
3.2.6 User button . . . 35
3.2.7 AIROC™ Bluetooth® LE module . . . 36
3.3 Bill of materials . . . 38
Glossary . . . 39
Revision history . . . 41

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Table of contents

Trademarks 44

Disclaimer 45

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1 Introduction

Thank you for your interest in the CY8CKIT-149 PSOC™ 4100S Plus Prototyping Kit. The PSOC™ 4100S Plus Prototyping Kit is designed as an easy-to-use and inexpensive prototyping platform. The PSOC™ 4100S Plus Prototyping Kit supports the PSOC™ 4100S Plus device, delivering a complete system solution for a wide range of embedded applications at a very low cost. The PSOC™ 4100S Plus device is a true programmable embedded system-on-chip, integrating custom digital peripheral functions, memory, and an Arm® Cortex®-M0+ MCU on a single chip with flexible automatic routing. The programmable digital peripheral functions allow higher flexibility, in-field tuning of the design, and faster time-to-market. It is a combination of an MCU with standard communication and timing peripherals and a capacitive touch sensing system with best-in-class performance.

The PSOC™ 4100S Plus Prototyping Kit offers an open-footprint breakout board to maximize the end utility of the PSOC™ 4100S Plus device. This kit provides a low-cost alternative to device samples while providing a platform to easily develop and integrate the PSOC™ 4100S Plus device into your end system. In addition, the board includes the following features:

- Two LEDs to provide feedback (one each for the 4100S Plus device and AIROC™ Bluetooth® LE module)
- A push button to provide a simple user input
- Three CAPSENSE™ buttons of different sizes with feedback LEDs
- 6-Segment CAPSENSE™ slider with feedback LEDs
- AIROC™ Bluetooth® LE module with feedback LED
- External ECO crystal (4 MHz)
- External WCO crystal (32.768 kHz)
- 1.8 V to 5 V operation

The CY8CKIT-149 PSOC™ 4100S Plus Prototyping Kit also integrates KitProg3, which enables onboard programming, debugging, and bridging functionalities, such as USB-UART and USB-I2C. KitProg3 is used to program and debug the target PSOC™ 4100S Plus device and AIROC™ Bluetooth® LE module (see AIROC™ Bluetooth® LE module). The prototyping kit allows you to separate the KitProg3 board from the target PSOC™ 4100S Plus Board. See the AN85951 - PSOC™ 4 and PSOC™ 6 MCU CAPSENSE™ design guide for details and features of the CAPSENSE™.

You can use ModusToolbox™ software to develop and debug your PSOC™ 4 projects. ModusToolbox™ software is a set of tools that enables you to integrate Infineon devices into your existing development methodology.

If you are new to PSOC™ 4 and the ModusToolbox™ software IDE, see the AN79953 - Getting started with PSOC™ 4 MCU to familiarize yourself with the PSOC™ 4 and help you in creating your own design.

1.1 Kit contents

The CY8CKIT-149 PSOC™ 4100S Prototyping Kit contains the following:

- PSOC™ 4100S Prototyping Board
- Quick start guide (part of packaging)

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1 Introduction

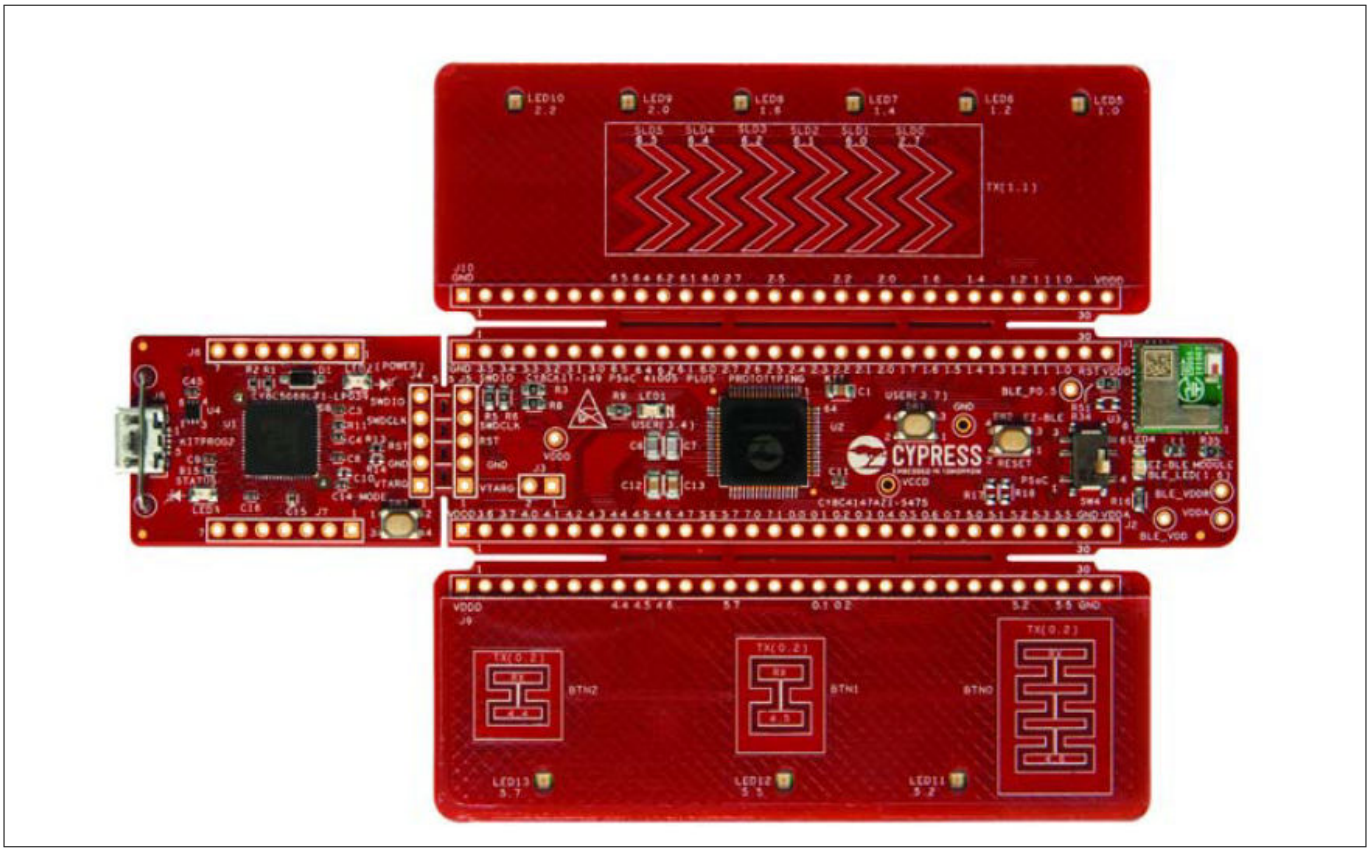

Figure 1 **CY8CKIT-149 PSOC™ 4100S Prototyping Board**

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1 Introduction

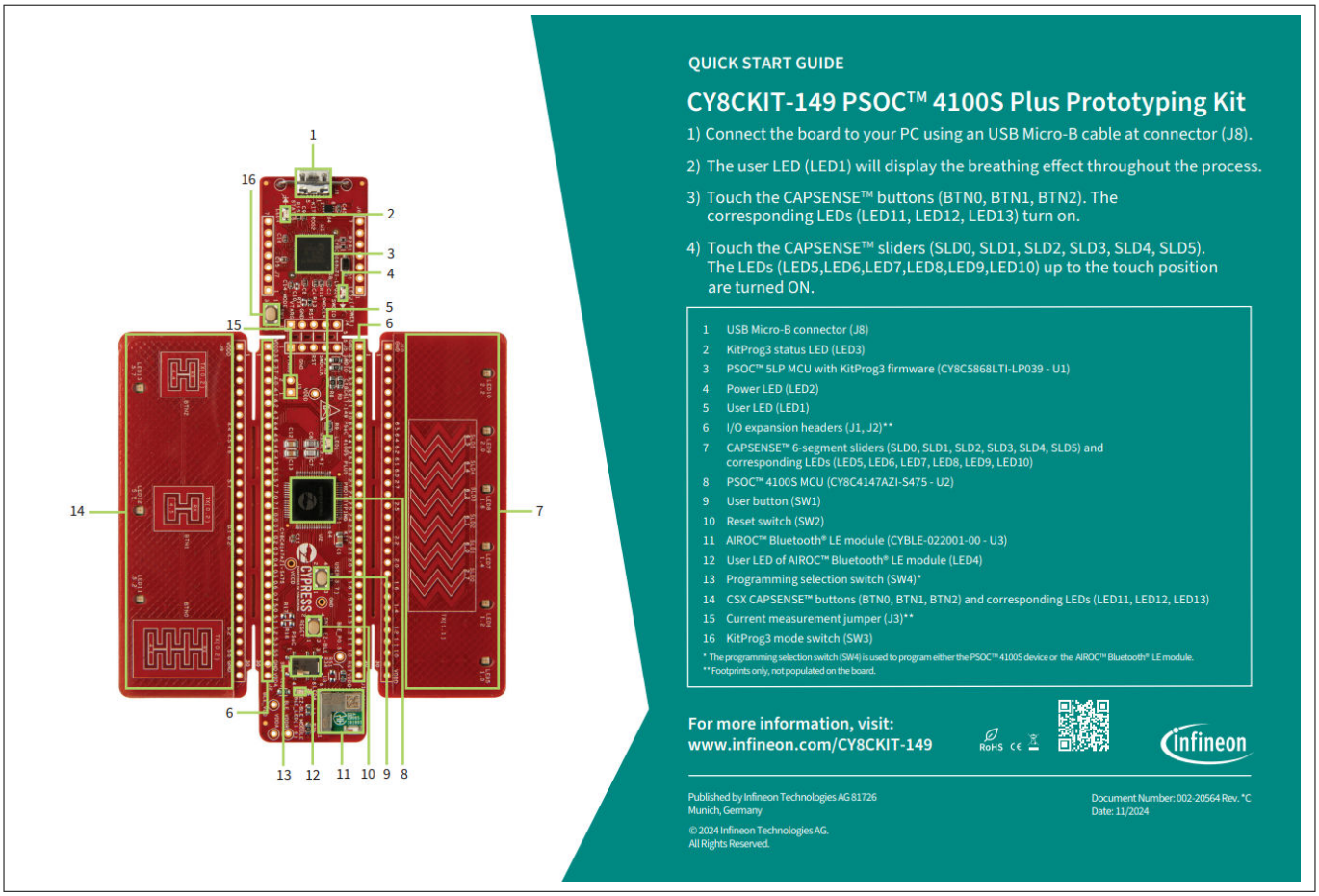

Figure 2 CY8CKIT-149 PSOC™ 4100S Prototyping Kit quick start guide

Inspect the kit's contents; if you find any part missing, go to Infineon's Support Page for assistance.

1.2 Getting started

This guide helps you get acquainted with the CY8CKIT-149 PSOC™ 4100S Plus Prototyping Kit.

- See the Kit operation section for an overview of PSOC™ 4100S device features. Follow the Using the OOB example – CE237532 section to have a quick review of the OOB project preprogrammed in this kit. It also provides the steps to create a project and program/debug using the ModusToolbox™ software
- See the Hardware section for the detailed hardware description, kit schematics, rework instructions, and the bill of materials (BOM)
- Use ModusToolbox™ software for application development using the CY8CKIT-149 PSOC™ 4100S Plus Prototyping Kit. For the latest software support for this development kit, see the kit webpage
  - ModusToolbox™ software is a free development ecosystem that includes the Eclipse IDE for the ModusToolbox™ software. Using the ModusToolbox™ software, you can enable and configure device resources, middleware libraries, and program and debug the device. You can download the software from the ModusToolbox™ software home page. For additional information, see the Eclipse IDE for ModusToolbox™ user guide
- See the wide range of code examples to evaluate the CY8CKIT-149 PSOC™ 4100S Plus Prototyping Kit. These examples help you familiarize with the PSOC™ 4100S device and create the design. You can also find code examples on the GitHub page dedicated to ModusToolbox™ software-based examples
  - To access code examples through ModusToolbox™ software, see the "Software development for PSOC™ 4" section in AN79953 - Getting started with PSOC™ 4 MCU under "PSOC™ 4 software resources"

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1.3 Board details

The PSOC™ 4100S Plus Prototyping Board has the following features:

- PSOC™ 4100S Plus device U2 (CY8C4147AZI-S475)
- PSOC™ 4100S Plus I/O headers J1 and J2
- KitProg3 (PSOC™ 5LP) device U1 (CY8C5868LTI-LP039)
- KitProg3 I/O headers J6 and J7
- SWD connection headers J4 and J5
- USB 2.0 Micro-B connector J8
- AIROC™ Bluetooth® LE Module U3
- ECO crystal (4 MHz)
- WCO crystal (32.768 kHz)
- One DPDT switch SW4 to select the SWD target device
- One blue LED, LED1 (User)
- One amber LED, LED2 (Power)
- One amber LED, LED3 (KitProg3 status)
- One blue LED, LED4 (AIROC™ Bluetooth® LE module user)
- One push button SW1 (User)
- One push button SW2 (Reset)
- One push button SW3 (KitProg3 mode)
- Current measurement jumper J3 (foot-print only) (shorted by zero ohm resistor R53)
- CAPSENSE™ sensors (three buttons BTN0, BTN1, and BTN2; one linear slider with six segments SLD0, SLD1, SLD2, SLD3, SLD4, and SLD5)
- Three green LEDs corresponding to CAPSENSE™ buttons (LED11, LED12, and LED13)
- Six green LEDs corresponding to CAPSENSE™ slider (LED5, LED6, LED7, LED8, LED9, and LED10)
- Perforated ‘snappable’ board design
- Overlay on CAPSENSE™ buttons and slider

The following figure shows the pinout of the evaluation board.

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1 Introduction

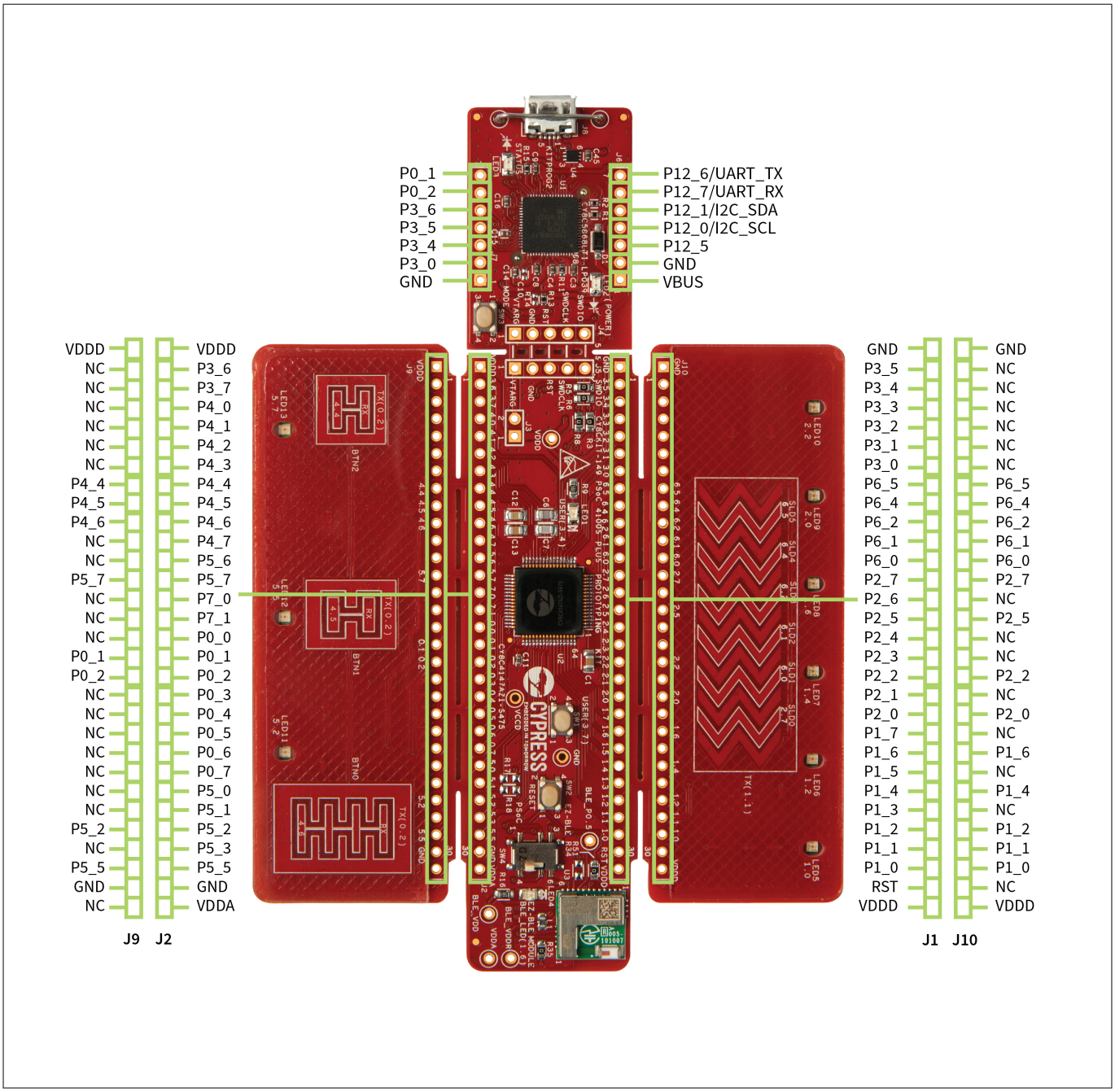

Figure 3 Board pinout

Table 2 Board pinout details

PSOC™ 4 pin	Primary onboard function	Secondary onboard function	Connection details
GND	Ground	-	-
RST	Hardware Reset	-	-
VDDA	Power	-	-
VDDD	Power	-	-
P0.0	GPIO	-	-

(table continues...)

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Table 2 (continued) Board pinout details

PSOC™ 4 pin	Primary onboard function	Secondary onboard function	Connection details
P0.1	BTN SHIELD	-	-
P0.2	BTN_TX	-	-
P0.3	GPIO	-	-
P0.4	WCO IN	-	-
P0.5	WCO OUT	-	-
P0.6	ECO IN	-	-
P0.7	ECO OUT	-	-
P1.0	LED 5	-	CAPSENSE™ slider 0 LED
P1.1	SLD TX	-	CAPSENSE™ slider TX
P1.2	LED 6	-	CAPSENSE™ slider 1 LED
P1.3	GPIO	-	-
P1.4	LED 7	-	CAPSENSE™ slider 2 LED
P1.5	GPIO	-	-
P1.6	LED 8	-	CAPSENSE™ slider 3 LED
P1.7	GPIO	SAR Bypass	-
P2.0	LED 9	-	CAPSENSE™ slider 4 LED
P2.1	GPIO	-	-
P2.2	LED 10	-	CAPSENSE™ slider 5 LED
P2.3	GPIO	-	-
P2.4	GPIO	-	-
P2.5	SLD SHIELD	-	-
P2.6	GPIO	-	-
P2.7	SLD0	-	CAPSENSE™ slider 0
P3.0	I2C_SCL	-	-
P3.1	I2C_SDA	-	-
P3.2	SWDIO	-	SWD interface data I/O
P3.3	SWDCLK	-	SWD interface clock
P3.4	USER LED	-	-
P3.5	GPIO	-	-
P3.6	GPIO	-	-
P3.7	USER SWITCH	-	-
P4.0	GPIO	-	-
P4.1	GPIO	-	-

(table continues...)

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Table 2 (continued) Board pinout details

PSOC™ 4 pin	Primary onboard function	Secondary onboard function	Connection details
P4.2	GPIO	-	-
P4.3	GPIO	-	-
P4.4	BTN2	-	CAPSENSE™ button 2 RX
P4.5	BTN1	-	CAPSENSE™ button 1 RX
P4.6	BTN0	-	CAPSENSE™ button 0 RX
P4.7	GPIO	-	-
P5.0	BLE RX	-	AIROC™ Bluetooth® LE Rx
P5.1	BLE TX	-	AIROC™ Bluetooth® LE Tx
P5.2	LED 11	-	CAPSENSE™ button 0 LED
P5.3	GPIO	-	-
P5.5	LED 12	-	CAPSENSE™ button 1 LED
P5.6	GPIO	-	-
P5.7	GPIO	-	-
P6.0	SLD1	-	CAPSENSE™ slider 1
P6.1	SLD2	-	CAPSENSE™ slider 2
P6.2	SLD3	-	CAPSENSE™ slider 3
P6.4	SLD4	-	CAPSENSE™ slider 4
P6.5	SLD5	-	CAPSENSE™ slider 5
P7.0	UART_RX	-	UART Receive
P7.1	UART_TX	-	UART Transmit

1.4 Additional learning resources

Infineon provides a wealth of data on the PSOC™ 4 product webpage to help you select the suitable PSOC™ device for your design and to help you quickly and effectively integrate the device into your design. Learn how to design capacitive touch-sensing applications with the PSOC™ 4 family of devices using the AN85951 - PSOC™ 4 and PSOC™ 6 MCU CAPSENSE™ design guide.

1.5 Technical support

For assistance, go to Infineon's Support Page or visit community.infineon.com to ask your questions in the Infineon developer community.

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

- Self-help (Technical documents)
- Local sales office locations

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2 Kit operation

This chapter provides an overview of the features of the PSOC™ 4100S device and a quick review of the OOB project preprogrammed in this kit. It also provides the steps to create a project and program/debug using the ModusToolbox™ software.

2.1 Theory of operation

The PSOC™ 4100S Plus Prototyping Kit is built around the PSOC™ 4100S Plus device. Figure 4 shows the block diagram of the PSOC™ 4100S Plus device used on the board. For details of device features, see the device datasheet.

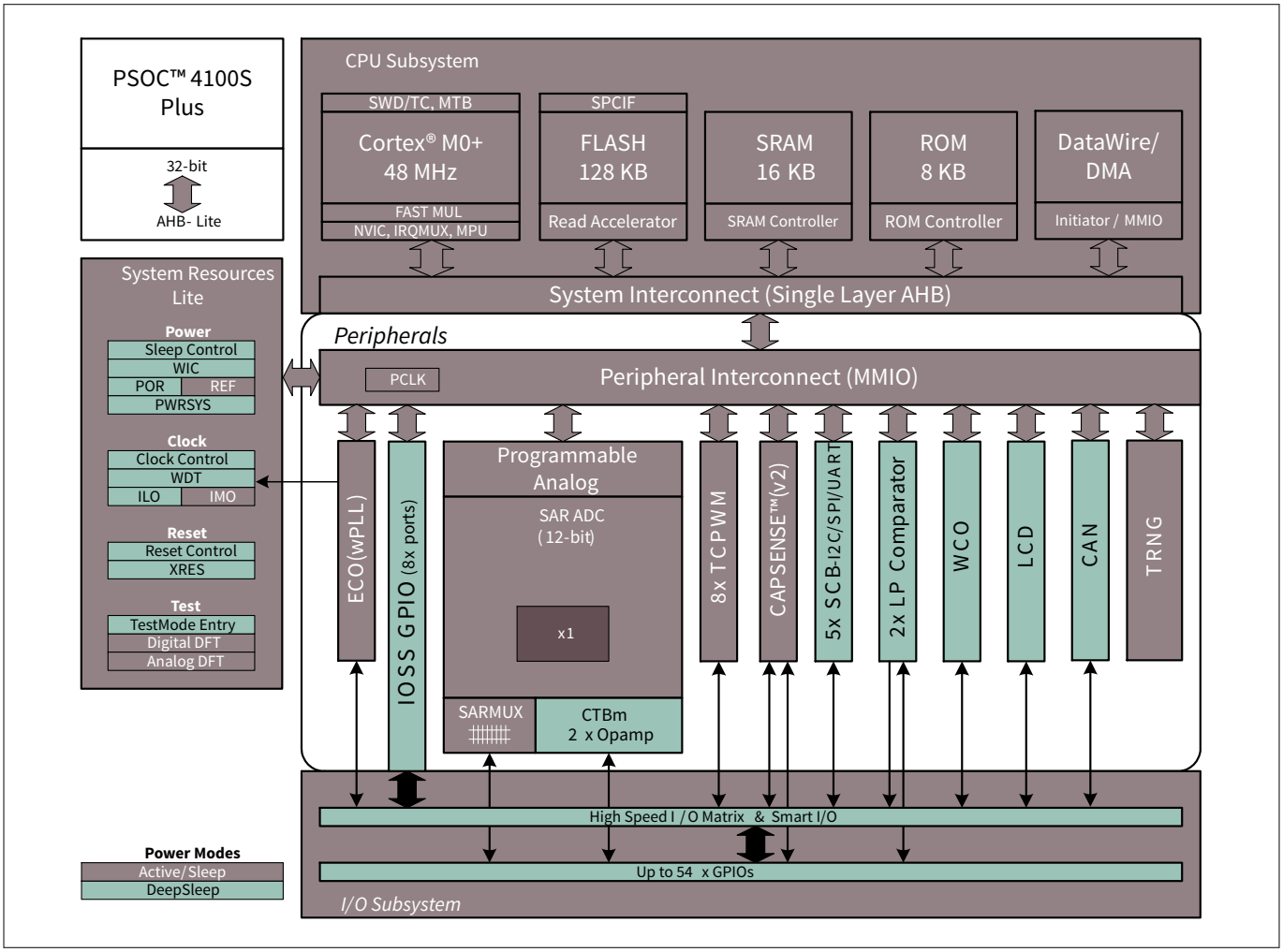

Figure 4 PSOC™ 4100S Plus device block diagram

Figure 5 shows the functional block diagram of the PSOC™ 4100S Plus Prototyping Board.

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2 Kit operation

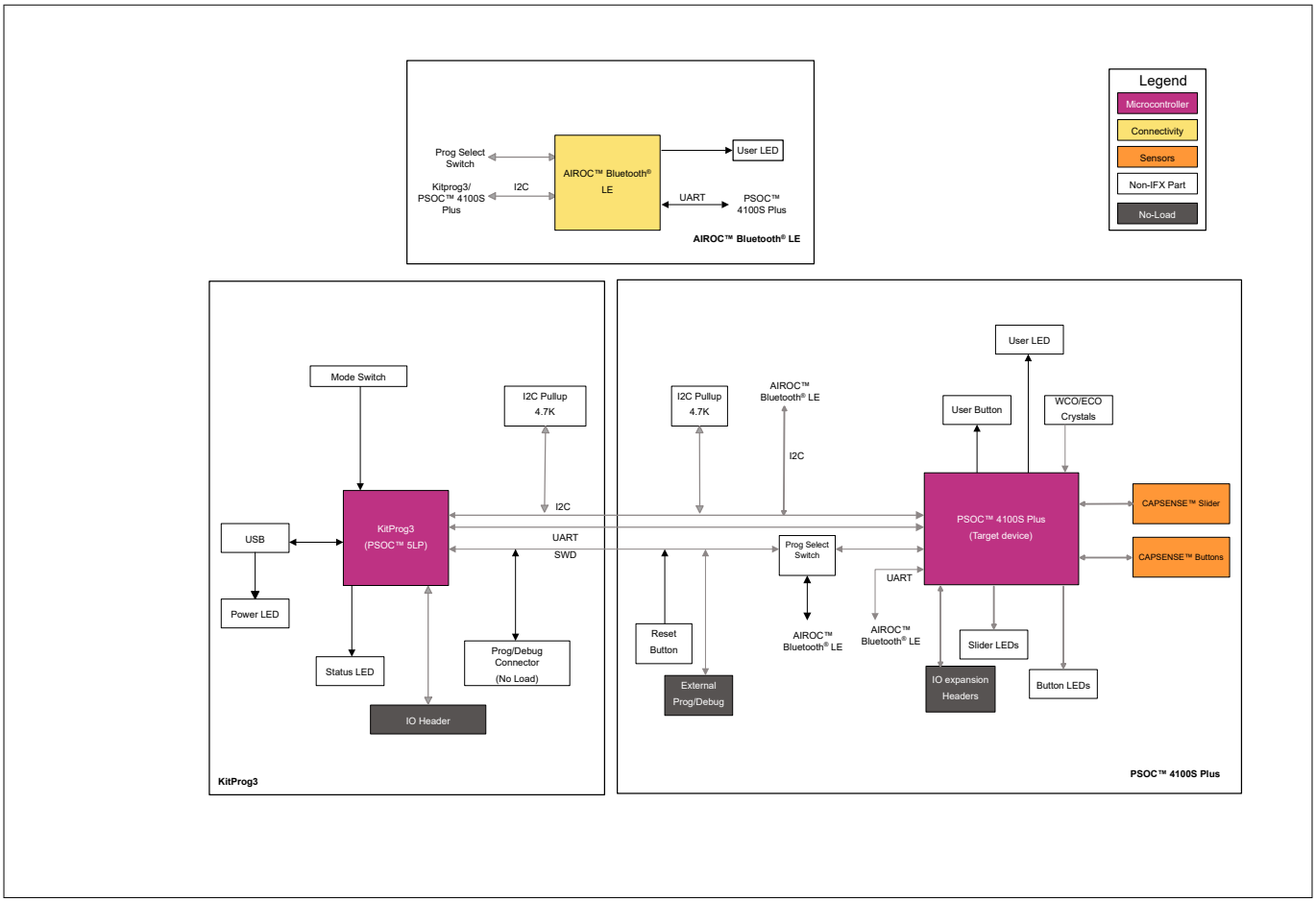

Figure 5 Functional block diagram of the PSOC™ 4100S Plus Prototyping Board

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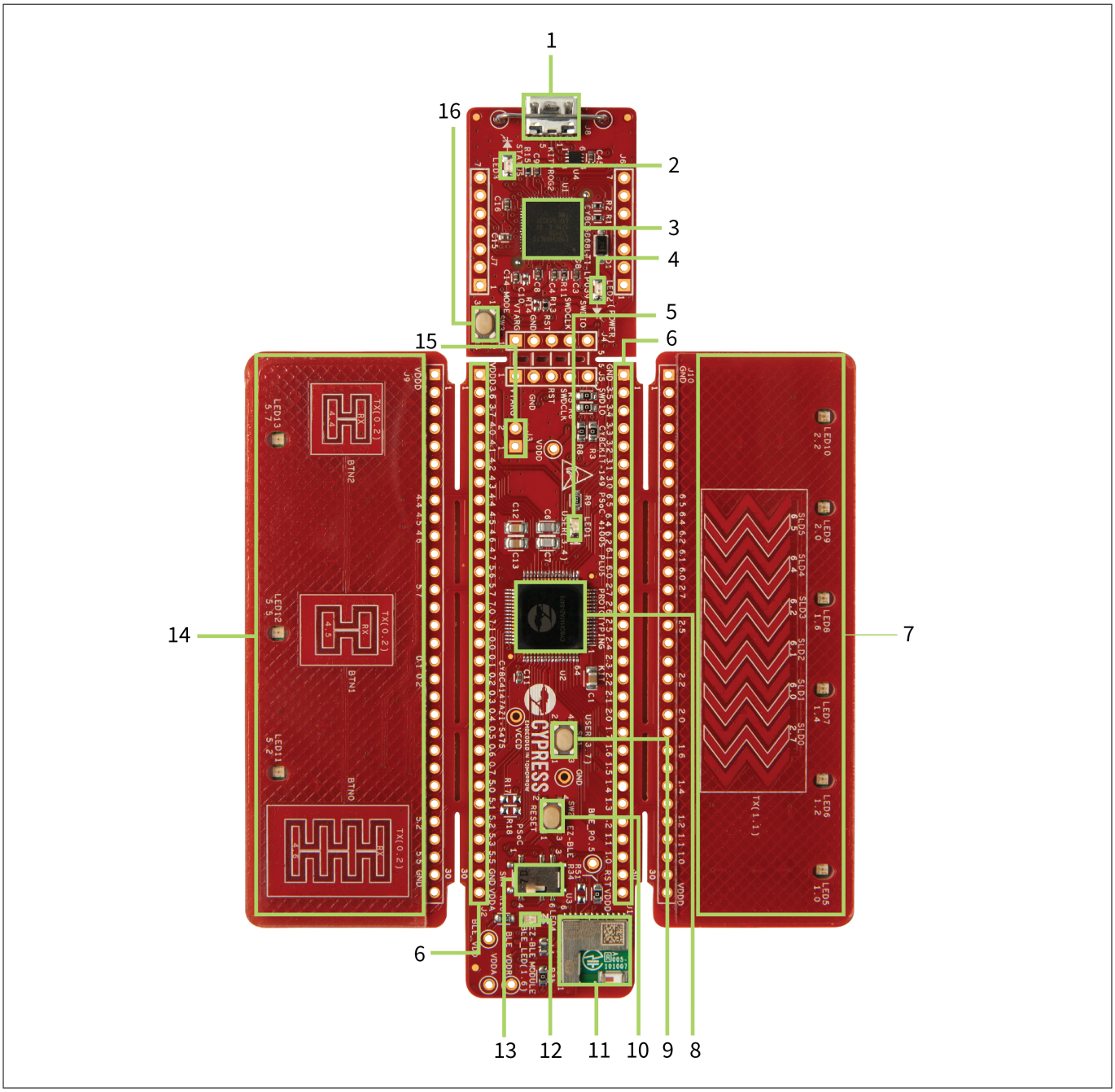

Figure 6 PSOC™ 4100S Plus Prototyping Board top view

The PSOC™ 4100S Plus Prototyping Kit is simple in design and provides complete access to develop applications using the PSOC™ 4100S Plus device family. This board has the following peripherals:

Table 3 Peripheral details

Sl. No.	Peripheral	Description
1	USB Micro-B connector (J8)	Use USB cable to connect kit to PC
2	KitProg3 status LED (LED3)	The amber LED3 indicates the status of KitProg3. For details on the KitProg3 status, see the KitProg3 user guide.

(table continues...)

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Table 3 (continued) Peripheral details

Sl. No.	Peripheral	Description
3	KitProg3 (PSOC™ 5LP) programmer and debugger (CY8C5868LTI-LP039, U1)	The PSOC™ 5LP device (CY8C5868LTI-LP039), serving as KitProg3, is a multifunctional system that includes a SWD programmer, debugger, USB-I2C bridge, and USB-UART bridge. For more details, see the KitProg3 user guide.
4	Power LED (LED2)	The amber power LED is turned on when the kit is connected and powered through a USB cable to a USB Micro-B connector (J8).
5	User LED (LED1)	An onboard LED that can be controlled by the P3.4 pin of the PSOC™ 4100S Plus MCU. The LED is active low, so the pin must be driven to low for turning ON the LED.
6	I/O expansion headers (J1, J2)	The PSOC™ 4100S Plus Prototyping Board brings all GPIOs of the target PSOC™ 4100S Plus device to the two expansion headers, enabling the user to have maximum access to the capabilities of the PSOC™ 4100S device.
7	CAPSENSE™ 6-segment slider and corresponding LEDs	A 6-segment linear slider (SLD0, SLD1, SLD2, SLD3, SLD4, and SLD5) is provided with their corresponding LEDs (LED5, LED6, LED7, LED8, LED9, and LED10).
8	PSOC™ 4100S MCU (U2)	This kit is designed to highlight the features of PSOC™ 4100S Plus (CY8C4147AZI-S475).
9	User button (SW1)	This kit has a push button, which can be used to provide an input to the PSOC™ 4100S Plus device. ***Note**: The switch connects the PSOC™ 4100S Plus device pin (P3.7) to ground when pressed. Therefore, you need to configure the PSOC™ 4100S Plus device pin as a 'resistive pull-up' for detecting the switch press.*
10	Reset switch (SW2)	This button is used to reset PSOC™ 4100S and AIROC™ Bluetooth® LE devices.
11	AIROC™ Bluetooth® LE module (U3)	The kit includes an AIROC™ Bluetooth® LE module for Bluetooth® LE connectivity.
12	User LED of AIROC™ Bluetooth® LE module (LED4)	A blue user LED (LED4) of the AIROC™ Bluetooth® LE module connected to P1.6 of its GPIO.
13	SWD selection switch (SW4)	A DPDT switch is provided on the prototyping board to select the SWD lines of either the PSOC™ 4100S Plus or AIROC™ Bluetooth® LE module for programming.
14	CSX CAPSENSE™ buttons and corresponding LEDs	Three CAPSENSE™ buttons (BTN0, BTN1, and BTN2) are provided with their corresponding LEDs (LED11, LED12, and LED13).
15	Current measurement jumper (J3)	Provision to mount a 2-pin jumper (J3) for measuring the current to the PSOC™ 4100S Plus device. To measure the current consumption of the PSOC™ 4100S Plus device, see the section Measure PSOC™ 4100S Plus current consumption.

(table continues...)

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Table 3 (continued) Peripheral details

Sl. No.	Peripheral	Description
16	KitProg3 programming mode selection button (SW3)	Use this button to switch between various modes of operation of KitProg3. Note that this board supports only CMSIS-DAP BULK mode. For more details, see the KitProg3 user guide. This button function is reserved for future use.

See the Functional description section for details on various hardware blocks.

2.2 Using the OOB example – CE237532

The CY8CKIT-149 PSOC™ 4100S Plus Prototyping Kit is pre-programmed with the CE237532–PSOC™ 4: CAPSENSE™ SmartSense buttons slider code example (CE). This CE demonstrates the key features of CAPSENSE™ technology in PSOC™ 4100S, such as the following:

- Self-capacitance (CSD)-based buttons and slider widgets in PSOC™ 4 devices using the CAPSENSE™ tuner
- CE also demonstrates a breathing effect on the onboard user led using SmartSense and TCPWM blocks

Do the following to use the example: For a detailed description of the project, see the example's README file in the GitHub repository or from the application's top-level directory when the example is created using ModusToolbox™ software.

***Note**: At any point in time, if you overwrite the OOB example, you can restore it by programming the CE237532–PSOC™ 4: CAPSENSE™ SmartSense buttons slider code example (CE). See Creating a project and program/debug using ModusToolbox™ software for programming the board.*

1. Connect the board to the PC using the USB cable through the KitProg3 USB connector, as shown in Figure 7

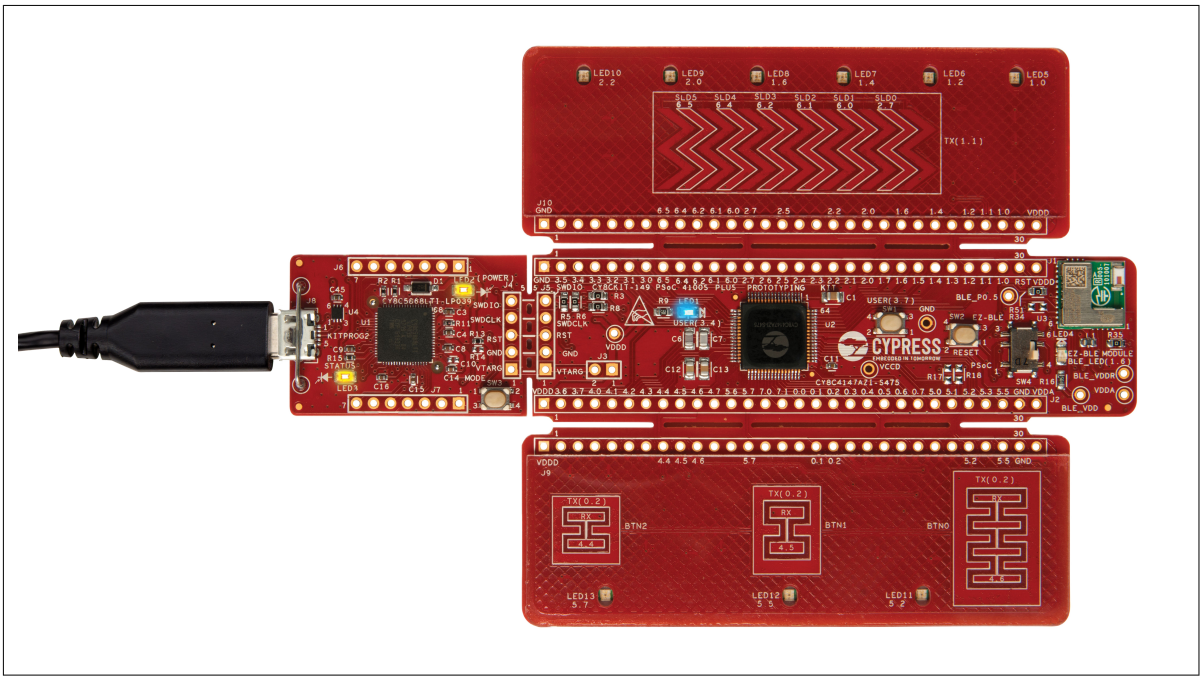

Figure 7 Connect the USB cable to the USB connector on the board

2. Touch the self-capacitance-based button (CSD) Button0, Button1, and Button2 with the finger and observe the LED11, LED12, and LED13 turning ON, respectively, as shown in Figure 8

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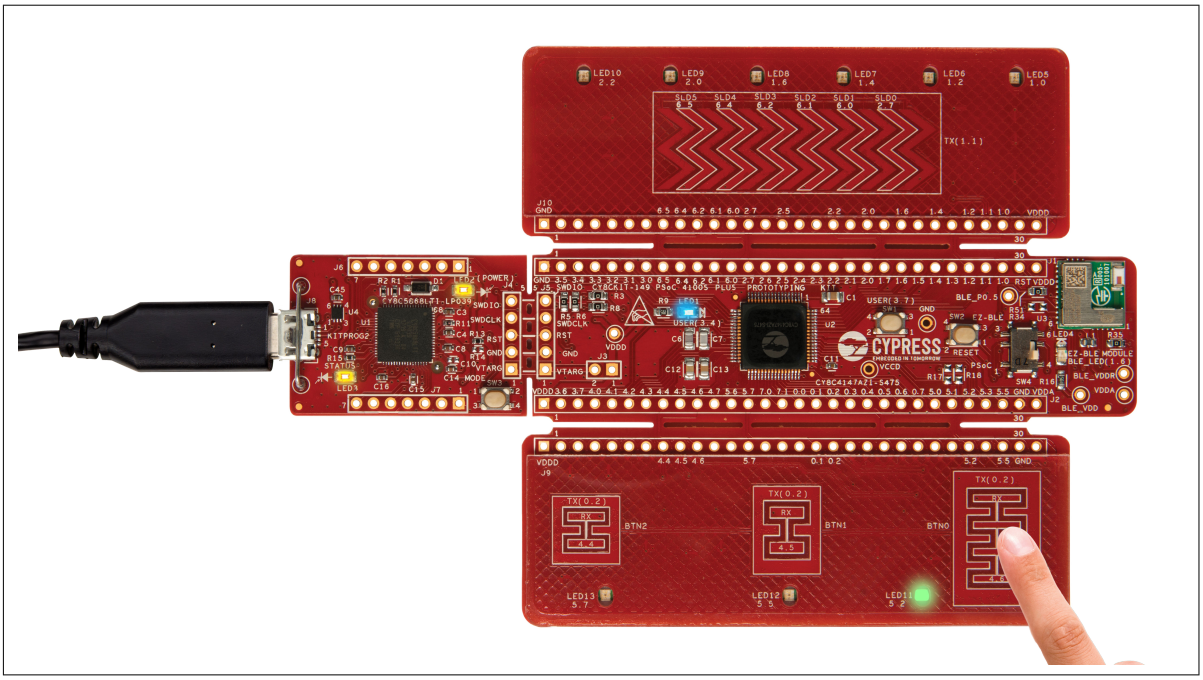

Figure 8 CAPSENSE™ button operation with LED indication

3. Touch the slider with the finger and observe that LED 5, LED 6, LED 7, LED 8, LED 9, and LED 10 turn ON based on touch position, as shown in Figure 9

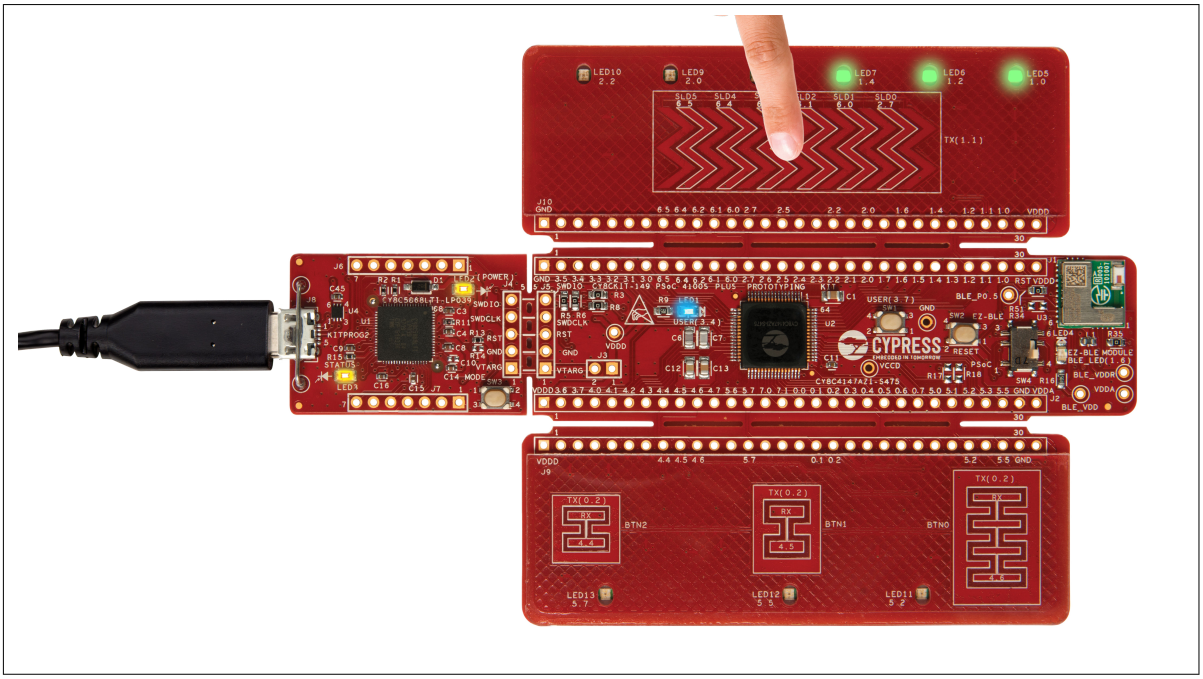

Figure 9 Capacitive slider operation with LED indication

2.3 Creating a project and program/debug using ModusToolbox™ software

This section briefly introduces the project creation, programming, and debugging using the ModusToolbox™ software. For detailed instructions, see **Help** > **ModusToolbox™ General Documentation** > **ModusToolbox™ User Guide**.

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1. Connect the board to the PC using the USB cable through the KitProg3 USB connector (J8). The kit enumerates as a USB composite device if you are connecting it to the PC for the first time. KitProg3 operates in CMSIS-DAP BULK mode; the status LED4 (amber) is always ON in CMSIS-DAP BULK mode.

   If you do not see the correct LED status, see the KitProg3 user guide for details on the KitProg3 status and troubleshooting instructions. For updating the KitProg3 firmware, see the "Updating KitProg3" section in the KitProg3 user guide. For commands, see the Firmware Loader user guide.

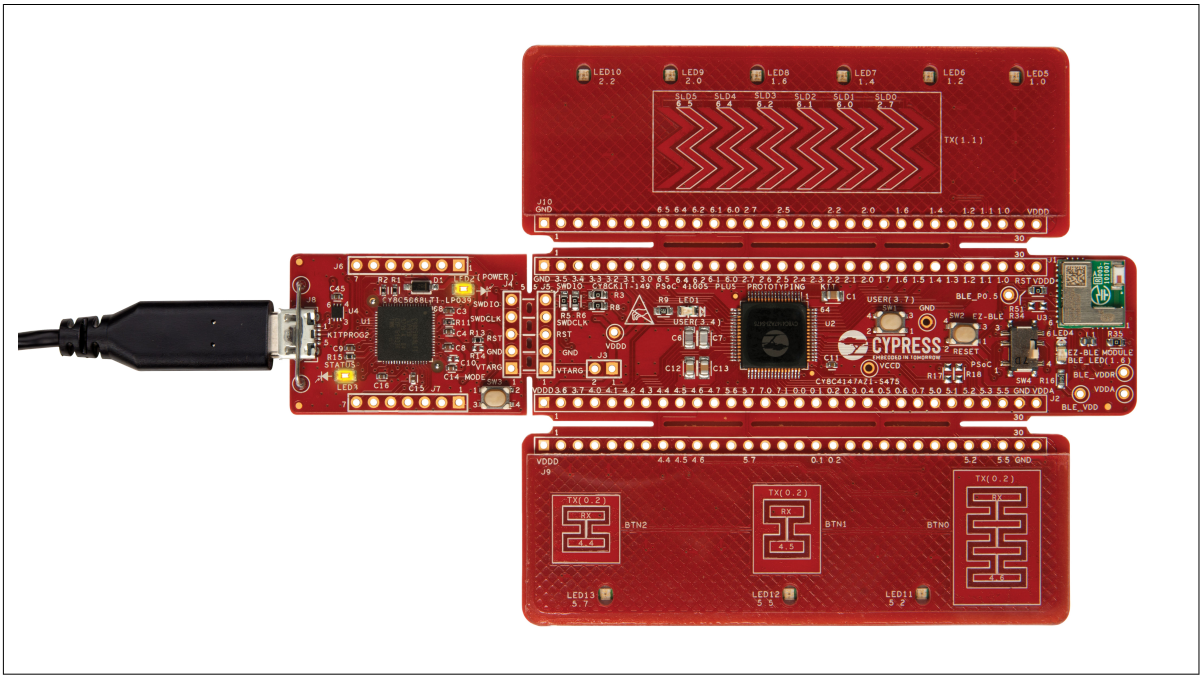

Figure 10 Connect the USB cable to the USB connector on the board

2. To import the required code example (application) into a new workspace in the Eclipse IDE for the ModusToolbox™ software, do the following:

   a. Click **New Application** on the **Quick Panel**

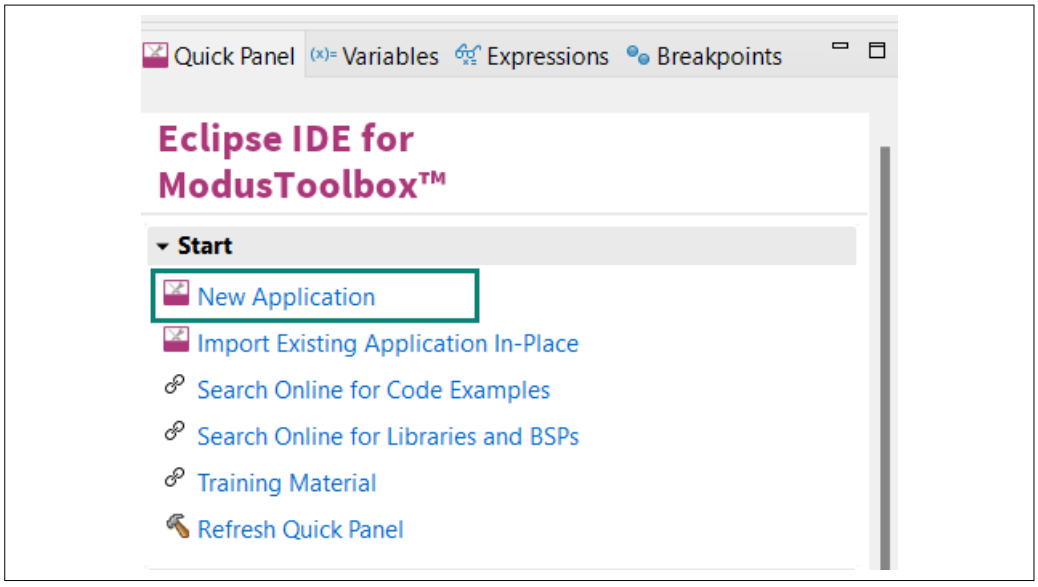

Figure 11 New Application in Quick Panel

   b. In the **Choose Board Support Package (BSP) - Project Creator 2.30** window, expand PSOC™ 4 BSPs, select **CY8CKIT-149**, and click **Next**, as shown in Figure 12

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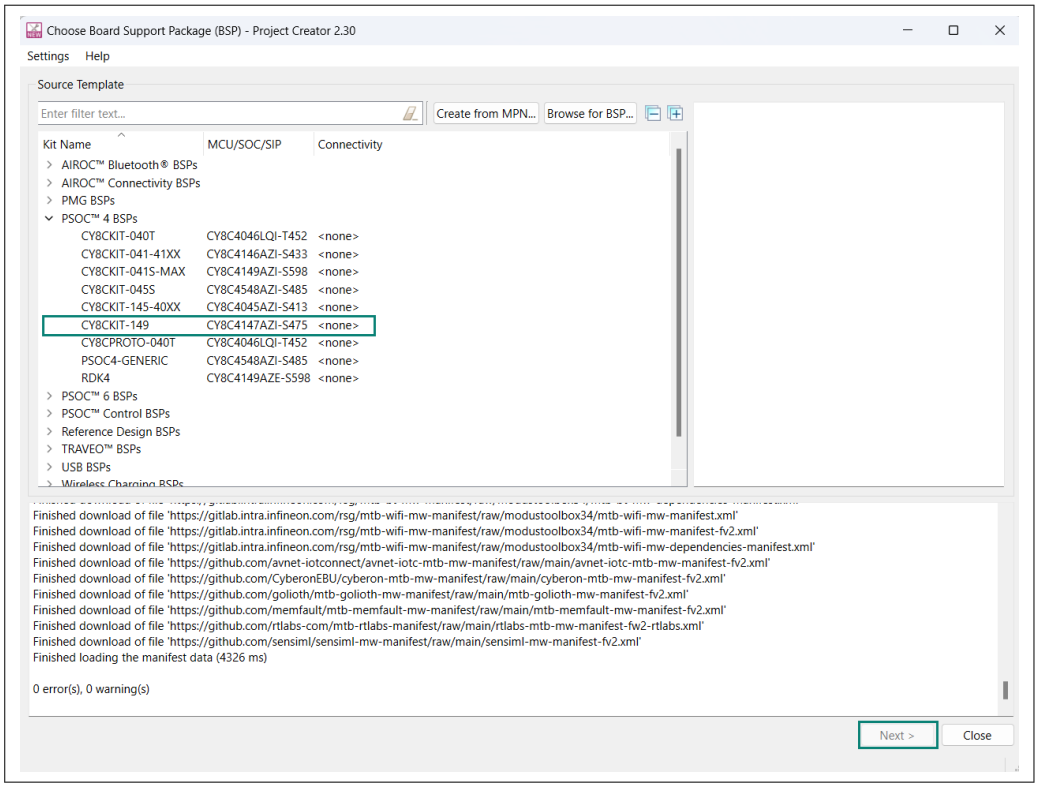

Figure 12 Creating a new application: Choose Board Support Package

c. Select the required application and click **Create**, as shown in Figure 13.

The right pane will display the code example description and the link to view the README file on GitHub.

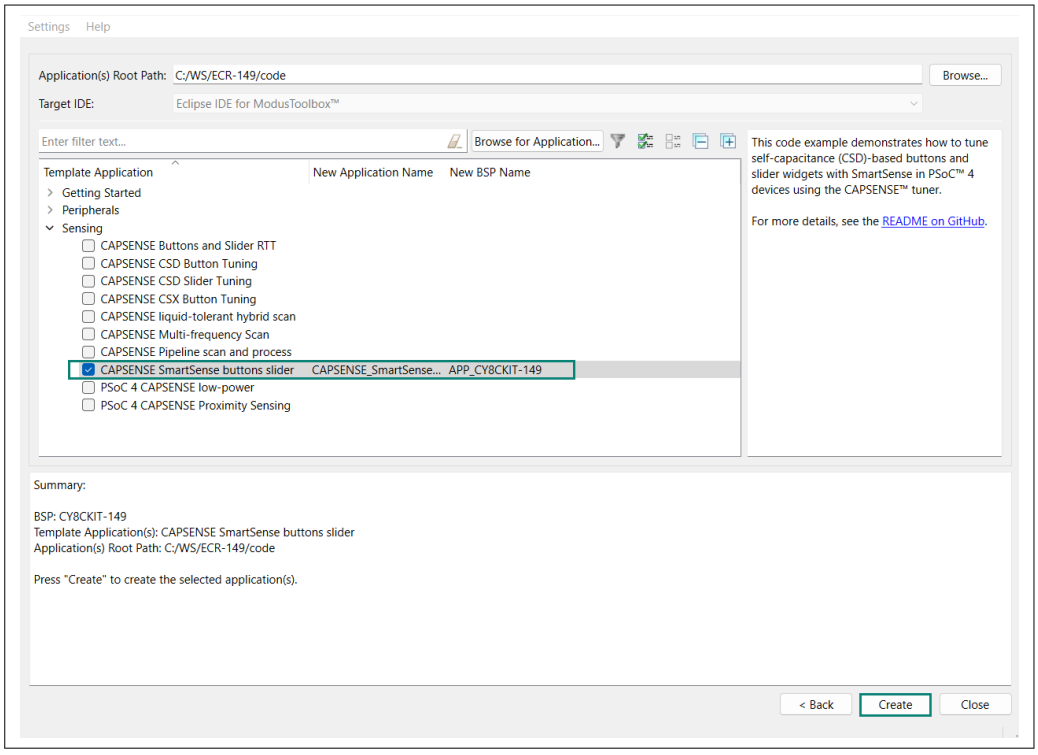

Figure 13 Creating a new application: Select Application

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3. To build and program a PSOC™ 4100S Plus device application, follow these steps:
   a. In the **Project Explorer** tab, select the **<App_Name>** project
   b. In the **Quick Panel** tab, scroll to the **Launches** section, and click the **<App_Name> Program (KitProg3_MiniProg4)** configuration, as shown in Figure 14

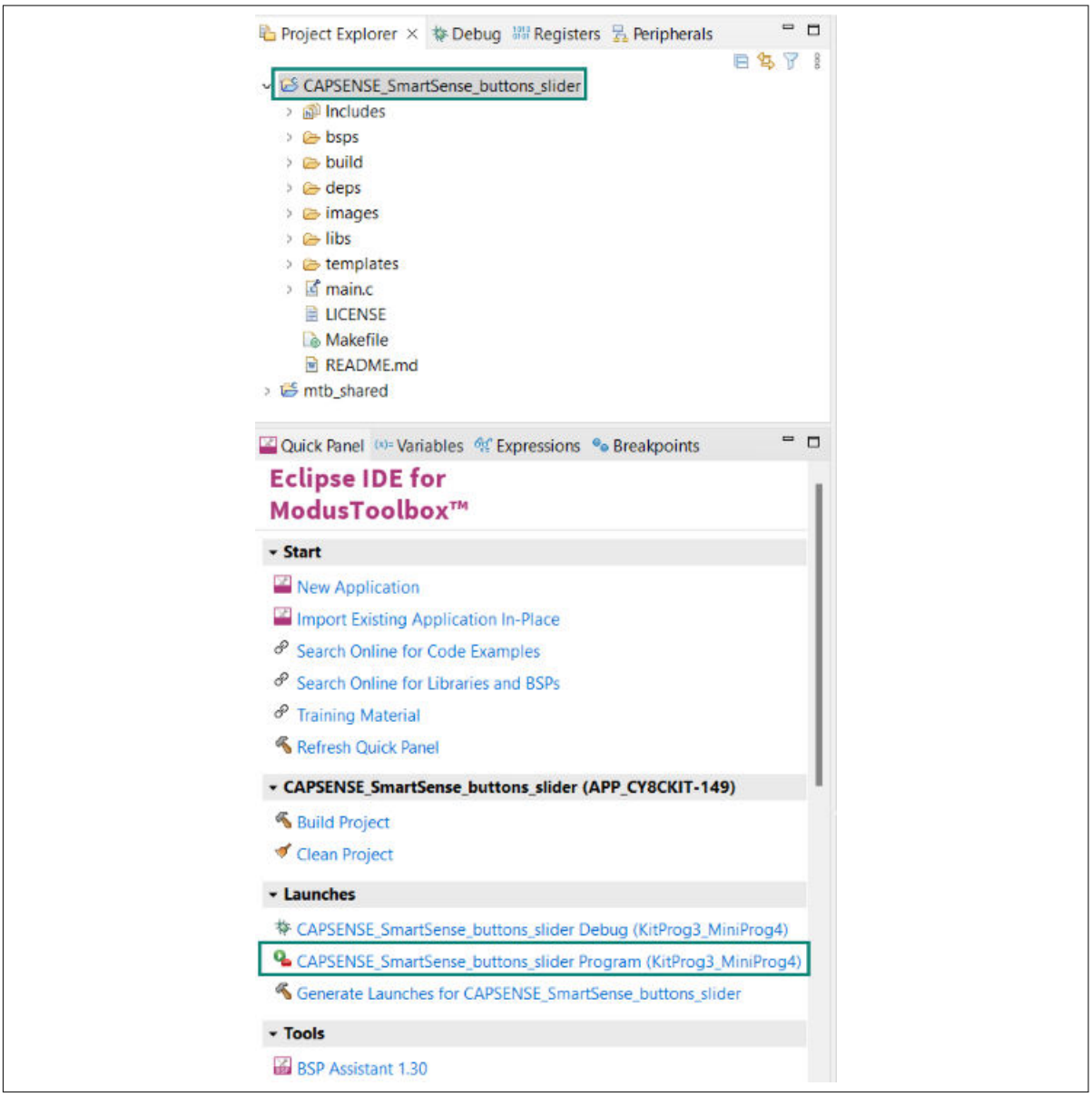

Figure 14 Building and programming the code example

4. ModusToolbox™ software has an integrated debugger. To debug a PSOC™ 4100S Plus device application, follow these steps:
   a. In the **Project Explorer** tab, select **<App_Name>** project
   b. In the **Quick Panel**, scroll to the **Launches** section, and click the **<App_Name> Debug (KitProg3_MiniProg4)** configuration, as shown in Figure 15

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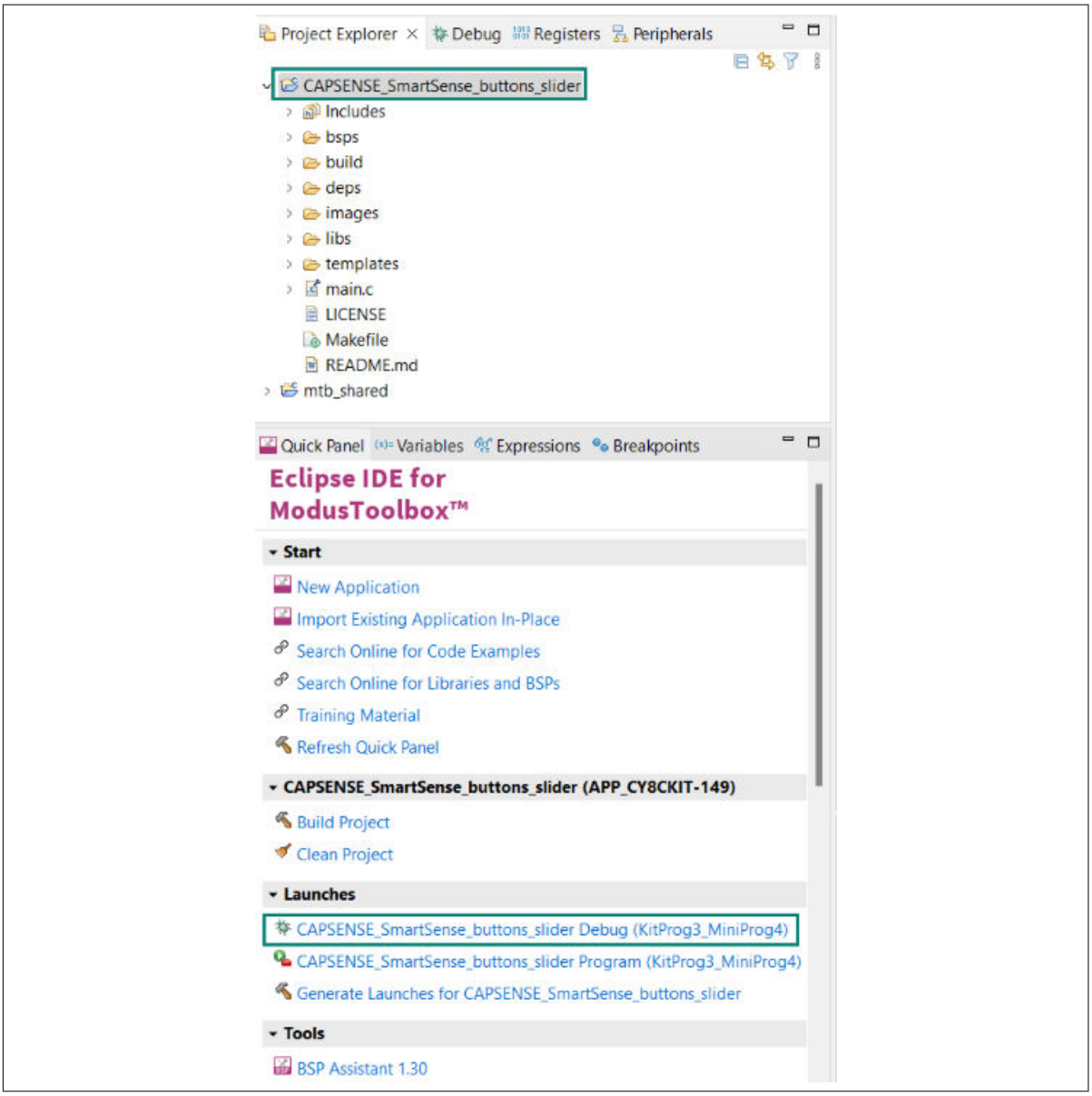

Figure 15 Debugging the code example

For a detailed explanation on how to debug using ModusToolbox™ software, see the “Program and debug” section in the Eclipse IDE for ModusToolbox™ user guide.

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3 Hardware

3.1 Schematics

See the schematic files available on the kit webpage.

3.2 Functional description

This section describes the individual hardware blocks. The kit comes with a PSOC™ 4100S Prototyping Board, which consists of the PSOC™ 4100S device, KitProg3 programmer/debugger and bridge, CAPSENSE™ buttons supporting CSD and CSX modes, CAPSENSE™ 6-segment slider supporting both CSX and CSD mode, LEDs corresponding to CAPSENSE™ buttons and slider, a user LED, a user button, a DPDT slide switch for interface selection, and other passives required for the essential operation of the kit.

3.2.1 PSOC™ 4100S Plus MCU features

This kit features a PSOC™ 4100S Plus device. PSOC™ 4100S Plus 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 digital blocks with flexible automatic routing. The PSOC™ 4100S Plus device, based on this platform architecture, is a combination of an MCU with digital programmable logic, programmable interconnect, and standard communication and timing peripherals. The PSOC™ 4100S Plus will be fully compatible with members of the PSOC™ 4 platform for new applications and design needs. The digital subsystems allow flexibility and in-field tuning of the design. For more information, see the PSOC™ 4100S Plus webpage and the PSOC™ 4100S Plus Datasheet.

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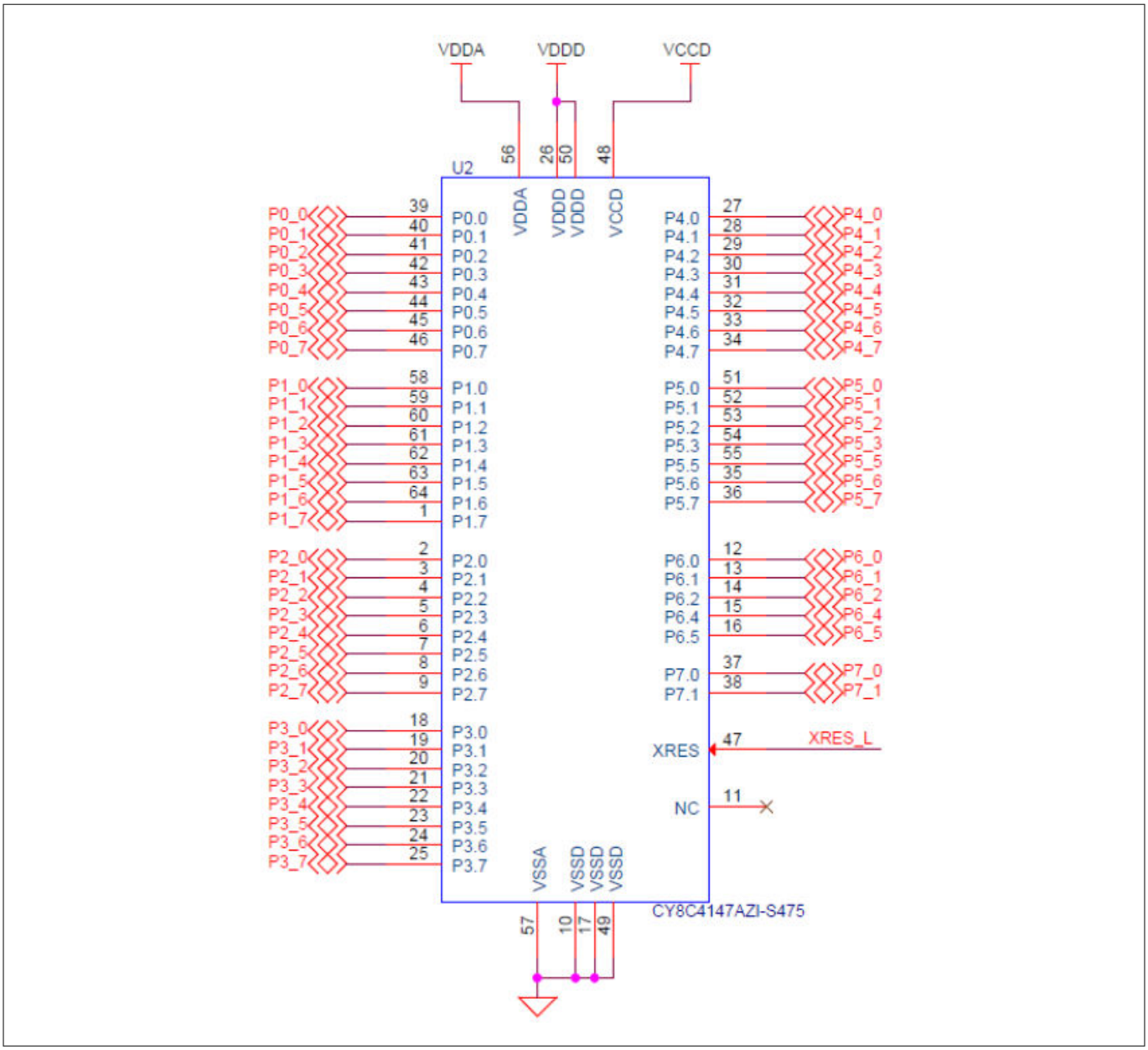

Figure 16 Schematic of PSOC™ 4100S Plus device

3.2.1.1 PSOC™ 4100S Plus device power supply system

The power supply system on this board is dependent on a 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 KitProg3 USB (J8)
- 1.8 V to 5.0 V from a regulated supply connected to VTARG or VDDD

***Note**: To use an external power supply with the KitProg3, which is also connected to the PC USB, first remove diode D1 from the board. This ensures that the VTARG supply from KitProg3 is not supplied to the target device. KitProg3 measures the target voltage and adjusts the logic levels on the programming pins accordingly.*

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Caution: It is important to understand that this prototyping kit does not have any onboard ESD protection circuitry. Therefore, the power source for the PSOC™ 4100S Plus Prototyping Kit must be of high quality to make sure that the board is protected from any overcurrent conditions and swapped-power connections.

3.2.1.2 Measure PSOC™ 4100S Plus current consumption

Follow these steps to measure the current consumption of the PSOC™ 4100S Plus device:

- Remove the resistor R53 and install a 2-pin jumper in the supplied holes of J3
- Connect an ammeter across the 2-pin jumper to measure the current to the PSOC™ 4100S Plus device

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

After measuring the current consumption, populate resistor R53 or place a shorting jumper across the two jumper pins for normal operation of the kit.

***Notes**:*
After removing R53, system may have some leakage power. Below are some of the probable paths for leakage:

1. *Communication circuitry between KitProg3 and target (I2C, UART, and SWDIO)*
2. *Inductive beads for Bluetooth® LE power circuitry*
3. *Reset switch between KitProg3 and target device along with Bluetooth® LE device*

To get rid of the leakage power completely, remove the 0 Ω connection and inductive beads.

3.2.1.3 Board separation (snapping)

The PSOC™ 4100S Plus Prototyping Kit consists of a PSOC™ 4100S Plus and a KitProg3 board. To separate the two boards for evaluation or development, break the two boards apart at the built-in perforated edge between J4 and J5.

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 KitProg3 board is off the table edge. Press gently on the KitProg3 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.

Caution: Once the boards are separated, direct UART and I2C connections between the PSOC™ 4100S Plus device and KitProg3 are lost. This is because the traces connecting the UART and I2C lines are cut off during the separation. However, you can access KitProg3's UART and I2C lines through header J6.

The CAPSENSE™ slider and buttons can also be snapped out and used for standalone applications. To reconnect the snapped CAPSENSE™ boards, you can connect male berg strips on the header and connect the central board with the CAPSENSE™ board.

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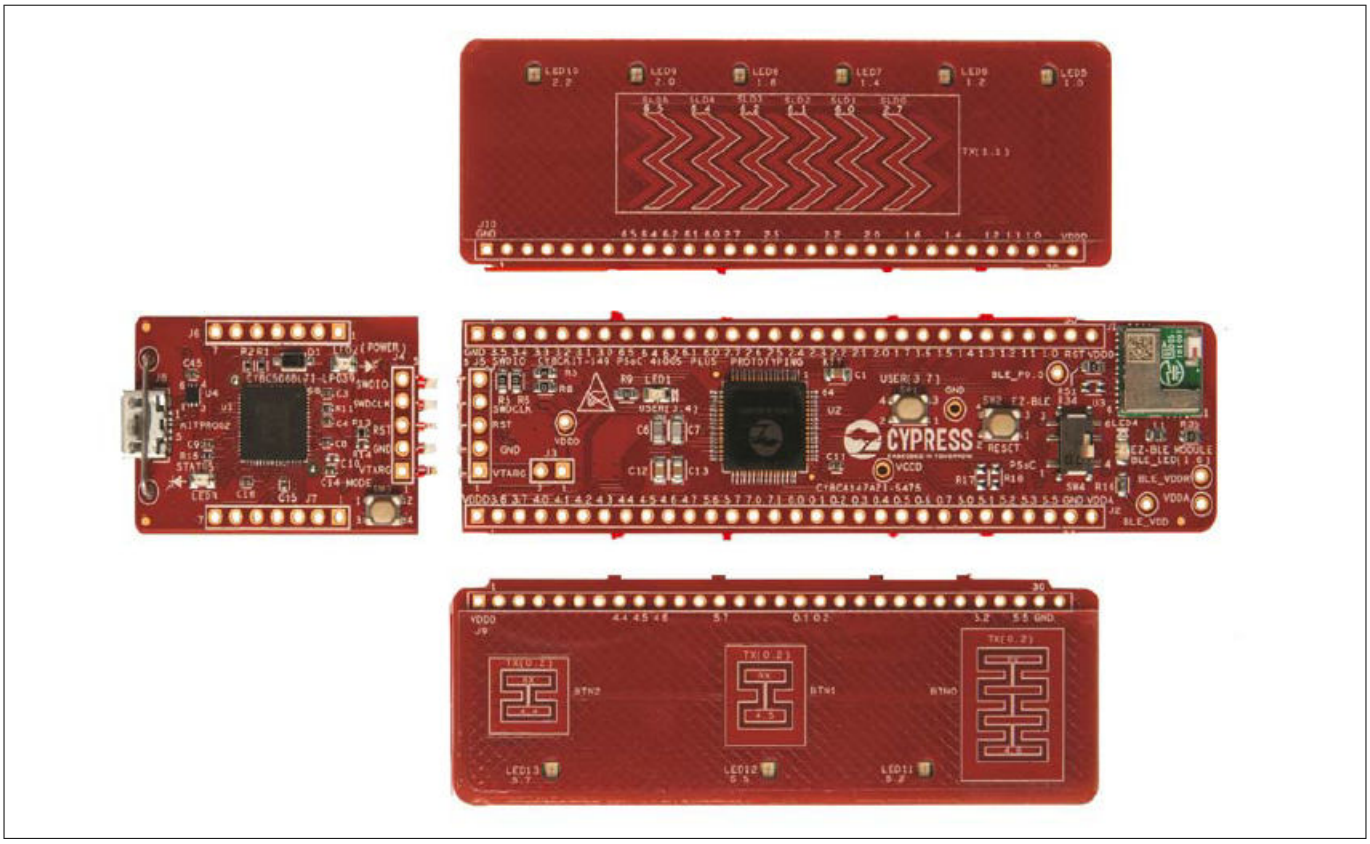

Figure 17 PSOC™ 4100S Plus Prototyping Kit broken into four parts

3.2.1.4 Header connections

- **Functionality of the J1 and J2 headers (target board):**

  The target PSOC™ 4100S Plus board contains two single inline headers (J1 and J2). These headers are both 1x30-pin headers and include all of the I/Os available on the PSOC™ 4100S Plus device. These headers support all of the available ports, GND, VDDD, VDDA, 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 a development breadboard.

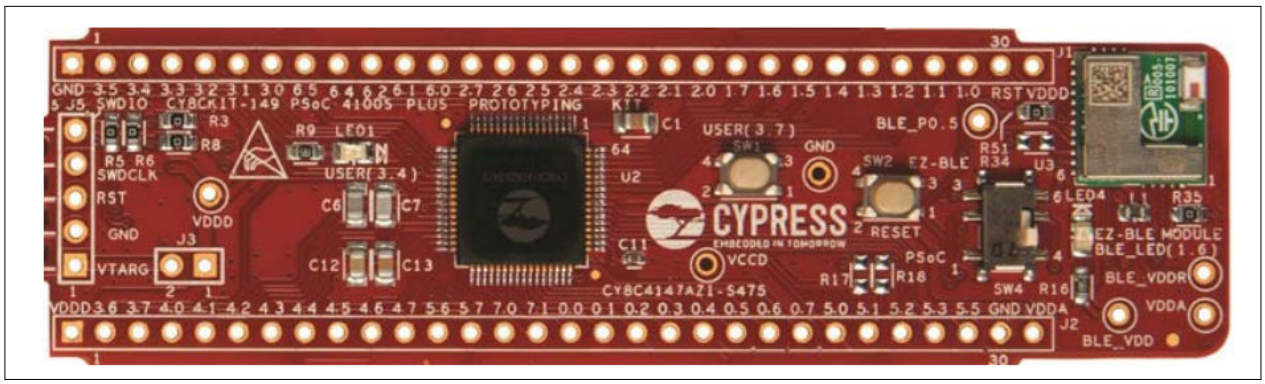

Figure 18 J1 and J2 headers

  See Table 2 for the pin details of the J1 and J2 headers.

- **Functionality of J4 and J5 headers (PSOC™ 4100S Plus to KitProg3):**

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The KitProg3 and target boards each contain a 1x5-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™ 4100S Plus device and the AIROC™ Bluetooth® LE module, power, ground, and reset.

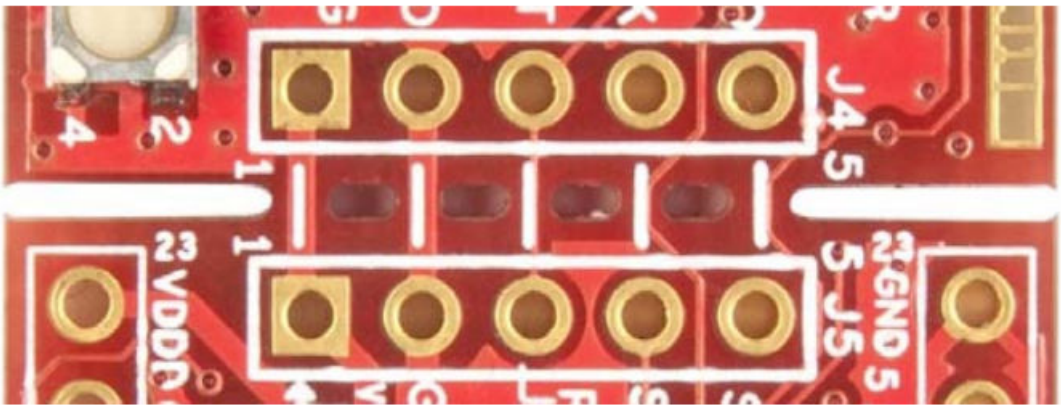

Figure 19 J4 and J5 headers

Table 4 Pin details of J4 header

Pin	Function	Connection details
J4_01	VTARG	Power
J4_02	GND	Ground
J4_03	P12.4	Reset
J4_04	P12.3	SWD_CLK
J4_05	P12.2	SWD_IO

Table 5 Pin details of J5 header

Pin	Function	Connection details
J5_01	VTARG	Power
J5_02	GND	Ground
J5_03	XRES	Reset
J5_04	P3.3	SWD_CLK
J5_05	P3.2	SWD_IO

When the boards are separated, the KitProg3 board can be used to program any other PSOC™ 3, PSOC™ 4, or PSOC™ 5LP family of devices via J4.

- **Functionality of J6 and J7 headers (KitProg3):**

  The KitProg3 board contains two single inline headers (J6 and J7). Both are 1x7-pin headers, used to pull out several pins of the PSOC™ 5LP to support advanced features like a low-speed oscilloscope and a low-speed digital logic analyzer. This header also contains the KitProg3 bridge pins that can be used when the two boards are separated.

  The J6 and J7 headers support 100-mil spacing, so you can solder connectors to connect the KitProg3 board to a development breadboard.

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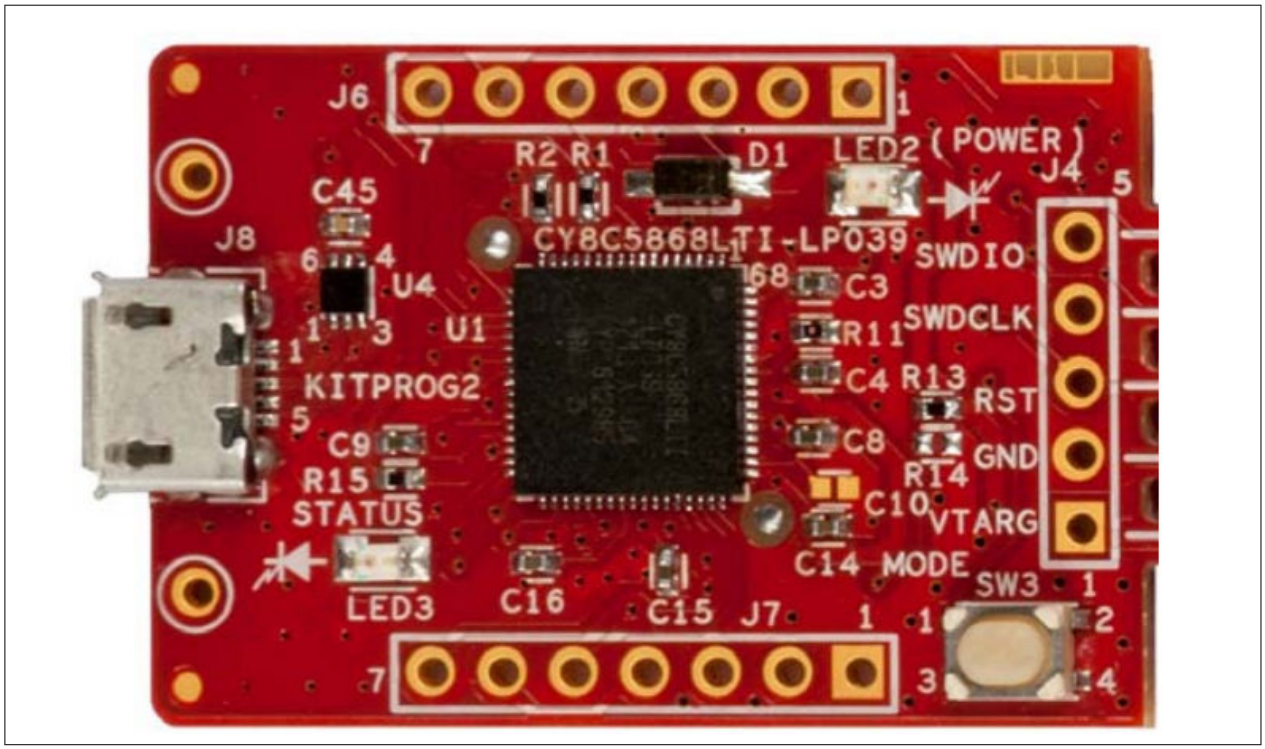

Figure 20 J6 and J7 headers

Table 6 Pin details of J6 header

Pin	Function	Connection details
J6_01	VBUS	Power
J6_02	GND	Ground
J6_03	P12.5	GPIO
J6_04	P12.0	GPIO/I2C_CLK
J6_05	P12.1	GPIO/I2C_SDA
J6_06	P12.7	GPIO/UART_RX
J6_07	P12.6	GPIO/UART_TX

Table 7 Pin details of J7 header

Pin	Function	Connection details
J7_01	GND	Ground
J7_02	P3.0	GPIO
J7_03	P3.4	GPIO
J7_04	P3.5	GPIO
J7_05	P3.6	GPIO
J7_06	P0.2	GPIO
J7_07	P0.1	GPIO

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3.2.1.5 Reset button

When the reset button is pressed, the XRES line of the PSOC™ 4100S Plus device is pulled to ground, which resets the target device.

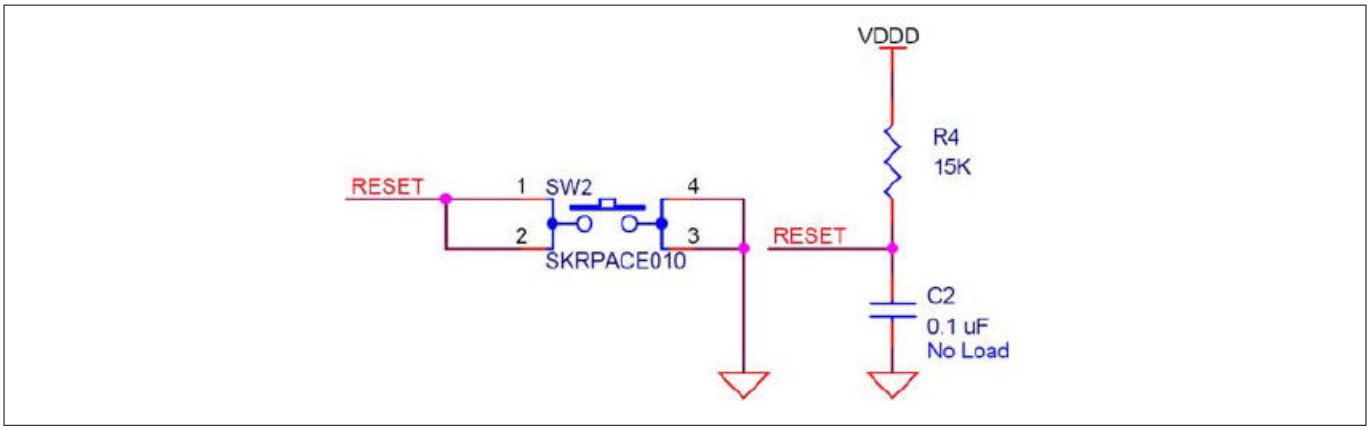

Figure 21 Reset (RST) switch

3.2.2 PSOC™ 5LP-based KitProg3 programmer and debugger

PSOC™ 5LP on the KitProg3 board is used to program and debug the target PSOC™ 4100S Plus device/AIROC™ Bluetooth® LE module. KitProg3 PSOC™ 5LP connects to the USB port of the computer through the PCB USB connector and to the SWD interface of the target PSOC™ 4100S Plus device/AIROC™ Bluetooth® LE module.

For more information, see the following:

- PSOC™ 5LP webpage
- CY8C58LPxx family datasheet

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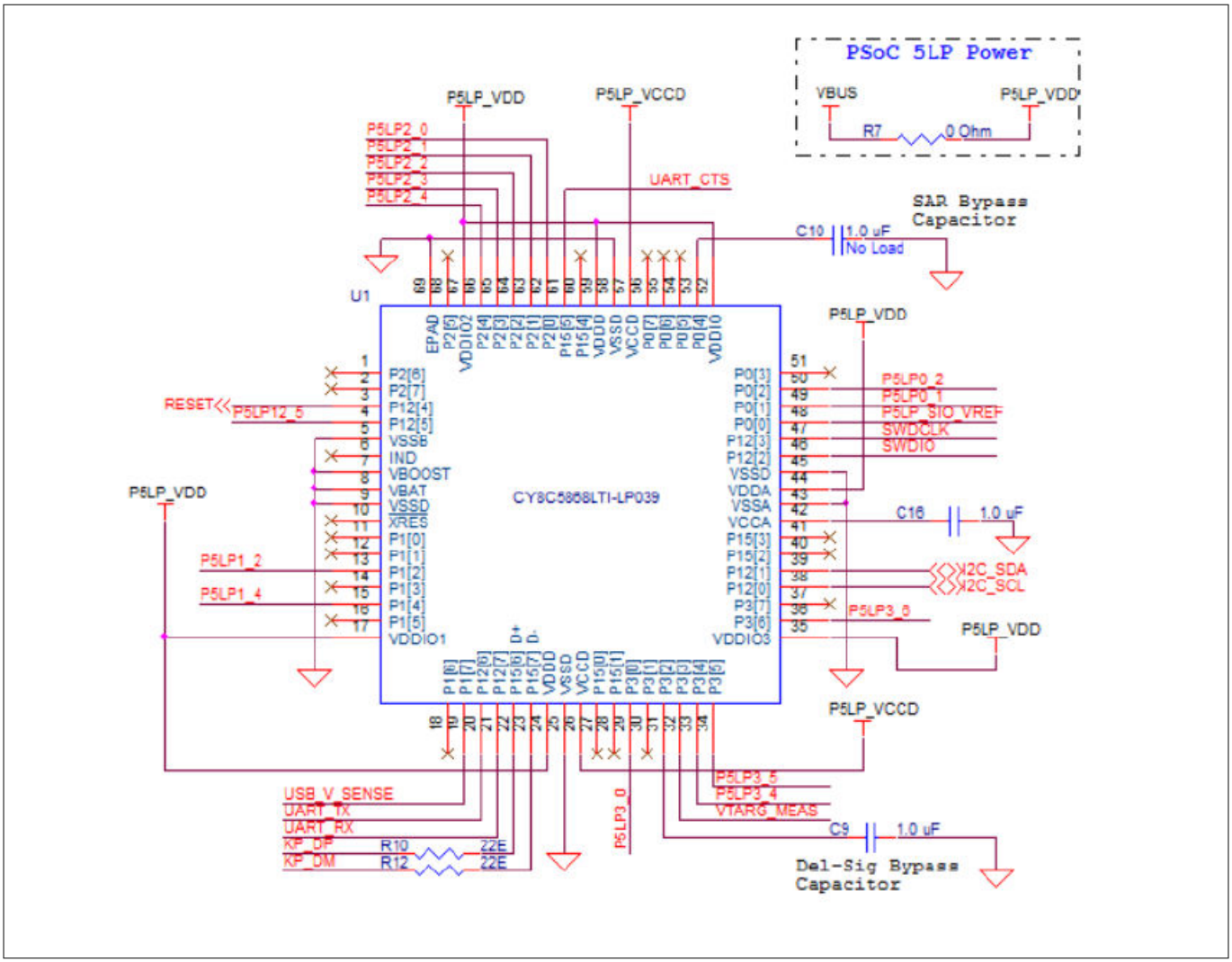

Figure 22 Schematic of PSOC™ 5LP-based KitProg3

3.2.2.1 KitProg3 onboard target voltage measurement

PSOC™ 5LP of KitProg3 uses an ADC to measure the onboard target voltage. There is a voltage divider before the ADC input to bring the target voltage within the dynamic range.

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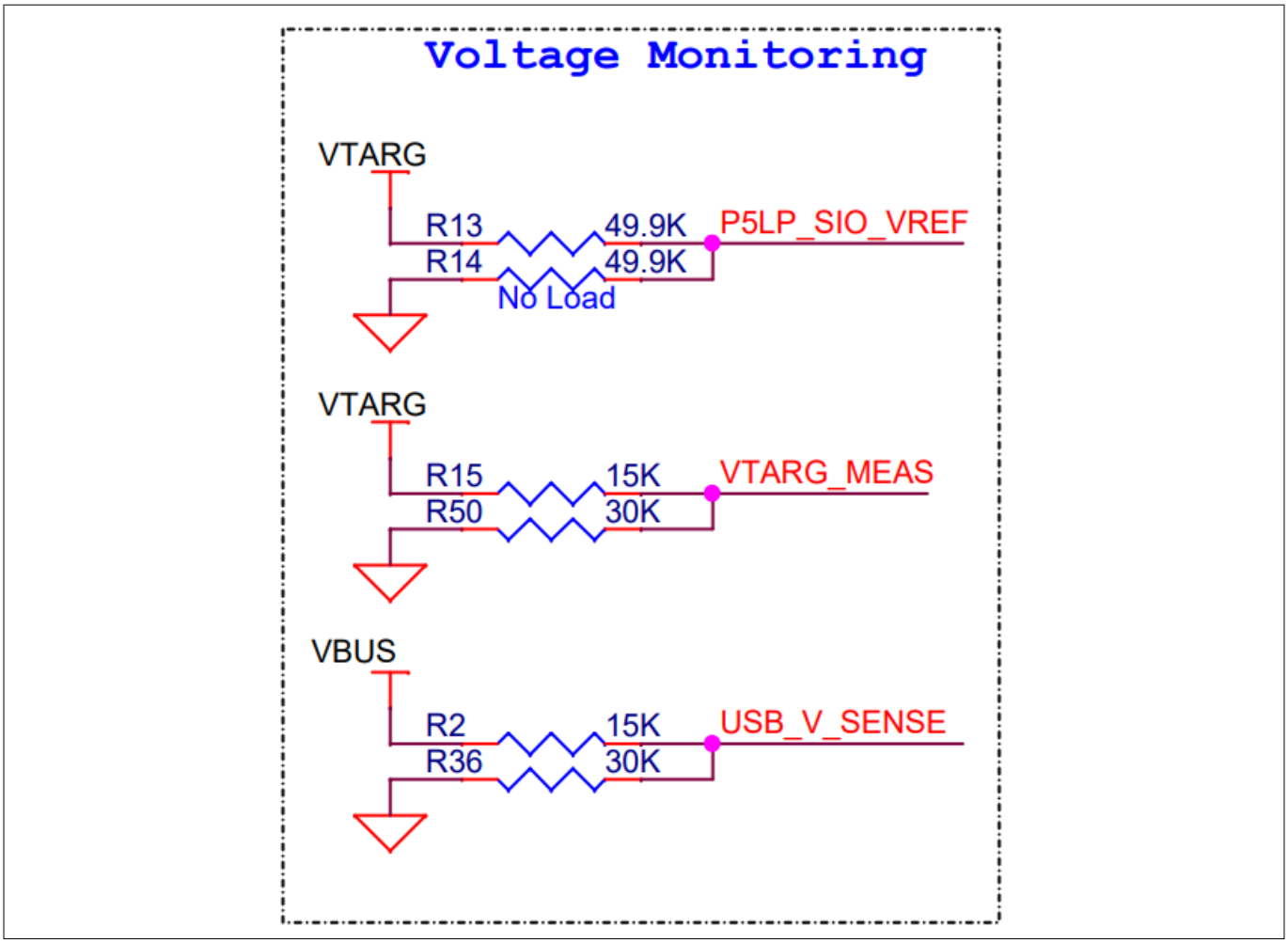

Figure 23 **Schematic of KitProg3 onboard target voltage monitoring circuit**

3.2.2.2 KitProg3 programming mode selection button and status LED

Use the SW3 button to switch between various modes of KitProg3 operation (from CMSIS-DAP HID to BULK mode, enabling the boot loader mode). Note that KitProg3 on this board supports the CMSIS-DAP BULK mode by default. This button function is also reserved for future use. The status LED (LED3) indicates the current mode of KitProg3. For more details, see the KitProg3 user guide.

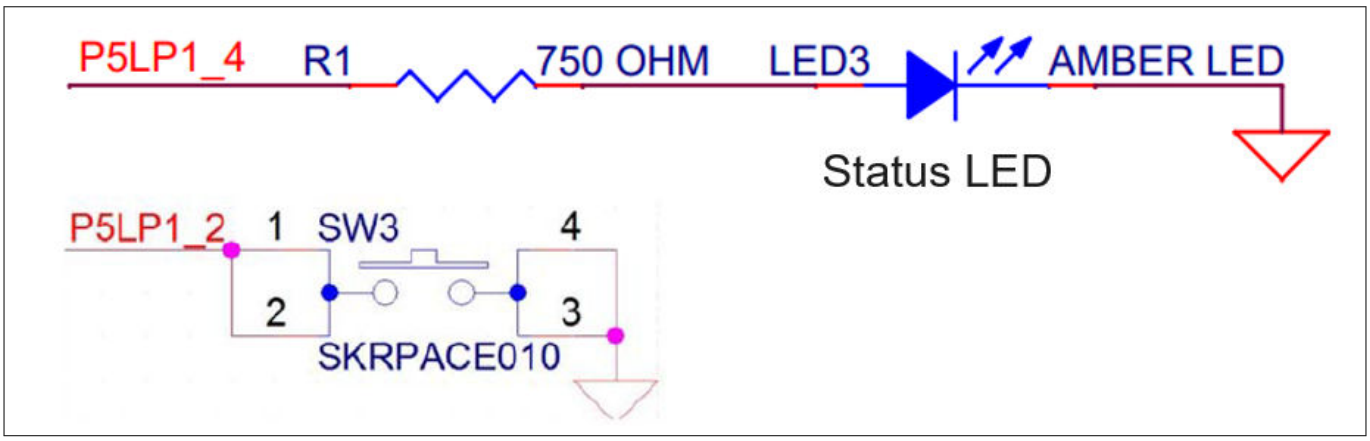

Figure 24 **Schematic of KitProg3 mode selection button (SW3) and status LED (LED3)**

Downloaded from Arrow.com.

3.2.2.3 USB-UART bridge

The KitProg3 on the PSOC™ 4100S Plus Prototyping Kit can act as a USB-UART bridge. The UART lines between the KitProg3 and the target are hardwired on the board, through the snappable area, with UART_RX assigned to P7[0] and UART_TX assigned to P7[1] on the target PSOC™ 4100S Plus device. For more details on the KitProg3 USB-UART functionality, see the KitProg3 user guide.

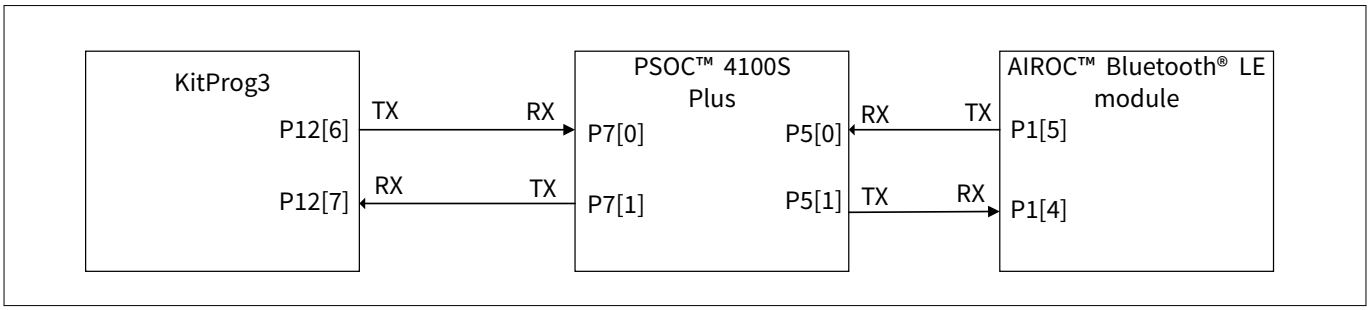

Figure 25 UART Connection between KitProg3, PSOC™ 4100S Plus device, and AIROC™ Bluetooth® LE module

3.2.2.4 USB-I2C bridge

The KitProg3 can function as a USB-I2C bridge and communicate with the software utility Bridge Control Panel (BCP). The I2C lines on the target PSOC™ 4100S Plus device are P3[1] (SDA) and P3[0] (SCL), which are hardwired on the board to the I2C lines of the KitProg3. The USB-I2C supports I2C speeds of 50 kHz, 100 kHz, 400 kHz, and 1 MHz. For more details on the KitProg3 USB-I2C functionality, see the KitProg3 user guide.

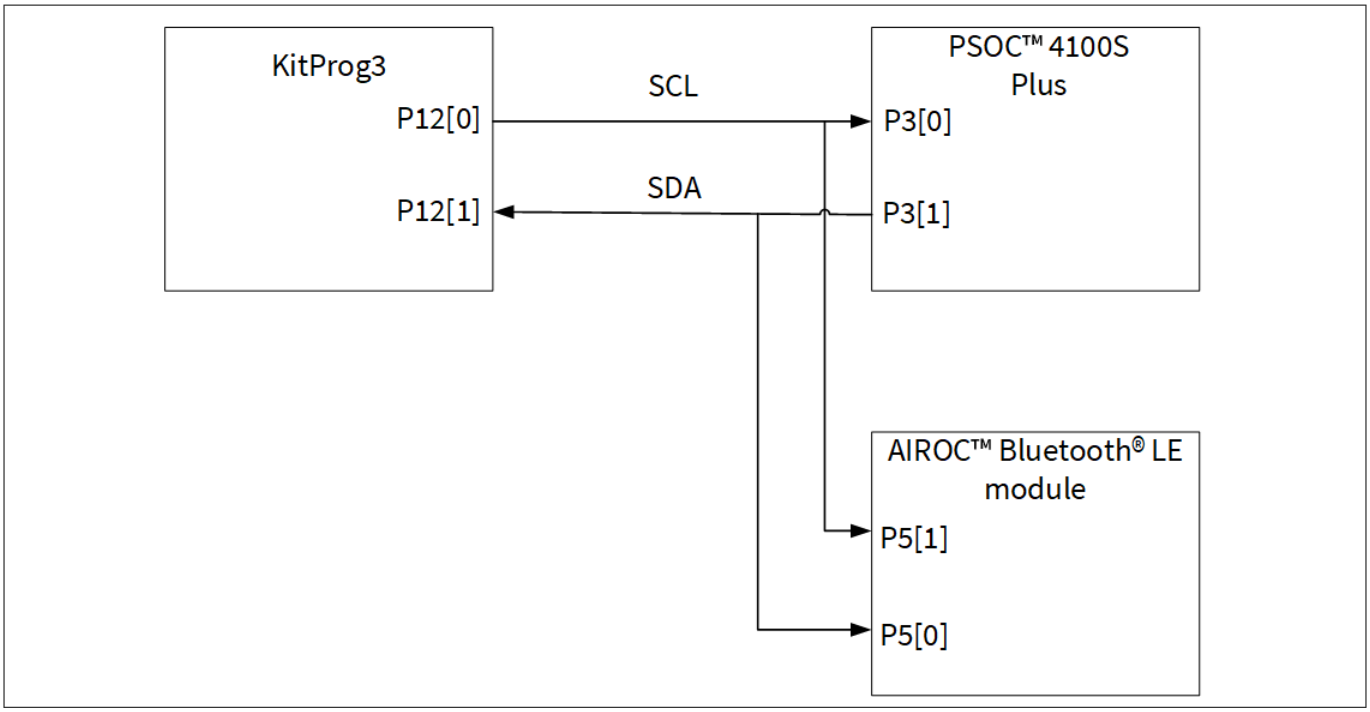

Figure 26 I2C connection between KitProg3, PSOC™ 4100S Plus device, and AIROC™ Bluetooth® LE module

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3.2.3 CAPSENSE™

The PSOC™ 4100S Prototyping Board consists of the following:

- **CAPSENSE™ buttons and their corresponding LEDs**

  Three CAPSENSE™ buttons (BTN0, BTN1, and BTN2) are provided on a breakout board to demonstrate the CAPSENSE™ button functionality of the PSOC™ 4100S Plus device. All the I/Os used for implementing the CAPSENSE™ buttons are exposed through the headers J2 and J9. Shield for button is connected to ground by default. If you want to connect it to port P0.1, remove R57 and load R58.

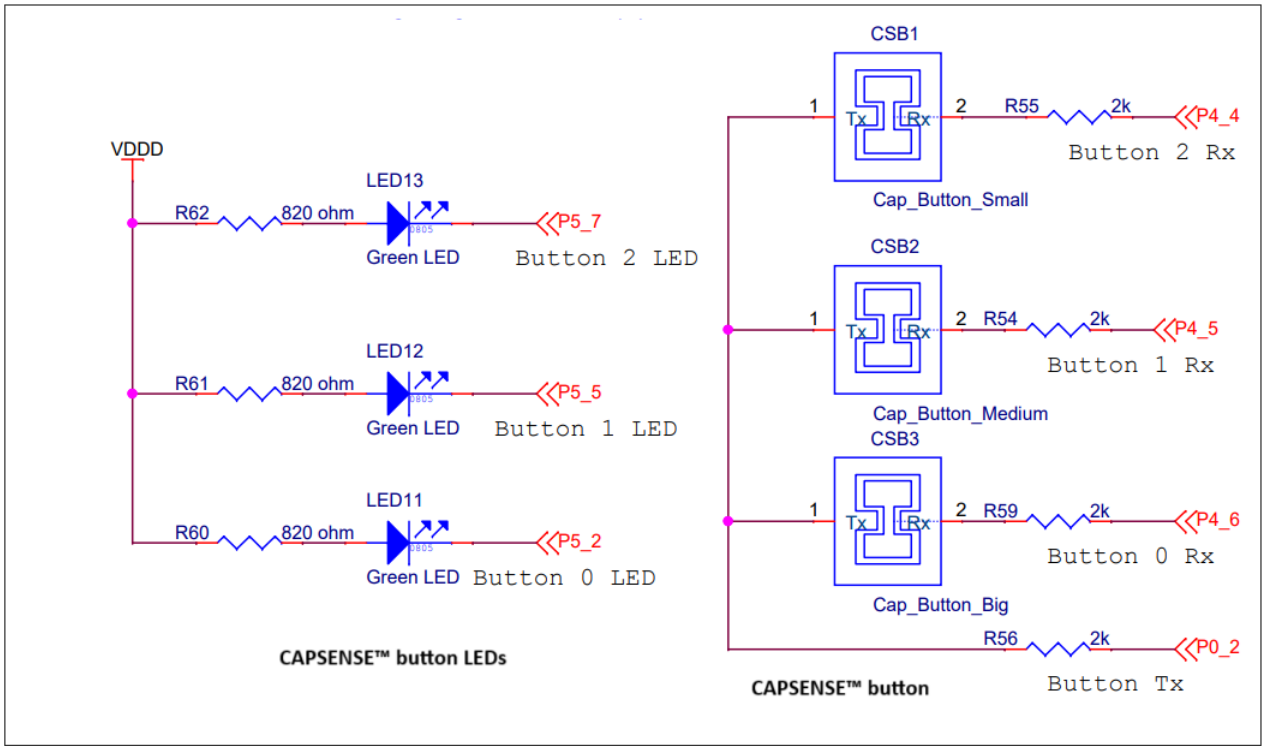

Figure 27 Schematic of CAPSENSE™ buttons and their corresponding LEDs

- **CAPSENSE™ slider and their corresponding LEDs**

  A 6-segment linear slider (SLD0, SLD1, SLD2, SLD3, SLD4, and SLD5) is provided on a breakout board to demonstrate the CAPSENSE™ slider functionality of the PSOC™ 4100S Plus device. All the I/Os used for implementing the CAPSENSE™ slider are exposed through the headers J1 and J10. Shield for slider is connected to ground by default. If you want to connect it to port P2.5, remove R26 and load R25.

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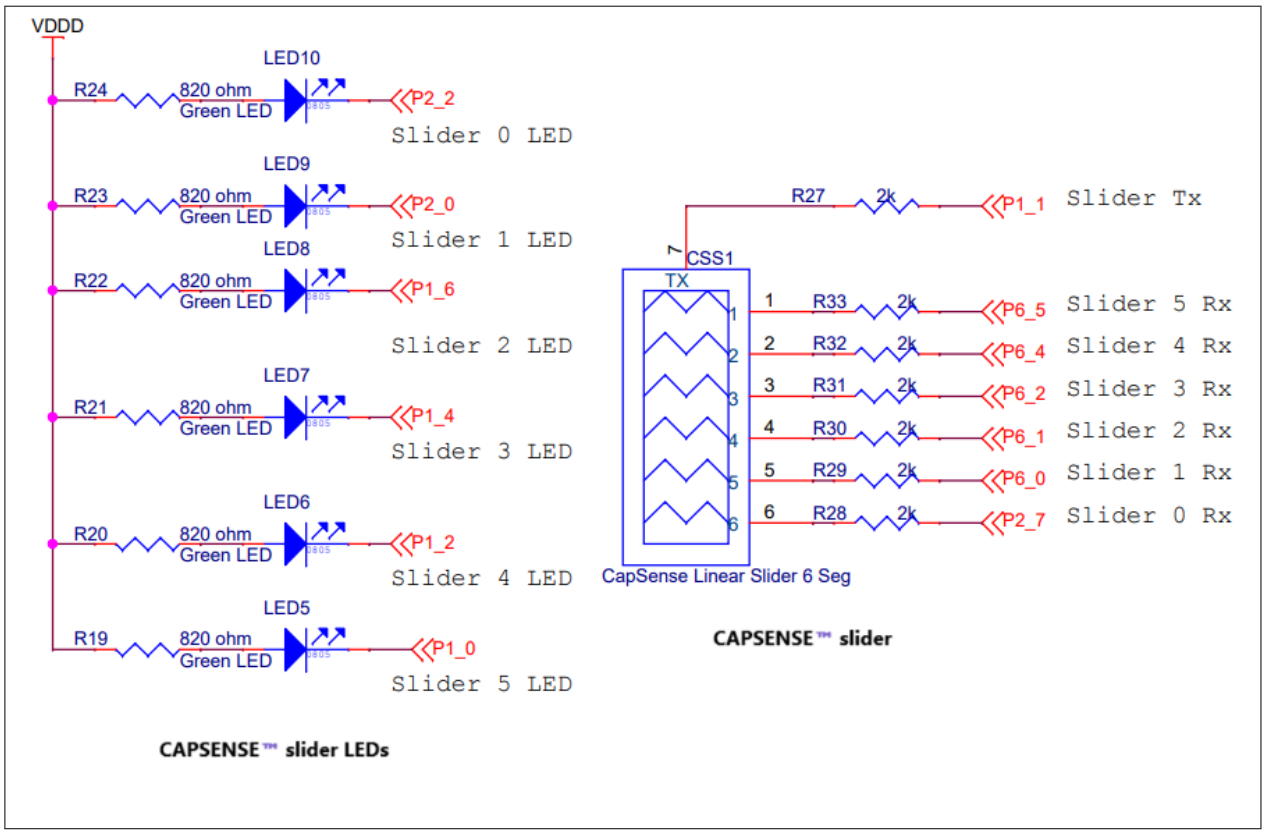

Figure 28 Schematic of CAPSENSE™ slider and their corresponding LEDs

3.2.3.1 Capacitive sensing

3.2.4 System capacitors

The CY8CKIT-149 PSOC™ 4100S Plus Prototyping Kit has eight capacitors in addition to power supply decoupling capacitors:

- Four CAPSENSE™ capacitors (CMOD, CSH, CintA, CintB): Required for CAPSENSE™ functionality of the PSOC™ 4100S Plus device
- SAR bypass capacitor for PSOC™ 4100S Plus device (C1 - loaded by default): To use port P1.7 as GPIO desolder C1
- Two biasing capacitors (C18 and C19 (no load)): Required to interface an external 32.768 kHz crystal oscillator (WCO)
- Two biasing capacitors (C28 and C26 (loaded)): Required to interface an external 4 MHz crystal oscillator (ECO)

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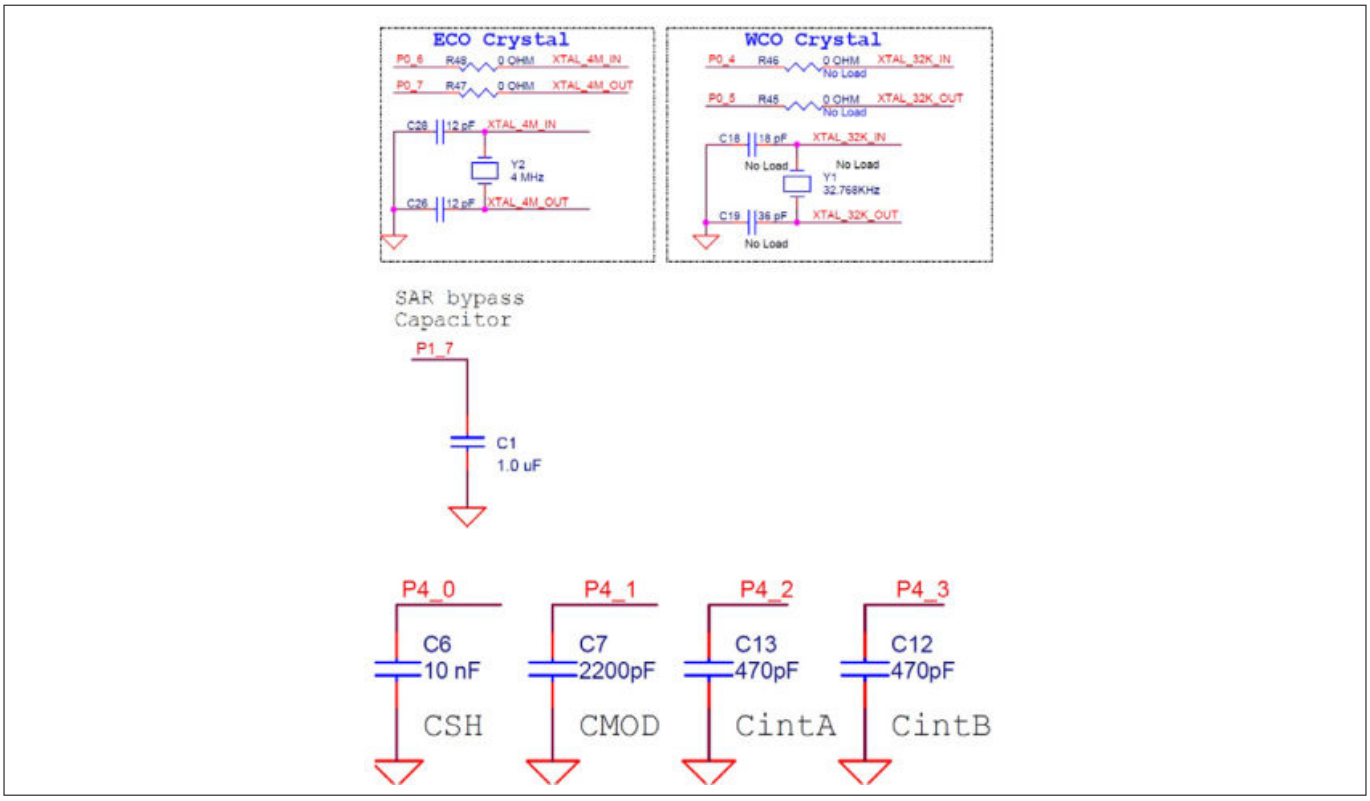

Figure 29 System capacitors circuit diagram

3.2.5 User LEDs

The PSOC™ 4100S Prototyping Board has a blue user LED (LED1) connected to P3[4] of the PSOC™ 4100S device.

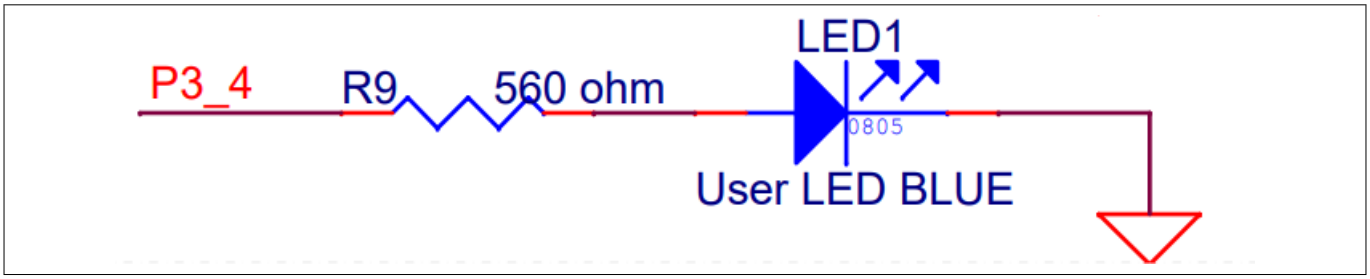

Figure 30 User LED's schematic

3.2.6 User button

The target PSOC™ 4100S Plus board contains a switch connected to the P3[7] pin on the PSOC™ 4100S Plus device. This switch can be used for general user inputs or to control different states in an application.

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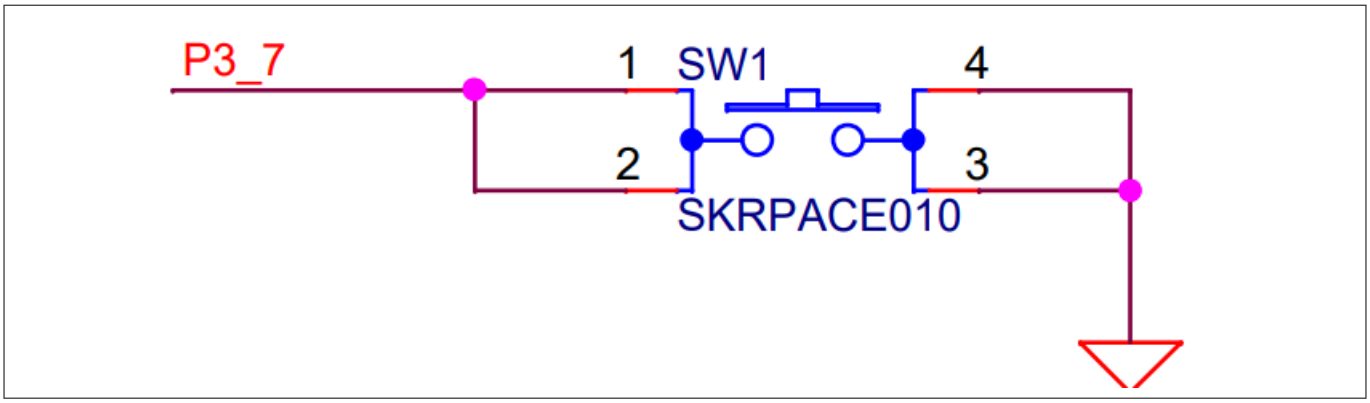

Figure 31 User Button's schematic

3.2.7 AIROC™ Bluetooth® LE module

The board includes an AIROC™ Bluetooth® LE module, which is loaded by default. The AIROC™ Bluetooth® LE module is a fully integrated, 10 x 10 x 1.8 mm, fully certified, programmable module designed for ease of use and reduced time to market. It contains an Infineon AIROC™ Bluetooth® LE chip, two crystals, a chip antenna, a shield, and passive components. For more details, see the AN96841 - Getting Started with EZ-BLE Creator Modules and AIROC™ Bluetooth® LE.

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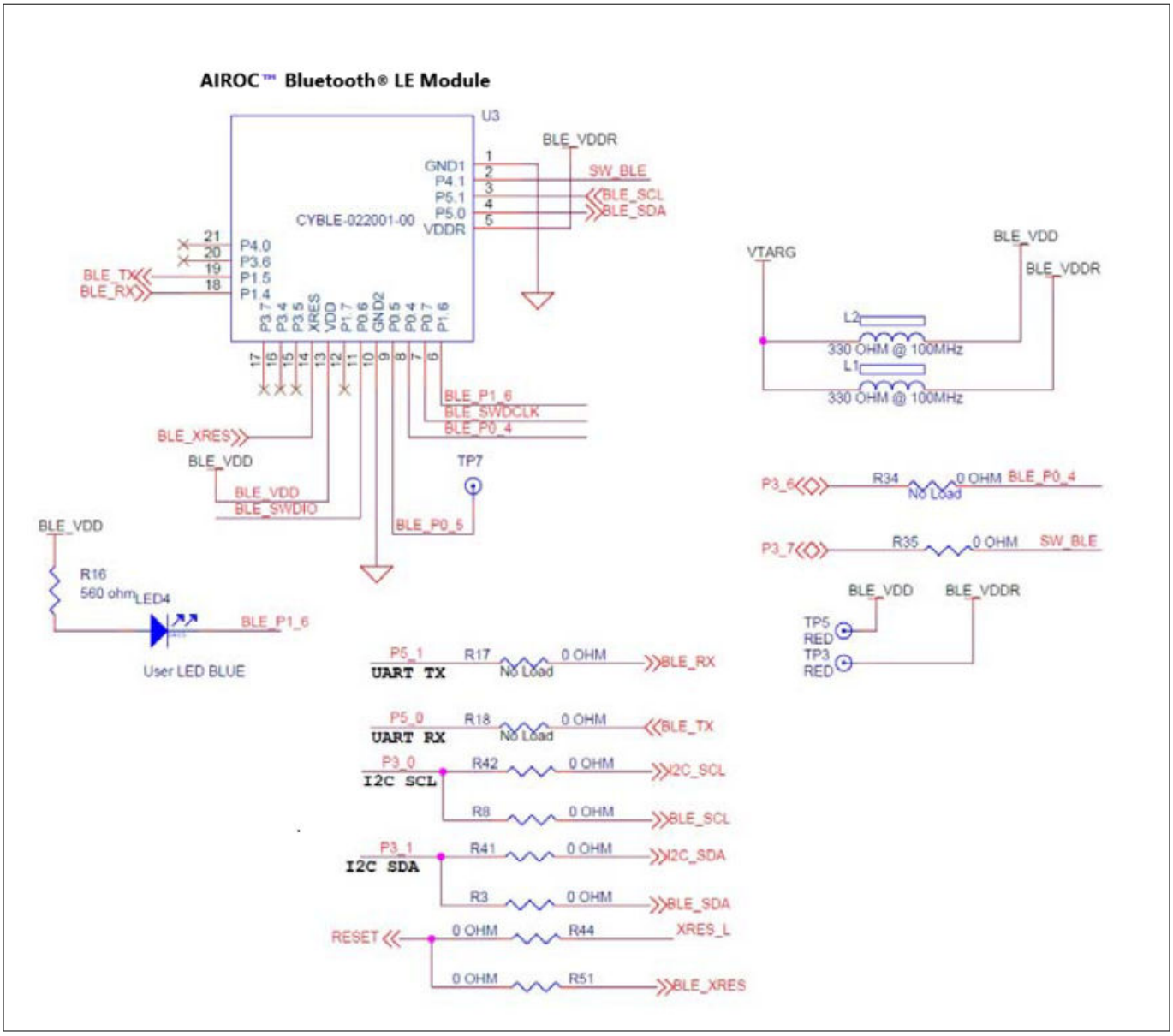

Figure 32 AIROC™ Bluetooth® LE connections

The AIROC™ Bluetooth® LE module includes the following connections to PSOC™ 4100S and KitProg3:

- UART connections to PSOC™ 4100S Plus through zero-ohm resistors R17 and R18 (see Figure 32 and Table 8). Note that R17 and R18 are not loaded by default
- I2C connections to KitProg3 and PSOC™ 4100S (see Table 8)
- SWD connections to KitProg3 through the DPDT switch SW4. The SWD connections are shared between the PSOC™ 4100S and AIROC™ Bluetooth® LE devices

Table 8 AIROC™ Bluetooth® LE connections

AIROC™ Bluetooth® LE	PSOC™ 4100S	KitProg3	Description
BLE_TX, P1_5	P5_0	-	UART_RX
BLE_RX, P1_4	P5_1	-	UART_TX
BLE_SDA, P5_0	P3_1	P12_1	I2C_SDA

(table continues...)

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Table 8 (continued) AIROC™ Bluetooth® LE connections

AIROC™ Bluetooth® LE	PSOC™ 4100S	KitProg3	Description
BLE_SCL, P5_1	P3_0	P12_0	I2C_SCL
BLE_SWDIO, P0_6	-	P12_2	SWDIO
BLE_SWDCLK, P0_7	-	P12_3	SWDCLK
P0_4	P3_6	-	GPIO
BLE_XRES	RESET	P12_4	RESET
P1_6	-	-	Bluetooth® LE LED
P4_1	P3_7	-	User button

Use the DPDT switch SW4 to switch the SWD connections between the PSOC™ 4100S or AIROC™ Bluetooth® LE Module as shown in Figure 33.

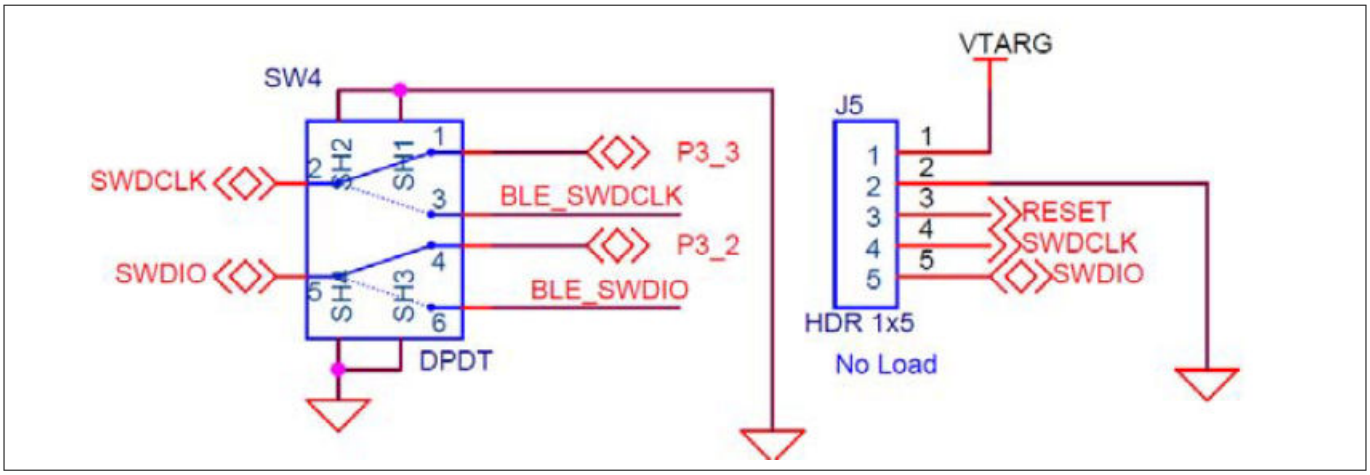

Figure 33 DPDT switch SW4 to select between PSOC™ 4100S and AIROC™ Bluetooth® LE module

3.3 Bill of materials

See the BOM files available on the kit webpage.

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Glossary

ADC
Analog-to-Digital Converter

BCP
Bridge Control Panel

BLE
Bluetooth® Low Energy

BOM
Bill of materials

BSP
Board Support Package

CLI
Command-line interface

CMOD
Modulator capacitor

CMP
Comparator

CMSIS-DAP
Cortex® Microcontroller System Interface Standard - Debug Access Port

CSD
Self-capacitance

CSX
Mutual-capacitance

CTANK
Shield tank capacitor

DAC
Digital to Analog Converter

DPDT
Double-Pole, Double-Throw

ECO
External Crystal Oscillator

ESD
Electrostatic discharge

Downloaded from Arrow.com.

Glossary

GND
Ground

GPIO
General-purpose input/output

I2C
Inter-integrated circuit

IDAC
Integrated Design Environment

IDE
Integrated development environment

KBA
Knowledge Based Article

LED
Light emitting diode

OOB
Out-of-the-box

PSOC™
Programmable system-on-chip

SAR
Successive Approximation Register

SCB
Serial Communication Block

SRAM
Static Random Access Memory

SWD
Serial wire debug

TCPWM
Timer, Counter, Pulse Width Modulator

UART
Universal Asynchronous Receiver Transmitter

USB
Universal Serial Bus

WCO
Watch Crystal Oscillator

XRES
External reset

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Revision history

Document revision	Date	Description of changes
**	09/26/2017	• New kit guide.
*A	10/05/2017	• Updated Document Title to read as “CY8CKIT-149 PSoC® 4100S Plus Prototyping Kit Guide”.
*B	11/02/2017	• Updated Introduction chapter • Updated “Kit Contents” • Updated Figure 1-1 • Updated “PSoC Creator” • Updated “PSoC Creator Code Examples” • Updated Figure 1-4. • Updated Software Installation chapter • Updated “Install Software” • Updated Figure 2-2. • Updated Kit Operation chapter • Updated “Programming and Debugging the Target PSoC 4100S Plus Device” • Updated “Programming Using PSoC Creator” • Updated Figure 3-2. • Updated “USB-UART Bridge” • Updated Figure 3-5. • Updated “USB-I2C Bridge” • Updated Figure 3-6. • Updated Code Examples chapter • Updated “Using Built-in PSoC Creator Code Examples with the Kit” • Updated Figure 4-9. • Updated Appendix chapter • Updated “Board Details” • Updated Figure A-1. • Updated “Hardware Details” • Updated “Board Separation (Snapping)” • Updated Figure A-4. • Updated “Header Connections” • Updated “Functionality of the J1 and J2 Headers (Target Board)” • Updated Figure A-5.

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Revision history

Document revision	Date	Description of changes
*C	11/16/2017	• Updated Introduction chapter • Updated “PSoC Creator” • Updated “PSoC Creator Code Examples” • Updated Figure 1-4. • Updated Code Examples chapter • Updated “Using Built-in PSoC Creator Code Examples with the Kit” • Updated Figure 4-8. • Updated Figure 4-9.
*D	12/05/2017	• Updated Introduction chapter • Updated “Technical Support” • Replaced “Ext. 2” with “Ext. 3”. • Updated Kit Operation chapter • Updated “Theory of Operation” • Updated Table 3-1. • Updated Code Examples chapter • Updated “Using Built-in PSoC Creator Code Examples with the Kit” • Updated description. • Updated Appendix chapter • Updated “Hardware Details” • Updated “User and Passive Inputs” • Updated “LEDs” • Updated Table A-7.
*E	12/26/2017	• Updated Appendix chapter • Updated “Hardware Details” • Updated “Power Supply System” • Updated “Measure PSoC 4100S Plus Device Current Consumption” • Updated description.
*F	12/28/2017	• Updated Figure 1-3, Figure 1-4, Figure 3-3, Figure 4-1, Figure 4-2, Figure 4-6, Figure 4-9, Figure 4-10

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Revision history

Document revision	Date	Description of changes
*G	2024-12-19	• Migrated to IFX template • Renamed PSoC™ to PSOC™ • Renamed EZ-BLE™ to AIROC™ Bluetooth® LE • Removed PSoC™ Creator sections • Removed KitProg2 sections • Updated Introduction • Updated Kit contents • Updated Getting started • Updated Board details • Updated Additional Learning Resources • Updated Technical support • Updated Theory of operation • Added Using the OOB example - CE237532 • Added Creating a project and program/debug using ModusToolbox™ software • Updated Schematics • Updated Functional description • Added PSOC™ 4100S Plus MCU features • Added PSOC™ 4100S Plus device power supply system • Added Measure PSOC™ 4100S Plus current consumption • Updated Board separation (Snapping) • Updated Header connections • Added Reset button • Added PSOC™ 5LP-based KitProg3 programmer and debugger • Added KitProg3 onboard target voltage measurement • Added KitProg3 programming mode selection button and status LED • Added Capacitive sensing • Updated System capacitors • Added User LEDs • Added User button • Added AIROC™ Bluetooth® LE module

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