

User Guide for XENSIV™ KIT CSK PASCO2

About this document

Scope and purpose

This document is a user guide for the XENSIV™ KIT CSK PASCO2, provided as part of the connected sensor kit (CSK) offering.

Intended audience

Customers interested in using CYSBSYSKIT-DEV-01 in combination with the XENSIV™ PAS CO2 or the XENSIV™ DPS368 barometric pressure sensor to build their own IoT solution for various consumer applications.

Important notice

Table of contents

About this document..... 1

Table of contents..... 2

1 Important notice..... 4

2 Introduction..... 5

2.1 Kit content.....5

2.2 CYSBSYSKIT-DEV-01.....6

2.2.1 CYSBSYSKIT-DEV-01 main components.....6

2.3 XENSIV™ PAS CO2 wing.....7

2.3.1 XENSIV™ PAS CO2.....7

2.3.2 XENSIV™ DPS368 barometric pressure sensor.....8

2.3.3 Board details.....9

2.3.4 Kit and system block diagram.....9

2.4 Getting started.....10

2.5 Abbreviations.....11

3 Quick IoT Experience.....12

4 Build your own application.....21

4.1.1 XENSIV™ PAS CO2 sensor library.....21

4.1.2 XENSIV™ DPS3xx pressure sensor library.....21

4.2 Code examples.....21

4.2.1 Getting started with ModusToolbox™.....21

5 Hardware description.....24

5.1 CYSBSYSKIT-DEV-01.....24

5.1.1 Baseboard components.....24

5.1.2 Hardware functional description.....28

5.1.3 CYSBSYS-RP01 module.....28

5.1.4 PSoC™ 5LP.....28

5.1.5 Serial interconnection between PSoC™ 5LP and module.....30

5.1.6 Power supply system.....30

5.1.7 Expansion headers.....32

5.1.8 QSPI.....32

5.1.9 LED.....33

5.1.10 User button.....33

5.1.11 ECO.....33

5.1.12 10-pin SWD/JTAG programming header.....34

5.1.13 KitProg3: on-board programmer/debugger.....34

5.1.14 Programming and debugging.....34

5.1.15 USB-UART bridge.....34

5.1.16 USB-I2C bridge.....35

5.2 XENSIV™ PAS CO2 wing.....35

5.2.1 Wing board components.....35

5.2.2 Adafruit feather-compatible connectors.....36

5.2.2.1 Power supply.....38

5.2.3 Mechanical buttons.....38

5.2.4 Hardware details.....39

5.2.4.1 Wing board schematics.....39

Appendix A.....45

Viewing debug data on the KitProg serial port of the kit.....45



Important notice

Reading LEDs	45
Troubleshooting guide	45
List of attributes with their definition and possible values.....	48
Appendix A: Frequently asked questions.....	52
Revision history.....	53

Important notice

1 Important notice

Infineon Technologies AG (Infineon) provides the evaluation unit XENSIV™ KIT CSK PASCO2 which is built to enable testing and evaluation of CYSBSYSKIT-DEV-01 in combination with the XENSIV™ PAS CO2 under the following conditions:

- The evaluation unit is intended to be used for development, TESTING and EVALUATION PURPOSES ONLY and is not considered by Infineon to be a finished end product fit for general consumer use.
- The evaluation unit (not being an end product) is not intended to be complete in various product aspects such as required design, marketing, manufacturing, product safety, security and environmental measures.
- The evaluation unit (evaluation kit) does not fall within the scope of the European Union directives and FCC regulation, and therefore may not meet the technical requirements of these directives or other related directives and regulations.
- The evaluation unit is provided for test and evaluation purposes only to evaluate XENSIV™ PAS CO2 or XENSIV™ DPS368. The evaluation unit is provided “as is” without any warranty or liability of any kind.
- The user assumes all responsibility and liability for proper and safe handling of the goods including following ESD precautions. Further, the user indemnifies Infineon from all claims arising from the handling or use of the goods.
- NEITHER PARTY SHALL BE LIABLE TO THE OTHER PARTY FOR ANY DAMAGES INCLUDING (BUT NOT LIMITED TO) INDIRECT, SPECIAL, INCIDENTAL AND CONSEQUENTIAL DAMAGES.

For additional information, please contact an Infineon application engineer or visit www.infineon.com.

Introduction

2 Introduction

The XENSIV™ KIT CSK PASCO2 supports customers in testing sensor-driven IoT products and CO2 use cases as well as in prototyping. It offers a real-time sensor evaluation with custom configurations and cloud-based PAS CO2 sensor data visualization.

2.1 Kit content

The XENSIV™ KIT CSK PASCO2 (Figure 1) comes with:

- Rapid IoT connect developer kit (CYSBSYSKIT-DEV-01) (Figure 2)
- XENSIV™ PAS CO2 wing (EVAL_PASCO2_Wing) (Figure 3)



Figure 1 XENSIV™ KIT CSK PASCO2



Figure 2 CYSBSYSKIT-DEV-01 rapid IoT connect developer kit



Figure 3 XENSIV™ PAS CO2 wing

Introduction

2.2 CYSBSYSKIT-DEV-01

The Rapid IoT connect developer kit carries a CYSBSYS-RP01 Rapid IoT connect system-on-module (SoM). The Rapid IoT connect SoM includes a PSoC™ 6 MCU device, a CYW43012 single-chip radio, on-board crystals, oscillators, chip antenna, and passive components. The PSoC™ 6 MCU device on the Rapid IoT connect SoM has two cores: Cortex M0+ (CM0+) and Cortex M4 (M4). The firmware running on the PSoC™ 6 MCU can be split into two parts: the application and device management. The device management part runs on the Cortex-M0+ core. The applications part run on the Cortex-M4 core. The Cortex-M0+ core is called the network processor (NP). The Cortex-M4 core is called the customer processor (CP). Resources such as flash, RAM and the peripherals are divided between the NP and CP.

The Rapid IoT connect SoM is the easiest way to provide a secure, scalable, and reliable connection from your device to your cloud. The Rapid IoT connect SoM is a pre-certified 802.11ac-friendly dual-band (2.4 and 5.0 GHz) Wi-Fi and Bluetooth® 5.0-compliant combo radio with an integrated PSoC™ 6 Secure IoT MCU provided in an easy-to-use package. Included within the SoM are the crystals, oscillators, RF switches, passive components, and antenna to help accelerate development of your secure IoT products. It provides up to 51 I/Os in a 26.6 x 14.0 x 2.5-mm castellated surface mount PCB for easy manufacturing.

Along with the Rapid IoT connect developer kit, Infineon® offers the Infineon® Rapid IoT connect cloud platform. This Rapid IoT connect cloud platform allows users to quickly and easily connect their kits to the cloud and see real time sensor data. Rapid IoT connect cloud platform provides several example projects that can be easily programmed onto the user's kit.

The user signs up with the Infineon® Rapid IoT connect cloud platform and registers the Rapid IoT connect developer kit with the unique serial number printed on it. The user chooses an application for evaluation on the Rapid IoT connect developer kit. The Rapid IoT connect cloud platform configures specific application images which are available for download and programming on the Rapid IoT connect developer kit.

Rapid IoT connect cloud platform offers an array of services such as: Firmware over the air (FOTA) updates, device management services such as Location services - parameter monitoring, and much more. Users who desire to use these services for a large number of devices can connect with their respective Infineon® sales support.

2.2.1 CYSBSYSKIT-DEV-01 main components

The Rapid IoT connect developer kit has the following features:

- CYSBSYS-RP01 module
- 512-Mbit external Quad SPI NOR Flash that provides a fast, external expansion memory for data and code
- KitProg3 on-board SWD programmer/debugger, USB-UART, and USB-I2C bridge functionality. KitProg3 is compatible with Mbed OS development flow and is CMSIS-DAP capable.
- A user LED, a user button, and a reset button
- Battery connector, charging IC, and charging indicator LED
- One KitProg3 mode button, one KitProg3 status LED, and one KitProg3 power LED
- **Optiga Trust M** advanced security controller for secure data storage
- Thermistor for sensing the ambient temperature.
- Power supply system consisting of a 3.6V buck-boost regulator with the 1.8V and 3.3V LDO derived from the 3.6V regulator. USB or LiPo battery powers the entire kit.

Introduction

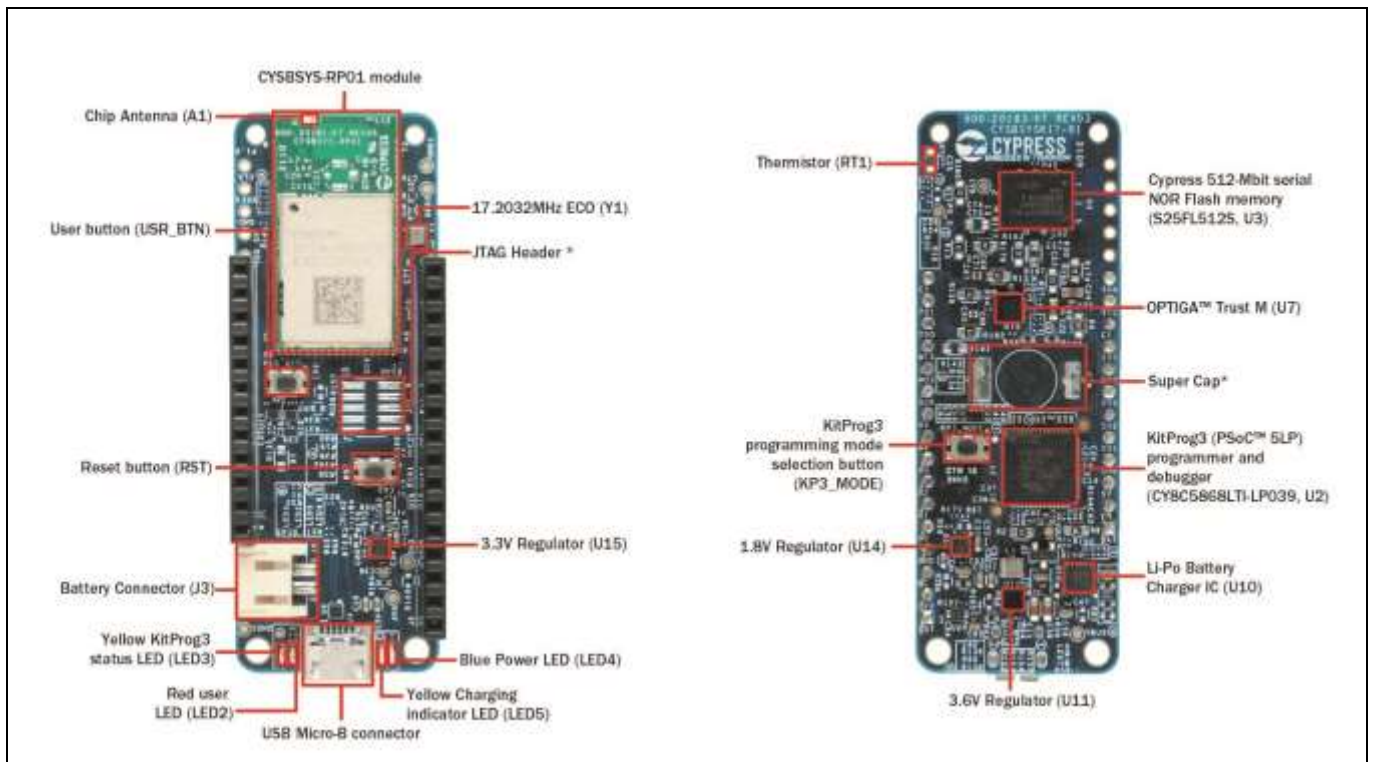


Figure 4 CYSBSYSKIT-DEV-01

2.3 XENSIV™ PAS CO2 wing

Increasingly efficient building insulation can help to mitigate the effects of climate change, but heavily insulated buildings are not always good for human health. Poor ventilation can result in lower oxygen levels and a build-up of carbon dioxide (CO₂). Even moderate levels of CO₂ can have a negative impact on health and productivity. Already at 1000 ppm, people begin to experience drowsiness and have difficulty concentrating. Consequently, there is a growing demand for smart indoor air quality sensors that can “smell” rising levels of CO₂ and either alert the user or trigger a system response. This user guide describes the required software and hardware, including how to set up and get started with Infineon’s CO₂ sensor solution using the CSK. Please refer to the CSK user manual for more details on the CSK. Additional documents are available and are listed at the end of this document.

The board also comprises the XENSIV™ DPS368 digital barometric pressure sensor. This high-precision pressure sensor can detect very small changes in barometric pressure, which makes it an ideal device for use cases where accurate pressure event detection is required (e.g., opening of doors or windows, or fall detection).

Having both the CO₂ sensor and pressure sensor on the board gives the possibility to develop and test more complex scenarios where data from both sensors is combined for more reliable event detection.

2.3.1 XENSIV™ PAS CO2

Infineon’s XENSIV™ PAS CO₂ sensor leverages photoacoustic spectroscopy (PAS) technology to provide an exceptionally small, real CO₂ sensor, overcoming the challenges of existing CO₂ sensor solutions. Its unprecedentedly small form factor in a surface-mounted device (SMD) package allows for smooth high-volume assembly and easy system integration.

Introduction

The XENSIV™ PAS CO₂ sensor integrates on the PCB the PAS transducer, including a detector, infrared source and optical filter; a microcontroller for signal processing and algorithms; and a MOSFET chip to drive the infrared source. The integrated microcontroller runs ppm calculations as well as advanced compensation and configuration algorithms.

Key benefits

- Space savings in customers' end products
- High-quality data and compliance with smart building standards
- Cost-effective high-volume assembly and easy system integration
- Plug and play for fast design-to-market
- Customer flexibility thanks to a variety of configuration options

Key features

- Exceptionally small form factor (14 x 13.8 x 7.5 mm³) sensor
- Accurate and robust performance at ppm level (± 30 ppm ± 3 percent of reading)¹
- Advanced compensation and self-calibration algorithms
- Configurable sampling rate via UART and I²C interfaces

2.3.2 XENSIV™ DPS368 barometric pressure sensor

The XENSIV™ DPS368 is a miniaturized digital barometric air pressure sensor robust against water, dust and humidity. It offers high accuracy and low current consumption and is capable of measuring both pressure and temperature. The pressure sensor element is based on a capacitive sensing principle which guarantees high precision during temperature changes. The small package makes the XENSIV™ DPS368 ideal for mobile applications and wearable devices. Due to its robustness, it can be used in harsh environments.

Key benefits

- Suitable even for harsh environments
- Easy to integrate and to operate; allows fast design-to-market
- High precision makes the XENSIV™ DPS368 an ideal device for applications such as fall detection, step counting, door or window opening, and environmental scene monitoring in general
- Variety of configurations allows user to choose optimum sensor settings for target application
- In combination with the XENSIV™ PAS CO₂, environmental pressure measured by the XENSIV™ DPS368 is used to increase CO₂ ppm accuracy of the XENSIV™ PAS CO₂ sensor

Key features

- IPx8 certified: temporary immersion at 50 m for 1 hour
- Interface: I²C and SPI (both with optional interrupt)

¹ Current engineering samples (early development samples) deviate from these specifications and are meant primarily to demonstrate functionality.

Introduction

- Operating modes: command (manual), background (automatic) and standby
- Pressure sensor precision: ± 0.002 hPa (or ± 0.02 m) (high precision mode)
- Absolute accuracy: ± 1 hPa (or ± 8 m)
- Package dimensions: 8-pin PG-VLGA-8-2, 2.0 mm x 2.5 mm x 1.1 mm

2.3.3 Board details

The CYSBSYSKIT-DEV-01 rapid IoT connect developer kit serves as the compute and connect part of the CSK. Infineon sensor wing boards, such as the XENSIV™ PAS CO2 wing, sense the environment. The wing board has Adafruit feather-compatible connectors to be stacked individually or combined with other CSK-compatible wing boards on the rapid IoT connect developer kit.

2.3.4 Kit and system block diagram

A block diagram of the wing board is shown in Figure 5. The wing board comprises the XENSIV™ PAS CO2, the XENSIV™ DPS368 and the required power supply components. Power lines are highlighted in red. It is also equipped with push buttons and LEDs.

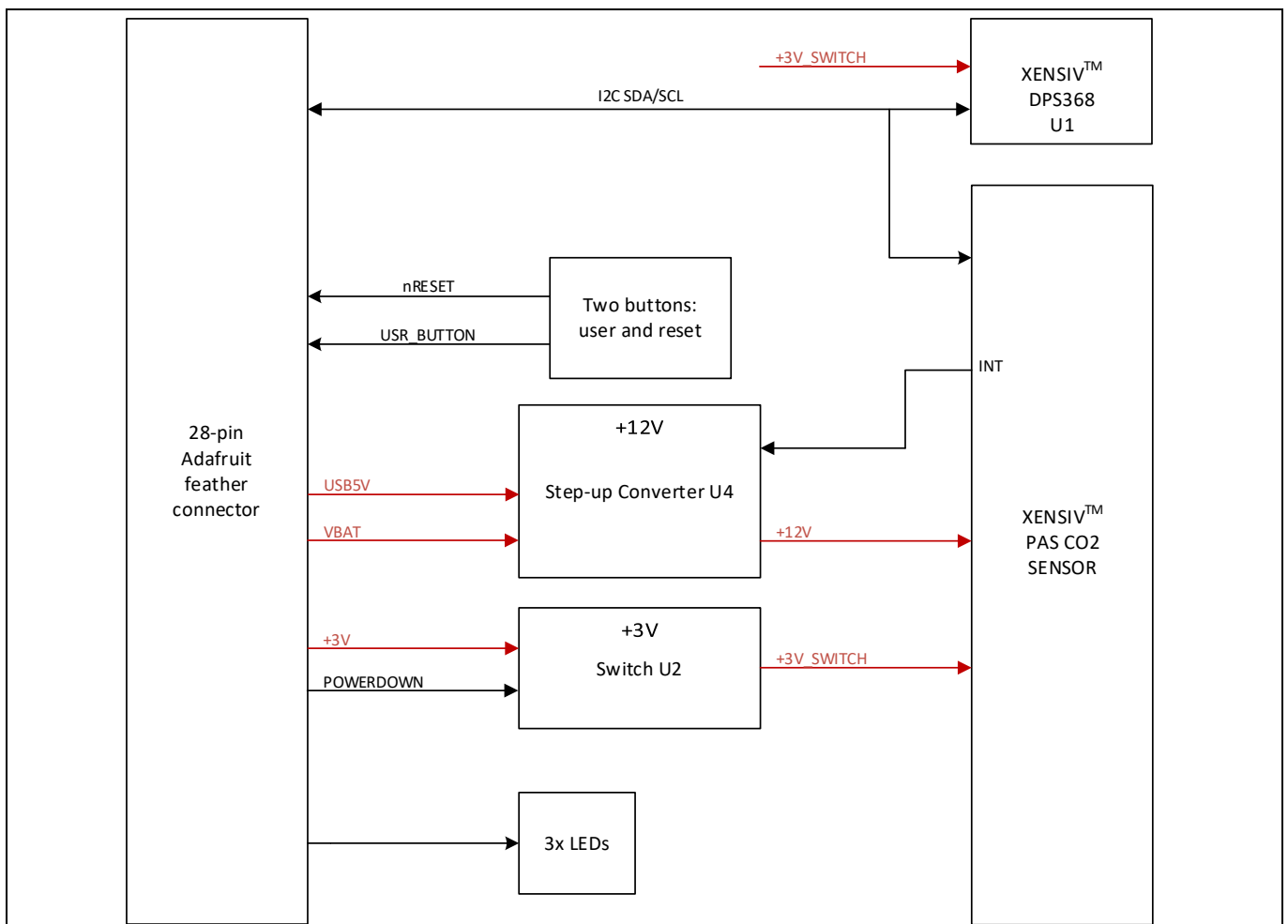


Figure 5 XENSIV™ PAS CO2 wing block diagram

A system block diagram showing the shield connected to the CSK rapid IoT baseboard is depicted in Figure 4. The interface from the shield to the rapid IoT baseboard includes I²C, digital signals, analog signals and power

Introduction

lines. The baseboard can interact with the outside world using Wi-Fi, Bluetooth, USB, or a combination of them depending on the firmware/software (FW/SW) that is installed on the rapid IoT baseboard. The kit can be powered from an external power supply or from a LiPo battery.

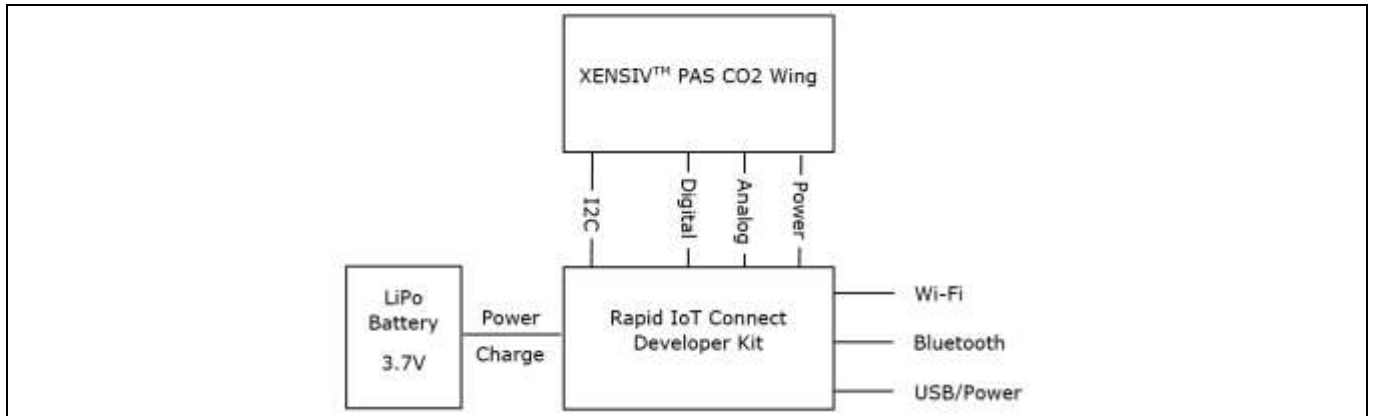


Figure 6 CSK system block diagram

2.4 Getting started

This guide will help you to get acquainted with the XENSIV™ KIT CSK PASCO2:

- Chapter Quick IoT Experience demonstrates how to read sensors and connect to the Rapid IoT connect cloud platform in less the 10 minutes
- Chapter Build your own application explains how to use ModusToolbox™ to build your own application to connect to your own cloud solution. ModusToolbox™ provides numerous code examples to make this process easier.

Note: CYSBSYSKIT-DEV-01 requires ModusToolbox™ 2.2 or higher to design and debug applications. Download and install ModusToolbox™ from www.cypress.com/modustoolbox. See the [ModusToolbox™ Installation Guide](#) and [ModusToolbox™ IDE Quick Start Guide](#) for additional information.

Users can experience the XENSIV™ KIT CSK PASCO2 in two ways:

- a) Quick IoT experience for straightforward evaluation
- b) Code examples in ModusToolbox™ for IoT solutions development

Introduction

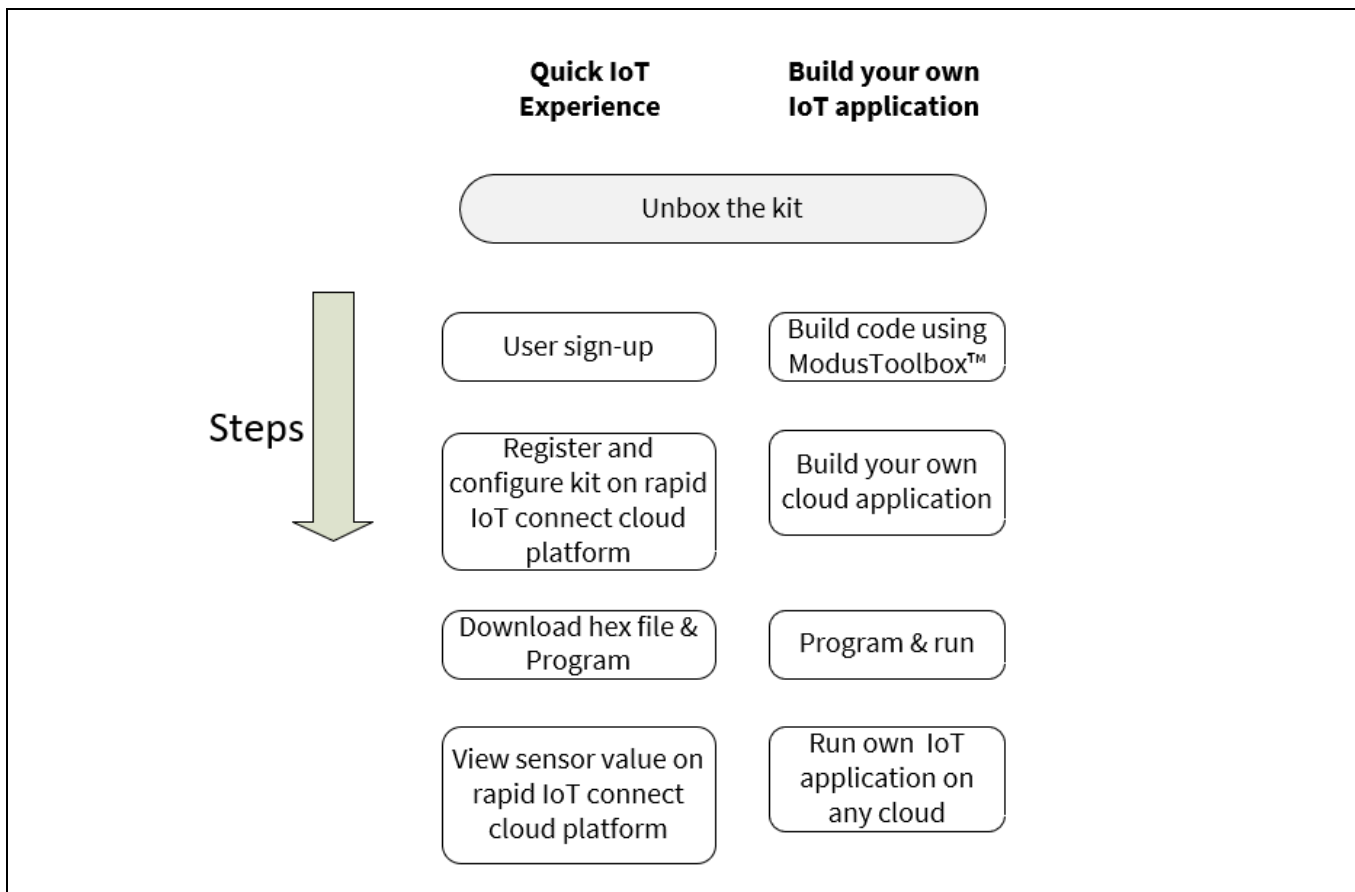


Figure 7 CSK experience steps

2.5 Abbreviations

Table 1 Abbreviation used in this document

Abbreviation	Description
BSP	Board support package
CO ₂	Carbon dioxide
CSK	Connected sensor kit
GPIO	General purpose input/output
HW	Hardware
I ² C	Inter-integrated circuit
IoT	Internet of Things
LED	Light-emitting diode
PAS	Photoacoustic spectroscopy
PCB	Printed circuit board
PSoC	Programmable system-on-chip
SPI	Serial peripheral interface
UART	Universal asynchronous receiver transmitter

Quick IoT Experience

3 Quick IoT Experience

1. **Signup and login:** Create an account with the **Infineon® Rapid IoT connect cloud platform** by signing up with your email address. You will receive the password in your registered email address. You will be prompted to change your password upon your first login to change it to the password of your choice.



Figure 8 Rapid IoT connect cloud platform sign-up view



Figure 9 Rapid IoT connect cloud platform login view

2. **Add device:** Click on the “Add device” button to add your new KIT CSK PASCO2. A pop-up wizard will guide you through the process. Provide a name and enter the development kit serial number as shown in the figure and click “Next” button to continue to next screen.

Quick IoT Experience



Figure 10 Add device

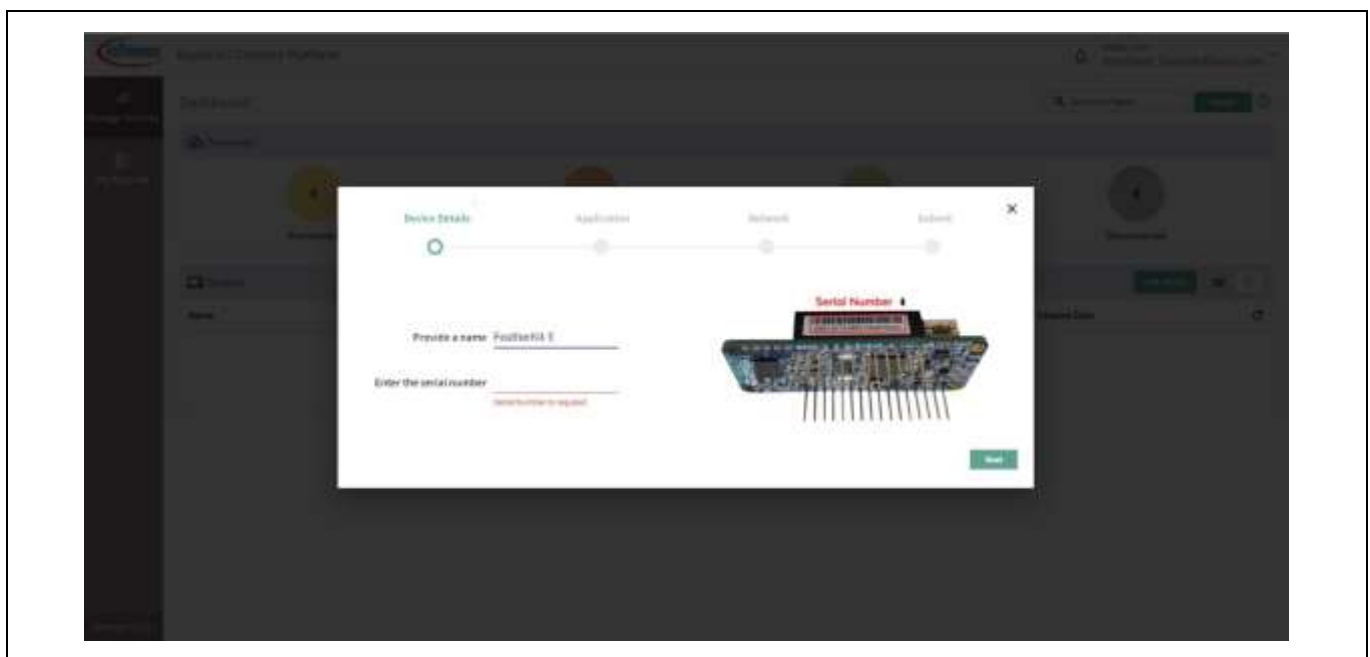


Figure 11 Add device wizard

- Application:** Quick IoT experience will provide a complete IoT sensor experience, in 10 minutes or less, that is inclusive of telemetry and fleet monitoring. After completing this wizard, you will download and program your development kit with a pre-built hex file that prepares and configures the development kit with latest Wi-Fi firmware, an example application, and all the required credentials to securely connect to the cloud. Kindly note that example application will automatically use integrated temperature sensor. Please select your desired application based on the XENSIV wing board present with you, in this case the XENSIV™ PAS CO2 wing.

Quick IoT Experience

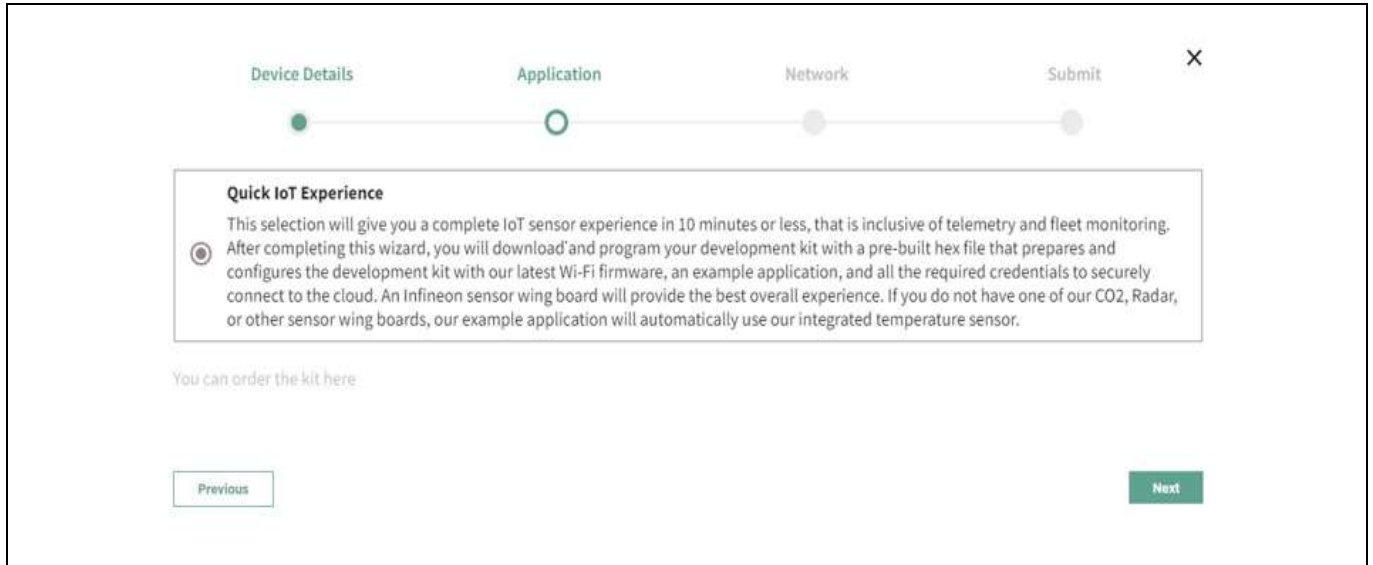


Figure 12 Select application

4. **Configure Wi-Fi network:** You have the option to get the firmware to connect to your preferred WPA2 network by providing the Wi-Fi SSID and password or setup an access point/hotspot of WPA2-PSK security with the following credentials.

SSID: *IFX_Sensor*
 Security: *WPA2-PSK*
 Password: *S66M14022021*

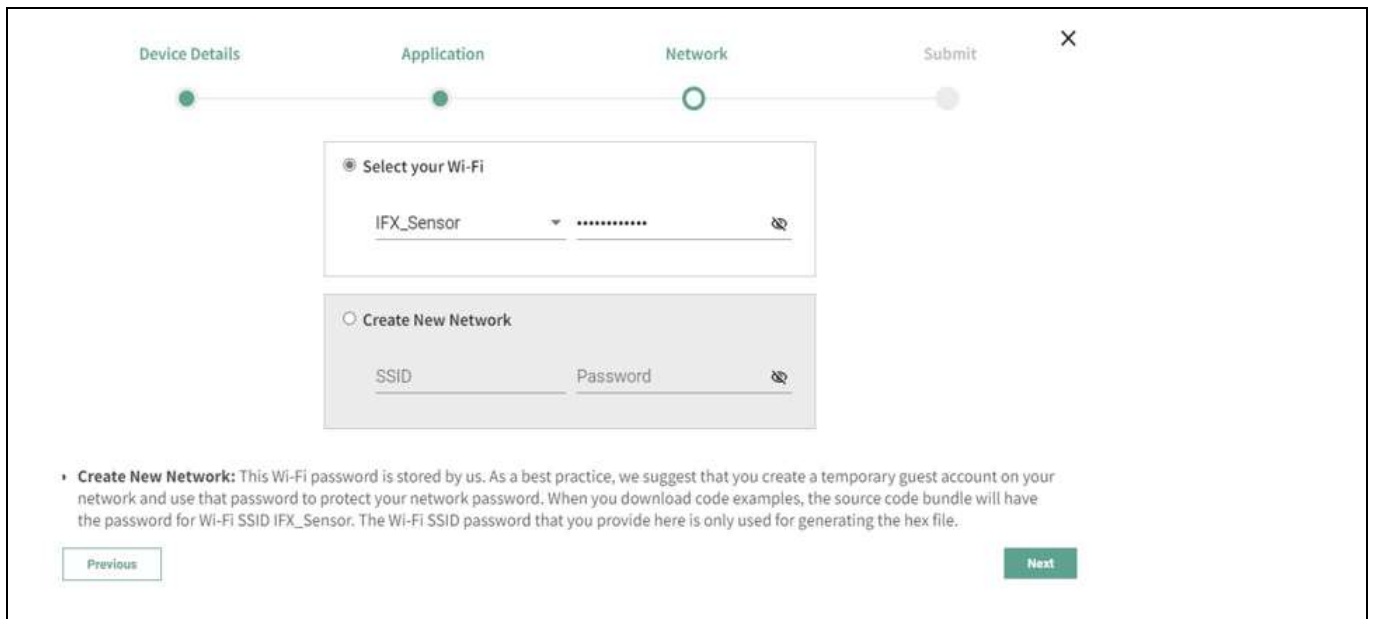


Figure 13 Configure and select network

5. **Submit your device configurations:** Please ensure all the details entered are correct before clicking on the “Submit” button. You can go back to earlier screens by pressing “Previous” if you need to change anything. Once you press “Submit”, a custom hex file is built for your device and a software bundle will be generated to program your development kit.

Note: You can add/register a maximum of 5 devices with Rapid IoT connect cloud platform account.

Quick IoT Experience

- Download the zip package** – Based on your laptop/PC’s operating system (Windows/Linux/Mac), you will be given with a downloadable package containing the firmware image in a hex file and programming tool to program your KIT CSK PASCO2. This will be a zip package. Click on the expand button to view the detailed device status. Please click the download Button next to Success on the application for downloading the zip package.

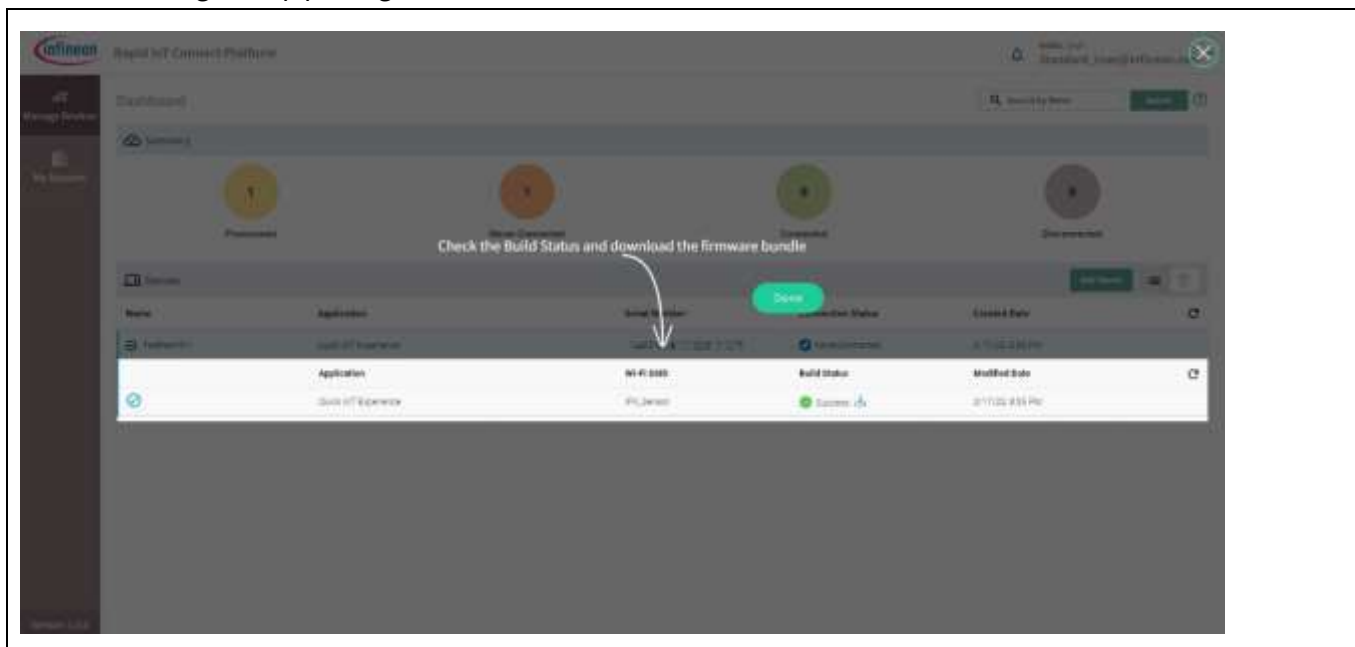


Figure 14 Device management dashboard

- Program the KIT CSK PASCO2:** Connect your development kit to your PC/laptop using a Micro USB cable. Extract the zip and run the *program_kit* script (*.cmd file for Windows, *.sh for Linux and *.command for Mac). For Linux and MAC users, please ensure that you run the script from a terminal with necessary permissions. Please refer the README for detailed instructions.

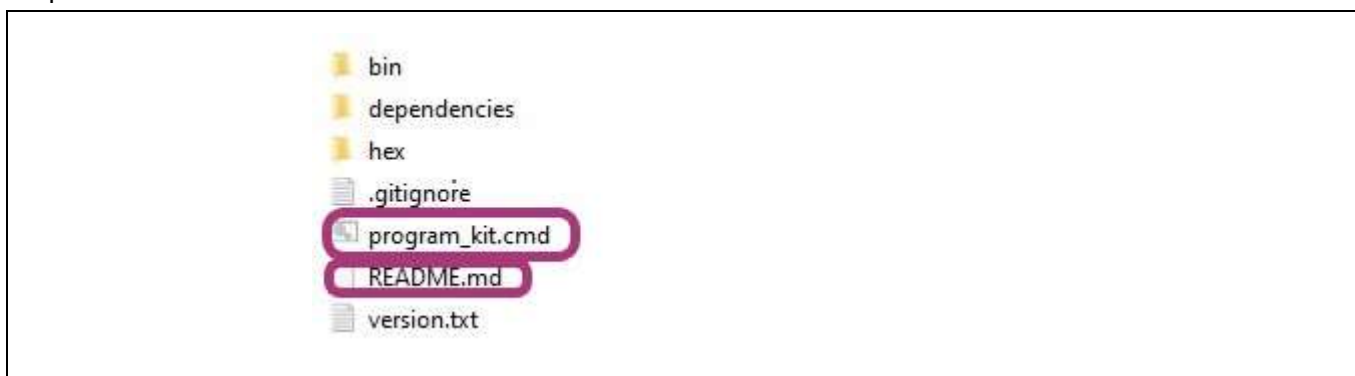



Figure 15 Package contents

Quick IoT Experience

8. **Device management:** Manage your device(s) and its configurations from the device management tab. Click on the expand icon  after the **Created Date** to view the respective device details.

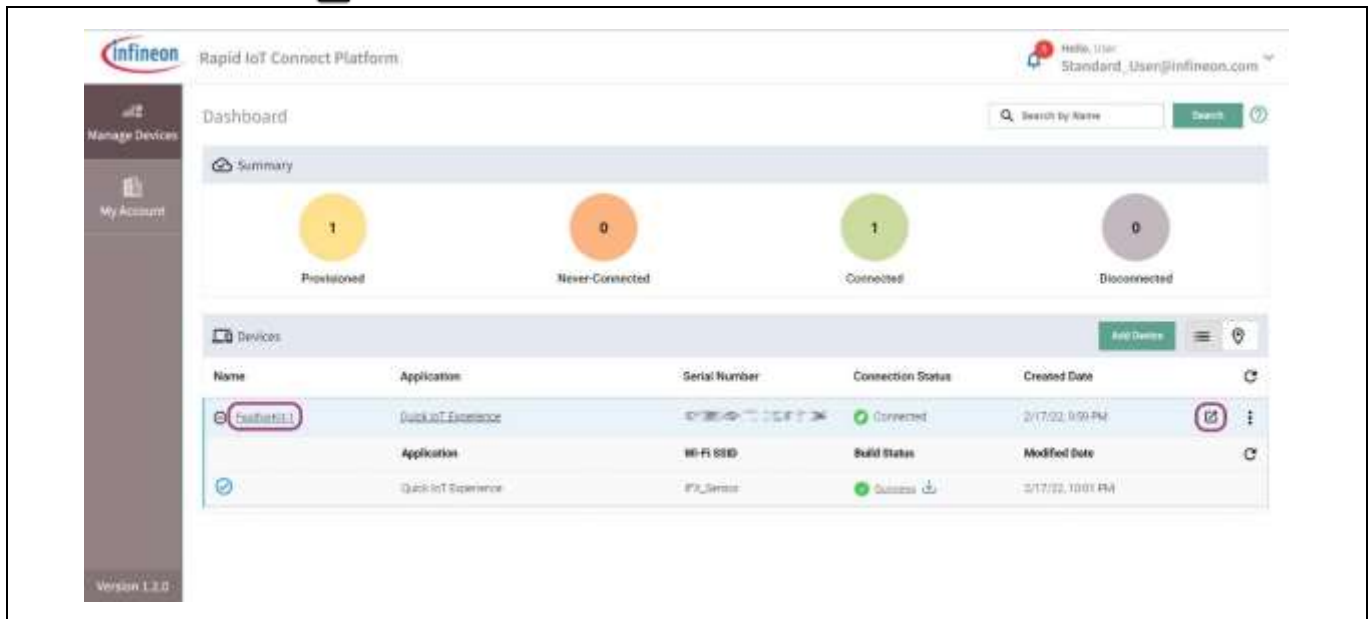


Figure 16 Device connection status

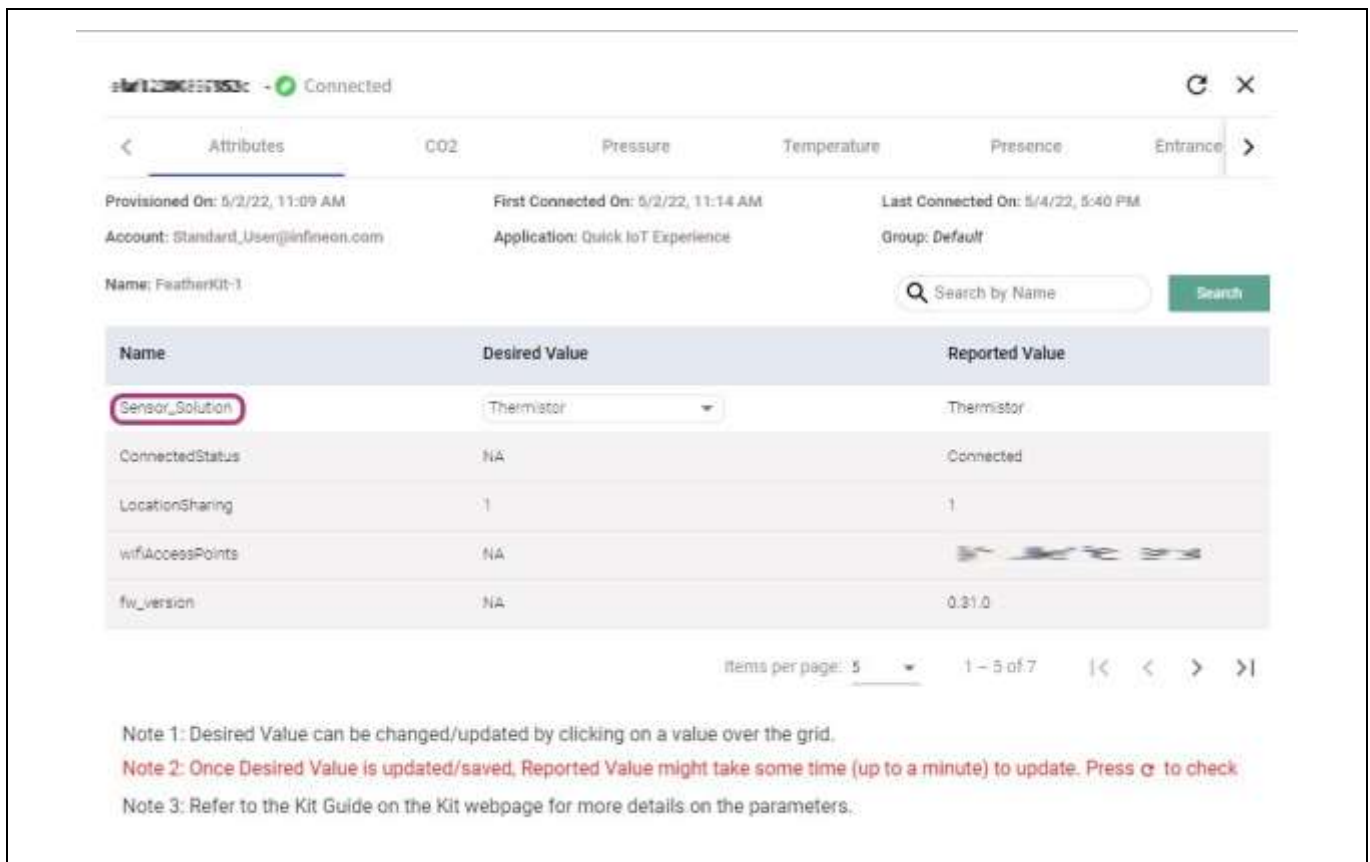


Figure 17 Device attributes

9. **Select desired application:** Select **Attributes** tab on the device details. Click on the dropdown menu for **Sensor_Solution** in the desired value. Please select the desired application based on the connected Infineon® sensor wing board, in our case **XENSIV PAS CO2**. Your application will be set to “Thermistor” as

Quick IoT Experience

default, since the only sensing element available on CYSBSYSKIT-DEV-01. After the application is selected, the attributes will be pushed to the device and the device will reboot to the desired application.

Note: This may cause the connectivity to disconnect and reconnect from the Rapid IoT connect cloud platform.

Please refer Appendix for detailed list of attributes with their definition and possible values.

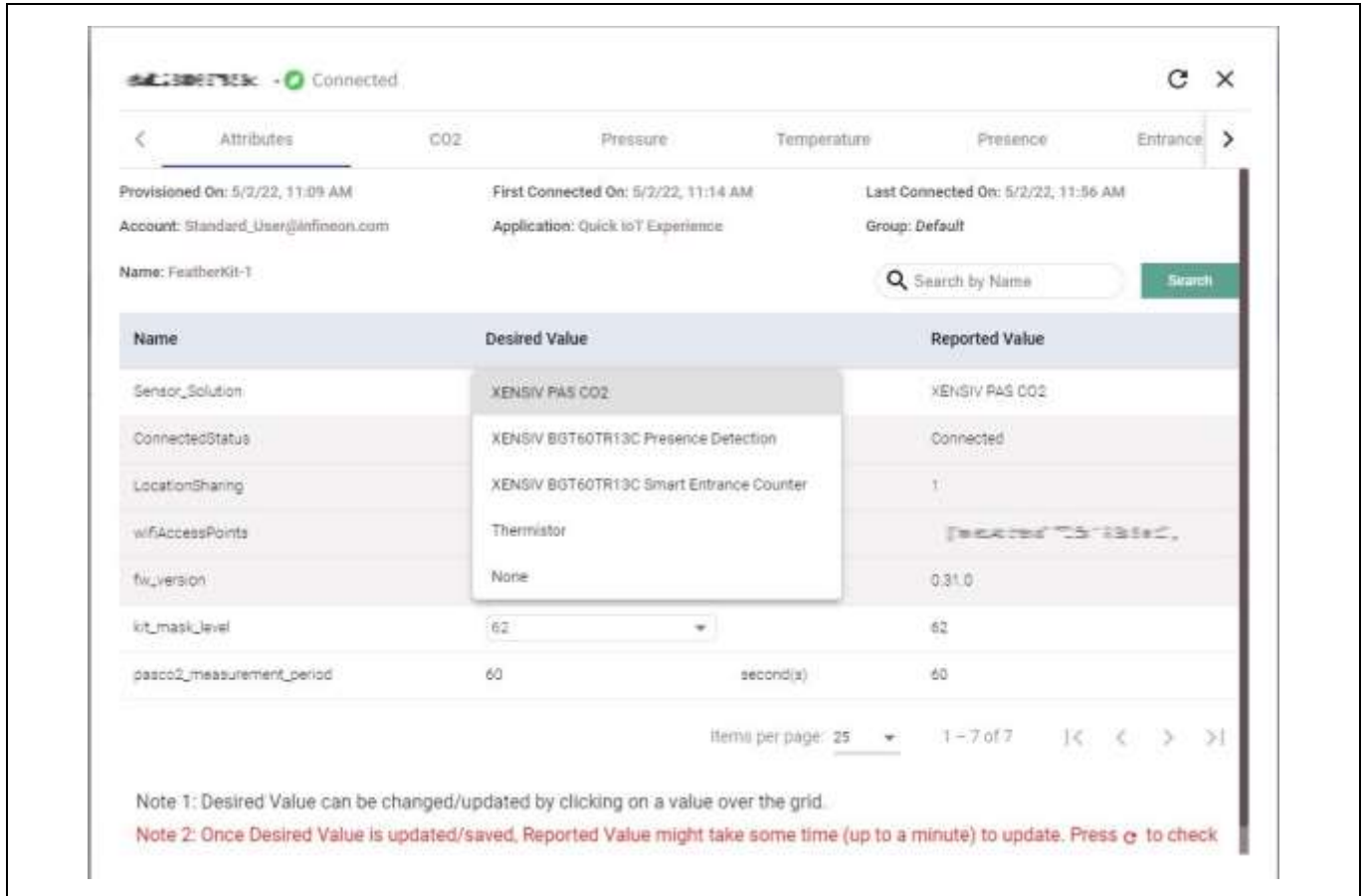


Figure 18 Select sensor solution

- Change measurement period:** Click on the **Items per page** drop-down menu at the bottom of the **Attributes** tab and change the number of items accordingly so that you can view all attributes in one page. You can change the **pasco2_measurement_period** value from 10 seconds up to 43200 seconds as needed. You can also alter **kit_mask_level** to disable logs, enable minimal logs or full logs to cloud by changing the drop-down menu.

Quick IoT Experience

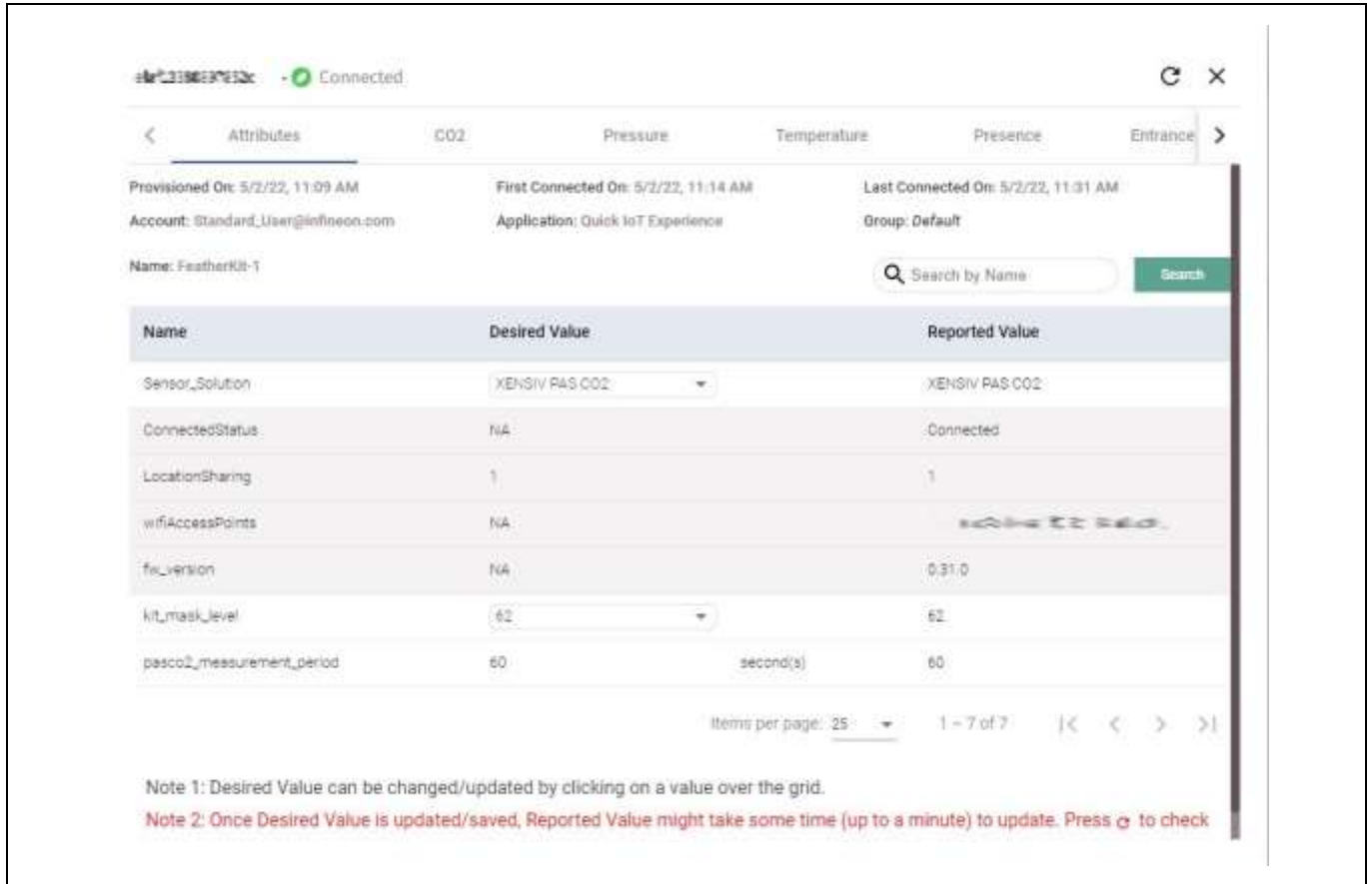


Figure 19 Kit_log level configuration

Quick IoT Experience

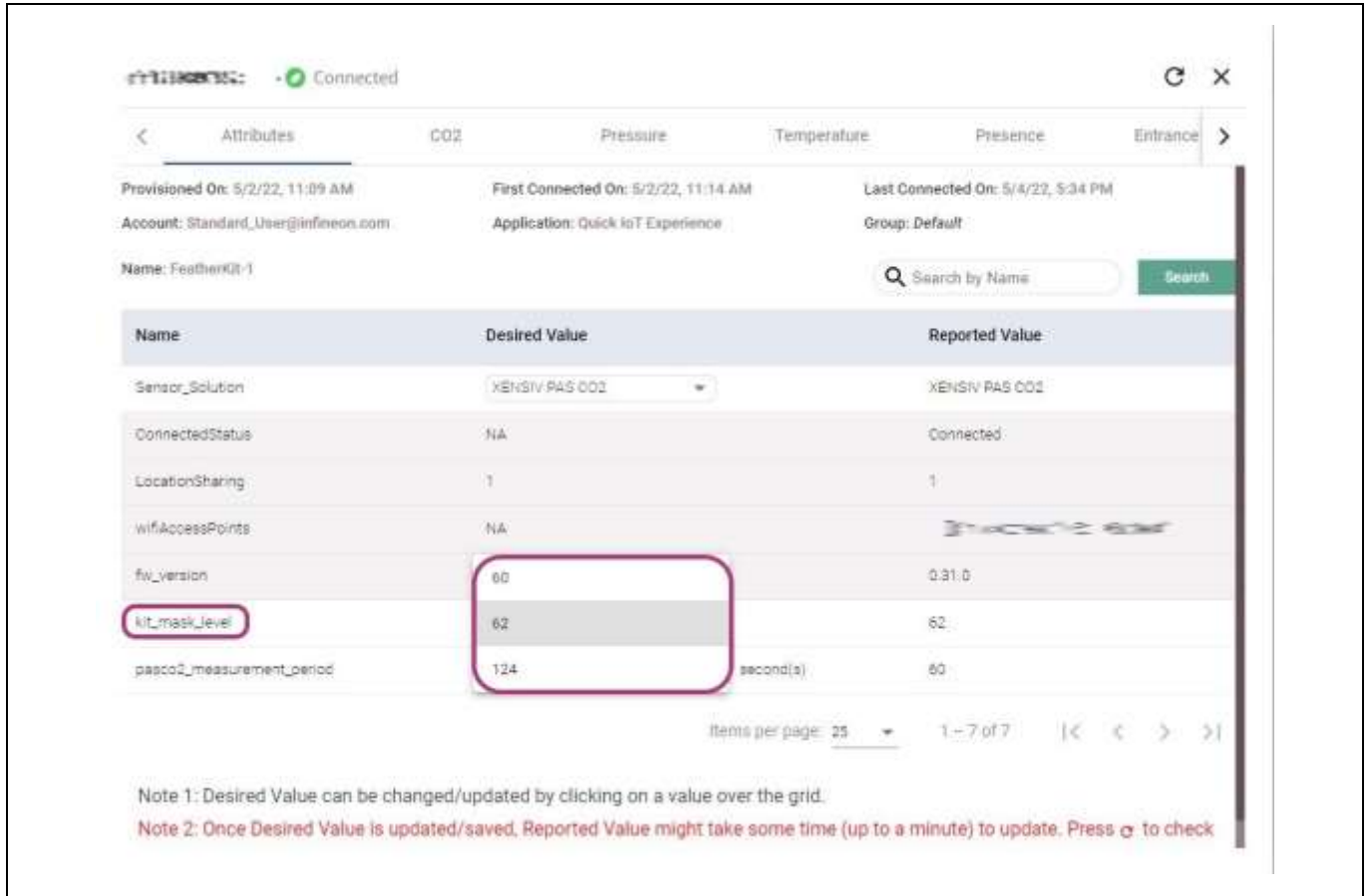


Figure 20 Device log level configuration

View sensor data: Click on the desired tab on the top of the device details window to view your sensor data on the cloud. Please select CO2 and Pressure if you have Infineon® XENSIV PAS CO2 wing board. Your application will be set to “Thermistor” as default. Click on the “CO2” tab to view the data represented as a graph for easy viewing. You can also download the raw data in csv format from the “Download” button on the top right corner.

By default, the data retention period is 14 days for a Standard User. In other words, data recorded more than 14 days ago cannot be retrieved. If you would like to have a data retention period greater than 14 days, please get in contact with us for an upgraded account.

Quick IoT Experience



Figure 21 PAS CO2 data visualisation

Build your own application

4 Build your own application

The XENSIV™ PAS CO2 wing is supported by the [sensor-xensiv-pasco2](#) and [sensor-xensiv-dps3xx](#) libraries. Use ModusToolbox™ to build your own application to connect to your own cloud solution. ModusToolbox™ provides code examples to make this process easier.

4.1.1 XENSIV™ PAS CO2 sensor library

This library provides functions for interfacing with the XENSIV™ PAS CO2 sensor that enables the user to read the CO₂ concentration. This library can be set up to use the ModusToolbox™ HAL interface, or user-provided communication functions. Refer to the README.md file for more details.

<https://github.com/Infineon/sensor-xensiv-pasco2>

4.1.2 XENSIV™ DPS3xx pressure sensor library

This library provides functions for interfacing with the XENSIV™ DPS-310/368 barometric pressure sensors. This library can be set up to use the ModusToolbox™ HAL interface, or user-provided communication functions. Refer to the README.md file for more details.

<https://github.com/Infineon/sensor-xensiv-dps3xx>

Note: The XENSIV™ DPS368 uses the alternate address (0x76) in the XENSIV™ PAS CO2 wing.

4.2 Code examples

The code example demonstrates the use of the Infineon XENSIV™ PAS CO2 sensor to measure the CO₂ level. The CO₂ concentration value acquired by the sensor is dependent on the external atmospheric pressure. To compensate for this effect, the code example uses the XENSIV™ DPS368 on the wing board to read the value of the atmospheric pressure. Refer to the README.md file for more details.

<https://github.com/Infineon/mtb-example-sensors-pasco2>

This code example demonstrates implementing an MQTT client using the [MQTT client library](#) for XENSIV™ sensor with Infineon connectivity devices. The library uses the following:

- AWS IoT device SDK MQTT client library that includes an MQTT 3.1.1 client
- sensor-xensiv-pasco2 library that is configured to detect the CO₂ concentration

<https://github.com/Infineon/mtb-example-sensors-pasco2-anycloud-mqtt-client>

Additional code examples can be downloaded directly from the Infineon® Rapid IoT connect cloud platform and imported to ModusToolbox™. Simply build the code example and program the kit. The sensor values will be visible on the Rapid IoT connect cloud platform.

Known issue: ModusToolbox™ sensor-xensiv-pasco2 library asset is not fully compatible with PSoC 6 HAL library v2.X. User should not make use of the `xensiv_pasco2_mtb_interrupt_init()` functionality in a project using PSoC 6 HAL library v2.X.

4.2.1 Getting started with ModusToolbox™

1. ModusToolbox™ software is a free development ecosystem that includes the ModusToolbox™ IDE. Using ModusToolbox™ IDE, you can enable and configure device resources, middleware libraries, and program and debug the device. You can download the software from the [ModusToolbox™ home page](#). See the ModusToolbox™ user guide for additional information.

Build your own application

- 2. In the ModusToolbox™ IDE, import the desired code example (application) into a new workspace.
 - Click on New application from quick panel



Figure 22 ModusToolbox™ – new application

- Select CYSBSYSKIT-DEV-01 in the choose Board Support Package (BSP) window and click Next, as shown in below figure.

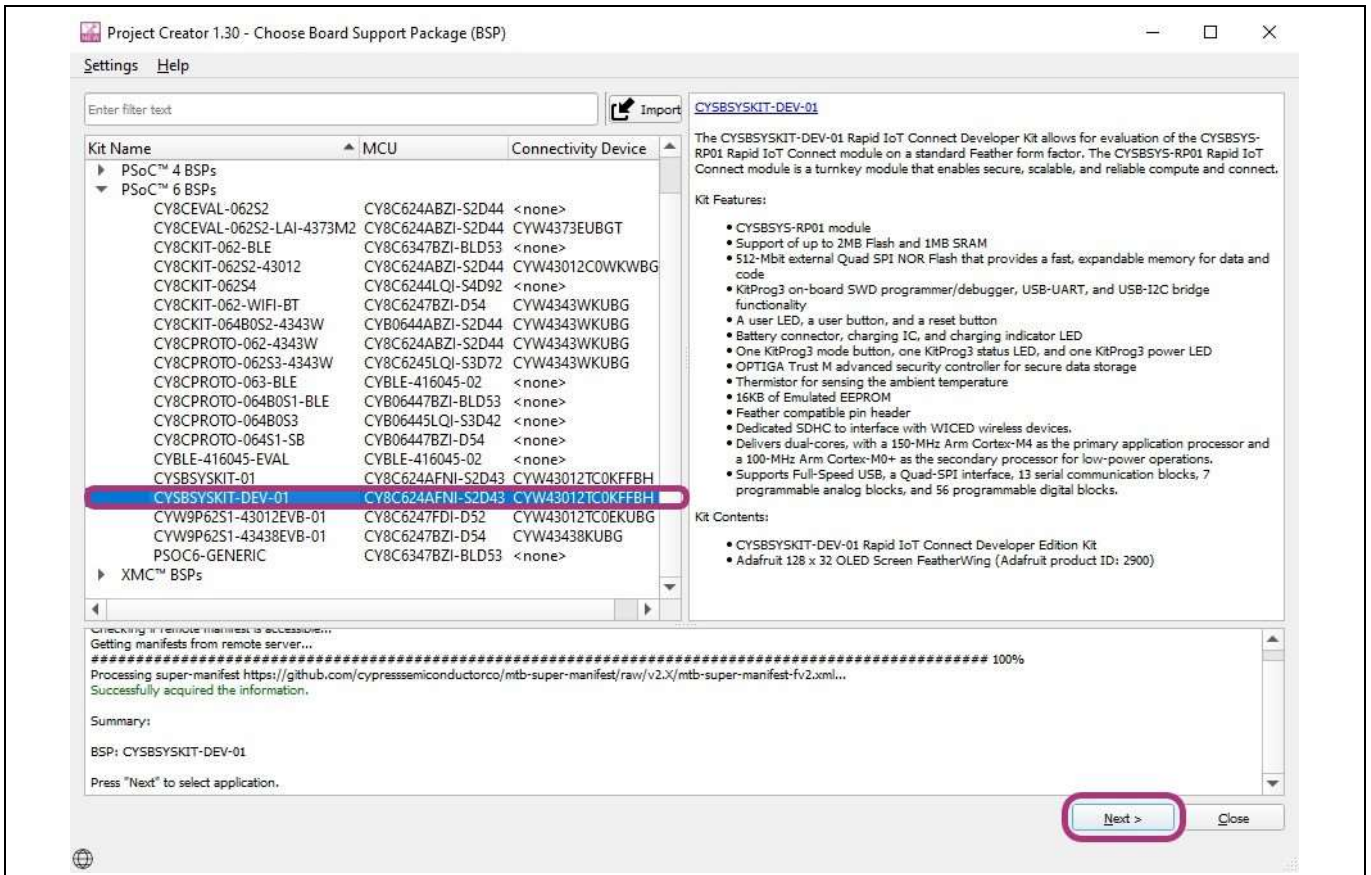


Figure 23 Select development kit

- Select the application and click **Create**, as shown in figure below.

Build your own application

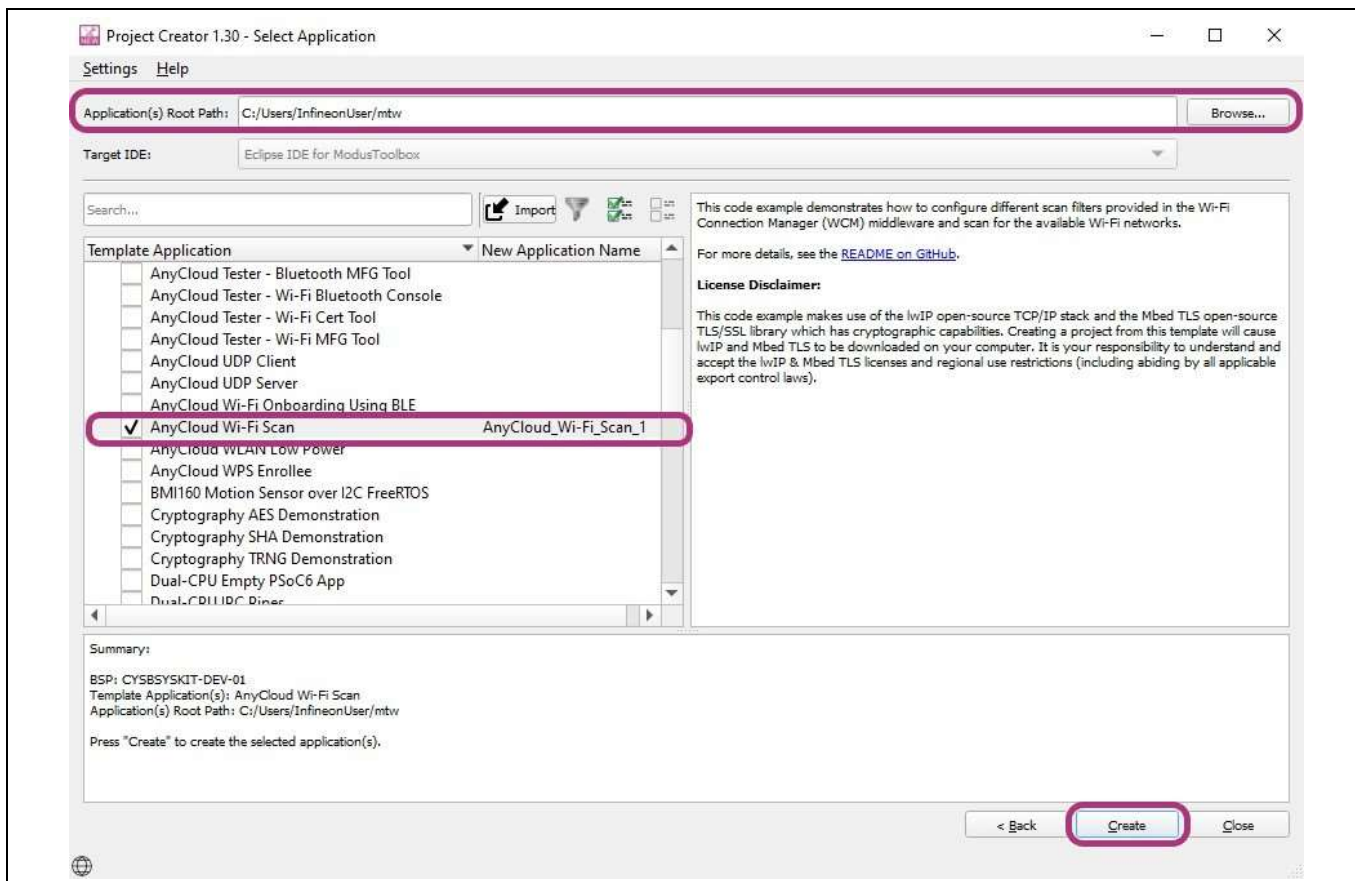


Figure 24 Select ModusToolbox™ application

3. To build and program the application, in the Project Explorer, select project. In the quick panel, scroll to the launches section and click the Program (KitProg3_MiniProg4) configuration.
4. ModusToolbox™ has an integrated debugger. To debug a PSoC™ 6 MCU application, in the Project Explorer, select project. In the quick panel, scroll to the launches section and click the Debug (KitProg3_MiniProg4) configuration.

Hardware description

5 Hardware description

This chapter introduces you to various features of the XENSIV™ KIT PAS CO2. Firstly, CYSBSYSKIT-DEV-01 and its components are described. Secondly, XENSIV™ PAS CO2 wing and its components are described.

5.1 CYSBSYSKIT-DEV-01

5.1.1 Baseboard components

The Rapid IoT connect developer kit is designed for evaluation of the CYSBSYS-RP01 Rapid IoT connect module on a form factor that is compatible with Breadboard and Feather wings. The CYSBSYS-RP01 SoM is a turnkey module that enables secure, scalable, and reliable compute and connect. It has all hardware resources of PSoC™ 6 MCU including Cortex®-M0+ and Cortex®-M4 cores available for the user. Please note that Cortex® M0+ will be used as network processor if you intend to use Infineon® Rapid IoT cloud platform and Subsystem Communication Layer for IoT Services.

The Rapid IoT connect developer kit contains CYSBSYS-RP01 Rapid IoT connect module with 512-Mbit SPI NOR Flash, Optiga Trust M Secure controller, NTC thermistor, reset button, user button, user LED, on-board programmer/debugger (KitProg3) along with USB-UART interface and USB-I2C interface in a compact form factor with stackable headers containing 1 SPI Interface, 1 UART interface, 1 I2C interface and 14 GPIOs where 6 pins can be configured as ADC as well. Apart from these, it also contains various power circuitry such as single cell Li-Po battery charger, buck-boost converter, LDOs, load switches, etc.

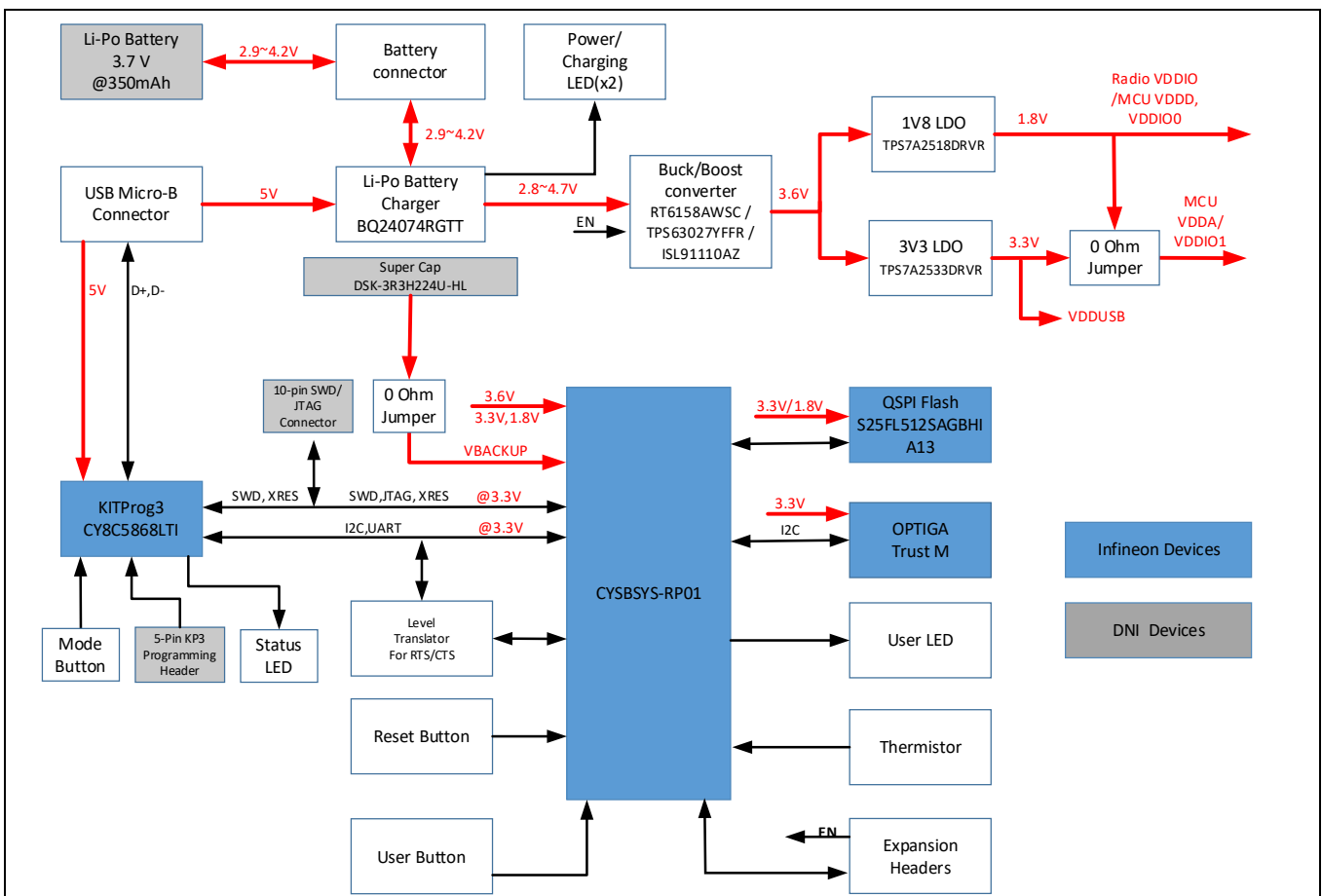


Figure 25 Hardware block diagram

Hardware description

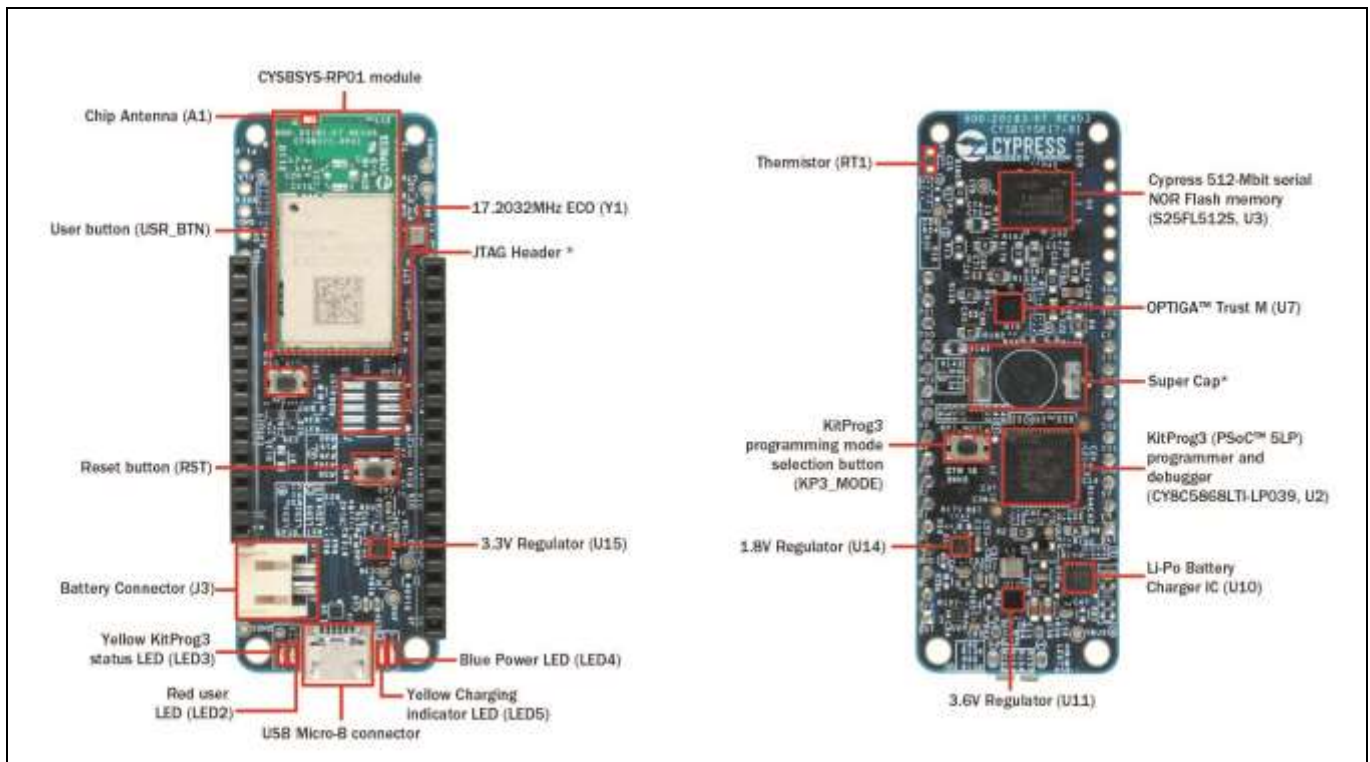


Figure 26 Rapid IoT connect developer kit top and bottom views

1. **CY5BSYS-RP01 module:** Rapid IoT connect module containing PSoC™ 6 MCU and Wi-Fi Bluetooth® radio with a chip antenna.
2. **17.2032Mhz ECO:** External Crystal Oscillator (ECO) for PSoC™ 6 MCU.
3. **JTAG header:** A 10-pin external programming header is provided to use external programmers like MiniProg4 to program the PSoC™ 6 MCU device over the SWD interface. This header is not loaded by default.
4. **Expansion headers (J1, J5):** These headers provide connectivity to PSoC™ 6 MCU GPIOs, and are compatible with Adafruit Feather pin mapping.
5. **User button:** Used for the user application. The PSoC™ 6 MCU pin is connected to power; when the push button is pressed, the PSoC™ 6 MCU pin is grounded.
6. **Chip antenna (A1):** An ultra-miniature chip antenna that supports 5GHz and 2.4GHz bands.
7. **3.3V regulator:** Regulator used to power the analog domain of PSoC™ 6 MCU.
8. **Power LED (LED4):** Blue LED that indicates the status of power supplied to the board.
9. **Charging LED (LED5):** Yellow LED that indicates the LiPo battery charging status by glowing continuously. If the LiPo battery is not connected, this LED does not glow. If the board is powered solely from the LiPo battery, this LED does not glow.
10. **USB connector:** The USB cable connects between this USB connector and the PC, used to power the entire board as well as the connection to the on-board KitProg3 programmer/debugger.
11. **User LED (LED2):** Active LOW red LED, so the PSoC™ 6 MCU pin must be driven to ground to turn ON the LED.
12. **KitProg3 status LED (LED3):** Yellow LED (LED3) that indicates the status of KitProg3. For details on the KitProg3 status, see the "Programming and Debugging" sub-section in the "KitProg3: On-board programmer/debugger" section of this document.
13. **Battery connector (J3):** Used for connecting a 3.7-V LiPo battery.
14. **Infineon® 512Mbit serial NOR flash memory (S25FL512S, U6):** The 512-Mbit S25FL512SAGBHIA13 NOR flash is connected to the serial memory interface (SMIF) of the PSoC™ 6 MCU device. The NOR device can be used for both data and code memory with execute-in-place (XIP) support and encryption.

Hardware description

15. **Optiga Trust M (U7):** Optiga Trust M is an advanced security controller with built-in tamper-proof NVM for secure storage and symmetric/asymmetric crypto engine to support ECC 256, AES-128 and SHA-256. This technology greatly enhances the overall system security.
16. **Super cap:** Used to power the backup domain of PSoC™ 6 MCU. This is no load by default.
17. **KitProg3 (PSoC™ 5LP) programmer and debugger (CY8C5868LTI-LP039, U2):** The PSoC™ 5LP device (CY8C5868LTI-LP039) serving as KitProg3 is a multi-functional system which includes a SWD programmer, debugger, USB-I2C bridge, and USB-UART bridge. For more details, see the [KitProg3 user guide](#).
18. **LiPo battery charger IC:** Used for charging the LiPo battery.
19. **3.6V regulator:** Powers the radio.
20. **1.8V regulator:** Powers the PSoC™ 6 MCU digital domain.
21. **KitProg3 programming mode selection button:** Used to switch between various modes of operation of KitProg3 (CMSIS-DAP/Bulk, CMSIS-DAP/HID mode and DAPLink mode). For more details, see the [KitProg3 user guide](#).
22. **CYSBSYS-RP01 reset button:** Used to reset the PSoC™ 6 MCU device. This button connects the PSoC™ 6 MCU reset (XRES) pin to ground.
23. **Thermistor (RT1):** On-board NTC thermistor for ambient temperature sensing.

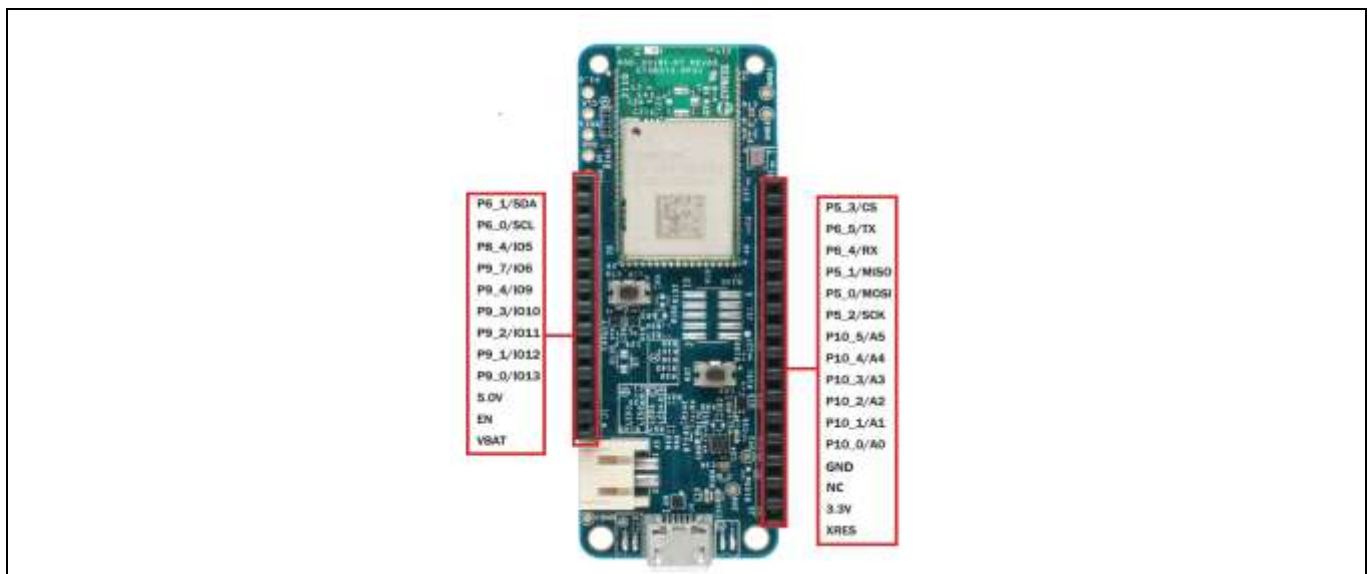


Figure 27 CYSBSYSKIT-DEV-01 pinouts

Table 2 CYSBSYSKIT-DEV-01 pinout

Header mapping	Primary on-board function	PSoC™ 6 MCU pin	Feather wing compatibility	Connection details
J1.1	VBAT	–	–	LiPo battery voltage
J1.2	EN	–	–	Input used to turn off on-board regulators
J1.3	VBUS	–	–	USB power
J1.4	GPIO	P9_0	GPIO13	–
J1.5	GPIO	P9_1	GPIO12	–
J1.6	GPIO	P9_2	GPIO11	–
J1.7	GPIO	P9_3	GPIO10	–
J1.8	GPIO	P9_4	GPIO9	–

Hardware description

Header mapping	Primary on-board function	PSoC™ 6 MCU pin	Feather wing compatibility	Connection details
J1.9	GPIO	P9_7	GPIO6	–
J1.10	GPIO	P8_4	GPIO5	–
J1.11	I2C SCL	P6_0	SCL	Connected to KitProg3. Note that this pin has a 4.7K pull-up for I2C communication.
J1.12	I2C SDA	P6_1	SDA	Connected to KitProg3. Note that this pin has a 4.7K pull-up for I2C communication.
J5.1	XRES	XRES	XRES	–
J5.2	3.3V	VDDA, VDDIO	VCC	Analog voltage for PSoC™ 6 MCU
J5.3	NC	–		Not connected
J5.4	GND	–	GND	–
J5.5	Analog GPIO	P10_0	A0	–
J5.6	Analog GPIO	P10_1	A1	–
J5.7	Analog GPIO	P10_2	A2	–
J5.8	Analog GPIO	P10_3	A3	–
J5.9	Analog GPIO	P10_4	A4	–
J5.10	Analog GPIO	P10_5	A5	–
J5.11	SPI Clock	P5_2	SCK	SPI clock
J5.12	SPI MOSI	P5_0	MOSI	SPI master out / slave in (MOSI)
J5.13	SPI MISO	P5_1	MISO	SPI master in / slave out (MISO)
J5.14	UART RX	P6_4	RX	Connected to KitProg3
J5.15	UART TX	P6_5	TX	Connected to KitProg3
J5.16	SPI CS	P5_3	GPIO14	SPI chip select

Table 3 On-board peripheral connections

PSoC™ 6 MCU pin#	Board function
P0_4	User button
P5_4	KitProg3 UART - RX
P5_5	KitProg3 UART - TX
P5_6	KitProg3 UART - RTS
P5_7	KitProg3 UART - CTS
P6_0	KitProg3 I2C SCL
P6_1	KitProg3 I2C SDA
P6_6	KitProg3 SWD data
P6_7	KitProg3 SWD CLK
P10_6	Thermistor power
P10_7	Thermistor ADC IN
P11_1	User LED
P11_2	QSPI chip select

Hardware description

PSoC™ 6 MCU pin#	Board function
P11_3	QSPI DAT3
P11_4	QSPI DAT2
P11_5	QSPI DAT1
P11_6	QSPI DAT0
P11_7	QSPI CLK
P12_6	ECO_In
P12_7	ECO_Out
XRES_L	Reset button

5.1.2 Hardware functional description

5.1.3 CYSBSYS-RP01 module

The Rapid IoT connect SoM is the easiest way to provide a secure, scalable, and reliable connection from your device to your cloud. The Rapid IoT connect SoM is a pre-certified 802.11ac-friendly dual-band (2.4 and 5.0 GHz) Wi-Fi and Bluetooth® 5.0-compliant combo radio with an integrated PSoC™ 6 Secure IoT MCU provided in an easy-to-use package. Included within the SoM are the crystals, oscillators, RF switches, passive components, and antenna to help accelerate development of your secure IoT products. It provides up to 51 I/Os in a 26.6 x 14.0 x 2.5-mm castellated surface mount PCB for easy manufacturing. See the datasheet at this [location](#) for additional details.

5.1.4 PSoC™ 5LP

An on-board PSoC™ 5LP device (CY8C5868LTI-LP039) is used as KitProg3 to program and debug the PSoC™ 6 MCU device. The PSoC™ 5LP device connects to the USB port of the PC through a USB connector and to the SWD and other communication interfaces of PSoC™ 6 MCU. The PSoC™ 5LP device is a system-level solution providing MCU, memory, analog, and digital peripheral functions in a single chip. For more information, see the [PSoC™ 5LP web page](#) and the [CY8C58LPxx family datasheet](#).

Hardware description

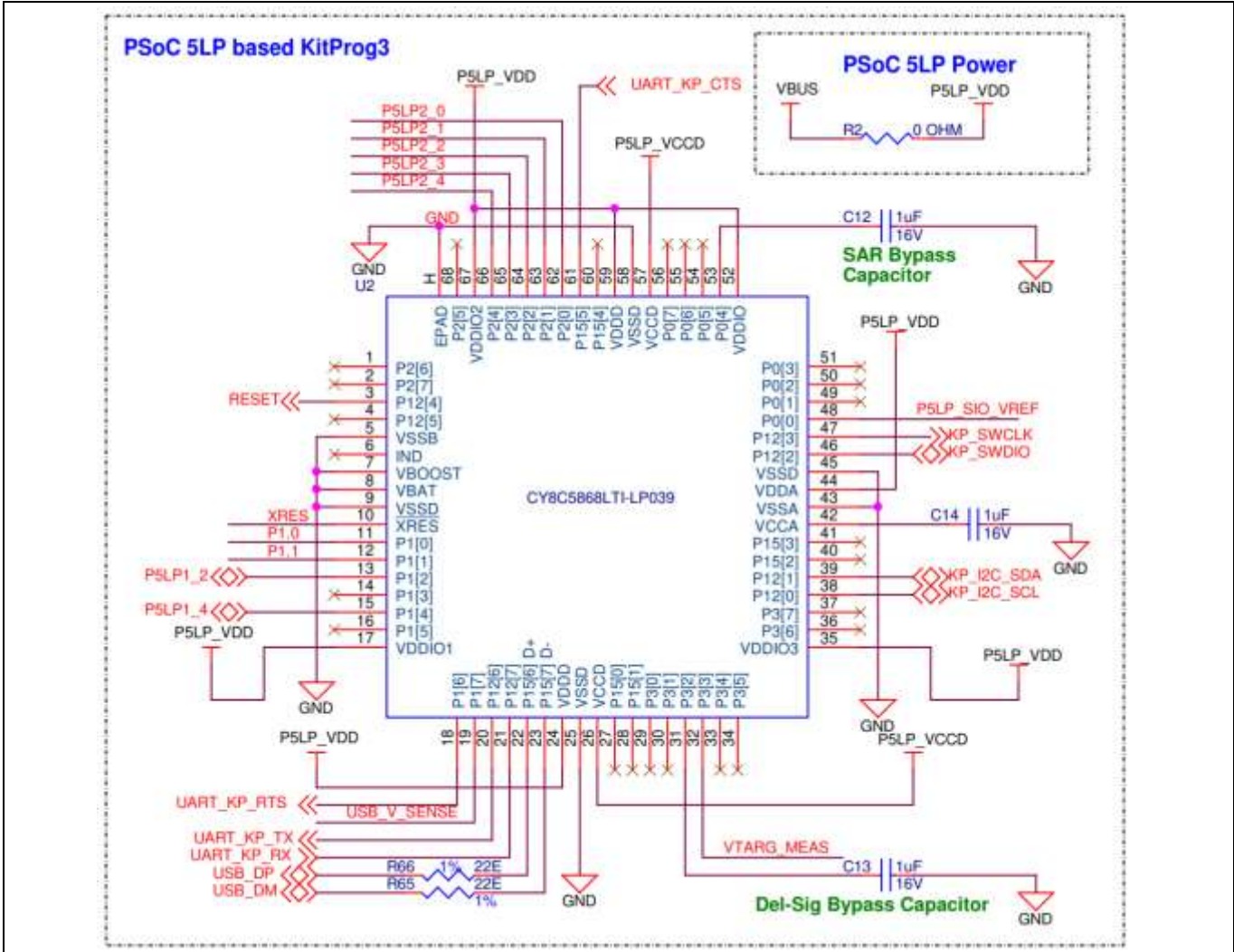


Figure 28 KitProg3 programmer

Hardware description

5.1.5 Serial interconnection between PSoC™ 5LP and module

In addition to its use as an on-board programmer, the PSoC™ 5LP device functions as an interface for the USB-UART and USB-I2C bridges. The serial pins of the PSoC™ 5LP device are hard-wired to the I2C/UART pins of the PSoC™ 6 MCU device.

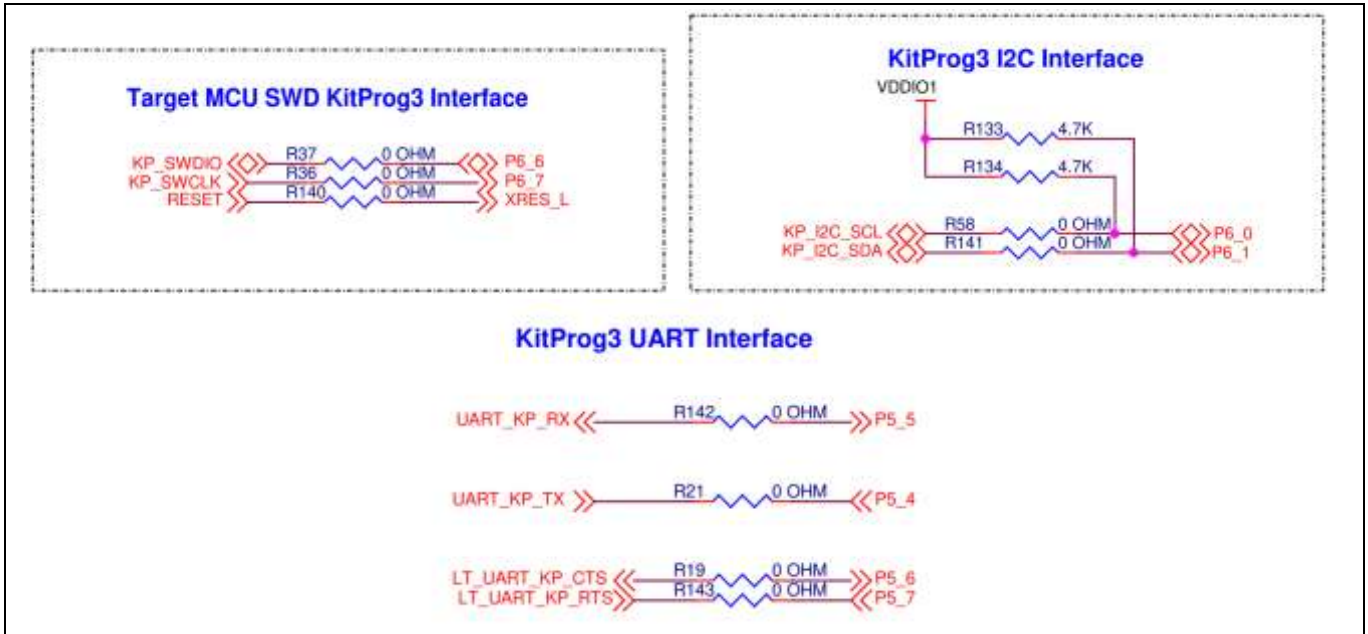


Figure 29 KitProg3 interface

5.1.6 Power supply system

The kit has the following input voltage sources:

- 5 V from KitProg3 USB Micro-B port (J4)
- LiPo battery @ 3.7 V, 350 mAh (J3)

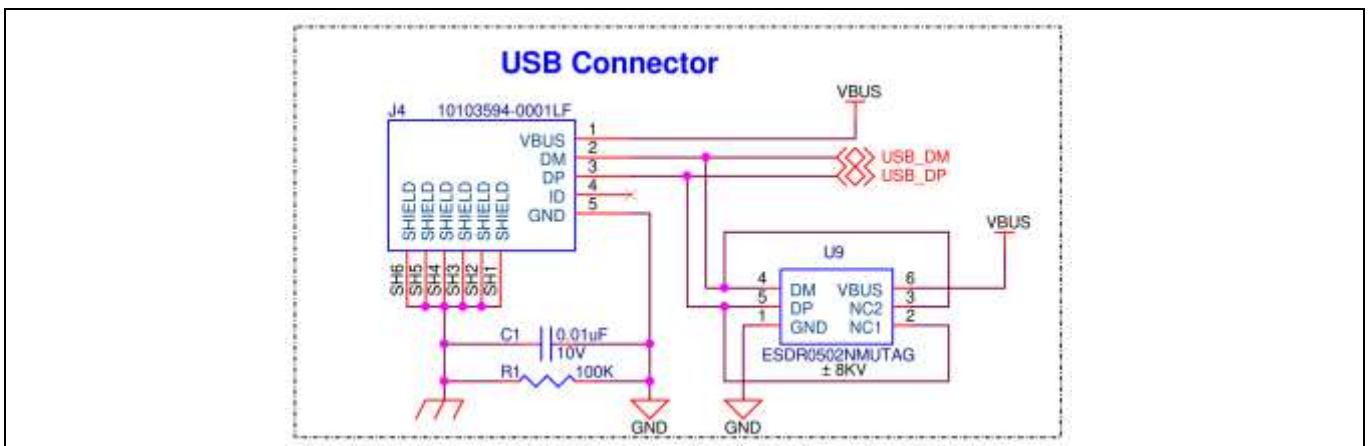


Figure 30 USB connector

The LiPo battery is connected to the LiPo battery charger IC (U10) with a 10µF bypass capacitor. The LiPo battery charger takes the VBUS (5V) from the USB connector (J4) as a source for charging the battery as well as the supply (VOUT) for other components when battery power is not available. A yellow LED (LED5) attached to the \overline{CHG} pin of the charger IC indicates the battery charging status by glowing continuously. It automatically turns off when the battery is fully charged. The TS pin is meant for an external negative temperature coefficient (NTC)

Hardware description

thermistor. In this kit, it is connected to GND through a 10K resistor. CE is the charge enable pin which is kept low always to enable the charger circuit. EN2 and EN1 pins are used to set the maximum input current at input pin. EN2 is set as logic 1 through the 10K pull-up resistor (R154) and EN1 is set to logic 0 through the 10K pull-down resistor (R152), which sets the maximum input current to be adjusted by external resistor (R59) connected to pin ILIM. Currently, ILIM is designed to let 850 mA of current (R59). The output VOUT is decoupled with a 10µF and a 0.1µF capacitor. VOUT will be in the range VBUS to VBUS-0.237 V while powering from VBUS, and VBAT to VBAT-0.0625V while powering from the battery.

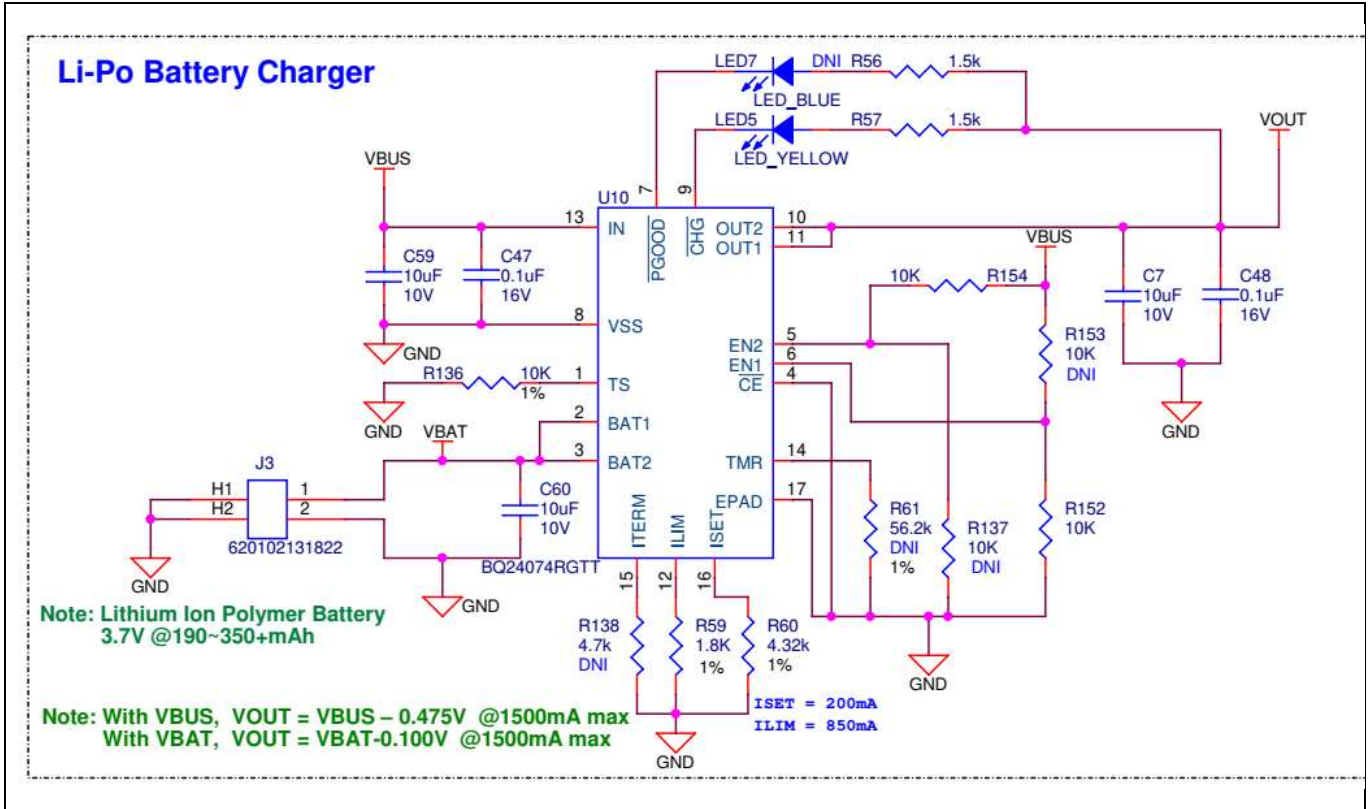


Figure 31 Battery charger

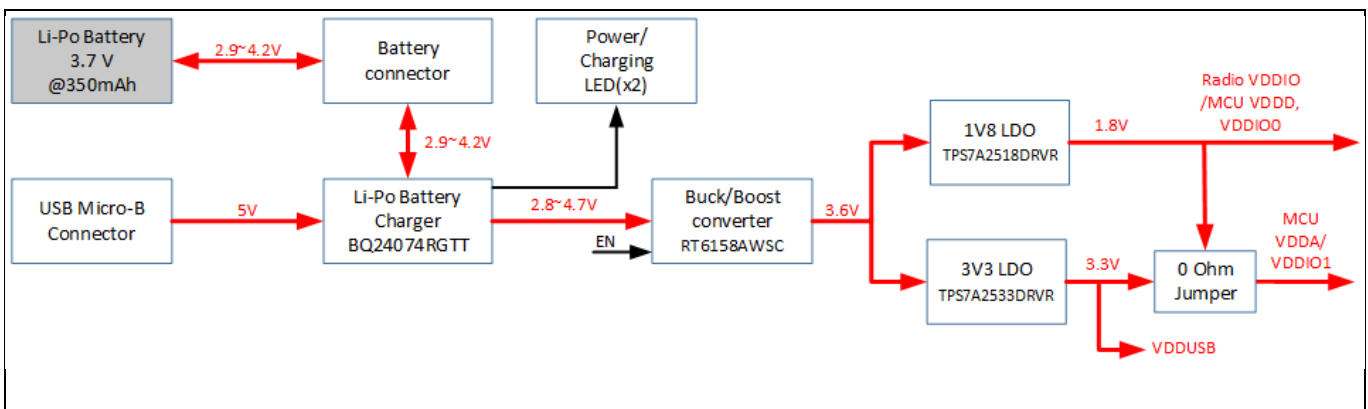


Figure 32 CYBSYSKIT-DEV-01 power tree

The EN pin is an input used to turn off the on-board regulators. An on-board resistive pull-up ensures that regulators are on by default and an external trigger from wing board can be used to turn off the on-board supply.

Hardware description

5.1.7 Expansion headers

The Rapid IoT connect developer kit contains two single inline headers (J1 and J5). All pins of the PSoC™ 6 MCU device that are not dedicated to a function are connected to the stackable expansion headers. The I/O header signals include signals from PSoC™ 6 MCU and system power signals.

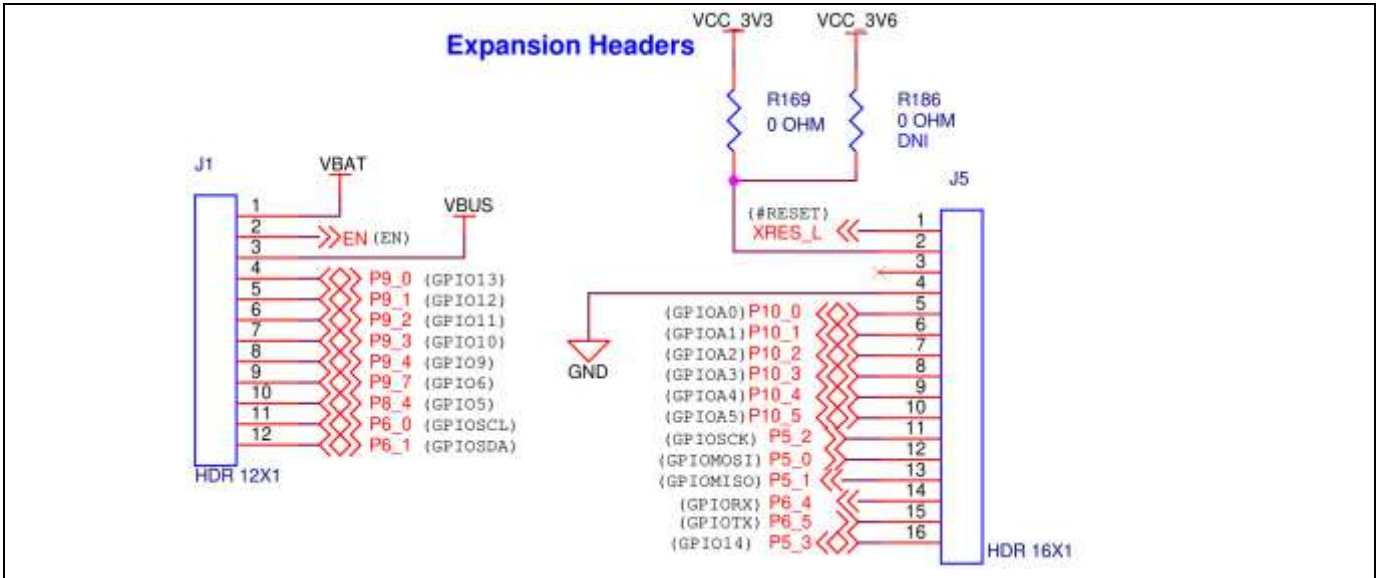


Figure 33 CYSBSYSKIT-DEV-01 headers

5.1.8 QSPI

This board has a 24-BGA 512 Mbit QSPI NOR flash. This device uses a Serial Peripheral Interface (SPI) to communicate with the PSoC™ 6 MCU device. The device supports four-bit (Quad I/O) serial commands. The PSoC™ 6 MCU device supports up to 70MHz clock on the QSPI interface. 33Ω series termination resistors are provided as close as possible to the module footprint on the clock and all I/O lines.

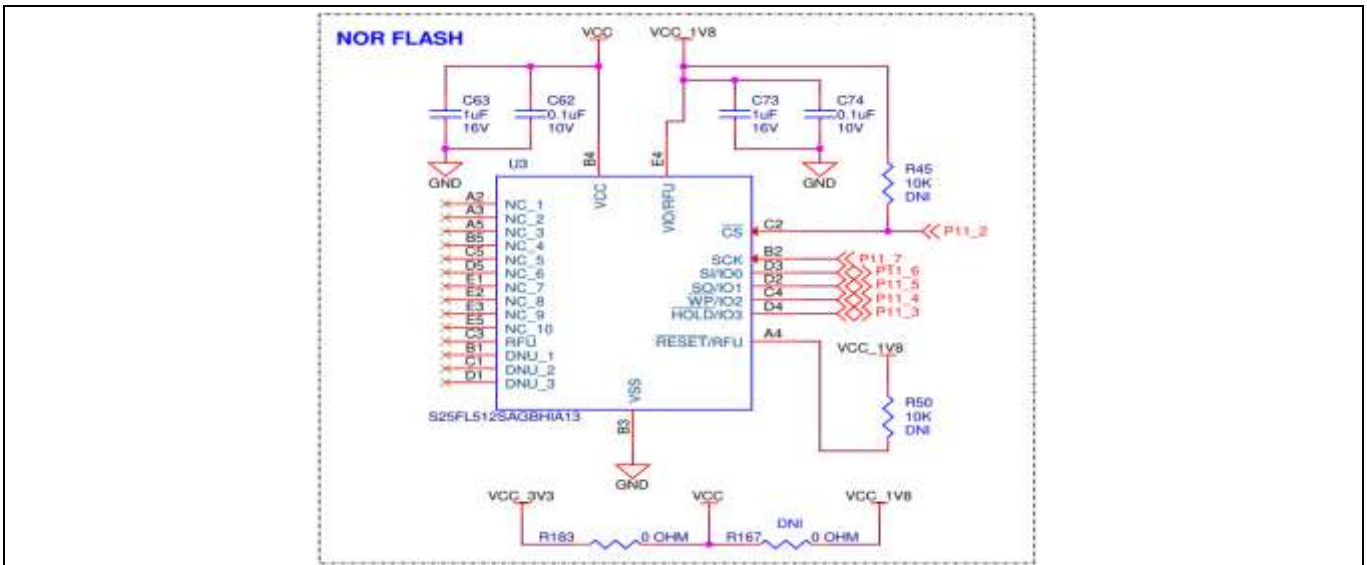


Figure 34 NOR Flash interface

Hardware description

5.1.9 LED

Rapid IoT connect developer kit has 1x RED user LED for general-purpose applications. The series resistor is 330Ω for limiting the current. The User LED is configured in active low mode and connected to pin P11_1 of the PSoC™ 6 MCU device.

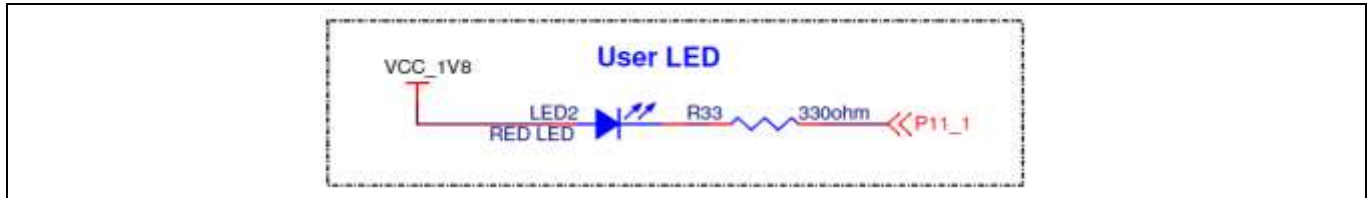


Figure 35 User LED

5.1.10 User button

The User button is used for general-purpose applications, and is connected to pin P0_4 of the PSoC™ 6 MCU device. It is configured in active low configuration by default. It is tied to the VBACKUP power rail through a 10K pull-up resistor (R9).

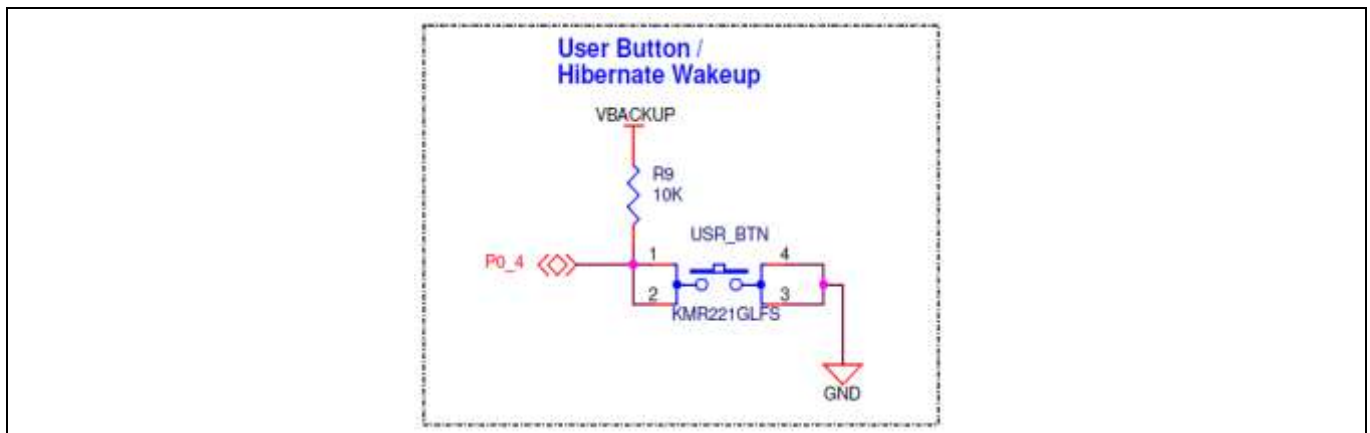


Figure 36 User button

5.1.11 ECO

The board has one crystal connected to the PSoC™ 6 MCU device: 17.2032-MHz ECO for audio applications. ECO pins ECO_IN and ECO_OUT are connected to the P12_6 and P12_7 pins of PSoC™ 6 MCU respectively.

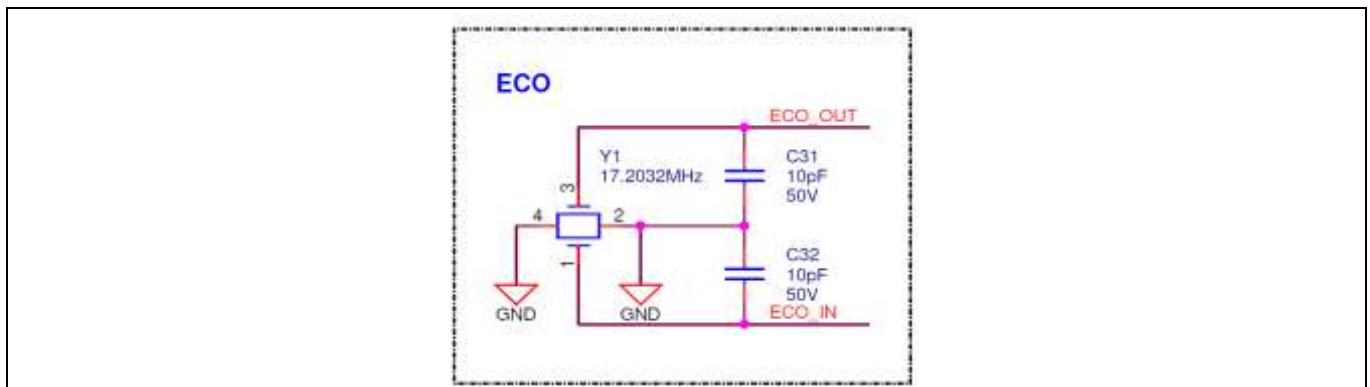


Figure 37 ECO crystal

Hardware description

5.1.12 10-pin SWD/JTAG programming header

A 10-pin (50-mil pitch) SWD header (J11) is provided to program and debug the target PSoC™ 6 MCU device using an external programmer like MiniProg4. This header is not populated by default.

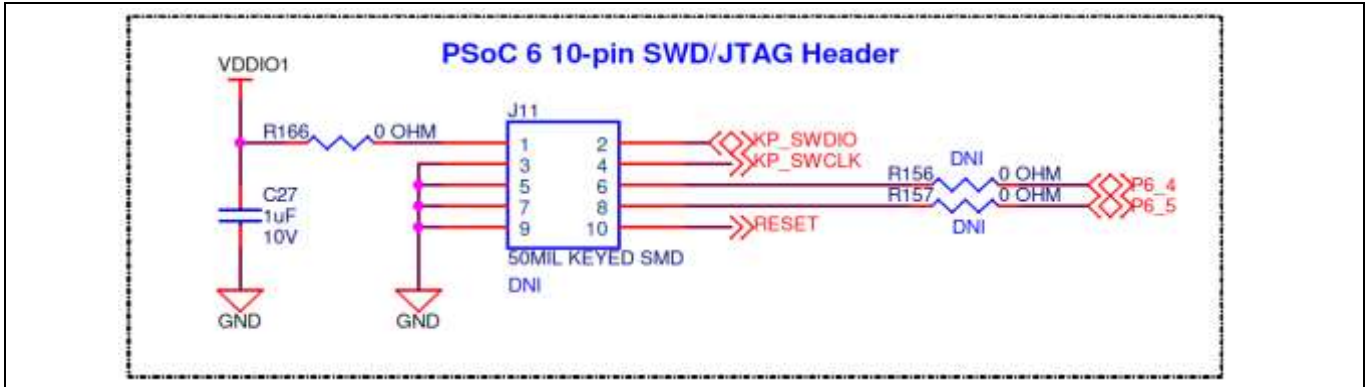


Figure 38 Programmer header

5.1.13 KitProg3: on-board programmer/debugger

The Rapid IoT connect developer kit can be programmed and debugged using the on-board KitProg3. KitProg3 is an on-board programmer/debugger with USB-UART and USB-I2C functionality. The Infineon® PSoC™ 5LP device is used to implement KitProg3 functionality. For more details on the KitProg3 functionality, see the [KitProg3 user guide](#).

5.1.14 Programming and debugging

- Connect the board to the PC using the Micro USB cable.
- It enumerates as a USB composite device if you are connecting it to your PC for the first time. KitProg3 can operate either in CMSIS-DAP bulk mode (default), or DAPLink mode. KitProg3 also supports CMSIS-DAP bulk with two UARTs. Programming is faster with the bulk mode. The status LED (Yellow) is always ON in bulk mode, and ramping at 2Hz rate in DAPLink mode.
- Press and release the mode select button to switch between these modes.
- If you do not see the desired LED status, see the [KitProg3 user guide](#) for details on the KitProg3 status and troubleshooting instructions.

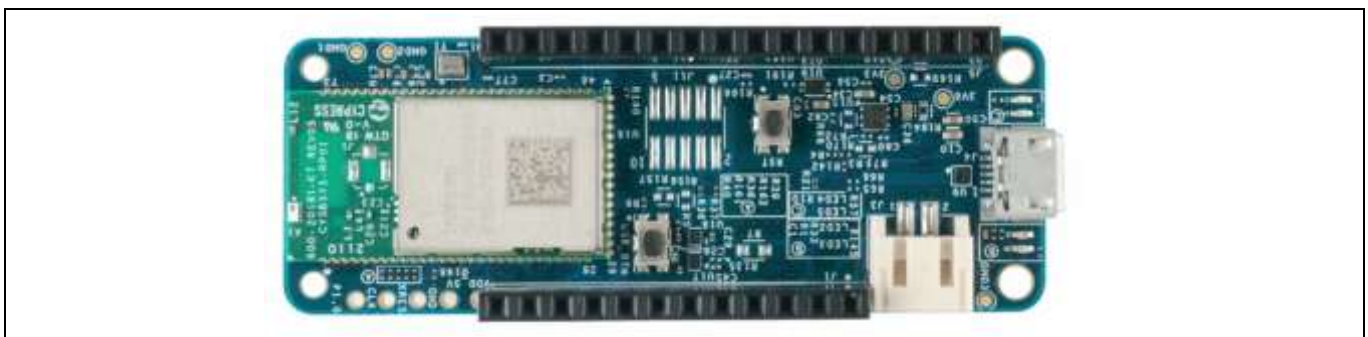


Figure 39 CYSBSYSKIT-DEV-01 top view

5.1.15 USB-UART bridge

The KitProg3 device on the Rapid IoT connect developer kit can act as a USB-UART bridge. The primary UART and flow control lines between the PSoC™ 6 MCU device and KitProg3 are hardwired on the board as shown in the

Hardware description

figure below. This UART is shared between the NP and CP; the messages from both the processors appear on this same port.

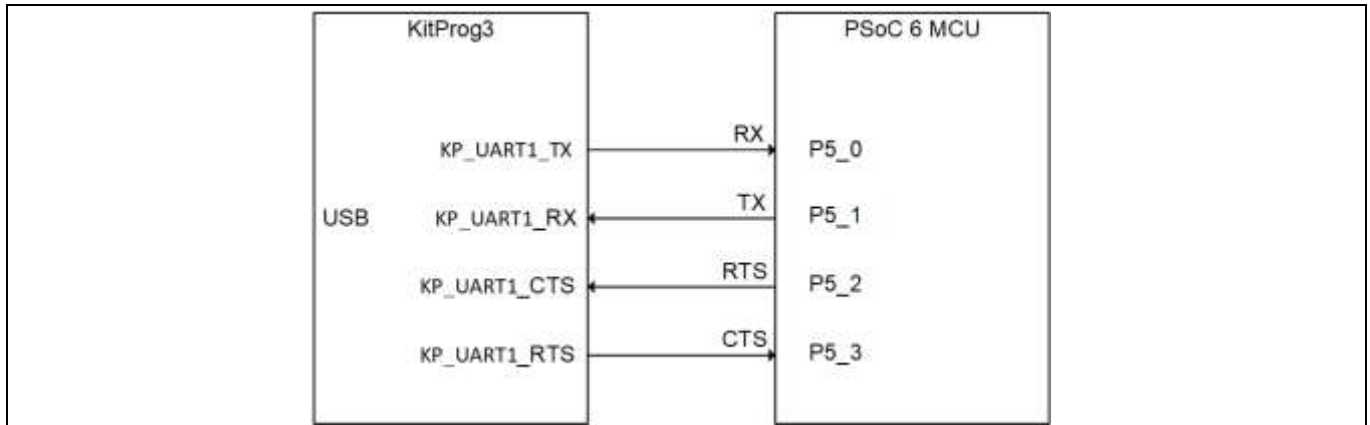


Figure 40 UART connection between KitProg3 and PSoC™ 6 MCU

5.1.16 USB-I2C bridge

The KitProg3 device can function as a USB-I2C bridge and can communicate with the Bridge Control Panel (BCP) software which acts as an I2C master. BCP is installed as part of the PSoC™ Programmer tool (download from this [location](#)). The I2C lines on the PSoC™ 6 MCU device are hard-wired on the board to the I2C lines of KitProg3, with on-board pull-up resistors as shown in the figure. The USB-I2C bridge supports I2C speeds of 50kHz, 100kHz, 400kHz, and 1MHz. For more details on the KitProg3 USB-I2C functionality, see the [KitProg3 user guide](#).

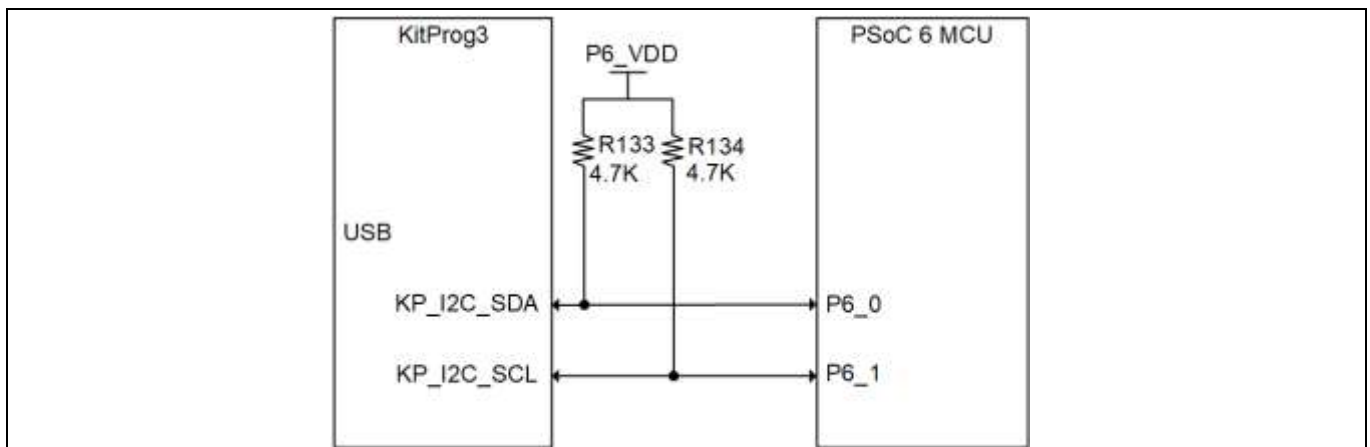


Figure 41 I2C connection between KitProg3 and PSoC™ 6 MCU

5.2 XENSIV™ PAS CO2 wing

5.2.1 Wing board components

Figure 42 and Table 4 describe the components mounted on the XENSIV™ PAS CO2 wing.

Important note: The cover on the PAS module metal can protect the inlet from dust and particles and should not be removed.

Hardware description

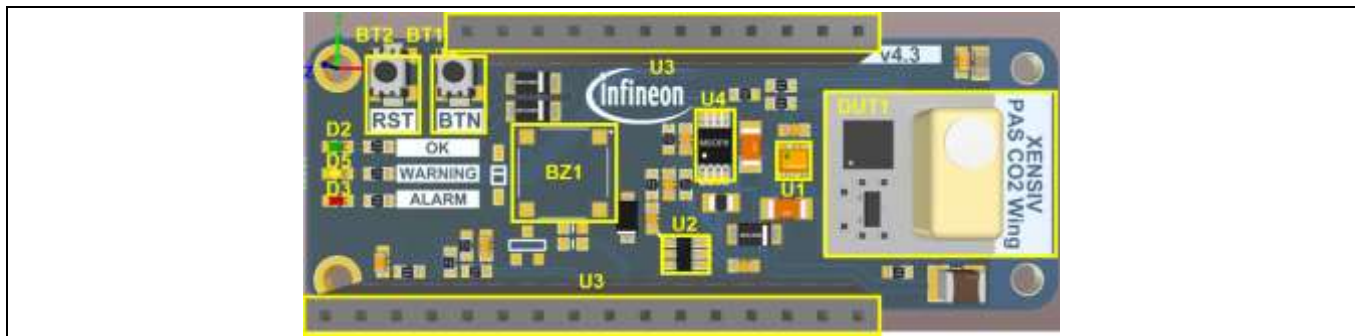


Figure 42 Front view of the XENSIV™ PAS CO2 wing

Table 4 Onboard HW description

Designator	Function
U1	Digital barometric pressure sensor DPS368
U2	2:1 (SPDT), 1-channel analog switch, programmable control of the on and off output 3 V
U3	28-pin Adafruit feather-compatible adaptor headers
U4	Boost/inverting DC-DC converter with 2 A switch, soft-start and synchronization
DUT1	XENSIV™ PAS CO2
BT1	Touch button, active low
BT2	Touch button, active low, system reset function
D2	Green color LED for acceptable level of CO ₂ concentration
D3	Red color LED for alarm level of CO ₂ concentration
D5	Yellow color LED for warning level of CO ₂ concentration
BZ1	Option for buzzer (not populated by default)

5.2.2 Adafruit feather-compatible connectors

The image highlights the 28-pin Adafruit feather-compatible adaptor headers. The function of the respective header pins is described in Table 3. The image also shows the test points which were used for testing the boards in the lab or production.

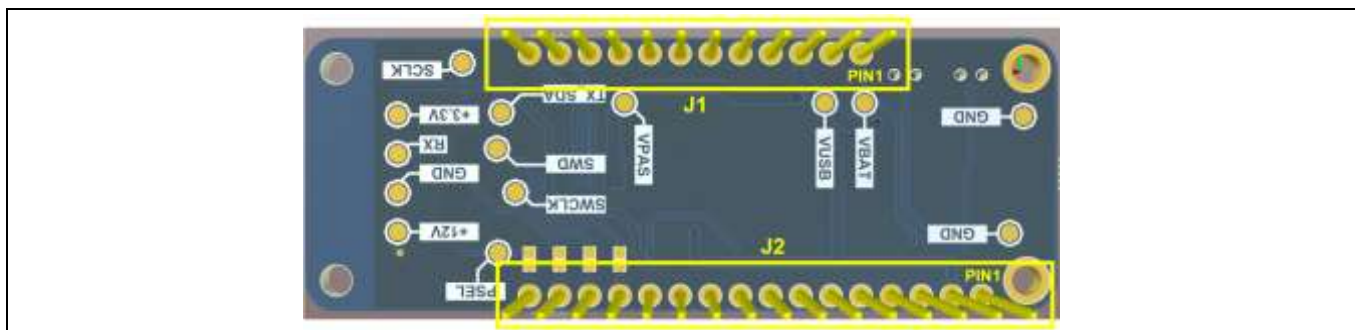


Figure 43 Adafruit headers and test points on the back view of the XENSIV™ PAS CO2 wing

Table 5 Adafruit feather-compatible pin-out

Hardware description

Header mapping	Primary onboard function	PSoC 6 MCU pin (rapid IoT kit)	Adafruit feather-compatible mapping (rapid IoT kit)	Adafruit feather-compatible mapping (CO ₂ wing board)	Details
J1.1	V _{BAT}	–	–	V _{BATT}	LiPo battery voltage
J1.2	EN	–	–	–	Not connected
J1.3	V _{BUS}	–	–	V _{USB}	USB power
J1.4	GPIO	P9_0	GPIO13	GREEN_LED	Green LED
J1.5	GPIO	P9_1	GPIO12	YELLOW_LED	Yellow LED
J1.6	GPIO	P9_2	GPIO11	–	Not connected
J1.7	GPIO	P9_3	GPIO10	–	Not connected
J1.8	GPIO	P9_4	GPIO9	RED_LED	Red LED
J1.9	GPIO	P9_7	GPIO6	–	Not connected
J1.10	GPIO	P8_4	GPIO5	–	Not connected
J1.11	I ² C SCL	P6_0	SCL	SCL	Connected to KitProg3. Note that this pin has a 4.7k pull-up for I ² C communication.
J1.12	I ² C SDA	P6_1	SDA	TX_SDA	Connected to KitProg3. Note that this pin has a 4.7k pull-up for I ² C communication.
J2.1	XRES	XRES	XRES	RST	Reset button
J2.2	3.3 V	VDDA, VDDIO	VCC	+3 V	Analog voltage for PSOC 6 MCU
J2.3	NC	–	NC	–	Not connected
J2.4	GND	–	GND	GND	Ground
J2.5	Analog GPIO	P10_0	A0	–	Not connected
J2.6	Analog GPIO	P10_1	A1	–	Not connected
J2.7	Analog GPIO	P10_2	A2	–	Not connected
J2.8	Analog GPIO	P10_3	A3	BTN	User button/V _{bat} voltage monitoring
J2.9	Analog GPIO	P10_4	A4	BUZZER	PAS buzzer
J2.10	Analog GPIO	P10_5	A5	POWERDOWN	PAS board POWERDOWN
J2.11	SPI clock	P5_2	SCK	–	Not connected
J2.12	SPI MOSI	P5_0	MOSI	–	Not connected
J2.13	SPI MISO	P5_1	MISO	SWD	SWD
J2.14	UART RX	P6_4	RX	SWCLK	SWCLK
J2.15	UART TX	P6_5	TX	RX	RX
J2.16	SPI CS	P5_3	GPIO	PSEL	PSEL at PAS sensor

Hardware description

5.2.2.1 Power supply

The kit can be powered from a 3.7 V LiPo battery or via a USB cable from an external 5 V power supply. The battery is automatically charged when the system is connected to an external power supply. Both the IoT baseboard and the the PAS CO2 wing board switch automatically to the provided power supply, so no manual adaption is needed by the user.

Note: The radar wing board must be manually switched to either battery or external 5 V supply – refer to the radar wing board user guide for more details.

5.2.3 Mechanical buttons

Table 6 Abbreviations used in this document

Abbreviation	Description
RST	System reset
BTN	User button, executed function can be individually programmed by user

Hardware description

5.2.4 Hardware details

The design of the shield was realized using the Altium PCB design tool. The Altium design files are available on request.

5.2.4.1 Wing board schematics

5.2.4.1.1 Sensors

Figure 44 and Figure 45 shows the schematic of the XENSIV™ PAS CO2 sensor and of the XENSIV™ DSP368.

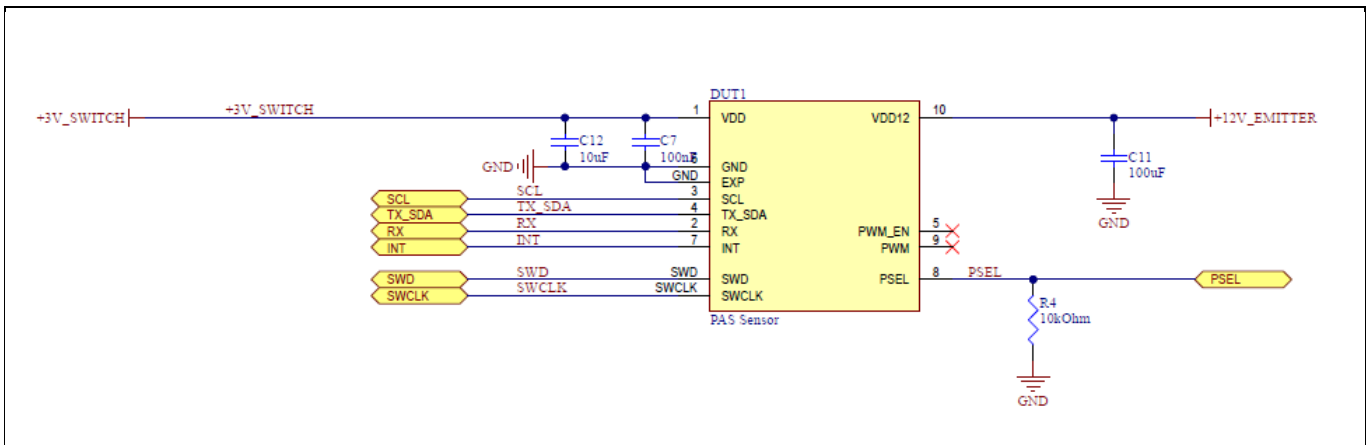


Figure 44 Schematic of Infineon XENSIV™ PAS CO2 sensor

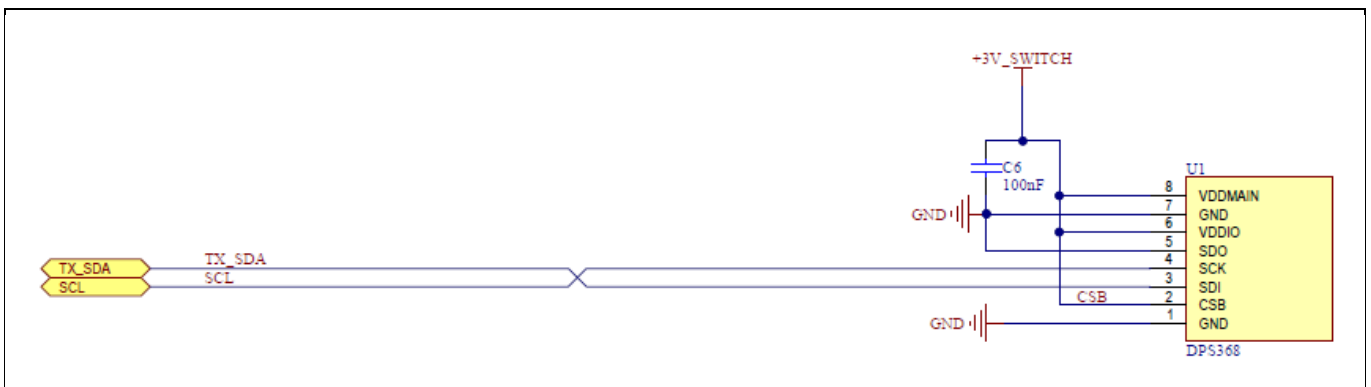


Figure 45 Schematic of Infineon DPS pressure sensor

5.2.4.1.2 Adafruit-feather headers

Figure 46 shows the pin assignment of J1 and J2 on the PAS CO2 wing board. The Adafruit feather-compatible header is used to plug into the CYCBSYSKIT-DEV-01 rapid IoT connect developer kit.

Hardware description

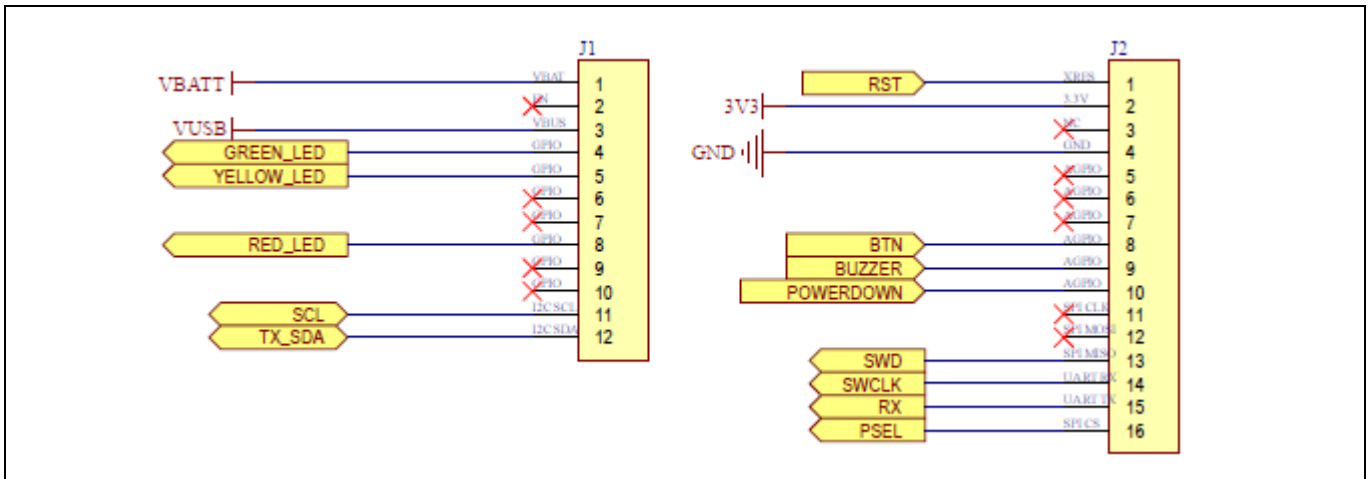


Figure 46 Schematic of Adafruit headers

5.2.4.1.3 User interface (buttons, LEDs)

The user interface on the wing board consists of two mechanical buttons and three LEDs.

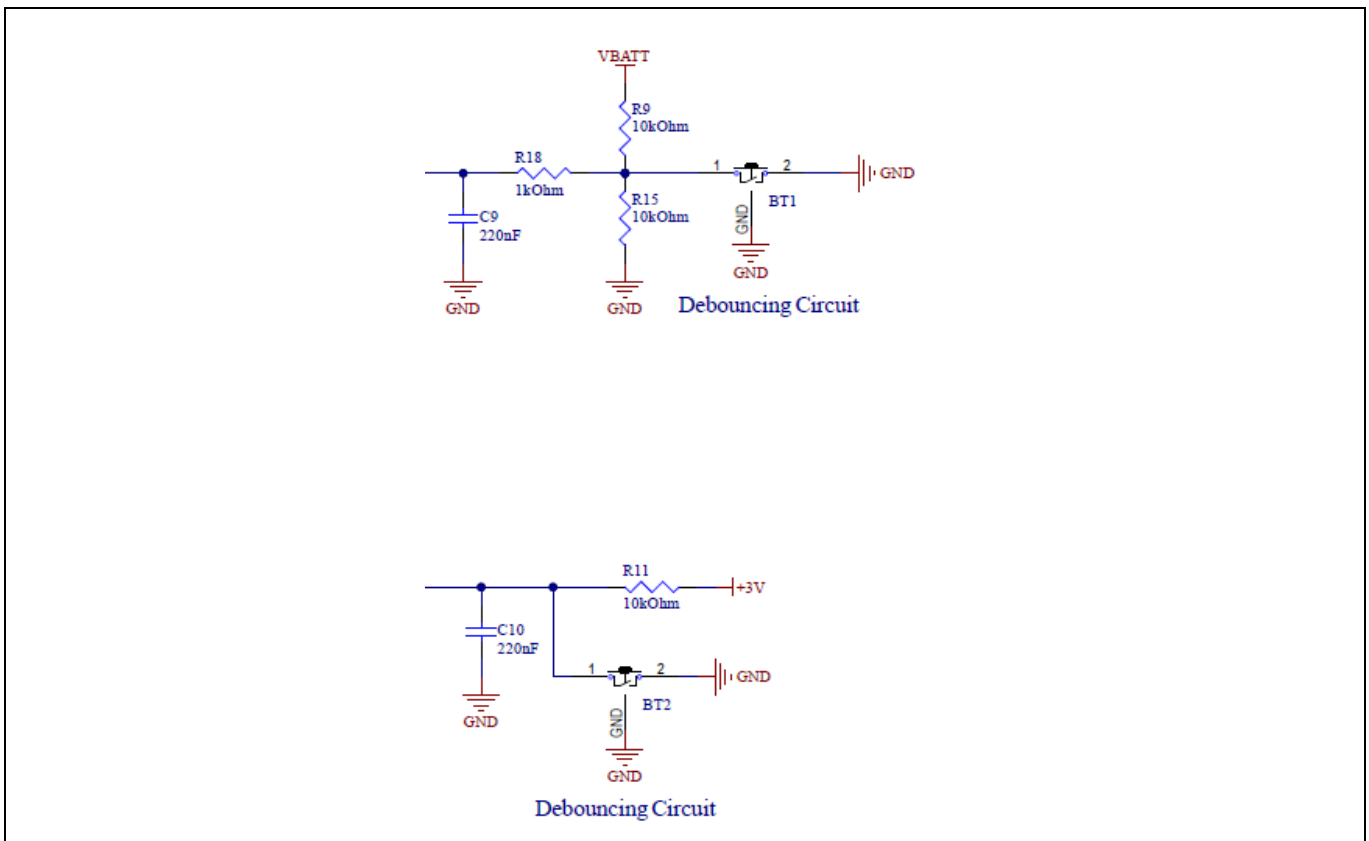


Figure 47 Schematic of user (BT1) and reset button (BT2)

Hardware description

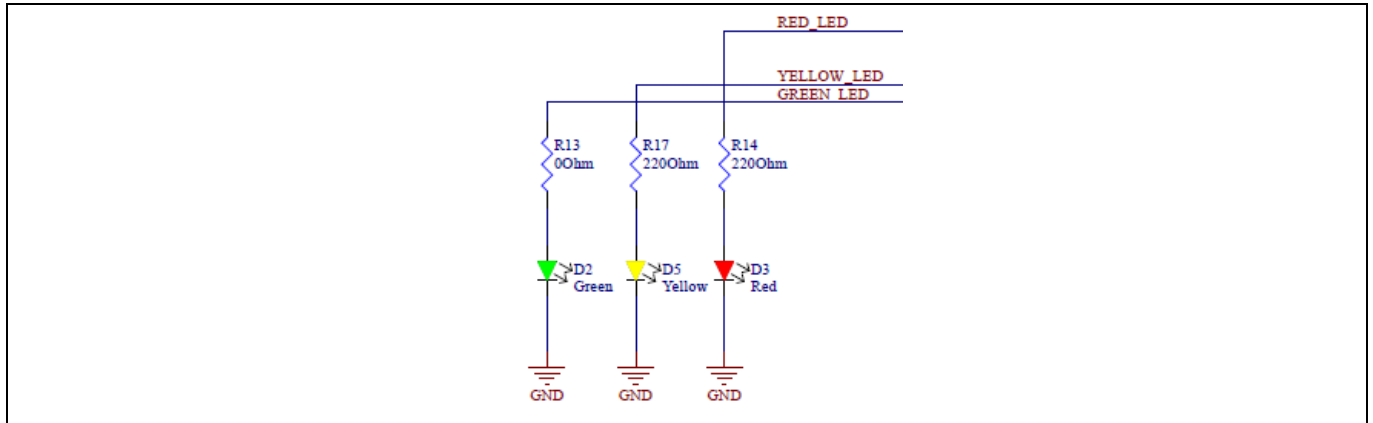


Figure 48 Schematic of LEDs

5.2.4.1.4 Others

Figure 49 shows the 1-channel analog switch. It is a programmable control of the 3 V output status, i.e., on or off. This function is used to switch the PAS module only on, when it is supposed to execute a measurement. That way the board’s power consumption is reduced.

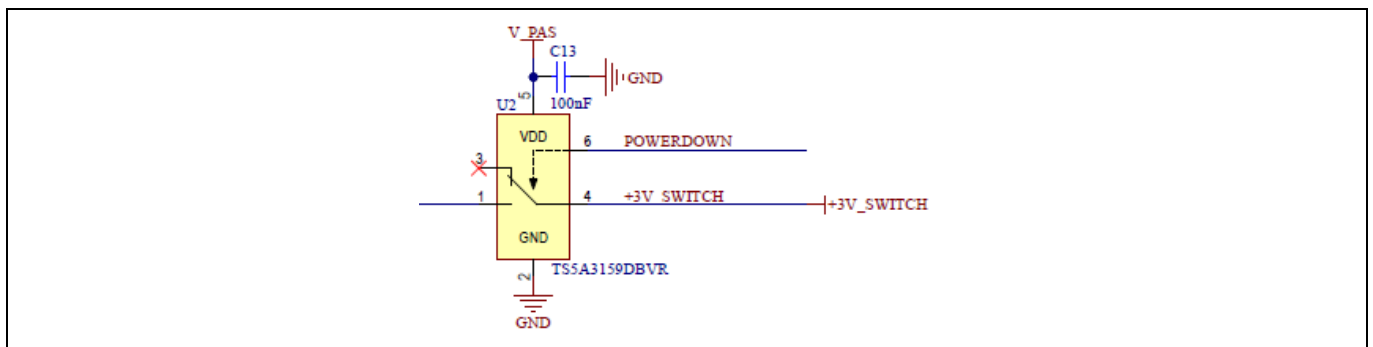


Figure 49 1-channel analog switch

Figure 50 shows the voltage booster circuit. It is required to switch from 5 V to 12 V supply for the CO₂ sensor module.

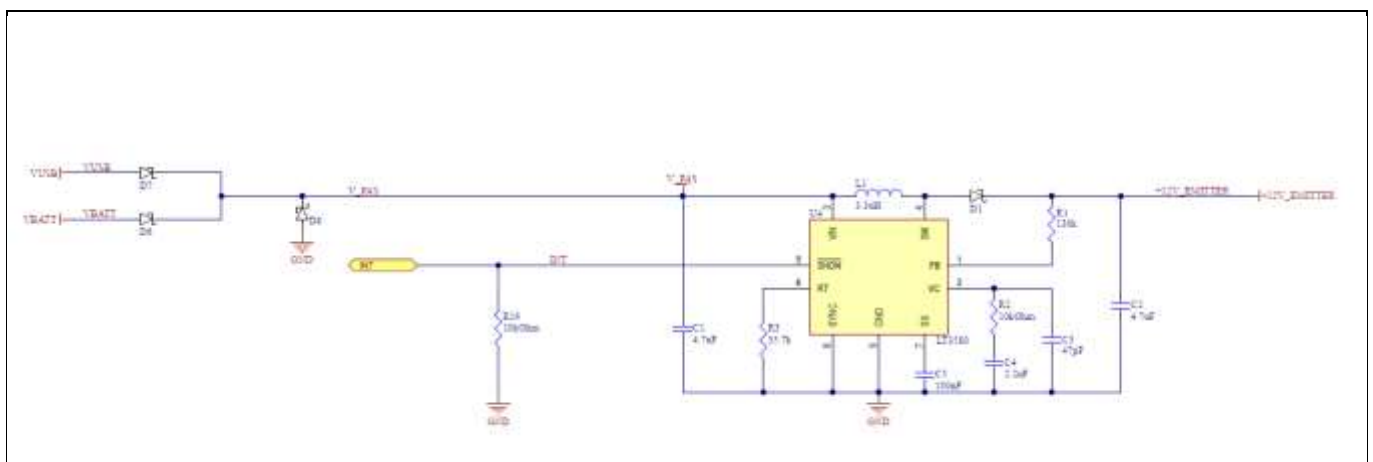


Figure 50 Booster circuit from 5 V to 12 V

Hardware description

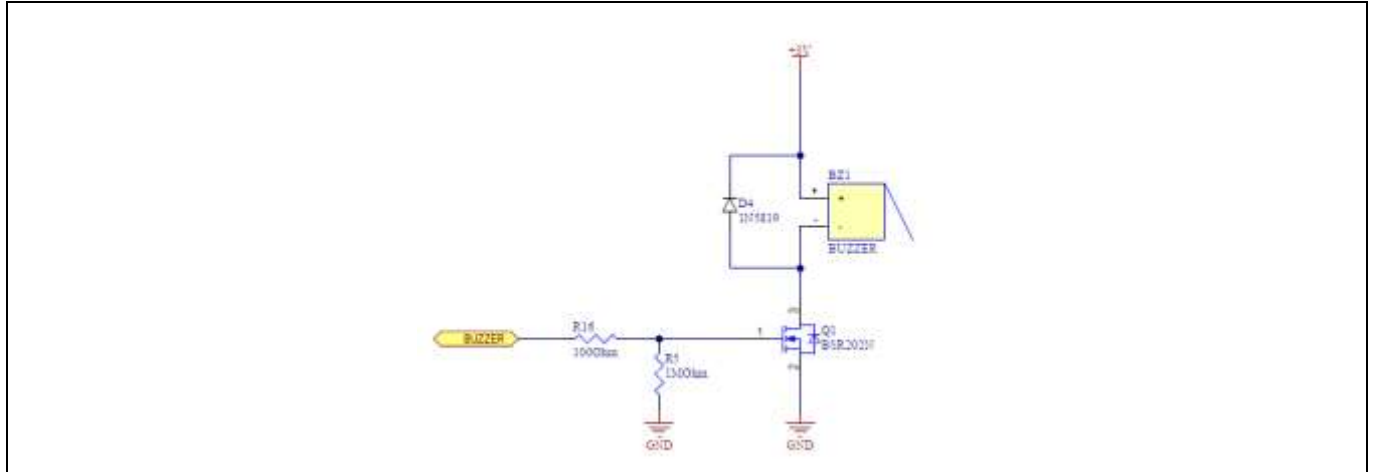


Figure 51 Optional buzzer circuit (not populated on wing board)

5.2.4.1.5 PCB layout

The size of the XENSIV™ PAS CO₂ wing is 63 mm (L) x 23 mm (W).

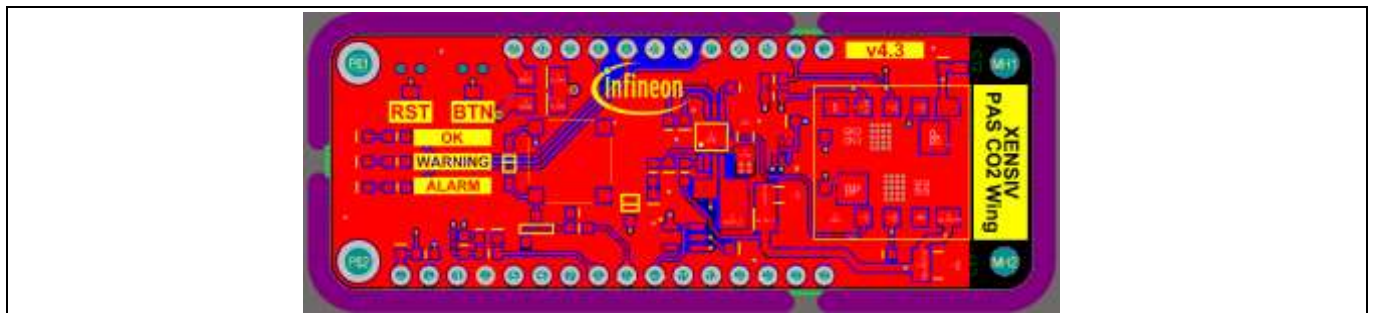


Figure 52 PCB layout of the XENSIV™ PAS CO₂ wing

5.2.4.1.6 Bill of materials

Table 7 BOM

Designator	Value	Quantity	Name	Description	Manufacturer 1	Manufacturer part number 1	Supplier 1	Supplier part number 1
BT1, BT2		2	Touch button	Touch button, 3 mm x 4 mm	ITT C&K	PTS820J20M SMTRLFS	Farnell	3023218
BZ1		1	Buzzer		Mallory Sonalert	AST7525MAT RQ	Farnell	1885162
C1, C2	4.7 µF	2	MC1206X475 K25OCT	Capacitor 1206 4.7 µF 25 V 10%	Multicomp	MC1206X475 K25OCT	Farnell	2320888
C3	47 pF	1	C0603C470J5 GACTU	Capacitor 0603 47 pF 50 V 5%	KEMET	C0603C470J5 GACTU	Farnell	1414639
C4	2.2 nF	1	C0603C222J8 RACTU	Capacitor 0603 2.2 nF 10 V 5%	KEMET	C0603C222J8 RACTU	Farnell	2904699
C5, C6, C7, C13	100 nF	4	06033C104JA T2A	Capacitor 0603 100 nF 25 V 5%	Kyocera AVX	06033C104JA T2A	Farnell	1740614

Hardware description

C9, C10	220 nF	2	GRM188R71 E224KA88	Capacitor 0603 220 nF 25 V 10%	Murata	GRM188R71 E224KA88D	Farnell	1828900
C11	100 µF	1	C1210C107M 4PACTU	Capacitor 1210 100 µF 16 V 20%	KEMET	C1210C107M 4PACTU	Farnell	2491298
C12	10 µF	1	08053D106K AT2A	Capacitor 0805 10 µF 25 V 10%	Kyocera AVX	08053D106K AT2A	Farnell	1867958
D1		1	Schottky diode PMEG2010E R	1 A low VF mega Schottky barrier rectifier	Nexperia	PMEG2010E R, 115	Farnell	1907681
D2	Green	1	SML-310MT	LED 0603 green 525 nm	Kingbright	KPG- 1608ZGC	Farnell	1686061
D3	Red	1	SML-310VT	LED 0603 red	Dialight	598-8010- 107F	Farnell	1465988
D4	1N5819	1	Diode 1N5819	Diode 1N5819 SOD123	Diodes	1N5819HW- 7-F	Farnell	1773475
D5	Yellow	1	SML-310YT	LED 0603 yellow	Rohm	SML- D12Y8WT86	Farnell	1685095
D6, D7		2	Schottky diode PMEG3020E R	2 A low VF mega Schottky barrier rectifier	Nexperia	PMEG3020E R, 115	Farnell	1907687
D8		1	Schottky diode STPS0520Z	STPS0520Z Schottky rectifier 20 V 500 mA single, SOD- 123, 2 pins, 320 mV	STMicroelect ronics	STPS0520Z	Farnell	1467545
DUT1		1	PAS sensor	PAS sensor new pin update on 28082019				
L1	3.3 µH	1	Coil MLZ2012N3R 3LT	Coil MLZ2012N3R 3LT	TDK	MLZ2012N3R 3LT	Farnell	2493076
Q1	BSR202N	1	igfet_n_ch_e nh_dio_1g2s 3d_3p	OptiMOS™ N-channel enhancemen t small signal transistor, 20 V	Infineon	BSR202NL63 27HTSA1	Farnell	2212888
R1	130k	1	ERJ- 3EKF1303V	Resistor 0603 130 kΩ 0.1 W 1%	Panasonic	ERJ- 3EKF1303V	Farnell	2059501
R2, R4, R9, R10, R11, R12, R15, R19	10 kΩ	8	CR0603-FX- 1002ELF	Resistor - 0603 10 kΩ 0.1 W 1%	Bourns	CR0603-FX- 1002ELF	Farnell	2008341
R3	35.7k	1	CRCW06033 5K7FKEA	Resistor 0603 35.7 kΩ 0.1 W 1%	Vishay	CRCW060335 K7FKEA	Farnell	2138458
R5	1 MΩ	1	CR0603-JW- 105GLF	Resistor 0603 1 MΩ 0.1 W 1%	Bourns	CR0603-JW- 105GLF	Farnell	2008367

Hardware description

R13	0 Ω	1	CRCW0603000Z0EA	Resistor 0603 0 Ω	Vishay	CRCW0603000Z0EA	Farnell	1469739
R14, R17	220 Ω	2	ERJ-3GEYJ221V	Resistor 0603 220 Ω 0.1 W 1%	Panasonic	ERJ-3GEYJ221V	Farnell	2059583
R16	100 Ω	1	CR0603-FX-1000ELF	Resistor 0603 100 Ω 0.1 W 1%	Bourns	CR0603-FX-1000ELF	Farnell	2008332
R18	1 kΩ	1	MCHP03W8F1001T5E	Resistor 0603 1 kΩ 0.125 W 1%	Multicomp	MCHP03W8F1001T5E	Farnell	1576283
U1		1	DPS368	Digital barometric pressure sensor for portable devices	Infineon	DPS368XTSA1	Farnell	3132269
U2		1	TS5A3159DBVR	1 Ω, 5 V, 2:1 (SPDT), 1-channel analog switch	Rochester Electronics	TS5A3159DBVR	Farnell	3005463
U4		1	LT3580	Boost/inverting DC-DC converter with 2 A switch, soft-start and synchronization	Analog Devices/Linear Technology	LT3580IMS8E#PBF	Farnell	1663577

Hardware description

Appendix A

Viewing debug data on the KitProg serial port of the kit

Please ensure that you have installed either ModusToolbox™ or CYPRESS™ programmer before using the Rapid IoT connect developer kit KitProg3 USB-UART bridge. KitProg3 enumerates as a root USB Composite Device with subordinate CMSIS-DAP, Bridge, and USB-UART interfaces.

Please open “TeraTerm” / “Minicom” / other serial terminal software installed in your laptop/ PC and select “KitProg3 serial port”, with following settings to view the debug data of the kit locally on your PC / laptop.

Baud rate:	115200
Data:	8
Parity:	None
Stop Bits:	1

Reading LEDs

Rapid IoT connect has four LEDs onboard. Please refer to the below picture for the same.

LED4 power LED is the leftmost LED on the picture. It glows in blue colour. This LED is always on when there is a powered USB cable or battery is connected to the Rapid IoT connect device.

LED5 charge LED is the next LED to the power LED. It glows in yellow colour. This LED blinks when the battery connected to the Rapid IoT connect developer kit is getting charged by the powered USB cable. This turns off when the battery is fully charged.

LED2 user LED is the next LED in sequence from left to right after the USB connector. This LED glows in red colour. This LED is available for user configuration. This LED also denotes an error message if it is blinking during the booting.

LED3 Kitprog3 LED is the last LED from left to right sequence. This LED glows in yellow colour. This LED glows continuously if the device is connected to the PC with right drivers installed and loaded.

Troubleshooting guide

5. Password missing after new user sign-up

Possible cause:

- Email has gone to junk/spam folder of your mailbox.
- You may have entered wrong email id while registering.

Possible solution:

- A mail from no-reply@infineon.com with your username and temporary password will be sent and check in spam/junk folders if you have received already. You will be prompted to change the password upon logging for the first time.
- Verify the email address entered during user registration. If it is wrong, register again with the correct email address.

6. Build failed / status not updated


Possible cause:

- Mismatch in the serial number of the Rapid IoT connect developer kit

Hardware description

- Device already provisioned
- 505 Error

Possible solution:

- Click on the Ellipsis icon  at the end of the devices list to open the drop-down menu and click on Edit to restart the Quick IoT experience wizard. Verify the entered kit serial number, Wi-Fi SSID, Wi-Fi password, etc. are correct.
- Check if the device is already registered by anyone with different email address. If so, contact Infineon® team to delete the old entry.
- Please contact Infineon® for further support.

7. Unable to program the kit after downloading the zip package from the dashboard

Possible cause:

- User tries to run the “program_kit” command without extracting.
- User has not granted permission to execute/run the script.
- Empty space on the name of the extracted folder
- Other program has control of Rapid IoT connect developer kit KitProg3 interface.
- Two or more devices are connected to the PC / laptop
- USB device not recognized. Mostly USB cable issue.
- Problem unknown

Possible solution

- Ensure to extract the zip package first and then run the “program_kit” command/cmd/sh from the extracted folder based on the operating system and bundle and also check if the device is connected to the PC / laptop before running the script.
- For Linux and MAC users, ensure that you have permissions to run the script.
- Check for empty space in the extracted folder name. If so, rename the folder name without empty space.
- Close the “Cypress™ programmer”, “PSoC™ programmer” or “ModusToolbox™” if running in the background and retry programming.
- Remove all other Cypress™ kits, KitProg programmers, MiniProg programmers and ensure that the correct device is connected and retry the programming.
- Try with a different USB cable.
- For more details, check the log file generated inside the log folder created in the same path as the script.


8. Device not connected to cloud after successful programming

Possible cause:

- Wi-Fi connection timed out
- Wrong SSID / password
- Wi-Fi network does not have internet connectivity
- SDIO error
- User LED blinking, hardware fault

Hardware description

Possible solution

- Open the debug serial interface in your laptop / PC and press “RST_BTN” in Rapid IoT connect developer kit to reset the node. The live connection status is established. Mostly, it may solve the problem.
- Click on the Ellipsis icon  at the end of the devices list and select “Edit” from the dropdown menu. This will open Quick IoT experience wizard with all data entered earlier. Verify the entered Kit Serial Number, Wi-Fi SSID, Wi-Fi Password, etc. are correct. If not, update the same and try with the updated Quick IoT experience.
- Open the debug serial interface in your laptop / PC and press “RST_BTN” in Rapid IoT connect developer kit to reset the node. In the “DHM resetting the node” an error message appears on the log, it implies that the device is not having internet access. Create a hotspot with username “IFX_Sensor” and password “S66M14022021” from your mobile network and verify the same. . Check if your Wi-Fi network has internet access from some other connected device, then resolve the firewall settings.
- Open the debug serial interface in your laptop / PC and press “RST_BTN” in Rapid IoT connect developer kit to reset the node. If the message “Unable to connect” appears, it implies that the device is not getting sufficient power from the USB port. Connect the node to a USB 3.0 port or to a USB charger with at least 1A output power and retry the connection.
- User blinking while booting up / after reset. This indicates the device build has issues. Reflash the node by running the script again. If problem prevails, rebuild the package by restarting the Quick IoT experience. Please refer to the 2nd point for steps to restart the Quick IoT experience and contact Infineon® team if the issue is still not resolved.

9. Sensor not found

Possible cause:

Applications other than “Thermistor” are selected in Sensor_solution attributes without any Infineon® XENSIV PAS CO2 wing board or Infineon® XENSIV BGT60TR13 Radar wing board

Possible solution:

Select “Thermistor” from the dropdown menu of Sensor_Solution under Attributes tab to resolve the same.

10. Scrambled logs

Possible cause:

Observe scrambling of logs on the debug UART port. The CM4 and CM0+ use the same UART port for printing debug logs. When both cores CM4 and CM0+ access the debug UART port at the same time, the logs get scrambled.

Possible solution:

This is not an issue with the CYSBSYSKIT-DEV-01 Rapid IoT connect developer Kit or the Rapid IoT connect system-on-module. For simplicity, we have chosen a single debug UART port so that the user can view the debug logs from both cores on the same port. In a final product, the customer can choose dedicated debug ports for each core.

11. Node not appearing in the fleet monitoring

Possible cause:

“unable to obtain semaphore for wifi-scan for CP” messages seen rarely on the UART terminal. Be aware that when enabling the location service feature on the cloud, the software on the node may rarely fail to get a semaphore lock for the Wi-Fi scan. CP stands for Customer Processor and the software is

Hardware description

running on the CM4 core. The Wi-Fi scan function is shared by both the cores and this situation arises when the CM4 is unable to get access to Wi-Fi scan.

Possible solution:

This issue does not have any implication on any other feature but only on the location service feature. The nodes will not be seen on a map. If this issue arises, reset the node so that the CM4 node is able to successfully scan the Wi-Fi networks and the fleet monitoring service can get the device details.

12. SSID “IFX_Sensor” cannot be altered

Possible cause:

This is the default SSID and password created to create a quick hotspot.

Possible solution:

A personalized hotspot can be created or add your local network and select the same while building the package.

13. “program_kit.command” not closing down after programming

Possible cause:

Macintosh OS is not allowing the window to close on its own.

Possible solution:

Close the terminal after “[Process Completed]” appears on the screen.

List of attributes with their definition and possible values.

Note: The string value of each attribute is case sensitive.

14. The attributes listed below are common for applications and cannot be changed in the ‘Attribute’ tab. The table below identifies and defines each of them. A user can visualize the value in the ‘Reported value’ column.

Table 8 Common attributes

Attribute name	Unit	Definition	Range of values
ConnectedStatus	-	Reported value shows if your device is connected to the sensor cloud or not	Connected, Disconnected
LocationSharing	-	Location sharing status, so you can visualize where your device is located	0 or 1 Default value is 1; that means location sharing is enabled If user do not want to share location, please contact Infineon sales person for disabling this feature

Hardware description

Attribute name	Unit	Definition	Range of values
wifiAccessPoints	-	Shows the MAC addresses of all Wi-Fi access points that are in reach of the CSK WLAN. This information is used for the location sharing feature.	
fw_version	-	Shows the firmware that is flashed on the developer board	

15. Depending on the use case to be evaluated, connect the desired wing board. For example, connect the PAS CO2 Wing board for evaluating the CO2 sensor or connect the BGT60TR13C radar wing board for evaluating a presence or entrance counter application. Change the attribute below to activate the application on the Feather board.

Table 9 Attribute to change the application

Attribute name	Unit	Definition	Range of values
sensor_solution	-	Change the active application on the developer board	PAS CO2 – ‘pasco2’ Entrance counter – ‘counter’ Presence detection- ‘presence’ No application – ‘none’
Kit_mask_level	-	Bitmask: INFO = 0x02, WARNING = 0x04, MINOR = 0x08, MAJOR = 0x10, FATAL = 0x20, CLD_INFO = 0x40 The flag CLD_INFO means that the logs will appear on the cloud in ‘Sensor Hub Logs’ tab Log value has to be in decimal.	The log value of 0x7C (0b 0111 1100) translates to 124. So, 124 (0x7C) means FATAL, MAJOR, MINOR, WARNING will appear on the cloud in ‘Sensor Hubs Logs’ tab. The log value of 0x7E (0b 0111 1110) translates to 126. So, 126 (0x7E) means INFO, FATAL, MAJOR, MINOR, WARNING will appear on the cloud in ‘Sensor Hubs Logs’ tab The default value for kit_mask_level is 124.

After activating the correct application, start your evaluation and change the attributes below to configure parameters according to your evaluation conditions.

Note: Changing ‘sensor_solution’ reboots the system and it can take up to 1 minute for the system to reboot

Hardware description

16. PAS CO2 evaluation

Table 10 List of changeable attributes for evaluating the PAS CO2 use case

Attribute name	Unit	Definition	Range of values
pasco2_measurement_period	seconds	CO2 measurement period (time in seconds between two consecutive samples)	10 – 4950 <i>Note: Values <60 seconds are not recommended</i>

17. Presence detection evaluation

Table 11 List of changeable attributes for evaluating the presence detection use case

Attribute name	Unit	Definition	Range of values
radar_presence_range_max	meters	Get or set the maximum detection distance for presence detection. The setting would be stored in Flash; default is 1.00 m.	0.35 – 10.2
radar_presence_sensitivity_range	-	Higher number means more sensitivity to small movements. Supported values are "high (1)", "medium (0.5)" and "low (0)". Default value is "medium (0.5)". The setting would be stored in Flash. Note that it is recommended to use a high-sensitivity setting for optimal performance at angles and for use cases such as a person sitting on a chair behind a table.	0.0-1.0

18. Entrance counter evaluation

Table 12 List of changeable attributes for evaluating entrance counter use case

Attribute name	Unit	Definition	Range of values/text
radar_counter_installation	-	Installation options: top/ceiling mount, side mount	side , ceiling
radar_counter_orientation	-	Board orientation: portrait, landscape	portrait, landscape
radar_counter_ceiling_height	meters	In case of top/ceiling mount installation, this parameter is used to set the height (meters) of sensor from ground	0.0-3.0
radar_counter_entrance_width	meters	Width of the entrance (meters) where people are passing through	0.0-3.0
radar_counter_sensitivity	-	Higher number means more sensitivity to small movements. Supported values are "high (1)",	0.0-1.0

Hardware description

Attribute name	Unit	Definition	Range of values/text
		"medium (0.5)" and "low (0)". Default value is "medium (0.5)". The setting would be stored in Flash	
radar_counter_traffic_light_zone	meters	Travel distance (while first person is walking though), during which second person behind is shown a Red stop sign (to wait in order to maintain social distancing) on a local display.	0.0-1.0
radar_counter_reverse	-	Definition of in & out counts can be reversed using this flag	true, false
radar_counter_min_person_height	meters	This parameter can be used to eliminate moving subjects/objects, which are below certain heights	0.0-2.0
room_capacity	-	Enter the capacity of the premises to visualize the capacity data in the People Counter tab	≥1

Appendix A

Appendix A: Frequently asked questions

1. Is the XENSIV™ PAS CO2 wing compatible with other Adafruit feather-compatible kits?

Yes, the XENSIV™ PAS CO2 wing can be used with any board that has an Adafruit feather-compatible pin-out.

2. Can we combine the XENSIV™ PAS CO2 wing with other boards, i.e., XENSIV™ BGT60TR13C radar wing?

Yes, the XENSIV™ PAS CO2 wing and XENSIV™ BGT60TR13C radar wing boards can be stacked together. It is simple to combine the radar code example, i.e., <https://github.com/Infineon/mtb-example-sensors-radar-presence-freertos> with the XENSIV™ PAS CO2 code example. Both examples use FreeRTOS task that can be easily integrated into a single application.



Revision history

Revision history

Document version	Date of release	Description of changes
V1.0	May 2022	Release version

Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

Edition 2022-25-04

Published by

Infineon Technologies AG

81726 Munich, Germany

© 2022 Infineon Technologies AG.

All Rights Reserved.

Do you have a question about this document?

Email: erratum@infineon.com

AppNote Number

Document reference:

UM_2205_PL38_2205_101147

IMPORTANT NOTICE

The information contained in this application note is given as a hint for the implementation of the product only and shall in no event be regarded as a description or warranty of a certain functionality, condition or quality of the product. Before implementation of the product, the recipient of this application note must verify any function and other technical information given herein in the real application. Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind (including without limitation warranties of non-infringement of intellectual property rights of any third party) with respect to any and all information given in this application note.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office (www.infineon.com).

WARNINGS

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.