QCIoT-ICM42688P

Pmod™ Evaluation Board

The QCIoT-ICM42688P enables quick prototyping of the ICM-42688-P 6-axis MEMS MotionTracking device that combines a 3-axis gyroscope and a 3-axis accelerometer. The board provides standard Pmod™ Type 6A (expanded I2C) or Type 2A (expanded SPI) connections for the onboard sensor to plug into any required MCU evaluation kit with matching connector.

The QCIoT-ICM42688P board features Pmod connectors on both sides of the board to allow additional Type 6/6A or Type 2/2A boards to be connected in a daisy-chained solution with multiple sensors on the same MCU Pmod connector. Software support present in the QuickConnect Studio provides code generation to connect the sensor and the MCU, thereby significantly reducing development time. With its standard connector and software support, the QCIoT-42688P is ideal for the Renesas QuickConnect Studio to rapidly create an IoT system.

Kit Contents

- QCIoT-ICM42688P

Features

- ICM-42688-P IMU sample mounted:
  - Gyroscope Noise: 2.8 mdps/√Hz
  - Accelerometer Noise: 70 µg/√Hz
  - Low-Noise mode 6-axis current consumption of 0.88 mA
  - User selectable Gyro Full-scale range (dps): ± 15.6/31.2/62.5/125/250/500/1000/2000
  - User selectable Accelerometer Full-scale range (g): ± 2/4/8/16
  - User-programmable digital filters for gyro, accel, and temp sensor
  - APEX Motion Functions: Pedometer, Tilt Detection, Tap Detection, Wake on Motion, Raise to Wake/Sleep, Significant Motion Detection
- Standardized type 2A/6A Pmod connector supports I2C or SPI expanded interface Software support in QuickConnect Studio minimizes development time with one-click code generation

Related Documents

- ICM-42688-P Datasheet
- Renesas QuickConnect IoT Manual

Figure 1. QCIoT-ICM42688P Pmod Board

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Contents

1 SETUP 3
1.1 REQUIRED OR RECOMMENDED USER EQUIPMENT 3
1.2 SOFTWARE INSTALLATION AND USAGE 3
1.3 KIT HARDWARE CONNETIONS 3
2 USAGE GUIDE 6
2.1 OVERVIEW OF THE QCIOT-ICM42688P 6
2.2 PROGRAMMING INTERFACE 7
3 QCIOT-42688P APPLICATION SCHEMATIC 12
4 BILL OF MATERIALS (BOM) 13
5 BOARD LAYOUT 14
6 ORDERING INFORMATION 15
7 REVISION HISTORY 16

Figures

Figure 1. QCIoT-ICM42688P Pmod Board 1
Figure 2. QCIoT-ICM42688P connected to the US082-INTERPEVZ interposer board 4
Figure 3. Evaluation Kit Connections using the QCIoT-ICM42688P, US159-DA14531EVZ, and EK-RA6M4 5
Figure 4. QCIoT-ICM42688P Application Schematic 12
Figure 5. Top Layer 14
Figure 6. Bottom Layer 14

1 SETUP

1.1 REQUIRED OR RECOMMENDED USER EQUIPMENT

The following additional equipment (sold separately) is required for using the board:

- Supported connectivity module like US159-DA14531EVZ BLE or US159-DA16200MEVZ Wi-Fi Pmod.
- Any MCU board that supports Type 6A or Type 2A Pmod.
- If one of the Renesas MCU kits shown in Table 1 does not support Pmod Type 6A (expanded I2C) and the user prefers to use I2C, the US082-INTERPEVZ interposer board is needed to make the Renesas MCU board compatible with Type 6A (This table is not a comprehensive list of supported MCU Kits).

RA
EK-RA4W1
EK-RA2A1
EK-RA2E1
EK-RA4M1
EK-RA6M1
EK-RA6M2
EK-RA6M3
EK-RA6M3G
EK-RA6M4

Table 1.Renesas MCU Evaluation Kits Capable of Supporting Type 6A PMODs When Used with the US082-INTERPEVZ

1.2 SOFTWARE INSTALLATION AND USAGE

Visit the Renesas QuickConnect Studio webpage for more information about creating your customized system solution.

1.3 KIT HARDWARE CONNETIONS

Follow these procedures to set up the kit as shown on Figure 3.

1. Ensure MCU evaluation kit being used has a Pmod connector set to appropriate Pmod Type (refer to the kit hardware manual if unsure).

2. To configure QCIoT-ICM42688P for Type 6A (expanded I2C), short pins 9-10, 11-12, 13-14, 15-16 and leave pins 1-2, 3-4, 5-6, 7-8 open on J3 jumper. To configure QCIoT-ICM42688P for Type 2A (expanded SPI), short pins 1-2, 3-4, 5-6, 7-8 and leave pins 9-10, 11-12, 13-14, 15-16 open. (Refer to Table 2 for pinout for Type 2A and Type 6A) *As of now, QCIoT-ICM42688P is not configured for SPI communication on QuickConnect Studio. This feature will be enabled soon.*

3. Plug in the QCIoT-ICM42688P to the US082-INTERPEVZ interposer board as shown below, then connect it to MCU kit. US082-INTERPEVZ interposer board needed for to convert Pmod Type 2A to Type 6A I2C interface on EK-RA6M4.

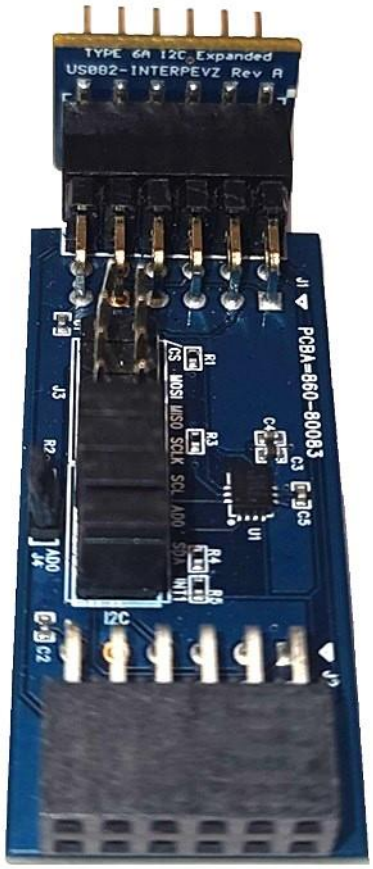


Figure 2. QCIoT-ICM42688P connected to the US082-INTERPEVZ interposer board

4. The sensor is now ready to be used in the system. Follow the MCU kit instructions for connecting and powering up the evaluation kit.

Document Number: AN-000493
Revision: 1.0

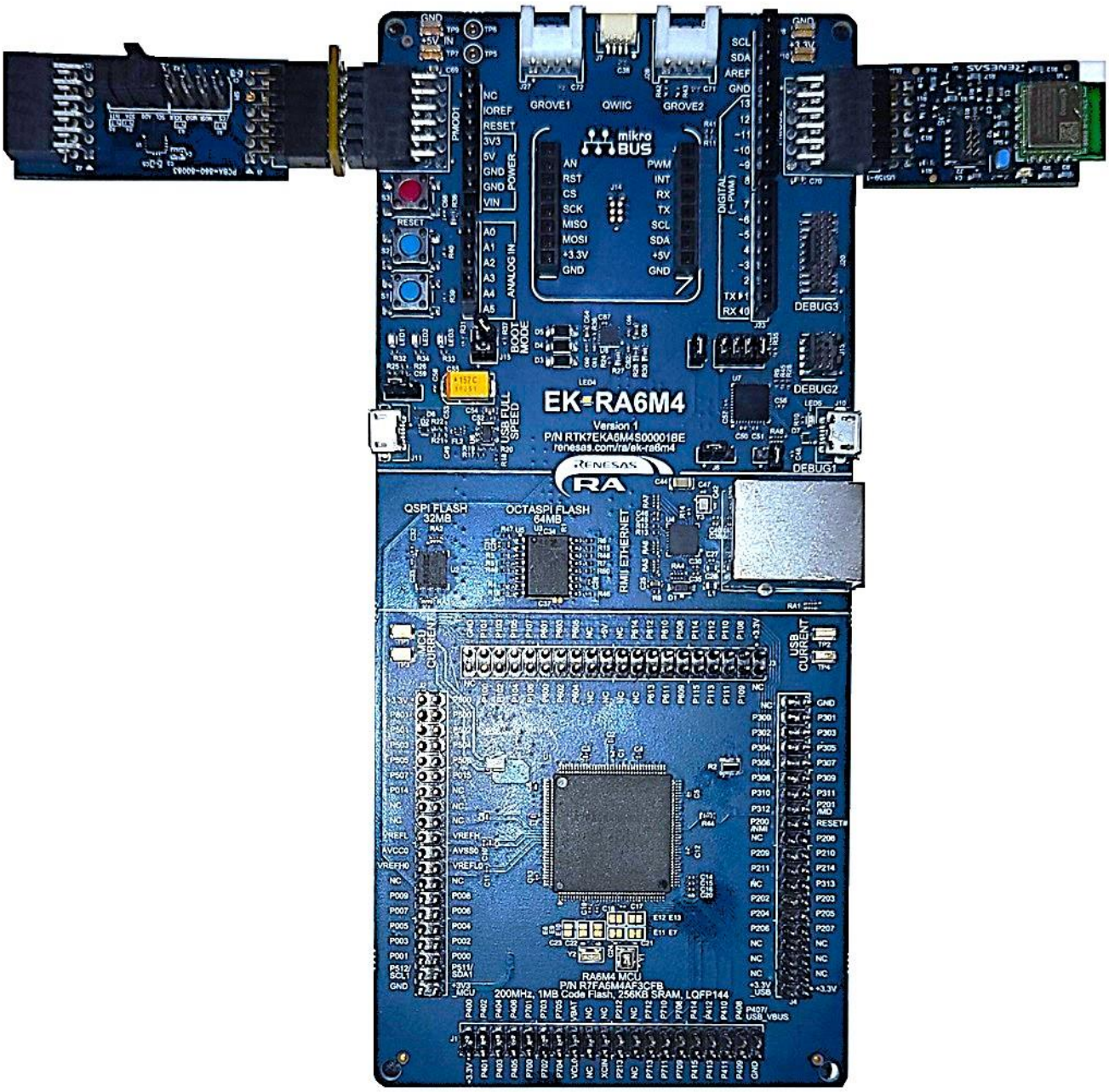
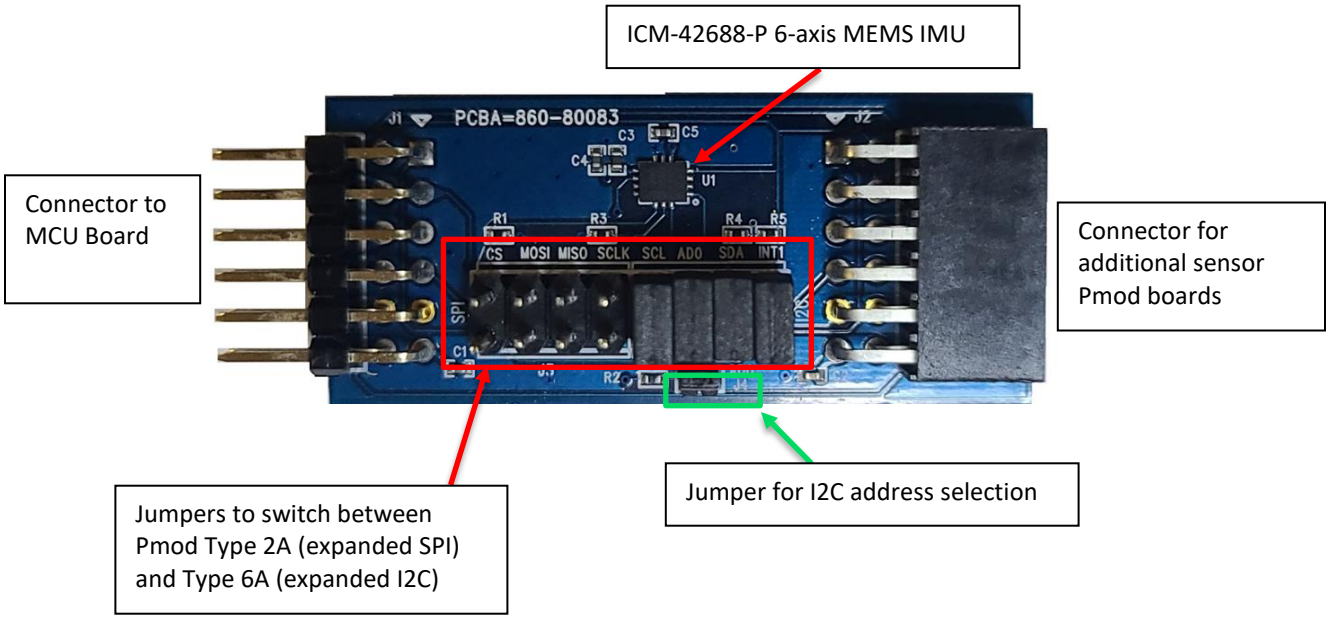


Figure 3. Evaluation Kit Connections using the QCIoT-ICM42688P, US159-DA14531EVZ, and EK-RA6M4

2 USAGE GUIDE

The QCIoT-ICM42688P functions as a sensor building block to create a custom system solution. It can be used individually or with a combination of other sensors using the Pmod Type 2A/6A interface. See the Renesas QuickConnect Studio webpage for a list of available Pmod sensor boards. Along with a simple hardware connection, the software sensor block in the Renesas software package allows the user to generate all the necessary glue code between the sensor and the MCU with the simple click of a button.

2.1 OVERVIEW OF THE QCIoT-ICM42688P



Pin #	Signal
1	CS
2	MOSI
3	MISO
4	SCK
5	GND
6	VCC
7	GPIO
8	GPIO
9	GPIO
10	GPIO
11	GND
12	VCC

Table 2. Pmod Interface Type 2A (expanded SPI)

Pin #	Signal
1	NC
2	NC
3	SCL
4	SDA
5	GND
6	VCC
7	GPIO
8	GPIO
9	GPIO
10	GPIO
11	GND
12	VCC

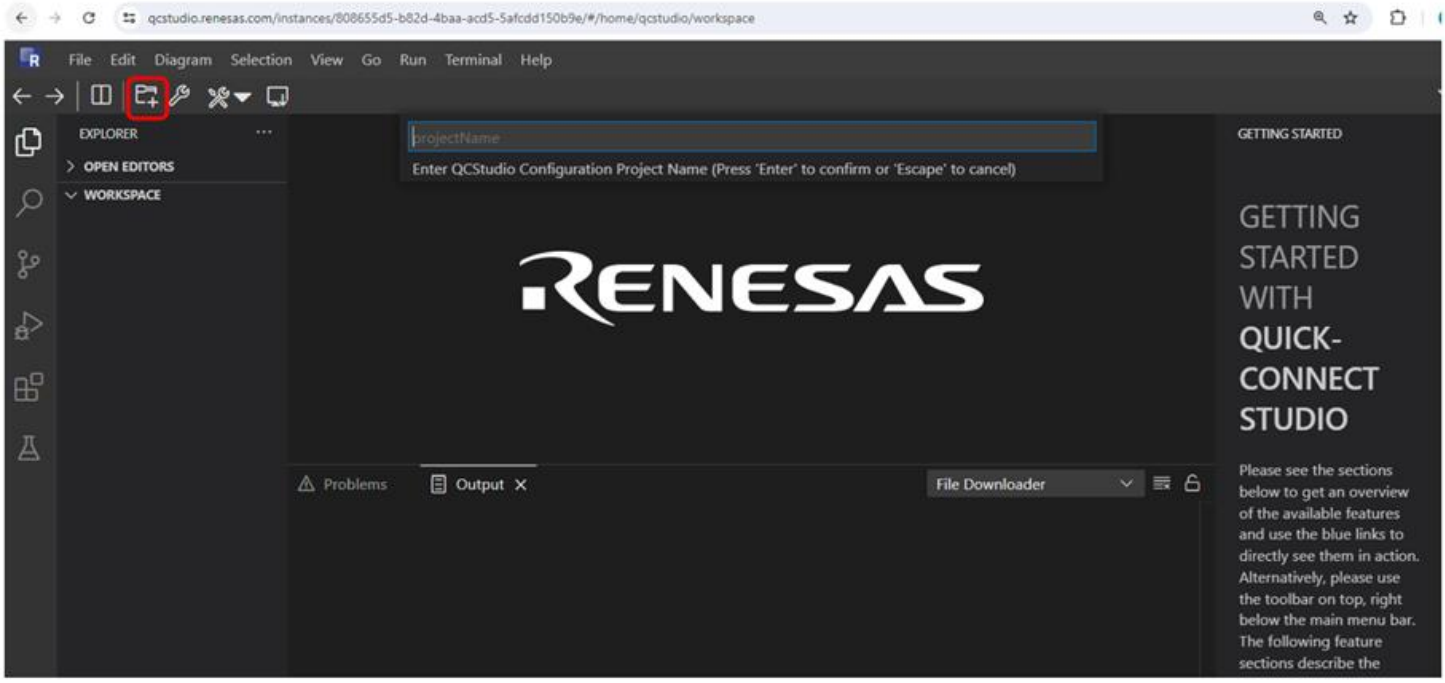
Pmod Interface Type 6A (expanded I2C)

Document Number: AN-000493
Revision: 1.0

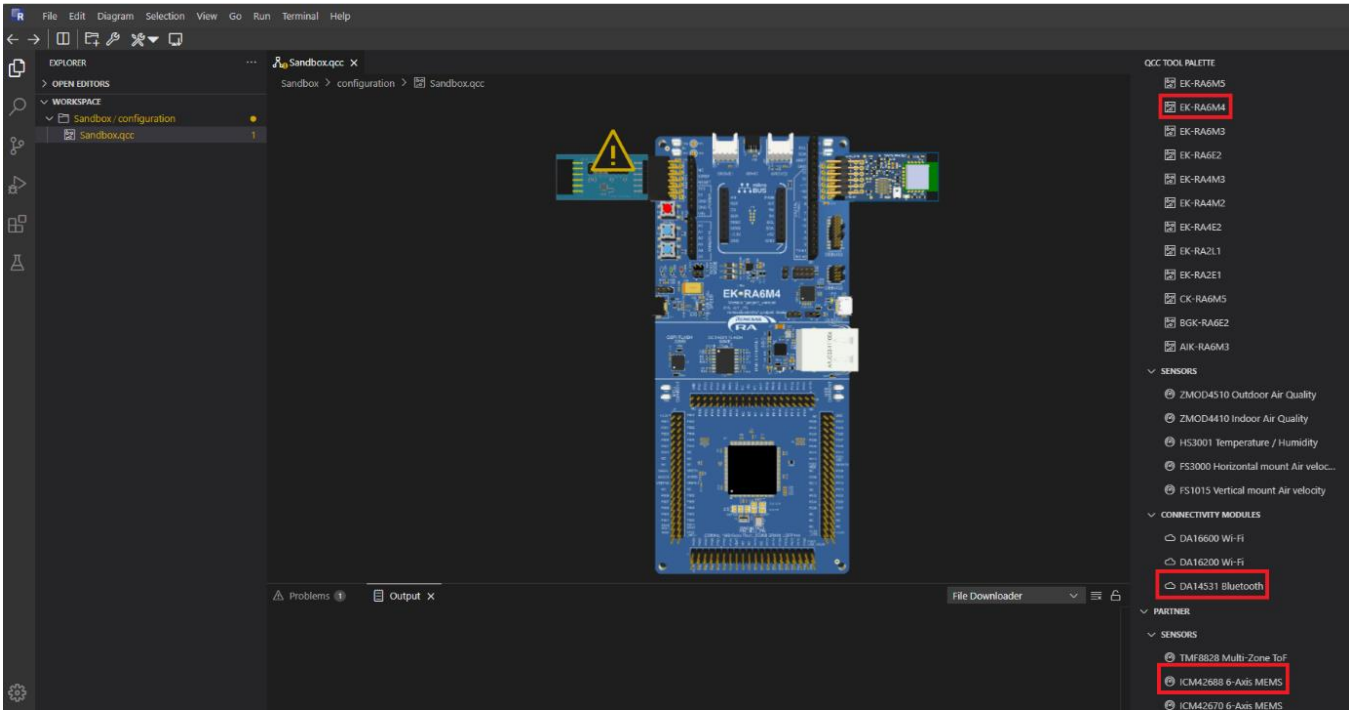
2.2 PROGRAMMING INTERFACE

Programming of the system can be accomplished through QuickConnect Studio. See the MCU evaluation kit documentation for programming interface guideline. This section explains how to program QCIoT-ICM42688P with EK-RA6M4, US159-DA14531EVZ BLE and US082-INTERPEVZ Pmod interposer board.

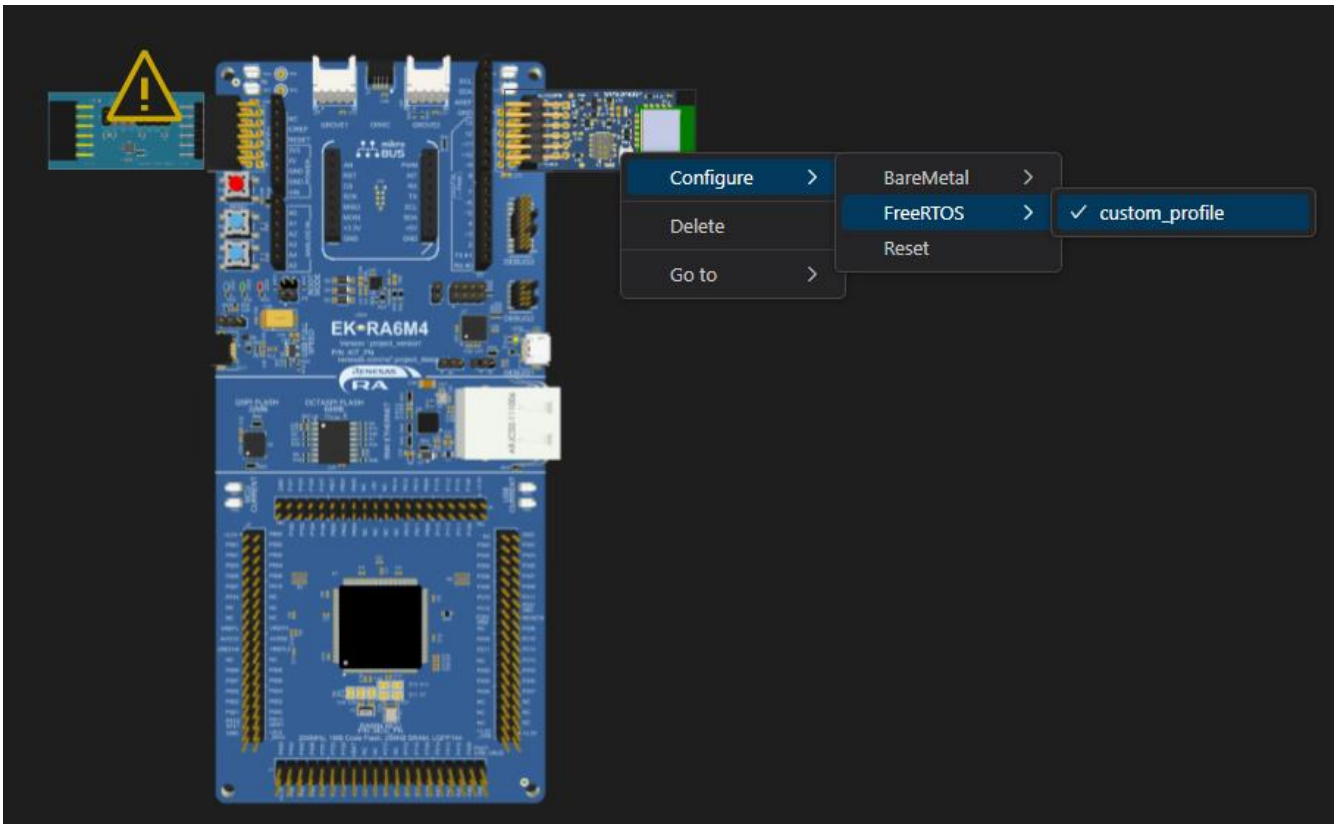
1. Launch the QuickConnect Studio platform by clicking on the Launch OuickConnect Studio button in a PC browser window.
2. At the following screen, click on the MyRenesas button to log in using MyRenesas login credentials. If you are a new user, click on Register | Renesas Electronics Corporation, and then log in using MyRenesas.
3. Create a new project by clicking the New Project icon from the menu. Type in a project name in the highlighted window.



4. A menu with a list of supported devices is shown on the right side of the browser. Next, drag and drop the system blocks from the QCStudio tool palette. In this reference application, the following are used: the MCU board (EK-RA6M4), the BLE module DA14531 PMOD board, and the QCIoT-ICM42688P board.

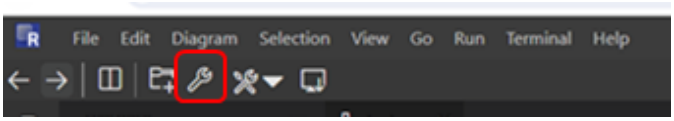


5. Right-click on the wireless module (DA14531 PMOD board) and configure the module with **Configure > FreeRTOS > custom_profile**.

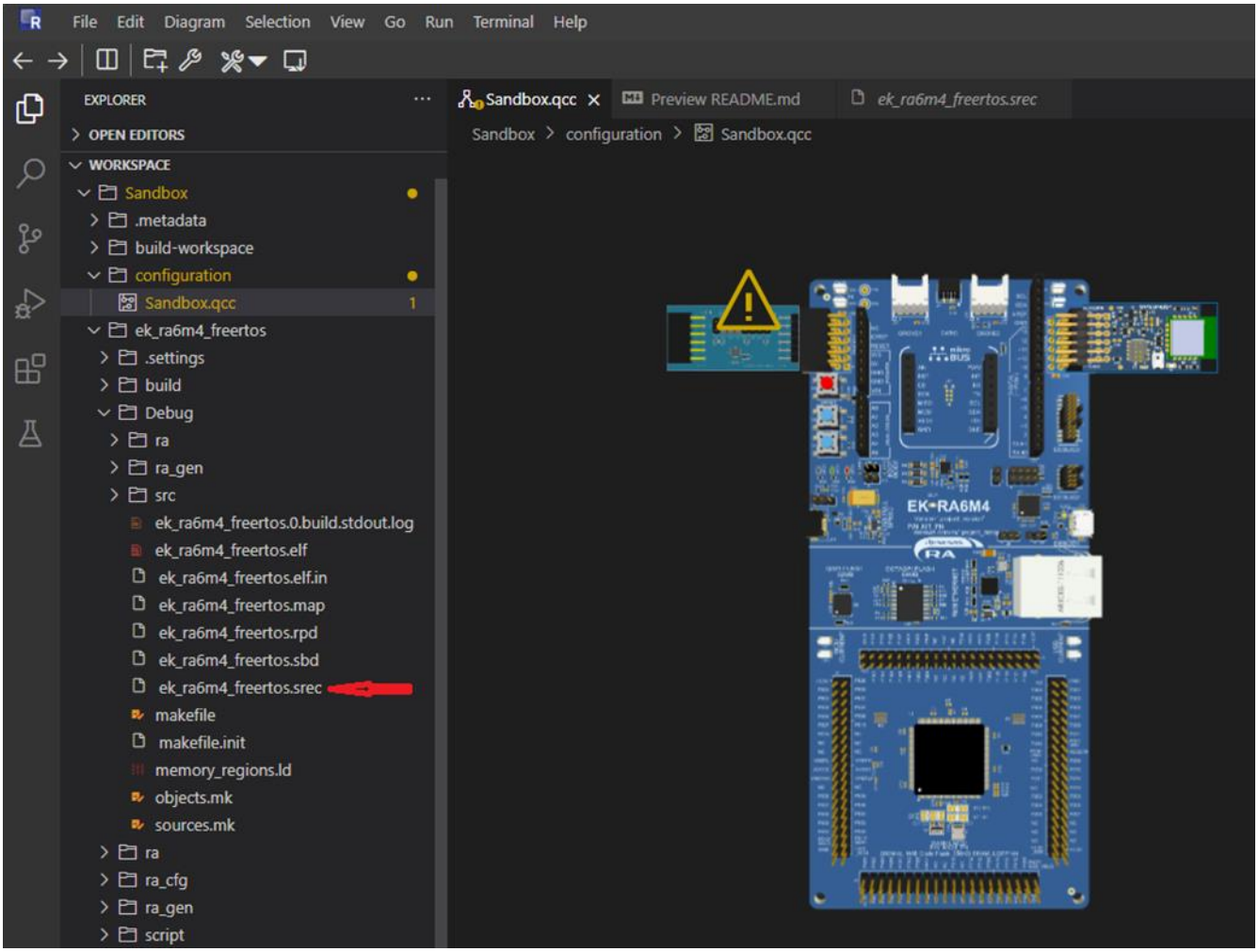


Document Number: AN-000493
Revision: 1.0

6. QCStudio project is now ready to build and generate the application binary that can be tested on the actual hardware kit.
7. To generate and build projects, click on the Generate/Build QCS Project icon on the top left-hand side corner. QCStudio automatically generates the required software package including drivers, middleware, and network stacks required for the user-created system solution.

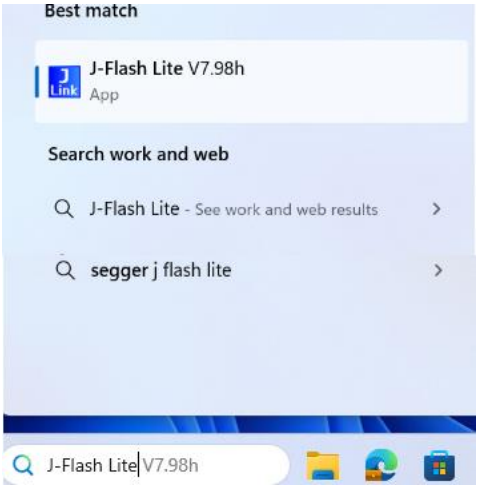


8. After successful build, download the .srec file from the project debug folder to your local PC by right-click on the file. Refer to the instructions in the readme file from the generated application project. The **README.md** file is found under the project directory.

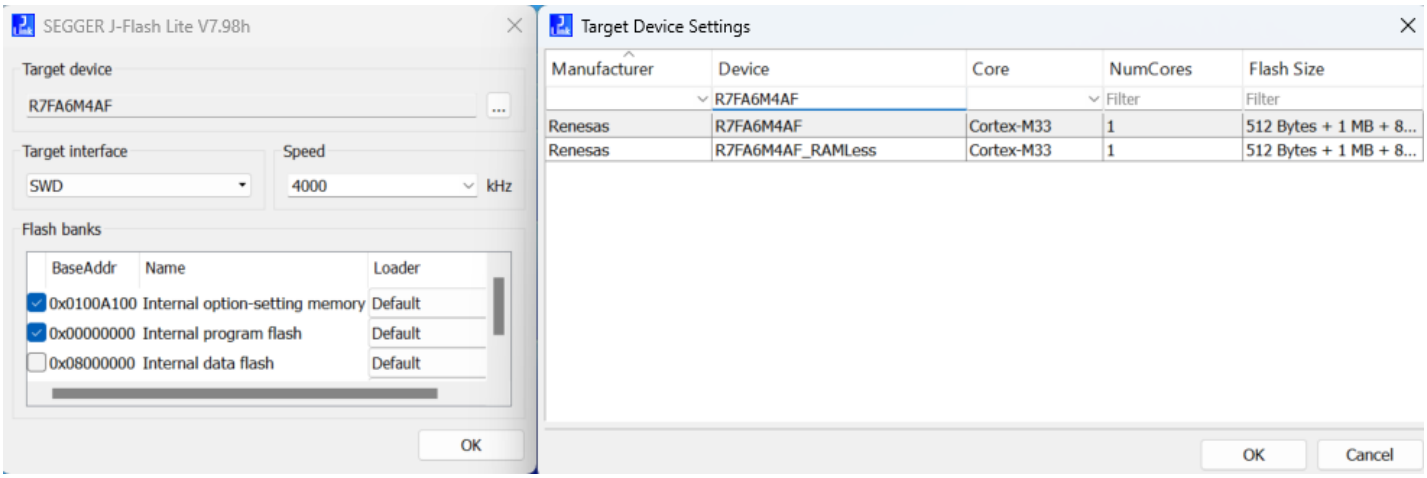


9. Use the J-Flash Lite programmer to program the .srec file into the chosen MCU kit. Download SEGGER - The Embedded Experts - Downloads - J-Link / J-Trace.

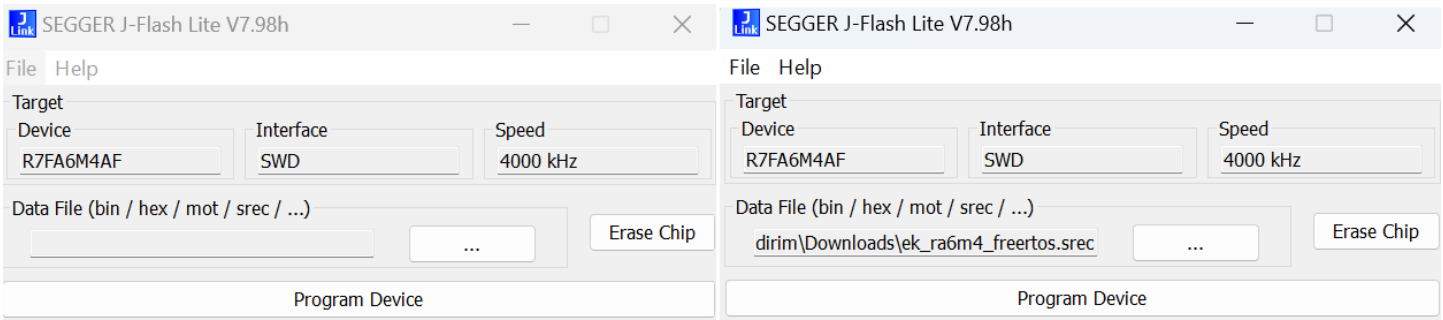
10. Open Segger J-Flash Lite from the start menu search.



11. In the J-Flash Lite window, click on the **(…)** button next to the **Target Device** field. A new window will appear. Here, user can select the manufacturer and device. For this project, as we are using the **RA6M4 MCU**, search for the part number **R7FA6M4AF**. Select the target device and click **OK**. Ensure the target interface is set to **SWD**, then click **OK**.



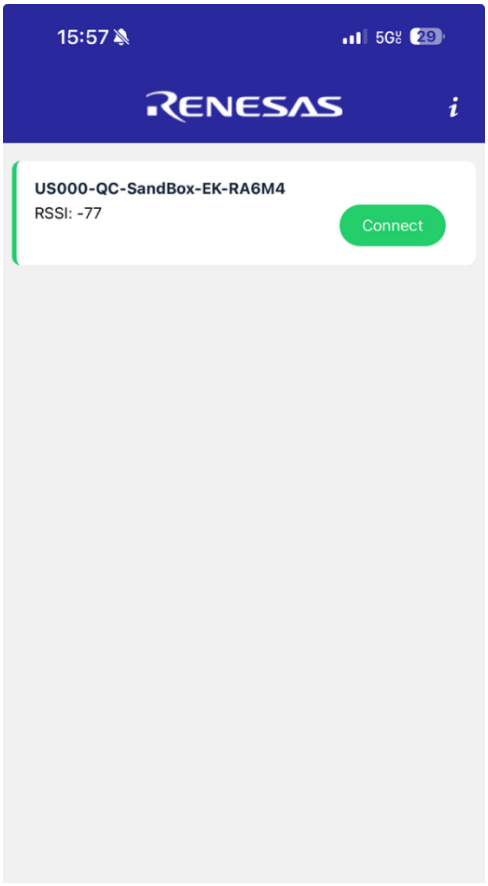
12. A new J-Flash Lite window pops up, locate the **Data File (bin / Hex / mot / srec / …)** section. Click on the **(…)** button to import the **.srec** file that was downloaded by following the steps in the Quick Start procedure.

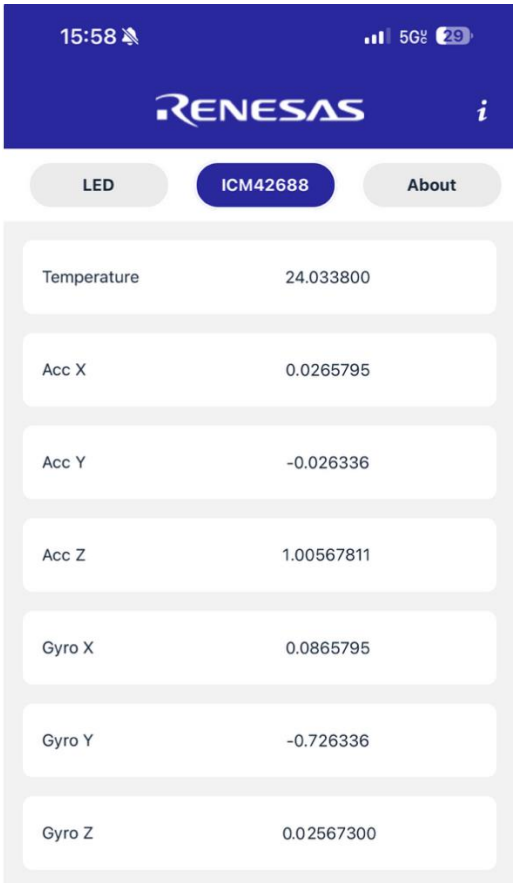


13. Click on **Program Device**. A prompt may appear asking if you want to update to the latest firmware version. Select **No**. The code will now be flashed to the MCU. Once the process is complete, the log section of the screen will display **Done**.

Document Number: AN-000493
Revision: 1.0

14. Download the Quick-Connect Mobile Sandbox application on phone/tablet to view accelerometer and gyroscope data via Bluetooth.
    Apple Store Quick-Connect Mobile Sandbox: Quick-Connect Mobile Sandbox on the App Store (apple.com)
    Google Play Quick-Connect Mobile Sandbox: Quick-Connect Mobile Sandbox - Apps on Google Play
15. Scan for BLE device and connect to RA MCU Kit. After connection to the BLE peripheral, user can check the sensor data published on the mobile application.





Document Number: AN-000493
Revision: 1.0

3 QCIoT-42688P APPLICATION SCHEMATIC

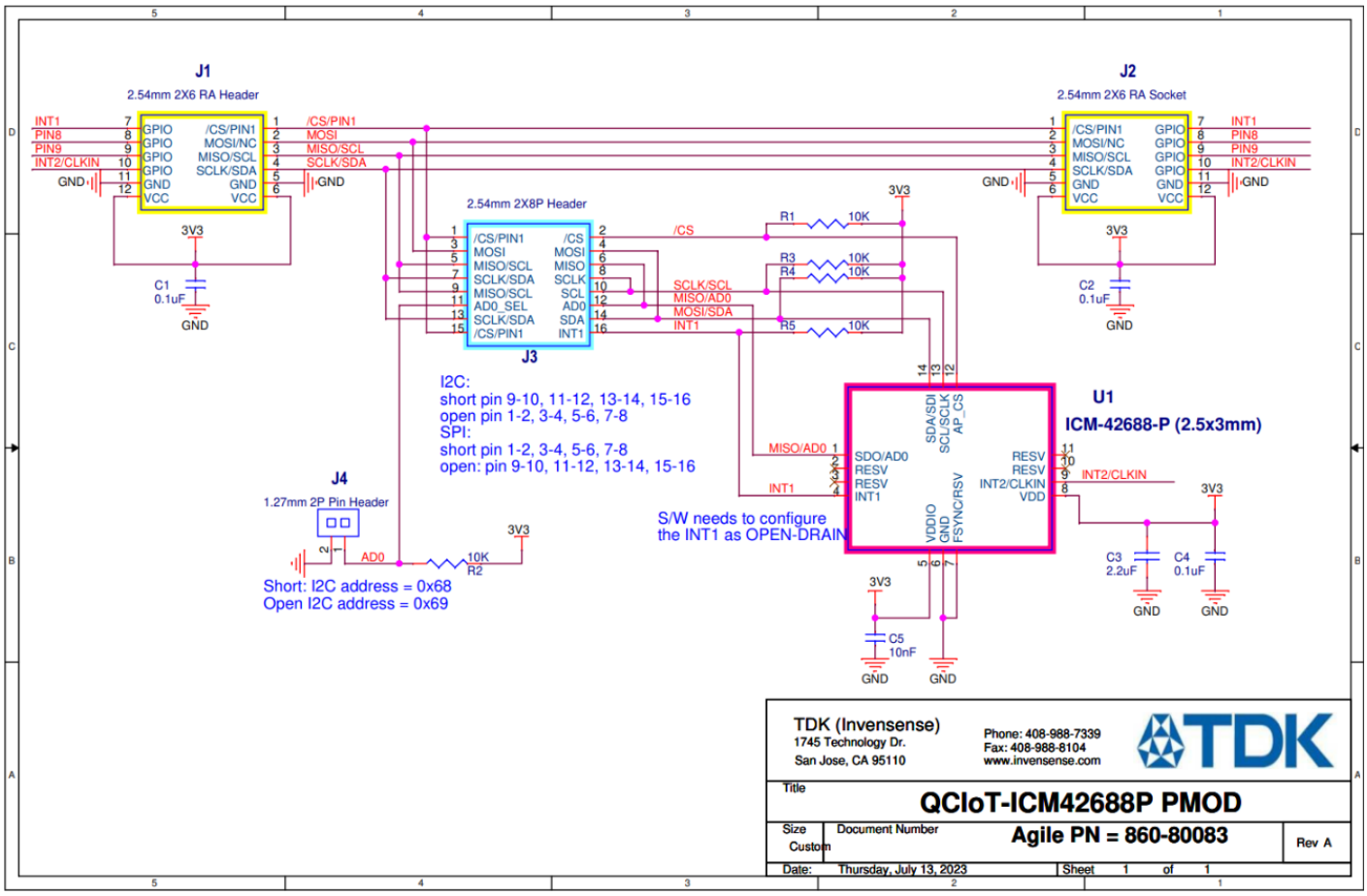


Figure 4. QCIoT-ICM42688P Application Schematic

Document Number: AN-000493
Revision: 1.0

4 BILL OF MATERIALS (BOM)

Quantity	Reference	Part	PCB Footprint	Manufacturer Part Number
3	C1,C2,C4	0.1uF	C0402	CC0402KRX5R6BB104
1	C3	2.2uF	C0402	C1005X7S1A225K050BC
1	C5	10nF	C0402	C0402C103K3REC7411
1	J1	2.54mm 2X6 RA Header	socket2x6p-2_54h-pmod_male	PH2RA-12-UA
1	J2	2.54mm 2X6 RA Socket	socket2x6p-2_54h-pmod_female	SSW-106-02-F-D-RA
1	J3	2.54mm 2X8P Header	HEADER2X8	PH2-16-UA
1	J4	1.27mm 2P Pin Header	con2p-1_27h	M50-3530242
5	R1,R2,R3,R4,R5	10K	R0402	RC0402JR-0710KL
1	U1	TDK-InvenSense IMU (2.5x3mm)	LGA-14_2.5x3	ICM-42688-P
1	J4	1.27mm 2P Pin Header Shunt		M50-2000005
4	J3 (1-2, 3-4, 5-6, 7-8) SPI	Shunt 0.100"		SPC02SYAN

5 BOARD LAYOUT

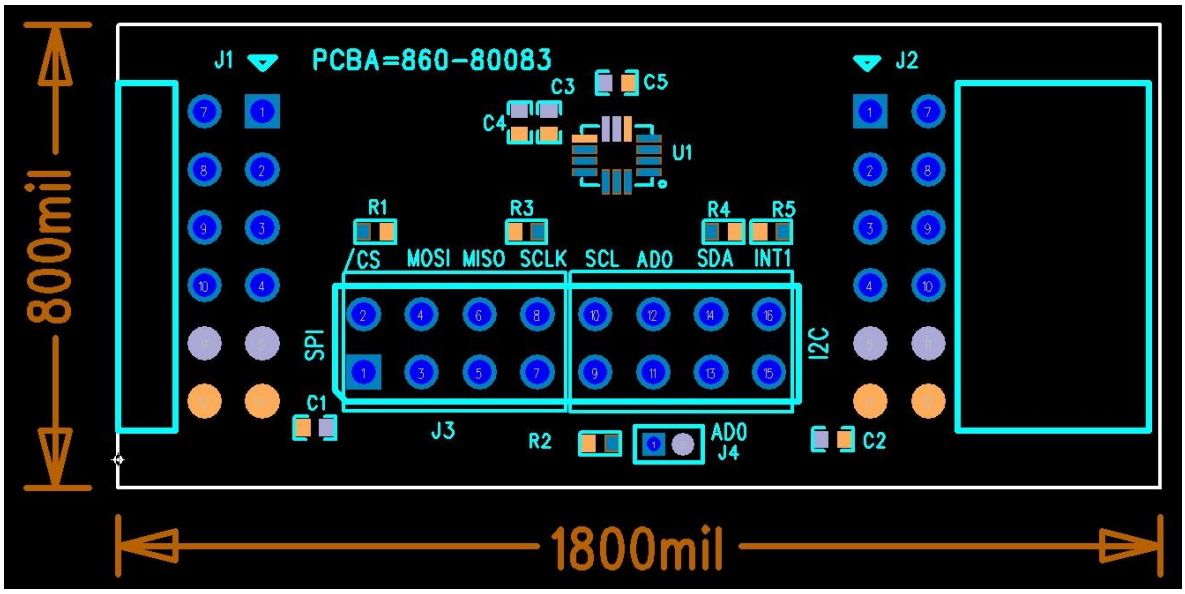


Figure 5. Top Layer

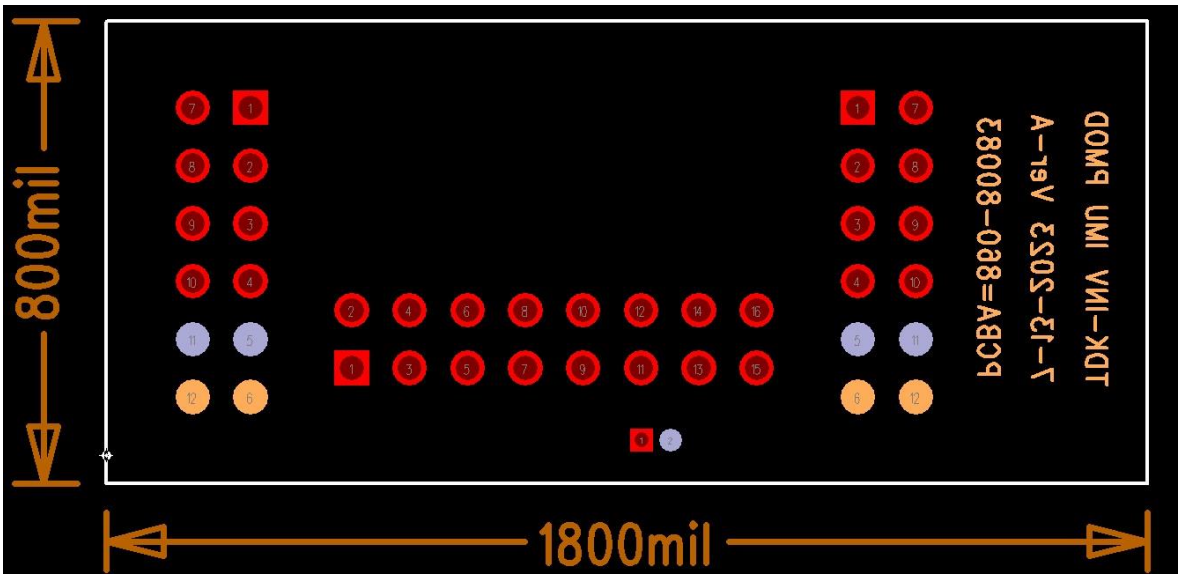


Figure 6. Bottom Layer

Document Number: AN-000493
Revision: 1.0

6 ORDERING INFORMATION

Part Number	Description
QCIoT-ICM42688P	ICM-42688-P Pmod™ Board
US159-DA14531EVZ	Low Power Bluetooth® Pmod™ Board
US082-INTERPEVZ	Pmod™ Interposer Board to convert Type 2A and 3A to Type 6A on older Renesas MCU kits.

7 REVISION HISTORY

Revision Date	Revision	Description
10/02/2024	1.0	Initial Release

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