

The QCIOT31-ZMID4200POCZ Board enables quick prototyping of the [ZMID4200](#) PWM-to-Digital Output Sensor for a custom system design. The ZMID4200 is an inductive position sensor IC with PWM, used for absolute rotary and linear motion sensing. The board provides a standard PMOD™ Type 6A (Extended I<sup>2</sup>C) connection for the on-board sensor to plug into any MCU evaluation kit with a matching connector.

The QCIOT31-ZMID4200POCZ features PMOD™ connectors on both sides of the board to allow additional Type 6/6A boards to be connected in a daisy-chained solution with multiple sensors on the same MCU/MPU PMOD™ connector. Software support present in the Renesas IDE (e2 studio) provides code generation to connect the sensor and the MCU, thereby significantly reducing development time. With its standard connector and software support, the QCIOT31-ZMID4200POCZ is ideal for Renesas [Quick-Connect IoT](#) to rapidly create an IoT system.

## Kit Contents

- QCIOT31-ZMID4200POCZ PMOD™ Board.

## Evaluation Board

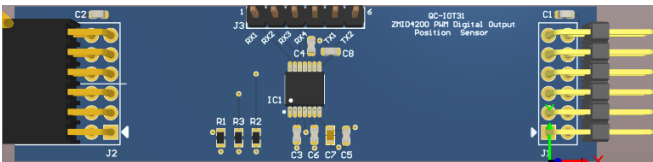


Figure 1: QCIOT31-ZMID4200POCZ PMOD™ Board

## Features

- Inductive principle.
- Analog, PWM or SENT output with programmable limits.
- Overvoltage, reverse polarity, ESD and short circuit protection
- 10-bit resolution (Analog and PWM)
- Standardized Type 6A PMOD™ connector supports I<sup>2</sup>C Extended interface.
- Dual connectors allow pass-through signals for daisy-chained solutions.
- Software support in e2 studio minimizes development time with one-click code generation.

## Related Documents

- ZMID4200 Datasheet.
- ZMID4200 EVK User Manual.
- Renesas Quick-Connect IoT Manual.

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# 1. Functional Description

The QCIOT31-ZMID4200POCZ functions as PWM-to-Digital Output Sensor converter building block to create a custom system solution. Use the board individually or with a combination of other sensors by using the PMOD™ Type 6A interface. (See the Renesas Quick-Connect IoT web page for a list of available sensors PMOD™ boards)

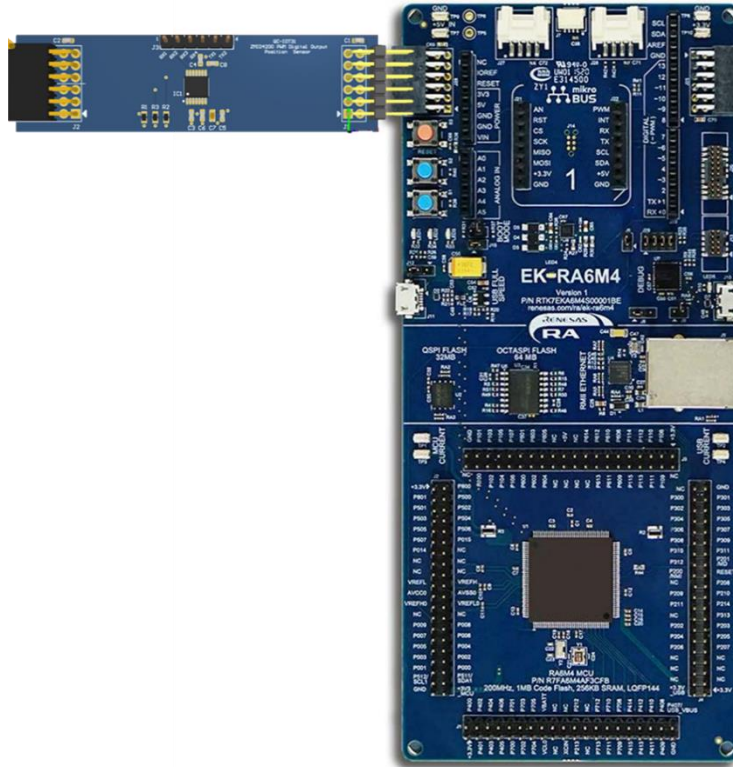


Figure 2: Evaluation Kit Connections using of QCIOT31-ZMID4200POCZ with EK-RA6M4.

# 2. Operating Environment

The operation of this software project has been confirmed with the following environment.

**Table 1: Operating Environment**

Item	Description
Demonstration board	RTK7EKA6M4S00001BE (EK-RA6M4)
Microcontroller	RA6M4
Operating frequency	48 MHz
Operating voltage	+5V
Integrated development environment	e2 Studio 2023-04
C compiler	GCC 10.3.1.20210824
Flexible Software Package (FSP)	V.3.3.0
RTOS	N/A
Emulator	On board (J-LINK)
Sensor board	QCIOT31-ZMID4200POCZ PMOD™ Board

### 3. Setup

#### 3.1 Required or Recommended User Equipment

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

- Any MCU/MPU board that supports Type 6A PMOD™.
- [ZMID4200STKIT](#) Inductive Position Sensing Starter Kit.
- The US082-INTERPEVZ interposer board when using one of the Renesas MCU kits shown in Table 1.

**Table 2: Renesas MCU Evaluation Kits capable of supporting type 6A PMODs when used with the QC10T31-ZMID4200POCZ.**

RA	RX	Synergy
EK-RA4W1	RX111-Starter-Kit	PK-S5D9
EK-RA2A1	RX231-Starter-Kit	DK-S3A7
EK-RA4M1	RX23W-Starter-Kit	DK-S128
EK-RA6M1	RX23T-Starter-Kit	TB-S1JA
EK-RA6M2	RX24T-Starter-Kit	TB-S3A6
EK-RA6M3	RX24U-Starter-Kit	DK-S7G2
EK-RA6M3G		

Note 1. This table is not a comprehensive list of supported MCU Kits. See the evaluation kit hardware manual to confirm PMOD™ pinout.

#### 3.2 Software Tools and Versions required:

There is a tool to calibrate the ZMID4200 IC called “ZMID4200 EVKIT Application” with the help of this tool we can calibrate our ZMID4200 IC’s. The tool you can download by clicking [Here](#), this will open ZMID4200 product page from here under ‘Design & Development’ section download “ZMID4200 Starter Kit Software”.

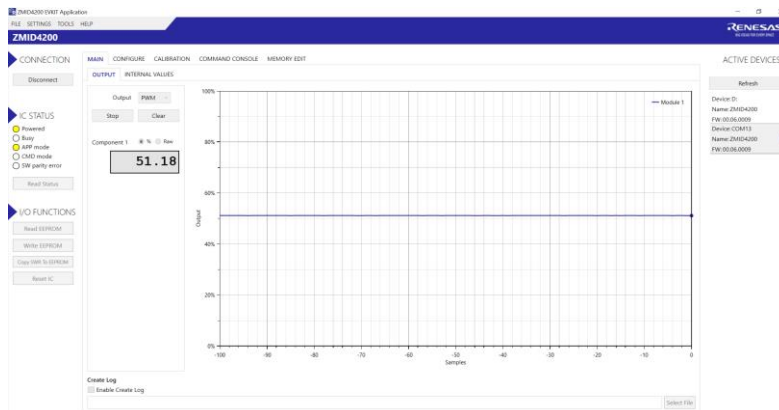


Figure 3: Calibration GUI.

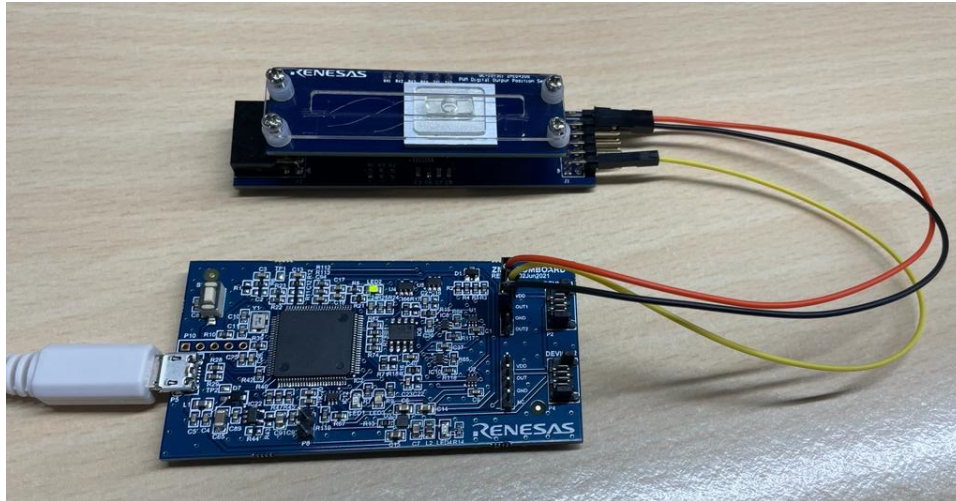


Figure 4: QC-IOT31-ZMID4200POCZ & ZMID4200STKI Hardware Setup

**3.2.1 How to setup connection between QC-IOT31-ZMID4200POCZ & ZMID4200STKI:**

To establish connection between the two boards, connect P1 connector on Starter kit with the J1 connector on QC-IOT31 board as per shown below,

ZMID4200STKI (P1)			QC-IOT31-ZMID4200POCZ (J1)	
PIN No.	PIN Name		PIN No.	PIN Name
PIN 1	VDD	→	PIN 6/12	5V0
PIN 2	Out1	→	PIN 1	IRQ
PIN 3	GND	→	PIN 5/11	GND

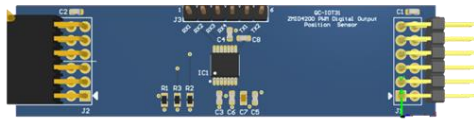
**3.2.2 Steps to calibrate the ZMID4200 IC:**

- 1 Connect the ‘ZMID4200STKI Inductive Position Sensing Starter Kit’ with the PC on which the above application is installed. As shown in figure 3.
- 2 After opening the application, click on “refresh” button on the top right corner. Then the new device will come under the refresh button.
- 3 Select that device and click on “Connect” button on the top left side.
- 4 After the successful connection we will be able to see the window as shown above. As shown in figure 4.
- 5 After this we can calibrate the device by following the steps mentioned here “Calibrations→ Output Range→ Start Calibration”.

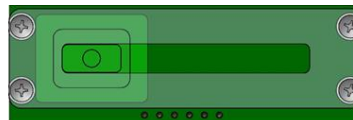
**3.3 Board Hardware Assembly:**

There are total 3 boards coming up with QC-IOT31-ZMID4200POCZ, which we must assemble as per shown in figure 5.

1. QC-IOT31 PMOD Base Board.
2. Coil Daughter Card Board.
3. Metallic Contact Board.



1. QC-IOT31 PMOD Base Board



2. Coil Daughter Card Board



3. Metallic Contact Board

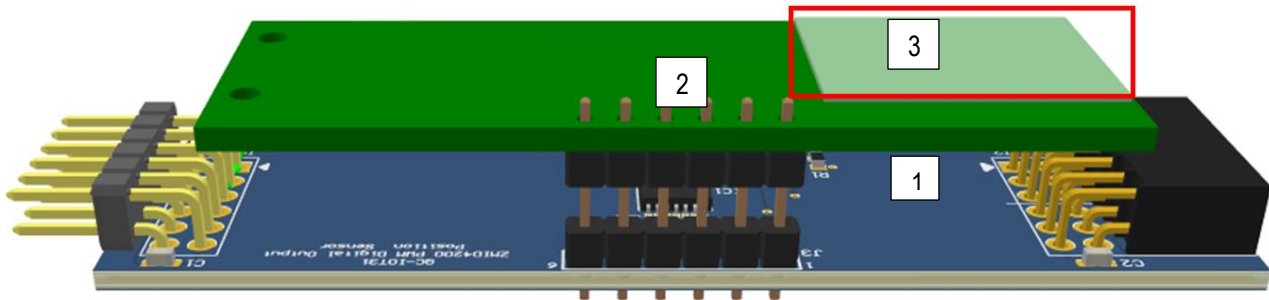


Figure 5: QC-IoT31 Hardware Setup with Linear Coil

### 3.4 Kit Hardware Connections:

Follow these procedures to set up the kit as shown on

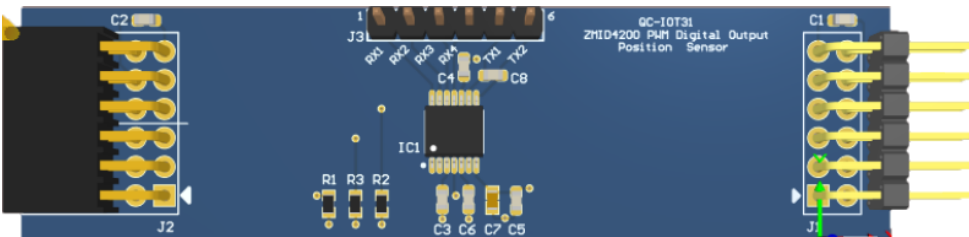


Figure 6: Evaluation Kit Connections

Number	Function
1	Connect to Board
2	Other PMOD™ connects here
3	I2C pull-up resistors (R2&R3)
4	IRQ pull-up resistor (R1)

1. Ensure the MCU evaluation kit being used has a PMOD connector set to Type 6A (refer to the kit hardware manual if unsure).
  - a. If no Type 6A PMOD™ is available, ensure the MCU evaluation kit can use the PMOD interposer board and insert the board into the MCU connector before adding any sensor boards.
2. Plug in the QC-IOT31-ZMID4200POCZ to the Type 6A connector, being careful to align Pin 1 on the sensor board and MCU kit.

3. Connect the J3, J4 and J5 jumpers to place 1k pull-up resistors on the IRQ and I<sup>2</sup>C bus lines.
  - a. Only one set of pull-up resistors should be used on the I<sup>2</sup>C bus lines. If multiple sensor boards are used, only one board should have the jumpers present.
  - b. MCU kits typically do not have pull-up resistors present on these lines but be sure to check for them.
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.

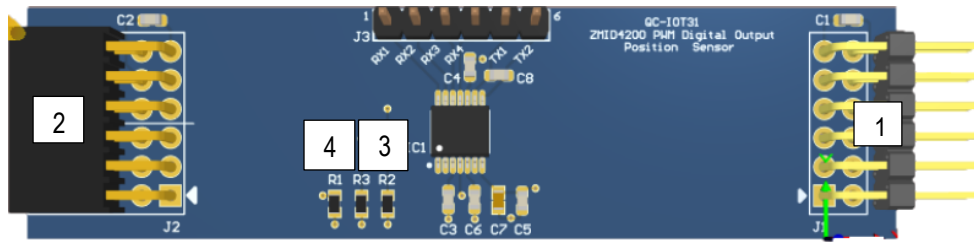


Figure 6: Evaluation Kit Connections

Number	Function
1	Connect to Board
2	Other PMOD™ connects here
3	I <sup>2</sup> C pull-up resistors (R2&R3)
4	IRQ pull-up resistor (R1)

## 4. Programming Interface

Programming of the system can be accomplished through the Renesas IDE, e2 studio. See the MCU evaluation kit documentation to set up the initial project in e2 studio. As the project is initialized, adding the ISL76683 sensor to the project only takes a few steps.

1. **Project settings, configuration, and Source code building:**  
 IDE environment used for code development is e2-studio, and Toolchain is Renesas CCRL. Figure 7 shows the steps to debug the board for the first time.

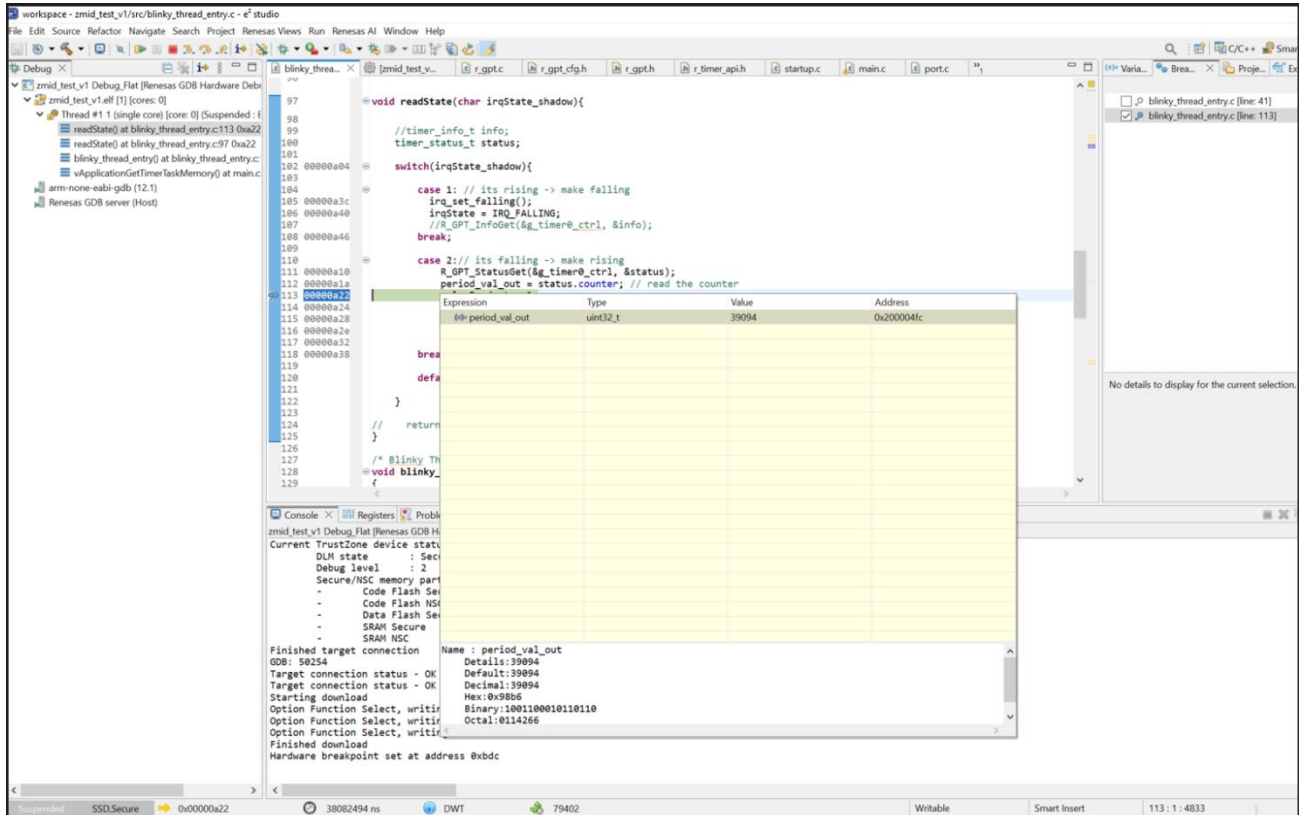


Figure 7: Steps to debug the board



## 5. QCIOT30-ISL76683EVZ Application Schematic

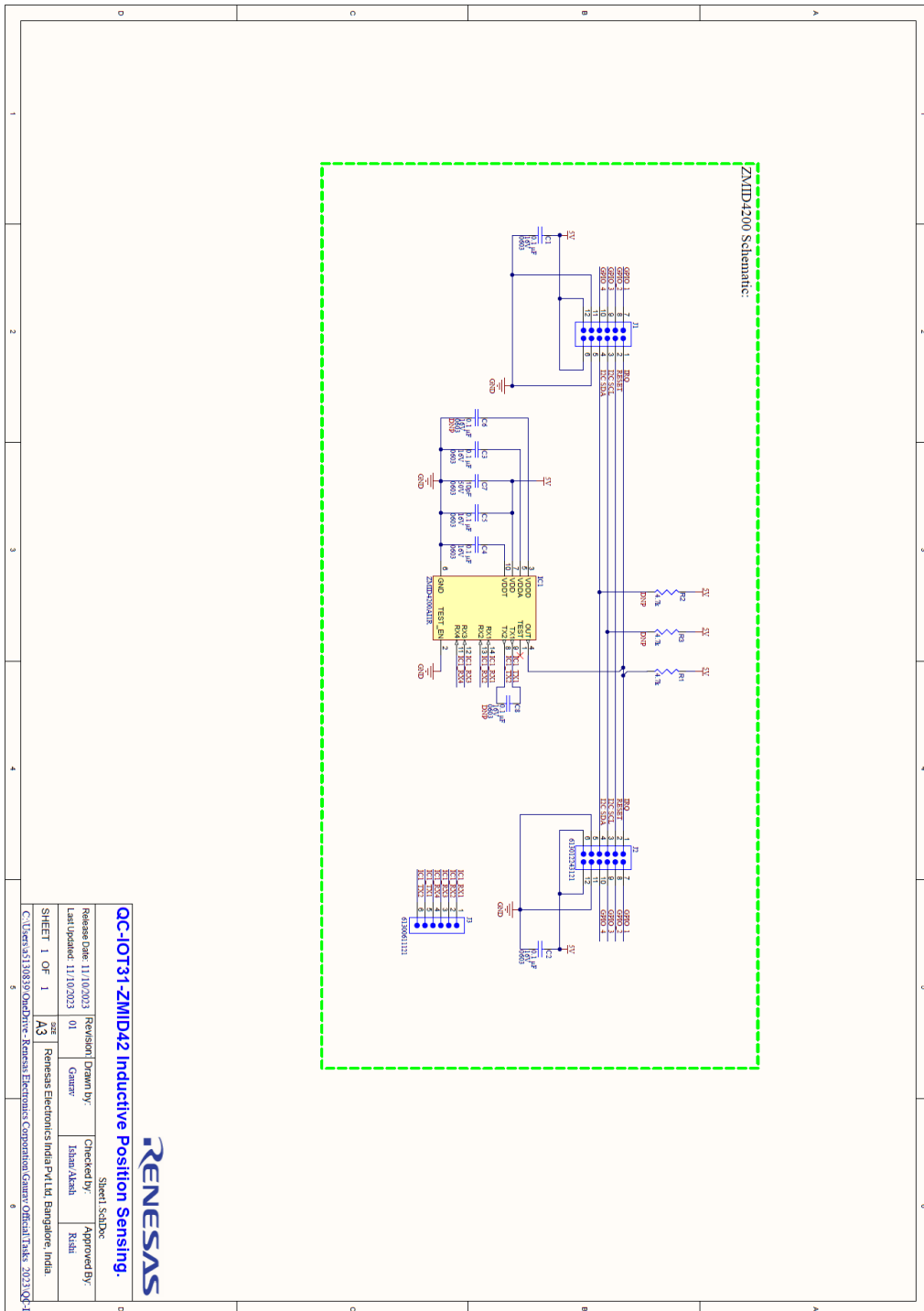


Figure 8: Application Schematic

<b>QC-IOT31-ZMID42 Inductive Position Sensing.</b>		Sheet 1 of 2	
Release Date: 11/10/2023	Revision: 01	Drawn by: Suman Akshay	Checked by: Kshiti
Last Updated: 11/10/2023	01	Genarator: Suman Akshay	Approved by: Kshiti
SHEET 1 OF 1		A3	
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## 6. Bill of Materials (BOM)

### 6.1 PMOD Base Board BOM:

**Table 3: QC10T30-ISL76683EVZ BOM**

Designator	Description	Qty	Assy Note	Manufacturer Part Number	Manufacturer 1
C1, C2, C3, C4, C5	0.1 $\mu$ F $\pm$ 10% 16V Ceramic Capacitor X7R 0603	5	Fitted	885012206046	Würth Elektronik
C6, C8	0.1 $\mu$ F $\pm$ 10% 16V Ceramic Capacitor X7R 0603	2	Not Fitted	885012206046	Würth Elektronik
C7	Ceramic Capacitor, 10 pF, +/- 5%, 50 V, 0603 (1608 Metric)	1	Fitted	GRM1885C1H100JA01D	Renesas
IC1	Renesas Inductive Position Sensor IC, Analog output 14pin TSSOP	1	Fitted	ZMID4200A1R	Würth Elektronik
J1	Connector Header Through Hole, Right Angle 12 position 0.100" (2.54mm)	1	Fitted	61301221021	Würth Elektronik
J2	12 Position Receptacle Connector 0.100" (2.54mm) Through Hole, Right Angle Gold	1	Fitted	613012243121	Samtec Inc.
J3	Connector Header Through Hole 6 position 0.100" (2.54mm)	1	Fitted	61300611121	Harwin Inc.
R1	4.7 kOhms $\pm$ 1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Moisture Resistant Thick Film	1	Fitted	RC0603FR-134K7L	YAGEO
R2, R3	4.7 kOhms $\pm$ 1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Moisture Resistant Thick Film	2	Not Fitted	RC0603FR-134K7L	Yageo

### 6.2 Coil Daughter Card BOM:

Designator	Description	Qty	Assy Note	Manufacturer Part Number	Manufacturer 1
J3	6 Position Receptacle Connector 0.100" (2.54mm) Through Hole Gold	1	Fitted	61300611821	Würth Elektronik

## 7. Board Layout

### 7.1 PMOD Base Board Layout:

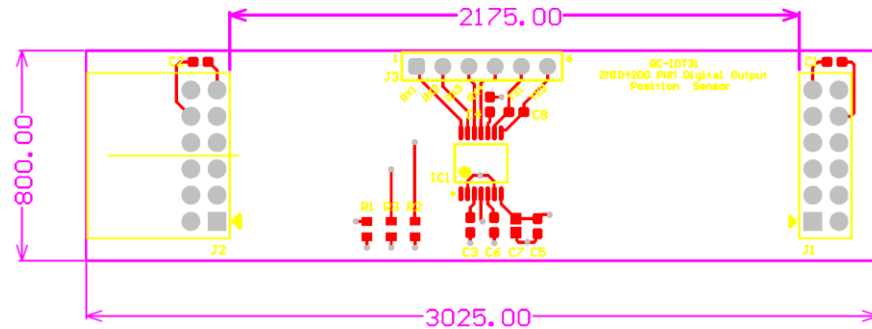


Figure 9. Top Layer

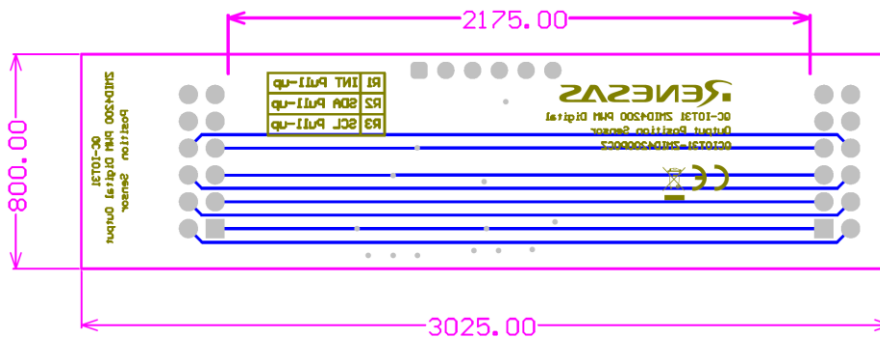


Figure 10. Bottom Layer

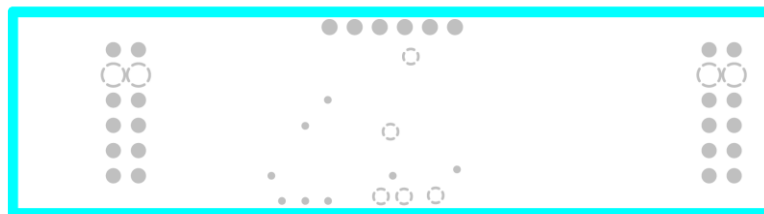


Figure 11. Internal Plane-1 (GND)



Figure 12: Internal Plane-2 (PWR)

### 7.1 Coil Daughter Card Board Layout:

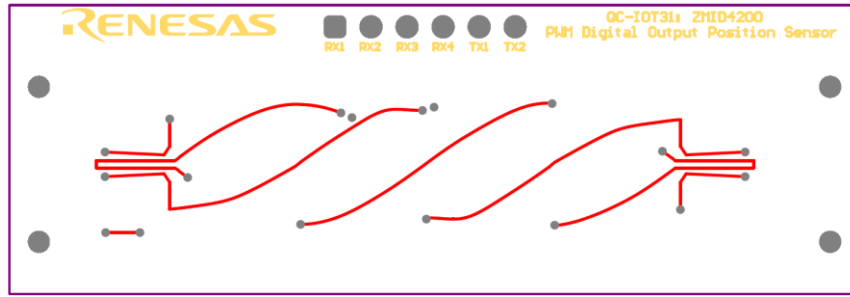


Figure 13: Top Layer

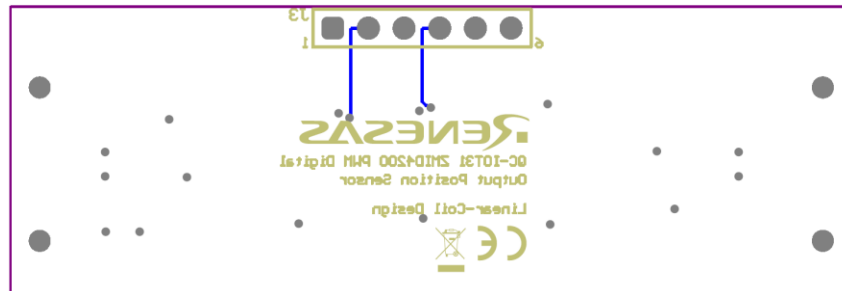


Figure 14: Bottom Layer

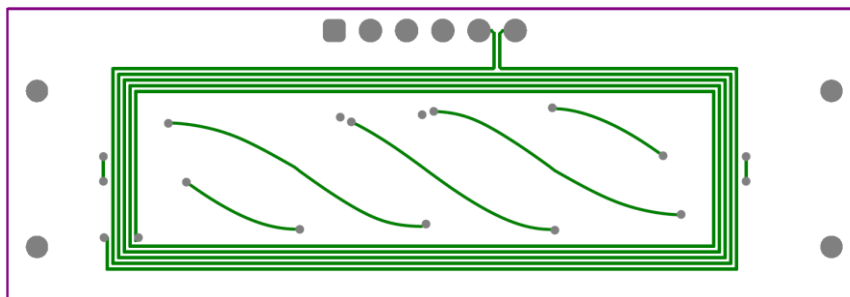


Figure 15: Internal Plane-1

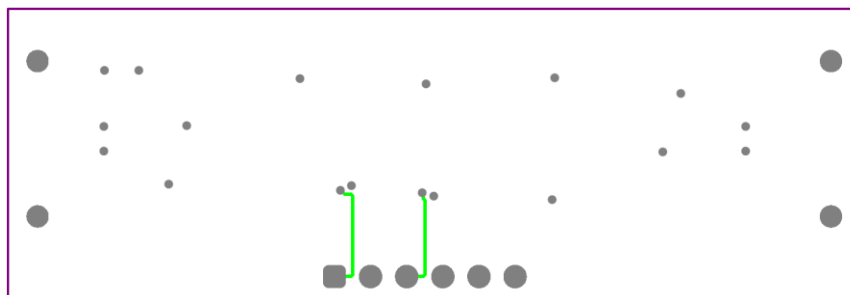


Figure 16: Internal Plane-2 (PWR)

## 7.2 Metallic Contact Board Layout:

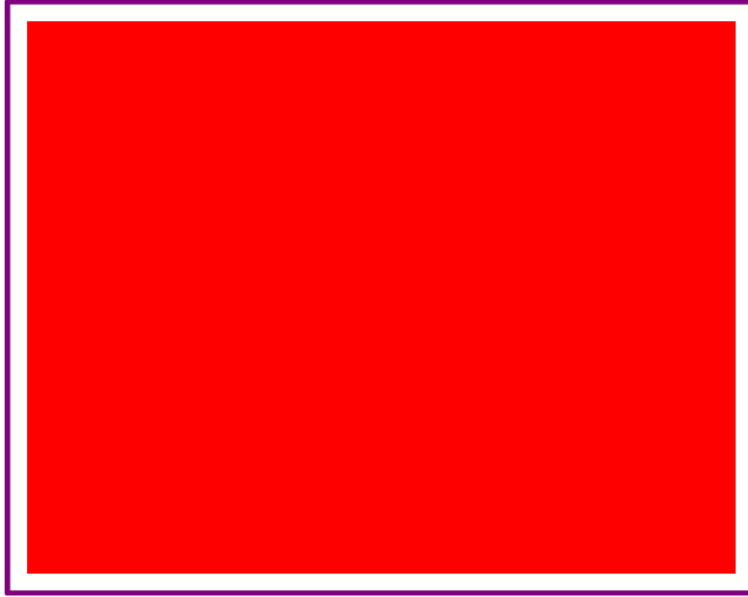


Figure 17: Top Layer



Figure 18: Bottom Layer

## 8. Ordering Information

Orderable Part Number[a]	Description
QCIOT31-ZMID4200POCZ	ZMID4200 PWM-to-Digital Output Sensor.
US082-INTERPEVZ	PMOD™ interposer board to convert Type 2A and 3A to Type 6A on older Renesas MCU kits.

## 9. Revision History

Revision Date	Description of Change
December 25, 2023	Initial release.
December 25, 2023	Update status of software