The US082-ZMOD4450EVZ board enables quick prototyping of the ZMOD4450 gas sensor module for refrigeration air quality (RAQ) in a custom system design. The board provides a standard Pmod™ Type 6A (Extended I2C) connection for the on-board sensor to plug into any desired MCU evaluation kit with a matching connector.

The US082-ZMOD4450EVZ 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 Pmod connector. Because of the standard connector and software support, the US082-ZMOD4450EVZ is the best choice to rapidly create an IoT system with the Renesas Quick-Connect IoT.

### Features
- Gas sensor module for RAQ ZMOD4450 sensor sample mounted:
  - Measures gases associated with food ripening and storage: volatile organic compounds (including ethylene), amines, volatile sulfur compounds
  - Provides configurable methods of operation based on application and use case
- Standardized Type 6A Pmod connector supports I2C Extended interface
- Dual connectors allow pass-through signals for daisy-chained solutions

### Board Contents
- US082-ZMOD4450EVZ Board

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Figure 1. US082-ZMOD4450EVZ Pmod Board
# Contents

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1. Functional Description

The US082-ZMOD4450EVZ 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 6A interface. For more information on creating your full system design, further information on software development, and additional hardware availability, see Renesas Quick-Connect IoT.

Figure 2. US082-ZMOD4450EVZ Pmod Board with RA2L1 MCU Kit
2. Setup

2.1 Required or Recommended User Equipment

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

- Any MCU board that supports Type 6A Pmod.
- US082-INTERPEVZ interposer board if using one of the Renesas MCU kits shown in Table 1.

Table 1. Renesas MCU Evaluation Kits\(^\text{[1]}\) capable of supporting Type 6A PMODs when used with the US082-INTERPEVZ

<table>
<thead>
<tr>
<th>RA</th>
<th>RX</th>
<th>Synergy</th>
</tr>
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<tbody>
<tr>
<td>EK-RA4W1</td>
<td>RX111-Starter-Kit</td>
<td>PK-S5D9</td>
</tr>
<tr>
<td>EK-RA2A1</td>
<td>RX231-Starter-Kit</td>
<td>DK-S3A7</td>
</tr>
<tr>
<td>EK-RA4M1</td>
<td>RX23W-Starter-Kit</td>
<td>DK-S128</td>
</tr>
<tr>
<td>EK-RA6M1</td>
<td>RX23T-Starter-Kit</td>
<td>TB-S1JA</td>
</tr>
<tr>
<td>EK-RA6M2</td>
<td>RX24T-Starter-Kit</td>
<td>TB-S3A6</td>
</tr>
<tr>
<td>EK-RA6M3</td>
<td>RX24U-Starter-Kit</td>
<td>DK-S7G2</td>
</tr>
</tbody>
</table>

\(^\text{1. This table is not a comprehensive list of supported MCU Kits. See the evaluation kit hardware manual to confirm Pmod pinout.}\)

2.2 Software Installation and Usage

See the Renesas website for the latest version of the e2 studio installer. The minimum FSP version supporting sensor blocks is FSP 3.1.0. For the latest sensor support, ensure you are using the latest release.

Visit Renesas Quick-Connect IoT for more information about creating your customized system solution.

2.3 Kit Hardware Connections

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

1. Ensure the MCU evaluation kit has a Pmod connector set to Type 6A (see the kit hardware manual if unsure).
   a. If no Type 6A Pmod is available, ensure the MCU evaluation kit can use the US082-INTERPEVZ interposer board and insert the board into the MCU connector before adding any sensor boards.

2. Plug in the US082-ZMOD4450EVZ to the Type 6A connector, being careful to align Pin 1 on the sensor board and MCU kit.

3. Connect the J4 and J5 jumpers to place 4.7k pull-up resistors on the I^2C bus lines.
   a. Only one set of I^2C pull-up resistors should be used on the bus. 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 the bus lines but double check for them.

4. The INT pin of the ZMOD4450 is a push-pull output signaling if a measurement is being taken. Connect it to the Busy (GPIO) pin of the Pmod connector by placing Jumper J6 on Pins 1-2. Connect it to the INT pin of the Pmod connector by placing Jumper J6 on Pins 2-3. Connect Jumper J3 to add an optional 4.7k pull-up resistor to this line.
5. The sensor is now ready to be used in the system. Follow the MCU kit instructions for connecting and powering up the evaluation kit.

3. **Board Design**

![Figure 3. Evaluation Kit Connections](image)

![Figure 4. US082-ZMOD4450EVZ Evaluation Board (Top)](image)

![Figure 5. US082-ZMOD4450EVZ Evaluation Board (Bottom)](image)
### 3.1 Schematic Diagrams

![Schematic Diagram](image)

Figure 6. US082-ZMOD4450EVZ Schematic

### 3.2 Bill of Materials

<table>
<thead>
<tr>
<th>Qty</th>
<th>Reference</th>
<th>Description</th>
<th>Value</th>
<th>PCB Footprint</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>C1, C2, C3, C4</td>
<td>Capacitor, 0.1µF, 50V, 0603</td>
<td>0.1µF</td>
<td>0603</td>
<td>C0603C104J5RACTU</td>
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<tr>
<td>1</td>
<td>J1</td>
<td>Male Header 0.1&quot; pitch PMOD 2x6 Right Angle</td>
<td>Pmod™</td>
<td>PMOD-MALE-TOP</td>
<td>M20-9950645</td>
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<tr>
<td>1</td>
<td>J2</td>
<td>Female Header 0.1&quot; pitch PMOD 2x6 Right Angle</td>
<td>CON-000050-01</td>
<td>SSW-106-02-F-D-RA</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>J3, J4, J5</td>
<td>CONN HEADER VERT 2POS 1.27 MM</td>
<td>HDR-1X2-FTS</td>
<td>FTS-102-01-L-S</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>J6</td>
<td>CONN HEADER VERT 3POS 1.27 MM</td>
<td>HDR-1X3-FTS</td>
<td>FTS-103-01-L-D</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>R1, R2, R3</td>
<td>Resistor, 4.7k, 0603</td>
<td>4.7k</td>
<td>0603</td>
<td>RC0603JR-074K7L</td>
</tr>
<tr>
<td>1</td>
<td>U1</td>
<td>Gas Sensor Module</td>
<td>ZMOD4450</td>
<td>ZMOD4450</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>U2</td>
<td>Single Inverter Buffer/Driver With Open-Drain Output</td>
<td>DCK0005A_N</td>
<td>SN74LVC1G06DCKT</td>
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<tr>
<td>4</td>
<td>J3, J4, J5, J6</td>
<td>1.27&quot; 1x2 Jumper with Grip, Gold</td>
<td></td>
<td></td>
<td>NPB02SVFN-RC</td>
</tr>
</tbody>
</table>
### 3.3 Board Layout

**Figure 7. Silkscreen Top Layer**

**Figure 8. Top Layer**

**Figure 9. Layer 1**

**Figure 10. Layer 2**

**Figure 11. Bottom Layer**

**Figure 12. Silkscreen Bottom Layer**
4. Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>US082-ZMOD4450EVZ</td>
<td>ZMOD4450 Pmod Board</td>
</tr>
<tr>
<td>US082-INTERPEVZ</td>
<td>Pmod interposer board to convert Type 2A and 3A to Type 6A on older Renesas MCU kits.</td>
</tr>
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</table>

5. Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Jun 10, 2021</td>
<td>Initial release</td>
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