The US082-HS3001EVZ board enables quick prototyping for a custom system design with the HS3001, a high-performance relative humidity and temperature sensor. 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-HS3001EVZ features Pmod connectors on both sides of the board allowing additional Type 6/6A boards to be connected in a daisy-chained solution with multiple sensors on the same MCU Pmod connector. Significantly reducing development time, software support present in the Renesas IDE (e² studio) generates code that connects the sensor and the MCU. Because of the standard connector and software support, the US082-HS3001EVZ is the best choice to rapidly create an IoT system with the Renesas Quick-Connect IoT.

Features
- Relative humidity HS3001 sensor sample mounted:
  - RH accuracy: ±1.5%RH
  - Operating temperature: -40 to 105°C
- Standardized Type 6A Pmod connector supports I²C 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

Board Contents
- US082-HS3001EVZ Board

Figure 1. US082-HS3001EVZ Pmod Board
## Contents

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1. **Functional Description**

The US082-HS3001EVZ functions as a sensor 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. With this simple hardware connection, the software sensor block in the Renesas software package allows you to generate all the required code between the sensor and the MCU with the simple click of a button. (See the Renesas Quick-Connect IoT web page for a list of available sensor Pmod boards.)

![Figure 2. Evaluation Kit Connections using the US082-HS3001EVZ and EK-RA2L1](image)

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 a Type 6A Pmod.
- The US082-INTERPEVZ interposer board when using one of the Renesas MCU kits shown in Table 1.

<table>
<thead>
<tr>
<th>RA</th>
<th>RX</th>
<th>Synergy</th>
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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>
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<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>

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

Table 1. Renesas MCU Evaluation Kits[1] that support a Type 6A Pmod when used with the US082-INTERPEVZ
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 2.

1. Ensure the MCU evaluation kit being used has a Pmod connector set to Type 6A. (If unsure, see the kit hardware manual).
   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-HS3001EVZ 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 I2C bus lines.
   a. Only one set of I2C 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 it is important 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 3. US082-HS3001EVZ Pmod Board
3. 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 HS3001 sensor to the project only takes a few steps.

1. Navigate to the Components tab, open the Middleware/Generic folder, and select the desired sensor. For the case shown in Figure 4, select the r_hs3001_rx.

![Figure 4. Component Configuration in Renesas e² Studio](image)

2. Click the Generate Code icon and the system generates the code to configure the sensor with the MCU.

3. Write three to four lines of code to check the version, initialize the sensor, start the measurement cycle, and get the data. Example code to start the sensor after configuration to an RX MCU:

   ```c
   R_HS3001_GetVersion(&gs_hs3001_version); // Check version (optional)
   err = R_HS3001_Open(&gs_hs3001_ctrl[device_no], &gs_hs3001_cfg[device_no]); // configure the sensor
   err = R_HS3001_IOCTL(&gs_hs3001_ctrl[device_no], &gs_w_buf[0], 0, HS3001_IOCTL_CMD_START_MEASUREMENT);
   err = R_HS3001_Read(&gs_hs3001_ctrl[device_no], &gs_r_buf[0], 4, NULL); // Get data
   ```

4. Use the data in your given application. Sample projects are available on the Renesas website as well.

For more information on creating your full system design, further information on software development, and additional hardware availability, visit Renesas Quick-Connect IoT.
3.1 Schematic Diagram

![Schematic Diagram]

Figure 5. US082-HS3001EVZ Application 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>
</tr>
<tr>
<td>1</td>
<td>J1</td>
<td>Male Header 0.1&quot; pitch PMOD 2x6 Right Angle</td>
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<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></td>
<td>CON-000050-01</td>
<td>SSW-106-02-F-D-RA</td>
</tr>
<tr>
<td>2</td>
<td>J4, J5</td>
<td>CONN HEADER VERT 2POS 1.27 MM</td>
<td></td>
<td>HDR-1X2-FTS</td>
<td>FTS-102-01-L-S</td>
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<tr>
<td>2</td>
<td>R2, R3</td>
<td>Resistor, 4.7k, 0603</td>
<td>4.7k</td>
<td>0603</td>
<td>RC0603JR-074K7L</td>
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<tr>
<td>1</td>
<td>U1</td>
<td>Relative Humidity Sensor</td>
<td></td>
<td>6-LGA_(3x2.41)</td>
<td>HS3001</td>
</tr>
<tr>
<td>2</td>
<td>J4, J5</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 6. Silkscreen Top

Figure 7. Copper Top

Figure 8. Copper L1 Layer

Figure 9. Copper L2 Layer

Figure 10. Copper Bottom

Figure 11. Silkscreen Bottom
4. Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>US082-HS3001EVZ</td>
<td>HS3001 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>
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</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Jun 15, 2021</td>
<td>Initial release</td>
</tr>
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