

QCIOT-RRH46410POCZ

The RRH46410 is Renesas intelligent sensor module. The design encompasses the on-board microcontroller with integrated firmware, MEMS gas sensing element, and CMOS signal conditioning IC in one package. Examples of available support for RRH46410 are the evaluation kit hardware/software, application notes, white papers, and examples codes. For faster development, Renesas offers the RRH46410 sensor module in popular form factor Pmod™ board. Using the e2 studio IDE and RRH46410 Flexible Support Package (FSP), the method of adding the sensor into the project is simplified. The IDE software features a code generation tool providing an excellent starting point for code development.

The QCIOT-RRH46410POCZ 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 QCIOT-RRH46410POCZ 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. With its standard connector and software support, the QCIOT-RRH46410POCZ is ideal for rapidly creating an IoT system using the Renesas Quick-Connect IoT tools.

**Features**

- Sensor output based on AI machine learning algorithm:
  - Absolute measurement of total organic compounds (TVOC) concentrations and indoor air quality (IAQ)
  - Absolute TVOC output to meet Public Building Air Quality (PBAQ) standards
  - Relative IAQ based on TVOC and odor changes
  - Estimated carbon dioxide level (eCO<sub>2</sub>)
- Ultra-low power consumption down to 226μW
- Siloxane resistant
- JEDEC JESD47 qualified for 10 years time-of-life
- Supply voltage: 1.8V to 3.3V
- Programmable GPIO pins
- Operating temperature: -40°C to +65°C
- IP67 rating
- Package: 4.5 × 4.0 × 0.950 mm body, 0.50 pitch 20-LGA
- Support I<sup>2</sup>C and UART

**Kit Contents**

- QCIOT-RRH46410POCZ Board



Figure 1. QCIOT-RRH46410POCZ Pmod Board

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# 1. Functional Description

The QCIOT-RTC22MPOCZ board functions as a sensor building block enabling the designer to create a fast prototyping custom system solution. Use the board individually or with a combination of other sensor boards by using the Pmod Type 6A interface. For a list of available sensor Pmod boards, visit the Renesas [Quick-Connect IoT](#) web page.

## 1.1 Setup and Configuration

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

- Any MCU board that supports Type 6A Pmod
- US082-INTERPEVZ interposer board (see [Table 1](#))

### 1.1.1 Software Installation and Usage

For more information on creating a full system design, further information on software development, and additional hardware availability, visit the Renesas website for the latest version of the [e2 studio installer](#). The minimum FSP version supporting the RRH46410 sensor block is FSP 5.3.0. For the latest sensor support, ensure that the latest release is used.

Visit the Renesas [Quick-Connect IoT](#) site for more information about creating your customized system solution.

### 1.1.2 Software Setup

The [US082-INTERPEVZ](#) interposer board is required when using one of the Renesas MCU kits listed in [Table 1](#).

**Table 1. MCU Kits<sup>[1]</sup> Capable of Supporting Type 6A Pmod Boards When Used with US082-INTERPEVZ**

RA	RX	Synergy
<a href="#">EK-RA4W1</a> Evaluation Kit	<a href="#">RSK-RX111</a> Starter Kit	<a href="#">PK-S5D9</a> Promotion Kit
<a href="#">EK-RA2A1</a> Evaluation Kit	<a href="#">RSK-RX231</a> Starter Kit	<a href="#">DK-S3A7</a> Development Kit
<a href="#">EK-RA4M1</a> Evaluation Kit	<a href="#">RSK-RX23W</a> Starter Kit	<a href="#">DK-S128</a> Development Kit
<a href="#">EK-RA6M1</a> Evaluation Kit	<a href="#">RSK-RX23T</a> Starter Kit	<a href="#">TB-S1JA</a> Target Board
<a href="#">EK-RA6M2</a> Evaluation Kit	<a href="#">RSK-RX24T</a> Starter Kit	<a href="#">TB-S3A6</a> Target Board
<a href="#">EK-RA6M3</a> Evaluation Kit	<a href="#">RSK-RX24U</a> Starter Kit	<a href="#">DK-S7G2</a> Development Kit
<a href="#">EK-RA6M3G</a> Evaluation Kit	-	-

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

### 1.1.3 Programming Interface

Programming of the system is accomplished through the Renesas IDE [e2 studio](#). See the MCU evaluation kit documentation to setup the initial project in e2 studio. Add the RRH46410 sensor during project initialization with the following steps:

1. From the Project Explorer tab, locate and open the **script** folder and double-click on **configuration.xml**.
2. Open the FSP Configuration view/file.
3. Add the following stack element by clicking the *New Stack* button and editing the configuration values for desired operation (see [Figure 2](#)).
4. Select **RRH46410 Gas Sensor Module (rm\_rrh46410)**.
5. Click the *Generate Project Content* icon and the system will generate the code for the MCU to communicate to the RRH Pmod board.

6. Sample calls displaying the functions to open the sensors are shown in [Figure 3](#). Similar calls are required for the I<sup>2</sup>C bus. Utilize the data given in your application. For additional information, refer to the manual related to FSP configuration and function APIs.

*Note:* Renesas recommends downloading and reviewing sample projects that are available on the Renesas website.

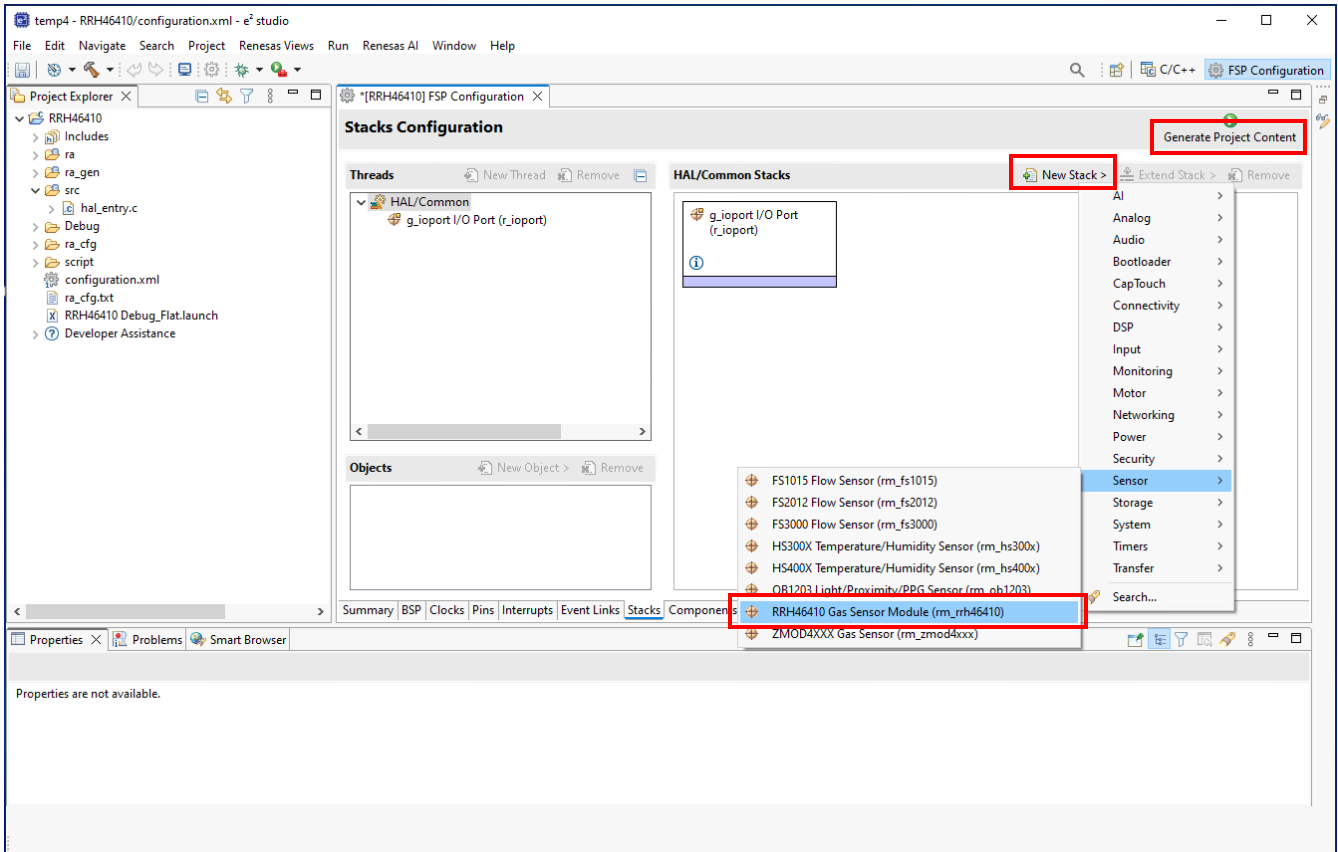


Figure 2. Stacks Configuration Window

```

/* Quick setup for g_rrh46410_sensor0.
 * - i2c_bus_name must be setup before calling this function
 *   (See Developer Assistance -> g_rrh46410_sensor0 -> RRH46410 ***** on rm_rrh46410 -> g_comms_i2c_device0 -> i2c_bus_name -> Quick Setup).
 */
void g_rrh46410_sensor0_quick_setup(void);

/* Quick setup for g_rrh46410_sensor0. */
void g_rrh46410_sensor0_quick_setup(void)
{
    fsp_err_t err;

    /* Open RRH46410 sensor instance, this must be done before calling any RRH46410 API */
    err = RM_RRH46410_Open(&g_rrh46410_sensor0_ctrl, &g_rrh46410_sensor0_cfg);
    assert(FSP_SUCCESS == err);

    /* Clear the flag */
    g_rrh46410_measurement_start = false;
}
    
```

Figure 3. Example Code to Start the Sensor after FSP Configuration

### 1.1.4 Kit Hardware Connections

Follow these procedures to set up the kit as shown in [Figure 4](#).

1. Ensure the MCU evaluation kit being used has a Pmod connector set to Type 6A (refer to the kit's hardware manual for settings).
  - a. If a Type 6A Pmod is unavailable, ensure the MCU evaluation kit can use the US082-INTERPEVZ interposer board. Insert the interposer board into the MCU connector before adding any sensor boards.
2. Plug in the QCIOT-RRH46410POCZ board to the Type 6A connector. Care must be taken when aligning Pin 1 on the MCU connector.
3. Connect the J4 and J5 jumpers to place 4.7k pull-up resistors on the 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, however, ensure to check and verify if resistors are present.
4. Connect the J3 jumper to place 4.7k pull-up resistors on the Pmod INT# line.
  - a. Only one pull-up resistor should be used on the Pmod INT# line. If multiple sensor boards using the INT# signal are used, only one board should have the jumpers present.

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

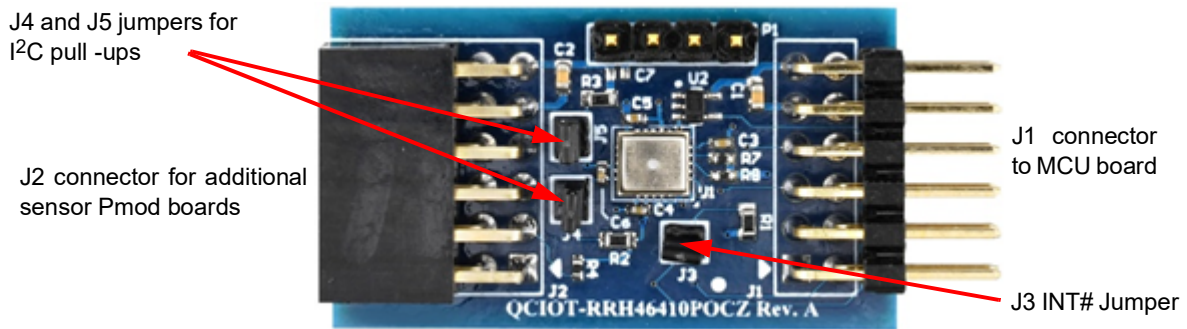


Figure 4. QCIOT-RTC22MPOCZ Board Connections

## 2. Board Design

### 2.1 Application Schematic Diagram

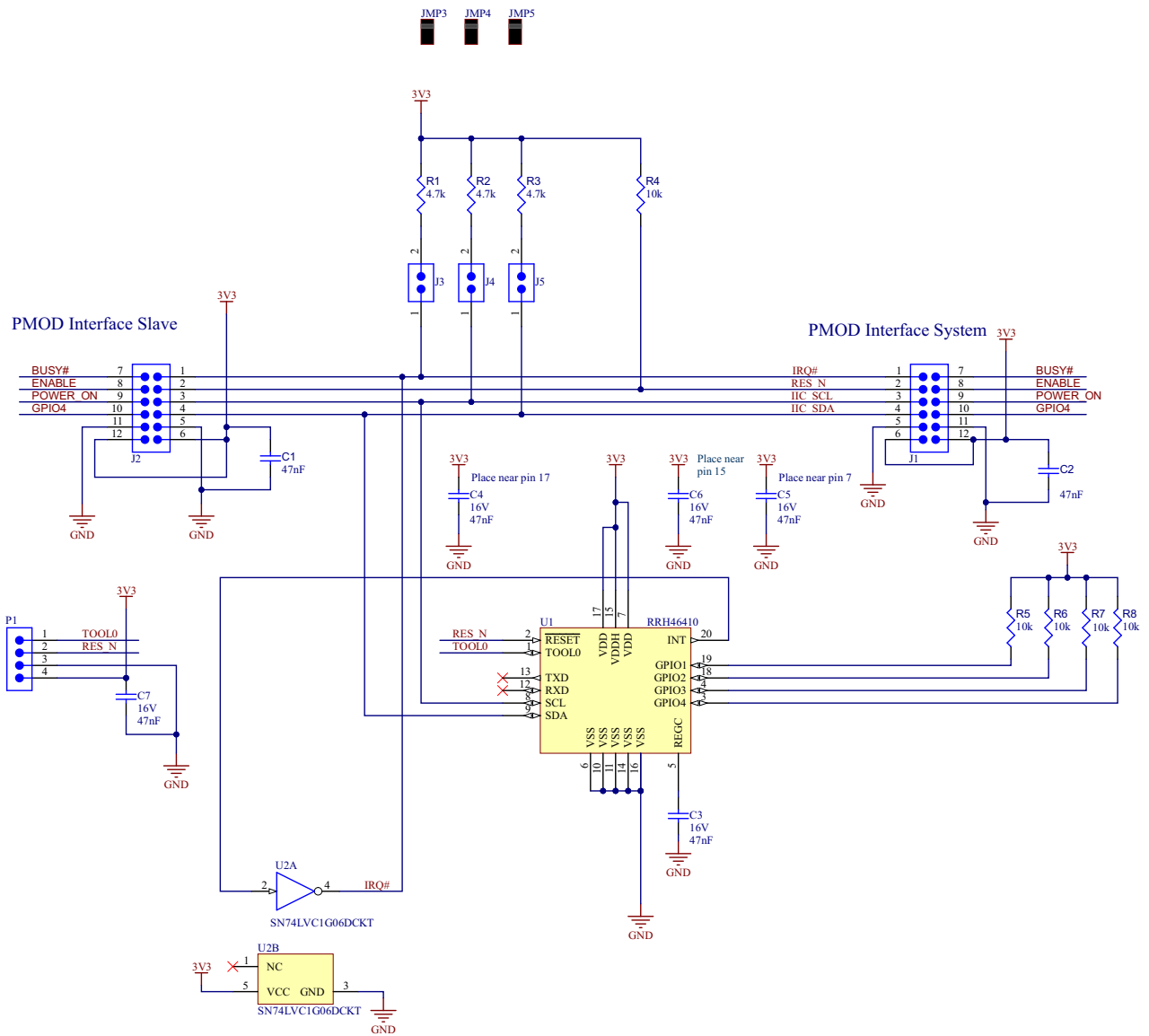


Figure 5. QCIOT-RRH46410MPOCZ Application Schematic

## 2.2 Bill of Materials

Qty	Reference Designator	Description	Manufacturer	Part Number
2	C1, C2	Ceramic Capacitor, Multilayer, Ceramic, 50V, 10% +Tol, 10% -Tol, X7R, 15% TC, 0.047uF, Surface Mount, 0603	Kyocera AVX	06035C473KAZ2A
4	C3, C4, C5, C6	Ceramic Chip Capacitor 0402 47nF 16V	Samsung	CL05B473KO5NNNC
1	FOOT1	Foot, Rubber, Self-adhesive, Black, 6.4mm diameter, 2.1mm tall	Bumper Specialties	BS25BL07X30RP
1	J1	Male Header 0.1" pitch PMOD 2 × 6 Right Angle	Wurth Elektronik	61301221021
1	J2	Female Header 0.1" pitch PMOD 2 × 6 Right Angle	Wurth Electronics	613012243121
3	J3, J4, J5	Conn Header Vert 2Pos 1.27mm	Samtec	FTS-102-01-L-S
3	JMP3, JMP4, JMP5	2 C, Closed Top, .050" CC; No Mounting, 105 C, Nylon 66; Phos Bronze, Gold Flash	Sullins	NPB02SVFN-RC
3	R1, R2, R3	Chip Resistor, 4.7kOhm, ±1%, 0.1W, -55 to +155 °C, 0603 (1608 Metric)	Yageo	RC0603FR-134K7L
1	R4	Chip Resistor, 10kOhm, ±1%, 63mW, -55 to +155 °C, 0402 (1005 Metric)	Panasonic	RC0402FR-0710KL
4	R5, R6, R7, R8	Chip Resistor, 10kOhm, ±1%, 0.1W, -55 to +155 °C, 0402 (1005 Metric)	Sullins	ERJ-2RKF1002X
1	U1	RRH46410 Integrated Air Quality Sensor, I2C and UART Interface.	Renesas	RRH46410-A3R
1	U2	Single Inverter Buffer/Driver With Open-Drain Output, DCK0005A, Small T&R	Texas Instrument	SN74LVC1G06DCKT

## 2.3 Board Layout

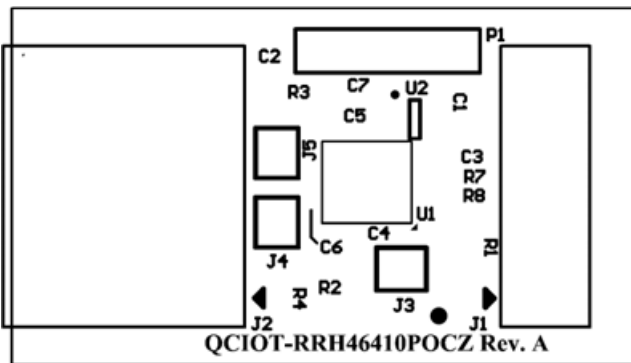


Figure 6. Silkscreen Top

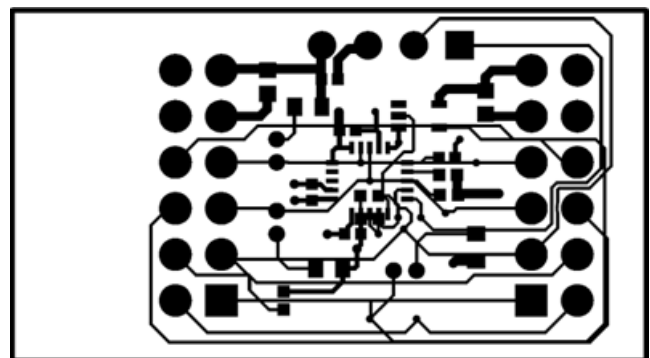


Figure 7. Copper Top

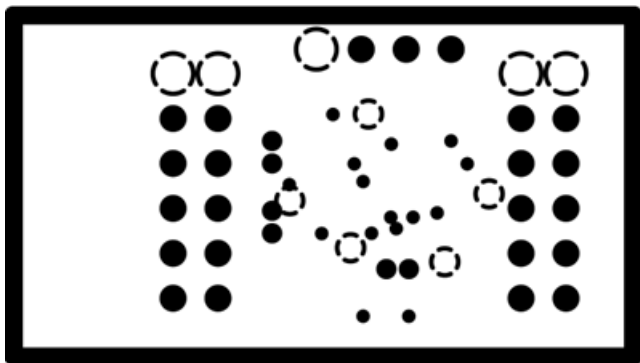


Figure 8. Copper L1 Layer

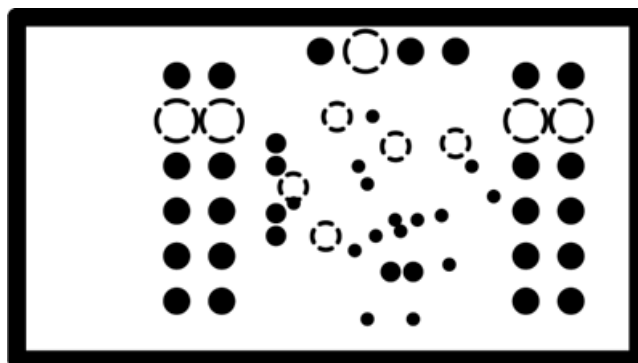


Figure 9. Copper L2 Layer

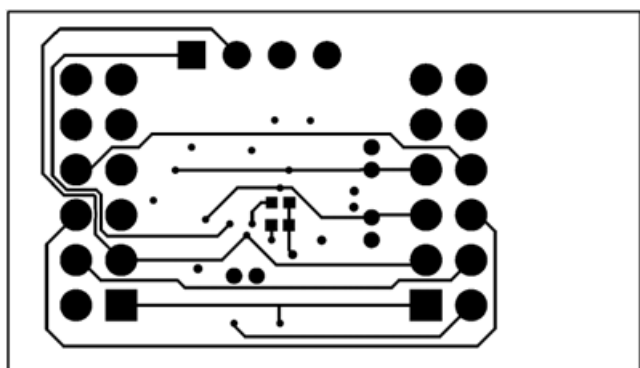


Figure 10. Copper Bottom

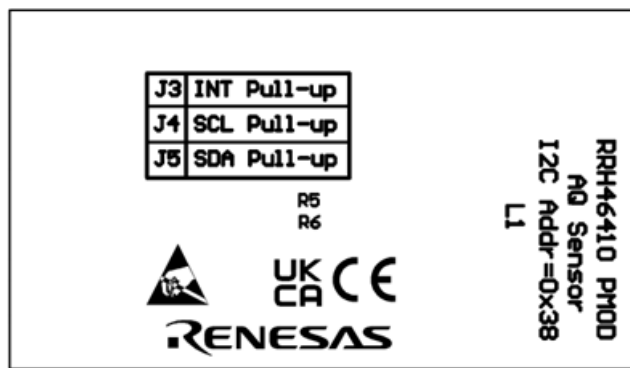


Figure 11. Silkscreen Bottom

### 3. Ordering Information

Part Number	Description
QCIOT-RRH46410POCZ	RRH46410 Pmod Board
US082-INTERPEVZ	Pmod interposer board to convert Type 2A and 3A to Type 6A on older Renesas MCU kits.

### 4. Revision History

Revision	Date	Description
1.00	Jul 17, 2024	Initial release.



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