QCIOT-013-28022POCZ

QCIOT-013 Digital Power Monitor Board

This document provides quick-start instructions for the QCIOT-013 Digital Power Monitor (DPM) Board that include setting up and programming the board.

Important: To ensure the QCIOT-013 Digital Power Monitor (DPM) Board is set up correctly, complete the steps in the order listed in *Quick Start Procedure*.

Contents

1. Board Information

1.1 How to Get the Board

To obtain the QCIOT-013 Digital Power Monitor (DPM) Board (QCIOT-013-28022POCZ), go to the Renesas product page.

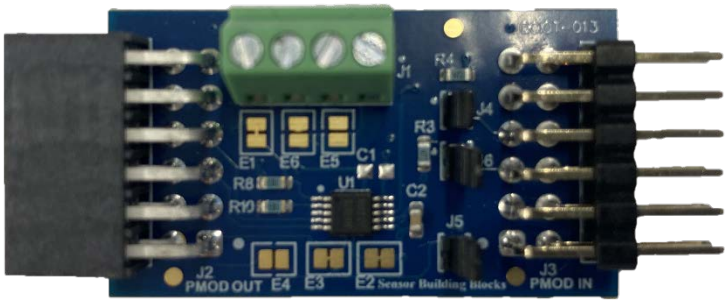
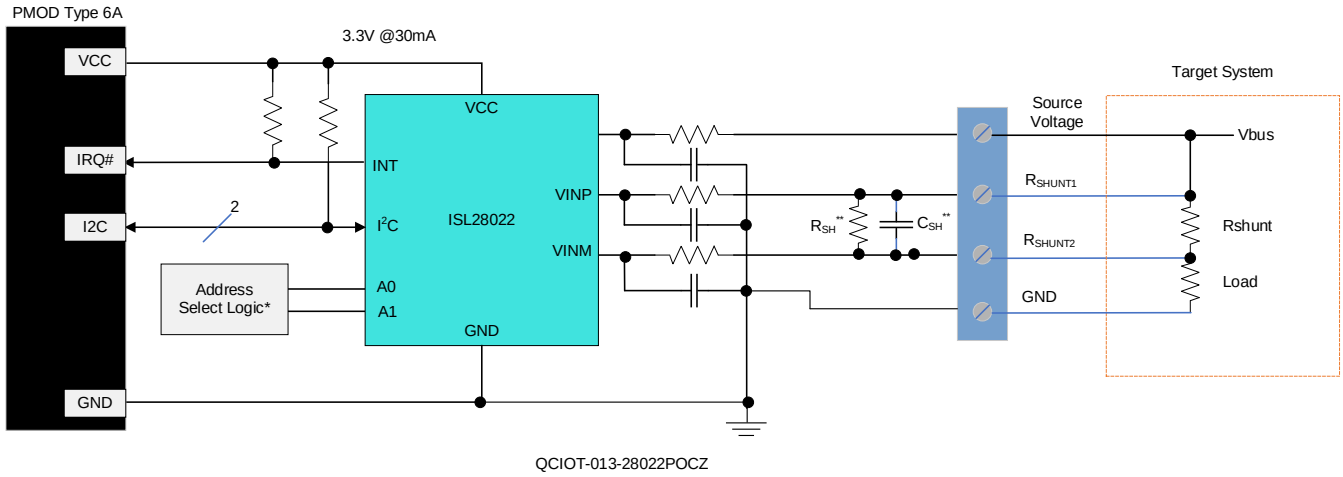


Figure 1. QCIOT-013 Digital Power Monitor Board

Part Number	Description
QCIOT-013-28022POCZ	QCIOT Digital Power Monitor Pmod Board

1.2 Board Contents

The QCIOT-013 board can measure voltages in the presence of common-mode voltages ranging from 0V to 60V, and it can measure the variable input current and power consumption. The board can also report diagnostics by configuring the fault thresholds of the bus voltage and shunt voltage.



*Design Detail, usually 0Ω resistors
** R_{SH} and C_{SH} are footprints for optionally mounting on the PMOD. Because these can be large and disipate considerable power, on-board RC is limited in it capabilities.

Figure 2. QCIOT-013 Digital Power Monitor Board Block Diagram

The setup and configuration for the QCIOT-013 board is comprised of the following required or recommended hardware:

- Renesas Fast Prototyping Board: FPB-RA4E1
- USB micro-B cable (provided with FPB board)
- PC running Windows 10/11 with at least one USB port.
- DC Power supply (0 to 60V output)
- Shunt resistor and load resistor

The following is required or recommended software:

- Renesas Flexible Software Package v4.5.0 platform installation:
  - e² studio 2023-01 or later
  - FSP 4.5.0 or later
  - GCC Arm Embedded 10.3.1 (10 2021.10)
- Sample code files (available on the Renesas product page for this device)

2. Quick Start Procedure

Complete the following quick-start steps in the order listed.

2.1 Install e²studio and the Mobile App

Visit the Renesas website for the latest version of the e² studio installer. The minimum FSP version supporting the QCIOT-013 board is FSP 4.5.0.

2.2 Kit Hardware Connection

Follow these procedures to set up the kit.

1. Ensure that the MCU development kit has at least one Type 6A Pmods.
   a. For FPB-RA4E1, two Pmods, PMOD1 and PMOD2, are available.
   b. For the kits other than FPB-RA4E1, if no Type 6A Pmod is available, ensure that the kit can use the US082-INTERPEVZ interposer board. Insert the board into the MCU connector before adding any sensor boards.
2. Ensure that the Pin 12 of Pmod is 3.3V, which is requested by QCIOT-013.
   a. For FPB-RA4E1 and FPB-RA6E1, the Pin 12 of Pmod is 5V by default. Short the trace jumper E1 and open E2 to get 3.3V on Pmod1.
   b. For some evaluation boards, the Pin 12 of Pmod is 3.3V by default. No change needed. Check the user manual before using it.
3. Mount the J4, J5, and J6 jumpers on QCIOT-013.
4. Connect the terminal of shunt resistor to VINP and VINM of J1 using wires or terminal pins.
   a. Connect the load in this guide, and if using wires, ensure the wire gauge has sufficient thickness to carry the operating current load.

   The Vbus and current load should be from the target-tested system. This guide uses the DC power supply and load resistor to simulate the measured voltage and current.

   Renesas recommends the following settings for the board.

   Rshunt: 25Ω/0.25W

   Rload: 5kΩ/2W

   DC power supply: 0 to 60V

   Choose a different shunt resistor based on the required load and Vbus voltage. Refer to the *ISL28022 Datasheet* for more details about shunt resistor selection.

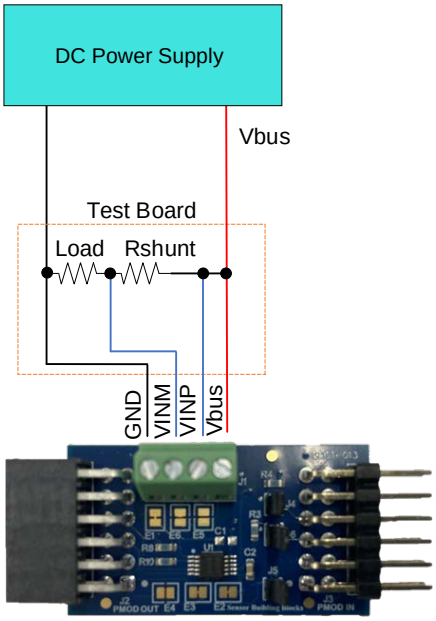


Figure 3. Connect the Target System with QCIOT-013

5. Plug in the QCIOT-013 Board to PMOD1 connector of FPB4AE1. Be careful to align Pin 1 on the power board and MCU kit.
6. Connect the FPB board with the computer using the USB micro-B cable.
7. Set the DC Power supply output to 3.3V and turn on the output.
8. The kit is now ready for use.

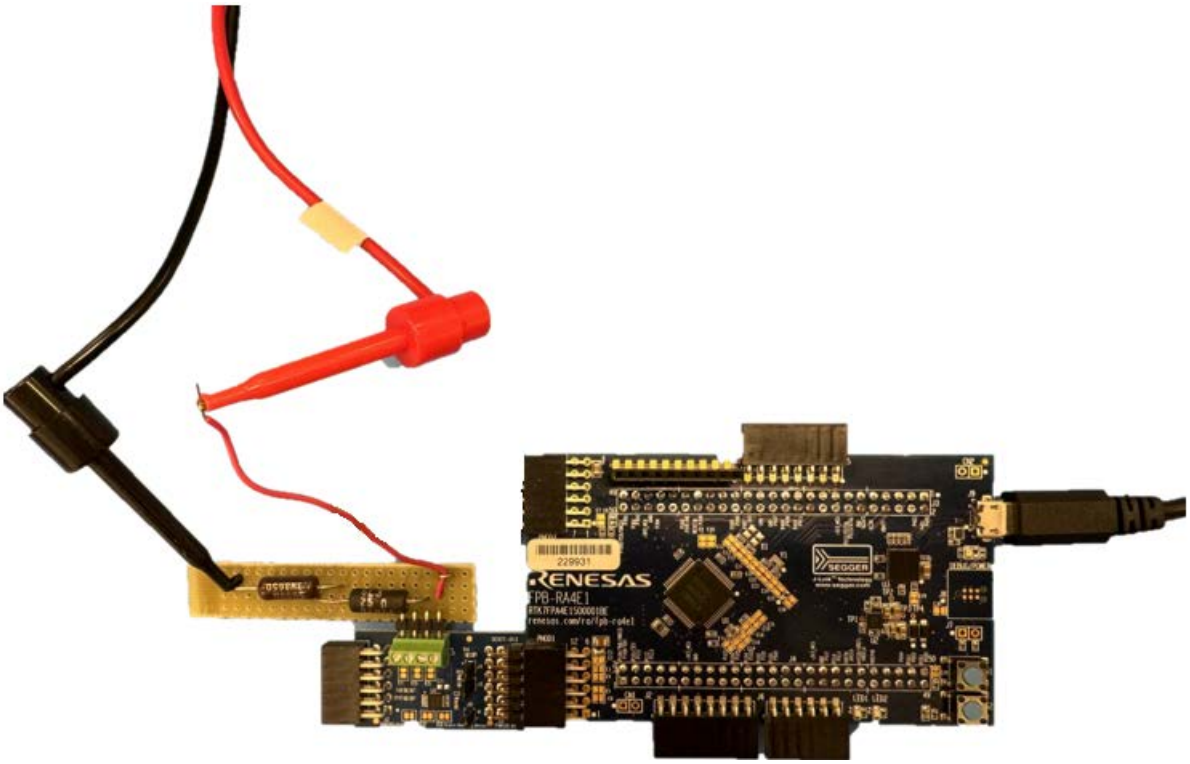


Figure 4. QCIOT-013 Power Monitor Board with FPB-RA4E1 MCU Kit

3. Board Test

3.1 Program the Renesas Development Board

1. Open the sample project in e^{2}studio.

See Figure 5.

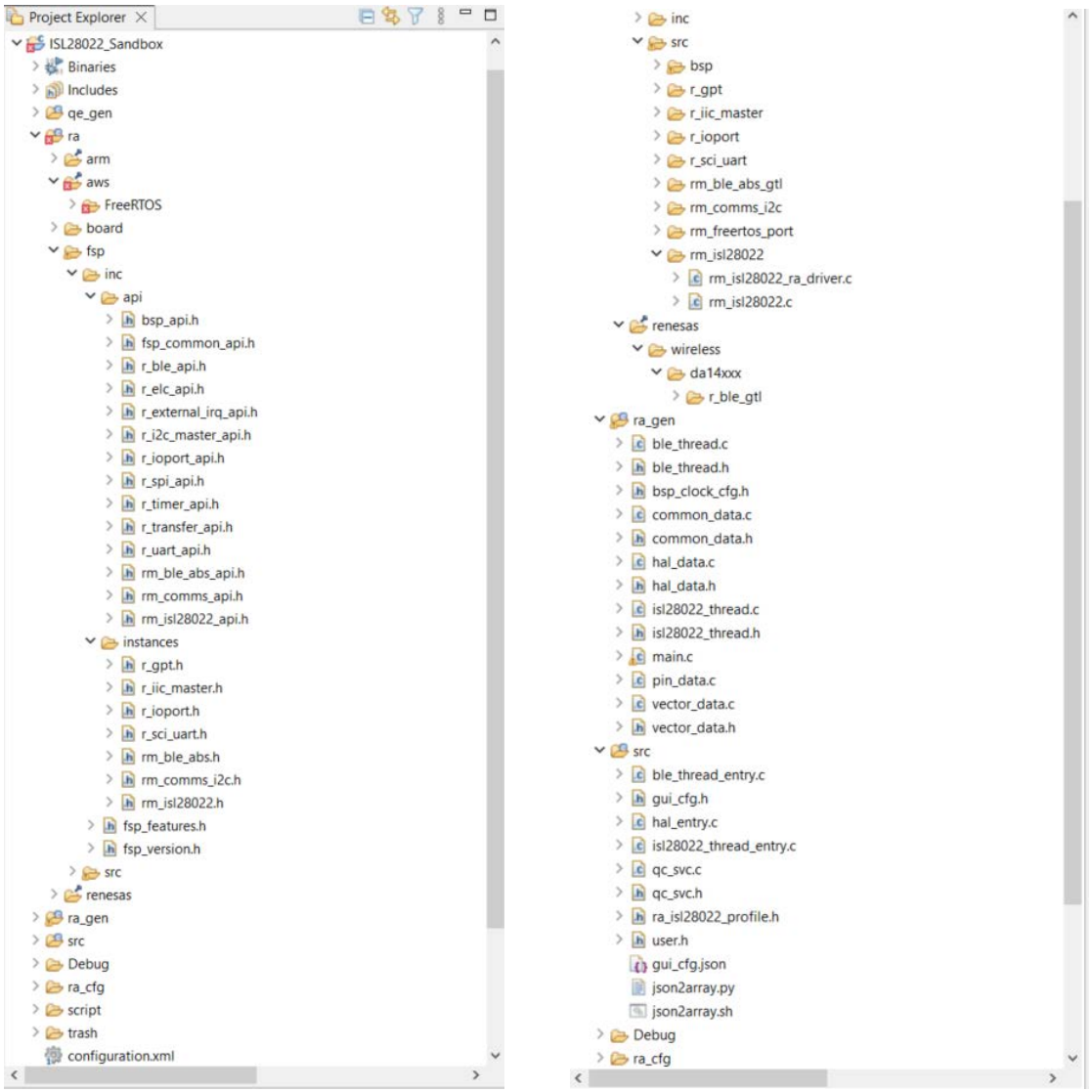


Figure 5. ISL28022 Project Structure

Open the `ra_isl28022_profile.c` file. Verify the ISL28022_RSHUNT_OHM_USER setting. This value should match the shunt resistor you have chosen. In this example, the default 25Ω resistor is used. If the shunt resistor is different than 25Ω, change this setting.

ra_isl28022_profile.h

```
 2   * Includes
 4
 5   #include "rm_isl28022_api.h"
 6
 8   * Macro definitions
10
11  #define ISL28022_RSHUNT_OHM_USER                    (25.0f)
12  //#define ISL28022_RSHUNT_OHM_USER                  (0.05f)
13  #define ISL28022_VSHUNT_MAX_THRESHOLD_V_USER        (0.32f)
14  #define ISL28022_VSHUNT_MIN_THRESHOLD_V_USER        (-0.32f)
15  #define ISL28022_VBUS_MAX_THRESHOLD_V_USER          (60.0f)
16  #define ISL28022_VBUS_MIN_THRESHOLD_V_USER          (0.0f)
17  #define ISL28022_CONFIG_MODE_USER                   RM_ISL28022_MODE_SHUNTANDBUS_CONTINUOUS
18  #define ISL28022_VBUS_FULL_SCALE_USER               RM_ISL28022_VBUS_FULLSCALE_60V
19  #define ISL28022_VSHUNT_FULL_SCALE_USER             RM_ISL28022_VSHUNT_FULLSCALE_320MV
20  #define ISL28022_AUX_INT_PIN_EN_USER                RM_ISL28022_AUXCONTROL_INTERRUPT_PIN_DISABLE
21  #define ISL28022_AUX_INT_PIN_FORCE_USER             RM_ISL28022_AUXCONTROL_INTERRUPT_PIN_FORCE_NOACTIVE
22  #define ISL28022_AUX_EXTCLK_EN_USER                 RM_ISL28022_AUXCONTROL_EXTCLK_DISABLE
23  #define ISL28022_AUX_EXTCLK_DIV_USER                RM_ISL28022_AUXCONTROL_EXTCLK_DIV0
24
25  /*The following setting is for board best*/
26  #define BOARDTEST_VBUS_TARGET_V_USER                (3.314f)
27  #define BOARDTEST_VBUS_TOLERANCE_PERCENT_USER       (0.01f)
28  #define BOARDTEST_LOAD_RESISTOR_OHM_USER            (5000)
29  #define BOARDTEST_CURRENT_TOLERANCE_PERCENT_USER    (0.05f)
30
31
```

Figure 6. Project Header Files

2. Go to the menu bar and select **Run** > **Debug Configuration**.

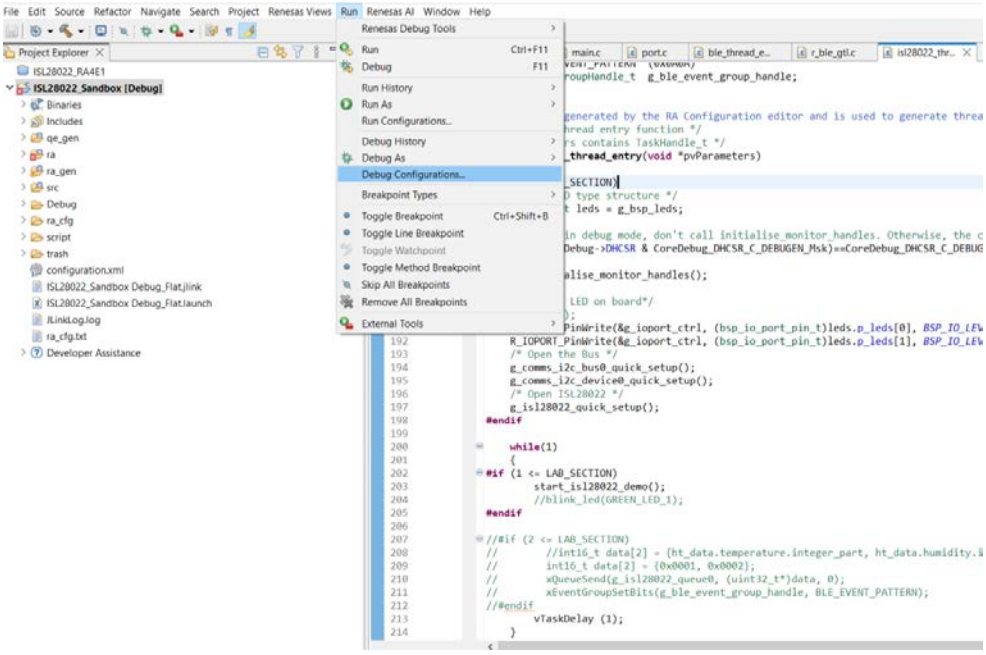


Figure 7. Debug Configuration

3. Select **Renesas GDB Hardware Debugging** > **isl28022_Sandbox_Debug**.
4. Click the **Debug** button.

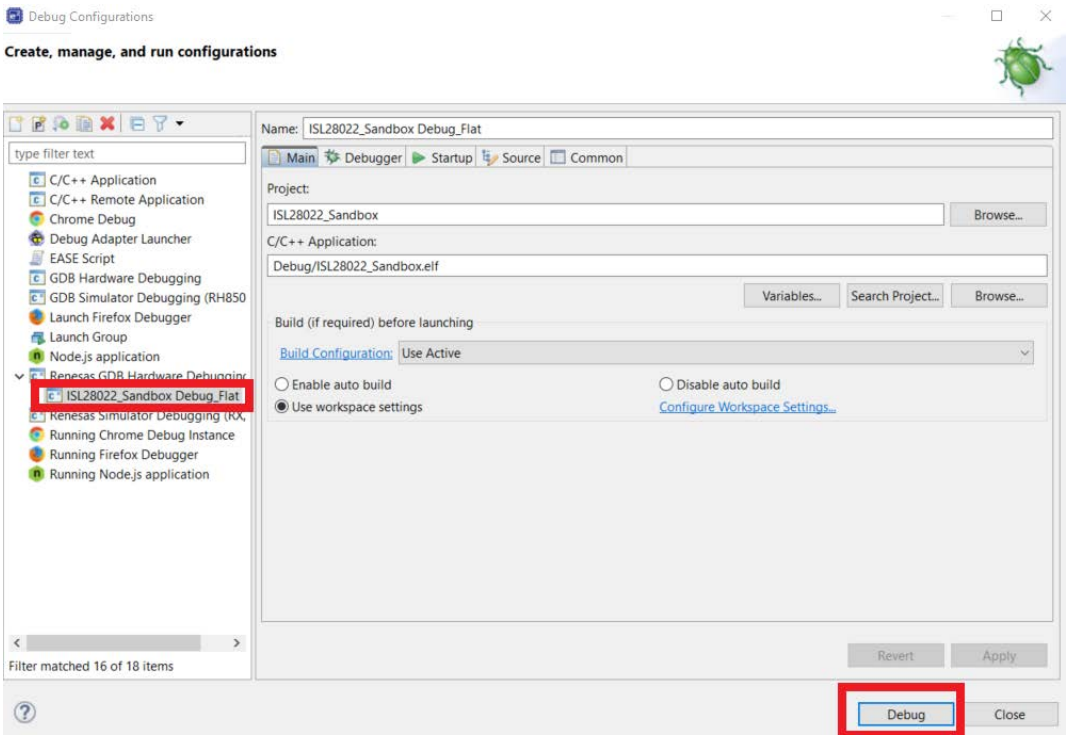


Figure 8. Start Debug Mode

After clicking the **Debug** button, the code enters debug mode.

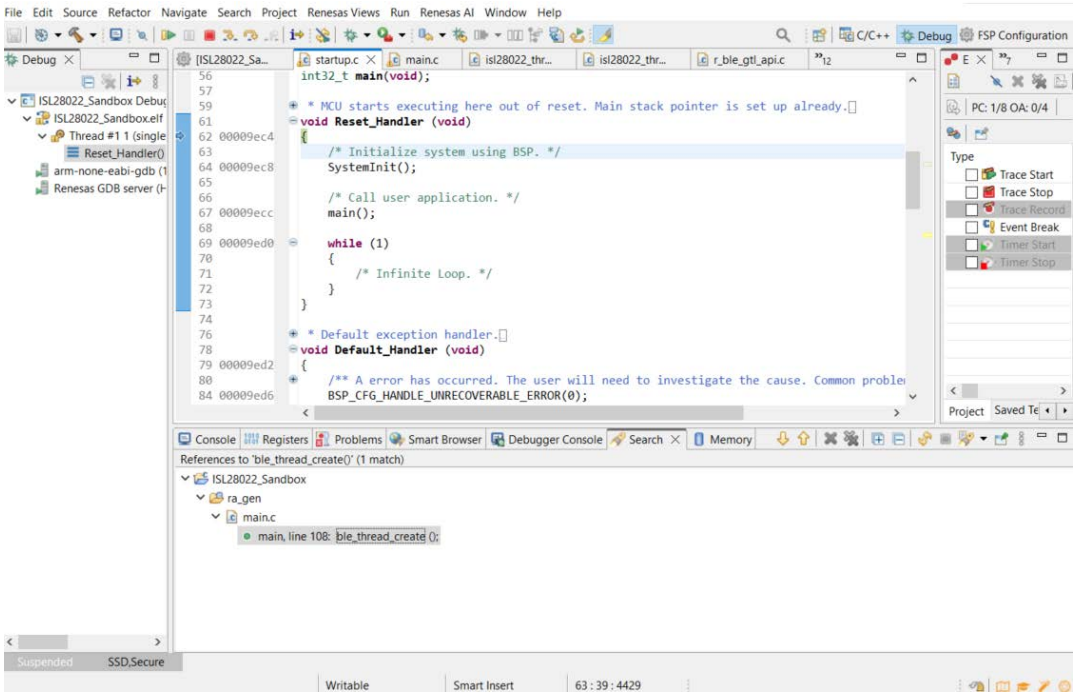


Figure 9. Debug Mode

5. Go to the menu bar, select **Renesas Views** > **Debug** > **Renesas Debug Virtual Console**.

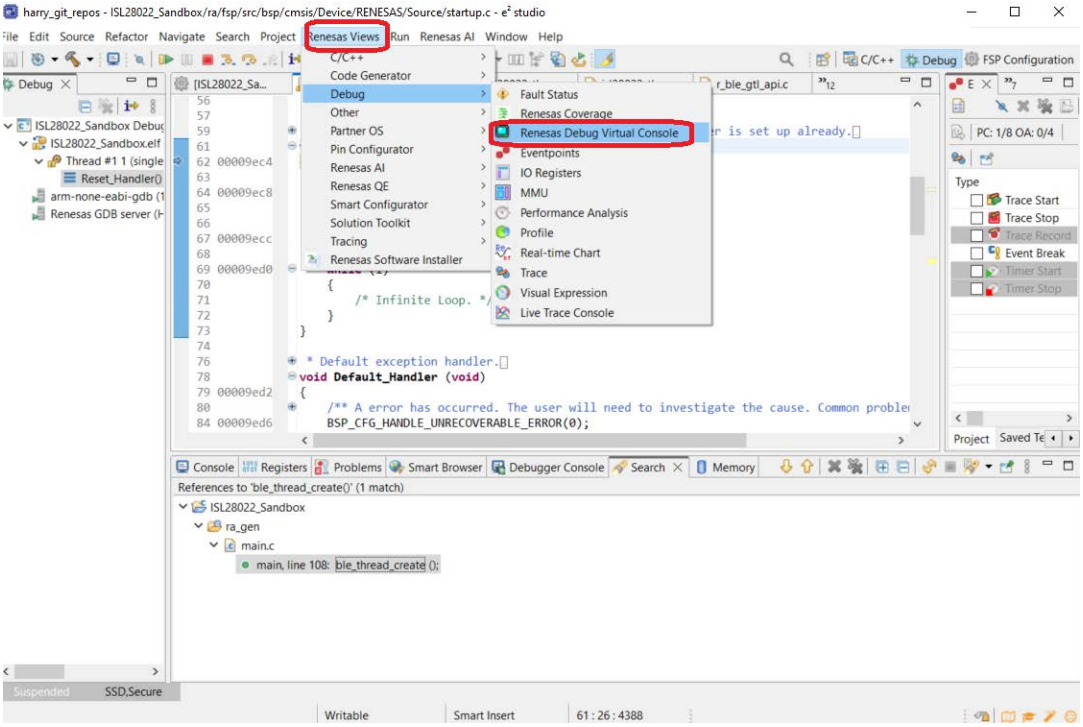


Figure 10. Open Virtual Console

In the bottom panel, the **Renesas Debug Virtual Console** appears.

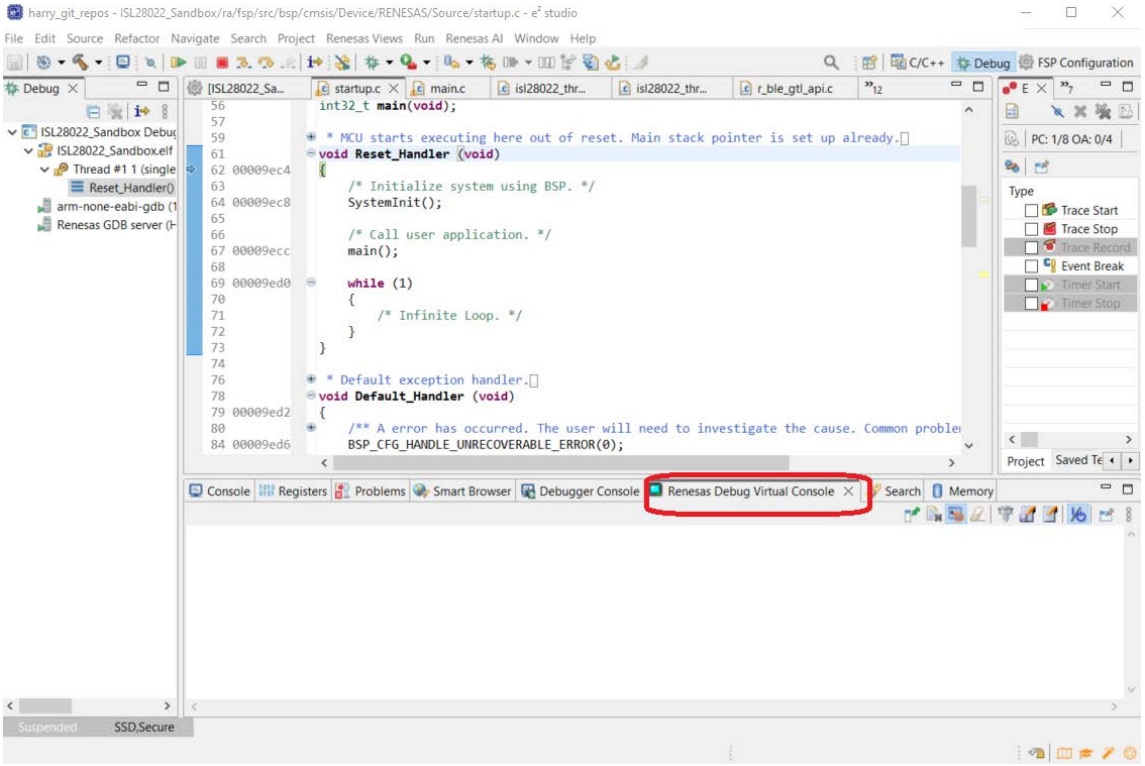


Figure 11. Renesas Debug Virtual Console

6. Click and information appears in the **Renesas Debug Virtual Console** window.

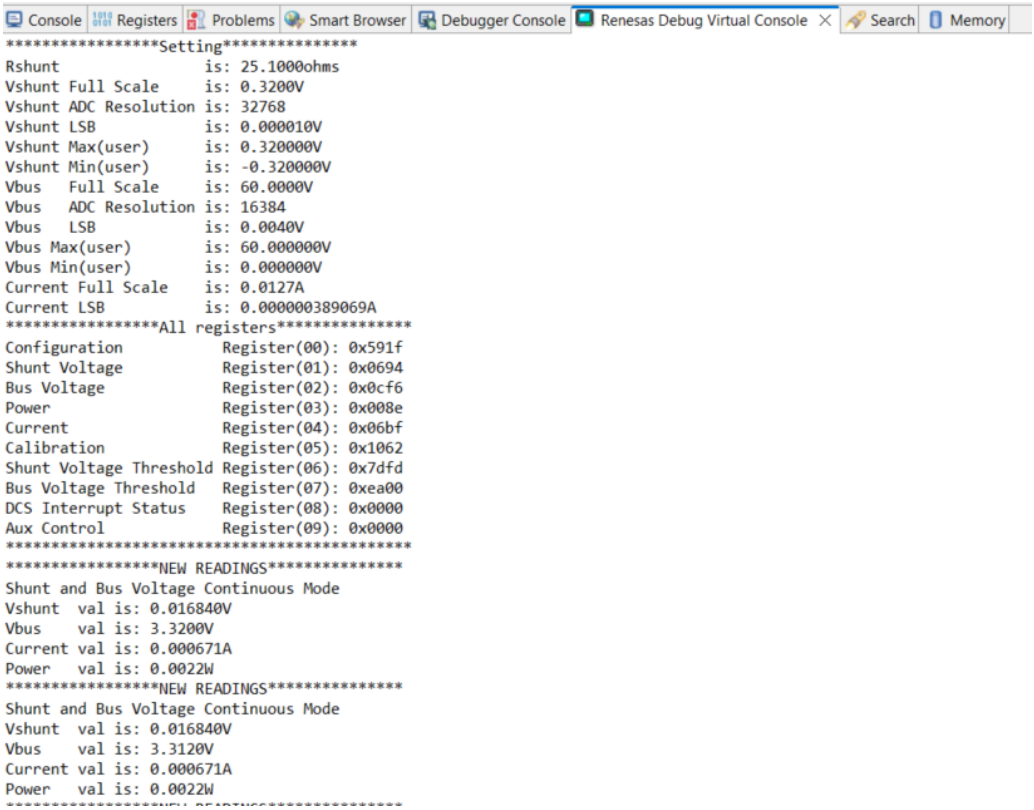


Figure 12. Debug Information

4. Revision History

Revision	Date	Description
1.00	Mar 25, 2024	Initial release.

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