QCIOT-ICL3222EPOCZ

RS232 Pmod™ Board

The QCIOT-ICL3222EPOCZ RS232 Pmod™ Board demonstrates the functionality and performance of the ICL3222. Its primary function is to bridge the gap between different voltage level standards in digital communication devices. It effectively converts digital logic voltage levels to RS232 voltage levels, ensuring seamless data exchange between devices with disparate voltage requirements.

This RS232 module is intelligently configured as a Data Communications Equipment (DCE) device. As a DCE, it takes on the role of a communication controller and typically connects to Data Terminal Equipment (DTE) devices. Common examples of DTE devices include personal computers and other equipment with serial ports. When establishing these connections, a straightforward approach is used with a straight-through cable, making the integration process simple and user-friendly.

Board Contents

- QCIOT-ICL3222EPOCZ RS232 Pmod™ Board

Features

- Standard RS232 DB9 connector
- Optional RTS and CTS handshaking functions
- 6-Pin Pmod-Compatible Connector (Pmod Interface Type 3/3A UART)
- Software support in e² studio minimizes development time with one-click code generation.

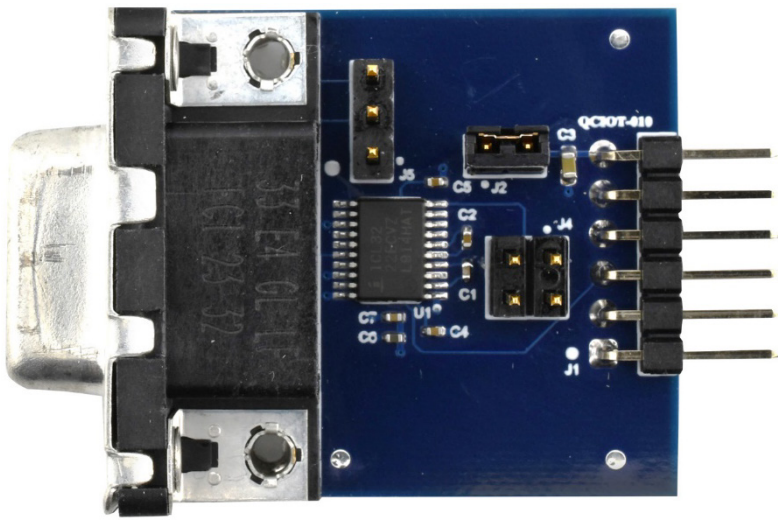


Figure 1. QCIOT-ICL3222EPOCZ RS232 Pmod Board Image

Contents

Figures

1. Functional Description

The QCIOT-ICL3222EPOCZ RS232 Pmod Board is intended as a quick connect prototyping solution for the RS232 interface. The RS232 Pmod employs the ICL3222 transceiver and enables communication between the system board and UART-compatible devices or other components utilizing a serial interface. Figure 2 highlights the main parts of the system.

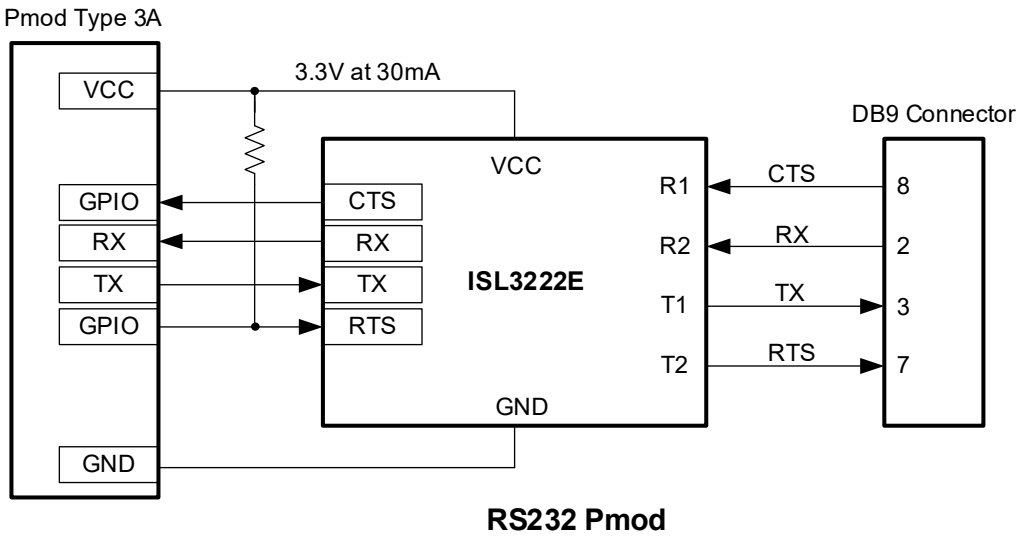


Figure 2. QCIOT-ICL3222EPOCZ RS232 Pmod Board Block Diagram

1.1 Setup and Configuration

Required or recommended user equipment:

- Renesas Evaluation Board: EK-RA2E1
- USB micro-B cable (provided with EK board)
- PC running Windows 10/11 with at least two USB ports
- USB-RS232 cable

Required or recommended software:

- Renesas Flexible Software Package v4.5.0 platform installation
  - Renesas e2 studio 2023-01 or later
  - FSP 4.5.0 or later
  - GCC Arm Embedded 10.3.1 (10 2021.10) or later
- Sample code files (available on the webpage for this device on Renesas Website)
- Serial port terminal software such as puTTy or Tera Term

1.1.1 Software Installation

Visit the Renesas website for the latest version of the e2 studio installer.

1.1.2 Kit Hardware Connections

Follow these procedures to set up the kit (refer to Figure 3).

1. Ensure that the MCU dev. kit supports Type 3 or Type 3A Pmod connector.
   a. For EK-RA2E1, PMOD2 connector is available.
2. Install J2 jumper and leave J4 and J5 open.

3. Plug in QCIOT-ICL3222EPOCZ Board to the **top row** of PMOD2 connector of EK-RA2E1. Use caution to align Pin 1 on the Pmod board and MCU kit.
4. Connect RS232 Pmod board connector J1 with computer using the USB-RS232 cable.
5. Connect EK board with computer using the USB Micro-B cable.
6. The device is now ready to be used in the system. Go to section 4 for board test.

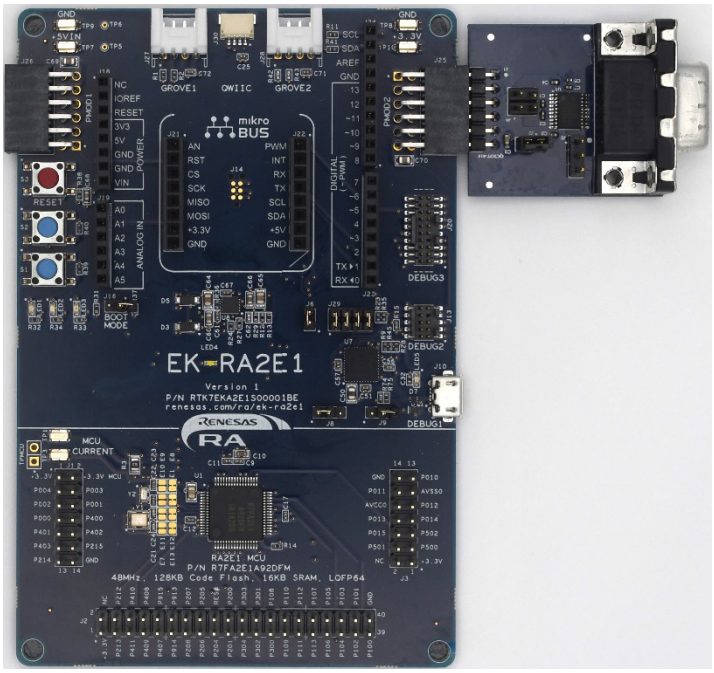


Figure 3. QCIOT-ICL3222EPOCZ RS232 Pmod Board with EK-RA2E1 MCU Kit

2. Board Design

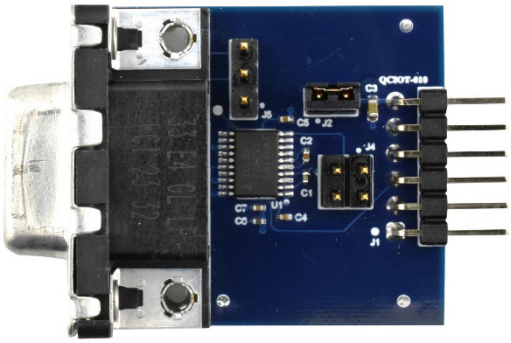


Figure 4. QCIOT-ICL3222EPOCZ RS232 Pmod Board Image (Top)

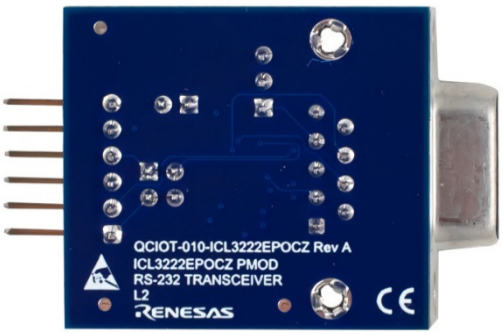
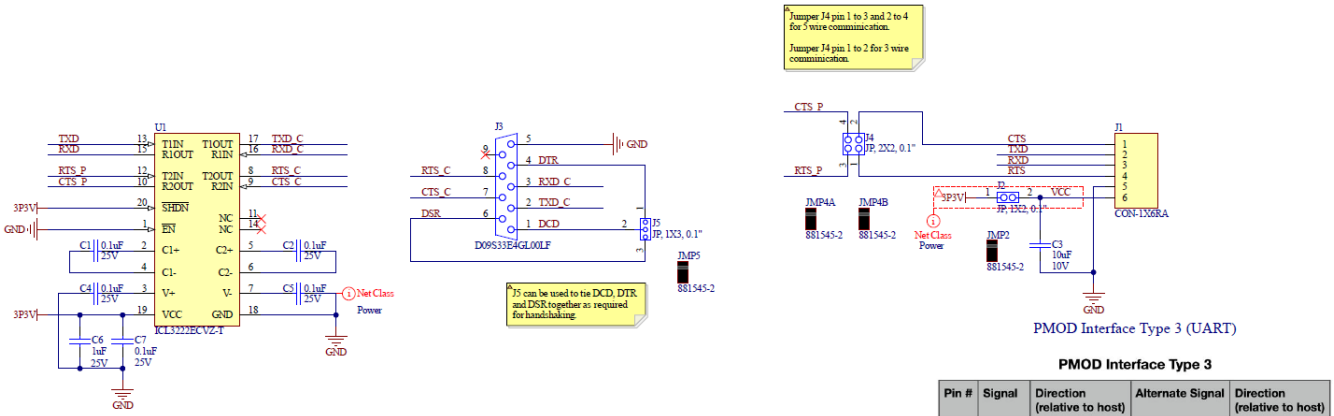


Figure 5. QCIOT-ICL3222EPOCZ RS232 Pmod Board Image (Bottom)

2.1 Schematic Diagram



PMOD Interface Type 3

Pin #	Signal	Direction (relative to host)	Alternate Signal	Direction (relative to host)
1	CTS	In	GPIO	In/Out
2	TXD	Out	-	-
3	RXD	In	-	-
4	RTS	Out	GPIO	In/Out
5	GND	-	-	-
6	VCC	-	-	-

Figure 6. QCIOT-ICL3222EPOCZ RS232 Pmod Board Schematic

2.2 Bill-of-Materials (BOM)

Item	Quantity	Designator	Description	Manufacturer	Part Number
1	5	C1, C2, C4, C5, C7	Capacitor, 0.1µF, 25V, SM	Taiyo Yuden	TMK105B7104KVHF
2	1	C3	Capacitor, 10µF, 10V, SM	Murata	GRM188R61A106KE69D
3	1	C6	Capacitor, 1µF, 25V, SM	Taiyo Yuden	TMK105BJ105KV-F
4	1	FOOT1	Foot, Rubber, Self-adhesive, Black, 6.4mm diameter, 2.1mm tall	Bumper Specialties	BS25BL07X30RP
5	1	J1	Connector, 1 × 6, 0.1", PMOD, Header, Right Angle, Unshrouded	Harwin	M20-9960645
6	1	J2	Jumper, 1 × 2, 0.1" Pitch	Sullins	PBC02SAAN
7	1	J3	Connector, D-Sub, 9 Pin, Socket, R/A, TH	Amphenol ICC / FCI	D09S33E4GL00LF
8	1	J4	Jumper, 2 × 2, 0.1" Pitch	Sullins	PBC02DAAN
9	1	J5	Jumper, 1 × 3, 0.1" Pitch	Sullins	PBC03SAAN
10	4	JMP2, JMP4A, JMP4B, JMP5	Post Shunt; 2; 3; 1000; Phosphor Bronze; Gold over Nickel; Open Top; Black	TE Connectivity AMP	881545-2
11	1	U1	Transceiver, RS-232, 2 Driver, 2 Receiver, Power-Down, SM	Renesas	ICL3222ECVZ-T

2.3 Board Layout

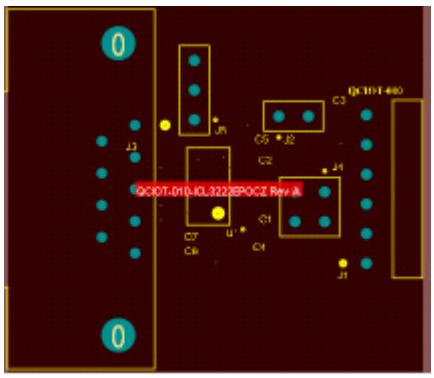


Figure 7. Top Overlay

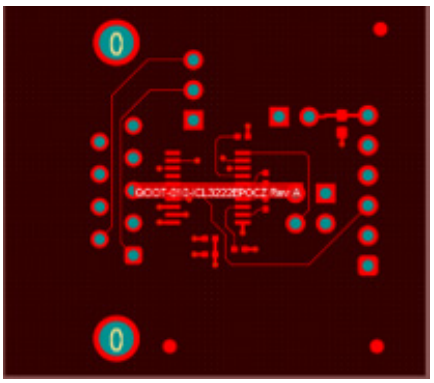


Figure 8. Top Layer

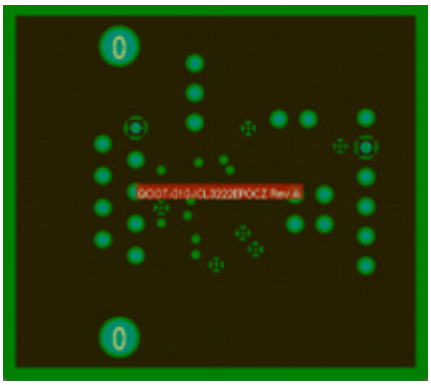


Figure 9. Layer 2 (GND)

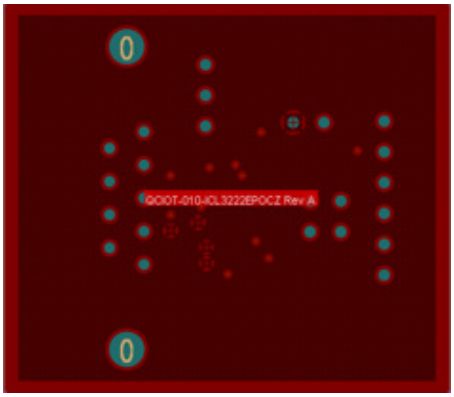


Figure 10. Layer 3 (Signal)

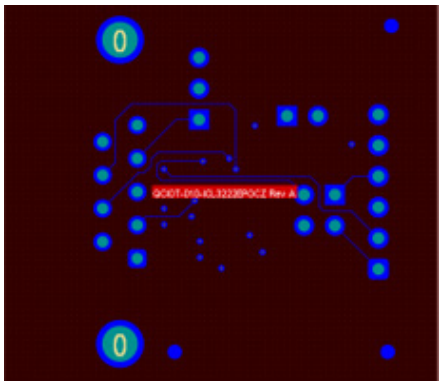


Figure 11. Bottom Layer

Figure 12. Bottom Overlay

3. Software Design

The following sections give an overview of the software implementation for the QCIOT-ICL3222EPOCZ RS232 Pmod Board which is based on the Renesas RA Family's Flexible Software Package (FSP). These sections detail the project's code structure, the system's software modules, and the main system flow.

3.1 Project Code Structure

The Quick Connect project is designed to be an easily configurable, highly modular solution independent of other modules (if required) or ported to other end applications. Figure 13 shows the structure of the project in e2 studio.

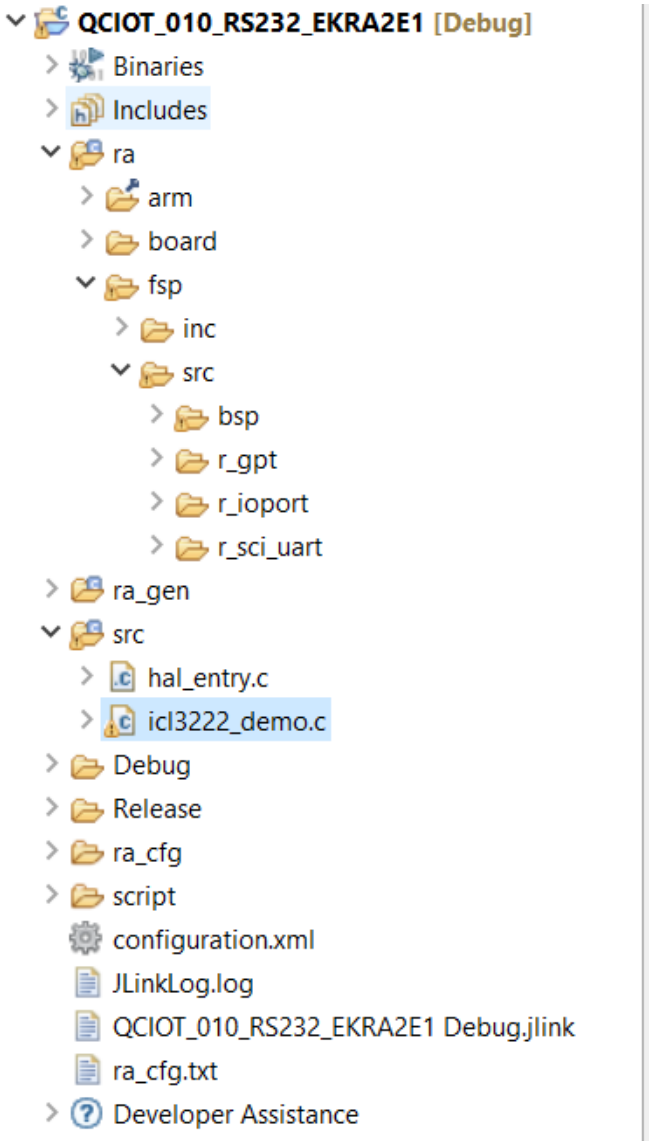


Figure 13. Project Structure

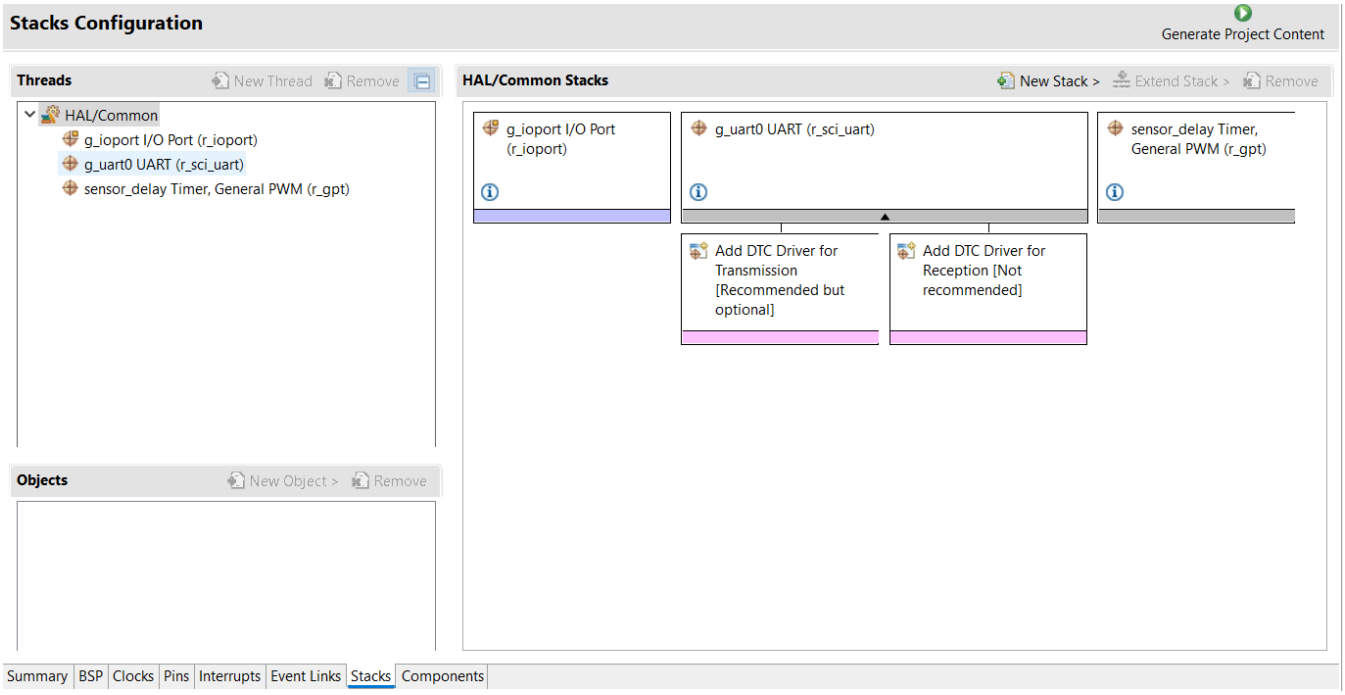


Figure 14. Stacks Configuration–Hal/Common

4. Board Testing

4.1 Programming the Board

1. Open the sample project code in the Renesas e2 studio IDE. From the menu bar, click *Run* and choose *Debug Configurations*.

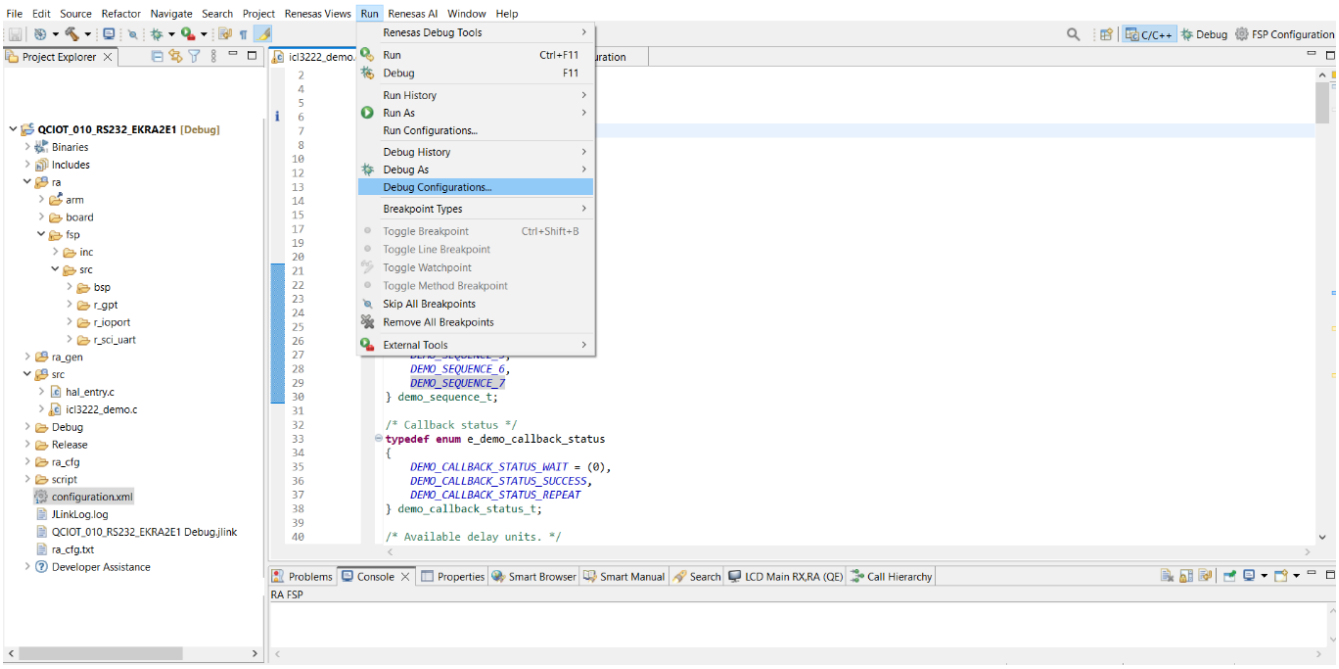


Figure 15. Debug Configuration

2. Click on the **Renesas GDB Hardware Debugging** file and select **QCIOT_010_RS232_EKRA2E1_Debug**. Click the *Debug* button at the bottom of the window.

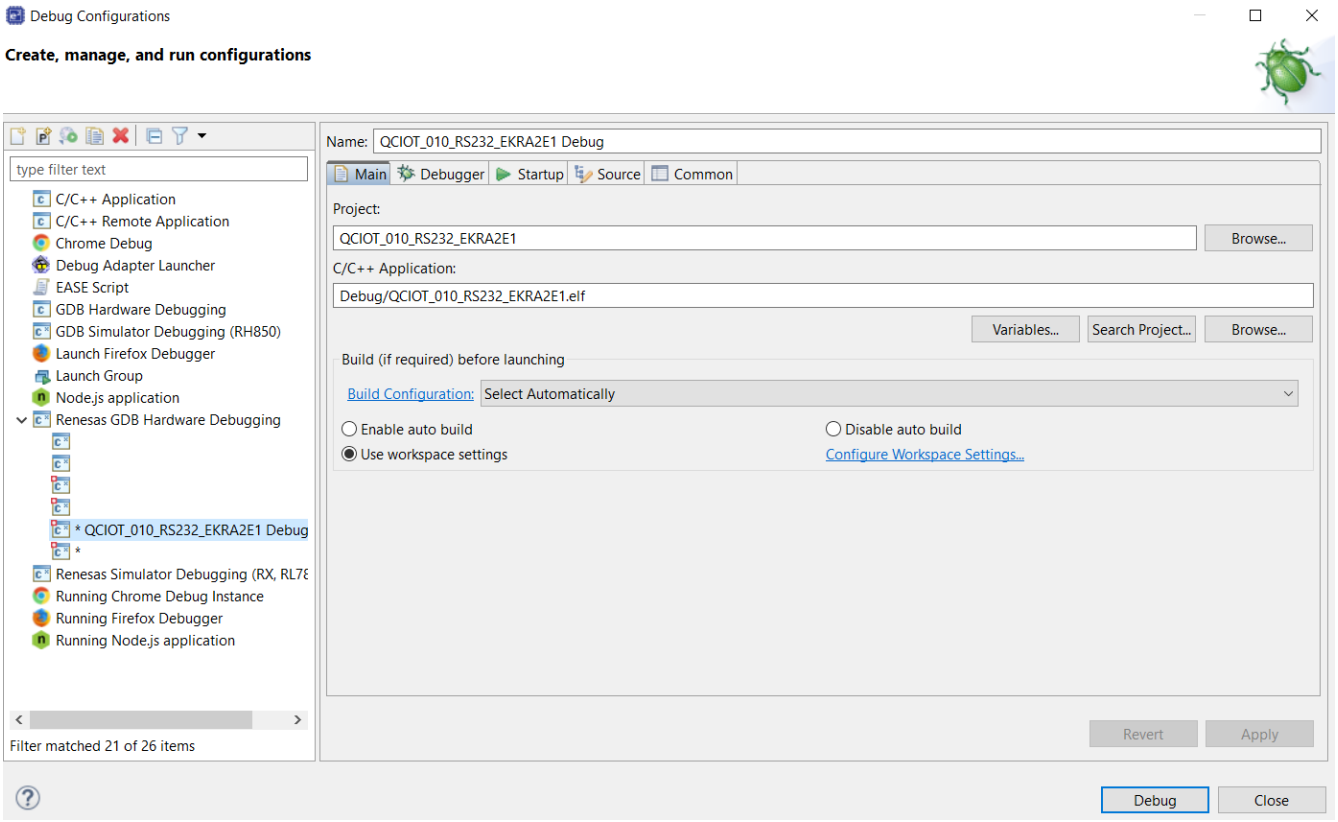


Figure 16. Start Debug Mode

The code will enter the debug mode as shown in in Figure 17.

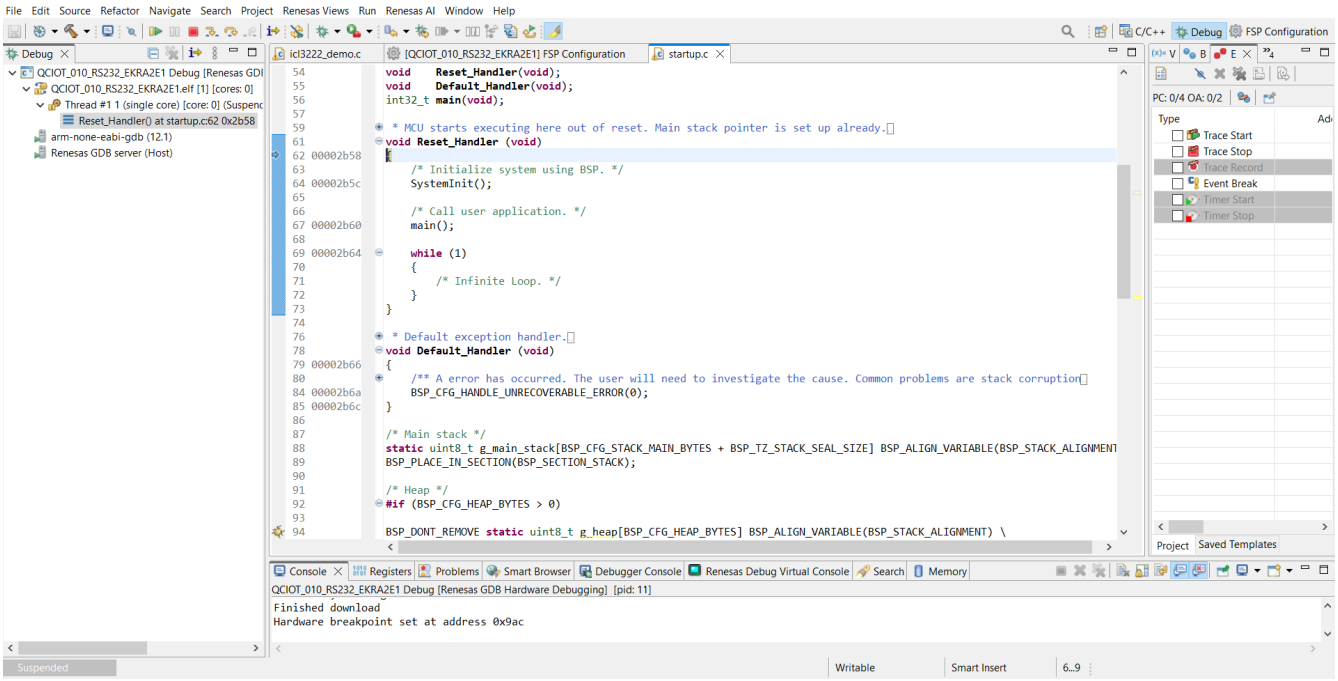


Figure 17. Viewing Debug Mode Results

3. Press **F8** or click on the resume  icon to run the demo code.

4.2 Check the Output in Serial Terminal

Open the serial terminal by using the following settings:

Baud Rate	9600
Data bits	8
Stop bits	1
Parity	none
Flow control	none

Once the serial terminal window opens, press '**t**' on the keyboard to display the data packet, "ICL3222 TEST x" (where x = 1 in this example) sent by the Pmod RS232 board.

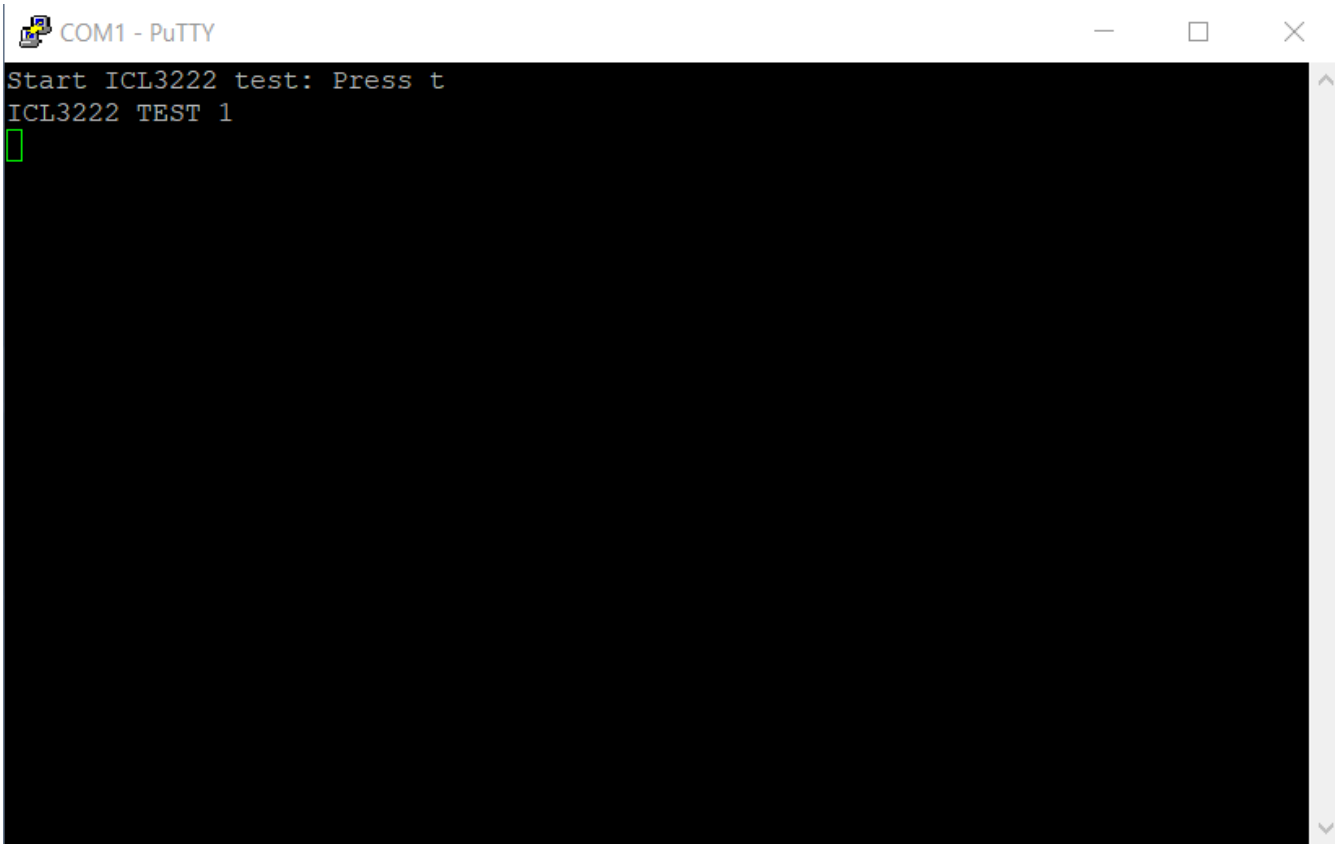


Figure 18. Serial Terminal Window–Debug Information

5. Ordering Information

Part Number	Description
QCIOT-ICL3222EPOCZ	RS232 Pmod™ Board

6. Revision History

Revision	Date	Description
1.01	Nov 12, 2024	Changed part number to QCIOT-ICL3222EPOCZ from QCIOT-010-ICL3222EPOCZ.
1.00	Jun 18, 2024	Initial release.

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