

US082-SSC3240EVZ

Sensor Signal Conditioner Pmod

Description

The US082-SSC3240EVZ board demonstrates the functionality and performance of the high-end 24-bit [ZSSC3240](#) Sensor. The ZSSC3240 is used for highly accurate amplification, digitization, and sensor-specific correction of resistive sensor signals. The ZSSC3240 evaluation board is a generic design enabling the customer to embed the sensor into their specific application.

The board provides a standard Pmod™ Type 6A (extended I²C) connection for the onboard sensor to plug into any required MCU evaluation kit with a matching connector. The ZSSC3240 evaluation board can be added to the end of a daisy-chained solution with multiple Type 6/6A devices on the same MCU Pmod connector.

The ZSSC3240 provides measurement value readouts and programming capabilities via an I²C, SPI, or one-wire interface (OWI). Three different operation modes allow optimal development of digital, digital-analog, and analog-output smart sensor modules including wake-up on request, continuous-on/fast-response, and automatic/cyclic sensor measurement operations.

Board Contents

- US082-SSC3240EVZ Sensor

Features

- Programmable 16-bit digital-to-analog-converter and output:
 - (0V to 1V) or (0V to 5V) absolute voltage output
 - VDD-ratiometric voltage output
 - 4mA to 20mA current-loop output supported
 - 0V to 10V absolute-voltage output supported
- On-chip temperature sensor
- Supports different sensor element configurations:
 - Resistive bridge or half-bridge
 - Resistive divider string
 - Voltage source
- Standardized type 6A Pmod connector support
- I²C/SMBUS extended interface

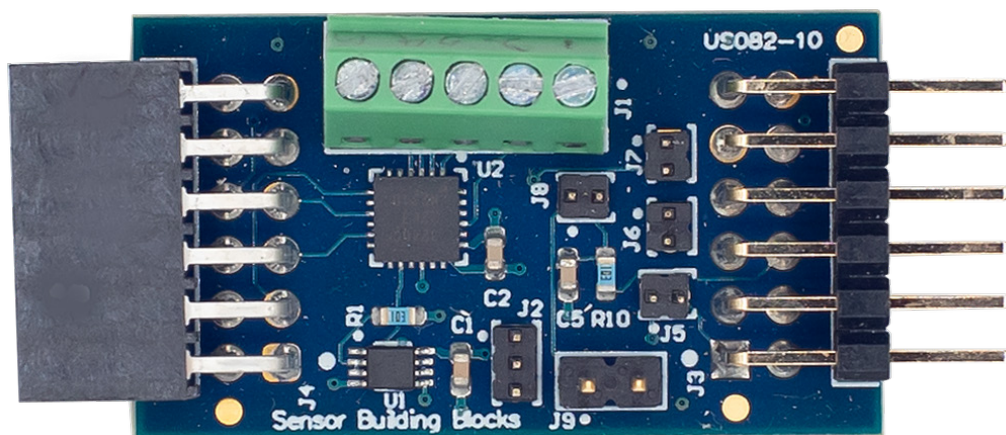


Figure 1. US082-SSC3240EVZ Pmod Board

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1. Functional Description

The ZSSC3240 Pmod is intended as a quick connect prototyping solution for the ZSSC3240. [Figure 2](#) highlights the main parts of the system.

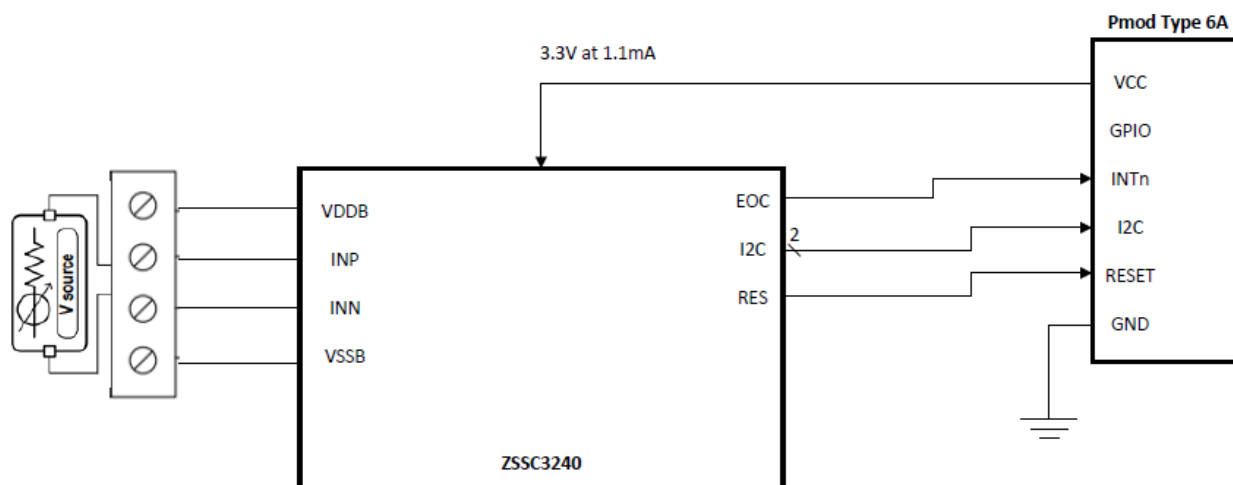


Figure 2. US082-SSC3240EVZ Functional Block Diagram

1.1 Setup and Configuration

The setup and configuration for the US082-SSC3240EVZ Pmod is comprised of the following required or recommended hardware:

- EK-RA6M4 Eval Kit
- USB micro-B cable (provided with EK-RA6M4 board)
- PC running Windows® 10/11 with at least one USB port
- US082-INTERPEVZ

The following software is required or recommended:

- [Renesas Flexible Software Package](#) (FSP) v5.2.0 platform installation:
 - [e2 studio](#) 2024-01 or later
 - FSP 5.2.0 or later
 - GCC Arm Embedded 13.2.1
- Sample code files (see the US082-SSC3240EVZ product page)

1.1.1 Software Installation and Usage

- Install the latest version of [e2 studio](#).
- Install the latest version of [J-Link RTT Viewer](#).

1.1.2 Kit Hardware Connections

Use the following procedures and refer to [Figure 3](#) to set up the kit.

1. Ensure that the MCU development kit has at least one Type 6A Pmod.
 - a. For the EK-RA6M4 board, a PMOD1 connector is available.
2. On the US082-SSC3240EVZ board, populate the J7, J6, J5 and J8 jumpers and leave the other jumpers open.
3. Plug the US082-INTERPEVZ board into PMOD1 of the EK-RA6M4. Care must be taken to align Pin 1 on the Pmod board and MCU kit.
4. Plug in the US082-SSC3240EVZ board to the US082-INTERPEVZ board.
5. Connect the EK-RA6M4 board with a computer using a USB micro-B cable.
6. The device is now ready to be used in the system.

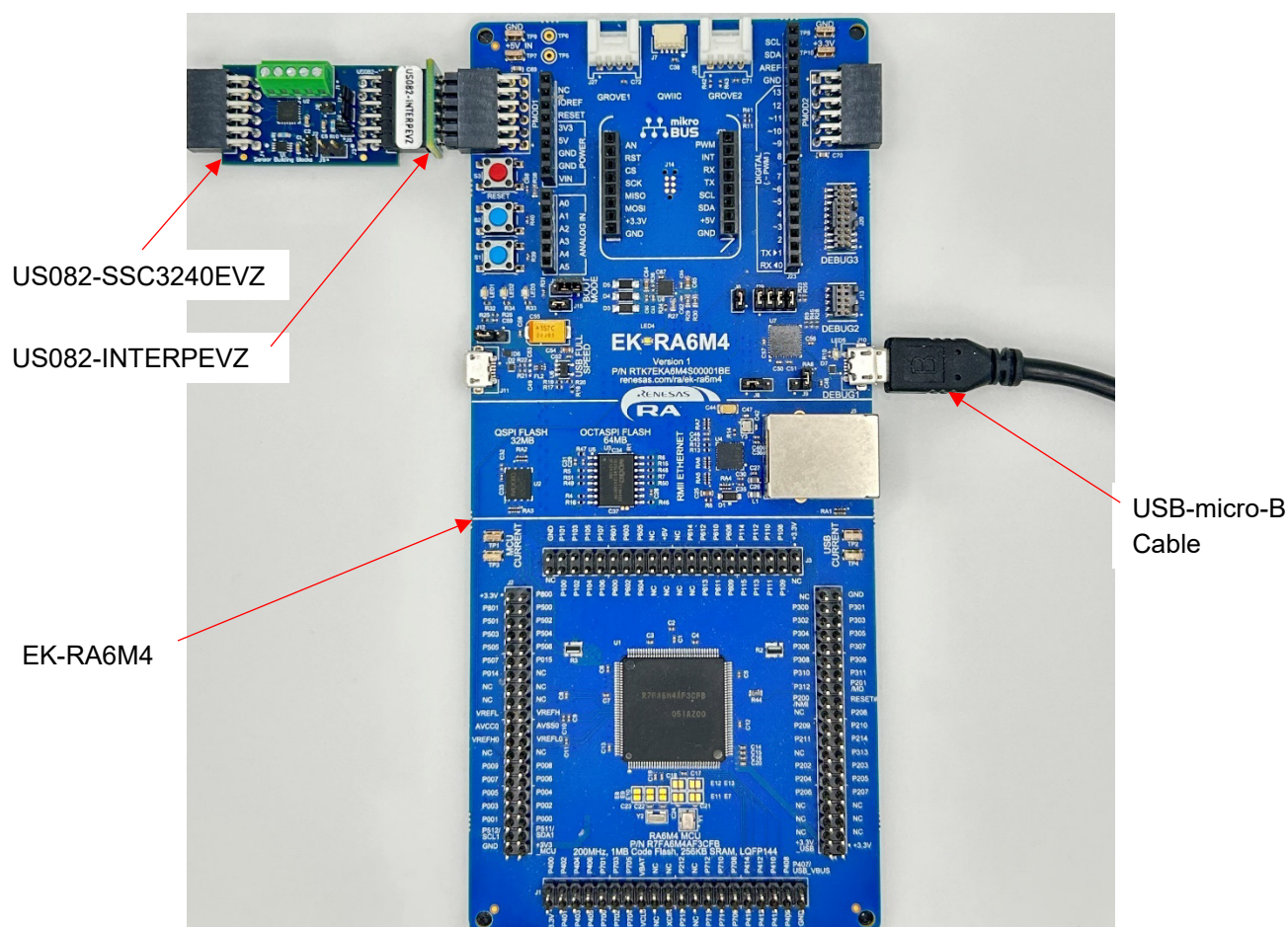


Figure 3. US082-SSC3240EVZ Pmod with EK-RA6M4 MCU Kit

2. Board Design

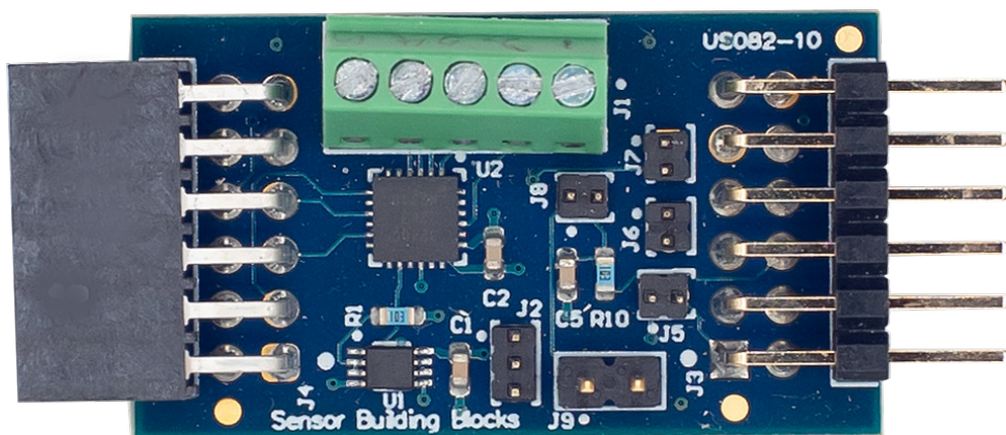


Figure 4. US082-SSC3240EVZ (Top)



Figure 5. US082-SSC3240EVZ (Bottom)

2.1 Schematic Diagrams

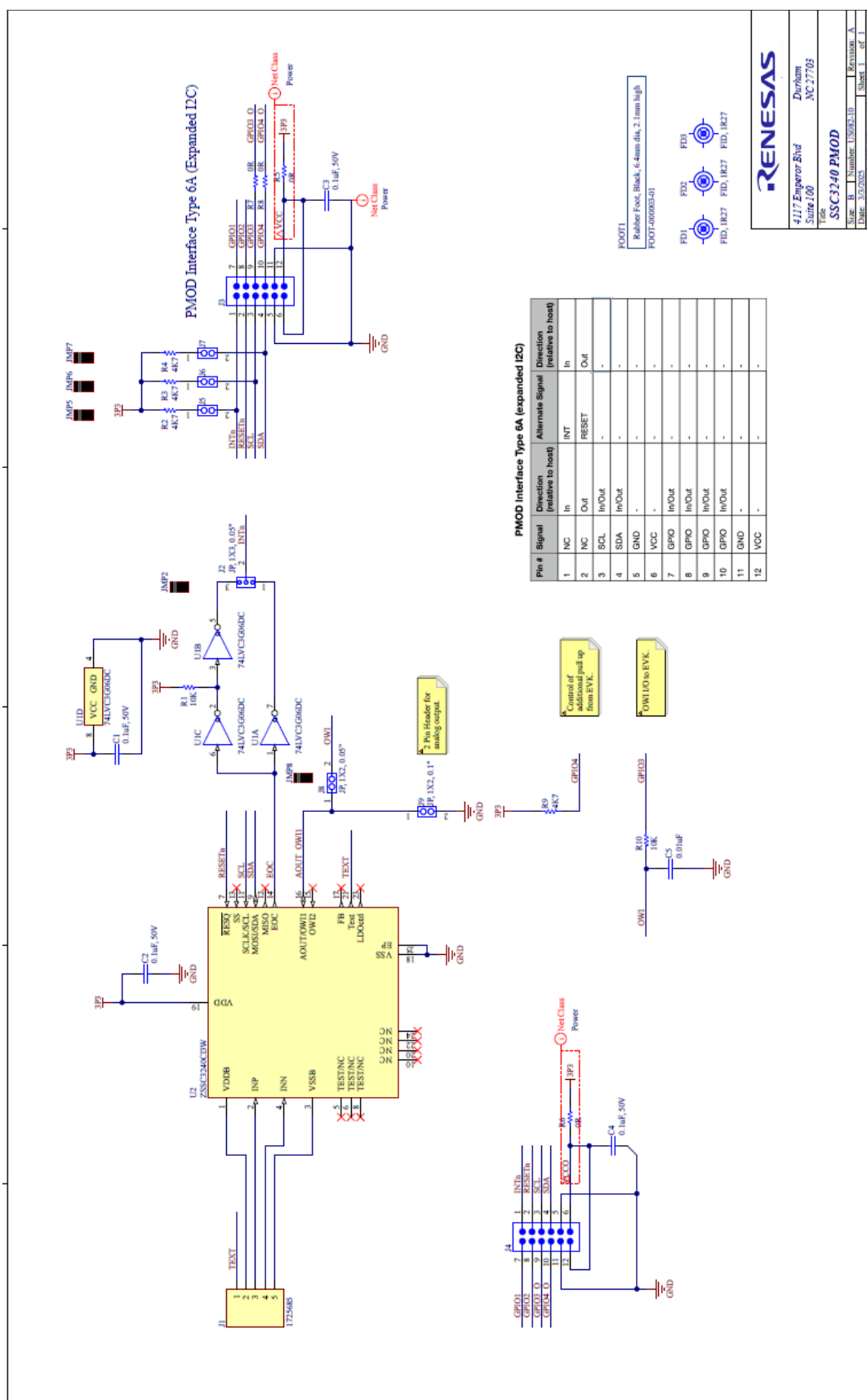


Figure 6. US082-SSC3240EVZ Schematic

2.2 Bill of Materials

Qty	Description	Designator	Manufacturer	Manufacturer Part Number
1	Capacitor, 0.01 μ F, 50V, SM	C5	Würth Electronics	885012206089
1	Jumper, 1 $\times$ 3, 0.05" Pitch	J2	Sullins	GRPB031VWVN-RC
1	Connector, 1 $\times$ 5, 2.54mm, RA, Terminal Block, TH	J1	Würth Electronics	691210910005
4	Jumper, 1 $\times$ 2, 0.05" Pitch	J5, J6, J7, J8	Sullins	GRPB021VWVN-RC
1	Jumper, 1 $\times$ 2, 0.1" Pitch	J9	Würth Electronics	61300211121
4	Resistor, 4.7K Ω , 1/8W, 1%, SM	R2, R3, R4, R9	KOA Speer	RK73H1JTDD4701F
4	Resistor, 0 ohms, 1/8W, 1%, SM	R5, R6, R7, R8	KOA Speer	RK73Z1JTDD
2	Resistor, 10K Ω , 1/8W, 1%, SM	R1, R10	KOA Speer	RK73H1JTDD1002F
1	Sensor Signal Conditioner, Resistive Sensors, SM	U2	Renesas	ZSSC3240CI3W
4	Capacitor, 0.1 μ F, 50V, SM	C1, C2, C3, C4	Würth Electronics	885012206095
1	Foot, Rubber, Self-adhesive, Black, 6.4mm diameter, 2.1mm tall	FOOT1	Bumper Specialties	BS25BL07X30RP
1	Male Header 0.1" pitch PMOD 2 $\times$ 6 Right Angle	J3	Würth Electronics	61301221021
1	PMOD_6X2_RA_TH_SOCKET	J4	Würth Electronics	613012243121
5	2-position Shunt Jumper, 0.05"	JMP2, JMP5, JMP6, JMP7, JMP8	Sullins	NPB02SVFN-RC
1	IC, Digital, Buffer, Triple, Inverting, Open Drain, SM	U1	Nexperia	74LVC3G07DC,125

2.3 Board Layout

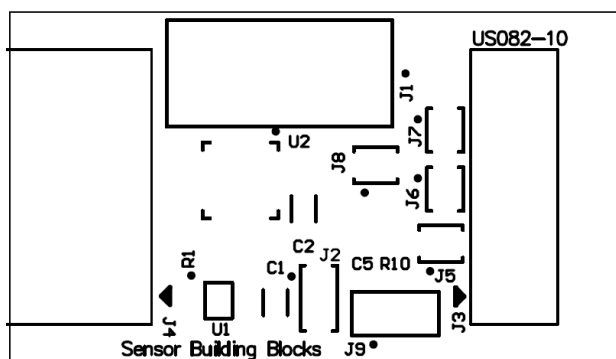


Figure 7. Top Overlay

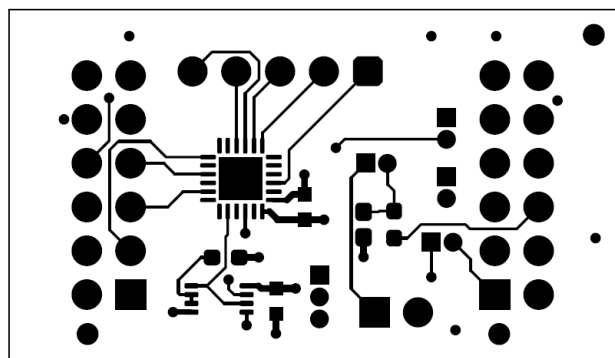


Figure 8. Top Layer

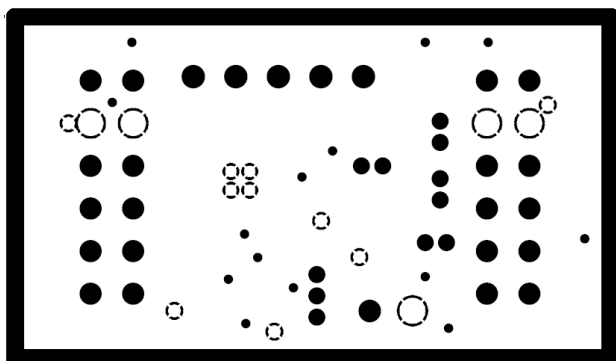


Figure 9. Int 1 (GND)

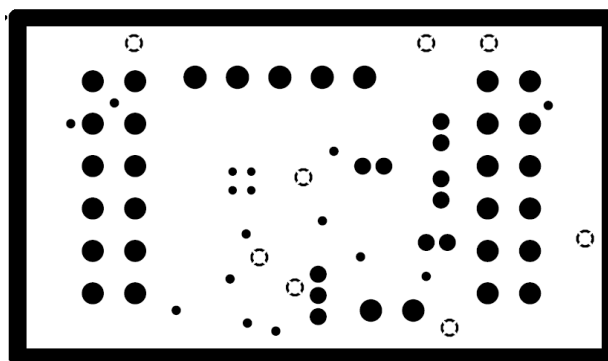


Figure 10. Int 2 (PWR)

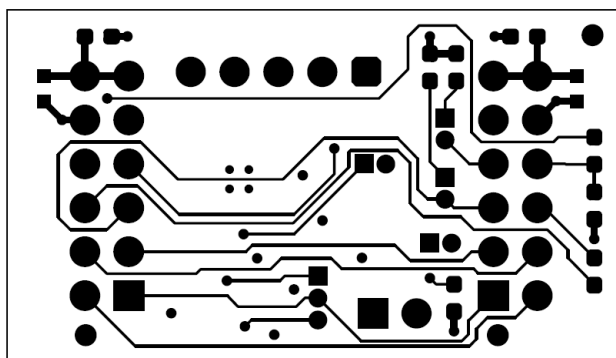


Figure 11. Bottom Layer

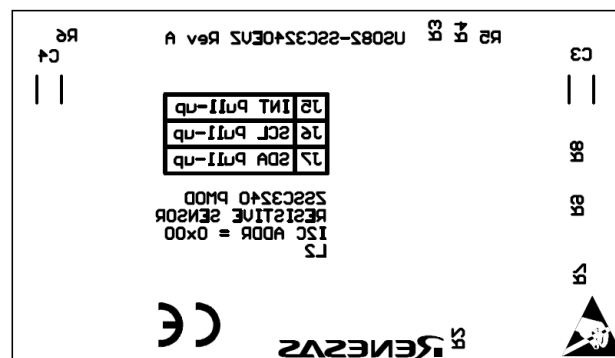


Figure 12. Bottom Overlay

3. Software Design

The following sections present an overview of the software implementation for the US082-ZSSC3240EVZ Pmod and detail the project's code structure, the system's software modules, and the main system flow.

3.1 Project Code Structure

The US082-ZSSC3240EVZ project is designed as a highly modular solution that can be easily configured independently of other modules (if required) or ported to other end applications.

The project is split into two main parts:

- ZSSC3240 driver – Device driver code for ZSSC3240 that includes the I²C communication driver.
- Application code – Main system code that enables the driver code and implements system flow.

The driver module contains the C-source files and header files. The specific user configuration is included in the application code.

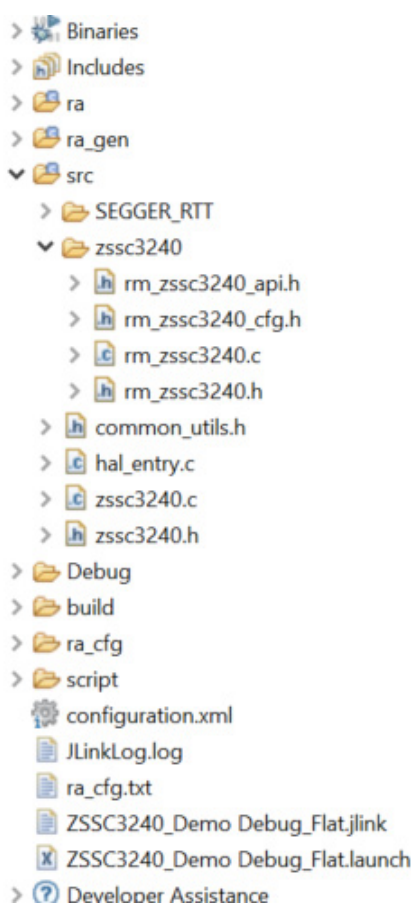


Figure 13. ZSSC3240 Project Structure

- SEGGER_RTT – RTT Viewer support files
- Zssc3240 – ZSSC3240 driver source code and header files:
 - rm_zssc3240_api.h – Driver function declarations
 - rm_zssc3240_cfg.h – Sensor configuration file
 - rm_zssc3240.c – Driver source file
 - rm_zssc3240.h – Driver header file
- Common_utils.h – Header file for application code in hal_entry.c – Start of code execution
- zssc3240.c – Device setup source file
- zssc3240.h – Device setup header file

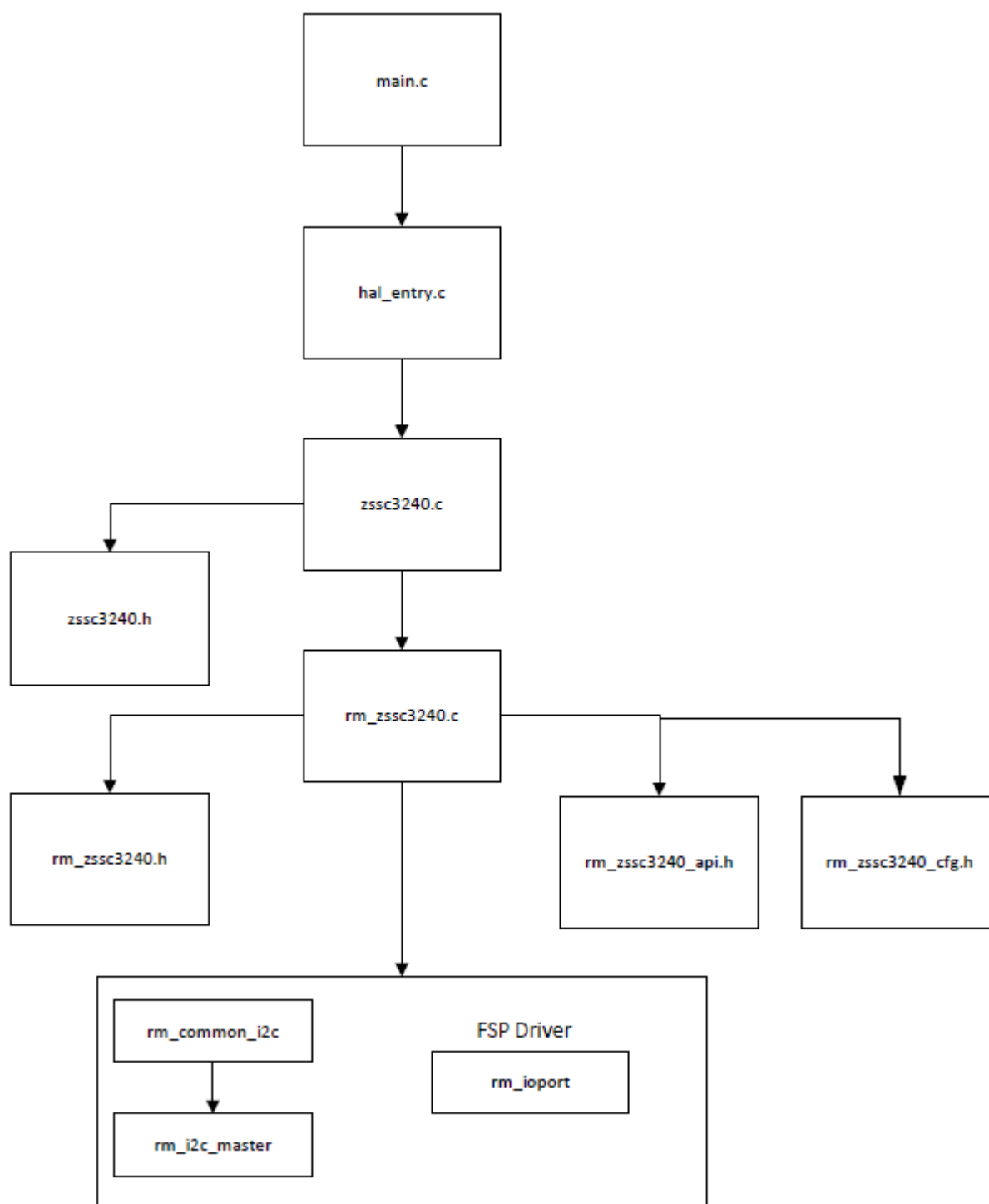


Figure 14. Code Dependency Graph

3.2 Software Module Overview

The ZSSC3240 demo shows the basic use of firmware API to setup and read sensor data from the ZSSC3240.

3.2.1 Hal_entry

This module is responsible for initializing the FSP I2C driver and setting up the ZSSC3240 device with the user-configured settings. After setup, the module provides the following features:

- Performs device setup commands
- Reads sensor data
- Prints sensor data to RTT Viewer

3.2.2 Algorithm Flowchart

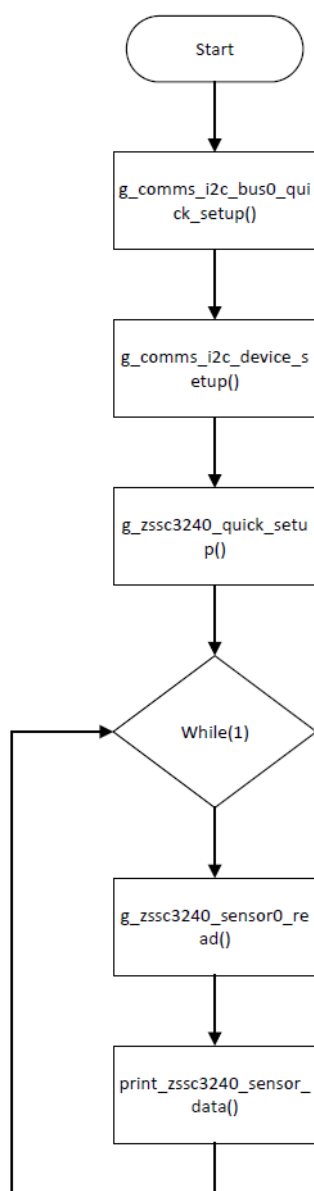


Figure 15. Algorithm Flowchart

3.2.3 Algorithm Overview

The I²C bus is opened by `g_comms_i2c_bus0_quick_setup()` and `g_comms_device0_quick_setup()`. Next, the ZSSC3240 instance is opened by `g_zssc3240_quick_setup()`.

The main program loops continuously to get the sensor readings by calling `g_zssc3240_sensor0_read()`. The sensor readings can be seen in the Expression window or through RTT Viewer.

The functions outlined in [Figure 15](#) are described as follows:

`hal_entry ()`

- Call `g_comms_i2c_bus0_quick_setup()`
 - Opens the I²C driver. This must be performed before calling device setup.
- Call `g_comms_i2c_device0_quick_setup()`
 - Opens the I²C Communications device instance. This must be performed before calling any COMMS_I2C_API.
- Call `g_zssc3240_quick_setup()`
 - Opens the ZSSC3240 instance. This must be performed before calling any ZSSC3240 API.
- Continuously call `g_zssc3240_sensor0_read()`
 - Sends the read data command to the ZSSC3240.
 - Waits for Measurement to finish.
 - Converts raw sensor data to calculated data.
- Continuously call `print_zssc3240_sensor_data()`
 - Prints sensor data to the RTT Viewer terminal.

4. Importing Project to e2 Studio

This section outlines how to import the ZSSC3240_Demo into e2 studio.

1. Open e2 studio and click *File > Import*.

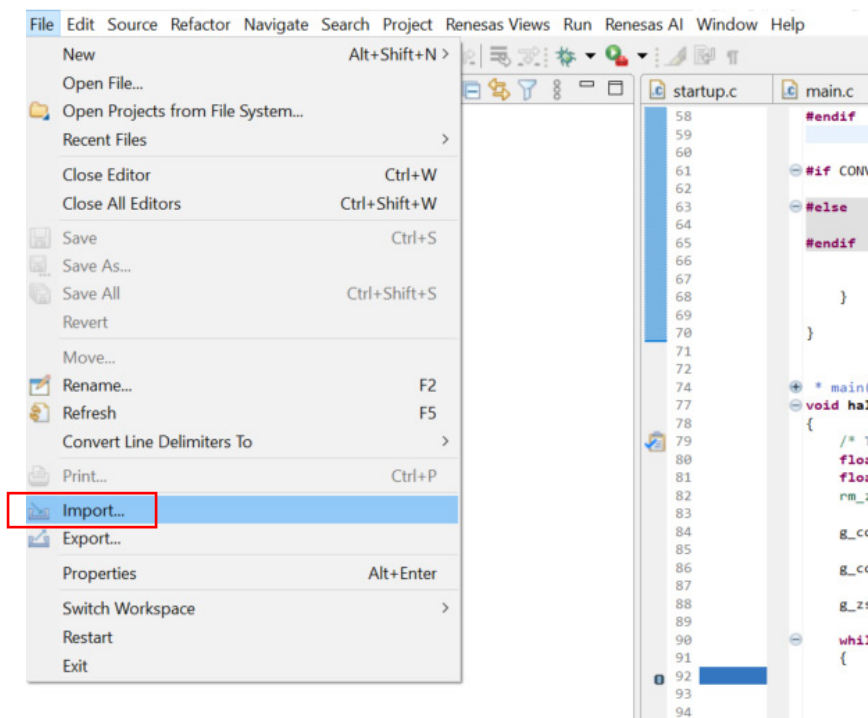


Figure 16. File Window

2. Select “Archive File”, then click *Next*.

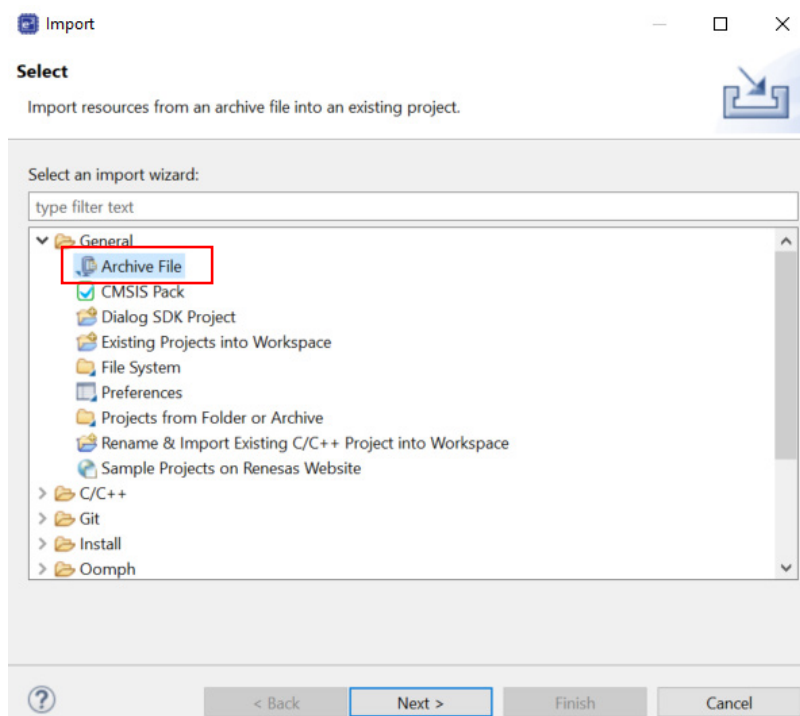


Figure 17. Import Window

3. Click *Browse*.

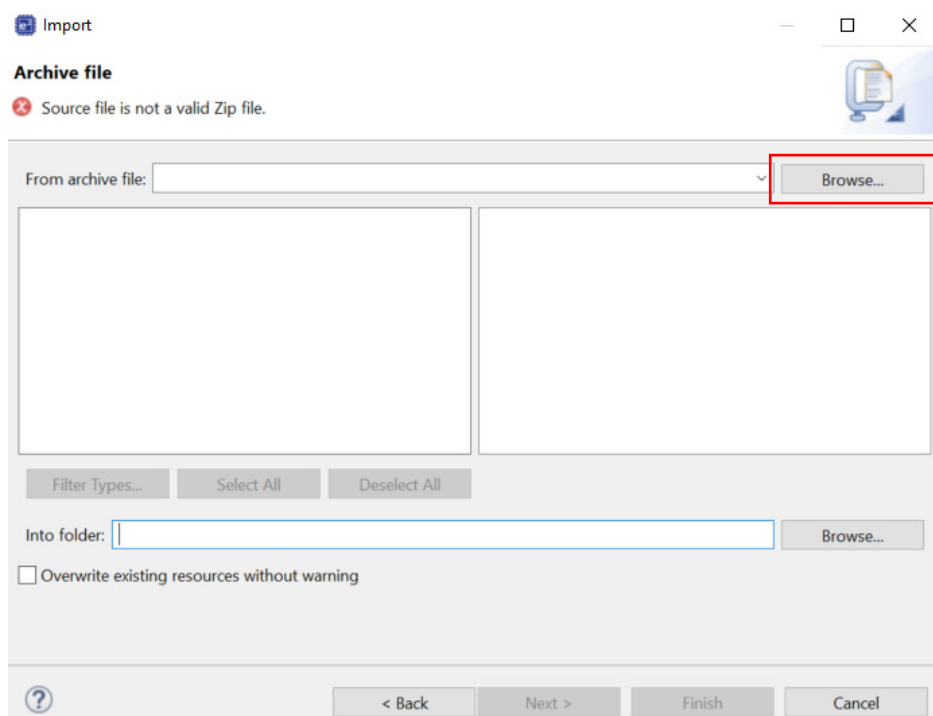


Figure 18. Import Selection Window

4. Select “ZSSC3240_Demo.zip” from your file system.
5. Click *Finish*.

5. Board Test

5.1 Setting Up the Boards and Cable

Verify that you have followed the procedure in [Kit Hardware Connections](#).

5.2 Programming the Development Board and Running Example Code in Debug Mode

1. Open the sample project in e2 Studio.
2. Click the “Build” icon (see Figure 19).

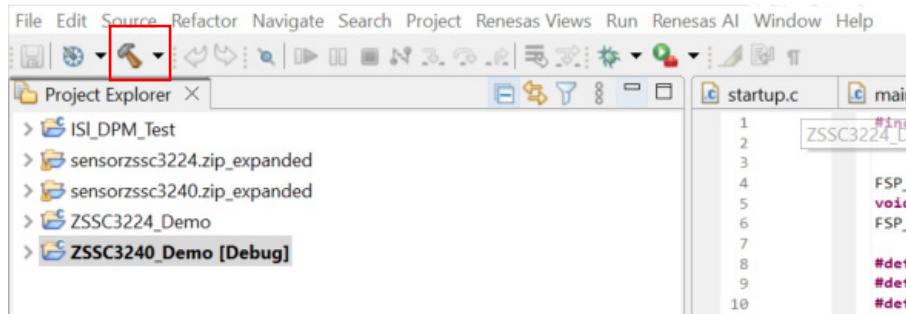


Figure 19. Project Build

3. From the menu bar, select *Run > Debug Configurations*.

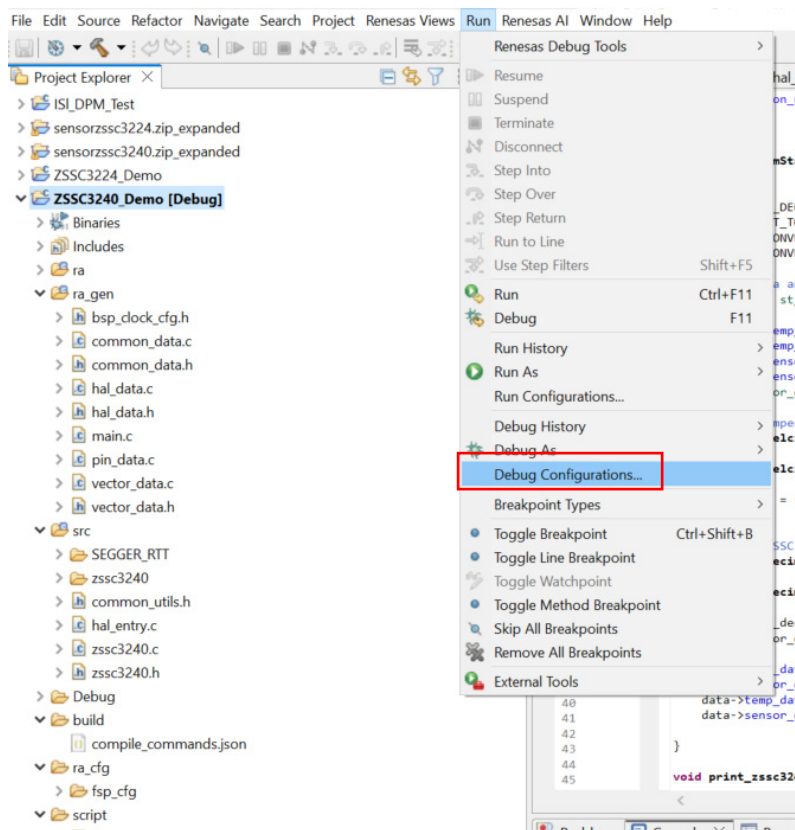


Figure 20. Debug Configurations

4. Select *Renesas GDB Hardware Debugging > ZSSC3240_Demo Debug_Flat* (see Figure 21).
5. Click the *Debug* button.

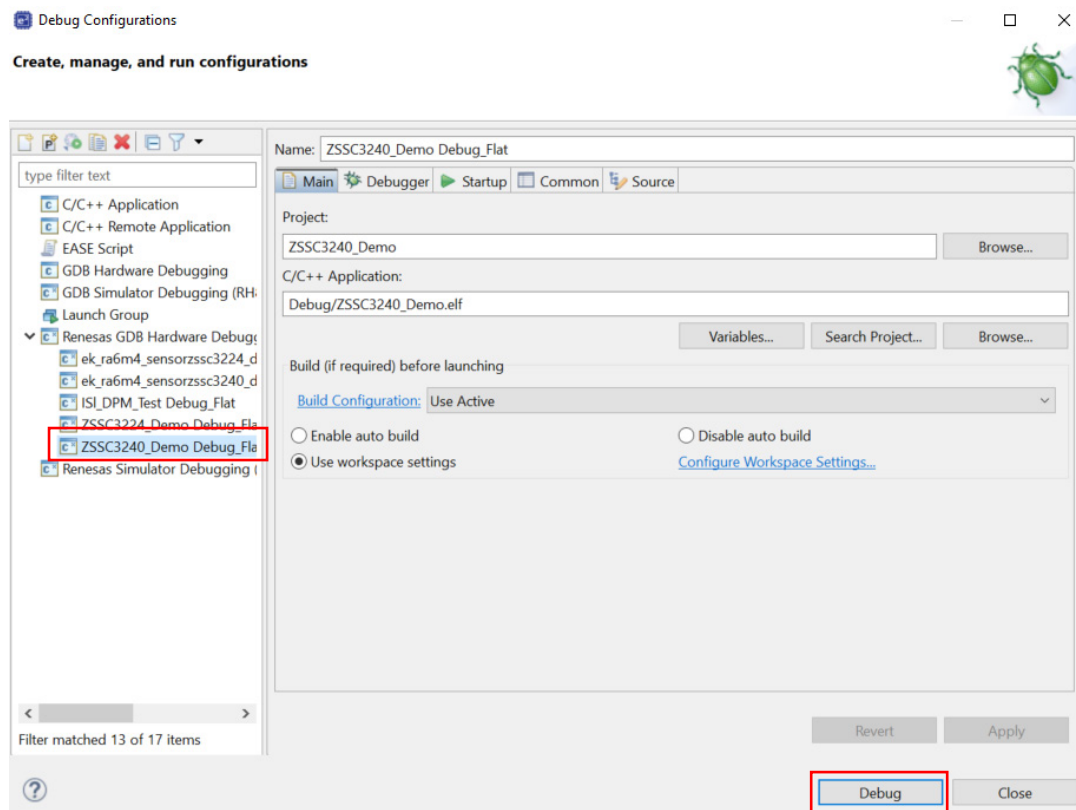


Figure 21. Start Debug Mode

6. Click the “Play” button to run the code (see Figure 22).

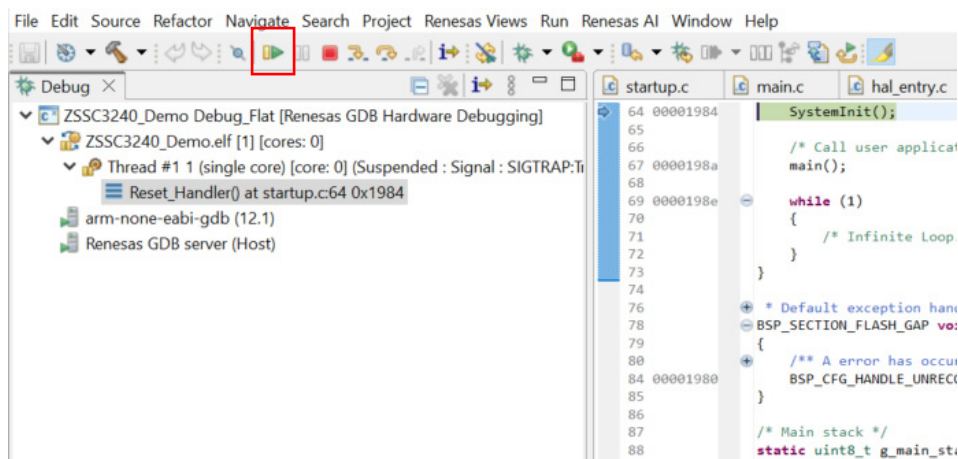


Figure 22. Running the Code

5.3 Using RTT Viewer

1. Open the [J-Link RTT Viewer](#).
2. Unplug the EK-RA6M4 from your PC and then plug it back in.
3. Press S3 on the EK-RA6M4.

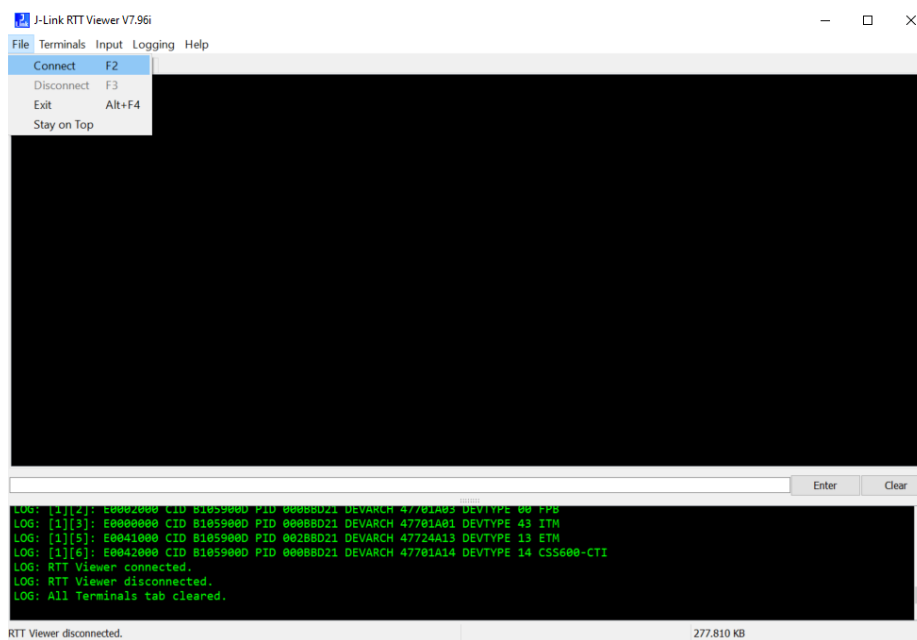


Figure 23. RTT Viewer

4. Click *File > Connect*.

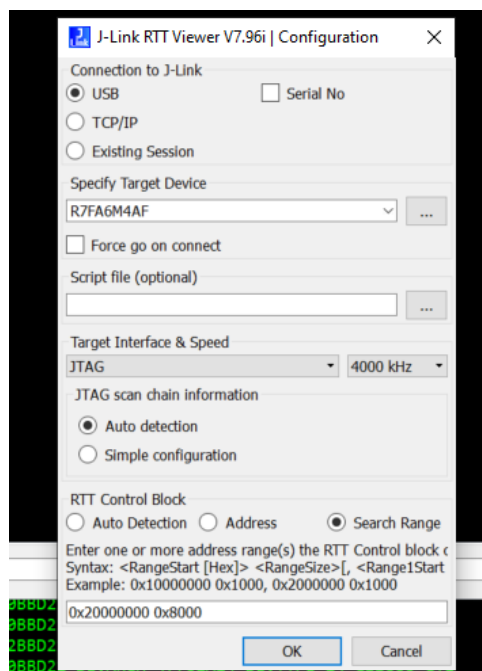


Figure 24. RTT Viewer Options

5. Ensure your configuration matches the configuration shown in [Figure 24](#).
 - a. Search Range: 0x20000000 0x8000.
6. Click OK.

7. The following output in the “All Terminals” tab is displayed (see [Figure 25](#)).

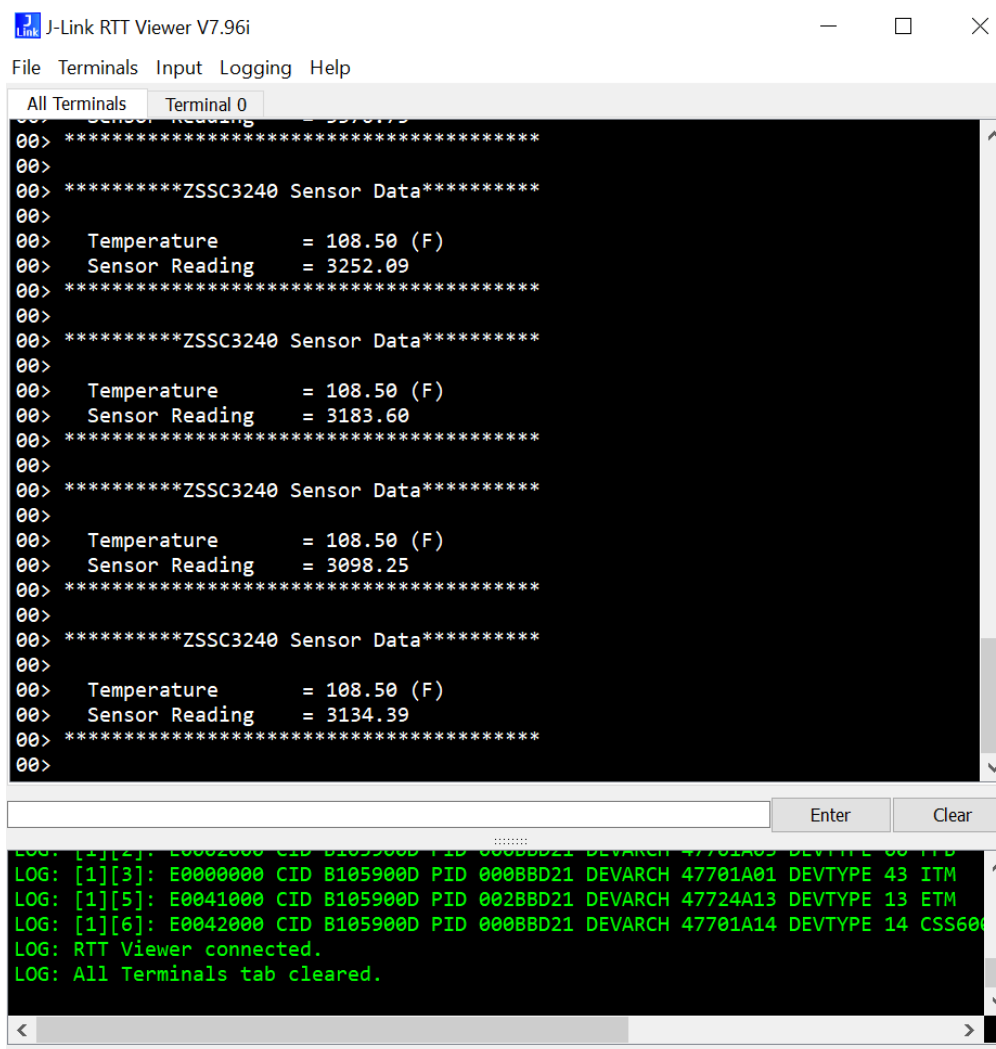
The image is a screenshot of the J-Link RTT Viewer V7.96i application window. The window has a menu bar with 'File', 'Terminals', 'Input', 'Logging', and 'Help'. Below the menu bar, there are two tabs: 'All Terminals' and 'Terminal 0'. The 'All Terminals' tab is active, displaying a black terminal window with white text. The text shows a series of sensor readings for the ZSSC3240 sensor, including Temperature (108.50 F) and Sensor Reading (3252.09, 3183.60, 3098.25, 3134.39). Below the sensor data, there is a section of green text logs showing various system messages, including 'LOG: RTT Viewer connected.' and 'LOG: All Terminals tab cleared.' The terminal window has a scrollbar on the right side. Below the terminal window, there are two buttons: 'Enter' and 'Clear'.

Figure 25. Demo Output

6. References

Use the following links to learn about key elements of the RA family, download components, related documentation, and obtain support.

[ZSSC3240 Product Page](#)

[e2 Studio Website](#)

[RA Product Information](#)

[RA Product Support Forum](#)

[RA Flexible Software Package](#)

[Renesas Support](#)

7. Ordering Information

Part Number	Description
US082-SSC3240EVZ	Sensor Signal Conditioner Pmod Board

8. Revision History

Revision	Date	Description
1.00	Mar 21, 2025	Initial release.

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