

LoRa®-based Wireless Software Package

Quick Start Guide

1. Hardware Setup

This software package supports the following hardware configurations.

- RL78/G23-64p Fast Prototyping Board + Semtech SX1261/SX1262 Shield + Sensor (Optional).
This configuration is provided to simply run the pre-compiled sample applications for RL78/G23.
For more detail, please refer to [Hardware Basic Setup for RL78/G23-64p Fast Prototyping Board](#)
- RL78/G23-64p Fast Prototyping Board + Semtech SX1261/SX1262 Shield + Sensor (Optional) + E2Lite
This configuration is provided to develop software based on the sample applications for RL78/G23.
For more detail, please refer to [Hardware Advanced Setup for RL78/G23-64p Fast Prototyping Board](#)
- RL78/G14 Fast Prototyping Board + Semtech SX1261/SX1262 Shield + Sensor (Optional)
This configuration is provided to run the pre-compiled sample application or develop software based on the sample applications for RL78/G14.
For more detail, please refer to [Hardware Setup for RL78/G14 Fast Prototyping Board](#)

REFERENCES:

For more detail of each boards, please refer to the following websites.

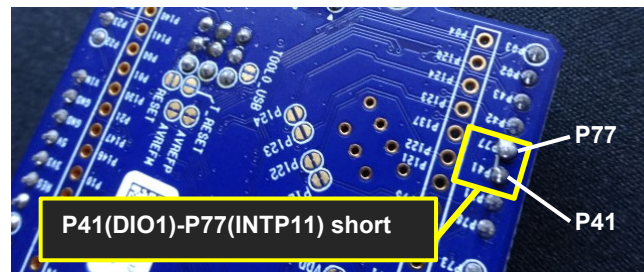
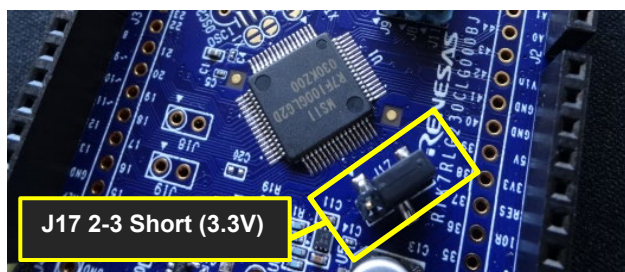
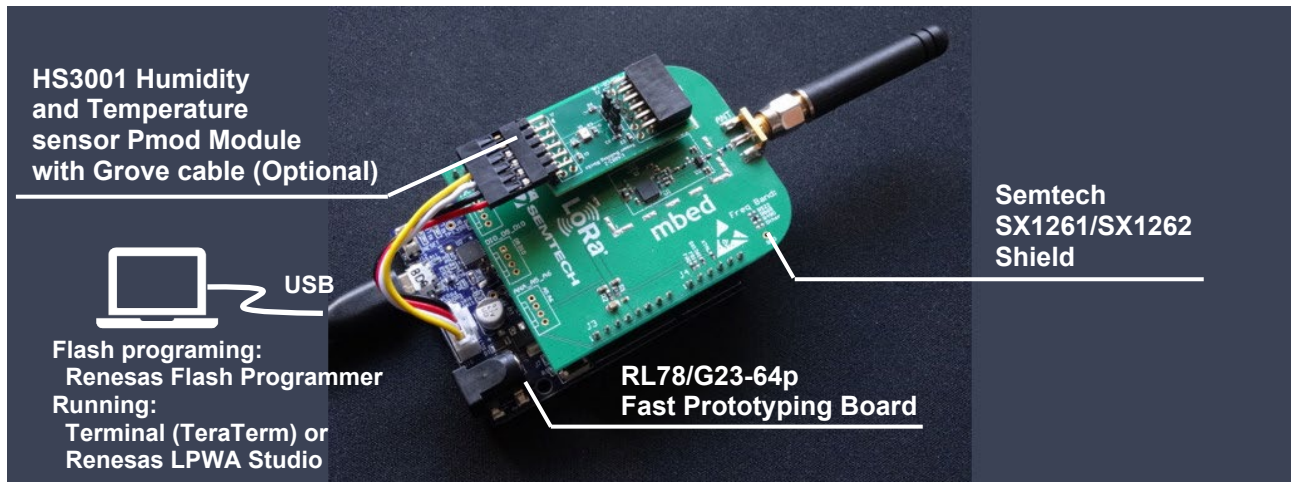
- RL78/G23-64p Fast Prototyping Board (RTK7RLG230CLG000BJ) (https://www.renesas.com/rl78g23-64p_fpb)
- RL78/G14 Fast Prototyping Board (RTK5RLG140C00000BJ) (<https://www.renesas.com/rl78fpb>)
- Semtech SX1261 Shield (<https://www.semtech.com/products/wireless-rf/lora-transceivers/sx1261>)
- Semtech SX1262 Shield (<https://www.semtech.com/products/wireless-rf/lora-transceivers/sx1262>)
- Digilent Pmod USBUART (<https://reference.digilentinc.com/reference/pmod/pmodusbuart/start>)
- Renesas HS3001 Humidity and Temperature Sensor Pmod Module (US082-HS3001EVZ)
For more information about this module, please contact Renesas.

IMPORTANT:

The use of wireless receivers and transmitters is restricted by international standards and domestic regulations. Wireless receivers and transmitters must therefore be used in accordance with the applicable laws and regulations of the country in which they are being used.

1.1 Hardware Basic Setup for RL78/G23-64p Fast Prototyping Board

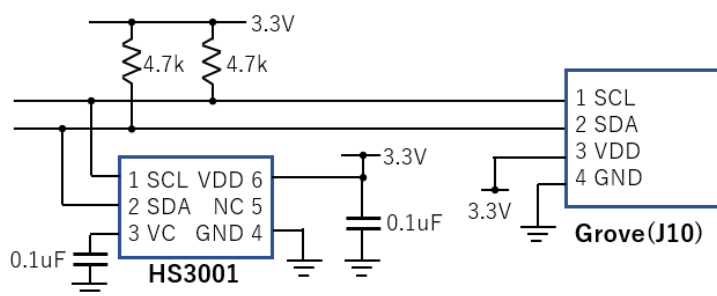
This configuration is provided to simply run the pre-compiled sample applications for RL78/G23. Please setup the boards and cables shown as below.



NOTE1: Power supply selection header (J17: default 5V) should be changed to 3.3V(J17 2-3 short).

NOTE2: P41(SX126x.DIO1 interrupt signal) and P77(RL78/G23.INTP11) should be short by jumper wire.

NOTE3: HS3001 (Humidity and Temperature Sensor) should be connected to the Grove(J10) connector.



IMPORTANT:

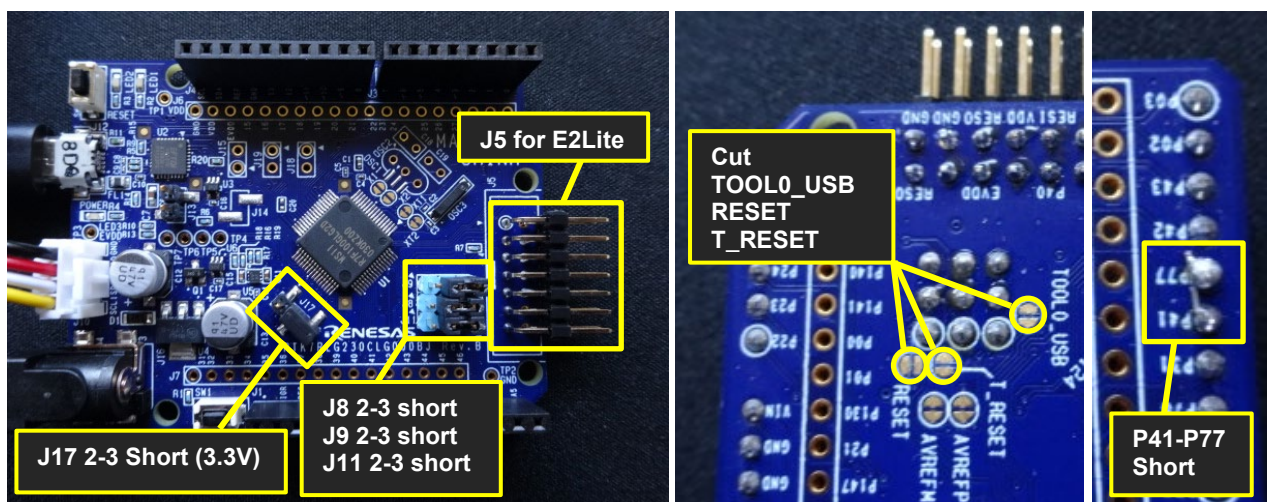
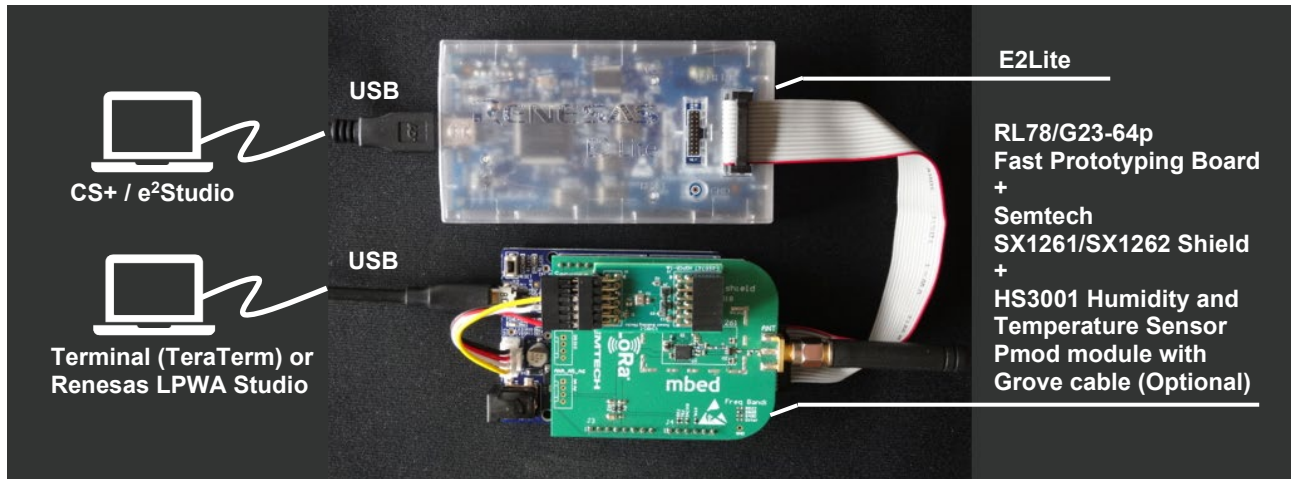
In this configuration, the RL78/G23 is reset when you connect or reconnect the COM Port associated with RL78/G23-64p Fast Prototyping Board. After connecting to the COM port, you should wait for 2-3 seconds for the MCU to boot up before sending AT commands.

If you don't want the MCU to be reset when the COM port is re-connected, there is a workaround below.

- Cut pattern on RESET (See next section)
- Install the 3pin header on J11(See next section)
- J11 1-2 short for downloading a sample application.
- J11 2-3 short for running a sample application.

1.2 Hardware Advanced Setup for RL78/G23-64p Fast Prototyping Board

This configuration is provided to develop the software based on the sample applications for RL78/G23. To debug the software, E2Lite is required because all sample applications use the USB-UART interface which is conflict with the COM Port debug interface. To enable the E2Lite debug interface, following board modification is required because RL78/G23-64p Fast Prototyping Board is configured for COM Port debug interface by default.



STEP1: Setup the board by referring the previous section.

STEP2: For E2Lite, modify the board with following instruction, and connect to the E2Lite.

Install the 14pin Dual Right Angle pin header on J5 (for E2Lite).

Install the 3pin header on J8, J9 and J11. Short 2-3.

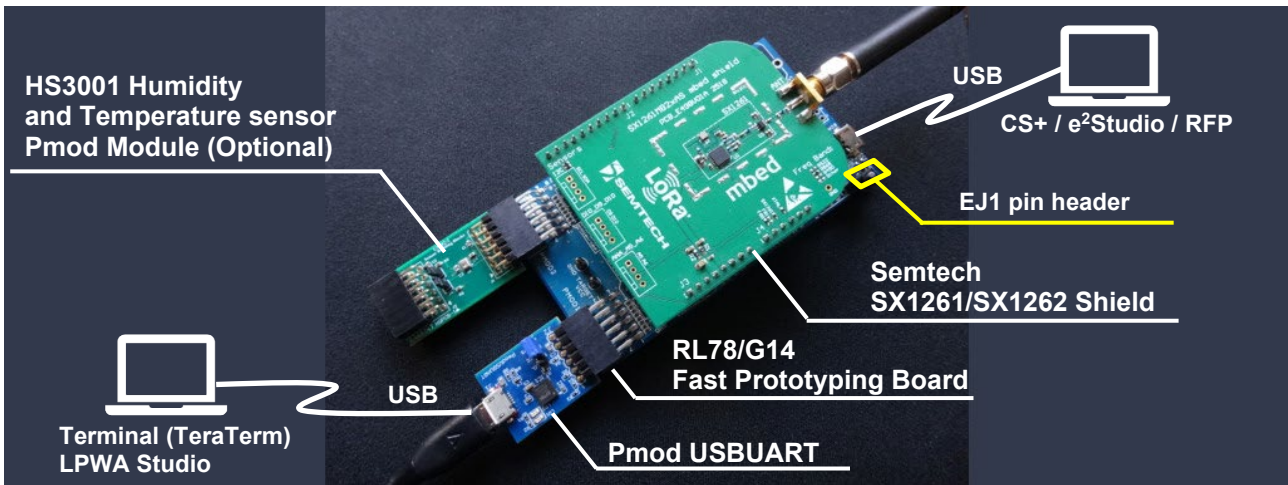
Cut pattern on TOOL0_USB, RESET and T_RESET.

For more detail regarding E2Lite integration, please refer to the following websites.

- RL78/G23-64p Fast Prototyping Board (RTK7RLG230CLG000BJ)(https://www.renesas.com/rl78g23-64p_fpb)

1.3 Hardware Setup for RL78/G14 Fast Prototyping Board

This configuration is provided to run the pre-compiled sample application or develop software based on the sample applications for RL78/G14. Please setup the boards and cables shown as below.

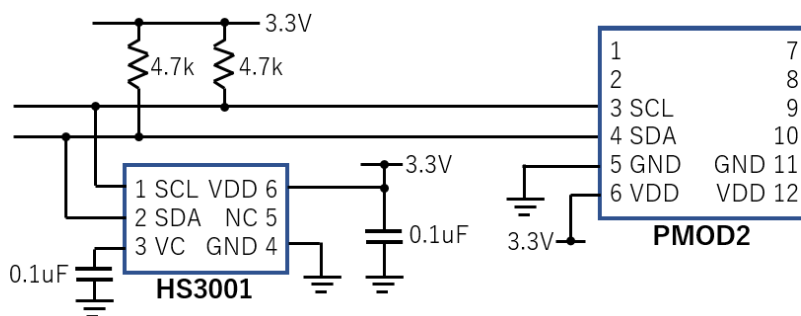


NOTE1: For Flash Programming or Debugging with IDE(CS+/e²studio), EJ1 pin header should be OPEN.

After Flash Programming, standalone operation w/o IDE can be enabled by setting EJ1 to SHORT.

NOTE2: Pmod USBUART(USB-Serial Converter) should be connected to the PMOD1 connector.

NOTE3: HS3001 (Humidity and Temperature Sensor) should be connected to the PMOD2 connector.



2. Sample Application Software Setup

This software package includes the following sample applications.

- RadioEvalApp (Radio Evaluation Program with AT-command)
- ping-pong (simple application using radio driver, source code only)
- LoRaSample (LoRaWAN sample application with AT-command)
- LoRaFuotaSample (Firmware Update over LoRaWAN sample application with AT-command)

2.1 Software setup for simply run the pre-compiled sample applications.

STEP1. Install the Renesas Flash Programmer V3.08.2 or later.

STEP2. Download the sample application (.mot file) to the MCU with Renesas Flash Programmer.

Click "File" > Click "New Project .."

Microcontroller:

Choose "RL78/G23" for RL78/G23-64p Fast Prototyping Board.

Choose "RL78" for RL78/G14 Fast Prototyping Board.

Project Name: any (e.g. "sample1")

Project Folder: any (e.g. "C:\Temp\rfp")

Communication:

For RL78/G23-64p Fast Prototyping Board

Tool: "COM port", Interface: "2 wire UART", Click "Tool Dtails.." > Select your COM Port

For RL78/G14 Fast Prototyping Board

Tool: "E2 emulator Lite"

Click "Connect"

Choose pre-compiled sample application file (e.g. RadioEvalApp.mot).

pre-compiled sample application file are located in

(package top)\samples\project\e2studio\{BOARD}\{APPS}\DefaultBuild\{APPS}.mot

{BOARD} : rl78g23-64pfpb_sx126x or rl78g14fpb_sx126x,

{APPS} : RadioEvalApp, LoRaSample, LoRaFuotaSample.

NOTE1: LoRaFuotaSample does not support RL78/G23-64p Fast Prototyping Board.

Click "Start". If OK is shown, Click "File" > "Exit"

STEP3. Connect to the sample application with TeraTerm or Renesas LPWA Studio.

2.2 Software setup for developing software based on the sample applications.

STEP1. Install the following IDE and C compiler.

CS+ for CC V8.05.00 with CC-RL V1.10

(For RL78/G23, you should install "Device Information for RL78 V8.05.01" by CS+ Update Manager)

or e2studio 2021-04 with CC-RL V1.10

STEP2. Open project file with CS+ or Import project file with e²studio.

The project files are located in

(package top)\samples\project\{IDE}\{BOARD}\{APPS}\

{IDE} : csplus or e2studio,

{BOARD} : rl78g23-64pfpb_sx126x or rl78g14fpb_sx126x,

{APPS} : RadioEvalApp, ping-pong, LoRaSample, LoRaFuotaSample.

NOTE1: LoRaFuotaSample does not support RL78/G23-64p Fast Prototyping Board.

NOTE2: All project files are configured to use the E2Lite as debug interface by default.

STEP3. Build and Run.

IMPORTANT:

All binaries and project files are developed by preliminary version of CS+/e2studio. The files developed by official version of CS+/e2studio will be release in the next release.

3. Utility Tools Setup for Windows 10

- Renesas LPWA Studio (Windows GUI frontend for RadioEvalApp)
Double-Click following windows installer.

(package top)\samples\tools\RLPWASudio\setup.exe

If you use this tool with Wireshark, additional setup is required.

For more detail, please refer to User's Manual located in (package top)\documents\RLPWASudio\

- Renesas LPWA Power Estimator (Windows Excel application program)
No setup is required. Only open the following excel sheet.

(package top)\samples\tools\RLPWAPowerEstimator\RLPWAPowerEstimator.xlsx

Revision History

Rev.	Date	Description	
		Page	Summary
1.20	Nov. 29, 2019	All	Initial version.
1.30	Apr. 9, 2020	Notice	Fixed the notification regarding trademarks.
2.10	July 10, 2020	2	Delete LoRaMAC/classA, LoRaMAC/classC
2.20	Oct. 8, 2020	1	Add optional HS3001 sensor module.
		2	Add LoRaFuotaSample
3.00	Mar. 24, 2021	ALL	Supports RL78/G23-64p Fast Prototyping Board.
		5	Change supported development tool version.

General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)

A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity.

Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

2. Processing at power-on

The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.

3. Input of signal during power-off state

Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

4. Handling of unused pins

Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.

5. Clock signals

After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.

6. Voltage application waveform at input pin

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).

7. Prohibition of access to reserved addresses

Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

8. Differences between products

Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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