

INTRODUCTION OF IOT SOLUTIONS FOR RL78 FAMILY

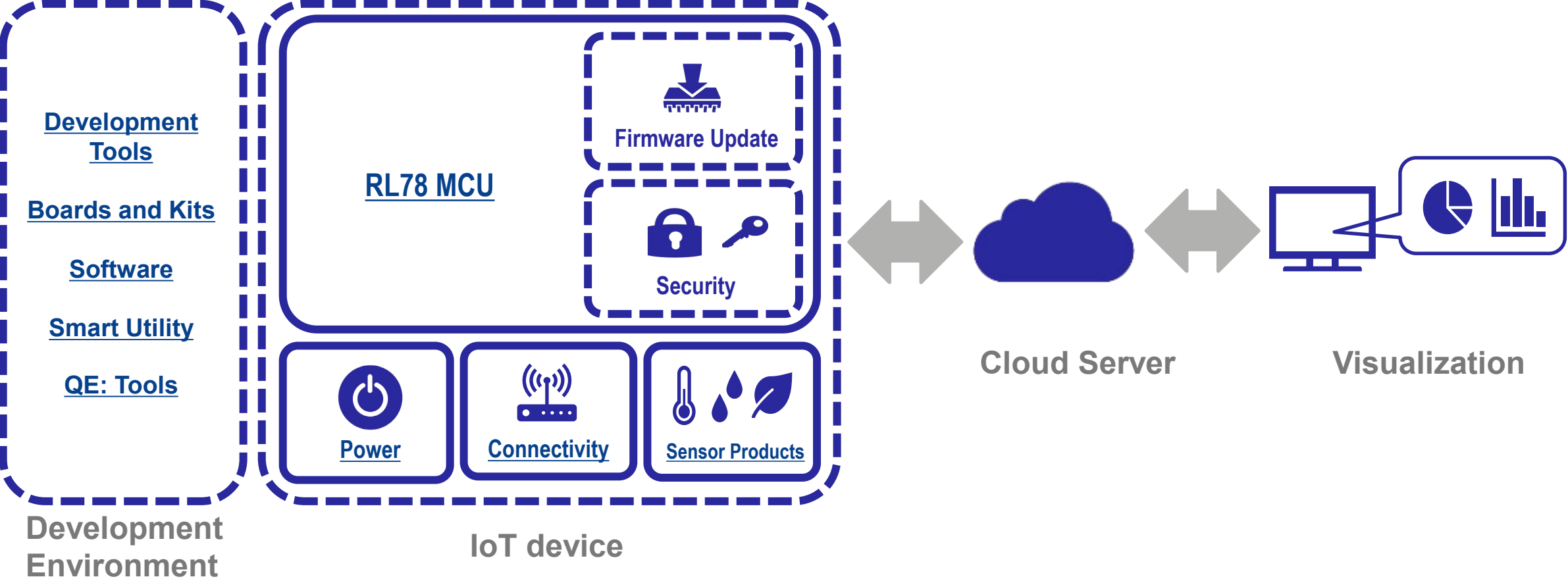
20TH, NOV., 2024

EP2P-AA-24-0450 REV.1.10

EMBEDDED PROCESSING 2ND BUSINESS DIVISION
EMBEDDED PROCESSING PRODUCT GROUP
RENESAS ELECTRONICS CORPORATION





RL78 FAMILY IOT SOLUTIONS

By using the RL78 family, it is possible to develop IoT device that take advantage of features such as the industry's highest level of low power consumption. We offer various evaluation kits, an easy-to-use development environment (e2 studio and so on), and software solutions for connectivity, sensing, firmware updates, and security to enable IoT.





SOLUTIONS TO REALIZE IOT (1)

Renesas provides various software solutions for IoT development using RL78.

<p>Connectivity</p> 	<ul style="list-style-type: none">• <u>LoRa®-based Solutions for RL78 Family</u>• <u>LTE RYZ024A MQTT Communication</u>• <u>US159-DA14531EVZ BLE Control Module Using Software Integration System</u>• <u>HS300x sensor data communication with Bluetooth LE DA14531</u>• <u>US159-DA16XXXMEVZ Wi-Fi Control Module Using Software Integration System</u>• <u>Wireless Communication with the XBee ZB 2SC and HS300x (AT Solution)</u>• <u>Wi-Fi Communication (Soft AP mode) with DA16200/DA16600</u>
<p>Sensing</p> 	<ul style="list-style-type: none">• <u>Sensor Software Modules for Renesas MCU Platforms</u> Humidity and Temperature, Air Velocity Sensor, Air Quality Sensor, and so on
<p>Firmware updates</p> 	<ul style="list-style-type: none">• <u>Firmware Update Module</u>• <u>Updating Firmware by Using UART Communication and Boot Swapping</u>• <u>Firmware Upgrade Using External Flash Memory via Simplified SPI (CSI) Communication</u>
<p>Security</p> 	<ul style="list-style-type: none">• <u>Crypto Library</u> AES Library, RSA Library, SHA Hash Function Library

SOLUTIONS TO REALIZE IOT (2)

Renesas provides various software solutions for IoT development using RL78.

<p>Cloud connection</p> 	<ul style="list-style-type: none">• <u>Software for cloud connectivity</u>
<p>Firmware update OTA</p> 	<ul style="list-style-type: none">• <u>Remote Firmware Update via OTA</u>

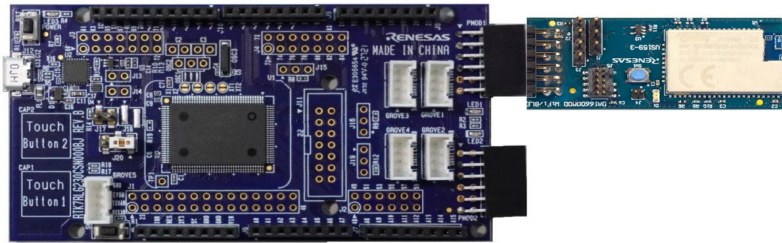
CLOUD CONNECTION

For cloud connectivity, it supports FreeRTOS, a real-time OS for IoT device development provided by Amazon Web Services (AWS). The evaluation board program has AWS device certification, so you can start development immediately. We support your IoT development with various application notes such as visualization of data uploaded to the cloud and OTA firmware updates.

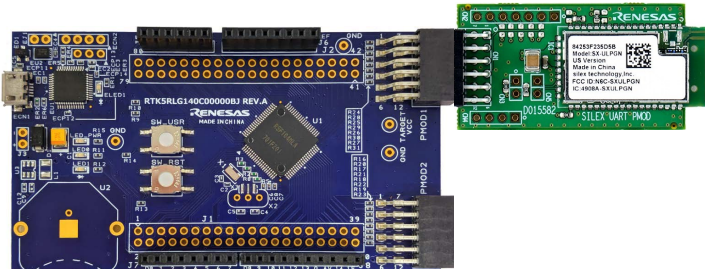
RL78 MICROCONTROLLER EVALUATION BOARD FOR CLOUD CONNECTIVITY

The following evaluation boards that use Wi-Fi and Cellular communications are AWS certified and listed in [AWS Partner Device Catalog](#). (Environments of older OS versions are also included for reference.)

W-Fi Environment

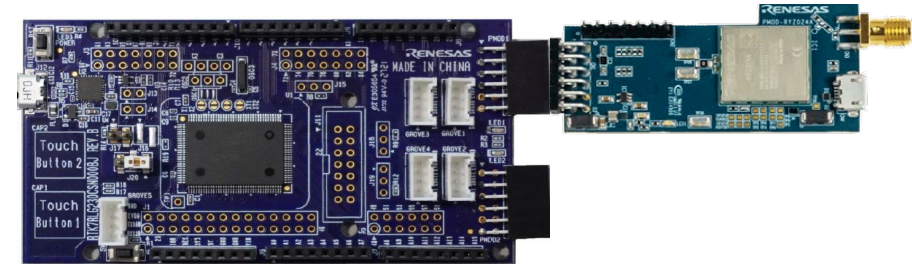


[RL78/G23-128p Fast Prototyping Board
US159-DA16600EVZ](#)



[RL78/G14 Fast Prototyping Board
RTK00WFMX0B](#)

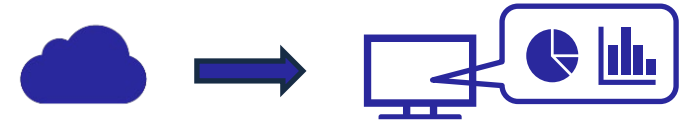
Cellular Environment



[RL78/G23-128p Fast Prototyping Board
RTKYZ024A0B00000BE](#)

The existing LTE module RYZ024A will no longer be manufactured and shipped. Sequans' product model number GM02S is pin- and function-compatible replacement.

SOFTWARE FOR CLOUD CONNECTIVITY



To import AWS certified software, please refer to the “Getting Started Guide”. For cloud connectivity, see “How to Connect to Amazon Web Services with FreeRTOS.” We also provide an application note explaining how to visualize sensor information. (Environments of older OS versions are also included for reference.)

Wi-Fi Environmentwith

- Using DA16600MOD [RL78/G23 Getting Started Guide for Connecting Amazon Web Services in Wi-Fi Communication: RL78/G23-128p Fast Prototyping Board + FreeRTOS](#)
 - [RL78/G23 Getting Started Guide for Connecting Amazon Web Services in Wi-Fi Communication: RL78/G23-128p Fast Prototyping Board + FreeRTOS - Sample Code](#)
 - * FreeRTOS 202210.01 LTS Library, OTA dataplane MQTT
- Using SX-ULPGN [RL78/G23 Connecting AWS Cloud with FreeRTOS Getting Started Guide for RL78/G23-128p Fast Prototyping Board](#)
 - [RL78/G23 Connecting to Amazon Web Services Using FreeRTOS with RL78/G23-128p FPB](#)
 - [RL78/G23 Visualization of Sensor Information on Amazon Web Services using RL78/G23-128p FPB and FreeRTOS](#)
 - * AWS Service FreeRTOS 202012.00 Wi-Fi Integration
- Using SX-ULPGN [Getting started with the RL78/G14 Fast Prototyping Board / WiFi-Pmod-Expansion-Board](#)
 - [RL78/G14 Group Connecting to Amazon Web Services Using FreeRTOS with RL78/G14 FPB](#)
 - [RL78/G14 Group Visualization of Sensor Information on Amazon Web Services using RL78/G14 FPB and FreeRTOS](#)
 - * AWS Service FreeRTOS 202002.00 Wi-Fi Integration

Cellular Environment

- [RL78/G23 Getting Started Guide for Connecting Amazon Web Services in LTE Communication: RL78/G23-128p Fast Prototyping Board + FreeRTOS](#)
 - [RL78/G23 Group Connecting to Amazon Web Services in LTE communication using FreeRTOS with RL78/G23 FPB](#)
 - [RL78/G23 Visualization of Sensor Information with Connecting Amazon Web Services in LTE Communication: RL78/G23-128p Fast Prototyping Board + FreeRTOS - Sample Code](#)
 - * FreeRTOS 202210.01 LTS Library, OTA dataplane MQTT

REMOTE FIRMWARE UPDATE VIA OTA (1)



The RL78 MCU, which supports AWS FreeRTOS, can perform OTA (Over The Air) firmware updates using the cloud (AWS). We provide an application note to easily incorporate the firmware update function into your system, and a [development support tool \(QE for OTA\)](#) to easily try out OTA (Over The Air).

- [RL78/G22,RL78/G23,RL78/G24 Firmware Update Module](#)
- [QE for OTA: Development Assistance for Cloud](#)

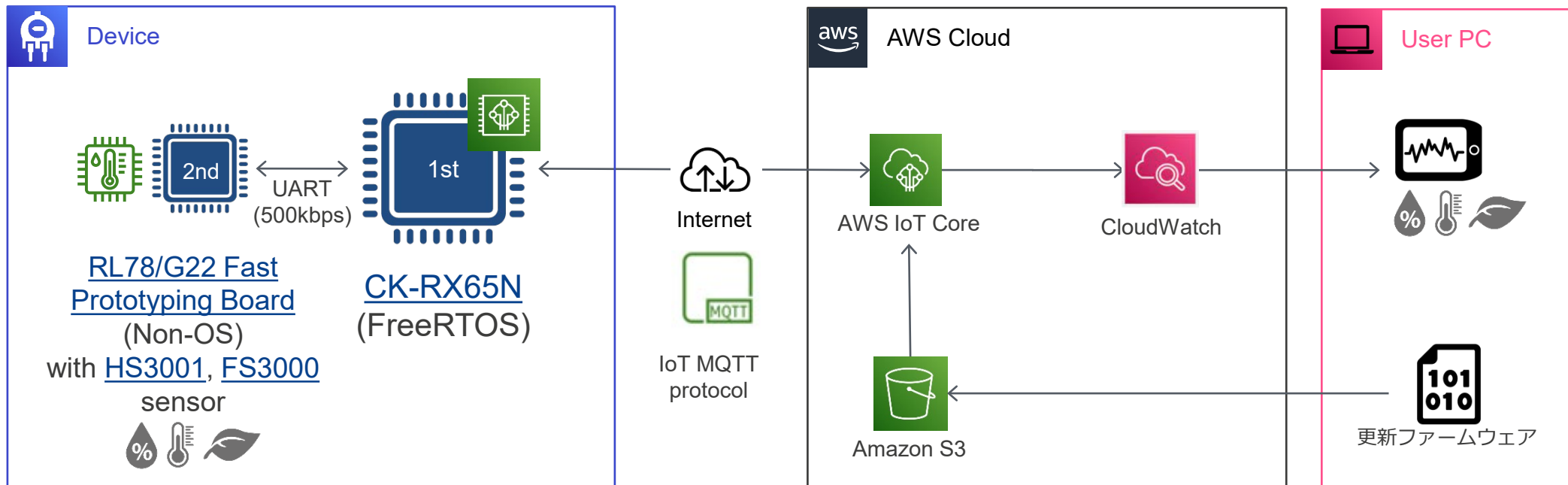
REMOTE FIRMWARE UPDATE VIA OTA (2)



We also provide a sample program that enables OTA firmware update of the 2nd MCU (RL78/G22) connected via a communication path via the 1st MCU (RX65N) with AWS FreeRTOS communication function.

- **RL78/G22 OTA Firmware Update for a Secondary MCU**

Configure OTA firmware update for secondary MCU:



PARTNER ECOSYSTEM

Renesas is enabling a comprehensive partner ecosystem to deliver an array of software and hardware building blocks that will work out-of-the-box with [Renesas RL78 Family MCUs](#).

Renesas RL78 Partner Ecosystem Solutions

- [Security & Safety](#)
- [Connectivity & Cloud](#)

APPENDIX



BOARDS & KITS

Main boards & kits related to RL78 IoT solutions

	<u>RTK7RLG230CSN000BJ - RL78/G23-128p Fast Prototyping Board (RL78/G23-128p FPB)</u>
	<u>RTK7RLG220C00000BJ - RL78/G22 Fast Prototyping Board (RL78/G22 FPB)</u>
	<u>RTK5RLG140C00000BJ - RL78/G14 Fast Prototyping Board (RL78/G14 FPB)</u>
	<u>US159-DA16600EVZ - Ultra-Low-Power Wi-Fi + Bluetooth Low Energy Combo Pmod Board</u>
	<u>RTK00WFMX0B - 802.11b/g/n 2.4G Wi-Fi Pmod Expansion Board</u>
	<u>RTKYZ024A0B00000BE - PMOD Expansion Board for RYZ024A</u>

DOCUMENTATION (CONNECTIVITY)

[RL78/G22 Wi-Fi Communication \(Soft AP mode\) with DA16200/DA16600](#) [日本語](#) Related Files:[Sample Code](#)

[RL78 Family US159-DA14531EVZ BLE Control Module Using Software Integration System](#) Related Files:[Sample Code](#)

[RL78 Family US159-DA16XXXMEVZ Wi-Fi Control Module Using Software Integration System](#) Related Files:[Sample Code](#)

[RL78/G15 HS300x sensor data communication with Bluetooth LE DA14531 Application Note](#) [日本語](#) Related Files:[Sample Code](#)

[RL78/G15 Wireless Communication with the XBee ZB 2SC and HS300x \(AT Solution\)](#) [日本語](#) Related Files:[Sample Code](#)

[RL78/G22 LTE MQTT Communication Application Note](#) [日本語](#) Related Files:[Sample Code](#)

[RL78/G15 Wireless Communication with the XBee ZB S2C and HS300x](#) [日本語](#) Related Files:[Sample Code](#)

[LoRaWAN® Stack Reference Guide](#)

[LoRaWAN® Stack Sample Application](#)

[RL78/G23, RL78/G22, RL78/G14 LoRaWAN® Sensor Demo](#) Related Files:[Sample Code](#)

[RL78/G23, RL78/G22, RL78/G14 LoRa®-based Wireless Software Package](#) Related Files:[Sample Code](#)

DOCUMENTATION (SENSING)

[Sensor Software | Renesas](#)

[Sensor Software Combination Manual](#) [日本語](#)

[RL78 Family Sensor Control Modules Software Integration System](#)

[RL78 Family ZMOD4410, ZMOD4450 and ZMOD4510 Sensor Control Module Software Integration System](#) Related Files:[Sample Code](#)

[RL78 Family Renesas FS3000 Sensor Control Module Software Integration System](#) Related Files:[Sample Code](#)

[RL78 Family Renesas RRH46410 Sensor Control Module Software Integration System](#) Related Files:[Sample Code](#)

[RL78 Family FS2012 Sensor Control Module Software Integration System](#) Related Files:[Sample Code](#)

[RL78 Family HS400X Sensor Control Module Software Integration System](#) Related Files:[Sample Code](#)

[RL78 Family FS1015 Sensor Control Module Software Integration System](#) Related Files:[Sample Code](#)

[RL78 Family OB1203 Sensor Control Module Software Integration System](#) Related Files:[Sample Code](#)

[RL78 Family Sensor I2C Communication Middleware Control Module Software Integration System](#) Related Files:[Sample Code](#)

[RL78/G23 SMS HS300x Humidity sensor control by I2C communication Application Notes Rev.1.10](#) [日本語](#) Related Files:[Sample Code](#)

DOCUMENTATION (SECURITY)

[Crypto Library | Renesas](#)

[RL78/G24 FAA AES Library Introduction Guide](#) [日本語](#) Related Files:[Sample Code](#)

[RL78 Family How to change devices in the sample project for the DSP Library and the Security Library](#) [日本語](#)

[RL78 Family SHA Hash Function Library: Introduction Guide](#) [日本語](#) Related Files:[Sample Code](#)

[RL78 Family AES Library: Introduction Guide](#) [日本語](#) Related Files:[Sample Code](#)

[RL78 Family RSA Library: Introduction Guide](#) [日本語](#) Related Files:[Sample Code](#)

DOCUMENTATION (FIRMWARE UPDATE)

[RL78/G22 OTA Firmware Update for a Secondary MCU](#) [日本語](#) Related Files:[Sample Code](#)

[RL78/G22, RL78/G23, RL78/G24 Firmware Update Module](#) [日本語](#) Related Files:[Sample Code](#)

[RL78/G23 Updating Firmware by Using UART Communication and Boot Swapping](#) [日本語](#) Related Files:[Sample Code](#)

[RL78/G23 Firmware Upgrade Using External Flash Memory via Simplified SPI \(CSI\) Communication Rev.1.00 \(renesas.com\)](#) [日本語](#)
Related Files: [Sample Code](#)

DOCUMENTATION (CLOUD CONNECTION WITH VISUALIZATION)

[Getting Started Guide for Connecting Amazon Web Services in Wi-Fi Communication: RL78/G23-128p Fast Prototyping Board + FreeRTOS](#) [Related Files:Sample Code](#) Using DA16600MOD

[RL78/G23 Connecting to Amazon Web Services Using FreeRTOS with RL78/G23-128p Fast Prototyping Board](#) [日本語](#) Using SX-ULPGN

[RL78/G23 Getting Started Guide for Connecting Amazon Web Services in LTE Communication: RL78/G23-128p Fast Prototyping Board + FreeRTOS](#) [日本語](#) [Related Files:Sample Code](#) Using SX-ULPGN

[RL78/G23 Visualization of Sensor Information on Amazon Web Services using RL78/G23-128p Fast Prototyping Board and FreeRTOS](#) [日本語](#) [Related Files:Sample Code](#) Using SX-ULPGN

[Getting started with the RL78/G14 Fast Prototyping Board / Wi-Fi-Pmod-Expansion-Board](#) Using SX-ULPGN

[RL78/G14 Group Connecting to Amazon Web Services Using FreeRTOS with RL78/G14 Fast Prototyping Board](#) [日本語](#)
[Related Files:Sample Code](#) Using SX-ULPGN

[RL78/G14 Group Visualization of Sensor Information on Amazon Web Services using RL78/G14 Fast Prototyping Board and FreeRTOS Application Note](#) [日本語](#) [Related Files:Sample Code](#) Using SX-ULPGN

[RL78/G23 Getting Started Guide for Connecting Amazon Web Services in LTE Communication: RL78/G23-128p Fast Prototyping Board + FreeRTOS Rev.1.00](#) [日本語](#) [Related Files:Sample Code](#)

[RL78/G23 Visualization of Sensor Information with Connecting Amazon Web Services in LTE Communication: RL78/G23-128p Fast Prototyping Board + FreeRTOS](#) [日本語](#)[Related Files:Sample Code](#)



VIDEOS (1)

[RL78 Family LTE CAT-M1 MQTT Communication Solution \[06:12\]](#)

This video will show the steps to operate MQTT communication for send and receive (Publish/Subscribe) via MQTT Broker in an LTE CAT-M1 cellular communication.

[RL78 Family Secondary Device OTA Update Solution \[6:14\]](#)

This video will show the steps to operate the secondary device OTA firmware update solution via primary device with the AWS Cloud, tailored for low-end microcontrollers lacking direct internet connectivity.

[RL78/G23 Quick Start Guide - Visualizing Sensor Info with AWS through LTE \(Part 1\) \[07:36\]](#)

[RL78/G23 Quick Start Guide - Visualizing Sensor Info with AWS through LTE \(Part 2\) \[06:43\]](#)

This video guide shows how to visualize sensor information through a connection with Amazon Web Services (AWS) by LTE communications. The target MCU is an RL78/G23.



VIDEOS (2)

[RL78 LoRa®-based Solution \[03:26\]](#)

This video introduces RL78 LoRa®-based Solution. It realizes a true low-power wireless IoT system by combination of the world's top-class low power RL78 microcontroller and LoRaWAN®

[RL78 LoRaWAN® Sensor Demo Tutorial \[06:02\]](#)

This video will show you how to set up the RL78 LoRaWAN® Sensor Demo. Using the RL78 / G23 and LoRaWAN® ecosystem, you can realize both the "LoRaWAN sensor network evaluation" and "IoT system construction using LoRaWAN" with minimal man-hours.

BLOG POSTS

- [Renesas Initiatives in Smart Agriculture - Part 1](#)
- [Would You Like to Use a LoRa®-Based Solution from Renesas to Develop IoT Applications with Low Power Consumption?](#)
- [Why Not Connect to Amazon Web Services \(AWS\) with RL78?](#)

RESOURCES FOR IOT SOLUTIONS

- [IoT Cloud Solutions](#)
- [QuickConnect Platform](#)
- [Applications](#)
- [Sensor Software](#)
- [Crypto Library](#)
- [Wireless Connectivity](#)
- [\[Flyer\] RL78 Family Real-time OS](#)

REVISION HISTORY

Rev.	Date	Description
1.00	2024/ 5/ 7	1st edition
1.10	2024/11/20	<p>Main changes</p> <ul style="list-style-type: none">• Add US159-DA16XXXMEVZ Wi-Fi Control Module Using Software Integration System• Add RL78/G23 Getting Started Guide for Connecting Amazon Web Services in Wi-Fi Communication: RL78/G23-128p Fast Prototyping Board + FreeRTOS• Add RL78/G23 Visualization of Sensor Information with Connecting Amazon Web Services in LTE Communication: RL78/G23-128p Fast Prototyping Board + FreeRTOS Rev.1.00 (renesas.com)• Add RL78 Family Renesas FS3000 Sensor Control Module Software Integration System• Add RL78 Family Renesas RRH46410 Sensor Control Module Software Integration System <p>Added Boards & Kits, Documentation, and Videos related to the above.</p>

[Renesas.com](https://www.renesas.com)