

RL78/G23

Getting Started Guide for Connecting Amazon Web Services in LTE Communication: RL78/G23-128p Fast Prototyping Board + FreeRTOS

Introduction

This document describes how to connect to Amazon Web Services (AWS) by using a Renesas MCU board combined with a cellular IoT module.

Related Documents

RL78/G23 User's Manual: Hardware (R01UH0896) RL78/G22, RL78/G23, RL78/G24 Firmware Update Module (R01AN6374) RL78/G23-128p Fast Prototyping Board User's Manual (R20UT4870) Renesas Flash Driver RL78 Type 01 User's Manual (R20UT4830)



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Notes:

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1. Overview

The sample program <u>iot-reference-rl78</u> provides the reference of IoT solution with using RL78 family, AWS, and FreeRTOS. You can easily try to run AWS IoT demos while it works with our various other products.

1.1 Overview of Demo Projects

The sample program contains the following demo projects. These demo projects realize the operation for connecting to the AWS clouds by using the Renesas MCU board RL78/G23-128p Fast Prototyping Board and cellular IoT module.

Table 1-1List of demo projects

ItemName of Demo Project	Description
Demo project (PubSub)	Perform simple data upload via MQTT communication.
Demo project (OTA)	Perform firmware update via OTA.

For details about summary of each demo projects, refer to the following chapters.

- Section 2, Description of Hardware
- Section 3, Description of Software

For details about how to run the demo projects, refer to the following chapters.

- Demo project (PubSub)
 - Section 4, Setup Common to Demo Projects (PubSub and OTA)
 - Section 5, Setup Specific to Demo Project (PubSub)
- Demo project (OTA)
 - Section 4, Setup Common to Demo Projects (PubSub and OTA)
 - Section 6, Setup Specific to Demo Project (OTA)



1.2 Operation Confirmation Conditions

Demo project operations have been confirmed in the following conditions.

Table 1-2 Operation Confirmation Conditions (RL78/G23)

Item	Description	
MCU used	RL78/G23 (R7F100GSN CF 768KB)	
Board used	RL78/G23-128p Fast Prototyping Board	
	(RTK7RLG230CSN000BJ)	
Operating frequency	High-speed on-chip oscillator clock: 32 MHz	
Operating voltage	3.3 V	
IDE (Integrated Development	Renesas Electronics	
Environment)	e ² studio 2024-01.1	
C compiler	Renesas Electronics	
	CC-RL V1.12.01	
Firmware programming tool Renesas Flash Programmer V3.14.00		
Smart Configurator (SC)	Renesas Smart Configurator for RL78 24.1.0.v20231218-0132	
Board support package (BSP)	v1.60 (r_bsp)	
Flash library (RFD)	Renesas Flash Driver (RFD) RL78 Type01 for RL78/G2x V1.20	
	Note: Code Flash Libraries (Flash Self Programming Libraries) ->	
	Renesas Flash Driver RL78 Type 01 Package V1.20 for RL78/G2x	
Firmware update module (FWUP)	RL78/G22,RL78/G23,RL78/G24 Firmware Update Module v2.01	
Utility tool to generate firmware images	Renesas Image Generator V3.03	
	Note: Included in the firmware update module (FWUP)	
Python	Python 3.10.1	
OpenSSL	OpenSSL 3.1.4	



Item	Description
iot-reference-rl78	v202210.01-LTS-rl78-1.0.0 (Based FreeRTOS 202210.01-LTS)
	https://github.com/renesas/iot-reference-rl78/tree/v202210.01-LTS-
	<u>rl78-1.0.0</u>
FreeRTOS Cellular Interface	1.3.0
	https://github.com/FreeRTOS/FreeRTOS-Cellular-Interface
FreeRTOS Kernel	10.5.1
	https://github.com/FreeRTOS/FreeRTOS-Kernel
backoffAlgorithm	1.3.0
	https://github.com/FreeRTOS/backoffAlgorithm
coreJSON	3.2.0
	https://github.com/FreeRTOS/coreJSON
coreMQTT Client	2.1.1
	https://github.com/FreeRTOS/coreMQTT
coreMQTT Agent	1.2.0
	https://github.com/FreeRTOS/coreMQTT-Agent
AWS IoT Over-the-air Update	3.4.0
	https://github.com/aws/ota-for-aws-iot-embedded-sdk
tinycbor	0.5.2
	https://github.com/intel/tinycbor
FreeRTOS-Plus network_transport	No version
	https://www.freertos.org/network-interface.html
Logging Interface	1.1.3
	https://github.com/aws/amazon-freertos/tree/main/libraries/logging
TinyCrypt Cryptographic Library	0.2.8
	https://github.com/intel/tinycrypt

 Table 1-3
 Operation Confirmation Conditions (Others, such as OSS Library)



1.3 Equipment List

The following lists the equipment required for the demo projects.

Table 1-4 Equipment List

Item	Description		
MCU board	RL78/G23-128p Fast Prototyping Board		
	RTK7RLG230CSN000BJ - RL78/G23-128p Fast Prototyping Board		
Cellular IoT module	PMOD Expansion Board for RYZ024A (referred to as RYZ024A hereafter)		
	RTKYZ024A0B00000BE - PMOD Expansion Board for RYZ024A		
SIM card	LTE communication must be possible.		
	Example: SIM card by Truphone bundled with <u>RTKYZ024A0B00000BE</u> (Note)		
	DHA-SIM-132 by Nippon SIM		
USB-UART conversion	Pmod USBUART		
board	https://reference.digilentinc.com/reference/pmod/pmodusbuart/start		
Micro USB Type-B cable	Used to connect the USB-UART conversion board to the PC		
x 3	Used to connect the MCU board to the PC		
	Used to supply power to RYZ024A		
Jumper wire x 3	Used to connect the USB-UART conversion board to the MCU board		
Jumper pin x 3	Pins J15, J16, and J19 are used to select the MCU board power supply.		

Note:

When using a SIM card by Truphone bundled with PMOD Expansion Board for RYZ024A (<u>RTKYZ024A0B00000BE</u>), you must activate your SIM card by the following document: <u>RA6M5 Group RYZ024A PMOD LTE Connectivity with RA6M5 MCU Quick Start Guide</u> (R21QS0007).

Overall figure of equipment connections

Refer to the followings for overall figure of equipment connections for each demo.

- demo project (PubSub): Figure 4-1 Overall Hardware Configuration of the Demo Project
- demo project (OTA): Same as above

Precaution about equipment for debugging

The demo projects use the COM port for debugging, but debugging with the emulator is also possible. When using the emulator, you need to mount the connector for connecting the emulator and change the circuit. For details, refer to section 7.2.1, Setting Jumper Pins, Mounting the Connector, and Cutting Patterns or the following manual.

Table 1-5 Debug Equipment

Description
E2 emulator Lite https://www.renesas.com/us/en/software-tool/e2-emulator-lite- rte0t0002lkce00000r



2. Description of Hardware

2.1 Demo Project (PubSub)

2.1.1 System Configuration

The following shows the system configuration of the demo project (PubSub).

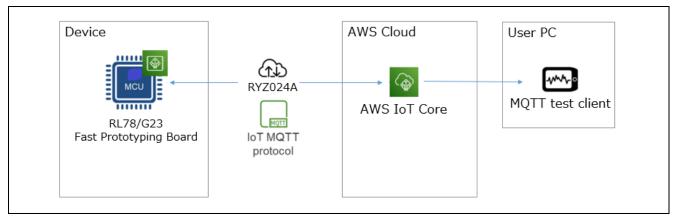


Figure 2-1 System Configuration of Demo Project (PubSub)

2.1.2 List of Pins Used

The following lists and describes the pins used with the demo project (PubSub).

Table 2-1 Pins Used with Demo Project (PubSub) and Their Functions

Pin Name	I/O	Description	
P143/RxD3	Input	UART communication (reception) with RYZ024A	
P144/TxD3	Output	UART communication (transmission) with RYZ024A	
P00	Output	Reset to RYZ024A	
P142	Output	UART communication (RTS) with RYZ024A	
P14/RxD2	Input	Terminal input	
P13/TxD2	Output	Terminal output	
P50	Output	LED1	



2.2 Demo Project (OTA)

2.2.1 System Configuration

The following shows the system configuration of the demo project (OTA).

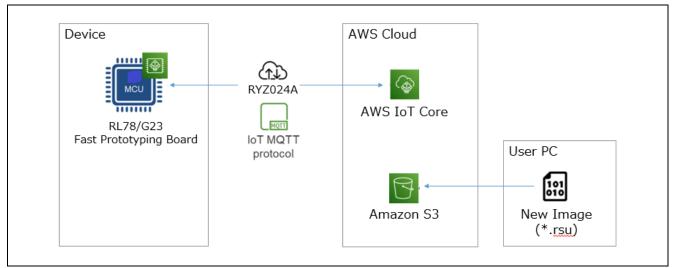


Figure 2-2 System Configuration of Demo Project (OTA)

2.2.2 List of Pins Used

The following lists and describes the pins used with the demo project (OTA).

Table 2-2 Pins Used with Demo Project (OTA) and Their Functions

Pin Name	I/O	Description
P143/RxD3	Input	UART communication (reception) with RYZ024A
P144/TxD3	Output	UART communication (transmission) with RYZ024A
P00	Output	Reset to RYZ024A
P142	Output	UART communication (RTS) with RYZ024A
P14/RxD2	Input	Terminal input
P13/TxD2	Output	Terminal output
P50	Output	LED1



3. Description of Software

3.1 Demo Project (PubSub)

3.1.1 Demo Project Structure

This demo project connects to the AWS from the MCU board, and then issues messages on a regular basis by using the MQTT library.

3.1.2 List of Option Bytes Settings

The followings show the option bytes settings.

Table 3-1 Option Bytes Settings

Address	Settings	Description	
000C0H/040C0H	11101111B	Stops the watchdog timer operation.	
		(Stops counting after the release from the reset state.)	
000C1H/040C1H	00111010B	LVD0 off (using an external reset input from the RESET pin)	
000C2H/040C2H	11101000B	HS (high-speed main) mode and	
		High-speed on-chip oscillator clock (fIH): 32 MHz	
000C3H/040C3H	10000100B	Enables on-chip debugging.	



3.2 Demo Project (OTA)

3.2.1 Demo Project Structure

The firmware update mechanism of this demo project uses the partial update method (buffer side is internal flash) provided by the firmware update module. For details, refer to "<u>RL78/G22,RL78/G23,RL78/G24</u> <u>Firmware Update Module</u>".

The following illustrates the firmware update mechanism and shows the memory map.

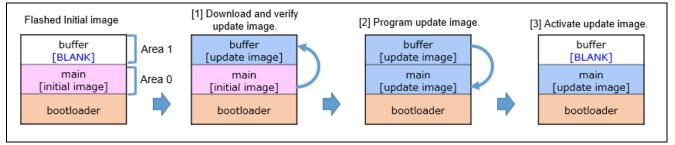


Figure 3-1 Firmware Update Mechanism

Vector tables, etc.	0x0000 0x0FFF
Main side (size=0x58000)	0x1000 - 0x11FF:Header 0x1200 - 0x12FF:List 0x1300 - 0x13FF:Vector 0x1400 - 0x58FFF:App
Buffer side (size=0x58000)	0x58FFF 0x59000 - 0x591FF:Header 0x59200 - 0x592FF:List 0x59300 - 0x593FF:Vector 0x59400 - 0xB0FFF:App
	0xB0FFF
Bootloader (size=0xF000)	0xB1000 0xBFFFF
	Main side (size=0x58000) Buffer side (size=0x58000)

Figure 3-2 Memory Map of Demo Project (OTA)



3.2.2 List of Option Bytes Settings

The followings show the option bytes settings.

Table 3-2 Option Bytes Settings

Address	Settings	Description
000C0H/040C0H	11101111B	Stops the watchdog timer operation.
		(Stops counting after reset.)
000C1H/040C1H	00111010B	LVD0 off (using an external reset input from the RESET pin)
000C2H/040C2H	11101000B	HS (high-speed main) mode and
		High-speed on-chip oscillator clock (fIH): 32 MHz
000C3H/040C3H	10000100B	Enables on-chip debugging.



3.3 Folder Structure

The following shows the folder structure of the sample program.

 Table 3-3
 Folder Structure of the Sample Program

Folder Name	Description
iot-reference-rl78	The sample program described in this Getting Started Guide.
Common	
FreeRTOS_common	
ports	
└─ota_pal	
– Configuration	
rl78g23-fpb	
	OTA demo configurations.
	PubSub demo configurations.
test	
Demos	
Common	
include	
——mqtt_agent	
-OtaOverMqtt	OTA demo source codes.
SimplePubSub	PubSub demo source codes.
IDT_config	
Application-Protocols	
hetwork_transport	
AWS	
ota-for-aws-iot-embedded-sdk	
FreeRTOS	FreeRTOS Kernel and libraries.
backoffAlgorithm	
CoreJSON	
COREMQTT	
CoreMQTT-Agent	
FreeRTOS-Cellular-Interface	
FreeRTOS-Kernel	
-Projects	
└─rl78g23-fpb	
application_code	
flash_proj	
helper	
—modules	
projects	Import below folders to IDE.
aws_ryz024a_rl78g23-fpb	PubSub demo and OTA demo. Select by Build Configurations.
boot_loader	Boot loader for OTA demo.
└──test_aws_cellular_ryz024a	
rtos_skelton	
-Test	
Tools	



3.4 Code Size

The following table shows the ROM and RAM size of demo projects confirmed in the following conditions.

- CC-RL
 - Compile options:
 - -Odefault: Optimization that is effective for both the object size and execution speed.
 - Link options:
 - -optimize=symbol_delete: Deleting variables or functions that have not been referenced even once.

Table 3-4 ROM and RAM Size of Demo Projects

Demo Project Name	ROM (byte)	RAM (byte)	
aws_ryz024a_rl78g23-fpb	142311	29913	
(demo project (PubSub))			
aws_ryz024a_rl78g23-fpb	234729	36790	
(demo project (OTA))			
boot_loader	22147	1348	



4. Setup Common to Demo Projects (PubSub and OTA)

The following describes the setup procedure applicable to demo project (PubSub) and demo project (OTA).

4.1 Hardware Setup

4.1.1 Overall Configuration

First, the following shows the overall configuration of hardware that makes up the demo project.

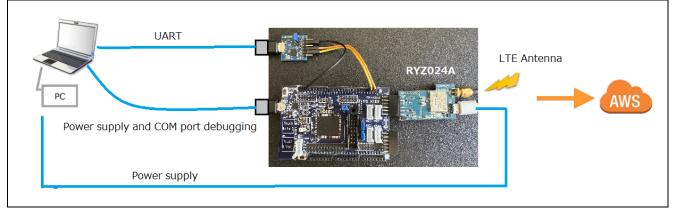


Figure 4-1 Overall Hardware Configuration of the Demo Project

4.1.2 Connecting Hardware

The following describes how to connect hardware.

(1) Insert the activated SIM cart into RYZ024A.

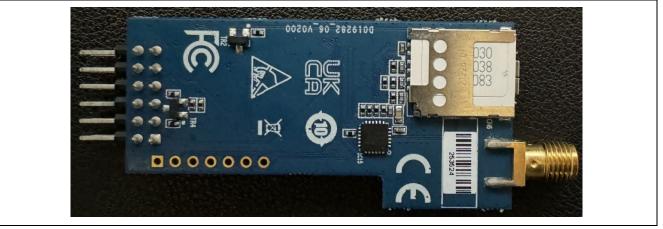


Figure 4-2 Inserting Activated SIM Cart into RYZ024A



(2) Connect the antenna and power supply USB cable to RYZ024A.



Figure 4-3 Connecting Antenna and Power Supply USB Cable to RYZ024A

(3) Connect RYZ024A to PMOD1 of the MCU board.

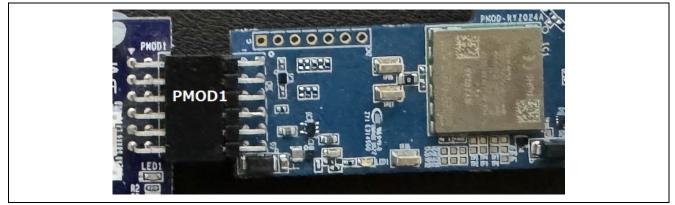


Figure 4-4 Connecting RYZ024A to PMOD1 of the MCU Board

(4) Connect the USB-UART conversion board to the MCU board.

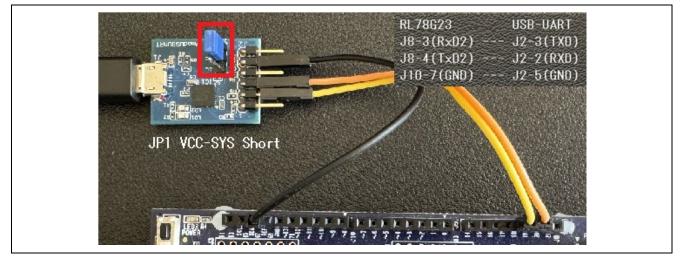


Figure 4-5 Connecting the USB-UART Conversion Board to the MCU Board



(5) On the MCU board, set the power supply selection header to J20 2-3 Short to select 3.3 V power supply.

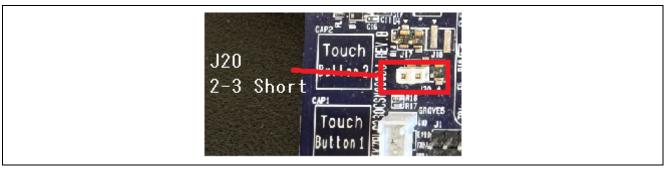


Figure 4-6 Setting MCU Board Power Supply to 3.3 V

(6) Configure the COM port debugging that uses a USB-to-serial converter.

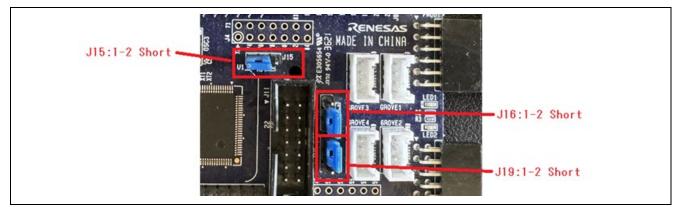


Figure 4-7 Settings for Using COM Port Debugging (Top Side)

(7) Connect the USB cable to supply power to the MCU board.

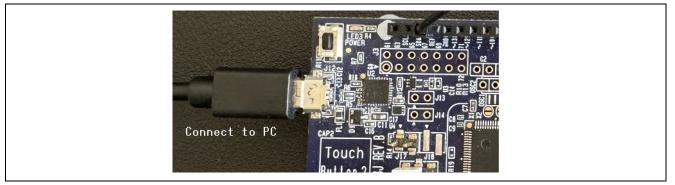


Figure 4-8 Supplying Power to the MCU Board

(8) Confirm the COM port number.

The COM port number will be used for programming and debugging firmware.

(9) Remove the USB cable to stop power supply to the MCU board.



4.2 Software Setup

4.2.1 Terminal Software Settings

Terminal software (example: Tera Term) is required to output demo project logs. The followings show the serial port settings.

Table 4-1Serial Port Settings

Item	Description
Baud rate	115200 bps
Data	8 bits
Parity	None
Stop bit	1 bit
Flow control	None

4.2.2 Installing Flash Writer

A flash writer is used for programming initial images.

Renesas Flash Programmer (Programming GUI)

4.2.3 Adding SIM Card Information to the Demo Project

Specify the SIM card information for the following macros in the demo project. Refer to a manual of your SIM card for SIM card information.

- iot-reference-rl78\Projects\rl78g23-fpb\modules\r_config\r_aws_cellular_config.h
 - AWS_CELLULAR_CFG_AP_NAME: Access point name
 - AWS_CELLULAR_CFG_AP_USERID: User ID for access point (Note 1)
 - AWS CELLULAR CFG AP PASSWORD: Password for access point (Note 1)
 - AWS_CELLULAR_CFG_PIN_CODE: PIN code (Note 2)
 - AWS_CELLULAR_CFG_AUTH_TYPE: Authentication type

Note 1: Specify an empty value for the macro if there is no information. Note 2: Specify an empty string for the macro if there is no information.

The followings show setting examples of each SIM card described in this document.

(1) Case: SIM card by Truphone bundled with RTKYZ024A0B00000BE

iot-reference-rl78\Projects\rl78g23-fpb\modules\r_config\r_aws_cellular_config.h

#define AWS_CELLULAR_CFG_AP_NAME	" <mark>iot.</mark>	truphone.com" /* Access point name */
#define AWS_CELLULAR_CFG_AP_USERID		/* Login ID */
#define AWS_CELLULAR_CFG_AP_PASSWORD		<pre>/* Access point password */</pre>
#define AWS_CELLULAR_CFG_PIN_CODE		/* SIM card PIN code */
#define AWS_CELLULAR_CFG_AUTH_TYPE	(<mark>0</mark>)	<pre>/* Authentication protocol type</pre>
(0=None,1=PAP,2=CHAP) */		



(2) Case: DHA-SIM-132 by Nippon SIM

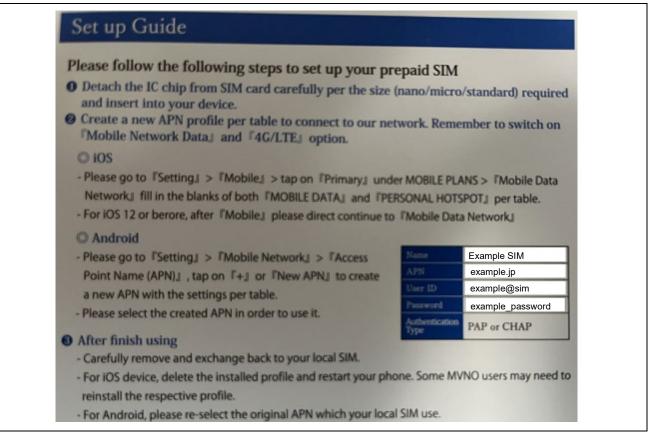


Figure 4-9 Example of SIM Card Manual

iot-reference-rl78\Projects\rl78g23-fpb\modules\r_config\r_aws_cellular_config.h

#define AWS_CELLULAR_CFG_AP_NAME	" <mark>example.jp</mark> " /* Access point name */
#define AWS_CELLULAR_CFG_AP_USERID	" <mark>example@sim</mark> " /* Login ID */
#define AWS_CELLULAR_CFG_AP_PASSWORD	" <mark>example_password</mark> " /* Access point password */
#define AWS_CELLULAR_CFG_PIN_CODE	/* SIM card PIN code */
#define AWS_CELLULAR_CFG_AUTH_TYPE	(<mark>2</mark>) /* Authentication protocol type
(0=None, 1=PAP, 2=CHAP) */	



4.2.4 Adding AWS IoT Connection Settings to the Demo Project

Add the settings required for AWS IoT connection to the demo project. The following describes the procedure.

The parts that should be changed according to the user environment are highlighted in yellow.

(1) Register the device to the IoT Core service then obtain the information (endpoint, thing name, and credential) required for connection. For details, refer to the following.

Register device to AWS IoT · renesas/iot-reference-rx Wiki · GitHub

(2) Set the endpoint and thing name to the demo project. iot-reference-rl78\Demos\include\aws clientcredential.h

```
/*
 * @brief MQTT Broker endpoint.
 * @todo Set this to the fully-qualified DNS name of your MQTT broker.
*/
#define clientcredentialMQTT BROKER ENDPOINT
                                                "YOUR ENDPOINT"
/*
* @brief Host name.
* @todo Set this to the unique name of your IoT Thing.
* Please note that for convenience of demonstration only we
* are using a #define here. In production scenarios the thing
* name can be something unique to the device that can be read
 * by software, such as a production serial number, rather
 * than a hard coded constant.
*/
#define clientcredentialIOT THING NAME
                                                 "YOUR THING NAME"
```



(3) Set the credential (client certificate and private key) to the demo project. iot-reference-rl78\Demos\include\aws_clientcredential_keys.h

Note: Add \n" to the end of each line.

```
/*
 * @brief PEM-encoded client certificate.
 * @todo If you are running one of the FreeRTOS demo projects, set this
 * to the certificate that will be used for TLS client authentication.
 * @note Must include the PEM header and footer:
 * "----BEGIN CERTIFICATE----\n"\
 * "...base64 data...\n"\
 * "----END CERTIFICATE----\n"
 */
#define keyCLIENT CERTIFICATE PEM \
"----BEGIN CERTIFICATE----\n"\
"MIIDWTCCAkGgAwIBAgIUFeYR3JSsJbTOS7huEq++YBGgwtowDQYJKoZIhvcNAQEL\n"\
. . .
"7qHumsC6fsEapoptgcfEpdER14c9hJR45jHamDVhxZjitQD4klLA0gqTlBNL\n"\
"----END CERTIFICATE----\n"
/*
 * @brief PEM-encoded client private key.
 * @todo If you are running one of the FreeRTOS demo projects, set this
...
* @note Must include the PEM header and footer:
 * "----BEGIN RSA PRIVATE KEY----\n"\
 * "...base64 data...\n"\
 * "----END RSA PRIVATE KEY----\n"
 */
#define keyCLIENT_PRIVATE_KEY_PEM \
"----BEGIN RSA PRIVATE KEY----\n"\
"MIIEowIBAAKCAQEA3Fb707jQW4lgHmPE3AInUTWUCaR7kWeWHubEk9YbNf3xwxdg\n"\
. . .
"s/OlVUiygf0RgeoMVx/3GzZPfmTrB0cQ8XZ7mxCd2dgY9UXQ/oja\n"\
"----END RSA PRIVATE KEY----\n"
```



5. Setup Specific to Demo Project (PubSub)

The following describes the setup procedure specific to the demo project (PubSub).

5.1 Preparation

None

5.2 Importing the Project

Import the aws_ryz024a_rl78g23-fpb project to e² studio. Open the Import wizard according to the following process.

File > Import... > Existing Projects into Workspace > Next

Next, select the aws_ryz024a_rl78g23-fpb project. Ensure that copy projects into workspace is not selected. Then click the Finish button.

ſ	
	👩 Import — 🗆 X
	Import Projects Select a directory to search for existing Eclipse projects.
	Select root directory: C+ C+ Kr20an0666xx0100-rl78¥ic Browse
	O Select archive file: Browse Projects:
	✓ aws_ryz024a_r178g23-fpb (C.¥ ¥r20an0666xx0100-r1i Select All
	boot_loader (C:¥ ¥r20an0666xx0100-r/78¥iot-referent test_aws_ryz024a_rl78g23-fpb (C:¥ ¥r20an0666xx010
	Rgfresh
	Coptions Search for nested projects Copy projects into workspace Clase newly imported projects upon completion Hide projects that already exist in the workspace
	Working sets
	Add project to working sets Neg
	Working sets: Sglect
	Cancel

Figure 5-1 Selecting the aws_ryz024a_rl78g23-fpb Project

The imported project is showed in the Project Explorer view.



Figure 5-2 Completing to Import the aws_ryz024a_rl78g23-fpb Project



5.3 Setting the Build Configuration

Activate the build configuration "HardwareDebug" of the aws_ryz024a_rl78g23-fpb project.

Build Configurations > Set Active > Select "HardwareDebug"



Figure 5-3 Activating Build Configuration "HardwareDebug"

5.4 Building the Demo Project

Build the aws_ryz024a_rl78g23-fpb project to create a MOT file.

Then, make sure that aws_ryz024a_rl78g23-fpb.mot has been created in the HardwareDebug folder directly under the project folder.

5.5 Preparing the MQTT Test Client

Access to the AWS Management Console, then subscribe "pubsub_demo" in the MQTT test client in the IoT Core service so that messages sent from the MCU board can be checked in text format.

(1) Select the "Subscribe to a topic" tab.

AWS IoT > MQTT test client >Select "Subscribe to a topic"

(2) Enter "pubsub_demo/#" for the topic filter, and then click "Subscribe".

Services Q	Search		[Alt+S]	۶.	\$	0	۲	Tokyo 🔻			.
AWS IoT	×	AWS IOT > MQTT test client									
Monitor		MQTT test client 🖬	ō								
Connect Connect one device		You can use the MQTT test client to r topics to communicate their state to to MQTT message topics and publish	AWS IoT. AWS IoT also publish	s MQTT mess	- ages to i	inform d				-	
Connect many devices	_	Connection details	ile hushaning Discover days and soul		ha Catabi					(Connected
Test		You can update the connection deta	ails by choosing Disconnect and mak	ing updates on t	he Establi	ish conne	ction to c	ontinue page.			
Device Advisor											
MQTT test client		Subscribe to a topic	Publish to a topic								
Device Location New			-								
	- 1	Topic filter Info							1		
Manage		The topic filter describes the topic(s) to	which you want to subscribe. The to	pic filter can inc	lude MQT	T wildcan	d charact	ers.			
All devices		Enter the topic filter									
Greengrass devices		Additional configuration							-		
LPWAN devices											
Software packages New	<u>v</u>	Subscribe									
Remote actions	- H										
Message routing											
Retained messages		Subscriptions	Торіс								
Security											
Fleet Hub		You have no topic subscriptions.		Subscribe o	r select a	a topic t	o view ir	ncoming me	ssages.		

Figure 5-4 MQTT Test Client Settings



5.6 Running the Demo Project

The following describes the running procedure for the demo project (PubSub).

(1) Use Renesas Flash Programmer to program aws_ryz024a_rl78g23-fpb.mot to the MCU board.

For the programming method, refer to Chapter 7, Using Renesas Flash Programmer.

(2) When programming terminates, the demo project (PubSub) starts.

Check the terminal to make sure that the message transmission results of PubSub Demo Task0 and PubSub Demo Task1 are successful.

4 6404 [MAIN TASK]STARTING DEMO
5 6408 [MQIT] [INFO]Start MQIT Agent Task
8 6409 [MQTT] [INFO] Creating a TLS connection to a3lklnx40jlphd-ats.iot.ap-northeast-1.amazonaws.com:8883. 7 8318 [MQTT] [INFO] Creating an MQTT connection to the broker. 8 9182 [MQTT] [INFO] MQTT connected to MQTT broker. 10 9183 [PUBSUB] [INFO]Start PubSub Demo Task 0 11 9184 [PUBSUB] [INFO]Start PubSub Demo Task 1 12 9184 [13 9185 [PUBSUB] [INFO] Sending subscribe request to agent for topic filter: pubsub_demo/rx-ota-firm-things-rx65n-rskPUBSUB] 14 9834 [PUBSUB] [INFO] Successfully subscribed to topic: pubsub_demo/rx-ota-firm-things-rx65n-rskPUBSUB] 15 9835 [PUBSUB] [INFO] Sending subscribed to topic: "pubsub_demo/rx-ota-firm-things-rx65n-rsk/task_1" 16 10483 [MQTT] [INFO] Publishing message to pubsub_demo/rx-ota-firm-things-rx65n-rsk/task_1"
17 11137 [PUBSUB] [INFO] Successfully subscribed to topic: pubsub_demo/rx-ota-firm-things-rx65n-rsk/task_0 18 11138 [PUBSUB] [INFO] Sending publish request on topic "pubsub_demo/rx-ota-firm-things-rx65n-rsk/task_0" 19 11156 [MQTT] [INFO] Ack packet deserialized with result: MQTISuccess. 20 11157 [MQTT] [INFO] State record updated. New state=MQITPublishDone. 21 11158 [PUBSUB] [INFO] Successfully sent QoS 1 publish to topic: pubsub_demo/rx-ota-firm-things-rx65n-rsk/task_1 (PassCount:1, FailCount:0). 22 11158 [PUBSUB] [INFO] Successfully sent QoS 1 publish to topic: pubsub_demo/rx-ota-firm-things-rx65n-rsk/task_1 (PassCount:1, FailCount:0).
13 11645 [PUESUB] [INFO] Successfully sent QoS 0 publish to topic: pubsub_demo/rx-ota-firm-things-rx65n-rsk/task_0 (PassCount:1, FailCount:0). 24 11676 [MUTT] [INFO] De-serialized incoming FUELISH packet. DeserializerResult=MUTTSuccess. 25 11677 [MUTT] [INFO] State record updated. New state=MUTTPubAckSend. 26 11678 [MUTT] [INFO] Received incoming publish message Task 1 publishing message 0 27 11445 [MUTT] [INFO] Received incoming PUERISH packet: DeserializerResult=MUTTSuccess.

Figure 5-5 Checking Demo Project Execution Results on the Terminal

(3) Use the MQTT test client to make sure that the messages sent from PubSub Demo Task0 and PubSub Demo Task1 are displayed.

pubsub_demo/#	F	Clear	Export	Edit
You cannot publish messages to a Please select a different topic to pu				
▼ pubsub_demo	/task_1	November 14, 202	5, 09:47:08 (UTC+0)900)
Message cannot be displayed in	specified format.			
Task 1 publishing message 9				
Properties				

Figure 5-6 Checking Demo Project Execution Results with the MQTT Test Client



5.7 Debugging the Demo Project

The following describes the procedure for starting the demo project (PubSub) from e^2 studio and debugging it.

(1) Build the demo project.

Refer to section 5.2, Importing the Project, section 5.3, Setting the Build Configuration, and section 5.4, Building the Demo Project.

(2) Start debugging.

Refer to Chapter 8, Debug Procedure.



6. Setup Specific to Demo Project (OTA)

This demo project connects to the AWS from the MCU board, and then performs firmware update by using AWS IoT OTA. This chapter describes the setup procedure.

6.1 Preparation

6.1.1 Installing Tools

Install the tools necessary for running the demo project.

- (1) Install Python
 - 1. Python is required for operation of Renesas Image Generator. Install version 3.9.0 or later. You can download Python from https://www.python.org/.
 - 2. After installing Python, install the package pycryptodome by using the following command:

> pip install pycryptodome

(2) Install OpenSSL

Create the key necessary for verifying the code signature when creating an initial image and update image. Use OpenSSL to create the key.

- 1. If OpenSSL is not installed, open the following URL on your browser: <u>Win32/Win64 OpenSSL Installer for Windows - Shining Light Productions (slproweb.com)</u>
- 2. Download and install Win64OpenSSL v3.x.x Light.

(3) Download Renesas Image Generator

Download Renesas Image Generator (V3.03) contained in the <u>RL78/G22,RL78/G23,RL78/G24 firmware</u> <u>update module</u>.



6.1.2 Generating Keys for Signature Generation and Verification

Use OpenSSL to generate firmware verification keys. The parts highlighted in yellow indicate the commands to be entered.

(1) CA certificate

\$ openssl ecparam -genkey -name secp256r1 -out ca.key using curve name prime256v1 instead of secp256r1 \$ openss1 req -x509 -sha256 -new -nodes -key ca.key -days 3650 -out ca.crt You are about to be asked to enter information that will be incorporated into your certificate request. What you are about to enter is what is called a Distinguished Name or a DN. There are quite a few fields but you can leave some blank For some fields there will be a default value, If you enter '.', the field will be left blank. ____ Country Name (2 letter code) [AU]: JP State or Province Name (full name) [Some-State]: Tokyo Locality Name (eq, city) []:Kodaira Organization Name (eg, company) [Internet Widgits Pty Ltd]:Renesas Electronics Organizational Unit Name (eg, section) []:Software Development Division Common Name (e.g. server FQDN or YOUR name) []:Renesas Tarou Email Address []: Tarou.Renesas@sample.com

(2) Elliptic curve cryptography (secp256r1) key pair

\$ openssl ecparam -genkey -name secp256r1 -out secp256r1.keypair using curve name prime256v1 instead of secp256r1

(3) Key pair certificate

```
$ openss1 req -new -sha256 -key secp256r1.keypair > secp256r1.csr
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
____
Country Name (2 letter code) [AU]:JP
State or Province Name (full name) [Some-State]: Tokyo
Locality Name (eg, city) []:Kodaira
Organization Name (eg, company) [Internet Widgits Pty Ltd]: Renesas Electronics
Organizational Unit Name (eg, section) []:Software Development Division
Common Name (e.g. server FQDN or YOUR name) []: Renesas Tarou
Email Address []: Tarou.Renesas@sample.com
Please enter the following 'extra' attributes
to be sent with your certificate request
A challenge password []:
An optional company name []:
```



(4) Genarating a key pair certificate by using the CA certificate

```
$ openssl x509 -req -sha256 -days 3650 -in secp256rl.csr -CA ca.crt -CAkey ca.key -
CAcreateserial -out secp256rl.crt
Signature ok
subject=C = JP, ST = Tokyo, L = Kodaira, O = Renesas Electronics, OU = Software
Development Division, CN = Renesas Tarou, emailAddress = Tarou.Renesas@sample.com
Getting CA Private Key
```

(5) Extracting the elliptic curve cryptography (secp256r1) private key

```
$ openssl ec -in secp256r1.keypair -outform PEM -out secp256r1.privatekey
read EC key
writing EC key
```

(6) Extracting the elliptic curve cryptography (secp256r1) public key

\$ openssl ec -in secp256r1.keypair -outform PEM -pubout -out secp256r1.publickey
read EC key
writing EC key



6.1.3 Settings for OTA Update

6.1.3.1 Creating Amazon S3 Buckets

(1) Amazon S3 > Buckets > "Create bucket"

 Account snapshot 			View Storage Lens da	ishboard
Last updated: Nov 13, 2023 b	by Storage Lens. Metrics are generated every 24 hours. Learn r	more 🔼		
Total storage	Object count	Average object size	You can enable advanced metri	cs in the
973.1 MB	2.1 k	484.9 KB	"default-account-dashboard" co	nfiguration.
Buckets (27) Info Buckets are containers for data st	tored in S3. Learn more	С 🗇 Кору	ARN Empty Delete Creat	e bucket
Q. Find buckets by name			< 1	> @

Figure 6-1 Crate Bucket

- (2) General configuration
- Bucket name: Your bucket name
- AWS Region: Asia Pacific (Tokyo) ap-northeast-1

Bucket name				
myawsbucket				
Bucket name must be uni	que within the global namespace and foll	ow the bucket naming rules. <u>See ru</u>	ules for bucket naming	2
AWS Region				
Asia Pacific (Tokyo) a	p-northeast-1		,	
Asia Facilie (Tokyo) a	•			
Asia Facilie (Tokyo) a				
	isting bucket - <i>optional</i>			

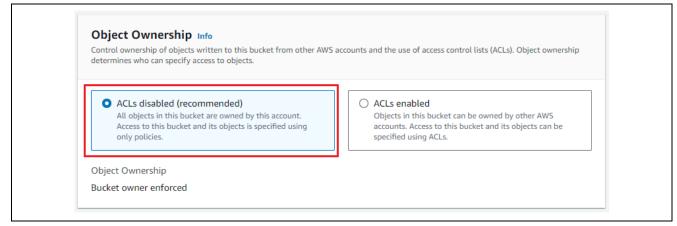
Figure 6-2 General Configuration

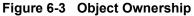


•

(3) Object Ownership

Choose ACLs disabled





- (4) Block Public Access settings for this bucket
- Choose Block all public access

ensure and its applica	access is granted to buckets and objects through access control lists (ACLs), bucket policies, access point policies, or all. In order to that public access to this bucket and its objects is blocked, turn on Block all public access. These settings apply only to this bucket access points. AWS recommends that you turn on Block all public access, but before applying any of these settings, ensure that your tions will work correctly without public access. If you require some level of public access to this bucket or objects within, you can ize the individual settings below to suit your specific storage use cases. Learn more.
Ble	ock <i>all</i> public access
Tur	ming this setting on is the same as turning on all four settings below. Each of the following settings are independent of one another.
	Block public access to buckets and objects granted through new access control lists (ACLs)
	S3 will block public access permissions applied to newly added buckets or objects, and prevent the creation of new public access ACLs for existing buckets and objects. This setting doesn't change any existing permissions that allow public access to S3 resources using ACLs.
	Block public access to buckets and objects granted through any access control lists (ACLs)
	S3 will ignore all ACLs that grant public access to buckets and objects.
	Block public access to buckets and objects granted through <i>new</i> public bucket or access point policies S3 will block new bucket and access point policies that grant public access to buckets and objects. This setting doesn't change any
	existing policies that allow public access to S3 resources.
	Block public and cross-account access to buckets and objects through <i>any</i> public bucket or access point policies
	53 will ignore public and cross-account access for buckets or access points with policies that grant public access to buckets and objects.

Figure 6-4 Block Public Access Settings for this bucket



(5) Bucket Versioning

Bucket Versioning: Disable

Bucket Versioning	
	ping multiple variants of an object in the same bucket. You can use versioning to preserve, retrieve, and restore stored in your Amazon S3 bucket. With versioning, you can easily recover from both unintended user actions more Z
Bucket Versioning	
 Disable 	
O Enable	

Figure 6-5 Bucket Versioning

(6) Default encryption

- Encryption type: Server-side encryption with Amazon S3 managed keys (SSE-S3)
- Bucket Key: Enable

Server-side enc	ryption is automatically applied to new objects stored in this bucket.
Encryption ty	pe Info
Server-sid	le encryption with Amazon S3 managed keys (SSE-S3)
O Server-sid	le encryption with AWS Key Management Service keys (SSE-KMS)
Secure you	r server-side encryption with AWS Key Management Service keys (DSSE-KMS) objects with two separate layers of encryption. For details on pricing, see DSSE-KMS pricing on the Storage tab of the pricing page.
Bucket Key	
Using an S3 Bu KMS. <u>Learn mo</u>	cket Key for SSE-KMS reduces encryption costs by lowering calls to AWS KMS. S3 Bucket Keys aren't supported for DSSE-
O Disable	

Figure 6-6 Default encryption

(7) Click "Create bucket"

After creating the bucket, you can upload files and folders to the bucket, and config	ure additiona	al bucket settings.
	Cancel	Create bucket

Figure 6-7 Clicking "Crate bucket"



6.1.3.2 Creating an OTA Update Service Role

(1) IAM > Roles > "Create role"

IAM > Roles	
Roles (81) Info	C Delete Create role
An IAM role is an identity you can create that has specific permissions wi	with credentials that are valid for short durations. Roles can be

Figure 6-8 IAM > Roles > Create role

- (2) Step 1: Select trusted entity
- Trusted entity type: AWS service
- Use case: Service or use case > IoT

IAM > Roles > Create role	
Step 1 Select trusted entity	Select trusted entity Info
Step 2 Add permissions	Trusted entity type
Step 3 Name, review, and create	AWS services like EC2, Lambda, or others to perform actions in this account.
	SAML 2.0 federation Allow users federated with SAML 2.0 from a corporate directory to perform actions in this account.
	Use case Allow an AWS service like EC2, Lambda, or others to perform actions in this account.
	Service or use case IoT Choose a use case for the specified service.
	Use case IoT Allows IoT to call AWS services on your behalf. IoT - Device Defender Audit
	Provides AWS IoT Device Defender read access to IoT and related resources. O IoT - Device Defender Mitigation Actions Provides AWS IoT Device Defender write access to IoT and related resources for execution of Mitigation Actions.
	Cancel

Figure 6-9 Step 1: Select trusted entity



- (3) Step 2: Add permissions
- AWSIoTLogging
- AWSIoTRuleActions
- AWSIoTThingsRegistration

IAM > Roles > Create role Step 1 Select trusted entity	Add permissions Info	
Step 2 Add permissions	Permissions policies (3) Info The type of role that you selected requires the following p	olicy.
Step 3	Policy name 🔼	▲ Type マ
Name, review, and create	AWSIoTLogging	AWS managed
	AWSIoTRuleActions	AWS managed
	AWSIoTThingsRegistration	AWS managed
	Set permissions boundary - optional	nl
	Can	ncel Previous Next

Figure 6-10 Step 2: Add permissions

- (4) Step 3: Name, review, and create > Role details
- Role name: Any
- Description: Any

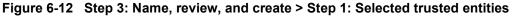
Step 1 Select trusted entity	Name, review, and create
Step 2 Add permissions	Role details
Step 3 Name, review, and create	Role name Enter a meaningful name to identify this role.
	Add a short explanation for this role. Allows IoT to call AWS services on your behalf.

Figure 6-11 Step 3: Name, review, and create > Role details



- (5) Step 3: Name, review, and create > Step 1: Selected trusted entities
- Default





- (6) Step 3: Name, review, and create > Step 2: Add permissions
- Default

Permissions policy summaryPolicy name [2]TypeTypeAttached asTopeAWSIoTLoggingAWS managedPermissions policyImage: Second	Step 2: Add permissions			[Edit
AWSIoTLogging AWS managed Permissions policy AWSIoTRuleActions AWS managed Permissions policy	Permissions policy summary				
AWSIoTRuleActions AWS managed Permissions policy	Policy name 🗹 🔹 🔺	Туре	⊽	Attached as	▽
	AWSIoTLogging	AWS managed		Permissions policy	
AWSIoTThingsRegistration AWS managed Permissions policy	AWSIoTRuleActions	AWS managed		Permissions policy	
	<u>AWSIoTThingsRegistration</u>	AWS managed		Permissions policy	

Figure 6-13 Step 3: Name, review, and create > Step 2: Add permissions



- (7) Step 3: Name, review, and create > Step 3: Add tags
- Default
- Click "Create role"

Add tags - optional Info Tags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resources.
No tags associated with the resource.
Add new tag You can add up to 50 more tags.
Cancel Previous Create role

Figure 6-14 Step 3: Name, review, and create > Step 3: Add tags



6.1.3.3 Creating an OTA Update User Policy

(1) Click to open the role created in section 6.1.3.2, Creating an OTA Update Service Role.

IAM > Roles		
Roles (83) Info	C Delete Creat	e role
An IAM role is an identity you can create that has sp be assumed by entities that you trust.	pecific permissions with credentials that are valid for short durations. F	toles can
Q, rl78	X 3 matches < 1	0
Role name	Trusted entities	Last a
rl78 g25 fpb_oto_rote_matanabe	click AWS Service: iot	-

Figure 6-15 Opening the Created OTA Update Service Role

(2) My role > Summary: Default

IAM > Roles > rl78	Delete
Allows IoT to call AWS services on your behalf. Summary	Edit
Creation date November 16, 2023, 15:04 (UTC+09:00)	ARN
Last activity -	Maximum session duration 1 hour

Figure 6-16 Displaying the Summary of the Created OTA Update Service Role

- (3) Attach the policy "AmazonFreeRTOSOTAUpdate".
- My role > Permissions policies > "Add permissions" > Attach policies

Permissions Trust relationships Tags	Access Advisor Revoke sessions	
Permissions policies (3) Info You can attach up to 10 managed policies.		Add permissions 🔺
Q Search	Filter by Type All types	Create inline policy
□ Policy name 🖸 🔺 Type	▼ Attached entities	∇
AWSIoTLogging AWS	managed <u>16</u>	
□ I I AWSIoTRuleActions AWS	managed <u>16</u>	
□	managed <u>34</u>	

Figure 6-17 Attaching Policies to the Created OTA Update Service Role



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• Choose "AmazonFreeRTOSOTAUpdate" > "Add permissions"

		Filter by Type		
AmazonFreeRTOSC	DTAUpdate	X All types	1 match	< 1 > @
		_		
Policy name	▲	Туре	▼ Description	5 5766 671 11 1 1
. ● ▲ Amazo	onFreeRTOSOTAUpdate	AWS managed	Allows user to access Ama	azon FreeRTOS OTA Update
				Cancel Add permissions
⊘ Policy wa	as successfully attached to role.			×
, J70	a 27 fab			
	g23-fpb	Info		Delete
Altows to	n to call Awa Schnees on your benau.			
Sum	ımary			Edit
	ion date mber 16, 2023, 15:04 (UTC+09:00)	ARN		
		•	··	
Last a	activity		mum session duration	
-		1 hoi	ur	
Perm	issions Trust relationships	Tags Access Ad	visor Revoke sessions	
		- ,		
Perr	missions Trust relationships	Tags Access Adv		Id permissions 🔻
Perr	nissions policies (4) Info	- ,		Id permissions 🔻
Perr You ca	nissions policies (4) Info	C Simula		ld permissions ▼ < 1 > ③
Perr You ca	missions policies (4) Info an attach up to 10 managed policies. Search	C Simula Filter by Type All types	ate 🚺 Remove Ac	< 1 > ©
Perr You ca	nissions policies (4) Info an attach up to 10 managed policies. Search Policy name 🖸	C Simula Filter by Type All types	ate 🔁 Remove Ac	< 1 >
Perr You ca	missions policies (4) Info an attach up to 10 managed policies. Search Policy name [2]	C Simula Filter by Type All types Type date AWS ma	ate [2] Remove Ac	< 1 > ⁽ ⁽) ⁽ ⁽)
Perr You ca	nissions policies (4) Info an attach up to 10 managed policies. Search Policy name 🖸	C Simula Filter by Type All types	ate [2] Remove Ac	< 1 >

Figure 6-18 Attaching the Policy "AmazonFreeRTOSOTAUpdate" to the Created OTA Update Service Role



(4) Add the inline policy (S3).

• "Add permissions" > Create inline policy > "JSON"

Permissions Trust relationships Tags	Access Advisor Revoke sessions	
Permissions policies (5) Info You can attach up to 10 managed policies.	C Simulate 🖸 Remo	Add permissions Attach policies
Q. Search	Filter by Type	Create inline policy
Specify permissions Int	fo	
Add permissions by selecting services, action editor.	ons, resources, and conditions. Build permission state	ements using the JSON
Policy editor	Visual JSON	Actions 🔻 🔳

Figure 6-19 Creating an S3 Inline Policy



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Paste the following information to the Policy editor, and then click "Next".
 — Change s3-bucket-test to the bucket name created in section 6.1.3.1, Creating Amazon S3 Buckets.

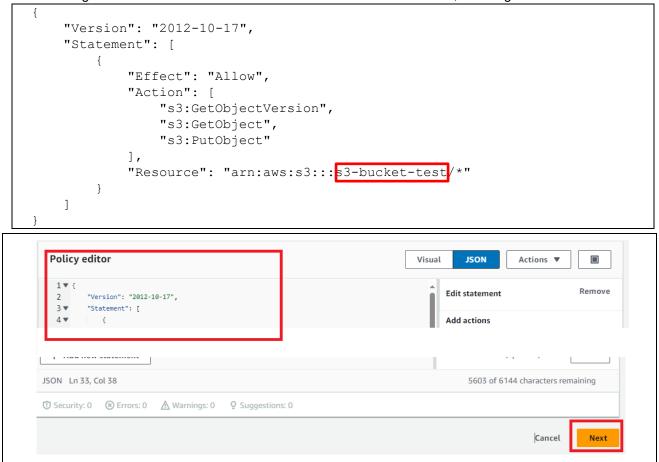


Figure 6-20 Adding S3 Policies to the Policy Editor



• Policy name: Any (Example: inline-policy-s3-test) > "Create policy"

eview the permission	ons, specify details, and tags.			
Policy details	5			
Policy name Enter a meaningful	name to identify this policy.			
inline-policy-s3				
Maximum 128 chara	icters. Use alphanumeric and '+=,.@' cha	iracters.		
Permissions	defined in this policy Info			Edit
	in this policy document specify which acti	ions are allowed or denied. 1	o define permissions for an IAM	1 identity (user,
Q Search				
Allow (1 of 384	4 services)		Show remaining 38	3 services
Service	▲ Access level	~	Resource	R
<u>53</u>	Limited: Read		BucketName string like bucket-test, ObjectPath	s3-
<u>53</u>	Limited: Read		BucketName string like bucket-test, ObjectPath like All	s3-
_	Limited: Read	l, Write	BucketName string like bucket-test, ObjectPath like All	s3- string N
Permissions Permissions		l, Write Cance	BucketName string like s bucket-test, ObjectPath s like All Previous C Revoke sessions C Simulate [2]	s3- string N
Permissions Permissions	Trust relationships Tags Doolicies (5) Info	l, Write Cance	BucketName string like s bucket-test, ObjectPath s like All Previous C Revoke sessions C Simulate [2 Type	s3- string N
Permissions Permissions You can attach up to	Trust relationships Tags policies (5) Info to 10 managed policies.	I, Write Cance Access Advisor Filter by	BucketName string like s bucket-test, ObjectPath s like All Previous C Simulate [2 Type	s3- string N
Permissions Permissions You can attach up to Q Search D Policy na	Trust relationships Tags policies (5) Info to 10 managed policies.	I, Write Cance Access Advisor Filter by All type Ty	BucketName string like s bucket-test, ObjectPath s like All Previous C Simulate [2 Type	s3- string N reate policy
Permissions Permissions Vou can attach up to Q Search D Policy na	Trust relationships Tags policies (5) Info to 10 managed policies. ame	I, Write Cance Access Advisor Filter by All type AW	BucketName string like s bucket-test, ObjectPath s like All Previous Revoke sessions C Simulate C Type s	s3- string N reate policy
Permissions Permissions Vou can attach up to Q Search Q S	Trust relationships Tags policies (5) Info to 10 managed policies. ame	I, Write Cance Access Advisor Filter by All type AW AW	BucketName string like s bucket-test, ObjectPath s like All Previous C Revoke sessions C Simulate C Type is V	s3- string N reate policy reate policy Remove ↓ Attach 41

Figure 6-21 Creating the S3 Policy with a Name (Example: inline-policy-s3-test)

(5) Add an IAM inline policy.

• "Add permissions" > Create inline policy > "JSON"

Permissions policies (5) Info You can attach up to 10 managed policies.	C Simulate 🛛 Rem	ove Add permissions ▲ Attach policies
	Filter by Type	Create inline policy
Q Search	All types 🔻	< 1 > 🔘
Specify permissions	S Info	
	actions, resources, and conditions. Build permission sta	tements using the JSON

Figure 6-22 Creating an Inline Policy



•

- Paste the following information to the Policy editor, and then click "Next".
- Change ota-role-test to the role name created in section 6.1.3.2, Creating an OTA Update Service Role.

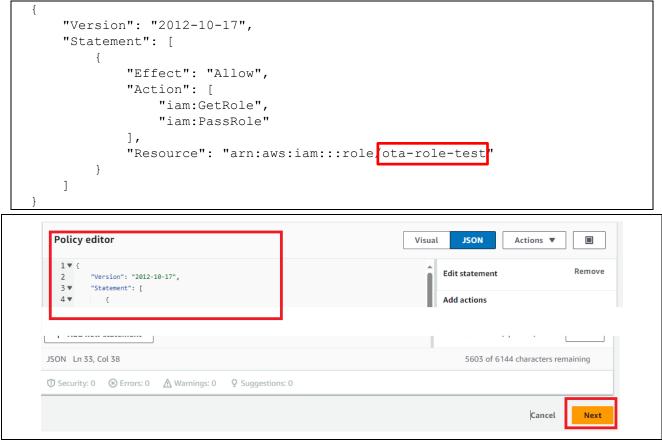


Figure 6-23 Adding the IAM Role to the Inline Policy



• Policy name: Any (Example: inline-policy-iam-test) > "Create policy"

	eate Info
eview the permissions, specif	ify details, and tags.
Policy details	
Policy name Enter a meaningful name to ide	entify this policy.
inline-policy-iam-test	
Maximum 128 characters. Use a	alphanumeric and '+=,.@' characters.
Permissions defined	in this policy Info
Permissions defined in this poli group, or role), attach a policy t	icy document specify which actions are allowed or denied. To define permissions for an IAM identity (user, user to it
Q Search	
Allow (1 of 384 service	es) Show remaining 383 services
Service	▲ Access level ▼ Resource Reques
IAM	Limited: Read, Write Read, Wri
	Cancel Previous Create policy
	Cancel Previous Create policy
Permissions policies (
Permissions policies (You can attach up to 10 managed	(6) Info C Simulate I Remove Add permissions ▼
You can attach up to 10 managed	(6) Info C Simulate Remove Add permissions ▼ Add permissions ▼ Filter by Type
-	(6) Info C Simulate [2] Remove Add permissions ▼ ed policies.
You can attach up to 10 managed	(6) Info C Simulate Remove Add permissions ▼ Add permissions ▼ Filter by Type
You can attach up to 10 managed Q Search Policy name	(6) Info ed policies. Filter by Type All types ▼ < 1 > ③
You can attach up to 10 managed Q Search Policy name	(6) Info C Simulate Remove Add permissions ▼ ad policies. Filter by Type Image: Content of the system of the sy
You can attach up to 10 managed Q Search Policy name	(6) Info C Simulate Remove Add permissions ▼ ad policies. Filter by Type I
You can attach up to 10 managed Q Search Policy name [2] • • AmazonFr • • AWSIOTLO • • • • • • • • • • • • • • • • • • • • • • • • • • • •	(6) Info C Simulate Remove Add permissions ▼ ad policies. Filter by Type All types < 1 > ▲ Type ▼ Attached entities ▼ reeRTOSOTA AWS managed 41 ogging AWS managed 16
You can attach up to 10 managed Q Search Policy name [2] • • AmazonFr • • AWSIOTLO • • • •	(6) Info C Simulate Remove Add permissions ▼ ad policies. Filter by Type All types < 1 > All types ✓ Attached entities ✓ reeRTOSOTA AWS managed 41 add permissions ✓ 41

Figure 6-24 Saving the IAM Inline Policy with a Name (Example: inline-policy-iam-test)



6.1.3.4 Allocating an OTA Update Policy to IAM User

- (1) Create an OTA Update policy.
- IAM > Policies > "Create policy" > "JSON"

A policy is an object in AWS that defines permissions.	C Actions T Delete Create policy
	sources, and conditions. Build permission statements using the JSON
editor.	

Figure 6-25 Creating an OTA Update Policy



RL78/G23

- Paste the following information to the Policy editor, and then click "Next".
 - Change s3-bucket-test to the bucket name specified in section 6.1.3.1, Creating Amazon S3 Buckets.
 - Change ota-role-test to the role name specified in section 6.1.3.2, Creating an OTA Update Service

```
Role.
```

```
{
    "Version": "2012-10-17",
    "Statement": [
         {
              "Effect": "Allow",
              "Action": [
                   "s3:ListBucket",
                   "s3:ListAllMyBuckets",
                  "s3:CreateBucket",
                   "s3:PutBucketVersioning",
                   "s3:GetBucketLocation",
                   "s3:GetObjectVersion",
                   "acm:ImportCertificate",
                   "acm:ListCertificates",
                   "iot:*",
                   "iam:ListRoles",
                   "freertos:ListHardwarePlatforms",
                   "freertos:DescribeHardwarePlatform"
              ],
              "Resource": "*"
         },
         {
              "Effect": "Allow",
              "Action": [
                   "s3:GetObject",
                   "s3:PutObject"
              ],
              "Resource": "arn:aws:s3:::s3-bucket-test
                                                               / * "
         },
         {
              "Effect": "Allow",
              "Action": "iam:PassRole",
              "Resource": "arn:aws:iam::xxxxxxxx:role/ota-role-test"
         }
    1
l
     Policy editor
                                                                       Actions v
                                                                                 Visual
                                                                JSON
      1
                                                             Edit statement
                                                                                Remove
           "Version": "2012-10-17".
      2
      3 🔻
          "Statement": [
      4.
            {
                                                             Add actions
     JSON Ln 33, Col 38
                                                                5603 of 6144 characters remaining
    ⑦ Security: 0 ⊗ Errors: 0 A Warnings: 0 9 Suggestions: 0
                                                                         Cancel
                                                                                 Next
```

Figure 6-26 Creating an OTA Update Policy with the Policy Editor



• Policy name: Any (Example: rl78g23-fpb_ota_policy) > "Create policy"

Policy details			
Policy name Enter a meaningful name to identify this policy.			
rl78g23-fpb_ota_policy			
Maximum 128 characters. Use alphanumeric and '+=,.@' characters.			
Description - optional			
Add a short explanation for this policy.]		
	4		
Maximum 1,000 characters. Use alphanumeric and '+=,.@' characters.			
Add tags - <i>optional</i> Info			
Add tags – <i>optional</i> Info Fags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resources.			
Fags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resources.			
Fags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resources.			
Tags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resources. No tags associated with the resource.			
Tags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resources. No tags associated with the resource.			
Tags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resources. No tags associated with the resource.	Cancel	Previous	Create policy
Tags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resources. No tags associated with the resource.	Cancel	Previous	Create policy

Figure 6-27 Saving the OTA Update Policy with a Name (Example: rl78g23-fpb_ota_policy)



(2) Add the created OTA Update policy to the IAM user.

• IAM > Users > Choose User > Add permissions

Users (17) Info			C	Delete Create user
An IAM user is an identity with	h long-term credentials that is used to ir	nteract with AWS in an account.	:ch	< 1 > @
User name (Click A Path		/ ▼ MFA ▼	Password age ▼ Console la:
	<u>hexz</u> /	1 🕜 6 hours a	igo -	▲ 976 days November
Permissions Groups (1) Tags Security cr	redentials Access Advisor		
Permissions policies (14)		CR	emove Add permissions 🔺
	es attached to the user directly or th	rough groups.		Add permissions
ermissions are defined by policie				
Permissions are defined by policie		Filter by Type		Create inline policy

Figure 6-28 Selecting the IAM User

- Permissions options: Attach policies directly
- Permissions policies > Policy name: Name of created OTA Update policy (Example: rl78g23fpb_ota_policy)
- Click "Next"

IAM > Users > Immediately Step 1 Add permissions	Add permissions Add permissions Add user to an existing group or create a new one. Using groups is a best-practice way to manage user's permissions by job functions. Learn more
Step 2 Review	Permissions options
	 Add user to group Add user to a rexisting group, or create a new group. We recommend using groups to manage user permissions by job function. Copy all group memberships, attached managed policies, inline policies, and any existing permissions boundaries from an existing user. Attach policies directly Attach a managed policy directly to a user. As a best practice, we recommend attaching policies to a group instead. Then, add the user to the appropriate group.
	Permissions policies (1/1230)
	Filter by Type Q. rl78 X All types 1 match < 1 >
	Policy name [2] Image: Type Image: Attached entities
	Image:
	Cancel

Figure 6-29 Selecting the OTA Update Policy for Permissions to Be Added to the IAM User

- User details: Your account
- Permissions summary > Name: Name of created OTA Update policy (Example: rl78g23-fpb_ota_policy)
- Click "Add permission"

Review The following policies will be attache	ed to this user. Learn more 🔀		
User details			
User name			
Permissions summary (1)		<	1 >
Name 🖸	⊽ Туре	Used as	
rl78g23-fpb_ota_policy	Customer managed	Permissions policy	
		Cancel Previous Add pe	missions
⊙ 1 pol	licy added		

Figure 6-30 Adding the OTA Update Policy to the Selected IAM User



6.1.3.5 Granting Access Permissions to AWS IoT Code Signature

- (1) Create an IAM policy.
- IAM > Policies > "Create policy" > "JSON"

Policies (1237) Info A policy is an object in AWS that defines permissions.	C Actions Delete Create policy
Specify permissions Info Add permissions by selecting services, actions, resc editor.	ources, and conditions. Build permission statements using the JSON

Figure 6-31 Creating an IAM Policy



RL78/G23

Paste the following information to the Policy editor, and then click "Next".

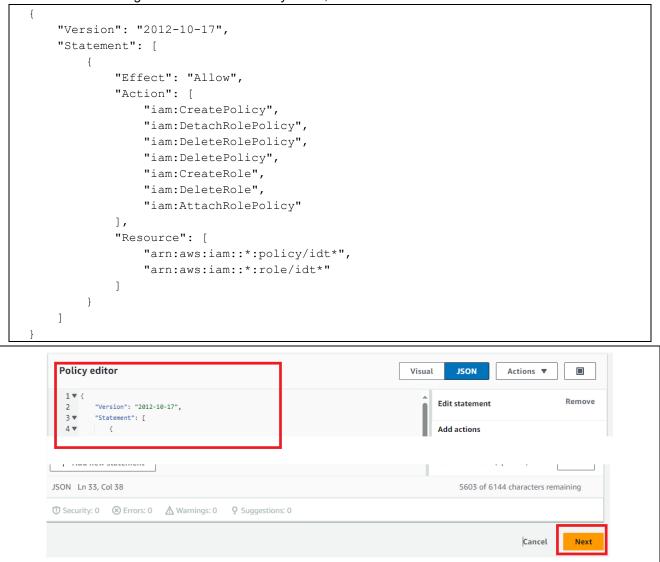


Figure 6-32 Creating an IAM Policy with the Policy Editor



• Policy name: Any (Example: IDTFreeRTOSIAMPermissions_rl78g23-fpb) > "Create policy"

Policy name inter a meaningful name to identify this policy. IDTFreeRTOSIAMPermissions_rl78g23-fpb	
IDTFreeRTOSIAMPermissions_rl78g23-fpb	
Aaximum 128 characters. Use alphanumeric and '+=,.@' characters.	
Description - optional	
Add a short explanation for this policy.	
Maximum 1,000 characters. Use alphanumeric and '+=,.@' characters.	
Add tags - optional Info	
ags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resources.	
No tags associated with the resource.	
Add new tag	
/ou can add up to 50 more tags.	
	Create policy
Cancel Previous	

Figure 6-33 Saving the IAM Policy with a Name (Example: IDTFreeRTOSIAMPermissions_rl78g23-fpb)



(2) Attach the created IAM policy to the IAM user.

• IAM > Users > Choose User > Add permissions

Users (17) Info An IAM user is an identity with long-term credentials that is used	to interact with AWS in an account	C Delete Create user
	X 1 match	< 1 > 🕲
□ User name Click ▲ Path	▼ Group! ▼ Last activity	▼ MFA ▼ Password age ▼ Console la
I terretile untersteak z /	1 📀 6 hours ago	- 🔥 976 days November
		4
ermissions Groups (1) Tags Security	y credentials Access Advisor	
	y credentials Access Advisor	C Remove Add permissions
Permissions policies (14) ermissions are defined by policies attached to the user directly of		C Remove Add permissions Add permissions
Permissions policies (14)		

Figure 6-34 Selecting the User to Assign the Created IAM Policy



- Permissions options: Attach policies directly
- Policy name:
 - AWSIoTDeviceTesterForFreeRTOSFullAccess
 - Name of created IAM policy (Example: IDTFreeRTOSIAMPermissions_rl78g23-fpb)
 - Click "Next" > Click "Add permissions"

Permissions options		
Add user to an existing group, or create a new Copy a group. We recommend using groups to manage user permissions by job function. existin	permissions ill group memberships, attached ged policies, inline policies, and any g permissions boundaries from an g user.	• Attach policies directly Attach a managed policy directly to a user. As a best practice, we recommend attaching policies to a group instead. Then, add the user to the appropriate group.
Permissions policies (2/1230)	Filter by Type	C
Q FreeRTOS		4 matches < 1 > 🙆
Policy name 🛽	▲ Туре	
AWSIoTDeviceTesterForFreeRTOSFullAccess	Customer managed	0
DTFreeRTOSIAMandLC2Fermissions	Customer managed	2
✓ IDTFreeRTOSIAMPermissions_rl78g23-fpb	Customer managed	0
DTFree DTFree Commence Commenc	Customer managed	1
		Cancel

Figure 6-35 Adding Permissions to the Selected IAM User



6.2 Creating an Initial Image

An initial image is a MOT file generated by joining a bootloader's MOT file and an initial application's MOT file by using Renesas Image Generator.

Renesas Image Generator is a tool provided with the <u>RL78/G22,RL78/G23,RL78/G24 firmware update</u> <u>module</u>. For details, refer to the application note in this link.

The file names related to an initial image are as follows in this document.

- Bootloader: boot_loader.mot
- Initial application: aws_ryz024a_rl78g23-fpb_ota.mot
- Initial image: initial_image.mot

6.2.1 Creating a Bootloader

6.2.1.1 Importing the Bootloader Project

Import the boot_loader project to e² studio. Open the Import wizard according to the following process.

File > Import... > Existing Projects into Workspace > Next

Next, select the boot_loader project. Ensure that copy projects into workspace is not selected. Then click the Finish button.

Import	h	σ×
Import Projects		
Select a directory to search for existing Eclipse	projects.	
Select root directory: C:¥	¥r20an0666xx0100-rl78¥ic ~	Browse
O Select archive file:	~	Browse
Projects:		
✓ aws_ryz024a_rl78g23-fpb (C:¥	¥r20an0666xx0100-rl7	Select All
boot_loader (C:¥ test_aws_ryz024a_rl78g23-fpb (C:¥	¥r20an0666xx0100-rl78¥iot-referen ¥r20an0666xx010	Deselect All
test_aws_ryzu24a_n/og23-tpb (C:#	#12Uanu666xx01L	Refresh
Options Search for nested projects Copy projects into workspace Clase newly imported projects upon comp Hide projects that already exist in the work		
Working sets		
Add project to working sets		Ne <u>w</u>
Working sets:		Sglect
? < Back	Next > Einish	Cancel

Figure 6-36 Selecting the boot_loader Project

The imported project is showed in the Project Explorer view.

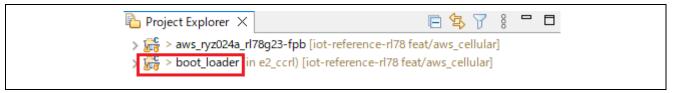


Figure 6-37 Completing to Import the boot_loader Project



6.2.1.2 Adding the Firmware Verification Key to the Bootloader Project

(1) Add the firmware verification key (secp256r1.publickey) to code_signer_public_key.h in the boot_loader project.

Note: Add \ to the end of each line.

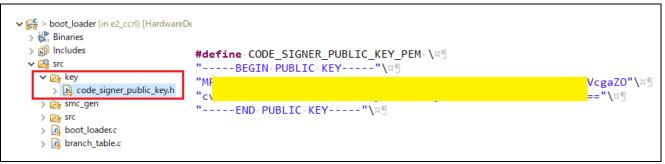


Figure 6-38 Adding the Firmware Verification Key to the Bootloader

6.2.1.3 Building the Bootloader Project

Build the boot_loader project to create a MOT file.

Then, make sure that boot_loader.mot has been created in the HardwareDebug folder directly under the project folder.



6.2.2 Creating an Initial Application 6.2.2.1 Importing the Initial Application

Import the aws_ryz024a_rl78g23-fpb project to e² studio. Open the Import wizard according to the following process.

File > Import... > Existing Projects into Workspace > Next

Next, select the aws_ryz024a_rl78g23-fpb project. Ensure that copy projects into workspace is not selected. Then click the Finish button.

🔁 Import	11	
Import Projects		
Select a directory to search for existing Eclips	e projects.	
Select root directory: C:¥	¥r20an0666xx0100-rl78¥ic ~	Browse
○ Select <u>a</u> rchive file:	×	Browse
Projects:		
aws_ryz024a_rl78g23-fpb (C:¥	¥r20an0666xx0100-rl7	Select All
✓ boot_loader (C:¥ test_aws_ryz024a_ri78g23-fpb (C:¥	¥r20an0666xx0100-rl78¥iot-referen ¥r20an0666xx010	Deselect All
		Refresh
Coptions Search for nested projects Copy projects into workspace Clgse newly imported projects upon com Hijde projects that already exist in the work		
Working sets		
Add project to working sets		Ne <u>w</u>
Working sets:	Next > Einish	Sglect Cancel

Figure 6-39 Selecting the aws_ryz024a_rl78g23-fpb Project

The imported project is showed in the Project Explorer view.



Figure 6-40 Completing to Import the aws_ryz024a_rl78g23-fpb Project



6.2.2.2 Setting the Build Configuration of the the Initial Application

Set the build configuration of the aws_ryz024a_rl78g23-fpb project to "HardwareDebug_OTA".

Build Configurations > Set Active > Select "HardwareDebug_OTA"

Build Configurations >	>	Set Active >		1 HardwareDebug (Debug on hardware)
Source >	>	Manage	~	2 HardwareDebug_OTA (Debug on hardware)

Figure 6-41 Activating Build Configuration "HardwareDebug_OTA"

6.2.2.3 Adding the Firmware Verification Key to the Initial Application

Add the firmware verification key (secp256r1.publickey) to code_signer_public_key.h in the aws_ryz024a_rl78g23-fpb project.





Figure 6-42 Adding the Firmware Verification Key to the Initial Application

6.2.2.4 Building the Initial Application

Build the aws_ryz024a_rl78g23-fpb project to create a MOT file.

Then, make sure that aws_ryz024a_rl78g23-fpb_ota.mot has been created in the HardwareDebug_OTA folder directly under the project folder.



6.2.3 Creating an Initial Image by Using Renesas Image Generator

Join the bootloader and the initial application by using Renesas Image Generator to generate the initial image.

(1) Store the following files in the same folder as Renesas Image Generator.

- Bootloader: boot_loader.mot
- Initial application: aws_ryz024a_rl78g23-fpb_ota.mot
- Private key for initial application verification: secp256r1.privatekey



Figure 6-43 Storing Necessary Files in the Same Folder as Renesas Image Generator

(2) Run the following command to generate the initial image.

```
python image-gen.py -iup .\aws_ryz024a_r178g23-fpb_ota.mot -ibp
boot_loader.mot -o initial_image -ip .\RL78_G23_ImageGenerator_PRM.csv
```

(3) Make sure that the initial image (initial_image.mot) has been generated.

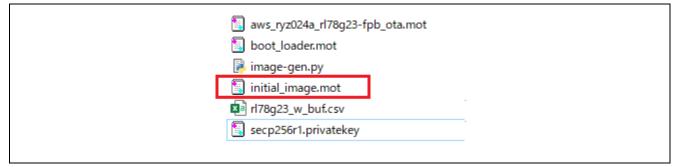


Figure 6-44 Initial Image Generated in the Same Folder as Renesas Image Generator



6.3 Creating an Update Image

An update image is a binary format (extension: rsu) firmware used for update which are converted an update application's MOT file by using Renesas Image Generator. Update images can be generated by Renesas Image Generator. For details about the update image format, refer to "<u>RL78/G22,RL78/G23,RL78/G24</u> <u>Firmware Update Module</u>".

The file names related to an update image are as follows in this document.

- Update application: aws_ryz024a_rl78g23-fpb_ota_093.mot
- Update image: aws_ryz024a_rl78g23-fpb_ota_093.rsu

6.3.1 Creating an Update Application

6.3.1.1 Changing the Source Code of the Application

To create an update application,

in iot-reference-rl78\Configuration\rl78g23-fpb\ota\cellular\frtos_config\demo_config.h, change the definition of the APP_VERSION_BUILD macro from 2 to 3.

```
iot-reference-r178\Configuration\r178g23-
fpb\ota\cellular\frtos_config\demo_config.h
/**
 * @brief Build version of the firmware.
 *
 * This is used in the OTA demo to set the appFirmwareVersion variable that
is
 * declared in the ota_appversion32.h file in the OTA library.
 */
#ifndef APP_VERSION_BUILD
 #define APP_VERSION_BUILD 3
#endif
```

6.3.1.2 Building the Update Application

Build the aws_ryz024a_rl78g23-fpb project to create a MOT file. Then, make sure that aws_ryz024a_rl78g23-fpb_ota.mot has been overwritten and created in the HardwareDebug_OTA folder directly under the project folder.

6.3.1.3 Renaming the MOT File of the Update Application

Rename aws_ryz024a_rl78g23-fpb_ota.mot to aws_ryz024a_rl78g23-fpb_ota_093.mot.



6.3.2 Generating an Update Image by Using Renesas Image Generator

Convert the update application to an update image by using Renesas Image Generator.

- (1) Store the following files in the same folder as Renesas Image Generator.
- MOT file of the update application: aws_ryz024a_rl78g23-fpb_ota_093.mot
- Private key for update application verification: secp256r1.privatekey

aws_ryz024a_rl78g23-fpb_ota.mot	
aws_ryz024a_rl78g23-fpb_ota_093.mot	
🔄 boot_loader.mot	
🛃 image-gen.py	
🔄 initial_image.mot	
🕼 rl78g23_w_buf.csv	
secp256r1.privatekey	

Figure 6-45 Storing Necessary Files in the Same Folder as Renesas Image Generator

(2) Run the following command to generate an update image (aws_ryz024a_rl78g23-fpb_ota_093.rsu) in RSU format.

```
python image-gen.py -iup .\aws_ryz024a_r178g23-fpb_ota_093.mot -o
aws_ryz024a_r178g23-fpb_ota_093 -ip .\RL78_G23_ImageGenerator_PRM.csv -vt
ecdsa -ff RTOS
```

(3) Make sure that aws_ryz024a_rl78g23-fpb_ota_093.rsu has been generated.

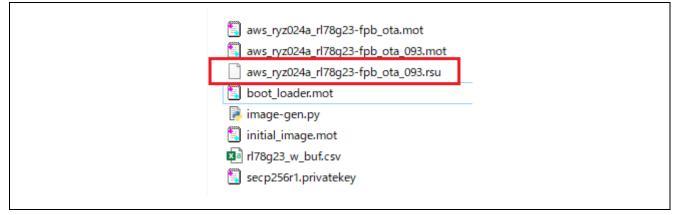


Figure 6-46 Update Image Generated in the Same Folder as Renesas Image Generator



6.4 Running the Demo Project

The following describes the running procedure for the demo project (OTA).

6.4.1 Programming the Initial image (initial_image.mot) to Board

(1) Program the initial image (initial_image.mot).

For the programming method, refer to Chapter 7, Using Renesas Flash Programmer.

- (2) When programming terminates, the demo project starts.
- (3) Check the terminal to make sure that the initial application (version 0.9.2) has started.

==== RL78G23 : BootLoader [with buffer] ==== verify install area O [sig-sha256-ecdsa]OK execute new image Hello World. O 15763 [MAIN_TASK] Connecting Access Point is OK.	
1 15763 [MAIN_TASK]STARTING DEMO	
2 15765 [MQTT] [INFO]Start MQTT Agent Task	
3 15766 [MQTT] [INFO] Creating a TLS connection to a3lklnx40jlphd-ats.iot.ap-northeast-1.amazonaws.com:8883. 4 15779 [MQTT] [INFO] Created new TCP socket. 5 21505 [MQTT] [INFO] Established TCP connection with a3lklnx40jlphd-ats.iot.ap-northeast-1.amazonaws.com. 8 21505 [MQTT] [INFO] Creating an MQTT connection to the broker. 7 21834 [MQTT] [INFO] MQTT connection established with the broker. 8 21835 [MQTT] [INFO] Successfully connected to MQTT broker. 9 21836 [OTA Demo Ta] [INFO]Start OTA Task	
10 21836 [OTA Demo Ta] [INFO] OTA over MQIT demo, Application version 0.9.2 11 21845 [OTA Agent T] [INFO] otaral_detriationmimagestate is called. otaralimageState_t = 2 12 21845 [OTA Agent T] [INFO] Current State=[RequestingJob], Event=[Start], New state=[RequestingJob] 13 21856 [OTA Demo Ta] [INFO] Received: 0 Queued: 0 Processed: 0 Dropped: 0 14 22875 [OTA Agent T] [INFO] Subscribed to topic \$aws/things/rx-ota-firm-things-rx85n-rsk/jobs/notify-next.	

Figure 6-47 Initial Application (Version 0.9.2) Started



6.4.2 Registering the Update Image (aws_ryz024a_rl78g23-fpb_ota_093.rsu) with OTA Jobs (1) AWS IoT > Manage > Remote actions > Jobs > Click "Create job"

Device Location New	AWS IoT > Manage > Remote actions > Jobs			
Manage All devices Greengrass devices LPWAN devices 	Jobs (200+) Info C Edit Cancel Delete Create job Jobs define a set of remote operations to send to and run on one or more devices that are connected to AWS IoT. If you have remote operations that are frequently performed, such as rebooting or installing new applications, use job templates to create reusable jobs. Q. Filter jobs All status values All types			
Crivin devices Software packages <u>New</u> Remote actions	<pre></pre>			

Figure 6-48 Jobs

(2) Check "Create FreeRTOS OTA update job" > Click "Next"

AWS IoT > Manage > Remote actions > Jobs > Create job
Create job Info Jobs define remote operations to send to and run on devices that are connected to AWS IoT. Create a custom job or a FreeRTOS over-the-air (OTA) update job.
Job type
Create custom job Create a job to send an executable job file to one or more devices connected to AWS IoT.
• Create FreeRTOS OTA update job Send a request to acquire an executable job file from one of your S3 buckets to one or more devices connected to AWS IoT.
Cancel

Figure 6-49 Crate Job



- (3) Step 1: OTA job properties
- Job name: Any

AWS IoT > Jobs > Create job > OTA job			
Step 1 of 3			
OTA job properties 🗤			
Job properties			
Job name		1	
Enter a unique name without spaces. Valid characters: a-z, A-Z, 0-9, - (hyphen), and _ (undersco	ore)		
Description - optional		_	
Enter job description			
▶ Tags - optional			
		Cancel	
		Cancel	

Figure 6-50 Step 1: OTA job properties

(4) Step 2: OTA file configuration > Devices

•

• Devices to update: "Name of the thing" in aws_clientcredential.h

#define clientcredentialIOT_THING_NAME	"YOUR_THING_NAME
Select the protocol for file transfer: MQTT	

AWS loT > Jobs > Create job > OTA job
Step 2 of 3 OTA file configuration Info
Devices Info This OTA update job will send your file securely over MQTT or HTTP to the FreeRTOS-based things and/or the thing groups that you choose.
Devices to update Choose things and/or thing groups
Select the protocol for file transfer Select the protocol that your device supports. MQTT HTTP

Figure 6-51 Step 2: OTA file configuration > Devices



- (5) Step 2: OTA file configurations > File
- Sign and choose your file: Sign a new file for me.

File Info			
Sign and choose your file Code signing ensures that devices only ru been changed or corrupted since it was si			
Sign a new file for me.	Choose a previously signed file.	Use my custom signed file.	

Figure 6-52 Step 2: OTA file configurations > File (1)

Code signing profile: Click "Create new profile"

Code signing profile	
This profile will contain information needed to created device's hardware platform, certificate from AWS Cension and the signing certificate path on your device.	
Existing code signing profile	
Existing code signing prome	

Figure 6-53 Step 2: OTA file configurations > File (2)



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- Create a code signing profile.
 - Profile name: Any (Example: rl78g23_fpb_ota_cert)
 - Device hardware platform: Windows Simulator
 - Code signing certificate: "Import new code signing certificate"
 - Certificate body: secp256r1.crt
 - Certificate private key: secp256r1.privatekey
 - Certificate chain optional: ca.crt
 - Path name of code signing certificate on device: Any

Profile name		
Enter a unique name without spaces. Va	lid characters: a-z, A-Z, 0-9, and _ (underscore)	
Device hardware platform		
Windows Simulator	▼	
	the complexity of creating, managing, or importing SSL/TLS in ACM Certificate or import a third-party certificate that you use to sign code.	
 Import new code signing certificate 	 Select an existing certificate 	
Certificates		
Certificate body	secp256r1.crt 906 bytes O Uploaded	
Certificate private key Choose file	secp256r1.privatekey 232 bytes Olyploaded	
Certificate chain - optional	ca.crt 1030 bytes O Uploaded	
Import Path name of code signing certific	ate on device	
	ificate that your FreeRTOS device firmware uses to perform	
/ ccluncates, refolds ipb_ota_cc	•	

Figure 6-54 Create a code signing profile



٦

• File > "Upload a new file." > "Choose file" > aws_ryz024a_rl78g23-fpb_ota_093.rsu

ad a	a nev	w fil	e.) Se	lect	an e	exist	ing	file.							
ose	file																				
yz0 8 by	24a tes	_rl7	8g2	3-fp	ob_o	ta_0	93.r	su													
3 by	tes																				

Figure 6-55 Upload a new file > aws_ryz024a_rl78g23-fpb_ota_093.rsu

- File upload location in S3: Specify the created bucket (Bucket name specified in section 6.1.3.1, Creating Amazon S3 Buckets.
- Path name of file on device: Any

File upload location in S3	
This is the location in S3 where your	ır file will be stored.
S3 URL	
Q s3://	View 🖸 🛛 Browse S3 Create S3 bucket
Format: s3://bucket/prefix/object.	
Path name of file on device This is the name and location where	e the file will be stored on the FreeRTOS device.

Figure 6-56 File upload location in S3

- (6) Step 2: OTA file configurations > IAM role
- Role: Specify the created role (Role name specified in section 6.1.3.2, Creating an OTA Update Service Role).

IAM role Info	
Role Choose a role that grants AWS IoT access	to S3, AWS IoT jobs, and AWS Code signing resources.
	Cancel Back Next

Figure 6-57 Step 2: OTA file configurations > IAM role



(7) Step 3: OTA job configuration

• Job run type: Your job will complete after deploying to the devices and groups that you chose (snapshot)

Job run type Choose how to run this job.			
 Your job will complet (snapshot) 	e after deploying to the devices and <u>c</u>	Jroups that you chose	1
	to deploy to any devices added to th	e groups that you chose	-
	configuration - optional		
Specity now quickly devic	es will be notified when a pending job start	S.	
	ration - optional ne when to automatically stop the job. The sployed. The job cancels if any of the criteria		vices fail the deployment after a
Job run timeout Specify how long the job	configuration - <i>optional</i> will run.		
		Cancel	Back Create job
uccessfully created Job:			
AWS IoT > Manage > Remote	actions > Jobs		
Jobs (200+) Info	ns to send to and run on one or more devices tha	t are connected to AWS IoT. If you	
Jobs define a set of remote operatio or installing new applications, use jo	b templates to create reusable jobs.		

Figure 6-58 Step 3: OTA job configuration



RL78/G23

(8) After a while, the log of programming the update image to the MCU board is output to the terminal.

-92c2-7c962e01f5f8] 13 12176 [OTA Agent T] [INFO] Extracted parameter: [key: value]=[execution.jobDocument.afr_ota.protocols: [~MQTT"]] 14 12187 [OTA Agent T] [INFO] Extracted parameter: [key: value]=[filepath: /device/ota] 15 12190 [OTA Agent T] [INFO] Extracted parameter: [key: value]=[fileisize: 193920] 16 12194 [OTA Agent T] [INFO] Extracted parameter: [key: value]=[fileid: 0] 17 12197 [OTA Agent T] [INFO] Extracted parameter: [key: value]=[fileid: 0] 18 12209 [OTA Agent T] [INFO] Extracted parameter: [key: value]=[certfile: watanabe_ota_cert] 18 12209 [OTA Agent T] [INFO] Extracted parameter: [key: value]=certfile: watanabe_ota_cert] 18 12209 [OTA Agent T] [INFO] Extracted parameter: [key: value]=certfile: watanabe_ota_cert] 19 12216 [OTA Agent T] [INFO] Job document was accepted. Attempting to begin the update. 10 12217 [OTA Agent T] [INFO] Job document was accepted. Attempting to begin the update. 20 12217 [OTA Agent T] [INFO] Setting OTA data interface. 21 12218 [OTA Agent T] [INFO] Setting OTA data interface. 22 12219 [OTA Agent T] [INFO] Current State=[CreatingFile], Event=[ReceivedJobDocument], New state=[CreatingFile] 31 20334 [OTA Agent T] [INFO] Current State=[RequestingFile], Event=[CreateFile], New state=[RequestingFile] 23 12034 [OTA Agent T] [INFO] Publishing message to \$aws/things/rx-ota-firm-things-rx65n-rsk/streams/AFR_OTA-5931dc99-6ce0-428e-92c2-7c962e0
If5f8/get/cbor. 25 13429 [OTA Agent T] [INFO] Published to MOTT topic to request the next block: topic=\$aws/things/rx-ota-firm-things-rx65n-rsk/strea ns/AFR_OTA-5931dc99-6ce0-428e-92c2-7c962e01f5f8/get/cbor 26 13430 [OTA Agent T] [INFO] Current State=[WaitingForFileBlock], Event=[RequestFileBlock], New state=[WaitingForFileBlock] 27 13668 [MOTT] [INFO] De-serialized incoming PUBLISH packet: DeserializerResult=MQTTSuccess. 28 13669 [MOTT] [INFO] State record updated. New state=MQTTPublishDone. 29 13672 [OTA Agent T] [INFO] Received valid file block: Block index=0, Size=0 30 13676 [OTA Agent T] W 0x59300, 768 OK

Figure 6-59 Programming the Update Image to the MCU Board

(9) When programming terminates, the update image (version 0.9.3) starts.

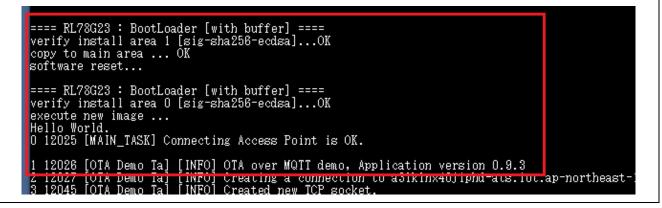


Figure 6-60 Update Image (Version 0.9.3) Started after Programming Terminates



6.5 Debugging the Initial Application

The following describes the procedure for starting the initial application from e² studio and debugging it. Because the bootloader is not used in this procedure, downloaded update images cannot be started.

(1) Change the setting to not use the bootloader.

Change the "USE_BOOTLOADER_V2" macro of the aws_ryz024a_rl78g23-fpb project to 0, and then click "Apply and Close".

- Configuration: HardwareDebug_OTA
- Languages: GNU C
- USE_BOOTLOADER_V2: 0

type filter text	Paths and Symbols			<> ▼ ⇒ ▼ 8
 Resource Builders C/C++ Build C/C++ General Code Analysis Documentation 		wareDebug_OTA [Active]	Manag	e Configurations
File Types Formatter Indexer Language Mappings MISRA-C In-editor Check Paths and Symbols Preprocessor Include Pat Git Project Natures	Languages GNU C GNU C++ Object File Assembly Assembly	Symbol #LITTLE_ENDIAN #TEST # USE_BOOTLOADER_V2	Value 0	Add Edit Delete Export
Project References Refactoring History Renesas QE Run/Debug Settings Task Tags > Validation	 Preprocessor In Show built-in valu Market Settings 		y define additional entries Restore Default	s Apply

Figure 6-61 Setting the "USE_BOOTLOADER_V2" Macro to 0

(2) Build the aws_ryz024a_rl78g23-fpb project.

(3) Start debugging.

Refer to Chapter 8, Debug Procedure.



7. Using Renesas Flash Programmer

The following describes the procedure for using Renesas Flash Programmer to program MOT files to the MCU board.

7.1 When Using COM Port

The following describes how to program a MOT file via the COM port.

7.1.1 Setting Jumper Pins

Set J15: 1-2 Short, J16: 1-2 Short, and J19: 1-2 Short.

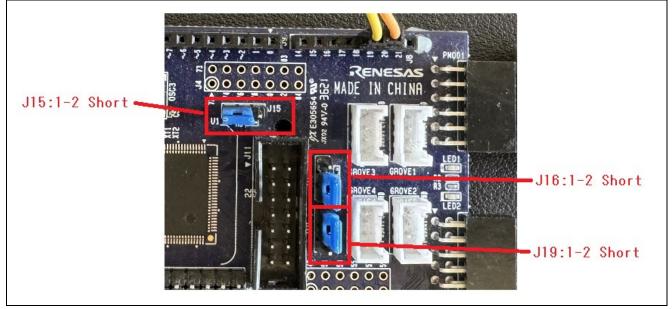


Figure 7-1 Settings for Using COM Port Debugging (Top Side)

7.1.2 Supplying Power to the MCU Board

Connect the USB cable to supply power to the MCU board.



7.1.3 Creating a New Project and Connecting to the MCU Board

(1) File > New project

- Microcontroller: RL78/G2x
- Project Name: Any (Example: rl78g23-fpb)
- Project Folder: Any
- Tool: COM port
- Interface: 2 wire UART
- Tool Details...: COM port number
- Click "Connect"

🜠 Create New Project		_		\times
Project Information		_		
Microcontroller:	RL78/G2× ~	٦		
Project Name:	r178g23-fpb			
Project Folder:)ocuments¥Renesas Flash Programmer¥V3.1	1	Browse	
Communication				
Tool: COM port	✓ Interface: 2 wire UART ✓		Wide Voltag	е
Tool Details	Num: COM8			
	controller: RL78/G2x t Name: r178g23-fpb t Folder: Documents¥Renesas Flash Programmer¥V3.11 Browse cation COM port v Interface: 2 wire UART v Wide Voltage			

Figure 7-2 Creating a New Project and Connecting to the MCU Board



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(2) The connection is successful if the following window appears.

File Ta	sas Flash Progr arget Device	Help							
			lock Settings	Flash Options	Connect Settings	Unique	Code		
Projec Curr Micr	ct Information rent Project: rocontroller: am File	r178g23 R7F100	3-fpb.rpj					owse	1
	n Operation use >> Program	>> Verify	,						
			Ctore	L					
			Star	t					
Device: Boot Fir Device (Code Flash		4 000000000,	. Size : 768 K.	Erase Size : 2 k)				^
Boot Fir Device (Code Flash Data Flash Disconnect	rmware Version Code: 10 00 0A h (Address : 0x1	4 000000000,	. Size : 768 K.)				^
Device: Boot Fir Device (Code Flash Data Flash Disconnect	rmware Version Code: 10 00 0A h (Address : 0x) h (Address : 0x0 ting the tool	4 000000000,	. Size : 768 K.	Erase Size : 2 k)				~

Figure 7-3 Operation completed (Connect)



7.1.4 Programming a MOT File to the MCU Board

- (1) In the Program File field, enter the path to the MOT file to be programmed, and then click "Start".
- Program File: MOT file to be programmed (Example: initial_image.mot, aws_ryz024a_rl78g23-fpb.mot)
- Click "Start"

📕 Rene	sas Flash Programme	r V3.11.01			_	
File T	arget Device Help					
Operation	Operation Settings	Block Settings	Flash Options	Connect Settings	Unique Code	
Curi		s23-fpbrpj 100GSN				
	am File Users¥a5124249¥Desl	ktop¥ImageGener	ator¥v302¥r178g2	23¥w_buffer¥initial_ir	nage.mot E	Browse
				CRC-32 : A	D8559B3	
	Operation se >> Program >> Ve	rify				
		Star	t			

Figure 7-4 Programming a MOT File to the MCU Board

(2) Make sure that programming is successful.

Erase >> Program >> Verify	
Start	ок

Figure 7-5 Successful programming



7.2 When Using Emulator

The following describes how to program a MOT file via the emulator.

7.2.1 Setting Jumper Pins, Mounting the Connector, and Cutting Patterns

The 14-pin connector (J11) is used for connection with the E2 emulator or E2 emulator Lite, which are Renesas Electronics on-chip debug emulators with the programming feature (the connector component is not mounted). Use the emulator to program and debug the evaluation MCU.

When connecting the emulator, you need to change the circuit as following figures. For details, refer to section 5.20 in <u>RL78/G23-128p Fast Prototyping Board User's Manual Rev.1.00</u>.

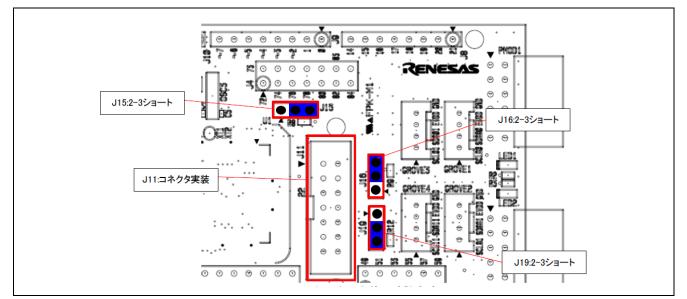


Figure 7-6 Settings for Using Emulator Connector (Top Side)

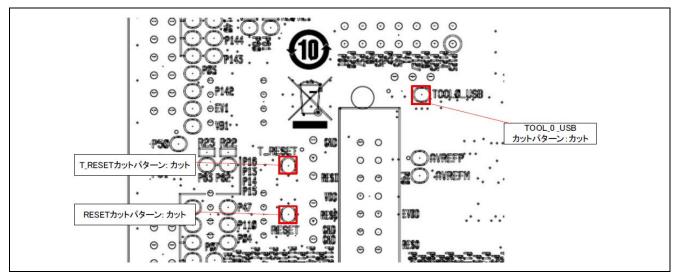


Figure 7-7 Settings for Using Emulator Connector (Solder Side)

For details about how to use the emulator, refer to "E1/E20/E2 Emulator, E2 Emulator Lite Additional Document for User's Manual (Notes on Connection of RL78)" (R20UT1994).



7.2.2 Supplying Power to the MCU Board

Connect the USB cable to supply power to the MCU board.

7.2.3 Creating a New Project and Connecting to the MCU Board

(1) File > New project

- Microcontroller: RL78/G2x
- Project Name: Any (Example: rl78g23-fpb)
- Project Folder: Any
- Tool: E2 emulator
- Click "Connect"

📕 Create New Projec	t –	_	×
Project Information			
Microcontroller:	RL78/G2× ~	1	
Project Name:	r178g23-fpb		
Project Folder:	C:¥Users¥a5124249¥Documents¥Renesas Fla:	Browse	
Communication Tool: E2 emulate Tool Details	or Interface: 1 wire UART Num: AutoSelect Power: None] Wide Voltage	
	Connect	Cance	:1

Figure 7-8 Creating a New Project and Connecting to the MCU Board



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(2) The connection is successful if the following window appears.

		r V3.11.01			_		×
File Ta	arget Device Help						
Operation	Operation Settings	Block Settings	Flash Options	Connect Settings	Unique Co	ode	
Projec	t Information						
Curr	ent Project: r178	g23-fpbrpj					
Micr	ocontroller: R7F	100GSN					
Progra	am File						
						Browse	
Elash	Operation						
	se >> Program >> Ve	rifu					-
	se // Frogram // Ve	, ny			1		-
	se // rrogram // Ve	Star	t				
	se // rrogram // ve		t				
	se // rrogram // ve		t				
ignature:			t				^
iignature: Device:	R7F100GSN mware Version: V1.0;	Star	t				^
iignature: Device: Boot Fir Device (R7F100GSN mware Version: V1.0; Code: 10 00 0A	Star					^
iignature: Device: Boot Fir Device (Code Flash	R7F100GSN mware Version: V1.0; Code: 10 00 0A (Address : 0x000000	Star 2 100, Size : 768 K,	Erase Size : 2 I	κ)			^
iignature: Device: Boot Fir Device (Code Flash	R7F100GSN mware Version: V1.0; Code: 10 00 0A	Star 2 100, Size : 768 K,	Erase Size : 2 I	κ)			^
iignature: Device: Boot Fir Device (Code Flash Data Flash Disconnect	R7F100GSN mware Version: V1.0; Code: 10 00 0A (Address : 0x000000 (Address : 0x000F10 ing the tool	Star 2 100, Size : 768 K,	Erase Size : 2 I	K)			^
Bignature: Device: Boot Fir Device (Code Flash Data Flash Disconnect	R7F100GSN mware Version: V1.0) Code: 10 00 0A (Address : 0x000000 (Address : 0x000F10	Star 2 100, Size : 768 K,	Erase Size : 2 I	K)			^
iignature: Device: Boot Fir Device (Code Flash Data Flash Disconnect	R7F100GSN mware Version: V1.0; Code: 10 00 0A (Address : 0x000000 (Address : 0x000F10 ing the tool	Star 2 100, Size : 768 K,	Erase Size : 2 I	K)			^

Figure 7-9 Operation completed (Connect)

7.2.4 Programming a MOT File to the MCU Board

Refer to section 7.1.4, Programming a MOT File to the MCU Board.



8. Debug Procedure

8.1 When Using COM Port

The following describes how to perform debugging by using the COM port.

8.1.1 Setting Jumper Pins

Refer to section 7.1.1, Setting Jumper Pins.

8.1.2 Supplying Power to the MCU Board

Connect the MCU board to the PC by using the USB cable.

8.1.3 Debug Configurations

Select the configuration you want to use for debugging.

Debug Configurations > Renesas GDB Hardware Debugging
 — For the demo project (PubSub), select aws_ryz024a_rl78g23-fpb HardwareDebug.

🗋 🖻 🍋 🗎 🗶 📄 🖓 🔸	Name: aws_ryz024a_rl78g23-fpb HardwareDebug	
type filter text	📄 Main 🕸 Debugger 🐌 Startup 🔲 Common 🧤 Source	
C/C++ Application C/C++ Remote Application	Project:	
EASE Script	aws_ryz024a_rl78g23-fpb	Browse
C GDB Hardware Debugging	C/C++ Application:	
💽 GDB Simulator Debugging (RH850) 🚘 Launch Group	HardwareDebug/aws_ryz024a_rl78g23-fpb.x	
✓ E [™] Renesas GDB Hardware Debugging	Variables Search Proj	ect Browse
exe_ryz024a_rl78g23-fpb HardwareDebug exe_ryz024a_rl78g23-fpb HardwareDebug_OTA	Build (if required) before launching	
boot_loader HardwareDebug	Build Configuration: Use Active	\sim
©े test_aws_cellular_ryz024a HardwareDebug ऌ त्र Renesas Simulator Debugging (RX, RL78)	O Enable auto build O Disable auto build	
	Use workspace settings <u>Configure Workspace Set</u>	tings

Figure 8-1 Debug Configurations of Project (PubSub)

— For the demo project (OTA), select aws_ryz024a_rl78g23-fpb HardwareDebug_OTA.

' 🖻 🍋 📔 🗶 🖻 🏹 👻	Name: aws_ryz024a_rl78g23-fpb HardwareDebug_OTA	
/pe filter text	📄 Main 🕸 Debugger 🕨 Startup 🧤 Source 🔲 Common	
C C/C++ Application	Project:	
EASE Script	aws_ryz024a_rl78g23-fpb	Browse
GDB Hardware Debugging	C/C++ Application:	
💽 GDB Simulator Debugging (RH850)	HardwareDebug_OTA/aws_ryz024a_rl78g23-fpb_ota.x	
📪 Launch Group		
🛚 💽 Renesas GDB Hardware Debugging	Variables Search Project	Browse
📧 aws_ryz024a_rl78g23-fpb HardwareDebug	Build (if required) before launching	-
aws_ryz024a_rl78g23-fpb HardwareDebug_OTA		
💽 boot_loader HardwareDebug	Build Configuration: Use Active	\sim
test_aws_cellular_ryz024a HardwareDebug	O Enable auto build	
💽 Renesas Simulator Debugging (RX, RL78)		
	Use workspace settings <u>Configure Workspace Settings</u>	

Figure 8-2 Debug Configurations of Project (OTA)



8.1.4 Debugger Settings

Select "Debugger" tab.

• Debug hardware: COM Port (RL78)

Name: aws_ryz024a_rl78g23-fpb Hardwa	areDebug_OTA
📄 Main 🕸 Debugger 🕨 Startup 🖏	Source Common
Debug hardware: COM Port (RL78)	✓ Target Device: R7F100GSN
GDB Settings Connection Settings GDB Connection Settings	Debug Tool Settings
Autostart local GDB server	Host name or IP address: localhost
O Connect to remote GDB server	GDB port number: 61234
	Connection timeout (s): 30 V

Figure 8-3 Debug hardware: COM Port (RL78)

Select "Connection Settings" tab > Connection with Target Borad.

- COM Port: COMxx
- Reset control pin: DTR

📄 Main 🕸 Debugger 🍉 Startup 🧤 Source 🔲 Com	mon	
Debug hardware: COM Port (RL78) V Target Device:	R7F100GSN	
GDB Settings Connection Settings Debug Tool Setting	gs	
✓ Clock		
Main Clock Frequency[MHz]	Using Internal Clock	¥
Sub Clock Frequency[kHz]	Using Internal Clock	¥
Monitor Clock	System	¥
 Connection with Target Board 		
COM Port	COM7	
Reset control pin	DTR	¥
Baud Rate [bps]	Auto	¥
✓ Flash		
Current Security ID (HEX)	000000000000000000000000000000000000000	
Current Serial Programming Security ID (HEX)	FFFFFFFFFFFFFFFFFFFFFFFF	FFFFFF

Figure 8-4 Connection Settings for Using COM Port

Start debugging by clicking





8.2 When Using Emulator

The following describes how to perform debugging by using the E2 emulator Lite.

8.2.1 Mounting the Connector, Setting Jumper Pins, and Cutting Patterns

Refer to section 7.2.1, Setting Jumper Pins, Mounting the Connector, and Cutting Patterns.

8.2.2 Connecting the Emulator to the MCU Board

Connect the emulator as shown in the following figure.



Figure 8-5 Connecting Emulator to MCU Board



8.2.3 Debug Configurations

Select the configuration you want to use for debugging.

Debug Configurations > Renesas GDB Hardware Debugging

— For the demo project (PubSub), select aws_ryz024a_rl78g23-fpb HardwareDebug.

	Name: aws_ryz024a_rl78g23-fpb HardwareDebug
type filter text	📄 Main 🕸 Debugger 🐌 Startup 🔲 Common 🧤 Source
C C/C++ Application	Project:
EASE Script	aws_ryz024a_rl78g23-fpb Browse
C GDB Hardware Debugging	C/C++ Application:
GDB Simulator Debugging (RH850) 民 Launch Group	HardwareDebug/aws_ryz024a_rl78g23-fpb.x
Renesas GDB Hardware Debugging	Variables Search Project Browse
aws_ryz024a_rl78g23-fpb HardwareDebug aws_ryz024a_rl78g23-fpb HardwareDebug_OTA	Build (if required) before launching
C boot_loader HardwareDebug	Build Configuration: Use Active
E™ test_aws_cellular_ryz024a HardwareDebug E™ Renesas Simulator Debugging (RX, RL78)	O Enable auto build O Disable auto build
	Use workspace settings <u>Configure Workspace Settings</u>

Figure 8-6 Debug Configurations of Project (PubSub)

— For the demo project (OTA), select aws_ryz024a_rl78g23-fpb HardwareDebug_OTA.

	Name: aws_ryz024a_rl78g23-fpb HardwareDebug_OTA
type filter text	📄 Main 🕸 Debugger 🔛 Startup 🦆 Source 🔲 Common
C C/C++ Application C C/C++ Remote Application	Project:
 EASE Script GDB Hardware Debugging 	aws_ryz024a_rl78g23-fpb Browse C/C++ Application: Browse
GDB Simulator Debugging (RH850) Launch Group	HardwareDebug_OTA/aws_ryz024a_rl78g23-fpb_ota.x
✓ C [™] Renesas GDB Hardware Debugging C [™] aws ryz024a rl78q23-fpb HardwareDebug	Variables Search Project Browse
aws_ryz024a_rl78g23-fpb HardwareDebug_OTA	Build (if required) before launching
c [®] boot_loader HardwareDebug c [®] test_aws_cellular_ryz024a HardwareDebug	Build Configuration: Use Active
💽 Renesas Simulator Debugging (RX, RL78)	O Enable auto build O Disable auto build Image: O Use workspace settings Configure Workspace Settings

Figure 8-7 Debug Configurations of Project (OTA)



8.2.4 Debugger Settings

Select "Debugger" Tab.

• Debug hardware : E2 Lite (RL78)

📄 Main 🔅 Debugger 🕨 Startup 🖏	Source Common Target Device: R7F100	GSN
GDB Settings Connection Settings GDB Connection Settings	Debug Tool Settings	
Autostart local GDB server	Host name or IP address:	localhost
 Connect to remote GDB server 	GDB port number:	61234
	Connection timeout (s):	30 ~

Figure 8-8 Debug hardware: E2 Lite (RL78)

Select "Connection Settings" tab > Connection with Target Borad.

• Power Target From The Emulator (MAX 200mA): No

ame: aws_ryz024a_rl78g23-fpb HardwareDebug_OTA		
🗎 Main 隊 Debugger 🕨 Startup 🧤 Source 🔲 Com	imon	
Debug hardware: E2 Lite (RL78) V Target Device	: R7F100GSN	
GDB Settings Connection Settings Debug Tool Setting	gs	
✓ Clock		
Main Clock Frequency[MHz]	Using Internal Clock	\checkmark
Sub Clock Frequency[kHz]	Using Internal Clock	¥
Monitor Clock	System	¥
 Connection with Target Board 		
Emulator	(Auto)	
Low voltage OCD board	No	\lor
Power Target From The Emulator (MAX 200mA)	No	¥
Supply Voltage[V]	3.3	\lor
Hot Plug	No	\lor
✓ Flash		
Current Security ID (HEV)	000000000000000000000000000000000000000	

Figure 8-9 Connection Settings for Using Emulator

Start debugging by clicking

Debug



9. Appendix

9.1 Precautions on Porting Third-Party Libraries to RL78

Because RL78 is a 16-bit system, the following must be noted when applying a third-party library to RL78.

9.1.1 Width of int Is 16 Bits

Modification might be required in the parts in which processing-dependent types (such as int and size_t) are used. Pay particular attention in the case of variables that handle the size.

This demo projects modified the following libraries:

- tinycbor(0.5.2) <u>https://github.com/intel/tinycbor</u>
- TinyCrypt Cryptographic Library (0.2.8) https://github.com/intel/tinycrypt

9.1.2 Size Limitation of Section

Some sections cannot extend accross a boundary of 64KB – 1; in other words, they can only allocate a maximum size of 64KB. Therefore, for example, if porting a large library to RL78, data larger than 64KB may be allocated in a default section, causing a linker error. For details, refer to <u>CC-RL Compiler User's Manual</u> (R20UT3123).

For details, refer to <u>CC-RL Complier User's Manual</u> (R20013123).

To avoid this limitation, you need to adjust section size. The following explains how to adjust the default constant section (.constf) as an example.

First, define a new constant section.

0x00003000	.const
	.text
	.data
	.sdata
	.RLIB
	.SLIB
0x00010000	.constf
0x00020000	const_*
	.textf
0x000F3F04	.dataR
	.bss
0x000FFE20	.sdataR
	.sbss

Figure 9-1 Newly Defined Constant Section (e² studio)



Next, change section so that library data is allocated in the newly defined constant section by one of the following methods.

(1) #pragma section directive

Add #pragma section directive to library source codes.

example:core_mqtt.c

```
#if defined(_CCRL_) || defined(_ICCRL78_) || defined(_RL)
#pragma section const const_coreMqtt
#endif
/**
 * @file core_mqtt.c
 * @brief Implements the user-facing functions in core_mqtt.h.
 */
#include <string.h>
#include <assert.h>
 ...Codes...
#if defined(_CCRL_) || defined(_ICCRL78_) || defined(_RL)
#pragma section
#endif
```

Figure 9-2 Added #pragma section Directive (3rd Party Library)

(2) Link option -REName

Change section so that library data is allocated in the newly defined constant section for each file by specifying a link option as shown following. This method has the advantage that you don't need to modify source files.

-REName=.\Middleware\FreeRTOS\coreMQTT\source\core_mqtt.obj(.constf=const_coreMqtt_f)

9.2 License Information for Open Source Software Used with Demo Projects

The demo projects of this product use open source software (OSS). The user must comply with the license terms stipulated by OSS. Check the license terms on the official website of the respective OSS. Table 1-3 Operation Confirmation Conditions (Others, such as OSS Library) shows the link of each OSS.



10. Websites and Supports

Sample programs in this Getting Started Guide: <u>https://github.com/renesas/iot-reference-rl78</u>

AWS forum: http://forums.aws.amazon.com



Revision History

		Description	
Rev.	Date	Page	Summary
1.00	Feb. 29, 2024	-	First edition issued



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 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 systemevaluation test for the given product.

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