

RL78/G23

Getting Started Guide for Connecting Amazon Web Services in Wi-Fi 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 Wi-Fi DA16600 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 Wi-Fi DA16600 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 2024-04.0
C compiler	Renesas Electronics
	CC-RL V1.13.00
Firmware programming tool	Renesas Flash Programmer V3.14.00
Smart Configurator (SC)	Renesas Smart Configurator for RL78 24.4.0.v20240415-1426
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 3.12.1
OpenSSL	OpenSSL 3.1.4



Item	Description
iot-reference-rl78	v202210.01-LTS-rl78-1.1.0 (Based FreeRTOS 202210.01-LTS)
	https://github.com/renesas/iot-reference-rl78/tree/v202210.01-LTS-
	<u>rl78-1.1.0</u>
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

ltem	Description
MCU board	RL78/G23-128p Fast Prototyping Board
	RTK7RLG230CSN000BJ - RL78/G23-128p Fast Prototyping Board
Wi-Fi DA16600 module	PMOD Expansion Board for DA16600MOD
	US159-DA16600EVZ - Ultra-Low-Power Wi-Fi + Bluetooth Low Energy
	Combo Pmod Board Renesas
USB-UART conversion	Pmod USBUART
board	CP2101 USB TO TTL BOARD V4.2 (agencyelectronics.com)
Micro USB Type-B cable	Used to connect the USB-UART conversion board to the PC
x 2	Used to connect the MCU board to the PC
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.

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

ltem	Description	
Emulator	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 DA16600MOD	
P144/TxD3	Output	UART communication (transmission) with DA16600MOD	
P00	Output	Reset to DA16600MOD	
P142	Output	UART communication (RTS) with DA16600MOD	
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 DA16600MOD	
P144/TxD3	Output	UART communication (transmission) with DA16600MOD	
P00	Output	Reset to DA16600MOD	
P142	Output	UART communication (RTS) with DA16600MOD	
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

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	OTA demo configurations.
pubsub	PubSub demo configurations.
test	
Demos	
Common	
include	
└	
	OTA demo source codes.
SimplePubSub	PubSub demo source codes.
IDT_config	
Middleware	
Application-Protocols	
network_transport	
AWS	
ota-for-aws-iot-embedded-sdk	
FreeRTOS	FreeRTOS Kernel and libraries.
backoffAlgorithm	
coreJSON	
coreMQTT-Agent	
FreeRTOS-Kernel	
logging	
_ iwifi	
– Projects	
└─rl78g23-fpb	
application_code	
flash_proj	
helper	
modules	
	Import below folders to IDE.
aws_da16600_rl78g23-fpb	PubSub demo and OTA demo. Select by Build Configurations.
boot_loader	Boot loader for OTA demo.
test_aws_da16600_rl78g23-fpb	
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_da16600_rl78g23-fpb	120520	34733
(demo project (PubSub))		
aws_da16600_rl78g23-fpb	206610	44404
(demo project (OTA))		
boot_loader	22165	1349



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) Connect DA16600MOD to PMOD1 of the MCU board.



Figure 4-2 Connecting DA16600MOD to PMOD1 of the MCU Board



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



Figure 4-3 Connecting the USB-UART Conversion Board to the MCU Board

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



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

(4) If you changed circuit to mount emulator connector on the MCU board, configure the COM port debugging that uses a USB-to-serial converter. If you don't change circuit, you don't need this process.



Figure 4-5 Settings for Using COM Port Debugging (Top Side)



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



Figure 4-6 Supplying Power to the MCU Board

(6) Confirm the COM port number.

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

(7) 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 4-1 Serial 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 Wi-Fi Information to the Demo Project

Specify the Wi-Fi information for the following macros in the demo project.

- iot-reference-rl78\Projects\rl78g23-fpb\modules\r_config\r_wifi_da16xxx_config.h
 - WIFI_CFG_COUNTRY_CODE: Country code in ISO3166-1 alpha-2 standard
 - WIFI_CFG_TLS_SUPPORT: TLS on-chip protocol
 - WIFI_CFG_TLS_CERT_NAME: CA certificate name
 - WIFI_CFG_TLS_CERT_CLIENT_NAME: Client certificate name
 - WIFI_CFG_TLS_CERT_PRIVATE_NAME: Private certificate name

iot-reference-rl78\Projects\rl78g23-fpb\modules\r_config\r_wifi_da16xxx_config.h

```
/* Country code
  Country code defined in ISO3166-1 alpha-2 standard.
*/
#define WIFI CFG COUNTRY CODE
                                                "VN"
/* Enables or disables TLS on-chip protocol.
   0 = disabled.
   1 = enabled.
* /
#define WIFI CFG TLS SUPPORT
                                                1
/* Configures CA certificate name.
*/
#define WIFI_CFG_TLS_CERT_CA_NAME
                                                "CA CERT"
/* Configures Client certificate name.
*/
#define WIFI CFG TLS CERT CLIENT NAME
                                                "CERT KEY"
/* Configures Private certificate name.
*/
#define WIFI_CFG_TLS_CERT_PRIVATE_NAME
                                                 "CERT KEY"
```



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, 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 Wi-Fi network to the demo project.
  iot-reference-rl78\Demos\include\aws clientcredential.h
   * @brief Wi-Fi network to join.
   * @todo If you are using Wi-Fi, set this to your network name.
   */
  #define clientcredentialWIFI SSID
                                                         "YOUR WIFI SSID"
  /*
   * @brief Password needed to join Wi-Fi network.
   * @todo If you are using WPA, set this to your network password.
   */
                                                         "YOUR WIFI PASSWORD"
  #define clientcredentialWIFI PASSWORD
  /*
   * @brief Wi-Fi network security type.
   * @see WIFISecurity t.
   * @note Possible values are eWiFiSecurityOpen, eWiFiSecurityWEP,
  eWiFiSecurityWPA,
   * eWiFiSecurityWPA2 (depending on the support of your device Wi-Fi radio).
   */
  #define clientcredentialWIFI SECURITY
                                                         YOUR WIFI SECURITY
```



(4) 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 \setminus
"----BEGIN RSA PRIVATE KEY----\n"\
"MIIEowIBAAKCAQEA3Fb707jQW4lqHmPE3AInUTWUCaR7kWeWHubEk9YbNf3xwxdq\n"\
. . .
"s/OlVUiygf0RgeoMVx/3GzZPfmTrB0cQ8XZ7mxCd2dgY9UXQ/oja\n"\
"----END RSA PRIVATE KEY----\n"
```



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(5) Set the hook function (Only using Wi-Fi to the demo project). For PubSub demo project : iot-reference-rl78\Configuration\rl78g23-fpb\pubsub\wifi\frtos_config\user_tcp_hook_config.h

For OTA demo project :

iot-reference-rl78\Configuration\rl78g23-fpb\ota\wifi\frtos_config\user_tcp_hook_config.h

<pre>/* The limit of number for WIFI_ERR_MODULE_COM when it comes continuously. * If counter is over than this limit, hook the reset */ #define USER_COMM_ERROR_TRIES 3</pre>
/*Connection retry limit*/ #define USER_RECONNECT_TRIES <mark>3</mark>
/*Socket closing retry limit*/ #define USER_CLOSE_SOCKET_TRIES
/*Enable SocketErrorHook*/ #define USER_TCP_HOOK_ENABLED
<pre>#endif /* FRTOS_CONFIG_USER_TCP_HOOK_CONFIG_H_ */</pre>



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_da16600_rl78g23-fpb project to e^2 studio. Open the Import wizard according to the following process.

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

Next, select the aws_da16600_rl78g23-fpb project. Ensure that copy projects into workspace is not selected. Then click the Finish button.

Import		
Import Projects		
Select a directory to search for existing Eclipse projects.		
Select root directory: C	Projects\rl78g23-fpb ~	Browse
○ Select archive file:	×.	Browse
Projects:		
✓ aws_da16600_rl78g23-fpb (C:	Projects\rl78g2:	Select All
		Deselect All
		Refresh
Coptions Search for nested projects Copy projects into workspace Close newly imported projects upon completion Hide projects that already exist in the workspace	>	
Working sets		
Add project to working sets		New
Working sets:	Ŷ	Select
(?) < Back Next >	Finish	Cancel

Figure 5-1 Selecting the aws_da16600_rl78g23-fpb Project

The imported project is showed in the Project Explorer view.



Figure 5-2 Completing to Import the aws_da16600_rl78g23-fpb Project



5.3 Setting the Build Configuration

Activate the build configuration "HardwareDebug" of the aws_da16600_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_da16600_rl78g23-fpb project to create a MOT file.

Then, make sure that aws_da16600_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".

WS Services Q	Search		[Alt+S]	۶.	¢	0	۲	Tokyo 🔻		
AWS IoT	×	AWS IOT > MQTT test client								
Monitor		MQTT test client 🖬	fo							
Connect Connect one device		You can use the MQTT test client to topics to communicate their state to to MQTT message topics and publish	monitor the MQTT messages b AWS IoT. AWS IoT also publish MQTT messages to topics by	eing passed in es MQTT mess using the MQT	your AW ages to i I test cli	'S accoui inform d ent.	nt. Devic levices a	es publish N nd apps of c	1QTT messa hanges and	ges that are identified b events. You can subscrib
Connect many devices	- 1	 Connection details 	alle by choosing Disconnect and ma	ing undator on t	ho Ectabli	ich conno	rtion to c	atious page		⊘ Connected
Test	- 11		aits by choosing disconnect and ma	ang upuates on t	IIE ESLADI	ISTI COTITIE		priuriue page.		
Device Advisor	- 11									
MQTT test client	- 11	Subscribe to a topic	Publish to a topic							
Device Location New	- 11		_							
	- 11	Topic filter Info							1	
Manage		The topic filter describes the topic(s) to	which you want to subscribe. The t	ppic filter can inc	ude MQT	T wildcar	d characte	ers.		
All devices		Enter the topic filter								
Greengrass devices		Additional configuration							-	
LPWAN devices										
Software packages New		Subscribe								
Remote actions										
Message routing										
Retained messages		Subscriptions	Торіс							
Security										
		You have no topic subscriptions		6 h						

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_da16600_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.

Hello World.
STARTING DEMO
0 12882 [MQTT] [INFO]Start MQTT Agent Task
1 12883 [MQTT] [INFO] Creating a TLS connection to attvj79f5fqjo-ats.iot.ap-northeast-1.amazonaws.com:8883.
2 14790 [MOTT] [INFO] Creating an MOTT connection to the broker.
3 15085 [MOTT] [INFO] MOTT connection established with the broker.
4 15086 [MOTT] [INFO] Successfully connected to MOTT broker.
5 15093 [PUBSUB] [INFO]Start PubSub Demo Task 0
6 15099 [FUBSUB] [INFO] Sending subscribe request to agent for topic filter: pubsub demo/r178g23-128p-fpb/task 0
7 15105 [PUBSUB] [INFO]Start PubSub Demo Task 1
8 15117 [FUBSUB] [INFO] Sending subscribe request to agent for topic filter; pubsub demo/r178g23-128p-fpb/task 1
9 15458 [PUBSUB1 [INFO] Successfully subscribed to topic: pubsub demo/r178g23-128p-fpb/task 0
10 15459 [PUBSUB] [INFO] Sending publish request on topic "pubsub demo/r178g23-128p-fpb/task 0"
11 15558 [MOTT] INFO! Publishing message to pubsub demo/r178g23-128p-fpb/task 0.
12 5617 (PUBSUB) (INFO) Successfully sent QoS 0 publish to topic; pubsub demo/r178g23-128p-fpb/task 0 (PassCount:1, FailCount:0),
13 15/17 [PUBSUB] [INFU] Successfully subscribed to topic: pubsub demo/r1/8g/3-128p-rpb/task 1
14 15718 [PUBSUB] [INFO] Sending publish request on topic "pubsub demo/r178g23-128p-fpb/task 1"
15 15817 [MOTT] [INFO] De-serialized incoming PUBLISH packet: DeserializerResult=MOTTSuccess.
16 15817 [MOTT] INFO State record undated. New state=MOTTPublishDone.
17 15818 [MOTT] [INFO] Received incoming publish message Task 0 publishing message 0
18 15920 [MOTT] [INFO] Publishing measage to pubsub demo/r178g23=128p-fpb/task 1.
the state lefter fraces reactioned another on become state and statement's
19 16245 [MOTT] [INFO] Ack macket descriptized with result: MOTTSuccess.
20 16245 [MOTT] [INFO] State record undated. New state=MOTTPublishDone.
21 16253 [PUBSUB] [INFO] Successfully sent OoS 1 publish to topic: pubsub demo/t178g23-128p-fpb/task 1 (PassCount:1, FailCount:0).
22 ISSNE IMULTI INFUL DESERTATIZED INCOMING FUNCTION DESERTATIZETRESULTENUITSUCCESS.
23 16346 [MOTT] [INFO] State record undated, New state=MOTTPubAckSend.
24 16347 (MOTT) (INFO) Received incoming publish message Task 1 publishing message 0
25 17705 (PUBSUB) (INFO) Sending publish request on topic "pubsub demo/r178g23-128p-fpb/task 0"
26 17706 (MOTT) [INFO] Publishing message to pubsub demo/r178g23-128p-frb/task 0.
rearing the state of the second of the second state of the second

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.

pubsi	ıb_demo/#	Pause Clear	Export Edit
3	You cannot publish messages to a wildcard topic. Please select a different topic to publish messages to	λ.	
• •	ubsub_demo <mark>/</mark> task_1	November 14, 20	23, 09:47:08 (UTC+0900)
	Message cannot be displayed in specified format.		
Tasi	<pre>c 1 publishing message 9</pre>		
•	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 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 secp256r1.csr -CA ca.crt -CAkey ca.key -
CAcreateserial -out secp256r1.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	ashboard
Last updated: Nov 13, 2023 b	y Storage Lens. Metrics are generated every 24 hours. Learn	more 🖸	L	
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.
Puckots (27) to			ADM Function Delate	
Buckets are containers for data st	ored in S3. Learn more	С Ц сору	Akn Empty Detete Creat	e bucket
Q Find buckets by name			< .	> @

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 unique v	within the global namespace and follow	w the bucket naming rules. See rule	es for bucket naming 🔽	
AWS Region				
	antheast 1	•		
Asia Pacific (Tokyo) ap-n	lortneast- I			
Asia Pacific (Tokyo) ap-n	lortheast- I			
Asia Pacific (Tokyo) ap-n	in hucket - ontional			

Figure 6-2 General Configuration



•

(3) Object Ownership

Choose ACLs disabled



Figure 6-3 Object Ownership

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

Public 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 nize the individual settings below to suit your specific storage use cases. Learn more
Bl	ock <i>all</i> public access
Tu	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
	S3 will ignore public and cross-account access for buckets or access points with policies that grant public access to buckets and

Figure 6-4 Block Public Access Settings for this bucket



(5) Bucket Versioning

• Bucket Versioning: Disable

Bucket Versionin	I G
every version of every obj and application failures. L	eeping inductive variants of an object in the same bucket. You can use Versioning to preserve, retrieve, and restore ect stored in your Amazon S3 bucket. With versioning, you can easily recover from both unintended user actions earn more.
Bucket Versioning	
 Disable 	
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-s	de encryption is automatically applied to new objects stored in this bucket.
Encrypt	ion type Info
Server	ver-side encryption with Amazon S3 managed keys (SSE-S3)
O Serv	er-side encryption with AWS Key Management Service keys (SSE-KMS)
O Dua Secu <u>Ama</u>	I-layer server-side encryption with AWS Key Management Service keys (DSSE-KMS) re your objects with two separate layers of encryption. For details on pricing, see DSSE-KMS pricing on the Storage tab of the zon S3 pricing page. 🔀
Bucket	Key
Using an KMS. <u>Lea</u>	S3 Bucket Key for SSE-KMS reduces encryption costs by lowering calls to AWS KMS. S3 Bucket Keys aren't supported for DSSE- rm more [
🔿 Disa	ble

Figure 6-6 Default encryption

(7) Click "Create bucket"

(After creating the bucket, you can upload files and folders to the bucket, and configure	additiona	l 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 permission	ons 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 service Allow AWS services like EC2, Lambda, or others to perform actions in this account. Allow entities in other AWS arry to perform actions in this account. O Web identity Allow users federated by the specified external web identity provider to assume this role to perform actions in this account.
	SAML 2.0 federation Custom trust policy Allow users federated with Create a custom trust policy to SAML 2.0 from a corporate enable others to perform directory to perform actions in 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 Iot Iot
	Use case I or Allows lot to call AWS services on your behalf. O IoT - Device Defender Audit Provider MMS for Device Defender and score to IoT and related recourses
	Frondes Aws in Device Defender Rational 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 policy.	
Step 3	Policy name 🖸 🔺	Type 🗢
Name, review, and create	AWSIoTLogging	AWS managed
	AWSIoTRuleActions	AWS managed
	AWSIoTThingsRegistration	AWS managed
	Set permissions boundary - optional	
	Cancel	Previous

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. Maximum 64 characters. Use alphanumeric and '+=,-@' characters. Description
	Add a snort 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

Step 2: Add permissions		Edit
Permissions policy summary		
Policy name 🖸 🔹 🔺	Type 🗢	Attached as ∇
AWSIoTLogging	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"

No tags associated with the resource. Add new tag You can add up to 50 more tags. Cancel Previous	No tags associated with the resource. Add new tag You can add up to 50 more tags. Cancel Previous 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.
Cancel Previous Create role	Cancel Previous Create role Role r Created. View role	No tags associated with the resource. Add new tag You can add up to 50 more tags.
	Role r created. View role	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 C	Create role
An IAM role is an identity you can create be assumed by entities that you trust.	e that has specific permissions with credentials that are valid for short durat	ions. Roles can
Q rl78	X 3 matches <	1 > @
*		
Role name	Trusted entities	Last a
rl78g25-fpb_ora_role_m	click AWS Service: iot	

Figure 6-15 Opening the Created OTA Update Service Role

(2) My role > Summary: Default

Summary Edit Creation date ARN November 16, 2023, 15:04 (UTC+09:00) Image: arritage:	IAM > Roles > r178	Delete
Creation date ARN November 16, 2023, 15:04 (UTC+09:00) Image: Comparison of the second secon	Summary	Edit
1 hours	Creation date November 16, 2023, 15:04 (UTC+09:00) Last activity	ARN Arntaws: Maximum session duration

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.	C Simulate C Remove Add	permissions 🔺
Q Search	Filter by Type Creat All types	<pre>e inline policy < 1 > ③</pre>
□ Policy name 🖸 🔺 Type	▼ Attached entities	∇
AWSIoTLogging AWS r	nanaged <u>16</u>	
□ I I AWSIoTRuleActions AWS r	nanaged <u>16</u>	
□ ● I AWSIoTThingsRegi AWS r	managed 34	

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



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• Choose "AmazonFreeRTOSOTAUpdate" > "Add permissions"

her permiss	ons policies (1/981)			C
		Filter by Type		
AmazonFreeR	[OSOTAUpdate	X All types	▼ 1 match	< 1 > @
Policy nan	1e	▲ Type マ	Description	
÷ 🚺 A	mazonFreeRTOSOTAUpdate	AWS managed	Allows user to access Amazon Fre	eRTOS OTA Update
			Ca	ncel Add permission
📀 Poli	cy was successfully attached to role	e		×
rl	78g23-fpb	Info		Delete
Allo	ws IoT to call AWS services on your	behalf.		
	Summary			Edit
	, annar y			Luit
0	reation date	ARN		
1	lovember 16, 2023, 15:04 (UTC+09:	00)		
L	.ast activity	Maximur	n session duration	
-		1 hour		
	Permissions Trust relationshi	os Tags Access Adviso	r Revoke sessions	
F	Permissions policies (4) Info	C Simulate	Remove Add perm	nissions 🔻
Y	ou can attach up to 10 managed policies.	Filter by Type		
ſ	Q Search	All types	•	1 > @
	Policy name 🗹	▲ Туре		d entities ▼
			ed 41	
	AmazonFreeRTOSC	<u>TAUpdate</u> AWS manag		-
	AmazonFreeRTOS	AWS manag	ed <u>16</u>	
	AmazonFreeRTOS(AwsIoTLogging AWSIoTRuleAction	AWS manag AWS manag <u>s</u> AWS manag	ed <u>16</u> ed <u>16</u>	

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



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(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 🖄 Remove	e Add permissions ▲ Attach policies
Q Search	All types	
Specify permissions Info	s, resources, and conditions. Build permission statem	nents using the JSON
editor. Policy editor	Visual JSON A	ctions 🔻 🔳

Figure 6-19 Creating an S3 Inline Policy



RL78/G23

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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 permiss	ions, specify details, and tags.			
Policy detai	ls			
Policy name Enter a meaningfu	l name to identify this policy.			
inline-policy-s	3-test			
Maximum 128 cha	acters. Use alphanumeric and '+=,.@'	characters.		
Permissions	defined in this policy Info			Edit
Permissions define user group, or role	d in this policy document specify which), attach a policy to it	actions are allowed or der	nied. To define permissions for an I	AM identity (user,
Q Search				
Allow (1 of 38	4 services)		Show remaining	383 services
Service	▲ Access lev	el	✓ Resource	R
			BucketName string like	e s3-
<u>53</u> ∢ ←	Limited: Re	ead, Write	BucketName string lik bucket-test, ObjectPat like All ancel Previous	e s3- h string N ▶
S3	Limited: Re Trust relationships Tag	ead, Write C gs Access Advi	BucketName string like bucket-test, ObjectPatilike All ancel Previous sor Revoke sessions	e s3- h string N •
S3 Permissions Permissions You can attach up to	Limited: Re Trust relationships Tag policies (5) Info to 10 managed policies.	ead, Write C gs Access Advi	BucketName string lik bucket-test, ObjectPatilike All ancel Previous sor Revoke sessions	e s3- h string N Create policy
S3 Permissions Permissions You can attach up to Q. Search	Limited: Re Trust relationships Tag policies (5) Info to 10 managed policies.	ead, Write C gs Access Advi Filte	BucketName string lik bucket-test, ObjectPatilike All ancel Previous sor Revoke sessions C Simulate types	e s3- h string N Create policy
S3 Permissions You can attach up to Q. Search	Limited: Re Trust relationships Tag policies (5) Info to 10 managed policies.	ead, Write C gs Access Advi Filte All	BucketName string lik bucket-test, ObjectPatilike All ancel Previous sor Revoke sessions C Simulate types •	e s3- h string N Create policy Remove
S3 Permissions Permissions You can attach up Q Search D Policy r	Limited: Re Trust relationships Tag policies (5) Info to 10 managed policies.	ead, Write C gs Access Advi Filte All	BucketName string like bucket-test, ObjectPatilike All ancel Previous sor Revoke sessions C Simulate types •	e s3- h string N Create policy Create policy Remove
S3 Permissions You can attach up Q Search Policy r	Limited: Re Trust relationships Tag policies (5) Info to 10 managed policies.	ead, Write C gs Access Advi Filte All	BucketName string lik bucket-test, ObjectPatilike All ancel Previous sor Revoke sessions C Simulate types Type types AWS managed	e s3- h string N Create policy Create policy Remove
S3 Permissions You can attach up Q Search Q Policy r	Limited: Re Trust relationships Tag policies (5) Info to 10 managed policies. AmazonFreeRTOSOTAUpdate AWSIoTLogging	ead, Write C gs Access Advi Filte All	BucketName string lik bucket-test, ObjectPatilike All ancel Previous sor Revoke sessions C Simulate types Type AWS managed AWS managed	e s3- h string N Create policy Create policy Remove
S3 Permissions You can attach up Q Search Q Search Q E	Limited: Re Trust relationships Tag policies (5) Info to 10 managed policies. AmazonFreeRTOSOTAUpdate AWSIoTLogging AWSIoTRuleActions	ead, Write	BucketName string lik bucket-test, ObjectPatilike All	e s3- h string N Create policy Create policy Remove 41 16 16

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"

Specify permissions info	policy
Q. Search All types ✓ 1 Specify permissions Info	
Specify permissions Info	> ©
Add permissions by selecting services, actions, resources, and conditions. Build permission statements using the J editor.	SON

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"

eview the permissions, specify details, and tag	iqs.
Policy details	
Policy name Enter a meaningful name to identify this policy.	
inline-policy-iam-test	
Maximum 128 characters. Use alphanumeric and '+	+=,.@' characters.
Permissions defined in this policy	V Inf
Permissions defined in this policy document specify	<i>y</i> into
group, or role), attach a policy to it	
Q Search	
Allow (1 of 384 services)	Show remaining 383 services
Service 🔺 Acce	ess level ∇ Resource Reques
IAM Limi	ited: Read, Write RoleName string like ota-role-
	test
	Cancel Previous Create policy
Permissions policies (6) Info	C: Simulate [2: Remove Add permissions ▼
You can attach up to 10 managed policies.	
You can attach up to 10 managed policies.	Filter by Type
You can attach up to 10 managed policies.	Filter by Type All types Image: Contract of the second sec
You can attach up to 10 managed policies. Q Search	Filter by Type All types Type ▼ Attached entities
You can attach up to 10 managed policies. Q Search Policy name [2] ▲ ① ① ① ① ① ① ① ① ① ① ① ① ① ① ① ① ① ① ① ① ▲ ③	Filter by Type All types <
You can attach up to 10 managed policies. Q Search Policy name [2] Image: Imag	Filter by Type All types < 1 > ○ Image: Constraint of the stress of the st
You can attach up to 10 managed policies. Q Search Image: Policy name	Filter by Type All types < 1 > ○ All types ▼ Attached entities ▼ AWS managed 41 AWS managed 16 AWS managed 16
You can attach up to 10 managed policies. Q Search Image: Policy name	Filter by Type All types Type AWS managed AWS managed 16
You can attach up to 10 managed policies. Q. Search Image: Policy name Image: Policy	Filter by Type All types Type V AWS managed AWS managed 16 0

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"

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 6-25 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
     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 ♀ 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.		
Maximum 1,000 characters. Use alphanumeric and '+=,.@' characters.		
Add tags - optional Info		
Add tags - <i>optional</i> Info Tags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resour	rces.	
Add tags - optional Info Fags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resour	rces.	
Add tags - optional Info Fags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resour No tags associated with the resource.	rces.	
Add tags - optional Info Tags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resour No tags associated with the resource. Add new tag	rces.	
Add tags - optional Info Tags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resour No tags associated with the resource. Add new tag You can add up to 50 more tags.	rces.	
Add tags - optional Info Fags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resour No tags associated with the resource. Add new tag You can add up to 50 more tags.	rces.	
Add tags - optional Info Tags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resour No tags associated with the resource. Add new tag You can add up to 50 more tags.	rces. Cancel Previous Create	e policy
Add tags - optional Info Tags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resour No tags associated with the resource. Add new tag You can add up to 50 more tags.	rces. Cancel Previous Create	e policy

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



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(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 long-term credentials that is used to interact w	1 match	< 1 > ©
□ User name Click ▲ Path ▼	Group: ▼ Last activity	▼ MFA ▼ Password age ▼ Console la:
. <u>here billenedes berg</u> /	1 Ø 6 hours ago	- 🔥 976 days November
1.4		
		4
Permissions Groups (1) Tags Security credenti	als Access Advisor	•
Permissions Groups (1) Tags Security credenti	als Access Advisor	
Cermissions Groups (1) Tags Security credenti Permissions policies (14) ermissions are defined by policies attached to the user directly or through or	als Access Advisor	C Remove Add permissions
Permissions Groups (1) Tags Security credention Permissions policies (14) Permissions are defined by policies attached to the user directly or through generations are defined by policies attached to the user directly or through generations are defined by policies attached to the user directly or through generations are defined by policies attached to the user directly or through generations are defined by policies.	als Access Advisor	C Remove Add permissions Add permissions 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 > International 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 an existing group, or create a new group. We recommend using groups to manage user permissions by job function. Copy permissions 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 > Imatch
	Policy name [2] Image: Type Image: Attached entities
	✓ • rl78g23-fpb_ota_policy Customer managed 0
	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	d 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 permissions
⊘ 1 poli	cy added		
IAM	> Users >		

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	C Actions Delete Create policy
Specify permissions Info Add permissions by selecting services, actions editor.	s, resources, 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			
IDTFreeRTOSIAMPermissions_rl78g23-fpb			
aximum 128 characters. Use alphanumeric and '+=,.@' characters.			
Description - optional			
Maximum 1 000 characters Lice alphanumeric and '+= @_ ' characters			
Add tags - optional Info			
rags 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			
Add Henrica g			
/ou can add up to 50 more tags.			
'ou can add up to 50 more tags.			
/ou can add up to 50 more tags.	Cancel	Previous	Create policy

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	with AWC in an account	C Delete	Create user
	X 1 match		< 1 > 🔘
□ User name Click ▲ Path ▼	Group! ▼ Last activity	▼ MFA ▼ Passwor	d age 🔻 🛛 Console la:
□ <u>terrebileuritereber</u> z /	1 O 6 hours ago	- 🔥 976 c	days November
1			4
Commissions Groups (1) Tags Security credential	ials Access Advisor		
Permissions policies (14)		CRemove	Add permissions
Permissions policies (14) rermissions are defined by policies attached to the user directly or through g	groups.	C	Add permissions Add permissions

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 group Add user to an existing group, or create a new group. We recommend using groups to manage user permissions by job function.	Copy pe Copy all managed existing existing	ermissions group membersh d policies, inline p permissions boun user.	ips, attached olicies, and any daries from an	•	Attach policies of Attach a managed best practice, we r to a group instead appropriate group	directly policy directly to ecommend attach . Then, add the us	a user. As a ing policies er to the
Permissions policies (2/1230)		Filter by Typ	e				C
Q FreeRTOS	×	All types		4 match	25	<	1 > ⊚
- Policy name 🔀		▲	Туре		▽	Attached	entities 🔻
AWSIoTDeviceTesterForFreeRTOSFullA	ccess		Customer man	aged		0	
IDTFreeRTO SIAmandLezr emissions			Customer mana	aged		2	
✓ IDTFreeRTOSIAMPermissions_rl78g23-	fpb		Customer mana	aged		0	
DTFree DTFree			Customer man	aged		<u>1</u>	
						Cancel	Next

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_da16600_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 Projects
Select a directory to search for existing Eclinse projects
Select root directory: C: Projects\rl78g23-fpb Browse
O Select archive file: Browse
Projects:
✓ boot_loader (C:Projects\rl78g23-fpb\projects' Select All
Deselect All
Refresh
٢
Options
Search for nested projects
Copy projects into workspace
Close newly imported projects upon completion
I hide projects that aiready exist in the workspace
Working sets
Add project to working sets New
Working sets: Yelect
Reck Next > Finish 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_da16600_rl78g23-fpb project to e^2 studio. Open the Import wizard according to the following process.

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

Next, select the aws_da16600_rl78g23-fpb project. Ensure that copy projects into workspace is not selected. Then click the Finish button.

3 Import	-	
Import Projects		
Select a directory to search for existing Eclipse projects.		
		-
Select root directory: C	Projects\rl78g23-fpb ~	Browse
O Select archive file:	×	Browse
Projects:		
aws_da16600_rl78g23-fpb (C:	Projects\rl78g2	Select All
		Deselect All
	[Refresh
<	>	
Options		
Search for nested projects		
Close newly imported projects upon completion		
Hide projects that already exist in the workspace		
Working sets		
Add project to working sets		New
Working sets:	~	Select
Reck Next >	Finish	Cancel

Figure 6-39 Selecting the aws_da16600_rl78g23-fpb Project

The imported project is showed in the Project Explorer view.



Figure 6-40 Completing to Import the aws_da16600_rl78g23-fpb Project



6.2.2.2 Setting the Build Configuration of the the Initial Application

Set the build configuration of the aws_da16600_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_da16600_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_da16600_rl78g23-fpb project to create a MOT file.

Then, make sure that aws_da16600_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_da16600_rl78g23-fpb_ota.mot
- Private key for initial application verification: secp256r1.privatekey

Γ	aws da16600 rl78o23-fpb ota.mot	
	boot_loader.mot	
e	image-gen.py	
	initial_image.mot	
13	RL78_G22_ImageGenerator_PRM.c	
8	RL78_G23_ImageGenerator_PRM.c	
12	RL78_G24_ImageGenerator_PRM.c	
	secp256r1.privatekey	
	test_aws_da16600_rl78g23-fpb.rsu	

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_da16600_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_da16600_rl78g23-fpb_ota_093.mot
- Update image: aws_da16600_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\wifi\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\wifi\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_da16600_rl78g23-fpb project to create a MOT file. Then, make sure that aws_da16600_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_da16600_rl78g23-fpb_ota.mot to aws_da16600_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_da16600_rl78g23-fpb_ota_093.mot
- Private key for update application verification: 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_da16600_rl78g23-fpb_ota_093.rsu) in RSU format.

```
python image-gen.py -iup .\aws_da16600_r178g23-fpb_ota_093.mot -o
aws_da16600_r178g23-fpb_ota_093 -ip .\RL78_G23_ImageGenerator_PRM.csv -vt
ecdsa -ff RTOS
```

(3) Make sure that aws_da16600_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.



Figure 6-47 Initial Application (Version 0.9.2) Started



6.4.2 Registering the Update Image (aws_da16600_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
Software packages <u>New</u> Remote actions Jobs	<pre></pre>

Figure 6-48 Jobs

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

Crea Jobs defin	te job Info
reeRTOS	S over-the-air (OTA) update job.
Job t	type
0	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 Info			
Job properties			
lob name		1	
Enter a unique name without spaces. Valid characters: a-z, A-Z, 0-9, - (hyphen), and _ (underscore)			
Description - optional		•	
Enter job description			
	/_		
Tags - optional			
		Cancel	Next
		cancer	Next

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_TH	ING_NAME	"YOUR_THING_NAME
Select the protocol for file transfer: MQTT		

AWS IOT > 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 to	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 run code been changed or corrupted since it was signed.	published by trusted aut You have three options fo	hors and that the code hasn't r code signing.	
file		signed file.	

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

• Code signing profile: Click "Create new profile"

This profile will contain information needed to create a code signing job. The profile specifies your device's hardware platform, certificate from AWS Certificate Manager, and the location of your code signing certificate path on your device. Existing code signing profile Choose existing code signing profile Create new profile	Code signing profile	
Existing code signing profile Choose existing code signing profile Create new profile Create new profile	This profile will contain information needed to create a cod device's hardware platform, certificate from AWS Certificat signing certificate path on your device.	de signing job. The profile specifies your te Manager, and the location of your code
Choose existing code signing profile Create new profile	Eviating and signing grafile	
	Existing code signing profile	

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		
120,02 (,)		
Enter a unique name without spaces. Va	lid characters: a-z, A-Z, 0-9, and _ (underscore)	
Device hardware platform		
Windows Simulator	▼	
Code signing certificate AWS Certificate Manager (ACM) handles certificates. You can use ACM to create a for signing. You must have a certificate	s the complexity of creating, managing, or importing SSL/TLS an 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 Choose file	secp256r1.crt 906 bytes	
Certificate private key	secp256r1.privatekey 232 bytes O Uploaded	
Certificate chain - optional	ca.crt 1030 bytes	
Import Path name of code signing certific	ate on device	
This is the name and location of the cer OTA image signature verification.	tificate that your FreeRTOS device firmware uses to perform	
/certificates/H7023 fpb_ota_cer	•	

Figure 6-54 Create a code signing profile



٦

• File > "Upload a new file." > "Choose file" > aws_da16600_rl78g23-fpb_ota_093.rsu

File	
• Upload a new file.	 Select an existing file.
File to upload Choose file	
aws_da16600_rl78g23-fpb_ota_093. 211072 bytes	rsu

Figure 6-55 Upload a new file > aws_da16600_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 file	will be stored.	
S3 URL		
Q s3://	X View 🖄 Browse S3 Create S3 buc	cet
Format: s3://bucket/prefix/object.		
Path name of file on device This is the name and location where the	file will be stored on the FreeRTOS device.	
(device (etc.		

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).

Role Choose a role that grants AWS IoT access to S3, AWS IoT jobs, and AWS Code signing resources.	IAM role Info
	Role
	mete finn rele

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)

Choose how to run this job. Vour job will complete after deploying to the devices and groups that you chose (snapshot) Vour job will continue to deploy to any devices added to the groups that you chose (continuous) Job start rollout configuration - optional Specify how quickly devices will be notified when a pending job starts. Job stop configuration - optional These configurations define when to automatically stop the job. The job stops if a percentage of devices fail the deployment after a minimum number have deployed. The job cancels if any of the criteria are met after the job starts. Job run timeout configuration - optional Specify how long the job will run. Cancel Back Create job Successfully created Job: Create job Successfully created Job: Create job Jobs (200+) info Jobs (200+) info Jobs defines 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 per or installing mere applications, use job templates to create reasable jobs.	Job run type	
 Your job will complete after deploying to the devices and groups that you chose (snapshot) Your job will continue to deploy to any devices added to the groups that you chose (continuous) Job start rollout configuration - optional Specify how quickly devices will be notified when a pending job starts. Job stop configuration - optional These configurations define when to automatically stop the job. The job stops if a percentage of devices fail the deployment after a minimum number have deployed. The job cancels if any of the criteria are met after the job starts. Job run timeout configuration - optional Specify how long the job will run. 	Choose how to run this job.	
 Your job will continue to deploy to any devices added to the groups that you chose (continuous) Job start rollout configuration - optional Specify how quickly devices will be notified when a pending job starts. Job stop configuration - optional These configurations define when to automatically stop the job. The job stops if a percentage of devices fail the deployment after a minimum number have deployed. The job cancels if any of the criteria are met after the job starts. Job run timeout configuration - optional Specify how long the job will run. Lobs define age > Remote actions > Jobs Musical > Manage > Remote actions > Jobs Lobs (200+) info Lobs 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 frequenty per or installing new applications, use job templates to create reusable jobs. 	 Your job will complete (snapshot) 	e after deploying to the devices and groups that you chose
 Job start rollout configuration - optional Specify how quickly devices will be notified when a pending job starts. Job stop configuration - optional These configurations define when to automatically stop the job. The job stops if a percentage of devices fail the deployment after a minimum number have deployed. The job cancels if any of the criteria are met after the job starts. Job run timeout configuration - optional Specify how long the job will run. Cancel Back Create job Successfully created Job: f Manage > Remote actions > Jobs Jobs (200+) Info Descriptions to send to and run on one or more devices that are connected to AWS IoT. If you have remote operations that are frequently pro- or installing new applications, use job templates to create reusable jobs.	 Your job will continue (continuous) 	e to deploy to any devices added to the groups that you chose
Specify how quickly devices will be notified when a pending job starts. Job stop configuration - optional These configurations define when to automatically stop the job. The job stops if a percentage of devices fail the deployment after a minimum number have deployed. The job cancels if any of the criteria are met after the job starts. Job run timeout configuration - optional Specify how long the job will run. Cancel Back Create job Successfully created Job: for account account XMS lot > Manage > Remote actions > Jobs Jobs (200+) info Edit Cancel Delet 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 per or installing new applications, use job templates to create reusable jobs. 	Job start rollout of	configuration - optional
 Job stop configuration - optional These configurations define when to automatically stop the job. The job stops if a percentage of devices fail the deployment after a minimum number have deployed. The job cancels if any of the criteria are met after the job starts. Job run timeout configuration - optional Specify how long the job will run. Cancel Back Create job Successfully created Job: r Manage Remote actions Jobs Jobs (200+) Info Edit Cancel Delet Jobs define as et 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 per or installing new applications, use job templates to create reusable jobs.	Specify how quickly device	es will be notified when a pending job starts.
Social configurations of the when to automatically stop the job. The job stops if a percentage of devices fail the deployment after a minimum number have deployed. The job cancels if any of the criteria are met after the job starts. Job run timeout configuration - optional Specify how long the job will run. Cancel Back Create job Successfully created Job: r AWS IoT > Manage > Remote actions > Jobs Jobs (200+) Info 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 per or installing new applications, use job templates to create reusable jobs.	Iob stop configur	ration - ontional
 Job run timeout configuration - optional Specify how long the job will run. Cancel Back Create job Successfully created Job: Create job Successfully created Job Successfull	These configurations defin minimum number have dep	ne when to automatically stop the job. The job stops if a percentage of devices fail the deployment after a eployed. The job cancels if any of the criteria are met after the job starts.
Specify how long the job will run. Cancel Back Create job Successfully created Job: r AWS lot > Manage > Remote actions > Jobs Jobs (200+) Info Concel Delet 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 per or installing new applications, use job templates to create reusable jobs.	► Job run timeout o	configuration - optional
Cancel Back Create job Successfully created Job: r AWS lot > Manage > Remote actions > Jobs AWS lot > Manage > Remote actions > Jobs Jobs (200+) Info 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 per or installing new applications, use job templates to create reusable jobs.	Specify how long the job w	will run.
Successfully created Job: r AWS IoT > Manage > Remote actions > Jobs Jobs (200+) Info 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 per or installing new applications, use job templates to create reusable jobs.		Cancel Back Create job
AWS IoT > Manage > Remote actions > Jobs Jobs (200+) Info 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 per or installing new applications, use job templates to create reusable jobs.	Successfully created Job: r	
Jobs (200+) Info C Edit Cancel Delet 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 per or installing new applications, use job templates to create reusable jobs.	Successfully created 500.1	
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 per or installing new applications, use job templates to create reusable jobs.	AWS IoT > Manage > Remote a	actions > Jobs
	AWS IoT > Manage > Remote a	actions > Jobs

Figure 6-58 Step 3: OTA job configuration



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



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_da16600_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 File Types Formatter Indexer Language Mappings MISRA-C In-editor Check Paths and Symbols Preprocessor Include Patl Git Project Natures Project References Refactoring History Renesas QE Run/Debug Settings Task Taos 	Configuration: Hardwa	reDebug_OTA [Active]	Value 0	Add Edit Delete Export
> Validation	 "Preprocessor Inch Show built-in values Import Settings 	ude Paths, Macros etc." property page may def	ne additional entries Restore Defaults	Apply

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

(2) Build the aws_da16600_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. If you don't change circuit, you don't need this process.



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		-			×	
Project Information						
Microcontroller:	RL78/G2x ~	٦				
Project Name:	r178g23-fpb					
Project Folder:	Documents¥Renesas Flash Programmer¥V3.1	1	E	Browse		
Communication						
Tool: COM port	\checkmark Interface: 2 wire UART \checkmark		Wid	e Voltage		
Tool Details	Num: COM3					
	Comment		E F	Gance	J	

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.

	arget Device Hel	p					
Operation	Operation Setting:	s Block Settings	Flash Options	Connect Settings	Unique Code		
- Projec	ct Information						
Cun	rent Project: r17	8g23-fpbrpj					
Micr	rocontroller: R7	F100GSN					
Progr	am File						
					F	Browse	
	о::						
Flash	Operation	,					
Era	se >> Program >> V	erify					
		Star	t				
							_
							^
Signature: Device:	R7F100GSN						
Signature: Device: Boot Fir	R7F100GSN mware Version: V1.	02					
Signature: Device: Boot Fir Device Code Flash	R7F100GSN mware Version:V1. Code:10:00:0A (Address:0x00000	02 1000 Size : 768 K	Frase Size : 9 k	0			
Signature: Device: Boot Fir Device Code Flash Data Flash	R7F100GSN mware Version: V1. Code: 10:00:00 (Address: 0x00001 (Address: 0x0000F1	02)000, Size:768 K, 000, Size:8 K, E	Erase Size : 2 k rase Size : 256)	0			ļ
Signature: Device: Boot Fin Device I Code Flash Data Flash	R7F100GSN mware Version: V1. Code: 10:00:0A (Address: 0x0000 (Address: 0x000F1 ing the tool	02)000, Size: 768 K, 000, Size: 8 K, E	Erase Size : 2 k rase Size : 256)	0			ł
Signature: Device: Boot Fin Device F Code Flash Data Flash Disconnect Operation	R7F100GSN rmware Version:V1. Code:10:00:0A (Address:0x00001 (Address:0x0000F1 ing the tool	02)000, Size: 768 K, 000, Size: 8 K, E	Erase Size : 2 k rase Size : 256)	0			ł

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_da16600_rl78g23-fpb.mot)
- Click "Start"

File Target Device Help Operation Operation Operation Current Project: rl78g23-fpbrpj Microcontroller: R7F100GSN Program File D¥Users¥a5124249¥Desktop¥ImageGenerator¥v302¥rl78g23¥w_buffer¥initial_image.mot CRC-32 : AD8559B3 Flash Operation Erase >> Program >> Verify Start	.						_
File Target Device Help Operation Operation Settings Block Settings Flash Options Connect Settings Unique Code Project Information Current Project: r178g23-fpbrpj Microcontroller: R7F100GSN Program File Start Browse CRC-32: AD8559B3	Kenes	sas Flash Programm	er V3.11.01			_	
Operation Operation Settings Block Settings Flash Options Connect Settings Unique Code Project Information Current Project: r178g23-fpb.rpj Microcontroller: R7F100GSN Program File >¥Users¥a5124249¥Desktop¥ImageGenerator¥v302¥r178g23¥w_buffer¥initial_image.mot Browse CRC-32 : AD8559B3 Browse Flash Operation Erase >> Program >> Verify Start	File Ta	arget Device Help	, ,				
Operation Operation Settings Block Settings Flash Options Connect Settings Unique Code Project Information Current Project: r178g23-fpbrpj Microcontroller: R7F100GSN Program File >¥Users¥a5124249¥Desktop¥ImageGenerator¥v302¥r178g23¥w_buffer¥initial_image.mot Browse CRC-32: AD8559B3 Flash Operation Erase >> Program >> Verify Start Image Set Start	.	-					
Project Information Current Project r178g23-fpbrpj Microcontroller: R7F100GSN Program File >¥Users¥a5124249¥Desktop¥ImageGenerator¥v302¥r178g23¥w_buffer¥initial_image.mot CRC-32 : AD8559B3 Flash Operation Erase >> Program >> Verify Start	Operation	Operation Settings	Block Settings	Flash Options	Connect Settings	Unique Code	
Project Information Current Project: rl78g23-fpbrpj Microcontroller: R7F100GSN Program File >¥Users¥a5124249¥Desktop¥ImageGenerator¥v302¥rl78g23¥w_buffer¥initial_image.mot CRC-32 : AD8559B3 Browse Flash Operation Erase >> Program >> Verify Start	Dusia	• T. (
Current Project: r178g23-fpbrpj Microcontroller: R7F100GSN Program File >¥Users¥a5124249¥Desktop¥ImageGenerator¥v302¥r178g23¥w_buffer¥initial_image.mot CRC-32 : AD8559B3 Flash Operation Erase >> Program >> Verify Start	Projec	ct Information					
Microcontroller: R7F100GSN Program File D:¥Users¥a5124249¥Desktop¥ImageGenerator¥v302¥r178g23¥w_buffer¥initial_image.mot CRC-32 : AD8559B3 Browse Flash Operation Erase >> Program >> Verify Start Image Start	Curr	ent Project: r17	Bg23-fpbrpj				
Program File D#Users¥a5124249¥Desktop¥ImageGenerator¥v302¥r178g23¥w_buffer¥initial_image.mot Browse CRC-32 : AD8559B3 Browse Flash Operation Erase >> Program >> Verify Start	Micr	ocontroller: R7	F100GSN				
Program File D:#Users¥a5124249¥Desktop¥ImageGenerator¥v302¥r178g23¥w_buffer¥initial_image.mot Browse CRC-32 : AD8559B3 CRC-32 : AD8559B3 Flash Operation Erase >> Program >> Verify Start Image Start							
>¥Users¥a5124249¥Desktop¥ImageGenerator¥v302¥r178g23¥w_buffer¥initial_image.mot CRC-32 : AD8559B3 Flash Operation Erase >> Program >> Verify Start	Progra	am File					
Start	DWI		liter VIII O	-+¥000¥-170-9	0W E		
Flash Operation Erase >> Program >> Verify Start	J.≆U	Jsers#a0124249#De:	sktop#imageGener	ator#v3U2#r1/8g2	3¥W_Dutter¥Initiai_Ir	nage.mot B	irowse
Flash Operation Erase >> Program >> Verify Start					CRC-32 : A	D8559B3	
Flash Operation Erase >> Program >> Verify Start							
Erase >> Program >> Verify Start	-Flash	Operation					
Start	Fra	ce >> Program >> V	arifu				
Start		se // 110grain // V	any			1	
Start							
			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 Pr	oject –	-	×
Project Informatio	n		
Microcontrolle	· RL78/G2× ∽		
Project Name	r178g23-fpb		
Project Folder	C:¥Users¥a5124249¥Documents¥Renesas Fla:	Browse	
Communication Tool: E2 em Tool Detail	Interface: 1 wire UART V] Wide Voltage	9
	Connect	Cance	el

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.

File Ta	arget Device Help							
Operation	Operation Settings	Block Settings	Flash Options	Connect Settings	Unique C	ode		
Projec	ct Information							
Curr	rent Project: r178	g23-fpbrpj						
Micr	rocontroller: R7F	100GSN						
Program	am Fila							
Frogra	am rile					Dro		
<u>I</u>						Dru	wse	
Flash	Operation							
-								
Era	se >> Program >> Ve	rify						
Era	se >> Program >> Ve	rify						
Era	se >> Program >> Ve	^{rify} Star	t					
Era	se >> Program >> Ve	rify Star	t					
	se >> Program >> Ve	rify Star	t					
iignature: Device:	se >> Program >> Ve	rify Star	t					^
ignature: Device: Boot Fir	se >> Program >> Ve R7F100GSN mware Version: V1.0:	rify Star 2	t					^
iignature: Device: Boot Fir Device Content	se >> Program >> Ve R7F100GSN mware Version: V1.0: Code: 10 00 0A	rify Star 2	t					^
ignature: Device: Boot Fir Device (Code Flash Data Flash	se >> Program >> Ve R7F100GSN mware Version: V1.0: Code: 10 00 0A (Address : 0x000000 (Address : 0x000010	rify Star 2 2000, Size : 768 K, 2000, Size : 8 K, E	t Erase Size : 2 f rase Size : 256)	0				^
Signature: Device: Boot Fir Device (Code Flash Data Flash	se >> Program >> Ve R7F100GSN mware Version: V1.0: Code: 10 00 0A i (Address : 0x000000 (Address : 0x000F10	rify Star 2 000, Size : 768 K, 000, Size : 8 K, E	t Erase Size : 2 P irase Size : 256)	0				^
Bignature: Device: Boot Fir Device (Code Flash Data Flash Disconnect	se >> Program >> Ve R7F100GSN mware Version: V1.0: Code: 10 00 0A (Address : 0x000000 (Address : 0x0000F10	rify Star 2 000, Size : 768 K, 000, Size : 8 K, E	t Erase Size : 2) irase Size : 256)	0				^
Signature: Device: Boot Fir Device (Code Flash Data Flash Disconnect Operation	se >> Program >> Ve R7F100GSN mware Version: V1.0: Code: 10 00 0A i (Address : 0×000000 (Address : 0×000F10 ing the tool i completed .	rify Star 2 000, Size : 768 K, 000, Size : 8 K, E	t Erase Size : 2 P irase Size : 256)	0				^
ignature: Device: Boot Fir Device (Code Flash Data Flash Disconnect	se >> Program >> Ve R7F100GSN mware Version: V1.0: Code: 10 00 0A (Address : 0x000000 (Address : 0x000F10 ing the tool completed.	rify Star 2 000, Size : 768 K, 000, Size : 8 K, E	t Erase Size : 2 f rase Size : 256)	0				^

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_da16600_rl78g23-fpb HardwareDebug.

	Name: aws_da16600_rl78g23-fpb HardwareDebu	g
type filter text C C/C++ Application C C/C++ Remote Application E EASE Script C GDB Hardware Debugging C GDB Simulator Debugging (RH850)	Main 参 Debugger Startup Commo Project: aws_da16600_rl78g23-fpb C/C++ Application: HardwareDebug/aws_da16600_rl78g23-fpb x	n Source Browse
 Launch Group Renesas GDB Hardware Debugging aws_da16600_rl78g23-fpb HardwareDebug aws_da16600_rl78g23-fpb HardwareDebug_OTA boot_loader HardwareDebug test_aws_da16600_rl78g23-fpb HardwareDebug test_aws_da16600_rl78g23-fpb HardwareDebug test_aws_da16600_rl78g23-fpb HardwareDebug_OTA Renesas Simulator Debugging (RX, RL78) 	Build (if required) before launching Build Configuration: Use Active C Enable auto build O Use workspace settings	Variables Search Project Browse O Disable auto build Configure Workspace Settings

Figure 8-1 Debug Configurations of Project (PubSub)

— For the demo project (OTA), select aws_da16600_rl78g23-fpb HardwareDebug_OTA.

C 🖻 🗫 🗎 ≍ 🗁 🍸 👻	Name: aws_da16600_rl78g23-fpb HardwareD	ebug_OTA
type filter text	📄 Main 🎋 Debugger 🕨 Startup 🔲 Com	nmon 🤤 Source
C/C++ Application C/C++ Remote Application	Project:	
I EASE Script	aws_da16600_rl78g23-fpb	Browse
🖸 GDB Hardware Debugging	C/C++ Application:	
C GDB Simulator Debugging (RH850)	HardwareDebug_OTA/aws_da16600_rl78g23	-fpb_ota.x
Renesas GDB Hardware Debugging		Variables Search Project Browse
C ¹ aws_da16600_rl78g23-fpb HardwareDebug C ¹ aws_da16600_rl78g23-fpb HardwareDebug_OTA	Build (if required) before launching	
💽 boot_loader HardwareDebug	Build Configuration: Use Active	~
C test_aws_da16600_rl78g23-fpb HardwareDebug test_aws_da16600_rl78g23-fpb HardwareDebug_OTA	○ Enable auto build	 Disable auto build
Renesas Simulator Debugging (RX, RL78)	• Use workspace settings	Configure Workspace Settings

Figure 8-2 Debug Configurations of Project (OTA)



8.1.4 Debugger Settings

Select "Debugger" tab.

• Debug hardware: COM Port (RL78)

Name: aws_da16600_rl78g23-fpb Hardv	wareDebug_OTA	
📄 Main 券 Debugger 🕨 Startup 🔳	🛿 Common 🦻 Source	
Debug hardware: COM Port (RL78)	Target Device: R7F1000	GSN
GDB Settings Connection Settings D	ebug Tool Settings	
GDB Connection 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 ~

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 🔲 Con Debug hardware: COM Port (RL78) 🗸 Target Device	mon R7F100GSN]
GDB Settings Connection Settings Debug Tool Settin	gs	
✓ Clock		
Main Clock Frequency[MHz]	Using Internal Clock	\sim
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)	FFFFFFFFFFFFFFFFFFFFFF	FFFFFF

Figure 8-4 Connection Settings for Using COM Port

Start debugging by clicking

Debug



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_da16600_rl78g23-fpb HardwareDebug.

C 🖻 😳 🗎 🗙 🖻 🍸 👻	Name: aws_da16600_rl78g23-fpb HardwareDeb	bug
type filter text	📄 Main 🎋 Debugger 🕨 Startup 🔲 Comn	non 🦞 Source
C/C++ Application C/C++ Remote Application	Project:	
EASE Script	aws_da16600_rl78g23-fpb	<u>B</u> rowse.
📧 GDB Hardware Debugging	C/C++ Application:	
C GDB Simulator Debugging (RH850)	HardwareDebug/aws_da16600_rl78g23-fpb.x	
🗸 💽 Renesas GDB Hardware Debugging		Variables Search Project Browse
c aws_da16600_r178g23-fpb HardwareDebug c aws_da16600_r178g23-fpb HardwareDebug_OTA	Build (if required) before launching	
📴 boot_loader HardwareDebug	Build Configuration: Use Active	
test_aws_da16600_rl78g23-fpb HardwareDebug test_aws_da16600_rl78g23-fpb HardwareDebug_OTA) Enable auto build	O Disable auto build
Renesas Simulator Debugging (RX, RL78)	Use workspace settings	Configure Workspace Settings

Figure 8-6 Debug Configurations of Project (PubSub)

— For the demo project (OTA), select aws_da16600_rl78g23-fpb HardwareDebug_OTA.

	Name: aws_da16600_rl78g23-fpb HardwareDebug		
type filter text	📄 Main 🏇 Debugger 🕨 Startup 🔲 Common 🎙	✓ Source	
C/C++ Remote Application	Project:		
EASE Script	aws_da16600_rl78g23-fpb		<u>B</u> rowse
C GDB Hardware Debugging	C/C++ Application:		
C GDB Simulator Debugging (RH850)	HardwareDebug/aws_da16600_rl78g23-fpb.x		
 ➡ Launch Group ✓ ☑ Renesas GDB Hardware Debugging 		<u>V</u> ariables Searc <u>h</u> Project	B <u>r</u> owse
C [®] aws_da16600_rl78g23-fpb HardwareDebug C [®] aws_da16600_rl78g23-fpb HardwareDebug_OTA	Build (if required) before launching		
boot_loader HardwareDebug	Build Configuration: Use Active		~
test_aws_da16600_rl78g23-fpb HardwareDebug test_aws_da16600_rl78g23-fpb HardwareDebug	○ Enable auto build	 Disable auto build 	
 Renesas Simulator Debugging (RX, RL78) 	• 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)

Name: aws_da16600_rl78g23-fpb Hardw	vareDebug_OTA Source Common
Debug hardware: E2 Lite (RL78)	Target Device: R7F100GSN
GDB Connection Settings	
 Autostart local GDB server Connect to remote GDB server 	Host name or IP address:localhostGDB 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

ne: aws_da16600_rl78g23-fpb HardwareDebug	g_OTA	
Main 🏂 Debugger 🕨 Startup 🧤 Source	Common	
Debug hardware: E2 Lite (RL78) × Target	Device: R7F100GSN	
GDB Settings Connection Settings Debug Tool	Settings	
✓ Clock		,
Main Clock Frequency[MHz]	Using Internal Clock	~
Sub Clock Frequency[kHz]	Using Internal Clock	~
Monitor Clock	System	~
 Connection with Target Board 		
Emulator	(Auto)	
Low voltage OCD board	No	\sim
Power Target From The Emulator (MAX 20	0mA) No	~
Supply Voltage[V]	3.3	\sim
Hot Plug	No	\sim
✓ Flash		
Current Security ID (HEX)	000000000000000000000000000000000000000	
Current Serial Programming Security ID (H	EX) FFFFFFFFFFFFFFFFFFFFFFFFFFFFFF	
Permit rewrite the serial programming sec	urity ID No	\sim
Permit Flash Programming	Yes	~
Use Wide Voltage Mode	Yes	~
Eraco Elach ROM When Starting	Vec	v *

Figure 8-9 Connection Settings for Using Emulator

Start debugging by clicking





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

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 CC-RL Compiler User's Manual (R20UT3123).

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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.

.const
.text
.data
.sdata
.RLIB
.SLIB
.constf
const_*
.textf
.dataR
.bss
.sdataR

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	Oct. 08, 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 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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