

RL78/G23

AWS Cloud Connectivity for MCU Firmware Update Over-the-Air on RL78/G23-128p Fast Prototyping Board with Wi-Fi DA16600

Introduction

This document provides instructions for running the AWS Cloud Connectivity for MCU Firmware Update Overthe-Air on RL78/G23-128p Fast Prototyping Board with Wi-Fi DA16600, utilizing the MCU firmware update commands of Wi-Fi DA16600 module.

Target Device

RL78 Family RL78/G2x Series RL78/G23 Group

Related Documents

[1] RL78/G23 User's Manual: Hardware (R01UH0896)

[2] RL78/G22, RL78/G23, RL78/G24 Firmware Update Module (R01AN6374)

[3] RL78/G23-128p Fast Prototyping Board User's Manual (R20UT4870)

[4] US159-DA16600EVZ Evaluation Board Manual (R15UZ0006)



Contents

1.	Overview	3
1.1	Workflow	. 4
1.2	Operation Confirmation Conditions	. 5
1.3	Equipment List	. 5
1.4	Sample Project Code Sizes	. 6
2.	Demo Project Setup	7
2.1	Hardware Setup	. 7
2.2	Software Setup	. 8
2.2.1	Installing Tool	. 8
2.2.2	Terminal Software Setting	15
2.2.3	Generate Key Pairs and Certificates	16
2.2.4	Project Description	17
2.2.5	Importing The Demo Project	18
2.2.6	Create Firmware Initialization	21
2.2.7	Create Firmware File and Upload to the Amazon S3 Bucket	24
3.	Execute the Demonstration Project	33
3.1	Creating a New Project and Connecting to the MCU Board	33
3.2	Programming a MOT File to the MCU Board	35
3.3	Request to update the firmware.	36
3.4	Observe the Firmware Update Over-the-Air process	38
4.	Appendix	39
4.1	Known Issues for DA16600	39
4.1.1	Firmware Size Limit Causes Update Failure	39
4.1.2	Resolution	39
4.2	Debugging	41
Rev	sion History	42



1. Overview

This demo project shows the integration of AWS Cloud Connectivity for MCU Firmware Update Over-the-Air on the RL78/G23-128p FPB development board, utilizing the MCU firmware update commands of Wi-Fi DA16600 module for seamless wireless communication.

Key Steps in the Project:

- **Prepare an AWS Account and S3 Bucket:** Set up an AWS account and create an S3 bucket to serve as the server for uploading firmware.
- Generate Key Pairs and Certificates: Generate a public key and a private key to create both the initial firmware and the firmware used for updates.
- **Generate and Upload the Firmware File:** Generate the new firmware to be flashed onto the board via OTA and upload it to the Amazon S3 bucket.
- Generate the initial firmware: Configure and build the initial firmware, then generate the firmware file using the designated tool.
- Execute the Demonstration Project: Execute the demo project to validate the OTA process.

The following section provides a network stack related structure for Firmware Update Over-the-Air (OTA) demonstration.

DA16600 Wi-Fi Module with OTA On-Chip Commands. The DA16600 module connects to the AWS server and downloads the firmware directly. The downloaded firmware is then transferred to the MCU host for deployment. In this demonstration, HTTP and firmware downloads are offloaded, the firmware file URL is securely retrieved and pre-signed using a web browser.



Figure 1.1 OTA Demonstrates with Wi-Fi DA16600 OTA On-Chip Commands



1.1 Workflow



Figure 1.2 End-to-End OTA Workflow



1.2 Operation Confirmation Conditions

Demo project operations have been confirmed in the following conditions.

Table 1.1 Operation	Confirmation	Conditions
---------------------	---------------------	------------

Item	Description
MCU	R7F100GSNxFB
Board	RL78/G23-128p Fast Prototyping Board
	(Product no.: (RTK7RLG230CSN000BJ)
IDE (Integrated Development	Renesas Electronics
Environment)	e2 studio 2025-01
C compiler	Renesas Electronics
	CC-RL V1.15.0
Firmware programming tool	Renesas Flash Programmer V3.18.00
Firmware update module	https://www.renesas.com/document/apn/rl78g22-rl78g23-rl78g24-
(FWUP)	firmware-update-module v2.01
Python	Python 3.12.7
Keygen tool	Win64 OpenSSL v3.0.12
SDK (Software Development	DA16200/DA16600 SDK V3.2.9.2
Kit)	

1.3 Equipment List

The following lists the equipment required for the demo project. Table 1.2 Equipment List

Item	Description
Board	RL78/G23-128p Fast Prototyping Board
	https://www.renesas.com/rtk7rlg230csn000bj
Wi-Fi DA16600 module	PMOD Expansion Board for DA16600MOD
	US159-DA16600EVZ - Ultra-Low-Power Wi-Fi + Bluetooth Low
	Energy Combo Pmod Board
USB-UART conversion board	CP2101 USB TO TTL BOARD V4.2
	CP2101 USB TO TTL BOARD V4.2 (agencyelectronics.com)
Micro USB Type-B cable	Connect another USB port on the base board to a PC for
	debugging purposes.
Jumper pin x 3	It is used to enable debugging mode.
Jumper wire x 3	Used to connect the USB-UART conversion board to the MCU
	board



1.4 Sample Project Code Sizes

The tables below show the ROM and RAM sizes for the sample projects included in the package associated with this application note. The values in the table below have been confirmed under the following conditions:

Compiler version: Renesas Electronics C/C++ Compiler for RL Family V1.15.00

CC-RL

• Optimization level: Size and execution speed (-Odefault)

Memory Usage				
Device	Category	Memory Used (bytes)	Remarks	
	ROM	47055	ota da16600 rl78a22 fab	
DI 79/C00	RAM	5395	01a_0a10000_11/0g23_1pb	
RL70/G23	ROM	31313	boot loodor	
	RAM	1655		



2. Demo Project Setup

2.1 Hardware Setup

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



Figure 2.1 Hardware Connection



2.2 Software Setup

2.2.1 Installing Tool

2.2.1.1 Install Python

Python generates initialization firmware from bootloader and application projects, and application firmware from the new application project.

Follow the steps below to install Python:

(1) Access the Python download web site.

Download Python | Python.org

(2) Download the Python 3.12.7 installer.

Click the **Download** link for Python 3.12.7.

Looking for	a specific release?
Python releases	by version number:

Release version	Release date		Click for more	
Python 3.10.16	Dec. 3, 2024	🕹 Download	Release Notes	A
Python 3.9.21	Dec. 3, 2024	🕹 Download	Release Notes	
Python 3.13.0	Oct. 7, 2024	🕹 Download	Release Notes	
Python 3.12.7	Oct. 1, 2024	🕹 Download	Release Notes	
Python 3.11.10	Sept. 7, 2024	🕹 Download	Release Notes	
Python 3.10.15	Sept. 7, 2024	🕹 Download	Release Notes	
Python 3.12.6	Sept. 6, 2024	🕹 Download	Release Notes	
Durkey a a aa	C + C 2004	A N 1 1	D.I. M.	¥

Figure 2.2 The Options for Installing the Release Version of Python

Download the installer for the operating system you are using.

Version	Operating System	Description	MD5 Sum	File Size	GPG	Sigstore	SBOM
Gzipped source tarball	Source release		5d0c0e4c6a022a87165a9addcd869109	25.8 MB	SIG	.sigstore	SPDX
XZ compressed source tarball	Source release		c6c933c1a0db52597cb45a7910490f93	19.5 MB	SIG	.sigstore	SPDX
macOS 64-bit universal2 installer	macOS	for macOS 10.13 and later	82711848a795f6d7b25e81844d5a9a3f	43.3 MB	SIG	.sigstore	
Windows installer (64-bit)	Windows	Recommended	b51e0889be50c55fbdd809f4ad587120	25.3 MB	SIG	.sigstore	SPDX
Windows installer (32-bit)	Windows		5d5452249401822cb3ad1bce7105d5fd	24.1 MB	SIG	.sigstore	SPDX
Windows installer (ARM64)	Windows	Experimental	19bdd2de8a7ccb6f1115f85bc54c1764	24.6 MB	SIG	.sigstore	SPDX
Windows embeddable package (64-bit)	Windows		4c0a5a44d4ca1d0bc76fe08ea8b76adc	10.6 MB	SIG	.sigstore	SPDX
Windows embeddable package (32-bit)	Windows		21a051ecac4a9a25fab169793ecb6e56	9.4 MB	SIG	.sigstore	SPDX
Windows embeddable package (ARM64)	Windows		6fc899d8dbd46dd2b585a038f7cf68a4	9.8 MB	SIG	.sigstore	SPDX

Figure 2.3 Python Windows Installer



- (3) Run the installer and follow the prompts to install Python
- On the installation screen, select the Add python.exe to PATH check box.

b Python 3.12.7 (64-bit) Setup		-		×
	Install Python 3.12.7 (64-bit) Select Install Now to install Python with default setting Customize to enable or disable features.	s, or ch	oose	
?	→ Install Now C:\Users\cthanhpham\AppData\Local\Programs\Python Includes IDLE, pip and documentation Creates shortcuts and file associations	\Python:	312	
author	→ Customize installation Choose location and f-atures			
windows	 Python Launcher is already installed Add python.exe to PATH 	(Cano	cel

Figure 2.4 Python 3.12.7 installer

(4) Install the Python encryption library (pycryptodome)

Install the encryption library by executing the following command: \$ pip install pycryptodome



Figure 2.5 Installing Python Encryption Library



2.2.1.2 Installing OpenSSL

OpenSSL is a tool used to generate the cryptographic key pair required for firmware encryption and decryption during initialization and application firmware creation. OpenSSL can generate the following keys for use in the firmware update process:

- Private key: Used to encrypt the firmware and ensure its integrity.
- **Public key**: Used by the bootloader to decrypt and verify the firmware during update.

Follow the steps below to install and configure OpenSSL for this purpose.

(1) Access the Win32/Win64 Download Website for OpenSSL

Win32/Win64 OpenSSL Installer for Windows - Shining Light Productions

(2) Download the OpenSSL Installer

Download the installer for the operating system you are using.

Win64 OpenSSL v3.0.12 Light <u>EXE MSI</u>	5MB Installer	Installs the most commonly used essentials of Win64 C by the creators of <u>OpenSSL</u>). Only installs on 64-bit ve chipsets. Note that this is a default build of OpenSSL a information can be found in the legal agreement of the
Win64 OpenSSL v3.0.12 <u>EXE MSI</u>	140MB Installer	Installs Win64 OpenSSL v3.0.12 (Recommended for so <u>OpenSSL</u>). Only installs on 64-bit versions of Windows this is a default build of OpenSSL and is subject to loca found in the legal agreement of the installation.
Win32 OpenSSL v3.0.12 Light EXE <u>MSI</u>	4MB Installer	Installs the most commonly used essentials of Win32 C 32-bit OpenSSL for Windows. Note that this is a defau and state laws. More information can be found in the le
Win32 OpenSSL v3.0.12	116MB Installer	Installs Win32 OpenSSL v3.0.12 (Only install this if you

Figure 2.6 The Options for Installing the Release Version of OpenSSL

(3) Run the Installer and Follow the Prompts to Install OpenSSL.

Select the option to copy the OpenSSL DLLs to the OpenSSL binaries directory.



(4) From the Start Menu, Open the Win64 OpenSSL Command Prompt.



Figure 2.7 OpenSSL Windows (64-bit)

(5) Confirm the OpenSSL Command from the Command Prompt.

Execute the following command and confirm that version information appears.



Figure 2.8 Checking OpenSSL Version



2.2.1.3 Installing Renesas Image Generator

Renesas Image Generator is a tool that generates the firmware images used by the firmware update module. Renesas Image Generator can generate the following images for use by the firmware update module:

- Initial image: An image file containing the bootloader and application program written by flash writer during initial system configuration (extension: mot).
- Update image: An image file containing the updated firmware (extension: rsu).
- Renesas Image Generator is provided as part of the Firmware Update Module.

(1) Download the Firmware Update Module:

https://www.renesas.com/document/scd/rl78g22-rl78g23-rl78g24-firmware-update-module

(2) Extract the Downloaded Firmware Update Module

Extract the file RenesasImageGenerator.zip in the firmware update module.

The **RenesasImageGenerator** folder contains the Renesas Image Generator script file (image-gen.py) and the parameter files for various devices (*_ImageGenerator_PRM.csv).

Do	Downloads > r01an6374xx0202-rl78g23-fwupdate > RenesasImageGenerator					
)	i ii	↑↓ Sort ~	\equiv View $\scriptstyle{\scriptstyle \vee}$			
	Name			Date modified	Туре	Size
	\sim A long time	e ago				
	💿 image-gen	.ру		12/2/2024 2:23 PM	Python Source File	50 KB
	RL78_G22_I	mageGenerator_F	PRM.csv	3/31/2023 11:39 AM	Microsoft Excel C	1 KB
1	🔊 RL78_G23_I	mageGenerator_F	PRM.csv	3/28/2023 12:06 PM	Microsoft Excel C	1 KB
	🔊 RL78_G24_I	mageGenerator_F	PRM.csv	9/29/2023 11:45 AM	Microsoft Excel C	1 KB

Figure 2.9 Renesas Image Generator Package



2.2.1.4 Installing Tera Term

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

(1) Access the Tera Term Download Site.

Releases · TeraTermProject/osdn-download · GitHub

(2) Download the Tera Term Installer.

Tera Term 5.0 (Latest)		
ource code is not available. era Term 5.0 is available <u>here</u> .		
Assets 5		
	8.29 MB	Oct 15, 2023
𝔅teraterm-5.0.zip	10.7 MB	Oct 15, 202
<pre></pre>	15.1 MB	Oct 15, 202
Source code (Zip)		Jul 12, 202

Figure 2.10 Tera Term Version 5.0

- Run the installer and follow the prompts to install Tera Term.
- Confirm that Tera Term starts when you click the Tera Term icon in the Start menu.



2.2.1.5 Installing Renesas Flash Programmer

Renesas Flash Programmer (RFP) is a utility provided by Renesas that allows users to write firmware to support Renesas MCUs via various interfaces such as USB, UART, or serial programming. It is an essential tool for flashing both the initial firmware and subsequent updates during development and production. Follow the steps below to install Renesas Flash Programmer on your computer.

(1) Access the Renesas download web site.

Renesas Flash Programmer (Programming GUI)

Downloads

All Types 🗸	Q Start typing to filter results by title	
Туре 🗘	Title 🗘	Date 🗘
Software & Tools - Evaluation Software	Renesas Flash Programmer V3.17.00 macOS(ARM64) 合 Log in to Download ZIP 40.63 MB 日本語	Oct 22, 2024
Software & Tools - Evaluation Software	Renesas Flash Programmer V3.18.00 Windows 企 Log in to Download ZIP 84.59 MB 日本語	Jan 20, 2025
Software & Tools - Evaluation Software	Renesas Flash Programmer V3.18.00 Linux(x64) 奇 Log in to Download TGZ 43.46 MB 日本語	Jan 20, 2025
Software & Tools - Evaluation Software	Renesas Flash Programmer V3.18.00 Linux(ARM64) ① Log in to Download TGZ 42.35 MB 日本語	Jan 20, 2025
Software & Tools - Evaluation Software	Renesas Flash Programmer V3.18.00 Linux(ARM32) 合 Log in to Download TGZ 40.95 MB 日本語	Jan 20, 2025
Software & Tools - Evaluation Software	Renesas Flash Programmer V3.18.00 macOS(ARM64) ① Log in to Download ZIP 41.96 MB 日本語	Jan 20, 2025

Figure 2.11 Renesas Flash Programmer



2.2.2 Terminal Software Setting

- With the UART TTL connection port of the RL78/G23-128p FPB:
- (1) Open Tera Term select New connection and select Serial and the appropriate COM port for your

UART-to-USB adapter, and click OK

○ T CP/IP	Host:	myhost.exar	nple.com		\sim
	Service:	History Telnet	ТСР ро	rt#: 22	
		O SSH	SSH version:	SSH2	~
		○ 0ther	Protocol:	UNSPEC	~
 Serial 	Port:	COM6: Silico	on Labs CP210x l	JSB to UA	F ~

Figure 2.12 Tera Term Serial Connection

(2) Click Setup > Terminal..., in "New-line" section, set "Receive" as AUTO.

Tera Term: Terminal setup		×
Terminal size	New-line	οκ
80 × 24	Receive: AUT0 ~	
Term size = win size	Transmit: CR ~	Cancel
Auto window resize		
Terminal ID: VT100 ~	🗆 Local echo	Help
Answerback:	□ Auto switch (VT<->TE	EK)
Coding (receive)	Coding (transmit)	
UTF-8 ~	UTF-8 ~	
locale: american	CodePage: 6500	1

Figure 2.13 Terminal Setup for the UART TTL



Port.	COM3	~	New open
Speed:	115200	~	·
Data:	8 bit	~	Cancel
Parity:	none	~	
Stop bits:	1 bit	~	Help
Flow control	: none	~	
	0 msec/char	0	msec/line
Device Frien	dly Name: Intel(R) nce ID: PCI\VEN_8 facturer: Intel) Active № 3086&DE ^v	łanagement Technolog [.] ▲ V_51E3&SUBSYS_50B

(3) Click Setup > Serial port... and ensure that the speed is set to 115200.

Figure 2.14 Serial Port Setup for UART TTL

2.2.3 Generate Key Pairs and Certificates

This section will generate a public key and a private key to create the initial firmware and the firmware used for updates.

To do this, open OpenSSL and enter the commands highlighted in yellow to generate the firmware verification keys.

openssl ecparam -genkey -name secp256r1 -out secp256r1.keypair
using curve name prime256v1 instead of secp256r1
openssl ec -in secp256r1.keypair -outform PEM -out secp256r1.privatekey
read EC key
writing EC key
openssl ec -in secp256r1.keypair -outform PEM -pubout -out secp256r1.publickey
read EC key
writing EC key



2.2.4 **Project Description**

The demo project is structured into multiple components to support the firmware update process. Each component plays a specific role in demonstrating the OTA update mechanism on the RL78/G23-128p FPB platform.

- **ota_da16600_rl78g23_fpb**: The existing application that the MCU runs **before** the firmware update process begins.
- **bootloader**: The bootloader is responsible for handling the firmware update process.

ota-rl78-project > Project > rl78g	23-fpb > project	>
Image: Book of the state of		
Name	Date modified	Туре
友 boot_loader	5/13/2025 3:09 PM	File folder
友 ota_da16600_rl78g23_fpb	5/13/2025 3:29 PM	File folder

Figure 2.15 The Project Folder Structure Consists of Two Main Components



2.2.5 Importing The Demo Project

- (1) Clone the demo project
- (2) Extract the demo project
- (3) Start e2 studio
- (4) From the File menu, select Import

8	WorkS	paceRX -	e ² studio					
File	Edit	Source	Refactor	Navigate	Search	Project	Renesas Views	Ru
•	New Open Open Recen	File Projects nt Files	from File S	ystem	Alt+Sł	nift+N >		
	Close Close	Editor All Edito	rs		C Ctrl+Sh	trl+W ift+W		
	Save Save Save Rever	As All t			Ctrl+S	Ctrl+S hift+S		
2 2 2	Move Renar Refree Conve	 ne sh ert Line D	elimiters To	D		F2 F5		
۵	Print				(Ctrl+P		
è	Impor	rt						
≌	Expor	t						
	Prope	rties			Alt	Enter		

Figure 2.16 Importing the Project



(5) Select Existing Projects into Workspace

📴 Import	
Select Create new projects from an archive file or directory.	Ľ
Select an import wizard:	
type filter text	
 General Archive File Existing Projects into Workspace File System Preferences Projects from Folder or Archive Rename & Import Existing C/C++ Project into Workspace Renesas CC-RX project conversion to Renesas GCC RX Renesas CS+ Project for CA78K0R/CA78K0 Renesas CS+ Project for CC-RX, CC-RL and CC-RH Renesas GitHub FreeRTQS (with IoT libraries) Project Sample Projects on Renetas Website C/C++ Code Generator 	~
October Control Con	Cancel

Figure 2.17 Select Existing Projects into Workspace



(6) In **Select root directory**, select the folder extracted, select the check boxes for the following projects,

and then click Finish

Import				o x
Import Projects Select a directory to search for existing Eclip	ose projects.			
O Select root directory:	your workspace	\ota-rl78-project	~(Browse
◯ Select archive file:			~	Browse
Projects:				
		\ota-rl78-project\Project\rl78g23-fpb\project\boot_loader)	ab)	Select All
				Deselect All
		2	(Refresh
		•		
Options				
Copy projects into workspace	3			
Close newly imported projects upon co	mpletion			
Hide projects that already exist in the w	orkspace			
Working sets				
Add project to working sets				New
Working sets:			~	Select
		4		
?		< Back Next > Fini	sh	Cancel

Figure 2.18 Complete Import Project



2.2.6 Create Firmware Initialization 2.2.6.1 Building Bootloader Project

(1) Update public key

Since the Renesas Image Generator is used to create the initial firmware, the public key must be pasted into the bootloader project to match the private key located in the Renesas Image Generator folder. This ensures that the initial firmware can be generated successfully. Follow the instructions below to complete this setup. 1. Copy the contents of the **secp256r1.publickey** file you created in **Section 2.2.3**.

2. Paste the public key into CODE_SIGNENR_PUBLIC_KEY_PEM in \bootloader\src\key\code_signer_public_key.h.



Figure 2.19 Assign a Public Key to Bootloader Project

(2) Building the project.



2.2.6.2 Building ota_da16600_rl78g23_fpb Project

(1) Configure firmware version, Wi-Fi, firmware type, and URL in demo_config.h at

\ota_da16600_rl78g23_fpb\src\helper\demo_config.h

Θ/*	
* @brief Wi-Fi network to join.	
*	
* @todo If you are using Wi-Fi, set this to your network name.	
*/	
<pre>#define clientcredentialWIFI SSID "SSID"</pre>	SSID
<u></u>	
* @brief Password needed to join Wi-Fi network.	
* Mtodo If you are using WPA set this to your network password	
*/	
	PASSWORD
#define clientcredentialWIFI_PASSWORD "PASSWORD"	PASSWORD

Figure 2.20 Configure Firmware Version, Wi-Fi Network, and Firmware URL

- Check the current firmware version.
- AP_WIFI_SSID: Set the access point name (SSID) of the local Wi-Fi network that the board will connect to.
- AP_WIFI_PASSWORD: Set the password for the local Wi-Fi network

(2) Building the project.



2.2.6.3 Creating the Initial Firmware

This section is used to create the initial firmware(**initial_firm.mot**), which is executed on the MCU before the Over-The-Air process begins. Follow the setup steps below to generate the initial firmware correctly: (1) Place the following files in the Renesas Image Generator folder:

- The results of the building process in <u>Section 2.2.6.2</u>: ota_da16600_rl78g23_fpb.mot
- The results of building the bootloader in <u>Section 2.2.6.1</u>: boot_loader.mot
- The private key created in <u>Section 2.2.3</u>: secp256r1.privatekey

(2) Use Renesas Image Generator to generate the initial firmware

Open a command prompt, navigate to the Renesas Image Generator folder, and execute the following command to generate the file **initial_firm.mot**.



- Parameter explanation:
- -iup: Input user program (.mot file for application firmware)
- **-ip:** Input parameter file (.csv with image generation settings)
- **-o:** Output file prefix (e.g., userprog.mot)
- -ibp: Input bootloader program (.mot file)
- **-vt:** Verification type (e.g., ecdsa for digital signature)



2.2.7 Create Firmware File and Upload to the Amazon S3 Bucket

2.2.7.1 Create Firmware File

(1) Changing the firmware version

Change the firmware version to a higher version. (Example: Because previous versions is 1.0.0, so the new version we can choose 1.0.1)

Repeat the build process in <u>Section 2.2.6.2</u>, this time 3 specified for the DEMO_VERSION_BUILD definition in **\ota_da16600_rI78g23_fpb\src\helper\demo_config.h**



Figure 2.22 Setting New Version for Firmware

(2) Use Renesas Image Generator to Generate the Updated Firmware

Overwrite the file in the Renesas Image Generator folder with the firmware you rebuilt in 2.2.7.1(1) (ota_da16600_rl78g23_fpb.mot), and then execute the following command at the command prompt:

python image-gen.py -iup ota_da16600_rl78g23_fpb.mot -ip RL78_G23_ImageGenerator_PRM.csv -o ^ ota_da16600_rl78g23_fpb_v101 -vt ecdsa -key secp256r1.privatekey

This command generates a file named ota_da16600_rl78g23_fpb_v101.rsu.



2.2.7.2 Uploading Firmware to Amazon S3 Bucket

(1) Create Amazon S3 Bucket

Access the AWS web site (<u>Cloud Computing Services - Amazon Web Services (AWS)</u> and click Sign In to the Console.

\leftarrow	\rightarrow	С	Ô ł	ittps://aws.a	mazon.com/	ree/?trk=f42f	ef03-b1e6-48	41-b001-c	:44b4eccaf4	≻_channe	el=ps&ef_id=0	CjwKCAi	A»		\$ D	£≡	Ê	₸ 🖏
	aws	5					Ab	ut AWS	Contact Us	Support 🗸	English	∨ My	Account	t 🗸	Sign In	to the Co	onsole	
	re:Inve	ent	Product	s Solutio	ns Pricing	Documer	ntation Le	arn Par	tner Netwo	rk AWS I	Marketplace	Custor	ner Ena	ablement	Events	Explore	e More	Q
	AWS Fi	ree Ti	er	Overview	Free Tier C	ategories 🔻	How to Cr	eate an Ac	count F	atured Offe	rs for Busines	s▼ F	AQs	Terms and	d Condition	s		

Figure 2.23 Sign-In to Console AWS

(2) Enter your email address or account ID, and then click Next.

If you are using the root account to sign in, select the "Sign in using root user email" option and enter the email address of the root account. If you are an IAM user, enter the **Account ID** (12-digit number or account alias), **IAM username**, and **Password** in the corresponding fields.

Account ID (12 digits) or account alias IAM username Password Show Password Having trouble?		
IAM username Tune in for free Password to get all the Show Password biggest AWS Updates this year. updates this year.	account ID (12 digits) or account alias	reiniverit
Password biggest AWS updates this year.	AM username	Tune in for free
Show Password Having trouble? updates this year.	assword	biggest AWS
	Show Password Having trouble?	updates this year.
Sign in DECEMBER 2-6, 2024 LAS VEGAS, NEVADA	Sign in	DECEMBER 2-6, 2024 LAS VEGAS, NEVADA
Sign in using root user email	Sign in using root user email	





(3) After logging in to AWS, select your region in the top right of the screen.

٤	<u> </u>	Asia Pacific (Singapore) 🔺
	United States	
Reset to default layout	N. Virginia	us-east-1
(Reset to deliant layour)	Ohio	us-east-2
: (0) + c	N. California	us-west-1
Create appl	Oregon	us-west-2
ic (Singapore)	Asia Pacific	
	Mumbai	ap-south-1
Q Find applications	Osaka	ap-northeast-3
	Seoul	ap-northeast-2
▼ Description ▼ Region ▼ Origi	Singapore	ap-southeast-1
	Sydney	ap-southeast-2
No applications	Tokyo	ap-northeast-1
Get started by creating an application.	Canada	
Create application	Central	ca-central-1
	Europe	
	Frankfurt	eu-central-1
	Ireland	eu-west-1
Go to myApplications	London	eu-west-2

Figure 2.25 Setting Region in AWS

(4) From the **Services** menu, select **Storage** and then **S3**.







(5) On the **Buckets** page, click the **Create bucket** button.

Amazon S3 <	Account spanshot updated guary 24 hours guarge at	View Storage Loss dashboard
General purpose buckets	Account snapshot - updated every 24 hours Allaws regions Storage lens provides visibility into storage usage and activity trends. Metrics don't include in Storage lens provides visibility into storage usage and activity trends. Metrics don't include in the storage lens provides visibility into storage usage and activity trends.	directory buckets Learn more [7
Pirectory buckets	Stange ens prondes visibility into storage asage and activity dends. Hearts don't include s	anceory success common a
ALL A LOUGH AND A		
able buckets New		
ccess Grants	General purpose buckets Directory buckets	
cess Grants cess Points	General purpose buckets Directory buckets	
cess Grants cess Points vject Lambda Access Points	General purpose buckets Directory buckets General purpose buckets (9) Info All AWS Regions	Copy ARN Empty Delete Create bucket
Die Duckets New cess Grants cess Points oject Lambda Access Points ultli-Region Access Points	General purpose buckets Directory buckets General purpose buckets (9) Info All AWS Regions Buckets are containers for data stored in S3.	Create bucket

Figure 2.27 Create a Bucket

(6) Enter an S3 Bucket name.

Amazon S3 > Buckets > Create bucket

Create bucket Info

Buckets are containers for data stored in S3.

General configuration	
AWS Region	
Asia Pacific (Tokyo) ap-northeast-1	
Bucket type Info	
• General purpose Recommended for most use cases and access patterns. General purpose buckets are the original S3 bucket type. They allow a mix of storage classes that redundantly store objects across multiple Availability Zones.	O Directory Recommended for low-latency class, which provides faster pro
Bucket name Info	
myawsbucket	
Bucket name must be unique within the global namespace and follow the bucket naming rules. See rules for bucket	et naming [
Copy settings from existing bucket - optional Only the bucket settings in the following configuration are copied. Choose bucket Format: s3://bucket/prefix	

Figure 2.28 Create a Bucket Name

(7) Create Bucket.

After creating the bucket, you can upload files and folders to the bucket, and configure additional bucket settings.
 Cancel
 Figure 2.29 Create Bucket



- (2) Upload the Firmware File to the Amazon S3 Bucket
- (1) Choose your S3 bucket, and then click **Upload**.

Amazon S3 > Buckets >					
Info					
Objects Properties Pr	ermissions Metrics Management	Access Points			
Objects (0) Objects are the fundamental entities	stored in Amazon 53, You can use Amazon 53, inv	Copy S3 URI	→ Download Open [2]	Delete Actions Create folder	T Upload
Q Find objects by prefix					< 1 > 🛞
Name	🔺 Туре	▼ Last modified	▼ Size	▼ Storage class	▽
		No objects You don't have any objects in TUpload	this bucket.		

Figure 2.30 Uploading the Firmware File

(2) Click on **Add File**, then select the firmware you created in the previous section. Double-check to ensure it is the correct firmware before clicking **Upload**.

	Drag and drop fil	es and folders you want to upload here, or choose Add files or	Add folder.	
Files and folders (1 total, 50.	5 KB)		Remove	files Ad
All files and folders in this table will be u	ploaded.		7	
Q Find by name				
✓ Name	▼ Folder	⊽ Туре	▼ Size	
ota_da16600_rl78g23_fpb_v10	1.rsu -	-	50.5 KB	
Destination Info Destination s3:// 2	2			

Figure 2.31 Add Firmware File



(3) Get the Object URL of the firmware

 On the **Objects** page of your S3 bucket, locate and select your firmware file (ota_da16600_rl78g23_fpb_v101.rsu).

Click Copy S3 URL to copy the file's download link.

Amazon S3	>	ckets >	
	C		
	-	bjects Properties Permissions Metrics Management Access Points	
		bjects (1/1) (C Copy S3 UR) (C Copy URL) (Download) Open [Delete Actions ▼ Create folder) T Upload	
		bjects are the fundamental entities stored in Amazon 53. You can use Amazon 53 inventory 🖸 to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. Learn more 🕻	
		Q. Find objects by prefix < 1 > (9)	
		2 Name ▲ Type ▼ Last modified ▼ Size ▼ Storage class ▼	
	ľ	D ots. ds16600_r178g23_fpb_v101.rsu rsu May 14, 2025, 10:09:23 (UTC+07:00) 50.5 KB Standard	j

Figure 2.32 Get Firmware URL

(2) Open CloudShell and create presigned URL

aws 🏭 🖸	Q CloudShell	×	
API Gate		Services	4
API Gatew	Services	CloudShell	☆
APIs	Resources New	A browser-based shell with AWS CLI access from the AWS Management Console	
Custom doma	Marketplace		
Domain name	Blog posts	Resources / for a focused search	
VPC links		Introducing resource search Enable to show cross-region resources for your account in search results. Takes less	×

Figure 2.33 Open CloudShell

Execute the following command at the command prompt of CloudShell:

aws s3 pres	<mark>sign <your-s3-ւ< mark=""></your-s3-ւ<></mark>	<mark>ırl>expires-ir</mark>	n 600	
CloudShell				Actions 🔻 🛞
ap-southeast-1 +				
- \$ aws s3 presign	your s3 object url	expires-in 600		
			Generated presigned URL	
jhdC49XuXM%28sL4ygwWHL1Kd3%28G dTnR5xSUh0R9iyY20soEfESCEN0r06 ~ \$	VMjKBy9s1vVAPxdfqipxZCW13Tsp81%2F%2FCm2 UeTQwLK5%2FzQvvnSiSSA%3D%3D&X-Amz-Signa	CQju1wLdtSU%28GDXVFG00N11v0AmP1pSYDw8 ture=868ea66fd6bf63fe33bdad10c75f82e9	BRD.cdm.zuldet.cm.lxx4af1114cz.com/e22a47947200071976552340ah.900at.y1a031xt824-000cy82493449ac278x3p49056me88000ah.t0jx4362804275<22a4847562804759621152158522a411520 12999Ccce5122ca4c34e31487c6c8596	ix14R1eXaV5iVe1DoHjR

Figure 2.34 Generate presigned URL

(3) Open API Gateway

aws 🛛 🏭 🗌	Q API Gateway	×	
Amazon :		Services	Show more
Amazon S: General purp	Services Features Resources New	API Gateway Build, Deploy and Manage APIs	\$
Directory bud Table buckets Access Grants	Documentation Knowledge articles Marketplace	Storage Gateway Hybrid Storage Integration	\$
Access Points Object Lambo Multi-Region .	Blog posts Tutorials Events	CloudTrail Track User Activity and API Usage	\$
Batch Operati IAM Access Ar		Features	Show more

Figure 2.35 Open API Gateway



(4) Create short link for pre-signed URL

aws I III Q Search		[Alt+S]			<u>ک</u>	🕜 🗐 Asia Pacific ((Singapore) 🔻 🛛
API Gateway > APIs						2	0
API Gateway <	APIs (0/0) Q. Find APIs					C Delete	Create API
Domain name access associations	Name	Description	▼ ID	▼ Protocol	▼ API endpoint type	▼ Created	~
				No API			
Usage plans				You don't have any apis.			
API keys							
Client costificates							
cuent certificates				(Create API)			

Figure 2.36 Create API

• Click on Create API

aws	Ⅲ (Q Search [Alt+S]	Σ	4	0	٢	Asia Pacific (Singapo
≡ /	API Gatew	way > APIs > Create API					
		Choose an API type Info					
		(HTTP API)					
		Build low-latency and cost-effective REST APIs with built-in features such as OIDC and OAuth2, and native CORS support.					
		Works with the following: Lambda, HTTP backends					
					C	Import	Build

Figure 2.37 Create HTTP API

• Create HTTP API

aws III Q Search

= <u>API Gateway</u> > <u>APIs</u> > <u>Create API</u> > Create HTTP A	PI	
Step 1 Configure API	Configure API	
 Step 2 - optional Configure routes Step 3 - optional Define stages Step 4 Review and create 	API details PI name API details PI name API that have a name. The name is a non-unique value you use to identify and organize your APIs. To programmatically refer to this API, use the API ID that API Gateway of v_v101 Pradicess type Info Select the type of IP addresses that can invoke the default endpoint for your API. You don't need to redeploy your API for the update to take effect. Pradices type Info Select the type of IP addresses. Integrations (1) info Select for addresses that grow and IPv6 addresses. Integrations (1) info Select for the default endpoint the request to the URL that you specify and returns the response from the URL. HTTP Method URL endpoint (BET (https:// /ota_da166600_rt78g23_fpb_v101.rsu/Y.Am) Add integration	enerates for you. with the response from the function. For an HTTP Remove
		Cancel Review and create

Figure 2.38 Configure API

- Step 1: Enter your API name.
- Step 2: Select HTTP.
- Step 3: Select the GET method.
- Step 4: Enter your generated pre-signed URL from Section 2.2.7.2(3)(2).
- Step 5: Click Next to finish the API configuration.



aws III (Q. Search ≡ API Gateway > APIs > Create API > Create H	[Alt+5]		区 🗘 ⑦ 稔 Asia Pacific (Singapor
Step 1 Configure API	Configure routes - optional		
Step 2 - optional Configure routes Step 3 - optional Define stages ctor 4	Configure routes Info API Gateway uses routes to expose integrations to consumers of your API. Rou methods for your integration (GET, POST, PUT, PATCH, HEAD, OPTIONS, and D	utes for HTTP APIs consist of two parts: an HTTP method and a resource DELETE) or use the ANY method to match all methods that you haven't d	path (e.g., GET /pets). You can define specific HTTP lefined on a given resource.
 scy 4 Review and create 	Method Resource path GET Add route Method Resource path /ota_da16600_rd78g23_fpb_v101.rsu Add route	Integration target	Remove 2
		Cancel	Review and create Previous Next
	Figure 2.39 Conf	igure routes	

- Step 1: Select GET method.
- Step 2: Click Next to finish the routes configuration.

aws	। 🏭 🔍	Search	[Alt+S]		2	ф	0	٢	Asia Pacific (Singapo
≡	API Gateway	> <u>APIs</u> > <u>Create API</u> > Create HTT	'P API						
		Step 1 Configure API	Define stages - optional						
		Step 2 - optional Configure routes	Configure stages Info						
		Step 3 - optional Define stages Step 4	Stages are independently configurable environments that your API can be deployed to. Y autodeploy. By default, all HTTP APIs created through the console have a default stage n represent environments such as development or production.	ou must deploy to a stage for API configuration changes to take effec amed \$default. All changes that you make to your API are autodeploy	t, unles ed to th	s that s hat stag	tage is o je. You o	configure can add s	ed to stages that
		Review and create	Stage name	Auto-deploy					
			\$default				Ren	nove	
			Add stage						
						Cance	et (Previo	us Next

Figure 2.40 Define stages

• Let the "Define stages" by default, click Next to finish the define stages configuration.

Stages		Edit
Stages		
\$default (Auto-deploy: enabled)		
	Cancel	Previous

Figure 2.41 Review and create

• Click Create to finish creating the API.



RL78/G23

AWS Cloud Connectivity for MCU Firmware Update Over-the-Air on RL78/G23-128p Fast Prototyping Board with Wi-Fi DA16600

	f		•	
API Gateway > APIs > fw_v1	101			0
API Gateway <	Successfully created AP	91 fw_v101]	x
APIs Custom domain names	fw_v101			→ Stage: - ▼) Deploy
Domain name access associations VPC links	API details			Edit
API: fw_v101			Protocol HTTP	Created 2025-05-14
- Develop	Description No Description		IP address type -	Default endpoint
Routes	ARN			https:/lexecute-api.ap-southeast-1.amazonaws.com
Integrations				
			Figure 2.42 API details	
 Copy c 	default endpoi	int URL.		
API Gatewa	y	<	Doutos	
101			Routes	
APIS				
Custom domain	1 names		Routes for fw_v101	Create
Domain name a	access associatio	ns		
VPC links			Q Search	
			/ota_da16600_rl78g23_fpb	_v101.rsu
API: fw_v101()		GET	
Develop				
Routes				
Authorization				
Authorization				
Integrations				
CORS				
Reimport				

Figure 2.43 API routes

Get API routes

Our final URL will have a form as below:

<your-default-endpoint>/<your-route>

Example:

https://xadwczzqe.execute-api.ap-southeast-1.amazonaws.com/ota_da16600_rl78g23_fpb_v101.rsu

Note: The obtained URL will be used to input from the terminal in the **Section 3.3(Figure 53)**, so make sure to save it.



3. Execute the Demonstration Project

3.1 Creating a New Project and Connecting to the MCU Board

- (1) Start the Renesas Flash Programmer
- 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"

Microcontroller:	RL78/G2x V
Project Name:	rl78g23-fpb
Project Folder:	ra\beeumente\Beneese Each Programmer\\/2.19
rioject rolder.	a Documents menesas riasri Programmer (v.s. 16
	a pocuments thenesas Plash Programmer (V3.18)
nmunication	a pocuments theresas hash Programmer v3.18

Figure 3.1 Creating a New Project and Connecting to the MCU Board



AWS Cloud Connectivity for MCU Firmware Update Over-the-Air on RL78/G23-128p Fast Prototyping Board with Wi-Fi DA16600

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

Renesas Flash Programmer V3.18.00	- 🗆 X
File Target Device Help	
Operation Operation Settings Block Settings Flash Options Connect Settings Unio	que Code
Project Information Current Project: rl78g23-fpb.rpj Microcontroller: R7F100GSN	
Program Files	
	Add/Remove Files
Command	
Erase >> Program >> Verify	
Start	
Connecting the tool Tool: COM port (COM10), Interface: 2 wire UART Connecting to the target device Query the device information. Signature: Device: R7F100GSN Boot Firmware Version: V1.02 Device Code: 10:00:0A Code Flash 1 (Address: 0x00000000, Size: 768 K, Erase Size: 2 K) Data Flash 1 (Address: 0x000F1000, Size: 8 K, Erase Size: 256) Disconnecting the tool Operation completed.	
	Clear status and message

Figure 3.2 Operation completed (Connect)



3.2 **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, ota_da16600_rl78g23_fpb.mot)
- Click "Start"

		_	
💒 Renesas Flash Programmer V3.18.00	-	_	×
File Target Device Help			
Operation Operation Settings Block Settings Flash Options Connect Settings 1	Inique Code		
operation operation settings block settings hash options connect settings of	inque code		
Project Information			
Current Project: rl78g23-fpb.rpj			
Microcontroller: R7F100GSN			
			~
Program Files			
		\initial_firm.mot	<u>t</u>
CRC-32: B60D53E7	Add/Rem	Vinitial_firm.mot	
CRC-32: B60D53E7	Add/Rem	Vinitial_firm.mot	
CRC-32: B60D53E7 Command	Add/Rem	Vinitial_firm.mo	
CRC-32: B60D53E7 Command Erase >> Program >> Verify	Add/Rem	Vinitial_firm.mo	
CRC-32: B60D53E7 Command Erase >> Program >> Verify	Add/Rem	vinitial_firm.mo	
CRC-32: B60D53E7 Command Erase >> Program >> Verify Start	Add/Rem	vinitial_firm.mo	
CRC-32: B60D53E7 Command Erase >> Program >> Verify Start	Add/Rem	vinitial_firm.mo	

Figure 3.3 Programming a MOT File to the MCU Board

(2) Make sure that programming is successful.



Figure 3.4 Successful programming



3.3 Request to update the firmware.

1. Waiting for the network connection to be successfully established (see **Figure 3.7**).



Figure 3.5 Successfully setup Wi-Fi

2. Press User Switch button to trigger OTA firmware update



Figure 3.6 User Switch



3. After the user switch was pressed, input the firmware URL go get from Section 2.2.7.2(3)



Figure 3.7 Wait for input firmware URL

Click the Edit tab of the Tera Term and "Paste<CR>" and verify and confirm the valid string and press OK.



Figure 3.8 Input firmware URL (1)



Figure 3.9 Input firmware URL (2)



3.4 Observe the Firmware Update Over-the-Air process

• The firmware update process starts with progress messages such as download progress, "W 0x59000, 128" (indicating that address of flash memory and block size that was written new firmware) displayed in the terminal. **Upon successful completion**, the firmware is updated from **1.0.0** to **1.0.1**. If an error occurs during the update, the MCU automatically resets, and the previous stable firmware version is retained.

У	СОМ	7 - Tera	Term VT							-		×
File	Edit	Setup	Control	Window	Help							
=== ver: exe	= RL' ify : cute	78G23 instal new i	: BootLo 1 area m image	Dader [u main [s: •	with buf ig-sha25	ferl = 56-ecds	=== a]0K					
	= Wei	lcome	to PoC-I	Demo ==:	==							
=== 6	= RL	78G23	: OTA or	n-chip d	lemo vei	1.0.0]====					
Est	ablis	shing	connect	to Wi-	Fi acces	s poin	t					
Plea	ase j	press	setup w: user sw:	itch to	trigger	• OTA f	irmware	update				
htt:	ase ps://	imut	the firm	ware u <mark>kecute-</mark> a	KL api.ap−s	outhea	<u>st-1.ama</u>	azonaws.	<u>com/ota_</u>	da16600	<u>_r178</u>	g23_
f <u>pb</u> Stai	-010 rting	J OTA	down load	t <u>.</u>								
ОТА ОТА	dowr dowr	nload	progress	s:0% s:0%								
OTA OTA	dowr dowr	nload	progress	s: 0 %								
ŎŤŔ	dow	load	progress	s 0 %								
ŎŤŔ	dow	load	progress	s 0 %								
OTA	dowi	load	progress	s: 0 %								
OTA OTA	dowi dowi	nload nload	progress	s:0% s:0%								
OTA Ota	dowi dowi	nload	progress	s: 0 %								
OTA	dow	load	progress	s: 0 %								
ŎŤĂ	dow	load	progress	s 0 %								
OTA	dowi	load	progress	s: 0 %								
OTA Ota	dowi dowi	nload nload	progress	s: 0 % s: 0 %								
OTA Ota	dowr dowr	nload	progress	s: 0 % s: 0 %								
OTA	dow	load	progress	s 0 %								
ŎŤŔ	dow	load	progress	s 0 %								
OTA	dowi	load	progress	s: 0 %								
OTA OTA	dowi dowi	nload nload	progress	s: 2 % s: 5 %								
OTA Ota	dowi dowi	nload	progress	s: 7 % s: 7 %								
ŎŤŔ	dow	load	progress	\$ 7%								
ŎŤŔ	dow	load	progress	10×								
OTA	dowi	load	progress	s: 13 %								
OTA Ota	dowi dowi	n Load n Load	progress	s: 23 × s: 29 ×								
OTÁ	dow	nload	progress	s: 35 % Fir	ure 3	10 0	TA Ro	sult (1)			
-					, ai e 0			oun (I	,			
V	COM	7 - Tera	Term VT							-		×
<u>F</u> ile	<u>E</u> dit	<u>S</u> etup	Control	Window	<u>H</u> elp							_
W Ø	×74E8	10, 10	24 0)K								
ΨD	R 7 B Z ł	10, 14	24 0	()								

<u>Eile Edit Setup Control Window H</u> elp	
W Øx7AA80, 1024 OK W Øx7AF80 1024	
W 0x7B280, 1024 OK	
W 0x7B680, 1024 OK W 0x7B680, 1024 OK	
W 0x7BE80, 1024 OK	
W 0x7C280, 1024 OK W 0x7C680, 1024 OK	
W Øx7CA80, 1024 OK	
W 0×7D280, 1024 OK	
W 0x7D680, 1024 OK W 0x7D680, 1024 OK	
W 0x7DE80, 1024 OK	
verify install area buffer [sig-sha256-ecdsa]OK	
software reset	
==== RL78G23 : BootLoader [with buffer] ====	
copy to main area OK	
software reset ==== RL78G23 : BootLoader [with buffer] ====	
verify install area main [sig-sha256-ecdsa]0K	
execute new image	
==== Welcome to PoC-Demo ====	
==== RL78G23 : OTA on-chip demo ver 1.0.1 ====	
Successfully open module Wi-Fi? Establishing connect to Wi-Fi access point	
Successfully setup Wi-Fit	
r rease press user switch to trigger on rinnware update	

Figure 3.11 OTA Result (2)

Remark: Successfully updated the version from **1.0.0** to **1.0.1**.



4. Appendix

4.1 Known Issues for DA16600

4.1.1 Firmware Size Limit Causes Update Failure

 The DA16200/DA16600 SDK V3.2.9.2 restricts firmware downloads from the server to under 256 KB. Attempting to download firmware exceeding this limit results in an error, preventing successful completion. This affects users needing larger firmware updates.

- OTA Update : <MCU_FW> Download - Start - OTA: <MCU_FW> FW size error. <a>(Allowable size = 262143, Receiving size = 1048576)

Figure 4.1 Error Log

4.1.2 Resolution

- (1) Download DA16200/DA16600 FreeRTOS SDK V3.2.9.2
- Access the <u>DA16XXX Ultra-Low Power Wi-Fi SoC for Battery-Powered IoT Devices | Renesas</u> to Download the **DA16200/DA16600 FreeRTOS SDK V3.2.9.2**
- (2) Importing DA16600 FreeRTOS SDK Project into e2 studio.
- Importing the DA16600 FreeRTOS SDK Project into e2 studio is similar to importing the DA16200
 FreeRTOS SDK Project. Therefore, please refer to UM-WI-056 DA16200 DA16600 FreeRTOS Getting
 Started Guide under Section 5.4 Importing DA16200 FreeRTOS SDK Project into e2 studio for detailed
 instructions on the process.
- (3) Modify the project.
- In e2 studio Project Explorer, open the file config_generic_sdk.h in the folder da16600\get_started\include\user_main and modify the macro highlighted as below.

#if defined (__SUPPORT_OTA__)
#define __OTA_UPDATE_MCU_FW__
#endif //__SUPPORT_OTA__



 In e2 studio Project Explorer, open the file da16200_map.h in the folder da16600\core\bsp\driver\include\DA16200 and modify the two macros highlighted as below.

/* DA14531 BLE Firmware Download st	art */
<pre>#define SFLASH_BLE_FW_BASE</pre>	
(SFLASH_14531_BLE_AREA_START)	
/* DA14531 BLE Security DB Area sta	art */
#define SELASH LISER AREA RUE SECUR	TV DR (SELACH RIE EN PACE
#defile SFLASE_OSEK_AREA_DLE_SECOR	LIT_DD (SFLASH_DLE_FW_DASE
BLE_IMG_SIZE)	
/* SFLASH User Area */	
HARTER CELACIE UCED ADEA 1 CTADT	0,0000000
#define SFLASH_USER_AREA_I_START	0X0000000

- (4) Building project.
- Please refer to <u>UM-WI-056 DA16200 DA16600 FreeRTOS Getting Started Guide</u> under **Section 5.5 Building Projects** for detailed instructions on the process.
- (5) Flash the new firmware.
- Flash the new firmware via Tera Term by following the instructions provided in the <u>UM-WI-056 DA16200</u> <u>DA16600 FreeRTOS Getting Started Guide</u> under **Section 4.5.2 Using Macro Script of Tera Term**.



4.2 Debugging

printf() in the project is used to provide additional error information during the debugging process.



Revision History

		Revision History		
Rev.	Date	Page	Summary	
1.00	May. 30, 2025	-	First edition issued	



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

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

1. Precaution against Electrostatic Discharge (ESD)

A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

2. Processing at power-on

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

3. Input of signal during power-off state

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

4. Handling of unused pins

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

5. Clock signals

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

6. Voltage application waveform at input pin

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

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8. Differences between products

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

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