

The background of the slide features a collection of human-shaped figures. On the left side, there are several unpainted wooden figures. On the right side, there are several painted plastic figures in various colors including green, orange, purple, yellow, blue, and red. The figures are scattered across a white surface, casting soft shadows.

RL78/G22, RL78/G23, RL78/G24 INTRODUCTION OF FIRMWARE UPDATE MODULE

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EMBEDDED PROCESSING 2ND BUSINESS DIVISION

EMBEDDED PROCESSING PRODUCT GROUP

RENESAS ELECTRONICS CORPORATION

CONTENT

Renesas provides the firmware update module for the RL78/G22 and RL78/G23,RL78/G24.

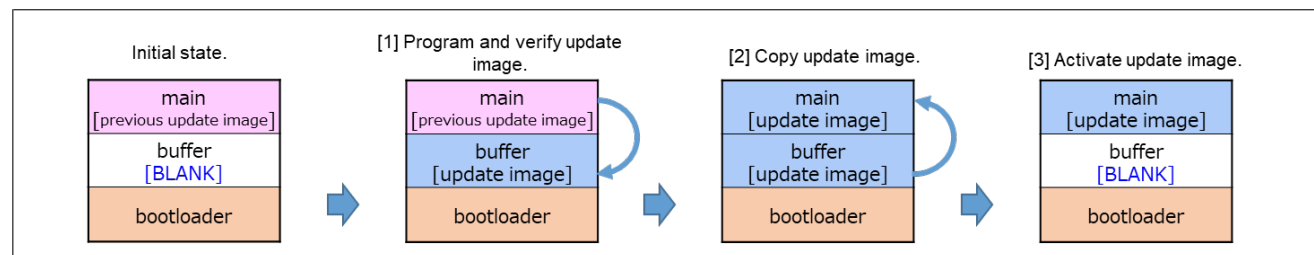
By using the module, users can easily incorporate firmware update functionality into their applications.

This application note explains the specifications of the firmware update module and how to incorporate its API functions into user applications.

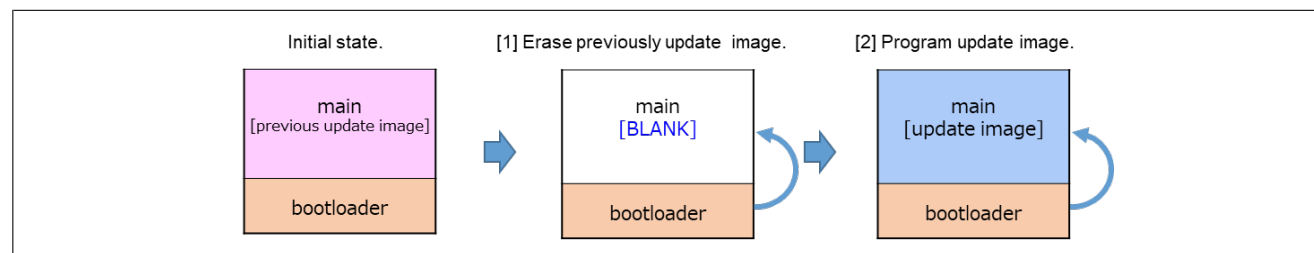
OVERVIEW

- ✓ Providing a mechanism for easily incorporating firmware update functions into customers' systems
- ✓ The firmware update module for the RL78 Family provides functionality for the following three firmware update methods.
 - ✓ Partial update method (buffer side is internal flash)
 - ✓ Full update method (without buffer side)
 - ✓ Full update method (buffer side is external flash)
- ✓ A tool (Renesas Image Generator) for creating firmware images is provided as a utility. Renesas Image Generator can generate the following types of images for use by the firmware update module.

Partial update method (buffer side is internal flash)



Full update method (without buffer side)



[RL78/G22, RL78/G23, RL78/G24 Firmware Update Module \(Sample Code\)](#)

TOOLS FOR GENERATING FIRMWARE IMAGES

RENESAS IMAGE GENERATOR

Renesas Image Generator:
A utility tool that generates firmware images for use with firmware update modules. Generate the following images used by the firmware update module.

ECDSA NIST P-256 and SHA256 are used for validation.

Functionality for validating the update image:

- sha256: Appends the hash of the image
- ecdsa: Appends the signature of the image

BareMetal and FreeRTOS OTA update image

RSU Format type:

- BareMetal : BareMetal adds RSU header signature information
- RTOS: Generate update image for FreeRTOS OTA. The update image for FreeRTOS OTA does not add RSU header signature information

Update Image: RSU Header Format

Offset	Item	Length (Bytes)	Description
0x00000000	Magic Code	7	Magic code ("RELFVW2")
0x00000007	Reserved	1	Reserved area
0x00000008	Firmware Verification Type	32	Image verification method Set sig-sha256-ecdsa to use ECDSA for image verification, and hash-sha256 to use hash.
0x00000028	Signature size	4	Data size of signature value or hash value stored in Signature Set 0x40 if Firmware Verification Type is sig-sha256- ecdsa, and 0x20 if hash-sha256.
0x0000002C	Signature	64	Signature value used for firmware verification For SHA-256 signature data, bytes 33 to 64 are set to 0x00.
0x0000006C	RSU File Size	4	File size of entire update image file
0x00000070	Reserved	400	Reserved area
0x00000200	Program Data Num	4	Number of subsequent divided application programs or data flashes (maximum 31)
0x00000204	Start Address[0]	4	Start address of the first application program or data flash
0x00000208	Data Size[0]	4	Size of the first application program or data flash
0x0000020C	Start Address[1]	4	Start address of second application program or data flash
0x00000210	Data Size[1]	4	Second application program or data flash size
:	:		
0x000002F4	Start Address[30]	4	Start address of the 31st application program or data flash
0x000002F8	Data Size[30]	4	Size of the 31st application program or data flash
0x000002FC	Reserved	4	Reserved area

FIRMWARE IMAGE GENERATION AND USAGE EXAMPLE

Generate firmware images with a tool that facilitates updates (Renesas Image Generator)

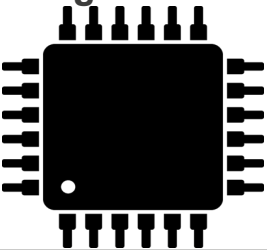
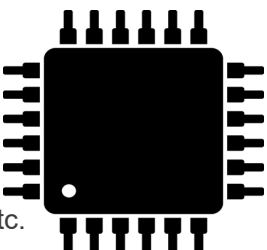
Usage example:

Initial Image

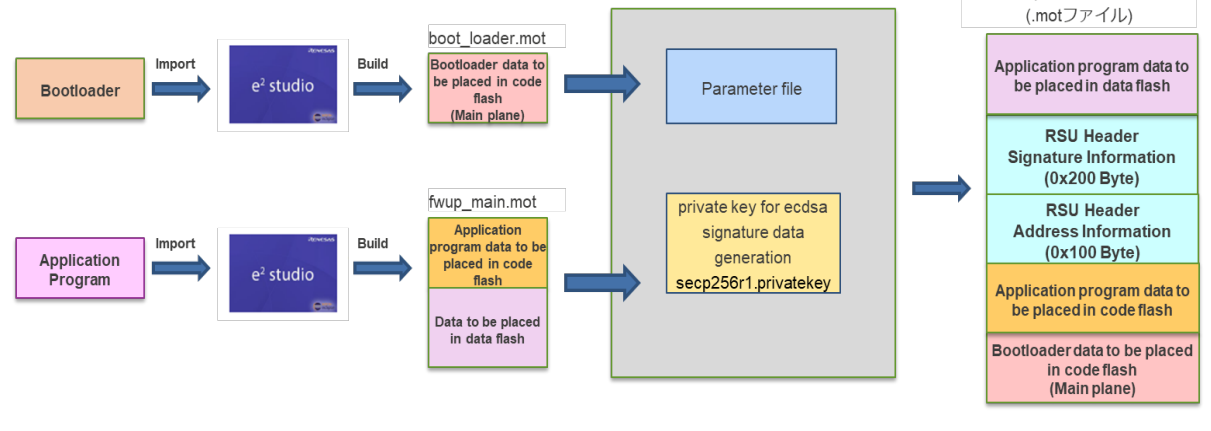
Writing by Renesas Flash Programmer and etc.

- Importing the update image to the MCU via a communication interface
- Validating the update image
- Programming the update image to the on-chip flash memory (self-programming)
- Activating the update image

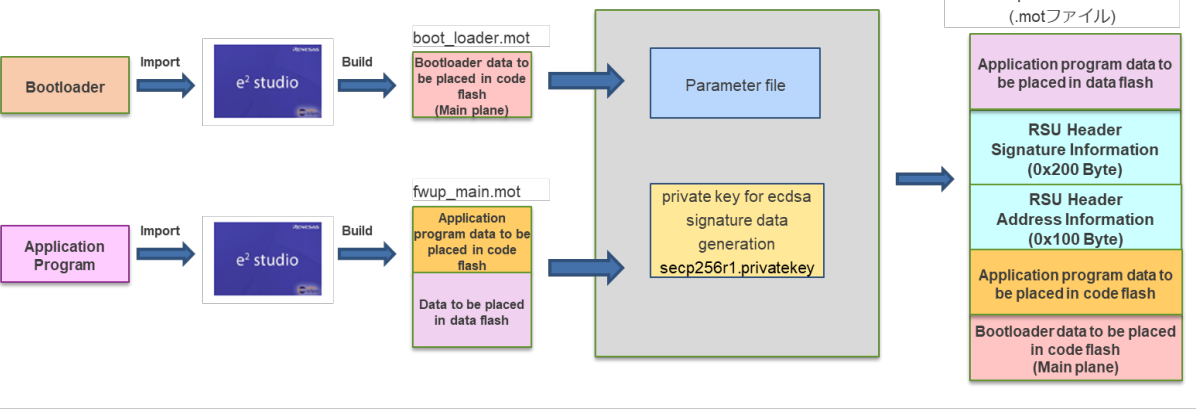
Update Image



Generating the Initial Image File



Generating an update image file

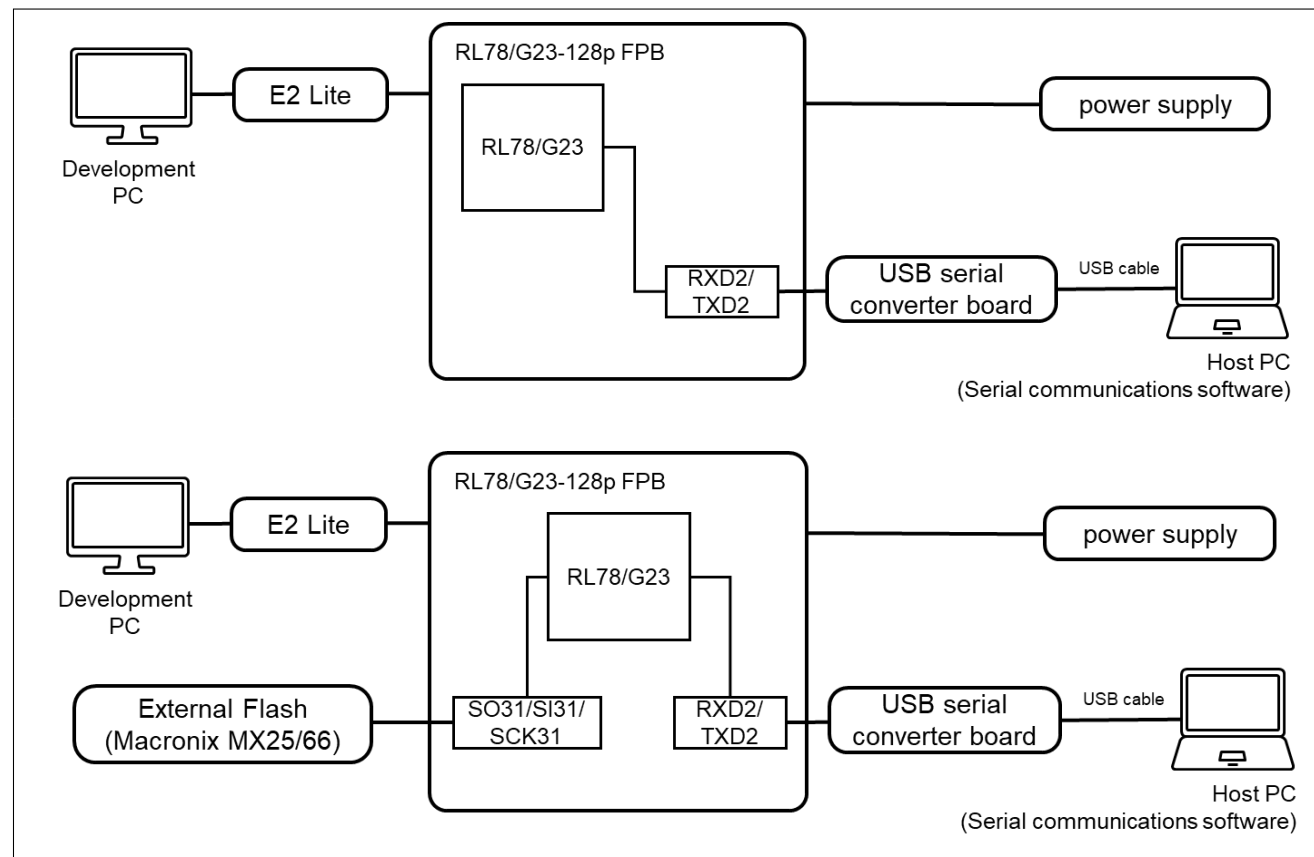


DEMO PROJECT

Sample program for demonstrating firmware update using serial communication interface (SCI)

The firmware update demo consists of the following projects.

- **boot_loader:** Bootloader
This program runs first after a reset. It verifies that the user program has not been tampered with and then, if verification is successful, launches the user program.
- **fwup_main:** Application program
An application program (initial firmware) that downloads updated firmware and performs signature verification.
- **fwup_leddemo:** Application program (for update)
This is an application program (for updating) that blinks an LED.



SAMPLE PROJECT CODE SIZE

The table below shows an example of the ROM, RAM, and maximum stack size of the bootloader Mr./Ms. project. Others are available for applications.

MCU	MODE/Verification	Items	Category	Memory Used (byte)	
				CC-RL Compiler	IAR Compiler
RL78/G22	Full Update Method (without buffer side) / SHA256	boot_loader	ROM	11807	15915
			RAM	767	2054
			Stack	402	1956
RL78/G23	Partial Update Method (buffer side is internal flash) / ECDSA	boot_loader	ROM	21230	30358
			RAM	1343	3660
			Stack	516	3152
RL78/G24	Partial Update Method (buffer side is internal flash)) / ECDSA	boot_loader	ROM	21541	30648
			RAM	1343	3669
			Stack	516	3152

Conditions:
Module revision: Firmware update module for RL78 v2.0.0
Compiler version: Renesas Electronics C Compiler Package for RL78 Family V1.11 IAR C/C++ Compiler for Renesas RL78 version 5.10.1
Configuration options: Configuration option settings are listed in each FPB

CC-RL Compiler (Renesas Compiler)
Optimization level: size & execution speed (-Odefault)
Delete variables/functions that have never been referenced (-optimize=symbol_delete)
IAR Compiler
Optimization level: High (balanced)

FIRMWARE UPDATE RELATED

APPLICATION NOTE

Using the Firmware Update Module

RL78/G22, RL78/G23, RL78/G24 Firmware Update Module 日本語 Related Files: Sample Code
RL78/G22 OTA Firmware Update for a Secondary MCU 日本語 Related Files: Sample Code

Firmware update module not used

RL78/G23 Updating Firmware by Using UART Communication and Boot Swapping 日本語 Related Files: Sample Code
RL78/G23 Firmware Upgrade Using External Flash Memory via Simplified SPI (CSI) Communication Rev.1.00 (renesas.com) 日本語 Related Files: Sample Code

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