RL78/G14, R8C/36M Group

Migration Guide from R8C to RL78: Flash Memory

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Introduction

This application note describes flash memory functions, in the R8C/36M group and RL78/G14 (a 64-pin product is taken as an example in this document).

Target Device

RL78/G14, R8C/36M Group

When using this application note with other Renesas MCUs, careful evaluation is recommended after making modifications to comply with the alternate MCU.

Contents

1. Flash Memory of RL78/G14 and R8C/36M Group

The flash memory of the R8C/36M Group and that of the RL78/G14 have different functions. This application note therefore gives useful information on migration from the R8C/36M Group to RL78/G14.

This application note only gives brief outline of the flash memory specifications; refer to the pertinent user's manuals and application notes for details on how to use the flash memory.

1.1 Rewriting Flash Memory of RL78/G14 and R8C/36M Group

1.1.1 Rewriting Flash Memory of R8C/36M Group

Figure 1.1 shows the flash memory map of R8C/36M group (Summary). Table 1.1 shows the flash memory rewrite mode in R8C/36M group (Summary).

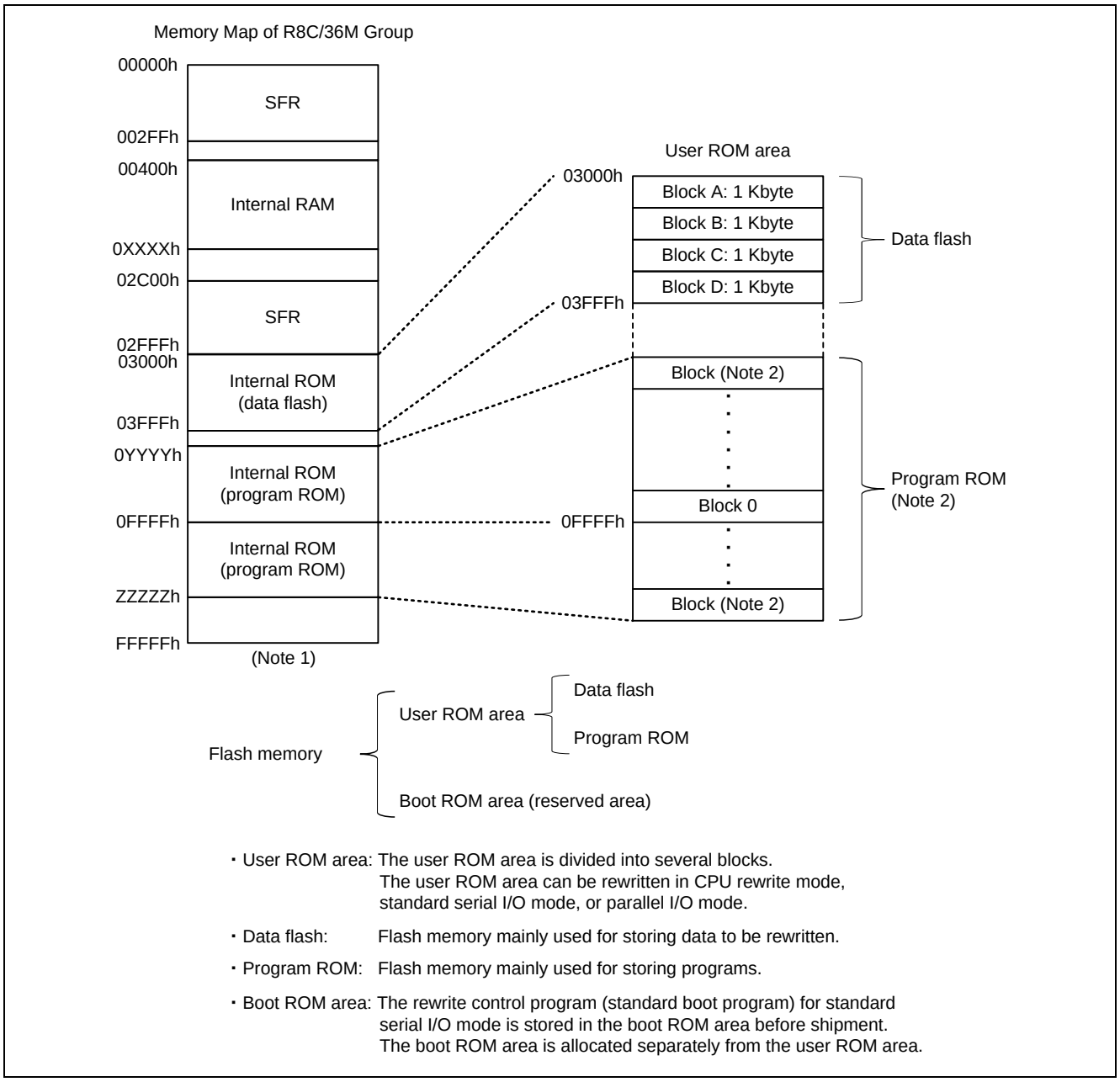

Figure 1.1 Flash Memory Map of R8C/36M Group (Summary)

Note 1. 0XXXXh, 0YYYYh, and ZZZZZh address values depend on the product.
For details, refer to the figure, Memory Map of R8C/36M Group, of the user's manual.

Note 2. The number of blocks and how the area is divided into blocks (capacity and address value of each block) depend on the product.
For details, refer to the figure, R8C/36M Group Flash Memory Block Diagram, of the user's manual.

Table 1.1 Flash Memory Rewrite Mode in R8C/36M Group (Summary)

Flash Memory Rewrite Mode in R8C/36M Group	
Mode	**Function**
CPU Rewrite Mode	• Rewritable area: User ROM • Program to be used for rewriting flash memory: User program The user ROM area can be rewritten by executing software commands from the CPU. Therefore, the user ROM area can be rewritten directly while the MCU is mounted on a board without using a serial programmer.
Standard Serial I/O Mode	• Rewritable area: User ROM • Program to be used for rewriting flash memory: Standard boot program A serial programmer which supports the MCU can be used to rewrite the user ROM area while the MCU is mounted on-board. (Note 1)
Parallel I/O Mode	• Rewritable area: User ROM • Program to be used for rewriting flash memory: － A dedicated parallel programmer can be used to rewrite the user ROM area. (Contact the parallel programmer manufacturer for more information.)

Note 1. The dedicated serial programmers include the E8a emulator, E1 emulator, and programming tool Flash Development Toolkit (FDT). For details, refer to the pertinent manual of the serial programmer. It is also possible to use the serial programmer for the R8C/3x Group developed by the user.

1.1.2 Rewriting Flash Memory of RL78/G14

Figure 1.2 shows the flash memory map of RL78/G14 (Summary). Table 1.2 shows the programming method of flash memory in RL78/G14 (Summary).

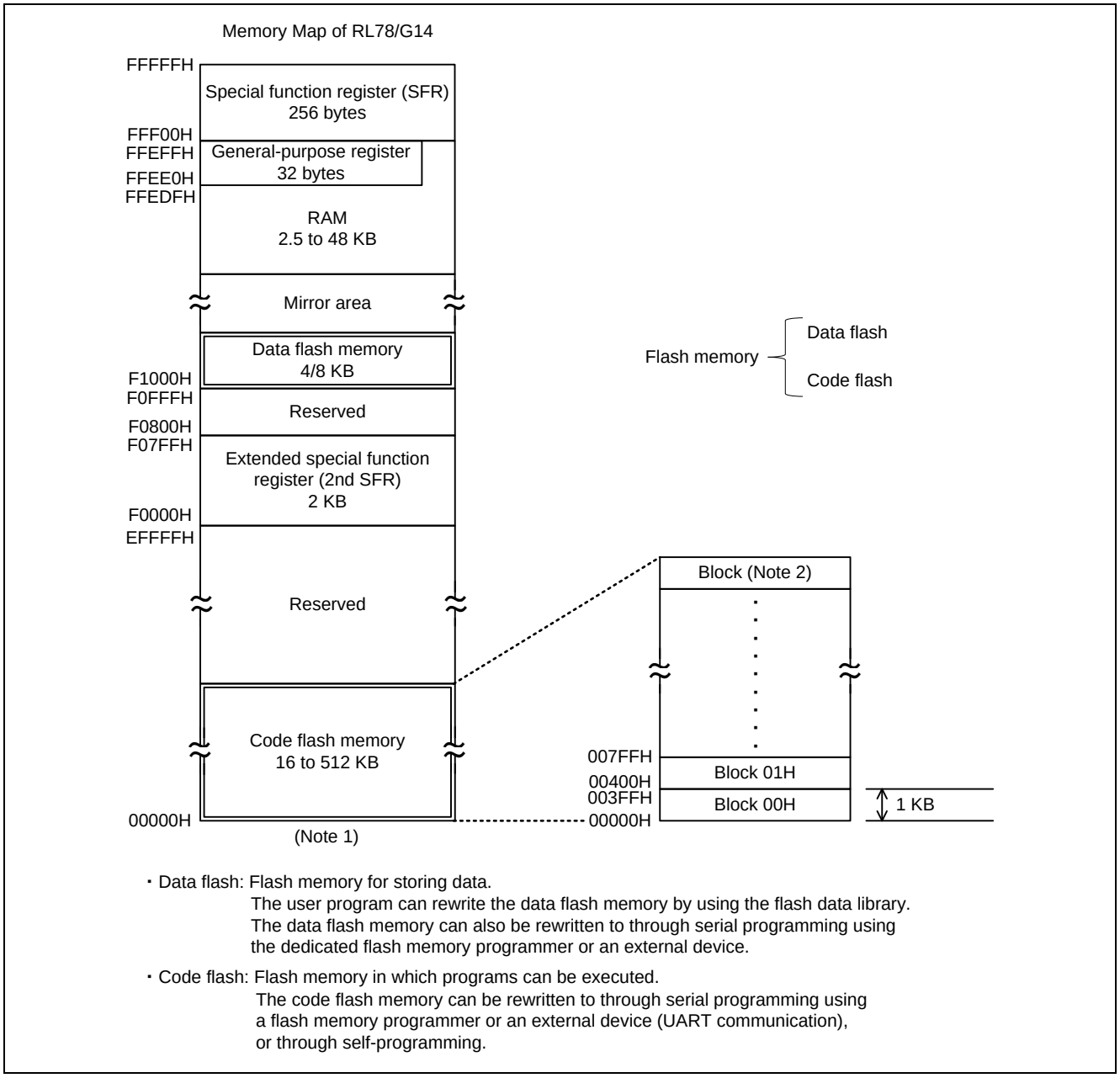

Figure 1.2 Flash Memory Map of RL78/G14 (Summary)

Note 1. The capacity and address values of the RAM, mirror area, data flash memory, and code flash memory depend on the product.
For details on the memory allocation, refer to the figure, Memory Map, of the user's manual.

Note 2. Flash memory is divided into blocks (1 block = 1 Kbyte).
The number of blocks depend on the product.
For details on the address values and block numbers, refer to the table, Correspondence between Address Values and Block Numbers in Flash Memory, of the user's manual.

Table 1.2 Programming method of Flash Memory in RL78/G14 (Summary)

Programming method of Flash Memory in RL78/G14		
Programming method		**Function**
Rewriting of flash memory using user program	Self-Programming (Rewriting code flash)	The user program can rewrite the code flash by using the Flash Self-Programming Library. For details, refer to the following document. • RL78 Family Flash Self-Programming Library Type01 Japanese Release (R01US0050)
	Programming using the Data Flash Library (Rewriting data flash)	The user program can rewrite the data flash by using the Data Flash Library. For details, refer to the following document. • RL78 Family Data Flash Library Type04 Japanese Release (R01US0049)
Rewriting of flash memory using UART communication	Serial programming using flash memory programmer	Data can be written to the flash memory on-board or off-board (Note 1), by using a dedicated flash memory programmer (Note 2).
	Serial programming using external device (that incorporates UART)	Data can be written to the flash memory on-board through UART communication with an external device (microcontroller or ASIC). On the development of flash memory programmer by user, refer to the following document. • RL78 Microcontrollers (RL78 Protocol A) Programmer Edition Application Note (R01AN0815)

Note 1. Off-board programming is available when a program adapter (FA series) is used as FL-PR5.

Note 2. The dedicated flash memory programmers include the PG-FP5, FL-PR5, and E1 on-chip debugging emulator, and programming tool Renesas Flash Programmer (RFP). For details, refer to the pertinent manual of the flash memory programmer.

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1.2 Differences between Flash Memory of RL78/G14 and R8C/36M Group

Table 1.3 and Table 1.4 show the differences between programming method of flash memory in R8C/36M group and RL78/G14.

Table 1.5 shows the differences between flash memory.

Table 1.3 Differences between programming method of flash memory in R8C/36M group and RL78/G14 (1/2)

Item	R8C/36M Group	RL78/G14
Rewriting of flash memory using user program	CPU rewrite mode • EW0 mode • EW1 mode	• Self-Programming (Rewriting code flash) • Programming using the Data Flash Library (Rewriting data flash)
Rewriting of flash memory using UART communication	Standard serial I/O mode • Standard serial I/O mode 2 (Two-line UART) • Standard serial I/O mode 3 (Single-line UART)	• Serial programming using flash memory programmer (Single-line UART) • Serial programming using external device (that incorporates UART) (Single-line UART, two-line UART)
Rewriting of flash memory using parallel programmer	• Parallel I/O mode	—

Table 1.4 Differences between programming method of flash memory in R8C/36M group and RL78/G14 (2/2)

Item	R8C/36M Group	RL78/G14
Programming and erasure control method	[CPU rewrite mode] Programming and erasure control by using software commands	[Self-Programming/ Programming using the Data Flash Library] Rewriting flash memory using the library
	[Standard serial I/O mode] Programming and erasure control by sending control commands	[Serial programming using flash memory programmer/ Serial programming using external device (that incorporates UART)] Programming and erasure control by sending control commands
Programming method	[CPU rewrite mode] Writing data in byte units	[Self-Programming] Writing data in 4-byte units × n (data quantity)
		[Programming using the Data Flash Library] Writing data in 1-byte units × n (data quantity)
	[Standard serial I/O mode] Writing data in 1-byte units × n (data quantity) or in 256-byte units	[Serial programming using flash memory programmer/ Serial programming using external device (that incorporates UART)] Writing data into the area specified in units of block start/end addresses
Erasure method	Erasure in block units (In data flash, 1 block = 1-Kbyte units. In program ROM, capacity of a block depends on the product.)	Erasure in block units (1 block = 1-Kbyte units)

Table 1.5 Differences between Flash Memory (Summary)

Item		R8C/36M Group	RL78/G14
Program, erase voltage		V_{CC} = 2.7 V to 5.5 V (operating ambient temperature (T_{opr}) = 0 to 60 ℃)	• V_{DD} = 1.8 to 5.5 V (operating ambient temperature (T_A) = -40 to +85 ℃) • V_{DD} = 2.4 V to 5.5 V (G: industrial use (operating ambient temperature (T_A) = -40 to +105 ℃))
Number of programming and erasure times (program/ erase endurance)	Program ROM/ Code flash	1,000 times	1,000 times
	Data flash	10,000 times	10,000 times
Security functions		Data protect function (Enables/disables program ROM rewrite. Supports CPU rewrite mode). Data can be protected from being rewritten in block units using the lock bit. (The lock bit is set using the software command. The FMR13 bit enables/disables the lock bit.)	Flash shield window function (Supports self-programming.) Writing to and erasing the areas outside the range specified as a window can be disabled. (Available only for code flash.)
		Enables/disables data flash rewrite (supports CPU rewrite mode). Data can be protected from being rewritten in block units. (The FMR14, FMR15, FMR16, and FMR17 bits in the FMR1 register enable/disable rewriting.)	—
		—	• Prohibition of block erasure (Supports serial programming.) • Prohibition of writing (Supports serial programming.) • Prohibition of rewriting boot cluster 0
		ID code check function (Supports standard serial I/O mode.)	On-chip debug security ID
		ROM code protect function (Supports parallel I/O mode.)	—
Other functions		• BGO (background operation) function • Erase-suspend function	• Background operation (BGO) • Suspension of flash self-programming (through a use of the library) • Boot swap function
Program execution on data flash		Possible	Prohibited

2. Reference Application Note

RL78 Microcontrollers (RL78 Protocol A) Programmer Edition Application Note (R01AN0815)
The latest versions can be downloaded from the Renesas Electronics website.

3. Reference Documents

User's Manual: Hardware
RL78/G14 User's Manual: Hardware (R01UH0186)
R8C/36M Group User's Manual: Hardware (R01UH0259)
RL78 Family Flash Self-Programming Library Type01 Japanese Release (R01US0050)
RL78 Family Data Flash Library Type04 Japanese Release (R01US0049)
The latest versions can be downloaded from the Renesas Electronics website.

Library
Flash Self Programming Library Type01 Ver.x.xx for the CC-RL Compiler for the RL78 Family
(ZIP file name: JP_R_FSL_RL78_T01_Vx.xx_CCRL_A_E)
Data Flash Library Type04 Ver.x.xx for the CC-RL Compiler for the RL78 Family
(ZIP file name: JP_R_FDL_RL78_T04_Vx.xx_CCRL_A_E)
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Revision History

		Description	
Rev.	**Date**	**Page**	**Summary**
1.00	Oct. 26, 2018	-	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. 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 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. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

   The state of the product is undefined at the moment 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 moment 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 moment 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 moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

   Access to reserved addresses is prohibited.

   — The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

   After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has 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. Moreover, 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.

5. Differences between Products

   Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

   — The characteristics of Microprocessing unit or Microcontroller unit products in the same group but having a different part number may differ in terms of the 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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