

## RL78/G13

## Boot Loader through SCI

R01AN1424ET0100 Rev.1.00 Jan 22, 2013

#### Introduction

This application note introduces a self-programming boot-loader example. User could update boot-loader program or user program through SCI.

#### **Target Device**

RL78/G13

#### Contents

1.	Overview	2
2	Development Environment	2
3.	Boot Loader Program	3
4.	Implementation	5
5.	File Format	10



#### 1. Overview

• The RL78/G13 has a self-programming function that can be used to rewrite the flash memory via a user program. The communication interface can be decided by user's design in user program, such as UART, I<sup>2</sup>C and so on. In this application note, the communication between host PC and RL78/G13 is via UART (see Figure 1). User can achieve the communication by using terminal emulation software like "HyperTerminal".

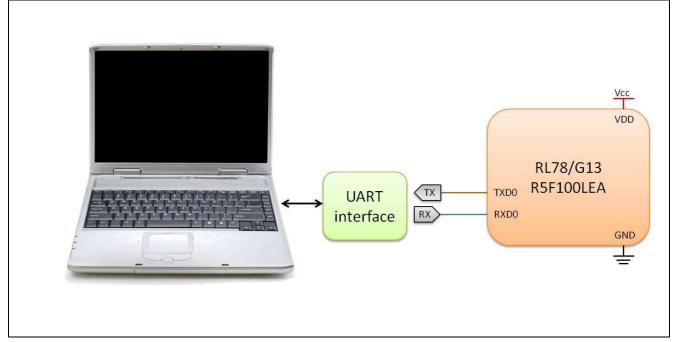


Figure 1 Hardware platform

#### 2. Development Environment

• The RL78/G13 supports on-chip debug. To start the development, the E1 on-chip debugging emulator is used as the debug tool. The system configuration about PC, E1 emulator and user's system is shown in Figure 2.

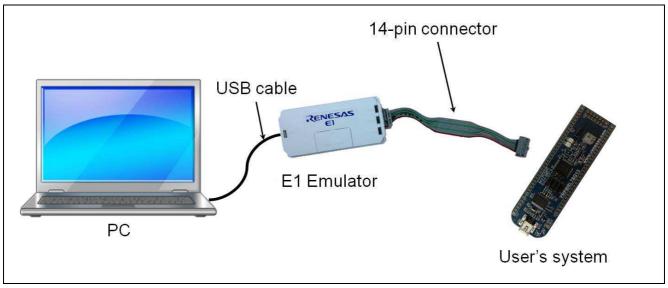


Figure 2 System configuration

• Figure 3 shows the connection example circuit. The V<sub>DD</sub>, GND, TOOL0, and RESET# pins are used for communication with the host machine via the E1 on-chip debugging emulator. For more details, please read CHAPTER 26 ON-CHIP DEBUG FUNCTION in the "User's Manual: Hardware" of RL78/G13.

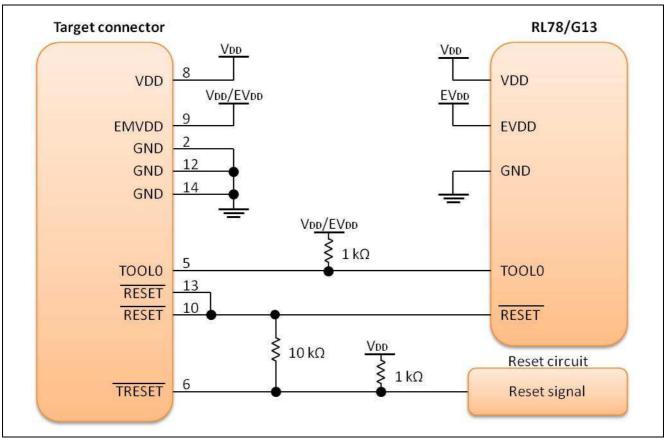


Figure 3 Connection example of E1 and RL78/G13

#### 3. Boot Loader Program

• The boot loader is used for updating user's application program and boot loader itself. To rewrite flash memory, it uses self-programming library of RL78/G13 for programming actions. In this application note, the flash memory is mainly separated into two parts, boot loader area and application program area. To update application program, the updating procedure erases the application area, and then writes new application firmware into application program area. Figure 4 shows the procedure diagram.



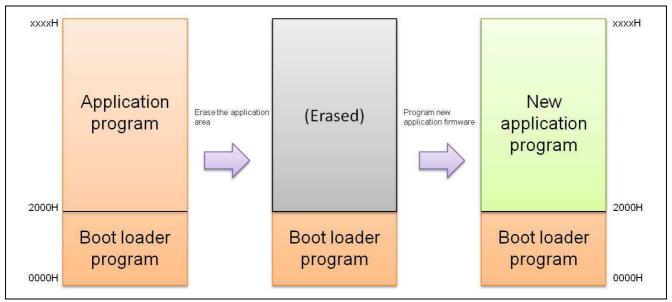


Figure 4 Application program update

• To update boot loader program, it is similar with the procedure of updating application program. The RI78/G13 has a boot swap function for updating the boot loader program. The boot loader area is treated as two parts, boot cluster 0 and boot cluster 1. First step is to erase boot cluster 1 and program a new boot loader firmware into boot cluster 1. And then run the boot swap function to swap the two boot clusters. Finally reset the system to active the new boot loader. After reset, the program will start from boot cluster 1. Figure 5 shows a diagram of updating the boot loader program.

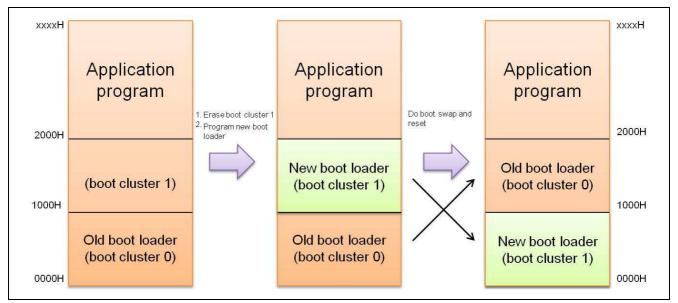


Figure 5 Boot loader program update

• About the usage of self-programming library, please refer the document, Flash Self-programming Library, for more details.



#### 4. Implementation

• In this example, the "HyperTerminal" is used as the terminal emulation software. The setting of communication configuration is shown in Figure 6. After power on the system, you would see the operation menu (see Figure 7).

<u>B</u> its per second:	115200	
<u>D</u> ata bits: [	8	
Parity:	None	~
Stop bits:	1	
Elow control:	None	

Figure 6 Communication configuration



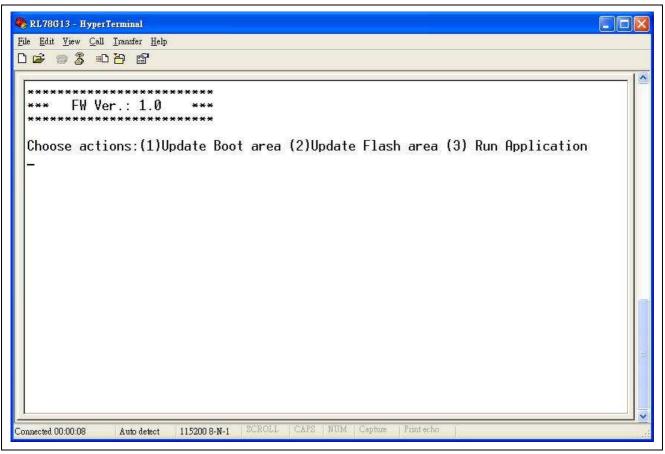


Figure 7 Operation menu

• In this menu, the first option is to update the boot loader program. After choosing option 1 of this menu, click the "Send File" from the "Transfer" menu option of HyperTerminal (see Figure 8). On the "Send File" dialog (see Figure 9), select the file for updating (must be a binary file<sup>1</sup>) into "Filename" item, and choose "Xmodem" as the transmission protocol. Click "Send" button and updating process will start within 10 seconds. Figure 10 shows the dialog of updating progress. After finishing the process, the result message of updating will be displayed on the screen of HyperTerminal (see Figure 11). If it is successful to update new firmware, the program will restart to run the new boot loader (see Figure 12). Otherwise, the program would stop until reset the system.

#### • Note :

In this application, the file for updating must be a binary file. About the format of the firmware, please see chapter 5 "File Format" in this application note for more details.



#### RL78/G13

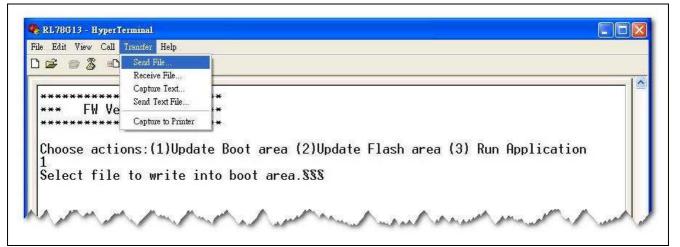


Figure 8 Transfer menu

<b>≥ ∞ 3 07 8</b>	
*****	****
•** FW Ver.: 1.0	***
N	-1 +
noose actions:(1)U	pdate Boot area (2)Update Flash area (3) Run Application
Select file to writ	e in Send File
	Folder: C:\Firmware
	Filename: C:\Firmware\1.1.BIN Browse
	Protocol
	Xmodem 🛛
	Send Close Cancel

Figure 9 Send file dialog



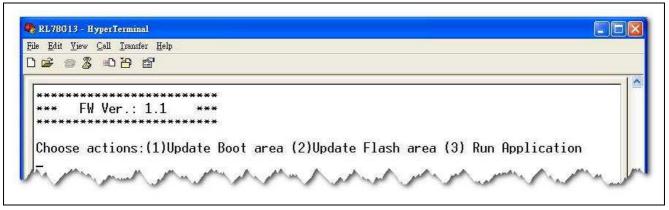
**** FW Ver.: 1.0			- 01 70/01 2				
Choose actions:(1)			11. <u>22-12-02</u>			Application	
1 Select file to writ	t Packet:	14	Error checking:	Checksum			
	Retries:	0	Total retries:	0			
	Last error:						
	File:				OK ol 4K		
	Elapsed:		Remaining:		Throughput:		

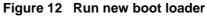
Figure 10 Progress dialog

<u>File Edit View Call Transfer H</u> elp	
D 😂 🍘 🕉 🗉 🖰 🖆	
**************************************	
Choose actions:(1)Update Boot area 1	a (2)Update Flash area (3) Run Application
Select file to write into boot are Update flash area: Success Reset	ea.\$\$

Figure 11 Update result message







• Option 2 is the function for updating firmware into application program area. The operation process is same as option 1. After updating new application program, the result message of updating will be displayed on the screen of HyperTerminal (see Figure 13). If it is successful to update new firmware, the program will run the new application program. Otherwise, the program would stop until reset the system.

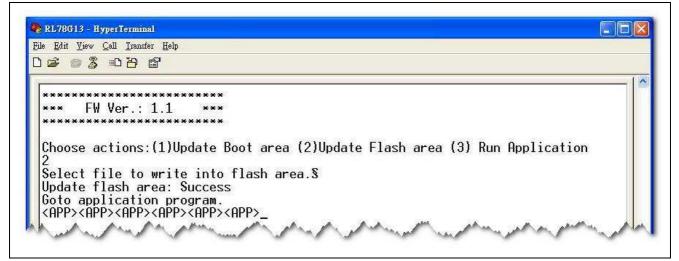


Figure 13 Result of updating application program

- Choosing option 3 would run the application program. In this demonstration, it would print "App" on the screen every 100 ms within 1 second. Then the program would wait for timeout (949.80 ms).
- The flow chart<sup>2</sup> of this example program is shown in Figure 14.



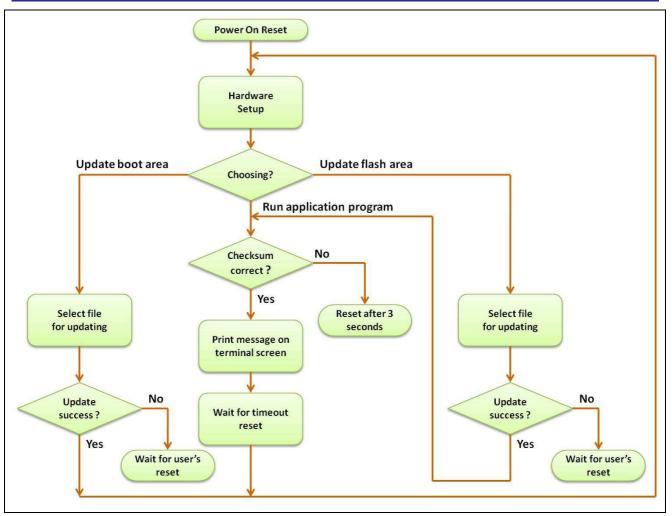


Figure 14 Flow chart

#### • Note :

If transmission dose not start in 100 seconds after choosing update action (option 1 or option 2), it will show "Update failed" message on the screen of HyperTerminal and the boot loader program will stop until the system reset.

#### 5. File Format

- In this application, the firmware file is separated into two parts. One is for boot area, the other one is for flash area. The steps for setting of IDE are as follows:
  - (Step 1) Right click the [Build Tool] node on the [Flash] subproject tree (see Figure 15) and select the [Property] option in the context menu (popup menu).
  - (Step 2) Click the [Object Convert Options] tab and select [Yes] on the [Split hex file] property in the [Hex File] category.
  - (Step 3) Select [No] on the [Fill free memory space] property in the [Hex File Filling] category.



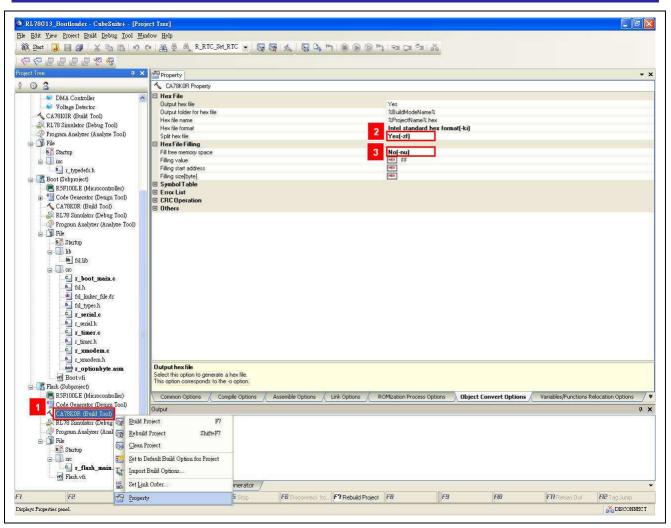


Figure 15 Steps of setting

• After building project, there would be two hex files named Flash.hxb and Flash.hxf in the output file folder. ("..\Flash\DefaultBuild\") The Flash.hxb file is the boot loader firmware and the Flash.hxf file is the user program firmware. Then transfer these two files into binary format and modify the user program firmware (delete the area from 0x0000 to 0x1FFFF, see Figure 16). Finally, these two binary files could be used for updating boot loader or user program.



	Q	-			4			_	100	9				_				
00000000h: 00000010h:																		
000000108:																		
			00			20		90		100		100		00		- dial	-	
100 to	00	4.	00	<b>b</b> .		00	_0	00	Lad	00	-10	00		00		00		An A
00001fe0h:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	;	
00001ff0h:																	:	
00002000h:																		?. <app>.坶僠A.</app>
																		6?4.瀅?坏.D?
00002020h:																		裞6?4.瀅.A
00002030h:																		
																		瀅.?.佈裐A.6.?
																		.瀅?.佈裌A.6?
00002060h:																		4.瀅?坏.D??
																		?.?.瀅.?.佈裐
00002080h:																		
																		「」(≦) 2□樹泉調査
																		.樵矧.??1. ?
																		`r氣類.a邰`r鰡釸
000020c0h:																		
000020d0h:																		
000020e0h:	E2	FC	CE	AB	AC	71	4B	E2	A7	17	44	E9	03	DE	14	17	**	禕姶段K傰.D??.
							13	F1	61	68	DF	EZ	30	04	20			Rd?鎙h蜋O. a
00002100h:	84	EF	DB	CB														
					21												1	湛神
									P								;	他们
								_	5	_	1	~					;	極作已
	Q	1			4		6	7	\$	- 9	2	þ	ç	¢	ę	ţ	2	· 後代
00000000h:		_	2	3	4	Ş			_				_			ţ		被們□ ? . <app>.坶僠A.</app>
	EC	OA	2 20	3 00	4 3C	5 41	50	50	ЗE	00	CB	F8	EO	FE	41	ţ 00	;	
	EC 36	OA DB	2 20 20	3 00 34	4 3C 00	5 41 EF	50 EF	50 05	3E 11	00 8B	CB 99	F8 A7	EO AS	FE 17	41 44	f OO DB		?. <app>.坶僠A.</app>
00000010h:	EC 36 20	OA DB DF	2 20 20 F5	3 00 34 36	4 3C 00 DB	5 41 EF 20	50 EF 34	50 05 00	3E 11 EF	00 8B EF	CB 99 0A	F8 A7 41	E0 A5 00	FE 17 11	41 44 8B	f 00 DB 41		? . <app>.坶僠ል. 6?4.瀅?坏.D? 裞6?4.瀅.à</app>
00000010h: 00000020h: 00000030h:	EC 36 20 0F	OA DB DF 11	2 20 20 F5 99	3 00 34 36 A7	4 3C 00 DB A5	5 41 EF 20	50 EF 34 44	50 05 00 DB	3E 11 EF 20	00 8B EF DF	CB 99 0A F0	F8 A7 41 36	E0 A5 00 00	FE 17 11 EF	41 44 8B 30	f 00 DB 41 00		? . <app>.坶僠ል. 6?4.瀅?坏.D? 裞6?4.瀅.à</app>
00000010h: 00000020h: 00000030h: 00000040h: 00000050h:	EC 36 20 0F EF 00	OA DB DF 11 EF EF	20 20 F5 99 04 EF	3 00 34 36 A7 CC	4 3C 00 DB A5 00 11	5 41 EF 20 17 00 CC	50 EF 34 44 A7 00	50 05 00 DB 47 00	3E 11 EF 20 DF A7	00 8B EF DF F9 47	CB 99 0A F0 41 DF	F8 A7 41 36 OF F8	E0 A5 00 00 36 41	FE 17 11 EF 00 00	41 44 8B 30 EF 36	f 00 DB 41 00 30 DB	** ** ** ** **	? . <app>.姆番A. 6?4.瀅?坏.D? 裞6?4.瀅.A  2D?蝟6.?. 瀅.?.佈裐A.6.? .瀅?.佈裌A.6?</app>
00000010h: 00000020h: 00000030h: 00000040h: 00000050h: 00000060h:	EC 36 20 0F EF 00 20	OA DB DF 11 EF EF 34	2 20 20 55 99 04 EF 00	3 00 34 36 A7 CC 05 EF	4 3C 00 DB A5 00 11 EF	5 41 EF 20 17 00 CC 05	50 EF 34 44 A7 00 11	50 05 00 DB 47 00 8B	3E 11 EF 20 DF A7 99	00 8B EF DF F9 47 A7	CB 99 0A F0 41 DF A5	F8 A7 41 36 0F F8 17	E0 A5 00 36 41 44	FE 17 11 EF 00 00 DB	41 44 8B 30 EF 36 20	f 00 DB 41 00 30 DB DF		? . <app>. 姆番A. 6?4.瀅2杯.D? 税6?4.瀅.A  2D?蛹6.?. 瀅.?.佈裐A.6.? 4.瀅?坏.D??</app>
00000010h: 00000020h: 00000030h: 00000040h: 00000050h: 00000060h: 00000070h:	EC 36 20 0F EF 00 20 F5	0A DF 11 EF 34 36	2 20 20 F5 99 04 EF 00 00	3 00 34 36 A7 CC 05 EF EF	4 3C DB A5 00 11 EF 30	5 41 EF 20 17 00 CC 05 00	50 EF 34 44 A7 00 11 EF	50 05 00 DB 47 00 8B EF	3E 11 EF 20 DF 47 99 04	00 8B EF DF F9 47 A7 CC	CB 99 F0 41 DF A5 00	F8 A7 41 36 0F F8 17 00	E0 A5 00 36 41 44 A7	FE 17 11 EF 00 00 DB 47	41 44 8B 30 EF 36 20 DF	f 00 41 00 30 DB DF F9		? . <app>.毋借A. 6?4.瀅2坏.D? 稅6?4.瀅.A  2D2蛹6.?. 瀅.?.佈得A.6.? 4.瀅?坏.D?? 2.2.瀅.?.佈祸</app>
00000010h: 00000020h: 00000030h: 00000040h: 00000050h: 00000060h: 00000070h:	EC 36 20 F EF 20 20 F5 FC	0A DF 11 EF 34 36 DB	20 20 F5 99 04 EF 00 20	3 00 34 36 27 05 EF 00	4 3C 00 DB A5 00 11 EF 30 F6	5 41 EF 20 17 00 CC 05 00 FC	50 EF 34 44 A7 00 11 EF BF	50 05 00 DB 47 00 88 EF 20	3E 11 EF 20 DF A7 99 04 00	00 8B EF F9 47 A7 CC EF	CB 99 F0 41 DF A5 00 FE	F8 A7 41 36 0F F8 17 00 82	E0 A5 00 36 41 44 A7 92	FE 17 11 EF 00 00 DB 47 DD	41 44 30 EF 36 20 DF 2B	f 00 DB 41 00 30 DB DF F9 61	11 11 11 11 11 11 11 11 11 11 11 11 11	? . <app>. 毋冊A. 6?4.瀅2杯.D? 稅6?4.瀅.A  2D2蛹6.?. 瀅.?.佈裐A.6.? .瀅?.怖裌A.6? 4.瀅2杯.D?? 2.?.瀅.?.佈裐 .簽?.獶??a</app>
00000010h: 00000020h: 00000030h: 00000040h: 00000050h: 00000060h: 00000070h: 00000080h: 00000090h:	EC 36 20 0F EF 00 20 F5 FC DD	0A DF 11 EF 34 36 DB 71	20 20 F5 99 04 EF 00 20 78	3 00 34 36 47 CC 05 EF EF 00 FA	4 3C 00 DB A5 00 11 EF 30 F6 CF	5 41 EF 20 17 00 CC 05 00 FC E8	50 EF 34 44 A7 00 11 EF BF 00	50 05 00 08 47 00 88 EF 20 80	3E 11 20 DF A7 99 04 00 BE	00 8B DF F9 47 A7 CC EF F0	CB 99 6A F0 41 DF A5 00 FE F6	F8 A7 41 36 0F F8 17 00 82 BE	E0 A5 00 36 41 44 A7 92 F2	FE 17 11 EF 00 00 DB 47 DD BE	41 44 30 EF 36 20 DF 2B F4	f 00 DB 41 00 DB DF F9 61 62	* * * * * * * * * *	? .<4PP>.姆番A. 6?4.瀅2杯.D? 税6?4.瀅.A 2D?蛹6.?. 瀅.?.佈裐A.6.? .瀅?.怖裌A.6? 4.瀅2杯.D?? ?.?.瀅.?.佈裐 .簽?.獶??a 傒(□樹舄翽瀨
00000010h: 00000020h: 00000030h: 00000040h: 00000050h: 00000060h: 00000070h: 00000080h: 00000080h:	EC 36 20 FF 20 F5 FC DD 80	0A DF 11 EF 34 36 DB 71 BE	2 20 20 F5 99 04 EF 00 20 78 F6	3 00 34 36 27 05 EF EF 00 FA CF	4 3C 00 DB A5 00 11 EF 30 F6 CF E8	5 41 EF 20 17 00 CC 05 00 FC E8 00	50 EF 34 44 A7 00 11 EF BF 00 81	50 05 00 08 47 00 88 EF 20 80 8F	3E 11 20 DF 47 99 04 00 BE 88	00 8B DF F9 47 A7 CC EF F0 00	CB 99 6A F0 41 DF A5 00 FE F6 31	F8 41 36 0F F8 17 00 82 BE 03	E0 A5 00 36 41 44 A7 92 F2 F2	FE 17 11 EF 00 00 00 08 47 DD 8E AF	41 44 8B 30 EF 36 20 DF 2B F4 E0	f 00 DB 41 00 30 DB DF F9 61 62 00		<ol> <li>.<app>.毋借A.</app></li> <li>624.瀅2坏.D?</li> <li>稅624.瀅.A</li> <li></li></ol>
00000010h: 00000020h: 00000030h: 00000040h: 00000050h: 00000060h: 00000070h: 00000080h: 00000090h: 000000a0h:	EC 36 20 F EF 20 F 5 F 00 F 5 60	0A DF 11 EF 34 36 DB 71 BE 72	20 20 F5 99 04 EF 00 20 78 F6 AE	3 00 34 36 47 05 EF EF CF FA CF FO	4 3C DB A5 00 11 EF 30 CF E8 F5	5 41 EF 20 17 00 CC 05 00 FC E8 00 E8	50 EF 34 44 A7 00 11 EF BF 00 81 00	50 05 00 47 00 88 EF 20 80 87 61	3E 11 EF 20 DF A7 99 04 00 BE E8 CD	00 8B EF F9 47 A7 CC EF F0 00 D7	CB 99 60 41 DF A5 00 FE 56 31 60	F8 A7 41 36 0F F8 17 00 82 BE 03 72	E0 A5 00 36 41 44 A7 92 F2 F2 FA	FE 17 11 EF 00 00 DB 47 DD BE AF B1	41 44 8B 30 EF 36 20 DF 28 F4 E0 D7	f 00 DB 41 00 DB DF F9 61 62 00 FB	A M M M M M M M M M M M M	? . <app>.姆番A. 624.瀅2坏.D? 稅624.瀅.A  2D2蛹6.?. 瀅.?.佈裐A.6.? .瀅.?.佈裐A.6? 4.瀅?.佈裐  .簽?.獶?2a 慀( 2D樹製翽瀨 .樵矧.??1. 2 `r氣類.a尙`r鰡釸</app>
00000010h: 00000020h: 00000030h: 00000050h: 00000050h: 00000060h: 00000080h: 00000080h: 00000080h: 00000080h: 00000080h:	EC 36 20 FF 20 FS FC DD 60 8A	0A DF 11 EF 34 36 DB 71 BE 72 F3	20 20 55 99 04 20 20 20 78 F6 AE F6	3 00 34 36 A7 CC 5 EF EF CF FO 47	4 3C DB A5 00 11 EF 30 F6 F5 DD	5 41 20 17 00 CC 05 00 FC E8 00 E8 13	50 EF 34 44 A7 00 11 EF BF 00 81 00 B7	50 05 00 DB 47 00 88 EF 20 80 87 61 C7	3E 11 EF 20 DF 47 99 04 00 8E E8 CD 17	00 8B EF F9 47 A7 CC EF F0 00 D7 31	CB 99 60 41 DF 45 60 FE 60 20	F8 A7 41 0F F8 17 00 82 BE 03 72 04	E0 A5 00 36 41 44 A7 92 F2 F2 F2 FA F6 OA	FE 17 11 EF 00 00 DB 47 DD 8E 47 DD 8E 81 F3	41 44 8B 30 EF 36 20 DF 2B F4 E0 D7 16	f 00 DB 41 00 30 DF F9 61 62 00 FB 80		<ol> <li><app>. 姆番A.</app></li> <li>624.瀅2坏.D?</li> <li>液624.瀅.A</li> <li>2D2铺6.2.</li> <li>?.佈清A.6.?</li> <li>.瀅.2.佈清A.6?</li> <li>4.瀅.2.标清</li> <li>.袋? 復?2a</li> <li>(奚 21樹鶉鯽瀧</li> <li>.熾矧.221. 2</li> <li>`r氣類.a郃`r鰡鈔</li> <li>嚩?準.1??</li> </ol>
00000010h: 00000020h: 00000030h: 00000050h: 00000050h: 00000060h: 00000080h: 00000080h: 00000080h: 00000080h: 00000080h: 00000080h:	EC 36 20 FF 20 FC 20 FS DD 88 60 80 80 80	0A DB DF EF EF 34 36 DB 71 BE 72 F3 9E	20 20 F5 99 04 EF 00 20 7B F6 AE F6 F6	3 00 34 26 27 05 EF 20 50 FA 50 47 AB	4 3C DB A5 00 11 EF CF E8 F5 DD C6	5 41 EF 20 17 00 CC 05 00 FC E8 00 E8 13 61	50 EF 34 47 00 11 EF BF 00 81 00 B7 CA	50 05 00 08 47 00 88 EF 20 80 87 61 C7 EF	3E 11 EF 20 DF 47 99 04 00 BE E8 CD 17 E9	00 8B EF F9 47 CC EF F0 00 D7 31 EF	CB 99 0A F0 41 DF A5 00 FE 31 60 2D FE	F8 A7 41 36 OF F8 17 00 82 BE 03 72 04 C7	E0 A5 00 36 41 A7 92 F2 F2 F2 F2 F6 OA F6	FE 17 11 EF 00 00 00 00 00 00 00 00 00 00 00 00 00	41 44 8B 30 EF 36 20 DF 2B F4 E0 D7 16 31	f 00 DB 41 00 30 DF F9 61 62 00 FB 8C C4		<ol> <li><app>. 姆番A.</app></li> <li>624.瀅2坏.D?</li> <li>液624.瀅.A</li> <li>2D2蛹6.2.</li> <li>瀅.2.佈得A.6.?</li> <li>.澄.2.佈液A.6?</li> <li>4.瀅.2.佈消</li> <li>.袋?.擾??a</li> <li>(奚 2.1荷潟勳郡 .條矧.2?1.2?</li> <li>* 定氣類.a郃、r鰡約 嚩?準.1??</li> <li>: 宦a抵濈 217</li> </ol>
00000010h: 00000020h: 00000030h: 00000050h: 00000050h: 00000070h: 00000090h: 00000090h: 00000000h: 00000000h: 00000000h:	EC 36 20 0F EF 00 20 F5 FC DD 08 60 8A 02 E2	0A DB DF EF 34 36 DB 71 BE 72 F3 9E FC	20 20 F5 99 04 EF 00 20 7B F6 F6 F6 F6 CE	3 00 34 26 27 26 26 26 27 26 27 28 26 27 28 26 27 28 26 27 27 28 27 28 27 27 28 27 27 28 27 27 27 27 27 27 27 27 27 27 27 27 27	4 3C DB A5 00 11 EF 306 F6 F5 DD C6 AC	5 41 EF 20 17 00 CC 5 00 E8 00 E8 13 61 71	50 EF 34 47 00 11 EF BF 00 81 00 B7 CA 4B	50 05 00 DB 47 00 88 EF 20 80 87 61 C7 EF E2	3E 11 EF 20 DF 47 99 04 00 BE E8 CD 17 E9 A7	00 8B EF F9 47 A7 CC EF F0 00 D7 31 EF 17	CB 99 0Å 41 DF 45 00 FE 56 31 60 2D FE 44	F8 A7 41 36 0F F8 17 00 82 BE 03 72 04 C7 E9	E0 A5 00 36 41 44 A7 92 F2 F2 FA F6 0A F6 03	FE 17 11 EF 00 00 DB 47 DD 8E 47 B1 F3 16 DE	41 44 8B 30 EF 36 20 DF 2B F4 E0 D7 16 31 14	f 00 DB 41 00 30 DF 61 62 00 FB 8C C4 17		2 . <app>.姆番A. 624.瀅2坏.D2 液624.瀅.A . 2D2蛹6.2. 瀅.2.佈捐A.6.2 .瀅.2.佈祸A.62 4.瀅.2.佈祸 .發2.擾22a 傒(20樹鶉鯽瀸 .熾矧.221.2 下氣類.a鉛、r鰡鈔 嚩?準.122 . 宦a抵谶 212 諱齡段K漰.D22.</app>
00000010h: 00000020h: 00000040h: 00000050h: 00000060h: 00000070h: 00000090h: 00000090h: 00000000h: 00000000h: 00000000h:	EC 36 20 0F EF 00 75 FC 00 80 80 80 81 02 52	0Å DB DF 11 EF 54 36 71 BE 72 F3 F3 F3 F3 64	2 20 20 55 99 04 EF 00 20 7B F6 F6 F6 F6 F6 F6 F6	3 00 34 26 27 26 27 26 27 28 26 27 28 26 27 28 26 27 27 26 27 27 27 27 27 27 27 27 27 27 27 27 27	4 3C DB A5 00 11 EF 30 F6 CF E8 F5 DD C6 AC 20	5 41 EF 20 17 00 CC 5 00 E8 00 E8 13 61 71 00	50 EF 34 47 00 11 EF BF 00 81 00 B7 CA 4B	50 05 00 DB 47 00 88 EF 20 80 87 61 C7 EF E2	3E 11 EF 20 DF 47 99 04 00 BE E8 CD 17 E9 A7	00 8B EF F9 47 A7 CC EF F0 00 D7 31 EF 17	CB 99 0Å 41 DF 45 00 FE 56 31 60 2D FE 44	F8 A7 41 36 0F F8 17 00 82 BE 03 72 04 C7 E9	E0 A5 00 36 41 44 A7 92 F2 F2 FA F6 0A F6 03	FE 17 11 EF 00 00 DB 47 DD 8E 47 B1 F3 16 DE	41 44 8B 30 EF 36 20 DF 2B F4 E0 D7 16 31 14	f 00 DB 41 00 30 DF 61 62 00 FB 8C C4 17 61		? .<4PP>. 姆爾A. 624.瀅2杯.D? 液624.瀅.A. 2D2開6.?. 瀅.?.佈得A.6.? .瀅.?.佈得A.6? 4.瀅2杯.D?? ?.?.瀅?.?.佈祸 .簽?.擾??a 〔〔20樹鶪翩瀸 .樵矧[.??1. ? 下氣類.a尙`r鰡扮 嚩?準.1?? . 宦a抵谶 21?

Figure 16 Modification



#### Website and Support

Renesas Electronics Website <u>http://www.renesas.com/</u>

Inquiries

http://www.renesas.com/contact/

All trademarks and registered trademarks are the property of their respective owners.



### **Revision Record**

		Descript	lion	
Rev.	Date	Page	Summary	
1.00	Jan 22, 2013		First edition issued	

### General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU products from Renesas. For detailed usage notes on the products covered by this manual, refer to the relevant sections of the manual. If the descriptions under General Precautions in the Handling of MPU/MCU Products and in the body of the manual differ from each other, the description in the body of the manual takes precedence.

1. Handling of Unused Pins

Handle unused pins in accord 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 one with a different type number, confirm that the change will not lead to problems.

— The characteristics of MPU/MCU in the same group but having different type numbers may differ because of the differences in internal memory capacity and layout pattern. When changing to products of different type numbers, implement a system-evaluation test for each of the products.

#### Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renes Electronics such as that disclosed through our website 2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part. 4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information . When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations 6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein. 7. Renesas Electronics products are classified according to the following three quality grades: "Standard", "High Quality", and "Specific". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as "Specific" without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as "Specific" or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is "Standard" unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc. "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots. "High Quality": Transportation equipment (automobiles, trains, ships, etc.): traffic control systems: anti-disaster systems: anti-crime systems: safety equipment; and medical equipment not specifically designed for life support. "Specific": Aircraft: aerospace equipment: submersible repeaters: nuclear reactor control systems: medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life. 8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges. 9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you. 10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations 11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics. 12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries. (Note 1)

"Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries (Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

# RENESAS

#### SALES OFFICES

**Renesas Electronics Corporation** 

http://www.renesas.com

Refer to "http://www.renesas.com/" for the latest and detailed information Renesas Electronics America Inc. 2880 Scott Boulevard Santa Clara, CA 95050-2554, U.S.A. Tel: +1-408-588-6000, Fax: +1-408-588-6130 Renesas Electronics Canada Limited 1101 Nicholson Road, Newmarket, Ontario L3Y 9C3, Canada Tel: +1-905-898-5441, Fax: +1-905-898-3220 Renesas Electronics Europe Limited Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K Tel: +44-1628-585-100, Fax: +44-1628-585-900 Renesas Electronics Europe GmbH Arcadiastrasse 10, 40472 Düsseldorf, Germany Tel: +49-211-6503-0, Fax: +49-211-6503-1327 Renesas Electronics (China) Co., Ltd. 7th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China Tel: +88-10-8235-1155, Fax: +88-10-8235-7679 Renesas Electronics (Shanghai) Co., Ltd. Unit 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China Tel: +86-21-5877-1818, Fax: +86-21-6887-7858 / -7898 Renesas Electronics Hong Kong Limited Unit 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong Tel: +852-2868-9318, Fax: +852 2868-9022/9044 Renesas Electronics Taiwan Co., Ltd. 13<sup>th</sup> Fl., No. 363 Fu Shing N. Rd., Taipei, 10543 Taiwan R.O.C. Tel: +886-2-8175-9600, Fax: +886 2-8175-9672 Renesas Electronics Singapore Pte. Ltd. 1 harbourFront Avenue, #06-10, keppel Bay Tower, Singapore 098632 Tel: +65-6213-0200, Fax: +65-6278-8001 Renesas Electronics Malaysia Sdn.Bhd. Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia Tei: +60-3-7955-9390, Fax: +60-3-7955-9510 Renesas Electronics Korea Co., Ltd. 11F., Samik Lavied' or Bldg., 720-2 Yeoksam-Dong, Kangnam-Ku, Seoul 135-080, Korea