RL78/G13

Boot Loader through SCI

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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

- 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^2C 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".

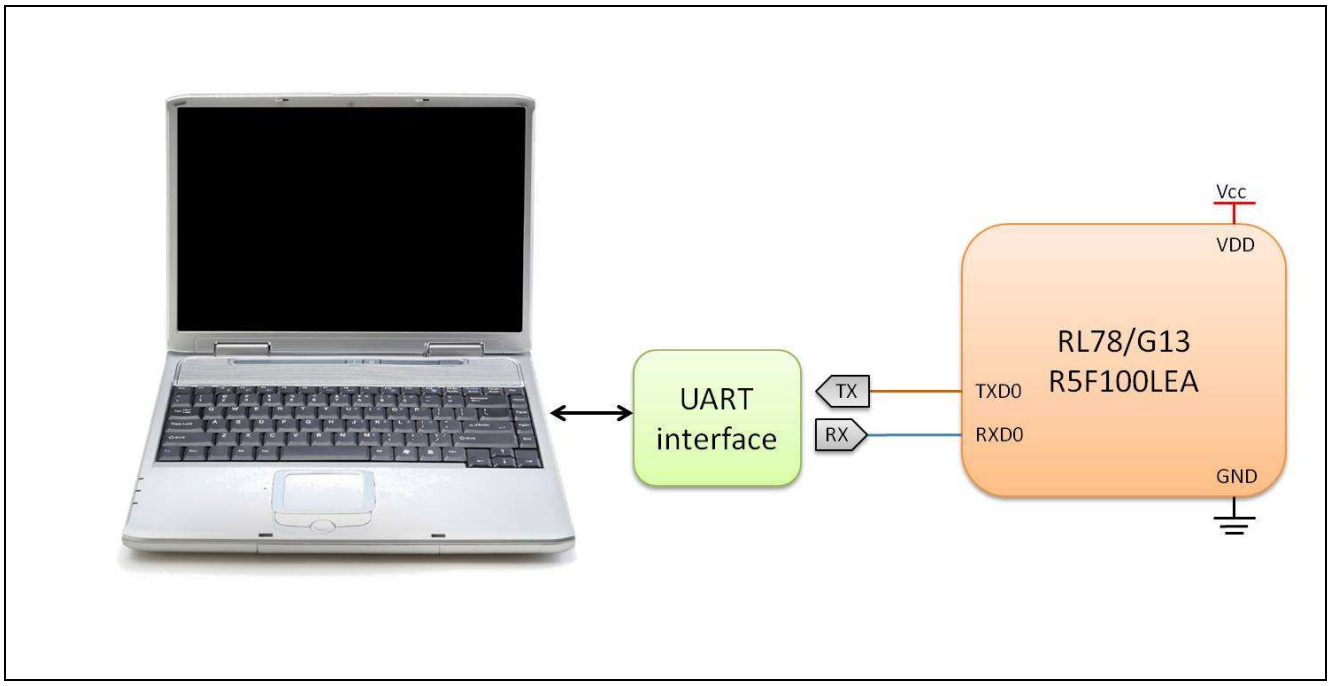

Figure 1 Hardware platform

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.

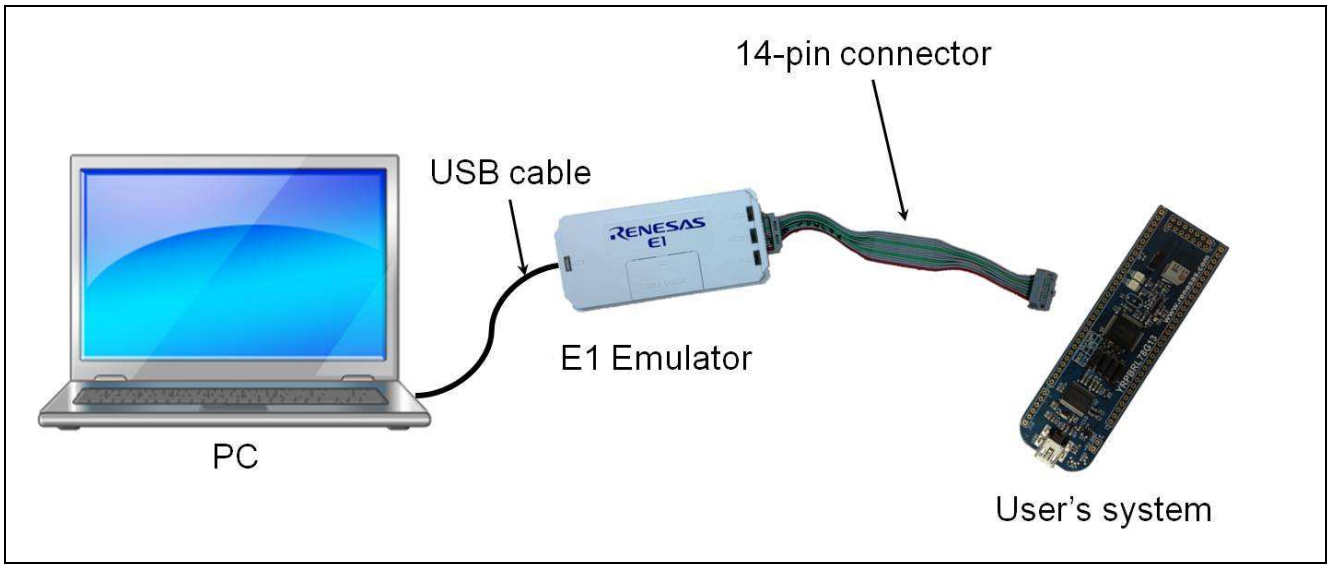

Figure 2 System configuration

- Figure 3 shows the connection example circuit. The V_{DD}, 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.

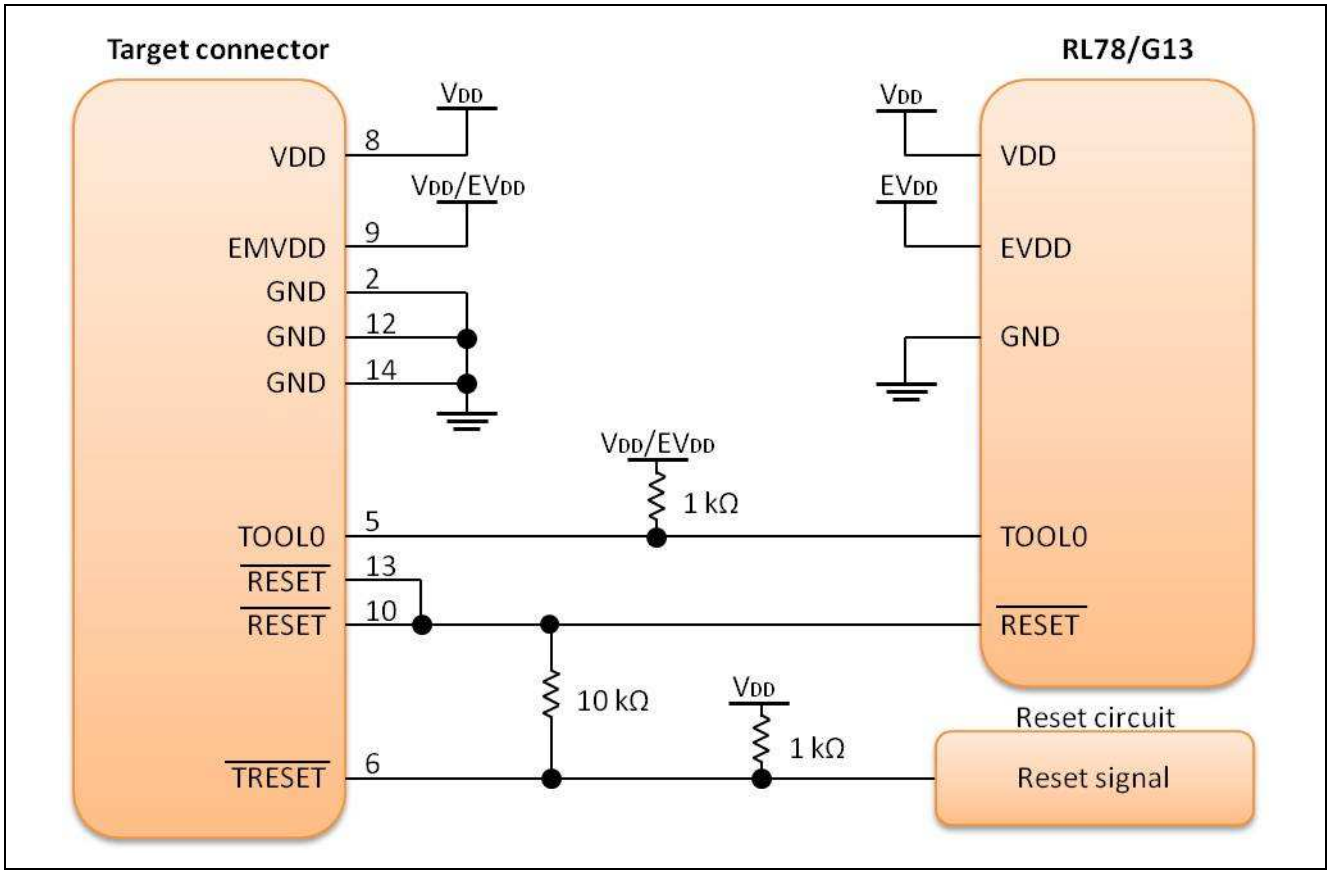

Figure 3 Connection example of E1 and RL78/G13

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.

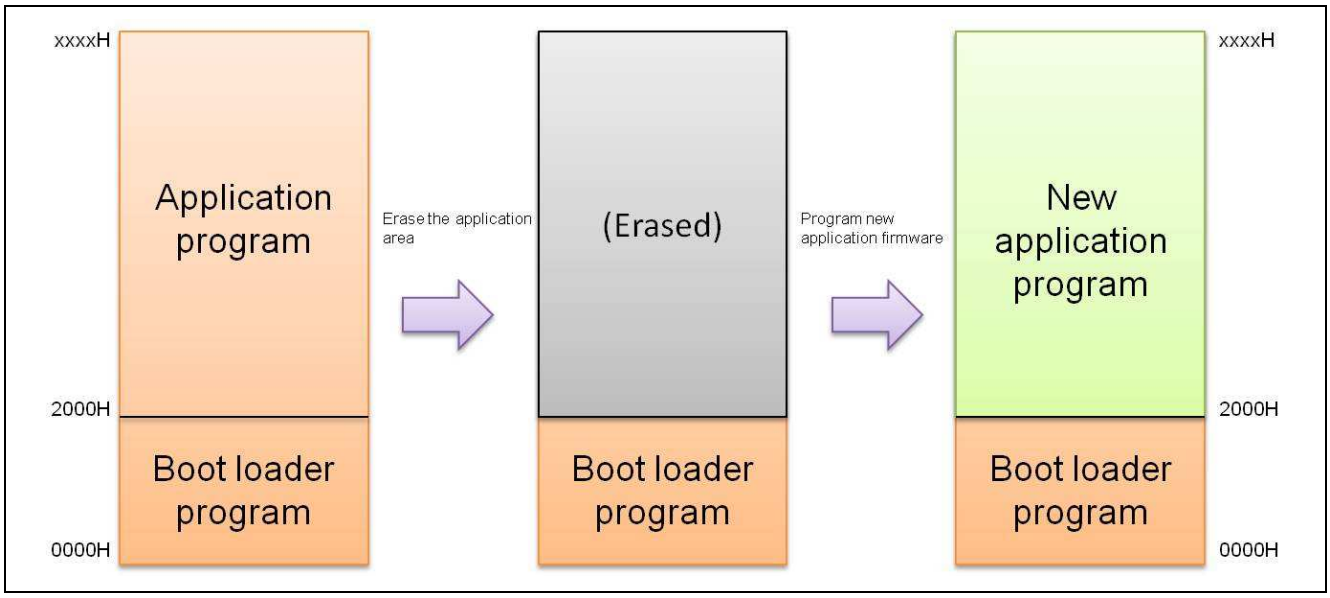

Figure 4 Application program update

- To update boot loader program, it is similar with the procedure of updating application program. The Rl78/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.

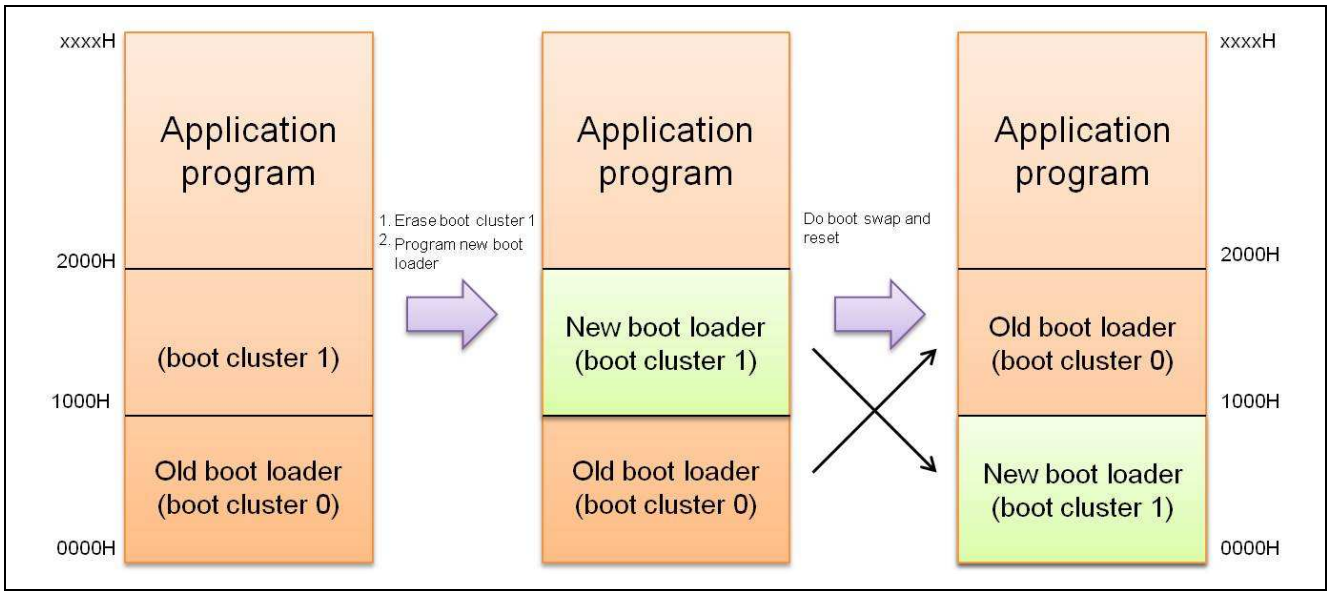

Figure 5 Boot loader program update

- 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).

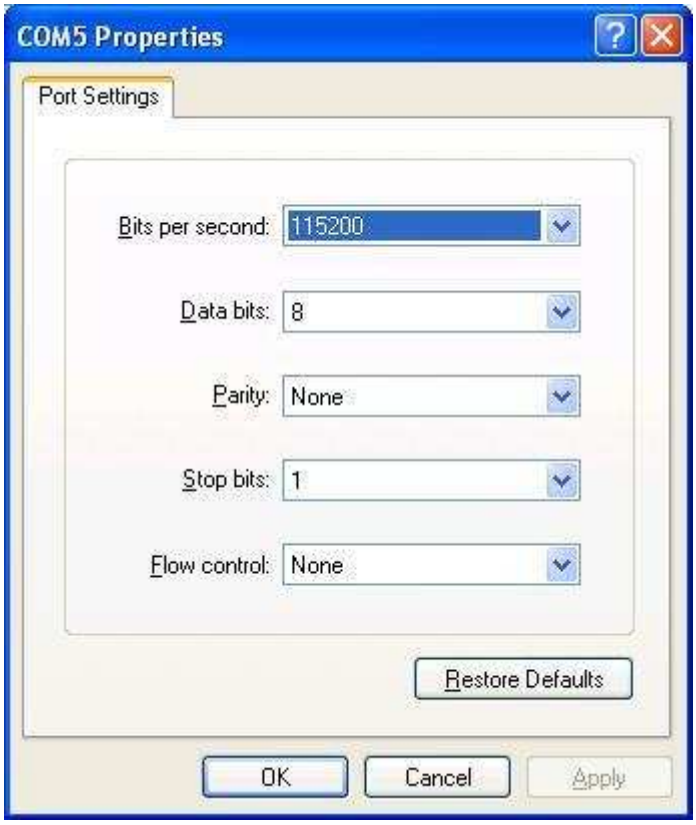

Figure 6 Communication configuration

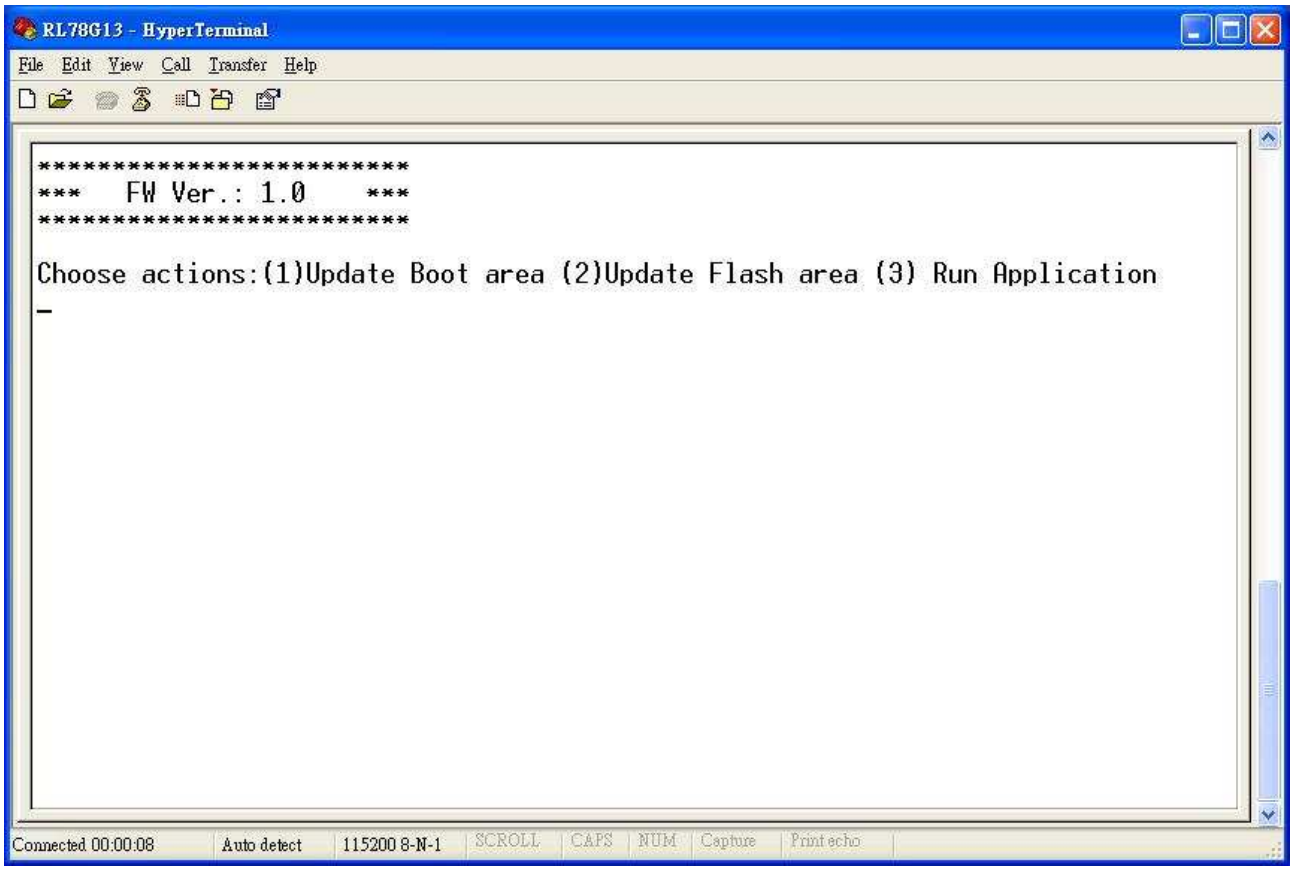

Figure 7 Operation menu

- 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[1]) 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.

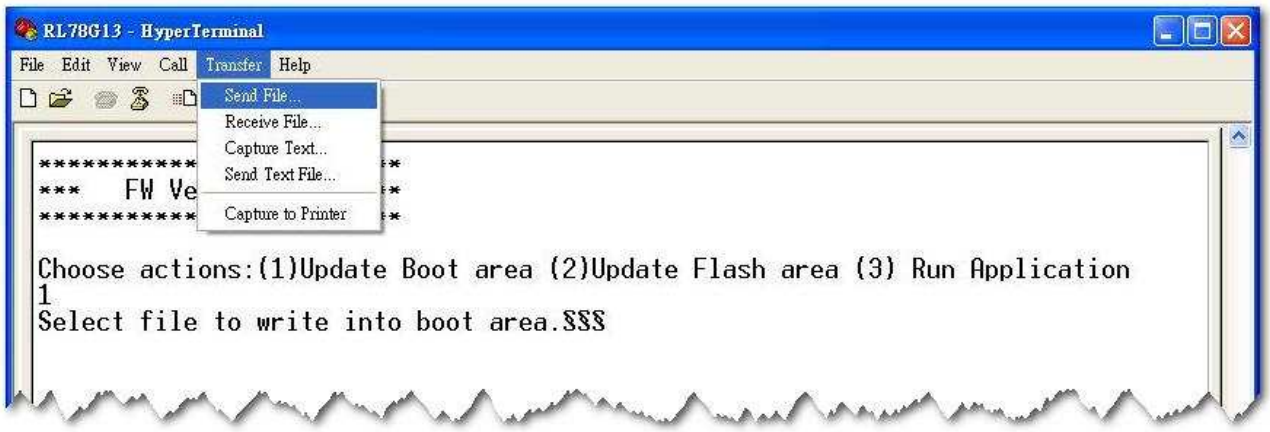

Figure 8 Transfer menu

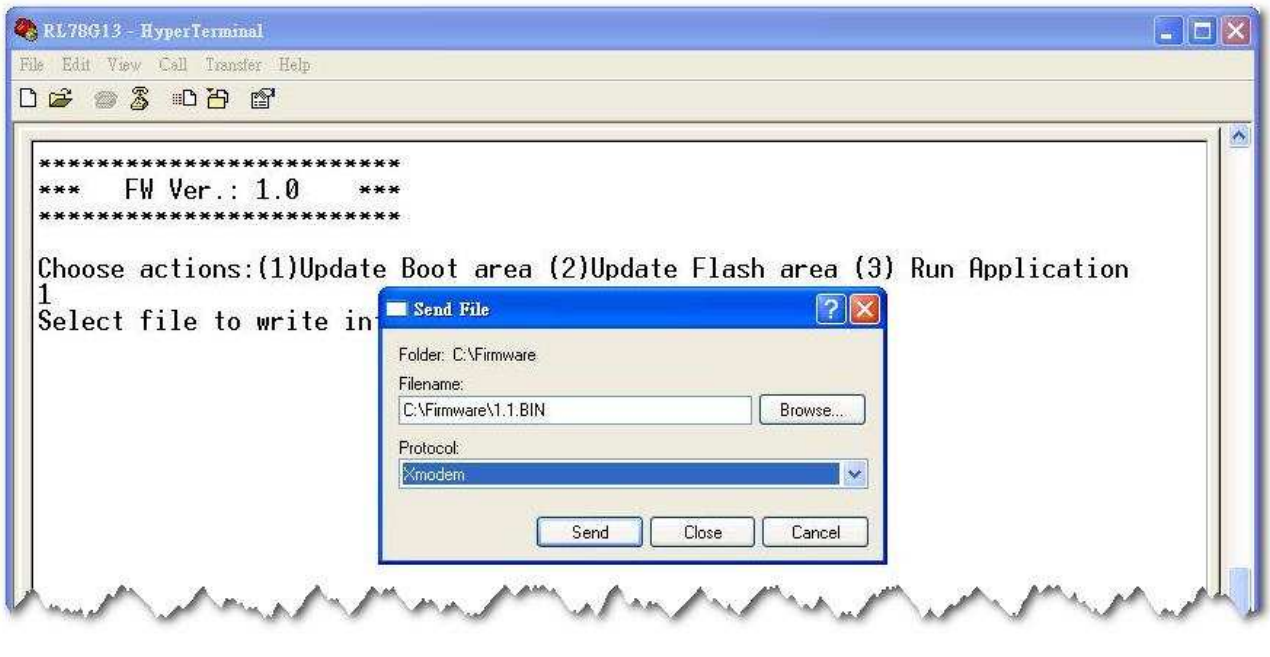

Figure 9 Send file dialog

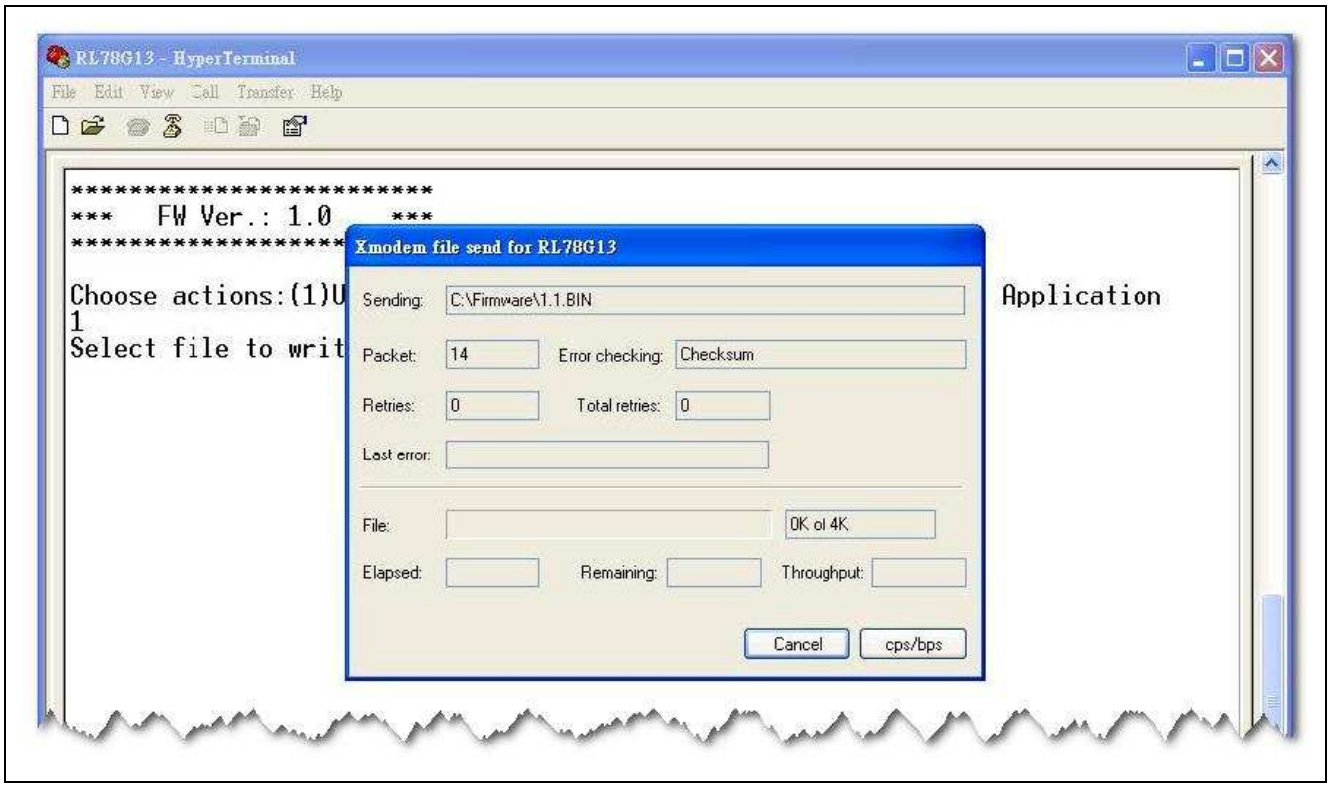

Figure 10 Progress dialog

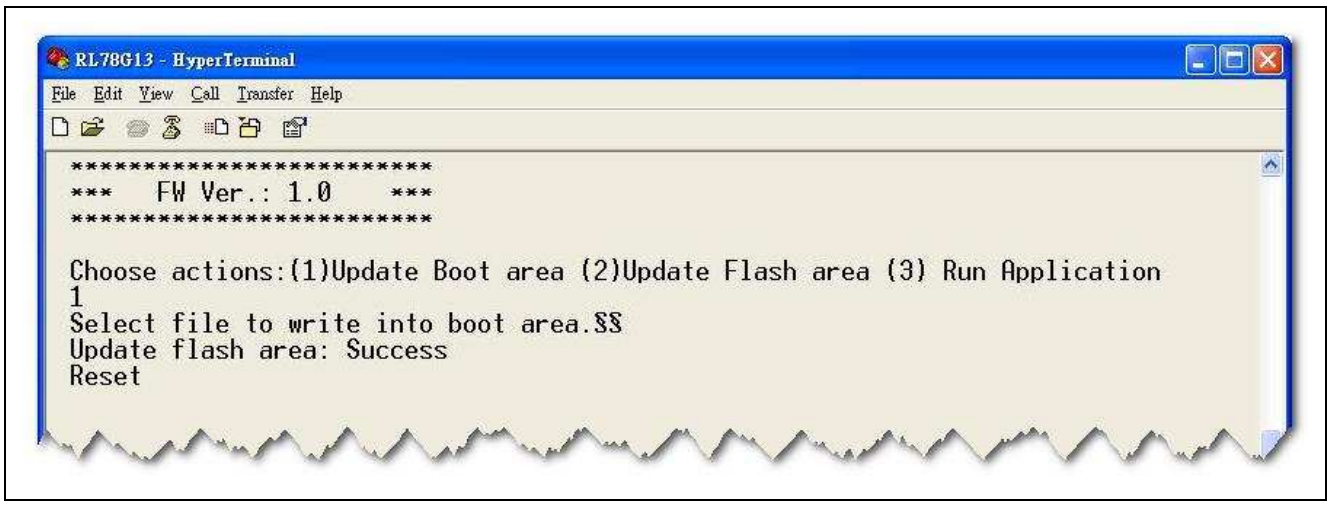

Figure 11 Update result message

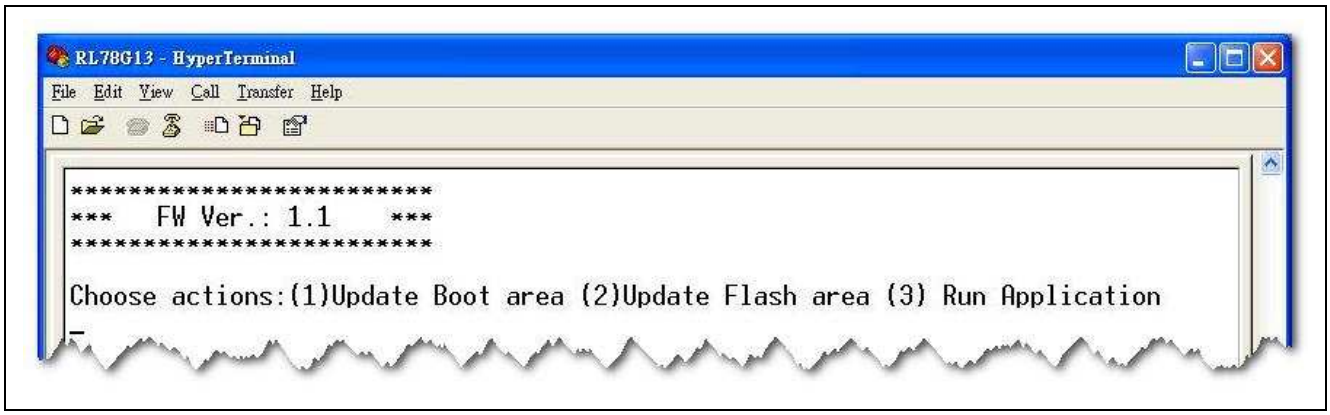

Figure 12 Run new boot loader

- 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.

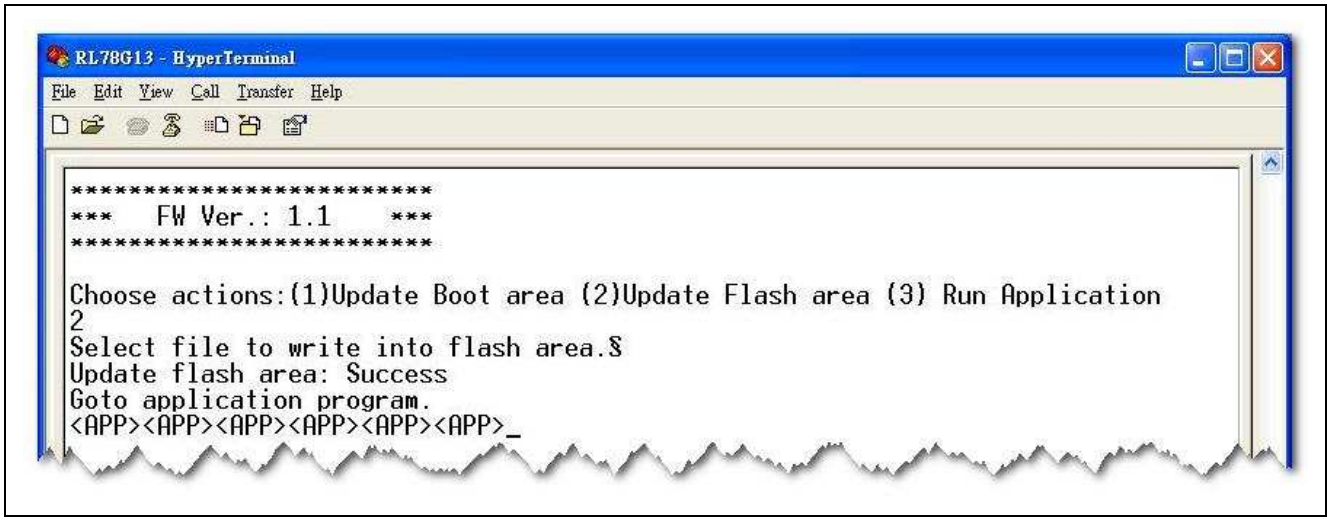

Figure 13 Result of updating application program

- 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[2] of this example program is shown in Figure 14.

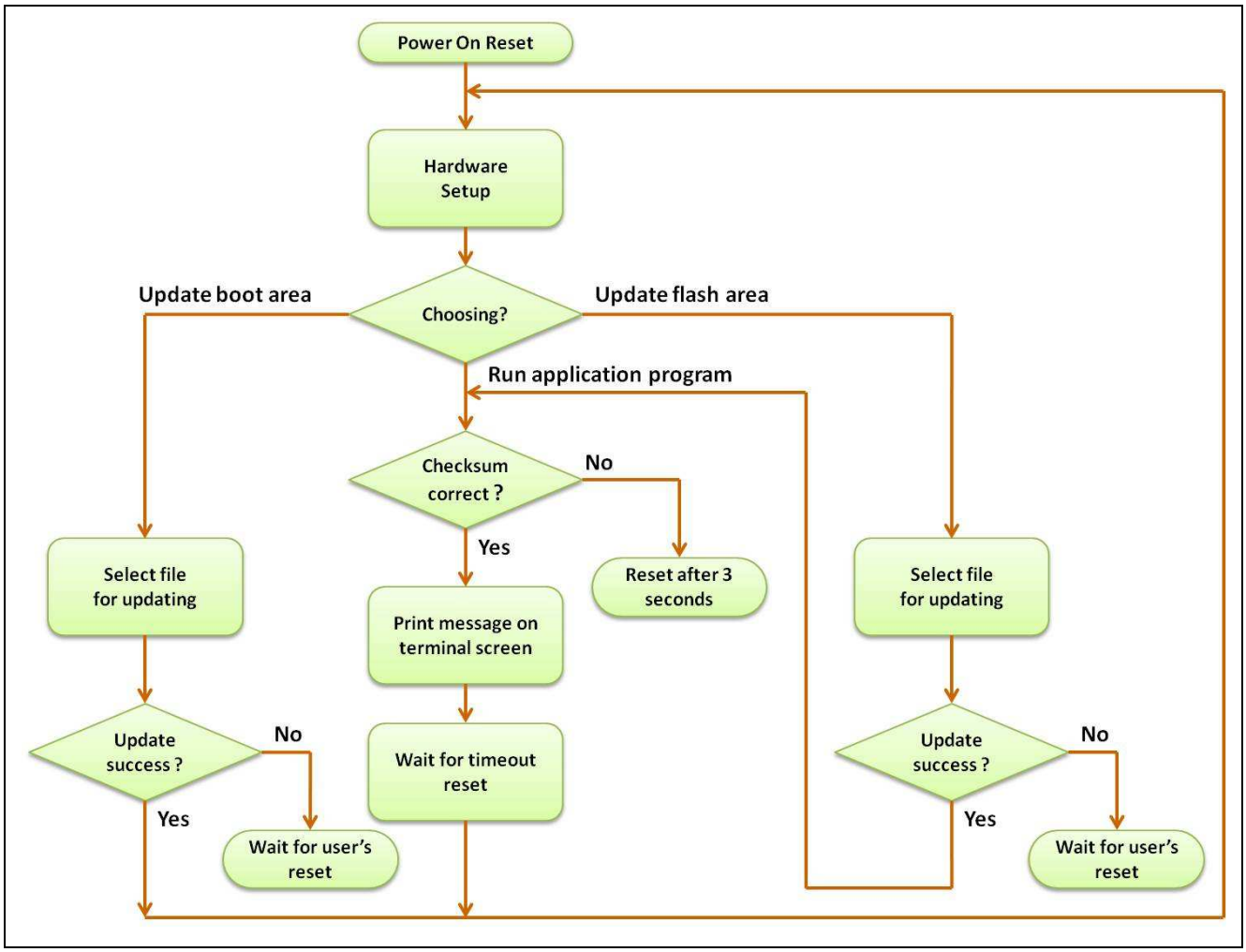

Figure 14 Flow chart

- **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.

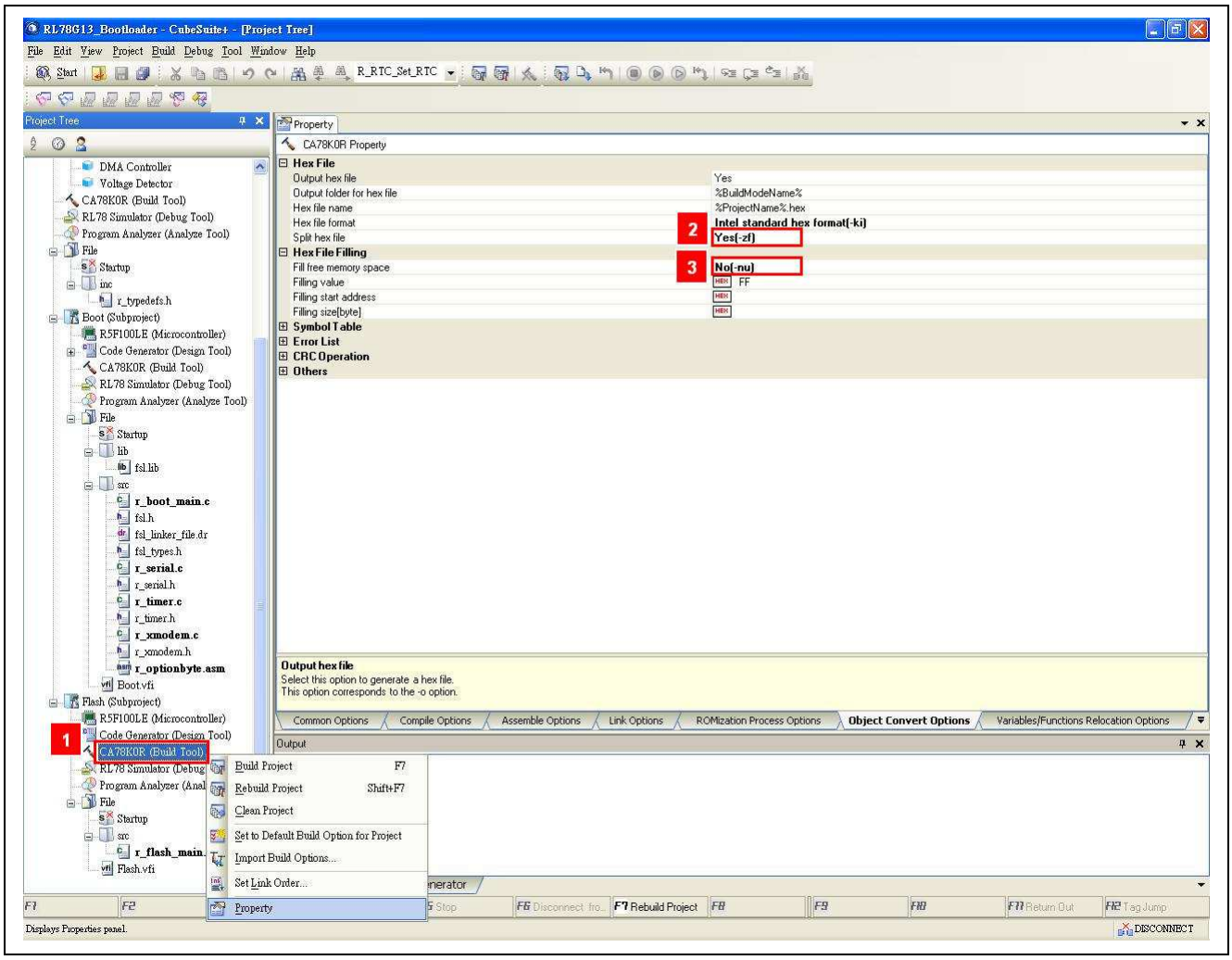

Figure 15 Steps of setting

- 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.

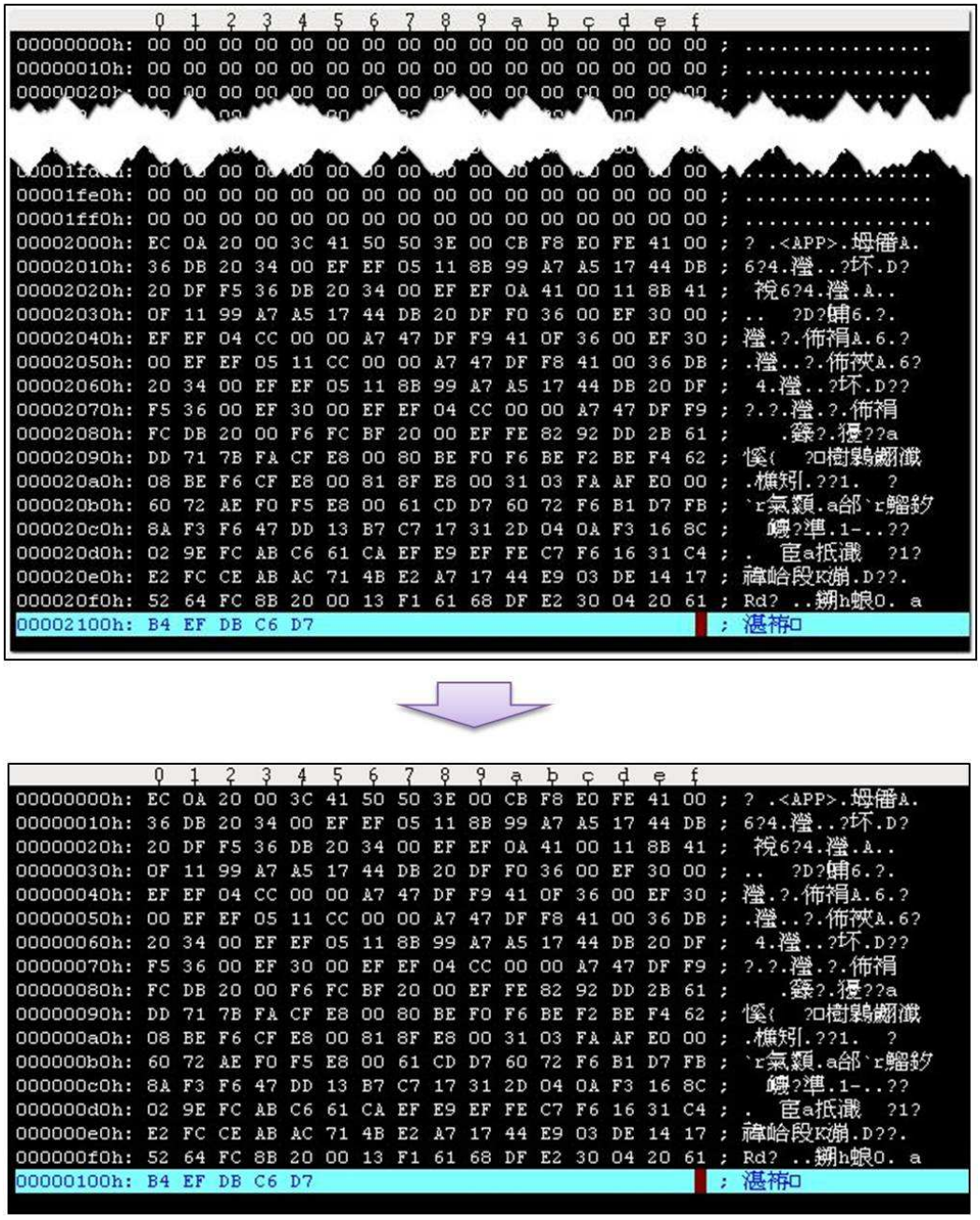

Figure 16 Modification

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Revision Record

		Description	
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.

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