SH7211 Group

Using User Program Mode

R01AN0238EJ0100
Rev. 1.00
Nov. 30, 2010

Summary

This application note describes an example to run the flash memory reprogramming program in SH7211 microcomputers (MCUs) user program mode. An external device which is connected to the SH7211 stores the data to write to the flash memory, and communicates with the flash memory using the Serial Communication Interface with FIFO.

The flash memory reprogramming program described in this application note is stored on the SH7211 user MAT. The simple flash API for SH2 and SH2A (Standard API) provided by the Renesas Electronics is used to reprogram the flash memory.

Target Device

SH7211 MCU

Contents

1. Introduction

1.1 Specifications

This application programs, erases, and reads the flash memory using user program mode. User program mode handles programming, erasing, and reading with a desired interface. This application uses the serial communication between the host computer and the SH7211 to handle these processing.

When the SH7211 receives the flash memory reprogramming/erasing command (user control command) from the host computer while executing the user application, the SH7211 programs or erases the flash memory. When it receives the flash memory reading command from the host computer, it reads the flash memory.

Figure 1 shows the system configuration of this application.

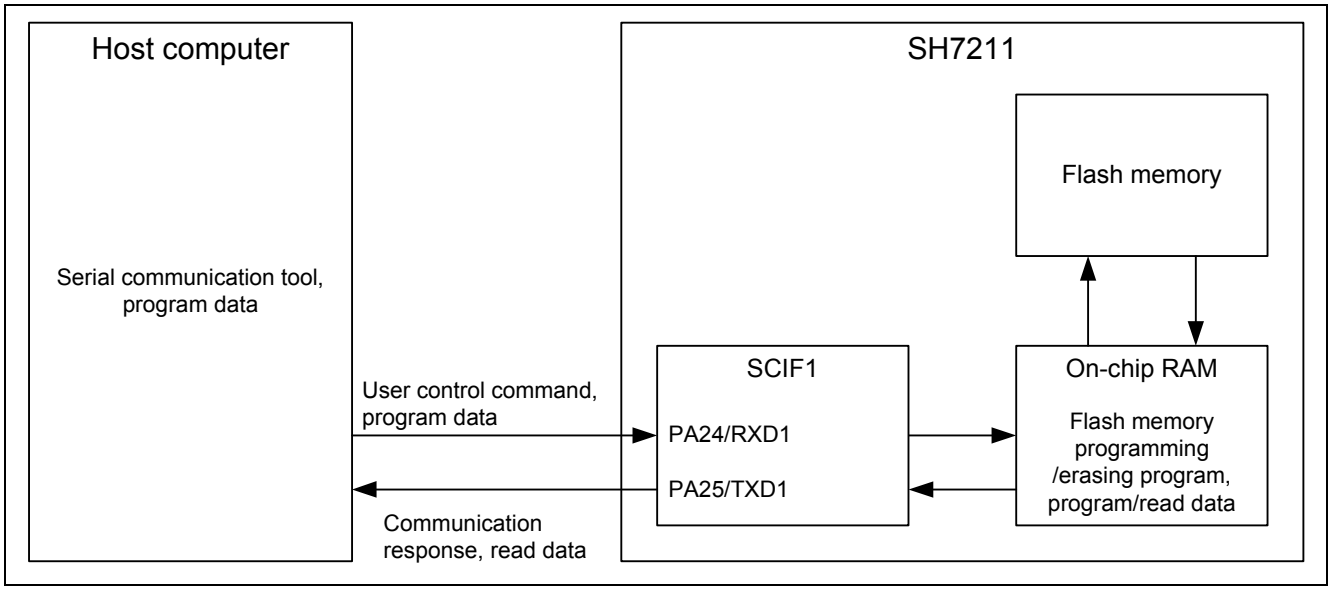

Figure 1 System Configuration

1.2 Modules Used

- Serial Communication Interface with FIFO (SCIF)
- Flash Memory

1.3 Applicable Conditions

MCU	SH7211 (512-KB flash memory version)
Operating Frequency (1)	Internal clock: 40 MHz Bus clock: 40 MHz Peripheral clock: 40 MHz
Integrated Development Environment (2)	Renesas Electronics Corporation High-performance Embedded Workshop Ver.4.04.01
C Compiler	Renesas Electronics SuperH RISC engine Family C/C++ compiler package Ver.9.01 Release 01
Compiler Options	Default setting in the High-performance Embedded Workshop (-cpu=sh2a -debug -gbr=auto -global_volatile=0 -opt_range=all -infinite_loop=0 -del_vacant_loop=0 -struct_alloc=1)

Notes: 1. When downloading the on-chip program to program or erase the flash memory, set the ratio of internal clock (Iφ), bus clock (Bφ), and peripheral clock (Pφ) by the Frequency control register (FRQCR) as 4:4:4 to the input clock frequency.

2. As the E10A-USB emulator does not support boot mode, user boot mode, and user program mode, the flash memory reprogramming program cannot be debugged by the E10A-USB emulator.

1.4 Related Application Note

For more information, refer to the following application note:

- SH Family Simple Flash API for SH2 and SH2A

2. Overview

This application uses the Serial Communication Interface with FIFO (SCIF) to connect the SH7211 with the external device.

2.1 Overview of Modules

2.1.1 Serial Communication Interface with FIFO (SCIF)

SCIF supports both asynchronous and clocked synchronous serial communication. It also supports full-duplex communication and has 16 FIFO buffers both at transmitter and receiver to transmit/receive the serial data continuously at high speed.

This application uses the SCIF for the handshake between the SH7211 and an external device, and to transmit/receive the flash memory reprogram data.

Figure 2 shows the SCIF block diagram.

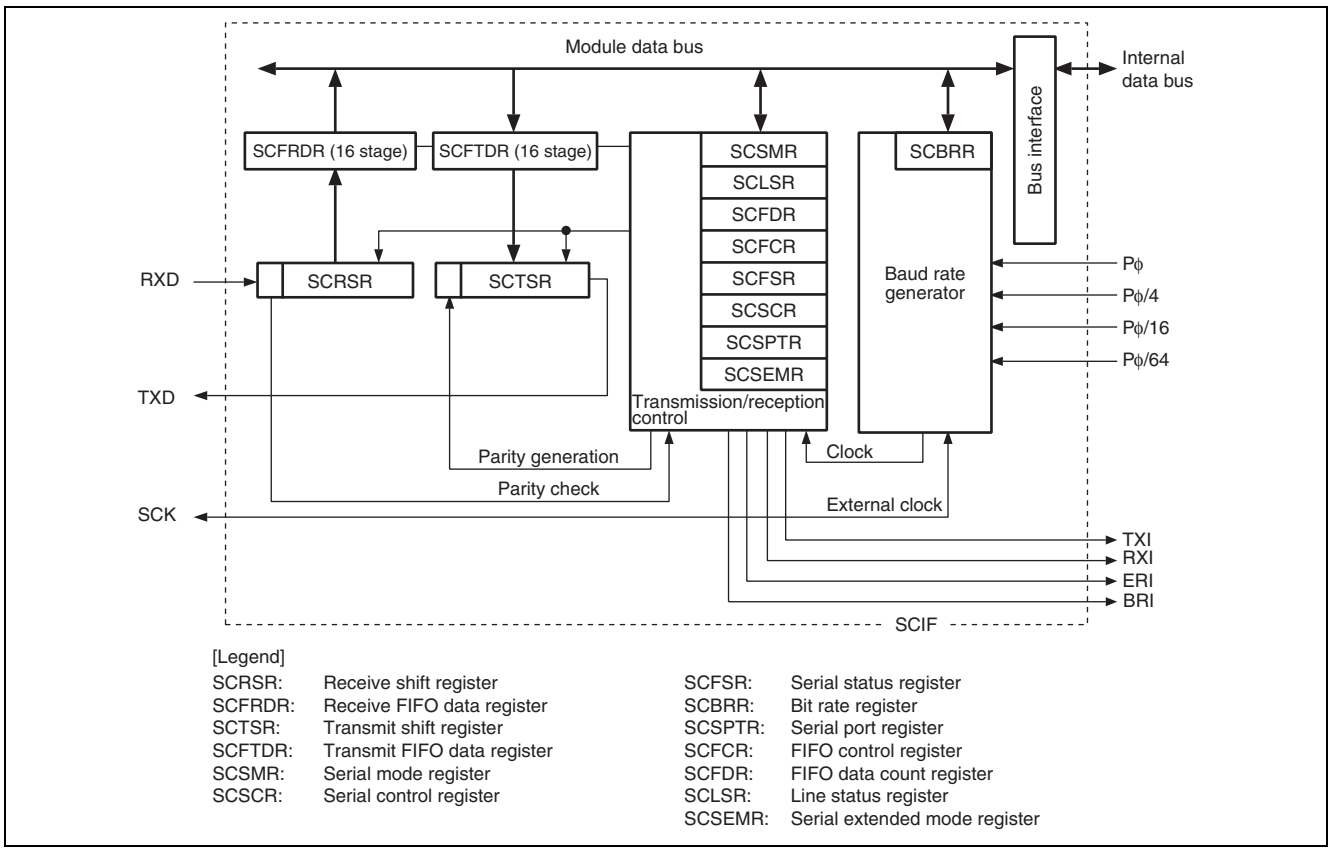

Figure 2 SCIF Block Diagram

2.1.2 Flash Memory

The SH7211 programs or erases the flash memory using its on-chip program.

Figure 3 shows the flash memory block diagram.

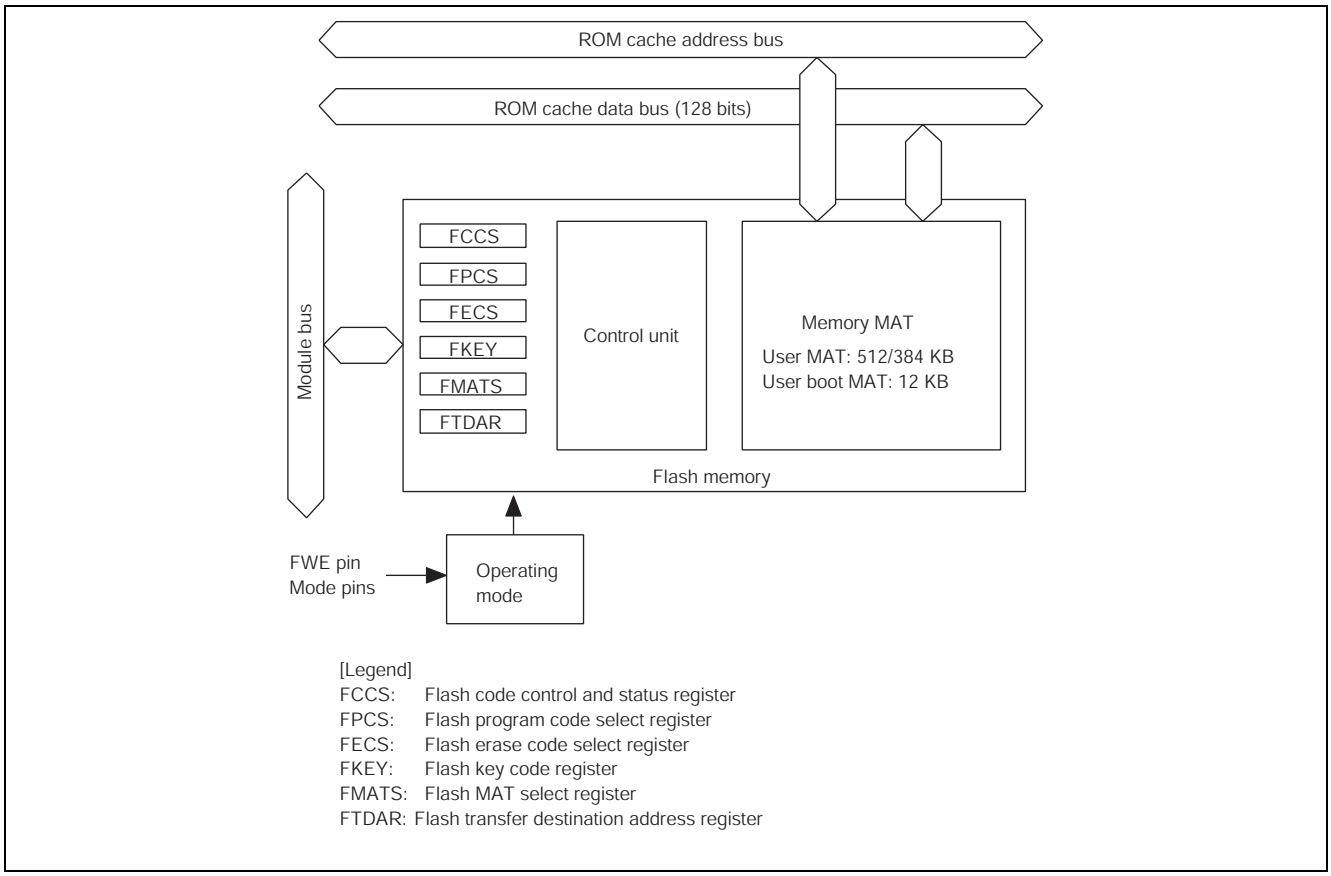

Figure 3 Flash Memory Block Diagram

2.2 Programming/Erasing the Flash Memory

The SH7211 uses its on-chip program to program and erase the flash memory. This section describes how to reprogram the flash memory. For more information, refer to the SH7211 Group Hardware Manual. This application uses the Standard API. For more information about the API, refer to the related application note.

2.2.1 Preparing to Program/Erase the Flash Memory

To use the MCU on-chip program, the user must download the program to the on-chip RAM. After downloading is completed, specify the program address or data, erase block to the Programming/erasing interface registers/parameters and the downloaded program programs/erases the flash memory.

User must prepare programs to request to download, program and erase the flash memory, and detect the outcome, however, the SCO bit in the FCCS register must be set in on-chip RAM. As all downloaded on-chip programs are in on-chip RAM, make sure not to use the same area in on-chip RAM.

Figure 4 shows the downloaded program area memory map.

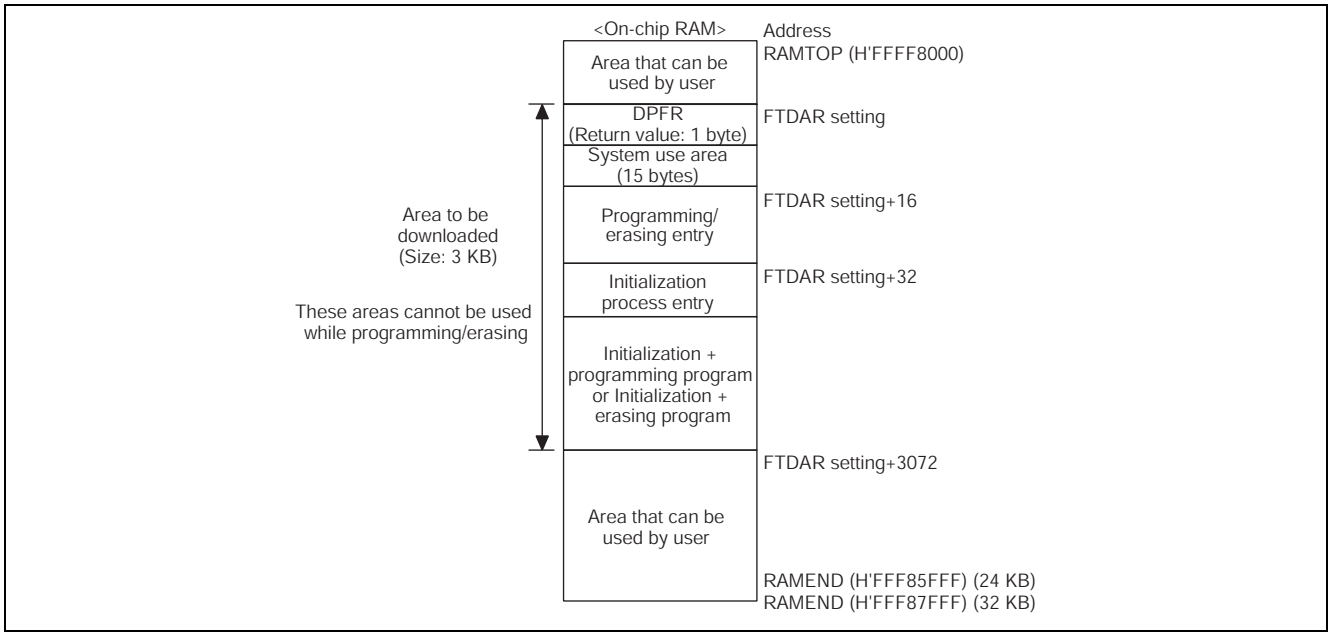

Figure 4 Memory Map After Downloading the Program

2.2.2 Erasing the Flash Memory

Change the download destination on-chip RAM address in the FTDAR register to download the erasing program and programming program in other on-chip RAM areas separately.

Figure 5 shows the flow chart for erasing the flash memory.

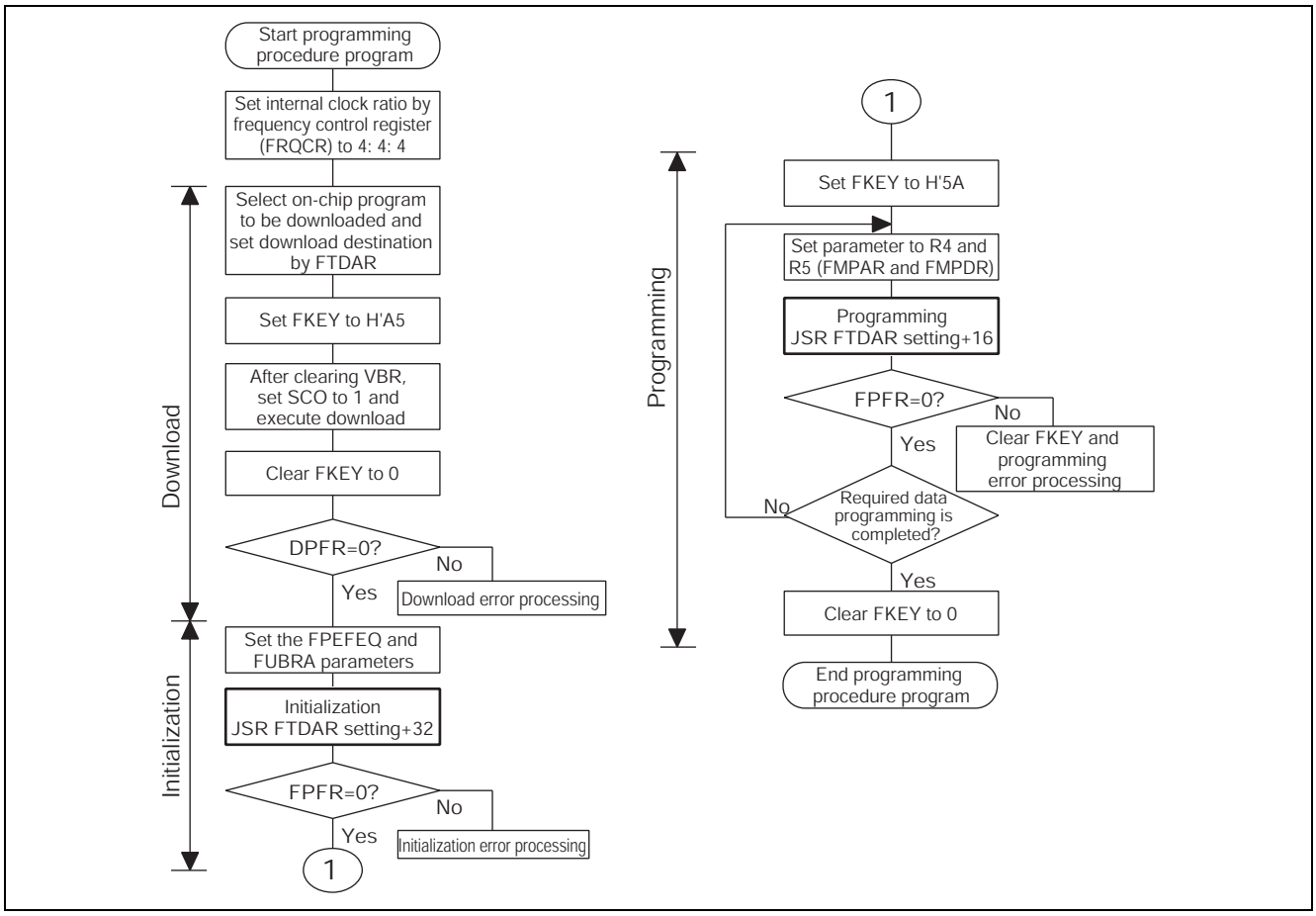

Figure 5 Erasing the Flash Memory

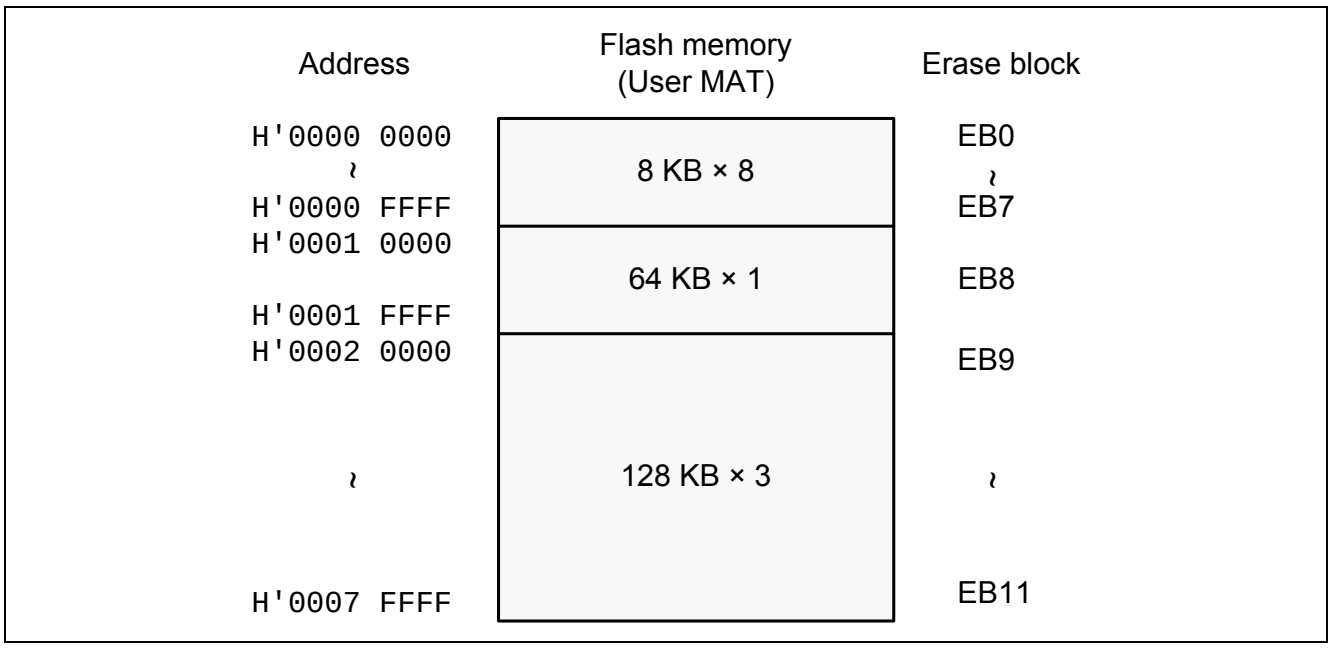

Figure 6 Dividing the Flash Memory Erase Block

Table 1 Erase Block and Address

Erase Block	Address	Capacity
EB0	H'0000_0000 to H'0000_1FFF	8 KB
EB1	H'0000_2000 to H'0000_3FFF	
EB2	H'0000_4000 to H'0000_5FFF	
EB3	H'0000_6000 to H'0000_7FFF	
EB4	H'0000_8000 to H'0000_9FFF	
EB5	H'0000_A000 to H'0000_BFFF	
EB6	H'0000_C000 to H'0000_DFFF	
EB7	H'0000_E000 to H'0000_FFFF	
EB8	H'0001_0000 to H'0001_FFFF	64 KB
EB9	H'0002_0000 to H'0003_FFFF	128 KB
EB10	H'0004_0000 to H'0005_FFFF	
EB11	H'0006_0000 to H'0007_FFFF	

2.2.3 Programming the Flash Memory

Change the download destination on-chip RAM address in the FTDAR register to download the erasing program and programming program in other on-chip RAM areas separately.

Figure 7 shows the flow chart for programming the flash memory.

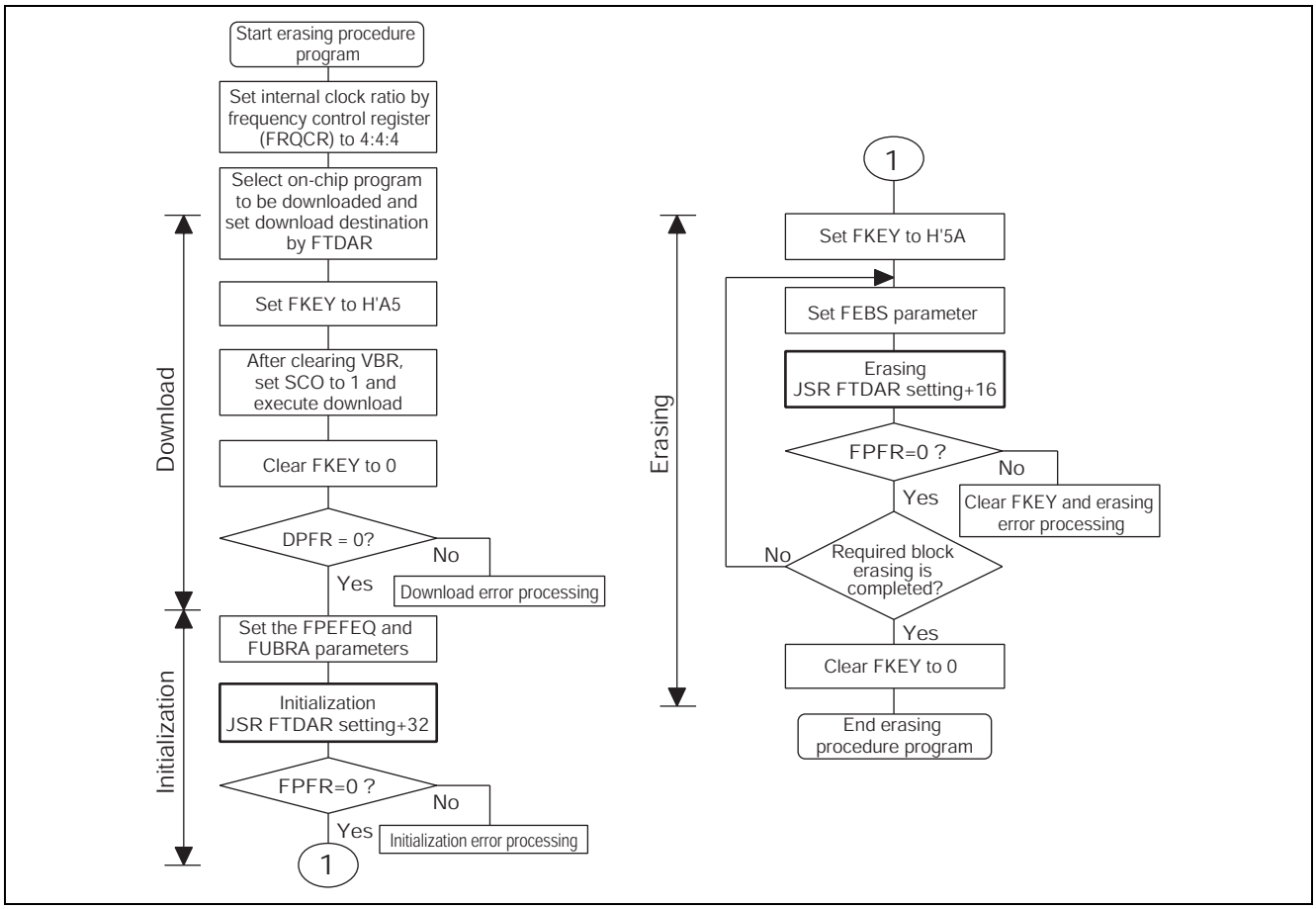

Figure 7 Programming the Flash Memory

2.3 Flash Program Data Buffer

This application has the buffer area to hold the program data in the SH7211 on-chip RAM. The capacity of the buffer area is 256 bytes, which is equivalent to a flash programming.

Figure 8 shows the operation image of the buffer. Table 2 lists the data buffer area address (note).

Note: Data buffer area is divided into sections. Change the section allocation address to set the desired buffer area address. Make sure not to use the same area as the on-chip program in on-chip RAM.

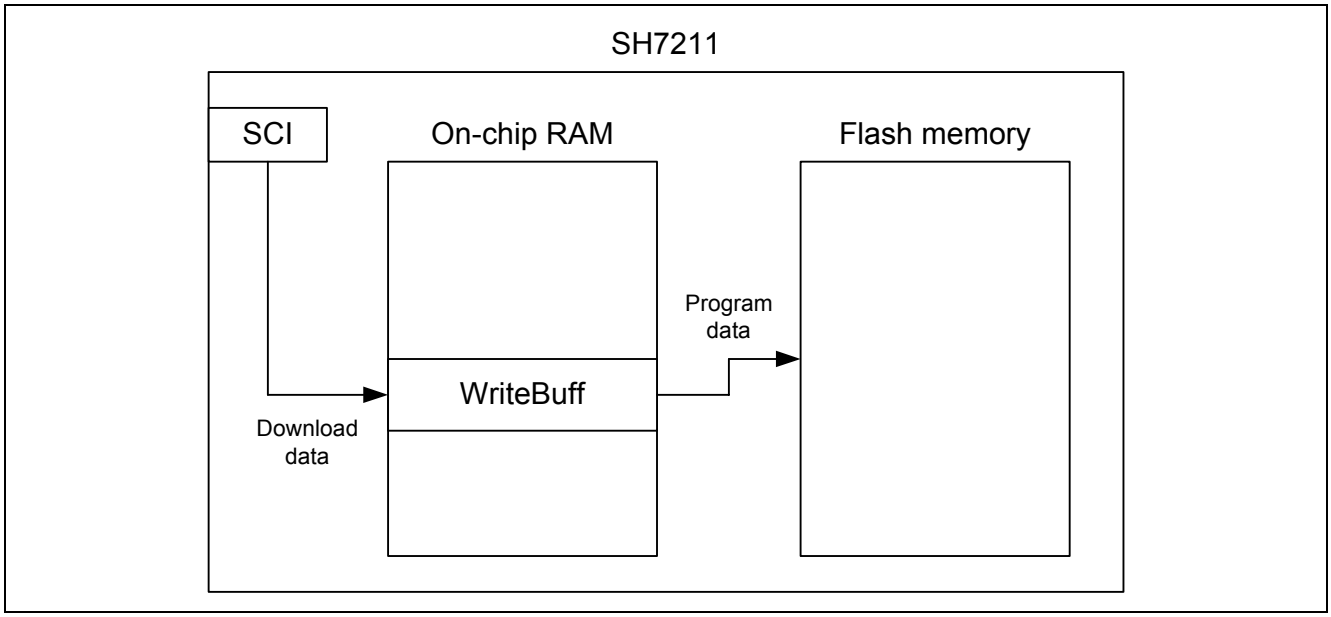

Figure 8 Buffer Operating Image

Table 2 Data Buffer Area Address

Buffer Name	Address	Capacity
WriteBuff	H'FFF8_5000 to H'FFF8_50FF	256 bytes

3. Sample Program External Specifications

This application allocates the flash memory reprogramming sample program including main function (sample program) in EB0 block in the user MAT (address: H'0000 0000 to H'0000 1FFF). Sample program consists of the user application (main function), serial communication program, flash memory reprogramming program, and Standard API.

The target area to program or erase in the flash memory is the user MAT (EB1 to EB11 block address: H'0000 2000 to H'0007 FFFF) other than EB0 block where the sample program is allocated.

Figure 9 shows the image of programming and erasing the flash memory by the sample program.

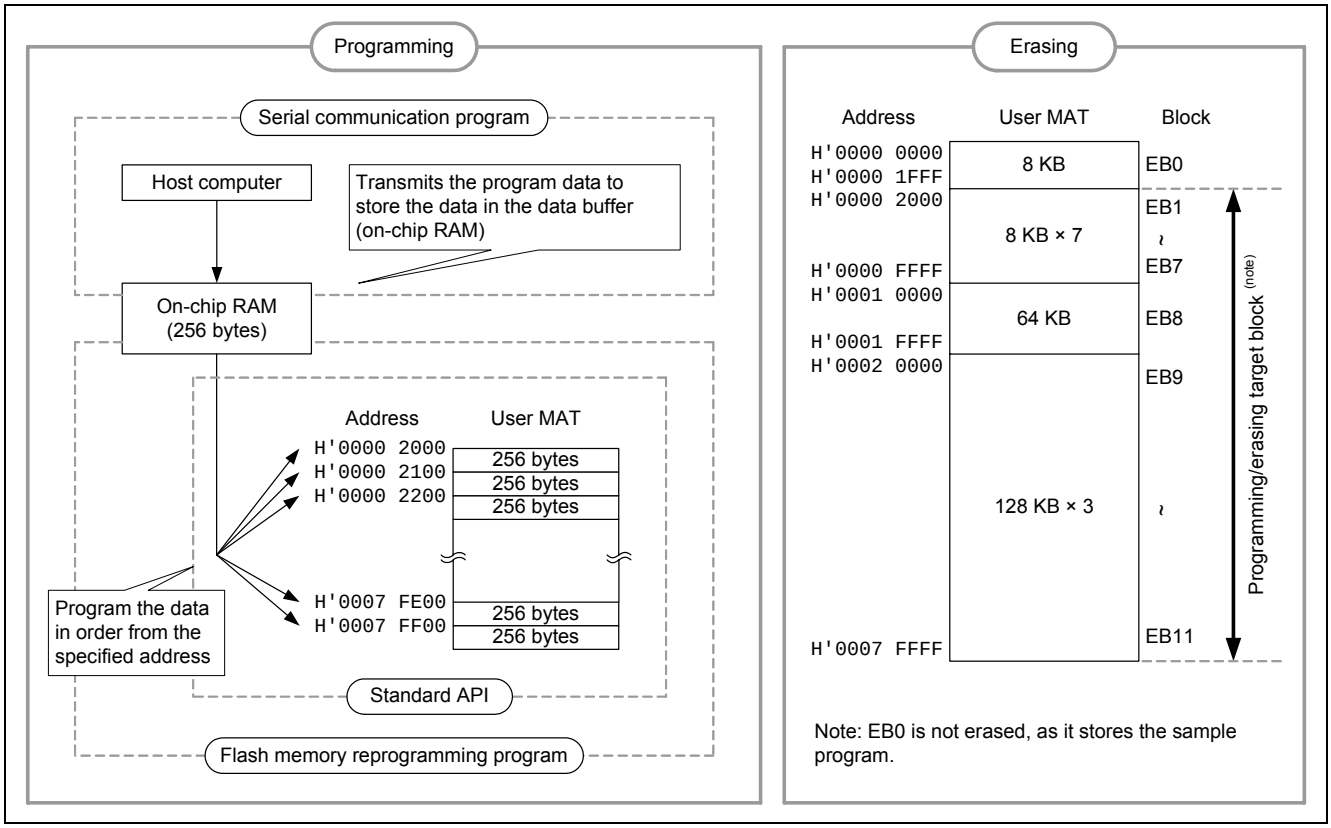

Figure 9 Programming and Erasing the Flash Memory

3.1 Sample Program Operation

This application executes the serial communication with the host computer and transmits/receives the user control commands for communication and data to program, erase and read the flash memory. It uses SCIF channel 1 (SCIF1) for the serial communication. The sample program these processing to control the flash memory in on-chip RAM.

The sample program checks whether the flash memory is program-/erase-enabled or not. When the flash memory is program-/erase-enabled, the sample program requests the host computer to issue the user control command for communication; otherwise, the sample program polls the FWE bit until the flash memory is program-/erase-enabled.

Figure 10 shows the main processing flow chart.

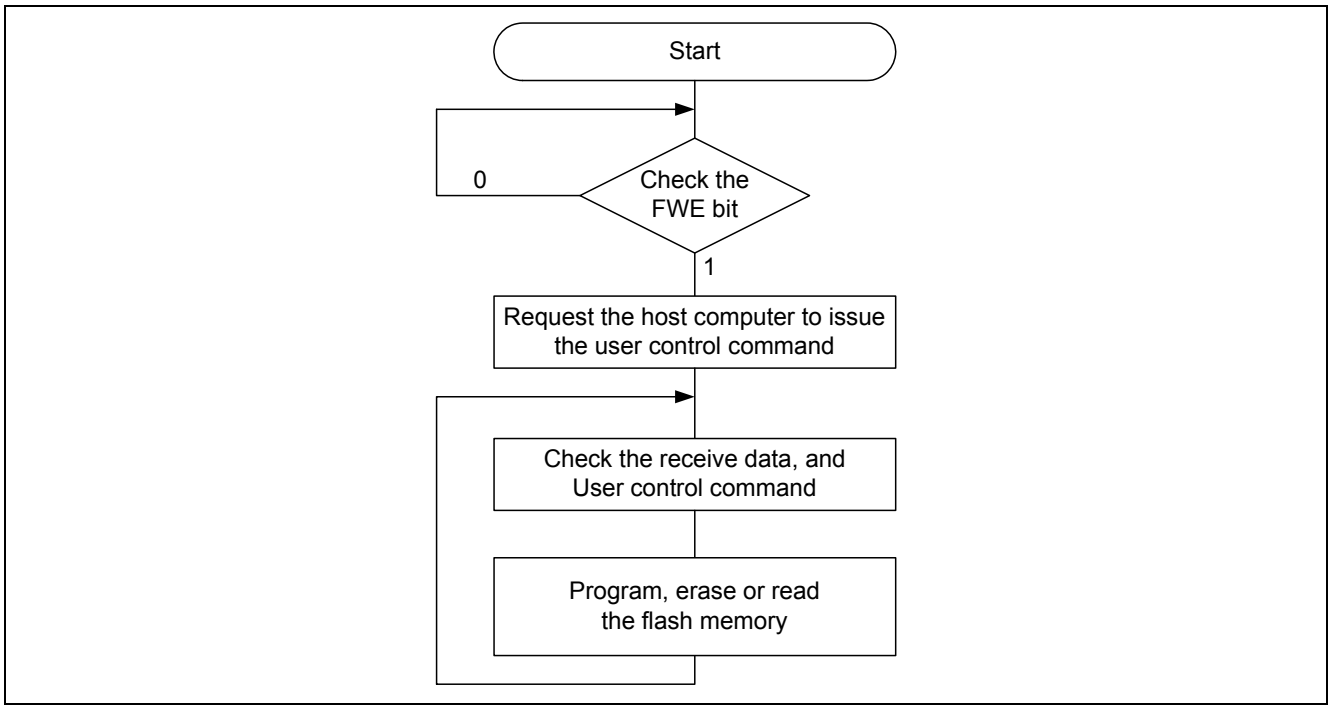

Figure 10 Main Processing Flow Chart

Table 3 lists the user control commands for communication from the host computer. Table 4 lists the notification from the SH7211.

When an error occurs while programming or erasing the flash memory, the sample program notifies the error end (RET_NG) to the host computer and enters an infinite loop. Add the error processing as appropriate.

Table 3 User Control Commands from the Host Computer to SH7211

Command Name	Value	Description
CMD_GO	H'55	Starts programming/erasing the flash memory
CMD_READ	H'AA	Reads the flash memory
CMD_ERASE	H'77	Erases the flash memory
CMD_WRITE	H'88	Programs the flash memory
CMD_WEND	H'99	Ends programming/erasing the flash memory

Table 4 Notifications from the SH7211 to the Host Computer

Notification Name	Value	Description
Normal end (RET_OK)	H'00	Notifies the host computer that the command handling ends successfully
Error end (RET_NG)	H'01	Notifies the host computer that the command handling ends in error
Transmit request (RET_REQ)	H'11	Notifies the host computer that the sample program is requesting to transmit the user control command or the program data

3.1.1 Programming or Erasing the Flash Memory

When the host computer transmits the flash memory programming/erasing start command (CMD_GO), the sample program transitions to the flash memory programming/erasing state, and notifies the transmission request (RET_REQ) to the host computer.

Next, the host computer transmits the flash memory erasing command (CMD_ERASE), and specifies the program/erase destination block number (other than EB0) in units of 2 bytes. This 2-byte data must be set to 1 to the bit that indicates the specified block number (i.e. Set the data to H'0002 for programming EB1, to H'0800 for programming EB11.)

When the specified block does not exist (H'0000 is specified), bit 0 corresponding to EB0 is set to 1, or either one of bits 15 to 12 is set to 1, the sample program notifies the error end (RET_NG) to the host computer, and enters an infinite loop. When erasing the flash memory in the specified block is completed, the sample program notifies the normal end (RET_OK) to the host computer.

Then, the host computer transmits the flash memory programming command (CMD_WRITE), and the destination start address and program data size (4-byte data). Make sure to specify the address (H'0000 2000 to H'0007 FFFF) within the specified block when erasing the flash memory at 256-byte boundary. Otherwise, the operation is not guaranteed.

When the host computer transmits the destination start address and program data size, the sample program notifies the host computer to request transmitting the program data (RET_REQ), and the host computer transmits the program data size data. As the program data in the user MAT must be in units of 256 bytes, the sample program programs the flash memory at every 256-byte data is received. (When the specified program data size is less than 256 bytes, the sample program sets the remaining data to H'FF.)

When the total number of programming the flash memory does not reach the program data size, the sample program notifies the host computer to request transmitting (RET_REQ) the program data. The host computer must repeat transmitting data until the size reaches the program data size. When the total number of programming the flash memory reaches the program data size, the sample program notifies the normal end (RET_OK) to the host computer.

Finally, the host computer transmits the flash memory programming/erasing end command (CMD_WEND), and the sample program ends programming or erasing the flash memory.

Figure 11 shows the communication command sequence when programming or erasing the flash memory by the sample program.

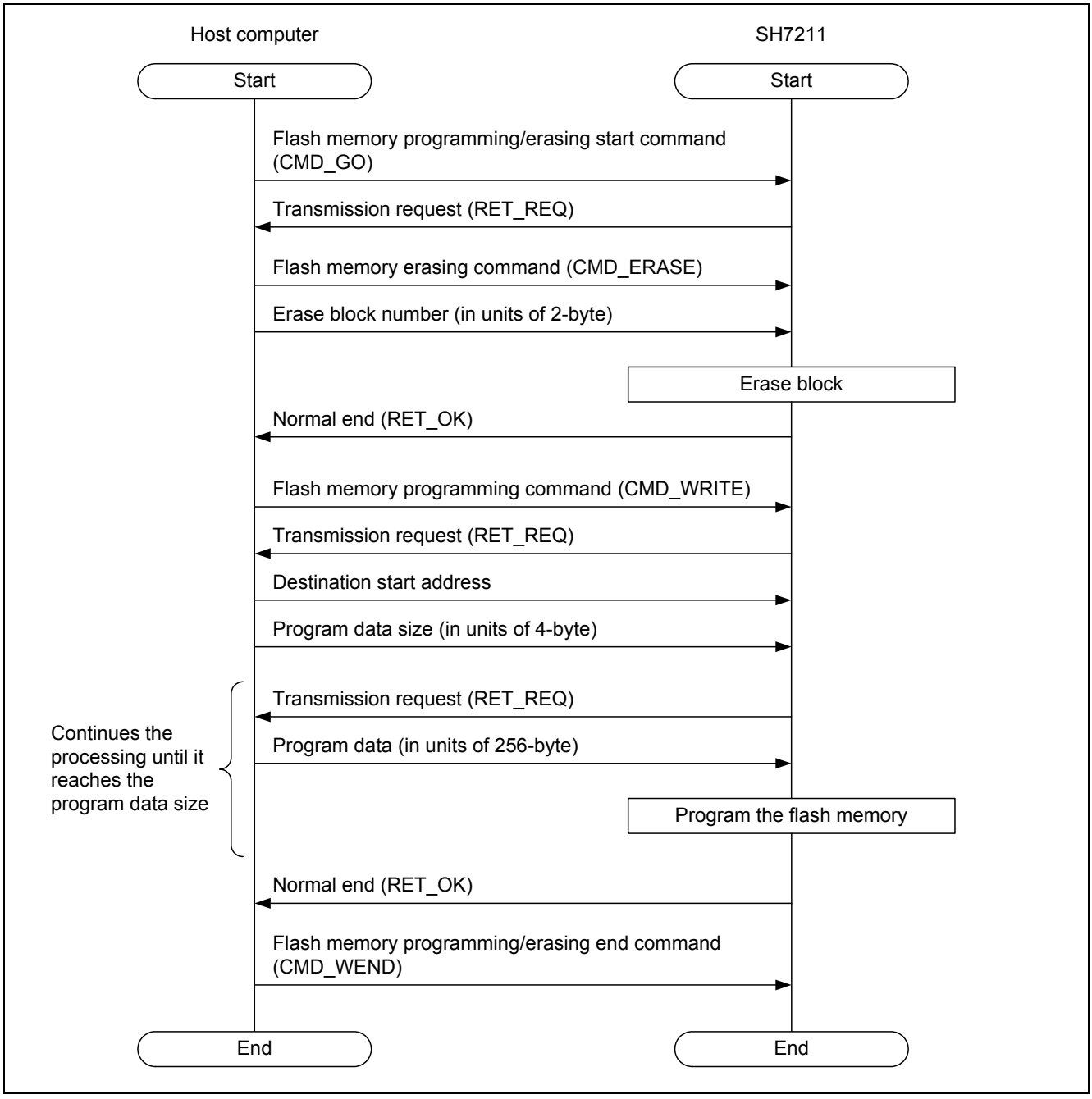

Figure 11 Communication Command Sequence When Programming/Erasing the Flash Memory

3.1.2 Reading the Flash Memory

The sample program reads the specified size of data from the destination start address and transmits the data to the host computer by the flash memory reading command (CMD_READ).

When the sample program receives the flash memory reading command (CMD_READ), it notifies the transmission request (RET_REQ) to the host computer. When the sample program receives the destination start address (in units of 4-byte) and read data size (in units of 4-byte) from the host computer (8 bytes in total), it reads the specified size of data from the destination address, and transmits the data to the host computer.

Specify the address (H'0000 0000 to H'0007 FFFF) within blocks EB0 to EB11 (User MAT) as the read destination start address. Otherwise, the sample program does not read the flash memory, notifies the error end (RET_NG) to the host computer to enter an infinite loop. As the sample program does not include the error check when the specified address is not on the user MAT, do not specify the address that is out of bounds.

Figure 12 shows the communication command sequence when reading the flash memory.

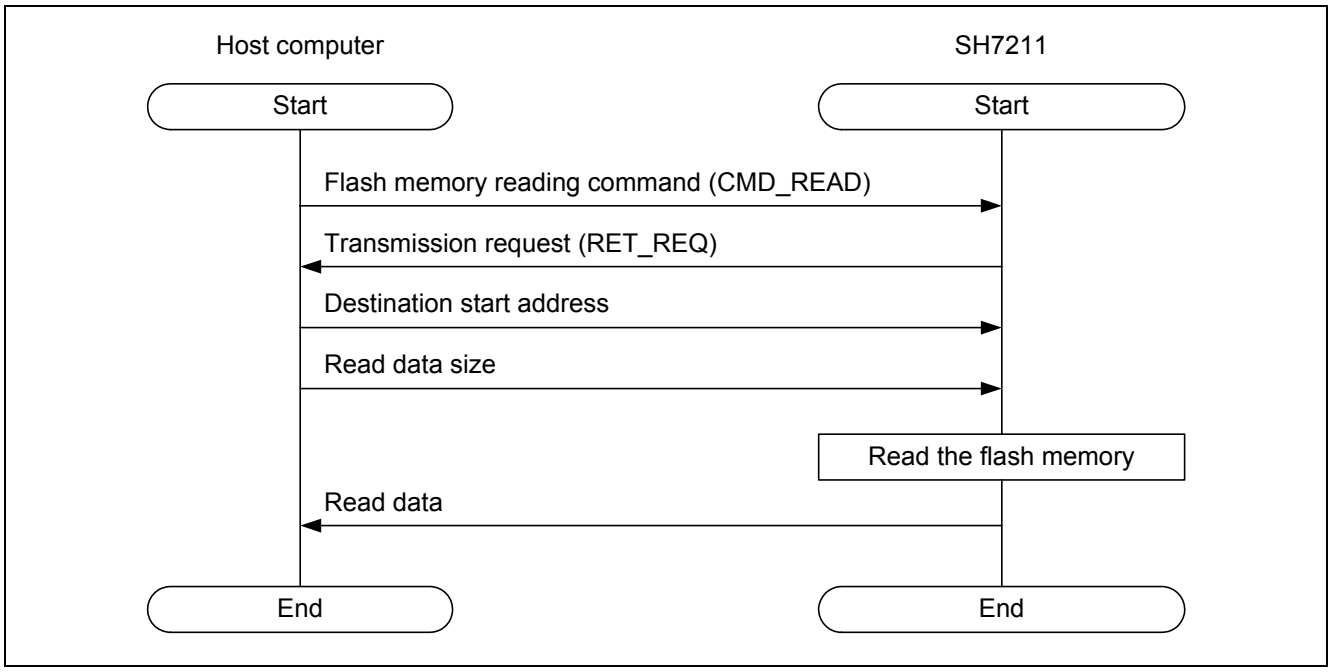

Figure 12 Communication Command Sequence When Reading the Flash Memory

4. Sample Program Internal Specifications

4.1 Modules

Table 5 lists the specifications of sample program modules.

Table 5 Sample Program Modules

Type	Module Name	Function Name	Description	Flow Chart
User application	Main processing	main	Executes the user application	See Figure 13
Flash memory reprogramming	Flash memory programming/ erasing	ocf_write	Programs or erasing the flash memory	See Figure 14 and Figure 15
	Flash memory reading	ocf_read	Reads the flash memory	See Figure 16
	Flash memory program-/erase-enabled check	ocf_pe_chk	Checks that the flash memory is program-/erase-enabled	See Figure 17
Serial communication control	SCIF configuration	io_scif_init	Configures the SCIF (channel 1)	–
	SCIF receive data existence check	io_scif_chk_rcv	Checks if the receive data is stored in the SCFRDR register	–
	SCIF transmit	io_scif_snd	Transmits one-byte data	–
	SCIF receive	io_scif_rcv	Receives the specified bytes of data	–
	SCIF module stop	io_scif_stop	Stop supplying the clock to the SCIF (channel 1)	–
Standard API	Block erase	R_FlashErase	Erases the data in the specified block	–
	Flash memory programming	R_FlashWrite	Programs the data in the specified address	–

4.2 Variable Used

Table 6 lists a variable used in the sample program.

Table 6 Variable

Variable Label Name	Description	Module to Use
unsigned char WriteBuff[256]	Stores the program data	ocf_write

4.3 Register Settings

Table 7 lists the register settings for the peripherals.

Table 7 Register Settings in the Sample Program

Register Name	Address	Setting	Description
Frequency control register (FRQCR)	H'FFFE 0010	H'1333	• STC [1:0] = "B'11": PLL circuit 1 frequency multiplier ratio = 4 • IFC [2:0] = "B'011": Internal clock division ratio = 1/4 • PFC [2:0] = "B'011": Peripheral clock division ratio = 1/4
Standby control register 4 (STBCR4)	H'FFFE 040C	H'B6	MSTP46 = "0": SCIF1 is operating
Serial mode register_1 (SCSMR_1)	H'FFFE 8800	H'0000	• C/A# = "0": Asynchronous mode • CHR = "0": 8-bit data • PE = "0": Disables to add and check the parity bit • STOP = "0" 1 stop bit • MP = "0": Disables the multiprocessor mode • CKS [1:0] = "B'00": Peripheral clock
Bit rate register_1 (SCBRR_1)	H'FFFE 8804	D'129	Bit rate = 9600 bps (Peripheral clock = 40 MHz)
Serial control register_1 (SCSCR_1)	H'FFFE 8808	H'0030	• TE = "1": Enables the transmitter • RE = "1": Enables the receiver
Port A control register H3 (PACRH3)	H'FFFE 380A	H'0055	• PA25MD [2:0] = "B'101": Outputs TXD1 (SCIF1) • PA24MD [2:0] = "B'101": Inputs RXD1 (SCIF1)

4.4 Flow Charts

This section describes the flow charts of the sample program.

4.4.1 Main Flow Chart

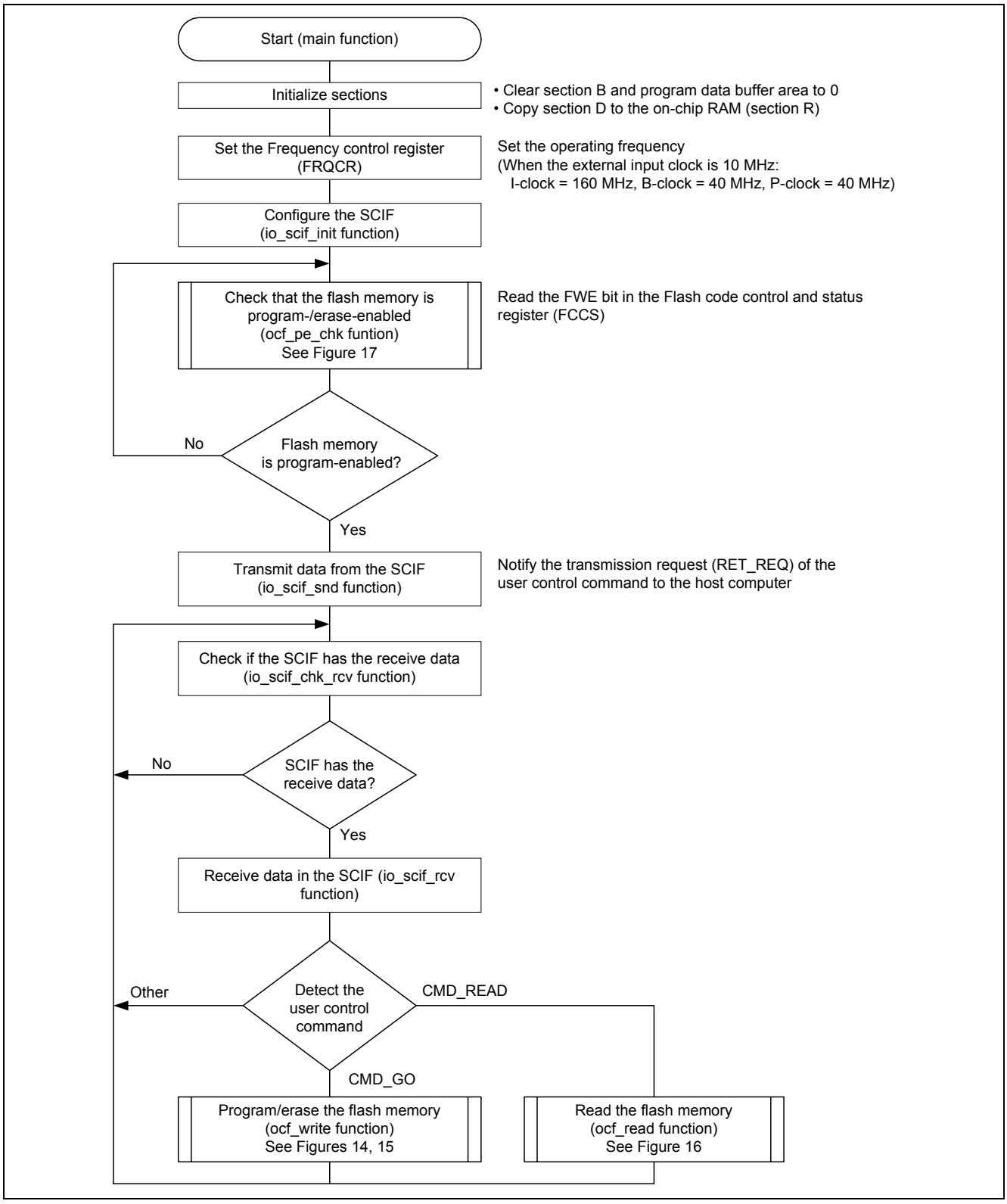

Figure 13 Main Processing Flow Chart

4.4.2 Programming/Erasing the Flash Memory

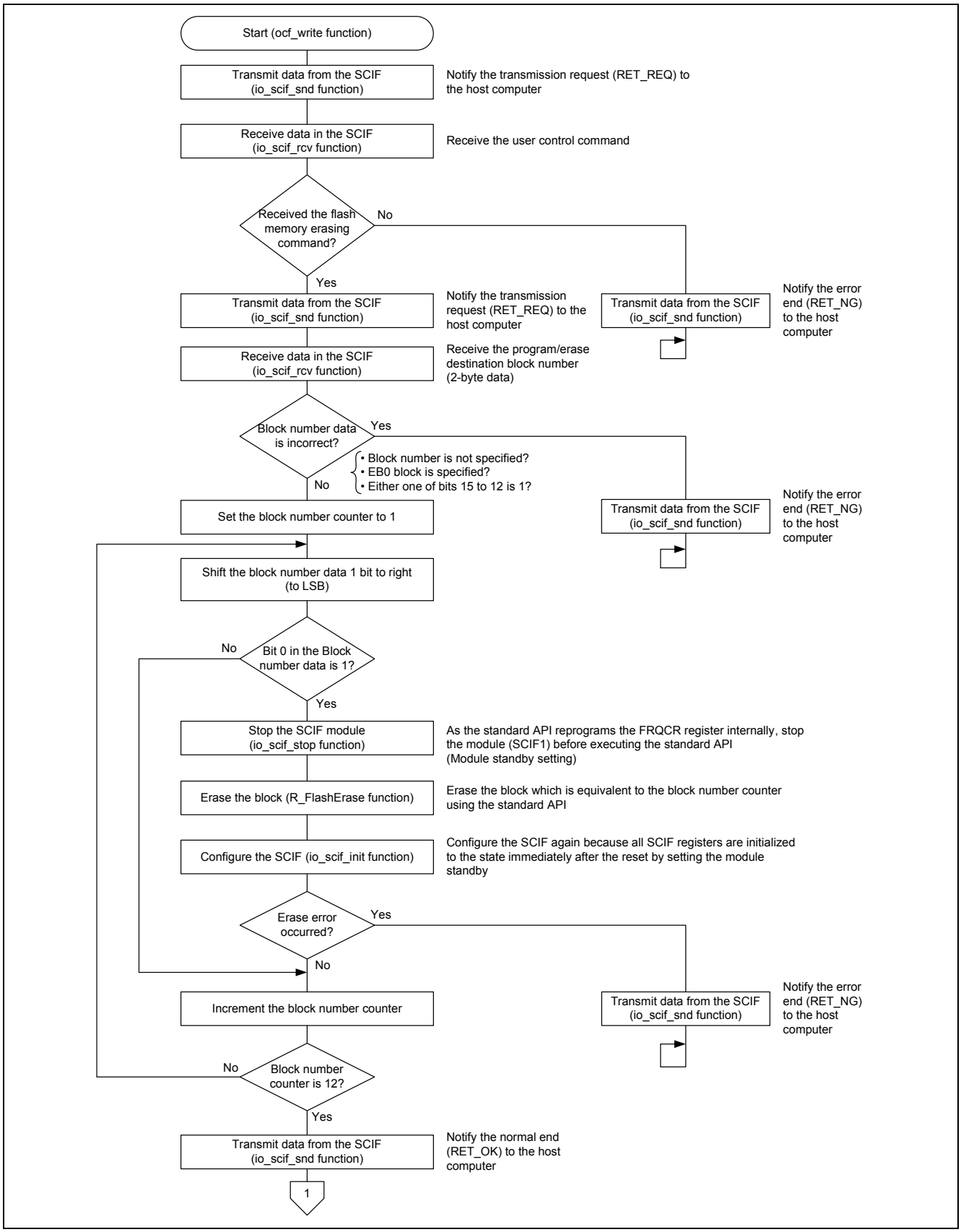

Figure 14 Programming/Erasing the Flash Memory (1/2)

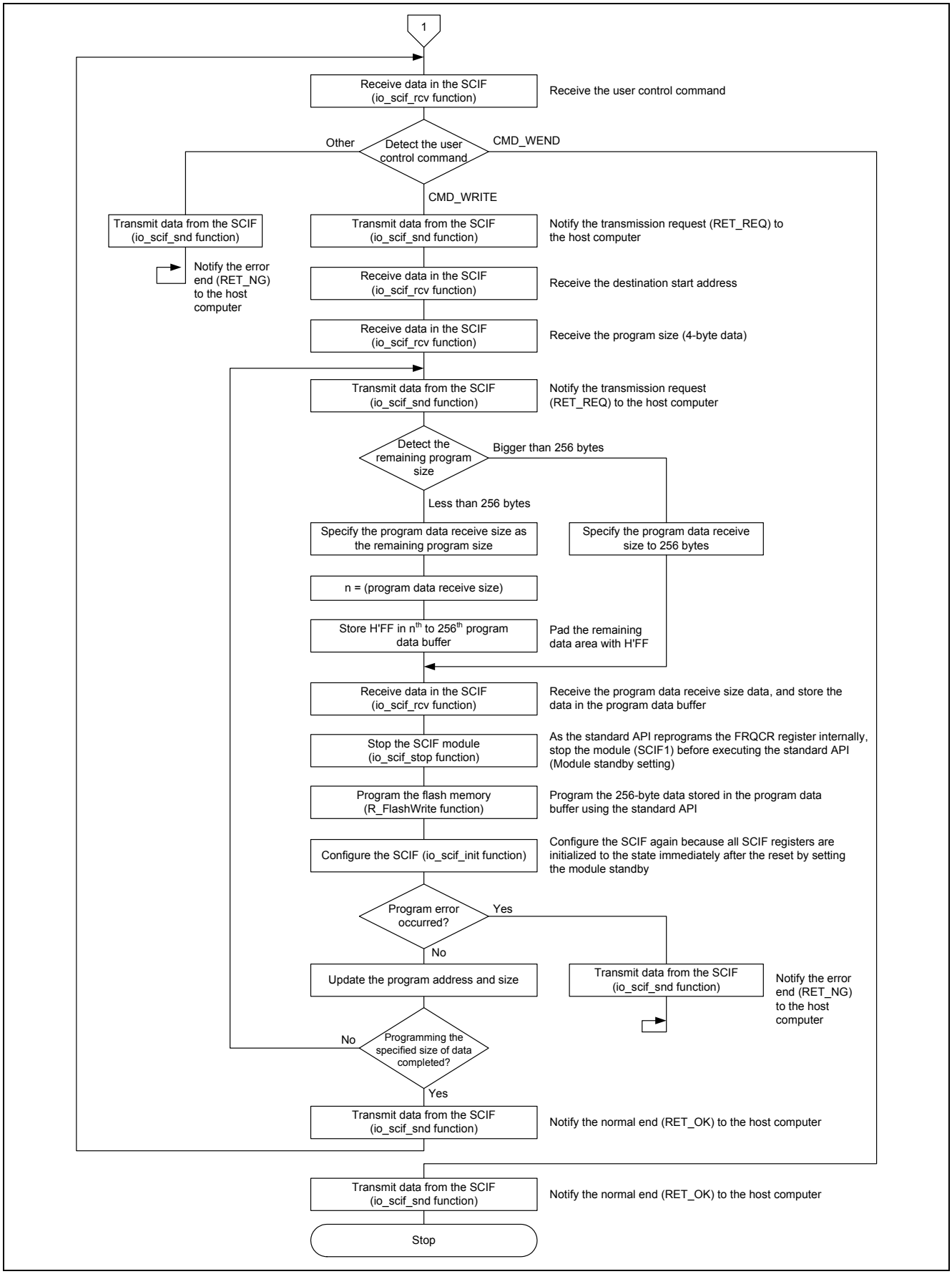

Figure 15 Programming/Erasing the Flash Memory (2/2)

4.4.3 Reading the Flash Memory

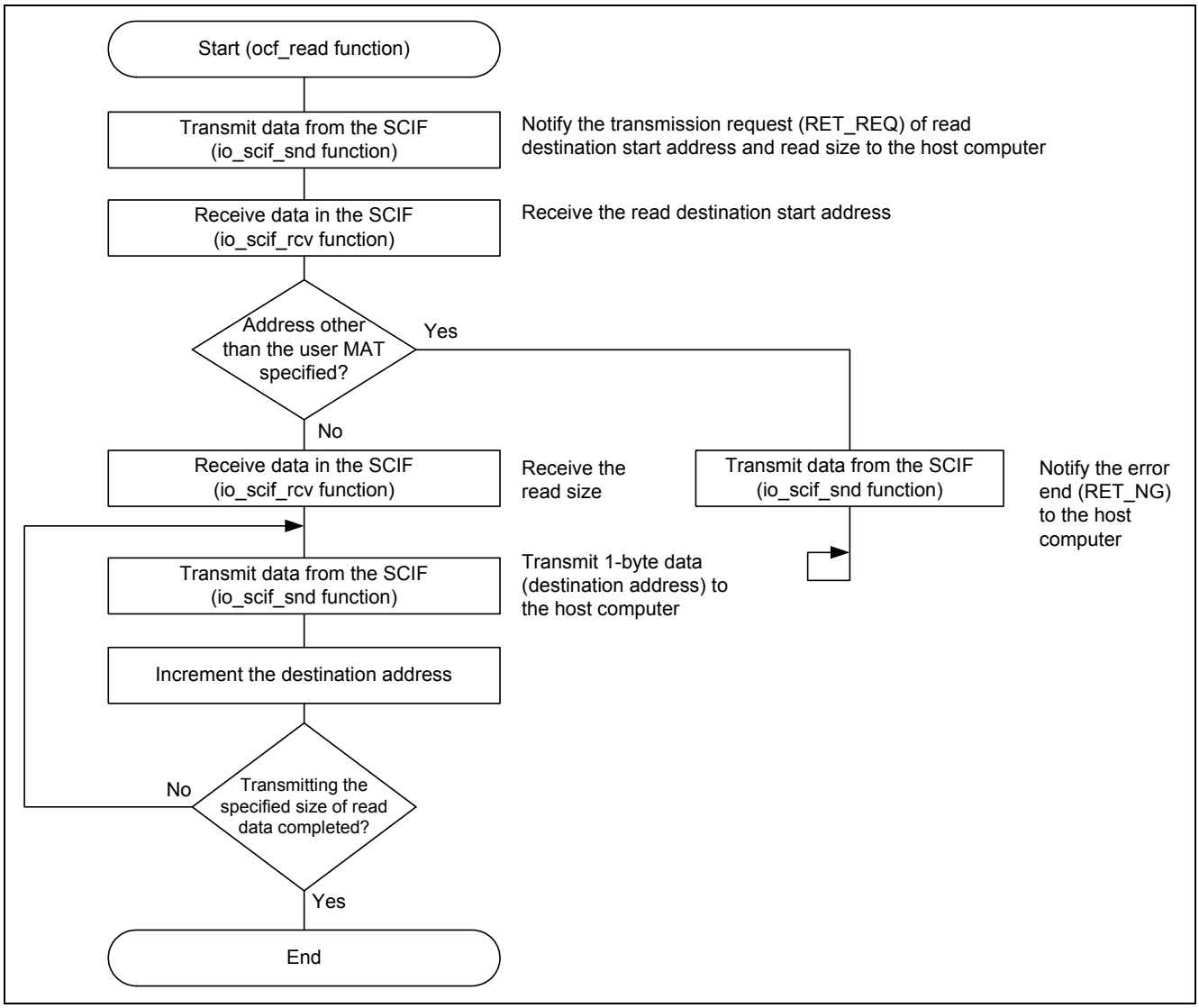

Figure 16 Reading the Flash Memory

4.4.4 Checking the Flash Memory is Program-/Erase-enabled

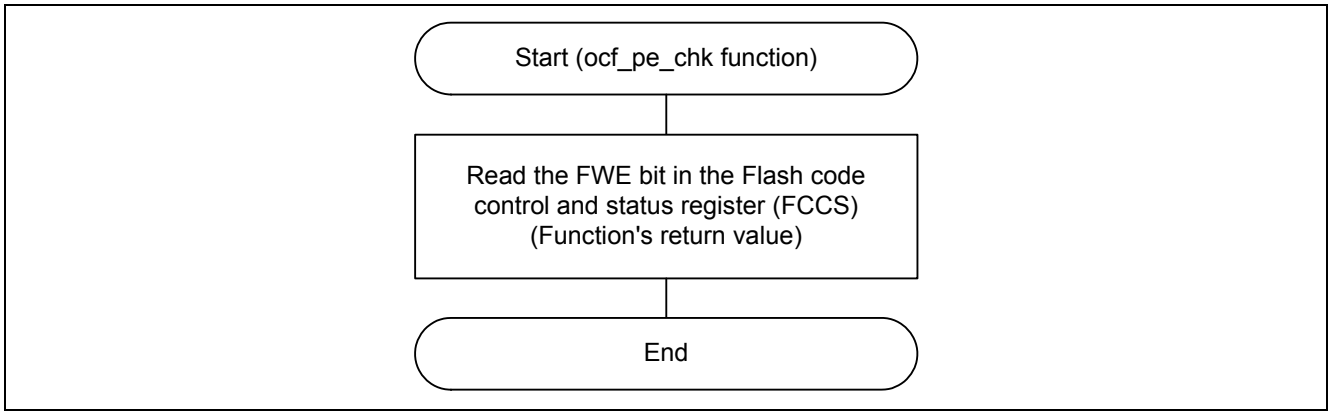

Figure 17 Checking the Flash Memory is Program-/Erase-enabled

5. Sample Program Listing

5.1 Sample Program Listing "main.c" (1/10)

```
/***********************************************************************
*   DISCLAIMER
*
*   This software is supplied by Renesas Electronics Corp. and is only
*   intended for use with Renesas products.  No other uses are authorized.
*
*   This software is owned by Renesas Electronics Corp. and is protected under
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*   REGARDING THIS SOFTWARE, WHETHER EXPRESS, IMPLIED OR STATUTORY,
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*   PARTICULAR PURPOSE AND NON-INFRINGEMENT.  ALL SUCH WARRANTIES ARE EXPRESSLY
*   DISCLAIMED.
*
*   TO THE MAXIMUM EXTENT PERMITTED NOT PROHIBITED BY LAW, NEITHER RENESAS
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*   conditions found by accessing the following link:
*   http://www.renesas.com/disclaimer
***********************************************************************
*   Copyright (C) 2010 Renesas Electronics Corporation. All rights reserved.
***********************************************************************/
/*""FILE COMMENT""*********** Technical reference data ************************
*   System Name : SH7211 Sample Program
*   File Name   : main.c
*   Abstract    : Using user program mode
*   Version     : 1.00.00
*   Device      : SH7211
*   Tool-Chain  : High-performance Embedded Workshop (Ver.4.04.01).
*               : C/C++ compiler package for the SuperH RISC engine family
*               :                             (Ver.9.01 Release01).
*   OS          : None
*   H/W Platform: M3A-HS11 (CPU board)
*   Description :
***********************************************************************
*   History     : Sep.15,2010 Ver.1.00.00
*""FILE COMMENT END""*****************************************************/
#include <machine.h>
#include "iodefine.h"
#include "Flash_API_SH7211.h"

```

5.2 Sample Program Listing "main.c" (2/10)

```
49  /* ==== Macro definition ==== */
50  #define FLASH_PE_ENABLE       1   /* Flash program/erase enabled       */
51  #define FLASH_PE_DISABLE   0   /* Flash program/erase disabled      */
52  #define PROGRAM_SIZE      256 /* Flash programming size unit       */
53
54  #define CMD_GO         0x55    /* Flash memory programming/erasing start command */
55  #define CMD_READ       0xaa    /* Flash memory reading command */
56  #define CMD_ERASE      0x77    /* Flash memory erasing command */
57  #define CMD_WRITE      0x88    /* Flash memory programming command */
58  #define CMD_WEND       0x99    /* Flash memory programming/erasing end command */
59  #define RET_OK         0x00    /* Normal end */
60  #define RET_NG         0x01    /* Error end */
61  #define RET_REQ        0x11    /* Transmission request */
62
63  /* ==== Prototype declaration ==== */
64  void main(void);              /* main function                           */
65  void _section_init(void);     /* section initialization function         */
66  void io_cpg_init(void);           /* FRQCR setting function                  */
67  int ocf_pe_chk(void);         /* Flash P/E check function                */
68  void ocf_write(void);         /* Flash program/erase processing function */
69  void ocf_read(void);          /* Flash reading function                  */
70  void dummy_f(void);               /* Dummy interrupt function                */
71  /* ---- External reference ---- */
72  extern void io_scif_init(void);
73  extern int io_scif_chk_rcv(void);
74  extern void io_scif_snd(unsigned char data);
75  extern void io_scif_rcv(unsigned char *data, unsigned long num);
76  extern void io_scif_stop(void);
77
78  /* ==== Global variable ==== */
79  #pragma section WriteDATA  /* Program data buffer area */
80  unsigned char WriteBuff[PROGRAM_SIZE];
81  #pragma section
82
```

5.3 Sample Program Listing "main.c" (3/10)

```
83    /*""FUNC COMMENT""*****************************************************************
84     * ID           :
85     * Outline      : Sample program main
86     *-------------------------------------------------------------------------------
87     * Include      :
88     *-------------------------------------------------------------------------------
89     * Declaration  : void main(void);
90     *-------------------------------------------------------------------------------
91     * Description  :
92     *-------------------------------------------------------------------------------
93     * Argument     : void
94     *-------------------------------------------------------------------------------
95     * Return Value : void
96     *-------------------------------------------------------------------------------
97     * Note         : None
98     *""FUNC COMMENT END""*************************************************************/
99    void main(void)
100   {
101     unsigned char RcvData;
102     int pe_ok;
103
104     /* ==== Initializes sections ==== */
105     _section_init();
106
107     /* ==== Initializes the FRQCR ==== */
108     io_cpg_init();
109
110     /* ==== Configures the SCIF ==== */
111     io_scif_init();
112
113     /* ==== Checks the flash memory is program-/erase-enabled ==== */
114     do{
115       pe_ok = ocf_pe_chk();      /* FWE pin = High ? */
116     }while(pe_ok != FLASH_PE_ENABLE);
117
118     /* ==== Notifies the transmission request to the host computer ==== */
119     io_scif_snd(RET_REQ);
120
121     /* ==== Programs/erases the flash memory or reads the flash memory ==== */
122     while(1){
123       /* ---- Checks the user control command ---- */
124       if(io_scif_chk_rcv() != 0){
125           io_scif_rcv(&RcvData, 1);
126           if(RcvData == CMD_GO){
127               ocf_write();          /* Programs or erases the flash memory */
128           }
129           else if(RcvData == CMD_READ){
130               ocf_read();           /* Reads the flash memory */
131           }
132       }
133     }
134   }
135
```

5.4 Sample Program Listing "main.c" (4/10)

```
/*""FUNC COMMENT""*****************************************************************
 * ID           :
 * Outline      : Section initialization
 *-----------------------------------------------------------------------------
 * Include      : <machine.h>
 *-----------------------------------------------------------------------------
 * Declaration  : void _section_init(void);
 *-----------------------------------------------------------------------------
 * Description  : Clears section B and program data buffer area to 0, and copies
 *              : section D to the on-chip RAM (section R).
 *-----------------------------------------------------------------------------
 * Argument     : void
 *-----------------------------------------------------------------------------
 * Return Value : void
 *-----------------------------------------------------------------------------
 * Note         : None
 *""FUNC COMMENT END""*************************************************************/
void _section_init(void)
{
  unsigned char *src, *dst, *end;

  /* Zero our all un-initialized (BSS) RAM data as specified by ANSI. */
  src = (unsigned char *)(__sectop("B"));
  end = (unsigned char *)(__secend("B"));
  while(src < end){
    *src++ = 0x00;
  }

  src = (unsigned char *)(__sectop("BWriteDATA"));
  end = (unsigned char *)(__secend("BWriteDATA"));
  while(src < end){
    *src++ = 0x00;
  }

  /* Copy in our all initialized (DATA) RAM data as specified by ANSI. */
  src = (unsigned char *)(__sectop("D"));
  dst = (unsigned char *)(__sectop("R"));
  end = (unsigned char *)(__secend("D"));
  while(src < end){
    *dst++ = *src++;
  }
}

```

5.5 Sample Program Listing "main.c" (5/10)

```
/*""FUNC COMMENT""*****************************************************************
 * ID           :
 * Outline      : FRQCR initialization
 *-----------------------------------------------------------------------------
 * Include      : <machine.h> and "iodefine.h"
 *-----------------------------------------------------------------------------
 * Declaration  : void io_cpg_init(void);
 *-----------------------------------------------------------------------------
 * Description  : Initializes the FRQCR register.
 *-----------------------------------------------------------------------------
 * Argument     : void
 *-----------------------------------------------------------------------------
 * Return Value : void
 *-----------------------------------------------------------------------------
 * Note         : None
 *""FUNC COMMENT END""*************************************************************/
void io_cpg_init(void)
{
  volatile unsigned short dummy;

  WDT.WRITE.WTCSR = 0xa51e;   /* WDT stop, WDT count clock: 1/4096 x P-clock */
                           /* (Overflow cycle = 26.21 ms at P-clock 40 MHz) */
  WDT.WRITE.WTCNT = 0x5a9e;   /* WDT counter for 10 ms */
  CPG.FRQCR.WORD = 0x1333;/* PLL1(x4), PLL2(x4), I:B:P = 4:4:4 */
                           /* Clock-in = 10 MHz */
                           /* I-clock = 40 MHz */
                           /* B-clock = 40 MHz */
                           /* P-clock = 40 MHz */
  dummy = CPG.FRQCR.WORD;     /* Readout FRQCR (1/3) */
  dummy = CPG.FRQCR.WORD;     /* Readout FRQCR (2/3) */
  dummy = CPG.FRQCR.WORD;     /* Readout FRQCR (3/3) */
}

```

5.6 Sample Program Listing "main.c" (6/10)

```
/*""FUNC COMMENT""*****************************************************************
 * ID           :
 * Outline      : Flash memory program-/erase-enabled state check
 *-----------------------------------------------------------------------------
 * Include      : "iodefine.h"
 *-----------------------------------------------------------------------------
 * Declaration  : int ocf_pe_chk(void);
 *-----------------------------------------------------------------------------
 * Description  : Reads the FWE bit in the Flash code control and status register
 *              : (FCCS) and returns the value.
 *-----------------------------------------------------------------------------
 * Argument     : void
 *-----------------------------------------------------------------------------
 * Return Value : 0 ; Flash memory is program-/erase-disabled
 *              : 1 ; Flash memory is program-/erase-enabled
 *-----------------------------------------------------------------------------
 * Note         : None
 *""FUNC COMMENT END""*************************************************************/
int ocf_pe_chk(void)
{
  return FLASH.FCCS.BIT.FWE;
}

/*""FUNC COMMENT""*****************************************************************
 * ID           :
 * Outline      : Programming/erasing the flash memory
 *-----------------------------------------------------------------------------
 * Include      : "Flash_API_SH7280.h"
 *-----------------------------------------------------------------------------
 * Declaration  : void ocf_write(void);
 *-----------------------------------------------------------------------------
 * Description  : Erases the program/erase destination block (other than EB0)
 *              : which is specified by the host computer, and programs the
 *              : specified size of data from the destination start address.
 *-----------------------------------------------------------------------------
 * Argument     : void
 *-----------------------------------------------------------------------------
 * Return Value : void
 *-----------------------------------------------------------------------------
 * Note         : None
 *""FUNC COMMENT END""*************************************************************/
void ocf_write(void)
{
  unsigned char error;    /* Function return value */
  unsigned char RcvData;      /* Receive data */
  unsigned char EraseBlkNum;  /* Erase block number */
  unsigned short EraseBlkSelect;  /* Specified erase block number by bit field */
  unsigned long WriteAddr;/* Start address to be programmed */
  unsigned long WriteSize;/* Data size to be programmed */
  unsigned long RcvSize;      /* Receiving size for data to be programmed */
  unsigned long i;        /* Loop counter */

```

5.7 Sample Program Listing "main.c" (7/10)

```
264     /* ==== Transmission request ==== */
265     io_scif_snd(RET_REQ);
266
267     /* ==== Receives the flash memory erasing command ==== */
268     io_scif_rcv(&RcvData, 1);
269     if(RcvData != CMD_ERASE){   /* Received the command other than the CMD_ERASE? */
270       io_scif_snd(RET_NG);      /* Error end */
271       while(1){
272       }
273     }
274
275     /* ==== Transmission request ==== */
276     io_scif_snd(RET_REQ);
277
278     /* ==== Receives the erase block number data ==== */
279     io_scif_rcv((unsigned char *)&EraseBlkSelect, 2);
280     if( (EraseBlkSelect == 0x0000) ||
281       ((EraseBlkSelect & 0xf001) != 0) ){
282       /* Block number is not specified or EB0 is specified or erase block number */
283       /* data is incorrect? */
284       io_scif_snd(RET_NG);          /* Error end */
285       while(1){
286       }
287     }
288
289     /* ==== Erases the flash memory ==== */
290     EraseBlkNum = BLOCK_1;
291     do{
292       EraseBlkSelect >>= 1;
293       if((EraseBlkSelect & 0x0001) != 0){
294           /* ---- Sets the SCIF in module standby ---- */
295           io_scif_stop();
296           /* ---- Erases a block ---- */
297           error = R_FlashErase((uint8_t)EraseBlkNum);
298           /* ---- Configures the SCIF ---- */
299           io_scif_init();
300           if(error != 0){           /* Erase error occurred? */
301               io_scif_snd(RET_NG);      /* Error end */
302               while(1){
303               }
304           }
305       }
306     } while(EraseBlkNum++ <= BLOCK_11);
307
308     io_scif_snd(RET_OK);            /* Normal end */
309
310
```

5.8 Sample Program Listing "main.c" (8/10)

```
311     /* ==== Programs the flash memory ==== */
312     while(1){
313       io_scif_rcv(&RcvData, 1);     /* Receives the user control command */
314       if(RcvData == CMD_WRITE){     /* Received the CMD_WRITE? */
315           io_scif_snd(RET_REQ);     /* Transmission request */
316       }
317       else if(RcvData == CMD_WEND){ /* Received the CMD_WEND? */
318           io_scif_snd(RET_OK);          /* Normal end */
319           break;
320       }
321       else{
322           io_scif_snd(RET_NG);          /* Error end */
323           while(1){
324           }
325       }
326
327       /* ---- Receives the destination start address ---- */
328       io_scif_rcv((unsigned char *)&WriteAddr, 4);
329
330       /* ---- Receives the program data size ---- */
331       io_scif_rcv((unsigned char *)&WriteSize, 4);
332
333       while(WriteSize > 0){
334           io_scif_snd(RET_REQ);         /* Transmission request */
335
336           if(WriteSize > PROGRAM_SIZE){
337               RcvSize = PROGRAM_SIZE;
338           }
339           else{
340               RcvSize = WriteSize;
341               for(i = RcvSize; i < PROGRAM_SIZE; i++){
342                   WriteBuff[i] = 0xff;
343               }
344           }
345
346           /* ---- Receives the program data ---- */
347           io_scif_rcv(WriteBuff, RcvSize);  /* Stores the data in the program data buffer */
348
```

5.9 Sample Program Listing "main.c" (9/10)

```
349         /* ---- Sets the SCIF in module standby ---- */
350         io_scif_stop();
351         /* ---- Programs the flash memory ---- */
352         error = R_FlashWrite((uint32_t)WriteAddr, (uint32_t)WriteBuff, PROGRAM_SIZE);
353         /* ---- Configures the SCIF ---- */
354         io_scif_init();
355         if(error != 0){               /* Program error occurred? */
356             io_scif_snd(RET_NG);      /* Error end */
357             while(1){
358             }
359         }
360
361         WriteAddr += PROGRAM_SIZE;
362         WriteSize -= RcvSize;
363       }
364       io_scif_snd(RET_OK);                /* Normal end */
365     }
366
367   }
368
369   /*""FUNC COMMENT""*****************************************************************
370    * ID           :
371    * Outline      : Reading the flash memory
372    *-----------------------------------------------------------------------------
373    * Include      :
374    *-----------------------------------------------------------------------------
375    * Declaration  : void ocf_read(void);
376    *-----------------------------------------------------------------------------
377    * Description  : Reads the specified size of data from the read destination
378    *              : start address and transmits the data to the host computer.
379    *-----------------------------------------------------------------------------
380    * Argument     : void
381    *-----------------------------------------------------------------------------
382    * Return Value : void
383    *-----------------------------------------------------------------------------
384    * Note         : None
385    *""FUNC COMMENT END""*************************************************************/
386   void ocf_read(void)
387   {
388     unsigned char *ReadData;/* Pointer for readout data */
389     unsigned long ReadAddr;     /* Start address to be read */
390     unsigned long ReadSize;     /* Reading size */
391     unsigned long i;        /* Loop counter */
392
393     /* ==== Transmission request ==== */
394     io_scif_snd(RET_REQ);
395
```

5.10 Sample Program Listing "main.c" (10/10)

```
396     /* ==== Receives the read destination start address ==== */
397     io_scif_rcv((unsigned char *)&ReadAddr, 4);
398     if(ReadAddr >= 0x00080000){
399       /* Specified the address other than the user MAT? */
400       io_scif_snd(RET_NG);          /* Error end */
401       while(1){
402       }
403     }
404
405     /* ==== Receives the read data size ==== */
406     io_scif_rcv((unsigned char *)&ReadSize, 4);
407
408     /* ==== Transmits the data which is read from ROM ==== */
409     ReadData = (unsigned char *)ReadAddr;
410     for(i = 0; i < ReadSize; i++){
411       io_scif_snd(*ReadData++);
412     }
413   }
414
415   /*""FUNC COMMENT""*****************************************************************
416    * ID           :
417    * Outline      : Interrupt handling (dummy function).
418    *-----------------------------------------------------------------------------
419    * Include      :
420    *-----------------------------------------------------------------------------
421    * Declaration  : void dummy_f(void);
422    *-----------------------------------------------------------------------------
423    * Description  :
424    *-----------------------------------------------------------------------------
425    * Argument     : void
426    *-----------------------------------------------------------------------------
427    * Return Value : void
428    *-----------------------------------------------------------------------------
429    * Note         : None
430    *""FUNC COMMENT END""*************************************************************/
431   #pragma interrupt dummy_f
432   void dummy_f(void)
433   {
434     while(1){
435       /* Infinite loop */
436     }
437   }
438
439   /* End of File */
```

6. References

- Software Manual
  SH-2A/SH2A-FPU Software Manual Rev. 3.00
  The latest version of the software manual can be downloaded from the Renesas Electronics website.

- Hardware Manual
  SH7211 Group Hardware Manual Rev. 3.00

The latest version of the hardware manual can be downloaded from the Renesas Electronics website.

- Technical update
  Prohibition of Interrupts during Programming/Erasing in User Program Mode (TN-SH7-A657A/E)

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Revision Record

Rev.	Date	Description	
		Page	Summary
1.00	Nov.30.10	–	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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