致尊敬的顾客

关于产品目录等资料中的旧公司名称

NEC电子公司与株式会社瑞萨科技于2010年4月1日进行业务整合（合并），整合后的新公司暨“瑞萨电子公司”继承两家公司的所有业务。因此，本资料中虽还保留有旧公司名称等标识，但是并不妨碍本资料的有效性，敬请谅解。

瑞萨电子公司网址：http://www.renesas.com

2010年4月1日
瑞萨电子公司

【发行】瑞萨电子公司（http://www.renesas.com）

【业务咨询】http://www.renesas.com/inquiry

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 Renesas 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.
3. 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.
5. 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.

38D2 群

ROM 修正功能

1. 要点

本篇资料介绍如何使用 38D2 群单片机的 ROM 修正功能。

2. 说明

该应用说明适用于以下条件：

采用的 MCU：38D2 群（例如：M38D24G4HP）

振荡频率： 10MHz

存储容量： ROM 16KB，RAM 640 字节

3. 内容

3.1 实例说明

- 38D2 群是 QzROM 单片机，正常情况下，它只能被烧写一次。但在空白未写保护的 ROM 区域，它可再次被追加烧入修正用程序码。例如，如图 1 所示，可以把初始程序代码烧入写保护区域 1，把修正用程序码追加烧入从 F000H 地址开始的未写保护区域。
- 在此实例中，选用 ROM 区域的 ROM 修正用向量 1 进行功能介绍（在实际应用中，可以同时使能 ROM 修正用向量 1 和 ROM 修正用向量 2）。在初始主程序中，有一条 Port 1 输出的指令。我们通过 ROM 修正功能对此端口输出值进行修正。
- 在此实例中，源程序设计软件工具为 HEW（High-performance Embedded Workshop 4.0.3.1）；烧写程序代码的软件工具为 FDT（Flash Development Toolkit 3.05）；MCU 类型为 M38D24G4HP。

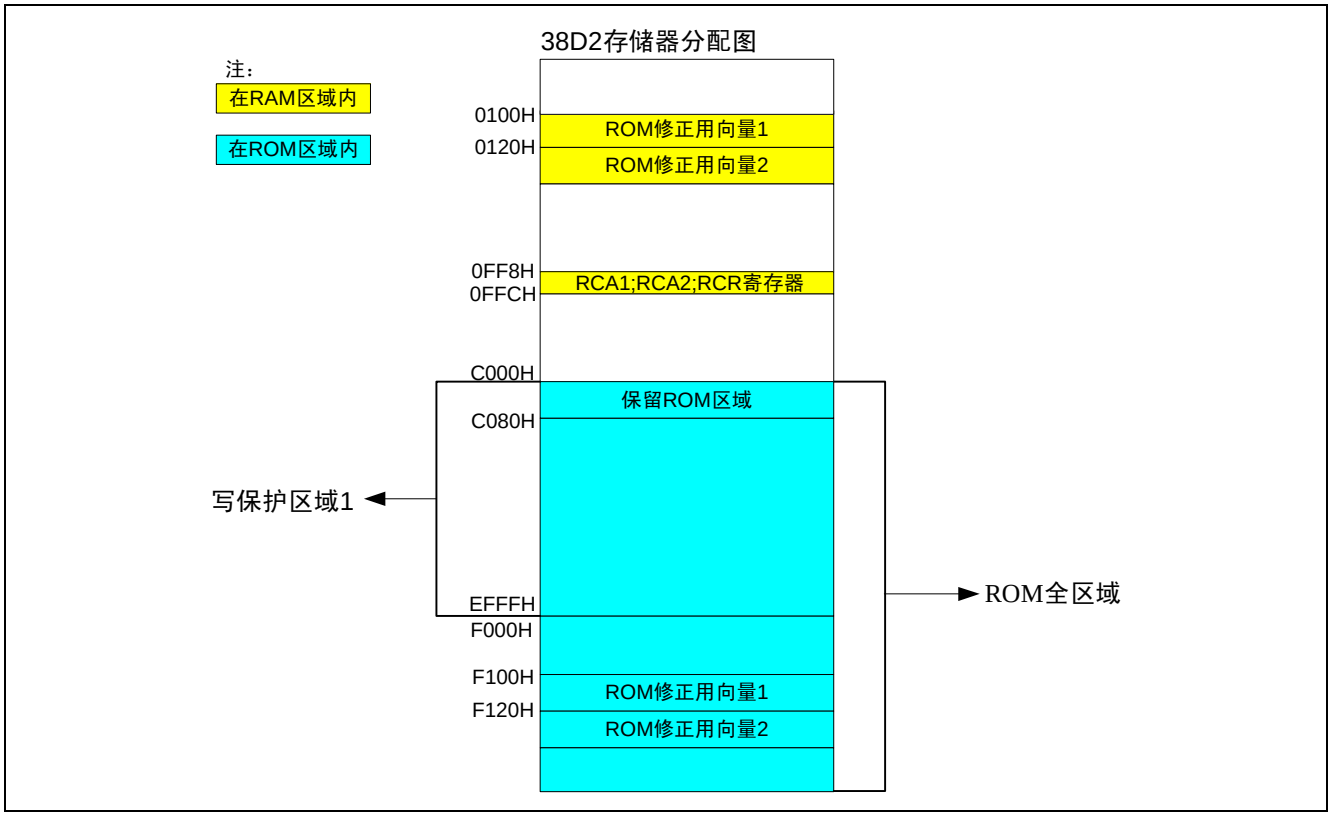


图 1. ROM 保护区域

3.2 操作

- 应用 FDT 烧写软件，从 C080H 开始首次烧入包含有可以使能 ROM 修正功能的初始程序代码。并设置对 ROM 区域 1 写保护。
- 安装此片 M38D2 单片机到用户系统板上，上电运行。可以观察到 P1 口的输出为 FFH。
- 从 F000H 开始（一个未写保护的空白 ROM 区域），追加烧入使能 ROM 修正功能的操作码。
- 从 ROM 修正用向量 1 的 F100H 开始，追加烧入修正用程序码。
- 再次安装此片 M38D2 单片机到用户系统板上，上电运行修正后的程序。可以观察到 P1 口输出为 0FH。

3.3 操作码设定

- 在初始程序中的错误指令
  在初始程序中，有一条需要修正的错误指令，如图 2 所示。

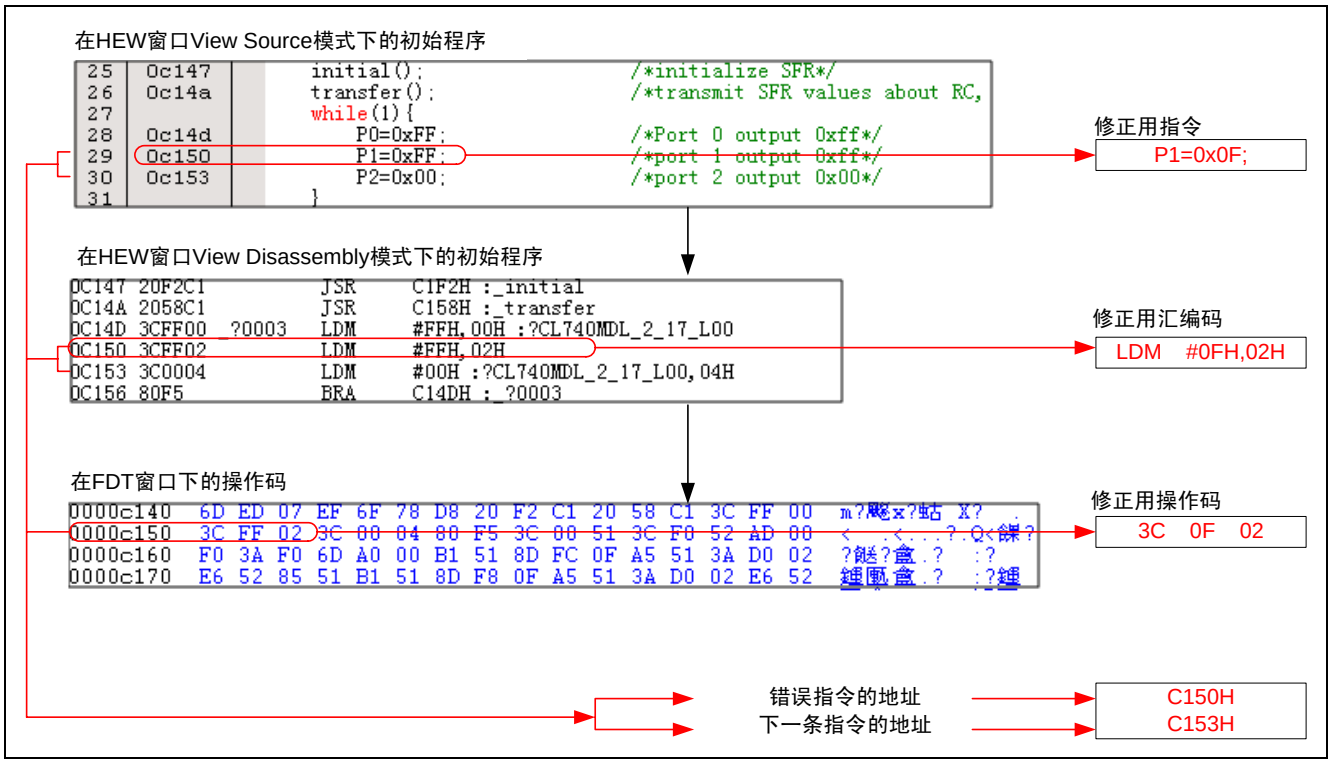


图 2. 初始程序中的错误指令

- ROM 修正功能相关的 SFR 设定
  为使能 ROM 修正功能，需要从 F000H 开始的未写保护的空白 ROM 区域追加烧入 RCR、RCA1H 和 RCA1L 的设定值。此操作说明如图 3 所示。

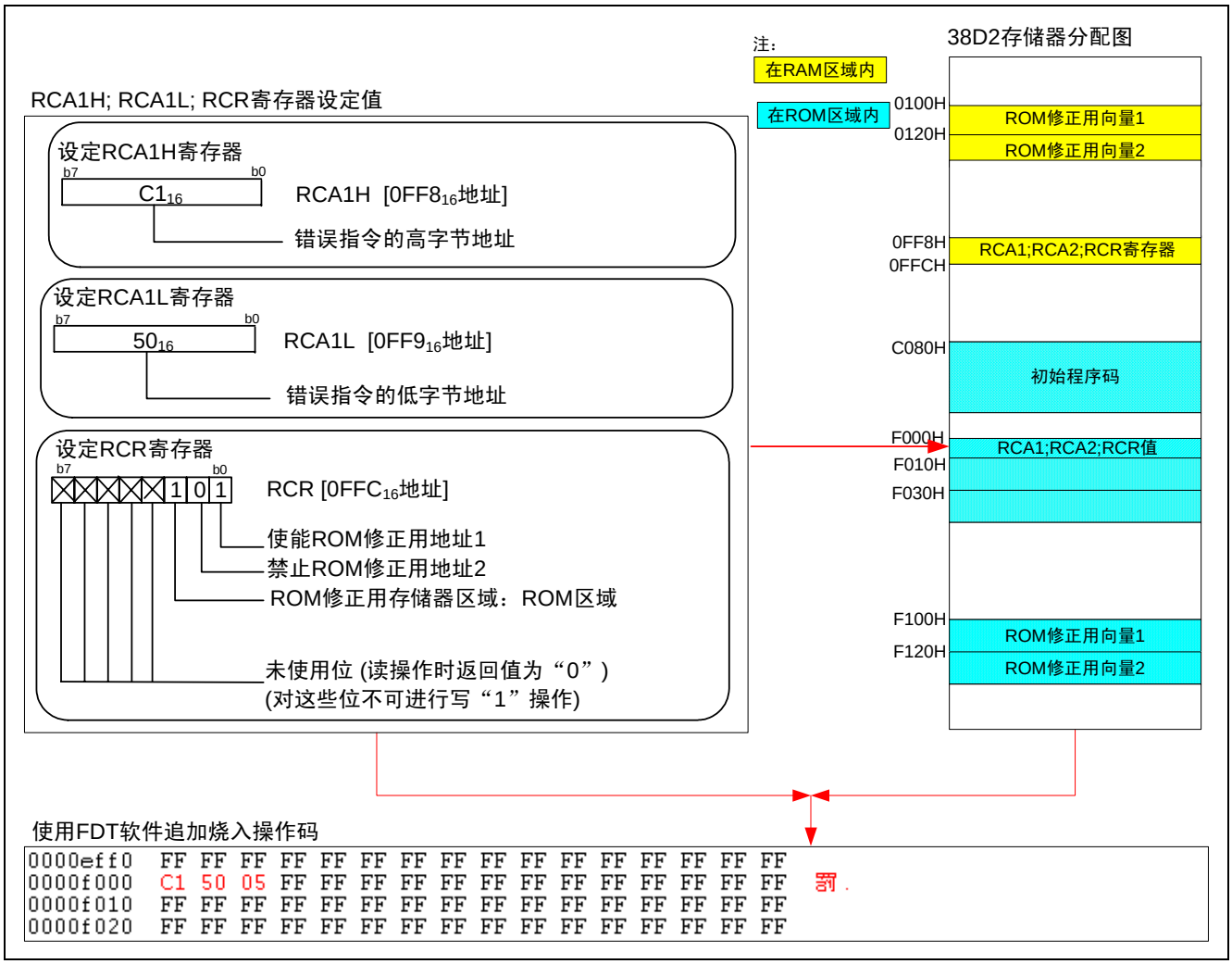
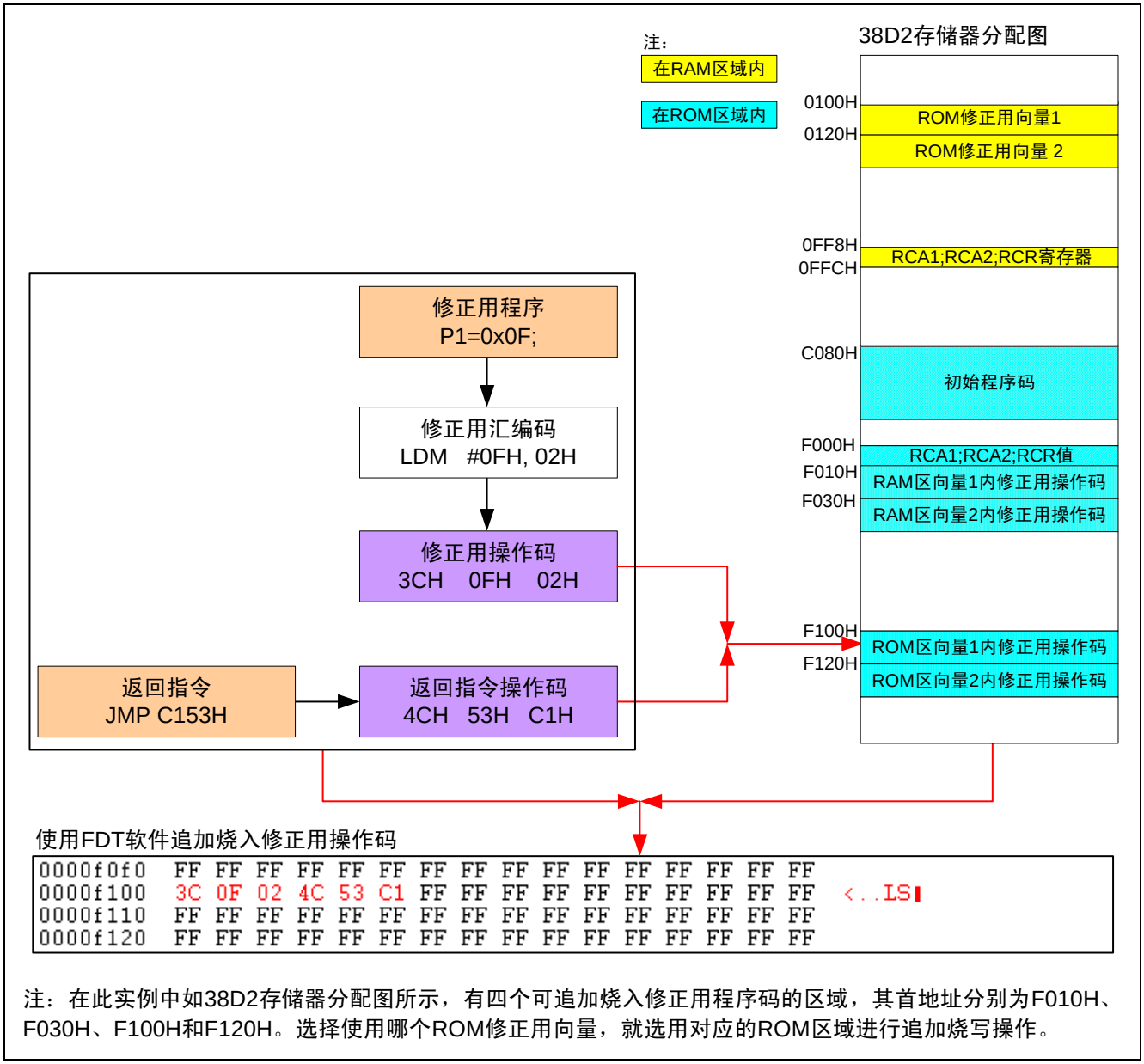


图 3. ROM 修正功能相关的 SFR 设定

- 修正用程序码
  在此实例中，选用 ROM 区域的 ROM 修正用向量 1。所以把追加烧入的修正用程序码烧入此区域。应该注意，为使 PC（程序计数器）能从 ROM 修正用向量 1 返回，在追加的程序码后，需要加入一条 JMP 指令。此操作如图 4 所示。



注：在此实例中如38D2存储器分配图所示，有四个可追加烧入修正用程序码的区域，其首地址分别为F010H、F030H、F100H和F120H。选择使用哪个ROM修正用向量，就选用对应的ROM区域进行追加烧写操作。

图 4. 修正用程序码

3.4 ROM 修正功能的实现

- 当程序被执行并且 PC（程序计数器）的值与在 ROM 修正地址寄存器里所设定的地址值相一致时，程序将自动跳转到 ROM 修正用向量并执行修正用程序。
- 在此实例中，当 PC（程序计数器）的值为 C150H 时，程序将自动跳转到 ROM 修正用向量 1（首地址为 F100H 的区域）去修正端口 1 的输出值。当执行到 JMP 指令时，程序将返回到初始程序的 C153H 地址处继续执行主程序。程序码的烧入操作如图 5 所示。实现 ROM 修正功能的原理如图 6 所示。

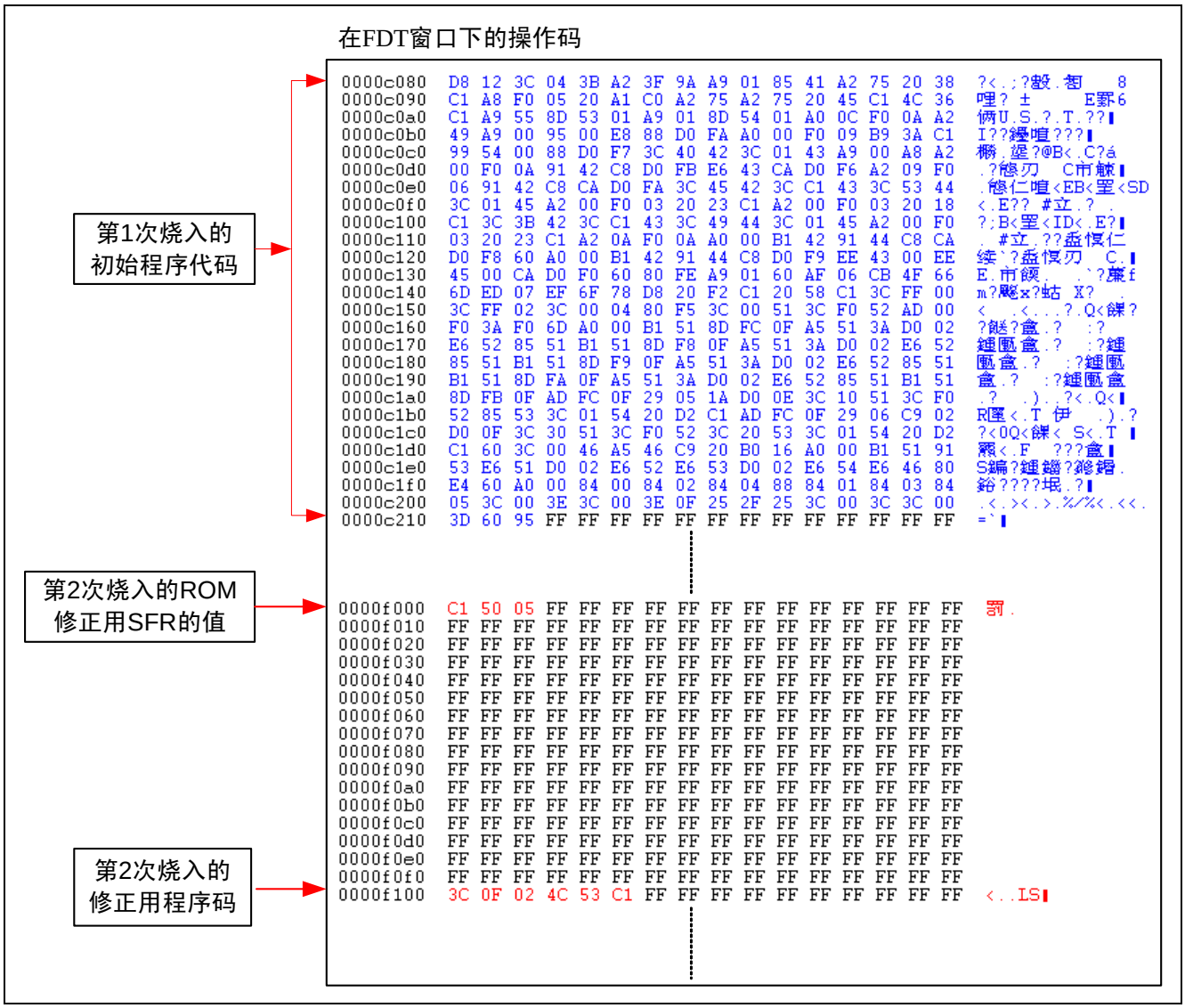


图 5. 程序码的烧入操作

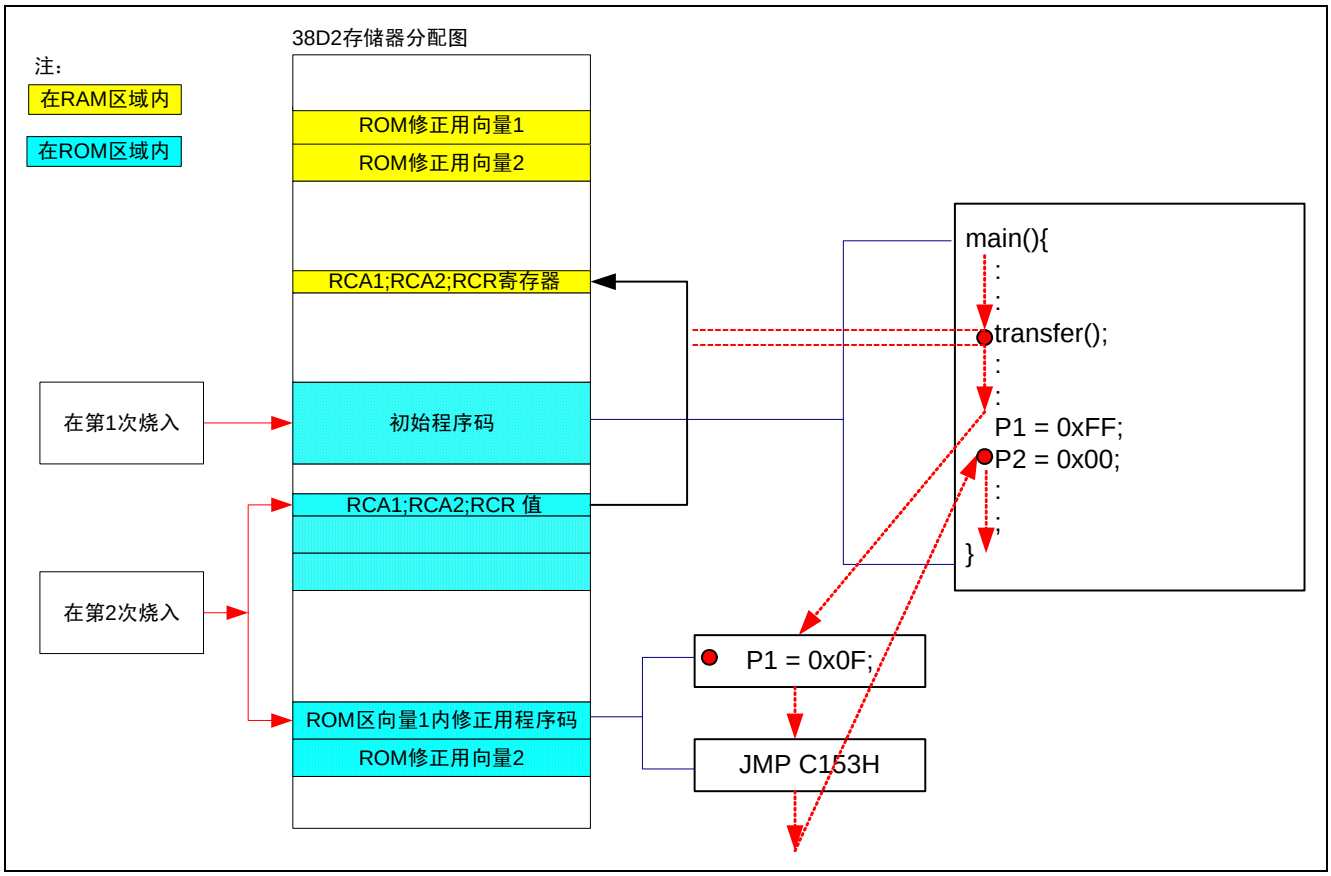
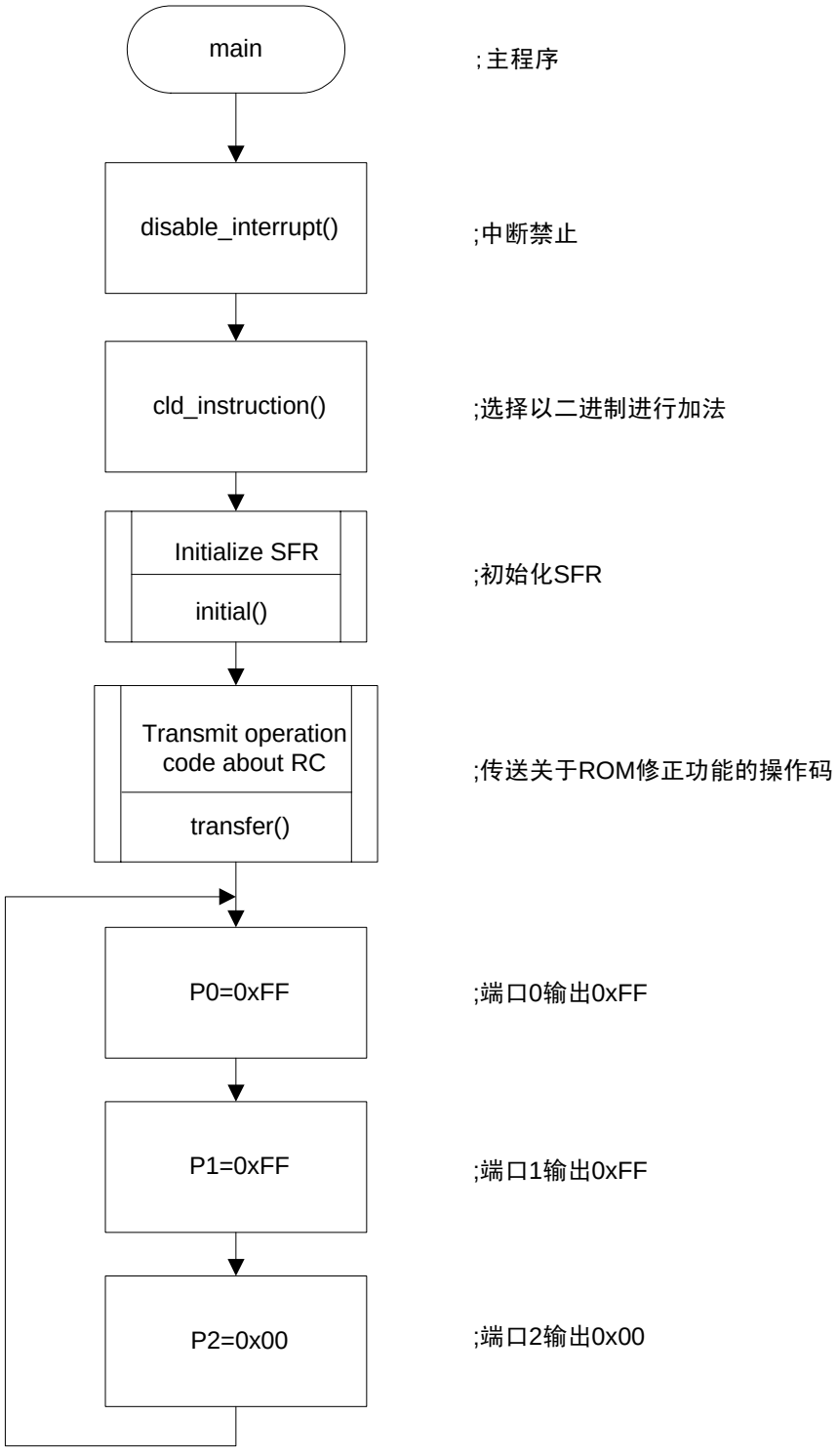


图 6. 实现 ROM 修正功能的过程

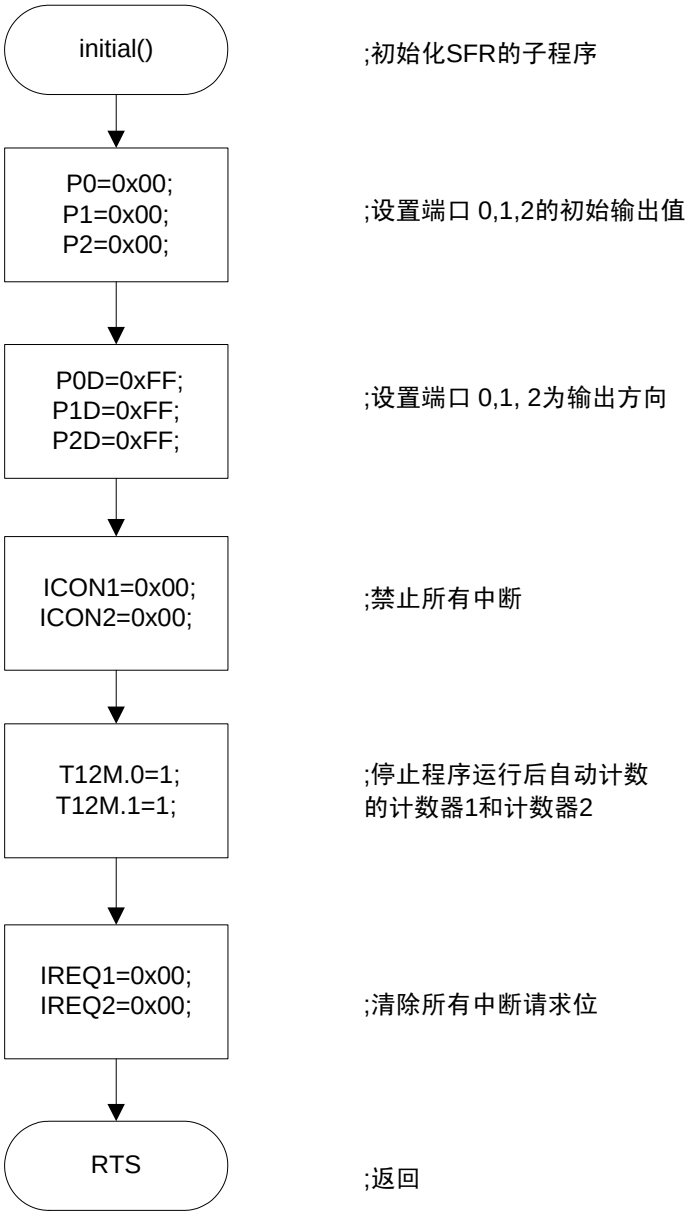
4. 流程图

下述内容为第一次烧入的初始程序的流程图。

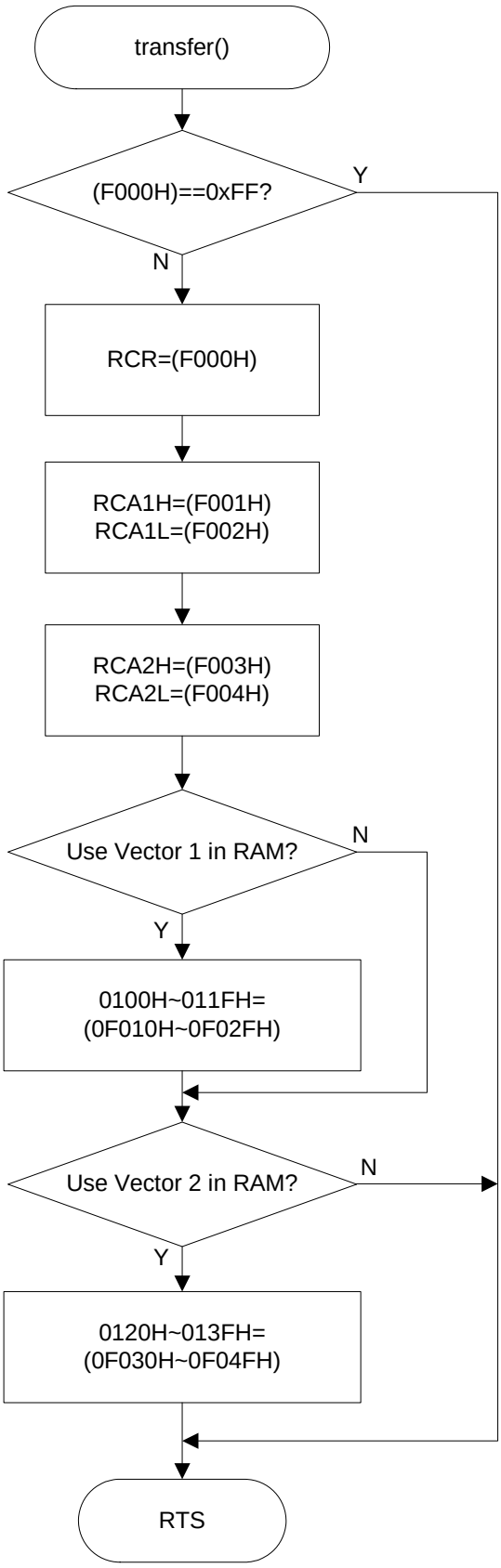
4.1 主程序流程图



4.2 子程序 initial 流程图



4.3 子程序 transfer 流程图



;传送修正用操作码的子程序

;判断F000H的地址上是否有再次被烧入的值。如果有，读取这些值。如果没有，返回

;从再次被烧入的ROM区域读取RCR的值传送到RCR寄存器中。

;从再次被烧入的ROM区域读取RCA1H和RCA1L的值传送到相应寄存器中。
(如果未用到修正用向量1，传送的为空值)

;从再次被烧入的ROM区域读取RCA2H和RCA2L的值传送到相应寄存器中。
(如果未用到修正用向量2，传送的为空值)

;通过RCR寄存器的值来判断是否应用到了RAM区域内的修正用向量1。如果是，传送修正用程序码到RAM区域内的向量1内。

;从再次烧入的ROM区域读取修正用程序码，传送到RAM区域内的向量1内。

;通过RCR寄存器的值来判断是否应用到了RAM区域内的修正用向量2。如果是，传送修正用程序码到RAM区域内的向量2内。

;从再次烧入的ROM区域读取修正用程序码，传送到RAM区域内的向量2内。

;返回

4.4 对于 transfer 子程序的说明

对应于上述 transfer 子程序的流程图，当使用 ROM 修正功能时，需要被再次烧入的操作码的位置和传送值的过程如图 7 所示。选择哪个修正用向量，就对应地设置相应的 RCR 寄存器的值，并且写入修正用程序码到对应的向量地址区域内。其他修正用向量地址区域内不需要设置任何值。

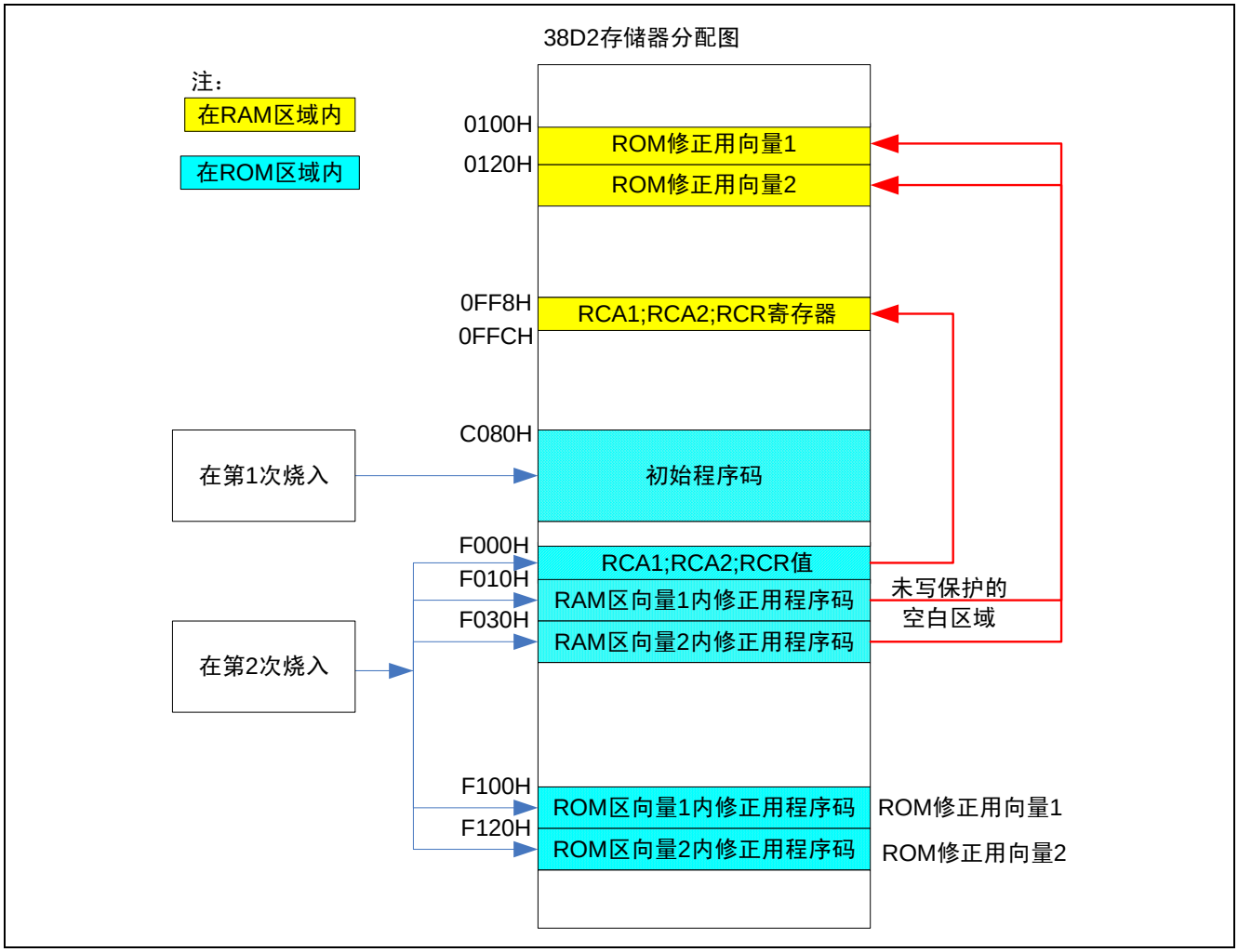


图 7. 对于 transfer 子程序的说明

5. 参考例程

下述内容为第一次烧入的初始程序的参考例程。

```
/************************************************************************
*    File Name    : rec05b0017_0100_source.c
*    CPU          : M38D24 Group
*    Function     : ROM Correction Function
*                 (use ROM correction vector 1)
*    Version      : 1.00 (2006-04-18)
*    Copyright (C) 2006, Renesas Technology Corp. All right reserved.
************************************************************************/

/************************************************************************
*       Include File
************************************************************************/
#include <intr740.h>
#include "io38d2.h"

/************************************************************************
*       Define Variable
************************************************************************/
zpage unsigned char *pt1_RC = 0x00;     /*address point in blank ROM area */
zpage unsigned char *pt2_RC = 0x00;     /*address point in SFR or RC vector*/

/************************************************************************
*       Function Declaration
************************************************************************/
void initial(void);                     /*initialize SFR subroutine*/
void transfer(void);                    /*transmit operation code subroutine*/
void transmit_pro_code(void);           /*transmit program code subroutine*/

/************************************************************************
Name       : Main
************************************************************************/
void main(void)
{
     disable_interrupt();               /* Interrupt Disable */
     cld_instruction();                 /* Binary Arithmetic Executed */

     initial();                         /*initialize SFR*/
     transfer();                        /*transmit operation code subroutine*/
     while(1){
        P0 = 0xFF;                      /*Port 0 output 0xff*/
        P1 = 0xFF;                      /*port 1 output 0xff*/
        P2 = 0x00;                      /*port 2 output 0x00*/
     }
}
/************************************************************************
Name       : initial
Function   : initialize SFR
************************************************************************/
void initial(void){
     P0 = 0x00;                         /*port 0 output 0x00*/
     P1 = 0x00;                         /*port 1 output 0x00*/
     P2 = 0x00;                         /*port 2 output 0x00*/
     P0D = 0xFF;                        /*set port 0 to output direction*/
     P1D = 0xFF;                        /*set port 1 to output direction*/
```

```
    P2D = 0xFF;                         /*set port 2 to output direction*/
    ICON1 = 0x00;                       /*disable all interrupt*/
    ICON1 = 0x00;
    T12M.0 = 1;                         /*stop Timer 1*/
    T12M.1 = 1;                         /*stop Timer 2*/
    IREQ1 = 0x00;                       /*clear all interrupt request bits*/
    IREQ2 = 0x00;
}
/************************************************************************
Name       : transfer
Function   : transmit operation code
************************************************************************/
void transfer(void){
    pt1_RC = (char *)0xF000;            /*set the blank ROM area address*/

    if (*pt1_RC!=0xFF){                 /*if there are values, transmit them*/

       RCR    = *pt1_RC;               /*set RCR register*/
       pt1_RC = pt1_RC+1;

       RCA1H  = *pt1_RC;               /*set RCA1H register*/
       pt1_RC = pt1_RC+1;
       RCA1L  = *pt1_RC;               /*set RCA1L register*/
       pt1_RC = pt1_RC+1;

       RCA2H  = *pt1_RC;               /*set RCA2H register*/
       pt1_RC = pt1_RC+1;
       RCA2L  = *pt1_RC;               /*set RCA2L register*/

       if ((RCR&0x05)==0x01){          /*if use RC vector 1 in RAM area*/
          pt1_RC = (char *)0xF010;     /*set program code address in F010H*/
          pt2_RC = (char *)0x0100;     /*point to RC vector 1 address*/
          transmit_pro_code();         /*transmit program code to RC vector 1*/
       }
       if ((RCR&0x06)==0x02){          /*if use RC vector 2 in RAM area*/
          pt1_RC = (char *)0xF030;     /*set program code address in F030H*/
          pt2_RC = (char *)0x0120;     /*point to RC vector 2 address*/
          transmit_pro_code();         /*transmit program code to RC vector 2*/
       }
    }
}
/************************************************************************
Name       : transmit_pro_code
Function   : transmit program code to RC vector in RAM if use them
************************************************************************/
void transmit_pro_code(void){

zpage unsigned char k = 0x00;
    for(k=0;k<32;k++){                  /*loop for transmitting program code*/
       *pt2_RC = *pt1_RC;               /*execute transmitting*/
       pt1_RC++;                        /*blank ROM area address increase*/
       pt2_RC++;                        /*RC vector address increase*/
    }
}
```

6. 参考文献

硬件手册

38D2 群数据手册

（最新版本请从瑞萨科技网页上取得）

技术信息/技术更新

（最新信息请从瑞萨科技网页上取得）

公司主页和咨询窗口

瑞萨科技公司主页

http://www.cn.renesas.com

咨询

http://www.cn.renesas.com/inquiry

contact.china@renesas.com

修订记录

Rev.	发行日	修订内容	
		页	要点
1.00	2006.04.25	—	初版发行
1.01	2008.03.17	14	增加咨询邮箱地址，修改硬件手册名称
		16－17	更新版权声明

Notes regarding these materials

1. This document is provided for reference purposes only so that Renesas customers may select the appropriate Renesas products for their use. Renesas neither makes warranties or representations with respect to the accuracy or completeness of the information contained in this document nor grants any license to any intellectual property rights or any other rights of Renesas or any third party with respect to the information in this document.
2. Renesas shall have no liability for damages or infringement of any intellectual property or other rights arising out of the use of any information in this document, including, but not limited to, product data, diagrams, charts, programs, algorithms, and application circuit examples.
3. You should not use the products or the technology described in this document for the purpose of military applications such as the development of weapons of mass destruction or for the purpose of any other military use. When exporting the products or technology described herein, you should follow the applicable export control laws and regulations, and procedures required by such laws and regulations.
4. All information included in this document such as product data, diagrams, charts, programs, algorithms, and application circuit examples, 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 products listed in this document, please confirm the latest product information with a Renesas sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas such as that disclosed through our website. (http://www.renesas.com)
5. Renesas has used reasonable care in compiling the information included in this document, but Renesas assumes no liability whatsoever for any damages incurred as a result of errors or omissions in the information included in this document.
6. When using or otherwise relying on the information in this document, you should evaluate the information in light of the total system before deciding about the applicability of such information to the intended application. Renesas makes no representations, warranties or guaranties regarding the suitability of its products for any particular application and specifically disclaims any liability arising out of the application and use of the information in this document or Renesas products.
7. With the exception of products specified by Renesas as suitable for automobile applications, Renesas products are not designed, manufactured or tested for applications or otherwise in systems the failure or malfunction of which may cause a direct threat to human life or create a risk of human injury or which require especially high quality and reliability such as safety systems, or equipment or systems for transportation and traffic, healthcare, combustion control, aerospace and aeronautics, nuclear power, or undersea communication transmission. If you are considering the use of our products for such purposes, please contact a Renesas sales office beforehand. Renesas shall have no liability for damages arising out of the uses set forth above.
8. Notwithstanding the preceding paragraph, you should not use Renesas products for the purposes listed below:
   (1) artificial life support devices or systems
   (2) surgical implantations
   (3) healthcare intervention (e.g., excision, administration of medication, etc.)
   (4) any other purposes that pose a direct threat to human life
   Renesas shall have no liability for damages arising out of the uses set forth in the above and purchasers who elect to use Renesas products in any of the foregoing applications shall indemnify and hold harmless Renesas Technology Corp., its affiliated companies and their officers, directors, and employees against any and all damages arising out of such applications.
9. You should use the products described herein within the range specified by Renesas, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas shall have no liability for malfunctions or damages arising out of the use of Renesas products beyond such specified ranges.
10. Although Renesas endeavors to improve the quality and reliability of its products, IC products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Please be sure to implement safety measures to guard against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas 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 applicable measures. Among others, since the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
11. In case Renesas products listed in this document are detached from the products to which the Renesas products are attached or affixed, the risk of accident such as swallowing by infants and small children is very high. You should implement safety measures so that Renesas products may not be easily detached from your products. Renesas shall have no liability for damages arising out of such detachment.
12. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written approval from Renesas.
13. Please contact a Renesas sales office if you have any questions regarding the information contained in this document, Renesas semiconductor products, or if you have any other inquiries.

注意

本文只是参考译文，前页所载英文版“Cautions”具有正式效力。

关于利用本资料时的注意事项

1. 本资料是为了让用户根据用途选择合适的本公司产品的参考资料，对于本资料中所记载的技术信息，并非意味着对本公司或者第三者的知识产权及其他权利做出保证或对实施权力进行的承诺。
2. 对于因使用本资料所记载的产品数据、图、表、程序、算法及其他应用电路例而引起的损害或者对第三者的知识产权及其他权利造成侵犯，本公司不承担任何责任。
3. 不能将本资料所记载的产品和技术用于大规模破坏性武器的开发等目的、军事目的或其他的军需用途方面。另外，在出口时必须遵守日本的《外汇及外国贸易法》及其他出口的相关法令并履行这些法令中规定的必要手续。
4. 本资料所记载的产品数据、图、表、程序、算法以及其他应用电路例等所有信息均为本资料发行时的内容，本公司有可能在未做事先通知的情况下，对本资料所记载的产品或者产品规格进行更改。所以在购买和使用本公司的半导体产品之前，请事先向本公司的营业窗口确认最新的信息并经常留意本公司通过公司主页（http://www.renesas.com）等公开的最新信息。
5. 对于本资料中所记载的信息，制作时我们尽力保证出版时的精确性，但不承担因本资料的叙述不当而致使顾客遭受损失等的任何相关责任。
6. 在使用本资料所记载的产品数据、图、表等所示的技术内容、程序、算法及其他应用电路例时，不仅要对所使用的技术信息进行单独评价，还要对整个系统进行充分的评价。请顾客自行负责，进行是否适用的判断。本公司对于是否适用不负任何责任。
7. 本资料中所记载的产品并非针对万一出现故障或是错误运行就会威胁到人的生命或给人体带来危害的机器、系统(如各种安全装置或者运输交通用的、医疗、燃烧控制、航天器械、核能、海底中继用的机器和系统等)而设计和制造的，特别是对于品质和可靠性要求极高的机器和系统等（将本公司指定用于汽车方面的产品用于汽车时除外）。如果要用于上述的目的，请务必事先向本公司的营业窗口咨询。另外，对于用于上述目的而造成的损失等，本公司概不负责。
8. 除上述第7项内容外，不能将本资料中记载的产品用于以下用途。如果用于以下用途而造成的损失，本公司概不负责。
   1）生命维持装置。
   2）植埋于人体使用的装置。
   3）用于治疗（切除患部、给药等）的装置。
   4）其他直接影响到人的生命的装置。
9. 在使用本资料所记载的产品时，对于最大额定值、工作电源电压的范围、放热特性、安装条件及其他条件请在本公司规定的保证范围内使用。如果超出了本公司规定的保证范围使用时，对于由此而造成的故障和出现的事故，本公司将不承担任何责任。
10. 本公司一直致力于提高产品的质量和可靠性，但一般来说，半导体产品总会以一定的概率发生故障、或者由于使用条件不同而出现错误运行等。为了避免因本公司的产品发生故障或者错误运行而导致人身事故和火灾或造成社会性的损失，希望客户能自行负责进行冗余设计、采取延烧对策及进行防止错误运行等的安全设计（包括硬件和软件两方面的设计）以及老化处理等，这是作为机器和系统的出厂保证。特别是单片机的软件，由于单独进行验证很困难，所以要求在顾客制造的最终的机器及系统上进行安全检验工作。
11. 如果把本资料所记载的产品从其载体设备上卸下，有可能造成婴儿误吞的危险。顾客在将本公司产品安装到顾客的设备上时，请顾客自行负责将本公司产品设置为不容易剥落的安全设计。如果从顾客的设备上剥落而造成事故时，本公司将不承担任何责任。
12. 在未得到本公司的事先书面认可时，不可将本资料的一部分或者全部转载或者复制。
13. 如果需要了解关于本资料的详细内容，或者有其他关心的问题，请向本公司的营业窗口咨询。