R8C/25 Group

Power Control

REJ05B1064-0102
Rev.1.02
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1. Abstract

This document describes a power control program using stop mode.

2. Introduction

The application example described in this document applies to the following MCU and parameter(s):

- MCU : R8C/25 Group
- Oscillation frequency : 20 MHz

This program can be used with other R8C/Tiny Series MCUs which have the same special function registers (SFRs) as the R8C/25 Group. Check the manual for any additions and modifications to functions. Careful evaluation is recommended before using this application note.

3. Application Example Description

The power control specifications are as follows.

(1) The power control mode is switched by key input. The display changes depending on the mode.
The following pins are used for key input:
S2 : “L” active, P1_7
S3 : “L” active, P4_5/$\overline{\text{INT0}}$

(2) After reset is deasserted, the MCU enters high-speed clock mode (no division mode) by a program.

(3) When S2 is pressed during high-speed clock mode (no division mode), the MCU enters stop mode (mode = 1) by a program. If S2 is continuously at a “L” level three times for each 10-ms interval, it is determined as S2 was pressed. Timer RA is used to measure 10 ms.

(4) When S3 is pressed during stop mode, the MCU returns to normal operating mode (mode = 0) by an $\overline{\text{INT0}}$ interrupt. After exiting stop mode, the MCU enters high-speed clock mode (divided-by-8 mode). The MCU enters high-speed clock mode (no division mode) by a program.

This sample program may include operations of unused bit functions for the SFR bit layout. Set these values according to the operating conditions of the user system.

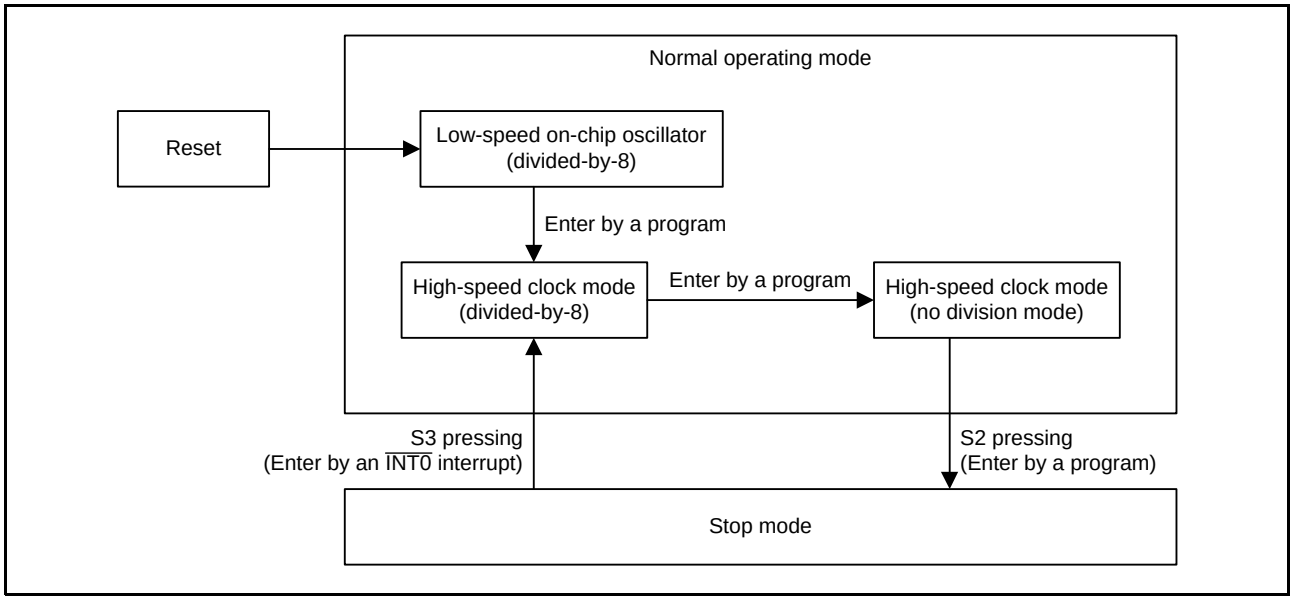


Figure 3.1 Mode Transition

3.1 Pin Usage

Table 3.1 Pin Usage and Functions

Pin	I/O	Function
P1_7	Input	S2 input
P4_5/INT0	Input	S3 input

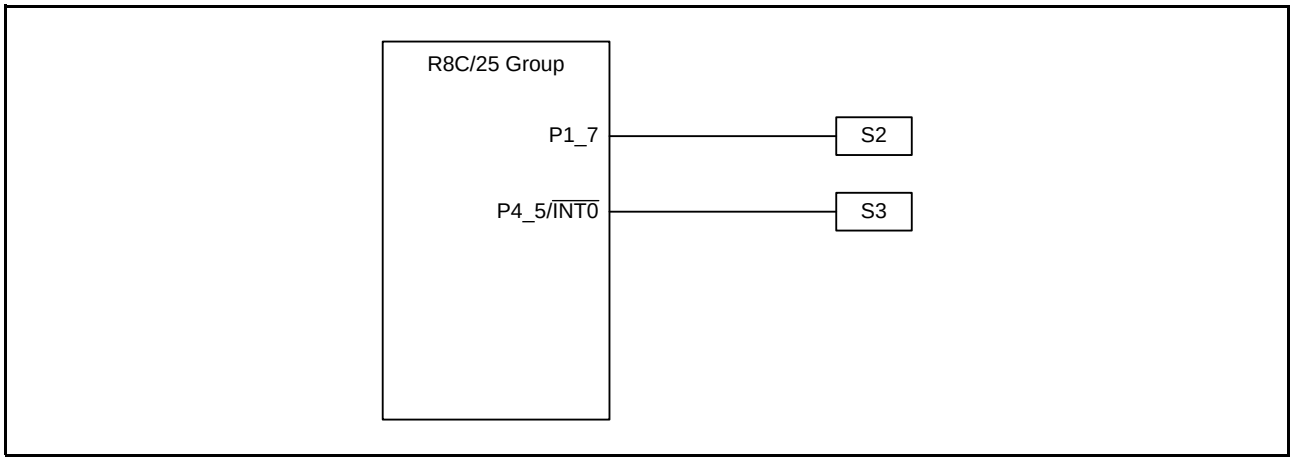


Figure 3.1 Key Input

3.2 Memory Usage

Table 3.2 Memory Usage

Memory Usage	Size	Remark
ROM	343 bytes	In main.c module
RAM	2 bytes	In main.c module
Maximum user stack usage	10 bytes	main function: 7 bytes sfr_init function: 3 bytes key_in function: 3 bytes power_control function: 3 bytes
Maximum interrupt stack usage	18 bytes	int_INT0 function: 18 bytes

Memory usage varies depending on the C compiler version and the compile option.
The above applies under the following conditions:

- C compiler: M16C/60, 30, 20, 10, Tiny, R8C/Tiny Series Compiler V.5.40 Release 00
- Compile option: -c -finfo; NOTE: -dir “$(CONFIGDIR)” -R8C

NOTE: Unavailable in the R8C/Tiny-exclusive free version.

Table 3.3 RAM Usage and Definition

Symbol	Type	Size	Content
mode	unsigned char	1 byte	Mode control
s2_bit	unsigned char	1 byte	S2 input information

4. Setup

This section shows the initial setting procedures and values to perform the example described in "**3. Application Example Description**". Refer to the **R8C/25 Group Hardware Manual** for details on individual registers.

4.1 Stop Mode

Figure 4.1 shows the Mode Entry Procedure.

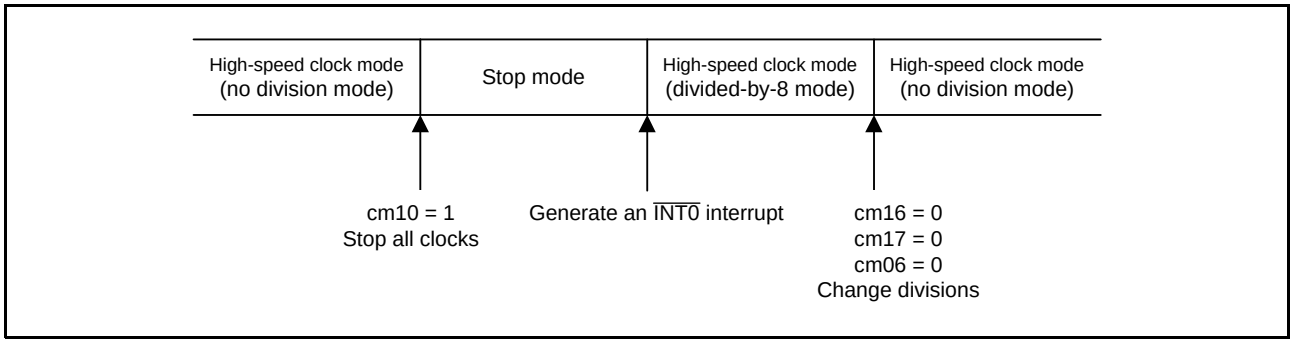
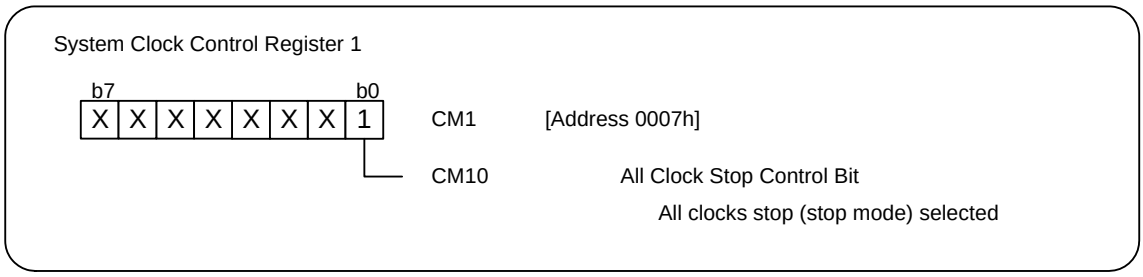


Figure 4.1 Mode Entry Procedure

All clocks stop by setting the all clock stop control bit (CM10) in the system clock control register 1 (CM1) to "1: All clocks stop (stop mode)". This allows the MCU to enter stop mode.



After exiting stop mode, the MCU enters high-speed clock mode (divided-by-8). The following procedures allows the MCU to enter high-speed clock mode (no division mode):

(1) Set the system clock division select bits 1(CM17, CM16) to “00: No division mode”.

System Clock Control Register 1

b7							b0
0	0	X	X	X	X	X	X

CM1 [Address 0007h]

CM17, CM16 System Clock Division Select Bits

No division mode selected

(2) Set the system clock division select bit 0(CM06) to “0: CM16, CM17 enabled)”.

System Clock Control Register 0

b7							b0
X	0	X	X	X	X	X	X

CM0 [Address 0006h]

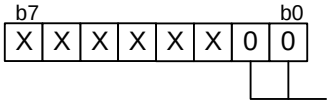
CM06 System Clock Division Select Bit 0

CM16, CM17 enabled selected

4.2 $\overline{\text{INT0}}$ Interrupt (Exiting Stop Mode)

To exit stop mode, an $\overline{\text{INT0}}$ interrupt generated by S3 pressing is used. The $\overline{\text{INT0}}$ interrupt is enabled before entering stop mode. The following settings allow an interrupt request to be generated at a falling edge of the $\overline{\text{INT0}}$ pin.

$\overline{\text{INT}}$ Input Filter Select Register

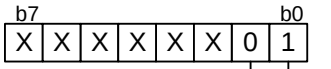


INTF [Address 00FAh]

INT0F1, INT0F0 $\overline{\text{INT0}}$ Input Filter Select Bits

No filter selected

External Input Enable Register



INTEN [Address 00F9h]

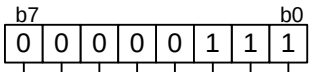
INT0EN $\overline{\text{INT0}}$ Input Enable Bit

Enabled selected

INT0PL $\overline{\text{INT0}}$ Input Polarity Select Bit

One edge selected

$\overline{\text{INT0}}$ Interrupt Control Register



INT0IC [Address 005Dh]

ILVL2 to ILVL0 Interrupt Priority Level Select Bits

Level 7 selected

IR Interrupt Request Bit

No interrupt request selected

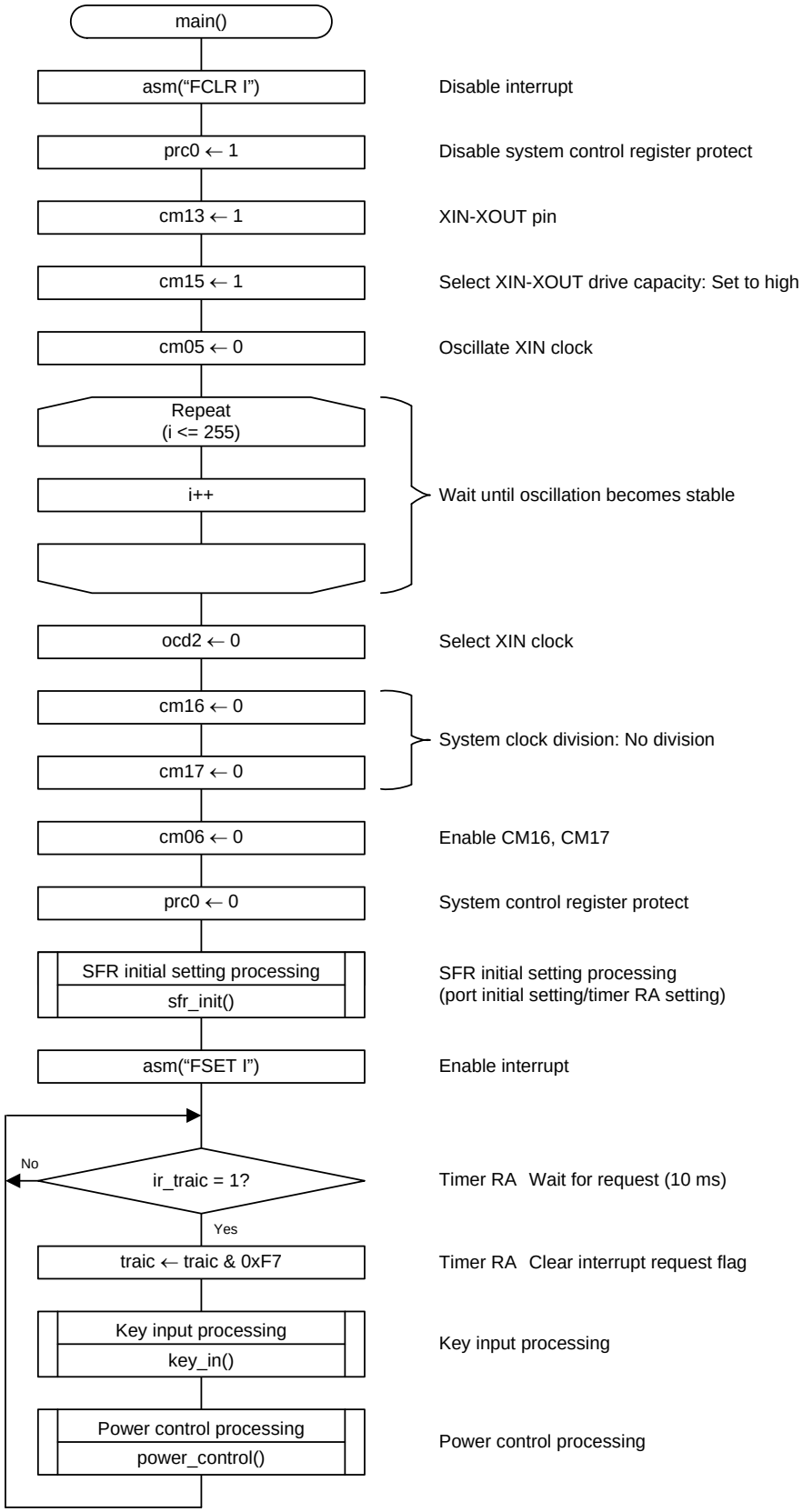
POL Polarity Switch Bit

Falling edge selected

— Unavailable. Set to 0.

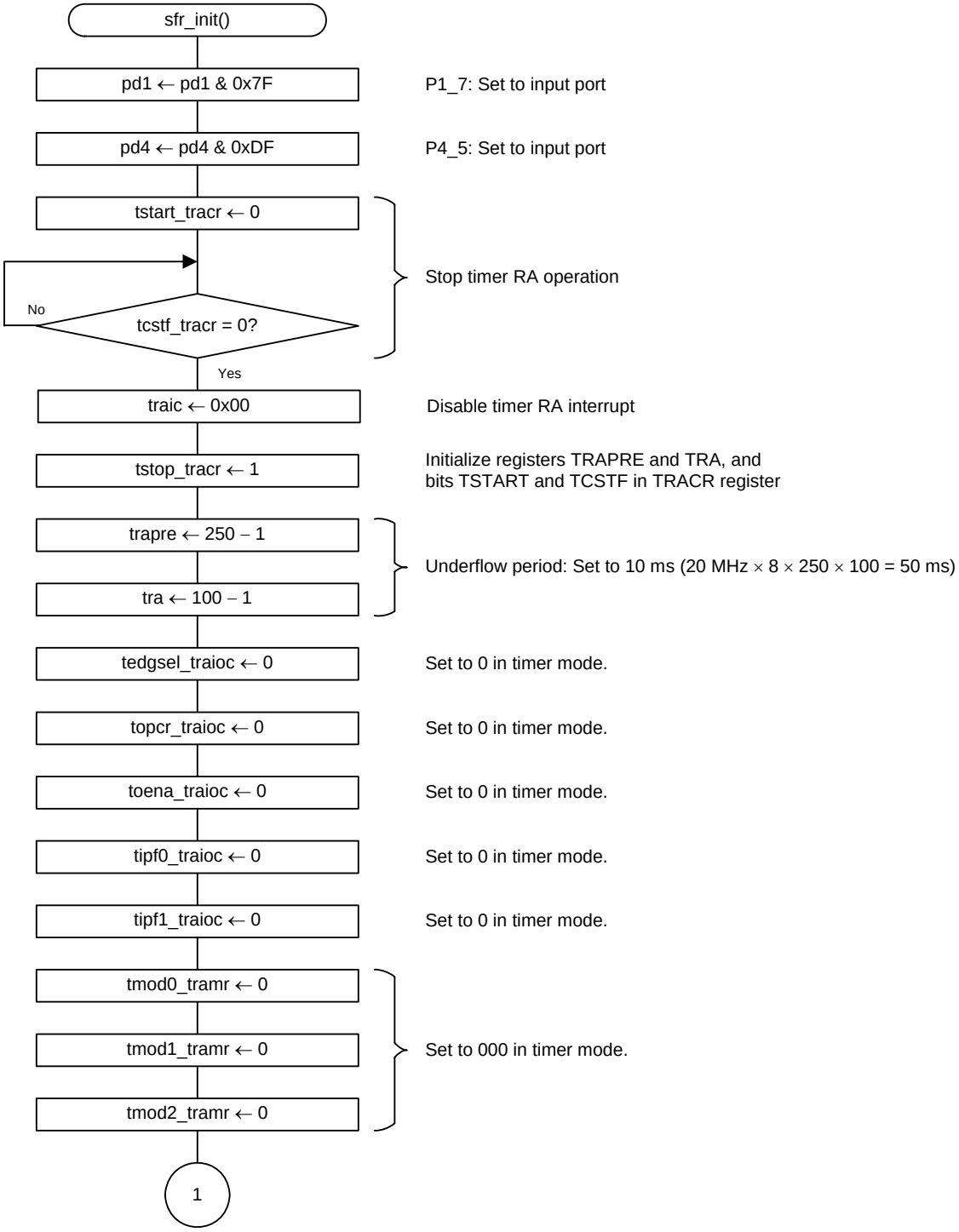
5. Flowchart

5.1 Main Function

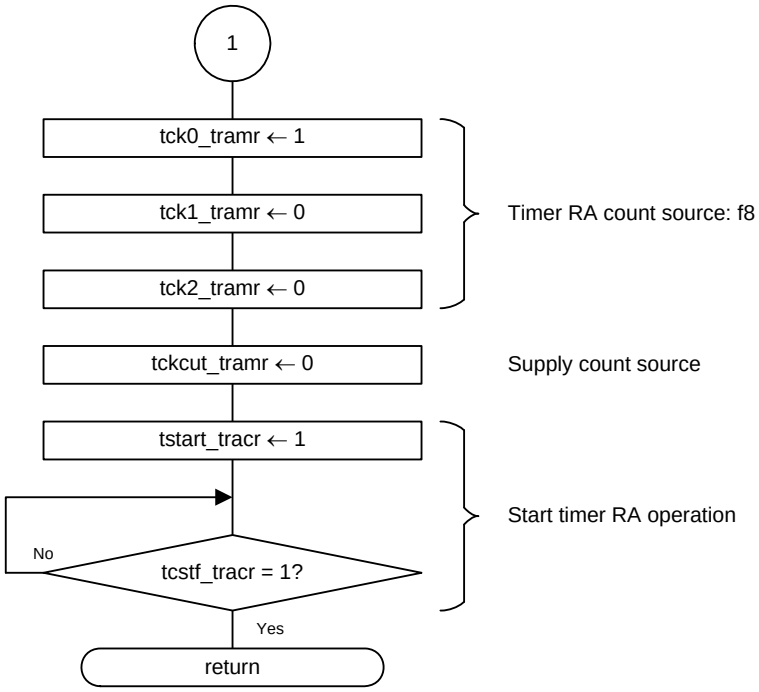


5.2 SFR Initial Setting Processing

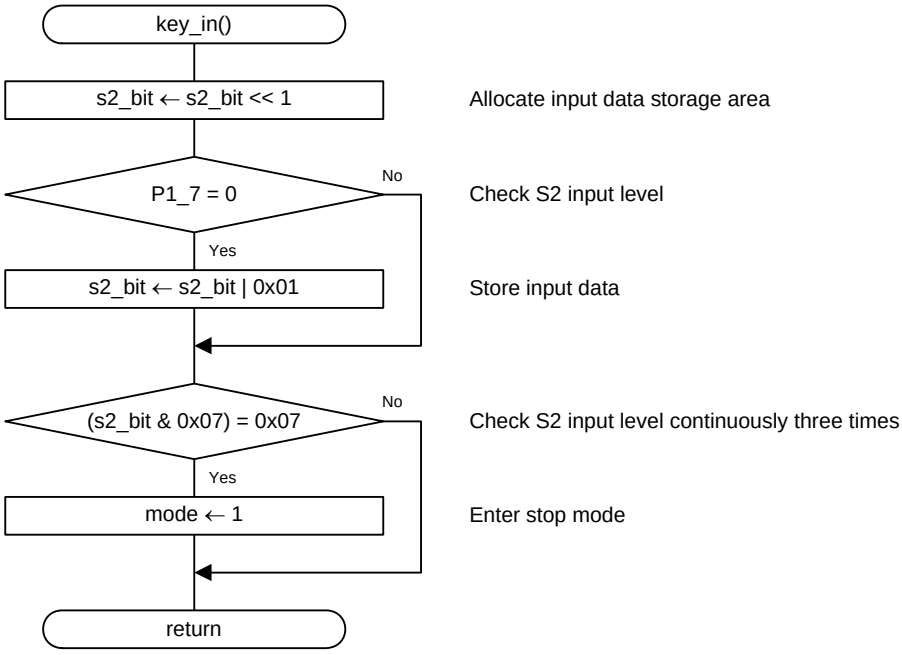
5.2.1 SFR Initial Setting Processing 1



5.2.2 SFR Initial Setting Processing 2

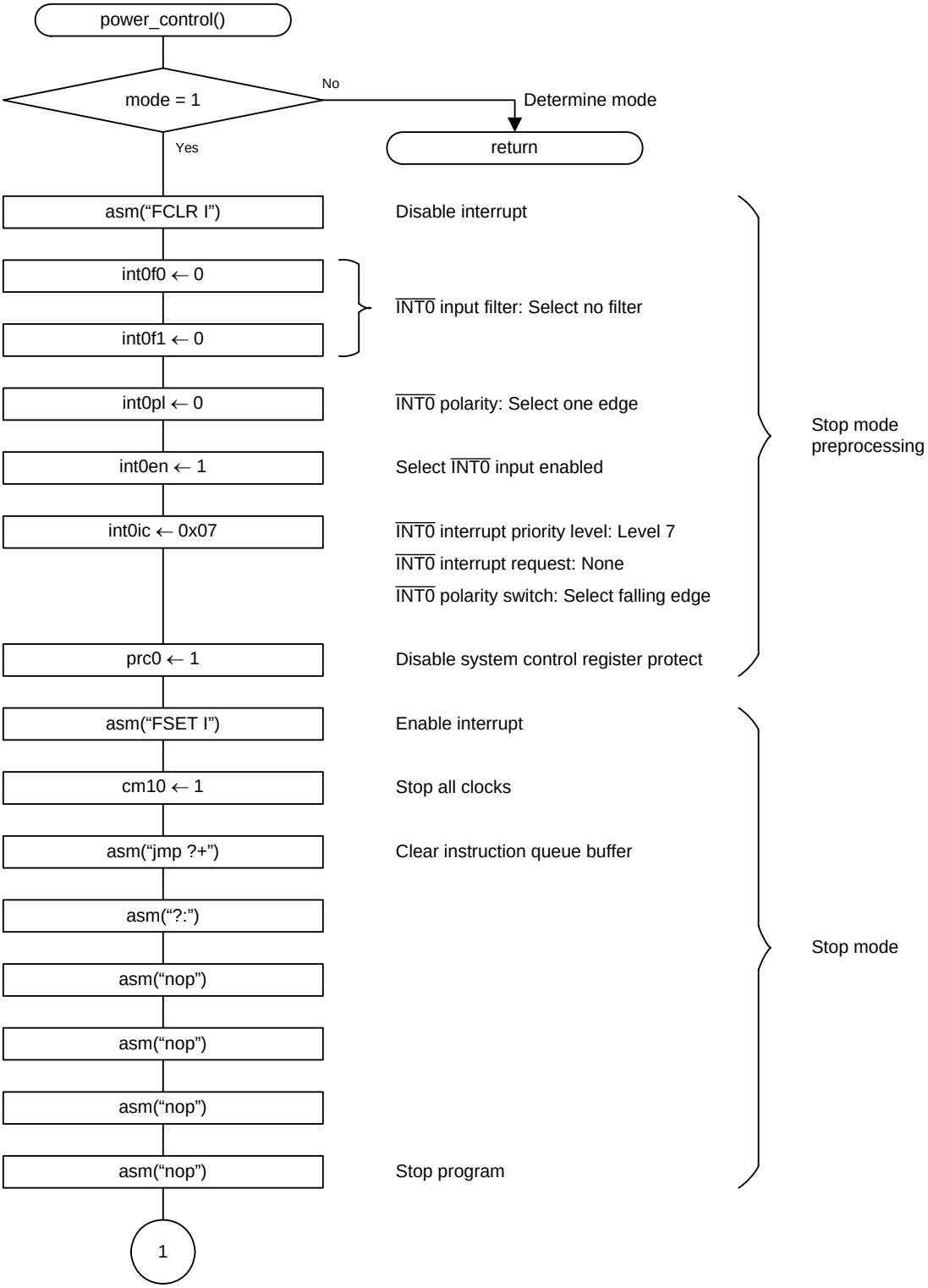


5.3 Key Input Processing

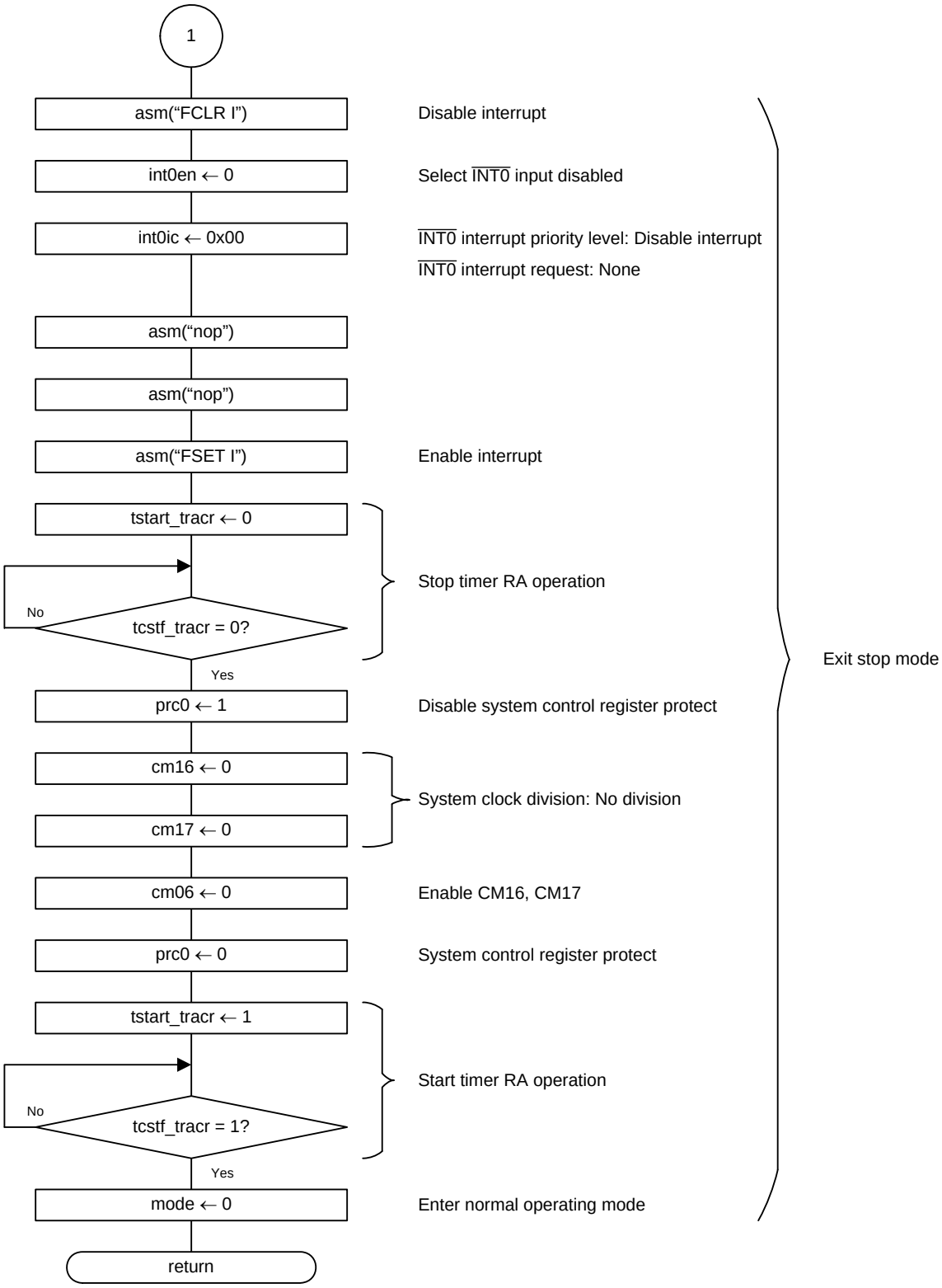


5.4 Power Control Processing

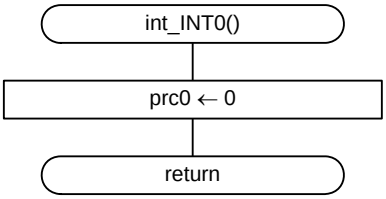
5.4.1 Power Control Processing 1



5.4.2 Power Control Processing 2



5.5 $\overline{\text{INT0}}$ Interrupt Handling



System control register protect

6. Sample Program

A sample program can be downloaded from the Renesas Electronics website.
To download, click “Application Notes” in the left-hand side menu of the R8C Family page.

7. Reference Documents

Hardware Manual
R8C/25 Group Hardware Manual
The latest version can be downloaded from the Renesas Electronics website.

Technical Update/Technical News
The latest information can be downloaded from the Renesas Electronics website.

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Revision History	R8C/25 Group Power Control

Rev.	Date	Description	
		Page	Summary
1.00	Mar. 30, 2007	—	First edition issued
1.02	Nov. 30, 2010	11	Power control processing changed

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 part number, confirm that the change will not lead to problems.

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

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