

RH850/U2C Group

Real time clock (RTCA) Application Note

Summary

This application note summarizes operation examples using Real Time Clock (RTCA). The RTCA program is assumed to be located in the user area.

This document and program are intended to help users understand the functions implemented in the RH850/U2C and are not intended for use in mass production design.

In addition, it does not reflect the latest manuals, errata, technical updates, or updates to the development environment. When using the relevant functions, treat this program as a reference only and use the latest documentation and development environment at your own risk.

Applicable device

This document applies to RH850/U2Cx.

【Note】 When downloading to the Configuration Setting Area, set the desired option bytes in “set_csa.c”, enable downloading, and then rewrite the option bytes.
For details, refer to the RH850/U2C Series Startup Application Note.

- (1) Select "***** (Debug Tool)" from the project tree.
- (2) Select the “Download file settings” tab.
- (3) “Allow downloads to the Configuration Setting Area” = set to “Yes”

Contents

1. Introduction.....	3
1.1 Functions Used.....	3
2. Operation Example	4
2.1 Basic Operation	4
2.1.1 Specification Overview	4
2.1.2 System Configuration	4
2.1.3 Software Description	4
2.2 Recovery from Standby Mode (STOP Mode) by Alarm Occurrence	8
2.2.1 Overview of Specifications	8
2.2.2 System Configuration	8
2.2.3 Software Description	8
4. Revision Record	12

1. Introduction

This application note provides information on how to use the Real Time Clock (RTCA) module on the RH850/U2Cx and examples of software development.

1.1 Functions Used

The hardware functions of RH850/U2Cx used in this application note are shown below.

- Real Time Clock (RTCA)

2. Operation Example

2.1 Basic Operation

2.1.1 Specification Overview

In this operation example, the time information is updated every one second, an interrupt is generated, and a pulse is output from a port pin.

The RTC operates in 12-hour mode, and the initial time is set to 8:00:00 a.m. on August 1, 2025.

A fixed periodic interrupt is generated every one second to blink LED0.

A pulse is also output from RTCA0OUT every one second.

The alarm time is set to 8:03:00 a.m. on August 1, 2025, which is three minutes after the initial time.

When the alarm occurs, an alarm interrupt is generated, and LED1 turns on.

2.1.2 System Configuration

Figure 2-1 shows the system configuration.

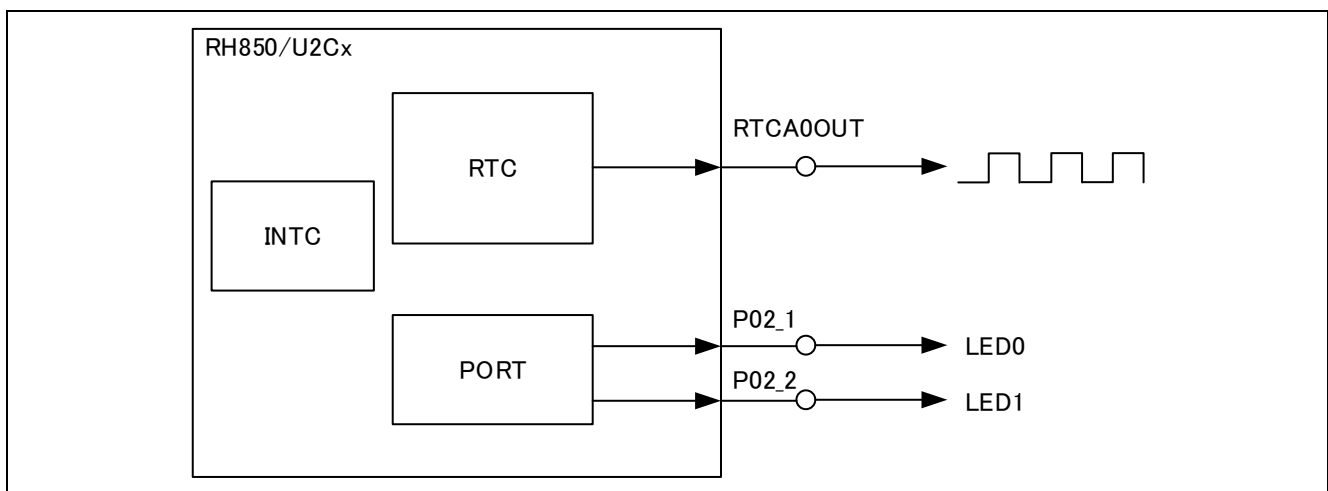


Figure 2-1 System Configuration

2.1.3 Software Description

- Module Description

Table 2-1 shows the list of modules used in this operation example.

Table 2-1 Module List

Module Name	Function Name	Function
Main Routine	main_pm0	Performs various settings and starts the application.
Port Initialization Routine	port_init	Initializes the ports.
RTCA Initialization Routine	rtca_init	Initializes the RTCA.
RTCA Start Routine	rtca_start	Starts the RTCA.
Interrupt Function Initial Setting Routine	intc_init	Configures the RTCA interrupt.
Fixed Periodic Interrupt Processing	rtca_0r_int	Blinks LED0 in the fixed periodic interrupt.
Alarm Interrupt Processing	rtca_alm_int	Turns on LED1 in the alarm interrupt.

-

- Register Settings

The register settings for each function in this operation example are shown below.

Table 2-2 RTC ch0 Register

Register Name	Setting Value	Function
RTCA0CTL0	0x10	Operation Start: Enabled
		Mode Selection: 12-hour mode
		Frequency Selection Mode
RTCA0CTL1	0x33	1 Hz Pulse Output: Enabled
		Alarm Interrupt: Enabled
		Fixed Periodic Interrupt: Enabled (1 second)
RTCA0SCMP	0x00008050	Subcounter Compare Value: 0x00008050
RTCA0YEAR	0x25	Year information: 2025
RTCA0MONTH	0x08	Month information: August
RTCA0DAY	0x01	Date information: 1
RTCA0WEEK	0x02	Week information: Tuesday
RTCA0HOUR	0x08	Hour information: 8
RTCA0MIN	0x00	Minute information: 0
RTCA0SEC	0x00	Second information: 0
RTCA0ALW	0x04	Weekday Alarm: Tuesday
RTCA0ALH	0x08	Hour Alarm: 8
RTCA0ALM	0x03	Minute Alarm: 3

Table 2-3 System Register Settings

Register Name	Setting Value	Function
SYSCTRLCLKKCPROT1	0xA5A5A501	Protection Release
SYSCTRLCKS_ARTCAC	0x00000001	Clock Source Selection: CLK_LSIOSC

Table 2-4 Interrupt Register Settings

Register Name	Setting Value	Function
EIBD235	0x00000000	Bind Fixed Periodic Interrupt to PE0 (CPU0)
EIBD234	0x00000000	Bind Alarm Interrupt to PE0 (CPU0)
EIC233	0x0040	Table Reference / Priority Level 0
EIC234	0x0040	Table Reference / Priority Level 0

Table 2-5 Port Register Settings

Register Name	Setting Value	Function
PORT0.PCR02_1	0x00000000	Set P02_1 as General-Purpose Port
PORT0.PCR02_2	0x00000000	Set P02_2 as General-Purpose Port

- Operation Flow

The flowchart of this operation example is shown below.

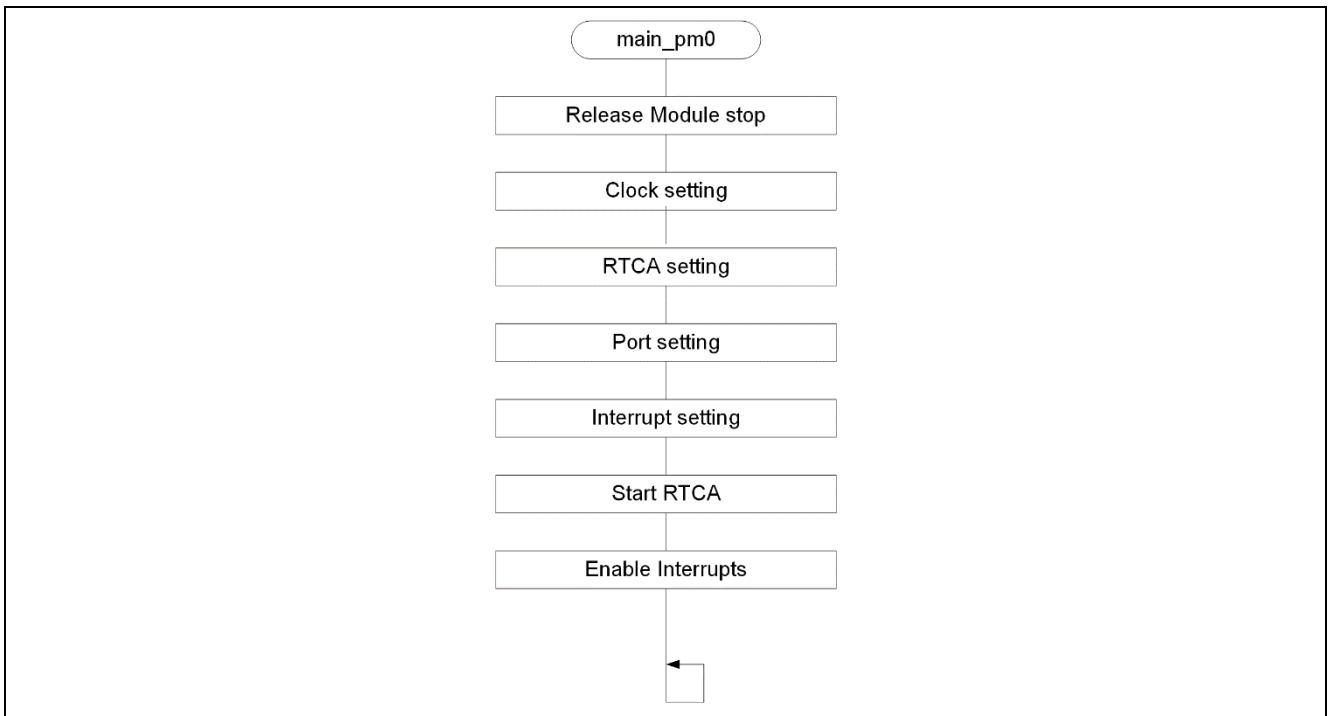


Figure 2-2 Main Function Flowchart

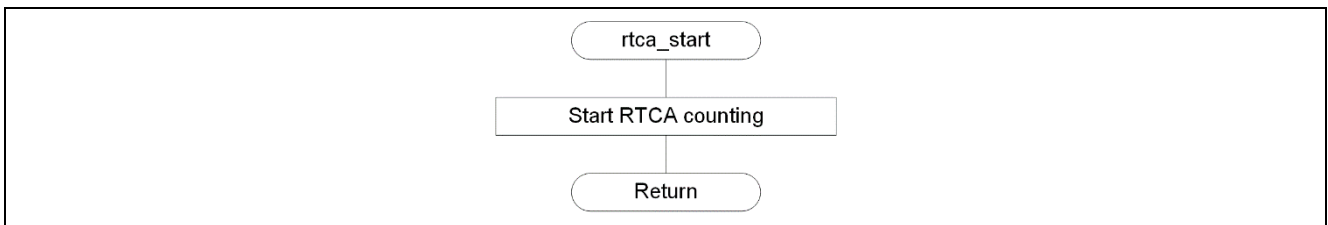


Figure 2-2 RTCA Start Function Flowchart

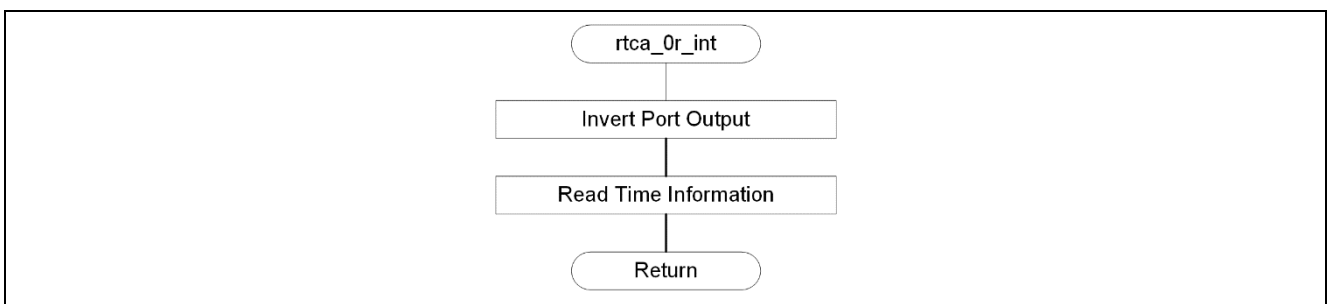


Figure 2-3 Fixed-Period Interrupt Function Flowchart

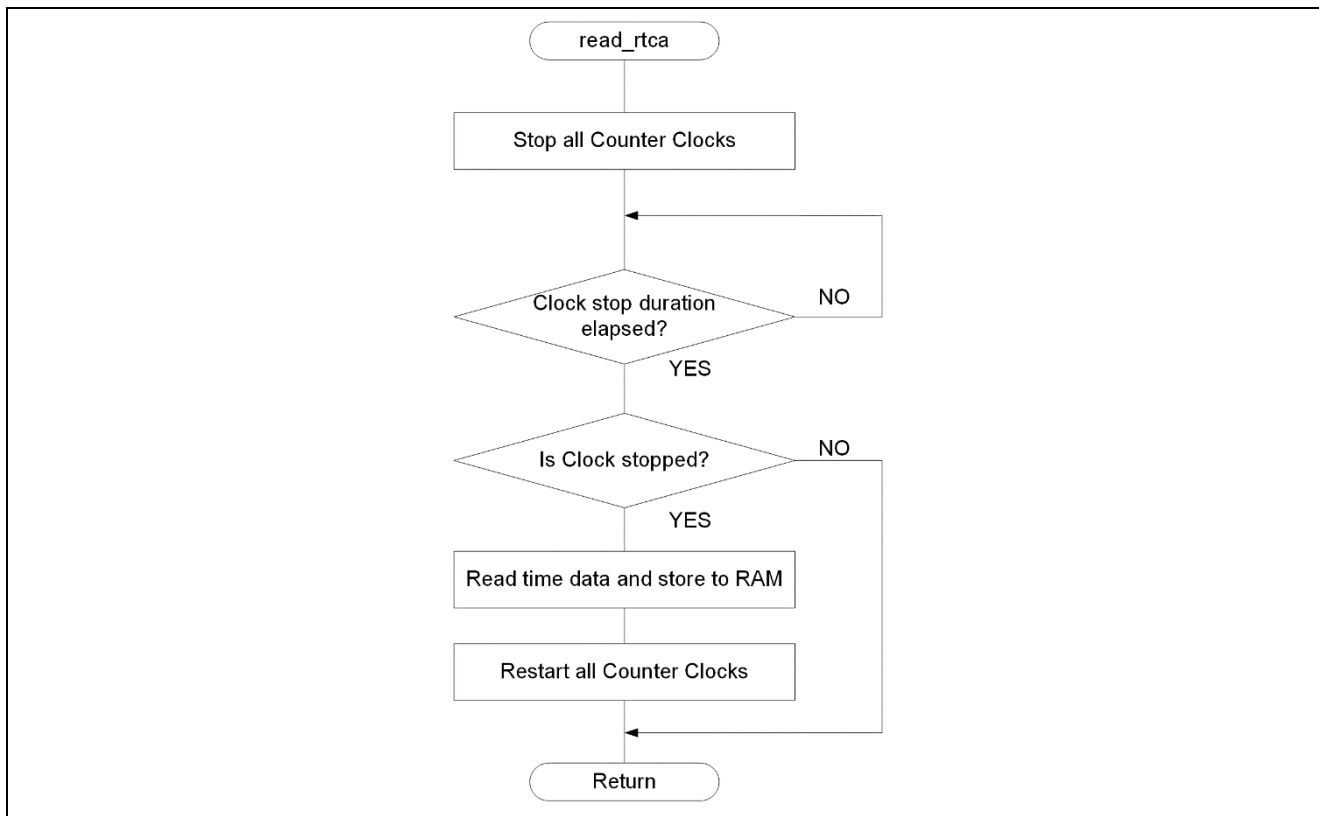


Figure 2-4 Time Information Read Function Flowchart

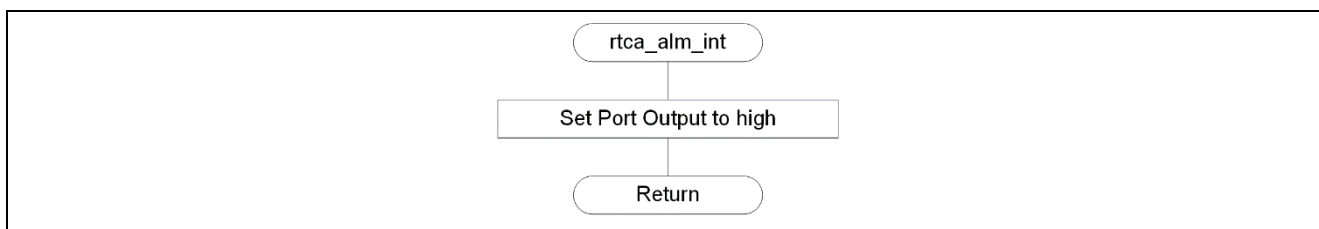


Figure 2-5 Alarm Interrupt Function Flowchart

2.2 Recovery from Standby Mode (STOP Mode) by Alarm Occurrence

2.2.1 Overview of Specifications

In this operation example, the recovery from standby mode (STOP mode) by RTCA alarm occurrence is performed.

The RTCA is used in 24-hour mode, and the initial time is set to 08:08:00 on August 8, 2025.

The alarm time is set to 08:09:00 on August 8, 2025, one minute after the initial time.

The wake-up source in STOP mode is configured to the RTCA alarm.

During STOP mode, the RTCA operation continues.

INTRTCA0S generates an interrupt every second to blink the LED.

2.2.2 System Configuration

Figure 2-7 shows the system configuration.

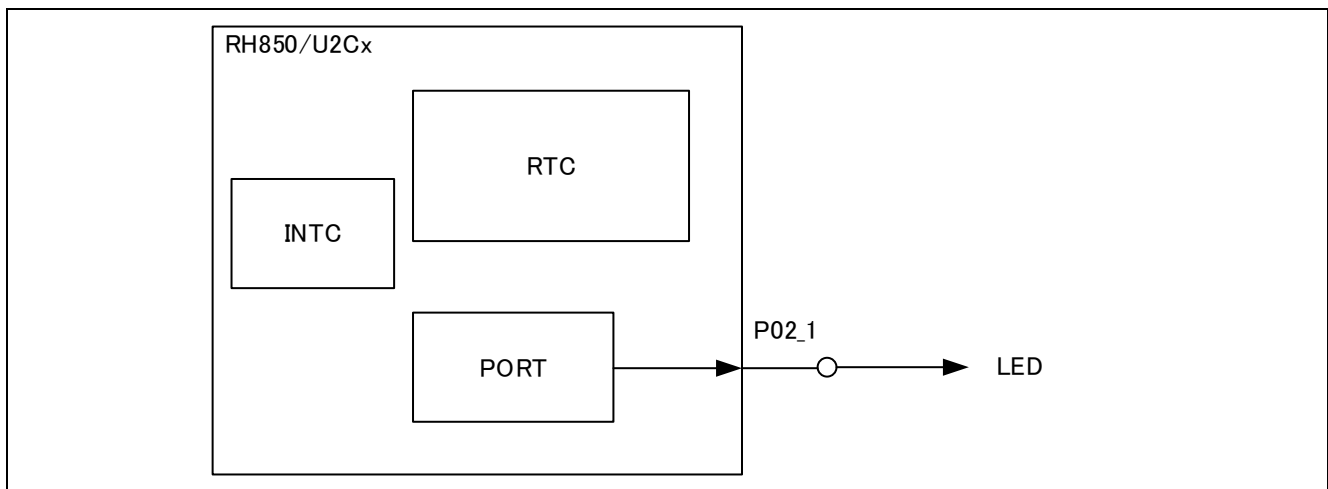


Figure 2-6 System Configuration

2.2.3 Software Description

- Module Description
- Table 2-6 shows the list of modules used in this operation example.

Table 2-6 Module List

Module Name	Function Name	Function
Main Routine	main_pm0	Performs various settings and starts the application.
Port Initialization Routine	port_init	Initializes the ports.
RTCA Initialization Routine	rtca_init	Initializes the RTCA.
Interrupt Function Initial Setting Routine	intc_init	Configures the RTCA interrupt.
1-second periodic interrupt processing	rtca_1s_int	Performs LED blinking processing by the INTRTCA0S interrupt. At the first execution, the system enters STOP mode and waits for wakeup by the alarm.

•

- Register Settings

The register settings for each function in this operation example are shown below.

Table 2-7 RTC ch0 Register

Register Name	Setting Value	Function
RTCA0CTL0	0x30	Operation Start: Enabled
		Mode Selection: 24-hour mode
		Frequency Selection Mode
RTCA0CTL1	0x18	1 Hz Pulse Output: Enabled
		Alarm Interrupt: Enabled
RTCA0SCMP	0x00008050	Subcounter Compare Value: 0x00008050
RTCA0YEAR	0x25	Year information: 2025
RTCA0MONTH	0x08	Month information: August
RTCA0DAY	0x08	Date information: 8
RTCA0WEEK	0x02	Week information: Tuesday
RTCA0HOUR	0x08	Hour information: 8
RTCA0MIN	0x08	Minute information: 8
RTCA0SEC	0x00	Second information : 0
RTCA0ALW	0x04	Weekday Alarm: Tuesday
RTCA0ALH	0x08	Hour Alarm: 8
RTCA0ALM	0x09	Minute Alarm: 9

Table 2-8 Standby Register Settings

Register Name	Setting Value	Function
STBCKCPROT	0xA5A5A501	Protection Release
STBC0STPT	0x00000001	Transition to STOP Mode

Table 2-9 System Register Settings

Register Name	Setting Value	Function
SYSCTRLCLKKCPROT1	0xA5A5A501	Protection Release
SYSCTRLCKS_ARTCAC	0x00000001	Clock Source Selection: CLK_LSIOSC
SYSCTRLWUFMSK0_A2	0xFFFFEFFF	Wake-up Cause: INTRTCA0AL
SYSCTRLWUFC0_A0	0xFFFFFFFF	Wake-up Cause Clear
SYSCTRLWUFC0_A1	0xFFFFFFFF	Wake-up Cause Clear
SYSCTRLWUFC0_A2	0xFFFFFFFF	Wake-up Cause Clear

Table 2-10 Interrupt Register Settings

Register Name	Setting Value	Function
EIBD233	0x00000000	Bind 1-second periodic interrupt to PE0 (CPU0)
EIC233	0x0040	Table Reference / Priority Level 0

Table 2-11 Port Register Settings

Register Name	Setting Value	Function
PORT0.PCR02_1	0x00001000	Set P02_1 as General-Purpose Port

- Operation Flow

The flowchart of this operation example is shown below.

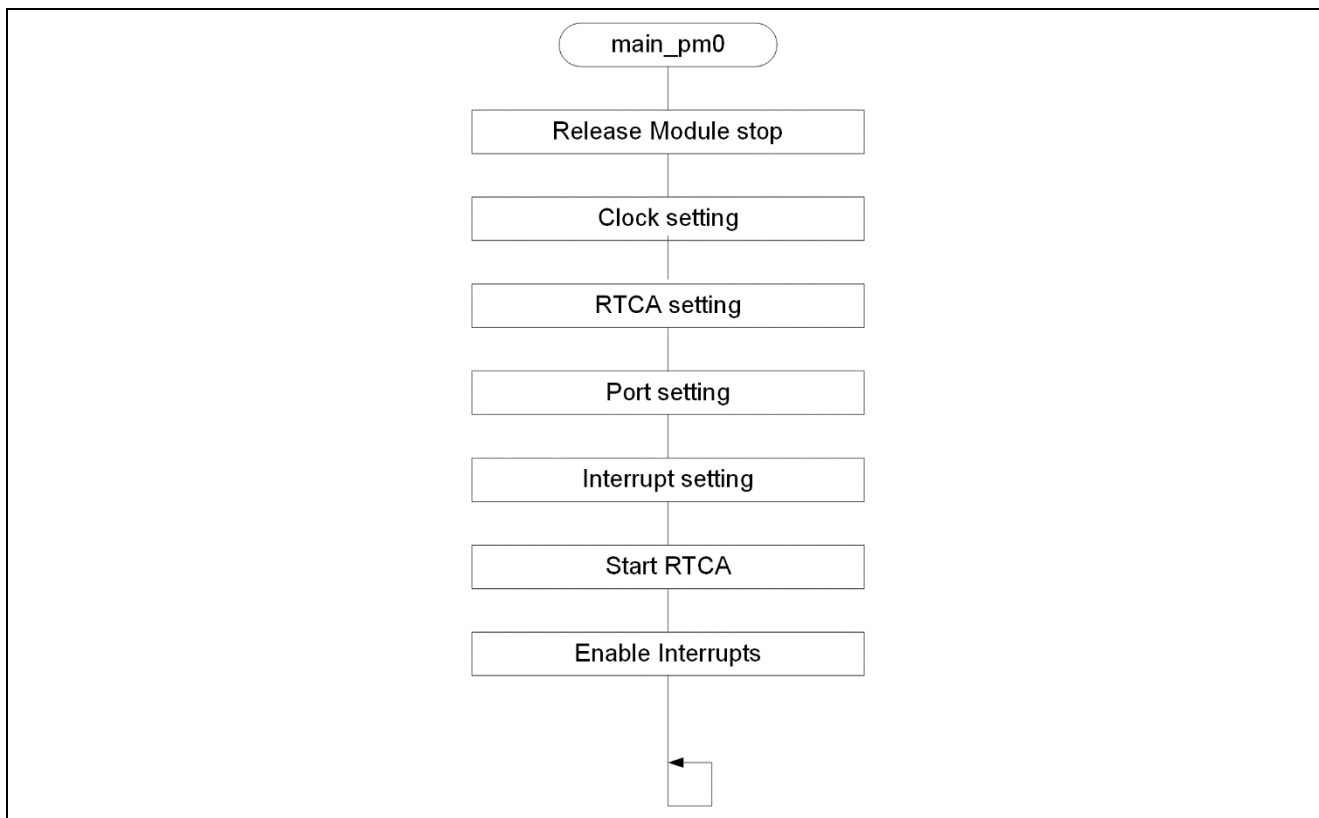


Figure 2-7 Main Function Flowchart

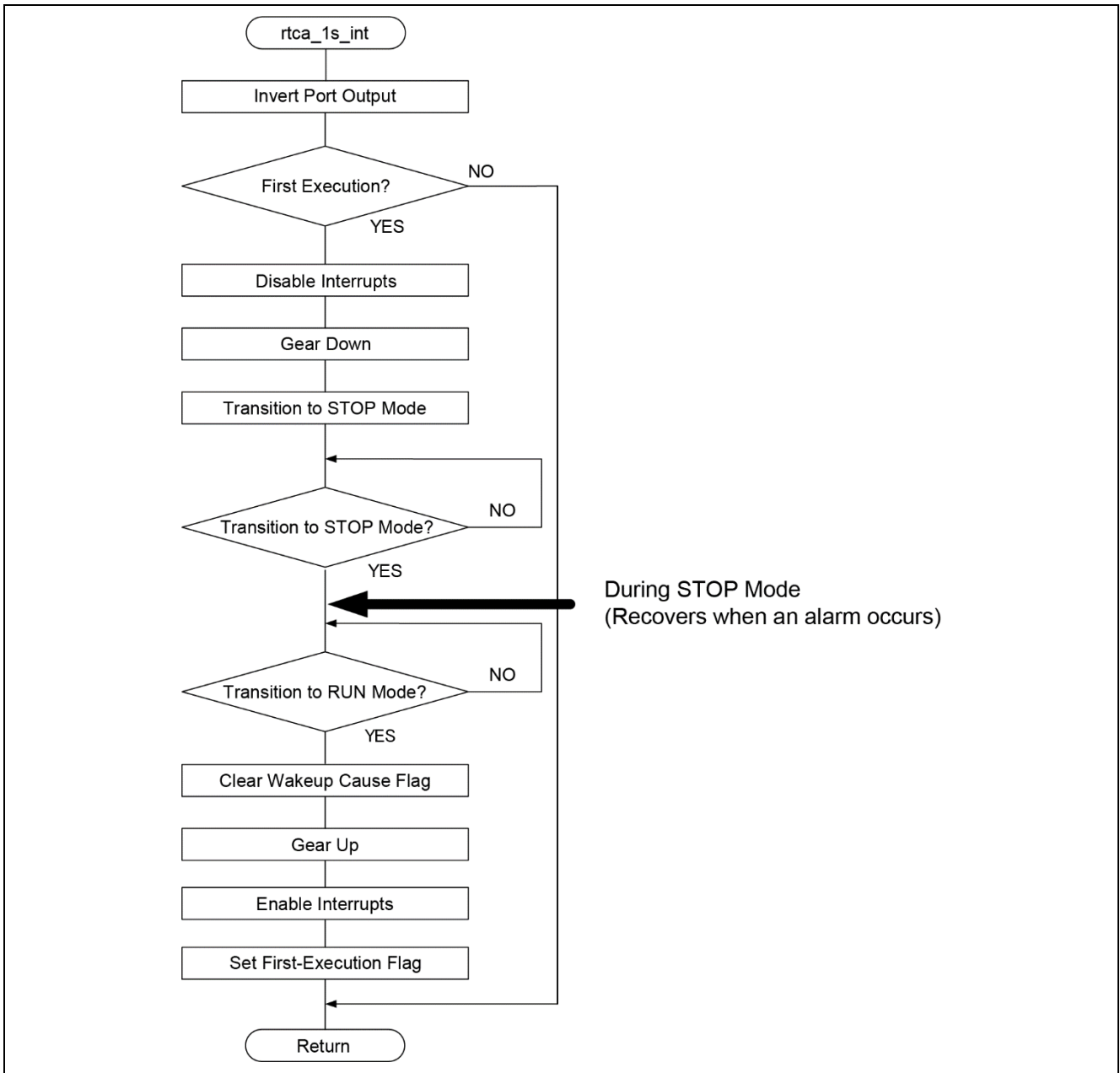


Figure 2-8 Flowchart of 1-Second Periodic Interrupt Function

4. Revision Record

Rev.	Issue date	Revised contents	
		Page	Points
1.00	Dec. 24, 2025	Pages	First edition

General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)

A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

2. Processing at power-on

The state of the product is undefined at the time 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 time 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 time 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 time when power is supplied until the power reaches the level at which resetting is specified.

3. Input of signal during power-off state

Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

4. Handling of unused pins

Handle unused pins in accordance 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 the 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.

5. Clock signals

After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is 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. Additionally, 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.

6. Voltage application waveform at input pin

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).

7. Prohibition of access to reserved addresses

Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

8. Differences between products

Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

Notice

1. 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 or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving 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, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall be responsible for determining what licenses are required from any third parties, and obtaining such licenses for the lawful import, export, manufacture, sales, utilization, distribution or other disposal of any products incorporating Renesas Electronics products, if required.
5. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
6. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.

"Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.

"High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.

Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.
7. No semiconductor product is absolutely secure. Notwithstanding any security measures or features that may be implemented in Renesas Electronics hardware or software products, Renesas Electronics shall have absolutely no liability arising out of any vulnerability or security breach, including but not limited to any unauthorized access to or use of a Renesas Electronics product or a system that uses a Renesas Electronics product. RENESAS ELECTRONICS DOES NOT WARRANT OR GUARANTEE THAT RENESAS ELECTRONICS PRODUCTS, OR ANY SYSTEMS CREATED USING RENESAS ELECTRONICS PRODUCTS WILL BE INVULNERABLE OR FREE FROM CORRUPTION, ATTACK, VIRUSES, INTERFERENCE, HACKING, DATA LOSS OR THEFT, OR OTHER SECURITY INTRUSION ("Vulnerability Issues"). RENESAS ELECTRONICS DISCLAIMS ANY AND ALL RESPONSIBILITY OR LIABILITY ARISING FROM OR RELATED TO ANY VULNERABILITY ISSUES. FURTHERMORE, TO THE EXTENT PERMITTED BY APPLICABLE LAW, RENESAS ELECTRONICS DISCLAIMS ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO THIS DOCUMENT AND ANY RELATED OR ACCOMPANYING SOFTWARE OR HARDWARE, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE.
8. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, 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 and impractical, you are responsible for evaluating the safety of the final products or systems 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. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. Renesas Electronics products and technologies shall 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. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
12. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
13. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
14. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.

(Note2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.5.0-1 October 2020)

Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan

www.renesas.com

Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

Contact information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:

www.renesas.com/contact/.