RH850/U2B Group

R01AN7073EJ0100
Rev.1.00

RTCA Application Note

Summary

This application note summarizes the operation example uses the real time clock (RTCA) of RH850/U2Bx

The operation examples described in this application note have been confirmed to operate, be sure to confirm the operation before using them.

Items

1. Introduction

This application note describes the usage and farm ware of the real time clock (RTCA) in RH850/U2Bx.

1.1 Usage

The following shows the hardware function of RH850/U2Bx used in this application note.

- Real Time Clock (RTCA)

2. Operation Example

2.1 Basic Operation

2.1.1 Specification Overview

In this operation example, the time information updating, the interrupt occurrence, and the pulse outputting from the pin are performed every 1 second.

Set “2023, August 1st, 08:00:00” to the initial time by using 12-hour format.

Signal LED0 by occurring INTRTCA0R interrupt every 1 second.

Output the pulse from RTCA0OUT every 1 second.

Set “2023, August 1st, 08:03:00” to the alarm time after 3 minutes form the initial time.

Signal LED1 by occurring the alarm interrupt.

2.1.2 System Configuration

Figure 2-1 shows the system configuration.

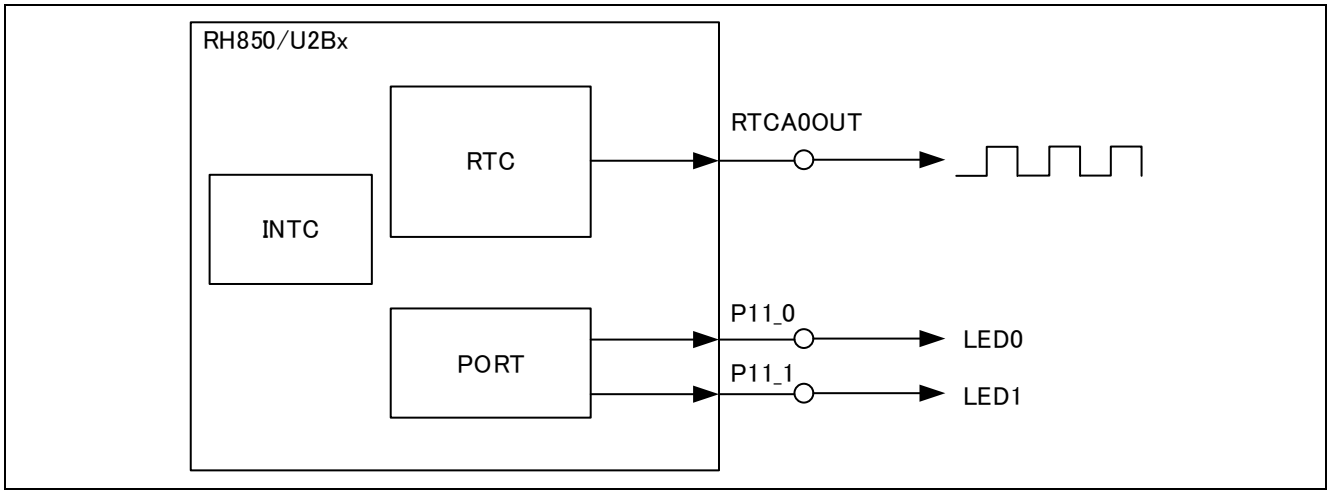

Figure 2-1 System Configuration

2.1.3 Software Explanation

- Module Explanation

The following shows the module list in this operation example.

Table 2-1 Module List

Module Name	Function Name	Function
Main routine	main_pe0	Perform various setting and application startup.
Port initialization routine	port_init	Initialize port.
RTCA initialization routine	rtca_init	Initialize RTCA.
RTCA start routine	rtca _start	Start RTCA.
Interrupt function initialization routine	intc_init	Perform RTCA interrupt setting.
RTCA interrupt processing	rtca_0r_int	Perform signal processing of LED0 by RTCA cycle interrupt.
Alarm interrupt processing	rtca_alm_int	Perform signal processing of LED1 by alarm interrupt.

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- Register Setting

The following shows the register setting of various function in this operation example.

Table 2-2 RTC ch0 Register

Register Name	Setting Value	Function
RTCA0CTL0	0x10	Operation start : Enable
		Mode selection : 12-hour format
		Frequency selection mode
RTCA0CTL1	0x33	1Hz pulse output : Enable
		Alarm interrupt : Enable
		Cycle interrupt : Enable (1 second)
RTCA0SCMP	0x0003D3B4	Sub counter comparison value : 0x0003D3B4
RTCA0YEAR	0x23	Years : 2023
RTCA0MONTH	0x08	Months : August
RTCA0DAY	0x01	Day of month : 1st
RTCA0WEEK	0x02	Day of week : Tuesday
RTCA0HOUR	0x08	Hours : 08
RTCA0MIN	0x00	Minutes : 00
RTCA0SEC	0x00	Seconds : 00
RTCA0ALW	0x04	Day of week : Tuesday
RTCA0ALH	0x08	Hours : 08
RTCA0ALM	0x03	Minutes : 03

Table 2-3 System Register Setting

Register Name	Setting Value	Function
SYSCTRLCLKKCPROT1	0xA5A5A501	Protect release
SYSCTRLCKS_ARTCAC	0x00000001	Clock source selection : CLK_LSIOSC

Table 2-4 Interrupt Register Setting

Register Name	Setting Value	Function
EIBD971	0x00000000	Bind RTCA cycle interrupt to PE0 (CPU0).
EIBD972	0x00000000	Bind alarm interrupt to PE0 (CPU0).
EIC971	0x0040	Table reference / Priority level 0
EIC972	0x0040	Table reference / Priority level 0

Table 2-5 Port Register Setting

Register Name	Setting Value	Function
PORT0.PCR11_0	0x00000000	Set P11_0 to general-purpose port.
PORT0.PCR11_1	0x00000000	Set P11_1 to general-purpose port.

- Operation Flow

The following shows the flowchart in this operation example.

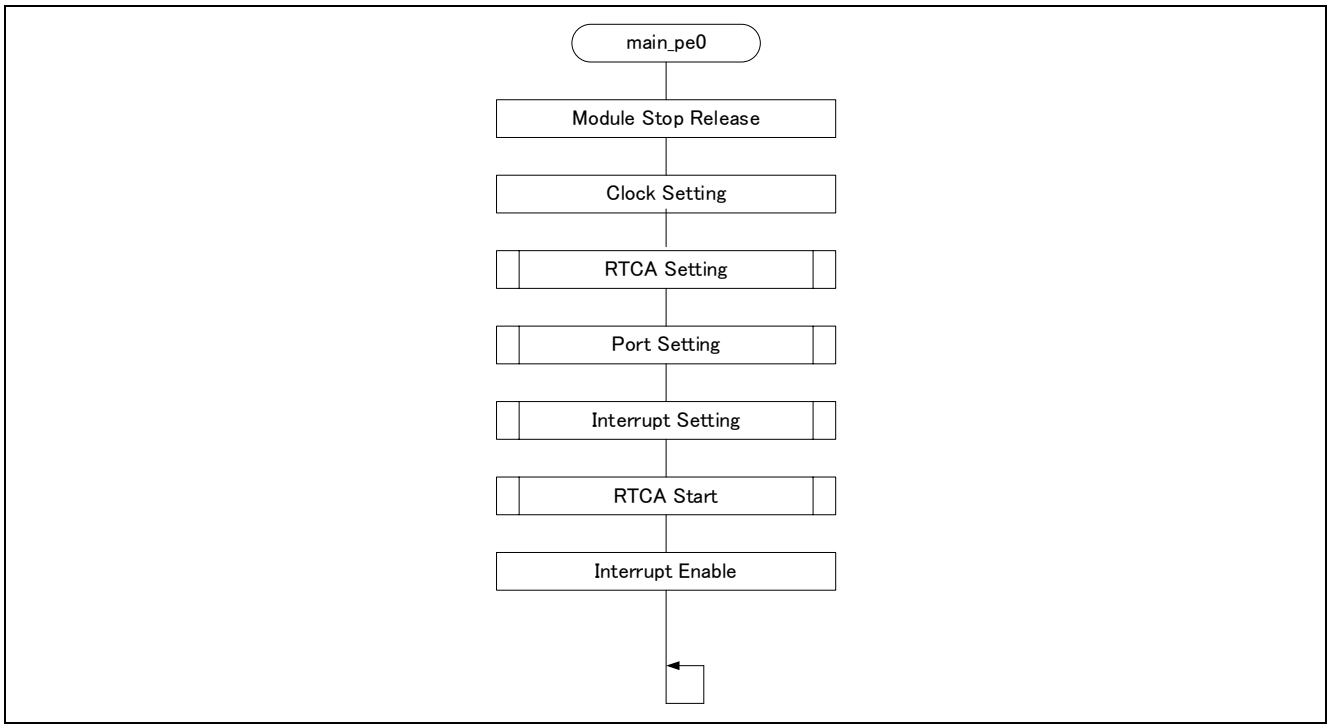

Figure 2-2 main Function Flowchart

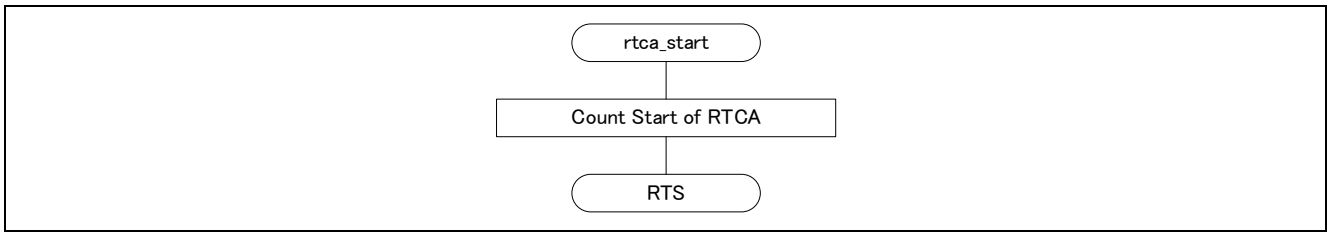

Figure 2-3 RTCA Start Function Flowchart

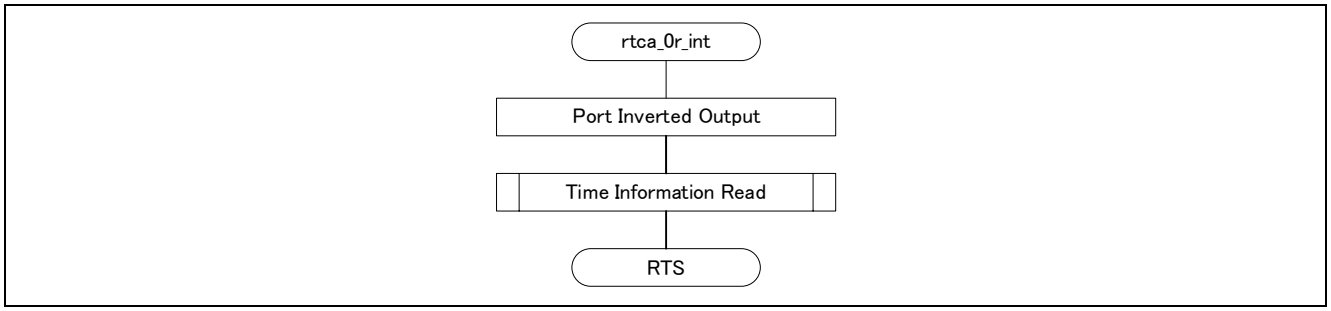

Figure 2-4 RTCA0R Interrupt Function Flowchart

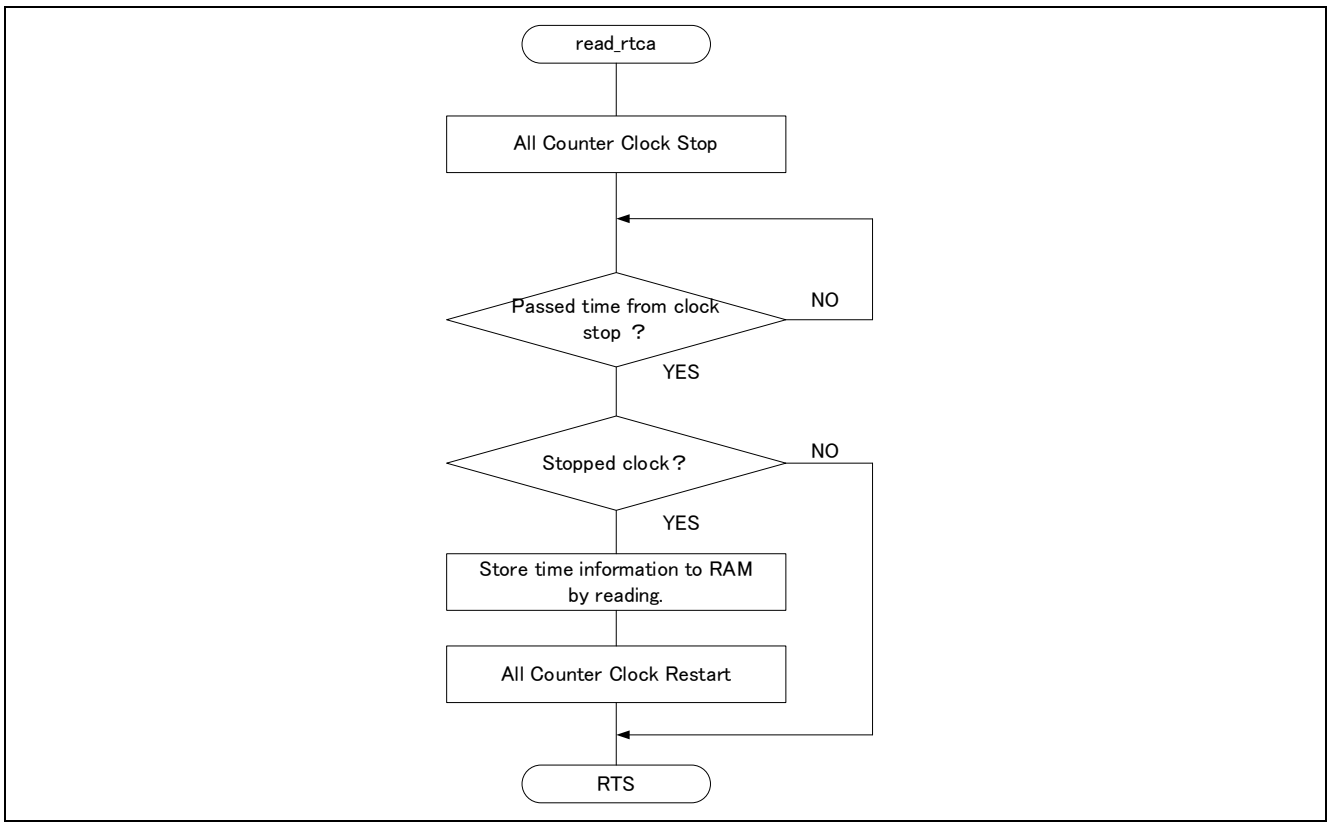

Figure 2-5 Time Information Read Function Flowchart

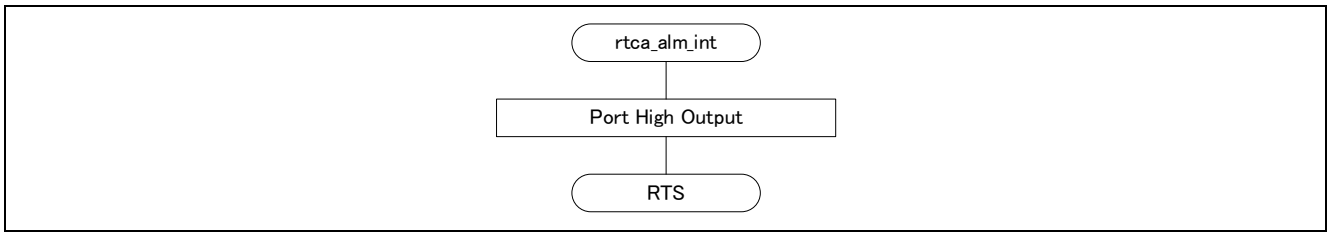

Figure 2-6 Alarm Interrupt Function Flowchart

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

2.2.1 Specification Overview

In this operation example, perform the recovery from standby mode by the alarm occurrence of RTCA.

Set “2023, August 8th, 08:08:00” to the initial time by using 24-hour format.

Set “2023, August 8th, 08:09:00” to the alarm time after 1 minutes form the initial time.

Set the wakeup factor of STOP mode to RTCA alarm.

In the stop mode, set to RTCA operation continuation.

Signal LED by occurring interrupt every 1 second by INTRTCA0S.

2.2.2 System Configuration

Table 2-7 shows the system configuration.

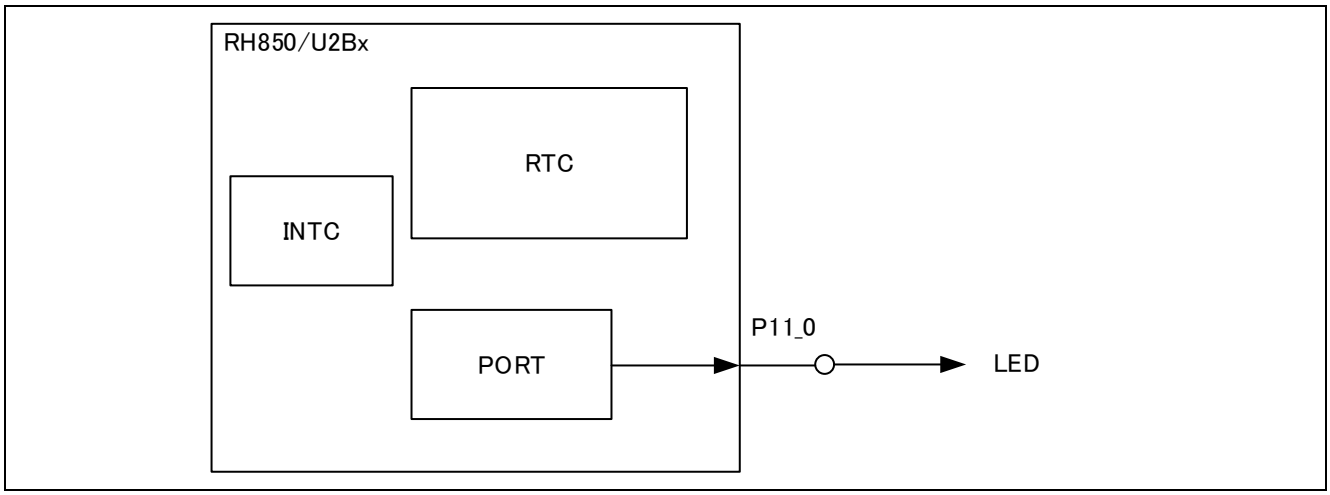

Figure 2-7 System Configuration

2.2.3 Software Explanation

- Module Explanation

The following shows the module list in this operation example.

Table 2-6 Module List

Module Name	Function Name	Function
Main routine	main_pe0	Perform various setting and application startup.
Port initialization routine	port_init	Initialize port.
RTCA initialization routine	rtca_init	Initialize RTCA.
Interrupt function initialization routine	intc_init	Perform RTCA interrupt setting.
RTCA interrupt processing	rtca_1s_int	Perform signal processing of LED by RTCA INTRTCA0S interrupt. Transfer to stop mode and wait until releasing alarm at the first time.

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- Register Setting

The following shows the register setting of various function in this operation example.

Table 2-7 RTC ch0 Register

Register Name	Setting Value	Function
RTCA0CTL0	0x30	Operation start : Enable
		Mode selection : 24-hour format
		Frequency selection mode
RTCA0CTL1	0x18	1Hz pulse output : Enable
		Alarm interrupt : Enable
RTCA0SCMP	0x0003D3B4	Sub-counter comparison value : 0x0003D3B4
RTCA0YEAR	0x23	Years : 2023
RTCA0MONTH	0x08	Months : August
RTCA0DAY	0x08	Day of month : 8st
RTCA0WEEK	0x02	Day of week : Tuesday
RTCA0HOUR	0x08	Hours : 08
RTCA0MIN	0x08	Minutes : 08
RTCA0SEC	0x00	Seconds : 00
RTCA0ALW	0x04	Day of week : Tuesday
RTCA0ALH	0x08	Hours : 08
RTCA0ALM	0x09	Minutes : 09

Table 2-8 Standby Register Setting

Register Name	Setting Value	Function
STBCKCPROT	0xA5A5A501	Protect release
STBC0STPT	0x00000001	STOP mode transfer

Table 2-9 System Register Setting

Register Name	Setting Value	Function
SYSCTRLCLKKCPROT1	0xA5A5A501	Protect release
SYSCTRLCKS_ARTCAC	0x00000001	Clock source selection : CLK_LSIOSC
SYSCTRLWUFMSK0_A2	0xFFFFEFFF	Wakeup factor : INTRTCA0AL
SYSCTRLWUFC0_A0	0xFFFFFFFF	Wakeup factor clear
SYSCTRLWUFC0_A1	0xFFFFFFFF	Wakeup factor clear
SYSCTRLWUFC0_A2	0xFFFFFFFF	Wakeup factor clear

Table 2-10 Interrupt Register Setting

Register Name	Setting Value	Function
EIBD970	0x00000000	Bind RTCA 1 second cycle interrupt to PE0 (CPU0).
EIC970	0x0040	Table reference / Priority level 0

Table 2-11 Port Register Setting

Register Name	Setting Value	Function
PORT0.PCR11_0	0x00001000	Set P11_0 to general-purpose port.

- Operation Flow

The following shows the flowchart in this operation example.

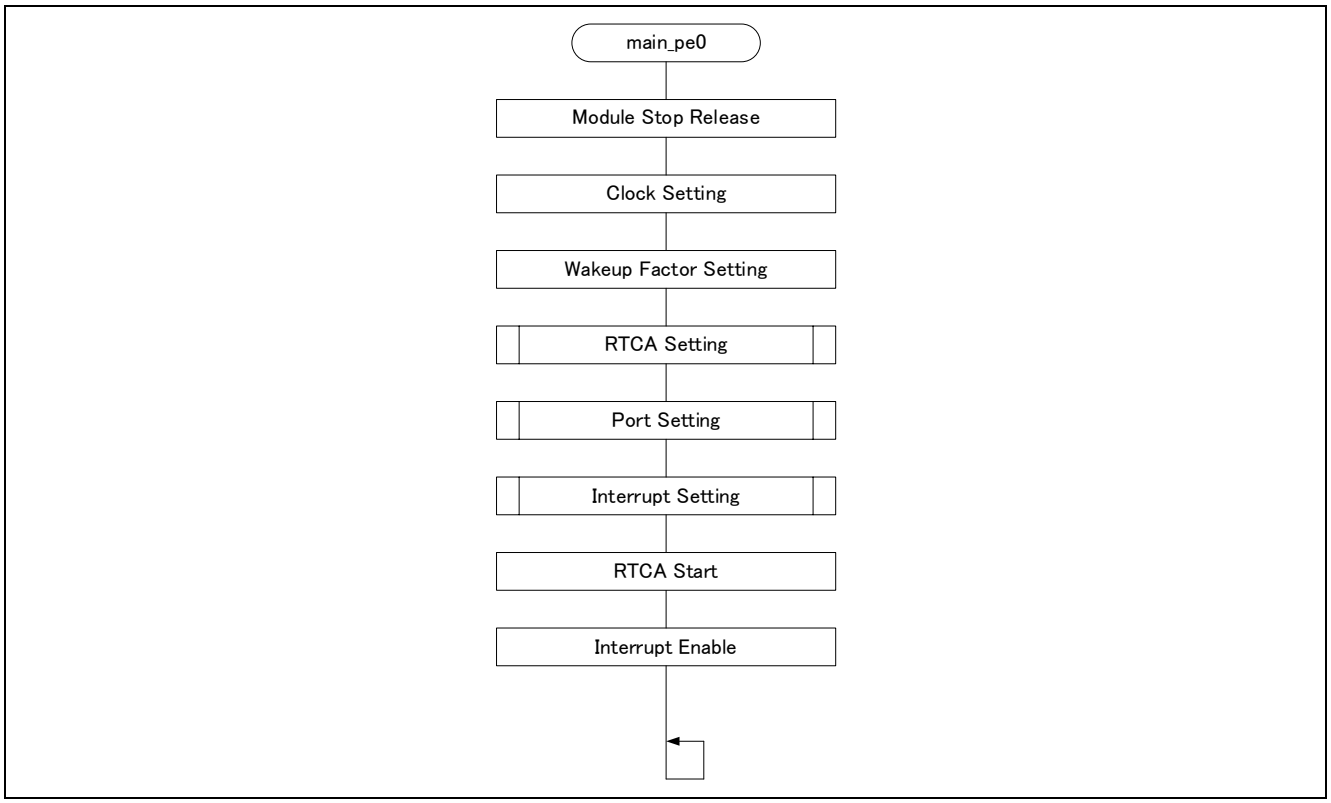

Figure 2-8 main Function Flowchart

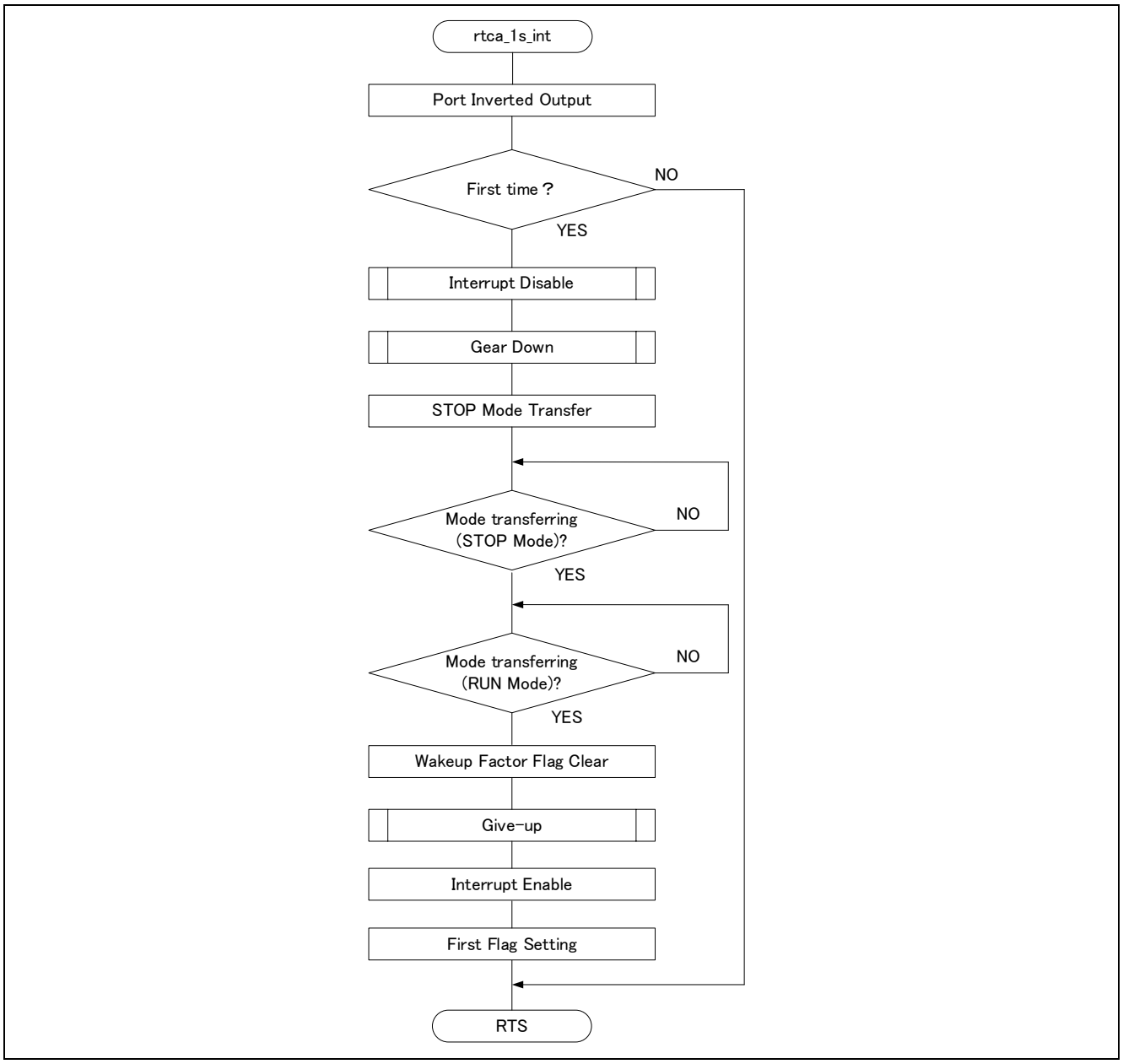

Figure 2-9 RTCA1S Interrupt Function Flowchart

Our Company's Website and Inquiry

Website
http://japan.renesas.com/

Inquiry
http://japan.renesas.com/contact/

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	2024.4.2	-	Initial edition

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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.).

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