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RENESAS TECHNICAL UPDATE

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

Product Category	MPU/MCU		Document No.	TN-RL*-A085A/E	Rev.	1.00
Title	RL78/I1C RTC with Independent Power Supply The Limitation Addition Regarding Simultaneous Use of Alarm Interrupt and Periodic Interrupt and Reading RTC Count		Information Category	Technical Notification		
Applicable Product	RL78/I1C R5F10Nxx	Lot No. All lots	Reference Document	RL78/I1C User's Manual: Hardware Rev. 1.00 R01UH0587EJ0100 May 27, 2016		

For RL78/I1C RTC with independent power supply, it is confirmed that the limitation needs to add on simultaneous use of alarm interrupt and periodic interrupt and reading RTC count.

The following limitation is added to the above applicable product user's manual. The precaution will be made for the next revision of the user's manual.

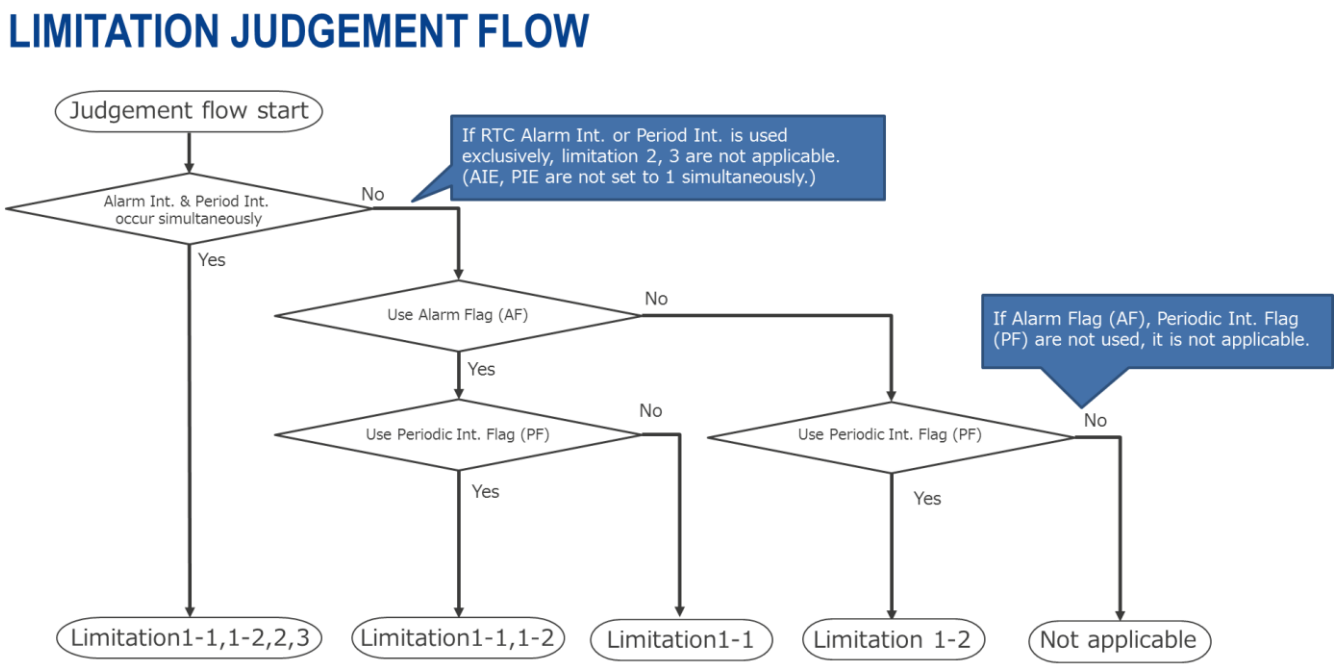
1. The Limitation Regarding Alarm Interrupt and Periodic Interrupt

1.1. Limitation

[Limitation Judgement Flow]

Figure 1 shows the judgement flow of the limitation using RTC with independent power supply.

Figure 1 Limitation Judgement Flow for RTC with Independent Power Supply Usage



Limitation 1-1

In the following conditions, the limitation is needed for alarm flag (AF) of RTC status register (RSR) operation.

[Occurrence condition]

(1) In the case of using alarm flag (AF) of RTC with independent power supply

(2) In the case of executing STOP instruction or setting VRTCEN=0 during the alarm condition matching

(3) After Condition (1) and (2) are true, and in the case of keeping STOP status or VRTCEN=0 status till the next alarm matching

[Limitation]

- At the next alarm matching, the alarm interrupt (INTRTCALM) occurs but alarm flag (AF) is not set to 1.

Limitation 1-2

In the following conditions, the limitation is needed for periodic interrupt Flag (PF) of RTC status register (RSR) operation.

[Occurrence condition]

(1) In the case of using periodic interrupt flag (PF) of RTC with independent power

(2) In the case of executing STOP instruction or setting VRTCEN=0 during the periodic interrupt occurrence

(3) After Condition (1) and (2) are true, and in the case of keeping STOP status or VRTCEN=0 status till the next periodic interrupt matching

[Limitation]

- At the next periodic interrupt occurrence, the periodic interrupt (INTRTCPRD) occurs. but periodic interrupt flag (PF) is not set to 1.

Limitation 2

In the following conditions, the limitation is needed for interrupt when RTC alarm interrupt (INTRTCALM) and periodic interrupt (INTRTCPRD) are used simultaneously.

[Occurrence condition]

(1) In the case of using alarm interrupt and periodic interrupt simultaneously

(2) Periodic interrupt occurs during the alarm condition matching.

[Limitation]

- During the alarm condition matching, periodic interrupt is masked and does not occur. However, periodic interrupt flag is set.

Limitation 3

In the following conditions, the limitation is needed for alarm flag (AF) update timing when alarm interrupt (INTRTCALM) and periodic interrupt (INTRTCPRD) occurred simultaneously.

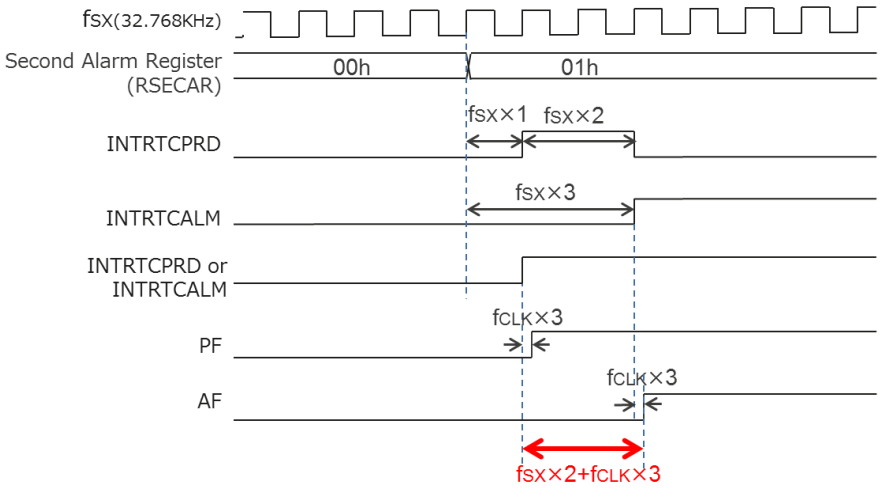
(1) In the case of using alarm interrupt and periodic interrupt simultaneously

(2) Using alarm flag (AF) and periodic interrupt flag (PF) to judge the interrupt source

[Limitation]

- In the case that periodic interrupt and alarm interrupt occur simultaneously at the timing of second carry generating, periodic interrupt occurs ahead. Alarm interrupt should occur after f_{SX} x2 clocks after periodic interrupt occurred but is masked by periodic interrupt and does not occur.
- Right after periodic interrupt generation, periodic interrupt flag (PF) and alarm flag (AF) are not set. Periodic interrupt flag (PF) is set after f_{CLK} x3 clocks. Alarm flag (AF) is set after f_{SX} x2 clocks + f_{CLK} x3 clocks.
- To process periodic interrupt flag (PF) and alarm flag (AF) simultaneously by periodic interrupt occurrence, it is necessary to wait f_{SX} x2 clocks + f_{CLK} x3 clocks after periodic interrupt generation.

Figure 2 Alarm Flag (AF) Update Timing



1.2. Precaution

Please follow the precautions below according to the corresponding limitation combination.

Precaution for Limitation 1-1

Please follow the precaution below according to usage conditions.

- In the case of using alarm interrupt only
- Please do not use AF but use RTCAIF flag of interrupt request flag register (IF1H) at alarm interrupt occurrence.

- In the case of using alarm interrupt or periodic interrupt exclusively
- Please do not use AF but use AIE bit and PIE bit of RTC Control Register 1 (RCR1) to judge alarm interrupt or periodic interrupt source in interrupt processing routine.

- In the case of necessity to use alarm flag (AF)
- Before the next alarm interrupt occurrence, please provide more than f_{CLK} x2 clocks to RTC by releasing CPU from the STOP mode and setting VRTCEN=1 in the condition of non-alarm-matching.

Precaution for Limitation 1-2

Please follow the precaution below according to usage conditions.

- In the case of using periodic interrupt only
- Please do not use PF but use RTCRIF flag of interrupt request flag register (IF1H) at periodic interrupt occurrence.

- In the case of using alarm interrupt or periodic interrupt exclusively
- Please do not use PF but use AIE bit and PIE bit of RTC Control Register 1 (RCR1) to judge alarm interrupt or periodic interrupt source in interrupt processing routine.

- In the case of necessity to use periodic interrupt flag (PF)

  Please choose either of the following precaution.

  (1) Please execute STOP instruction or set VRTCEN=0 after f_{SX} x2 clocks + f_{CLK} x3 clocks after periodic interrupt (INTRTCPRD) occurs.

  (2) Before the next periodic interrupt occurrence, please provide more than f_{CLK} x2 clocks to RTC by releasing CPU from the STOP mode and setting VRTCEN=1 in the condition of non-periodic-interrupt period.

Precaution for Limitation 1-1, 1-2

Please follow the precaution below according to usage conditions.

- In the case of using alarm interrupt or periodic interrupt exclusively
  - Please do not use AF, PF but use AIE bit and PIE bit of RTC Control Register 1 (RCR1) to judge alarm interrupt or periodic interrupt source in interrupt processing routine

- In the case of necessity to use alarm flag (AF)
  - Before the next alarm interrupt occurrence, please provide more than f_{CLK} x2 clocks to RTC by releasing CPU from the STOP mode and setting VRTCEN=1 in the condition of non-alarm-matching,

- In the case of necessity to use periodic interrupt flag (PF)

  Please choose either of the following precaution.

  ① Please execute STOP instruction or set VRTCEN=0 after f_{SX} x2 clocks + f_{CLK} x3 clocks after periodic interrupt (INTRTCPRD) occurs.

  ② Before the next periodic interrupt occurrence, please provide more than f_{CLK} x2 clocks to RTC by releasing CPU from the STOP mode and setting VRTCEN=1 in the condition of non-periodic-interrupt period,

Precaution for Limitation 1-1, 1-2, 2, 3

Please follow the precautions below according to usage conditions.

- In the case of non-necessity to use alarm interrupt and periodic interrupt simultaneously
  - Please use alarm interrupt or periodic interrupt exclusively.
  - Please do not use AF, PF but use AIE bit and PIE bit of RTC Control Register 1 (RCR1) to judge alarm interrupt or periodic interrupt source.

- In the case of necessity to use alarm interrupt and periodic interrupt simultaneously
  - For the alarm interrupt judgement, please read alarm flag (AF) at f_{SX} x2 clocks + f_{CLK} x3 clocks later after periodic interrupt (INTRTCPRD) occurs.
  - Before next alarm interrupt (INTRTCALM) occurrence, please provide more than f_{CLK} x2 clocks to RTC by releasing CPU from the STOP mode and setting VRTCEN=1 in the condition of non-alarm-matching.
  - Please execute STOP instruction or set VRTCEN=0 after f_{SX} x2 clocks + f_{CLK} x3 clocks after periodic interrupt (INTRTCPRD) occurs.
  - During the alarm matching period, periodic interrupt is masked and does not occur. So, please make polling periodic interrupt flag (PF) by CPU during the alarm matching period.

1.3. User's Manual modification

1.3.1. 9.2.31 RTC Status Register (RSR) (p.357)

Add the following Usage Note below Figure 9-49 RTC Status Register (RSR) format.

Note 3: Please use alarm interrupt or periodic interrupt exclusively.
Please do not use AF, PF but use AIE bit and PIE bit of RTC Control Register 1 (RCR1) to judge alarm interrupt or periodic interrupt source in interrupt processing routine.

Note 4: In the case of using alarm interrupt only, please do not use AF but use RTCAIF flag of interrupt request flag register (IF1H).

Note 5: In the case of using periodic interrupt only, please do not use PF but use RTCRIF flag of interrupt request flag register (IF1H).

1.3.2. 9.3.6 Reading 64-Hz Count and Time (p.368)

Add the following Usage Note below Figure 9-59 Reading Time procedure.

Note: In the status of VRTCEN=0, carry flag (CF) is not set to 1. Shown as Figure 9-59 Reading Time procedure, it must be performed in the status of VRTCEN=1.

1.3.3. 9.3.7 Alarm Function (p.369)

Add the following Usage Note below Figure 9-60 Using Alarm Function.

Note 1: Please use alarm interrupt or periodic interrupt exclusively.
Please do not use AF, PF but use AIE bit and PIE bit of RTC Control Register 1 (RCR1) to judge alarm interrupt or periodic interrupt source in interrupt processing routine.

Note 2: In the case of using alarm interrupt only, please do not use AF but use RTCAIF flag of interrupt request flag register (IF1H) at alarm interrupt occurrence.

1.3.4. 9.4 Interrupt Sources (p.375)

Add the following Usage Note below (1) Alarm interrupt (ALM).

Note 1: Please use alarm interrupt or periodic interrupt exclusively.
Please do not use AF, PF but use AIE bit and PIE bit of RTC Control Register 1 (RCR1) to judge alarm interrupt or periodic interrupt source in interrupt processing routine.

Note 2: In the case of using alarm interrupt only, please do not use AF but use RTCAIF flag of interrupt request flag register (IF1H) at alarm interrupt occurrence.

Add the following Usage Note below (2) Periodic interrupt (PRD).

Note 1: Please use alarm interrupt or periodic interrupt exclusively.
Please do not use AF, PF but use AIE bit and PIE bit of RTC Control Register 1 (RCR1) to judge alarm interrupt or periodic interrupt source in interrupt processing routine.

Note 2: In the case of using periodic interrupt only, please do not use PF but use RTCRIF flag of interrupt request flag register (IF1H).

2 Limitation regarding Reading RTC Count

2.1 Limitation

After setting VRTCEN from 0 to 1, in the status of time operation (RCR2.START bit =”1”), please wait 1/128 second before reading the timer counter.

2.2 User’s Manual modification

2.2.1 9.6.5 User’s Notes When Writing to And Reading from Registers

Modify the Usage Note as following;

(Before Modification)

To read the value from the timer counter after return from a reset, period in STOP mode, or the battery backup state, wait for1/128 second while the clock is operating (RCR2.START bit = 1).

(After Modification)

To read the value from the timer counter after one of the following conditions, please wait for 1/128 seconds while the clock is operating (RCR2.START bit = 1).

- After return from reset
- After return from STOP mode
- After return from battery backup status
- After setting VRTCEN from 0 to 1

Best Regard