[Notes]

RX Driver Package,

RX Family RTC Module Using Firmware Integration Technology

R20TS0222EJ0100
Rev.1.00
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Outline

When using the RX Driver Package and RX Family RTC Module Using Firmware Integration Technology (referred to as RTC FIT module hereafter), note the following points.

1. Time read processing using the R_RTC_Read function
2. Temporary stop of the time counter during warm start with the R_RTC_Open function

1. Time Read Processing Using the R_RTC_Read Function

1.1 Applicable Products

(1) RX Family RTC Module Using Firmware Integration Technology

The relevant revisions and documents are as shown in "Table 1.1, RTC FIT Module Applicable Products".

Table 1.1 RTC FIT Module Applicable Products

Revision of the RTC FIT module	Document number*1
Rev.2.50	R01AN1817EJ0250
Rev.2.70	R01AN1817EJ0270

The problem also applies to the following RX Driver Package products which include the above RTC FIT module*2.

*1: Only English documents are provided for versions earlier than Rev.2.50.
2: The RTC FIT module is included as r_rtc_rx_v.**.zip (*.** is the revision number).

(2) RX Driver Package

The product name and revision of the relevant RX Driver Package products and the revision of the included RTC FIT module are as shown in "Table 1.2, Products Which Include the RTC FIT Module".

Table 1.2 Products Which Include the RTC FIT Module

Product name of the RX Driver Package	Revision of the RX Driver Package	Document number	Revision of the included RTC FIT module
RX Family RX Driver Package Ver.1.11	Rev.1.11	R01AN3467EJ0111	Rev.2.50
RX Family RX Driver Package Ver.1.12	Rev.1.12	R01AN3651EJ0112	Rev.2.50

1.2 Applicable MCUs

RX110, RX111, RX113, RX130, RX230, RX231, RX64M, RX65N, RX71M, RX210[*1], RX63N[*1], and RX631[*1] groups

*1: RTC FIT module Rev.2.70 or later does not support the RX210, RX63N, and RX631 groups.

1.3 Details

The time that is read by the R_RTC_Read function might be fast by anything between 1 year and 59 seconds. Alternatively, the read time might be 1 second slow.

- Example 1: Case when the read time is 59 seconds fast

  If the actual time is 2017/08/29 10:11 00:

  The read time is "2017/08/29 10:11 59".

- Example 2: Case when the read time is 1 year fast

  If the actual time is 2018/01/01 00:00 00:

  The read time is "2018/12/31 23:59 59".

- Example 3: Case when the read time is 1 second slow

  If the actual time is 2017/08/29 10:10 01:

  The read time is "2017/08/29 10:10 00".

1.4 Conditions

If a carry occurs in the RTC second counter while the RTC year, month, day, day of the week, hour, and minute counters are being read, a time that differs from the actual time is read.

```
void rtc_read_current (tm_t *p_current)
{
    uint16_t bcd_years; // Used for converting year.
    do
    {
        /* Clear carry flag in ICU */
        ICU.IR[IR_RTC_CUP].BIT.IR = 0;
        /* Read and convert RTC registers; mask off unknown bits and hour
am/pm. */
        /* Seconds. (0-59) */
        p_current->tm_sec  = rtc_bcd_to_dec((uint8_t) (RTC.RSECCNT.BYTE &
0x7fu));
        /* Minutes. (0-59) */
        p_current->tm_min  = rtc_bcd_to_dec((uint8_t) (RTC.RMINCNT.BYTE &
0x7fu));
        /* Hours. (0-23) */
        p_current->tm_hour = rtc_bcd_to_dec((uint8_t) (RTC.RHRCNT.BYTE &
0x3fu));
        /* Day of the month (1-31) */
        p_current->tm_mday = rtc_bcd_to_dec(RTC.RDAYCNT.BYTE);
        /* Months since January (0-11) */
        p_current->tm_mon  = rtc_bcd_to_dec(RTC.RMONCNT.BYTE) - 1;
        /* Years since 2000 */
        bcd_years = (uint16_t) RTC.RYRCNT.WORD;
        /* years years since 1900 (100-199) */
        p_current->tm_year = rtc_bcd_to_dec((uint8_t) (bcd_years & 0xFF)) +
100;
        /* Days since Sunday (0-6) */
        p_current->tm_wday = (int) (RTC.RWKCNT.BYTE & 0x07u);
    } while (1 == ICU.IR[IR_RTC_CUP].BIT.IR); //Reread if carry occurs
during read
    return;
}
```

If a carry of the second counter occurs in this section, a time that differs from the actual time is read.

1.5 Workaround

In the RTC FIT module source code “r_rtc_rx_private.h”, modify the value of “RTC_INT_ENABLE” from 0x05 to 0x07.

The details of the modification are as follows. Modify the value in blue to the value in red.

Before modification:

```
#define RTC_INT_ENABLE          (0x05)  /* Enable the AIE bit and the PIE
bit. */
```

After modification:

```
#define RTC_INT_ENABLE          (0x07)  /* Enable the AIE bit and the PIE
bit. */
```

1.6 Schedule for Fixing the Problem

(1) RTC FIT module

This problem will be fixed in Rev.2.71, which will be the next release.

(2) RX Driver Package

The RTC FIT module Rev.2.71 modified in accord with this note will be included in Ver.1.13 of the RX Family RX Driver Package, which will be the next release.

2. Temporary Stop of the Time Counter during Warm Start with the R_RTC_Open Function

2.1 Applicable Products

(1) RX Family RTC Module Using Firmware Integration Technology

The relevant revisions and documents are as shown in "Table 2.1, RTC FIT Module Applicable Products".

Table 2.1 RTC FIT Module Applicable Products

Revision of the RTC FIT module	Document number[*1]
Rev.2.00	R01AN1817EU0200
Rev.2.10	R01AN1817EU0210
Rev.2.20	R01AN1817EU0220
Rev.2.30	R01AN1817EU0230
Rev.2.40	R01AN1817EU0240
Rev.2.41	R01AN1817EJ0241
Rev.2.50	R01AN1817EJ0250
Rev.2.70	R01AN1817EJ0270

The problem also applies to the following RX Driver Package products which include the above RTC FIT module[*2].

*1: Only English documents are provided for versions earlier than Rev.2.50.
2: The RTC FIT module is included as r_rtc_rx_v.**.zip (*.** is the revision number).

(2) RX Driver Package

The product name and revision of the relevant RX Driver Package products and the revision of the included RTC FIT module are as shown in "Table 2.2, Products Which Include the RTC FIT Module".

Table 2.2 Products Which Include the RTC FIT Module

Product name of the RX Driver Package	Revision of the RX Driver Package	Document number	Revision of the included RTC FIT module
RX64M Group RX Driver Package User's Manual	Rev.1.01	R01AN2460EJ0101	Rev.2.10
RX64M, RX71M Group RX Driver Package Ver.1.02	Rev.1.02	R01AN2606EJ0102	Rev.2.30
RX64M, RX71M Group RX Driver Package Ver.1.02	Rev.1.03	R01AN2606EJ0103	Rev.2.30
RX64M, RX71M Group RX Driver Package Ver.1.02	Rev.1.04	R01AN2606EJ0104	Rev.2.30
RX110, RX111, RX113, RX231 Group RX Driver Package Ver.1.01	Rev.1.01	R01AN2670EJ0101	Rev.2.40
RX110, RX111, RX113, RX130, RX231, RX23T Group RX Driver Package Ver.1.02	Rev.1.02	R01AN3159EJ0102	Rev.2.40
RX110, RX111, RX113, RX130, RX230, RX231, RX23T, RX24T Group RX Driver Package Ver.1.03	Rev.1.03	R01AN3233EJ0103	Rev.2.41
RX Family RX Driver Package Ver.1.10	Rev.1.00	R01AN3345EJ0100	Rev.2.41
RX Family RX Driver Package Ver.1.11	Rev.1.11	R01AN3467EJ0111	Rev.2.50
RX Family RX Driver Package Ver.1.12	Rev.1.12	R01AN3651EJ0112	Rev.2.50

2.2 Applicable MCUs

RX110, RX111, RX113, RX130, RX230, RX231, RX64M, RX65N, RX71M, RX210*1, RX63N*1 , and RX631*1 groups

*1: RTC FIT module Rev.2.70 or later does not support the RX210, RX63N, and RX631 groups.

2.3 Details

The RTC clock counter stops temporarily although warm start is selected for the R_RTC_Open function call. This is because the clock counter is stopped and started within the rtc_set_output function called by the R_RTC_Open function, and the rtc_set_output function is executed although warm start is selected.

Warm start is set for the R_RTC_Open function when the set_time member of the rtc_init_t structure of the actual argument is set to "false".

```
void rtc_set_output (rtc_output_t output_freq)
{
    uint8_t counter_state;



    /* NOTE: valid output_freq verified before entering this routine */


    counter_state = RTC.RCR2.BIT.START;        // save start bit/counter
state

    rtc_counter_run(RTC_COUNTER_STOP);         // set start bit to 0/stop
counters
    RTC.RCR2.BIT.RTCOE = 0;                   // disable output


    if (RTC_OUTPUT_OFF != output_freq)
    {
        RTC.RCR1.BIT.RTCOS = (uint8_t) ((RTC_OUTPUT_64_HZ == output_freq) ?
1 : 0); // set bit for 64Hz or 1 Hz operation
       RTC.RCR2.BIT.RTCOE = 1;                // enable output
    }

    rtc_counter_run(counter_state);           // restore start bit
setting/counter state
    return;
}
```

2.4 Conditions

The problem always arises if warm start is selected for the R_RTC_Open function call.

Warm start is set for the R_RTC_Open function when the set_time member of the rtc_init_t structure of the actual argument is set to "false".

2.5 Workaround

Modify the R_RTC_Open function of the RTC FIT module source code “r_rtc_rx.c”, to call the rtc_set_output function only in cold start mode.

To output clocks during warm start, after the R_RTC_Open function call, add an R_RTC_Control function call for which "RTC_CMD_SET_OUTPUT" is selected for the command.

The details of the modification are as follows. Move the processing in blue to the location in red.

Before modification:

```
rtc_err_t R_RTC_Open (rtc_init_t * p_init, tm_t *p_current)
{
   rtc_err_t err=RTC_SUCCESS;
(Omitted)
   /* Set the current time if specified (implied cold start) */
   if (true == p_init->set_time)
   {
      rtc_init();
      rtc_set_current_time(p_current);
   }

   /* Enable the RTC interrupts */
   rtc_enable_ints();

   /* Set the RTC output */
   rtc_set_output(p_init->output_freq);

   /* Set callback function for interrupts */
   rcb.p_callback = p_init->p_callback;

   /* Set the periodic frequency */
   rtc_set_periodic(p_init->periodic_freq, p_init->periodic_priority);

(Omitted)
   return err;    // SUCCESS
}
```

After modification:

```
rtc_err_t R_RTC_Open (rtc_init_t * p_init, tm_t *p_current)
{
    rtc_err_t err=RTC_SUCCESS;
(Omitted)
    /* Set the current time if specified (implied cold start) */
    if (true == p_init->set_time)
    {
        rtc_init();
        rtc_set_current_time(p_current);

        /* Set the RTC output */
        rtc_set_output(p_init->output_freq);
    }

    /* Enable the RTC interrupts */
    rtc_enable_ints();

    /* Set callback function for interrupts */
    rcb.p_callback = p_init->p_callback;

    /* Set the periodic frequency */
    rtc_set_periodic(p_init->periodic_freq, p_init->periodic_priority);

(Omitted)
   return err;    // SUCCESS
}
```

2.6 Schedule for Fixing the Problem

(1) RTC FIT module

This problem will be fixed in Rev.2.71, which will be the next release.

(2) RX Driver Package

The RTC FIT module Rev.2.71 modified in accord with this note will be included in Ver.1.13 of the RX Family RX Driver Package, which will be the next release.

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Nov. 1, 2017	-	First edition issued

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