# RL78/G14, H8/36109

## Migration Guide from H8 to RL78: Realtime Clock (RTC)

### Introduction

This application note describes how to migrate the Realtime Clock (RTC) of the H8/36109 to the Real-time Clock (RTC) of the RL78/G14.

### Target Device

RL78/G14, H8/36109

When using this application note with other Renesas MCUs, careful evaluation is recommended after making modifications to comply with the alternate MCU.

## Contents

# 1. Functions of Realtime Clock (RTC) of H8/36109 and Real-time Clock (RTC) of RL78/G14

Table 1.1 shows the functions of the Realtime Clock (RTC) of H8/36109, and Table 1.2 shows the functions of the Real-time Clock (RTC) of RL78/G14.

Table 1.1 Function of Realtime Clock (RTC) of H8/36109

| Function | Explanation |
|---|---|
| Realtime Clock (RTC) | This is a timer used to count time ranging from a second to a week.<br>There are five kinds of RTC interrupts: week interrupts, day interrupts, hour interrupts, minute interrupts, and second interrupts.<br>Note that you cannot use multiple interrupts simultaneously. |
| Free running counter | When a clock other than 32.768 kHz is selected, the RTC is disabled and operates as an 8-bit free running counter. When the RTC operates as an 8-bit free running counter, RSECDR enables counter values to be read.<br>An interrupt can be generated by setting 1 to the FOIE bit in RTCCR2 and enabling an overflow interrupt of the free running counter. |
| Clock Output | When TMOW bit of PMR1 register is set to 1, TMOW pin outputs clock signals (φ/4 to φ/32). |

Table 1.2 Functions of Real-time clock (RTC) of RL78/G14

| Function | Explanation |
|---|---|
| Real-time Clock | - The count of year, month, week, day, hour, minutes and second can be performed when the subsystem clock ($f_{SUB}$ = 32.768 kHz) is selected as the operation clock.<br>- When the low-speed oscillation clock ($f_{IL}$ = 15 kHz) is selected, only the constant-period interrupt function is available. |
| Constant-period interrupt function | - The interrupt request signal is generated at a period of 0.5 seconds, 1 second, 1 minute, 1 hour, 1 day, or 1 month when the subsystem clock ($f_{SUB}$ = 32.768 kHz) is selected as the operation clock.<br>- The constant-period interrupt interval is calculated with the constant-period x ($f_{SUB}$ / $f_{IL}$) when the low-speed oscillation clock ($f_{IL}$ = 15 kHz) is selected as the operation clock. |
| Alarm interrupt function | The interrupt request signal is generated at the specified alarm day of the week, hour, and minute when the subsystem clock ($f_{SUB}$ = 32.768 kHz) is selected as the operation clock. |
| Pin output function of 1 Hz | The 1-Hz pin output function is available when the subsystem clock ($f_{SUB}$ = 32.768 kHz) is selected as the operation clock. |

Remark. Different products are provided with different functions. For details, refer to the appropriate user's manuals (hardware).

Table 1.3 shows Real-time Clock (RTC) of RL78/G14 corresponding to the Realtime Clock (RTC) of H8/36109.

Table 1.3 Correspondence between Functions

| H8/36109<br>RTC | RL78/G14<br>RTC |
|---|---|
| Realtime Clock (RTC) | Real-time Clock |
| Free running counter | None (None) |
| Clock Output | None (None) |
| None | Constant-period interrupt function |
| None | Alarm interrupt function |
| None | Pin output function of 1 Hz |

Note. The free running counter function of H8/36109 realtime clock (RTC) can be replaced by various timers of RL78/G14. The function of the RTC clock output pin of H8/36109 can be replaced by the clock output/buzzer output controller of RL78/G14.

Remark. Different products are provided with different functions. For details, refer to the appropriate user's manuals (hardware).

## 2. Summary of Differences between Functions

Table 2.1 summarizes the differences between the functions of the Realtime Clock (RTC) of H8/36109 and Real-time Clock of RL78/G14.

Table 2.1 Summary of Differences between Functions

| Item | H8/36109<br>Realtime Clock (RTC) | RL78/G14<br>Real-time Clock (RTC) |
|---|---|---|
| Count sources | RTC: 32.768kHz<br>Free running Counter: φ/8 - φ/8192 | $f_{SUB}$, $f_{IL}$ |
| Clock count | Second, Minute, Hour, Day, and Week | Second, Minute, Hour, Day, Week, Month, Year |
| Counter value initialization timing | None (Initial setting of RTC register) | When a reset occurs |
| Interrupt source | RTC<br>- Second Periodic Interrupt<br>- Minute Periodic Interrupt<br>- Hour Periodic Interrupt<br>- Day Periodic Interrupt<br>- Week Periodic Interrupt<br>Free running Counter<br>- Overflow Interrupt | Alarm interrupt<br>Constant-period interrupt<br>- Once per 0.5s (synchronized with second count up)<br>- Once per 1 s (same time as second count up)<br>- Once per 1 m (second 00 of every minute)<br>- Once per 1 hour (minute 00 and second 00 of every hour)<br>- Once per 1 day (hour 00, minute 00, and second 00 of every day)<br>- Once per 1 month (Day 1, hour 00 a.m., minute 00, and second 00 of every month) |
| Setting by BCD code | Yes | Yes |
| Watch error correction of real-time clock | None | Yes |

## 3. Comparison between Registers

Table 3.1 and Table 3.2 compares the registers for the H8/36109 Realtime Clock (RTC) and the registers for the RL78/G14 Real-time Clock (RTC).

Table 3.1 Comparison between Registers (1/2)

| Item | H8/36109<br>Realtime Clock (RTC) | RL78/G14<br>Real-time Clock (RTC) |
|---|---|---|
| Control of Realtime Clock input clock supply | MSTCR1 register<br>MSTTA bit | PER0 register<br>RTCEN bit |
| Second data register/free running counter data register | RSECDR register | SEC register |
| RTC Busy | RSECDR register<br>BSY bit | None |
| Counting Ten's Position of Seconds | RSECDR register<br>SC12 - SC10 bit | SEC register<br>SEC40 bit, SEC20 bit,<br>SEC10 bit |
| Counting One's Position of Seconds | RSECDR register<br>SC03 - SC00 bit | SEC register<br>SEC8 bit, SEC4 bit,<br>SEC2 bit, SEC1 bit, |
| Minute Data Register | RMINDR register | MIN register |
| RTC Busy | RMINDR register<br>BSY bit | None |
| Counting Ten's Position of Minutes | RMINDR register<br>MN12 - MN10 bit | MIN register<br>MIN40 bit, MIN20 bit,<br>MIN10 bit |
| Counting One's Position of Minutes | RMINDR register<br>MN03 - MN00 bit | MIN register<br>MIN8 bit, MIN4 bit,<br>MIN2 bit, MIN1 bit |
| Hour Data Register | RHRDR register | HOUR register |
| RTC Busy | RHRDR register<br>BSY bit | None |
| Counting Ten's Position of Hours | RHRDR register<br>HR11 - HR10 bit | HOUR register<br>HOUR20 bit, HOUR10 bit |
| Counting One's Position of Hours | RHRDR register<br>HR03 - HR00 bit | HOUR register<br>HOUR8 bit, HOUR4 bit,<br>HOUR2 bit, HOUR1 bit |
| Day count register | None | DAY register |
| Day-of-Week Data Register | RWKDR register | WEEK register |
| RTC Busy | RWKDR register<br>BSY bit | None |
| Day-of-Week Counting | RWKDR register<br>WK2 - WK0 bit | WEEK register<br>WEEK4 bit, WEEK2 bit,<br>WEEK1 bit |
| Month count register | None | MONTH register |
| Year count register | None | YEAR register |
| Watch error correction register | None | SUBCUD register |
| Setting of watch error correction timing | None | SUBCUD register<br>DEV bit |
| Setting of watch error correction value | None | SUBCUD register<br>F6 bit |

Table 3.2 Comparison between Registers (2/2)

| Item | H8/36109<br>Realtime Clock (RTC) | RL78/G14<br>Real-time Clock (RTC) |
|---|---|---|
| RTC Control Register | RTCCR1 register<br>RTCCR2 register | RTCC0 register<br>RTCC1 register |
| RTC Operation Start | RTCCR1 register<br>RUN bit | RTCC0 register<br>RTCE bit |
| Operating Mode | RTCCR1 register<br>12/24 bit | RTCC0 register<br>AMPM bit |
| a.m./p.m. | RTCCR1 register<br>PM bit | None |
| Reset | RTCCR1 register<br>RST bit | None |
| Interrupt Generation Timing | RTCCR1 register<br>INT bit | None |
| Free Running Counter Overflow Interrupt Enable | RTCCR2 register<br>FOIE bit | None |
| Week Periodic Interrupt Enable | RTCCR2 register<br>WKIE bit | RTCC0 register<br>CT2 - CT0 bit |
| Day Periodic Interrupt Enable | RTCCR2 register<br>DYIE bit | |
| Hour Periodic Interrupt Enable | RTCCR2 register<br>HRIE bit | |
| Minute Periodic Interrupt Enable | RTCCR2 register<br>MNIE bit | |
| Second Periodic Interrupt Enable | RTCCR2 register<br>SEIE bit | |
| Clock Source Select Register | RTCCSR register | None |
| Clock Output Selection | RTCCSR register<br>RCS6 bit, RCS5 bit | None |
| Clock Source Selection | RTCCSR register<br>RCS3 - RCS0 bit | OSMC register<br>WUTMMCK0 bit |
| RTC1HZ pin output control | None | RTCC0 register<br>RCLOE1 bit |
| Alarm minute register | None | ALARMWM register |
| Alarm hour register | None | ALARMWH register |
| Alarm week register | None | ALARMWW register |
| Alarm operation control | None | RTCC1 register<br>WALE bit |
| Control of alarm interrupt (INTRTC) function operation | None | RTCC1 register<br>WALIE bit |
| Alarm detection status flag | None | RTCC1 register<br>WAFG bit |
| Constant-period interrupt status flag | None | RTCC1 register<br>RIFG bit |
| Wait status flag of real-time clock | None | RTCC1 register<br>RWST bit |
| Wait control of real-time clock | None | RTCC1 register<br>RWAIT bit |

## 4. Sample Code for real-time clock

The sample code for the real-time clock is explained in the following application notes.

- RL78/G13 Real-Time Clock CC-RL (R01AN2590)

  The latest versions can be downloaded from the Renesas Electronics website.

## 5. Documents for Reference

User's Manual:

- RL78/G14 User's Manual: Hardware (R01UH0186)
- H8/36109 Group User's Manual: Hardware (R01UH0294)

  The latest versions can be downloaded from the Renesas Electronics website.

Technical Update/Technical News:

The latest information can be downloaded from the Renesas Electronics website.

## Revision History

| Rev. | Date | Description | |
|---|---|---|---|
| | | Page | Summary |
| 1.00 | Sep.15, 2020 | - | First edition issued |
| | | | |

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

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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.).
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.

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