
RL78/G15 Simulator V1.04.00

Release Note

Thank you for using the RL78/G15 simulator.

This document describes restrictions on and points for caution regarding the simulator.

Read this document before using the product.

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Chapter 1. Target Devices and Supported Simulation Functions

The RL78/G15 simulator supports the following target device.

| Device group | Device name |
|--------------|----------------------------|
| RL78/G15 | 8 pins R5F12007, R5F12008 |
| | 10 pins R5F12017, R5F12018 |
| | 16 pins R5F12047, R5F12048 |
| | 20 pins R5F12067, R5F12068 |

As well as CPU instructions, the RL78/G15 simulator is capable of simulating the following items in the target devices.

- Peripheral modules such as timers, the serial array unit, and the serial interface
- Virtual target board (simulation via the [I/O panel] window)
- MCU pin signal waveforms (simulation via the [Timing chart] window)

Note that the RL78/G15 simulator does not support simulation of current drawn by these MCUs.

Chapter 2. Changes

This chapter describes changes from V1.03.00 to V1.04.00 of the RL78/G15 simulator.

2.1 Improvements to the RL78/G15 simulator

2.1.1 Improvement to the operation related to the SSRmn registers during UART transmission by the serial array unit

In previous versions of the simulator, writing to the serial data registers mn (SDRmn) during UART transmission by the serial array unit led to the BFFmn bit (the flag indicating the state of the buffer register in the serial status register mn (SSRmn)) being cleared to 0 rather than set to 1. This has been rectified so that the BFFmn bit is set to 1.

Chapter 3. Points for Caution

This section lists points for caution on using the RL78/G15 simulator. These points for caution are in the following two categories.

- Differences in behavior between the target devices and the simulator due to simulator specifications
- Usage of simulation functions (operations in and configuration of the GUI windows)

CS+ for CC supports the [Virtual Board] panel which is described in those points for caution.

3.1 Differences in behavior between the target devices and the simulator

3.1.1 Peripheral functions not supported by the simulator

The simulator is not capable of simulating the following peripheral functions of the target devices.

- Selectable power-on-reset circuit
- Flash self-programming

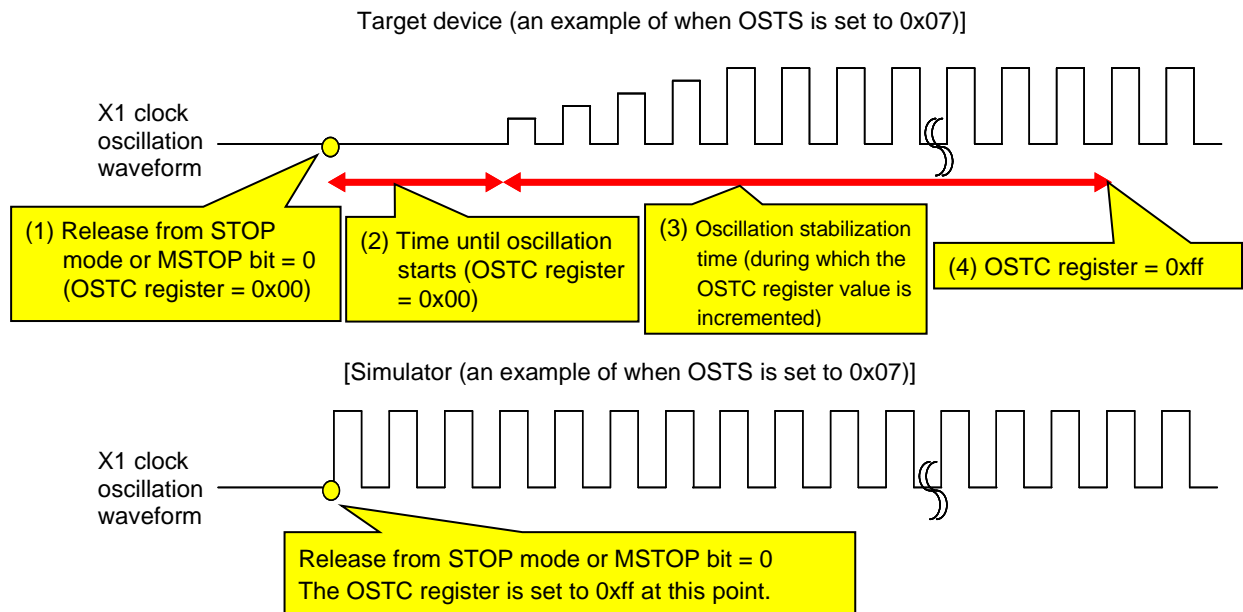
3.1.2 Oscillation stabilization time for the clock generator

Since the simulator does not simulate the clock oscillator oscillation stabilization time, stabilization always takes no time. When the oscillation is started, the OSTC register is set to one of the following values (i.e. not incremented).

| OSTS Setting | OSTC Value |
|--------------------|------------|
| 0x0 : $2^8/f_x$ | 0x80 |
| 0x1 : $2^9/f_x$ | 0xc0 |
| 0x2 : $2^{10}/f_x$ | 0xe0 |
| 0x3 : $2^{11}/f_x$ | 0xf0 |
| 0x4 : $2^{13}/f_x$ | 0xf8 |
| 0x5 : $2^{15}/f_x$ | 0xfc |
| 0x6 : $2^{17}/f_x$ | 0xfe |
| 0x7 : $2^{18}/f_x$ | 0xff |

The following figure illustrates this operation.

In the target device, oscillation by the X1 clock starts after operation has passed through states (1) to (4). In the simulator, states (1) through (4) are skipped and oscillation instantly starts.



Therefore, pay attention to the code that waits for oscillation stabilization.

There is no problem if a program is created under the condition that execution proceeds after the oscillation stabilization wait period when the OSTC register value becomes the maximum value, or when the OSTC register value exceeds the specified value, but if a program is created under the condition that execution proceeds after the oscillation stabilization wait period when the OSTC register value becomes a value other than the maximum value, execution will enter an endless loop.

The following shows examples of code that causes and does not cause problems.

The examples are when the OSTS is set to 0x07.

| <u>Correct code example (1)</u> | <u>Correct code example (2)</u> | <u>Example of code that may cause problems</u> |
|---|--|---|
| <pre>while(OSTC != 0xff) { NOP();/* wait */ }</pre> | <pre>while(OSTC <= 0xf0) { NOP();/* wait */ }</pre> | <pre>while(OSTC != 0xf0) { NOP();/* wait */ }</pre> |

3.1.3 SFRs (CMC and HIOTRM) in the clock generator

The following SFRs which belong to the clock generator are not simulated. Although read/write access for each register can proceed normally, the operation does not change even if the value is changed.

- Bit 0 (AMPH) of the clock operating mode control register (CMC)
- High-speed on-chip oscillator trimming register (HIOTRM)

3.1.4 Operating clock of the timer array unit

Do not specify an operating clock that runs at or below 233 Hz. If the operating clock for the timer array unit runs at or below 233 Hz, then the timer array unit will not work properly (it will behave as if operating with a clock that is faster than the one selected).

3.1.5 Noise filter of the timer array unit

Although the target device's timer array unit has a function to turn the noise filters on and off in order to reduce noise from the timer input pins, the simulator does not simulate this function since there is no noise in the simulator's signals. That is, whether filtering is on or off makes no difference to the behavior.

3.1.6 Interval interrupts generated by the watchdog timer

The timing of the generation of interval interrupts by the watchdog timer differs between the target device and the simulator.

[Target device]

When $75\% + 3/4f_{IL}$ of overflow time is reached

[Simulator]

When 75% of overflow time is reached

3.1.7 Clock used in the serial array unit

Do not specify a clock that is 233 Hz or lower in the following cases. If the following clock of the serial array unit is 233 Hz or lower, then the serial array unit will not operate correctly (it will behave as if operating via a clock that is faster than the one selected).

- Operating clock (f_{MCK}) is 233Hz or lower.
- Transfer clock setting by dividing the operation clock ($f_{MCK} \div (SDRmn[15:9] + 1)$) is 233 Hz or lower.

3.1.8 Noise filter of the serial array unit

Although the target device's serial array unit has a function to turn the noise filter on and off in order to reduce noise on the input pin, the simulator does not simulate this function since there is no noise in the simulator's signals. That is, whether filtering is on or off makes no difference to the behavior.

3.1.9 SDRmn registers of the serial array unit

The values read from the seven higher-order bits of the serial data registers (SDRmn) during serial operation differ between the target device and the simulator.

[Target device]

0 is read.

[Simulator]

The value read is that at the time serial operation starts.

3.1.10 IICA serial interface

IICA supports pin waveform generation and the communications through the [Serial] window. The following functions are not supported.

- Digital filter

- Arbitration
- Detection of transmission errors
- Communication reservation

3.1.11 Reset

Among the sources for generating reset signals, the following types of internal reset do not occur in the simulator.

- Internal reset by comparison of supply voltage and detection voltage of selectable power-on-reset (SPOR) circuit
- Internal reset by execution of illegal instruction
- Internal reset by data retention power supply voltage
- Internal reset by illegal-memory access

In addition, the behavior differs as follows if a reset signal is input from the RESET pin.

[Target device]

The MCU is reset when the RESET pin goes low. Release from the reset state proceeds when the RESET pin goes high.

[Simulator]

The MCU is not reset when the RESET pin goes low. The simulator is reset momentarily and then released when the RESET pin goes high.

3.1.12 Reset control flag register (RESF)

The simulator only supports the WDTRF bit of the reset control flag register (RESF).

The simulator is not capable of simulating the operations of the other bits (TRAP, IAWRF, and SPORF).

Only the default values of these bits are indicated.

The reset control flag register (RESF) of the target device is cleared by an external reset, a reset by the data retention lower limit voltage, or reading the RESF register. However, on the simulator, the RESF is only cleared by an external reset.

3.1.13 A/D converter

When no voltage is being applied to the VDD or AVREFP pin, the default reference voltage of the A/D converter is 5.0 V.

To change the reference voltage, input the desired voltage values for VDD and AVREFP via the [Signal Data Editor] window.

3.1.14 Clock output/buzzer output controller

When f_{MAIN} is selected as an output clock, the [Timing chart] window does not show the clock waveform of the PCLBUZn signal.

When $f_{\text{MAIN}}/2$ or a slower signal is selected as an output clock, the [Timing chart] window shows the clock waveform.

3.1.15 Executing illegal instructions

If an illegal instruction (instruction code: 0xFF) is executed, the target device will be reset, but the simulator will go into an endless loop (the illegal instruction will be executed repeatedly).

3.1.16 Reference voltage of the comparators (CMP)

When no voltage value is set for the VDD pin, the simulator generates the reference voltage on the assumption that 5 V is being input to the VDD pin.

To change the reference voltage, specify the desired voltage value for the VDD pin via the [Signal Data Editor] window or some other means.

3.1.17 Digital filters in the comparators (CMP)

The simulator does not simulate the digital filters in the comparators (CMP).

3.1.18 Response time of the comparators

Since the simulator does not simulate the response time of the comparators, the response time is always 0 second. This does not change even if the speed of the comparators is changed in the comparator output control register (COMPOCR).

3.1.19 SS_m registers in the serial array unit

During serial communications, when the operation start trigger of channel *n* (SS_{mn}) in the serial channel start register *m* (SS_m) is set to 1, operation of the simulator differs from that of the actual target device in the way stated below.

[Target device]

The target device stops communications and enters the suspended state.

[Simulator]

The simulator does not stop communications. Accordingly, the TSF_{mn} and BFF_{mn} bits in the serial status register *mn* (SSR_{mn}) are not cleared to 0.

3.2 Usage of simulation functions

3.2.1 Simulation speed

The simulation speed of RL78/G15 simulator depends on the number of operating peripheral functions. If many peripheral functions are operating, the simulation speed becomes from several to ten times slower than the actual device. ^{Note}

With the use of only a few, or even no peripheral functions, the simulation speed may become faster than the actual device.

Note: The measurement environment for simulation speed is as follows.

CPU: 3.20 GHz (Quad-Core); memory: 8 Gbytes; OS: Windows10 64-bit edition

3.2.2 Pin waveforms in the [Timing chart] window

The maximum length of a pin waveform is 4096 signal-level changing points. After reaching this maximum length, the data will be overwritten from the oldest value. If this length is not sufficient, use the following methods.

- Reduce the number of registered pins
- Stop the user program at the place where you want to confirm the waveform by using a breakpoint

3.2.3 Controlling windows


The following keyboard operations are not available in the simulator windows ([Signal Data Editor], [I/O panel], and [Serial]).


- Navigation via tab or arrow keys (←, ↑, →, ↓)
- Deletion via the Del or Backspace keys
- Cut & paste and other operations via the Ctrl + C, V, X, A, or Z keys.

Perform the above operations as follows.

- Navigation: Navigate by using the mouse.
- Deletion: Right-click and perform the action from the context menu.
- Cut & paste, etc.: Right-click and perform the action from the context menu.

3.2.4 Closing the [Simulator GUI] window

The [Simulator GUI] window can only be closed by disconnecting from the debugging tool, or by closing CS+ in proper manner. The  button cannot be used.

Additionally, although it appears that the  button can be pressed if Aero is enabled in Windows, pressing this button will not close the [Simulator GUI] window.

3.2.5 Disconnecting the debug tool

CS+ may be closed if the debugging tool is disconnected while any of the following dialog boxes is open from the [Simulator GUI] window. Be sure that the following dialog boxes have been closed before disconnecting the simulator.

- Save As
- Open
- New
- Color
- Font
- Customize
- Loop
- Select Pin
- Search Data
- Format (UART)
- Format (CSI)
- Format (IIC)
- Message (e.g. Error)
- Parts Button Properties
- Analog Button Properties
- Parts Key Properties
- Parts Level Gauge Properties
- Parts Led Properties
- Parts Segment LED Properties
- Parts Matrix Led Properties
- Parts Buzzer Properties
- Pull up / Pull down
- Entry Bitmap
- Object Properties

3.2.6 [Serial] window

When using the [Serial] window as the data receiver for the simplified I²C of the serial array unit or IICA, only ACK can be generated after receiving the data. NACK cannot be generated.

3.2.7 Setting the pins in the simulator GUI or the [Virtual Board] panel

The peripheral I/O redirection register (PIOR) can be manipulated by a program or debugger operations to re-assign specific multiplexed pin functions to alternative port pins in the same way as on the actual device. However, if the assignment of serial interface functions to port pins is changed to use the [Serial] window or the serial communication component of the [Virtual Board] panel, set the changed port pins when making settings of the [Format] dialog box in the [Serial] window or the serial communication component of the [Virtual Board] panel. This enables the use of the [Serial] window or the serial communication component of the [Virtual Board] panel when port pins to which multiplexed functions are assigned by the PIOR are changed.

After re-assigning a given pin function by using the PIOR, be sure to select the name of the pin you are currently using in the [Select Pin] dialog box of the simulator GUI or “Connected To” of the component in the [Virtual Board] panel.

Revision History

| Rev. | Date | Description | |
|----------|-----------|-------------|---------------|
| | | Page | Summary |
| Rev.1.00 | Jun.01.24 | - | First Edition |

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