RL78/L12 Simulator V1.09.00

Release Note

Thank you for using the RL78/L12 simulator.

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

Read this document before using the product.

Contents

Chapter 1. Target Devices and Supported Simulation Functions

The RL78/L12 simulator supports the following target devices.

Device group	Device name
RL78/L12	R5F10RBC
	R5F10RFC
	R5F10RGC
	R5F10RJC
	R5F10RLC
	R5F10RBA
	R5F10RFA
	R5F10RGA
	R5F10RJA
	R5F10RLA
	R5F10RB8
	R5F10RF8
	R5F10RG8
	R5F10RJ8

The RL78/L12 simulator is capable of simulating the following items as well as CPU instructions.

- 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)
- Current drawn

Chapter 2. Changes

This chapter describes changes from V1.08.00 to V1.09.00 of the RL78/L12 simulator.

2.1 Improvements to the RL78/L12 simulator

2.1.1 Improvement to displaying pin names of multiplexed functions assigned by the peripheral I/O redirection register (PIOR)

The names of multiplexed pin functions assigned by the settings of the peripheral I/O redirection register (PIOR) had previously not been displayed as the names of the pins to be connected that are selected in the [Select Pin] dialog box of the simulator GUI or “Connected To” of the component in the [Virtual Board] panel. This has been rectified so that such names are displayed in ().

Example: P50/INTP5/SEG7/(PCLBUZ0) in 48-pin products

Chapter 3. Points for Caution

This section lists points for caution on using the RL78/L12 simulator. These points for caution are in the following two categories.

• Differences in behavior between the target device 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 device 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 device.

- Regulator
- Power-on-reset circuit
- Voltage detector
- Flash self-programming

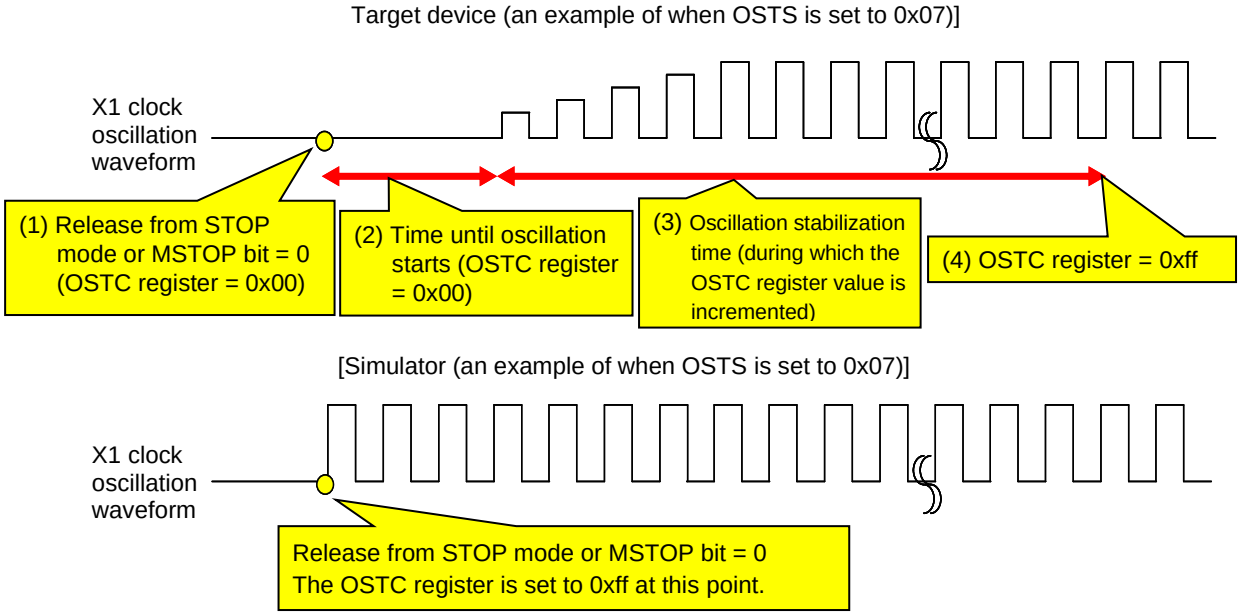
3.1.2 Oscillation stabilization time for the clock generator

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/fx	0x80
0x1 : 2^9/fx	0xc0
0x2 : 2^{10}/fx	0xe0
0x3 : 2^{11}/fx	0xf0
0x4 : 2^{13}/fx	0xf8
0x5 : 2^{15}/fx	0xfc
0x6 : 2^{17}/fx	0xfe
0x7 : 2^{18}/fx	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.

Correct code example (1)

```
while(OSTC != 0xff)
{
NOP();/* wait */
}
```

Correct code example (2)

```
while(OSTC <= 0xf0)
{
NOP();/* wait */
}
```

Example of code that may cause problems

```
while(OSTC != 0xf0)
{
NOP();/* wait */
}
```

3.1.3 SFRs (AMPH, AMPHS0, AMPHS1, 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.

- Bits 0, 1, and 2 (AMPH, AMPHS0, and AMPHS1) of the clock operating mode control register (CMC)
- High-speed internal 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% + 1/2f_{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} ÷ (SDRmn[15:9] + 1)) is 233Hz 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

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, RPERF, IAWRF, and LVIRF). Only the default values of these bits are indicated.

The reset control flag register (RESF) of the target device is automatically cleared if it is read by an 8-bit memory manipulation instruction; however, this does not clear the register in the case of the simulator.

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.

The temperature sensor output voltage is always 1.05 V.

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 $f_{MAIN}/2$ 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 DMA controller

The transfer rates of the target device and simulator differ as follows when simulating the DMA controller.

[Target device]

- Completing one DMA transfer takes two clock cycles. The CPU waits during this period.
- In cases of contention with DMA transfer on another channel, one of the DMA transfers will be placed on hold until the other DMA transfer has been completed.

[Simulator]

- Completing one DMA transfer takes zero clock cycles. For this reason, the CPU does not wait.
- Even with contention, transfer on all DMA channels will proceed simultaneously.

3.1.17 LCD controller/driver

The simulator does not support simulation of the following items.

- LCD driver waveforms (waveforms A and B)
- LCD driver voltage generator (external resistance division, internal voltage boosting, and capacitive splitting)
- Biasing methods for LCD panels
- Output waveforms of common and segment signals

Even when no voltage is applied to the VDD pin, the simulator behaves as if 5 V is being applied to the VDD pin. If you wish to avoid this behavior, input a desired voltage value via the [Signal Data Editor] window.

3.1.18 ISCLCD register in the LCD controller/driver

The simulator does not support the functions of the ISCVL3 and ISCCAP bits (to control input through Schmitt trigger buffers) of the LCD input switch control register (ISCLCD).

3.1.19 Registers PFSEG0 to PFSEG4 in the LCD controller/driver

The behavior of the PFSEGxx bits (xx = 04 to 46) of LCD port function registers 0 to 4 (PFSEG0 to PFSEG4) being 1 differs between the target device and the simulator.

[Target device]

The pin is used as a segment output pin.

[Simulator]

The pin is used as a segment output or port pin.

3.1.20 Segment signal output pins for use by the LCD controller/driver

When a pin is to be used as a segment signal output pin, registers that control port functions (PUxx, POM1, PIM1, PMCxx, PMxx, and Pxx) must be set accordingly on the target device.

In the simulator, on the other hand, each pin works as a segment signal output pin without such settings and ports operate according to the settings of registers PUxx, POM1, PIM1, PMCxx, PMxx, and Pxx.

3.1.21 Safety functions

The simulator does not support the following safety functions.

- Flash memory CRC operation function (high-speed CRC, general-purpose CRC)
- RAM parity error detection
- RAM guard function
- SFR guard function
- Invalid memory access detection
-

3.1.22 SSm registers in the serial array unit

During serial communications, when the operation start trigger of channel n (SSmn) in the serial channel start register m (SSm) 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 TSFmn and BFFmn bits in the serial status register mn (SSRmn) are not cleared to 0.

3.2 Usage of simulation functions

3.2.1 Simulation of current drawn

The following notes apply to the function of measuring current.

- The current is calculated roughly as that drawn by the MCU alone based on the typical values (TYP.) for the actual devices. Note that the current values other than for the MCU are not included.
- The number of change points of measurable current is 200,000. The program stops when the number exceeds 200,000.

3.2.2 Simulation speed

The simulation speed of RL78/L12 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

3.2.3 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

3.2.4 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.

3.2.5 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 [X] button cannot be used.

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

3.2.6 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

3.2.7 [Serial] window

When using the [Serial] window as the data receiver for IICA, only ACK can be generated after receiving the data. NACK cannot be generated.

3.2.8 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. 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	Dec.01.23	-	First Edition

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Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

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