e² studio V5.4.0 RL78/G12 Simulator

Release Note

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This document outlines the target devices, simulation functions and cautions of RL78/G12 simulator.

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Contents

Chapter 1. Target Devices and simulation functions

The following target devices are supported by the RL78/G12 simulator.

In addition to CPU instruction simulation, the following simulation functions are available.

(For other RL78 devices, the simulator works as CPU instruction simulation mode alone.)

- The MCU peripheral function simulation
- Virtual target board simulation by using “I/O panel” window
- MCU pin signal waveform by using “Timing chart” window
- Current consumption simulation of MCU

Device group	Device name
RL78/G12	R5F10266, R5F10267, R5F10268, R5F10269, R5F1026A, R5F10366, R5F10367, R5F10368, R5F10369, R5F1036A, R5F10277, R5F10278, R5F10279, R5F1027A, R5F10377, R5F10378, R5F10379, R5F1037A, R5F102A7, R5F102A8, R5F102A9, R5F102AA, R5F103A7, R5F103A8, R5F103A9, R5F103AA

Chapter 2. Changes

This chapter describes changes of RL78/G12 simulator from e² studio V5.3.0 to V5.4.0.

2.1 Additional functions

Current consumption simulation function is added. Please refer to “e² studio Current Consumption View” in the e² studio Help for usage.

Chapter 3. Cautions

This section describes cautions for using RL78/G12 simulator. The following two types of cautions are described:

•Differences between target devices and simulator : Behavior differences between simulator and the target devices due to simulator specifications

•Cautions for using simulation functions : Cautions for the usage of simulator (e.g. configurations and GUI operation)

3.1 Differences between target devices and simulator

3.1.1 Unsupported peripheral functions

The simulator does not support the following peripheral functions of the target device (the following functions are not simulated).

- Regulator
- Power-on-reset circuit
- Voltage detector
- Flash self programming function
- Simplified I^2C of serial array unit

3.1.2 Peripheral I/O redirection register (PIOR)

If using Peripheral I/O redirection register (PIOR), simulator's alternate pin functions are switched same as target device. Note that the PIOR register setting for serial interface pins should not be changed, because "Serial" window could not communicate with a serial interface, if the port related to the serial interface pins is switched.

In addition, in case of switching alternate pin function, be sure to select port name on the "Select Pin" dialog. Do not use alternate function pin name.

3.1.3 Oscillation stabilization time of Clock Generator

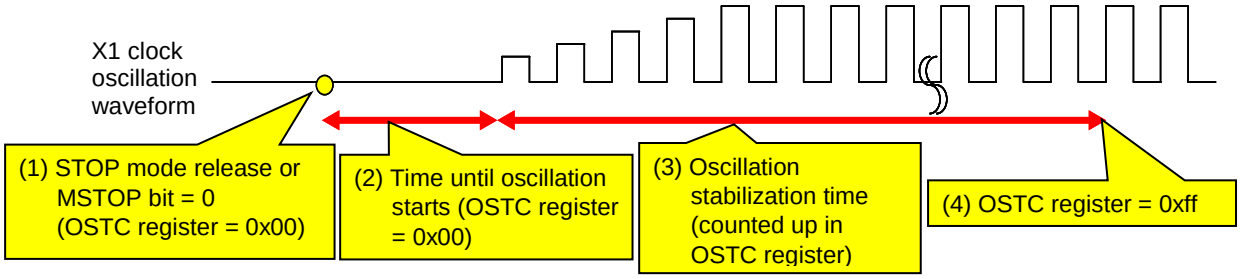
Since the simulator does not simulate the clock oscillator oscillation stabilization time, the value remains at 0 second. When the oscillation is started, the OSTC register is set to one of the following values without counting-up operations.

OSTS Setting Value	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

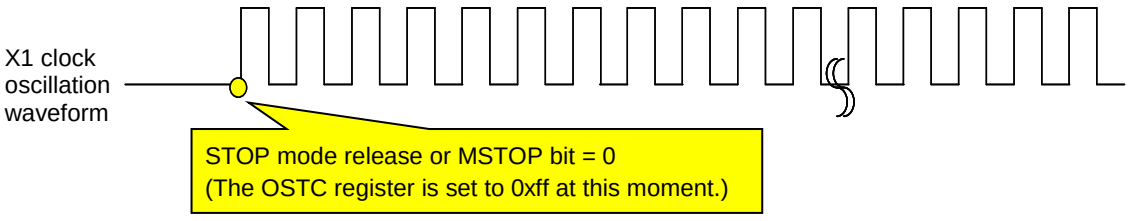
The following figure illustrates this operation.

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

[In target device (an example of when OSTS is set to 0x07)]



[In simulator (an example of when OSTS is set to 0x07)]



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

There is no problem if a program is created with the condition that the execution exits 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 with the condition that the execution exits the oscillation stabilization wait period when the OSTC register value becomes a value other than the maximum value, the execution enters an infinite loop.

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

(This is an example of when OSTS is set to 0x07)

Correct program example (1)

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

Correct program example (2)

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

Example of program that may cause problems

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

3.1.4 SFR with clock generator (AMPH/HIOTRM)

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

- Bit 0 (AMPH) of clock operation mode control register (CMC)
- High-speed internal oscillator trimming register (HIOTRM)

3.1.5 Operation clock of timer array unit

Do not specify an operation clock that is 233 Hz or lower. If the operation clock of the timer array unit is 233 Hz or lower, then the timer array unit will not work properly (it will behave as if operating via a clock that is faster than the one selected).

3.1.6 Noise filter of timer array unit

Although the target device's timer array unit has a function to turn the noise filter on and off in order to reduce noise from the timer input pin, the simulator does not simulate this function. (There is no difference in behavior whether filtering is on or off.) Since there is no noise in the simulator's signal, it would be meaningless to simulate this function.

3.1.7 Interval interrupt of watchdog timer

The following differences occur between the target device and simulator when using an interval interrupt of watchdog timer.

[Target device]

An interval interrupt is generated when 75% + 1/2f_{IL} of overflow time is reached.

[Simulator]

An interval interrupt is generated when 75% of overflow time is reached.

3.1.8 Operation clock of serial array unit

Do not specify an operation clock that is 233 Hz or lower. If the operation 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).

3.1.9 Noise filter of 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. (There is no difference in behavior whether filtering is on or off.) Since there is no noise in the simulator's signal, it would be meaningless to simulate this function.

3.1.10 SDRmn register of serial array unit

The following differences occur between the target device and simulator when the serial data register (SDRmn) is read during serial operation.

[Target device]

The value is 0.

[Simulator]

The value remains right before starting serial operation.

3.1.11 Serial interface IICA

IICA supports pin waveform generation, current consumption measurement and the communication with "Serial" window. The following functions are not supported.

- Digital filter
- Arbitration
- Detection of transmission errors
- Communication reservation

3.1.12 Reset

The behavior differs as follows if a reset is generated by the RESET pin.

[Target device]

MCU goes into reset status when the RESET pin goes to low level. Reset status is released when it goes to high level.

[Simulator]

MCU does not go into reset status when the RESET pin goes to low level. When it goes to high level, the simulator momentarily goes into reset status, and then the reset status is released immediately.

3.1.13 Reset control flag register (RESF)

The simulator only responses to WDTRF bit of Reset control flag register (RESF).

TRAP bit and RPERF bit and IAWRF bit and LVIRF bit remains the initial value.

3.1.14 A/D converter

When VDD, AVREFP signal has no input, the default reference voltage of A/D converter is 5.0V.

For changing the reference voltage, input it to VDD, AVREFP signal by using signal data editor and so on.

The temperature sensor output voltage is always 1.05V.

3.1.15 Clock output/buzzer output controller

When selecting f_{MAIN} as an output clock, “Timing chart” window does not show the clock waveform of PCLBUZn signal.
When selecting f_{MAIN}/2 or slower as an output clock, “Timing chart” window shows the clock waveform.

3.1.16 Execution of illegal instructions

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

3.1.17 DMA controller

The transfer speeds of the target device and simulator differ as follows when simulating the DMA controller.
[Target device]

- It takes two clock cycles to complete one DMA transfer. The CPU waits during this period.
- Contended with another channel's DMA transfer, then one of the DMA transfers will be placed on hold until the other DMA transfer has been completed.

[Simulator]

- It takes zero clock cycles to complete one DMA transfer. For this reason, the CPU does not wait.
- Even with contentions, all DMA channel's transfers will be performed simultaneously.

3.2 Cautions for using simulation function

3.2.1 Cautions for current consumption simulation

There are 3 cautions about current consumption simulation.

- The current consumption value is estimated from typical current value of the actual device. This value is approximated value as MCU alone. Not including the current values of other parts.
- When using current consumption simulation, open “Current Consumption” view from the menu “Renesas Views” and “Debug”, and turn on the switch of “Current Consumption” view before connecting the simulator.
- The maximum length of the current consumption calculation is 200,000 current changing points. If the changing current points reach the maximum length, the user program execution is stopped.

3.2.2 Cautions for simulation speed

The simulation speed of RL78/G12 simulator depends on the numbers of operating peripheral functions.
If many peripheral functions are operating, the simulation speed becomes several times to ten and several times slower than actual devices [Note].
Using a few, or even no peripheral functions, the simulation speed becomes faster than actual devices.
Note: The measurement environment of simulation speed.
CPU: 3.10GHz (Quad-Core), Memory: 4Gbyte, OS: Windws7 32-bit edition

3.2.3 Cautions for terminal waveform of “Timing chart” window

The maximum length of the terminal waveform is 4096 pin changing points. After reached to the maximum length, the data will be overwritten from the oldest one. If the length is not enough, please use the following method.

- Reduce the numbers of registered terminal
- Stop the user program at the place where you want to confirm the waveform by using breakpoint.

3.2.4 Cautions for controlling each window

The following keyboard operations are not available in the simulator windows (“Signal-data editor” window, “I/O panel” window, and “Serial” window).

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

Perform the above operations as follows.

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

3.2.5 Cautions for closing “Simulator GUI” window

The “Simulator GUI” window can only be closed by disconnecting from the debugging tool, or by closing e² studio in proper manner. (The [X] 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 GUI window.

3.2.6 Cautions for disconnecting the debug tool

e² studio may exit if the debugging tool is disconnected while any of the following dialog boxes is open from the “Simulator GUI” window. Please 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 Cautions for setting the Host Machine's language and region

If a Japanese OS is installed on your Host Machine, then if the language or region is set to other than Japanese/Japan, the menus and dialog-box names of the “Simulator GUI” window will be shown in English.
Similarly, if a non-Japanese OS is installed on your Host Machine, then if the language or region is set to Japanese/Japan, the menus and dialog-box names of the “Simulator GUI” window will be shown in Japanese.

3.2.8 Cautions for “Serial” window

When using “Serial” window as the data receiver of IICA, only ACK signal can be generated after receiving the data.
NACK signal cannot be generated.

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