RL78/G11 Simulator V2.03.00

Release Note

Thank you for using the RL78/G11 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 following target devices are supported by the RL78/G11 simulator.

Device group	Device name
RL78/G11	R5F1051A, R5F1054A, R5F1056A, R5F1057A, R5F1058A

The RL78/G11 simulator is capable of simulating the following items along with 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. Points for Caution

This section lists points for caution on using the RL78/G11 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)

2.1 Differences in behavior between the target device and the simulator

2.1.1 Peripheral functions not supported by the simulator

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

- Simplified I^2C of Serial Array Unit
- Regulator
- Power-on-reset circuit
- Voltage detector
- Flash self programming function

2.1.2 Peripheral I/O redirection register (PIOR)

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. Note, however, that the assignment of serial interface functions to port pins must not be changed since doing so will disable normal connections through the [Serial] window.

After re-assigning a given pin function by using the PIOR, be sure to select the name of the port pin you are currently using in the [Select Pin] dialog box of the simulator GUI.

2.1.3 Oscillation stabilization time of Clock Generator

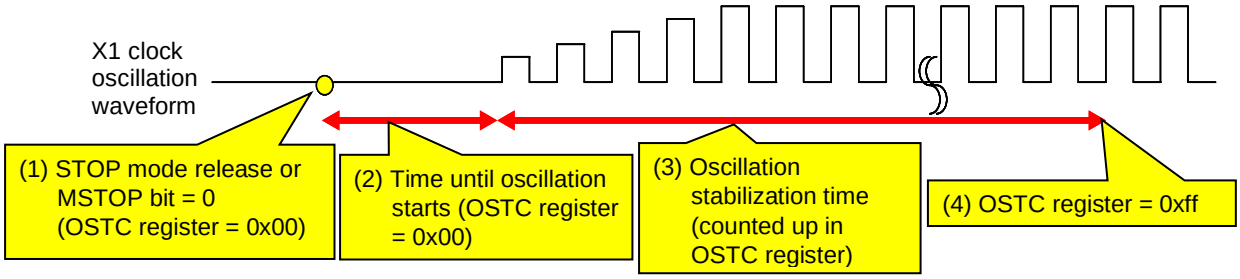
Since the simulator does not simulate the clock oscillator oscillation stabilization time, the value remains at 0 second. When the oscillation is started, the OSTC register is set to one of the following values without count up operations.

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

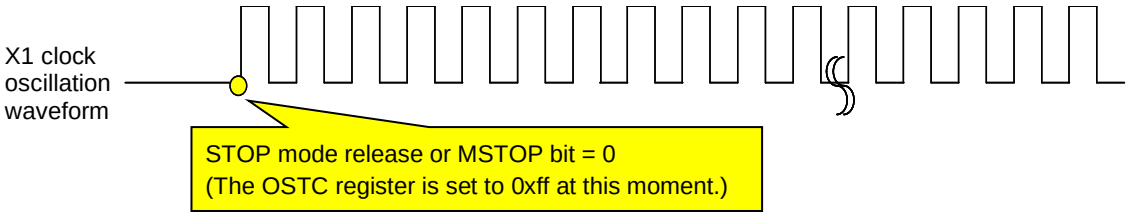
The following figure illustrates this operation.

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 */
}
```

2.1.4 SFRs 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 operation mode control register (CMC)
- High-speed internal oscillator trimming register (HIOTRM)

2.1.5 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).

2.1.6 Noise filter / digital filter of timer

Although the target device's Timer array unit has a function to turn the noise filter / digital filter on and off in order to reduce noise from the timer 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.

2.1.7 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

2.1.8 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.

2.1.9 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

2.1.10 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.

2.1.11 IICA serial interface

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

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

2.1.12 Reset

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

2.1.13 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.

2.1.14 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.

2.1.15 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.

2.1.16 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).

2.1.17 Times taken for data transfer by the data transfer controller (DTC)

The times taken for data transfer by the data transfer controller (DTC) differ between the target device and the simulator.
[Target device]
- A response time is required from detection of a DTC activation source until data transfer starts.
- A waiting time is required for access to extended special function registers (2nd SFRs).
- The DTC puts the data transfer on hold when the CPU executes any instruction that holds the DTC pending.
- Access to the data bus by the CPU is put on hold during DTC transfer.

[Simulator]
- Data transfer starts immediately after detection of a DTC activation source.
- No waiting time is required even for access to extended special function registers (2nd SFRs).
- The DTC does not put the data transfer on hold even when the CPU executes any instruction that should hold the DTC pending.
- Access to the data bus by the CPU is not put on hold even during DTC transfer.

2.1.18 Repeat mode of the data transfer controller (DTC)

If any of the conditions listed below is satisfied while the data transfer controller (DTC) is in repeat mode, the DTC ignores activation sources and will thus fail to transfer data.

- A DTC transfer count register j (DTCCTj) is set to 00H (number of transfers: 256 times).
- A DTC block size register j (DTBLSj) is set to 00H (block size: 256 or 512 bytes).
- A DTC control register j (DTCCRj) is used to set the transfer data size to 16 bits and the corresponding DTC block size register j (DTBLSj) is used to set the block size to 256 bytes or more.

2.1.19 Event Link Controller(ELC)

If any of the peripheral-module functions listed below is selected for linking by the event link controller (ELC), the simulator causes the peripheral-module function to operate immediately after reception of the event signal. The ELC in the actual device, on the other hand, causes the peripheral-module function to start operation several cycles after the ELC has received the event signal.

[Peripheral-module functions]

- Timer input channel 0 of timer array unit 0
- Timer input channel 1 of timer array unit 0

2.1.20 D/A converter

When no voltage value is set for the VDD pin, the default reference voltage of the D/A converter is 5.0 V. To change the reference voltage, specify the desired voltage value for the VDD pin via the [Signal Data Editor] window or some other means.

2.1.21 Reference voltage of the comparators

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.

2.1.22 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).

2.1.23 Digital filters in the comparators

The simulator does not simulate the digital filters in the comparators.

2.1.24 Voltages amplified by the programmable gain amplifier (PGA)

In the hardware configuration of the target device, the voltages amplified by the programmable gain amplifier (PGA) depend on the voltages on the PGAGND and VSS pins. The voltages amplified by the simulated PGA, on the other hand, only depend on the voltage on the PGAI pin (i.e. not on those on the PGAGND and VSS pins).

2.1.25 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

2.2 Usage of simulation functions

2.2.1 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.

2.2.2 Simulation speed

The simulation speed of RL78/G11 simulator depends on the number of operating peripheral functions. If many peripheral functions are operating, the simulation speed becomes from several to ten and several 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

2.2.3 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

2.2.4 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.

2.2.5 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.

2.2.6 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

2.2.7 [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.

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Jun.08.21	-	First Edition

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