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CS+ RL78/G13 Simulator V1.08.00

Release Note

This document outlines the target devices, simulation functions and cautions of RL78/G13 simulator.

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Contents

Chapter 1. Target Devices and simulation functions

The following target devices are supported by the RL78/G13 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. Timer, Serial, and so on.

- Virtual target board simulation by using "I/O panel" window

- MCU pin signal waveform by using "Timing chart" window

- Current consumption simulation

Device group	Device name
RL78/G13	R5F1006A, R5F1016A, R5F1007A, R5F1017A, R5F1008A, R5F1018A, R5F100AA, R5F101AA, R5F100BA, R5F101BA, R5F100CA, R5F101CA, R5F100EA, R5F101EA, R5F100FA, R5F101FA, R5F100GA, R5F101GA, R5F1006C, R5F1016C, R5F1007C, R5F1017C, R5F1008C, R5F1018C, R5F100AC, R5F101AC, R5F100BC, R5F101BC, R5F100CC, R5F101CC, R5F100EC, R5F101EC, R5F100FC, R5F101FC, R5F100GC, R5F101GC, R5F100JC, R5F101JC, R5F100LC, R5F101LC, R5F1006D, R5F1016D, R5F1007D, R5F1017D, R5F1008D, R5F1018D, R5F100AD, R5F101AD, R5F100BD, R5F101BD, R5F100CD, R5F101CD, R5F100ED, R5F101ED, R5F100FD, R5F101FD, R5F100GD, R5F101GD, R5F100JD, R5F101JD, R5F100LD, R5F101LD, R5F1006E, R5F1016E, R5F1007E, R5F1017E, R5F1008E, R5F1018E, R5F100AE, R5F101AE, R5F100BE, R5F101BE, R5F100CE, R5F101CE, R5F100EE, R5F101EE, R5F100FE, R5F101FE, R5F100GE, R5F101GE, R5F100JE, R5F101JE, R5F100LE, R5F101LE, R5F100AF, R5F101AF, R5F100BF, R5F101BF, R5F100CF, R5F101CF, R5F100EF, R5F101EF, R5F100FF, R5F101FF, R5F100GF, R5F101GF, R5F100JF, R5F101JF, R5F100LF, R5F101LF, R5F100MF, R5F101MF, R5F100PF, R5F101PF, R5F100AG, R5F101AG, R5F100BG, R5F101BG, R5F100CG, R5F101CG, R5F100EG, R5F101EG, R5F100FG, R5F101FG, R5F100GG, R5F101GG, R5F100JG, R5F101JG, R5F100LG, R5F101LG, R5F100MG, R5F101MG, R5F100PG, R5F101PG, R5F100EH, R5F101EH, R5F100FH, R5F101FH, R5F100GH, R5F101GH, R5F100JH, R5F101JH, R5F100LH, R5F101LH, R5F100MH, R5F101MH, R5F100PH, R5F101PH, R5F100SH, R5F101SH, R5F100FJ, R5F101FJ, R5F100GJ, R5F101GJ, R5F100JJ, R5F101JJ, R5F100LJ, R5F101LJ, R5F100MJ, R5F101MJ, R5F100PJ, R5F101PJ, R5F100SJ, R5F101SJ, R5F100FK, R5F101FK, R5F100GK, R5F101GK, R5F100JK, R5F101JK, R5F100LK, R5F101LK, R5F100MK, R5F101MK, R5F100PK, R5F101PK, R5F100SK, R5F101SK, R5F100FL, R5F101FL, R5F100GL, R5F101GL, R5F100JL, R5F101JL, R5F100LL, R5F101LL, R5F100ML, R5F101ML, R5F100PL, R5F101PL, R5F100SL, R5F101SL

Chapter 2. User's Manuals

Please read the following user's manuals along with this document.

Manual Name	Document Number
CS+ V8.01.00 Python Console	R20UT4404EJ0100
CS+ V8.01.00 Message	R20UT4415EJ0100
CS+ V8.01.00 RL78 Debug Tool	R20UT4403EJ0100

Chapter 3. Uninstallation

This simulator is included CS+ for CC installer. Therefore when uninstalling this simulator, please uninstall "CS+ for CC".

Chapter 4. Cautions

This section describes cautions for using RL78/G13 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)

4.1   Differences between target devices and simulator

4.1.1   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

4.1.2   Peripheral I/O redirection register (PIOR)

If using Peripheral I/O redirection register (PIOR), simulator's alternate pin function 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.
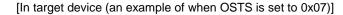
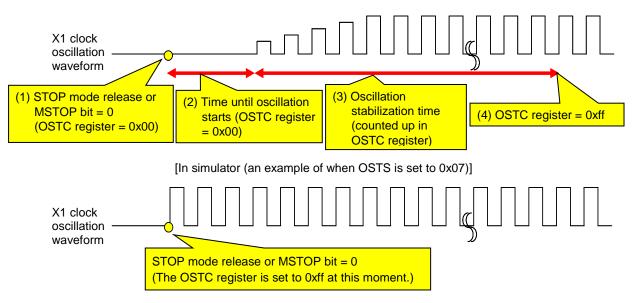### 4.1.3 Oscillation stabilization time of Clock Generator

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)]

X1 clock
oscillation
waveform

(1) STOP mode release or MSTOP bit = 0 (OSTC register = 0x00)

(2) Time until oscillation starts (OSTC register = 0x00)

(3) Oscillation stabilization time (counted up in OSTC register)

(4) OSTC register = 0xff

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

X1 clock
oscillation
waveform

STOP mode release or MSTOP bit = 0
(The OSTC register is set to 0xff at this moment.)

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)	Correct program example (2)	Example of program that may cause problems
while(OSTC != 0xff)	while(OSTC <= 0xf0)	while(OSTC != 0xf0)
{	{	{
NOP();/* wait */	NOP();/* wait */	NOP();/* wait */
}	}	}

4.1.4   SFR with clock generator (AMPHS0/AMPHS1/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 1, 2 (AMPHS0, AMPHS1) of clock operation mode control register (CMC)
- High-speed internal oscillator trimming register (HIOTRM)

4.1.5   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).

4.1.6   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.

4.1.7   1-Hz pin output of real-time counter

If the waveform of the RTC1HZ pin is checked in the "Timing chart" window using 1 Hz pin output of the real-time counter, the output waveform frequency becomes 32.768 KHz or 15KHz.

In this case, determine that 1 Hz output is being performed without problems.

4.1.8 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.

4.1.9 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).

4.1.10 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.

4.1.11 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 at the moment of serial operation started.

4.1.12 Simplified I²C of serial array unit

The simplified I²C supports the pin waveform generation. The communication with "Serial" window is not available. "ACK output function" and "ACK detection function" are not available.

4.1.13 Serial interface IICA

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

4.1.14 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.

4.1.15 Reset control flag register (RESF)

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

The simulator does not support TRAP bit and RPERF bit and IAWRF bit and LVIRF bit.

These bits are not changed from the initial value.

4.1.16 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.

4.1.17 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.

4.1.18 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).

4.1.19 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.
- Conflicted 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 conflictions, all DMA channel's transfers will be performed simultaneously.

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4.2   Cautions for using simulation function

4.2.1   Cautions for current consumption simulation

The function of measuring current consumption has the following notes.

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

4.2.2   Cautions for simulation speed

The simulation speed of RL78/G13 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 may become faster than actual devices.

Note: The measurement environment of simulation speed.

CPU: 3.10GHz (Quad-Core), Memory: 4Gbyte, OS: Windws7 64-bit edition

4.2.3   Cautions for pin waveform of "Timing chart" window

The maximum length of the pin 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 pin
- Stop the user program at the place where you want to confirm the waveform by using breakpoint.

4.2.4   Cautions for controlling each windows

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.

4.2.5   Cautions for closing "Simulator GUI" window

The "Simulator GUI" window can only be closed by disconnecting from the debugging tool, or by closing CS+ in proper manner. (The ⊠ 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.

4.2.6   Cautions for disconnecting the debug tool

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

4.2.7   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.

4.2.8   Cautions for "Serial" window

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

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