This document outlines the target devices, simulation functions and cautions of RL78/G10 simulator.

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Chapter 1. Target Devices

The following target devices are supported by the RL78/G10 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 (Maximum and average current measurement by Python command)

<table>
<thead>
<tr>
<th>Nickname</th>
<th>Device name</th>
</tr>
</thead>
<tbody>
<tr>
<td>RL78/G10</td>
<td>R5F10Y14(10pin), R5F10Y16(10pin), R5F10Y17(10pin), R5F10Y44(16pin), R5F10Y46(16pin), R5F10Y47(16pin)</td>
</tr>
</tbody>
</table>
Chapter 2. User's Manuals

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

<table>
<thead>
<tr>
<th>Manual Name</th>
<th>Document Number</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS+ V5.00.00 RL78 Debug Tool</td>
<td>R20UT3939EJ0100</td>
<td>When using CS+ for CC</td>
</tr>
<tr>
<td>CS+ V5.00.00 Message</td>
<td>R20UT3952EJ0100</td>
<td>When using CS+ for CC</td>
</tr>
<tr>
<td>CS+ V5.00.00 Python Console</td>
<td>R20UT3932EJ0100</td>
<td>When using CS+ for CC</td>
</tr>
</tbody>
</table>
Chapter 3. Uninstallation

This simulator is included CS+ for CC installer. Therefore when uninstalling this simulator, please uninstall “CS+ for CC”.
Chapter 4. Changes

This chapter describes changes from V1.02.00 to V2.02.00.

4.1 Additional functions

The following functions have been added.

- Serial interface IICA simulation
  Simulation of Serial interface IICA is now supported.
- Current Consumption simulation
  Simulation of current consumption is now supported. (Only maximum and average current measurement by python command.)
Chapter 5. Cautions

This section describes cautions for using RL78/G10 simulator. The following two types of caution 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)

5.1 Differences between target devices and simulator

5.1.1 Unsupported peripheral functions

The simulator does not support the following peripheral functions of the target device (the following functions cannot be debugged on the simulator).

* Regulator
* Selectable power-on-reset circuit
* Simplified I2C of Serial array unit
* CSI slave communication mode of Serial array unit

5.1.2 Peripheral I/O redirection register (PIOR)

If using Peripheral I/O redirection register (PIOR), simulator's alternate function are switched same as target device. Therefore please refer to following table to select the pin name of "select pin dialog" on simulator GUI.

<table>
<thead>
<tr>
<th>Pin name</th>
<th>PIOR register value</th>
<th>Using pin name of select Pin dialog on Simulator GUI</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTP3</td>
<td>PIOR4 : 0</td>
<td>P06/ANI5/SCLA0/INTP3/SI01</td>
</tr>
<tr>
<td></td>
<td>PIOR4 : 1</td>
<td>P121/X1</td>
</tr>
<tr>
<td>INTP2</td>
<td>PIOR3 : 0</td>
<td>P41/TI03/INTP2</td>
</tr>
<tr>
<td></td>
<td>PIOR3 : 1</td>
<td>P122/X2/EXCLK</td>
</tr>
<tr>
<td>INTP1</td>
<td>PIOR2 : 0</td>
<td>P00/S00/TXD0/INTP1</td>
</tr>
<tr>
<td></td>
<td>PIOR2 : 1</td>
<td>P03/ANI2/TO00/KR4/IVCMP0</td>
</tr>
<tr>
<td>TI01</td>
<td>PIOR1: 0</td>
<td>P04/ANI3/TI01/TO01/KR5</td>
</tr>
<tr>
<td></td>
<td>PIOR1: 1</td>
<td>P40/KR0/TOOL0</td>
</tr>
<tr>
<td>TO01</td>
<td>PIOR1: 0</td>
<td>P04/ANI3/TI01/TO01/KR5</td>
</tr>
<tr>
<td></td>
<td>PIOR1: 1</td>
<td>P40/KR0/TOOL0</td>
</tr>
<tr>
<td>PCLBUZ0</td>
<td>PIOR0: 0</td>
<td>P02/ANI1/_SCK00/SCL00/PCLBUZ0/KR3</td>
</tr>
<tr>
<td></td>
<td>PIOR0: 1</td>
<td>P40/KR0/TOOL0</td>
</tr>
</tbody>
</table>
5.1.3 Oscillation stabilization time of Clock Generator

The simulator does not simulate the clock oscillator oscillation stabilization time. The oscillation stabilization time is always 0 seconds. When the oscillation is started, the OSTC register is set to the following values without count up operation.

<table>
<thead>
<tr>
<th>OSTS Setting Value</th>
<th>OSTC Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x0 : ((2^8+16)/fx)</td>
<td>0x80</td>
</tr>
<tr>
<td>0x1 : ((2^9+16)/fx)</td>
<td>0xc0</td>
</tr>
<tr>
<td>0x2 : ((2^{10}+16)/fx)</td>
<td>0xe0</td>
</tr>
<tr>
<td>0x3 : ((2^{11}+16)/fx)</td>
<td>0xf0</td>
</tr>
<tr>
<td>0x4 : ((2^{13}+16)/fx)</td>
<td>0xf8</td>
</tr>
<tr>
<td>0x5 : ((2^{15}+16)/fx)</td>
<td>0xfc</td>
</tr>
<tr>
<td>0x6 : ((2^{17}+16)/fx)</td>
<td>0xfe</td>
</tr>
<tr>
<td>0x7 : ((2^{18}+16)/fx)</td>
<td>0xff</td>
</tr>
</tbody>
</table>

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) to (4) end instantly and the X1 clock oscillation starts.
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)

<table>
<thead>
<tr>
<th>Correct program example (1)</th>
<th>Correct program example (2)</th>
<th>Example of program that may cause problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>while(OSTC != 0xff)</td>
<td>while(OSTC &lt;= 0xf0)</td>
<td>while(OSTC != 0xf0)</td>
</tr>
<tr>
<td>{</td>
<td>{</td>
<td>{</td>
</tr>
<tr>
<td>NOP();/* wait */</td>
<td>NOP();/* wait */</td>
<td>NOP();/* wait */</td>
</tr>
<tr>
<td>}</td>
<td>}</td>
<td>}</td>
</tr>
</tbody>
</table>

5.1.4 AMPH bit of Clock operation mode control register (CMC)

The simulator does not simulate AMPH bit of Clock operation mode control register (CMC). Although it is possible to read / write the value of this bit, the operation is not changed if changing it.

5.1.5 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 operate correctly (it will behave as if operating via a clock that is faster than the one selected).

5.1.6 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 on the timer input pin, the simulator does not simulate this. (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.

5.1.7 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).
5.1.8  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. (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.

5.1.9  SDR0nH register of serial array unit

The following differences occur between the target device and simulator when the serial data register (SDR0nH) is read during serial operation.

[Target device]
   The value is 0.

[Simulator]
   The value is immediately before start of serial operation.

5.1.10  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.

5.1.11  Reset control flag register (RESF)

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

The operation of TRAP bit and SPORF bit are not supported.

5.1.12  Reference voltage of A/D converter

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

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

5.1.13  Digital filter of Comparator

The simulator does not simulate the digital filter function of Comparator.

So bit 0 and bit 1 of COMPFIR register are not operated.
5.1.14  Response delay time of Comparator

The simulator does not simulate the response delay time of Comparator.
So the operation of high-speed mode and low-speed mode is same.

5.1.15  Clock output/buzzer output controller

When selecting f\text{MAIN} as an output clock, timing chart window cannot display the clock waveform of
PCLBUZn signal.
When selecting f\text{MAIN}/2 or slower as an output clock, timing chart window can display the clock waveform.

5.1.16  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).

5.1.17  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
5.2 Cautions for using simulation function

5.2.1 Cautions for current consumption simulation

In this version, simulator supports only maximum and average current measurement by python command.

5.2.2 Cautions for simulation speed

The simulation speed of RL78/G10 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: 8Gbyte, OS: Windws7 64-bit edition

5.2.3 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.

5.2.4 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.

5.2.5 Cautions for closing simulator GUI window

The simulator GUI window can only be closed by disconnecting from the debugging tool, or by closing CS+ proper. (The [X] button cannot be clicked.)

Additionally, although it appears that the [X] button can be pressed if Aero is enabled in Windows Vista, pressing this button will not close the GUI window.
5.2.6  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
- 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

5.2.7  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.

5.2.8  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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