RH850/U2C Group

U2C Virtual Environment Construction Guide

Introduction

This application note describes the procedure for constructing the virtual environment for running program for RH850/U2C (hereinafter referred to as U2C) series in the automotive single-chip microcomputer by Renesas Electronics.

Aim of this document and software is to provide supplemental information for the function on RH850/U2C. It is not intended to implement in the design for mass production.

There is no guarantee to update in this document and software to reflect the latest manual, errata, technical update and development environment. You are fully responsible for the incorporation or any other use of the information of this document in the design of your product or system, and please refer to latest manual, errata, technical update, and development environment.

Target program

- RH850/U2C8 Startup Routine APN Rev.0.10 Sample Code for MULTI

Target integrated development environment

- MULTI (by Green Hills Software)
  Product : IDE for V800
  Version : 2022.1.4(v 7.1.6)
  Target : V800/RH850

Target virtual environment

- VLAB (by VLAB Works)
  Version : VLAB 2.8.0 (win-vc140-x64)
- VLAB Toolbox (by VLAB Works)
  Version : rh850g4-1.21.1-win-vc140-x64.vlabtoolbox

Reference Document

This document has been written with reference to the following manuals.

- MULTI: Building Applications for Embedded RH850 v2022.1 (build_v800.pdf)
- VLAB RH850 G4 Virtual Platform Toolbox User Manual V1.21.1 (VLAB_RH850_G4_Virtual_Platform_Toolbox_User_Manual.pdf)
- VLAB RH850 G4 Virtual Platform Toolbox U2C Addendum V1.21.1 (RH850_Toolbox_U2C_Addendum.pdf)

Contents

Overview

This document describes how to debug the RH850/U2C8 Startup Routine APN Sample Code with the virtual environment software (VLAB by VLAB Works) and the integrated development environment (MULTI by Green Hills Software).

1. Installation

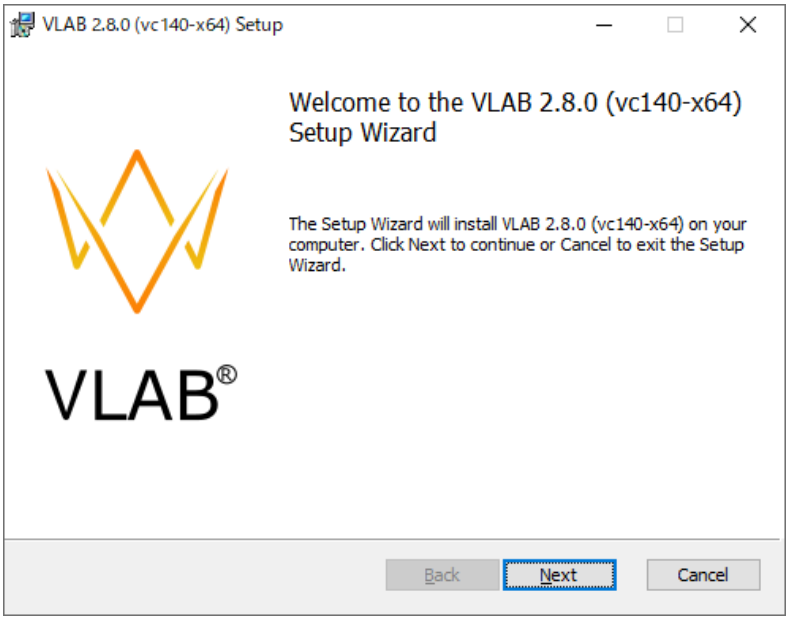
1.1 MULTI

Install MULTI. How to install MULTI is not covered in this document.

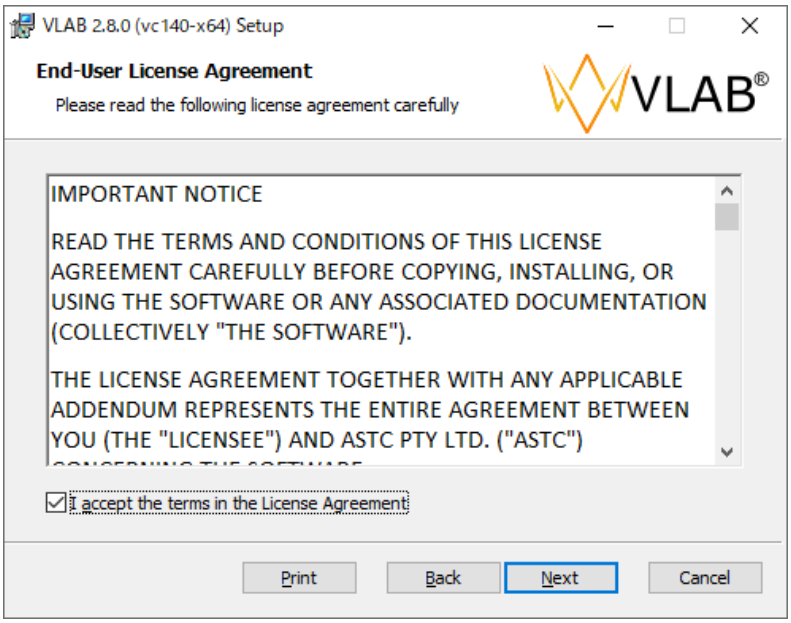
1.2 VLAB

Install VLAB. Setting up the VLAB license is not covered in this document.

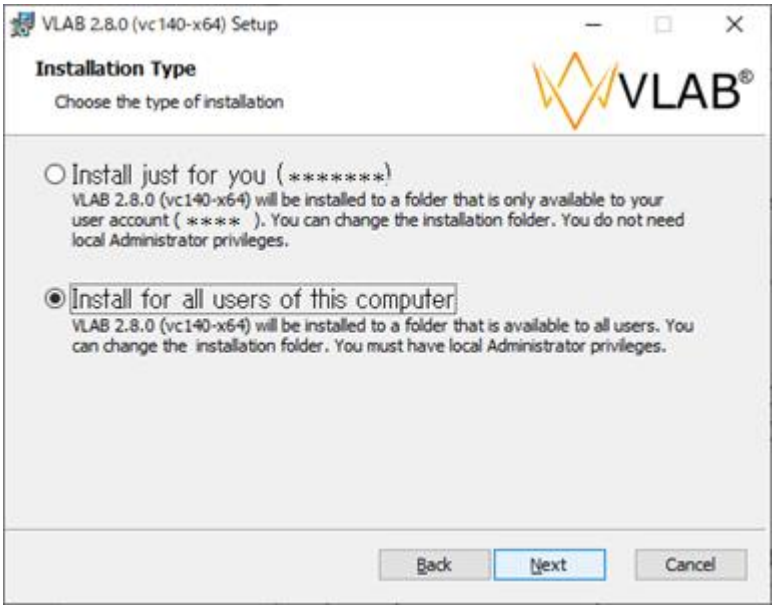
1. Double-click “the vlab-setup-2.8.0-win-vc140-x64.msi” file.
2. Press [Next] button.



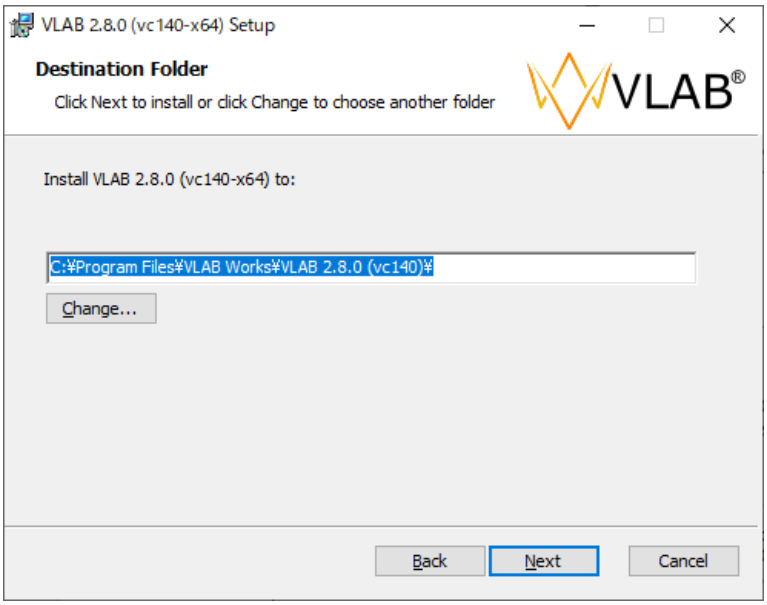
3. Press [Next] button.



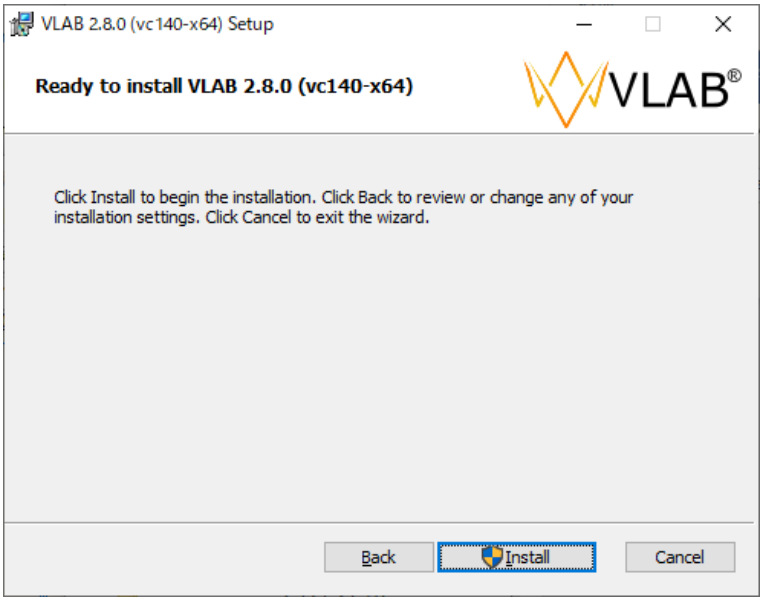
4. Press [Next] button.



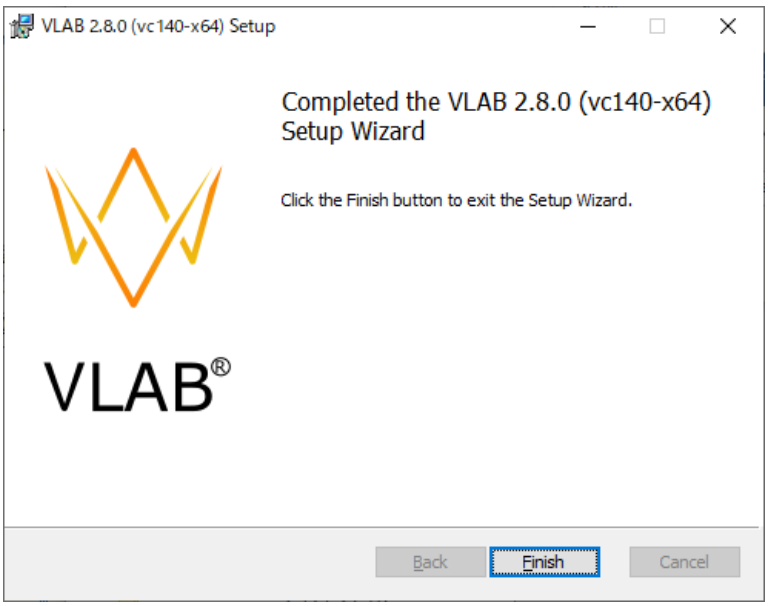
5. Press [Next] button.



6. Press [Install] button.



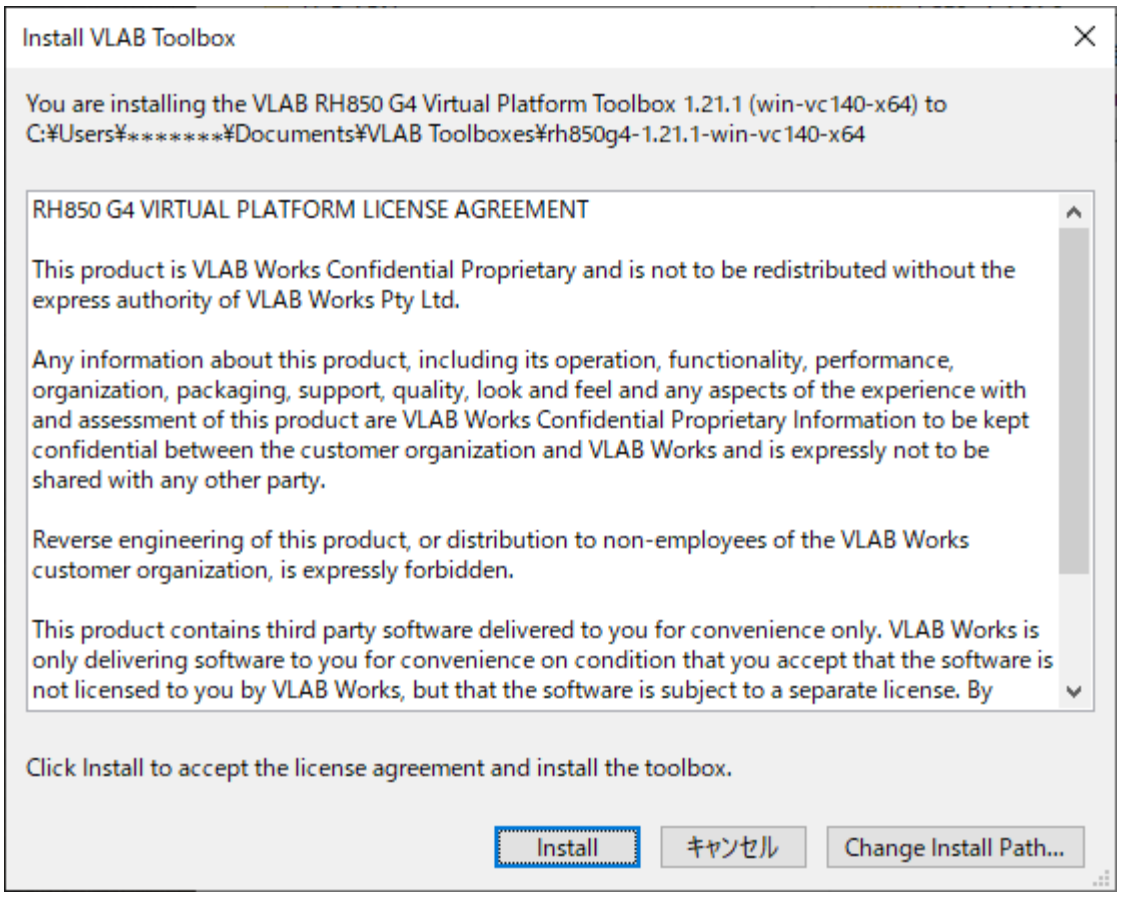
7. Press [Finish] button.



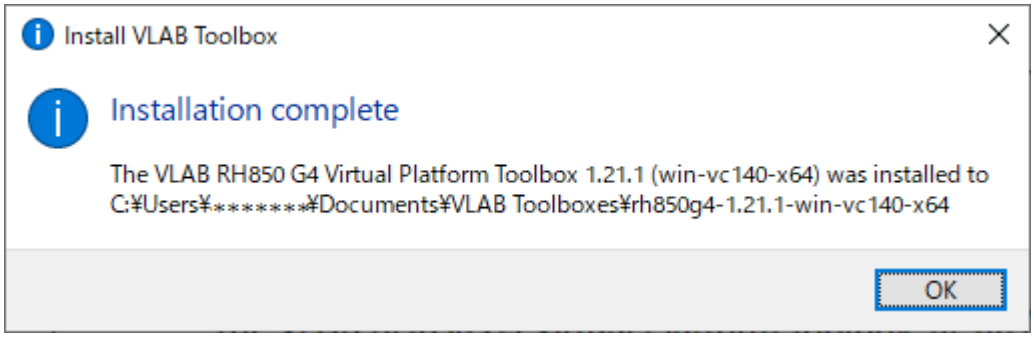
1.3 VLAB Toolbox

Install VLAB Toolbox.

1. Double-click “rh850g4-1.21.1-win-vc140-x64.vlabtoolbox” file.
2. Press [Install] button.



3. Press [OK] button.



1.4 GTKWave

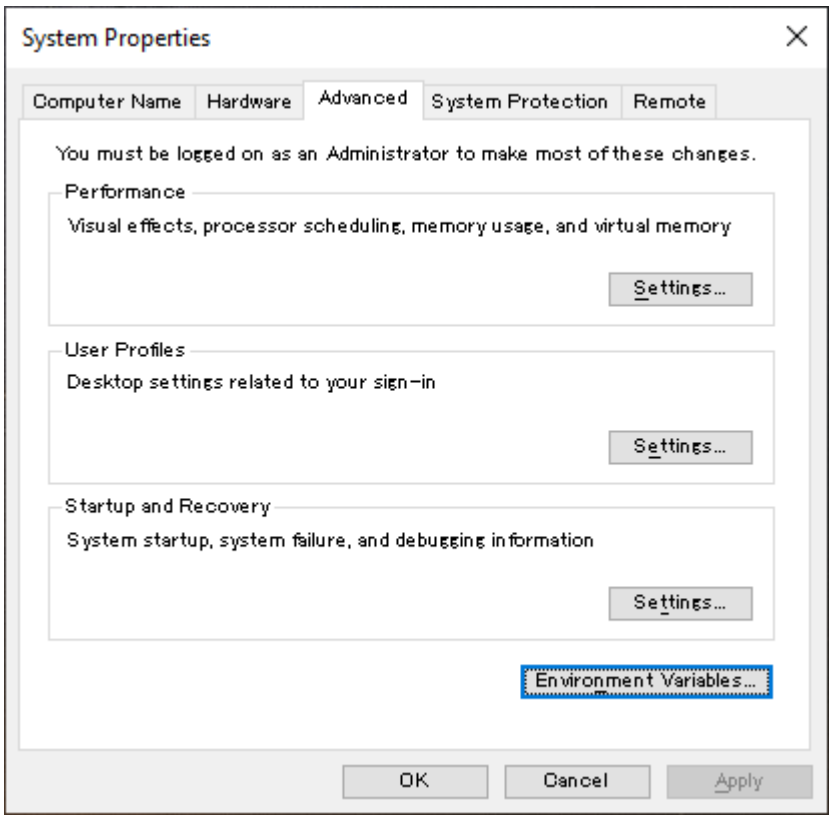
In this document, GTKWave (gtkwave-3.3.100-bin-win64) is installed as the waveform display tool.

URL: https://sourceforge.net/projects/gtkwave/files/

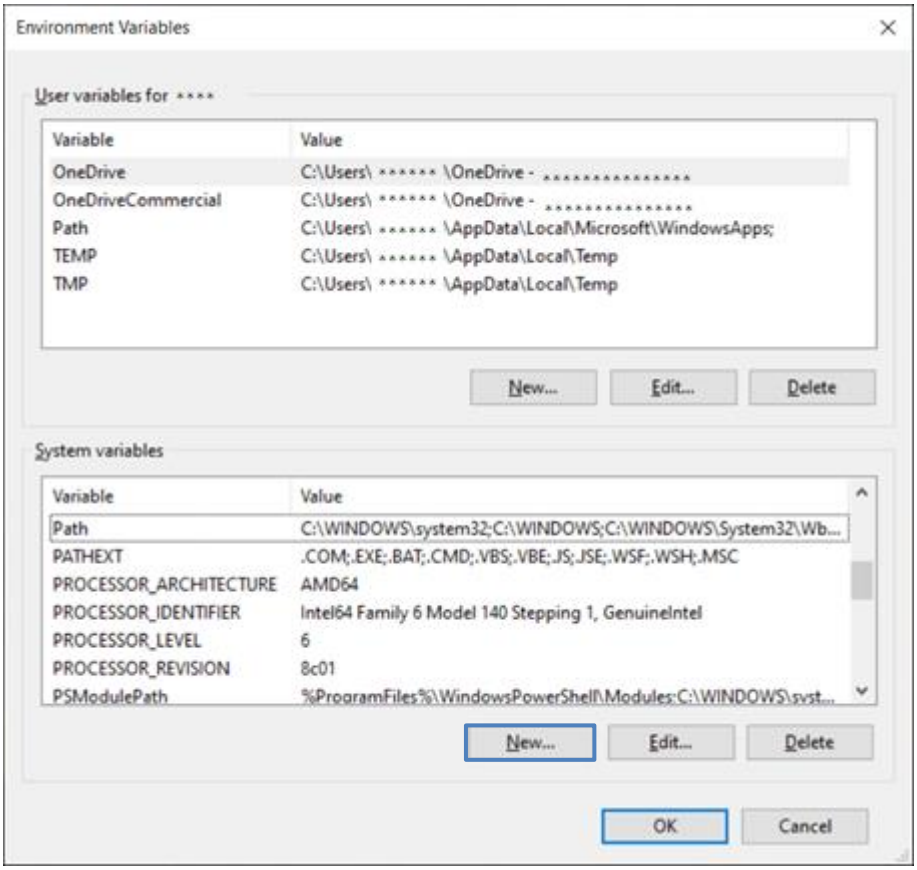
2. Environment Variable Settings

To cooperate between VLAB and MULTI, set Windows "System variables". For details of “System variables”, see “7.1, Green Hills MULTI” on VLAB_RH850_G4_Virtual_Platform_Toolbox_User_Manual.pdf file in VLAB Toolbox installation folder.

1. Click the icon  on the Windows taskbar.
2. Type "Environment Variables" and then press Enter key.
3. Press "Environment Variables" button.



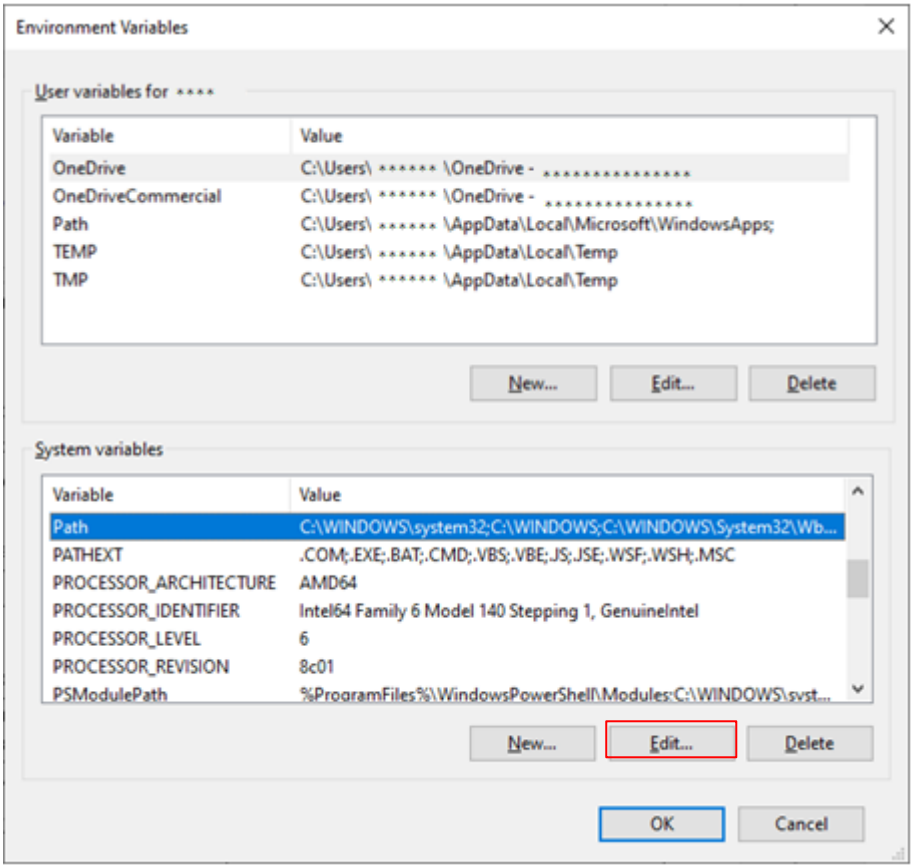
4. Press [New] button.



5. Add the following variable and value to Windows "System variables" and press [OK] button.

Variable	Value	Example of Value
MULTI_ROOT	Path to the folder where MULTI (multi.exe) is installed	C:\ghs\multi_716d
MULTI_COMP_ROOT	GHS compiler installation folder path	C:\ghs\comp_202214

6. Select “Path” in Windows "System variables" and press [Edit] button.



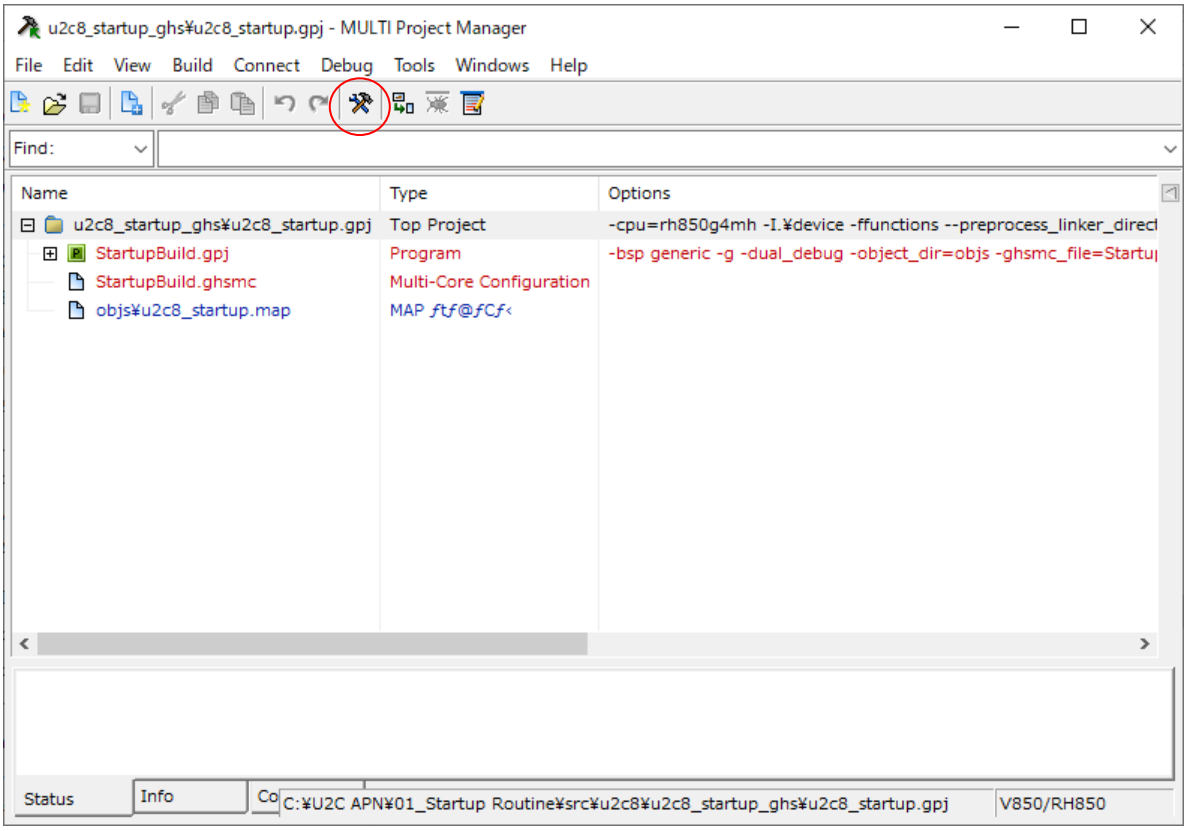
7. Press [New] button and type the following VLAB installation folder path and press [OK] button.

Variable	Value	Example of Value
Path	VLAB installation folder path	C:\Program Files\VLAB Works\VLAB 2.8.0 (vc140)

8. Press [OK].
9. Press [OK].

3. Building software with MULTI

Build a software to run in the virtual environment with MULTI. In this document, open the project file (u2c8_startup_ghs\u2c8_startup.gpj) in "U2C8 Startup Routine APN Sample Code for MULTI" and build it.



- “dwarf2” option is set in "U2C8 Startup Routine APN Sample Code for MULTI" as the build options of MULTI because it is necessary to specify the ELF file generated by “dwarf2” option to the vlab-ide command described later.
- After building "U2C8 Startup Routine APN Sample Code for MULTI", “u2c8_startup.out” file is generated in “u2c8_startup_ghs\objs” folder.

4. Launching Virtual Environment

1. Start the VLAB IDE and MULTI by the vlab-ide command.

   In this document, launch the VLAB IDE and MULTI by double-click "debug.bat" file in "U2C8 Startup Routine APN Sample Code for MULTI".

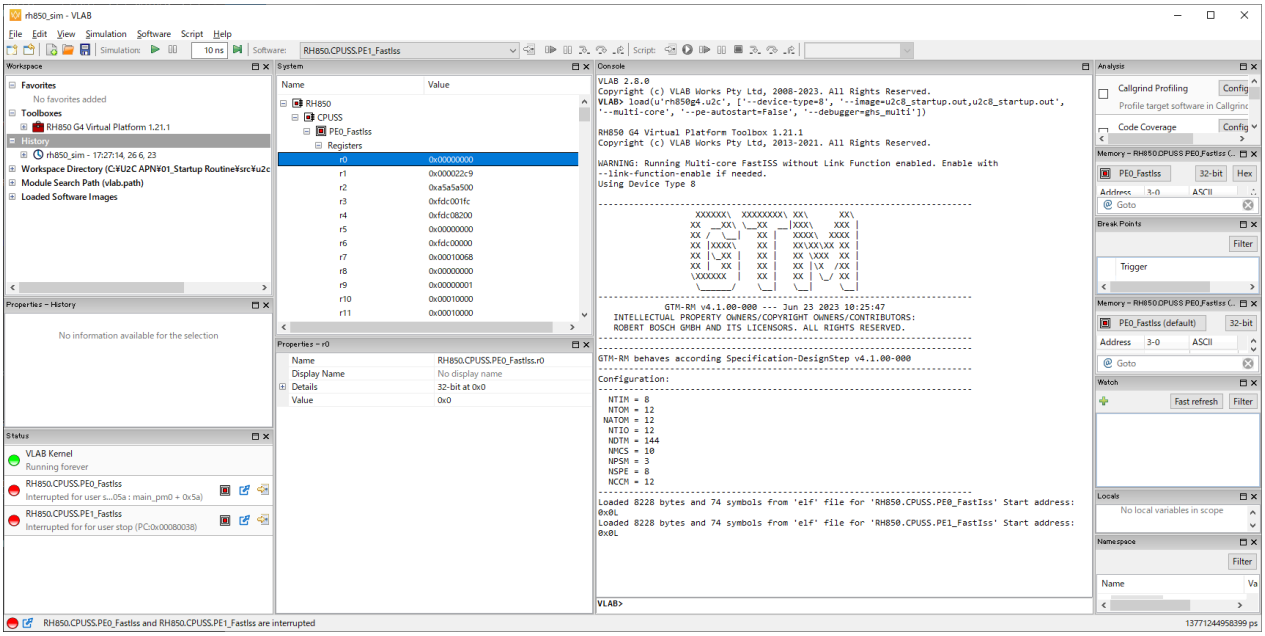
- File name：u2c8_startup_ghs\debug.bat

```
set PE0_FILE=u2c8_startup.out
set PE1_FILE=u2c8_startup.out
cd objs
vlab-ide rh850g4.u2c --device-type=8 --image=%PE0_FILE%,%PE1_FILE% --multi-core --pe-autostart=False --debugger=ghs_multi
```

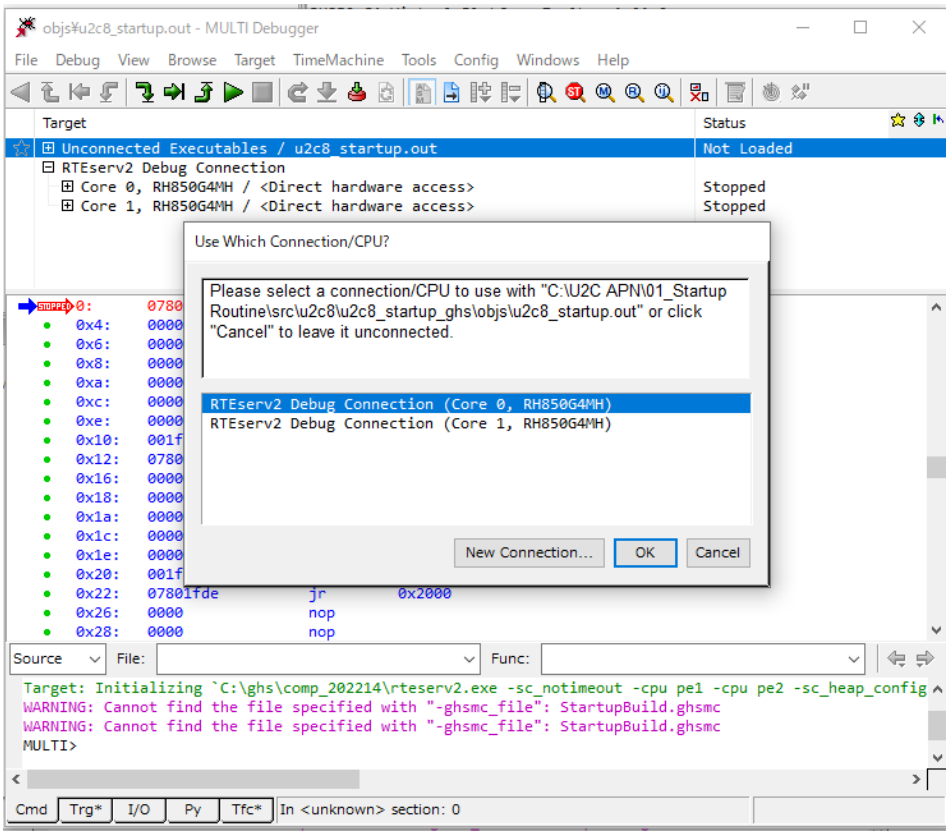
- The options for the vlab-ide command are described below.

option	explanation	reference
rh850g4.u2c	Specify U2C as the target to load into VLAB.	RH850_Toolbox_U2C_Addendum.pdf ・3 How to Run ・3.1 Device Type Selection
--device-type=8	Specify U2C8 (2 core).	
--image= u2c8_startup.out, u2c8_startup.out	Specify ELF files for PE0 and PE1 separated by commas.	VLAB_RH850_G4_Virtual_Platform_Toolbox_User_Manual.pdf ・3.2.4 Target Code Image Loading ・12 PE Autostart Mode ・7.1.2 Debugging
--multi-core	Specify Multicore debug.	
--pe-autostart=False	Set so that cores other than PE0 do not start automatically when the debugger is connected.	
--debugger=ghs_multi	Specify MULTI as the debugger.	

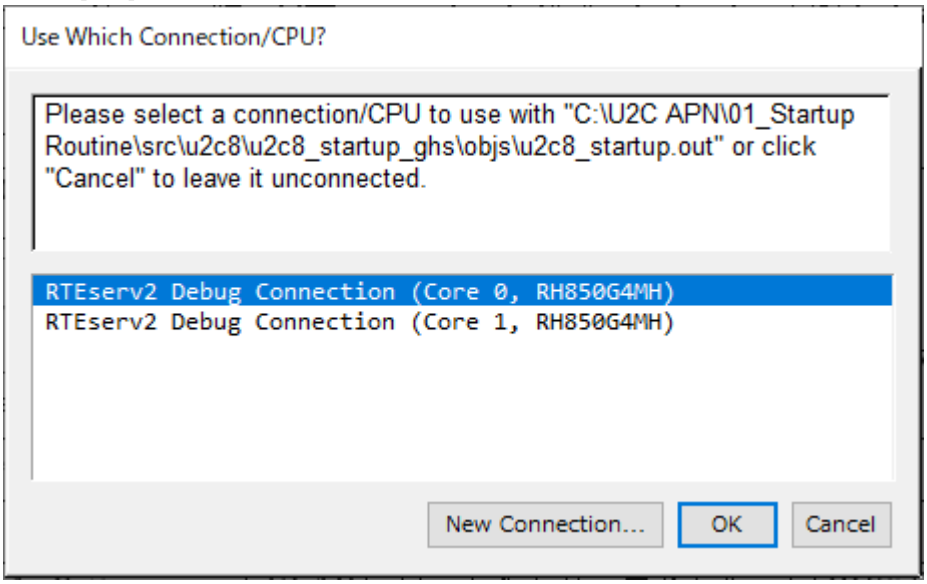
2. VLAB IDE screen is launched.



3. MULTI screen is launched.



4. Press [OK] button.



5. Software Debugging Example with Virtual Environment and IDE

"U2C Startup Routine APN Sample Code for MULTI" executes the following:

- U2C's PE0 and PE1 start from address 0 after reset.
- Initialization of general-purpose registers, system registers, LRAM, and CRAM on U2C.
- U2C's PE0 toggles P2_0 pin's output.
- U2C's PE1 toggles P2_1 pin's output.

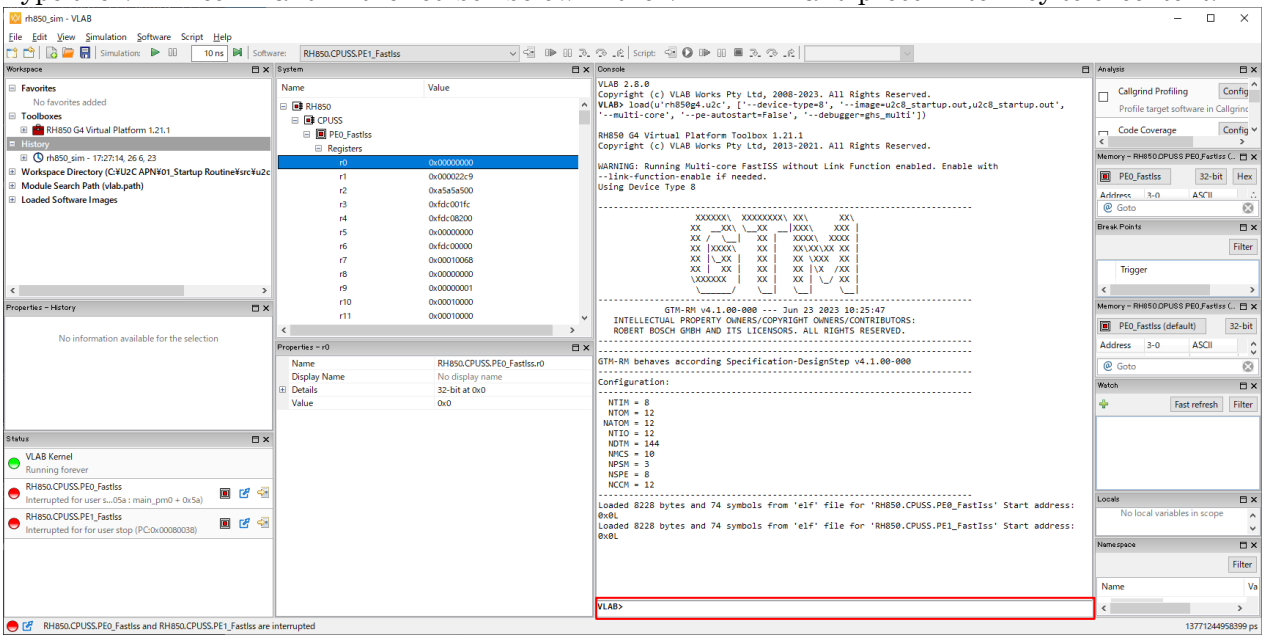
This chapter describes debugging examples of "U2C Startup Routine APN Sample Code GHS Version" in a virtual environment.

5.1 VLAB trace configuration example

To trace the outputs of P2_0 pin and P2_1 pin, excecute the following VLAB command before starting MULTI debugging.

```
add_trace(subject="RH850.P2_0", sink=sink.vcd)
add_trace(subject="RH850.P2_1", sink=sink.vcd)
```

Type the VLAB command in the red box below in the VLAB IDE and press Enter key to execute it.

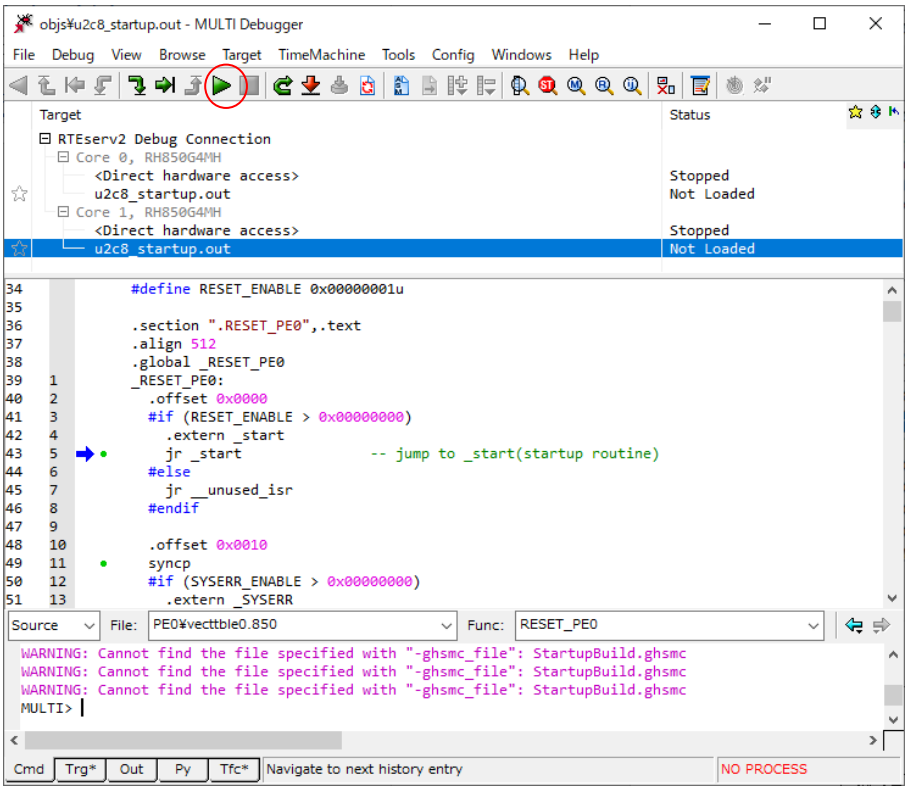


The outputs of P2_0 pin and P2_1 pin are dumped to the specified "*.vcd" file when outputs of the P2_0 pin and P2_1 pin output are changed.

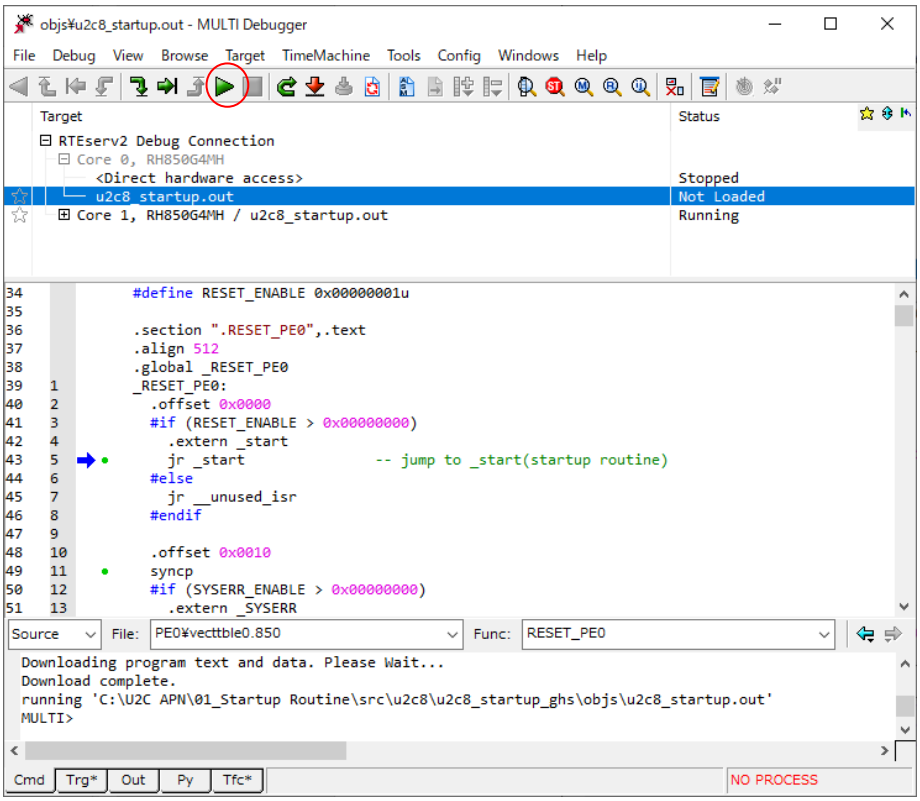
5.2 MULTI debugging example

5.2.1 Debug Execution

In MULTI, select "u2c8_startup.out" in "Core 1, RH850G4H", and then press [Go on Selected Item] button.

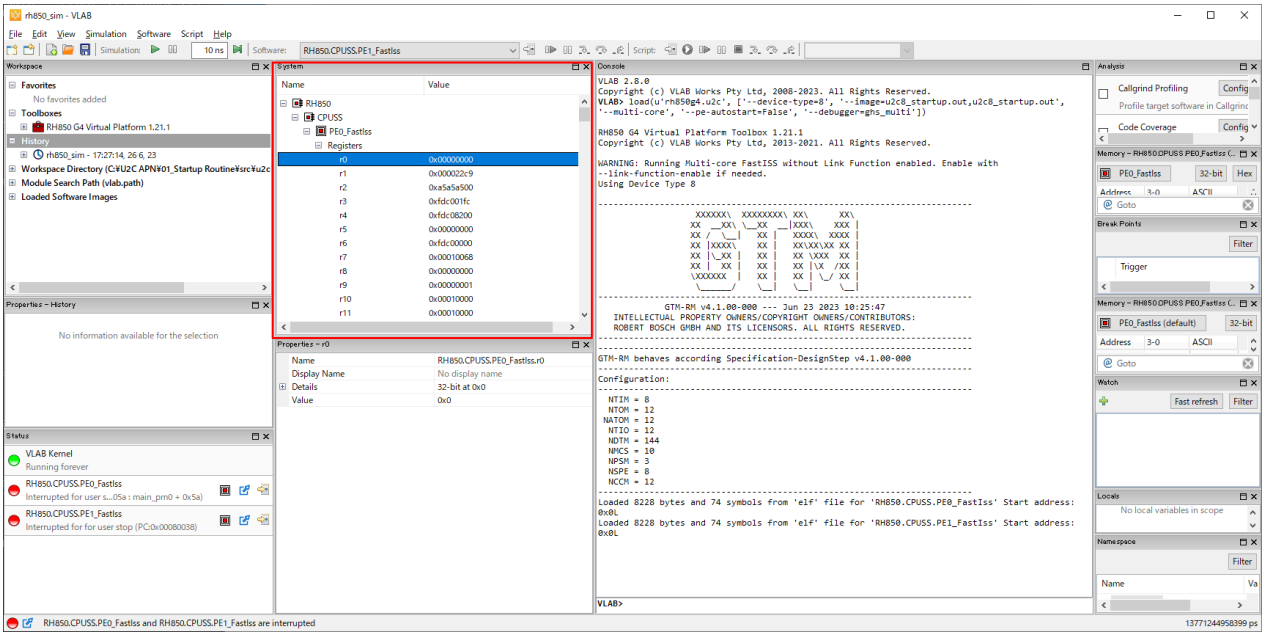


Next, select "u2c8_startup.out" in "Core 0, RH850G4H" in MULTI, and then press [Go on Selected Item] button.



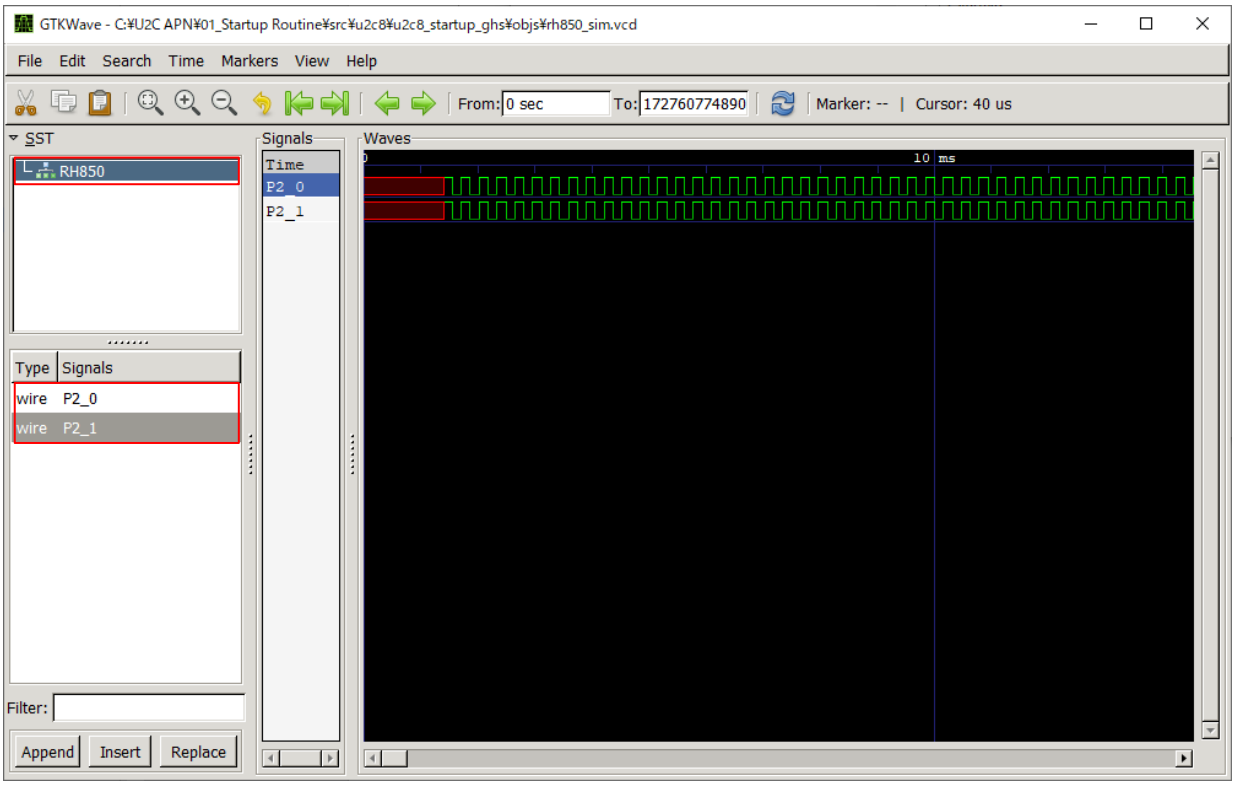
5.2.2 Register

On MULTI, press [Halt on Selceted Item], and then check U2C register value shown in "System" pane of VLAB IDE.



5.2.3 Pin output

1. Launch GTKWave (gtkwave.exe), and then drag and drop “*.vcd” file onto the screen of GTKWave. “*.vcd” file is dumped under “objs” folder in “U2C8 Startup Routine APN Sample Code for MULTI”.
2. Select "RH850" in "SST" pane on GTKWave screen.
3. Double-click "P2_0" and "P2_1" in "Signals" column on GTKWave screen.
4. In the "Waves" pane on GTKWave screen, make sure the P2_0 and P2_1 pins outputs are toggled.



5.3 Cautions

rh850g4-1.21.1-win-vc140-x64.vlabtoolbox does not support the following U2C registers:

- CKD_HSIOSCC
- CKD_HSIOSCS

Revision History

Rev.	Publication date	Description	
		Page	Summary
0.10	2023.6.30	All Sections	Issued the 1st version.

General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)

   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

2. Processing at power-on

   The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.

3. Input of signal during power-off state

   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

4. Handling of unused pins

   Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.

5. Clock signals

   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.

6. Voltage application waveform at input pin

   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).

7. Prohibition of access to reserved addresses

   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

8. Differences between products

   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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