

# RH850/U2A Starter Kit

R12QS0070ED0200

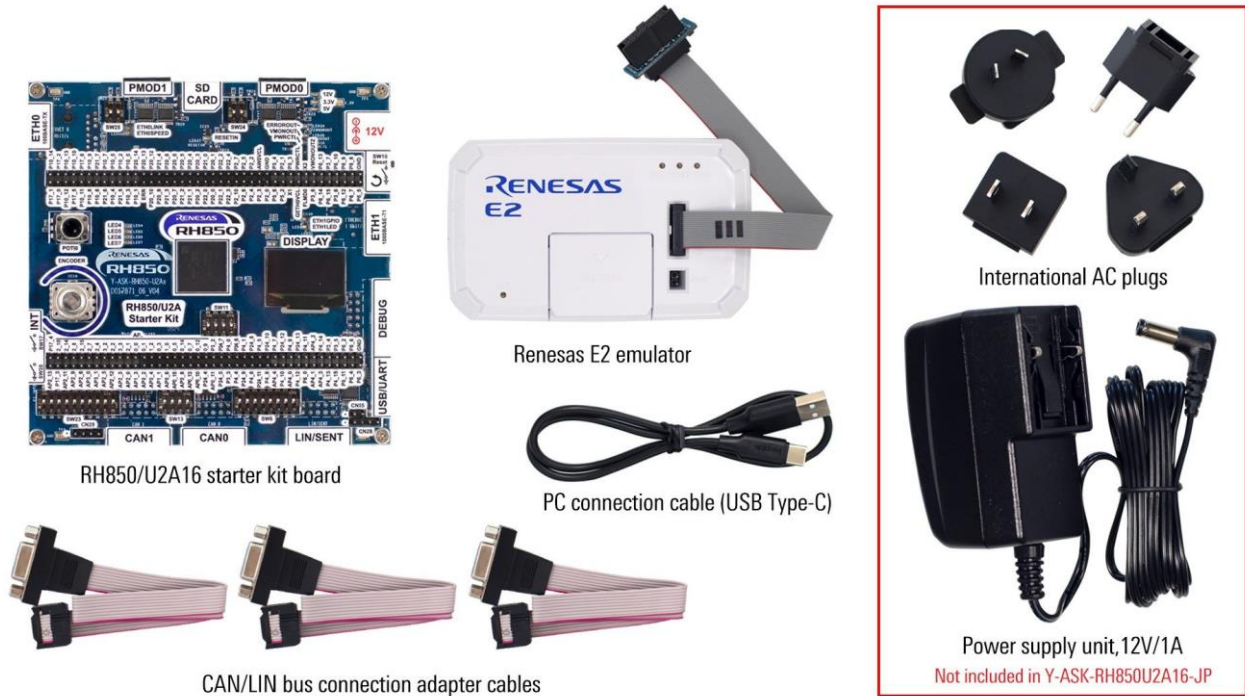


Figure 1 RH850/U2A Starter Kit Package Content

## 1. Tools

Note:

- Installation of the tool packages requires administrative rights on Windows™ machine.
- The E2 emulator must not be connected to the machine until the emulator software has been installed.
- Windows™ users may see “User Account Control” dialog box. If applicable, enter the administrator password and click <OK>.
- You will be able to install either Green Hills MULTI, IAR Embedded Workbench for RH850, or Renesas CS+ for CC IDE tools. If you already have a Kickstart-, evaluation- or fully-licensed-version of one of these tools it is unnecessary to re-install them. Skip to chapter 1.3 *Installation of the Sample Software*

## 1.1 Installation of Green Hills MULTI and IAR Embedded Workbench for RH850

- GHS and IAR installation and licensing request procedures are explained in the RH850 Starter Kit License Information Document. Paper printout is included as part of the product package.

## 1.2 Installation of Renesas CS+

- Ensure no other instance of CS+ is running.
- Please use the link to download Renesas CS+ for CC V8.12.00 or later. It will re-direct you as shown in *Figure 2 Renesas CS+ for CC V8.12.00*. It is recommended to use the latest versions available.
- [CS+ for CC V8.12.00 | Renesas](#)



By clicking on the "I accept" button or other button or mechanism designed to acknowledge agreement to the terms of an electronic copy of the Disclaimer<sup>20</sup> (the "Agreement"), or by downloading, installing, accessing, or otherwise copying or using all or any portion of the licensed software, documentation, or other materials described in the Agreement (the "Licensed Materials"), (a) you accept the Agreement on behalf of the licensee for whom you are authorized to act (the "Licensee"), and acknowledge that the Licensee is legally bound by the Agreement, and (b) you represent and warrant that you have the right, power, and authority to act on behalf of and bind the Licensee. IF THE LICENSEE DOES NOT AGREE TO THE TERMS CONTAINED IN THIS AGREEMENT, OR IF YOU DO NOT HAVE THE RIGHT, POWER, AND AUTHORITY TO ACT ON BEHALF OF AND BIND THE LICENSEE, DO NOT SELECT THE "I ACCEPT" BUTTON OR OTHER BUTTON OR MECHANISM DESIGNED TO ACKNOWLEDGE ACCEPTANCE OF THE AGREEMENT, AND DO NOT DOWNLOAD, INSTALL, ACCESS, OR OTHERWISE COPY OR USE ALL OR ANY PORTION OF THE LICENSED MATERIALS.

Accept and download

**Figure 2 Renesas CS+ for CC V8.12.00**

### License

- Refer to the Compiler Licenses details for working with the Renesas [CS+ at Compiler Licenses](#)
- Evaluation Edition of the licenses can as well be attained which works as the Professional editions during a trial period of 60 days from the day the first build is executed after installing an evaluation edition.
- Please refer to the *Figure 3 Evaluation Edition Compiler Licenses* below for a quick highlight



**Figure 3 Evaluation Edition Compiler Licenses**

## 1.3 Installation of the Sample Software

- Sample Code for the RH850/U2A will be distributed via Renesas website. It can be downloaded from: <http://www.renesas.com/y-ask-rh850u2a>
- Note: To avoid possible problems please choose a directory without any blank characters or country specific characters in its name or path! Please use only letters, numbers, and the characters '-', '+', and '\_'.

## 1.4 Installation of ancillary Tools and Documentation

- If you do not have “Renesas Flash Programmer” installed, then please download the necessary package preferable for your operating system from [Renesas Flash Programmer \(Programming GUI\) | Renesas](#)
- Follow the on-screen instructions to install the latest version. Earlier versions may not have the necessary device support.
- The documentation can be downloaded from [Y-ASK-RH850U2A - RH850/U2A Starter Kits | Renesas](#)

## 2. Board Configuration

Before using the starter kit with a sample application, please configure the jumpers and switches being used in *Table 1 Switches* below. Please see the starter kit overview in the *Figure 4 RH850/U2A Starter Kit Board Top View*

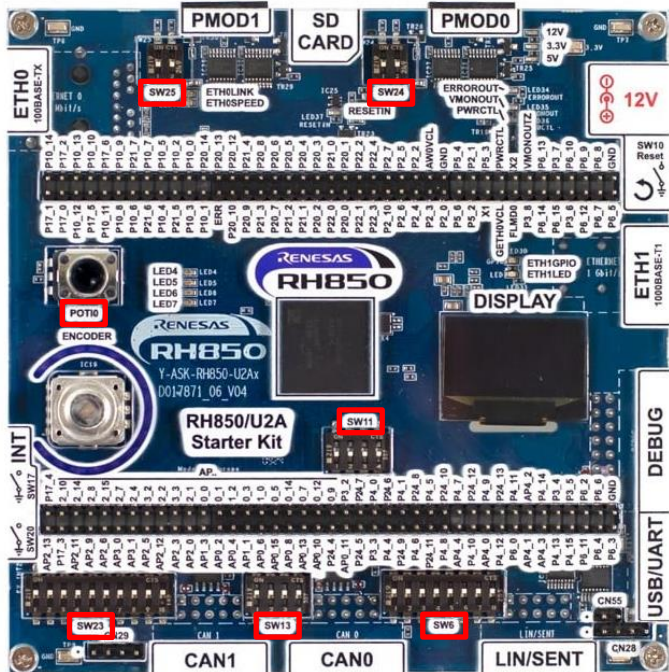


Figure 4 RH850/U2A Starter Kit Board Top View

Peripheral/Function	Enable Switch	Configuration Switch
LIN	SW23[6] = ON	SW6[1] = ON
USB/UART	SW23[9] = ON	
CAN0	SW23[4] = ON	SW13[1,2] = ON
CAN1	SW23[3] = ON	SW13[3,4] = ON
10BASE-T/100BASE-TX Ethernet	SW23[7] = ON	
ENC_LED_CSI_OE	SW23[8] = ON	
POT10		Always ON
User LEDs	SW23[2] = ON	
Operating Mode		SW11[1,2,3,4] = OFF Normal Operating Mode
100/1000BASE-T1 Ethernet	SW23[10] = ON	
EXT INT 1&2	SW23[1] = ON	
PMOD0		SW24[1] = ON(3A)/OFF(6A) SW24[2] = ON(3A/6A)/OFF(2A)
PMOD1		SW25[1] = ON(3A)/OFF(6A) SW25[2] = ON(3A/6A)/OFF(2A)

Table 1 Switches

For an overview of switches and connectors please refer to [Appendix A](#).

### 3. Power Supply Configuration

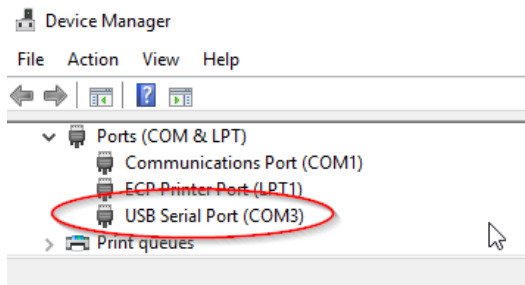
The starter kit uses an external power supply of 12V and generates all required voltages using a Renesas dual standard buck regulator IC ISL78208 for all the digital circuitry on the device and on the board. No manual configuration is necessary. After connecting the external power supply, the green LEDs LED1 12V, LED2 3.3V and LED3 5V light up. RESET-LED LED37 will remain lighted as long as you press the RESET button. Power supply unit is illustrated in *Figure 5 External Power Supply*.



Figure 5 External Power Supply

### 4. Terminal Connection

After jumper configuration and power supply connection is completed, please connect the USB/UART port with a free USB port of your PC. The first time the starter kit is connected to a PC, a FTDI USB serial port device is detected, and the necessary USB driver is installed by the Windows™ operating system automatically. After the successful driver-installation a USB serial port is listed in the Windows™ device manager:



Please keep the COM-port number in mind for the configuration of the terminal program. You can use your preferred terminal program, one possibility is e.g., [Tera Term](#).

Please use the default-standard serial terminal settings except the ones mentioned here. The Speed should be kept as **115200**. Moreover, in Setup tab, go to Terminal. Set the **New-Line Receive** as “**AUTO**” instead of Default “**CR**”.

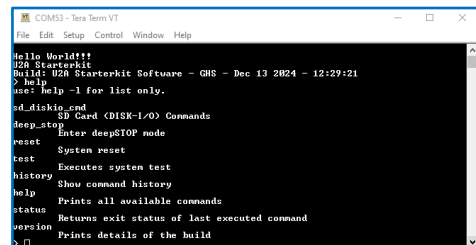
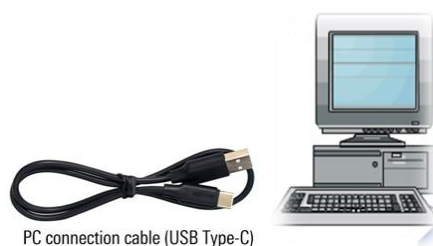
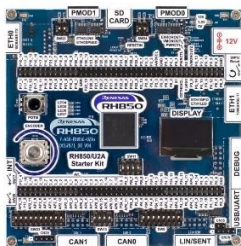


Figure 6 Detecting & Setting Terminal Connection

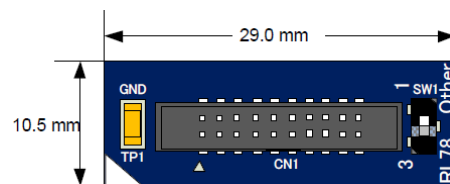


## 5. Debug Connection

- Connect the Renesas E2 emulator to the connector marked 'CN7' on the board using the ribbon cable and adapter.
- *Figure 7 20-Pin to 14-Pin Conversion Adapter for the Renesas E2 Emulator* shows adapter for the E2 Emulator. It is important to note that switch SW1 on the Renesas E2 target connector must be set to position 1 (labelled "Other". These are not printed on some versions of the conversion adapter) for RH850 or RX MCUs or in position 3 (labelled "RL78". These are not printed on some versions of the conversion adapter) for RL78 MCUs.
- Connect the Renesas E2 emulator module (shown in *Figure 8 Renesas E2 Emulator*) to a spare USB port of your PC. The green 'ACT' LED on the E2 Emulator will illuminate.



**Figure 8 Renesas E2 Emulator**







**Figure 7 20-Pin to 14-Pin Conversion Adapter for the Renesas E2 Emulator**

The first time the E2 is used, the 'Found New Hardware' wizard will appear. Please follow the steps below to install the drivers. Please note that administrator privileges are required for a Windows™ machine. "Device driver software installed successfully" pop-up will appear in the Windows™ toolbar and installation will complete.

Note: If the driver is not detected automatically, it can be found at [E2 emulator \[RTE0T00020KCE00000R\] | Renesas](#). The Windows driver signing dialog may be displayed. Please accept the driver to continue.

## 6. Using Green Hills MULTI

Green Hills MULTI integrates various tools such as compiler, assembler, debugger, and editor into a common graphical user interface. To learn more on how to use MULTI, open the user manual via the help menu of the Green Hills MULTI IDE.

- The first time this is launched, no license will be detected; please refer to RH850 Starter Kit License Information Document about the procedure.
- Upon receipt of the license email, follow the instructions to install the license and re-launch MULTI.
- Close Green Hills MULTI. Open directly "Y-ASK-RH850U2A16.gpj" for U2A16 device or "Y-ASK-RH850U2A6.gpj" for U2A6 device available at <https://www.renesas.com/y-ask-rh850u2a> under folder structure: Y-ASK-RH850U2A16-v0200\toolchain\GHS\U2A16 or Y-ASK-RH850U2A6-v0200\toolchain\GHS\U2A6.
- Select the 'Build' button  to build the project.
- To download and debug, select the 'Debug' button . The 'MULTI Debugger' window will open.
- Now, press the 'connect' button  and choose setup from the connection organizer.
- Continue running the program by pressing .
- The flow is illustrated in *Figure 9 Green Hills MULTI Build and Debug Flow*

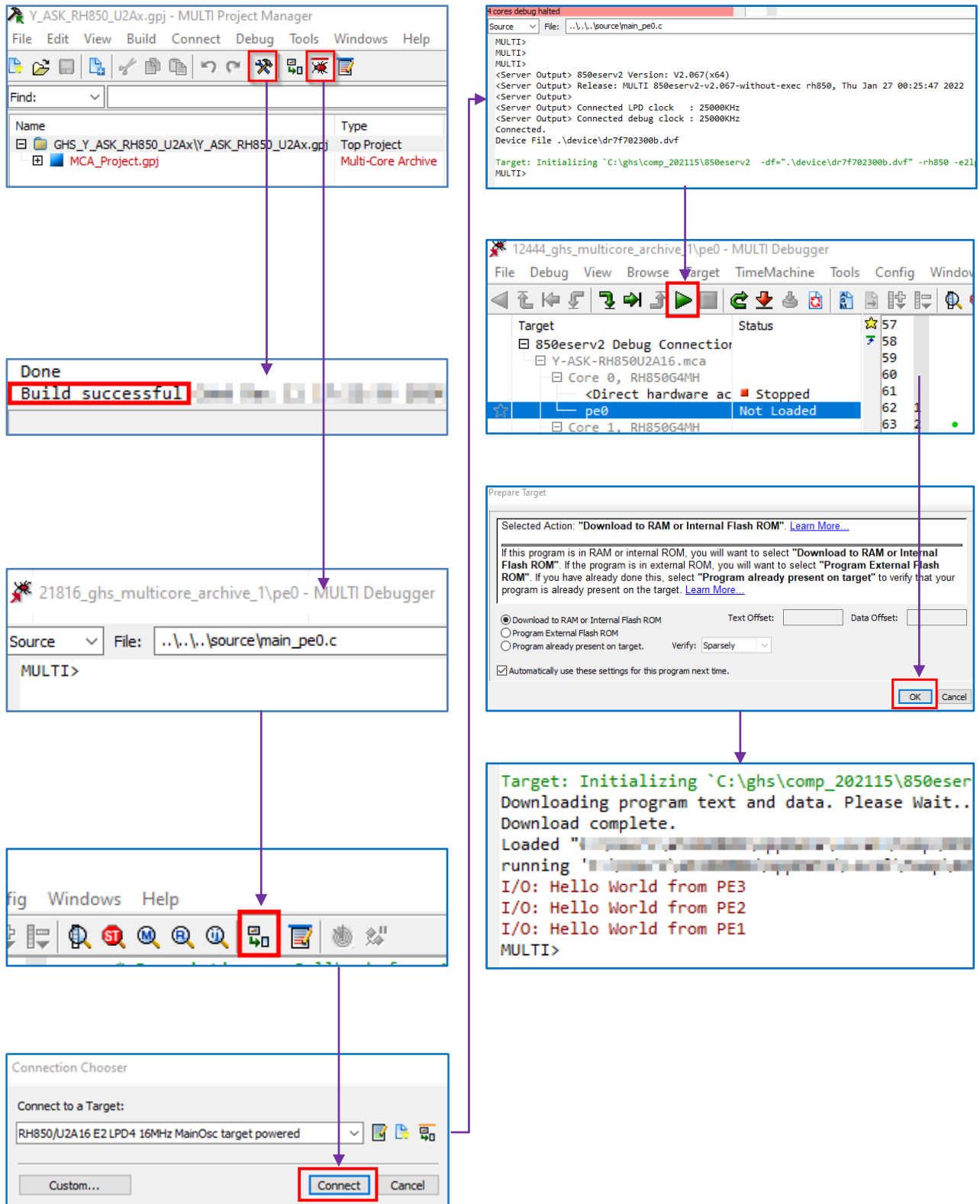





Figure 9 Green Hills MULTI Build and Debug Flow

## 7. Using IAR Embedded Workbench for RH850

IAR Embedded Workbench for RH850 (EWRH850) integrates various tools such as compiler, assembler, linker, debugger, and editor into a common graphical user interface. For further information on how to use EWRH850, open the user manual installed on your computer (Start Menu > IAR Embedded Workbench for Renesas RH850 Vx.xx > Release Notes)

- Please refer to RH850 Starter Kit License Information Document about the licensing procedure.
- Close IAR Embedded Workbench for RH850. Open directly the workspace “Y-ASK-RH850U2A16.eww” for U2A16 device or “Y-ASK-RH850U2A6.eww” for U2A6 device available at <http://www.renesas.com/y-ask-rh850u2a>. It is located under the folder structure: Y-ASK-RH850U2A16-v0200\toolchain\IAR\U2A16 or Y-ASK-RH850U2A6-v0200\toolchain\IAR\U2A6.
- Click the ‘Download & Debug’ button , this builds the project and starts the debugger.
- Use the ‘Go’ button  to run the project.
- To stop the debugger, use the ‘Stop’ button .
- After finishing the debug session simply disconnect the Renesas E2 Emulator.
- For more details on the IAR tools, please refer to their documentation.
- It is important to uncheck the “TRESET” and “RESET” in the Pin mask section of Hardware Setup for E2 OCD RH850 G4MH. It can be accessed from Emulator drop down menu as illustrated in *Figure 10 Emulator Hardware Setup*. Press OK.

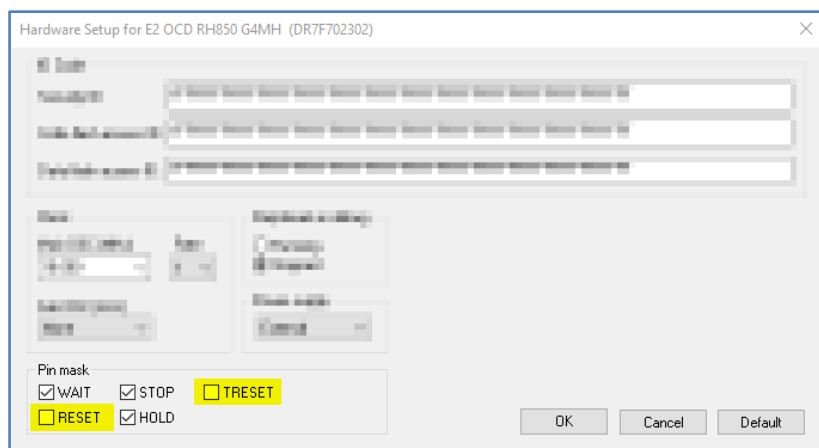
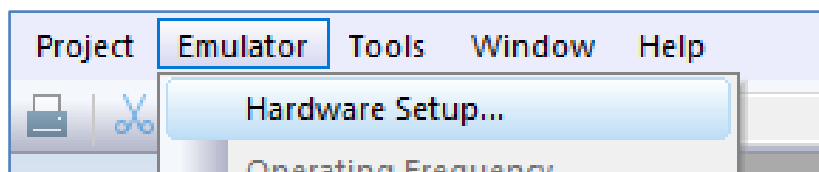





Figure 10 Emulator Hardware Setup



## 8. Using Renesas CS+

CS+ combines various tools such as the C Compiler Package for RH850 Family [CC-RH], debugger, and editor into a common graphical user interface.

- Close Renesas CS+. Open directly the project “Y-ASK-RH850U2A16.mtpj” for U2A16 device or “Y-ASK-RH850U2A6.mtpj” for U2A6 device available at <http://www.renesas.com/y-ask-rh850u2a>. It is located under the folder structure: Y-ASK-RH850U2A16-v0200\toolchain\CSPlus\U2A16 or Y-ASK-RH850U2A6-v0200\toolchain\CSPlus\U2A6.
- Click the 'Download & Debug' button , this builds the project and starts the debugger.
- Use the 'Go' button  to run the project.
- To stop the debugger, use the 'Stop' button .
- After finishing the debug session simply disconnect the Renesas E2 Emulator.
- For more details on the CS+ tools, please refer to the Help menu.

## 9. Next Step

After you have completed this quick start procedure, please review the documentation available on the product website (see [chapter 10 “Support”](#)). The sample code project contains all you need to get started developing your own projects. The software tools provided are evaluation versions and have limitations that are described in tool vendor’s documentation. To purchase fully functional versions, please contact your Renesas sales office.

## 10. Support

To access the online resources and find the latest updates of the sample code or documentation please visit our website <http://www.renesas.com/y-ask-rh850u2a> or scan the code to the right:



In case of questions, please feel free to contact the technical support team:  
[device\\_support.rh850-eu@lm.renesas.com](mailto:device_support.rh850-eu@lm.renesas.com)

©2024 Renesas Electronics Corporation. All rights reserved.

## 11. Appendix A

The following tables provide an overview of all switches and connectors.

Connector	Function	Remark
SW6	8-position DIP switch to enable LIN and SENT signal output to connector CN44	Refer to RH850/U2A starter Kit User's Manual chapter 6.11
SW10	Reset switch	Refer to RH850/U2A starter kit User's Manual chapter 6.2
SW11	4-position DIP switch to select RH850/U2A operation mode	Refer to RH850/U2A starter kit User's Manual chapter 6.1
SW13	4-position DIP switch to enable load on CAN outputs	Refer to RH850/U2A starter kit User's Manual chapter 6.10
SW17	Switches for external interrupt signals	Refer to RH850/U2A starter kit User's Manual chapter 6.4
SW20		
SW23	10-position DIP switch to enable various functions	Refer to RH850/U2A starter kit User's Manual chapter 6.3
SW24	2-position DIP switch to configure PMOD0 interface	Refer to RH850/U2A starter kit
SW25	2-position DIP switch to configure PMOD1 interface	User's Manual chapter 6.16

**Table 2 Overview Switches**

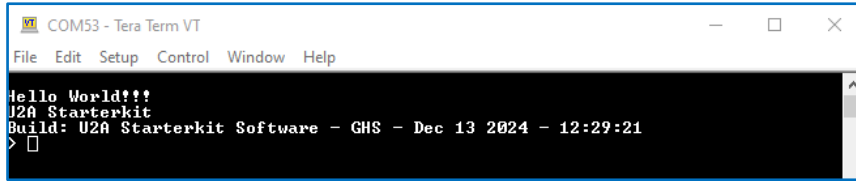
Connector	Function	Remark
CN1	+12.0 V external power supply	Refer to RH850/U2A starter kit User's Manual chapter 3.1
CN2	USB-C connector for UART1	Refer to RH850/U2A starter kit User's Manual chapter 6.13
CN7	Debug and programming interface	Refer to RH850/U2A starter kit User's Manual chapter 5
CN8	Ethernet interface ETH1	Refer to RH850/U2A starter kit User's Manual chapter 6.14
CN10	Ethernet interface ETH0	
CN28	LIN / SENT monitor connector	Refer to RH850/U2A starter kit User's Manual chapter 6.11
CN29	CAN0 / CAN1 monitor connector	Refer to RH850/U2A starter kit User's Manual chapter 6.10
CN35	Device port connectors	Refer to RH850/U2A starter kit User's Manual chapter 9.8
CN36		
CN37		
CN38		
CN39		
CN40		
CN44	LIN / SENT interface connector	Refer to RH850/U2A starter kit User's Manual chapter 6.11
CN46	CAN0 interface connector	Refer to RH850/U2A starter kit User's Manual chapter 6.10
CN47	CAN1 interface connector	
CN55	UART1 monitor connector	Refer to RH850/U2A starter kit User's Manual chapter 6.13
CN57	MicroSD card interface	Refer to RH850/U2A starter kit User's Manual chapter 6.15
CN61	PMOD0 interface connector	Refer to RH850/U2A starter kit User's Manual chapter 6.16
CN62	PMOD1 interface connector	
CN63	Display connector	For board version D017871_06_V04 only; Refer to RH850/U2A starter kit User's Manual chapter 6.8.2
U1	Display connector	For board version D017871_06_V03 only; Refer to RH850/U2A starter kit User's Manual chapter 6.8.1

**Table 3 Overview Connectors**

## 12. Appendix B

The program startup with shell interface can be seen upon successful compiler specific build and flashing of the target as shown in *Figure 11 Shell Program*.

- Note: Make sure that SW23[9] is ON.
- Note: Refer to the Chapter *Terminal Connection* for the setting target and host communication.



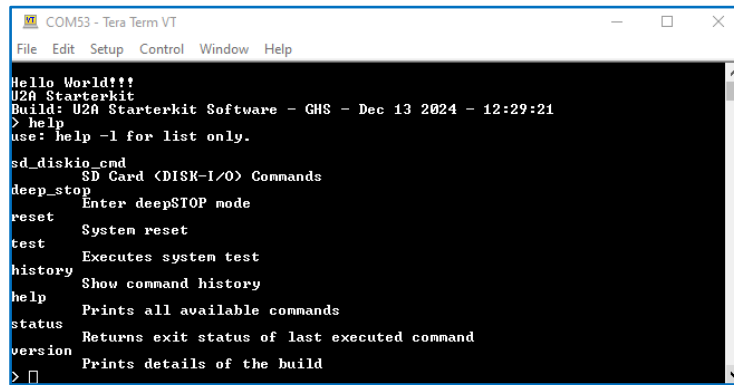
```

COM53 - Tera Term VT
File Edit Setup Control Window Help
hello World!!!
U2A Starterkit
Build: U2A Starterkit Software - GHS - Dec 13 2024 - 12:29:21
>

```

**Figure 11 Shell Program**

- Please ensure that the board is configured to minimal settings as per the *Table 1 Switches*
- The user can execute “help” command in the shell interface and see the available commands as shown in *Figure 12 Help Command*.



```

COM53 - Tera Term VT
File Edit Setup Control Window Help
Hello World!!!
U2A Starterkit
Build: U2A Starterkit Software - GHS - Dec 13 2024 - 12:29:21
> help
use: help -l for list only.
sd_diskio_cmd SD Card (DISK-I/O) Commands
deep_stop Enter deepSTOP mode
reset System reset
test Executes system test
history Show command history
help Prints all available commands
status Returns exit status of last executed command
version Prints details of the build
>

```

**Figure 12 Help Command**

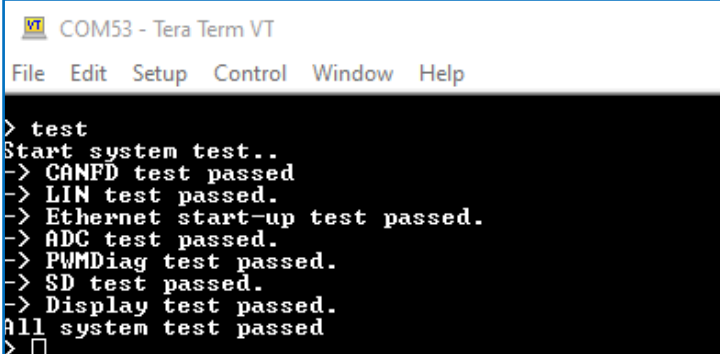
- The commands are self-explanatory, but in other case it will provide a prompt back. Before any commands are executed, it is important to set up the hardware correctly. Few of the commands are explained in *Appendix D*.
- CAN test requires the physical connection between CN46: CAN0 and CN47: CAN1. This can be achieved using the provided cables and gender changer along with package as shown in the *Figure 13 CAN0 and CAN1 connection adapter cables and methodology*.



CAN/LIN bus connection adapter cables

**Figure 13 CAN0 and CAN1 connection adapter cables and methodology.**

- The SD Card test requires insertion of a physical card owing to the HW detect switch functionality. Note: The SD card interface may not work with all available SD cards. The functionality must be checked case-by-case. SD Card should be formatted as FAT (tested till 32GB). exFAT is not implemented. A few tested SD Cards were from SanDisk, Kingston and Transcend.
- Connect an ethernet cable between the target and the host.
- A system test of features can be executed using the “test” command. The result of the test will be prompted on the terminal as shown in *Figure 14 test Command Execution*. In case of failure please see the failure, comments and ensure the necessary board configuration is followed as depicted in Chapter *Board Configuration*.



```
COM53 - Tera Term VT
File Edit Setup Control Window Help
> test
Start system test..
-> CANFD test passed
-> LIN test passed.
-> Ethernet start-up test passed.
-> ADC test passed.
-> PWMDiag test passed.
-> SD test passed.
-> Display test passed.
All system test passed
>
```

Figure 14 test Command Execution

- Ethernet test 100Base-T requires the physical ethernet cable connection from target to the host.
  - Direct connection to the PC without using DHCP.
    - As DHCP is not available on direct connection, the device will configure the default IP address programmed as per the file: "**r\_eth.c**".
      - Default IPv4 address: 192.168.10.35
    - Make sure that the PC ethernet IPv4 address is configured for the same subnetwork "192.168.10.xxx".
      - For example: 192.168.10.195
    - Open Browser: http://192.168.10.35:80
    - You should be able to see *Figure 15 Interactive web-interface*

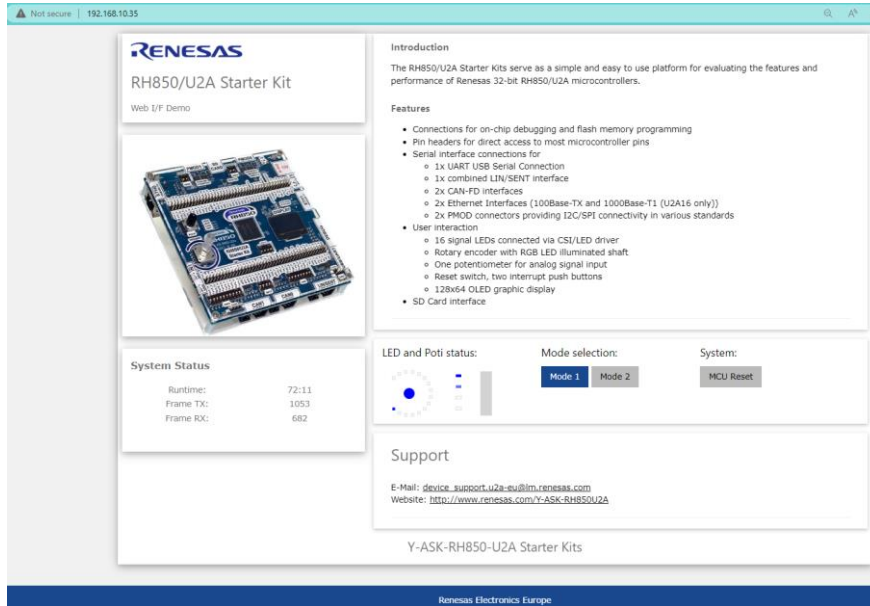


Figure 15 Interactive web-interface

- Working with the Interactive web-interface is explained in the following points.
- Selecting Mode 1 either using web-interface or by pressing the SW17.
- The user inputs for the circular LEDs controlled using encoder button by turning clockwise and counter clockwise is reflected on the web-interface for all possible positions. The encoder RGB LED will stay blue in color. Few of them are shown in the below *Figure 16 Circular LED status*



Figure 16 Circular LED status

- The User LEDs: LED4, LED5, LED6 and LED7 produce a cyclic pattern of glowing continuously. As shown in *Figure 17 User LED status*.



Figure 17 User LED status

- The potentiometer POT10 when turned right raises the value of the bar and when turned left reduces the value of the bar as shown in *Figure 18 POT10 Status*.



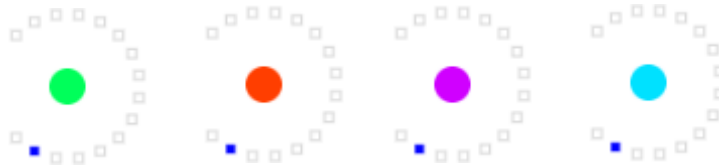
Figure 18 POT10 Status

- Selecting Mode 2 either using web-interface or by pressing the SW17.
- The User LEDs: LED4, LED5, LED6 and LED7 go to OFF state as shown in the *Figure 19 User LED Mode 2*. The circular user LEDs around the encoder behave as they used to as Mode 1 setting.



**Figure 19 User LED Mode 2**

- On changing the POT10 value the encoder RGB LED will update its color. Few of the combinations are shown in the *Figure 20 Encoder RGB LED*.



**Figure 20 Encoder RGB LED**

- Executing RESET using web-interface “MCU Reset” or SW10 will reset the microcontroller unit.
- System Status displays note-worthy details like Runtime when the system is running and not halted.



### 13. Appendix C

The following appendix mainly focuses on how to work with the display menu.

- The display screen will be ON after flashing the software as shown in the *Figure 21 Display ON*.



Figure 21 Display ON

- The pointer will already be at the “Change Mode”. By default, the system will be in Mode1. The following features will stay activated namely as seen in the *Figure 22 Change Mode 1*: -
  - Encoder RGB LED will stay activated as blue in color.
  - The traversing of the circular user LEDs will work.
  - User LEDs: LED4, LED5, LED6 and LED7 will be activated in a cyclic fashion.
  - POT10 in general will work but will have no influence on changing Encoder RGB LED color.



Figure 22 Change Mode 1

- Press the encoder button to toggle the Mode. On switching to Mode 2 the following can be observed as seen in the *Figure 23 Change Mode 2*: -
  - Encoder RGB LED will stay activated.
  - The traversing of the circular user LEDs will work.
  - User LEDs: LED4, LED5, LED6 and LED7 will be de-activated.
  - Upon rotating the potentiometer (POT10), the encoder RGB LED will update its color.



Figure 23 Change Mode 2

- Rotate the encoder CW to move the pointer to the next position or CCW to move the pointer to the previous position. So, after moving the pointer to the “System Info”, press the encoder button to enter. As can be seen, in the *Figure 24 System Info*, the System Test status is not “NOT DONE”. Upon executing the “Do System Test”, one can see the updated “System Test” status to OK. To go back to the previous menu, please use “return”.

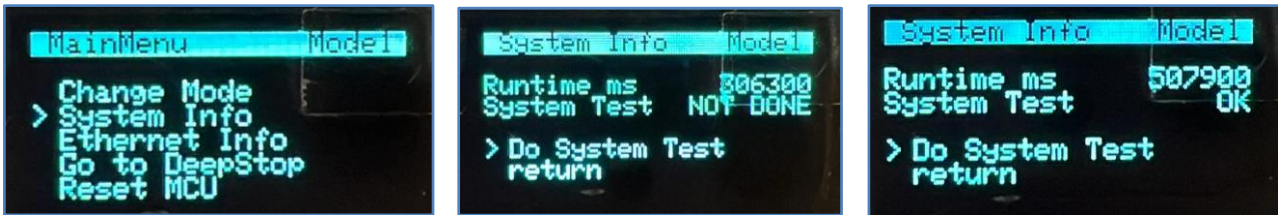


Figure 24 System Info

- Move the pointer to “Ethernet Info” and enter. If the ethernet cable is not attached to the target, then you can see the “Link” is down. On connecting the cable, with the connection established, you can see the “Link” status is UP. One can also see the IP address information assigned to the target, as can be seen here to be 192.168.10.35. To return to the previous menu, please go to “return” and press the encoder button. The following has been illustrated in the *Figure 25 Ethernet Info*.



Figure 25 Ethernet Info

- Move the pointer to “Go to DeepStop” and press the encoder button to enter the Microcontroller Unit (MCU) DeepSTOP mode. Please note that the user LEDs and circular LEDs will go OFF and the display will show the status of the MCU. To wake up from this state, please press either the “encoder button” or “SW17 INT”. The illustration is shown in *Figure 26 Go to DeepStop*.



Figure 26 Go to DeepStop

## 14. Appendix D

This appendix provides insights into working with the shell commands.

- **help**
  - Please refer to *Figure 12 Help Command*.
- **sd\_diskio\_cmd**
  - Creating a directory is illustrated in *Figure 27 Directory creation*.
  - Creating a file inside the directory is illustrated in *Figure 28 Text file creation*.
  - Writing to a file is illustrated in *Figure 29 Writing to a file*.
  - Reading from a file is illustrated in *Figure 30 Reading from a file*.

```
COM53 - Tera Term VT
File Edit Setup Control Window Help

> sd_diskio_cmd -mkdir renesas_dir
Mounting passed.

Directory creation passed.

> □
```

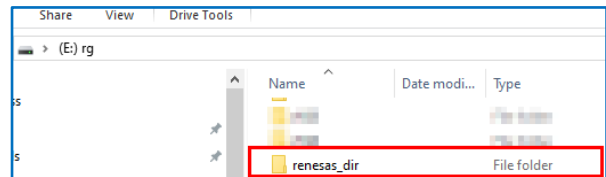


Figure 27 Directory creation

```
> sd_diskio_cmd -f_open /renesas_dir/test_file.txt
Mounting passed.

File creation passed.

> □
```

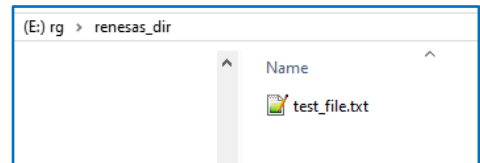


Figure 28 Text file creation

```
> sd_diskio_cmd -f_write /renesas_dir/test_file.txt renesas
Mounting passed.

File open passed.

Writing successful.

> □
```

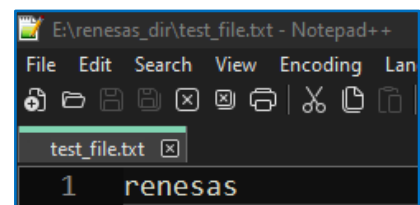


Figure 29 Writing to a file

```
> sd_diskio_cmd -f_gets /renesas_dir/test_file.txt
Mounting passed.

READ ONLY mode file open passed.

renesas

Reading passed.

> □
```

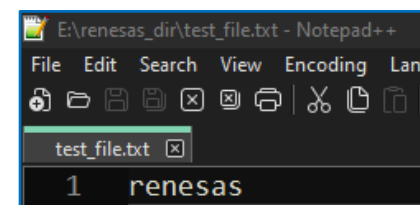


Figure 30 Reading from a file



- **deep\_stop**

- Entering and waking up from deep stop is illustrated in *Figure 31 deep stop mode operation*.

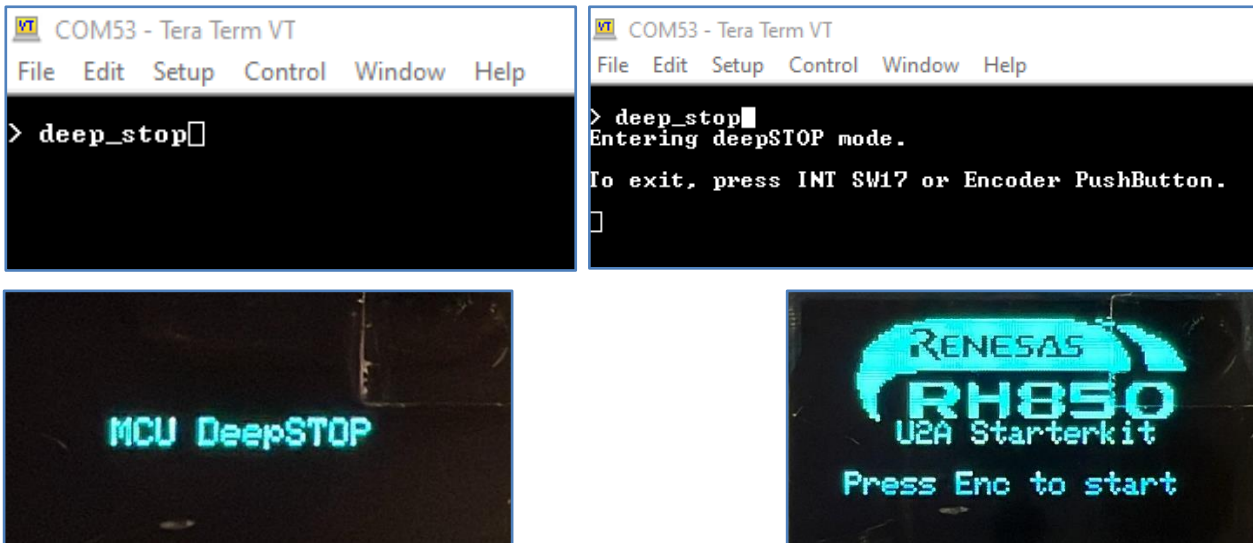


Figure 31 deep stop mode operation

- **reset**

- Executing a system reset is illustrated in *Figure 32 reset operation*.

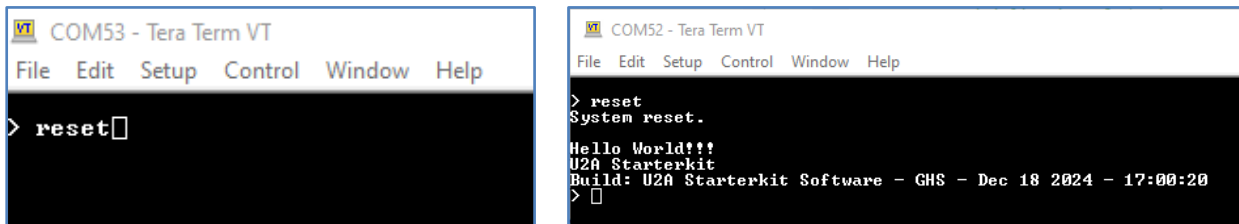


Figure 32 reset operation

- **test**

- Please refer to *Figure 14 test Command Execution*

## 15. Appendix E

### Revision History

Rev.	Date	Description	
		Page	Summary
Rev.1.00	Sep. 25, 2023	-	First edition
Rev.2.00	Dec 20, 2024		The second edition includes changes to the updated software package including the U2A6 release.



## 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.

## Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall be responsible for determining what licenses are required from any third parties, and obtaining such licenses for the lawful import, export, manufacture, sales, utilization, distribution or other disposal of any products incorporating Renesas Electronics products, if required.
5. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
6. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
  - "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.
  - "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.
7. No semiconductor product is absolutely secure. Notwithstanding any security measures or features that may be implemented in Renesas Electronics hardware or software products, Renesas Electronics shall have absolutely no liability arising out of any vulnerability or security breach, including but not limited to any unauthorized access to or use of a Renesas Electronics product or a system that uses a Renesas Electronics product. RENESAS ELECTRONICS DOES NOT WARRANT OR GUARANTEE THAT RENESAS ELECTRONICS PRODUCTS, OR ANY SYSTEMS CREATED USING RENESAS ELECTRONICS PRODUCTS WILL BE INVULNERABLE OR FREE FROM CORRUPTION, ATTACK, VIRUSES, INTERFERENCE, HACKING, DATA LOSS OR THEFT, OR OTHER SECURITY INTRUSION ("Vulnerability Issues"). RENESAS ELECTRONICS DISCLAIMS ANY AND ALL RESPONSIBILITY OR LIABILITY ARISING FROM OR RELATED TO ANY VULNERABILITY ISSUES. FURTHERMORE, TO THE EXTENT PERMITTED BY APPLICABLE LAW, RENESAS ELECTRONICS DISCLAIMS ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO THIS DOCUMENT AND ANY RELATED OR ACCOMPANYING SOFTWARE OR HARDWARE, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE.
8. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
12. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
13. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
14. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.

(Note2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.5.0-1 October 2020)

## Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,  
Koto-ku, Tokyo 135-0061, Japan  
[www.renesas.com](http://www.renesas.com)

## Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

## Contact information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:  
[www.renesas.com/contact/](http://www.renesas.com/contact/).