Renesas RA Family

EK-RA2A2 Example Project Bundle

Introduction

This document describes the contents of the Example Project Bundle for the EK-RA2A2 kit. The Example Projects contained within the bundle show how to write code for the various Renesas Flexible Software Package (FSP) modules supported by the EK-RA2A2 kit.

Flexible Software Package is an optimized software package designed to provide easy to use, scalable, high-quality software for embedded system design. The primary goal is to provide lightweight, efficient drivers that meet common use cases in embedded systems. FSP code quality is enforced by peer reviews, automated requirements-based testing, and automated static analysis. FSP provides uniform and intuitive APIs that are well documented. Each module is supported with detailed user documentation including example code. FSP modules can be used on any MCU in the RA family, provided the MCU has any peripherals required by the module. FSP modules can be configured at build-time to optimize the size of the module for the feature set required by the application.

Supported Kit

EK-RA2A2

Supported FSP Version

FSP v6.0.0

Supported Toolchains

For the latest version of each Integrated Development Environment (IDE) and toolchain listed below, please refer to the FSP release notes

- e² studio with GCC Arm Embedded (GCC) or LLVM embedded toolchain for Arm (LLVM)
- Keil MDK with Arm compiler toolchain
- IAR EWARM with IAR toolchain for Arm

1. Using the Example Projects

To use EK-RA2A2 Example Projects, follow the steps mentioned in the following documents:

- Example Project Usage Guide
  https://github.com/renesas/ra-fsp-examples/blob/master/example_projects/Example%20Project%20Usage%20Guide.pdf
- e² studio AC6 porting Guide
  https://en-support.renesas.com/knowledgeBase/19375553

Users who are new to the FSP are recommended to refer to the section **Starting Development** > **Tutorial: Your First RA MCU Project – Blinky** in the RA FSP Documentation prior to attempting to program or debug an example project.

2. List of Example Projects Supported on Different Toolchains in the Bundle

The following table lists example projects supported by each IDE. These are ready to import using the import process for each IDE.

Note:

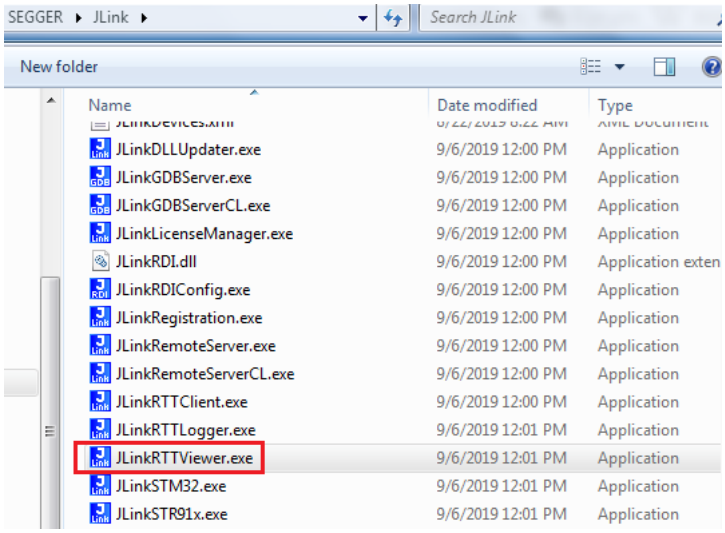
1. Additional example projects other than those mentioned above, may be available in the example project repository. However, they are supported with older version of FSP. Please refer the example_projects/version_info_table.md file in the repository to identify the appropriate FSP version for the example project of interest.
2. All projects supported by e^2 studio/GCC are supported with e^2 studio/AC6 via port from GCC.

Table 1. IDE Support for the Example Project

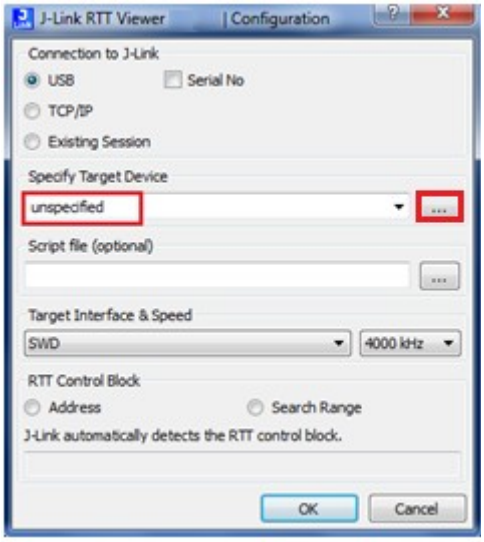
	IDE Support		
Example Project	**e² studio**	**IAR**	**Keil MDK**
_quickstart	Supported		
adc	Supported		
adc_gpt_periodic_sampling	Supported		
agt	Supported	Supported	Supported
audio_playback_pwm	Supported		
baremetal	Supported		
cac	Supported		
clock_output	Supported		
cpp	Supported		
crc	Supported		
doc	Supported		
elc	Supported		
flash_lp	Supported	Supported	Supported
freertos	Supported	Supported	Supported
gpt	Supported	Supported	Supported
gpt_input_capture	Supported		
icu	Supported	Supported	Supported
iic_master	Supported		
iic_slave	Supported	Supported	Supported
iwdt	Supported		
lpm	Supported		
rtc	Supported	Supported	Supported
sci_i2c	Supported		
sci_spi	Supported		
sci_uart	Supported	Supported	Supported
sdadc	Supported		
slcdc	Supported		
smbus	Supported		
vee_flash	Supported		
wdt	Supported	Supported	Supported
wifi	Supported		
wifi_on_chip_http_client	Supported		
wifi_on_chip_udp_freertos	Supported		

3. Running the Project

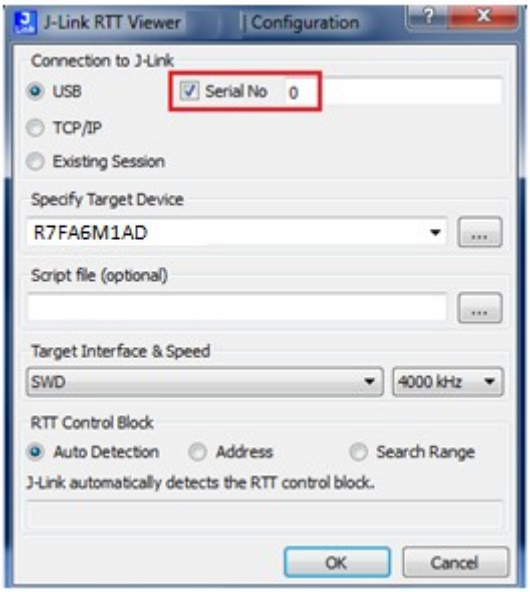
1. Open RTT Viewer by double clicking `JLinkRTTViewer.exe` in the downloaded `/Segger/JLink` folder.



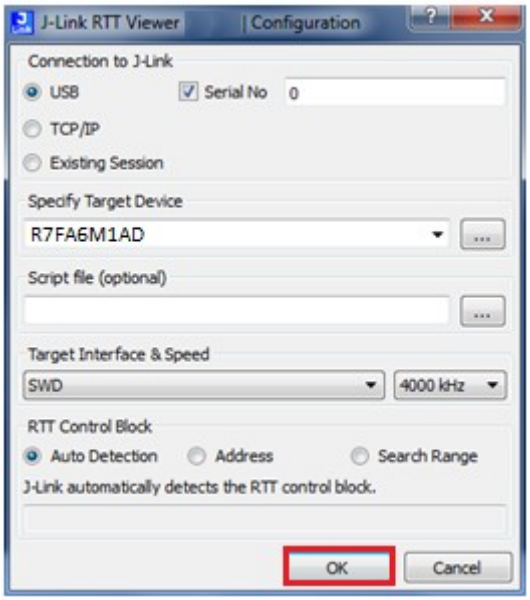
2. On opening, the field **Specify Target Device** shows up as **unspecified**. With USB selected, click on the ... tab and select the desired Renesas RA device. Keep a note the Core type.



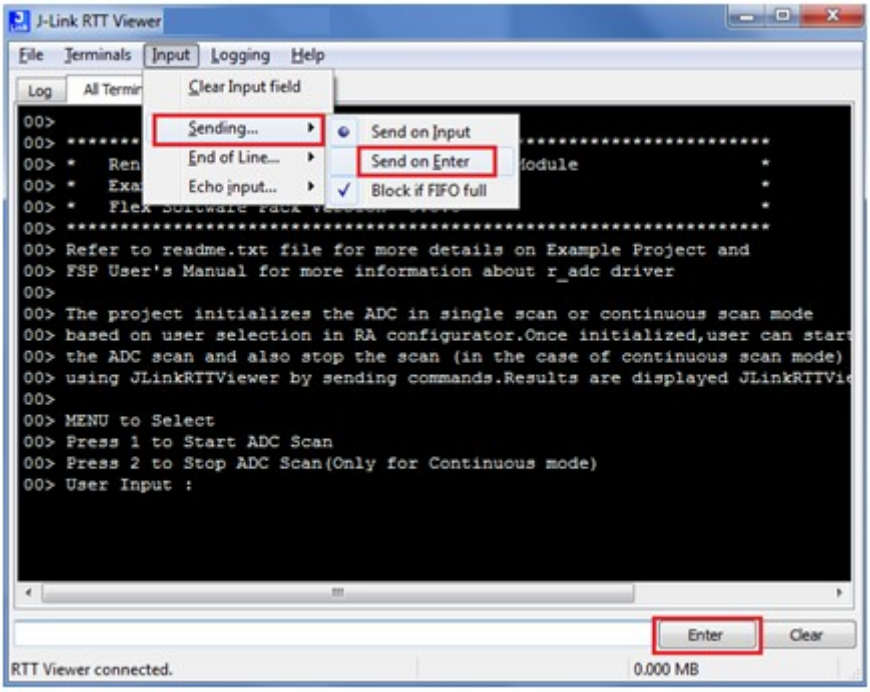
3. If multiple kits are connected to the PC, make sure to choose the corresponding serial number. The default is 0.
   Note: For MCUs such as RA6M4, RA6M5, RA4E1, RA6E2, and RA6T2, the exact address of the RTT Control Block must be specified. When Auto Detection is used, RTT Viewer parses all RAM memory to find the RTT Block. As TrustZone boundaries are configured for all projects for these MCUs, RTT Viewer will encounter access failures and you will not see the output logs in RTT viewer. The exact address for the SEGGER_RTT data structure in RAM is found in the readme.txt file associated with the module under evaluation or in the map file when a binary is built. (Refer Appendix for an example).



4. For parts other than Cortex-M33, click **OK**. For MCUs based on Cortex M33 Core, refer the Appendix.



5. Click on the **Input** tab and change **Sending** option to **Send on Enter**. Every time input in entered, you must either press the **Enter** or **Enter** tab on the RTT viewer.

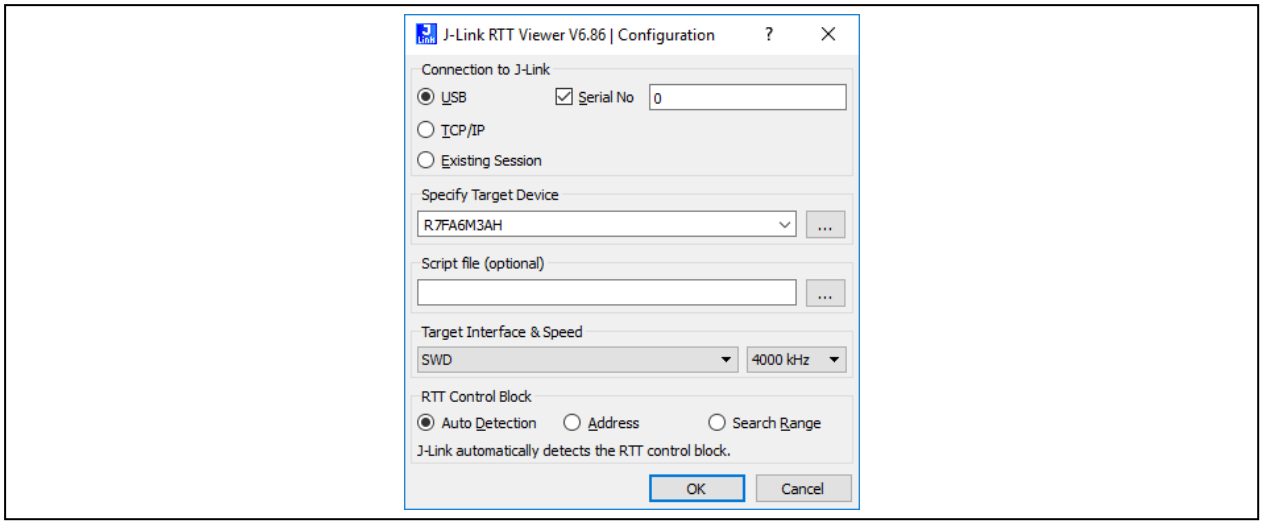


Follow the instructions displayed on the RTT Viewer as shown above. Also refer to `readme.txt` file in the project folder (downloaded.zip file or in https://github.com/renesas/ra-fsp) to run the project.

Appendix

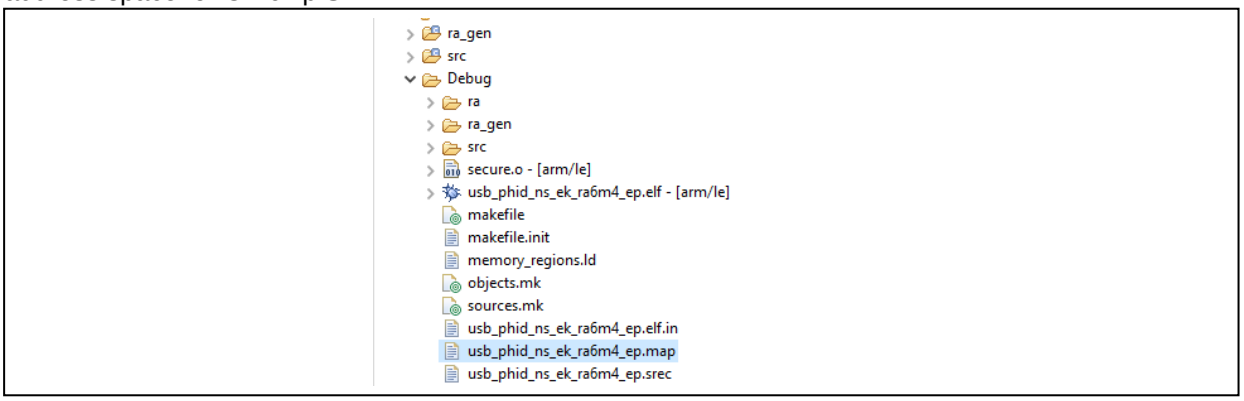
a. Limitations in connecting with J-Link RTT Viewer v7.68b or later

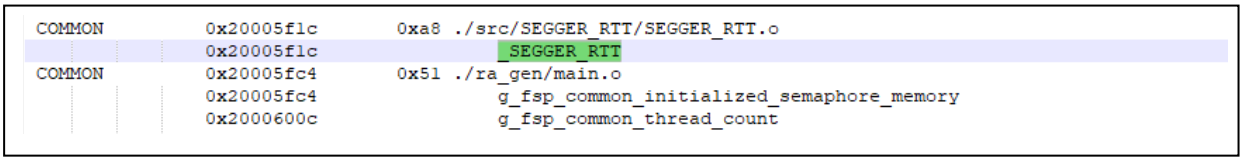
When using Auto Detection option for the RTT Control Block, J-Link RTT Viewer may not be able to find the SEGGER_RTT variable in RAM memory due to restrictions on memory access imposed by TrustZone settings made by the Renesas Device Partition Manager. Restrictions are typically applied for TrustZone Example Projects If the RTT Control Block cannot be found by RTT Viewer, then output from an Example Project may not be visible in the RTT Viewer Console with Auto Detection.



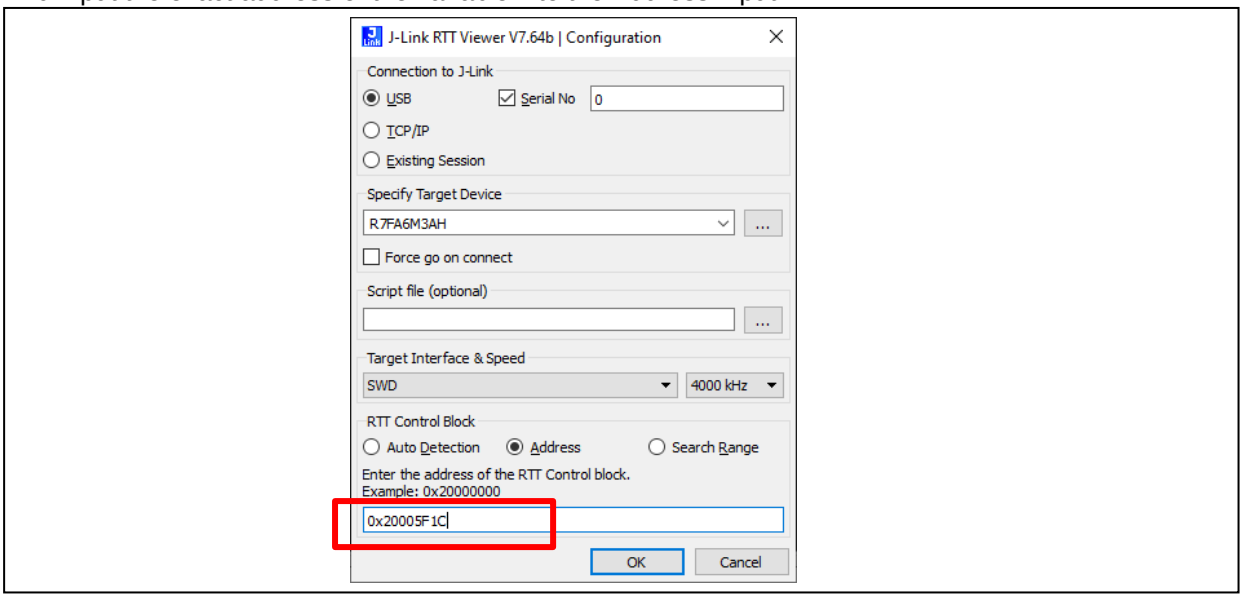
To mitigate this situation, you may use any one of the following approaches:

1. **Method 1:** The recommended approach is to search _SEGGER_RTT variable in the map file, generated upon successfully building a configuration of an Example Project, which is by default located in the address space for On-chip SRAM.

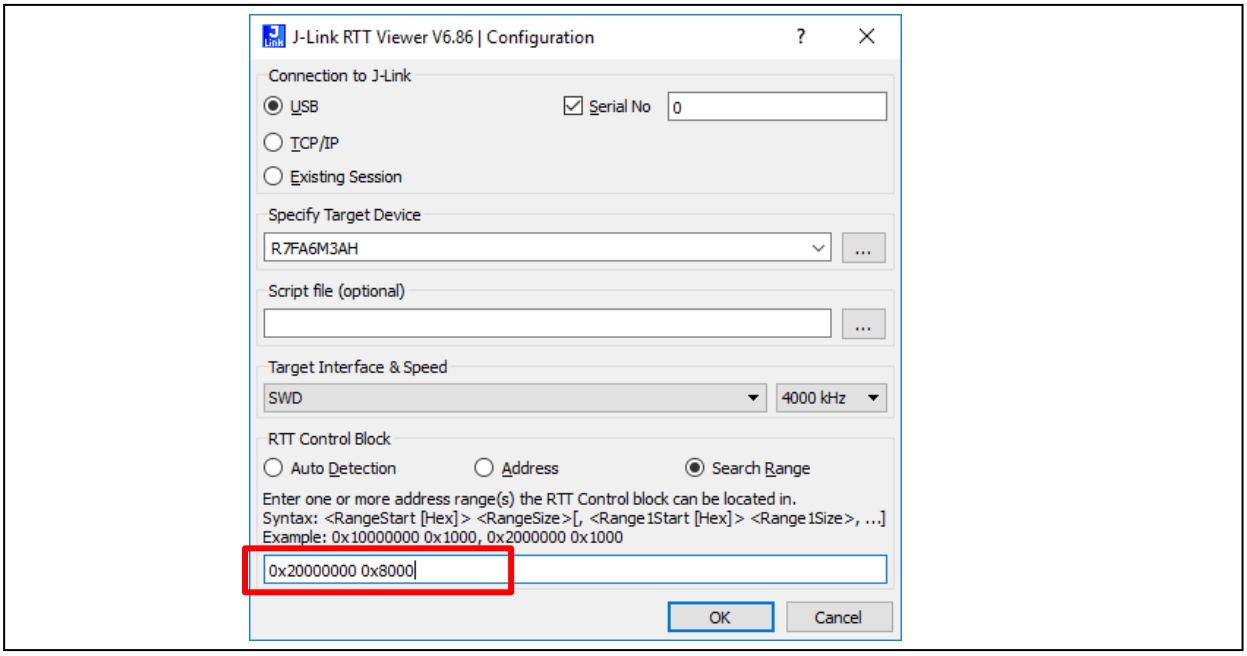




And input the exact address of the variable into the Address Input.



2. **Method 2:** Apply a search range within the first 32kB of SRAM Memory. This approach works when the compiler places _SEGGER_RTT variable in the first 32kB of SRAM memory.


J-Link RTT Viewer V6.86 | Configuration
Connection to J-Link
USB
Serial No
0
TCP/IP
Existing Session
Specify Target Device
R7FA6M3AH
Script file (optional)
Target Interface & Speed
SWD
4000 kHz
RTT Control Block
Auto Detection
Address
Search Range
Enter one or more address range(s) the RTT Control block can be located in.
Syntax: <RangeStart [Hex]> <RangeSize>[, <Range1Start [Hex]> <Range1Size>, ...]
Example: 0x10000000 0x1000, 0x2000000 0x1000
0x20000000 0x8000
OK
Cancel

Website and Support

Visit the following URLs to learn about key elements of the RA family, download components and related documentation, and get support.

RA Product Information	renesas.com/ra
RA Product Support Forum	renesas.com/ra/forum
RA Flexible Software Package	renesas.com/FSP
Renesas Support	renesas.com/support

Revision History

		Description	
Rev.	**Date**	**Page**	**Summary**
1.00	Mar.21.24	—	First release document.
1.01	May.09.24	—	Added support for FSP v5.3.0 (1).
1.02	Jun.14.24	—	Added support for FSP v5.3.0 (3).
1.03	Jul.05.24	—	Added support for FSP v5.4.0 (1).
1.04	Aug.15.24	—	Added support for FSP v5.4.0 (2).
1.05	Sep.10.24	—	Added support for FSP v5.5.0 (1).
1.06	Oct.14.24	—	Added support for FSP v5.5.0 (2).
1.07	Dec.17.24	-	Added support for FSP v5.7.0 (1).
1.08	Feb.28.25	-	Added support for FSP v5.8.0 (2).
1.09	Apr.28.25	-	Added support for FSP v5.9.0 (2).
1.10	Jun.06.25	-	Added support for FSP v5.9.0 (3).
1.11	Jul.08.25	-	Added support for FSP v6.0.0 (2).

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

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/.