Renesas RA Family

EK-RA4E2 Example Project Bundle

Introduction

This EK-RA4E2 Example Project Bundle introduces practical examples projects for the EK-RA4E2 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-RA4E2 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-RA4E2

Supported FSP Version

FSP v6.6.0

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-RA4E2 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 e² studio/GCC are supported with e² studio/AC6 via port from GCC.

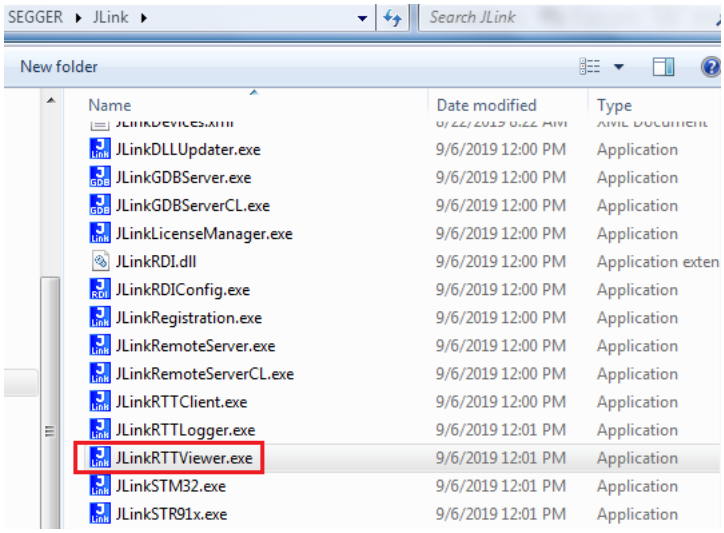
Table 1. IDE Support for the Example Project

	IDE Support		
Example Project	**e² studio**	**IAR**	**Keil MDK**
NetX_wifi	Supported		
USBX_phid	Supported		
USBX_pprn	Supported		
_quickstart	Supported		
adc	Supported		
adc_gpt_periodic_sampling	Supported		
agt	Supported	Supported	Supported
audio_playback_pwm	Supported		
baremetal	Supported		
cac	Supported		
can_fd	Supported		
clock_output	Supported		
cpp	Supported		
crc	Supported		
dac	Supported		
dac_agt_periodic_signal_generator	Supported		
dmac	Supported	Supported	Supported
doc	Supported		
elc	Supported		
flash_hp	Supported	Supported	Supported
freertos	Supported	Supported	Supported
gpt	Supported	Supported	Supported
gpt_input_capture	Supported		
i3c_master	Supported		
i3c_slave	Supported		
icu	Supported	Supported	Supported
iwdt	Supported		
lpm	Supported		
lvd	Supported		
rtc	Supported	Supported	Supported
sci_i2c_master	Supported		
sci_spi	Supported	Supported	Supported
sci_uart	Supported	Supported	Supported
smbus	Supported		
spi	Supported	Supported	Supported
ssi	Supported		
ssi_slave	Supported		

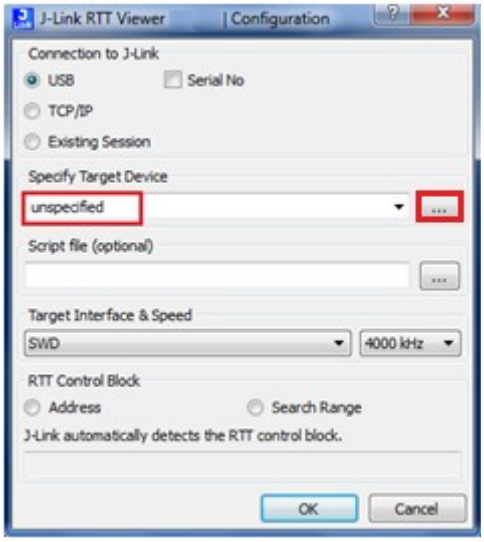
	IDE Support		
Example Project	**e² studio**	**IAR**	**Keil MDK**
tfu	Supported		
usb_pcdc	Supported		
usb_phid	Supported		
usb_pvnd	Supported		
vee_flash	Supported		
wdt	Supported	Supported	Supported
wifi_on_chip_http_client	Supported		
trustzone/agt	Supported	Supported	Supported
trustzone/doc	Supported	Supported	Supported
trustzone/rtc	Supported	Supported	Supported
trustzone/usb_phid	Supported	Supported	Supported

3. Running the Project

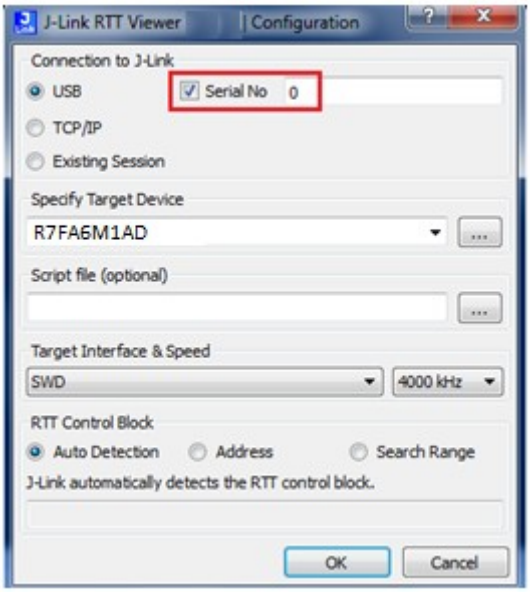
1. Open RTT Viewer by double clicking `JLinkRTTViewer.exe` in the downloaded `/Segger/JLink` folder.



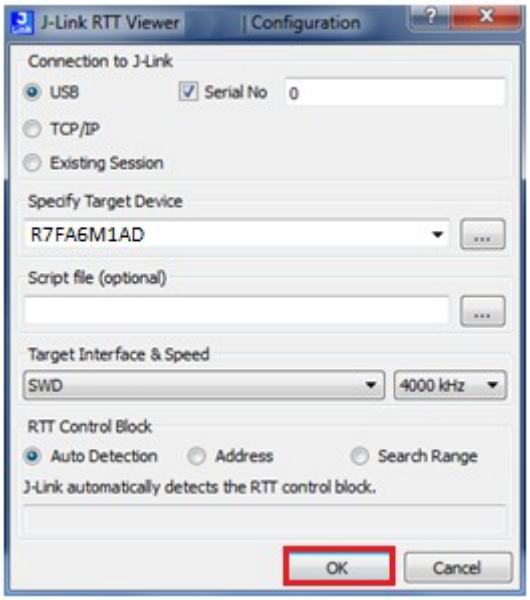
2. On opening, the field **Specify Target Device** shows up as **unspecified**. With USB selected, click on the ... tab and select the desired Renesas RA device. Keep a note the Core type.



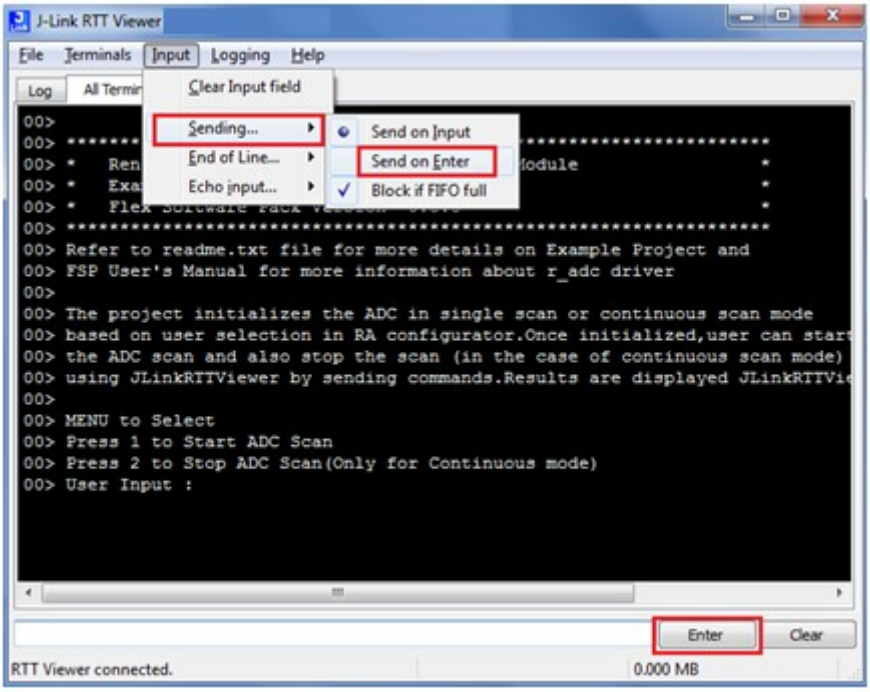
3. If multiple kits are connected to the PC, make sure to choose the corresponding serial number. The default is 0.
   Note: For MCUs such as RA6M4, RA6M5, RA4E1, RA6E2, and RA6T2, the exact address of the RTT Control Block must be specified. When Auto Detection is used, RTT Viewer parses all RAM memory 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.

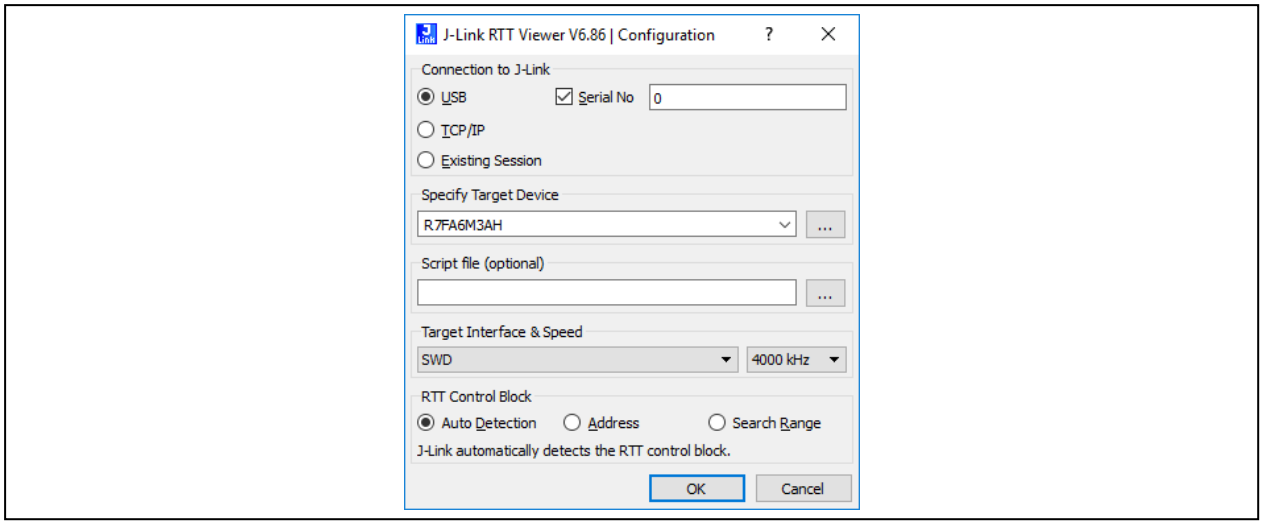


Follow the instructions displayed on the RTT Viewer as shown above. Also refer to `readme.txt` file in the project folder (downloaded.zip file or in https://github.com/renesas/ra-fsp) to run the project.

Appendix

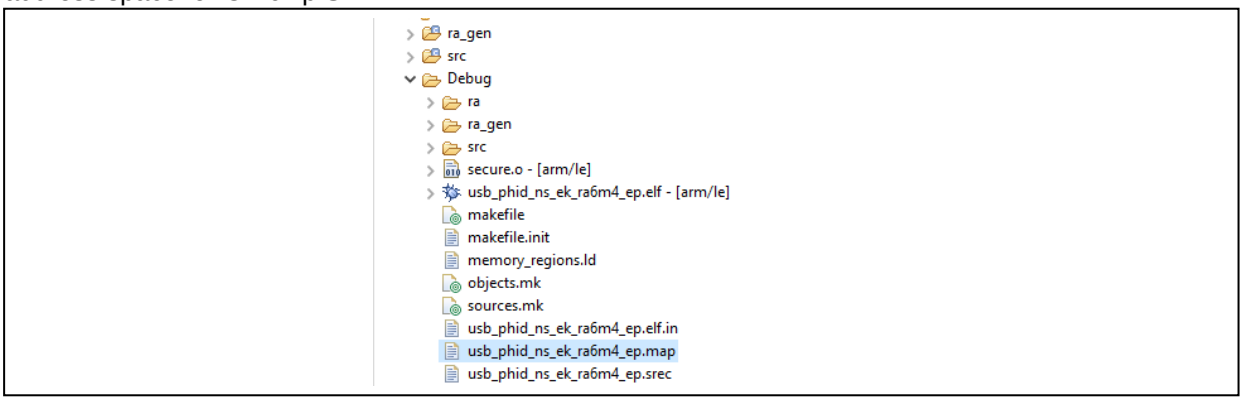
a. Limitations in connecting with J-Link RTT Viewer v7.68b or later

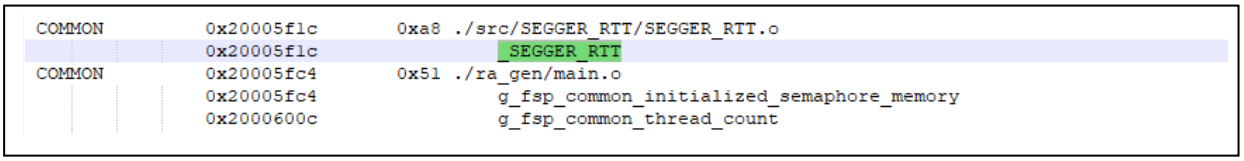
When using Auto Detection option for the RTT Control Block, J-Link RTT Viewer may not be able to find the SEGGER_RTT variable in RAM memory due to restrictions on memory access imposed by TrustZone settings made by the Renesas Device Partition Manager. Restrictions are typically applied for TrustZone 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.



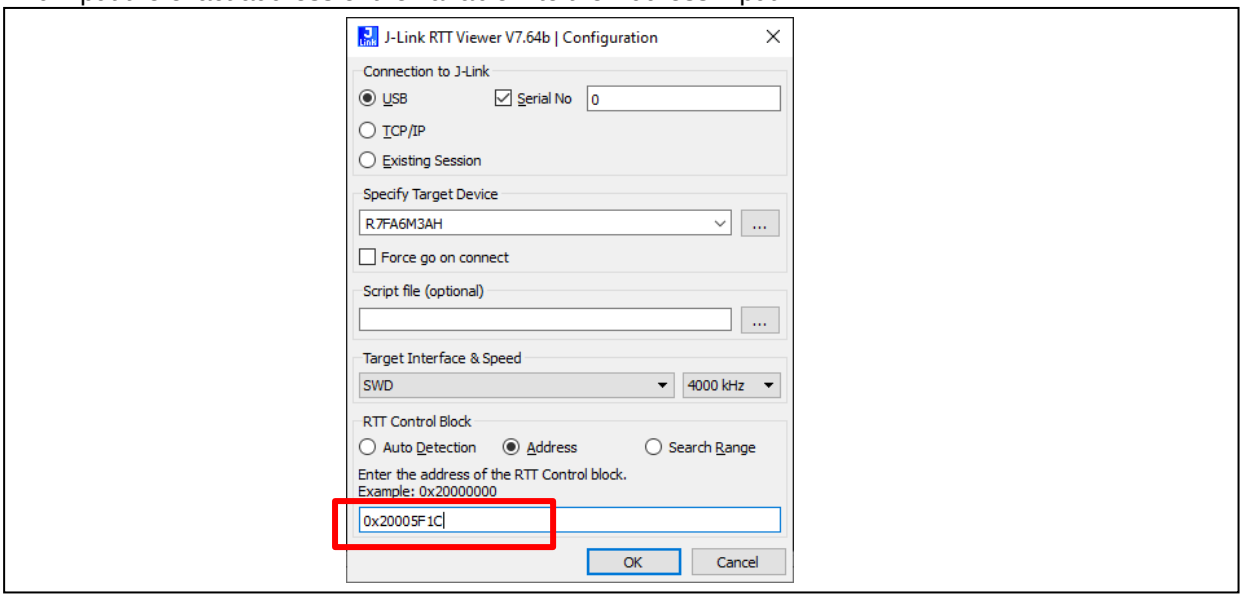
To mitigate this situation, you may use any one of the following approaches:

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.

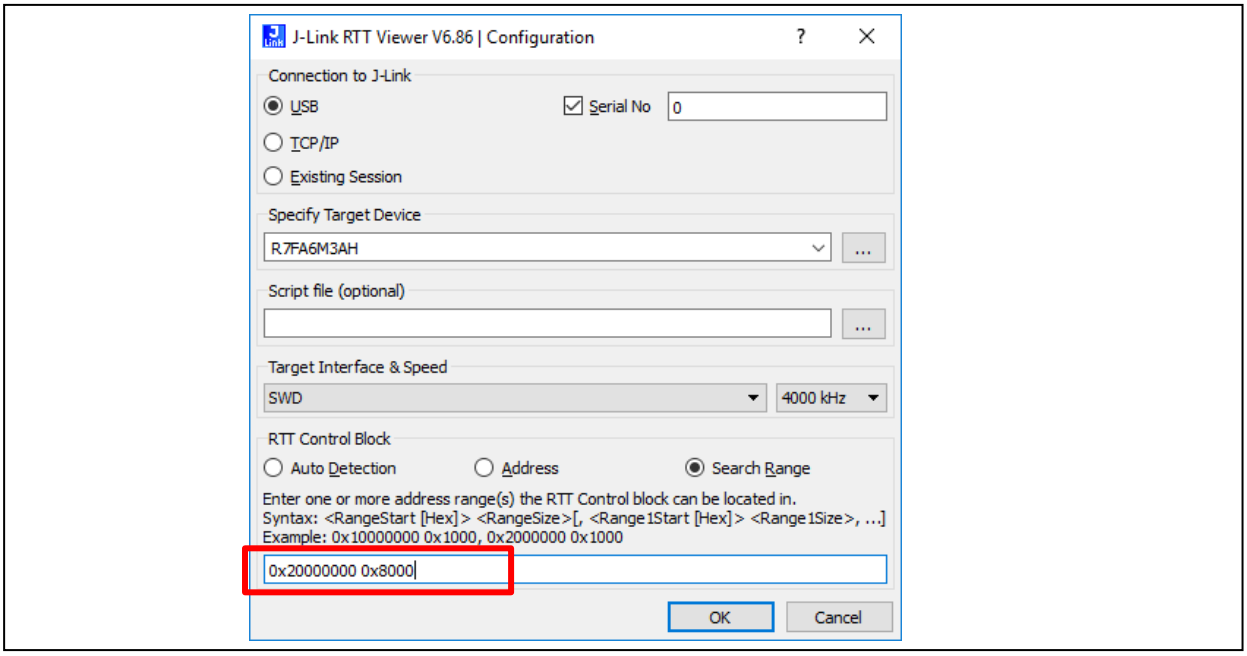




And input the exact address of the variable into the Address Input.



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.15.23	—	First release document.
1.01	Mar.29.23	—	Second release.
1.02	Apr.28.23	—	Added FSP 4.4.0 (1) support.
1.03	Jun.01.23	—	Added FSP 4.4.0 (2) support.
1.04	Jul.17.23	—	Added FSP 4.5.0 (1) support.
1.05	Sep.18.23	—	Added support for FSP v4.5.0 (2).
1.06	Sep.26.23	—	Added support for FSP v4.6.0 (1).
1.07	Oct.23.23	—	Added support for FSP v4.6.0 (2).
1.08	Nov.06.23	—	Added support for FSP v5.0.0 (2).
1.09	Dec.05.23	—	Added support for FSP v5.0.0 (3).
1.10	Dec.19.23	—	Added support for FSP v5.1.0 (2).
1.11	Jan.29.24	—	Added support for FSP v5.1.0 (4).
1.12	Mar.11.24	—	Added support for FSP v5.2.0 (1).
1.13	Mar.21.24	—	Added support for FSP v5.2.0 (2).
1.14	Apr.09.24	—	Added support for FSP v5.2.0 (3).
1.15	May.09.24	—	Added support for FSP v5.3.0 (1).
1.16	Jun.14.24	—	Added support for FSP v5.3.0 (3).
1.17	Jul.05.24	—	Added support for FSP v5.4.0 (1).
1.18	Aug.15.24	—	Added support for FSP v5.4.0 (2).
1.19	Sep.10.24	—	Added support for FSP v5.5.0 (1).
1.20	Oct.14.24	—	Added support for FSP v5.5.0 (2).
1.21	Dec.17.24	-	Added support for FSP v5.7.0 (1).
1.22	Feb.28.25	-	Added support for FSP v5.8.0 (2).
1.23	Apr.28.25	-	Added support for FSP v5.9.0 (2).
1.24	Jun.06.25	-	Added support for FSP v5.9.0 (3).
1.25	Jul.08.25	-	Added support for FSP v6.0.0 (2).
1.26	Aug.02.25	-	Added support for FSP v6.0.0 (3).
1.27	Sep.09.25	-	Added support for FSP v6.1.0 (1).
1.28	Sep.23.25	-	Added support for FSP v6.1.0 (3).
1.29	Oct.30.25	-	Added support for FSP v6.2.0 (2).
1.30	Dec.26.25	-	Added support for FSP v6.3.0 (1).
1.31	Mar.11.26	-	Added support for FSP v6.4.0 (2).
1.32	Jun.03.26	-	Added support for FSP v6.5.0 (1).
1.33	Sep.16.26	-	Added support for FSP v6.6.0 (1).

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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