# RENESAS

# Smart Configurator for RISC-V MCU Plug-in in e<sup>2</sup> studio 2025-04 Smart Configurator for RISC-V MCU V1.4.0

# Release Note

# Introduction

Thank you for using the Smart Configurator for RISC-V MCU. This document describes the restrictions and points for caution. Read this document before using the product.

# Contents

1. Introduction
1.1 System Requirements
1.1.1 Windows PC
1.1.2 Linux PC
1.1.3 Development Environments
2. Support List
2.1 Support Devices List
2.2 Support Components List
2.3 New support
2.3.1 Support CMake generation for Smart Configurator with Visual Studio Code
2.3.2 Show preferences link at Overview tab
2.3.3 Support searching for property grid configuration
3. Changes7
3.1 Specification changes
3.1.1 Improve blinky sample project in e <sup>2</sup> studio version
4. Points for Limitation
4.1 List of Limitation
4.2 Details of Limitation
4.2.1 Note on extra help document issue
4.2.2 Note on UI display with High Contrast theme on Linux OS
5. Points for Caution9
5.1 List of Caution
5.2 Details of Caution
5.2.1 Note on the installation of the Smart Configurator
5.2.2 Note on the include path update issue when renaming the component's configuration name
5.2.3 Note on TAU Input Signal High/Low level Measurement component
5.2.4 Note on using the user code protection feature

# Smart Configurator for RISC-V MCU Plug-in in e2 studio 2025-04 Smart Configurator for RISC-V MCU V1.4.0 Release Note

5.2.5	Note on the build error when an interrupt is not allocated to any interrupt vector	11
5.2.6	Note on the start address 00000000 is not from start.s file function for Blinky CPP LLVM project	12
5.2.7	Note on the issue when opening the emProject file in SEGGER	13
Revisi	on History	14



## 1. Introduction

Smart Configurator is a utility for combining software to meet your needs. It supports the following three functions related to the embedding of Renesas drivers in your systems: importing middleware, generating driver code, and setting pins.

Smart Configurator for RISC-V MCU V1.4.0 is equivalent to Smart Configurator for RISC-V MCU Plug-in in e<sup>2</sup> studio 2025-04.

#### 1.1 System Requirements

The operating environment is as follows.

#### 1.1.1 Windows PC

- System: x64/x86 based processor
  - Windows® 11

Windows® 10 (64-bit version)

- Memory capacity: We recommend 4 GB or more.
- Capacity of hard disk: At least 300 MB of free space.
- Display: Graphics resolution should be at least 1024 x 768, and the mode should display at least 65,536 colors.
- Processor: 1 GHz or higher (must support hyper-threading, multi-core CPUs)

## 1.1.2 Linux PC

Smart Configurator for RISC-V MCU plug-in in e<sup>2</sup> studio 2024-07 or later is supported on Linux OS.

• System: x64 based processor, 2 GHz or faster (with multicore CPUs)

Ubuntu 24.04 LTS Desktop (64-bit version)

Ubuntu 22.04 LTS Desktop (64-bit version)

- Memory capacity: We recommend 2 GB or more.
- Capacity of hard disk: At least 2 GB of free space.

#### **1.1.3 Development Environments**

Windows

LLVM for Renesas RISC-V 17.0.2.202401 or later IAR Embedded Workbench for RISC-V 3.30.1 or later SEGGER Embedded Studio for RISC-V 8.10 or later

• Linux

LLVM for Renesas RISC-V 17.0.2.202406 or later IAR bxriscv-3.30.1 or later SEGGER Embedded Studio 8 for RISC-V 8.12a or later



## 2. Support List

#### 2.1 Support Devices List

Below is a list of devices supported by the Smart Configurator for RISC-V MCU V1.4.0.

#### Table 2-1 Support Devices

Group (HW Manual number)	PIN	Device name
RISC-V/G021 Group	16pin	R9A02G0214CBY
(R01UH1036EJ0110)	24pin	R9A02G0214CNK
	32pin	R9A02G0214CNH
	48pin	R9A02G0214CNE

#### 2.2 Support Components List

Below is a list of Components supported by the Smart Configurator for RISC-V MCU V1.4.0.

#### Table 2-2 Support Components

G02' No Components Mode Remarks A/D Converter 1 / 2 Comparator / 3 D/A Converter ./ Data Transfer Controller 4 1 5 Delay Counter Divider Function 6 / 7 Event Link Controller / External Event Counter / 8 9 IIC Communication (Master mode) 1 10 IIC Communication (Slave mode) / Input Pulse Interval/Period Measurement 11 ./ Input Signal High-/Low-Level Width Measurement 12 ./ 13 Interrupt Controller 1 14 Interval Timer 8 bit count mode / 16 bit count mode / 16 bit capture mode / 32 bit count mode / 15 Key Interrupt 1 16 One-Shot Pulse Output / 17 Ports ./ PWM Output 18 ./ 19 Real-Time Clock 20 Remote Control Signal Receiver ./ Simple SPI Communication 21 Transmission / Reception / Transmission/reception 1 22 Square Wave Output ./ 23 UART Communication Transmission ./ Reception / Transmission/reception 1 24 Voltage Detector / 25 Watchdog Timer ./



✓: Support (\*), -: Non-support

Smart Configurator for RISC-V MCU Plug-in in e2 studio 2025-04 Smart Configurator for RISC-V MCU V1.4.0 Release Note

## 2.3 New support

#### 2.3.1 Support CMake generation for Smart Configurator with Visual Studio Code

From Smart Configurator for RISC-V MCU V1.4.0, when using Visual Studio Code (VS Code) with Renesas Debug extension v25.6.2 or later to create RISC-V MCU project by choosing "Renesas: Create RISC-V MCU project with Smart Configurator", CMake project is generated for easier build the driver code generated by Smart Configurator for RISC-V MCU on Visual Studio Code. LLVM toolchain is supported for CMake generation. Both Windows OS and Linux OS are supported. For detailed how to use the CMake generation for Smart Configurator, please refer to Renesas VS Code Extensions User Guide.

>					
Renesas: Create RISC-V MCU project with Smart Configurator recently used 🐯					
Renesas: Open Renesas S	upport Files Manager				
CMake: Delete Cache and	Reconfigure				
Figure 2-1 Select "Renes	as: Create RISC-V MCU project	with Smart Configurat	or" in VS Code		
¢	EXPLORER				
Q	× × Welcome				



Figure 2-2 CMake LLVM project created for VS Code



#### 2.3.2 Show preferences link at Overview tab

From Smart Configurator for RISC-V MCU V1.4.0, there is a link at Overview tab to help users quickly navigate to preferences setting.

Overview	information		Generate Code Generate Report			
	User's Guide API manual Application Notes Tool news FAQ : Smart Configurator	Y	MCU Hardware			
Note: The co Selected boa	Denfiguration de generation behavior can be customized in th ard/device: R9A02G0214CNE (ROM size: 128 KB, acation (PROJECT_LOC\): src\smc_gen apponents:		<ul> <li>KB, Pin c</li> <li>The available customizations include:</li> <li>Omitting PDF documentation from the generated source.</li> <li>Options to output all API functions or only initialization functions.</li> <li>Options to change API code style from macros to hex values.</li> </ul>			
Component     Version     Component       Board Support Packages v1.22 (r_bsp)     1.22     r_bsp(used)						
Overview Boa	rd Clocks System Components Pins Interrup	ot				

Figure 2-3 Preferences link at Overview tab

#### 2.3.3 Support searching for property grid configuration

From Smart Configurator for RISC-V MCU V1.4.0, a search text box is added at property grid configuration to help users quickly find a configuration name or macro name.

	type filter text (* = any string, ? = any character)		
er text	Property	Value	
artup	V @ Configurations		
Generic	✓		
bsp	# Machine timer	Disable	
	# Clock source select	Machine timer clock	
	# Timer mode	One-shot	
	# Interval value		
	# Interval value unit		
	# mtip priority		
	# Machine software interrupt (msip)	Disable	
	# msip priority		
	# Startup select	Enable (use BSP startup)	
	# Flash Read Protection Access Control Registe	er (FLR Disable	
	# Flash Read Protection Shirt Address Register		
	# Flash Read Protection End Address Register		
	# Enable OCD/Serial Programmer ID Setting	Disable	
	# OCD/Serial Programmer ID Setting Register		
	# OCD/Serial Programmer ID Setting Register	1 valu 0xFFFFFFF	
	# OCD/Serial Programmer ID Setting Register		
	# OCD/Serial Programmer ID Setting Register		
	# Enable Access Window Block Address Settin		
	A constant of the state of the	o.arr	
	Macro definition: BSP_CFG_MACHINE_TIMER		
	0 = Machine timer not to be used.		
	1 = Machine timer is to be used.		

Figure 2-4 Search text box at property grid configuration



## 3. Changes

This chapter describes changes to the Smart Configurator for RISC-V MCU V1.4.0.

## 3.1 Specification changes

#### Table 3-1 List of Correction of issues/limitations

✓: Applicable, -: Not Applicable

No	Description	G021	Remarks
1	Improve blinky sample project in e <sup>2</sup> studio version		

#### 3.1.1 Improve blinky sample project in e<sup>2</sup> studio version

From Smart Configurator for RISC-V MCU V1.4.0, blinky sample project is improved to blink 2 LEDs with different frequency.



#### Figure 3-1 Improved code of blinky sample project



## 4. Points for Limitation

This section describes points for limitation regarding the Smart Configurator for RISC-V MCU V1.4.0.

## 4.1 List of Limitation

#### Table 4-1 List of Limitation

No	Description	G021	Remarks
1	Note on extra help document issue		
2	Note on UI display with High Contrast theme on Linux OS		

✓: Applicable, -: Not Applicable

## 4.2 Details of Limitation

#### 4.2.1 Note on extra help document issue

For Smart Configurator, there is an extra help "Smart Browser" under "[Help] > [Help Contents]". Please ignore it.

?	Help Contents	📑 🔣 Help - Smart Configu	urator
	Home Page	Search:	Go
	Release Notes	Contents	👜 - 🚀 🖻 🔄 ۵
	Tool News	🗷 🏶 Smart Browser	
	API Manual	🖲 🥯 Smart Configura	ator for RISC-V MCU
13	About		

#### Figure 4-1 Extra help issue

#### 4.2.2 Note on UI display with High Contrast theme on Linux OS

When using e<sup>2</sup> studio with High Contrast theme on Linux OS, some display texts of Smart Configurator cannot be seen.

To avoid this issue, please use other themes.

Components 🚵 🖆 🖓 🖻	Configure			
type filter text	Detection type Falling edge $\checkmark$ Digital filter No filter $\checkmark$			
✓ ➢ Startup ✓ ➢ Generic ♂ r_bsp ✓ ➢ Drivers	Detection type       Falling edge       Digital filter       No filter       >         Priority       Level 15 (low			
✓ ➢ Interrupt ✓ Config ICU				
	Detection type       Falling edge       Digital filter       No filter       ~         Priority       Level 15 (low       ~       ~       ~       ~			
	<b>Detection type</b> Falling edge $\checkmark$ <b>Digital filter</b> No filter $\checkmark$			
	Priority Level 15 (low 🗸			
Dverview Board Clocks System Components Pins Interrupt				

Figure 4-2 UI display with High Contrast theme



## 5. Points for Caution

This section describes points for caution regarding the Smart Configurator for RISC-V MCU V1.4.0.

## 5.1 List of Caution

#### Table 5-1 List of Caution

✓: Applicable, -: Not Applicable

No	Description	G021	Remarks
1	Note on the installation of the Smart Configurator	$\checkmark$	
2	Note on the include path update issue when renaming the component's configuration name		
3	Note on TAU Input Signal High/Low level Measurement components.		
4	Note on using the user code protection feature		
5	Note on the build error when an interrupt is not allocated to any interrupt vector		
6	Note on SIS modules cannot be showed in New Component window		
7	Note on the start address 00000000 is not from start.s file function for Blinky CPP LLVM project		
8	Note on the issue when opening the emProject file in SEGGER	$\checkmark$	

## 5.2 Details of Caution

#### 5.2.1 Note on the installation of the Smart Configurator

Do not set more than 64 characters for the installation directory.

The user might see an error message "The specified path is too long" and will not be able to install Smart Configurator.

# 5.2.2 Note on the include path update issue when renaming the component's configuration name

When renaming the added component's configuration in e<sup>2</sup> studio Smart Configurator project that has selfdefined include path setting for any folder or file, include path setting for that folder or file will keep the old name setting after code generation. This will cause build error when compiling the newly generated codes so please manually update the include path.

The folder or file which has self-defined include path setting can be recognized by checking the overlay icon

 $(\stackrel{6}{\leftarrow})$  on that folder or file. Below is an example on how to handle the include path update after renaming Compare Match Timer component configuration.

웥 Project Explorer 🗡	🖻 🔩 🍸 🕴 🗖 🗖	₿ test.scfg ×	
∽ 😂 test		Overview information	
> 🖑 Binaries			
> 🔊 Includes		<ul> <li>General Information</li> </ul>	
👻 🐸 src			
<mark>≻ ⊜ smc_gen</mark>		Overview Overview	
> State Config_ADC		Get an <u>overview</u> of the features provided by Smart	
> 😕 Config_TAU0_1		Configurator.	
> 😕 general 🛛 🖌			
> 🗁 r_bsp	Folder with	Folder with	overlay icon indicates
> 🗁 r_config	that "Confi	g_ADC" folder has	
> 🖻 test.c	self-define	d include path setting	
> 🗁 HardwareDebug		(<>>) VVnat s New	
> 🖻 trash		Check out what's new in the latest release.	
🖹 test.rcpc			
test.scfg		Product Documentation	
🗎 test HardwareDebug.laun	ch	User manual and release notes	

Figure 5-1 Interval Timer component configuration before renaming



Smart Configurator for RISC-V MCU Plug-in in e2 studio 2025-04 Smart Configurator for RISC-V MCU V1.4.0 Release Note

Software component configuration     > ☆ East     > ☆ Binaries   > ŵ Includes   > ŵ Src   > ŵ Config_ADC   > ŵ Config_TAU0_1   > ŵ general	🔁 Project Explorer × 📃 🗖	✿ *test.scfg ×
<ul> <li>✓ Includes</li> <li>✓ Includes</li></ul>	🖻 🛱 🍸 🕴	Software component configura
<ul> <li>&gt; Includes</li> <li>&gt; Src</li> <li>&gt; Smc_gen</li> <li>&gt; Config_ADC</li> <li>&gt; Config_TAU0_1</li> <li>&gt; E general</li> </ul>	👻 📂 test	Software component configura
<ul> <li>&gt; Includes</li> <li>&gt; Src</li> <li>&gt; Smc_gen</li> <li>&gt; Config_ADC</li> <li>&gt; Config_TAU0_1</li> <li>&gt; E general</li> </ul>	> 🖑 Binaries	Components 🖻 🖄 🕒 🕂
<ul> <li>✓ ▷ src</li> <li>✓ ▷ smc_gen</li> <li>✓ ▷ Config_ADC</li> <li>✓ ▷ Config_TAU0_1</li> <li>✓ ▷ general</li> <li>✓ ▷ r_bsp</li> </ul>	> 🔊 Includes	
> <pre>Sinc_gen       &gt; <pre>Sconfig_ADC       &gt; <pre>Sconfig_TAU0_1       &gt; <pre>Segeneral</pre></pre></pre></pre>	👻 🖴 src	📲 🔯
<ul> <li>&gt; Config_TAU0_1</li> <li>&gt; General</li> <li>&gt; General</li> <li>&gt; Config_TAU0_1</li> <li>&gt; Config_TAU0_</li></ul>	👻 🗁 smc_gen	type filter text
> 🦻 general 🔹 r_bsp	> 🗳 Config_ADC	🕆 🗁 Startup 🔨
	> 😕 Config_TAU0_1	👻 🗁 Generic
	> 😕 general	♂ r_bsp
> 🗁 r_bsp 🛛 🖌 🎽 Drivers	> 🗁 r_bsp	🕆 🗁 Drivers
> 🗁 r_config 🛛 🗸 🗁 Timers	> 🗁 r_config	Y 🗁 Timers
> 🗟 test.c 📀 My_Config_TAU0_1	> 🖻 test.c	My_Config_TAU0_1
> 🗁 HardwareDebug 🗸 🗠 A/D converter	> 😕 HardwareDebug	✓ ➢ A/D converter
> > trash	> 🖻 trash	Renamed from "Config TAU0_1" to
i test.rcpc  # test.scfg  # test.scfg  # test.scfg #		

Figure 5-2 The Interval Timer component configuration after renaming

Properties for Cor	nfig_ADC			
	Paths and Symbols			⇔ ◄ ⇔ ▼ ៖
<ul> <li>Resource</li> <li>C/C++ Build</li> <li>C/C++ General Paths and Sym Preprocessor I</li> </ul>	Configuration: Hardw	<u> </u>	∼ Manage C	Configurations
Run/Debug Settir	Includes # Symbol          Languages         GNU C         GNU C++         Assembly         Assembly	<ul> <li>Source Location</li> <li>Include directories</li> <li>\${TCINSTALL}/inc</li> <li>\${ProjName}/src/smc_gen/r_bsp</li> <li>\${ProjName}/src/smc_gen/r_config</li> <li>\${ProjName}/src/smc_gen/config_ADC</li> <li>\${ProjName}/src/smc_gen/general</li> <li>\${ProjName}/src/smc_gen/Config_TAU0_1</li> </ul>	^ ~	Add Edit Delete Export Move Up
	<ol> <li>"Preprocessor Inclu</li> <li>Show built-in value</li> <li>Import Settings</li> </ol>	de Paths, Macros etc." property page may define addit s S Export Setting Include path for rena updated after code r To avoid build error, "Config_TAU0_1" to	amed con e-genera please m	tion. nanually upda

Figure 5-3 Include path setting for the "Config\_ADC" configuration



#### 5.2.3 Note on TAU Input Signal High/Low level Measurement component

When using TAU Input Signal High/Low level Measurement component, after used noise filter function for TImn input pulse, please make sure the High/Low level width min value needs to be greater than two times the minimum value prompted on the UI.

For example, the High/Low level width min value is 0.032us (min value), when use noise filter function, the width min value should be 0.064us.

Clock setting			
Operation clock	СК00	$\sim$	
Clock source	PCLKB	~	
(Clock frequency: 32000 kHz, High-/lo	ow-level width range	e: $0.032 \ (\mu s) \le T100 \le 4.096$	(ms))

Figure 5-4 High/Low level width min value

#### 5.2.4 Note on using the user code protection feature

The user code protection feature will be supported for all Code Generation components. Please use the following specific tags to add user code when using the user code protection feature. If the specific tags do not match exactly, inserted user code will not be protected after the code generation.

/* Start user code */
User code can be added between the specific tags
/* End user code */

#### 5.2.5 Note on the build error when an interrupt is not allocated to any interrupt vector

Use IRQ0 as example, when IRQ0 is used in interrupt component, but an interrupt error is shown in "Configuration Problems" window. It means all interrupt vectors which can used by IRQ0 have been used.

Components 🛛 🖓 🔁 🕀	Configure				
type filter text	NMI pin interrupt settir	Detection type Falling edge	~	Digital filter No filter	<
✓ 😂 Startup ✓ 🧁 Generic 💣 r_bsp ✓ 😭 Drivers	IRQ0 setting	Detection type Falling edge Priority Level 15 (low)	~	Digital filter No filter	~
Config_ICU	IRQ1 setting	Detection type Falling edge Priority Level 15 (low)	~	Digital filter No filter	~
Overview Board Clocks Components Pine	Interrupt				
Configuration Proble	ems ×				
1 error, 0 warnings, 0 ot	hers				
Description		^			
🗸 🥝 Interrupt (1 item)					
😣 E04010004: P0	ORT_IRQ0 used by Con	fig_ICU is not allocated to any	inte	rrupt vector.	

Figure 5-5 An interrupt is not allocated to any interrupt vector

When you generate code, some build error will be shown:

	55	⊖void R_Config_ICU_Create(void)	
	56	{	
4	57	CLIC->clicintie_b.IE = 0U;	<pre>/* disable IRQ0 interrupt */</pre>
2	58	ICU->IELSR &= 0xFFFEFFFFU;	<pre>/* clear IRQ0 interrupt flag */</pre>
	FO		

Figure 5-6 Build errors when an interrupt is not allocated to any interrupt vector

To solve these build errors, please refer to Smart Configurator User's Manual e<sup>2</sup> studio or IAREW, SEGGER Embedded Studio chapter 4.6.4 Resolving Interrupt error.



# 5.2.6 Note on the start address 00000000 is not from start.s file function for Blinky CPP LLVM project

When using a Blinky CPP LLVM project, the start addresse 00000000 is not from start.s file function.



Figure 5-7 Incorrect function of start address 00000000

Correct start function address should in BSP start.s file a	and _Powe	erON_Reset().
<ul> <li>▼ isrov_cpp_livm_blinky; HardwareDebug [Renesas GDB Hardware Debugging]</li> <li>♥ isrov_cpp_livm_blinky; HardwareDebug [Renesas GDB server (Host)</li> </ul>	29 30 31 32 33 34 35 36 37 38 39 40	<pre>/*reset_program.asm*/ .extern initialize_vect .text .global _PowerON_Reset /*! global Start routine */ .type _PowerON_Reset, @function /* call to _PowerON_Reset */ _PowerON_Reset: # Initialize global pointer .option push .option norelax 1:</pre>
	<ul> <li>41 0000000</li> <li>42 0000004</li> <li>43</li> <li>44</li> <li>45</li> <li>46 0000008</li> <li>47 0000010</li> </ul>	<pre>auipc gp, %pcrel_hi(_global_pointer\$) addi gp, gp, %pcrel_lo(1b) .option pop # initialize the stack and frame pointers la sp,stack add s0, sp, zero</pre>

Figure 5-8 Start address 00000000 is from start.s file and \_PowerON\_Reset()

As a workaround, please changed the [Debug format] to dwarf-2 or dwarf-3:

Properties for Blinky_CPF				-	-		×
type filter text	Settings				$\Diamond$	• <>	<b>₩</b> 00
<ul> <li>&gt; Resource</li> <li>Builders</li> <li>C/C++ Build     <li>Build Variables</li> <li>Environment</li> </li></ul>	Configuration: HardwareD			Manage		-	
Logging Settings Tool Chain Editor > C/C++ General Project Natures	<ul> <li>Tool Settings Toolch</li> <li>CPU</li> <li>Optimization</li> <li>Debug</li> <li>Warnings</li> </ul>	ain 🛞 Device 🎤 Build Steps 🙅 Build Debug level (-g) Debug format dwarf-2 Other flags	Artifa			Parsers	~
Project References Refactoring History Renesas QE Run/Debug Settings	<ul> <li>Settings</li> <li>Settings</li> <li>Compiler</li> <li>Source</li> <li>Includes</li> </ul>						
?	<	Арр	oly and	Close		Cancel	>

Figure 5-9 Change the [Debug format] CPP LLVM project



#### 5.2.7 Note on the issue when opening the emProject file in SEGGER

When opening the emProject file generated by SEGGER. The following prompt box will be pop up.



#### Figure 5-10 The issue when opening the emProject file

As a workaround, please "Ctrl + A" right-click change Line ending to "Unix".

				<u> </u>				
0	Toggle Breakpoint	F9						
2	Check Syntax	Ctrl+Q, Ctrl+Y						
	Compare To Disk Copy							
	Add File to Project	•						
×	Cut	Ctrl+X						
Ē	Сору	Ctrl+C						
ĥ	Paste	Ctrl+V						
	Tools	,						
	Folding	,						
	Text Size	,						
	Options	•	a-b	Visible Whitespace	Ctrl+Shift+8			
			~	Display Code Completion Suggestions While Typing				
			~	Return or Enter				
				Tab				
				Code Completion Replaces Existing Word				
			~	Include Preprocessor Definitions in Suggestions				
				Include Templates in Suggestions				
				Check Spelling				
				Column-mode Tab				
			~	Show Inactive Code				
			~	Show Symbol Declaration Tooltips				
			~	Highlight All Selected Text				
			*	Toggle Split Window	Ctrl+K, S			
				Tab Size	•			
				Syntax Highlighting	•			
				Code Formatting	•			
				Text Encoding	•			
				Line Endings	•		Windows	(CR+LF)
			P	Editor Properties		~	Unix	(LF)
			_				OS-9	(CR)

Figure 5-10 Change Line ending to "Unix"



# **Revision History**

Rev.	Section	Description
1.00	-	First edition issued



#### 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 to 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 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 pullup 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 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

- 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 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/.