

# RX651 Group

## Handbook for RX651

### Introduction

This document compiles useful information for each stage of device selection, development, and Mass production. You can also select what you need for your application from our rich selection of application notes that describe how to use a peripheral function, example applications, how to create a program, and more.

Please utilize these information, materials and application notes as a handbook when developing.

### Target Device

RX651 Group

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## 1. The table of information and materials needed for Device Selection, Development and Mass production

### 1.1 Step1: Device Selection

This section summarizes the information that is useful for the preliminary survey phase (Step1-1) and for the evaluation phase of device performance and features (Step1-2) when selecting the device.

#### 1.1.1 Step1-1: Preliminary survey phase

#	Item	Content	Link
1	Hardware information	Datasheet	<a href="#">Doc</a>
2		RX Family Brochure	<a href="#">Doc</a>
3	Products & Solutions	Video & blog	<a href="#">Web site</a>
4		Product deatures, Application block diagram(Winning combination)	<a href="#">Web site</a>
5	Product longevity program (PLP)	Overview of product longevity program (PLP)	<a href="#">Web site</a>
6		Product selection (product selector) Note: Refer to Longevity column in the chart.	<a href="#">Web site</a>
7		Product Specification Comparison	<a href="#">Web site</a>
8		Differences of specification among RX products	<a href="#">Doc</a>
9		[SH/H8/H8S/H8SX/M16C/V850] → RX microcontroller migration guide	<a href="#">Doc</a>
10		Design guide for migration between RX family differences in package external form	<a href="#">Doc</a>
11		Differences between the products bigger than 1MB code flash ROM and the others	<a href="#">Doc</a>

### 1.1.2 Step1-2: Evaluation phase of device performance and features

#	Item	Content	Link
<b>User's Manual / Documentation</b>			
1	Hardware information	User's manual: Hardware	<a href="#">Doc</a>
2		RX family hardware manual guidance - electrical characteristics (how to read user's manual: hardware)	<a href="#">Doc</a>
3		RX family hardware manual guidance - peripheral functions (how to read user's manual: hardware)	<a href="#">Doc</a>
4		Technical update (errata information)	<a href="#">Web site</a>
5		Product change notice (PCN)	<a href="#">Web site</a>
6		Part number guide for RX family product (the meaning of character in part number)	<a href="#">Doc</a>
7		Semiconductor reliability handbook	<a href="#">Doc</a>
8		RELIABILITY REPORT	<a href="#">Doc</a>
9		RoHS Note: Please refer to "RoHS" column on the respective part number of the product options.	<a href="#">Web site</a>
10	Software information	Instruction set for RXv2 core architecture (user's manual)	<a href="#">Doc</a>
<b>Evaluation board</b>			
11	Evaluation board (for general purpose)	Renesas starter kit (all functions could be evaluated)	<a href="#">Web site</a>
12		Target board (low-cost model)	<a href="#">Web site</a>
13	Solution board	CK-RX65N (for cloud evaluation)	<a href="#">Web site</a>
14		Envision kit (for graphics evaluation)	<a href="#">Web site</a>
15		Industrial automation functional safety reference board	<a href="#">Web site</a>
<b>Evaluation environment (set up method)</b>			
16	Setup method	Getting started with the RX family development environment	<a href="#">Web site</a>
17	Software tool	Development tools for RX family	<a href="#">Web site</a>
18		Software environment (OS, middleware, drivers)	<a href="#">Web site</a>
19		RX smart configurator user's guide (tools for code generation)	<a href="#">Doc</a>
<b>Solution</b>			
20	Cloud	RX cloud connectivity solution	<a href="#">Web site</a>
21	Security	IoT Security	<a href="#">Web site</a>
22		Security key management tool manual	<a href="#">Web site</a>
23	GUI	Graphical user interface (GUI) solutions	<a href="#">Web site</a>
24	Functional safety	Functional safety solutions for Industrial automation	<a href="#">Web site</a>
25		Functional safety solution for industrial automation	<a href="#">Doc</a>

#	Item	Content	Link
26		Introduction to Renesas functional safety for industrial appliance(video)	<a href="#">Web site</a>
27		Functional safety solution for home appliances	<a href="#">Web site</a>
28		Introduction to Renesas functional safety for home appliance (video)	<a href="#">Web site</a>
<b>Training</b>			
29	Training information	Smart configurator tutorial - create a LED blinking program using RX family MCU	<a href="#">Web site</a>
30		How to use tools and solutions (video clips)	<a href="#">Web site</a>
<b>Partner</b>			
31	Partner information	Partner products (system solutions provider)	<a href="#">Web site</a>
32		Partner products (trusted technology partners that deliver commercial-grade building blocks)	<a href="#">Web site</a>

## 1.2 Step2: Product Design Development

This section summarizes useful information for product design and development.

#	Item	Content	Link
1	Board Design	Hardware design guide	<a href="#">Doc</a>
2		Design guide for main clock circuit and Sub-Clock circuit	<a href="#">Doc</a>
3		Notes regarding high-temperature operation	<a href="#">Doc</a>
4		Guidelines for full-speed USB2.0 board design	<a href="#">Doc</a>
5		CAD Model Note: When you click the link in the CAD model column in the "Product Options" table on the product page, the CAD model information for each part# is displayed.	<a href="#">Web site</a>
6		board simulation model (IBIS) *	<a href="#">Web site</a>
7		Resonator and matching circuit information	<a href="#">Doc</a>
8		Package information (package outline information, mount manual, etc.)	<a href="#">Web site</a>

\* It requires My Renesas account to access the content.

## 1.3 Step3: Mass Production

#	Item	Content	Link
1	Writing a program	PG-FP6	<a href="#">Web site</a>
2		Renesas flash programmer (GUI tool for PC)	<a href="#">Web site</a>
3	Firmware update	Firmware update module using firmware integration technology Application note	<a href="#">Doc</a>
4		Firmware update module using firmware integration technology Sample code	<a href="#">Sample</a>
5		MCUboot Firmware Integration Technology Application note	<a href="#">Doc</a>
6		MCUboot Firmware Integration Technology Sample code	<a href="#">Sample</a>
7	Memory protection	How to manage the access control for flash memory	<a href="#">Doc</a>
8	Inspection	Boundary Scan Description Language (BSDL) file *	<a href="#">Web site</a>

## 1.4 Supportive information

Get help from our technical staff and community.

#	Item	Content	Link
1	Support information	FAQ (frequently asked inquiries)	<a href="#">Website</a>
2		RX forum (community)	<a href="#">Website</a>
3		Ask technical/sales support(support tickets)	<a href="#">Website</a>

## 2. Highlighted Application Notes

This part presents the main application notes for this product. In addition to this list, many more application notes and sample codes are available on the product website <[www.renesas.com/RX651](http://www.renesas.com/RX651)> for your reference. (Note: To access the content of sample code, My Renesas account is required.)

#	Item	Content	Link	
1	System design	Examples of transitioning to low power consumption modes Application note	<a href="#">Doc</a>	
2		Examples of transitioning to low power consumption modes Sample code	<a href="#">Sample</a>	
3	Cloud	AWS cloud connectivity on CK-RX65N v2 with Wi-Fi DA16600 – getting started guide Application note	<a href="#">Doc</a>	
4		AWS cloud connectivity on CK-RX65N v2 with Wi-Fi DA16600 – getting started guide Sample code	<a href="#">Sample</a>	
5		Getting start guide (GitHub)	<a href="#">Web site</a>	
6		RX Family How to Implement FreeRTOS OTA Using Amazon Web Services (202406-LTS Version)	<a href="#">Doc</a>	
7		RX65N Group Sample Code for OTA Update of a Secondary Device by Amazon Web Services with the Use of FreeRTOS Application note	<a href="#">Doc</a>	
8		RX65N Group Sample Code for OTA Update of a Secondary Device by Amazon Web Services with the Use of FreeRTOS Sample code	<a href="#">Sample</a>	
9		RX Family Provisioning Procedure for IoT Devices	<a href="#">Doc</a>	
10		Azure RTOS sample projects using e2 studio or IAR EW	<a href="#">Doc</a>	
11		GUI	GUI development sample using QE for display [RX] Application note	<a href="#">Doc</a>
12			GUI development sample using QE for display [RX] Sample code	<a href="#">Sample</a>
13	QE for display [RX] user's manual Application note		<a href="#">Doc</a>	
14	QE for display [RX] user's manual Sample code		<a href="#">Sample</a>	
15	WVGA display sample program using GLCDC Application note		<a href="#">Doc</a>	
16	WVGA display sample program using GLCDC Sample code		<a href="#">Sample</a>	
17	WQVGA display sample program using GLCDC Application note		<a href="#">Doc</a>	
18	WQVGA display sample program using GLCDC Sample code		<a href="#">Sample</a>	
19	Module for image rendering (emWin) Application note		<a href="#">Doc</a>	
20	Module for image rendering (emWin) Sample code		<a href="#">Sample</a>	
21	Security	TSIP (Trusted Secure IP) driver Application note	<a href="#">Doc</a>	
22		TSIP (Trusted Secure IP) driver Sample code	<a href="#">Sample</a>	



**Revision History**

Rev.	Date	Description	
		Page	Summary
1.00	Mar. 6,2026	-	First edition issued

This handbook incorporates information available as of its publication date. For the most up-to-date details, please refer to the product page on our official website: <[www.renesas.com/RX651](http://www.renesas.com/RX651)>

# 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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