

RX Family

RX Driver Package Ver.1.23

Introduction

This document is the RX Family RX Driver Package Application Note, version 1.23.

This application note describes basic structures, features and usage of RX Driver Package applications, and about the sample application program using the FIT modules included in this package.

Note that older versions of the RX Driver Package can be obtained by clicking the "Sample Code" link after accessing the following URL.

RX Driver Package webpage: <https://www.renesas.com/rdp>

Target Devices

RX110, RX111, RX113, RX130 Group

RX230, RX231, RX23E-A, RX23T, RX23W, RX24T, RX24U Group

RX64M, RX65N, RX651 Group, RX66T Group

RX71M Group, RX72T Group, RX72M Group

For Evaluation board, Renesas Starter Kit is used.

When using this application note with your product, careful evaluation is recommended.

And when using this application note with other Renesas MCUs, careful evaluation is recommended after making modifications to comply with the alternate MCU.

Version of Integrated development environments Used for Operation Confirmation

Operation of the RX Driver Package has been confirmed on e² studio V. 7.6.0 or IAR Embedded Workbench for Renesas RX 4.12.01.

Target Compilers

Renesas Electronics C/C++ Compiler Package for RX Family

GCC for Renesas RX

IAR C/C++ Compiler for Renesas RX

For details of the confirmed operation contents of each compiler, refer to "1.2 Operating Environment".

Related Documents

- RX Family Board Support Package Module Using Firmware Integration Technology (R01AN1685)
- The User's Manual provided with the RX Driver Package Application.

Contents

1. Overview	3
1.1 Applicability	3
1.2 Operating Environment	4
2. About RX Driver Package.....	5
3. FIT Modules	6
3.1 Board Support Package (BSP)	6
3.2 Device Driver	7
3.3 Middleware/Interface Module	9
4. Usage.....	10
5. Supplement.....	11
5.1 Sample Program	11
5.2 Location of the API Information for FIT Module	11
5.3 Check the RX Driver Package Downloaded	12
Revision History.....	13

1. Overview

1.1 Applicability

This application note applies to the RX Family RX Driver Package, version 1.23. The System Build of this package is described below.

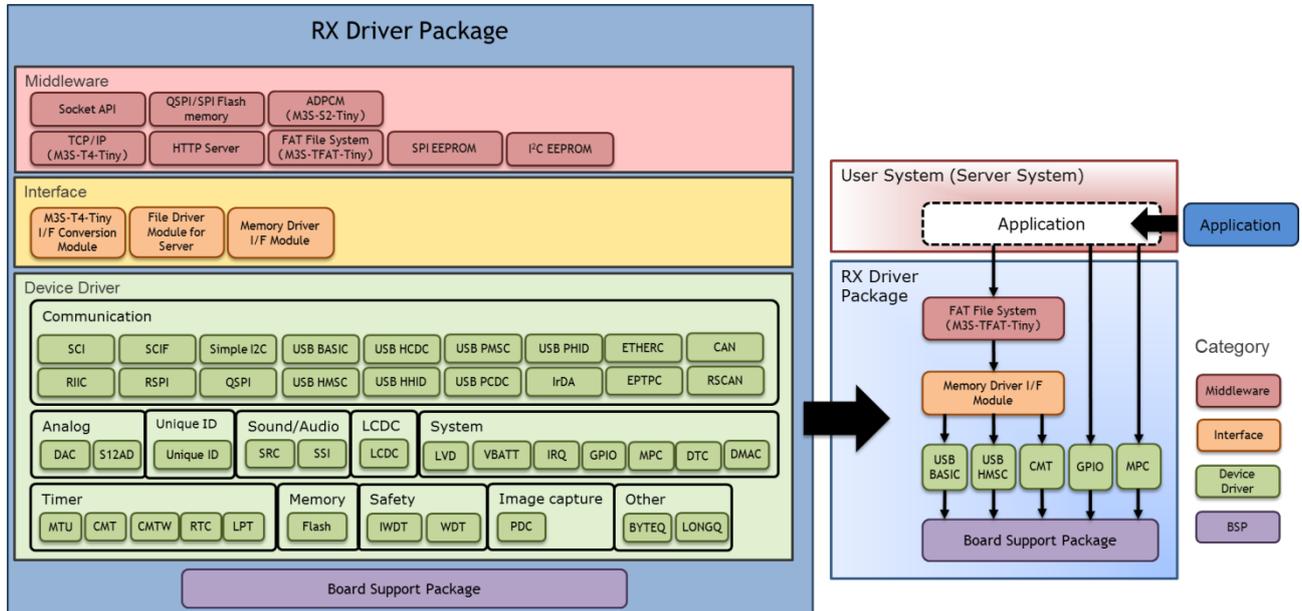


Figure 1-1 An Example of System Build

1.2 Operating Environment

This package runs under the operating environment described below.

Table 1-1 Operating Environment

Item	Contents
Integrated development environment	Renesas Electronics e ² studio V7.6.0 IAR Embedded Workbench for Renesas RX 4.12.01
C compiler	Renesas Electronics C/C++ compiler for RX Family V. 3.01.00 Compiler options: The integrated development environment default settings are used, with the following option added. -lang = c99
	GCC for Renesas RX 4.08.04.201902 Compiler option: The following option is added to the default settings of the integrated development environment. -std=gnu99
	IAR C/C++ Compiler for Renesas RX version 4.12.01 Compiler option: The default settings of the integrated development environment.
Endian order	Big-endian/Little-endian
RDP version	Ver. 1.23

2. About RX Driver Package

The RX Driver Package is a software platform (framework) that combines the following modules to be required for development in a single package. Since the package contains multiple modules, you can start developing immediately without having to obtain each module separately.

Board Support Package (BSP) module

FIT peripheral function modules (free version)

FIT middleware modules (free version)

FIT interface modules

You can develop the user application layer with ease by using the Sample Application Program (RX Driver Package Application) which utilizes the RX Driver Package.

3. FIT Modules

The table below lists the FIT modules included in this package.

After the release of RX Family RX Driver Package Ver. 1.22 (R01AN4873), we updated Firmware Integration Technology (FIT) modules. Differences from Family RX Driver Package Ver. 1.22 are shown in Table 3-1, Table 3-2 and Table 3-3.

The meaning of the terms shown in "Update Information" column is as follows:

"Same"	Includes the same module as previous.
"Updated"	Includes updated modules. Updated contents differ depending on the driver used. Check with the driver's document.
"Added"	Includes the added modules this time.

The meanings of the terms shown in "GCC/IAR status" column is as follows:

"Supported"	Supported.
"Restricted"	Limited support. Please check the documentation of each FIT module for details.
"Not supported"	Not supported. It will be supported in a future version.

3.1 Board Support Package (BSP)

Table 3-1 Update Informations of Board Support Package (BSP)

Module	FIT Module Name	Rev	Update Information	GCC/IAR status
Board Support Package (BSP)	r_bsp	5.40	Updated	Supported ^(*)

Note: not supported the Double-precision floating point and the arithmetic unit for trigonometric functions.

3.2 Device Driver

Table 3-2 Update Informations of Device Driver

Module	FIT Module Name	Rev	Update Information	GCC/IAR status
Voltage Detection Circuit (LVD)	r_lvd_rx	3.20	Same	Supported
Low Power Consumption (LPC)	r_lpc_rx	2.00	Updated	Supported
Battery Backup (VBATT)	r_vbatt_rx	1.04	Same	Supported
Interrupt Controller (IRQ)	r_irq_rx	3.20	Same	Supported
Data Transfer Controller (DTC)	r_dtc_rx	3.21	Updated	Supported
DMA Controller (DMAC)	r_dmaca_rx	2.20	Same	Supported
I/O Ports (GPIO)	r_gpio_rx	3.20	Same	Supported
Multi-Function Pin Controller (MPC)	r_mpc_rx	3.20	Same	Supported
Compare Match Timer (CMT)	r_cmt_rx	4.20	Same	Supported
Compare Match Timer W (CMTW)	r_cmtw_rx	2.10	Same	Supported
Real-Time Clock (RTC)	r_rtc_rx	2.77	Same	Supported
Low Power Timer (LPT)	r_lpt_rx	1.23	Same	Not supported
Independent Watchdog Timer (IWDT)	r_iwdt_rx	3.20	Same	Supported
Watchdog Timer (WDT)	r_wdt_rx	2.20	Same	Supported
Serial Communications Interface (SCI: Asynchronous/Clock Synchronous)	r_sci_rx	3.21	Updated	Supported
Serial Communications Interface with FIFO (SCI: Asynchronous/Clock Synchronous)	r_scif_rx	1.22	Same	Not supported
Serial Communications Interface (SCI: Simple I ² C Bus)	r_sci_iic_rx	2.43	Same	Supported
I ² C Bus Interface (RIIC)	r_riic_rx	2.43	Same	Supported
Serial Peripheral Interface	r_rspi_rx	2.03	Same	Supported
Quad Serial Peripheral Interface (QSPI: Device Driver for Serial Memory Control)	r_qspi_smstr_rx	1.13	Same	Supported
USB Basic Firmware	r_usb_basic	1.27	Same	Supported
USB Host Mass Storage Class	r_usb_hmsc	1.27	Same	Supported
USB Host Communication Device Class	r_usb_hcdc	1.27	Same	Supported
USB Host Human Interface Device Class	r_usb_hhid	1.27	Same	Supported
USB Peripheral Mass Storage Class	r_usb_pmesc	1.27	Same	Supported
USB Peripheral Communications Device Class	r_usb_pcdc	1.27	Same	Supported
USB Peripheral Human Interface Device Class	r_usb_phid	1.27	Same	Supported
USB Basic Firmware mini	r_usb_basic_mini	1.12	Same	Supported
USB Host Mass Storage Class mini	r_usb_hmsc_mini	1.12	Same	Supported
USB Host Communication Device Class mini	r_usb_hcdc_mini	1.12	Same	Supported
USB Host Human Interface Device Class mini	r_usb_hhid_mini	1.12	Same	Supported
USB Peripheral Mass Storage Class mini	r_usb_pmesc_mini	1.12	Same	Supported

USB Peripheral Communications Device Class mini	r_usb_pcdc_mini	1.12	Same	Supported
USB Peripheral Human Interface Device Class mini	r_usb_phid_mini	1.12	Same	Supported
PTP Module for the Ethernet Controller (EPTPC)	r_ptp_rx	1.16	Same	Supported
EPTPC Light Module	r_ptp_light_rx	1.13	Same	Supported
Ethernet controller (ETHERC)	r_ether_rx	1.17	Same	Supported
CAN Module (CAN)	r_can_rx	3.11	Updated	Supported
CAN Module (RSCAN)	r_rscan_rx	2.20	Updated	Supported
IrDA Interface (IrDA)	r_irda_sci_rx	1.01	Same	Not supported
Parallel Data Capture Unit (PDC)	r_pdc_rx	2.04	Same	Supported
SD Host Interface (SDHI)	r_sdhi_rx	2.05	Same	Supported
SD Slave Interface (SDSI)	r_sdsi_rx	2.02	Same	Supported
MMC Mode MMCIF Driver (MMCIF)	r_mmcif_rx	1.06	Same	Supported
12-Bit A/D Converter (S12AD)	r_s12ad_rx	4.20	Same	Supported
D/A Converter (DAC)	r_dac_rx	4.20	Same	Supported
BLE Module (BLE)	r_ble_rx23w	1.01	Added	Not supported
QE Utility Module (Profile)	r_ble_qe_utility	0.90	Added	Not supported
Mesh Module (Mesh)	r_mesh_rx23w	1.00	Added	Not supported
Delta-Sigma Modulator Interface (DSMIF)	r_dsmif_rx	1.00	Same	Restricted
Flash Memory (On-chip flash memory Programming)	r_flash_rx	4.40	Updated	Restricted
Sampling Rate Converter (SRC)	r_src_api_rx	1.13	Same	Supported
Serial Sound Interface (SSI)	r_ssi_api_rx	1.24	Same	Supported
LCD Controller/Driver (LCDC)	r_lcdc_rx	1.01	Same	Supported
Graphic LCD Controller (GLCDC)	r_glcdd_rx	1.20	Same	Supported
Unique ID Read	r_uid_rx	1.12	Same	Supported
Byte Queue Buffer (Data Management)	r_byteq	1.80	Same	Supported
Long Queue Buffer (Data Management)	r_longq	1.80	Same	Supported
Event Link Controller (ELC)	r_elc_rx	1.21	Same	Not supported
QE CTSU Module(CTSU)	r_ctsu_qe	1.00	Same	Not supported

3.3 Middleware/Interface Module

Table 3-3 Update Informations of Middleware/Interface Module

Module	FIT Module Name	Rev	Update Information	GCC/IAR status
TCP/IP M3S-T4-Tiny for Embedding	r_t4_rx	2.09	Same	Supported
Interface conversion module for Ethernet Driver and Embedded system M3S-T4-Tiny	r_t4_driver_rx	1.08	Same	Supported
System Timer Module	r_sys_time_rx	1.01	Same	Supported
SD Mode SD Memory Card Driver	r_sdc_sdmem_rx	2.03	Same	Not supported
Flash Memory Data Management Module(DATFRX)	r_datfrx_rx	2.01	Same	Not supported
SPI Serial EEPROM Module	r_eeprom_spi	3.01	Same	Supported
SPI Serial Flash memory Module	r_flash_spi	3.01	Same	Supported
Memory Access Driver Interface Module	r_memdrv_rx	1.01	Same	Supported
JPEG Decoder Module	r_jpegd_rx	2.06	Same	Not supported
JPEG Encoder Module	r_jpege_rx	1.01	Same	Not supported
Sound playback system and compression system (original ADPCM codec)	r_s2_rx	3.04	Same	Not supported
M3S-TFAT-Tiny (FAT file system)	r_tfat_rx	3.04	Same	Not supported
M3S-TFAT-Tiny Memory Driver Interface Module	r_tfat_driver_rx	1.05	Same	Not supported
QE Touch Module	r_touch_qe	1.00	Same	Not supported

4. Usage

You can easily construct application programs incorporating the RX Driver Package by using the Smart Configurator^(*) or FIT Configurator^(*).

For details on usage, refer to one of the documents in Table 4-1 depending on the tool used.

Note1: Supported by e² studio, CS+ and IAREW.

Note2: Only devices not supported by Smart Configurator are supported by e² studio.

Table 4-1 related documents for instructions

Item	Related Documents
e ² studio Smart Configurator	RX Smart Configurator User's Guide: e ² studio (R20AN0451)
CS+ Smart Configurator	RX Smart Configurator User's Guide: CS+ (R20AN0470)
IAREW Smart Configurator	RX Smart Configurator User's Guide: IAREW (R20AN0535)
e ² studio FIT Configurator	RX Family Adding Firmware Integration Technology Modules to Projects (R01AN1723)

5. Supplement

5.1 Sample Program

RX Driver Package is composed of FIT module group in a package, which does not include the sample program for operation confirmation. If the sample program is required, download the FIT module unit package separately^{*1}. FIT module unit package has "FITDemos" folder and includes sample program or sample project.

Or use supporting download and import sample project of FIT module with Smart Configurator. FIT module Guide function can easily import the sample program into e²studio Workspace. Please see for Renesas e²studio Smart Configurator V.2.0.0 Release Note (R20UT4475) for details.

Note 1. Note that some FIT modules may not provide sample program.

5.2 Location of the API Information for FIT Module

For the API information of FIT module embedded in the project, refer to the doc folder of each FIT module folder.

5.3 Check the RX Driver Package Downloaded

When successfully downloaded, FIT module is stored in the folder specified in "FIT Module Folder Path:" described in "4 Usage" (Related Documents)(for example, C:\Renesas\e2_studio\FITModules).

In "FITModules\Downloaded" folder, ZIP file of the package is stored.

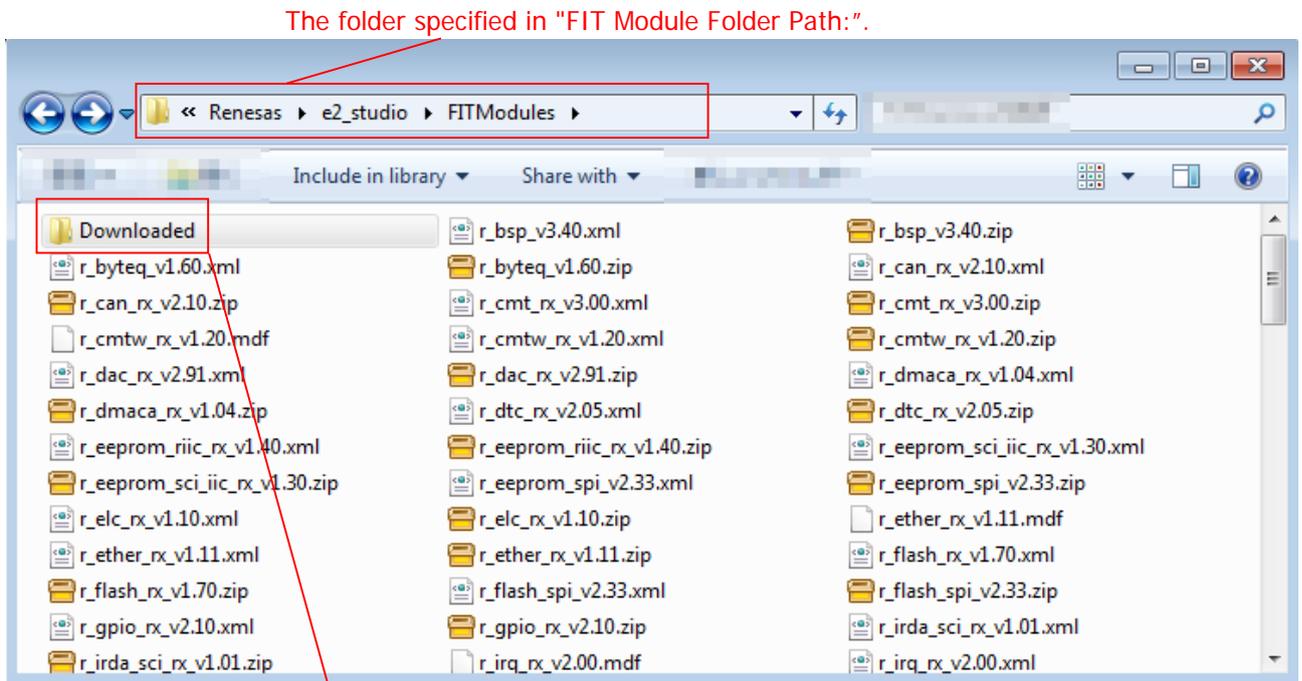


Figure 5-1 RX Driver Package

ZIP file of the package is stored.

(r01an****xx****-rx-fit.zip)

Revision History

Rev.	Date	Description	
		Page	Summary
1.23	Dec 16, 2019	-	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 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 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.
 5. 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.
6. 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.
 7. 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.
 8. 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.
 9. 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.
 10. 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.
 11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
 12. 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.4.0-1 November 2017)

Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Trademarks

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/.