

# RX Family

## RX Driver Package Ver.1.36

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### Introduction

This document is the RX Family RX Driver Package Application Note, version 1.36.

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 Group, RX111 Group, RX113 Group, RX130 Group, RX13T Group, RX140 Group

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

RX64M Group, RX65N Group, RX651 Group, RX660 Group, RX66N Group, RX66T Group, RX671 Group

RX71M Group, RX72T Group, RX72M Group, RX72N 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 e<sup>2</sup> studio 2022-04 or IAR Embedded Workbench for Renesas RX 4.20.01.

### 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.

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# 1. Overview

## 1.1 Applicability

This application note applies to the RX Family RX Driver Package, version 1.36 The System Build of this package is described below.

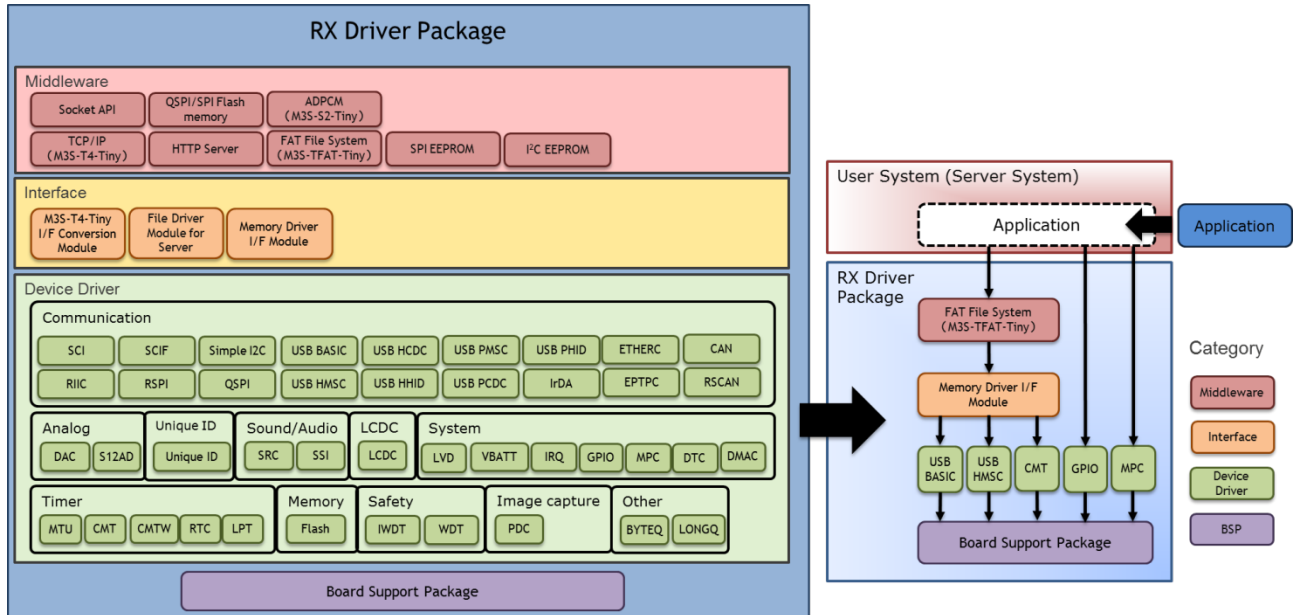


Figure 1-1 An Example of System Build

## 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 <sup>2</sup> studio 2022-04<br>IAR Embedded Workbench for Renesas RX 4.20.01                                      |
| C compiler                         | Renesas Electronics C/C++ compiler for RX Family V. 3.04.00<br>Compiler option: The default settings when using the Smart Configurator. |
|                                    | GCC for Renesas RX 8.3.0.202104<br>Compiler option: The default settings when using the Smart Configurator.                             |
|                                    | IAR C/C++ Compiler for Renesas RX version 4.20.01<br>Compiler option: The default settings of the integrated development environment.   |
| Endian order                       | Big-endian/Little-endian  |
| RDP version                        | Ver. 1.36   |

## 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. 1.34 (R01AN6323), we updated Firmware Integration Technology (FIT) modules. Differences from Family RX Driver Package Ver. 1.34 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.<br>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.<br>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           | 7.20 | Updated            | Supported      |

### 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         | 4.10 | Updated            | Supported      |
| Low Power Consumption (LPC)  | r_lpc_rx         | 2.04 | Updated            | Supported      |
| Battery Backup (VBATT)   | r_vbatt_rx       | 2.10 | Same               | Supported      |
| Interrupt Controller (IRQ)   | r_irq_rx         | 4.10 | Updated            | Supported      |
| Data Transfer Controller (DTC)   | r_dtc_rx         | 4.10 | Updated            | Supported      |
| DMA Controller (DMAC)  | r_dmaca_rx       | 2.90 | Updated            | Supported      |
| I/O Ports (GPIO)   | r_gpio_rx        | 4.50 | Updated            | Supported      |
| Multi-Function Pin Controller (MPC)  | r_mpc_rx         | 4.40 | Updated            | Supported      |
| Compare Match Timer (CMT)  | r_cmt_rx         | 5.20 | Updated            | Supported      |
| Compare Match Timer W (CMTW)   | r_cmtw_rx        | 2.60 | Updated            | Supported      |
| Real-Time Clock (RTC)  | r_rtc_rx         | 2.83 | Updated            | Supported      |
| Low Power Timer (LPT)  | r_lpt_rx         | 3.01 | Same               | Supported      |
| Independent Watchdog Timer (IWDT)  | r_iwdt_rx        | 4.10 | Updated            | Supported      |
| Watchdog Timer (WDT)   | r_wdt_rx         | 2.80 | Updated            | Supported      |
| Serial Communications Interface (SCI: Asynchronous/Clock Synchronous)            | r_sci_rx         | 4.40 | Updated            | Supported      |
| Serial Communications Interface (RSCI)   | r_rsci_rx        | 2.10 | Updated            | Supported      |
| Serial Communications Interface with FIFO (SCI: Asynchronous/Clock Synchronous)  | r_scif_rx        | 2.01 | Same               | Supported      |
| Serial Communications Interface (SCI: Simple I <sup>2</sup> C Bus)               | r_sci_iic_rx     | 2.50 | Updated            | Supported      |
| I <sup>2</sup> C Bus Interface (RIIC)  | r_riic_rx        | 2.50 | Updated            | Supported      |
| High-Speed I <sup>2</sup> C Bus Interface (RIICHS)                               | r_riichs_rx      | 1.00 | Same               | Supported      |
| Serial Peripheral Interface  | r_rspi_rx        | 3.04 | Updated            | Supported      |
| Serial Peripheral Interface (RSPIA)  | r_rs pia_rx      | 1.10 | Same               | Supported      |
| Quad-SPI Memory Interface (QSPIX)  | r_qspix_rx       | 1.20 | Same               | Supported      |
| Quad Serial Peripheral Interface (QSPI: Device Driver for Serial Memory Control) | r_qspi_smstr_rx  | 1.15 | Same               | Supported      |
| USB Basic Firmware   | r_usb_basic      | 1.40 | Updated            | Supported      |
| USB Host Mass Storage Class  | r_usb_hmsc       | 1.31 | Same               | Supported      |
| USB Host Communication Device Class  | r_usb_hcdc       | 1.31 | Same               | Supported      |
| USB Host Human Interface Device Class  | r_usb_hhid       | 1.31 | Same               | Supported      |
| USB Peripheral Mass Storage Class  | r_usb_pm sc      | 1.31 | Same               | Supported      |
| USB Peripheral Communications Device Class                                       | r_usb_pc dc      | 1.40 | Updated            | Supported      |
| USB Peripheral Human Interface Device Class                                      | r_usb_phid       | 1.31 | Same               | Supported      |
| USB Basic Firmware mini  | r_usb_basic_mini | 1.20 | Same               | Supported      |
| USB Host Mass Storage Class mini   | r_usb_hmsc_mini  | 1.20 | Same               | Supported      |
| USB Host Communication Device Class mini   | r_usb_hcdc_mini  | 1.20 | Same               | Supported      |
| USB Host Human Interface Device Class mini                                       | r_usb_hhid_mini  | 1.20 | Same               | Supported      |
| USB Peripheral Mass Storage Class mini   | r_usb_pm sc_mini | 1.20 | Same               | Supported      |

|  |                 |      |         |               |
|--|-----------------|------|---------|---------------|
| USB Peripheral Communications Device Class mini  | r_usb_pcdc_mini | 1.20 | Same    | Supported     |
| USB Peripheral Human Interface Device Class mini | r_usb_phid_mini | 1.20 | Same    | Supported     |
| PTP Module for the Ethernet Controller (EPTPC)   | r_ptp_rx        | 1.17 | Same    | Supported     |
| EPTPC Light Module                               | r_ptp_light_rx  | 1.14 | Same    | Supported     |
| Ethernet controller (ETHERC)                     | r_ether_rx      | 1.23 | Updated | Supported     |
| CAN Module (CAN)                                 | r_can_rx        | 5.21 | Same    | Supported     |
| CANFD (CANFD)                                    | r_canfd_rx      | 1.00 | Added   | Supported     |
| CAN Module (RSCAN)                               | r_rscan_rx      | 2.41 | Updated | Supported     |
| IrDA Interface (IrDA)                            | r_irda_sci_rx   | 1.01 | Same    | Not supported |
| Parallel Data Capture Unit (PDC)                 | r_pdc_rx        | 2.06 | Same    | Supported     |
| SD Host Interface (SDHI)                         | r_sdhi_rx       | 2.07 | Same    | Supported     |
| SD Slave Interface (SDSI)                        | r_sdsi_rx       | 2.02 | Same    | Supported     |
| MMC Mode MMCIF Driver (MMCIF)                    | r_mmcif_rx      | 1.07 | Same    | Supported     |
| Delta-Sigma Modulator Interface (DSMIF)          | r_dsmif_rx      | 1.00 | Same    | Restricted    |
| 12-Bit A/D Converter (S12AD)                     | r_s12ad_rx      | 5.00 | Updated | Supported     |
| D/A Converter (DAC)                              | r_dac_rx        | 4.80 | Updated | Supported     |
| Flash Memory (On-chip flash memory Programming)  | r_flash_rx      | 4.90 | Updated | Supported     |
| Sampling Rate Converter (SRC)                    | r_src_api_rx    | 1.14 | Same    | Supported     |
| Serial Sound Interface (SSI)                     | r_ssi_api_rx    | 2.03 | Same    | Supported     |
| Trusted Secure IP(TSIP)                          | r_tsip_rx       | 1.15 | Same    | Supported     |
| LCD Controller/Driver (LCDC)                     | r_lcdc_rx       | 1.02 | Same    | Supported     |
| Graphic LCD Controller (GLCDC)                   | r_glcddc_rx     | 1.50 | Same    | Supported     |
| Unique ID Read                                   | r_uid_rx        | 1.14 | Same    | Supported     |
| Byte Queue Buffer (Data Management)              | r_byteq         | 2.00 | Same    | Supported     |
| Long Queue Buffer (Data Management)              | r_longq         | 1.90 | Same    | Supported     |
| QE CTSU Module (CTSU)                            | r_ctsu_qe       | 2.10 | Same    | Supported     |
| Event Link Controller (ELC)                      | r_elc_rx        | 2.01 | Same    | Supported     |
| RX DRW2D Driver (DRW2D)                          | r_drw2d_rx      | 1.11 | Same    | 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          | 2.10 | Same               | Supported      |
| Interface conversion module for Ethernet Driver and Embedded system M3S-T4-Tiny | r_t4_driver_rx   | 1.09 | Same               | Supported      |
| System Timer Module   | r_sys_time_rx    | 1.01 | Same               | Supported      |
| SX-ULPGN-2000 Wi-Fi Module Control Module Using                                 | r_wifi_sx_ulpgn  | 1.16 | Updated            | Supported      |
| BLE Module (BLE)  | r_ble_rx23w      | 2.40 | Updated            | Restricted     |
| RYZ012 Bluetooth Low Energy   | r_ryz012_rx      | 1.01 | Same               | Not supported  |
| QE Utility Module (Profile)   | r_ble_qe_utility | 1.10 | Same               | Not supported  |
| Mesh Module (Mesh)  | r_mesh_rx23w     | 1.20 | Same               | Not supported  |
| RYZ014A Cellular  | r_cellular       | 1.06 | Updated            | Restricted     |
| SD Mode SD Memory Card Driver   | r_sdc_sdmem_rx   | 3.00 | Same               | Supported      |
| Flash Memory Data Management Module (DATFRX)                                    | r_datfrx_rx      | 2.01 | Same               | Not supported  |
| SPI Serial Flash memory Module  | r_flash_spi      | 3.03 | Same               | Supported      |
| SPI Serial EEPROM Module  | r_eeprom_spi     | 3.02 | Same               | Supported      |
| Memory Access Driver Interface Module   | r_memdrv_rx      | 1.04 | 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        | 4.02 | Same               | Supported      |
| M3S-TFAT-Tiny Memory Driver Interface Module                                    | r_tfat_driver_rx | 2.20 | Same               | Supported      |
| Firmware Update Module  | r_fwup           | 1.04 | Updated            | Not supported  |
| Sensor Communication Middleware Control Module                                  | r_comms_i2c_rx   | 1.21 | Same               | Supported      |
| HS300x Sensor Control Module  | r_hs300x_rx      | 1.22 | Same               | Supported      |
| HS400x Sensor Control Module  | r_hs400x_rx      | 1.00 | Added              | Supported      |
| FS2012 Sensor Control Module  | r_fs2012_rx      | 1.02 | Same               | Supported      |
| FS3000 Sensor Control Module  | r_fs3000_rx      | 1.00 | Added              | Supported      |
| FS1015 Sensor Control Module  | r_fs1015_rx      | 1.00 | Added              | Supported      |
| OB1203 Sensor Control Module  | r_ob1203_rx      | 1.01 | Added              | Supported      |
| ZMOD4410 and ZMOD4510 Sensor Control Module                                     | r_zmod4xxx_rx    | 1.20 | Same               | Supported      |
| QE Touch Module   | rm_touch_qe      | 2.01 | Same               | Supported      |
| Aeropoint Module  | r_aeropoint_rx   | 1.00 | Same               | Not supported  |
| emWin v.6.22 Module (EMWIN)   | r_emwin_rx       | 1.00 | Same               | Not supported  |

## 4. Usage

You can easily construct application programs incorporating the RX Driver Package by using the Smart Configurator<sup>(\*)</sup> or FIT Configurator<sup>(\*)</sup>.

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

Note1: Supported by e<sup>2</sup> studio, CS+ and IAREW.

Note2: Only devices not supported by Smart Configurator are supported by e<sup>2</sup> studio.

**Table 4-1 related documents for instructions**

| Item  | Related Documents   |
|---|---|
| e <sup>2</sup> studio<br>Smart Configurator | RX Smart Configurator User's Guide: e <sup>2</sup> studio<br>(R20AN0451)            |
| CS+<br>Smart Configurator                   | RX Smart Configurator User's Guide: CS+<br>(R20AN0470)                              |
| IAREW<br>Smart Configurator                 | RX Smart Configurator User's Guide: IAREW<br>(R20AN0535)                            |
| e <sup>2</sup> studio<br>FIT Configurator   | RX Family Adding Firmware Integration Technology Modules to Projects<br>(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<sup>\*1</sup>. 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 e<sup>2</sup>studio Workspace. Please see for Renesas e<sup>2</sup>studio 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.

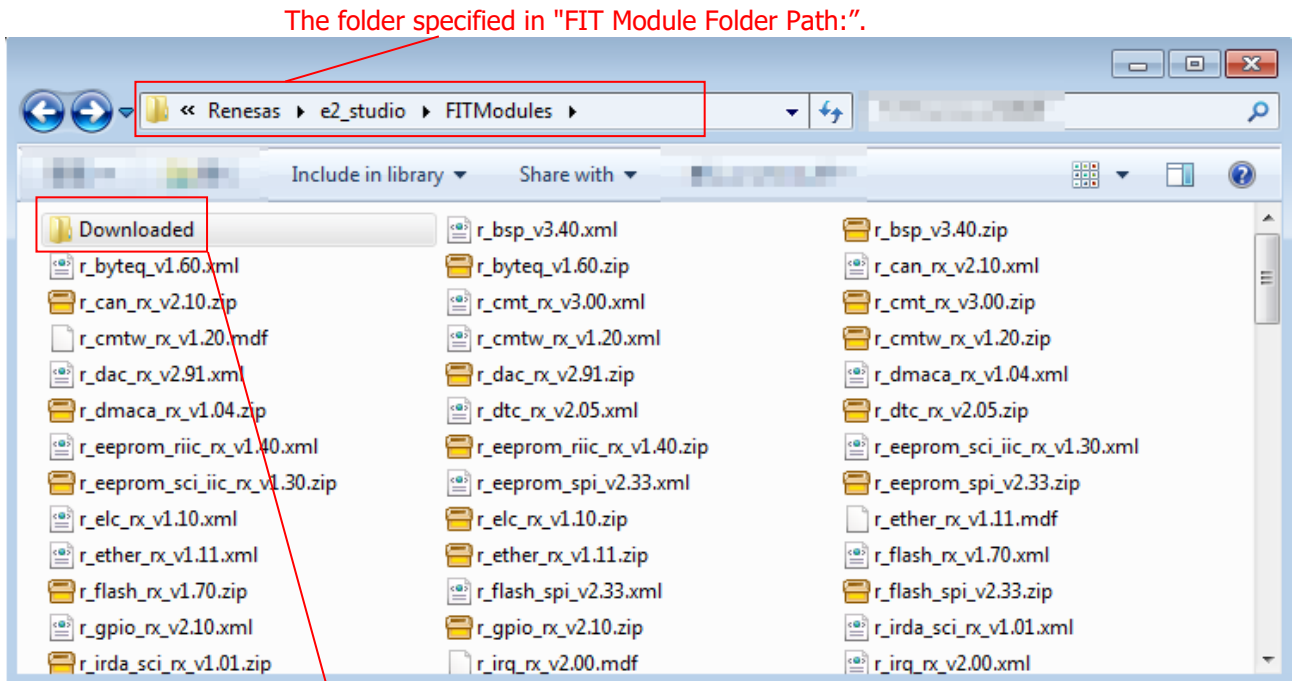


Figure 5-1 RX Driver Package

ZIP file of the package is stored.

(r01an\*\*\*\*x\*\*\*\*-rx-fit.zip)

**Revision History**

| Rev. | Date         | Description |                      |
|------|--------------|-------------|----------------------|
|      |              | Page        | Summary              |
| 1.36 | Jul 26, 2022 | -           | 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.

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