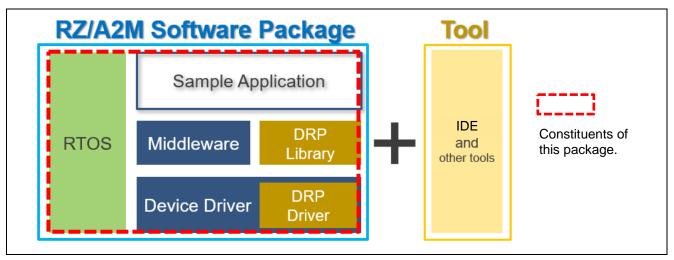# RZ/A2M Group

RZ/A2M Simple Applications Package (Arm Development Studio) V4.00 Release Note

Introduction

This Software Package has several simple applications for RZ/A2M.

The Software Package shows how easy it is to create a professional, user-friendly and platform-independent user interface for your product. The entire application source code is included in the workspace enabling the Software Package to be ported to the platform of your choice.
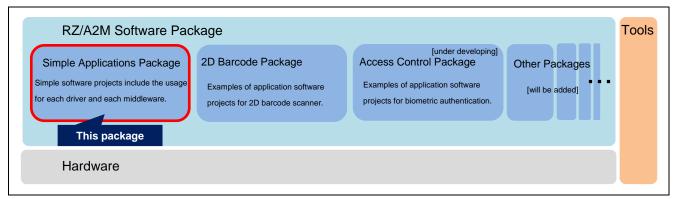
This package is one of RZ/A2M Software Package. RZ/A2M Software Package is a software development kit for the RZ/A2M that supports various RZ/A2M functions such as DRP (Dynamically Reconfigurable Processor), camera input, LCD output, and image adjustment. This package has the structure of the red frame in the following figure. However, device driver and middleware are only included what is necessary for the sample application.

RZ/A2M Software Package Configuration

Figure below shows the relation of RZ/A2M Software Package and this package. For details, refer following URL:

https://www.renesas.com/products/software-tools/software-os-middleware-driver/software-package/rza2-software-development-kit-free-rtos/armcompiler.html

The relation of RZ/A2M Software Packages and this package

Note that each software project includes only driver software and middleware used by each application. If you want to add software that is not included in the project, please use Smart Configurator. For more detail, please refer "RZ/A2M Software Package Quick Start Guide" (R01QS0040) bundled in this package.

Following sample applications are bundled in this package.

Example of initialization:

This sample is a simple sample program that blinks the LED on the RZ/A2M evaluation board. You can use this application as base project of your product and you can add various functions using Smart Configurator. Refer "RZ/A2M Software Package Quick Start Guide" (R01QS0040) bundled in this package.

Example of FreeRTOS:

This sample is a simple sample program that blinks the LED on the RZ / A2M evaluation board. In this sample, FreeRTOS is used. You can use this application as base project of your product and you can add various functions using Smart Configurator. Refer "RZ/A2M Software Package Quick Start Guide" (R01QS0040) bundled in this package.

Camera and Display sample application:

This program captures video from the MIPI CSI-2 interface camera module bundled in RZ/A2M Evaluation Board Kit and displays it on the display. In this sample, FreeRTOS is used.

DRP basic sample program

The DRP basic sample program provides the following sample. In this sample, FreeRTOS is used.

DRP Basic Operation Sample Program
Converts the input image from MIPI camera to grayscale image using DRP and outputs to display.

Ethernet sample program

This sample program connects the RZ / A2M evaluation board and the PC via Ethernet, outputs data to the Echo server of the PC, and confirms the response. In this sample, FreeRTOS is used.

SCIFA using DMAC Sample Application

This sample program outputs text via debugging-serial with combination between DMA controller and UART(SCIFA). In this sample, FreeRTOS is used.

Example of Low power mode

This sample program handles the stand-by mode process. (Stand-by in/out). In this sample, FreeRTOS is NOT used.

SDHI FAT Sample Application

This sample program accesses to SD card via FatFS filesystem middleware. This package bundles both FreeRTOS version and OS-less version of this sample.

SD driver used in this sample does not support High-Speed mode and Ultra-High-Speed mode. RZ/A2M group SD Package (R01AN4680) contains driver and sample project that supports these modes. To get this package, please contact Renesas sales.

USB HOST FAT Sample Application

This sample program accesses to USB flash memory via FatFS filesystem middleware. This package bundles both FreeRTOS version and OS-less version of this sample.

USB HOST HID Sample Application

This sample program receives the USB mouse information. In this sample, FreeRTOS is used.

USB Function CDC Sample Application

This sample program echo backs the data from USB host. This package bundles both FreeRTOS version and OS-less version of this sample.

USB Function CDC Sample Application

This sample program echo backs the data from USB host. This package bundles both FreeRTOS version and OS-less version of this sample.

Pmod ESP32 Wi-Fi Sample program

This sample program transmits the JPEG data converted from captured image from MIPI camera using Digilent Pmod ESP32 module. In this sample, FreeRTOS is used.

RTC Counter Sample program

This sample program uses RTC to perform time count and alarm detection in calendar count mode / binary count mode. In addition, it works with the LPM driver to return from deep standby mode when an alarm occurs. In this sample, FreeRTOS is NOT used.

GPT-PWM Sample program

This sample program outputs a PWM waveform using GPT. In this sample, FreeRTOS is NOT used.

Firmware Update Sample program

This sample program rewrites the serial flash with the update image input from the debug UART and executes the updated image. In this sample, FreeRTOS is used.

Touch Panel Sample program

This sample program controls the touch panel based on data input from the FocalTech FT5216 via the I2C bus. In this sample, FreeRTOS is used.

SSIF Sample program

This sample program inputs and outputs audio using the Cirrus audio codec WM8978. In this sample, FreeRTOS is used.

Environment

- Target Device: RZ/A2M
- Target Board: RZ/A2M Evaluation Board Kit (RTK7921053S00000BE)
- IDE: Arm® Development Studio (hereinafter called "Arm DS")
- Tool Chain: Arm Compiler 6
- Download Tool: SEGGER J-Links 6.48 or later

The IDE is available from the following site.

https://developer.arm.com/tools-and-software/embedded/arm-development-studio/downloads

The Download Tool is available from the following site.
https://www.segger.com/downloads/jlink/#J-LinkSoftwareAndDocumentationPack

Contents

1.   Package Contents

1.1   Software

This package contains the following software.

Table 1-1 Software of this package

No	Name	File
1	RZ/A2M Group Example of Initialization	rza2m_blinky_sample_osless_arm.zip
2	RZ/A2M Group Example of FreeRTOS	rza2m_blinky_sample_freertos_arm.zip
3	RZ/A2M Group Camera and Display sample application	rza2m_cam_and_disp_sample_freertos_arm.zip
4	RZ/A2M Group DRP Basic Operation sample program	rza2m_drp_library_sample_freertos_arm.zip
5	RZ/A2M Group Ethernet sample program	rza2m_ethernet_sample_freertos_arm.zip
6	RZ/A2M Group SCIFA using DMAC Sample Application	rza2m_dmac_scifa_sample_freertos_arm.zip
7	RZ/A2M Group Example of Low power mode	rza2m_lpm_sample_osless_arm.zip
8	RZ/A2M Group USBH MSC FAT Sample Application(FreeRTOS)	rza2m_usbh_msc_sample_freertos_arm.zip
9	RZ/A2M Group USBF CDC Sample Application(FreeRTOS)	rza2m_usbf_cdc_sample_freertos_arm.zip
10	RZ/A2M Group Pmod ESP32 Wi-Fi Sample program	rza2m_wifi_pmod_esp32_sample_freertos_arm.zip
11	RZ/A2M Group RTC Counter Sample Program	rza2m_rtc_sample_osless_arm.zip
12	RZ/A2M Group USBH MSC FAT Sample Application(OS-less)	rza2m_usbh_msc_sample_osless_arm.zip
13	RZ/A2M Group USBF CDC Sample Application(OS-less)	rza2m_usbf_cdc_sample_osless_arm.zip
14	RZ/A2M Group USBH HID Sample Application(FreeRTOS)	rza2m_usbh_hid_sample_freertos_arm.zip
15	RZ/A2M Group SDHI FAT Sample Application (FreeRTOS)	rza2m_sdhi_fat_sample_freertos_arm.zip
16	RZ/A2M Group SDHI FAT Sample Application (OS-less)	rza2m_sdhi_fat_sample_osless_arm.zip
17	RZ/A2M Group GPT-PWM Sample Application	rza2m_gpt-pwm_sample_osless_arm.zip
18	RZ/A2M Group Firmware Update Sample Application	rza2m_fw_update_sample_freertos_arm.zip
19	RZ/A2M Group Touch Panel Sample Application	rza2m_touch_panel_sample_freertos_arm.zip
20	RZ/A2M Group SSIF Sample Application	rza2m_ssif_sample_freertos_arm.zip
21	RZ/A2M Group SPIBSC Bootloader program	rza2m_sflash_boot_loader_arm.zip
22	RZ/A2M Group HyperFlash Bootloader Program	rza2m_hyperbus_boot_loader_arm.zip
23	RZ/A2M Group HyperFlash boot sample program	rza2m_hyperbus_boot_sample_osless_arm.zip

1.2   Documents

This package contains the following documents.

Table 1-2 Documents of this package

No	Title	Document Number
1	RZ/A2M Group	R01AN5068
	RZ/A2M Simple Applications Package (Arm Development Studio)	(This document)
	V4.00 Release Note	

Also, each project indicated in Table 1-1 includes the sample program's application notes.
Each driver folder includes the document for the driver.

The documentation for these drivers is written for the GCC compiler. Replace the Operation Confirmation Conditions with the following.

Integrated development environment	Arm Development Studio 2020.0
C compiler	"Arm Compiler 6.12"
	compiler options(except directory path)
	Release:
	--target=arm-arm-none-eabi -march=armv7-a -mcpu=cortex-a9
	-mfpu=neon-fp16 -mfloat-abi=hard -marm -mlittle-endian -Os
	Debug:
	--target=arm-arm-none-eabi -march=armv7-a -mcpu=cortex-a9
	-mfpu=neon-fp16 -mfloat-abi=hard -marm -mlittle-endian -O0 -g3

2.   Folder Structure

Folder structure of this package and outline of contents are shown in Figure 2.1.
Figure 2.2 shows an example of the sample application's folder structure. The DRP basic sample application is used in the Figure 2.2.

```
TOP                                                    : top folder
|
+---rza2m_blinky_sample_osless_arm.zip                 : RZ/A2M Group Example of Initialization
+---rza2m_blinky_sample_freertos_arm.zip               : RZ/A2M Group Example of FreeRTOS
+---rza2m_cam_and_disp_sample_freertos_arm.zip         : RZ/A2M Group Camera and Display Sample
+---rza2m_dmac_scifa_sample_freertos_arm.zip           : RZ/A2M Group SCIFA using DMAC Sample Application
+---rza2m_drp_basic_sample_freertos_arm.zip            : RZ/A2M Group DRP Basic Operation sample program
+---rza2m_ethernet_sample_freertos_arm.zip             : RZ/A2M Group Ethernet sample program
+---rza2m_fw_update_sample_freertos_arm.zip            : RZ/A2M Group Firmware Update Sample Application
+---rza2m_gpt-pwm_sample_osless_arm.zip                : RZ/A2M Group GPT-PWM Sample Application
+---rza2m_hyperbus_boot_loader_arm.zip                 : RZ/A2M Group HyperFlash Bootloader Program
+---rza2m_hyperbus_boot_sample_osless_arm.zip          : RZ/A2M Group HyperFlash boot sample program
+---rza2m_lpm_sample_osless_arm.zip                    : RZ/A2M Group Example of Low power mode
+---rza2m_rtc_sample_osless_arm.zip                    : RZ/A2M Group RTC Counter Sample Program
+---rza2m_sdhi_fat_sample_freertos_arm.zip             : RZ/A2M Group SDHI FAT Sample Application(FreeRTOS)
+---rza2m_sdhi_fat_sample_osless_arm.zip               : RZ/A2M Group SDHI FAT Sample Application(OS-less)
+---rza2m_sflash_boot_loader_arm.zip                   : RZ/A2M Group Bootloader program
+---rza2m_ssif_sample_freertos_arm.zip                 : RZ/A2M Group SSIF Sample Application
+---rza2m_touch_panel_sample_freertos_arm.zip          : RZ/A2M Group Touch Panel Sample Application
+---rza2m_usbh_hid_sample_freertos_arm.zip             : RZ/A2M Group USBH HID Sample Application(FreeRTOS)
+---rza2m_usbh_msc_sample_freertos_arm.zip             : RZ/A2M Group USB HOST FAT Sample Application (FreeRTOS)
+---rza2m_usbh_msc_sample_osless_arm.zip               : RZ/A2M Group USB HOST FAT Sample Application (OS-less)
+---rza2m_usbf_cdc_sample_freertos_arm.zip             : RZ/A2M Group USB Function CDC Sample Application (FreeRTOS)
+---rza2m_usbf_cdc_sample_osless_arm.zip               : RZ/A2M Group USB Function CDC Sample Application (OS-less)
+---rza2m_wifi_pmod_esp32_sample_freertos_arm.zip      : RZ/A2M Group Pmod ESP32 Wi-Fi Sample program
+---r01an5068ej0400-rza2m-simple-apl-swpkg-arm.pdf     : RZ/A2M Group Simple Applications Package (Arm Development Studio) V4.00 Release
                                                         Note (this document)
+---r01an5068jj0400-rza2m-simple-apl-swpkg-arm.pdf     : RZ/A2M Group Simple Applications Package (Arm Development Studio) V4.00 Release
                                                         Note (Japanese)
+---r01qs0040ej0101-rza2m-quick-guide-arm.pdf          : RZ/A2M Group RZ/A2M Software Package Quick Start Guide (English)
+---r01qs0040jj0101-rza2m-quick-guide-arm.pdf          : RZ/A2M Group RZ/A2M Software Package Quick Start Guide (Japanese)
```

Figure 2.1   Folder Structure

```
rza2m_drp_basic_sample_freertos_arm.zip          : Project Top Folder
+---document_index.html                           : links to bundled documents are described
+---.settings                                     : Project Setting Files
+---bootloader                                    : QSPI boot loader
+---doc                                           : Document of this sample application.
+--- FlashTools                                   : Download tool for bootloader and target program.
+---generate                                      : Source files generated / configured by Smart Configurator
|   +---compiler                                  : Source files depended on the compiler
|   +---configuration                             : Header files for project configuration
|   +---drivers                                   : Basic drivers
|   |   +---r_cache                               : Cache deriver
|   |   |   +---doc                               : Document of Cache driver
|   |   |   +---inc                               : Header files for Cache driver
|   |   |   \---src                               : Source files for Cache driver
|   |   +---r_cpg                                 : Clock pulse generator driver (same folder structure as Cache driver)
|   |   +---r_gpio                                : GPIO driver (same folder structure as Cache driver)
|   |   +---r_intc                                : INTC driver (same folder structure as Cache driver)
|   |   +---r_mmu                                 : MMU driver (same folder structure as Cache driver)
|   |   \---r_stb                                 : STB driver (same folder structure as Cache driver)
|   +---os_abstraction                            : OS abstraction layer (same folder structure as Cache driver)
|   |   +---doc                                   : Document of OS abstraction layer
|   |   +---inc                                   : Header files for OS abstraction layer
|   |   \---src                                   : Source files for OS abstraction layer
|   +---sc_drivers                                : General drivers
|   |   +---r_cbuffer                             : Ring buffer (same folder structure as DRP driver)
|   |   +---r_ceu                                 : CEU driver (same folder structure as DRP driver)
|   |   +---r_drp                                 : DRP driver (same folder structure as DRP driver)
|   |   |   +---doc                               : Documents of DRP driver
|   |   |   |   r01us0355ej0102-rza2m-drp-driver-gcc.pdf   : RZ/A2M Group DRP Driver User's Manual (R01US0355) (English)
|   |   |   |   r01us0355jj0102-rza2m-drp-driver-gcc.pdf   : RZ/A2M グループ DRP Driver ユーザーズマニュアル (R01US0355) (Japanese)
|   |   |   |   r01us0367ej0108-rza2m-drp-library.pdf      : RZ/A2M Group DRP Library User's Manual (English)
|   |   |   |   r01us0367jj0108-rza2m-drp-library.pdf      : RZ/A2M グループ DRP Library ユーザーズマニュアル (R01US0367) (Japanese)
|   |   |   +---drp_lib                           : Source files for DRP library
|   |   |   +---inc                               : Header files for DRP driver
|   |   |   \---src                               : Source files for DRP driver
|   |   +---r_mipi                                : MIPI driver (same folder structure as DRP driver)
|   |   +---r_ostm                                : OS timer driver (same folder structure as DRP driver)
|   |   +---r_riic                                : I2C driver (same folder structure as DRP driver)
|   |   +---r_rvapi                               : Video utility (same folder structure as DRP driver)
|   |   +---r_scifa                               : SCIFA driver (same folder structure as DRP driver)
|   |   \---r_vdc                                 : VDC driver (same folder structure as DRP driver)
|   +---scatter_file                              : Scatter load file that defines the execution region
|   \---system                                    : System files for example, IO registers
\---src                                           : Source files for application
    +---config_files                              : Configuration file for FreeRTOS
    +---FreeRTOS                                  : FreeRTOSTM
    +---renesas                                   : Software developed by Renesas
    |   +---application                           : Application source files developed by Renesas
    |   +---hwsetup                               : Hardware setup setting
    |   \---StandardHeaders                       : Standard header file
    +---user_prog                                 : User program e.g. main.c
    \---LICENSE
```

Figure 2.2   Folder Structure of DRP basic sample programs

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3.   How to use the projects bundled in this package

Regarding how to use, refer to the documents in each folder in this package.

4.   Reference Application Notes

Following is the list of application notes related to this software package.

   RZ/A2M Group RZ/A2M Software Core Package (R01AN5443).
   Drivers and middleware for RZ/A2M that can be added to the project bundled in this package.

5.   Restrictions

The Restrictions of this package are shown as follow.

Table 5-1 Restrictions

No.	Type	Description
1	DRP Driver*	The following API Functions are not supported. - R_DK2_Uninitialize - R_DK2_Inactivate If these functions are called, these functions occur an error and return "R_DK2_ERR_INTERNAL".
2	DRP Driver *	The function that load the configuration data in background is not supported. This function validates when argument "pload" of R_DK2_Load Function is set to anything other than NULL. In the version in this package this function occurs an error and return "R_DK2_ERR_INTERNAL".
3	DRP Driver *	R_DK2_Load Function notifies the return value "R_DK2_ERR_DEVICE", when detects a transfer error of the configuration data. In the version in this package this function is not supported.
4	DRP Driver *	Processing Completion Callback Function notifies the argument "result" is "R_DK2_ERR_DEVICE", when detects a transfer error in DRP. In the version in this package this function is not supported.
5	DRP Driver *	Processing Completion Callback Function notifies the argument "result" is "R_DK2_ERR_STOPPED", when detects a transfer stopped by calling R_DK2_Unload Function of R_DK2_Inactivate Function. In the version in this package this function is not supported.
6	Driver (USBH)	Full Speed Hub is not supported.

Note 1   Please refer to "RZ/A2M Group DRP Driver User's Manual(R01US0355)" for details of DRP Driver's function.

6. Precautions

The Precautions of this package are shown as follow.

Table 6-1 Precautions

No.	Type	Description
1	Environment	If it is happened a build error while building the project of this package as it is, the setting of environment may be incorrect. Check following items: • Follow section 3 of "RZ/A2M Software Package Quick Start Guide"(R01QS0040) • Install Arm DS v2019.0 or later again.
2	Environment	To avoid build error, expand the project to the folder with short full-path.
3	Environment	To avoid build error, expand the project to the folder without multi-byte character.
4	Environment	To obtain the bootloader function specifications, download the following application note from the Renesas site. RZ/A1LU Group Example of Booting from Serial Flash Memory (R01AN4333)
5	Tool	To avoid download fail, use SEGGER J-Links version 6.48 or later.
6	File System	src\fatfs\documents.zip includes *.c files. If you unzipped the zip file, exclude the documents\res from your build.
7	File System	Long file name support is disabled. For details, refer to the following file in the sample project. src\fatfs\documents.zip

7. Used open source software and licenses

Open source software used in this package and license of them are shown as following:

- FreeRTOS™ is a trade mark of Amazon Web Services, Inc.
- FreeRTOS is used under MIT license described in following site:
    https://www.freertos.org/a00114.html
    https://github.com/aws/amazon-freertos/blob/master/LICENSE
    https://aws.amazon.com/freertos/faqs/
- mbedTLS is used under the Apache License, Version 2.0 described in following site:
    http://www.apache.org/licenses/LICENSE-2.0
- FatFs is used under the license described in following site:
    http://elm-chan.org/fsw/ff/doc/appnote.html#license

Revision History

		Description	
Rev.	**Date**	**Page**	**Summary**
1.00	Nov. 29.19	-	First Edition issued
2.00	Feb. 28.20	P4-5	Added applications that are included in the package. 　　Example of Low power mode 　　Pmod ESP32 Wi-Fi Sample program
3.00	May. 29.20	P2-6	Added applications that are included in the package. 　　SCIFA using DMAC Sample Application 　　USB HOST FAT Sample Application 　　USB Function CDC Sample Application 　　RTC Counter Sample program 　　HyperFlash Boot program
4.00	Sep.30.20	P2-6	Added applications that are included in the package. 　　USB HOST HID Sample Application 　　SDHI FAT Sample Application 　　GPT-PWM Sample Application 　　Firmware Update Sample Application 　　Touch Panel Sample Application 　　SSIF Sample Application

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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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