SH7231 Group

Setting the SRAM Interface for Bus State Controller

R01AN0847EJ0100
Rev.1.00
Dec. 28, 2011

Abstract

This application note describes an example to access an SRAM. The operation is achieved by using the function of the SRAM interface with byte selection equipped in the SH7231 bus state controller.

Products

SH7231

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

Contents

1. Specifications

Get SRAM accessed using the SRAM interface function with byte selection pin on the bus state controller. The SRAM of 2M bytes (1 Mwords x 16 bits) connects to the bus state controller in the bus width of 16 bits.

Table 1.1 lists the peripheral functions used and their applications. Figure 1.1 shows their memory map

Table 1.1 Peripheral Functions and Applications

Peripheral Function	Application
Bus state controller	Interface for connecting the SRAM with byte selection

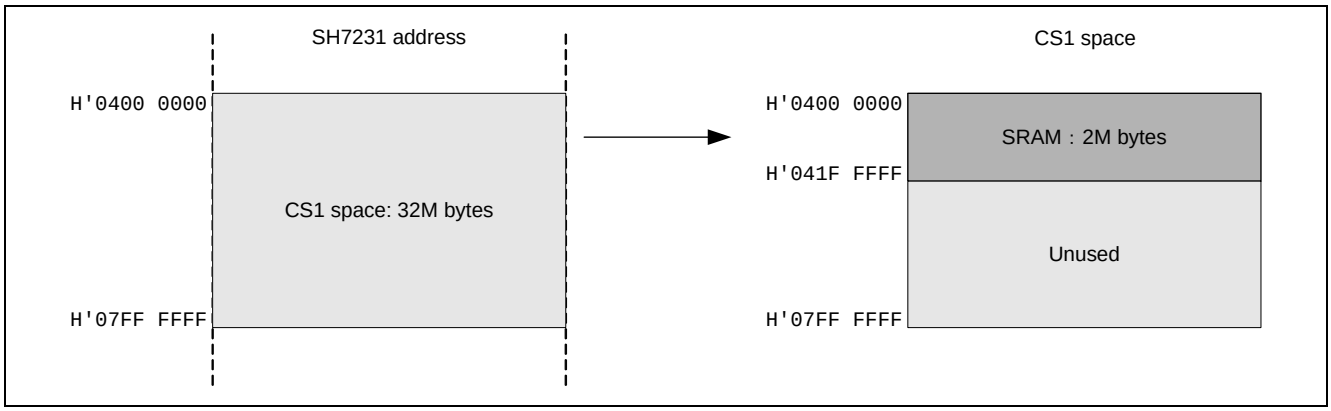


Figure 1.1 SRAM Memory Map

2. Operation Confirmation Conditions

The sample code accompanying this application note has been run and confirmed under the conditions below.

Table 2.1 Operating Conditions

Item	Contents
MCU used	SH7231
Devices used	Renesas Electronics Corporation SRAM (model: R1LV1616RSA-7S)
Operating frequency	• CPU clock: 100MHz • Bus clock: 50MHz • Peripheral clock: 50MHz
Operating voltage	• Vcc: 3.3V • PVcc: 3.3V or 1.8V
Integrated development environment	Renesas Electronics Corporation High-performance Embedded Workshop Ver.4.08.00
C compiler	Renesas Electronics Corporation SuperH RISC engine family C/C++ compiler package V.9.04 Release 00
	Compile options: -cpu=sh2afpu -fpu=single -include="$(WORKSPDIR)\inc" -object="$(CONFIGDIR)\$(FILELEAF).obj" -debug -gbr=auto -chgincpath -errorpath -global_volatile=0 -opt_range=all -infinite_loop=0 -del_vacant_loop=0 -struct_alloc=1 -nologo
Operating mode	MCU expansion mode 2
Sample code version	1.00

3. Reference Application Notes

For additional information associated with this document, refer to the following application notes.

- SH7231 Group Example of Initialization (document No.: R01AN0322EJ)
- SH7231 Group Setting the SDRAM Interface for Bus Controller (Document No.: R01AN0848EJ)

4. Hardware

4.1 SRAM Specification

Table 4.1 lists the specification of SRAM adopted in this application.

Table 4.1 SRAM Specification in the Application

Item	Description
Model	R1LV1616RSA-7S
Volume, Configuration	16M bits (1 Mwords x 16 bits) x 1
Data bus width	16 bits

4.2 Pins Used

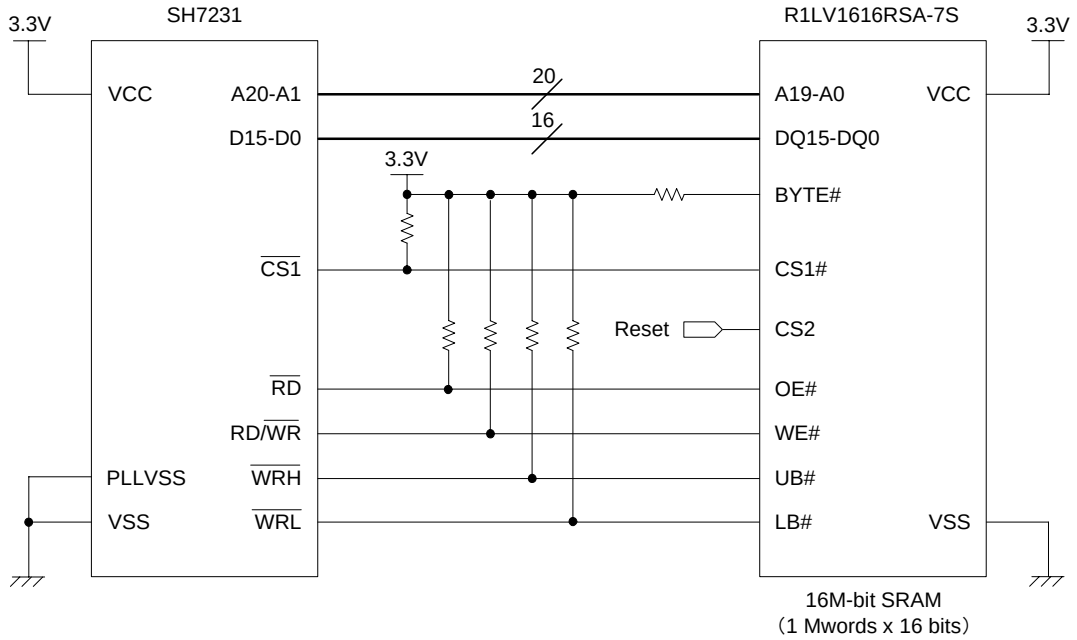
Table 4.2 lists the pins used and their functions. All the pins are set to I/O ports by default. The change for pin function by the pin function controller is required. This application uses the SRAM interface function with byte selection, therefore the BAS bit in the CS1 space wait control register (CS1WCR) is set to 1.

Table 4.2 Pins Used and their Function

Pin Name	I/O	Function
A20 to A1	Output	Address pass
D15 to D0	Input	Data bus
$\overline{CS1}$	Output	Chip select 1
RD/$\overline{WR}$	Output	Write enable
$\overline{RD}$	Output	Read pulse signal 8read data output enable)
$\overline{WRH}$	Output	Selection for upper byte in data bus (D15 to D8)
$\overline{WRL}$	Output	Selection for lower bye in data bus (D7 to D0)

4.3 A Diagram for Reference

Figure 4.1 shows the sample connection to the SRAM.



Note: “#” represents the negative logic or the active low.

Figure 4.1 Connection to SRAM

5. Software

5.1 Operation Overview

The sample code sets the bus state controller before executing the main function, and sets the interface with the SRAM with byte selection. The main function carries out no processing but the processing of the endless loop. Therefore this chapter describes only the initial setting for the bus state controller.

5.2 Flowchart

5.2.1 Initial Setting for Bus State Controller

Figure 5.1 shows the procedure for initializing the bus state controller.

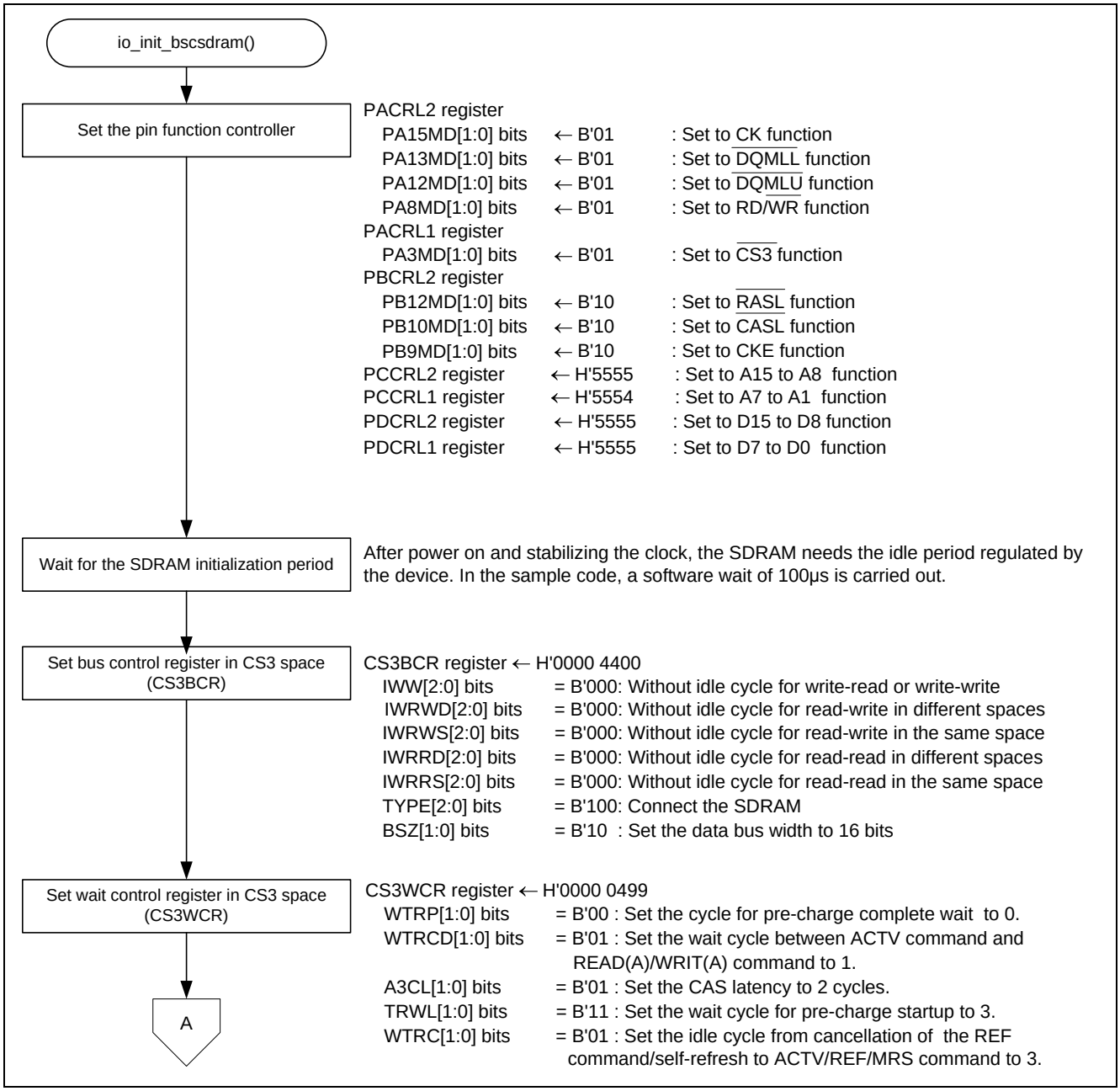


Figure 5.1 Initial Setting for Bus State Controller

5.3 Timing Charts

This section describes the access timing of read or write from the SH7231 in the same space to the SRAM with byte selection used in this application.

Figure 5.2 shows the read-write access timing. Figure 5.3 shows the read-write access timing using t_{ACC} and t_{OE} to specify the read data set up.

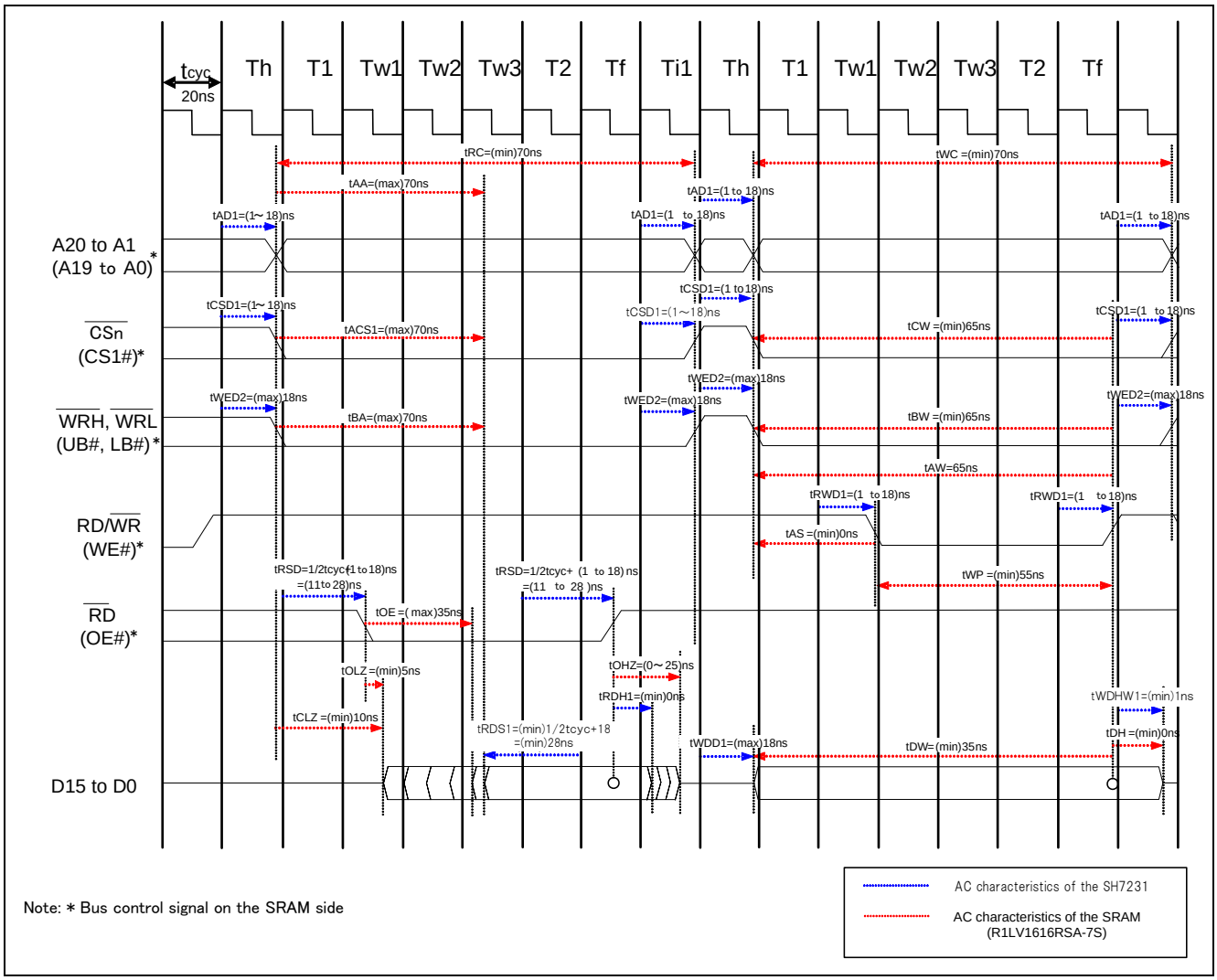


Figure 5.2 Read-write Access Timing

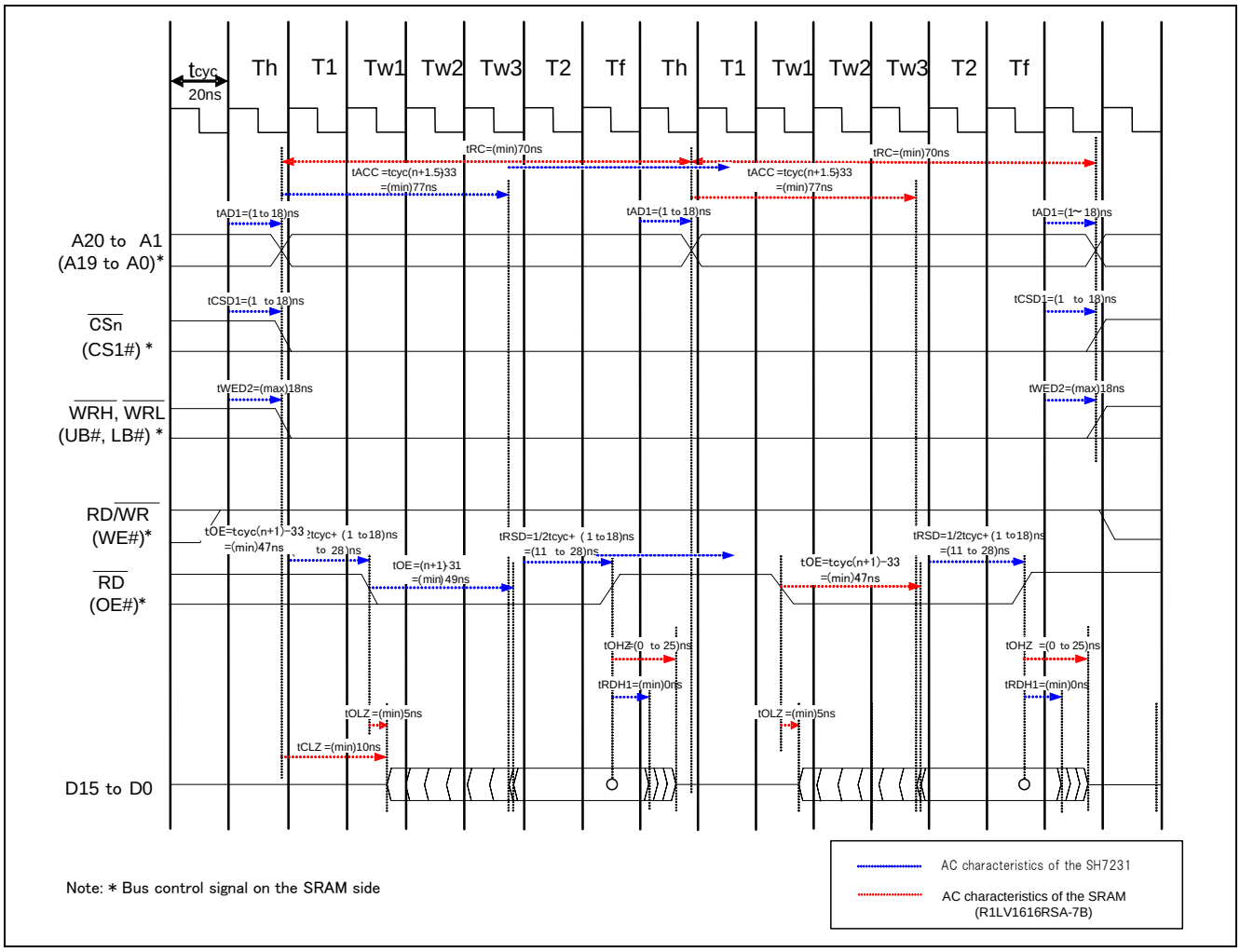


Figure 5.3 Read-read Access Timing with t_{ACC} and t_{OE}

[Remarks] Specification of set up timing for the data signal when reading

The SH-2/SH-2A series products with the general flash ROM (including this MCU) prescribes two times besides the read data set up time as t_{RDS} for the data set up timing when reading the general external memory. Refer to the following.

- Read data access time (t_{ACC})
- Access time from read strobe (t_{OE})

Design the read timing to fulfill the following relationship at the same time along with the specification in the t_{ACC} and t_{OE}. In this case, the prescription in the t_{PDS} does not need to be considered.

- The address access time on the SRAM side t_{AA} *(max). <= t_{ACC} (min) on the MCU side.
- The access time from the read strobe on the SRAM side t_{OE} * (max) <= t_{OE} (min) on the MCU side.

When designing the read timing to fulfill the prescription in the t_{PDS}, the above mentioned prescription on the MCU as t_{ACC} and t_{OE} do not need to be considered.

Note: "*" is the symbol which represents the timing prescription on the SRAM (R1LV1616RSA-7S) side used in this application.

6. Sample Code

Sample code can be downloaded from the Renesas Electronics website.

7. Reference Documents

Hardware Manual

SH7231 Group User's Manual: Hardware Rev.1.00
The latest version can be downloaded from the Renesas Electronics website.

Technical Update/Technical News

The latest version can be downloaded from the Renesas Electronics website

Development Tool Manual

SuperH C/C++ Compiler Package V.9.04 User's Manual Rev.1.01
The latest version can be downloaded from the Renesas Electronics website.

Website and Support

Renesas Electronics website

http://www.renesas.com/

Inquiries

http://www.renesas.com/contact/

Revision History	SH7231 Group Application Note Bus State Controller SRAM Interface Setting

Rev.	Date	Description	
		Page	Summary
1.00	Dec. 28, 2011	—	First edition issued

General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU products from Renesas. For detailed usage notes on the products covered by this manual, refer to the relevant sections of the manual. If the descriptions under General Precautions in the Handling of MPU/MCU Products and in the body of the manual differ from each other, the description in the body of the manual takes precedence.

1. Handling of Unused Pins
   Handle unused pins in accord 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 LSI, an associated shoot-through current flow internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.
2. Processing at Power-on
   The state of the product is undefined at the moment 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 moment 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 moment 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 moment when power is supplied until the power reaches the level at which resetting has been specified.
3. Prohibition of Access to Reserved Addresses
   Access to reserved addresses is prohibited.
   — The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.
4. Clock Signals
   After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has 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. Moreover, 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.
5. Differences between Products
   Before changing from one product to another, i.e. to one with a different type number, confirm that the change will not lead to problems.
   — The characteristics of MPU/MCU in the same group but having different type numbers may differ because of the differences in internal memory capacity and layout pattern. When changing to products of different type numbers, implement a system-evaluation test for each of the products.

Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of 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. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. 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 of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may 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.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: "Standard", "High Quality", and "Specific". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as "Specific" without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as "Specific" or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is "Standard" unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.
   - "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.
   - "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.
   - "Specific": Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, 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, please evaluate the safety of the final products or system 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. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be 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, or if you have any other inquiries.

(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

RENESAS

SALES OFFICES

Renesas Electronics Corporation

http://www.renesas.com

Refer to "http://www.renesas.com/" for the latest and detailed information.

Renesas Electronics America Inc.
2880 Scott Boulevard Santa Clara, CA 95050-2554, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited
1101 Nicholson Road, Newmarket, Ontario L3Y 9C3, Canada
Tel: +1-905-898-5441, Fax: +1-905-898-3220

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-585-100, Fax: +44-1628-585-900

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-65030, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
7th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China
Tel: +86-21-5877-1818, Fax: +86-21-6887-7858 / -7898

Renesas Electronics Hong Kong Limited
Unit 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2886-9318, Fax: +852 2886-9022/9044

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
1 harbourFront Avenue, #06-10, keppel Bay Tower, Singapore 098632
Tel: +65-6213-0200, Fax: +65-6278-8001

Renesas Electronics Malaysia Sdn.Bhd.
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics Korea Co., Ltd.
11F., Samik Lavied' or Bldg., 720-2 Yeoksam-Dong, Kangnam-Ku, Seoul 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

Colophon 1.1