R8C/56E Group

Timer RC Output Compare Function

R01AN0972EJ0100
Rev.1.00
June 29, 2012

Abstract

This document describes a setting example of the output compare function in timer RC.

Products

R8C/56E Group

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 2
2. Operation Confirmation Conditions 3
3. Hardware 3
   3.1 Pin Used 3
4. Software 4
   4.1 Operation Overview 4
   4.2 Required Memory Size 4
   4.3 Functions 4
   4.4 Function Specifications 5
   4.5 Flowcharts 6
      4.5.1 Main Processing 6
      4.5.2 System Clock Setting 7
      4.5.3 Initial Setting of Timer RC 8
5. Sample Code 9
6. Reference Documents 9

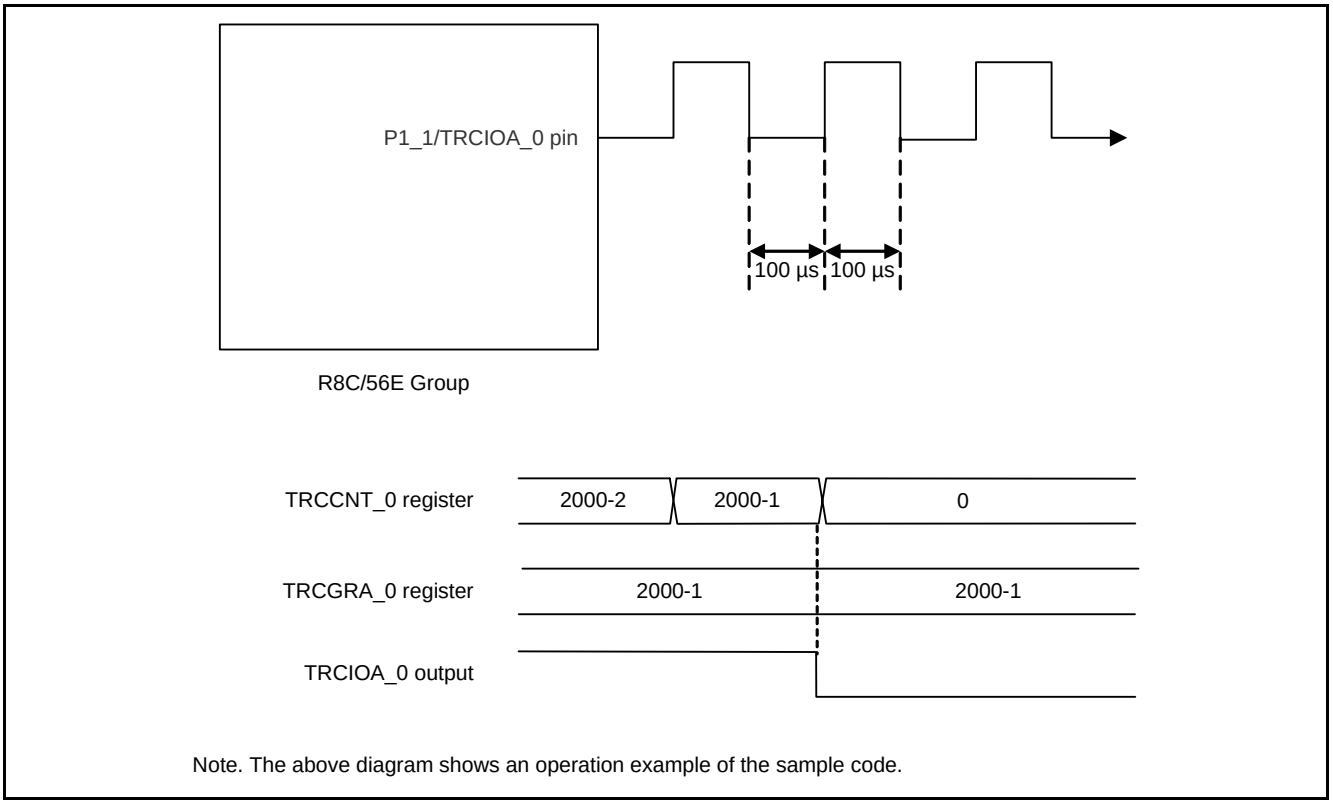
1. Specifications

Output from the TRCIOA_0 pin is toggled when there is a compare match between the timer RC counter value and the TRCGRA_0 register value.

Table 1.1 lists the Peripheral Function and Its Application and Figure 1.1 shows the Operation Overview.

Table 1.1 Peripheral Function and Its Application

Peripheral Function	Application
Output compare function in timer RC	Toggle output from TRCIOA_0 pin



Note. The above diagram shows an operation example of the sample code.

Figure 1.1 Operation Overview

2. Operation Confirmation Conditions

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

Table 2.1 Operation Confirmation Conditions

Item	Contents
MCU used	R8C/56E Group
Operating frequencies	• XIN: 20 MHz • System clock: 20 MHz • CPU clock: 20 MHz
Operating voltage	5.0 V (2.7 and 5.5 V)
Integrated development environment	Renesas Electronics Corporation High-performance Embedded Workshop Version 4.09.00.007
C compiler	Renesas Electronics Corporation M16C Series, R8C Family C Complier V.5.45 Release 01
	Compile options -D__UART0__ -c -finfo -dir "$(CONFIGDIR)" -R8C (Default setting is used in the integrated development environment.)

3. Hardware

3.1 Pin Used

Table 3.1 lists the Pin Used and Its Function.

Table 3.1 Pin Used and Its Function

Pin Name	I/O	Function
P1_1/TRCIOA_0	Output	Signal output for timer RC

4. Software

4.1 Operation Overview

(1) Perform initial setting of timer RC_0 by a program. Set the initial output level of TRCIOA_0 pin as high.

(2) Set the CTS bit in the TRCMR_0 register to 1 to start the timer RC_0 count.

(3) When the count value in the TRCCNT_0 register matches the value of the TRCGRA_0 register, the output level of the TRCIOA_0 pin is toggled. Then, the count value in the TRCCNT_0 register is cleared.

Table 4.1 lists the Timer RC Setting.

Table 4.1 Timer RC Setting

Item	Setting
Timer RC channel	Channel 0
Operation mode	Timer mode: Output compare function : Toggle output (output inverted every 100 µs) 100 µs = f1 × (TRCGRA_0 + 1) = 1/20 MHz × 2000
Output compare register	TRCGRA_0 register
Counter clear function	Used
Pulse output forced cutoff input function	Not used
Interrupts	Not used

4.2 Required Memory Size

Table 4.2 lists the Required Memory Size.

Table 4.2 Required Memory Size

Memory Used	Size	Remarks
ROM	185 bytes	In the r01an0972_src.c.module
RAM	0 bytes	In the r01an0972_src.c.module
Maximum user stack usage	10 bytes	
Maximum interrupt stack usage	0 bytes	

Note: The required memory size varies depending on the C compiler version and compile options.

4.3 Functions

Table 4.3 lists the Functions.

Table 4.3 Functions

Function Name	Outline
mcu_init	System clock setting
timer_rc_init	Initial setting of timer RC

4.4 Function Specifications

The following tables list the sample code function specifications.

mcu_init	
Outline	System clock setting
Header	None
Declaration	void mcu_init(void)
Description	Set the system clock.
Arguments	None
Returned Value	None

timer_rc_init	
Outline	Initial setting of timer RC
Header	None
Declaration	void timer_rc_init(void)
Description	Perform initial setting to use the output compare function in timer RC.
Arguments	None
Returned Value	None

4.5 Flowcharts

4.5.1 Main Processing

Figure 4.1 shows the Main Processing.

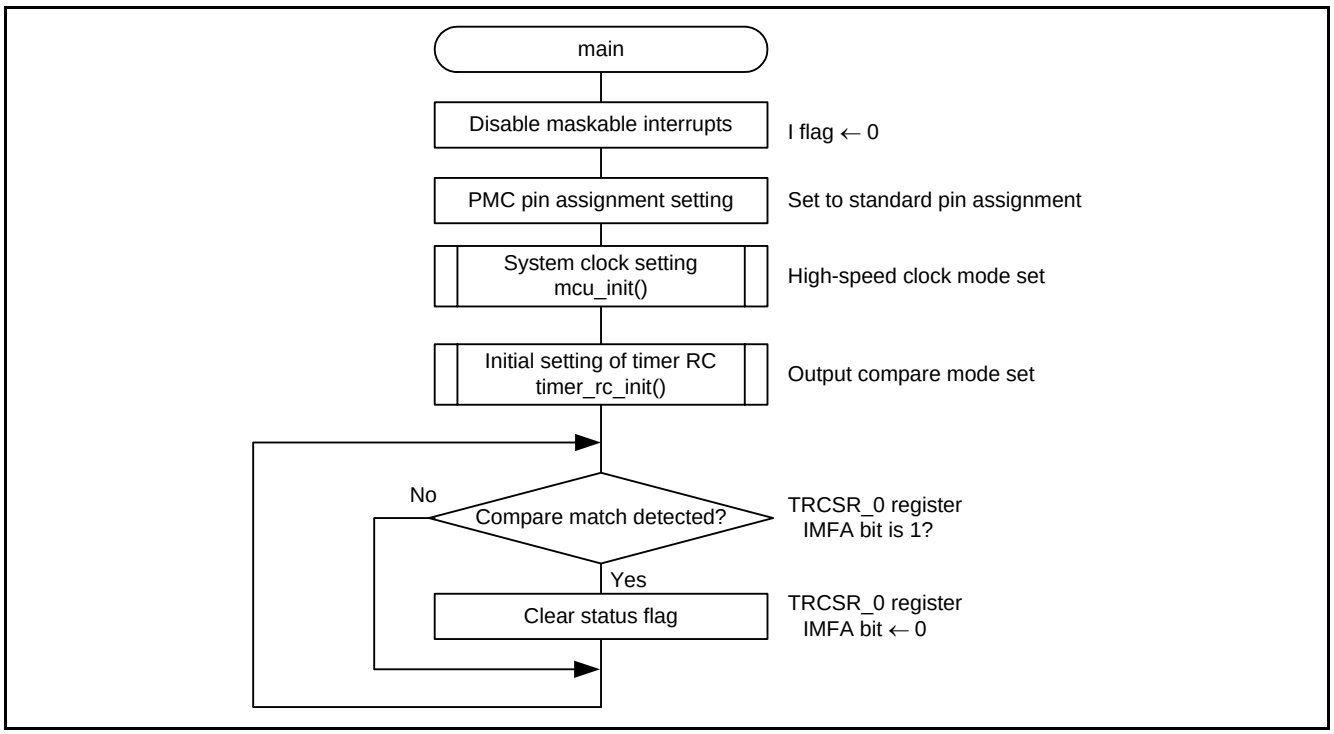


Figure 4.1 Main Processing

4.5.2 System Clock Setting

Figure 4.2 shows the System Clock Setting.

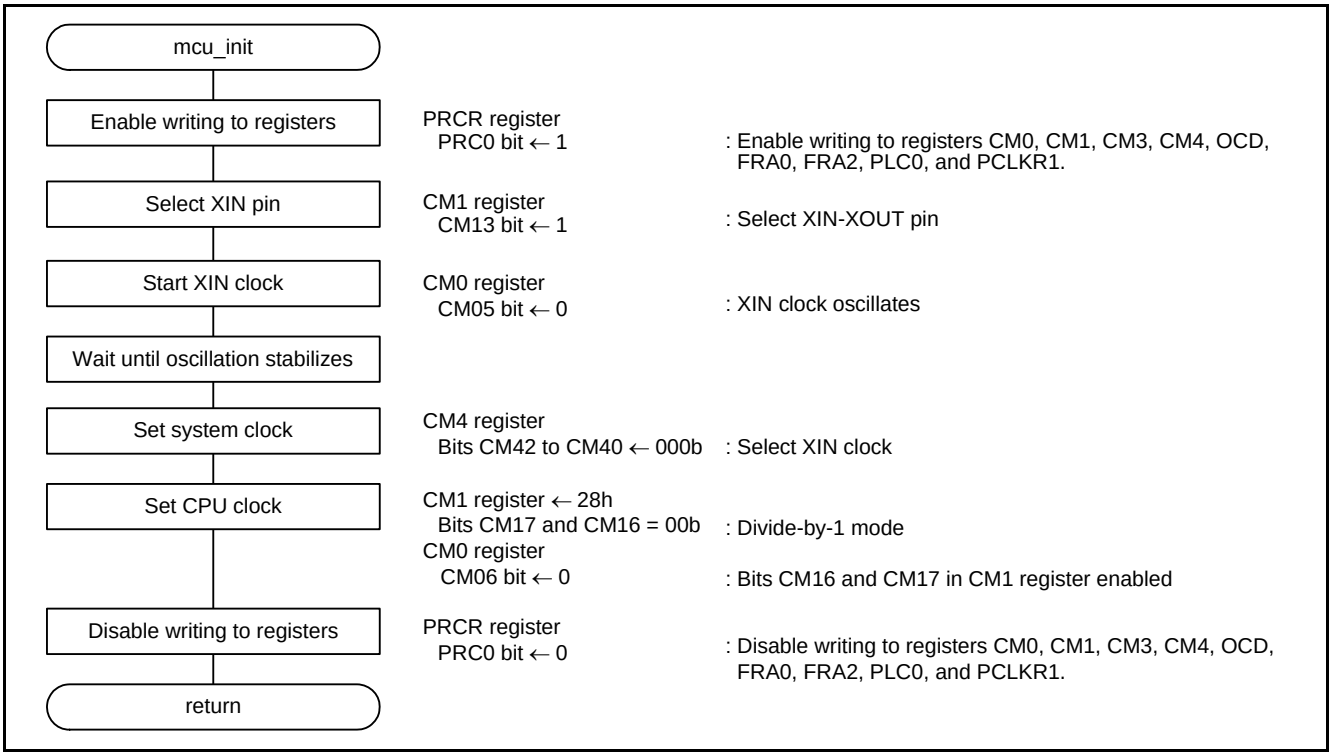


Figure 4.2 System Clock Setting

4.5.3 Initial Setting of Timer RC

Figure 4.3 shows the Initial Setting of Timer RC.

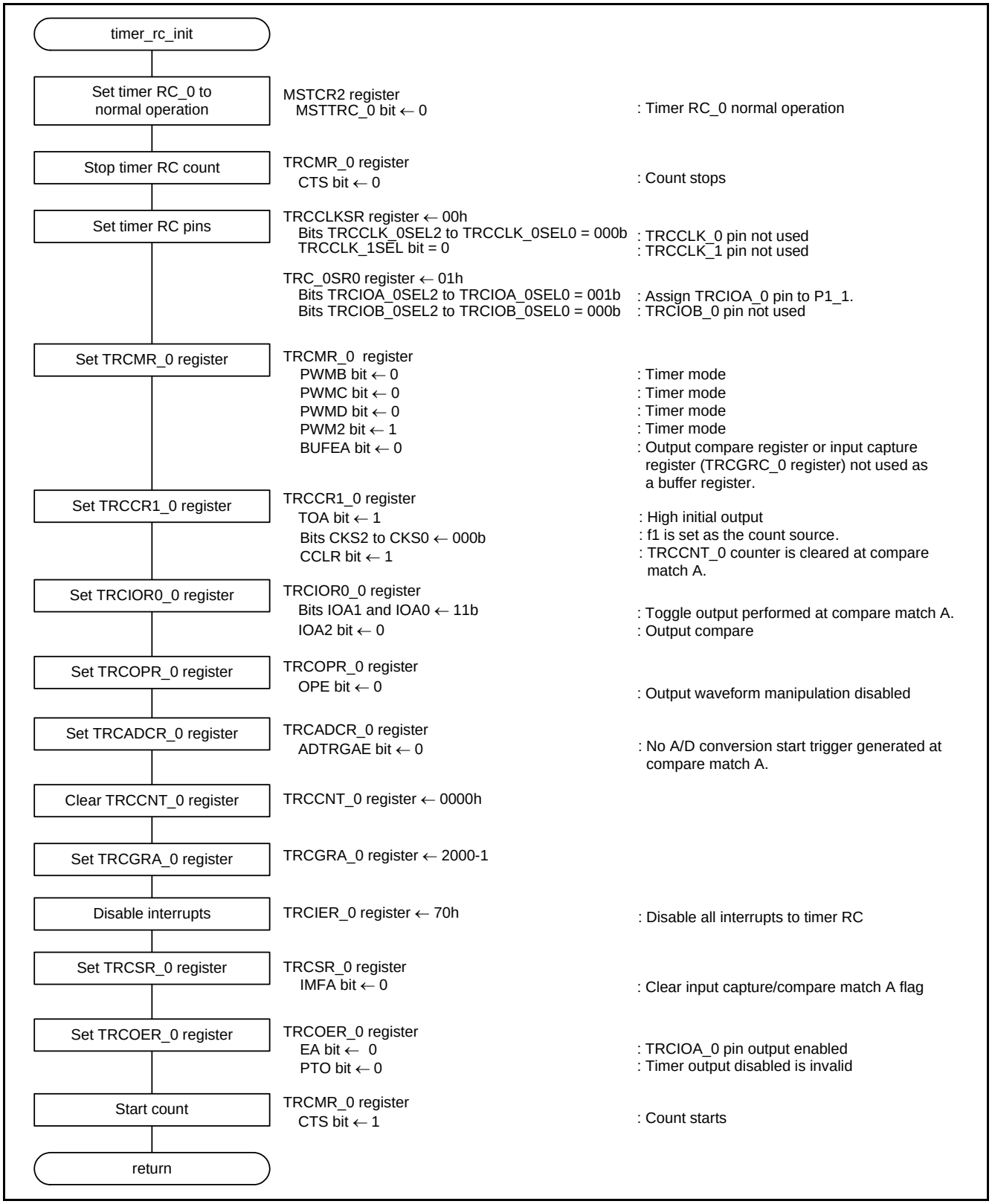


Figure 4.3 Initial Setting of Timer RC

5. Sample Code

Sample code can be downloaded from the Renesas Electronics website.

6. Reference Documents

User's Manual: Hardware

R8C/56E 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 information 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	R8C/56E Group Application Note Timer RC Output Compare Function

Rev.	Date	Description	
		Page	Summary
1.00	June 29, 2012	—	First edition issued

All trademarks and registered trademarks are the property of their respective owners.

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 flows 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. 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.
2. 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.
3. 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.
4. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from such alteration, modification, copy or otherwise misappropriation of Renesas Electronics product.
5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The recommended 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; and industrial robots etc.
   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; and safety equipment etc.
   Renesas Electronics products are neither intended nor 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 damages (nuclear reactor control systems, military equipment etc.). 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 for which it is not intended. 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 which the product is not intended by Renesas Electronics.
6. 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.
7. 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 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. 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.
9. 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. You should not use Renesas Electronics products or 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. When exporting the Renesas Electronics 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.
10. It is the responsibility of the buyer or distributor of Renesas Electronics products, who distributes, disposes of, or otherwise places the product with a third party, to notify such third party in advance of the contents and conditions set forth in this document, Renesas Electronics assumes no responsibility for any losses incurred by you or third parties as a result of unauthorized use of Renesas Electronics products.
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

© 2012 Renesas Electronics Corporation. All rights reserved.

Colophon 2.0