To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

Send any inquiries to http://www.renesas.com/inquiry.

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.

38D2 Group

Serial I/O 1, 2 (Clock Synchronous Serial I/O Mode: Example 2)

1. Abstract

The following article introduces and shows an example of how to use the Serial I/O 1, 2 (Clock Synchronous Serial I/O Mode: Example 2) on the 38D2 Group device.

2. Introduction

The application explained in this document applies to the following MCU and parameter(s):
Applicable MCU: 38D2 Group
Oscillation frequency: 4 MHz

This sample program may include operations of unused bit functions for the convenience of the SFR bit layout. Set the values according to the operational conditions of the user system.

3. Contents

3.1 Cyclic Transmission or Reception of Block Data (Data of Specified Number of Bytes) Between Two Microcomputers

Outline: When the clock synchronous serial I/O is used for communication, the synchronization of the clock and data between the transmit side and the receive side may be shifted because of noise included in the synchronous clock. Normal operations are performed constantly by using “heading adjustment” to correct the shift. The “heading adjustment” is carried out by using the interval between blocks in this application exapmle.

Specifications:

- Serial I/O (clock synchronous serial I/O mode) is used.
- Synchronous clock frequency: 125 kHz (f(XIN) = 4 MHz divided by 32)
- Byte cycle: 500 µs
- Number of transimit bytes: 8 bytes/block
- Block transfer cycle: 16 ms
- Block transfer term: 4 ms
- Interval between blocks: 12 ms
- Heading adjustment time: 8 ms

  Master control
- Data is transmitted and received by interrupt routine executed every byte cycle (500 µs)

  Slave control
- Data is transmitted and received by serial I/O 1 receive interrupt routine
- The heading adjustment is carried out by interrupt routine executed every 1ms

Limitations of specifications:

- Reading the receive data and writing the next transmit data must be completed within the time obtained from the calculation formula “byte cycle - 1 byte transfer time”.

  Note: The time taken from generating this serial I/O 1 receive interrupt to inputting the next synchronous clock must be 436 µs.
- “Heading adjustment time < interval between blocks” must be satisfied.

Figure 3.1 shows the Connection Diagram.

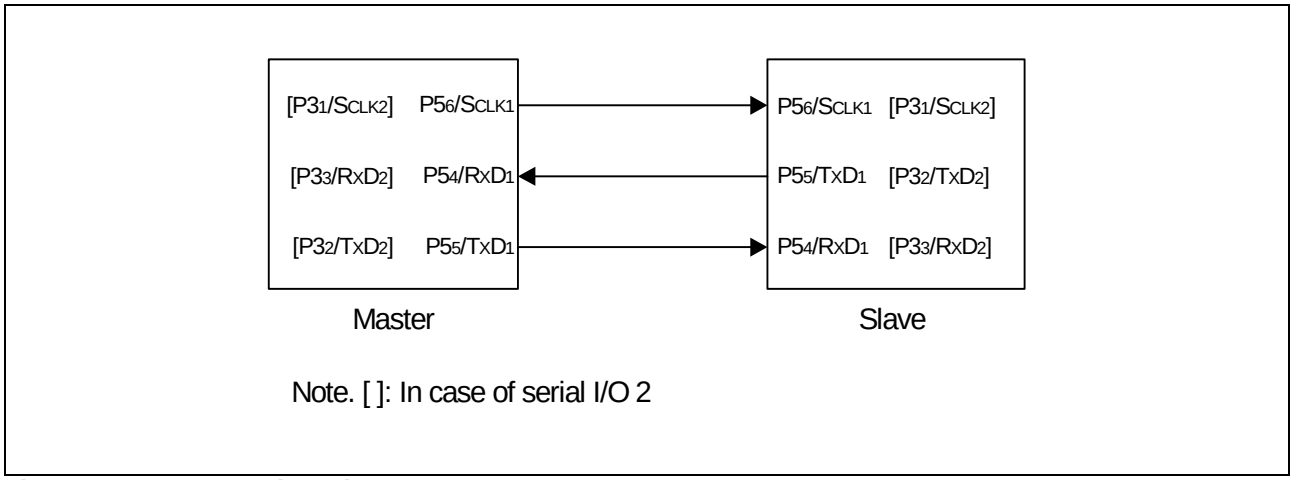


Figure 3.1 Connection Diagram

Figure 3.2 shows the Timing Chart. In the slave, when a synchronous clock is not input within a predetermined amount of time (heading adjustment time), the next clock input is processed as the beginning (heading) of a block. When a clock is input again after one block (8 bytes) is received, the clock is ignored.
Figure 3.3 shows the Relevant Register Settings.

.

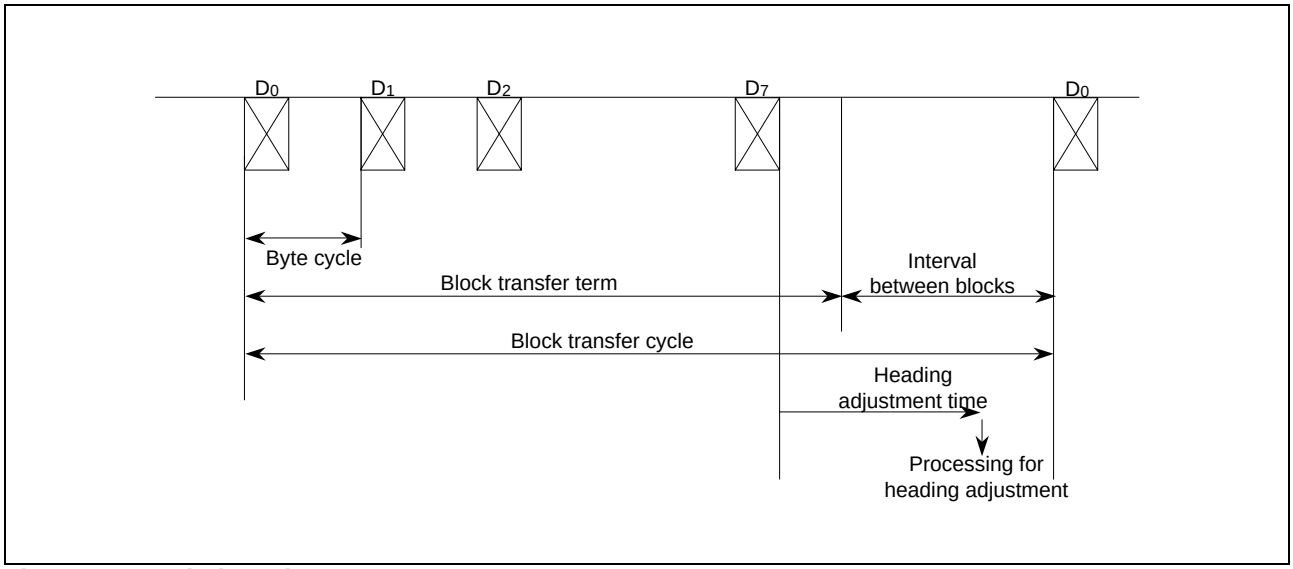
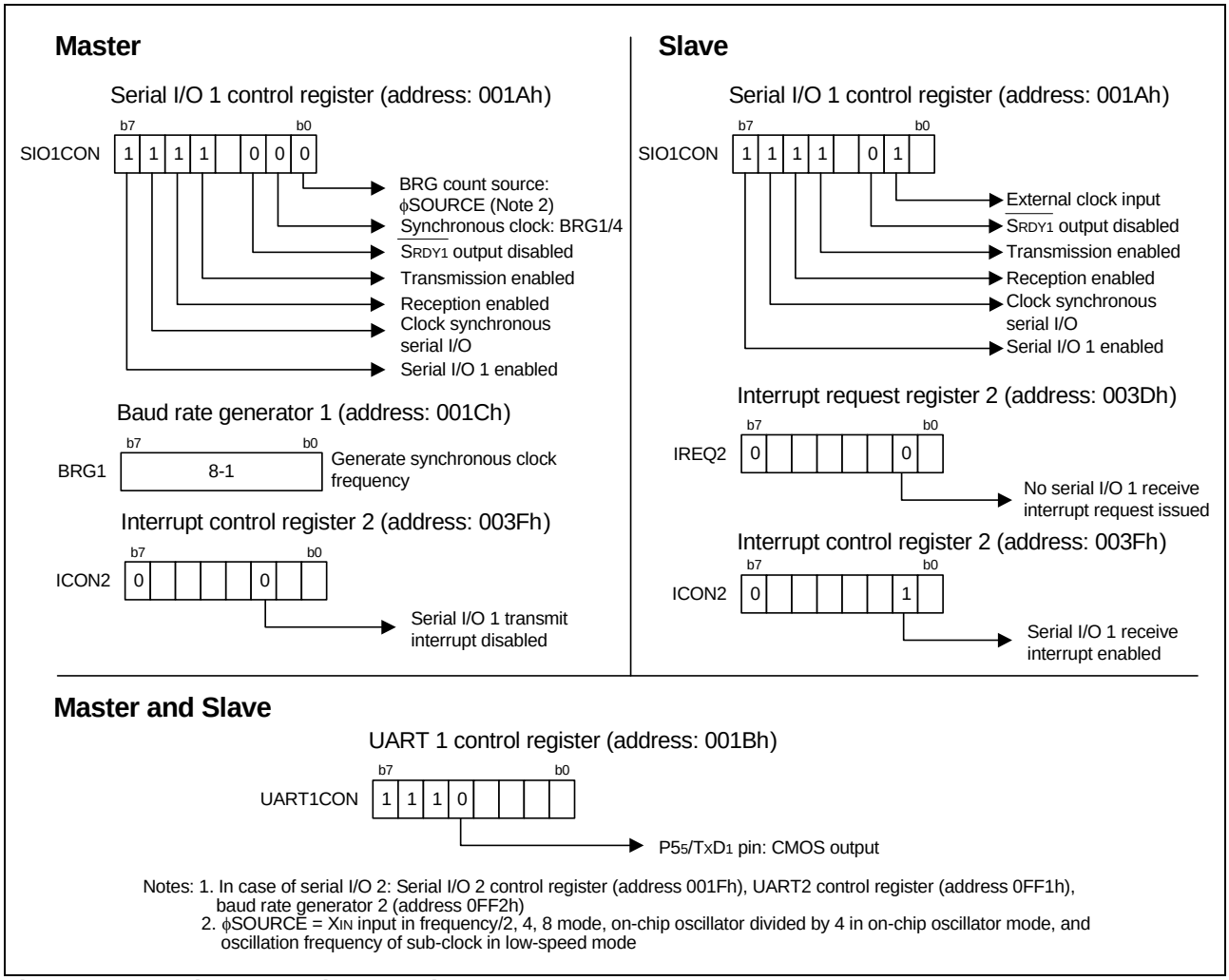


Figure 3.2 Timing Chart



Notes: 1. In case of serial I/O 2: Serial I/O 2 control register (address 001Fh), UART2 control register (address 0FF1h), baud rate generator 2 (address 0FF2h)
2. φSOURCE = XIN input in frequency/2, 4, 8 mode, on-chip oscillator divided by 4 in on-chip oscillator mode, and oscillation frequency of sub-clock in low-speed mode

Figure 3.3 Relevant Register Settings

Control by software:

• Master Control

The master starts transmission or reception by writing transmit data to the transmit buffer register in the interrupt routine executed every 500 µs. In this interrupt routine, the receive data is read and then the next transmit data is written to the transmit buffer register. Additionally, the master controls one block (8 bytes) transmission and reception and generates block intervals.

Figure 3.4 shows the Master Control Procedure.

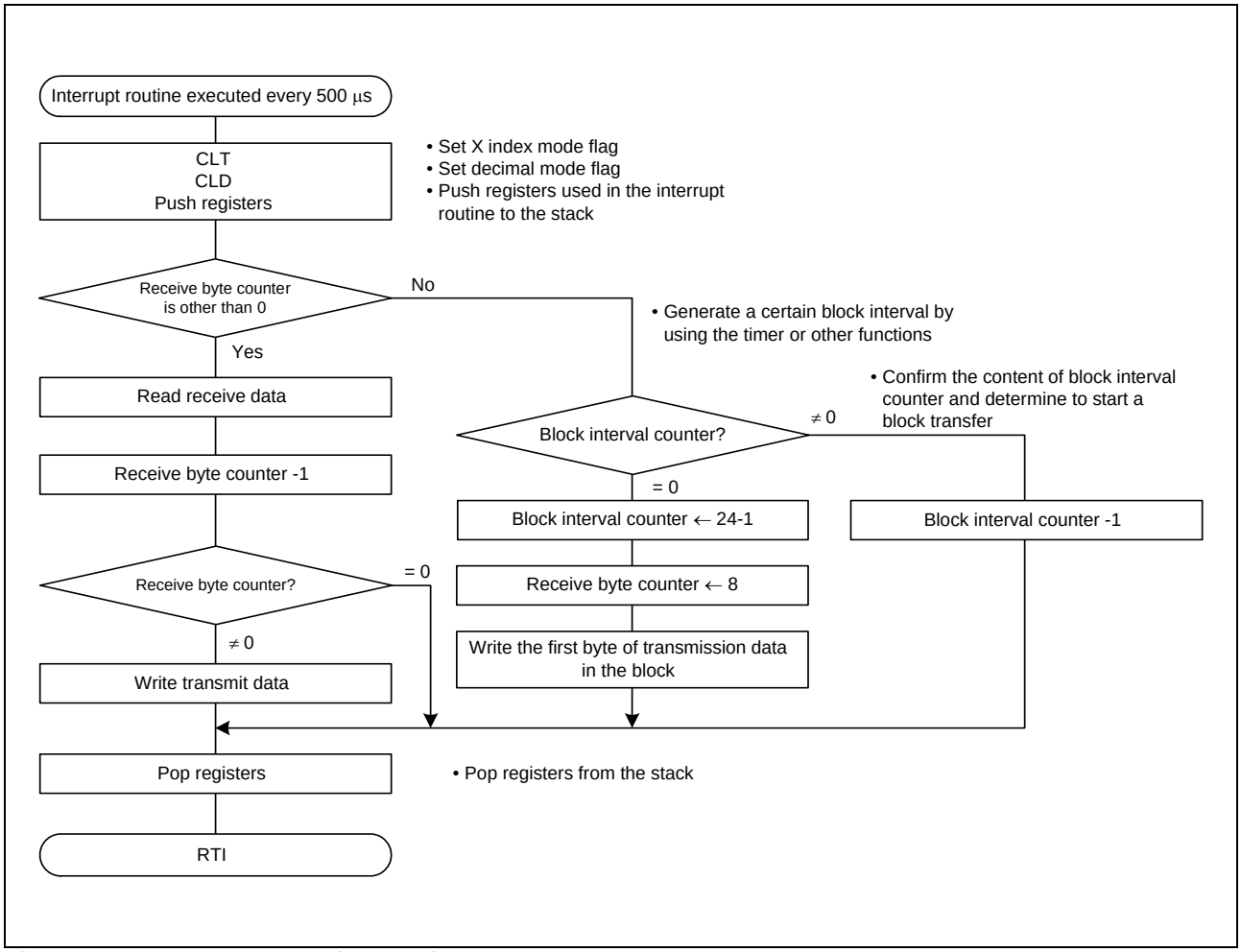


Figure 3.4 Master Control Procedure

Control by software:

• Slave control

After setting the relevant registers as shown in figure 3.3, the slave will be able to receive a synchronous clock at any time, and the serial I/O 1 receive interrupt request occurs each time an 8-bit data is received. In the serial I/O 1 receive interrupt routine, the data to be transmitted next is written to the transmit buffer register after the receive data is read out. However, if no serial I/O 1 receive interrupt request occurs after a predetermined amount of time (heading adjustment time), the following processing will be performed in the interrupt routine executed every 1ms.

1. Serial I/O is initialized.
2. The first byte of the transmission data in the block is written into the transmit buffer register.
3. The receive byte counter is initialized in order to process the next receive data as the first byte of receive data in the block.

Figure 3.5 shows the Slave Control Procedure.

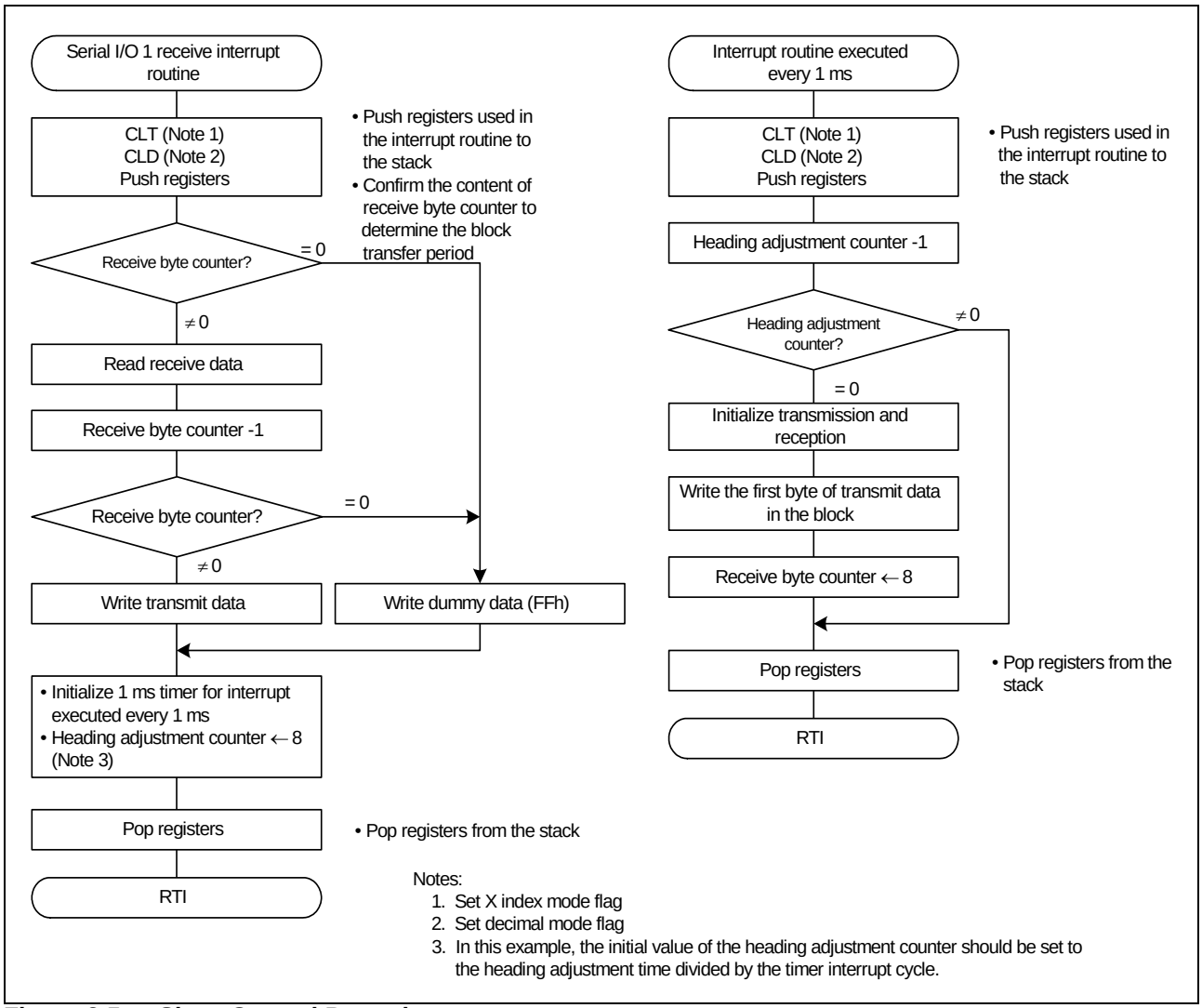


Figure 3.5 Slave Control Procedure

4. Sample Programming Code

Download a sample program from the Renesas Technology website.
To download, click “Application Notes” in the left side menu on the page of the 38D2 Group.

5. Reference Document

Datasheet
38D2 Group Datasheet
Download the latest version from the Renesas Technology website.

Technical News/Technical Update
Download the latest information from the Renesas Technology website.

Website and Support

Renesas Technology website
http://www.renesas.com

Inquiries
http://www.renesas.com/inquiry
csc@renesas.com

REVISION HISTORY	38D2 Group Serial I/O 1, 2 (Clock Synchronous Serial I/O Mode: Example 2)

Rev.	Date	Description	
		Page	Summary
1.00	Feb 9, 2007	–	First Edition issued

Keep safety first in your circuit designs!

1. Renesas Technology Corp. puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage. Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of non-flammable material or (iii) prevention against any malfunction or mishap.

Notes regarding these materials

1. These materials are intended as a reference to assist our customers in the selection of the Renesas Technology Corp. product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Renesas Technology Corp. or a third party.
2. Renesas Technology Corp. assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
3. All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Renesas Technology Corp. without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor for the latest product information before purchasing a product listed herein.
   The information described here may contain technical inaccuracies or typographical errors. Renesas Technology Corp. assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.
   Please also pay attention to information published by Renesas Technology Corp. by various means, including the Renesas Technology Corp. Semiconductor home page (http://www.renesas.com).
4. When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Renesas Technology Corp. assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
5. Renesas Technology Corp. semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
6. The prior written approval of Renesas Technology Corp. is necessary to reprint or reproduce in whole or in part these materials.
7. If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.
   Any diversion or reexport contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
8. Please contact Renesas Technology Corp. for further details on these materials or the products contained therein.