

To our customers,

---

## Old Company Name in Catalogs and Other Documents

---

On April 1<sup>st</sup>, 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 1<sup>st</sup>, 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.

## 7542 Group

### Clock Asynchronous Serial I/O (UART)

---

#### 1. Abstract

The following article introduces and shows an application example of clock asynchronous (UART) of serial I/O1.

#### 2. Introduction

The explanation of this issue is applied to the following condition:  
Applicable MCU: 7542 Group

### 3. Contents

For clock asynchronous serial I/O (UART), the baud rate and transfer formats used by a transmitter and receiver must be identical.

In the 7542 Group, eight serial data transfer formats can be selected.

Also, as for the serial I/O2, it has an equivalent function to serial I/O1 except that TxD2 output structure for serial I/O2 is CMOS only. Accordingly, the application example of the following serial I/O1 is applicable for serial I/O2.

#### 3.1 Data Transfer Rate

The transfer bit rate is calculated by the following formula;

- When the internal clock is selected (when baud rate generator is used)

$$\text{Transfer bit rate [bps]} = \frac{f(X_{IN})}{\text{Division ratio}^{*1} \times (\text{BRG1 setting value}^{*2} + 1) \times 16}$$

Division ratio<sup>\*1</sup> : "1" or "4" is selected (set by bit 0 of serial I/O1 control register)

BRG1 setting value<sup>\*2</sup> : 0 to 255 (00<sub>16</sub> to FF<sub>16</sub>) is set

- When the external clock is selected

$$\text{Transfer bit rate [bps]} = \text{Clock input to S}_{CLK1} \text{ pin}/16$$

Table 1 shows the setting example of baud rate generator and transfer bit rate values.

**Table 1 Setting example of baud rate generator1 (BRG1) and transfer bit rate values**

BRG count source	BRG1 set value	Transfer bit rate (bps)	
		At f(X <sub>IN</sub> ) = 4.9152 MHz	At f(X <sub>IN</sub> ) = 8 MHz
f(X <sub>IN</sub> ) / 4	255 (FF <sub>16</sub> )	300	488.28125
f(X <sub>IN</sub> ) / 4	127 (7F <sub>16</sub> )	600	976.5625
f(X <sub>IN</sub> ) / 4	63 (3F <sub>16</sub> )	1200	1953.125
f(X <sub>IN</sub> ) / 4	31 (1F <sub>16</sub> )	2400	3906.25
f(X <sub>IN</sub> ) / 4	15 (0F <sub>16</sub> )	4800	7812.5
f(X <sub>IN</sub> ) / 4	7 (07 <sub>16</sub> )	9600	15625
f(X <sub>IN</sub> ) / 4	3 (03 <sub>16</sub> )	19200	31250
f(X <sub>IN</sub> ) / 4	1 (01 <sub>16</sub> )	38400	62500
f(X <sub>IN</sub> )	3 (03 <sub>16</sub> )	76800	125000
f(X <sub>IN</sub> )	1 (01 <sub>16</sub> )	153600	250000
f(X <sub>IN</sub> )	0 (00 <sub>16</sub> )	307200	500000

### 3.2 UART Setting Method

Figure 1 and Figure 2 show the setting method for UART of serial I/O1.

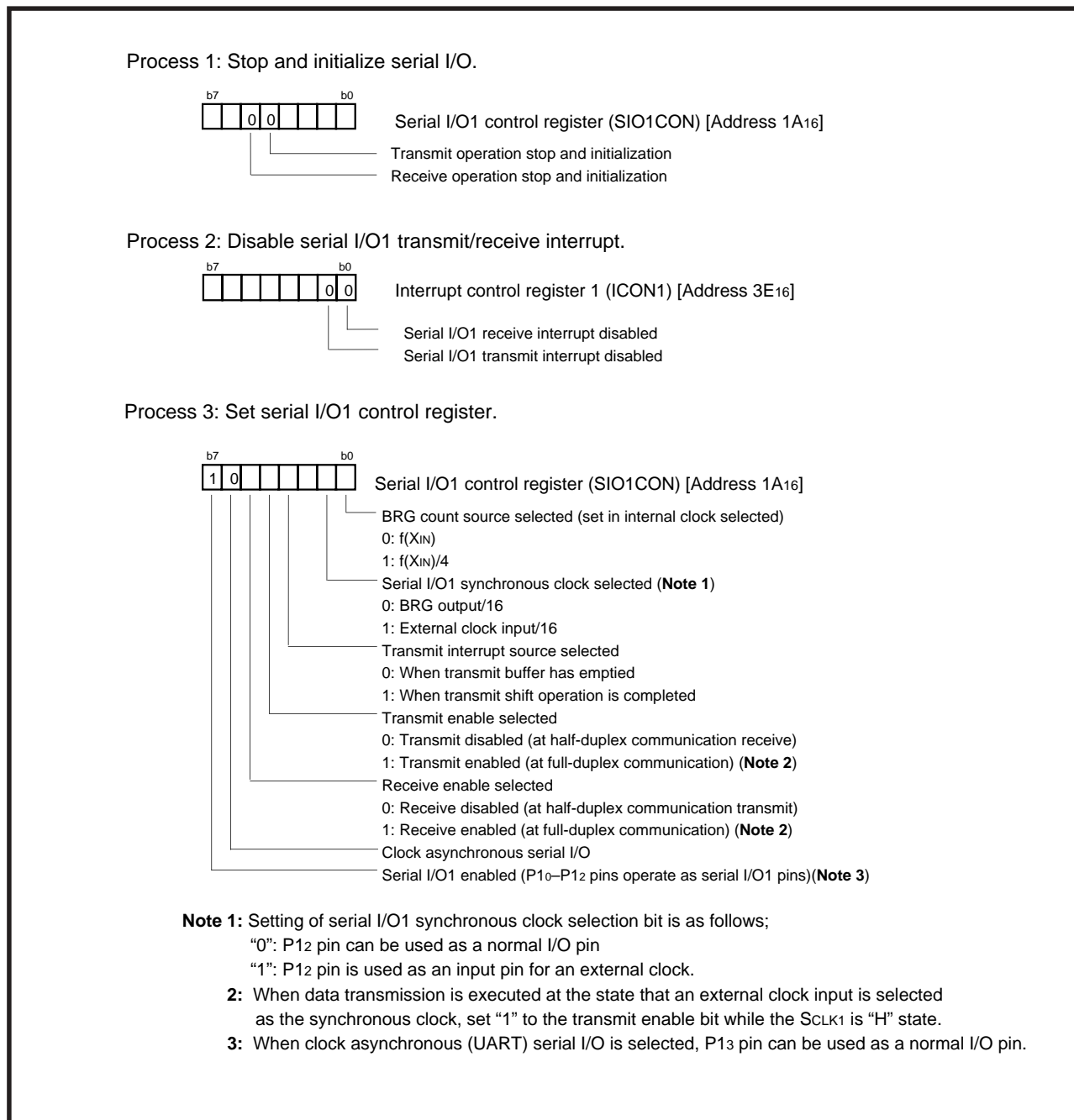
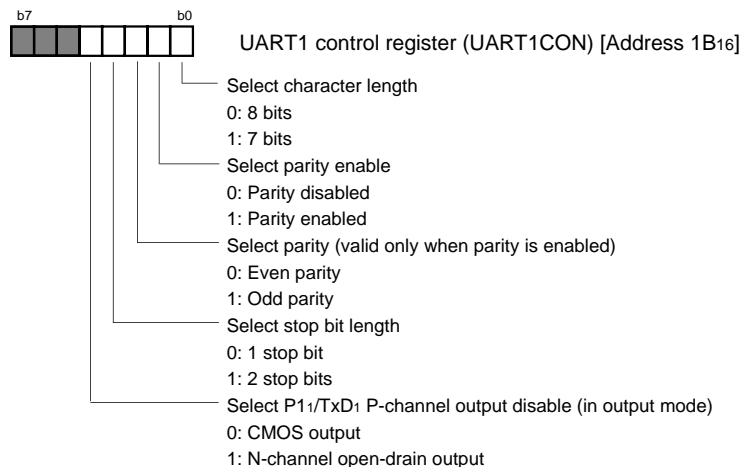
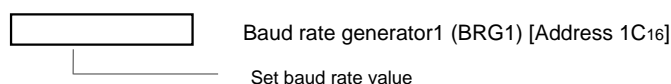


Figure 1 Setting method for UART of serial I/O1 (1)

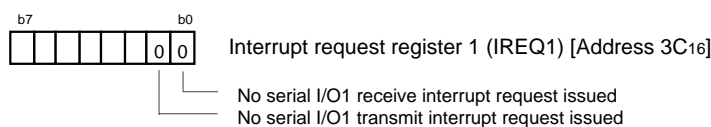
Process 4: Set UART control register.



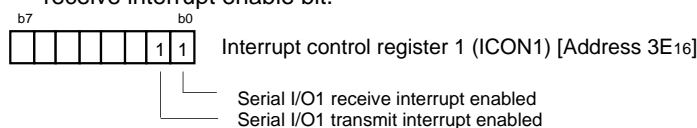
Process 5: When BRG output/16 is selected as synchronous clock, set value to baud rate generator.



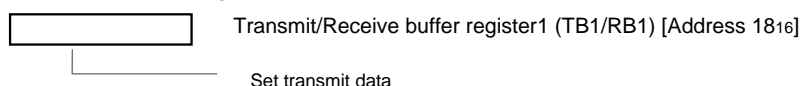
Process 6: In order not to execute the no requested interrupt processing, set "0" (no requested) to the serial I/O1 transmit/receive interrupt request bit.



Process 7: When the interrupt is used, set "1" (interrupt enabled) to the serial I/O1 transmit/receive interrupt enable bit.



Process 8: When transmitting, start serial data transmission (**Note**).



**Note:** When data transmission is executed at the state that an external clock input is selected as the synchronous clock, set the transmit data while the SCLK1 is "H" state.

Figure 2 Setting method for UART of serial I/O1 (2)

### 3.3 Communication Using UART of Serial I/O (Transmit/Receive)

**Outline** : 2-byte data is transmitted and received, using UART. Port P0<sub>0</sub> is used for communication control.

**Specifications** : •The Serial I/O1 (UART selected ) is used.

- Transfer bit rate : 9600 bps ( $f(X_{IN}) = 4.9152 \text{ MHz}$  divided by 512)
- Communication control using port P0<sub>0</sub> (output level of port P0<sub>0</sub> is controlled by software)
- 2-byte data is transferred from the transmitter to the receiver at 10 ms intervals which the timer generates.

Figure 3 shows a connection diagram, Figure 4 shows a timing chart, Figure 5 shows the control procedure of transmitter, and Figure 6 shows an example of control procedure of receiver.

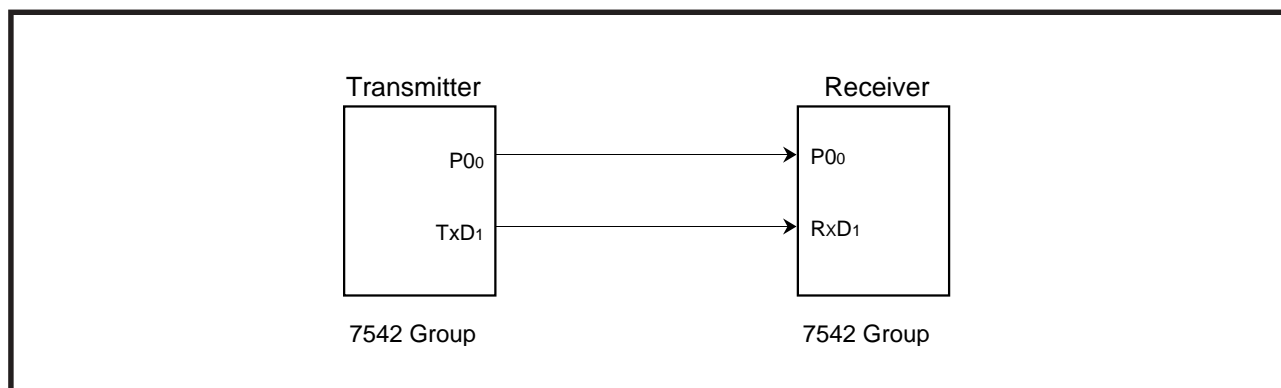


Figure 3 Connection diagram

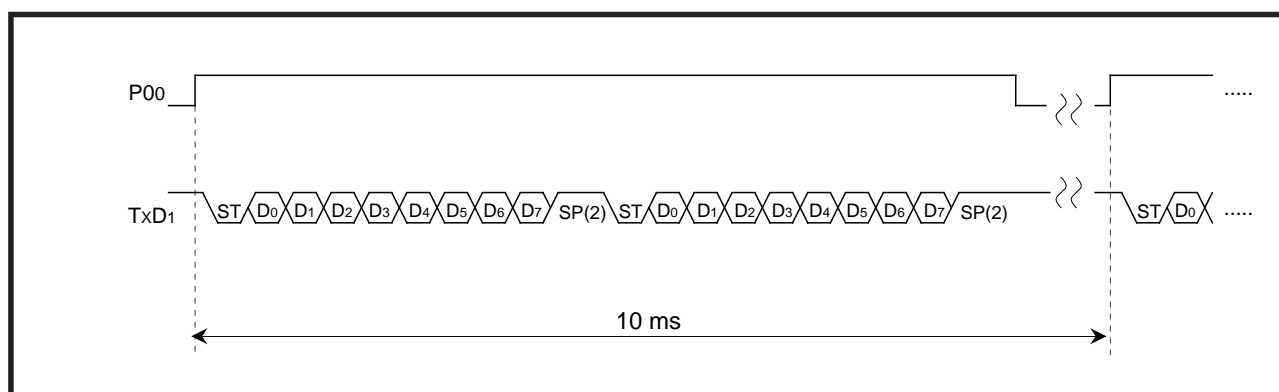


Figure 4 Timing chart

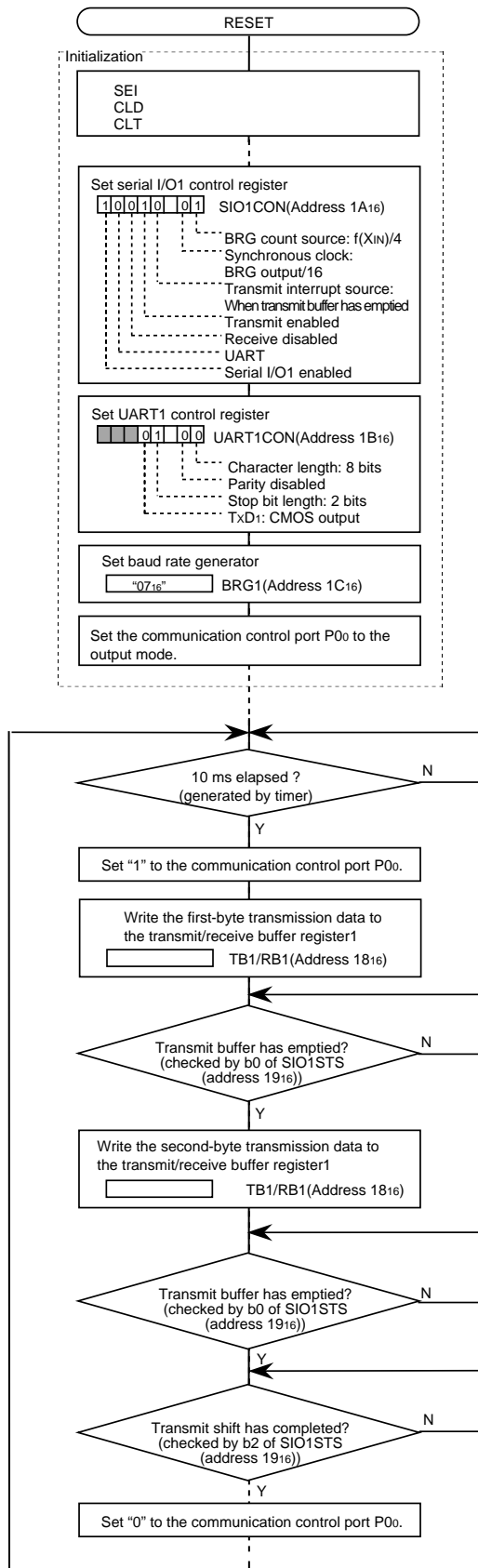


Figure 5 Control procedure of transmitter

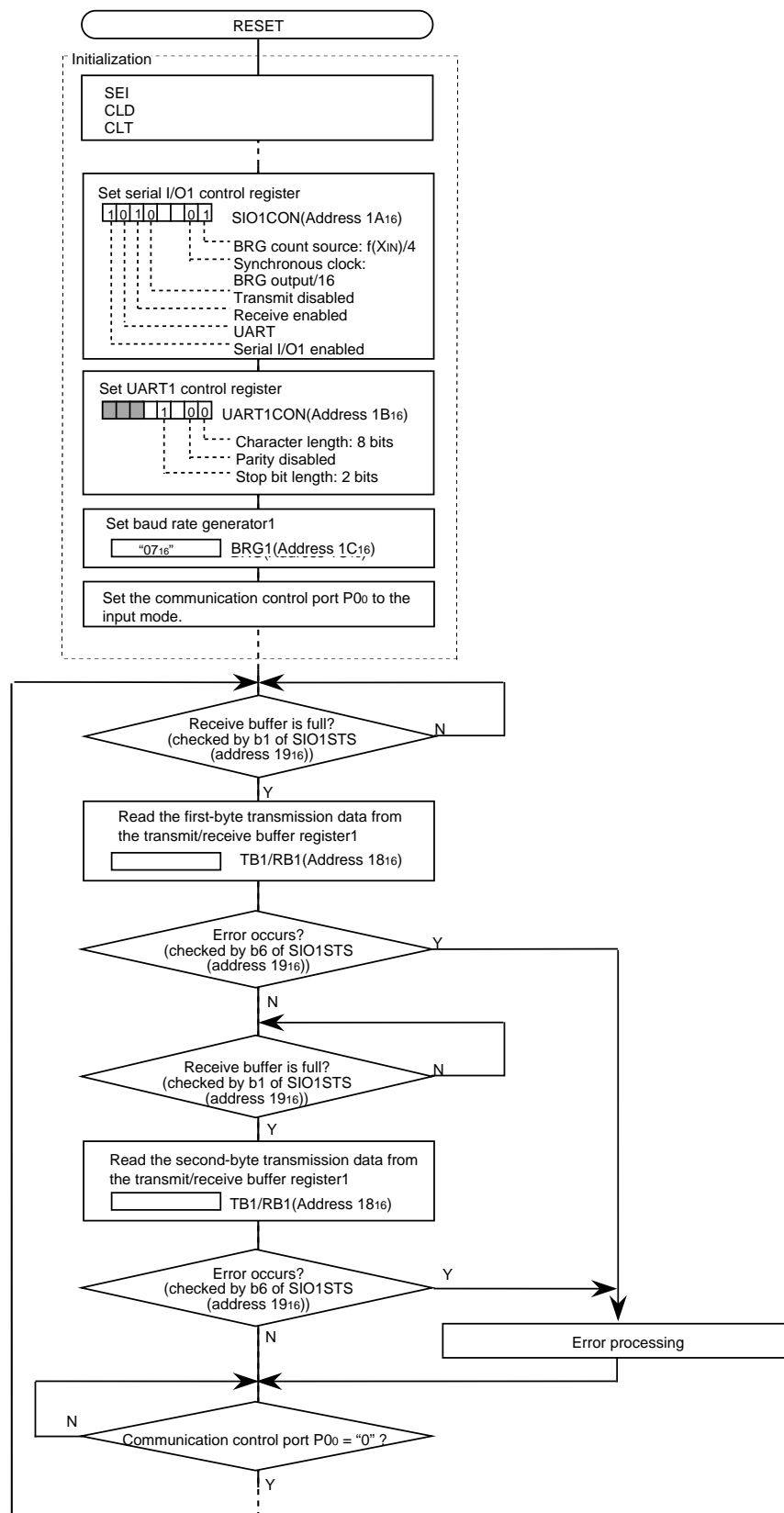


Figure 6 Control procedure of receiver

#### 4. Reference

Data Sheet  
7542 Group Data sheet

Before using this manual, please visit our website to verify that this is the most updated document available.

Renesas Technology Corporation Semiconductor Home Page  
<http://www.renesas.com/en/740>

E-mail Support  
E-mail: [support\\_apl@renesas.com](mailto:support_apl@renesas.com)

REVISION HISTORY	7542 Group Clock Asynchronous Serial I/O (UART)
------------------	---

Rev.	Date	Description	
		Page	Summary
1.00	Apr 01, 2003	-	First Edition issued
2.00	Jul 01, 2005	2	3.Contents: Description revised.

### Keep safety first in your circuit designs!

1. Renesas Technology Corporation 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 nonflammable 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 Corporation 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 Corporation or a third party.
2. Renesas Technology Corporation 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 Corporation without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corporation or an authorized Renesas Technology Corporation 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 Corporation 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 Corporation by various means, including the Renesas Technology Corporation 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 Corporation assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
5. Renesas Technology Corporation 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 Corporation or an authorized Renesas Technology Corporation 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 Corporation 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 Corporation for further details on these materials or the products contained therein.