

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.

## 38D5 Group

### Serial I/O

---

#### 1. Abstract

This document describes serial I/O for 38D5 Group.

#### 2. Introduction

The application explained in this document applies to the following MCU.

- Applicable MCU: 38D5 Group

3. Description

3.1 Serial I/O Connection Examples

3.1.1 Controlling Peripheral IC Equipped with CS Pins

Figure 3.1 shows a connection example of serial I/O. This example is a connection with a peripheral IC equipped with a CS pin in clock synchronous serial I/O mode.

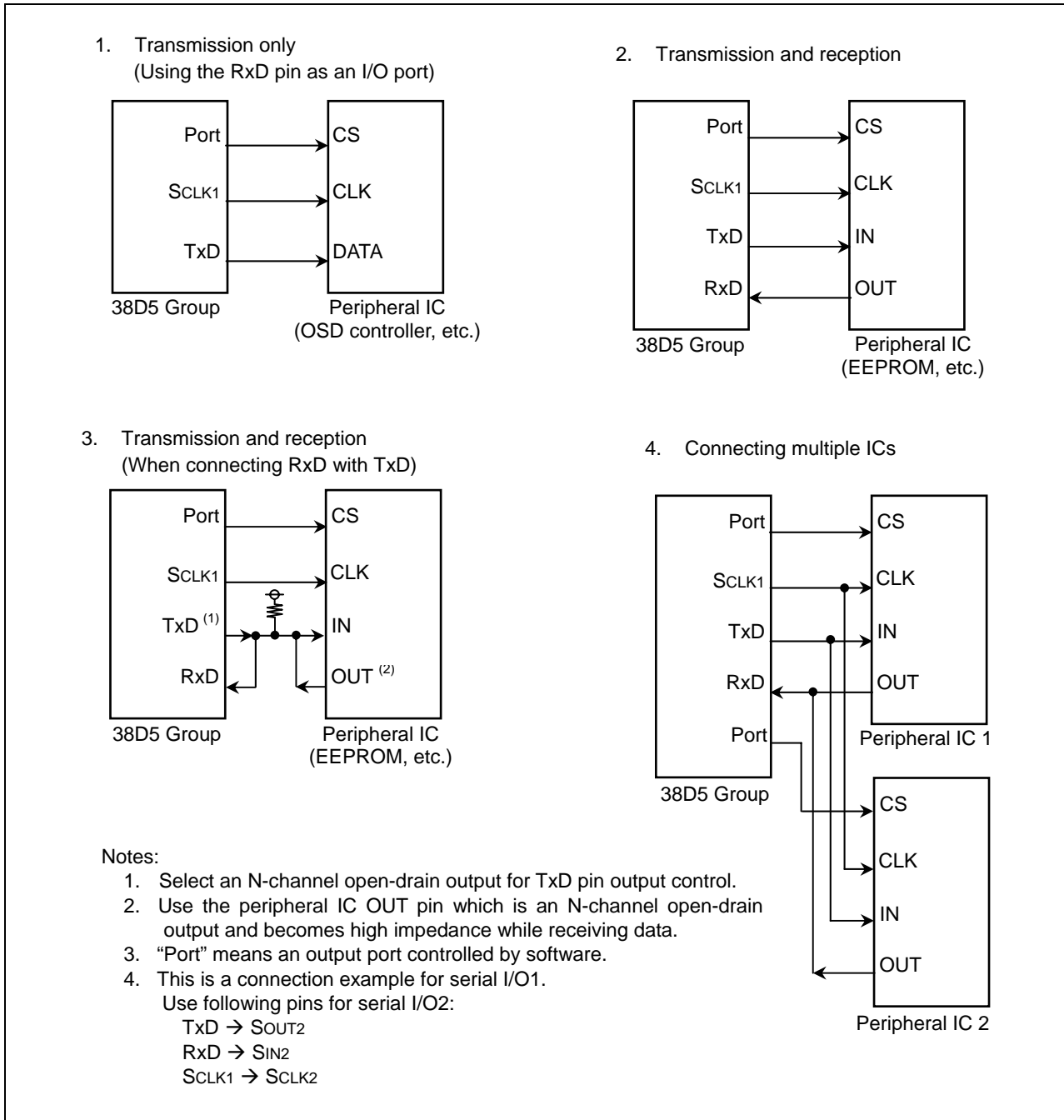


Figure 3.1 Serial I/O Connection Examples (1/2)

3.1.2 Connection with MCU

Figure 3.2 shows a connection example of serial I/O. This example shows a connection with another MCU.

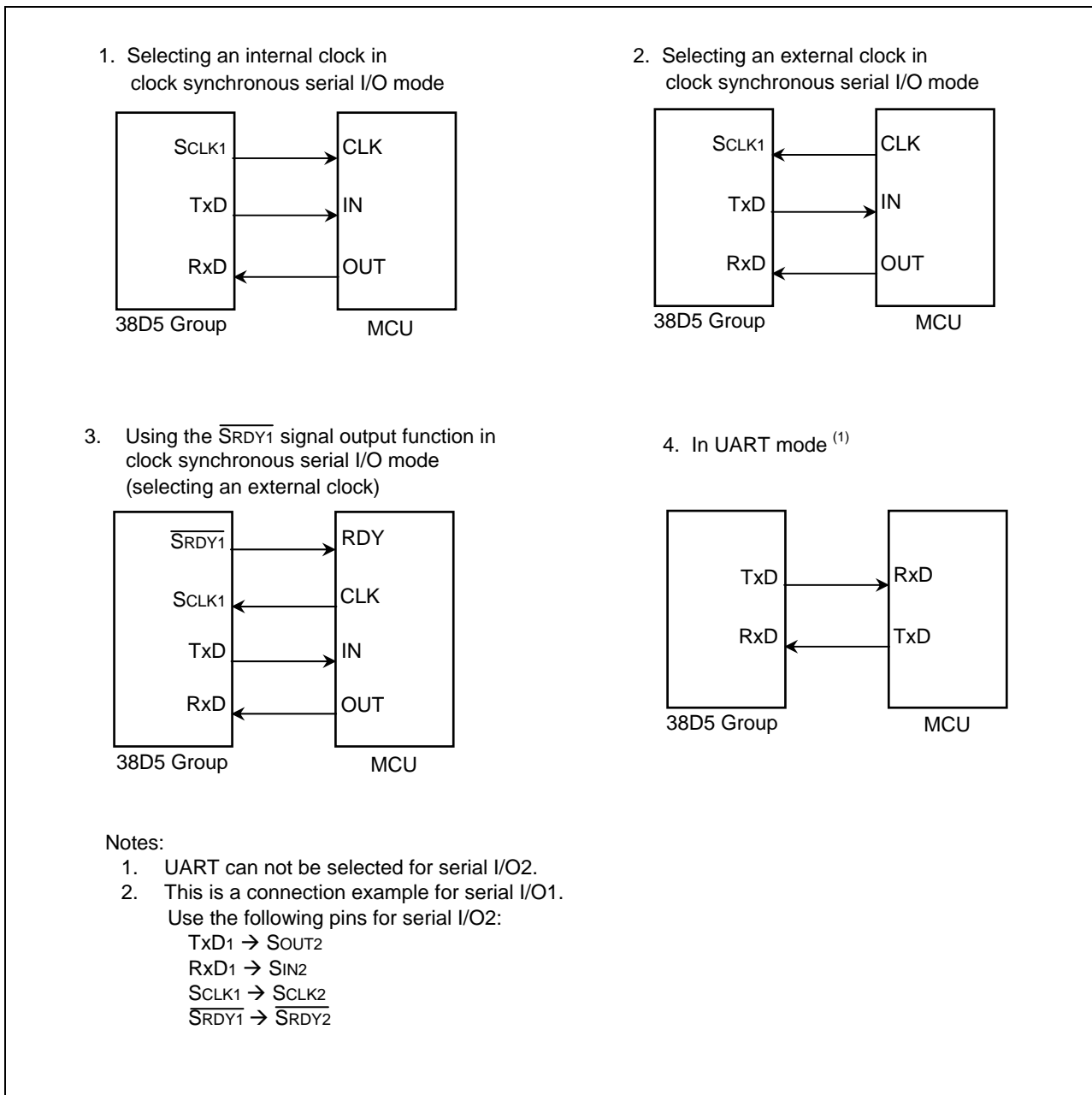


Figure 3.2 Serial I/O Connection Examples (2/2)

### 3.2 Serial I/O Transfer Data Format

Clock synchronous or clock asynchronous (UART) can be selected for serial I/O1.

Serial I/O2 operates in clock synchronous mode.

Figure 3.3 shows the serial I/O transfer data format.

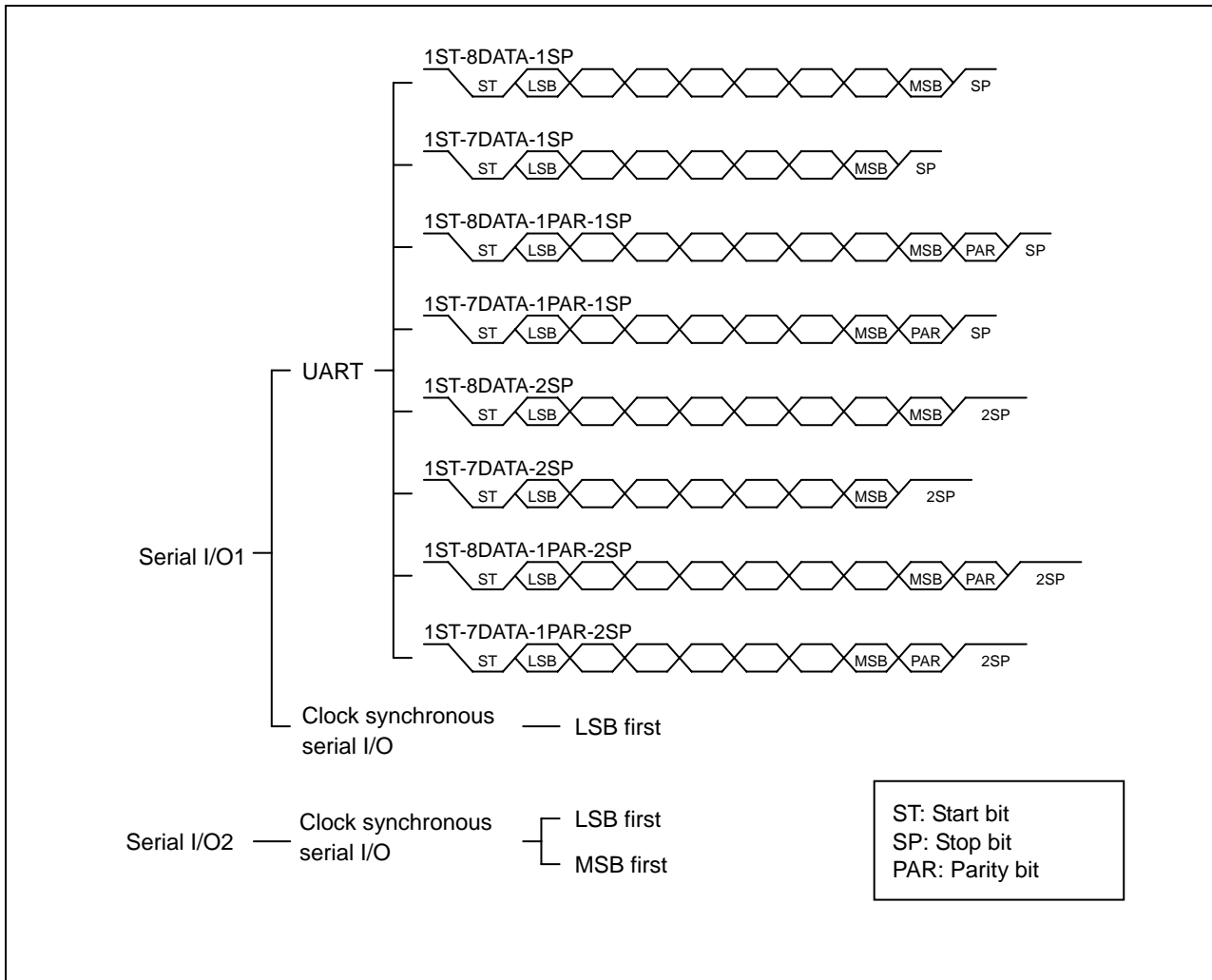


Figure 3.3 Serial I/O Transfer Data Format

### 3.3 Serial I/O1 Operation: Stop and Initialize

#### 3.3.1 Clock Synchronous Serial I/O Mode

- Stop/initialize transmit operation only when transmitting  
 Set the transmit enable bit to 0.

By setting the transmit enable bit to 0, the transmit operations listed below will be stopped and initialized:

- Stop supply of shift clock to transmit shift register
- Initialize transmit clock control circuit
- Transmit buffer empty flag becomes 0
- Transmit shift register shift complete flag becomes 0
- P41/TxD pin: I/O port P41

By setting the serial I/O1 enable bit to 0, pins P40/RxD, P41/TxD, P42/SCLK1, and P43/ $\overline{\text{SRDY1}}$  all become I/O ports.

- Stop/initialize receive operation only when receiving  
 Set the receive enable bit or serial I/O1 enable bit to 0.

By setting the receive enable bit to 0, the receive operations listed below will be stopped and initialized.

- Stop supply of shift clock to receive shift register
- Initialize receive clock control circuit
- Error flags (over-run, parity, framing, and summing error flags) become 0
- Receive buffer full flag becomes 0
- P40/RxD pin: I/O port P40

By setting the serial I/O enable bit to 0, the receive operations listed below will be stopped and initialized.

- Stop supply of shift clock to receive shift register
- Initialize receive clock control circuit
- Error flags (over-run, parity, framing, and summing error flags) become 0
- Receive buffer full flag becomes 0
- P40/RxD, P41/TxD, P42/SCLK1, and P43/ $\overline{\text{SRDY1}}$  pins: I/O ports P40, P41, P42, and P43

- Stop/initialize receive/transmit operation when both transmitting and receiving  
 Set the transmit enable bit and receive enable bit to 0 simultaneously.

#### 3.3.2 UART Mode

- Stop/initialize transmit operation  
 Set the transmit enable bit to 0.
- Stop/initialize receive operation  
 Set the receive enable bit to 0.

### 3.4 Serial I/O Pin Function and Selection Method

#### 3.4.1 Serial I/O1

Table 3.1 shows the pin functions in clock synchronous serial I/O mode, and Table 3.2 shows the pin functions in UART mode.

Table 3.1 Pin Functions in Clock Synchronous Serial I/O Mode

Pin Name	Function	Serial I/O1 Control Register (Address 1A16)								Corresponding Direction Register
		b7	b6	b5	b4	b3	b2	b1	b0	
		SIOE	SIOM	RE	TE	TIC	SRDY	SCS	CSS	
P40/RxD	RxD	1	1	1	x	x	x	x	x	x
	P40	1	1	0	x	x	x	x	x	0/1
P41/TxD	TxD	1	1	x	1	x	x	x	x	x
	P41	1	1	x	0	x	x	x	x	0/1
P42/SCLK1	SCLK1 (external clock input)	1	1	x	x	x	x	1	x	x
	SCLK1 (internal clock output)	1	1	x	1	x	x	0	x	x
P43/ $\overline{\text{SRDY1}}$	$\overline{\text{SRDY1}}$	1	1	x	x	x	1	x	x	x
	P43	1	1	x	x	x	0	x	x	0/1

Note: When SIOE is 0, all pins become I/O ports regardless of the values set to b6 to b0.

x: This is not used for the pin's function setting.

Table 3.2 Pin Functions in UART Mode

Pin Name	Function	Serial I/O1 Control Register (Address 1A16)								Corresponding Direction Register
		b7	b6	b5	b4	b3	b2	b1	b0	
		SIOE	SIOM	RE	TE	TIC	SRDY	SCS	CSS	
P40/RxD	RxD	1	0	1	x	x	x	x	x	x
	P40	1	0	0	x	x	x	x	x	0/1
P41/TxD	TxD	1	0	x	1	x	x	x	x	x
	P41	1	0	x	0	x	x	x	x	0/1
P42/SCLK1	SCLK1 (external clock input)	1	0	x	x	x	x	1	x	x
	P42	1	0	x	x	x	x	0	x	0/1
P43/ $\overline{\text{SRDY1}}$	P43	1	0	x	x	x	x	x	x	0/1

Note: When SIOE is 0, all pins become I/O ports regardless of the values set to b6 to b0.

x: This is not used for the pin's function setting.



### 3.4.2 Serial I/O2

Table 3.3 shows the pin functions in clock synchronous serial I/O mode.

Table 3.3 Pin Functions in Clock Synchronous Serial I/O Mode

Pin Name	Function	Serial I/O2 Control Register								Corresponding Direction Register
		SIO2CON (Address 1D16)								
		b7	b6	b5	b4	b3	b2	b1	b0	
P44/SIN2	SIN2 <sup>(1)</sup>	x	x	x	x	1	x	x	x	0
	P44	x	x	x	x	x	x	x	x	0/1
P45/SOUT2	SOUT2	x	x	x	x	1	x	x	x	x
P46/SCLK2	SCLK2 <sup>(2)</sup> (external clock input)	x	0	x	x	1	x	x	x	x
	SCLK2 (internal clock output)	x	1	x	x	1	x	x	x	x
P47/ $\overline{\text{SRDY2}}$	$\overline{\text{SRDY2}}$	1	x	x	x	1	x	x	x	x
	P47	0	x	x	x	1	x	x	x	0/1

Notes:

1. Although this pin functions as SIN2 when SIO2CON.b3 is 0, set SIO2CON.b3 to 1.
2. Although this pin functions as SCLK2 when SIO2CON.b3 and corresponding direction register are 0, set SIO2CON.b3 to 1.
3. When SIO2CON.b3 is 0, all pins become I/O ports regardless of the values set to SIO2CON.b7 to SIO2CON.b4 and SIO2CON.b2 to SIO2CON.b0.

x: This is not used for the pin's function setting.

#### 4. Reference Document

##### Datasheet

##### 38D5 Group Datasheet

The latest version can be downloaded from the Renesas Technology Website.

##### Technical News/Technical Updates

The latest information can be downloaded from the Renesas Technology Website.

## Website and Support

Renesas Technology Website  
<http://www.renesas.com/>

Inquiries  
<http://www.renesas.com/inquiry>  
[csc@renesas.com](mailto:csc@renesas.com)

REVISION HISTORY	38D5 Group Serial I/O
------------------	--------------------------

Rev.	Date	Description	
		Page	Summary
1.00	Sep 30, 2008	—	First Edition issued

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

## Notes regarding these materials

1. This document is provided for reference purposes only so that Renesas customers may select the appropriate Renesas products for their use. Renesas neither makes warranties or representations with respect to the accuracy or completeness of the information contained in this document nor grants any license to any intellectual property rights or any other rights of Renesas or any third party with respect to the information in this document.
2. Renesas shall have no liability for damages or infringement of any intellectual property or other rights arising out of the use of any information in this document, including, but not limited to, product data, diagrams, charts, programs, algorithms, and application circuit examples.
3. You should not use the products or the technology described in this document for the purpose of military applications such as the development of weapons of mass destruction or for the purpose of any other military use. When exporting the products or technology described herein, you should follow the applicable export control laws and regulations, and procedures required by such laws and regulations.
4. All information included in this document such as product data, diagrams, charts, programs, algorithms, and application circuit examples, 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 products listed in this document, please confirm the latest product information with a Renesas sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas such as that disclosed through our website. (<http://www.renesas.com>)
5. Renesas has used reasonable care in compiling the information included in this document, but Renesas assumes no liability whatsoever for any damages incurred as a result of errors or omissions in the information included in this document.
6. When using or otherwise relying on the information in this document, you should evaluate the information in light of the total system before deciding about the applicability of such information to the intended application. Renesas makes no representations, warranties or guaranties regarding the suitability of its products for any particular application and specifically disclaims any liability arising out of the application and use of the information in this document or Renesas products.
7. With the exception of products specified by Renesas as suitable for automobile applications, Renesas products are not designed, manufactured or tested for applications or otherwise in systems the failure or malfunction of which may cause a direct threat to human life or create a risk of human injury or which require especially high quality and reliability such as safety systems, or equipment or systems for transportation and traffic, healthcare, combustion control, aerospace and aeronautics, nuclear power, or undersea communication transmission. If you are considering the use of our products for such purposes, please contact a Renesas sales office beforehand. Renesas shall have no liability for damages arising out of the uses set forth above.
8. Notwithstanding the preceding paragraph, you should not use Renesas products for the purposes listed below:
  - (1) artificial life support devices or systems
  - (2) surgical implantations
  - (3) healthcare intervention (e.g., excision, administration of medication, etc.)
  - (4) any other purposes that pose a direct threat to human life
 Renesas shall have no liability for damages arising out of the uses set forth in the above and purchasers who elect to use Renesas products in any of the foregoing applications shall indemnify and hold harmless Renesas Technology Corp., its affiliated companies and their officers, directors, and employees against any and all damages arising out of such applications.
9. You should use the products described herein within the range specified by Renesas, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas shall have no liability for malfunctions or damages arising out of the use of Renesas products beyond such specified ranges.
10. Although Renesas endeavors to improve the quality and reliability of its products, IC products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Please be sure to implement safety measures to guard against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas 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 applicable measures. Among others, since the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
11. In case Renesas products listed in this document are detached from the products to which the Renesas products are attached or affixed, the risk of accident such as swallowing by infants and small children is very high. You should implement safety measures so that Renesas products may not be easily detached from your products. Renesas shall have no liability for damages arising out of such detachment.
12. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written approval from Renesas.
13. Please contact a Renesas sales office if you have any questions regarding the information contained in this document, Renesas semiconductor products, or if you have any other inquiries.