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April 1st, 2010
Renesas Electronics Corporation

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# 3823 Group

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

## 1. Abstract

The following article introduces and shows an example of how to use the Serial I/O (Clock Asynchronous Serial I/O (UART) Mode) on the 3823 group device.

## 2. Introduction

The explanation of this issue is applied to the following conditions:
Applicable MCU: 3823 Group
Oscillation frequency: 4.9152 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 Communication Using Asynchronous Serial I/O (UART) (Transmit/Receive)

Outline: 2-byte data is transmitted and received using UART
Port P41 is used for communication control

Specifications:

- Serial I/O (UART mode) is used.
- Transfer bit rate: 9600 bps (f(XIN) = 4.9152 MHz divided by 512)
- Communication is controlled by port P41 (output level of P41 is controlled by a program).
- 2-byte data is transferred from the transmitting side to the receiving side at 10 ms intervals (generated by a timer).

Figure 3.1 shows the Connection Diagram and Figure 3.2 shows the Timing Chart

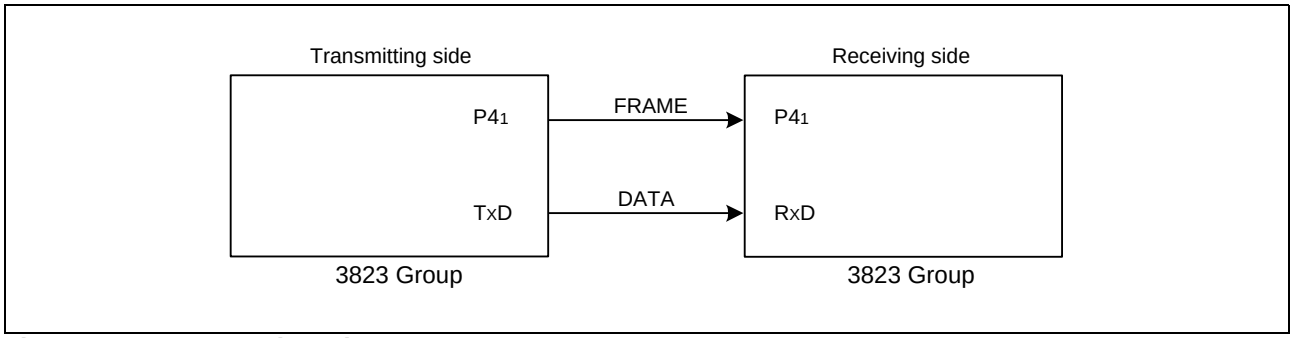



**Figure 3.1 Connection Diagram**

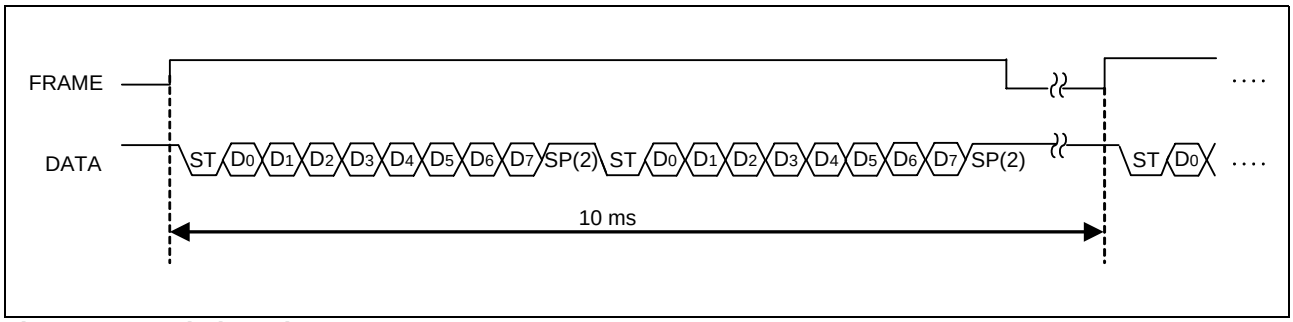



**Figure 3.2 Timing Chart**

Table 3.1 lists an Example of Baud Rate Generator Set Value and Transfer Bit Rate Selection, Figure 3.3 shows the Transmission Related Register Settings, Figure 3.4 shows the Reception Related Register Settings, Figure 3.5 shows the Transmitting Side Control Procedure, and Figure 3.6 shows the Receiving Side Control Procedure.

Table 3.1 Example of Baud Rate Generator Set Value and Transfer Bit Rate Selection

| BRG Count Source (Note 1) | BRG Setting Value | Transfer Bit Rate (bps) (Note 2) | |
|---|---|---|---|
| | | f(XIN) = 4.9152MHz | f(XIN) = 8MHz |
| f(XIN)/4 | 255($FF_{16}$) | 300 | 488.28125 |
| f(XIN)/4 | 127($7F_{16}$) | 600 | 976.5625 |
| f(XIN)/4 | 63($3F_{16}$) | 1200 | 1953.125 |
| f(XIN)/4 | 31($1F_{16}$) | 2400 | 3906.25 |
| f(XIN)/4 | 15($0F_{16}$) | 4800 | 7812.5 |
| f(XIN)/4 | 7($07_{16}$) | 9600 | 15625 |
| f(XIN)/4 | 3($03_{16}$) | 19200 | 31250 |
| f(XIN)/4 | 1($01_{16}$) | 38400 | 62500 |
| f(XIN) | 3($03_{16}$) | 76800 | 125000 |
| f(XIN) | 1($01_{16}$) | 153600 | 250000 |
| f(XIN) | 0($00_{16}$) | 307200 | 500000 |

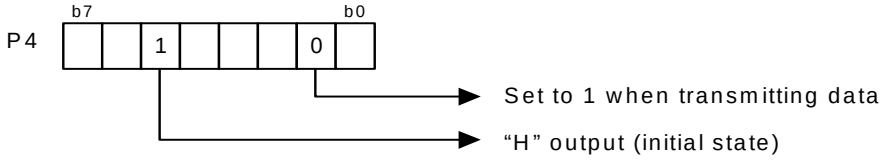
Notes:
1. The BRG count source is selected by bit 0 at the serial I/O control register.
2. Calculating formula of the transfer bit rate

$$\text{Transfer bit rate (bps)} = \frac{f(X_{IN})}{(\text{BRG set value} + 1) \times 16 \times m}$$

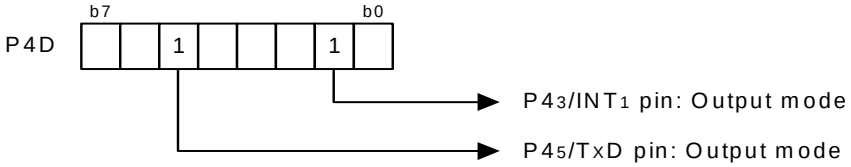
m : When bit 0 at the serial I/O control register = 0, m = 1
When bit 0 at the serial I/O control register = 1, m = 4

## Transmitting Side

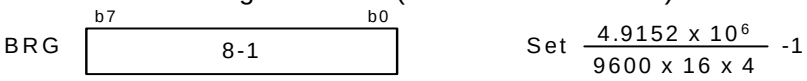
Port P4 register (Address: 0008$_{16}$)



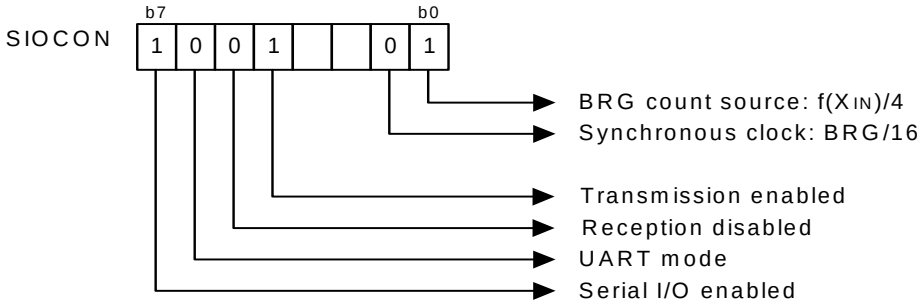

Port P4 direction register (Address: 0009$_{16}$)



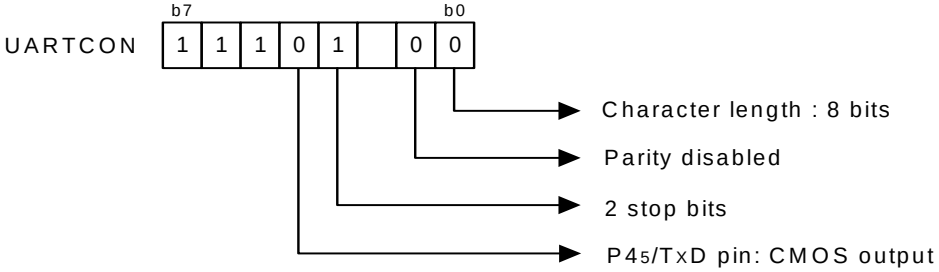

Baud rate generator (Address: 001C$_{16}$)



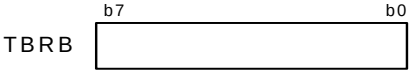

Serial I/O control register (Address: 001A$_{16}$)




UART control register (Address: 001B$_{16}$)




Transmit buffer register (Address: 0018$_{16}$)




Write transmission data
Write data after confirming transmission of the previous data is completed (TSC = 1)

Serial I/O Status Register (Address: 0019$_{16}$)

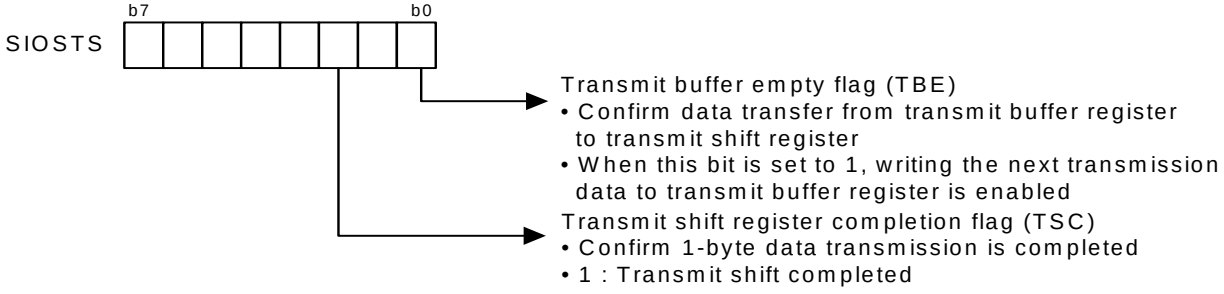



**Figure 3.3 Transmission Related Register Settings**

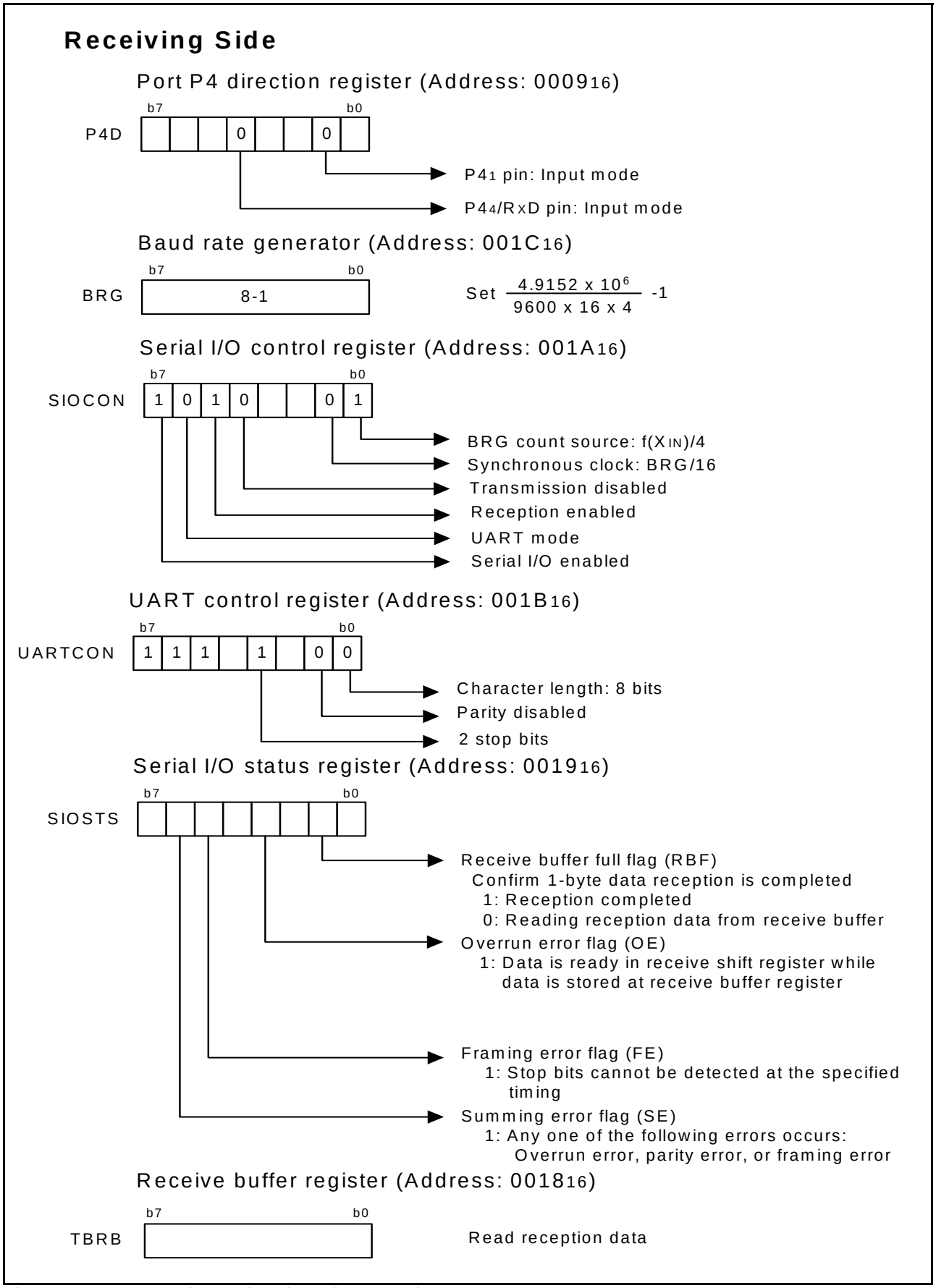



**Figure 3.4 Reception Related Register Settings**

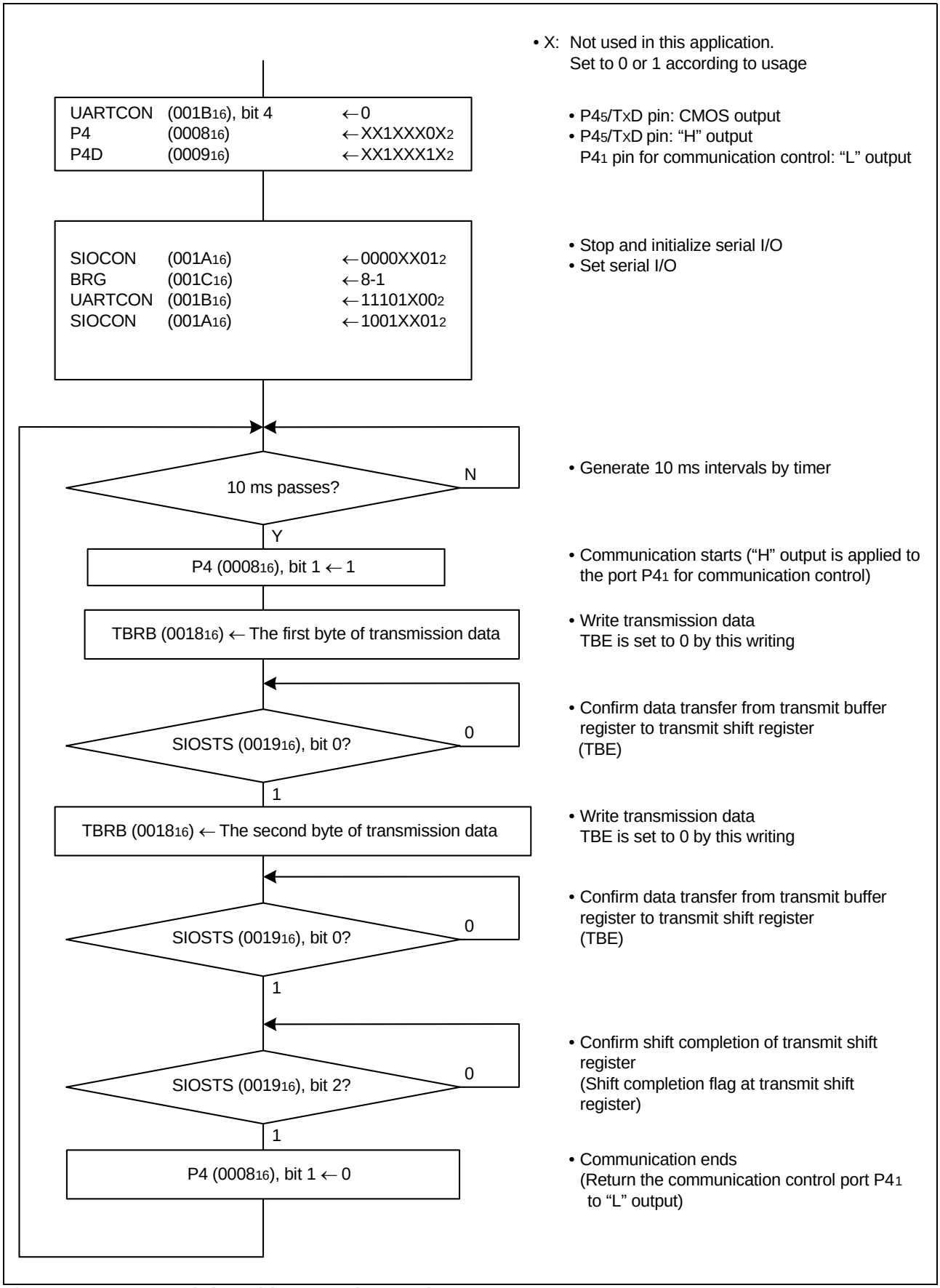



**Figure 3.5 Transmitting Side Control Procedure**

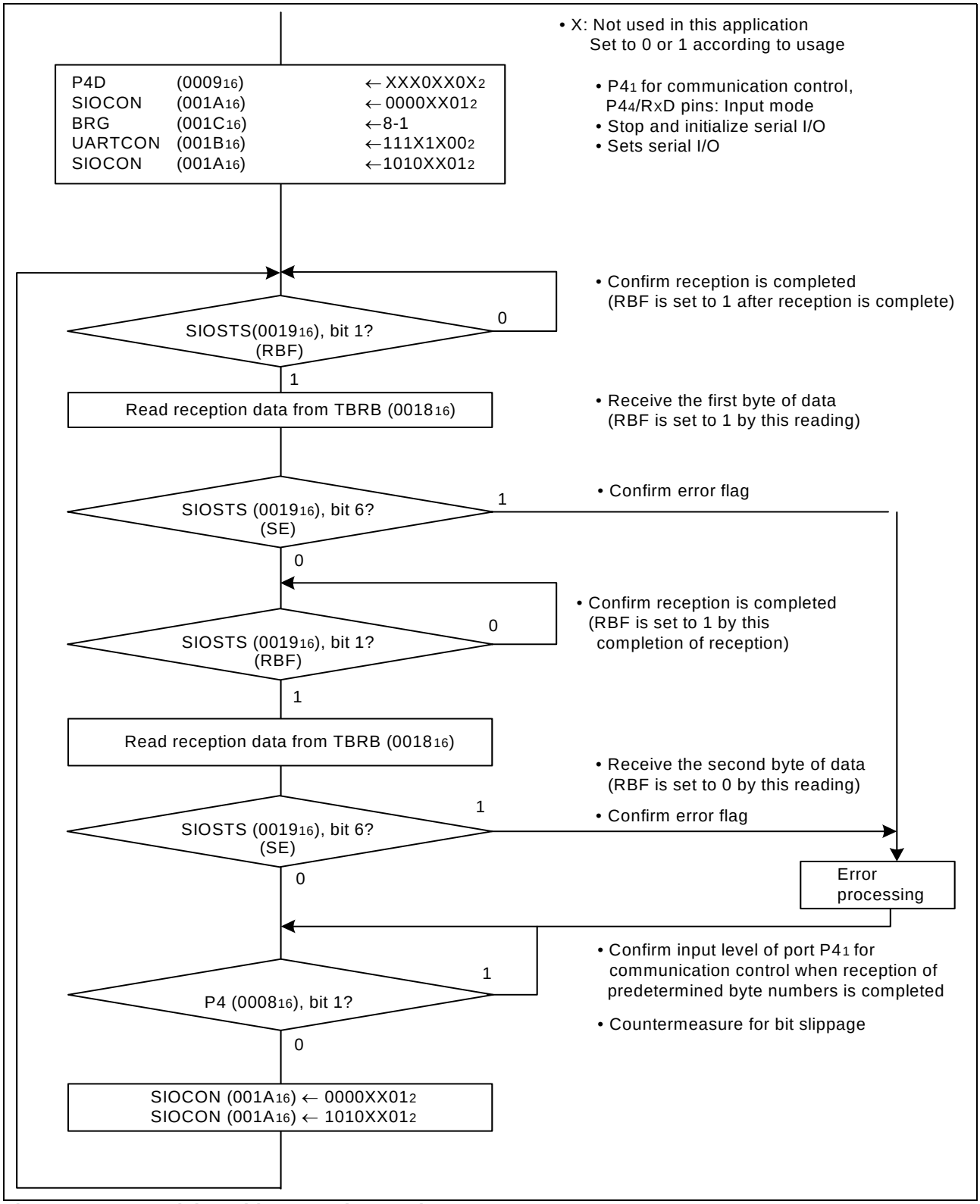



**Figure 3.6 Receiving Side Control Procedure**

## 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 3823 Group.

## 5. Reference Document

Datasheet
3823 Group Data sheet
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|---|---|

| Rev. | Date | Description | |
|---|---|---|---|
| | | Page | Summary |
| 1.00 | Aug 10, 2006 | – | First Edition issued |
| | | | |

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