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April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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## 38C2 Group

### Serial I/O 1,2 (Asynchronous Serial I/O (UART) Mode)

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#### 1. Abstract

The following document describes examples how to set the serial I/O1 (clock asynchronous serial I/O (UART) mode) and application examples in the 38C2 group.

The serial I/O2 can be used as well as the serial I/O1.

#### 2. Introduction

The application example described in this document is applied to the following conditions:

Applicable MCU: 38C2 Group

Oscillation frequency: 4.9152MHz

Set transfer speed within the timing requirements and switching characteristics of data sheet.

In this sample program, the bit of the function which is not used may be operated according to the bit assignment of SFR. Please set these setting values according to the use status of a user system.

3. Contents

3.1 Communication Using Asynchronous Serial I/O (UART) (Transmit/Receive)

Outline: 2-byte data is transmitted and received, using the UART.  
The port P51 is used for communication control.

Specifications:

- Serial I/O1 (UART mode) is used.
- Bit rate : 9600bps ( $f(XIN)=\text{divided-by-512 of } 4.9152\text{MHz}$ )
- Communication control using the port P51 (output level of the P51 is controlled by a program).
- 2-byte data is transferred from transmitting side to receiving side at 10ms intervals (generated by a timer)

Figure 3.1 shows the Connection Diagram; Figure 3.2 shows the Timing Chart.

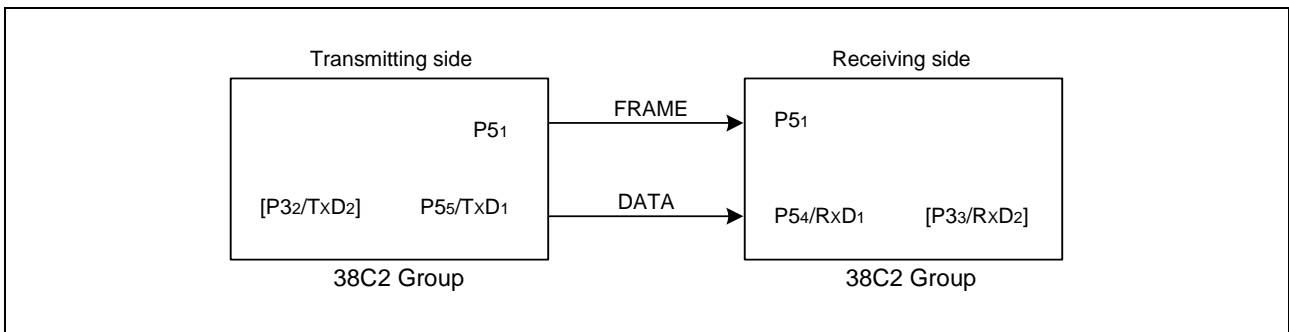


Figure 3.1 Connection Diagram

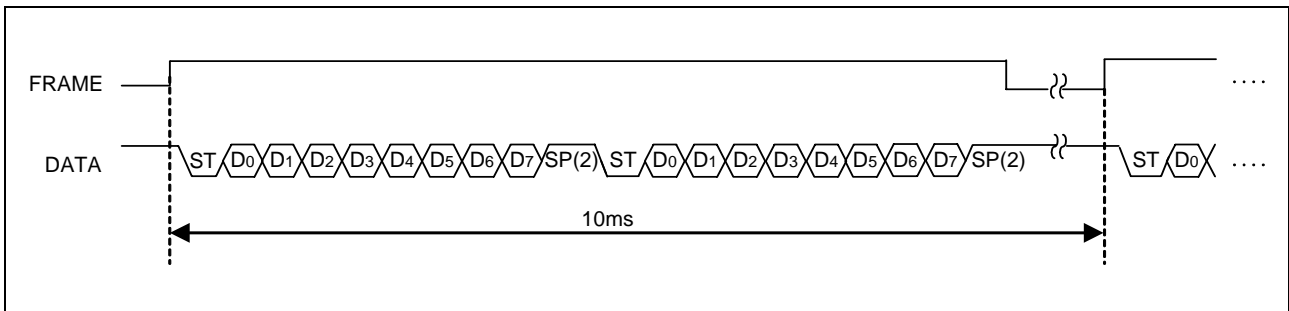


Figure 3.2 Timing Chart

Table 3.1 lists a Selecting Example of Baud Rate Generator Setting Value and Bit Rate; Figure 3.3 shows the Registers Setting Relevant to the Transmitting Side; Figure 3.4 shows the Registers Setting Relevant to the Receiving Side; Figure 3.5 shows the Control Procedure of Transmitting Side; Figure 3.6 shows the Control Procedure of Receiving Side.

Table 3.1 Selecting Example of Baud Rate Generator Setting Value and Bit Rate

BRG Count Source <sup>(1)</sup>	BRG Setting Value	Bit Rate (bps) <sup>(2)</sup>	
		f(XIN) = 4.9152MHz	f(XIN) = 8MHz
f(Xin)/4	255(FF <sub>16</sub> )	300	488.28125
f(Xin)/4	127(7F <sub>16</sub> )	600	976.5625
f(Xin)/4	63(3F <sub>16</sub> )	1200	1953.125
f(Xin)/4	31(1F <sub>16</sub> )	2400	3906.25
f(Xin)/4	15(0F <sub>16</sub> )	4800	7812.5
f(Xin)/4	7(07 <sub>16</sub> )	9600	15625
f(Xin)/4	3(03 <sub>16</sub> )	19200	31250
f(Xin)/4	1(01 <sub>16</sub> )	38400	62500
f(Xin)	3(03 <sub>16</sub> )	76800	125000
f(Xin)	1(01 <sub>16</sub> )	153600	250000
f(Xin)	0(00 <sub>16</sub> )	307200	500000

NOTES:

1. The BRG count source is selected by the bit 0 of the BRG count source selection bit (the bit 0 in the serial I/O1 control register (00FE0<sub>16</sub>) or the bit 0 in the serial I/O 2 control register (00FE3<sub>16</sub>)).
2. Calculating formula of bit rate

$$\text{Bit rate (bps)} = \frac{f(\text{XIN})}{(\text{BRG setting value} \times 16 \times m)}$$

m : When BRG count source selection bit = "0", m=1  
 When BRG count source selection bit = "1", m=4

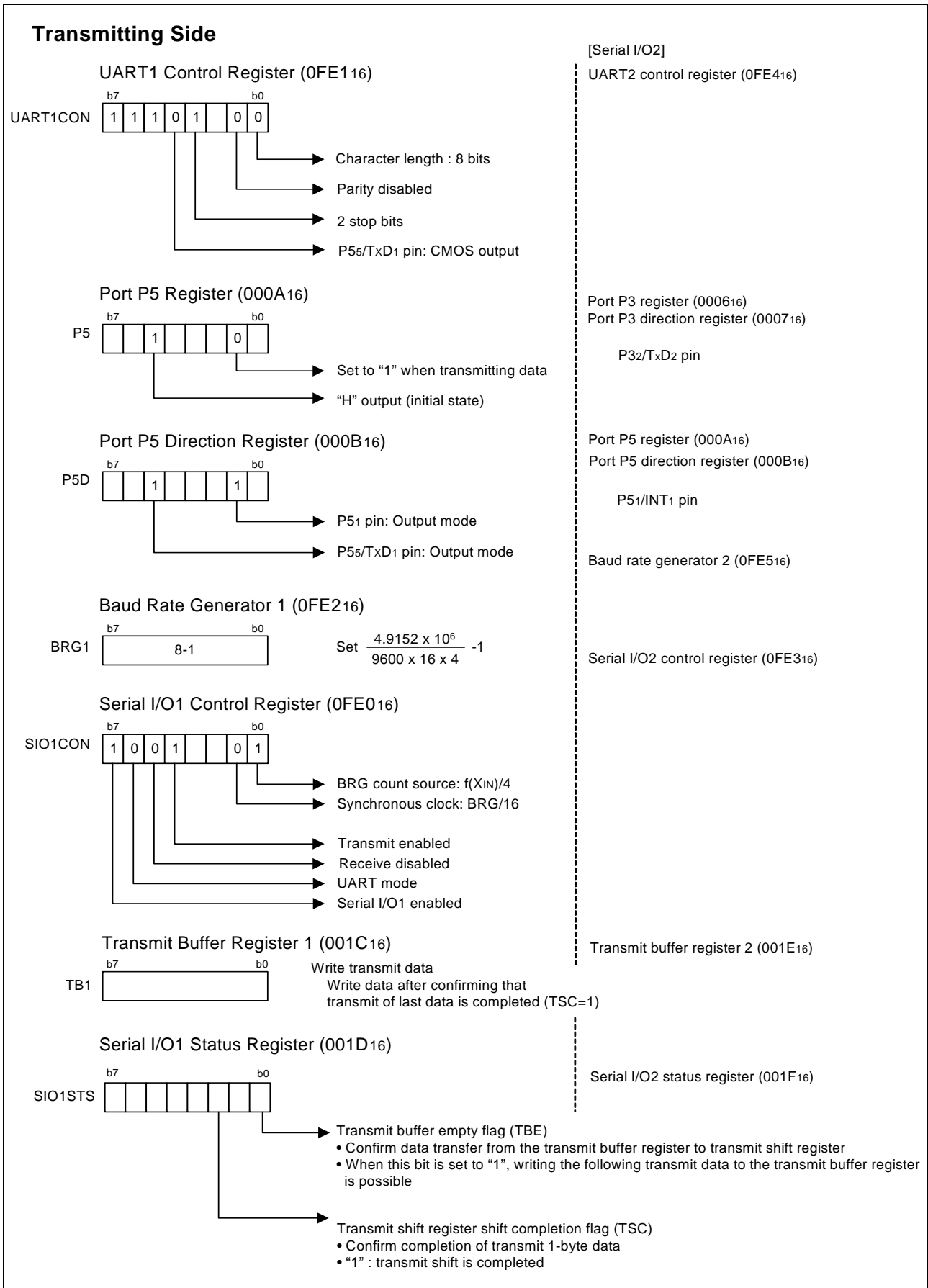


Figure 3.3 Registers Setting Relevant to the Transmitting Side



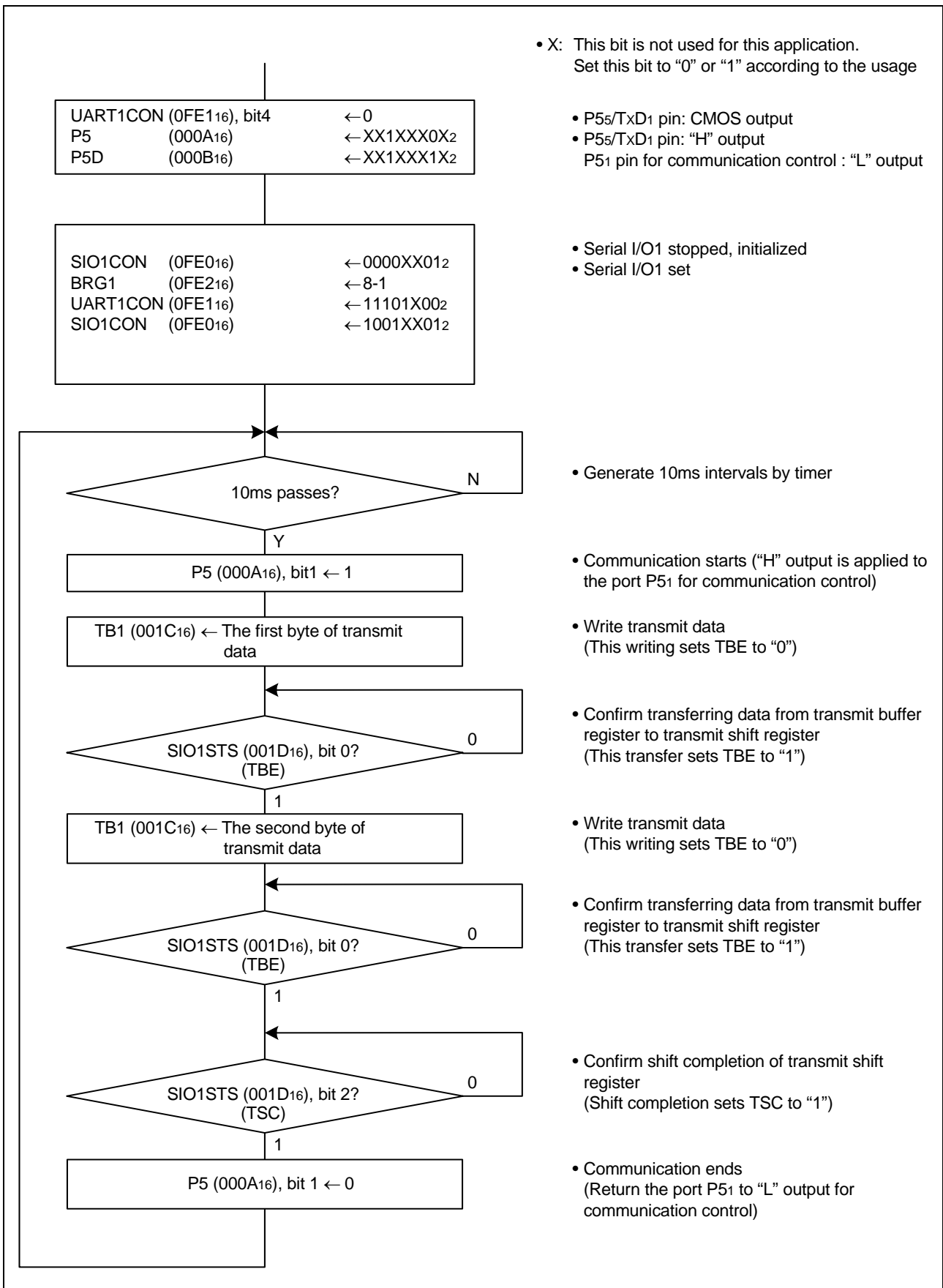


Figure 3.5 Control Procedure of Transmitting Side



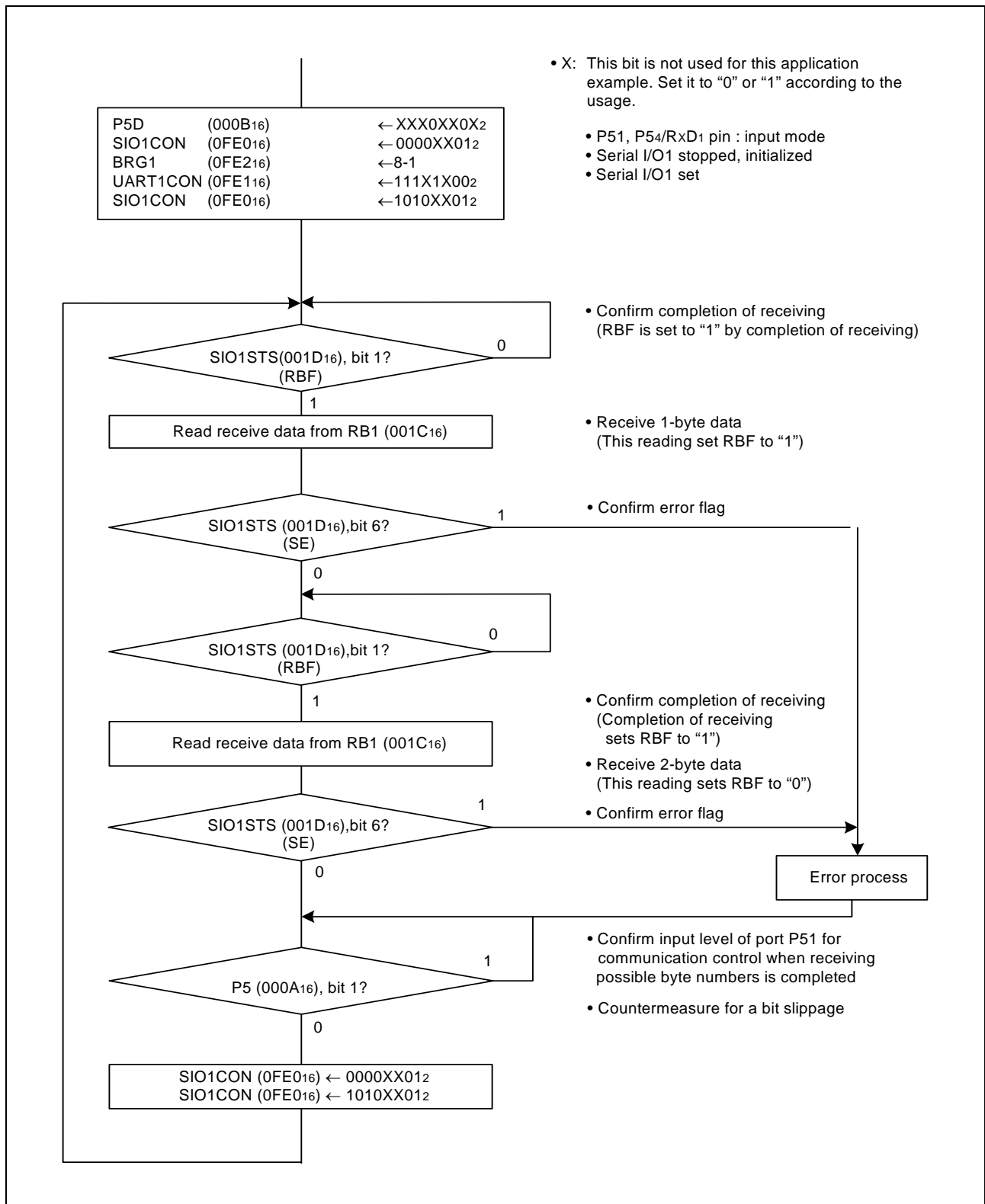


Figure 3.6 Control Procedure of Receiving Side

## 4. Sample Programming Code

```

Transmitting Side
[Setting of control register]

    LDA UART1CON           ;Set TXD CMOS-OUT
    AND #%11101111
    STA UART1CON
    LDM #%00100000,P5      ;Set Port P5 register
    LDM #%00100010,P5D    ;Set Port P5 direction register
;
    LDA #%00000001        ;Set Serial I/O1 control register
    STA SIO1CON
    LDA #8-1              ;Set SIO/UART bit rate generator 1
    STA BRG1
    LDA #%11101000        ;Set UART control register 1
    STA UART1CON
    LDA #%10010001        ;Set SIO/UART bit rate generator
    STA SIO1CON
;
;   Generate 10ms by Timer2
;

[Main routine process]

__MAIN:
    BBC 1,IREQ2,__MAIN    ;10ms check ?-> no
    CLB 1,IREQ2
;
    SEB 1,P5
;
    LDA SEND_DATA
    STA TB1               ;Send data write
;
__MAIN00:
    BBC 0,SIO1STS,__MAIN00 ;data send? -> no
;
    LDA SEND_DATA+1
    STA TB1               ;Next send data write
;
__MAIN01:
    BBC 0,SIO1STS,__MAIN01 ;data send? -> no
;
__MAIN02:
    BBC 2,SIO1STS,__MAIN02 ;Shift end check ?-> no
;
    CLB 1,P5              ;Send end
;
    BRA __MAIN
;

```

```

Receiving Side
[Setting of control register]

    LDM #%00000000,P5D      ;Set Port P5 direction register
;
    LDA #%00000001        ;Set Serial I/O1 control register
    STA SIO1CON
    LDA #8-1              ;Set SIO/UART bit rate generator 1
    STA BRG1
    LDA #%11101000        ;Set UART control register 1
    STA UART1CON
    LDA #%10100001        ;Set Serial I/O1 control register
    STA SIO1CON
;

[Main routine process]

__MAIN:
    BBC 1,SIO1STS,__MAIN   ;Receive end ?-> no
;
    LDA RB1
    STA RECV_DATA          ;Receive data set
;
    BBS 6,SIO1STS,__ERROR  ;Error flag ?-> yes
;
__MAIN00:
    BBC 1,SIO1STS,__MAIN00 ;Receive end ?-> no
;
    LDA RB1
    STA RECV_DATA+1        ;Receive data set
;
    BBC 6,SIO1STS,__MAIN01 ;Error flag ?-> no
;
__ERROR:
    ;Error
    LDA #$0
    STA RECV_DATA          ;Receive data set
;
__MAIN01:
    BBS 1,P5,__MAIN01     ;P51 input? -> no
;
    LDM #%00000001,SIO1CON ;Set Serial I/O1 control register
    LDM #%10100001,SIO1CON ;Set Serial I/O1 control register
;
    BRA __MAIN
;

```

## 5. Reference

Data Sheet  
38C2 Group (A version) Data sheet

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REVISION HISTORY	38C2 Group Serial I/O 1,2 (Asynchronous Serial I/O (UART) Mode)
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Rev.	Date	Description	
		Page	Summary
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