7542 Group

Clock Asynchronous Serial I/O (UART)

1.0 Abstract

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

2.0 Introduction

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

3.0 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, since it has an equivalent function to serial I/O1, 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*1 : "1" or "4" is selected (set by bit 0 of serial I/O1 control register)
BRG1 setting value*2 : 0 to 255 (00_{16} to FF_{16}) is set

● When the external clock is selected

Transfer bit rate [bps] = Clock input to S_{CLK1} pin/16

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

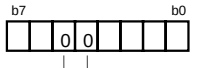
Table 1 Setting example of baud rate generator1 (BRG1) and transfer bit rate values

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

3.2 UART Setting Method

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

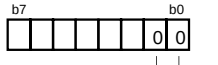
Process 1: Stop and initialize serial I/O.



Serial I/O1 control register (SIO1CON) [Address $1A_{16}$]

Transmit operation stop and initialization
Receive operation stop and initialization

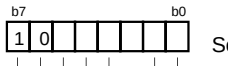
Process 2: Disable serial I/O1 transmit/receive interrupt.



Interrupt control register 1 (ICON1) [Address $3E_{16}$]

Serial I/O1 receive interrupt disabled
Serial I/O1 transmit interrupt disabled

Process 3: Set serial I/O1 control register.



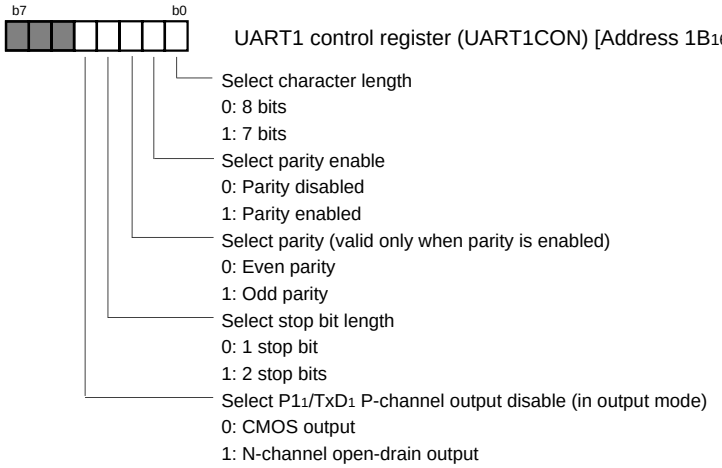
Serial I/O1 control register (SIO1CON) [Address $1A_{16}$]

BRG count source selected (set in internal clock selected)
0: f(X_{IN})
1: f(X_{IN})/4
Serial I/O1 synchronous clock selected (**Note 1**)
0: BRG output/16
1: External clock input/16
Transmit interrupt source selected
0: When transmit buffer has emptied
1: When transmit shift operation is completed
Transmit enable selected
0: Transmit disabled (at half-duplex communication receive)
1: Transmit enabled (at full-duplex communication) (**Note 2**)
Receive enable selected
0: Receive disabled (at half-duplex communication transmit)
1: Receive enabled (at full-duplex communication) (**Note 2**)
Clock asynchronous serial I/O
Serial I/O1 enabled ($P1_0$–$P1_2$ pins operate as serial I/O1 pins)(**Note 3**)

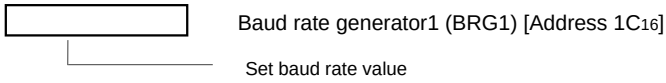
Note 1: Setting of serial I/O1 synchronous clock selection bit is as follows;
"0": $P1_2$ pin can be used as a normal I/O pin
"1": $P1_2$ pin is used as an input pin for an external clock.
2: When data transmission is executed at the state that an external clock input is selected as the synchronous clock, set "1" to the transmit enable bit while the S_{CLK1} is "H" state.
3: When clock asynchronous (UART) serial I/O is selected, $P1_3$ pin can be used as a normal I/O pin.

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

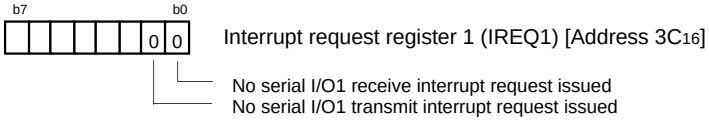
Process 4: Set UART control register.



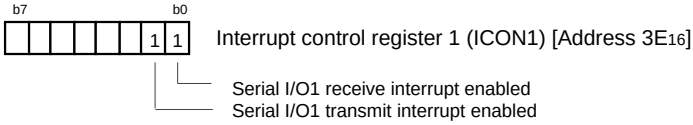
Process 5: When BRG output/16 is selected as synchronous clock, set value to baud rate generator.



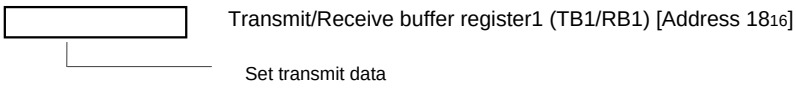
Process 6: In order not to execute the no requested interrupt processing, set “0” (no requested) to the serial I/O1 transmit/receive interrupt request bit.



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 $P0_0$ is used for communication control.

Specifications : •The Serial I/O1 (UART selected) is used.
•Transfer bit rate : 9600 bps ($f(X_{IN})$ = 4.9152 MHz divided by 512)
•Communication control using port $P0_0$ (output level of port $P0_0$ 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.

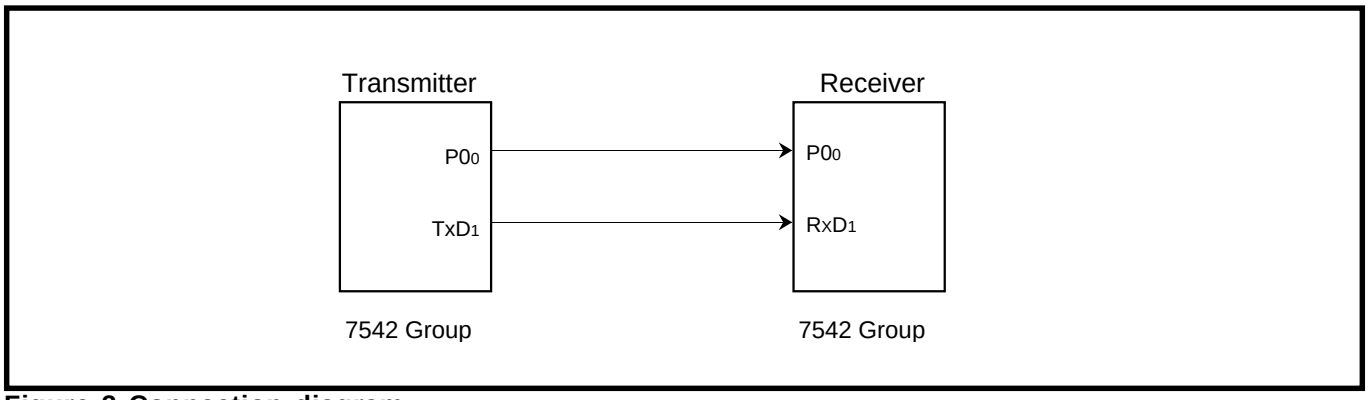


Figure 3 Connection diagram

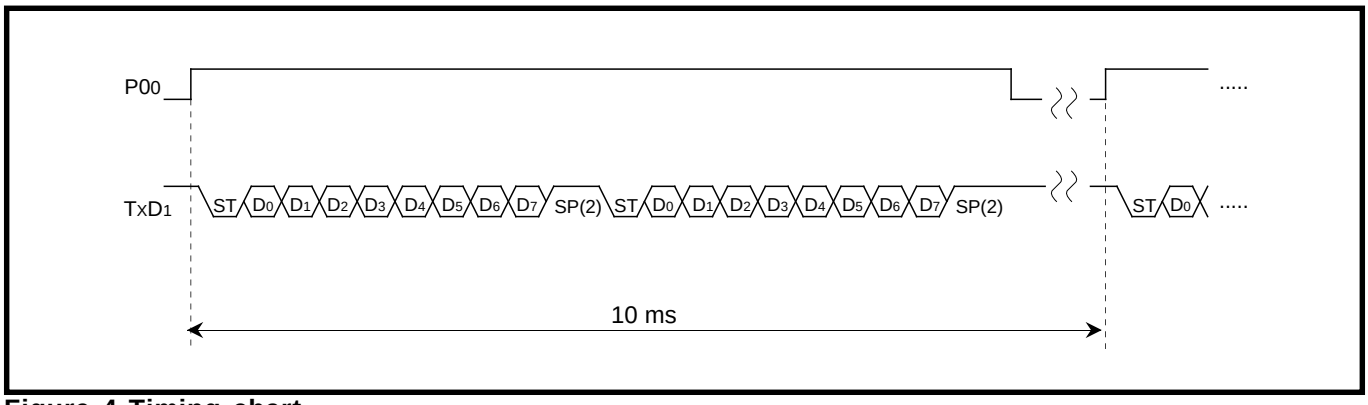


Figure 4 Timing chart

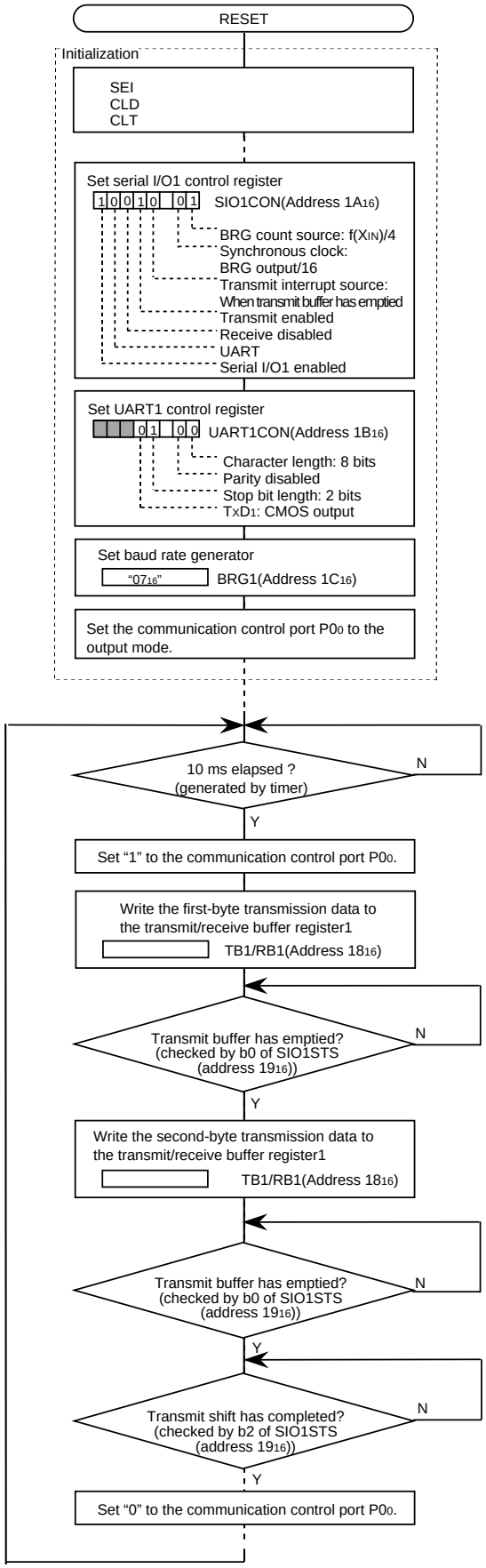


Figure 5 Control procedure of transmitter

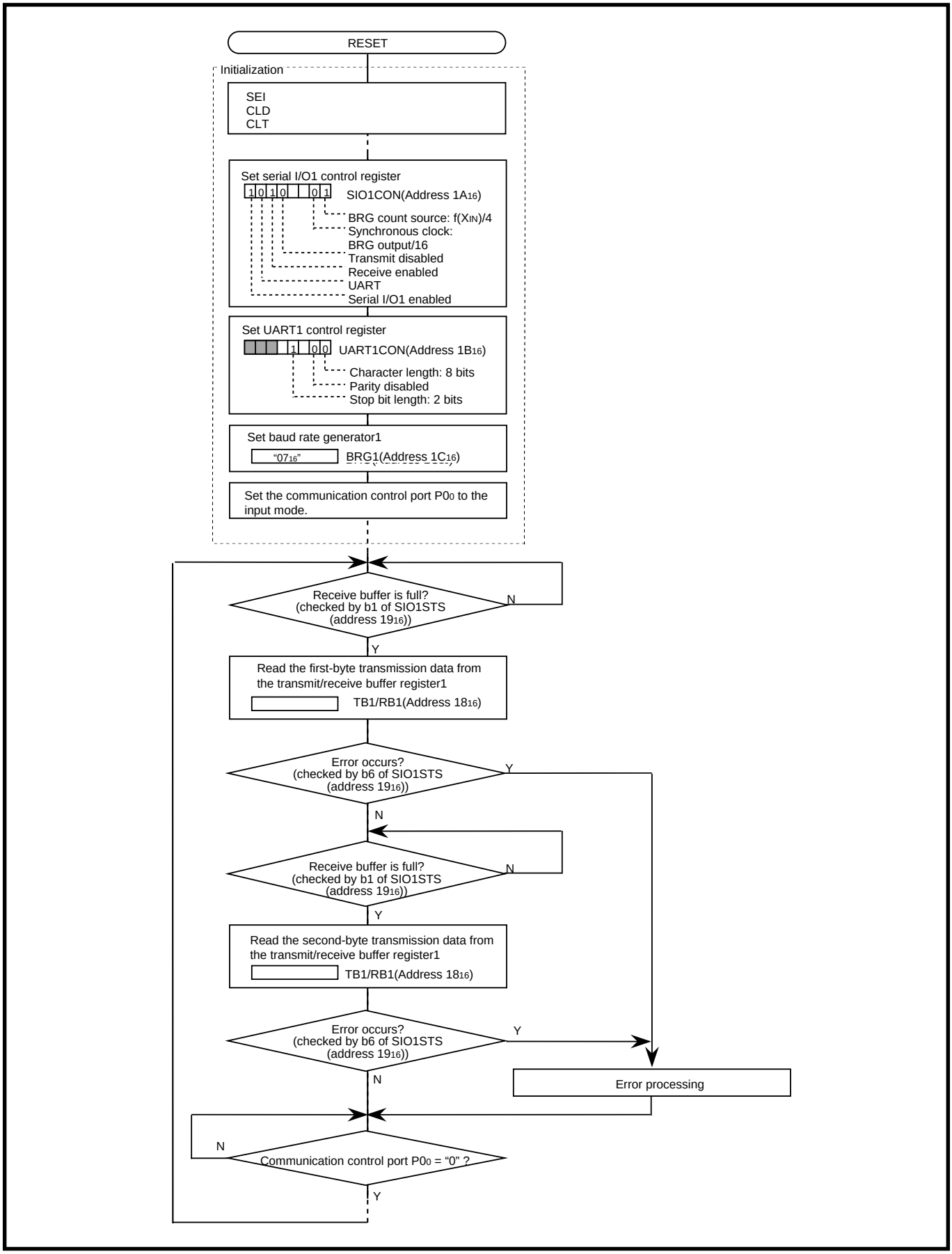


Figure 6 Control procedure of receiver

4.0 Reference

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