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M16C/65 群

串行 I/O 操作（时钟同步串行 I/O 模式下的发送）

1. 要点

在时钟同步串行 I/O 模式下发送数据，可以选择如表 1 中所列的各种功能。在表 1 中用符号“○”表示本篇资料所选的项目，图 1 是串行 I/O 的工作时序图。本篇资料的参考例程是使用 UART0 在时钟同步模式下发送数据的例子。

2. 说明

本篇资料，适用于 M16C/65 群单片机。

本篇应用说明也适用于 M16C 族中与上面所述的群具有相同 SFR（特殊功能寄存器）定义的产品。关于产品功能的改进，请参看手册中的相关信息。在使用本篇应用说明的程序前，需进行详细的评价。

3. 选定功能

表 1. 选定功能

| 设定项目 | 设定内容 | | 设定项目 | 设定内容 | |
|---------|-----------------------|------------------------------------|--------------------|-----------------------|--------|
| 分频前时钟选择 | <input type="radio"/> | f1 | 传送格式 | <input type="radio"/> | LSB 先 |
| | | foco-F | | | MSB 先 |
| 外围时钟 | <input type="radio"/> | f1SIO | 发送中断请求产生条件 | <input type="radio"/> | 发送缓冲器空 |
| | | f2SIO | | | 发送结束 |
| 传送时钟源 | <input type="radio"/> | 内部时钟 (f1SIO/f2SIO/f8SIO/f32SIO) | 输出传送时钟到多个引脚（注 1） | <input type="radio"/> | 不选择 |
| | | 外部时钟（CLKi 引脚） | | | 选择 |
| CTS 功能 | <input type="radio"/> | CTS 功能允许 | 数据逻辑选择功能 | <input type="radio"/> | 不反转 |
| | | CTS 功能禁止 | | | 反转 |
| CLK 极性 | <input type="radio"/> | 在传送时钟的下降沿输出发送数据 | CTS /RTS 引脚独立（注 2） | <input type="radio"/> | 复用引脚 |
| | | 在传送时钟的上升沿输出发送数据 | | | 独立 |

注 1: 只能在 UART1 使用内部时钟时选择。

注 2: CTS₀/RTS₀ 独立功能是 CTS₀ 与 RTS₀ 引脚功能不复用，从 P6_0 引脚输出 RTS₀，从 P6_4 引脚输出 CTS₀ 的功能。当选择这个功能时，不能使用 UART1 的 CTS /RTS 功能，请将 CTS /RTS 禁止位设置为“1”。

4. 串行 I/O 的操作

- (1) 将发送允许位置为“1”，对 UART_i 发送缓冲寄存器中写入发送数据，进入数据发送状态就绪。
- (2) 当输入到 CTS_i 引脚的电平变为“L”时，发送开始（CTS_i 引脚必须由接收方控制）。
- (3) 与传送时钟的第一个下降沿同步，UART_i 发送缓冲寄存器中发送数据被发送到 UART_i 发送寄存器中。此时，产生 UART_i 发送中断请求位变为“1”，发送数据的 bit0 也从 TxDi 引脚发送出去。然后，发送数据与下降沿同步按照从低到高的顺序逐位被发送出去。
- (4) 当一个字节的数据发送结束时，发送寄存器空标志位变为“1”，表示发送结束。并且，发送时钟停止输出，并保持为“H”电平。
- (5) 如果在发送过程中将下一个传送数据设置到 UART_i 发送缓冲寄存器中（在输出当前传送数据的 bit8 之前），数据就被连续发送。

使用 UARTi 在时钟同步 I/O 模式下发送数据的工作时序图如下所示：

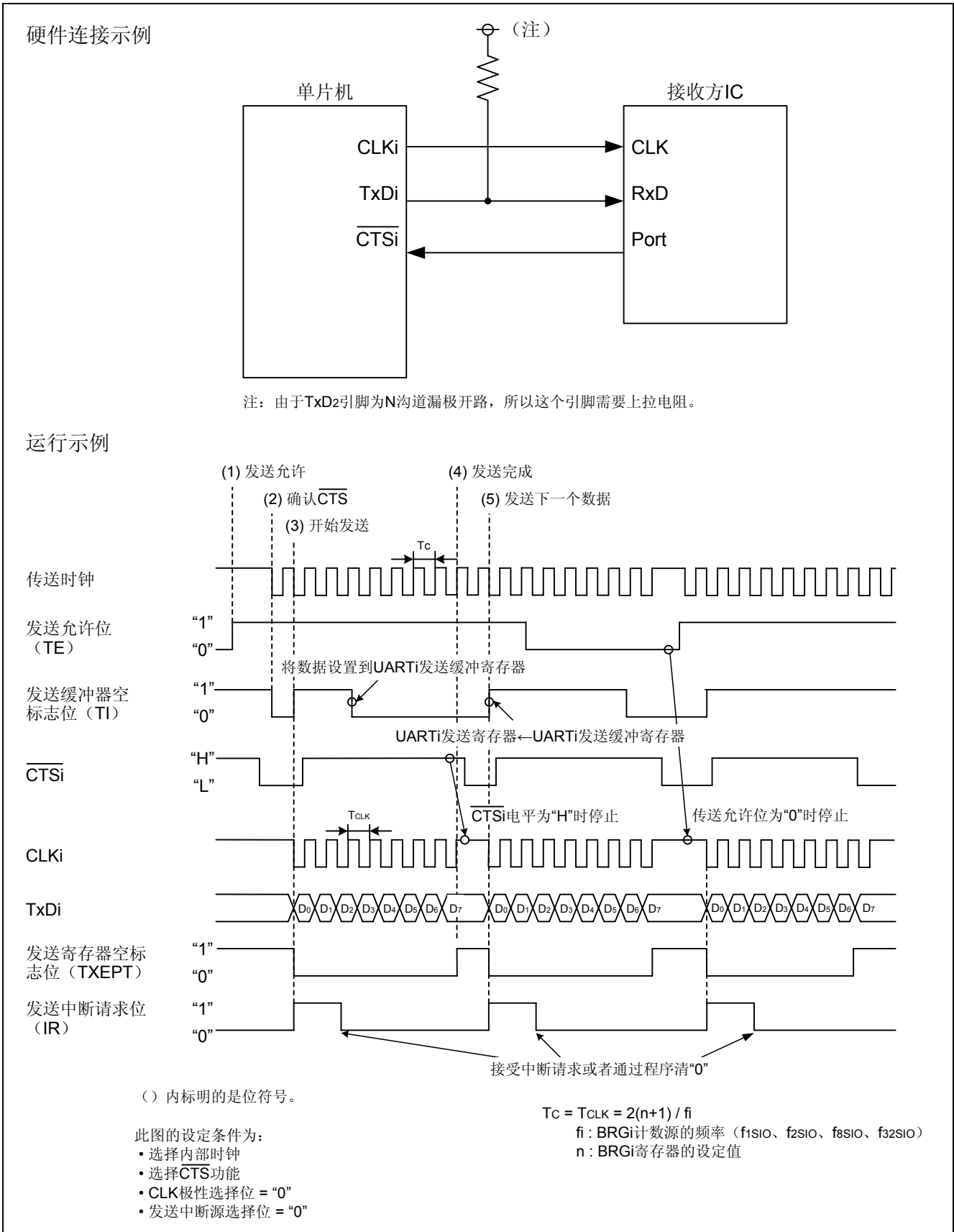


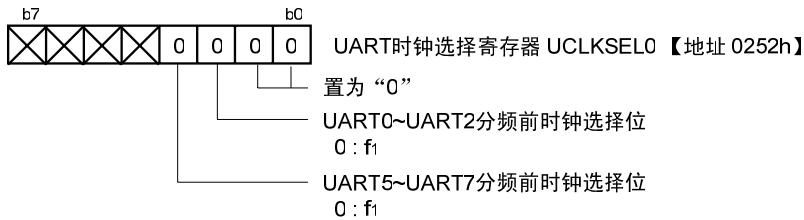
图 1. 使用 UARTi 在时钟同步 I/O 模式下发送数据的工作时序图

5. 寄存器设置

为了能够实现定义在“4. 串行 I/O 的操作”的功能，下列寄存器必须按步骤顺序进行设置。对于每个寄存器的具体结构，请参考 M16C/65 群的硬件手册。

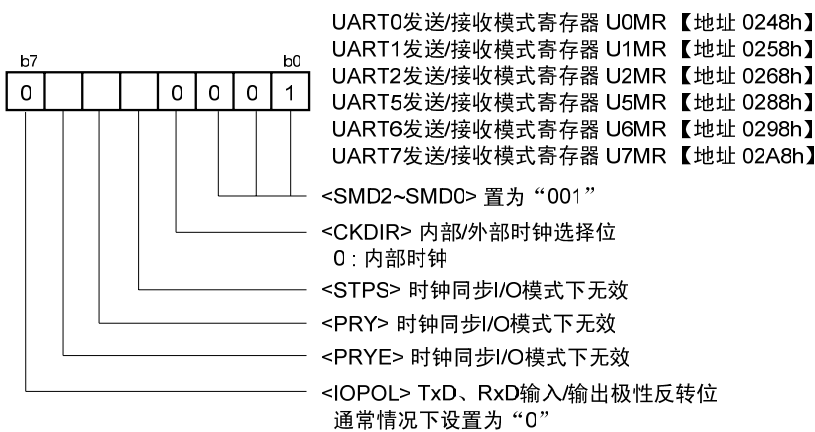
设定UART时钟选择计数器

（请在设定和UART0~UART2、UART5~UART7相关的其它寄存器之前设定OCOSEL0位或者OCOSEL1位。在改变OCOSEL0位或者OCOSEL1位后，请再次设定和UART0~UART2、UART5~UART7相关的其它寄存器。）

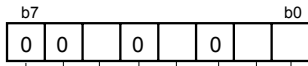


注：请在UART0~UART2、UART5~UART7发送/接收停止时设定OCOSEL0位和OCOSEL1位。

设定UARTi发送/接收模式寄存器（i = 0~2、5~7）



设置UARTi发送/接收控制寄存器 (i = 0~2、5~7)



- UART0发送/接收控制寄存器 U0C0 【地址 024Ch】
- UART1发送/接收控制寄存器 U1C0 【地址 025Ch】
- UART2发送/接收控制寄存器 U2C0 【地址 026Ch】
- UART5发送/接收控制寄存器 U5C0 【地址 028Ch】
- UART6发送/接收控制寄存器 U6C0 【地址 029Ch】
- UART7发送/接收控制寄存器 U7C0 【地址 02ACh】

<CLK1, CLK0> UiBRG计数源选择位

- b1 b0
- 0 0 : f1SIO或f2SIO (注1)
- 0 1 : f8SIO
- 1 0 : f32SIO
- 1 1 : 不能设定

<CRS> CTS/RTS功能选择位 (在bit4 = “0” 时有效)

- 0 : 选择CTS功能 (注2)

<TXEPT> 发送寄存器空标志

- 0 : 发送寄存器中有数据 (在发送中)
- 1 : 发送寄存器中无数据 (发送结束)

<CRD> CTS/RTS禁止位

- 0 : 允许CTS/RTS功能

<NCH> 数据输出选择位

- 0 : TxDi/SDAi、SCLi引脚为CMOS输出
- 1 : TxDi/SDAi、SCLi引脚为N沟道漏极开路

<CKPOL> CLK极性选择位

- 0 : 在传送时钟的下降沿输出发送数据, 在上升沿输入接收数据

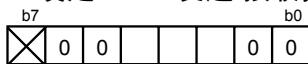
<UFORM> 传送格式选择位

- 0 : LSB先

注1: 当PCLKR寄存器的PCLK0位为“1”时, 选择时钟 f1SIO, 当PCLKR寄存器的PCLK0位为“0”时, 选择时钟 f2SIO。

注2: 请将对应引脚的端口方向位清“0” (输入模式)。

设定UART发送/接收控制寄存器2



UART发送/接收控制寄存器2 UCON 【地址 0250h】

<U0IRS> UART0发送中断源选择位

- 0 : 发送缓冲器空 (TI = 1)

<U1IRS> UART1发送中断源选择位

- 0 : 发送缓冲器空 (TI = 1)

<CLKMD0> 在bit5= “1” 时有效

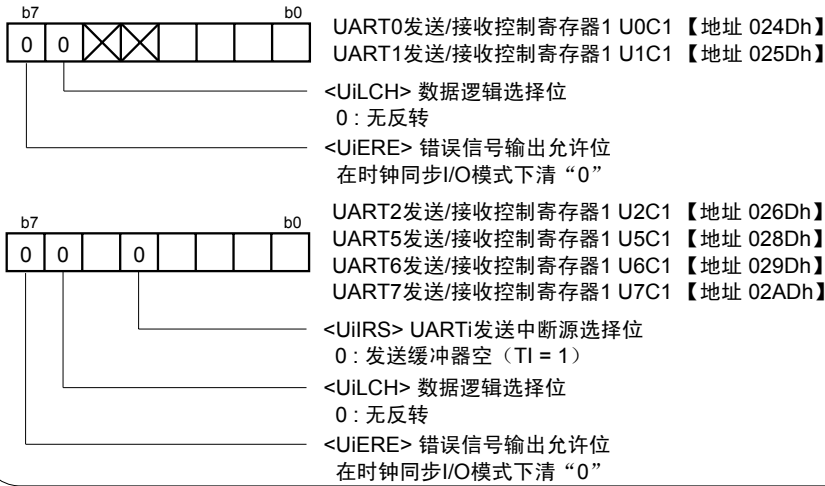
<CLKMD1> UART1的CLK/CLKS选择位1

- 0 : CLK输出仅为CLK1

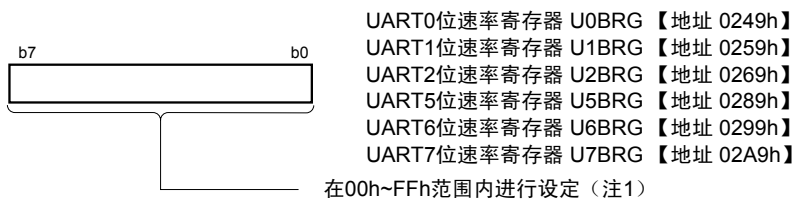
<RCSP> UART0 CTS/RTS独立位

- 0 : CTS/RTS复用引脚

设定UARTi发送/接收控制寄存器1 (i = 0~2、5~7)

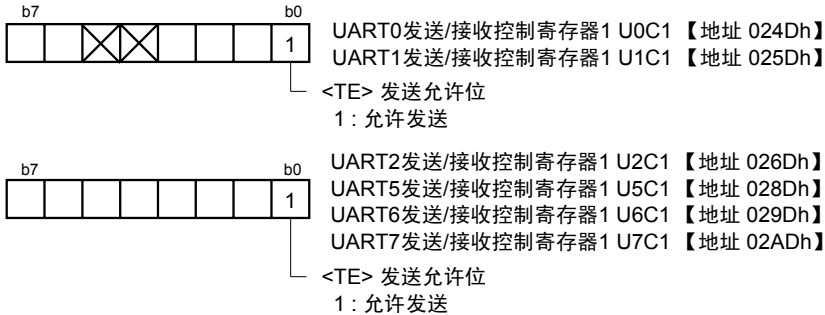


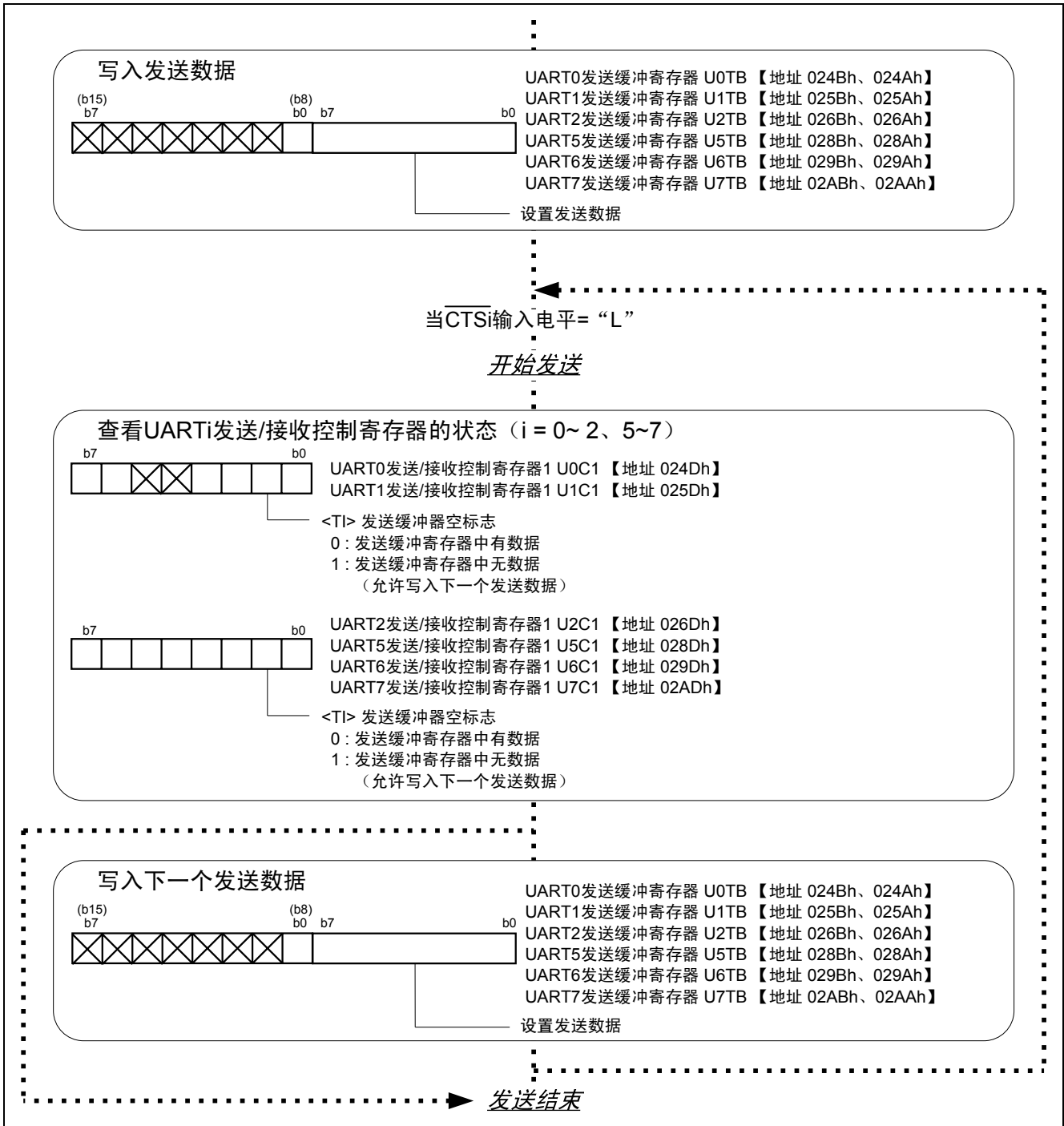
设定UARTi位速率寄存器 (i = 0~2、5~7)



注1: 请在发送/接收停止时对UiBRG寄存器进行写操作。请使用MOV指令写UiBRG寄存器。请在设定Uic0寄存器的CLK1和CLK0位后写UiBRG寄存器。

发送允许





6. 参考文献

数据手册

M16C/65 群硬件手册

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