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2010年4月1日
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M16C/65 群

SI/O3、SI/O4 的操作

1. 要点

SI/O3、SI/O4 的操作，可选择如表 1 中所列的各种功能。在表 1 中用符号“〇”表示本篇资料所选的项目，图 1 是 SI/O3、SI/O4 发送数据的工作时序图。

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

<table>
<thead>
<tr>
<th>设定项目</th>
<th>设定内容</th>
<th>设定项目</th>
<th>设定内容</th>
</tr>
</thead>
<tbody>
<tr>
<td>传送时钟源</td>
<td>O 内部时钟 (f1SIO/f2SIO/f5SIO/f32SIO)</td>
<td>SOUTi 初始值设定功能</td>
<td>O 不使用</td>
</tr>
<tr>
<td></td>
<td>外部时钟 (CLKi 引脚)</td>
<td></td>
<td>使用</td>
</tr>
<tr>
<td>传送格式</td>
<td>O LSB 先</td>
<td>SOUTi 输出控制功能</td>
<td>高阻抗</td>
</tr>
<tr>
<td></td>
<td>MSB 先</td>
<td>（传送后 SOUTi 的状态）</td>
<td>O 保持最后一位的电平</td>
</tr>
</tbody>
</table>

4. 串行 I/O 的操作

(1) 写入发送数据，即标志着发送开始。此数据将随着传送时钟的下降沿，通过 SOUTi 引脚同步输出。
(2) SOUT 发送完一位数据后，中断请求位将会变为“1”。
(3) 当 S34C2 寄存器的 SM26 位、SM27 位设定为“1”（保持最后一位的电平）时，全部传输结束后，SOUT 引脚将保持最后一个传输数据。

注:
• 请在发送和接收停止时，写 SI/Oi 发送/接收寄存器（i = 3、4，地址分别为 0270h 和 0274h）。
使用 SI/O3、SI/O4 发送数据的工作时序图如下所示:

![硬件连接示例](chart.png)

### 运行示例

- 内部时钟
- SI/O3 发送，接收寄存器
- 信号
- SM26，SM27 = 0
  - (高阻抗)
- SM26，SM27 = 1
  - (保持最后一位电平)
- SI/O3 输入
- SI/O3 中断请求位

图 1. SI/O3、SI/O4 发送数据的工作时序

$T_{CLK} = 2 \left( n + 1 \right) / f_i$

$fi$: BRG 计数器的频率 ($f_{BRG}$、$f_{SRG}$、$f_{SHG}$、$f_{SHG}$)

接受中断请求或者通过程序清除
5. 寄存器设置

为了能实现定义在“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。

### 清除保护（设置为写入允许状态）

清除保护寄存器（地址 000Ah）

- 允许对端口P9方向寄存器（地址 03F3h）和 SI/O控制寄存器 (i = 3, 4) （地址 0272h, 0276h）写入操作
- 1：写入允许

### 设置SI/O发送、接收控制寄存器 (i = 3, 4)（注 1）

<table>
<thead>
<tr>
<th>b7</th>
<th>b6</th>
<th>b5</th>
<th>b4</th>
<th>b3</th>
<th>b2</th>
<th>b1</th>
<th>b0</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

- 内部同步时钟选择位
  - b1 b0: 00：fS10或fS20, 01：f1SIO, 10：f2SIO, 11：不能设定
- Soun 输出禁止位
  - 0：Soun 输出, 1：Soun 输入
- SI/O端口选择位
  - 1：Soun 输入, CLKi 功能
- 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, 1：在传送时钟的上升沿输出发送数据, 在下降沿输入接收数据
- 传送格式选择位
  - 0：LSB先发送, 1：MSB先发送
- 同步时钟选择位
  - 1：内部时钟
- Soun 初始值设定位（当 bit 6= “0” 时有效）
  - 0：输出“L”电平, 1：输出“H”电平

注1: 请在设置保护寄存器后连续设置SI/O控制寄存器。

### 设置SI/O波特率寄存器 (i = 3, 4)

<table>
<thead>
<tr>
<th>b7</th>
<th>b6</th>
<th>b5</th>
<th>b4</th>
<th>b3</th>
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<tr>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
</tbody>
</table>

- 设定为00h ~ FFh (注 1)

注1: 当数据发送、接收停止后再设置SI/O 波特率寄存器。请使用MOV指令设置SI/O 波特率寄存器。

### 写入发送数据

<table>
<thead>
<tr>
<th>b7</th>
<th>b6</th>
<th>b5</th>
<th>b4</th>
<th>b3</th>
<th>b2</th>
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<tbody>
<tr>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
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</table>

- 设置传送的数据 (注1)

注1: 当数据发送、接收停止后再设置SI/O 发送接收寄存器。即使是在接收时，也需要在每次接收时设置SI/O 发送接收寄存器。
设置SI/O3寄存器2

- SI/O3控制寄存器2【地址 0278h】
- S34C2
  - 保留位
  - 请置为“0”
  - 什么也不指定
  - 只能写“0”，读时值不定
  - SI/O3、SI/O4分频前时钟选择位
    - 0：n
  - 什么也不指定
  - 只能写“0”，读时值不定
  - S0ut3输出控制位 (注1)
    - 传送后S0ut3的状态
      - 0：高阻态
      - 1：保持最后一位的电平
  - S0ut4输出控制位 (注1)
    - 传送后S0ut4的状态
      - 0：高阻态
      - 1：保持最后一位的电平

注1：当S3C、S4C寄存器的SM3位设置为“1”（S0ut、CLK）时，SM26位和SM27位有效。
6. 参考文献

数据手册
M16C/65 群硬件手册
（最新版本请从瑞萨科技网页上取得）

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