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瑞萨电子公司

2010年4月1日

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【发行】瑞萨电子公司（http://www.renesas.com）

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7544 群
异步串行 I/O（UART）

要点
这是串行 I/O 的异步（UART）应用例子。

动作确认器件
本资料说明的应用例子适合下列单片机和使用条件：

・单片机：7544 群

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   1.2 设定方法 ................................................................................................................... 3
   1.3 使用 UART 的通信（发送和接收） ................................................................. 5

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1. 应用例子的说明

对于异步串行I/O（以下简称UART），发送侧和接收侧统一波特率和传送数据格式，异步进行数据的发送和接收。

7544群根据UART控制寄存器的设定，能选择8种串行数据传送格式。

1.1 有关数据传送速度

位传送速率的计算式如下所示:

在选择内部时钟时（在使用波特率发生器时）

\[
\text{位传送速率 (bps)} = \frac{f(XIN)}{\text{分频比} \times (\text{BRG设定值} + 1) \times 16}
\]

- 分频比: 选择“1”或者“4”（通过串行I/O控制寄存器的位0设定）
- BRG设定值: 设定0～255（0016～FF16）

在选择外部时钟时

\[
\text{位传送速率 (bps)} = \frac{\text{SCLK管脚的输入时钟}}{16}
\]

波特率发生器的设定值和位传送速率的选择例如表1所示:

<table>
<thead>
<tr>
<th>BRG计数源</th>
<th>BRG设定值</th>
<th>位传送率 (bps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>f(XIN)/4</td>
<td>255(FF16)</td>
<td>300 (488.28125)</td>
</tr>
<tr>
<td>f(XIN)/4</td>
<td>127(7F16)</td>
<td>600 (976.5625)</td>
</tr>
<tr>
<td>f(XIN)/4</td>
<td>63(3F16)</td>
<td>1200 (1953.125)</td>
</tr>
<tr>
<td>f(XIN)/4</td>
<td>31(1F16)</td>
<td>2400 (3906.25)</td>
</tr>
<tr>
<td>f(XIN)/4</td>
<td>15(0F16)</td>
<td>4800 (7812.5)</td>
</tr>
<tr>
<td>f(XIN)/4</td>
<td>7(0716)</td>
<td>9600 (15625)</td>
</tr>
<tr>
<td>f(XIN)/4</td>
<td>3(0316)</td>
<td>19200 (31250)</td>
</tr>
<tr>
<td>f(XIN)/4</td>
<td>1(0116)</td>
<td>38400 (62500)</td>
</tr>
<tr>
<td>f(XIN)</td>
<td>3(0316)</td>
<td>76800 (125000)</td>
</tr>
<tr>
<td>f(XIN)</td>
<td>1(0116)</td>
<td>153600 (250000)</td>
</tr>
<tr>
<td>f(XIN)</td>
<td>0(0016)</td>
<td>307200 (500000)</td>
</tr>
</tbody>
</table>

表1 波特率发生器（BRG）的设定值和位传送率的选择例
1.2 设定方法

串行I/O的UART设定方法如图1和图2所示。

### 步骤1：停止串行I/O的运行，进行初始化

串行I/O控制寄存器 (SIOCON)【1A16地址】

<table>
<thead>
<tr>
<th>位</th>
<th>功能描述</th>
</tr>
</thead>
<tbody>
<tr>
<td>b7</td>
<td>串行I/O控制寄存器 (SIOCON) 【1A16地址】</td>
</tr>
<tr>
<td>b6-b0</td>
<td>停止发送的运行，进行初始化</td>
</tr>
<tr>
<td>b5-b0</td>
<td>停止接收的运行，进行初始化</td>
</tr>
</tbody>
</table>

### 步骤2：禁止串行I/O发送和接收中断

中断控制寄存器1 (ICON1) 【3E16地址】

<table>
<thead>
<tr>
<th>位</th>
<th>功能描述</th>
</tr>
</thead>
<tbody>
<tr>
<td>b7-b0</td>
<td>禁止串行I/O接收中断</td>
</tr>
<tr>
<td>b5-b0</td>
<td>禁止串行I/O发送中断</td>
</tr>
</tbody>
</table>

### 步骤3：设定串行I/O控制寄存器

串行I/O控制寄存器 (SIOCON) 【1A16地址】

<table>
<thead>
<tr>
<th>位</th>
<th>功能描述</th>
</tr>
</thead>
<tbody>
<tr>
<td>b7-b0</td>
<td>BRG计数器选择 (在选择内部时钟时设定)</td>
</tr>
<tr>
<td>b6-b0</td>
<td>串行I/O同步时钟选择 (注1)</td>
</tr>
<tr>
<td>b5-b0</td>
<td>串行I/O异步时钟选择 (注3)</td>
</tr>
</tbody>
</table>

- 0: f(Xn)
- 1: f(Xn)/4
- 串行I/O同步时钟选择 (注1)
- 0: BRG输出的16分频
- 1: 外部时钟的16分频

发送中断源选择
- 0: 在发送缓冲器为空时
- 1: 在发送完成时

发送允许选择
- 0: 禁止发送 (在半双工通信接收时)
- 1: 允许发送 (在全双工通信时) (注2)

接收允许选择
- 0: 禁止接收 (在半双工通信发送时)
- 1: 允许接收 (在全双工通信时)

异步串行I/O
- 允许串行I/O (P10～P17管脚为串行I/O管脚功能) (注3)

注1. 串行I/O同步时钟选择位的设定

- “0”：P17管脚可作为通常的输入/输出管脚使用。
- “1”：P17管脚变为外部时钟的输入管脚。

2. 在数据发送时，如果选择外部时钟作为同步时钟，就必须在Sclk为“H”电平的状态下发送允许位置“1”。

3. 在选择异步 (UART) 串行I/O时，P17管脚可作为通常的输入/输出管脚使用。

图1 串行I/O的UART设定方法（1）
### 步骤4：设定UART控制寄存器

<table>
<thead>
<tr>
<th>07</th>
<th>00</th>
</tr>
</thead>
<tbody>
<tr>
<td>UART控制寄存器 (UARTCON)【1B16地址】</td>
<td></td>
</tr>
</tbody>
</table>

- 字符长选择
  - 0: 8位
  - 1: 7位
- 奇偶校验允许选择
  - 0: 禁止奇偶校验
  - 1: 允许奇偶校验
- 奇偶校验选择 (仅在允许奇偶校验时有效)
  - 0: 偶数校验
  - 1: 奇数校验
- 停止位长选择
  - 0: 1停止位
  - 1: 2停止位
- P1/TxD P沟道输出禁止选择 (在输出模式时)
  - 0: CMOS输出
  - 1: N沟道源极开路输出

### 步骤5：在选择BRG输出的16分频作为同步时钟时，对波特率发生器进行设定

<table>
<thead>
<tr>
<th>00</th>
</tr>
</thead>
<tbody>
<tr>
<td>波特率发生器 (BRG)【1C16地址】</td>
</tr>
</tbody>
</table>

- 设定波特率值

### 步骤6：为了不执行不必要的中断处理，必须将串行I/O发送和接收中断请求位置“0”（无请求）

<table>
<thead>
<tr>
<th>00</th>
</tr>
</thead>
<tbody>
<tr>
<td>中断请求寄存器1 (IREQ1)【3C16地址】</td>
</tr>
</tbody>
</table>

- 无串行I/O接收中断请求
- 无串行I/O发送中断请求

### 步骤7：在执行中断时，必须将串行I/O发送和接收中断允许位置“1”（允许中断）

<table>
<thead>
<tr>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>中断控制寄存器1 (ICON1)【3E16地址】</td>
</tr>
</tbody>
</table>

- 允许串行I/O接收中断
- 允许串行I/O发送中断

### 步骤8：在发送时，开始数据的发送 (注)

<table>
<thead>
<tr>
<th>00</th>
</tr>
</thead>
<tbody>
<tr>
<td>发送/接收缓冲寄存器 (TB/RB)【1816地址】</td>
</tr>
</tbody>
</table>

- 设定发送数据

**注**：在数据发送时，如果选择外部时钟作为同步时钟，就必须在SCLK为“H”电平的状态下进行。

---

#### 图 2 串行I/O的UART设定方法（2）

<table>
<thead>
<tr>
<th>00</th>
</tr>
</thead>
<tbody>
<tr>
<td>串 行 I/O 的 UART 设定方法（2）</td>
</tr>
</tbody>
</table>
1.3 使用 UART 的通信（发送和接收）

■ 要点
使用 UART，发送和接收 2 字节的数据。通信控制使用端口 P00。

■ 说明
使用串行 I/O（选择 UART），位传送速率为 9600bps（对 f(XIN)=4.9152MHz 进行 512 分频）。通信控制使用端口 P00（端口 P00 的输出电平由软件控制）。每隔 10ms（由定时器产生）从发送侧将 2 字节数据传送给接收侧。

连接图、时序图、发送侧控制步骤的例子、接收侧控制步骤的例子分别如图 3、图 4、图 5、图 6 所示。
异步串行 I/O（UART）

图 5 发送侧的控制步骤例子
图 6 接收侧的控制步骤例子
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数据表
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<table>
<thead>
<tr>
<th>Rev.</th>
<th>发行日</th>
<th>修订内容</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>2004.09.15</td>
<td>— 初版发行</td>
</tr>
</tbody>
</table>

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