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2010年4月1日
瑞萨电子公司

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M16C/65 群
延迟单次触发输出

1. 要点
使用定时器 A0 和定时器 A1，实现外部触发之后，延迟一段固定时间，输出单次脉冲的功能。
使用下面的外围功能:
- 定时器 A 的单次触发模式

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. 规格

在 TA0IN 引脚的下降沿输入后 1ms，从 TA1OUT 引脚输出长为 50us 的“高”电平。
(1) 设置定时器 A0 为单次触发定时器模式，设置定时器 A1 为单次触发定时器脉冲输出模式。
(2) 用定时器 A0 设定脉冲输出前的延迟时间为 1ms，用定时器 A1 设定输出脉宽为 50μs。设定定时器 A0 的下溢作为定时器 A1 的计数开始条件。定时器 A0 和定时器 A1 都使用 f1TIMAB 作为计数源。
(3) 连接一个 20MHz 的振荡器到 XIN。
(4) 通过 TAPOFs 寄存器的 POFS1 位，选择 TA1OUT 引脚的输出极性。

4. 定时器 A 的操作

(1) 将触发选择位设定为“1”，并设定计数启动标志为“1”，定时器 A0 开始计数。
(2) 如果外部触发选择位选择的有效边沿输入至 TA0IN 引脚，定时器 A0 以 f1TIMAB 为时钟源开始进行递减计数。
(3) 定时器 A0 计数器的值变为“0000h”时，重加载寄存器中的值被加载到计数器，计数器停止计数。此时，定时器 A0 的中断请求位置为“1”。
(4) 定时器 A0 的下溢触发定时器 A1 开始计数。当定时器 A1 的计数器开始计数时，TA1OUT 引脚输出“高”电平。
(5) 定时器 A1 计数器的值变为“0000h”时，TA1OUT 引脚输出“低”电平，重加载寄存器中的值被加载到计数器，计数器停止计数。此时定时器 A1 的中断请求位置为“1”
工作时序图如下所示:

![工作时序图](image)

图 1. 延迟单次触发输出的工作时序图
连接示意图如下所示:

![连接示意图](image)

图 2. 延迟单次触发输出的定时器连接示意图
5. 寄存器设置

在定时器模式中，定时器A可以选择如表1中所列的各种计数源，定时器A计数源的结构框图如图3所示。

表1. 定时器A计数源的选择

<table>
<thead>
<tr>
<th>TCKDIV00 寄存器（注1）</th>
<th>TACSi 寄存器（注2）</th>
<th>TAiMR 寄存器</th>
<th>计数源</th>
<th>计数源周期</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCDIV00</td>
<td>TCS3/ TCS7</td>
<td>TCS2/ TCS6</td>
<td>TCS1/ TCS5</td>
<td>TCS0/ TCS4</td>
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</table>

注1：TCDIV00位是定时器AB分频前时钟选择位。请在设定和定时器A相关的其它寄存器之前设定TCDIV00位。在改变TCDIV00位后，请再次设定和定时器A相关的其它寄存器。

注2：TACSi寄存器的TCS3~TCS0位和定时器A0计数源的选择相对应。TACSi寄存器的TCS7~TCS4位和定时器A1计数源的选择相对应。TACSi寄存器的TCS3~TCS0位和定时器A2计数源的选择相对应。TACSi寄存器的TCS7~TCS4位和定时器A3计数源的选择相对应。TACSi寄存器的TCS3~TCS0位和定时器A4计数源的选择相对应。

注3：如PCLKR寄存器中的PCLK0位为“0”选择f2TIMAB作为计数源PCLK0位为“1”选择f1TIMAB作为计数源（复位设定值）。

f(XIN):20MHz  
f(XcIN):32.768kHz  
f(oco-F):约 20MHz  
f(oco-s):约 125kHz

50ns/100ns  
400ns  
1600ns  
976.56μs  
50ns/100ns  
400ns  
1600ns  
976.56μs  
50ns/100ns  
约 50ns  
约 8μs  
约 50ns/100ns  
约 400ns  
约 1600ns  
约 3200ns
为了能实现定义在“4. 定时器 A 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。
### 选择定时器计数源

定时器A计数源选择寄存器0 TACS0【地址 01D0h】

- `<TCS2~TCS0>` TA0计数源选择位 (注1)

<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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<td>1</td>
<td>0</td>
<td>0</td>
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</tbody>
</table>

- 注1：关于各种设定情况下的计数源周期，请参考表1。

### 设定定时器A0

选择单触发定时器模式和功能

定时器A0模式寄存器 TA0MR【地址 0336h】

- `<TMOD1, TMOD0>` 选择单触发定时器模式
- `<MR0>` 脉冲输出功能选择位
  - 0：脉冲不输出 (TA0OUT引脚为普通端口引脚)
- `<MR1>` 外部触发选择位
  - 0：TA0IN引脚输入信号的下降沿
- `<MR2>` 触发选择位
  - 1：通过事件/触发选择寄存器选择
- `<TCK1, TCK0>` 计数源选择位 (注1)

<table>
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<th>b4</th>
<th>b3</th>
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<td>1</td>
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</tbody>
</table>

- 注1：TACS0~TACS2寄存器的TCS3位和TCS7位置为0（TCK0位、TCK1位有效）。关于各种设定情况下的计数源周期，请参考表1。

- 注2：如果PCLKR寄存器中的PCLK0位为0选择fTIMAB作为计数源，PCLK0位为1选择fTIMAB作为计数源（复位设定值）。
设定单次触发启动标志
(设定由TA0IN引脚输入TA0触发)

- 单次触发启动标志ONSF【地址 0322h】
  - <TA0TGH, TA0TGL> 定时器A0 事件/触发选择位
  - b7 b6 b5 b4 b3 b2 b1 b0 : 选择 TA0IN引脚的输入注1)

注1: 请将相应的端口方向寄存器清“0”（输入模式）

设置单触发定时器的时间

- 定时器A0寄存器 TA0【地址 0327h～0326h】

设定定时器 A1

选择单触发定时器模式和功能

- 定时器A1模式寄存器 TA1MR【地址 0337h】
  - <TMOD1, TMOD0> 选择单触发定时器模式
  - <MR0> 脉冲输出功能选择位
    1 : 输出脉冲 (TA1OUT引脚为脉冲输出引脚)
  - <MR1> 外部触发选择位
    在选择定时器溢出时无效
  - <MR2> 触发选择位
    1 : 通过事件/触发选择寄存器选择
  - <MR3> 在单触发定时器模式时，置为“0”
  - <TCK1, TCK0> 计数源选择位 (注1)
    0 0 : fTIMAB或f2TIMAB (注2)
    0 1 : f8TIMAB
    1 0 : fc32
    1 1 : fc16

注1: TACS0~TACS2寄存器的TCS3位和TCS7位设置为0（TCK0位、TCK1位有效），关于各种设定条件下的计数器周期，请参考表1。
注2: 如果PCLKR寄存器中的PCLK0位为0选择fTIMAB作为计数源，PCLK0位为1选择f2TIMAB作为计数源（复位设定值）。

设置事件/触发选择位 (设定定时器A0触发定时器A1)

- 触发选择寄存器TRGSR 【地址 0323h】
  - <TA1TGH, TA1TGL> 定时器A1事件/触发选择位
    b7 b6 b5 b4 b3 b2 b1 b0 : 选择TA0的上溢或者下溢
延迟单次触发输出

设置单触发定时器的时间

| b15 | b7 | 03h | 00 | E8h |

定时器A1寄存器 TA1【地址 0329h～0328h】

选择定时器波形输出功能

定时器A波形输出功能选择寄存器 TAPOFS【地址 01D5h】

- <POFS0> TA0out输出极性控制位
  - 0：输出波形’高’电平有效
- <POFS1> TA1out输出极性控制位
  - 0：输出波形’高’电平有效

什么也不指定。只能写’0’，读时值不定

设置定时器计数开始标志位

| b7 | b0 | 1 | 1 |

计数开始标志 TABSR【地址 0320h】

- <TA0S> 定时器A0计数开始标志
  - 1：开始计数
- <TA1S> 定时器A1计数开始标志
  - 1：开始计数

开始计数
6. 参考文献

数据手册
M16C/65 群硬件手册
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技术信息/技术更新
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