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瑞萨电子公司

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M16C/65 群

定时器 A 操作（计数器模式）

1. 要点

在定时器模式中，可以选择如表 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 是定时器的工作时序图。本篇资料的参考例程是定时器 A1 选择定时器模式的例子。

2. 说明

本篇资料，适用于 M16C/65 群单片机。

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3. 选定功能

表 1. 选定功能

设定项目	设定内容	
计数源	○	内部时钟源（f1TIMAB/f2TIMAB/f8TIMAB/f32TIMAB/f64TIMAB/fOCO-F/fOCO-S/fC32）
脉冲输出功能	○	无脉冲输出
		有脉冲输出
门控功能	○	无门控功能
		只有在 TAiIN 引脚为“低”电平期间进行计数
		只有在 TAiIN 引脚为“高”电平期间进行计数
输出极性控制	○	输出波形“高”电平有效
		输出波形“低”电平有效（输出反转）

注: i = 0~4

4. 定时器 A 的操作

(1) 把计数开始标志位置为“1”，计数器开始对计数脉冲源的下降沿计数。

(2) 在发生下溢时，重加载寄存器的设定值被加载到计数器，计数器继续进行计数。同时，定时器 Ai 中断请求位置为“1”。

(3) 把计数开始标志位置为“0”，计数器停止计数，并且保持当前值。

选择定时器模式的定时器工作时序图如下所示：

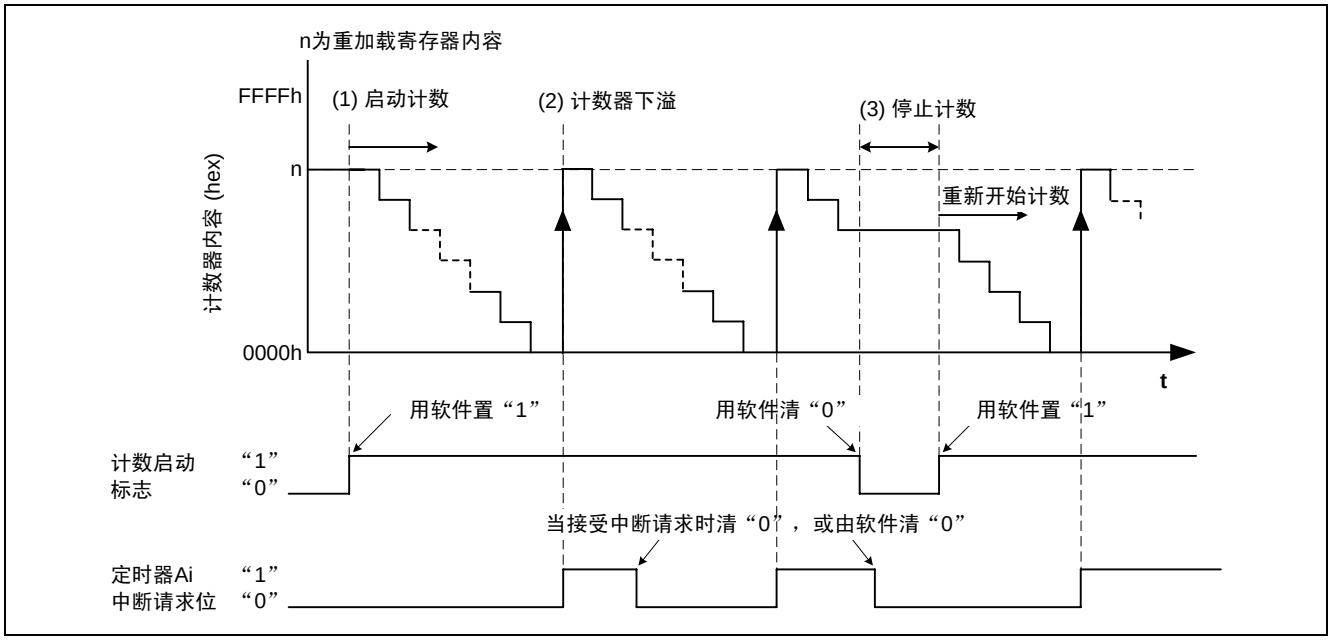


图 1. 选择定时器模式定时器的工作时序图

5. 寄存器设置

在定时器模式中，定时器 A 可以选择如表 2 中所列的各种计数源，定时器 A 计数源的结构框图如图 2 所示。

表 2. 定时器 A 计数源的选择

TCKDIVC0 寄存器（注 1）	TACSi 寄存器（注 2）				TAiMR 寄存器		计数源	计数源周期
TCDIV00	TCS3/ TCS7	TCS2/ TCS6	TCS1/ TCS5	TCS0/ TCS4	TCK1	TCK0		f(XIN):20MHz f(XCIN):32.768kHz f(oco-F):约 20MHz f(oco-s):约 125kHz
0	0	-	-	-	0	0	f1TIMAB/f2TIMAB（注 3）	50ns/100ns
0	0	-	-	-	0	1	f8TIMAB	400ns
0	0	-	-	-	1	0	f32TIMAB	1600ns
0	0	-	-	-	1	1	fc32	976.56μs
0	1	0	0	0	-	-	f1TIMAB/f2TIMAB（注 3）	50ns/100ns
0	1	0	0	1	-	-	f8TIMAB	400ns
0	1	0	1	0	-	-	f32TIMAB	1600ns
0	1	0	1	1	-	-	f64TIMAB	3200ns
0	1	1	0	0	-	-	foco-F	约 50ns
0	1	1	0	1	-	-	foco-S	约 8μs
0	1	1	1	0	-	-	fc32	976.56μs
1	1	0	0	0	-	-	f1TIMAB/f2TIMAB（注 3）	约 50ns/100ns
1	1	0	0	1	-	-	f8TIMAB	约 400ns
1	1	0	1	0	-	-	f32TIMAB	约 1600ns
1	1	0	1	1	-	-	f64TIMAB	约 3200ns

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: TACS0 寄存器的 TCS3~TCS0 位和定时器 A0 计数源的选择相对应，TACS0 寄存器的 TCS7~TCS4 位和定时器 A1 计数源的选择相对应，TACS1 寄存器的 TCS3~TCS0 位和定时器 A2 计数源的选择相对应，TACS1 寄存器的 TCS7~TCS4 位和定时器 A3 计数源的选择相对应，TACS2 寄存器的 TCS3~TCS0 位和定时器 A4 计数源的选择相对应。

注 3：如果 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）。

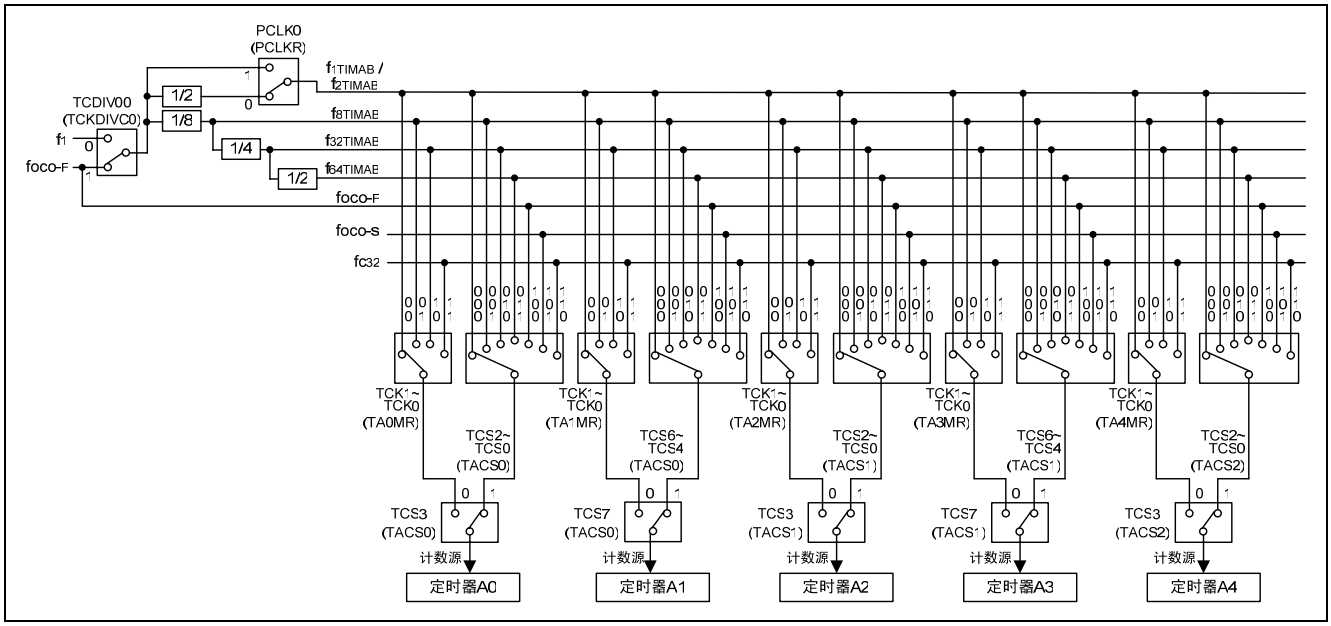


图 2. 定时器 A 的计数源

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。

(1) 选择定时器计数源

（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。）

b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	×	0	0	0

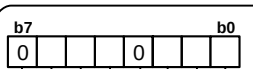
定时器AB分频控制寄存器0 TCKDIVC0【地址 01CBh】

b0：定时器AB分频前时钟选择位
0 : f_1

b1：保留位
设定为“0”

b2：什么也不指定。只能写“0”，读时值不定

b3：保留位
设定为“0”



定时器A计数源选择寄存器0 TACS0【地址 01D0h】
定时器A计数源选择寄存器1 TACS1【地址 01D1h】

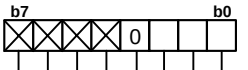
<TCS2~TCS0> TAi计数源选择位 (注1)
000 : f_{1TIMAB}或f_{2TIMAB} (注2)
001 : f_{8TIMAB}
010 : $f_{32TIMAB}$
011 : $f_{64TIMAB}$
100 : f_{OCO-F}
101 : f_{OCO-S}
110 : f_{C32}
111 : 不能设定

<TCS3> TAi计数源选择指定位 (注1)
0 : TCK0、TCK1有效，TCS2~TCS0无效

<TCS6~TCS4> TAi计数源选择位 (注1)
000 : f_{1TIMAB}或f_{2TIMAB} (注2)
001 : f_{8TIMAB}
010 : $f_{32TIMAB}$
011 : $f_{64TIMAB}$
100 : f_{OCO-F}
101 : f_{OCO-S}
110 : f_{C32}
111 : 不能设定

<TCS7> TAi计数源选择指定位 (注1)
0 : TCK0、TCK1有效，TCS6~TCS4无效

TACS0寄存器：i = 0、j = 1，TACS1寄存器：i = 2、j = 3
注1：关于各种设定情况下的计数源周期，请参考表2。
注2：如果PCLKR寄存器中的PCLK0位为0选择f_{2TIMAB}作为计数源，PCLK0位为1选择f_{1TIMAB}作为计数源（复位设定值）。



定时器A计数选择寄存器2 TACS2【地址 01D2h】

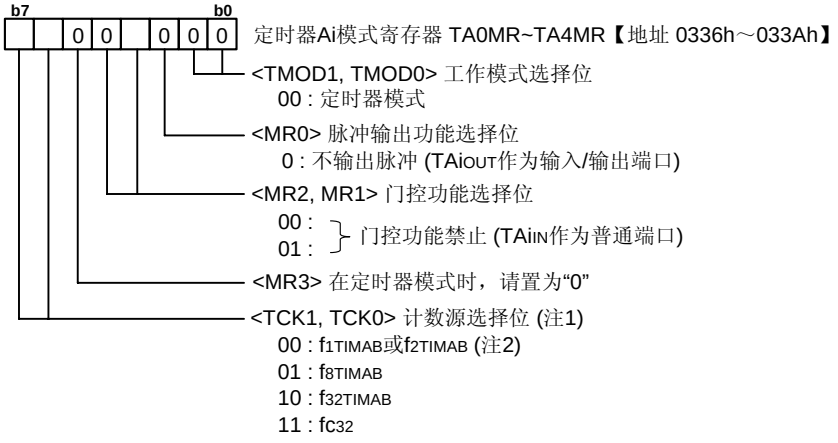
<TCS2~TCS0> TA4计数源选择位 (注1)
000 : f_{1TIMAB}或f_{2TIMAB} (注2)
001 : f_{8TIMAB}
010 : $f_{32TIMAB}$
011 : $f_{64TIMAB}$
100 : f_{OCO-F}
101 : f_{OCO-S}
110 : f_{C32}
111 : 不能设定

<TCS3> TA4计数源选择指定位 (注1)
0 : TCK0、TCK1有效，TCS2~TCS0无效

什么也不指定。只能写“0”，读时值不定

注1：关于各种设定情况下的计数源周期，请参考表2。
注2：如果PCLKR寄存器中的PCLK0位为0选择f_{2TIMAB}作为计数源，PCLK0位为1选择f_{1TIMAB}作为计数源（复位设定值）。

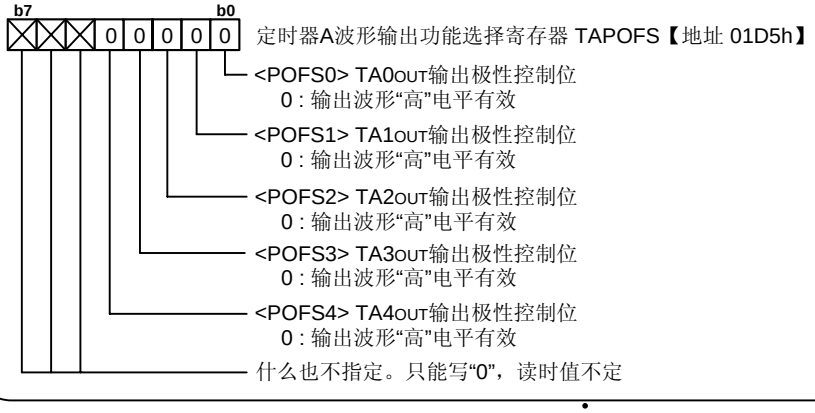
(2) 选择定时器模式和功能



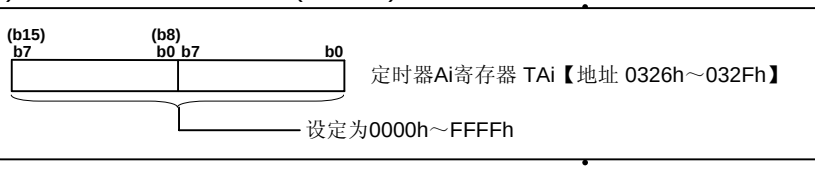
注1：TACS0~TACS2寄存器的TCS3位和TCS7位设置为0（TCK0位、TCK1位有效）。关于各种设定情况下的计数源周期，请参考表2。

注2：如果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）。

(3) 选择定时器波形输出功能

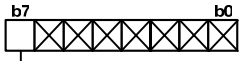


(4) 设置定时器Ai寄存器 (i=0～4)



(5) 设置时钟预分频器复位标志位

这一功能只在选择fc32作为计数源时有效，复位预分频器的目的是为了产生XCIN时钟的32分频即fc32。



时钟预分频器复位标志 CPSRF【地址 0015h】

<CPSR> 时钟预分频器复位标志
0：没有影响
1：复位预分频器（读时值为“0”）

(6) 设置定时器计数开始标志位

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

<TA2S> 定时器A2计数开始标志
1：开始计数

<TA3S> 定时器A3计数开始标志
1：开始计数

<TA4S> 定时器A4计数开始标志
1：开始计数

开始计数

6. 参考文献

数据手册

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   2）植埋于人体使用的装置。
   3）用于治疗（切除患部、给药等）的装置。
   4）其他直接影响到人的生命的装置。
9. 在使用本资料所记载的产品时，对于最大额定值、工作电源电压的范围、放热特性、安装条件及其他条件请在本公司规定的保证范围内使用。如果超出了本公司规定的保证范围使用时，对于由此而造成的故障和出现的事故，本公司将不承担任何责任。
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