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M16C/64 群

定时器 A 操作（单次触发模式、外部触发）

1. 要点

在单次触发模式中，可以选择如表 1 中所列的各种功能。在表 1 中用符号“○”表示本篇资料所选的项目，图 1 是定时器的工作时序图。

2. 说明

本篇资料，适用于 M16C/64 群单片机。

本篇资料中的参考例程也适用于 M16C 族产品中与 M16C/64 群具有相同 SFR（特殊功能寄存器）定义的产品。

由于 M16C 系列产品中有些功能会有所改进，请参看用户手册。如果使用本篇资料中所列功能时，请仔细检查每一步操作。

3. 选定功能

表 1. 选定功能

设定项目	设定内容	
计数源	<input type="radio"/>	内部时钟源 (f1TIMAB/f2TIMAB/f8TIMAB/f32TIMAB/f64TIMAB/fOCO-S/fc32)
脉冲输出功能	<input type="checkbox"/>	无脉冲输出
	<input type="radio"/>	有脉冲输出
计数开始条件	<input type="checkbox"/>	外部触发输入 (TAiIN 引脚输入信号的下降沿)
	<input type="radio"/>	外部触发输入 (TAiIN 引脚输入信号的上升沿)
	<input type="checkbox"/>	计数器溢出 (TB2/TAj/TAK 溢出)
	<input type="checkbox"/>	向单次触发开始标志写“1”
输出极性控制	<input type="radio"/>	输出波形“高”电平有效
	<input type="checkbox"/>	输出波形“低”电平有效 (输出反转)

注: $j = i - 1$, 在 $i = 0$ 时 $j = 4$ $k = i + 1$, 在 $i = 4$ 时 $k = 0$

4. 定时器 A 的操作

(1) 当 TAiIN 引脚的输入电平从“L”变为“H”时，并且把计数开始标志位置为“1”时，计数器开始对计数脉冲源的下降沿计数。同时，TAiOUT 引脚输出“H”电平

(2) 当计数值达到“0000h”时，TAiOUT 引脚输出“L”，重加载寄存器的设定值被加载到计数器，计数器停止计数。此时，定时器 Ai 中断请求位置为“1”。

(3) 当计数过程中发生触发时，重加载寄存器的设定值被加载到计数器，计数器继续计数。重加载的时序是在触发后的下一次计数的时刻。

(4) 把计数开始标志位置为“0”，计数器停止计数，重加载寄存器的设定值被加载到计数器。同时，TAiOUT 输出“L”电平。此时，定时器 Ai 中断请求位置为“1”。

注意: 如果定时器 Ai 寄存器的值被设定为“0000h”，定时器不会工作，因此定时器 Ai 中断请求也不会产生。如果设定了脉冲输出，也不会有脉冲从 TAiOUT 引脚输出，

选择单次触发模式的定时器工作时序图如下所示：

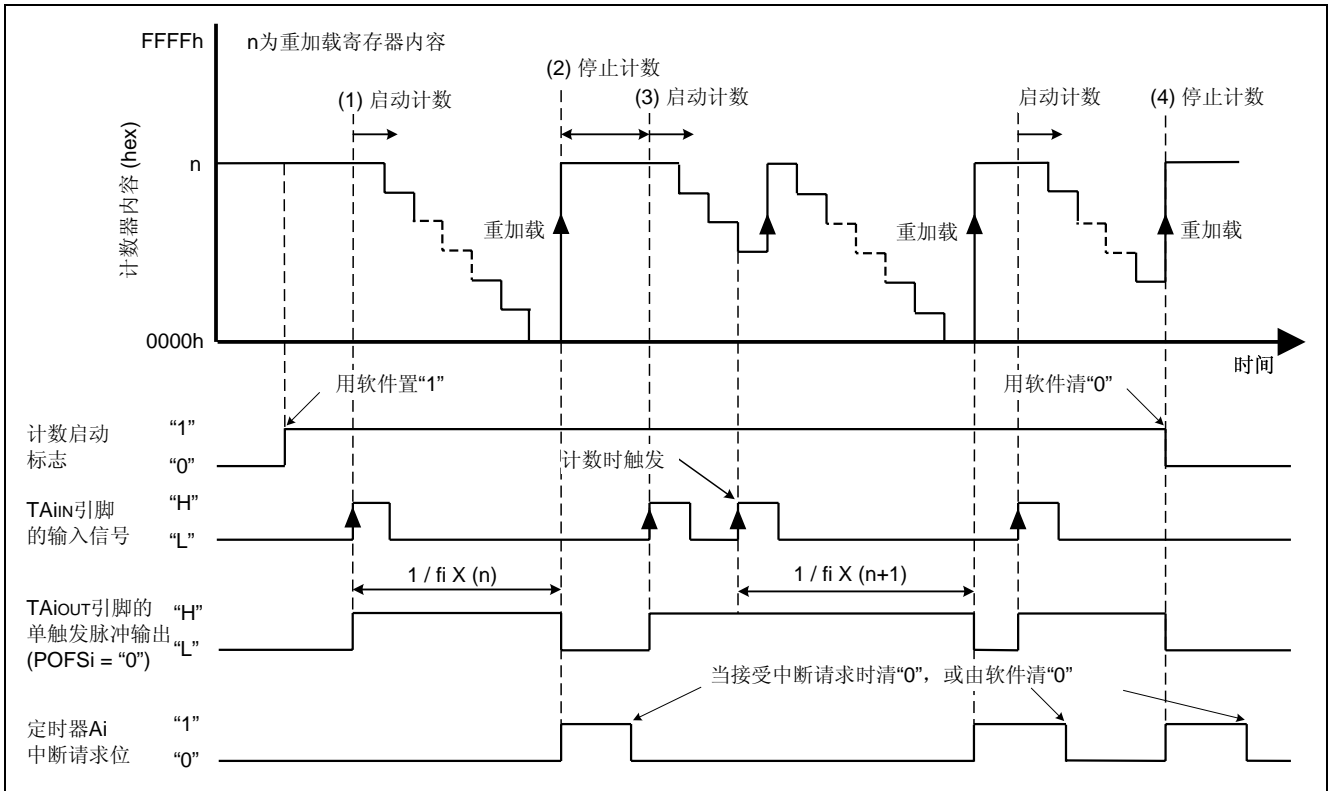


图 1. 选择单次触发模式的定时器的工作时序图

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

TACSi 寄存器 (注 1)				TAiMR 寄存器		计数源	计数源周期
TCS3/ TCS7	TCS2/ TCS6	TCS1/ TCS5	TCS0/ TCS4	TCK1	TCK0		f(PLL):24MHz f(XCIN):32.768kHz
0	-	-	-	0	0	f1TIMAB/f2TIMAB (注 2)	41.7ns/83.3ns
0	-	-	-	0	1	f8TIMAB	333.3ns
0	-	-	-	1	0	f32TIMAB	1333.3ns
0	-	-	-	1	1	fc32	976.56ns
1	0	0	0	-	-	f1TIMAB/f2TIMAB (注 2)	41.7ns/83.3ns
1	0	0	1	-	-	f8TIMAB	333.3ns
1	0	1	0	-	-	f32TIMAB	1333.3ns
1	0	1	1	-	-	f64TIMAB	2666.7ns
1	1	0	1	-	-	foco-s	约 8μs
1	1	1	0	-	-	fc32	976.56μs

注 1: 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 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）。

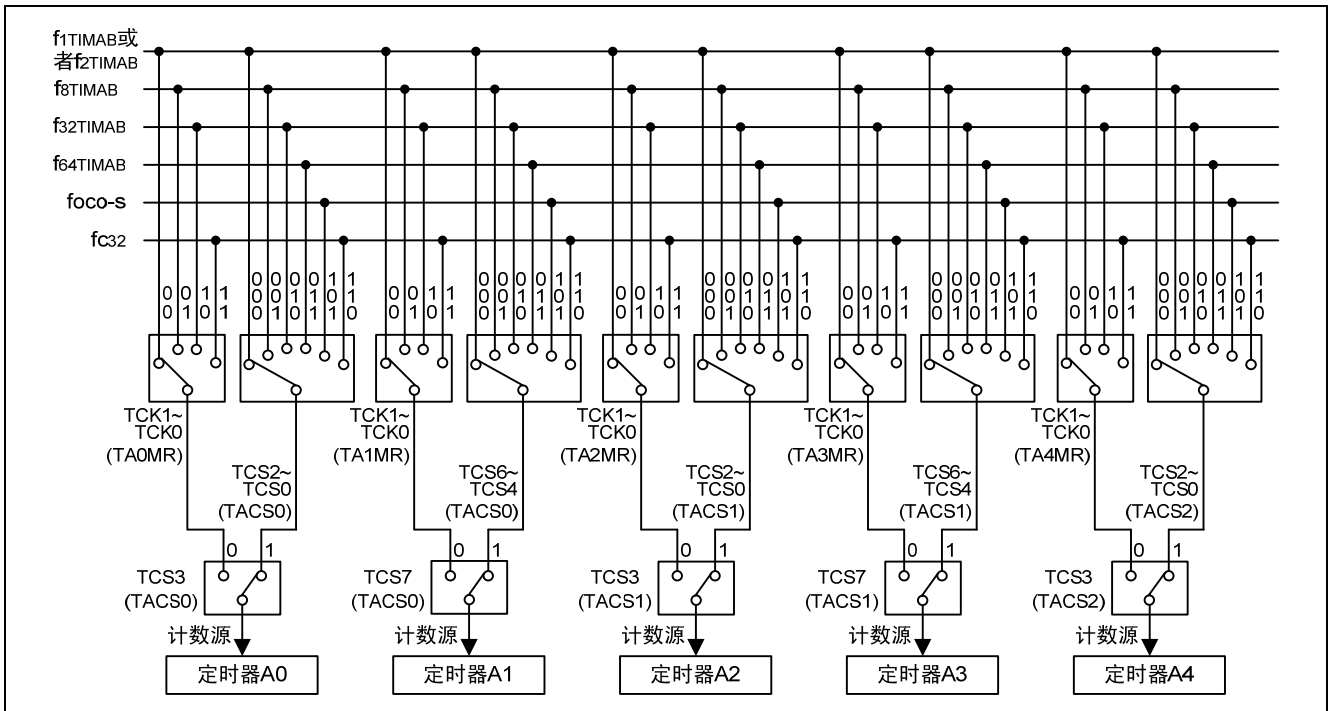
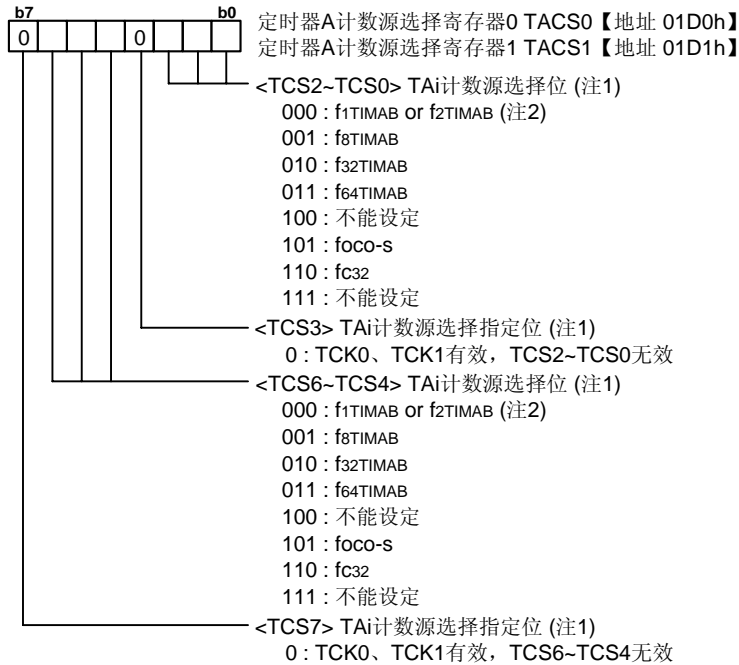


图 2. 定时器 A 的计数源

为了能够实现定义在“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/64 群的硬件手册。

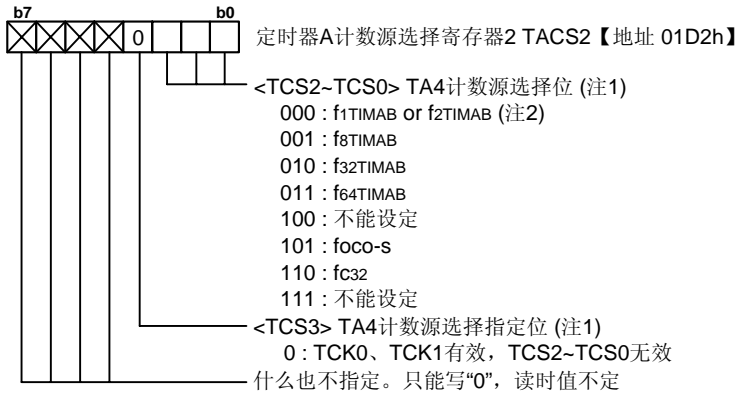
(1) 选择定时器计数源



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。

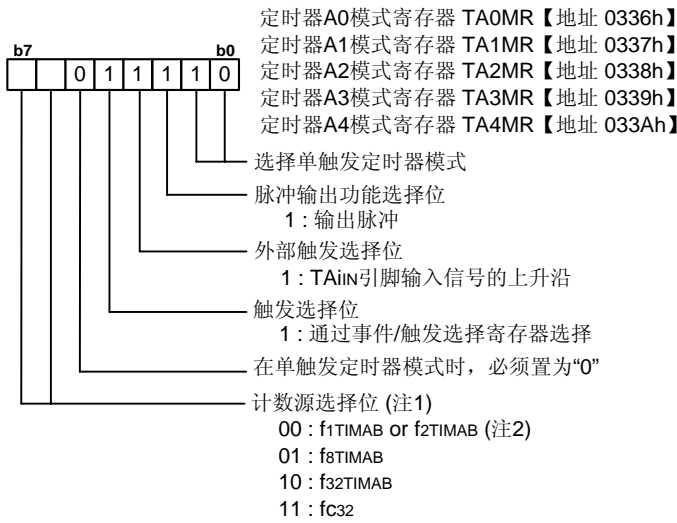
注2: 如果PCLKR寄存器中的PCLK0位为0选择f2TIMAB作为计数源, PCLK0位为1选择f1TIMAB作为计数源(复位设定值)。



注1: 关于各种设定情况下的计数源周期, 请参考表2。

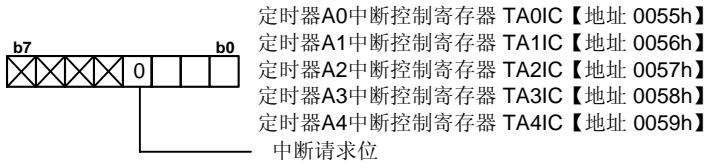
注2: 如果PCLKR寄存器中的PCLK0位为0选择f2TIMAB作为计数源, PCLK0位为1选择f1TIMAB作为计数源(复位设定值)。

(2) 选择单触发定时器模式和功能

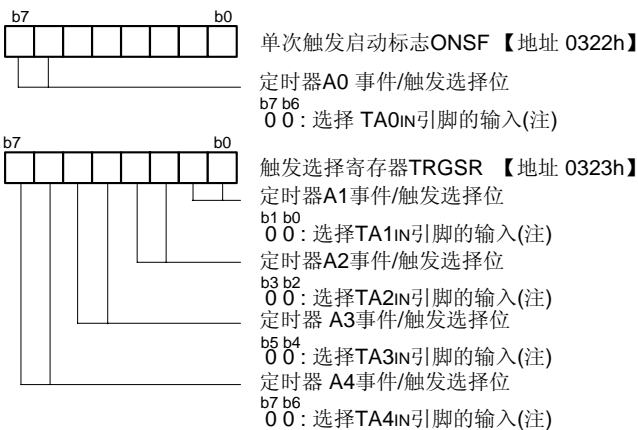


注1: TACS0~TACS2寄存器的TCS3位和TCS7位设置为0 (TCK0位、TCK1位有效)。关于各种设定情况下的计数源周期, 请参考表2。
 注2: 如果PCLKR寄存器中的PCLK0位为0选择f2TIMAB作为计数源, PCLK0位为1选择f1TIMAB作为计数源 (复位设定值)。

(3) 清零定时器Ai中断请求位 参考“定时器A (单触发定时器模式) 注意事项”



(4) 设置事件/触发选择位



注: 必须将相应的端口方向寄存器清“0” (输入模式)

(5) 设置单触发定时器的时间

定时器A0寄存器 TA0【地址 0327h~0326h】
 定时器A1寄存器 TA1【地址 0329h~0328h】
 定时器A2寄存器 TA2【地址 032Bh~032Ah】
 定时器A3寄存器 TA3【地址 032Dh~032Ch】
 定时器A4寄存器 TA4【地址 032Fh~032Eh】
 必须设定为0001h~FFFFh

(6) 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
- <POFS2> TA2out输出极性控制位
0: 输出波形“高”电平有效
- <POFS3> TA3out输出极性控制位
0: 输出波形“高”电平有效
- <POFS4> TA4out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

(7) 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 CPSFRF【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”）

(8) 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

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M16C/64 群硬件手册

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8. 除上述第7项内容外，不能将本资料中记载的产品用于以下用途。如果用于以下用途而造成的损失，本公司概不负责。
 - 1) 生命维持装置。
 - 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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