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2010年4月1日
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M16C/64 群

定时器 A 操作（单次触发模式）

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“〇”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	○	内部时钟源（f1TIMAB/f2TIMAB/f8TIMAB/f32TIMAB/f64TIMAB/fOCO-S/fC32）
脉冲输出功能		无脉冲输出
	○	有脉冲输出
计数开始条件		外部触发输入（TAiIN 引脚输入信号的下降沿）
		外部触发输入（TAiIN 引脚输入信号的上升沿）
		计数器溢出（TB2/TAj/TAk 溢出）
	○	向单次触发开始标志写“1”
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: 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) 将单次触发开始标志置“1”，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：

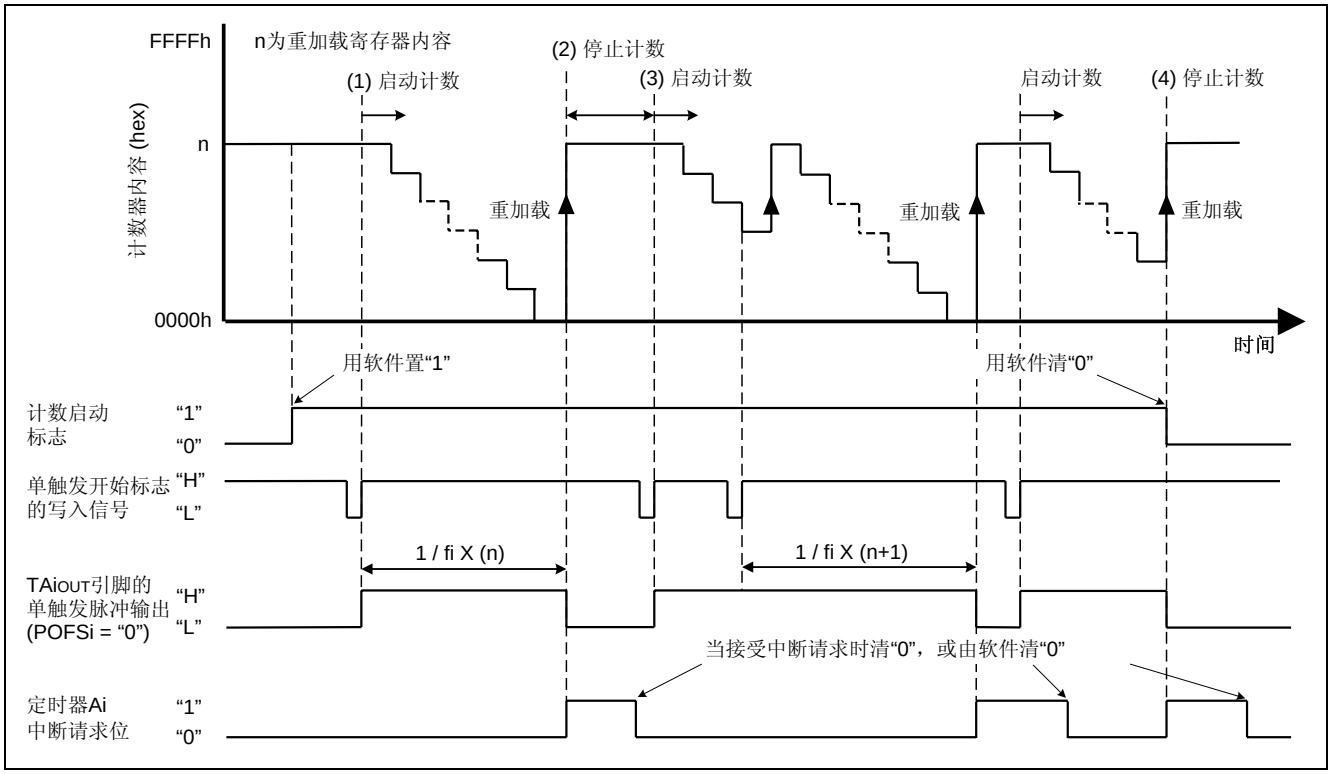


图 1. 选择单次触发模式的定时器的工作时序图

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	f_{1TIMAB}/f_{2TIMAB}（注 2）	41.7ns/83.3ns
0	-	-	-	0	1	f_{8TIMAB}	333.3ns
0	-	-	-	1	0	$f_{32TIMAB}$	1333.3ns
0	-	-	-	1	1	f_{C32}	976.56ns
1	0	0	0	-	-	f_{1TIMAB}/f_{2TIMAB}（注 2）	41.7ns/83.3ns
1	0	0	1	-	-	f_{8TIMAB}	333.3ns
1	0	1	0	-	-	$f_{32TIMAB}$	1333.3ns
1	0	1	1	-	-	$f_{64TIMAB}$	2666.7ns
1	1	0	1	-	-	foco-s	约 8μs
1	1	1	0	-	-	f_{C32}	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 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）。

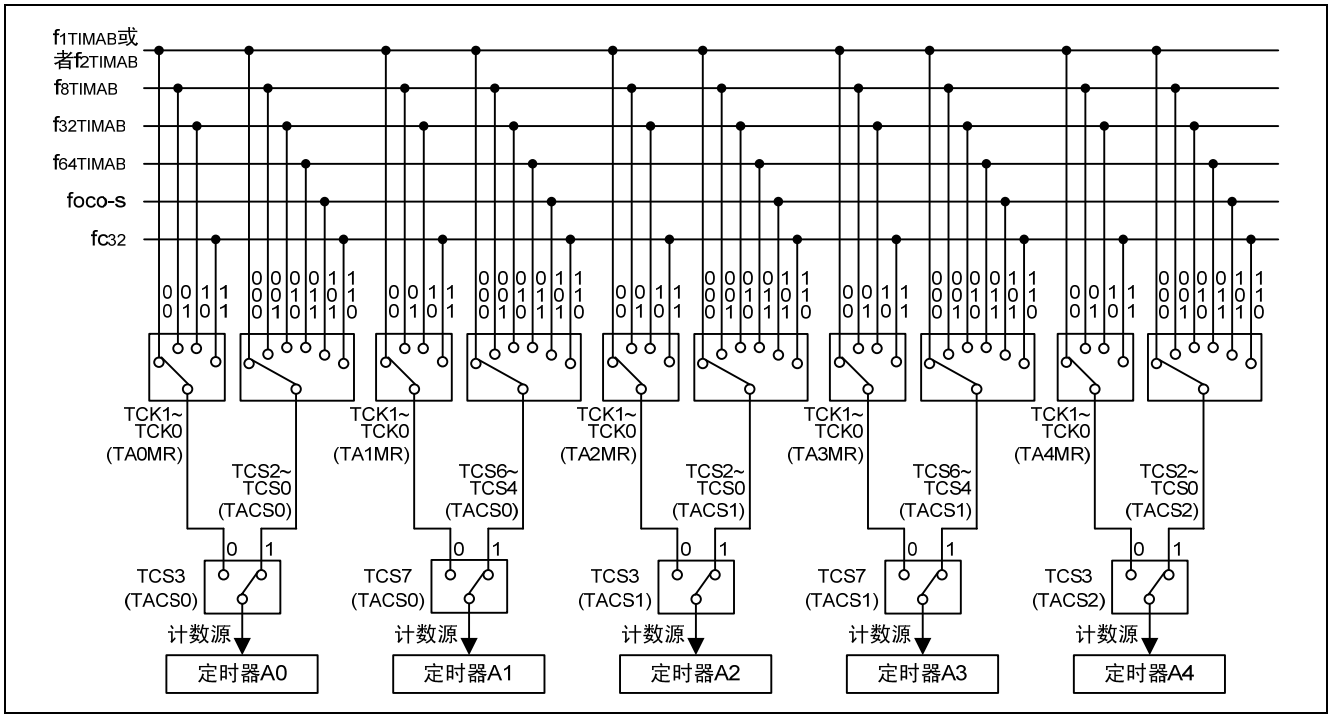
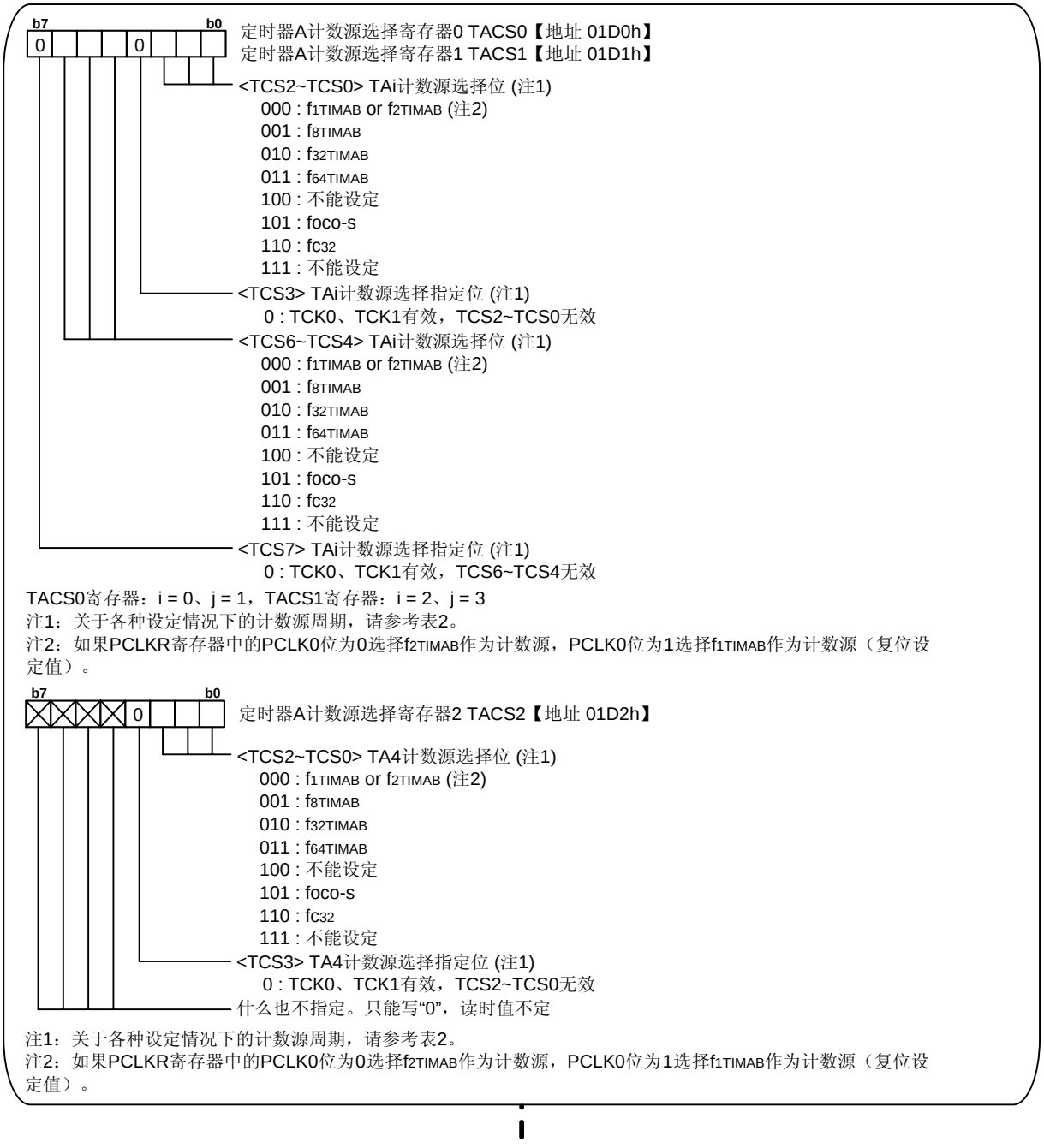


图 2. 定时器 A 的计数源

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/64 群的硬件手册。

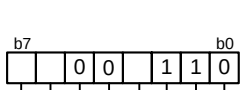
(1) 选择定时器计数源



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



定时器A0模式寄存器 TA0MR【地址 0336h】
定时器A1模式寄存器 TA1MR【地址 0337h】
定时器A2模式寄存器 TA2MR【地址 0338h】
定时器A3模式寄存器 TA3MR【地址 0339h】
定时器A4模式寄存器 TA4MR【地址 033Ah】

选择单触发定时器模式

脉冲输出功能选择位
1：输出脉冲

外部触发选择位
当选择内部触发时，这位既可设置为“1”也可设置为“0”。

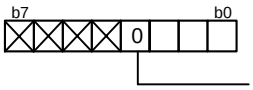
触发选择位
0：向单次触发开始标志位写“1”

在单触发定时器模式时，必须置为“0”

计数源选择位 (注1)
00：f_{1TIMAB} or f_{2TIMAB} (注2)
01：f_{8TIMAB}
10：$f_{32TIMAB}$
11：fc_{32}

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）。

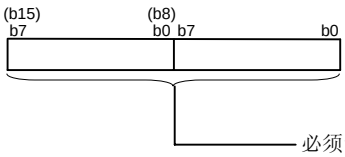
(3) 清零定时器Ai中断请求位 参考“定时器A（单触发定时器模式）注意事项”



定时器Ai中断控制寄存器【地址 0055h～0059h】
TAiIC（i=0～4）

中断请求位

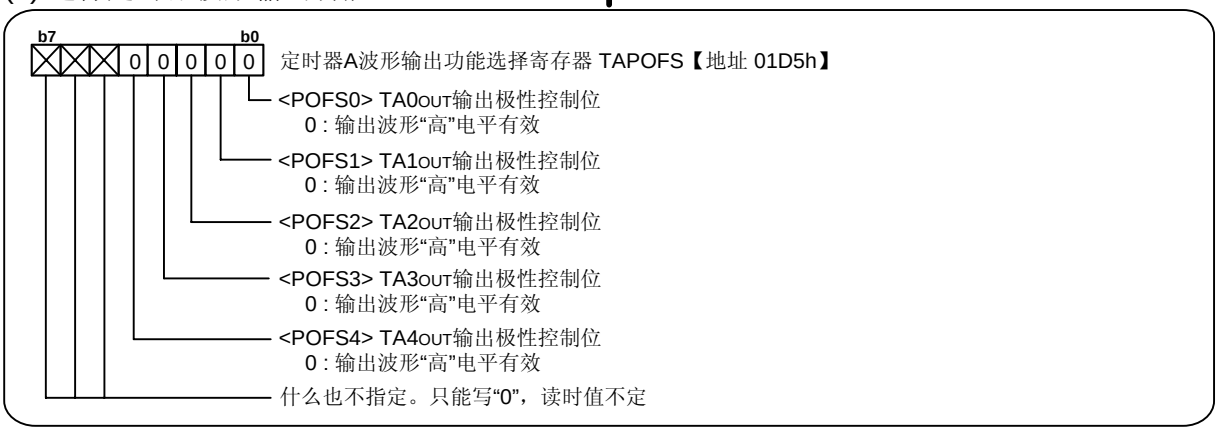
(4) 设置单触发定时器的时间



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】

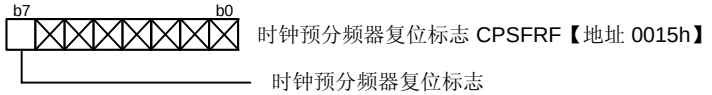
必须设定为0001h～FFFFh

(5) 选择定时器波形输出功能



(6) 设置时钟预分频器复位标志位

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



(7) 设置定时器计数开始标志位

(8) 设置单触发开始标志位

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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11. 如果把本资料所记载的产品从其载体设备上卸下，有可能造成婴儿误吞的危险。顾客在将本公司产品安装到顾客的设备上时，请顾客自行负责将本公司产品设置为不容易剥落的安全设计。如果从顾客的设备上剥落而造成事故时，本公司将不承担任何责任。
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