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M16C/64 群

定时器 A 操作（计数器模式、脉冲输出功能）

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“○”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/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
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

- 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。
- 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”。另外，TAiOUT 引脚的输出极性反转。
- 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。另外，TAiOUT 引脚输出“低”电平。

选择定时器模式的定时器工作时序图如下所示：

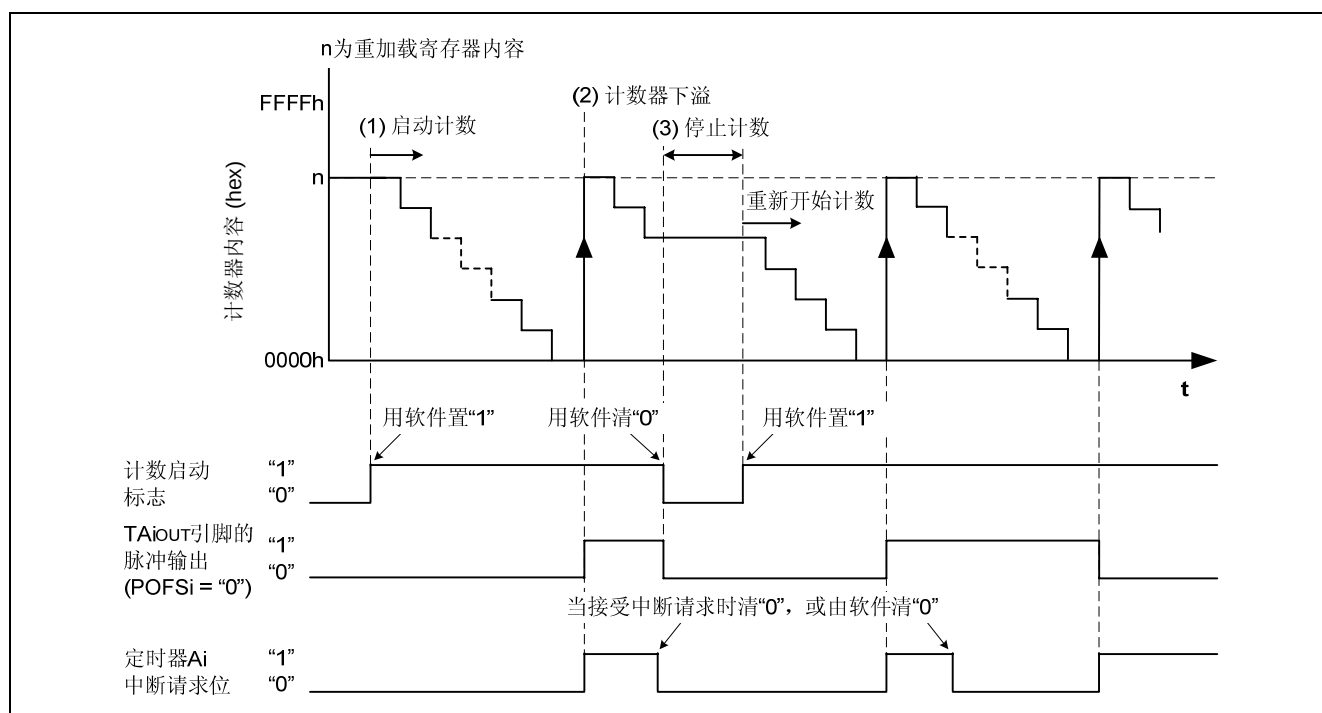


图 1. 选择定时器模式、脉冲输出功能时的工作时序图

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）。

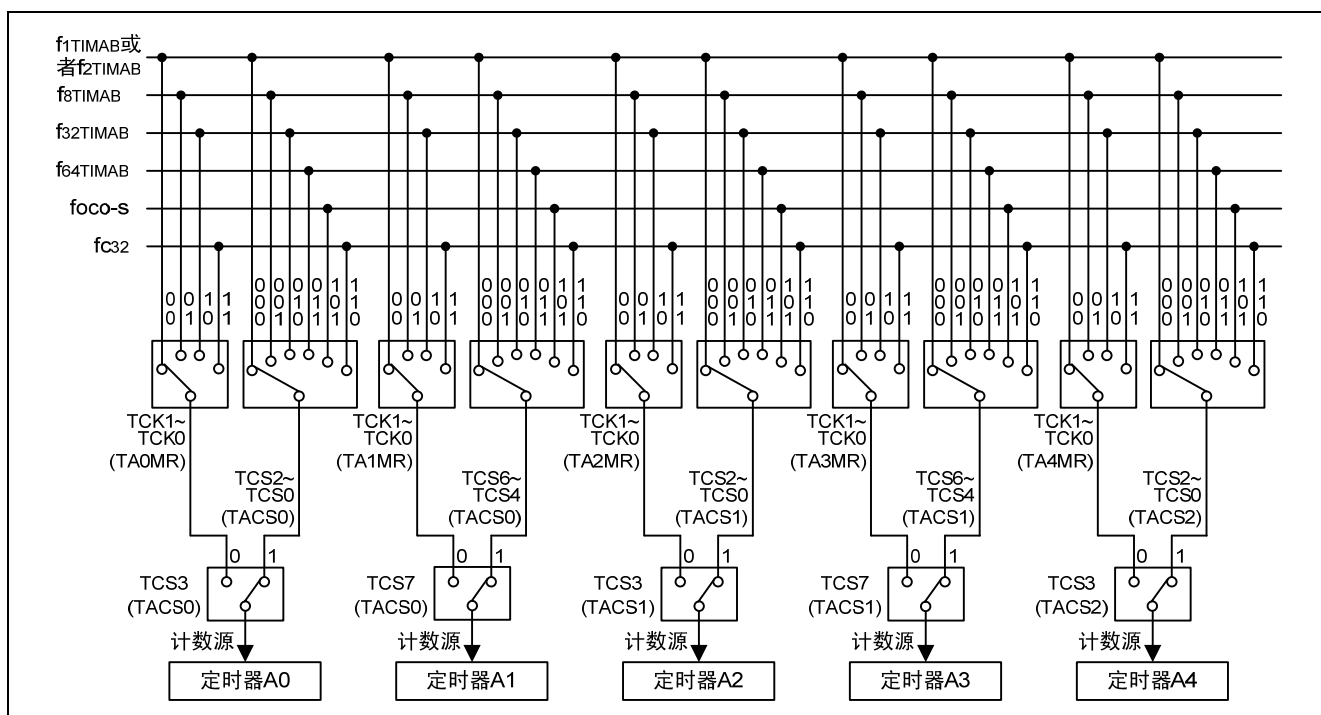
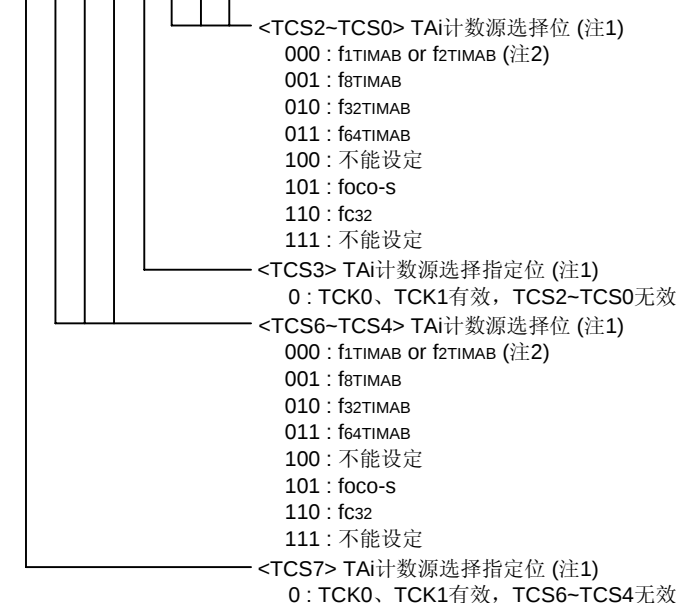


图 2. 定时器 A 的计数源

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

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】

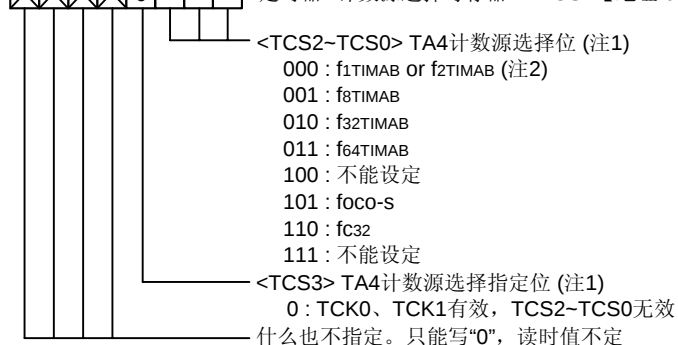


TACS0寄存器: i = 0、j = 1, TACS1寄存器: i = 2、j = 3

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）。

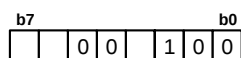
定时器A计数源选择寄存器2 TACS2【地址 01D2h】



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】

<TMOD1, TMOD0> 工作模式选择位

00: 定时器模式

<MR0> 脉冲输出功能选择位

1: 输出脉冲 (注1) (TAiout作为脉冲输出端口)

<MR2, MR1> 门控功能选择位

00:

01: } 门控功能禁止 (TA0in作为普通端口)

<MR3> 在定时器模式时, 必须置为“0”

<TCK1, TCK0> 计数源选择位 (注2)

00: f1TIMAB or f2TIMAB (注3)

01: f8TIMAB

10: f32TIMAB

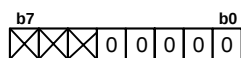
11: fc32

注1: 对应的端口寄存器和端口方向寄存器的设定无效。

注2: 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)。

(3) 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

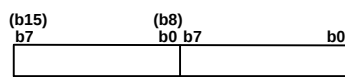
0: 输出波形“高”电平有效

<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

(4) 设置定时器Ai寄存器 (i=0~4)



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】

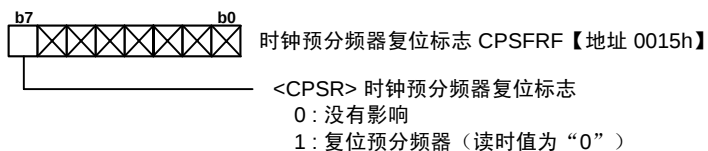
定时器A3寄存器 TA3 【地址 032Dh~032Ch】

定时器A4寄存器 TA4 【地址 032Fh~032Eh】

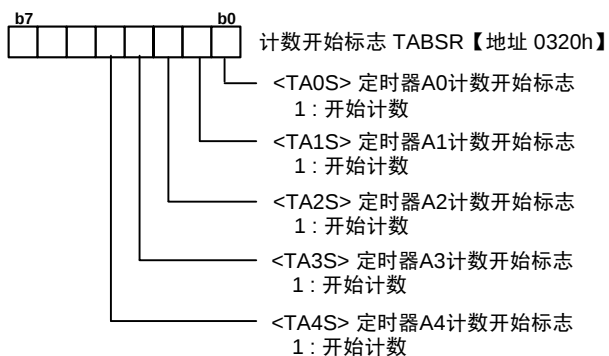
——必须设定为0000h~FFFFh

(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。



(6) 设置定时器计数开始标志位



开始计数

6. 参考文献

数据手册

M16C/64 群硬件手册

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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。
10. 本公司一直致力于提高产品的质量和可靠性，但一般来说，半导体产品总会以一定的概率发生故障、或者由于使用条件不同而出现错误运行等。为了避免因本公司的产品发生故障或者错误运行而导致人身事故和火灾或造成社会性的损失，希望客户能自行负责进行冗余设计、采取延烧对策及进行防止错误运行等的安全设计（包括硬件和软件两方面的设计）以及老化处理等，这是作为机器和系统的出厂保证。特别是单片机的软件，由于单独进行验证很困难，所以要求在顾客制造的最终的机器及系统上进行安全检验工作。
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。
12. 在未得到本公司的事先书面认可时，不可将本资料的一部分或者全部转载或者复制。
13. 如果需要了解关于本资料的详细内容，或者有其他关心的问题，请向本公司的营业窗口咨询。

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