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瑞萨电子公司

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M16C/64 群

长周期定时器

1. 要点

将定时器 A0 和定时器 A1 相连接，作为一个带 16 位预定标器的 16 位定时器使用。

使用下面的外围功能：

- 定时器 A 的定时器模式
- 定时器 A 的事件计数模式

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. 规格

(1) 设置定时器 A0 为定时器模式，设置定时器 A1 为事件计数模式。

(2) 用定时器 A0 实现对计数源 f1TIMAB 进行 1ms 计时，用定时器 A1 实现对 A0 的 1 秒计数。

(3) 连接一个 16MHz 的振荡器到 XIN。

(4) 通过 TAPOFS 寄存器的 POFSi 位，选择 TAiOUT 引脚的输出极性不反转（TAi 位为“0”，即计数停止时，输出“低”电平）。（i = 0、1）

4. 定时器 A 的操作

(1) 设定计数启动标志为“1”，开始计数。定时器 A0 对计数源 f1TIMAB 进行递减计数。

(2) 如果定时器 A0 递减计数发生下溢时，重加载寄存器的设定值将被加载到计数器，计数器继续进行计数。同时，定时器 A0 的中断请求位置为“1”。用定时器 A1 实现对定时器 A0 的下溢次数进行递减计数。

(3) 如果定时器 A1 减计数溢出，重加载寄存器的设定值也将被加载到计数器，计数器继续进行计数。此时定时器 A1 的中断请求位置为“1”。

工作时序图如下所示：

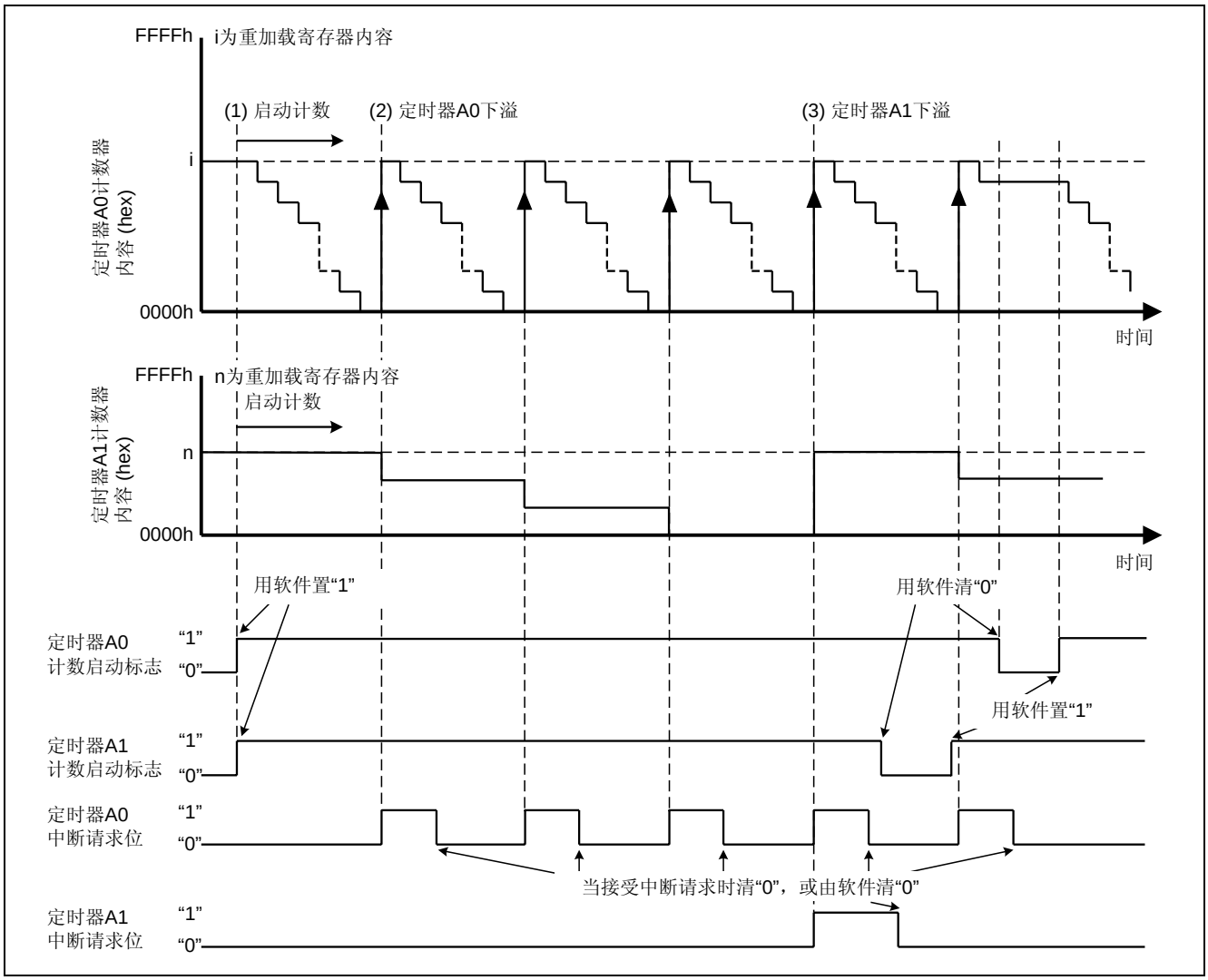


图 1. 长周期定时器的工作时序图

连接示意图如下所示：

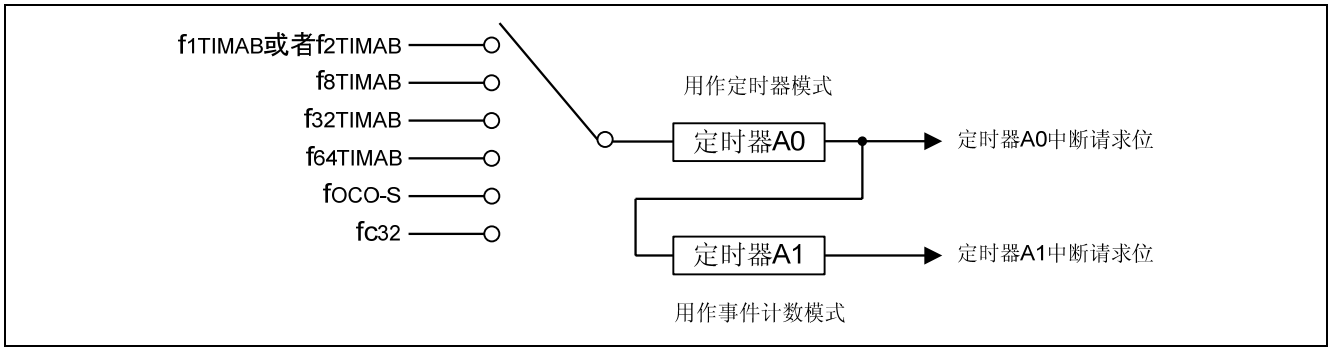


图 2. 长周期定时器的连接示意图

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

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）。

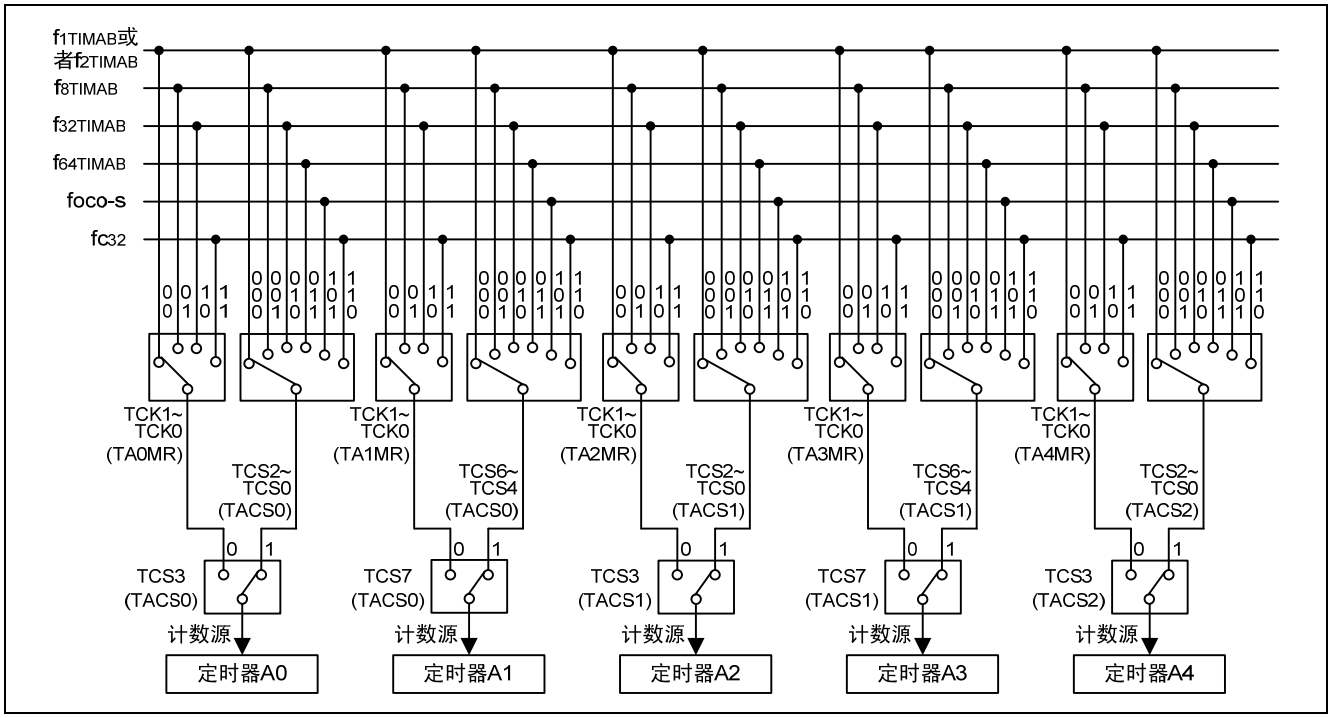


图 3. 定时器 A 的计数源

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。

设定定时器A0

选择定时器计数源

b7 b0

0

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)
000 : f_{1TIMAB} or f_{2TIMAB} (注2)
001 : f_{8TIMAB}
010 : $f_{32TIMAB}$
011 : $f_{64TIMAB}$
100 : 不能设定
101 : foco-s
110 : f_{C32}
111 : 不能设定

<TCS3> TA0计数源选择指定位 (注1)
0 : TCK0、TCK1有效，TCS2~TCS0无效

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）。

选择定时器模式和功能

b7 b0

0 0 0 0 0 0 0 0

定时器A0模式寄存器 TA0MR【地址 0336h】

<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
0 : 不输出脉冲 ($TA0_{OUT}$作为输入/输出端口)

<MR2, MR1> 门控功能选择位
00 : 门控功能禁止 ($TA0_{IN}$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1)
00 : f_{1TIMAB} or f_{2TIMAB} (注2)
01 : f_{8TIMAB}
10 : $f_{32TIMAB}$
11 : f_{C32}

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）。

设置定时器A0寄存器

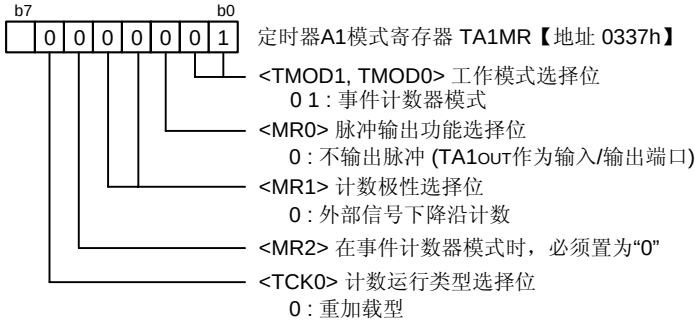
(b15) (b8)
b7 b0 b7 b0

3Eh	7Fh

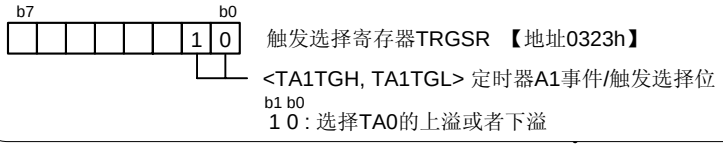
定时器A0寄存器 TA0【地址 0327h～0326h】

设定定时器A1

选择事件计数器模式和功能

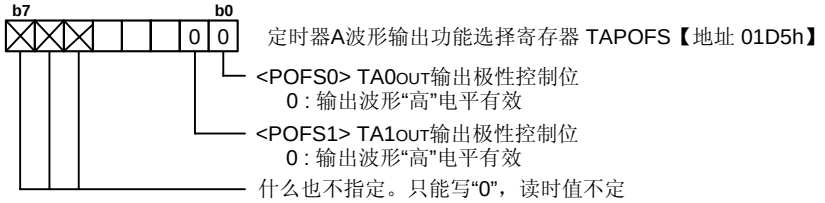


触发选择寄存器

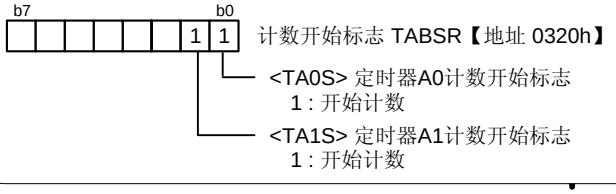


设置定时器A1寄存器

选择定时器波形输出功能



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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