

晟矽微电 应用笔记

MS32F031

ADC TimerTrigger

AN22008

V1.0





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1 适用范围

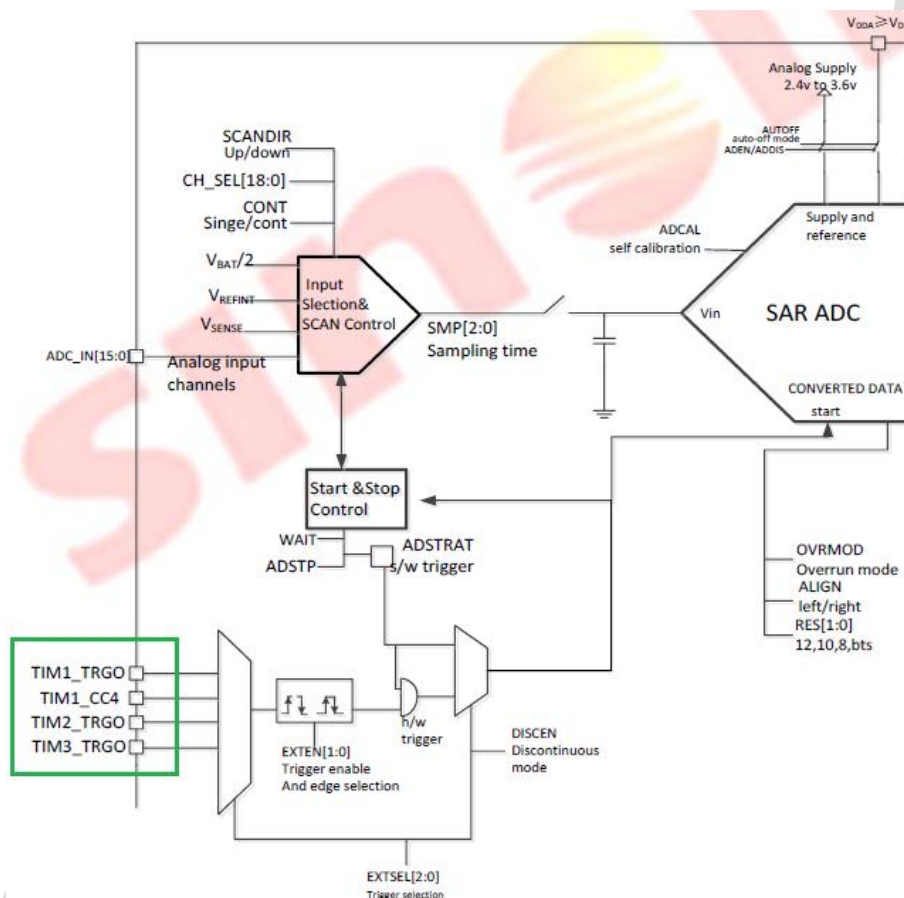
本文档适用于 MS32F031A6, ADC Timer 触发应用参考。
基于 MS32F031A6 EV Board V1.1 (2021-11-25) 测试。

2 ADC 硬件触发

2.1 ADC_CFGR1

2.1.1 理论分析

MS32F031A6 用户手册 V1.0.2, “12.4 章节” ADC 模块部分框图如下:



ADC_CFGR1 寄存器硬件触发源相关“位”如下:

BIT[8:6]

EXTSEL[2:0]

外部触发选择

这些位用于选择触发 ADC 转换的外部事件:

000: TRG0(TIM1_TRGO)

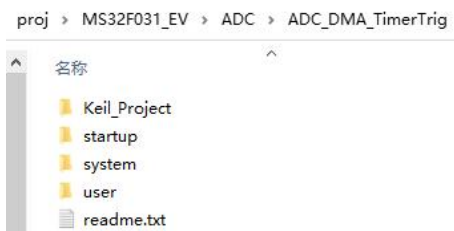
001: TRG1(TIM1_CC4)

010: TRG2(TIM2_TRGO)

011: TRG3(TIM3_TRGO)

2.1.2 例程测试

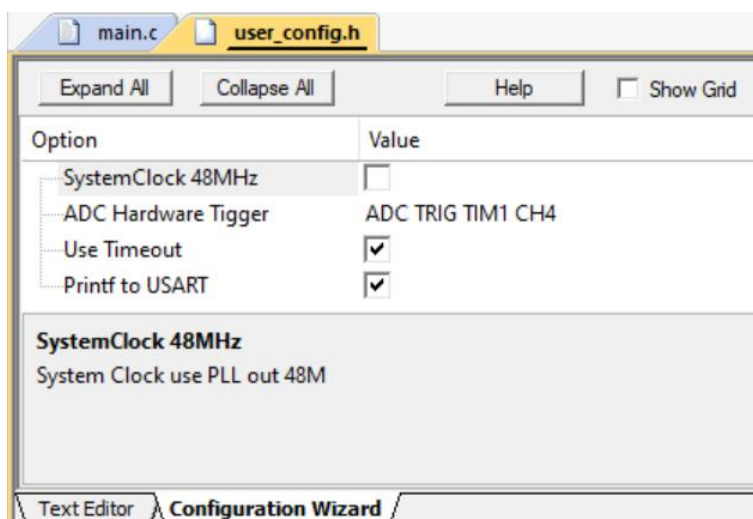
附件例程解压后放在 MS32F0x1_Periph_Lib_Example\proj\MS32F031_EV\ADC 目录下。



2.1.2.1 分析及运行

例程提供 TIM1 TRGO、TIM1 CC4、TIM2 TRGO 示例，并对 TIM1 TRGO 输出信号源提供了 UIF、OC3REF、OC4REF 三种（其它未在例程中体现）。

例程默认 TIM1 CC4。



编译后，相关程序如下：

```
63 MS32_TIM_SetTriggerOutput(TIM1, MS32_TIM_TRGO_OC4REF);
64 #else // ADC_HW_TRIG == 3 // user_config.h, 3:ADC TRIG TIM1 CH4
65 MS32_TIM_OC_Init(TIM1, MS32_TIM_CHANNEL_CH4, &TimerOCInitStruct);
66 MS32_TIM_CC_EnableChannel(TIM1, MS32_TIM_CHANNEL_CH4); // enable channel,ADC_TIMER_TIM1_CH4
67 MS32_TIM_EnableAllOutputs(TIM1); // enable ouput,ADC_TIMER_TIM1_CH4
68 #endif
69 #endif
```

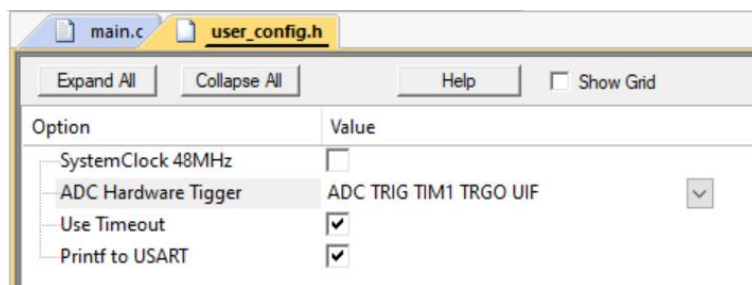
TIM1 CC4 作为 ADC 触发信号时，需要使能通道，并开启主输出；无需开始对应中断。

运行，结果如下 (PA2 VDDA, PA3 AGND, PA4 VDDA)：

```
*****ADC DMA Timer Trig Example*****
--Inf: System Core Clock 8000000 Hz.
--Inf: Timer1 CH4 Trigger.
ADC PA1: 1336 mV, PA2: 3300 mV, PA3: 2 mV, PA4: 3300 mV
ADC PA1: 1326 mV, PA2: 3300 mV, PA3: 1 mV, PA4: 3300 mV
ADC PA1: 1324 mV, PA2: 3300 mV, PA3: 2 mV, PA4: 3300 mV
ADC PA1: 1326 mV, PA2: 3300 mV, PA3: 3 mV, PA4: 3300 mV
ADC PA1: 1324 mV, PA2: 3300 mV, PA3: 2 mV, PA4: 3300 mV
--Inf: running count:1
```

2.2 TIM1 TRGO UIF

程序功能调整：



编译后，相关程序如下：

```
43 #if(( ADC_HW_TRIG == 0) || ( ADC_HW_TRIG == 1) || ( ADC_HW_TRIG == 2) || ( ADC_HW_TRIG == 3)) //Timer1
44   TimerInitStruct.RepetitionCounter = 0;
45   MS32_TIM_Init(TIM1, &TimerInitStruct); // init function had enable clock
46
47   MS32_TIM_SetClockSource(TIM1, MS32_TIM_CLOCKSOURCE_INTERNAL); // clk form RCC:PCLK <-- AHP_RRE=1,sysclk <-- HSI
48   MS32_TIM_EnableARRPreload(TIM1);
49   MS32_TIM_DisableMasterSlaveMode(TIM1); // disable the Master/Slave mode.
50
51 #if( ADC_HW_TRIG == 0) // user_config.h, 0:ADC TRIG TIM1 TRGO UIF
52   MS32_TIM_SetTriggerOutput(TIM1, MS32_TIM_TRGO_UPDATE);
53 #elif (( ADC_HW_TRIG == 1) || ( ADC_HW_TRIG == 2) || ( ADC_HW_TRIG == 3)) // user_config.h, 1,2,3
```

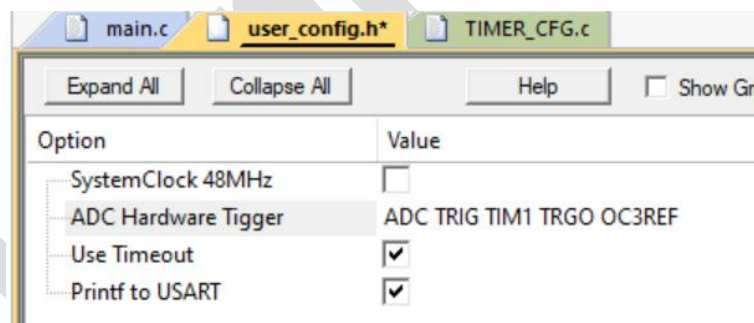
TIM1 TRGO UIF 作为 ADC 触发信号时，设置 UIF 置位为触发输出即可。

运行，结果如下(PA2 VDDA, PA3 AGND, PA4 VDDA)：

```
*****ADC DMA Timer Trig Example*****
--Inf: System Core Clock 8000000 Hz.
--Inf: Timer1 Trigger UIF.
ADC PA1: 1328 mV, PA2: 3300 mV, PA3: 2 mV, PA4: 3300 mV
ADC PA1: 1326 mV, PA2: 3300 mV, PA3: 2 mV, PA4: 3300 mV
ADC PA1: 1326 mV, PA2: 3300 mV, PA3: 3 mV, PA4: 3300 mV
ADC PA1: 1325 mV, PA2: 3300 mV, PA3: 3 mV, PA4: 3300 mV
ADC PA1: 1325 mV, PA2: 3300 mV, PA3: 1 mV, PA4: 3300 mV
--Inf: running count:1
```

2.3 TIM1 TRGO OC3REF

程序功能调整：



编译后，相关程序如下：

```
51 #if( ADC_HW_TRIG == 0) // user_config.h, 0:ADC TRIG TIM1 TRGO UIF
52   MS32_TIM_SetTriggerOutput(TIM1, MS32_TIM_TRGO_UPDATE);
53 #elif (( ADC_HW_TRIG == 1) || ( ADC_HW_TRIG == 2) || ( ADC_HW_TRIG == 3)) // user_config.h, 1,2,3
54   MS32_TIM_OC_StructInit(&TimerOCInitStruct);
55   TimerOCInitStruct.OCMode = MS32_TIM_OCMODE_PWM1; // PWM1 mode
56   TimerOCInitStruct.CompareValue = ((( MS32_TIM_GetAutoReload(TIM1) + 1 ) * 25 ) / 100); // set duty cycle 25%
57
58 #if ( ADC_HW_TRIG == 1) // user_config.h, 1:ADC TRIG TIM1 TRGO OC3REF
59   MS32_TIM_OC_Init(TIM1, MS32_TIM_CHANNEL_CH3, &TimerOCInitStruct);
60   MS32_TIM_SetTriggerOutput(TIM1, MS32_TIM_TRGO_OC3REF);
61 #elif ( ADC_HW_TRIG == 2) // user_config.h, 2:ADC TRIG TIM1 TRGO OC4REF
62   MS32_TIM_OC_Init(TIM1, MS32_TIM_CHANNEL_CH4, &TimerOCInitStruct);
63   MS32_TIM_SetTriggerOutput(TIM1, MS32_TIM_TRGO_OC4REF);
```

TIM1 TRGO OC3REF 作为 ADC 触发信号时，设置输出比较模式及比较寄存器的值，并设置 OC3REF 信号被用于触发输出(TRGO)。

运行，结果如下(PA2 VDDA, PA3 AGND, PA4 VDDA)：



```
*****ADC DMA Timer Trig Example*****
—Inf: System Core Clock 8000000 Hz.
—Inf: Timer1 Trigger OC3REF.
ADC PA1: 1327 mV, PA2: 3300 mV, PA3: 4 mV, PA4: 3300 mV
ADC PA1: 1326 mV, PA2: 3300 mV, PA3: 2 mV, PA4: 3300 mV
ADC PA1: 1325 mV, PA2: 3300 mV, PA3: 1 mV, PA4: 3300 mV
ADC PA1: 1325 mV, PA2: 3300 mV, PA3: 1 mV, PA4: 3300 mV
ADC PA1: 1325 mV, PA2: 3300 mV, PA3: 2 mV, PA4: 3300 mV
—Inf: running count:1
```

2.4 TIM1 TRGO OC4REF

参考“2.3TIM1 TRGO OC3REF”小节。

Option	Value
SystemClock 48MHz	<input type="checkbox"/>
ADC Hardware Tigger	ADC TRIG TIM1 TRGO OC4REF
Use Timeout	<input checked="" type="checkbox"/>
Printf to USART	<input checked="" type="checkbox"/>

```
*****ADC DMA Timer Trig Example*****
—Inf: System Core Clock 8000000 Hz.
—Inf: Timer1 Trigger OC4REF.
ADC PA1: 1327 mV, PA2: 3300 mV, PA3: 2 mV, PA4: 3300 mV
ADC PA1: 1325 mV, PA2: 3300 mV, PA3: 3 mV, PA4: 3300 mV
ADC PA1: 1326 mV, PA2: 3300 mV, PA3: 3 mV, PA4: 3300 mV
ADC PA1: 1326 mV, PA2: 3300 mV, PA3: 4 mV, PA4: 3300 mV
ADC PA1: 1325 mV, PA2: 3297 mV, PA3: 2 mV, PA4: 3300 mV
—Inf: running count:1
```

2.5 TIM2 TRGO UIF

参考“2.2TIM1 TRGO UIF”小节。

Option	Value
SystemClock 48MHz	<input type="checkbox"/>
ADC Hardware Tigger	ADC TRIG TIM2 TRGO
Use Timeout	<input checked="" type="checkbox"/>
Printf to USART	<input checked="" type="checkbox"/>

```
*****ADC DMA Timer Trig Example*****
—Inf: System Core Clock 8000000 Hz.
—Inf: Timer2 Trigger.
ADC PA1: 1336 mV, PA2: 3300 mV, PA3: 2 mV, PA4: 3300 mV
ADC PA1: 1326 mV, PA2: 3300 mV, PA3: 0 mV, PA4: 3300 mV
ADC PA1: 1326 mV, PA2: 3300 mV, PA3: 2 mV, PA4: 3300 mV
ADC PA1: 1326 mV, PA2: 3300 mV, PA3: 2 mV, PA4: 3300 mV
ADC PA1: 1327 mV, PA2: 3300 mV, PA3: 2 mV, PA4: 3300 mV
—Inf: running count:1
```

2.6 说明

例程向上计数，通道为 PWM1 模式；

TIM1 TRGO UIF 重复计数器例程为 0；

TIM1 TRGO OC1REF、OC2REF，Timer2 TRGO OCxREF，Timer3 例程未提供，可参考例程实现。



3 修订记录

版本	修订日期	修订内容
V1.0	2022-08-26	1359, 初版。