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Topic: Timer Interrupts on Due (Read 116677 times)

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Newbie

Posts: 3

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(<http://forum.arduino.cc/index.php?action=karma;sa=applaud;u=id=153016;b8af6cf=2290d28274121ddf0035d3f4611a191a>)

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(<http://forum.arduino.cc/index.php?action=profile;u=105845>)



(<http://forum.arduino.cc/index.php?action=profile;u=105845>)



Full Member



Timer Interrupts on Due (<http://forum.arduino.cc/index.php?topic=130423.msg981027#msg981027>)

Nov 03, 2012, 12:02 am (<http://forum.arduino.cc/index.php?topic=130423.msg981027#msg981027>)

I've been searching through the library code as well as thoroughly searched Google and haven't come across any working timer interrupt code for the Due. I could do this on the Uno in my sleep, but have yet to figure it out on the Due. Any pointers (<http://xkcd.com/138/>) or example code would be greatly appreciated. Basically I want to get a function to run once every X microseconds. Thanks.



Re: Timer Interrupts on Due (<http://forum.arduino.cc/index.php?topic=130423.msg981418#msg981418>)

Nov 03, 2012, 12:23 pm (<http://forum.arduino.cc/index.php?topic=130423.msg981418#msg981418>)

#1

Yeah, I was hoping to get timer interrupt hints on my thread for Tone.cpp code. I've done timers on Uno and Maple, but Maple IO architecture is quite different from DUE. There is PWM timer code in `hardware/arduino/sam/cores/arduino/wiring_analog.c` but no interrupt code. The Timer/Counter support routines (no interrupt routines) are in `hardware/arduino/sam/system/libsam/source/tc.c` with the `#define`'s in `hardware/arduino/sam/system/CMSIS/Device/ATMEL/sam3sd8/include/component/component_tc.h`

Posts: 119
Karma: 15 [add]
(<http://forum.arduino.cc/index.php?action=karma;sa=applaud;uid=105845;b8af6cf=2290d28274121ddf0035d3f4611a191a>)

stimmer
(<http://forum.arduino.cc/index.php?action=profile;u=18681>)



(<http://forum.arduino.cc/index.php?action=profile;u=18681>)
☆☆☆☆☆
God Member
Posts: 507
Karma: 35 [add]
(<http://forum.arduino.cc/index.php?action=karma;sa=applaud;uid=18681;b8af6cf=2290d28274121ddf0035d3f4611a191a>)

DuaneB
(<http://forum.arduino.cc/index.php?action=profile;u=61029>)



(<http://forum.arduino.cc/index.php?action=profile;u=61029>)
★
Edison Member
Posts: 1,675
(<http://rcarduino.blogspot.com/>)

The ISR handler's are named TCx_Handler(), e.g. TC0_Handler()

I'm guessing (don't have a DUE yet) that interrupt enable would be something like
tc->TC_CHANNEL[chan].TC_IER = TC_IER_CPCS;
but there is also an interrupt mask register TC_IMR?

not much help, but hopeful ...

 **Re: Timer Interrupts on Due** (<http://forum.arduino.cc/index.php?topic=130423.msg982062#msg982062>)

Nov 04, 2012, 04:17 am (<http://forum.arduino.cc/index.php?topic=130423.msg982062#msg982062>)

#2

I think I'm getting somewhere with this... try this:

Code: [Select]

```
volatile boolean l;  
  
void TC0_Handler()  
{  
    long dummy=REG_TC0_SR0; // vital - reading this clears some flag  
                             // otherwise you get infinite interrupts  
    l = !l;  
}
```

The timer controls the output of pin 2 and the interrupt toggles a flag which is output on pin 13.

Due VGA library - <http://arduino.cc/forum/index.php/topic,150517.0.html>

 **Re: Timer Interrupts on Due** (<http://forum.arduino.cc/index.php?topic=130423.msg982105#msg982105>)

Nov 04, 2012, 06:21 am (<http://forum.arduino.cc/index.php?topic=130423.msg982105#msg982105>)

#3

Hi,
Whats the best resource you have found for describing the timer registers ?

Thanks

Duane B

rcarduino.blogspot.com (<http://rcarduino.blogspot.com>)

Read this
<http://rcarduino.blogspot.com/2012/04/servo-problems-with-arduino-part-1.html>
then watch this

Karma: 24 [add]
(<http://forum.arduino.cc/index.php?action=karma;sa=applaud;uid=61029;b8af6cf=2290d28274121ddf0035d3f4611a191a>)
RC Car Meets Arduino
(<http://rcarduino.blogspot.com/>)

Sebastian Vik
(<http://forum.arduino.cc/index.php?action=profile;u=153174>)



(<http://forum.arduino.cc/index.php?action=profile;u=153174>)



Newbie

Posts: 19

Karma: 0 [add]

(<http://forum.arduino.cc/index.php?action=karma;sa=applaud;uid=153174;b8af6cf=2290d28274121ddf0035d3f4611a191a>)

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mantoui
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(<http://forum.arduino.cc/index.php?action=profile;u=105845>)

(<http://forum.arduino.cc/index.php?action=profile;u=105845>)



Full Member

Posts: 119

Karma: 15 [add]

(<http://forum.arduino.cc/index.php?action=karma;sa=applaud;uid=105845;b8af6cf=2290d28274121ddf0035d3f4611a191a>)

<http://rcarduino.blogspot.com/2012/04/servo-problems-part-2-demonstration.html>

Rcarduino.blogspot.com

Re: Timer Interrupts on Due (<http://forum.arduino.cc/index.php?topic=130423.msg982214#msg982214>)

Nov 04, 2012, 10:55 am (<http://forum.arduino.cc/index.php?topic=130423.msg982214#msg982214>)

#4

Not what you're looking for, but on a similar topic:

I wanted to use the TC* timers to create a software servo library but I couldn't find out how to use the timers so I ended up using the PWM clock to generate the output.

While testing the PWM pulse I used attachInterrupt on the same pin to measure the pulse timing, effectively creating software interrupts. It's a hack, but if you're interested the code is here: <http://arduino.cc/forum/index.php/topic,130631.0.html> (<http://arduino.cc/forum/index.php/topic,130631.0.html>)

It doesn't use any registers, so I can't tell you about those - just add attachInterrupt()

Re: Timer Interrupts on Due (<http://forum.arduino.cc/index.php?topic=130423.msg982344#msg982344>)

Nov 04, 2012, 01:06 pm (<http://forum.arduino.cc/index.php?topic=130423.msg982344#msg982344>)

#5

timer/counter registers are detailed in chapter 37 of datasheet

dex.php?
action=karma;sa=applaud;u
id=105845;b8af6cf=2290d2
8274121ddf0035d3f4611a191
a)

bg94
(<http://forum.arduino.cc/index.php?action=profile;u=153016>)



(<http://forum.arduino.cc/index.php?action=profile;u=153016>)



Newbie
Posts: 3
Karma: 0 [add]
(<http://forum.arduino.cc/index.php?action=karma;sa=applaud;u=id=153016;b8af6cf=2290d28274121ddf0035d3f4611a191a>)

Re: Timer Interrupts on Due (<http://forum.arduino.cc/index.php?topic=130423.msg982521#msg982521>)
Nov 04, 2012, 04:14 pm (<http://forum.arduino.cc/index.php?topic=130423.msg982521#msg982521>)

#6

Quote from: stimmer on Nov 04, 2012, 04:17 am (<http://forum.arduino.cc/index.php?topic=130423.msg982062#msg982062>)

“

I think I'm getting somewhere with this... try this:

Code: [Select]

```
volatile boolean L;  
  
void TC0_Handler()  
{  
    Long dummy=REG_TC0_SR0; // vital - reading this clears some flag  
                             // otherwise you get infinite interrupts  
    L= !L;  
}
```

```
void setup()
```

The timer controls the output of pin 2 and the interrupt toggles a flag which is output on pin 13.

I'll give this a shot thanks. I am curious though why you didn't do a digitalWrite() inside the handler? Arduino's digitalWrite() function is pretty clock-cycle heavy, but the following code works just fine for writing a digital output and only takes a couple of clock cycles if that was the primary concern.

Code: [Select]

```
static inline void pinOutput(int pin, int val)  
{  
    if (val)  
        g_APinDescription[pin].pPort->PIO_SODR = g_APinDescription[pin].pPort->PIO_SODR | (1<<pin);  
    else  
        g_APinDescription[pin].pPort->PIO_CODR = g_APinDescription[pin].pPort->PIO_CODR | (1<<pin);  
}
```

On another note, Maple uses a different processor, but gives as good of an explanation / example of how timers work as I've found so far:

<http://leaflabs.com/docs/timers.html>

<http://leaflabs.com/docs/lang/api/hardwaretimer.html>

<http://leaflabs.com/docs/libmaple/api/timer.html>

I haven't tried to implement any of their code yet, but thought I'd share the links.

stimmer
(<http://forum.arduino.cc/index.php?action=profile;u=18681>)



(<http://forum.arduino.cc/index.php?action=profile;u=18681>)



God Member

Posts: 507

Karma: 35 [add]

(<http://forum.arduino.cc/index.php?action=karma;sa=applaud;uid=18681;b8af6cf=2290d28274121ddf0035d3f4611a191a>)

bg94
(<http://forum.arduino.cc/index.php?action=profile;u=153016>)



(<http://forum.arduino.cc/index.php?action=profile;u=153016>)



Newbie

Posts: 3

Karma: 0 [add]

(<http://forum.arduino.cc/index.php?action=karma;sa=applaud;uid=153016;b8af6cf=2290d28274121ddf0035d3f4611a191a>)

Re: Timer Interrupts on Due (<http://forum.arduino.cc/index.php?topic=130423.msg982913#msg982913>)

Nov 04, 2012, 09:20 pm (<http://forum.arduino.cc/index.php?topic=130423.msg982913#msg982913>)

#7

I recognize that code fragment 🤔

As for digitalWrite not being in the handler, actually it was there originally, but you have to understand that I'd been struggling for hours with interrupt code that wouldn't fire, then it only fired once, then it got hammered with constant interrupts, and I didn't know what was going on. So I did what is pretty much standard debugging practice and changed the interrupt handler to do the absolute bare minimum just to be sure that digitalWrite wasn't causing a side effect (there's some architectures where you can't write certain registers in an interrupt). But the important thing turned out to be the dummy read of TC_SRO. By then it was late so I just posted what I'd done.

Since then I have tried putting digitalWrite and direct port writes back in and they don't seem to cause any odd side effects.

The Maple hardware is completely different unfortunately and the registers are incompatible.

Due VGA library - <http://arduino.cc/forum/index.php/topic,150517.0.html>

Re: Timer Interrupts on Due (<http://forum.arduino.cc/index.php?topic=130423.msg982973#msg982973>)

Nov 04, 2012, 10:00 pm (<http://forum.arduino.cc/index.php?topic=130423.msg982973#msg982973>)

#8

I understand. Thanks 😊

dex.php?
action=karma;sa=applaud;u
id=153016;b8af6cf=2290d2
8274121ddf0035d3f4611a191
a)

Sebastian Vik
(<http://forum.arduino.cc/index.php?action=profile;u=153174>)



(<http://forum.arduino.cc/index.php?action=profile;u=153174>)
☆
Newbie
Posts: 19
Karma: 0 [add]
(<http://forum.arduino.cc/index.php?action=karma;sa=applaud;u=153174;b8af6cf=2290d28274121ddf0035d3f4611a191a>)

 **Re: Timer Interrupts on Due (<http://forum.arduino.cc/index.php?topic=130423.msg984328#msg984328>)**
Nov 05, 2012, 09:48 pm (<http://forum.arduino.cc/index.php?topic=130423.msg984328#msg984328>) #9

Using this code, you can set a timer for any of the ISRs TCO_Handler through TC8_Handler, see table of parameters below. It is possible to use the timers without a physically mapped pin, such as TC1 channel 0 (TC3_Handler) shown here:

Code: [Select]

```
volatile boolean l;  
  
//TC1 ch 0  
void TC3_Handler()  
{  
    TC_GetStatus(TC1, 0);  
    digitalWrite(13, l = !l);  
}
```

Here is the table of parameters:

ISR/IRQ TC		Channel Due pins	
TC0	TC0	0	2, 13
TC1	TC0	1	60, 61
TC2	TC0	2	58
TC3	TC1	0	none <- this line in the example above
TC4	TC1	1	none
TC5	TC1	2	none
TC6	TC2	0	4, 5

TC7	TC2	1	3, 10
TC8	TC2	2	11, 12

mantoui
(<http://forum.arduino.cc/index.php?action=profile;u=105845>)



(<http://forum.arduino.cc/index.php?action=profile;u=105845>)



Full Member

Posts: 119

Karma: 15 [add]

(<http://forum.arduino.cc/index.php?action=karma;sa=applaud;u=105845;b8af6cf=2290d28274121ddf0035d3f4611a191a>)

mnpumar
(<http://forum.arduino.cc/index.php?action=profile;u=154844>)



(<http://forum.arduino.cc/index.php?action=profile;u=154844>)



Newbie

Posts: 11

Karma: 0 [add]

(<http://forum.arduino.cc/index.php?action=karma;sa=applaud;u=154844;b8af6cf=2290d28274121ddf0035d3f4611a191a>)

 **Re: Timer Interrupts on Due** (<http://forum.arduino.cc/index.php?topic=130423.msg984517#msg984517>)

Nov 05, 2012, 11:40 pm (<http://forum.arduino.cc/index.php?topic=130423.msg984517#msg984517>)

#10

Sebastian:

Well done! thanks

 **Re: Timer Interrupts on Due** (<http://forum.arduino.cc/index.php?topic=130423.msg1002284#msg1002284>)

Nov 19, 2012, 06:32 pm (<http://forum.arduino.cc/index.php?topic=130423.msg1002284#msg1002284>) Last

#11

Edit: Nov 19, 2012, 06:36 pm by mnpumar Reason: 1

Quote from: Sebastian Vik on Nov 05, 2012, 09:48 pm (<http://forum.arduino.cc/index.php?topic=130423.msg984328#msg984328>)

a)

“

Using this code, you can set a timer for any of the ISRs TCO_Handler through TC8_Handler, see table of parameters below. It is possible to use the timers without a physically mapped pin, such as TC1 channel 0 (TC3_Handler) shown here:

Code: [Select]

```
volatile boolean L;

//TC1 ch 0
void TC3_Handler()
{
    TC_GetStatus(TC1, 0);
    digitalWrite(13, L = !L);
}

void startTimer(Tc *tc, uint32_t channel, TPOnType on, uint32_t frequency)
```

Here is the table of parameters:

ISR/IRQ	TC	Channel	Due pins
TC0	TC0	0	2, 13
TC1	TC0	1	60, 61
TC2	TC0	2	58
TC3	TC1	0	none <- this line in the example above
TC4	TC1	1	none
TC5	TC1	2	none
TC6	TC2	0	4, 5
TC7	TC2	1	3, 10
TC8	TC2	2	11, 12

Noob question here, could someone please explain the inputs to the startTimer function? What is channel, and how do we use the frequency input? Also, what are the pins in the table for?

(<http://forum.arduino.cc/index.php?action=profile;u=156087>)



(<http://forum.arduino.cc/index.php?action=profile;u=156087>)



Newbie

Posts: 9

Karma: 1 [add]

(<http://forum.arduino.cc/index.php?action=karma;sa=applaud;u=156087;b8af6cf=2290d28274121ddf0035d3f4611a191a>)

Selachii
(<http://forum.arduino.cc/index.php?action=profile;u=156087>)



(<http://forum.arduino.cc/index.php?action=profile;u=156087>)



Newbie

Posts: 9

Karma: 1 [add]

(<http://forum.arduino.cc/index.php?action=karma;sa=applaud;u=156087;b8af6cf=2290d28274121ddf0035d3f4611a191a>)

cmaglie
(<http://forum.arduino.cc/index.php?action=profile;u=3796>)

topic=130423.msg1006900#msg1006900)

Nov 23, 2012, 02:52 pm (<http://forum.arduino.cc/index.php?topic=130423.msg1006900#msg1006900>)

#12

Same question; please explain the inputs to the startTimer function.

Re: Timer Interrupts on Due (<http://forum.arduino.cc/index.php?topic=130423.msg1007311#msg1007311>)

Nov 23, 2012, 11:31 pm (<http://forum.arduino.cc/index.php?topic=130423.msg1007311#msg1007311>) Last Edit: #13

Nov 23, 2012, 11:54 pm by Selachii Reason: 1

Are there any ready-to-use-libs (like <http://www.arduino.cc/playground/Code/Timer1> (<http://www.arduino.cc/playground/Code/Timer1>)) for using Hardware Timer on Due?

Or is there a beginner-friendly How-To (like <http://www.engblaze.com/microcontroller-tutorial-avr-and-arduino-timer-interrupts/> (<http://www.engblaze.com/microcontroller-tutorial-avr-and-arduino-timer-interrupts/>)) for the Due?

Re: Timer Interrupts on Due (<http://forum.arduino.cc/index.php?topic=130423.msg1007641#msg1007641>)

Nov 24, 2012, 10:04 am (<http://forum.arduino.cc/index.php?topic=130423.msg1007641#msg1007641>) Last

#14

Edit: Nov 24, 2012, 10:15 am by cmaglie Reason: 1

9)



(<http://forum.arduino.cc/index.php?action=profile;u=37969>)



Forum Administrator

Sr. Member

Posts: 379

(<http://bug.st/>)

Karma: 30 [add]

(<http://forum.arduino.cc/index.php?action=karma;sa=applaud;u>

[id=37969;b8af6cf=2290d28](http://forum.arduino.cc/index.php?action=karma;sa=applaud;u)

[274121ddf0035d3f4611a191a\)](http://forum.arduino.cc/index.php?action=karma;sa=applaud;u)

bug.st (<http://bug.st/>)

Quote from: Sebastian Vik on Nov 05, 2012, 09:48 pm (<http://forum.arduino.cc/index.php?topic=130423.msg984328#msg984328>)

“

Here is the table of parameters:

ISR/IRQ	TC	Channel	Due pins
TC0	TC0	0	2, 13
TC1	TC0	1	60, 61
TC2	TC0	2	58
TC3	TC1	0	none <- this line in the example above
TC4	TC1	1	none
TC5	TC1	2	none
TC6	TC2	0	4, 5
TC7	TC2	1	3, 10
TC8	TC2	2	11, 12

A brief explanation:

The SAM3X8E CPU has 3 Timer Counters (TC) they are called TC0, TC1, TC2.

Every Timer Counter contains 3 Channels numbered 0, 1 and 2 (this give us a total of 9 Channels).

Every Channel has its own counters and interrupt handler that are independent from other Channels.

In other words each Channel can be considered as a separate "Timer", and is like having 9 separate timers.

To initialize a Channel you need the following parameters:

TC0/TC1/TC2 - The Timer Counter instance

0 / 1 / 2 - The Channel number inside Timer Counter

If you want to use interrupts you must enable the NVIC (Nested Vector Interrupt Controller) for that channel with:

Code: [Select]

```
NVIC_EnableIRQ(TCx_IRQn);
```

where TCx_IRQn is the ID of the interrupt to enable. These id are listed in the following table together with the ISR handler function name:

TC	Chan	NVIC "irq"	IRQ handler function	PMC id
TC0	0	TC0_IRQn	TC0_Handler	ID_TC0
TC0	1	TC1_IRQn	TC1_Handler	ID_TC1
TC0	2	TC2_IRQn	TC2_Handler	ID_TC2
TC1	0	TC3_IRQn	TC3_Handler	ID_TC3
TC1	1	TC4_IRQn	TC4_Handler	ID_TC4
TC1	2	TC5_IRQn	TC5_Handler	ID_TC5
TC2	0	TC6_IRQn	TC6_Handler	ID_TC6
TC2	1	TC7_IRQn	TC7_Handler	ID_TC7
TC2	2	TC8_IRQn	TC8_Handler	ID_TC8

(note that TC2_IRQn is the irq id for TC0-channel-2 not for TC2...)

but this is still not enough! Every peripheral in the SAM3X is off by default (to save power) and should be turned on. To turn on you need to run the following command:

Code: [Select]

```
pmc_enable_periph_clk(id);
```

where **id** is found on the last column of the above table (ID_TCx). It happened that ID_TCx constant equals TCx_IRQn, so Sebastian Vik has simplified a bit the function using TCx_IRQn as input for pmc_enable_periph_clk:

Code: [Select]

```
pmc_enable_periph_clk((uint32_t)irq);
```

Hope this helps to decode whats happening with timers inside SAM3X.

Quote from: Selachii on Nov 23, 2012, 11:31 pm (<http://forum.arduino.cc/index.php?topic=130423.msg1007311#msg1007311>)

“

Are there any ready-to-use-libs (like <http://www.arduino.cc/playground/Code/Timer1> (<http://www.arduino.cc/playground/Code/Timer1>)) for using Hardware Timer on Due?

Or is there a beginner-friendly How-To (like <http://www.engblaze.com/microcontroller-tutorial-avr-and-arduino-timer-interrupts/> (<http://www.engblaze.com/microcontroller-tutorial-avr-and-arduino-timer-interrupts/>)) for the Due?

Nope, there are no libs neither tutorials.

I've planned a SAM3Timer library (to simplify implementation of Arduino Core and some libraries) but I didn't started it yet.

Volunteers? 😊

C.

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