



Mod5282 - PWM Generation Using General Purpose Timers

Application Note

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Introduction

The MCF5282 has two 4-channel general purpose timer modules (GPTA and GPTB). Each consists of a 16-bit counter driven by a 7-stage programmable prescaler. This application uses channel 3 in each module to generate three PWM outputs on channels 0, 1 and 2. This method can be used to provide up to six PWM channels, three from each timer module. Chapter 20 of the 5282 User's Manual contains details of the GPT's, but does not explicitly tell you how to create PWM outputs.

Theory

The system clock is has a prescale divider of 1, and it 66,355,200 Hz. The system clock is then divided by 2 before going into the timer system, resulting in a timer clock value of 33,177,600 Hz.

The channels in each timer module are numbered from 0 to 3. Channel 3 can be configured to perform an output compare and periodically reset the timer to 0. The output compare value in this example sets both the PWM frequency and resolution. The table below shows example values with the system clock divider set to 1.

Ch 3 Output Compare Value	PWM Frequency	PWM Resolution
99	331,776 Hz	1 part in 100
255	129,600 Hz	1 part in 256
511	64,800 Hz	1 part in 512
999	33,177.6 Hz	1 part in 1000
1023	32,400 Hz	1 part in 1024
2047	16,200 Hz	1 part in 2048
9999	3317.76 Hz	1 part in 10000
32767	1012.5 Hz	1 part in 32768
65535	506.25 Hz	1 part in 65536

As part of the channel 3 output compare operation the timer count is set to 0, and output channels 0, 1 and 2 are set high. In addition, channels 0, 1 and 2 are configured to set their outputs low on their output compare. The PWM high time is varied by setting the output compare time for the individual channels. The example below illustrates this operation.

Example Operation

GPTA Timer channel 3 is configured to count to 1000 (this is the resolution), and channels 0, 1 and 2 are set to PWM output compare count values of 100, 200 and 500 respectively.

One Example cycle:

- 1) The timer counts to a value of 1000, and the channel 3 output compare matches
 - a) The timer count is reset to 0 on the next clock
 - b) The outputs of channels 0, 1 and 2 are set high
- 2) The timer counts to a value of 100, and the channel 0 output compare matches
 - a) This causes the channel 0 output to go low
 - b) The channel 0 output was high from a count of 0 to 100
- 3) The timer counts to a value of 200 and the channel 1 output compare matches
 - a) This causes the channel 1 output to go low
 - b) The channel 1 output was high from a count of 0 to 200
- 4) The timer counts to a value of 500 and the channel 2 output compare matches
 - a) This causes the channel 2 output to go low
 - b) The channel 2 output was high from a count of 0 to 500
- 5) The timer continues to count with the outputs of channels 0, 1 and 2 low until the timer reaches a value of 1000 and the cycle begins again at step #1.

Example Code

Initialization Function

```
#include <../mod5282/system/sim5282.h>

/*****
Initialize Three Phases of PWM
Parameters:
    GPT_num, The GPT to use, 0 for GPTA and 1 for GPTB
    pwm_resolution, The number of timer counts in a single PWM cycle
    p0, channel 0 initial PWM timer count value
    p1, channel 1 initial PWM timer count value
    p2, channel 2 initial PWM timer count value
*****/
void InitThreePhasePWM(int GPT_num,int pwm_resolution,int p0,int p1,int p2);
{
    sim.gpt[GPT_num].scr1=0; /* Turn the timer system off */
    sim.gpt[GPT_num].ios=0x0f; /* Turn on output compare for all four channels */

    sim.gpt[GPT_num].oc3m=0x07; /* Set up the condition for ch 3 output compare */
    sim.gpt[GPT_num].oc3d=0x07; /* Set up the condition for ch 3 output compare */

    sim.gpt[GPT_num].tov=0; /* No toggle on overflow */

    sim.gpt[GPT_num].ctl1=0xAA; /* Set output to 0 on output compare */
    sim.gpt[GPT_num].ctl2=0x00; /* No input capture */
    sim.gpt[GPT_num].scr2=0x08; /* Enable ch 3 reset with sys clk prescale of 1 */

    sim.gpt[GPT_num].tie=0x00; /* No interrupts */

    sim.gpt[GPT_num].c0=p0; /* Set up the initial compare values */
    sim.gpt[GPT_num].c1=p1;
    sim.gpt[GPT_num].c2=p2;
    sim.gpt[GPT_num].c3=pwm_resolution;

    sim.gpt[GPT_num].ddr=0x0F; /* Set all four channel pins as outputs. */

    sim.gpt[GPT_num].scr1=0x90; /* Enable the timer */
}

/* Set new values for the three PWMS */
void SetPwmValues(int GPT_num,int p0, int p1, int p2)
{
    sim.gpt[GPT_num].c0=p0;
    sim.gpt[GPT_num].c1=p1;
    sim.gpt[GPT_num].c2=p2;
}
}
```

Example Function Call

This example function call will configure GPTA to a resolution of 256 counts per cycle, with channel 0, 1 and 2 output compare counts of 32, 64 and 128 (these are the counts that will transition the output from high to low).

```
InitThreePhasePwm(0, 256, 32, 64, 128);
```