

Timers

ELE 271: Laboratory 7

Introduction

In this experiment you will begin to learn how to use timers to perform some basic measurement operations. Timers are typically used to accurately measure time intervals. In this first of two experiments you will toggle the green LED with an accurate timing waveform and vary the width of the pulse in a timing waveform. Much if not all of the information you will need to complete these tasks can be found in Chapter 15 of the textbook.

Part 1

In an earlier experiment you toggled the green LED (PA.5) using a counter which kept the CPU busy and unable to perform other tasks. Here the same will be accomplished using a hardware counter, freeing the CPU from keeping a count of the elapsed time.

For this purpose it is convenient to use Timer 2, Channel 1 (TIM2_CH1) as it can be easily connected to GPIO pin PA.5 by means of Alternate Function 1 (AF1).

Steps

- Configure LED pin
- Use registers TIM2_PSC, TIM2_ARR and TIM2_CCR1 to create a timing waveform with a period of 1 sec (frequency 1 Hz) from the default system clock of 4 MHz.
- Enable Timer 2 clock (check which bus and register needs to be configured)
- Set the timer to output mode (see register TIM2_CCMR1)
- In the same register, set the timer to toggle mode to obtain a symmetric timing waveform (50% duty cycle)
- Enable the output of channel 1 (see register TIM2_CCER)
- Start the timer (see register TIM2_CR1)

Display and capture the timing waveform using the logic analyzer.

Part 2

Switch Timer 2 to PWM mode (see register TIM2_CCMR1). Use the PWM mode to create a 20% duty cycle 1 Hz waveform, namely 200 msec ON and 800 msec OFF. Repeat by reversing the ON and OFF pulse

durations. Capture both with the logic analyzer.

Part 3

Create and output a timing waveform of frequency 1/10th of the default MSI system clock. Display and capture both waveforms together on the logic analyzer.

Question

What are the longest and shortest timing waveform periods that can be obtained from the default system clock using general-purpose timer 2?

Solution