Lab Exercise #2

Objectives

- Measure elapsed time using a timer, specifically TPM0
- Create a pulse width modulated digital signal
- Have a little fun

References

- [1] NXP Kinetis KL25 processor sub-family data sheet (pdf) on class web page.
- [2] NXP Kinetis KL25 processor sub-family reference manual (pdf) on class web page.

Lab 2 Problem Statement, part A

There are situations when software initiates an action to be performed by circuits external to the microcontroller by asserting an output signal using a GPIO configured I/O pin followed by measuring elapsed time until the external circuit completes the requested action. Completion of the action is indicated by a signal asserted by the external circuit that is connected to an input pin of the microcontroller.

a) Write a function to initialize TPM0 and its channel zero to measure elapsed time and set up port pin PTD7 for GPIO output.
b) Write a second function named "distance" that will do the following:
   - Reset TPM0 counter to zero
   - Create a negative pulse on port pin PTD7 about 100us long
   - Poll TPM0 channel zero for assertion of its channel flag (CHF)
   - When CHF is set read channel zero capture register TPM0_C0V to get elapsed time
   - Return the value read from TPM0_C0V to the caller
c) In main.c
   - Call to initialize TPM0
   - Initialize the LCD
   - Initialize anything else that needs initialization
   - In the endless while loop
      - call the distance function
      - display measured distance on the LCD in 10s of microseconds
      - delay a short time to give a reasonable update rate on the LCD
d) Test using a one-shot timer circuit built with an LMC555C timer chip.

Lab 2 Problem Statement, part B

a) Write a function to initialize TPM0 and its channel 5 for output to create a Pulse Width Modulated (PWM) signal output on portD pin PTD5. The period of this signal is to be 20 milliseconds (or close to that) with an initial pulse length of 1.5 milliseconds.

Design Flow

The general design flow for today's lab is:

Design a program per problem definition
- Confirm understanding of the problem

Code your design

Debug

<u>To</u> <u>Turn</u> <u>In</u>

- In the "comment header" of your main.c file report success, failure, or other observations
- Submit your main.c file to a D2L drop box
- Zip up your complete lab 2 uVision project and submit to the D2L drop box