MW 2411 Lab #3
Digital-to-Analog Conversion - DAC
Winter 2022/2023

1 Overview

In this lab you will be introduced to Digital-to-Analog Converter (DAC) on the Flex-UI/dsPIC33F board. The DAC provided by the Flex-UI board is a Microchip MCP4822. You must write a program that does all of the following.

1. Configure the MCP4822 to perform three conversions in such a way that the outputs are 1V, 2.5V, and 3.5V. You must show the conversions using the oscilloscope.
2. After each conversion, you should have a delay of 500ms, 2000ms, and 1000ms, respectively. The delay must be implemented using a Timer and its interrupt.
3. You have to repeat the three conversions in an infinite loop and toggle LED1 in each iteration.

2 Procedure

1. Before getting started, read sections 4.11 and 4.12 in the Laboratory Manual, and the MCP4822 datasheet (especially Section 5 and Section 1: AC Characteristics (SPI Timing Specifications)).
2. You can find an MPLAB X IDE project with template code on the Moodle course page.
3. A demonstration version of the Lab 03 program that you now need to write is provided in compiled form.
4. Update lab03.c such that it fulfills the requirements specified in the Overview section.
   (a) DAC configuration.
      i. Set the proper digital Pins (three pins) to output, as discussed in section 4.11 (this should be done only once).
      ii. Set a reasonable default state (see Section 5 of the MCP4822 datasheet).
      iii. Clear the CS bit before starting a conversion (look at Table 7 in the lab manual to check the bits and ports).
      iv. Now in a loop send the conversions command value (data format described in the MCP4822 datasheet: Section 5, Register 5-1, Figure 5-1, most significant bit first):
         A. Set the SDI bit according to the current bit of the command value
         B. Toggle the serial clock, use the SCK bit (SETBIT and CLEARBIT), inserting a Nop() instruction between both (see MCP4822 datasheet Figure 5-1)
      v. After the sending clear CS bit
      vi. Clear Data Bit (SDI), insert a Nop() after

vii. Toggle the (inverse) LDAC signal, use the LDAC bit (CLEARBIT and SETBIT, with two Nop() in between, see Section 1: AC Characteristics (SPI Timing Specifications)

(b) Remember to insert a Nop() between subsequent Write and Read operations to the same IO port.

(c) The see the output of DAC channel A connect a jumper cable to Pin 5 (DAC_CHAN_A) of Jumper J3 and one jumper cable to Pin 8 (GND) (see Table 8 in the lab manual).

Due date of code submission can be found on the Moodle submission page for this lab. Only one member of the group must upload the code (all .c and .h files that your project uses compressed in one zip file). At the start of Lab 4, each lab group will be asked to demonstrate and explain their Lab 3 code to the lab instructor.

3 Questions to Ponder

The following questions are provided for your lab group to think about. No written response is required.

1. How many different values can be converted by the MPC4822 DAC?
2. How can we increase the precision of a DAC?