

Lab #3: MSP430: ADC12_A

Report due: 2/24/2022 by 2:00 pm (this is a two-week lab; try to finish early)

Introduction

The goal of this laboratory is to use ADC12_A to sample an analog signal, and use the board's LCD to display the results.

Equipment:

CrossStudio for MSP430.

TI MSP-EXP430F5438 Experimenter Board

Oscilloscope

Tasks:

1. Set the MCLK and SMCLK to 16 MHz.
2. Wait for the user to press the button switch S1 and then:
 - Take 8 consecutive samples from the internal temperature sensor (with as little delay as possible) using SMCLK. Don't forget to use appropriate sampling time.
 - Send the ADC12 reference voltage out and check it.
 - Calculate the average temperature expressed in degrees Celsius.
 - Calibrate the temperature sensor using the data provided in the TLV structure
 - Display a message with the current temperature on the LCD.
3. Toggle the display backlight on/off when the user presses the button switch S2.

Mandatory for EE645 students, optional but recommended for EE444 students:

4. Use joystick to change the brightness level of the LCD up and down.
5. Measure the execution time for the complete temperature measurement process (between the button press and the end of last conversion).
6. Measure the time it takes to print the message on the LCD.

NOTES:

- Use interrupts rather than polling.
- Keep the microcontroller in the low(est) power mode, for as long as possible.
- To make the LCD work properly, you have to *initialize* it and *initialize the backlight*.
- Good starting values for the contrast and backlight levels are 90 and 5 respectively.
- **Use the provided precompiled library (LCDlib.hza) and the header file hal_lcd.h**
 - o Add LCDlib.hza to "Source Files" and #include hal_lcd.h in your main.
- **Note that LCDlib uses TimerA0, meaning that you shouldn't use it in your program**
- Use the provided IncrementVcore.c file.
- Compare your temperature with the temperature measured by others in the lab.

Report requirements:

Use the lab report template provided on Blackboard.

1. The report should include all the programming files you wrote.
2. The report should include all the measurements.
3. The report should include the detailed description of the program and the procedures used in completing this task.
4. The code should be reasonably commented. *Upload your code to Blackboard and include key sections in your report.*

NOTE: Please be extra careful when handling the board