ELEG 3923 Microprocessor System Design

Lab 5 ADC and Temperature Sensor

I. Objectives

- To learn to interface 8051 with parallel analog to digital converter (ADC 0804).
- To measure room temperature with an analog temperature sensor LM34.

II. Materials

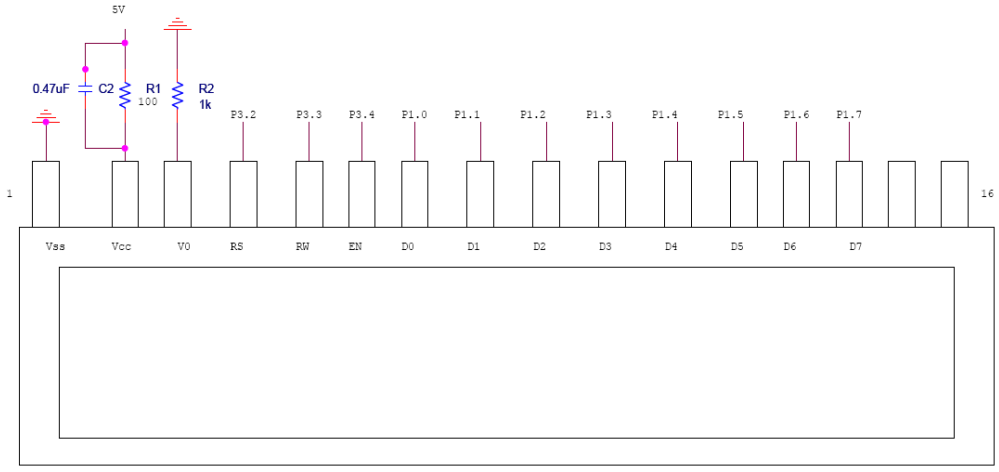
- Keil uVision3 development environment.
- 8051 hardware development kit (MDE-8051)
- Jumper kit
- OPTREX DMC-20481 LCD display
- ADC 0804
- LM34
- Resistor: 41 Ohm
- Capacitor: 0.22F (code printed on capacitor: 224)

III. Procedures

You can write the code in either C or Assembly.

Part 1. LCD Display (Week 1)

1. Connect trainer board with DMC-20481 as shown in the following figure. (**IMPORTANT**: Be careful with the power supply and connections. Wrong connection might damage the LCD display or the trainer board)

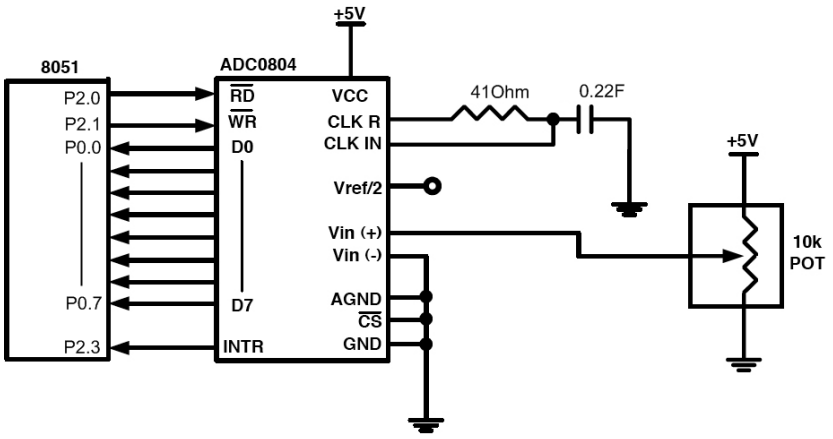


2. Write a program to display the decimal value read in port 0.
   (1) Use a subroutine, INIT_LCD, to initialize the LCD display
   (2) Use a subroutine, BIN2ASCII, to convert the binary value in register A into three ASCII codes.

(3) Use a subroutine, DATA_DISPLAY, to display the three ASCII codes at the middle of the first line on LCD screen.
(4) Test the program by assigning decimal values to register A and make sure the result displayed on LCD is correct.
(5) DO NOT dissemble your circuit.

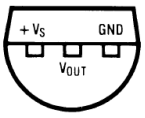
Part 2. ADC (Week 1 and 2)

1. Connect ADC to 8051 as shown in the following figure. (IMPORTANT: Be careful with the power supply and connections. Wrong connection might destroy the ADC chip).
2. Use the program in Part 1 to display the output of the ADC. Refer to the code in P.379 of Mazidi book for sample code. (IMPORTANT: we use different pin connections as in the textbook. You need to change the code accordingly.)
   (1) Insert a delay of 50 ms between two consecutive reading of the ADC. Implement the delay with timer 0 built inside ADC.
   (2) Use BIT directives for the control pins.
   (3) Once your code is ready, adjusting the potentiometer should result in a reading between 0 (or a small number) to 255.



Part 3. Temperature Sensor (Week 2)

1. Replace the potentiometer with a temperature sensor. (**IMPORTANT**: BE EXTREMELY CAREFUL with the order of the pins. Wrong polarity of power supply WILL DESTROY the temperature sensor!!!).



Bottom view (Pins are pointing out of the paper)

2. With 5 Volt power supply, the temperature sensor can sense the temperature in the range between 5F to 300F. The output voltage of the temperature sensor scales linearly with respect to temperature at a rate 10.0mV/F, e.g. 0 mV → 5F, 10 mV → 6F, 20 mV → 7F, etc. The voltage of the temperature sensor is then scaled by the ADC in the range of 0 to 255. Thus the relationship between temperature (T) and ADC output (X)

can be expressed as

$$T = \frac{X/255 \cdot 5V}{10mV/F} - 5F = X\frac{100}{51} - 5 \approx 2X - 5(F)$$

Using the above equation to convert the ADC output to temperature in Fahrenheit, and display the result.