ECE 3720

Microcomputer Interfacing Laboratory

Section 002

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Lab 2

ABSTRACT:

This lab was designed to show how to use the digital input/output on the PIC32 microcontroller, how the 74LS373 D-Latch and how to use it in a circuit, and how to use a low active push button to send a signal to the microcontroller.

Introduction:

For this lab a circuit was setup that took two digital input signals into the microcontroller and then sent two digital output signals to two separate latches on the 74LS373 D-Latch and two LEDs. A pushbutton was then hooked up to another digital input on the microcontroller so that a digital low signal was input when the button was push. When the digital low signal was sent, the microcontroller sent a digital high signal to the 75LS372 enable pin which would update the output of the latches to the two digital signals that were being input into it and light two more LEDs to those corresponding outputs. This circuit would light two LEDs based on whatever inputs were put into it and change two more LEDs to match only when the button was pressed.

Experimental Procedure:

From **FIGURE 1** below, all these pins were chosen because they were in the same register and were all 5V tolerant. Pins 1 was input power for the microcontroller and pins 40 and 39 were ground. Pins 10 and 11 were chosen for the digital input because they were in the B register and 5V tolerant. The input voltage was then hooked up to 200-ohm resistor and pushbutton so that a high voltage would be sent to pin 4 of the microcontroller when the button was not pressed, and a low signal was sent when the button was pressed. Pin 4 was chosen because it was 5V tolerant and was in the B register. Pin 21, 22, and 23 were chosen for the digital output because they were in the same register as the input pins. Pins 21 and 22 were output to two LEDs, so that they were be lit or unlit based on whatever the digital inputs were at the time, and pins 3 and 4 on the 74LS373, because these were the inputs of two separate latches. Pin 23 output a low signal to the enable pin (11) on the 74LS373 when the input to pin 4 was high and a high signal when a low signal was sent. This was to create a low active pushbutton that would update the outputs of the latches when the button was pressed and keep them the

same when it was not. Pins 2 and 5 were then hooked up to two more LEDs to light them to the current inputs when the pushbutton was pressed. These pins were chosen because they were the outputs of the D-Latches that were chosen for the inputs.

From **CODE 1** below, the command TRISBbits.TRISBx = 1 was used to set bits 9, 10, and 11 of the B register as inputs individually and TRISBbits.TRISBx = 0 was used to set bits 1, 2, and 3 of the B register as outputs individually. It was done this way because 3 inputs and 3 outputs were needed, and the rest of the register was not. I while loop was then entered that used the command LATBbits.LATBx = PORTBbits.RBx to set the output bits 1 and 2 to the same value as the input bits 10 and 11. LATBbits.LATBx writes the output to the corresponding bits and PORTBbits.RBx read the input of the corresponding bits. An if/else statement was then entered that read the input value at bit 9 and if it was equal to 0 would set the output of bit 3 to 1, else it would set the output bit equal to 0. This would then keep repeating until the microcontroller was turned off.

RESULTS and DISCUSSION:

The final observed behavior of the circuit was that two of the LEDs would be lit corresponding the digital inputs of the circuit and another two LEDs would be light up to be the same as the first set of LEDs only when the pushbutton was pressed and would stay the same, regardless of the digital inputs were changed or not, if the push button was not being pressed. The only problem I had with this lab was wiring the microcontroller wrong. I had the microcontroller turned the opposite way of the diagram in the reference manual, so the pins were reversed. This can be avoided by paying closer attention to the direction of the diagrams. The low active pushbutton could be useful in later labs or applications to activate devices only when

the button is pressed. The D-Latches could be useful to temporarily store individual bits of data when while the inputs into a circuit are constantly changing.

CONCLUSION:

This lab helped build an understanding of how the digital input and output of the microcontroller can be used, how to use pushbuttons in circuits, and the use and application for D-Latches in a circuit.

REFERENCES:

Clemson University ECE 3720 Lab 2 PowerPoint.

74LS373 Reference Manual

chipKIT Cmod Reference Manual

FIGURES and TABLES:

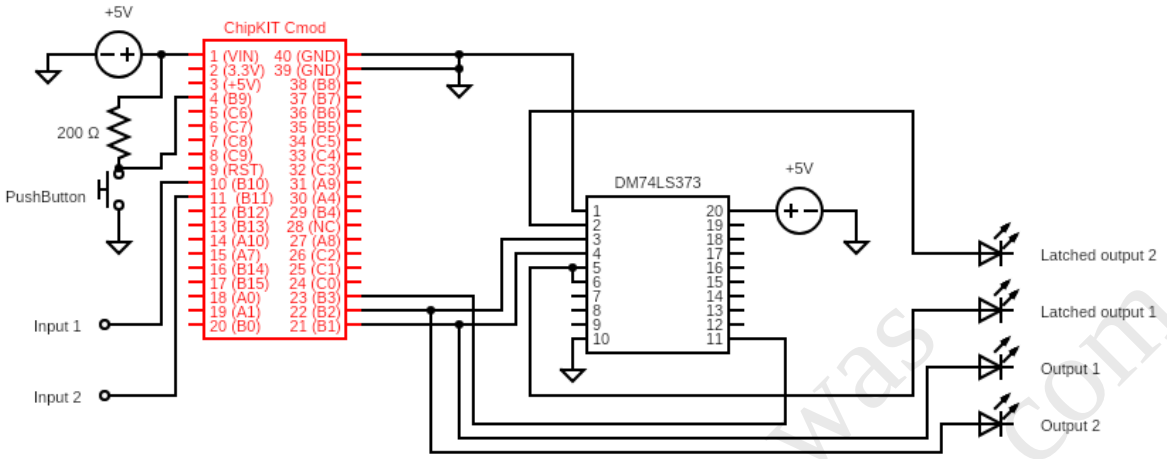

FIGURE 1: Wiring for lab 2(Pin Connections described in Experimental Procedures)

CODE:

```
#include <plib.h>
int main(void){

    TRISBbits.TRISB9 = 1;
    TRISBbits.TRISB10 = 1;
    TRISBbits.TRISB11 = 1;
    TRISBbits.TRISB1 = 0;
    TRISBbits.TRISB2 = 0;
    TRISBbits.TRISB3 = 0;

    while(1){
        LATBbits.LATB1 = PORTBbits.RB10;
        LATBbits.LATB2 = PORTBbits.RB11;

        if (PORTBbits.RB9 == 0){
            LATBbits.LATB3 = 1;
        }
        else {
            LATBbits.LATB3 = 0;
        }
    }
}
```

CODE 1