CoE 115 Lab 6: I2C Communication

April 1, 2019

Topics/Objectives:

- Use the built-in I2C module of PIC24FJ to interface with an external device
- Create a program that performs read and write operations on an I2C EEPROM device

Pre-lab:

- Review the lecture on I2C bus protocol.
- Study Section 16 of PIC24FJ64GB002 manual and Section 24 of PIC24F family reference manual.
- Study 24LC32A datasheet

Overview:

The Inter-Integrated Circuit^{TM}(I^{2}C) is a serial interface useful for communicating with other peripheral or micro controller devices. The I^{2}C bus is a two-wire serial interface, where the two lines are designated as SCL (clock signal) and SDA (data line). In a basic I^{2}C communication environment, there is 1 master and 1 slave. The master initiates the communication and controls(drives) the SCL line. The SDA line can be controlled(driven) by the master or the slave depending on the type of operation. In a write operation, the master drives the SDA line while in read operation, the slave drives the SDA line. For this exercise, you will demonstrate a basic I^{2}C using PIC24F as master and an EEPROM as slave as shown in figure below. The goal is to write data on the EEPROM then, read that data and display it as text on the LCD.
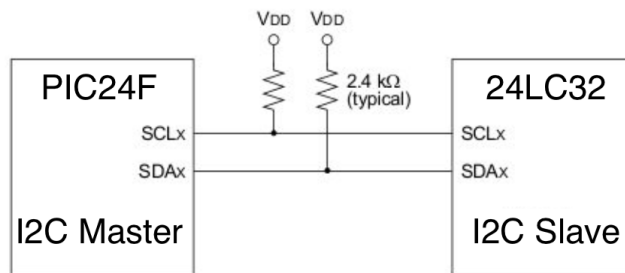
Circuit Setup:

1. Wire up the circuit shown above. The primary I^{2}C lines in PIC24FJ are found on pins 17(SCL) and 18(SDA). For the EEPROM, see the pin outs diagram found in 24LC32A datasheet. Note the pull-up resistors that are connected to SCL and SDA lines. These are needed to ensure that during idle mode or line control transition, the lines have defined voltage value and are not floating.

2. Wire up the 24LC32A such that its address is 0x50 and write-protect is disabled.

3. Connect the LCD similar to the one used in Lab2A.

PIC24F I²C Configuration:

Similar to other peripherals we have encountered, you need to setup configuration registers before using the I²C peripheral. There are four registers that you need to setup:

- I2C1CON - enables control of I²C operation

- I2C1BRG - holds the Baud Rate Generator(BRG) reload value

- IEC1 - controls interrupt of I²C peripheral

Aside from these registers, during an I²C operation, you may also need to use the following registers:

- I2C1STAT - contains status flags indicating the I²C module's state

- I2C1TRN - transmit buffer

- I2C1RCV - receive buffer

- IFS1 - I²C interrupt flags

Read Section 16 of PIC24FJ64GB002 manual and Section 24 of PIC24F family reference manual to know more about the configuration registers.

Requirements:

- An EEPROM with predetermined contents will be given to you during checking.

- The instructor will give you two addresses: WRITE_ADDR and READ_ADDR.

- Program PIC24F to write your student number(201XXXXXX) in to EEPROM starting at address WRITE_ADDR. Write 1 byte each number.

- After writing, your program will read 16 bytes starting from address READ_ADDR. Each byte read should be displayed on the first line of LCD.

- Configure PIC24F's I²C for the following operation:

  - SCL frequency = 400KHz at F_{CY} = 16MHz
  - 7-bit addressing mode
  - Discontinue operation when idle
  - Send ACK bit for acknowledge

- Use the template code provided as guide for your program.