

Last Name (Print): _____

First Name (Print): _____

ID number (Last 4 digits): _____

Section: _____

Submission deadlines:

- Each EE 200 student must complete the circuit in problem 25 prior to attending Laboratory #14. At the beginning of Laboratory #14, each student must show the **completed** circuit to the instructor to receive a grade for problem 25. As the instructor may ask you to verify operation of the circuit, you must bring your myDAQ and test leads to Laboratory #14.
- Turn in the written solutions for problems 26 through 28 by 4:00 pm on **Friday March 7** in the homework slot outside 121 EE East.

Problem	Weight	Score
25	25	
26	25	
27	25	
28	25	
Total	100	

Problem 25: (25 points)

As a first step towards using the Microchip Technology dsPIC33EP64MC502 microcontroller, construct the circuit in Figure 1 that includes a voltage regulator and a circuit for interfacing the microcontroller to the PICKit 3 Programmer/Debugger. In addition to this problem set, the compressed file ps7.zip contains data sheets for the LM2937-3.3 voltage regulator and dsPIC33EP64MC502 microcontroller, as well as the user guide for the PICKit 3 in-circuit Debugger/Programmer. **Before** constructing the circuit please complete the following steps.

- Read the voltage regulator data sheet. Note the TO-220 package connection diagram on page 2 and the application circuit diagram on page 8. The connection diagram identifies the unregulated input, regulated output, and ground terminals on the device. The comments appearing under the schematic on page 8 explains the necessity for using a $0.1\ \mu\text{F}$ input capacitor and a $10\ \mu\text{F}$ output capacitor.
- The PICKit 3 is an essential tool for programming and debugging microcontroller circuits in EE 200. Read Chapters 1 and 2 of the PICKit 3 User's Guide.
 - Figure 1-1 on page 14 and Figure 1-2 on page 15 specifies the location of pin 1 of the PICKit 3 Programmer/Debugger 6-pin connector.
 - Table 2-1 on page identifies the signals on the PICKit 3 Programmer/Debugger connector.
 - Figure 2-4 on page 20 shows the standard circuit for connecting the PICKit 3 Programmer/Debugger to a target microcontroller.
- Read pages 1 through 28 of the dsPIC33EP64MC502 microcontroller data sheet.
 - The pin diagram for the dsPIC33EP64MC502 microcontroller appears on the bottom of page 5.
 - Pinout descriptions appear in Table 1-1 on pages 24 through 26.
 - Sections 2.1 through 2.4, appearing on pages 27 through 28, discuss the basic connection requirements.

Figure 1 shows the required circuit for all microcontroller exercises in EE 200. The dsPIC33EP64MC502 microcontroller requires a 3.3 V power source while the myDAQ provides a 5 V supply. The LM2937-3.3 voltage regulator circuit in Figure 1 regulates the 5 V supply from the myDAQ down to 3.3 V for the microcontroller. Consult the LM2937-3.3 specification sheet to identify the input, ground, and output pins of the voltage regulator. Note that the $10\ \mu\text{F}$ electrolytic capacitor is polarized. The interface circuit uses the microcontroller data I/O (PGED2) and clock input (PGEC2) on channel 2 for data communications with the PICKit 3 Programmer/Debugger. Connect the 6-pin header for the PICKit 3 Debugger/Programmer using the pin diagram in Figure 1. Observe that the pin lengths on opposite sides of the header differ. Place the longer pins into the protoboard so that the weight of the PICKit 3 Debugger/Programmer does not detach the header from the protoboard. Slides 57 and 58 of Lecture 7 show photographs of the 6-pin header and an attached PICKit 3 Debugger/Programmer.

During Laboratory #14 the instructor will demonstrate how to write a program that sets the logic level on pin 3 (port A1) to that observed on pin 2 (port A0). In addition to the basic circuit connections in Figure 1, also include the connections in Figure 2 that allow you to set the logic level on pin 2 using a tactile switch and display a logic level on pin 3 using a LED.

At the beginning of Laboratory #14 the instructor will verify that each student has completed the circuits in Figures 1 and 2. The instructor may verify operation of the circuits by using your myDAQ to measure the voltage at pins 2 and 28 of the dsPIC33EP64MC502, or pins 1 and 2 of the 6 pin header required for the PICKit 3 Debugger/Programmer.

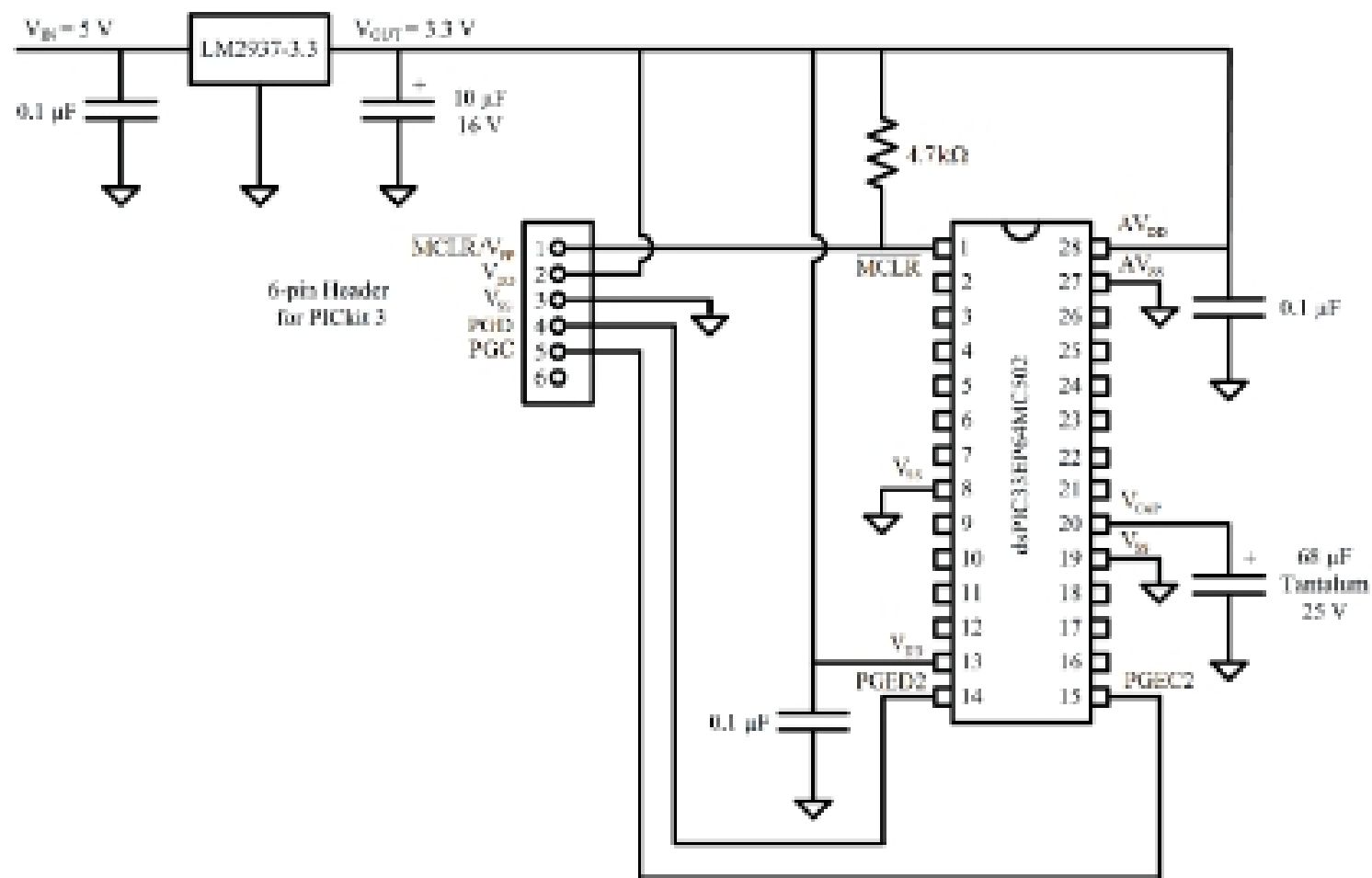


Figure 1: Basic connections for all EE 200 microcontroller exercises.

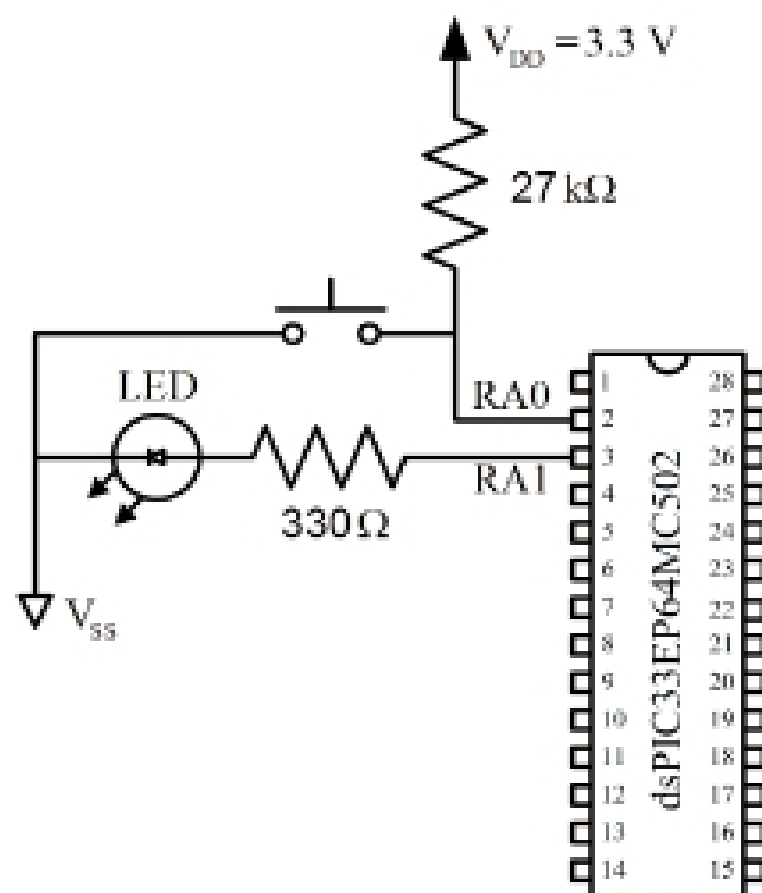


Figure 2: Additional circuit connections for the microcontroller exercise in Laboratory #14.