

ECE383 Spring 2020: Microcomputers – Lab 8

Analog-to-Digital and Digital-to-Analog Conversion

Modified by Zhe Chu on Apr/2020

Goals: The goals of this lab are to introduce students to a PIC24-based Microstick II system capable of analog-to-digital (ADC) and digital-to-analog (DAC) conversions. The laboratory requires students to connect a SPI-based MAXIM 548A DAC to the Microstick II and program the system to act as a data acquisition and display device.

1. Introduction

This lab introduces a basic analog to digital data conversion using an ADC module on the PIC24 and digital to analog conversion using the SPI-based MAXIM 548 DAC. The tasks in this lab include:

- Wiring a MAXIM 548A integrated circuit to the Microstick II on a breadboard.
- Write a C program to program the PIC24 system to act as a data acquisition and display device.

2. Pre-lab

For this lab assignment, all programs should be completed as a pre-lab assignment prior to your assigned lab time.

TA check: Show the TA your breadboard circuit and source code.

3. TASK 1: DAC wiring

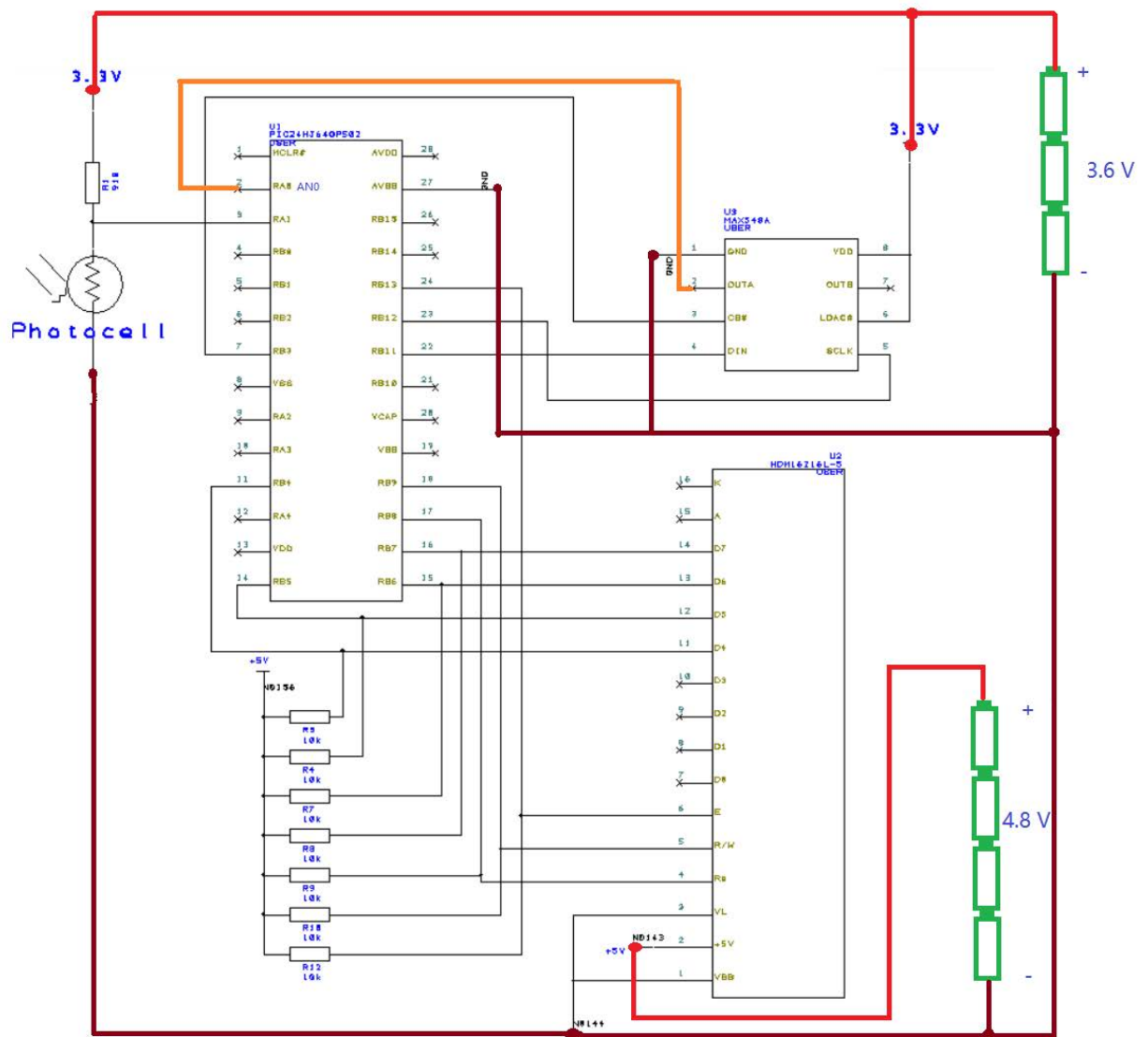
Wire the MAX548A DAC should be added to your **existing layout containing the LCD** wiring that was constructed in a previous lab as shown on Figure 1:

1. Connect all required **Vdd (3.3V)** and **Vss (GND)** pins on the MAX548A to your system power and ground rails respectively.
2. Connect the **LDAC# pin (pin 6)** to **Vdd**.
3. Connect the **CS# pin (pin 3)** on the MAX548A to **RB3 (pin 7)** on the PIC24 Processor.
4. Connect the **DIN pin (pin 4)** on the MAX548A to **SDO1/RP11 (pin 22)** on the PIC24 processor.
5. Connect the **SCLK pin (pin 5)** on the MAX548A to **SCK1/RP12 (pin 23)** on the PIC24 processor.
6. Connect the **OUTA pin (pin 2)** on the MAX548A to **RA0/AN0 (pin 2)** on the PIC24 processor.

Connect the photocell and resistor (910 Ω) to **RA1 pin (AN1)** of the PIC24 processor as shown in Figure 1.

Use the `chap11/adc_spidac_test.mcp` MPLAB projects from the code library as the starting point for this task. Modify the pin assignment as shown above. Then, compile and download it to the Microstick II for verification. Please also take a look at example project `chap11/adc2pots1.mcp` if you want to know how to read multiple analogy signals.

If your code and system are constructed correctly, you will have around 3.3V on the OUTA (pin2) of the MAX548A when the photocell is fully covered and 0V on the OUTA when the photocell is fully illuminated. Use a flash light from your cell phone to illuminate the photocell. You need to use AN0 on pic24 to read the output voltage level of MAX548. Then, **display the voltage level on the LCD.**



TA check: Show the TA that your code functions as expected. Use a screen capture tool to capture analog output results on the LCD and include them in your lab report. Include your source language programs in your lab report.

4. TASK 2: PIC24 Data Acquisition and Display

Write a program which can do the following applications:

1. Samples the analog value V_{in} on the AN1 input every 0.01 seconds. Use an infinite while loop with an interrupt-based timer to control the input sampling. Instead of outputting the analog output using **OUTA**, use **OUTB pin (pin 7)** on the MAX548A to display. Refer Page 9 of the MAX548 datasheet to see how to do this. The datasheet is available on the class website.

5. Laboratory Report

No later than a week from the day the lab is performed, provide the TA a printed copy of the lab report following the ECE383 Lab report Template given on the class website. Each lab group will submit one joint lab report to the TA. Your report should have the reporting requirements needed for Tasks 1-2. **The TA will take off a significant number of points (15 points from total lab grade) if your C source does not have the required comments.**

6. GRADING POLICY

1. Completion of Pre-Lab (20%)
2. Completion of Task 1 with results included in lab report (20%)
3. Completion of Task 2 with results included in lab report (40%)
4. Completeness, quality, and correctness of the lab report (20%)