Name:	Major: ☐ ELEC ☐ CSEN

ECEG 201 Laboratory 2, Part A: Characterizing I_{DD}

Introduction

In this laboratory exercise you will characterize the power supply current, I_{DD}, as a function of power supply voltage, V_{DD}, for a temperature sensor. This exercise will be completed in two parts. This is the first part, and when you have completed this part you will receive instructions for the second part.

You will be given either an MCP9700A (yellow) or an MCP9701A (red) temperature sensor. The datasheet for these devices is available on the course web page, under "Lab Resources". Your sensor is in a TO-92 package; be **very careful** to note the pinout shown at the bottom of the first page.

The relevant specifications are given in the table of "DC ELECTRICAL CHARACTERISTICS" on the second page of the datasheet. You will be measuring the power supply current (I_{DD}) for power supply voltage (V_{DD}) values from 3.1 V to 3.5 V. Note that this is within the specified "Operating Voltage Range" for both the MCP9700A and the MCP9701A. The datasheet further specifies that the power supply current for either part number will be less than 12 µA.

Your task for this activity is to measure the power supply current of your sensor for supply voltages of 3.1 V, 3.3 V, and 3.5 V.

Deliverables

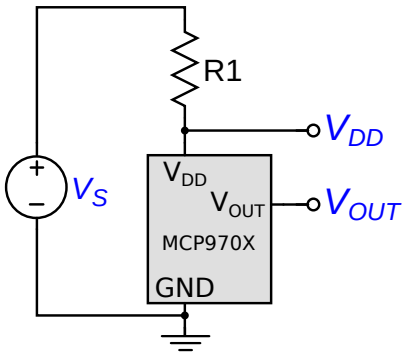
You must turn in this worksheet by **noon today** (Wednesday, 2020-01-29). Each student will work individually on this activity. You may discuss the activity with other students but you must do your own work and submit your own data.

Procedure

1. Note that you can not directly measure resistance or current using the Analog Discovery 2 (AD2). For this activity, you may use another instrument to measure **resistance** values (but not current). All voltage measurements **must** be made with the AD2. The AD2 must be the only source of power for your test circuit.

2. In addition to the sensor itself and your AD2, you may use one fixed resistor in your test circuits. No other components or devices may be used.

3. Construct the circuit shown below to use for your measurements.



⚠ **Be careful** to connect your sensor to V_{DD} and ground correctly. Reversing these connections will probably destroy the sensor.

Your AD2 will provide the power for your circuit with its built-in supplies. This voltage is shown as V_S in the schematic.

To determine the appropriate value for R1, assume that I_{DD} is its maximum specified value. The highest voltage available from the AD2 supply is 5 V and you want the value of V_{DD} to be at least 3.5 V. You want to use a high resistor value to improve the resolution of your current measurements. So, select the largest standard resistor value that will give $V_{DD} \geq 3.5\,\text{V}$.

4. Measure the actual value of R1 and **record** that value here.

5. Connect your AD2 to the computer and start the Waveforms application. Near the bottom right corner of the window you will see the serial number of your AD2, after the text "Discovery2 SN:". **Record** the serial number here.

6. Configure the AD2's V+ supply for an output voltage of 5 V, and turn the `Master Enable` on. Connect **Channel 1** of the AD2 voltmeter to V_{DD}. **Record** the measured value of V_{DD} here. This value should be greater than 3.5 V but less than 4.7 V... if not, stop and fix your circuit or your AD2 configuration.

7. Connect **Channel 2** of the AD2 voltmeter to V_{OUT}. **Record** the measured value of V_{OUT} here. For an MCP9700A this value should be about 720 mV, and for an MCP9701A this value should be about 830 mV. If your measured value is not within 10% of the expected value, stop and fix your circuit.

8. Disconnect **both** voltmeter channels from the test circuit.

9. Connect **Channel 2** of the AD2 voltmeter to V_{DD}. **Record** the measured value of V_{DD} here. This value should be greater than 3.5 V and should be within 50 mV of the value you measured earlier with Channel 1. If not, you should calibrate your AD2 before continuing.

10. Now connect both Channel 1 **and** Channel 2 to V_{DD}. **Record** both measured values of V_{DD} here. The two values should be within 50 mV of each other. **However**, the values you measured with both voltmeter channels connected to V_{DD} will be significantly **lower** than the values you measured with either channel alone!

11. **Show** your voltmeter screen to the instructor and have them **initial here**.

12. If the AD2 voltmeter was **ideal**, we would expect all of the measured values of V_{DD} to be the same. Given the uncertainty of the AD2's voltmeters, we would still expect all of the measured values to be within about 50 mV of each other. **Write** a sentence or two to explain why your final readings were so much lower.