Name:	Major: ☐ ELEC ☐ CSEN

ECEG 201 Laboratory 2, Part B: 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 the temperature sensor you used in Part A of this lab exercise.

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

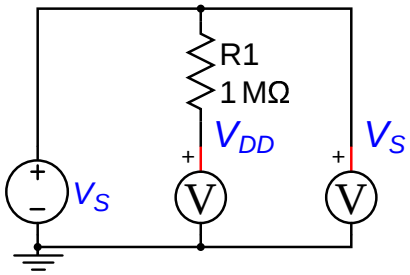
You must turn in this worksheet by **noon today** (Friday, 2020-01-31). Each student will work individually on this activity. You may discuss the activity with other students but you must do your own work and submit your own data.

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. Characterize AD2 voltmeter input resistance

   (a) Construct the circuit shown below to use for your measurements.



Your AD2 will provide the power for your circuit with its built-in supplies.

Select a 1.0 MΩ resistor from the parts bin. Measure the actual value of your resistor and **record** the measured value here.

You will use both of the AD2's voltmeter channels. Begin by connecting Channel 1 in **series** with the resistor, in order to measure V_{DD}. Connect Channel 2 to measure the supply voltage, V_S. Be sure to connect the negative wire from both channels to ground.

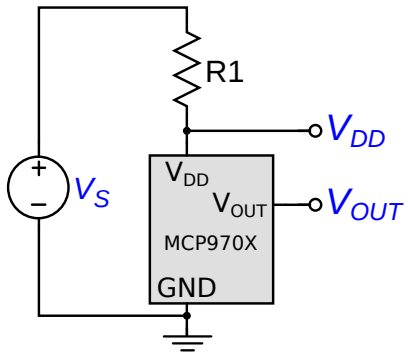
   (b) Configure the AD2's V+ supply for an output voltage of 5 V, and turn the `Master Enable` on.

   (c) **Record** the measured values of V_S and V_{DD}. Note that the input resistance of the voltmeter and the 1 MΩ resistor form a **voltage divider**. The only unknown value at this point is the input resistance of Channel 1 of the voltmeter. Rearrange the voltage divider equation and solve for this resistance. Show your work.

   (d) Swap the connections of Channel 1 and Channel 2, so that Channel 2 is now in series with the resistor. **Record** the measured values of V_S and V_{DD}. Calculate the input resistance of Channel 2. Show your work.

3. Characterize the temperature sensor I_{DD}

   (a) 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.

For R1 you can use the resistor from Part A of this procedure, or you can select a 100 kΩ resistor from the parts bin.

   (b) Measure the actual value of R1 and **record** that value here. If you connect multiple resistors in series to form R1, then connect them in series first and then measure the total resistance. **Do not** measure the individual resistors and add the values... each addition increases the uncertainty of the final result.

   (c) Configure the AD2's V+ supply for an output voltage of 5 V. Connect one voltmeter channel to measure V_{DD} and the other to measure V_S.

   (d) Carefully decrease the supply voltage until V_{DD} is between 3.500 V and 3.550 V. Note that you can type desired voltage values directly into the power supply, you don't have to use the pull-down menu.

   (e) **Record** the measured values of V_S and V_{DD}. Using Ohm's Law, calculate the current through the resistor. Using Ohm's Law, calculate the current flowing into the voltmeter that is connected to V_{DD}. Using KCL, calculate I_{DD}, the current flowing into the sensor. Show all of your work.

   (f) Carefully decrease the supply voltage until V_{DD} is between 3.275 V and 3.325 V. **Record** V_S and V_{DD}, then calculate I_{DD} using the same process that you used in the previous step.

   (g) Carefully decrease the supply voltage until V_{DD} is between 3.050 V and 3.100 V. **Record** V_S and V_{DD}, then calculate I_{DD} using the same process that you used in the previous step.