Prelab 7: Andrew Iliescu

**Introduction:**

In this lab you will be measuring the threshold voltage (Vth). This is the voltage that a transistor needs to overcome in order to output a certain signal. This signal, coupled with a resistor lets electrical components know whether or not they should be active, and it essentially acts as a switch. The specific type of transistor you will be using is known as an NMOS and you will be building an inverter circuit. The diagram for this circuit is presented in figure 1.

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Figure 1: NMOS inverter circuit diagram

**Procedure:**

It is your job to wire this circuit up using the Analog Discovery kit.

1. You may want to start by connecting W1 to your 1KΩ resistor as you will be outputting 5V AC.
2. You will also need to hook up the V+ to the gate of your NMOS transistor as shown in figure 1.
3. From there you want to make sure that you connect channel inputs 1 and 2 to the voltage from the gate to the source and the voltage from the drain to the source respectively.
4. Please see refer to the schematic at this [Link](https://www.onsemi.com/pub/Collateral/2N7000-D.PDF) for to know which pins do what for the NMOS.
5. Also attach the multimeter to display the voltage between the gate and the source, this will be needed for a later step.
6. When loading in the data from waveforms you will see a point at which the two channels you are measuring intersect.
7. That intersection point is when the transistor switches states. You can use the following equation (figure 2) to calculate the threshold voltage.

(2)

1. Now that you have the threshold voltage, we can use the saturation equation for an NMOS to solve for the conduction parameter kn.
2. Since we have left the circuit running with 5V AC being pumped through it, we know that the voltage is high enough to cause the transistor to saturate and turn on so we should record the VGS.
3. Now we want to switch the multimeter to measure the current through the NMOS by simply attaching the multimeter on either side of the transistor.
4. This means we can now use voltage VGS, the current which is on the multimeter, and the following equation (figure 3) to solve for our conduction parameter.

(3)

1. Compare you results with the expected values of Vth = 3V and Kn=23A/V2