Lab 4 Report

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1 Introduction

In this lab we are only analyzing one circuit. This is the circuit shown in Figure 1 and it features the 2N2700 MOSFET device known as a 2N2700. In this lab we aren't using that device as it is intended to be used, but rather we are going to be putting the device under unusual circumstances. This ended up resulting in some irregular patterns in our measurements as you'll see later in the lab report.

A MOSFET device is one that allow us to effectively "flip" a switch electronically by supplying a voltage into the device which determines if current should or shouldn't flow through the other portion of the device.

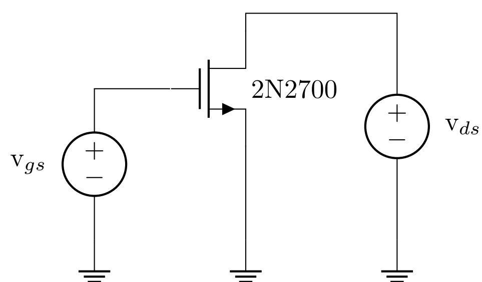

Figure 1: Circuit Featuring an NMOS IV Component

2 Sweeping the V_{gs}

For the first portion of the lab we set up the circuit as shown in Figure 1, and we kept the value of V_{ds} constant at 5 V while sweeping the value of V_{gs}. By doing this we are analyzing at what value V_{gs} does the MOSFET "turn on" and allow current to flow through the other portion of the device. As you can see from Figure 2, the current flowing through the device just started to flow at about $V_{gs} = 2.2$ V and made a significant jump at $v_{gs} = 2.3$ V. Essentially, when the voltage reached 2.3 volts you could consider the transistor as "turned on" and significant current was then flowing through the circuit.

These findings match our simulation from Multisim as shown in Figure 3.

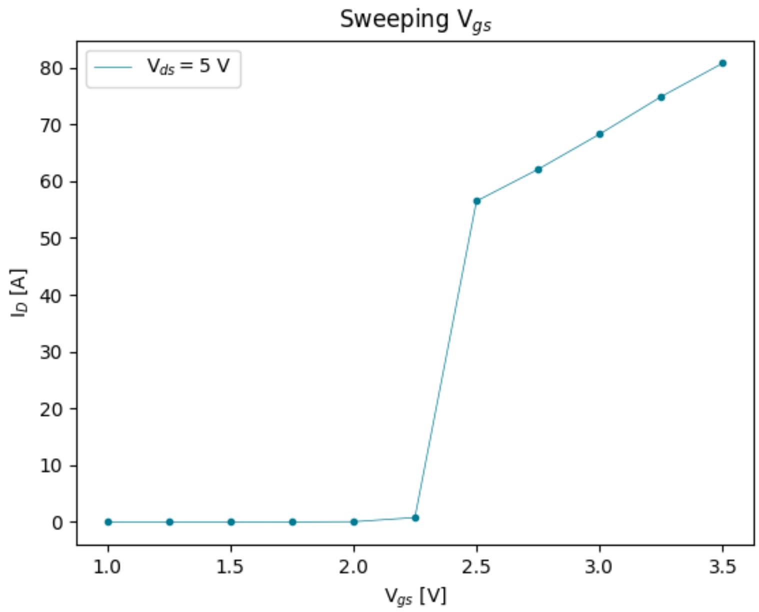

Figure 2: Results from Sweeping the V_{gs} Value

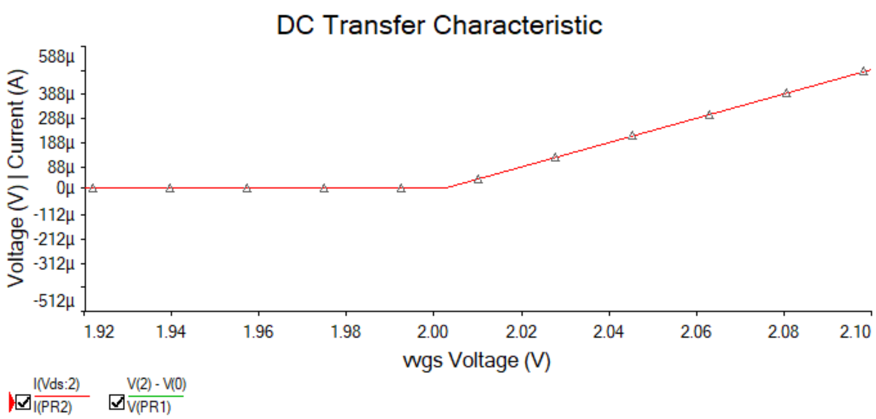

Figure 3: Simulation of Current Starting to Flow

3 Sweeping the V_{ds}

In this second portion of the lab we were tasked with sweeping the value of the V_{ds} voltage which is where the current that we are measuring is coming from. The point of this is to see how different voltage values of V_{gs} will affect the current output of the transistor. As you can see in Figure 4, the value of V_{gs} will change the current throughput of the transistor for the different ranges of V_{ds}. Our measurements showed a similar trend, though the results were affected by some unknown factor at the lower voltages of V_{ds}. Because of this unknown factor we found that there was an apparent bump in our graphs, and we couldn't find a way to prevent that. Regardless, we were able to determine that there was a consistent difference in the current throughput as the V_{gs} voltage changed. The higher the V_{gs} voltage, the higher the I_D output.

Our measurements from this portion of the lab can be seen in Figure 5.

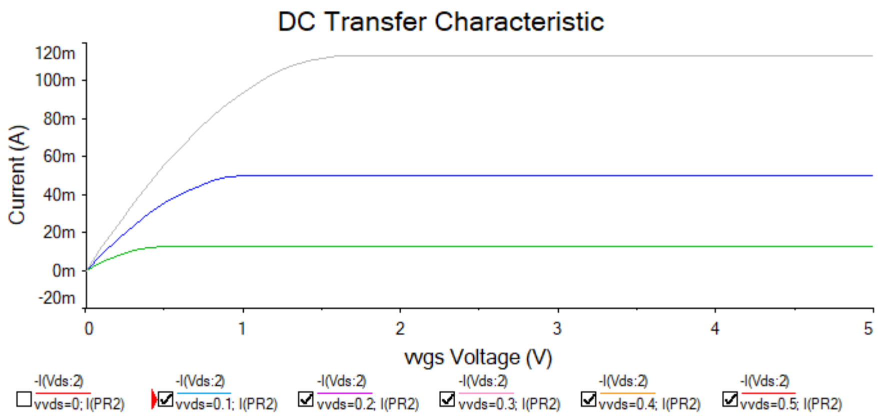

Figure 4: Currents Simulated for Various V_{gs} Values

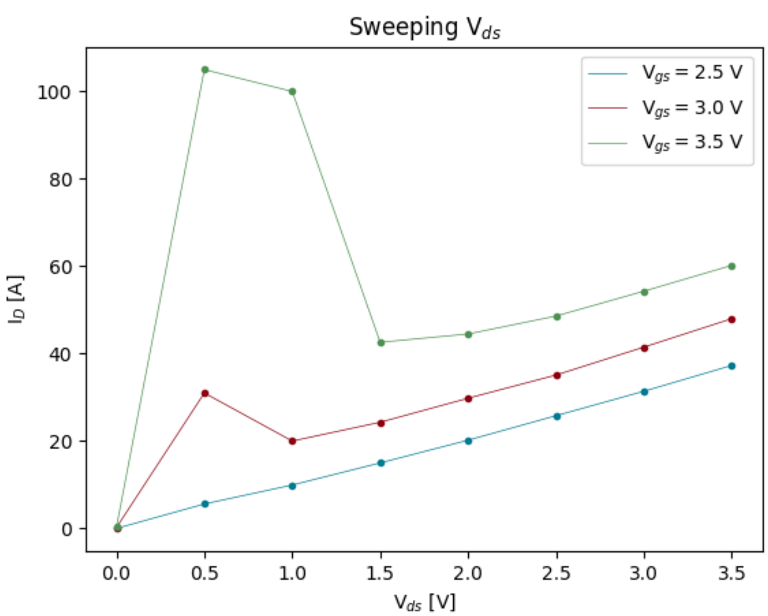

Figure 5: Results from Measurements when Sweeping V_{ds}

4 Conclusion

In this lab I was able to learn a little bit more about the function of MOSFET transistors. It's been interesting learning in this class about the details behind semiconductors and how they function in more detail. It's apparent why these are used so much in digital circuits because they seem to show such a binary response to stimulus, though I'm sure there are plenty of uses in analog circuits as well. I'd be interested in learning more about the analog applications of MOSFET and other transistors. It was interesting learning in this lab about the different behavior of the 2N2700 transistor when different voltage levels were applied.