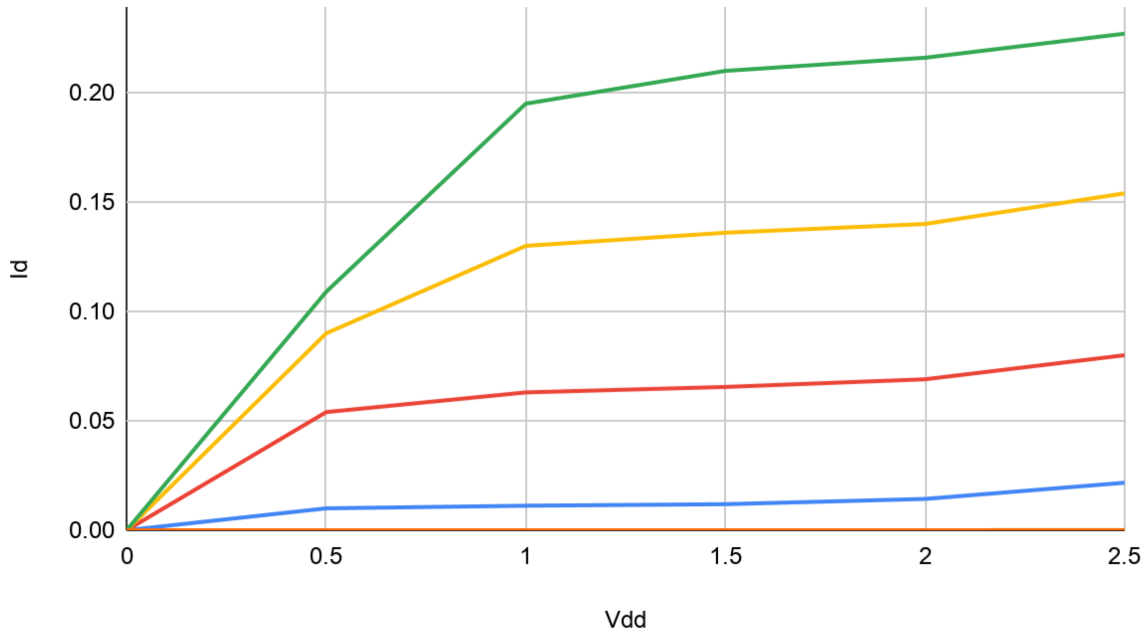
EE330 Lab 7
Section 5, 8:00 am

MOSFET Device Experimental Characterization and Basic Applications

Sean Gordon
Sgordon4

Part 2. Measurement of MOSFET output characteristics

For this section I chose not to use signal express, as it had recently been updated and there were no recent guides created. Instead, I hooked the transistor chip up to a breadboard and, using several voltage supplies and an ammeter, collected 30 data points represented by the graph below:

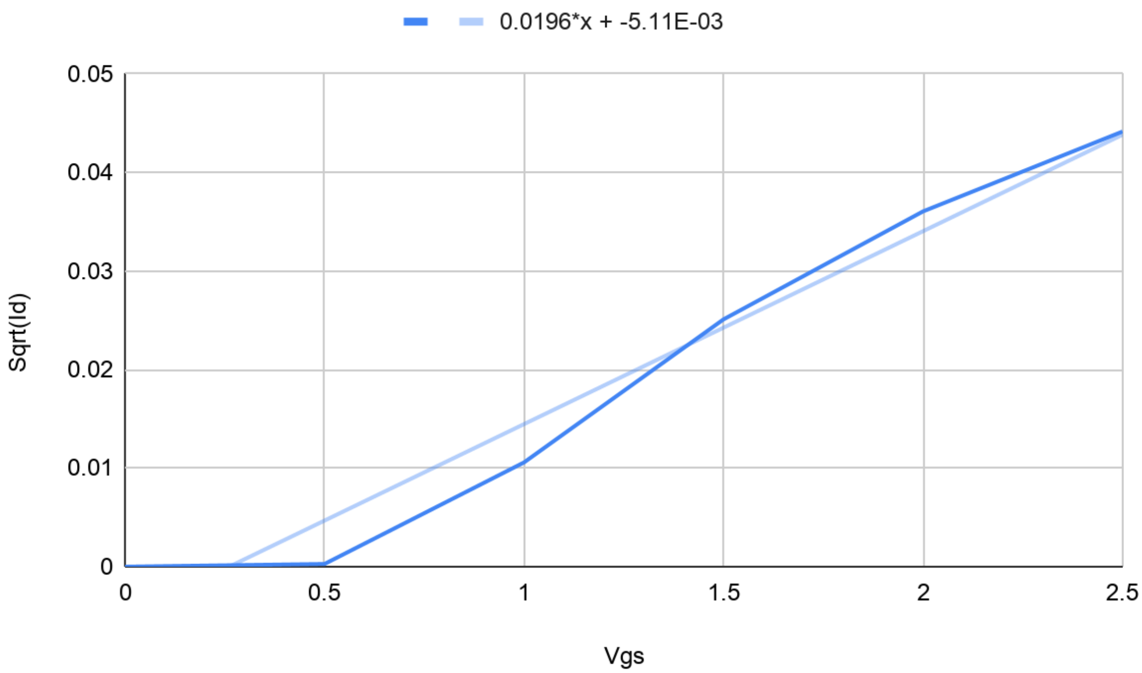


This data was collected by varying Vdd and Vgs in sequence, covering the range of Vdd: 0 → 2.5, and Vgs: 0.5 → 2.5

	Vg	0.5	1	1.5	2	2.5
Vdd						
0		0	0	0	0	0
0.5		60n	100u	540u	900u	1.09m
1		76n	112u	630u	1.3m	1.95m
1.5		92n	119u	655u	1.36m	2.1m
2		108n	143u	690u	1.4m	2.16m
2.5		125n	217u	800u	1.54m	2.27m

Part 3. Measurement of MOSFET parameters

As $I_D = \frac{uCox*W}{2*L}(V_{GS} - V_{T0})^2$, then $\sqrt{I_D} = \sqrt{\frac{uCox*W}{2*L}}(V_{GS} - V_{T0})$, where $\sqrt{\frac{uCox*W}{2*L}}$ is the slope of the line. Therefore, finding the slope of the I_D curve when holding Vdd constant and varying Vgs will allow us to find uCox:



0	0
0.5	0.000275680975
1	0.01058300524
1.5	0.0250998008
2	0.03605551275
2.5	0.04415880433

<u>Measuring uCox:</u>

I have no idea what the size of this transistor is, so I'm going to assume W/L = 5.

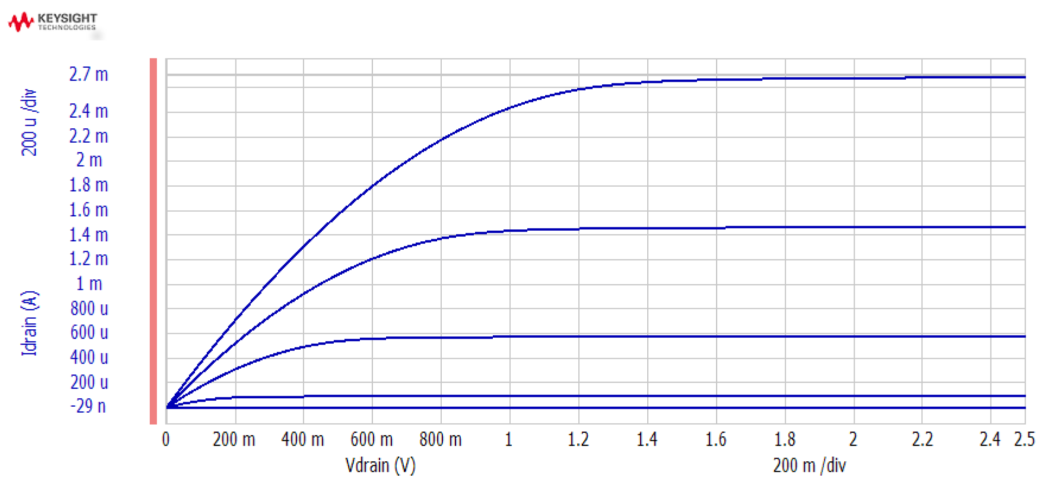
Then, as slope = .0196, **uCox = 154 uA/V^2**

This is very close to the typical value of 150 uA/V^2

<u>Measuring γ:</u>
No time. It's probably ~ 0.6.

<u>Measuring λ:</u>
I'd really rather not. Also probably around 0.015.

Part 4. Measurement of parameters using B1500a Parameter Analyzer



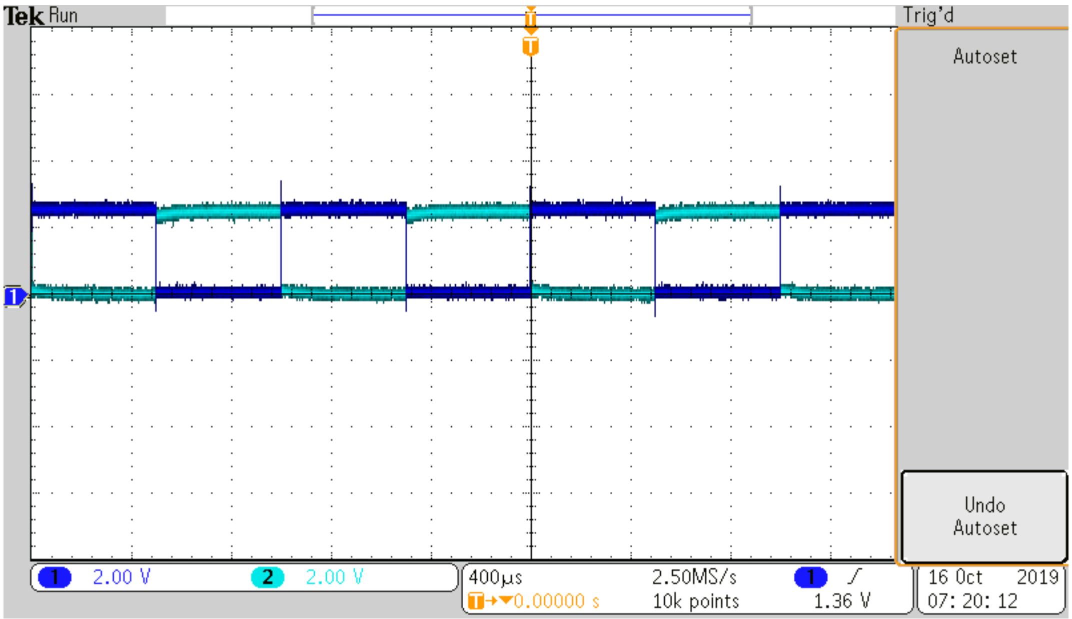
The graph output by the parameter analyzer is akin to that displayed on the datasheet, as well as those shown in multiple other classes, where we did labs just like this one for the same results.

Part 5. CMOS Inverter

Short Channel -

V_{in} = 0V: V_O = 1.625V V_{in} = 2.5V: V_O = 0.423V

There appears to be a small delay in the signal as it switches, but otherwise the inverted signal is a near complete match to the input.



Long Channel -

V_{in} = 0V: V_O = 2.501V V_{in} = 2.5V: V_O = 0.001V

The delay after a switch is more apparent with these transistors, but the model effectively inverts the input signal with near complete efficiency.