



Department of Electrical and Computer Engineering

Subject: Linear Integrated Circuit Design

LAB # 3 Device characteristics of an NMOS.

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Objective: To observe various graphs of NMOS transistor

LAB ASSESSMENT:

Attributes	Excellent (5)	Good (4)	Average (3)	Satisfactory (2)	Unsatisfactory (1)
Ability to Conduct Experiment					
Ability to assimilate the results					
Effective use of lab equipment and follows the lab safety rules					

Total Marks: 15

Obtained Marks :

LAB REPORT ASSESSMENT:

Attributes	Excellent (5)	Good (4)	Average (3)	Satisfactory (2)	Unsatisfactory (1)
Data presentation					
Experimental results					
Conclusion					

Total Marks: 15

Obtained Marks:

Date:

Signature:

Title:

- Device characteristics of an NMOS.

Equipment:

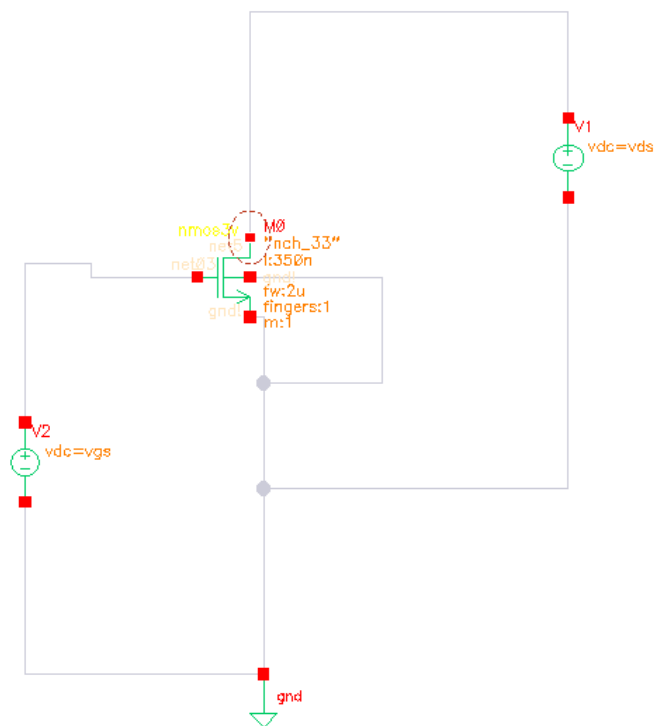
- Personal Computer
- VMware software
- Cadence Virtuoso

Introduction

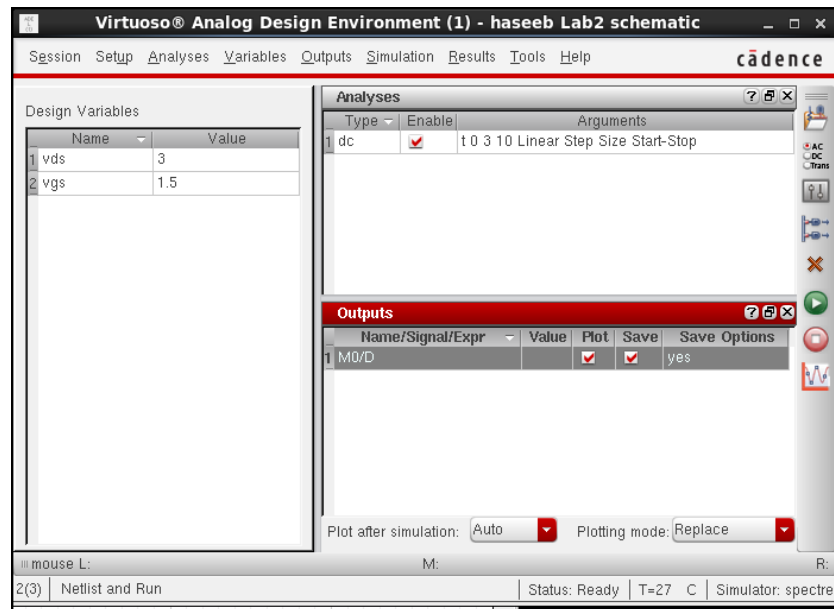
In this lab we will study about the characteristics of an NMOS transistor by obtaining various graphs between various variables and observe the region of operations.

Lab Task

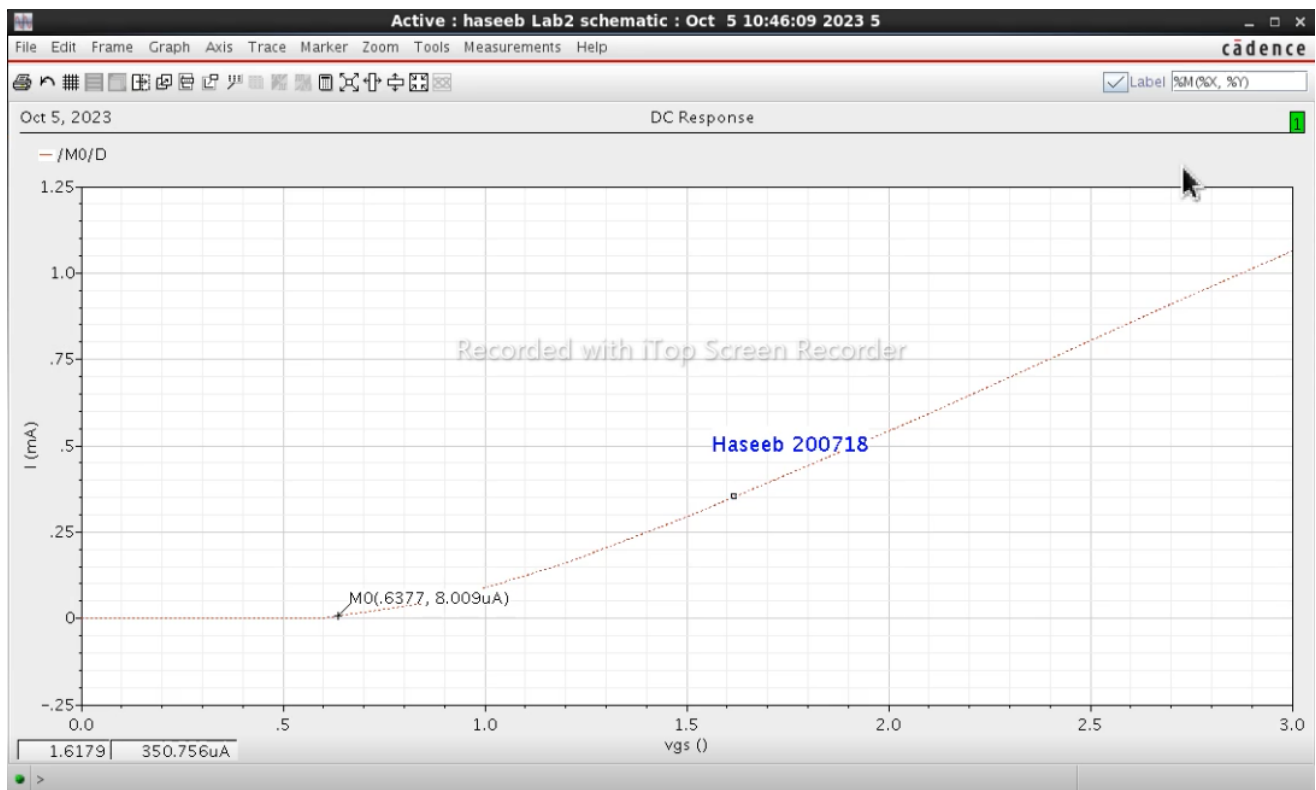
Below is the circuit which is designed on Cadence virtuoso to observe Nmos characteristics:



Click Ade L and select the following settings

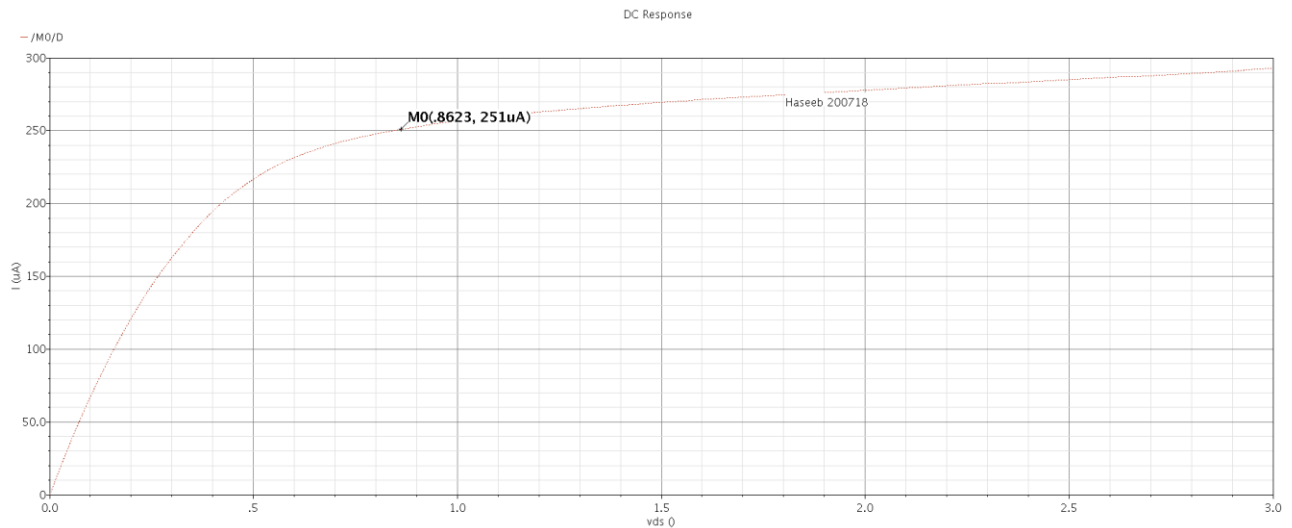


Click on run to get the following graph:



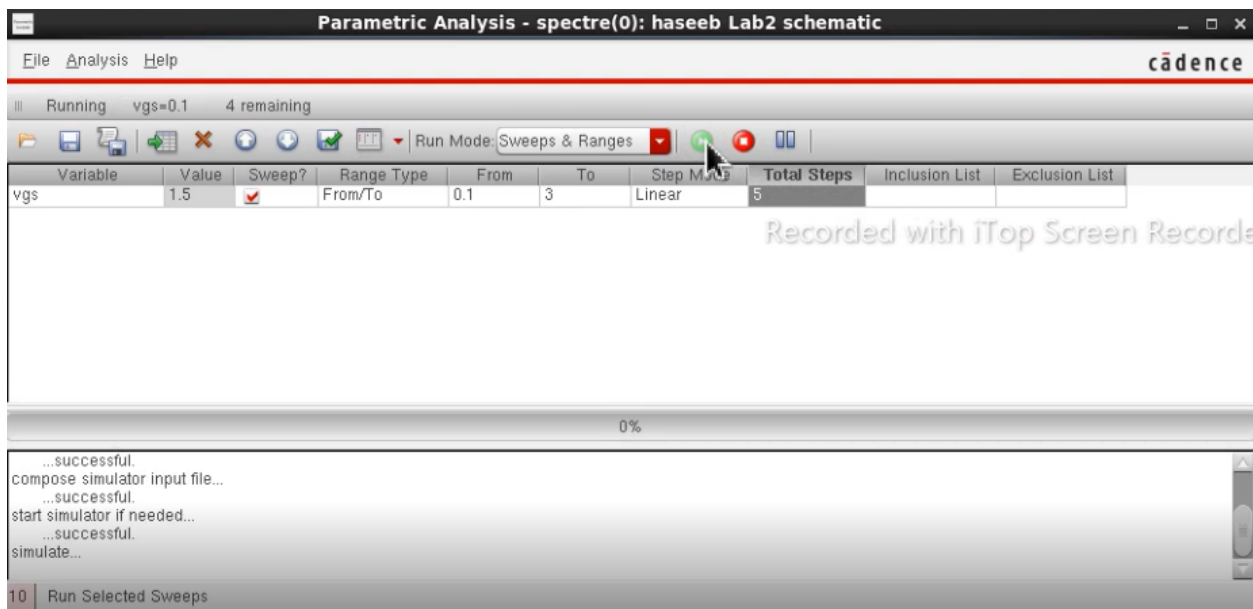
Graph Explanation: The labelled point on this graph is the threshold voltage V_{TH} . The variable on x-axis is v_{gs} and after it reaches V_{TH} the transistor goes into saturation mode and before that it remains in cutoff mode.

Now we will plot the drain current with the drain to source voltage. For this change the design variable to v_{ds} in the analysis window and then click on Run.

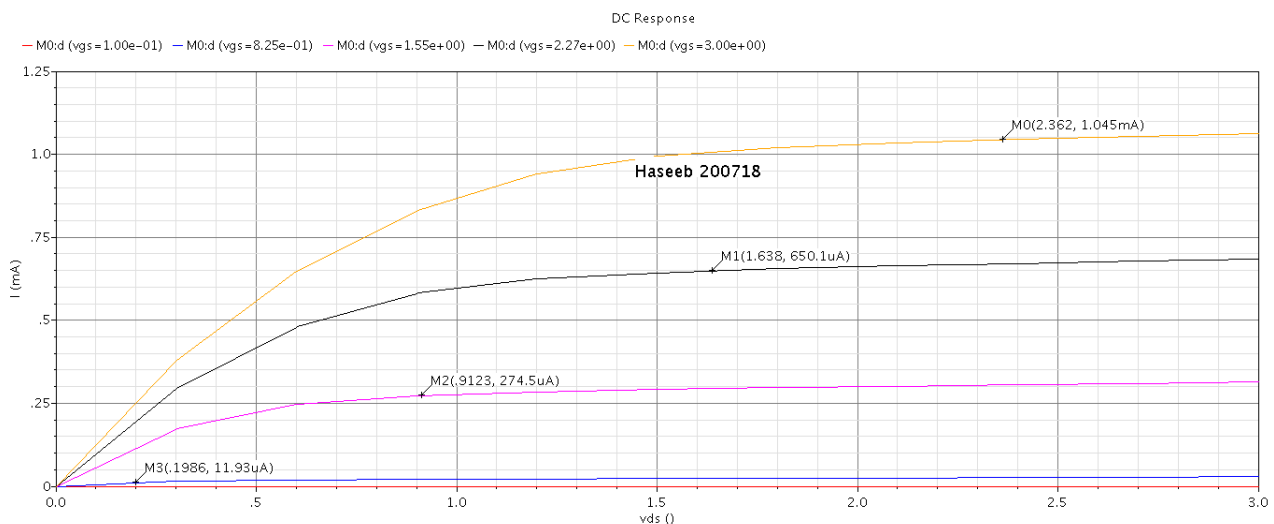


Graph Explanation: The labeled point is the subtraction of threshold voltage from the v_{ds} voltage (1.5V). In the graph the transistor before this point is in triode mode and after this point it is in saturation mode.

Now go to Parametric Analysis under tools and set the following settings:

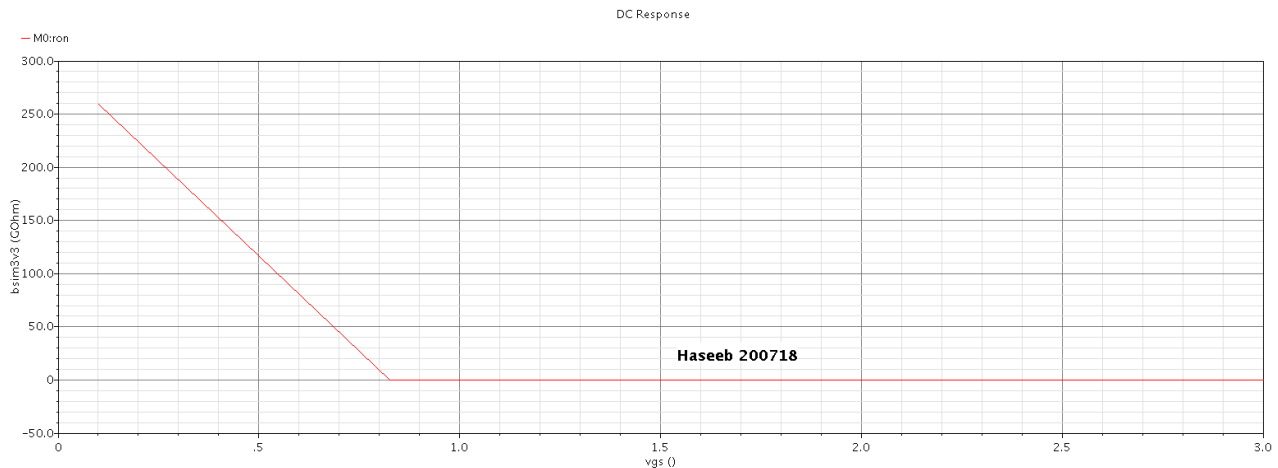


The following graph is obtained:



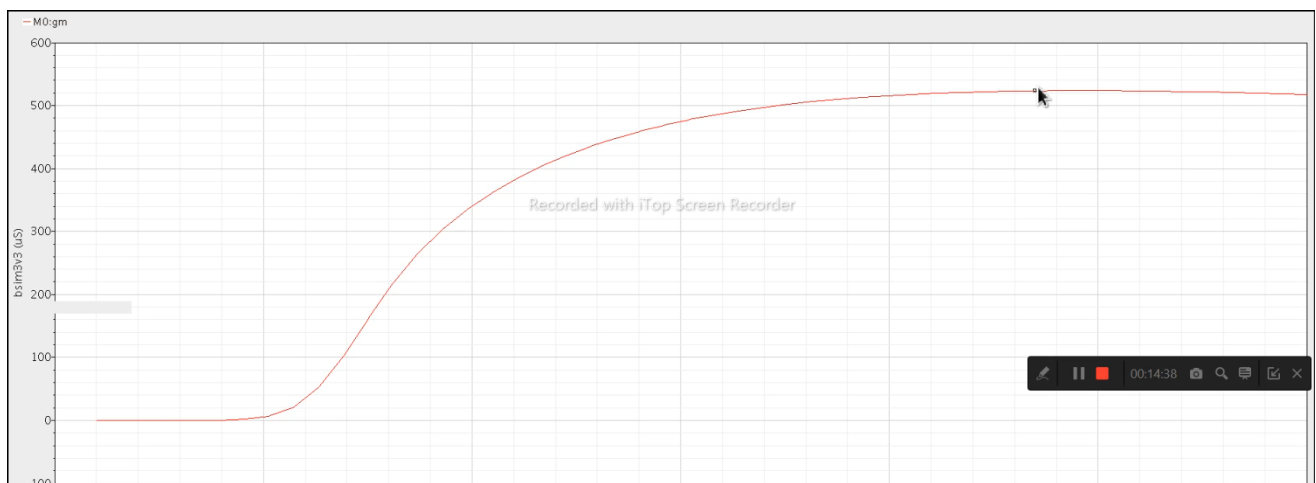
Graph Explanation: In parametric analysis we give a range of gate to source voltages V_{gs} from 0.1 to 3 volts. We will again subtract the threshold voltage V_{th} from all these different v_{gs} voltages to get the points on the graph.

On the same analysis window go to dcopt-info and select R_{on} :



Graph Explanation: When the graph reaches the straight line it enters in Deep triode region which is achieved when V_{ds} becomes less than 2 times overdrive voltage. ($V_{ds} < 2V_{ov}$)

Now we will plot the graph with g_m on y axis and V_{gs} on X axis:



Graph Explanation: G_m = Slope of current

CONCLUSION

In this lab we studied different graphs related to Nmos characteristics. We also Plotted graphs against current of V_{ds} and V_{gs} and then calculated points and labeled them which determine the different regions of the mode of operation of the transistor.