

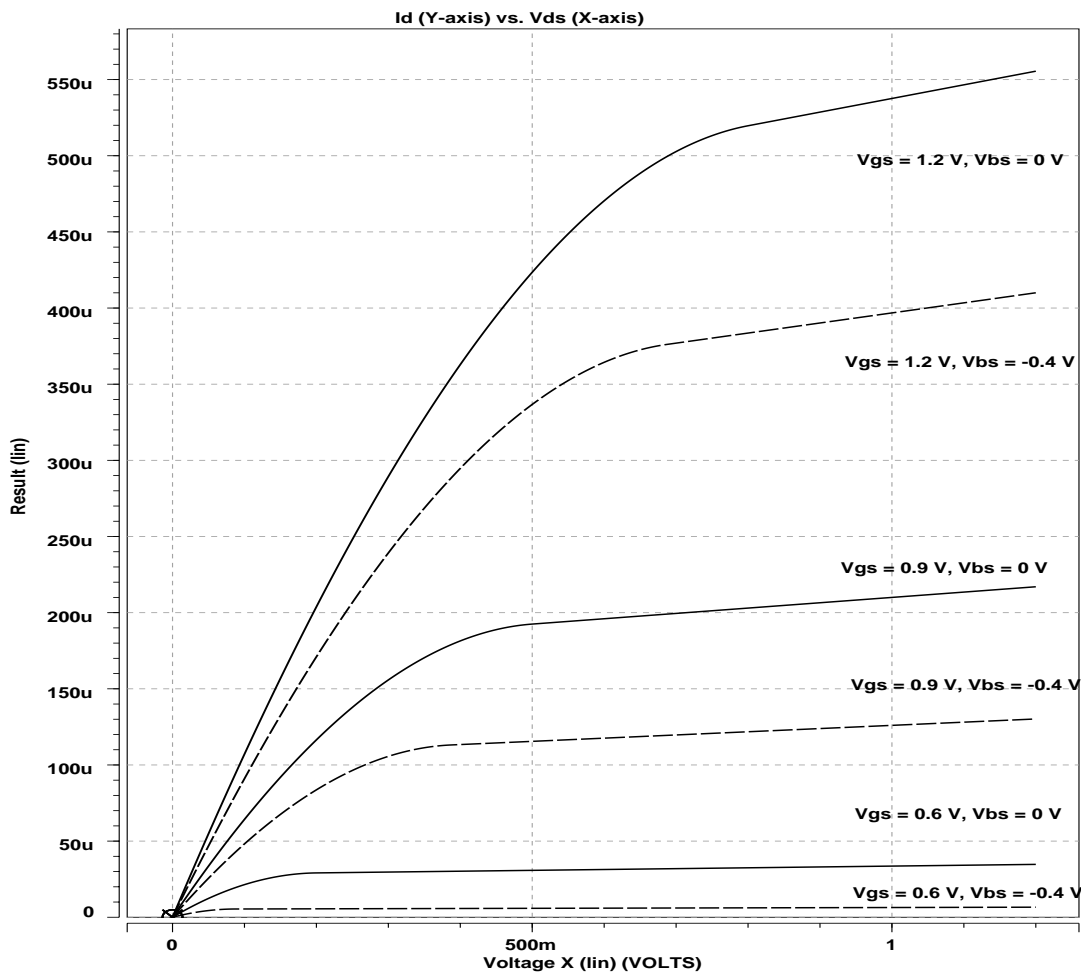
UNIVERSITY OF CALIFORNIA AT BERKELEY
College of Engineering
Department of Electrical Engineering and Computer Science

R.W. Brodersen
Mike Chen

Homework #1
(Due 1/29/04)

EECS 140
Spring 2004

- 1) Using the figure below, estimate the transistor model (Level 1) parameters: V_{TO} , γ , k' , and λ . Assume $W/L=10$, $\phi_F=0.3V$. Explain your method.

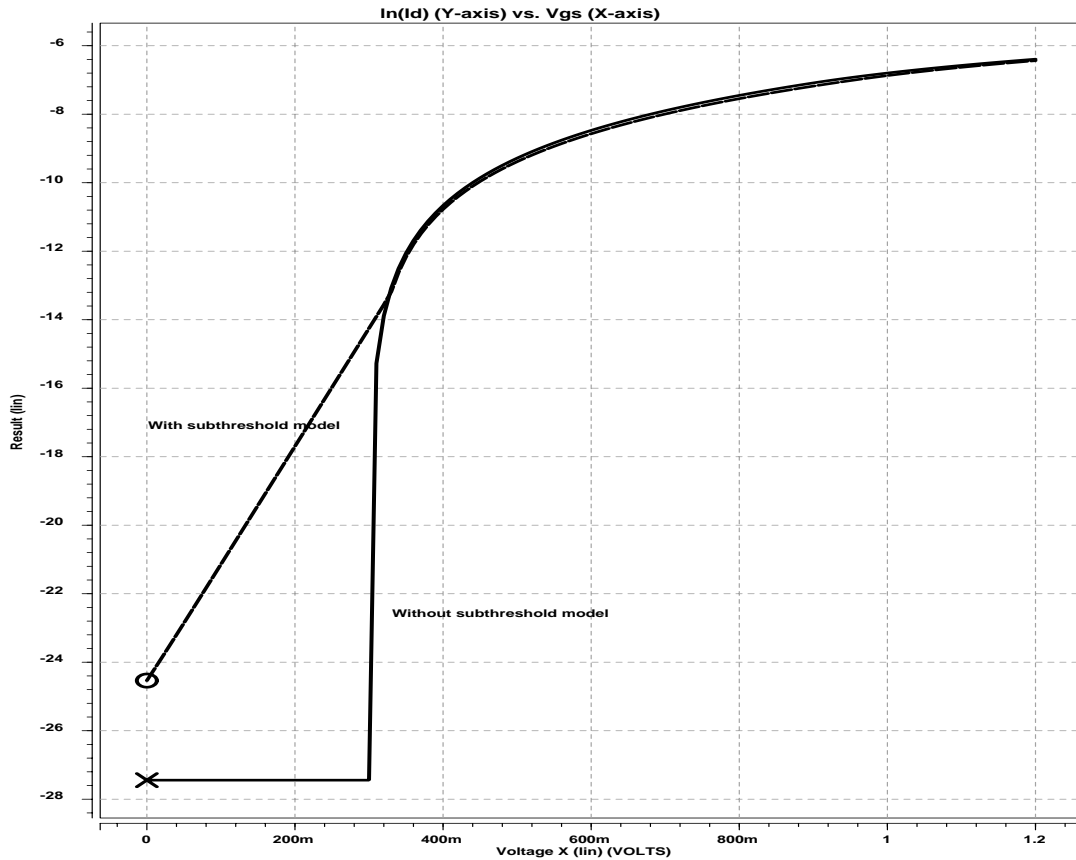


- 2) An NMOS transistor has the following parameters:
 $W=1.3 \mu\text{m}$, $L=0.13 \mu\text{m}$, $V_{TO}=0.4 \text{ V}$, $\gamma=0.5 \text{ V}^{1/2}$, $k'=100 \mu\text{A}/\text{V}^2$, and $\lambda=0.01 \text{ V}^{-1}$.
 Sketch g_m - V_{ds} characteristics for V_{ds} from 0 to 1V and $V_{bs}=0 \text{ V}$ and -0.5 V .
 Assume $V_{gs}=1 \text{ V}$.

- 3) The figure below is the $\ln(I_d)$ - V_{gs} characteristic with and without subthreshold modeling. Assuming the subthreshold current can be approximated with,

$$I_d = I_o e^{\frac{V_{gs} - V_{th}}{nV_T}}, \text{ where } V_T = 26mV$$

Estimate the value, n , in this model.



- 4) Learn to run HSPICE:

- a) Setup the HSPICE environment with the following instructions:
<http://bwrc.eecs.berkeley.edu/classes/ee140/howtos.htm>
- b) Copy the SPICE file (demo3.sp) to your working directory from
<http://bwrc.eecs.berkeley.edu/classes/ee140/notes.htm>
- c) Execute HSPICE and Awaves:

```
c199.> hspice demo3.sp >! demo3.lis
>info:      ***** hspice job concluded
c199.> awaves &
```
- d) View the results from awaves:
Load the design from **Design->Open**, and Choose the waveforms you would like to see from **Results Browser**.
- e) Print out the I_d - V_{gs} , and g_m - V_{gs} curves.