EE420/ECE620

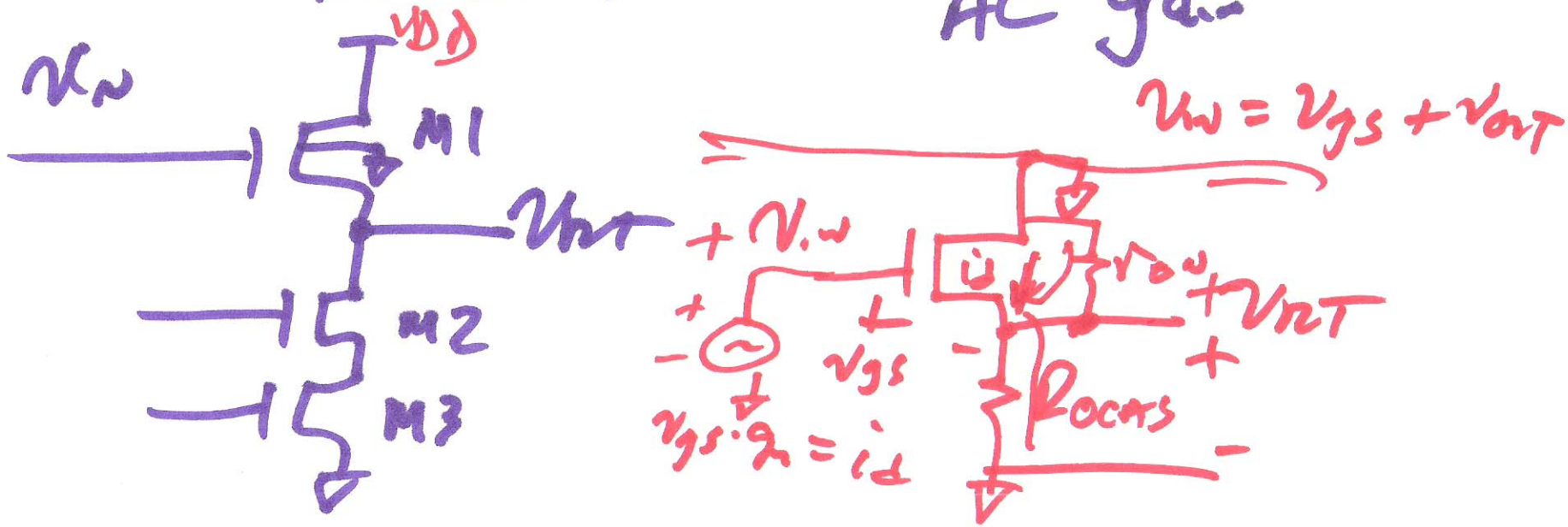
March 16, 2015

Lecture 17

S.F. = Common-Drain

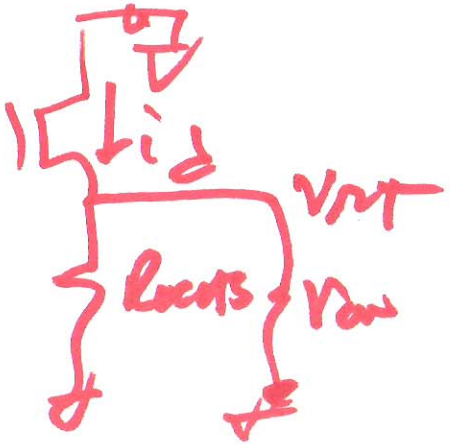
No Body effect

AC gain

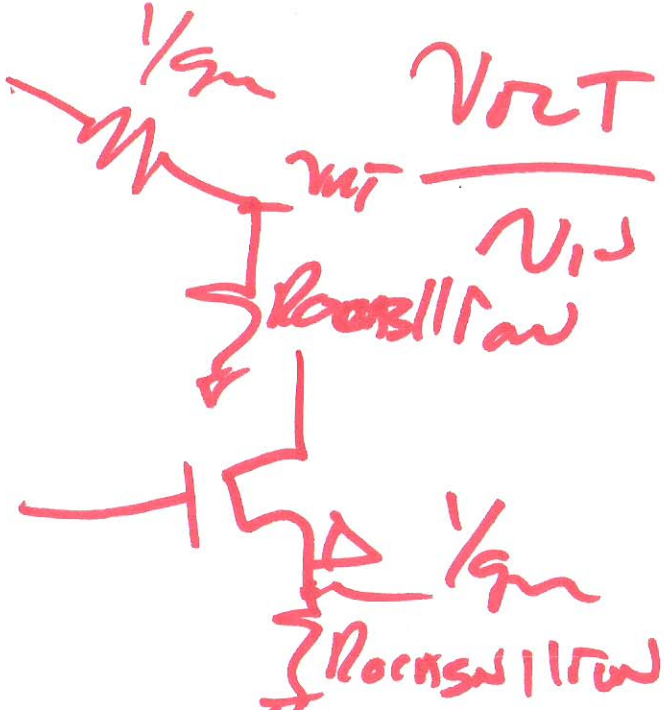


$$v_{IN} = v_{gs} + v_{OUT} = i_d\left(\frac{1}{g_m} + R_{source} \,||\, r_{ds}\right)$$

$$i_d = g_m v_{gs}$$

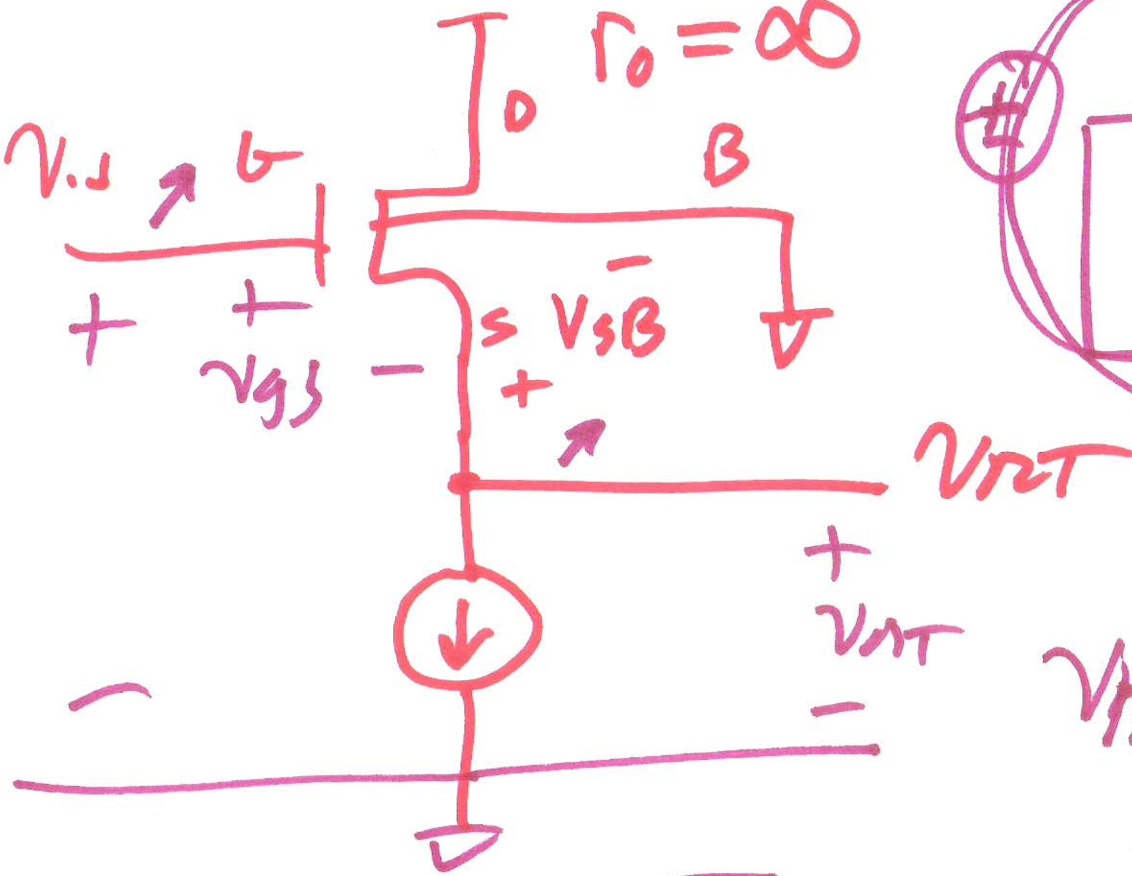


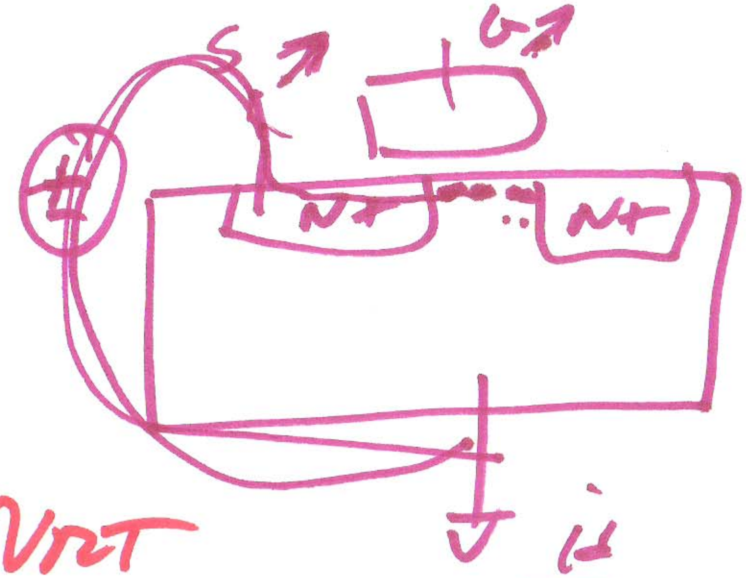
$$v_{OUT} = r_{ds} \,||\, R_{DRAIN} \cdot i_d$$



$$\frac{v_{OUT}}{v_{IN}} = \frac{i_d \cdot r_{ds} \,||\, R_{DRAIN}}{i_d\left(\frac{1}{g_m} + R_{source} \,||\, r_{ds}\right)}$$

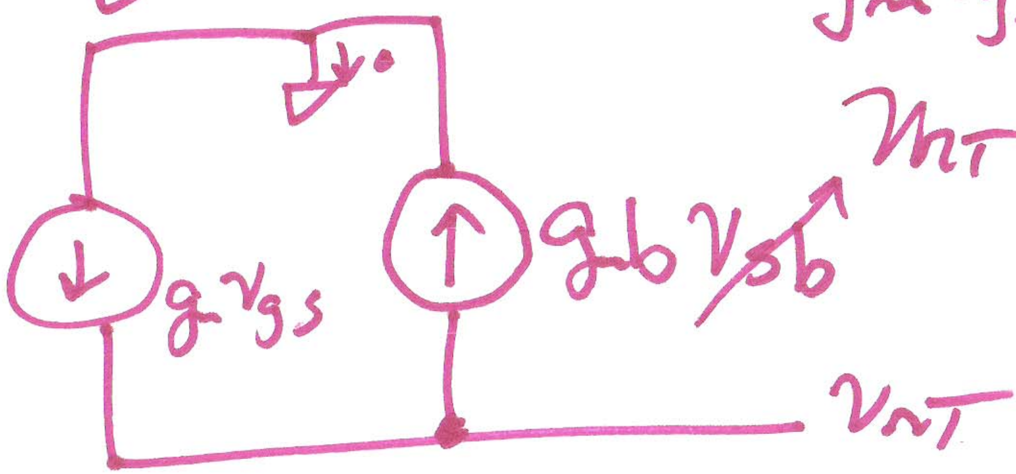
$$v_{OUT} = v_{IN} \cdot \frac{R_{source} \,||\, r_{ds}}{\frac{1}{g_m} + R_{source} \,||\, r_{ds}}$$





$v_{in} = v_{gs} + v_{out}$

$g_m v_{gs} = g_{mb} v_{out}$



$$v_{in} = v_{gs} + v_{bT}$$

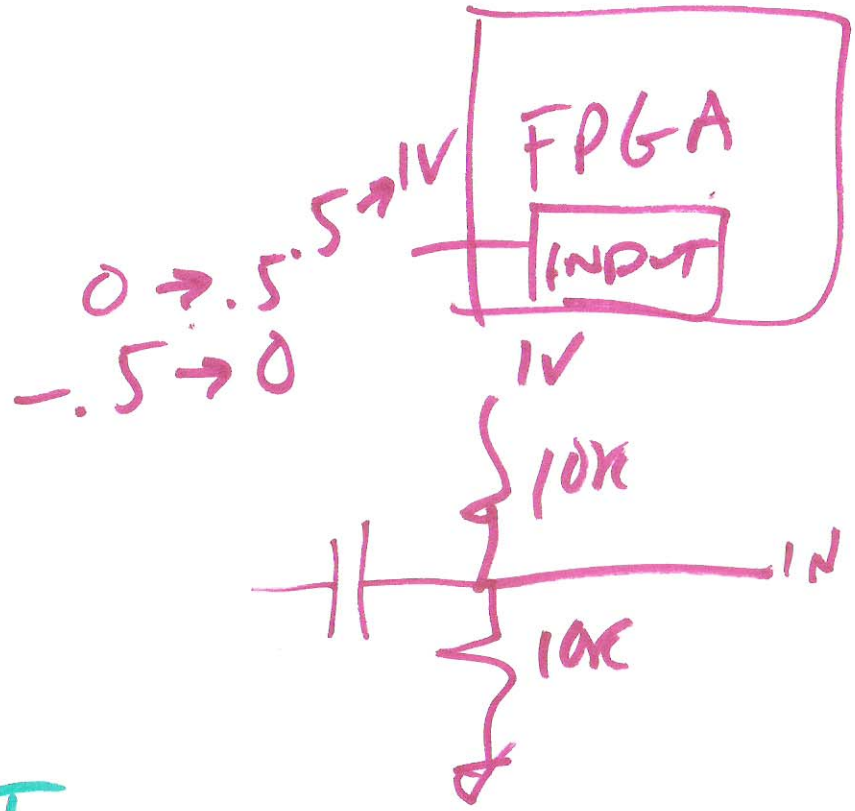
$$g_m v_{gs} = g_{mb} \cdot v_{bT}$$

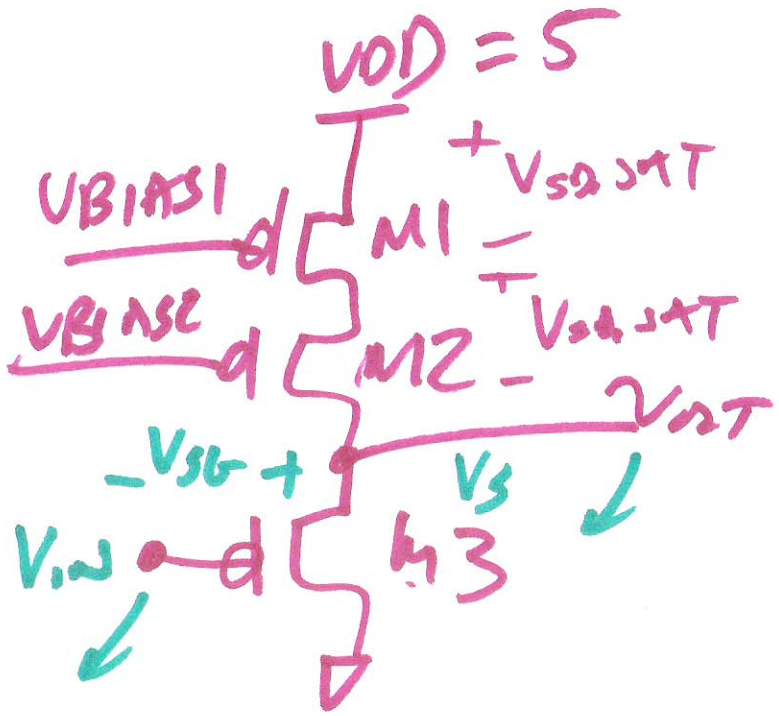
$$v_{gs} = \frac{g_{mb}}{g_m} \cdot v_{bT}$$

$$v_{in} = \frac{g_{mb}}{g_m} \cdot v_{bT} + v_{bT}$$

$$\frac{v_{bT}}{v_{in}} = \frac{1}{1 + \frac{g_{mb}}{g_m}}$$

$\eta \simeq .7$





SAT

$V_{SAT} - V_{SD} \geq V_{SG} - V_{THP}$

$V_S - V_D \geq V_S - V_{SG} - V_{THP}$

$0 \quad V_{IN}$

$V_{IN,MAX} =$

$VDD - 2V_{SD,SAT} - V_{SG}$

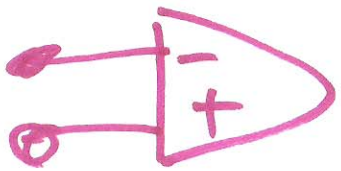
$V_{IN,MIN} =$

$V_{IN} \geq -V_{THP}$

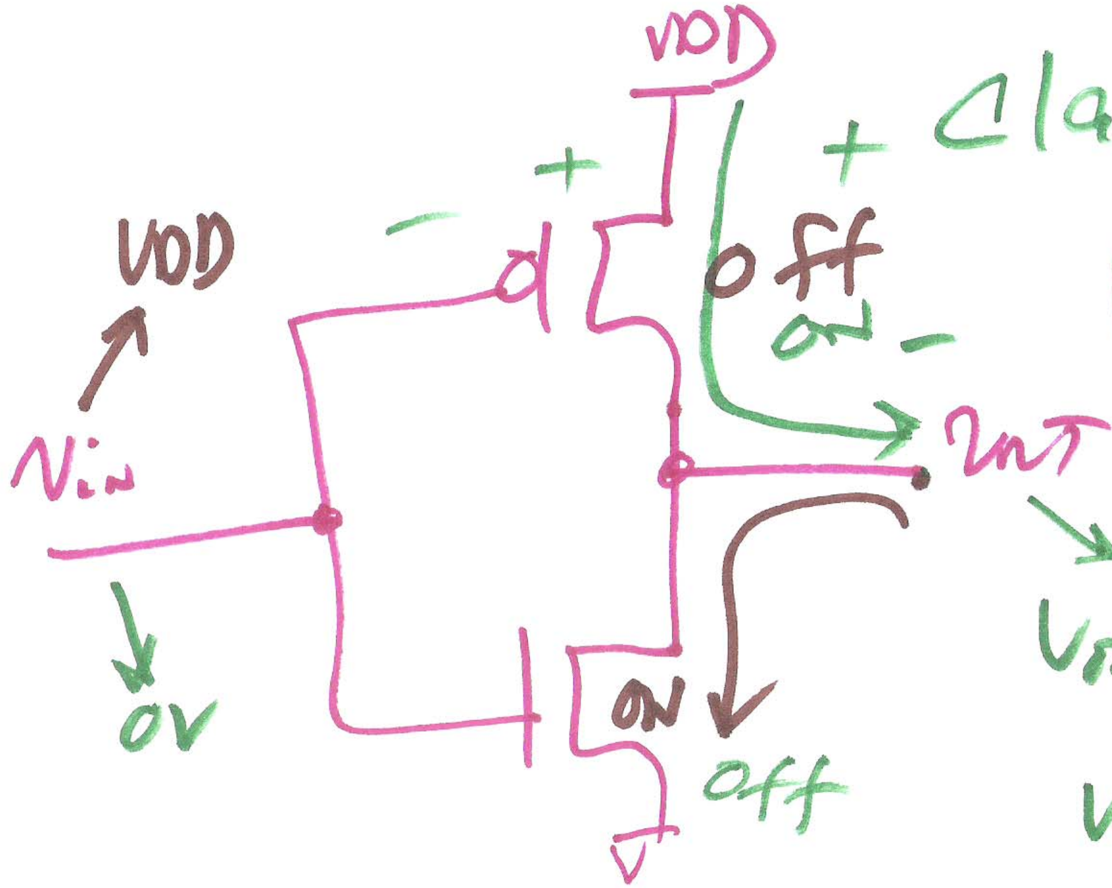
$0 \geq -V_{IN} - V_{THP}$

5)

S.F. on output buffer for op-amp



Class AB push-pull Amplifier



$$V_{OUT} \le VDD - V_{SD,sat}$$

$$V_{OUT} \ge V_{DS,sat}$$

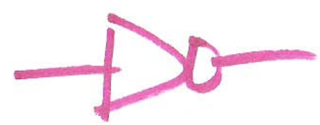
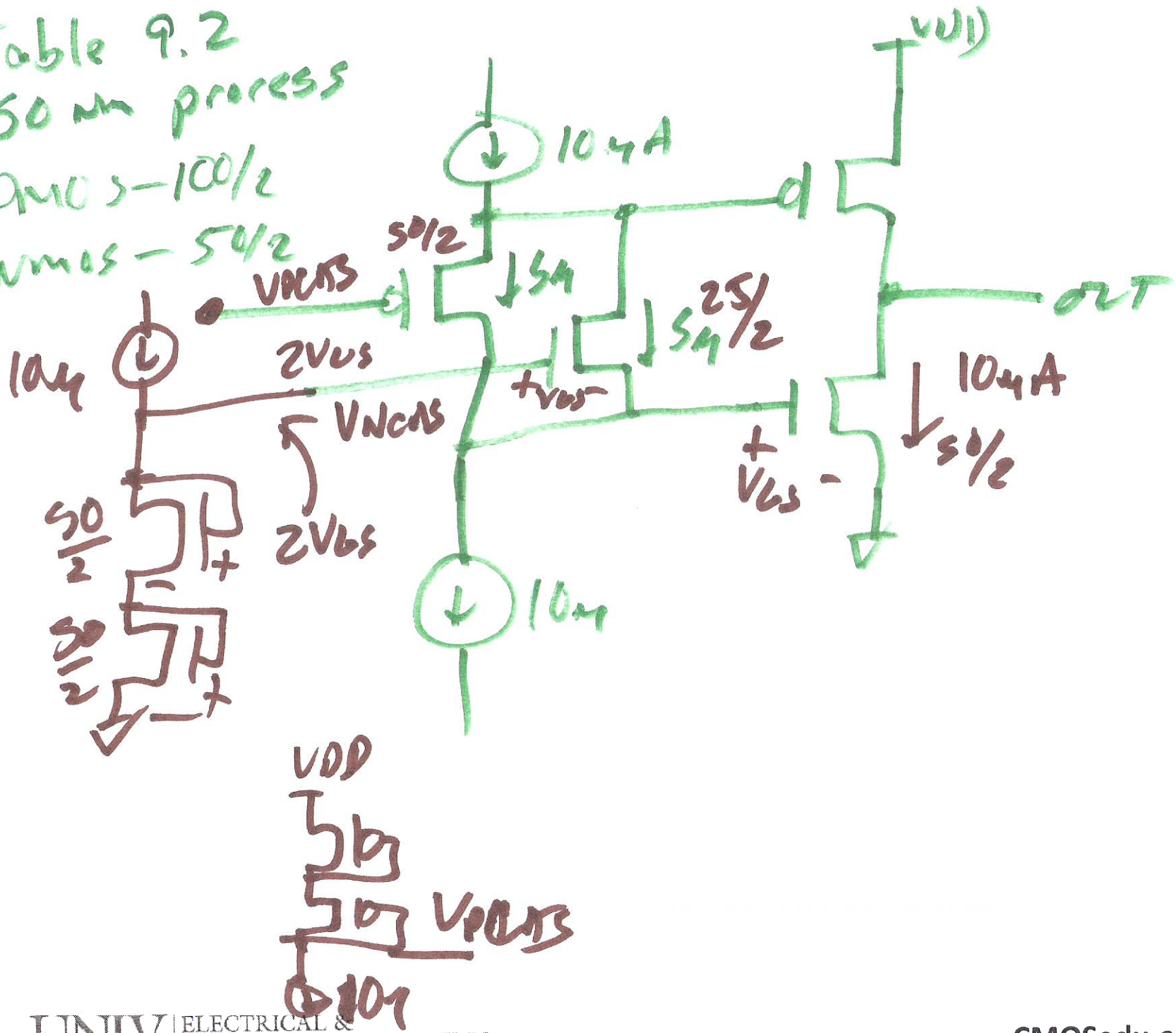
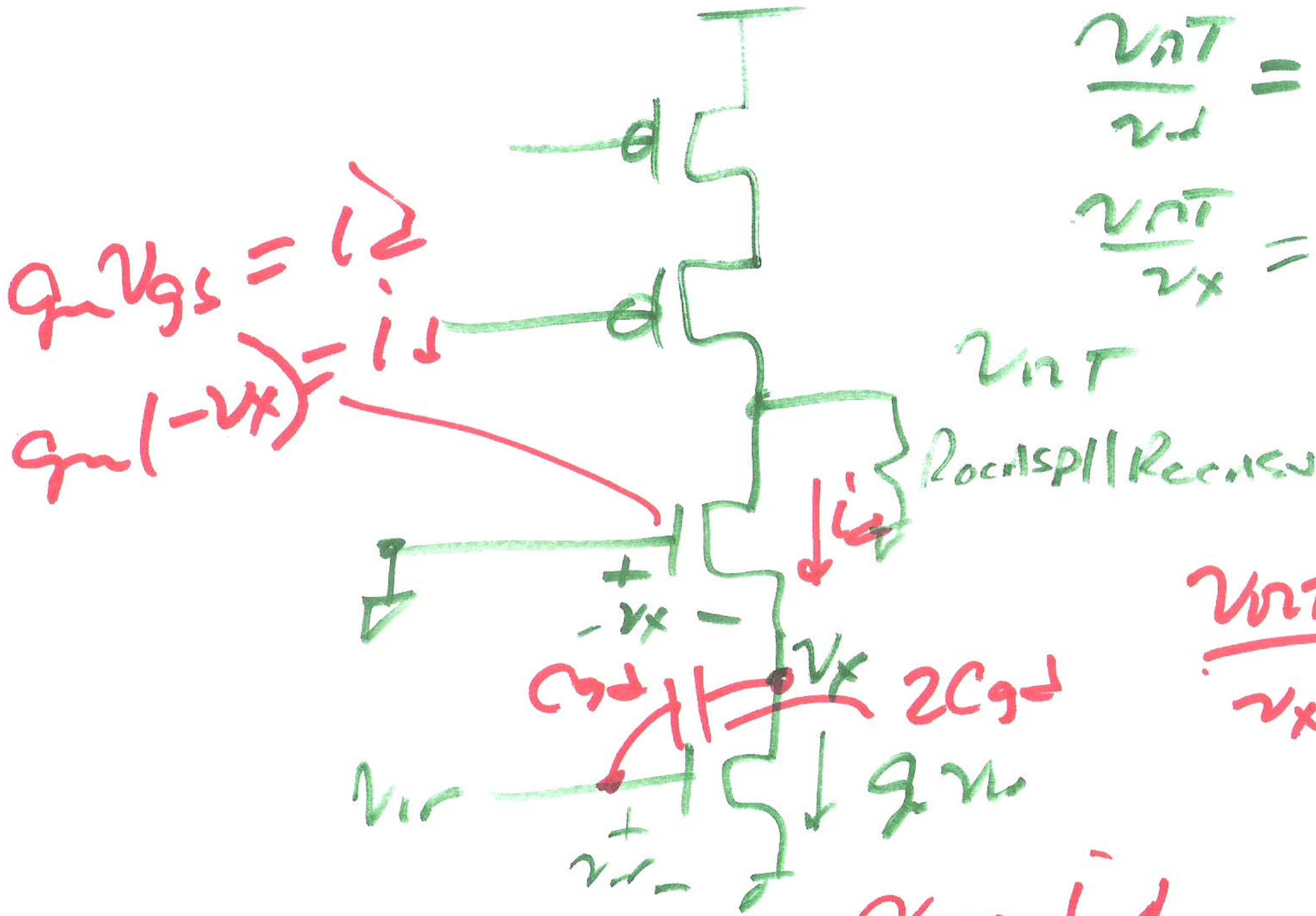


Table 9.2
50 nm process
PMOS – 100/2
NMOS – 50/2





$$\frac{v_{inT}}{v_d} = \frac{-i_d \cdot R_{ocasp} || R_{ocasn}}{i_d \cdot 1/g_m}$$

$$\frac{v_{inT}}{v_x} = \frac{-1/g_{mn}}{1/g_{mn}} = -1$$

$$\frac{v_{inT}}{v_x} = \frac{-i_d \cdot \frac{1}{g_m}}{\frac{i_d}{g_m}}$$

$$v_{in} = \frac{i_d}{g_m}$$

Miller

Killer