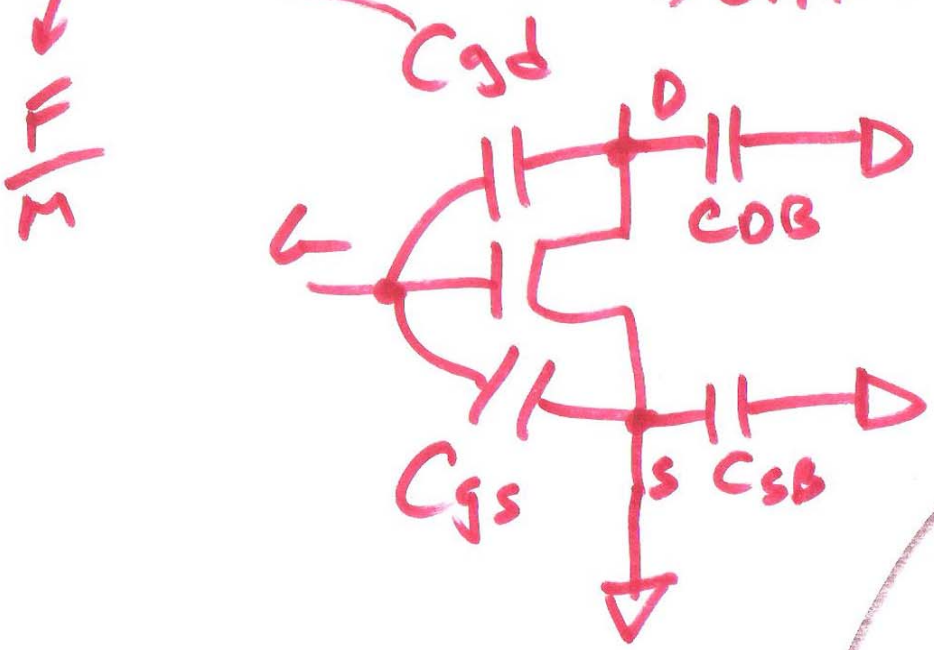
Lecture 15 EE 422/ECG 622

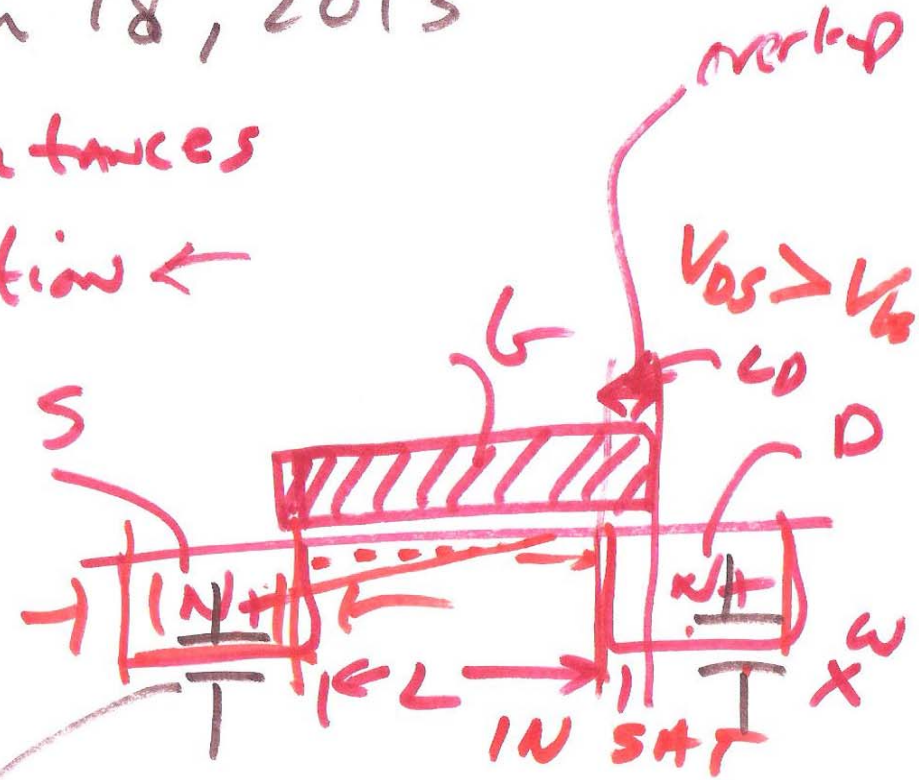
March 18, 2013

MOSFET Capacitances

→ SATURATION ←

$C_{GDO} \cdot W$ → F/M

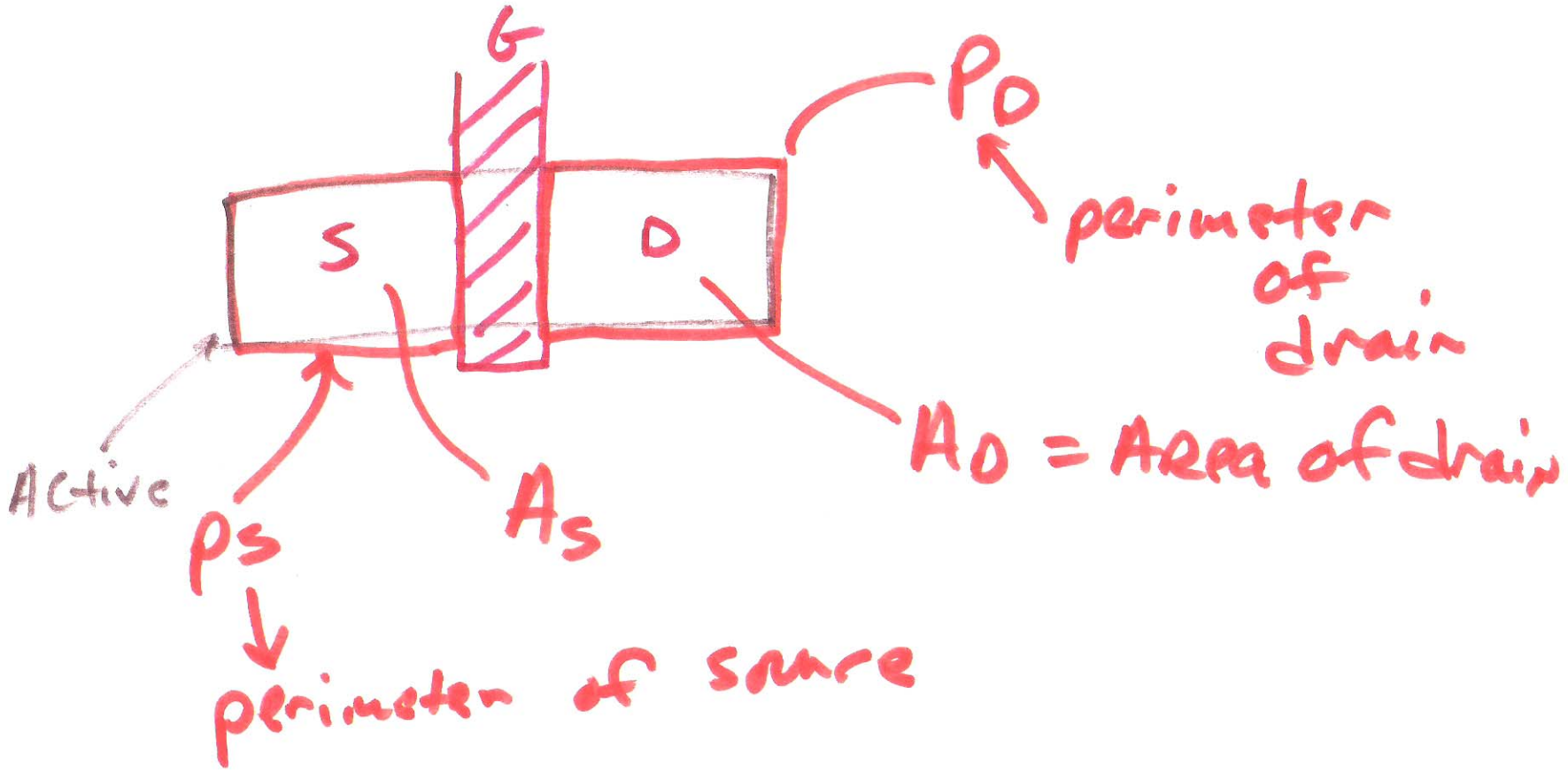




$$C_{gs} = \frac{2}{3} C_{ox}' \cdot W \cdot L$$

depletion capacitances!

$$= \frac{\varepsilon_{ox}}{t_{ox}}$$



$$C_{DB} = C_{DBAREA} + C_{DBSIDEWALL}$$

$$= \frac{C_j \cdot AD}{\left(1 + \frac{|V_{DB}|}{pb}\right)^{MJ}} + \frac{C_{jsw} \cdot PD}{\left(1 + \frac{|V_{DB}|}{pbsw}\right)^{MJSW}}$$

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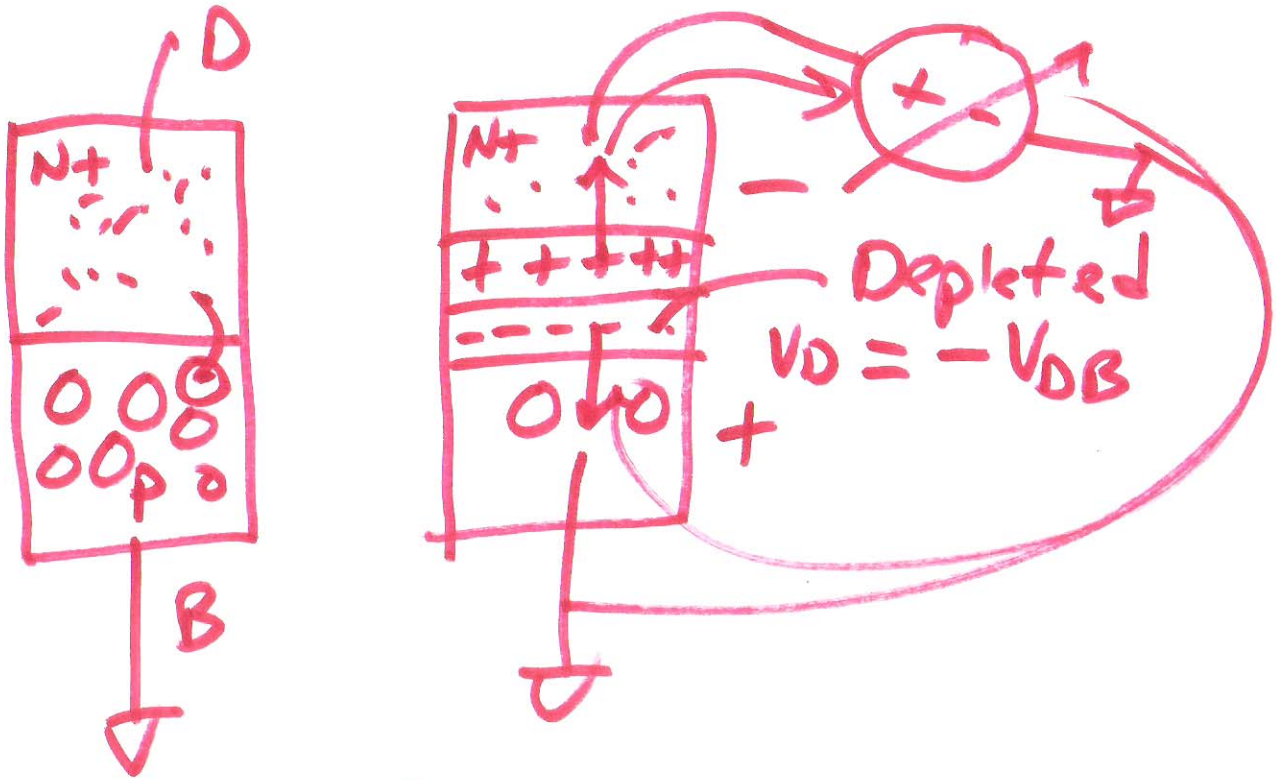
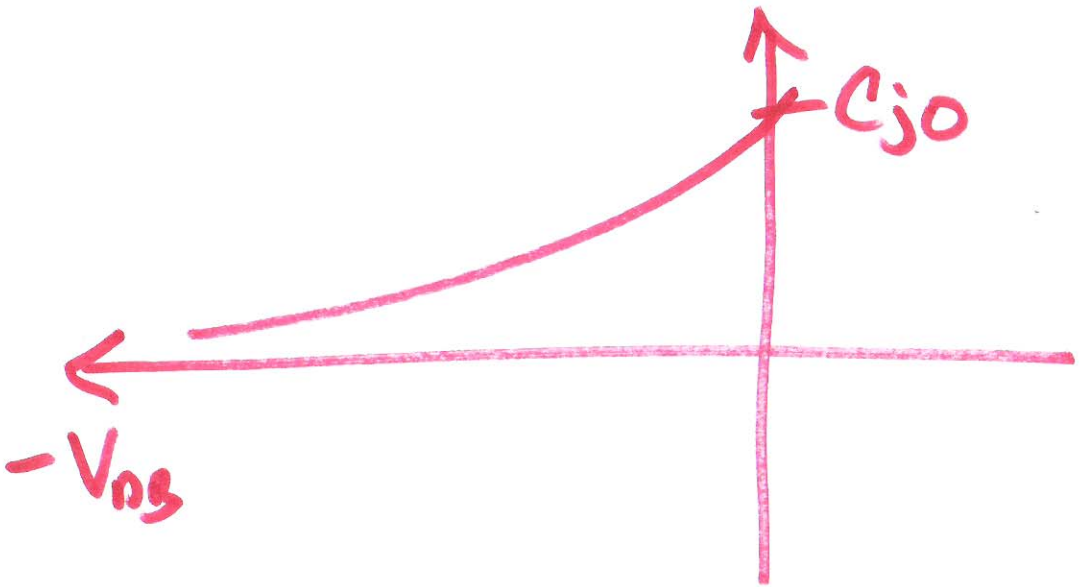
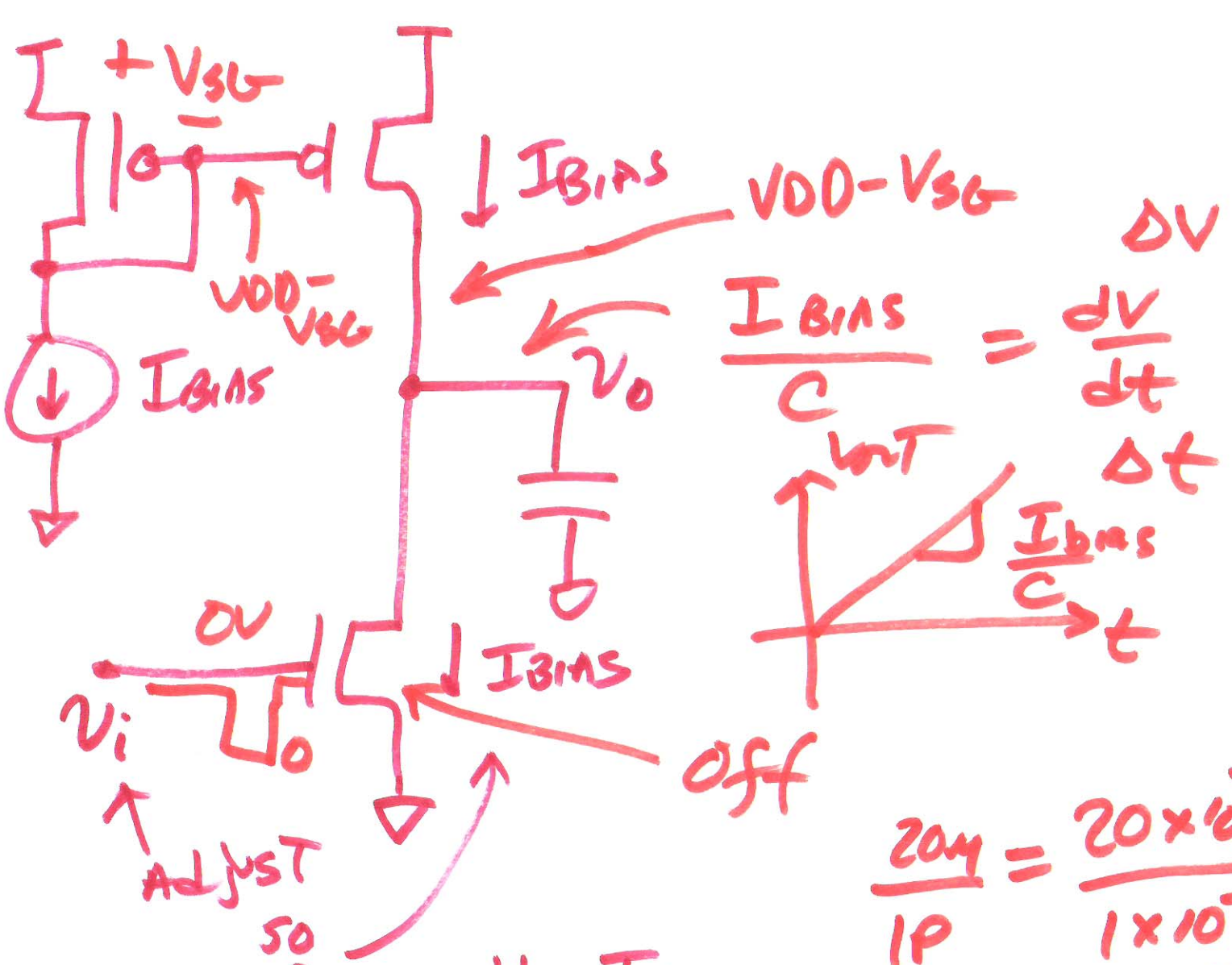
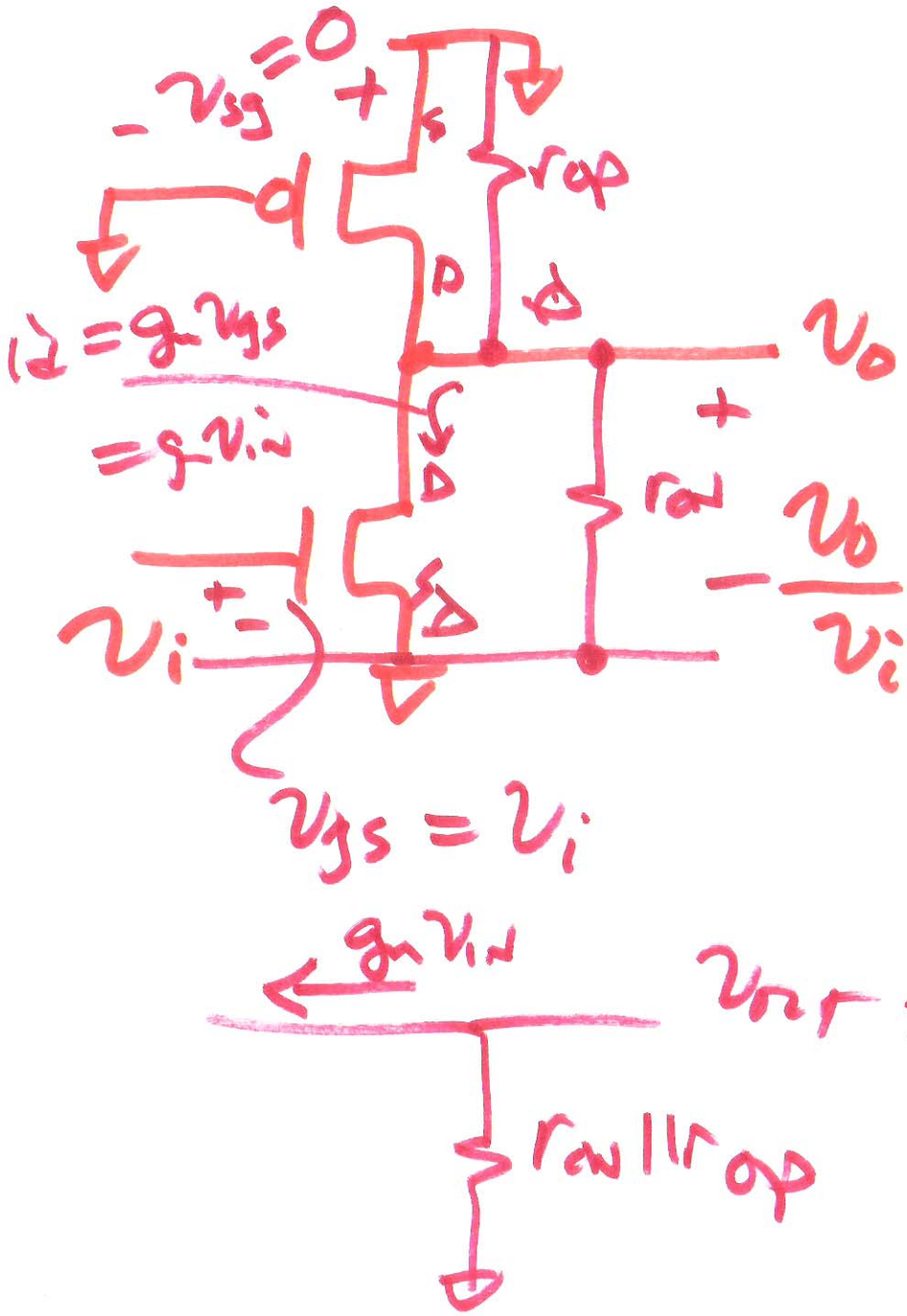

D
N+
B
N+
Depleted
$V_D = -V_{DB}$


C_{jo}
$-V_{DB}$


+ VSG −
IBIAS
VDD − VSG
VDD − VSG
IBIAS
VO
0V
Vi
IBIAS
Off
Adjust
so
is exactly IBIAS
Slew-rate limitations
constant current charging a CAP!
ΔV
IBIAS / C = dV / dt
Δt
ΔV
IBIAS / C
t
20μ / 1P = 20×10^-6 / 1×10^-12
20V / 4s = 0.02V / ns

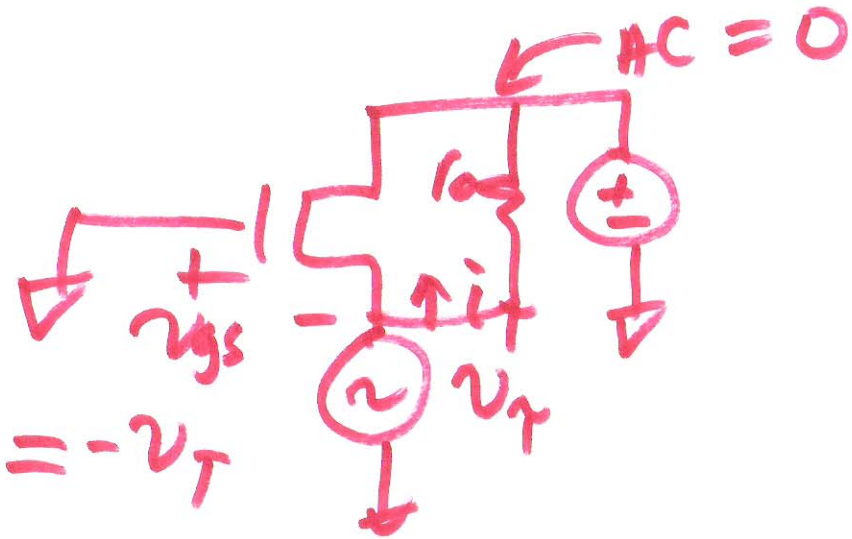


$$-\frac{v_o}{v_i} = -\frac{r_{ol} \| r_{op}}{1/g_{m,N}}$$

$$= -g_{m,N} \cdot r_{ol} \| r_{op}$$

$$v_{out} = g_m v_{in} \, r_{ol} \| r_{op}$$

5)

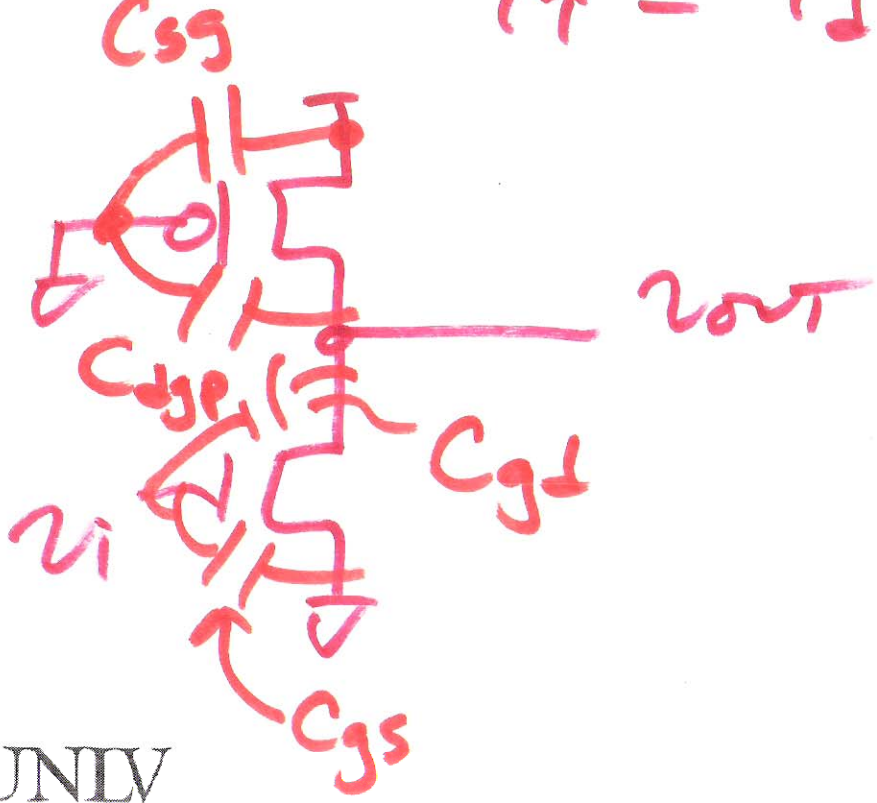


$$i_d = g_{mN} \cdot v_{gs}$$

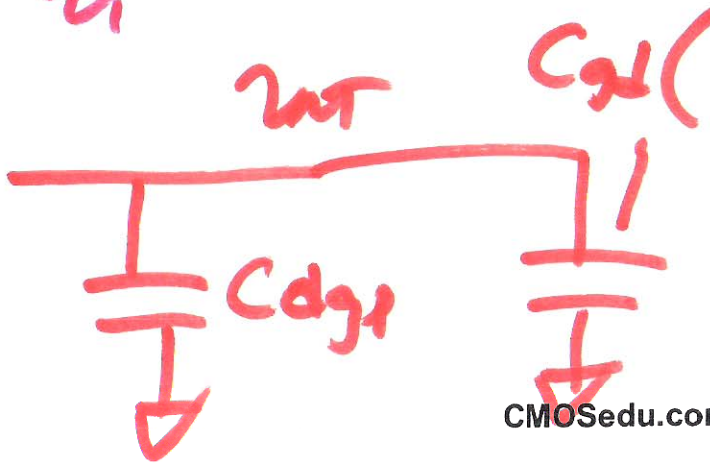
$$-i_T = g_{mN} \cdot -v_T$$

$$i_T = -i_d$$

$$\frac{v_T}{i_T} = \frac{1}{g_{mN}}$$



$$\frac{v_{out}}{v_i} = -g_{mN} r_{ds} \| R_D$$



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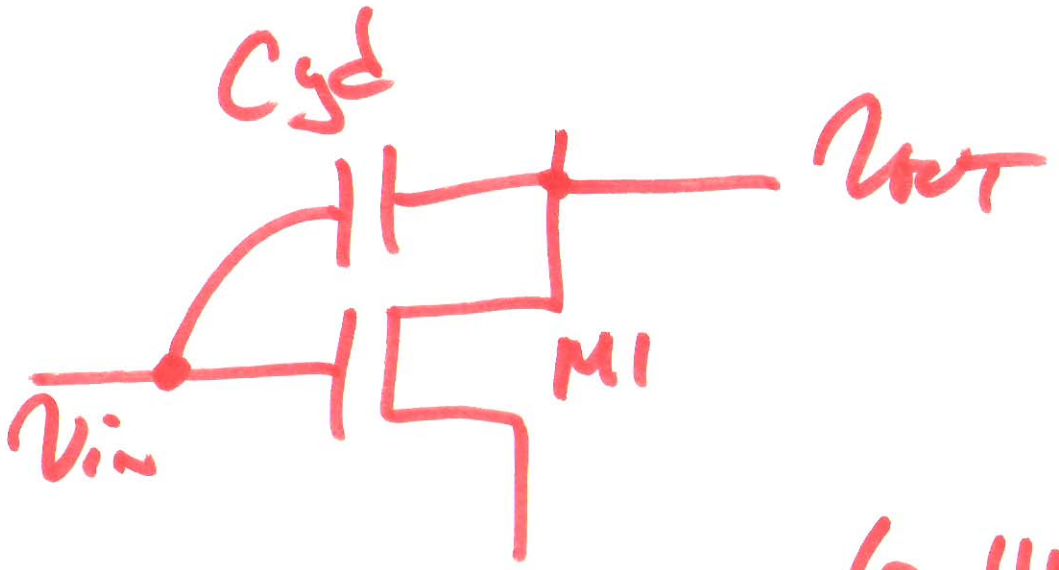
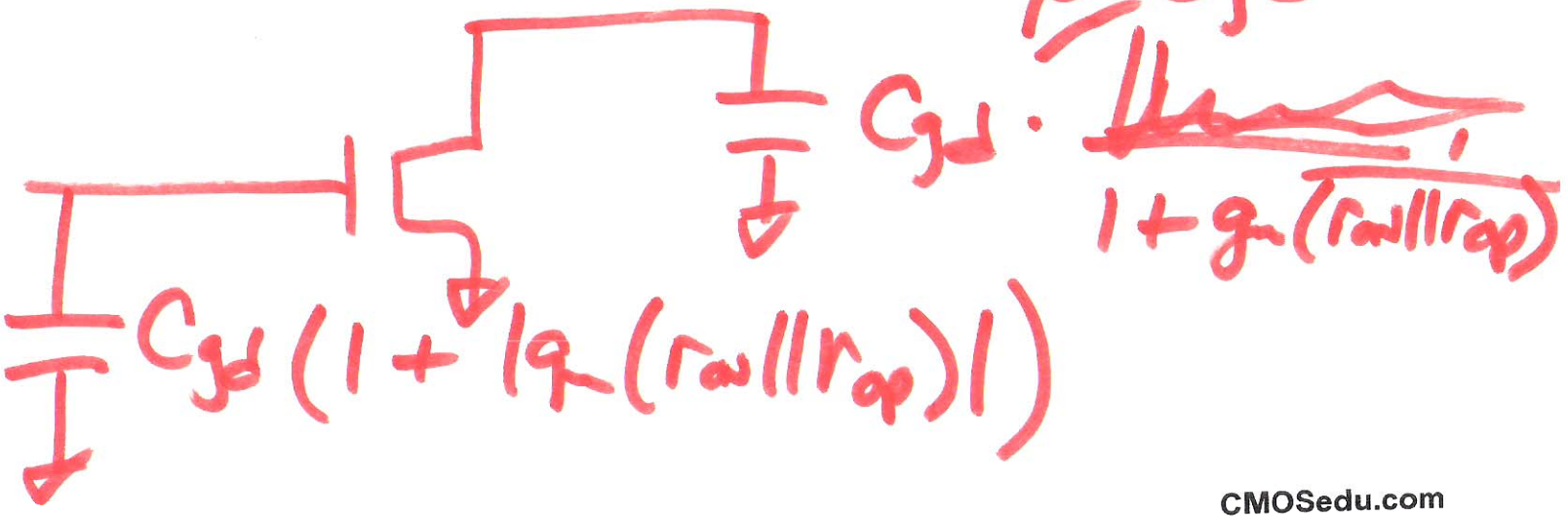


$$A = -g_m (r_o \| r_{op}) \quad C_{in} \left(1 + \frac{1}{|A|}\right)$$

$\approx C_{gd}$



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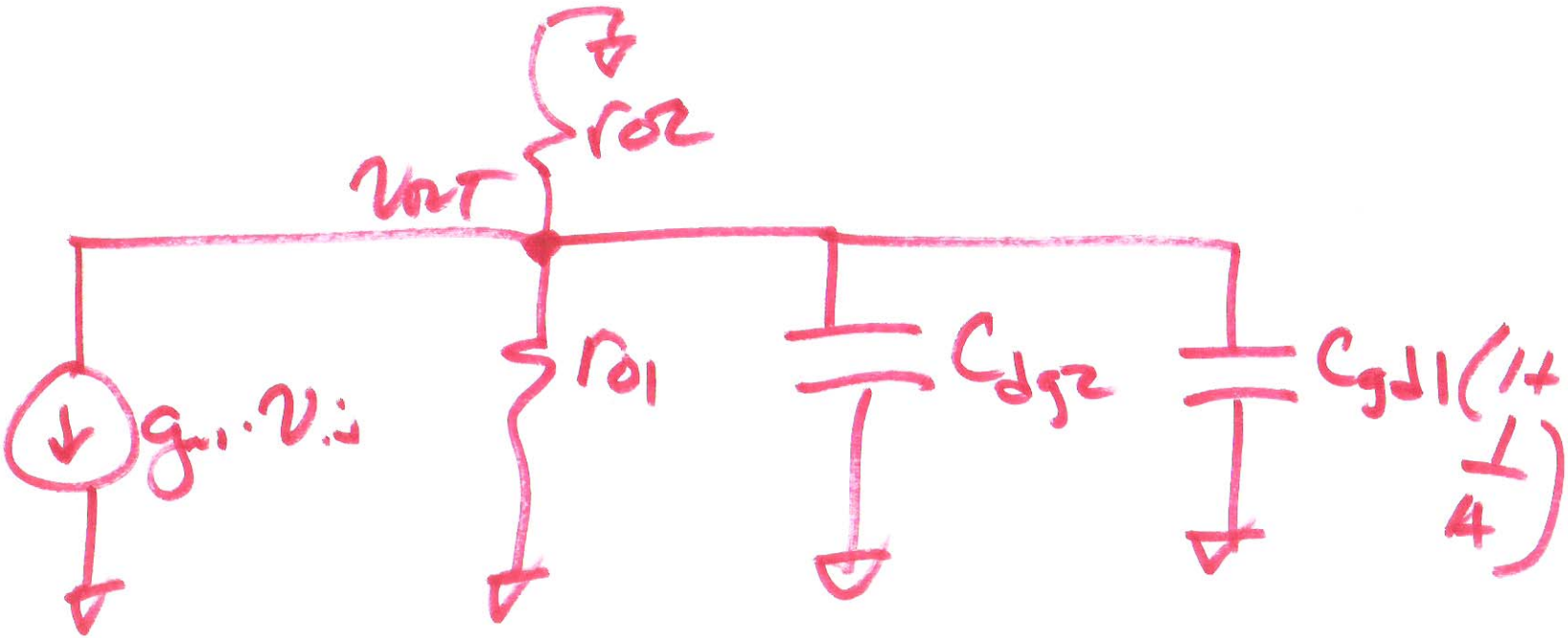

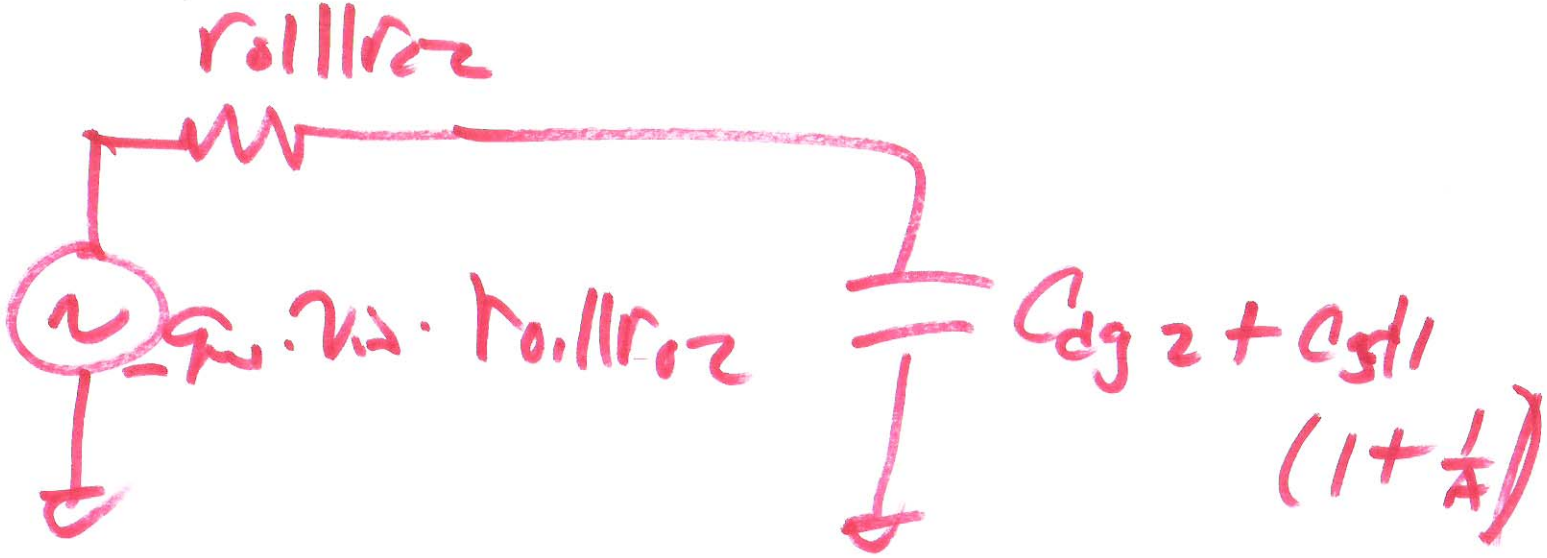

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