7/8/14

lec 6

$$I_D = \frac{1}{2}\mu_n C_{ox}\left(\frac{W}{L}\right)\left[V_{GS}-V_T\right]^2\left[1+\lambda V_{DS}\right]$$

λ → A/V^2

* $\lambda = V^{-1}$
* λ should be small

$$g_m \left(= y_{21}\right) = \frac{\partial I_D}{\partial V_{GS}} = \mu_n C_{ox}\left(\frac{W}{L}\right)\left(V_{GS}-V_T\right)\left(1+\lambda V_{DS}\right)$$

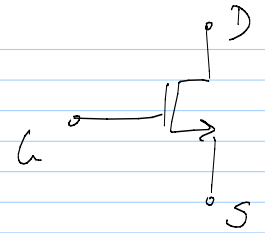
$$\approx \mu_n C_{ox}\left(\frac{W}{L}\right)\left(V_{GS}-V_T\right)$$

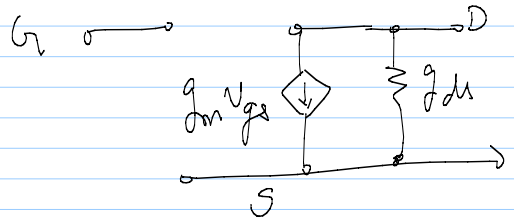
$$y_{22} = \frac{\partial I_D}{\partial V_{DS}}$$

$$= \underbrace{\frac{1}{2}\mu_n C_{ox}\left(\frac{W}{L}\right)\left(V_{GS}-V_T\right)^2}_{\approx I_D} \cdot \lambda$$

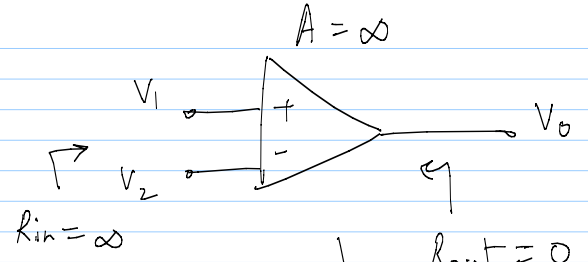
$$\boxed{g_{ds} = y_{22} = \lambda I_D}$$

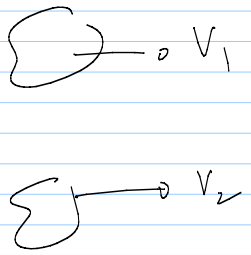
$$r_{ds} = 1/g_{ds}$$



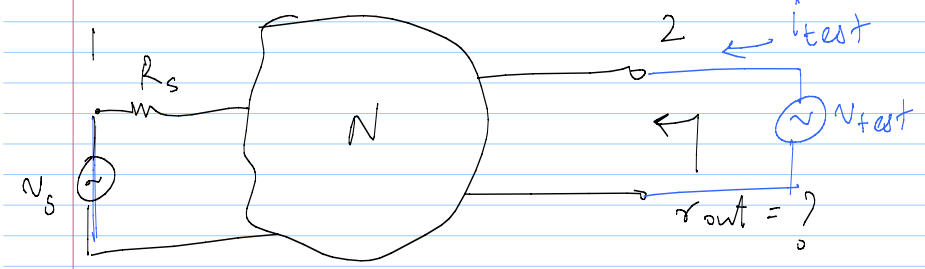


Small signal equivalent ckt of MOSFET

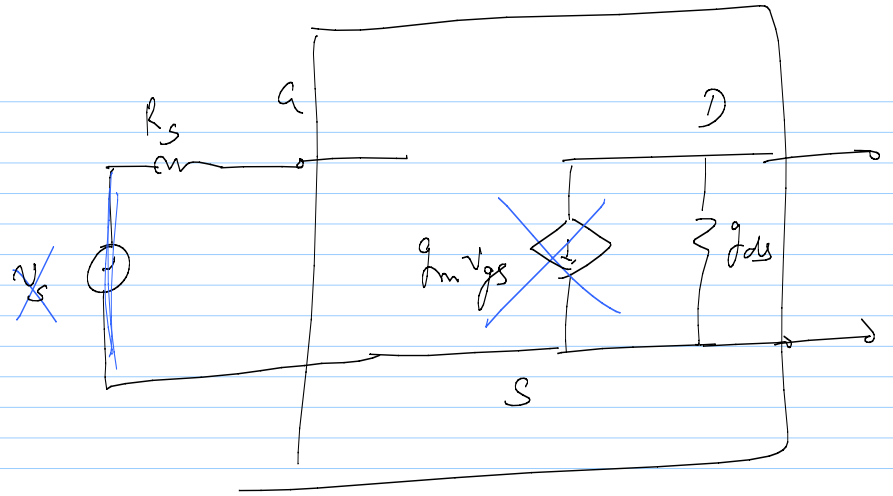




Build using MOSFETs



* Short v_s (indep. voltage source)
* apply v_{test} @ port 2
* find out i_{test} drawn from v_{test}
* $r_{out} = \frac{v_{test}}{i_{test}}$



$r_{out} = r_{ds} = \text{large}$