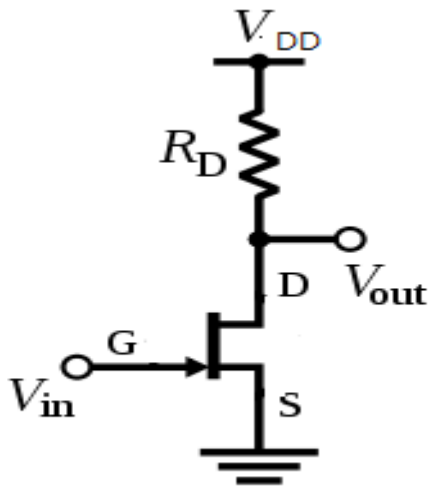


The NMOS Device Characteristics

성준호

Doubling voltage gain



Increase R_D

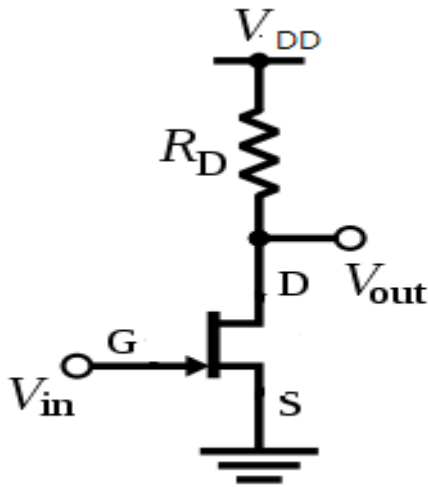
$$V_{DS} = V_{DD} - I_D R_D$$

For saturation, $V_{DS} > V_{GS} - V_{TH}$

But increase R_D , $V_{DS} < V_{GS} - V_{TH}$

MOS can go into triode region!

Doubling voltage gain



Increase g_m

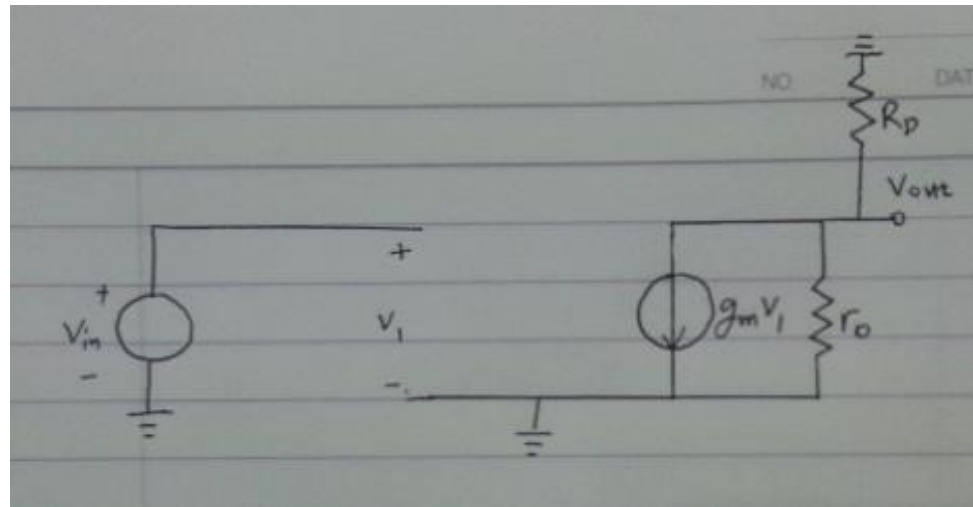
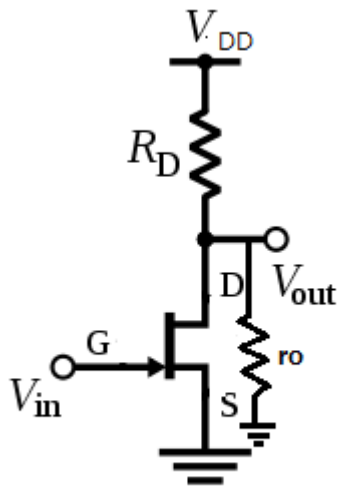
$$g_m = \sqrt{2\mu_n C_{ox} \frac{W}{L} I_D}$$

Increase I_D : Same problem increasing R_D

Increase $\frac{W}{L}$: Practical

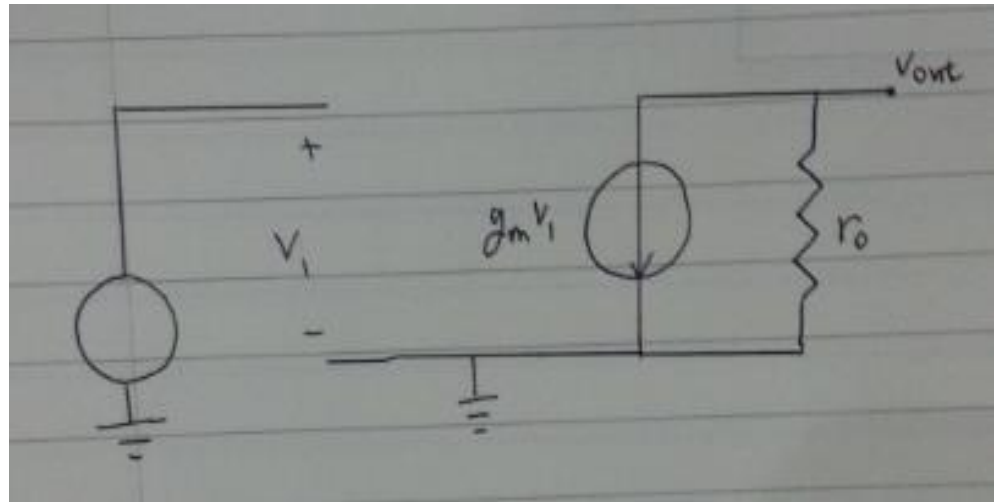
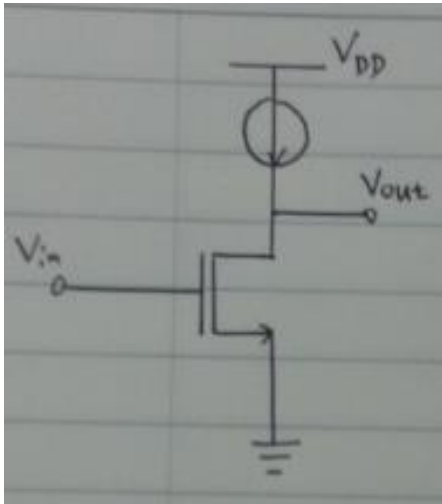
Sufficiently large $\frac{W}{L}$ $g_m = \frac{I_D}{1.5V_T}$

Channel length modulation



$$A_v = -g_m R_D // r_o$$

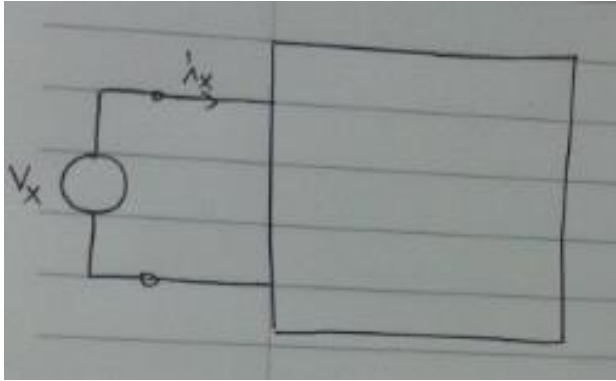
Channel length modulation



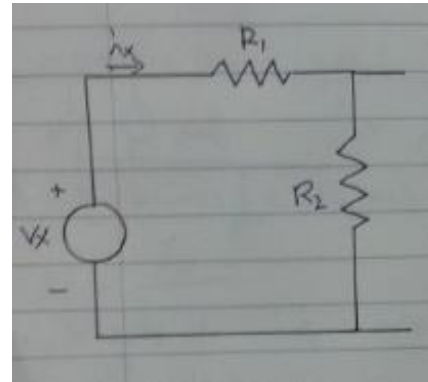
$$A_v = -g_m r_o$$

intrinsic gain!

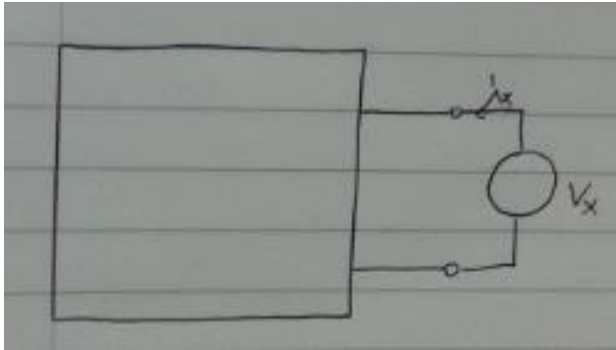
Port impedance



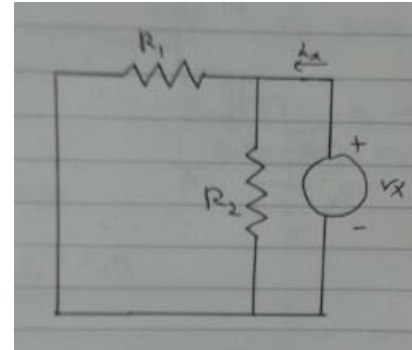
$$R_{in} = \frac{v_x}{i_x}$$



$$R_{in} = R_1 + R_2$$



$$R_{in} = \frac{v_x}{i_x}$$



$$R_{in} = R_1 // R_2$$