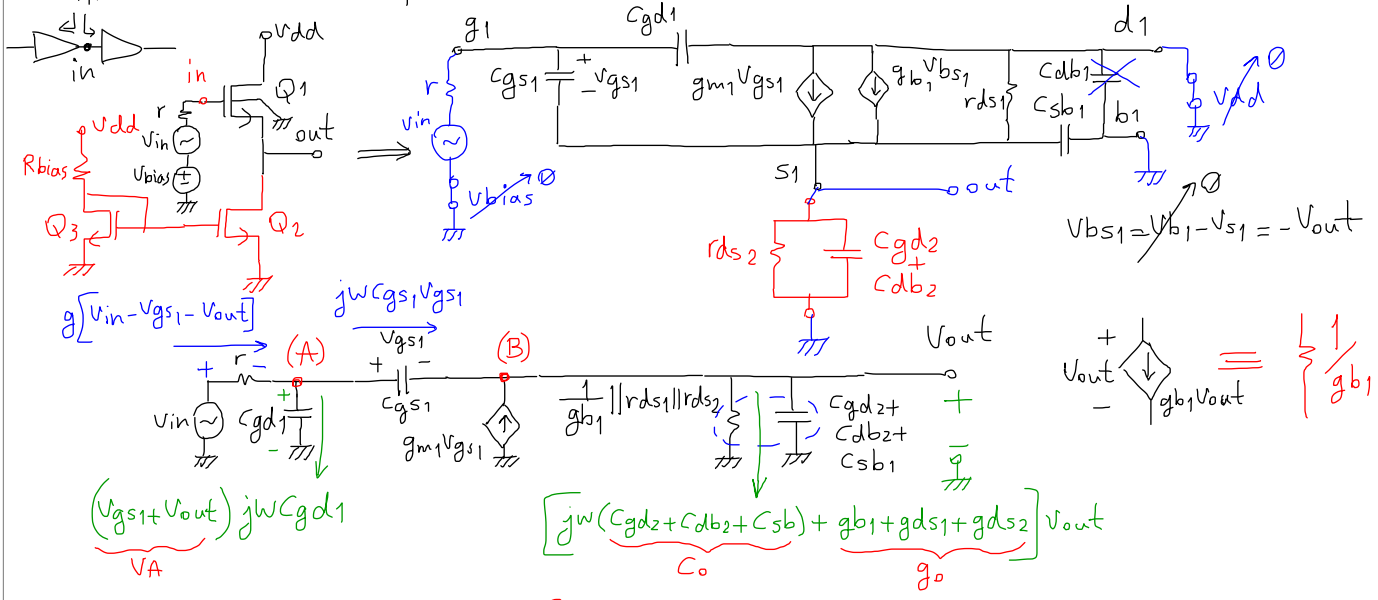
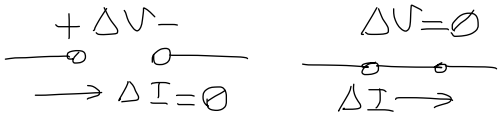
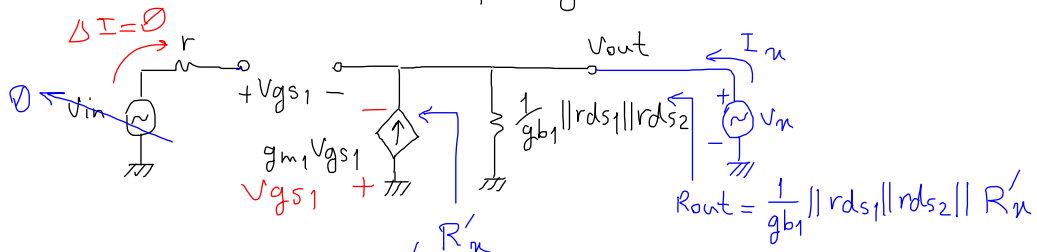
* Common Drain Amplifier:

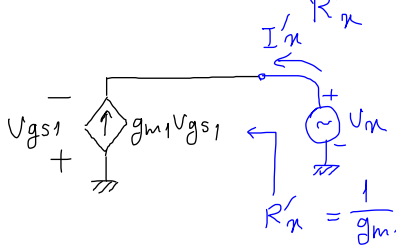


$$Z_{out} = R_{out} + \frac{1}{jwC_{out}}$$

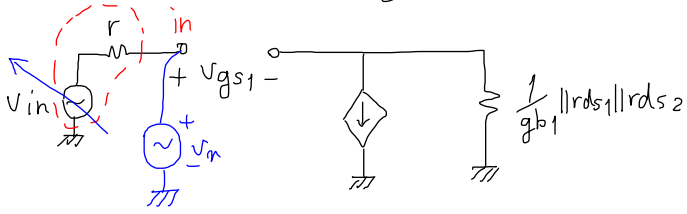


* find Rout @ Low-frequency:

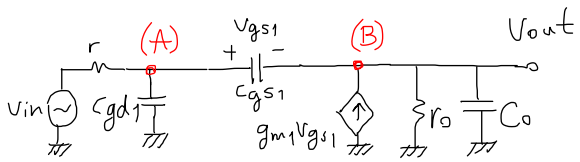




* find Rin @ low frequency



$$R_{in} = r \,||\, \infty$$

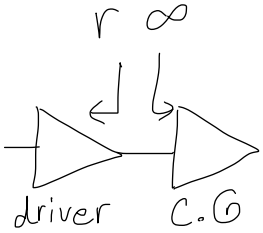


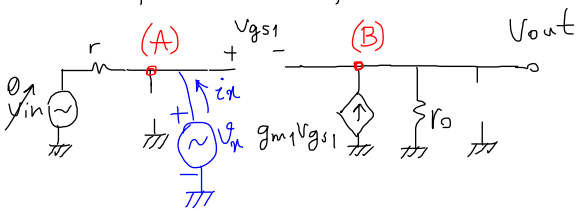
$r_o = \frac{1}{g_{b_1}} || r_{ds_1} || r_{ds_2}$

$C_o = C_{gd_2} + C_{db_2} + C_{sb_1}$

✳ find total resistance seen at node (A) ?

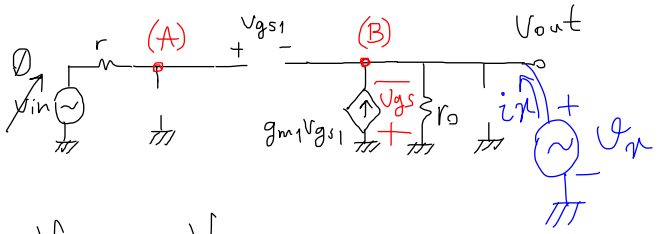
- connect test source to node A
- short indedependent Vin source
- open all capacitors





$$R_{(A)} = \frac{v_x}{i_x} = r \,||\, \infty$$

✳ find total resistance at node (B) ?

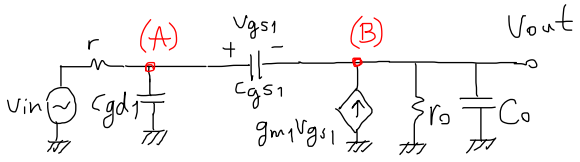


$V_B = V_x = -V_{gs}$

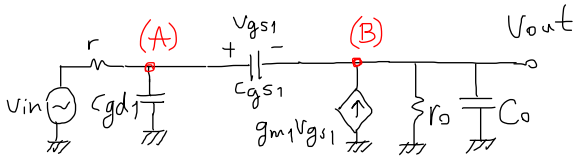
Anwer : $R_{(B)} = r_o \,||\, \frac{1}{g_m}$

or $R_{(B)} = \frac{1}{g_o + g_m}$

✳ find total resistance between nodes (A) and (B) ?

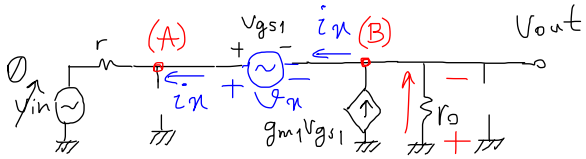


* find total resistance between nodes (A) and (B) ?



Answer:

$$R_{AB} = \frac{\vartheta_x}{i_x} = \frac{r + r_o}{1 + g_{m1} r_o}$$



$$\vartheta_x = V_{gs1} = r \cdot i_x - \left(-r_o\left[-i_x - g_{m1} V_{gs1}\right]\right)$$

V^+ V^-

$$\Rightarrow R_{AB} = \frac{\vartheta_x}{i_x} = \frac{r + r_o}{1 + g_{m1} r_o}$$

$$r_o = \frac{1}{g_{b1}} \| r_{ds2} \| r_{ds1}$$

$$C_o = C_{sb1} + C_L \quad C_{gd2} + C_{db2}$$

$$W_{3dB} = \frac{1}{r C_{gd1} + \frac{r + r_o}{1 + g_{m1} r_o} C_{gs1} + \left(\frac{1}{g_{m1}} \| r_o\right) C_o}$$

$$\frac{(g + g_i) g_{m1} + g_o'(g + g_i)}{(g + g_i) C_{gs1} + g_{m1} C_{gd1} + g_o'(C_{gd1} + C_{gs1}) + (g + g_i) C_o}$$

$$\frac{r + r_o}{1 + g_{m1} r_o} \times \frac{\frac{1}{r} \cdot \frac{1}{r_o}}{\frac{1}{r} \cdot \frac{1}{r_o}} = \frac{g_o + g}{g \cdot g_o + g_{m1} g}$$