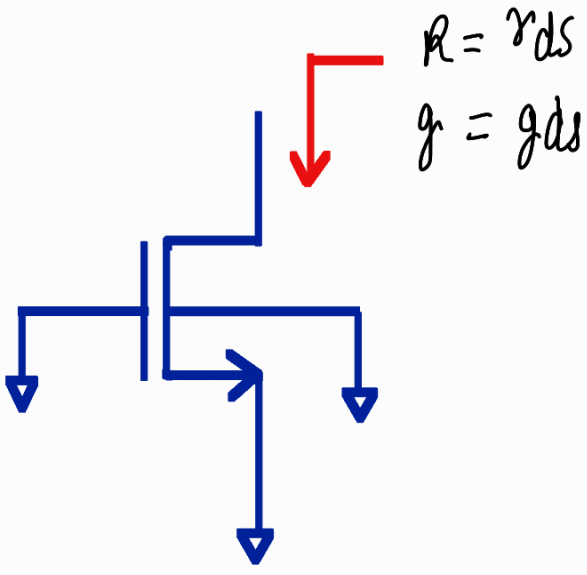
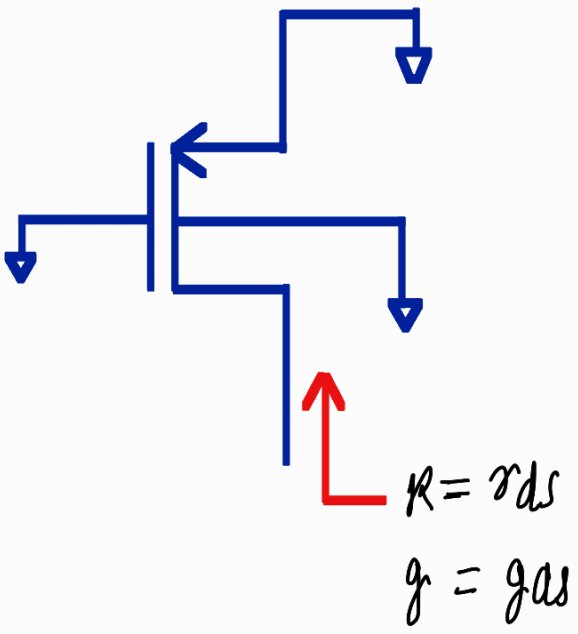
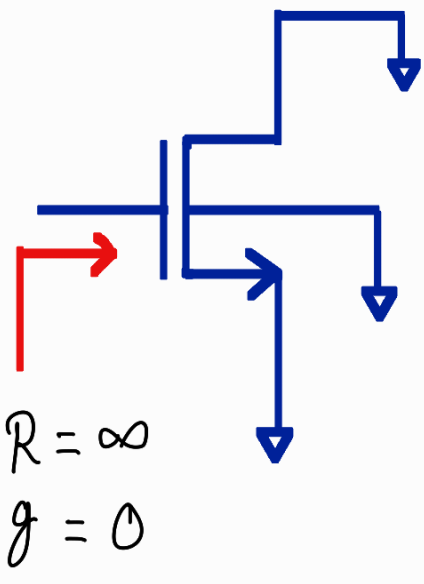
Looking into the Node

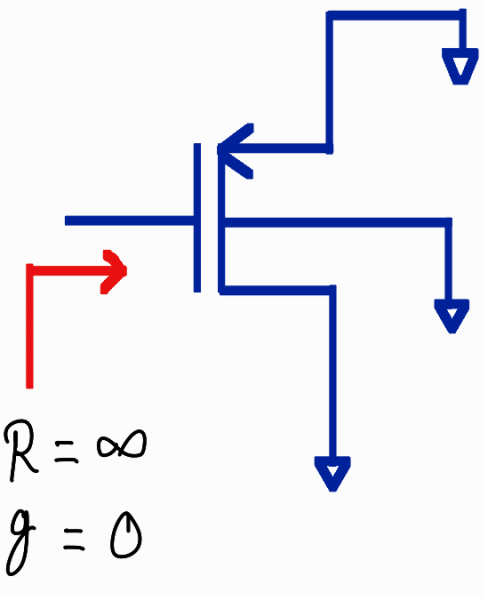
① Looking into Drain





② Looking into Gate

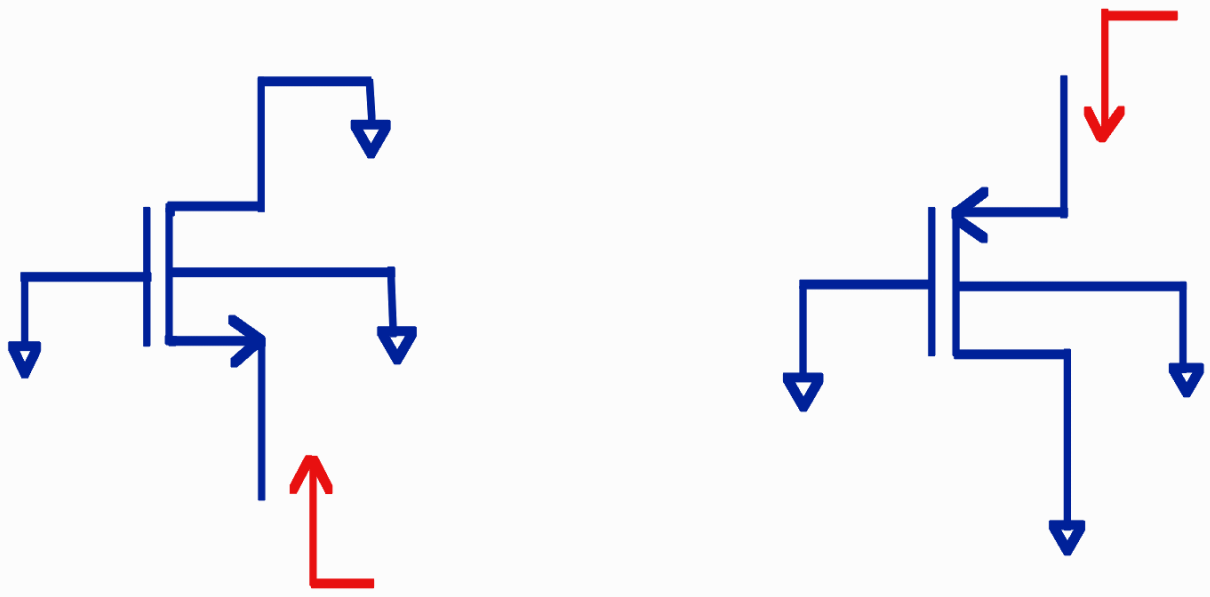




③ Looking into Source

$$R = \frac{1}{g_m} \| r_o \| \frac{1}{g_{mb}}$$

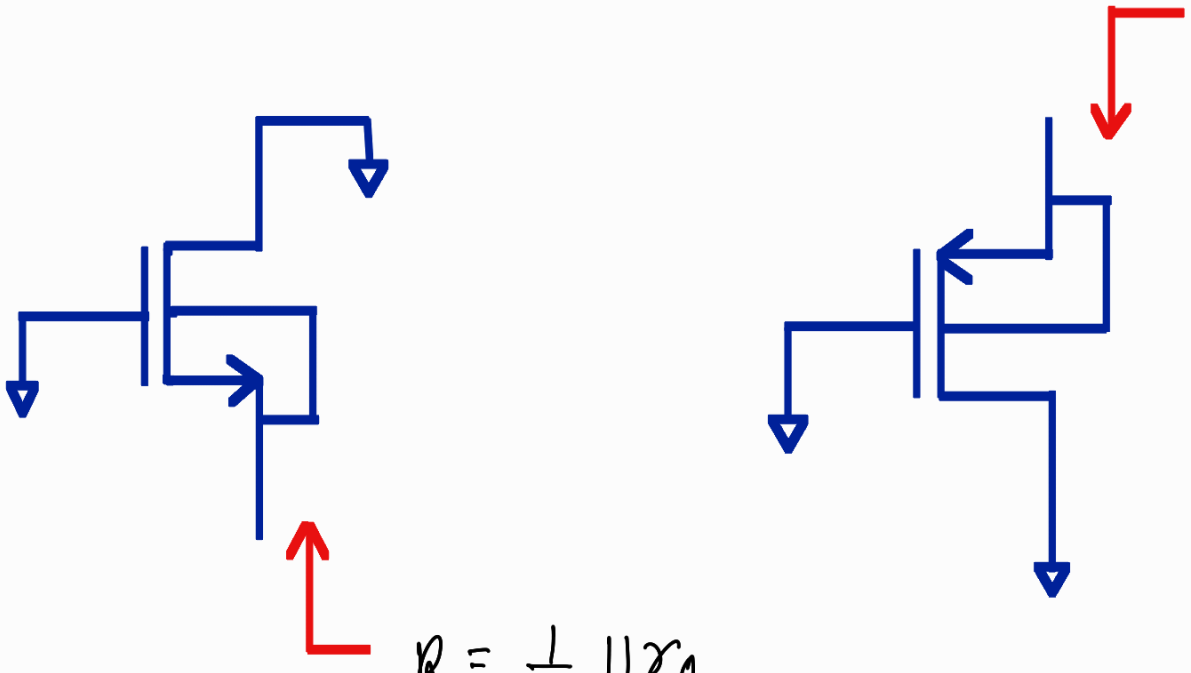
$$g = g_m + g_{mbs} + g_{ds}$$



$$R = \frac{1}{g_m} \| r_o \| \frac{1}{g_{mb}}$$

$$g = g_m + g_{mbs} + g_{ds}$$

④ Looking into source (Self Biased Well)



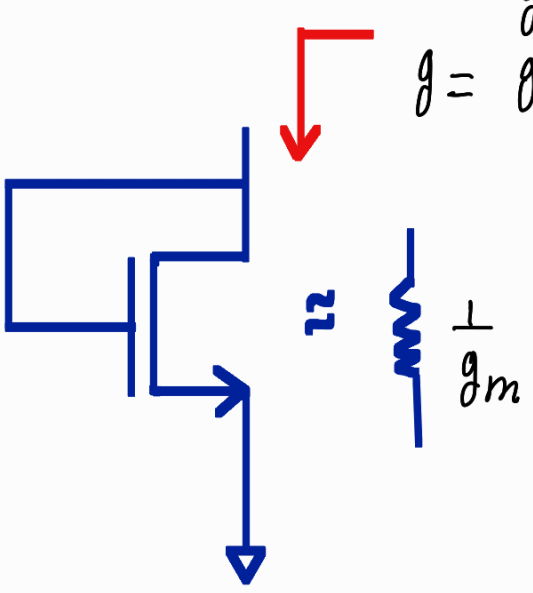
$$R = \frac{1}{g_m} \| r_o$$

$$g = g_m + g_{ds}$$

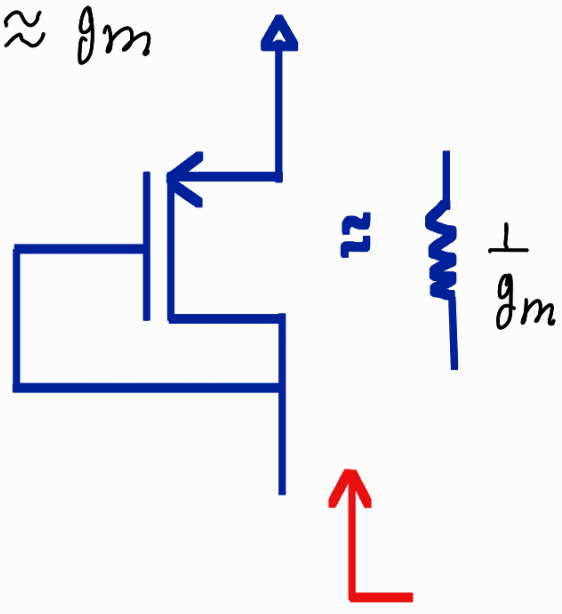
⑤ Diode connected

$$R = \frac{1}{g_m} \| r_o \approx \frac{1}{g_m}$$

$$g = g_m + g_{ds} \approx g_m$$



$\approx$

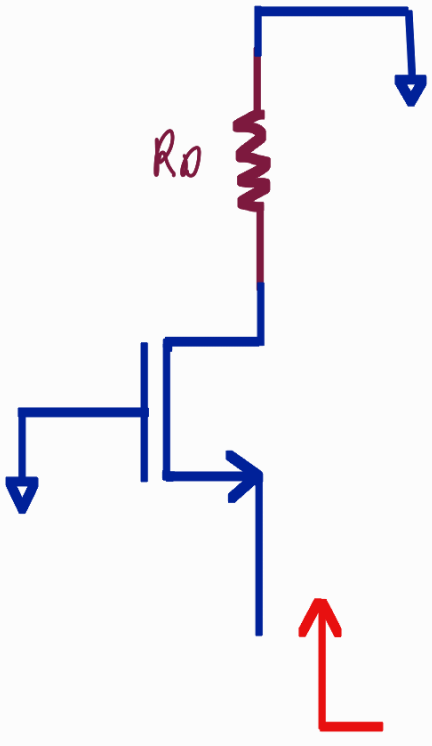


$\approx$

$$R = \frac{1}{g_m} \| r_o \approx \frac{1}{g_m}$$

$$g = g_m + g_{ds} \approx g_m$$

⑥ With RD



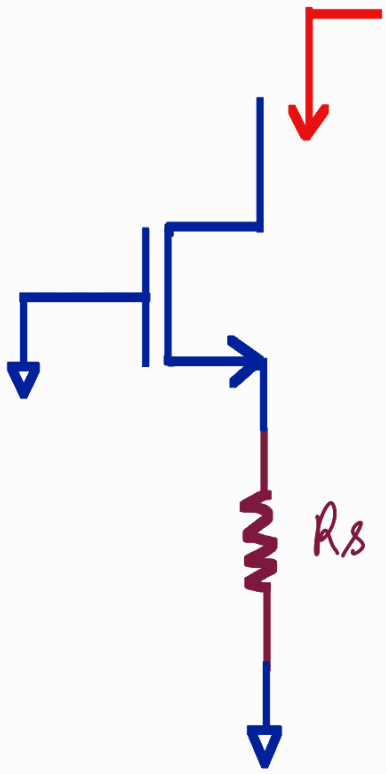
$$R = \frac{r_o + R_D}{1 + g_m r_o}$$

$$\approx \frac{1}{g_m} \qquad R_D << r_o$$

if RD is high then

$$R \neq \frac{1}{g_m}$$

⑦ Source Degeneration

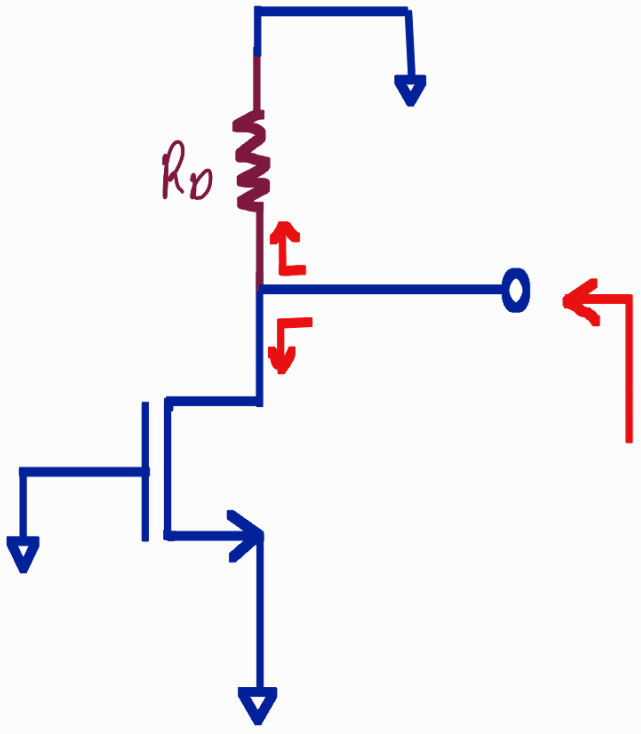


$$R = r_o + R_S \left[1 + g_m r_o\right]$$

$$\approx R_S \left(g_m r_o\right)$$

magnified by intrinsic gain

⑧

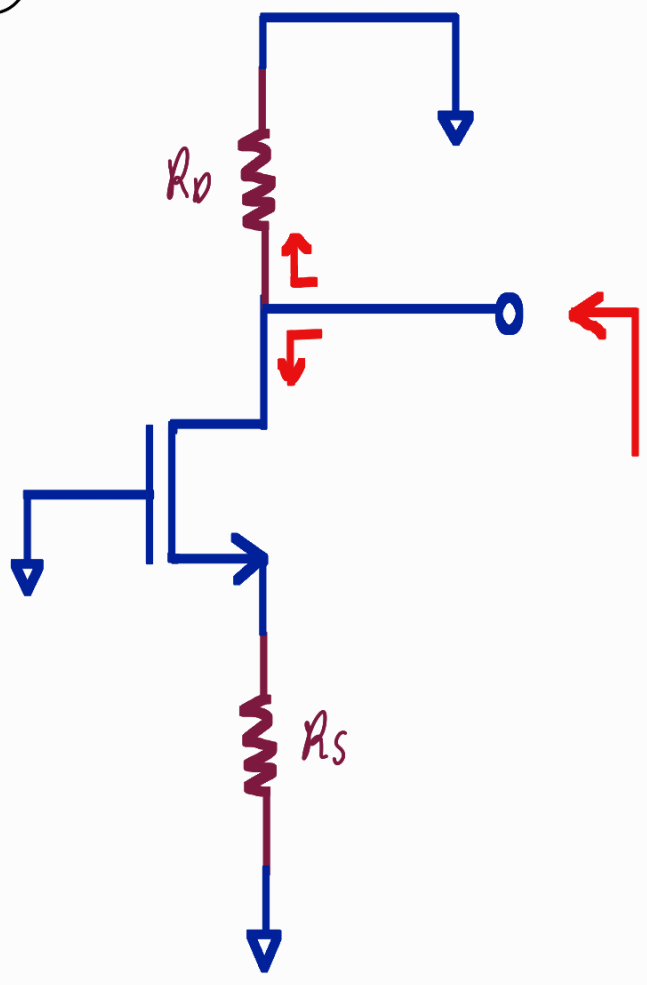


$$R = R_{up} \,||\, R_{down}$$

$$= R_D \,||\, r_o$$

$$\approx R_D$$

(9)

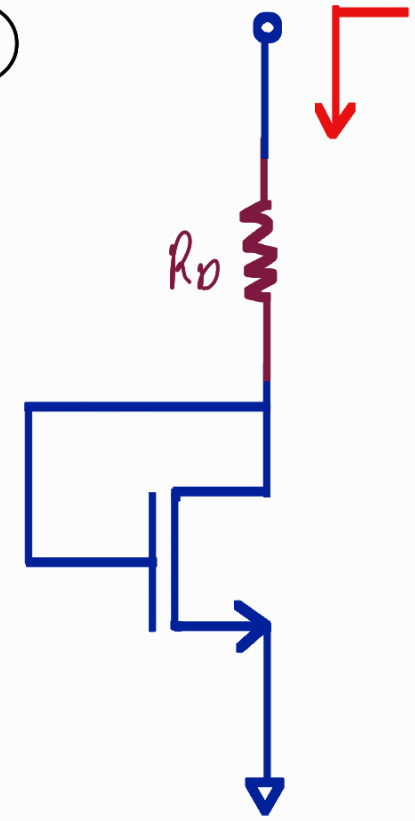


$$R = R_{up} \,||\, R_{down}$$

$$= R_D \,||\, \underbrace{R_S(g_m r_o)}_{\text{high}}$$

$$\approx R_D$$

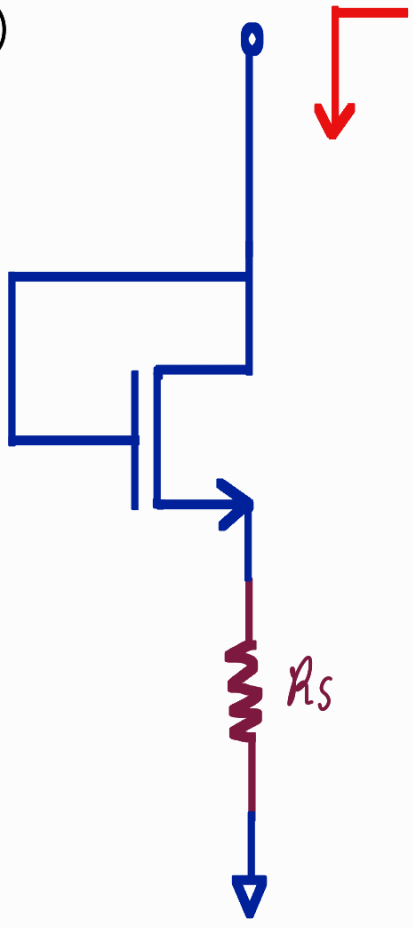
(10)



$$R = R_D + \frac{1}{g_m} \,||\, r_o$$

$$R \approx R_D + \frac{1}{g_m}$$

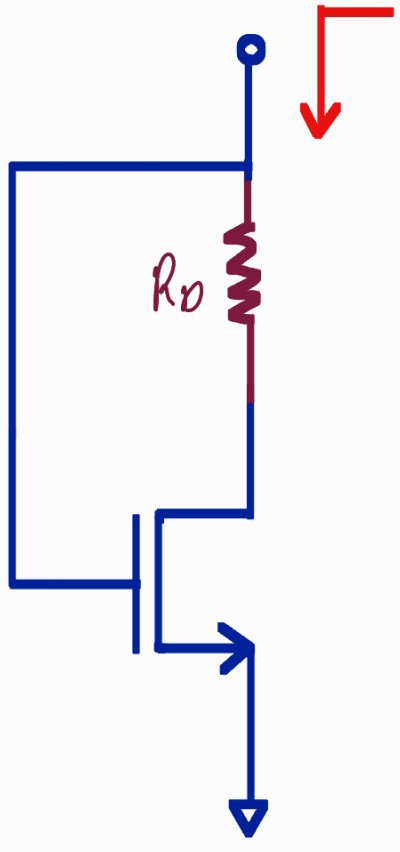
(11)



$\lambda = 0$

$$R = \frac{1}{g_m} + R_S$$

(12)



$\lambda = 0$

$$R = \frac{1}{g_m}$$

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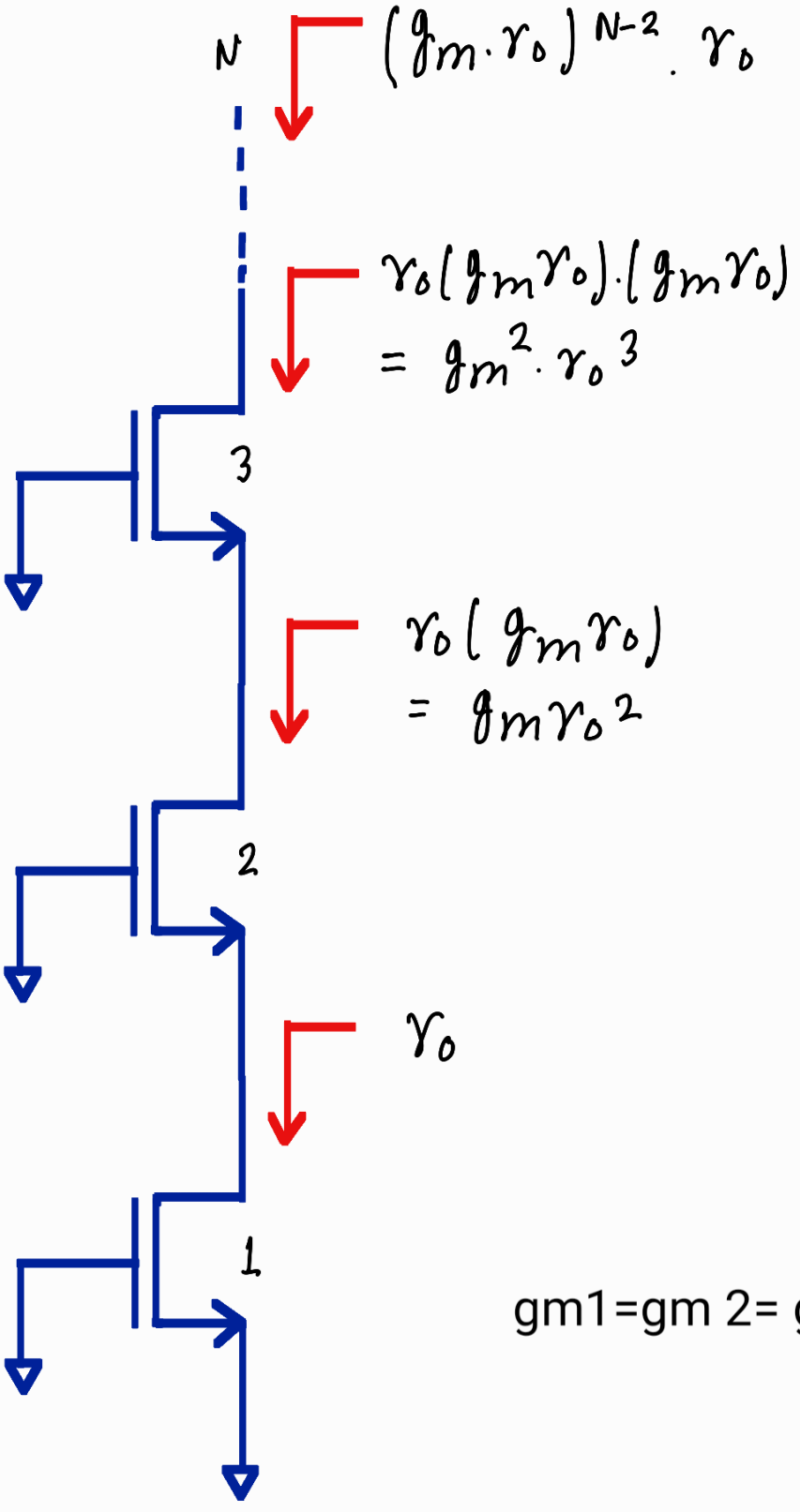

gm1=gm 2= gm3 =..... GmN

14

$$R = -\left(\frac{1}{g_{m1}} + \frac{1}{g_{m2}}\right)$$

$$= -\frac{2}{g_m} \quad \text{if gm1= gm2}$$