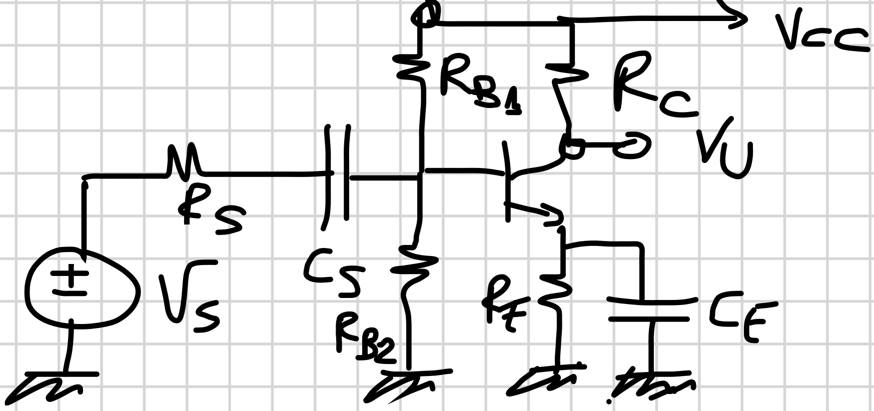
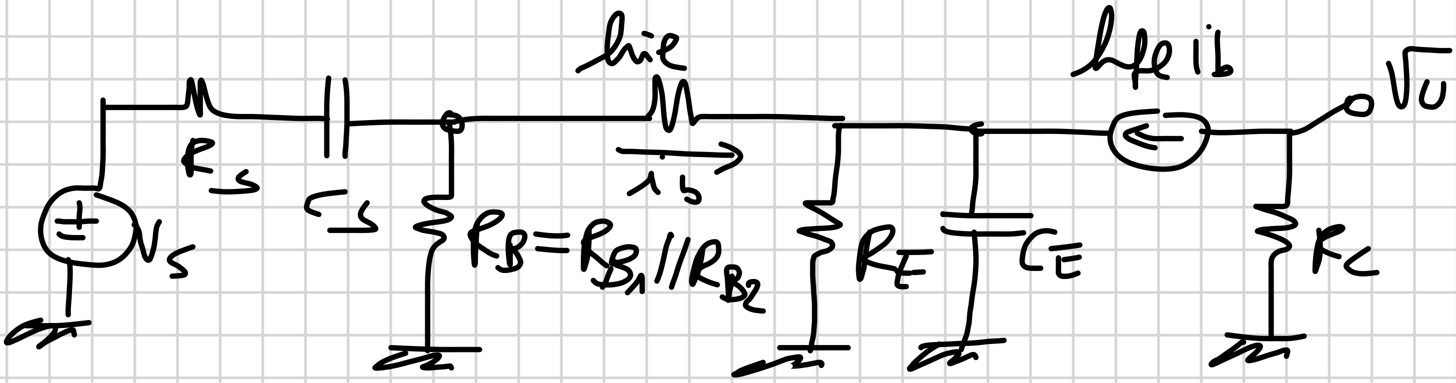




$$H(s) = \frac{K\left(\frac{s}{\omega_{z1}}+1\right)\left(\frac{s}{\omega_{z2}}+1\right)}{\left(\frac{s}{\omega_1}+1\right)\left(\frac{s}{\omega_2}+1\right)}$$

$$\lim_{s \to +\infty} H(s) = \frac{K\,\omega_1\omega_2}{\omega_{z1}\omega_{z2}} = A_{V\infty}$$

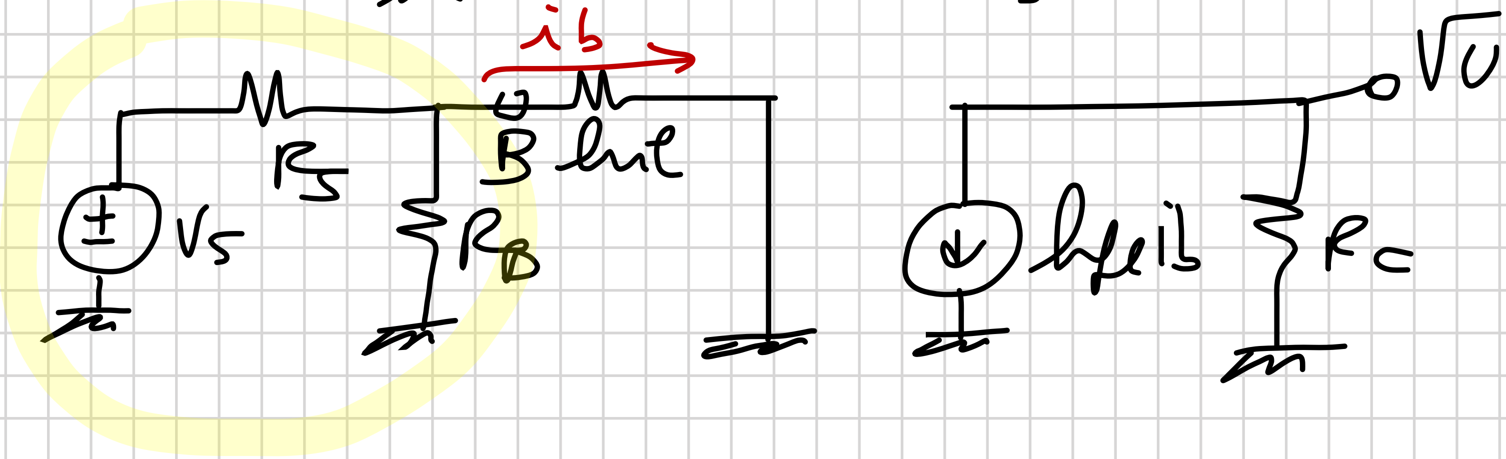
$$\omega_{z2} = \frac{1}{R_E C_E}$$

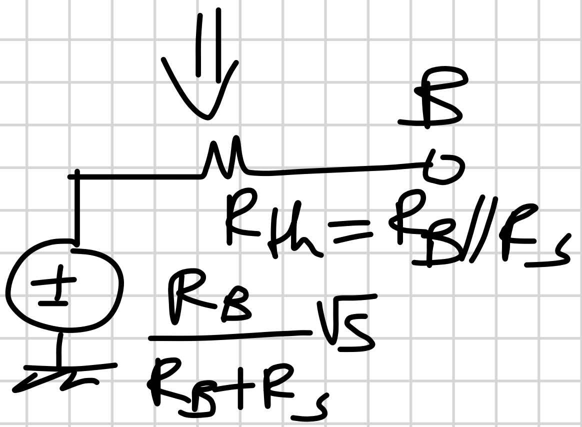
$$H(s) = \frac{K\,s\left(\frac{s}{\omega_{z2}}+1\right)}{\left(\frac{s}{\omega_1}+1\right)\left(\frac{s}{\omega_2}+1\right)}$$

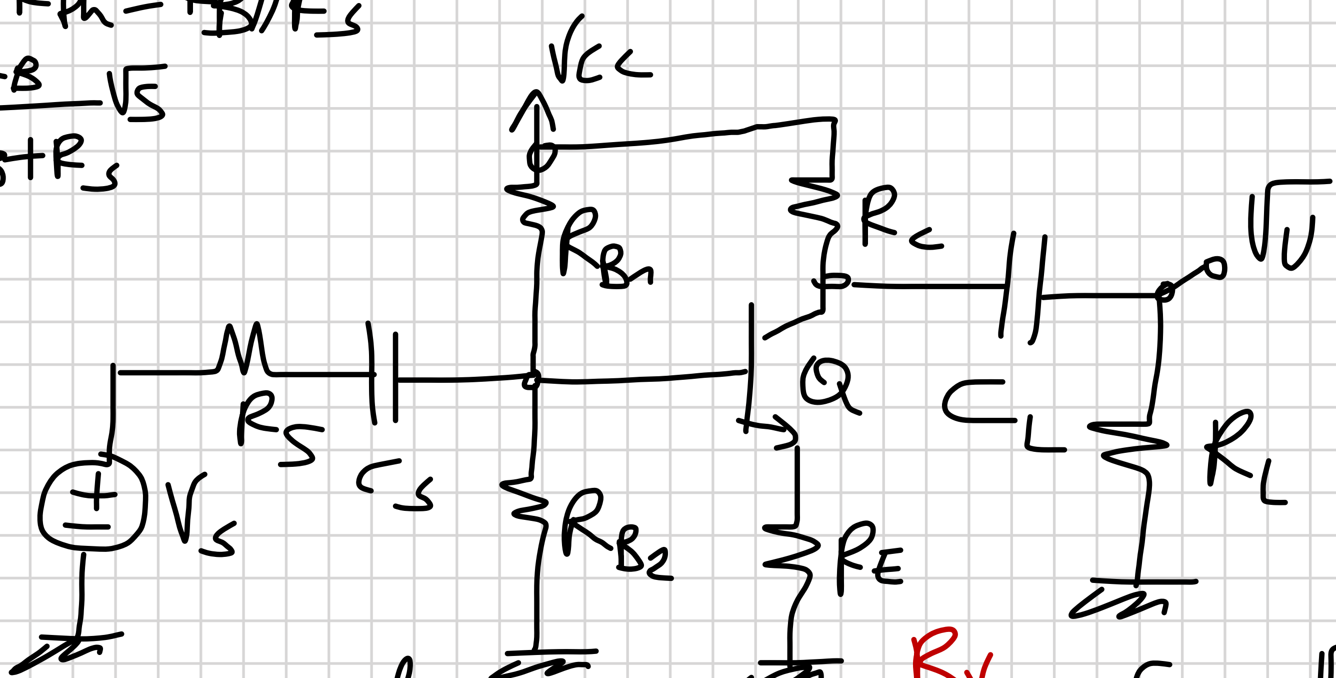
$$\omega_1 = \frac{1}{R^{\circ}_{V_{CS}} C_S} \Longrightarrow R^{\circ}_{V_{CS}} = R_s + R_B // \left[h_{ie} + R_E(h_{fe}+1)\right]$$

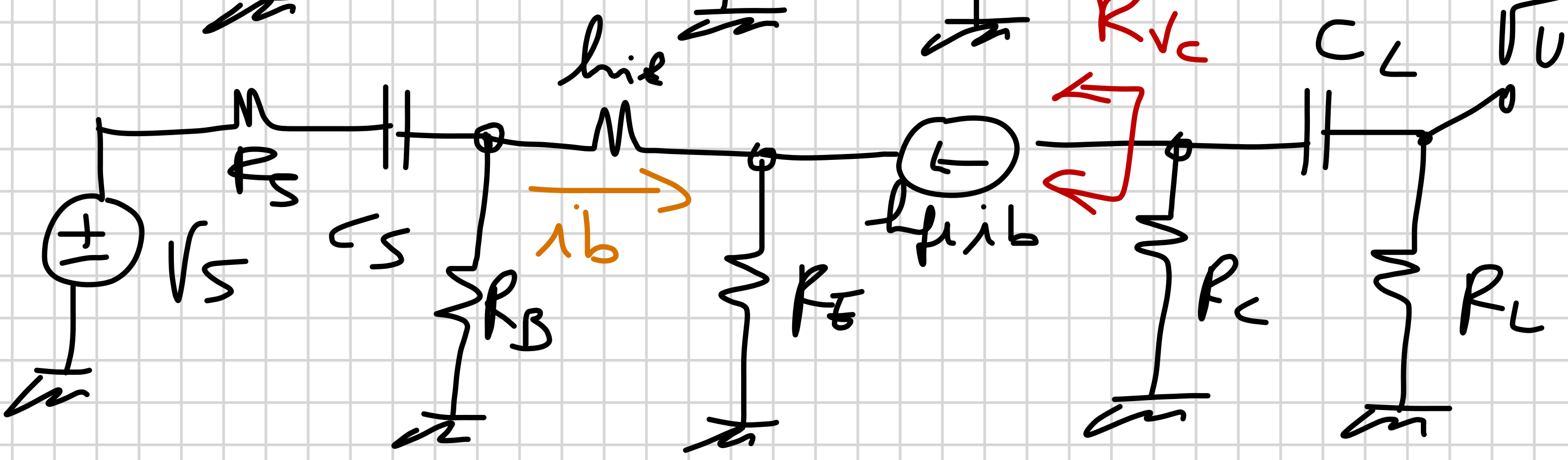
$$\omega_2 = \frac{1}{R^{C_S}_{V_{CE}} C_E} \Longrightarrow R^{C_S}_{V_{CE}} = R_E // \left[\frac{h_{ie} + R_B // R_S}{h_{fe}+1}\right]$$

$$A_{vc\infty} = -\frac{R_C h_{fe}}{h_{ie} + R_B // R_S} \cdot \frac{R_B}{R_S + R_B}$$

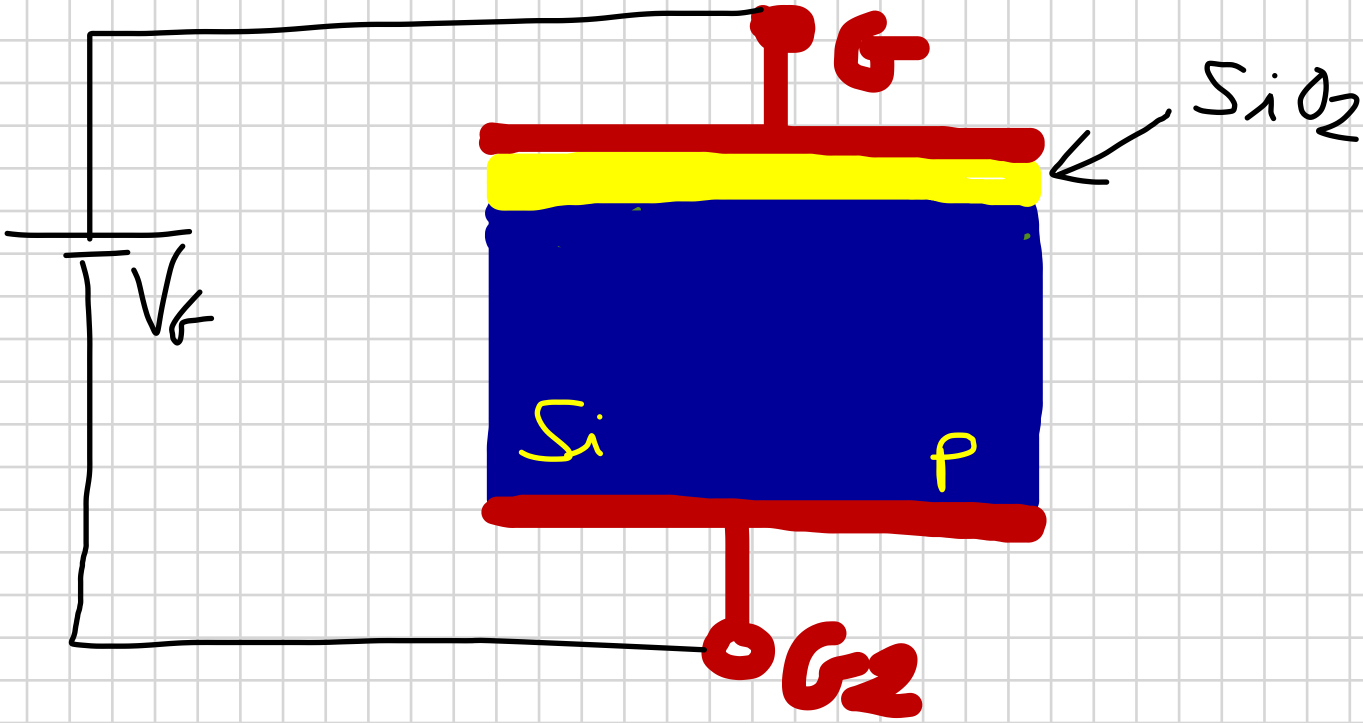






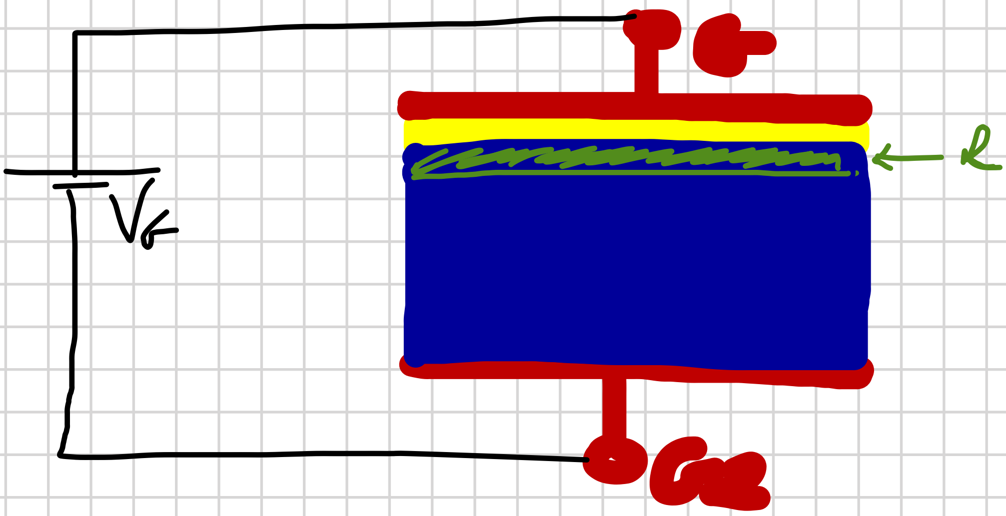


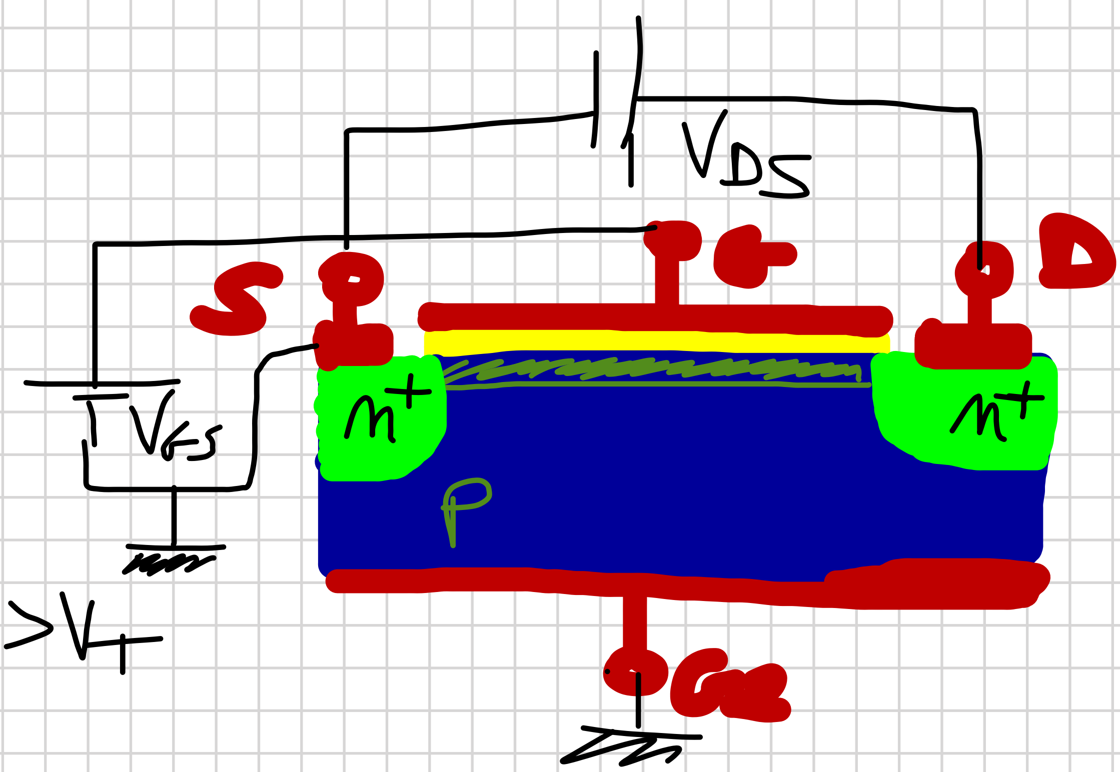
$$H(s) = \frac{K s^2}{\left(1 + \frac{s}{\omega_1}\right)\left(1 + \frac{s}{\omega_2}\right)}$$



MOS = Metallo
Ossido
Semiconduttore

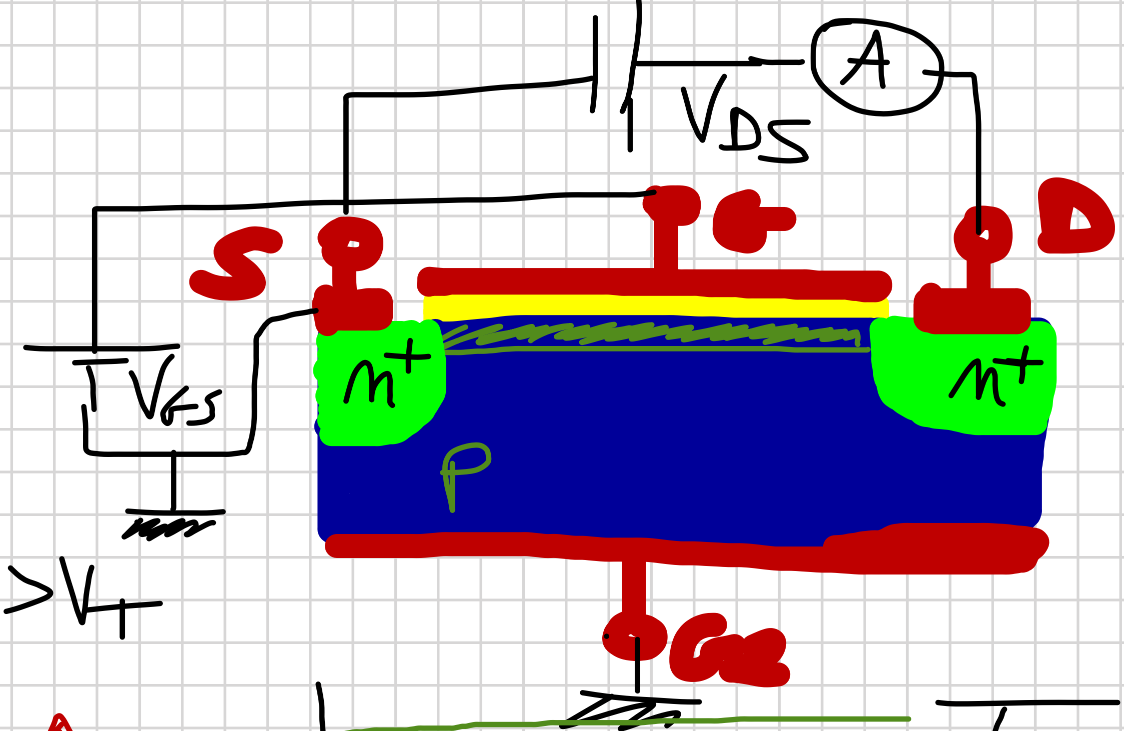
$V_G > V_T$

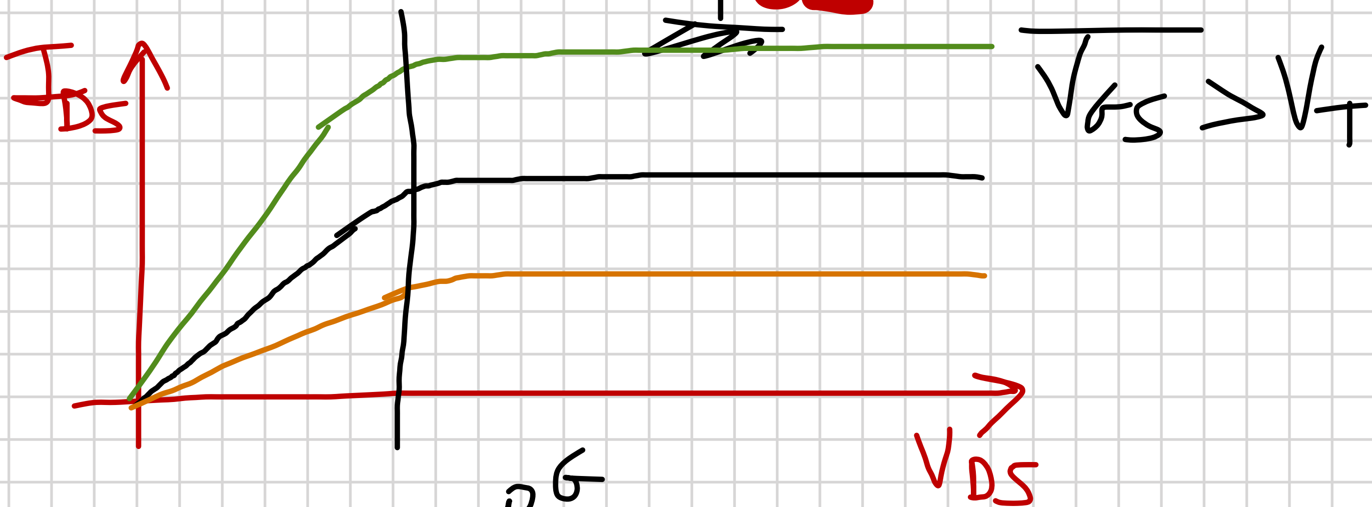


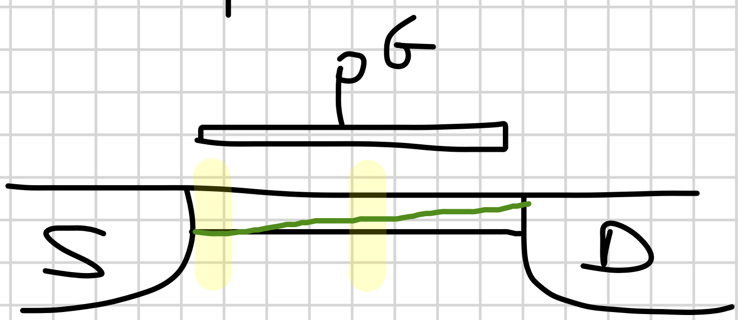


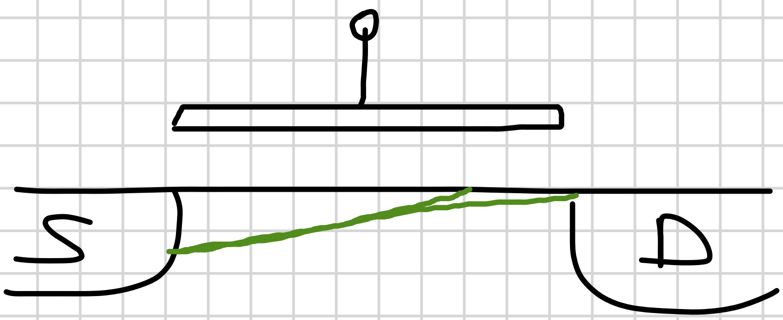
$V_{GS} > V_T$

$V_{GS} > V_T$

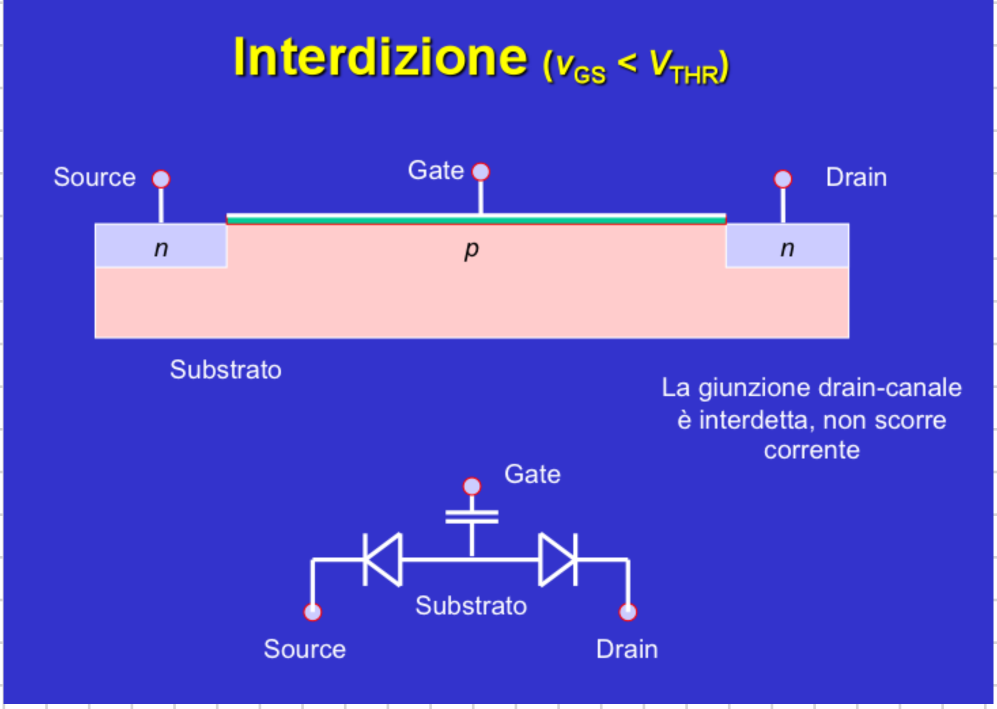


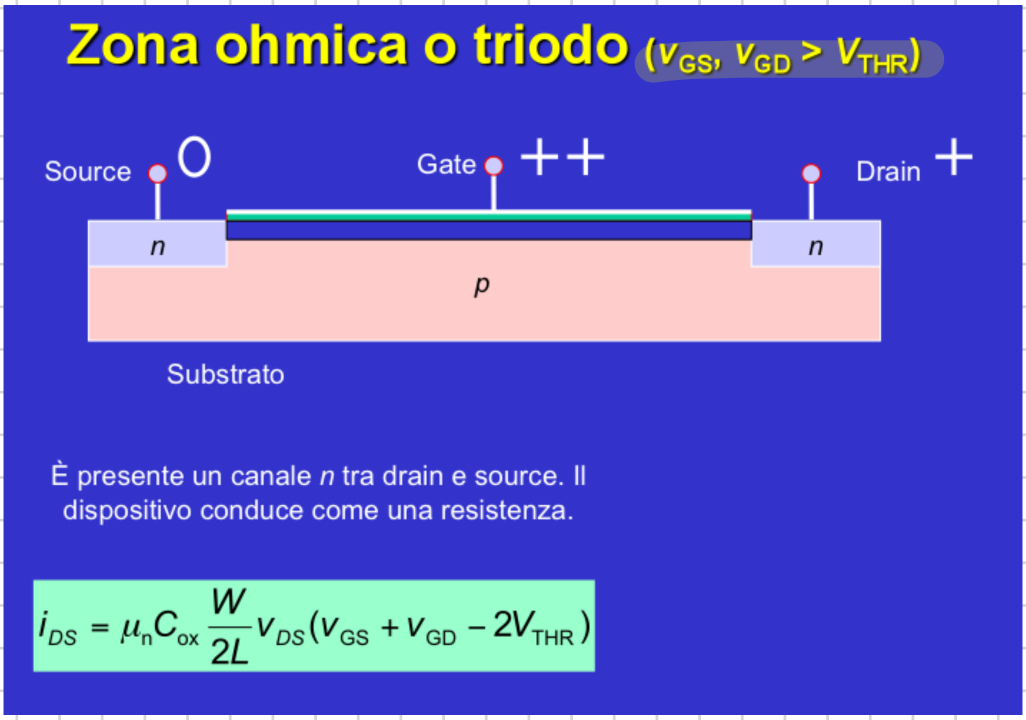




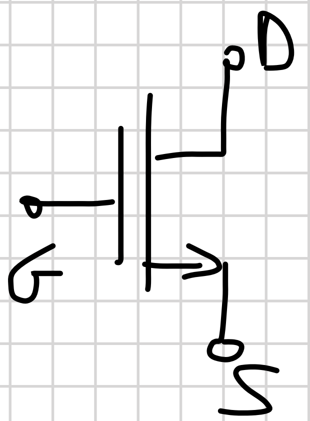


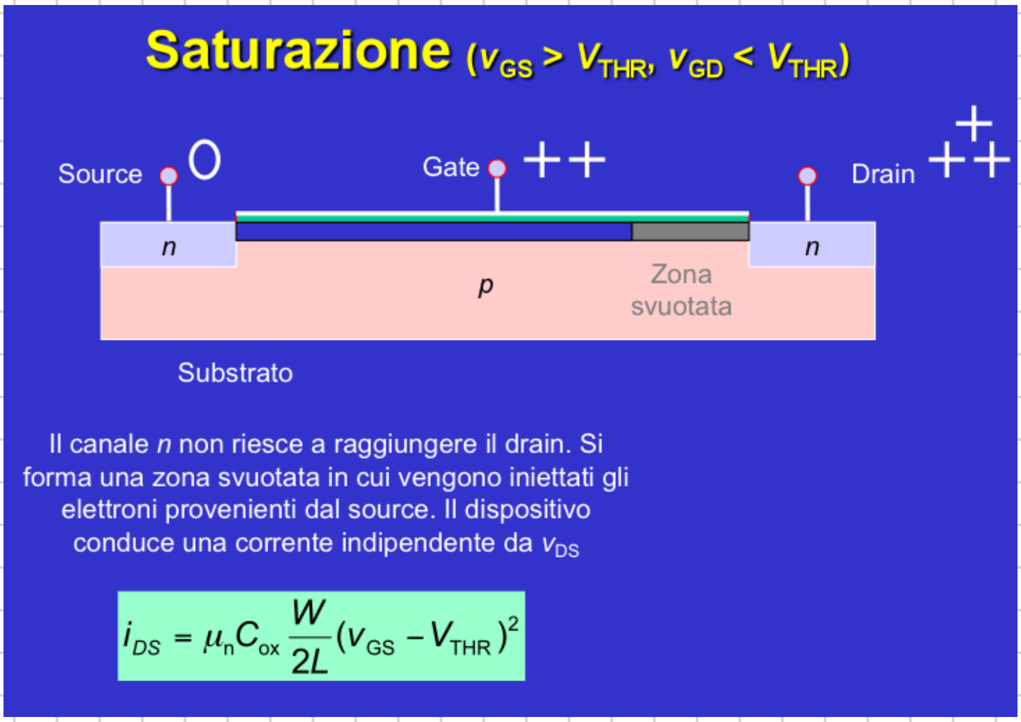
$$V_{DS} = V_{GS} - V_T$$


Interdizione ($v_{GS} < V_{THR}$)
Source
Gate
Drain
n
p
n
Substrato
La giunzione drain-canale è interdetta, non scorre corrente
Gate
Substrato
Source
Drain

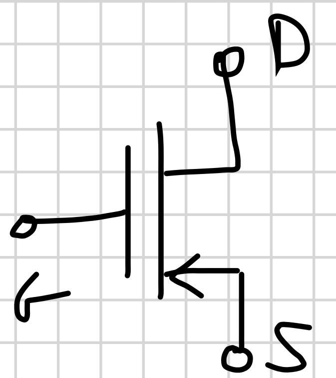

Zona ohmica o triodo ($v_{GS}, v_{GD} > V_{THR}$)
Source 0
Gate ++
Drain +
n
n
p
Substrato
È presente un canale *n* tra drain e source. Il dispositivo conduce come una resistenza.
$i_{DS} = \mu_n C_{ox} \frac{W}{2L} v_{DS}(v_{GS} + v_{GD} - 2V_{THR})$

N-MOS

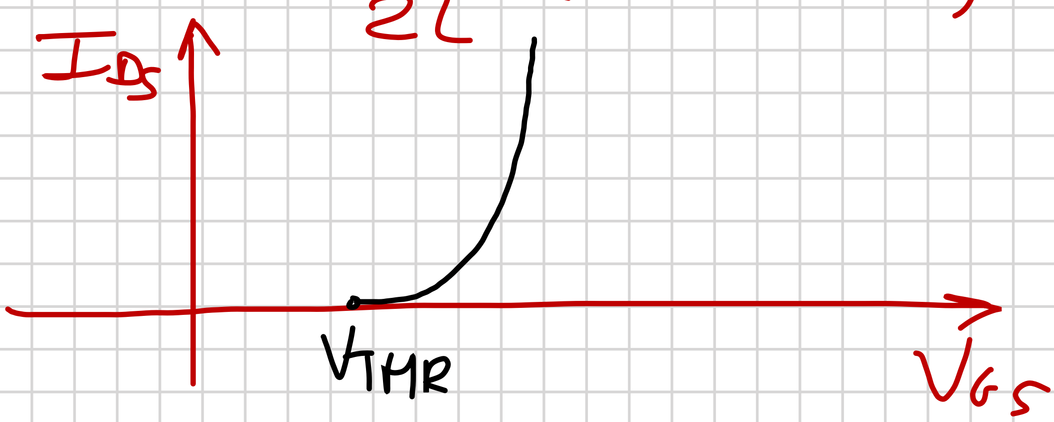

D
G
S

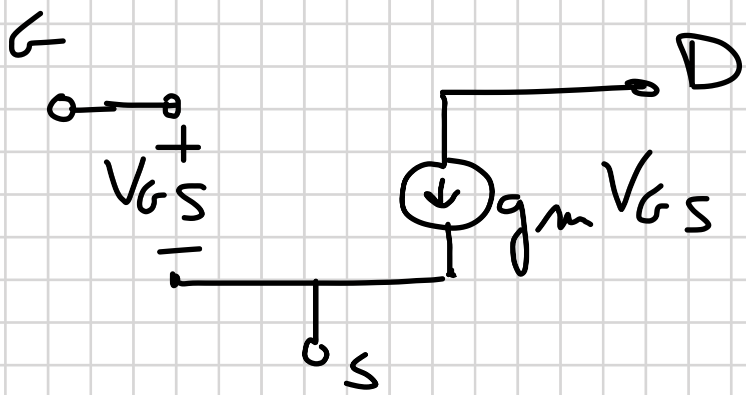

Saturazione ($v_{GS} > V_{THR}, v_{GD} < V_{THR}$)
Source 0
Gate ++
Drain +++
n
n
p
Zona svuotata
Substrato
Il canale *n* non riesce a raggiungere il drain. Si forma una zona svuotata in cui vengono iniettati gli elettroni provenienti dal source. Il dispositivo conduce una corrente indipendente da v_{DS}
$i_{DS} = \mu_n C_{ox} \frac{W}{2L}(v_{GS} - V_{THR})^2$

P-MOS


D
G
S

$$i_{DS} = \mu_n C_{ox} \frac{W}{2L} \left(V_{GS} - V_{THR}\right)^2$$

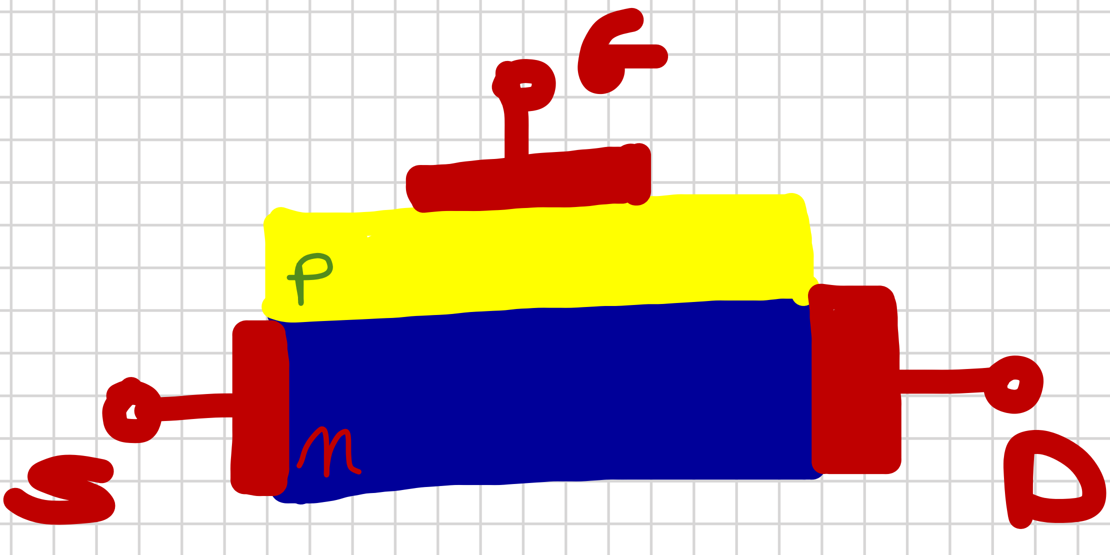


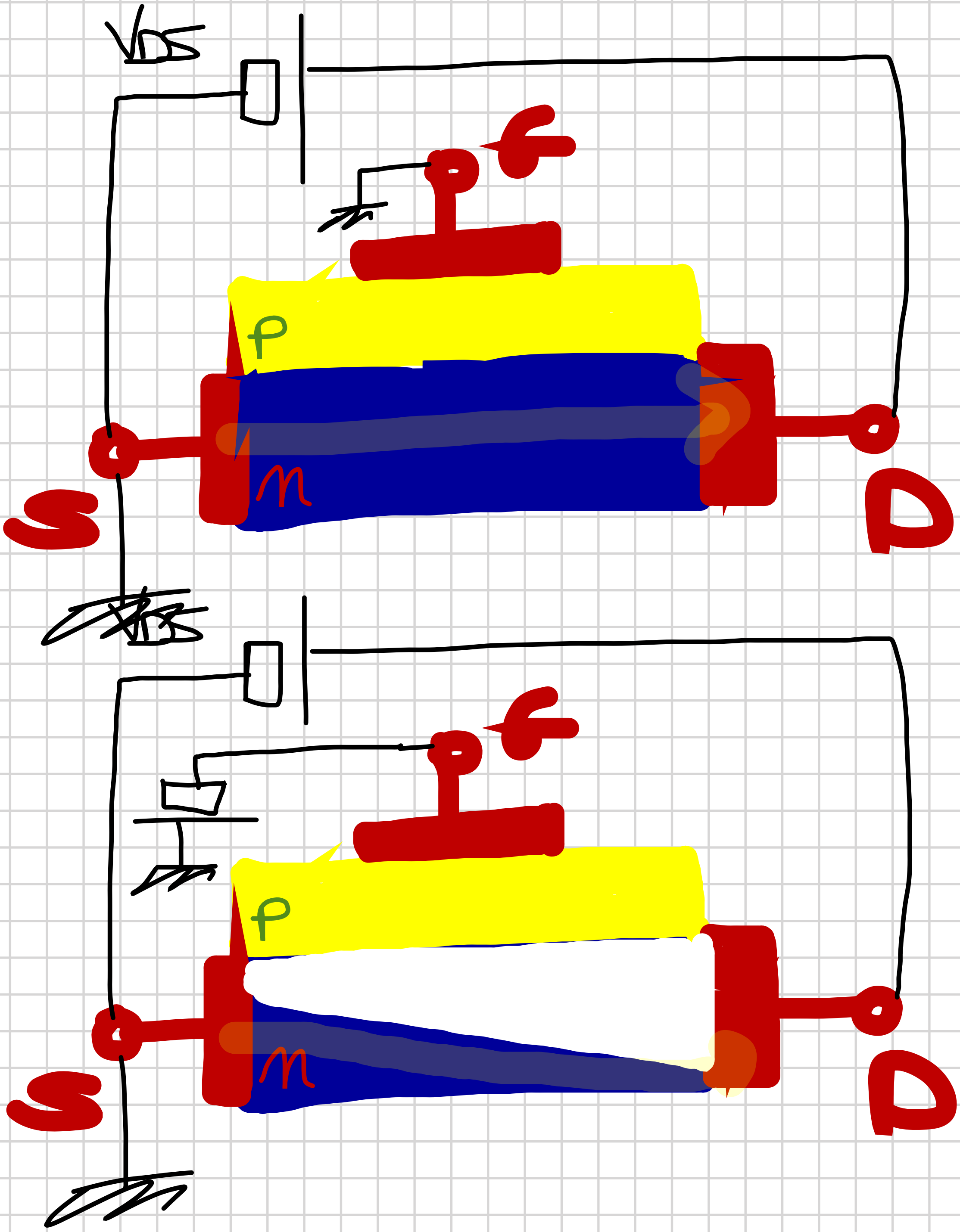


$$g_m = \left. \frac{\delta I_{DS}}{\delta V_{GS}} \right|_{V_{DS}}.$$

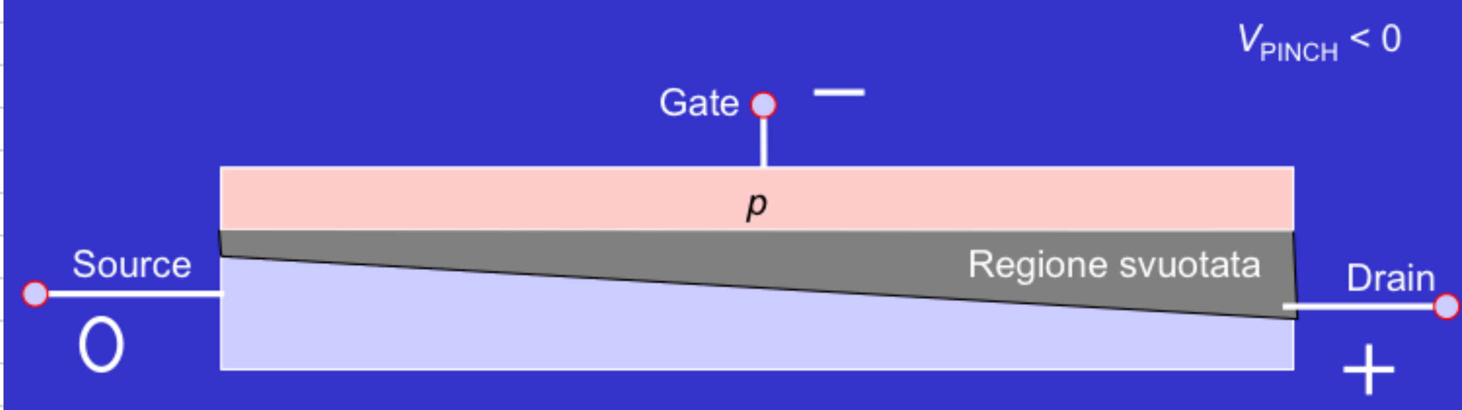
$$g_m = \mu_n C_{ox} \frac{W}{L} \left(V_{GS} - V_T\right)$$

JFET





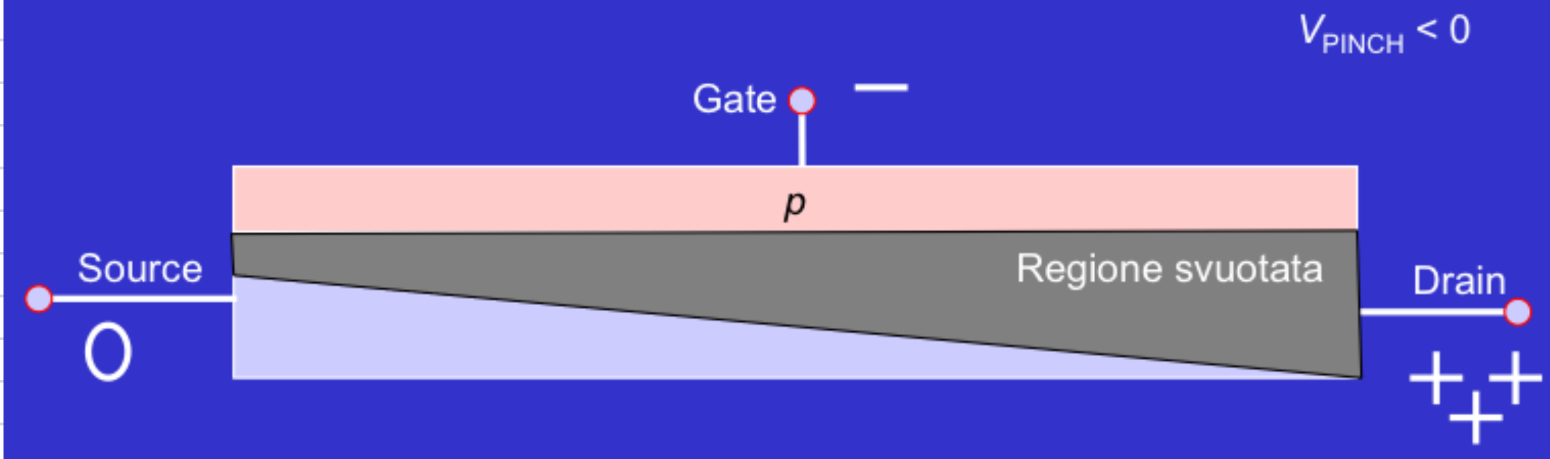
Zona ohmica (v_{GS}, v_{GD} > V_{PINCH})



Source e drain sono normalmente in contatto. Il dispositivo conduce come una resistenza. Questa resistenza aumenta all'aumentare della tensione inversa.

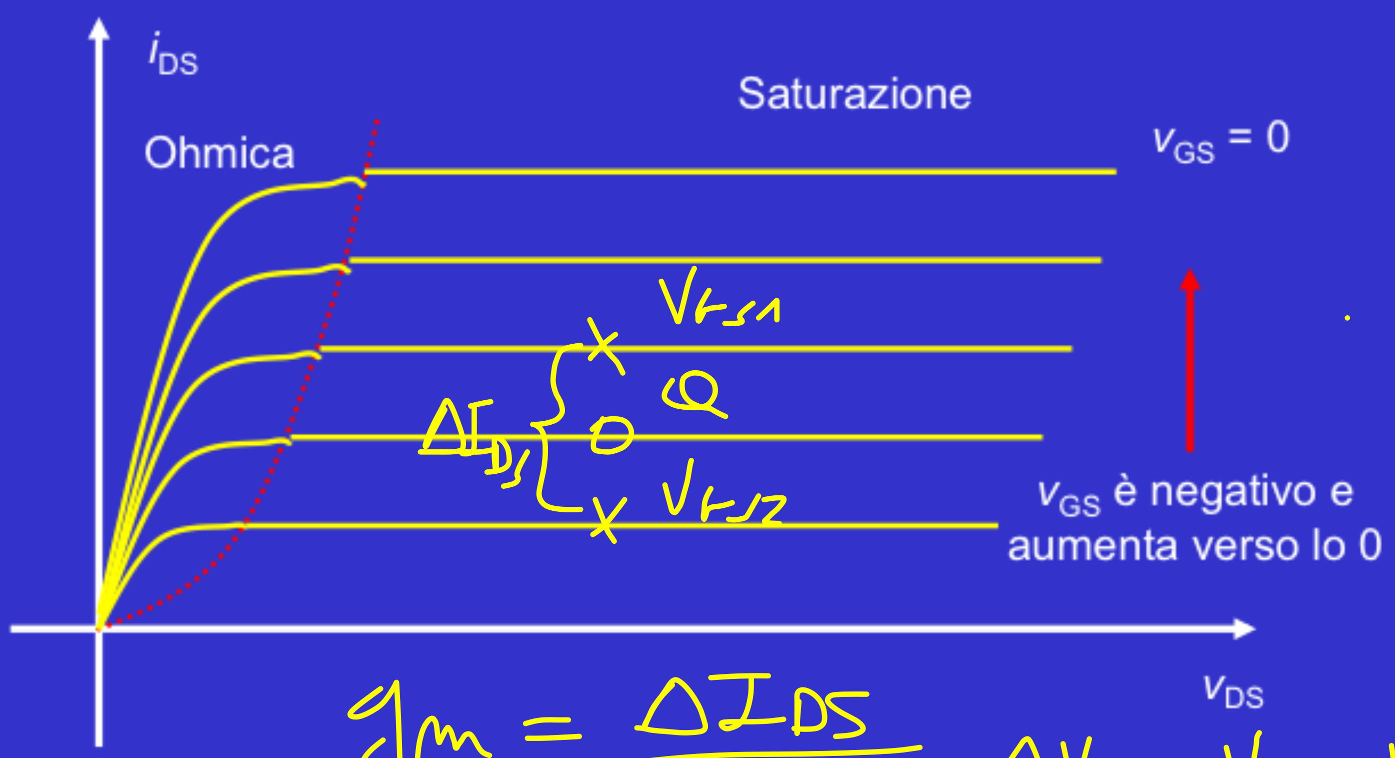
$$i_{DS} = \mu_n C \frac{W}{2L} v_{DS}(v_{GS} + v_{GD} - 2V_P)$$

Saturazione ($v_{GS} > V_{PINCH}$, $v_{GD} < V_{PINCH}$)

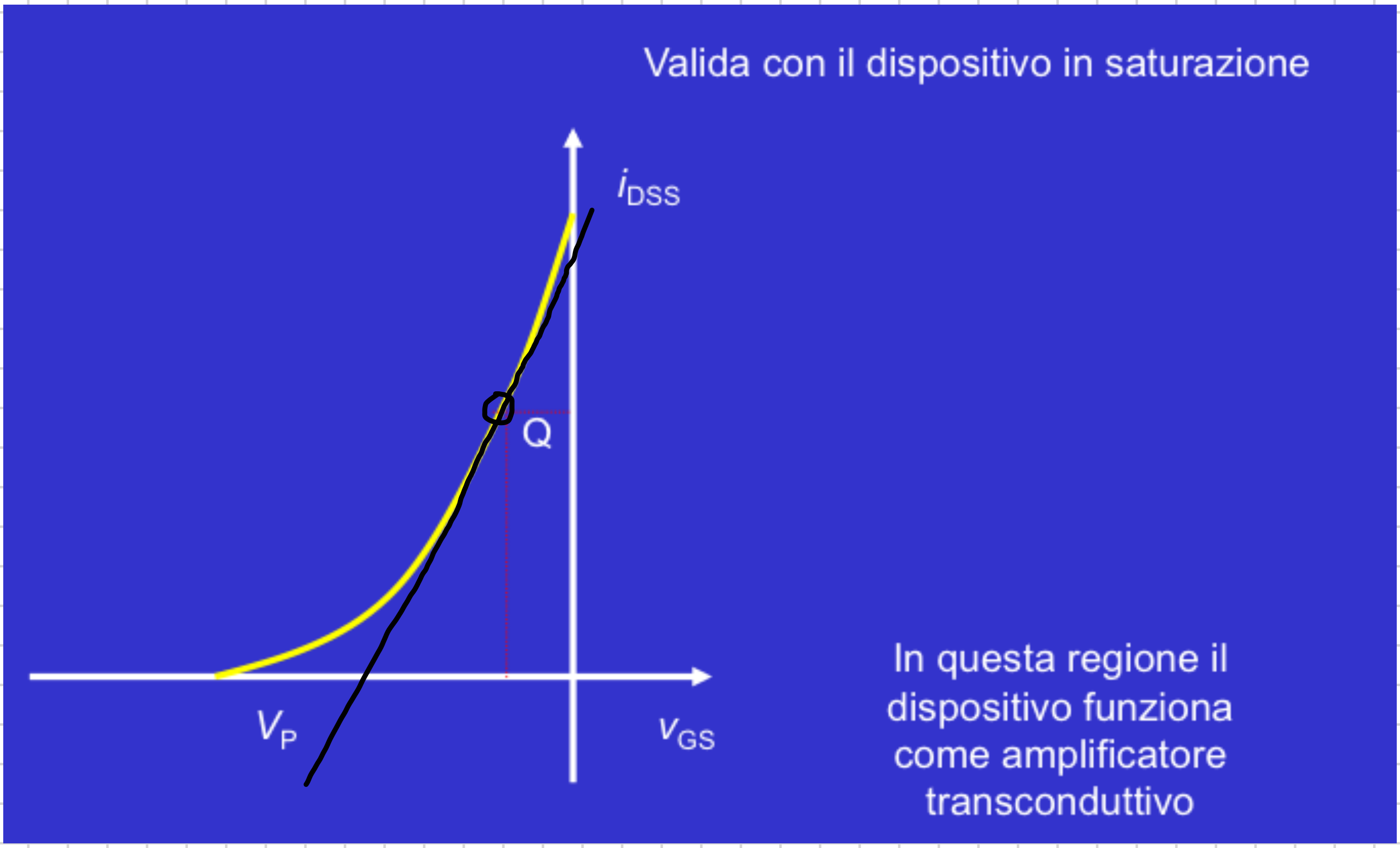


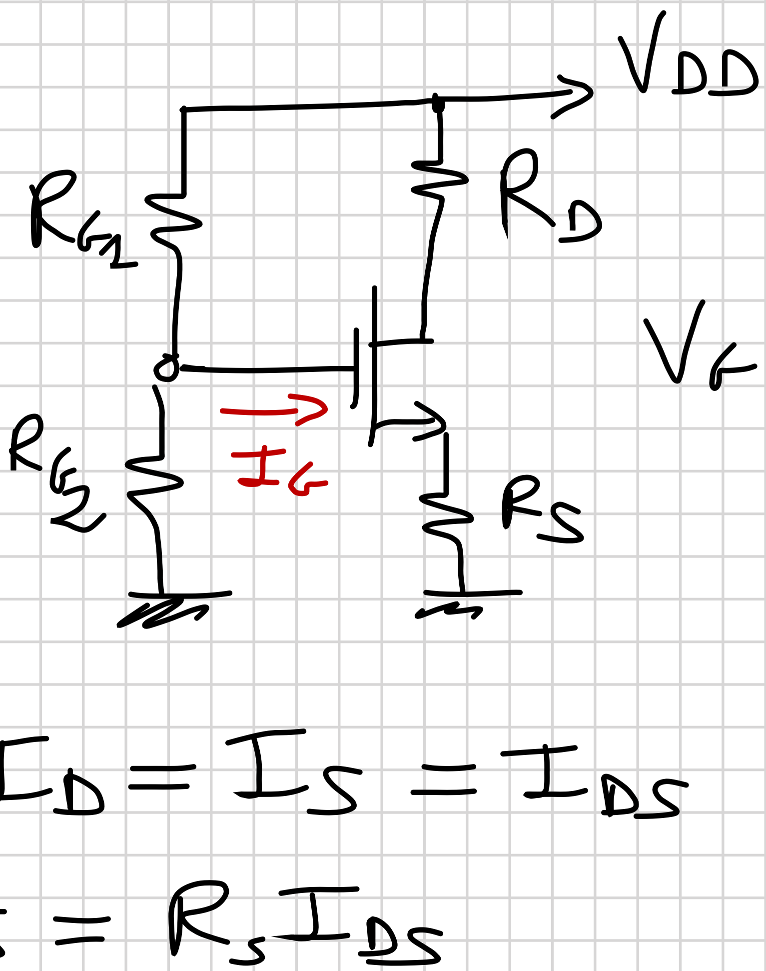
$$i_{DS} = \mu_n C \frac{W}{2L} (v_{GS} - V_P)^2$$

La zona di svuotamento arriva a strozzare (pinch) il canale. Nella zona svuotata vengono iniettati gli elettroni provenienti dal source. La corrente è indipendente da v_{DS}



$$g_m = \frac{\Delta I_{DS}}{\Delta V_{GS}} \qquad \Delta V_{GS} = V_{GS1} - V_{GS2}$$





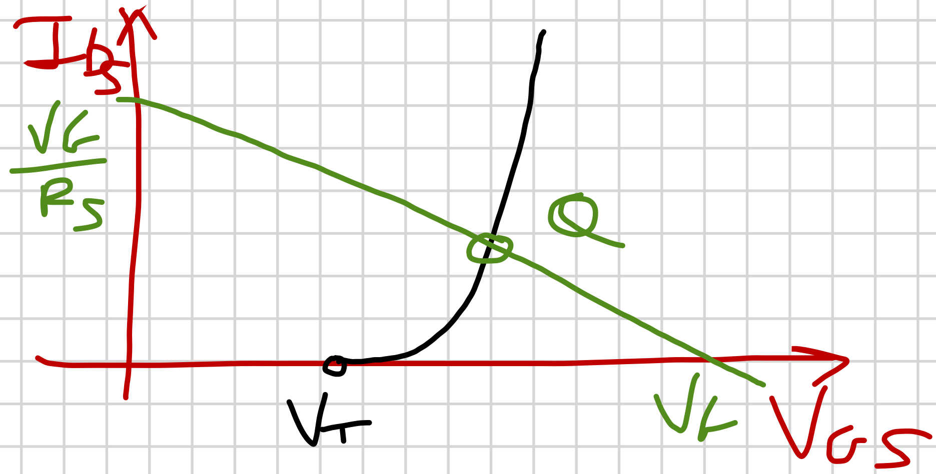
$$I_G = 0$$

$$V_G = \frac{R_{G2}}{R_{G1}+R_{G2}} V_{DD}$$

$$I_D = I_S = I_{DS}$$

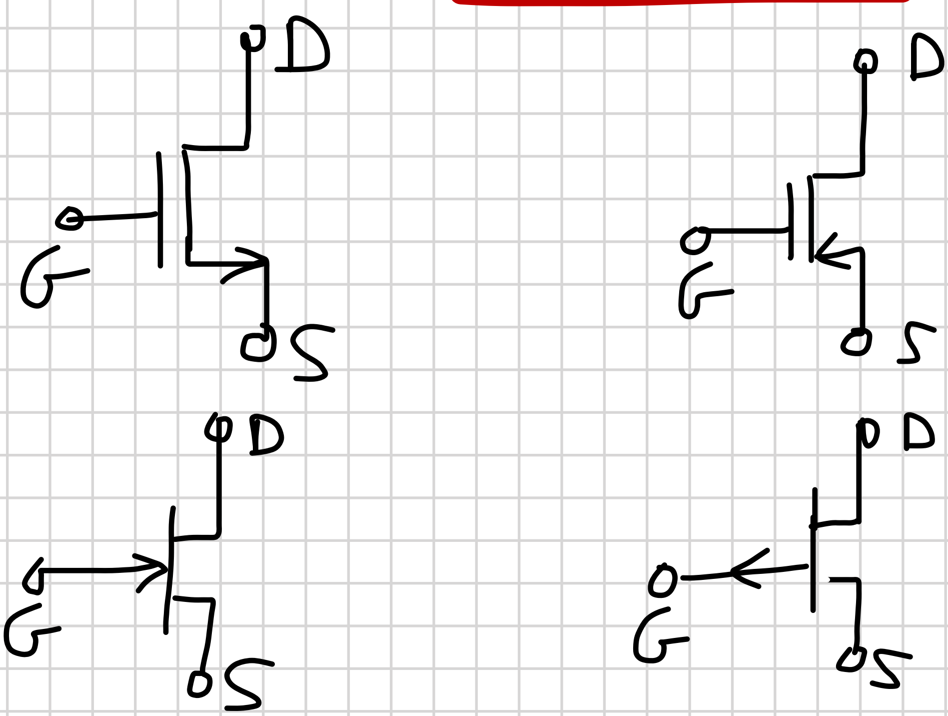
$$V_S = R_S I_{DS}$$

$$V_{GS} = \frac{R_{G2}}{R_{G1}+R_{G2}} V_{DD} - R_S I_{DS}$$

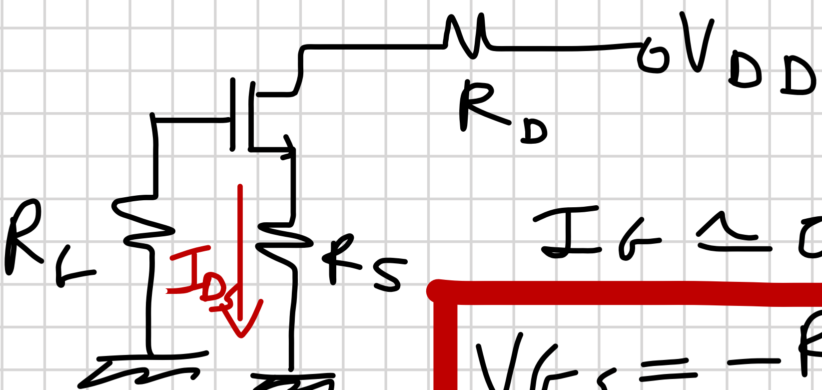


$$\begin{cases} V_{GS} = \dfrac{R_{G2}}{R_{G1}+R_{G2}} V_{DD} - R_S I_{DS} \\ I_{DS} = \dfrac{K}{2}\left(V_{GS}-V_T\right)^2 \end{cases}$$

$$K = \mu_n C_{ox} \frac{W}{L}$$

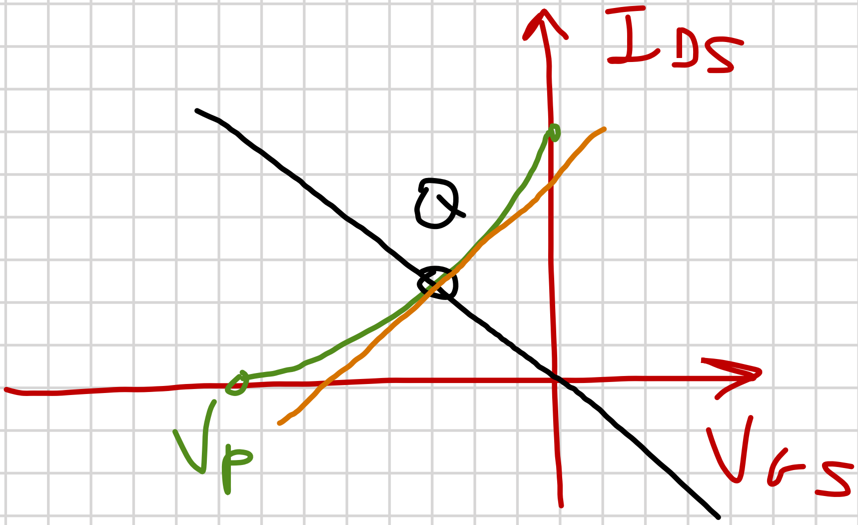


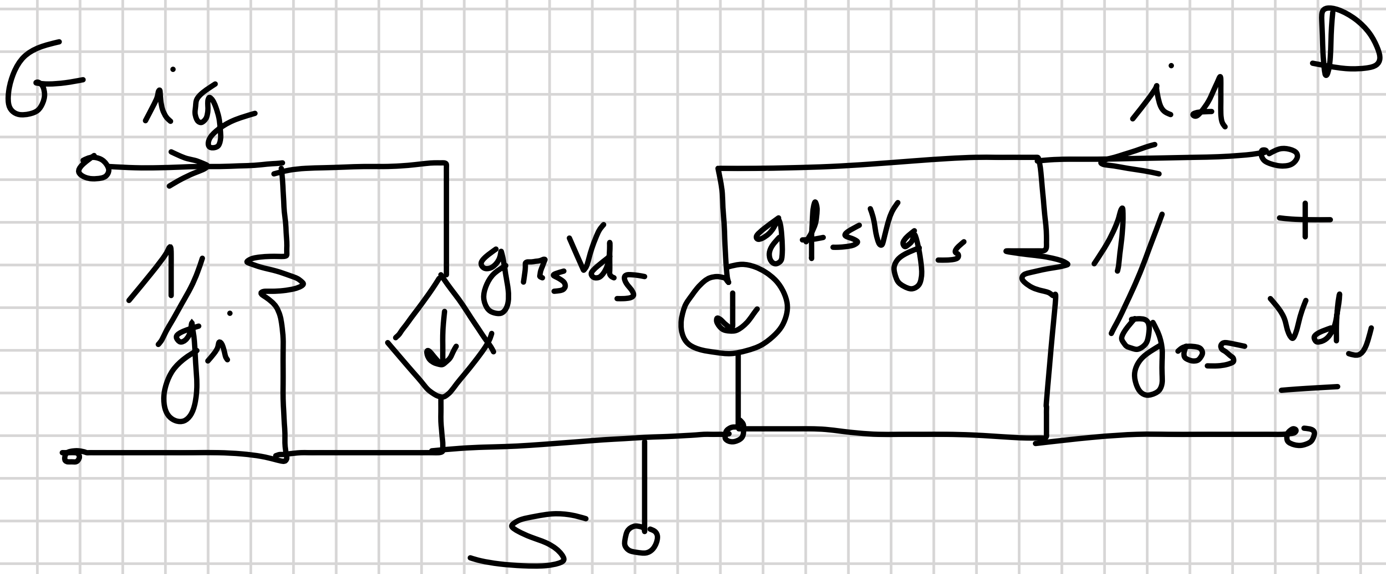
N-JFET P-JFET



$I_G \simeq 0$

$$V_{GS} = -R_S I_{DS}$$





$$\begin{cases} g_{rs} = 0 \\ 1/g_i \rightarrow +\infty \end{cases}$$

$$g_{os} = \left.\frac{\Delta I_{DS}}{\Delta V_{DS}}\right|_{V_{GS}}$$