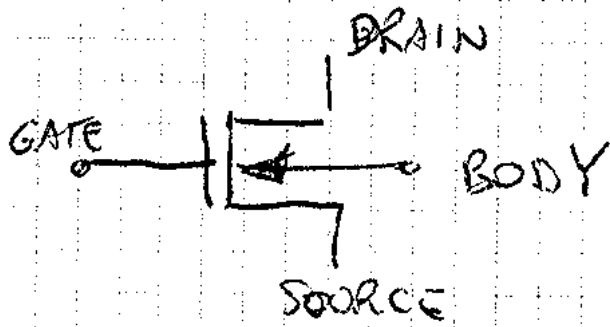


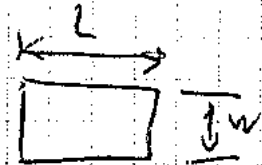
TRANSISTORI MOS (ad effetto di campo)

(31)



transistore N-MOS

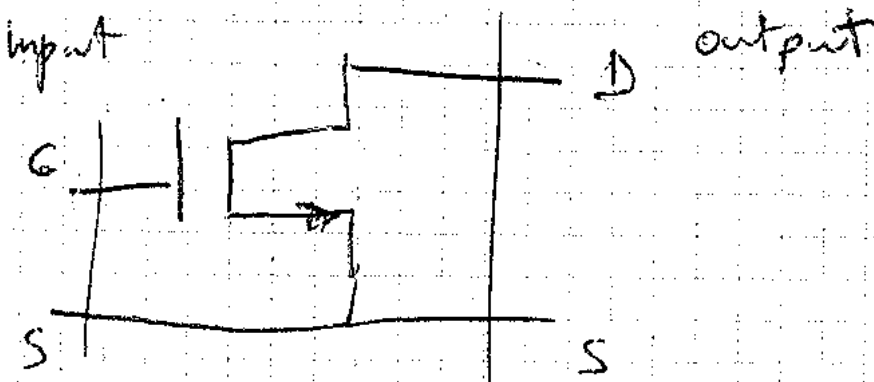
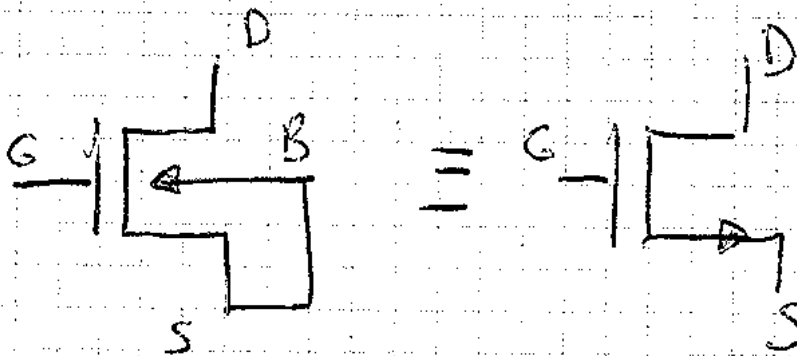
dimensioni minime per canali

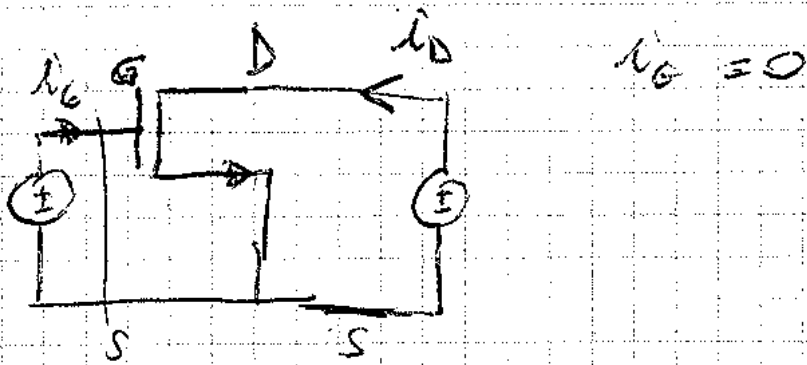


$L \approx 60 \text{ nm}$

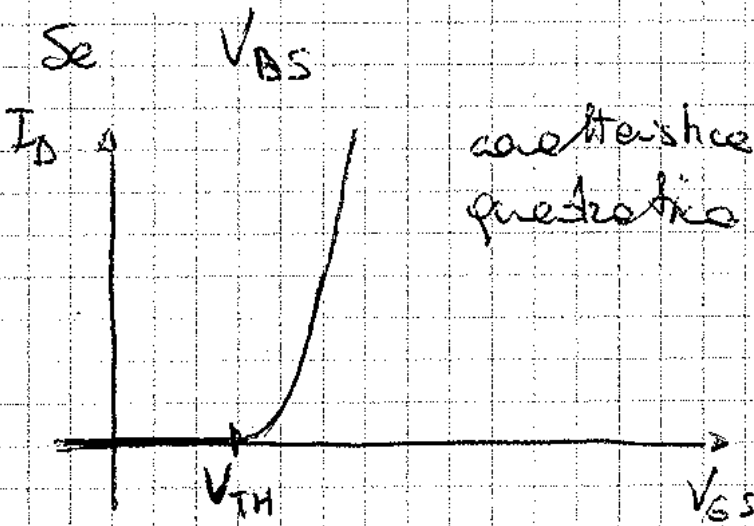
Spesso BODY è collegato al SOURCE

Per transistori di potenza si collegano tanti transistori MOS in parallelo



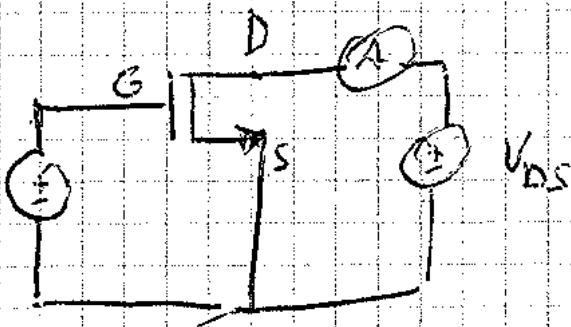


Plotto da tensione V_{GS}

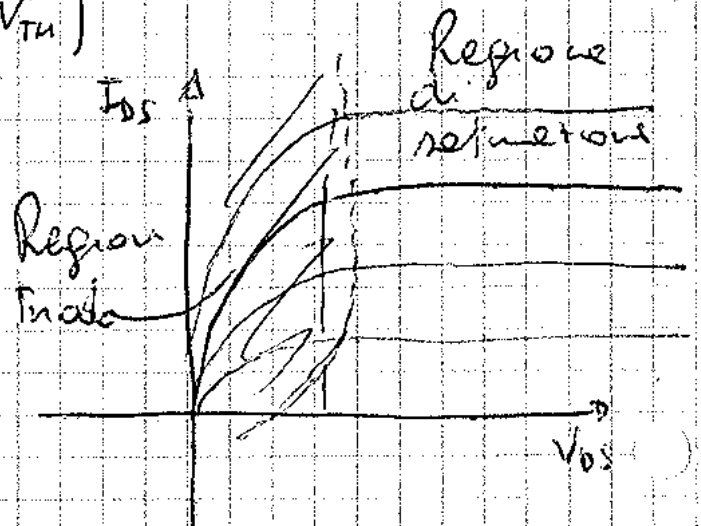


$$i_D = K_n (V_{GS} - V_{TH})^2$$

$$= \frac{1}{2} \mu_n C_{ox} \frac{W}{L} (V_{GS} - V_{TH})^2$$



$$V_{GS} > V_{TH}$$



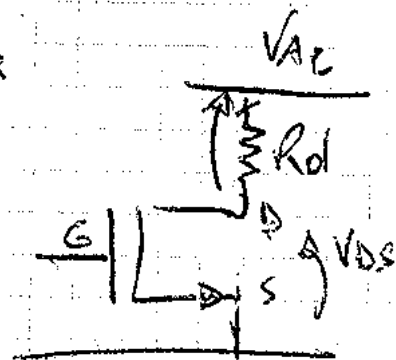
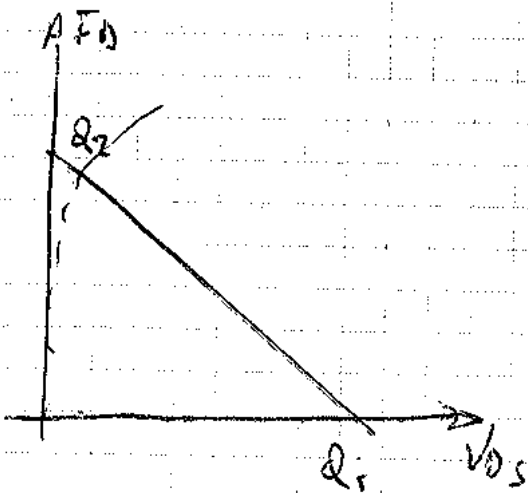
Se $\begin{cases} V_{GS} > V_{TH} \\ V_{DS} > V_{GS} - V_{TH} \end{cases} \Rightarrow I_D = (V_{GS} - V_{TH})^2 (1 + \lambda V_{DS})$ (32)
 Reg. sat.

Se $\begin{cases} V_{GS} > V_{TH} \\ V_{DS} < V_{GS} - V_{TH} \end{cases} \Rightarrow I_{DS} = \frac{2K_n}{2} (V_{GS} - V_{TH} - \frac{V_{DS}}{2}) \cdot V_{DS}$
 Reg. triode

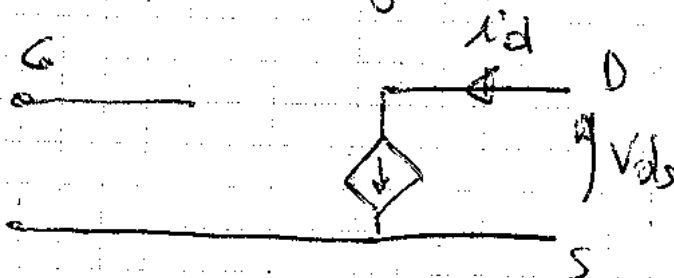
Se $\begin{cases} V_{GS} < V_{TH} \end{cases} \Rightarrow$ regione interazione
 $I_D = 0$

Modello di piccolo segnale del MOS

utilizzo come interuttore



utilizzo in regione di ~~attivazione~~ ^{soluzione}

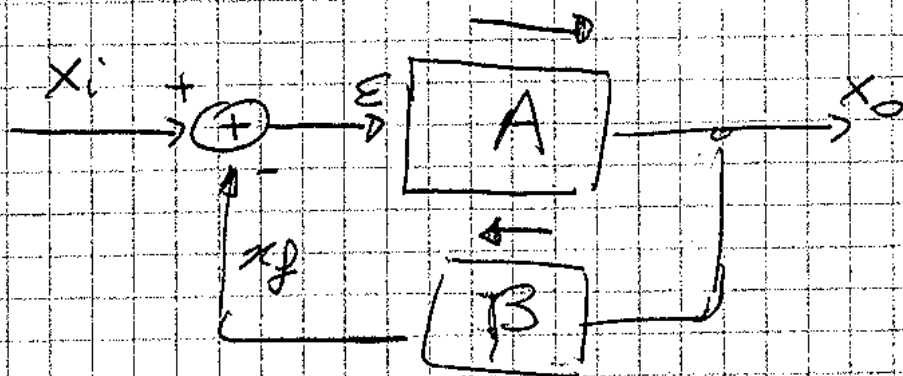


$$i_d = g_m v_{gs}$$

$$g_m = \left. \frac{\partial I_D}{\partial V_{GS}} \right|_{V_{DS} = \text{cost}} = 2k_n (V_{GSQ} - V_{TH})$$

fino ad ora ci sono occupati di amplificatori ed anelli.

AMPLIFICATORI RETROAZIONATI



A amplificatore come quelli già visti e cui non viene applicato tutto x_i ($E = x_i - x_f$)

$$x_f = \beta x_o$$

Dobbiamo trovare $A_f = \frac{x_o}{x_i}$

$$x_o = A E = A (x_i - x_f) = A (x_i - \beta x_o)$$

$$x_o (1 + \beta A) = A x_i$$

$$A_f = \frac{\cancel{1 + \beta A} A}{1 + \beta A}$$