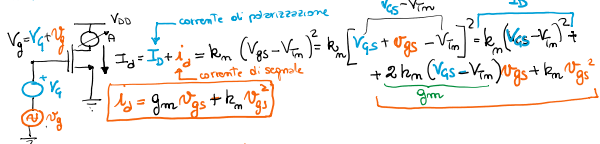
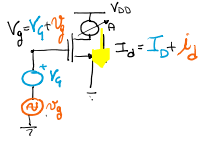
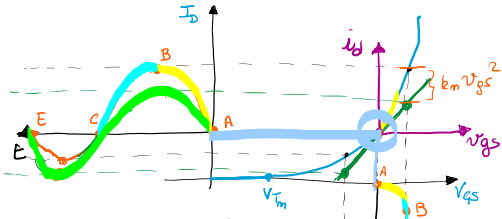


COMPORTAMENTO DI UN N MOSFET SU SEGNALE

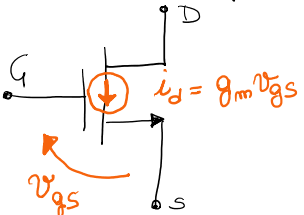


sotto le condizioni di piccolo segnale:

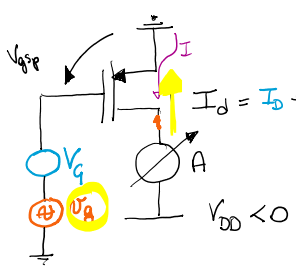
$$i_d = g_m v_{gs} \quad | \quad v_{gs} \ll 2(V_{gs} - V_{th})$$



m MOSFET su segnale



COMPORTAMENTO DEL P MOSFET SU SEGNALE



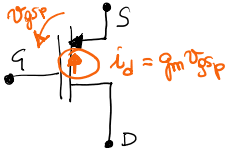
$$V_g < 0 \quad I_D = k_p (V_{GS_p} - V_{TP})^2 < 0$$

$$I_D = I_{D0} + i_d = k_p (V_{GS_p} + v_{gs_p} - V_{TP})^2 = g_{m_p} v_{gs_p} + k_p v_{gs_p}^2$$

$$i_d = g_{m_p} v_{gs_p} + k_p v_{gs_p}^2$$

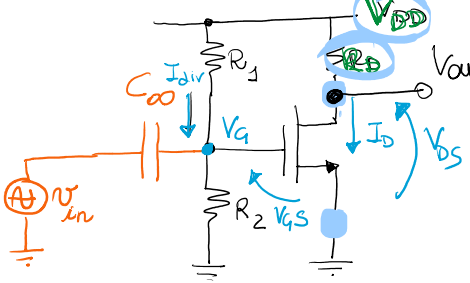
$v_{gs} > 0$ V_{gs_p} si riduce in modulo $\Rightarrow I_D$ diviene meno negativo
 ↳ è come se avessi la stessa I_D a cui sommare una corrente da drain a source positiva

p MOSFET su segnale



cond. di piccolo segnale
 $v_{gs} \ll 2|(V_{GS_p} - V_{TP})|$

STADIO AMPLIFICATORE SOURCE A MASSA (COMMON SOURCE AMPLIFIER)



C_{∞} : capacità di valore infinito

$$|Z| = \left| \frac{1}{j\omega C_{\infty}} \right| = 0 \quad \forall \omega$$

$$|Z| = \infty \quad \text{in DC}$$

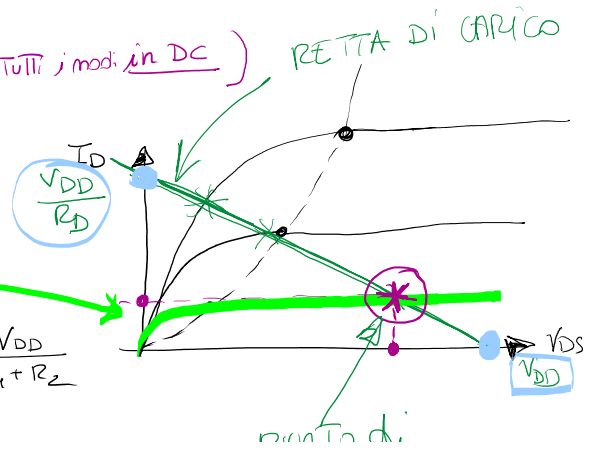
(A) POLARIZZAZIONE (correnti in tutti i rami e tensioni a tutti i nodi in DC)

- * condensatori circuiti aperti
- * Spegnere i generatori di segnale
- * (H_p) : MOSFET saturo

$$V_G = \frac{R_2}{R_1 + R_2} V_{DD}$$

$$I_{D0} = k_m (V_{GS} - V_{th})^2$$

$$I_{DIV} = \frac{V_{DD}}{R_1 + R_2}$$



$$V_G = \frac{V_{DD}}{R_1 + R_2}$$

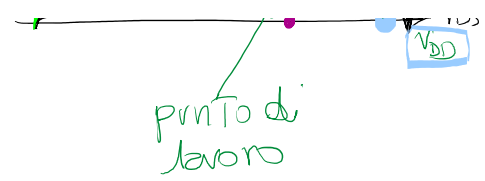
$$I_D = k_m (V_{GS} - V_{Tm})^2$$

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

I_D, V_{GS}, V_{DS}

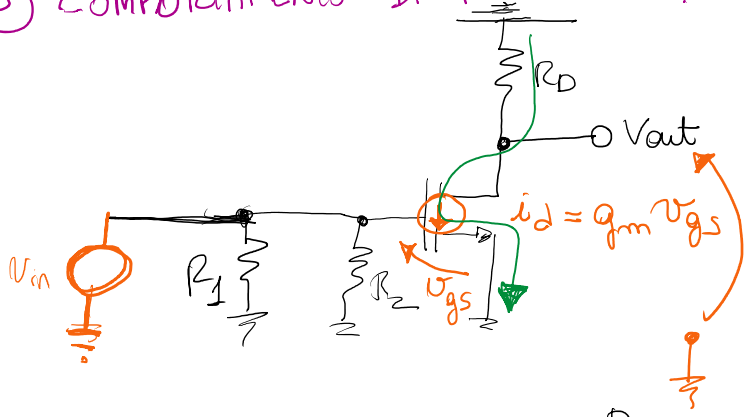
$V_{GS} > V_{Tm}$ MOS acceso
 $V_{GD} < V_{Tm}$ MOS saturo

$$I_{DIV} = \frac{V_{DD}}{R_1 + R_2}$$



COMPORIAMENTO DI PICCOLO SEGNALE

$v_{gs} \ll 2(V_{GS} - V_{Tm})$
 cond. di piccolo segnale
 $g_m = 2k_m (V_{GS} - V_{Tm})$

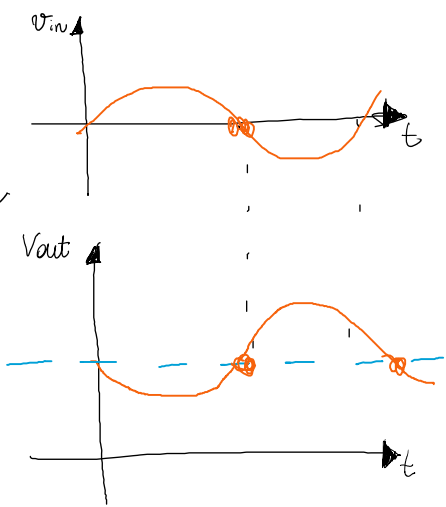


$$v_{out} = i_d R_D = -g_m v_{gs} R_D \Rightarrow -g_m R_D v_{in}$$

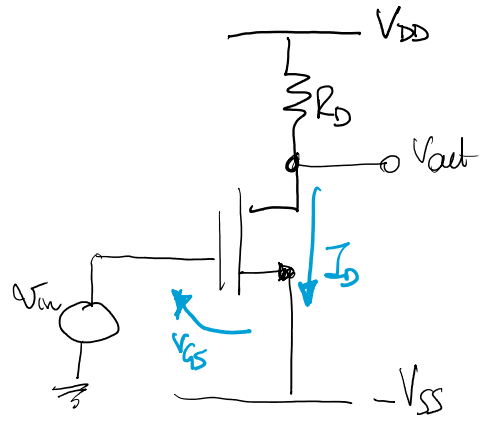
$v_{gs} = v_{in}$

$$G \triangleq \frac{v_{out}}{v_{in}} = -g_m R_D$$

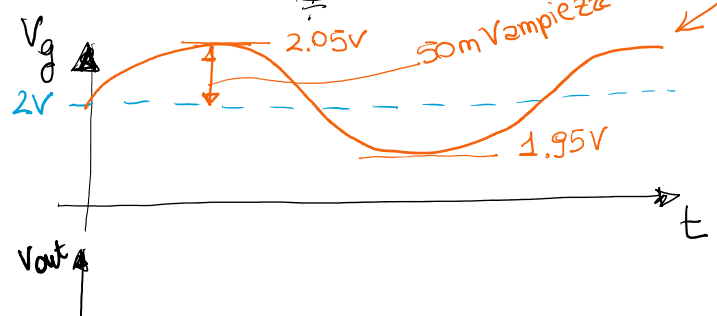
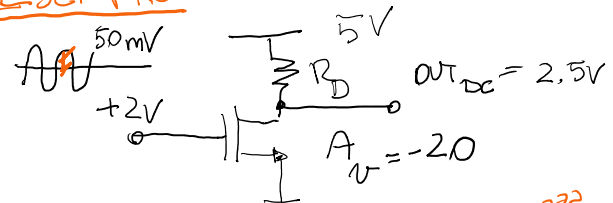
GUADAGNO DI PICCOLO SEGNALE



ACCOUPIAMENTO IN DC



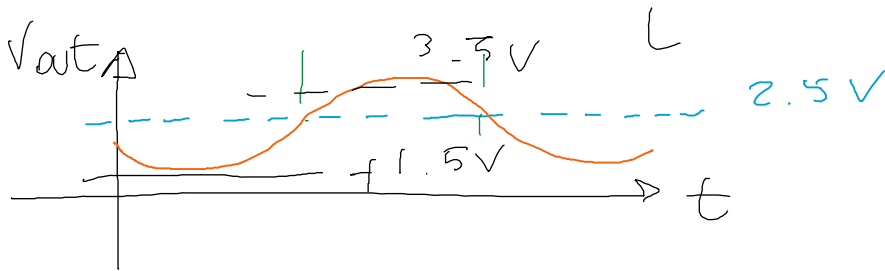
ESEMPIO



NON IN SCALA!



$$50 \text{ mV} \times (-20) = -1 \text{ V}$$



ESEMPIO

