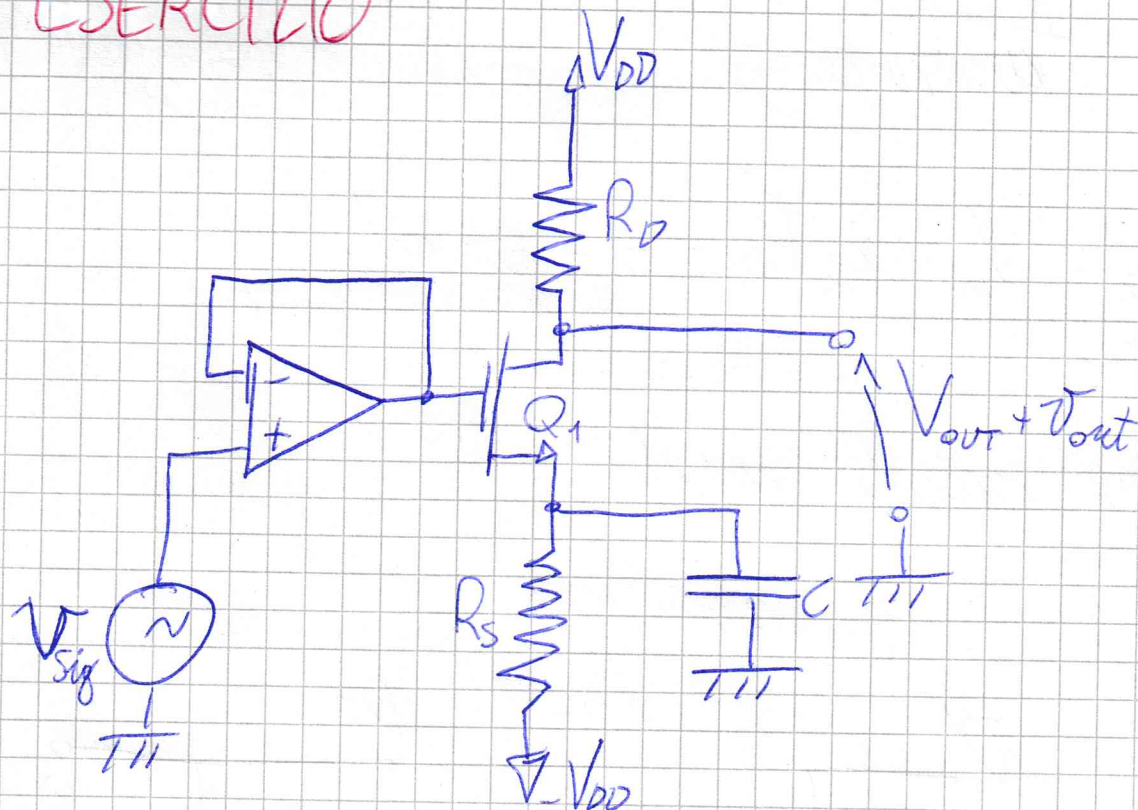


ESERCIZIO



$$Q_1 = \{ V_t = 1V; K = \frac{1}{8} \text{ mA/V}^2; \lambda = 0 \}$$

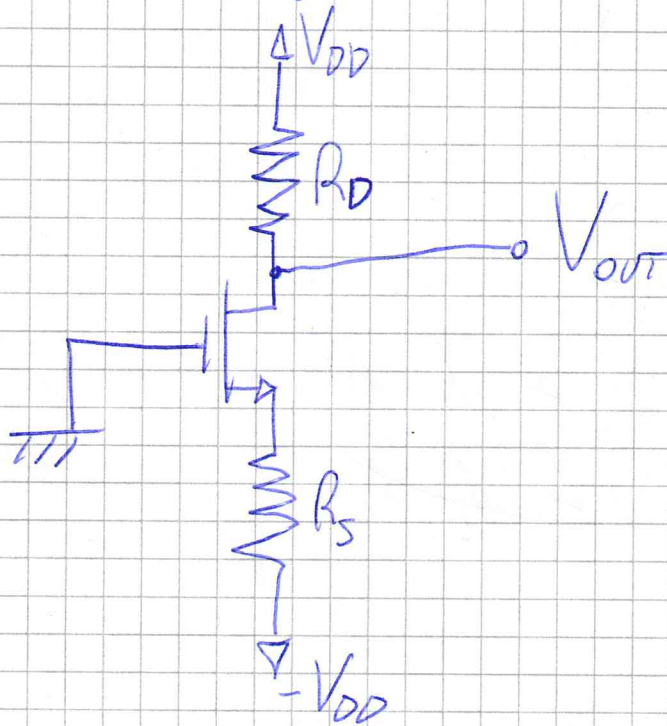
$$L^+ = |L^-| = 10V$$

$$V_{DD} = 5V$$

$$R_D = 10k\Omega$$

Determina R_S per avere $V_{out} = 0V$,
 poi calcola $A_0 = \frac{v_{out}}{v_{in}}$

studio in statica



$$V_G = 0V$$

$$V_{GS} = V_G - i_D R_S + V_{DD} = 5 - i_D R_S$$

$$i_D = \frac{1}{8} K (V_{GS} - V_t)^2 = \frac{1}{8} (V_{GS} - 1)^2 = 0,5 \text{ mA}$$

$$V_{DS} = V_{DD} - i_D R_D - i_D R_S + V_{DD}$$

$$V_{OUT} = V_D = V_{DD} - i_D R_D = 0V$$

$$i_D R_D = V_{DD} \rightarrow i_D = \frac{V_{DD}}{R_D} = \frac{5}{10} = 0,5 \text{ mA}$$

$$\frac{1}{8} (V_{GS} - 1)^2 = \frac{1}{2}$$

$$V_{GS}^2 - 2V_{GS} + 1 = 4$$

$$V_{GS}^2 - 2V_{GS} - 3 = 0$$

$$\Delta = 4 + 12 = 16$$

$$V_{GS} = \frac{2 \pm 4}{2} = \begin{cases} +3 \\ -1 \end{cases} \quad V > V_t = 1V$$

~~$-1V < V_t = 1V$~~

$$V_{GS} = 3V$$

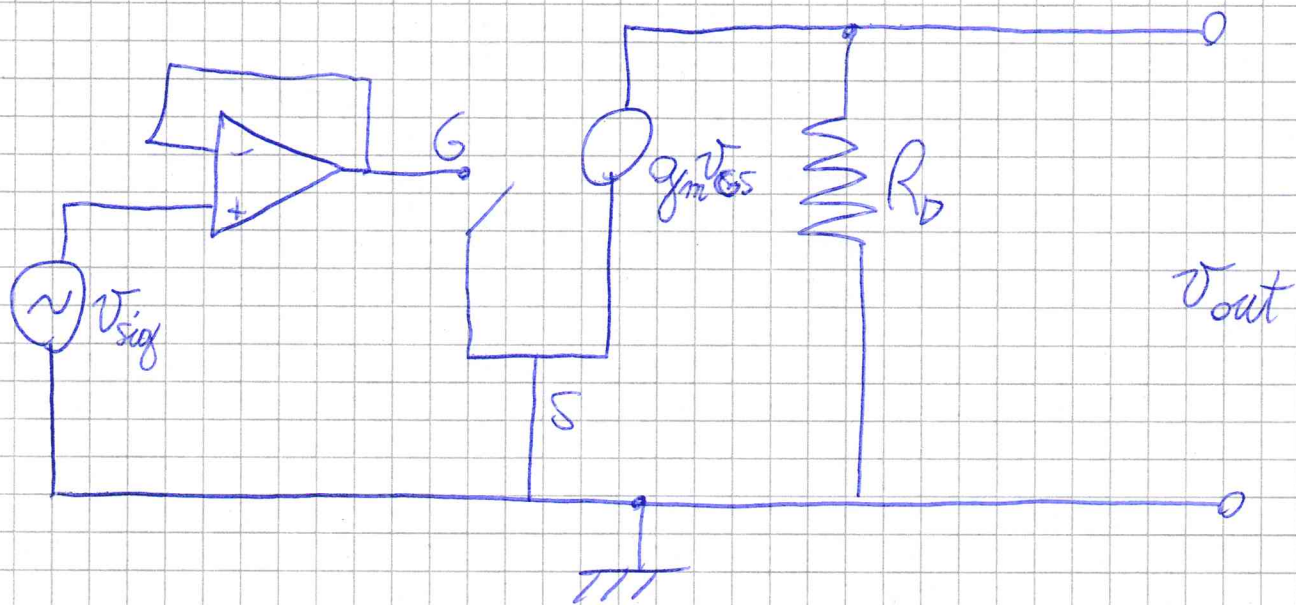
$$3 = 5 - \frac{1}{2}R_S \Rightarrow -\frac{1}{2}R_S = -2 \quad R_S = 4k\Omega$$

$$V_{DS} = V_{DD} - i_D R_D - i_D R_S + V_{DD} = 10 - \frac{1}{2} \cdot 10 - \frac{1}{2} \cdot 4 =$$

$$V_{DS} = 3V > V_{GS} - V_t = 3 - 1 = 2V$$

Q_1 è in saturazione

studio piccoli segnali



$$v_G = v_{sig}$$

$$g_m = 2K(V_{GS} - V_t) = 2 \cdot \frac{1}{8} (3 - 1) = 0,5 \frac{mA}{V}$$

$$v_{out} = g_m v_{sig} R_D = \frac{1}{2} \cdot 10 v_{sig} = 5 v_{sig}$$

$$A = \frac{v_{out}}{v_{sig}} = 5$$