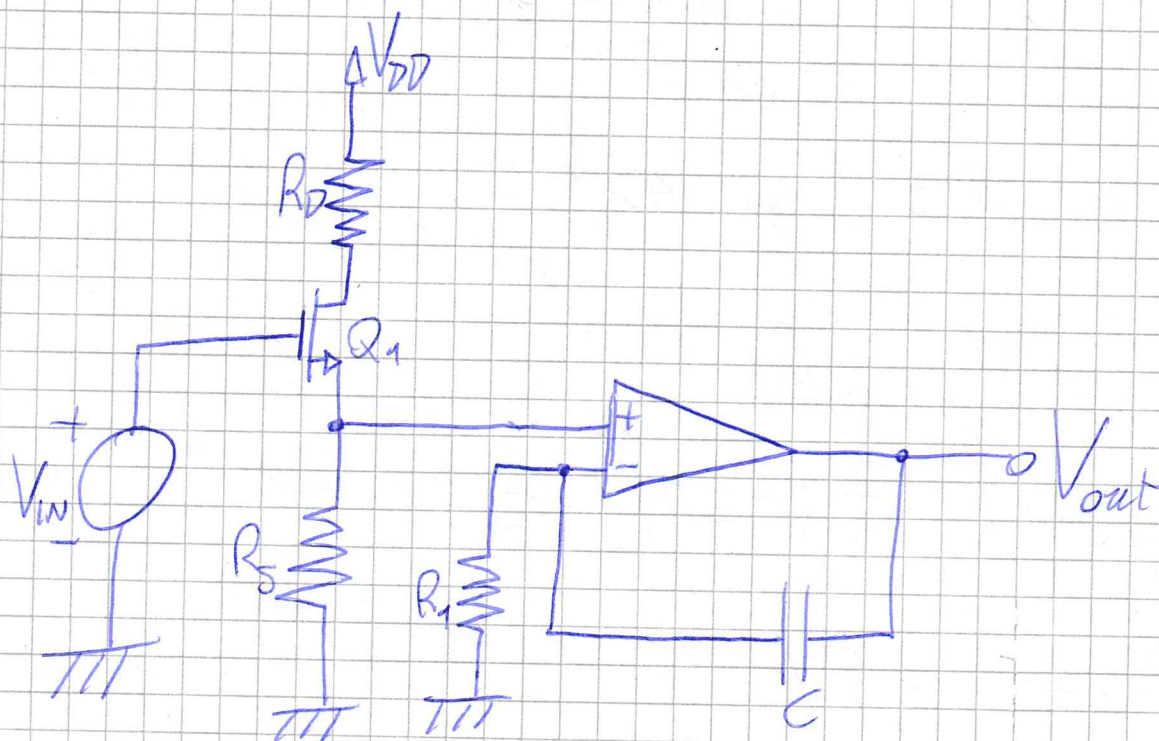


ESERCIZIO



$$V^+ = |V^-| = 12V$$

$$Q_1 = \{V_{th} = 1V; K = \frac{1}{2} \frac{mA}{V^2}; \lambda = 0\}$$

$$R_D = 6k\Omega \quad R_S = 2k\Omega \quad R_f = 10k\Omega \quad C = 100nF$$

$$V_{DD} = 10V$$



$$V_G = V_{IN}$$

2 casi $V_{IN} = 0V$ e $V_{IN} = 3V$

$$V_{IN} = 0V$$

$$V_G = 0V$$

$$\begin{cases} V_{GS} = V_G - V_S = -V_S = -i_D R_S \\ i_D = K(V_{GS} - V_t)^2 \end{cases}$$

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

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

$$V_{GS}^2 - V_{GS} + 1 = 0$$

$$\Delta = 1 - 4 = -3$$

transistor interdetto

$$V_S = 0V = V^+$$

$$V_{in} = 3V$$

$$\begin{cases} V_{GS} = V_G - V_S = 3 - i_D R_S \\ i_D = K(V_{GS} - V_t)^2 \end{cases}$$

$$i_D = K(V_{GS} - V_t)^2$$

$$V_{GS} = 3 - 2 \frac{1}{2} (V_{GS} - 1)^2$$

$$3 - V_{GS} = V_{GS}^2 - 2V_{GS} + 1$$

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

$$\Delta = 1 + 8 = 9$$

$$V_{GS_{1/2}} = \frac{1 \pm 3}{2} = \begin{matrix} +2 > V_t = 1 \\ -1 \end{matrix} \quad \text{✓}$$

$$V_{GS} = 2V$$

$$i_D = \frac{1}{2} (2 - 1)^2 = 0,5 \text{ mA}$$

$$V_{DS} = V_D - V_S = V_{DD} - i_D R_D - i_D R_S = 10 - \frac{1}{2} \cdot 6 - \frac{1}{2} \cdot 2$$

$$= 10 - 3 - 1 = 6V > V_{GS} - V_t = 2 - 1 = 1$$

transistor saturates

$$V^+ = V_S = i_D R_S = \frac{1}{2} \cdot 2 = 1V$$

$$V_{out} = V^+ + V_{BC}$$

$$V_C = \frac{\int i_C dt}{C} = \frac{V^+}{R_1 C} t$$

$$i_C = \frac{V^+}{R_1}$$

$$V_{out} = V^+ + \frac{V^+}{R_1 C} t = 1 + 1 \frac{V}{ms}$$

$$R_1 C = \tau = 10 \cdot 10^3 \cdot 100 \cdot 10^{-9} = 1000 \cdot 10^{-6} = 10^{-3} s = 1ms$$

