

$$V_{DD} = 3.3 \text{ V}$$

$$V_{T1} = 0.4 \text{ V}$$

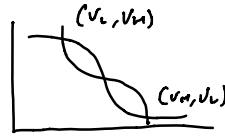
$$\beta_1 = 2.5 \frac{\mu\text{A}}{\text{V}^2}$$

$$V_{T2} = -0.2 \text{ V}$$

$$\beta_2 = 300 \frac{\mu\text{A}}{\text{V}^2}$$

$$\Delta V = V_H - V_L = 3 \text{ V}$$

$$? = R \quad ? = V_{TL}$$



$$V_L \quad V_H \rightarrow V_H \quad V_L$$

$$M_1: \begin{cases} V_{GS1} = V_i \\ V_{DS1} = V_o \end{cases} \rightarrow \begin{cases} \text{OFF: } V_i < V_{T1} \\ \text{SAT: } V_i < V_o + V_{T1} \rightarrow V_o > V_i - V_{T1} \\ \text{LIN: } V_o < V_i - V_{T1} \end{cases}$$

$$M_2: \begin{cases} V_{GS2} = V_i - V_o \\ V_{DS2} = V_{DD} - V_o \end{cases} \rightarrow \begin{cases} \text{OFF: } V_i - V_o < V_{T2} \rightarrow V_o > V_i + |V_{T2}| \\ \text{SAT: } V_i - V_o < V_{DD} - V_o + V_{T2} \rightarrow V_i < V_{DD} - |V_{T2}| \\ \text{LIN: } V_i > V_{DD} - |V_{T2}| \end{cases}$$

$$\bullet V_i = V_L, V_o = V_H$$

$$\text{UP: } V_L < V_{T1} \rightarrow M_1 = \text{OFF} \rightarrow I_{D1} = 0$$

$$I_{D1} = I_{D2} + I_R \rightarrow I_{D2} + I_R = 0$$

$$\text{Se } M_2 = \text{ON: } I_{D2} > 0 \rightarrow I_R < 0 \quad \left. \begin{array}{l} V_{DS2} > 0 \quad \text{na} \quad V_{DS} = V_R \rightarrow I_R > 0 \end{array} \right\} \text{No!} \rightarrow M_2 = \text{OFF} \quad I_{D2} = 0, I_R = 0$$

Non ci sono operazioni possibili

$$V_L = V_H - 3 = 0.3V$$

$$V_L < V_{T1} \rightarrow \text{off}$$

$$\bullet V_i = V_H, V_O = V_L$$

$$V_O < V_L - V_{T1} \rightarrow V_L < V_H - V_{T1}$$

$$M_1: 0.3 < 3.3 - V_{T1} \rightarrow \text{off} \rightarrow M_1 = \text{LN}$$

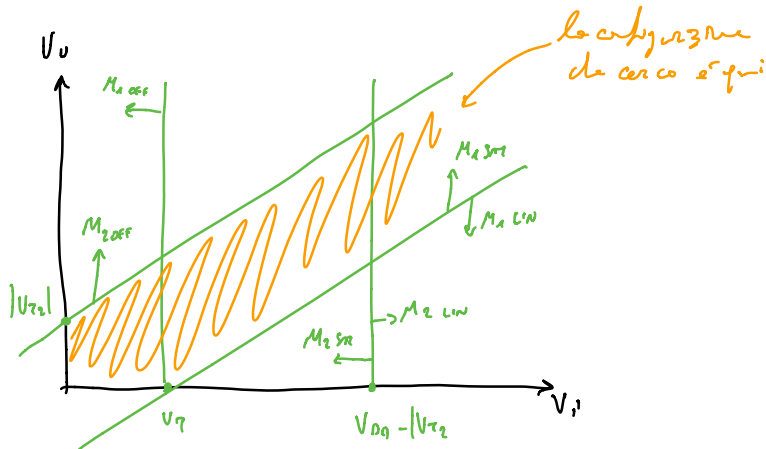
$$M_2: V_i > V_{O0} - |V_{T2}| \rightarrow 3.3 > 0.3 - |V_{T2}| \rightarrow \text{off}$$

$$I_{O1} = \beta_1 \left[(V_i - V_{T1}) V_O - \frac{V_O^2}{2} \right] = 1.06 \mu A$$

$$I_{O2} = \beta_2 \left[(V_H - V_L - V_{T2}) (V_{O0} - V_L) - \frac{(V_{O0} - V_L)^2}{2} \right]$$

$$I_n = \frac{V_{O0} - V_L}{R} \quad \mu A \quad I_{O1} = I_{O2} + I_n$$

$$\rightarrow R = \frac{V_{O0} - V_L}{I_{O1} - I_{O2}} = 5133.8 \Omega$$



$$\mu_p: M_1 = \text{sat} \quad M_2 = \text{sat}$$

$$I_{O1} = \frac{\beta_1}{2} (V_{T2} - V_{T1})^2$$

$$I_{O2} = \frac{\beta_2}{2} (V_{T2} - V_{T2} - V_{T2})^2$$

$$I_n = \frac{V_{O0} - V_{T2}}{R}$$

$$I_{O1} = I_{O2} + I_n$$

$$\frac{\beta_1}{2} (V_{T2} - V_{T1})^2 = \frac{\beta_2}{2} (V_{T2} - V_{T2} - V_{T2})^2 + \frac{V_{O0} - V_{T2}}{R}$$

$$\rightarrow V_i \begin{cases} -0.32 \\ \sqrt{+0.978V} \end{cases}$$

Passaggi risoluzioni

→ DIMENSIONE \mathbb{R}

→ ANNULLI STAZIONI, V_i, V_n , INGRESSO ALLO, \mathbb{R}

→ TROVARE V_{TC}

→ STATISTICA GRAFICA