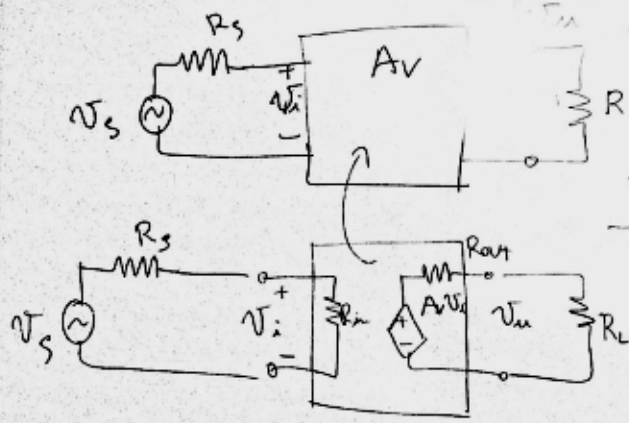


ID

$R_{in} \to \infty$

$R_{out} \to 0$

REALE

R_{in} GRANDE

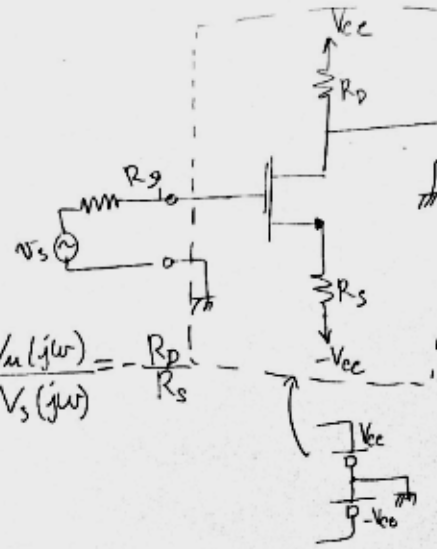
R_{out} PICCOLO $<< R_L$

$A_V(j\omega) = \dfrac{V_{out}(j\omega)}{V_S(j\omega)} = -\dfrac{R_D}{R_S}$

$(H(j\omega))$

$\to R_{in} \to +\infty$

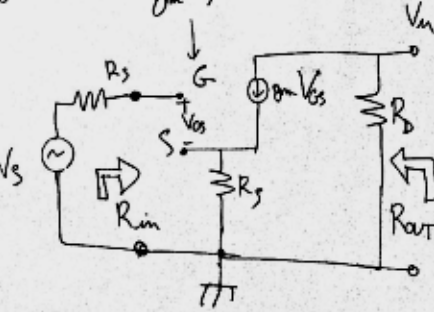
$\to R_D \cong K\Omega$.



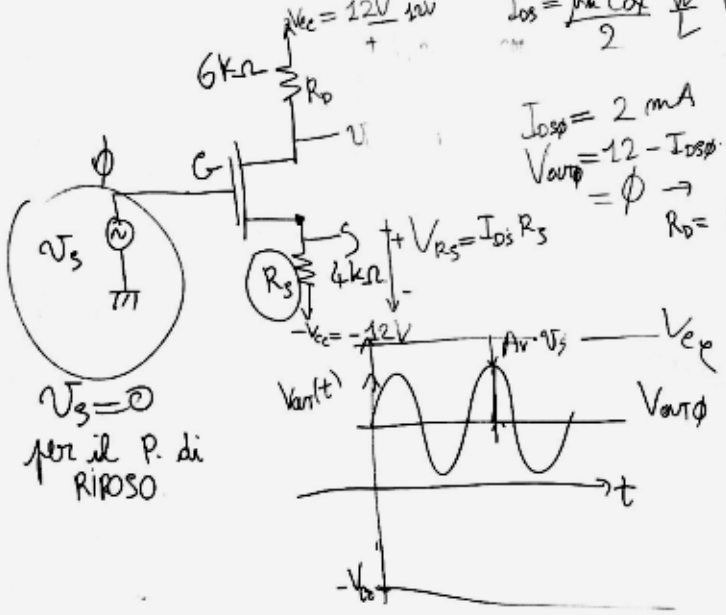
1) P mirato

2) Parametri dim.

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



$A_V \cong -\dfrac{R_D}{R_S}$



$V_s = 0$ per il P. di RIPOSO

$I_{DS} = \frac{\mu_n C_{ox}}{2} \frac{W}{L} (V_{GS} - V_{TH})^2$ $\quad V_{TH} = 2V$

$\mu_n = 0.1$ m²/V·s

$I_{DS\phi} = 2$ mA

$V_{out\phi} = 12 - I_{DS\phi} \cdot R_D = \phi \rightarrow R_D = \frac{12 - \phi}{I_{DS\phi}(2mA)} = 6k\Omega$

$C_{ox} = \frac{\varepsilon_0 \cdot \varepsilon_{ox}}{t_{ox}} = \frac{8.85 \times 10^{-12} \times 4}{30 \times 10^{-9}} = 1.18 \times 10^{-3}$ F/m²

$\frac{W}{L} = 10$

$V_{GS} = 0 - V_{SOURCE}$

$V_{SOURCE} = -12 + I_{DS} \cdot R_S$

$I_{DS\phi} = \frac{\mu_n C_{ox}}{2} \frac{W}{L} (-V_{SOURCE} - V_{TH})^2$ $\quad V_{GS} = 0 - V_{SOURCE}$

$2 \times 10^{-3} \text{ A} = 0.1 \times 1.18 \times 10^{-3} \cdot \frac{1}{2} \cdot 10 \left(12 - 2 \times 10^{-3} R_S - \frac{2}{V_{TH}}\right)^2$

$(I_{DS\phi} = 2mA)$

$2 \times 10^{-3} = 5.9 \times 10^{-4} \cdot (10 - 2 \times 10^{-3} R_S)^2$

$10 - 2 \times 10^{-3} R_S = \left(\frac{2 \times 10^{-3}}{5.9 \times 10^{-4}}\right)^{1/2} = 1.84$

$R_S = 4 \text{ k}\Omega$

$V_{cc} = 12V$

$-V_{cc} = -12V$

$R_D = 6k\Omega$

$R_S = 4k\Omega$

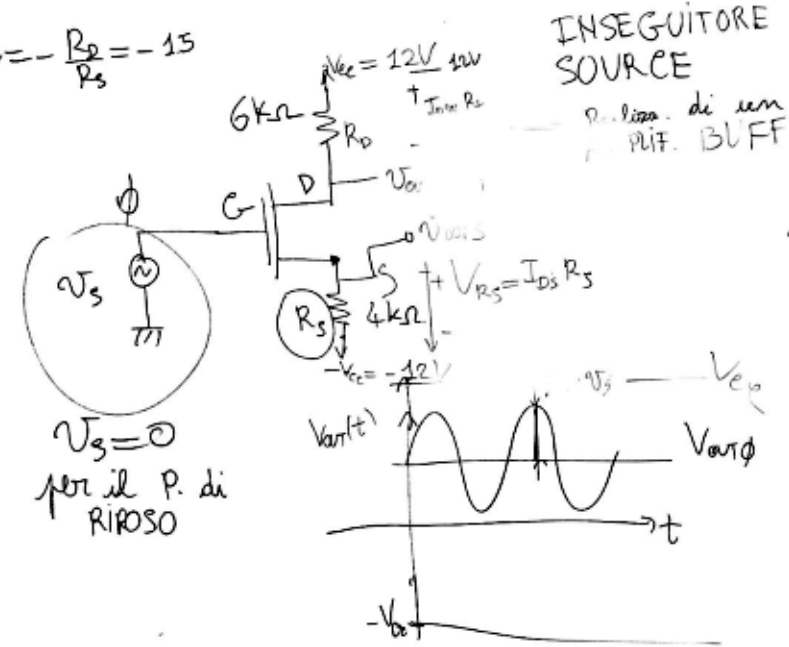
$\rightarrow I_{DS\phi} = 2mA$

$V_{GS\phi} = 0 - (-12 + 2mA \cdot 4k\Omega) = +4 \text{ V}$

$g_m = \mu_n C_{ox} \frac{W}{L} (V_{GS\phi} - V_{TH})$

$g_m = 5.9 \times 10^{-4} \cdot 2 = 1.18 \times 10^{-3}$

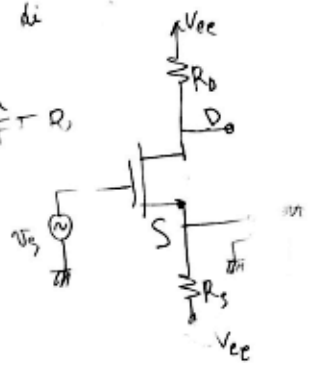
$A_V = -\frac{R_D}{R_S} = -15$



$V_S = 0$ per il P. di RIPOSO

INSEGUITORE di SOURCE

polariz. di un amplif. BUFFER

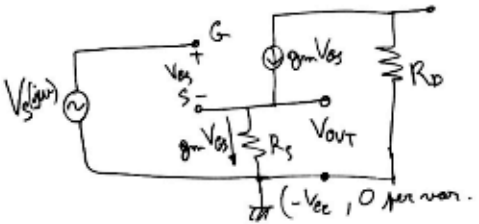


$$A_V = \frac{V_{out}}{V_S} = \frac{g_m R_S}{1 + g_m R_S}$$

SE $g_m R_S > 1$

$$\boxed{A_V \simeq \frac{g_m R_S}{g_m R_S} \simeq 1}$$

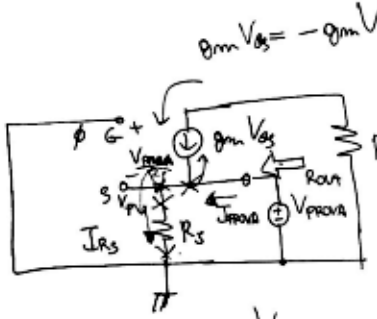
Amplif. col SOURCE



$$V_{GS} = V_S - V_{SOURCE} = V_S - g_m V_{GS} R_S$$

$$V_{GS}(1 + g_m R_S) = V_S \rightarrow V_{GS} = \frac{V_S}{1 + g_m R_S}$$

$$V_{OUT} = + (g_m V_{GS}) R_S = \frac{g_m R_S}{1 + g_m R_S} V_S$$



$$R_{OUT} = \frac{V_{PROVA}}{I_{PROVA}}$$

(R_{THENIN})

INSEGUITORE di SOURCE

- Realizz. di un BUFFER

$$V_{GS} = -V_{PROVA}$$

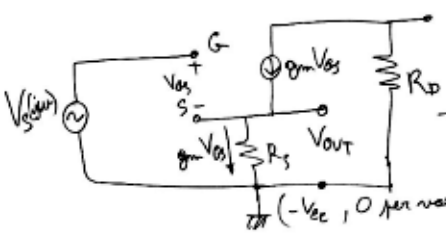
$V_{PROVA} =$

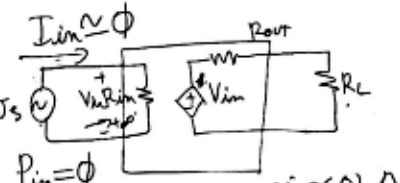
$$I_{R_S} = \frac{V_{PROVA}}{R_S}$$

$$I_{PROVA} = \frac{V_{PROVA}}{R_S} + g_m V_{PROVA}$$

$$I_{PROVA} = V_{PROVA}\left(\frac{1}{R_S} + g_m\right) \qquad \frac{V_{PROVA}}{I_{PROVA}} = \frac{R_S}{1 + g_m R_S}$$

Amplif. sul SOURCE





$$P_{OUT} = V_{in} \cdot I_{OUT} = V_{OUT}$$

$$V_{gs} = V_S - V_{SOURCE} = V_S - g_m V_{gs} R_S$$

$$V_{gs}(1 + g_m R_S) = V_S \rightarrow V_{gs} = \frac{V_S}{1 + g_m R_S}$$

$$V_{OUT} = +(g_m V_{gs}) R_S = \frac{g_m R_S}{1 + g_m R_S} V_S$$

$P_{OUT} \gg P_{in} \neq \phi$ (R_L)

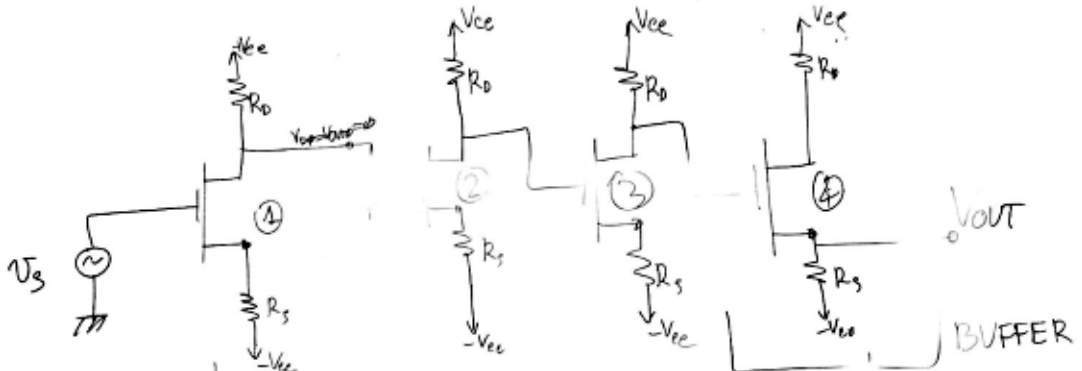
$$\frac{V_{OUT}^2}{R_L} = \frac{V_{in}^2}{R_L}$$

$V_S = V_{in}$ NON eroga POTENZA

$$\rightarrow P_{OUT} = \frac{V_{in}^2}{R_L}$$

$V_{OUT} = V_{in}$

$A_V = 1$



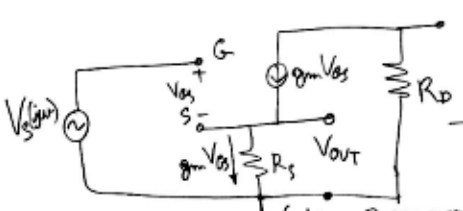
$A_V = A_{V_1} \cdot A_{V_2} \cdot A_{V_3} \cdot 1$

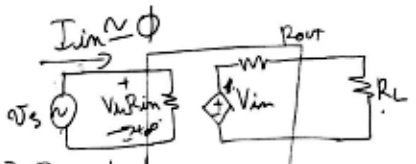
$A_{V_3} = 1$

$R_{in} \to +\infty$

$R_{out} \to 0$ SOURCE

Amplif. col SOURCE





$P_{in} = \phi$

$P_{out} = V_{in} \cdot I_{in}$ ROUT PICCOLA

$P_{out} = V_{in} \cdot I_{out}$

$= V_{out}$

$V_{GS} = V_S - V_{source} = V_S - g_m V_{GS} R_S$

$V_{GS}(1 + g_m R_S) = V_S \to V_{GS} = \frac{V_S}{1 + g_m R_S}$

$V_{out} = + (g_m V_{GS}) R_S = \frac{g_m R_S}{1 + g_m R_S} V_S$

$P_{out} \gg P_{in} \approx \phi$ (R_L)

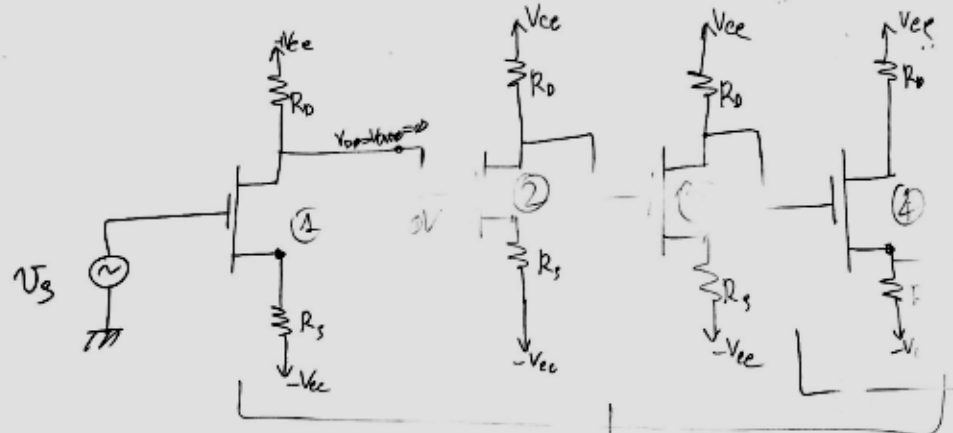
$\frac{V_{out}^2}{R_L} = \frac{V_{in}^2}{R_L}$

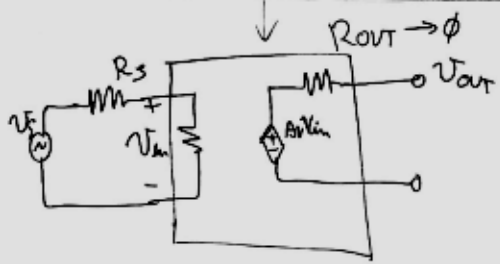
$V_S = V_{in}$ NON eroga POTENZA

$\to P_{out} = \frac{V_{in}^2}{R_L}$

$V_{OUT} = V_{in}$

$A_V = 1$



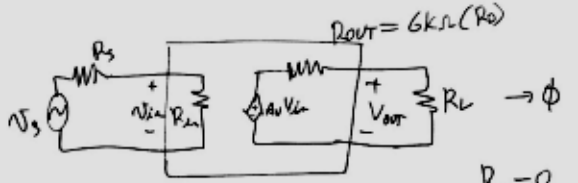


$A_V = A_{V1} \cdot A_{V2} \cdot A_{V3} \cdot 1$

$A_{V3} = 1$

$R_{in} \to +\infty$

$R_{OUT} \to 0$ SOURCE



$R_L = 0$

$I_{MAX} = A_V \frac{V_{in}}{R_{OUT}}$

$V_{OUT} = A_V V_{in} \cdot \frac{R_L}{R_{OUT} + R_L}$

V_{OUT} DIPENDE da R_L

ID. $R_{OUT} \to \phi$

$R_{OUT} \simeq 0.1\,\Omega$.

$R_L = 8\,\Omega \gg R_{OUT}$

$(R_{OUT} \to 0)$

$R_{OUT} = 10\,\Omega$.

$R_L > 500\,\Omega$.

$R_{OUT} = 1\,\Omega$

$R_L > 100\,\Omega$.