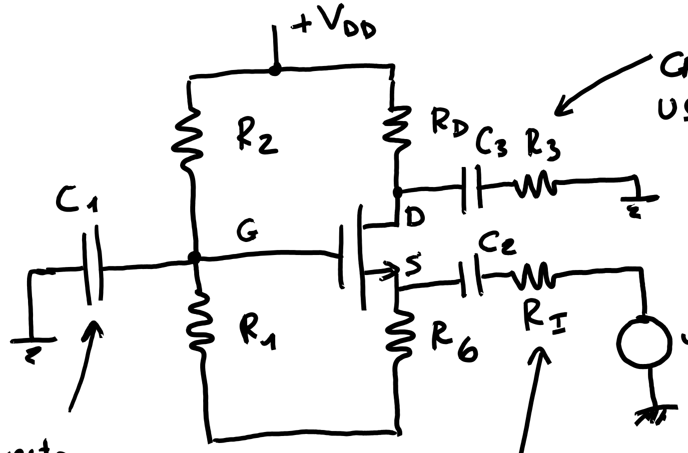
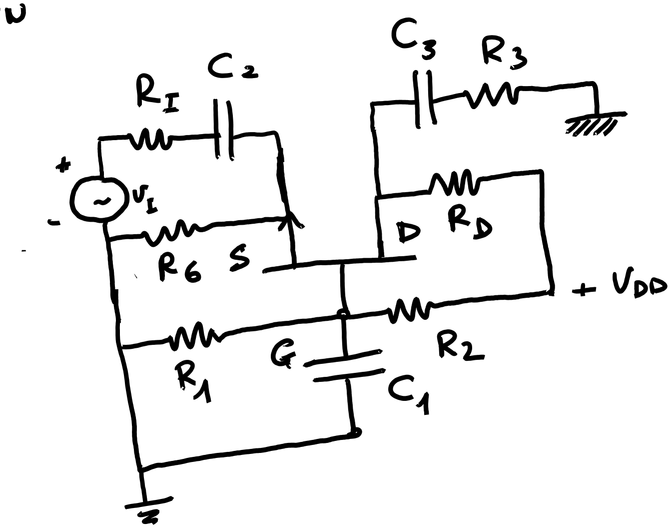
AMPLIFICATORE A GATE COMUNE

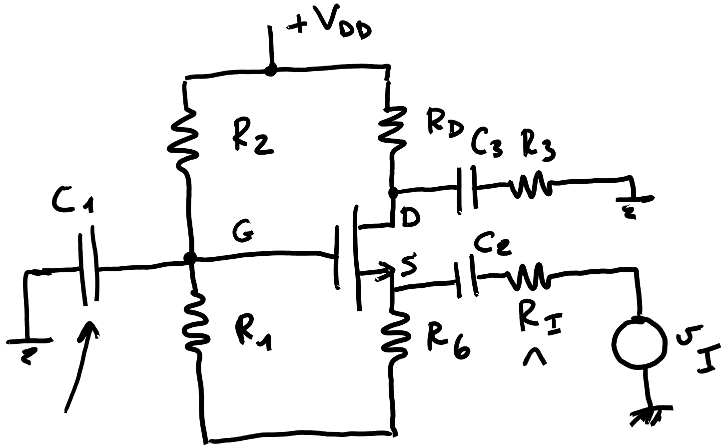


CARICO IN USCITA

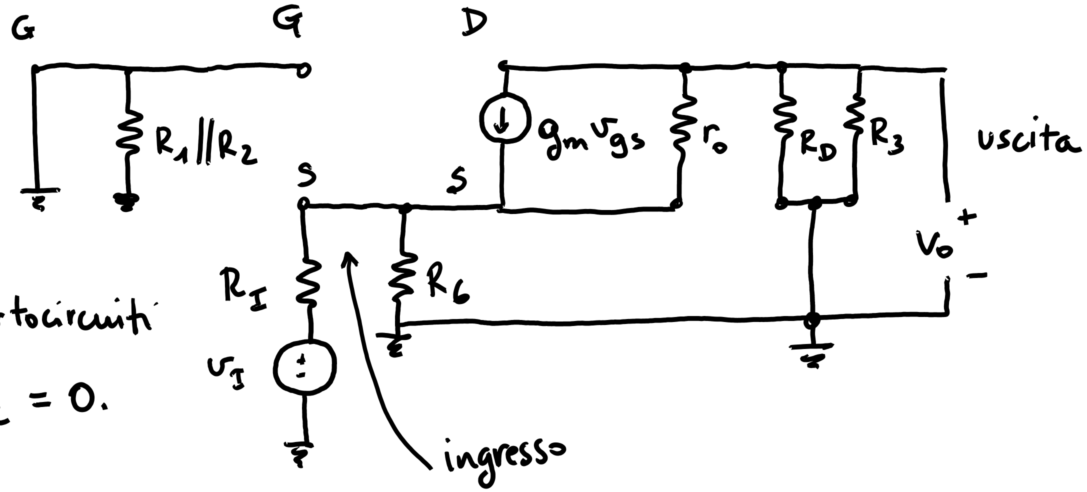
questo condensatore mette a massa il gate dal punto di vista del segnale

resistenza del generatore v_I





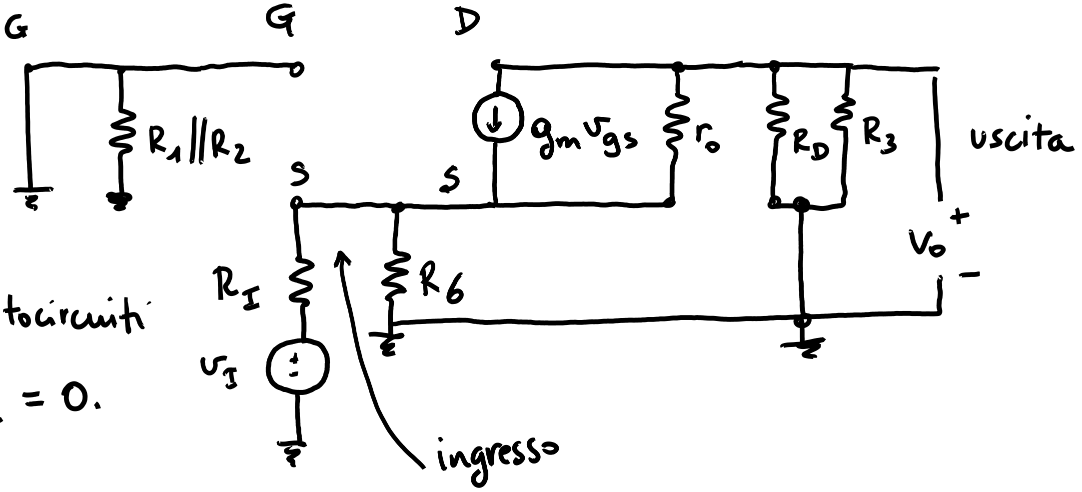
modello per piccolo segnale



C = cortocircuiti

$V_{DC}, I_{DC} = 0.$

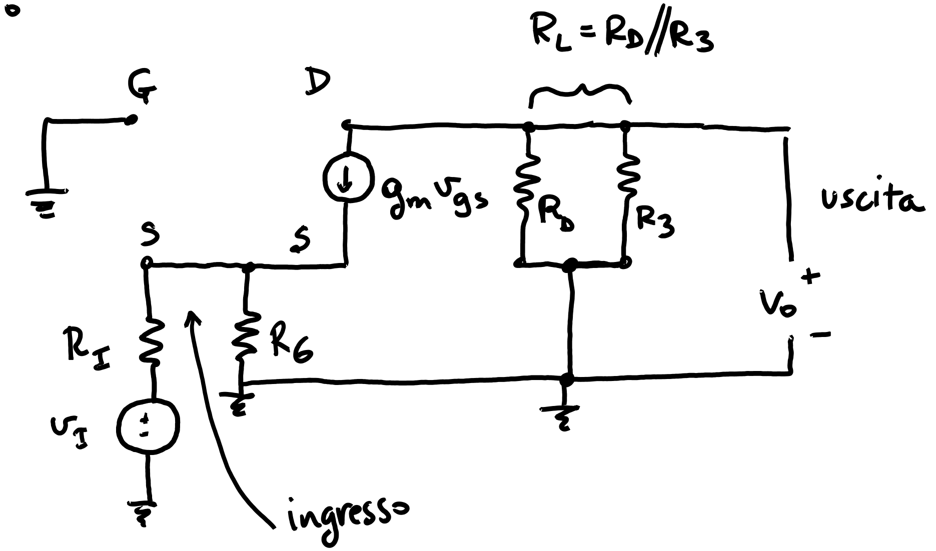
modello per piccolo segnale

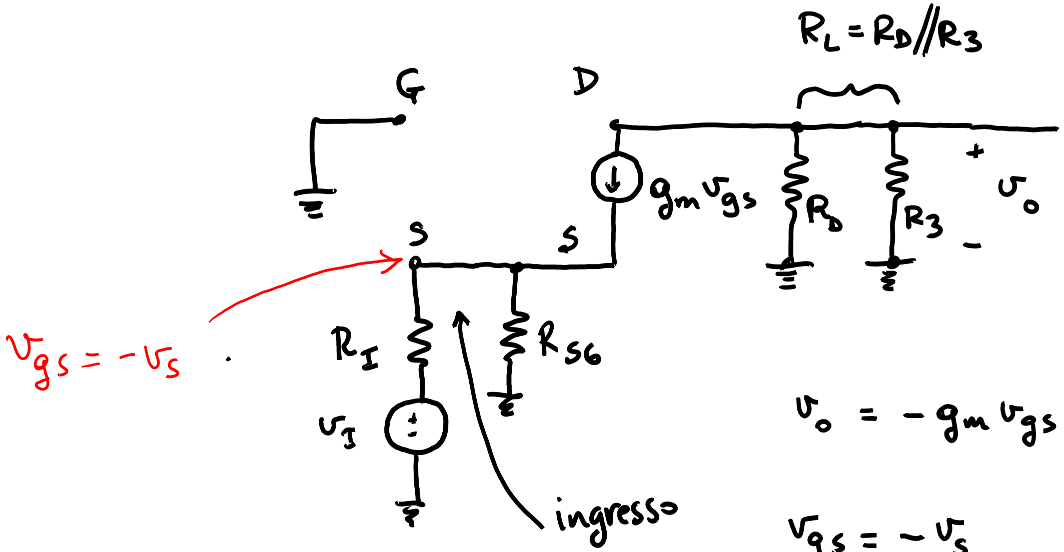


C = cortocircuiti

$V_{DC}, I_{DC} = 0.$

semplificchiamo: trascuro r_o





$$v_o = -g_m v_{gs} R_L$$

$$v_{gs} = -v_s$$

$$v_o = g_m v_s R_L$$

$$v_s = \left(g_m v_{gs} + \frac{v_I - v_s}{R_I}\right) R_6 \quad \Rightarrow \quad v_s = \left(-g_m v_s + \frac{v_I}{R_I} - \frac{v_s}{R_I}\right) R_6$$

$$v_s + g_m v_s R_6 + v_s \frac{R_6}{R_I} = v_I \frac{R_6}{R_I} \qquad v_s\left(1 + g_m R_6 + \frac{R_6}{R_I}\right) = v_I \frac{R_6}{R_I}$$

$$v_S\left(1+g_m R_6 + \frac{R_6}{R_I}\right) = v_I \frac{R_6}{R_I}$$

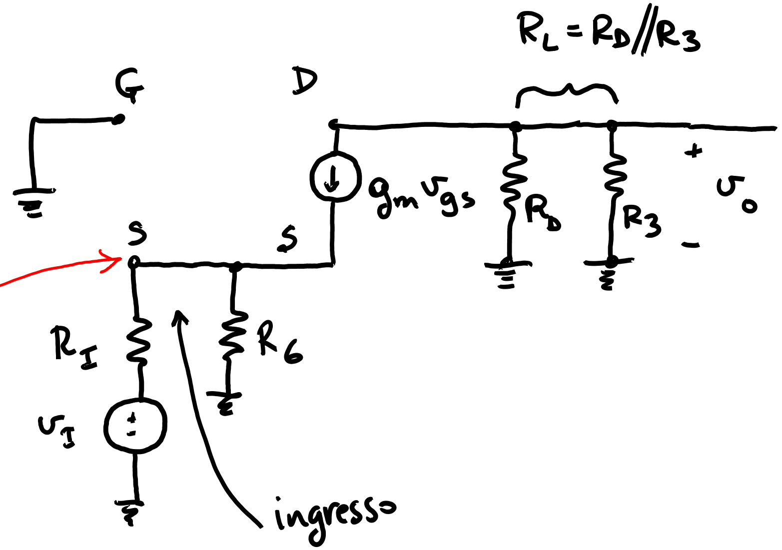
$$v_S\left(\frac{R_I}{R_6} + g_m R_I + 1\right) = v_I$$

$$v_o = g_m v_S R_L$$

$$v_o = v_S \frac{g_m R_L}{1 + g_m R_I + \frac{R_I}{R_6}}$$ moltiplico per R_6

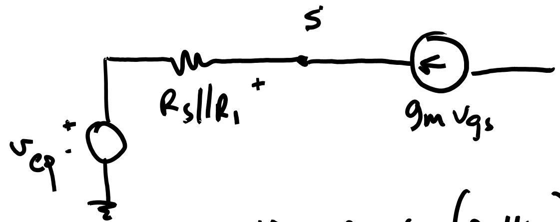
$$A_V = \frac{g_m R_L R_6}{R_6 + g_m R_I R_6 + R_I}$$

$$A_V = \frac{g_m R_L R_6}{R_6 + g_m R_I R_6 + R_I}$$



$v_{gs} = -v_S$

$$v_{eq} = v_I \frac{R_S}{R_S + R_I}$$



$$v_S = g_m v_{gs} (R_S \| R_1) + v_{eq} = -v_{gs}$$

$$\left[1 + g_m (R_S \| R_1)\right] v_{gs} = -v_{eq}$$

$$v_{gs} = -\frac{v_{eq}}{\left[1 + g_m (R_S // R_1)\right]}$$

$$A_v = -g_m v_{gs} R_L =$$

$$v_{gs} = -\frac{v_{eq}}{\left[1+g_m(R_6 /\!/ R_1)\right]} = -\frac{v_I}{\left[1+g_m(R_6 /\!/ R_1)\right]} \frac{R_6}{R_6+R_I}$$

$$v_o = -g_m v_{gs} R_L = \frac{g_m R_L}{\left[1+g_m(R_6 /\!/ R_1)\right]} \cdot \frac{R_6}{R_6+R_1}$$

Le due formule sono equivalenti

$$A_V = \frac{g_m R_L R_6}{R_6 + g_m R_I R_6 + R_I} = \frac{g_m R_L R_6}{(R_6+R_I) + g_m R_1 R_6} = \frac{g_m R_L}{1+g_m \frac{R_1 R_6}{R_1+R_6}} \cdot \frac{R_6}{R_1+R_6}$$

$$A_V = \underset{\substack{\uparrow \\ \text{NON INVERTENTE}}}{g_m R_L} \times \frac{1}{1+g_m R_S /\!/ R_1} \times \frac{R_6}{R_1+R_6}$$

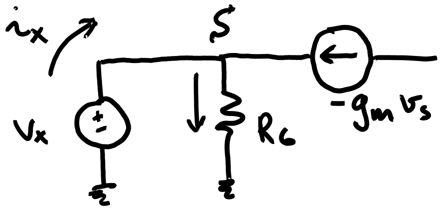
< 1 guadagna meno del "source comune"

$$A_V = \frac{g_m R_L R_G}{R_G + g_m R_I R_G + R_I} \quad \text{per } R_G \gg R_1$$

GATE COMUNE

$$A_V = \frac{g_m R_L}{1 + g_m R_I} \; ; \; \text{per } g_m \text{ grande} \rightarrow \frac{R_L}{R_I}$$

RESISTENZA DI INGRESSO



$$i_x = i_{R_G} + g_m v_s$$

$$i_x = \frac{V_x}{R_G} + g_m V_x$$

$$i_x = V_x \left(\frac{1}{R_G} + g_m \right)$$

$$R_{in} = \frac{V_x}{i_x} = \left(\frac{1 + g_m R_G}{R_G} \right)^{-1} = \frac{R_G}{1 + g_m R_G} = \frac{R_G \cdot \frac{1}{g_m}}{\frac{1}{g_m} + R_G} = R_G /\!/ \frac{1}{g_m}$$

MOLTO BASSA

La resistenza di ingresso di un common gate è $\frac{1}{g_m} /\!/ R_S$ molto bassa, buona per amplificatori di corrente

Resistenza di uscita

$$R_{out} = R_D \quad (\text{senza } r_o)$$

$$R_{out\,CG} = r_o\left[1 + g_m\left(R_G /\!/ R_I\right)\right] /\!/ R_D$$ con r_o non trascurabile