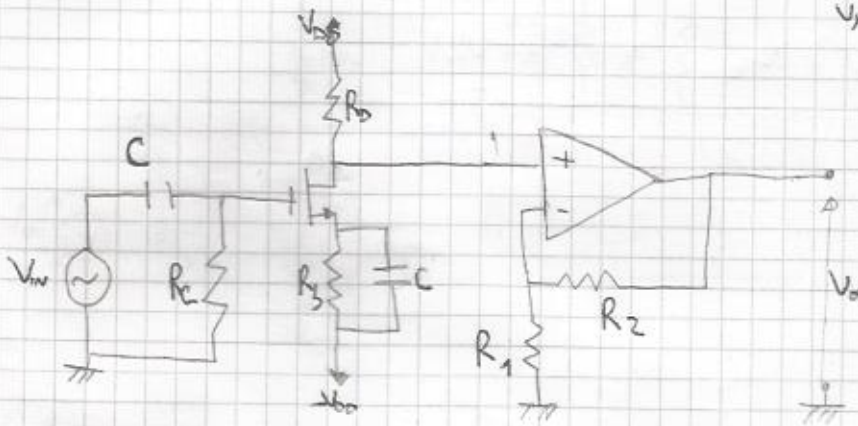
20/09/2010

Determinare R_S in modo che $V_{out} = 0V$, e $A = \frac{V_{out}}{V_{in}}$



$R_G = 10\,k\Omega$ $R_D = 2{,}5\,k\Omega$
$R_1 = 1\,k\Omega$ $R_2 = 4k\Omega$
$V_{DD} = 5V$
$V_T = 1V$ $K = 0{,}5\,mA/V^2$
$L^+ = -L^- = 5V$

$V_{GS} > V_T$

↳ $V_G - V_S = 0 - R_S I_D - (-V_{DD}) = V_{DD} - R_S I_D$

$V_D = V_{DD} - R_D I_D = 0$ ● $0 = 5 - 2{,}5 I_D \Rightarrow \boxed{I_D = 2\,mA}$

$I_D = K(V_{GS} - V_t)^2 \Rightarrow 2 = \frac{1}{2}(V_{GS} - 1)^2 \Rightarrow 4 = V_{GS}^2 - 2V_{GS} + 1$

$\Rightarrow V_{GS}^2 - 2V_{GS} - 3 = 0 \quad 1 \pm \sqrt{1+3}$ ③ ok, $3 > 1$; -1 NO

$\boxed{V_{GS} = 3V} = V_S$

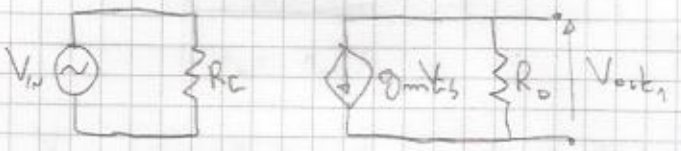
$V_{DS} = V_D - V_S = 0 - (-3) = 3V$

$V_{DS} = 2V_{DD} - I_D R_D - I_D R_S \Rightarrow 3 = 10 - 2 \cdot 2{,}5 - 2 \cdot R_S$

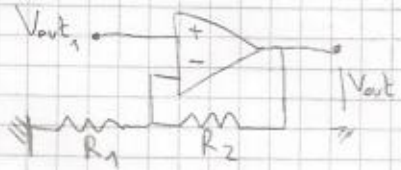
$-2R_S = -2$ $\boxed{R_S = 1K\Omega}$

PICCOLI SEGNALI

$g_m = 2K(V_{GS} - V_T)$ $\boxed{g_m = 2}$



$V_{out_1} = -g_m V_{IN} \cdot R_D$
$= -5 V_{IN}$



$V_{out} = V_{out_1} \cdot \left(1 + \frac{R_2}{R_1}\right) = 5 V_{out_1} \Rightarrow -25 V_{IN}$

$\boxed{A_V = \frac{V_{out}}{V_{IN}} = -25}$