ANALOG IC DESIGN.

01 FEBRUARY 2006

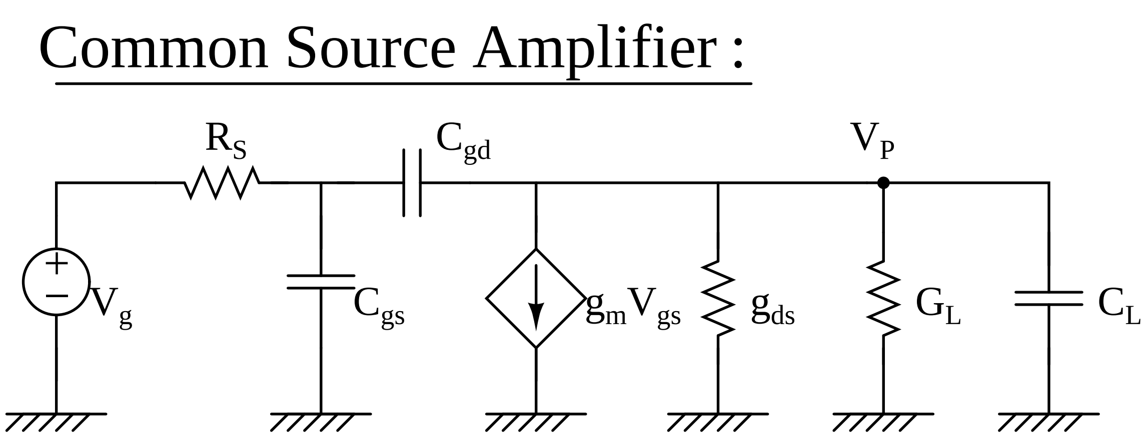
1

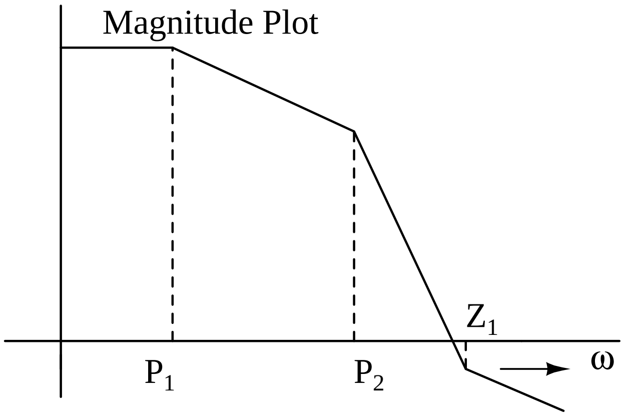
$$\frac{V_0}{V_i} = \frac{g_m}{g_{ds} + G_L} = \frac{1 - \frac{sC_{gd}}{g_m}}{(1 + \frac{s}{P_1})(1 + \frac{s}{P_2})};$$

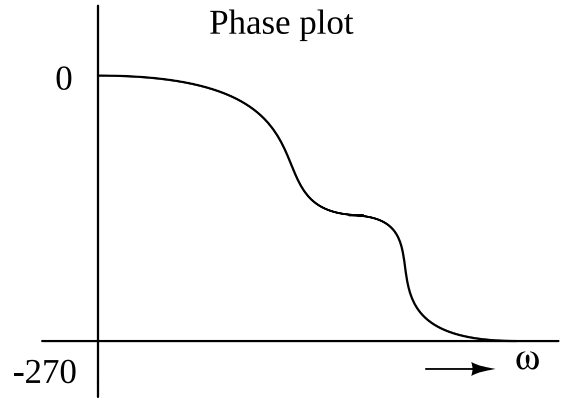
$$P_1 \approx \frac{1}{R_S(C_{gs} + C_{gs}A_{dc})}$$

$$P_2 \approx \frac{g_m + g_{ds} + G_L + G_s}{C_{gs} + C_L}$$

•C_{GD} causes pole spitting - i.e poles move apart as C_{GD} increases
The zero of the transfer function is at $Z = \frac{g_m}{C_{GD}}$







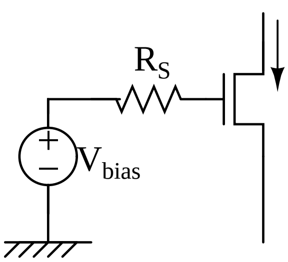
The zero can be before or after the second pole

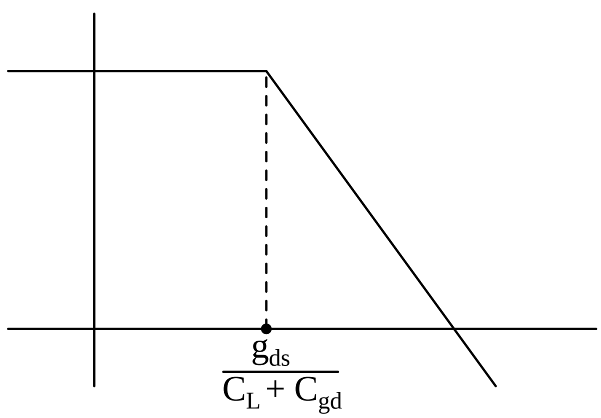
2

loading increases as the size increases
⇒ Amplifer stages of Common source amplifier has moderate Z_{out}

$$Z_{out} = \frac{1}{g_{ds} + sC_L + sg_{gd}}$$

As we increase frequency; it becomes a worse current source.





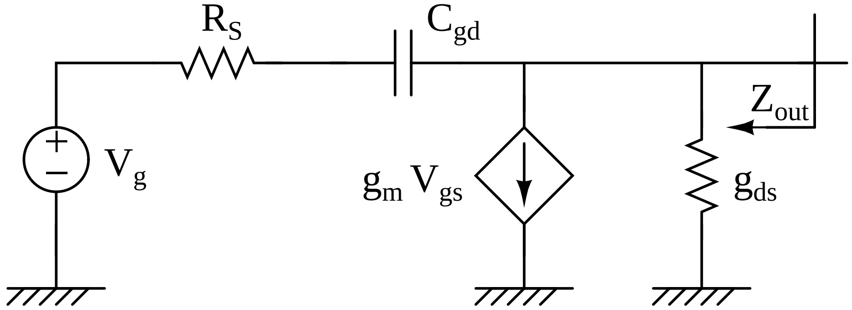
3

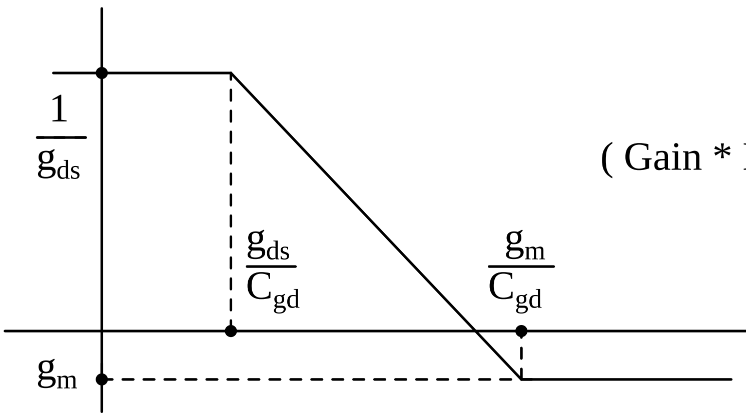
At high frequencies; we can neglect R_s compared to C_{gs}; C_{gs} and C_{gd} will come in series and will have a low impedence
At high frequencies..

To simplify analysis,
remove C_{gs}

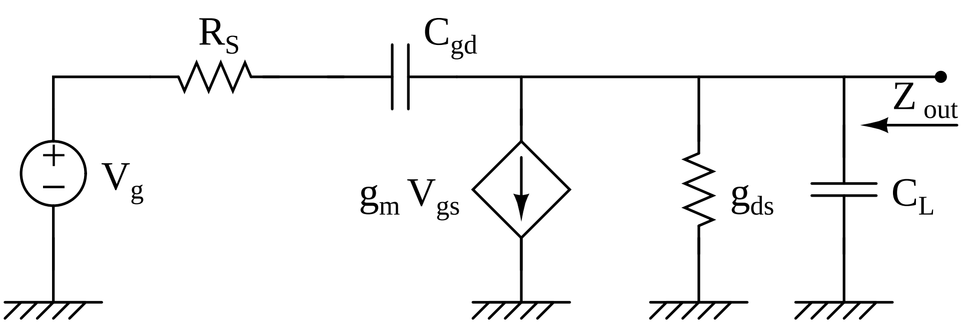
Low f $\Rightarrow Z_{out} = \frac{1}{g_{ds}}$

High f $\Rightarrow Z_{out} = \frac{1}{g_{ds} + G_s + g_m}$





(Gain * B.W = Const)



(If we include C_L)