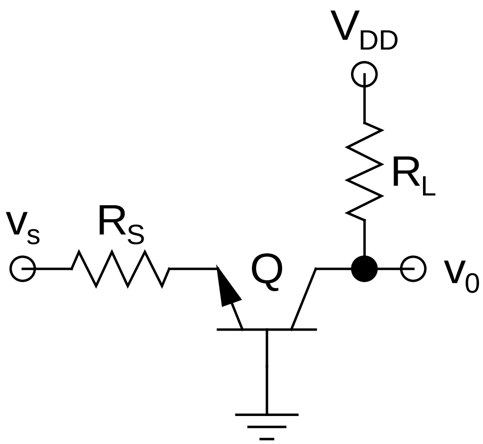
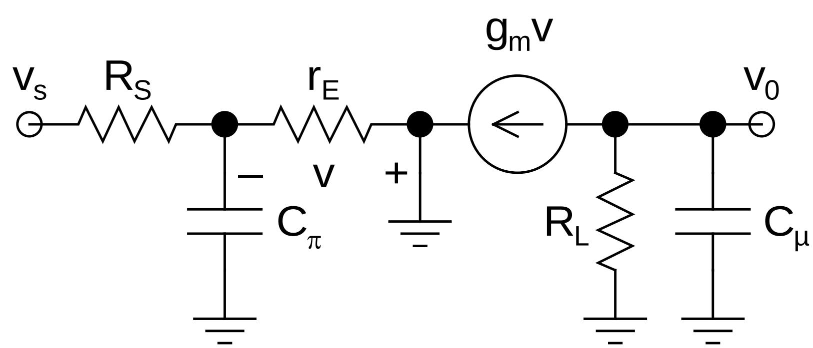
- ***CB***:



ac Schematic



High-Frequency Equivalent

➢ ***Note that there is no input-output coupling capacitor present in this circuit***

$\Rightarrow$ ***Miller effect will be absent***, and the ***circuit will have very high f_H***

- ***C_π***:

  $$R_\pi^0 = R_S \,||\, r_E \quad \text{and} \quad \tau_1 = R_\pi^0 C_\pi$$

- ***C_μ***:

  $$R_\mu^0 = R_L \quad \text{and} \quad \tau_2 = R_\mu^0 C_\mu$$

- Taking the ***values*** of our previous ***example***:

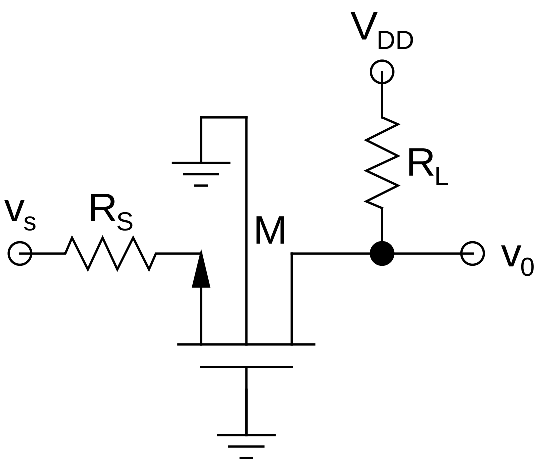
  $$R_\pi^0 = 25.34\ \Omega,\ \ \tau_1 = 0.253\ \text{ns}$$

  $$R_\mu^0 = 2\ \text{k}\Omega,\ \ \tau_2 = 1\ \text{ns}$$

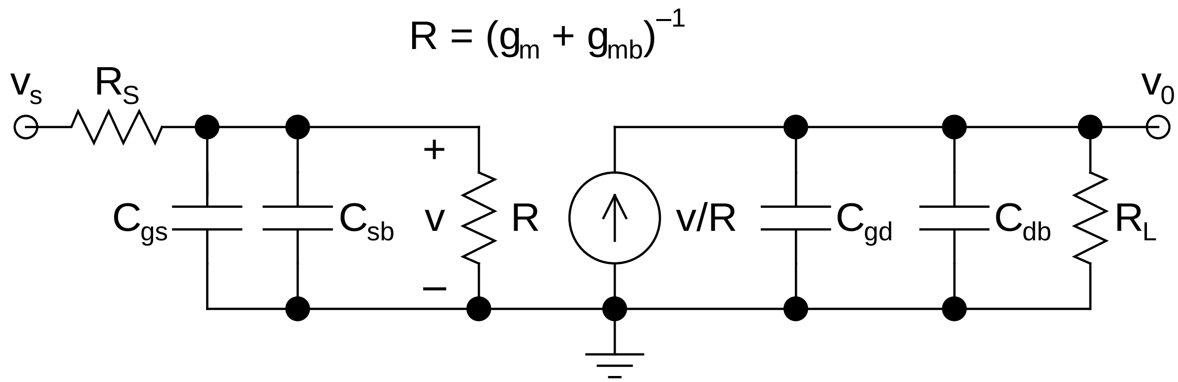
  $$\Rightarrow \tau_{net} = 1.25\ \text{ns} \quad \text{and} \quad f_H = 127.3\ \text{MHz}$$

- ***Note the enormous increase of f_H from about 4 MHz for a CE amplifier***

- ***CG***:



ac Schematic

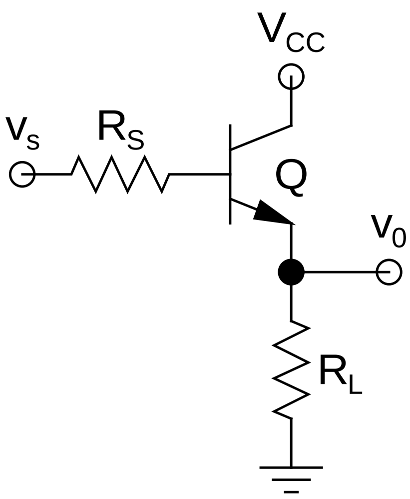


High-Frequency Equivalent

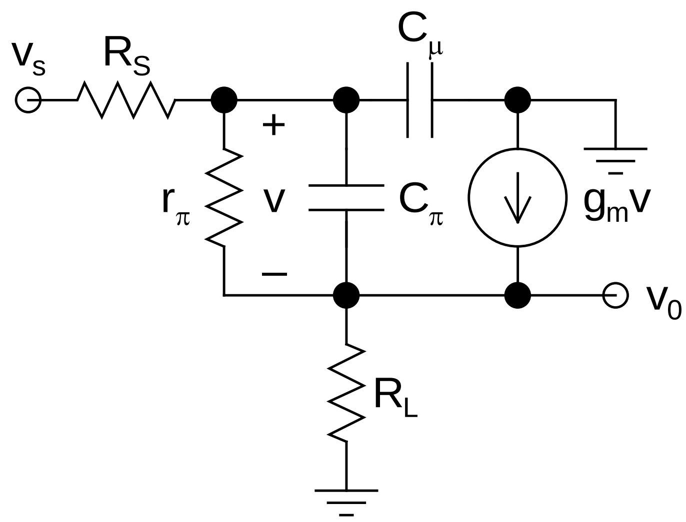
➢ ***Note that all 4 capacitors would be present*** and ***none could be eliminated***

- ***C_{gs} and C_{sb} are in parallel***
  - $\Rightarrow$ ***Can be clubbed to a single capacitor*** $C_1 = C_{gs} + C_{sb}$, with time constant τ_1
- Also, ***C_{gd} and C_{db} can be clubbed to another single capacitor*** $C_2 = C_{gd} + C_{db}$, with time constant τ_2
- ***Again note the absence of any input-output coupling capacitor***
  - $\Rightarrow$ ***This circuit should also have very high f_H***
- ***C_1***: $R_1^0 = R_S \parallel R$ and $\tau_1 = R_1^0 C_1$
- ***C_2***: $R_2^0 = R_L$ and $\tau_2 = R_2^0 C_2$

- ***CC***:



ac Schematic



High-Frequency Equivalent

- ***This circuit is slightly more involved*** **-** ***can't be done by inspection***
- ***But we will have some other Standard Forms***

- This circuit has a ***peculiar frequency response***
  - ***At midband***:

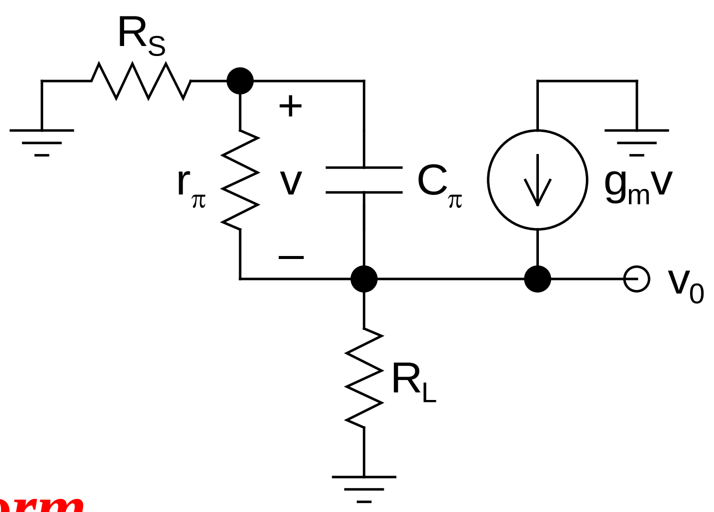
    $A_v = v_0/v_s = [R_L/(R_L + r_E)] \times [R_i/(R_i + R_S)]$

    $R_i = r_\pi + (\beta + 1)R_L$
  - ***Beyond f_H, as $f\uparrow$, reactance of $C_\pi\downarrow$ earlier than that of C_μ*** (***since, in general, $C_\pi >> C_\mu$***)
  - Eventually, ***reactance of C_π would approach zero***, thus ***shorting out r_π***
  - Under this condition, circuit behaves like a ***simple voltage divider*** with a ***gain*** of $R_L/(R_L + R_S)$
  - ***If $f\uparrow$ further***, then ***eventually C_μ also will short out***, and ***v_0 would go to zero***

- Thus, the ***frequency response*** of this circuit looks like a ***staircase***, having ***two steps***

➢ ***C_π***:

- R_π^0 ***can't be obtained by inspection***
- ***Analyze the circuit and show that***:



$$R_\pi^0 = r_\pi \,||\, \left(\frac{R_S + R_L}{1 + g_m R_L} \right)$$

$$\Rightarrow \tau_1 = R_\pi^0 C_\pi$$

- This is another ***Standard Form*** and the ***topology should be carefully noted***