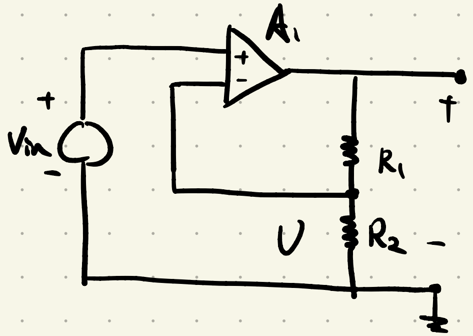
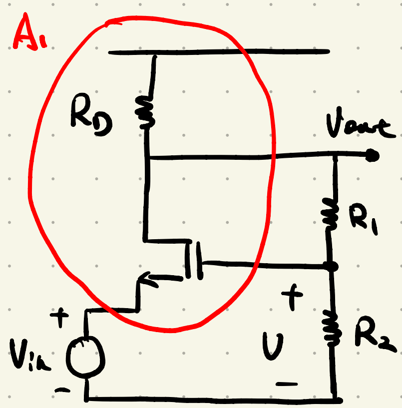
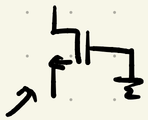
Lec 35

- Example of Voltage-Voltage Feedback
- Application Example

Example







$\frac{1}{g_m}$

$\begin{cases} R_1+R_2 \text{ Very Large} \\ \lambda=0 \end{cases}$

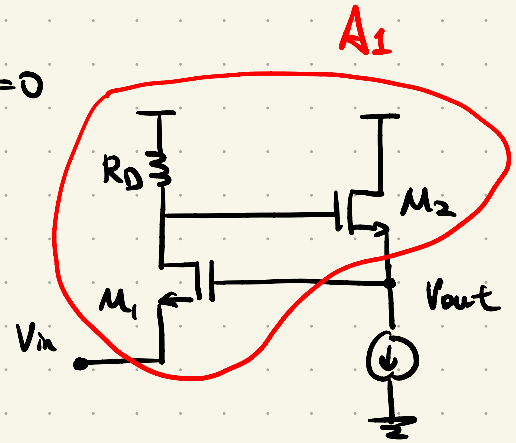
$$KA_1 = \frac{g_m R_D R_2}{R_1+R_2}$$

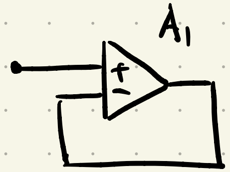
Closed-Loop Input Imp. $= \frac{1}{g_m}\left(1+\frac{g_m R_D R_2}{R_1+R_2}\right)$

Closed-Loop Output Imp. $= \dfrac{R_D}{1+\frac{g_m R_D R_2}{R_1+R_2}}$

Example

$\lambda = 0$



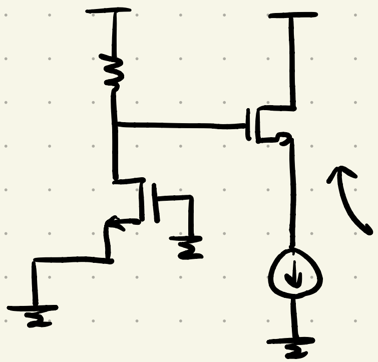


$K=1$

Closed-Loop Input Imp. $= \frac{1}{g_{m_1}}(1+A_1)$

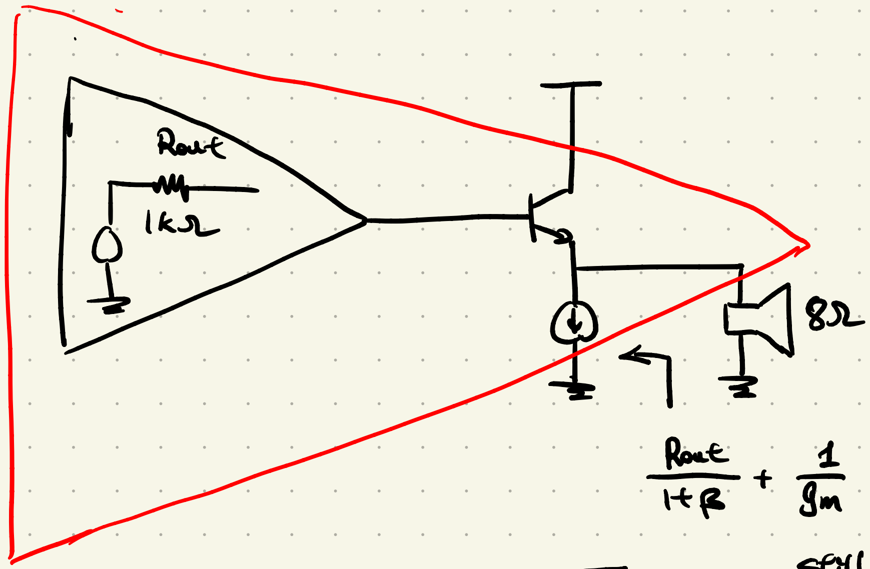
$= \frac{1}{g_{m_1}}(1+g_m R_D)$

Closed-Loop Output Imp. $= \frac{1}{g_{m2}} \frac{1}{1+g_m R_D}$



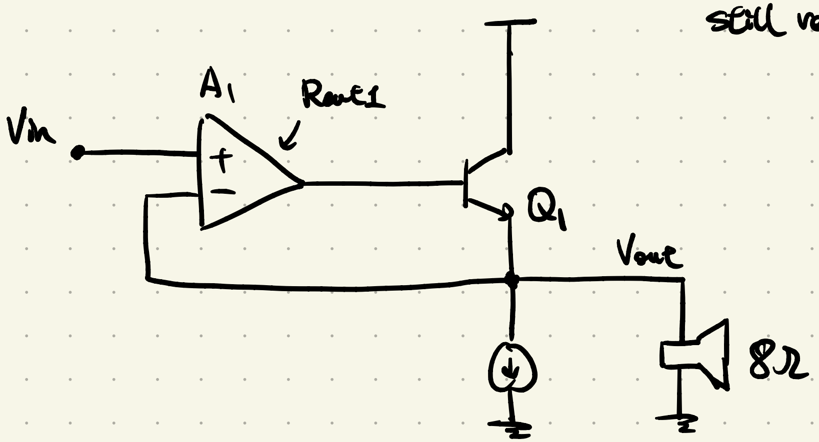
$R_{out} = \frac{1}{g_{m2}}$

Application Example: Audio Amp



$$\frac{R_{out}}{1+\beta} + \frac{1}{g_m} > 8\Omega$$

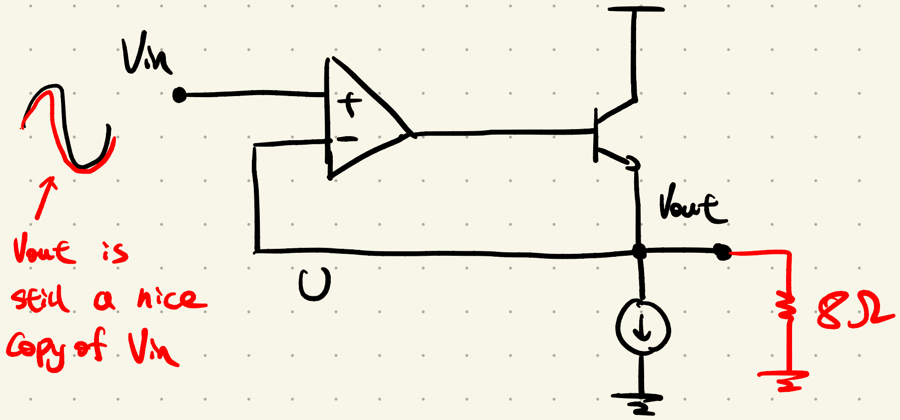
still very big



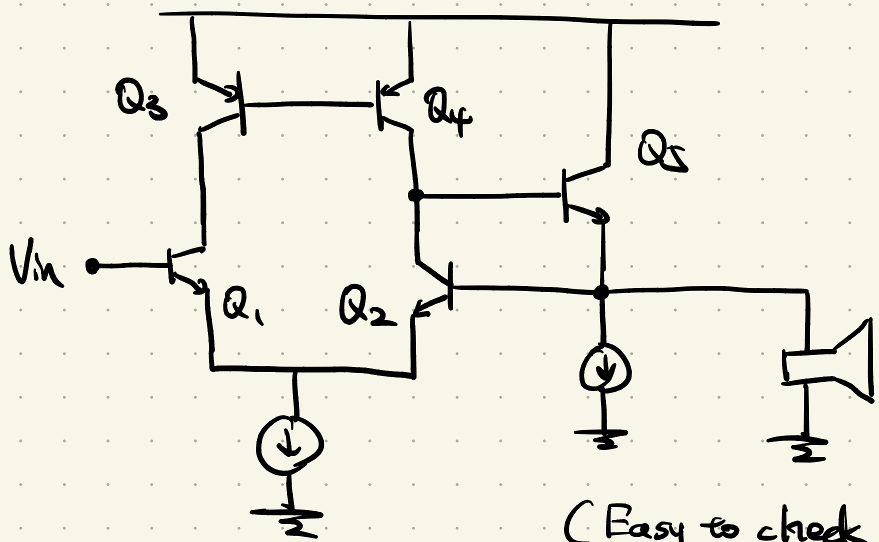
Closed-Loop Output Imp.

$$\frac{\text{Open-Loop Output Imp.}}{1 + \text{Loop gain}} = \frac{\frac{R_{out}}{1+\beta} + \frac{1}{g_m}}{1 + A_0}$$

Another Perspective:



Example How to implement the op amp in the previous example

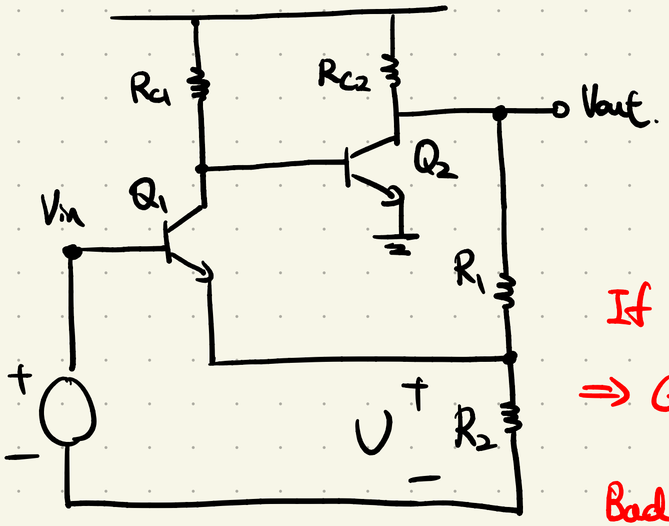


$A_0 \approx g_{mN} (r_{oN} // r_{oP})$

(Easy to check it is a negative feedback)

Example

Can we use a transistor in the feedback network?

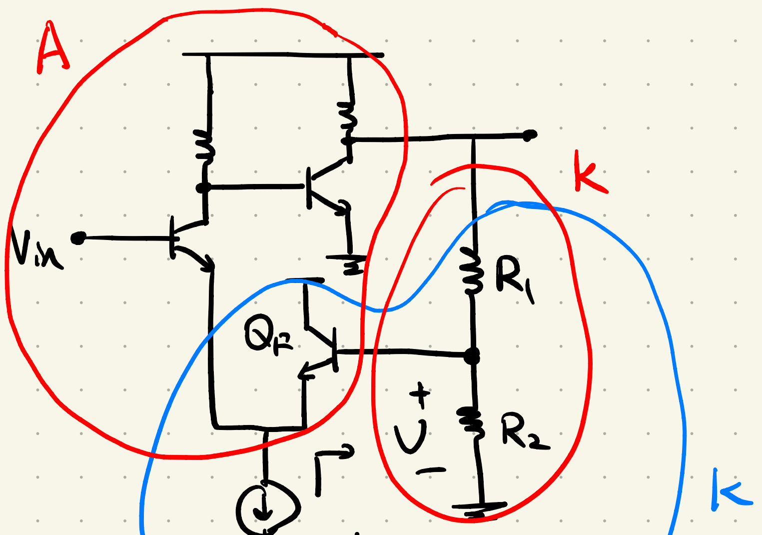


If $R_1 + R_2$ is large

$\Rightarrow$ Good for sensing V_{out}

Bad for returning U

V-V Feedback



$$\frac{1}{g_{mF}} + \frac{R_1 // R_2}{1+\beta}$$