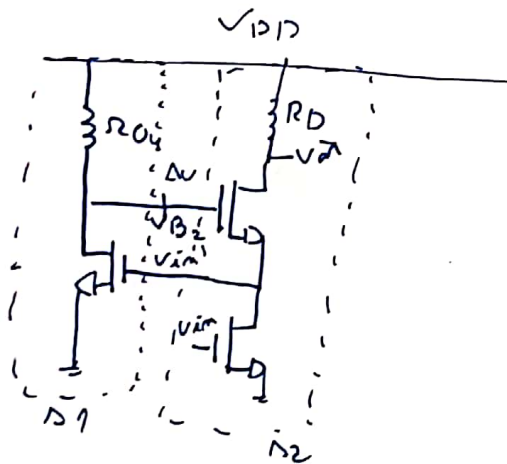
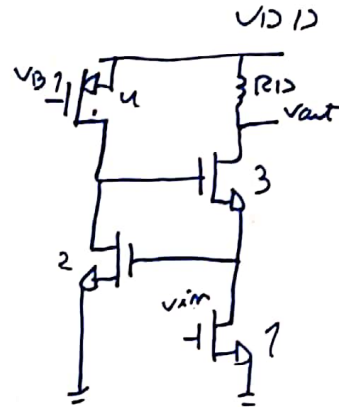
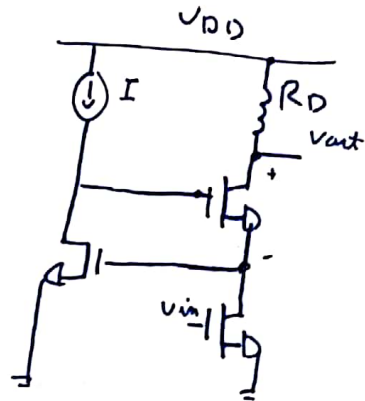


Simple active cascode (not good)



assuming λ_1 in the saturation
and assume λ_{im}
The gain is calculated

$$\beta \frac{v_{B2}}{v_{in}} = \frac{-g_{m2} \times r_{O4} \times r_{O2}}{r_{O4} + r_{O2}} = \frac{\Delta V}{\Delta v} \text{ Feedback gain}$$

where $g_{m2} r_{O2} \approx \frac{1}{V_{ID}}$

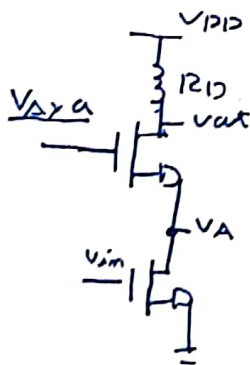
and where $r_{O4} \approx \frac{1}{I_D}$

$I_D \rightarrow \frac{W}{L}$

$r_{O4} \rightarrow$ Increases more with L

$V_{B1} \uparrow \rightarrow$ decreases I_D

$\downarrow \rightarrow$ Increases I_D



as V_A decreases

V_{Ax} Increases

Increases

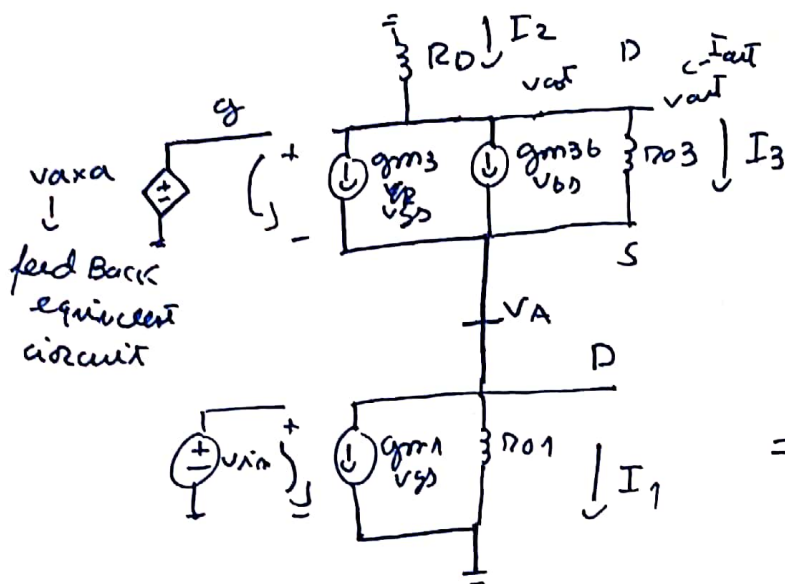
\downarrow
good output

good output impedance

good current source

low output impedance
good voltage source

IT serves To Increase
output Impedance
Ba a reason of α



$$\begin{aligned}
 & g_m v_{im} + \frac{V_A}{r_{o1}} \\
 & = -\frac{v_{out}}{R_D} \rightarrow I_2 \\
 & = \frac{v_{out} - V_A}{r_{o3}} + g_m3(v_{axa} - V_A) + g_m36(-V_A) \\
 & \quad \downarrow I_3
 \end{aligned}$$

$$I_1 = I_2$$

$$g_m v_{im} + \frac{V_A}{r_{o1}} = -\frac{v_{out}}{R_D}$$

$$\frac{V_A}{r_{o1}} = \frac{-v_{out} - g_m v_{im} R_D}{R_D}$$

$$V_A = \frac{-v_{out} r_{o1} - g_m v_{im} R_D r_{o1}}{R_D}$$

$$I_2 = I_3$$

$$\frac{-v_{out}}{R_{D1}} = \frac{-v_{out}}{r_{o3}} - \frac{V_A}{r_{o3}} + g_m3 v_{axa} - g_m3 v_A - g_m36 v_A$$

$$\frac{-v_{out}}{R_{D1}} + \frac{v_{out}}{r_{o3}} = -V_A \left(\frac{1}{r_{o3}} - g_m3 a + g_m3 + g_m36 \right)$$

$$-v_{out} \left(\frac{1}{r_{o3}} - \frac{1}{r_{o1}} + \frac{r_{o1}}{R_D} \left(\frac{1}{r_{o3}} - g_m3 a + g_m3 + g_m36 \right) \right)$$

$$= \frac{v_{im}}{R_D} \left(\frac{1}{r_{o3}} - g_m3 a + g_m3 + g_m36 \right) g_m1$$

$$\begin{aligned}
 \frac{+v_{out}}{v_{im}} & = \frac{-g_m1 \left(1 + r_{o3} (g_m3 + g_m36 - g_m3 a) \right)}{R_D - \frac{R_D r_{o3}}{r_{o1}} + r_{o1} \left(1 + r_{o3} (g_m3 + g_m36 - g_m3 a) \right)} \quad \text{Feed Back gain}
 \end{aligned}$$