Mitigating the effect of R.H.P. Zero

Method-1 : Nulling Resistor.

→ $R_c \geq \frac{1}{g_{m_2}}$

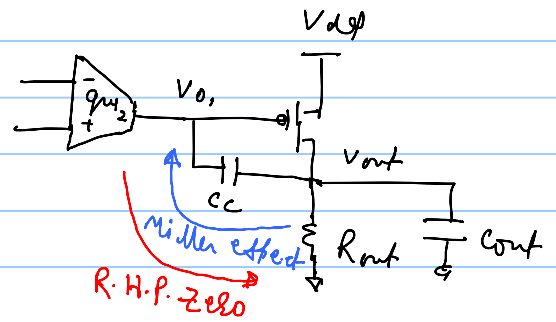
R.H.P. will go away or convert to L.H.P.

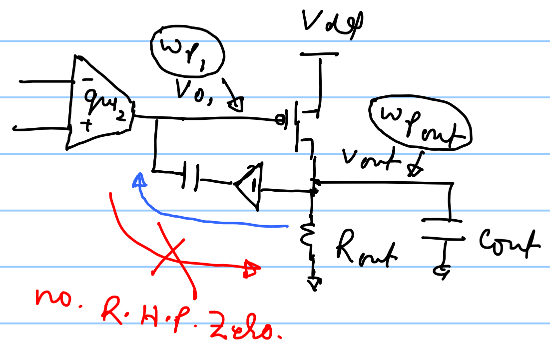
Method-2

choose $g_{m_3} >> g_{m_2}$

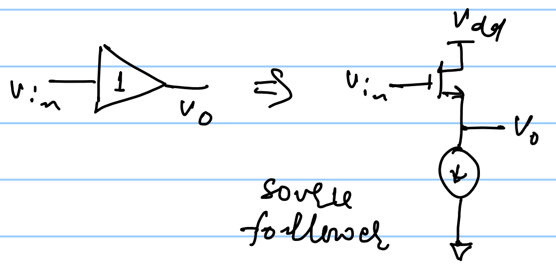
so R.H.P. is pushed at high freq. and phase margin is not affected.

Method-3



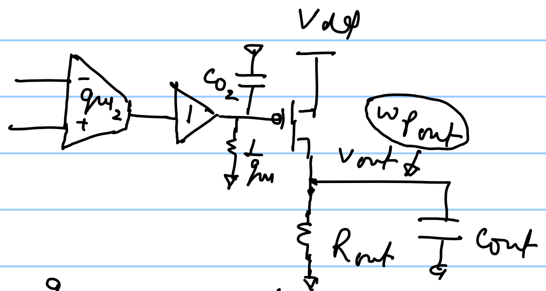


Vdd
ω_{p1}
V_{o1}
g_{m2}
−
+
1
$\omega_{p_{out}}$
V_{out}
R_{out}
C_{out}
no. R.H.P. Zero.



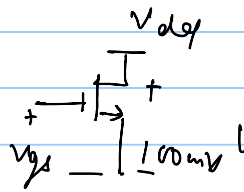
V_{in}
1
V_o
⇒
Vdd
V_{in}
V_o
source follower

Reducing the effect of ω_{p_1} if ω_{out} is dominant



$$\omega_{p_1} = \frac{g_m}{C_{O_2}} >> \frac{1}{R_{O_2} C_{O_2}}$$

Reducing the gate capacitance.



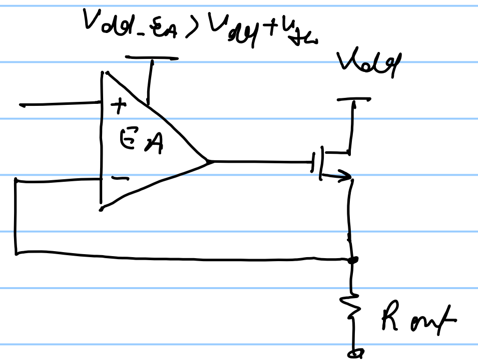
$V_{gs} > V_{th}$ if $V_{drop} = 100\,mV$

$V_s = V_{dd} - 100\,mV$

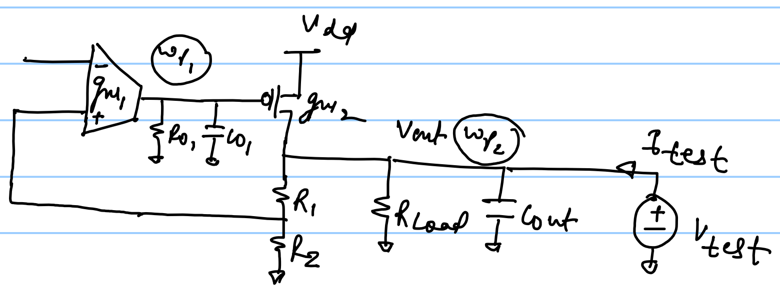
$V_g > V_{th} + V_{dd} - 100\,mV$

$V_{th} \approx 500\,mV$

$V_g > V_{dd} + 400\,mV$



Output Impedence of PMOS LDO



$$R_{out} = (R_1 + R_2) \| r_{o2} \| R_{Load}$$

$$Z_{out} = \frac{v_{test}}{i_{test}}$$

DC output impedance.

$$Z_{out}(dc) = \frac{R_{out}}{1 + \beta A_0}$$

$$A_0 = g_{m1} R_{o1} \times g_{m2} R_{out}$$

$$Z_{out} = \frac{R_{out} / (1 + R_{out} C_{out} s)}{1 + \beta A(s)} = \frac{R_{out}}{(1 + s/\omega_{p2})\left(1 + \beta \frac{A_0}{(1 + s/\omega_{p1})(1 + s/\omega_{p2})}\right)}$$

$$= \frac{R_{out}}{\cancel{(1 + s/\omega_{p2})}} \frac{(1 + s/\omega_{p1})\cancel{(1 + s/\omega_{p2})}}{\left((1 + s/\omega_{p1})(1 + s/\omega_{p2}) + \beta A_0\right)}$$

$$= \frac{R_{out}\,(1 + s/\omega_{p_1})}{(1 + s/\omega_{p_1})(1 + s/\omega_{p_2}) + \beta A_0}$$

for $\omega < \omega_{ugb}$

$$Z_{out} = \frac{R_{out}\,(1 + s/\omega_{p_1})}{1 + s/\omega_{p_1} + \beta A_0} = \left(\frac{R_{out}}{1 + \beta A_0}\right) \frac{(1 + s/\omega_{p_1})}{1 + s/_{(1+\beta A_0)\omega_{p_1}}}$$