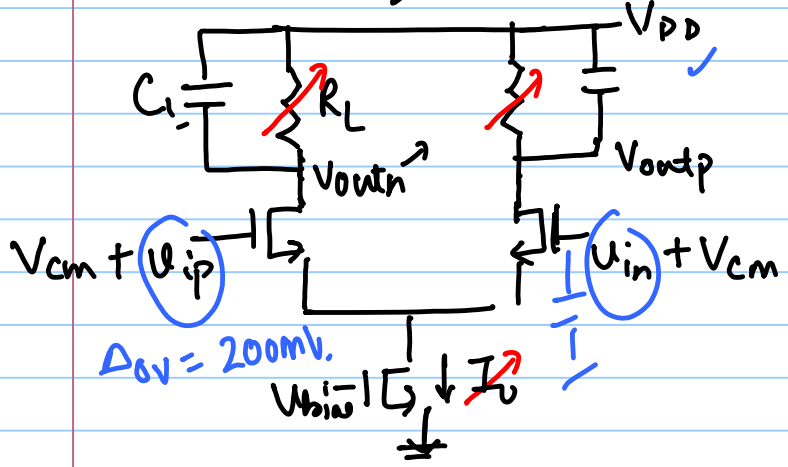
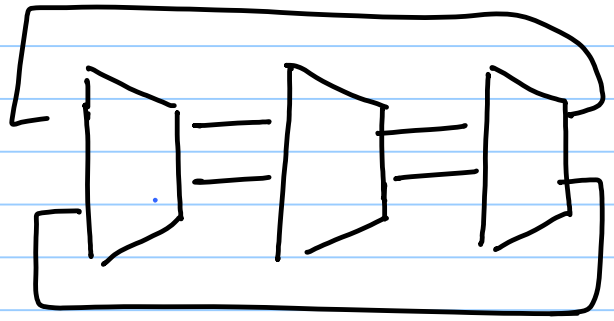
Lecture #21

Note Title 18-09-2018

Small swing oscillators.





$V_{outp} = V_{DD}$

$V_{outn} = V_{DD} - I_0 R_L$

$$A(s) = \frac{g_m R_L}{1 + s R_L C_L} = \frac{A_0}{1 + s/\omega_p}$$

$$\omega_{osc} = \sqrt{3}\,\omega_p = \frac{\sqrt{3}}{R_L C_L}$$

Amplitude $= I_0 R_L$

$I_0 \rightarrow 2I_0$ $\quad I_0 R_L \quad 2 I_0 R_L$

$R_L \rightarrow 2R_L$

$C_L \rightarrow C_L/2$

1. Oscillation amplitude

2. " frequency.

$f_{out} \xrightarrow{R} 2 f_{out}$

$V_{out} \xrightarrow{R} V_{out}/2$

$$\omega_{out_1} = \frac{1}{RC}$$

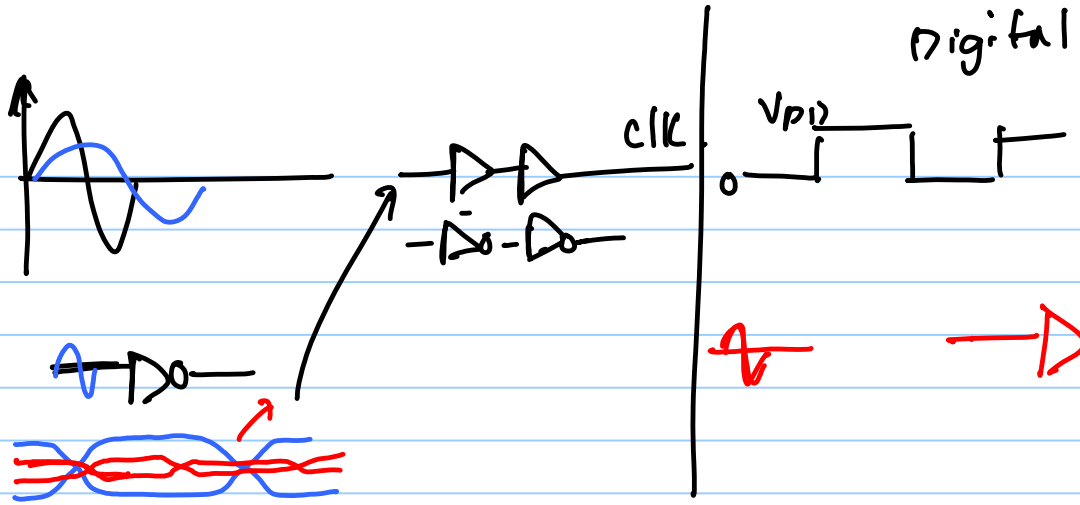
$$\omega_{out_2} = \frac{1}{\frac{R}{2} \cdot 2C}$$

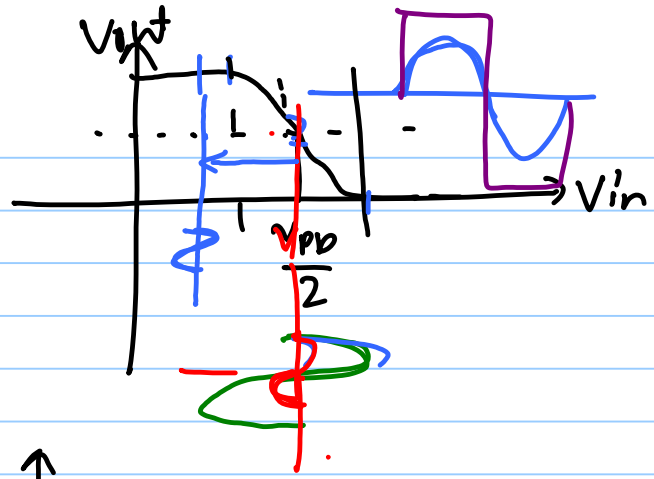
$$\omega_{out_3} = \frac{1}{2R \cdot C/2}$$

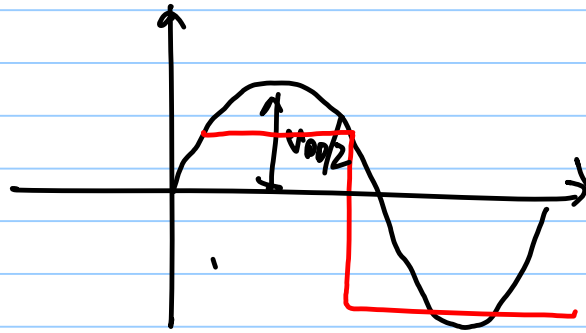
$V_{out} = I_0 \cdot R$

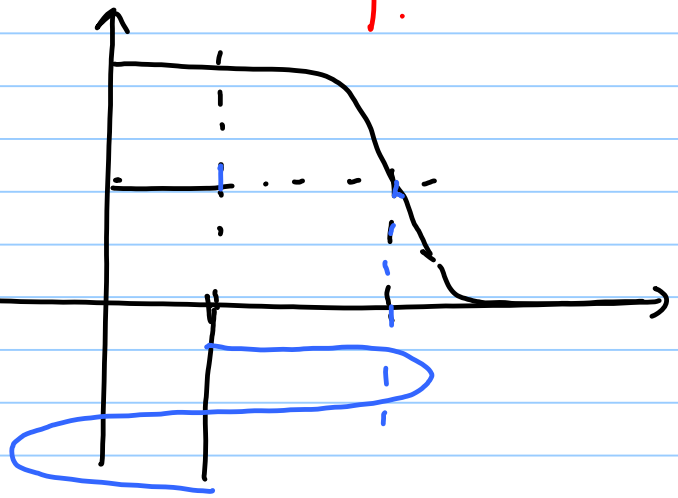
$V_{out} = 2I_0 \cdot R/2$

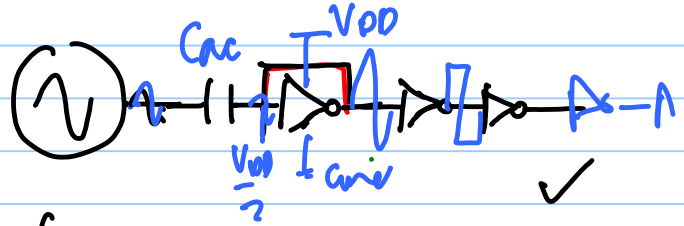
$V_{out} = \frac{I_0}{2} \cdot 2R.$











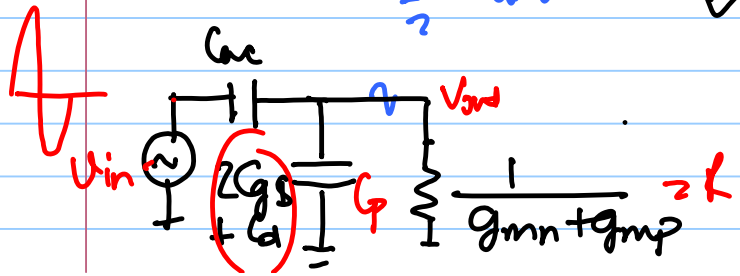
1. Power consumption

2.

0 , 1

0 Vdd.

400mV, 600mV. Digital.



$$\frac{V_{out}}{V_{in}} = \frac{\left(R \,||\, \frac{1}{s C_P}\right)}{\left(R \,||\, \frac{1}{s C_P}\right) + \frac{1}{s C_{ac}}}$$

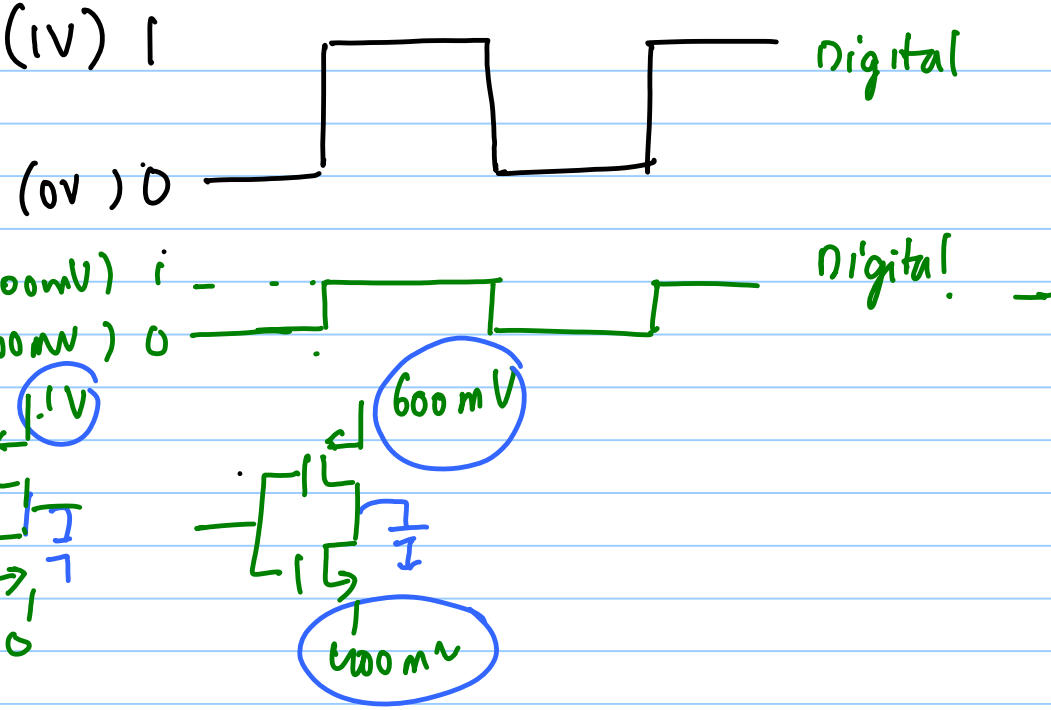
$$\approx \frac{C_{ac}}{C_{ac}+C_P}$$

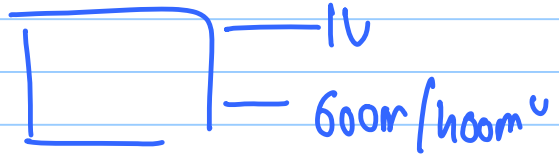
f_1 A_1

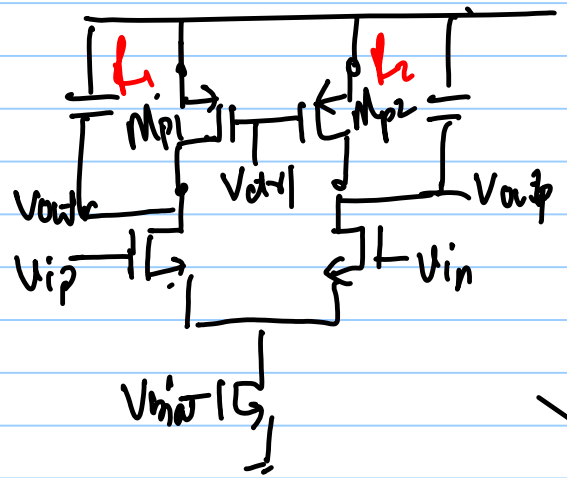
f_2 A_2

$\omega_p = \frac{f_3}{RC}$

$A = I_0 . R$







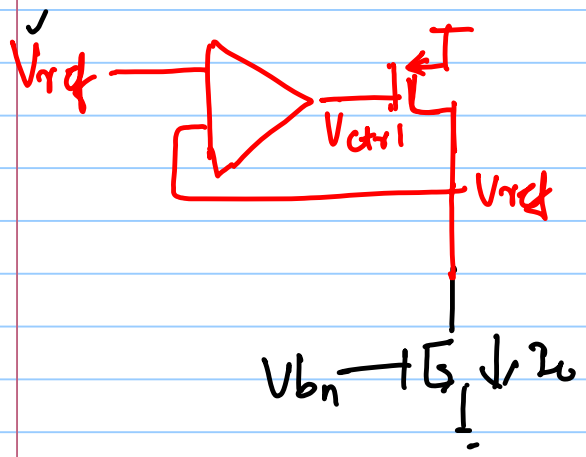
V_{outp}, V_{outn} — V_{DD} / $V_{DD} - I_0 . R_L$

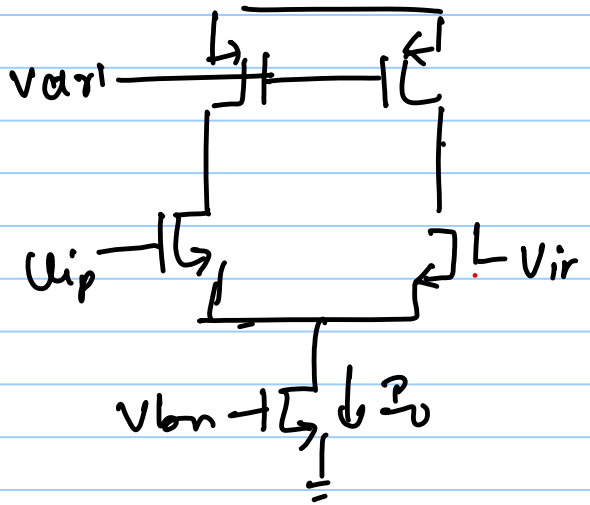
$V_{cm,out}$ — $V_{DD} - \frac{I_0 . R_L}{2}$

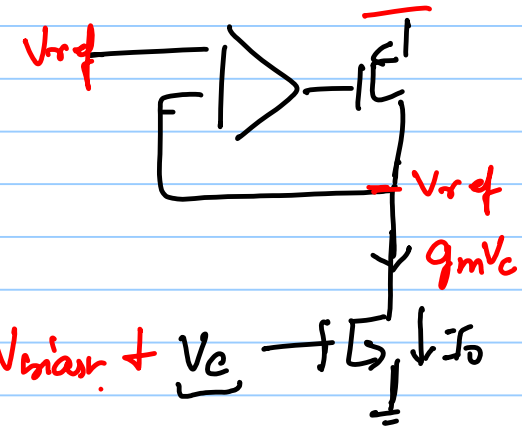
$\frac{I_0}{2} = \frac{k_n'}{L} \left((V_{DD} - V_{ctrl} - |V_{THp}|)(V_{DD} - V_{cm,out}) - \frac{V_{SD}^2}{2} \right)$

$$R \approx \frac{1}{\frac{kW}{L}\left((V_{DD}-V_{Ctrl}-|V_{TP}|)-\frac{V_{SD}}{2}\right)} = \frac{V_{SD}}{(I_D/2)}$$

$$I_D = \frac{KW}{L}\left[(V_{DD}-V_{Ctrl}-|V_{TP}|)\left(V_{DD}-V_{out}\right)-\left\{\frac{V_{DD}-V_{out}}{2}\right\}\right]$$







$$f_{osc} = \frac{\sqrt{3}}{RC} = \frac{\sqrt{3}\,(P_{total})}{C\,(V_{DD}-V_{ref})}$$

$$R = \frac{V_{DD}-V_{ref}}{P_{total}}$$

Amp: $(V_{DD} - V_{ref})$