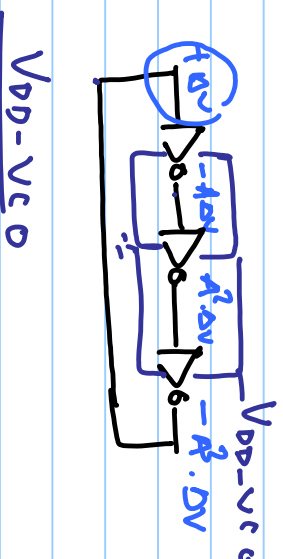
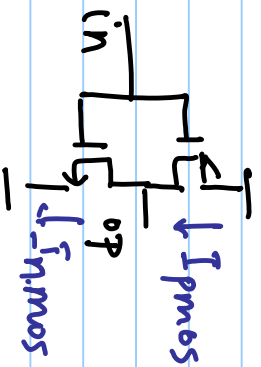
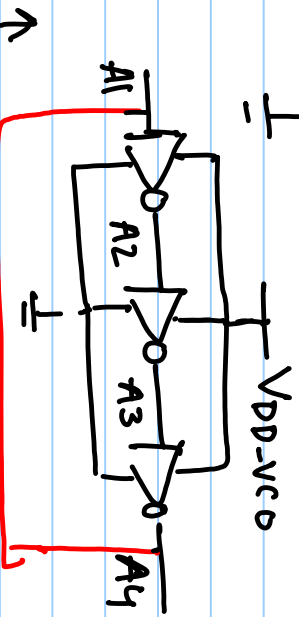
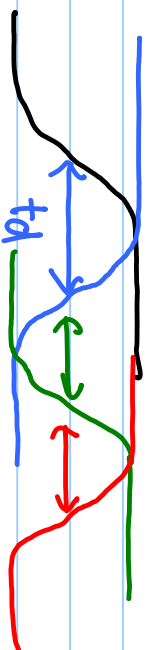


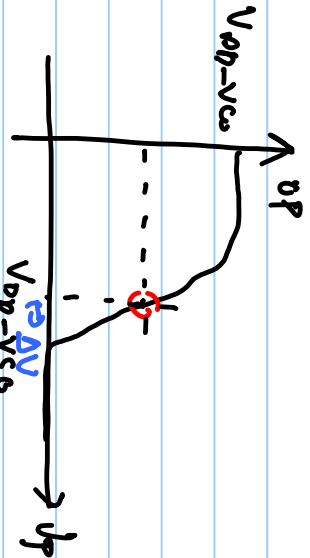
# Lecture # 23

## Large-swing oscillators

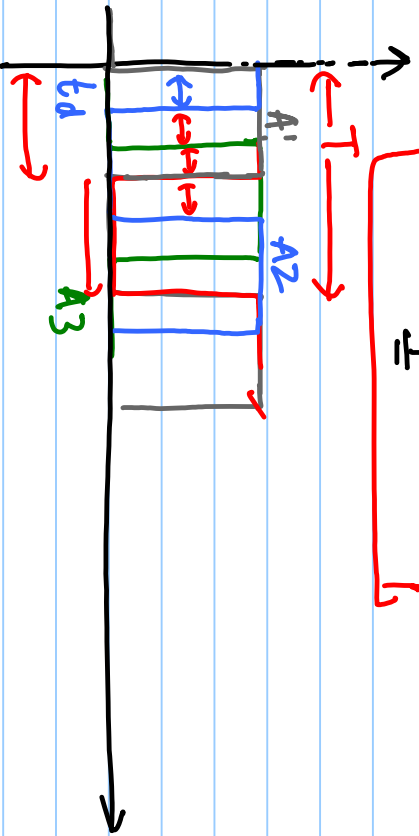
$$0 < V_{out} \leq V_{DD-V_{ce0}}$$



$$f_{osc} = \frac{1}{6 t_d}$$

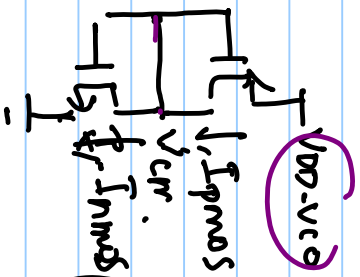


$$I_{pmos} = I_{nmos}$$



$$t_d A1 - A4 = 3 t_d = \frac{T}{2}$$

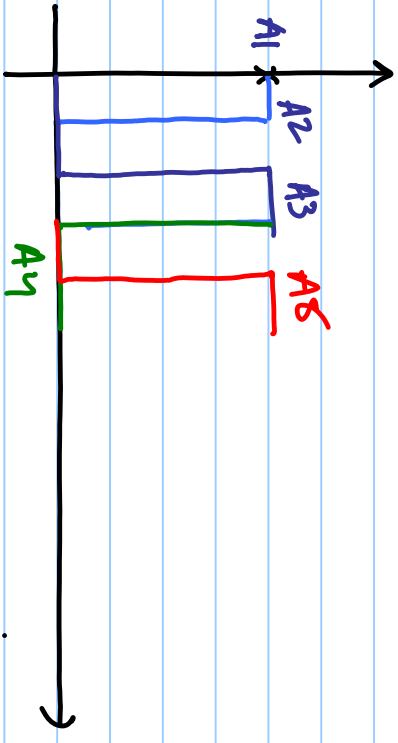
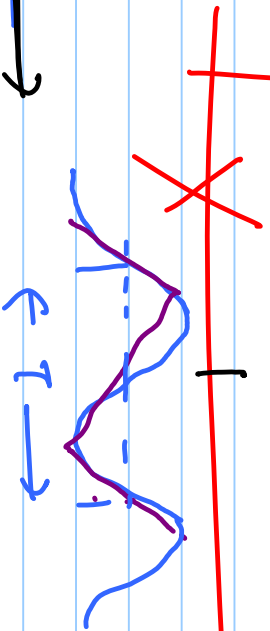
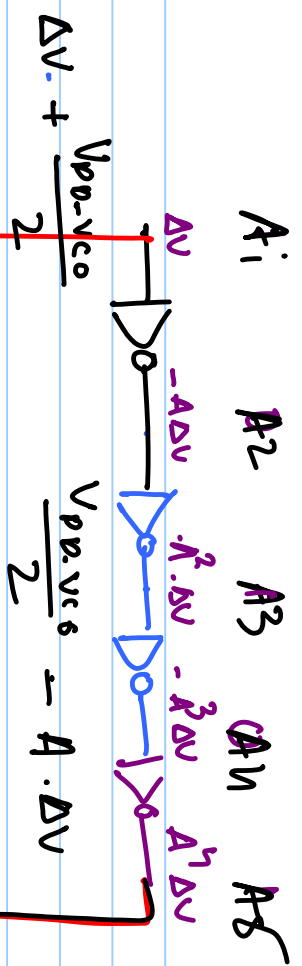
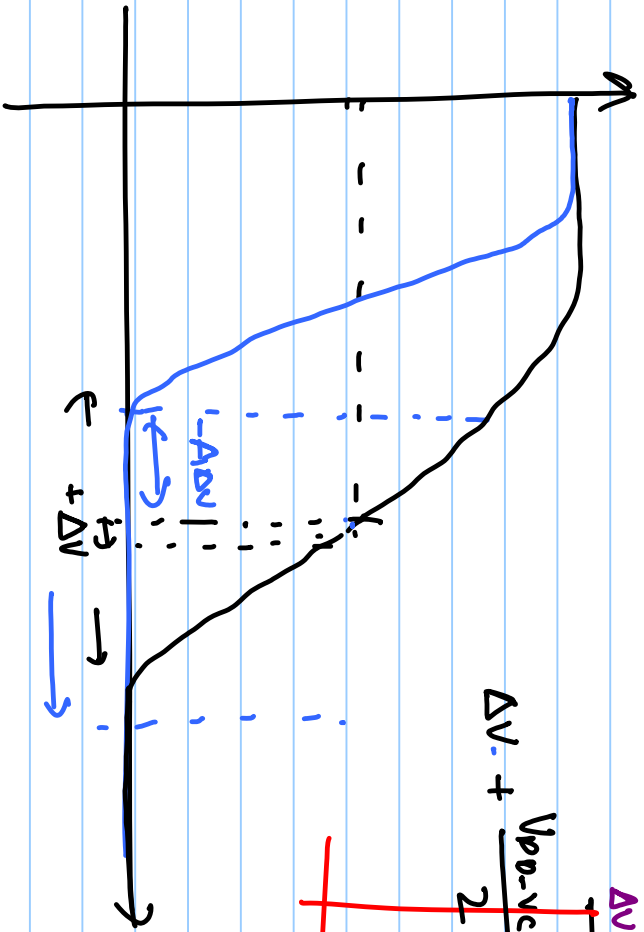
$$t_d = \frac{T}{6}$$

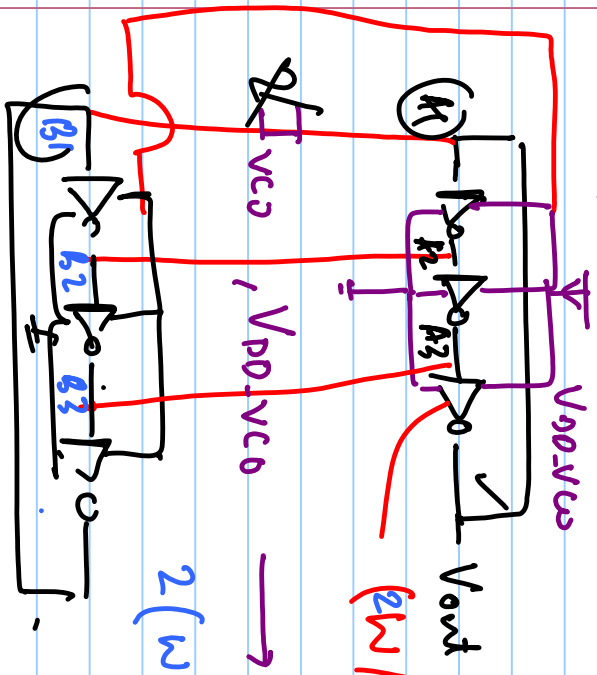
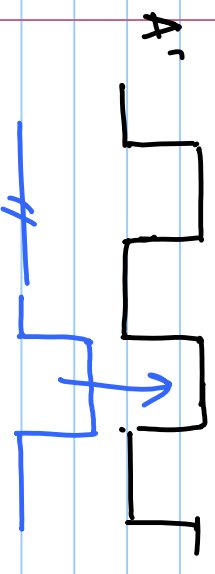
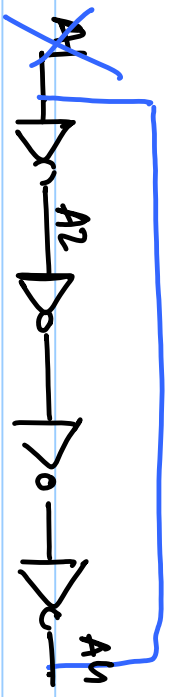


$$\left(\frac{W}{L}\right)_n = \frac{240 \mu\text{m}}{180 \text{ nm}}$$

$$\left(\frac{W}{L}\right)_p \cdot I_{pmos} = I_{pnmos}$$

$$V_{cm} = \frac{V_{DD} - V_{IO}}{2}$$



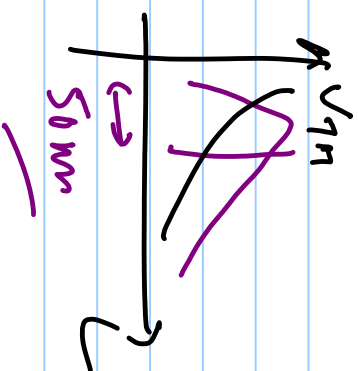
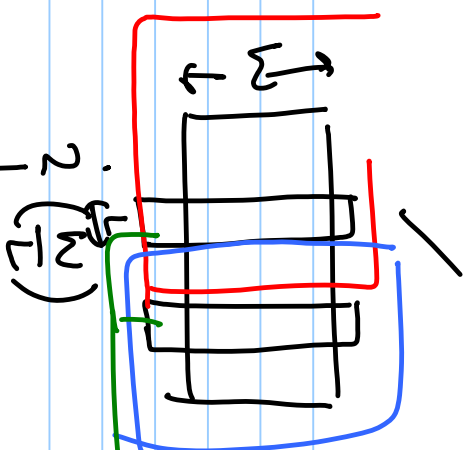
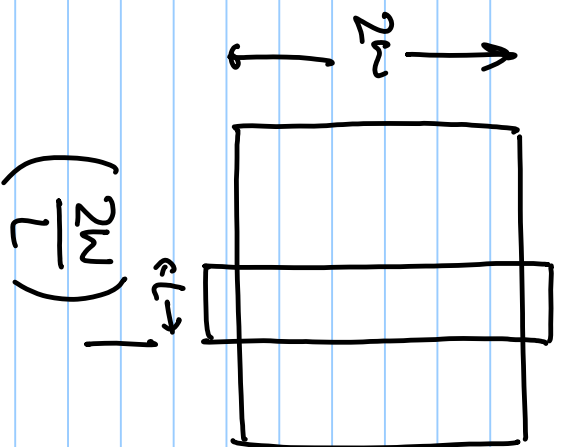
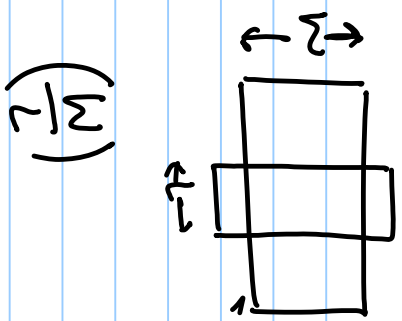


$2\omega/L)_p, (k-1/L)_n$

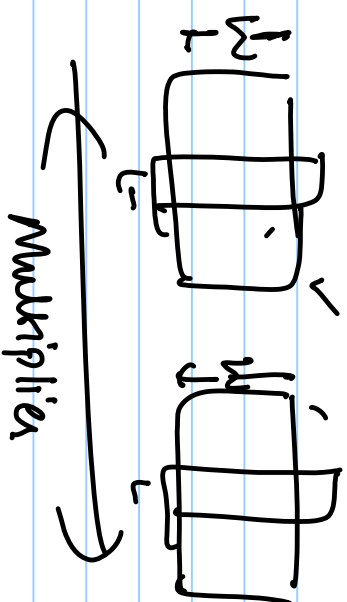
Phase Noise  $\rightarrow 2(\omega/L)_p, 2(\omega/L)_n$

$(-85 \text{ dBc/Hz @ } 1 \text{ MHz})$   
 $\downarrow$   
 $-88 \text{ dBc/Hz @ } 1 \text{ MHz}$





Multiplicator  $\times$  No. of fingers  $\times (\frac{W}{L})$



Mul  $\times$  NF  $\times (\frac{W}{L})$

5  $\mu m$

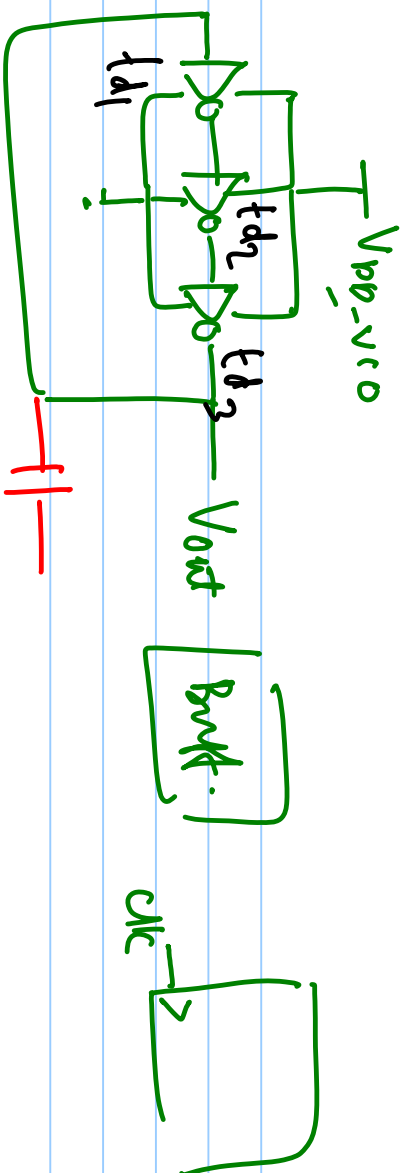
VCB : I,  $V_{DD}$ ,  $V_{DD}/2$ , Phase Noise.

-85 dBc/Hz

-82 dBc/Hz

0.24  $\mu m$

$\frac{500}{0.24}$



$$f_{osc} = f (V_{DD-VCO})$$

$$K_{VCO} = \frac{\Delta f_{out}}{\Delta V_{DD-VCO}} \quad [Hz/V]$$