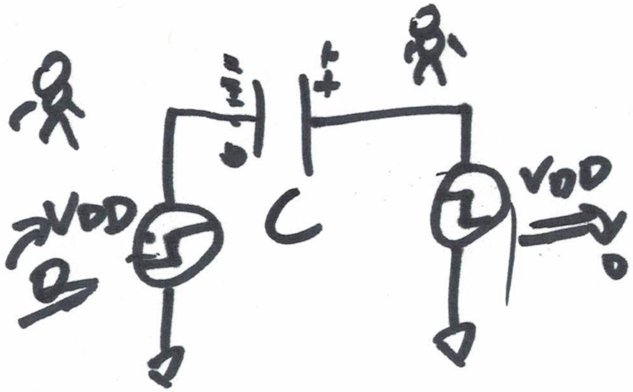
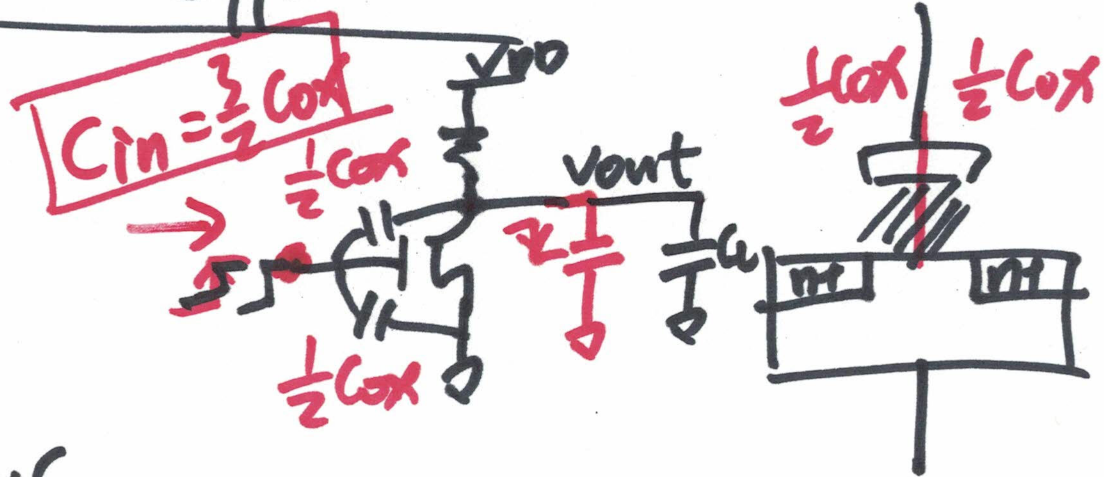
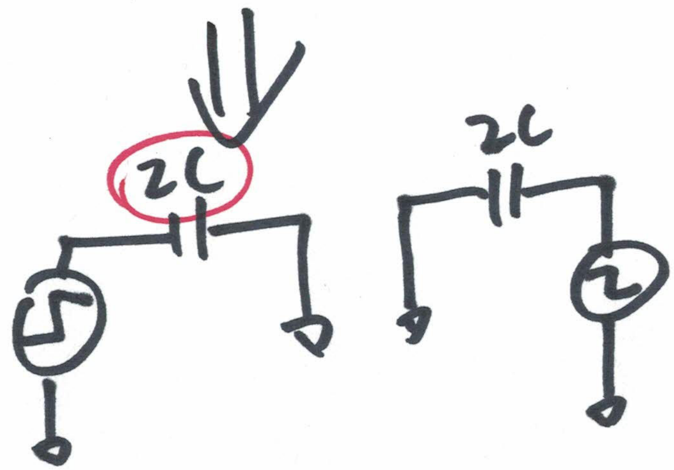
Miller Effect

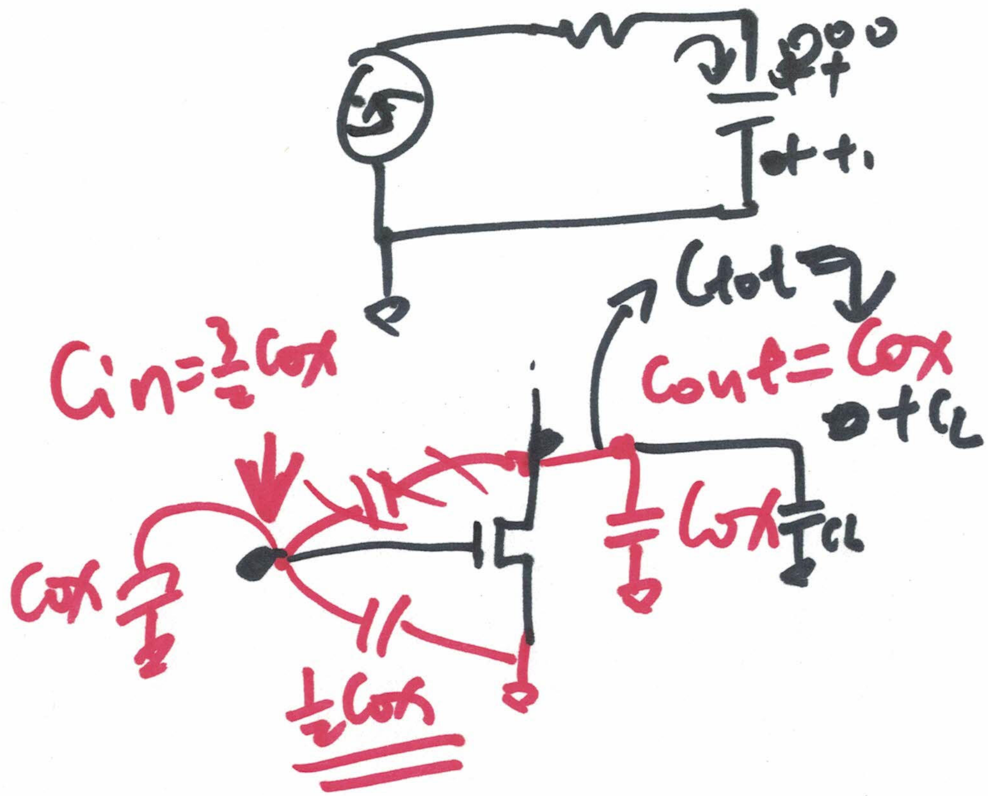


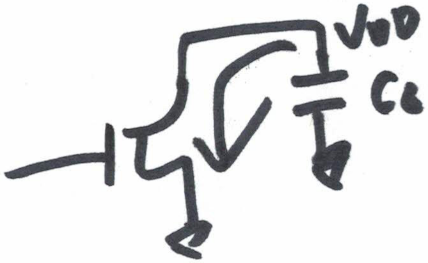


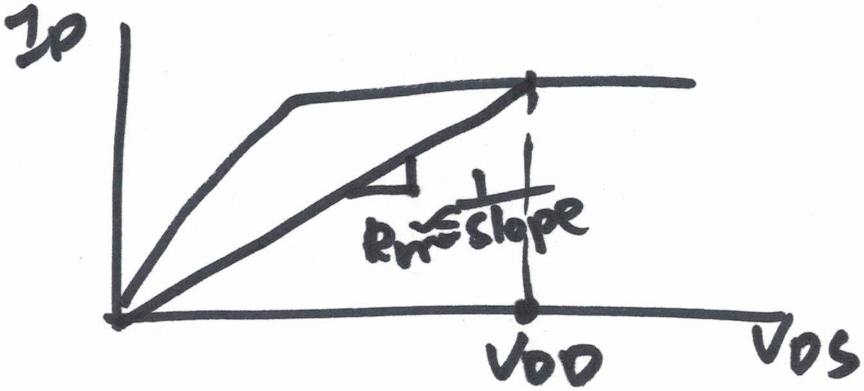
$\Delta Q = V_{DD} \cdot \underline{C}$ $\quad$ $\Delta Q = V_{DD} \cdot C$

$$\frac{2Q}{V_{DD}} = \underline{2C}$$

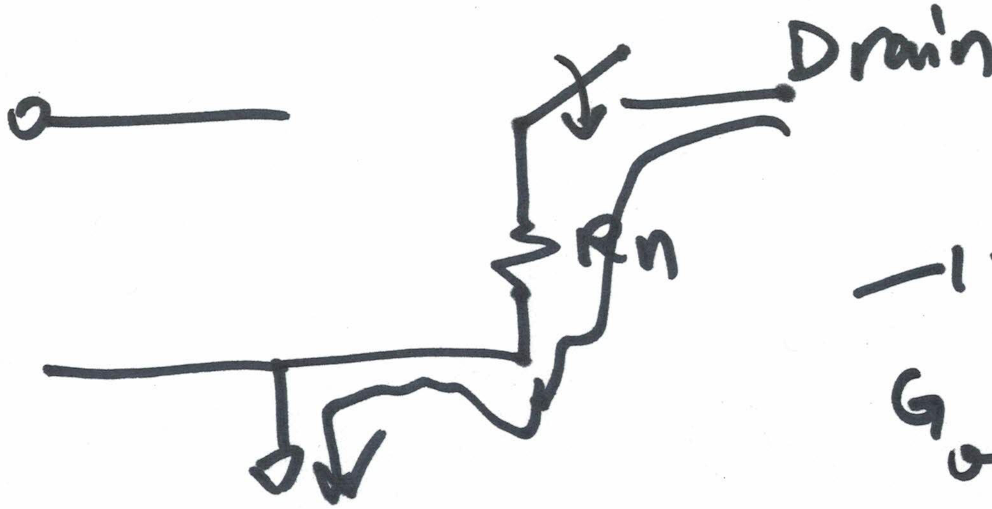


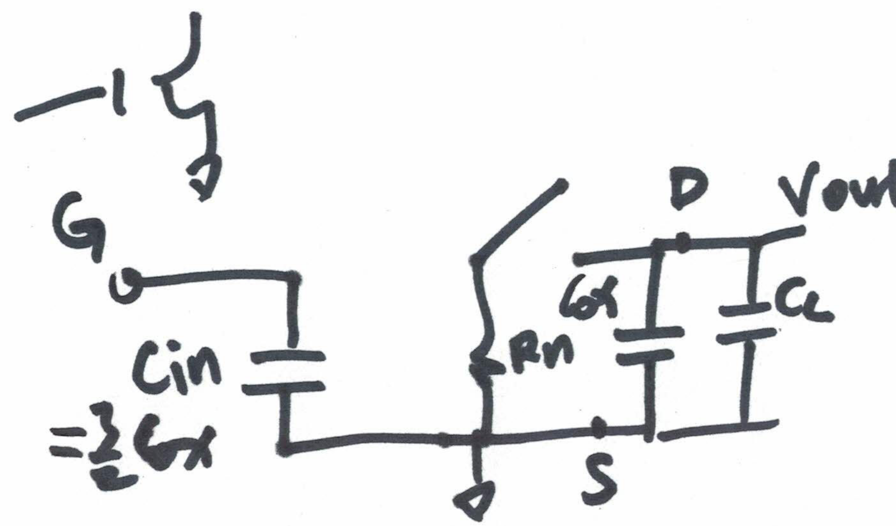


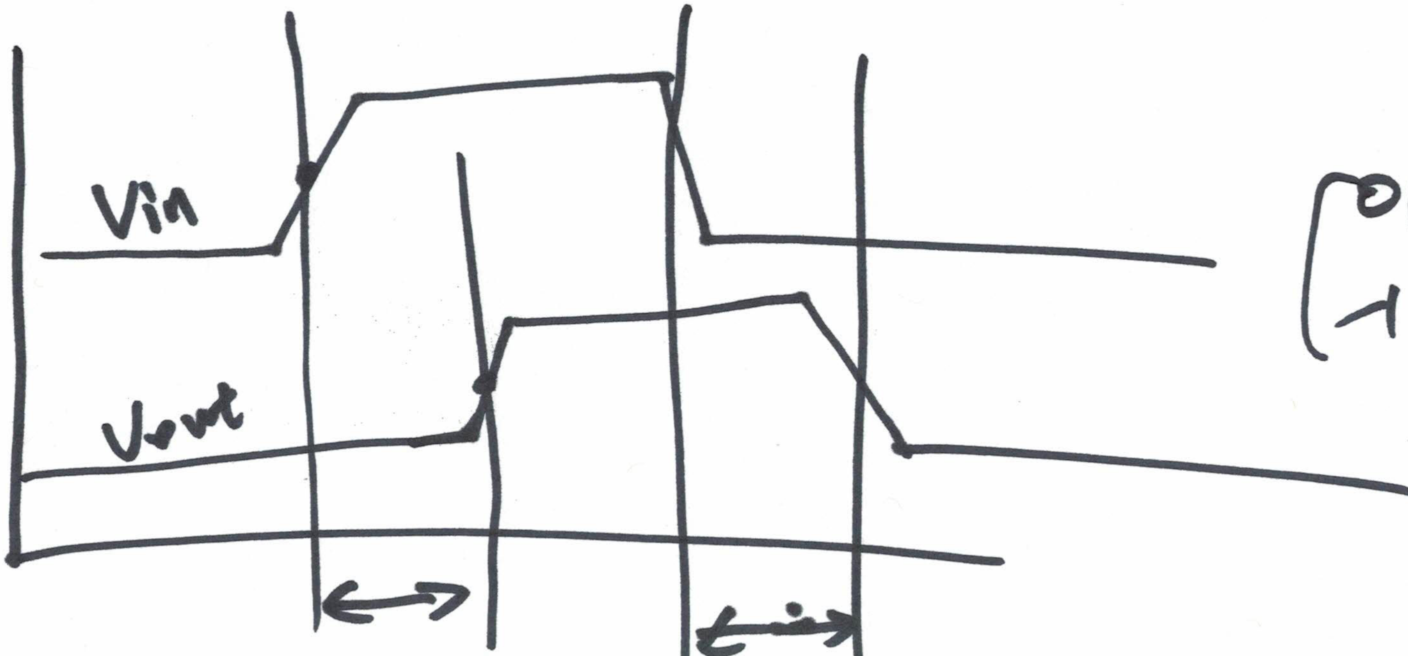


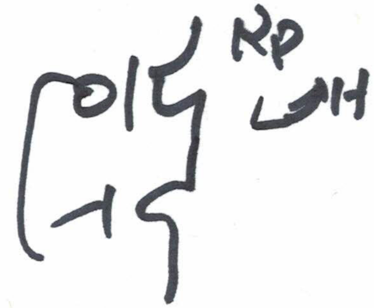


$$R_n \approx \frac{V_{DD}}{I_D} = \frac{V_{DD}}{\frac{KP_n}{2}\frac{W}{L}\left(V_{GS}-V_{THN}\right)^2}$$









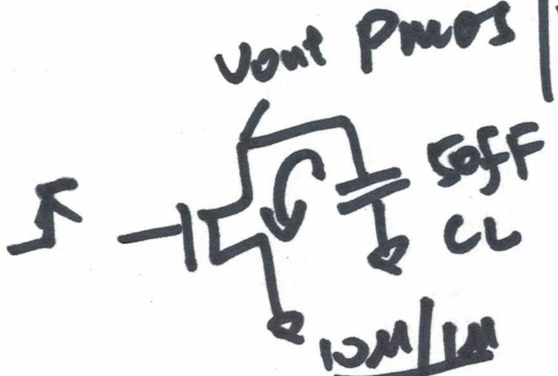
t_{PLH} t_{PHL}

propagation Delay

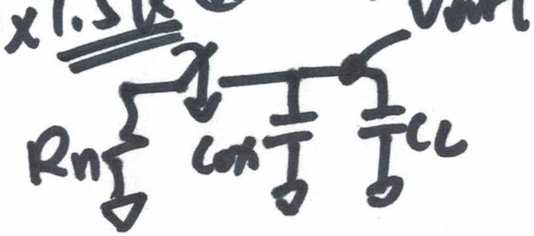
$t = 0.7RC$

Example : P320

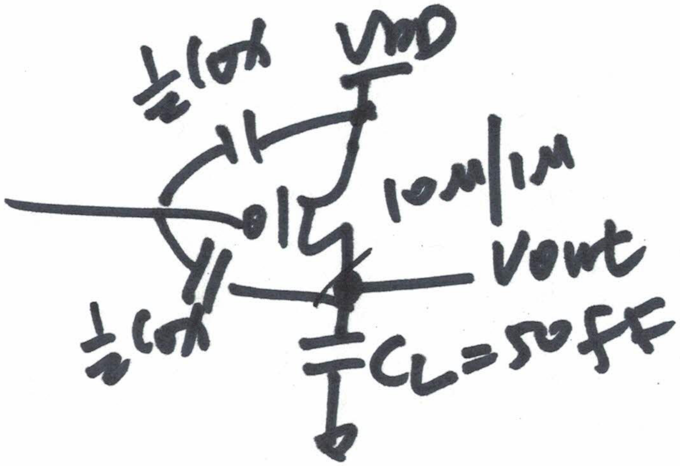
	size	$R_{n,p}$	$C_{ox\,n,p}$
NMOS	10M/1M	1.5K	17.5fF
PMOS	30M/1M	1.5K	52.5fF

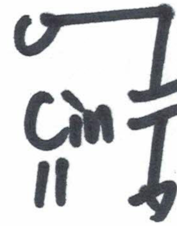


$t_{PHL} = 0.7RC = 0.7 \times 1.5k\,(C_{ox}+C_L)$

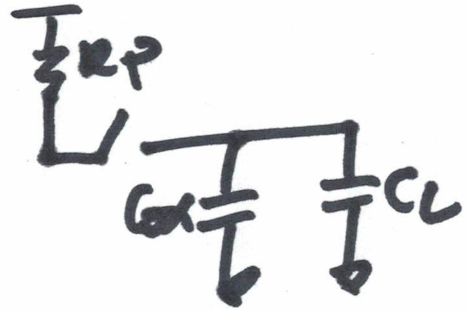


③





$C_{in} = \frac{3}{2}C_{ox}$

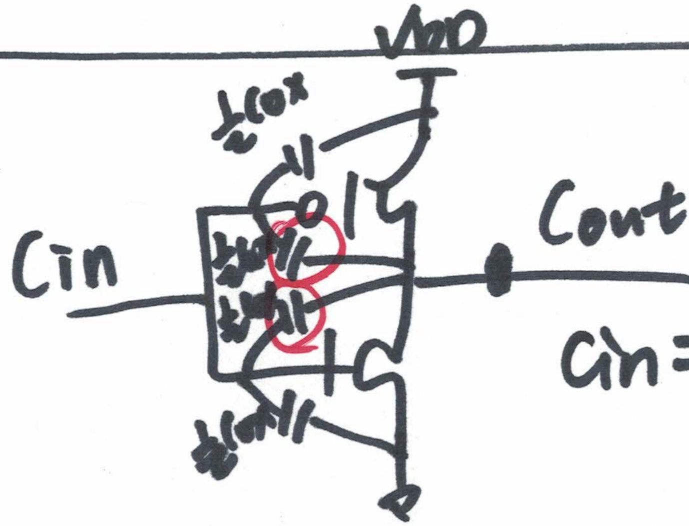


$$t_{pLH} = 0.7 \times R_p \times C_{tot}$$
$$= 0.7 \times 4.5K \times (17.5fF + 50fF)$$

$$\begin{cases} R_p = 4.5K \\ C_{oxp} = 17.5fF \end{cases}$$

$$C = \varepsilon \frac{A}{d}$$

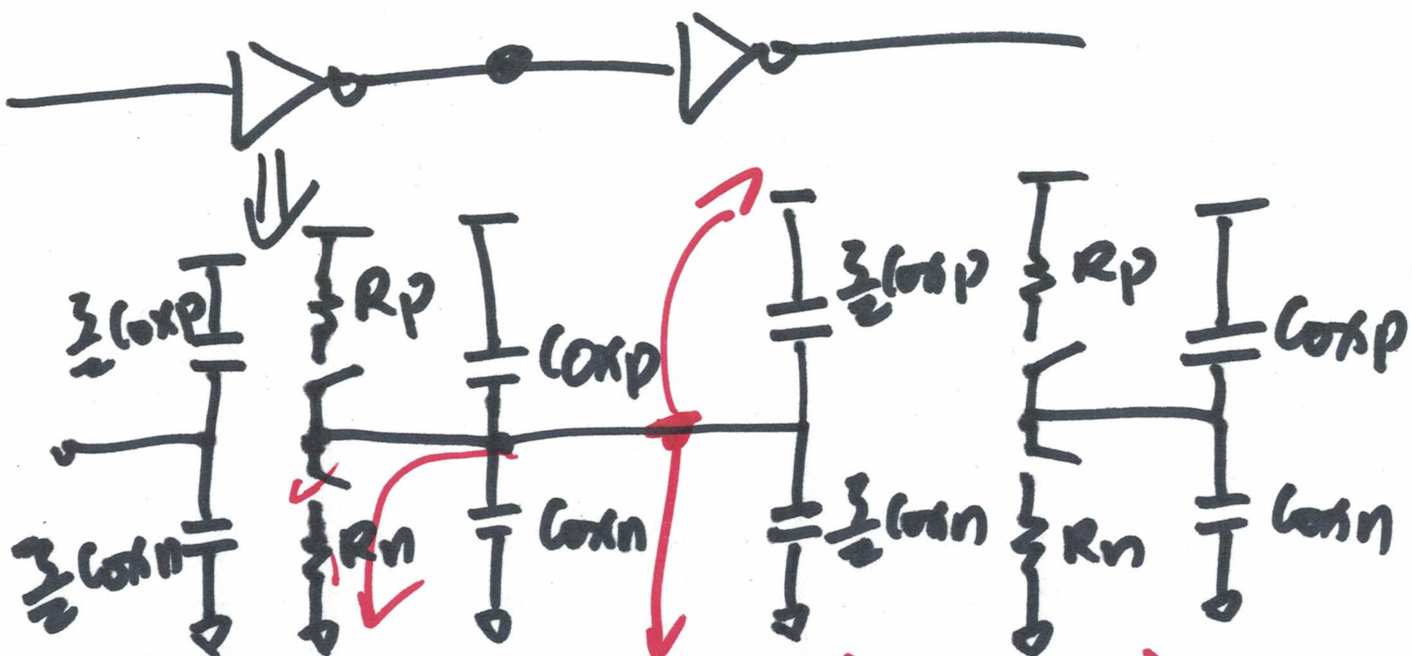
$$R = \rho \frac{L}{A}$$



$$C_{out} = C_{oxn} + C_{oxp}$$

$$C_{in} = C_{oxp} + C_{oxn} + \frac{1}{2}C_{oxp} + \frac{1}{2}C_{oxn}$$
$$= \frac{3}{2}(C_{oxp} + C_{oxn})$$

$$\begin{cases} \underline{\underline{t_{pHL}}} = 0.7 \times R_n \times C_{out} \\ \quad\quad\;\; = 0.7 \times R_n \times (C_{oxn} + C_{oxp}) \\ t_{pLH} = 0.7 \times R_p \times (C_{oxn} + C_{oxp}) \end{cases}$$



$$\underline{\underline{C_{tot}}} = \frac{5}{2}(C_{oxp} + C_{oxn})$$

5) $$\begin{cases} t_{pHL} = 0.7 \times R_n \times C_{tot} \\ t_{pLH} = 0.7 \times R_p \times C_{tot} \end{cases}$$