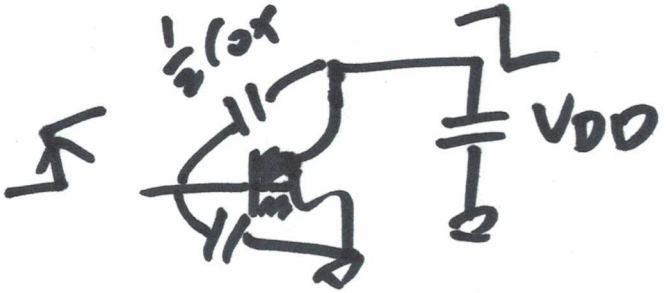
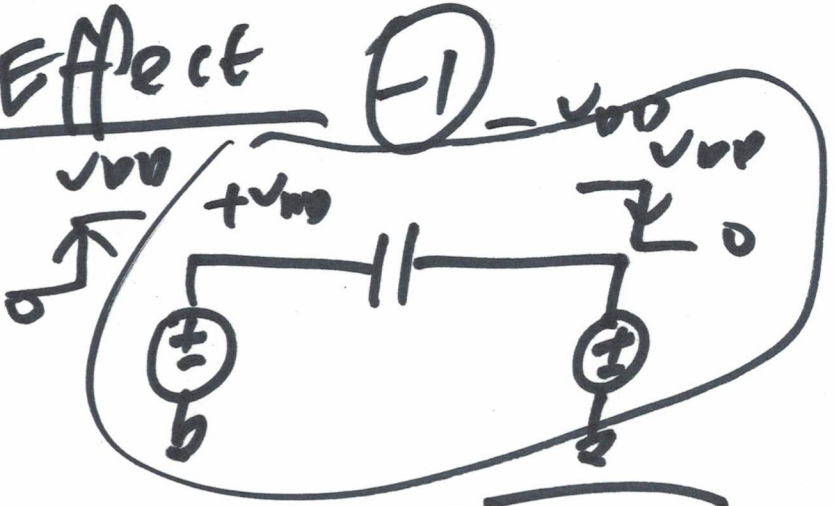
Miller Effect



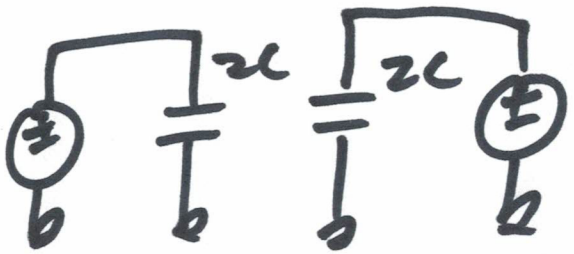


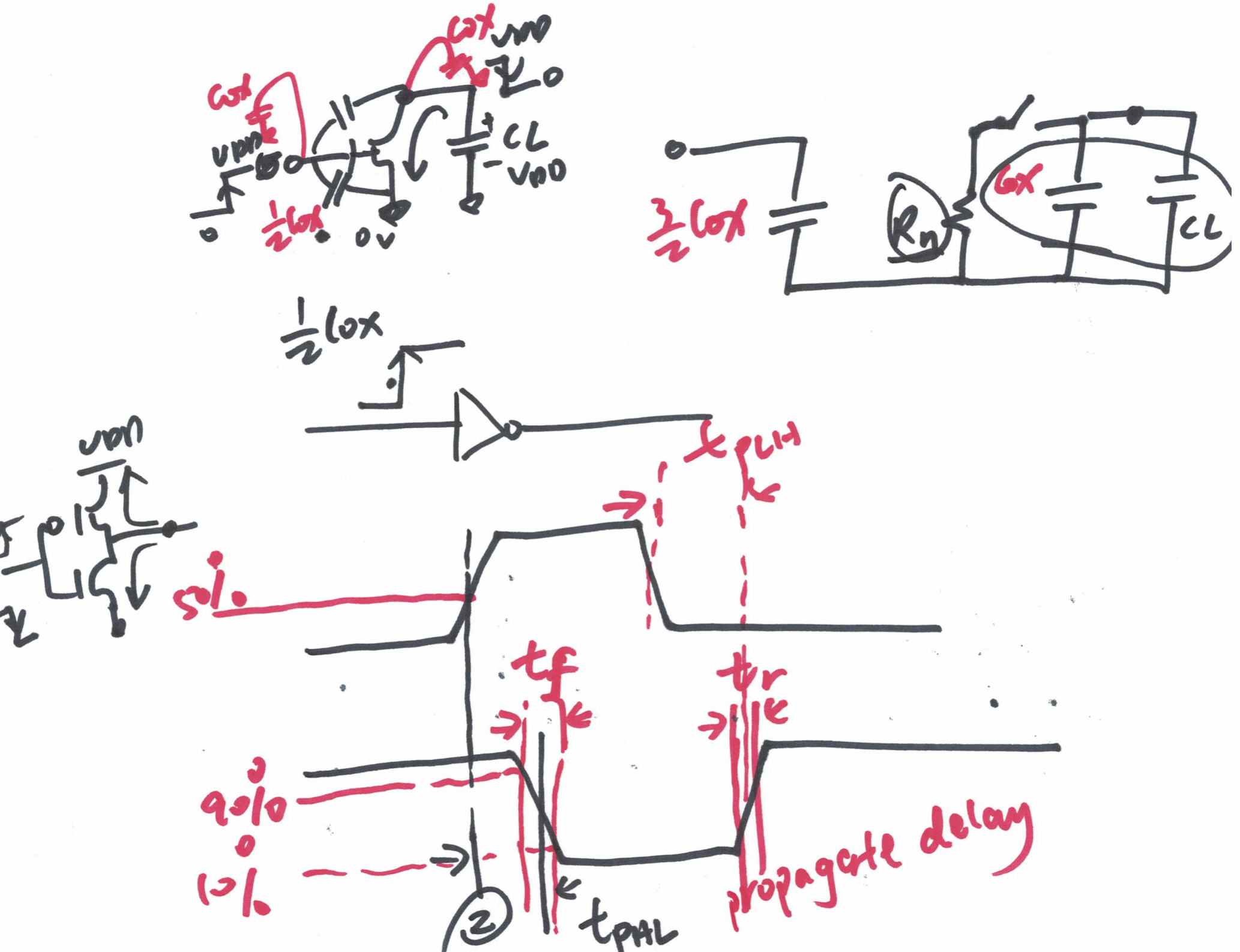
$Q = VC$

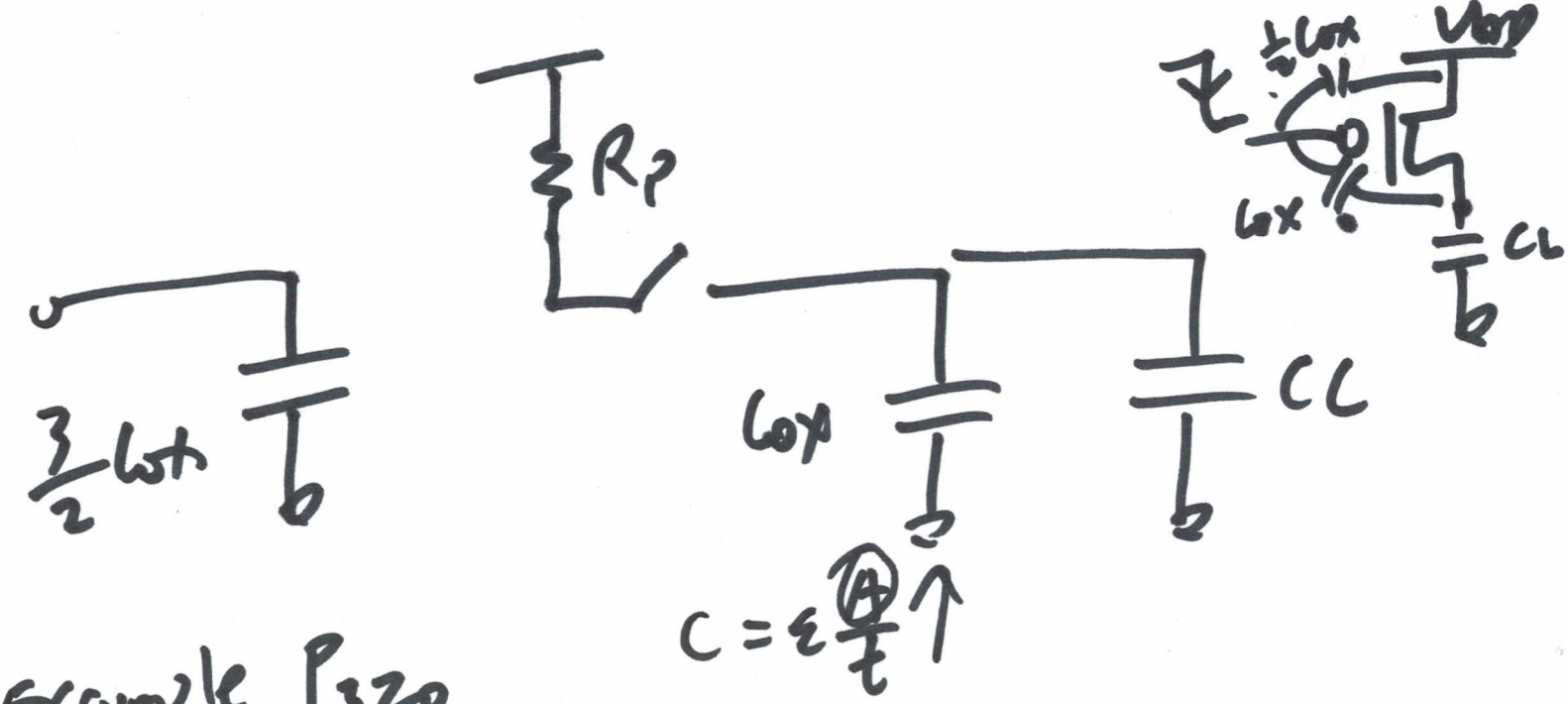
$\Delta V = 2V_{DD}$

$\Delta Q = 2V_{DD} \cdot C$

$C_{eff} = \frac{\Delta Q}{V_{DD}} = \frac{2V_{DD} \cdot C}{V_{DD}} = 2C$




Cox
VDD
CL
1/2 Cox
0V
3/2 Cox
Rn
tpLH
tf
tr
tpHL
propagate delay



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

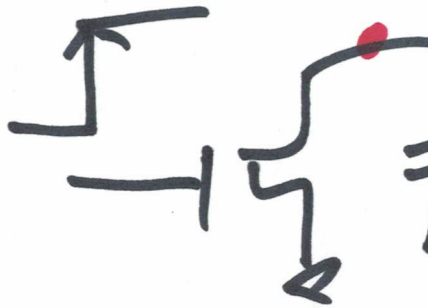
Example P320

	sizes	$R_{n,p}$	$C_{oxn,p}$
NMOS	10m/1u	1.5K	17.5 fF
pmos	30m/1m	1.5K	17.5 fF

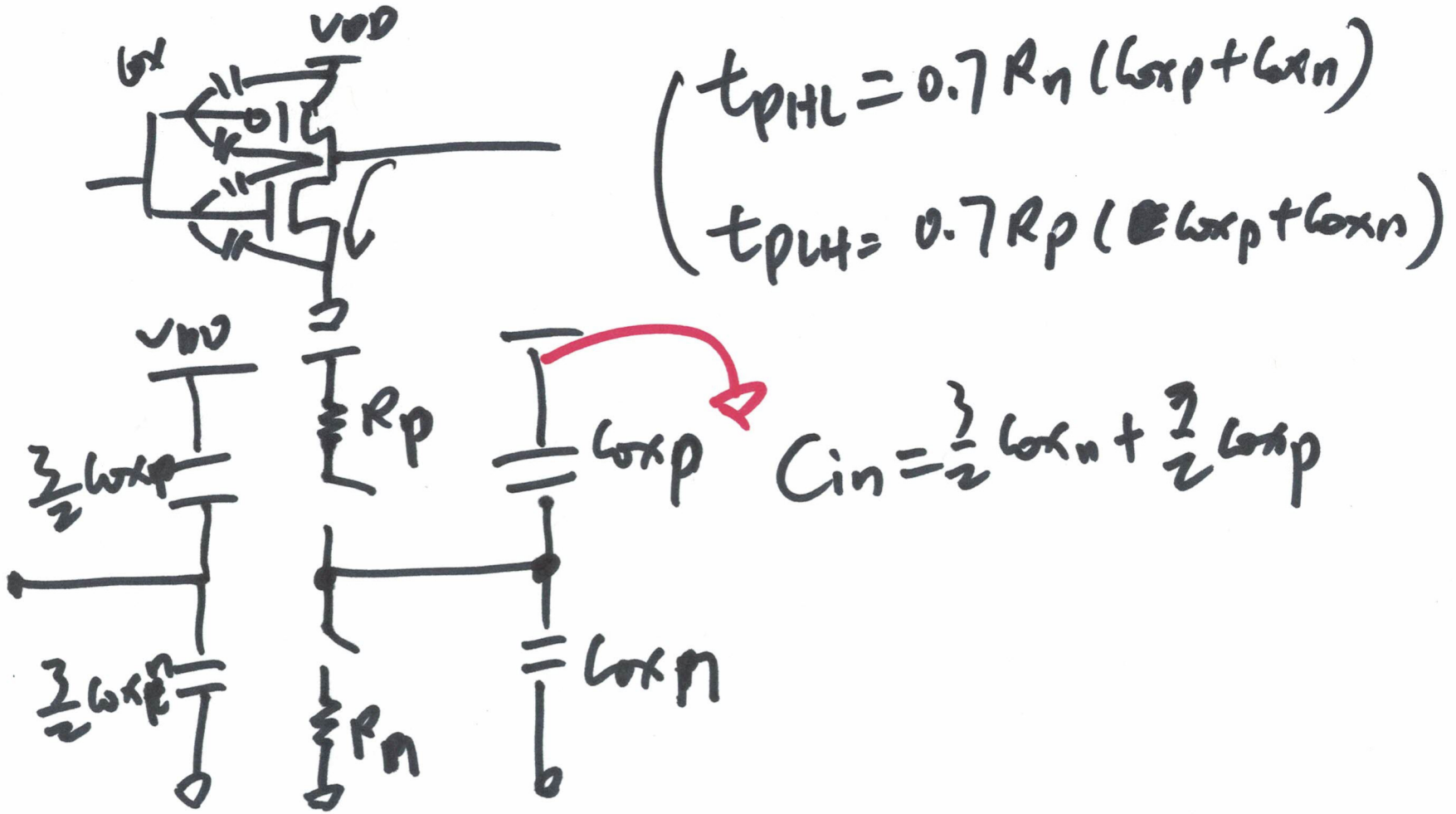
$$t_{pHL} = 0.7 R_n (C_{ox} + C_L)$$

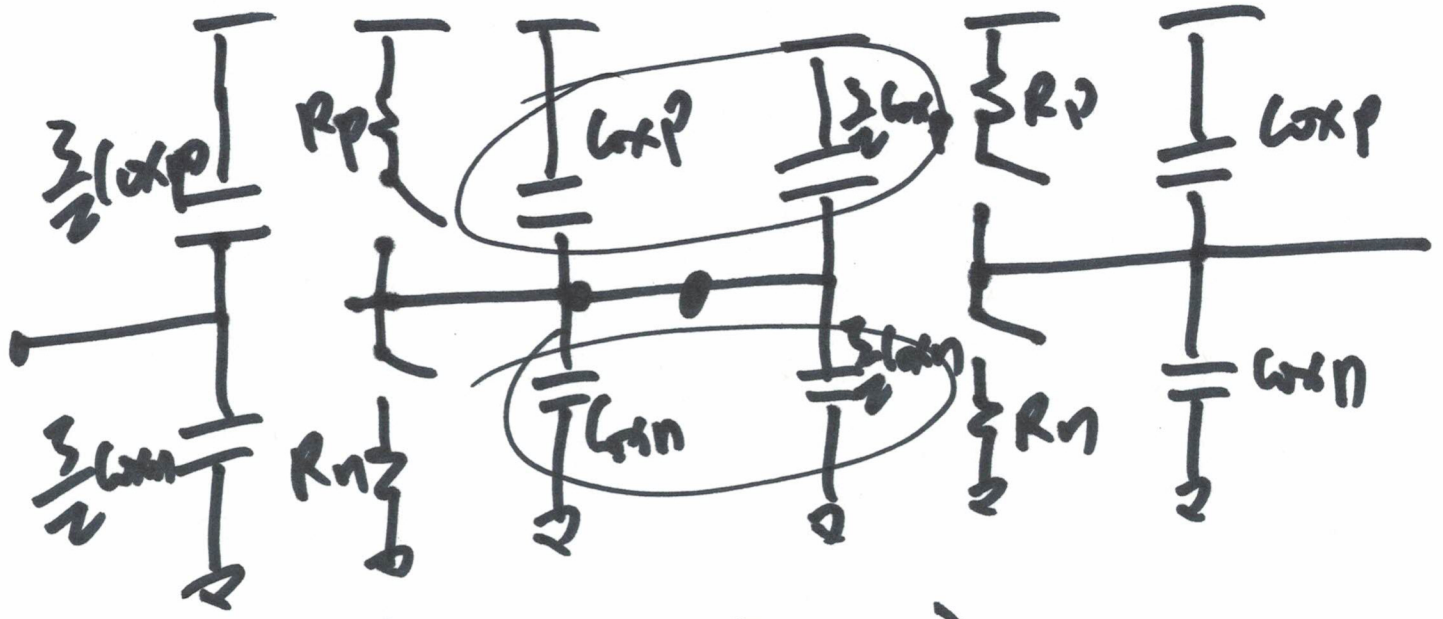
$$= 0.7 \cdot 3K (35fF + 50fF)$$

$$= \ldots\ldots$$



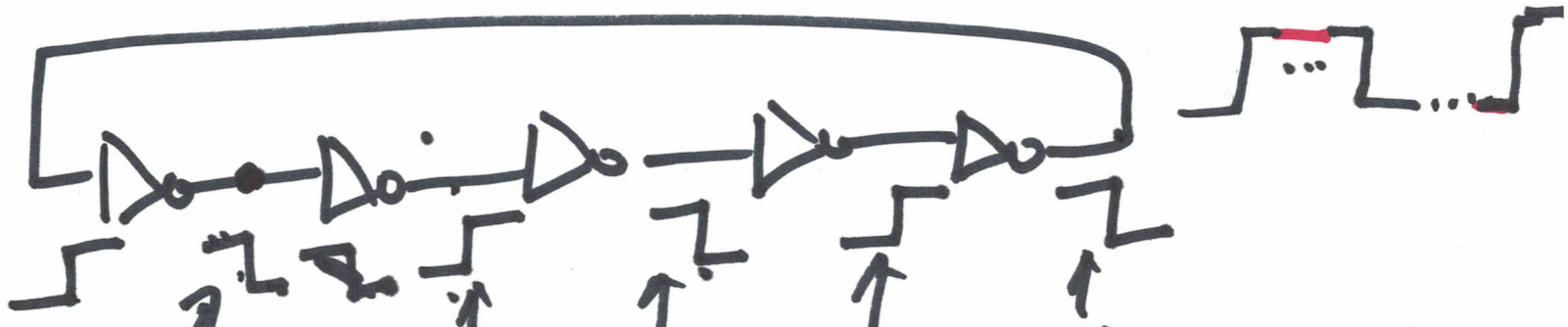
(3)


Gx
VDD
VDD
Rp
Rn
Coxp
Coxn
$\frac{3}{2}$Coxp
$\frac{3}{2}$Coxn
$t_{pHL} = 0.7 R_n (C_{oxp} + C_{oxn})$
$t_{pLH} = 0.7 R_p (\beta C_{oxp} + C_{oxn})$
$C_{in} = \frac{3}{2} C_{oxn} + \frac{3}{2} C_{oxp}$



$$t_{PLH} = 0.7 R_p \cdot \left(\frac{5}{2} C_{ox p} + \frac{5}{2} C_{ox n} \right)$$

$$t_{PHL} = 0.7 R_n \cdot \left(\frac{5}{2} C_{ox p} + \frac{5}{2} C_{ox n} \right)$$



$t_{pHL} + t_{pLH} + t_{pHL} + t_{pLH} + t_{pHL}$

$t_{pLH} + t_{pHL} + t_{pLH} + t_{pHL} + t_{pLH}$

$$f = \frac{}{5\,(t_{pHL} + t_{pLH})\,n}$$

$f \geq 500$ MHz

11.2

(b)

Dynamic Power Dissipation

$$I_{avg} = \frac{Q_{tot}}{T} = \frac{V_{DD} \cdot C_{tot}}{T}$$

$$P_{avg} = I_{avg} \cdot V_{DD} = \frac{V_{DD}^2 \cdot C_{tot}}{T}$$

$$= V_{DD}^2 \cdot C_{tot} \cdot f$$