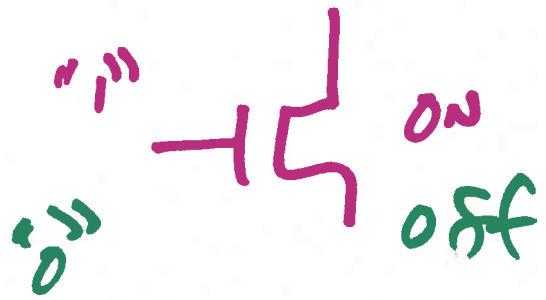
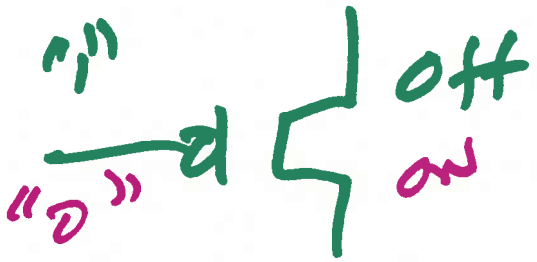
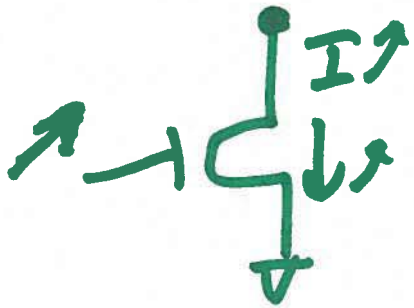
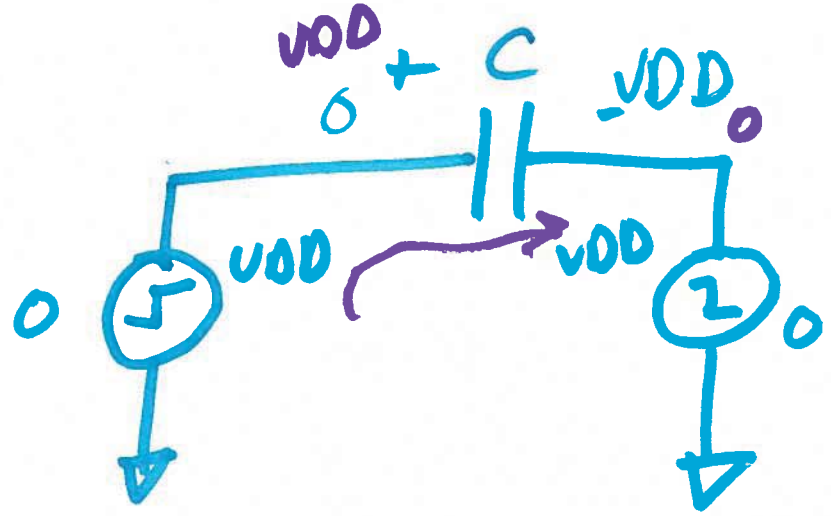
EE 421 / ECG 621
Lecture 15
OCT. 23, 2017









$Q = C(0 - VDD)$

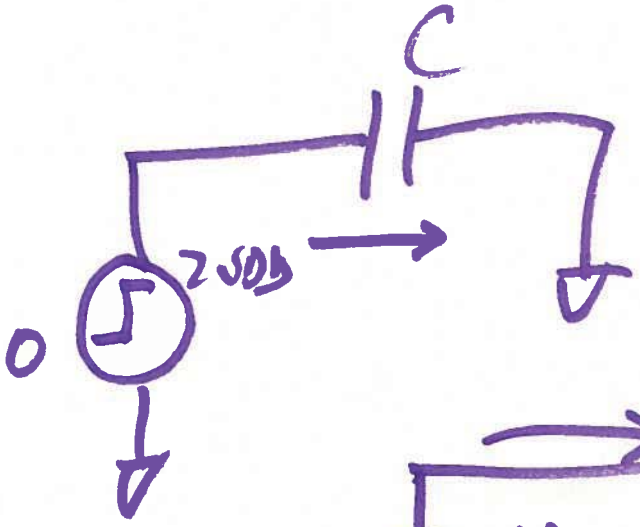
$Q = C(VDD - 0)$

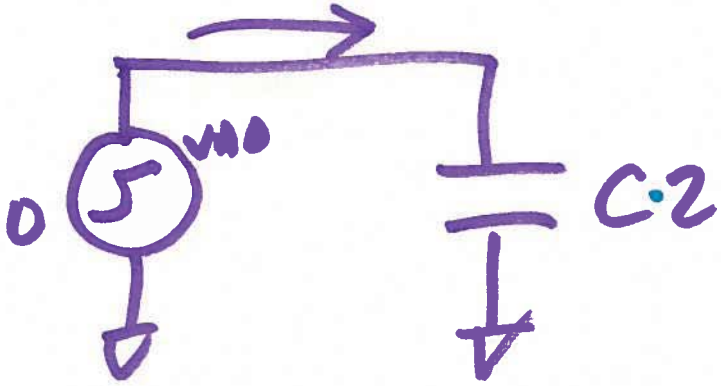
$\Delta Q = C(-VDD) - C\,VDD$

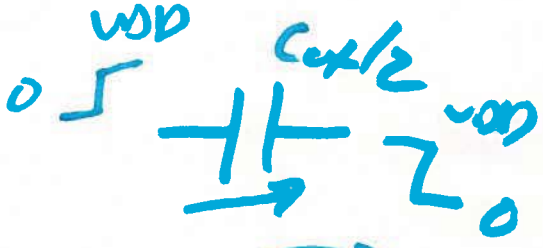
$= 2C\,VDD$

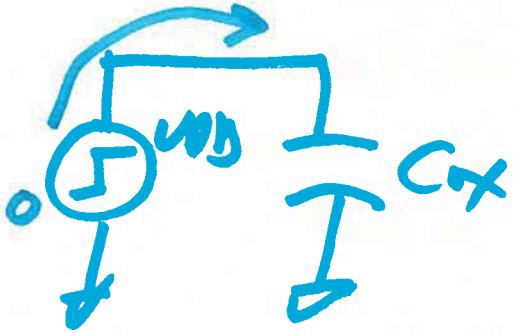
$= 2VDD \cdot C$

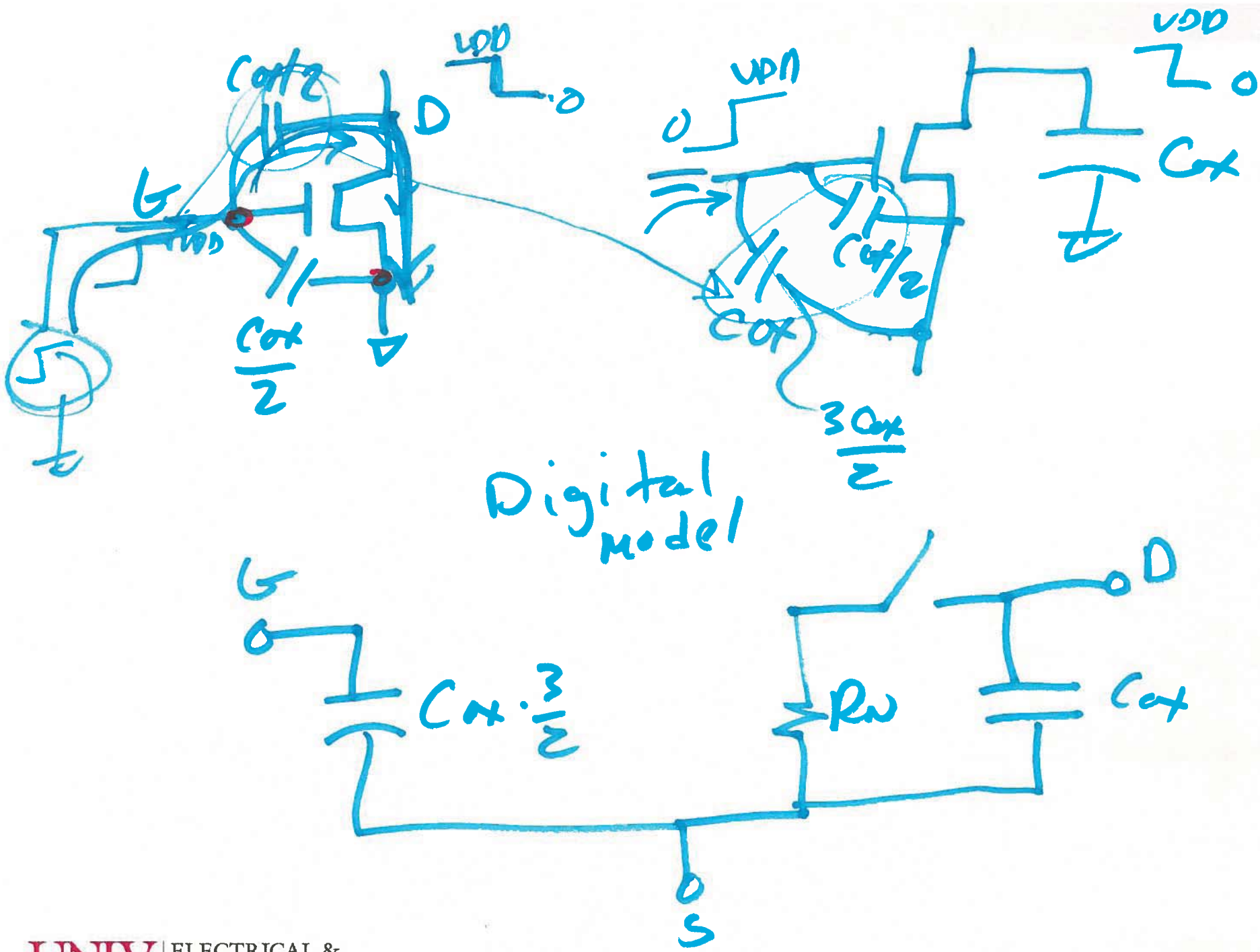
Miller

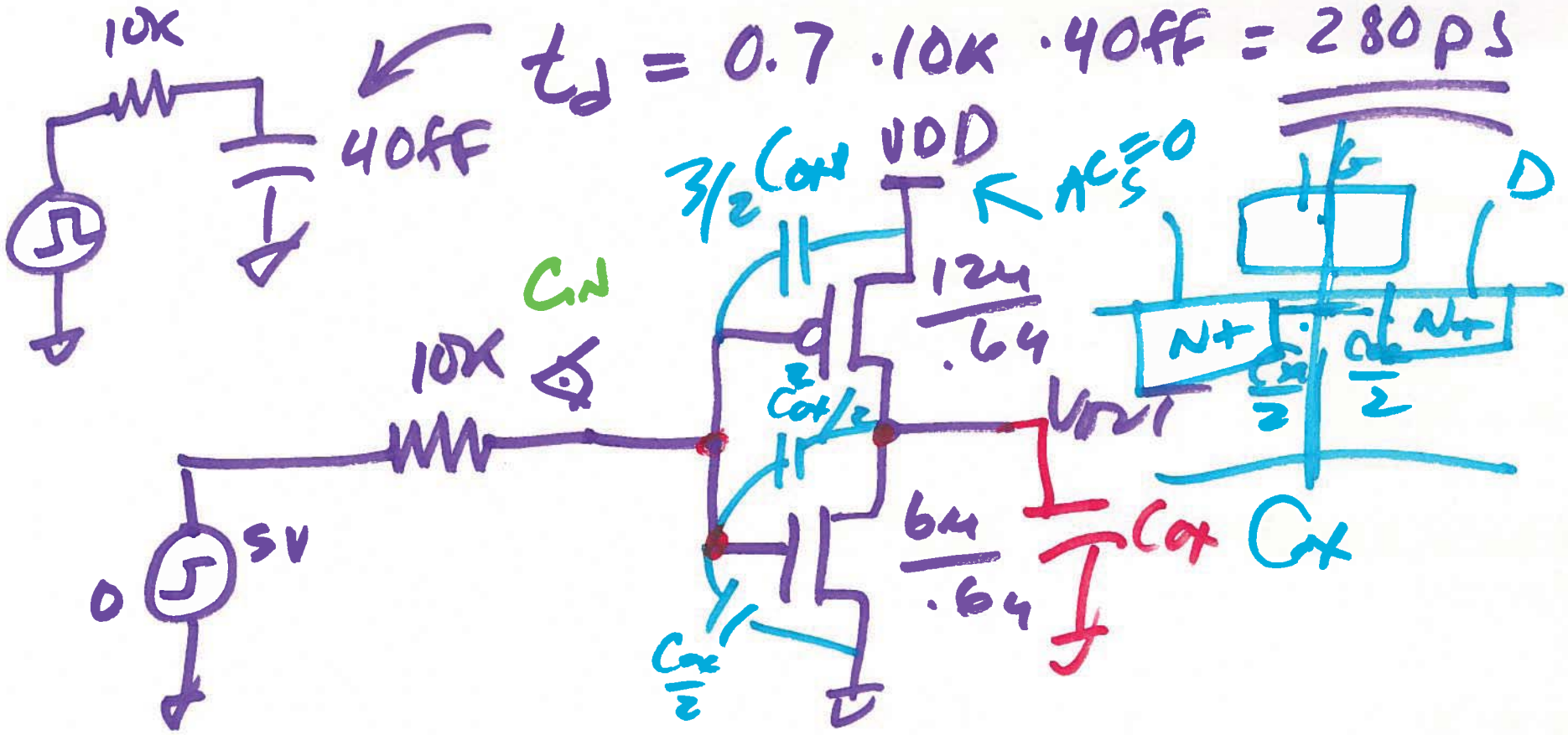









VDD
Cox/2
D
G
Cox/2
S
VDD
0
VDD
0
Cox
Cox/2
Cox
3Cox/2
Digital model
G
Cox · 3/2
RN
D
Cox
S



$$C_N = \frac{3}{2} \cdot 2.5 \frac{fF}{\mu m^2} \cdot 6\mu \cdot .6\mu + \frac{3}{2} \cdot 2.5 \frac{fF}{\mu m^2} \cdot$$

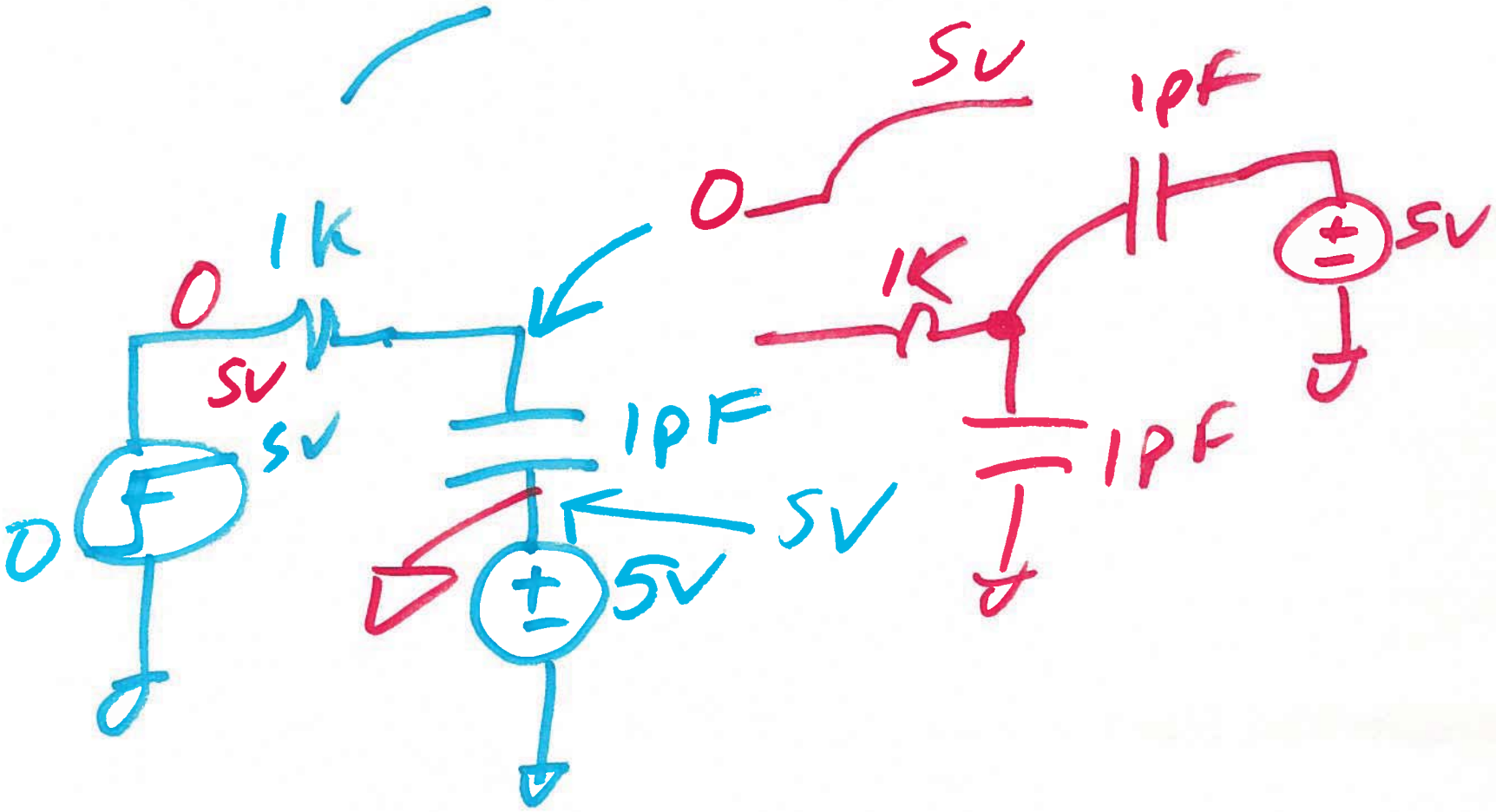
$$= 1.5 \cdot 2.5 fF \cdot (3.6 + 7.2) 12\mu \cdot .6\mu$$

$$1.5 \cdot 2.5$$

$$3.75 ff \cdot 10.8$$

$$\approx 37.5$$

$$\approx 40 fF$$

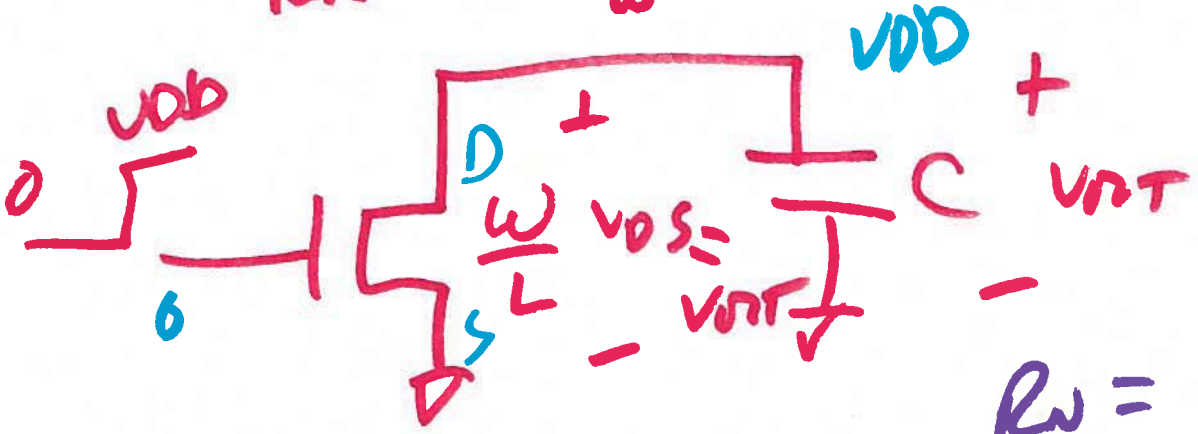

5V
1pF
0
1K
1K
0
5V
5V
1pF
5V
1pF
5V
0
F

$R_N = R_N' \cdot \frac{L}{W} = 20k \cdot \frac{L}{W}$

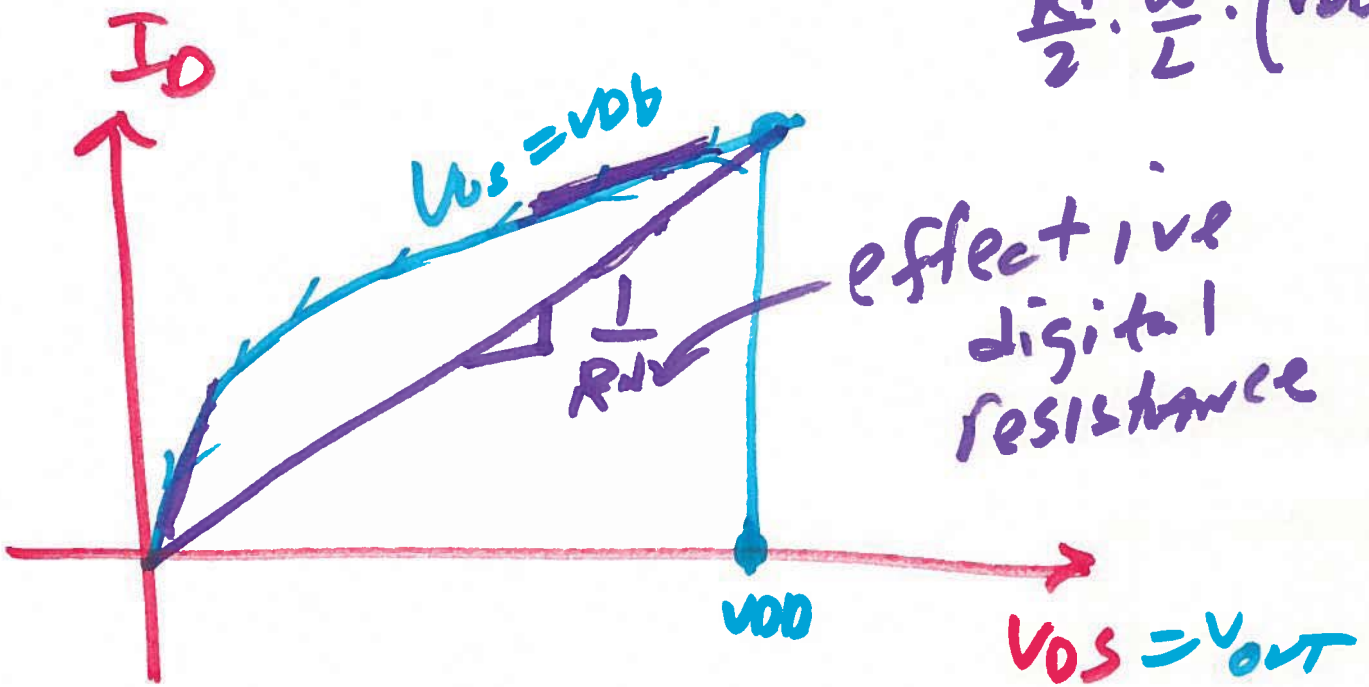
$R_N = R_N' \cdot \frac{L}{W} = \frac{5}{2.5u}$

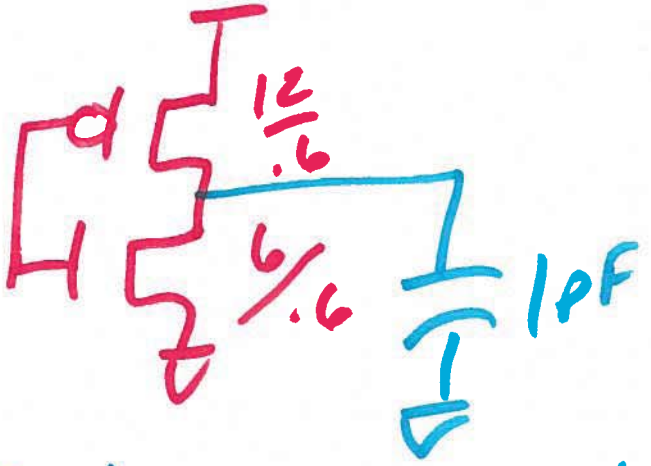
$= 20k$

~~$R_N' = 20k$~~

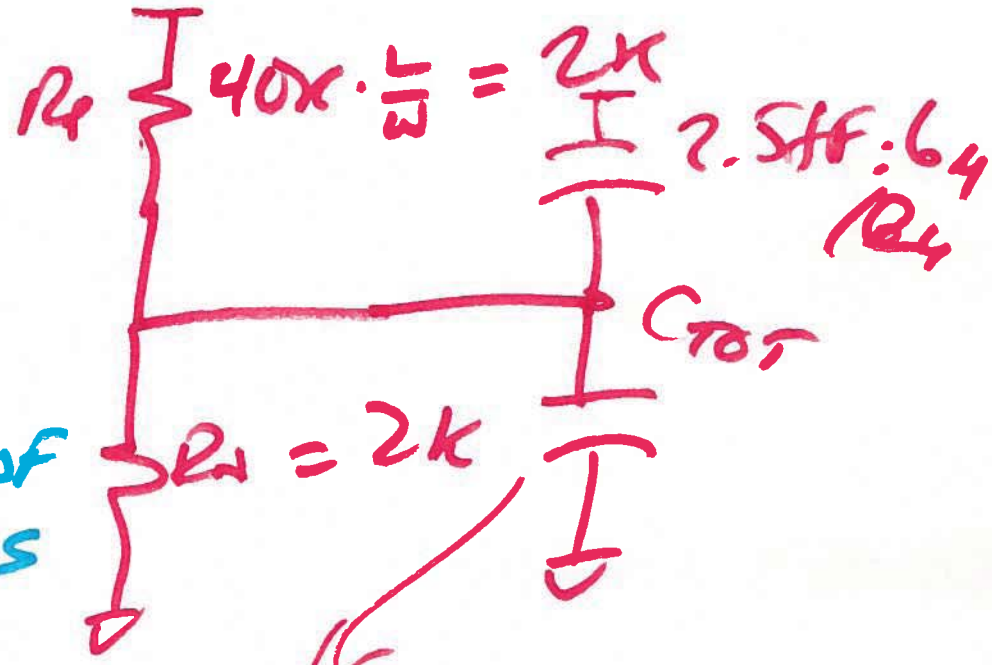


$$R_N = \frac{VDD}{\frac{KP}{2} \cdot \frac{W}{L} \cdot (VDD - V_{TN})^2}$$





$t_d = 0.7 \cdot 2k \cdot 1pF$
$= 1.4ns$



$C_{TOT} =$

$2.5\frac{fF}{\lambda_{1,2}^2} \cdot .6_4 (6_4 + 1_{2,1}) 2.5\frac{fF}{\lambda^2} \cdot 6_4 \cdot .6_4$

$1.3fF \cdot 18 = 23fF$

$t_d = t_{PHL} = t_{PLH} = 0.7 \cdot 2K \cdot 23fF$
$\sim 30ps$