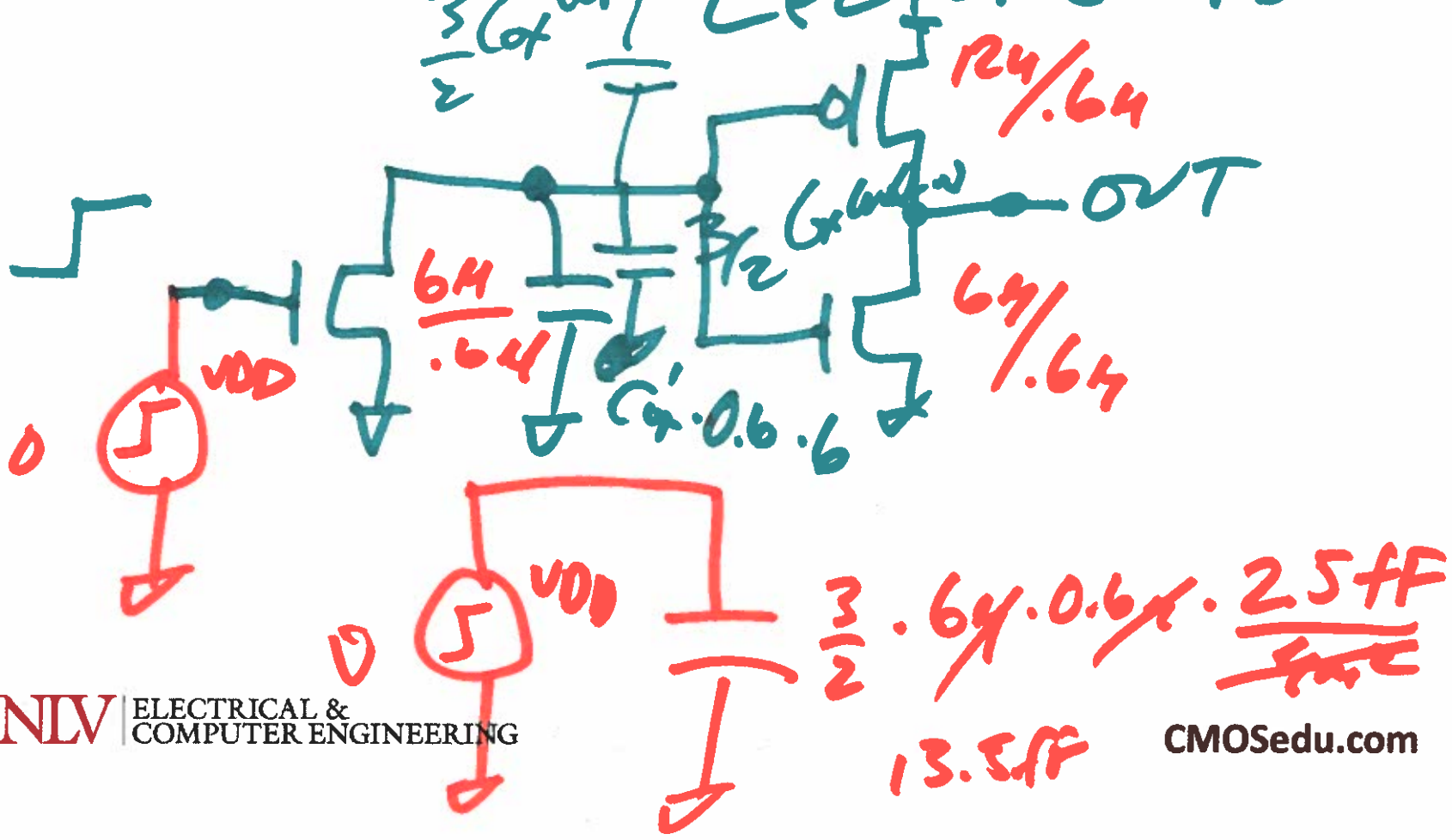
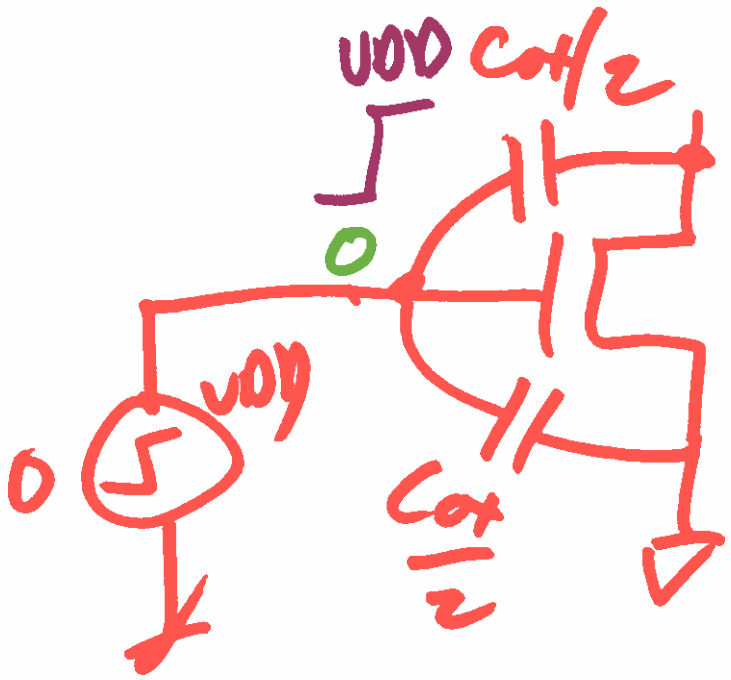
EE421/ECG 621
Digital IC Design
OCT. 23, 2019
Lecture 16



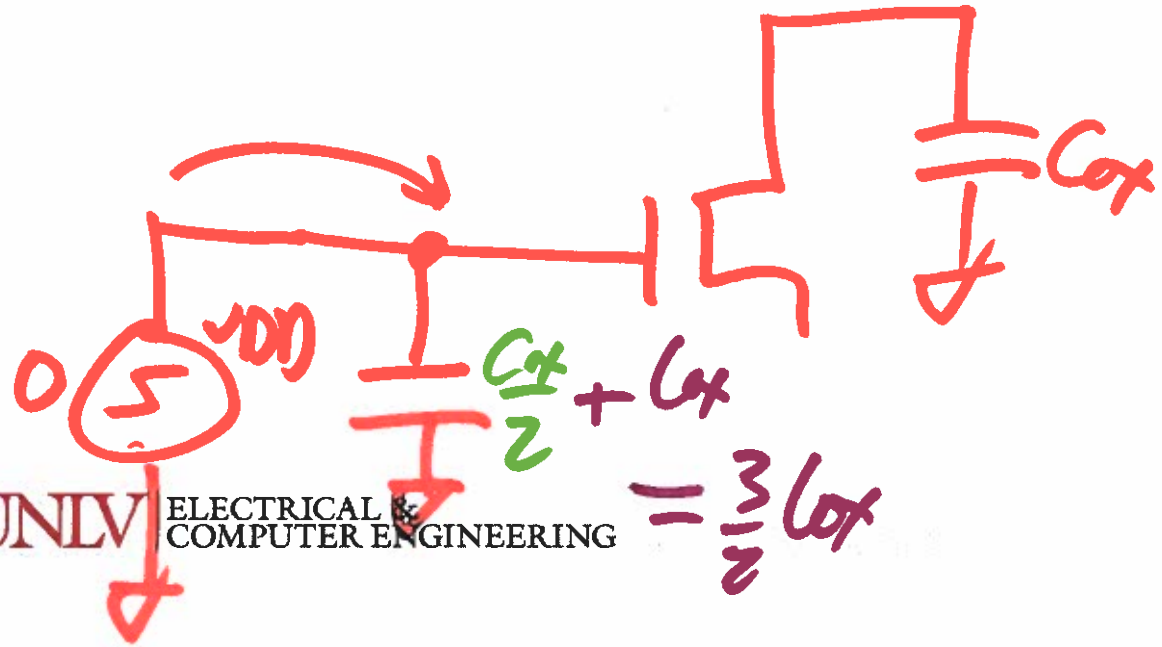


$(VDD-0)\cdot\frac{C_{ox}}{2}$ before switching

$(0-VDD)\cdot\frac{C_{ox}}{2}$

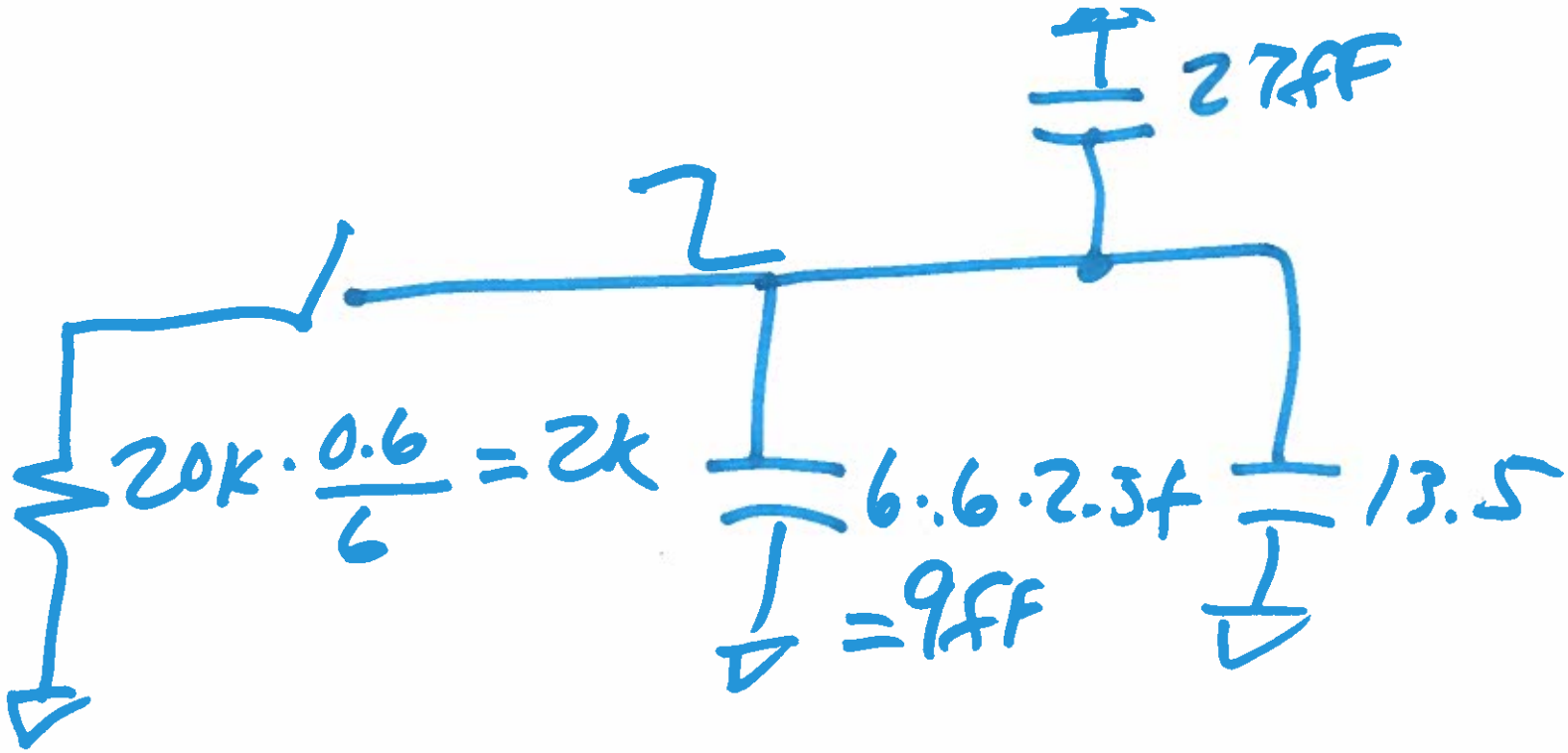
$VDD\cdot\frac{C_{ox}}{2}-\left(-VDD\cdot\frac{C_{ox}}{2}\right)$

$=VDD\cdot C_{ox}$



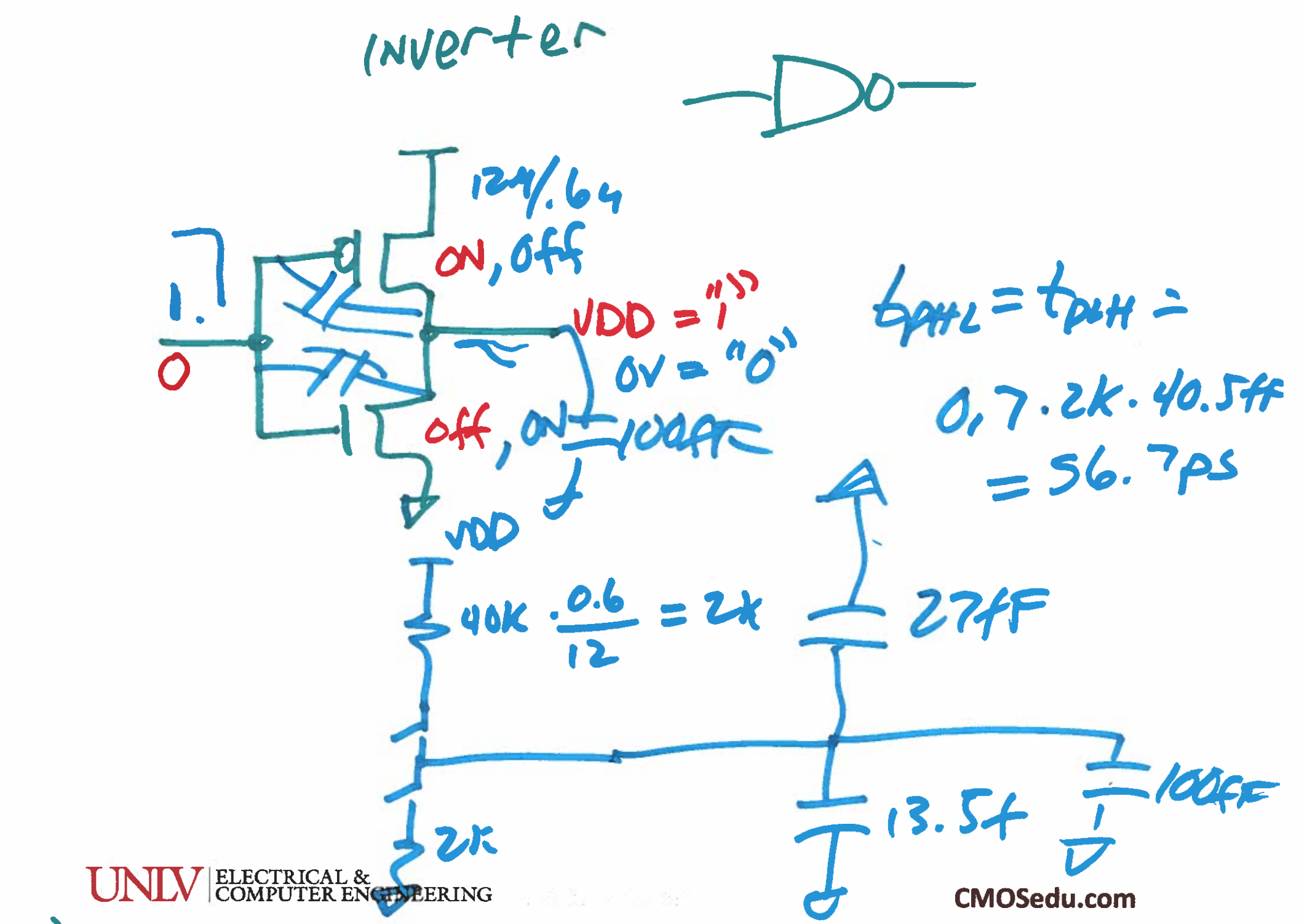
$=\frac{3}{2}C_{ox}$

2)



$$t_{pHL} = 0.7 \cdot 2k \cdot 49.5fF$$

$$= \underline{67.3ps}$$


inverter
12μ/.64
ON, Off
1.
0
VDD = "1"
0V = "0"
off, ON
100fF
$t_{pHL} = t_{pLH} \doteq$
0.7 · 2k · 40.5ff
= 56.7ps
VDD
40K · 0.6/12 = 2k
27fF
2k
13.5f
100fF
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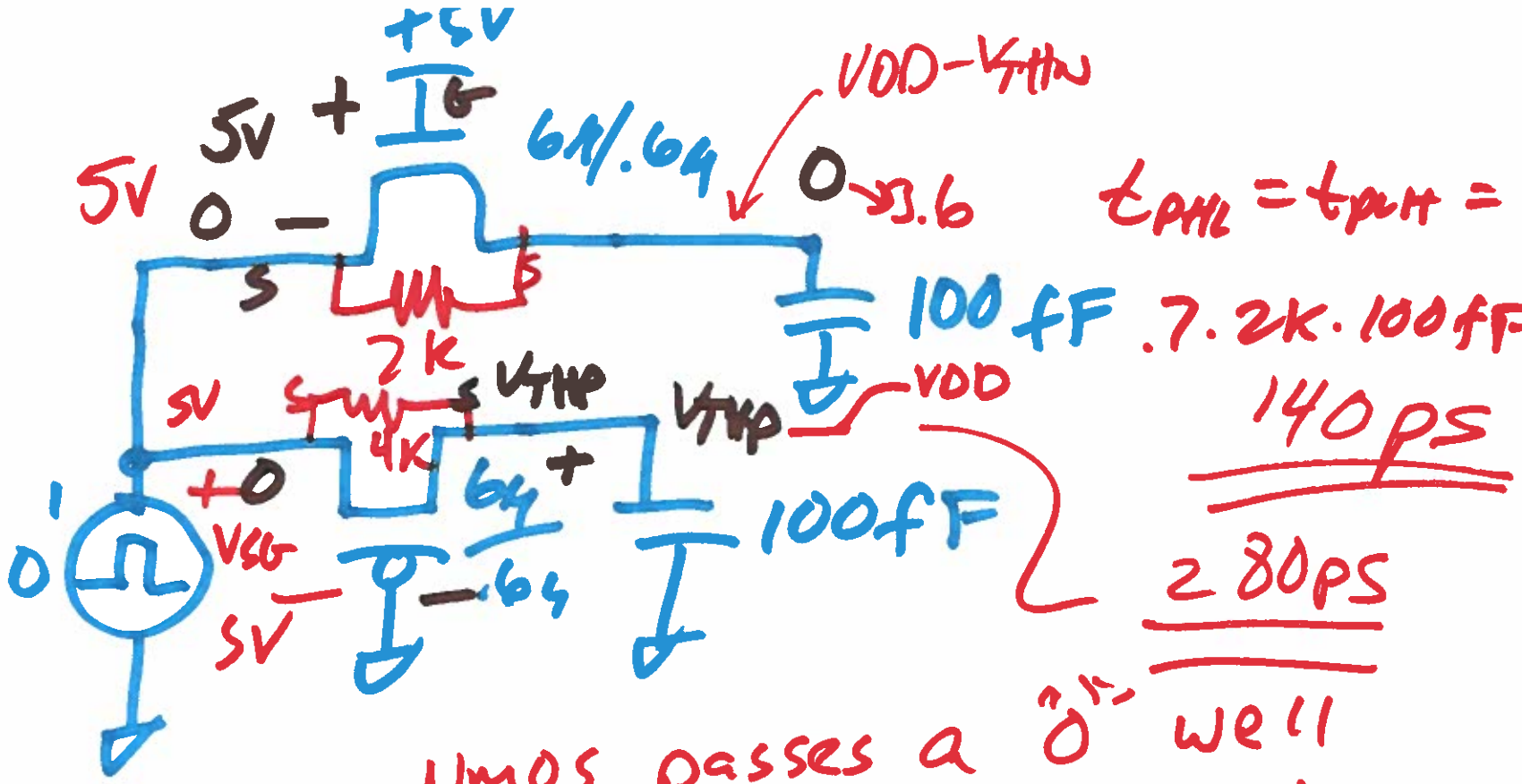
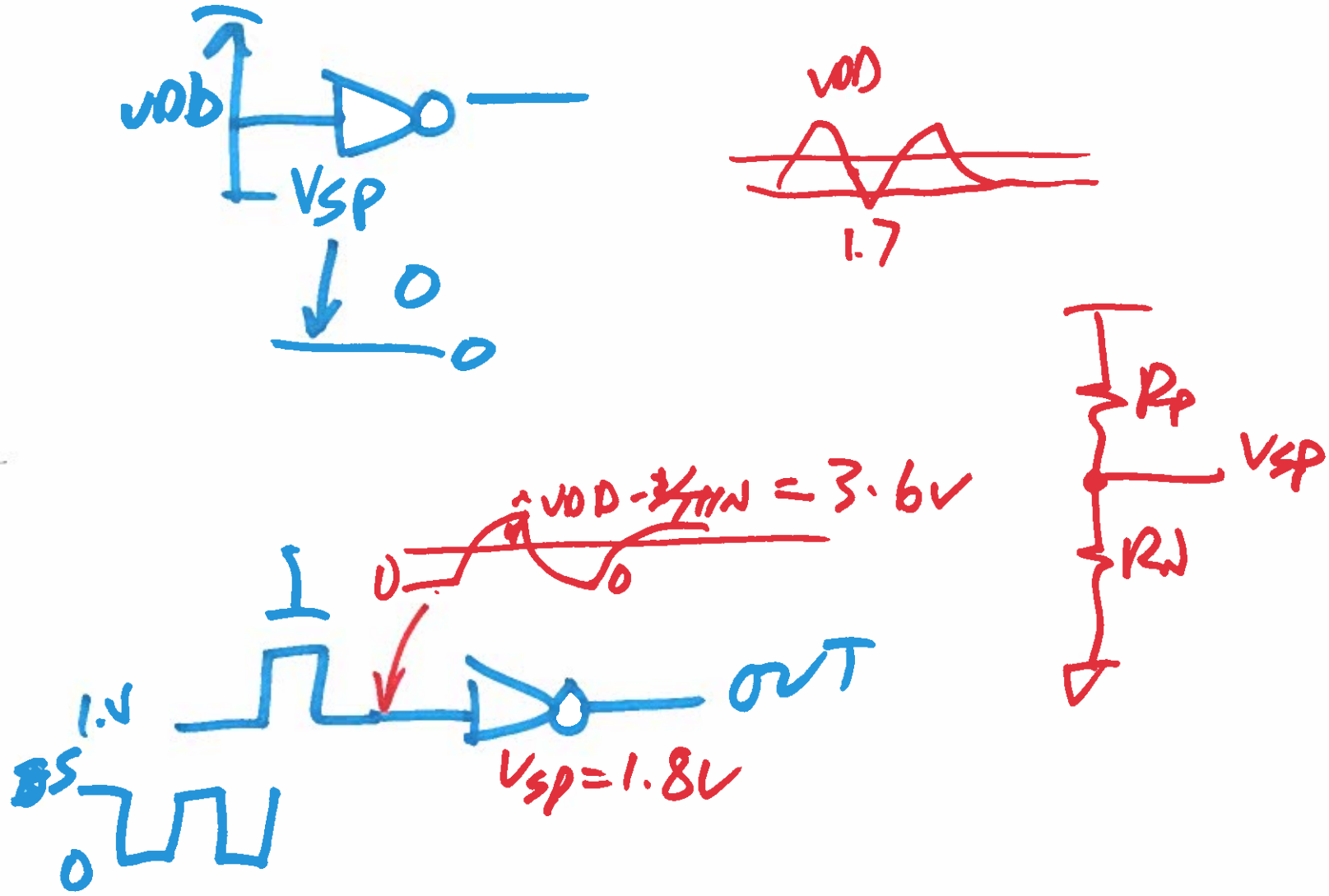
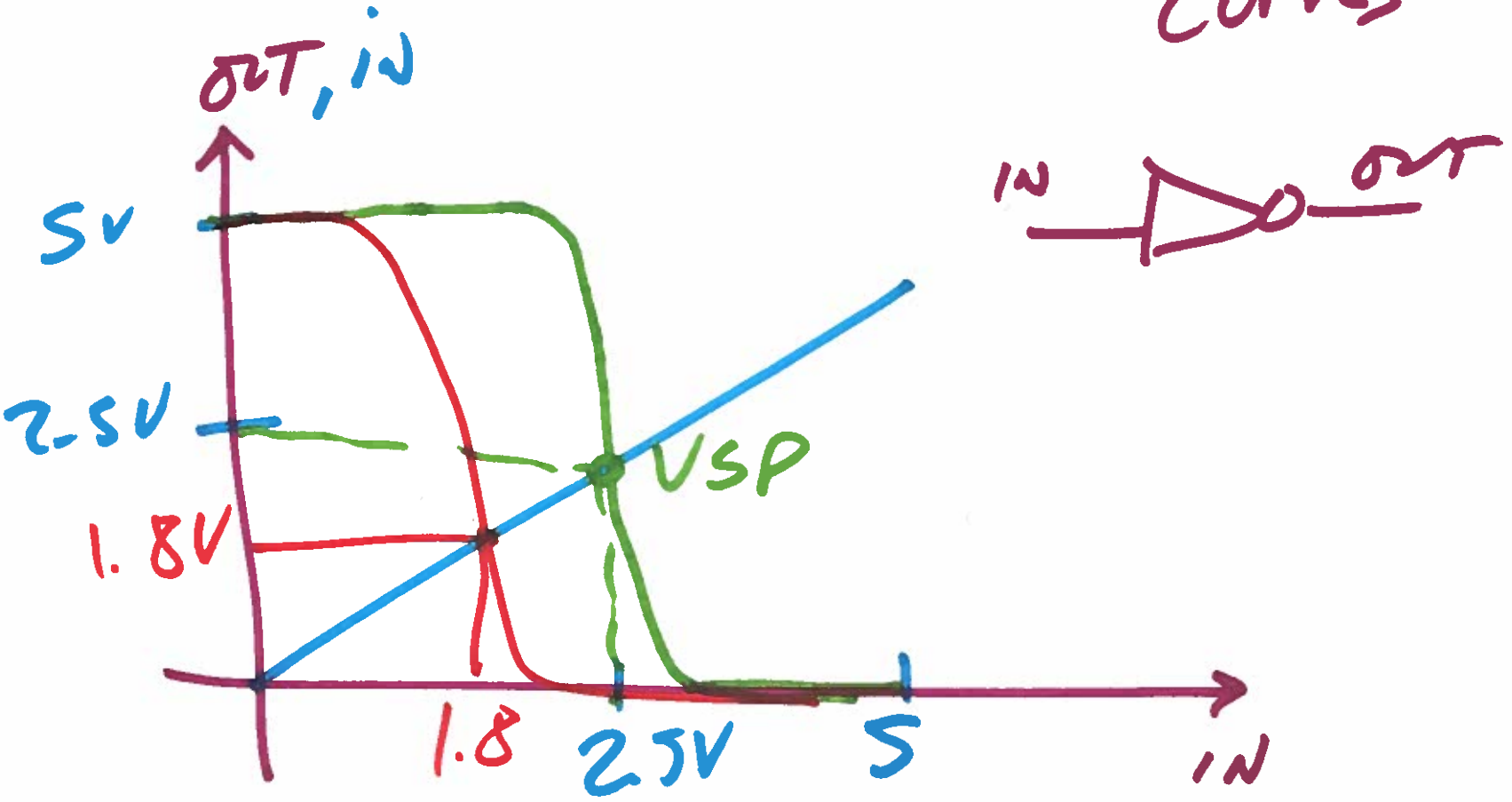
4)

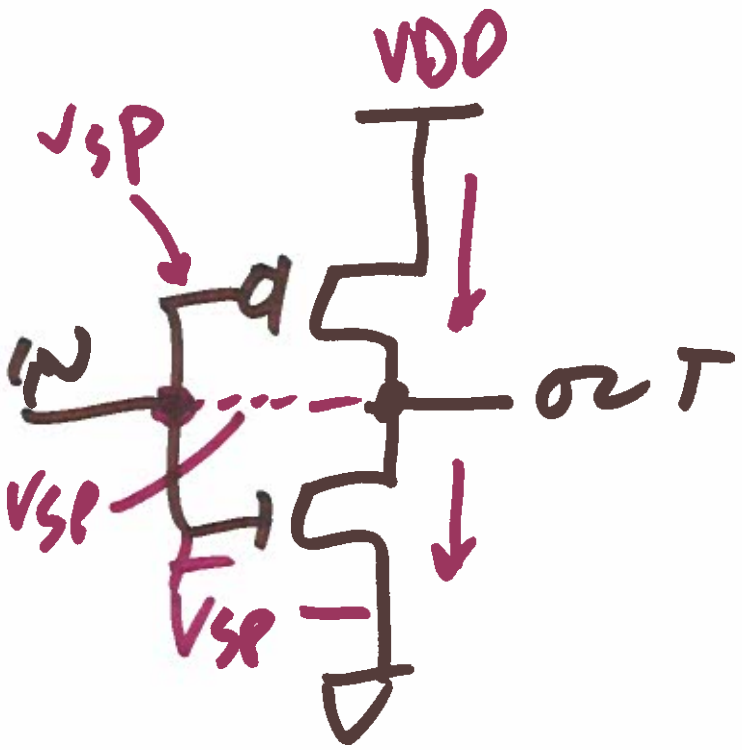

+5V
5V
+
6λ/.6μ
VDD-VthN
5V
0
0→3.6
tpHL = tpLH =
100 fF
.7.2K.100fF
140ps
2K
5V
VthP
VthP
VDD
4K
+0
6μ
100fF
1
0
VGG
280ps
5V
6μ
nMOS passes a "0" well
pMOS passes a "1" well
PASS GATES


VDD
VSP
0
0
VDD
1.7
VDD-|VTHN| = 3.6V
1
0
1.8
0
OUT
VSP=1.8V
RP
VSP
RN

VTC - Voltage Transfer Curves



derive V_{SP}



$$\frac{K_{PN}}{2}\frac{W_N}{L_N}\left(V_{SP}-V_{THN}\right)^2 =$$

$$\frac{K_{PP}}{2}\cdot\frac{W_P}{L_P}\left(VDD-V_{SP}-V_{THP}\right)^2$$

$$X=\sqrt{\frac{K_{PN}\cdot\frac{W_N}{L_N}}{K_P\cdot\frac{W_P}{L_P}}}$$

$$X\left(V_{SP}-V_{THN}\right)=VDD-V_{SP}-V_{THP}$$

~~V_{SP}~~

$$V_{SP}(1+X) = VDD-V_{THP}+V_{THN}$$

$$V_{SP} = \frac{VDD - V_{THP} + V_{THN}}{1 + \sqrt{\frac{K_{RN} \cdot W_N/L_N}{K_{RP} \cdot W_P/L_P}}}$$