

CS

$$R_{D1} = 20K$$

$$R_{D2} = 40K$$

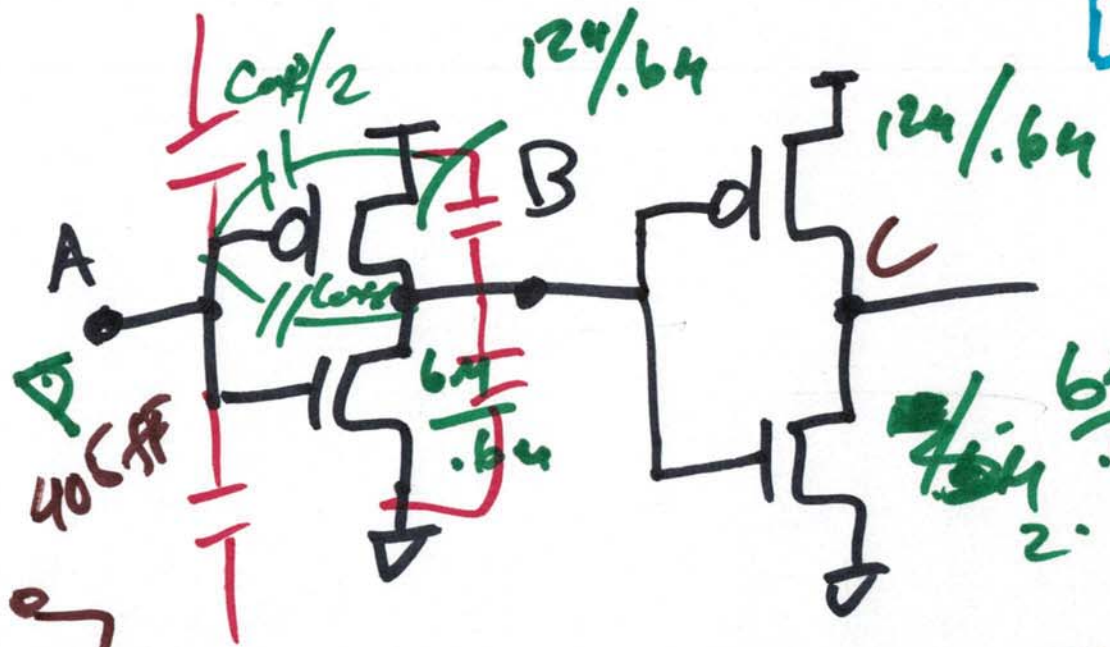
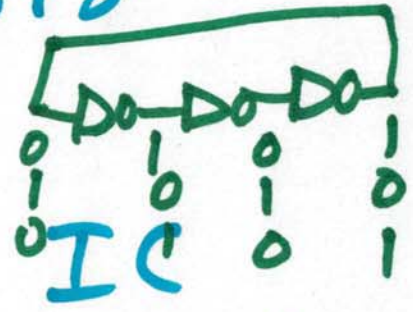
$$C_{ox} = 2.5 \frac{fF}{\mu m^2}$$

Lecture 17

14 → long L process
 50nm → short channel pr
 50nm → CS process

October 29, 2018
 EE 421 / ECG 621

Digital Design



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

1)

700

$$C_{oxp} = 12\mu \cdot 6\mu \cdot 2.5 \frac{fF}{\mu^2} = 180 fF$$

$$C_{oxN} = 6\mu \cdot 6\mu \cdot 2.5 \frac{fF}{\mu^2} = \frac{C_{oxP}}{2} = 90 fF$$

$t_{PLH} =$

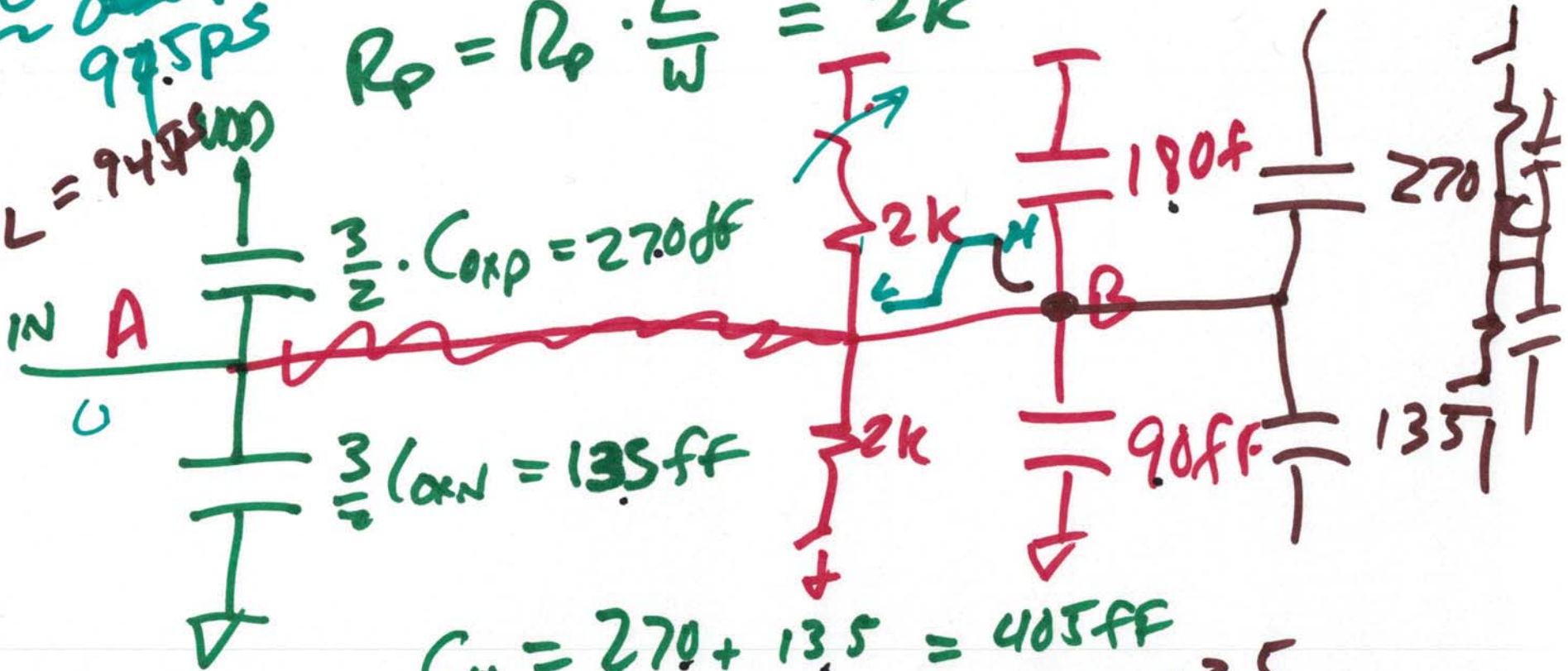
$$0.7 \cdot 2k \cdot 675 fF$$

$\approx 945 pS$
 $\approx 97.5 pS$

$$R_N = R_d' \cdot \frac{L}{W} = 20k \cdot \frac{6}{6} = 2k$$

$$R_P = R_p' \cdot \frac{L}{W} = 2k$$

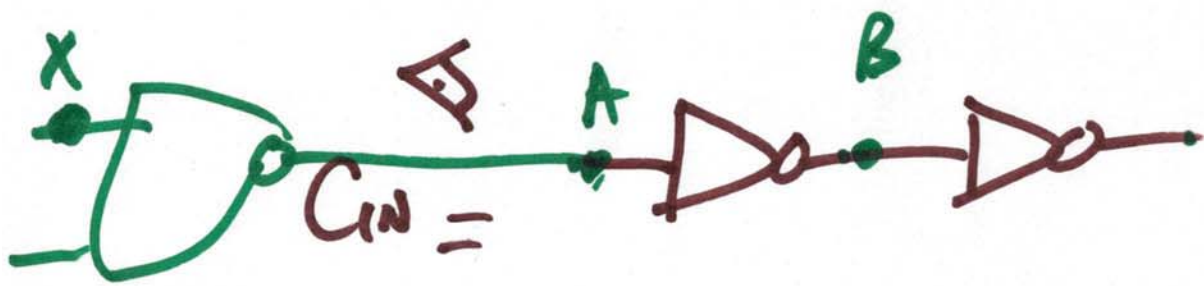
$$t_{PHL} = 945 pS$$



$$C_w = 270 + 13.5 = 405 fF$$

$$C_L = 180 + 90 + 270 + 13.5 = 675 fF$$

2)

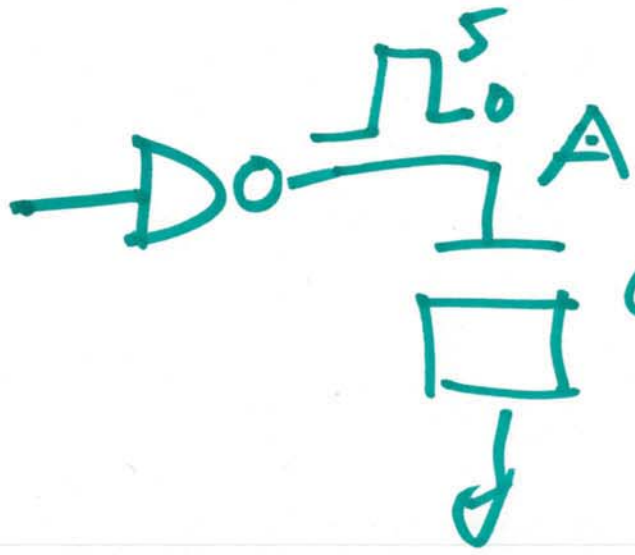


C_{IN}
+ C_{INP}

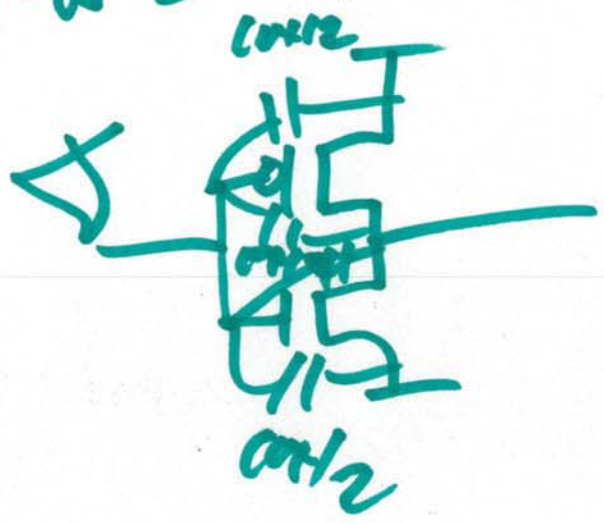
$$405 \text{ fF} = \frac{3}{2} C_{ox} \cdot 124 \cdot 64 + \frac{C_{INP}}{180 \text{ fF} \cdot \frac{3}{2}}$$

$$\frac{3}{2} C_{ox} \cdot 64 \cdot 64$$

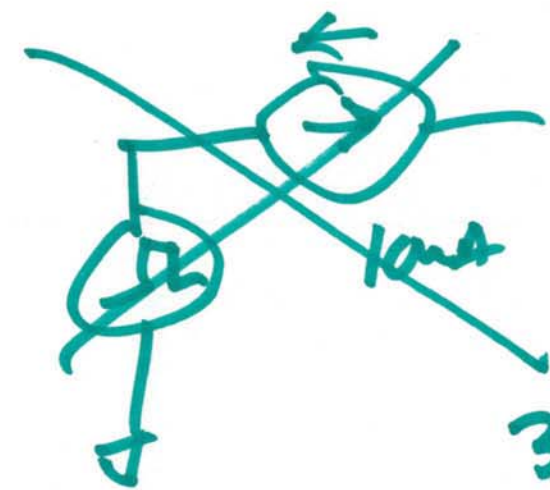
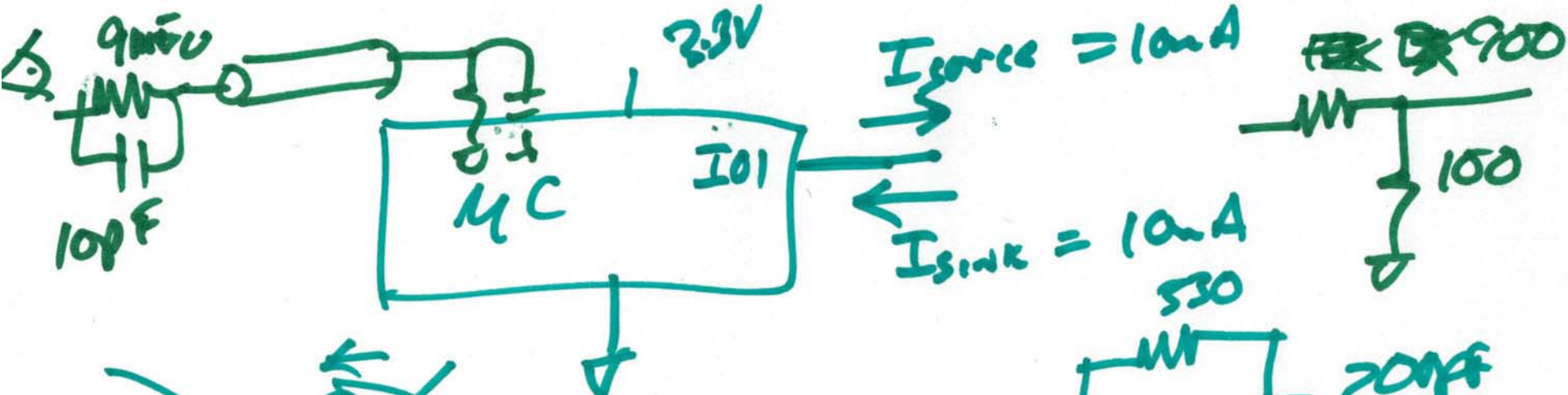
$$C_{IN} = 90 \text{ fF} \cdot \frac{3}{2}$$



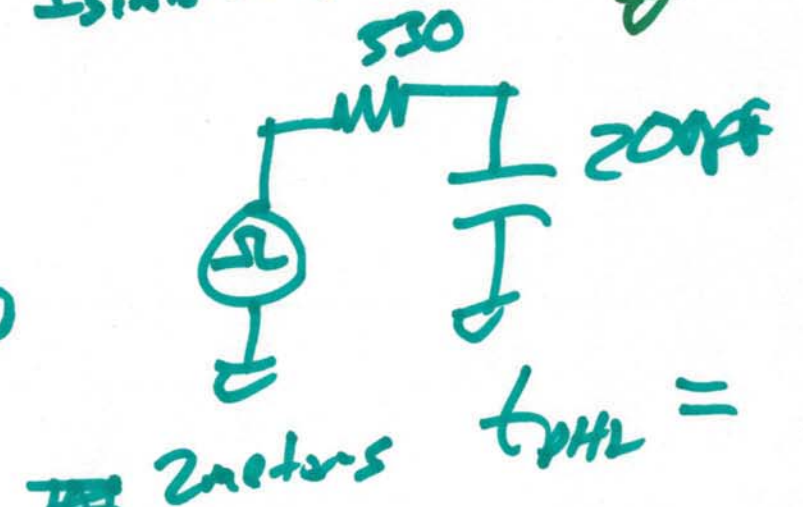
$C_{ox} \cdot W \cdot L$



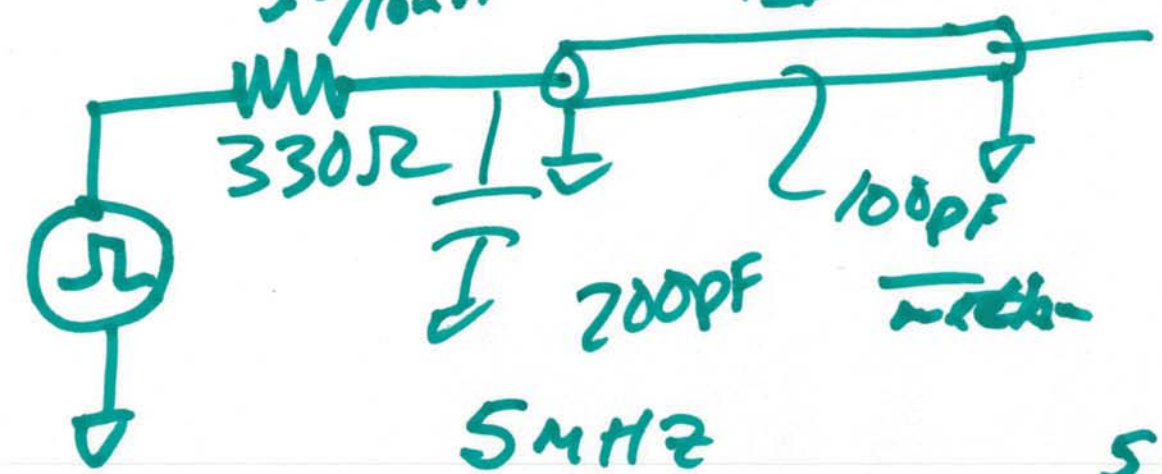
3)



$33 / 10nA = 330$

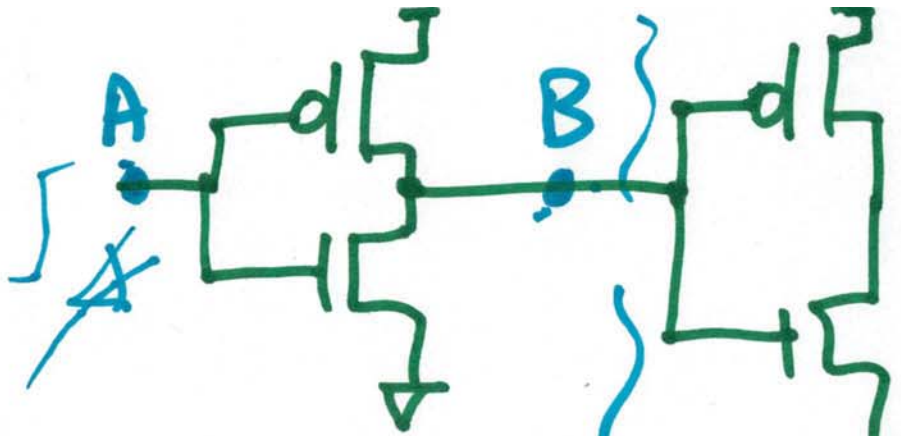


$t_{PHL} =$
 0.7
 $330 \cdot 200pF$
 $40000 pE$
 $40 nS$

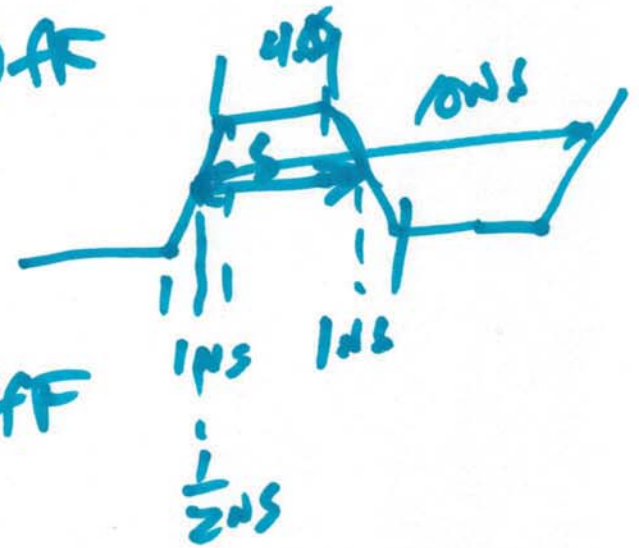
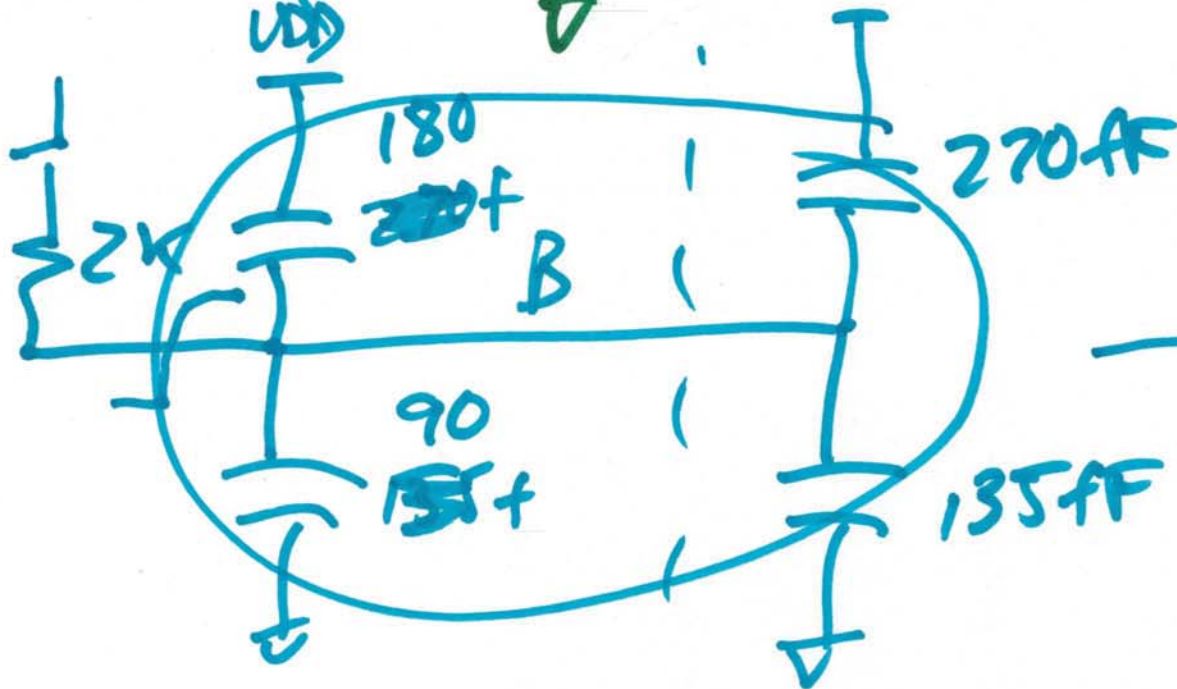


$5.40 nS$
 $\rightarrow 200nS$

4)



94 Tps



$$t_{pLH} = 0.7 \cdot 2k \cdot (180 + 90 + 270 + 135)$$

5)