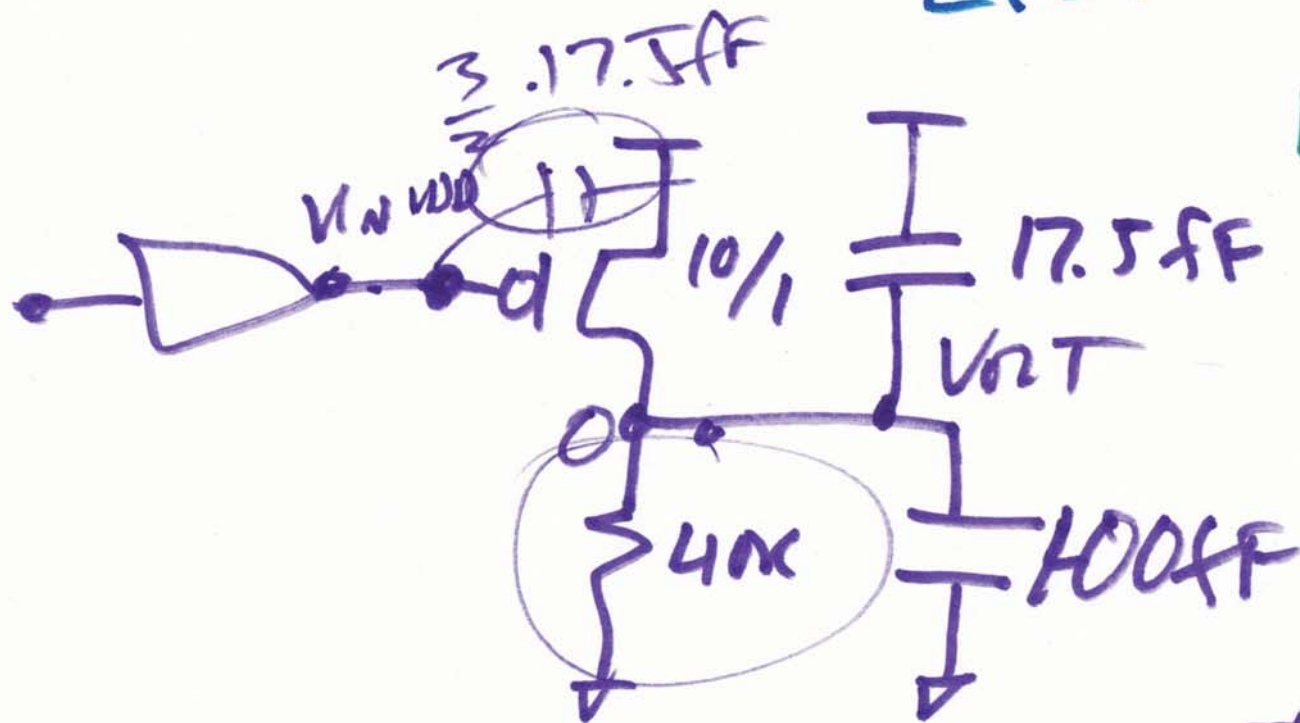


EE 421 / ECE 621

OCT. 26, 2015

Lecture 17



$$R_p = 4.5k$$

$$t_{PHL} = 40k.$$

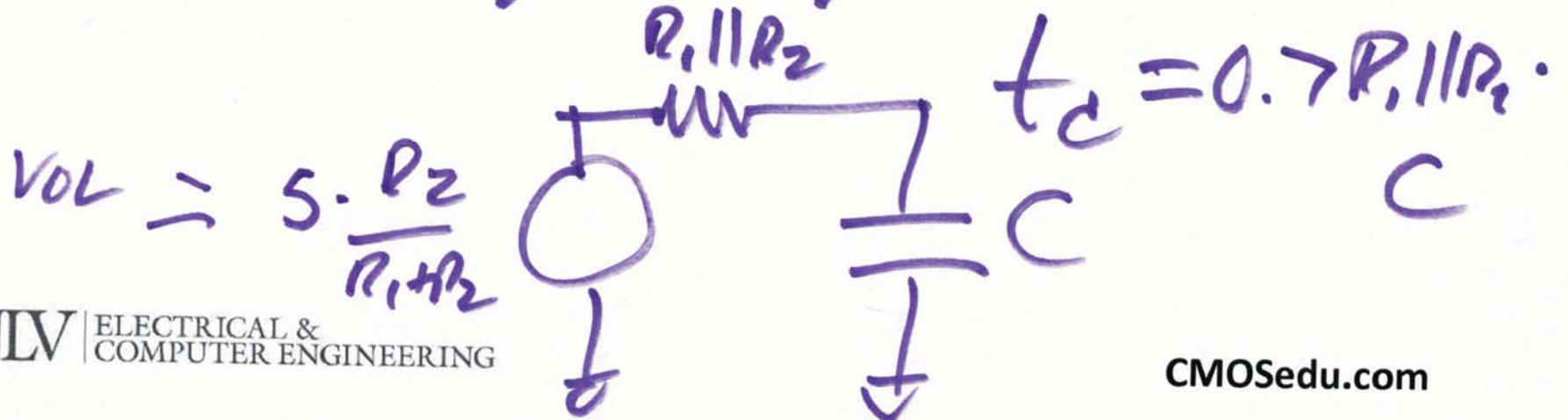
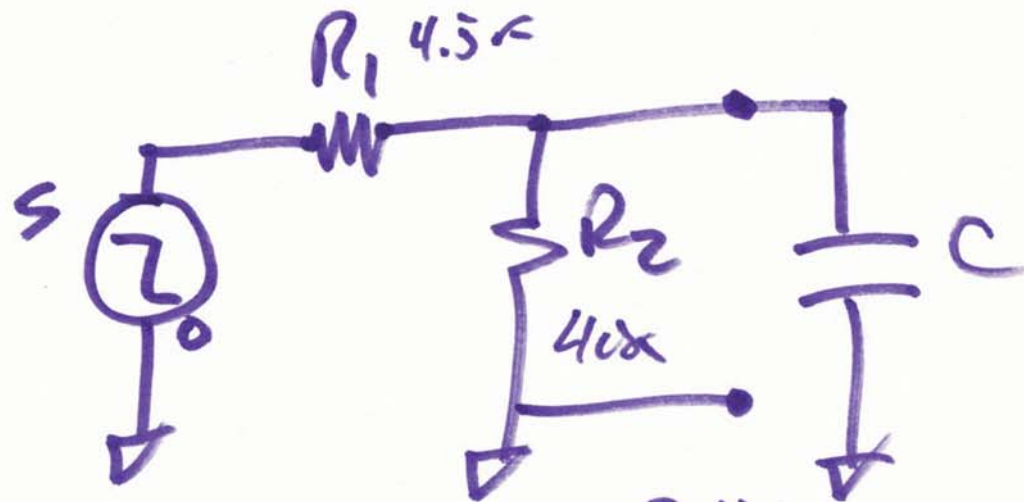
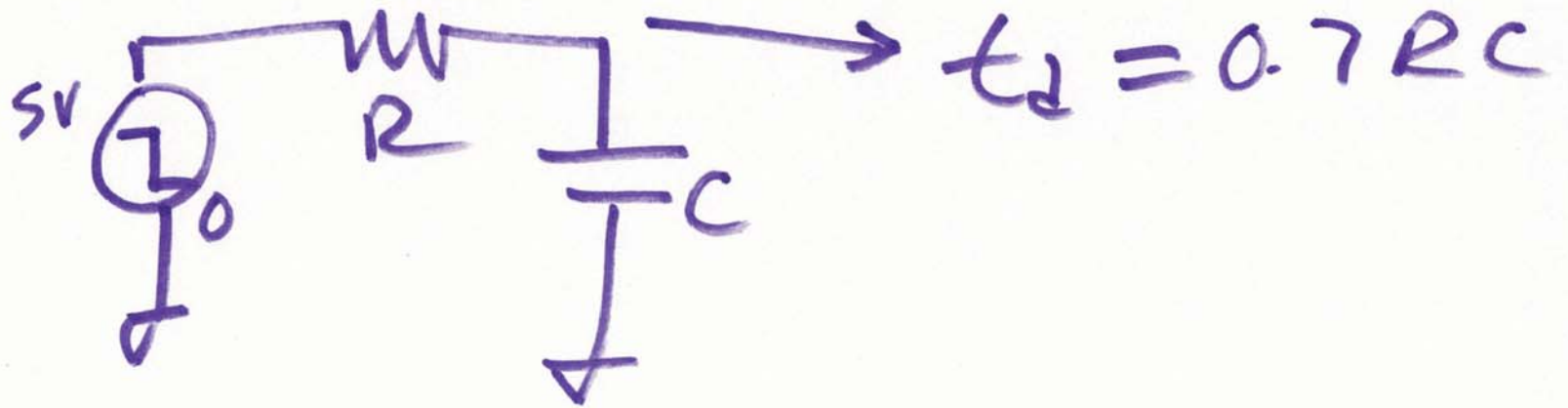
$$(117.5fF)$$

$$t_{PLH} = 40k \cdot 114.5k.$$

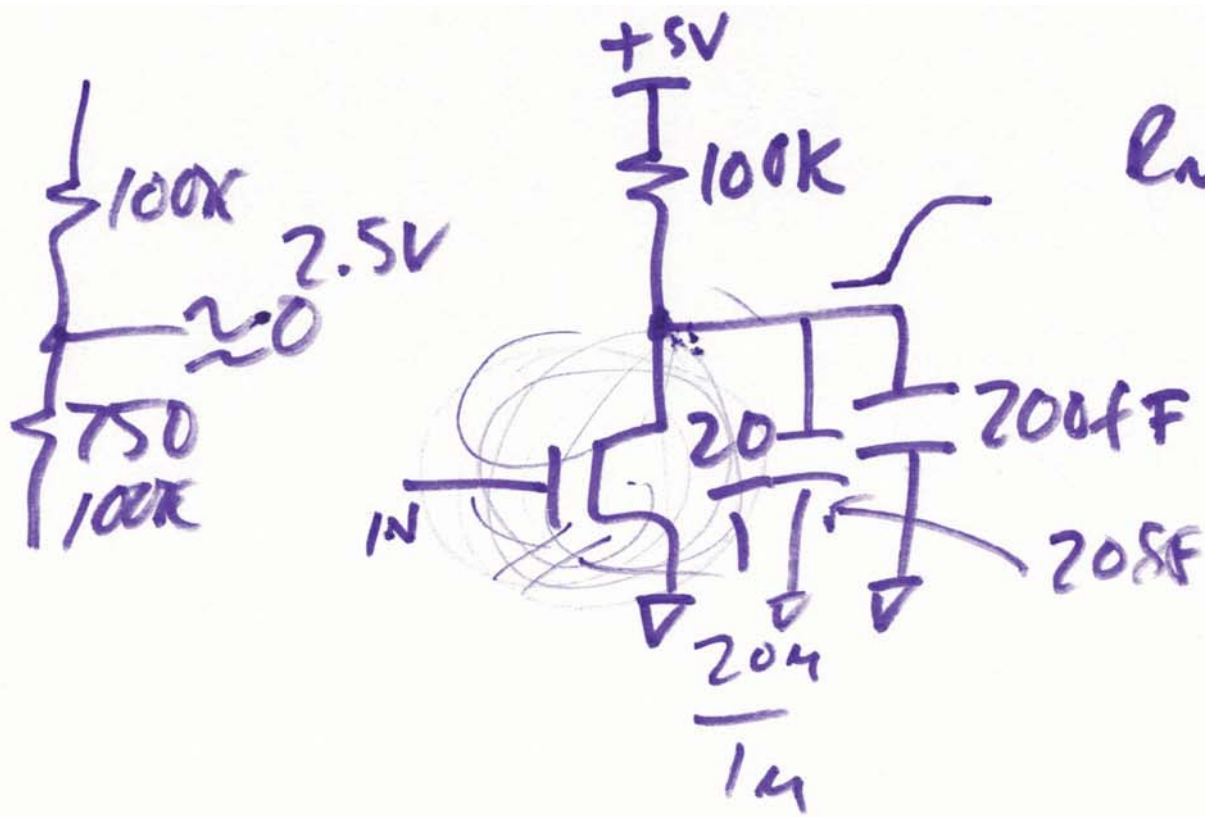
$$(117.5fF)$$

$$\approx 4.5k \cdot 117.5fF$$

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2)



$$R_N' = 15K \quad C_{ox}' = 1fF/\mu m^2$$

$$\lambda = 1\mu m$$

$$t_{PHL} = ?$$

$$t_{PLH} = ?$$

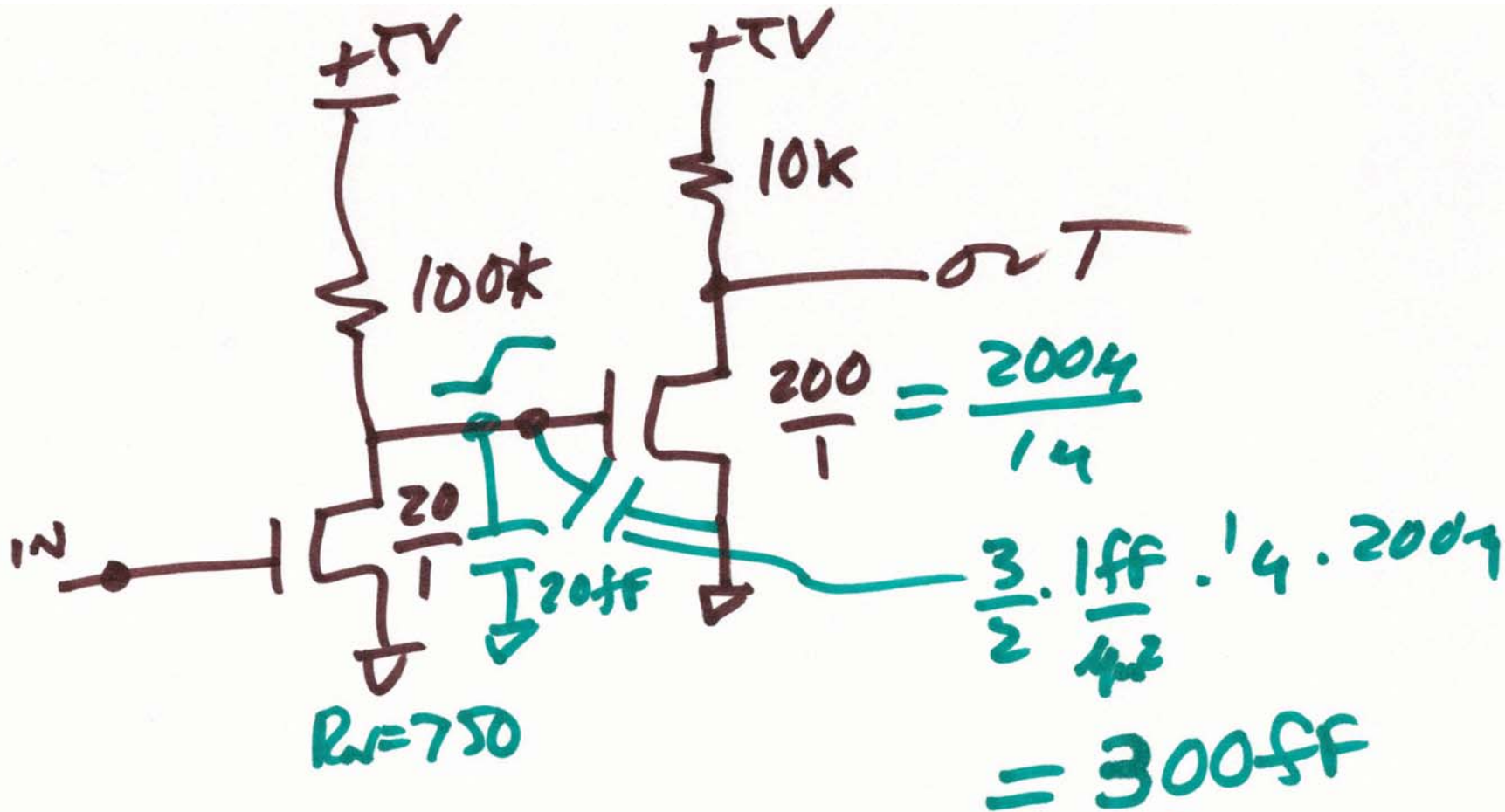
$$R_N = 15K \cdot \frac{1}{20} = 750$$

$$C_{ox} = \frac{1fF}{4.2} \cdot 1\mu \cdot 20\mu$$

$$= \underline{\underline{20fF}}$$

$$t_{PLH} = 0.7 \cdot 100K \cdot (220fF)$$

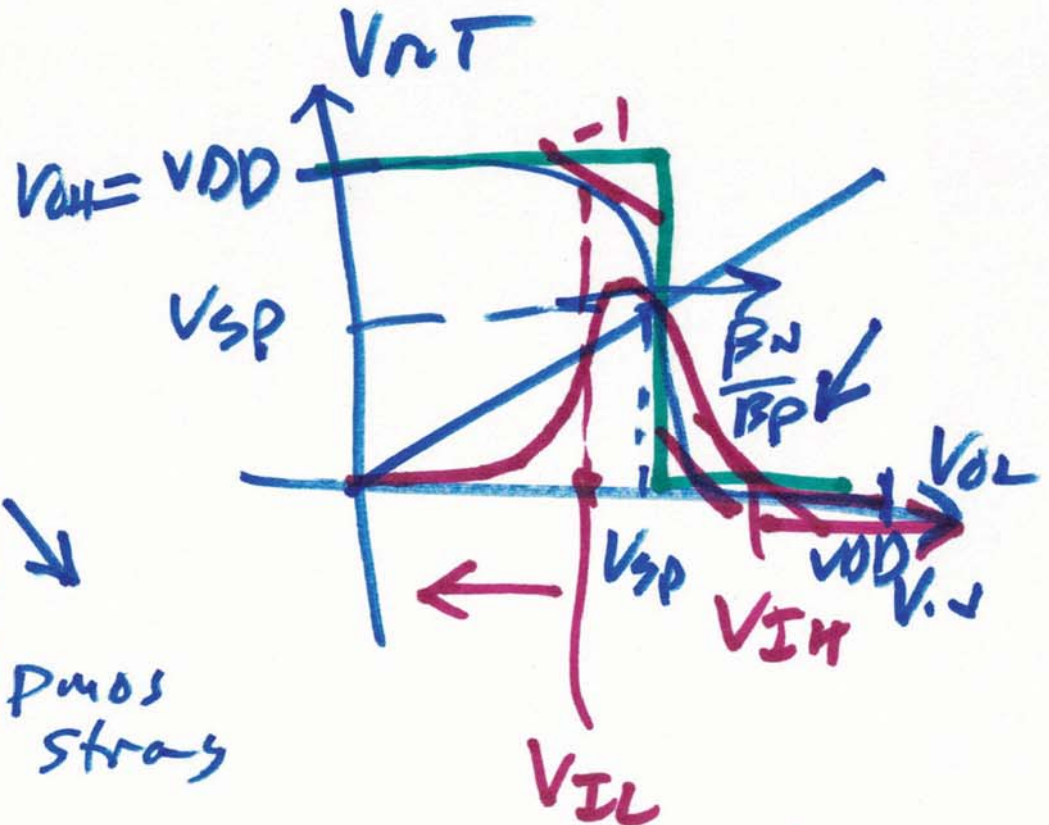
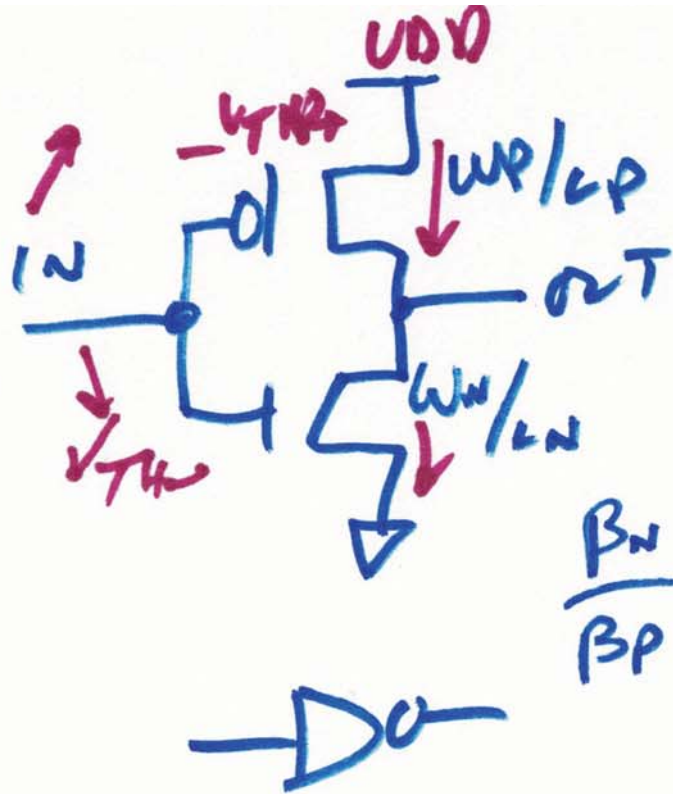
$$t_{PHL} = 0.7 \cdot \frac{100K || 750}{\approx 750} \cdot 220fF$$



$$t_{pHL} = 0.7 \cdot 100\text{k} \cdot 320\text{fF} =$$

$$t_{pHL} = (750 \parallel 100\text{k}) \cdot 320\text{fF} \quad \begin{matrix} 32000\text{ps} \\ 32\text{ns} \\ \underline{\underline{21\text{ns}}} \end{matrix}$$

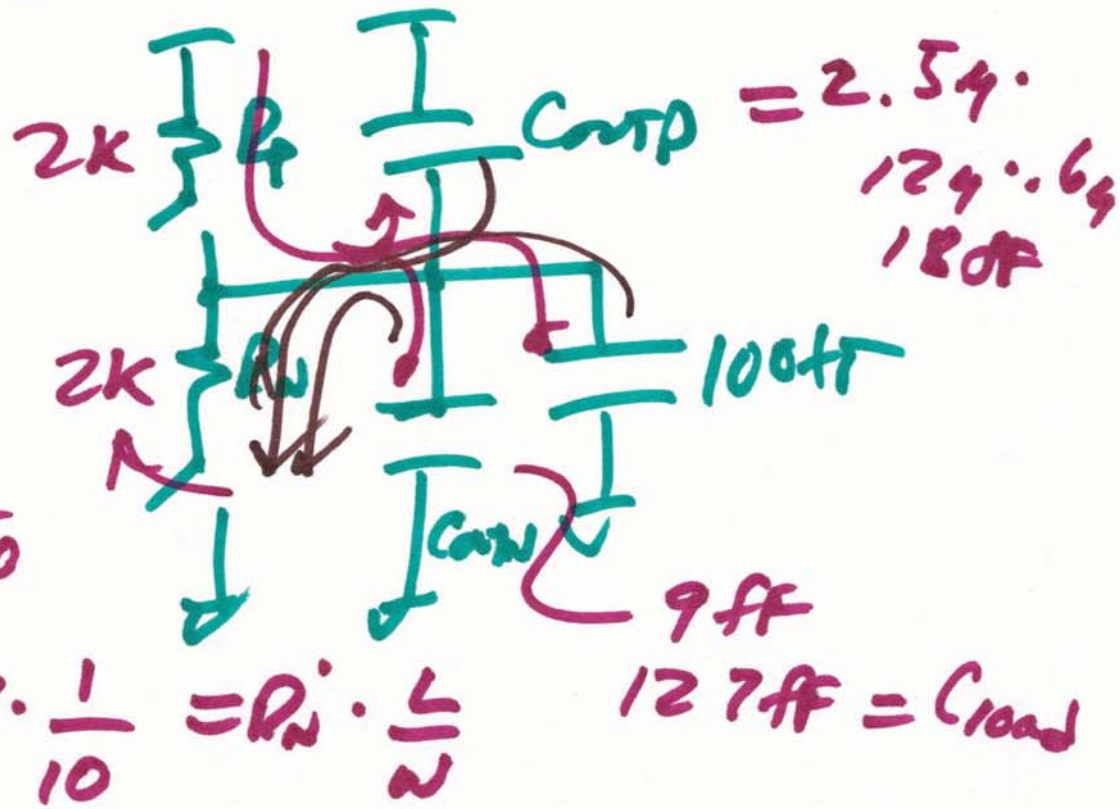
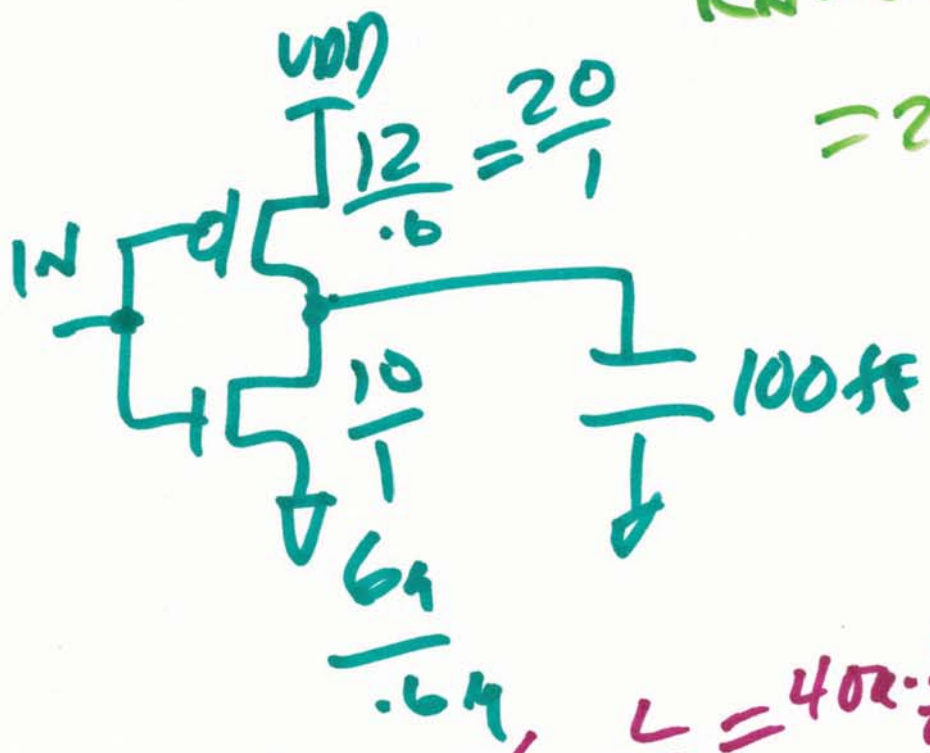
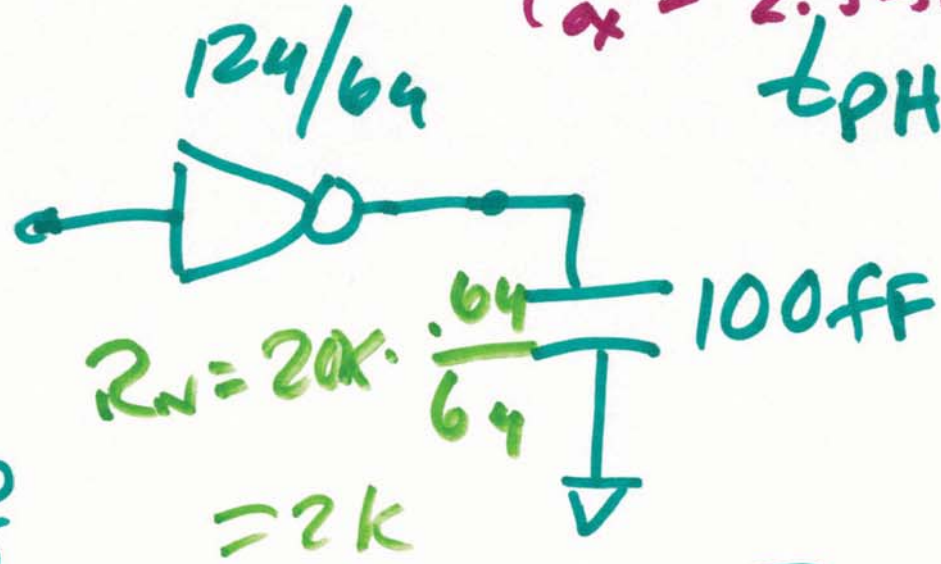
4)



$$\begin{aligned}
 NM_L &= V_{IL} - V_{OL} \\
 NM_H &= V_{OH} - V_{IH}
 \end{aligned}
 \left. \vphantom{\begin{aligned} NM_L \\ NM_H \end{aligned}} \right\} \frac{V_{DD}}{2}$$

$R'_N = 20k$
 $R'_P = 40k$

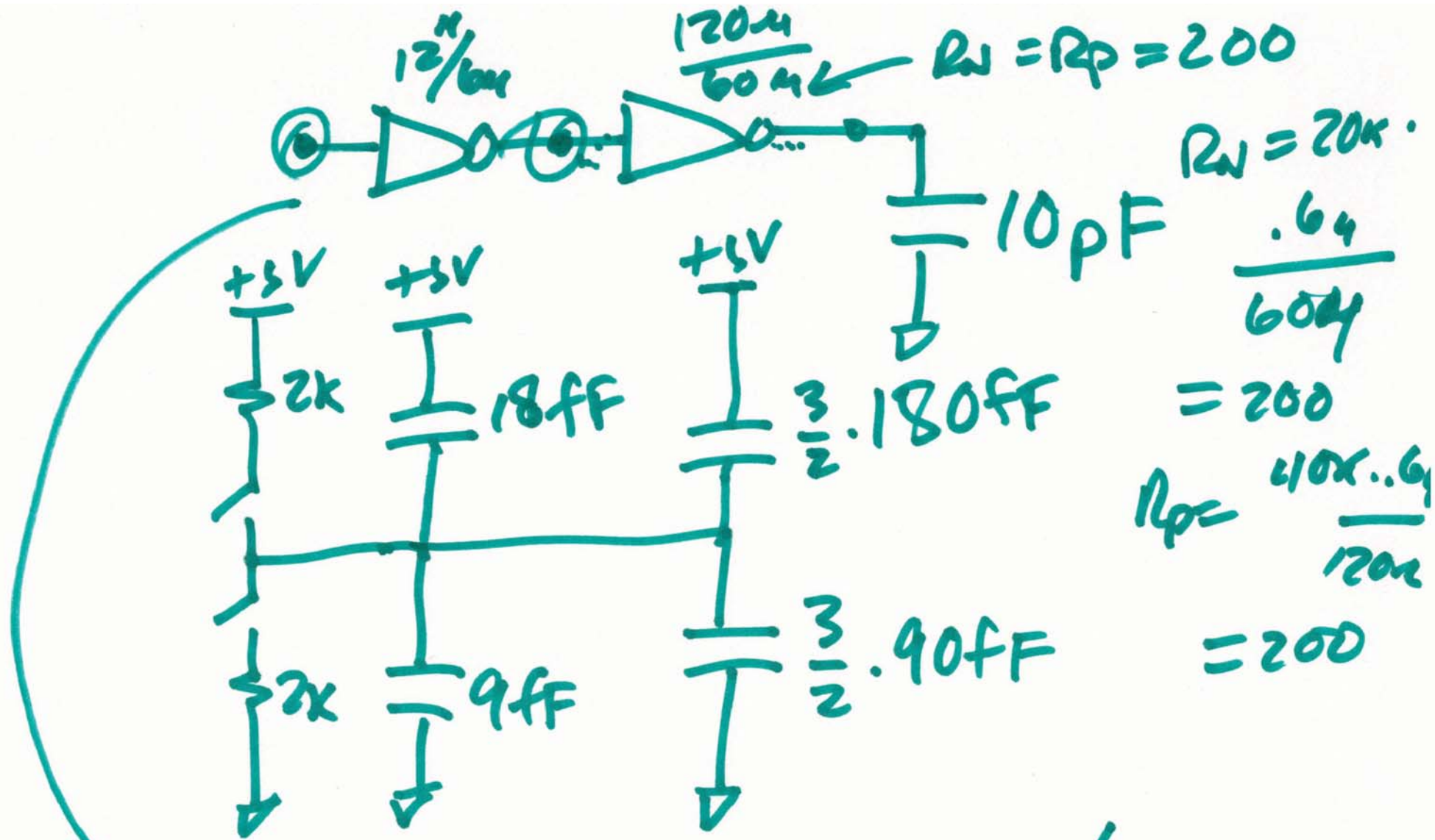
$C_{ox}' = 2.5 \text{ fF}/\mu\text{m}^2$
 t_{PHL}, t_{PLH}



$R_P = R'_P \cdot \frac{L}{W} = 40k \cdot \frac{1}{20}$

$R_N = 20k \cdot \frac{1}{10} = R'_N \cdot \frac{L}{W}$

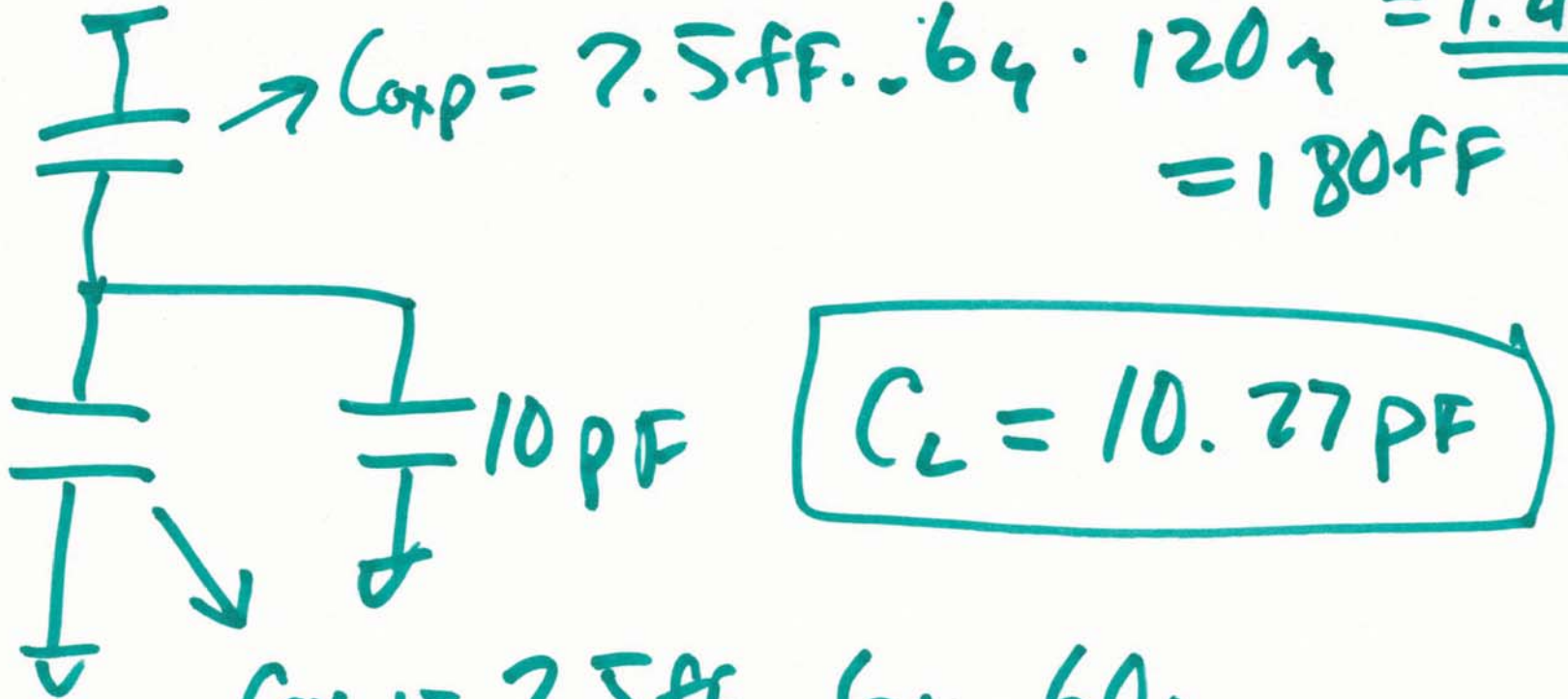
$t_{PHL} = t_{PLH} = 0.7 \cdot 2k \cdot 127 \text{ fF}$



$$t_{PHL} = t_{PLH} = 0.7 \cdot 200 \cdot 10.27 \text{ pF}$$

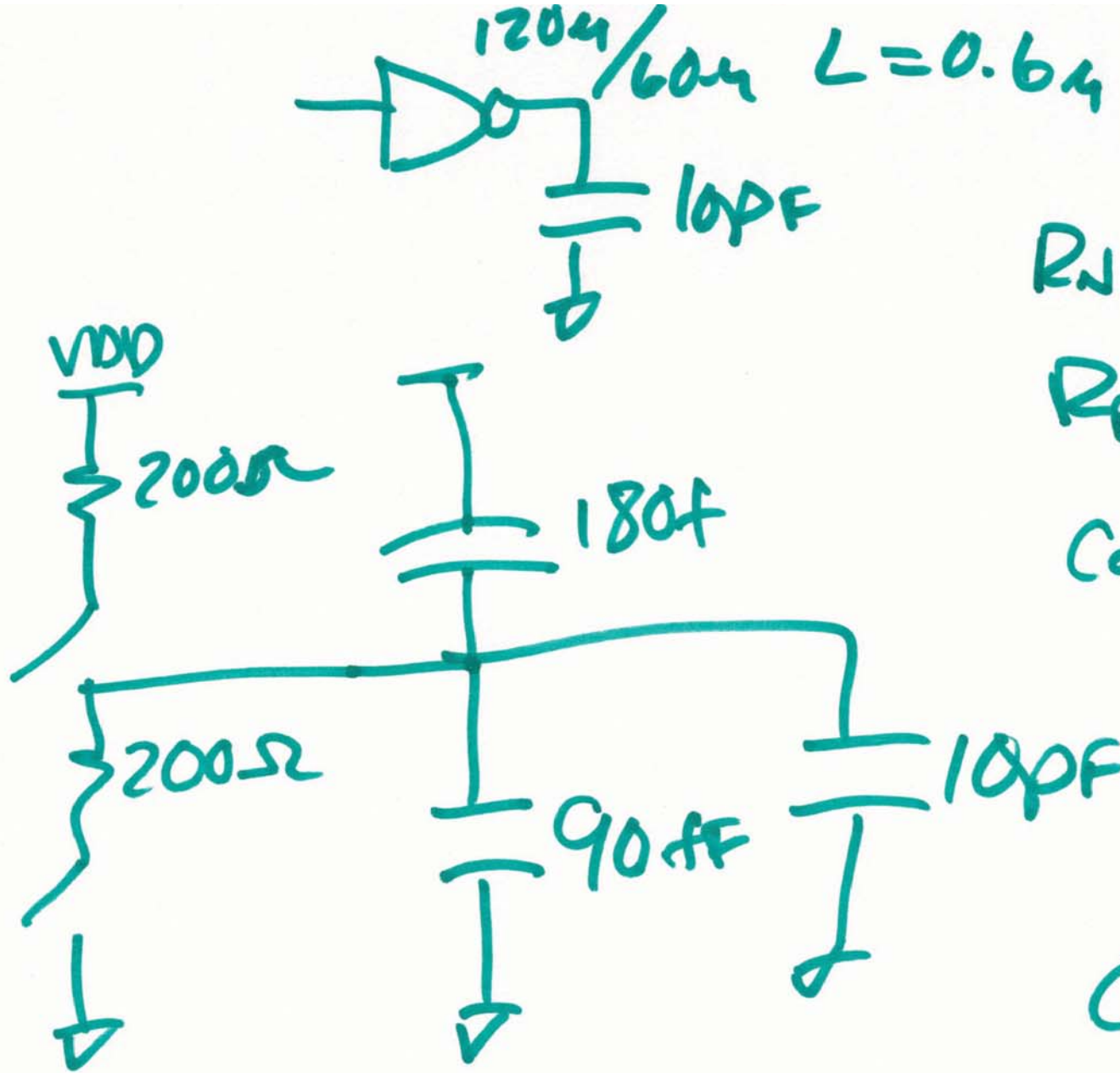
$$C_{\text{exp}} = 7.5 \text{ fF} \cdot 64 \cdot 120 \mu = \underline{\underline{1.4 \text{ nS}}}$$

$$= 180 \text{ fF}$$



$$C_{\text{exp}} = 7.5 \text{ fF} \cdot 64 \cdot 60 \mu$$

$$90 \text{ fF}$$



$$C_a' = 2.5 \text{ fF}/\mu\text{m}^2$$

$$R_N = R_N' \cdot \frac{L}{W} = 200$$

$$R_P = R_P' \cdot \frac{L}{W} = 200$$

$$C_{oxN} = C_{ox}' \cdot W_N \cdot L_N$$

$$= \frac{2.5 \text{ fF}}{\mu\text{m}^2} \cdot 60 \mu\text{m} \cdot 60 \mu\text{m}$$

$$= 90 \text{ fF}$$

$$C_{oxP} = 2 C_{oxN}$$

$$W_P = 2 W_N$$

$$= 180 \text{ fF}$$

$$t_{fall} = t_{rLH} =$$

$$0.7 \cdot 200 \cdot 10 \cdot 27 \text{ p}$$

$$= 1.4 \text{ ns}$$

