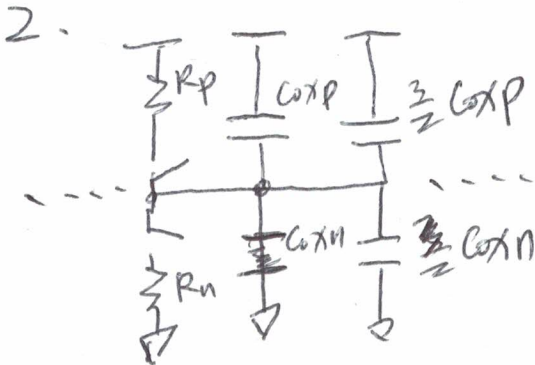


HW 5 Solution

$$\begin{aligned}
 1. \textcircled{a} \quad t_d &= 0.7 \cdot R_n \cdot C_{tot} \\
 &= 0.7 \cdot 3.4K \cdot (C_{oxn} + C_L) \\
 &= 0.7 \cdot 3.4K \cdot (0.625f + 20f) \\
 &= 49.0875ps
 \end{aligned}$$

$$\begin{aligned}
 \textcircled{b} \quad t_d &= 0.7 \times \frac{3.4K}{20} \times (1.25f \times 20 + 20f) \\
 &= 119 \times 45f \\
 &= 5.355ps \times 20 = 107.1ps
 \end{aligned}$$



$$\begin{aligned}
 \textcircled{a} \quad C_{tot} &= \frac{5}{2} (C_{oxn} + C_{oxp}) \\
 t_{PHL} &= 0.7 \times R_n \times C_{tot} \\
 &= 0.7 \times 3.4K \times \frac{5}{2} (0.625f + 1.25f) \\
 &= 11.15ps
 \end{aligned}$$

$$\begin{aligned}
 \textcircled{b} \quad t_{PLH} &= 0.7 \times R_p \times C_{tot} \\
 &= 11.15ps
 \end{aligned}$$

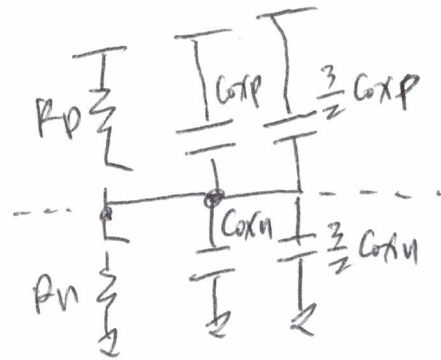
$$\begin{aligned}
 f_{osc} &= \frac{1}{11 \times (22.3ps)} \\
 &= 4.086GHz
 \end{aligned}$$

$$\begin{aligned}
 \textcircled{b} \quad t_{PHL} &= 0.7 \times 1.5K \times \frac{5}{2} (1.75f + 52.5f) \\
 &= 183.75ps
 \end{aligned}$$

$$\begin{aligned}
 t_{PLH} &= 0.7 \times 1.5K \times \frac{5}{2} (1.75f + 52.5f) \\
 &= 183.75ps
 \end{aligned}$$

$$\begin{aligned}
 f_{osc} &= \frac{1}{11 \times (367.5p)} \\
 &= 0.247GHz
 \end{aligned}$$

3.



$$\begin{aligned}
 t_{PHL} = t_{PLH} &= 0.7 \times 3.4K \times \frac{5}{2} (0.625f + 1.25f) \\
 &= 11.15ps
 \end{aligned}$$

$$f_{osc} = \frac{1}{7 \times 22.3ps} = 6.4GHz$$

$$4. \quad f = \frac{1}{2\mu s} = 0.5MHz$$

$$P_{avg} = V_{dd}^2 \times C_{tot} \times f$$

$$= 25 \times 2p \times 0.5MHz$$

$$= 25\mu W$$