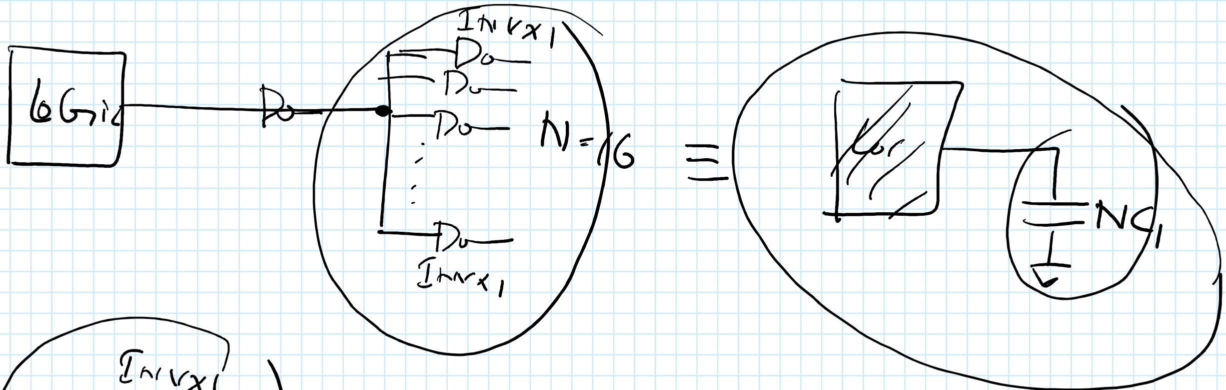
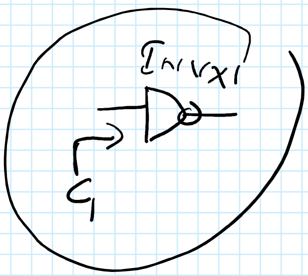
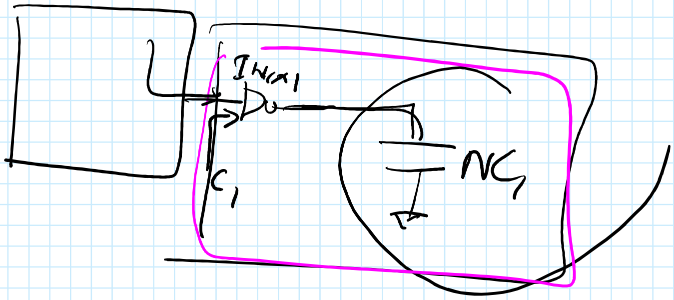
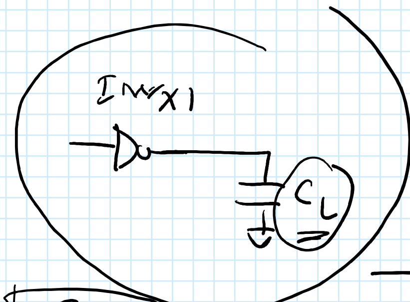




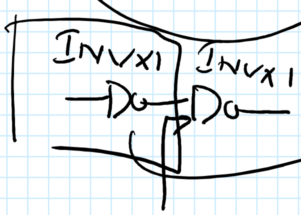




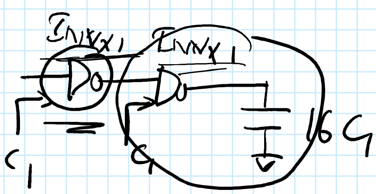
$$\boxed{t_p = 0.69 R C_L} = 16 \qquad R \equiv R_{avg}$$

$$0.69 R\, 16 C_1$$

$$\boxed{16 t_{pu}}$$

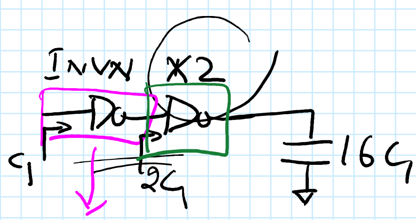


$$\boxed{t_p = 0.69 R C_1}$$

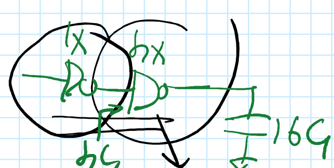


$$t_{pu} + 16 t_{pu} = 17 t_{pu}$$

$\Rightarrow$

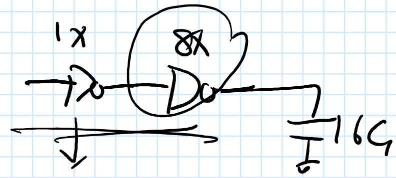


$$2t_{pu} + \frac{t_{pu}}{2} \times 16 = 10 t_{pu}$$

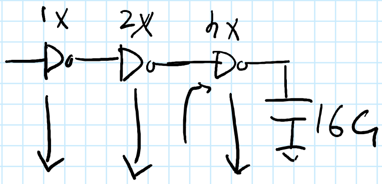


$$\boxed{4 t_{pu} + \frac{t_{pu}}{4} \times 16 = 8 t_{pu}}$$

$$4t_{pu} + \frac{t_{pu}}{4}\times 16 = 8t_{pu}$$

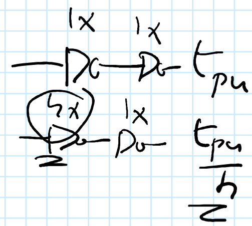


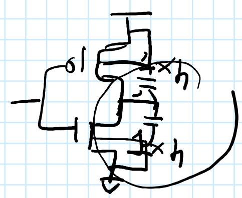
$$8t_{pu} + \frac{t_{pu}}{8}\times 16 = 10t_{pu}$$

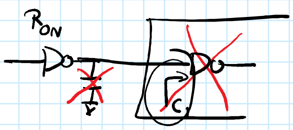


$$2t_{pu} + \frac{t_{pu}}{2}\times 4 + \frac{t_{pu}}{4}\times 16 = 8t_{pu}$$

2 2 4

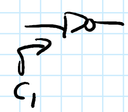




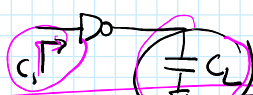


$$t_p = 0.69R_{on1}(C_1 + C_p) = \boxed{0.69R_{on}C_p}\left(1 + C_1/C_p\right)$$

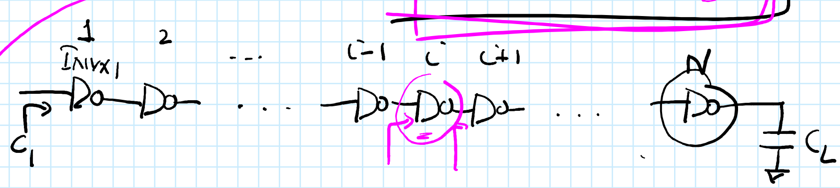
$$t_{p0}\left(1 + C_1/C_p\right) \quad C_p \rightarrow \gamma C_1$$



$$t_p = t_{p0}\left(1 + \frac{C_1}{\gamma C_1}\right)$$



$$\boxed{t_p = t_{p0}\left(1 + \frac{C_L}{\gamma C_1}\right)}$$



$$\text{Delay} = t_{p1} + t_{p2} + \dots\ t_{pi-1} + \dots - + t_{pN}$$

$$t_{pi} = t_{p0}\left(1 + \frac{C_{i+1}}{\gamma C_i}\right)$$

$i = N-1$

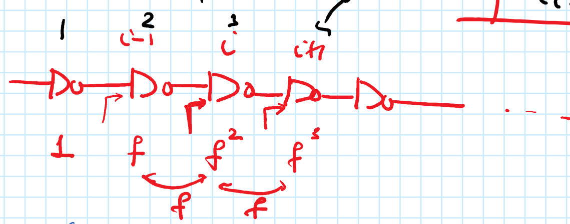
$$\text{Total delay} = \sum_{i=1}^{N} t_{p,i} = t_{p0}\left[1 + \frac{C_2}{\gamma C_1} + 1 + \frac{C_3}{\gamma C_2} + \dots \frac{C_i}{\gamma C_{i-1}} + \frac{C_{i+1}}{\gamma C_i} + \dots \frac{C_N}{\gamma C_{N-1}} + \frac{C_{N+1}}{\gamma C_N}\right]$$

$= C_L$

$$\text{total delay} = \sum_{i=1} t_{p,i} = t_{p0}\left[1 + \frac{C_2}{\gamma C_1} + 1 + \frac{C_3}{\gamma C_2} + \cdots \frac{C_i}{\gamma C_{i-1}} + \frac{C_{i+1}}{\gamma C_i} + \cdots \frac{C_N}{\gamma C_{N-1}} + \frac{C_{N+1}}{\gamma C_N}\right]$$

$$\frac{\partial T_D}{\partial C_i} = 0 \Rightarrow \left[\frac{1}{\gamma C_{i-1}} + \frac{\gamma C_i (0) - (C_{i+1})(\gamma)}{(\gamma C_i)^2}\right] = 0$$

$$\frac{1}{\gamma C_{i-1}} = \frac{C_{i+1}}{\gamma C_i^2} \qquad \boxed{\frac{C_i}{C_{i-1}} = \frac{C_{i+1}}{C_i}} = f$$



$$\cancel{\frac{C_2}{C_1}} \times \cancel{\frac{C_3}{C_2}} \times \cancel{\frac{C_4}{C_3}} \times \cdots \times \frac{C_L}{C_N} = f^N$$

$$H \leftarrow \boxed{\frac{C_L}{C_1} = f^{N}}$$

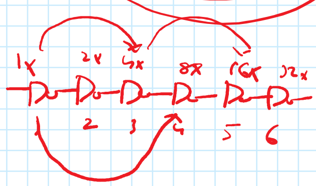
$$H = f^N \Rightarrow \ln H = N \ln f$$

$$\boxed{f = \sqrt[N]{H}} \qquad \boxed{N = \frac{\ln H}{\ln f}}$$

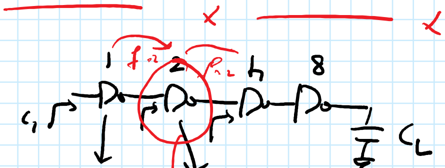
Inv x 1
2inv x 2
x 4
x 8
x 16
x 32

$\boxed{f = 2}$ $\rightarrow N = \{1, 6\}$

4 $\rightarrow N = \{1, 2, 3\}$



$f = 8$
$N = 1$



$$t_{p_i} = t_{p0}\left(1 + \frac{C_{i+1}}{\gamma C_i}\right)$$

$$t_{p0}\left(1 + \frac{2C}{\gamma C}\right) \qquad t_{p0}\left(1 + \frac{4C}{\gamma 2C}\right)$$

$$t_{p0}\left(1 + \frac{2}{\gamma}\right) \qquad = t_{p0}\left(1 + \frac{2}{\gamma}\right)$$

$$\boxed{t_i = t_{p0}\left(1 + f/\gamma\right)}$$

$$T_D = \sum t_i = N t_{p0}\left(1 + f/\gamma\right)$$

$$= \frac{t_{p0}}{\gamma}\frac{\ln H}{\ln f}\left[\gamma + f\right]$$

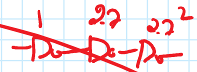
$\gamma \cdot \ln f \,($

$$T_D = \frac{t_{p0}\ln H}{\gamma}\left[\frac{\gamma + f}{\ln f}\right]$$

$$\frac{\partial T_D}{\partial f} = 0 \qquad \frac{t_{p0}\cancel{\ln H}}{\cancel{\gamma}}\left[\frac{\ln f(1) - (\gamma + f)\frac{1}{f}}{(\ln f)^2}\right] = 0$$

$$\boxed{\ln f = 1 + \gamma/f} \Rightarrow \boxed{f = e^{(1+\gamma/f)}}$$

$\gamma = 0$



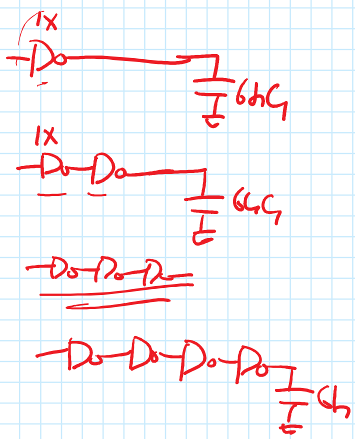
$\boxed{f = e} = 2.7$

γ fin.h

$\boxed{\gamma = 1, \; f \approx 3.6} \to 4$

N

$(\gamma$



N	f	t_p
1	64	$65\, t_{p0}$
2	8	$18\, t_{p0}$
3	4	$15\, t_{p0}$
4	2.8	$15.2\, t_{p0}$

$\sqrt[4]{64}$

$H = 64 \qquad f^N = H$

$t_{p0}\left(1 + \frac{64C}{\gamma C}\right)$

$t_i = t_{p0}(1 + f)$

$= t_{p0}(1 + 8) = 9\, t_{p0}$

$t_{p0}(1 + 4) = 5\, t_{p0}$

$t_{p0}(3.8) \times 4$

2