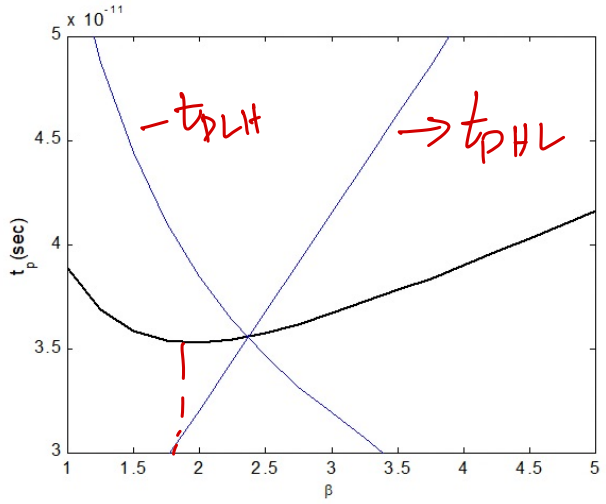
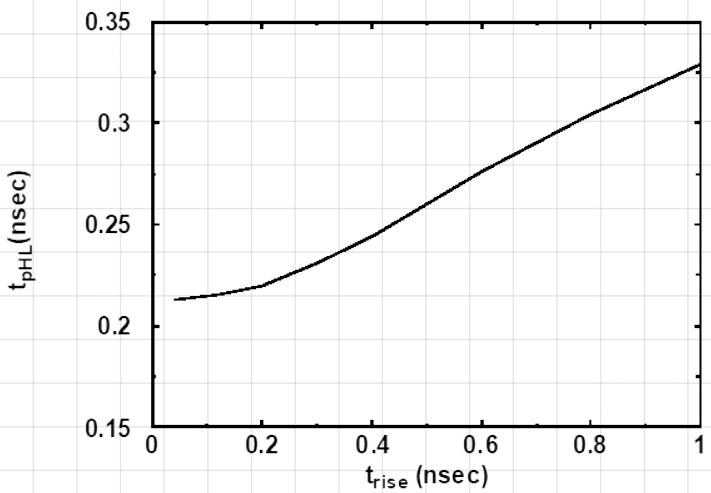
VLSI Design - Lecture 8

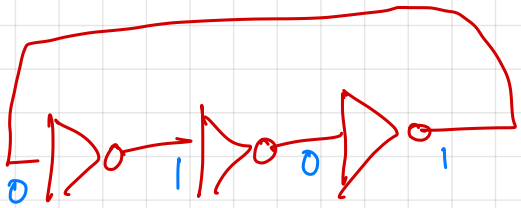
22nd Aug 2022

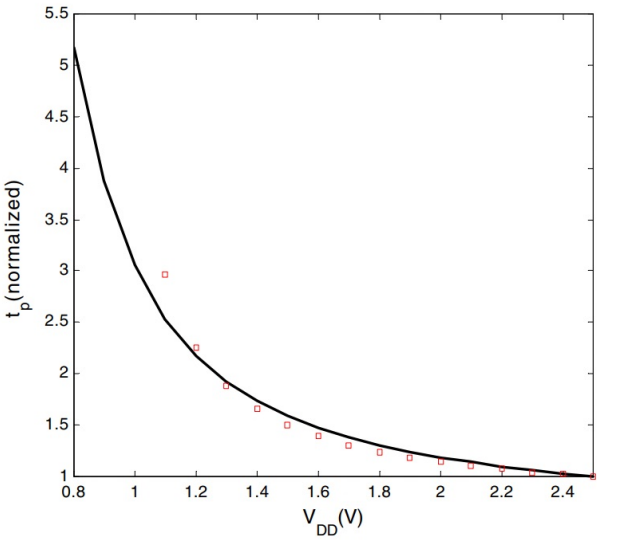
$$\beta = \sqrt{\mu}\left(1 + \frac{C_w}{C_{dn1} + C_{gn2}}\right)^{1/2}$$





$$t_{pHL} = \sqrt{t_{pHL,impulse}^2 + t_r^2}$$

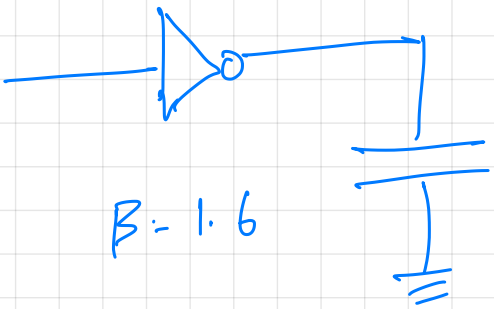




$$\frac{I_{on}}{I_{off}}$$

$$t_p = \frac{0.69}{2} R_{eq}\left(\underbrace{C_{dn1} + C_{dp1}}_{\text{Intrinsic}} + \underbrace{C_w + C_{gn2} + C_{gp2}}_{\text{Extrinsic}} \right)$$

$$= 0.69\, R_{eq}\left(C_{int} + C_{ext} \right)$$



S - scale factor

$$\beta = \frac{(W/L)_p}{(W/L)_n}$$

$S = 1 \quad L = 0.25 \quad W_n = 0.25 \quad W_p = 1.6 \times 0.25$

$S = 2 \quad " \quad 0.5 \quad W_p = 0.8$um

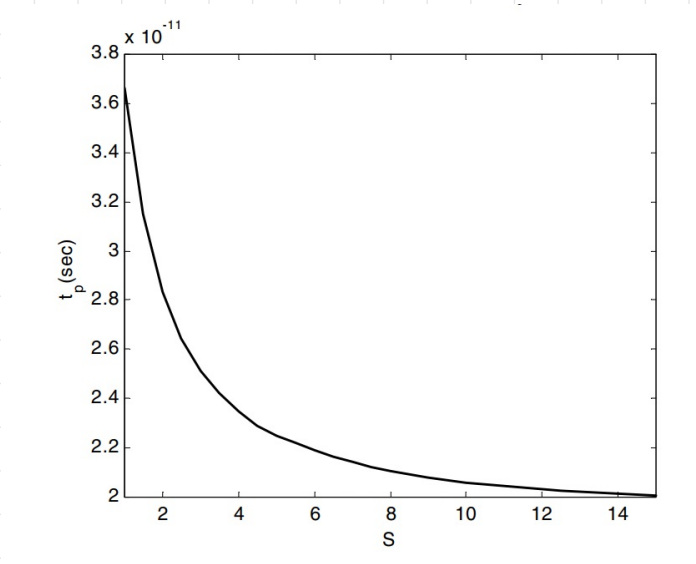
$S = 3$

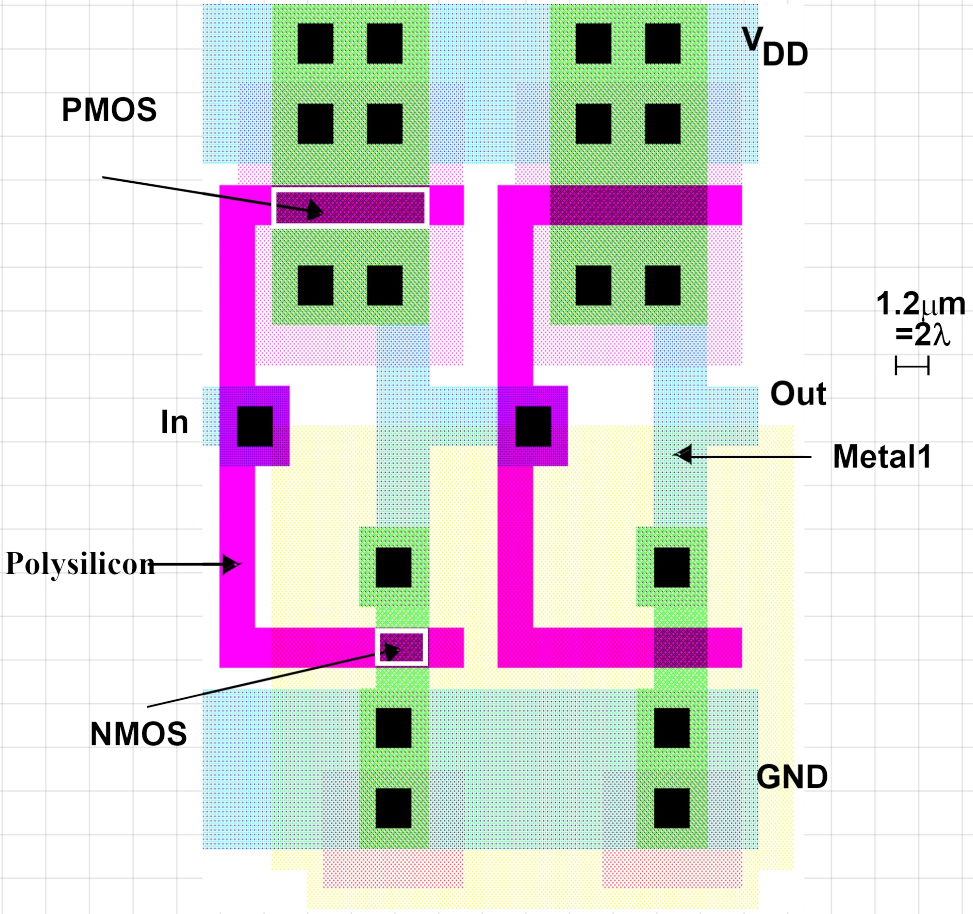
$$S: \quad R_{eq} \rightarrow R_{eq}/S \qquad C_{int} \rightarrow S\, C_{int}$$

$$t_p = 0.69 \frac{R_{eq}}{S}\left(S\, C_{int} + C_{ext} \right)$$

$$= \underbrace{0.69\, R_{eq}\, C_{int}}\left(1 + \frac{C_{ext}}{S\, C_{int}} \right)$$

Intrinsic delay
t_{p0}


x 10^-11
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
t_p (sec)
2
4
6
8
10
12
14
S


V_{DD}
PMOS
1.2μm
=2λ
Out
In
Metal1
Polysilicon
NMOS
GND