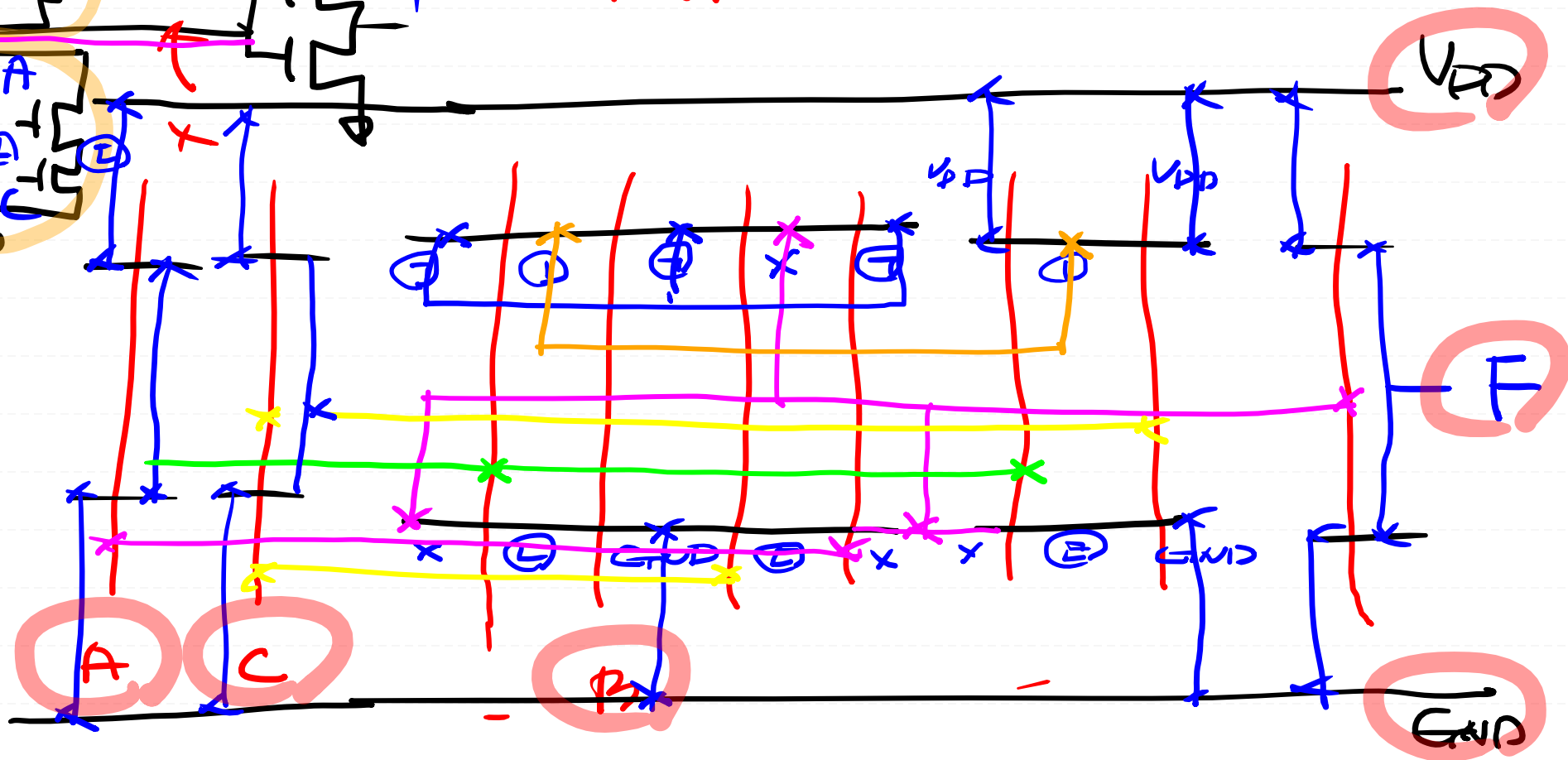


$$F = \bar{A}(\bar{C} + B) + AC$$

$$F = \bar{A}\bar{C} + \bar{A}B + AC$$

$$10 + 12 = 22\text{H.}$$

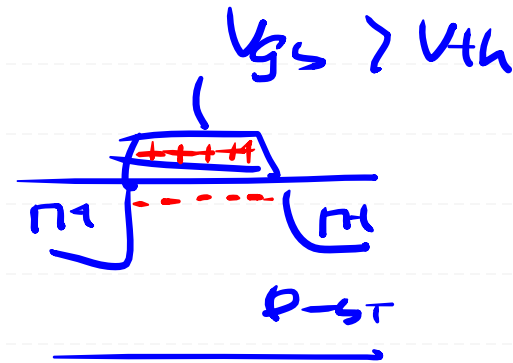
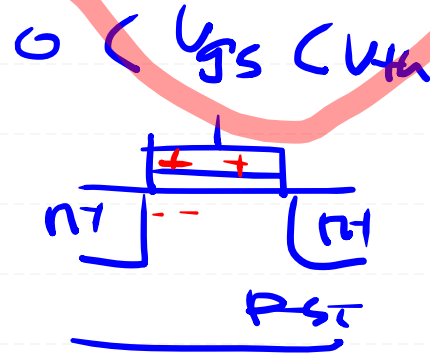
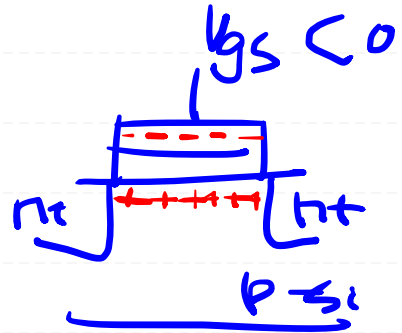
Path $\bar{A} - B - C - A$



$$C \propto \frac{A}{d}$$

nMOS

C_{gb}



Accumulation

Depletion

Inversion

0V

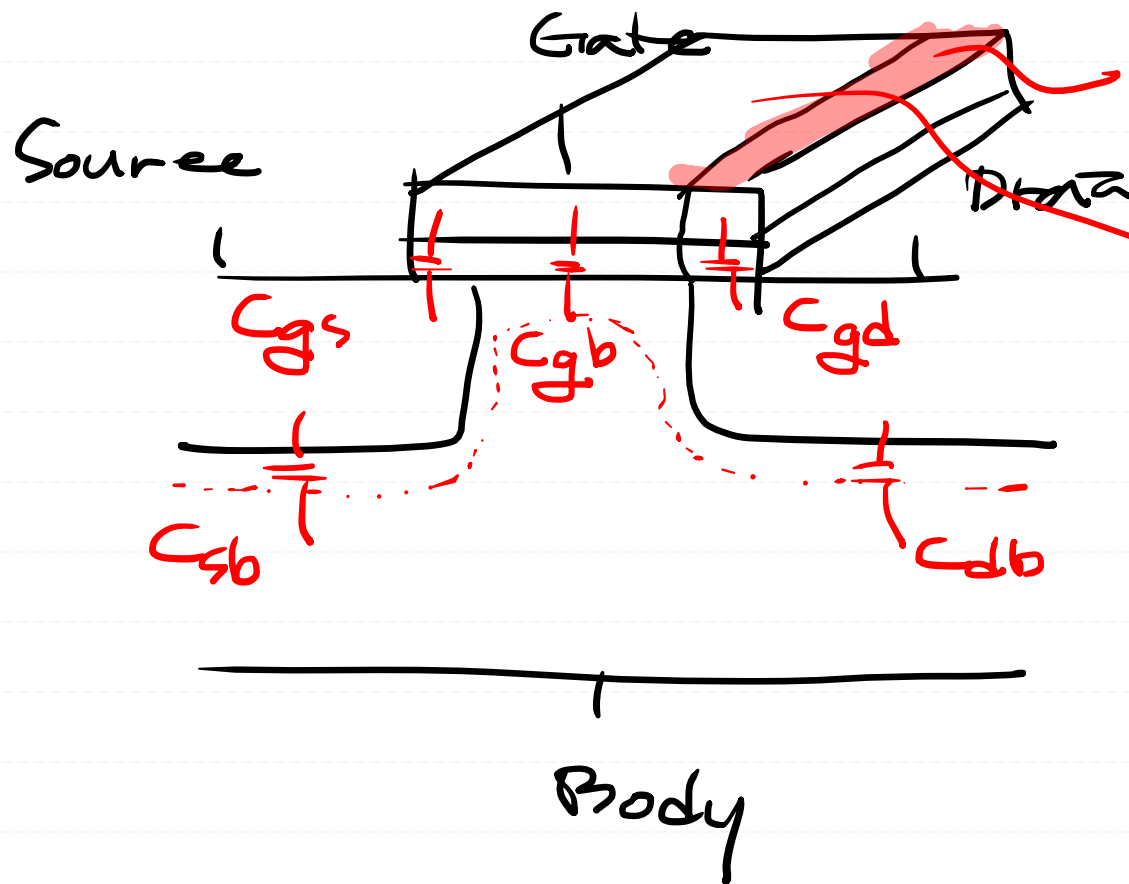
V_{th}

V_{gs}

off

off

on



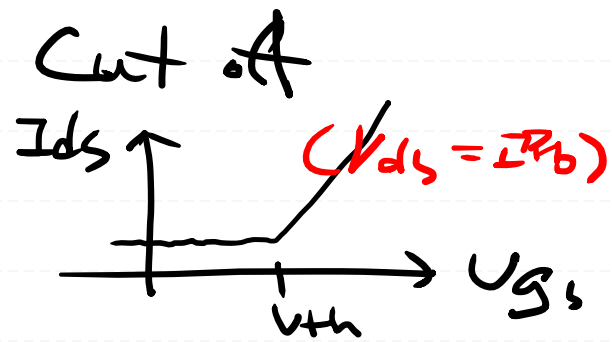
$$A = \Delta L \times W$$

$$A = L_{eff} \times W$$

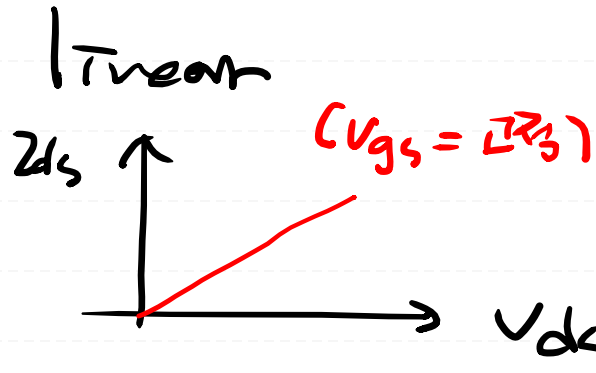
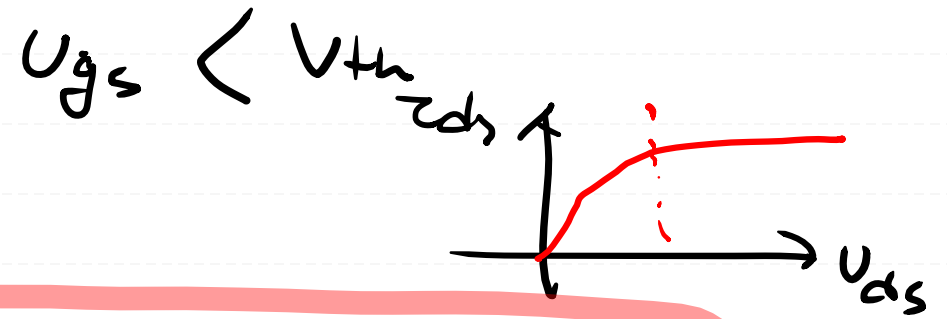
$$C \times \frac{A}{d} = \frac{1}{T_{ox}}$$

$$T_{ox} = \frac{1}{A} \text{ msk}$$

$$(10^{-10} \text{ m})$$



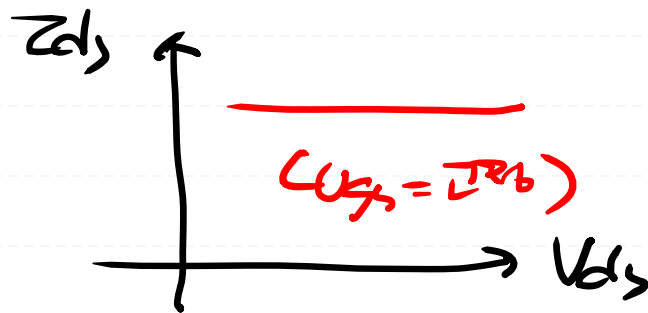
$$I_{ds} \approx 0$$



$$V_{gs} > V_{th} \quad V_{dsat} < V_{gs} - V_{th}$$

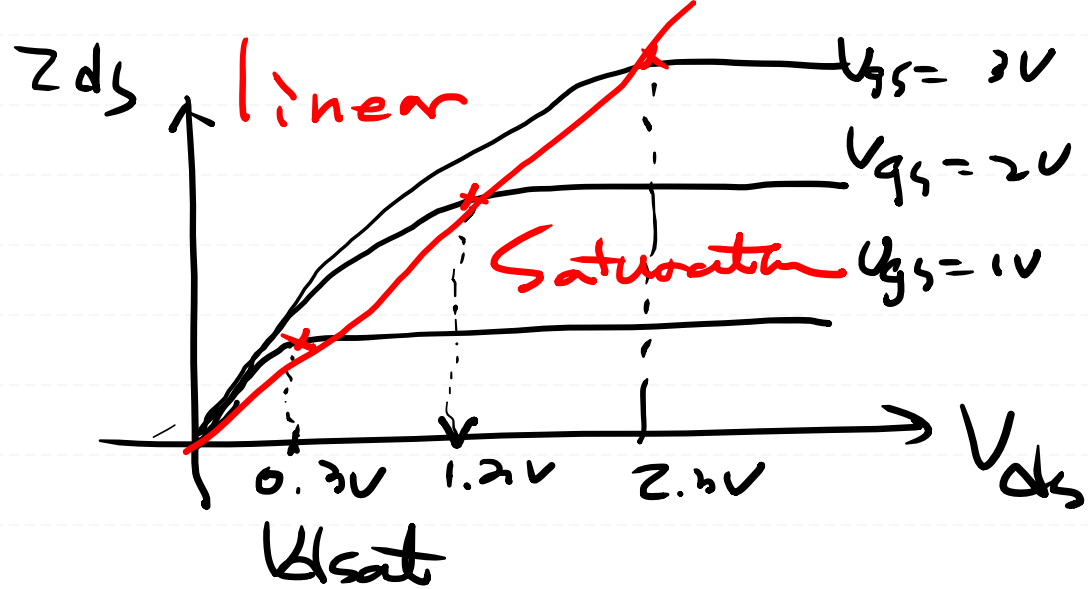
$$I_{ds} = \mu_n C_{ox} \frac{W}{L} \left(V_{gs} - V_{th} - \frac{V_{ds}}{2} \right) V_{ds}$$

Saturation



$$V_{gs} > V_{th} \quad V_{dsat} > V_{gs} - V_{th}$$

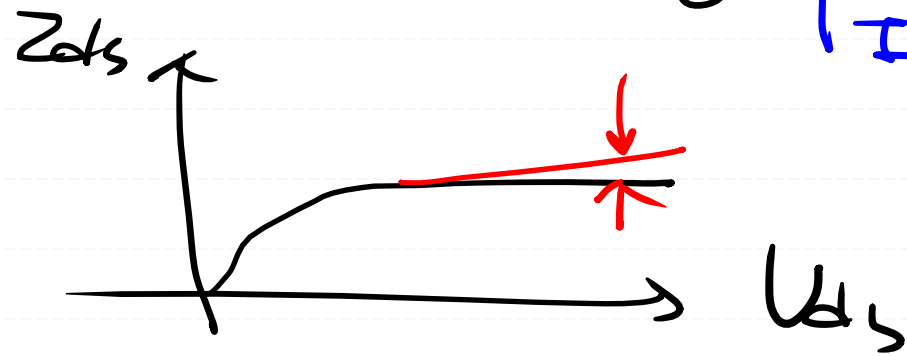
$$I_{dsat} = \frac{1}{2} \mu_n C_{ox} \frac{W}{L} (V_{gs} - V_{th})^2$$



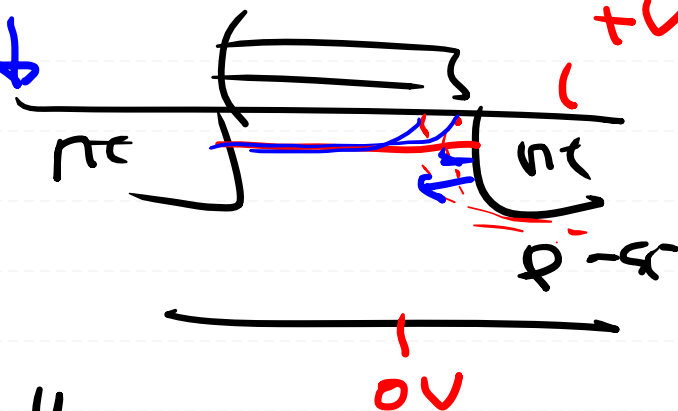
$$V_{Dsat} = V_{GS} - V_{th} \quad (0.7V)$$

$$3 - 0.7 = 2.3$$

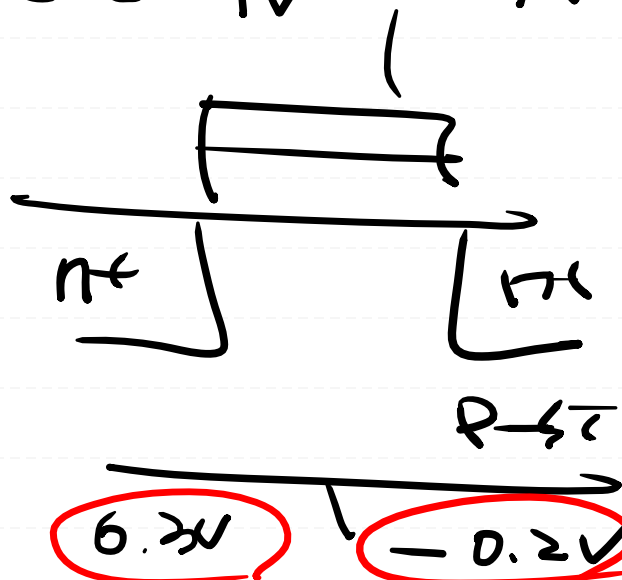
① Channel Length Modulation



$$\uparrow I \propto \frac{W}{L} \downarrow$$



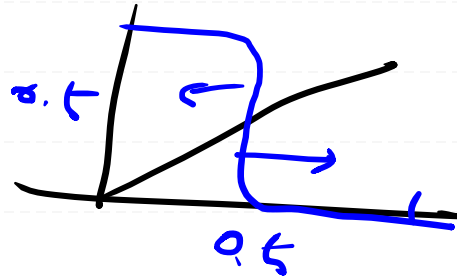
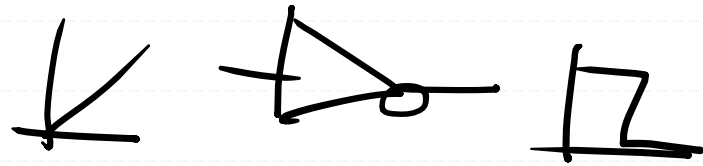
② Body Effect V_{th} $0.7V$



$$\underline{V_{th} = 0.7V}$$

$$\boxed{6.7V} \quad \boxed{-0.2V}$$

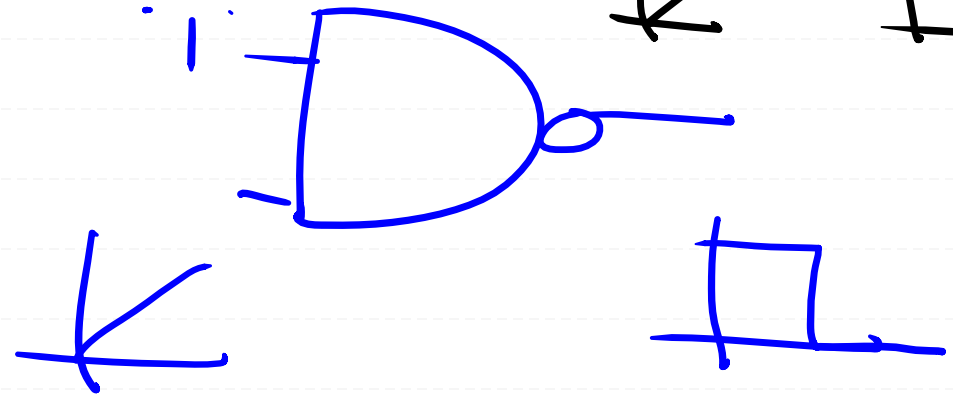
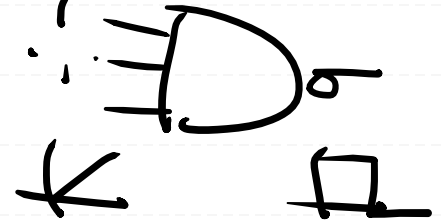
Logic gate Simulation



2 AND ?

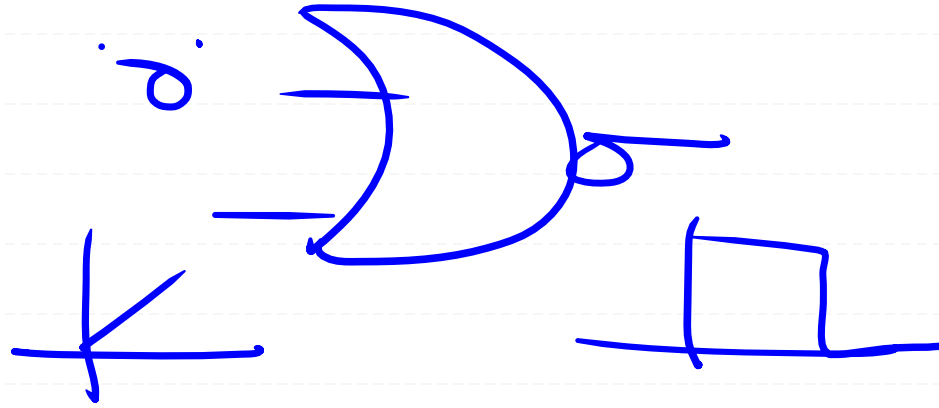
A	B	AND	XAND
0	0	0	1
0	1	0	1
1	0	0	1
1	1	1	0

A	B	C	F
1	1	0	1
1	1	1	0

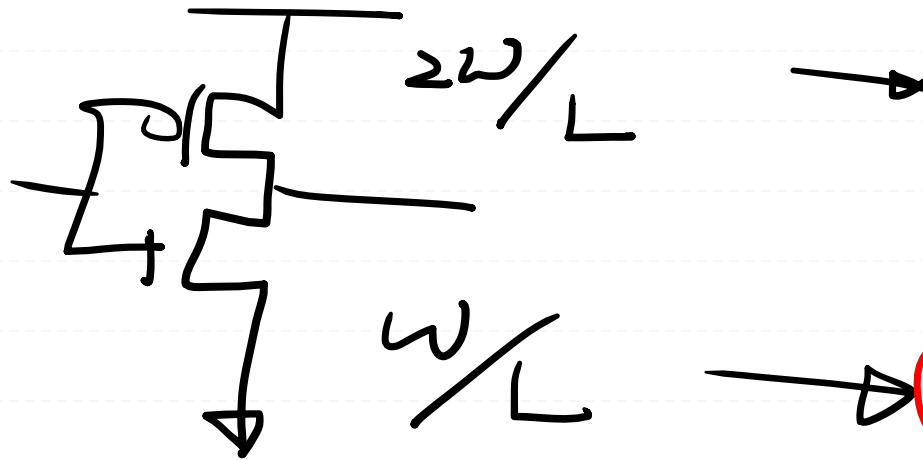


2 NOR

AB		B	NOR
0	0	0	1
0	1	1	0
1	0	1	0
1	1	1	0



$$\mu_n = 2\mu_p$$



$$2W = \textcircled{R}$$

$$W = 2R$$

$$\rightarrow \textcircled{R}$$

