

Règles de conception (Eléments de puissance, distributions de l'alimentation et de l'horloge)

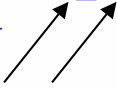
Analyse Temporelle

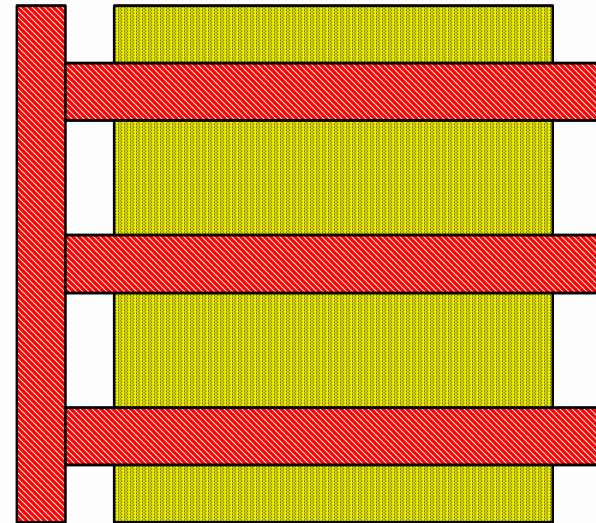
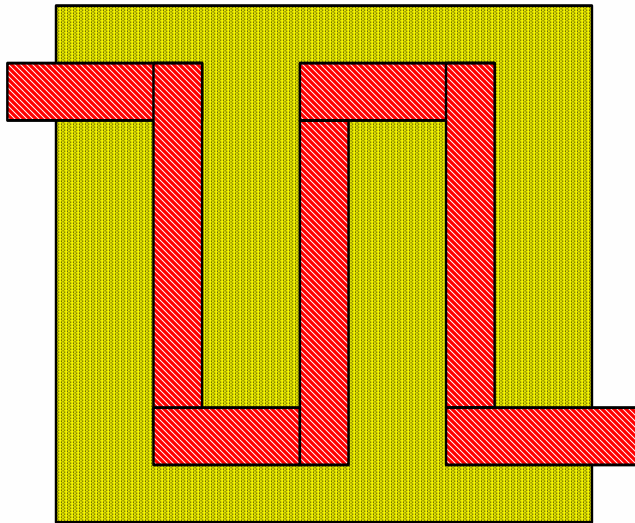
MASTER ACSI M2

Habib MEHREZ

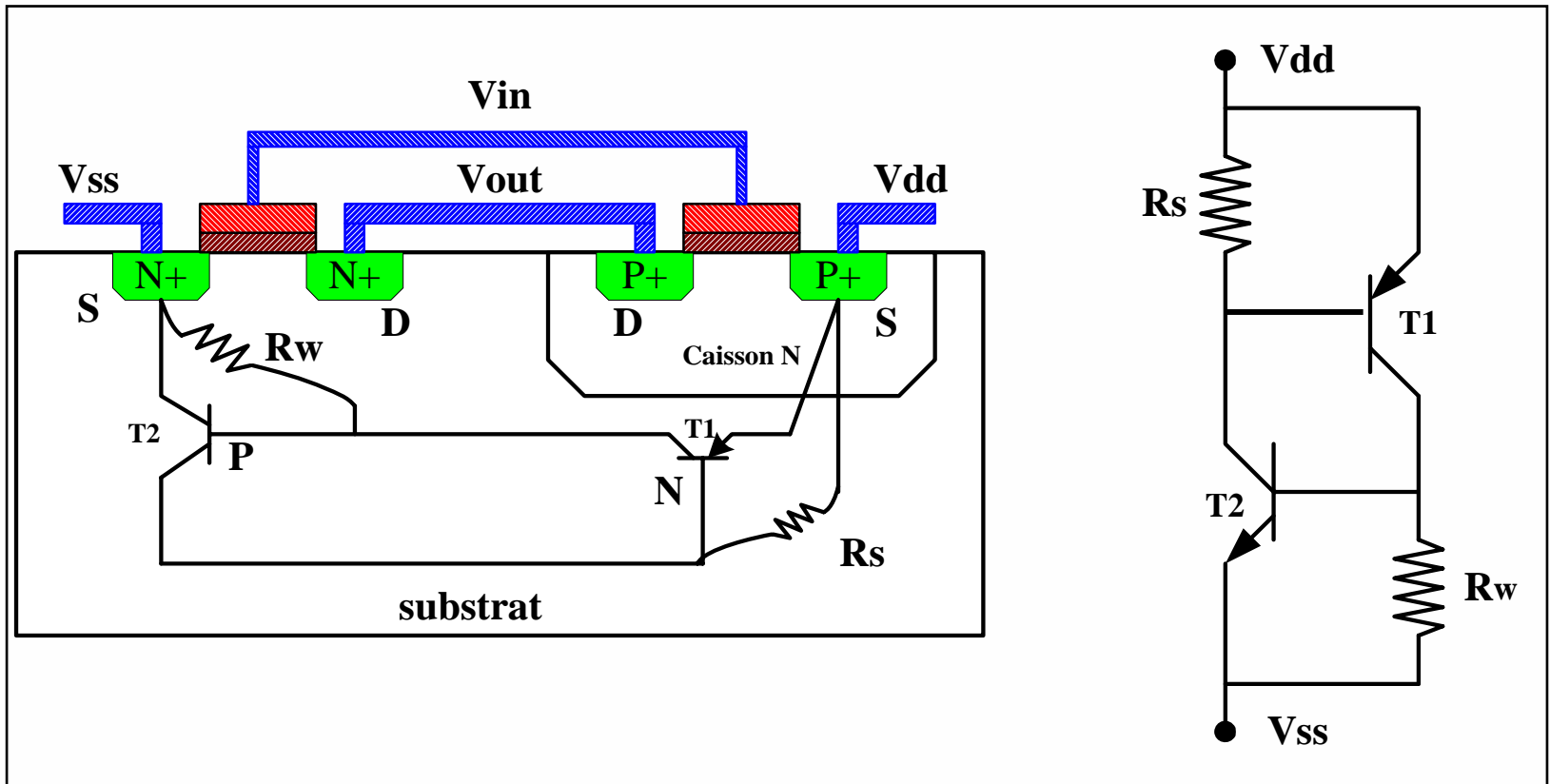


Les éléments de puissance

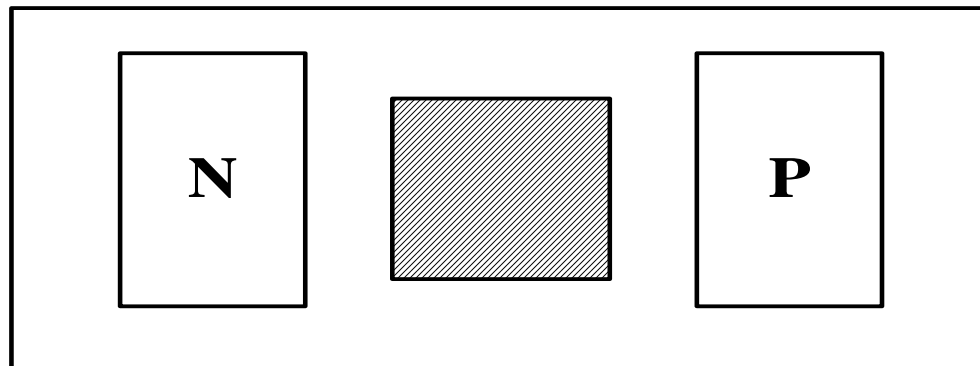
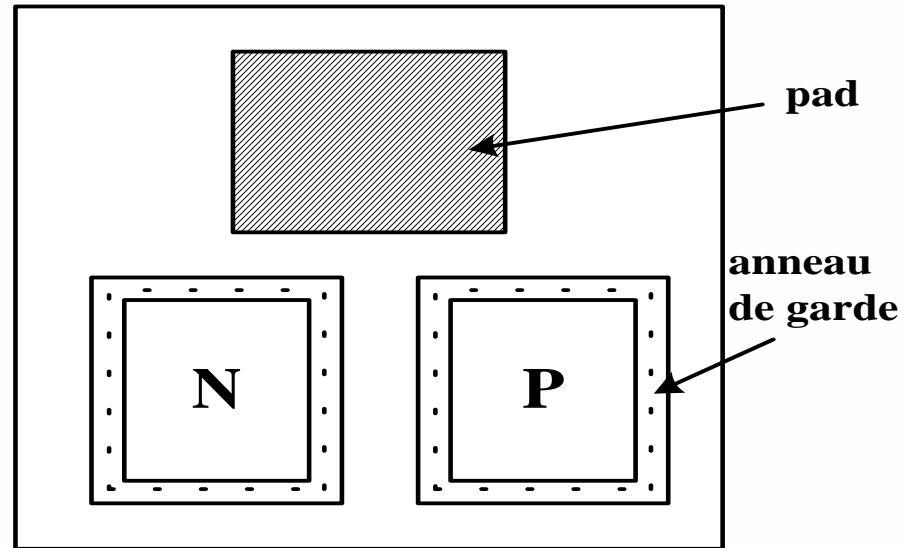
Buffer: Élément de puissance inverseur ou
suiveur avec W 



Effet de Latch-Up



Topologie des buffers de sortie

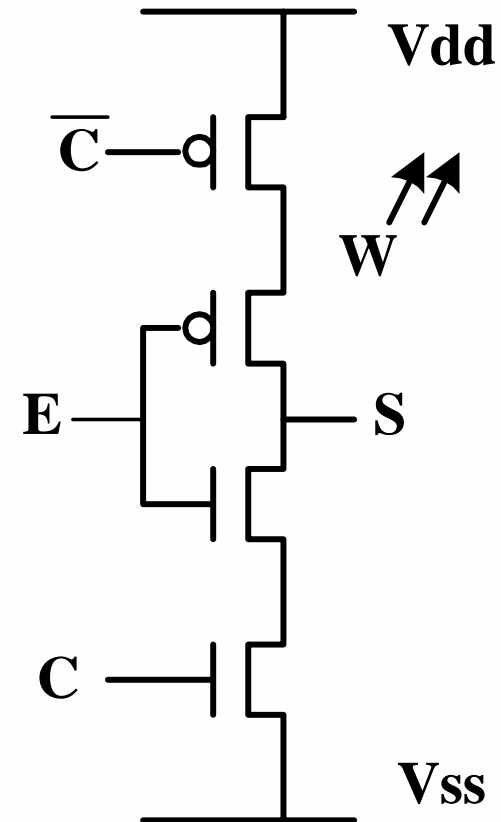


Buffer Tristate (problème)

$C=0 \Rightarrow S=\text{HIZ}$

$C=1 \Rightarrow S=\bar{E}$

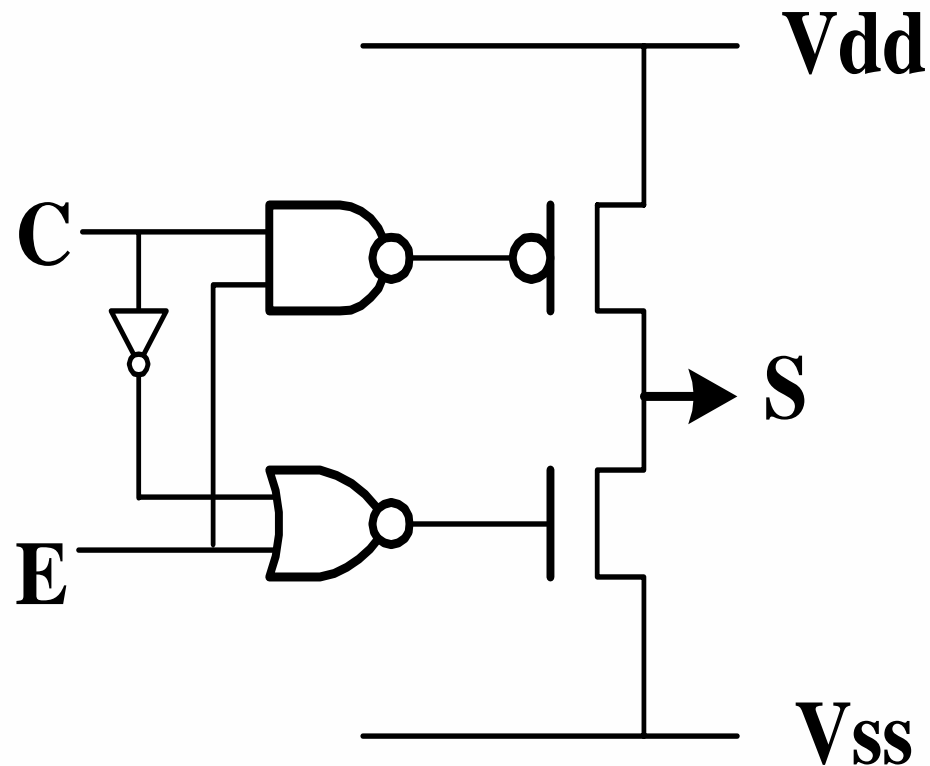
Pb : les transistors de commande
sont dans le chemin du courant
de puissance



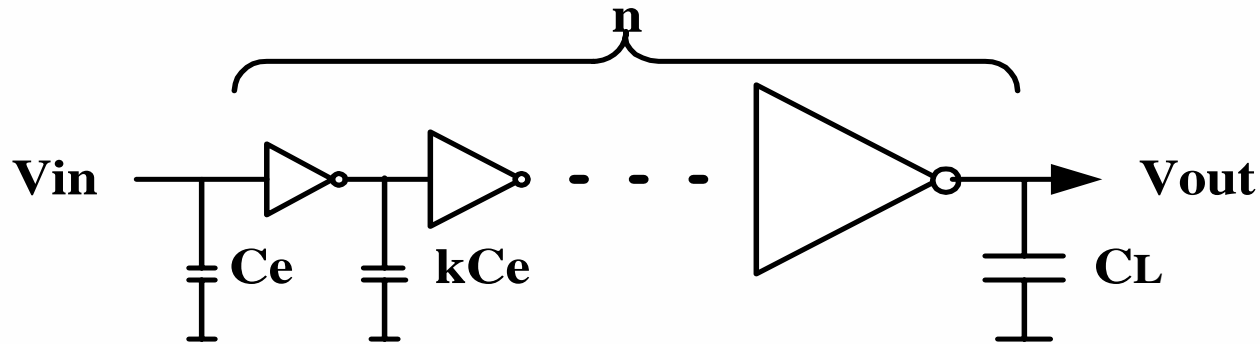
Buffer Tristate (solution)

$C=0 \Rightarrow S=\text{HIZ}$

$C=1 \Rightarrow S=\bar{E}$



Optimisation des Buffers



t_p min?

$$C_L = k^n C_e$$

t_{pe} : temps propagation élémentaire d'un inverseur

$$t_{pe} \approx k t_{p0} \Rightarrow t_p = n t_{pe} = n k t_{p0}$$

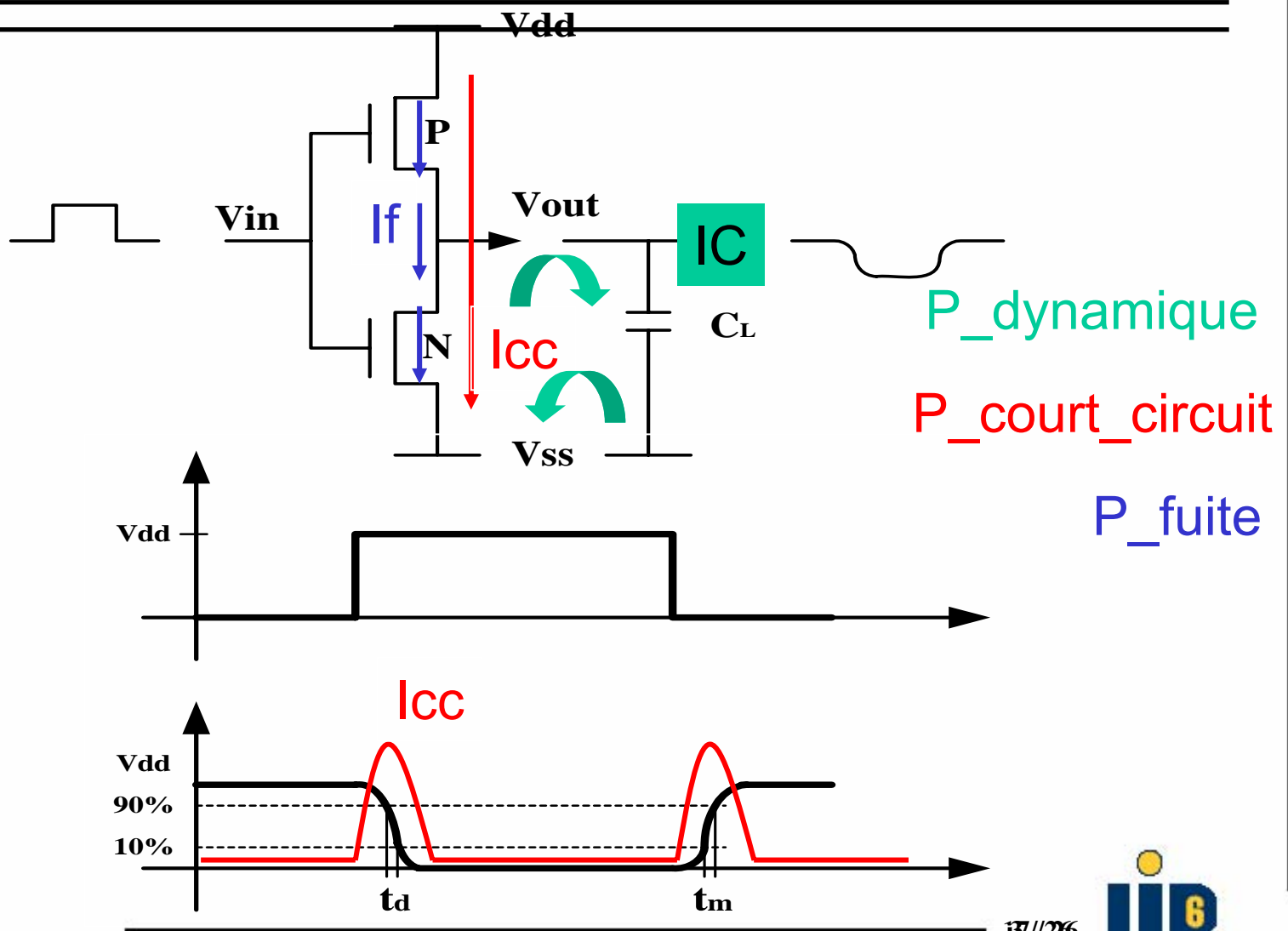
$$\frac{C_L}{C_e} = k^n \Rightarrow n \ln k = \ln \frac{C_L}{C_e} \Rightarrow n = \frac{\ln C_L / C_e}{\ln k} \Rightarrow t_p = \frac{k}{\ln k} \cdot t_{p0} \cdot \ln \frac{C_L}{C_e}$$

$$\frac{dt_p}{dk} \Rightarrow t_p \text{ min} \quad \text{pour} \quad k = e \approx 2.7$$

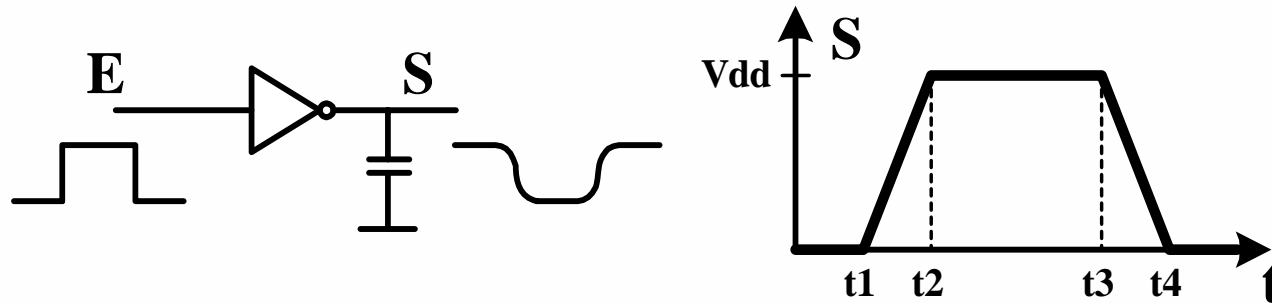


Evaluation de la puissance dissipée

-
-
-



Evaluation de la puissance dissipée



$$P_d = \frac{1}{T} \int_0^T S(t) \cdot i(t) dt = \frac{1}{T} \int_{t_1}^{t_2} S(t) \cdot C \cdot \frac{dS(t)}{dt} dt - \int_{t_3}^{t_4} S(t) \cdot C \cdot \frac{dS(t)}{dt} dt$$

$$= \frac{C}{T} \int_0^{V_{DD}} S \cdot dS + \frac{C}{T} \int_0^{V_{DD}} S \cdot dS = \frac{C \cdot V_{DD}^2}{T} \Rightarrow P_d = C \cdot V_{DD}^2 \cdot f$$

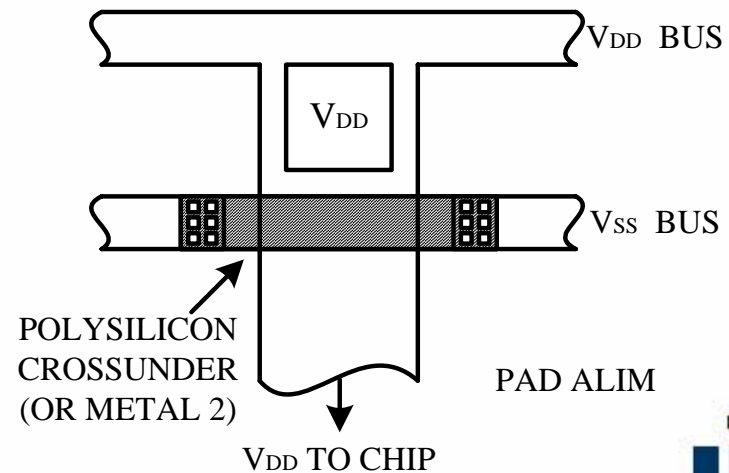
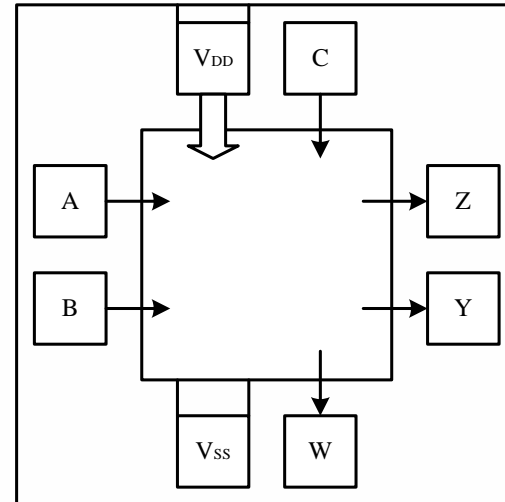
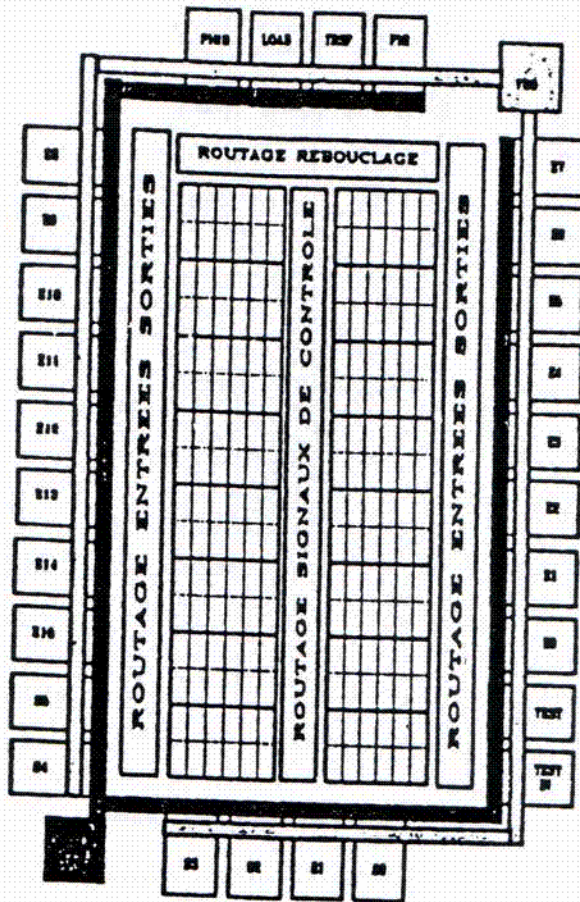
puissance dynamique dissipée

✓ courant moyen $\approx \frac{C \cdot V_{DD}}{t_m + t_d}$

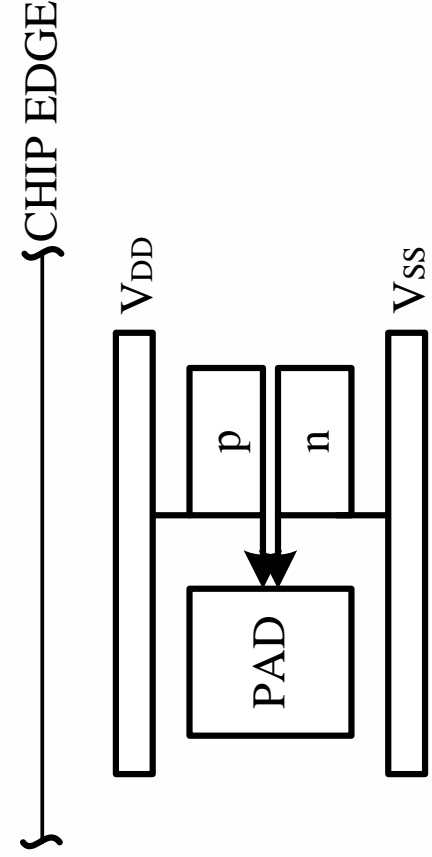
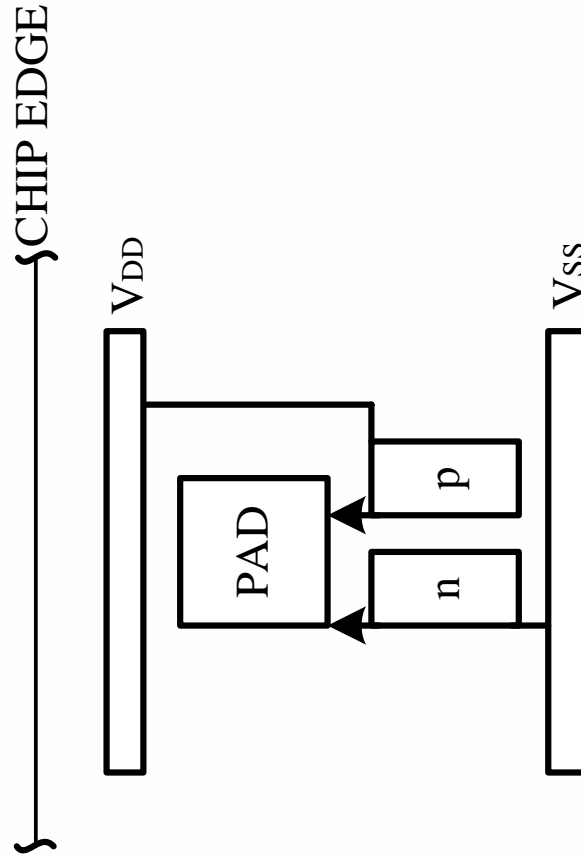
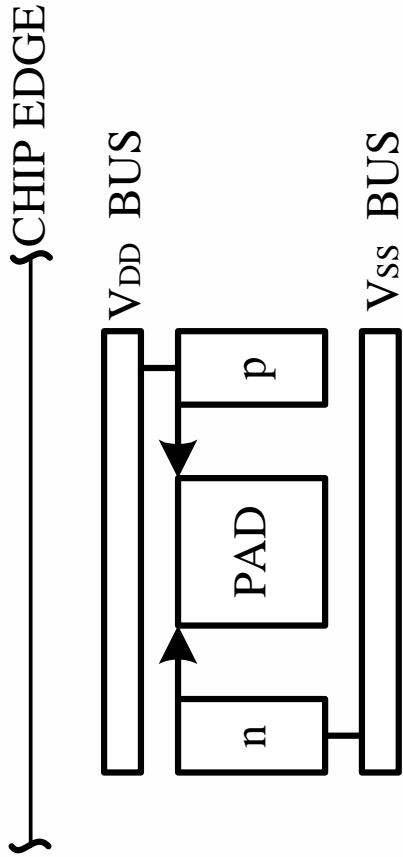
✓ puissance statique \ll puissance dynamique



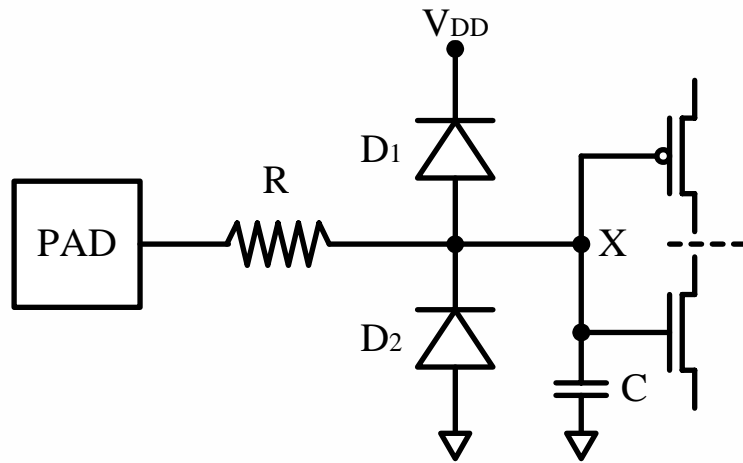
Interfaces entrée/sortie



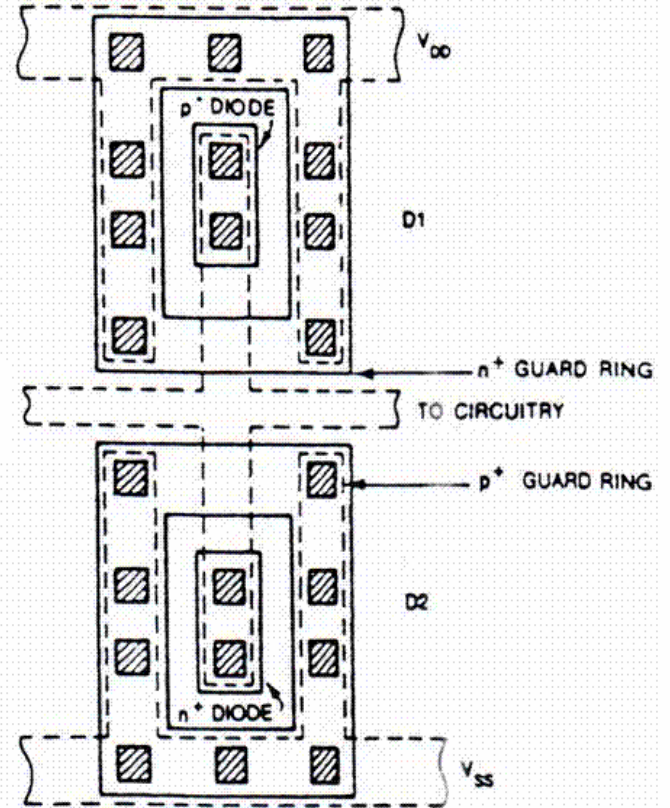
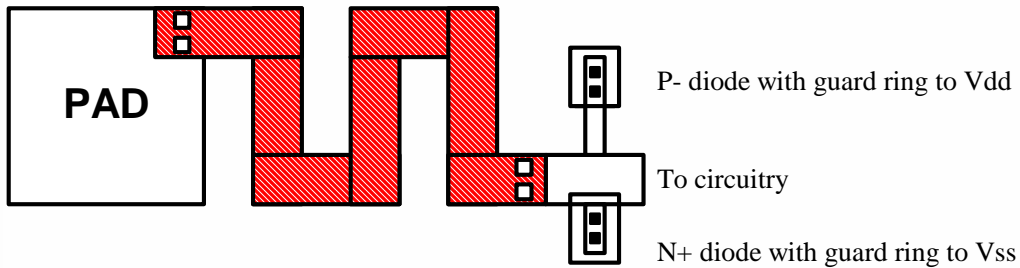
Différentes Topologies



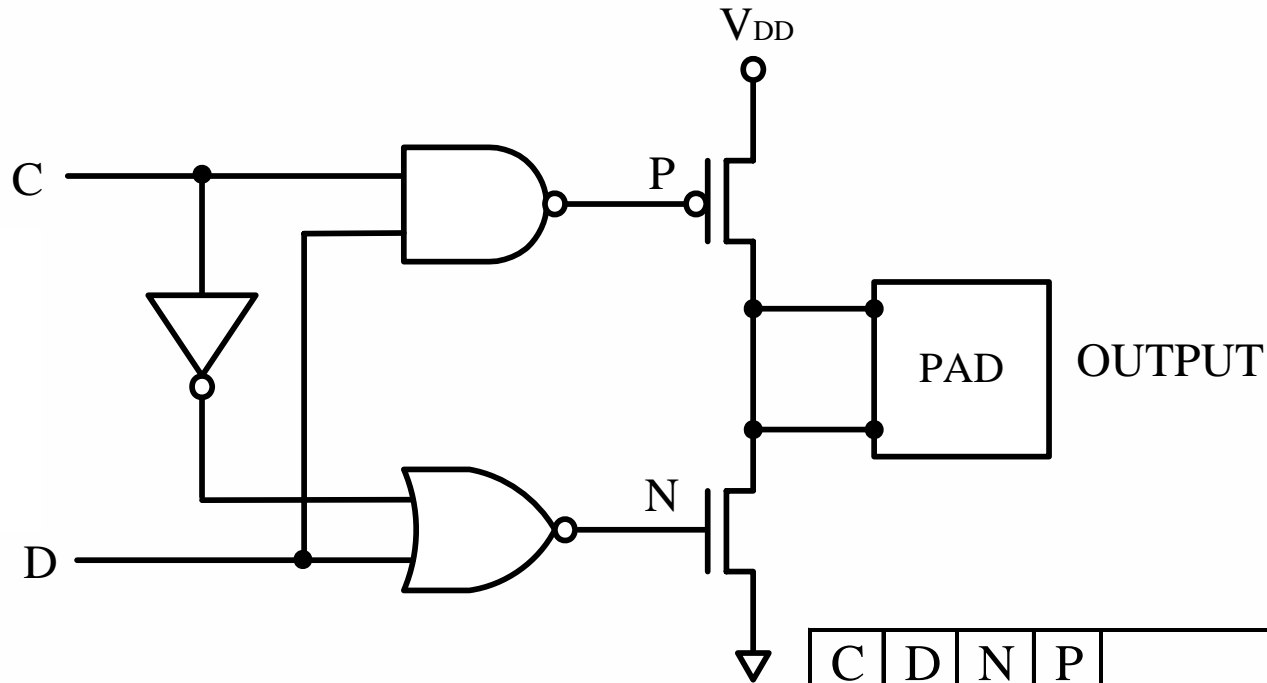
Plot d'entrée



Poly resistor



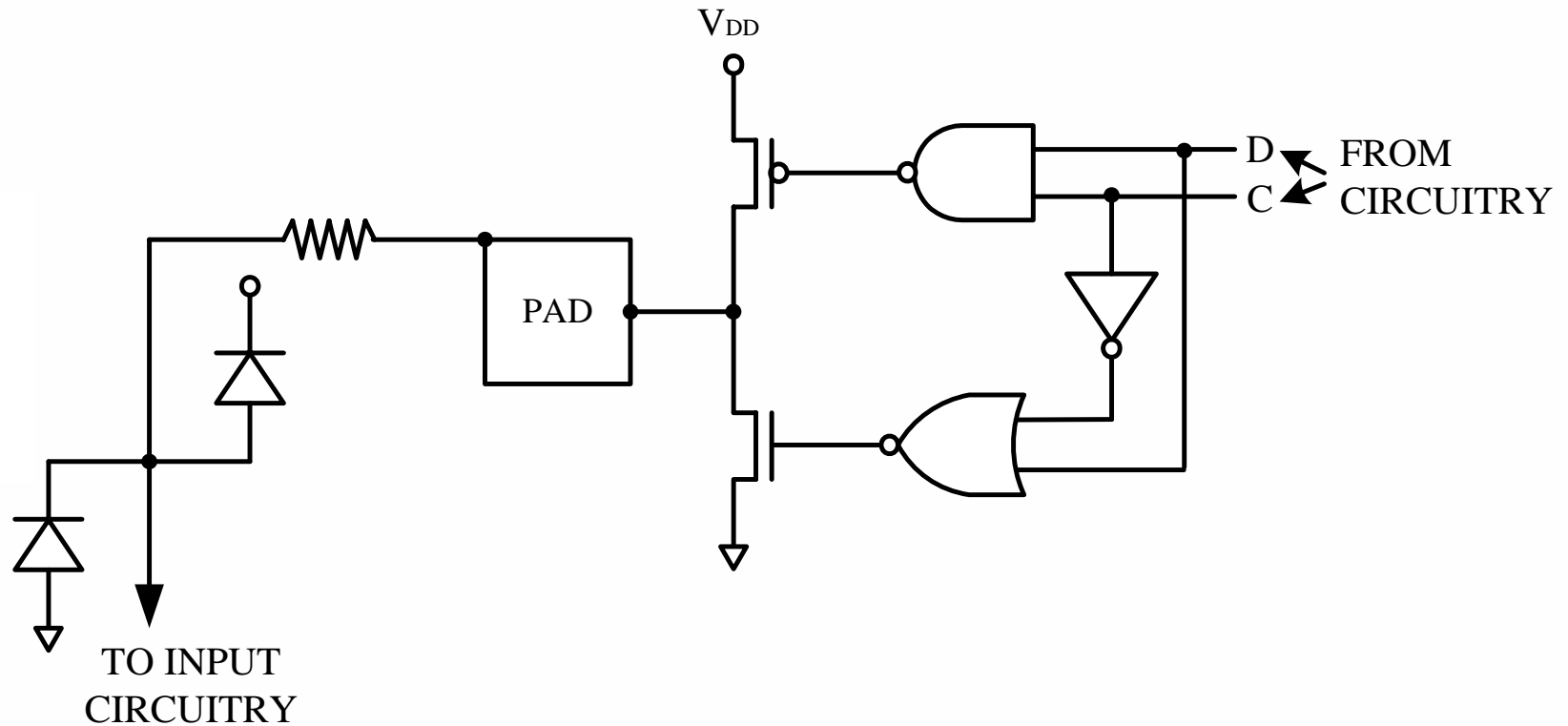
Plot de Sortie Trois Etats



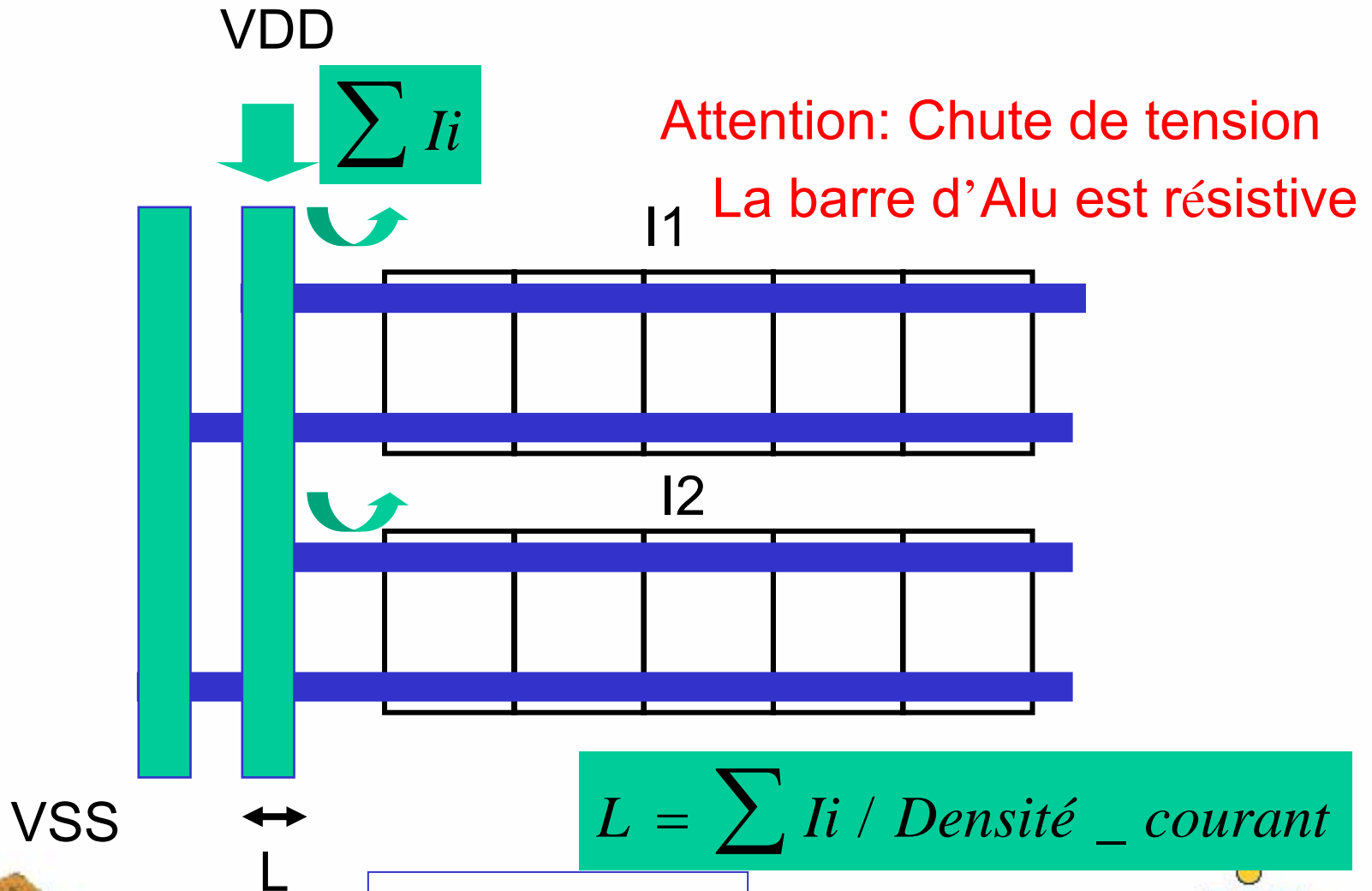
C	D	N	P	OUTPUT
0	X	0	1	Z (HIGH IMPEDANCE)
1	0	1	1	0
1	1	0	0	1



Plot Bidirectionnel et Trois Etats

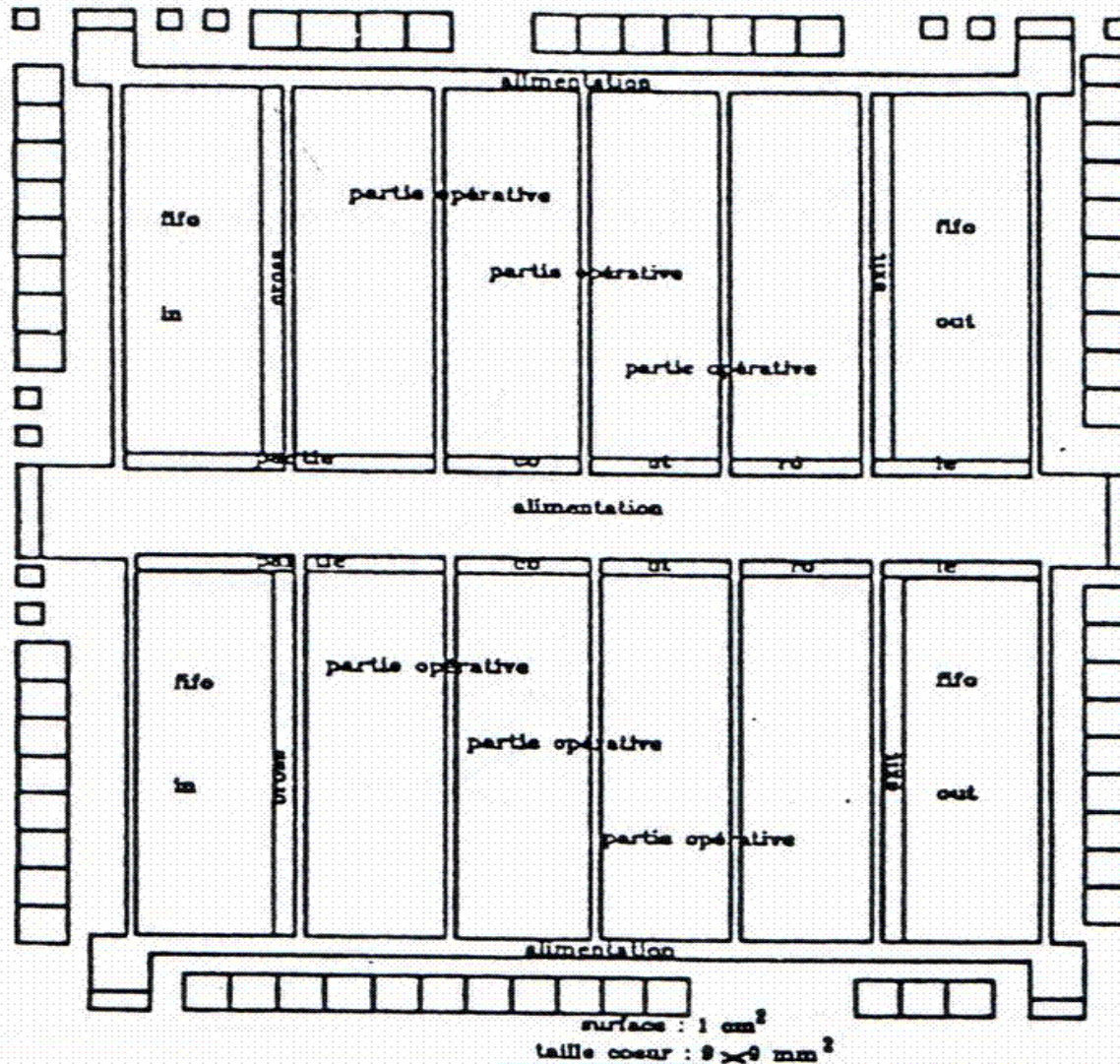


Distribution des Alims

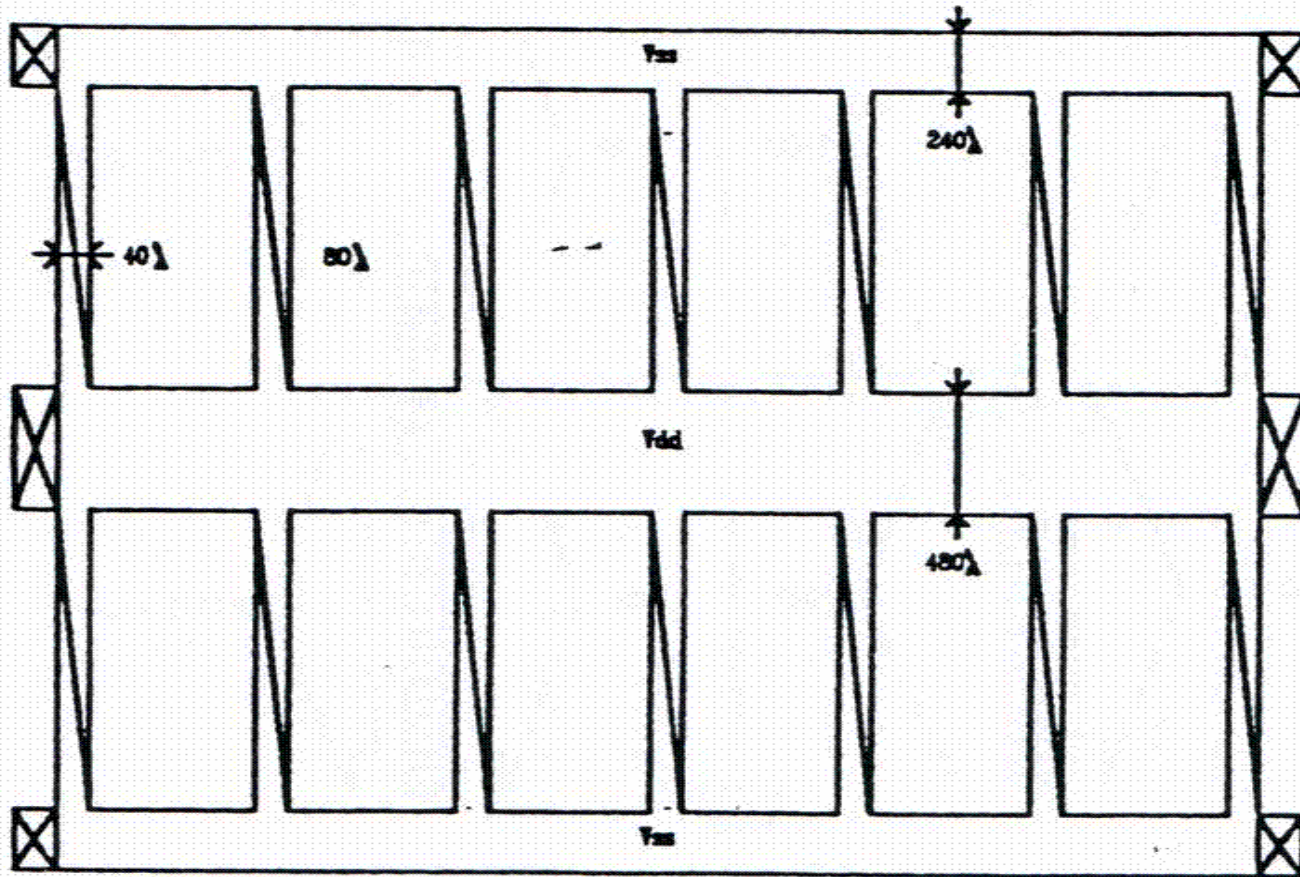


Rappel d'Alim

Distribution des Alims

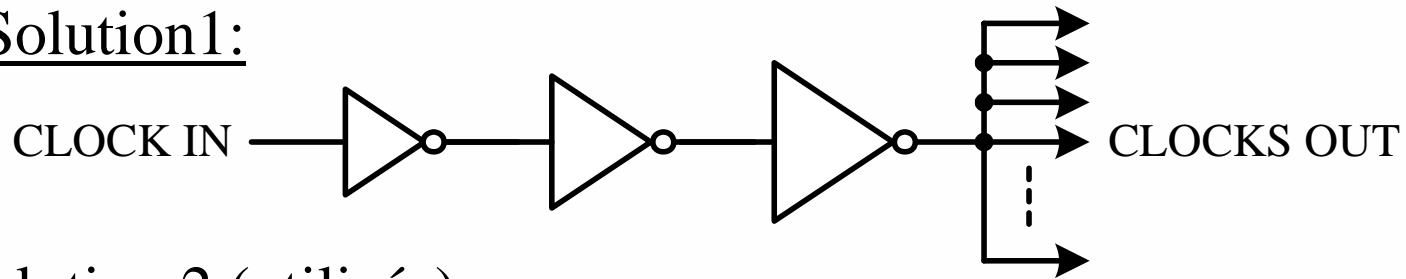


Distribution des Alims

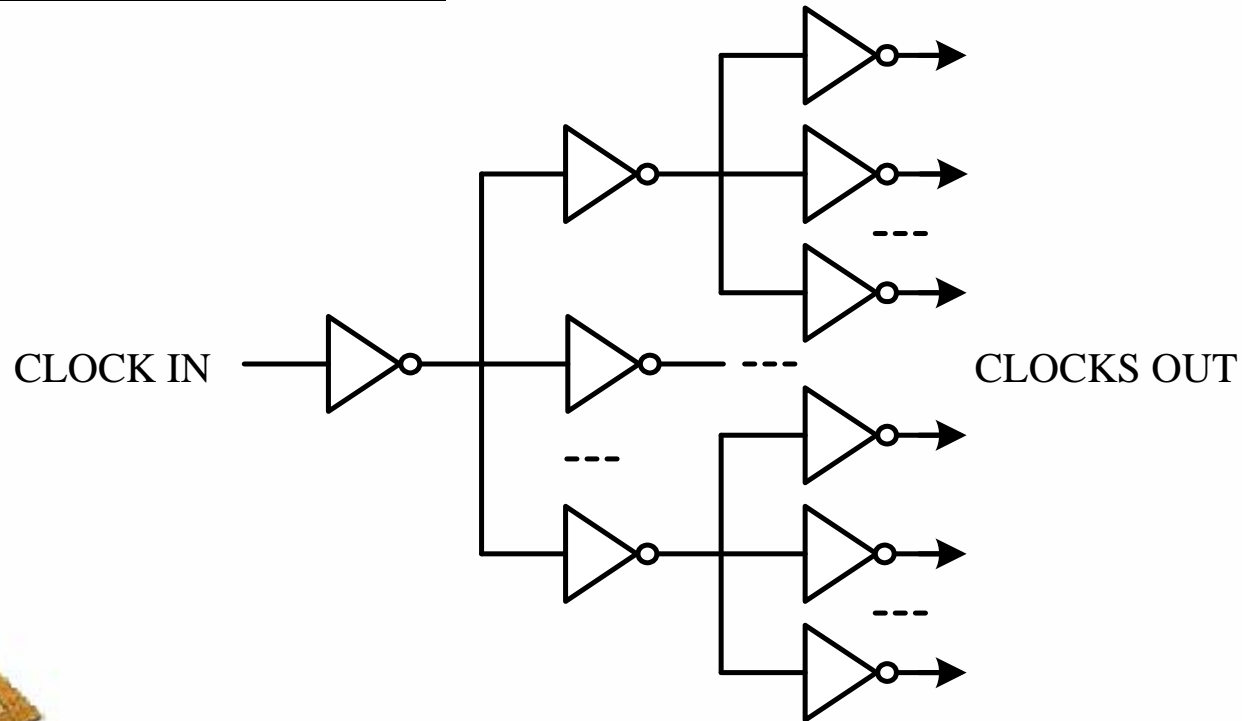


Distribution d'horloge

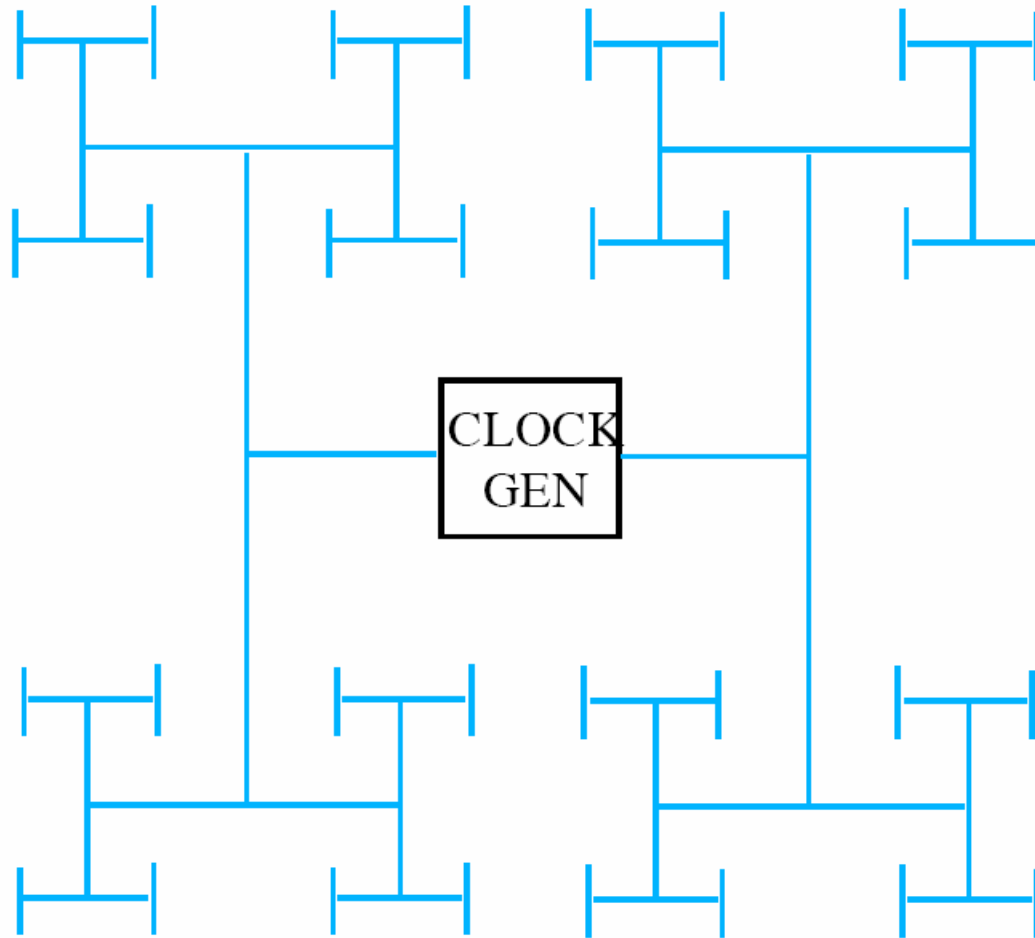
Solution 1:



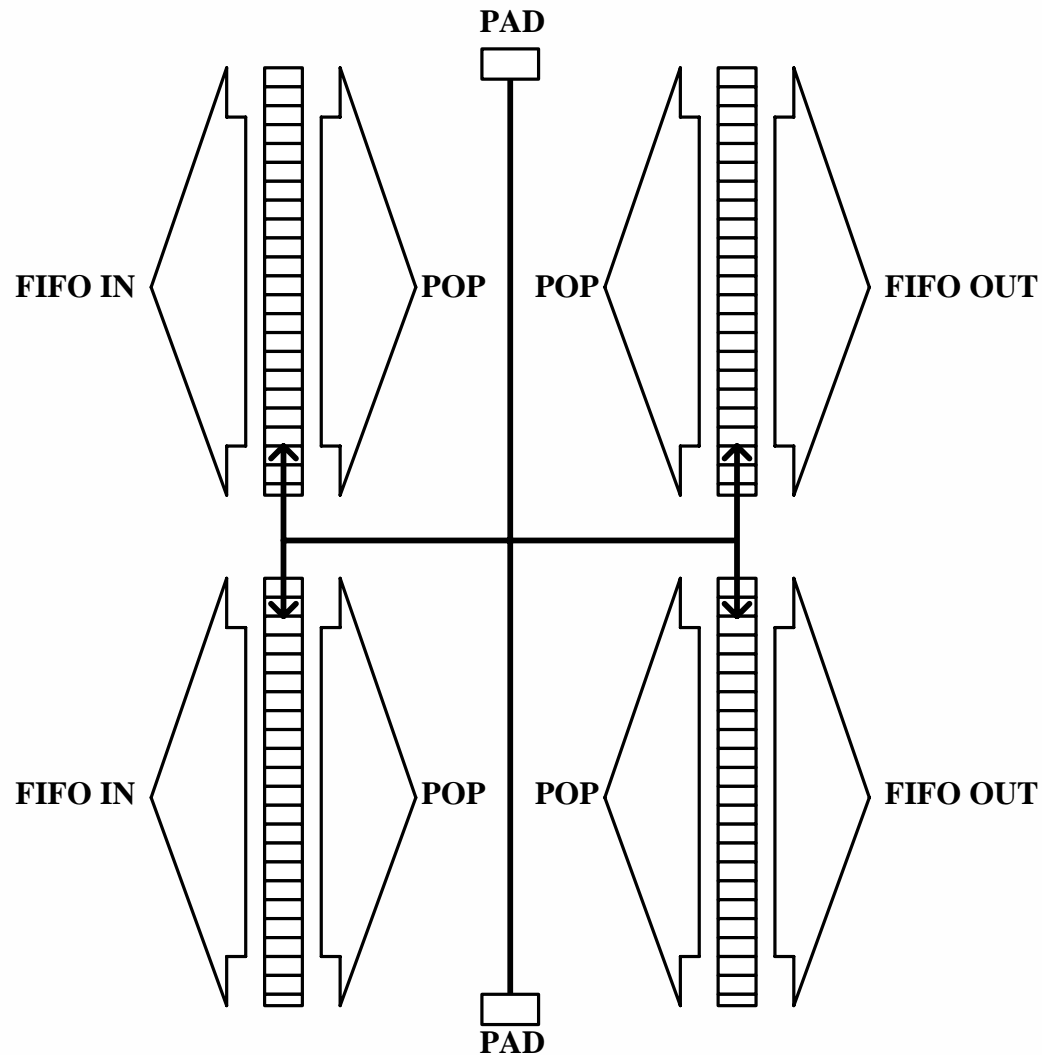
Solution 2 (utilisée):



Distribution d'horloge (Structure en H)



Distribution d'horloge



132 buffers

