

## Logic Families

- Improved TTL series :

\* 74H XX (high speed TTL) :

- reduce the internal resistor.

- increase consumption.

- Propagation delay =  $\frac{1}{2} t_P$  for fundamental.

\* 74L XX (Low Power TTL) :

- increase internal resistor

- Decrease consumption

- Schotky TTL : (74S XX)

ON  $\rightarrow$  0.3V

Equivalent circuit  $\Rightarrow$  schotky transistor

\* 74LS XX (Low Power schotky TTL)



Schotky transistor

\* 74ALS XX (Advanced Low Power schotky TTL) :

propagation delay = 4 ns

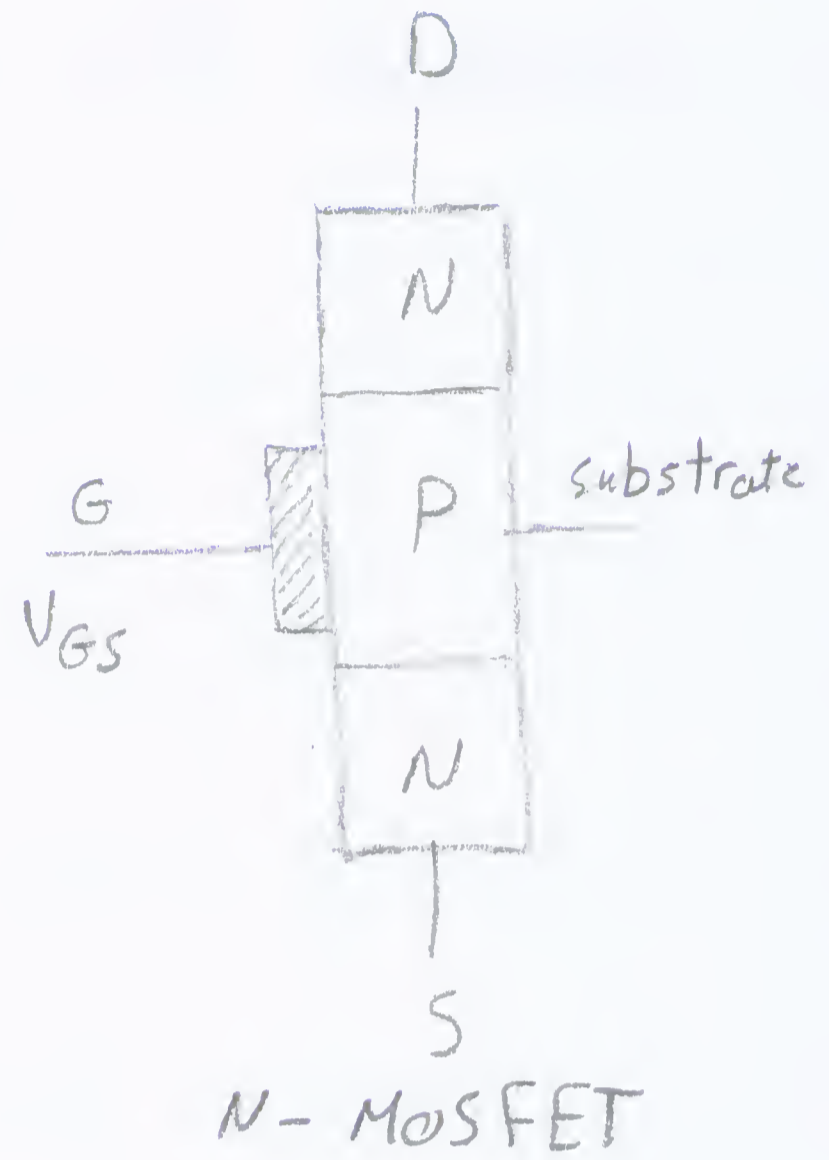
Power dissipation = 1 mW

CMOS family : (Complementary Metal oxide semiconductor)

MOSFET  $\left\{ \begin{array}{l} \text{N-MOSFET} \\ \text{P-MOSFET} \end{array} \right. \Rightarrow \begin{array}{l} \text{LSI} \\ \text{VLSI} \end{array}$

$\left\{ \begin{array}{l} V_{GS} > 0 \Rightarrow \text{ON} \\ V_{GS} \leq 0 \Rightarrow \text{off} \end{array} \right. \quad (\text{N-MOSFET})$

$\left\{ \begin{array}{l} V_{GS} \leq 0 \Rightarrow \text{ON} \\ V_{GS} > 0 \Rightarrow \text{off} \end{array} \right. \quad (\text{P-MOSFET})$



CMOS : (  $V_{DD} \rightarrow 3V : 15V$  )

$V_{in} \rightarrow \text{Logic 1}$

N-MOSFET  $\rightarrow$  ON

P- " "  $\rightarrow$  off

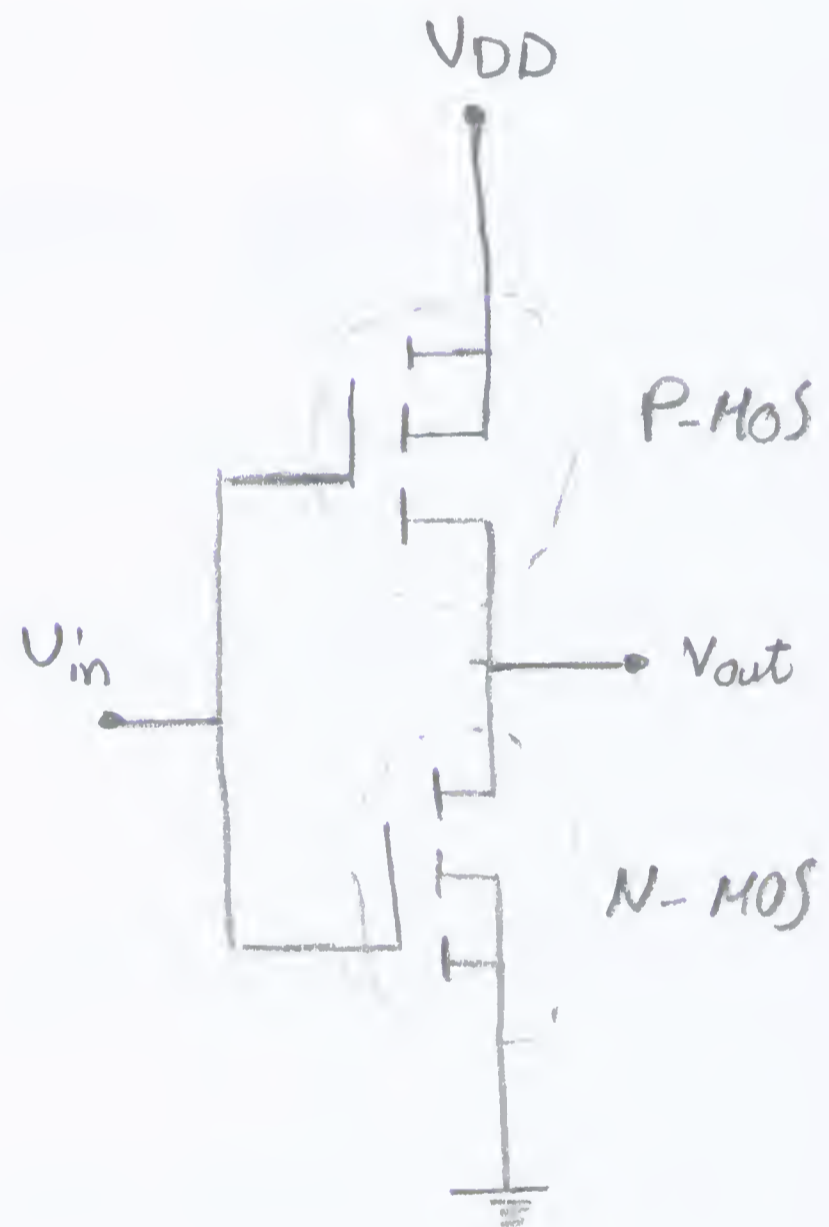
$V_{out} \rightarrow \text{Logic 0}$

$V_{in} \rightarrow \text{Logic 0}$

P-MOSFET  $\rightarrow$  ON

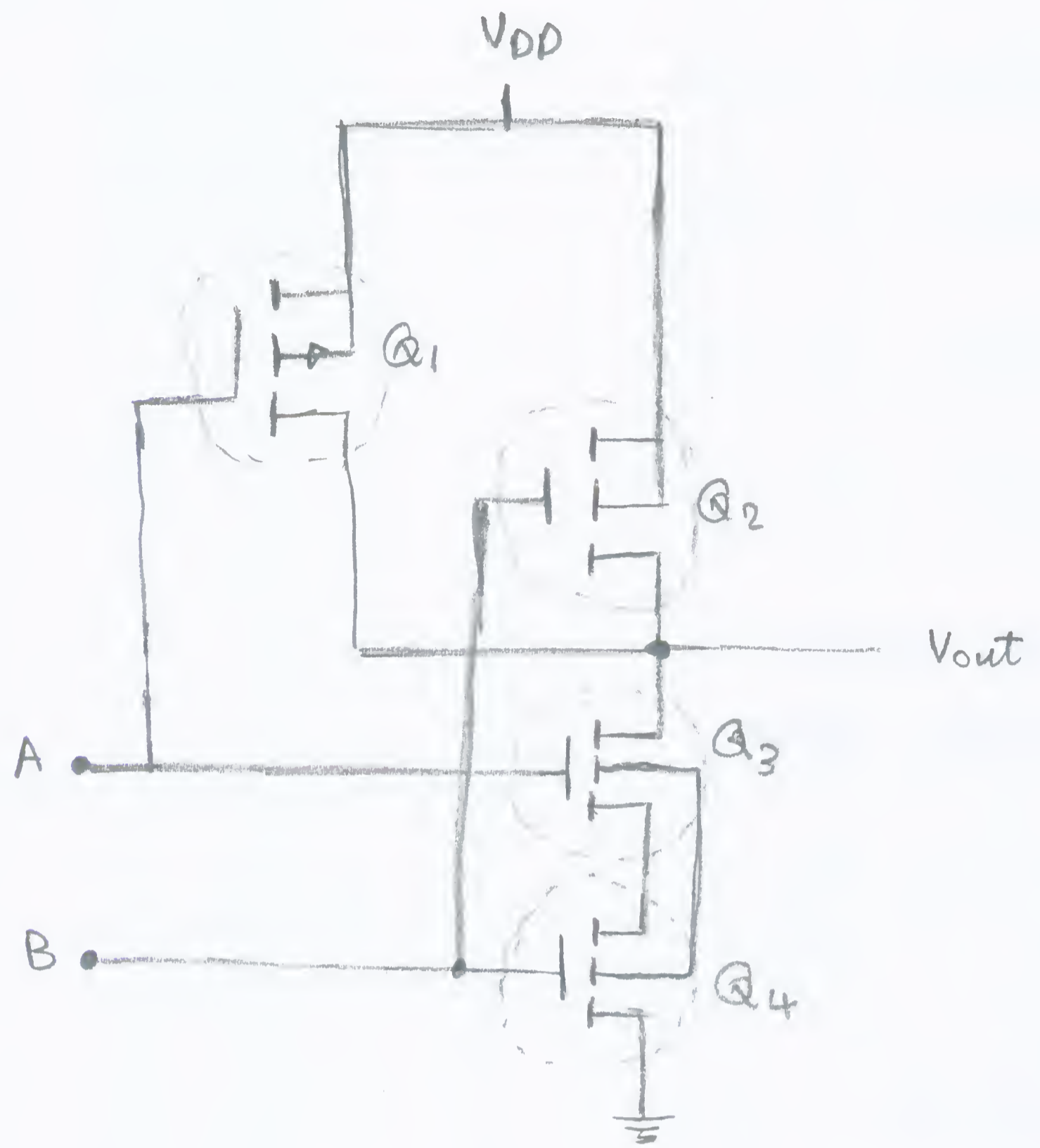
N- " "  $\rightarrow$  off

$V_{out} \rightarrow V_{DD}$



# CMOS - NAND gate :

\* operation Report





Voltage & Current rating :

$$I_{IH} (\text{max}) = 1 \text{ mA}$$

$$I_{IL} (\text{max}) = 1 \text{ mA}$$

$$I_{OH} (\text{max}) = 0.4 \text{ mA}$$

$$I_{OL} (\text{max}) = 0.4 \text{ mA}$$

\* 4000 Series

\* 74CXX Series

$$t_{D, \text{C-MOS}} > t_{D, \text{TTL}}, \quad P_D, \text{C-MOS} < P_D, \text{TTL}$$

\* 74L C XX

\* 74 - Bi-CMOS (TTL - CMOS)  $t_p \rightarrow 2.9 \text{ nsec}$

\* 74HCXX / 74HCTXX (High Speed / High Speed compatible with TTL)

\* 74VHCXX / 74VHCTXX

\* 74 - Low voltage series (Power supply  $\leq 3.3 \text{ V}$ )

for notebook & mobile phones

- 74LVC (Low voltage CMOS)

- 74LVT (Low Voltage Technology)

74HLV (High Speed - Low voltage)

