UNIVERSITÀ
DEGLI STUDI DI TRIESTE

dipartimento
di ingegneria
e architettura

CMOS structures for VLSI

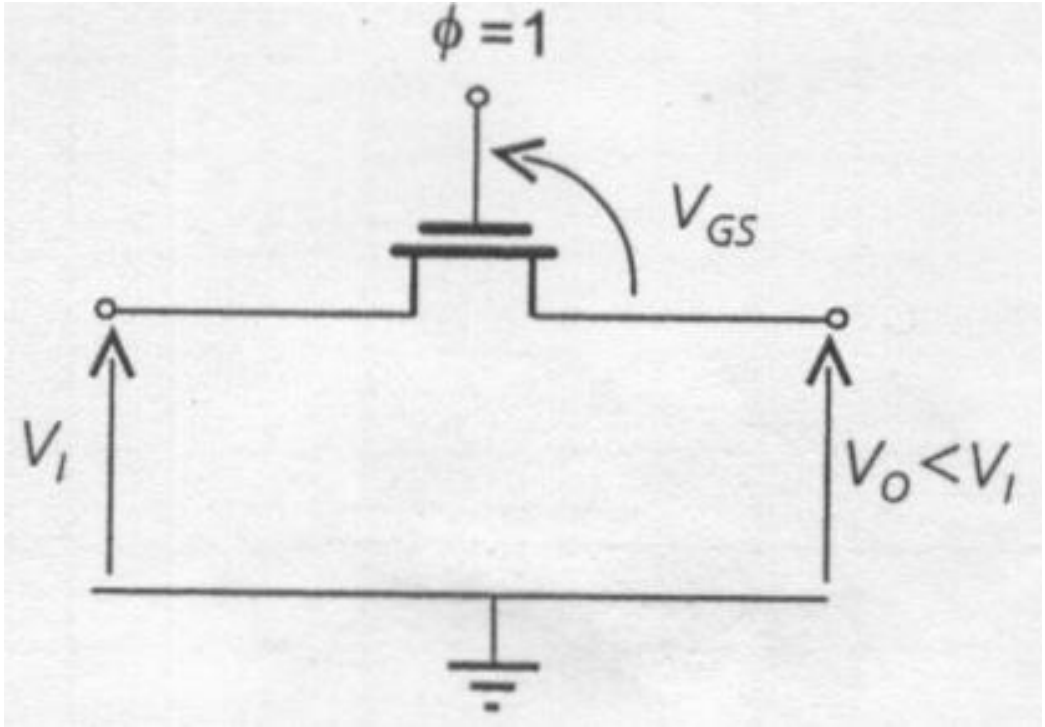
A.Carini – Digital Integrated Circuits

Pass-Transistor

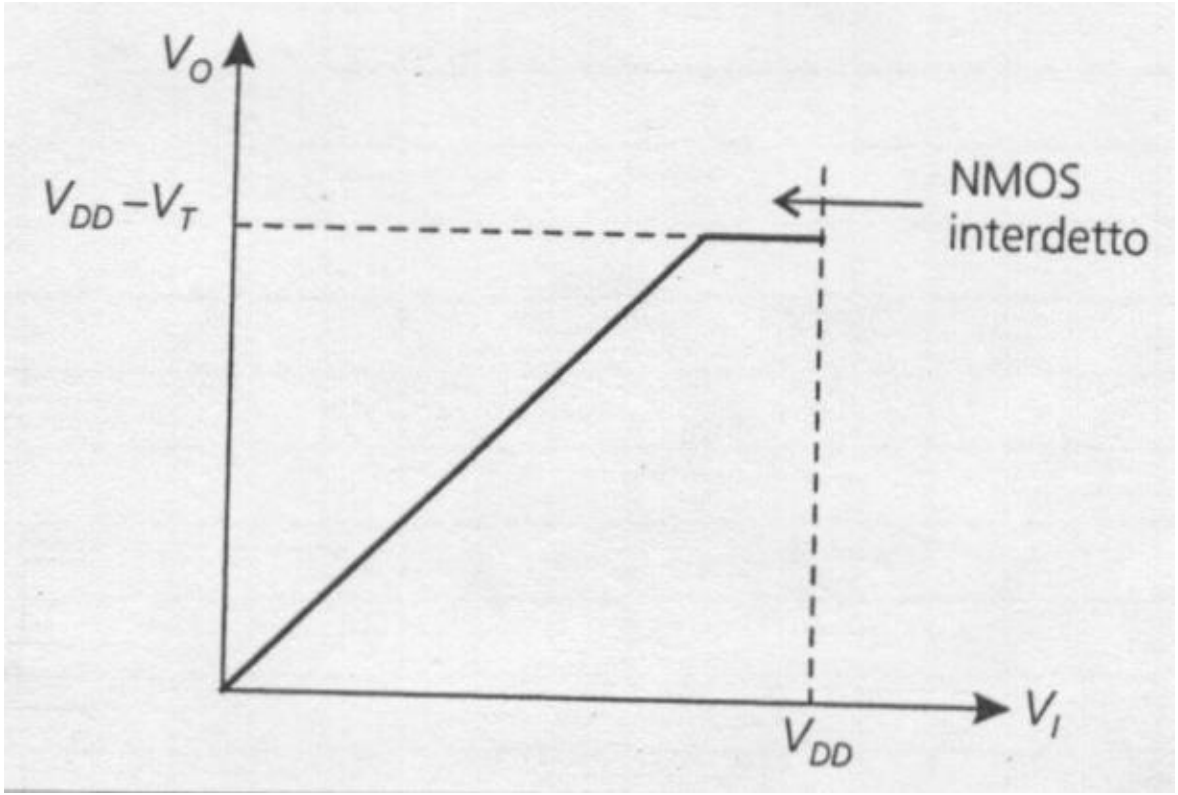
- With MOS transistors, it is possible to connect the device in series along the way of the signal, using it as a switch controlled on the gate terminal.
- The device is called a pass transistor or also a transmission gate.
- The control signal is called phase.

ϕ	A	Y
0	0	aperto
0	1	aperto
1	0	0
1	1	1

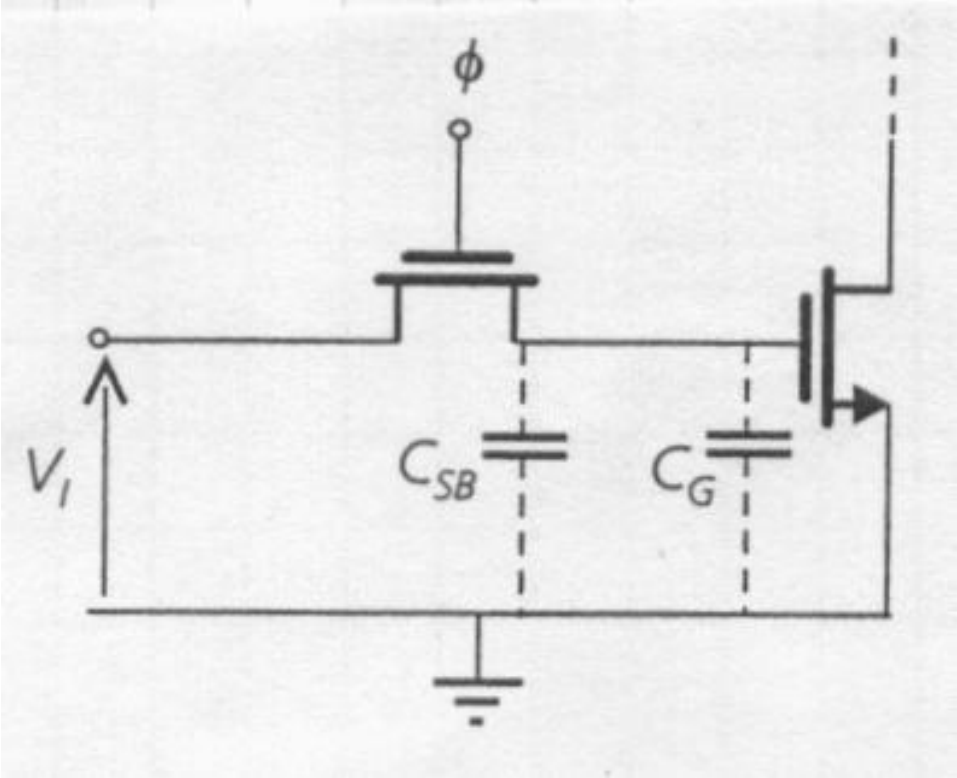
Pass Transistor



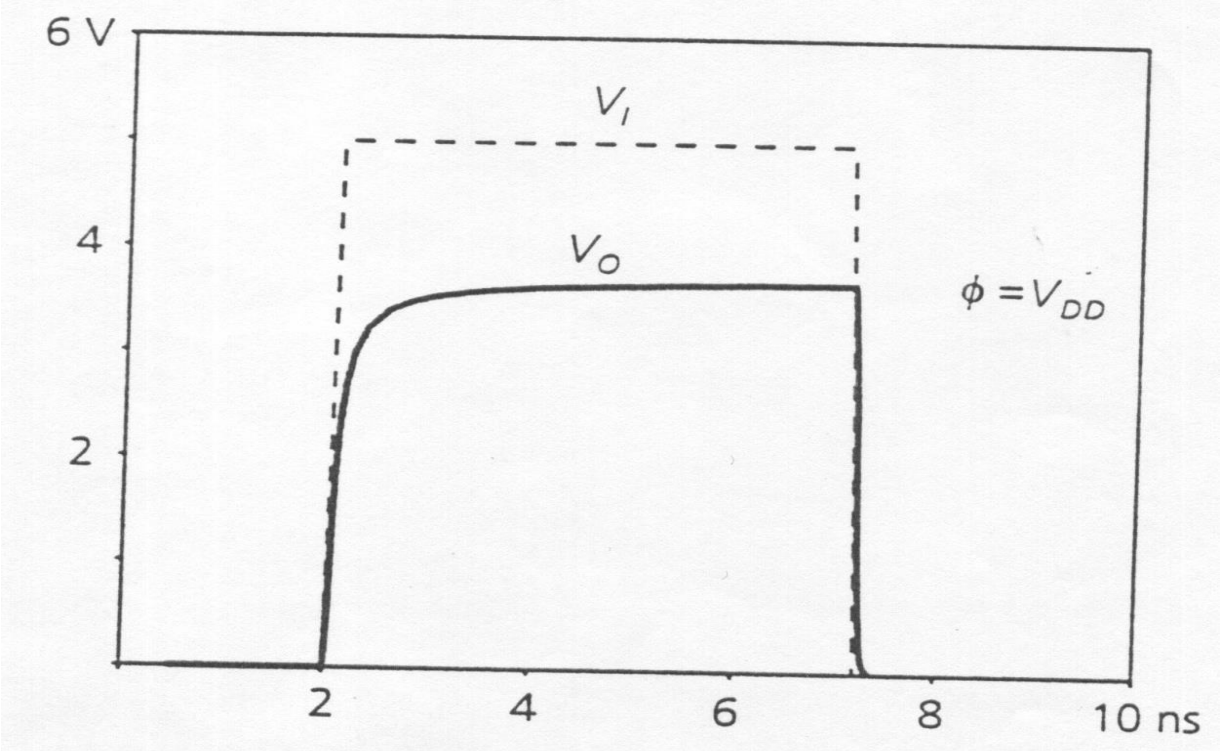
Pass Transistor



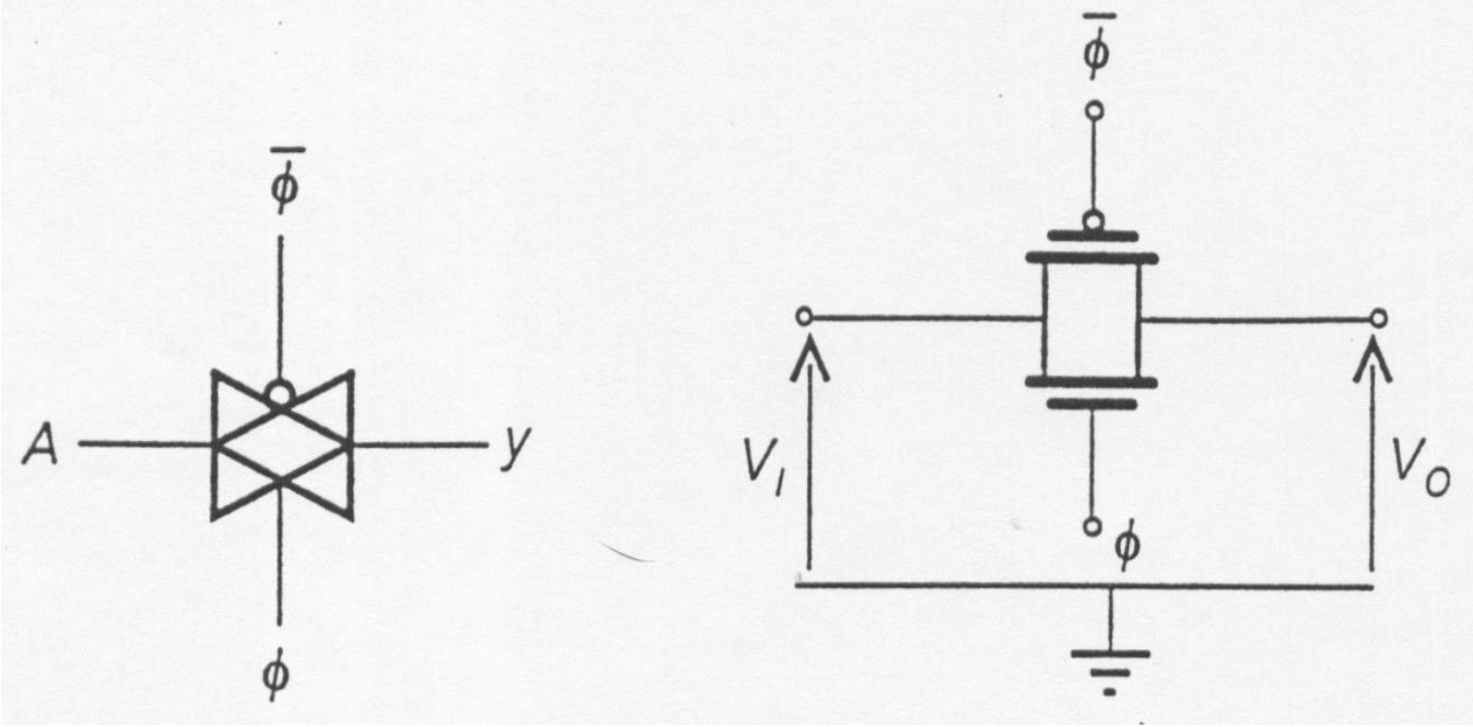
Pass Transistor



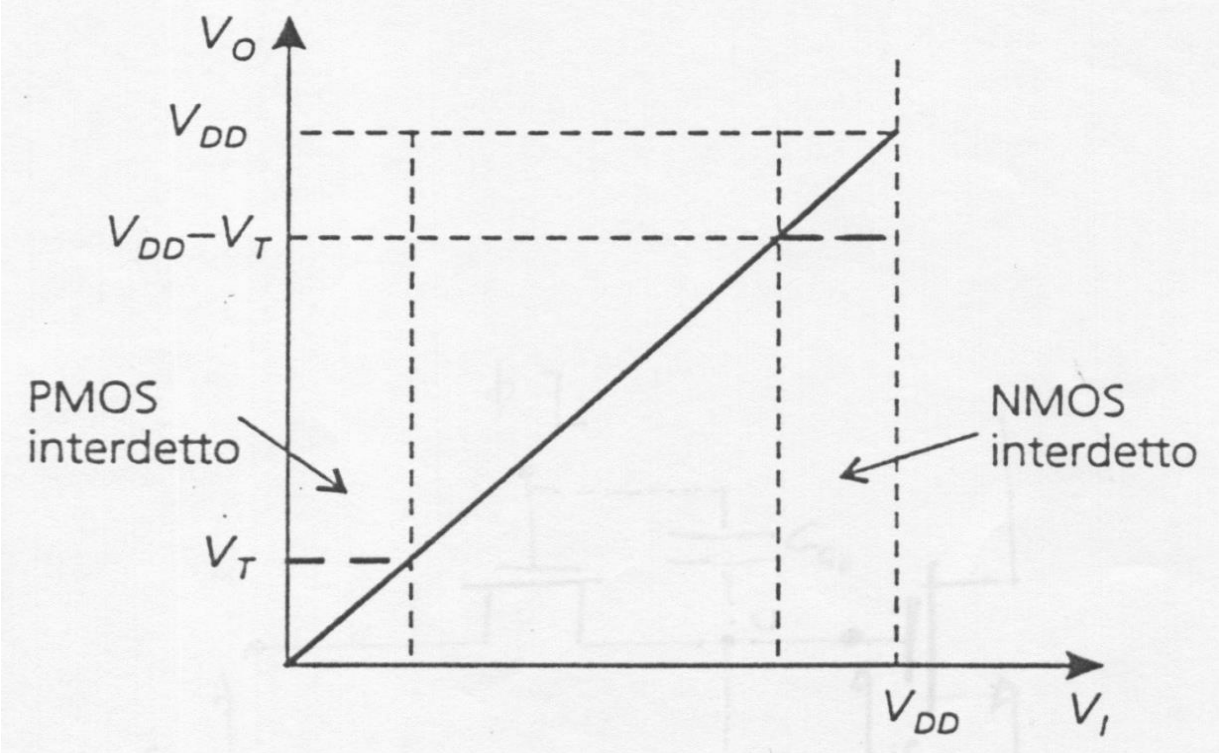
Pass Transistor



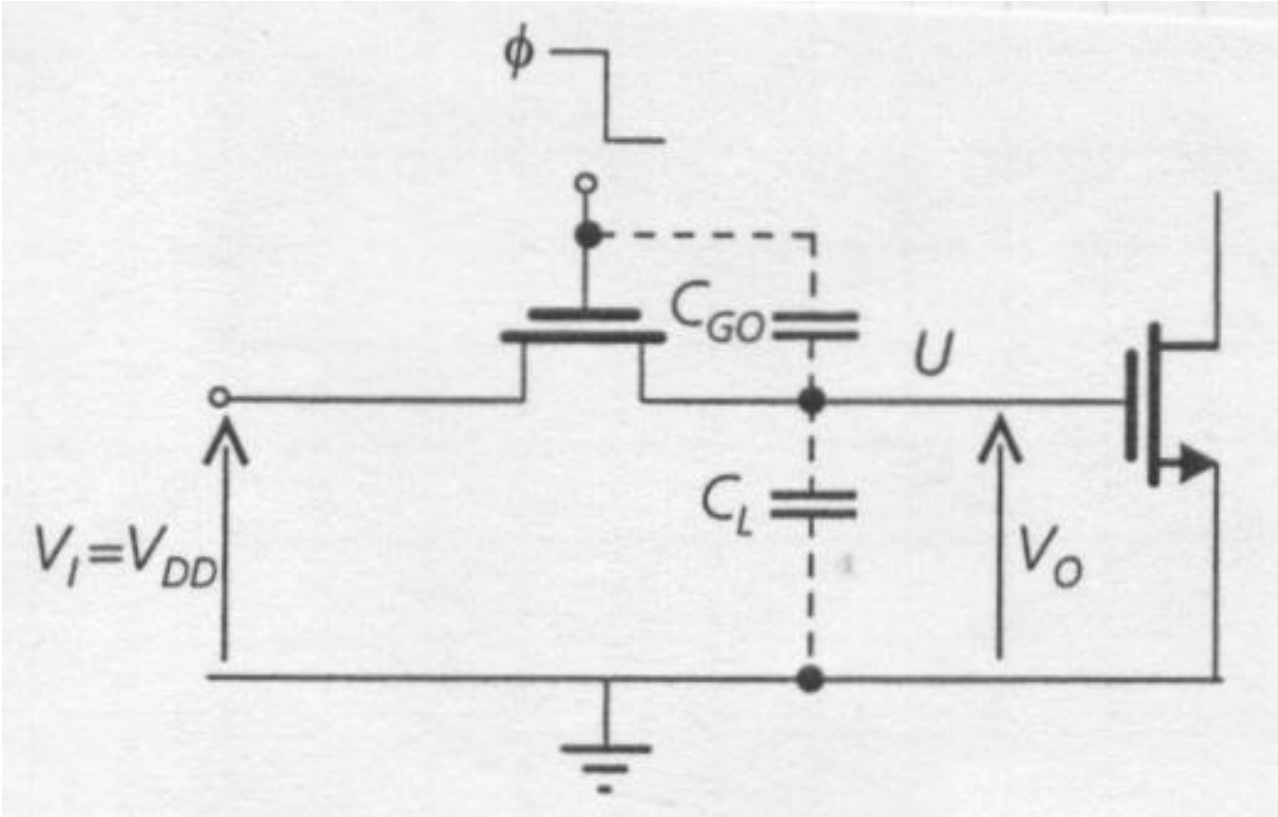
CMOS transmission gate



CMOS transmission gate



Phase signal disturbance



Phase signal disturbance

$$\phi = V_{DD} \longrightarrow V_O = V_{DD} - V_T$$

$$Q_U = C_L V_O + (-C_{GO} V_T)$$

$$\phi \mapsto 0 \longrightarrow Q'_U = Q_U = (C_L + C_{GO}) V'_O$$

The charge on node U (Q_U) is preserved during the transition of Φ from V_{DD} to 0.
The voltage variation is trasmitted to the output.

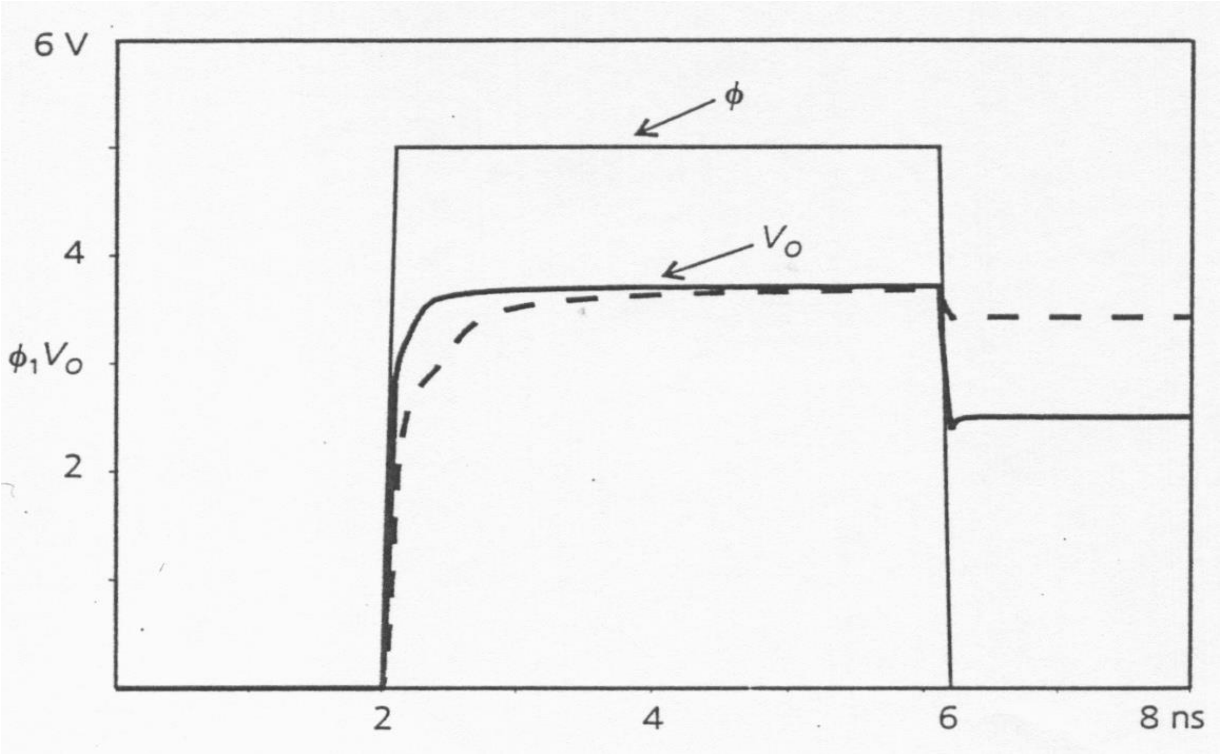
Phase signal disturbance

$$C_L V_O + (-C_{GO} V_T) = (C_L + C_{GO}) V_O'$$

$$\rightarrow \quad V_O' = \frac{C_L}{C_L + C_{GO}} V_{DD} - V_T$$

$$\Delta V_O = V_O' - V_O = -\frac{C_{GO}}{C_L + C_{GO}} V_{DD}$$

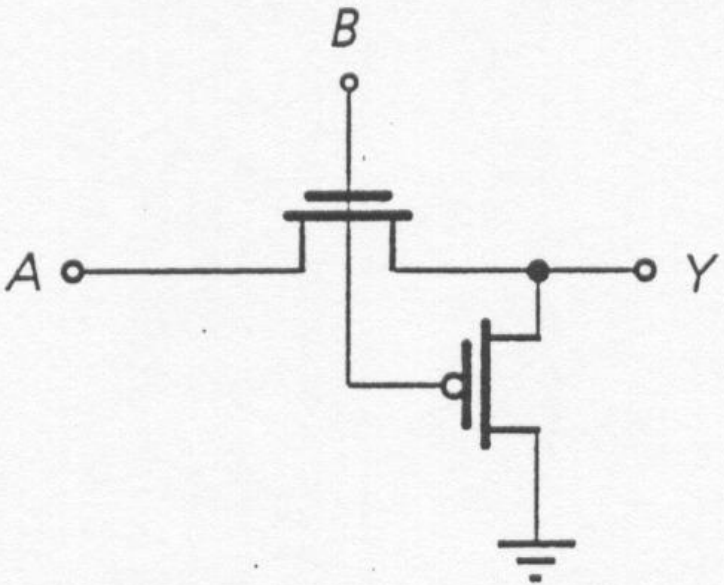
Phase signal disturbance



Pass-transistor logic – AND gate

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

(a)

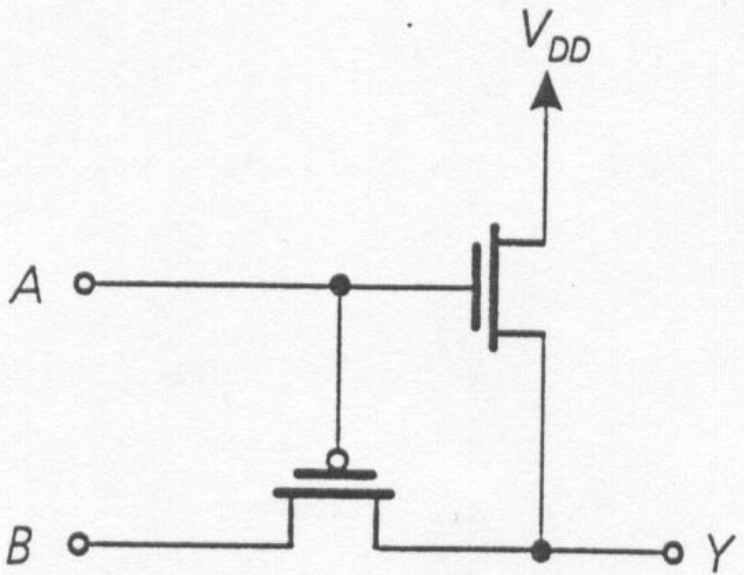


(b)

Pass-transistor logic – OR gate

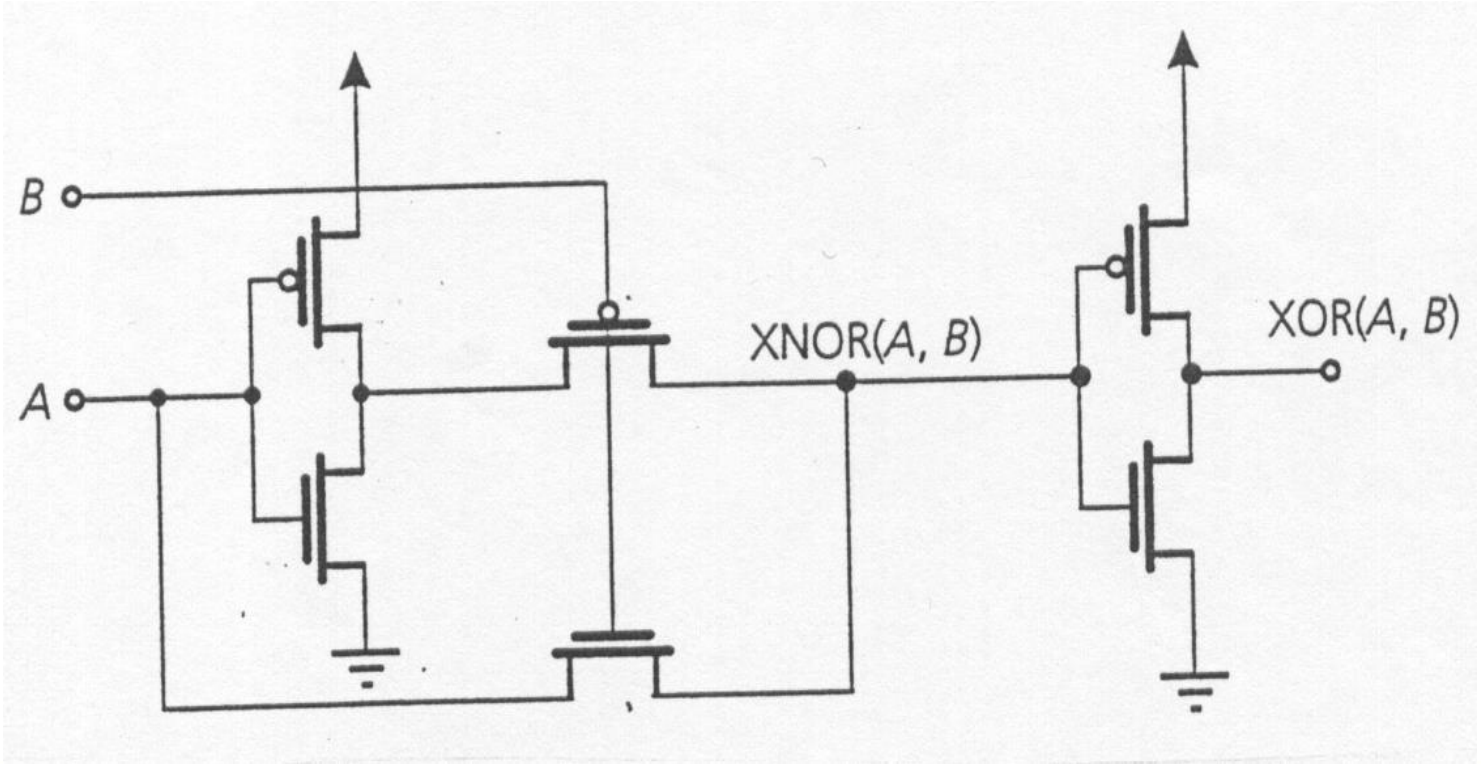
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

(a)

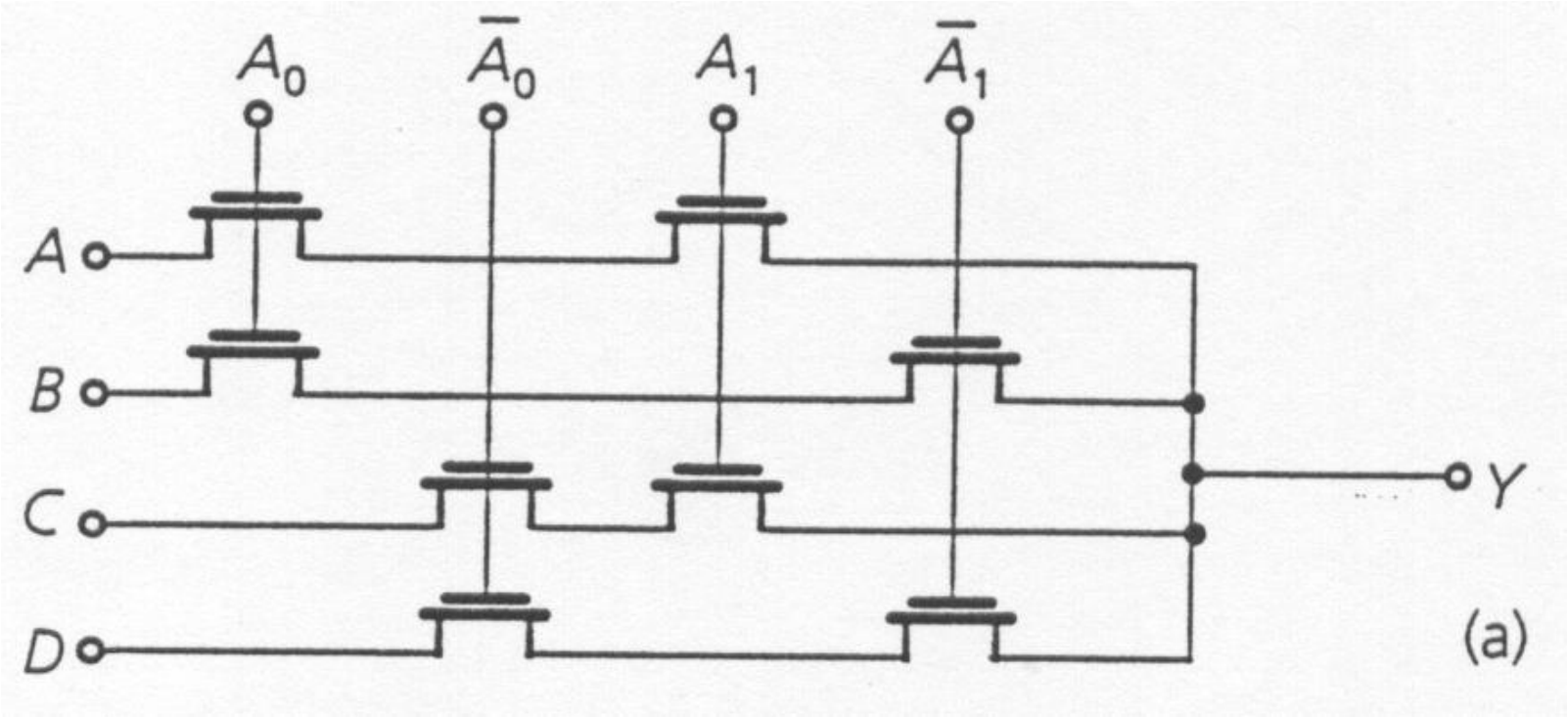


(b)

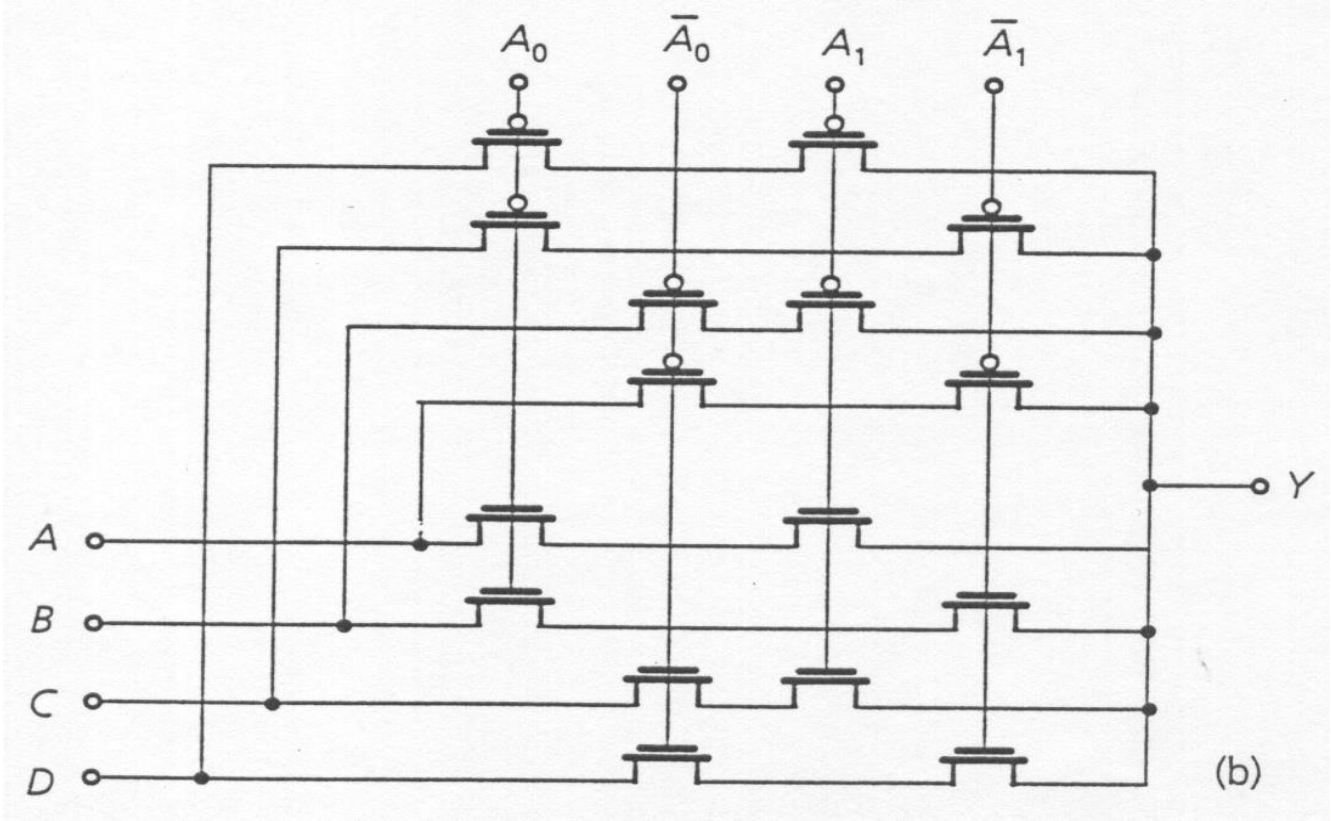
Pass-transistor logic – XOR gate



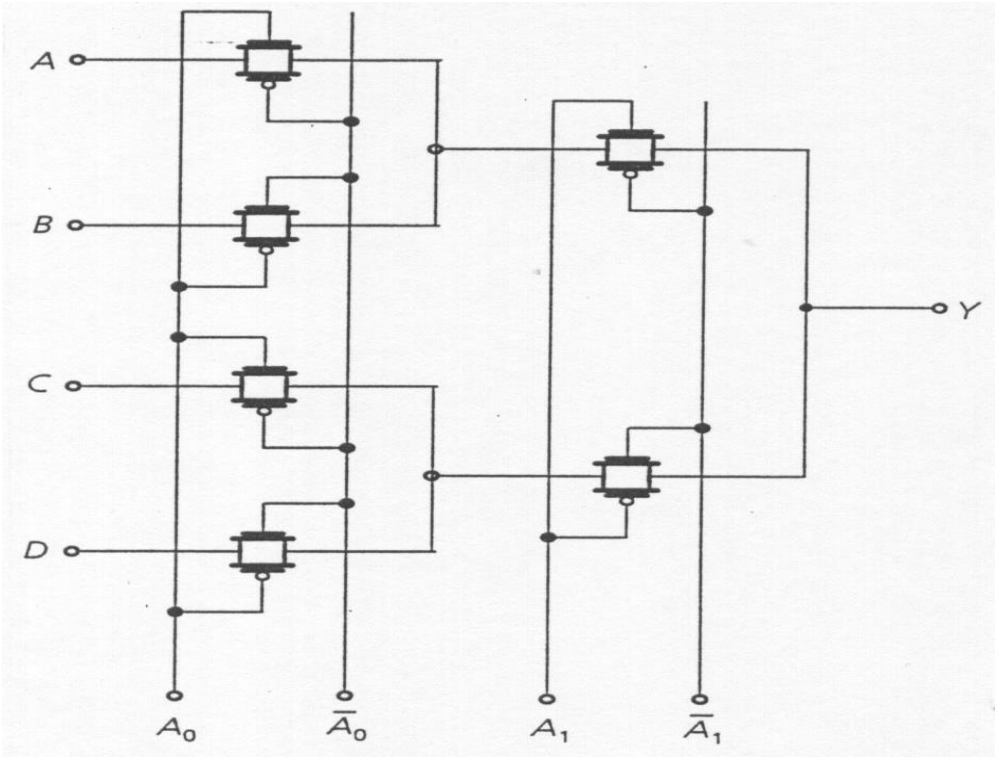
Pass-transistor logic - multiplexer



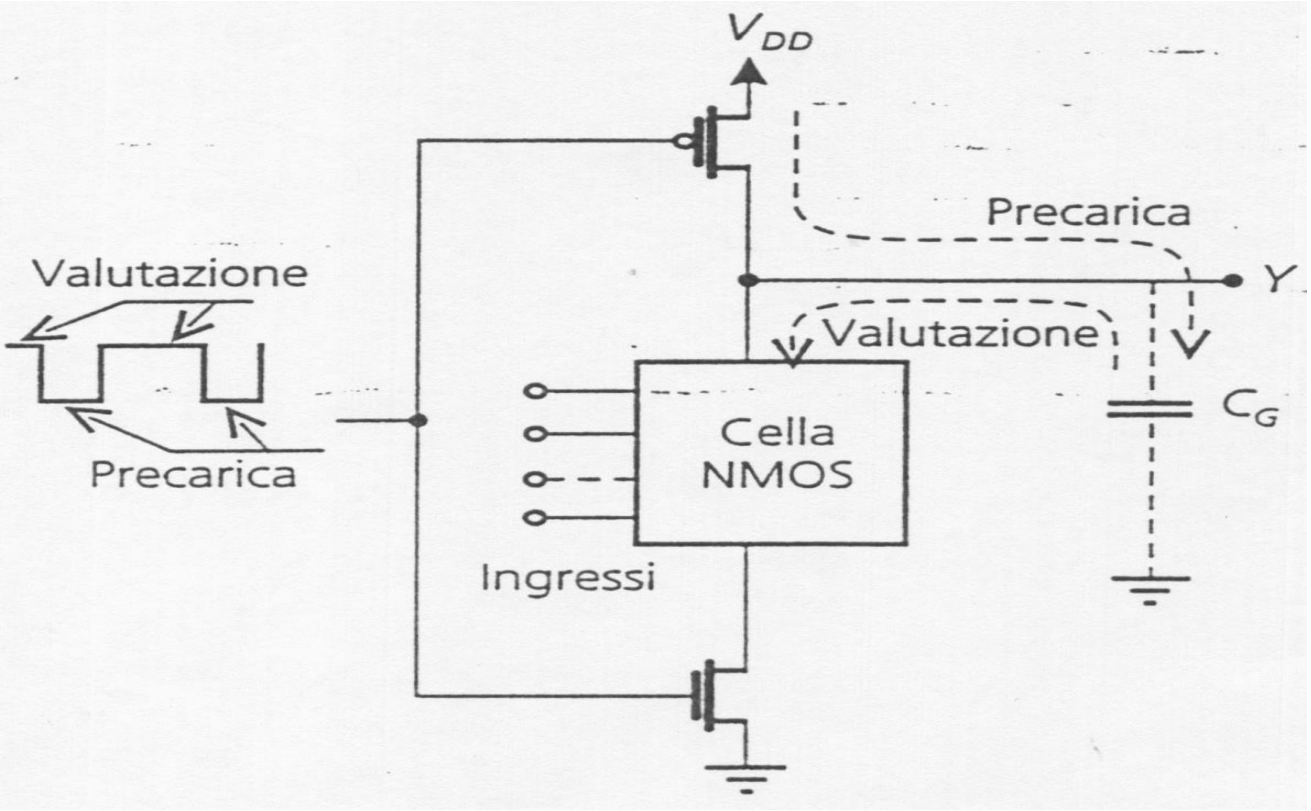
Pass-transistor logic - multiplexer



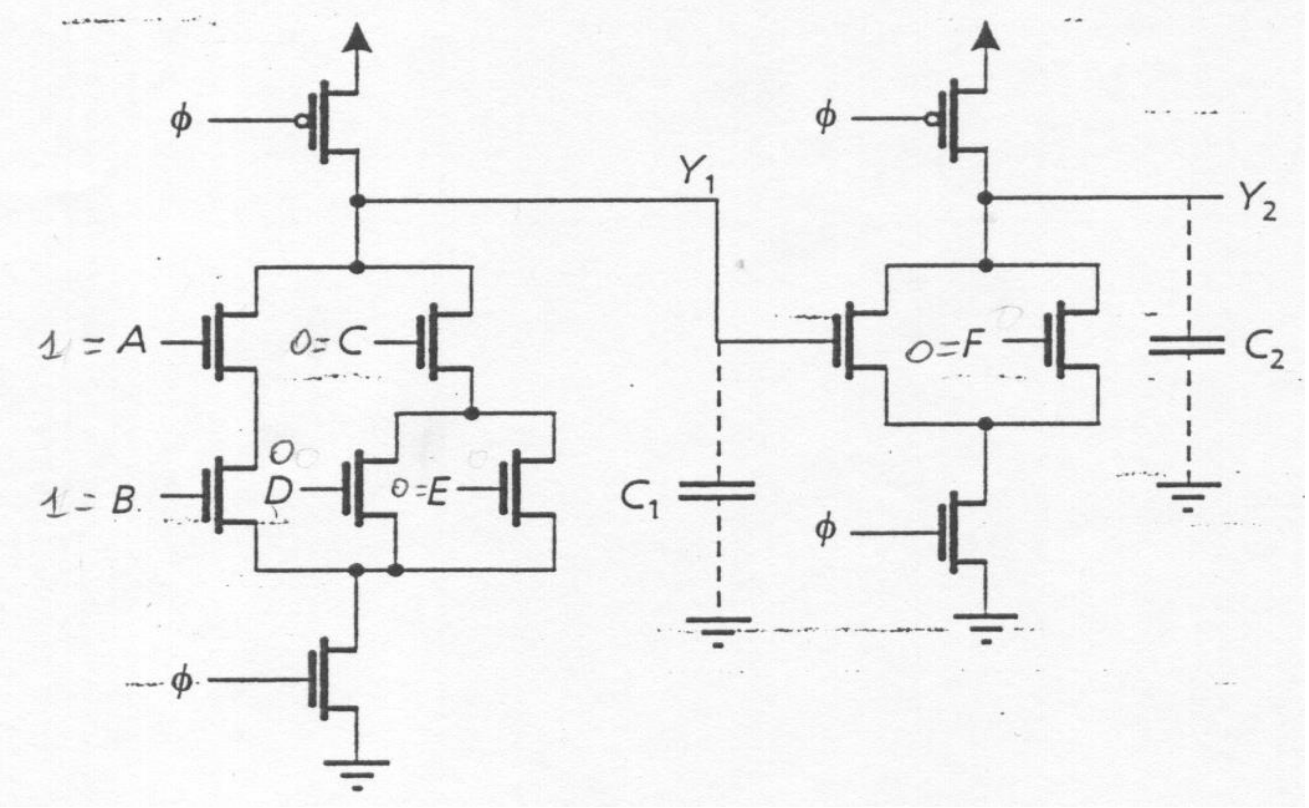
Pass-transistor logic - multiplexer



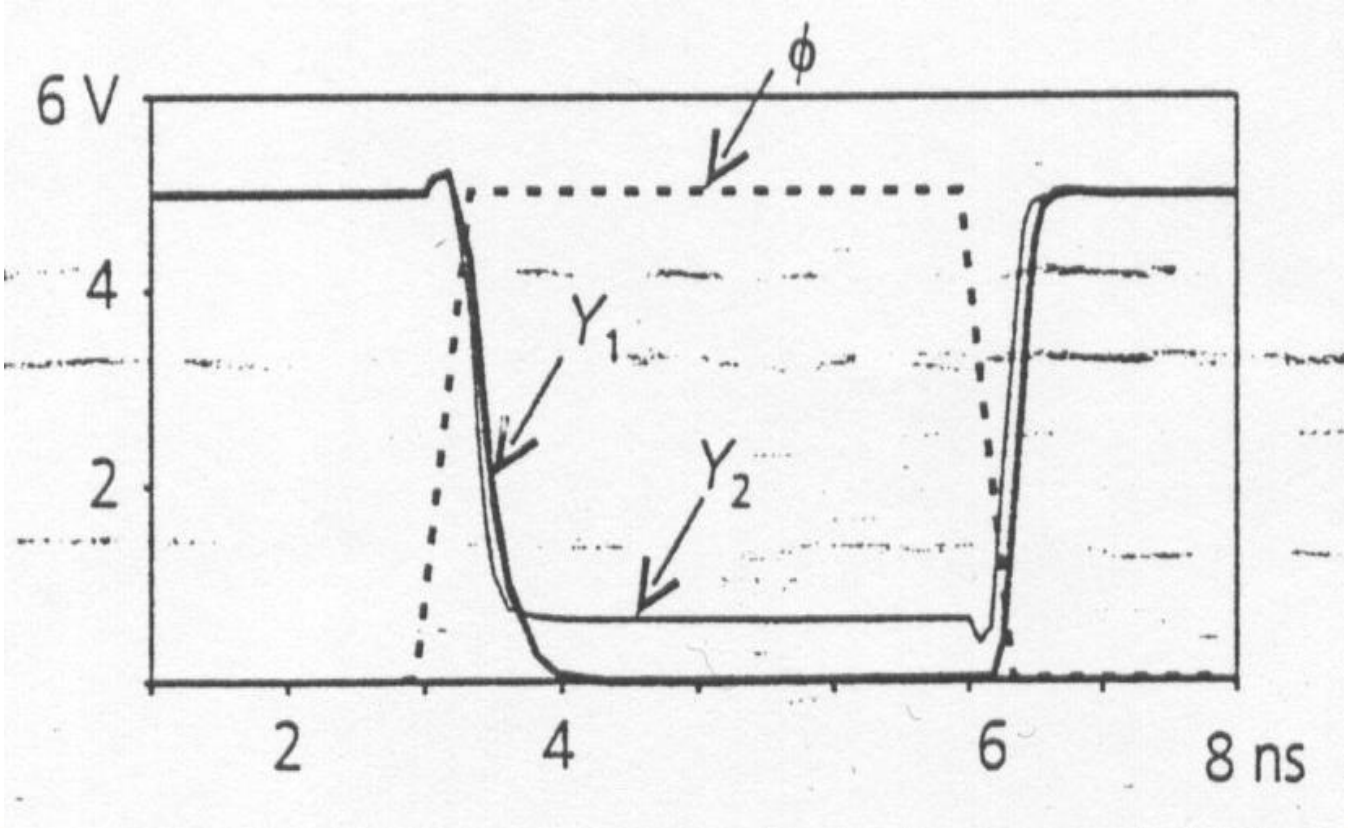
Dynamic logic



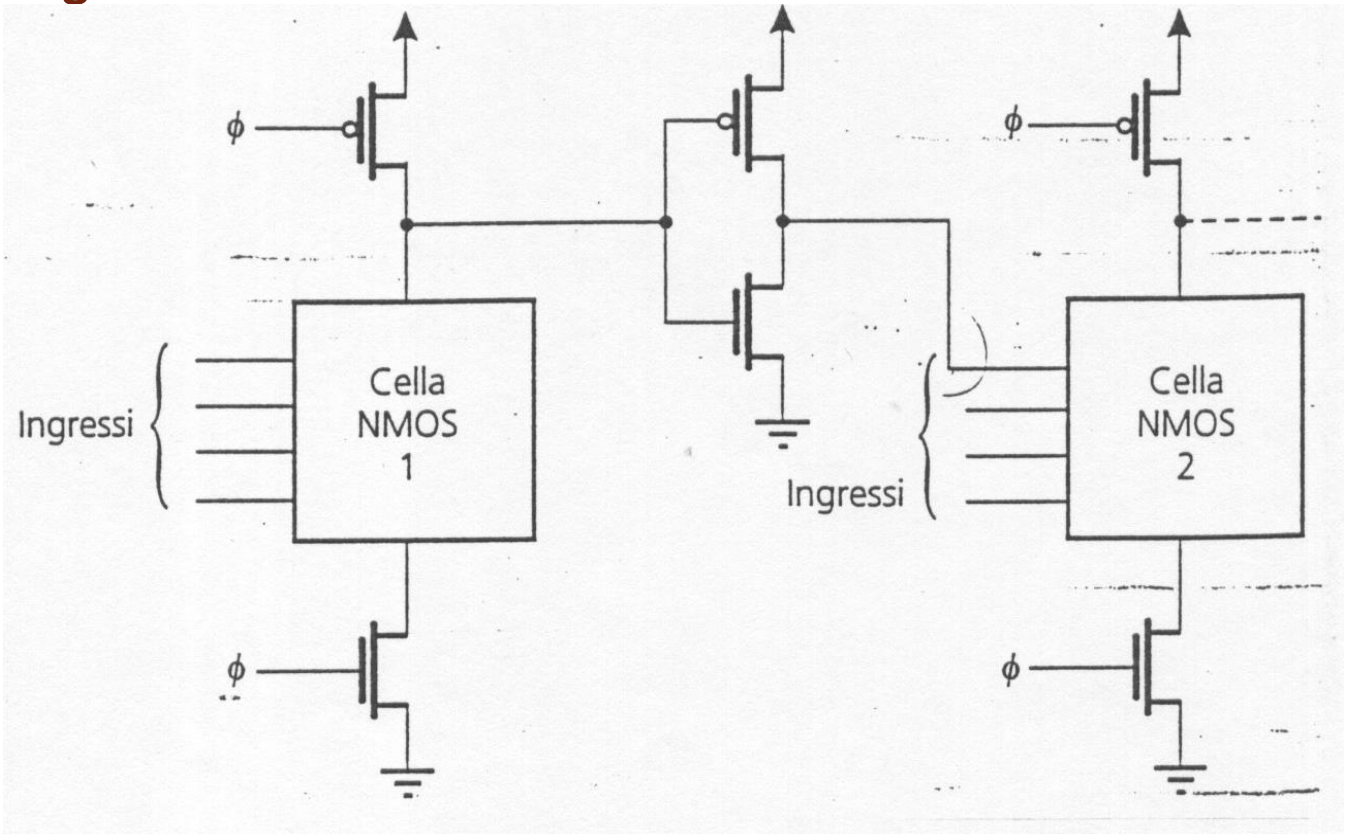
Dynamic logic



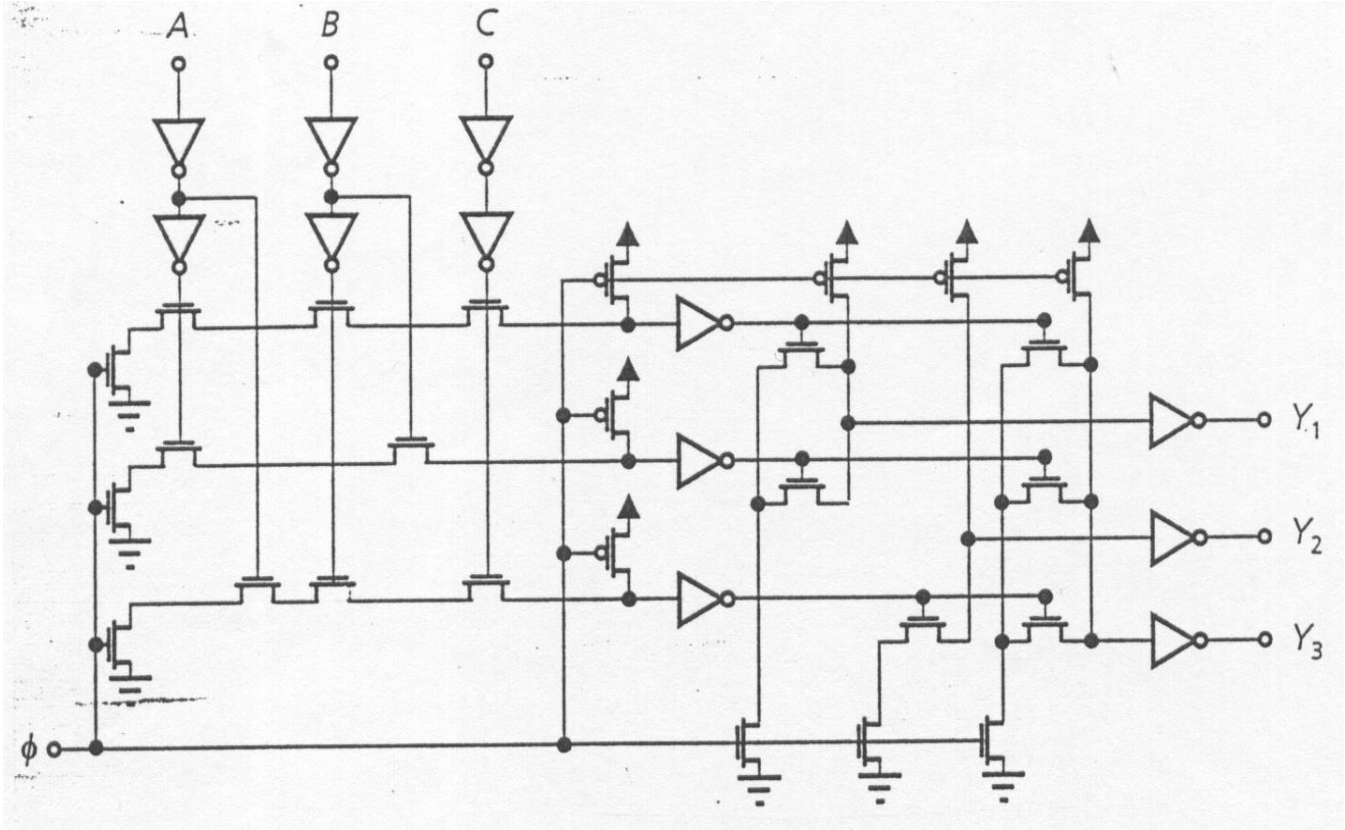
Dynamic logic



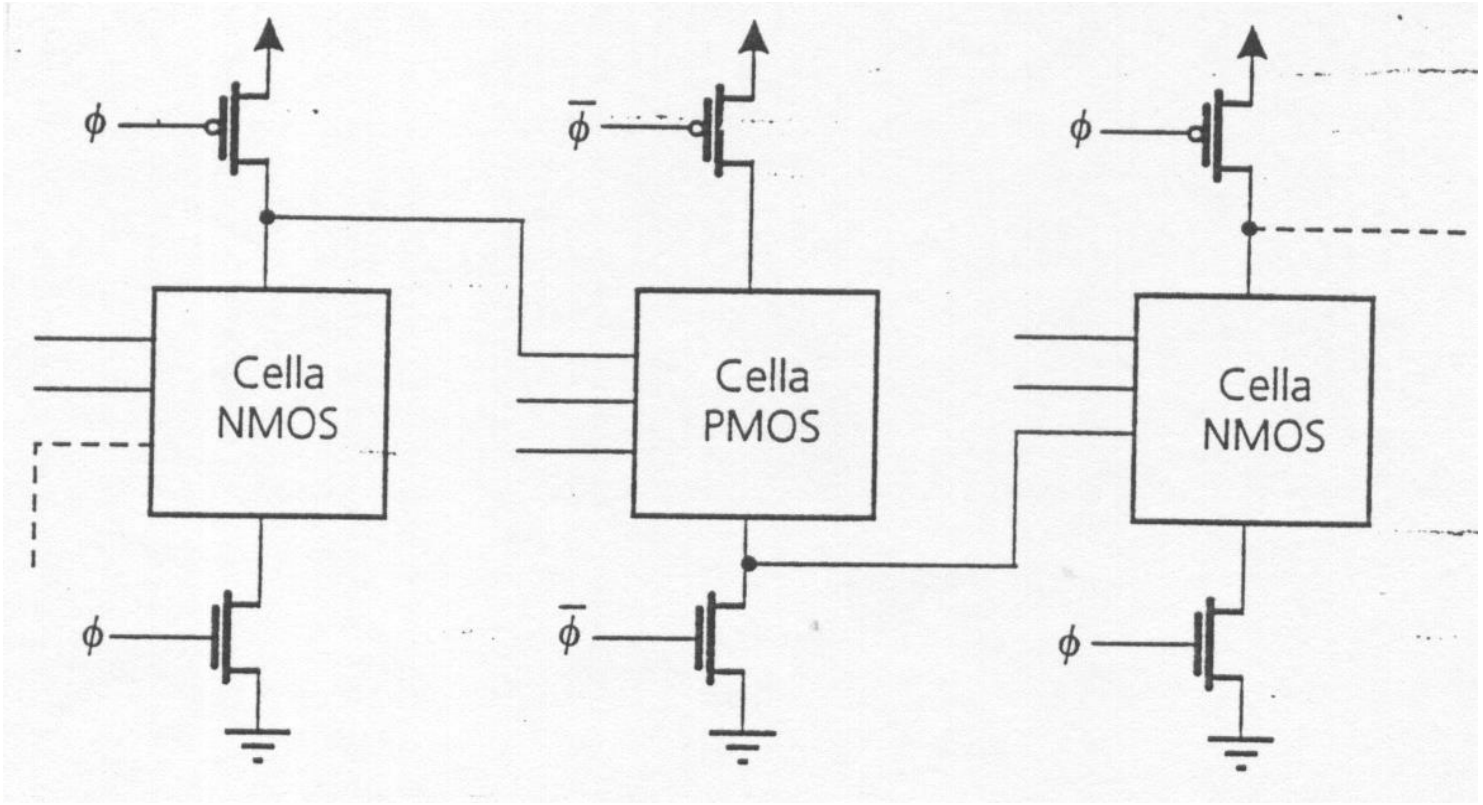
Domino logic



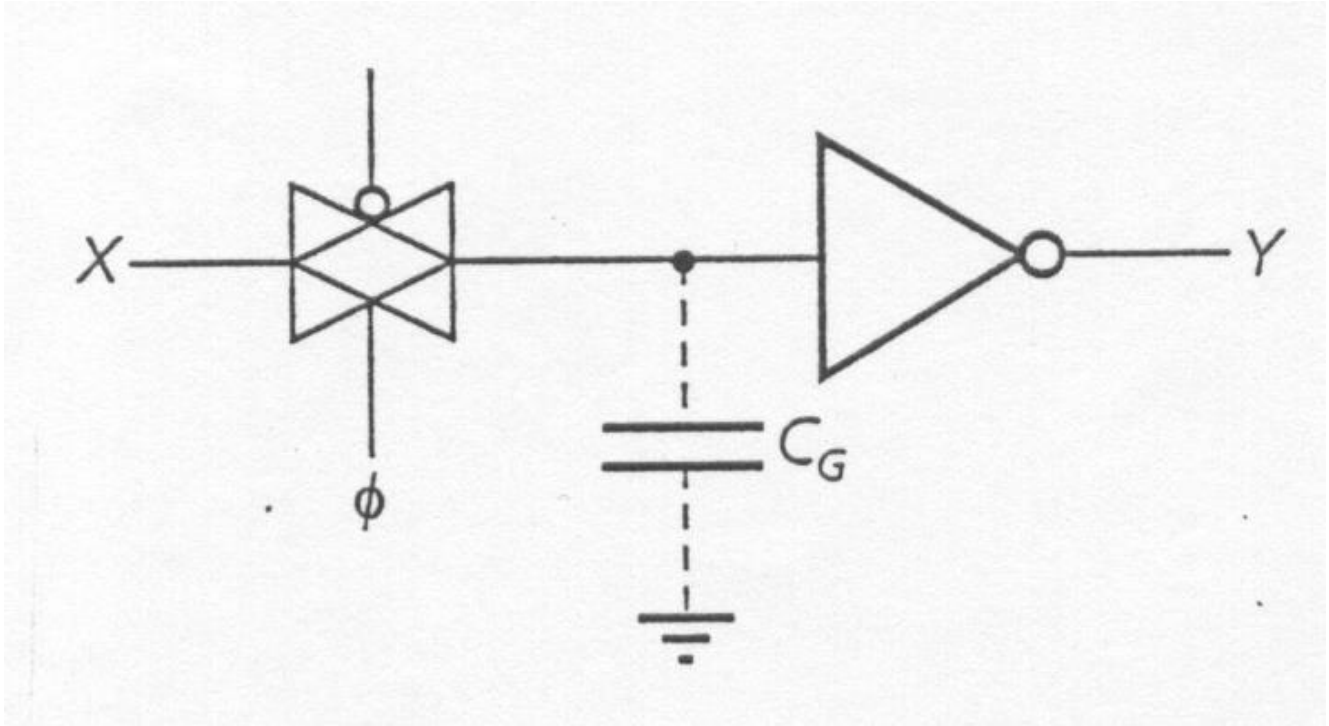
Domino logic – a PLA



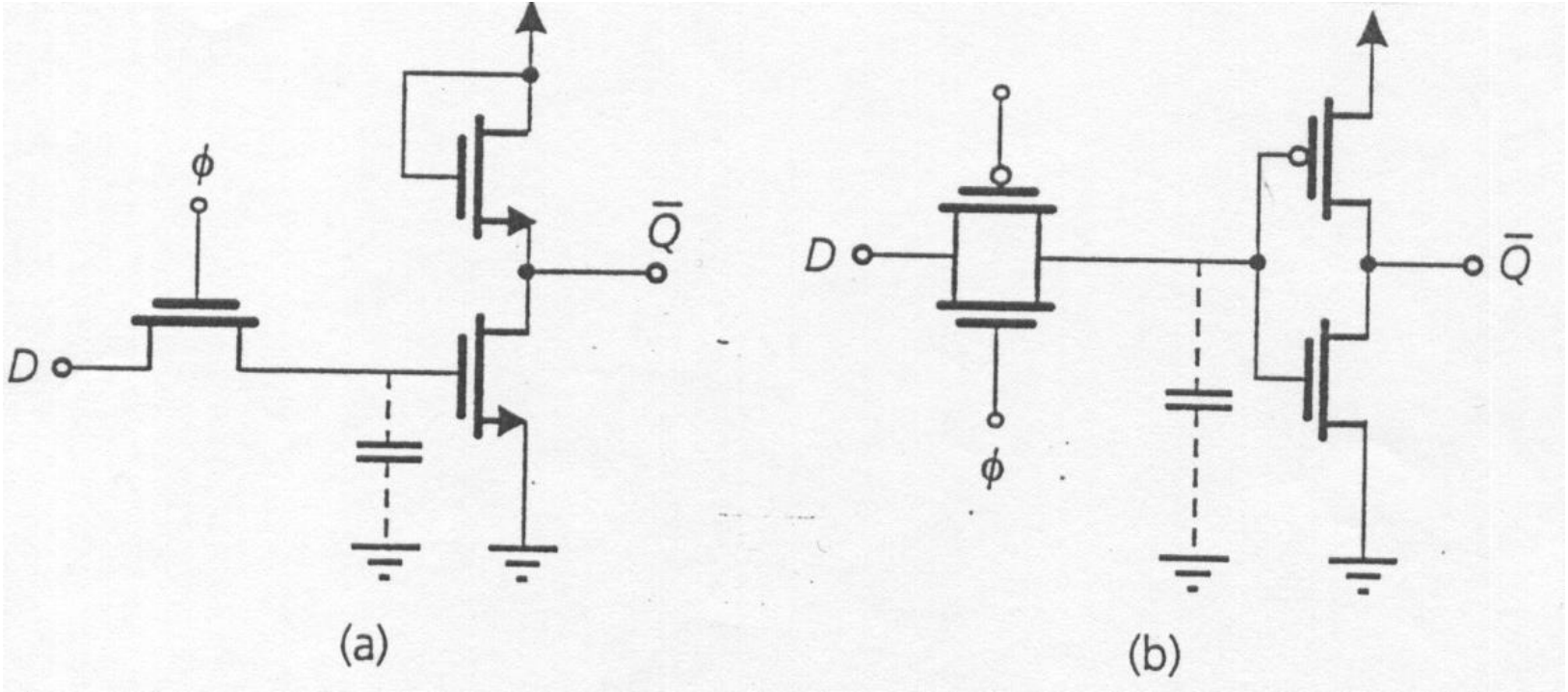
NORA CMOS Logic



Dynamic latches



Dynamic latches



See also:

- Paolo Spirito, “Elettronica Digitale”, Ed. McGraw-Hill
  - Cap. 11.3, 11.4, 11.7, 11.8