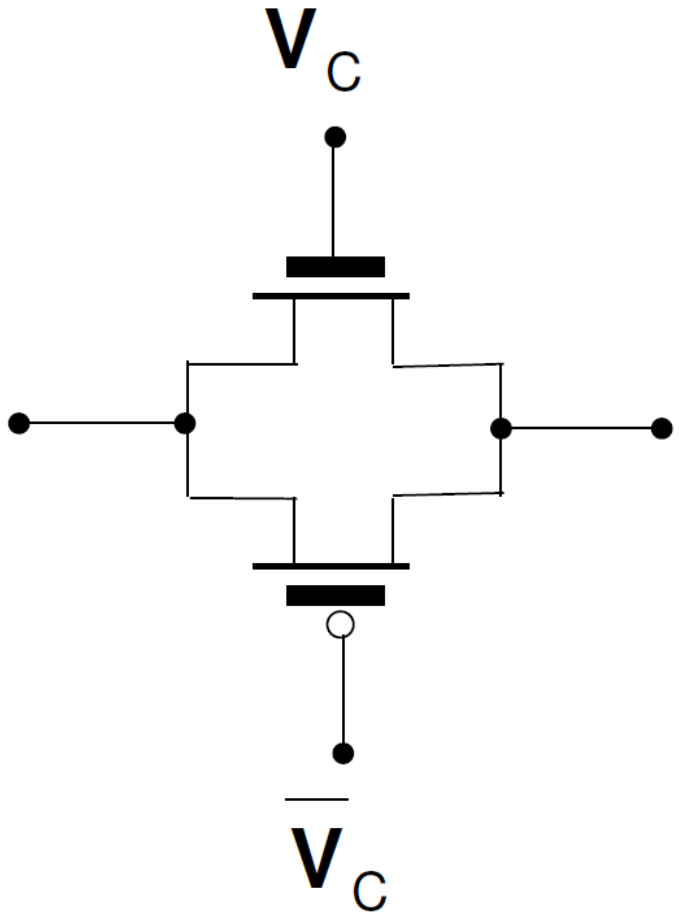
Elettronica Digitale
A.A. 2020-2021

Lezione 12/05/2021

Pass-Transistor Logic

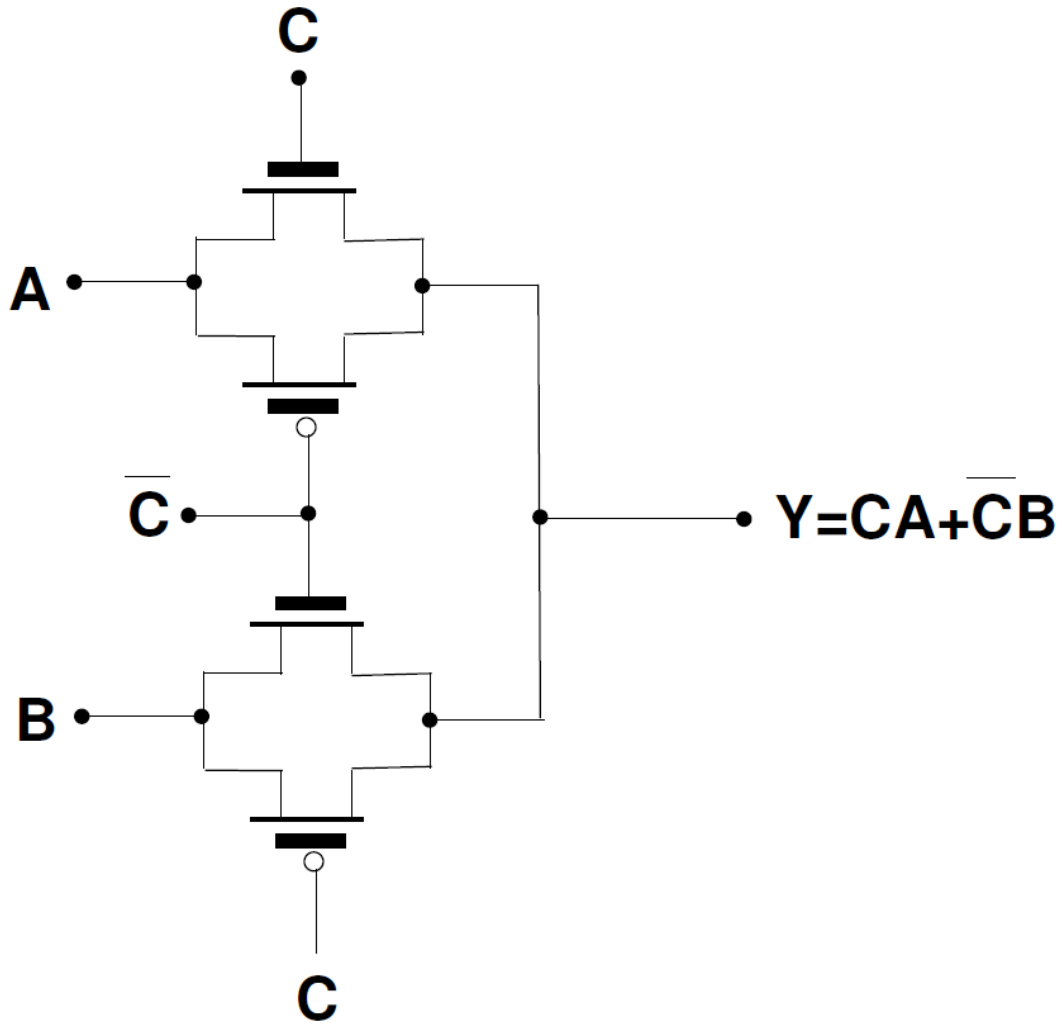
Pass gate CMOS



Pass-Transistor Logic

Multiplexer 2-a-1

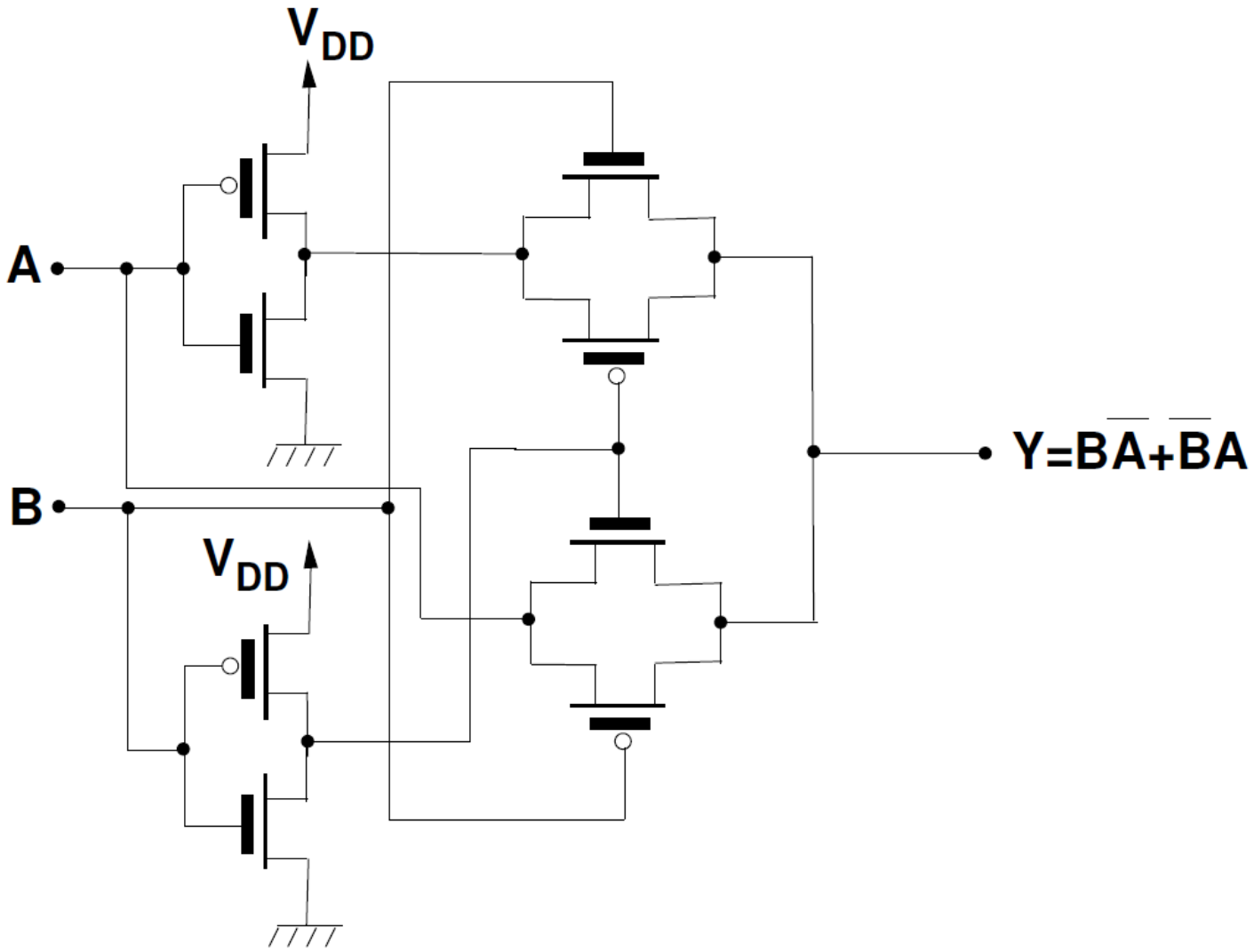
$$Y = AC + B\overline{C}$$



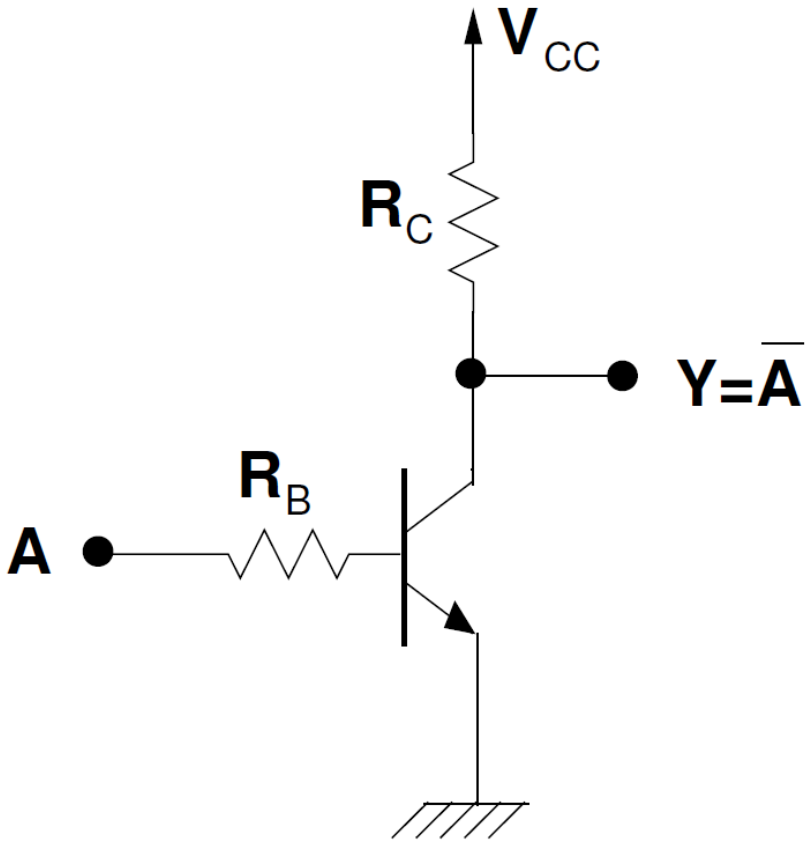
Pass-Transistor Logic

OR-esclusivo (XOR)

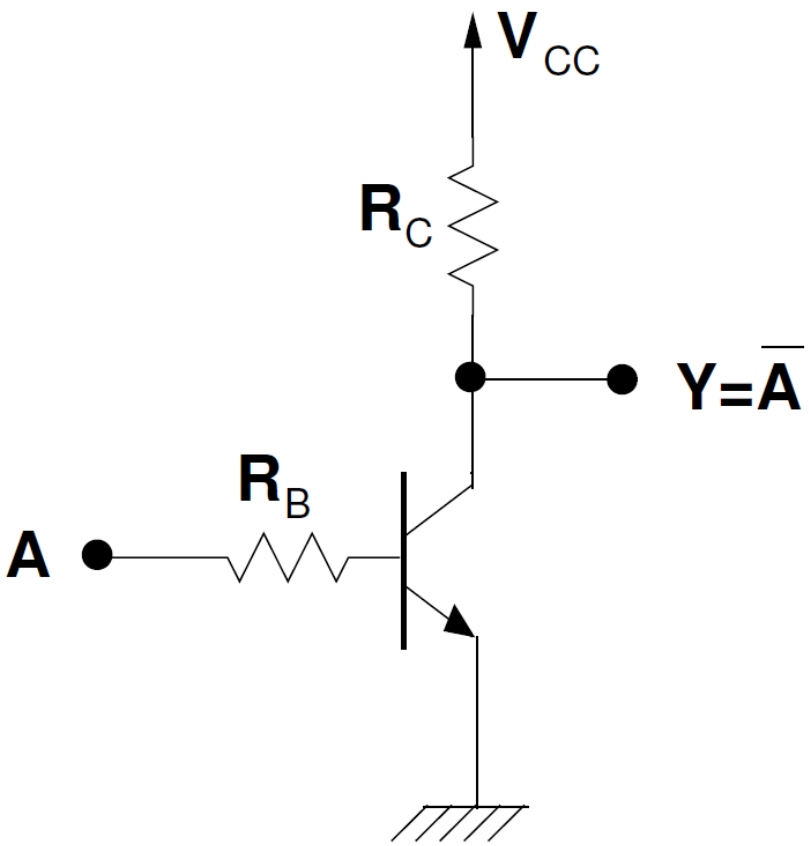
$$Y = \bar{A}B + A\bar{B}$$

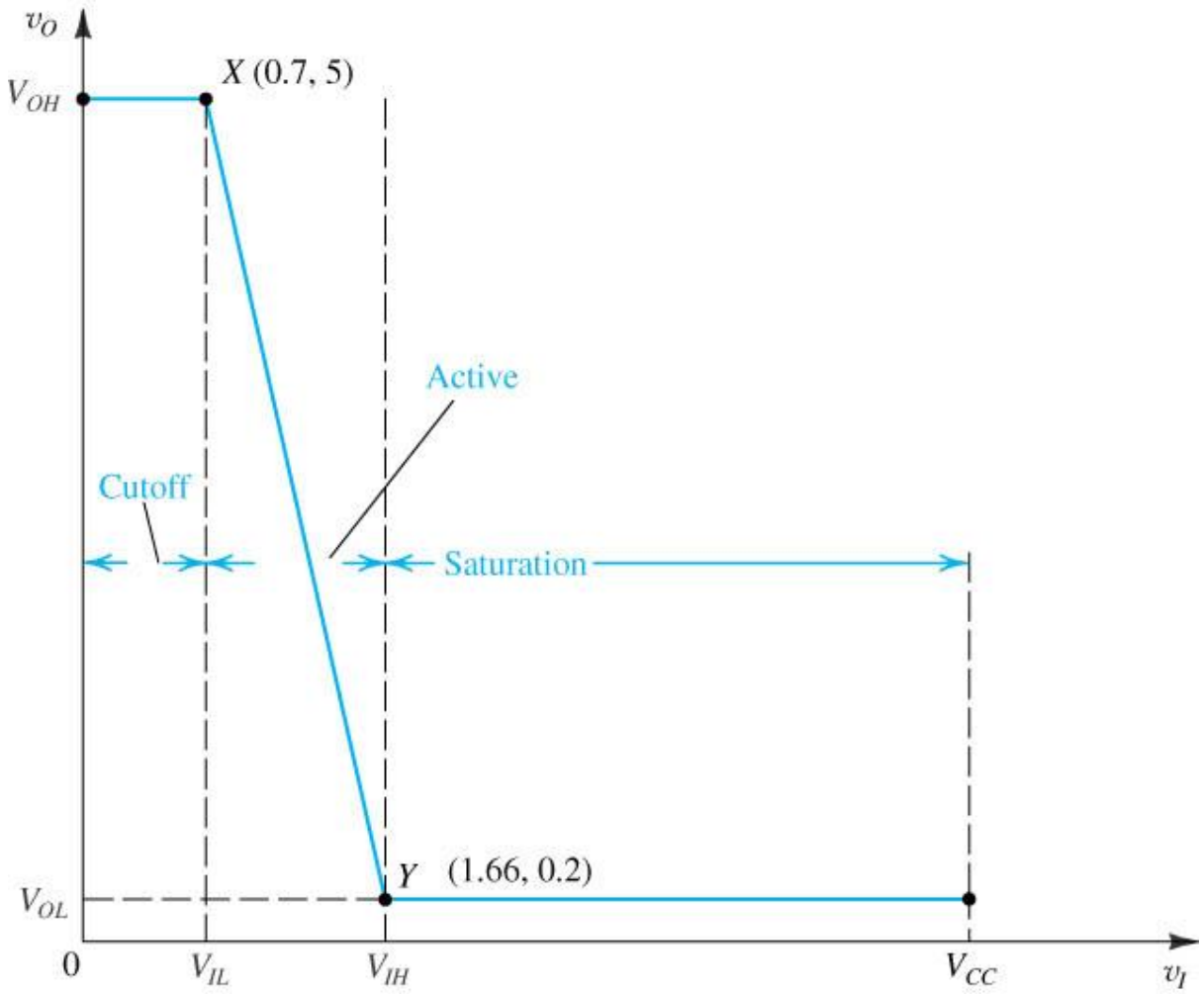


Famiglie logiche bipolari



Famiglie logiche bipolari





$R_B = 10\,k\Omega \qquad R_C = 1\,k\Omega$

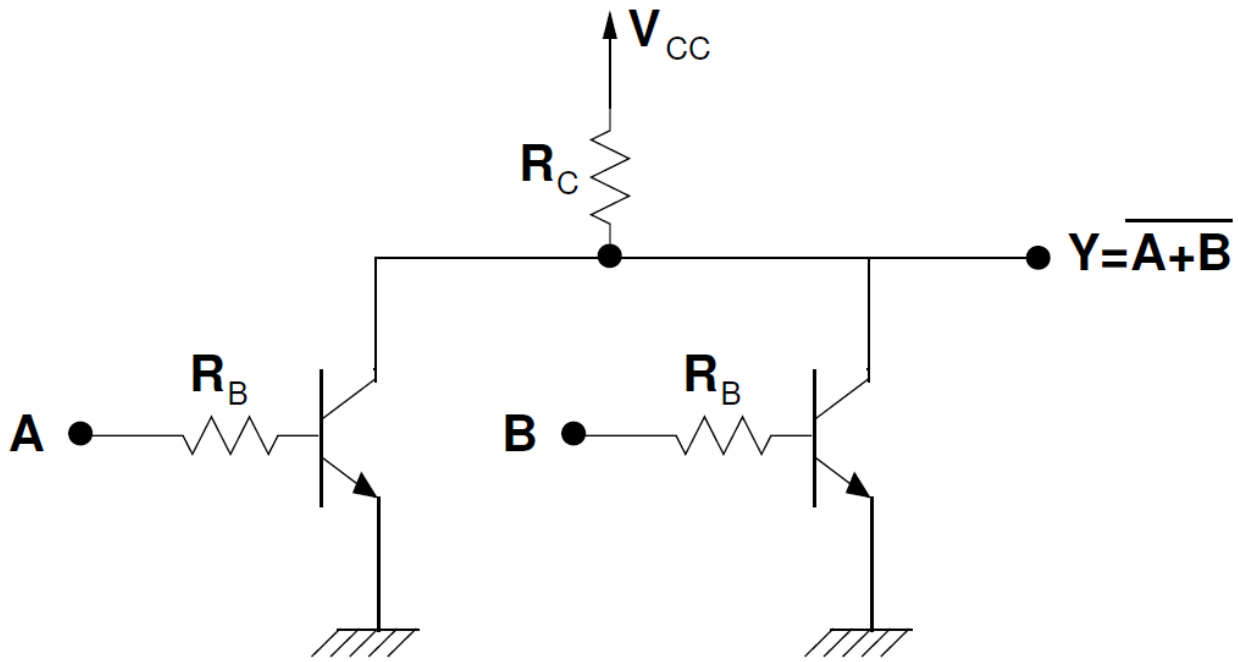
$V_{CC} = 5\,V \qquad \beta_F = h_{fe} = 50$

$NM_H = V_{OH} - V_{IH} = 5 - 1.66 = 3.34\,V$

$NM_L = V_{IL} - V_{OL} = 0.7 - 0.2 = 0.5\,V$

Famiglie logiche bipolari

RTL (Resistor Transistor Logic)

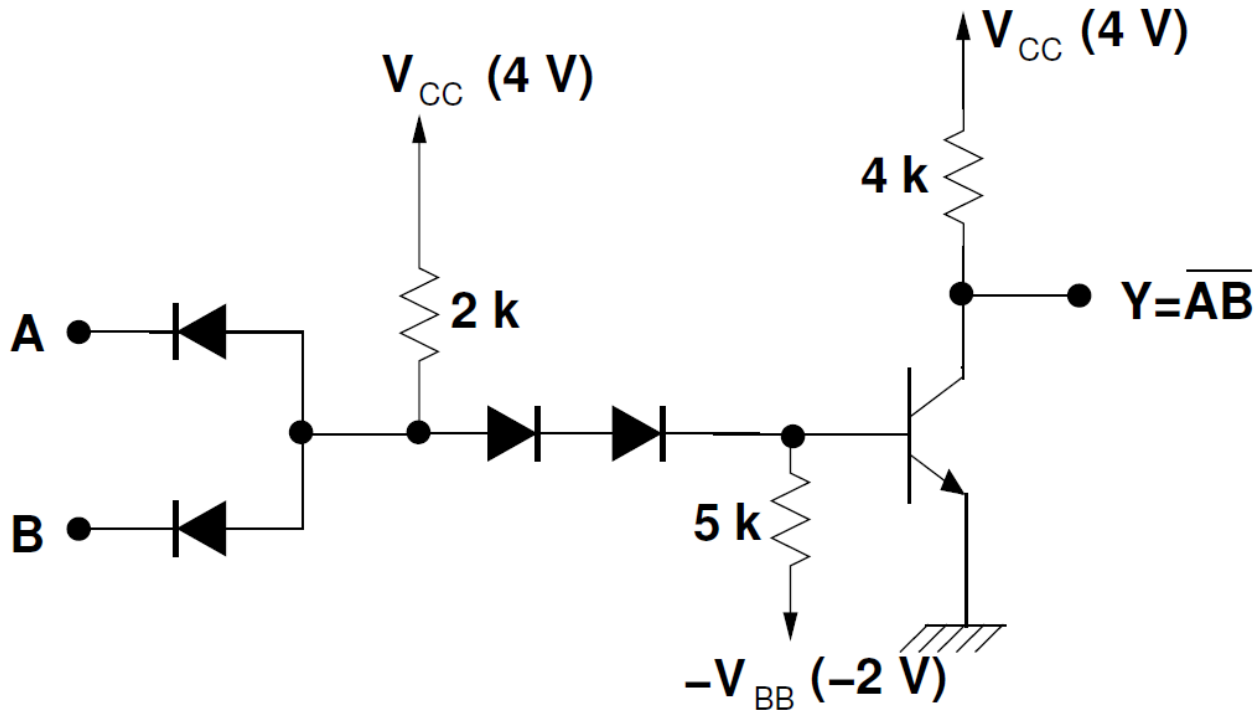


Problematiche:

- Margini di rumore diversi e NM_L molto piccolo
- Dissipazione di potenza statica non trascurabile
- Tempo di commutazione dal livello basso a quello alto (t_{PLH}) molto lungo
- Fan-out piccolo

Famiglie logiche bipolari

DTL (Diode Transistor Logic)

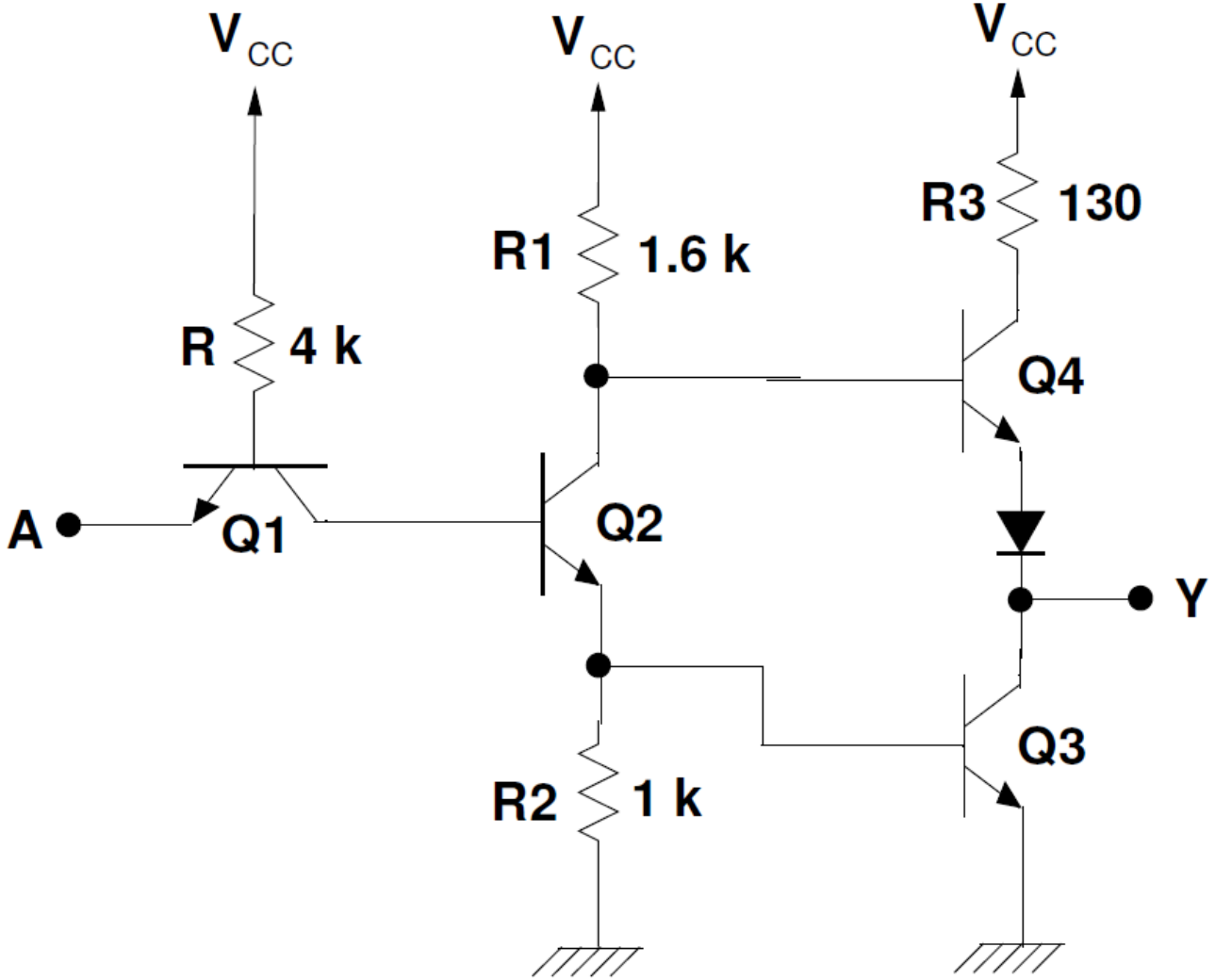


Miglioramenti introdotti:

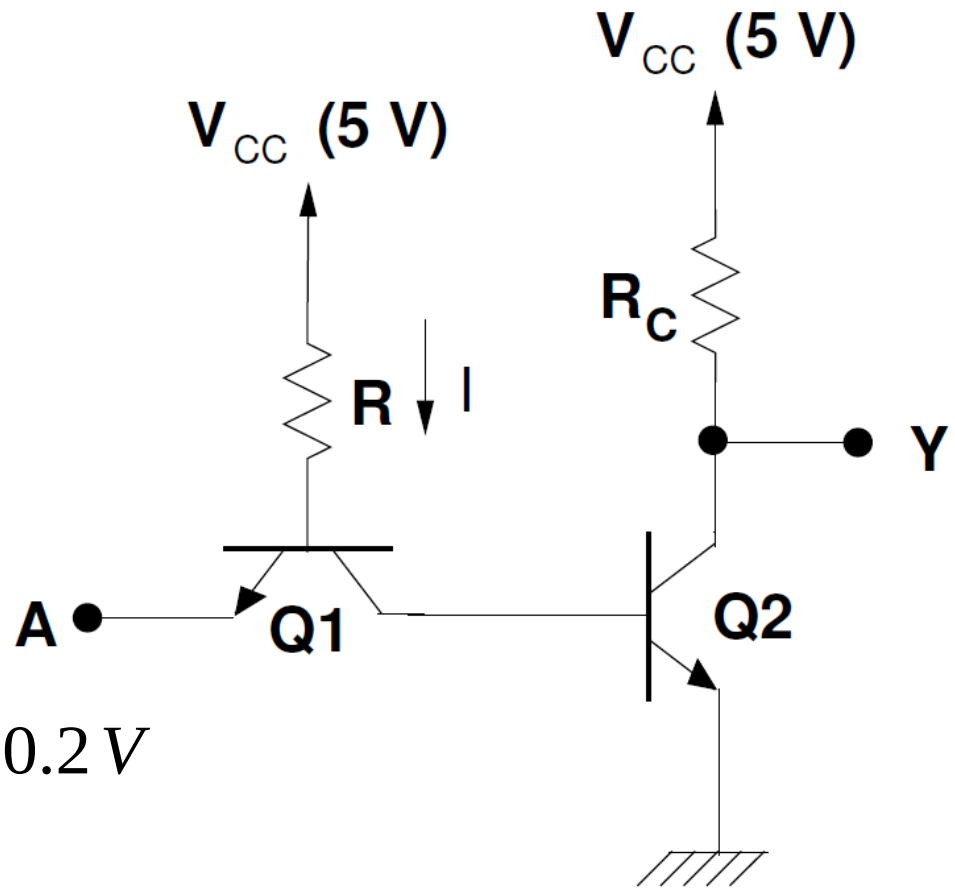
- I diodi di ingresso consentono una riduzione della corrente assorbita
- I diodi collegati alla base del BJT aumentano il margine di rumore
- La resistenza sulla base del BJT velocizza l'uscita dalla saturazione

Famiglie logiche bipolari

TTL (Transistor Transistor Logic)

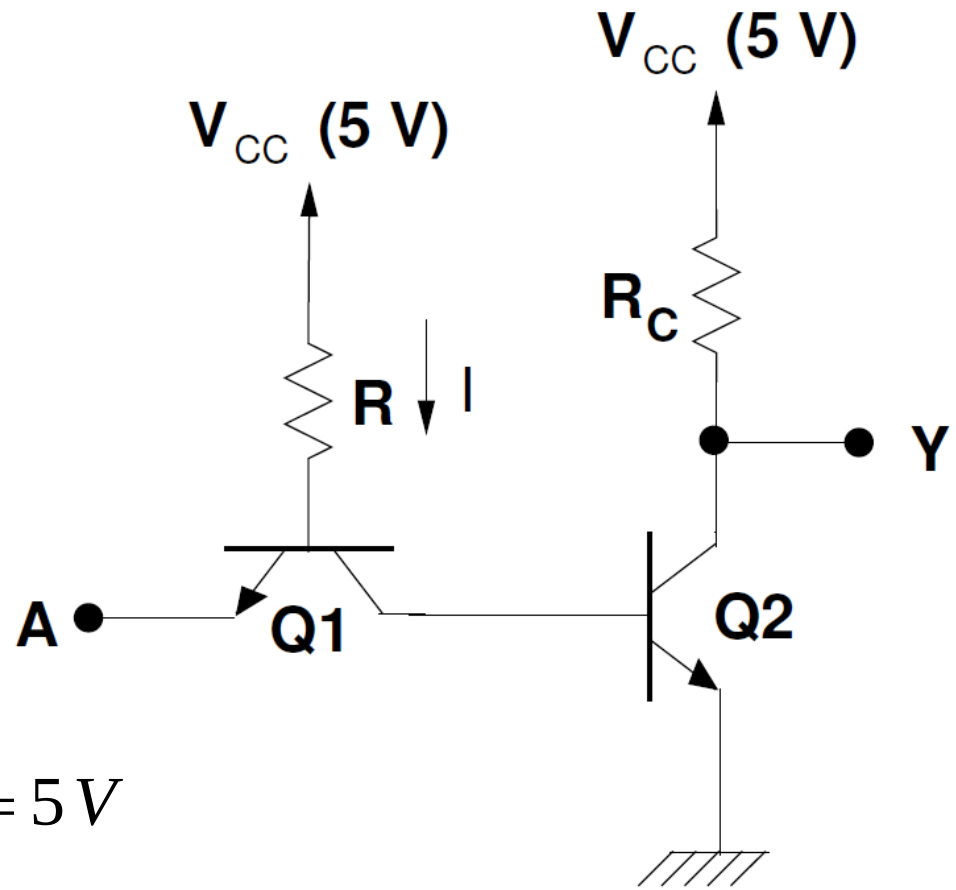


Famiglie logiche bipolari - TTL



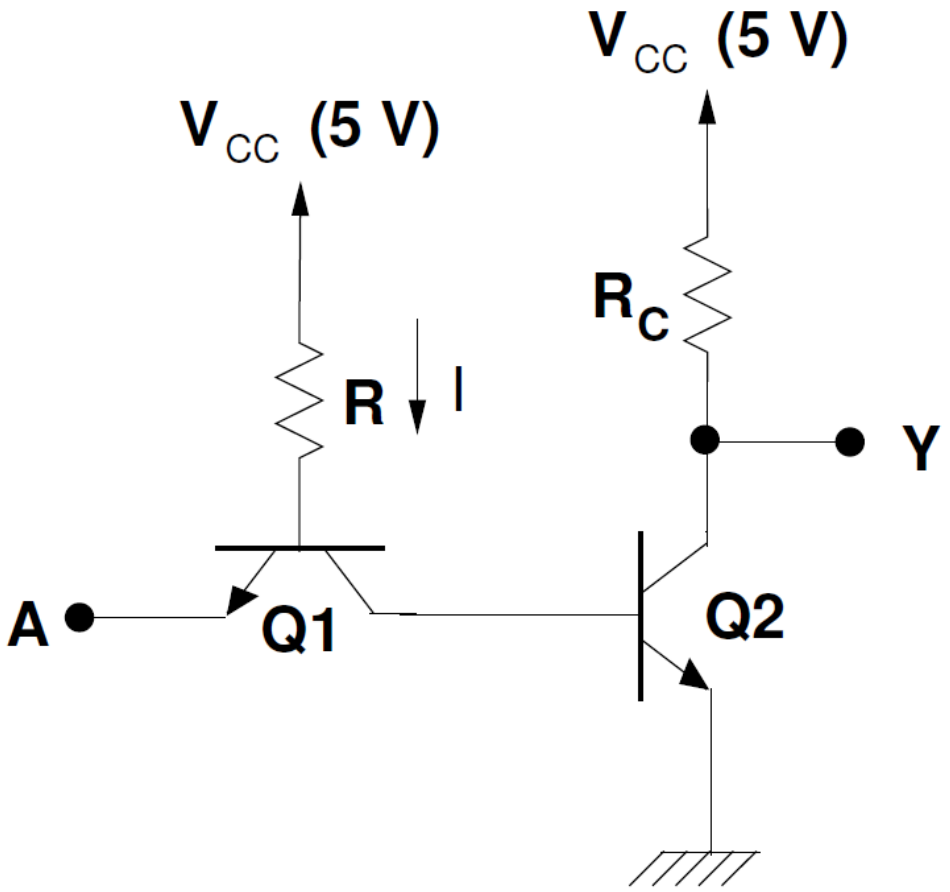
$V_A = 0.2\,V$

Famiglie logiche bipolari - TTL



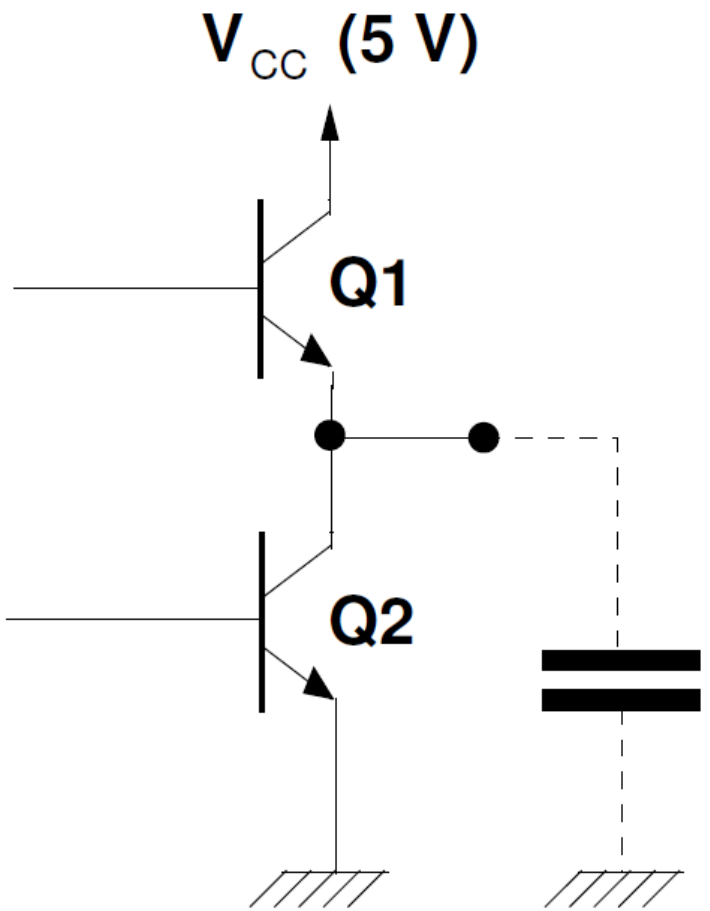
$V_A = 5\,V$

Famiglie logiche bipolari - TTL

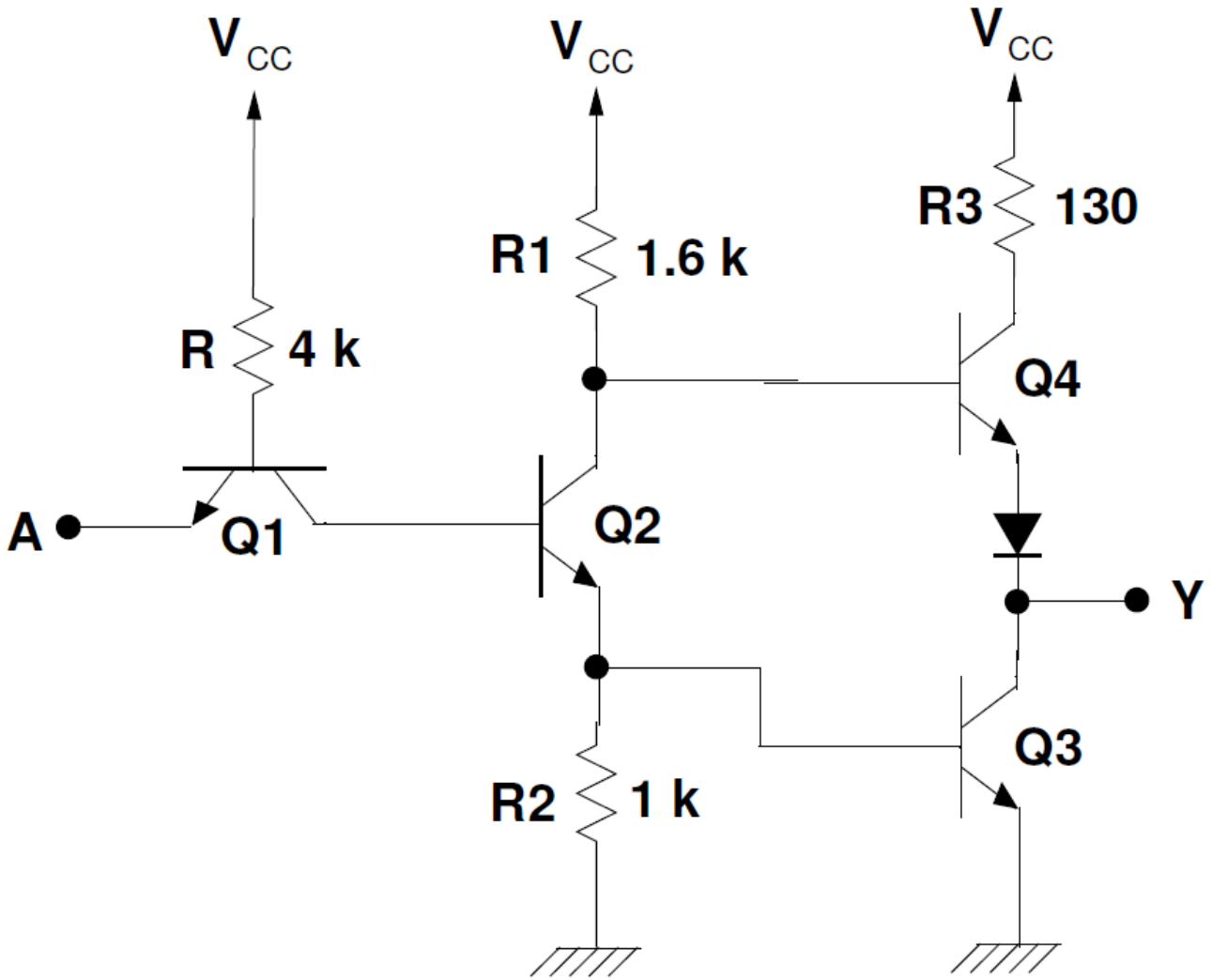


Famiglie logiche bipolari - TTL

TOTEM-POLE

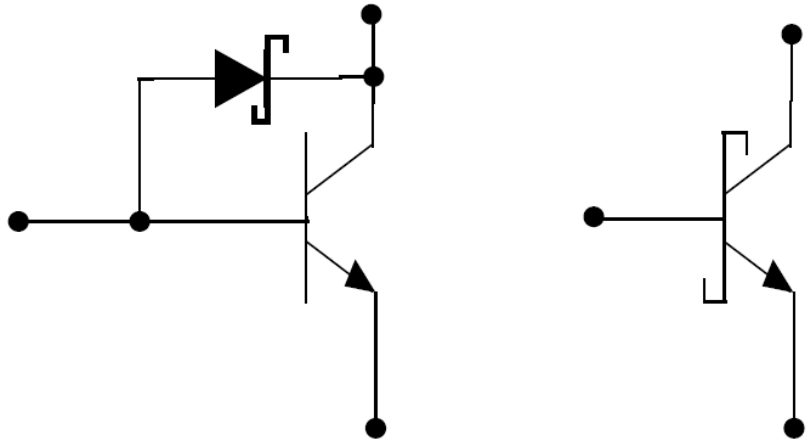


Famiglie logiche bipolari - TTL



Famiglie logiche bipolari - TTL

Transistore Schottky



$$V_{BCMax} = V_{\gamma} = 0.5\,V$$

$$V_{CEMin} = V_{CBMax} + V_{BEMax} = -0.5 + 0.8 = 0.3\,V$$

	74	74S	74LS	74ALS	74HC
P_D (mW)	10	20	2	1.2	0.025
t_P (ns)	10	3	10	4	10
$P_D t_P$ (pJ)	100	60	20	4.8	0.25

Famiglie logiche bipolari – ECL (Emitter-Coupled Logic)

Famiglie logiche bipolari – ECL (Emitter-Coupled Logic)