

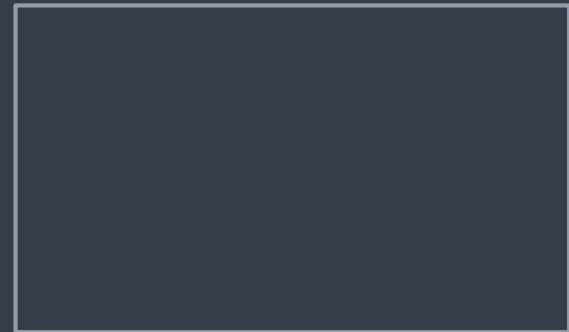


Departamento de
Engenharia Elétrica e
de Computação

SEL 414 - Sistemas Digitais

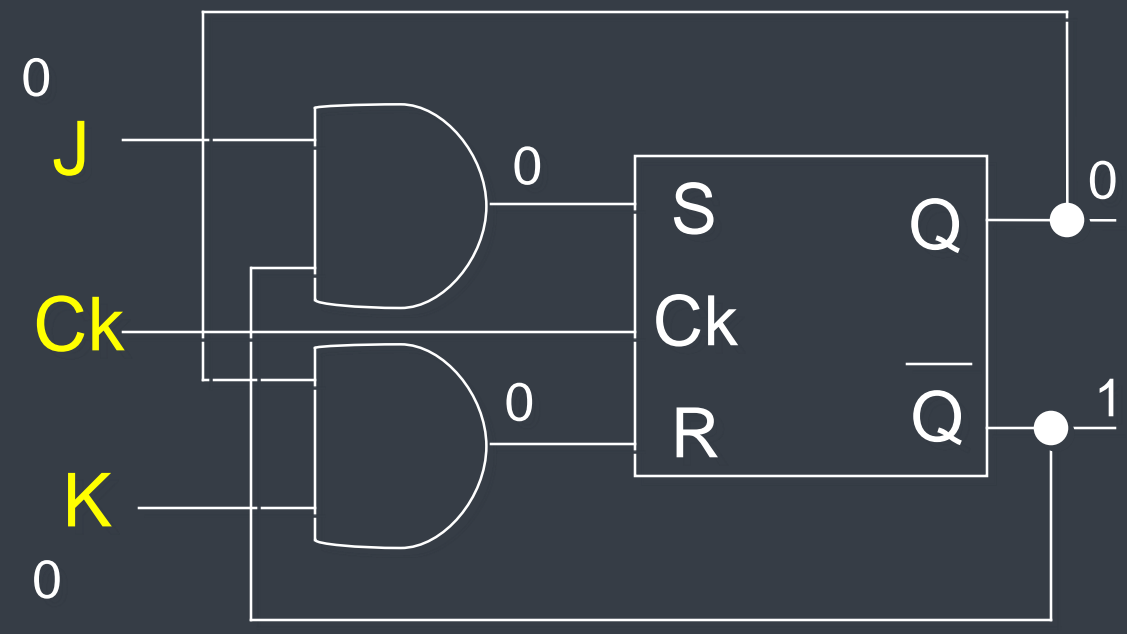
SISTEMAS SEQUENCIAIS (BIESTÁVEIS)

Prof. Homero Schiabel



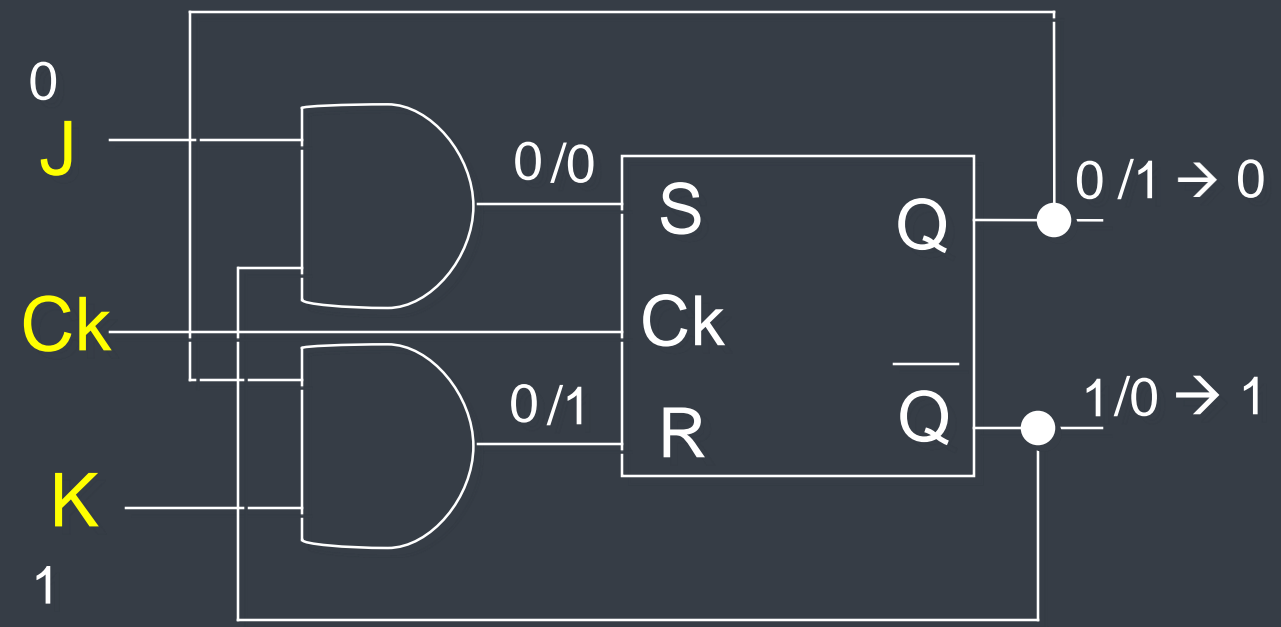
FLIP FLOP JK

SEL414 – Flip Flop JK



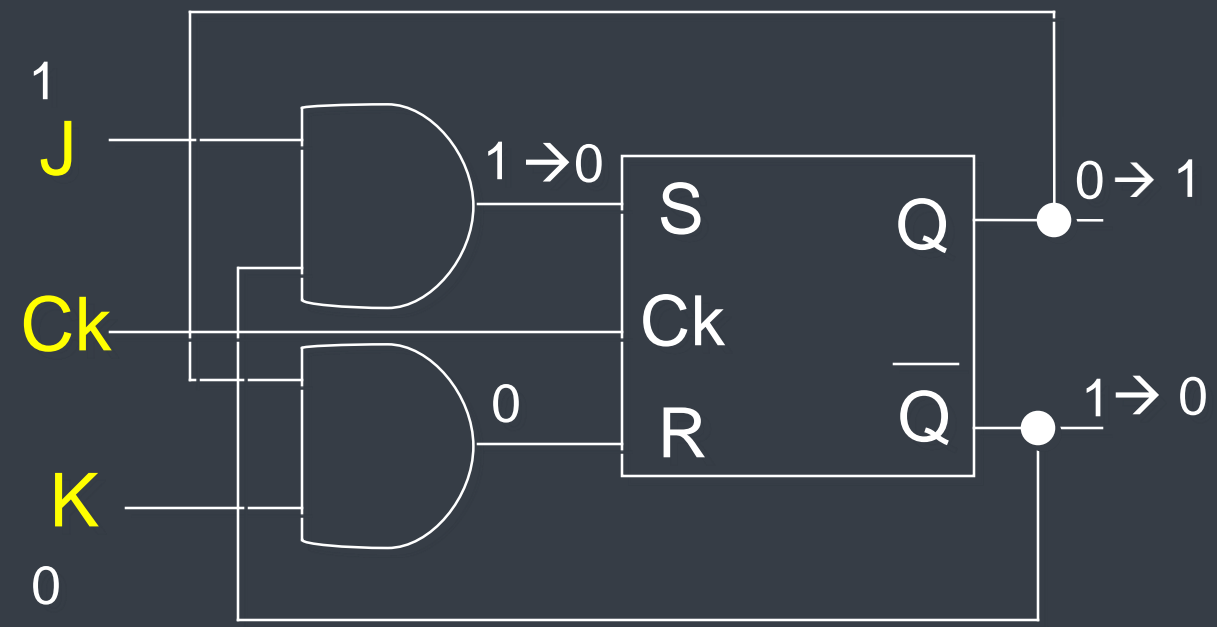
J	K	Q *
0	0	Q

SEL414 – Flip Flop JK

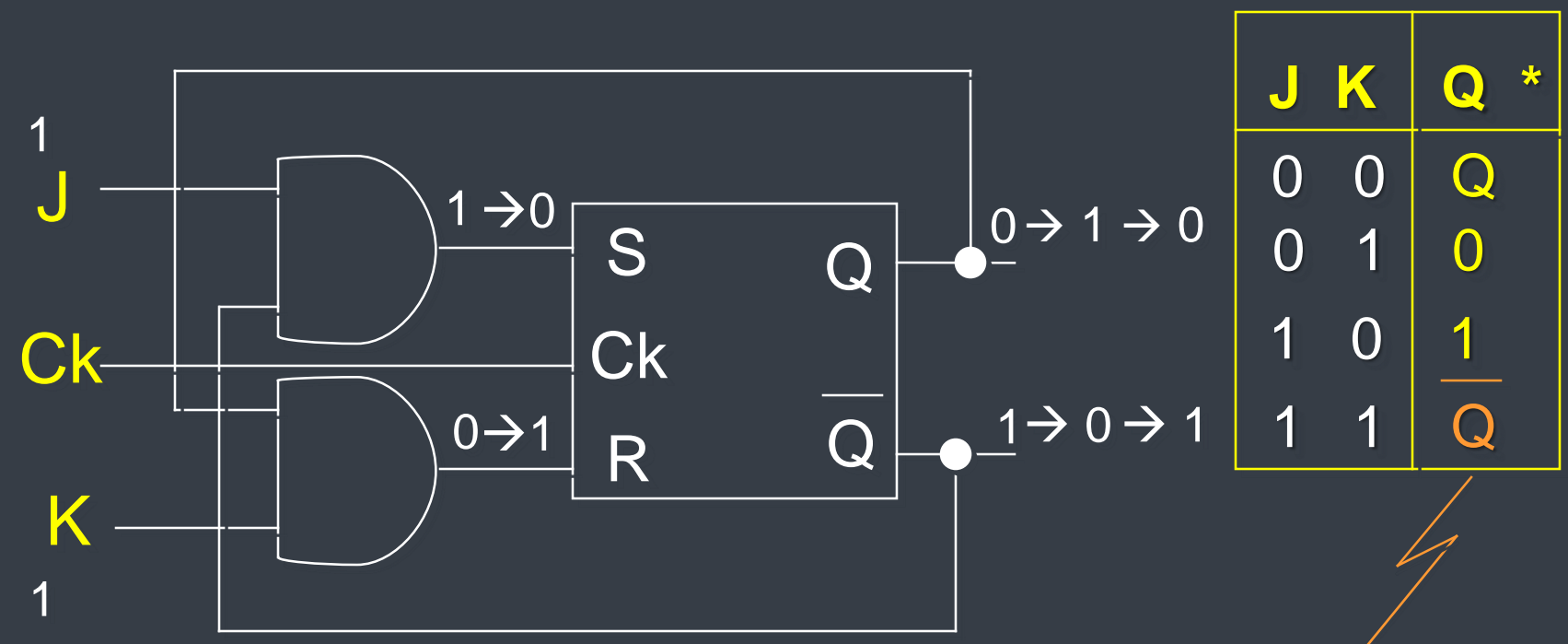


J	K	Q *
0	0	Q
0	1	0

SEL414 – Flip Flop JK



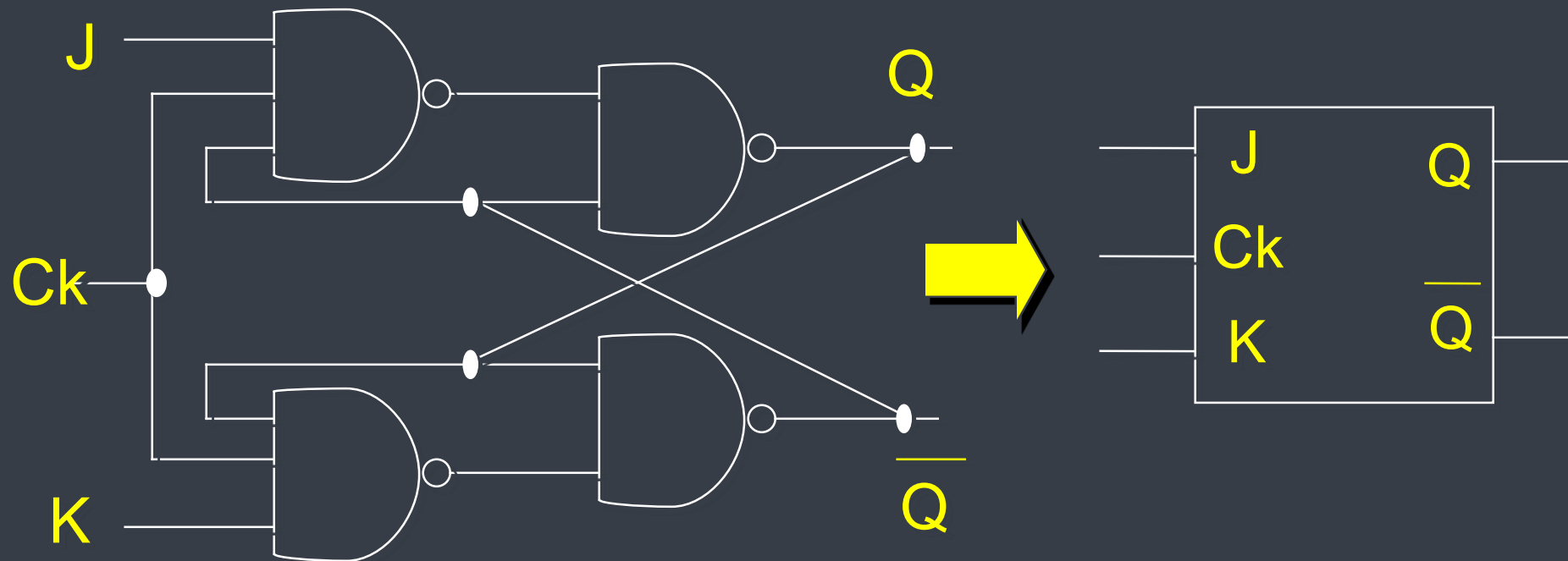
J	K	Q *
0	0	Q
0	1	0
1	0	1



* Após o pulso do Ck

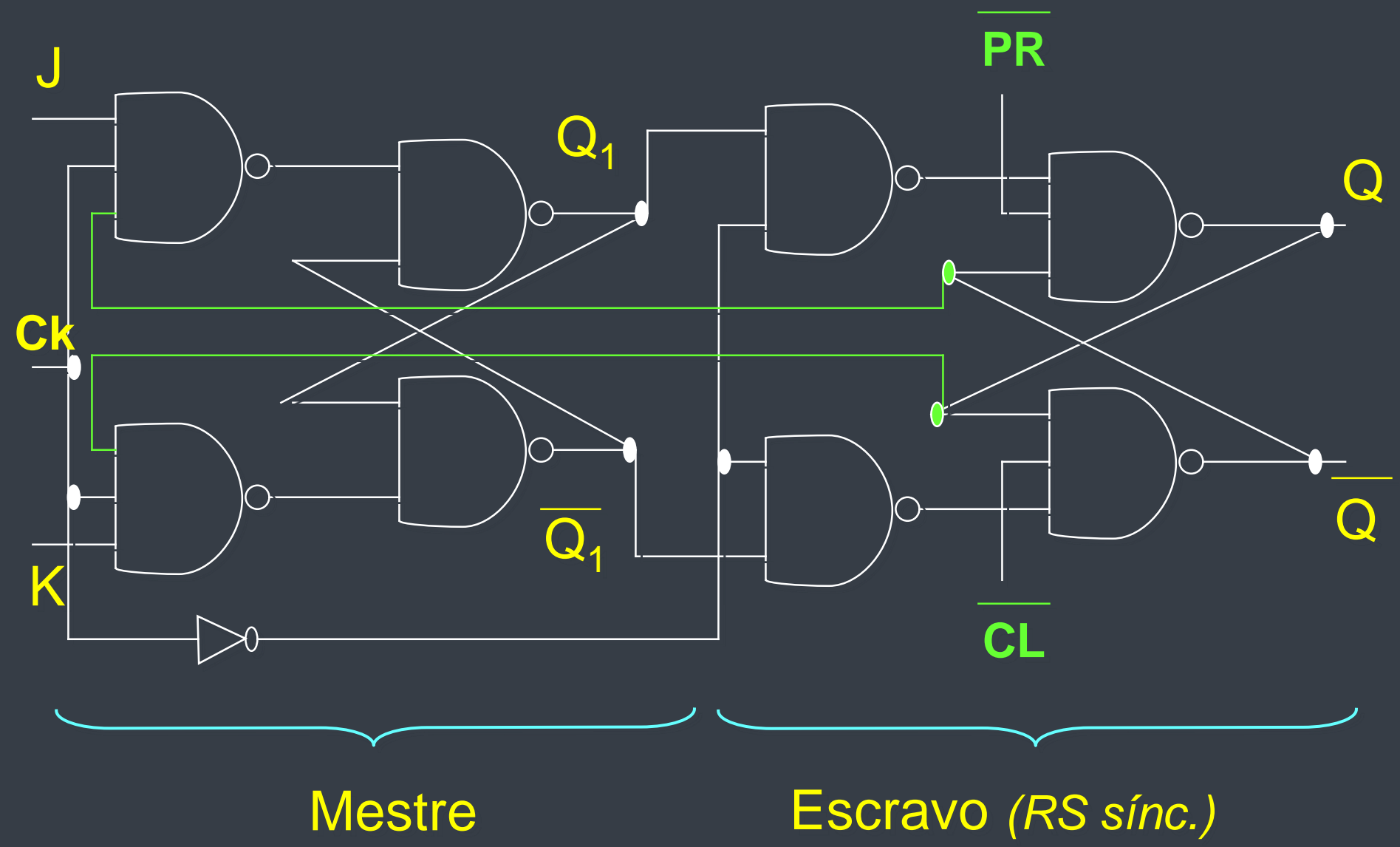
Resolve o problema da indeterminação quando as duas entradas são iguais a 1

Circuito básico real

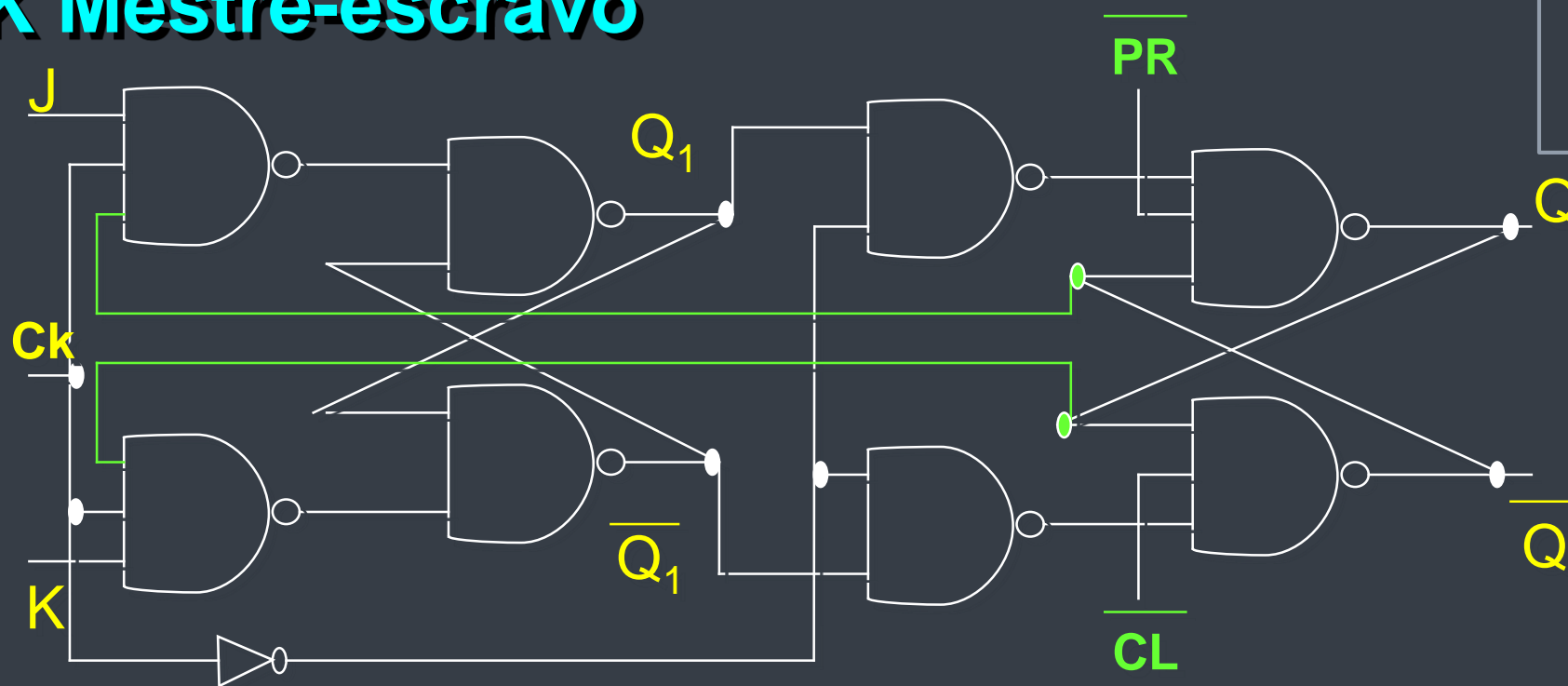


Problema do JK comum: quando o $Ck=1$, há passagem das entradas e realimentações; se, nesse instante, houver mudança de J e/ou K, haverá nova saída → comutação para outro estado mais de uma vez durante o mesmo pulso de Ck

FF JK Mestre-escravo

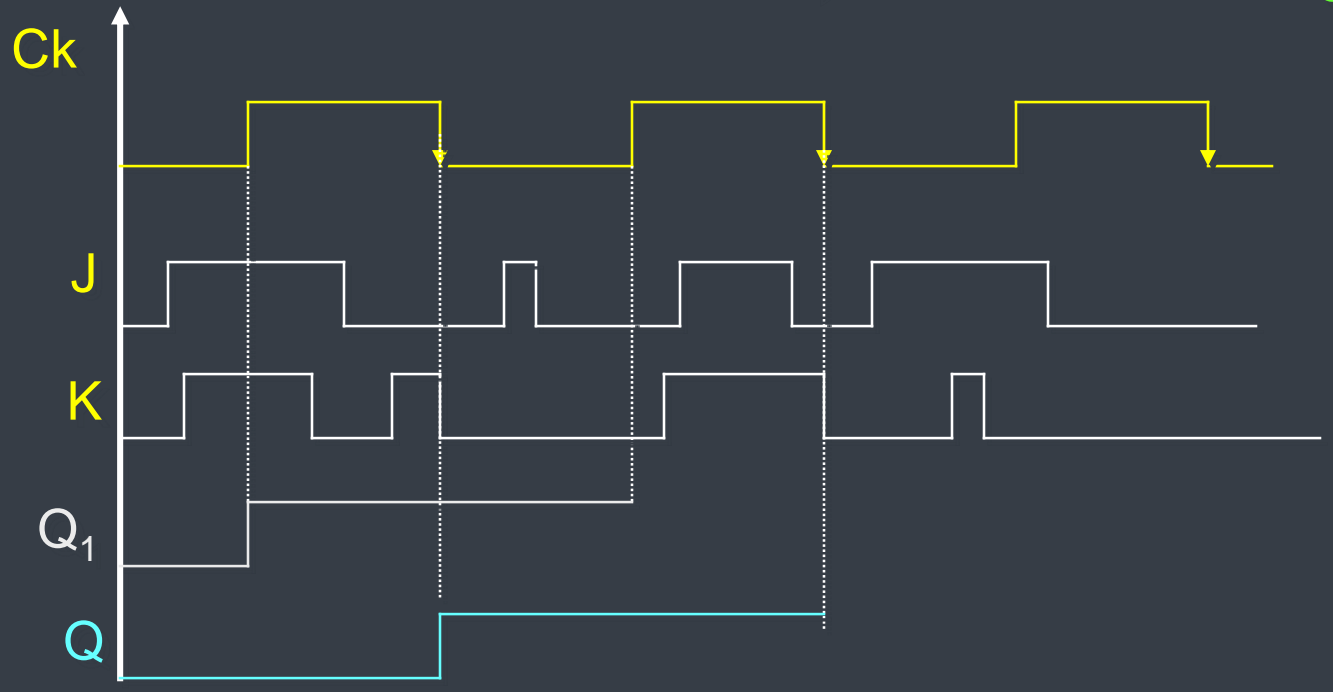
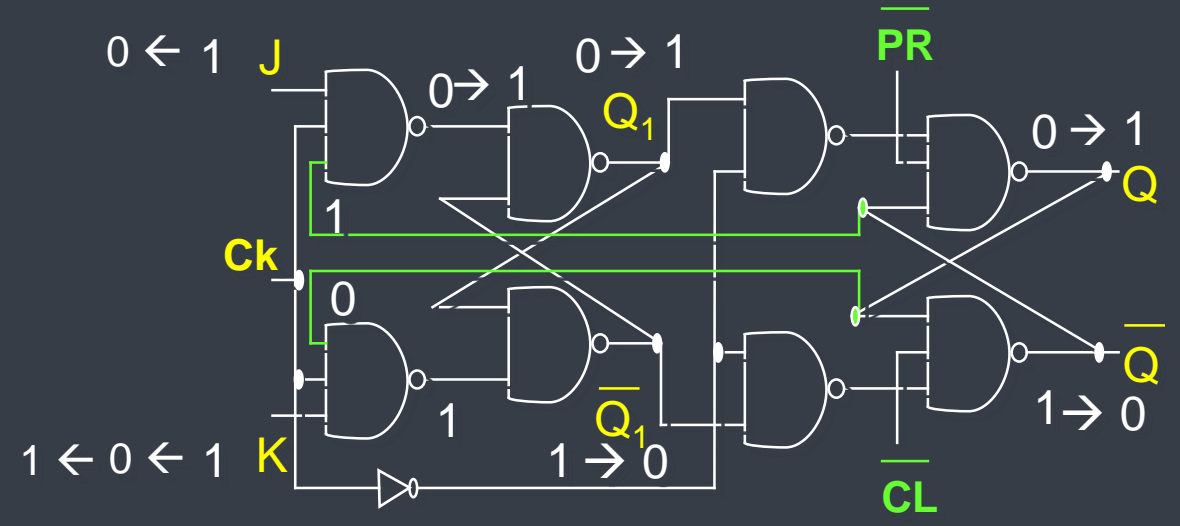


FF JK Mestre-escravo

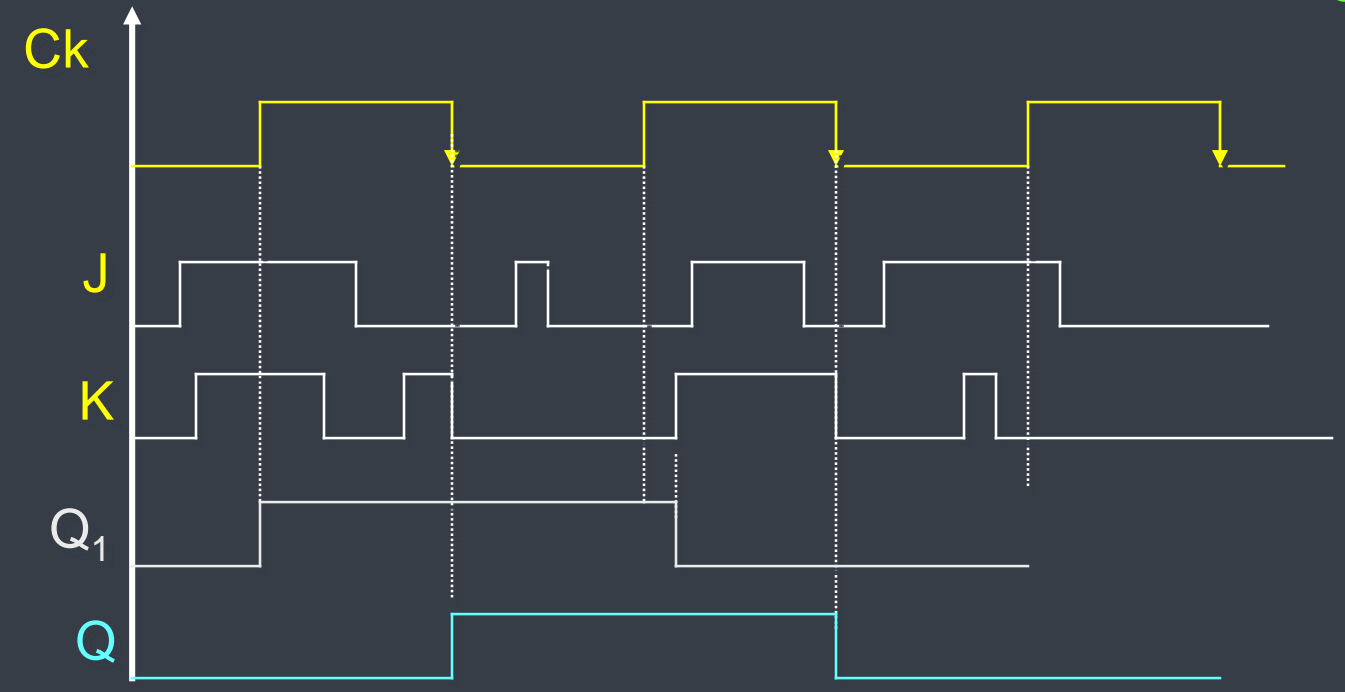
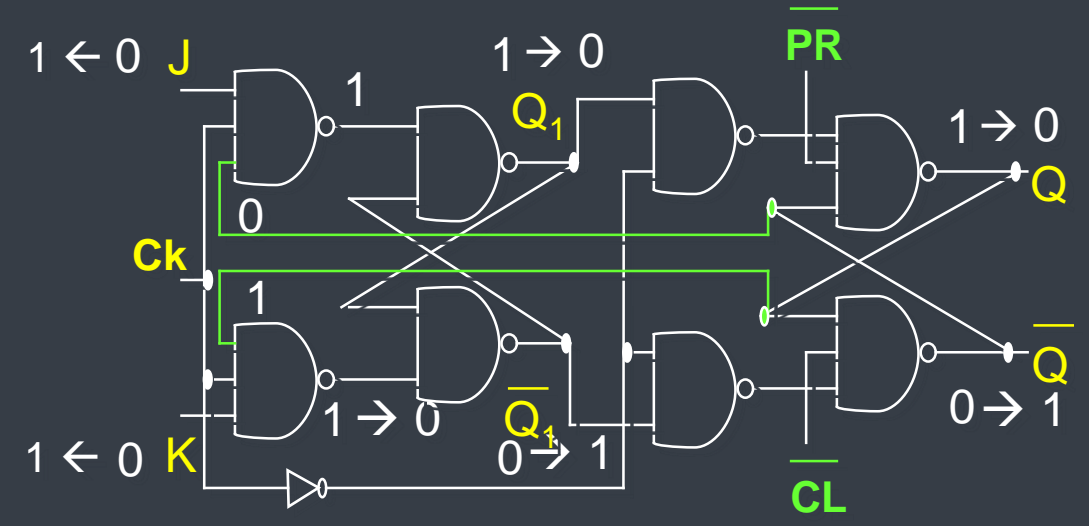


- $Ck=1 \rightarrow$ Entradas do Mestre habilitadas $\rightarrow Q_1$ e $\overline{Q_1}$ podem mudar (uma única vez) com J e K \rightarrow Entradas do Escravo desabilitadas $\rightarrow Q$ e $\overline{Q} = \text{ctes}$
- $Ck=1 \rightarrow 0 \rightarrow$ Entradas do Escravo habilitadas $\rightarrow Q$ e \overline{Q} podem mudar de acordo com Q_1 e $\overline{Q_1}$ \rightarrow Entradas do Mestre desabilitadas
- $Ck=0 \rightarrow Q_1$ e $\overline{Q_1} = \text{ctes} \rightarrow Q$ e $\overline{Q} = \text{ctes}$

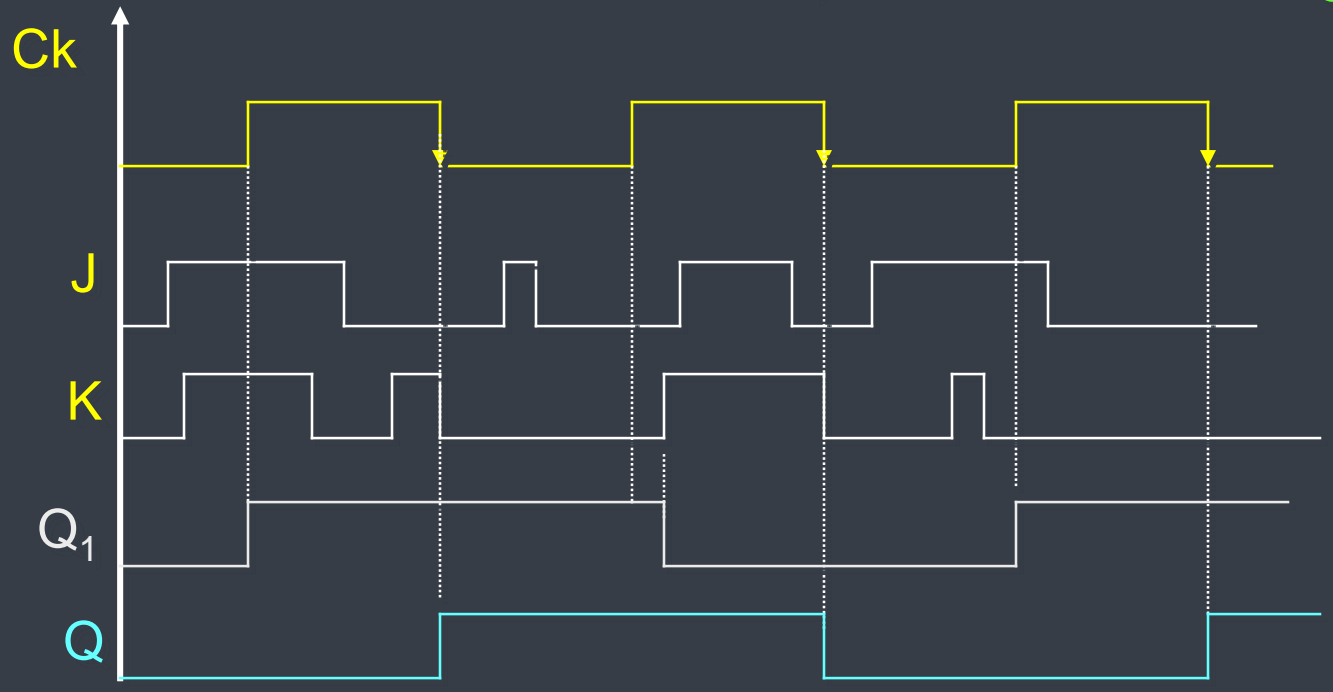
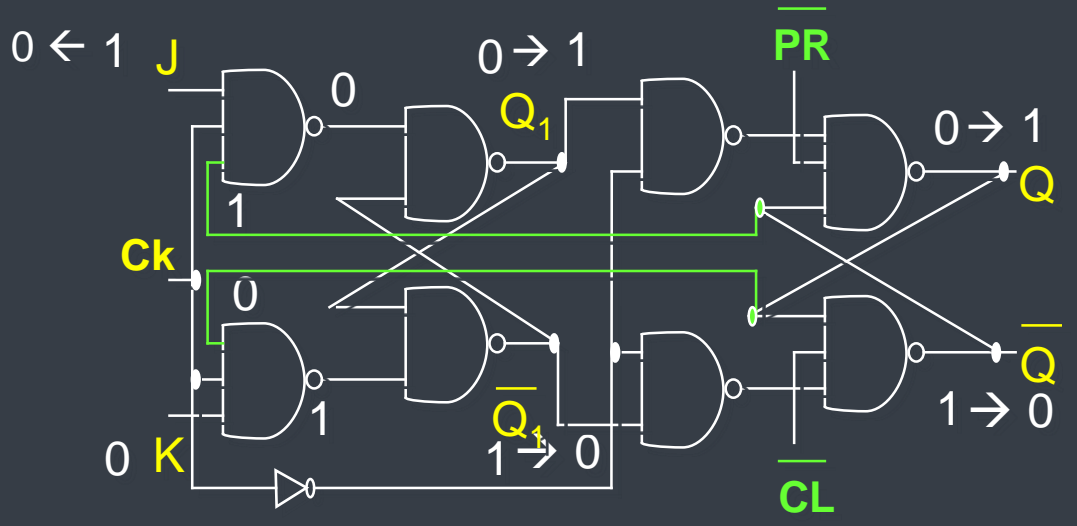
FF JK Mestre-escravo: comportamento



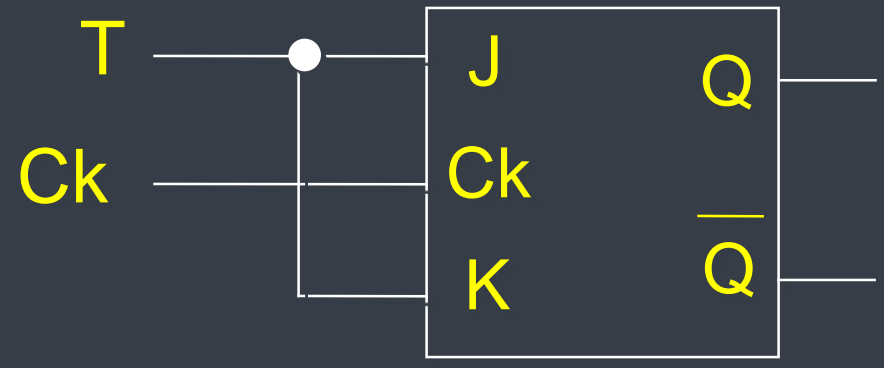
FF JK Mestre-escravo: comportamento



FF JK Mestre-escravo: comportamento



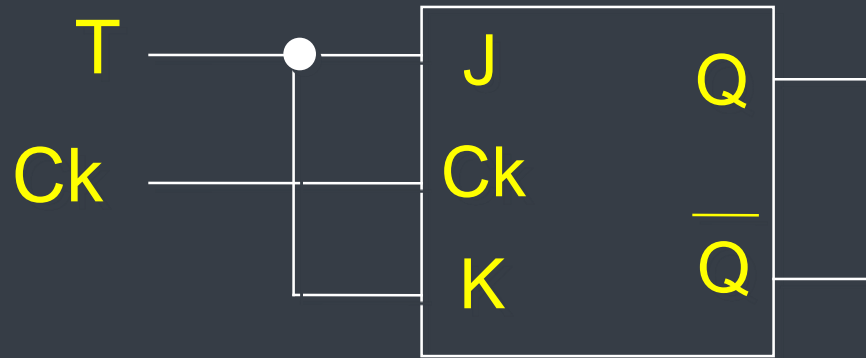
FF Tipo T (Toggle)



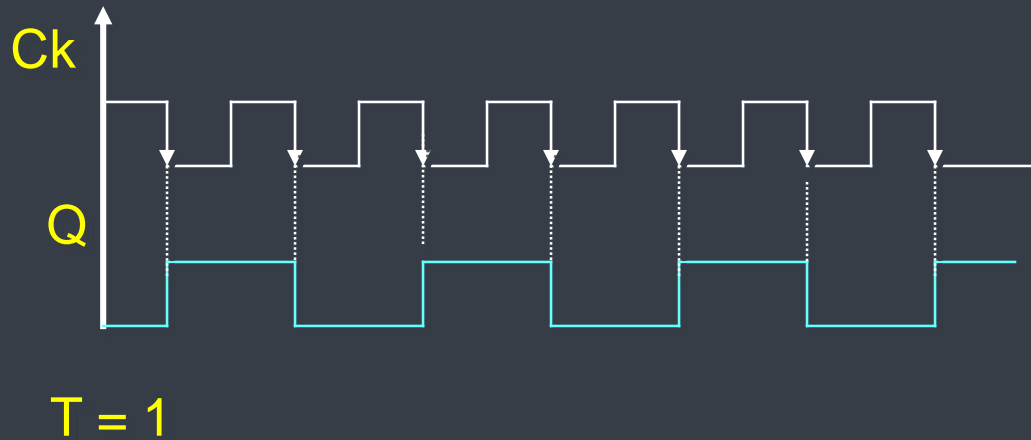
J	K	Q *
0	0	Q
0	1	0
1	0	1
1	1	\overline{Q}

T	Q
0	Q
1	\overline{Q}

FF Tipo T (Toggle)



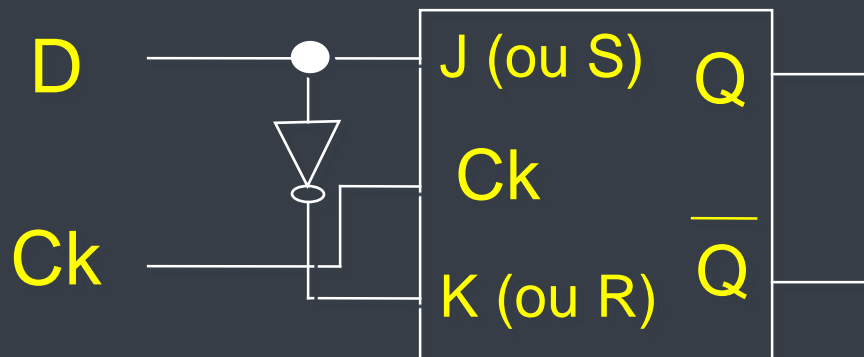
T	Q
0	\overline{Q}
1	Q



$$f_Q = f_{Ck} / 2$$

Divisor por 2

FF Tipo D (Data)

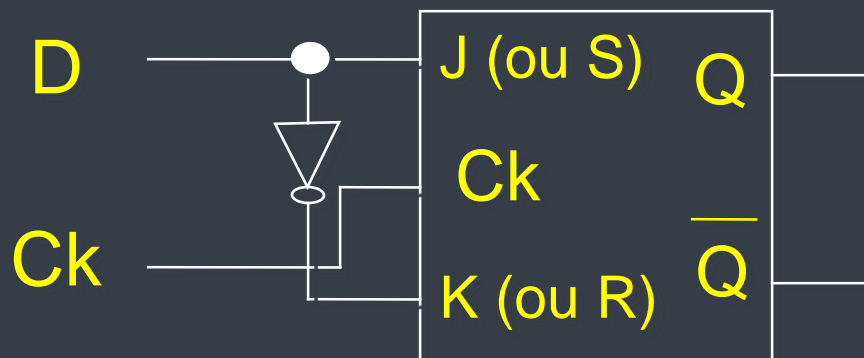


J	K	Q *
0	0	Q
0	1	0
1	0	1
1	1	\overline{Q}

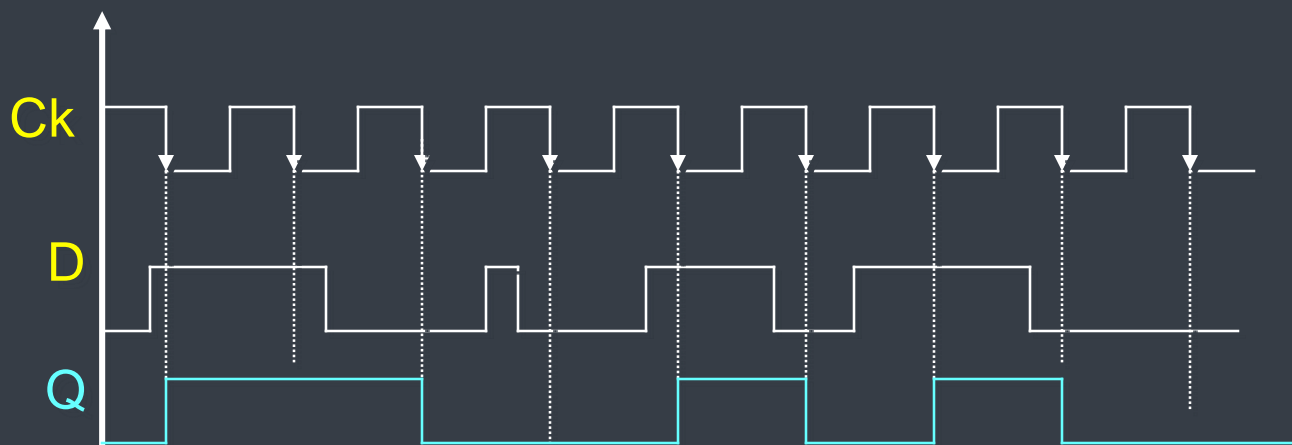
D	Q
0	0
1	1

Ck = \uparrow , \downarrow ou nível

FF Tipo D (Data)

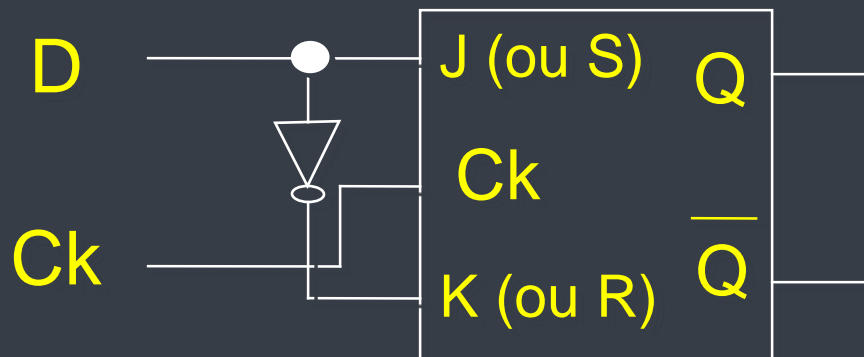


D	Q
0	0
1	1

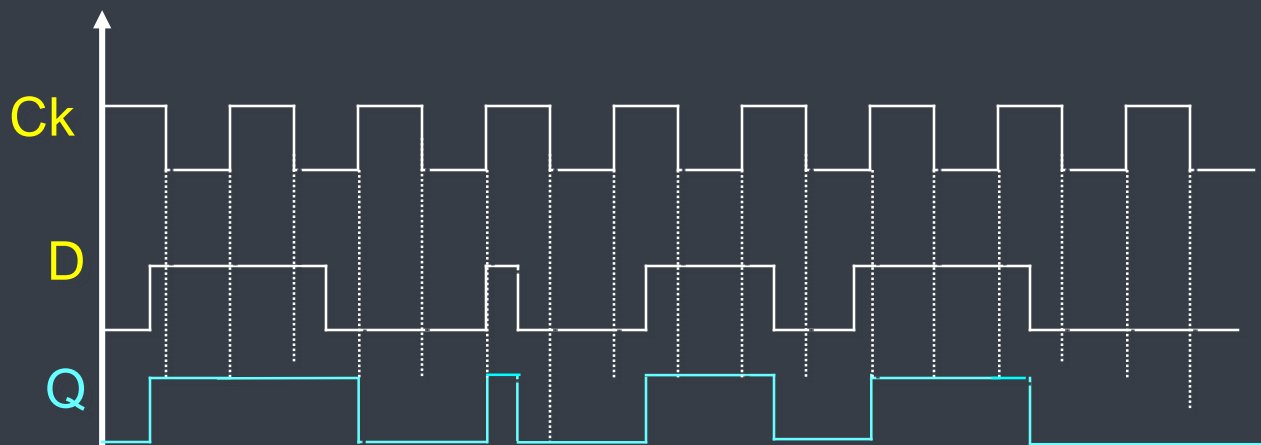


Ck = \uparrow , \downarrow ou nível

FF Tipo D (Data)



D	Q
0	0
1	1



Ck = \uparrow , \downarrow ou nível

