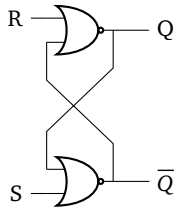
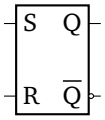
Flip-Flops

RS

Básculas RS

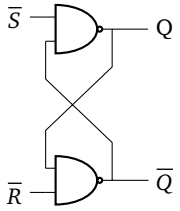
- **Puertas NOR:**

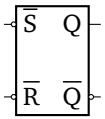




R	S	Q_{t+1}	$\overline{Q}_{t+1}$
0	0	Q_t	$\overline{Q}_t$
0	1	1	0
1	0	0	1
1	1	0	0

- **Puertas NAND:**

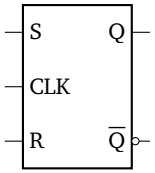




$\overline{R}$	$\overline{S}$	Q_{t+1}	$\overline{Q}_{t+1}$
0	0	1	1
0	1	0	1
1	0	1	0
1	1	Q_t	$\overline{Q}_t$

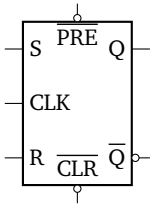
Flip-Flops RS

- **Síncrono:**



CLK	R	S	Q_{t+1}	$\overline{Q}_{t+1}$
0	X	X	Q_t	$\overline{Q}_t$
1	0	0	Q_t	$\overline{Q}_t$
1	0	1	1	0
1	1	0	0	1
1	1	1	0	0

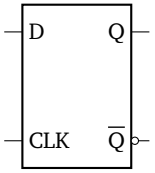
- **Síncrono con entradas ASYNC:**



$\overline{PRE}$	$\overline{CLR}$	CLK	R	S	Q_{t+1}	$\overline{Q}_{t+1}$	
0	0	X	X	X	0	0	No usado
0	1	X	X	X	1	0	Set ASYNC
1	0	X	X	X	0	1	Reset ASYNC
1	1	0	X	X	Q_t	$\overline{Q}_t$	Mantiene
1	1	1	0	0	Q_t	$\overline{Q}_t$	Mantiene
1	1	1	0	1	1	0	Set SYNC
1	1	1	1	0	0	1	Reset SYNC
1	1	1	1	1	0	0	No usado

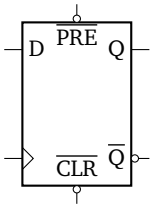
Tipo D

- **Disparado por Nivel:**



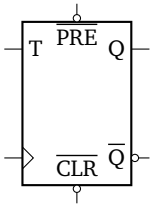
CLK	D	Q_{t+1}	$\overline{Q}_{t+1}$
0	X	Q_t	$\overline{Q}_t$
1	1	1	0
1	0	0	1

- **Disparado por Flanco:**



$\overline{PRE}$	$\overline{CLR}$	CLK	D	Q_{t+1}	$\overline{Q}_{t+1}$
0	0	X	X	No usado	
0	1	X	X	1	0
1	0	X	X	0	1
1	1	0	X	Q_t	$\overline{Q}_t$
1	1	↑	1	1	0
1	1	↑	0	0	1

Tipo T

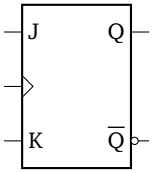


CLK	T	Q_{t+1}	$\overline{Q}_{t+1}$
0	X	Q_t	$\overline{Q}_t$
↑	0	Q_t	$\overline{Q}_t$
↑	1	$\overline{Q}_t$	Q_t

Para que un conjunto de FF...

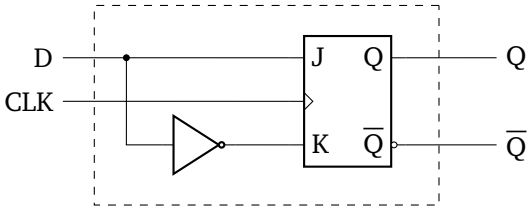
- **Empiecen en 0:** CLR
- **Empiecen en 1:** PRE
- **Empiecen en valor concreto:**
  - CLR para los 0
  - PRE para los 1

Tipo JK

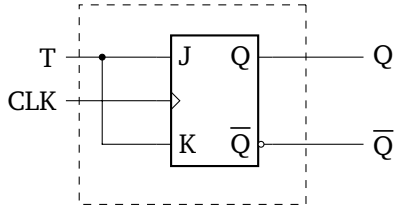


CLK	J	K	Q_{t+1}	$\overline{Q}_{t+1}$	Función
0	X	X	Q_t	$\overline{Q}_t$	No cambia
↑	0	0	Q_t	$\overline{Q}_t$	No cambia
↑	0	1	0	1	A 0: Reset
↑	1	0	1	0	A 1: Set
↑	1	1	$\overline{Q}_t$	Q_t	Conmuta

D por flanco con JK



T por flanco con JK



Procedimiento Nuevos Flip-Flop

Ejemplo JK con T

1. Conocer tabla de verdad de AMBOS flip-flop
2. Nueva tabla de verdad: $\begin{cases} IN: \text{IN FF want (J, K), OUT FF have (Q)} \\ OUT: \text{IN FF have (T)} \end{cases}$
3. Con tabla de 1., completar tabla:

J	K	Q	T
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	0	1

4. Karnaugh: $T = KQ + K\bar{Q}$