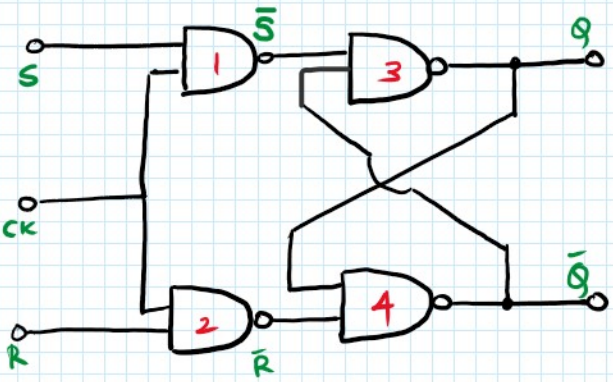
5. Bistable State

21 November 2023 14:42

S	R	Q	$\bar{Q}$	Status
0	0	0	1	Assume initial reset (No change)
0	1	0	1	Reset
1	0	1	0	Set
0	0	1	0	No change (Memory)
1	0	1	0	Set
0	1	0	1	Reset
1	1	1*	1*	Invalid / Forbidden

$\bar{S}$	$\bar{R}$	Q	$\bar{Q}$	Status
1	1	0	1	Assume initial reset (No change)
0	1	1	0	Set
1	0	0	1	Reset
1	1	0	1	No change (memory)
1	0	0	1	Reset
0	1	1	0	Set
0	0	1*	1*	Invalid / Forbidden / Undefined / Uncertain

GATED / CLOCKED S-R FLIP FLOP

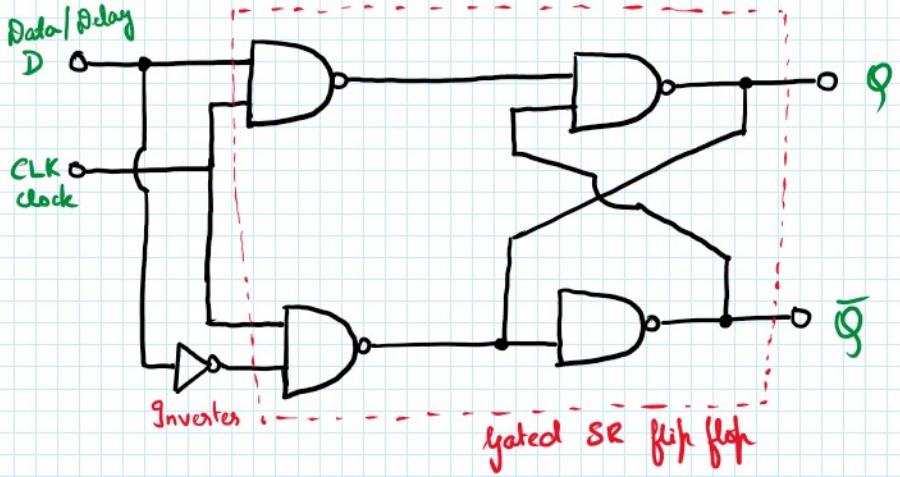


CLK	S	R	Q	$\bar{Q}$	Status
0	X	X	Q	$\bar{Q}$	No change (memory)
1	0	0	Q	$\bar{Q}$	No change (memory)
1	0	1	0	1	Reset
1	1	0	1	0	Set
1	1	1	1*	1*	Invalid / Forbidden

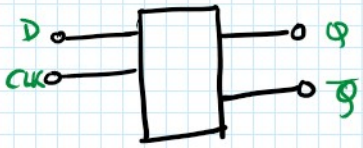
Problems

CLK	S	R	Q	$\bar{Q}$	Status
0	1	0	0	1	No change (memory)
0	0	1	0	1	No change (memory)
1	0	1	0	1	Reset
0	0	0	0	1	No change (memory)
1	0	1	0	1	Reset
1	1	0	1	0	Set
0	1	0	1	0	No change (memory)
1	1	0	1	0	Set

Data (D) Flip-Flop



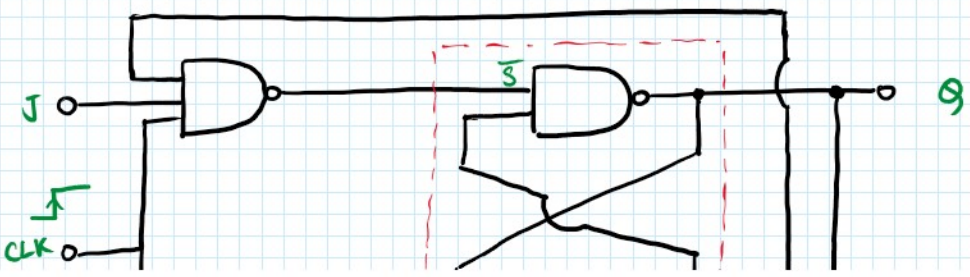
Symbol



CLK	D	Q	$\bar{Q}$	Status
0	x	Q	$\bar{Q}$	Memory
1	0	0	1	Reset
1	1	1	0	Set

JK Flip-Flop (Positive Edge Triggered)

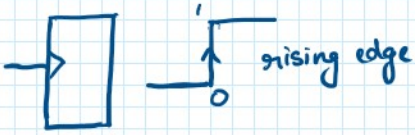
↳ inventor: Jack Kilby

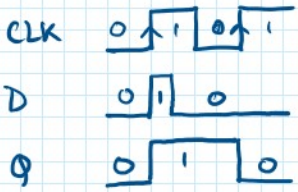


① Level Triggered

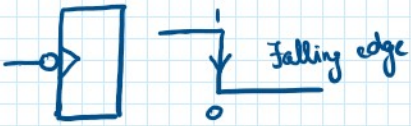
② Edge Triggered

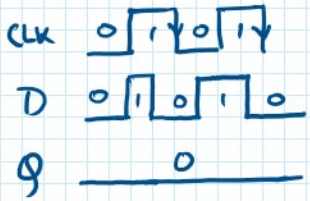
Positive ET (PT)





Negative ET (NT)





CLK	J	K	Q	$\bar{Q}$	Status
1→0 : ↓ or ↓	X	X	Q	$\bar{Q}$	Memory
0→1 : ↑ or ↑	0	0	Q	$\bar{Q}$	Memory
0→1 : ↑ or ↑	0	1	0	1	Reset
0→1 : ↑ or ↑	1	0	1	0	Set
0→1 : ↑ or ↑	1	1	$\bar{Q}$	Q	Toggle

We assume values of Q, $\bar{Q}$

Q = 0 → 0 $\quad$ $\bar{Q}$ = 1 → 1

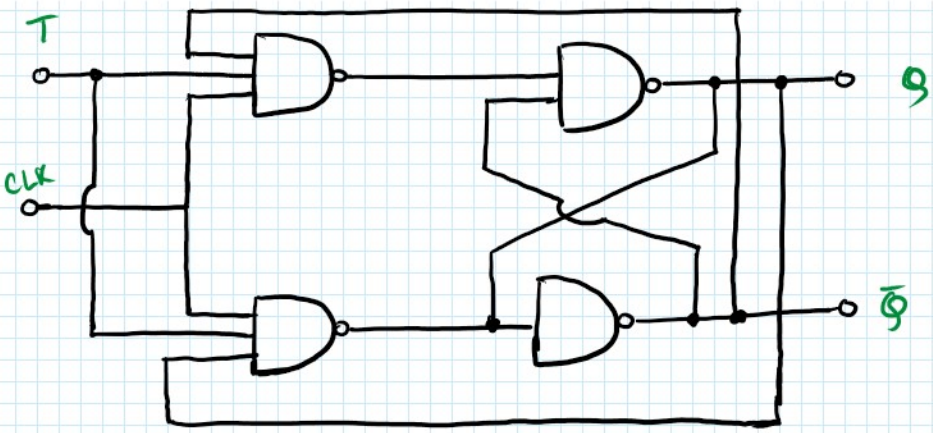
Q = 1 → 0 $\quad$ $\bar{Q}$ = 0 → 1

We assume values of Q, $\bar{Q}$

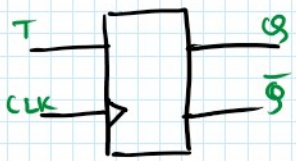
Q = 0 → 1 $\quad$ $\bar{Q}$ = 1 → 0

Q = 1 → 1 $\quad$ $\bar{Q}$ = 0 → 0

T (Toggle) Flip Flop



Symbol



CLK	T	Q	$\bar{Q}$	Status
0 : ↓	X	Q	$\bar{Q}$	No change
1 : ↑	0	Q	$\bar{Q}$	No change
1 : ↑	1	$\bar{Q}$	Q	Toggles