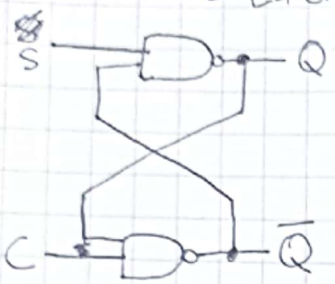
Flip Flops ❀ DE

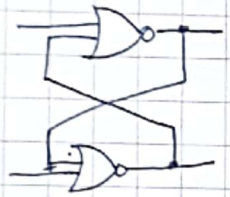
19/8/21

- NAND Gate Latch



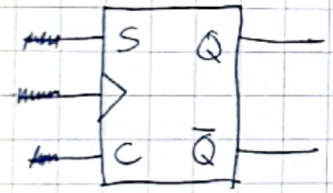
S C	Q_{n+1}	$\bar{Q}_{n+1}$	Remarks
0 0	1	1	No change
0 1	1	0	Set (0)
1 0	0	1	Clear (1)
1 1	Q_n	$\bar{Q}_n$	No change

- NOR Gate Latch

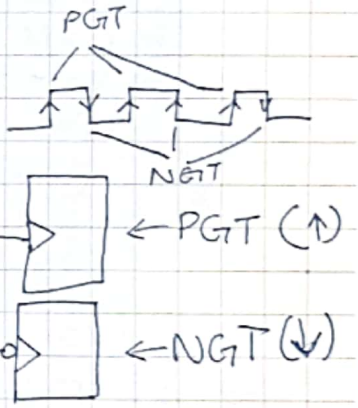


S C	Q_{n+1}	$\bar{Q}_{n+1}$	Remarks
0 0	Q_n	$\bar{Q}_n$	No change
0 1	0	1	clear (0)
1 0	1	0	set (1)
1 1	0	0	Invalid

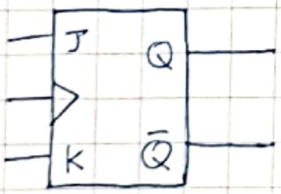
- Clocked SC Flip Flop



S C	CLK	Q
0 0	↑	No change.
0 1	↑	0
1 0	↑	1
1 1	↑	Invalid

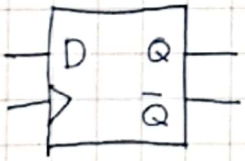


- Clocked JK Flip Flop



S C	CLK	Q
0 0	↑	Q_n, No change
0 1	↑	0
1 0	↑	1
1 1	↑	$\bar{Q}_n$, Toggle.

- Data Flip Flop (PGT)



D	CLK	Q
0	↑	0
1	↑	1

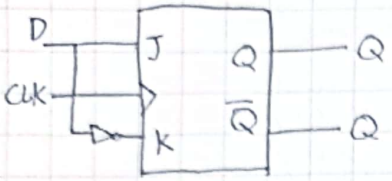
Output follows Input.

- Data Flip Flop (NGT)

D	CLK	Q
0	↓	0
1	↓	1

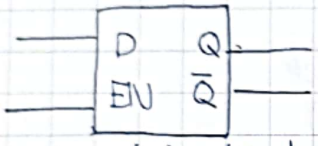
Q follows D at clock

- Data Flip Flops using JK Flip-Flop.



D	K	CLK	Q
0	0	↑	No change
0	1	↑	0
1	0	↑	1
1	1	↑	$\overline{Q_0}$

- D Latch



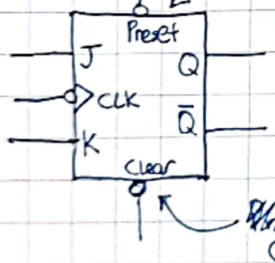
* No triangle at the EN input
→ level-triggered input.

Enable

EN	D	Q
0	X	No change
1	0	0
1	1	1

→ Q only follows D when EN is active (1).

→ Synchronous → CLK.
→ Asynchronous → Preset & clear
↳



Preset → make the output to 1.

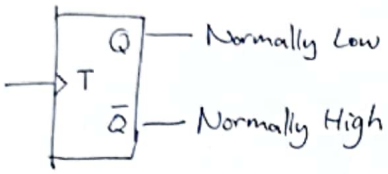
Clear → make the output to 0.

Monostabe → 1stable state. → one shot.

Bistabe → 2 stable state → Flip flip / multivibrator.

Astable → No stable state → constantly changing → oscillator

One shot.



Schmitt - Trigger oscillator generates rectangular pulse

FF can change the frequency of rectangular pulse

One shot can change the pulse width of rectangular pulse

It has a stable output state, normally Q = 0

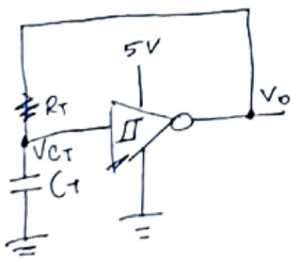
When T is triggered, it switches to Quasi-stable state (Q=1) for a fixed period, t_p.

Non-retriggerable one-shot don't respond to trigger during Quasi stable state.

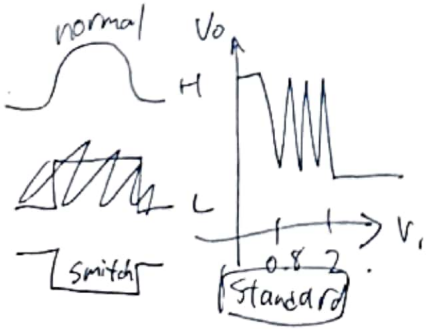
Retriggerable ~~~~ can be retriggered while it is in the Quasi-stable state.

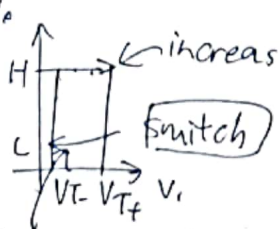
Schmitt-Trigger Inverter.

Oscillations may occur at output if input stays in the forbidden region (neither "0" nor "1") for too long.



Assume Vo was H initially. C_T will charge towards Vo, when V_{CT} goes above V_{T+}, Vo switch to L. This cause C_T to discharge, when V_{CT} goes below V_{T-}, Vo switch to H. This causing C_T to charge up again. This cycle repeats results in rectangular pulse at Vo.





increasing input must go higher than V_{T+} for the out to go L.

decreasing input must go lower than V_{T-} for the output to switch to H.