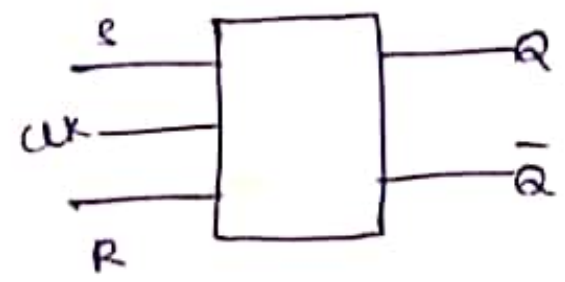
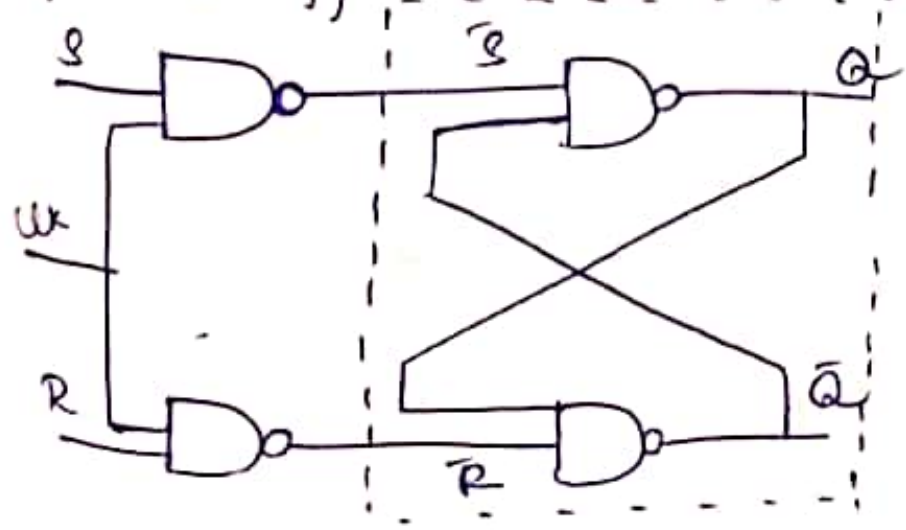


flip flop $\rightarrow$ clock
+ve edge triggering

$\left. \begin{matrix} \cdot SR \\ \cdot JK \\ \cdot D \\ \cdot T \end{matrix} \right\}$ master slave versions

clocked SR ff or clocked SR ff



S	R	Q	$\bar{Q}$	memory	$\bar{S}$	$\bar{R}$	Q	$\bar{Q}$
0	x	x	x		1	1	1*	1*
1	↑	0	0	$Q \bar{Q}$	0	0	1	0
1	↑	0	1	0 1	0	1	0	1
1	↑	1	0	1 0	1	0	Q	$\bar{Q}$
1	↑	1	1	1* 1* invalid	1	1		

Case 1: $ck=0$ irrespective of S, R values the ff retains the previous value $\rightarrow$ memory / No change

Case 2: $S=1, R=0, ck = \uparrow = 1$

$$\bar{S} = S \text{ NAND } ck = 1 \text{ NAND } 1 = 0 = \bar{S} \Rightarrow Q = 1$$

$$\bar{R} = R \text{ NAND } ck = 0 \text{ NAND } 1 = 1 = \bar{R} \Rightarrow \bar{Q} = 0$$

Case 3: $S=1, R=1$.

$$\bar{S} = 0, \bar{R} = 0 \text{ invalid.}$$

Case 4: $S=0, R=0$

$$S \text{ NAND } ck = 0 \text{ NAND } 1 = 1 = \bar{S} \quad Q = Q$$

$$R \text{ NAND } ck = 0 \text{ NAND } 1 = 1 = \bar{R} \quad Q = \bar{Q}$$

memory

Case 5: $S=0, R=1$

$$S \text{ NAND } UK = 0 \text{ NAND } 1 = 1 = \bar{S} \Rightarrow Q = 0$$

$$R \text{ NAND } UK = 1 \text{ NAND } 1 = 0 = \bar{R} \Rightarrow \bar{Q} = 1$$