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FLIP-FLOPS

In digital electronics, flip-flops are types of circuit that can store bit of information (0 and 1) and can be used to implement memory and sequential logic.

A flip-flop typically has two stable states, which can be represented by 0 and 1. it can be triggered to change its state by a clock signal or other control inputs. There are several types of flip-flops including:

1. SR FLIP-FLOP
2. J K FLIP-FLOP
3. D FLIP-FLOP 4. T FLIP-FLOP.

FLIP-FLOPS are widely used digital electronics and computer systems, including memory, counters, sequential logic etc.

To calculate the output of a flip-flop, you need to know the current state of the flip-flop(Q) and the inputs (S,R,J,K,D or T) depending on the type of flip-flop. Here are the steps to calculate the output:

1) SR FLIP-FLOP

   ➔ IF S = 1 and R = 0, the flip-flop sets (Q=1)
   ➔ IF S = 0 and R = 1, the flip-flop resets (Q=0)
   ➔ IF S = 0 and R = 0, the flip-flop retains it's current state (Q remains unchanged) ➔ IF S = 1 and R = 1, the flip-flop is not allowed (invalid inputs)

2) D FLIP-FLOP

   ➔ IF D = 1, the flip-flop sets (Q =1)
   ➔ IF D = 0, the flip-flop resets (Q =0)
   ➔ The current state of the flip-flop (Q) is updated on the rising edge of the clock signal.
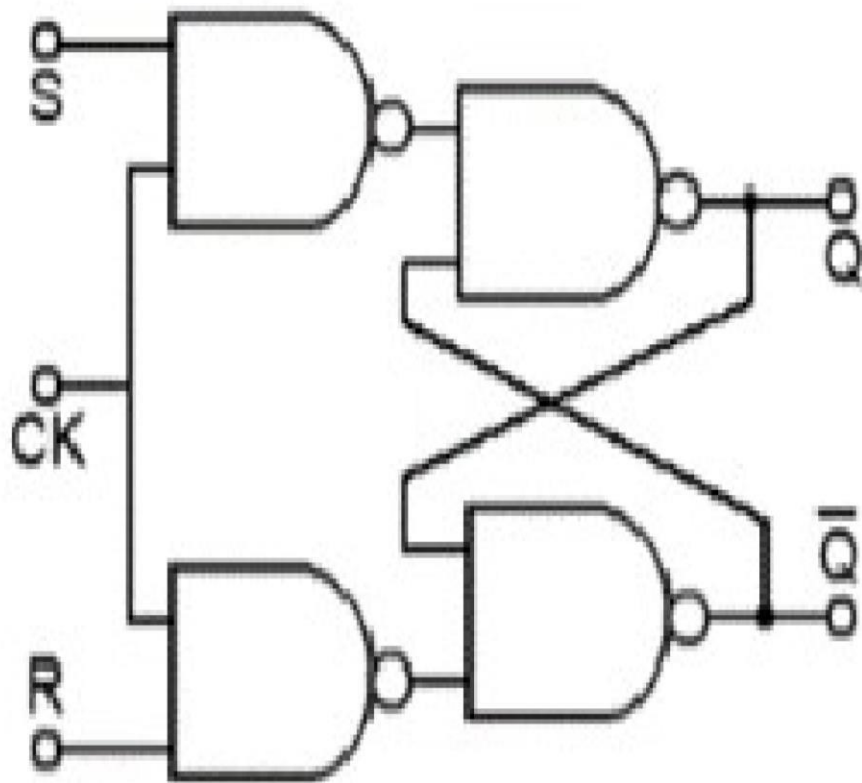
3) J K FLIP-FLOP

   ➔ IF J = K = 0, the flip-flop retains it's current state (Q remains unchanged)
   ➔ IF J = 1, k = 0, the flip-flop sets (Q = 1)
   ➔ IF J = 0, k = 1 the flip-flop resets (Q = 0)
   ➔ IF J = 1, k = 1, the flip-flop toggles (Q changes state)

4) T FLIP-FLOP

   ➔ IF T = 1, the flip-flop toggles (Q changes state)
   ➔ IF T = 0, the flip-flop retains it's current state (Q remains unchanged).
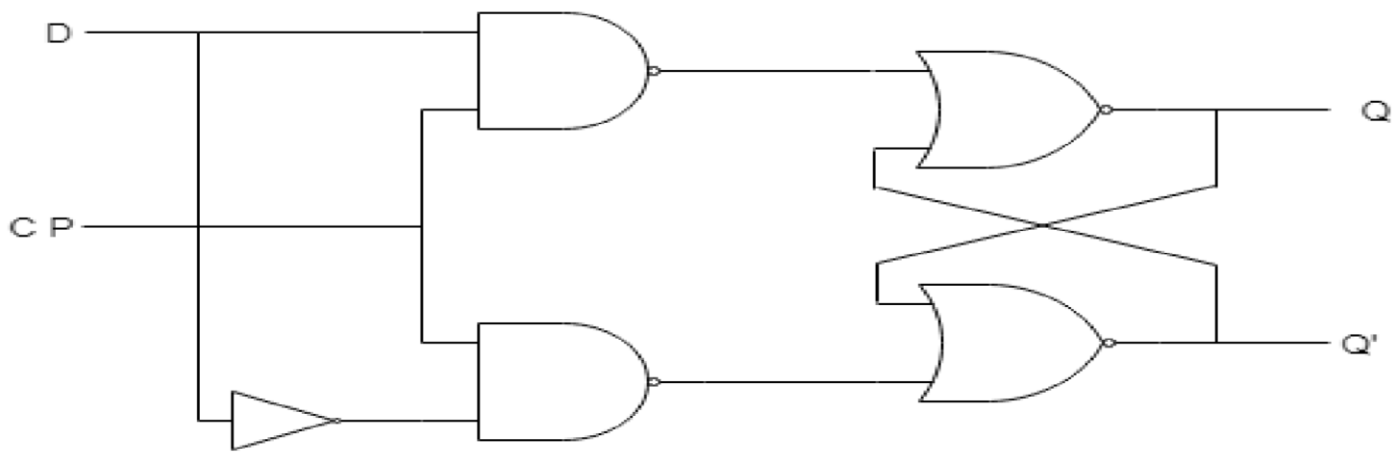
1. S R FLIP-FLOP

 a basic S R flip-flop (set – reset flip-flop) is a digital memory circuit that has two inputs , S and R and two outputs Q and Q'. the SR flip-flop can store a bit of information. Truth table

S	R	Q (t)	Q'(t + 1)
0	0	Q(t)	Q (t+1)
0	1	0	1
1	0	1	0
1	1	Not allowed	Not allowed

2. D FLIP-FLOP

 a D flip-flop (data flip-flop) is a digital memory circuit that has two inputs, D and CLK and

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two outputs, Q and Q' . the D flip-flop can store a bit of information.

Truth Table

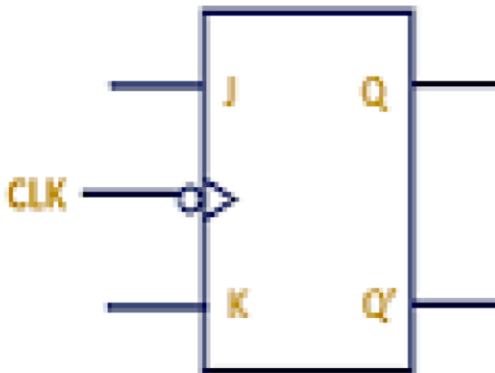| D	CLK	Q(t)	Q'(t+1)
0	0	0	1
1	0.	1	0
0	1	0	1
1	1	1	0

- The D flip-flop is a master and slave flip-flop, where the slave depends on the out put of the master.
- The master (Qm) follows D when the clock signal is high.
- The slave (Qs) follows Qm because the master's output is the slave's input, Qs only follow Qm where C is low because Qs is only feed the inverse of the clock signal

3 . J K FLIP-FLOP

a J K flip-flop is a digital memory circuit that has three inputs J, K and CLK and two outputs, Q and Q'. the J K flip-flop can store a bit of information.
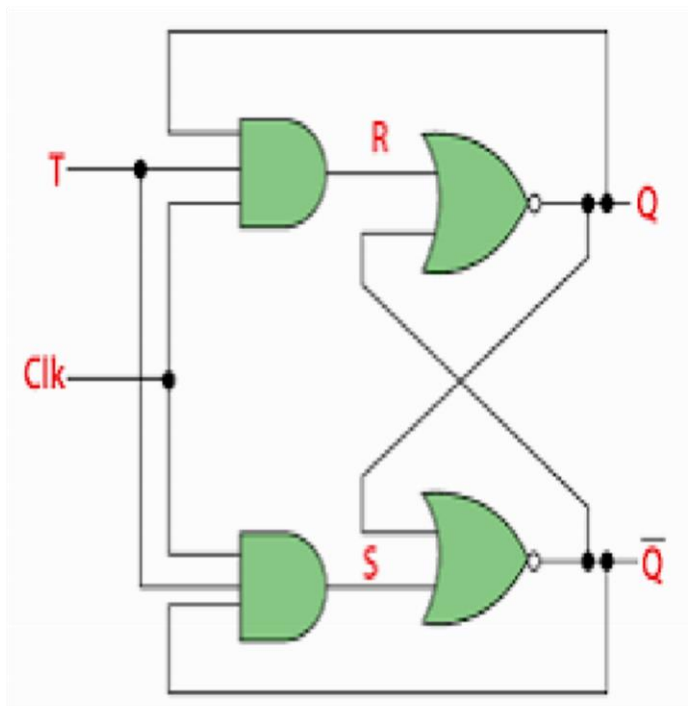
4 . T FLIP-FLOP

Symbol

CLK	J	K	Q_{n+1}
↓	0	0	Q_n
↓	0	1	0
↓	1	0	1
↓	1	1	Q_n'

A T flip-flop (toggle flip-flop) is a digital memory circuit that has two inputs, T and CLK, and two outputs, Q and Q' . the T flip-flop can store a bit of information.

(a) Logic diagram

(b) Graphical symbol

Q	T	Q(t+1)
0	0	0
0	1	1
1	0	1
1	1	0

In summary, flip-flops are fundamental components in digital electronics and they are used to implement memory, counters, and sequential logic circuits. So understanding them is very crucial and important in the world of digital electronics and circuits as a whole