



SNS COLLEGE OF ENGINEERING

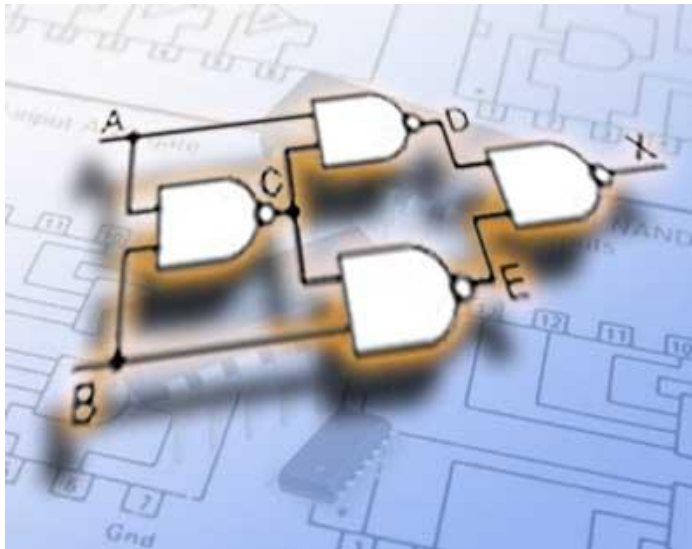
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING



DIGITAL CIRCUITS

Guess Today's Topic????





Flipflops -JK

What is Flip flop?

- A flipflop is a circuit that has two stable states and can be used to store state information.
- The flipflop can be made to change state by signals applied to one or more control inputs and will have one or two inputs.



JK Flipflop

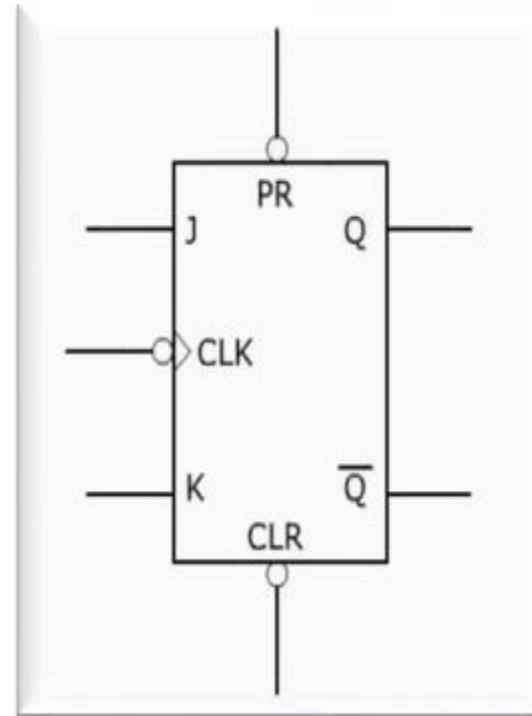
Has 5 inputs named:
J(set),K(reset), PR, CLR, and CLK

Has 2 outputs: Q and Q'

PR = Preset
CLR = Clear
CLK = Clock

Set: when it stores a binary 1

Cleared (reset): when it stores a binary 0





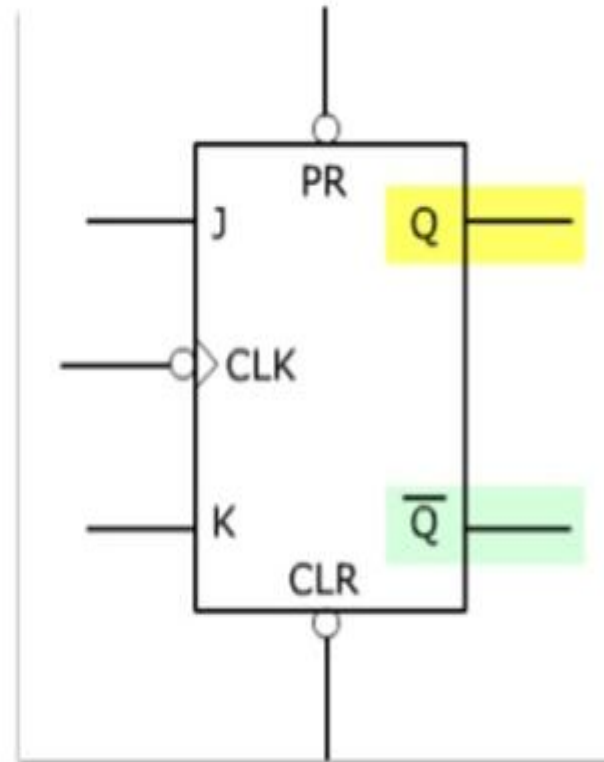
JK flipflop



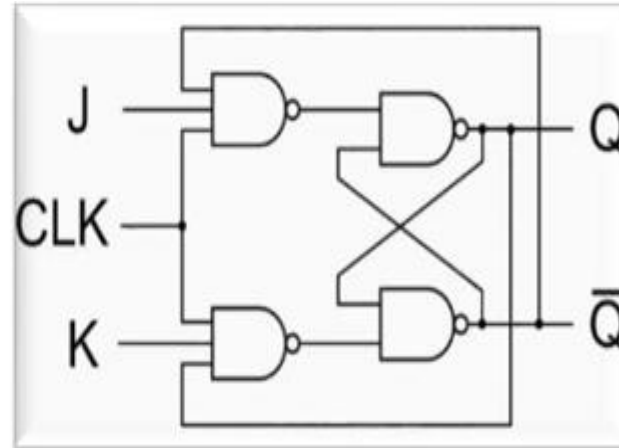
The Q output is the primary output. This means that the binary bit stored in the flip-flop, 1 or 0, is the **same** as Q.

The Q' output is the **opposite** binary bit value that is stored in Q.

The PR and CLR inputs always **override** the J,K inputs.



The 4 modes of operation are: **hold, set, reset, toggle**



J	K	Q	Q'	Mode
0	0	Q	Q'	Memory
1	0	1	0	Sets
0	1	0	1	Resets
1	1	Q'	Q	Toggle

JK contains an internal **Active Low SR latch.**

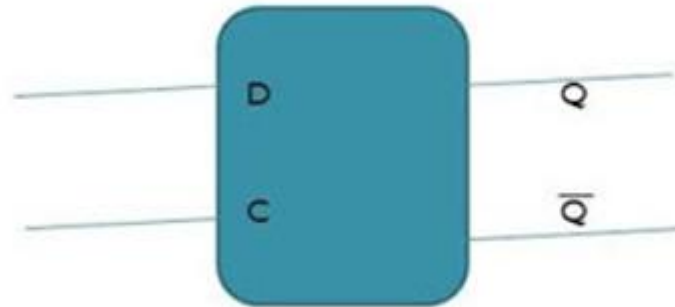




D-Flipflop

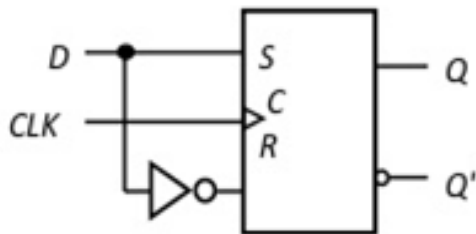


The D flip-flop is widely used. It is also known as a *data* or *delay* flip-flop



D-Flipflop Truth Table

- **D flip-flop:** single input D (data)
 - ❖ $D=HIGH \Leftrightarrow$ SET state
 - ❖ $D=LOW \Leftrightarrow$ RESET state
- Q follows D at the clock edge.
- Convert S-R flip-flop into a D flip-flop: add an inverter.



A positive edge-triggered D flip-flop formed with an S-R flip-flop.

D	CLK	$Q(t+1)$	Comments
1	↑	1	Set
0	↑	0	Reset

↑ = clock transition LOW to HIGH



T-Flipflop

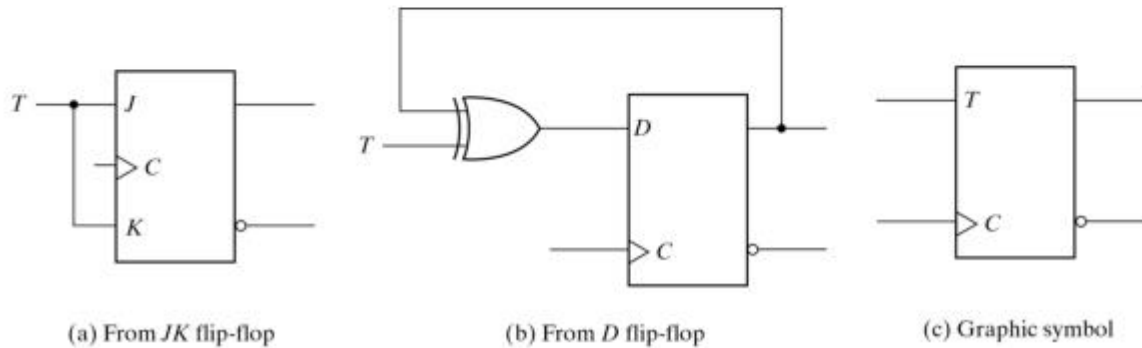
A T (toggle) flip-flop is a complementing flip-flop and can be obtained from a JK flip-flop when the two inputs are tied together.

$$\text{When } T = 0 \rightarrow D = T \oplus Q = Q$$

$D = Q$ and no change in output

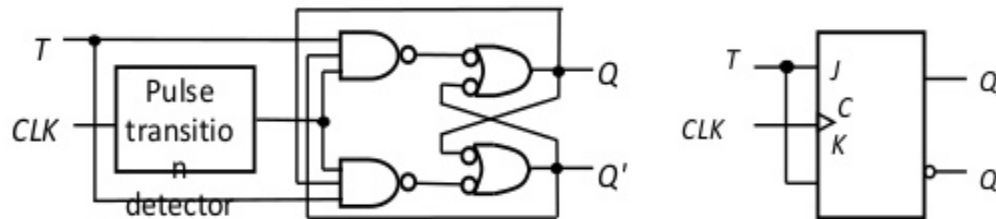
$$\text{When } T = 1 \rightarrow D = T \oplus Q = Q'$$

$D = Q'$ and the output complements



T-Flipflop Truth Table

- **T flip-flop:** single-input version of the J-K flip flop, formed by tying both inputs together.



- **Characteristic table.**

T	CLK	Q(t+1)	Comments
0	↑	Q(t)	No change
1	↑	Q(t)'	Toggle

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

$$Q(t+1) = T.Q' + T'.Q$$





Applications of Flipflop



- Edge triggered FF-Binary data, counter, transferring binary data from one location to other etc
- Registers
- Counters
- Event Detectors
- Frequency Divider Circuits
- Clocked operations

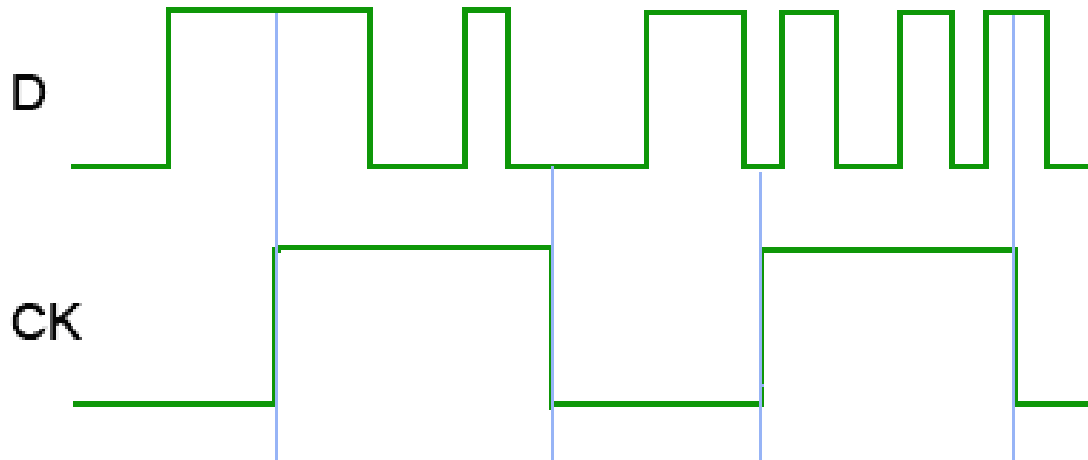




Assessment



Find the output for D-FF





Thank
you

