

FLIP FLOP

INTERCONVERSIONS

MADE BY: Rohnak Agarwal, 2ND Year, 3RD Sem, 2019.

MADE ON: 14-12-2019

SOURCE: 1. Rashmi mam's notes
2. Google

Types of Flip-flops:

1. SR flip flop
2. D flip flop
3. JK flip flop
4. T flip flop

SR Flip Flop → D Flip Flop

Input: D
Outputs: S R

Combined Table:

State Table of D Flip Flop			Excitation Table of SR Flip Flop	
Q_n	D	Q_{n+1}	S	R
0	0	0	0	d
0	1	1	1	0
1	0	0	0	1
1	1	1	d	0

K-maps and Equations:

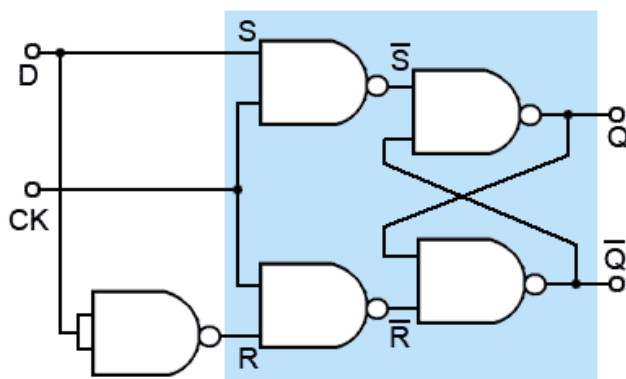
$Q(n)$	D	
	0	1
0	0	1
1	0	X

$$S = D$$

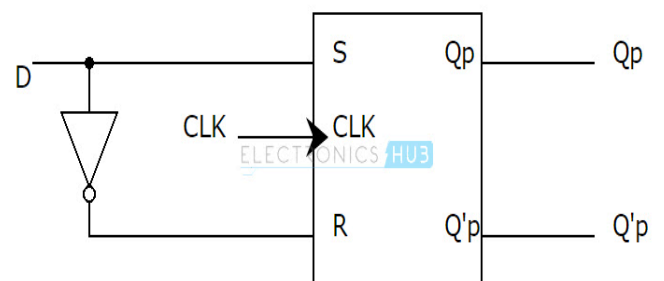
$Q(n)$	D	
	0	1
0	X	0
1	1	0

$$R = \bar{D}$$

Circuit Diagram:



Block Diagram:



SR Flip Flop → JK Flip Flop

Inputs: J K

Outputs: S R

Combined Table:

State Table of JK Flip Flop				Excitation table of SR Flip Flop	
Q_n	J	K	Q_{n+1}	S	R
0	0	0	0	0	d
0	0	1	0	0	d
0	1	0	1	1	0
0	1	1	1	1	0
1	0	0	1	d	0
1	0	1	0	0	1
1	1	0	1	d	0
1	1	1	0	0	1

K-maps and Equations:

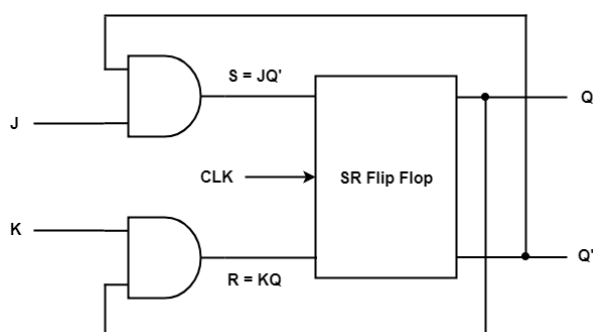
$Q(n)$	J K			
	00	01	11	10
0	X	X	0	0
1	0	1	1	0

$Q(n)$	J K			
	00	01	11	10
0	0	0	1	1
1	X	0	0	X

$$R = KQ_n$$

$$S = J\overline{Q_n}$$

Block Diagram:



SR Flip Flop → T Flip Flop

Inputs: T
Outputs: S R

Combined Table:

State Table of T Flip Flop			Excitation Table of SR Flip Flop	
Q_n	T	Q_{n+1}	S	R
0	0	0	0	d
0	1	1	1	0
1	0	1	d	0
1	1	0	0	1

K-maps and equation:

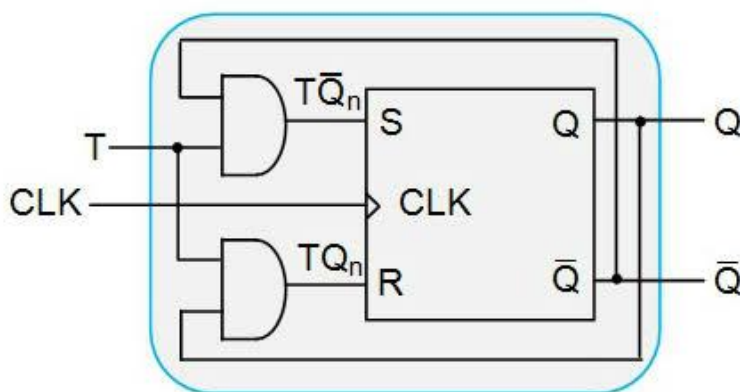
T		
	0	1
$Q(n)$		
0	0	1
1	x	0

T		
	0	1
$Q(n)$		
0	x	0
1	0	1

$$S = \overline{Q_n}T$$

$$R = Q_nT$$

Block Diagram:



JK Flip Flop → D Flip Flop

Inputs: D

Outputs: J K

Combined Table:

State Table of D Flip Flop			Excitation table of JK Flip Flop	
Q_n	D	Q_{n+1}	J	K
0	0	0	0	d
0	1	1	1	d
1	0	0	d	1
1	1	1	d	0

K-maps and Equations:

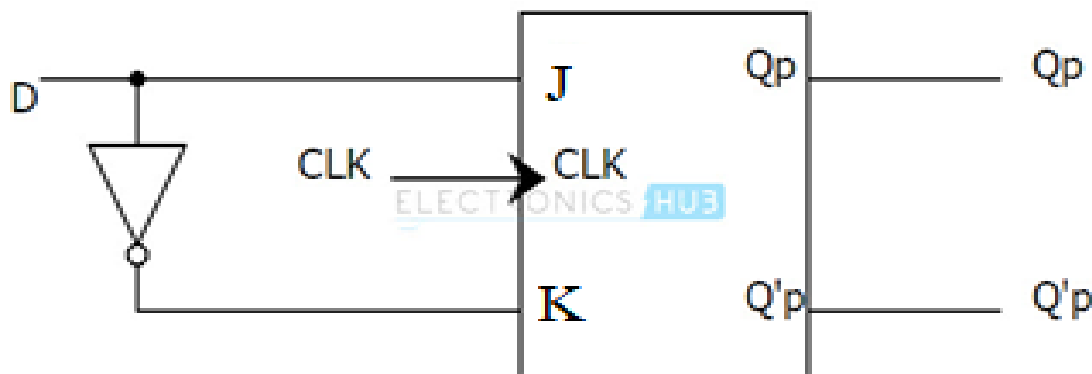
$Q(n)$	D	
	0	1
0	0	1
1	X	X

$$J = D$$

$Q(n)$	D	
	0	1
0	X	X
1	1	0

$$K = \bar{D}$$

Block Diagram:



JK Flip Flop \rightarrow T Flip Flop

Inputs: T
Outputs: J K

Combined Table:

State Table of T Flip Flop			Excitation table of JK Flip Flop	
Q_n	T	Q_{n+1}	J	K
0	0	0	0	d
0	1	1	1	d
1	0	1	d	0
1	1	0	d	1

K-map and Equations:

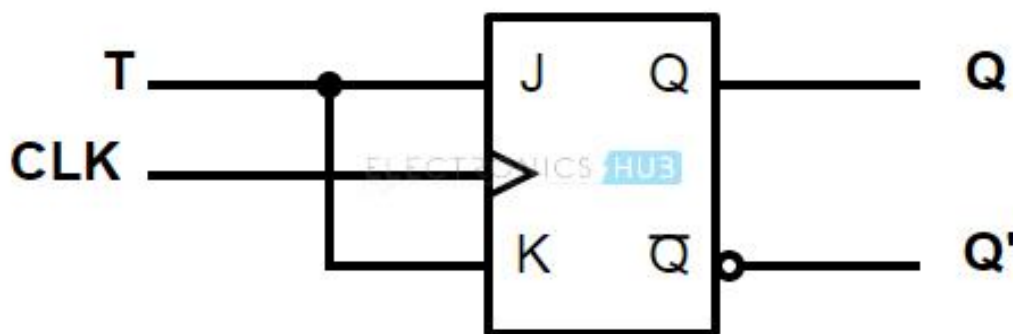
		T	
		0	1
$Q(n)$	0	0	1
	1	x	x

$$J = T$$

		T	
		0	1
$Q(n)$	0	x	x
	1	0	1

$$K = T$$

Block Diagram:



JK Flip Flop → SR Flip Flop

Inputs: S R

Outputs: J K

Combined Table:

State Table of SR Flip Flop				Excitation table of JK Flip Flop	
Q_n	S	R	Q_{n+1}	J	K
0	0	0	0	0	d
0	0	1	0	0	d
0	1	0	1	1	0
0	1	1	?	d	d
1	0	0	1	d	0
1	0	1	0	0	1
1	1	0	1	d	0
1	1	1	?	d	d

K-maps and Equations:

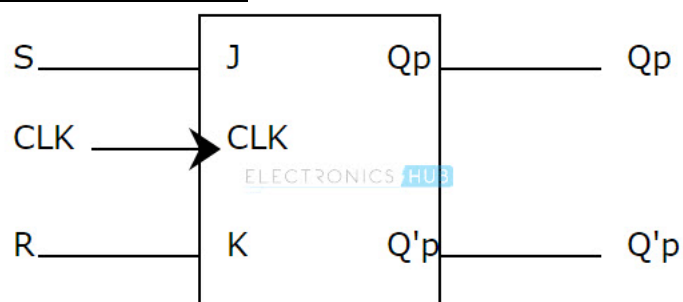
$Q(n)$	S R			
	00	01	11	10
0	0	0	X	1
1	X	0	X	X

$$J = S$$

$Q(n)$	S R			
	00	01	11	10
0	X	X	X	0
1	0	1	X	0

$$K = R$$

Block Diagram:



T Flip Flop → JK Flip Flop

Inputs: J K

Outputs: T

Combined Table:

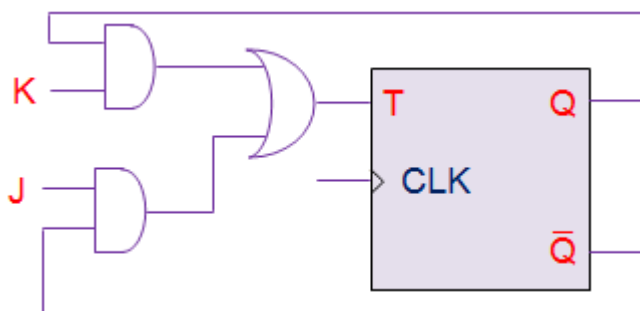
State Table of JK Flip Flop				Excitation table of T Flip Flop
Q_n	J	K	Q_{n+1}	T
0	0	0	0	0
0	0	1	0	0
0	1	0	1	1
0	1	1	1	1
1	0	0	1	0
1	0	1	0	1
1	1	0	1	0
1	1	1	0	1

K-map and Equation:

$Q(n)$	J K			
	00	01	11	10
0	0	0	1	1
1	0	1	1	0

$$Q_{n+1} = \overline{Q_n} J + Q_n K$$

Block Diagram:



T Flip Flop → SR Flip Flop

Inputs: S R

Outputs: T

Combined Table:

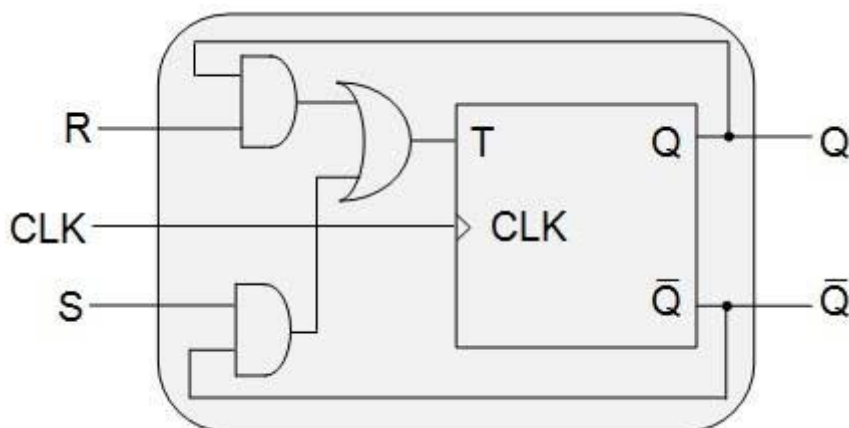
State Table of SR Flip Flop				Excitation Table of T Flip Flop
Q_n	S	R	Q_{n+1}	T
0	0	0	0	0
0	0	1	0	0
0	1	0	1	1
0	1	1	?	d
1	0	0	1	0
1	0	1	0	1
1	1	0	1	0
1	1	1	?	d

K-map and Equation:

S R		00	01	11	10
$Q(n)$	0	0	0	X	1
	1	0	1	X	0

$$T = \overline{Q_n}S + Q_nR$$

Block Diagram:



T Flip Flop → D Flip Flop

Inputs: D

Outputs: T

Combined Table:

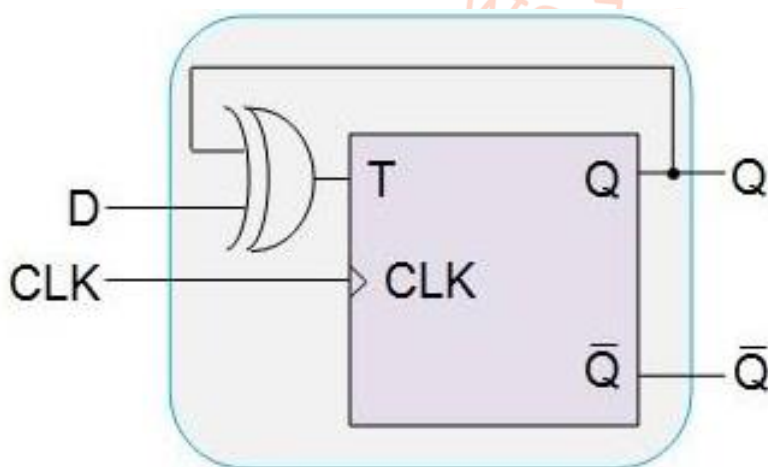
State Table of D Flip Flop			Excitation Table of T Flip Flop
Q_n	D	Q_{n+1}	T
0	0	0	0
0	1	1	1
1	0	0	1
1	1	1	0

K-map and Equation:

D	$Q(n)$	
	0	1
0	0	1
1	1	0

$$T = \overline{Q_n}D + Q_n\overline{D} = Q_n \oplus D$$

Block Diagram:



D Flip Flop → SR Flip Flop

Inputs: S R

Outputs: D

Combined Table:

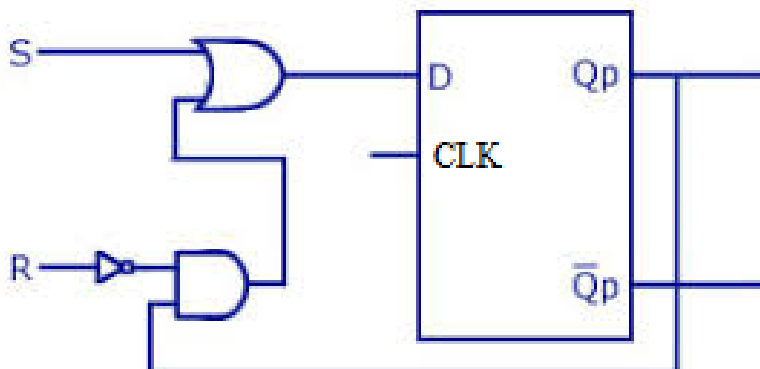
State Table of SR Flip Flop				Excitation Table of D Flip Flop
Q_n	S	R	Q_{n+1}	D
0	0	0	0	0
0	0	1	0	0
0	1	0	1	1
0	1	1	?	d
1	0	0	1	1
1	0	1	0	0
1	1	0	1	1
1	1	1	?	d

K-map and Equation:

S R		00	01	11	10
$Q(n)$	0	0	0	X	1
	1	1	0	X	1

$$D = S + Q_n \bar{R}$$

Block Diagram:



D Flip Flop → JK Flip Flop

Inputs: J k

Outputs: D

Combined Table:

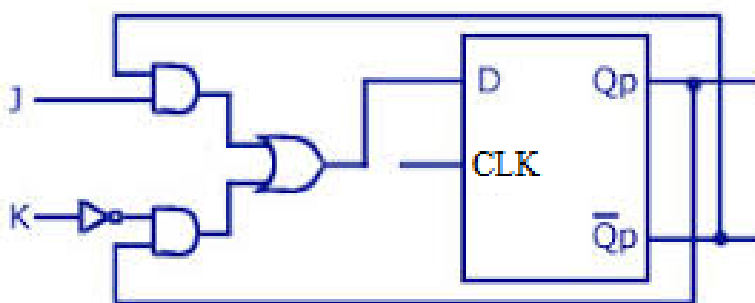
State Table of JK Flip Flop				Excitation Table of D Flip Flop
Q_n	J	K	Q_{n+1}	D
0	0	0	0	0
0	0	1	0	0
0	1	0	1	1
0	1	1	1	1
1	0	0	1	1
1	0	1	0	0
1	1	0	1	1
1	1	1	0	0

K-map and Equation:

J K		00	01	11	10
$Q(n)$	0	0	0	1	1
	1	1	0	0	1

$$D = \overline{Q_n}J + Q_n\overline{K}$$

Block Diagram:



D Flip Flop → T Flip Flop

Inputs: T

Outputs: D

Combined Table:

State Table of T Flip Flop			Excitation Table of D Flip Flop
Q_n	T	Q_{n+1}	D
0	0	0	0
0	1	1	1
1	0	1	1
1	1	0	0

K-map and Equation:

Q(n)	T	
	0	1
0	0	1
1	1	0

$$D = \overline{Q_n}T + Q_n\overline{T} = Q_n \oplus T$$

Block Diagram:

