CLOCK AND FREQUENCY

- A signal used to synchronize the operations of an electronic system. Clock pulses are continuous, precisely spaced changes in voltage.
- In electronics and especially synchronous digital circuits, a clock signal is a particular type of signal that oscillates between a high and a low state and is utilized to coordinate actions of circuits.
- Although the word signal has a number of other meanings, the term here is used for "transmitted energy that can carry information".
- A clock signal is produced by a clock generator.

JK FLIP-FLOP: CHARARCTERISTIC TABLE AND EQUATION

J	K	CLK	Q	
0	0	↑	Q_0	No Change
0	1	↑	0	Clear
1	0	↑	1	Set
1	1	↑	$\overline{Q}_0$	Toggle

↑ : Rising Edge of Clock

$\overline{Q}$: Complement of Q

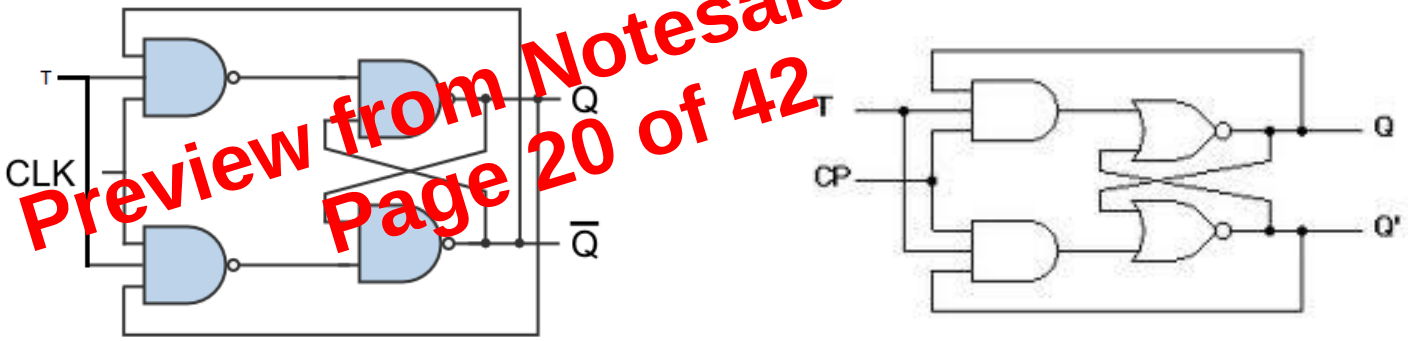
JK / Q	00	01	11	10
0			1	1
1	1			1

$Qn=JQ'_p+K'Q_p$

CLK	J	K	Qp	Qn
O	X	X	X	No change
1	O	O	O	O
1	O	O	1	1
1	O	1	O	0
1	O	1	1	0
1	1	O	O	1
1	1	O	1	1
1	1	1	O	1
1	1	1	1	0

- The JK flip-flop augments the behavior of the SR flip-flop (J=Set, K=Reset) by interpreting the S = R = 1 condition as a "flip" or toggle command.

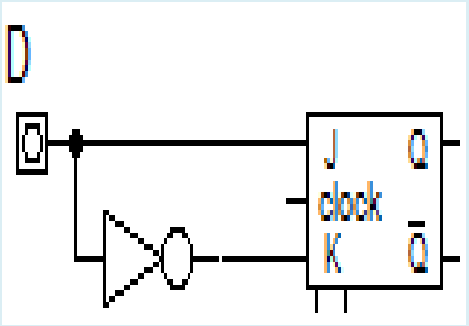
T FLIP-FLOP



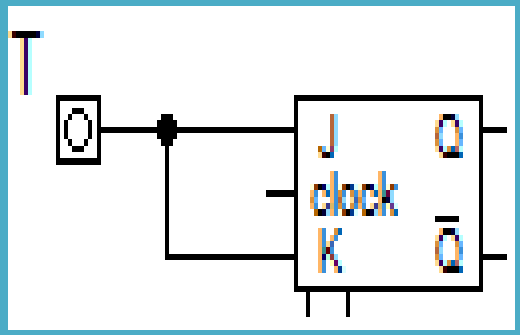
- Single input flip flop
- Also known as a Toggle or Triggered flip-flop
- They form the basis for counters
- Constructed from a pair of cross-coupled NOR logic gates OR NAND Logic gates
- With Clock high, the signals can pass through the input gates to the encapsulated latch. The latch is transparent.
- With Clock low, the latch is closed (opaque) and remains in the state it was left the last time Clock was high
- Modification of JK Flip-flop

OTHER FLIP-FLOPS FROM JK FLIP-FLOP

JK to D Flip-Flop



JK to T Flip-Flop



OTHER FLIP-FLOPS FROM T FLIP-FLOP

T to D Flip-Flop

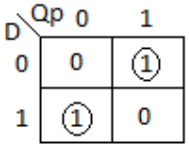
Required is D (Characteristic Table)

D	Qp	Qn
0	0	0
0	1	0
1	0	1
1	1	1

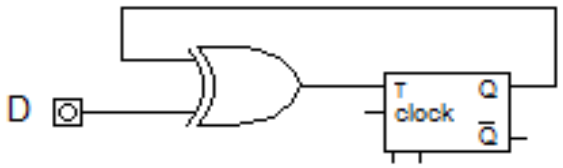
Given is T (Excitation Table)

Qp	Qn	T
0	0	0
0	1	1
1	0	1
1	1	0

D	Qp	Qn	T
0	0	0	O
0	1	0	1
1	0	1	1
1	1	1	0



T = D XOR Qp



T = D xor Qp

OTHER FLIP-FLOPS FROM T FLIP-FLOP

T to JK Flip-Flop

Required is JK(Characteristic Table)

J	K	Qp	Qn
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

Qp	Qn	T
0	0	0
0	1	1
1	0	1
1	1	0

Given is T (Excitation Table)

J	K	Qp	Qn	T
0	0	0	0	0
0	0	1	1	0
0	1	0	0	0
0	1	1	0	1
1	0	0	1	1
1	0	1	1	0
1	1	0	1	1
1	1	1	0	1

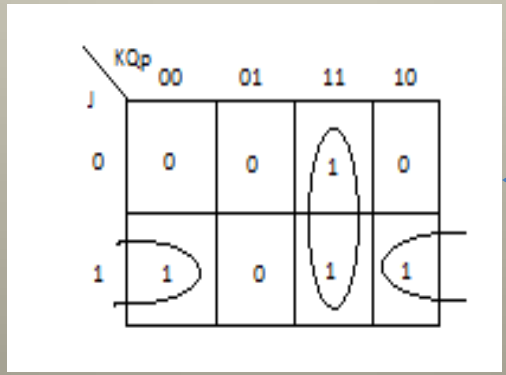


Diagram is in next slide

$T=JQ'_p+KQ_p$

BASIC FLIP-FLOP APPLICATIONS

3. Frequency Division