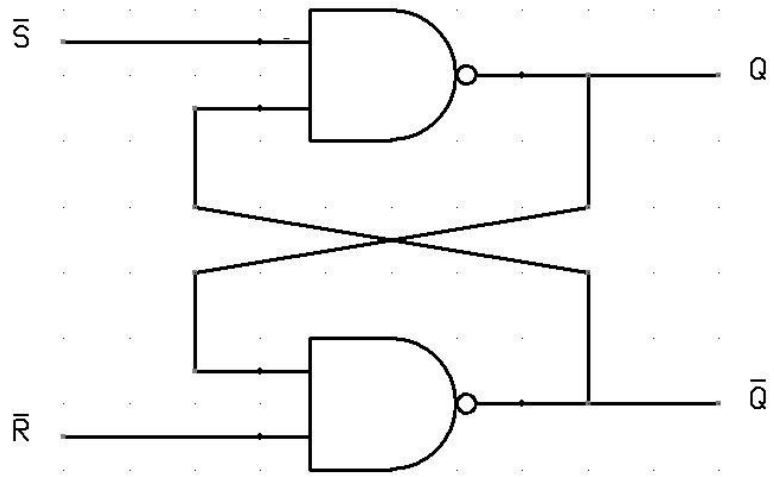
A flip flop is an electronic circuit with two stable states that can be used to store binary data. The stored data can be changed by applying varying inputs. Flip-flops and latches are fundamental building blocks of digital electronics systems used in computers, communications, and many other types of systems. Flip-flops and latches are used as data storage elements. It is the basic storage element in sequential logic. But first, let's clarify the difference between a latch and a flip-flop.

For example, let us talk about SR latch and SR flip-flops. In this circuit when you Set S as active the output Q would be high and Q' will be low. This is irrespective of anything else. (This is an active-low circuit so active here means low, but for an active high circuit active would mean high)



There are basically four different types of flip flops and these are:

- Set-Reset (SR) **flip-flop** or Latch.
- JK **flip-flop**.
- D (Data or Delay) **flip-flop**.
- T (Toggle) **flip-flop**.

Difference between Flip-flop and Latch :

SNO	FLIP-FLOP	LATCH
1	Flip-flop is a bistable device i.e., it has two stable states that are represented as 0 and 1.	Latch is also a bistable device whose states are also represented as 0 and 1.
2	It checks the inputs but changes the output only at times defined by the clock signal or any other control signal.	It checks the inputs continuously and responds to the changes in inputs immediately.
3	It is a edge triggered device.	It is a level triggered device.
4	Gates like NOR, NOT, AND, NAND are building blocks of flip flops.	These are also made up of gates.
5	They are classified into asynchronous or synchronous flipflops.	There is no such classification in latches.
6	It forms the building blocks of many sequential circuits like counters.	These can be used for the designing of sequential circuits but are not generally preferred.
7	a, Flip-flop always have a clock signal	latche doesn’t have a clock signal
8	Flip-flop can be build from Latches	Latches can’t build from gates

9	ex:D Flip-flop, JK Flip-flop	ex:SR Latch, D Latch

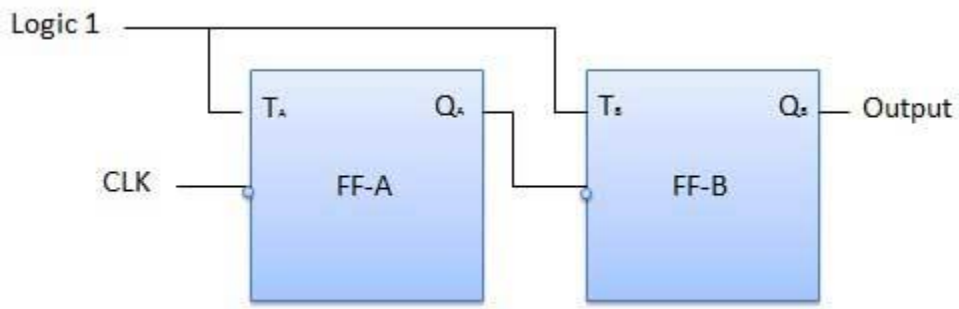
Counter is a sequential circuit. A digital circuit which is used for a counting pulses is known counter. Counter is the widest application of flip-flops. It is a group of flip-flops with a clock signal applied. Counters are of two types.

- Asynchronous or ripple counters.
- Synchronous counters.

Asynchronous or ripple counters

The logic diagram of a 2-bit ripple up counter is shown in figure. The toggle (T) flip-flop are being used. But we can use the JK flip-flop also with J and K connected permanently to logic 1. External clock is applied to the clock input of flip-flop A and Q_A output is applied to the clock input of the next flip-flop i.e. FF-B.

Logical Diagram



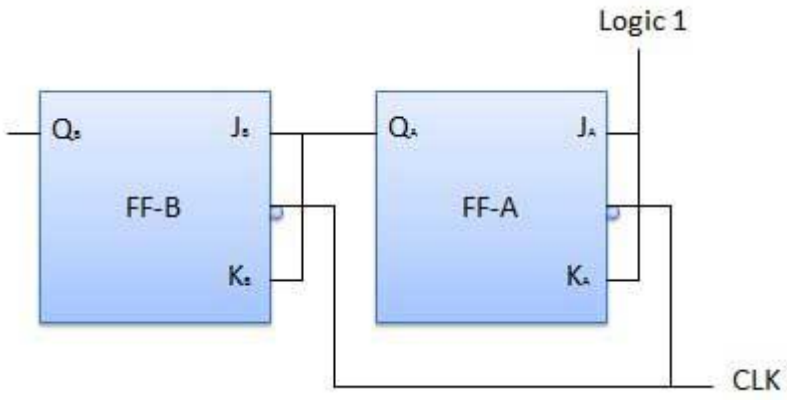
Synchronous counters

If the "clock" pulses are applied to all the flip-flops in a counter simultaneously, then such a counter is called as synchronous counter.

2-bit Synchronous up counter

The J_A and K_A inputs of FF-A are tied to logic 1. So FF-A will work as a toggle flip-flop. The J_B and K_B inputs are connected to Q_A.

Logical Diagram


Logic 1
Q_B
J_B
FF-B
K_B
Q_A
J_A
FF-A
K_A
CLK