

Objectives

- Verification of state tables of J-K flip-flop using AND and NOR gates.
- Verification of state Tables of T flip-flop using AND and NOR gates.

Apparatus

- IC 7410 (3-input NAND Gate)

Theory

Sequential logic is a type of logic circuit whose output depends not only on the present value of its input signals but on the sequence of past inputs, the input history as well. This is in contrast to combinational logic, whose output is a function of only the present input. This means that sequential logic circuits are able to take into account their previous input state as well as those actually present, a sort of “before” and “after” effect is involved with sequential circuits.

In other words, the output state of a “sequential logic circuit” is a function of the following three states, the “present input”, the “past input” and/or the “past output”. Sequential Logic circuits remember these conditions and stay fixed in their current state until the next clock signal changes one of the states, giving sequential logic circuits “Memory”.

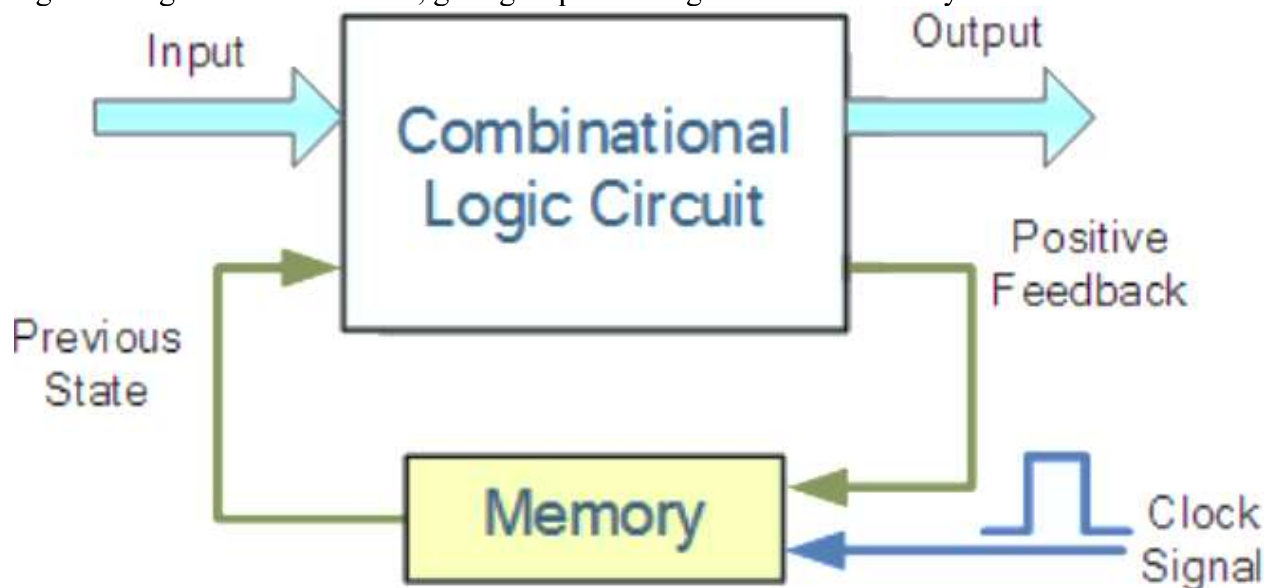


Figure 1

Flip Flop

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. Both are used as data storage elements. It is the basic storage element in sequential logic.

Applications of Flip -Flops

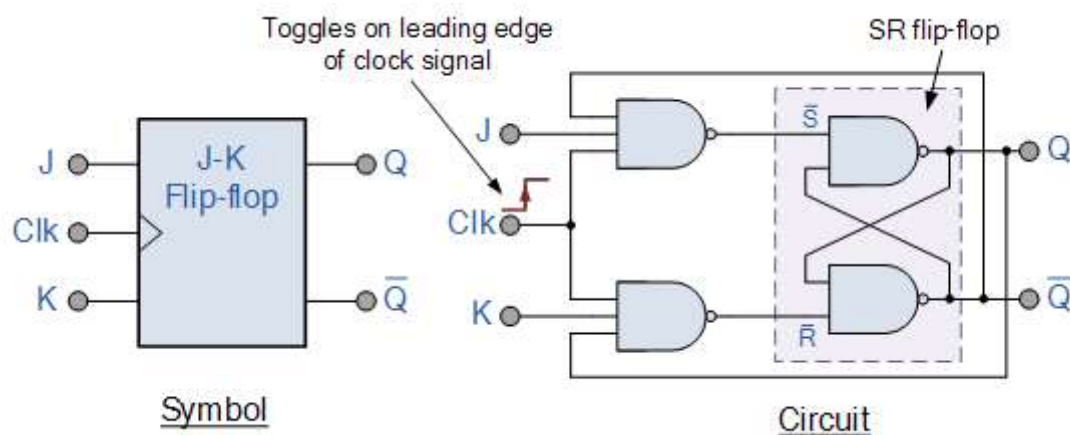
These are the various types of flip-flops being used in digital electronic circuits and the applications of Flip-flops are as specified below.

- Counters
- Frequency Dividers
- Shift Registers
- Storage Registers

J-K Flip Flop

The JK Flip-flop is similar to the SR Flip-flop but there is no change in state when the J and K inputs are both LOW. This simple JK flip Flop is the most widely used of all the flip-flop designs and is considered to be a universal flip-flop circuit. The two inputs labelled “J” and “K” are not shortened abbreviated letters of other words, such as “S” for Set and “R” for Reset, but are themselves autonomous letters chosen by its inventor Jack Kilby to distinguish the flip-flop design from other types.

Logic Diagram



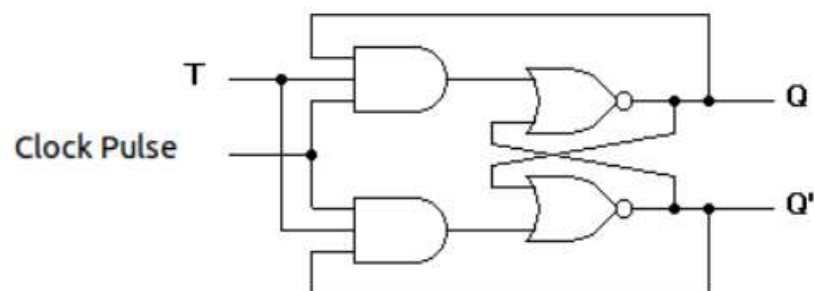
Truth Table

	Clock	Input		Output		Description
	Clk	J	K	Q	\overline{Q}	
same as for the SR Latch	X	0	0	1	0	Memory no change
	X	0	0	0	1	
	\downarrow	0	1	1	0	Reset Q » 0
	X	0	1	0	1	
	\downarrow	1	0	0	1	Set Q » 1
	X	1	0	1	0	
toggle action	\downarrow	1	1	0	1	Toggle
	\downarrow	1	1	1	0	

T Flip Flop

T flip-flop is known as toggle flip-flop. The T flip-flop is modification of the J-K flip-flop. Both the J-K inputs of the J-K flip-flop are held at logic 1 and the clock signal continuous to change.

Logic Diagram



Truth Table

CP	T	Q(t+1)
0	x	Q _t (NC)
1	0	Q _t (NC)
1	1	Q _t ' (Toggle)

Procedure

1. Connections are made as per circuit diagram.
2. Verify truth- tables for various combinations of input.
1. Precautions
 1. All the ICs should be checked before using the apparatus.
 2. All LEDs should be checked.
 3. All connections should be tight.
 4. Always connect GROUND first and then VCC.
 5. The circuit should be off before changing the connections.
 6. After completing the experiment switch off the supply to apparatus

Pre lab Question

- 1) Differentiate between combinational and sequential circuits.

A circuit whose output is dependent only on the inputs at that instant is called combinational circuit. And a circuit whose output is dependent on present and past history of the inputs is called sequential circuit.

- 2) What is a latch?

Storage elements that operate with signal levels are referred to as latches.

- 3) What is a flip-flop?

Storage elements controlled by clock transitions are called flip-flops

Implementation of Flip Flop in Lab

