

Lab 9: JK Flip Flop

9.1 Aim

To Design and verify the truth table of J K Flip flop using IC 7473.

9.2 Objective:

- To understand the principle of operation of sequential circuit
- To differentiate between combinational circuit and sequential circuit.
- To get familiar with basic Flip flops
- Determine the logic operation of JK flip flops.
- Connect and observe the state transition of JK as connected to the clock generator circuit.

9.3 Apparatus Required:

- Prototyping board (breadboard)
- DC Power Supply 5V
- Light Emitting Diode (LED)
- Digital ICs: 7473:Dual master Slave J K Flip flop
- Connecting Wires

9.4 Pin Diagram:

9.5 Theory:

Sequential Logic circuits: In digital circuit theory, sequential logic is a type of logic circuit whose output depends not only on the present input but also on the history

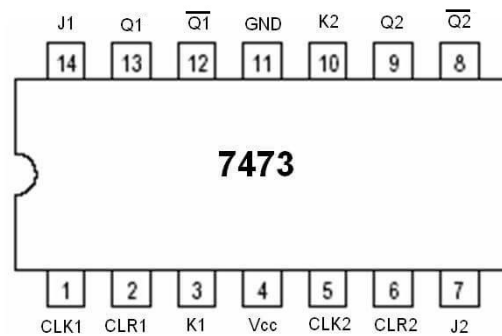


Figure 9.1: Pin Diagram of JK Flip-flop

of the input. This is in contrast to combinational logic, whose output is a function of, and only of, the present input. In other words, sequential logic has state (memory) while combinational logic does not. The memory elements are devices capable of storing binary info. The binary info stored in the memory elements at any given time defines the state of the sequential circuit. The input and the present state of the memory element determines the output. Memory elements next state is also a function of external inputs and present state. A sequential circuit is specified by a time sequence of inputs, outputs, and internal states.

Flip Flop: In electronics, a flip-flop is a circuit that has two stable states and can be used to store state information. The circuit can be made to change state by signals applied to one or more control inputs and will have one or two outputs. Flip-flops and latches are used as data storage elements. There are four types of flip flops. These are SR, D, JK and T. On this experiment we will explore the operation of JK flip flop. JK flip flop: JK flip flop is considered as the universal flip flop. When configured in various ways, it is capable of operating like most other types of flip flop. A JK flip-flop is a refinement of the SR flip-flop in that the indeterminate state of the SR type is defined in the JK type. Inputs J and K behave like inputs S and R to set and clear the flip-flop. When logic 1 inputs are applied to both J and K simultaneously, the flip-flop switches to its complement state, i.e., if $Q=1$, it switches to $Q=0$ and vice versa. In that way it is like a toggle. A clocked JK flip-flop is shown below. Output Q is ANDed with K and CLK inputs so that the flip-flop is cleared during a clock pulse only if Q was previously 1. Similarly, output \bar{Q} is ANDed with J and CLK inputs so that the flip-flop is set with a clock pulse only if \bar{Q} was previously 1.

9.6 Procedure:

1. Collect the components necessary to accomplish this experiment.
2. Plug the IC chip into the breadboard.
3. Connect the supply voltage and ground lines to the chips. PIN7 = Ground and

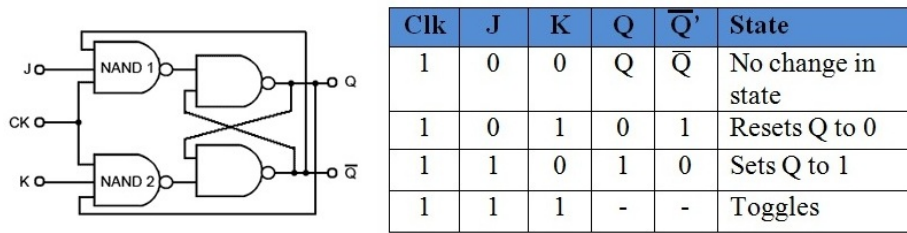


Figure 9.2: Logic circuit and truth table for JK Flip-flop

PIN14 = +5V.

4. According to the pin diagram of each IC mentioned above, make the connections according to circuit diagram.
5. Connect the inputs of the gate to the input switches of the LED.
6. Connect the output of the gate to the output LEDs.
7. Once all connections have been done, turn on the power switch of the breadboard
8. Operate the switches and fill in the truth table (Write "1" if LED is ON and "0" if LED is OFF Apply the various combination of inputs according to the truth table and observe the condition of Output LEDs.

9.7 Observation Table:

JK Flip flop: Input Variable: CLR, CLK, J, K

Output Variable: Q, Q bar

LED ON: RED Light:Logic 1

LED OFF: Green Light:Logic 0

Table 9.1: Add caption

Control inputs		Inputs		Outputs	
CLR BAR	CLK	J	K	Q	Q bar

9.8 Results and Discussion:

Flip-flops (FFs) are devices used in the digital field for a variety of purposes. Flip-flops are a fundamental building block of digital electronics systems used in computers, communications, and many other types of systems. In JK flip-flop, the letter J is for set and the letter K is for clear. When logic 1 inputs are applied to both J and K simultaneously, the flip-flop switches to its complement state, i.e, if $Q=1$, it switches to $Q=0$ and vice versa. Flip-flops and latches are used as data storage elements. Such data storage can be used for storage of state, and such a circuit is described as sequential logic. When used in a finite-state machine, the output and next state depend not only on its current input, but also on its current state (and hence, previous inputs.) It can also be used for counting of pulses, and for synchronizing variably-timed input signals to some reference timing signal.

9.9 Conclusion:

The function table of JK flip flop using IC 7473 has been verified.