Experiment No. 4
Study of flip flop IC
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Date of Performance: 21/08/2024
Date of Submission:

Aim - Study of flip flop IC

Objective -

1. To familiarize students with the operation of various types of flip-flops, including RS, JK, D, and T flip-flops.
2. To verify the truth tables for each type of flip-flop through practical circuit implementations.
3. To explore the role of flip-flops in memory storage and sequential logic circuits.

Components required -

1. ICs:
    - 7474 (Dual D Flip-flop)
    - 7476 (Dual JK Flip-flop)
    - 7400 (Quad 2-input NAND gate)
    - 7402 (Quad 2-input NOR gate)
    - 7404 (Hex Inverter)
    - 7408 (Quad 2-input AND gate)
    - 7432 (Quad 2-input OR gate)
    - 7486 (Quad 2-input XOR gate)
2. Breadboard
3. Connecting wires
4. Digital IC Tester
5. Clock Pulse Generator or Manual Switch for Clock Input
6. Power Supply (5V)

Theory -

Flip-flops are bistable devices that can store one bit of data. They have two stable states and can be used to store state information. The main types of flip-flops include:

1. RS Flip-flop

1. Inputs: Set (S) and Reset (R)
2. Outputs: Q and Q' (complement of Q)
3. Operation:
    - When S = 1 and R = 0, Q = 1 (Set state).
    - When S = 0 and R = 1, Q = 0 (Reset state).
    - When S = 0 and R = 0, Q remains unchanged.
    - S = 1 and R = 1 is an invalid state.

2. D Flip-flop

1. Input: Data (D)
2. Output: Q
3. Operation: Captures the value of D at the rising edge of the clock. The output Q follows the input D only at the clock transition.

3. JK Flip-flop

1. Inputs: J and K
2. Outputs: Q and Q'
3. Operation:
    - J = 1, K = 0: Set (Q = 1).
    - J = 0, K = 1: Reset (Q = 0).
    - J = 1, K = 1: Toggle the output.
    - J = 0, K = 0: No change.

4. T Flip-flop

1. Input: Toggle (T)
2. Output: Q
3. Operation: Toggles the output state on each clock pulse when T = 1; holds the previous state when T = 0.

Applications of Flip-flops

Flip-flops are used in various digital applications, including:

- Memory storage elements (registers)
- Frequency dividers
- Counters
- Shift registers
- State machines

Conclusion -

The experiment successfully demonstrates the functionality of various flip-flops, including RS, JK, D, and T types. The outputs observed during the experiments matched the expected results based on the truth tables. This practical experience enhances the understanding of flip-flops as essential components in digital circuits, particularly in memory storage and sequential logic applications. By implementing these circuits, students gain hands-on experience with digital electronics, preparing them for more complex systems involving memory and data storage. The knowledge acquired will be beneficial for future studies in digital systems and electronics design.