

Title: D FLIP-FLOPS**Materials:**

- [1] 7474 D-type flip-flop IC
- [1] clock (single pulses)

Procedure:

1. Insert the 7474 into the breadboard.
2. Refer to Figure 10 and wire the 7474.
3. Operate the *asynchronous* inputs CLR and PS according to the inputs in Table 10-1, and record the results in Table 10-1. Also write the name of the condition in the last column of the table.
Get Instructor's Signature.
4. Disable the asynchronous inputs (PS and CLR to 1).
5. Operate the *synchronous* inputs D and CLK of the 7474 according to the inputs in Table 10-2. Observe and record the results in Table 10-2. **Get Instructor's Signature.**

Questions (answer on a separate piece of paper – “**Draw**” means **you must use a template**):

1. **Draw** a logic symbol for a D flip-flop. Label the inputs D, CLK, PS, and CLR and the outputs Q and \bar{Q} .
2. What are the synchronous inputs of the D flip-flop?
3. What are the asynchronous inputs of the D flip-flop?
4. Which output column in Table 10-2 is exactly the same as the input D column?
5. A logical _____ at PS will preset the Q output of the 7474 D flip-flop to a logical _____, assuming that CLR is a 1.
6. The synchronous inputs of the D flip-flop only operate when the PS and CLR inputs are _____ (disabled, enabled) with a logical _____.
7. The 7474 D flip-flop is a _____ (negative-, positive-) edge triggered flip-flop.
8. Explain why the D flip-flop is often referred to as the *delay* flip-flop.

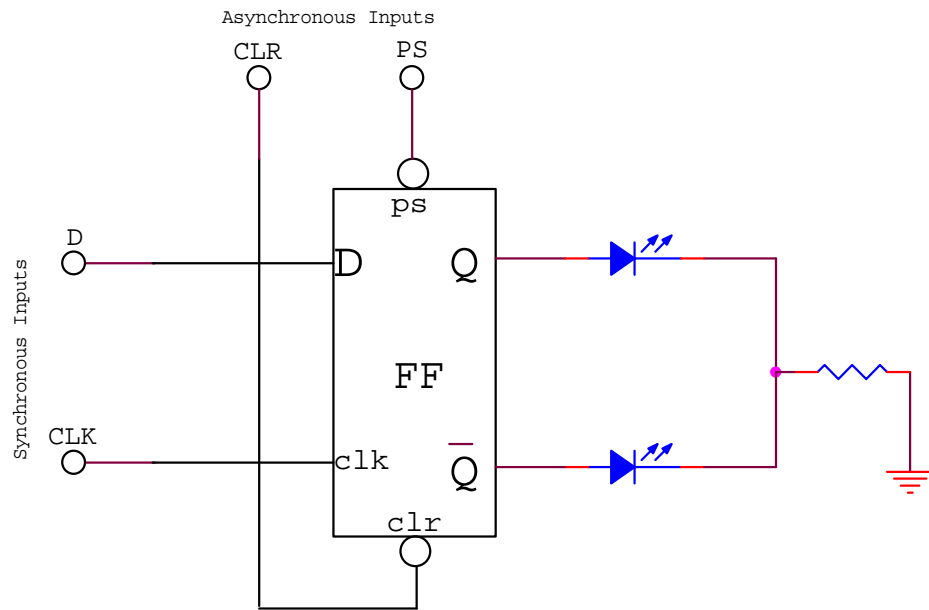


Figure 10 D-FlipFlop

| Inputs | | Outputs | | |
|--------|-------|--|-----------|-------------------|
| Preset | Clear | Q | \bar{Q} | Name of Condition |
| 0 | 0 | | | <i>Prohibited</i> |
| 0 | 1 | | | |
| 1 | 0 | | | |
| 1 | 1 | | | |
| | | Clear Q to 0, Preset Q to 1, Disable asynchronous inputs | | |

Table 10-1 TT for 7474 D Flip-Flop (asynchronous inputs)

| Inputs | | Outputs | | | |
|--------|------|--------------------|-----------|-------------------|-----------|
| Clock | Data | Before Clock Pulse | | After Clock Pulse | |
| CLK | D | Q | \bar{Q} | Q | \bar{Q} |
| ↑ | 0 | 0 | 1 | | |
| ↑ | 0 | 1 | 0 | | |
| ↑ | 1 | 0 | 1 | | |
| ↑ | 1 | 1 | 0 | | |

Table 10-2 TT for D Flip-Flop