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Experiment No.- 9

BCD Counter with 7-Segment Display

OBJECTIVE: Designing a BCD counter showing the count values on a 7-segment display.

MATERIALS REQUIRED

1. Components LED : one.
   Display : 7-Segment one (Common Anode)
   Resistance : Two 330Ω.
   ICs : one 7400 (NAND gate), one 7493 (4-bit binary counter), one 7447 (Decoder).

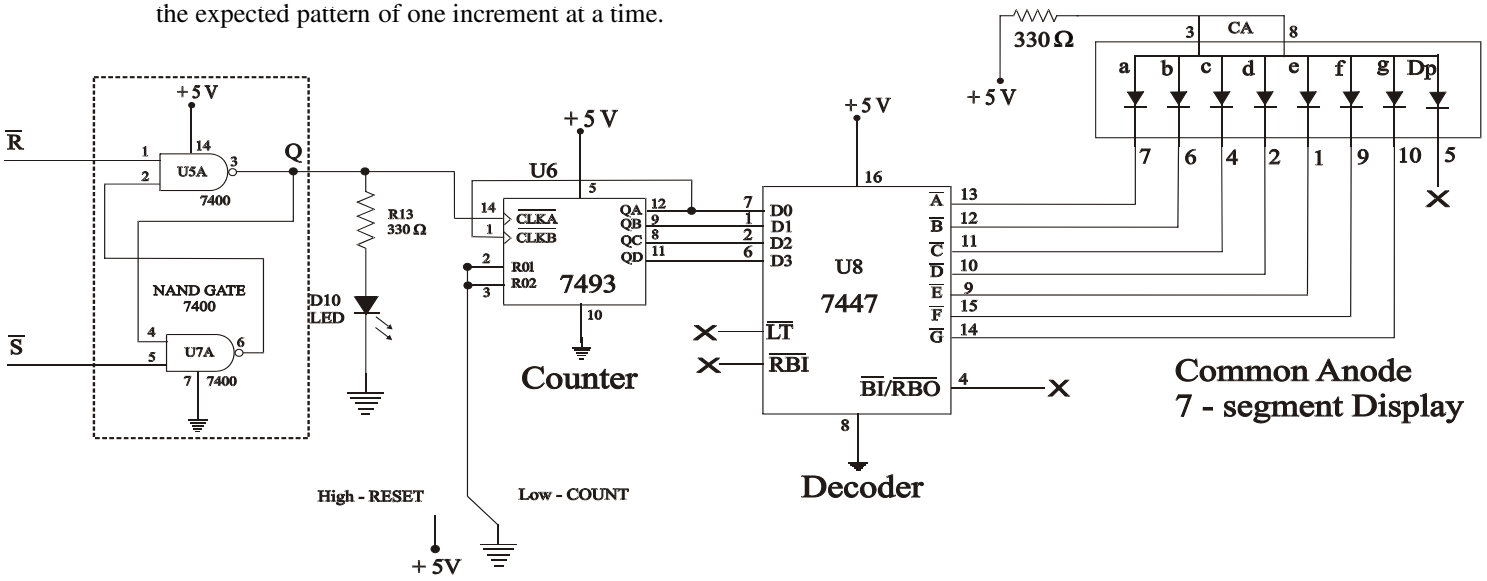
PRECAUTIONS AND GUIDELINES

1. While switching on the set-up, switch on the oscilloscope first, then the power supply to the circuit, and finally the function generator. When switching off, follow the sequence in reverse order.
2. For any IC, never exceed the input voltage beyond the power supply limits.
2. Keep ground terminals of the oscilloscope probes and function generator output, and power supply common connected together throughout the experiment.

The circuit shown in Fig. 9.1 is for obtaining a TTL level signal and feeding it to a counter.

Working Principle:

- Use the RS flip-flop to obtain a clean signal (i.e. no contact bounce) at 'Q'. To do this keep both R & S open (i.e. HIGH) [Note that both LOW is forbidden]. To give pulses to the counter do the following:
- The R point should be connected to ground momentarily and then leave it in open. Now connect S point to ground momentarily and then leave it open. You will observe that the 7-segment displayed value will be incremented by one. The 7447 is a BCD to seven segment decoder/driver. **The pin numbers of the seven segment LED display are counted anticlockwise starting from the bottom left corner (top view).**
- If the RS flip-flop is not used (i.e. disconnected) and instead 'CLKA' (pin 14 of IC 7493) is used to generate the pulse input (i.e. connected to ground momentarily and then leave it open), then the displayed value will not follow the expected pattern of one increment at a time.



BCD to 7-segment Decoder

Fig. 9.1:

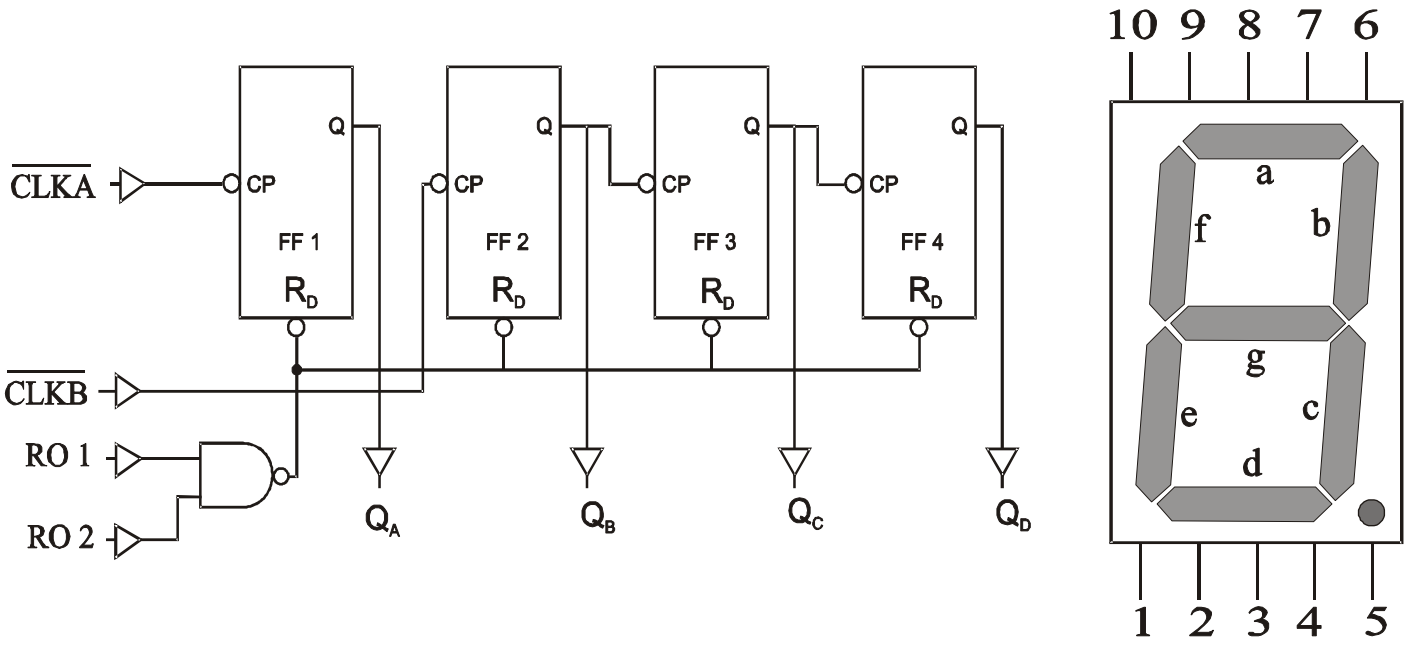


Fig. 9.2: Internal logic diagram of 7493 counter

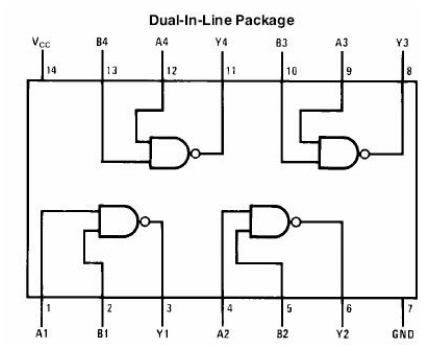


Fig. 9.3: Pin diagram of 7400 NAND gate

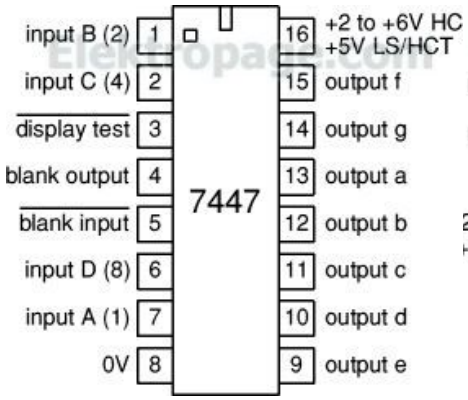


Fig. 9.4: Pin diagram of 7447

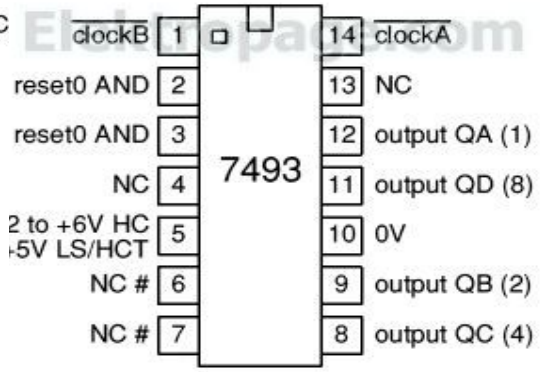


Fig. 9.5: Pin diagram of 7493

OBSERVATIONS:

1. Connect the circuit as shown in Fig. 9.1 with 'CLKB' connected to 'QA'. Make sure the power supply ground is connected to the circuit ground.

2. Make it a Mod-10(decade) counter. For this you can use the remaining NAND gates of 7400.

3. Toggle the flip-flop output ('Q') by changing R and S values as described in working principle above to give pulses to the counter 'CLKA' input.

4. Now, disconnect the RS flip-flop and try to give a single pulse to the counter 'CLKA' input (pin '14') by momentarily touching it to ground and then leave it open. You will expect the count value will increase by one.

Statutory warning: The displayed value will not follow the expected pattern of one increment at

a time by this hand touching method. Look for a better scheme.

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