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# SN5475, SN5477, SN54LS75, SN54LS77 SN7475, SN74LS75 4-BIT BISTABLE LATCHES

SDLS120 – MARCH 1974 – REVISED MARCH 1988

**FUNCTION TABLE**  
(each latch)

| INPUTS |   | OUTPUTS |             |
|--------|---|---------|-------------|
| D      | C | Q       | $\bar{Q}$   |
| L      | H | L       | H           |
| H      | H | H       | L           |
| X      | L | $Q_0$   | $\bar{Q}_0$ |

H = high level, L = low level, X = irrelevant

$Q_0$  = the level of Q before the high-to-low transition of G

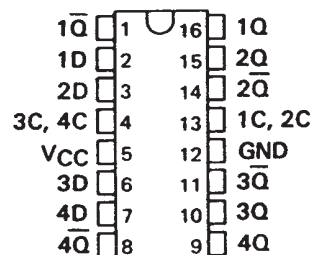
## description

These latches are ideally suited for use as temporary storage for binary information between processing units and input/output or indicator units. Information present at a data (D) input is transferred to the Q output when the enable (C) is high and the Q output will follow the data input as long as the enable remains high. When the enable goes low, the information (that was present at the data input at the time the transition occurred) is retained at the Q output until the enable is permitted to go high.

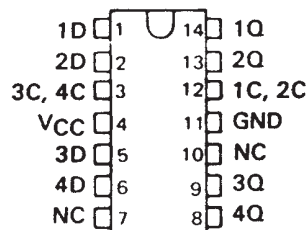
The '75 and 'LS75 feature complementary Q and  $\bar{Q}$  outputs from a 4-bit latch, and are available in various 16-pin packages. For higher component density applications, the '77 and 'LS77 4-bit latches are available in 14-pin flat packages.

These circuits are completely compatible with all popular TTL families. All inputs are diode-clamped to minimize transmission-line effects and simplify system design. Series 54 and 54LS devices are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ ; Series 74, and 74LS devices are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

**SN5475, SN54LS75 . . . J OR W PACKAGE**  
**SN7475 . . . N PACKAGE**  
**SN74LS75 . . . D OR N PACKAGE**  
(TOP VIEW)

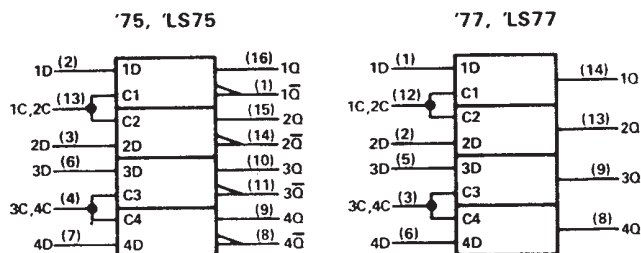


**SN5477, SN54LS77 . . . W PACKAGE**  
(TOP VIEW)



NC - No internal connection

## logic symbols†



†These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

|                                             |                                                |
|---------------------------------------------|------------------------------------------------|
| Supply voltage, $V_{CC}$ (See Note 1)       | 7 V                                            |
| Input voltage: '75, '77                     | 5.5 V                                          |
| 'LS75, 'LS77                                | 7 V                                            |
| Interemitter voltage (see Note 2)           | 5.5 V                                          |
| Operating free-air temperature range: SN54' | $-55^{\circ}\text{C}$ to $125^{\circ}\text{C}$ |
| SN74'                                       | $0^{\circ}\text{C}$ to $70^{\circ}\text{C}$    |
| Storage temperature range                   | $-65^{\circ}\text{C}$ to $150^{\circ}\text{C}$ |

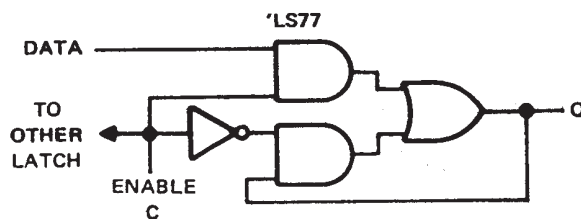
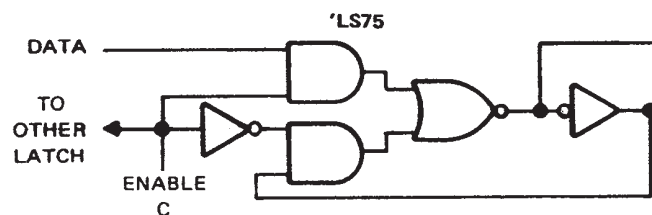
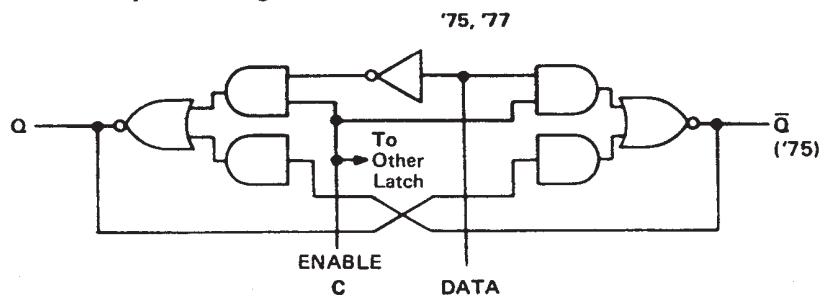
NOTES: 1. Voltage values are with respect to network ground terminal.

2. This is the voltage between two emitters of a multiple-emitter input transistor and is not applicable to the 'LS75 and 'LS77.

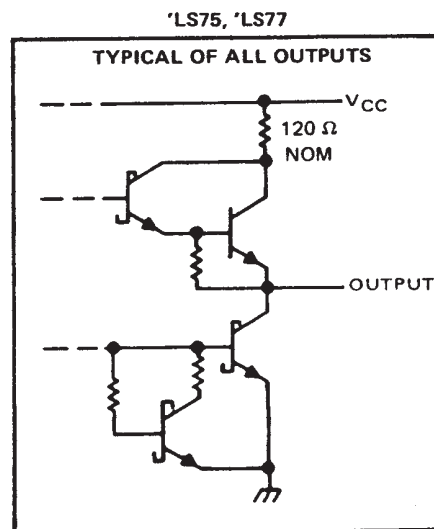
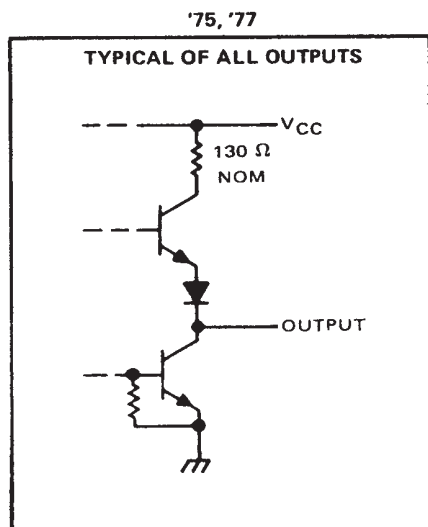
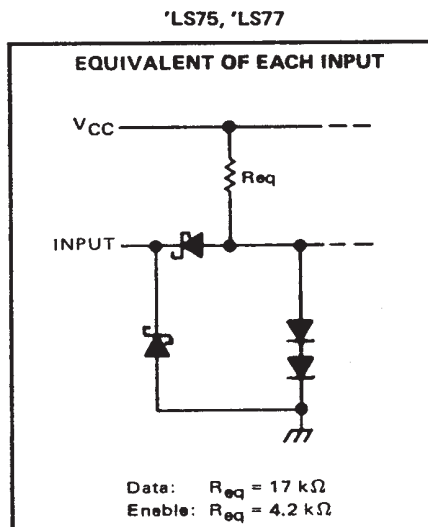
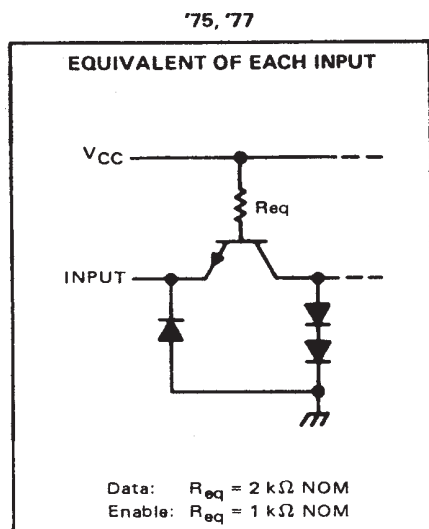
**SN5475, SN5477, SN54LS75, SN54LS77  
SN7475, SN74LS75**

SDLS120 – MARCH 1974 – REVISED MARCH 1988

**logic diagrams (each latch) (positive logic)**



### schematics of inputs and outputs



SN5475, SN5477, SN54LS75, SN54LS77  
SN7475, SN74LS75  
4-BIT BISTABLE LATCHES

SDLS120 – MARCH 1974 – REVISED MARCH 1988

recommended operating conditions

|                                       | SN5475, SN5477 |     |      | SN7475 |     |      | UNIT    |
|---------------------------------------|----------------|-----|------|--------|-----|------|---------|
|                                       | MIN            | NOM | MAX  | MIN    | NOM | MAX  |         |
| Supply voltage, $V_{CC}$              | 4.5            | 5   | 5.5  | 4.75   | 5   | 5.25 | V       |
| High-level output current, $I_{OH}$   |                |     | –400 |        |     | –400 | $\mu$ A |
| Low-level output current, $I_{OL}$    |                |     | 16   |        |     | 16   | mA      |
| Width of enabling pulse, $t_W$        | 20             |     |      | 20     |     |      | ns      |
| Setup time, $t_{su}$                  | 20             |     |      | 20     |     |      | ns      |
| Hold time, $t_h$                      | 5              |     |      | 5      |     |      | ns      |
| Operating free-air temperature, $T_A$ | –55            |     | 125  | 0      |     | 70   | °C      |

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER |                                        | TEST CONDITIONS†                                                                                           | MIN | TYP‡  | MAX  | UNIT    |
|-----------|----------------------------------------|------------------------------------------------------------------------------------------------------------|-----|-------|------|---------|
| $V_{IH}$  | High-level input voltage               |                                                                                                            | 2   |       |      | V       |
| $V_{IL}$  | Low-level input voltage                |                                                                                                            |     | 0.8   |      | V       |
| $V_{IK}$  | Input clamp voltage                    | $V_{CC} = \text{MIN}$ , $I_I = -12 \text{ mA}$                                                             |     |       | –1.5 | V       |
| $V_{OH}$  | High-level output voltage              | $V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ ,<br>$V_{IL} = 0.8 \text{ V}$ , $I_{OH} = -400 \mu\text{A}$ | 2.4 | 3.4   |      | V       |
| $V_{OL}$  | Low-level output voltage               | $V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ ,<br>$V_{IL} = 0.8 \text{ V}$ , $I_{OL} = 16 \text{ mA}$    |     | 0.2   | 0.4  | V       |
| $I_I$     | Input current at maximum input voltage | $V_{CC} = \text{MAX}$ , $V_I = 5.5 \text{ V}$                                                              |     |       | 1    | mA      |
| $I_{IH}$  | High-level input current               | $V_{CC} = \text{MAX}$ , $V_I = 2.4 \text{ V}$                                                              |     |       | 80   | $\mu$ A |
|           |                                        |                                                                                                            |     |       | 160  |         |
| $I_{IL}$  | Low-level input current                | $V_{CC} = \text{MAX}$ , $V_I = 0.4 \text{ V}$                                                              |     |       | –3.2 | mA      |
|           |                                        |                                                                                                            |     |       | –6.4 |         |
| $I_{OS}$  | Short-circuit output current§          | $V_{CC} = \text{MAX}$                                                                                      |     | SN54* | –20  | mA      |
|           |                                        |                                                                                                            |     | SN74* | –18  |         |
| $I_{CC}$  | Supply current                         | $V_{CC} = \text{MAX}$ ,<br>See Note 3                                                                      |     | SN54* | 32   | mA      |
|           |                                        |                                                                                                            |     | SN74* | 32   |         |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

§ Not more than one output should be shorted at a time.

NOTE 3:  $I_{CC}$  is tested with all inputs grounded and all outputs open.

switching characteristics,  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$

| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | TEST CONDITIONS                            | MIN | TYP | MAX | UNIT |
|-----------|-----------------|----------------|--------------------------------------------|-----|-----|-----|------|
| tPLH      | D               | Q              | CL = 15 pF,<br>RL = 400 Ω,<br>See Figure 1 | 16  | 30  | ns  |      |
| tPHL      |                 |                |                                            | 14  | 25  |     |      |
| tPLH¶     | D               | Q̄             |                                            | 24  | 40  | ns  |      |
| tPHL¶     |                 |                |                                            | 7   | 15  |     |      |
| tPLH      | C               | Q              |                                            | 16  | 30  | ns  |      |
| tPHL      |                 |                |                                            | 7   | 15  |     |      |
| tPLH¶     | C               | Q̄             |                                            | 16  | 30  | ns  |      |
| tPHL¶     |                 |                |                                            | 7   | 15  |     |      |

$t_{PLH}$   $\equiv$  propagation delay time, low-to-high-level output

$t_{PHL}$   $\equiv$  propagation delay time, high-to-low-level output

\P These parameters are not applicable for the SN5477.

**SN5475, SN5477, SN54LS75, SN54LS77**  
**SN7475, SN74LS75**  
**4-BIT BISTABLE LATCHES**

SDLS120 – MARCH 1974 – REVISED MARCH 1988

**recommended operating conditions**

|                                       | SN54LS75<br>SN54LS77 |     |      | SN74LS75 |     |      | UNIT         |
|---------------------------------------|----------------------|-----|------|----------|-----|------|--------------|
|                                       | MIN                  | NOM | MAX  | MIN      | NOM | MAX  |              |
| Supply voltage, $V_{CC}$              | 4.5                  | 5   | 5.5  | 4.75     | 5   | 5.25 | V            |
| High-level output current, $I_{OH}$   |                      |     | -400 |          |     | -400 | $\mu$ A      |
| Low-level output current, $I_{OL}$    |                      |     | 4    |          |     | 8    | mA           |
| Width of enabling pulse, $t_w$        | 20                   |     |      | 20       |     |      | ns           |
| Setup time, $t_{su}$                  | 20                   |     |      | 20       |     |      | ns           |
| Hold time, $t_h$                      | 5                    |     |      | 5        |     |      | ns           |
| Operating free-air temperature, $T_A$ | -55                  |     | 125  | 0        |     | 70   | $^{\circ}$ C |

**electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)**

| PARAMETER                                    | TEST CONDITIONS†                                                                                    | SN54LS75<br>SN54LS77    |      |      | SN74LS75 |      |      | UNIT |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------|-------------------------|------|------|----------|------|------|------|
|                                              |                                                                                                     | MIN                     | TYP‡ | MAX  | MIN      | TYP‡ | MAX  |      |
| $V_{IH}$ High-level input voltage            |                                                                                                     | 2                       |      |      | 2        |      |      | V    |
| $V_{IL}$ Low-level input voltage             |                                                                                                     |                         |      | 0.7  |          |      | 0.8  | V    |
| $V_{IK}$ Input clamp voltage                 | $V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$                                                         |                         |      | -1.5 |          |      | -1.5 | V    |
| $V_{OH}$ High-level output voltage           | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OH} = -400 \mu\text{A}$ | 2.5                     | 3.5  |      | 2.7      | 3.5  |      | V    |
| $V_{OL}$ Low-level output voltage            | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}$                            | $I_{OL} = 4 \text{ mA}$ |      | 0.25 | 0.4      | 0.25 |      | 0.4  |
|                                              |                                                                                                     | $I_{OL} = 8 \text{ mA}$ |      |      |          | 0.35 |      | 0.5  |
| $I_I$ Input current at maximum input voltage | $V_{CC} = \text{MAX}, V_I = 7 \text{ V}$                                                            | D input                 |      |      |          | 0.1  |      | 0.1  |
|                                              |                                                                                                     | C input                 |      |      |          | 0.4  |      | 0.4  |
| $I_{IH}$ High-level input current            | $V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$                                                          | D input                 |      |      |          | 20   |      | 20   |
|                                              |                                                                                                     | C input                 |      |      |          | 80   |      | 80   |
| $I_{IL}$ Low-level input current             | $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$                                                          | D input                 |      |      |          | -0.4 |      | -0.4 |
|                                              |                                                                                                     | C input                 |      |      |          | -1.6 |      | -1.6 |
| $I_{OS}$ Short-circuit output current§       | $V_{CC} = \text{MAX}$                                                                               | -20                     |      | -100 | -20      |      | -100 | mA   |
| $I_{CC}$ Supply current                      | $V_{CC} = \text{MAX}, \text{ See Note 2}$                                                           | 'LS75                   |      | 6.3  | 12       | 6.3  |      | 12   |
|                                              |                                                                                                     | 'LS77                   |      | 6.9  | 13       |      |      |      |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at  $V_{CC} = 5 \text{ V}, T_A = 25^{\circ}\text{C}$ .

§ Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second

NOTE 2:  $I_{CC}$  is tested with all inputs grounded and all outputs open.

**switching characteristics,  $V_{CC} = 5 \text{ V}, T_A = 25^{\circ}\text{C}$**

| PARAMETER¶       | FROM<br>(INPUT) | TO<br>(OUTPUT) | TEST CONDITIONS                                                   | 'LS75 |     |     | 'LS77 |     |     | UNIT |
|------------------|-----------------|----------------|-------------------------------------------------------------------|-------|-----|-----|-------|-----|-----|------|
|                  |                 |                |                                                                   | MIN   | TYP | MAX | MIN   | TYP | MAX |      |
| t <sub>PLH</sub> | D               | Q              | C <sub>L</sub> = 15 pF,<br>R <sub>L</sub> = 2 kΩ,<br>See Figure 1 |       | 15  | 27  |       | 11  | 19  | ns   |
| t <sub>PHL</sub> |                 |                |                                                                   |       | 9   | 17  |       | 9   | 17  |      |
| t <sub>PLH</sub> | D               | $\bar{Q}$      |                                                                   |       | 12  | 20  |       |     | ns  |      |
| t <sub>PHL</sub> |                 |                |                                                                   |       | 7   | 15  |       |     |     |      |
| t <sub>PLH</sub> | C               | Q              |                                                                   |       | 15  | 27  |       | 10  | 18  | ns   |
| t <sub>PHL</sub> |                 |                |                                                                   |       | 14  | 25  |       | 10  | 18  |      |
| t <sub>PLH</sub> | C               | $\bar{Q}$      |                                                                   |       | 16  | 30  |       |     | ns  |      |
| t <sub>PHL</sub> |                 |                |                                                                   |       | 7   | 15  |       |     |     |      |

¶  $t_{PLH}$  = propagation delay time, low-to-high-level output

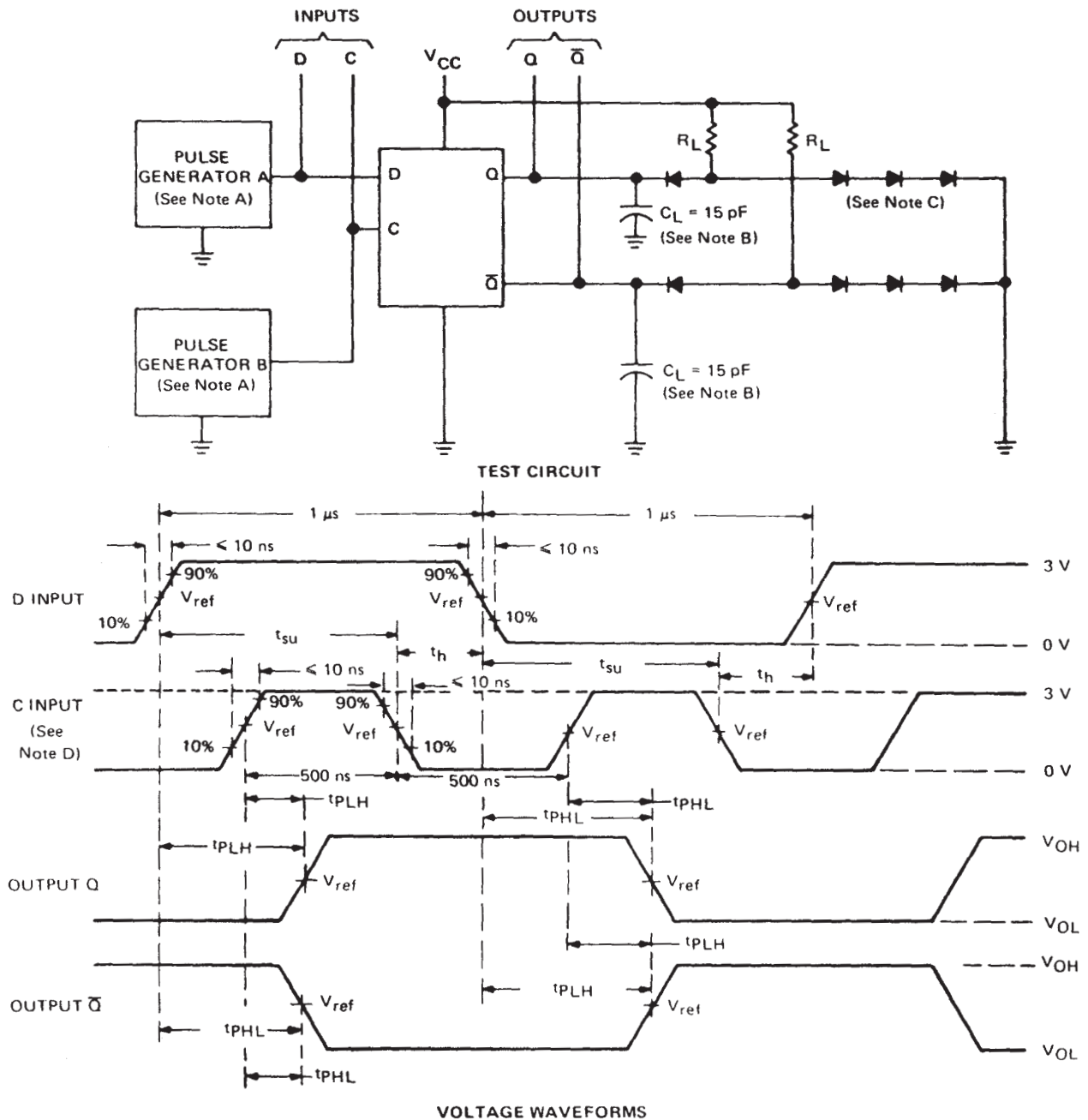
$t_{PHL}$  = propagation delay time, high-to-low-level output



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switching characteristics†

# PARAMETER MEASUREMENT INFORMATION



†Complementary Q outputs are on the '75 and 'LS75 only.

- NOTES: A. The pulse generators have the following characteristics: Z<sub>out</sub> ≈ 50 Ω; for pulse generator A, PRR ≤ 500 kHz; for pulse generator B, PRR ≤ 1 MHz. Positions of D and C input pulses are varied with respect to each other to verify setup times.
- B. C<sub>L</sub> includes probe and jig capacitance.
- C. All diodes are 1N3064 or equivalent.
- D. When measuring propagation delay times from the D input, the corresponding C input must be held high.
- E. For '75 and '77, V<sub>ref</sub> = 1.5 V; for 'LS75 and 'LS77, V<sub>ref</sub> = 1.3 V.

FIGURE 1

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