

# 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

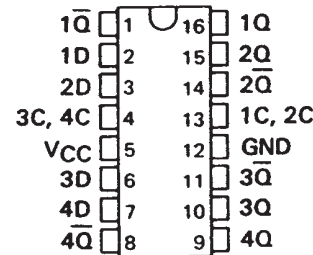
## description

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.

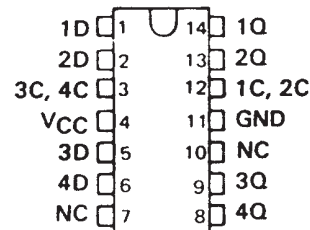
The '75 and 'LS75 feature complementary Q and  $\bar{Q}$  outputs from a 4-bit latch, and are available in various 16-pin packages. For higher component density applications, the '77 and 'LS77 4-bit latches are available in 14-pin flat packages.

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)

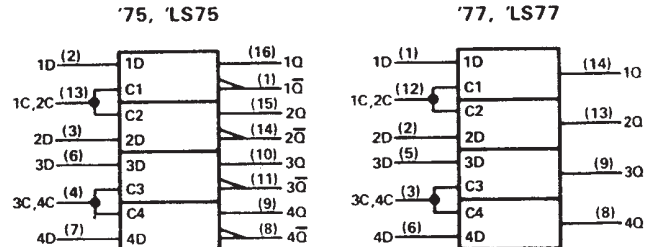


**SN5477, SN54LS77 . . . W PACKAGE**  
(TOP VIEW)



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 $150^{\circ}\text{C}$ |

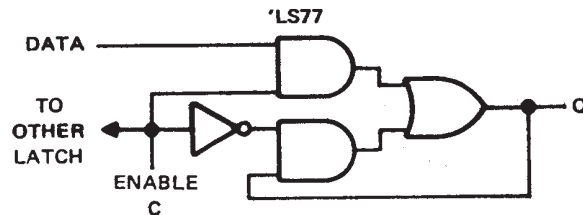
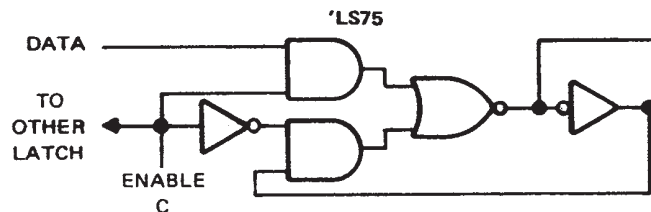
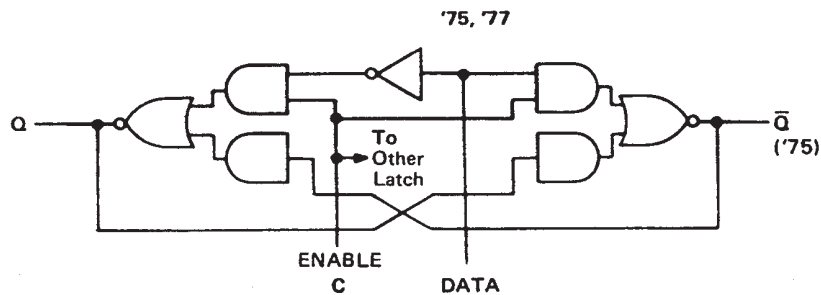
NOTES: 1. Voltage values are with respect to network ground terminal.

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

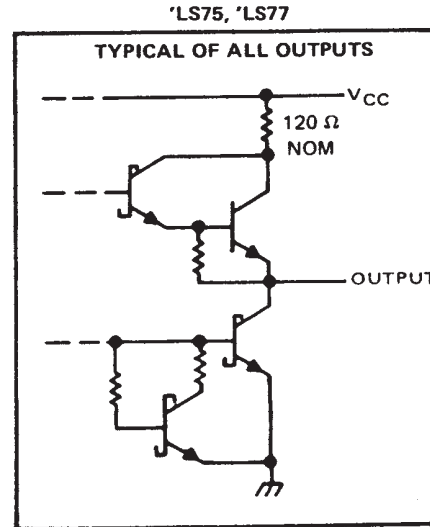
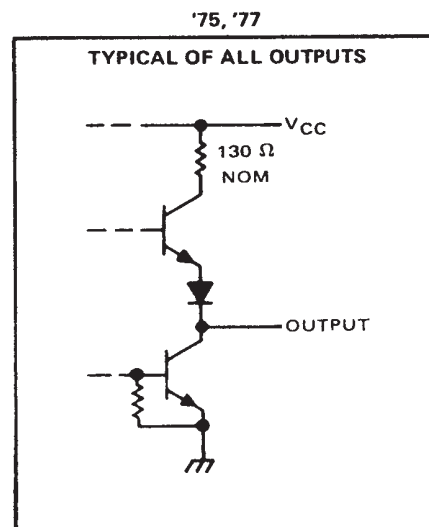
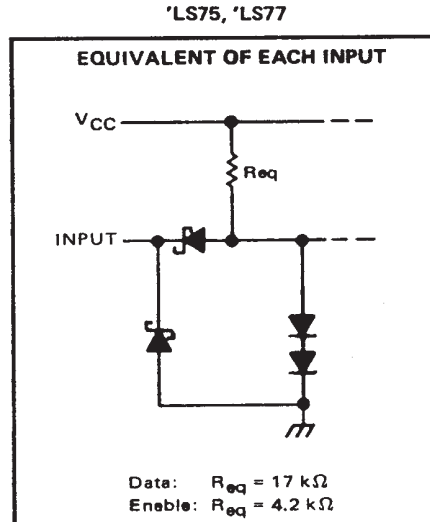
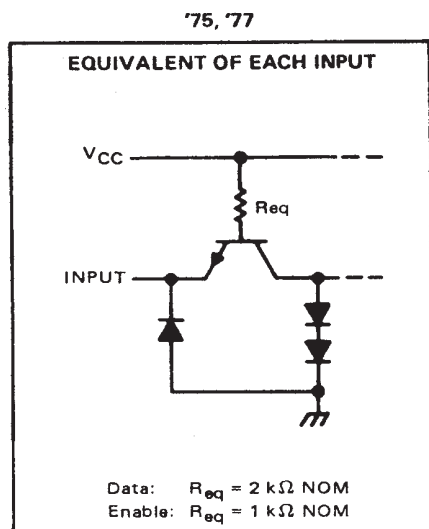
SN5475, SN5477, SN54LS75, SN54LS77  
 SN7475, SN74LS75  
 4-BIT BISTABLE LATCHES

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   | $^{\circ}$ 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               | D input                                                                                                    |     |      | 80   | $\mu$ A |
|           |                                        | C input                                                                                                    |     |      | 160  |         |
| $I_{IL}$  | Low-level input current                | D input                                                                                                    |     |      | –3.2 | mA      |
|           |                                        | C input                                                                                                    |     |      | –6.4 |         |
| $I_{OS}$  | Short-circuit output current§          | $V_{CC} = \text{MAX}$                                                                                      |     |      |      | mA      |
|           |                                        | SN54*                                                                                                      | –20 |      | –57  |         |
| $I_{CC}$  | Supply current                         | $V_{CC} = \text{MAX}$ ,<br>See Note 3                                                                      |     |      |      | mA      |
|           |                                        | SN54*                                                                                                      |     | 32   | 46   |         |
|           |                                        | SN74*                                                                                                      |     | 32   | 53   |         |

† 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‡ |
| V <sub>IH</sub> | High-level input voltage                  |                                                                  |                                                     | 2                    |      |          | 2    | V    |      |
| V <sub>IL</sub> | Low-level input voltage                   |                                                                  |                                                     |                      |      | 0.7      |      | 0.8  | V    |
| V <sub>IK</sub> | Input clamp voltage                       | V <sub>CC</sub> = MIN,                                           | I <sub>I</sub> = −18 mA                             |                      |      | −1.5     |      | −1.5 | V    |
| V <sub>OH</sub> | High-level output voltage                 | V <sub>CC</sub> = MIN,<br>V <sub>IL</sub> = V <sub>IL</sub> max, | V <sub>IH</sub> = 2 V,<br>I <sub>OH</sub> = −400 μA | 2.5                  | 3.5  |          | 2.7  | 3.5  | V    |
| V <sub>OL</sub> | Low-level output voltage                  | V <sub>CC</sub> = MIN,<br>V <sub>IL</sub> = V <sub>IL</sub> max  | I <sub>OL</sub> = 4 mA                              | 0.25                 | 0.4  |          | 0.25 | 0.4  | V    |
|                 |                                           |                                                                  | I <sub>OL</sub> = 8 mA                              |                      |      |          | 0.35 | 0.5  |      |
| I <sub>I</sub>  | Input current at<br>maximum input voltage | V <sub>CC</sub> = MAX,<br>V <sub>I</sub> = 7 V                   | D input                                             |                      | 0.1  |          |      | 0.1  | mA   |
|                 |                                           |                                                                  | C input                                             |                      | 0.4  |          |      | 0.4  |      |
| I <sub>IH</sub> | High-level input current                  | V <sub>CC</sub> = MAX,<br>V <sub>I</sub> = 2.7 V                 | D input                                             |                      | 20   |          |      | 20   | μA   |
|                 |                                           |                                                                  | C input                                             |                      | 80   |          |      | 80   |      |
| I <sub>IL</sub> | Low-level input current                   | V <sub>CC</sub> = MAX,<br>V <sub>I</sub> = 0.4 V                 | D input                                             |                      | −0.4 |          |      | −0.4 | mA   |
|                 |                                           |                                                                  | C input                                             |                      | −1.6 |          |      | −1.6 |      |
| I <sub>OS</sub> | Short-circuit output current §            | V <sub>CC</sub> = MAX                                            |                                                     | −20                  | −100 |          | −20  | −100 | mA   |
| I <sub>CC</sub> | Supply current                            | V <sub>CC</sub> = MAX,                                           | See Note 2                                          | 'LS75                | 6.3  | 12       | 6.3  | 12   | mA   |
|                 |                                           |                                                                  |                                                     | '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,  $V_{CC} = 5 \text{ V}, T_A = 25^{\circ}\text{C}$**

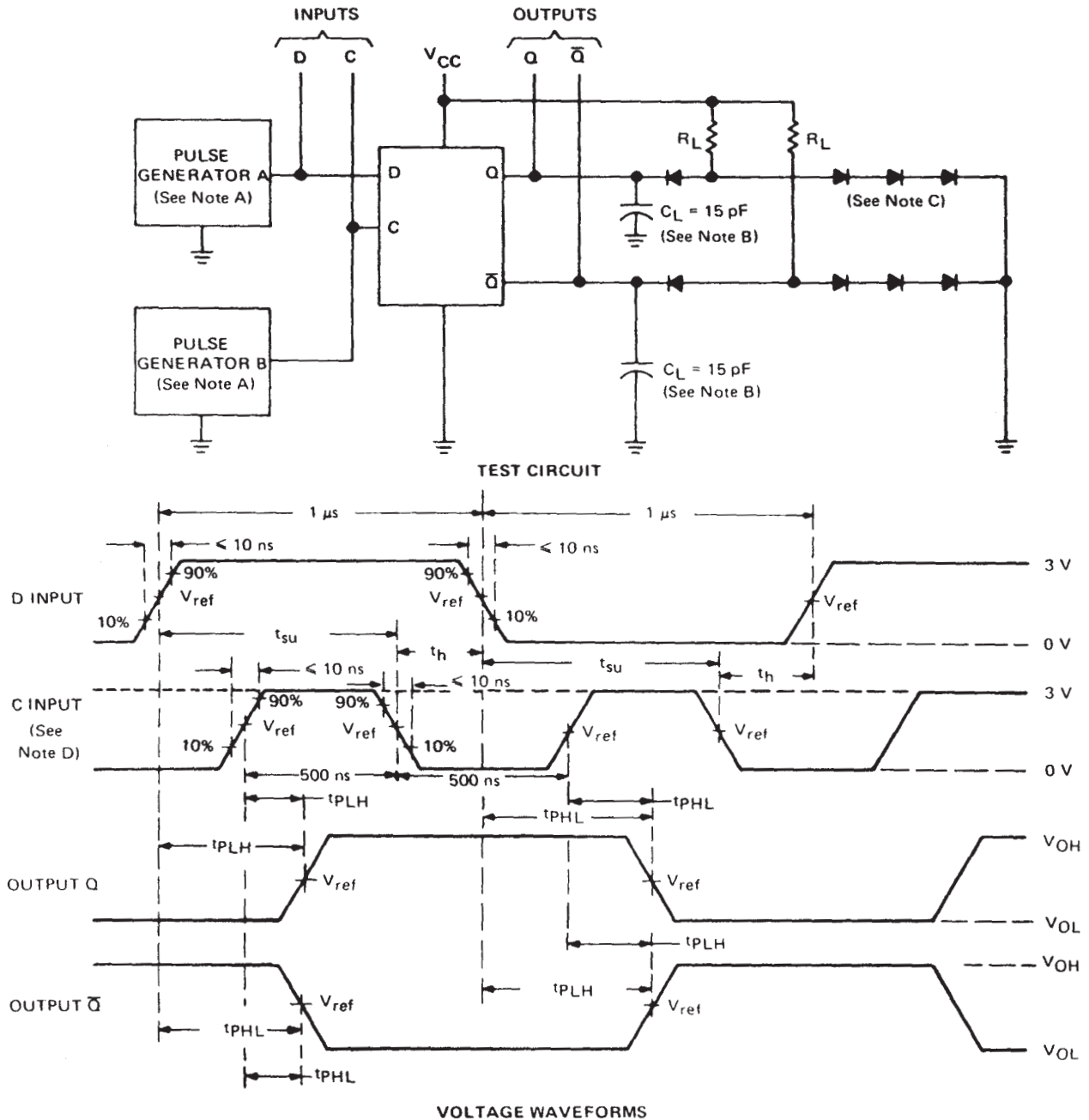
| PARAMETER¶ | FROM<br>(INPUT) | TO<br>(OUTPUT) | TEST CONDITIONS                           | 'LS75 |     |     | 'LS77 |     |     | UNIT |
|------------|-----------------|----------------|-------------------------------------------|-------|-----|-----|-------|-----|-----|------|
|            |                 |                |                                           | MIN   | TYP | MAX | MIN   | TYP | MAX |      |
| tPLH       | D               | Q              | CL = 15 pF,<br>RL = 2 kΩ,<br>See Figure 1 | 15    | 27  |     | 11    | 19  | ns  |      |
| tPHL       |                 |                |                                           | 9     | 17  |     | 9     | 17  |     |      |
| tPLH       | D               | Q̄             |                                           | 12    | 20  |     |       |     | ns  |      |
| tPHL       |                 |                |                                           | 7     | 15  |     |       |     |     |      |
| tPLH       | C               | Q              |                                           | 15    | 27  |     | 10    | 18  | ns  |      |
| tPHL       |                 |                |                                           | 14    | 25  |     | 10    | 18  |     |      |
| tPLH       | C               | Q̄             |                                           | 16    | 30  |     |       |     | ns  |      |
| tPHL       |                 |                |                                           | 7     | 15  |     |       |     |     |      |

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

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

switching characteristics†

# PARAMETER MEASUREMENT INFORMATION

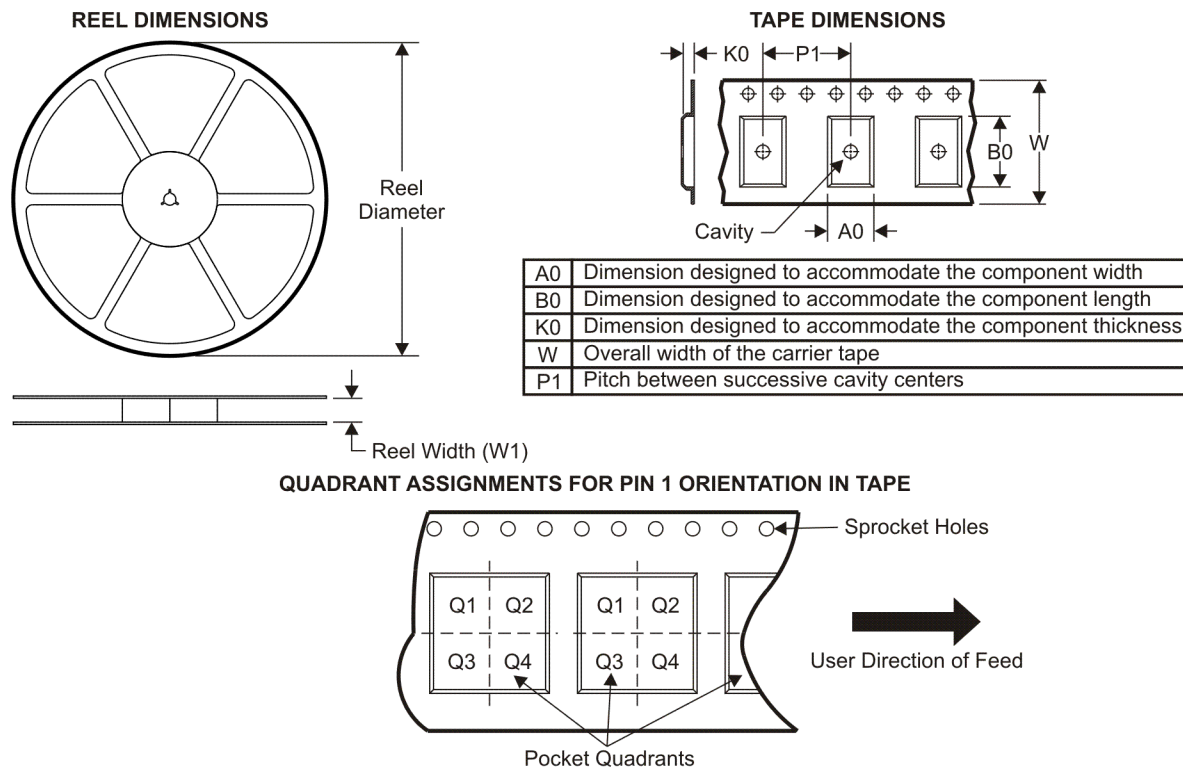


†Complementary Q outputs are on the '75 and 'LS75 only.

- 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

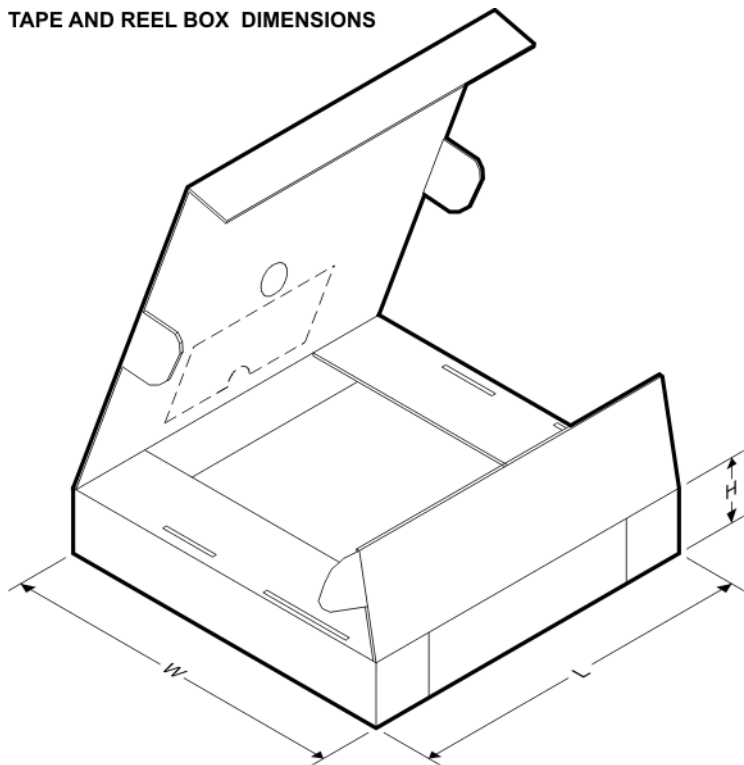
**TAPE AND REEL INFORMATION**



\*All dimensions are nominal

| Device      | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LS75DR  | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| SN74LS75NSR | SO           | NS              | 16   | 2000 | 330.0              | 16.4               | 8.2     | 10.5    | 2.5     | 12.0    | 16.0   | Q1            |

**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

| Device      | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LS75DR  | SOIC         | D               | 16   | 2500 | 333.2       | 345.9      | 28.6        |
| SN74LS75NSR | SO           | NS              | 16   | 2000 | 346.0       | 346.0      | 33.0        |

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

| Products                    |                                                                    | Applications               |                                                                                          |
|-----------------------------|--------------------------------------------------------------------|----------------------------|------------------------------------------------------------------------------------------|
| Amplifiers                  | <a href="http://amplifier.ti.com">amplifier.ti.com</a>             | Audio                      | <a href="http://www.ti.com/audio">www.ti.com/audio</a>                                   |
| Data Converters             | <a href="http://dataconverter.ti.com">dataconverter.ti.com</a>     | Automotive                 | <a href="http://www.ti.com/automotive">www.ti.com/automotive</a>                         |
| DLP® Products               | <a href="http://www.dlp.com">www.dlp.com</a>                       | Communications and Telecom | <a href="http://www.ti.com/communications">www.ti.com/communications</a>                 |
| DSP                         | <a href="http://dsp.ti.com">dsp.ti.com</a>                         | Computers and Peripherals  | <a href="http://www.ti.com/computers">www.ti.com/computers</a>                           |
| Clocks and Timers           | <a href="http://www.ti.com/clocks">www.ti.com/clocks</a>           | Consumer Electronics       | <a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>                   |
| Interface                   | <a href="http://interface.ti.com">interface.ti.com</a>             | Energy                     | <a href="http://www.ti.com/energy">www.ti.com/energy</a>                                 |
| Logic                       | <a href="http://logic.ti.com">logic.ti.com</a>                     | Industrial                 | <a href="http://www.ti.com/industrial">www.ti.com/industrial</a>                         |
| Power Mgmt                  | <a href="http://power.ti.com">power.ti.com</a>                     | Medical                    | <a href="http://www.ti.com/medical">www.ti.com/medical</a>                               |
| Microcontrollers            | <a href="http://microcontroller.ti.com">microcontroller.ti.com</a> | Security                   | <a href="http://www.ti.com/security">www.ti.com/security</a>                             |
| RFID                        | <a href="http://www.ti-rfid.com">www.ti-rfid.com</a>               | Space, Avionics & Defense  | <a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a> |
| RF/IF and ZigBee® Solutions | <a href="http://www.ti.com/lprf">www.ti.com/lprf</a>               | Video and Imaging          | <a href="http://www.ti.com/video">www.ti.com/video</a>                                   |
|                             |                                                                    | Wireless                   | <a href="http://www.ti.com/wireless-apps">www.ti.com/wireless-apps</a>                   |

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2010, Texas Instruments Incorporated