

7402, LS02, S02  
Gates

Quad Two-Input NOR Gate  
Product Specification

Logic Products

| TYPE   | TYPICAL PROPAGATION DELAY | TYPICAL SUPPLY CURRENT (TOTAL) |
|--------|---------------------------|--------------------------------|
| 7402   | 10ns                      | 11mA                           |
| 74LS02 | 10ns                      | 2.2mA                          |
| 74S02  | 3.5ns                     | 22mA                           |

ORDERING CODE

| PACKAGES    | COMMERCIAL RANGE                                        |
|-------------|---------------------------------------------------------|
|             | V <sub>CC</sub> = 5V ±5%; T <sub>A</sub> = 0°C to +70°C |
| Plastic DIP | N7402N, N74LS02N, N74S02N                               |
| Plastic SO  | N74LS02D, N74S02D                                       |

FUNCTION TABLE

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| L      | L | H      |
| L      | H | L      |
| H      | L | L      |
| H      | H | L      |

H = HIGH voltage level  
L = LOW voltage level

NOTE:

For information regarding devices processed to Military Specifications, see the Signetics Military Products Data Manual.

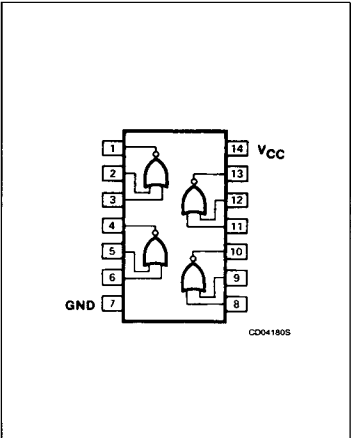
INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

| PINS | DESCRIPTION | 74   | 74S   | 74LS   |
|------|-------------|------|-------|--------|
| A, B | Inputs      | 1uI  | 1Sul  | 1LSul  |
| Y    | Output      | 10uI | 10Sul | 10LSul |

NOTE:

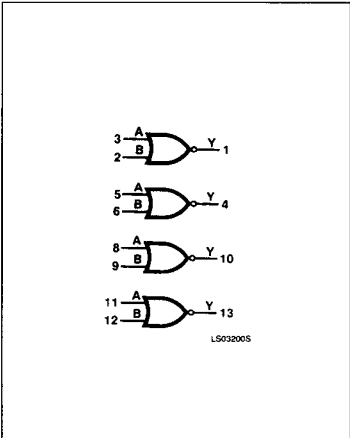
Where a 74 unit load (uI) is understood to be 40µA I<sub>IH</sub> and -1.6mA I<sub>IL</sub>, a 74S unit load (Sul) is 50µA I<sub>IH</sub> and -2.0mA I<sub>IL</sub>, and 74LS unit load (LSul) is 20µA I<sub>IH</sub> and -0.4mA I<sub>IL</sub>.

PIN CONFIGURATION



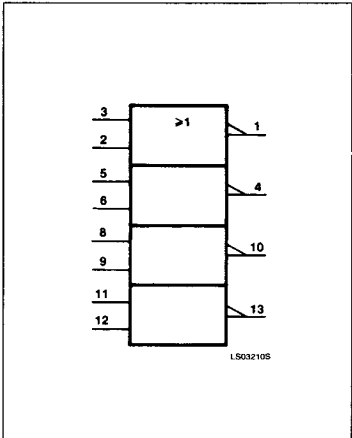
December 4, 1985

LOGIC SYMBOL



5-9

LOGIC SYMBOL (IEEE/IEC)



853-0502 81501

Gates

7402, LS02, S02

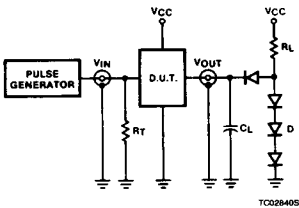
ABSOLUTE MAXIMUM RATINGS (Over operating free-air temperature range unless otherwise noted.)

| PARAMETER        |                                                | 74                       | 74LS                     | 74S                      | UNIT |
|------------------|------------------------------------------------|--------------------------|--------------------------|--------------------------|------|
| V <sub>CC</sub>  | Supply voltage                                 | 7.0                      | 7.0                      | 7.0                      | V    |
| V <sub>IN</sub>  | Input voltage                                  | -0.5 to +5.5             | -0.5 to +7.0             | -0.5 to +5.5             | V    |
| I <sub>IN</sub>  | Input current                                  | -30 to +5                | -30 to +1                | -30 to +5                | mA   |
| V <sub>OUT</sub> | Voltage applied to output in HIGH output state | -0.5 to +V <sub>CC</sub> | -0.5 to +V <sub>CC</sub> | -0.5 to +V <sub>CC</sub> | V    |
| T <sub>A</sub>   | Operating free-air temperature range           | 0 to 70                  |                          |                          | °C   |

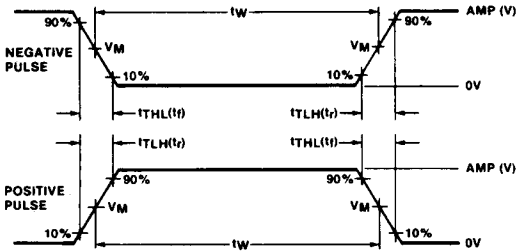
RECOMMENDED OPERATING CONDITIONS

| PARAMETER       |                                | 74   |     |      | 74LS |     |      | 74S  |     |       | UNIT |
|-----------------|--------------------------------|------|-----|------|------|-----|------|------|-----|-------|------|
|                 |                                | Min  | Nom | Max  | Min  | Nom | Max  | Min  | Nom | Max   |      |
| V <sub>CC</sub> | Supply voltage                 | 4.75 | 5.0 | 5.25 | 4.75 | 5.0 | 5.25 | 4.75 | 5.0 | 5.25  | V    |
| V <sub>IH</sub> | HIGH-level input voltage       | 2.0  |     |      | 2.0  |     |      | 2.0  |     |       | V    |
| V <sub>IL</sub> | LOW-level input voltage        |      |     | +0.8 |      |     | +0.8 |      |     | +0.8  | V    |
| I <sub>IK</sub> | Input clamp current            |      |     | −12  |      |     | −18  |      |     | −18   | mA   |
| I <sub>OH</sub> | HIGH-level output current      |      |     | −400 |      |     | −400 |      |     | −1000 | μA   |
| I <sub>OL</sub> | LOW-level output current       |      |     | 16   |      |     | 8    |      |     | 20    | mA   |
| T <sub>A</sub>  | Operating free-air temperature | 0    |     | 70   | 0    |     | 70   | 0    |     | 70    | °C   |

TEST CIRCUITS AND WAVEFORMS



TC02B405



WF064505

**Test Circuit For 74 Totem-Pole Outputs**

**DEFINITIONS**

R<sub>L</sub> = Load resistor to V<sub>CC</sub>; see AC CHARACTERISTICS for value.

C<sub>L</sub> = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

R<sub>T</sub> = Termination resistance should be equal to Z<sub>OUT</sub> of Pulse Generators.

D = Diodes are 1N916, 1N3064, or equivalent.

t<sub>TLH</sub>, t<sub>FHL</sub> Values should be less than or equal to the table entries.

**Input Pulse Definitions**

| FAMILY | INPUT PULSE REQUIREMENTS |           |             |                  |                  |
|--------|--------------------------|-----------|-------------|------------------|------------------|
|        | Amplitude                | Rep. Rate | Pulse Width | t <sub>TLH</sub> | t <sub>FHL</sub> |
| 74     | 3.0V                     | 1MHz      | 500ns       | 7ns              | 7ns              |
| 74LS   | 3.0V                     | 1MHz      | 500ns       | 15ns             | 6ns              |
| 74S    | 3.0V                     | 1MHz      | 500ns       | 2.5ns            | 2.5ns            |

## Gates

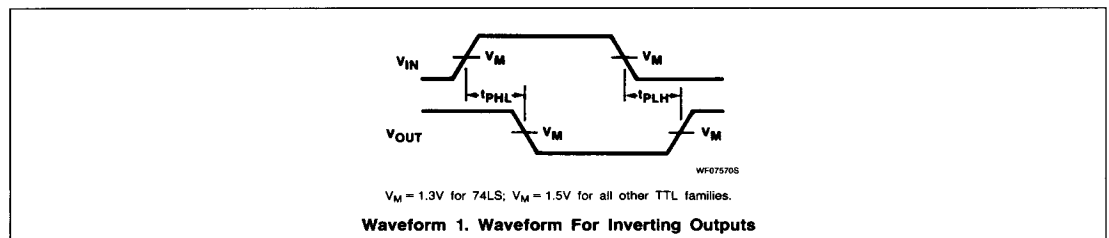
## 7402, LS02, S02

**DC ELECTRICAL CHARACTERISTICS** (Over recommended operating free-air temperature range unless otherwise noted.)

| PARAMETER                                                 | TEST CONDITIONS <sup>1</sup>                                        |                               | 7402 |                  |      | 74LS02 |                  |      | 74S02 |                  |      | UNIT |
|-----------------------------------------------------------|---------------------------------------------------------------------|-------------------------------|------|------------------|------|--------|------------------|------|-------|------------------|------|------|
|                                                           |                                                                     |                               | Min  | Typ <sup>2</sup> | Max  | Min    | Typ <sup>2</sup> | Max  | Min   | Typ <sup>2</sup> | Max  |      |
| V <sub>OH</sub> HIGH-level output voltage                 | V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, I <sub>OH</sub> = MAX |                               | 2.4  | 3.4              |      | 2.7    | 3.4              |      | 2.7   | 3.4              |      | V    |
| V <sub>OL</sub> LOW-level output voltage                  | V <sub>CC</sub> = MIN, V <sub>IH</sub> = MIN                        | I <sub>OL</sub> = MAX         |      | 0.2              | 0.4  |        | 0.35             | 0.5  |       |                  | 0.5  | V    |
|                                                           |                                                                     | I <sub>OL</sub> = 4mA         |      |                  |      |        | 0.25             | 0.4  |       |                  |      | V    |
| V <sub>IK</sub> Input clamp voltage                       | V <sub>CC</sub> = MIN, I <sub>I</sub> = I <sub>IK</sub>             |                               |      |                  | −1.5 |        |                  | −1.5 |       |                  | −1.2 | V    |
| I <sub>I</sub> Input current at maximum input voltage     | V <sub>CC</sub> = MAX                                               | V <sub>I</sub> = 5.5V         |      |                  | 1.0  |        |                  |      |       |                  | 1.0  | mA   |
|                                                           |                                                                     | V <sub>I</sub> = 7.0V         |      |                  |      |        |                  | 0.1  |       |                  |      | mA   |
| I <sub>IH</sub> HIGH-level input current                  | V <sub>CC</sub> = MAX                                               | V <sub>I</sub> = 2.4V         |      |                  | 40   |        |                  |      |       |                  |      | μA   |
|                                                           |                                                                     | V <sub>I</sub> = 2.7V         |      |                  |      |        |                  | 20   |       |                  | 50   | μA   |
| I <sub>IL</sub> LOW-level input current                   | V <sub>CC</sub> = MAX                                               | V <sub>I</sub> = 0.4V         |      |                  | −1.6 |        |                  | −0.4 |       |                  |      | mA   |
|                                                           |                                                                     | V <sub>I</sub> = 0.5V         |      |                  |      |        |                  |      |       |                  | −2.0 | mA   |
| I <sub>OS</sub> Short-circuit output current <sup>3</sup> | V <sub>CC</sub> = MAX                                               |                               | −18  |                  | −55  | −20    |                  | −100 | −40   |                  | −100 | mA   |
| I <sub>CC</sub> Supply current (total)                    | V <sub>CC</sub> = MAX                                               | I <sub>CCH</sub> Outputs HIGH |      | 8                | 16   |        | 1.6              | 3.2  |       | 17               | 29   | mA   |
|                                                           |                                                                     | I <sub>CCL</sub> Outputs LOW  |      | 14               | 27   |        | 2.8              | 5.4  |       | 26               | 45   | mA   |

**NOTES:**

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
- All typical values are at  $V_{CC} = 5\text{V}$ ,  $T_A = 25^\circ\text{C}$ .
- $I_{OS}$  is tested with  $V_{OUT} = +0.5\text{V}$  and  $V_{CC} = V_{CC} \text{ MAX} + 0.5\text{V}$ . Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.

**AC WAVEFORM****AC ELECTRICAL CHARACTERISTICS**  $T_A = 25^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V}$ 

| PARAMETER              |                   | TEST CONDITIONS | 74                                   |          | 74LS                                       |          | 74S                                  |            | UNIT |
|------------------------|-------------------|-----------------|--------------------------------------|----------|--------------------------------------------|----------|--------------------------------------|------------|------|
|                        |                   |                 | $C_L = 15\text{pF}, R_L = 400\Omega$ |          | $C_L = 15\text{pF}, R_L = 2\text{k}\Omega$ |          | $C_L = 15\text{pF}, R_L = 280\Omega$ |            |      |
|                        |                   |                 | Min                                  | Max      | Min                                        | Max      | Min                                  | Max        |      |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay | Waveform 1      |                                      | 22<br>15 |                                            | 15<br>15 |                                      | 5.5<br>5.5 | ns   |