

# **SN5437, SN54LS37, SN54S37, SN7437, SN74LS37, SN74S37** **QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS**

DECEMBER 1983—REVISED MARCH 1988

- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers and Flat Packages, and Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

## description

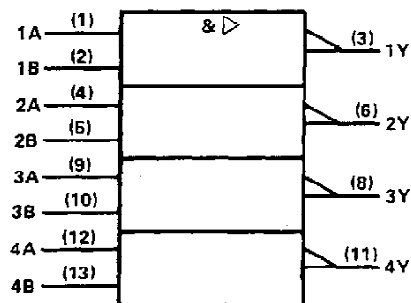
These devices contain four independent 2-input NAND buffer gates.

The SN5437, SN54LS37 and SN54S37 are characterized for operation over the full military range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN7437, SN74LS37 and SN74S37 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

**FUNCTION TABLE (each gate)**

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

## logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

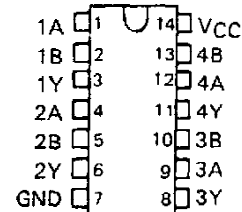
Pin numbers shown are for D, J, N, and W packages.

SN5437, SN54LS37, SN54S37 . . . J OR W PACKAGE

SN7437 . . . N PACKAGE

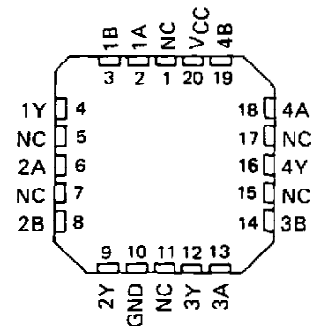
SN74LS37, SN74S37 . . . D OR N PACKAGE

(TOP VIEW)



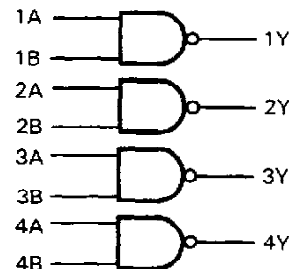
SN54LS37, SN54S37 . . . FK PACKAGE

(TOP VIEW)



NC - No internal connection

## logic diagram



## positive logic

$$Y = A \cdot B \text{ or } Y = \overline{A} + \overline{B}$$

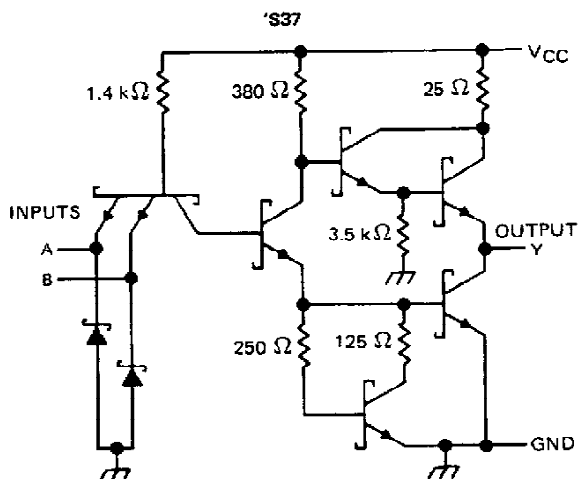
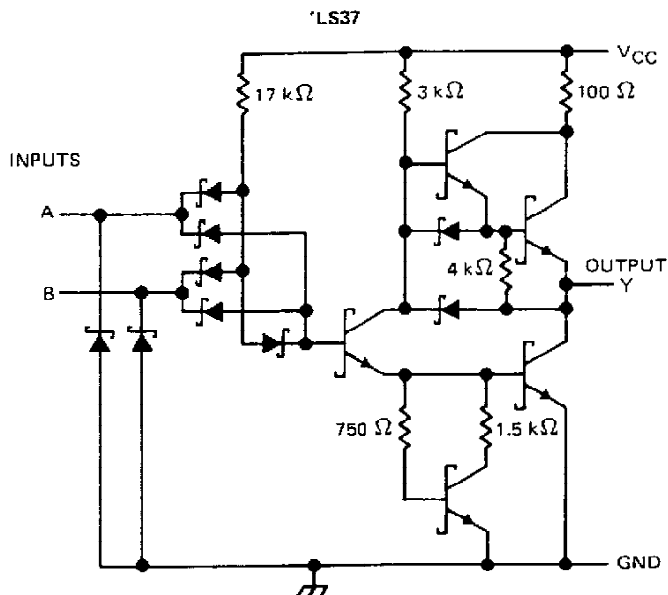
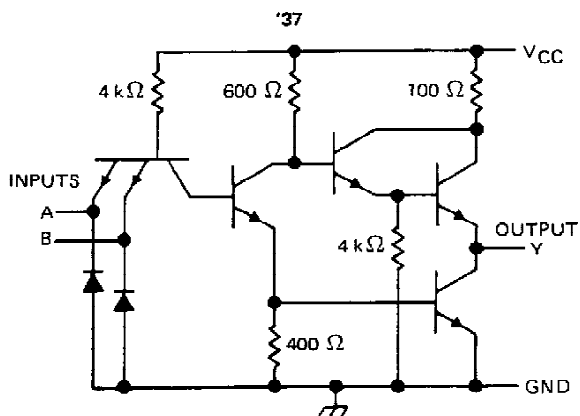
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# **SN5437, SN54LS37, SN437 SN7437, SN74LS37, SN7437 QUADRUPL 2-INPUT POSITIVE-NAND BUFFERS**

schematics (each gate)



Resistor values shown are nominal.

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

|                                       |                |
|---------------------------------------|----------------|
| Supply voltage, $V_{CC}$ (see Note 1) | 7 V            |
| Input voltage: '37, 'S37              | 5.5 V          |
| 'LS37                                 | 7 V            |
| Operating free-air temperature: SN54' | -55°C to 125°C |
| SN74'                                 | 0°C to 70°C    |
| Storage temperature range             | -65°C to 150°C |

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

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# SN5437, SN7437

## QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS

### recommended operating conditions

|                                      | SN5437 |     |      | SN7437 |     |      | UNIT |
|--------------------------------------|--------|-----|------|--------|-----|------|------|
|                                      | MIN    | NOM | MAX  | MIN    | NOM | MAX  |      |
| $V_{CC}$ Supply voltage              | 4.5    | 5   | 5.5  | 4.75   | 5   | 5.25 | V    |
| $V_{IH}$ High-level input voltage    | 2      |     |      | 2      |     |      | V    |
| $V_{IL}$ Low-level input voltage     |        |     | 0.8  |        |     | 0.8  | V    |
| $I_{OH}$ High-level output current   |        |     | -1.2 |        |     | -1.2 | mA   |
| $I_{OL}$ Low-level output current    |        |     | 48   |        |     | 48   | mA   |
| $T_A$ Operating free-air temperature | -55    |     | 125  | 0      |     | 70   | °C   |

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

| PARAMETER  | TEST CONDITIONS †                                                       | SN5437 |       |      | SN7437 |       |      | UNIT |
|------------|-------------------------------------------------------------------------|--------|-------|------|--------|-------|------|------|
|            |                                                                         | MIN    | TYP ‡ | MAX  | MIN    | TYP ‡ | MAX  |      |
| $V_{IK}$   | $V_{CC} = \text{MIN}, I_I = -12 \text{ mA}$                             |        |       | -1.5 |        |       | -1.5 | V    |
| $V_{OH}$   | $V_{CC} = \text{MIN}, V_{IL} = 0.8 \text{ V}, I_{OH} = -1.2 \text{ mA}$ | 2.4    | 3.3   |      | 2.4    | 3.3   |      | V    |
| $V_{OL}$   | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 48 \text{ mA}$     |        | 0.2   | 0.4  |        | 0.2   | 0.4  | V    |
| $I_I$      | $V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$                              |        |       | 1    |        |       | 1    | mA   |
| $I_{IH}$   | $V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$                              |        |       | 40   |        |       | 40   | µA   |
| $I_{IL}$   | $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$                              |        |       | -1.6 |        |       | -1.6 | mA   |
| $I_{OS} §$ | $V_{CC} = \text{MAX}$                                                   | -20    |       | -70  | -18    |       | -70  | mA   |
| $I_{CCH}$  | $V_{CC} = \text{MAX}, V_I = 0 \text{ V}$                                |        | 9     | 15.5 |        | 9     | 15.5 | mA   |
| $I_{CCL}$  | $V_{CC} = \text{MAX}, V_I = 4.5 \text{ V}$                              |        | 34    | 54   |        | 34    | 54   | mA   |

† 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 the duration of the short circuit should not exceed one second.

### switching characteristics, $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$ (see note 2)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS     |                       | MIN | TYP | MAX | UNIT |
|-----------|--------------|-------------|---------------------|-----------------------|-----|-----|-----|------|
| $t_{PLH}$ | A or B       | Y           | $R_L = 133 \Omega,$ | $C_L = 45 \text{ pF}$ |     | 13  | 22  | ns   |
| $t_{PHL}$ |              |             |                     |                       |     | 8   | 15  | ns   |

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

# SN54LS37, SN74LS37

## QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS

### recommended operating conditions

|          |                                | SN54LS37 |     |      | SN74LS37 |     |      | UNIT |
|----------|--------------------------------|----------|-----|------|----------|-----|------|------|
|          |                                | MIN      | NOM | MAX  | MIN      | NOM | MAX  |      |
| $V_{CC}$ | Supply voltage                 | 4.5      | 5   | 5.5  | 4.75     | 5   | 5.25 | V    |
| $V_{IH}$ | High-level input voltage       | 2        |     |      | 2        |     |      | V    |
| $V_{IL}$ | Low-level input voltage        |          |     | 0.7  |          |     | 0.8  | V    |
| $I_{OH}$ | High-level output current      |          |     | -1.2 |          |     | -1.2 | mA   |
| $I_{OL}$ | Low-level output current       |          |     | 12   |          |     | 24   | mA   |
| $T_A$    | Operating free-air temperature | -55      |     | 125  | 0        |     | 70   | °C   |

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

| PARAMETER  | TEST CONDITIONS †                                                    | SN54LS37 |       |      | SN74LS37 |       |      | UNIT |
|------------|----------------------------------------------------------------------|----------|-------|------|----------|-------|------|------|
|            |                                                                      | MIN      | TYP ‡ | MAX  | MIN      | TYP ‡ | MAX  |      |
| $V_{IK}$   | $V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$                          |          |       | -1.5 |          |       | -1.5 | V    |
| $V_{OH}$   | $V_{CC} = \text{MIN}, V_{IL} = \text{MAX}, I_{OH} = -1.2 \text{ mA}$ | 2.5      | 3.4   |      | 2.7      | 3.4   |      | V    |
| $V_{OL}$   | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 12 \text{ mA}$  |          | 0.25  | 0.4  |          | 0.25  | 0.4  | V    |
|            | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 24 \text{ mA}$  |          |       |      |          | 0.35  | 0.5  |      |
| $I_I$      | $V_{CC} = \text{MAX}, V_I = 7 \text{ V}$                             |          |       | 0.1  |          |       | 0.1  | mA   |
| $I_{IH}$   | $V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$                           |          |       | 20   |          |       | 20   | µA   |
| $I_{IL}$   | $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$                           |          |       | -0.4 |          |       | -0.4 | mA   |
| $I_{OS} §$ | $V_{CC} = \text{MAX}$                                                | -30      |       | -130 | -30      |       | -130 | mA   |
| $I_{CCH}$  | $V_{CC} = \text{MAX}, V_I = 0 \text{ V}$                             |          | 0.9   | 2    |          | 0.9   | 2    | mA   |
| $I_{CCL}$  | $V_{CC} = \text{MAX}, V_I = 4.5 \text{ V}$                           |          | 6     | 12   |          | 6     | 12   | mA   |

† 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 the duration of the short-circuit should not exceed one second.

### switching characteristics, $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$ (see note 2)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS                         | MIN | TYP | MAX | UNIT |
|-----------|--------------|-------------|-----------------------------------------|-----|-----|-----|------|
| $t_{PLH}$ | A or B       | Y           | $R_L = 667 \Omega, C_L = 45 \text{ pF}$ |     | 12  | 24  | ns   |
| $t_{PHL}$ |              |             |                                         |     | 12  | 24  | ns   |

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.



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# SN54S37, SN74S37 QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS

## recommended operating conditions

|                                               | SN54S37 |     |     | SN74S37 |     |      | UNIT |
|-----------------------------------------------|---------|-----|-----|---------|-----|------|------|
|                                               | MIN     | NOM | MAX | MIN     | NOM | MAX  |      |
| V <sub>CC</sub> Supply voltage                | 4.5     | 5   | 5.5 | 4.75    | 5   | 5.25 | V    |
| V <sub>IH</sub> High-level input voltage      | 2       |     |     | 2       |     |      | V    |
| V <sub>IL</sub> Low-level input voltage       |         |     | 0.8 |         |     | 0.8  | V    |
| I <sub>OH</sub> High-level output current     |         |     | -3  |         |     | -3   | mA   |
| I <sub>OL</sub> Low-level output current      |         |     | 60  |         |     | 60   | mA   |
| T <sub>A</sub> Operating free-air temperature | -55     |     | 125 | 0       |     | 70   | °C   |

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

| PARAMETER         | TEST CONDITIONS †                                                       | SN54S37 |       |      | SN74S37 |       |      | UNIT |
|-------------------|-------------------------------------------------------------------------|---------|-------|------|---------|-------|------|------|
|                   |                                                                         | MIN     | TYP ‡ | MAX  | MIN     | TYP ‡ | MAX  |      |
| V <sub>IK</sub>   | V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA                          |         |       | -1.2 |         |       | -1.2 | V    |
| V <sub>OH</sub>   | V <sub>CC</sub> = MIN, V <sub>IL</sub> = 0.8 V, I <sub>OH</sub> = -3 mA | 2.5     | 3.4   |      | 2.7     | 3.4   |      | V    |
| V <sub>OL</sub>   | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 60 mA   |         |       | 0.5  |         |       | 0.5  | V    |
| I <sub>I</sub>    | V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V                           |         |       | 1    |         |       | 1    | mA   |
| I <sub>IH</sub>   | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V                           |         |       | 0.1  |         |       | 0.1  | mA   |
| I <sub>IL</sub>   | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5 V                           |         |       | -4   |         |       | -4   | mA   |
| I <sub>OS</sub> § | V <sub>CC</sub> = MAX                                                   | -50     |       | -225 | -50     |       | -225 | mA   |
| I <sub>CCH</sub>  | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0 V                             |         | 20    | 36   |         | 20    | 36   | mA   |
| I <sub>CCL</sub>  | V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5                             |         | 46    | 80   |         | 46    | 80   | mA   |

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

‡ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

§ Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed 100 milliseconds.

## switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 2)

| PARAMETER        | FROM<br>(INPUT) | TO<br>(OUTPUT) | TEST CONDITIONS                                | MIN | TYP | MAX | UNIT |
|------------------|-----------------|----------------|------------------------------------------------|-----|-----|-----|------|
| t <sub>PLH</sub> | A or B          | Y              | R <sub>L</sub> = 93 Ω, C <sub>L</sub> = 50 pF  |     | 4   | 6.5 | ns   |
| t <sub>PHL</sub> |                 |                |                                                |     | 4   | 6.5 | ns   |
| t <sub>PLH</sub> |                 |                | R <sub>L</sub> = 93 Ω, C <sub>L</sub> = 150 pF |     | 6   |     | ns   |
| t <sub>PHL</sub> |                 |                |                                                |     | 6   |     | ns   |

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

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