

SDLS028

# SN5403, SN54LS03, SN54S03, SN7403, SN74LS03, SN74S03

## QUADRUPLE 2-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS

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

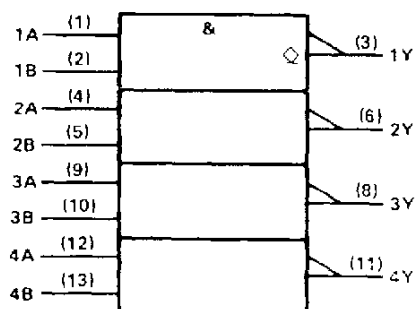
These devices contain four independent 2-input-NAND gates. The open-collector outputs require pull-up resistors to perform correctly. They may be connected to other open-collector outputs to implement active-low wired-OR or active-high wired-AND functions. Open-collector devices are often used to generate higher  $V_{OH}$  levels.

The SN5403, SN54LS03 and SN54S03 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN7403, SN74LS03 and SN74S03 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†

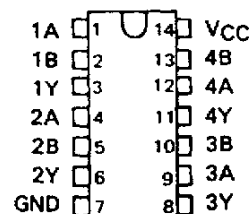


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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

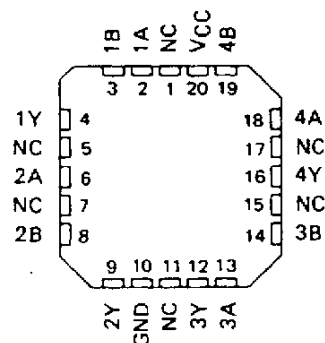
SN5403 . . . J OR W PACKAGE  
SN54LS03, SN54S03 . . . J OR W PACKAGE  
SN7403 . . . N PACKAGE  
SN74LS03, SN74S03 . . . D OR N PACKAGE

(TOP VIEW)



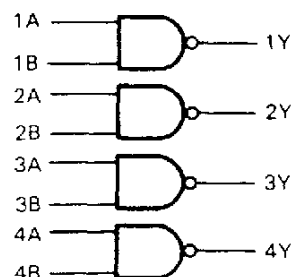
SN54LS03, SN54S03 . . . FK PACKAGE

(TOP VIEW)



NC - No internal connection

### logic diagram (positive logic)



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

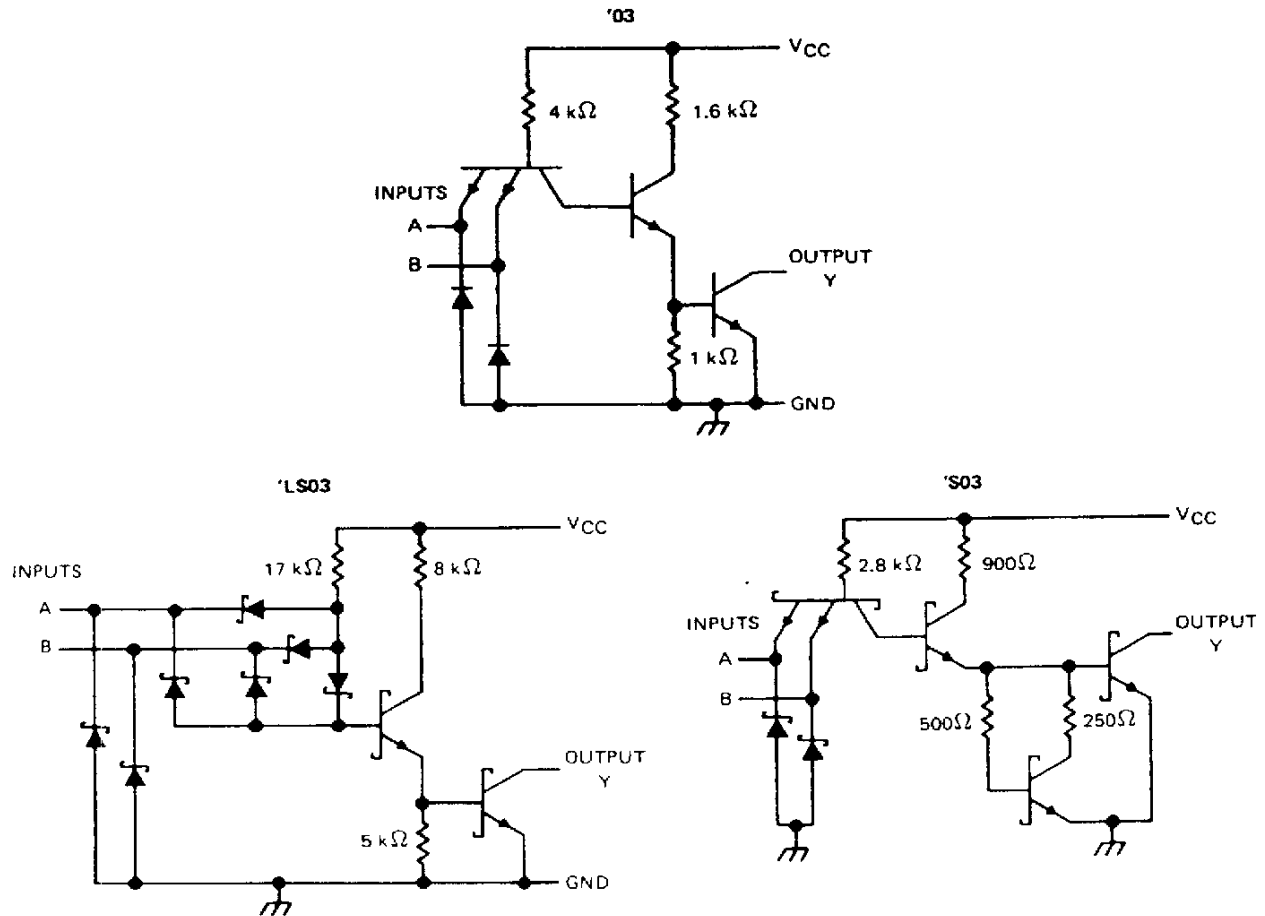
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TEXAS  
INSTRUMENTS

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**SN5403, SN54LS03, SN54S03,  
SN7403, SN74LS03, SN74S03**  
**QUADRUPLE 2-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS**

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: '03, 'S03                    | 5.5 V          |
| 'LS03                                       | 7 V            |
| Off-state output voltage                    | 7 V            |
| Operating free-air temperature range: 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.

# **SN5403, SN7403** **QUADRUPLE 2-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS**

## recommended operating conditions

|                                      | SN5403 |     |     | SN7403 |     |      | 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    |
| $V_{OH}$ High-level output voltage   |        |     | 5.5 |        |     | 5.5  | V    |
| $I_{OL}$ Low-level output current    |        |     | 16  |        |     | 16   | 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†  | SN5403 |      |      | SN7403 |      |      | UNIT |
|-----------|---|--------|------|------|--------|------|------|------|
|           |   | MIN    | TYP‡ | MAX  | MIN    | TYP‡ | MAX  |      |
| $V_{IK}$  | $V_{CC} = \text{MIN}, I_I = -12 \text{ mA}$                           |        |      | -1.5 |        |      | -1.5 | V    |
| $I_{OH}$  | $V_{CC} = \text{MIN}, V_{IL} = 0.8 \text{ V}, V_{OH} = 5.5 \text{ V}$ |        |      |      |        |      | 0.25 | mA   |
|           | $V_{CC} = \text{MIN}, V_{IL} = 0.7 \text{ V}, V_{OH} = 5.5 \text{ V}$ |        |      | 0.25 |        |      |      |      |
| $V_{OL}$  | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 16 \text{ mA}$   |        | 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   |
| $I_{CCH}$ | $V_{CC} = \text{MAX}, V_I = 0$  |        | 4    | 8    |        | 4    | 8    | mA   |
| $I_{CCL}$ | $V_{CC} = \text{MAX}, V_I = 4.5 \text{ V}$                            |        | 12   | 22   |        | 12   | 22   | mA   |

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

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

## 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           | $R_L = 4 \text{ k}\Omega,$ | $C_L = 15 \text{ pF}$ |     | 35  | 45  | ns   |
| $t_{PHL}$ |              |             | $R_L = 400 \Omega,$        | $C_L = 15 \text{ pF}$ |     | 8   | 15  | ns   |

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

# **SN54LS03, SN74LS03** **QUADRUPLE 2-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS**

## **recommended operating conditions**

|                                      | SN54LS03 |     |     | SN74LS03 |     |      | 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    |
| $V_{OH}$ High-level output voltage   |          |     | 5.5 |          |     | 5.5  | V    |
| $I_{OL}$ Low-level output current    |          |     | 4   |          |     | 8    | 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†   | SN54LS03 |      |     | SN74LS03 |      |     | UNIT |
|-----------|--|----------|------|-----|----------|------|-----|------|
|           |  | MIN      | TYP‡ | MAX | MIN      | TYP‡ | MAX |      |
| $V_{IK}$  | $V_{CC} = \text{MIN.}$ , $I_I = -18 \text{ mA}$                            |          | -1.5 |     |          | -1.5 |     | V    |
| $I_{OH}$  | $V_{CC} = \text{MIN.}$ , $V_{IL} = \text{MAX.}$ , $V_{OH} = 5.5 \text{ V}$ |          | 0.1  |     |          | 0.1  |     | mA   |
| $V_{OL}$  | $V_{CC} = \text{MIN.}$ , $V_{IH} = 2 \text{ V}$ , $I_{OL} = 4 \text{ mA}$  | 0.25     | 0.4  |     | 0.25     | 0.4  |     | V    |
|           | $V_{CC} = \text{MIN.}$ , $V_{IH} = 2 \text{ V}$ , $I_{OL} = 8 \text{ mA}$  |          |      |     | 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   |
| $I_{CCH}$ | $V_{CC} = \text{MAX.}$ , $V_I = 0$   | 0.8      | 1.6  |     | 0.8      | 1.6  |     | mA   |
| $I_{CCL}$ | $V_{CC} = \text{MAX.}$ , $V_I = 4.5 \text{ V}$                             | 2.4      | 4.4  |     | 2.4      | 4.4  |     | mA   |

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

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

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

| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | TEST CONDITIONS                                   | MIN | TYP | MAX | UNIT |
|-----------|-----------------|----------------|---|-----|-----|-----|------|
| $t_{PLH}$ | A or B          | Y              | $R_L = 2 \text{ k}\Omega$ , $C_L = 15 \text{ pF}$ | 17  | 32  |     | ns   |
| $t_{PHL}$ |                 |                |   | 15  | 28  |     | ns   |

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

# **SN54S03, SN74S03** **QUADRUPL 2-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS**

recommended operating conditions

|                                      | SN54S03 |     |     | SN74S03 |     |      | 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    |
| $V_{OH}$ High-level output voltage   |         |     | 5.5 |         |     | 5.5  | V    |
| $I_{OL}$ Low-level output current    |         |     | 20  |         |     | 20   | 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†  | SN54S03 |      |      | SN74S03 |      |     | UNIT |
|-----------|---|---------|------|------|---------|------|-----|------|
|           |   | MIN     | TYP‡ | MAX  | MIN     | TYP‡ | MAX |      |
| $V_{IK}$  | $V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$                           |         | -1.2 |      |         | -1.2 |     | V    |
| $I_{OH}$  | $V_{CC} = \text{MIN}, V_{IL} = 0.8 \text{ V}, V_{OH} = 5.5 \text{ V}$ |         |      |      |         | 0.25 |     | mA   |
|           | $V_{CC} = \text{MIN}, V_{IL} = 0.7 \text{ V}, V_{OH} = 5.5 \text{ V}$ |         |      | 0.25 |         |      |     |      |
| $V_{OL}$  | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 20 \text{ mA}$   |         |      | 0.5  |         |      | 0.5 | V    |
| $I_I$     | $V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$                            |         |      | 1    |         |      | 1   | mA   |
| $I_{IH}$  | $V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$                            |         |      | 50   |         |      | 50  | µA   |
| $I_{IL}$  | $V_{CC} = \text{MAX}, V_I = 0.5 \text{ V}$                            |         |      | -2   |         |      | -2  | mA   |
| $I_{CCH}$ | $V_{CC} = \text{MAX}, V_I = 0$  | 6       | 13.2 |      | 6       | 13.2 |     | mA   |
| $I_{CCL}$ | $V_{CC} = \text{MAX}, V_I = 4.5 \text{ V}$                            | 20      | 36   |      | 20      | 36   |     | mA   |

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

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

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           | $R_L = 280 \Omega, C_L = 15 \text{ pF}$ | 2   | 5   | 7.5 | ns   |
| $t_{PHL}$ |              |             |   | 2   | 4.5 | 7   | ns   |
| $t_{PLH}$ |              |             | $R_L = 280 \Omega, C_L = 50 \text{ pF}$ |     | 7.5 |     | ns   |
| $t_{PHL}$ |              |             |   |     | 7   |     | ns   |

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

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