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

APRIL 1985 — 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

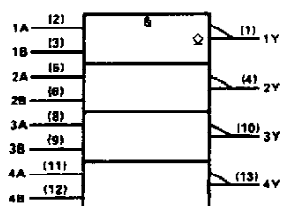
These devices contain four independent 2-input NAND gates. The open-collector outputs require pull-up resistors to perform correctly. They may be connected to other open-collector outputs to implement active-low wired-OR or active-high wired-AND functions. Open-collector devices are often used to generate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

The SN5401 and SN54LS01 are characterized for operation over the full military temperature range of -55°C to 125°C . The SN7401 and SN74LS01 are characterized for operation from 0°C to 70°C .

FUNCTION TABLE (each gate)

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

logic symbol†

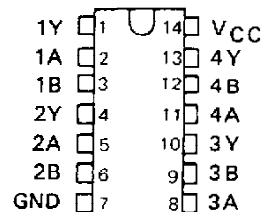


†This symbol is in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

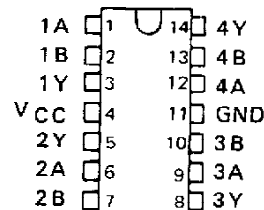
Pin numbers shown are for D, J, N, and W packages.

SN5401 . . . J PACKAGE
SN54LS01 . . . J OR W PACKAGE
SN7401 . . . N PACKAGE
SN74LS01 . . . D OR N PACKAGE

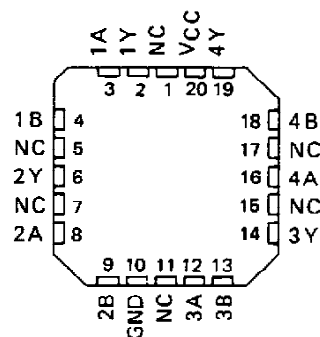
(TOP VIEW)



SN5401 . . . W PACKAGE
(TOP VIEW)



SN54LS01 . . . FK PACKAGE
(TOP VIEW)



NC - No internal connection

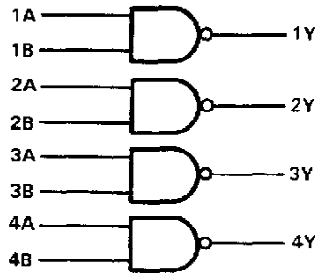
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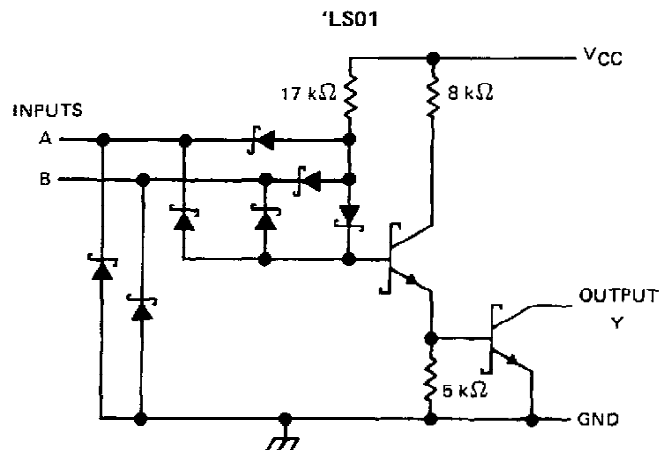
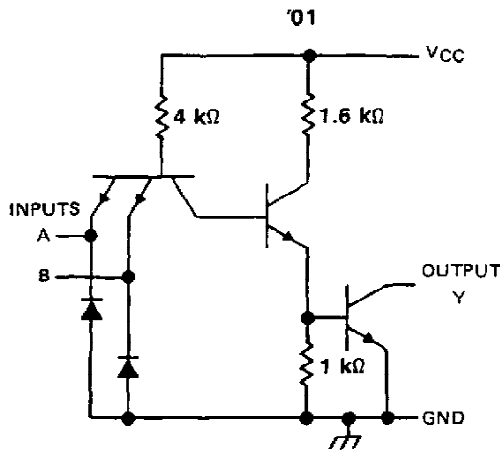
**SN5401, SN54LS01,
SN7401, SN74LS01
QUADRUPLE 2-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS**

logic diagram (positive logic)



positive logic: $Y = \overline{A \cdot B}$ or $Y = \overline{A} + \overline{B}$

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): '01, 'LS01 | 7 V |
| Input voltage: '01 | 5.5 V |
| 'LS01 | 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 terminals.

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SN5401, SN7401

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

recommended operating conditions

| | SN5401 | | | SN7401 | | | 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† | SN5401 | | SN7401 | | UNIT |
|------------------|---|--------|------|--------|------|------|
| | | MIN | TYP‡ | MAX | MIN | |
| V _{IK} | V _{CC} = MIN, I _I = -12 mA | | -1.5 | | -1.5 | V |
| I _{OH} | V _{CC} = MIN, V _{IL} = 0.8 V, V _{OH} = 5.5 V | | | | 0.25 | mA |
| | V _{CC} = MIN, V _{IL} = 0.7 V, V _{OH} = 5.5 V | | 0.25 | | | |
| V _{OL} | V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 16 mA | 0.2 | 0.4 | 0.2 | 0.4 | V |
| I _I | V _{CC} = MAX, V _I = 5.5 V | | 1 | | 1 | mA |
| I _{IH} | V _{CC} = MAX, V _I = 2.4 V | | 40 | | 40 | μA |
| I _{IL} | V _{CC} = MAX, V _I = 0.4 V | | -1.6 | | -1.6 | mA |
| I _{CCH} | V _{CC} = MAX, V _I = 0 | 4 | 8 | 4 | 8 | mA |
| I _{CCL} | V _{CC} = MAX, V _I = 4.5 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 V, T_A = 25°C.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see note 2)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|------------------|--------------|-------------|--|-----|-----|-----|------|
| t _{PLH} | A or B | Y | R _L = 4 kΩ, C _L = 15 pF | | 35 | 55 | ns |
| t _{PHL} | | | R _L = 400 Ω, C _L = 15 pF | | 8 | 15 | ns |

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


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SN54LS01, SN74LS01

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

recommended operating conditions

| | SN54LS01 | | | SN74LS01 | | | 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† | SN54LS01 | | | SN74LS01 | | | UNIT |
|------------------|---|----------|------|------|----------|------|------|------|
| | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| V _{IK} | V _{CC} = MIN, I _I = -18 mA | | | -1.5 | | | -1.5 | V |
| I _{OH} | V _{CC} = MIN, V _{IL} = MAX, V _{OH} = 5.5 V | | | 0.1 | | | 0.1 | mA |
| V _{OL} | V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 4 mA | | 0.25 | 0.4 | | 0.25 | 0.4 | V |
| | V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 8 mA | | | | | 0.35 | 0.5 | |
| I _I | V _{CC} = MAX, V _I = 7 V | | | 0.1 | | | 0.1 | mA |
| I _{IH} | V _{CC} = MAX, V _I = 2.7 V | | | 20 | | | 20 | μA |
| I _{IL} | V _{CC} = MAX, V _I = 0.4 V | | | -0.4 | | | -0.4 | mA |
| I _{CCH} | V _{CC} = MAX, V _I = 0 | | 0.8 | 1.6 | | 0.8 | 1.6 | mA |
| I _{CCL} | V _{CC} = MAX, V _I = 4.5 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 V, T_A = 25°C.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see note 2)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|------------------|--------------|-------------|------------------------|------------------------|-----|-----|-----|------|
| t _{PLH} | A or B | Y | R _L = 2 kΩ, | C _L = 15 pF | | 17 | 32 | ns |
| t _{PHL} | | | | | | 15 | 28 | ns |

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

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