

- 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

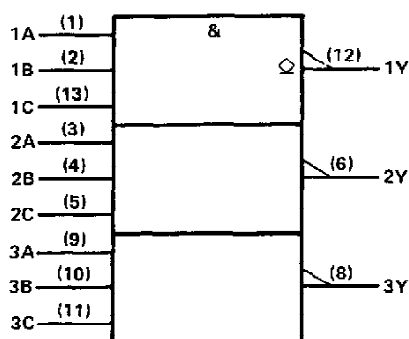
These devices contain three independent 3-input NAND gates with open-collector outputs. The open-collector outputs require pull-up resistors to perform correctly. They may be connected to other open-collector outputs to implement active-low wired-OR or active-high wired-AND functions. Open-collector devices are often used to generate higher  $V_{OH}$  levels.

The SN5412 and SN54LS12 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN7412 and SN74LS12 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

FUNCTION TABLE (each gate)

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

### logic symbol†



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

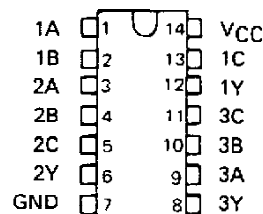
Pin numbers shown are for D, J, N, and W packages.

SN5412, SN54LS12 . . . J OR W PACKAGE

SN7412 . . . N PACKAGE

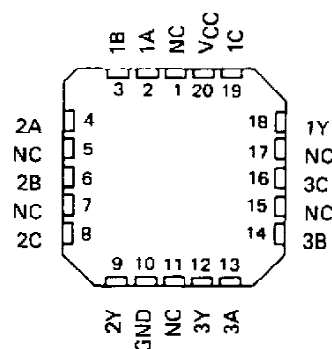
SN74LS12 . . . D OR N PACKAGE

(TOP VIEW)



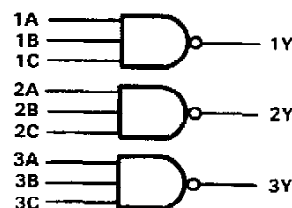
SN54LS12 . . . FK PACKAGE

(TOP VIEW)



NC—No internal connection

### logic diagram (positive logic)

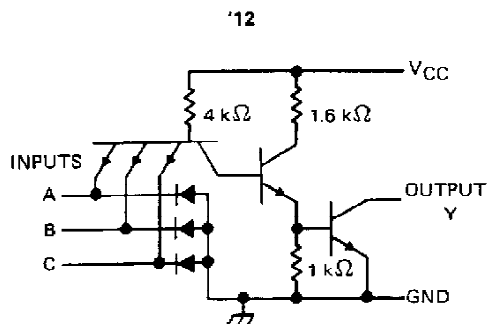


$$Y = \overline{A \cdot B \cdot C} \text{ or}$$

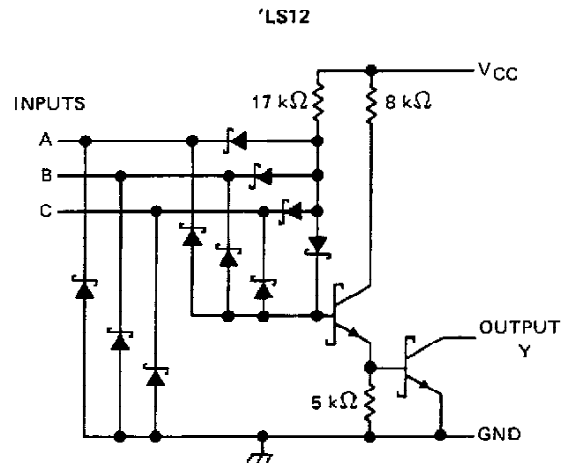
$$Y = \overline{A} + \overline{B} + \overline{C}$$

**SN5412, SN54LS12**  
**SN7412, SN74LS12**  
**TRIPLE 3-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: '12                    | 5.5 V  |
| 'LS12                                 | 7 V  |
| Off-state output voltage              | 7 V  |
| Operating free-air temperature: 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 $150^{\circ}\text{C}$ |

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

# SN5412, SN5412

## TRIPLE 3-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS

### recommended operating conditions

|   | SN5412 |     |     | SN7412 |     |      | 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    |
| V <sub>OH</sub> High-level output voltage     |        |     | 5.5 |        |     | 5.5  | V    |
| I <sub>OL</sub> Low-level output current      |        |     | 16  |        |     | 16   | 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†  | SN5412 |      |      | SN7412 |      |      | UNIT |
|------------------|---|--------|------|------|--------|------|------|------|
|                  |   | MIN    | TYP‡ | MAX  | MIN    | TYP‡ | MAX  |      |
| V <sub>IK</sub>  | V <sub>CC</sub> = MIN, I <sub>I</sub> = -12 mA                          |        |      | -1.5 |        |      | -1.5 | V    |
| I <sub>OH</sub>  | V <sub>CC</sub> = MIN, V <sub>IL</sub> = 0.8 V, V <sub>OH</sub> = 5.5 V |        |      |      |        |      | 0.25 | mA   |
|                  | V <sub>CC</sub> = MIN, V <sub>IL</sub> = 0.7 V, V <sub>OH</sub> = 5.5 V |        |      | 0.25 |        |      |      |      |
| V <sub>OL</sub>  | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 16 mA   | 0.2    | 0.4  |      | 0.2    | 0.4  |      | 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> = 2.4 V                           |        |      | 40   |        |      | 40   | µA   |
| I <sub>IL</sub>  | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V                           |        |      | -1.6 |        |      | -1.6 | mA   |
| I <sub>CCH</sub> | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0                               | 3      | 6    |      | 3      | 6    |      | mA   |
| I <sub>CCL</sub> | V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 V                           | 9      | 16.5 |      | 9      | 16.5 |      | 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.

### 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, B or C       | Y              | R <sub>L</sub> = 4 kΩ,  | C <sub>L</sub> = 15 pF | 35  | 45  |     | ns   |
| t <sub>PHL</sub> |                 |                | R <sub>L</sub> = 400 Ω, | C <sub>L</sub> = 15 pF | 8   | 15  |     | ns   |

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



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# SN54LS12, SN74LS12

## TRIPLE 3-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS

### recommended operating conditions

|   | SN54LS12 |     |     | SN74LS12 |     |      | 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       |          |     | 0.7 |          |     | 0.8  | V    |
| V <sub>OH</sub> High-level output voltage     |          |     | 5.5 |          |     | 5.5  | V    |
| I <sub>OL</sub> Low-level output current      |          |     | 4   |          |     | 8    | 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†  | SN54LS12 |      |       | SN74LS12 |      |       | UNIT |
|------------------|---|----------|------|-------|----------|------|-------|------|
|                  |   | MIN      | TYP‡ | MAX   | MIN      | TYP‡ | MAX   |      |
| V <sub>IK</sub>  | V <sub>CC</sub> = MIN, I <sub>I</sub> = − 18 mA                       |          |      | − 1.5 |          |      | − 1.5 | V    |
| I <sub>OH</sub>  | V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>OH</sub> = 5.5 V |          |      | 0.1   |          |      | 0.1   | mA   |
| V <sub>OL</sub>  | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 4 mA  |          | 0.25 | 0.4   |          | 0.25 | 0.4   | V    |
|                  | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 8 mA  |          |      |       |          | 0.35 | 0.5   |      |
| I <sub>I</sub>   | V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V                           |          |      | 0.1   |          |      | 0.1   | mA   |
| I <sub>IH</sub>  | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V                         |          |      | 20    |          |      | 20    | μA   |
| I <sub>IL</sub>  | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V                         |          |      | − 0.4 |          |      | − 0.4 | mA   |
| I <sub>CCH</sub> | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0                             |          | 0.7  | 1.4   |          | 0.7  | 1.4   | mA   |
| I <sub>CCL</sub> | V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 V                         |          | 1.8  | 3.3   |          | 1.8  | 3.3   | 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.

### 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, B or C       | Y              | R <sub>L</sub> = 2 kΩ, | C <sub>L</sub> = 15 pF | 17  |     | 32  | ns   |
| t <sub>PHL</sub> |                 |                |                        |                        | 15  |     | 28  | ns   |

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



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