

# SN5454, SN54LS54, SN7454, SN74LS54 4-WIDE AND-OR-INVERT GATES

SDLS115

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

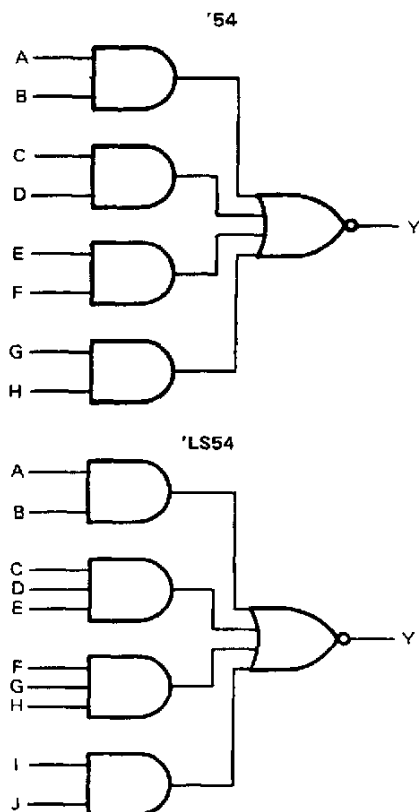
## description

These devices contain 4-wide AND-OR-INVERT gates. They perform the following Boolean functions:

$$\begin{aligned} \text{'54 } Y &= \overline{AB + CD + EF + GH} \\ \text{LS54 } Y &= \overline{AB + CDE + FGH + IJ} \end{aligned}$$

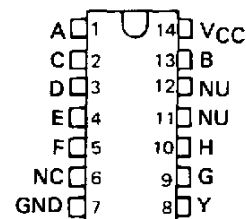
The SN5454 and SN54LS54 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN7454 and SN74LS54 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

## logic diagrams (positive logic)



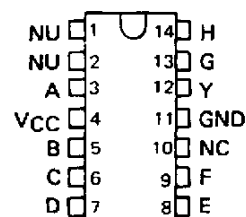
## SN5454 . . . J PACKAGE SN7454 . . . N PACKAGE

(TOP VIEW)



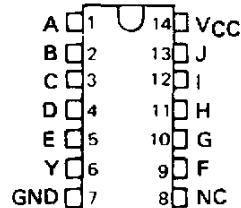
## SN5454 . . . W PACKAGE

(TOP VIEW)



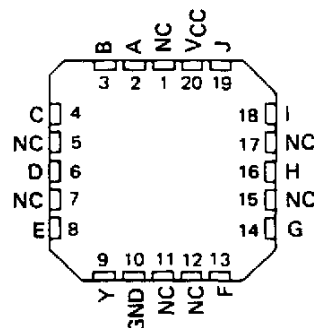
## SN54LS54 . . . J OR W PACKAGE SN74LS54 . . . D OR N PACKAGE

(TOP VIEW)



## SN54LS54 . . . FK PACKAGE

(TOP VIEW)



NC—No internal connection  
NU—Make no external connection

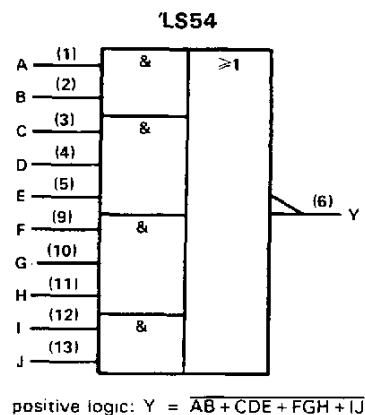
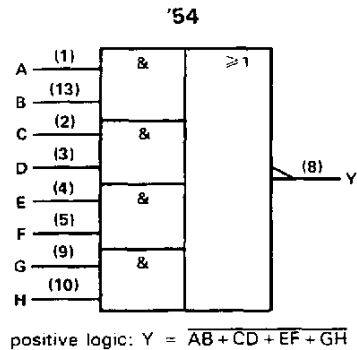
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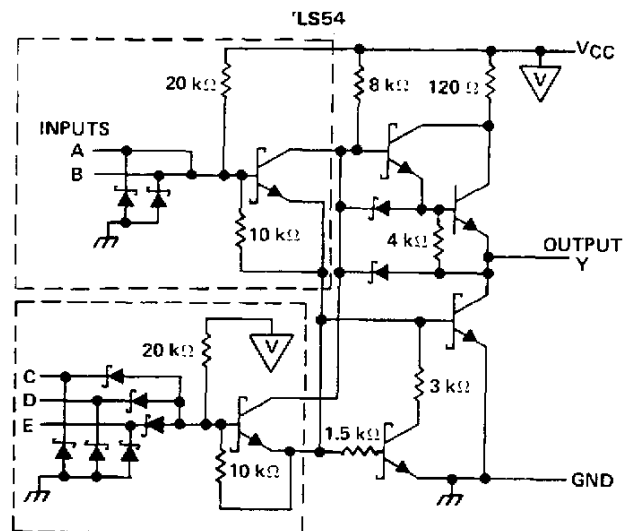
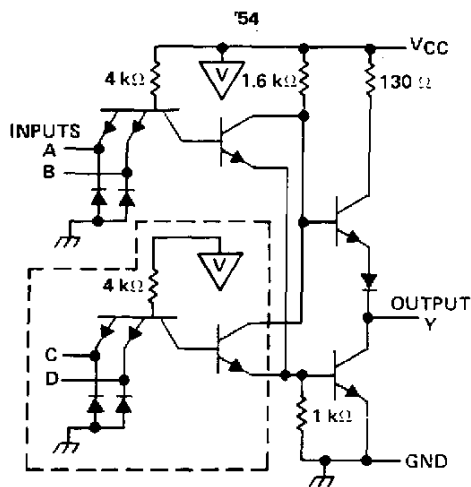
# **SN5454, SN54LS54, SN7454, SN74LS54** **4-WIDE AND-OR-INVERT GATES**

## **logic symbols†**



†These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.  
 Pin numbers shown are for D, J, and N package. For the SN54LS54 only, they apply also for the W package.

## **schematics**



Resistor values shown are nominal.

The portion of the circuits within the dashed lines is repeated for each additional 2- or 3-input AND section, as shown in the logic diagram and logic symbols.

# SN5454, SN7454 4-WIDE AND-OR-INVERT GATES

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

|                                        |                |
|----------------------------------------|----------------|
| Supply voltage, $V_{CC}$ (see Note 1)  | 7 V            |
| Input voltage                          | 5.5 V          |
| Operating free-air temperature: SN5454 | -55°C to 125°C |
| SN7454                                 | 0°C to 70°C    |
| Storage temperature range              | -65°C to 150°C |

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

## recommended operating conditions

|                                      | SN5454 |     |      | SN7454 |     |      | 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   |        |     | -0.4 |        |     | -0.4 | mA   |
| $I_{OL}$ 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†                                                        | SN5454 |      |      | SN7454 |      |      | UNIT |
|-----------|-------------------------------------------------------------------------|--------|------|------|--------|------|------|------|
|           |                                                                         | MIN    | TYP‡ | MAX  | MIN    | TYP‡ | MAX  |      |
| $V_{IK}$  | $V_{CC} = \text{MIN}, I_I = -12 \text{ mA}$                             |        |      | -1.5 |        |      | -1.5 | V    |
| $V_{OH}$  | $V_{CC} = \text{MIN}, V_{IL} = 0.8 \text{ V}, I_{OH} = -0.4 \text{ mA}$ | 2.4    | 3.4  |      | 2.4    | 3.4  |      | V    |
| $V_{OL}$  | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 16 \text{ mA}$     |        | 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   |
| $I_{OS}§$ | $V_{CC} = \text{MAX}$                                                   | -20    |      | -55  | -18    |      | -55  | mA   |
| $I_{CCH}$ | $V_{CC} = \text{MAX}, V_I = 0 \text{ V}$                                |        | 4    | 8    |        | 4    | 8    | mA   |
| $I_{CCL}$ | $V_{CC} = \text{MAX}, \text{ See Note 2}$                               |        | 5.1  | 9.5  |        | 5.1  | 9.5  | 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.

NOTE 2: All inputs of one AND gate at 4.5 V, all others at GND.

## switching characteristics, $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$ (see note 3)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS                         | MIN | TYP | MAX | UNIT |
|-----------|--------------|-------------|-----------------------------------------|-----|-----|-----|------|
| $t_{PLH}$ | Any          | Y           | $R_L = 400 \Omega, C_L = 15 \text{ pF}$ |     | 13  | 22  | ns   |
| $t_{PHL}$ |              |             |                                         |     | 8   | 15  | ns   |

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

## SN54LS54, SN74LS54 4-WIDE AND-OR-INVERT GATES

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

|                                          |                |
|------------------------------------------|----------------|
| Supply voltage, $V_{CC}$ (see Note 1)    | 7 V            |
| Input voltage                            | 7 V            |
| Operating free-air temperature: SN54LS54 | -55°C to 125°C |
| SN74LS54                                 | 0°C to 70°C    |
| Storage temperature range                | -65°C to 150°C |

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

recommended operating conditions

|                                      | SN54LS54 |     |      | SN74LS54 |     |      | 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   |          |     | -0.4 |          |     | -0.4 | mA   |
| $I_{OL}$ 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†                                                     | SN54LS54 |       |      | SN74LS54 |       |      | UNIT |
|-----------|----------------------------------------------------------------------|----------|-------|------|----------|-------|------|------|
|           |                                                                      | MIN      | TYP ‡ | MAX  | MIN      | TYP ‡ | MAX  |      |
| $V_{IK}$  | $V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$                          |          |       | -1.5 |          |       | -1.5 | V    |
| $V_{OH}$  | $V_{CC} = \text{MIN}, V_{IL} = \text{MAX}, I_{OH} = -0.4 \text{ mA}$ | 2.5      | 3.4   |      | 2.7      | 3.4   |      | V    |
| $V_{OL}$  | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 4 \text{ mA}$   |          | 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   |
| $I_{OS}§$ | $V_{CC} = \text{MAX}$                                                | -20      |       | -100 | -20      |       | -100 | mA   |
| $I_{CCH}$ | $V_{CC} = \text{MAX}, V_I = 0 \text{ V}$                             |          | 0.8   | 1.6  |          | 0.8   | 1.6  | mA   |
| $I_{CCL}$ | $V_{CC} = \text{MAX}, \text{ See Note 2}$                            |          | 1     | 2    |          | 1     | 2    | 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.

NOTE 2: All inputs of one AND gate at 4.5 V, all others at GND.

switching characteristics,  $V_{CC} = 5 \text{ V}, T_A = 25^\circ \text{C}$  (see note 3)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS                                | MIN | TYP  | MAX | UNIT |
|-----------|--------------|-------------|------------------------------------------------|-----|------|-----|------|
| $t_{PLH}$ | Any          | Y           | $R_L = 2 \text{ k}\Omega, C_L = 15 \text{ pF}$ |     | 12   | 20  | ns   |
| $t_{PHL}$ |              |             |                                                |     | 12.5 | 20  | ns   |

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

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