# 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

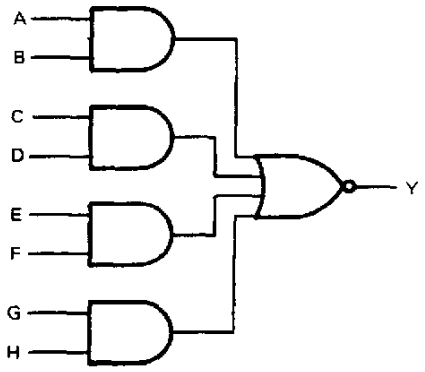
These devices contain 4-wide AND-OR-INVERT gates. They perform the following Boolean functions:

$$'54 \quad Y = \overline{AB + CD + EF + GH}$$
$$LS54 \quad Y = \overline{AB + CDE + FGH + IJ}$$

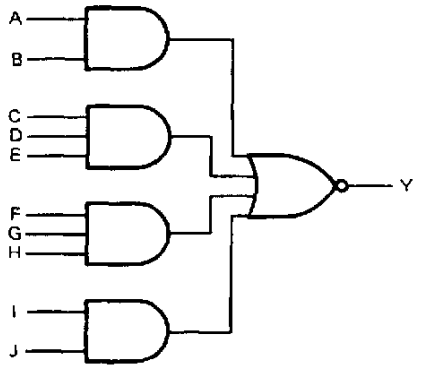
The SN5454 and SN54LS54 are characterized for operation over the full military temperature range of −55°C to 125°C. The SN7454 and SN74LS54 are characterized for operation from 0°C to 70°C.

## logic diagrams (positive logic)

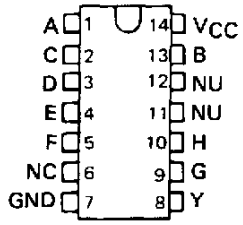
'54



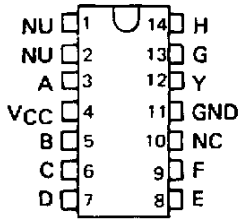

'LS54



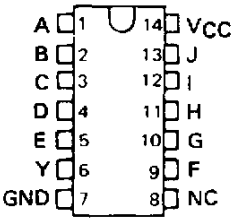

SN5454 . . . J PACKAGE
SN7454 . . . N PACKAGE
(TOP VIEW)



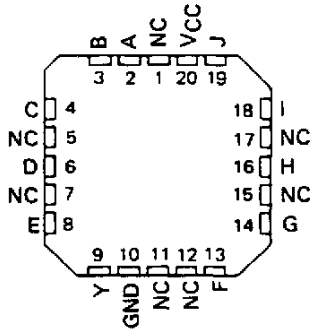

SN5454 . . . W PACKAGE
(TOP VIEW)




SN54LS54 . . . J OR W PACKAGE
SN74LS54 . . . D OR N PACKAGE
(TOP VIEW)




SN54LS54 . . . FK PACKAGE
(TOP VIEW)



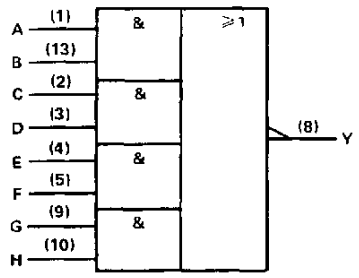

NC—No internal connection
NU—Make no external connection

PRODUCTION DATA documents contain information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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

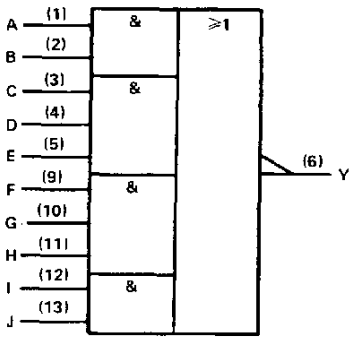
## logic symbols†

'54




positive logic: $Y = \overline{AB + CD + EF + GH}$

'LS54

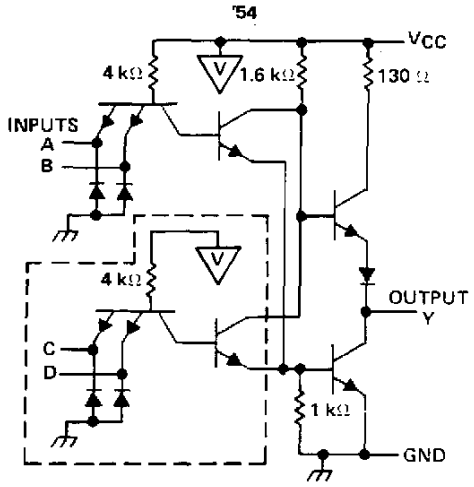



positive logic: $Y = \overline{AB + CDE + FGH + IJ}$

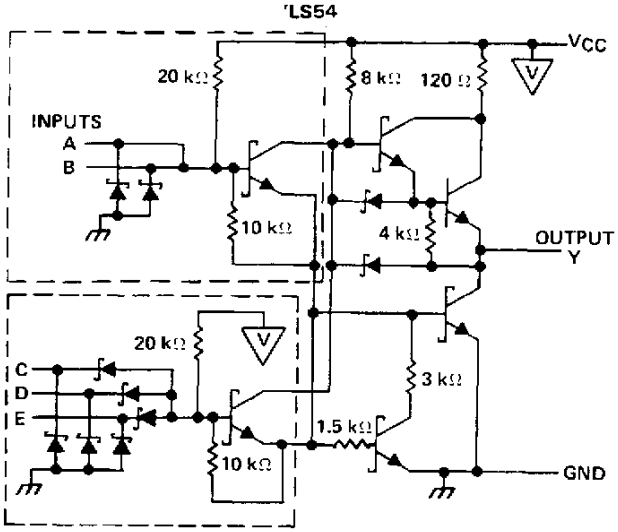
†These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for D, J, and N package. For the SN54LS54 only, they apply also for the W package.

## schematics

'54




'LS54




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.

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

| PARAMETER | TEST CONDITIONS† | | | SN5454 | | | SN7454 | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| $V_{IK}$ | $V_{CC}$ = MIN, | $I_I$ = −12 mA | | | | −1.5 | | | −1.5 | V |
| $V_{OH}$ | $V_{CC}$ = MIN, | $V_{IL}$ = 0.8 V, | $I_{OH}$ = −0.4 mA | 2.4 | 3.4 | | 2.4 | 3.4 | | V |
| $V_{OL}$ | $V_{CC}$ = 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 |
| $I_{OS}$§ | $V_{CC}$ = MAX | | | −20 | | −55 | −18 | | −55 | mA |
| $I_{CCH}$ | $V_{CC}$ = MAX, | $V_I$ = 0 V | | | 4 | 8 | | 4 | 8 | mA |
| $I_{CCL}$ | $V_{CC}$ = MAX, | 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 V, $T_A$ = 25°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 V, $T_A$ = 25°C (see note 3)

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

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

### 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 | |
| $V_{IK}$ | $V_{CC}$ = MIN, | $I_I$ = −18 mA | | | | −1.5 | | | −1.5 | V |
| $V_{OH}$ | $V_{CC}$ = MIN, | $V_{IL}$ = MAX, | $I_{OH}$ = −0.4 mA | 2.5 | 3.4 | | 2.7 | 3.4 | | V |
| $V_{OL}$ | $V_{CC}$ = 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 |
| $I_{OS}$§ | $V_{CC}$ = MAX | | | −20 | | −100 | −20 | | −100 | mA |
| $I_{CCH}$ | $V_{CC}$ = MAX, | $V_I$ = 0 V | | | 0.8 | 1.6 | | 0.8 | 1.6 | mA |
| $I_{CCL}$ | $V_{CC}$ = MAX, | 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 V, $T_A$ = 25°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 V, $T_A$ = 25°C (see note 3)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|
| $t_{PLH}$ | Any | Y | $R_L$ = 2 kΩ, | $C_L$ = 15 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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