- **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

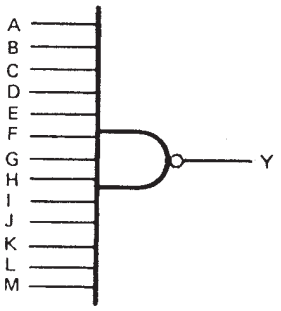
These devices contain a single 13-input NAND gate.

The SN54133 is characterized for operation over the full military temperature range of −55°C to 125°C. The SN74133 is characterized for operation from 0°C to 70°C.

**FUNCTION TABLE**

| INPUTS A THRU M | OUTPUT Y |
|---|---|
| All inputs H | L |
| One or more inputs L | H |

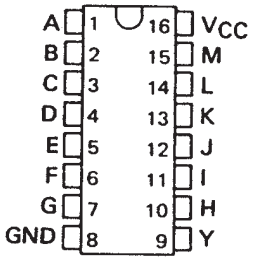
## logic diagram



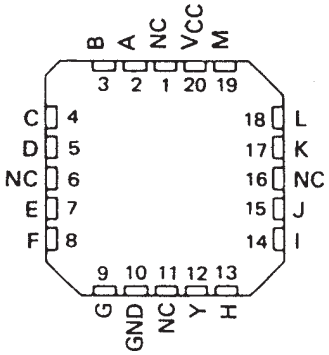

## positive logic

$$Y = \overline{A \cdot B \cdot C \cdot D \cdot E \cdot F \cdot G \cdot H \cdot I \cdot J \cdot K \cdot L \cdot M} \text{ or}$$
$$Y = \overline{A} + \overline{B} + \overline{C} + \overline{D} + \overline{E} + \overline{F} + \overline{G} + \overline{H} + \overline{I} + \overline{J} + \overline{K} + \overline{L} + \overline{M}$$

**SN54S133 . . . J OR W PACKAGE**
**SN74S133 . . . D OR N PACKAGE**
**(TOP VIEW)**

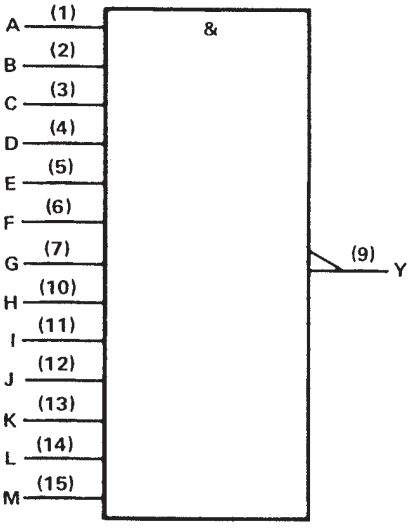



**SN54S133 . . . FK PACKAGE**
**(TOP VIEW)**



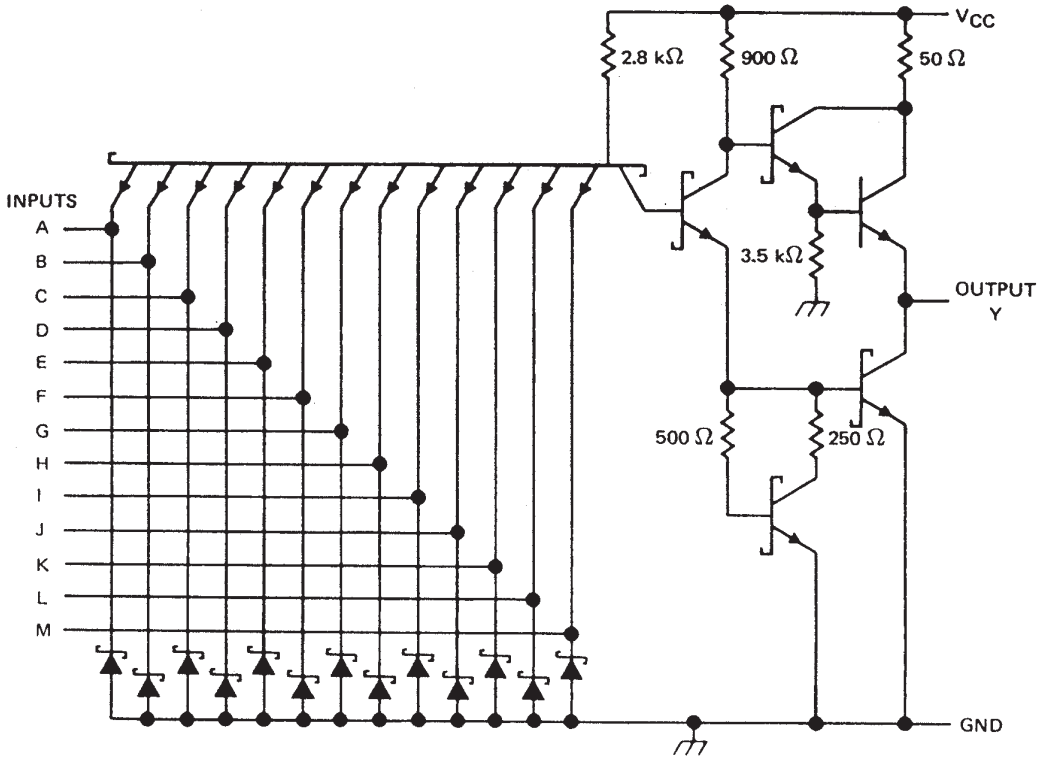

NC - No internal connection

## 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.

'S133




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 . . . . . 5.5 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.

## recommended operating conditions

| | | SN54S133 | | | SN74S133 | | | 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 | | | −1 | | | −1 | mA |
| $I_{OL}$ | 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 † | SN54S133 | | | SN74S133 | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| $V_{IK}$ | $V_{CC}$ = MIN, $I_I$ = −18 mA | | | −1.2 | | | −1.2 | V |
| $V_{OH}$ | $V_{CC}$ = MIN, $V_{IL}$ = 0.8 V, $I_{OH}$ = −1 mA | 2.5 | 3.4 | | 2.7 | 3.4 | | V |
| $V_{OL}$ | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $I_{OL}$ = 20 mA | | | 0.5 | | | 0.5 | V |
| $I_I$ | $V_{CC}$ = MAX, $V_I$ = 5.5 V | | | 1 | | | 1 | mA |
| $I_{IH}$ | $V_{CC}$ = MAX, $V_I$ = 2.7 V | | | 50 | | | 50 | μA |
| $I_{IL}$ | $V_{CC}$ = MAX, $V_I$ = 0.5 V | | | −2 | | | −2 | mA |
| $I_{OS}$§ | $V_{CC}$ = MAX | −40 | | −100 | −40 | | −100 | mA |
| $I_{CCH}$ | $V_{CC}$ = MAX, $V_I$ = 0 V | | 3 | 5 | | 3 | 5 | mA |
| $I_{CCL}$ | $V_{CC}$ = MAX, $V_I$ = 4.5 V | | 5.5 | 10 | | 5.5 | 10 | 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.

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

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| $t_{PLH}$ | Any | Y | $R_L$ = 280 Ω, $C_L$ = 15 pF | | 4 | 6 | ns |
| $t_{PHL}$ | | | | | 4.5 | 7 | ns |
| $t_{PLH}$ | | | $R_L$ = 280 Ω, $C_L$ = 50 pF | | 5.5 | | ns |
| $t_{PHL}$ | | | | | 6.5 | | ns |

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

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