

# DATA SHEET

For a complete data sheet, please also download:

- The IC06 74HC/HCT/HCU/HCMOS Logic Family Specifications
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Information
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Outlines

## **74HC133** 13-input NAND gate

Product specification  
File under Integrated Circuits, IC06

September 1993

## 13-input NAND gate

74HC133

## FEATURES

- Output capability: standard
- $I_{CC}$  category: SSI

## GENERAL DESCRIPTION

The HC133 is an high-speed Si-gate CMOS device and is pin compatible with low power Schottky TTL (LSTTL). It is specified in compliance with JEDEC standard no. 7A.

The 74HC133 provides the 13-input NAND function.

## QUICK REFERENCE DATA

GND = 0 V;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $t_r = t_f = 6\text{ ns}$

| SYMBOL            | PARAMETER                   | CONDITIONS                                   | TYPICAL | UNIT |
|-------------------|-----------------------------|--|---------|------|
| $t_{PHL}/t_{PLH}$ | propagation delay A..M to Y | $C_L = 15\text{ pF}$ ; $V_{CC} = 5\text{ V}$ | 9       | ns   |
| $C_I$             | input capacitance           |  | 3.5     | pF   |
| $C_{PD}$          | power dissipation per gate  | notes 1 and 2                                | 19      | pF   |

## Notes to the quick reference data

1.  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ )

$$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

$f_i$  = input frequency in MHz;  $C_L$  = output load capacitance in pF;

$f_o$  = output frequency in MHz;  $V_{CC}$  = supply voltage in V;

$\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.

2. For HC the condition is  $V_I = \text{GND to } V_{CC}$

## ORDERING INFORMATION

| TYPE NUMBER | PACKAGES |              |          |         |
|-------------|----------|--------------|----------|---------|
|             | PINS     | PIN POSITION | MATERIAL | CODE    |
| 74HC133N    | 16       | DIL          | plastic  | SOT38   |
| 74HC133D    | 16       | SO           | plastic  | SOT109A |

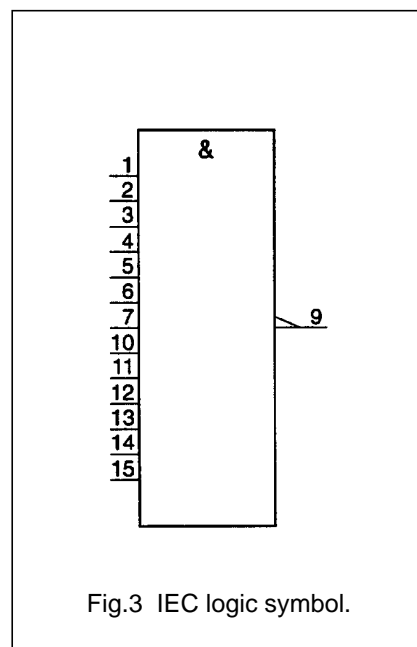
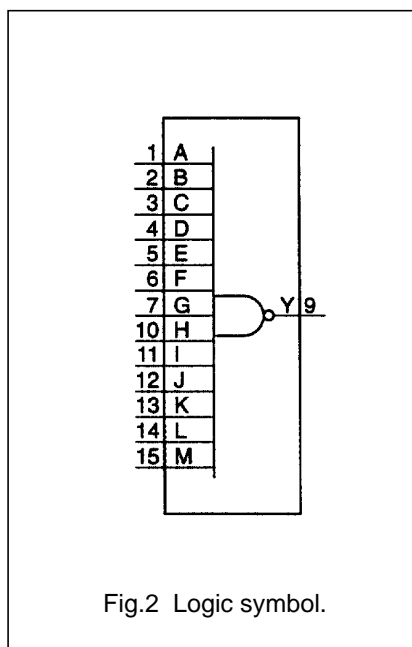
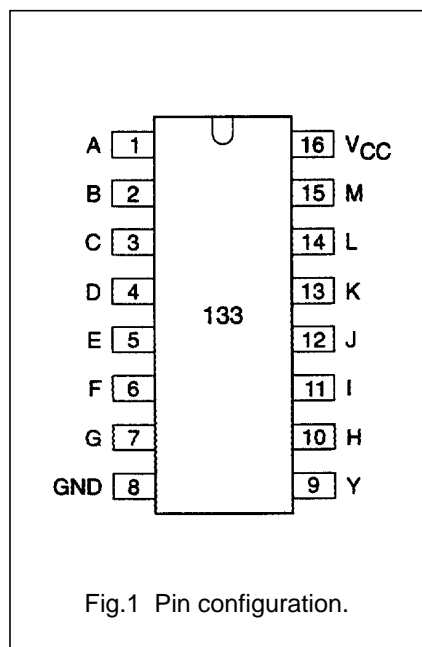
See also *"74HC/HCT/HCU/HCMOS Logic Package Information"*.

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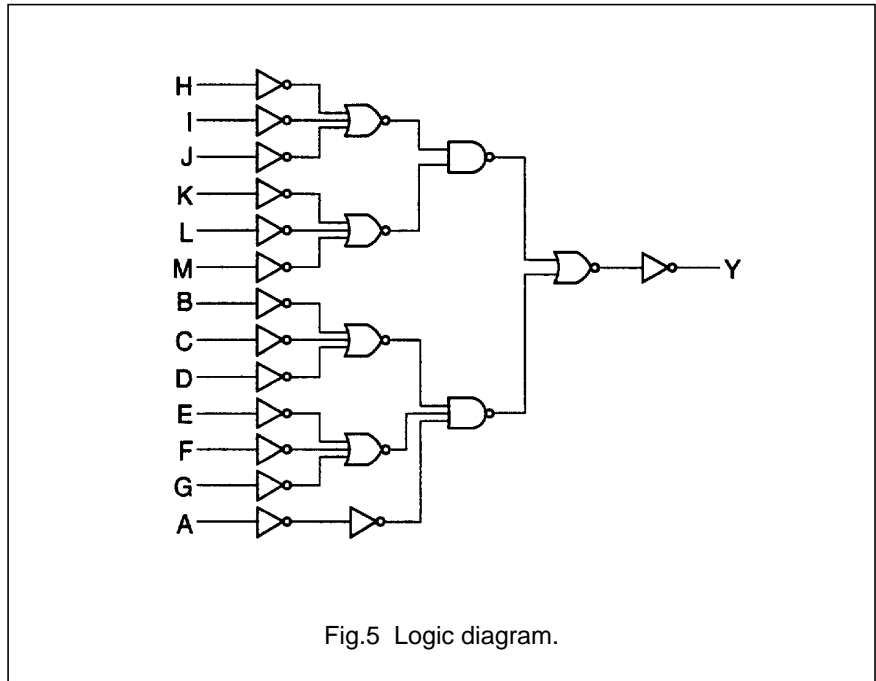
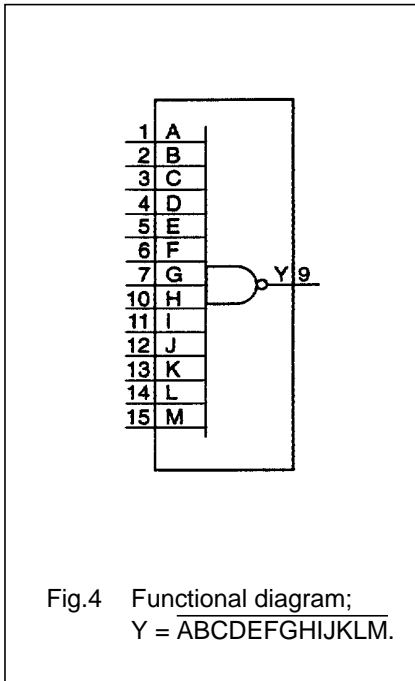
## PINNING

| PIN NO.       | SYMBOL          | NAME AND FUNCTION       |
|---------------|-----------------|-------------------------|
| 1..7, 10.. 15 | A.. G, H..M     | data input              |
| 8             | GND             | ground (0 V)            |
| 9             | Y               | data output             |
| 16            | V <sub>CC</sub> | positive supply voltage |



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FUNCTION TABLE

| INPUTS |   |   |   |   |   |   |   |   |   |   |   |   | OUTPUT |
|--------|---|---|---|---|---|---|---|---|---|---|---|---|--------|
| A      | B | C | D | E | F | G | H | I | J | K | L | M | Y      |
| L      | X | X | X | X | X | X | X | X | X | X | X | X | H      |
| X      | L | X | X | X | X | X | X | X | X | X | X | X | H      |
| X      | X | L | X | X | X | X | X | X | X | X | X | X | H      |
| X      | X | X | L | X | X | X | X | X | X | X | X | X | H      |
| X      | X | X | X | L | X | X | X | X | X | X | X | X | H      |
| X      | X | X | X | X | L | X | X | X | X | X | X | X | H      |
| X      | X | X | X | X | X | L | X | X | X | X | X | X | H      |
| X      | X | X | X | X | X | X | L | X | X | X | X | X | H      |
| X      | X | X | X | X | X | X | X | L | X | X | X | X | H      |
| X      | X | X | X | X | X | X | X | X | L | X | X | X | H      |
| X      | X | X | X | X | X | X | X | X | X | L | X | X | H      |
| X      | X | X | X | X | X | X | X | X | X | X | L | X | H      |
| X      | X | X | X | X | X | X | X | X | X | X | X | L | H      |
| H      | H | H | H | H | H | H | H | H | H | H | H | H | L      |

Notes

- H = HIGH voltage level  
 L = LOW voltage level  
 X = don't care

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## DC CHARACTERISTICS FOR 74HC

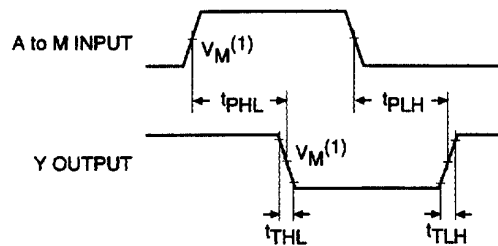
For the DC characteristics see *"74HC/HCT/HCU/HCMOS Logic Family Specifications"*.

Output capability: standard  
 $I_{CC}$  category: SSI

## AC CHARACTERISTICS FOR 74HC

GND = 0 V;  $t_f = t_r = 6$  ns;  $C_L = 50$  pF

| SYMBOL            | PARAMETER                      | $T_{amb}$ (°C) |      |      |            |      |             |      | UNIT | TEST CONDITIONS   |           |
|-------------------|--------------------------------|----------------|------|------|------------|------|-------------|------|------|-------------------|-----------|
|                   |                                | +25            |      |      | -40 to +85 |      | -40 to +125 |      |      | $V_{CC}$ (V)      | WAVEFORMS |
|                   |                                | MIN.           | TYP. | MAX. | MIN.       | MAX. | MIN.        | MAX. |      |                   |           |
| $t_{PHL}/t_{PLH}$ | propagation delay<br>A..M to Y | –              | 36   | 110  | –          | 140  | –           | 165  | ns   | 2.0<br>4.5<br>6.0 | Fig.6     |
| $t_{THL}/t_{TLH}$ | output transition<br>time      | –              | 19   | 75   | –          | 95   | –           | 110  | ns   | 2.0<br>4.5<br>6.0 | Fig.6     |



(1) HC:  $V_M = 50\%$ ;  $V_I = GND$  to  $V_{CC}$ .

Fig.6 Waveforms showing the input (A, B, C, D, E, F, G, H, I, J, K, L, M) to output (Y) propagation delays and the output transition times.

## PACKAGE OUTLINES

See *"74HC/HCT/HCU/HCMOS Logic Package Outlines"*.