

## QUAD 2-INPUT EXCLUSIVE-OR GATE

## FEATURES

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

## GENERAL DESCRIPTION

The 74HC/HCT86 are high-speed Si-gate CMOS devices and are pin compatible with low power Schottky TTL (LSTTL). They are specified in compliance with JEDEC standard no. 7A.

The 74HC/HCT86 provide the EXCLUSIVE-OR function.

| SYMBOL            | PARAMETER                                 | CONDITIONS                                      | TYPICAL |     | UNIT |
|-------------------|-------------------------------------------|-------------------------------------------------|---------|-----|------|
|                   |                                           |                                                 | HC      | HCT |      |
| $t_{PHL}/t_{PLH}$ | propagation delay<br>nA, nB to nY         | $C_L = 15 \text{ pF}$<br>$V_{CC} = 5 \text{ V}$ | 11      | 14  | ns   |
| $C_I$             | input capacitance                         |                                                 | 3.5     | 3.5 | pF   |
| $C_{PD}$          | power dissipation<br>capacitance per gate | notes 1 and 2                                   | 30      | 30  | pF   |

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

## Notes

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 outputs

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

For HCT the condition is  $V_I = \text{GND to } V_{CC} - 1.5 \text{ V}$

## PACKAGE OUTLINES

14-lead DIL; plastic (SOT27)

14-lead mini pack; plastic (SO14; SOT108A)

## PIN DESCRIPTION

| PIN NO.      | SYMBOL   | NAME AND FUNCTION       |
|--------------|----------|-------------------------|
| 1, 4, 9, 12  | 1A to 4A | data inputs             |
| 2, 5, 10, 13 | 1B to 4B | data inputs             |
| 3, 6, 8, 11  | 1Y to 4Y | data outputs            |
| 7            | GND      | ground (0 V)            |
| 14           | $V_{CC}$ | positive supply voltage |

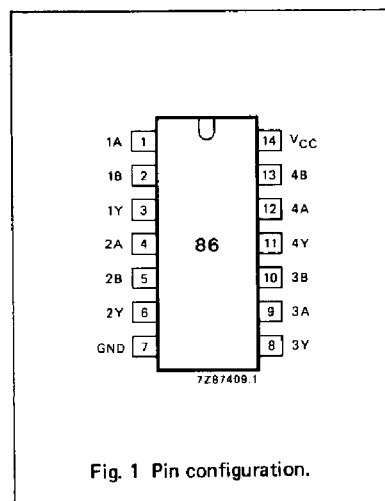


Fig. 1 Pin configuration.

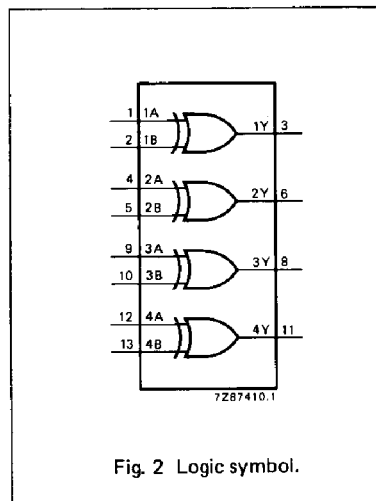


Fig. 2 Logic symbol.

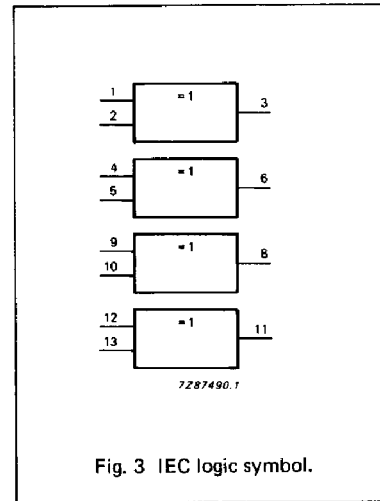


Fig. 3 IEC logic symbol.

**74HC/HCT86**  
**SSI**

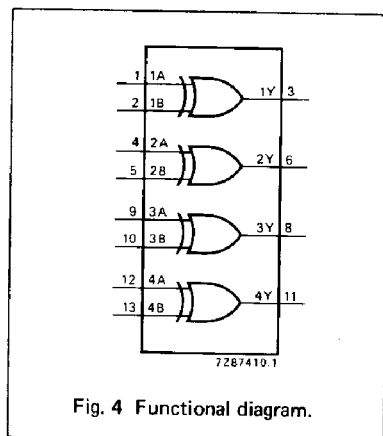


Fig. 4 Functional diagram.

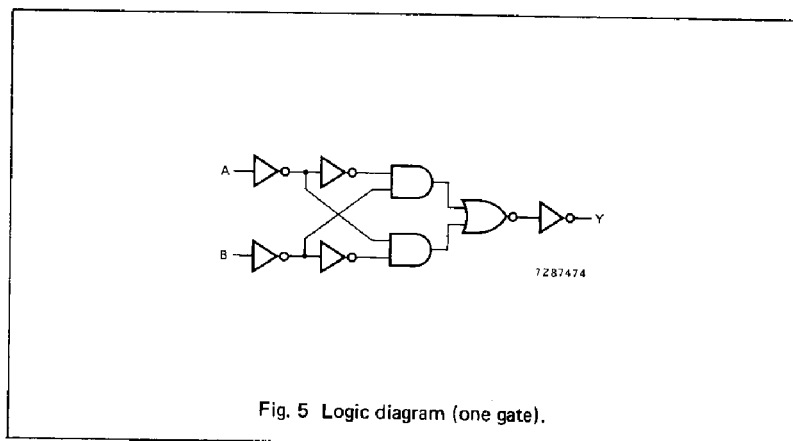


Fig. 5 Logic diagram (one gate).

**FUNCTION TABLE**

| INPUTS |    | OUTPUTS |
|--------|----|---------|
| nA     | nB | nY      |
| L      | L  | L       |
| L      | H  | H       |
| H      | L  | H       |
| H      | H  | L       |

H = HIGH voltage level  
L = LOW voltage level

**DC CHARACTERISTICS FOR 74HC**

For the DC characteristics see chapter "HCMOS family characteristics", section "Family specifications".

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

**AC CHARACTERISTICS FOR 74HC**

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

| SYMBOL                                 | PARAMETER                         | T <sub>amb</sub> (°C) |                |                 |            |                 |             |                 |    | UNIT              | TEST CONDITIONS      |           |
|----------------------------------------|-----------------------------------|-----------------------|----------------|-----------------|------------|-----------------|-------------|-----------------|----|-------------------|----------------------|-----------|
|                                        |                                   | 74HC                  |                |                 |            |                 |             |                 |    |                   | V <sub>CC</sub><br>V | WAVEFORMS |
|                                        |                                   | +25                   |                |                 | -40 to +85 |                 | -40 to +125 |                 |    |                   |                      |           |
|                                        |                                   | min.                  | typ.           | max.            | min.       | max.            | min.        | max.            |    |                   |                      |           |
| t <sub>PHL</sub> /<br>t <sub>PLH</sub> | propagation delay<br>nA, nB to nY |                       | 39<br>14<br>11 | 120<br>24<br>20 |            | 150<br>30<br>26 |             | 180<br>36<br>31 | ns | 2.0<br>4.5<br>6.0 | Fig. 6               |           |
| t <sub>THL</sub> /<br>t <sub>TLH</sub> | output transition time            |                       | 19<br>7<br>6   | 75<br>15<br>13  |            | 95<br>19<br>16  |             | 110<br>22<br>19 | ns | 2.0<br>4.5<br>6.0 | Fig. 6               |           |

**DC CHARACTERISTICS FOR 74HCT**

For the DC characteristics see chapter "HCMOS family characteristics", section "Family specifications".

Output capability: standard

$I_{CC}$  category: SSI

**Note to HCT types**

The value of additional quiescent supply current ( $\Delta I_{CC}$ ) for a unit load of 1 is given in the family specifications. To determine  $\Delta I_{CC}$  per input, multiply this value by the unit load coefficient shown in the table below.

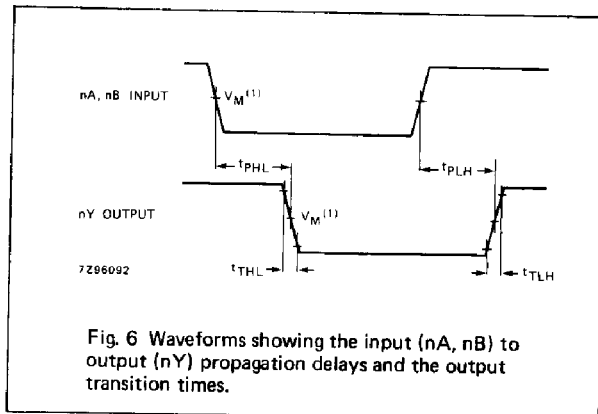
| INPUT  | UNIT LOAD COEFFICIENT |
|--------|-----------------------|
| nA, nB | 1.0                   |

**AC CHARACTERISTICS FOR 74HCT**

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

| SYMBOL                                 | PARAMETER                         | T <sub>amb</sub> (°C) |      |      |            |      |             | UNIT | TEST CONDITIONS      |           |        |
|----------------------------------------|-----------------------------------|-----------------------|------|------|------------|------|-------------|------|----------------------|-----------|--------|
|                                        |                                   | 74HCT                 |      |      |            |      |             |      | V <sub>CC</sub><br>V | WAVEFORMS |        |
|                                        |                                   | +25                   |      |      | −40 to +85 |      | −40 to +125 |      |                      |           |        |
|                                        |                                   | min.                  | typ. | max. | min.       | max. | min.        |      |                      |           | max.   |
| t <sub>PHL</sub> /<br>t <sub>PLH</sub> | propagation delay<br>nA, nB to nY |                       | 17   | 32   |            | 40   |             | 48   | ns                   | 4.5       | Fig. 6 |
| t <sub>THL</sub> /<br>t <sub>TLH</sub> | output transition time            |                       | 7    | 15   |            | 19   |             | 22   | ns                   | 4.5       | Fig. 6 |

# AC WAVEFORMS



## Note to AC waveforms

- (1) HC :  $V_M = 50\%$ ;  $V_I = \text{GND to } V_{CC}$ .  
HCT:  $V_M = 1.3 \text{ V}$ ;  $V_I = \text{GND to } 3 \text{ V}$ .