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Kind regards,

Team Nexperia

# 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

## **74HC/HCT688** 8-bit magnitude comparator

Product specification  
File under Integrated Circuits, IC06

December 1990

## 8-bit magnitude comparator

## 74HC/HCT688

## FEATURES

- Compare two 8-bit words
- Output capability: standard
- I<sub>CC</sub> category: MSI

## GENERAL DESCRIPTION

The 74HC/HCT688 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/HCT688 are 8-bit magnitude comparators. They perform comparison of two 8-bit binary or BCD words.

The output provides  $\overline{P = Q}$ .

## QUICK REFERENCE DATA

GND = 0 V; T<sub>amb</sub> = 25 °C; t<sub>r</sub> = t<sub>f</sub> = 6 ns

| SYMBOL                              | PARAMETER   | CONDITIONS                                    | TYPICAL |     | UNIT |
|-------------------------------------|---|---|---------|-----|------|
|                                     |   |   | HC      | HCT |      |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay                                     | C <sub>L</sub> = 15 pF; V <sub>CC</sub> = 5 V |         |     |      |
|                                     | P <sub>n</sub> , Q <sub>n</sub> to $\overline{P = Q}$ |   | 17      | 17  | ns   |
|                                     | E to $\overline{P = Q}$                               |   | 8       | 12  | ns   |
| C <sub>I</sub>                      | input capacitance                                     |   | 3.5     | 3.5 | pF   |
| C <sub>PD</sub>                     | power dissipation capacitance per package             | notes 1 and 2                                 | 30      | 30  | pF   |

## Notes

1. C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW):

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

f<sub>i</sub> = input frequency in MHz

f<sub>o</sub> = output frequency in MHz

∑ (C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of outputs

C<sub>L</sub> = output load capacitance in pF

V<sub>CC</sub> = supply voltage in V

2. For HC the condition is V<sub>I</sub> = GND to V<sub>CC</sub>  
For HCT the condition is V<sub>I</sub> = GND to V<sub>CC</sub> – 1.5 V

## ORDERING INFORMATION

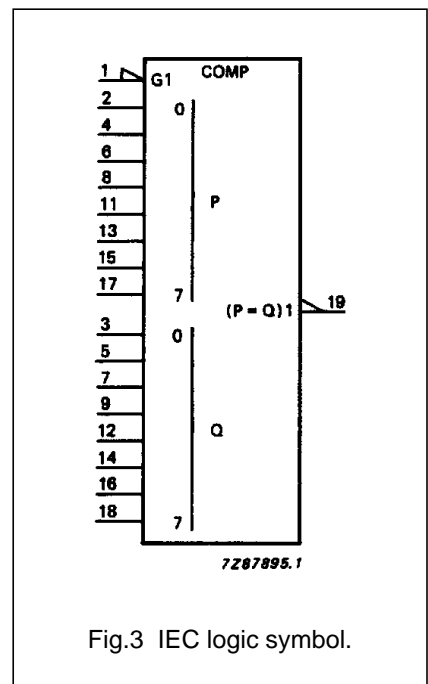
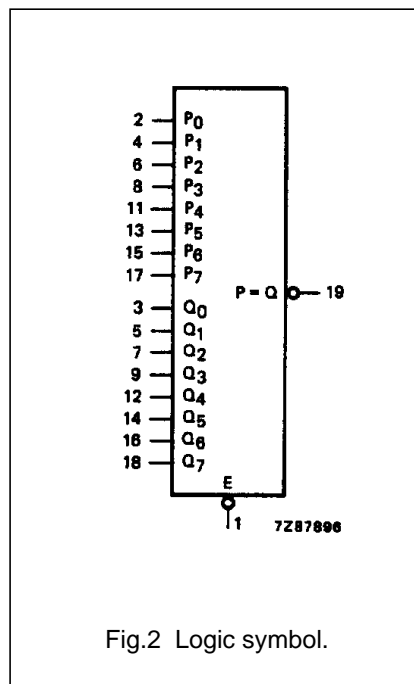
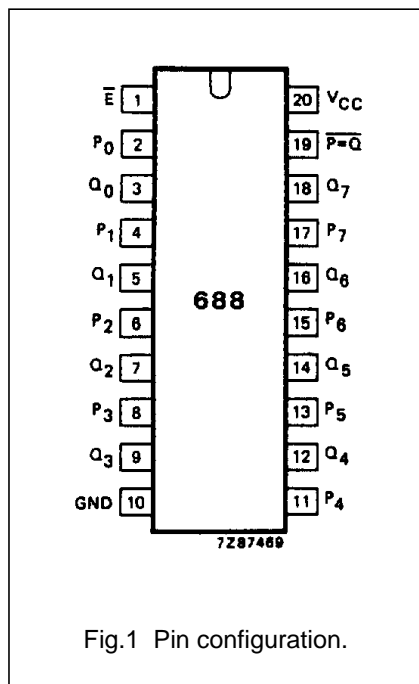
See "74HC/HCT/HCU/HCMOS Logic Package Information".

# 8-bit magnitude comparator

# 74HC/HCT688

## PIN DESCRIPTION

| PIN NO.                    | SYMBOL             | NAME AND FUNCTION         |
|----------------------------|--------------------|---------------------------|
| 1                          | $\bar{E}$          | enable input (active LOW) |
| 2, 4, 6, 8, 11, 13, 15, 17 | $P_0$ to $P_7$     | word inputs               |
| 3, 5, 7, 9, 12, 14, 16, 18 | $Q_0$ to $Q_7$     | word inputs               |
| 10                         | GND                | ground (0 V)              |
| 19                         | $\overline{P = Q}$ | equal to output           |
| 20                         | $V_{CC}$           | positive supply voltage   |



8-bit magnitude comparator

74HC/HCT688

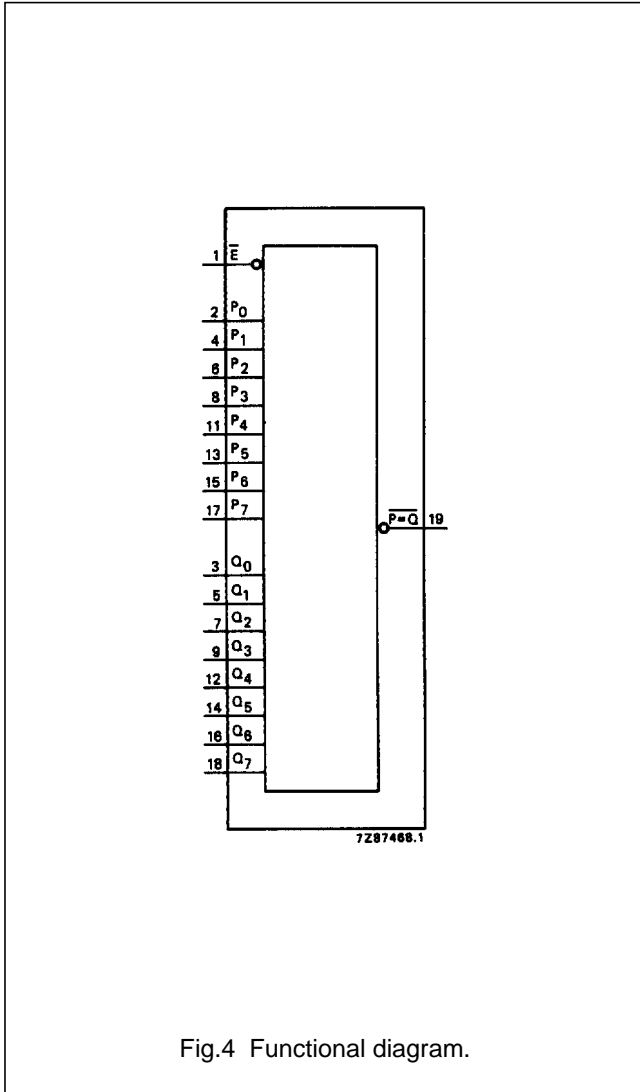


Fig.4 Functional diagram.

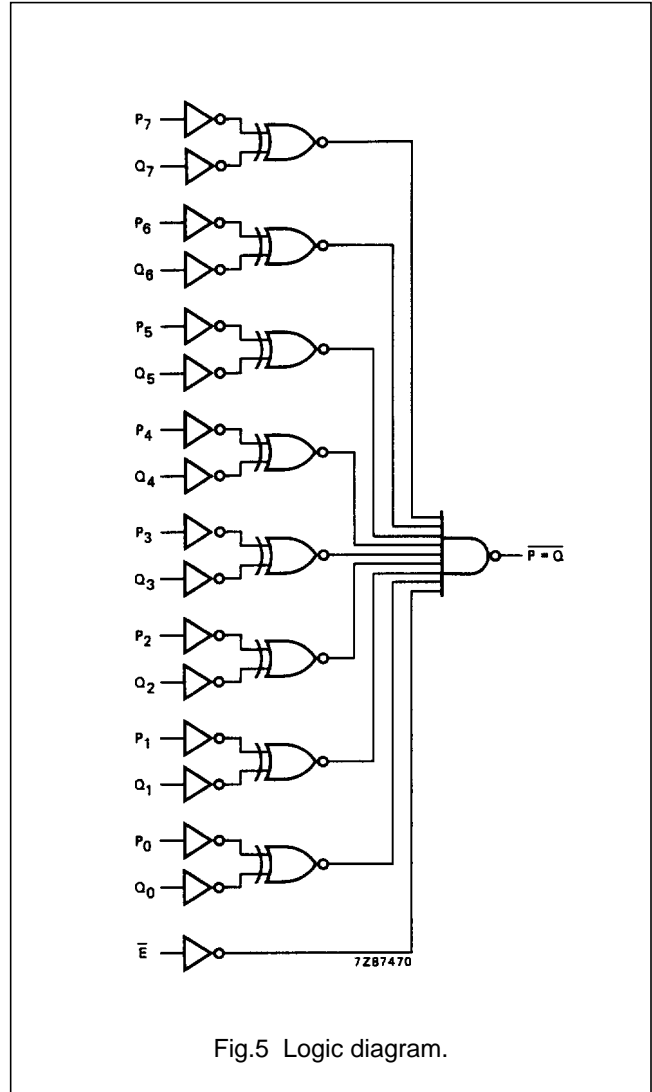


Fig.5 Logic diagram.

FUNCTION TABLE

| INPUTS                               |           | OUTPUT |
|--------------------------------------|-----------|--------|
| DATA P <sub>n</sub> , Q <sub>n</sub> | ENABLE Ē | P = Q̄ |
| P = Q                                | L         | L      |
| X                                    | H         | H      |
| P > Q                                | L         | H      |
| P < Q                                | L         | H      |

Notes

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

## 8-bit magnitude comparator

## 74HC/HCT688

**DC CHARACTERISTICS FOR 74HC**

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

Output capability: standard

I<sub>CC</sub> category: MSI

**AC CHARACTERISTICS FOR 74HC**

GND = 0 V; t<sub>r</sub> = t<sub>f</sub> = 6 ns; C<sub>L</sub> = 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> / t <sub>PLH</sub> | propagation delay<br>P <sub>n</sub> , Q <sub>n</sub> to $\overline{P} = \overline{Q}$ |                       | 55<br>20<br>16 | 170<br>34<br>29 |            | 215<br>43<br>37 |             | 255<br>51<br>43 | ns                     | 2.0<br>4.5<br>6.0 | Fig.6        |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>$\overline{E}$ to P = Q  |                       | 28<br>10<br>8  | 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.7        |
| t <sub>THL</sub> / 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 | Figs 6 and 7 |

## 8-bit magnitude comparator

## 74HC/HCT688

**DC CHARACTERISTICS FOR 74HCT**

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

Output capability: standard

$I_{CC}$  category: MSI

**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 |
|-----------|-----------------------|
| $P_n$     | 0.35                  |
| $Q_n$     | 0.35                  |
| $\bar{E}$ | 0.70                  |

**AC CHARACTERISTICS FOR 74HCT**

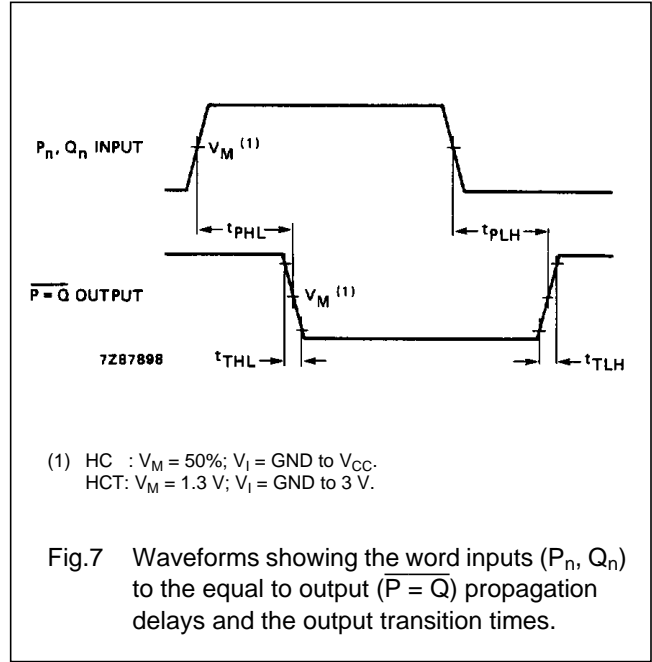
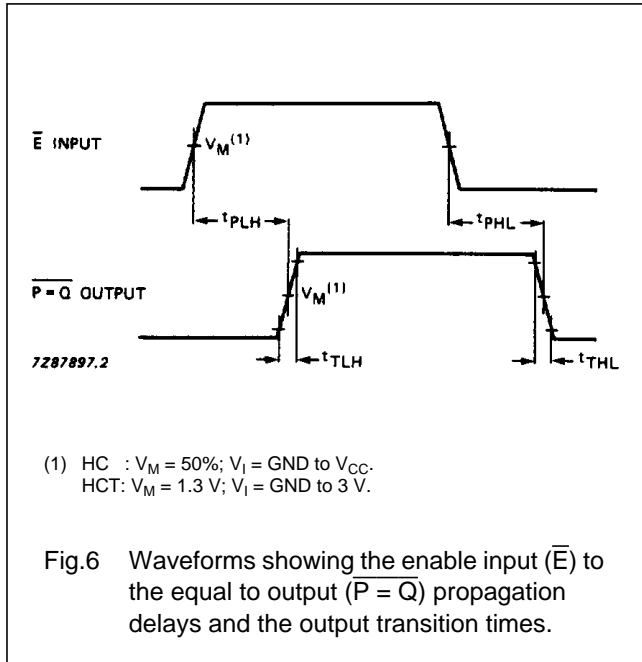
GND = 0 V;  $t_r = t_f = 6$  ns;  $C_L = 50$  pF

| SYMBOL            | PARAMETER  | $T_{amb}$ (°C) |      |      |            |      |             |      |    | UNIT | TEST CONDITIONS |           |
|-------------------|--|----------------|------|------|------------|------|-------------|------|----|------|-----------------|-----------|
|                   |  | 74HCT          |      |      |            |      |             |      |    |      | $V_{CC}$<br>(V) | WAVEFORMS |
|                   |  | +25            |      |      | -40 to +85 |      | -40 to +125 |      |    |      |                 |           |
|                   |  | min.           | typ. | max. | min.       | max. | min.        | max. |    |      |                 |           |
| $t_{PHL}/t_{PLH}$ | propagation delay<br>$P_n, Q_n$ to $\bar{P} = \bar{Q}$ |                | 20   | 34   |            | 43   |             | 51   | ns | 4.5  | Fig.6           |           |
| $t_{PHL}/t_{PLH}$ | propagation delay<br>$\bar{E}$ to $P = Q$              |                | 18   | 24   |            | 30   |             | 36   | ns | 4.5  | Fig.7           |           |
| $t_{THL}/t_{TLH}$ | output transition time                                 |                | 7    | 15   |            | 19   |             | 22   | ns | 4.5  | Figs 6 and 7    |           |

8-bit magnitude comparator

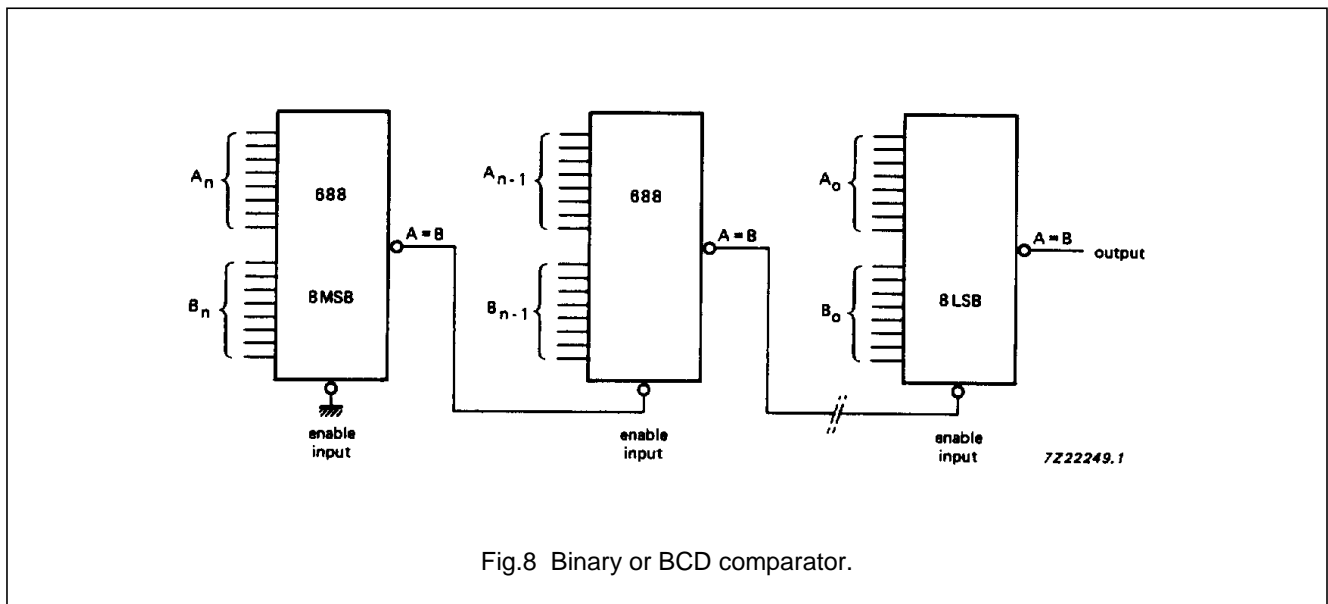
74HC/HCT688

AC WAVEFORMS



APPLICATION INFORMATION

Two or more "688" 8-bit magnitude comparators may be cascaded to compare binary or BCD numbers of more than 8 bits. An example is shown in Fig.8.



PACKAGE OUTLINES

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