

# DATA SHEET

For a complete data sheet, please also download:

- The IC04 LOCMOS HE4000B Logic Family Specifications HEF, HEC
- The IC04 LOCMOS HE4000B Logic Package Outlines/Information HEF, HEC

## HEF4585B

## MSI

## 4-bit magnitude comparator

Product specification  
File under Integrated Circuits, IC04

January 1995

4-bit magnitude comparator

HEF4585B

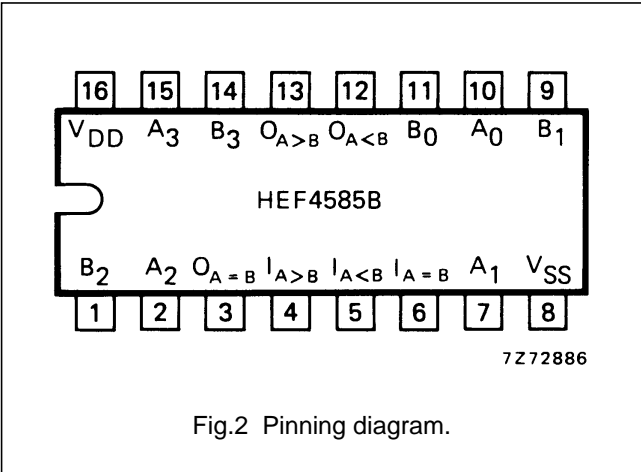
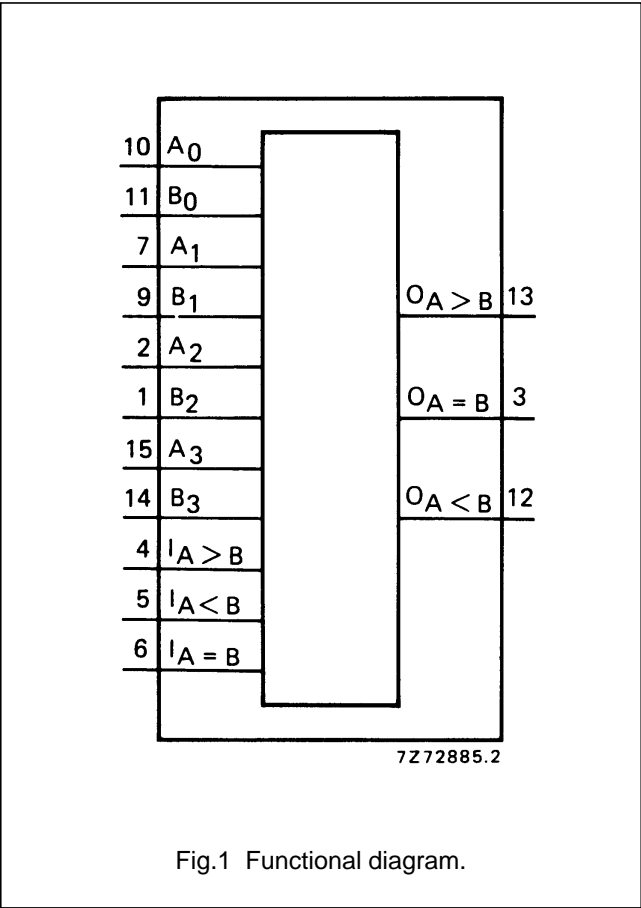
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DESCRIPTION

The HEF4585B is a 4-bit magnitude comparator which compares two 4-bit words (A and B), whether they are 'less than', 'equal to', or 'greater than'. Each word has four parallel inputs ( $A_0$  to  $A_3$  and  $B_0$  to  $B_3$ );  $A_3$  and  $B_3$  being the most significant inputs. Three outputs are provided; A greater than B ( $O_{A > B}$ ), A less than B ( $O_{A < B}$ ) and A equal to B ( $O_{A = B}$ ). Three expander inputs ( $I_{A > B}$ ,  $I_{A < B}$  and  $I_{A = B}$ ) allow cascading of the devices without external gates.

For proper compare operation the expander inputs to the least significant position must be connected as follows:  $I_{A = B} = I_{A > B} = \text{HIGH}$ ,  $I_{A < B} = \text{LOW}$ . For words greater than 4-bits, units can be cascaded by connecting outputs  $O_{A < B}$  and  $O_{A = B}$  to the corresponding inputs of the next significant comparator (input  $I_{A > B}$  is connected to a HIGH).

Operation is not restricted to binary codes, the devices will work with any monotonic code. The function table describes the operation of the device under all possible logic conditions.



- HEF4585BP(N): 16-lead DIL; plastic (SOT38-1)
- HEF4585BD(F): 16-lead DIL; ceramic (cerdip) (SOT74)
- HEF4585BT(D): 16-lead SO; plastic (SOT109-1)
- ( ): Package Designator North America

PINNING

- $A_0$  to  $A_3$  word A parallel inputs
- $B_0$  to  $B_3$  word B parallel inputs
- $I_{A > B}$ ,  $I_{A < B}$ ,  $I_{A = B}$  expander inputs
- $O_{A > B}$  A greater than B output
- $O_{A < B}$  A less than B output
- $O_{A = B}$  A equal to B output

FAMILY DATA,  $I_{DD}$  LIMITS category MSI

See Family Specifications

## 4-bit magnitude comparator

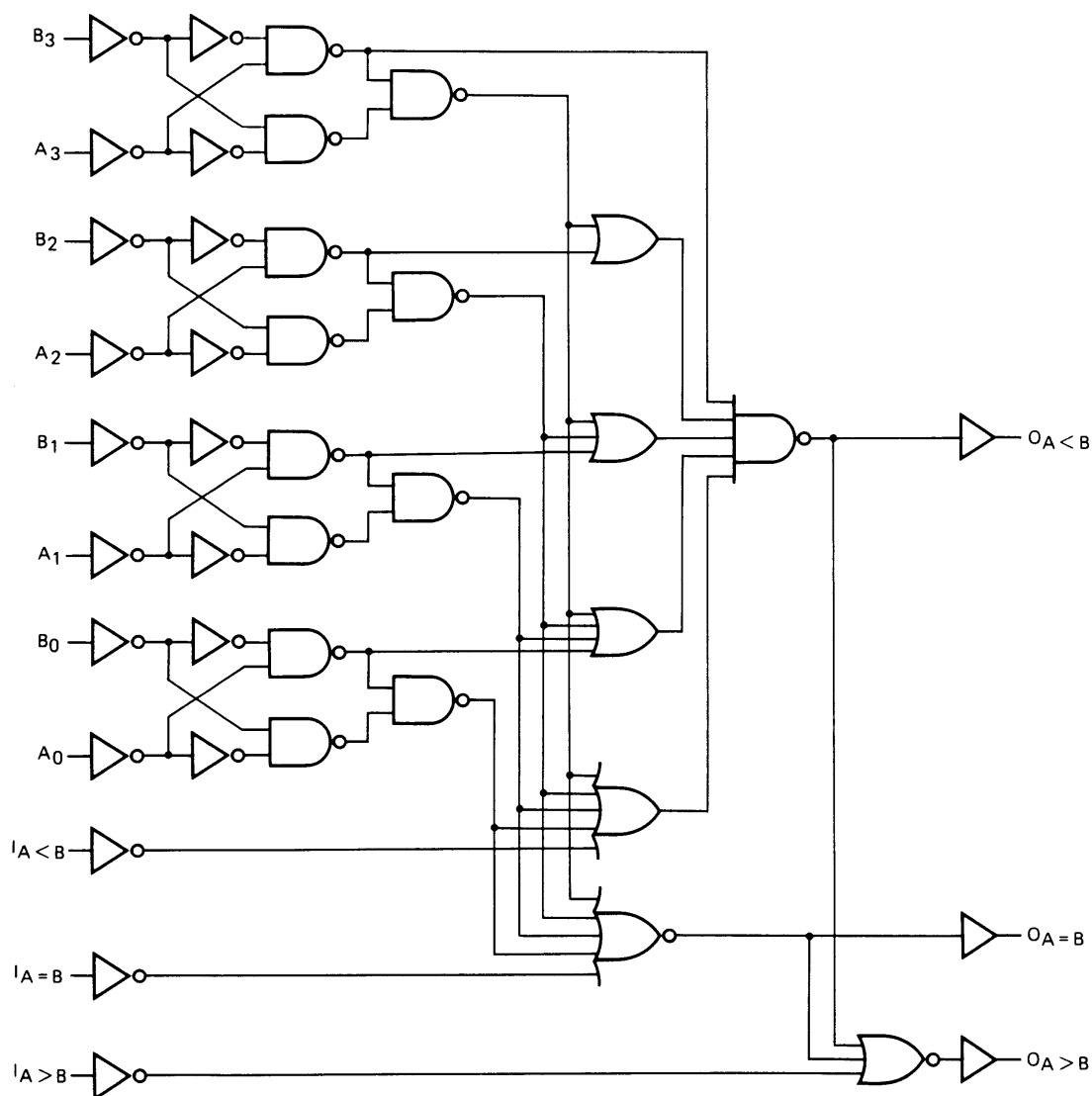
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Fig.3 Logic diagram.

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FUNCTION TABLE

COMPARING INPUTS				CASCADING INPUTS			OUTPUTS		
A <sub>3</sub> , B <sub>3</sub>	A <sub>2</sub> , B <sub>2</sub>	A <sub>1</sub> , B <sub>1</sub>	A <sub>0</sub> , B <sub>0</sub>	I <sub>A &gt; B</sub>	I <sub>A &lt; B</sub>	I <sub>A = B</sub>	O <sub>A &gt; B</sub>	O <sub>A &lt; B</sub>	O <sub>A = B</sub>
A <sub>3</sub> > B <sub>3</sub>	X	X	X	H	X	X	H	L	L
A <sub>3</sub> < B <sub>3</sub>	X	X	X	X	X	X	L	H	L
A <sub>3</sub> = B <sub>3</sub>	A <sub>2</sub> > B <sub>2</sub>	X	X	H	X	X	H	L	L
A <sub>3</sub> = B <sub>3</sub>	A <sub>2</sub> < B <sub>2</sub>	X	X	X	X	X	L	H	L
A <sub>3</sub> = B <sub>3</sub>	A <sub>2</sub> = B <sub>2</sub>	A <sub>1</sub> > B <sub>1</sub>	X	H	X	X	H	L	L
A <sub>3</sub> = B <sub>3</sub>	A <sub>2</sub> = B <sub>2</sub>	A <sub>1</sub> < B <sub>1</sub>	X	X	X	X	L	H	L
A <sub>3</sub> = B <sub>3</sub>	A <sub>2</sub> = B <sub>2</sub>	A <sub>1</sub> = B <sub>1</sub>	A <sub>0</sub> > B <sub>0</sub>	H	X	X	H	L	L
A <sub>3</sub> = B <sub>3</sub>	A <sub>2</sub> = B <sub>2</sub>	A <sub>1</sub> = B <sub>1</sub>	A <sub>0</sub> < B <sub>0</sub>	X	X	X	L	H	L
A <sub>3</sub> = B <sub>3</sub>	A <sub>2</sub> = B <sub>2</sub>	A <sub>1</sub> = B <sub>1</sub>	A <sub>0</sub> = B <sub>0</sub>	X	L	H	L	L	H
A <sub>3</sub> = B <sub>3</sub>	A <sub>2</sub> = B <sub>2</sub>	A <sub>1</sub> = B <sub>1</sub>	A <sub>0</sub> = B <sub>0</sub>	H	L	L	H	L	L
A <sub>3</sub> = B <sub>3</sub>	A <sub>2</sub> = B <sub>2</sub>	A <sub>1</sub> = B <sub>1</sub>	A <sub>0</sub> = B <sub>0</sub>	X	H	L	L	H	L
A <sub>3</sub> = B <sub>3</sub>	A <sub>2</sub> = B <sub>2</sub>	A <sub>1</sub> = B <sub>1</sub>	A <sub>0</sub> = B <sub>0</sub>	X	H	H	L	H	H
A <sub>3</sub> = B <sub>3</sub>	A <sub>2</sub> = B <sub>2</sub>	A <sub>1</sub> = B <sub>1</sub>	A <sub>0</sub> = B <sub>0</sub>	L	L	L	L	L	L

## Notes

1. H = HIGH state (the more positive voltage)  
L = LOW state (the less positive voltage)  
X = state is immaterial

The upper 11 lines describe the normal operation under all conditions that will occur in a single device or in a serial expansion scheme.

The lower 2 lines describe the operation under abnormal conditions on the cascading inputs. These conditions occur when the parallel expansion technique is used.

## 4-bit magnitude comparator

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## AC CHARACTERISTICS

 $V_{SS} = 0\text{ V}$ ;  $T_{amb} = 25\text{ °C}$ ;  $C_L = 50\text{ pF}$ ; input transition times  $\leq 20\text{ ns}$ 

	$V_{DD}$ V	SYMBOL	MIN.	TYP.	MAX.	TYPICAL EXTRAPOLATION FORMULA
Propagation delays $A_n, B_n \rightarrow O_n$ HIGH to LOW	5	$t_{PHL}$		160	320 ns	133 ns + (0,55 ns/pF) $C_L$
	10			65	130 ns	54 ns + (0,23 ns/pF) $C_L$
	15			45	90 ns	37 ns + (0,16 ns/pF) $C_L$
	5	$t_{PLH}$		150	300 ns	123 ns + (0,55 ns/pF) $C_L$
	10			60	120 ns	49 ns + (0,23 ns/pF) $C_L$
	15			45	90 ns	37 ns + (0,16 ns/pF) $C_L$
	5	$t_{PHL}$		110	220 ns	83 ns + (0,55 ns/pF) $C_L$
	10			45	90 ns	34 ns + (0,23 ns/pF) $C_L$
	15			30	60 ns	22 ns + (0,16 ns/pF) $C_L$
	5	$t_{PLH}$		120	240 ns	93 ns + (0,55 ns/pF) $C_L$
	10			50	100 ns	39 ns + (0,23 ns/pF) $C_L$
	15			35	70 ns	27 ns + (0,16 ns/pF) $C_L$
Output transition times HIGH to LOW	5	$t_{THL}$		60	120 ns	10 ns + (1,0 ns/pF) $C_L$
	10			30	60 ns	9 ns + (0,42 ns/pF) $C_L$
	15			20	40 ns	6 ns + (0,28 ns/pF) $C_L$
	5	$t_{TLH}$		60	120 ns	10 ns + (1,0 ns/pF) $C_L$
	10			30	60 ns	9 ns + (0,42 ns/pF) $C_L$
	15			20	40 ns	6 ns + (0,28 ns/pF) $C_L$

	$V_{DD}$ V	TYPICAL FORMULA FOR P ( $\mu\text{W}$ )	
Dynamic power dissipation per package (P)	5	$1250 f_i + \sum (f_o C_L) \times V_{DD}^2$	where $f_i$ = input freq. (MHz) $f_o$ = output freq. (MHz) $C_L$ = load capacitance (pF) $\sum (f_o C_L)$ = sum of outputs $V_{DD}$ = supply voltage (V)
	10	$5500 f_i + \sum (f_o C_L) \times V_{DD}^2$	
	15	$15\,000 f_i + \sum (f_o C_L) \times V_{DD}^2$	

## APPLICATION INFORMATION

Some examples of applications for the HEF4585B are:

- Process controllers.
- Servo-motor control.

4-bit magnitude comparator

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