

# 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 MSI

### 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.

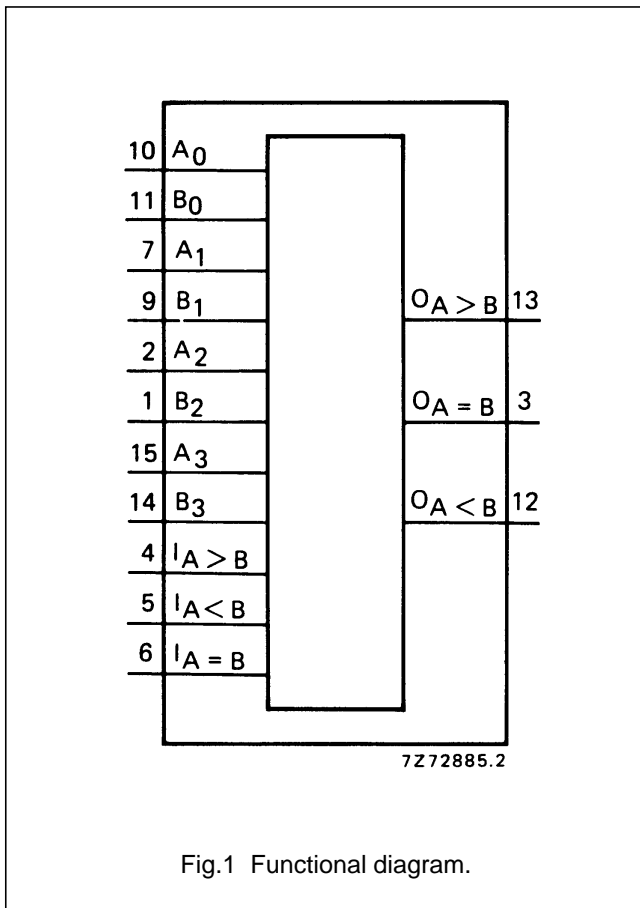


Fig.1 Functional diagram.

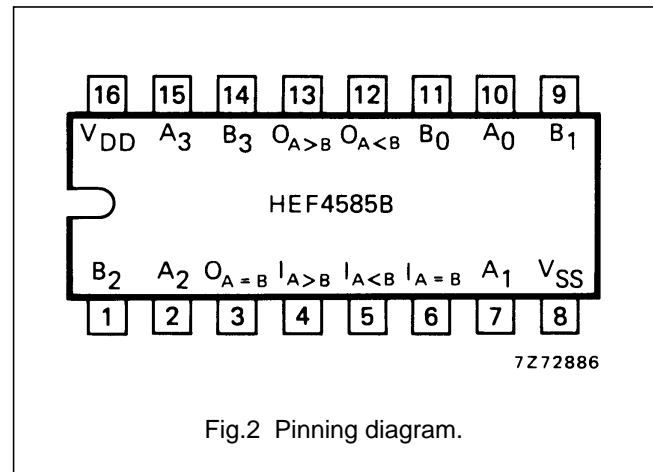


Fig.2 Pinning diagram.

- 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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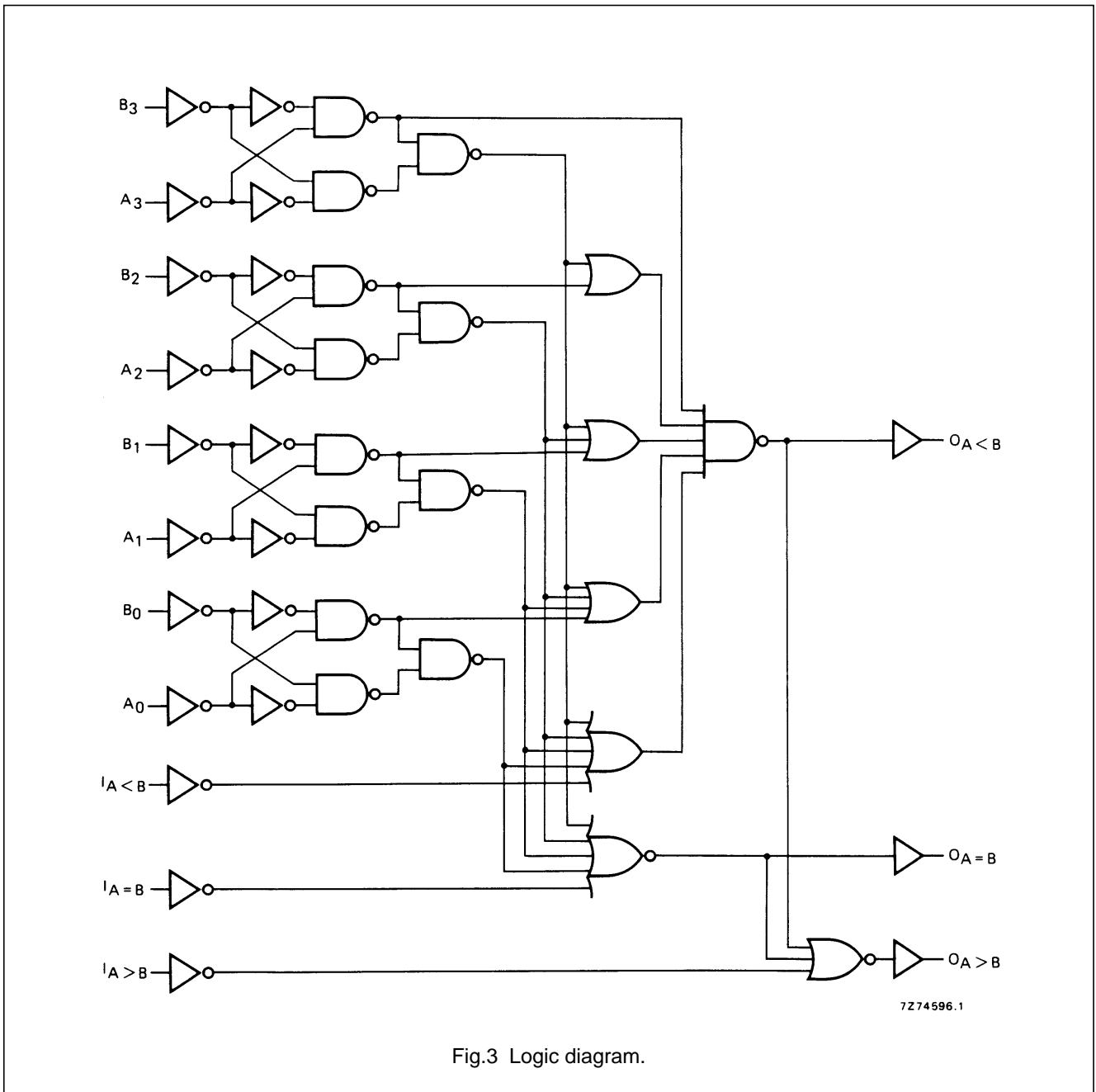


Fig.3 Logic diagram.

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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

- 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

HEF4585B  
MSI**AC CHARACTERISTICS** $V_{SS} = 0\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $C_L = 50\text{ pF}$ ; 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  LOW to HIGH  $I_n \rightarrow O_n$ HIGH to LOW  LOW to HIGH	5	$t_{PHL}$		160	320 ns	$133\text{ ns} + (0,55\text{ ns/pF}) C_L$
	10		65	130 ns	$54\text{ ns} + (0,23\text{ ns/pF}) C_L$	
	15		45	90 ns	$37\text{ ns} + (0,16\text{ ns/pF}) C_L$	
	5	$t_{PLH}$		150	300 ns	$123\text{ ns} + (0,55\text{ ns/pF}) C_L$
	10		60	120 ns	$49\text{ ns} + (0,23\text{ ns/pF}) C_L$	
	15		45	90 ns	$37\text{ ns} + (0,16\text{ ns/pF}) C_L$	
	5	$t_{PHL}$		110	220 ns	$83\text{ ns} + (0,55\text{ ns/pF}) C_L$
	10		45	90 ns	$34\text{ ns} + (0,23\text{ ns/pF}) C_L$	
	15		30	60 ns	$22\text{ ns} + (0,16\text{ ns/pF}) C_L$	
	5	$t_{PLH}$		120	240 ns	$93\text{ ns} + (0,55\text{ ns/pF}) C_L$
	10		50	100 ns	$39\text{ ns} + (0,23\text{ ns/pF}) C_L$	
	15		35	70 ns	$27\text{ ns} + (0,16\text{ ns/pF}) C_L$	
Output transition times HIGH to LOW  LOW to HIGH	5	$t_{THL}$		60	120 ns	$10\text{ ns} + (1,0\text{ ns/pF}) C_L$
	10		30	60 ns	$9\text{ ns} + (0,42\text{ ns/pF}) C_L$	
	15		20	40 ns	$6\text{ ns} + (0,28\text{ ns/pF}) C_L$	
	5	$t_{TLH}$		60	120 ns	$10\text{ ns} + (1,0\text{ ns/pF}) C_L$
	10		30	60 ns	$9\text{ ns} + (0,42\text{ ns/pF}) C_L$	
	15		20	40 ns	$6\text{ ns} + (0,28\text{ ns/pF}) C_L$	

	$V_{DD}$ 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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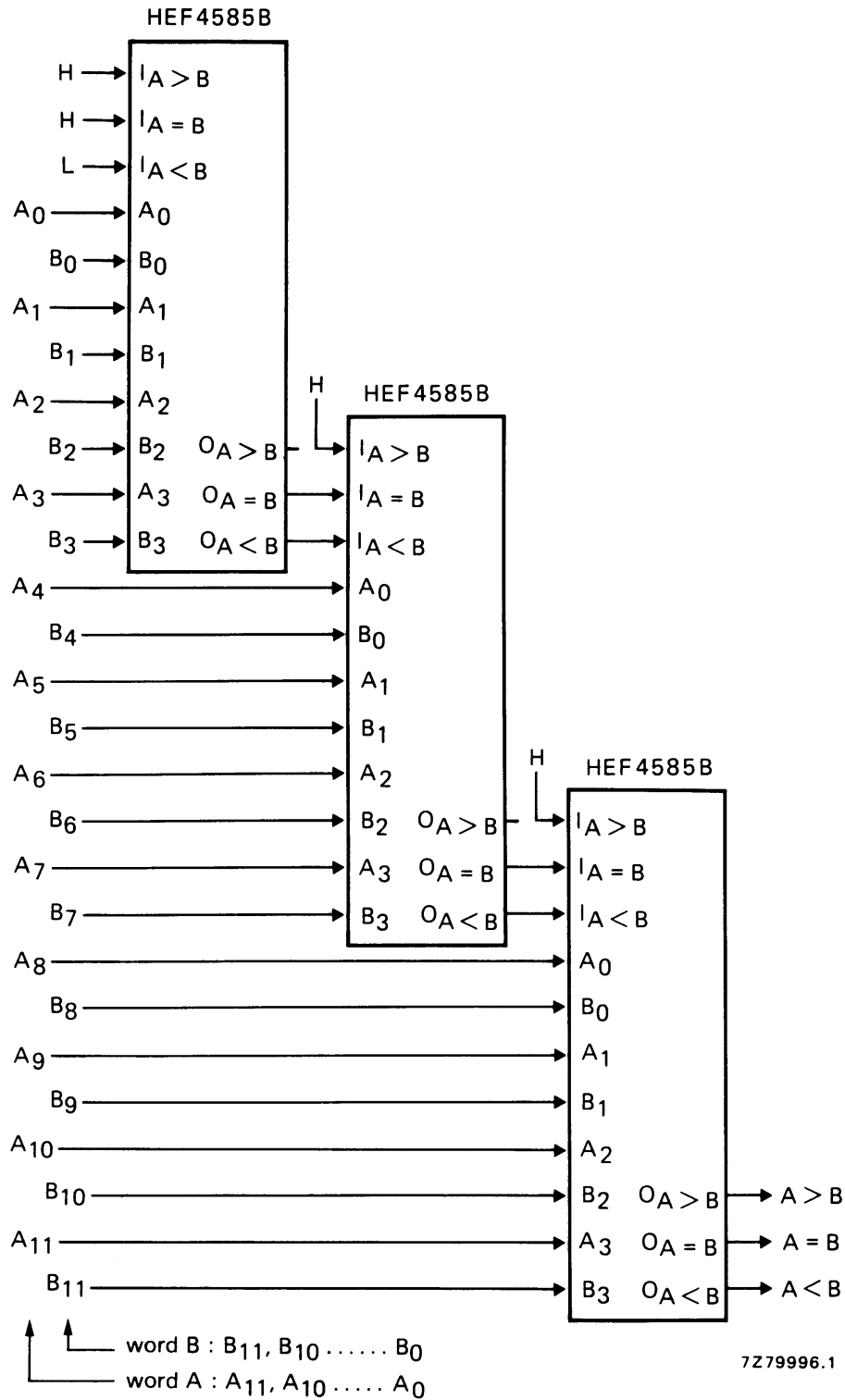


Fig.4 Example of cascading comparators.