

# 40085B/74C85/54C85

## 4-BIT MAGNITUDE COMPARATOR

**DESCRIPTION** – The 40085B is a 4-Bit Magnitude Comparator which compares two 4-bit words (A, B), each word having four Parallel Inputs ( $A_0$ - $A_3$ ,  $B_0$ - $B_3$ );  $A_3$ ,  $B_3$  being the most significant inputs. Operation is not restricted to binary codes, the device will work with any monotonic code. Three Outputs are provided: "A greater than B" ( $O_{A>B}$ ), "A less than B" ( $O_{A<B}$ ), "A equal to B" ( $O_{A=B}$ ). Three Expander Inputs,  $I_{A>B}$ ,  $I_{A<B}$ ,  $I_{A=B}$ , allow cascading without external gates. For proper compare operation the Expander Inputs to the least significant position must be connected as follows:  $I_{A<B} = I_{A>B} = L$ ,  $I_{A=B} = H$ . For serial (ripple) expansion, the  $O_{A>B}$ ,  $O_{A<B}$  and  $O_{A=B}$  Outputs are connected respectively to the  $I_{A>B}$ ,  $I_{A<B}$ , and  $I_{A=B}$  inputs of the next most significant comparator, as shown in Figure 1. Refer to Applications section of data sheet for high speed method of comparing large words.

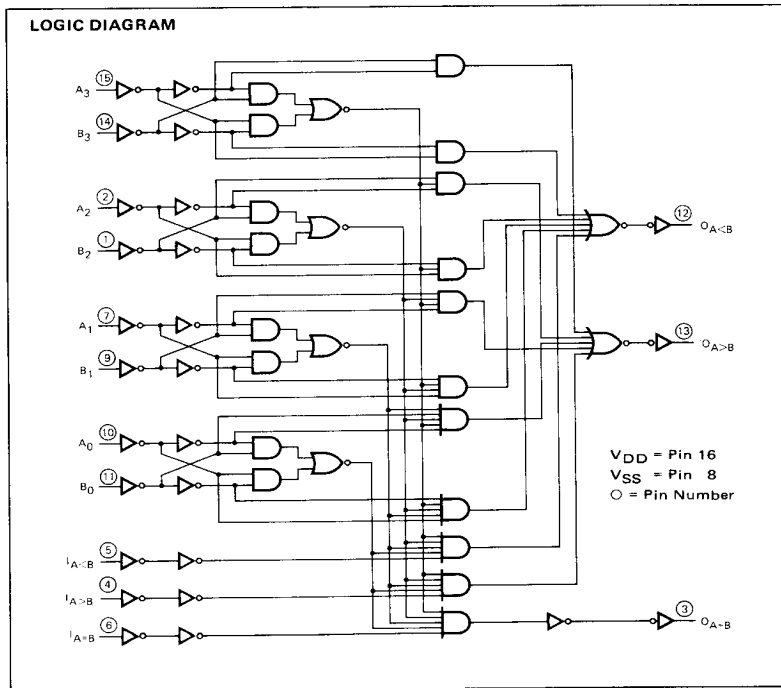
The Truth Table on the following page describes the operation of the 40085B under all possible logic conditions. The upper 11 lines describe the normal operation under all conditions that will occur in a single device or in a series expansion scheme. The lower five lines describe the operation under abnormal conditions on the cascading inputs. These conditions occur when the parallel expansion technique is used.

The 40085B is a direct replacement for the 74C85/54C85.

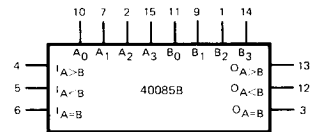
- EASILY EXPANDABLE
- BINARY OR BCD COMPARISON
- $O_{A>B}$ ,  $O_{A<B}$ , AND  $O_{A=B}$  OUTPUTS AVAILABLE

### PIN NAMES

$A_0$ - $A_3$	Word A Parallel Inputs
$B_0$ - $B_3$	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

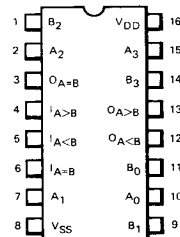


### LOGIC SYMBOL



$V_{DD}$  = Pin 16  
 $V_{SS}$  = Pin 8

### CONNECTION DIAGRAM DIP (TOP VIEW)



**NOTE:**  
 The Flatpak version has the same pinouts (Connection Diagram) as the Dual In-line Package.

TRUTH 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</sub> >B	I <sub>A</sub> <B	I <sub>A</sub> =B	O <sub>A</sub> >B	O <sub>A</sub> <B	O <sub>A</sub> =B
A <sub>3</sub> >B <sub>3</sub>	X	X	X	X	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	X	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	X	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>	X	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>	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>	L	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>	L	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>	L	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>	H	L	H	H	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	H	H	H	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>	H	H	L	H	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>	L	L	L	L	L	L

H = HIGH Level  
L = LOW Level  
X = Don't Care

DC CHARACTERISTICS: V<sub>DD</sub> as shown, V<sub>SS</sub> = 0 V (See Note 1)

SYMBOL	PARAMETER	LIMITS									UNITS	TEMP	TEST CONDITIONS	
		V <sub>DD</sub> = 5 V			V <sub>DD</sub> = 10 V			V <sub>DD</sub> = 15 V						
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX				
I <sub>DD</sub>	Quiescent Power Supply Current	XC			20			40			80	μA	MIN, 25°C MAX	All inputs at 0 V or V <sub>DD</sub>
					150			300			600			
		XM			5			10			20	μA	MIN, 25°C MAX	
			150			300			600					

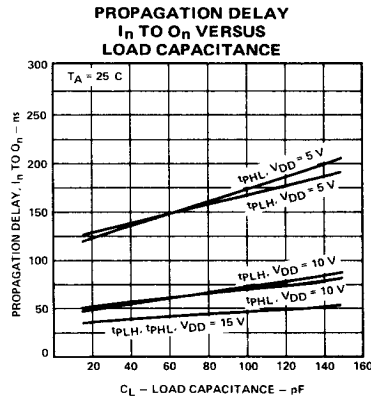
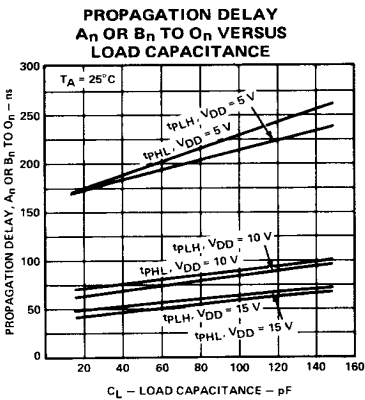
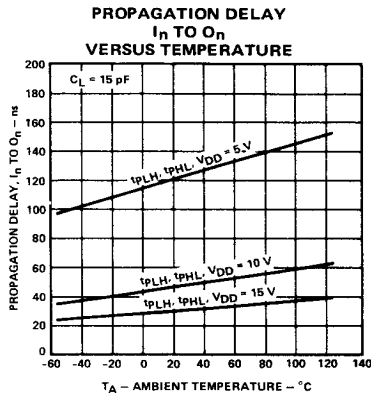
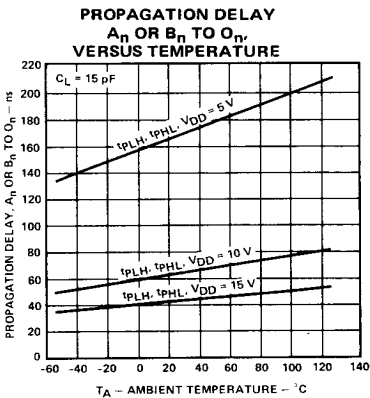
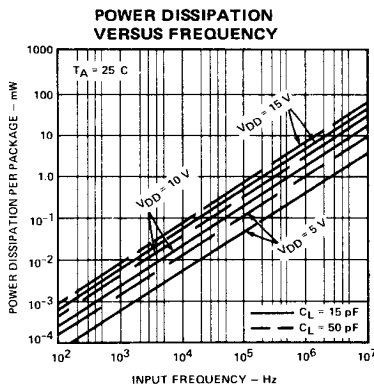
AC CHARACTERISTICS AND SET-UP REQUIREMENTS: V<sub>DD</sub> as shown, V<sub>SS</sub> = 0 V, T<sub>A</sub> = 25°C (See Note 2)

SYMBOL	PARAMETER	LIMITS									UNITS	TEST CONDITIONS
		V <sub>DD</sub> = 5 V			V <sub>DD</sub> = 10 V			V <sub>DD</sub> = 15 V				
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX		
t <sub>PLH</sub>	Propagation Delay, A <sub>n</sub> or B <sub>n</sub> to any Output		180	335		70	140		50	112	ns	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 200 kΩ Input Transition Times ≤ 20 ns
t <sub>PLH</sub>	Propagation Delay, Any I to any Output		135	275		55	120		40	96		
t <sub>PHL</sub>	Propagation Delay, Any I to any Output		135	275		55	120		40	96		
t <sub>TLH</sub>	Output Transition Time		60	135		30	70		20	45	ns	
t <sub>THL</sub>			60	135		30	70		20	45		

NOTES:

- Additional DC Characteristics are listed in this section under 4000B Series CMOS Family Characteristics.
- Propagation Delays and Output Transition Times are graphically described in this section under 4000B Series CMOS Family Characteristics.

TYPICAL ELECTRICAL CHARACTERISTICS



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APPLICATIONS

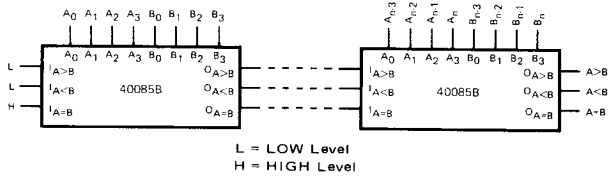


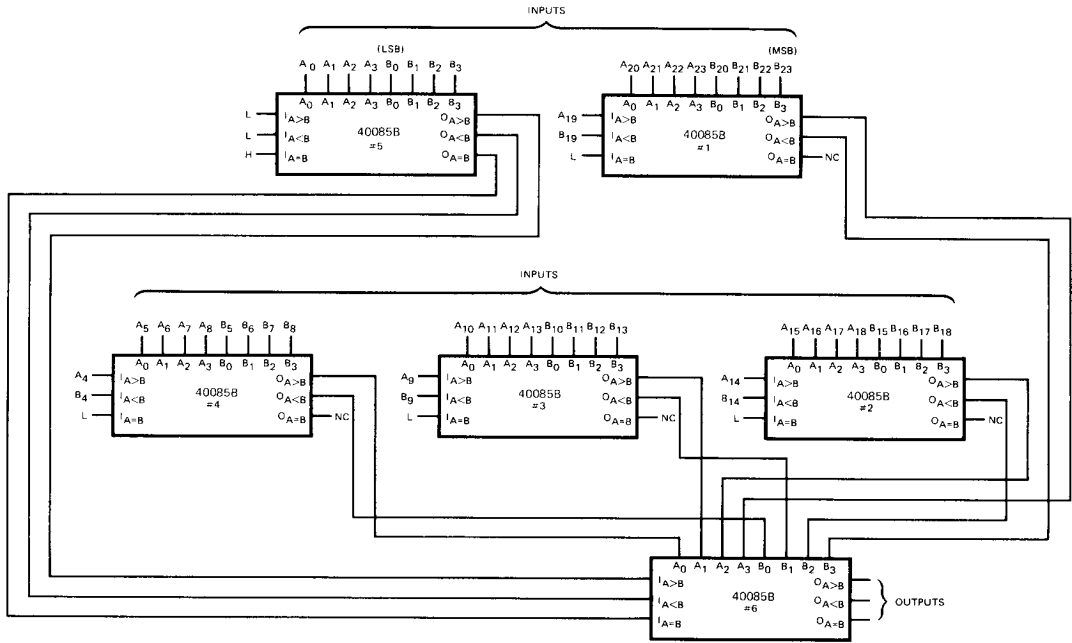
Fig. 1. COMPARING TWO n-BIT WORDS

Figure 2 shows a high speed method of comparing two 24-bit words with only two levels of device delay. With the technique shown in Figure 1, six levels of device delay result when comparing two 24-bit words. The parallel technique can be expanded to any number of bits, see Table I.

TABLE I

WORD LENGTH	NUMBER OF PKGS.
1-4 Bits	1
5-24 Bits	2 - 6
25-120 Bits	8 - 31

NOTE:  
The F40085 can be used as a 5-bit comparator only when the outputs are used to drive the A<sub>0</sub>-A<sub>3</sub> and B<sub>0</sub>-B<sub>3</sub> inputs of another 40085B as shown in Figure 2 in positions #1, 2, 3, and 4.



MSB = Most Significant Bit  
LSB = Least Significant Bit  
L = LOW Level  
H = HIGH Level  
NC = No Connection

Fig. 2. COMPARISON OF TWO 24-BIT WORDS