

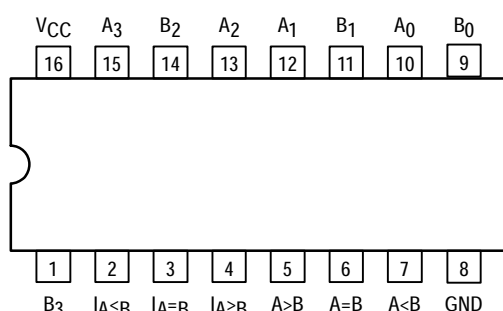


## 4-BIT MAGNITUDE COMPARATOR

The MC54/74F85 is a 4-Bit Magnitude Comparator which compares two 4-Bit words ( $A_0$ - $A_3$ ,  $B_0$ - $B_3$ ),  $A_3$ ,  $B_3$  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" ( $0_A > B$ ), "A less than B" ( $0_A < B$ ), "A equal to B" ( $0_A = B$ ). 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  $0_A > B$ ,  $0_A < B$  Outputs are connected respectively to the  $I_A > B$  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.

- High Impedance NPN Base Inputs for Reduced Loading (20  $\mu$ A in HIGH and LOW States)
- Magnitude Comparison of any Binary Words
- Serial or Parallel Expansion Without Extra Gating
- ESD > 4000 Volts

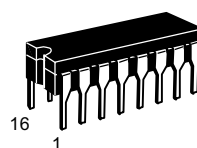
### CONNECTION DIAGRAM



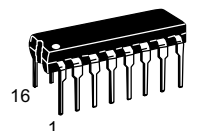
**MC54/74F85**

**4-BIT MAGNITUDE COMPARATOR**

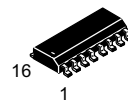
**FAST™ SCHOTTKY TTL**



**J SUFFIX**  
CERAMIC  
CASE 620-09



**N SUFFIX**  
PLASTIC  
CASE 648-08



**D SUFFIX**  
SOIC  
CASE 751B-03

### ORDERING INFORMATION

MC74FXXJ	Ceramic
MC74FXXN	Plastic
MC74FXXD	SOIC

### GUARANTEED OPERATING RANGES

Symbol	Parameter		Min	Typ	Max	Unit
$V_{CC}$	Supply Voltage	54, 74	4.5	5.0	5.5	V
$T_A$	Operating Ambient Temperature Range	54	-55	25	125	°C
		74	0	25	70	
$I_{OH}$	Output Current — High	54, 74			-1.0	mA
$I_{OL}$	Output Current — Low	54, 74			20	mA

# MC54/74F85

FUNCTION TABLE

Comparing Inputs				Expansion 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	A > B	A < B	A = 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>	X	X	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	H	L	L	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	L	L	H	H	L

H = HIGH Voltage Level

L = LOW Voltage Level

X = Don't Care

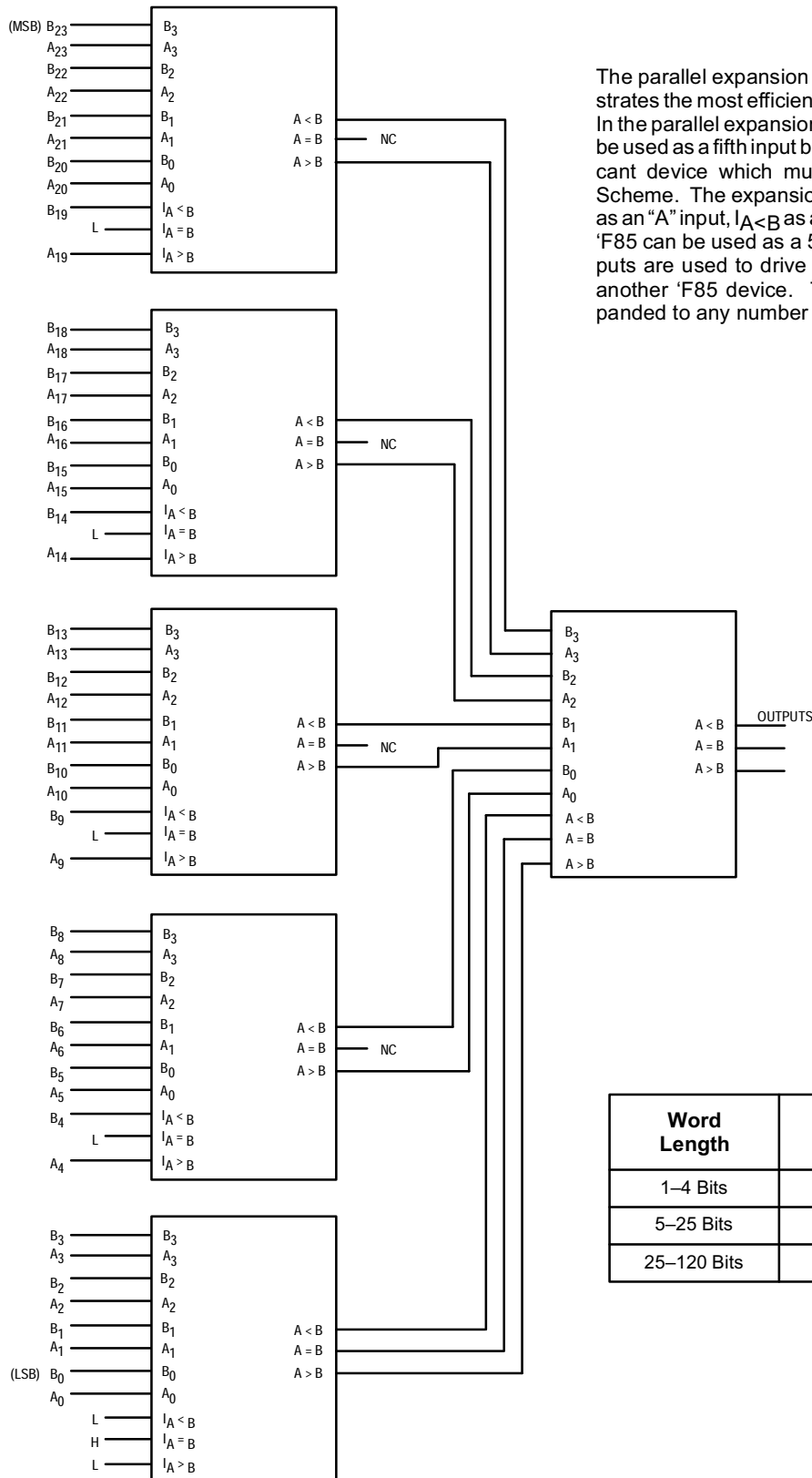
DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

Symbol	Parameter	Limits			Unit	Test Conditions
		Min	Typ	Max		
V <sub>IH</sub>	Input HIGH Voltage	2.0			V	Guaranteed Input HIGH Voltage
V <sub>IL</sub>	Input LOW Voltage			0.8	V	Guaranteed Input LOW Voltage
V <sub>IK</sub>	Input Clamp Diode Voltage			-1.2	V	V <sub>CC</sub> = MIN, I <sub>IN</sub> = -18 mA
V <sub>OH</sub>	Output HIGH Voltage	54, 74	2.5		V	I <sub>OH</sub> = -1.0 mA V <sub>CC</sub> = 4.50 V V <sub>CC</sub> = 4.75 V
		74	2.7			
V <sub>OL</sub>	Output LOW Voltage			0.5	V	I <sub>OL</sub> = 20 mA, V <sub>CC</sub> = MIN
I <sub>IH</sub>	Input HIGH Current			20	μA	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 2.7 V
				0.1	mA	V <sub>CC</sub> = 0 V, V <sub>IN</sub> = 7.0 V
I <sub>IL</sub>	Input LOW Current			-20	μA	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 0.5 V
I <sub>OS</sub>	Output Short Circuit Current (Note 2)	-60		-150	mA	V <sub>CC</sub> = MAX, V <sub>OUT</sub> = 0 V
I <sub>CC</sub>	Total Supply Current				mA	V <sub>CC</sub> = MAX
	HIGH V <sub>IN</sub> = HIGH			50		
	LOW A <sub>n</sub> = B <sub>n</sub> = I <sub>A-B</sub> = GND: I <sub>A&gt;B</sub> = I <sub>A&lt;B</sub> = 4.5 V			54		

NOTES:

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable device type.
- Not more than one output should be shorted at a time, nor for more than 1 second.

## MC54/74F85



The parallel expansion scheme shown in Figure 1 demonstrates the most efficient general use of these comparators. In the parallel expansion scheme, the expansion inputs can be used as a fifth input bit position except on the least significant device which must be connected as in the Serial Scheme. The expansion inputs are used by labelling I<sub>A > B</sub> as an "A" input, I<sub>A < B</sub> as a "B" input and setting I<sub>A = B</sub> low. The 'F85 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 'F85 device. The parallel technique can be expanded to any number of bits as shown in Table 1.

Table 1

Word Length	Number of Packages	Typical Speeds 74F
1-4 Bits	1	12 ns
5-25 Bits	2-6	22 ns
25-120 Bits	8-31	34 ns

Figure 1. Comparison of Two 24-Bit Words

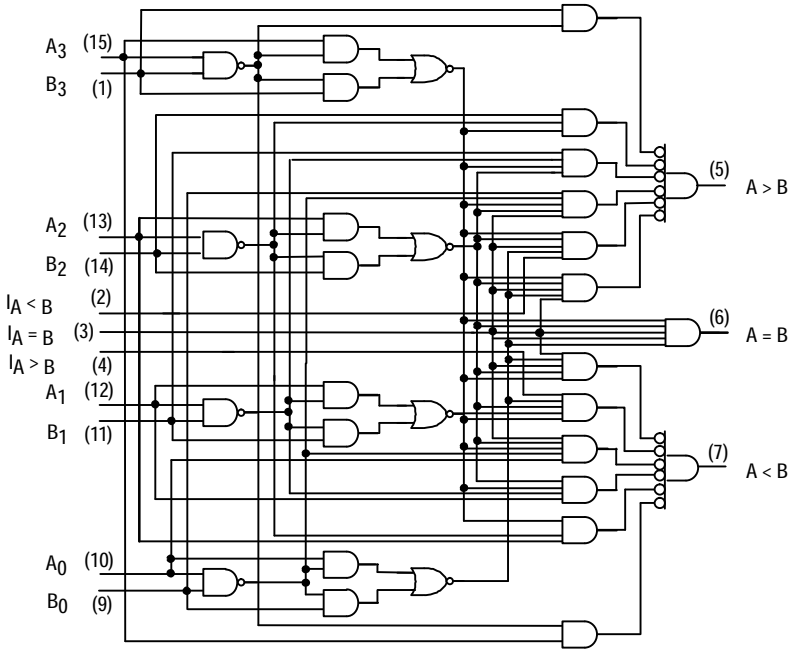
MC54/74F85

AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	54/74F		54F		74F		Unit
		T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0 V C <sub>L</sub> = 50 pF		T <sub>A</sub> = -55°C to +125°C V <sub>CC</sub> = 5.0 V ± 10% C <sub>L</sub> = 50 pF		T <sub>A</sub> = 0°C to + 70°C V <sub>CC</sub> = 5.0 V ± 10% C <sub>L</sub> = 50 pF		
		Min	Max	Min	Max	Min	Max	
t <sub>PLH</sub>	A or B Input to	6.0	11	5.5	14	5.5	13	ns
t <sub>PHL</sub>	A < B, A > B Output	6.0	14	5.5	16.5	5.5	15.5	
t <sub>PLH</sub>	A or B Input to	5.5	11.5	5.0	15	5.0	14	ns
t <sub>PHL</sub>	A = B Output	7.0	14	6.5	15.5	6.5	14.5	
t <sub>PLH</sub>	I <sub>A&lt;B</sub> and I <sub>A=B</sub> Input	3.0	7.5	2.5	10	2.5	9.0	ns
t <sub>PHL</sub>	to A>B Output	3.0	9.0	2.5	11	2.5	10	
t <sub>PLH</sub>	I <sub>A=B</sub> Input to	2.5	7.0	2.0	10	2.0	9.0	ns
t <sub>PHL</sub>	A = B Output	3.5	10	2.5	13	2.5	12	
t <sub>PLH</sub>	I <sub>A&gt;B</sub> and I <sub>A=B</sub> Input	3.0	8.0	3.0	10.5	3.0	9.5	ns
t <sub>PHL</sub>	to A<B Output	3.0	9.0	2.0	10.5	2.0	9.5	

The expansion inputs  $I_{A>B}$ ,  $I_{A=B}$ , and  $I_{A<B}$  are the least significant bit positions. When used for series expansion, the A>B, A=B, and A<B outputs of the least significant word are connected to the corresponding  $I_{A>B}$ ,  $I_{A=B}$ , and  $I_{A<B}$  inputs of the next higher stage. Stages can be added in this manner


to any length, but a propagation delay penalty of about 15 ns is added with each additional stage. For proper operation the expansion inputs of the least significant word should be tied as follows:  $I_{A>B}$  = LOW,  $I_{A=B}$  = HIGH, and  $I_{A<B}$  = LOW.



NOTE:  
This diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Figure 2. Logic Diagram

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