National Semiconductor

September 1989

MM54C85/MM74C85 4-Bit Magnitude Comparator

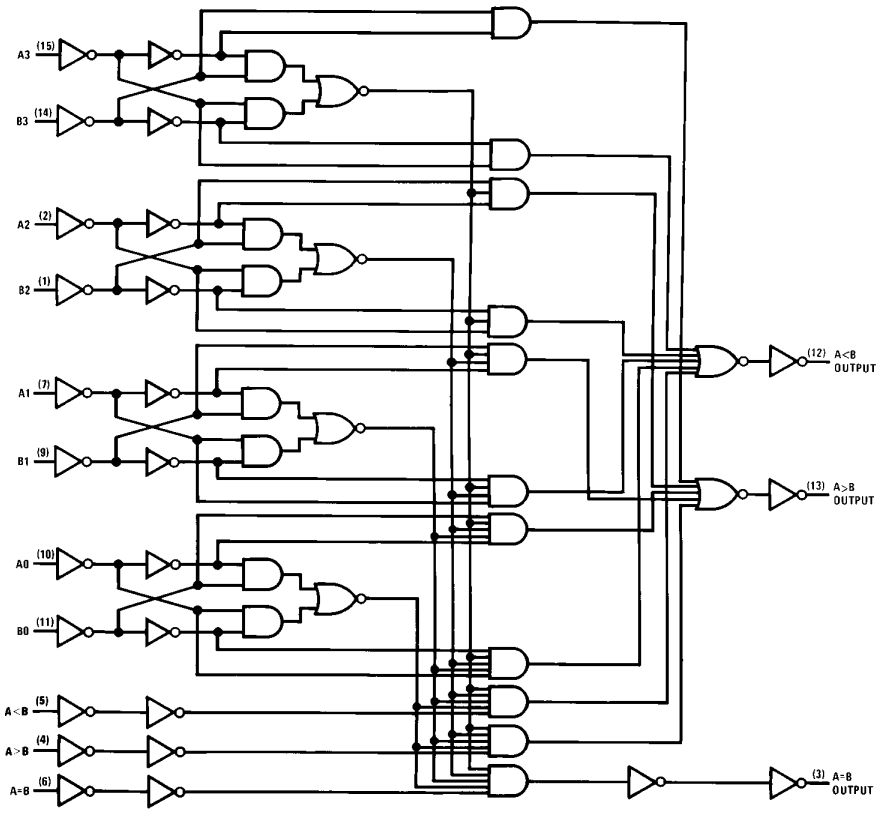
General Description

The MM54C85/MM74C85 is a four-bit magnitude comparator which will perform comparison of straight binary or BCD codes. The circuit consists of eight comparing inputs (A0, A1, A2, A3, B0, B1, B2, B3), three cascading inputs (A > B, A < B and A = B), and three outputs (A > B, A < B and A = B). This device compares two four-bit words (A and B) and determines whether they are "greater than," "less than," or "equal to" each other by a high level on the appropriate output. For words greater than four-bits, units can be cascaded by connecting the outputs (A > B, A < B, and A = B) of the least significant stage to the cascade inputs (A > B, A < B and A = B) of the next-significant stage. In addition the least significant stage must have a high level voltage ($V_{IN(1)}$) applied to the A = B input and low level voltage ($V_{IN(0)}$) applied to A > B and A < B inputs.

Features

■ Wide supply voltage range	3.0V to 15V
■ Guaranteed noise margin	1.0V
■ High noise immunity	0.4 V_{CC} (typ.)
■ Low power TTL compatibility	fan out of 2 driving 74L
■ Expandable to 'N' stages	
■ Applicable to binary or BCD	
■ Low power pinout: 54L85/74L85	

Logic Diagram



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Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Voltage at Any Pin	−0.3V to V_{CC} + 0.3V
Operating Temperature Range	
MM54C85	−55°C to +125°C
MM74C85	−40°C to +85°C
Storage Temperature Range	−65°C to +150°C
Power Dissipation (P_D)	
Dual-In-Line	700 mW
Small Outline	500 mW
Operating V_{CC} Range	3.0V to 15V
V_{CC}	18V
Lead Temperature	
(Soldering, 10 seconds)	260°C

DC Electrical Characteristics Min/Max limits apply across temperature range unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
CMOS TO CMOS						
$V_{IN(1)}$	Logical "1" Input Voltage	V_{CC} = 5.0V V_{CC} = 10V	3.5 8.0			V V
$V_{IN(0)}$	Logical "0" Input Voltage	V_{CC} = 5.0V V_{CC} = 10V			1.5 2.0	V V
$V_{OUT(1)}$	Logical "1" Output Voltage	V_{CC} = 5.0V, I_O = −10 μA V_{CC} = 10V, I_O = −10 μA	4.5 9.0			V V
$V_{OUT(0)}$	Logical "0" Output Voltage	V_{CC} = 5.0V, I_O = +10 μA V_{CC} = 10V, I_O = +10 μA			0.5 1.0	V V
$I_{IN(1)}$	Logical "1" Input Current	V_{CC} = 15V, V_{IN} = 15V		0.005	1.0	μA
$I_{IN(0)}$	Logical "0" Input Current	V_{CC} = 15V, V_{IN} = 0V	−1.0	−0.005		μA
I_{CC}	Supply Current	V_{CC} = 15V		0.05	300	μA
CMOS/LPTTL INTERFACE						
$V_{IN(1)}$	Logical "1" Input Voltage	54C, V_{CC} = 4.5V 74C, V_{CC} = 4.75V	V_{CC} − 1.5 V_{CC} − 1.5			V V
$V_{IN(0)}$	Logical "0" Input Voltage	54C, V_{CC} = 4.5V 74C, V_{CC} = 4.75V			0.8 0.8	V V
$V_{OUT(1)}$	Logical "1" Output Voltage	54C, V_{CC} = 4.5V, I_O = −360 μA 74C, V_{CC} = 4.75V, I_O = −360 μA	2.4 2.4			V V
$V_{OUT(0)}$	Logical "0" Output Voltage	54C, V_{CC} = 4.5V, I_O = 360 μA 74C, V_{CC} = 4.75V, I_O = 360 μA			0.4 0.4	V V
OUTPUT DRIVE (See 54C/74C Family Characteristics Data Sheet) (Short Circuit Current)						
I_{SOURCE}	Output Source Current (P-Channel)	V_{CC} = 5.0V, V_{OUT} = 0V T_A = 25°C	−1.75	−3.3		mA
I_{SOURCE}	Output Source Current (P-Channel)	V_{CC} = 10V, V_{OUT} = 0V T_A = 25°C	−8.0	−15		mA
I_{SINK}	Output Sink Current (N-Channel)	V_{CC} = 5.0V, V_{OUT} = V_{CC} T_A = 25°C	1.75	3.6		mA
I_{SINK}	Output Sink Current (N-Channel)	V_{CC} = 10V, V_{OUT} = V_{CC} T_A = 25°C	8.0	16		mA

AC Electrical Characteristics* T_A = 25°C, C_L = 50 pF, unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{pd}	Propagation Delay from any A or B Data Input to any Data Output	V_{CC} = 50V V_{CC} = 10V		250 100	600 300	ns ns
t_{pd}	Propagation Delay Time from any Cascade Input to any Output	V_{CC} = 50V V_{CC} = 10V		200 100	500 250	ns ns
C_{IN}	Input Capacitance	Any Inupt		5.0		pF
C_{PD}	Power Dissipation Capacitance	(Note 3) Per Package		45		pF

*AC Parameters are guaranteed by DC correlated testing.

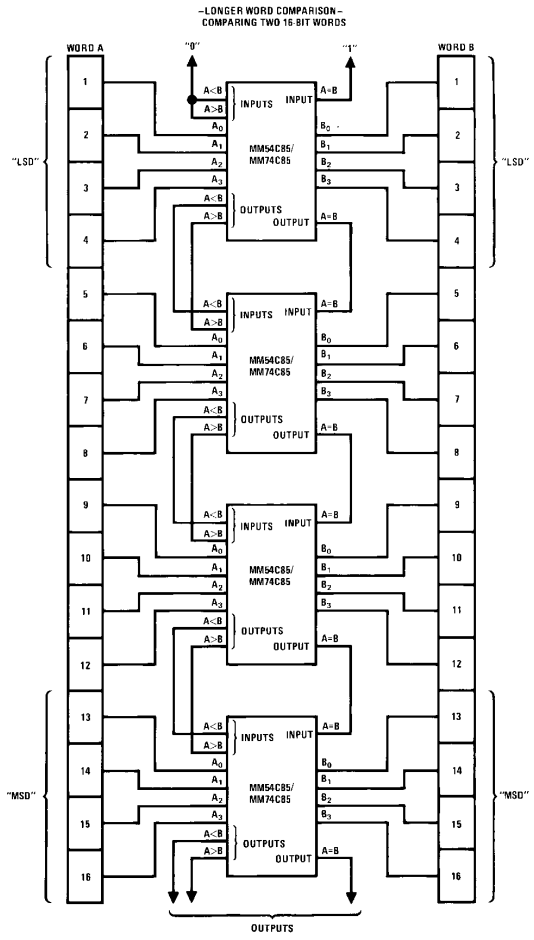
Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

Note 2: Capacitance is guaranteed by periodic testing.

Note 3: C_{PD} determines the no load AC power consumption of any CMOS device. For complete explanation see 54C/74C Family Characteristics application note, AN-90.

Typical Applications

Four Digit Comparator



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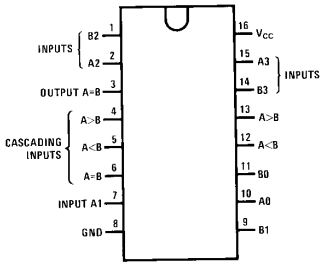
Connection Diagram

Dual-In-Line Package



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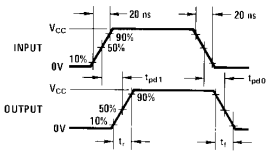
Top View

Order Number MM54C85 or MM74C85

Switching Time Waveforms



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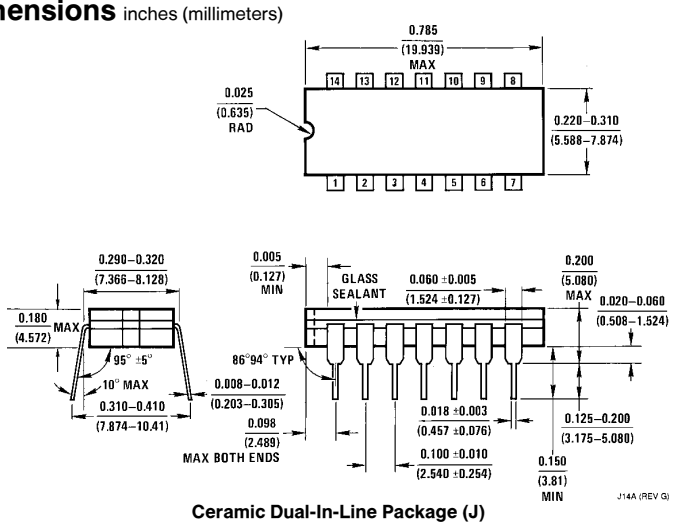
Unused inputs must be tied to an appropriate logic level.

Truth Table

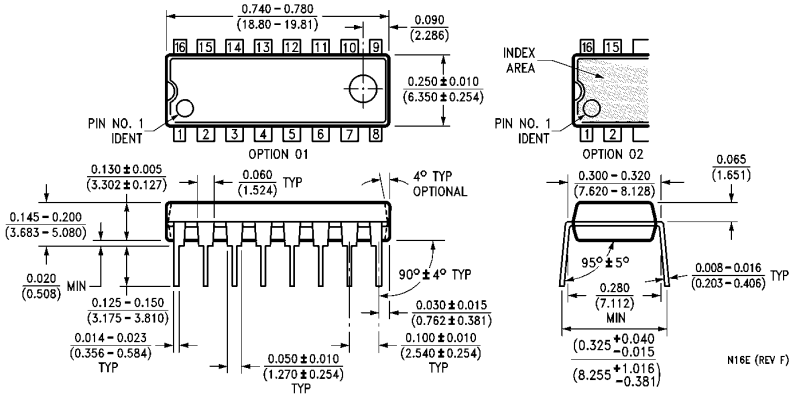
Comparing Inputs				Cascading Inputs			Outputs		
A3, B3	**A2, B2**	**A1, B1**	**A0, B0**	**A > B**	**A < B**	**A = B**	**A > B**	**A < B**	**A = B**
A3 > B3	X	X	X	X	X	X	H	L	L
A3 < B3	X	X	X	X	X	X	L	H	L
A3 = B3	A2 > B2	X	X	X	X	X	H	L	L
A3 = B3	A2 < B2	X	X	X	X	X	L	H	L
A3 = B3	A2 = B2	A1 > B1	X	X	X	X	H	L	L
A3 = B3	A2 = B2	A1 < B1	X	X	X	X	L	H	L
A3 = B3	A2 = B2	A1 = B1	A0 > B0	X	X	X	H	L	L
A3 = B3	A2 = B2	A1 = B1	A0 < B0	X	X	X	L	H	L
A3 = B3	A2 = B2	A1 = B1	A0 = B0	H	L	L	H	L	L
A3 = B3	A2 = B2	A1 = B1	A0 = B0	L	H	L	L	H	L
A3 = B3	A2 = B2	A1 = B1	A0 = B0	L	L	H	L	L	H
A3 = B3	A2 = B2	A1 = B1	A0 = B0	L	H	H	L	H	H
A3 = B3	A2 = B2	A1 = B1	A0 = B0	H	L	H	H	L	H
A3 = B3	A2 = B2	A1 = B1	A0 = B0	H	H	H	H	H	H
A3 = B3	A2 = B2	A1 = B1	A0 = B0	H	H	L	H	H	L
A3 = B3	A2 = B2	A1 = B1	A0 = B0	L	L	L	L	L	L

H = high level, L = low level, X = irrelevant

Physical Dimensions inches (millimeters)



Ceramic Dual-In-Line Package (J)
Order Number MM54C85J or MM74C85J
NS Package Number J14A



Molded Dual-In-Line Package (N)
Order Number MM54C85N or MM74C85N
NS Package Number N16E

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