

MM54C85/MM74C85 4-Bit Magnitude Comparator

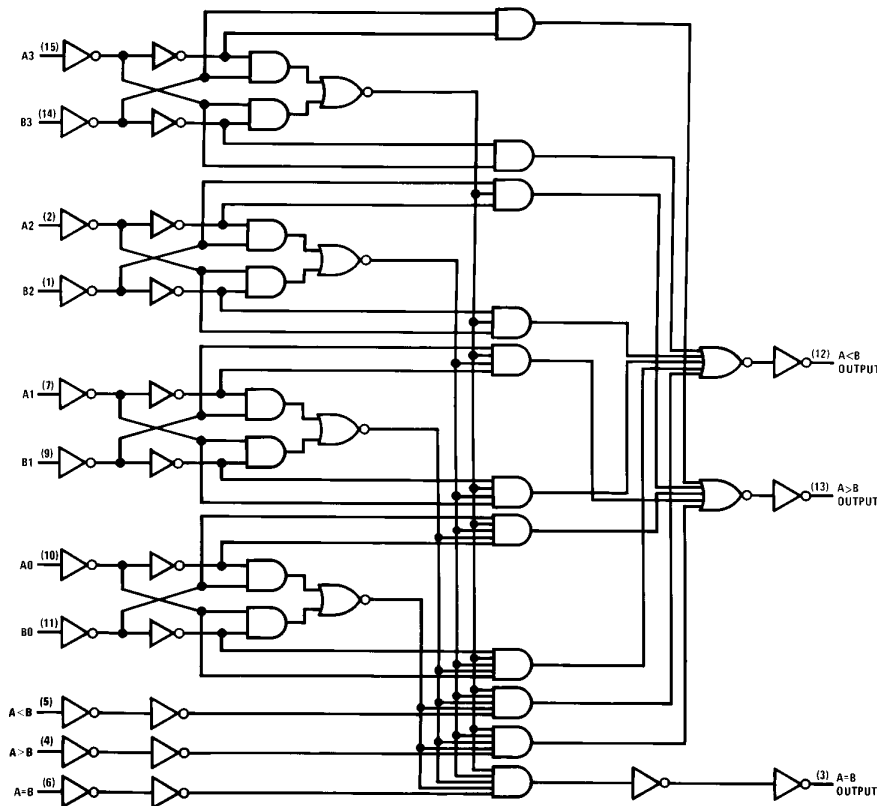
General Description

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 fan out of 2 driving 74L
- TTL compatibility
- Expandable to 'N' stages
- Applicable to binary or BCD
- Low power pinout: 54L85/74L85

Logic Diagram



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 | -55°C to +125°C |
| MM54C85 | -40°C to +85°C |
| MM74C85 | -65°C to +150°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 | $V_{CC} = 5.0V, I_O = -10 \mu A$ $V_{CC} = 10V, I_O = -10 \mu A$ | 4.5 9.0 | | | V V |
| $V_{OUT(0)}$ | Logical "0" Output Voltage | $V_{CC} = 5.0V, I_O = +10 \mu A$ $V_{CC} = 10V, I_O = +10 \mu A$ | | | 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, $V_{CC} = 4.5V, I_O = -360 \mu A$ 74C, $V_{CC} = 4.75V, I_O = -360 \mu A$ | 2.4 2.4 | | | V V |
| $V_{OUT(0)}$ | Logical "0" Output Voltage | 54C, $V_{CC} = 4.5V, I_O = 360 \mu A$ 74C, $V_{CC} = 4.75V, I_O = 360 \mu A$ | | | 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) | $V_{CC} = 5.0V, V_{OUT} = 0V$ $T_A = 25^\circ C$ | -1.75 | -3.3 | | mA |
| I_{SOURCE} | Output Source Current (P-Channel) | $V_{CC} = 10V, V_{OUT} = 0V$ $T_A = 25^\circ C$ | -8.0 | -15 | | mA |
| I_{SINK} | Output Sink Current (N-Channel) | $V_{CC} = 5.0V, V_{OUT} = V_{CC}$ $T_A = 25^\circ C$ | 1.75 | 3.6 | | mA |
| I_{SINK} | Output Sink Current (N-Channel) | $V_{CC} = 10V, V_{OUT} = V_{CC}$ $T_A = 25^\circ C$ | 8.0 | 16 | | mA |

AC Electrical Characteristics* $T_A = 25^\circ C, C_L = 50 pF$, 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 | $V_{CC} = 5.0V$ $V_{CC} = 10V$ | | 250 100 | 600 300 | ns ns |
| t_{pd} | Propagation Delay Time from any Cascade Input to any Output | $V_{CC} = 5.0V$ $V_{CC} = 10V$ | | 200 100 | 500 250 | ns ns |
| C_{IN} | Input Capacitance | Any Input | | 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.

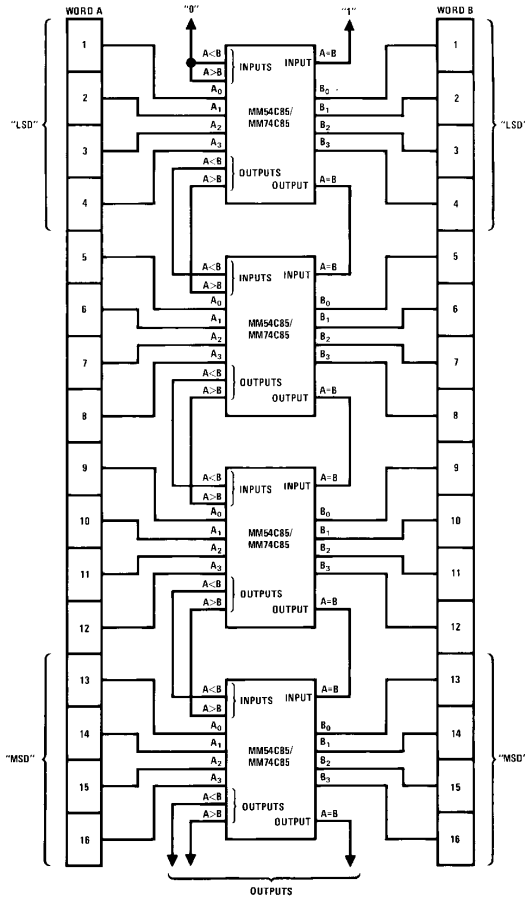
Note 2: Capacitance is guaranteed by periodic testing.

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

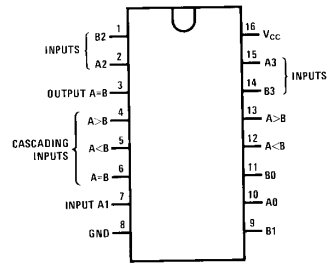
—LONGER WORD COMPARISON—
—COMPARING TWO 16-BIT WORDS—



TL/F/5886-2

Connection Diagram

Dual-In-Line Package

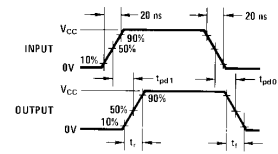


TL/F/5886-3

Top View

Order Number MM54C85
or MM74C85

Switching Time Waveforms



TL/F/5886-4

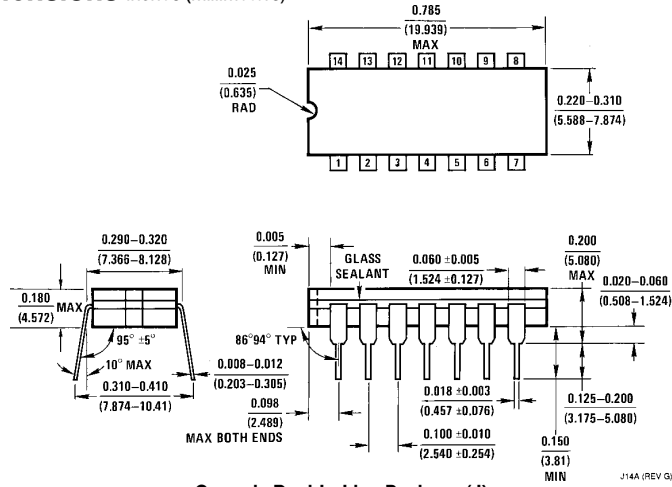
Unused inputs must be tied
to an appropriate logic level.

Truth Table

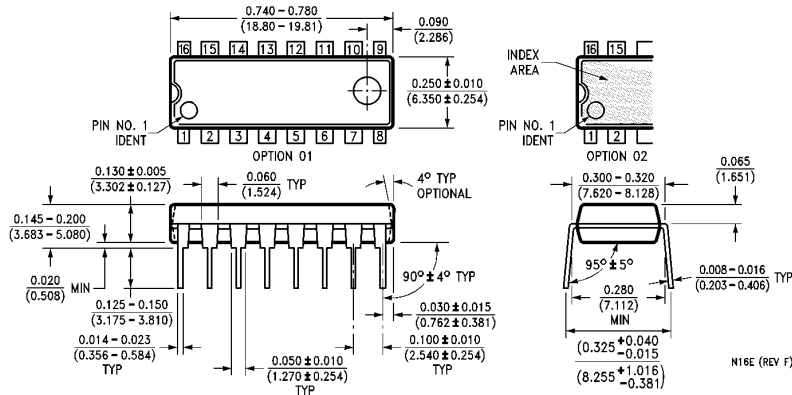
| | Comparing Inputs | | | Cascading Inputs | | | Outputs | | | |
|---------|------------------|---------|---------|------------------|-------|-------|---------|-------|-------|-------|
| | A3, B3 | A2, B2 | A1, B1 | A0, B0 | A > B | A < B | A = B | A > B | A < B | A = B |
| A3 > B3 | X | X | X | X |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