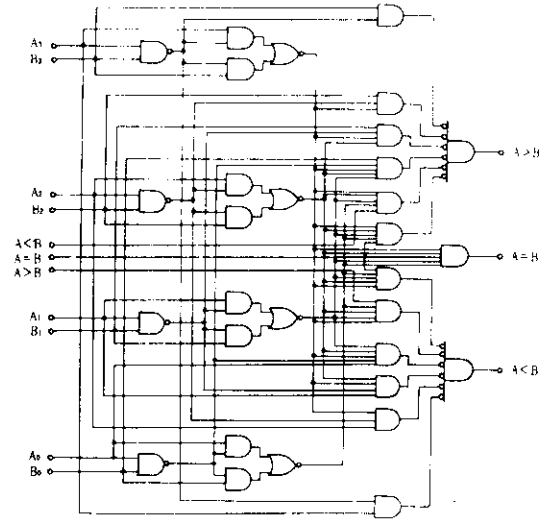


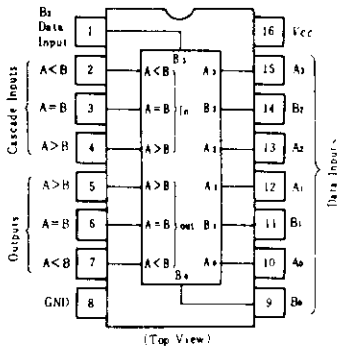
HD74LS85 • 4-bit Magnitude Comparators

This four bit magnitude comparator performs comparison of straight binary and straight BCD (8-4-2-1) codes. Three fully decoded decisions about two 4-bit words (A, B) are made and are externally available at three outputs. This device is fully expandable to any number of bits without external gates. Words of greater length may be compared by connecting comparators in cascade. The $A > B$, $A < B$, and $A = B$ outputs of a stage handling less-significant bits. The stage handling the least-significant bits must have a high-level voltage applied to the $A \geq B$ input. The cascading path is implemented with only a two-gate-level delay to reduce overall comparison times for long words.

■ BLOCK DIAGRAM



■ PIN ARRANGEMENT



■ FUNCTION TABLE

| Inputs | | | | Cascading inputs | | | Outputs | | |
|-------------|-------------|-------------|-------------|------------------|---------|---------|---------|---------|---------|
| A_3, B_3 | A_2, B_2 | A_1, B_1 | A_0, B_0 | $A < B$ | $A < B$ | $A = B$ | $A > B$ | $A < B$ | $A = B$ |
| $A_3 > B_3$ | X | X | X | X | X | X | H | L | L |
| $A_3 < B_3$ | X | X | X | X | X | X | L | H | L |
| $A_3 = B_3$ | $A_2 > B_2$ | X | X | X | X | X | H | L | L |
| $A_3 = B_3$ | $A_2 < B_2$ | X | X | X | X | X | L | H | L |
| $A_3 = B_3$ | $A_2 = B_2$ | $A_1 > B_1$ | X | X | X | X | H | L | L |
| $A_3 = B_3$ | $A_2 = B_2$ | $A_1 < B_1$ | X | X | X | X | L | H | L |
| $A_3 = B_3$ | $A_2 = B_2$ | $A_1 = B_1$ | $A_0 > B_0$ | X | X | X | H | L | L |
| $A_3 = B_3$ | $A_2 = B_2$ | $A_1 = B_1$ | $A_0 < B_0$ | X | X | X | L | H | L |
| $A_3 = B_3$ | $A_2 = B_2$ | $A_1 = B_1$ | $A_0 = B_0$ | H | L | L | H | L | L |
| $A_3 = B_3$ | $A_2 = B_2$ | $A_1 = B_1$ | $A_0 = B_0$ | L | H | L | L | H | L |
| $A_3 = B_3$ | $A_2 = B_2$ | $A_1 = B_1$ | $A_0 = B_0$ | X | X | H | L | L | H |
| $A_3 = B_3$ | $A_2 = B_2$ | $A_1 = B_1$ | $A_0 = B_0$ | H | H | L | L | L | L |
| $A_3 = B_3$ | $A_2 = B_2$ | $A_1 = B_1$ | $A_0 = B_0$ | L | L | L | H | H | L |

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

■ ELECTRICAL CHARACTERISTICS ($T_a = -20 \sim +75^\circ\text{C}$)

| Item | | Symbol | Test Conditions | min | typ* | max | Unit |
|------------------------------|---------------------|----------|---|-----------------------|------|------|---------------|
| Input voltage | | V_{IH} | | 2.0 | — | — | V |
| | | V_{IL} | | — | — | 0.8 | V |
| Output voltage | | V_{OH} | $V_{CC} = 4.75\text{V}, V_{IH} = 2\text{V}, V_{IL} = 0.8\text{V}, I_{OH} = -400\mu\text{A}$ | 2.7 | — | — | V |
| | | V_{OL} | $V_{CC} = 4.75\text{V}, V_{IH} = 2\text{V}$ $V_{IL} = 0.8\text{V}$ | $I_{OL} = 4\text{mA}$ | — | — | 0.4 |
| $I_{OL} = 8\text{mA}$ | — | | | — | 0.5 | | |
| Input current | A < B, A > B Inputs | I_{IH} | $V_{CC} = 5.25\text{V}, V_i = 2.7\text{V}$ | — | — | 20 | μA |
| | Other inputs | | | — | — | 60 | |
| | A < B, A > B Inputs | I_{IL} | $V_{CC} = 5.25\text{V}, V_i = 0.4\text{V}$ | — | — | -0.4 | mA |
| | Other inputs | | | — | — | -1.2 | |
| | A < B, A > B Inputs | I_I | $V_{CC} = 5.25\text{V}, V_i = 7\text{V}$ | — | — | 0.1 | mA |
| | Other inputs | | | — | — | 0.3 | |
| Short-circuit output current | | I_{OS} | $V_{CC} = 5.25\text{V}$ | -20 | — | -100 | mA |
| Supply current ** | | I_{CC} | $V_{CC} = 5.25\text{V}$ | — | 10.4 | 20 | mA |
| Input clamp voltage | | V_{IK} | $V_{CC} = 4.75\text{V}, I_{IK} = -18\text{mA}$ | — | — | -1.5 | V |

* $V_{CC} = 5\text{V}, T_a = 25^\circ\text{C}$

** I_{CC} is measured with outputs open, A=B grounded, and all other inputs at 4.5V.

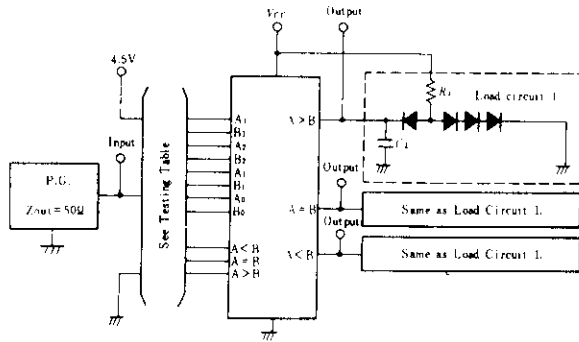
■ SWITCHING CHARACTERISTICS ($V_{CC} = 5\text{V}, T_a = 25^\circ\text{C}$)

| Item | Symbol | Inputs | Outputs | Number of gate levels | Test Conditions | min | typ | max | Unit |
|------------------------|-----------|-----------------------------|--------------|-----------------------|--|-----|-----|-----|------|
| Propagation delay time | t_{PLH} | Any A or B data Input | A < B, A > B | 1 | $C_L = 15\text{pF}$ $R_L = 2\text{k}\Omega$ | — | 14 | — | ns |
| | | | | 2 | | — | 19 | — | |
| | | | 3 | — | | 24 | 36 | | |
| | | | 4 | — | | 27 | 45 | | |
| | t_{PHL} | Any A or B data Input | A < B, A > B | 1 | | — | 11 | — | ns |
| | | | | 2 | | — | 15 | — | |
| | | | 3 | — | | 20 | 30 | | |
| | | | 4 | — | | 23 | 45 | | |
| | t_{PLH} | A < B or A = B | A > B | 1 | | — | 14 | 22 | ns |
| | t_{PHL} | A < B or A = B | A > B | 1 | | — | 11 | 17 | ns |
| | t_{PLH} | A = B | A = B | 2 | | — | 13 | 20 | ns |
| | t_{PHL} | A = B | A = B | 2 | | — | 13 | 26 | ns |
| | t_{PLH} | A > B or A = B | A < B | 1 | | — | 14 | 22 | ns |
| | t_{PHL} | A > B or A = B | A < B | 1 | | — | 11 | 17 | ns |

HD74LS85

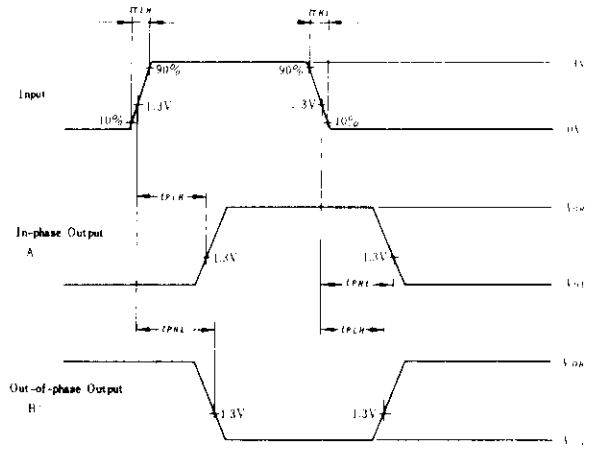
TESTING METHOD

1) Test Circuit



- Notes) 1. Input pulse; $t_{TLH} \leq 15\text{ns}$, $t_{THL} \leq 6\text{ns}$, $PRR = 1\text{MHz}$, duty cycle = 50%
 2. C_L includes probe and jig capacitance.
 3. All diodes are 1S2074 $\text{\textcircled{B}}$.

Waveform



2) Testing Table

| Item | Inputs | | | | | | | | | | | Output Waveforms | | |
|--|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-------|-------|-------|------------------|-------|-------|
| | A ₃ | B ₃ | A ₂ | B ₂ | A ₁ | B ₁ | A ₀ | B ₀ | A > B | A = B | A < B | A > B | A = B | A < B |
| <i>t_{PLH}</i> <i>t_{PHL}</i> | IN | 4.5V | 4.5V | GND | GND | GND | GND | GND | GND | GND | GND | A | | B |
| | 4.5V | IN | GND | 4.5V | GND | GND | GND | GND | GND | GND | GND | B | | A |
| | GND | GND | IN | 4.5V | 4.5V | GND | GND | GND | GND | GND | GND | A | | B |
| | GND | GND | 4.5V | IN | GND | 4.5V | GND | GND | GND | GND | GND | B | | A |
| | GND | GND | GND | GND | IN | 4.5V | 4.5V | GND | GND | GND | GND | A | | B |
| | GND | GND | GND | GND | 4.5V | IN | GND | 4.5V | GND | GND | GND | B | | A |
| | GND | GND | GND | GND | GND | GND | IN | 4.5V | 4.5V | GND | GND | A | | B |
| | GND | GND | GND | GND | GND | GND | 4.5V | IN | GND | 4.5V | GND | B | | A |
| | GND | GND | GND | GND | GND | GND | IN | 4.5V | GND | 4.5V | GND | | A | B |
| | GND | GND | GND | GND | GND | GND | 4.5V | IN | GND | 4.5V | GND | B | A | |
| | GND | GND | GND | GND | GND | GND | GND | GND | IN | GND | GND | | | B |
| | GND | GND | GND | GND | GND | GND | GND | GND | GND | IN | GND | B | A | B |
| | GND | GND | GND | GND | GND | GND | GND | GND | GND | GND | IN | B | | |



| | |
|--------------------------|----------|
| Hitachi Code | DP-16 |
| JEDEC | Conforms |
| EIAJ | Conforms |
| Weight (reference value) | 1.07 g |



*Dimension including the plating thickness
Base material dimension

| | |
|--------------------------|----------|
| Hitachi Code | FP-16DA |
| JEDEC | — |
| EIAJ | Conforms |
| Weight (reference value) | 0.24 g |



*Dimension including the plating thickness
 Base material dimension

| | |
|--------------------------|----------|
| Hitachi Code | FP-16DN |
| JEDEC | Conforms |
| EIAJ | Conforms |
| Weight (reference value) | 0.15 g |

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HITACHI

Hitachi, Ltd.

Semiconductor & Integrated Circuits.
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

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For further information write to:

Hitachi Semiconductor
(America) Inc.
179 East Tasman Drive,
San Jose, CA 95134
Tel: <1> (408) 433-1990
Fax: <1> (408) 433-0223

Hitachi Europe GmbH
Electronic components Group
Dornacher Straße 3
D-85622 Feldkirchen, Munich
Germany
Tel: <49> (89) 9 9180-0
Fax: <49> (89) 9 29 30 00

Hitachi Europe Ltd.
Electronic Components Group.
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: <44> (1628) 585000
Fax: <44> (1628) 778322

Hitachi Asia Pte. Ltd.
16 Collyer Quay #20-00
Hitachi Tower
Singapore 049318
Tel: 535-2100
Fax: 535-1533

Hitachi Asia Ltd.
Taipei Branch Office
3F, Hung Kuo Building, No.167,
Tun-Hwa North Road, Taipei (105)
Tel: <886> (2) 2718-3666
Fax: <886> (2) 2718-8180

Hitachi Asia (Hong Kong) Ltd.
Group III (Electronic Components)
7/F., North Tower, World Finance Centre,
Harbour City, Canton Road, Tsim Sha Tsui,
Kowloon, Hong Kong
Tel: <852> (2) 735 9218
Fax: <852> (2) 730 0281
Telex: 40815 HITEC HX

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