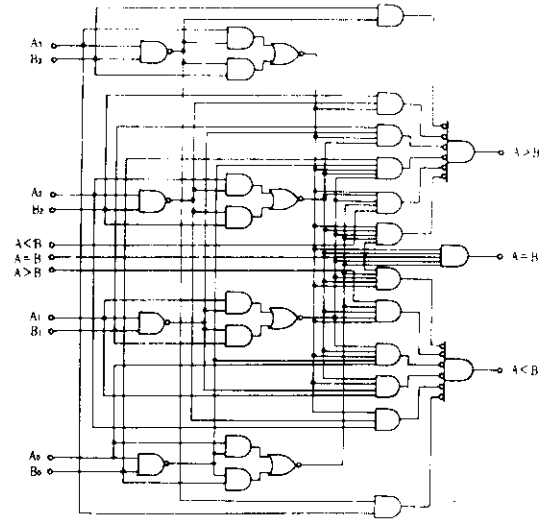


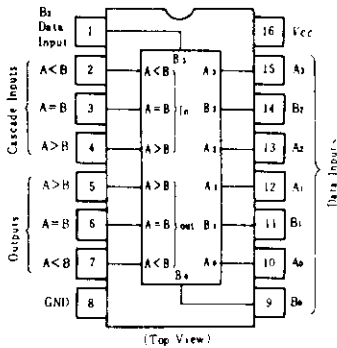
HD74LS85 • 4-bit Magnitude Comparators

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.

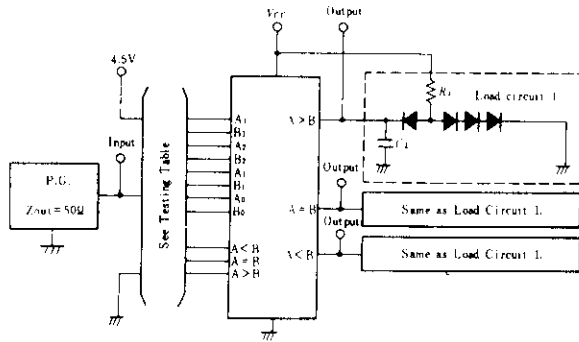
■ SWITCHING CHARACTERISTICS ($V_{CC} = 5\text{V}, T_a = 25^\circ\text{C}$)

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

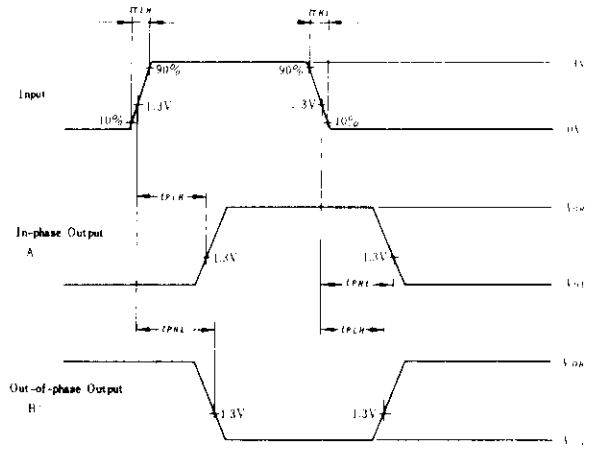
TESTING METHOD

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	4.5V	IN	GND	4.5V	GND		A	B
	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		

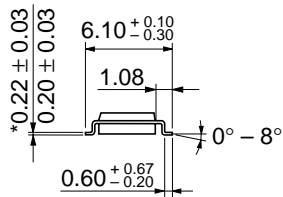
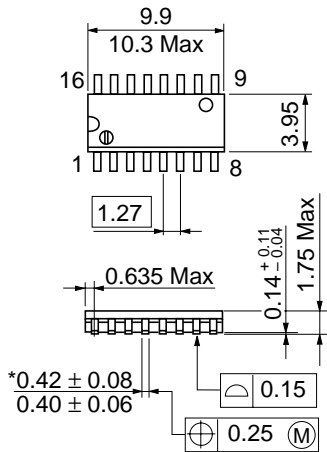


Hitachi Code	DP-16
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	1.07 g



*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

Cautions

1. Hitachi neither warrants nor grants licenses of any rights of Hitachi's or any third party's patent, copyright, trademark, or other intellectual property rights for information contained in this document. Hitachi bears no responsibility for problems that may arise with third party's rights, including intellectual property rights, in connection with use of the information contained in this document.
2. Products and product specifications may be subject to change without notice. Confirm that you have received the latest product standards or specifications before final design, purchase or use.
3. Hitachi makes every attempt to ensure that its products are of high quality and reliability. However, contact Hitachi's sales office before using the product in an application that demands especially high quality and reliability or where its failure or malfunction may directly threaten human life or cause risk of bodily injury, such as aerospace, aeronautics, nuclear power, combustion control, transportation, traffic, safety equipment or medical equipment for life support.
4. Design your application so that the product is used within the ranges guaranteed by Hitachi particularly for maximum rating, operating supply voltage range, heat radiation characteristics, installation conditions and other characteristics. Hitachi bears no responsibility for failure or damage when used beyond the guaranteed ranges. Even within the guaranteed ranges, consider normally foreseeable failure rates or failure modes in semiconductor devices and employ systemic measures such as fail-safes, so that the equipment incorporating Hitachi product does not cause bodily injury, fire or other consequential damage due to operation of the Hitachi product.
5. This product is not designed to be radiation resistant.
6. No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without written approval from Hitachi.
7. Contact Hitachi's sales office for any questions regarding this document or Hitachi semiconductor products.

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

URL North America : <http://semiconductor.hitachi.com/>
 Europe : <http://www.hitachi-eu.com/hel/ecg>
 Asia (Singapore) : <http://www.has.hitachi.com.sg/grp3/sicd/index.htm>
 Asia (Taiwan) : http://www.hitachi.com.tw/E/Product/SICD_Frame.htm
 Asia (HongKong) : <http://www.hitachi.com.hk/eng/bo/grp3/index.htm>
 Japan : <http://www.hitachi.co.jp/Sicd/indx.htm>

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

Copyright ' Hitachi, Ltd., 1999. All rights reserved. Printed in Japan.

HITACHI