

GD54/74LS85

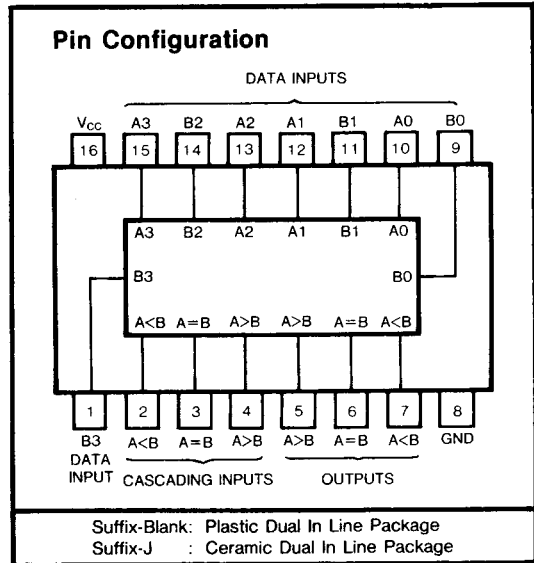
4-BIT MAGNITUDE COMPARATORS

Features

- Typical power dissipation 52 mW
- Typical delay (4-bit words) 24 ns

Description

These four-bit magnitude comparators perform comparison of straight binary or BCD codes. Three fully-decoded decisions about two 4-bit words (A, B) are made and are externally available at three outputs. These devices are 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 are connected to the corresponding inputs of the next stage handling more-significant bits. The stage handling the least-significant bits are connected to the corresponding inputs of the next stage handling more-significant bits. The stage handling the least-significant bits must have a high-level voltage applied to the $A = B$ input. The cascading path is implemented with only a two-gate-level delay to reduce overall comparison times for long words.



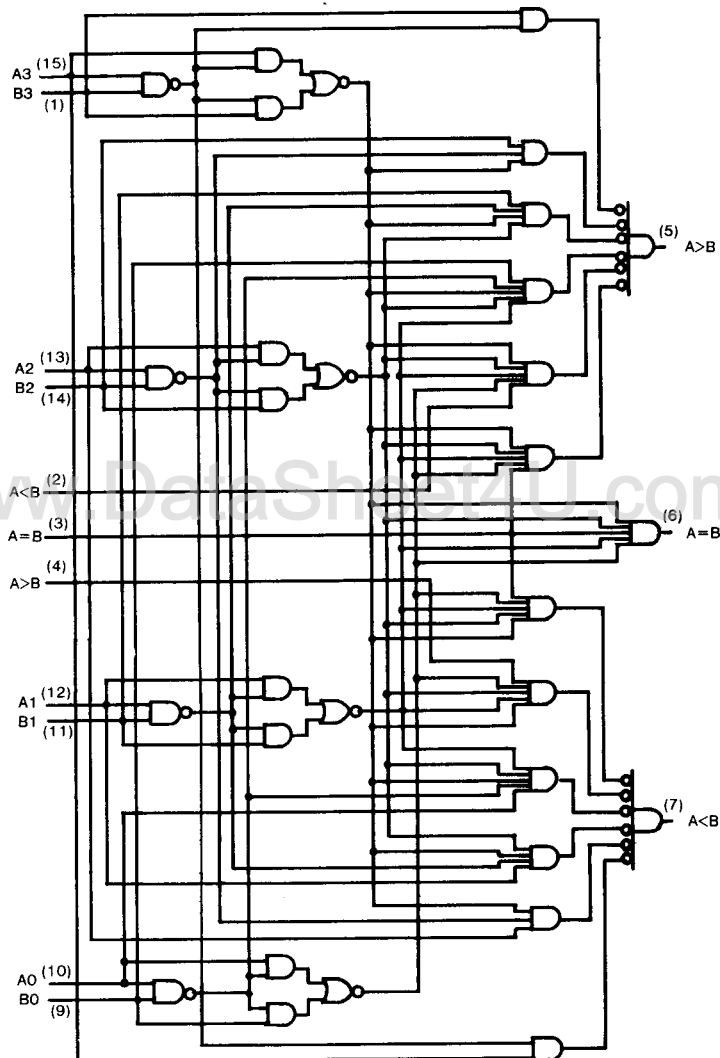
Function Table

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	L	H	L
A3=B3	A2=B2	A1=B1	A0=B0	L	H	L	L	L	H
A3=B3	A2=B2	A1=B1	A0=B0	L	L	H	L	L	H
A3=B3	A2=B2	A1=B1	A0=B0	X	X	H	L	L	H
A3=B3	A2=B2	A1=B1	A0=B0	H	H	L	L	L	L
A3=B3	A2=B2	A1=B1	A0=B0	L	L	L	H	H	L

H=High Level, L=Low Level, X=Don't Care

Absolute Maximum Ratings

- Supply voltage, V_{CC} 7V
- Input voltage 7V
- Operating free-air temperature range 54LS -55°C to 125°C
 74LS 0°C to 70°C
- Storage temperature range -65°C to 150°C

Function Block Diagram

Recommended Operating Conditions

SYMBOL	PARAMETER		MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage	54	4.5	5	5.5	V
		74	4.75	5	5.25	
I_{OH}	High-level output current	54, 74			-400	μA
I_{OL}	Low-level output current	54			4	mA
		74			8	
T_A	Operating free-air temperature	54	-55		125	$^{\circ}C$
		74	0		70	

Electrical Characteristics over recommended operating free-air temperature range (unless otherwise noted)

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	TYP (Note 1)	MAX	UNIT
V _{IH}	High-level input voltage			2			V
V _{IL}	Low-level input voltage			54	0.7		V
				74	0.8		
V _{IK}	Input clamp voltage	V _{CC} =Min, I _I =−18mA			−1.5		V
V _{OH}	High-level output Voltage	V _{CC} =Min I _{OH} =Max	V _{IL} =Max V _{IH} =Min	54	2.5	3.4	V
				74	2.7	3.4	
V _{OL}	Low-level output voltage	V _{CC} =Min V _{IL} =Max V _{IH} =Min	I _{OL} =4mA	54, 74	0.25	0.4	V
			I _{OL} =8mA	74	0.35	0.5	
I _I	Input current at maximum input voltage	V _{CC} =Max V _I =7V	A<B, A>B		0.1		mA
			others		0.3		
I _{IH}	High-level input current	V _{CC} =Max V _I =2.7V	A<B, A>B		20		μA
			others		60		
I _{IL}	Low-level input current	V _{CC} =Max V _I =0.4V	A<B, A>B		−0.4		mA
			others		−1.2		
I _{OS}	Short-circuit output current	V _{CC} =Max (Note 2)			−20	−100	mA
I _{CC}	Supply current	V _{CC} =Max (Note 3)			10	20	mA

Note 1: All typical values are at $V_{CC} = 5\text{V}$, $T_A = 25^{\circ}C$.

Note 2: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Note 3: I_{CC} is measured with all inputs at 4.5V, and all outputs open. A=B grounded.

Switching Characteristics, $V_{CC} = 5V$, $T_A = 25^\circ C$

PARAMETER	FROM INPUT	TO OUTPUT	NUMBER OF GATE LEVELS	TEST CONDITIONS	MIN TYP MAX	UNIT
t_{PLH}	Any A or B data input	A<B, A>B	1	$C_L = 15pF$, $R_L = 2k\Omega$,	14	ns
			2		19	
			3		24 36	
		A=B	4		27 45	
t_{PHL}	Any A or B data input	A<B, A>B	1		11	ns
			2		15	
			3		20 30	
		A=B	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