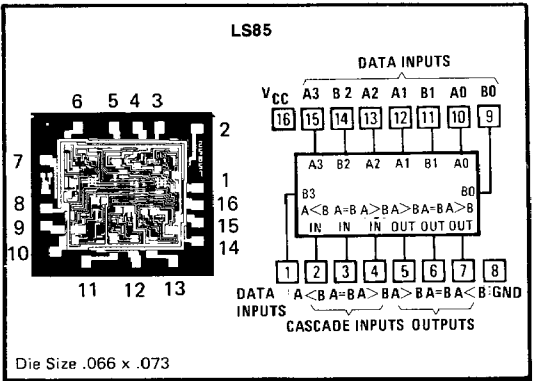


DESCRIPTION

These four-bit magnitude comparators perform 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. 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 $A > B$, $A < B$, and $A = B$ 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 paths of the '85, and 'LS85 are implemented with only a two-gate-level delay to reduce overall comparison times for long words. An alternate method of cascading which further reduces the comparison time is shown in the typical application data.

PIN-OUT AND LOGIC DIAGRAM

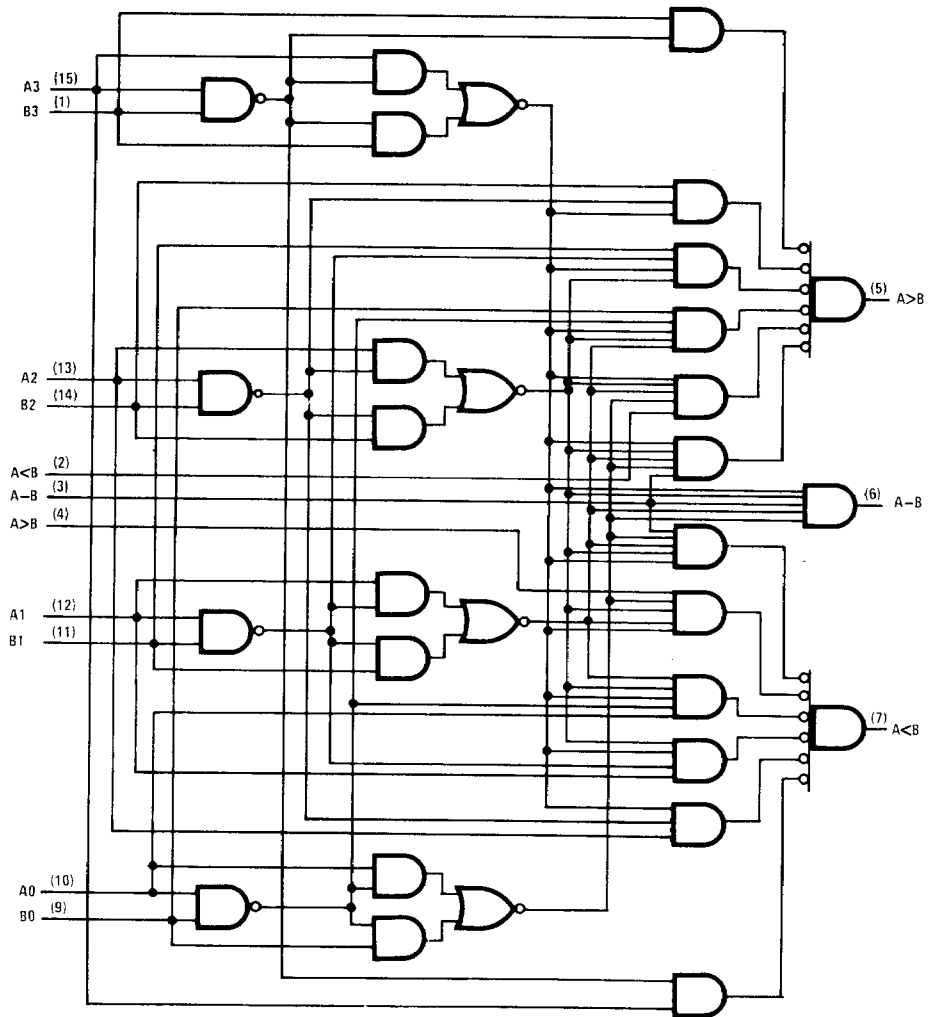


FUNCTION TABLES

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	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 = irrelevant

LOGIC DIAGRAM



Recommended Operating Conditions

	9LS/54LS			9LS/74LS			Unit
	Min	Nom	Max	Min	Nom	Max	
Supply voltage, V_{CC}	4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}			-400			-400	μA
Low-level output current, I_{OL}			4			8	mA
Operating free-air temperature, T_A	-55		125	0		70	$^{\circ}C$

Electrical Characteristics Over Recommended Free-Air Temperature Range (Unless Otherwise Noted)

Parameter		Test Conditions*	9LS/54LS			9LS/74LS			Unit
			Min	Typ**	Max	Min	Typ**	Max	
V_{IH}			2			2			V
V_{IL}					0.7			0.8	V
V_I		$V_{CC} = \text{MIN}, I_I = -18\text{mA}$			-1.5			-1.5	V
V_{OH}		$V_{CC} = \text{MIN}, V_{IH} = 2\text{V}, V_{IL} = V_{IL\text{max}}, I_{OH} = -400\mu A$	2.5	3.4		2.7	3.4		V
V_{OL}		$V_{CC} = \text{MIN}, V_{IH} = 2\text{V}, I_{OL} = 4\text{mA}$		0.25	0.4		0.25	0.4	V
		$V_{IL} = V_{IL\text{max}}, I_{OL} = 8\text{mA}$					0.35	0.5	
I_I	A < B, A > B inputs	$V_{CC} = \text{MAX}, V_I = 7\text{V}$			0.1			0.1	mA
	all other inputs				0.3			0.3	
I_{IH}	A < B, A > B inputs	$V_{CC} = \text{MAX}, V_I = 2.7\text{V}$			20			20	μA
	all other inputs				60			60	
I_{IL}	A < B, A > B inputs	$V_{CC} = \text{MAX}, V_I = 0.4\text{V}$			-0.4			-0.4	mA
	all other inputs				-1.2			-1.2	
$I_{OS}^{\dagger}$		$V_{CC} = \text{MAX}$	-15		-100	-15		-100	mA
$I_{CC}^{\dagger\dagger}$		$V_{CC} = \text{MAX},$		10.4	20		10.4	20	mA

*For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable device type.

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

$\dagger$ Not more than one output should be shorted at a time.

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

4-Bit Magnitude Comparators

LS85

Switching Characteristics, $V_{CC} = 5V$ Over Recommended Free-Air Temperature Range

Operating Characteristics: V_{CC} = 5V, Recommended Free-Air Temperature Range													
Parameter	From (Input)	To (output)	No. of Gate Levels	-55°C			+25°C			+125°C			Unit
				Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Test Conditions: $C_L = 15pF$, $R_L = 2k\Omega$ (See Fig. A, page 2-174)													
t_{PLH}	Any A or B data input	$A < B$, $A > B$	1		14			14			14		ns
			2		20			19			19		
			3		25	42		24	36		24	41	
		$A = B$	4		28	50		27	45		26	48	
t_{PHL}	Any A or B data input	$A < B$, $A > B$	1		11			11			12		ns
			2		15			15			16		
			3		21	34		20	30		20	33	
		$A = B$	4		22	48		23	45		22	48	
t_{PLH}	$A < B$ or $A = B$	$A > B$	1		14	27		14	22		14	27	ns
t_{PHL}	$A < B$ or $A = B$	$A > B$	1		12	23		11	17		11	22	ns
t_{PLH}	$A = B$	$A = B$	2		13	23		13	20		12	22	ns
t_{PHL}	$A = B$	$A = B$	2		14	30		13	26		14	30	ns
t_{PLH}	$A > B$ or $A = B$	$A < B$	1		16	26		14	22		15	25	ns
t_{PHL}	$A > B$ or $A = B$	$A < B$	1		12	21		11	17		11	20	ns
Test Conditions: $C_L = 50pF$, $R_L = 2k\Omega$ (See Fig. A, page 2-174)													
t_{PLH}	Any A or B data input	$A < B$, $A > B$	1		20			18			20		ns
			2		26			25			26		
			3		29	42		28	40		29	42	
		$A = B$	4		30	48		32	48		32	48	
t_{PHL}	Any A or B data input	$A < B$, $A > B$	1		15			14			15		ns
			2		18			18			18		
			3		26	36		26	36		26	36	
		$A = B$	4		38	50		36	48		37	49	
t_{PLH}	$A < B$ or $A = B$	$A > B$	1		17	28		17	27		18	30	ns
t_{PHL}	$A < B$ or $A = B$	$A > B$	1		14	21		14	20		15	21	ns
t_{PLH}	$A = B$	$A = B$	2		17	25		16	24		16	24	ns
t_{PHL}	$A = B$	$A = B$	2		15	31		14	30		15	32	ns
t_{PLH}	$A > B$ or $A = B$	$A < B$	1		18	27		17	26		17	30	ns
t_{PHL}	$A > B$ or $A = B$	$A < B$	1		15	22		14	21		14	22	ns

Note: AC specification shown under -55°C and +125°C are for 9LS devices only. All 50pF specifications are for 9LS only.