

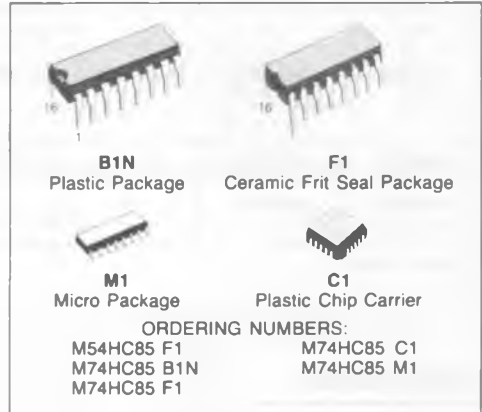
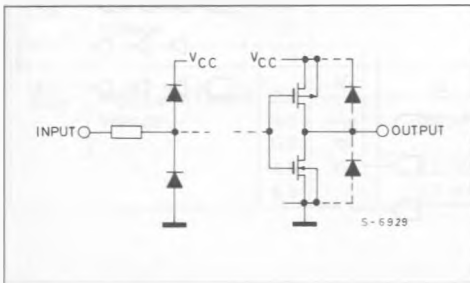
4-BIT MAGNITUDE COMPARATOR

- **HIGH SPEED**
 $t_{PD} = 24 \text{ ns (TYP.) at } V_{CC} = 5\text{V}$
- **LOW POWER DISSIPATION**
 $I_{CC} = 4 \mu\text{A (MAX.) at } T_A = 25^\circ\text{C}$
- **HIGH NOISE IMMUNITY**
 $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (MIN.)}$
- **OUTPUT DRIVE CAPABILITY**
 10 LSTTL LOADS
- **SYMMETRICAL OUTPUT IMPEDANCE**
 $|I_{OH}| = I_{OL} = 4 \text{ mA (MIN.)}$
- **BALANCED PROPAGATION DELAYS**
 $t_{PLH} = t_{PHL}$
- **WIDE OPERATING VOLTAGE RANGE**
 $V_{CC} \text{ (OPR)} = 2\text{V to } 6\text{V}$
- **PIN AND FUNCTION COMPATIBLE**
 WITH 54/74LS85

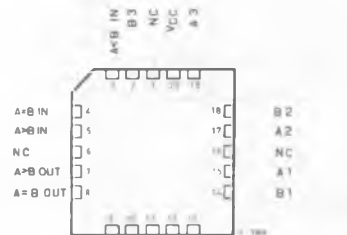
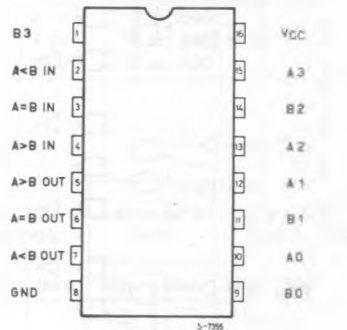
DESCRIPTION

The M54/74HC85 is a high speed CMOS 4-BIT MAGNITUDE COMPARATOR fabricated in silicon gate C²MOS technology. It has the same high speed performance of LSTTL combined with true CMOS low power consumption. This comparator compares two 4-bit words and provides a high voltage level on one of the A > Bout, A = Bout and A < Bout outputs. The comparing bit number is easily expanded by cascading several devices as shown in the typical application. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN CONNECTIONS (top view)



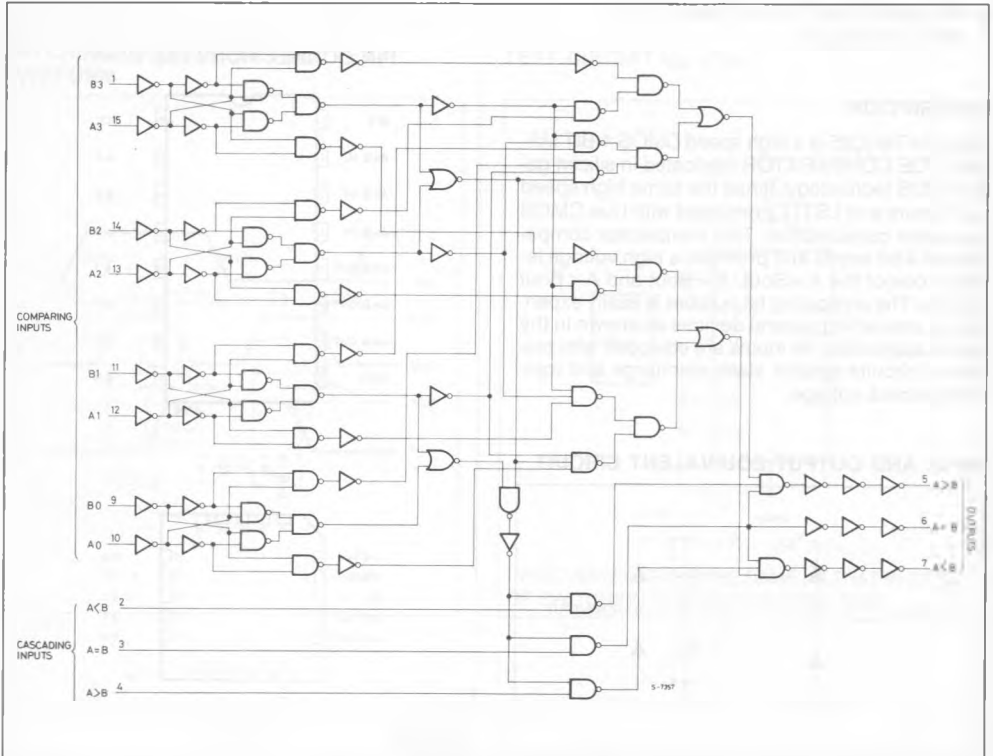
NC =
No Internal
Connection

TRUTH TABLE

COMPARING INPUTS				CASCADING INPUTS			OUTPUTS		
				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	A2 > B2	X	X	X	X	X	H	L	L
A3 = B3	A2 = B2	A1 > B1	X	X	X	X	H	L	L
A3 = B3	A2 = B2	A1 = B1	A0 > B0	X	X	X	H	L	L
A3 = B3	A2 = B2	A1 = B1	A0 = B0	L	L	L	H	H	L
				X	X	H	L	L	H
				L	H	L	L	H	L
				H	L	L	L	L	L
A3 = B3	A2 = B2	A1 = B1	A0 < B0	X	X	X	L	H	L
				X	X	X	L	H	L
				X	X	X	L	H	L
				X	X	X	L	H	L

X: DON'T CARE

LOGIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	-0.5 to 7	V
V_I	DC Input Voltage	-0.5 to $V_{CC} + 0.5$	V
V_O	DC Output Voltage	-0.5 to $V_{CC} + 0.5$	V
I_{IK}	DC Input Diode Current	± 20	mA
I_{OK}	DC Output Diode Current	± 20	mA
I_O	DC Output Source Sink Current Per Output Pin	± 25	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	± 50	mA
P_D	Power Dissipation	500 (*)	mW
T_{stg}	Storage Temperature	-65 to 150	$^{\circ}C$

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

(*) 500 mW: $\equiv 65^{\circ}C$ derate to 300 mW by 10 mW/ $^{\circ}C$: $65^{\circ}C$ to $85^{\circ}C$

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	2 to 6	V
V_I	Input Voltage	0 to V_{CC}	V
V_O	Output Voltage	0 to V_{CC}	V
T_A	Operating Temperature	74HC Series 54HC Series	$^{\circ}C$
		- 40 to 85 - 55 to 125	
t_r, t_f	Input Rise and Fall Time	$V_{CC} \begin{cases} 2 \text{ V} & 0 \text{ to } 1000 \\ 4.5 \text{ V} & 0 \text{ to } 500 \\ 6 \text{ V} & 0 \text{ to } 400 \end{cases}$	ns

DC SPECIFICATIONS

Symbol	Parameter	V_{CC}	Test Condition	$T_A = 25^{\circ}C$ 54HC and 74HC			$-40 \text{ to } 85^{\circ}C$ 74HC		$-55 \text{ to } 125^{\circ}C$ 54HC		Unit	
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.		
V_{IH}	High Level Input Voltage	2.0		1.5	—	—	1.5	—	1.5	—	V	
		4.5		3.15	—	—	3.15	—	3.15	—		
		6.0		4.2	—	—	4.2	—	4.2	—		
V_{IL}	Low Level Input Voltage	2.0		—	—	0.5	—	0.5	—	0.5	V	
		4.5		—	—	1.35	—	1.35	—	1.35		
		6.0		—	—	1.8	—	1.8	—	1.8		
V_{OH}	High Level Output Voltage	2.0	V_I	I_O	1.9	2.0	—	1.9	—	1.9	—	V
		4.5			4.4	4.5	—	4.4	—	4.4	—	
		6.0	V_{IH} or V_{IL}	- 20 μA	5.9	6.0	—	5.9	—	5.9	—	
		4.5			- 4.0 mA	4.18	4.31	—	4.13	—	4.10	
6.0	- 5.2 mA	5.68	5.8	—		5.63	—	5.60	—			

DC SPECIFICATIONS (Continued)

Symbol	Parameter	V _{CC}	Test Condition		T _A = 25°C 54HC and 74HC			- 40 to 85°C 74HC		- 55 to 125°C 54HC		Unit
					Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
V _{OL}	Low Level Output Voltage	2.0	V _I	I _O	—	0	0.1	—	0.1	—	0.1	V
		4.5	V _{IH} or V _{IL}	20 μA	—	0	0.1	—	0.1	—	0.1	
		6.0			—	0	0.1	—	0.1	—	0.1	
		4.5	4.0 mA 5.2 mA	—	0.17	0.26	—	0.33	—	0.40		
		6.0		—	0.18	0.26	—	0.33	—	0.40		
I _I	Input Leakage Current	6.0	V _I = V _{CC} or GND		—	—	±0.1	—	±1	—	±1	μA
I _{CC}	Quiescent Supply Current	6.0	V _I = V _{CC} or GND		—	—	4	—	40	—	80	μA

AC ELECTRICAL CHARACTERISTICS (V_{CC} = 5V, T_A = 25°C, C_L = 15pF, Input t_r = t_f = 6ns)

Symbol	Parameter	54HC and 74HC			Unit
		Min.	Typ.	Max.	
t _{TLH} t _{THL}	Output Transition Time		4	8	ns
t _{PLH} t _{PHL}	Propagation Delay Time (A, B, - OUT)		26	40	ns
t _{PLH} t _{PHL}	Propagation Delay Time (CASCADE - OUT)		12	20	ns

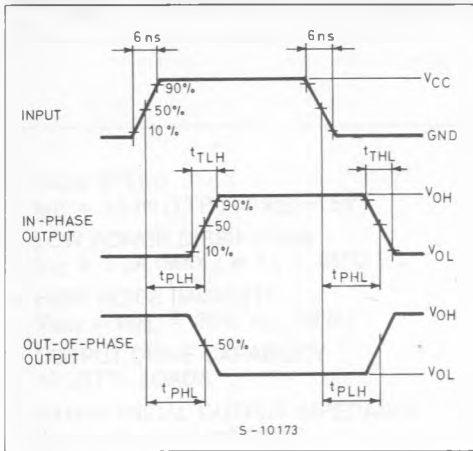
AC ELECTRICAL CHARACTERISTICS (C_L = 50pF, Input t_r = t_f = 6ns)

Symbol	Parameter	V _{CC}	Test Condition		T _A = 25°C 54HC and 74HC			- 40 to 85°C 74HC		- 55 to 125°C 54HC		Unit
					Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t _{TLH} t _{THL}	Output Transition Time	2.0			—	30	75	—	95	—	110	ns
		4.5			—	8	15	—	19	—	22	
		6.0			—	7	13	—	16	—	19	
t _{PLH} t _{PHL}	Propagation Delay Time (A, B, - OUT)	2.0			—	112	230	—	290	—	345	ns
		4.5			—	28	46	—	58	—	69	
		6.0			—	24	39	—	49	—	59	
t _{PLH} t _{PHL}	Propagation Delay Time (CASCADE-OUT)	2.0			—	60	120	—	150	—	180	ns
		4.5			—	15	24	—	30	—	36	
		6.0			—	13	20	—	26	—	31	
C _{IN}	Input Capacitance				—	5	10	—	10	—	10	pF
C _{PD} (*)	Power Dissipation Capacitance				—	28	—	—	—	—	—	pF

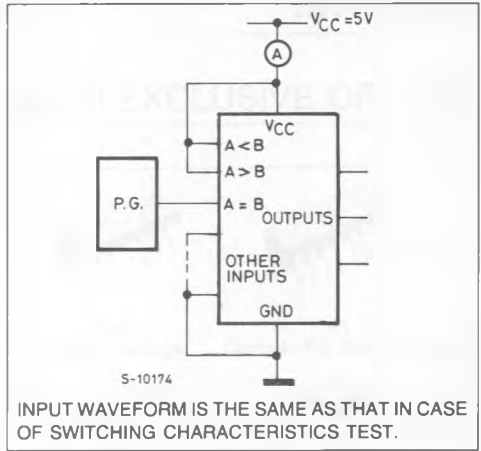
Note (*) C_{PD} is defined as the value of the IC's of internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit)

Average operating current can be obtained by the following equation: I_{CC(opp)} = C_{PD} · V_{CC} · f_{IN} + I_{CC}

SWITCHING CHARACTERISTICS TEST WAVEFORM



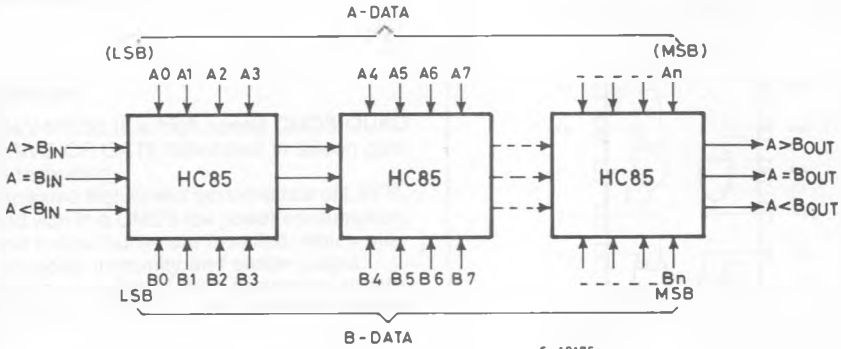
TEST CIRCUIT I_{CC} (Opr.)



INPUT WAVEFORM IS THE SAME AS THAT IN CASE OF SWITCHING CHARACTERISTICS TEST.

TYPICAL APPLICATION

N-BIT CASCADE CONNECTION



LSB = LOWEST SIGNIFICANT BIT MSB = MOST SIGNIFICANT BIT

COMPARING INPUTS	CASCADING INPUTS			OUTPUTS		
	A > B	A = B	A < B	A > B	A = B	A < B
(A) > (B)	X	X	X	H	L	L
(A) = (B)	H	L	L	H	L	L
	X	H	X	L	H	L
	L	L	H	L	L	H
(A) < (B)	X	X	X	L	L	H

X: DON'T CARE