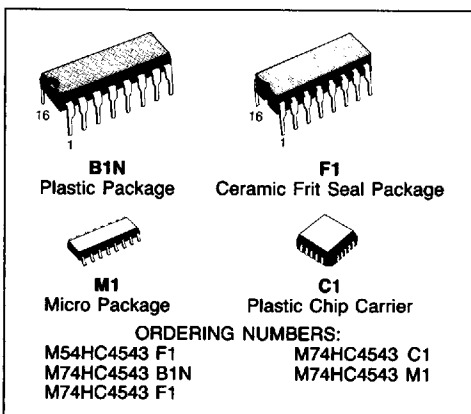




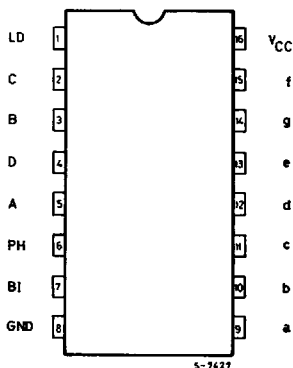
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M54HC4543
M74HC4543
BCD-TO-7 SEGMENT LATCH/DECODER/LCD DRIVER

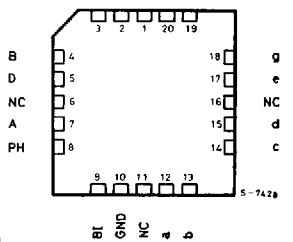
- **HIGH SPEED**
 $t_{PD} = 44 \text{ ns (TYP.) at } V_{CC} = 5\text{V}$
- **LOW POWER DISSIPATION**
 $I_{CC} = 4 \mu\text{A (MAX.) at } T_A = 25^\circ\text{C}$
- **HIGH NOISE IMMUNITY**
 $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (MIN.)}$
- **OUTPUT DRIVE CAPABILITY**
 10 LSTTL LOADS
- **SYMMETRICAL OUTPUT 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 4543B


DESCRIPTION

The M54/74HC4543 is a high speed CMOS BCD-TO-7 SEGMENT DECODER WITH LCD DRIVER fabricated in silicon gate C²MOS technology. High speed latch and decode operation 120 times as fast as standard CMOS 4511B while CMOS low power consumption is maintained. This device consist of BCD-TO-7 segment decoder with a BCD input latch and a 7-segment driver for a liquid crystal display (LCD). When any illegal BCD input signal is applied or input BI is held high, the display is blanked. When driving LCDs, a common square wave signal should be applied not only to the PH input of this device but also to the electrically common back-plane of the display. For other types of readouts, such as light-emitting diode (LED), some additional drivers, such as a transistor array is required. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

PIN CONNECTIONS (top view)


C LD NC V_{CC} T



NC =
No Internal
Connection

TRUTH TABLE

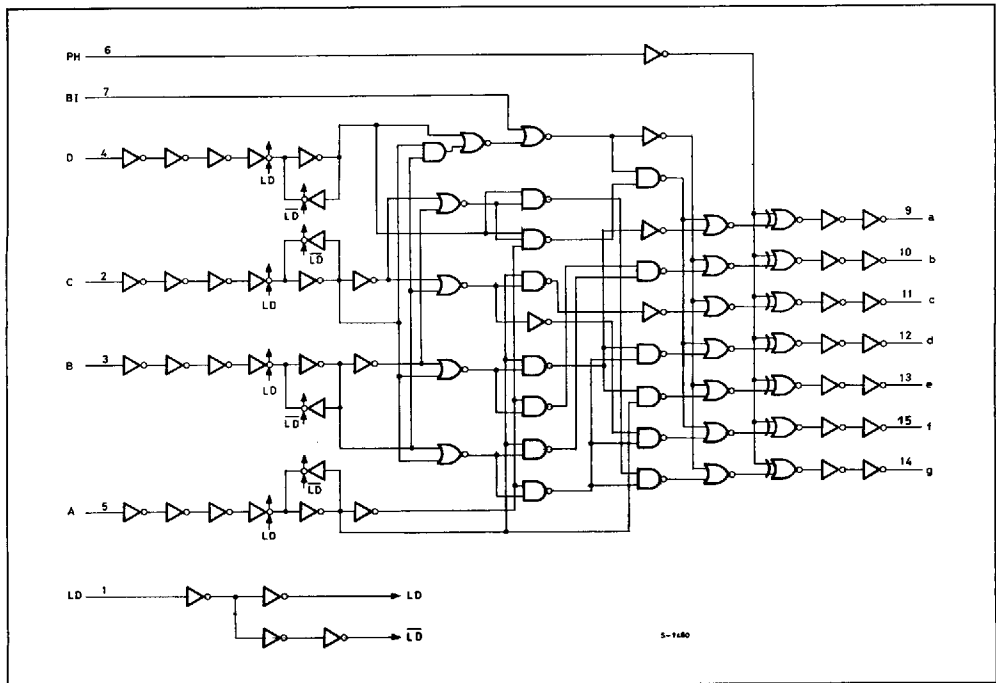
INPUTS							OUTPUTS							DISPLAY	
LD	BI	PH	D	C	B	A	a	b	c	d	e	f	g		
X	H	L	X	X	X	X	L	L	L	L	L	L	L	BLANK	
H	L	L	L	L	L	L	H	H	H	H	H	H	L	0	
H	L	L	L	L	L	H	L	H	H	L	L	L	L	1	
H	L	L	L	L	H	L	H	H	L	H	H	L	H	2	
H	L	L	L	L	H	H	H	H	H	L	L	L	H	3	
H	L	L	L	H	L	L	L	L	H	H	L	L	H	4	
H	L	L	L	H	H	L	H	H	L	H	L	H	H	5	
H	L	L	L	H	H	H	L	H	L	H	H	H	H	6	
H	L	L	L	L	H	H	H	H	H	L	L	L	L	7	
H	L	L	H	L	L	L	H	H	H	H	H	H	H	8	
H	L	L	H	L	L	L	H	H	H	H	L	H	H	9	
H	L	L	H	X	H	X	L	L	L	L	L	L	L	BLANK	
H	L	L	H	H	X	X	L	L	L	L	L	L	L	BLANK	
L	L	L	X	X	X	X		#	#	#				# # #	
↑	↑	H			↑									INVERSE OF ABOVE OUTPUT LEVEL	DISPLAY AS ABOVE

X: DON'T CARE

↑: SAME AS ABOVE COMBINATIONS

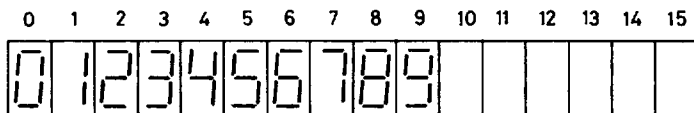
#: DEPENDS UPON THE BCD CODE PREVIOUSLY APPLIED WHEN LD = 'H'

LOGIC DIAGRAM

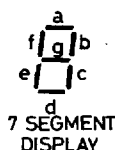


DISPLAY MODE

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S -10223



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 conditions is not implied.

(*) 500 mW: $\approx 65^{\circ}C$ 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} $\left\{ \begin{array}{l} 2 \text{ V} \\ 4.5 \text{ V} \\ 6 \text{ V} \end{array} \right.$	ns
		0 to 1000 0 to 500 0 to 400	

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DC SPECIFICATIONS

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 _{IH}	High Level Input Voltage	2.0 4.5 6.0		1.5 3.15 4.2	— — —	— — —	1.5 3.15 4.2	— — —	1.5 3.15 4.2	— — —	V	
V _{IL}	Low Level Input Voltage	2.0 4.5 6.0		— — —	— — —	0.5 1.35 1.8	— — —	0.5 1.35 1.8	— — —	0.5 1.35 1.8	V	
V _{OH}	High Level Output Voltage	2.0 4.5 6.0	V _I	I _O	1.9	2.0	—	1.9	—	1.9	—	V
			V _{IH} or V _{IL}	-20 μA	4.4 5.9	4.5 6.0	— —	4.4 5.9	— —	4.4 5.9	— —	
		4.5 6.0	V _{IH} or V _{IL}	-4.0 mA	4.18	4.31	—	4.13	—	4.10	—	
				-5.2 mA	5.68	5.8	—	5.63	—	5.60	—	
V _{OL}	Low Level Output Voltage	2.0 4.5 6.0	V _{IH} or V _{IL}	20 μA	—	0	0.1	—	0.1	—	0.1	V
				—	—	0	0.1	—	0.1	—	0.1	
		4.5 6.0	V _{IH} or V _{IL}	4.0 mA	—	0.17	0.26	—	0.33	—	0.40	
				5.2 mA	—	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 (BCD - OUT)		44	68	ns
t _{PLH} t _{PHL}	Propagation Delay Time (BI - OUT)		27	42	ns
t _{PLH} t _{PHL}	Propagation Delay Time (PH - OUT)		19	30	ns

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AC ELECTRICAL CHARACTERISTICS ($C_L = 50\text{pF}$, Input $t_r = t_f = 6\text{ns}$)

Symbol	Parameter	V_{CC}	Test Condition	$T_A = 25^\circ\text{C}$ 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 4.5 6.0		— — —	30 8 7	75 15 13	— — —	95 19 16	— — —	110 22 19	ns
t_{PLH} t_{PHL}	Propagation Delay Time (BCD - OUT)	2.0 4.5 6.0		— — —	200 50 43	385 77 66	— — —	485 97 83	— — —	580 116 98	ns
t_{PLH} t_{PHL}	Propagation Delay Time (BI - OUT)	2.0 4.5 6.0		— — —	124 31 36	240 48 41	— — —	300 60 51	— — —	360 72 61	ns
t_{PHL}	Propagation Delay Time (PH - OUT)	2.0 4.5 6.0		— — —	80 22 19	175 35 30	— — —	220 44 37	— — —	265 53 45	ns
$t_{W(H)}$	Minimum Pulse Width (LD)	2.0 4.5 6.0		— — —	30 8 7	75 15 13	— — —	95 19 16	— — —	110 22 19	ns
t_s	Minimum Set-Up Time	2.0 4.5 6.0		— — —	30 8 7	75 15 13	— — —	95 19 16	— — —	110 22 19	ns
t_h	Minimum Hold Time	2.0 4.5 6.0		— — —	— — —	0 0 0	— — —	0 0 0	— — —	0 0 0	ns
C_{IN}	Input Capacitance			—	5	10	—	10	—	10	pF
$C_{PD} (*)$	Power Dissipation Capacitance			—	30	—	—	—	—	—	pF

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

Average operating current can be obtained by the following equation. $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$.

SWITCHING CHARACTERISTICS TEST WAVEFORM

