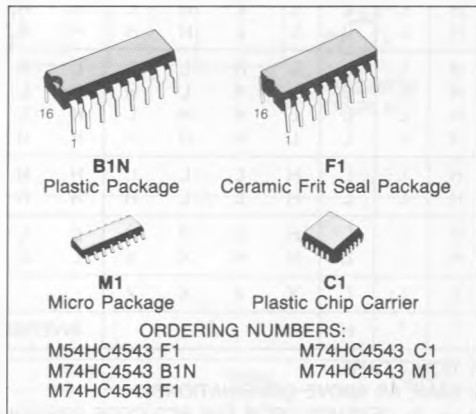


BCD-TO-7 SEGMENT LATCH/DECODER/LCD DRIVER

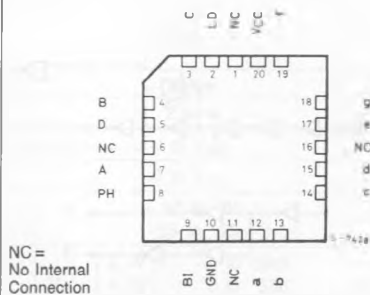
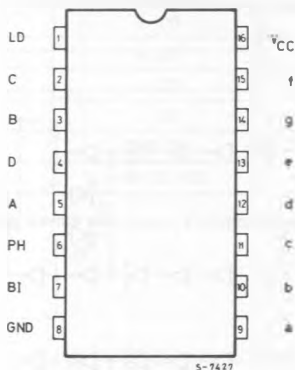
- **HIGH SPEED**
 $t_{PD} = 44 \text{ ns (TYP.) at } V_{CC} = 5\text{V}$
- **LOW POWER DISSIPATION**
 $I_{CC} = 4 \mu\text{A (MAX.) at } T_A = 25^\circ\text{C}$
- **HIGH NOISE IMMUNITY**
 $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (MIN.)}$
- **OUTPUT DRIVE CAPABILITY**
 10 LSTTL LOADS
- **SYMMETRICAL OUTPUT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



NC =
No Internal
Connection

TRUTH TABLE

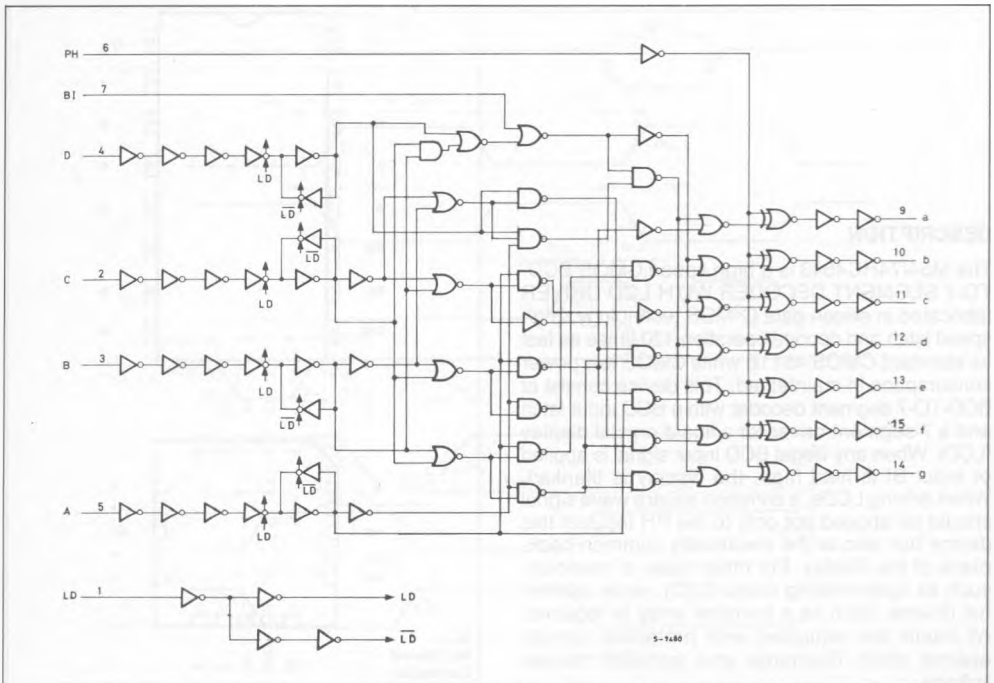
INPUTS							OUTPUTS							DISPLAY
LD	BI	PH	D	C	B	A	a	b	c	d	e	f	g	
X	H	L	X	X	X	X	L	L	L	L	L	L	L	BLANK
H	L	L	L	L	L	L	H	H	H	H	H	H	L	0
H	L	L	L	L	L	H	L	H	H	L	L	L	L	1
H	L	L	L	L	H	L	H	H	L	H	H	L	H	2
H	L	L	L	L	H	H	H	H	H	L	L	L	H	3
H	L	L	L	H	L	L	L	H	H	L	L	H	H	4
H	L	L	L	H	L	H	H	L	H	L	H	H	H	5
H	L	L	L	H	H	L	L	H	L	H	H	H	H	6
H	L	L	L	H	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	H	H	H	H	L	H	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

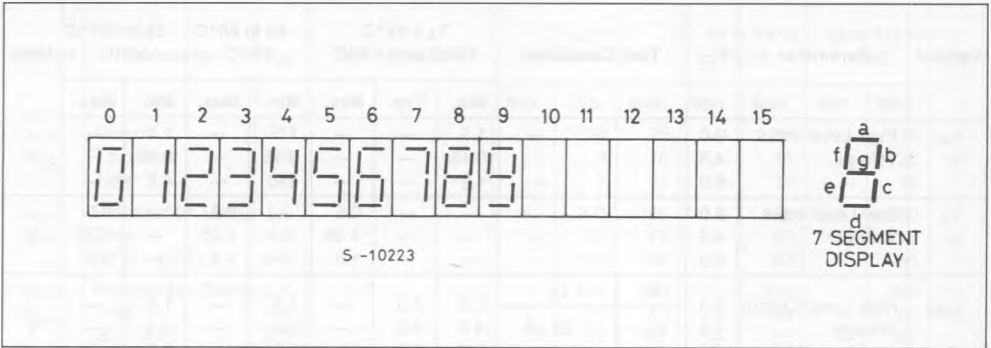
↑: SAME AS ABOVE COMBINATIONS

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

LOGIC DIAGRAM



DISPLAY MODE



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: $\cong 65^{\circ}C$ 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	-40 to 85 -55 to 125	$^{\circ}C$
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°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		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	V _{IH} or V _{IL}		- 20 μA	4.4	4.5	—	4.4	—	4.4		—
		6.0			- 4.0 mA	5.9	6.0	—	5.9	—	5.9		—
		4.5	V _{IH} or V _{IL}		- 5.2 mA	4.18	4.31	—	4.13	—	4.10		—
6.0	5.68	5.8		—	5.63	—	5.60	—					
V _{OL}	Low Level Output Voltage	2.0	V _{IH} or V _{IL}	20 μA	—	0	0.1	—	0.1	—	0.1	V	
		4.5			—	0	0.1	—	0.1	—	0.1		
		6.0			—	0	0.1	—	0.1	—	0.1		
		4.5			V _{IH} or V _{IL}	4.0 mA	—	0.17	0.26	—	0.33		—
6.0	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

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 De- lay 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. $I_{CC(oper)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$.

SWITCHING CHARACTERISTICS TEST WAVEFORM

