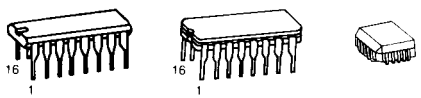
HS-C²MOS™ INTEGRATED CIRCUITS

PRELIMINARY DATA

BCD-TO-7 SEGMENT LATCH/DECODER LCD DRIVER

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 one twenty times as fast as standard CMOS 4511B while CMOS low power consumption in maintened. 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 ware 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 transitor array is required. All inputs are equipped with protection circuits against static discharge or transient excess voltage.



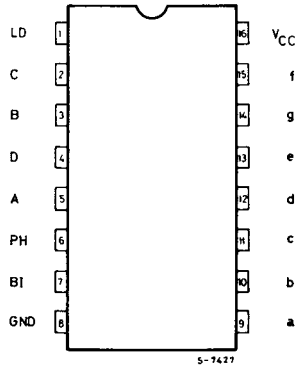
B1 Plastic Package | **F1** Ceramic Package | **C1** Chip Carrier

ORDERING NUMBERS: M54HC4543 F1
M74HC4543 B1
M74HC4543 F1
M74HC4543 C1

FEATURES

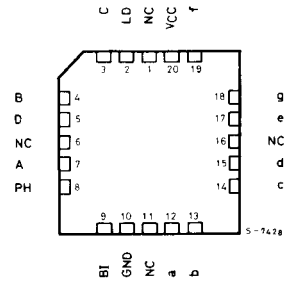
- High Speed
  t_{PD} = 44 ns (Typ.) at V_{CC} = 5V
- Low Power Dissipation
  I_{CC} = 4 μA (Max.) at T_A = 25°C
- High Noise Immunity
  $V_{NIH} = V_{NIL}$ = 28% V_{CC} (Min.)
- Output Drive Capability
  10 LSTTL Loads
- Symmetrical Output Impedance
  $|I_{OH}| = I_{OL}$ = 4 mA (Min.)
- Balanced Propagation Delays
  $t_{PLH} = t_{PHL}$
- Wide Operating Voltage Range
  V_{CC} (opr) = 2V to 6V
- Pin and Function compatible with 4543B

PIN CONNECTIONS
(top view)



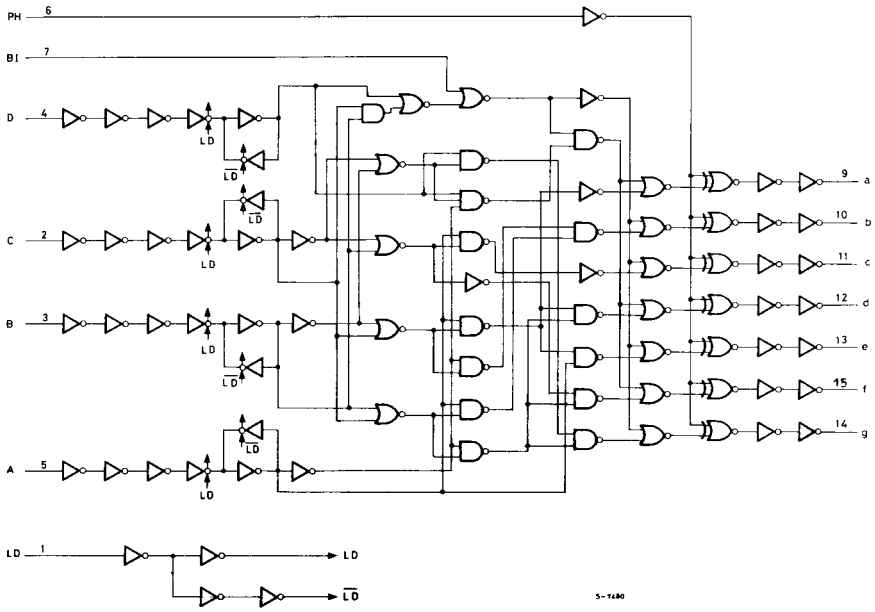
Dual in line

CHIP CARRIER



NC = No Internal Connection

LOGIC DIAGRAM

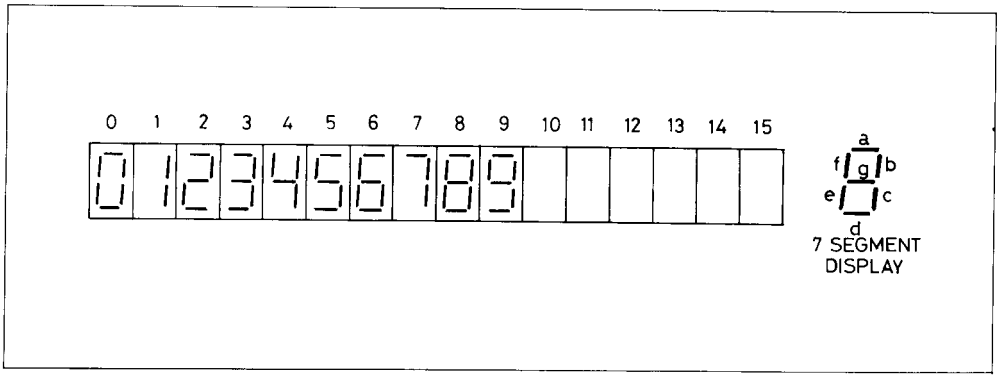


TRUTH TABLE

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	H	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	H	L	H	H	5
H	L	L	L	H	H	L	H	L	H	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	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'

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	°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: ≅ 65°C derate to 300 mW by 10 mW/°C: 65°C to 85°C.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Limit		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		°C
t_r, t_f	Input Rise and Fall Time	V_{CC}	2 V 4.5V 6 V	0 to 1000 0 to 500 0 to 400	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			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	—	
V_{OL}	Low Level Output Voltage	2.0			—	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	—	0.17	0.26	—	0.33	—	0.40	
		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
$t_{W(H)}$ $t_{W(H)}$	Minimum Pulse Width (LD)		8	15	ns
t_s	Minimum Set-up Time		7	15	ns
t_h	Minimum Hold Time		—	0	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	—	90			ns
		4.5		—	8	15	—	18			
		6.0		—	7	13	—	16			
t_{PLH} t_{PHL}	Propagation Delay Time (BCD - OUT)	2.0		—	200	385	—	465			ns
		4.5		—	50	77	—	93			
		6.0		—	43	66	—	79			
t_{PLH} t_{PHL}	Propagation Delay Time (BI - OUT)	2.0		—	110	240	—	290			ns
		4.5		—	31	48	—	58			
		6.0		—	27	41	—	50			
t_{PHL}	Propagation Delay Time (PH - OUT)	2.0		—	80	175	—	210			ns
		4.5		—	22	35	—	42			
		6.0		—	19	30	—	36			
$t_{W(H)}$	Minimum Pulse Width (LD)	2.0		—	30	75	—	90			ns
		4.5		—	8	15	—	18			
		6.0		—	7	13	—	16			
t_s	Minimum Set-up Time	2.0		—	35	75	—	90			ns
		4.5		—	7	15	—	18			
		6.0		—	6	13	—	16			
t_h	Minimum Hold Time	2.0		—	—	0	—	0			ns
		4.5		—	—	0	—	0			
		6.0		—	—	0	—	0	—		
C_{IN}	Input Capacitance			—	5	10	—	10			pF
C_{PD} (*)	Power Dissipation Capacitance			—	30	—	—	—			

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

Average operating current can be obtained by the following equation.

$I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$.