

TC74HC4543P BCD-TO-7 SEGMENT LATCH/DECODER/LCD DRIVER

GENERAL DESCRIPTION

The TC74HC4543 is a high speed CMOS BCD-TO-7 SEGMENT DECODER WITH LCD DRIVER fabricated with silicon gate C²MOS technology. It achieves the high speed latch and decode operation twenty times as fast as the standard CMOS 4511B while maintaining the CMOS low power dissipation. This device consists of BCD-TO-7 segment decoder with a BCD input latch and a 7-segment driver for the liquid crystal display (LCD). When any illegal BCD input signal is applied or BI input is held high, the display is blanked. In case of driving LCD, 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 transistor array is required. All inputs are equipped with protection circuits against static discharge or transient excess voltage.

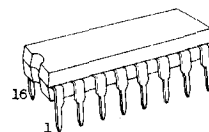
FEATURES:

- High Speed $t_w=8\text{ns}(\text{Typ.})$ at $V_{CC}=5\text{V}$
- Low Power Dissipation $I_{CC}=4\mu\text{A}(\text{Max.})$ 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 $|I_{OH}|=I_{OL}=4\text{mA}(\text{Min.})$
- Balanced Propagation Delays $t_{pLH}=t_{pHL}$
- Wide Operating Voltage Range $V_{CC}(\text{opr.})=2\text{V}\sim 6\text{V}$
- Pin and Function Compatible with 4543B

ABSOLUTE MAXIMUM RATINGS

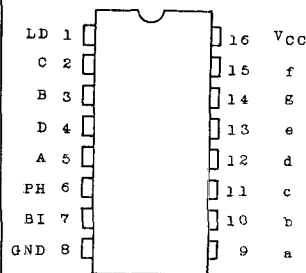
PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V_{CC}	$-0.5 \sim 7$	V
DC Input Voltage	V_{IN}	$-0.5 \sim V_{CC}+0.5$	V
DC Output Voltage	V_{OUT}	$-0.5 \sim V_{CC}+0.5$	V
Input Diode Current	I_{IK}	± 20	mA
Output Diode Current	I_{OK}	± 20	mA
DC Output Current	I_{OUT}	± 25	mA
DC V_{CC} /Ground Current	I_{CC}	± 50	mA
Power Dissipation	P_D	500*	mW
Storage Temperature	T_{stg}	$-65 \sim 150$	$^\circ\text{C}$
Lead Temperature 10sec	T_L	300	$^\circ\text{C}$

* 500mW in the range of $T_a=-40^\circ\sim 65^\circ\text{C}$ and from $T_a=65^\circ\text{C}$ up to 85°C derating factor of $-10\text{mW}/^\circ\text{C}$ shall be applied until 300mW.



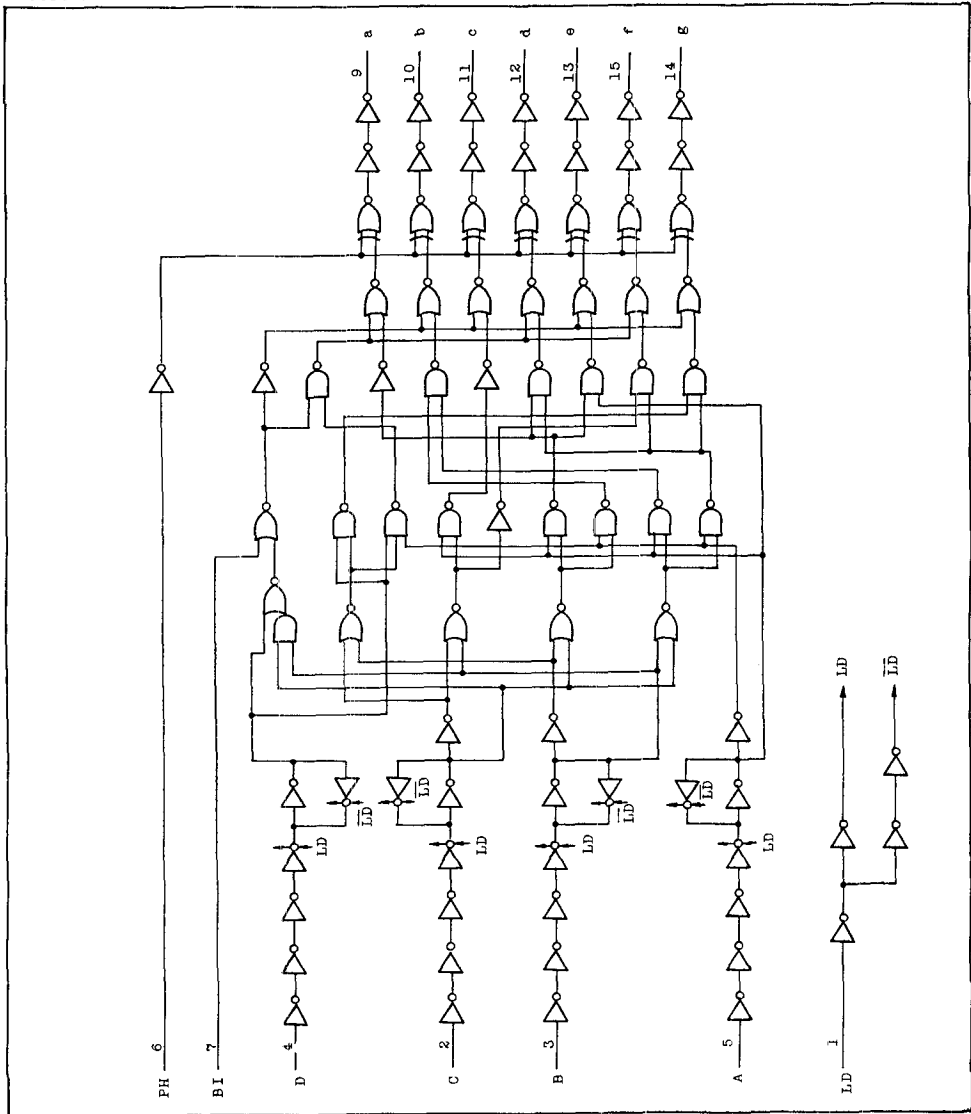
DIP(5-22E)

PIN ASSIGNMENT



(TOP VIEW)

LOGIC DIAGRAM



TC74HC4543P

TRUTH TABLE

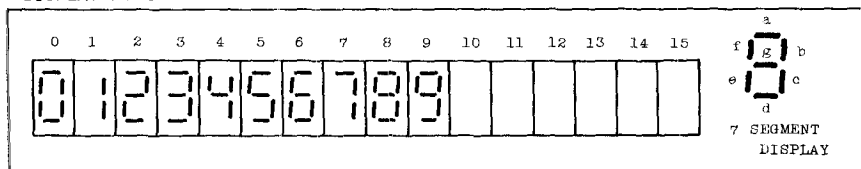
INPUTS							OUTPUTS							DISPLAY
LD	EI	PH	D	C	B	A	a	b	c	d	e	f	g	
X	H	L	X	X	X	X	L	L	L	L	L	L	L	BLANK
H	L	L	L	L	L	L	H	H	H	H	H	H	L	0
H	L	L	L	L	L	H	L	H	H	L	L	L	L	1
H	L	L	L	L	H	L	H	H	L	H	H	L	H	2
H	L	L	L	L	H	H	H	H	H	L	L	L	H	3
H	L	L	L	H	L	L	L	H	H	L	L	H	H	4
H	L	L	L	H	L	H	H	L	H	H	L	H	H	5
H	L	L	L	H	H	L	H	L	H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

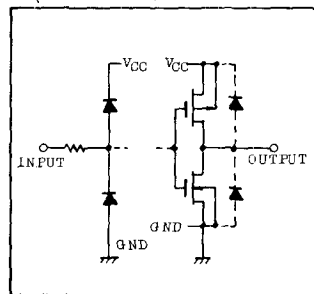
DISPLAY MODE



RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	LIMIT	UNIT
Supply Voltage	V_{CC}	2 ~ 6	V
Input Voltage	V_{IN}	0 ~ V_{CC}	V
Output Voltage	V_{OUT}	0 ~ V_{CC}	V
Operating Temperature	T_{opr}	-40 ~ 85	°C
Input Rise and Fall Time	t_r, t_f	0 ~ 1000 ($V_{CC}=2.0V$) 0 ~ 500 ($V_{CC}=4.5V$) 0 ~ 400 ($V_{CC}=6.0V$)	ns

INPUT and OUTPUT EQUIVALENT CIRCUIT



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DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION		Ta=25°C				Ta=-40~85°C		UNIT
				V _{CC}	MIN.	TYP.	MAX.	MIN.	MAX.	
High-Level Input Voltage	V _{IH}			2.0 4.5 6.0	1.5 3.15 4.2	- - -	- - -	1.5 3.15 4.2	- - -	V
Low-Level Input Voltage	V _{IL}			2.0 4.5 6.0	- - -	- - -	0.5 1.35 1.8	- - -	0.5 1.35 1.8	V
High-Level Output Voltage	V _{OH}	V _{IN} =V _{IH} or V _{IL}	I _{OH} =-20μA	2.0	1.9	2.0	-	1.9	-	V
				4.5	4.4	4.5	-	4.4	-	
				6.0	5.9	6.0	-	5.9	-	
			I _{OH} =-4mA I _{OH} =-5.2mA	4.5	4.18	4.31	-	4.13	-	
				6.0	5.68	5.80	-	5.63	-	
Low-Level Output Voltage	V _{OL}	V _{IN} =V _{IH} or V _{IL}	I _{OL} =20μA	2.0	-	0.0	0.1	-	0.1	V
				4.5	-	0.0	0.1	-	0.1	
				6.0	-	0.0	0.1	-	0.1	
			I _{OL} =4mA I _{OL} =5.2mA	4.5	-	0.17	0.32	-	0.37	
				6.0	-	0.18	0.32	-	0.37	
Input Leakage Current	I _{IN}	V _{IN} =V _{CC} or GND		6.0	-	-	±0.1	-	±1.0	μA
Quiescent Supply Current	I _{CC}	V _{IN} =V _{CC} or GND		6.0	-	-	4.0	-	40.0	

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

PARAMETER	SYMBOL	TEST CONDITION	V _{CC}	25°C			-40 ~ 85°C		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	
Output Transition Time	t _{TLH} t _{THL}		2.0	-	30	75	-	90	ns
			4.5	-	8	15	-	18	
			6.0	-	7	13	-	16	
Propagation Delay Time	t _{pLH} t _{pHL}		2.0	-	200	385	-	465	
			4.5	-	50	77	-	93	
			6.0	-	43	66	-	79	
BCD - OUT	t _{pLH} t _{pHL}		2.0	-	110	240	-	290	
			4.5	-	31	48	-	58	
			6.0	-	27	41	-	50	
BI - OUT	t _{pLH} t _{pHL}		2.0	-	80	175	-	210	
			4.5	-	22	35	-	42	
			6.0	-	19	30	-	36	
PH - OUT	t _{pLH} t _{pHL}		2.0	-	80	175	-	210	
			4.5	-	22	35	-	42	
			6.0	-	19	30	-	36	

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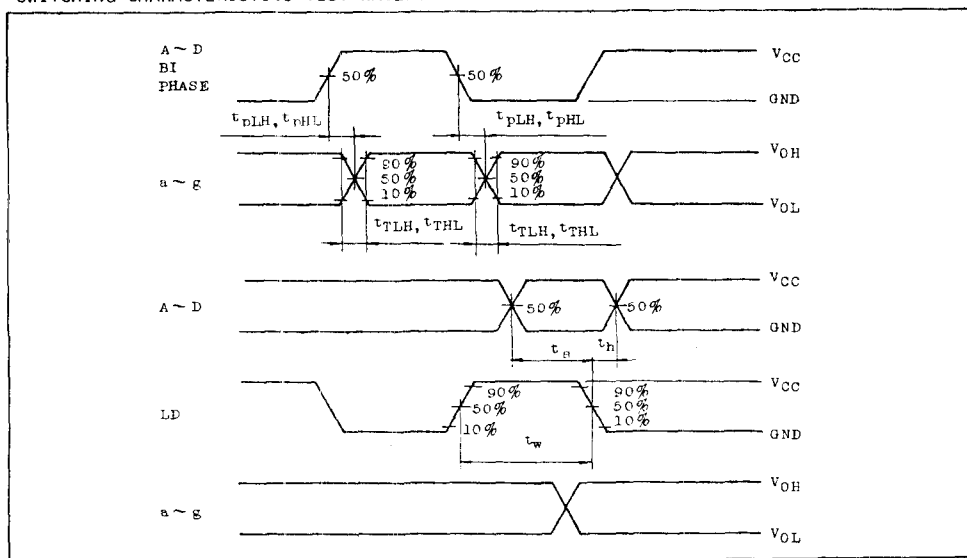
AC ELECTRICAL CHARACTERISTICS (Continued)

PARAMETER	SYMBOL	TEST CONDITION	25°C				-40 ~ 85°C		UNIT
			V _{CC}	MIN.	TYP.	MAX.	MIN.	MAX.	
Minimum Pulse Width (LD)	$t_{w(H)}$		2.0	-	30	75	-	90	ns
			4.5	-	8	15	-	18	
			6.0	-	7	13	-	16	
Minimum Set-up Time	t_s		2.0	-	35	75	-	90	
			4.5	-	7	15	-	18	
			6.0	-	6	13	-	16	
Minimum Hold Time	t_h		2.0	-	-	0	-	0	
			4.5	-	-	0	-	0	
			6.0	-	-	0	-	0	
Input Capacitance	C_{IN}		-	-	5	10	-	10	pF
Power Dissipation Capacitance	$C_{PD(1)}$		-	-	30	-	-	-	

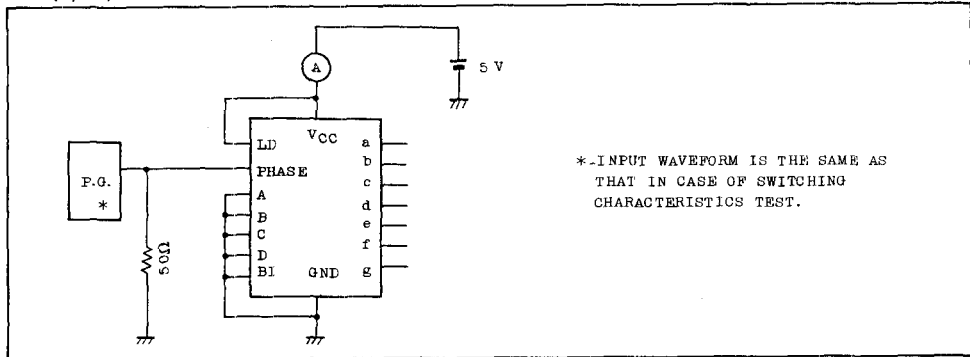
Note(1) C_{pp} is defined as the value of internal equivalent capacitance of IC which is calculated from the operating current consumption without load (refer to Test Circuit). Average operating current can be obtained by the equation hereunder.

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

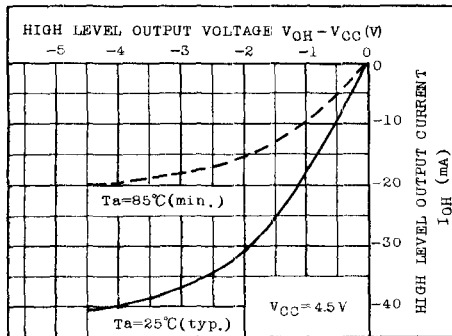
SWITCHING CHARACTERISTICS TEST WAVEFORM



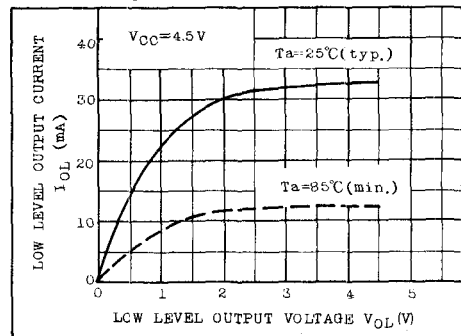
ICC(opr.) TEST CIRCUIT



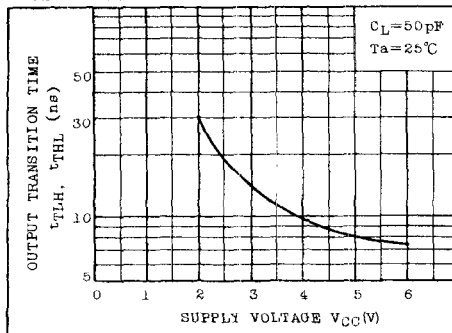
I_{OH} CHARACTERISTICS



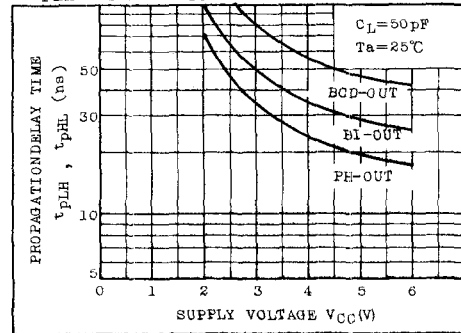
I_{OL} CHARACTERISTICS



t_{TLH}, t_{THL} - V_{CC} CHARACTERISTICS (TYP.)

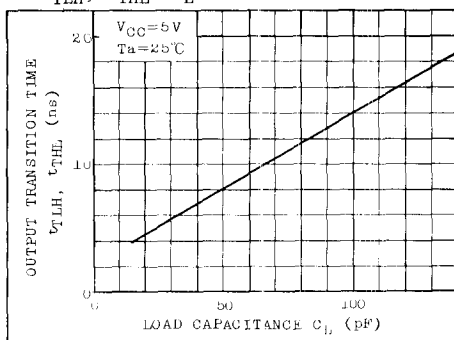


t_{PLH}, t_{PHL} - V_{CC} CHARACTERISTICS (TYP.)

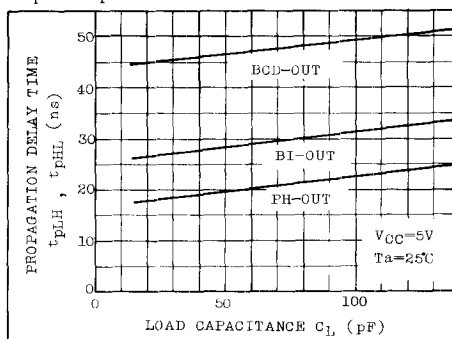


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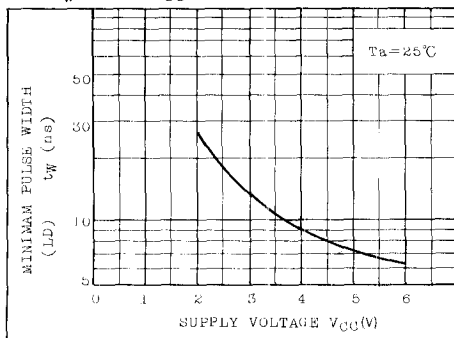
t_{TLH} , t_{THL} - C_L CHARACTERISTICS (TYP.)



t_{PLH} , t_{PHL} - C_L CHARACTERISTICS (TYP.)



$t_w(LD)$ - V_{CC} CHARACTERISTICS (TYP.)



t_s - V_{CC} CHARACTERISTICS (TYP.)

