

TC74HC4511P BCD-TO-7 SEGMENT LATCH/DECODER/DRIVER

The TC74HC4511 is a high speed CMOS BCD-TO-7 SEGMENT LATCH/DECODER/DRIVER fabricated with silicon gate C²MOS technology. It enables high speed latch and decode operation with identical pin connection and function to standard CMOS 4511B.

The segment output driver, which is CMOS construction, has large I_{OH} capability which enables to drive cathode common LED directly.

When lamp test ($\overline{LT}$) is taken "L", all segment outputs will go to "H", and when blanking ($\overline{BI}$) is taken "L" and $\overline{LT}$ is taken "H" all segment outputs will go to "L".

These functions are regardless of other inputs and used to test display.

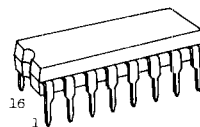
BI input is used to pulse-modulate the brightness of the display.

When error input code (over 10) is applied to BCD input, all segment outputs will go "L" (turn off).

All inputs are equipped with protection circuits against static discharge or transient excess voltage.

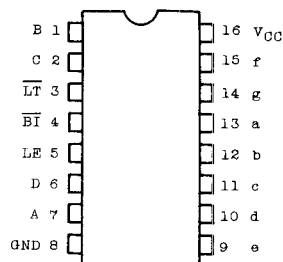
FEATURES:

- . High Speed..... $t_w=15\text{ns}(\text{Max.})$ at $V_{CC}=4.5\text{V}$
- . Low Power Dissipation..... $I_{CC}=4\mu\text{A}(\text{Max.})$ at $T_a=25^\circ\text{C}$
- . High Noise Immunity..... $V_{NIH}=V_{NIL}=28\% V_{CC}$ (Min.)
- . Output Drive Capability.....10 LSTTL Loads
- . High Output Current..... $|I_{OH}|=20\text{mA}$
- . Wide Operating Voltage Range. $V_{CC}(\text{opr})=2\text{V} \sim 6\text{V}$
- . Pin and Function Compatible with standard CMOS 4511B.



DIP (5-22P)

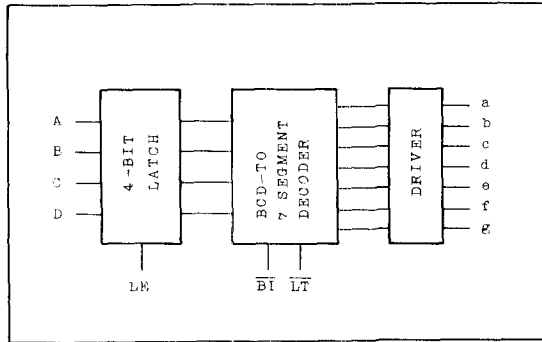
PIN ASSIGNMENT



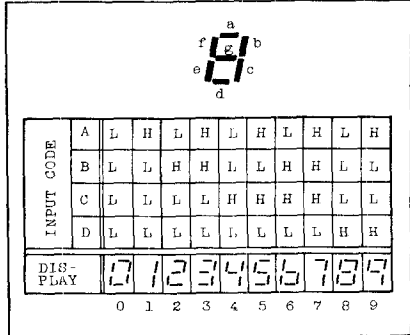
(Top View)

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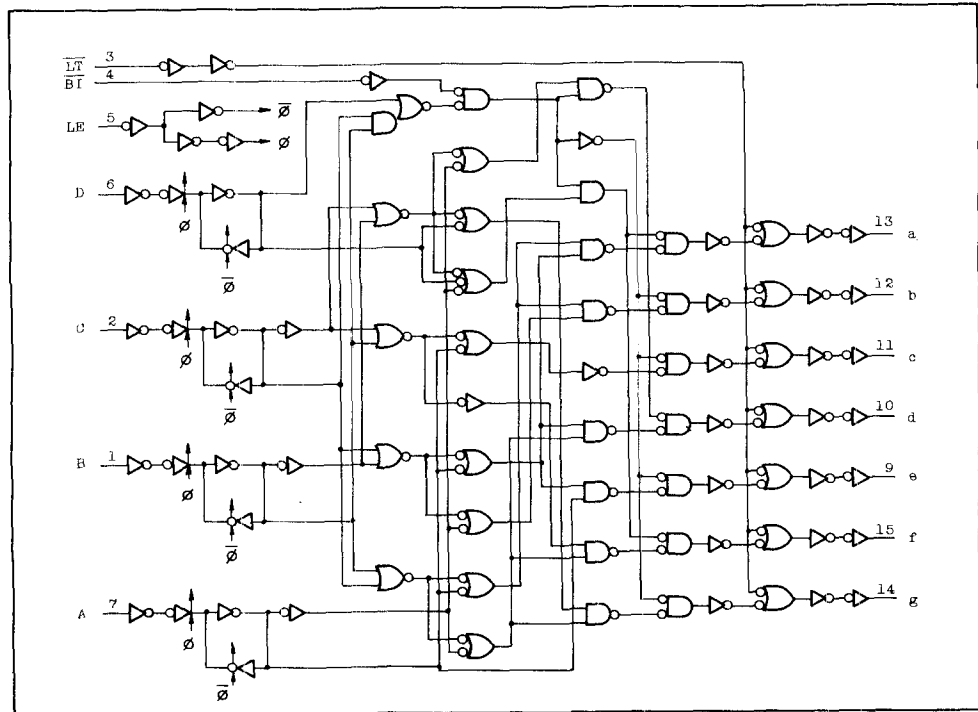
BLOCK DIAGRAM



DISPLAY MODE



LOGIC DIAGRAM



TC74HC4511P

TRUTH TABLE

INPUTS							OUTPUTS							DISPLAY MODE
LE	$\overline{\text{BI}}$	$\overline{\text{LT}}$	D	C	B	A	a	b	c	d	e	f	g	
*	*	L	*	*	*	*	H	H	H	H	H	H	H	8
*	L	H	*	*	*	*	L	L	L	L	L	L	L	BLANK
L	H	H	L	L	L	L	H	H	H	H	H	H	L	0
L	H	H	L	L	L	H	L	H	H	L	L	L	L	1
L	H	H	L	L	H	L	H	H	L	H	H	L	H	2
L	H	H	L	L	H	H	H	H	H	H	L	L	H	3
L	H	H	L	H	L	L	L	H	H	L	L	H	H	4
L	H	H	L	H	L	H	H	L	H	H	L	H	H	5
L	H	H	L	H	H	L	L	L	H	H	H	H	H	6
L	H	H	L	H	H	H	H	H	H	L	L	L	L	7
L	H	H	H	L	L	L	H	H	H	H	H	H	H	8
L	H	H	H	L	L	H	H	H	H	L	L	H	H	9
L	H	H	H	L	H	*	L	L	L	L	L	L	L	BLANK
L	H	H	H	H	*	*	L	L	L	L	L	L	L	BLANK
H	H	H	*	*	*	*	Hold the stage at the leading edge of LE							

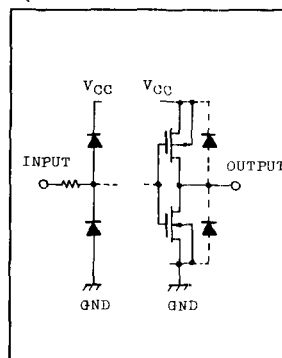
ABSOLUTE MAXIMUM RATINGS

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}	$-65 \sim 150$	°C
Lead Temperature 10sec	T_L	300	°C

* 500mW in the range of $T_a = -40^\circ\text{C} \sim 65^\circ\text{C}$.

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.

INPUT and OUTPUT
EQUIVALENT CIRCUIT



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 ~ 500	ns

DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION		T _a =25°C				T _a =-40~85°C		UNIT
				V _{CC}	MIN.	TYP.	MAX.	MIN.	MAX.	
High-Level Input Voltage	V _{IH}			2.0	1.5	-	-	1.5	-	V
				4.5	3.15	-	-	3.15	-	
				6.0	4.2	-	-	4.2	-	
Low-Level Input Voltage	V _{IL}			2.0	-	-	0.5	-	0.5	V
				4.5	-	-	1.35	-	1.35	
				6.0	-	-	1.8	-	1.8	
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} =-6mA	4.5	4.18	4.31	-	4.13	-	
			I _{OH} =-20mA	4.5	3.20	3.80	-	2.90	-	
			I _{OH} =-5.2mA	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	4.5	-	0.17	0.32	-	0.37	
			I _{OL} =5.2mA	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	

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

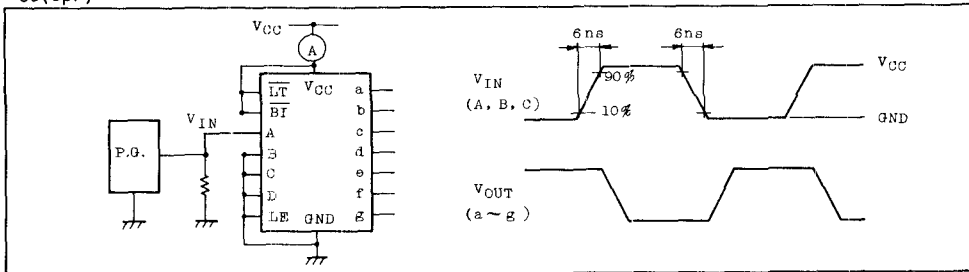
PARAMETER	SYMBOL	TEST CONDITION	$T_a=25^\circ\text{C}$				$T_a=-40\sim 85^\circ\text{C}$		UNIT
			VCC	MIN.	TYP.	MAX.	MIN.	MAX.	
Output Transition Time Low to High	t_{TLH}		2.0	-	24	60	-	75	ns
			4.5	-	6	12	-	15	
			6.0	-	5	10	-	13	
Output Transition Time High to Low	t_{THL}		2.0	-	30	75	-	90	
			4.5	-	8	15	-	18	
			6.0	-	7	13	-	16	
Propagation Delay Time (BCD-Segment)	t_{pLH} t_{pHL}		2.0	-	170	400	-	480	
			4.5	-	48	80	-	96	
			6.0	-	41	69	-	83	
Propagation Delay Time (BI - Segment)	t_{pLH} t_{pHL}		2.0	-	92	250	-	300	
			4.5	-	29	50	-	60	
			6.0	-	25	43	-	52	
Propagation Delay Time (LT - Segment)	t_{pLH} t_{pHL}		2.0	-	52	150	-	180	
			4.5	-	18	30	-	36	
			6.0	-	16	26	-	32	
Propagation Delay Time (LE - Segment)	t_{pLH} t_{pHL}		2.0	-	165	400	-	480	ns
			4.5	-	48	80	-	100	
			6.0	-	41	68	-	85	
Minimum Pulse Width (LE)	$t_w(L)$		2.0	-	25	75	-	90	
			4.5	-	8	15	-	18	
			6.0	-	7	13	-	16	
Minimum Data Set-up Time	t_s		2.0	-	35	75	-	90	
			4.5	-	9	15	-	18	
			6.0	-	7	13	-	16	
Minimum Data 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}	(Note 1)		-	136	-	-	-	

Note (1) C_{PD} 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).

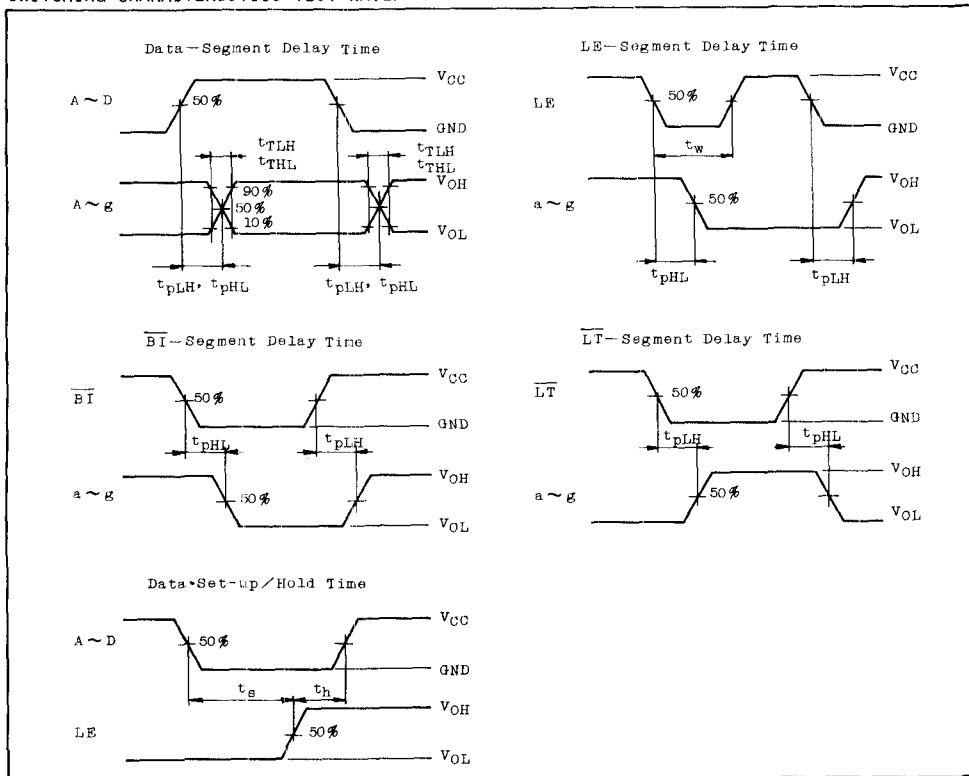
Average operating current can be obtained by the equation hereunder.

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

$I_{CC(opr)}$ TEST CIRCUIT

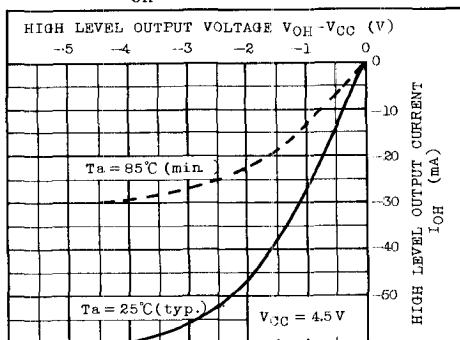


SWITCHING CHARACTERISTICS TEST WAVEFORM

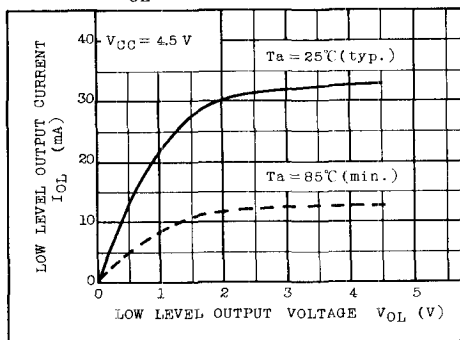


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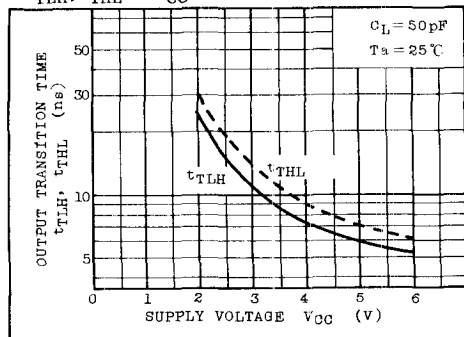
I_{OH} CHARACTERISTICS



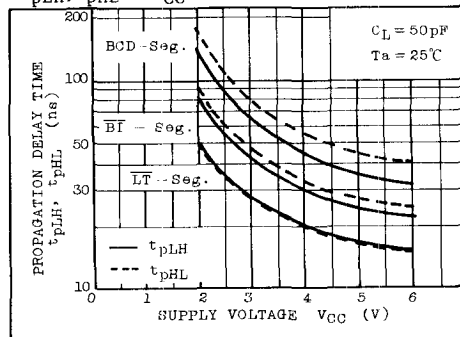
I_{OL} CHARACTERISTICS



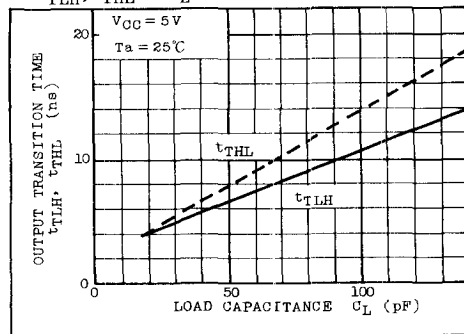
$t_{TLH}, t_{THL} - V_{CC}$ CHARACTERISTICS (TYP.)



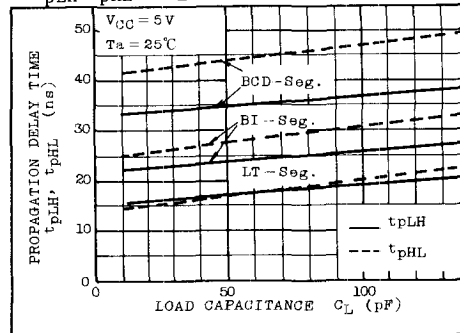
$t_{PLH}, t_{PHL} - V_{CC}$ CHARACTERISTICS (TYP.)



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



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



APPLICATION CIRCUIT

