

HD14511B

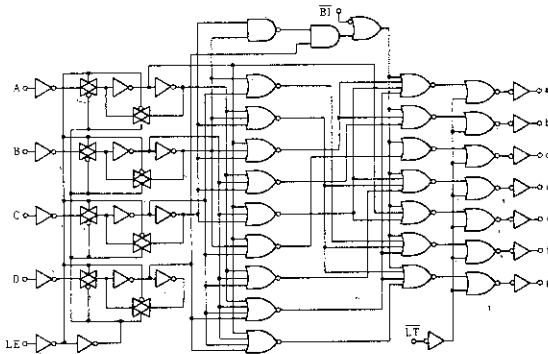
BCD-to-Seven Segment Latch/Decoder/Driver

The HD14511B BCD-to seven segment latch/decoder/driver provides the functions of a 4-bit storage latch, an 8421 BCD-to-seven segment decoder, and an output drive capability. Lamp test (LT), blanking (BI), and latch enable (LE) inputs are used to test the display, to turn-off or pulse modulate the brightness of the display, and to store a BCD code, respectively. It can be used with seven-segment light emitting diodes (LED), incandescent, fluorescent, gas discharge, or liquid crystal readouts either directly or indirectly. Applications include instrument (e.g., counter, DVM, etc.) display driver, computer/calculator display driver, cockpit display driver, and various clock, watch, and timer uses.

FEATURES

- Quiescent Current = 5nA/pkg typ. @5V
- High-current Sourcing Outputs (Up to 25mA)
- Latch Storage of Code
- Blanking Input
- Lamp Test Provision
- Readout Blanking on all Illegal Input Combinations
- Lamp Intensity Modulation Capability
- Time Share (Multiplexing) Facility
- Supply Voltage Range = 3 to 18V
- Capable of Driving One Low-power Schottky TTL Load Over the Rated Temperature Range

LOGIC DIAGRAM

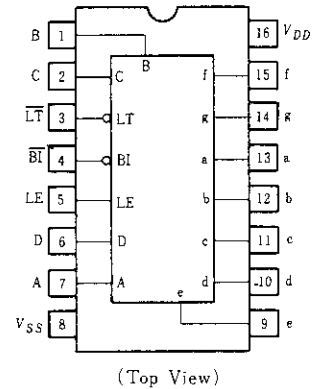


MAXIMUM RATINGS (Voltages referenced to V_{SS})

Characteristic	Symbol	Value	Unit
DC Supply Voltage	V_{DD}	-0.5 ~ +18	V
Input Voltage	V_{in}	-0.5 ~ $V_{DD} + 0.5$	V
Output Voltage	V_{out}	-0.5 ~ $V_{DD} + 0.5$	V
DC Current Drain per Input	I_{in}	10	mA
Operating Temperature Range	T_A	-40 ~ +85	°C
Storage Temperature Range	T_{stg}	-65 ~ +150	°C
Maximum Output Drive Current	$I_{OH\ max}$	25	mA
Maximum Continuous Output Power*	$P_{OH\ max}$	50	mW
Power Dissipation	P_D	300	mW

* $P_{OH\ max} \sim I_{OH} (V_{DD} - V_{OH})$

PIN ARRANGEMENT

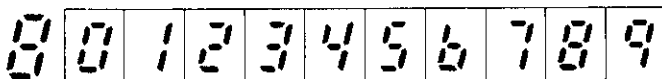


TRUTH TABLE

Inputs				Outputs								
LE	BI	LT	D C B A	a	b	c	d	e	f	g	Display	
x	x	0	x	x	x	1	1	1	1	1	1	8
x	0	1	x	x	x	0	0	0	0	0	0	Blank
0	1	1	0	0	0	1	1	1	1	1	0	0
0	1	1	0	0	1	0	1	1	0	0	0	1
0	1	1	0	1	0	1	1	0	1	0	1	2
0	1	1	0	1	1	1	1	1	0	0	1	3
0	1	1	0	1	0	0	0	1	1	0	1	4
0	1	1	0	1	0	1	1	0	1	1	1	5
0	1	1	0	1	1	0	0	0	1	1	1	6
0	1	1	0	1	1	1	1	1	0	0	0	7
0	1	1	1	0	0	0	1	1	1	1	1	8
0	1	1	1	0	0	1	1	1	0	0	1	9
0	1	1	1	0	1	0	0	0	0	0	0	Blank
0	1	1	1	1	0	1	0	0	0	0	0	Blank
0	1	1	1	1	0	0	0	0	0	0	0	Blank
0	1	1	1	1	0	1	0	0	0	0	0	Blank
0	1	1	1	1	1	0	0	0	0	0	0	Blank
0	1	1	1	1	1	1	0	0	0	0	0	Blank
1	1	1	x	x	x	x	x	x	x	x	x	*

x = Don't Care

* Depends upon the BCD code previously applied when LE=0



ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	$V_{DD}(V)$	Test Conditions	-40°C		25°C			85°C		Unit
				min	max	min	typ	max	min	max	
Output Voltage	V_{OL}	5.0	$V_{in} = V_{DD}$ or 0	-	0.05	-	0	0.05	-	0.05	V
		10		-	0.05	-	0	0.05	-	0.05	
		15		-	0.05	-	0	0.05	-	0.05	
	V_{OH}	5.0	$V_{in} = 0$ or V_{DD}	4.1	-	4.1	5.0	-	4.1	-	V
		10		9.1	-	9.1	10	-	9.1	-	
		15		14.1	-	14.1	15	-	14.1	-	
Input Voltage	V_{IL}	5.0	$V_{out} = 3.8$ or $0.5V$	-	1.5	-	2.25	1.5	-	1.5	V
		10	$V_{out} = 8.8$ or $1.0V$	-	3.0	-	4.50	3.0	-	3.0	
		15	$V_{out} = 13.8$ or $1.5V$	-	4.0	-	6.75	4.0	-	4.0	
	V_{IH}	5.0	$V_{out} = 0.5$ or $3.8V$	3.5	-	3.5	2.75	-	3.5	-	V
		10	$V_{out} = 1.0$ or $8.8V$	7.0	-	7.0	5.50	-	7.0	-	
		15	$V_{out} = 1.5$ or $13.8V$	11.0	-	11.0	8.25	-	11.0	-	
Output Drive Voltage	V_{OH}	5.0	$I_{OH} = 0\text{mA}$	4.10	-	4.10	4.57	-	4.1	-	V
			$I_{OH} = 5\text{mA}$	-	-	-	4.24	-	-	-	
			$I_{OH} = 10\text{mA}$	3.60	-	3.60	4.12	-	3.3	-	
			$I_{OH} = 15\text{mA}$	-	-	-	3.94	-	-	-	
			$I_{OH} = 20\text{mA}$	2.80	-	2.80	3.75	-	2.5	-	
			$I_{OH} = 25\text{mA}$	-	-	-	3.54	-	-	-	
		10	$I_{OH} = 0\text{mA}$	9.10	-	9.10	9.58	-	9.1	-	
			$I_{OH} = 5\text{mA}$	-	-	-	9.26	-	-	-	
			$I_{OH} = 10\text{mA}$	8.75	-	8.75	9.17	-	8.45	-	
			$I_{OH} = 15\text{mA}$	-	-	-	9.04	-	-	-	
			$I_{OH} = 20\text{mA}$	8.10	-	8.10	8.90	-	7.8	-	
			$I_{OH} = 25\text{mA}$	-	-	-	8.75	-	-	-	
		15	$I_{OH} = 0\text{mA}$	14.1	-	14.1	14.59	-	14.1	-	
			$I_{OH} = 5\text{mA}$	-	-	-	14.27	-	-	-	
			$I_{OH} = 10\text{mA}$	13.75	-	13.75	14.18	-	13.45	-	
			$I_{OH} = 15\text{mA}$	-	-	-	14.07	-	-	-	
			$I_{OH} = 20\text{mA}$	13.1	-	13.1	13.95	-	12.8	-	
			$I_{OH} = 25\text{mA}$	-	-	-	13.80	-	-	-	
Output Drive Current	I_{OL}	5.0	$V_{OL} = 0.4V$	0.52	-	0.44	0.88	-	0.36	-	mA
		10	$V_{OL} = 0.5V$	1.3	-	1.1	2.25	-	0.9	-	
		15	$V_{OL} = 1.5V$	3.6	-	3.0	8.8	-	2.4	-	
Input Current	I_{in}	15		-	± 0.3	-	± 0.0001	± 0.3	-	± 1.0	μA
Input Capacitance	C_{in}		$V_{in} = 0$	-	-	-	5.0	7.5	-	-	pF
Quiescent Current	I_{DD}	5.0	Zero Signal, per Package	-	20	-	0.005	20	-	150	μA
		10		-	40	-	0.010	40	-	300	
		15		-	80	-	0.015	80	-	600	
Total Supply Current*	I_T	5.0	Dynamic + I_{DD} , per Gate $C_L = 50\text{pF}$, $f = 1\text{kHz}$	-	-	-	1.9	-	-	-	μA
		10		-	-	-	3.8	-	-	-	
		15		-	-	-	5.7	-	-	-	

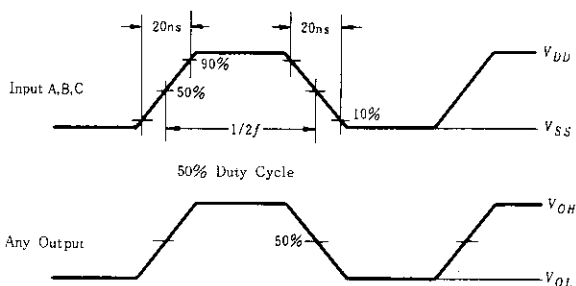
* To calculate total supply current at frequency other than 1kHz.

 $\text{@ } V_{DD} = 5.0V \quad I_T = (1.9\mu\text{A}/\text{kHz})f + I_{DD}$
 $\text{@ } V_{DD} = 10V \quad I_T = (3.8\mu\text{A}/\text{kHz})f + I_{DD}$
 $\text{@ } V_{DD} = 15V \quad I_T = (5.7\mu\text{A}/\text{kHz})f + I_{DD}$

■ SWITCHING CHARACTERISTICS ($C_L=50\text{pF}$, $T_a=25^\circ\text{C}$)

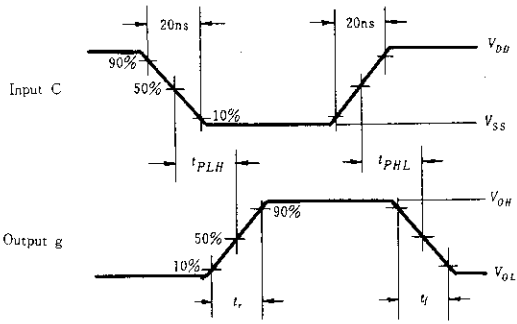
Characteristic	Symbol	V_{DD} (V)	min	typ	max	Unit	
Output Rise Time	t_r	5.0	—	40	80	ns	
		10	—	30	60		
		15	—	25	50		
Output Fall Time	t_f	5.0	—	125	250	ns	
		10	—	75	150		
		15	—	65	130		
Propagation Delay Time	Data	t_{PLH}	5.0	—	640	1280	ns
			10	—	250	500	
			15	—	175	350	
		t_{PHL}	5.0	—	720	1440	ns
			10	—	290	580	
			15	—	200	400	
	Blank	t_{PLH}	5.0	—	380	750	ns
			10	—	130	260	
			15	—	100	200	
		t_{PHL}	5.0	—	485	970	ns
			10	—	200	400	
			15	—	160	320	
Lamp Test	t_{PLH}	5.0	—	313	625	ns	
		10	—	125	250		
		15	—	90	180		
	t_{PHL}	5.0	—	313	625	ns	
		10	—	125	250		
		15	—	90	180		
Setup Time	t_{setup}	5.0	180	90	—	ns	
		10	76	38	—		
		15	40	20	—		
Hold Time	t_{hold}	5.0	0	-90	—	ns	
		10	0	-38	—		
		15	0	-20	—		
Latch Enable Pulse Width	PW_{LE}	5.0	520	260	—	ns	
		10	220	110	—		
		15	130	65	—		

■ POWER DISSIPATION SIGNAL WAVEFORMS

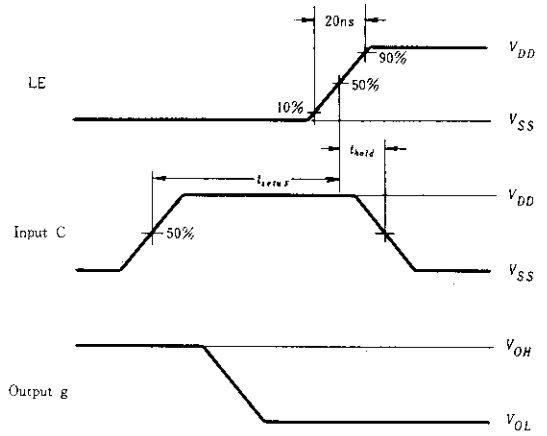


Input LE low, and Inputs \overline{D} , \overline{BI} and \overline{LT} high, f in respect to a system clock. All outputs connected to respective C_L loads.

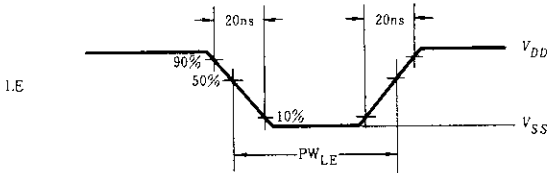
■ DYNAMIC SIGNAL WAVEFORMS

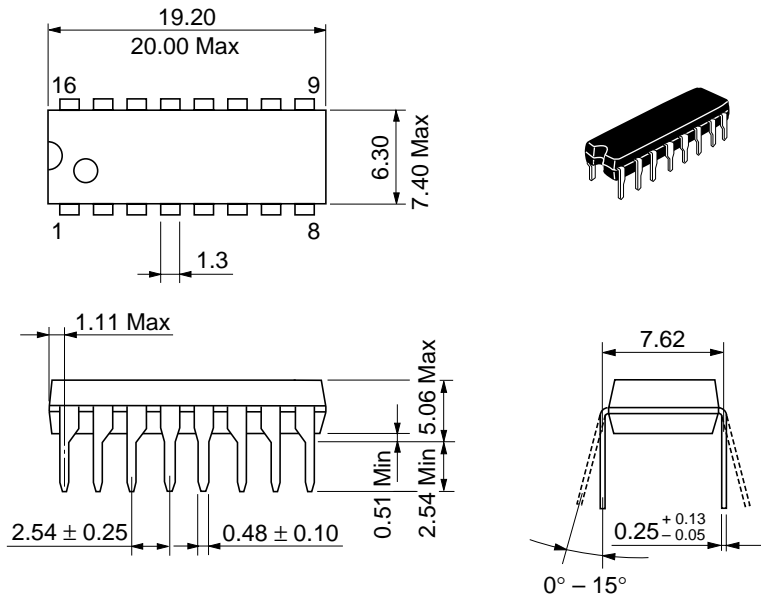


Inputs D and LE low, and Inputs A, B, \overline{BI} and \overline{LT} high.



Input D low, Inputs A, B, \overline{BI} and \overline{LT} high.





Hitachi Code	DP-16
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	1.07 g

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