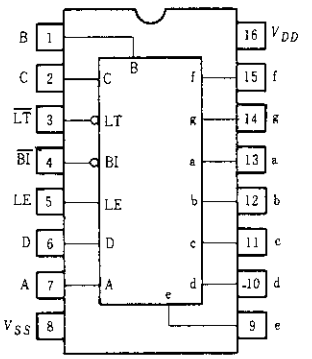
HD14511B

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 ($\overline{LT}$), blanking ($\overline{BI}$), 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.

■ PIN ARRANGEMENT

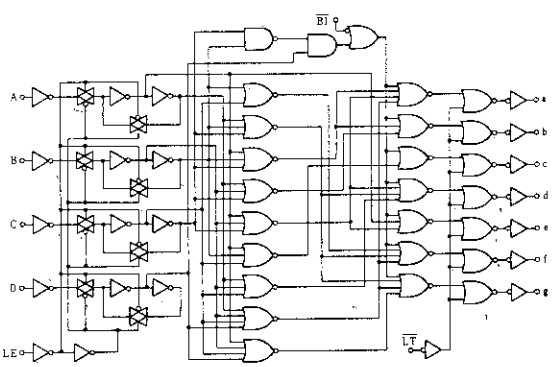


(Top View)

■ 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

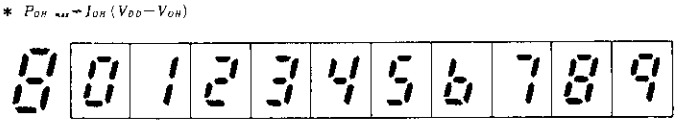
■ LOGIC DIAGRAM



■ MAXIMUM RATINGS (Voltages referenced to V_{SS})

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

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



■ TRUTH TABLE

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

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 min	−40°C max	25°C min	25°C typ	25°C max	85°C min	85°C max	Unit
Output Voltage	V_{OL}	5.0	$Vin = V_{DD}$ 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	Vin = 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 0.5 V	−	1.5	−	2.25	1.5	−	1.5	V
		10	V_{out} = 8.8 or 1.0 V	−	3.0	−	4.50	3.0	−	3.0	
		15	V_{out} = 13.8 or 1.5 V	−	4.0	−	6.75	4.0	−	4.0	
	V_{IH}	5.0	V_{out} = 0.5 or 3.8 V	3.5	−	3.5	2.75	−	3.5	−	V
		10	V_{out} = 1.0 or 8.8 V	7.0	−	7.0	5.50	−	7.0	−	
		15	V_{out} = 1.5 or 13.8 V	11.0	−	11.0	8.25	−	11.0	−	
Output Drive Voltge	V_{OH}	5.0	I_{OH} = 0 mA	4.10	−	4.10	4.57	−	4.1	−	V
			I_{OH} = 5 mA	−	−	−	4.24	−	−	−	
			I_{OH} = 10 mA	3.60	−	3.60	4.12	−	3.3	−	
			I_{OH} = 15 mA	−	−	−	3.94	−	−	−	
			I_{OH} = 20 mA	2.80	−	2.80	3.75	−	2.5	−	
			I_{OH} = 25 mA	−	−	−	3.54	−	−	−	
		10	I_{OH} = 0 mA	9.10	−	9.10	9.58	−	9.1	−	
			I_{OH} = 5 mA	−	−	−	9.26	−	−	−	
			I_{OH} = 10 mA	8.75	−	8.75	9.17	−	8.45	−	
			I_{OH} = 15 mA	−	−	−	9.04	−	−	−	
			I_{OH} = 20 mA	8.10	−	8.10	8.90	−	7.8	−	
			I_{OH} = 25 mA	−	−	−	8.75	−	−	−	
		15	I_{OH} = 0 mA	14.1	−	14.1	14.59	−	14.1	−	
			I_{OH} = 5 mA	−	−	−	14.27	−	−	−	
			I_{OH} = 10 mA	13.75	−	13.75	14.18	−	13.45	−	
			I_{OH} = 15 mA	−	−	−	14.07	−	−	−	
			I_{OH} = 20 mA	13.1	−	13.1	13.95	−	12.8	−	
			I_{OH} = 25 mA	−	−	−	13.80	−	−	−	
Output Drive Current	I_{OL}	5.0	V_{OL} = 0.4 V	0.52	−	0.44	0.88	−	0.36	−	mA
		10	V_{OL} = 0.5 V	1.3	−	1.1	2.25	−	0.9	−	
		15	V_{OL} = 1.5 V	3.6	−	3.0	8.8	−	2.4	−	
Input Current	Iin	15		−	±0.3	−	±0.00001	±0.3	−	±1.0	μA
Input Capacitance	Cin		Vin = 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 pF, f = 1 kHz	−	−	−	1.9	−	−	−	μA
		10		−	−	−	3.8	−	−	−	
		15		−	−	−	5.7	−	−	−	

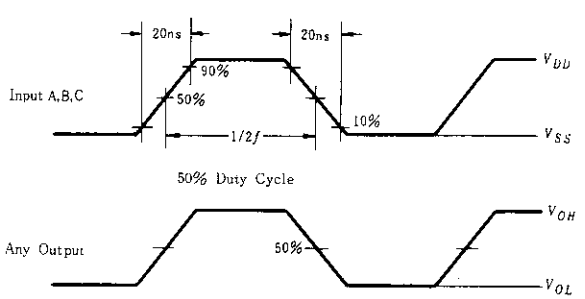
* To calculate total supply current at frequency other than 1kHz.

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

■ SWITCHING CHARACTERISTICS (C_L=50pF, Ta=25°C)

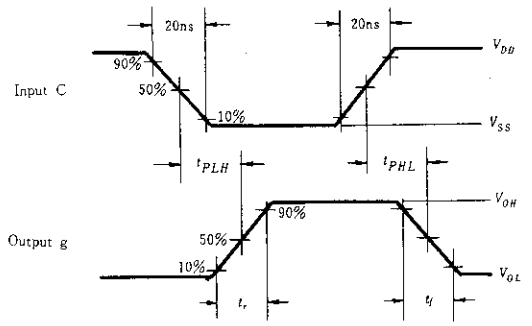
Characteristic		Symbol	V_{DD}(V)	min	typ	max	Unit
Output Rise Time		t_r	5.0	—	40	80	ns
			10	—	30	60	
			15	—	25	50	
Output Fall Time		t_f	5.0	—	125	250	ns
			10	—	75	150	
			15	—	65	130	
Propagation Delay Time	Data	t_{PLH}	5.0	—	640	1280	ns
			10	—	250	500	
			15	—	175	350	
		t_{PHL}	5.0	—	720	1440	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

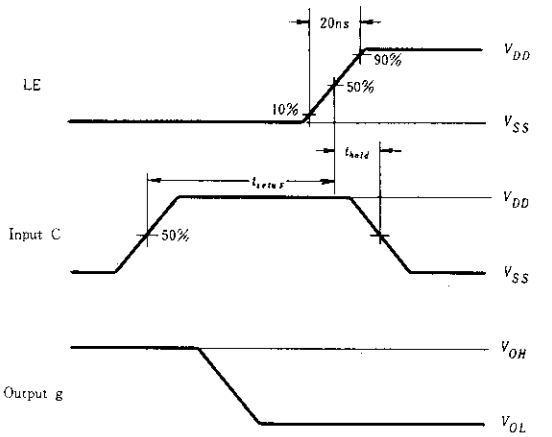


Input LE low, and Inputs D, $\overline{BI}$ and $\overline{LT}$ high. f in respect to a system clock All outputs connected to respective C_L loads.

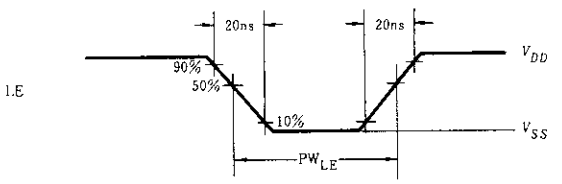
■ DYNAMIC SIGNAL WAVEFORMS



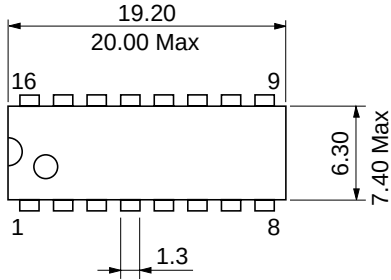
Inputs D and LE low, and Inputs A, B, $\overline{BI}$ and $\overline{LT}$ high.

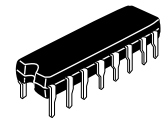


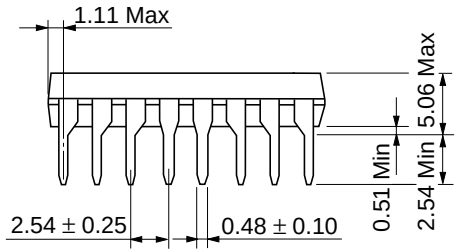
Input D low, Inputs, A, B, $\overline{BI}$ and $\overline{LT}$ high.

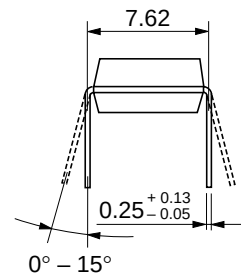


Unit: mm









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

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