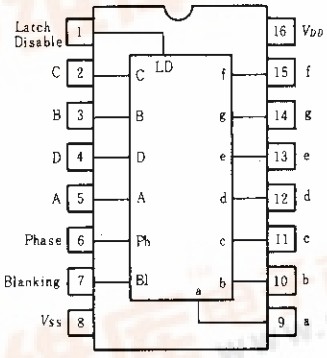
HD14543B

BCD-to-Seven Segment Latch/Decoder/Driver

The HD14543B BCD-to-seven segment latch/decoder/driver is designed for use with liquid crystal readouts. The circuit provides the functions of a 4-bit storage latch and an 8421 BCD-to-seven segment decoder and driver. The device has the capability to invert the logic levels of the output combination. The phase (Ph), blanking (BI), and latch disable (LD) inputs are used to reverse the truth table phase, blank the display, and store a BCD code, respectively. For liquid crystal (LC) readouts, a square wave is applied to the Ph input of the circuit and the electrically common backplane of the display, the outputs of the circuit are connected directly to the segments of the LC readout. For other types of readouts, such as light-emitting diode (LED), incandescent, gas discharge, and fluorescent readouts, connection diagrams are given on this data sheet. 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

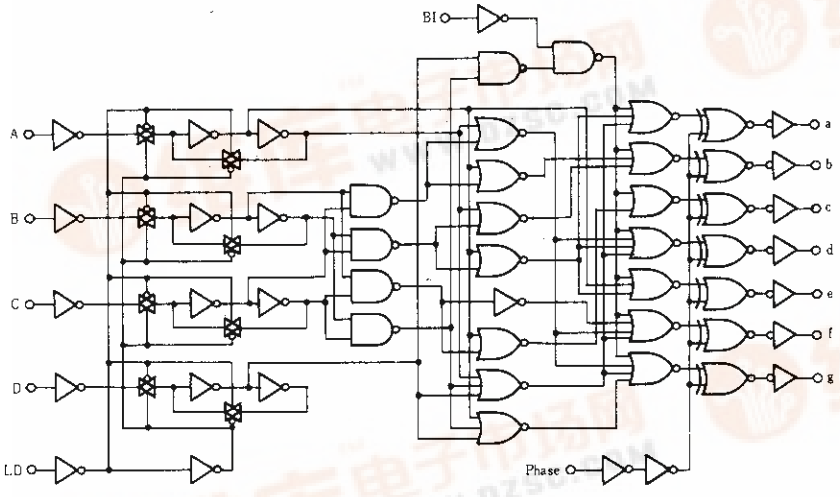


(Top View)

■ FEATURES

- Logic Circuit Quiescent Current = 5nA/pkg typ. @5V
- Latch Storage of Code
- Blanking Input
- Readout Blanking on All Illegal Input Combinations
- Direct LED (Common Anode or Cathode) Driving Capability
- Supply Voltage Range = 3 to 18V
- Capable of Driving One Low-power Schottky TTL Load Over the Rated Temperature Range

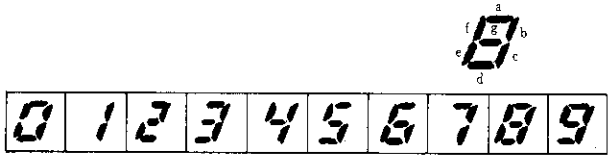
■ LOGIC DIAGRAM



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

Characteristic	Symbol	Value	Unit
DC Supply Voltage	V_{DD}	−0.5～+18	V
Input/Output Voltage	V_{in}, V_{out}	−0.5～V_{DD}+0.5	V
DC Current Drain per Input Pin	I_{in}	±10	mA
Maximum Output Drive Current	I_{OH} max I_{OL} max	±10	mA
Maximum Continuous Output Power*	P_{OH} max P_{OL} max	70	mW
Power Dissipation	P_D	300	mW
Operating Temperature Range	T_A	−40～+85	℃
Storage Temperature Range	T_{stg}	−65～+150	℃

* P_{OH} max = $I_{OH}(V_{OH}-V_{DD})$, P_{OL} max = $I_{OL}(V_{OL}-V_{SS})$



■ TRUTH TABLE

Inputs							Outputs							
LD	BI	Ph*	D	C	B	A	a	b	c	d	e	f	g	Disply
×	1	0	×	×	×	×	0	0	0	0	0	0	0	Blank
1	0	0	0	0	0	0	1	1	1	1	1	1	0	0
1	0	0	0	0	0	1	0	1	1	0	0	0	0	1
1	0	0	0	0	1	0	1	1	0	1	1	0	1	2
1	0	0	0	0	1	1	1	1	1	1	0	0	1	3
1	0	0	0	1	0	0	0	1	1	0	0	1	1	4
1	0	0	0	1	0	1	1	0	1	1	0	1	1	5
1	0	0	0	1	1	0	1	0	1	1	1	1	1	6
1	0	0	0	1	1	1	1	1	1	0	0	0	0	7
1	0	0	1	0	0	0	1	1	1	1	1	1	1	8
1	0	0	1	0	0	1	1	1	1	1	0	1	1	9
1	0	0	1	0	1	0	0	0	0	0	0	0	0	Blank
1	0	0	1	0	1	1	0	0	0	0	0	0	0	Blank
1	0	0	1	1	0	0	0	0	0	0	0	0	0	Blank
1	0	0	1	1	0	1	0	0	0	0	0	0	0	Blank
1	0	0	1	1	1	0	0	0	0	0	0	0	0	Blank
1	0	0	1	1	1	1	0	0	0	0	0	0	0	Blank
0	0	0	×	×	×	×	**							*

× : Don't Care

* : For liquid crystal readouts, apply a square wave to Ph. For common cathode LED readouts, select Ph = 0. For common anode LED readouts, select Ph = 1

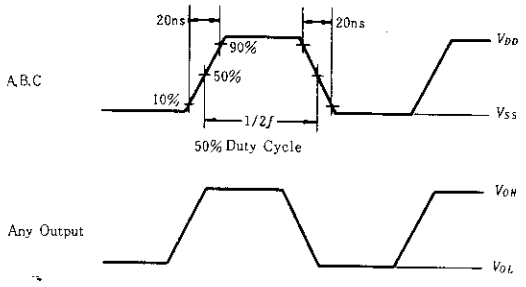
** : Depends upon the BCD coder previously applied when LD = 1

■ ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	V_{DD}(V)	Test Conditions	−40℃		25℃			85℃		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}	4.95	—	4.95	5.0	—	4.95	—	V
		10		9.95	—	9.95	10	—	9.95	—	
		15		14.95	—	14.95	15	—	14.95	—	
Input Voltage	V_{IL}	5.0	V_{out} = 4.5 or 0.5V	—	1.5	—	2.25	1.5	—	1.5	V
		10	V_{out} = 9.0 or 1.0V	—	3.0	—	4.50	3.0	—	3.0	
		15	V_{out} = 13.5 or 1.5V	—	4.0	—	6.75	4.0	—	4.0	
	V_{IH}	5.0	V_{out} = 0.5 or 4.5V	3.5	—	3.5	2.75	—	3.5	—	V
		10	V_{out} = 1.0 or 9.0V	7.0	—	7.0	5.50	—	7.0	—	
		15	V_{out} = 1.5 or 13.5V	11.0	—	11.0	8.25	—	11.0	—	
Output Drive Current	I_{OH}	5.0	V_{OH} = 2.5V	−1.0	—	−0.8	−1.7	—	−0.6	—	mA
		5.0	V_{OH} = 4.6V	−0.2	—	−0.16	−0.36	—	−0.12	—	
		10	V_{OH} = 0.5V	—	—	—	−8.7	—	—	—	
		10	V_{OH} = 9.5V	−0.5	—	−0.4	−0.9	—	−0.3	—	
		15	V_{OH} = 13.5V	−1.4	—	−1.2	−3.5	—	−1.0	—	
	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	—	
		10	V_{OL} = 9.5V	—	—	—	10.1	—	—	—	
		15	V_{OL} = 1.5V	3.6	—	3.0	8.8	—	2.4	—	
Input Current	I_{in}	15		—	±0.3	—	±0.00001	±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 = 50pF, f = 1kHz	—	—	—	1.6	—	—	—	μA
		10		—	—	—	3.1	—	—	—	
		15		—	—	—	4.7	—	—	—	

* To calculate total supply current at frequency other than 1kHz.
@V_{DD} = 5.0V I_T = (1.6 μA/kHz)f + I_{DD}, @V_{DD} = 10V I_T = (3.1 μA/kHz)f + I_{DD}, @V_{DD} = 15V I_T = (4.7 μA/kHz)f + I_{DD}

●Dynamic Power Dissipation Signal Waveforms



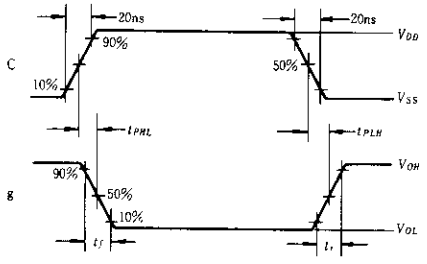
Note) 1. Input BI and Ph low, and Inputs D and LD high.
2. f in respect to a system clock.
3. All outputs connected to respective C_L loads.

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

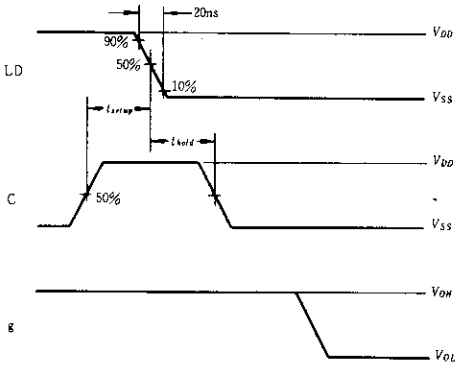
Characteristic	Symbol	V_{DD}(V)	min	typ	max	Unit
Output Rise Time	t_r	5.0	—	180	400	ns
		10	—	90	200	
		15	—	65	160	
Output Fall Time	t_f	5.0	—	120	250	ns
		10	—	60	125	
		15	—	40	100	
Propagation Delay Time	t_{PLH}	5.0	—	605	1650	ns
		10	—	250	660	
		15	—	185	495	
	t_{PHL}	5.0	—	505	1650	ns
		10	—	205	660	
		15	—	155	495	
Setup Time	t_{setup}	5.0	80	−40	—	ns
		10	30	−15	—	
		15	20	−10	—	
Hold Time	t_{hold}	5.0	120	40	—	ns
		10	45	15	—	
		15	30	10	—	
Latch Disable Pulse Width (Strobing Data)	PW_{LD}	5.0	375	125	—	ns
		10	150	50	—	
		15	120	40	—	

●DYNAMIC SIGNAL WAVEFORMS

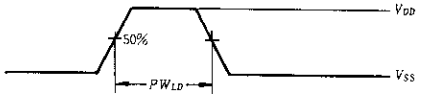
a) Inputs D, Ph, and BI low, and Inputs A, B, and LD high



b) Inputs D, Ph, and BI low, and Inputs A and B high.

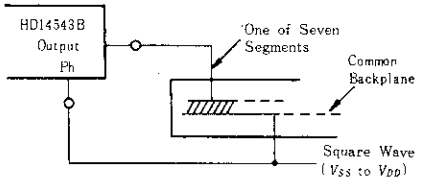


c) Data DCBA strobed into latches

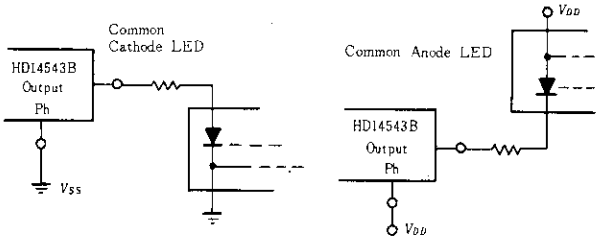


■ CONNECTIONS TO VARIOUS DISPLAY READOUTS

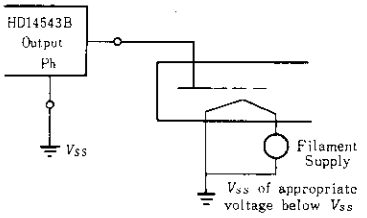
● LCD



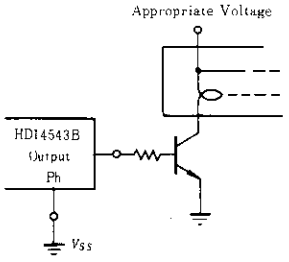
● LED



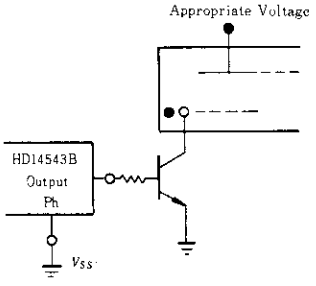
● Fluorescent Readout



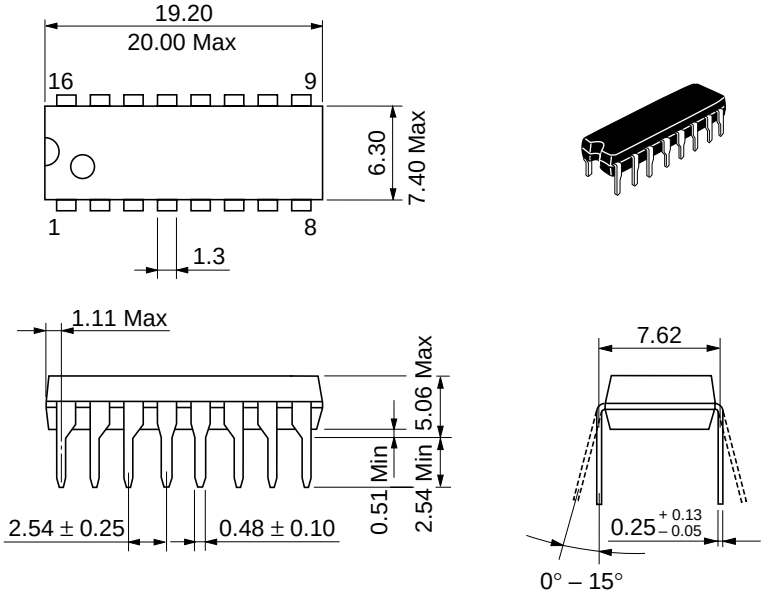
● Incandescent Readout



● Gas Discharge Readout



Unit: mm


19.20
20.00 Max
16
9
6.30
7.40 Max
1
8
1.3
1.11 Max
5.06 Max
0.51 Min
2.54 Min
2.54 ± 0.25
0.48 ± 0.10
7.62
0.25 + 0.13 − 0.05
0° – 15°

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