

# MN4543B/MN4543BS

## BCD-to-Seven Segment Decoder/Driver

### ■ Outline

The MN4543B/S is a liquid crystal BCD 7-segment decoder/driver having a blanking input, a phase input, and a latch disable input.

The combination of the output logic levels is invertible. Besides the BCD inputs, this decoder/driver has PH (phase input), BI (blanking input), and (latch disable input). The PH reverses the respective phase shown in the Truth Table and the BI covers the blanking display, while the LD stores the BCD codes.

For the liquid crystal display (LCD), impress common square wavepulses to the back plane of the display element and the phase input of the MN4543B/S, and directly connect the output pins with the LCD segments.

For the method of connection with an LED, an incandescent lamp, a gas discharge tube, a fluorescent lamp, or any other display element than the LCD, refer to the corresponding display diagrams in this catalog.

The MN4543B/S is usable as the display element of a counter, a DVM, a computer, a calculator, etc. and also applicable to a display driver, a clock, a timer, etc.

This 7-segment decoder/driver is equivalent to Motorola's MC14543B.

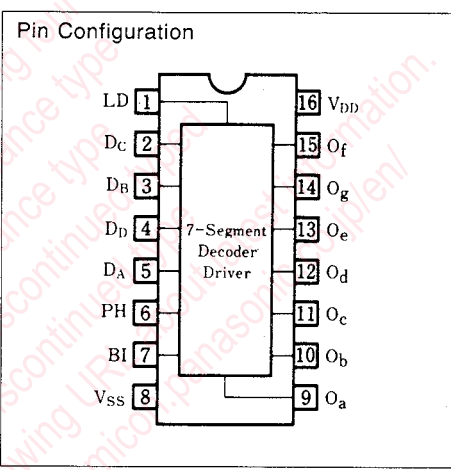
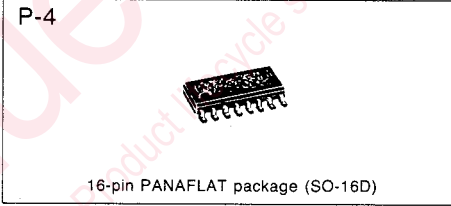
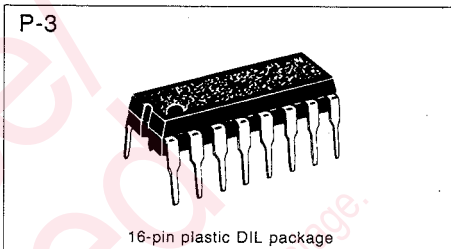
### ■ Truth Table

Input					Output							Display		
LD	BI	PH	D <sub>B</sub>	D <sub>C</sub>	D <sub>B</sub>	D <sub>A</sub>	O <sub>a</sub>	O <sub>b</sub>	O <sub>c</sub>	O <sub>d</sub>	O <sub>e</sub>		O <sub>f</sub>	O <sub>g</sub>
×	H	L	×	×	×	×	L	L	L	L	L	L	L	blank
H	L	L	L	L	L	L	H	H	H	L	L	L	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	L	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	L	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	L	H	L	L	L	L	L	L	L	L	blank
H	L	L	H	L	H	H	L	L	L	L	L	L	L	blank
H	L	L	H	H	L	L	L	L	L	L	L	L	L	blank
H	L	L	H	H	H	L	L	L	L	L	L	L	L	blank
H	L	L	H	H	H	H	L	L	L	L	L	L	L	blank
L	L	L	×	×	×	×	**	**	**	**	**	**	**	**
As above	H		As above				Inverse of above							As above

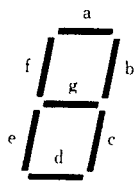
Note) × : don't care

\* In case of LCD, input square wave to PH. In case of cathode common LED, PH=L. In case of anode common LED, PH=H.

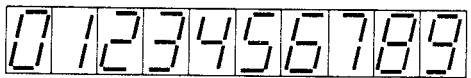
\*\* When LD=H, according to BCD code input beforehand.



### ■ Segment Assignment



### ■ Display



### ■ Absolute Maximum Ratings (Ta=25°C)

Item	Symbol	Rating	Unit
Supply voltage	V <sub>DD</sub>	-0.5~+18	V
Input voltage	V <sub>I</sub>	-0.5~V <sub>DD</sub> +0.5*	V
Output pin voltage	V <sub>O</sub>	-0.5~V <sub>DD</sub> +0.5*	V
Peak input · output pin current	±I <sub>I</sub>	max. 10	mA
Power dissipation (per package)	Ta=-40~+60°C	P <sub>D</sub>	mW
	Ta=+60~+80°C		
Power dissipation (per output pin)	P <sub>D</sub>	max. 100	mW
Operating ambient temperature	T <sub>opr</sub>	-40~+85	°C
Storage temperature	T <sub>stg</sub>	-65~+150	°C

\* V<sub>DD</sub>+0.5V should be lower than 18V.

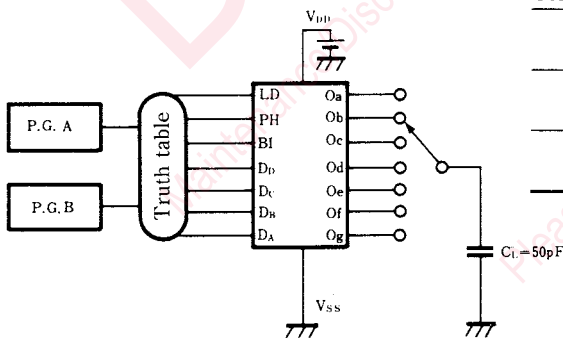
### ■ DC Characteristics (V<sub>SS</sub>=0V)

Item	V <sub>DD</sub> (V)	Symbol	Condition	Ta=-40°C		Ta=25°C		Ta=85°C		Unit
				min.	max.	min.	max.	min.	max.	
Static supply current	5	I <sub>DD</sub>	V <sub>I</sub> =V <sub>SS</sub> or V <sub>DD</sub>	—	20	—	20	—	150	μA
	10			—	40	—	40	—	300	
	15			—	80	—	80	—	600	
Output voltage low level	5	V <sub>OL</sub>	V <sub>I</sub> =V <sub>SS</sub> or V <sub>DD</sub>  I <sub>O</sub>  <1μA	—	0.05	—	0.05	—	0.05	V
	10			—	0.05	—	0.05	—	0.05	
	15			—	0.05	—	0.05	—	0.05	
Output voltage high level	5	V <sub>OH</sub>	V <sub>I</sub> =V <sub>SS</sub> or V <sub>DD</sub>  I <sub>O</sub>  <1μA	4.95	—	4.95	—	4.95	—	V
	10			9.95	—	9.95	—	9.95	—	
	15			14.95	—	14.95	—	14.95	—	
Input voltage low level	5	V <sub>IL</sub>	I <sub>O</sub>  <1μA V <sub>O</sub> =0.5V or 4.5V	—	1.5	—	1.5	—	1.5	V
	10			—	3	—	3	—	3	
	15			—	4	—	4	—	4	
Input voltage high level	5	V <sub>IH</sub>	I <sub>O</sub>  <1μA V <sub>O</sub> =0.5V or 4.5V	3.5	—	3.5	—	3.5	—	V
	10			7	—	7	—	7	—	
	15			11	—	11	—	11	—	
Output current low level	5	I <sub>OL</sub>	V <sub>O</sub> =0.4V, V <sub>I</sub> =0 or 5V V <sub>O</sub> =0.5V, V <sub>I</sub> =0 or 10V V <sub>O</sub> =1.5V, V <sub>I</sub> =0 or 15V	0.52	—	0.44	—	0.36	—	mA
	10			1.3	—	1.1	—	0.9	—	
	15			3.6	—	3	—	2.4	—	
Output current high level	5	-I <sub>OH</sub>	V <sub>O</sub> =4.6V, V <sub>I</sub> =0 or 5V V <sub>O</sub> =9.5V, V <sub>I</sub> =0 or 10V V <sub>O</sub> =13.5V, V <sub>I</sub> =0 or 15V	0.52	—	0.44	—	0.36	—	mA
	10			1.3	—	1.1	—	0.9	—	
	15			3.6	—	3	—	2.4	—	
Output current high level	5	-I <sub>OH</sub>	V <sub>O</sub> =2.5V, V <sub>I</sub> =0 or 5V	1.7	—	1.4	—	1.1	—	mA
Input leakage current	15	±I <sub>I</sub>	V <sub>I</sub> =0 or 15V	—	0.3	—	0.3	—	1	μA

■ Switching Characteristics (Ta=25°C, VSS=0V, CL=50pF)

Item	VDD(V)	Symbol	min.	typ.	max.	Unit
Output rise time	5	t <sub>TLH</sub>	—	60	180	ns
	10		—	30	90	
	15		—	20	60	
Output fall time	5	t <sub>THL</sub>	—	60	180	ns
	10		—	30	90	
	15		—	20	60	
Propagation time Dn→On (H→L)	5	t <sub>PHL</sub>	—	180	540	ns
	10		—	75	225	
	15		—	55	165	
Propagation time Dn→On (L→H)	5	t <sub>PLH</sub>	—	180	540	ns
	10		—	75	225	
	15		—	55	165	
Propagation time BI→On (H→L)	5	t <sub>PHL</sub>	—	145	435	ns
	10		—	65	195	
	15		—	45	135	
Propagation time BI→On (L→H)	5	t <sub>PLH</sub>	—	125	375	ns
	10		—	55	165	
	15		—	40	120	
Set-up time Dn→LD	5	t <sub>su</sub>	—	20	60	ns
	10		—	5	20	
	15		—	0	15	
Hold time Dn→LD	5	t <sub>hold</sub>	—	-15	0	ns
	10		—	0	15	
	15		—	5	20	
Minimum LD pulse width	5	t <sub>WLDH</sub>	—	30	90	ns
	10		—	15	45	
	15		—	10	30	
Input capacitance		C <sub>I</sub>	—	—	7.5	pF

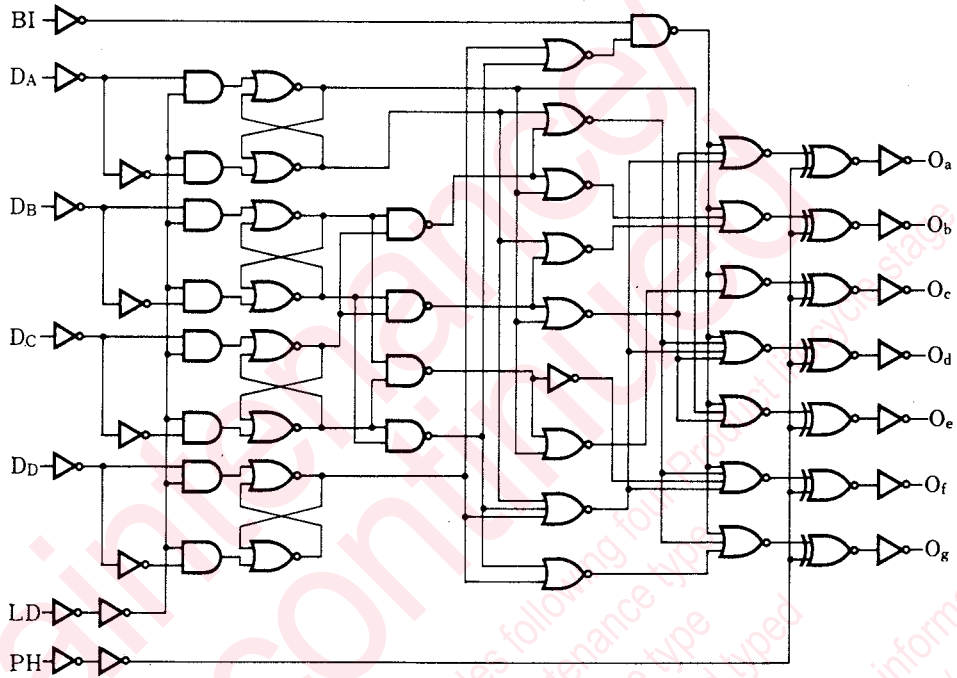
● Switching time measuring circuit



Condition table (example)

Test No.	Item	P.G. A	P.G. B	"H"	"L"
1	D <sub>A-D</sub> →On	D <sub>C</sub>	—	D <sub>A</sub> , D <sub>B</sub> , LD	D <sub>D</sub> , BI, PH
2	t <sub>WLDH</sub> t <sub>su</sub> , t <sub>hold</sub>	D <sub>C</sub>	LD	D <sub>A</sub> , D <sub>B</sub>	D <sub>D</sub> , BI, PH
3	BI→On	BI	—	D <sub>A</sub> , D <sub>B</sub> , LD	D <sub>C</sub> , D <sub>D</sub> , PH

■ Logic Diagram



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