DATA SHEET

For a complete data sheet, please also download:

- The IC04 LOCMOS HE4000B Logic Family Specifications HEF, HEC
- The IC04 LOCMOS HE4000B Logic Package Outlines/Information HEF, HEC

HEF4543B
MSI
BCD to 7-segment latch/decoder/driver

Product specification
File under Integrated Circuits, IC04

January 1995

Philips Semiconductors

PHILIPS

BCD to 7-segment latch/decoder/driver

HEF4543B
MSI

DESCRIPTION

The HEF4543B is a BCD to 7-segment latch/decoder/driver for liquid crystal and LED displays. It has four address inputs (D_A to D_D), an active HIGH latch disable input (LD), an active HIGH blanking input (BI), an active HIGH phase input (PH) and seven buffered segment outputs (O_a to O_g).

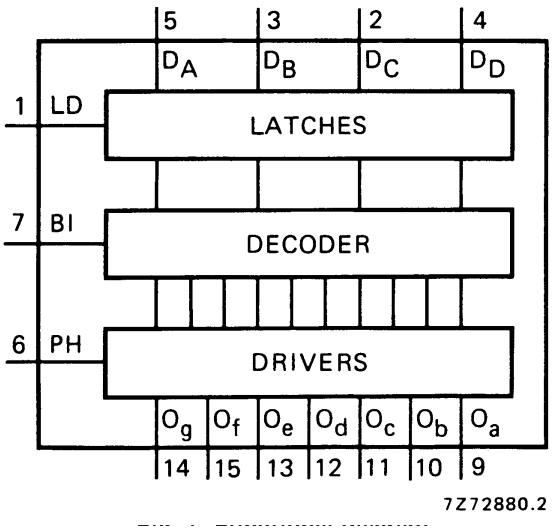

Fig.1 Functional diagram.

PINNING

D_A to D_D	address (data) inputs
PH	phase input (active HIGH)
BI	blanking input (active HIGH)
LD	latch disable input (active HIGH)
O_a to O_g	segment outputs

The circuit provides the function of a 4-bit storage latch and an 8-4-2-1 BCD to 7-segment decoder/driver. It can invert the logic levels of the output combination. The phase (PH), blanking (BI) and latch disable (LD) inputs are used to reverse the function table phase, blank the display and store a BCD code, respectively.

For liquid crystal displays a square-wave is applied to PH and the electrical common back-plane of the display. The outputs of the device are directly connected to the segments of the liquid crystal.

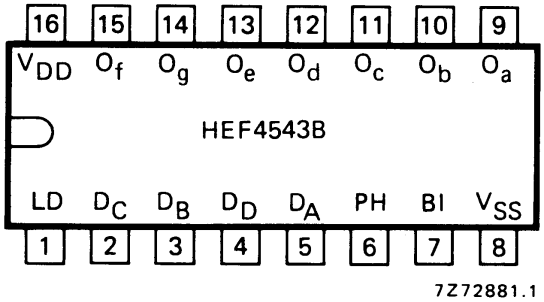

Fig.2 Pinning diagram.

HEF4543BP(N): 16-lead DIL; plastic (SOT38-1)
HEF4543BD(F): 16-lead DIL; ceramic (cerdip) (SOT74)
HEF4543BT(D): 16-lead SO; plastic (SOT109-1)
( ): Package Designator North America

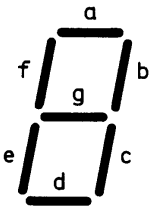

Fig.3 Segment designation.

FAMILY DATA, I_{DD} LIMITS category MSI

See Family Specifications

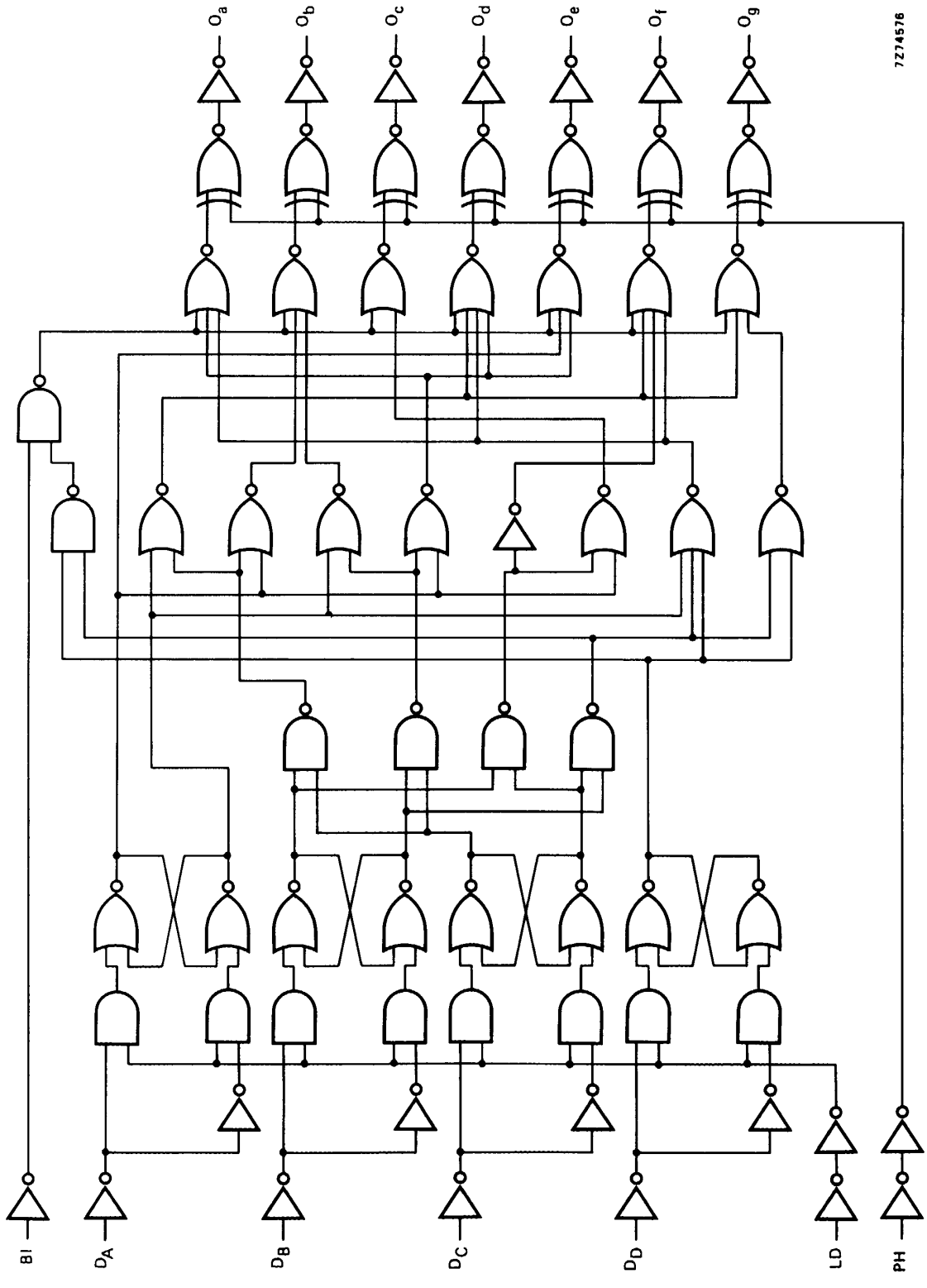

Fig.4 Logic diagram.

FUNCTION TABLE

INPUTS							OUTPUTS							
LD	**BI**	**PH** (4)	D_D	D_C	D_B	D_A	O_a	O_b	O_c	O_d	O_e	O_f	O_g	**DISPLAY**
X	H	L	X	X	X	X	L	L	L	L	L	L	L	blank
H	L	L	L	L	L	L	H	H	H	H	H	H	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	H	L	H	2
H	L	L	L	L	H	H	H	H	H	H	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	H	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	H	L	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	L	H	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	X	X	X	X	(5)							(5)
as above		H	as above				inverse of above							as above

Notes

1. H = HIGH state (the more positive voltage)
2. L = LOW state (the less positive voltage)
3. X = state is immaterial
4. For liquid crystal displays, apply a square-wave to PH.
   For common cathode LED displays, select PH = LOW.
   For common anode LED displays, select PH = HIGH.
5. Depends upon the BCD-code previously applied when LD = HIGH.

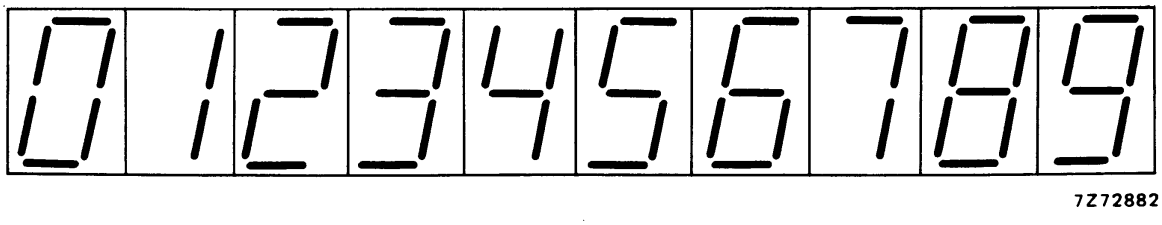

Fig.5 Display.

AC CHARACTERISTICS

V_{SS} = 0 V; T_{amb} = 25 °C; C_L = 50 pF; input transition times ≤ 20 ns

	V_{DD} V	SYMBOL	MIN.	TYP.	MAX.		TYPICAL EXTRAPOLATION FORMULA
Propagation delays							
$D_n \rightarrow O_n$	5			180	360	ns	153 ns + (0,55 ns/pF) C_L
HIGH to LOW	10	t_{PHL}		75	150	ns	64 ns + (0,23 ns/pF) C_L
	15			55	110	ns	47 ns + (0,16 ns/pF) C_L
	5			180	360	ns	153 ns + (0,55 ns/pF) C_L
LOW to HIGH	10	t_{PLH}		75	150	ns	64 ns + (0,23 ns/pF) C_L
	15			55	110	ns	47 ns + (0,16 ns/pF) C_L
$LD \rightarrow O_n$	5			170	340	ns	143 ns + (0,55 ns/pF) C_L
HIGH to LOW	10	t_{PHL}		80	160	ns	69 ns + (0,23 ns/pF) C_L
	15			60	120	ns	52 ns + (0,16 ns/pF) C_L
	5			190	380	ns	163 ns + (0,55 ns/pF) C_L
LOW to HIGH	10	t_{PLH}		80	160	ns	69 ns + (0,23 ns/pF) C_L
	15			60	120	ns	52 ns + (0,16 ns/pF) C_L
$BI \rightarrow O_n$	5			145	290	ns	118 ns + (0,55 ns/pF) C_L
HIGH to LOW	10	t_{PHL}		65	130	ns	54 ns + (0,23 ns/pF) C_L
	15			45	90	ns	37 ns + (0,16 ns/pF) C_L
	5			125	250	ns	98 ns + (0,55 ns/pF) C_L
LOW to HIGH	10	t_{PLH}		55	110	ns	54 ns + (0,23 ns/pF) C_L
	15			40	80	ns	32 ns + (0,16 ns/pF) C_L
Output transition times	5			60	120	ns	10 ns + (1,0 ns/pF) C_L
HIGH to LOW	10	t_{THL}		30	60	ns	9 ns + (0,42 ns/pF) C_L
	15			20	40	ns	6 ns + (0,28 ns/pF) C_L
	5			60	120	ns	10 ns + (1,0 ns/pF) C_L
LOW to HIGH	10	t_{TLH}		30	60	ns	9 ns + (0,42 ns/pF) C_L
	15			20	40	ns	6 ns + (0,28 ns/pF) C_L
Minimum LD	5		60	30		ns	
pulse width; HIGH	10	t_{WLDH}	30	15		ns	
	15		20	10		ns	
Set-up time	5		40	20		ns	
$D_n \rightarrow LD$	10	t_{su}	20	5		ns	
	15		15	0		ns	
Hold time	5		0	−15		ns	
$D_n \rightarrow LD$	10	t_{hold}	15	0		ns	
	15		20	5		ns	

	V_{DD} V	TYPICAL FORMULA FOR P (μW)	
Dynamic power dissipation per package (P)	5	$2\,200\ f_i + \sum (f_o C_L) \times V_{DD}^2$	where f_i = input freq. (MHz) f_o = output freq. (MHz) C_L = load capacitance (pF) $\sum (f_o C_L)$ = sum of outputs V_{DD} = supply voltage (V)
	10	$10\,400\ f_i + \sum (f_o C_L) \times V_{DD}^2$	
	15	$33\,000\ f_i + \sum (f_o C_L) \times V_{DD}^2$	

APPLICATION INFORMATION

Some examples of applications for the HEF4543B are:

- Driving LCD displays.
- Driving LED displays.
- Driving fluorescent displays.
- Driving incandescent displays.
- Driving gas discharge displays.

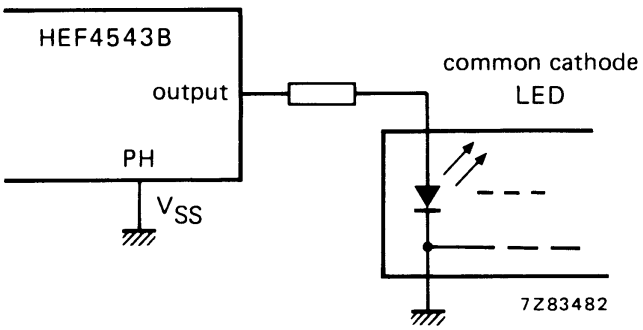

Fig.6 Connection to common cathode LED display readout.

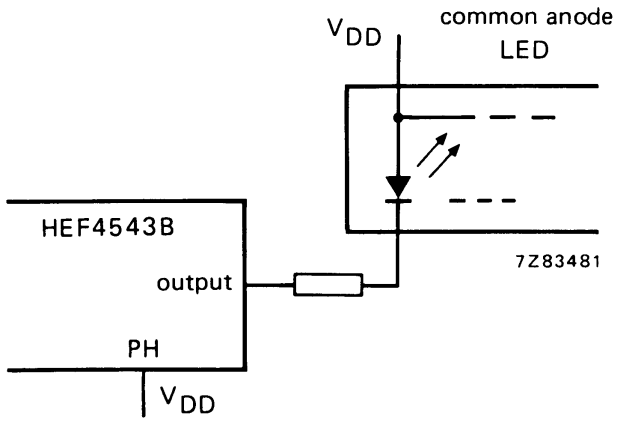

Fig.7 Connection to common anode LED display readout.

Note to Figs 6 and 7: bipolar transistors may be added for gain where $V_{DD} \leq 10$ V or $I_{out} \geq 10$ mA.

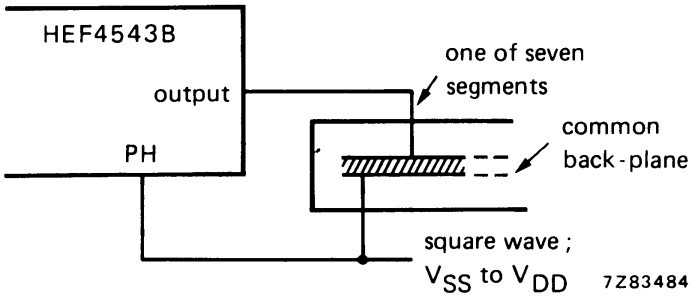

Fig.8 Connection to liquid crystal (LCD) display readout.

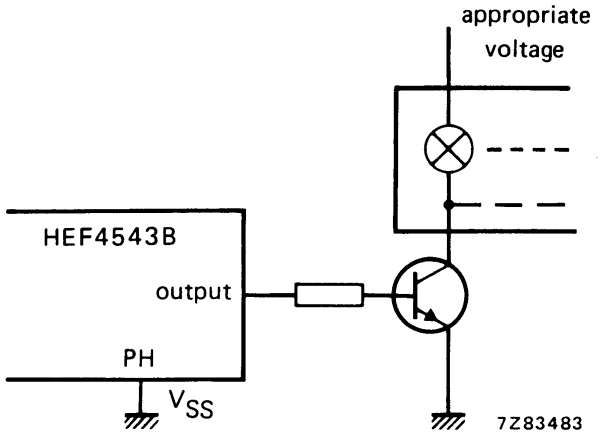

Fig.9 Connection to incandescent display readout.

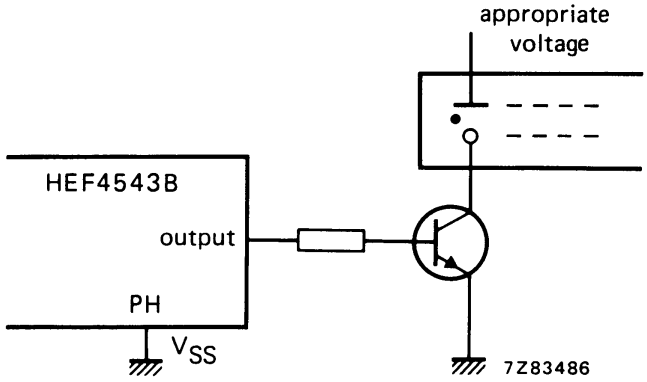

Fig.10 Connection to gas discharge display readout.

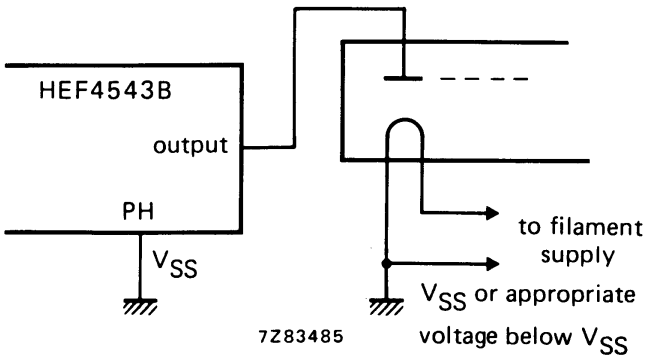

Fig.11 Connection to fluorescent display readout.