

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

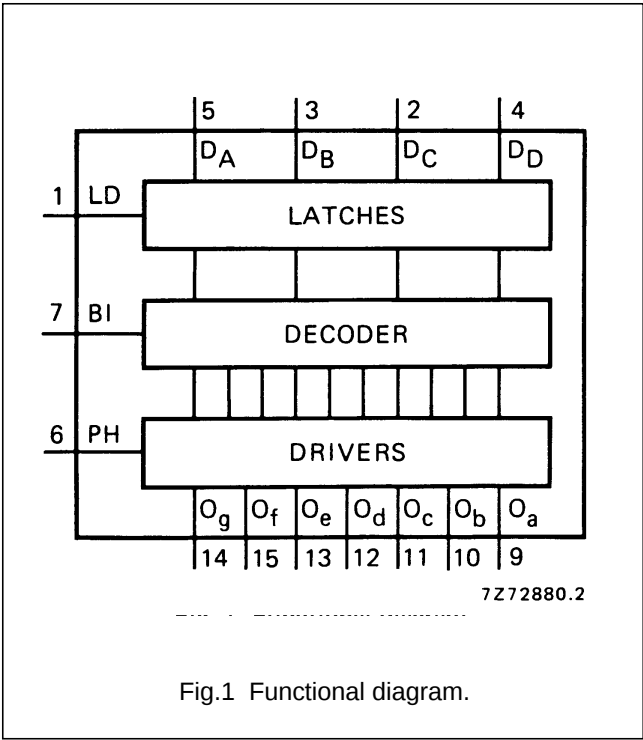
BCD to 7-segment latch/decoder/driver

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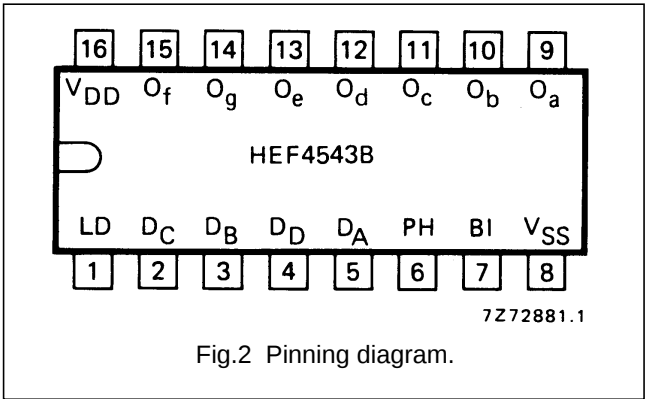
DESCRIPTION

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).



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.

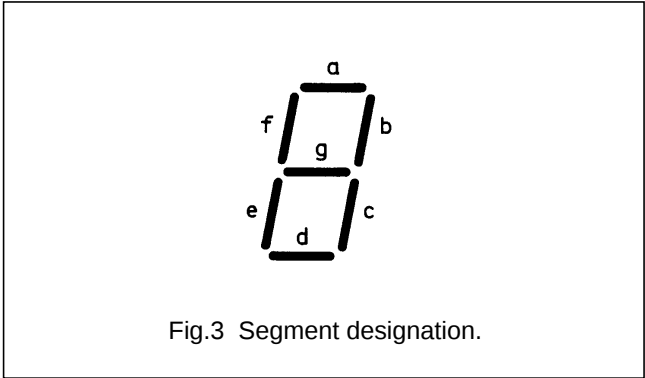
For liquid crystal displays a square-wave is applied to PH and the electrical common back-plane of the display. The outputs of the device are directly connected to the segments of the liquid crystal.



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

- 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



FAMILY DATA, I_{DD} LIMITS category MSI

See Family Specifications

BCD to 7-segment latch/decoder/driver

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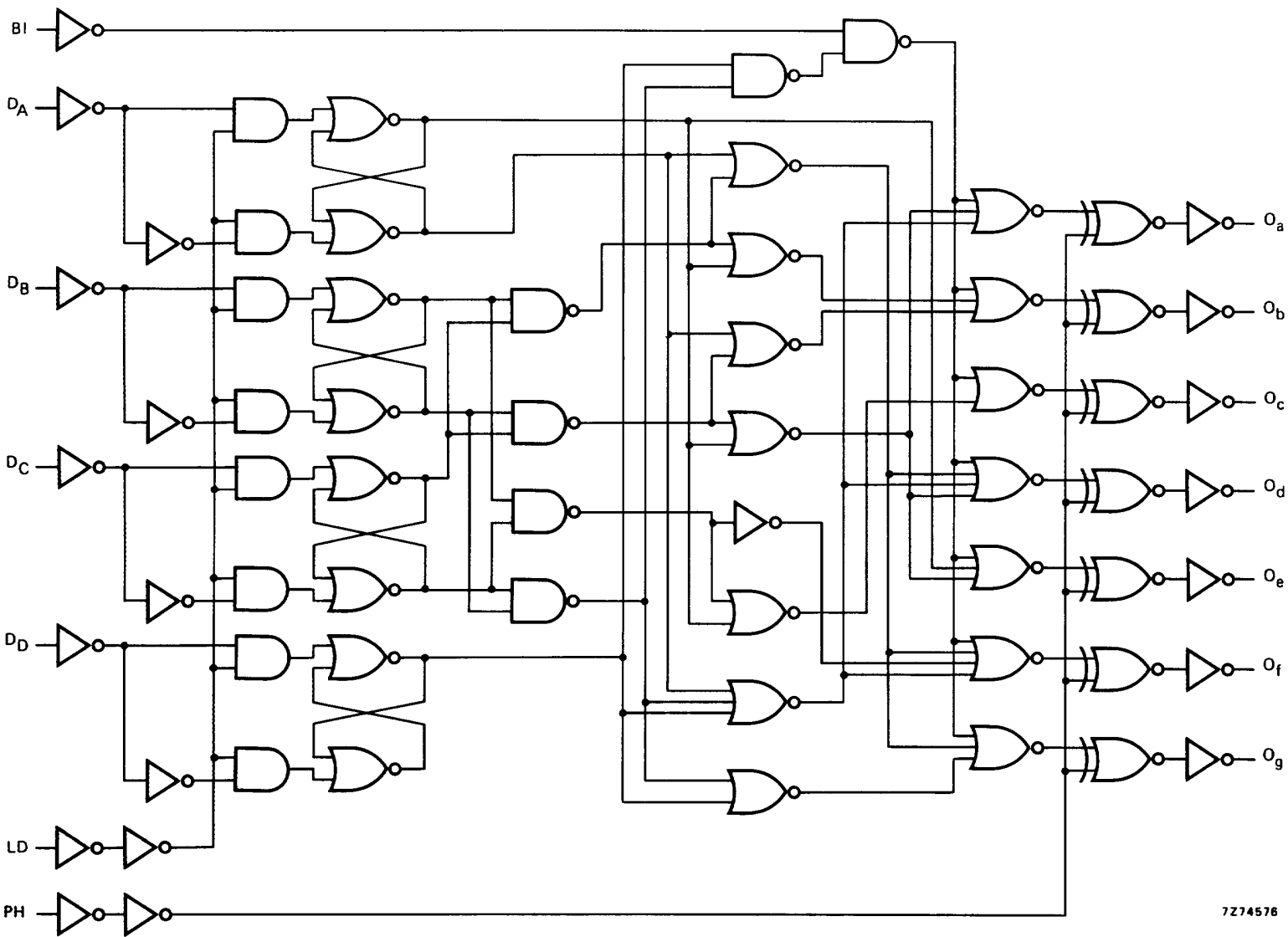


Fig.4 Logic diagram.

BCD to 7-segment latch/decoder/driver

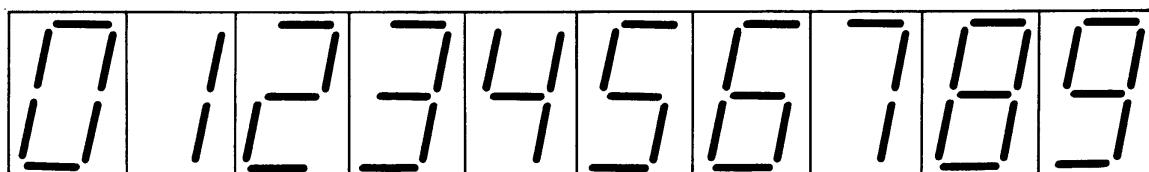
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FUNCTION TABLE

INPUTS							OUTPUTS							DISPLAY
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	
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.



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Fig.5 Display.

BCD to 7-segment latch/decoder/driver

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AC CHARACTERISTICS

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

	V _{DD} V	SYMBOL	MIN.	TYP.	MAX.	TYPICAL EXTRAPOLATION FORMULA	
Propagation delays							
D _n → 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
LOW to HIGH	5	t _{PLH}		180	360	ns	153 ns + (0,55 ns/pF) C _L
	10			75	150	ns	64 ns + (0,23 ns/pF) C _L
	15			55	110	ns	47 ns + (0,16 ns/pF) C _L
LD → 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
LOW to HIGH	5	t _{PLH}		190	380	ns	163 ns + (0,55 ns/pF) C _L
	10			80	160	ns	69 ns + (0,23 ns/pF) C _L
	15			60	120	ns	52 ns + (0,16 ns/pF) C _L
BI → 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
LOW to HIGH	5	t _{PLH}		125	250	ns	98 ns + (0,55 ns/pF) C _L
	10			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
LOW to HIGH	5	t _{TLH}		60	120	ns	10 ns + (1,0 ns/pF) C _L
	10			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 pulse width; HIGH	5		60	30		ns	
	10	t _{WLDH}	30	15		ns	
	15		20	10		ns	
Set-up time	5		40	20		ns	
D _n → LD	10	t _{su}	20	5		ns	
	15		15	0		ns	
Hold time	5		0	−15		ns	
D _n → LD	10	t _{hold}	15	0		ns	
	15		20	5		ns	

BCD to 7-segment latch/decoder/driver

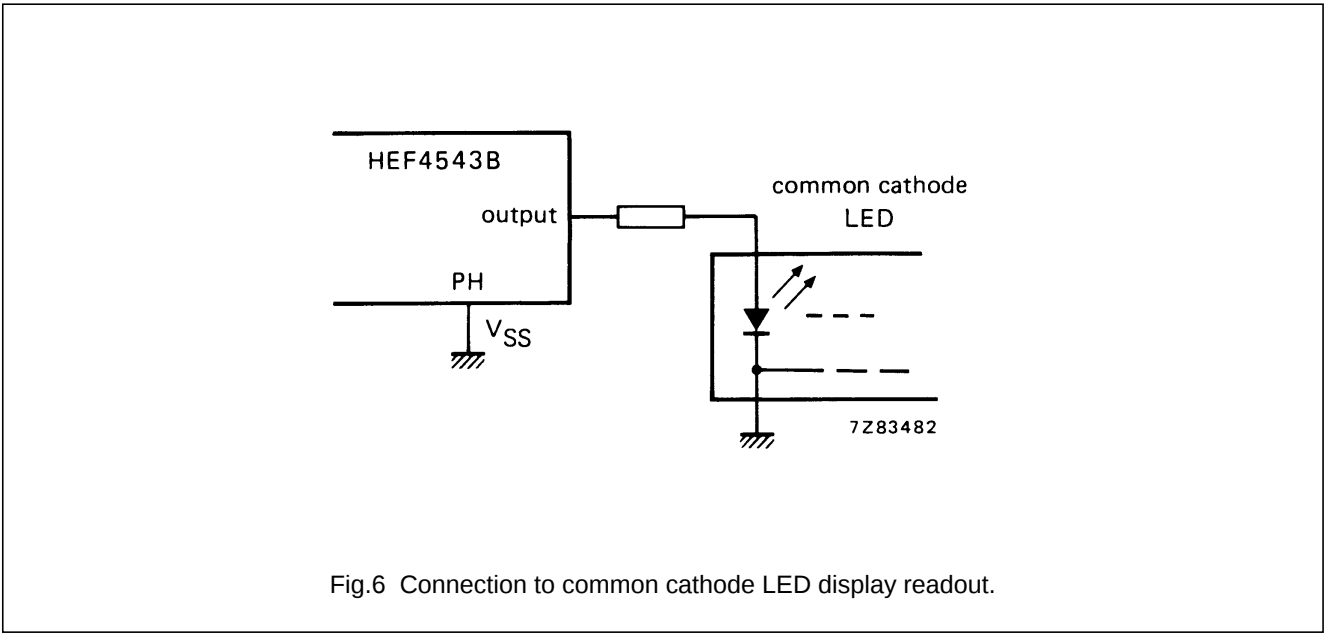
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	V_{DD} V	TYPICAL FORMULA FOR P (μW)	
Dynamic power dissipation per package (P)	5	$2\,200\,f_i + \sum (f_o C_L) \times V_{DD}^2$	where f_i = input freq. (MHz) f_o = output freq. (MHz) C_L = load capacitance (pF) $\sum (f_o C_L)$ = sum of outputs V_{DD}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



BCD to 7-segment latch/decoder/driver

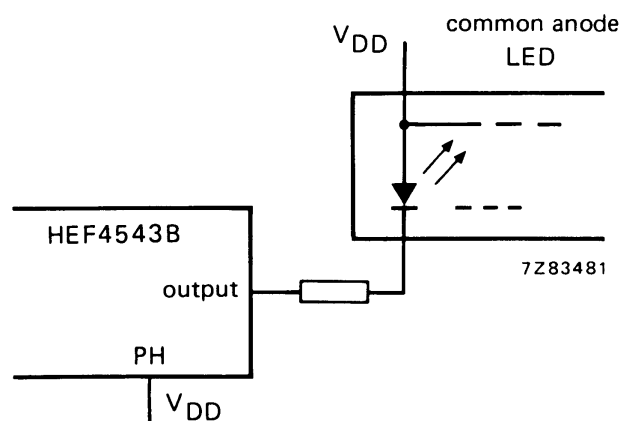
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Fig.7 Connection to common anode LED display readout.

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

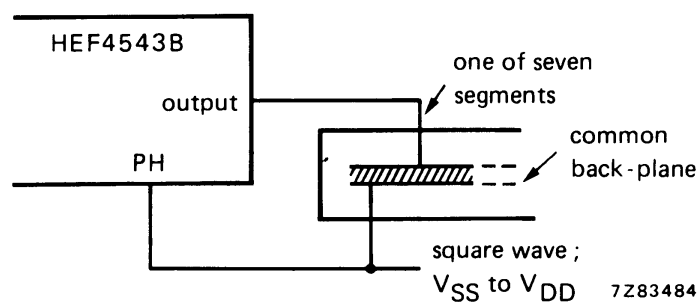


Fig.8 Connection to liquid crystal (LCD) display readout.

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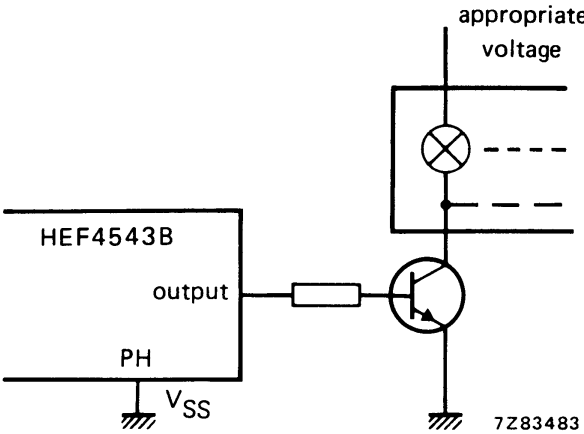


Fig.9 Connection to incandescent display readout.

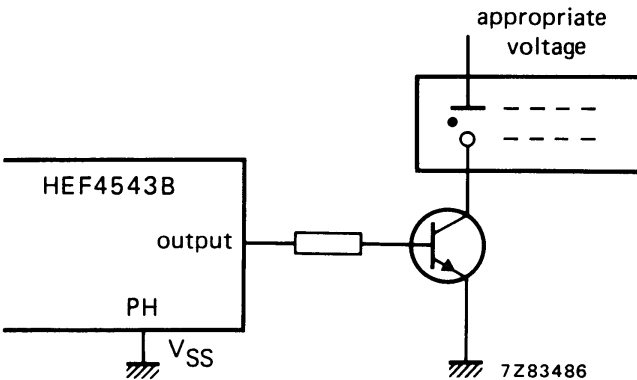


Fig.10 Connection to gas discharge display readout.

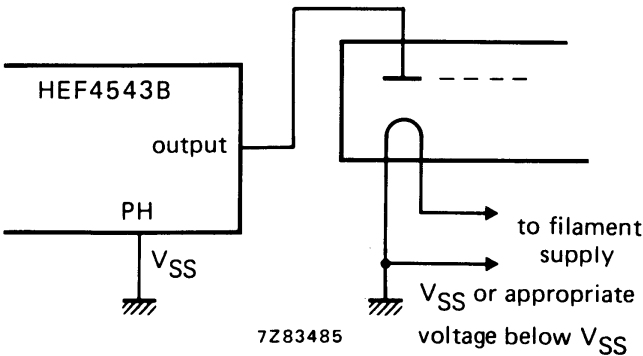


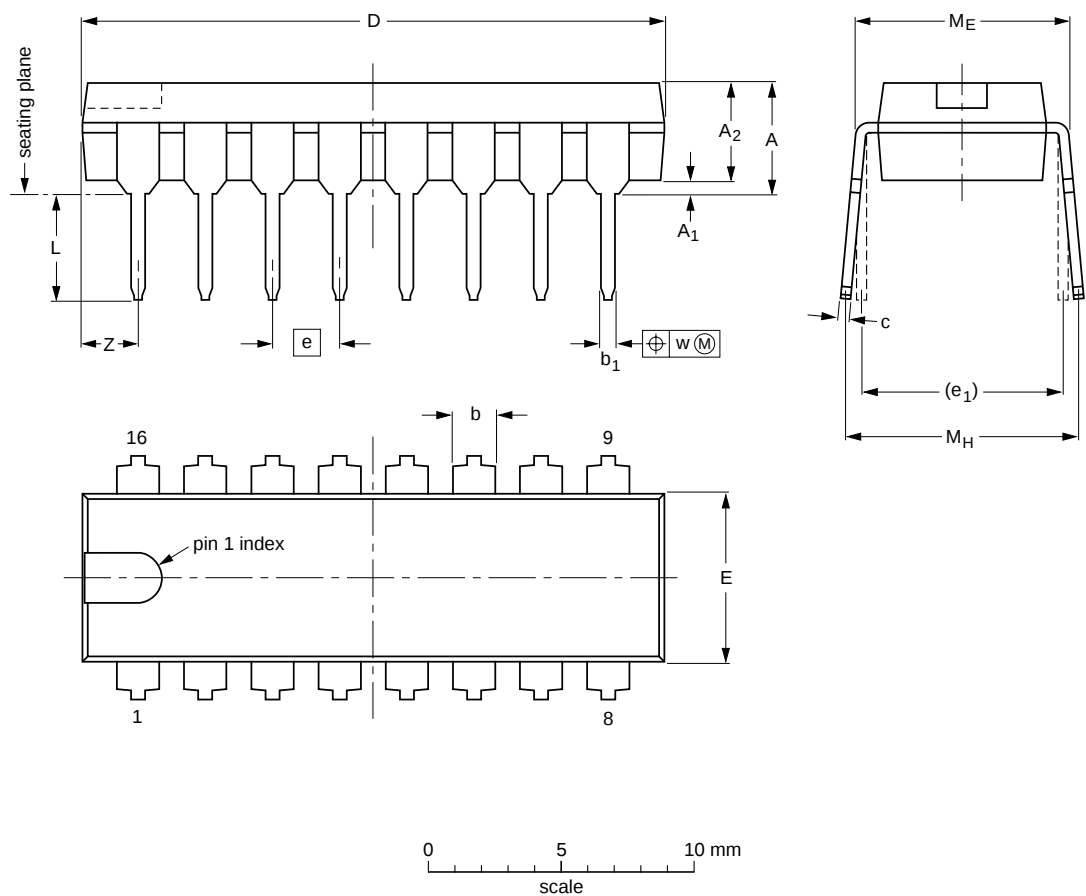
Fig.11 Connection to fluorescent display readout.

Package information

Package outlines

DIP16: plastic dual in-line package; 16 leads (300 mil); long body

SOT38-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A ₁ min.	A ₂ max.	b	b ₁	c	D ⁽¹⁾	E ⁽¹⁾	e	e ₁	L	M _E	M _H	w	Z ⁽¹⁾ max.
mm	4.7	0.51	3.7	1.40 1.14	0.53 0.38	0.32 0.23	21.8 21.4	6.48 6.20	2.54	7.62	3.9 3.4	8.25 7.80	9.5 8.3	0.254	2.2
inches	0.19	0.020	0.15	0.055 0.045	0.021 0.015	0.013 0.009	0.86 0.84	0.26 0.24	0.10	0.30	0.15 0.13	0.32 0.31	0.37 0.33	0.01	0.087

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

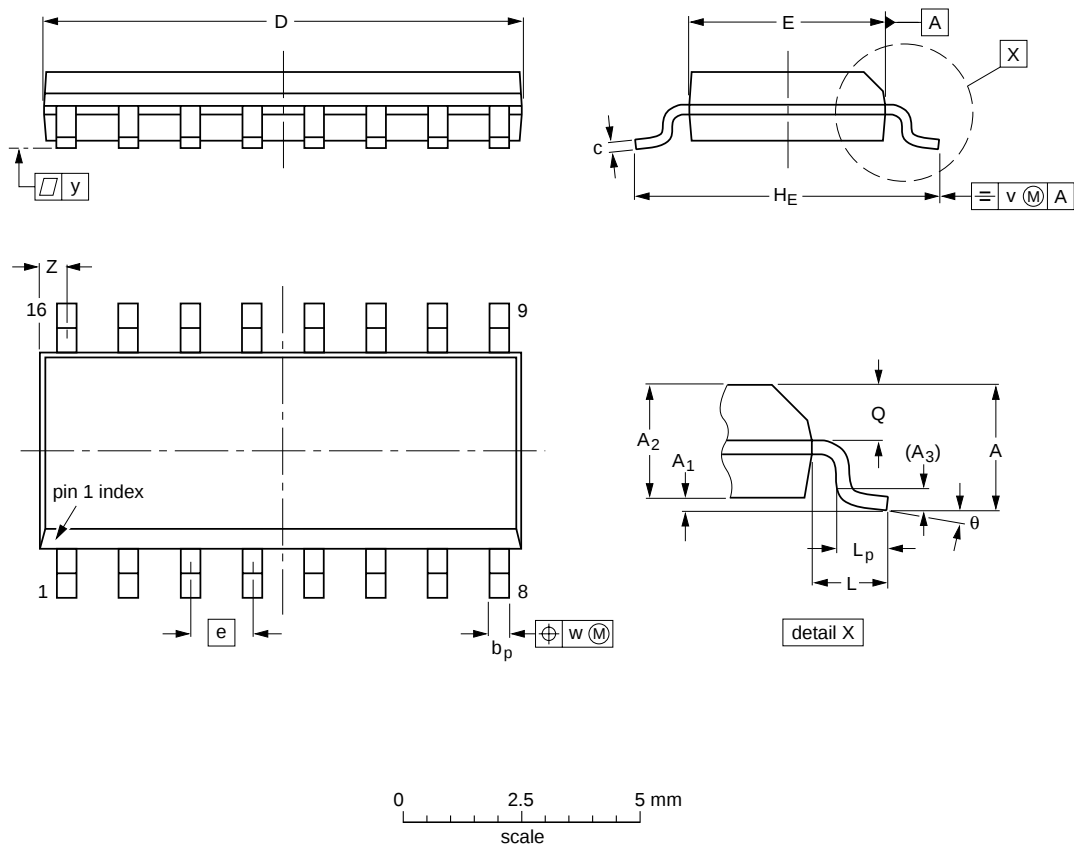
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT38-1	050G09	MO-001AE				92-10-02- 95-01-19

Package information

Package outlines

SO16: plastic small outline package; 16 leads; body width 3.9 mm

SOT109-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽¹⁾	e	H _E	L	L _p	Q	v	w	y	z ⁽¹⁾	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	10.0 9.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.39 0.38	0.16 0.15	0.050	0.244 0.228	0.041	0.039 0.016	0.028 0.020	0.01	0.01	0.004	0.028 0.012	

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT109-1	076E07S	MS-012AC				95-01-23 97-05-22