



## BCD TO SEVEN SEGMENT LATCH/DECODER/DRIVER

- HIGH OUTPUT SOURCING CAPABILITY (up to 25mA).
- INPUT LATCHES FOR BCD CODE STORAGE
- LAMP TEST AND BLANKING CAPABILITY.
- 7-SEGMENT OUTPUTS BLANKED FOR BCD INPUT CODES > 1001
- QUIESCENT CURRENT SPECIF. UP TO 20V
- STANDARDIZED SYMMETRICAL OUTPUT CHARACTERISTICS
- 5V, 10V, AND 15V PARAMETRIC RATINGS
- INPUT LEAKAGE CURRENT  
 $I_l = 100\text{nA (MAX) AT } V_{DD} = 18\text{V } T_A = 25^\circ\text{C}$
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC JESD13B "STANDARD SPECIFICATIONS FOR DESCRIPTION OF B SERIES CMOS DEVICES"

### DESCRIPTION

HCF4511B is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor technology available in DIP and SOP packages. HCF4511B is a BCD to 7 segment decoder driver made up of CMOS logic and n-p-n bipolar transistor output devices on a single monolithic structure. This device combines the low quiescent



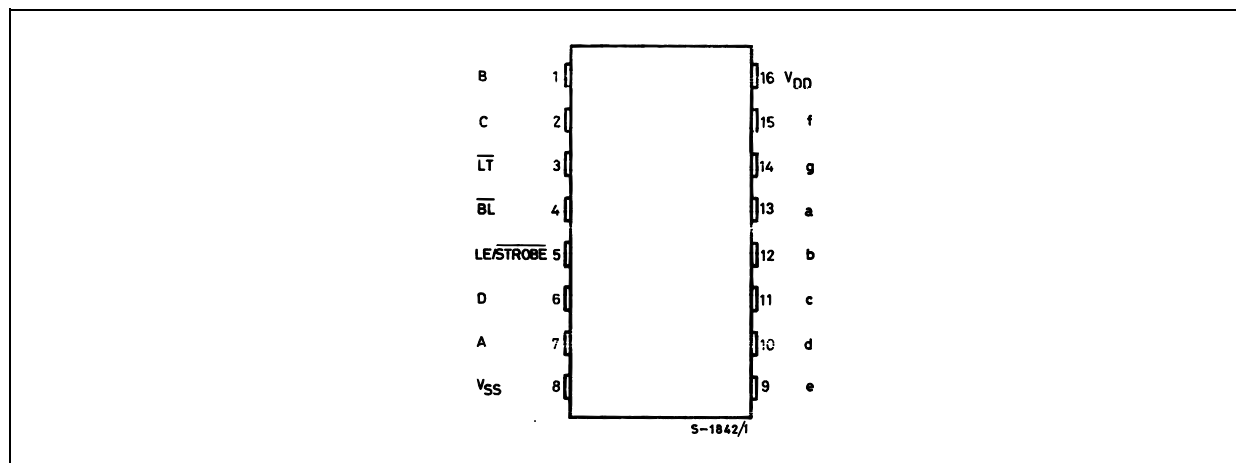
### ORDER CODES

PACKAGE	TUBE	T & R
DIP	HCF4511BEY	
SOP	HCF4511BM1	HCF4511M013TR

power dissipation and high noise immunity features of CMOS with n-p-n bipolar output transistor capable of sourcing up to 25mA. This capability allows HCF4511B to drive LEDs and other displays directly.

Lamp Test ( $\overline{\text{LT}}$ ), Blanking ( $\overline{\text{BL}}$ ), and Latch Enable or Strobe inputs are provided to test the display, shut off or intensity-modulate it, and store or strobe a BCD code, respectively. Several different signals may be multiplexed and displayed when external multiplexing circuitry is used.

### PIN CONNECTION



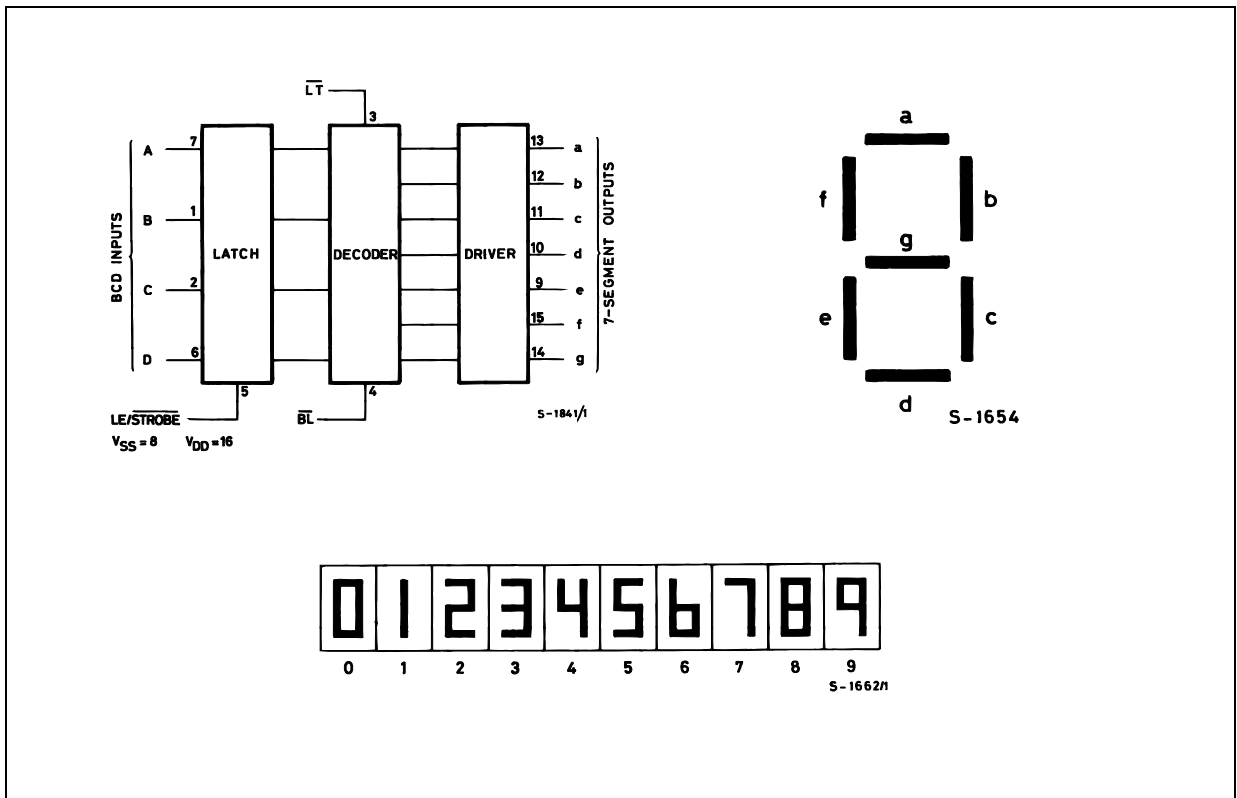
INPUT EQUIVALENT CIRCUIT



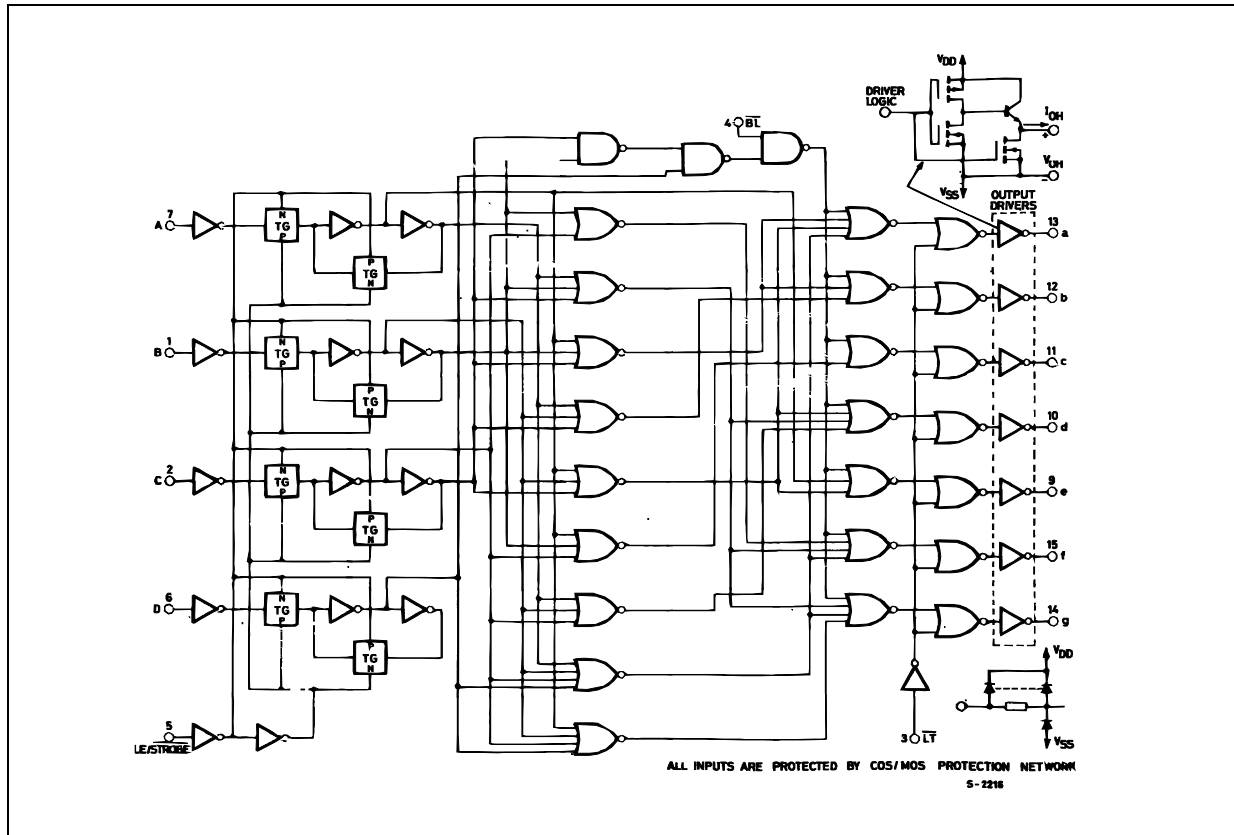
PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
7, 1, 2, 6	A, B, C, D	Bcd Inputs
13, 12, 11, 10, 9, 15, 14	a to g	7-Segment Outputs
3	$\overline{LT}$	Lamp Test Input
4	$\overline{BL}$	Blanking Input
5	$\overline{LE}/\overline{STROBE}$	Latch Enable or Strobe Input
8	V <sub>SS</sub>	Negative Supply Voltage
16	V <sub>DD</sub>	Positive Supply Voltage

FUNCTIONAL DIAGRAM



LOGIC DIAGRAM



TRUTH TABLE

LE	$\overline{BL}$	$\overline{LT}$	D	C	B	A	a	b	c	d	e	f	g	DISPLAY
X	X	L	X	X	X	X	H	H	H	H	H	H	H	8
X	L	H	X	X	X	X	L	L	L	L	L	L	L	Blank
L	H	H	L	L	L	L	H	H	H	H	H	H	L	0
L	H	H	L	L	L	H	L	H	H	L	L	L	L	1
L	H	H	L	L	H	L	H	H	L	H	H	L	H	2
L	H	H	L	L	H	H	H	H	H	H	L	L	H	3
L	H	H	L	H	L	L	L	H	H	L	L	H	H	4
L	H	H	L	H	L	H	H	L	H	H	L	H	H	5
L	H	H	L	H	H	L	L	L	H	H	H	H	H	6
L	H	H	L	H	H	H	H	H	H	L	L	L	L	7
L	H	H	H	L	L	L	H	H	H	H	H	H	H	8
L	H	H	H	L	L	H	H	H	H	L	L	H	H	9
L	H	H	H	L	H	L	L	L	L	L	L	L	L	Blank
L	H	H	H	L	H	H	L	L	L	L	L	L	L	Blank
L	H	H	H	H	L	H	L	L	L	L	L	L	L	Blank
L	H	H	H	H	H	L	L	L	L	L	L	L	L	Blank
L	H	H	H	H	H	H	L	L	L	L	L	L	L	Blank
H	H	H	X	X	X	X				*				*

X: Don't Care



**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
$V_{DD}$	Supply Voltage	-0.5 to +22	V
$V_I$	DC Input Voltage	-0.5 to $V_{DD} + 0.5$	V
$I_I$	DC Input Current	$\pm 10$	mA
$P_D$	Power Dissipation per Package	200	mW
	Power Dissipation per Output Transistor	100	mW
$T_{op}$	Operating Temperature	-55 to +125	°C
$T_{stg}$	Storage Temperature	-65 to +150	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

All voltage values are referred to  $V_{SS}$  pin voltage.

**RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Value	Unit
$V_{DD}$	Supply Voltage	3 to 20	V
$V_I$	Input Voltage	0 to $V_{DD}$	V
$T_{op}$	Operating Temperature	-55 to 125	°C

## DC SPECIFICATIONS

Symbol	Parameter	Test Condition				Value						Unit		
		V <sub>I</sub> (V)	V <sub>O</sub> (V)	I <sub>OL</sub>   ( $\mu$ A)	V <sub>DD</sub> (V)	T <sub>A</sub> = 25°C			-40 to 85°C		-55 to 125°C			
						Min.	Typ.	Max.	Min.	Max.	Min.		Max.	
I <sub>L</sub>	Quiescent Current	0/5			5		0.04	5		150		150	$\mu$ A	
		0/10			10		0.04	10		300		300		
		0/15			15		0.04	20		600		600		
		0/20			20		0.08	100		3000		3000		
V <sub>OH</sub>	High Level Output Voltage	0/5			5	4.95			4.95		4.95		V	
		0/10			10	9.95			9.95		9.95			
		0/15			15	14.95			14.95		14.95			
V <sub>OL</sub>	Low Level Output Voltage	5/0			5		0.05			0.05		0.05	V	
		10/0			10		0.05			0.05		0.05		
		15/0			15		0.05			0.05		0.05		
V <sub>IH</sub>	High Level Input Voltage		0.5/3.8		5	3.5			3.5		3.5		V	
			1/8.8		10	7			7		7			
			1.5/13.8		15	11			11		11			
V <sub>IL</sub>	Low Level Input Voltage		3.8/0.5		5			1.5		1.5		1.5	V	
			8.8/1		10			3		3		3		
			13.8/1.5		15			4		4		4		
V <sub>OH</sub>	Output Drive Voltage			0	5	4.1	4.57		4.1		4.1		V	
				5			4.24							
				10			3.6	4.12		3.3		3.3		
				15			3.94							
				20			2.8	3.75		2.5		2.5		
				25			3.54							
				0	10	9.1	9.58		9.1		9.1		V	
				5			9.26							
				10			8.75	9.17		8.45		8.45		
				15			9.04							
				20			8.1	8.90		7.8		7.8		
				25			8.75							
				0	15	14.1	14.59		14.1		14.1		V	
				5			14.27							
				10			13.75	14.18		13.45		13.45		
				15			14.07							
				20			13.1	13.95		12.8		12.8		
				25			13.80							
I <sub>OL</sub>	Output Sink Current	0/5	0.4		5	0.44	1		0.36		0.36		mA	
		0/10	0.5		10	1.1	2.6		0.9		0.9			
		0/15	1.5		15	3	6.8		2.4		2.4			
I <sub>I</sub>	Input Leakage Current (any input)	0/18			18		$\pm 10^{-5}$	$\pm 0.1$		$\pm 1$		$\pm 1$	$\mu$ A	
C <sub>I</sub>	Input Capacitance (any input)						5	7.5					pF	

The Noise Margin for both "1" and "0" level is: 1V min. with V<sub>DD</sub>=5V, 2V min. with V<sub>DD</sub>=10V, 2.5V min. with V<sub>DD</sub>=15V

## HCF4511B

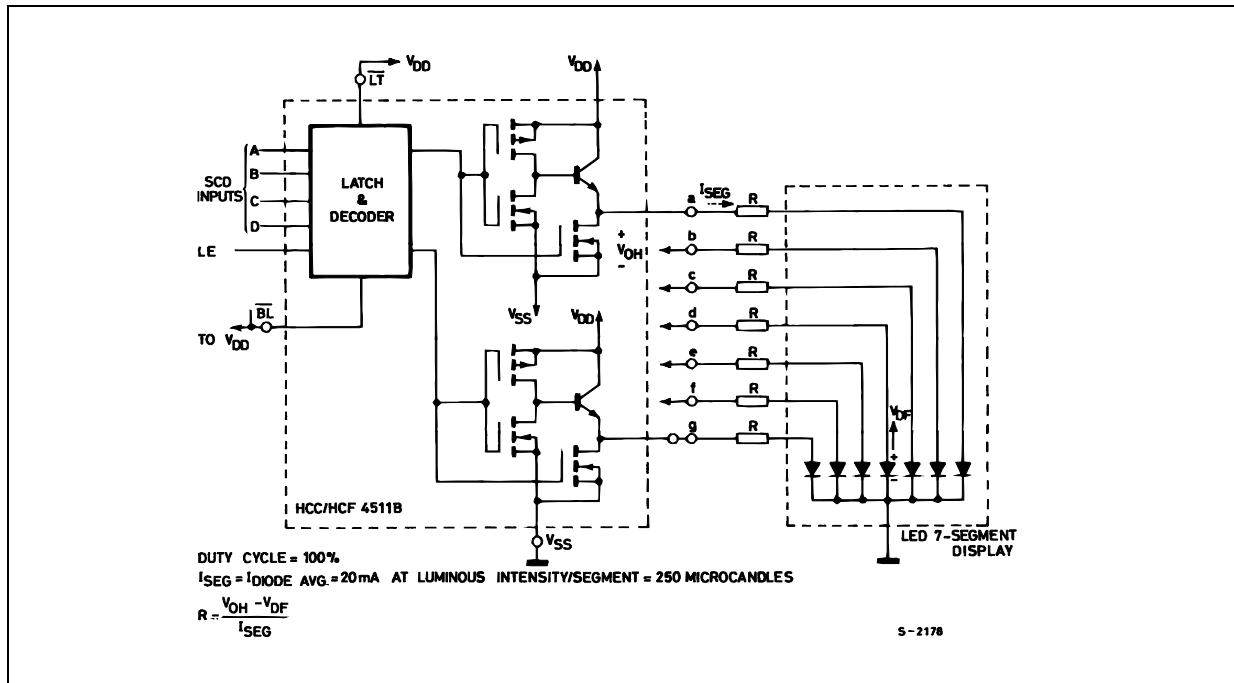
### DYNAMIC ELECTRICAL CHARACTERISTICS ( $T_{amb} = 25^{\circ}\text{C}$ , $C_L = 50\text{pF}$ , $R_L = 200\text{K}\Omega$ , $t_r = t_f = 20\text{ ns}$ )

Symbol	Parameter	TEST CONDITION		Value (*)			Unit
		$V_{DD}$ (V)		Min.	Typ.	Max.	
$t_{PHL}$	Propagation Delay Time (DATA)	5			520	1040	ns
		10			210	420	
		15			150	300	
$t_{PLH}$	Propagation Delay Time (DATA)	5			660	1320	ns
		10			260	520	
		15			180	360	
$t_{PHL}$	Propagation Delay Time (BL)	5			350	700	ns
		10			175	350	
		15			125	250	
$t_{PLH}$	Propagation Delay Time (BL)	5			400	800	ns
		10			175	350	
		15			150	300	
$t_{PHL}$	Propagation Delay Time (LT)	5			250	500	ns
		10			125	250	
		15			85	170	
$t_{PLH}$	Propagation Delay Time (LT)	5			150	300	ns
		10			75	150	
		15			50	100	
$t_{TLH}$	Transition Time	5			40	80	ns
		10			30	60	
		15			20	50	
$t_{THL}$	Transition Time	5			125	310	ns
		10			75	185	
		15			65	160	
$t_{setup}$	Setup Time	5		150	75		ns
		10		70	35		
		15		40	20		
$t_{hold}$	Hold Time	5		0	-75		ns
		10		0	-35		
		15		0	-20		
$t_w$	Strobe Pulse Width	5		400	200		ns
		10		160	80		
		15		100	50		

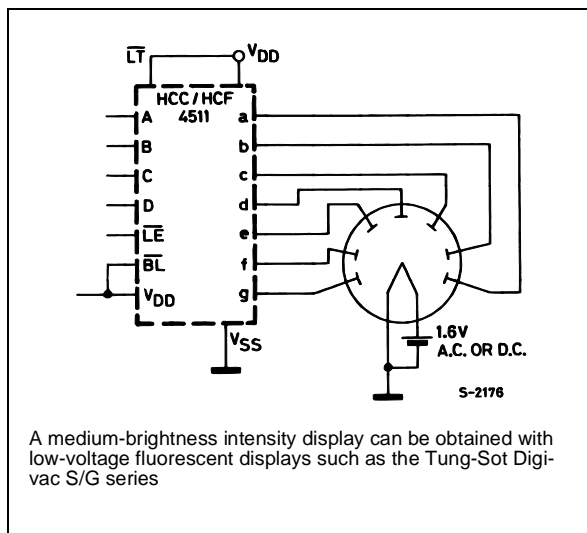
(\*) Typical temperature coefficient for all  $V_{DD}$  value is 0.3 %/°C.

TYPICAL APPLICATIONS (Interfacing with various displays)

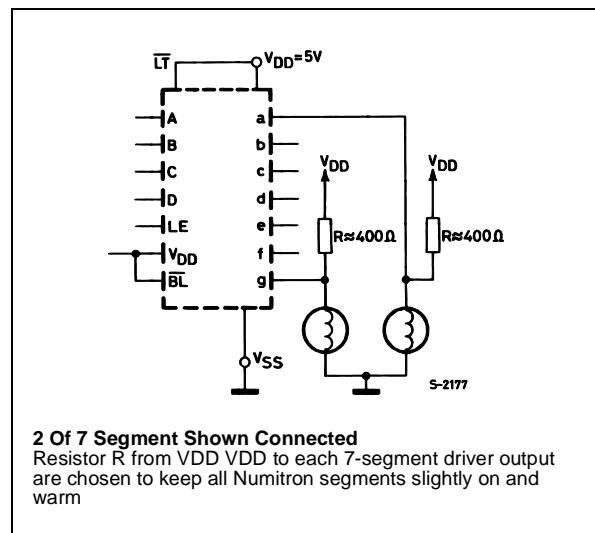
Driving Common-cathode 7 Segment Led Displays



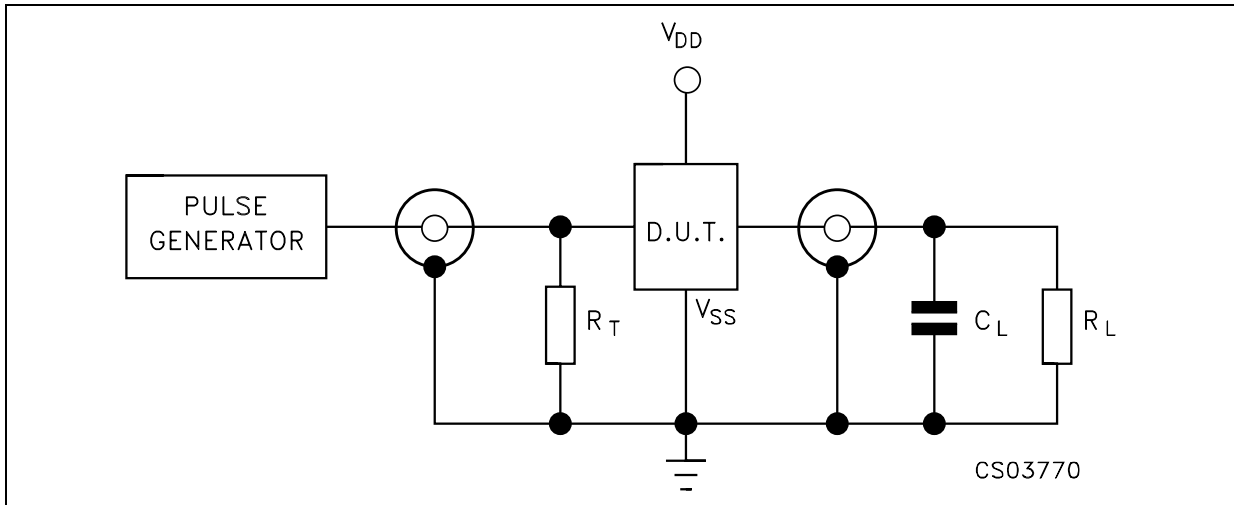
Driving Low-voltage Fluorescent Displays



Driving Incandescent Displays

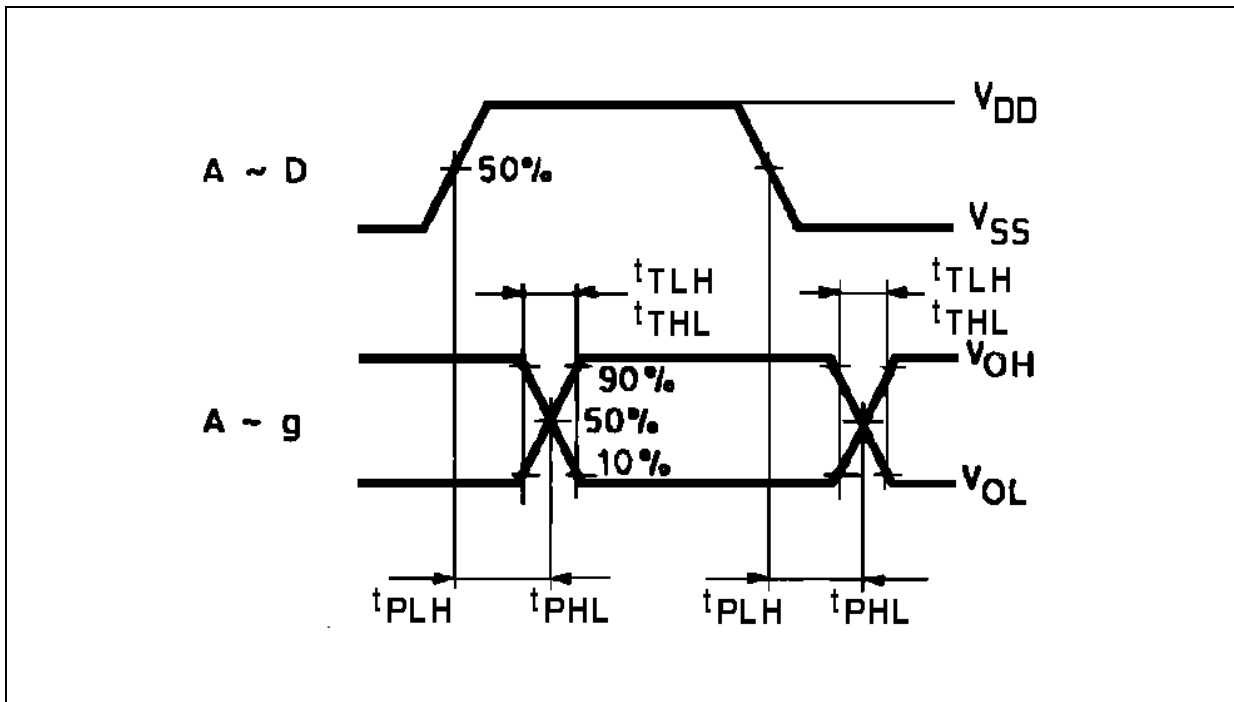


TEST CIRCUIT



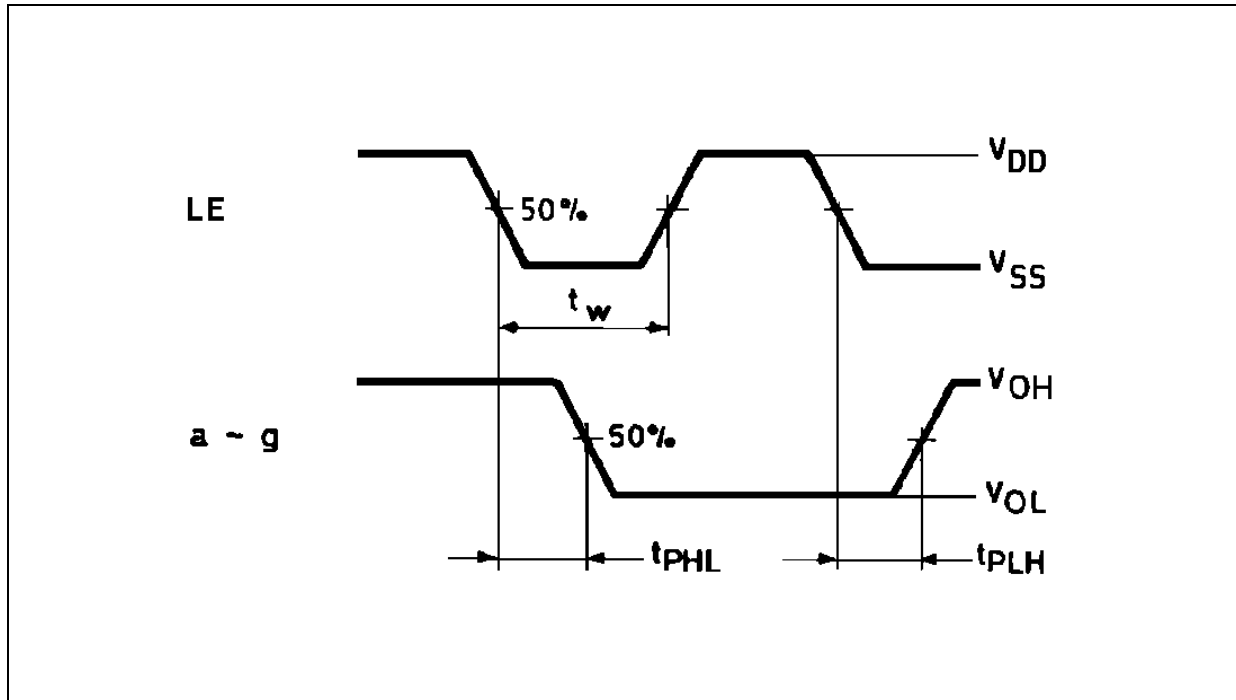
$C_L = 50\text{pF}$  or equivalent (includes jig and probe capacitance)  
 $R_L = 200\text{K}\Omega$   
 $R_T = Z_{OUT}$  of pulse generator (typically  $50\Omega$ )

WAVEFORM 1 : PROPAGATION DELAY TIMES ( $f=1\text{MHz}$ ; 50% duty cycle)

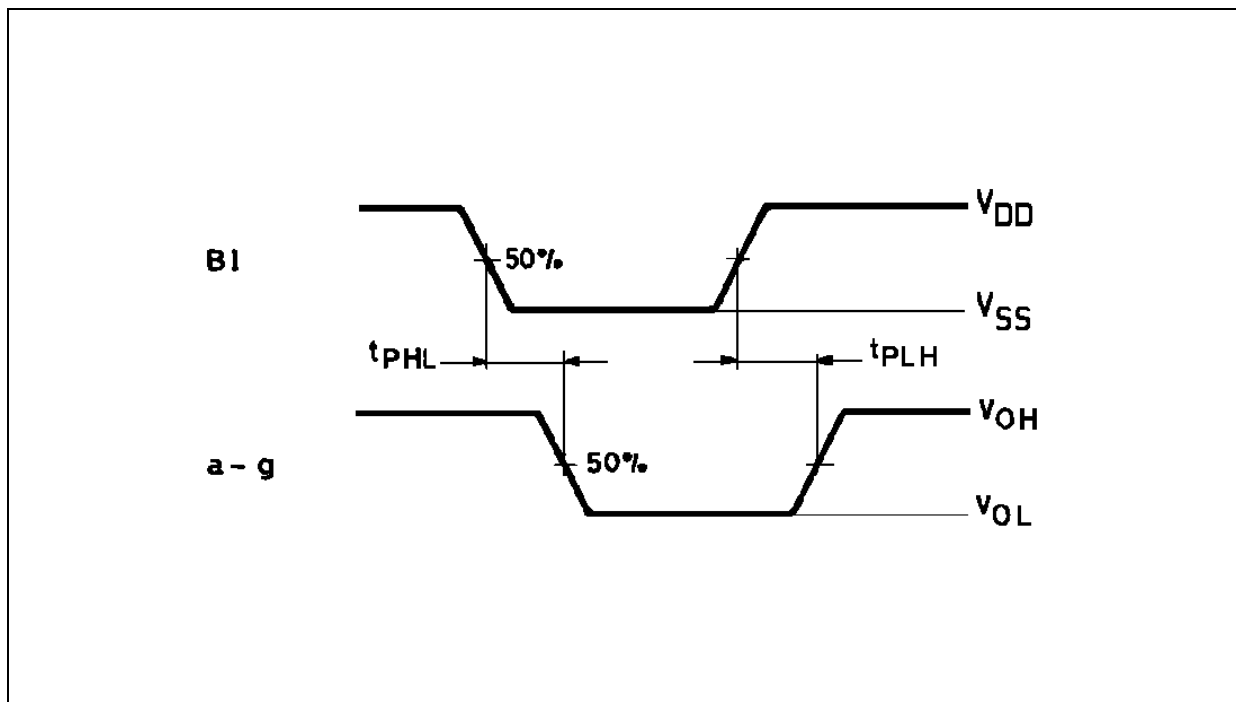




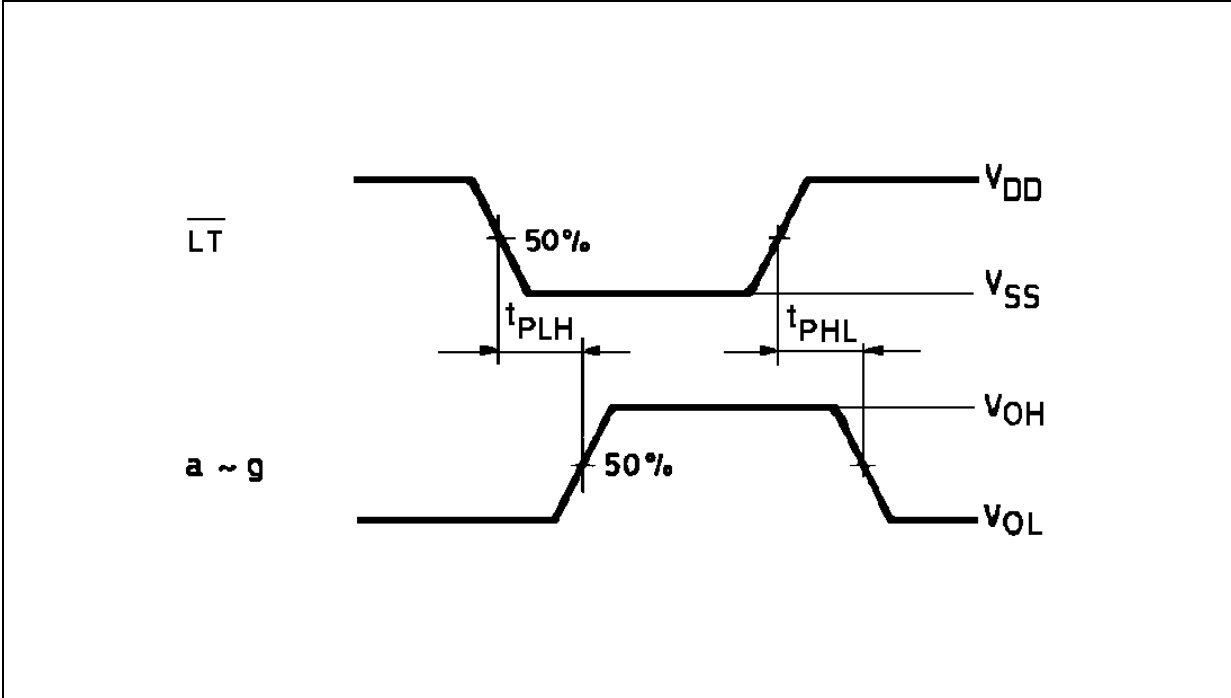
WAVEFORM 2 : MINIMUM PULSE WIDTH (f=1MHz; 50% duty cycle)



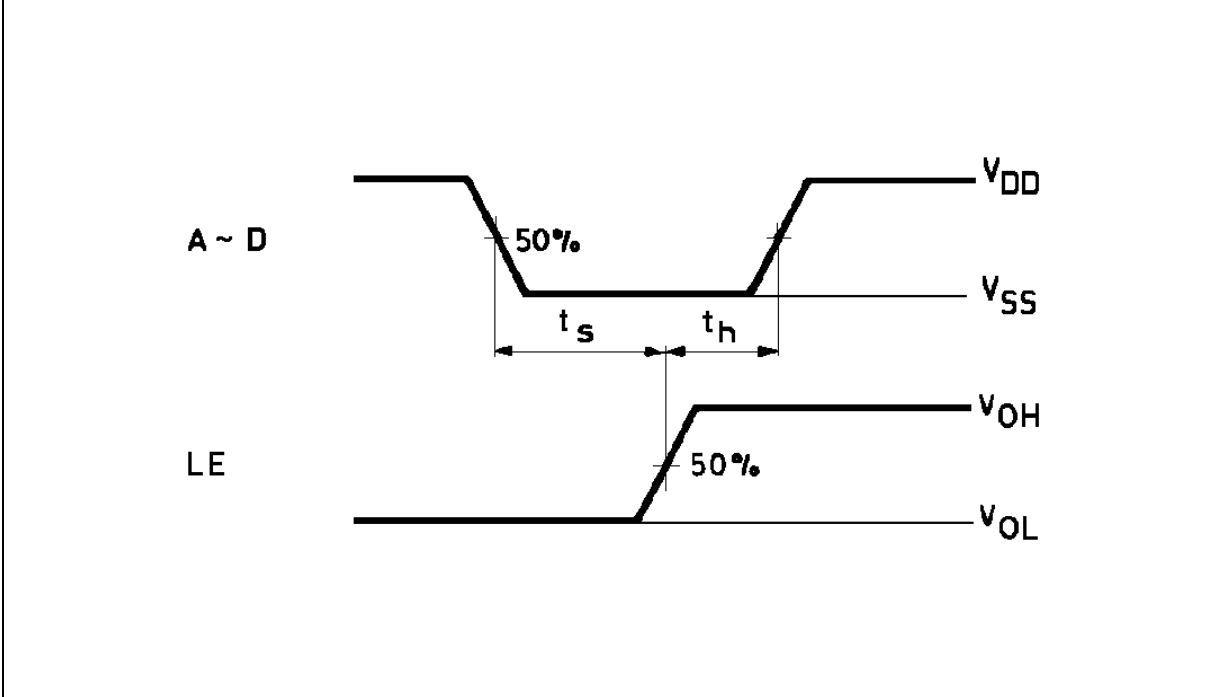
WAVEFORM 3 : PROPAGATION DELAY TIMES (f=1MHz; 50% duty cycle)



WAVEFORM 4 : PROPAGATION DELAY TIMES (f=1MHz; 50% duty cycle)

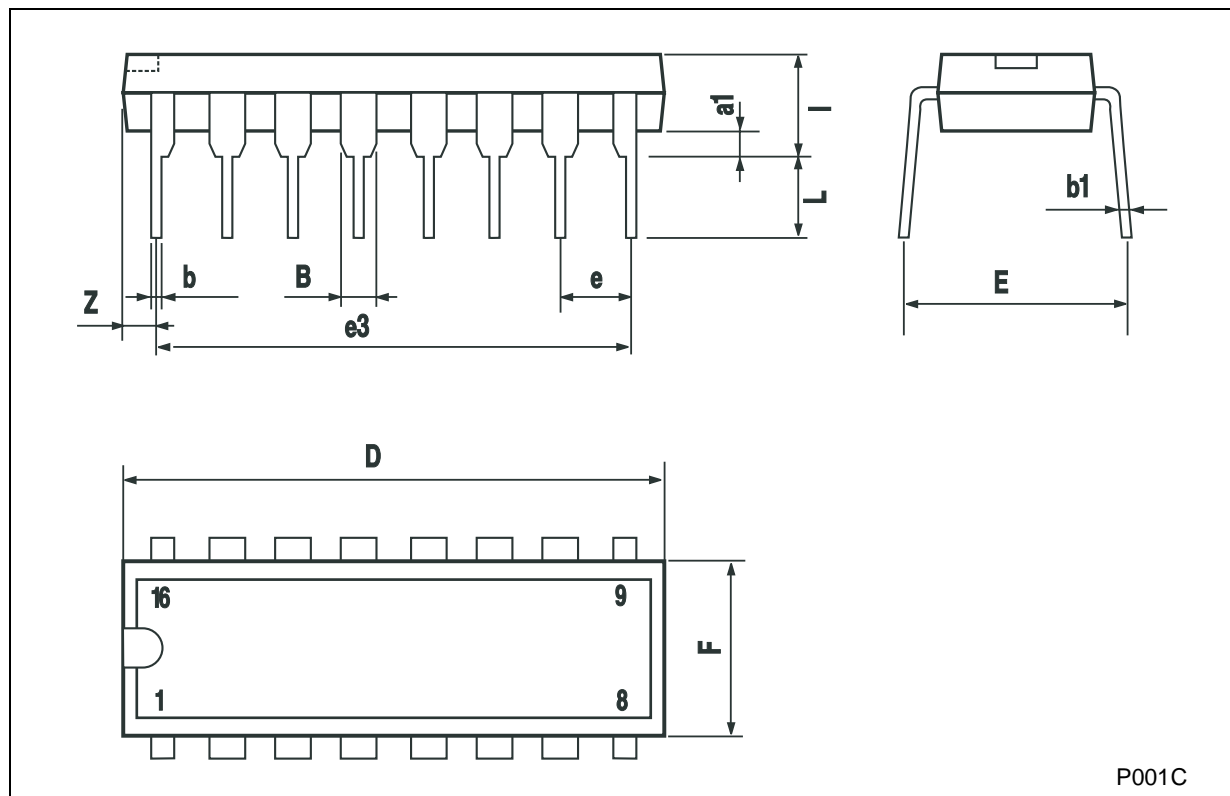


WAVEFORM 5 : MINIMUM SETUP AND HOLD TIME (f=1MHz; 50% duty cycle)



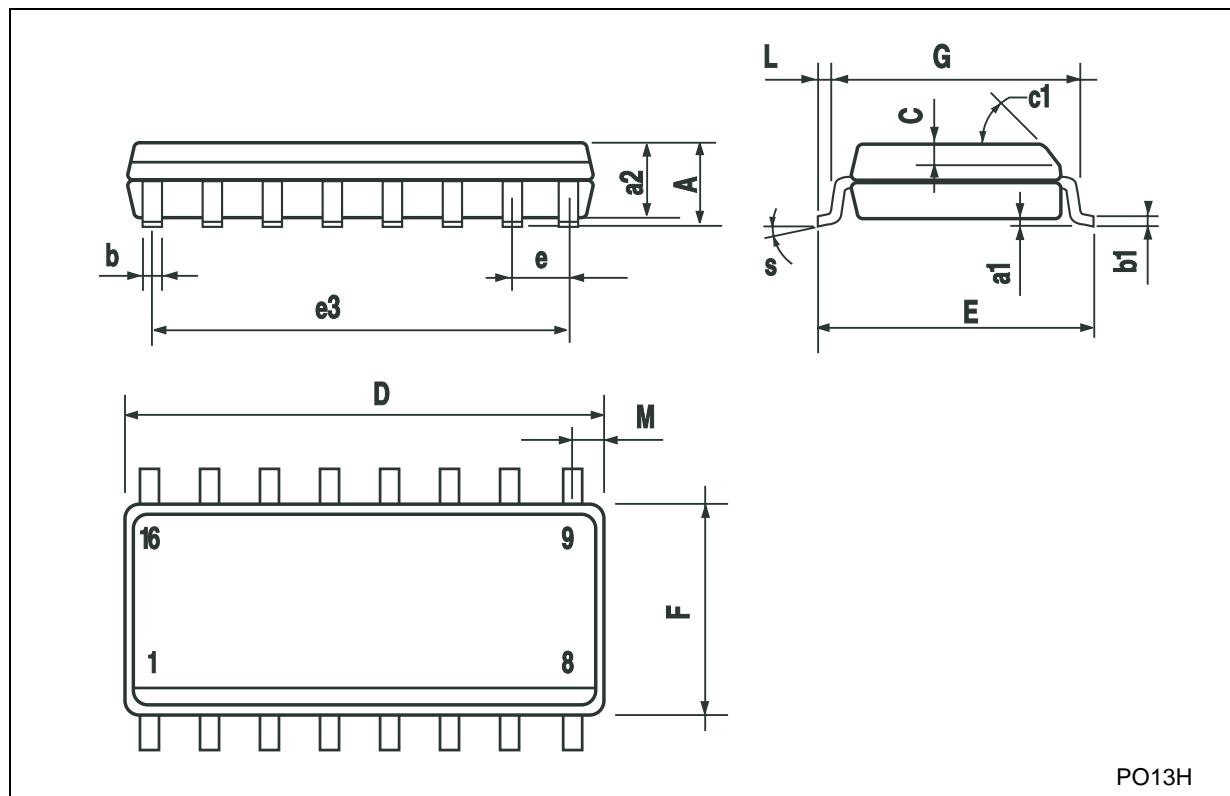
### Plastic DIP-16 (0.25) MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



## SO-16 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.003		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.62			0.024
S	8° (max.)					



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