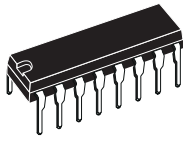
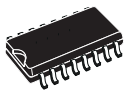
HCF4511B

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_I = 100nA (MAX) AT V_{DD} = 18V T_A = 25°C
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC JESD13B "STANDARD SPECIFICATIONS FOR DESCRIPTION OF B SERIES CMOS DEVICES"



DIP



SOP

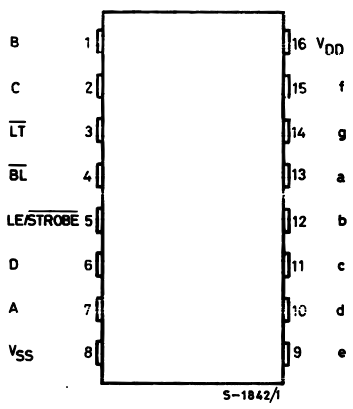
ORDER CODES

PACKAGE	TUBE	T & R
DIP	HCF4511BEY	
SOP	HCF4511BM1	HCF4511M013TR

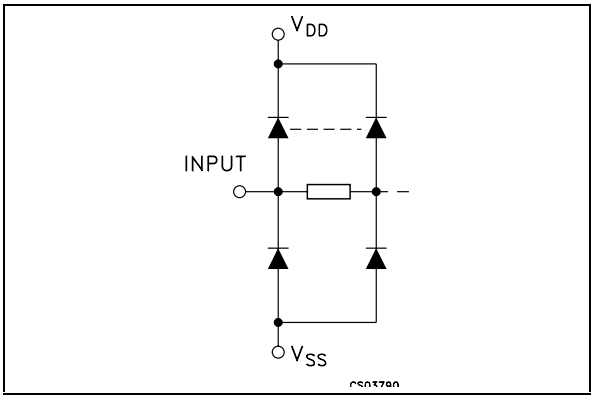
DESCRIPTION

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 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 ($\overline{LT}$), Blanking ($\overline{BL}$), 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



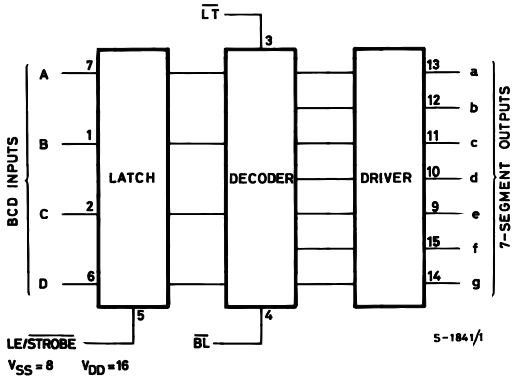
INPUT EQUIVALENT CIRCUIT

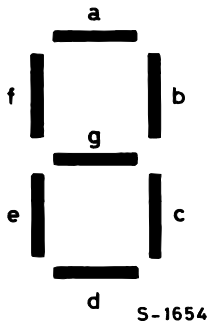


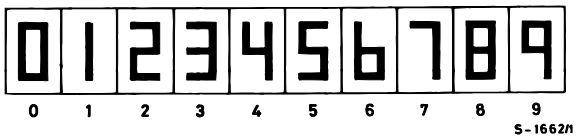
PIN DESCRIPTION

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	LE/$\overline{STROBE}$	Latch Enable or Strobe Input
8	V_{SS}	Negative Supply Voltage
16	V_{DD}	Positive Supply Voltage

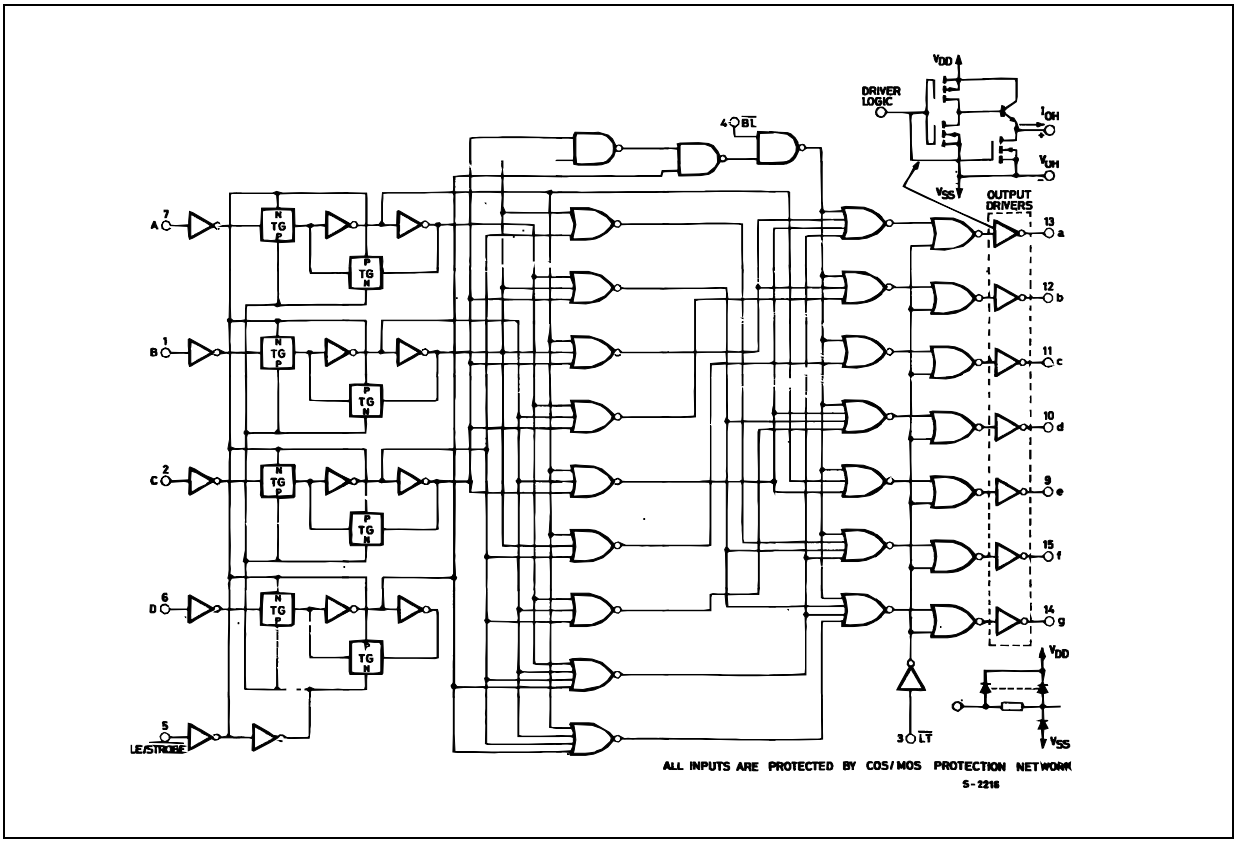
FUNCTIONAL DIAGRAM







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	L	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	± 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_I (V)	V_O (V)	$\|I_O\|$ (μA)	V_{DD} (V)	T_A = 25°C			-40 to 85°C		-55 to 125°C		
						Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
I_L	Quiescent Current	0/5			5		0.04	5		150		150	μA
		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_{OH}	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_{OL}	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_{IH}	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_{IL}	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_{OH}	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_{OL}	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_I	Input Leakage Current (any input)	0/18			18		$\pm 10^{-5}$	±0.1		±1		±1	μA
C_I	Input Capacitance (any input)						5	7.5					pF

The Noise Margin for both "1" and "0" level is: 1V min. with V_{DD}=5V, 2V min. with V_{DD}=10V, 2.5V min. with V_{DD}=15V

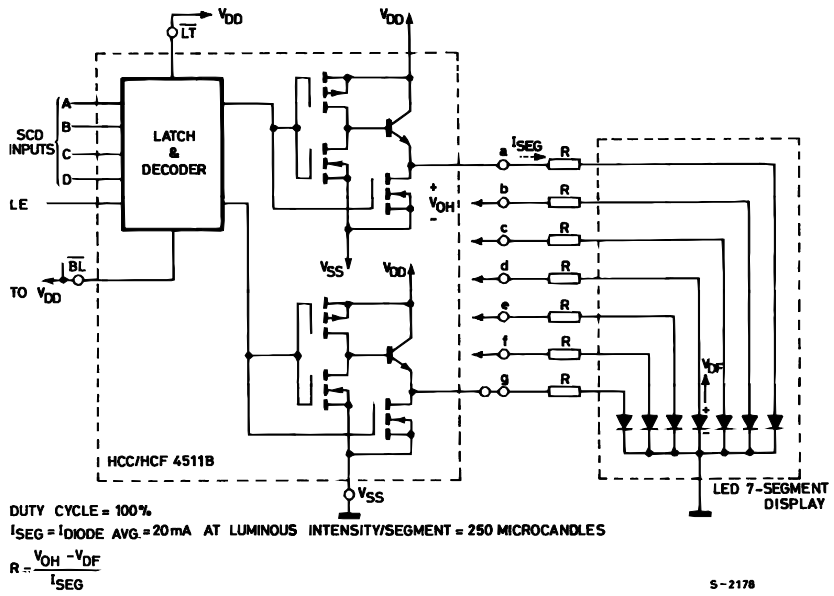
DYNAMIC ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C, C_L = 50pF, R_L = 200KΩ, $t_r = t_f$ = 20 ns)

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		

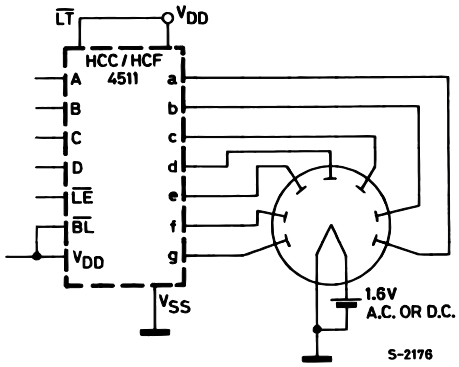
(*) Typical temperature coefficient for all V_{DD} value is 0.3 %/°C.

TYPICAL APPLICATIONS (Interfacing with various displays)

Driving Common-cathode 7 Segment Led Displays

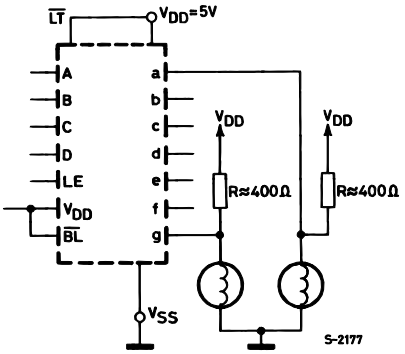


Driving Low-voltage Fluorescent Displays



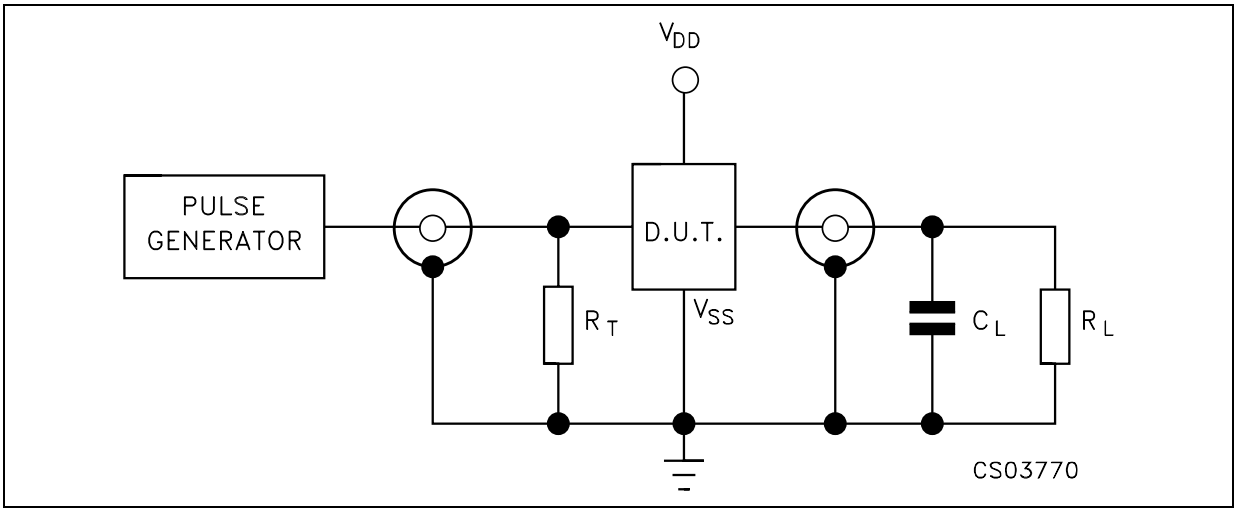
A medium-brightness intensity display can be obtained with low-voltage fluorescent displays such as the Tung-Sot Digivac S/G series

Driving Incandescent Displays



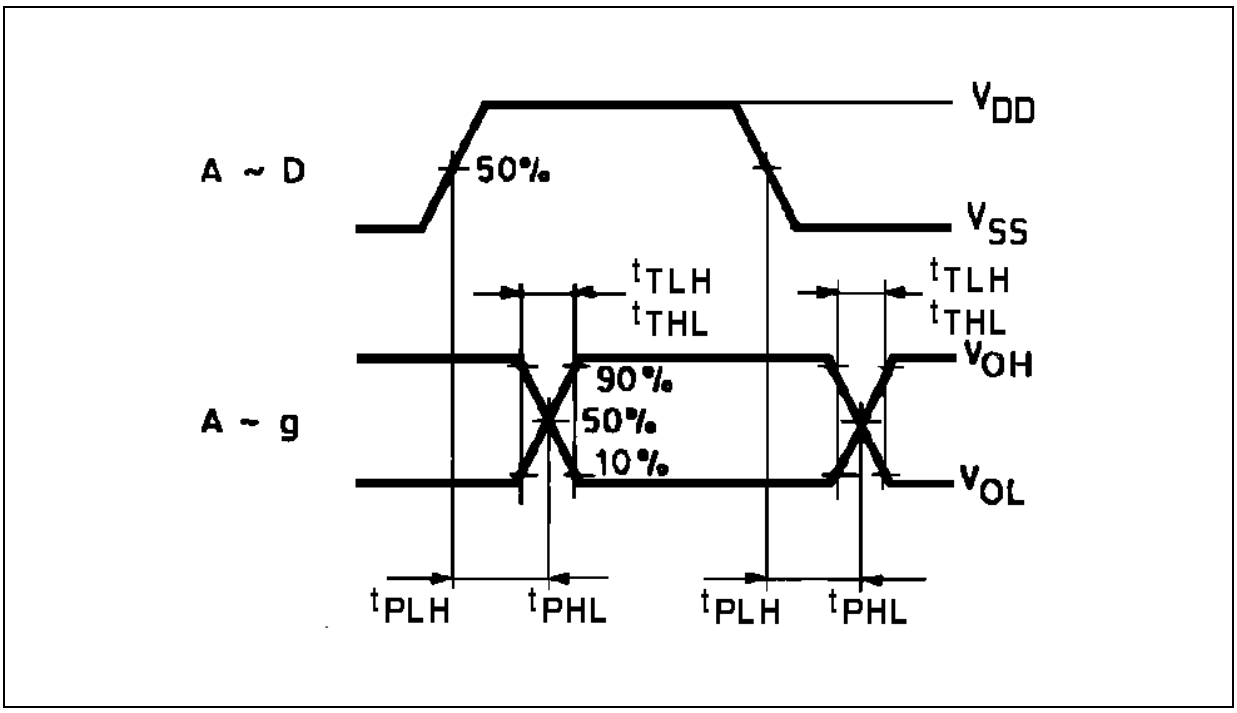
2 Of 7 Segment Shown Connected
Resistor R from VDD VDD to each 7-segment driver output are chosen to keep all Numitron segments slightly on and warm

TEST CIRCUIT

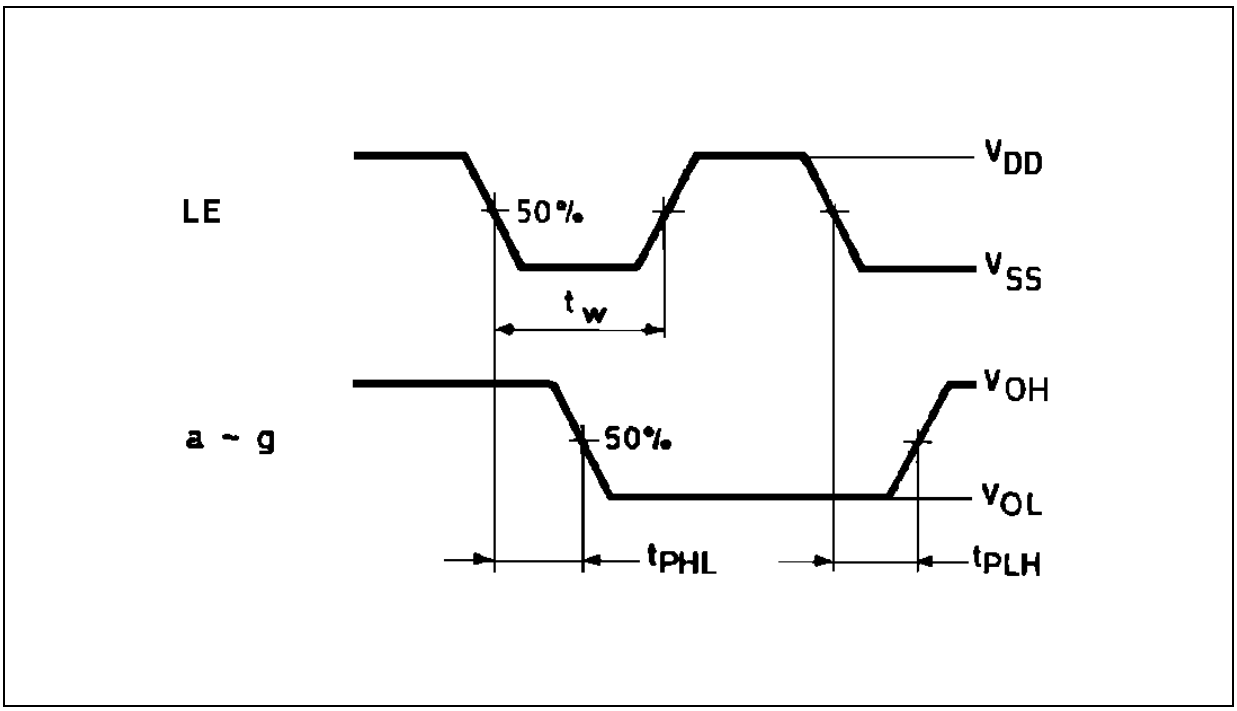


C_L = 50pF or equivalent (includes jig and probe capacitance)
R_L = 200KΩ
R_T = Z_{OUT} of pulse generator (typically 50Ω)

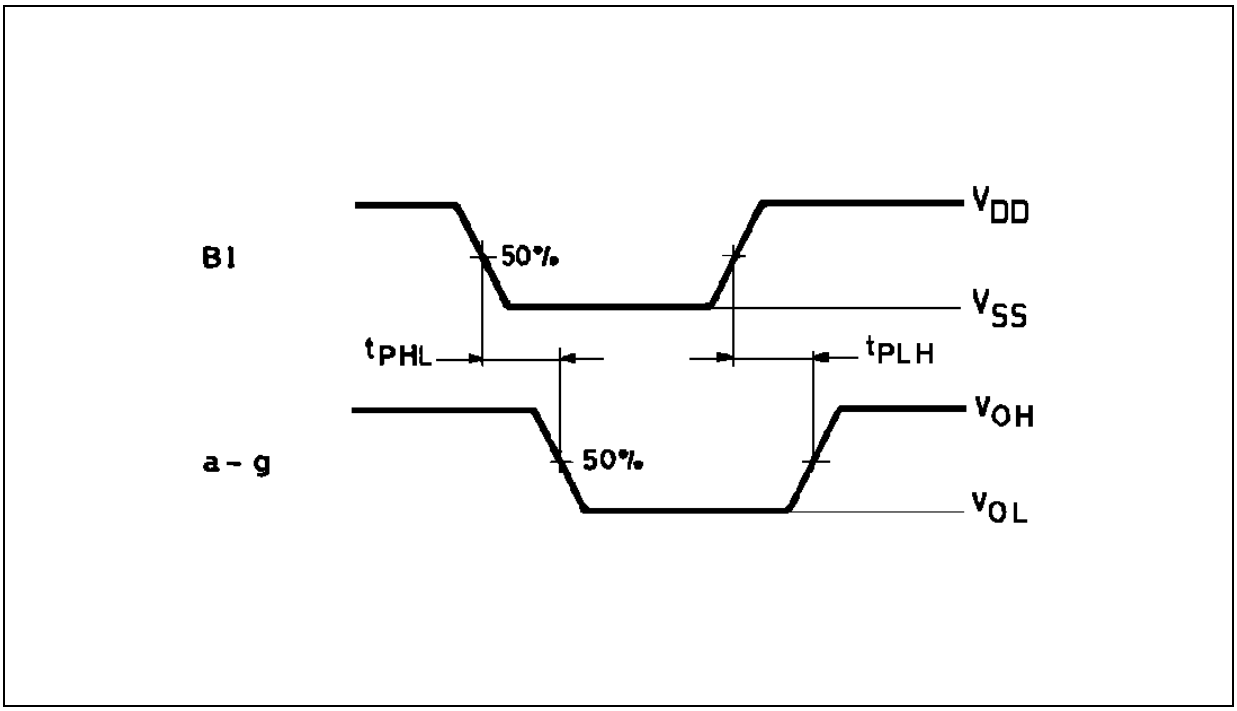
WAVEFORM 1 : PROPAGATION DELAY TIMES (f=1MHz; 50% duty cycle)



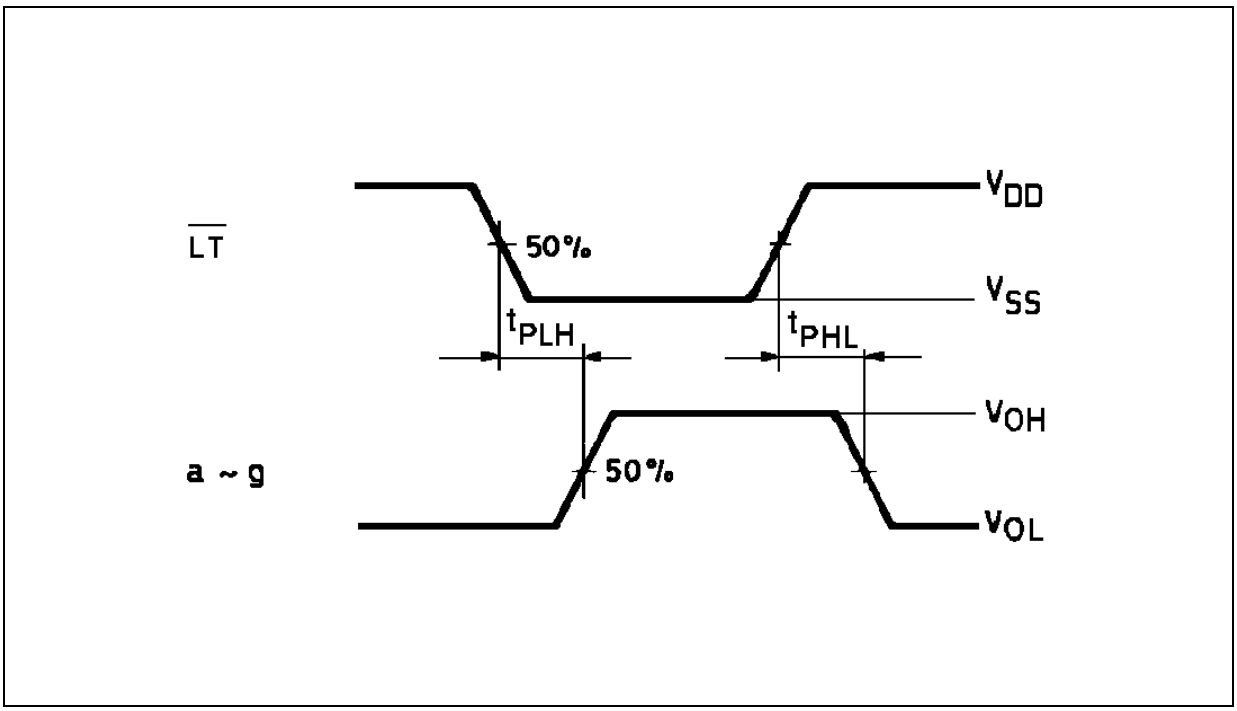
WAVEFORM 2 : MINIMUM PULSE WIDTH (f=1MHz; 50% duty cycle)



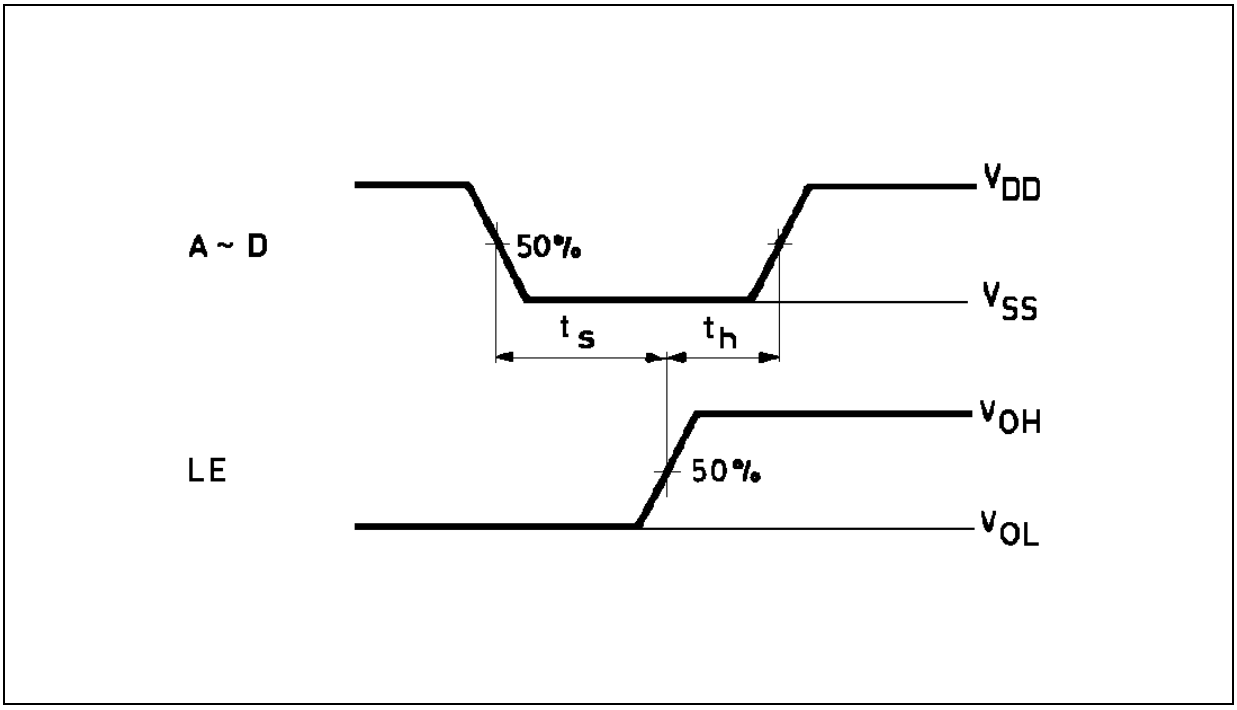
WAVEFORM 3 : PROPAGATION DELAY TIMES (f=1MHz; 50% duty cycle)



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

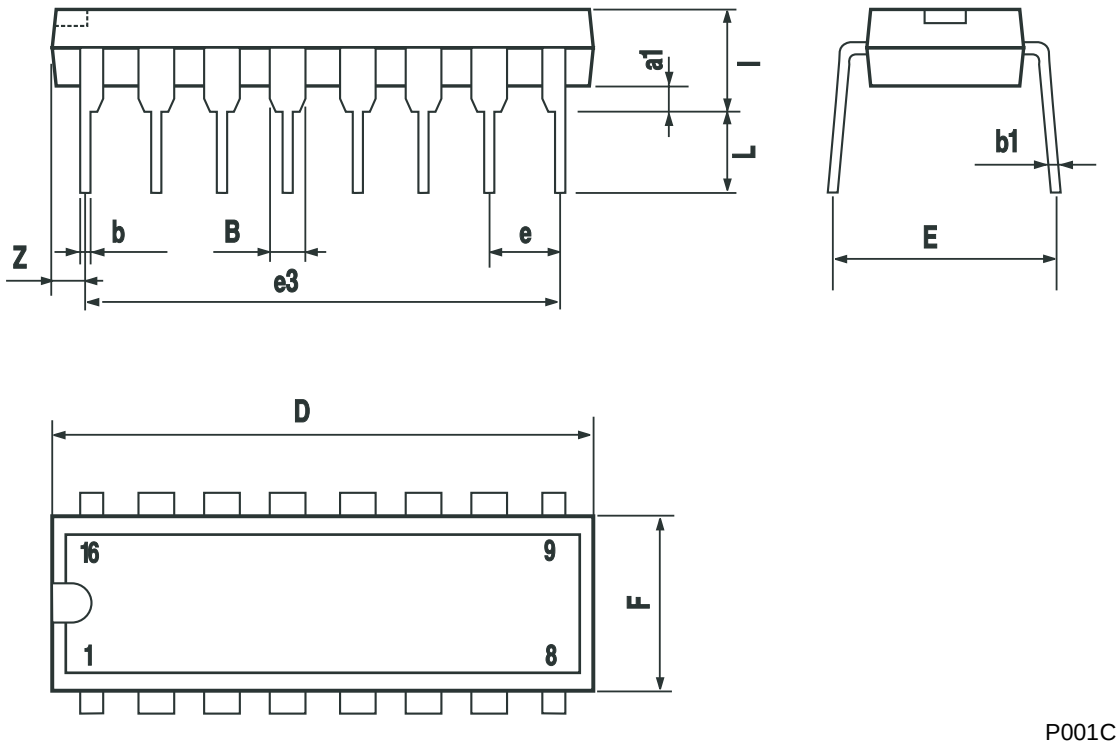


WAVEFORM 5 : MINIMUM SETUP AND HOLD TIME (f=1MHz; 50% duty cycle)



Plastic DIP-16 (0.25) MECHANICAL DATA

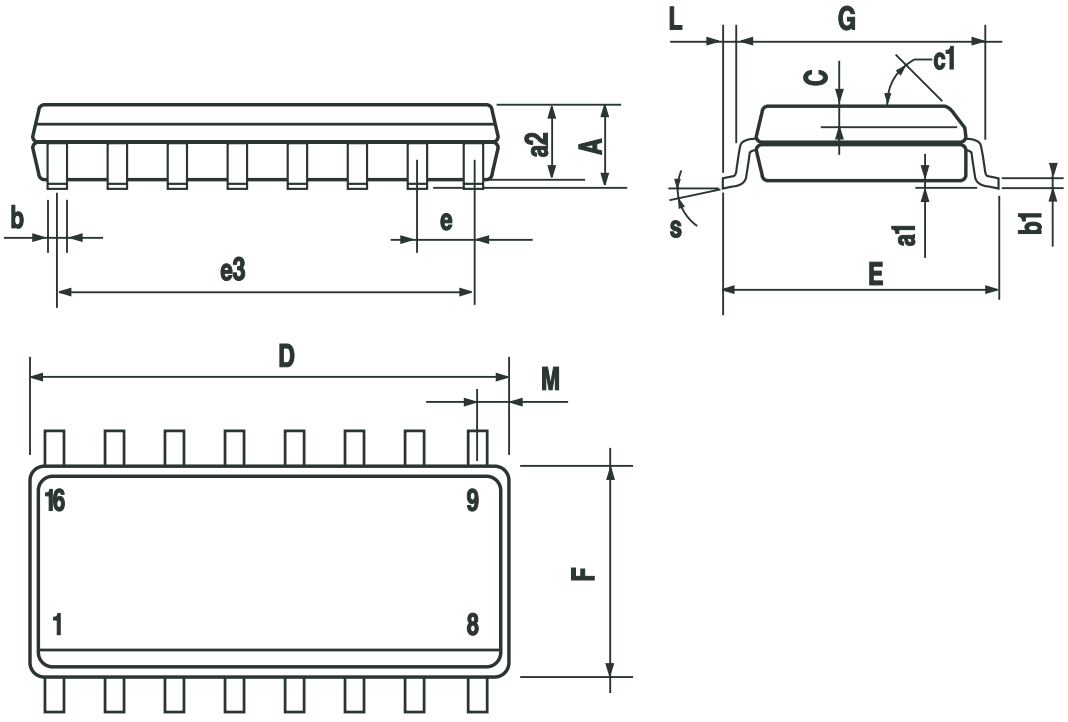
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

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.)					



PO13H