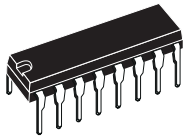
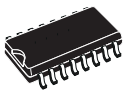
M74HC4511

BCD TO 7 SEGMENT LATCH/DECODER DRIVER

- HIGH SPEED:
  t_{PD}= 23ns (TYP.) at V_{CC} = 6V
- LOW POWER DISSIPATION:
  I_{CC} = 4µA(MAX.) at T_A=25°C
- HIGH NOISE IMMUNITY:
  $V_{NIH} = V_{NIL}$ = 28 % V_{CC} (MIN.)
- HIGH SOURGE CURRENT :
  $|I_{OH}|$ = 20 mA (MIN)
- BALANCED PROPAGATION DELAYS:
  $t_{PLH} \cong t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE:
  V_{CC} (OPR) = 2V to 6V
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 4511



DIP



SOP

TSSOP

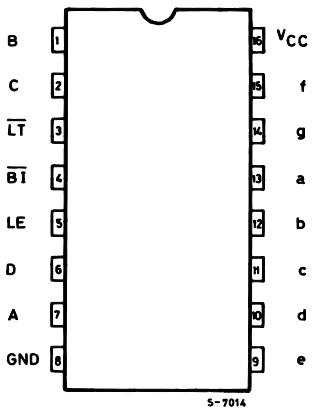
ORDER CODES

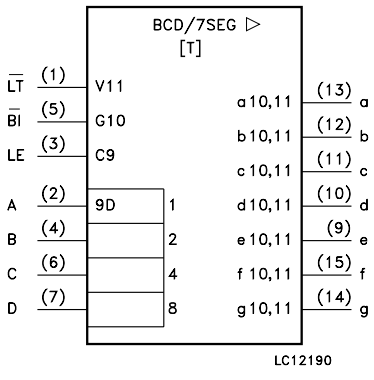
PACKAGE	TUBE	T & R
DIP	M74HC4511B1R	
SOP	M74HC4511M1R	M74HC4511RM13TR
TSSOP		M74HC4511TTR

DESCRIPTION

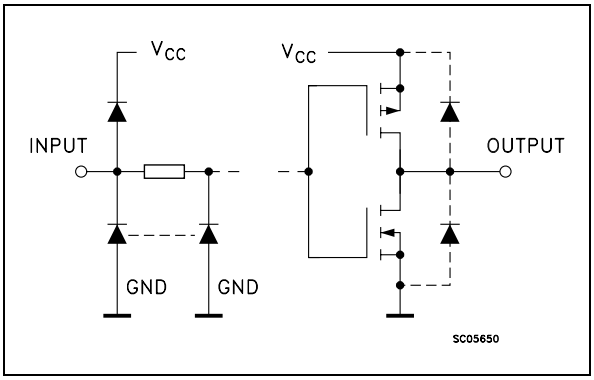
The M74HC4511 is an high speed CMOS BCD-TO-7 SEGMENT LATCH/DECODER/ DRIVER fabricated with silicon gate C^2MOS technology.
The segment output driver has large I_{OH} capability which enables common cathode leds to be directly driven.
When lamp test ($\overline{LT}$) is taken "L", all segment outputs will go to "H", and when blanking ($\overline{BI}$) is taken "L" and $\overline{LT}$ is taken "H" all segment outputs will go to "L".
These functions operate regardless of other inputs and are used to test the display.
Input BI is used to pulse-modulate the brightness of the display.
When an error input code (over 10) is applied to the BCD input, all segment outputs will go "L" (turn off).
All inputs are equipped with protection circuits against static discharge and transient excess voltage.

PIN CONNECTION AND IEC LOGIC SYMBOLS





INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

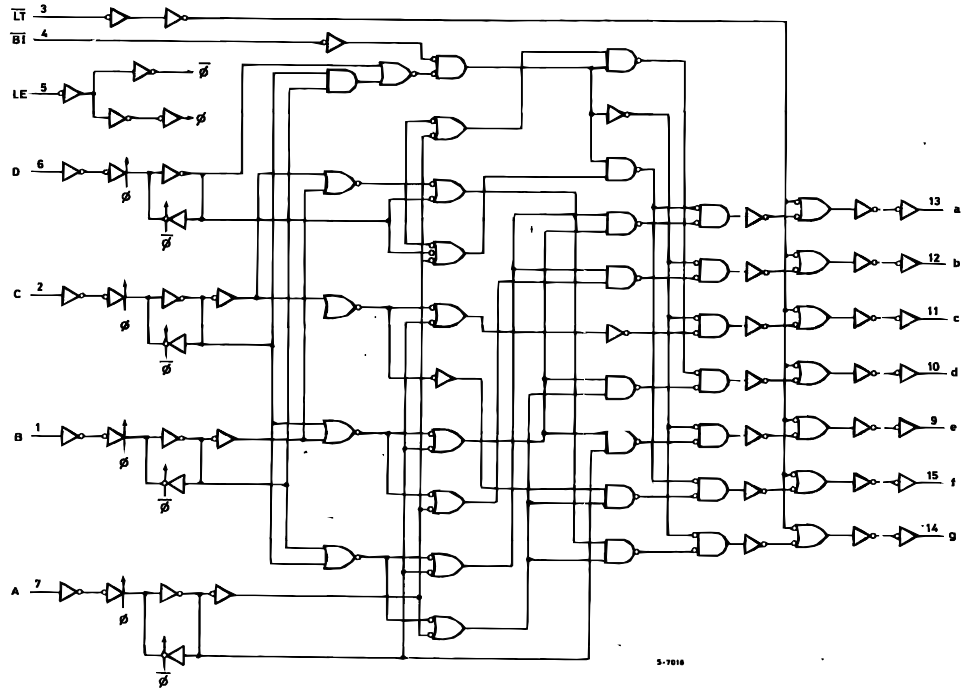
PIN No	SYMBOL	NAME AND FUNCTION
3	$\overline{LT}$	Lamp Test Input (Active LOW)
4	$\overline{BI}$	Ripple Blanking Input (Active LOW)
5	$\overline{LE}$	Latch Enable Input
7, 1, 2, 6	A to D	BCD Address Inputs
13, 12, 11, 10, 9, 15, 14	a to g	Segment Outputs
8	GND	Ground (0V)
16	V_{CC}	Positive Supply Voltage

TRUTH TABLE

INPUT							OUTPUT							DISPLAY MODE
$\overline{LE}$	$\overline{BI}$	$\overline{LT}$	D	C	B	A	a	b	c	d	e	f	g	
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	L	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	X	L	L	L	L	L	L	L	BLANK
L	H	H	H	H	X	X	L	L	L	L	L	L	L	BLANK
L	L	L	X	X	X	X	Hold the stage at the leading edge of LE							

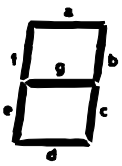
X : Don't Care

LOGIC DIAGRAM



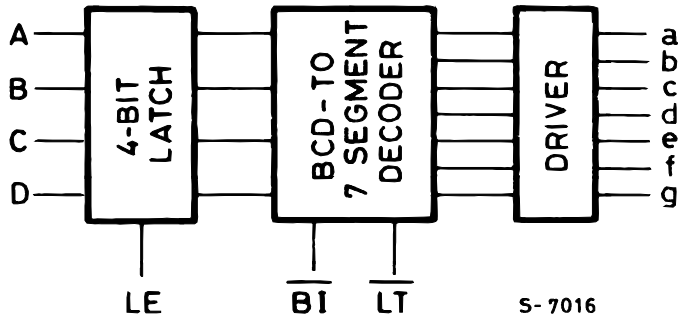
This logic diagram has not be used to estimate propagation delays

DISPLAY MODE



INPUT CODE										
	A	L	H	L	H	L	H	L	H	L	H
	B	L	L	H	H	L	L	H	H	L	L
	C	L	L	L	L	H	H	H	H	L	L
	D	L	L	L	L	L	L	L	L	H	H
DISPLAY		0	1	2	3	4	5	6	7	8	9
		0	1	2	3	4	5	6	7	8	9

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	-0.5 to +7	V
V_I	DC Input Voltage	-0.5 to V_{CC} + 0.5	V
V_O	DC Output Voltage	-0.5 to V_{CC} + 0.5	V
I_{IK}	DC Input Diode Current	± 20	mA
I_{OK}	DC Output Diode Current	± 20	mA
I_O	DC Output Current	-35/25	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	+150/-50	mA
P_D	Power Dissipation	500(*)	mW
T_{stg}	Storage Temperature	-65 to +150	°C
T_L	Lead Temperature (10 sec)	300	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied
(*) 500mW at 65 °C; derate to 300mW by 10mW/°C from 65°C to 85°C

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Value	Unit
V_{CC}	Supply Voltage		2 to 6	V
V_I	Input Voltage		0 to V_{CC}	V
V_O	Output Voltage		0 to V_{CC}	V
T_{op}	Operating Temperature		-55 to 125	°C
t_r, t_f	Input Rise and Fall Time	V_{CC} = 2.0V	0 to 1000	ns
		V_{CC} = 4.5V	0 to 500	ns
		V_{CC} = 6.0V	0 to 400	ns

DC SPECIFICATIONS

Symbol	Parameter	Test Condition		Value							Unit
		V_{CC} (V)		T_A = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
V_{IH}	High Level Input Voltage	2.0		1.5			1.5		1.5		V
		4.5		3.15			3.15		3.15		
		6.0		4.2			4.2		4.2		
V_{IL}	Low Level Input Voltage	2.0				0.5		0.5		0.5	V
		4.5				1.35		1.35		1.35	
		6.0				1.8		1.8		1.8	
V_{OH}	High Level Output Voltage	2.0	I_O=-20 µA	1.9	2.0		1.9		1.9		V
		4.5	I_O=-20 µA	4.4	4.5		4.4		4.4		
		6.0	I_O=-20 µA	5.9	6.0		5.9		5.9		
		4.5	I_O=-4.0 mA	4.18	4.31		4.13		4.10		
		6.0	I_O=-5.2 mA	5.68	5.8		5.63		5.60		
V_{OL}	Low Level Output Voltage	2.0	I_O=20 µA		0.0	0.1		0.1		0.1	V
		4.5	I_O=20 µA		0.0	0.1		0.1		0.1	
		6.0	I_O=20 µA		0.0	0.1		0.1		0.1	
		4.5	I_O=4.0 mA		0.17	0.26		0.37		0.40	
		6.0	I_O=5.2 mA		0.18	0.26		0.37		0.40	
I_I	Input Leakage Current	6.0	V_I = V_{CC} or GND			± 0.1		± 1		± 1	µA
I_{CC}	Quiescent Supply Current	6.0	V_I = V_{CC} or GND			4		40		80	µA

AC ELECTRICAL CHARACTERISTICS (C_L = 50 pF, Input $t_r = t_f$ = 6ns)

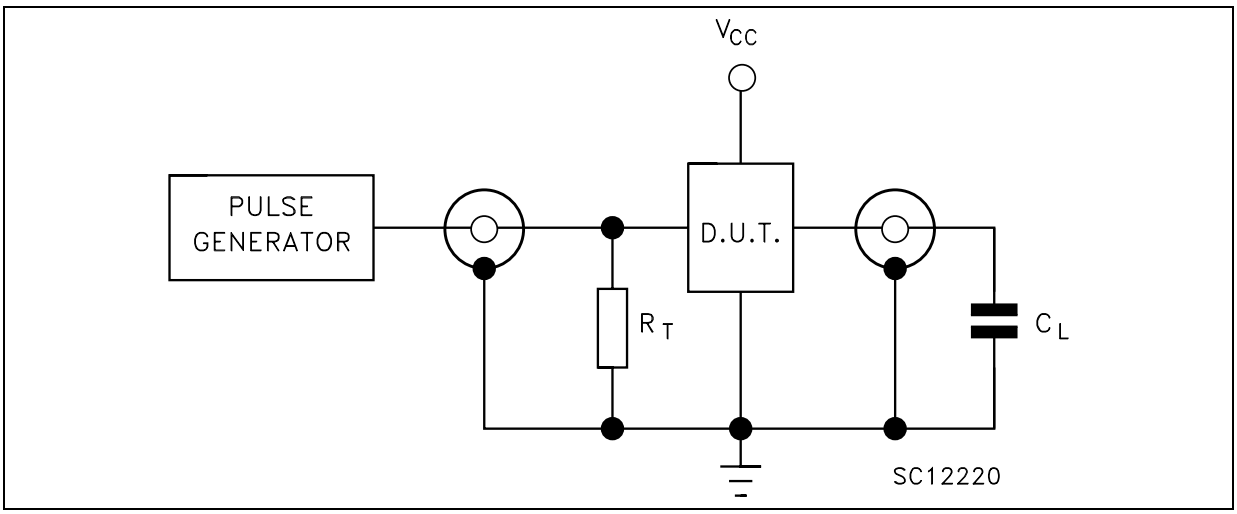
Symbol	Parameter	Test Condition		Value							Unit
		V_{CC} (V)		T_A = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t_{TLH}	Output Transition Time	2.0			25	60		75		90	ns
		4.5			7	12		15		18	
		6.0			6	11		13		15	
t_{THL}	Output Transition Time	2.0			30	75		95		110	ns
		4.5			8	15		19		22	
		6.0			7	13		16		19	
t_{PLH} t_{PHL}	Propagation Delay Time (BCD - Seg.)	2.0			125	255		320		385	ns
		4.5			33	51		64		77	
		6.0			23	43		54		65	
t_{PLH} t_{PHL}	Propagation Delay Time (BI - Seg.)	2.0			70	175		220		265	ns
		4.5			22	35		44		53	
		6.0			17	30		37		45	
t_{PLH} t_{PHL}	Propagation Delay Time ($\overline{LT}$ - Seg.)	2.0			60	120		150		180	ns
		4.5			15	24		30		36	
		6.0			12	20		26		31	
t_{PLH} t_{PHL}	Propagation Delay Time ($\overline{LE}$ - Seg.)	2.0			95	240		300		360	ns
		4.5			32	48		60		72	
		6.0			23	41		51		61	
$t_{W(L)}$	Minimum Pulse Width	2.0			30	75		95		110	ns
		4.5			8	15		19		22	
		6.0			7	13		16		19	
t_s	Minimum Set Up Time	2.0			20	75		95		110	ns
		4.5			5	15		19		22	
		6.0			4	13		16		19	
t_h	Minimum Hold Time	2.0				0		0		0	ns
		4.5				0		0		0	
		6.0				0		0		0	

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Condition		Value							Unit
		V_{CC} (V)		T_A = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
C_{IN}	Input Capacitance	5.0			5	10		10		10	pF
C_{PD}	Power Dissipation Capacitance (note 1)	5.0			95						pF

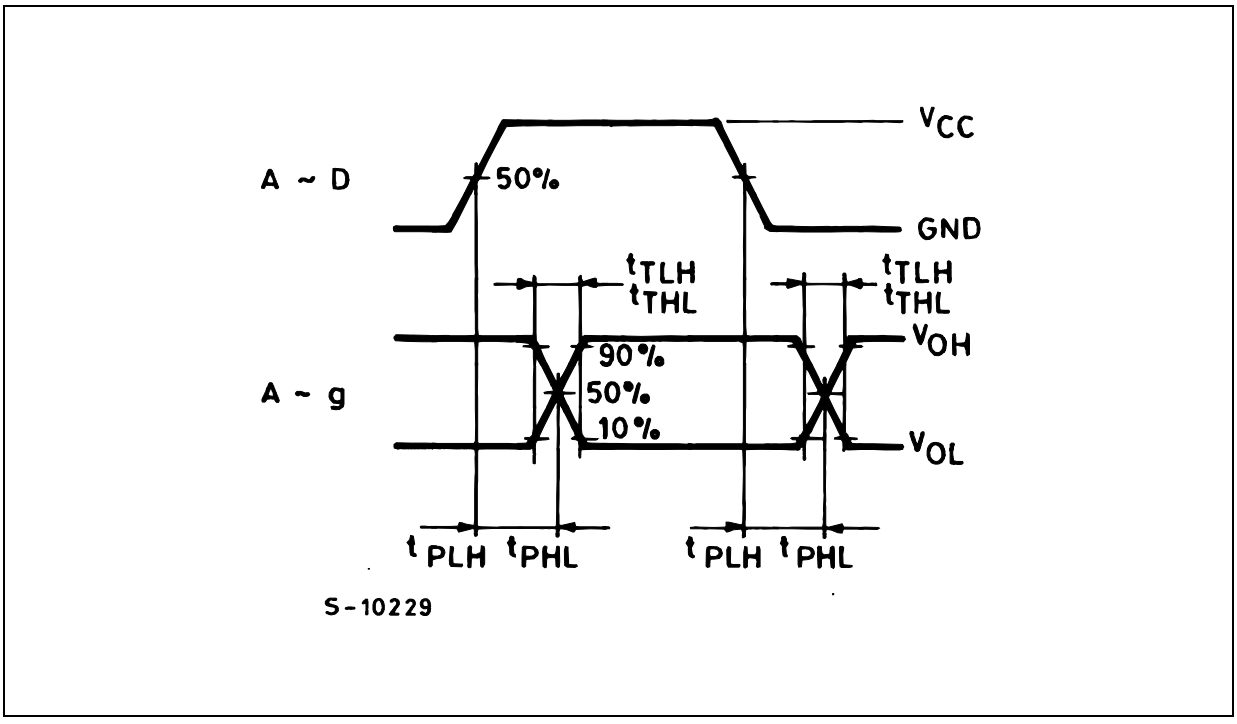
1) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}$

TEST CIRCUIT

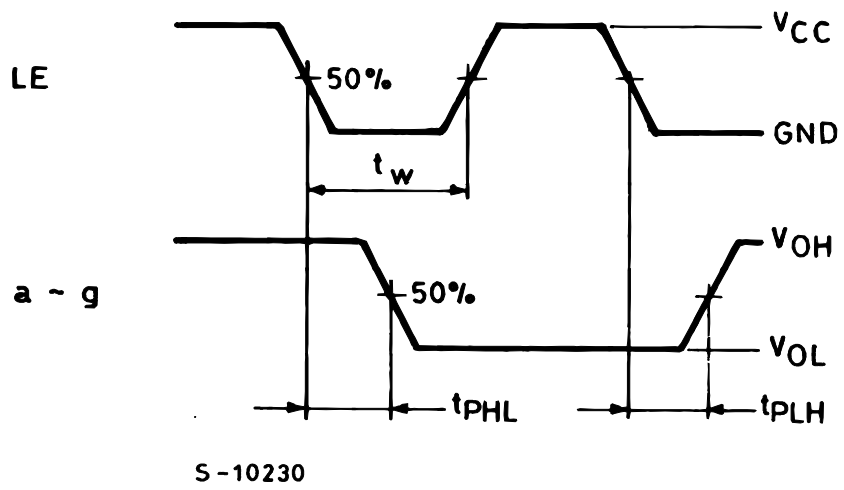


C_L = 50pF or equivalent (includes jig and probe capacitance)
R_T = Z_{OUT} of pulse generator (typically 50Ω)

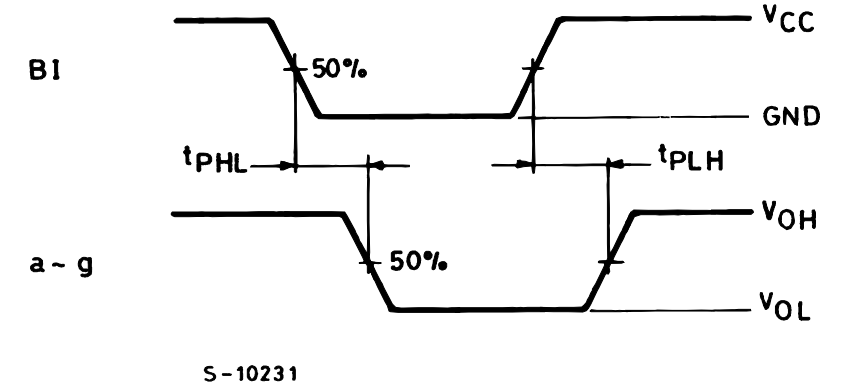
WAVEFORM 1 : PROPAGATION DELAY TIMES (f=1MHz; 50% duty cycle)



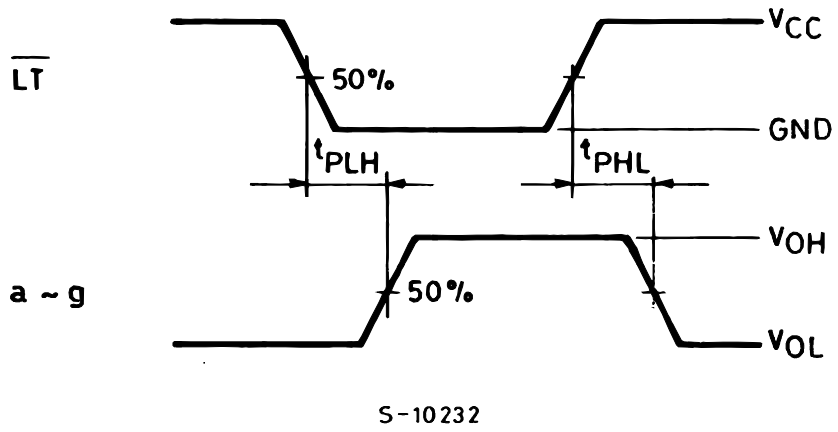
WAVEFORM 2 : MINIMUM PULSE WIDTH (f=1MHz; 50% duty cycle)



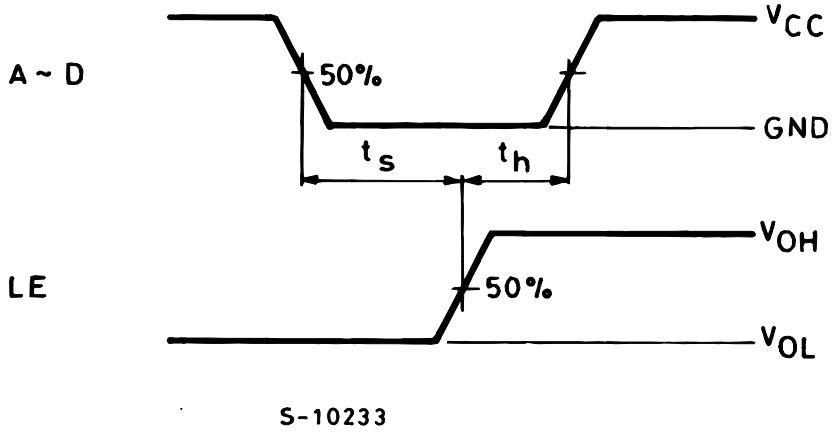
WAVEFORM 3 : PROPAGATION DELAY TIMES (f=1MHz; 50% duty cycle)



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

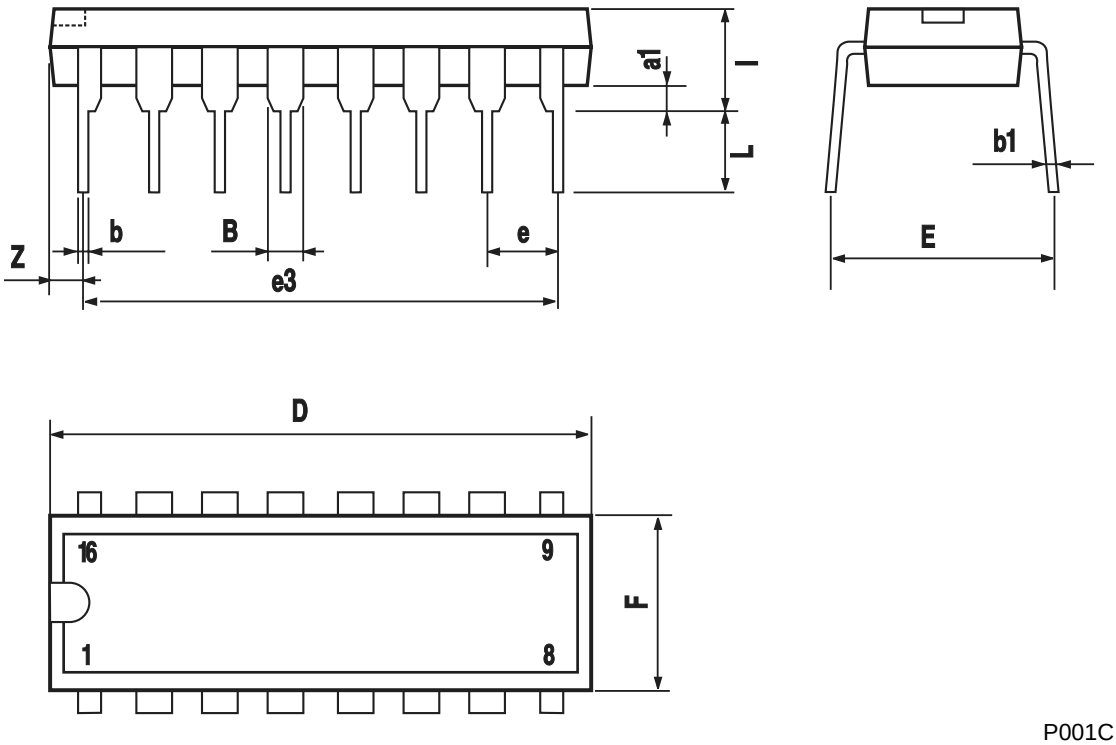


WAVEFORM 5 : MINIMUM SETUP AND HOLD TIME (f=1MHz; 50% duty cycle)



Plastic DIP-16 (0.25) MECHANICAL DATA

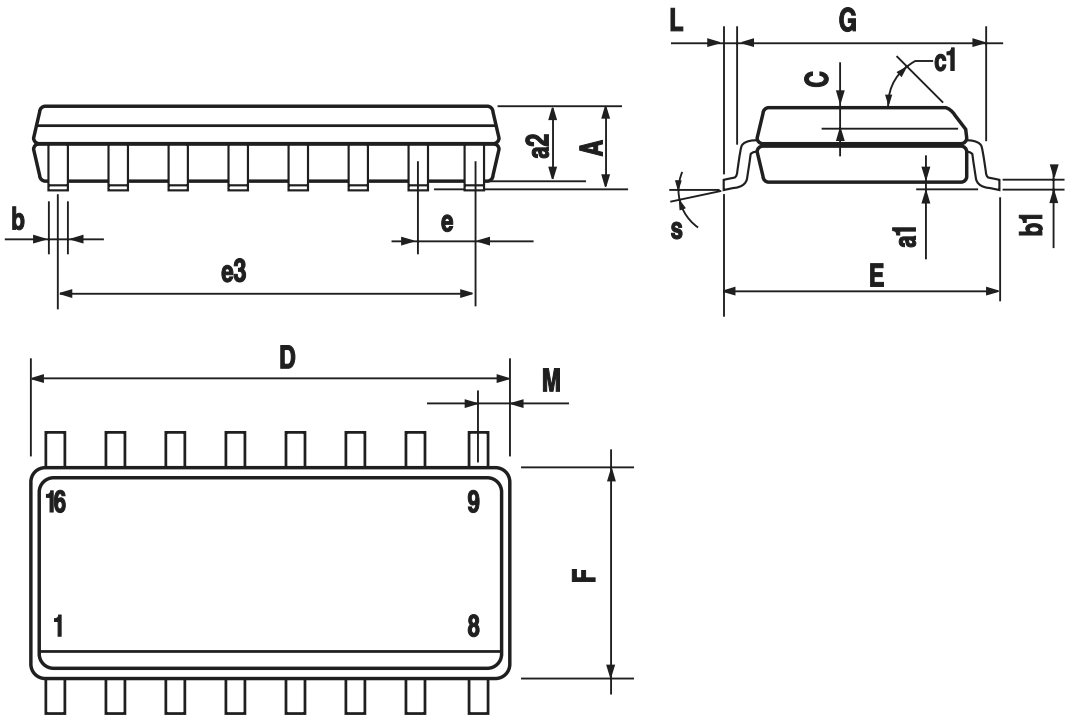
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



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

TSSOP16 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.2			0.047
A1	0.05		0.15	0.002	0.004	0.006
A2	0.8	1	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.012
c	0.09		0.20	0.004		0.0089
D	4.9	5	5.1	0.193	0.197	0.201
E	6.2	6.4	6.6	0.244	0.252	0.260
E1	4.3	4.4	4.48	0.169	0.173	0.176
e		0.65 BSC			0.0256 BSC	
K	0°		8°	0°		8°
L	0.45	0.60	0.75	0.018	0.024	0.030