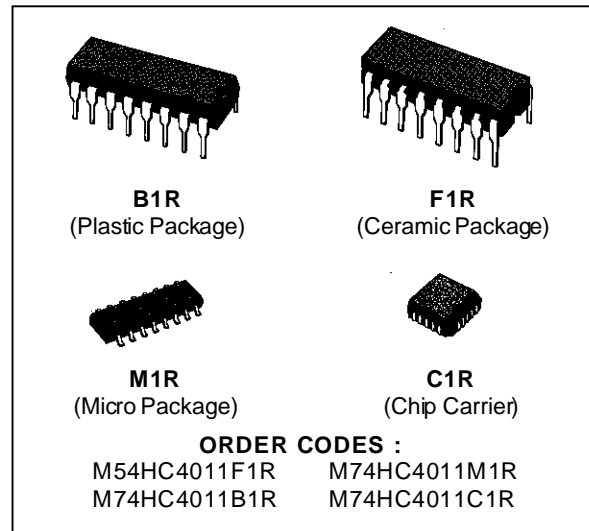


## BCD TO 7 SEGMENT LATCH/DECODER DRIVER

- HIGH SPEED  
 $t_{PD} = 28 \text{ ns (TYP.) AT } V_{CC} = 5 \text{ V}$
- LOW POWER DISSIPATION  
 $I_{CC} = 4 \mu\text{A (MAX.) AT } T_A = 25 \text{ }^\circ\text{C}$
- HIGH NOISE IMMUNITY  
 $V_{NIH} = V_{NIL} = 28 \% V_{CC} \text{ (MIN.)}$
- OUTPUT DRIVE CAPABILITY  
 10 LSTTL LOADS
- HIGH SOURCE CURRENT  
 $|I_{OH}| = 20 \text{ mA (MIN.)}$
- BALANCED PROPAGATION DELAYS  
 $t_{PLH} = t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE  
 $V_{CC} \text{ (OPR)} = 2 \text{ V TO } 6 \text{ V}$
- PIN AND FUNCTION COMPATIBLE  
 WITH 4511B



### DESCRIPTION

The M54/74HC4511 is a high speed CMOS BCD-TO-7 SEGMENT LATCH/DECODER/DRIVER fabricated with silicon gate C<sup>2</sup>MOS technology. It enables high speed latch and decode operation with identical pin connection and function to standard CMOS 4511B.

The segment output driver, which is CMOS fabricated in silicon gate C<sup>2</sup>MOS technology, has large I<sub>OH</sub> 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".

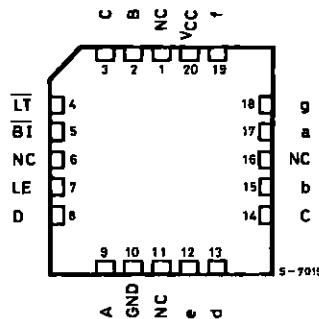
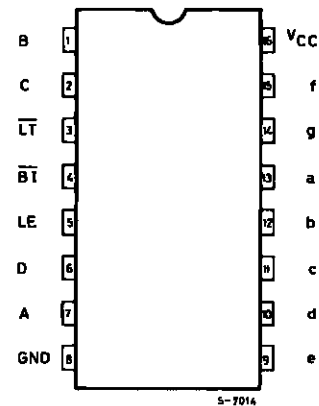
These functions operate regardless of other inputs and are used to test the display.

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 CONNECTIONS (top view)



NC =  
No Internal  
Connection

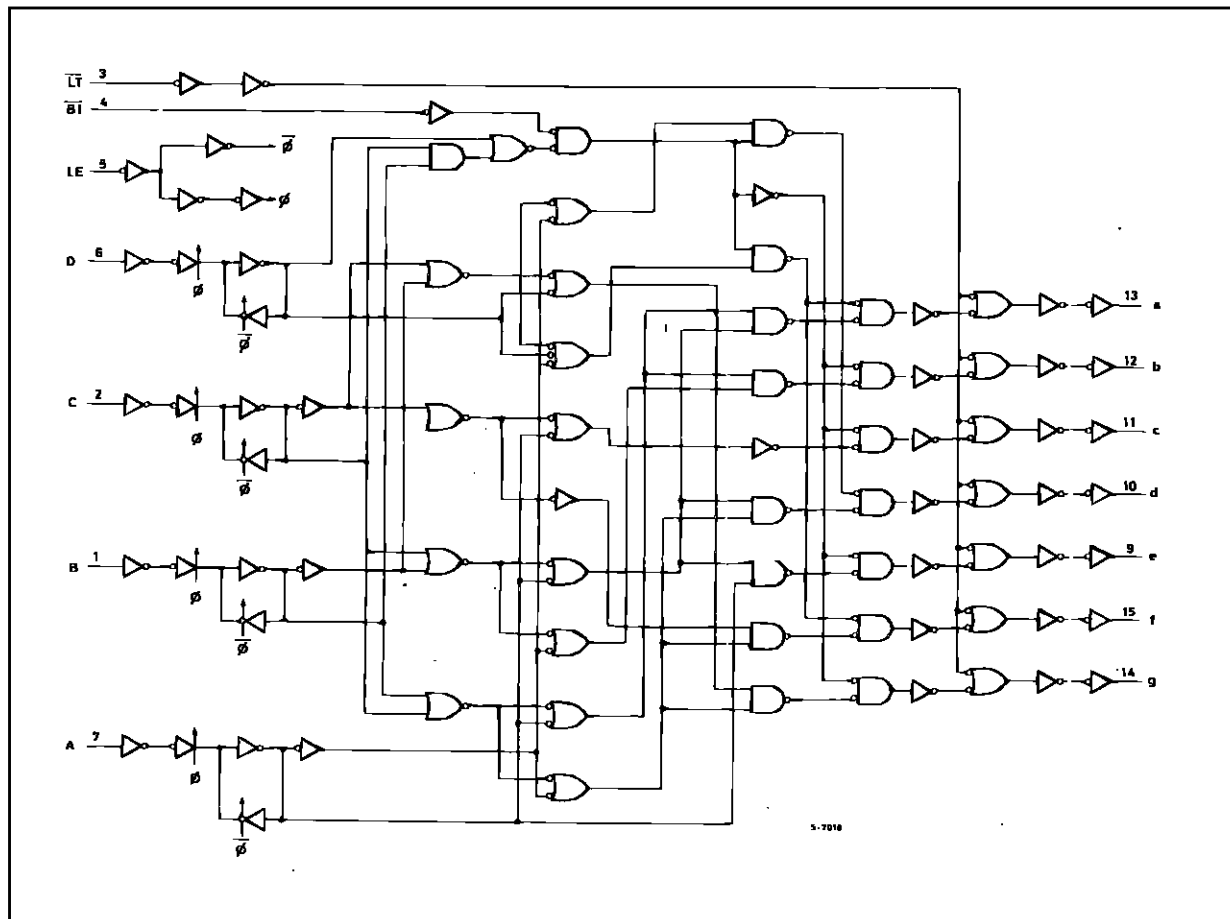
# M54/M74HC4511

## TRUTH TABLE

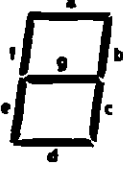
INPUTS							OUTPUTD							DISPLAY MODE
LE	BI	LT	D	C	B	A	a	b	c	d	e	f	g	
X	X	L	X	X	X	X	H	H	H	H	H	H	H	8
X	L	H	X	X	X	X	L	L	L	L	L	L	L	BLANK
L	H	H	L	L	L	L	H	H	H	H	H	H	L	0
L	H	H	L	L	L	H	L	H	H	L	L	L	L	1
L	H	H	L	L	H	L	H	H	L	H	H	L	H	2
L	H	H	L	L	H	H	H	H	H	H	L	L	H	3
L	H	H	L	H	L	L	L	H	H	L	L	H	H	4
L	H	H	L	H	L	H	H	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
H	H	H	X	X	X	X	Hold the stage at the leading edge of LE							

X: Don't Care

## LOGIC DIAGRAM

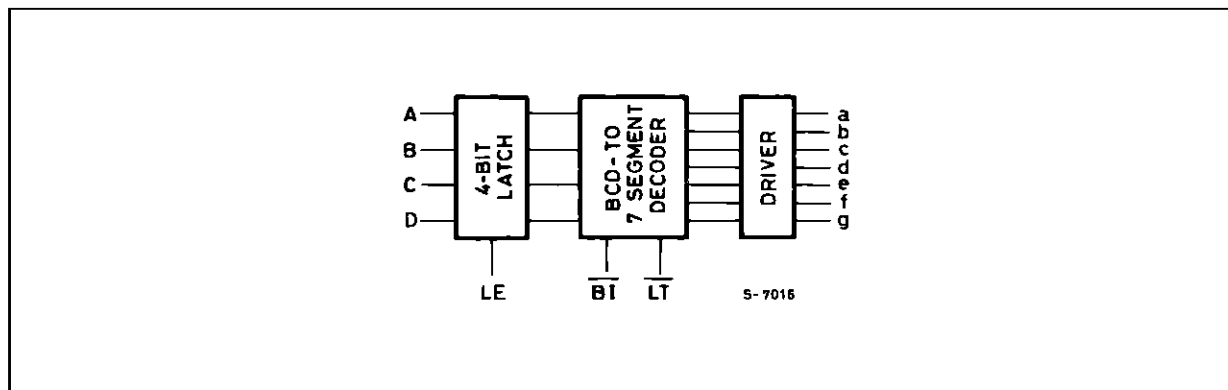


## DISPLAY MODE

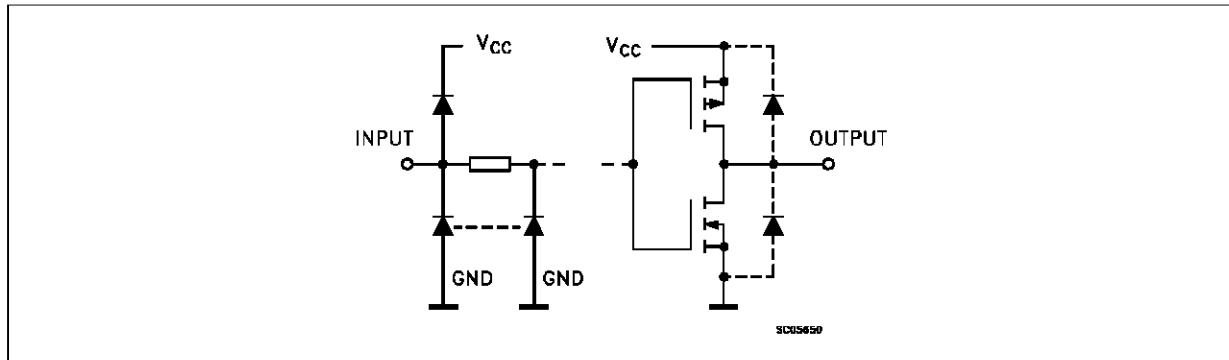


INPUT CODE	A	L	H	L	H	L	H	L	H	L	H
	B	L	L	H	H	L	L	H	H	L	L
	C	L	L	L	L	H	H	H	H	L	L
	D	L	L	L	L	L	L	L	L	L	H
DISPLAY		0	1	2	3	4	5	6	7	8	9

## BLOCK DIAGRAM



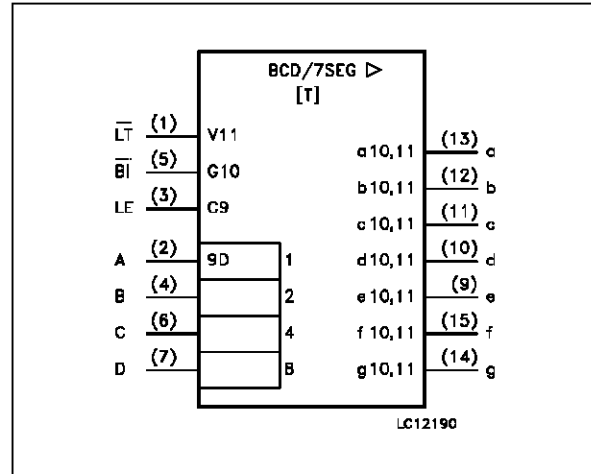
INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
3	LT	Lamp Test Input (Active LOW)
4	BI	Ripple Blanking Input (Active LOW)
5	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	Vcc	Positive Supply Voltage

IEC LOGIC SYMBOL



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply Voltage	-0.5 to +7	V
V <sub>I</sub>	DC Input Voltage	-0.5 to V <sub>CC</sub> + 0.5	V
V <sub>O</sub>	DC Output Voltage	-0.5 to V <sub>CC</sub> + 0.5	V
I <sub>IK</sub>	DC Input Diode Current	± 20	mA
I <sub>OK</sub>	DC Output Diode Current	± 20	mA
I <sub>O</sub>	DC Output Source Sink Current Per Output Pin	-35/25	mA
I <sub>CC</sub> or I <sub>GND</sub>	DC V <sub>CC</sub> or Ground Current	+150/-50	mA
P <sub>D</sub>	Power Dissipation	500 (*)	mW
T <sub>stg</sub>	Storage Temperature	-65 to +150	°C
T <sub>L</sub>	Lead Temperature (10 sec)	300	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.  
 (\*) 500 mW: ≅ 65 °C derate to 300 mW by 10mW/°C: 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: <b>M54HC Series</b> <b>M74HC Series</b>	-55 to +125 -40 to +85	°C °C
$t_r, t_f$	Input Rise and Fall Time	$V_{CC} = 2\text{ V}$	0 to 1000
		$V_{CC} = 4.5\text{ V}$	0 to 500
		$V_{CC} = 6\text{ V}$	0 to 400

## DC SPECIFICATIONS

Symbol	Parameter	Test Conditions		Value						Unit		
				$T_A = 25\text{ °C}$ 54HC and 74HC			$-40\text{ to }85\text{ °C}$ 74HC		$-55\text{ to }125\text{ °C}$ 54HC			
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.	
$V_{IH}$	High Level Input Voltage	2.0 4.5 6.0		1.5			1.5		1.5		V	
				3.15			3.15		3.15			
				4.2			4.2		4.2			
$V_{IL}$	Low Level Input Voltage	2.0 4.5 6.0				0.5		0.5		0.5	V	
						1.35		1.35		1.35		
						1.8		1.8		1.8		
$V_{OH}$	High Level Output Voltage	2.0 4.5 6.0 4.5 6.0	$V_I = V_{IH}$ or $V_{IL}$	$I_O = -20\text{ }\mu\text{A}$	1.9	2.0		1.9		1.9	V	
					4.4	4.5		4.4		4.4		
					5.9	6.0		5.9		5.9		
				$I_O = -4.0\text{ mA}$	3.2	3.8		2.9				
					$I_O = -5.2\text{ mA}$	5.68	5.8		5.63			5.60
$V_{OL}$	Low Level Output Voltage	2.0 4.5 6.0 4.5 6.0	$V_I = V_{IH}$ or $V_{IL}$	$I_O = 20\text{ }\mu\text{A}$		0.0	0.1		0.1		0.1	V
						0.0	0.1		0.1		0.1	
						0.0	0.1		0.1		0.1	
				$I_O = 4.0\text{ mA}$		0.17	0.26		0.37		0.40	
					$I_O = 5.2\text{ mA}$		0.18	0.26		0.37		
$I_I$	Input Leakage Current	6.0	$V_I = V_{CC}$ or GND			$\pm 0.1$		$\pm 1$		$\pm 1$	$\mu\text{A}$	
$I_{CC}$	Quiescent Supply Current	6.0	$V_I = V_{CC}$ or GND			4		40		80	$\mu\text{A}$	

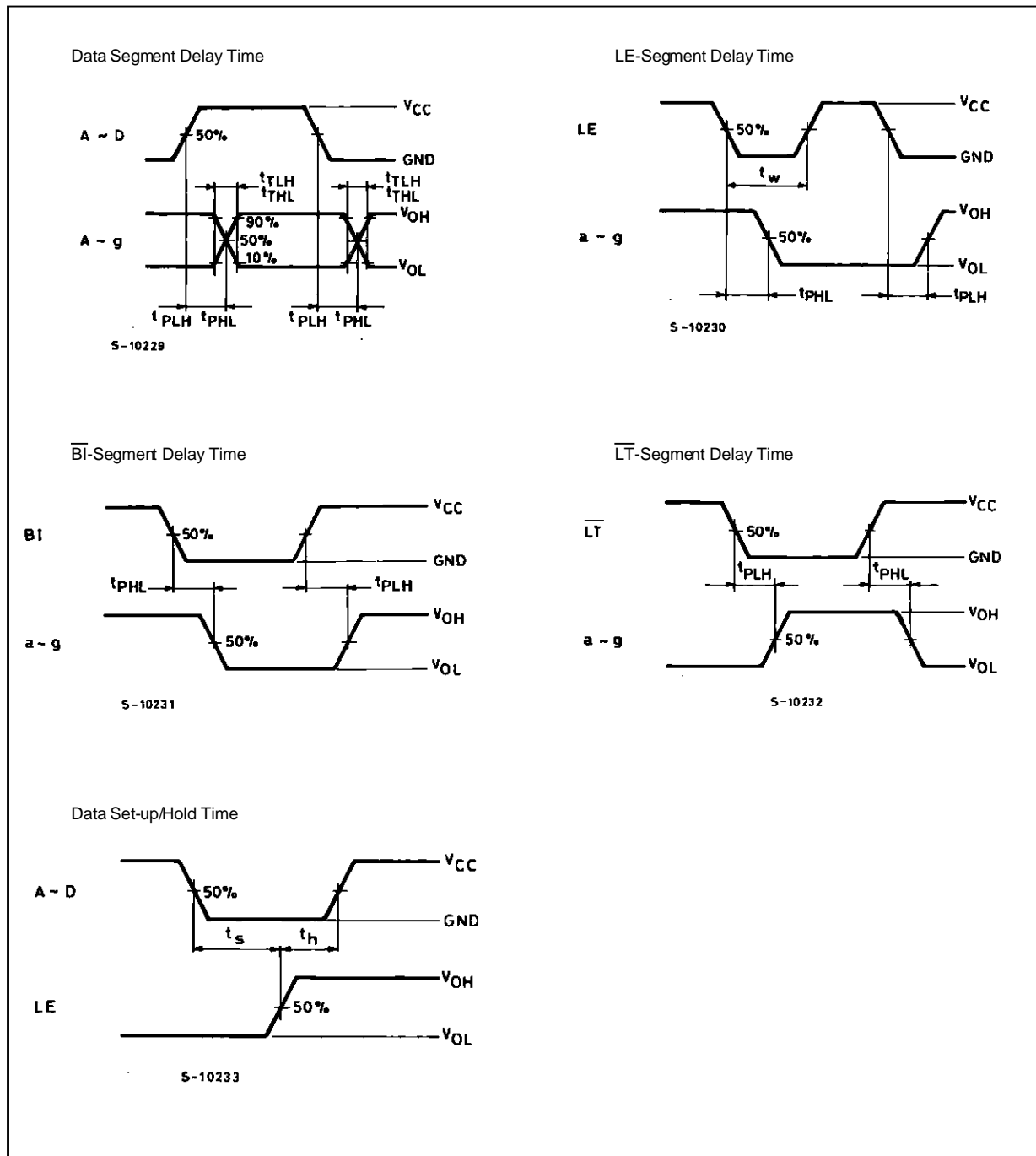
## M54/M74HC4511

### AC ELECTRICAL CHARACTERISTICS ( $C_L = 50 \text{ pF}$ , Input $t_r = t_f = 6 \text{ ns}$ )

Symbol	Parameter	Test Conditions		Value						Unit	
		V <sub>CC</sub> (V)		T <sub>A</sub> = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
t <sub>TLH</sub>	Output Transition Time	2.0			25	60		75		90	ns
		4.5			7	12		15		18	
		6.0			6	11		13		15	
t <sub>THL</sub>	Output Transition Time	2.0			30	75		95		110	ns
		4.5			8	15		19		22	
		6.0			7	13		16		19	
t <sub>PLH</sub> t <sub>PHL</sub>	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 <sub>PLH</sub> t <sub>PHL</sub>	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 <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay Time (LT - Seg.)	2.0			60	120		150		180	ns
		4.5			15	24		30		36	
		6.0			12	20		26		31	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay Time (LE - Seg.)	2.0			95	240		300		360	ns
		4.5			32	48		60		72	
		6.0			23	41		51		61	
t <sub>W(L)</sub>	Minimum Pulse Width	2.0			30	75		95		110	ns
		4.5			8	15		19		22	
		6.0			7	13		16		19	
t <sub>s</sub>	Minimum Set-up Time	2.0			20	75		95		110	ns
		4.5			5	15		19		22	
		6.0			4	13		16		19	
t <sub>h</sub>	Minimum Hold Time	2.0				0		0		0	ns
		4.5				0		0		0	
		6.0				0		0		0	
C <sub>IN</sub>	Input Capacitance				5	10		10		10	pF
C <sub>PD</sub> (*)	Power Dissipation Capacitance				95						pF

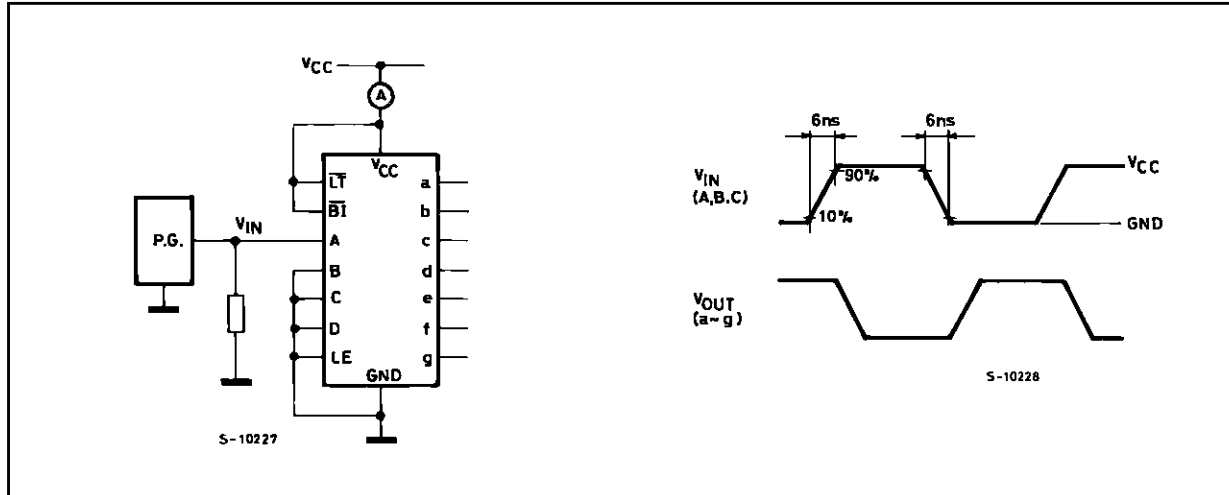
(\*) C<sub>PD</sub> is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation.  $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2$  (per FLIP/FLOP)

SWITCHING CHARACTERISTICS TEST WAVEFORM



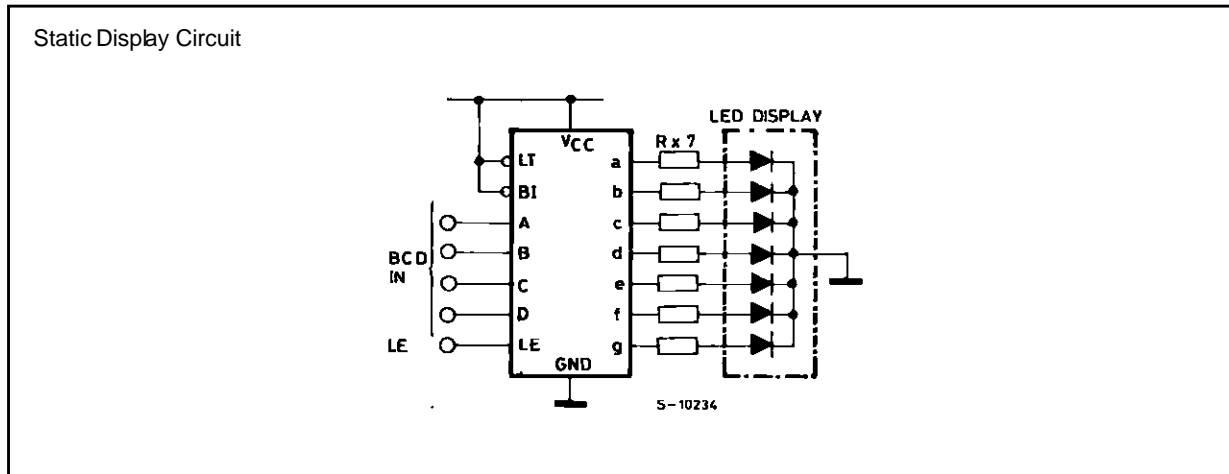
# M54/M74HC4511

## TEST CIRCUIT $I_{CC}$ (Opr.)



## APPLICATION CIRCUIT

### Static Display Circuit





## Plastic DIP16 (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



**Ceramic DIP16/1 MECHANICAL DATA**

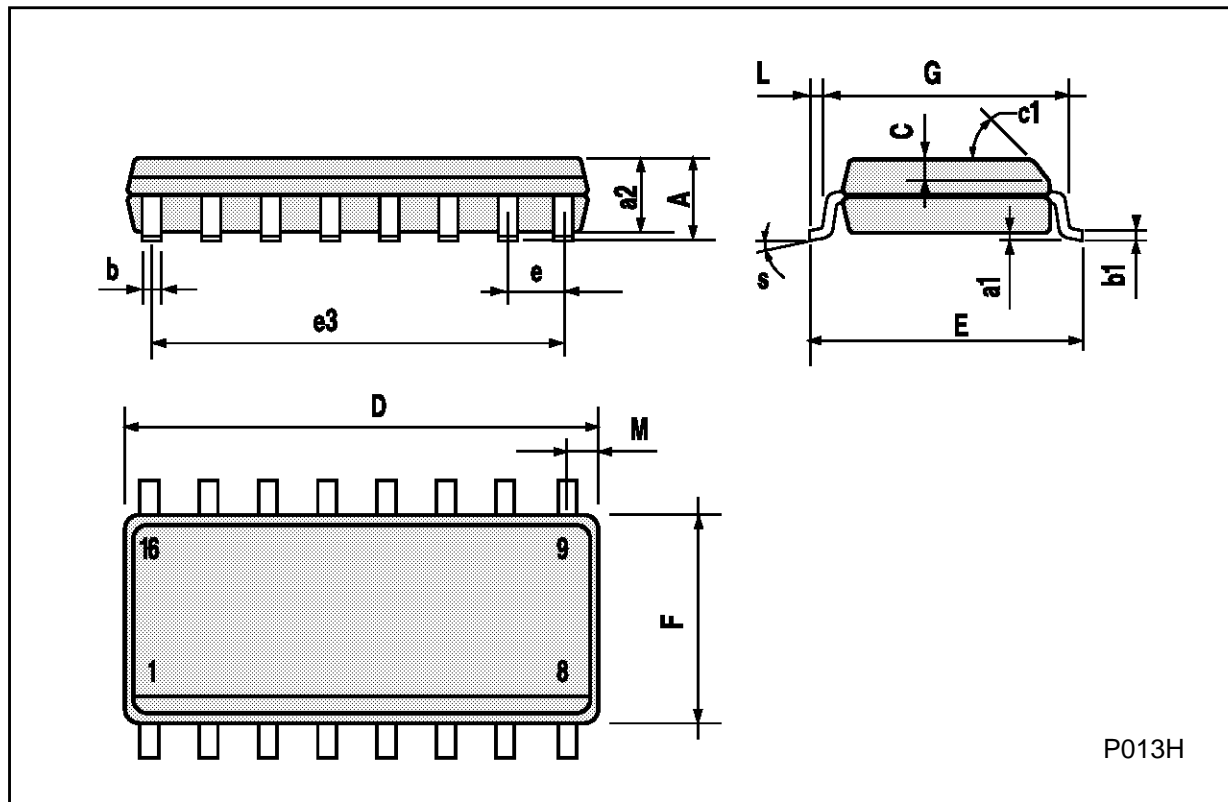
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			20			0.787
B			7			0.276
D		3.3			0.130	
E	0.38			0.015		
e3		17.78			0.700	
F	2.29		2.79	0.090		0.110
G	0.4		0.55	0.016		0.022
H	1.17		1.52	0.046		0.060
L	0.22		0.31	0.009		0.012
M	0.51		1.27	0.020		0.050
N			10.3			0.406
P	7.8		8.05	0.307		0.317
Q			5.08			0.200



P053D

## SO16 (Narrow) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.004		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.)					



P013H

**PLCC20 MECHANICAL DATA**

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	9.78		10.03	0.385		0.395
B	8.89		9.04	0.350		0.356
D	4.2		4.57	0.165		0.180
d1		2.54			0.100	
d2		0.56			0.022	
E	7.37		8.38	0.290		0.330
e		1.27			0.050	
e3		5.08			0.200	
F		0.38			0.015	
G			0.101			0.004
M		1.27			0.050	
M1		1.14			0.045	



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