

OCTAL BUS BUFFER WITH 3 STATE OUTPUTS
HC540: INVERTED - HC541 NON INVERTED

- HIGH SPEED
 $t_{PD} = 10 \text{ ns (TYP.) at } V_{CC} = 5V$
- LOW POWER DISSIPATION
 $I_{CC} = 4 \mu A \text{ (MAX.) at } T_A = 25^\circ C$
- HIGH NOISE IMMUNITY
 $V_{NIH} = V_{INL} = 28\% V_{CC} \text{ (MIN.)}$
- OUTPUT DRIVE CAPABILITY
 15 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE
 $|I_{OH}| = I_{OL} = 6 \text{ mA (MIN)}$
- BALANCED PROPAGATION DELAYS
 $t_{PLH} = t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE
 $V_{CC} \text{ (OPR)} = 2V \text{ to } 6V$
- PIN AND FUNCTION COMPATIBLE
 WITH 54/74LS540/541



DESCRIPTION

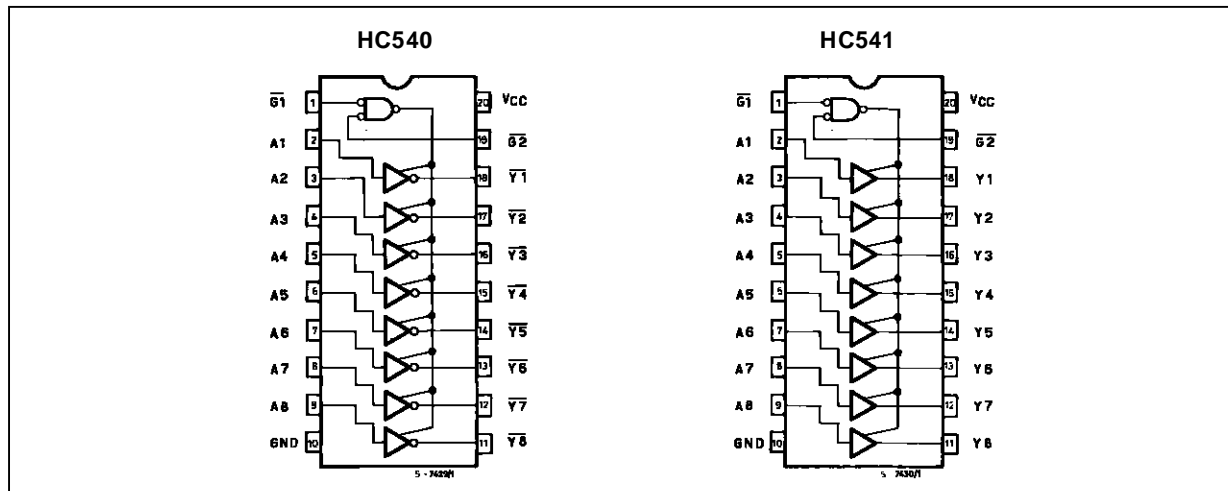
The M54/74HC540 and HC541 are high speed CMOS OCTAL BUS BUFFERS (3-STATE) fabricated in silicon gate C²MOS technology. They have the same high speed performance of LSTTL combined with true CMOS low power consumption. The HC540 is an inverting buffer and HC541 is a non inverting buffer.

The 3 STATE control gate operates as a two input AND such that if either G₁ and G₂ are high, all eight output are in the high impedance state. In order to

enhance PC board layout, the HC540 and HC541 offers a pinout having inputs and outputs on opposite sides of the package.

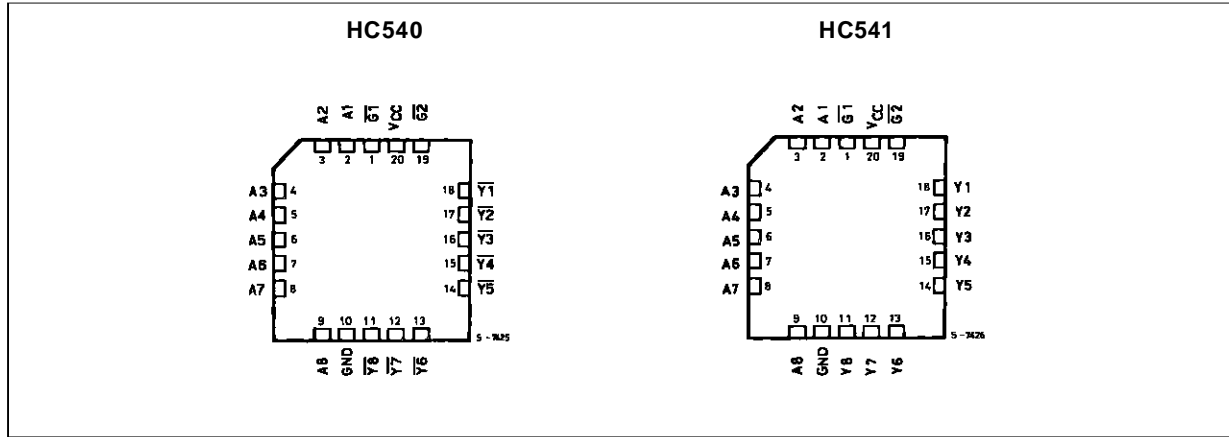
All inputs are equipped with protection circuits against static discharge and transient excess voltage.

PIN CONNECTION (top view)

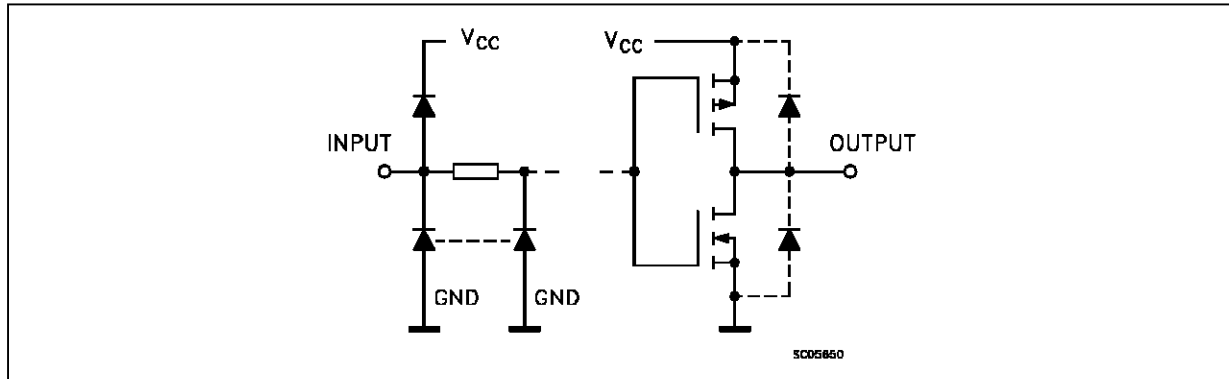


M54/M74HC540/541

CHIP CARRIER



INPUT AND OUTPUT EQUIVALENT CIRCUIT



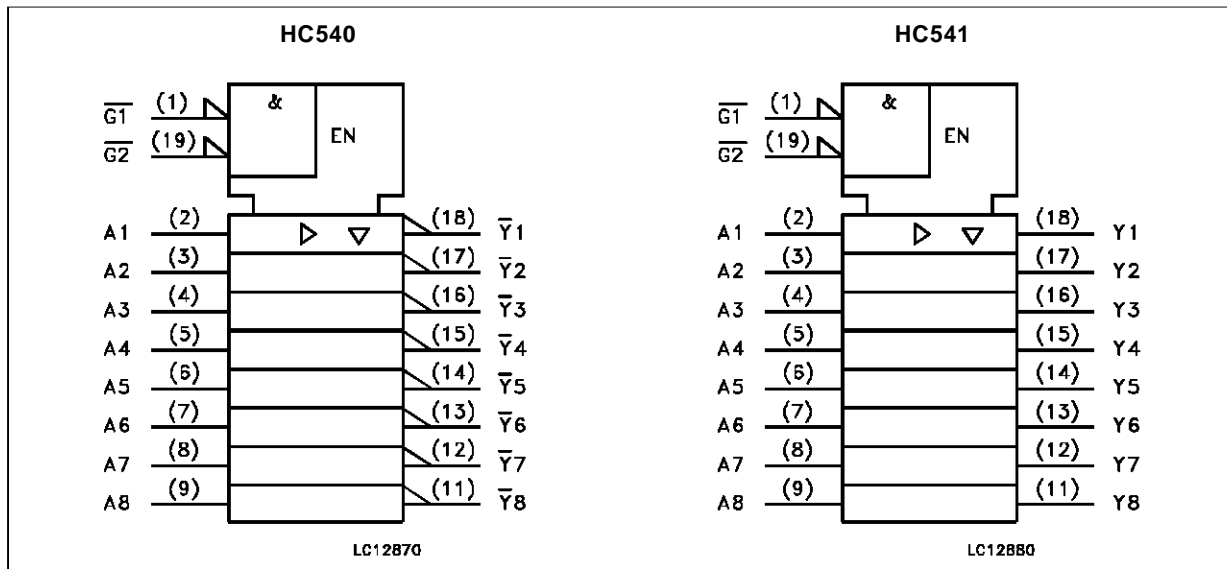
PIN DESCRIPTION (HC540)

PIN No	SYMBOL	NAME AND FUNCTION
1, 19	$\overline{1G}, \overline{G2}$	Output Enable Inputs
2, 3, 4, 5, 6, 7, 8, 9	A1 to A8	Data Inputs
18, 17, 16, 15, 14, 13, 12, 11	$\overline{Y1}$ to $\overline{Y8}$	Bus Outputs
10	GND	Ground (0V)
20	V _{CC}	Positive Supply Voltage

PIN DESCRIPTION (HC541)

PIN No	SYMBOL	NAME AND FUNCTION
1, 19	$\overline{1G}, \overline{G2}$	Output Enable Inputs
2, 3, 4, 5, 6, 7, 8, 9	A1 to A8	Data Inputs
18, 17, 16, 15, 14, 13, 12, 11	Y1 to Y8	Bus Outputs
10	GND	Ground (0V)
20	V _{CC}	Positive Supply Voltage

IEC LOGIC SYMBOLS

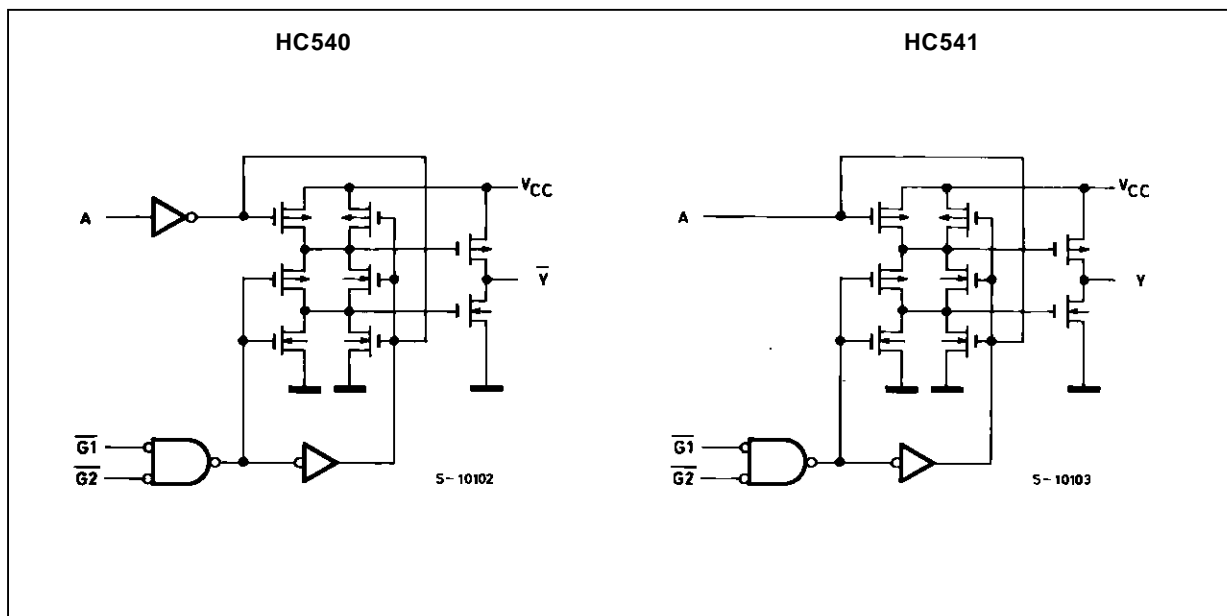


TRUTH TABLE

INPUT			OUTPUT	
$\overline{G1}$	$\overline{G2}$	A_n	$\overline{Y_n}$ (HC540)	Y_n (HC541)
H	X	X	Z	Z
X	H	X	Z	Z
L	L	H	L	H
L	L	L	H	L

X: "H" or "L"
Z: High impedance

CIRCUIT SCHEMATIC (Per Circuit)



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 Source Sink Current Per Output Pin	± 35	mA
I _{CC} or I _{GND}	DC V _{CC} or Ground Current	± 70	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.

(*) 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: M54HC Series	-55 to +125	°C
	M74HC Series	-40 to +85	°C
t _r , t _f	Input Rise and Fall Time	V _{CC} = 2 V 0 to 1000	ns
		V _{CC} = 4.5 V 0 to 500	
		V _{CC} = 6 V 0 to 400	

DC SPECIFICATIONS

Symbol	Parameter	Test Conditions		Value						Unit		
		V _{CC} (V)		T _A = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC			
				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	V _I = V _{IH} or V _{IL}	I _O = -20 μA	1.9	2.0		1.9		1.9	V	
		4.5			4.4	4.5		4.4		4.4		
		6.0			5.9	6.0		5.9		5.9		
		4.5	I _O = -6.0 mA	4.18	4.31		4.13		4.10			
		6.0		I _O = -7.8 mA	5.68	5.8		5.63		5.60		
V _{OL}	Low Level Output Voltage	2.0	V _I = V _{IH} or V _{IL}	I _O = 20 μA		0.0	0.1		0.1		0.1	V
		4.5				0.0	0.1		0.1		0.1	
		6.0				0.0	0.1		0.1		0.1	
		4.5		I _O = 6.0 mA		0.17	0.26		0.33		0.40	
		6.0			I _O = 7.8 mA		0.18	0.26		0.33		
I _I	Input Leakage Current	6.0	V _I = V _{CC} or GND			±0.1		±1		±1	μA	
I _{OZ}	3 State Output Off State Current	6.0	V _I = V _{IH} or V _{IL} V _O = V _{CC} or GND			±0.5		±5		±10	μA	
I _{CC}	Quiescent Supply Current	6.0	V _I = V _{CC} or GND			4		40		80	μA	

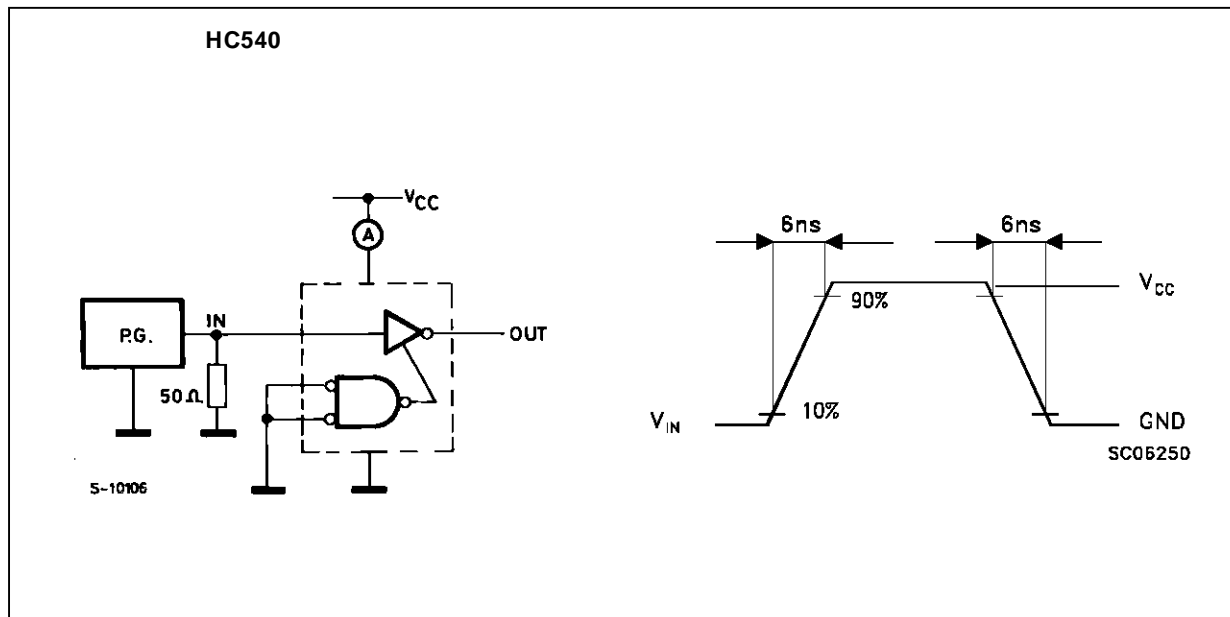
M54/M74HC540/541

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

Symbol	Parameter	Test Conditions			Value						Unit	
		V_{CC} (V)	C_L (pF)		$T_A = 25 \text{ }^\circ\text{C}$ 54HC and 74HC			$-40 \text{ to } 85 \text{ }^\circ\text{C}$ 74HC		$-55 \text{ to } 125 \text{ }^\circ\text{C}$ 54HC		
					Min.	Typ.	Max.	Min.	Max.	Min.		Max.
t_{TLH} t_{THL}	Output Transition Time	2.0 4.5 6.0	50			25 7 6	60 12 10		75 19 13		90 18 15	ns
t_{PLH} t_{PHL}	Propagation Delay Time	2.0 4.5 6.0	50			40 10 9	85 17 14		105 21 18		130 26 22	ns
		2.0 4.5 6.0	150			56 14 12	115 23 20		145 29 25		175 35 30	ns
t_{PZL} t_{PZH}	Output Enable Time	2.0 4.5 6.0	50	$R_L = 1\text{K}\Omega$		47 13 11	110 22 19		140 28 24		165 33 28	ns
		2.0 4.5 6.0	150	$R_L = 1\text{K}\Omega$		61 17 14	135 27 23		170 34 29		205 41 35	ns
t_{PLZ} t_{PHZ}	Output Disable Time	2.0 4.5 6.0	50	$R_L = 1\text{K}\Omega$		52 15 13	110 22 19		140 28 24		165 33 28	ns
C_{IN}	Input Capacitance					5	10		10		10	pF
$C_{PD} (*)$	Power Dissipation Capacitance					31						pF

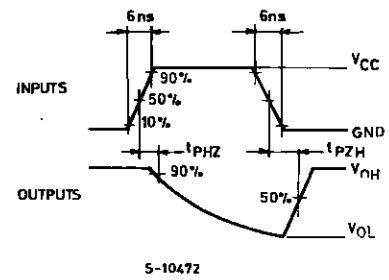
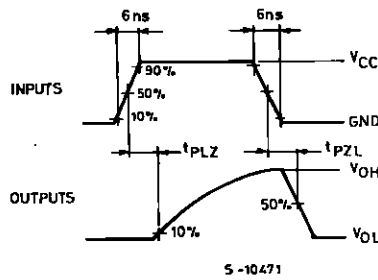
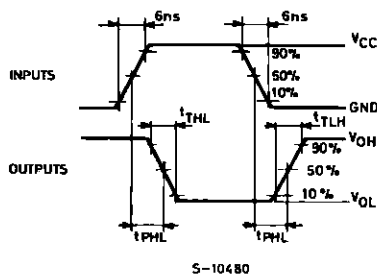
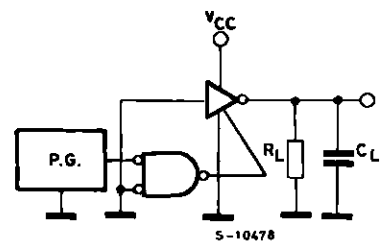
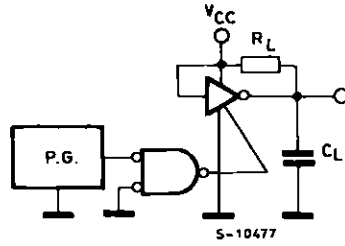
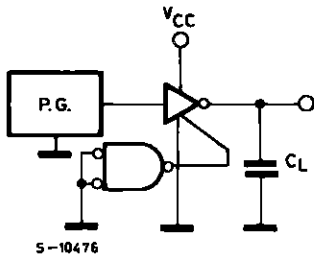
(*) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8$ (per gate)

TEST CIRCUIT I_{CC} (Opr.)

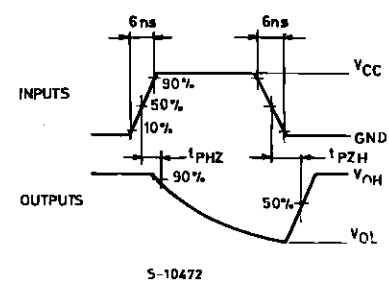
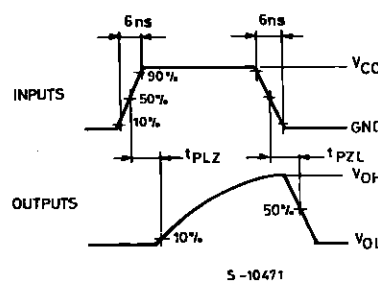
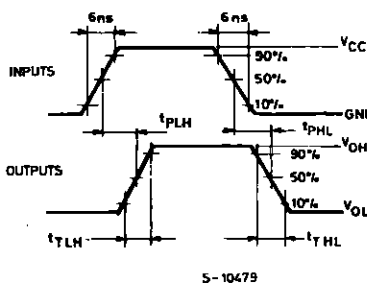
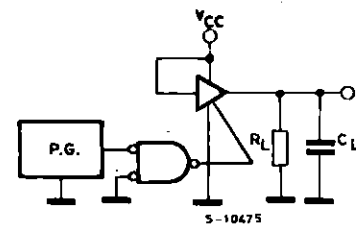
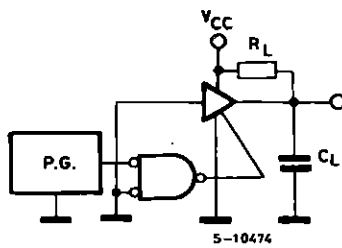
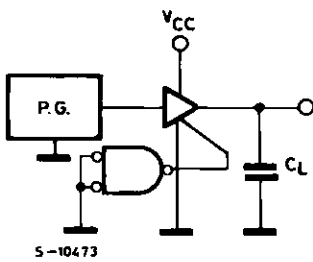


SWITCHING CHARACTERISTICS TEST CIRCUIT

HC540



HC541



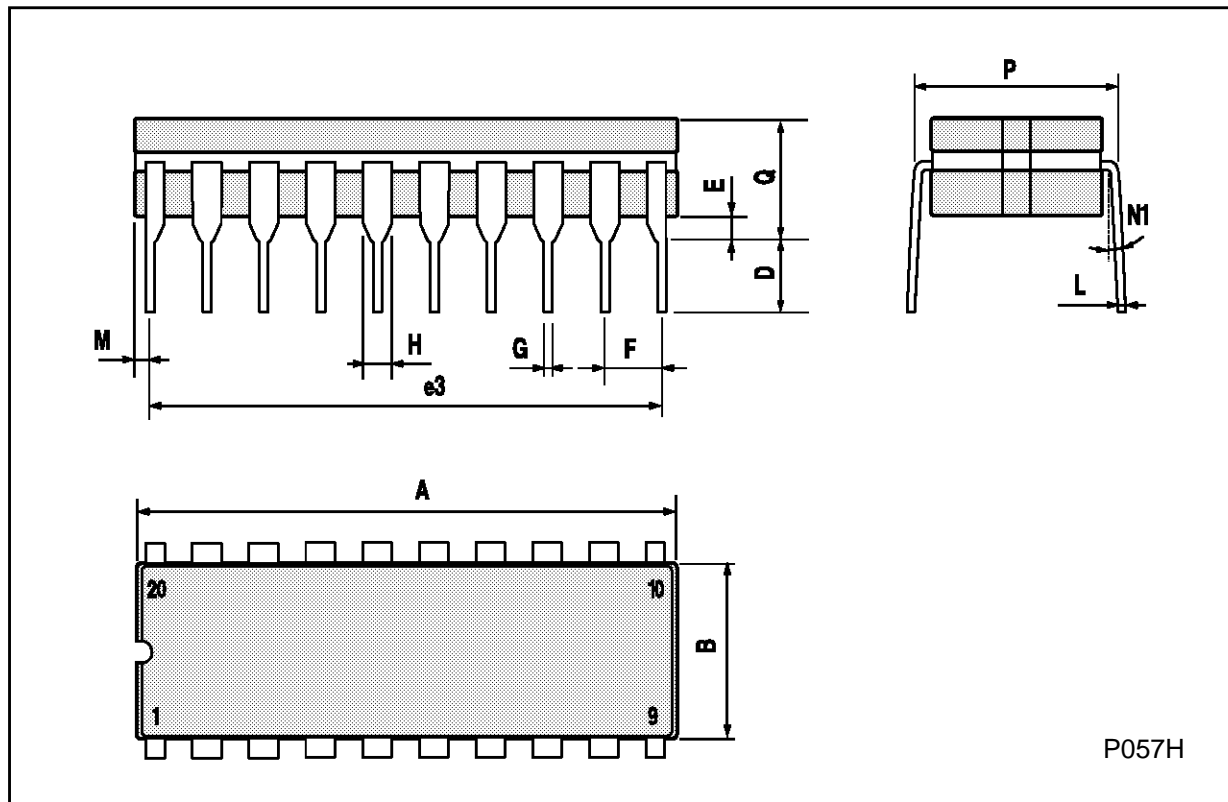
Plastic DIP20 (0.25) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.254			0.010		
B	1.39		1.65	0.055		0.065
b		0.45			0.018	
b1		0.25			0.010	
D			25.4			1.000
E		8.5			0.335	
e		2.54			0.100	
e3		22.86			0.900	
F			7.1			0.280
I			3.93			0.155
L		3.3			0.130	
Z			1.34			0.053



Ceramic DIP20 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			25			0.984
B			7.8			0.307
D		3.3			0.130	
E	0.5		1.78	0.020		0.070
e3		22.86			0.900	
F	2.29		2.79	0.090		0.110
G	0.4		0.55	0.016		0.022
I	1.27		1.52	0.050		0.060
L	0.22		0.31	0.009		0.012
M	0.51		1.27	0.020		0.050
N1	4° (min.), 15° (max.)					
P	7.9		8.13	0.311		0.320
Q			5.71			0.225



SO20 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			2.65			0.104
a1	0.10		0.20	0.004		0.007
a2			2.45			0.096
b	0.35		0.49	0.013		0.019
b1	0.23		0.32	0.009		0.012
C		0.50			0.020	
c1	45° (typ.)					
D	12.60		13.00	0.496		0.512
E	10.00		10.65	0.393		0.419
e		1.27			0.050	
e3		11.43			0.450	
F	7.40		7.60	0.291		0.299
L	0.50		1.27	0.19		0.050
M			0.75			0.029
S	8° (max.)					



P013L

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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