SGS-THOMSON MICROELECTRONICS

M54HC240/241/244
M74HC240/241/244

OCTAL BUS BUFFER WITH 3 STATE OUTPUTS
HC240: INVERTED - HC241/244 NON INVERTED

- HIGH SPEED
  $t_{PD} = 10$ ns (TYP.) at $V_{CC} = 5V$
- LOW POWER DISSIPATION
  $I_{CC} = 4$ μA (MAX.) at $T_A = 25$ °C
- HIGH NOISE IMMUNITY
  $V_{NIH} = V_{INL} = 28$ % V_{CC} (MIN.)
- OUTPUT DRIVE CAPABILITY
  15 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE
  $|I_{OH}| = I_{OL} = 6$ mA (MIN)
- BALANCED PROPAGATION DELAYS
  $t_{PLH} = t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE
  V_{CC} (OPR) = 2V to 6V
- PIN AND FUNCTION COMPATIBLE
  WITH 54/74LS240/241/244

B1R
(Plastic Package)

F1R
(Ceramic Package)

M1R
(Micro Package)

C1R
(Chip Carrier)

ORDER CODES :
M54HCXXXF1R   M74HCXXXM1R
M74HCXXXB1R   M74HCXXXC1R
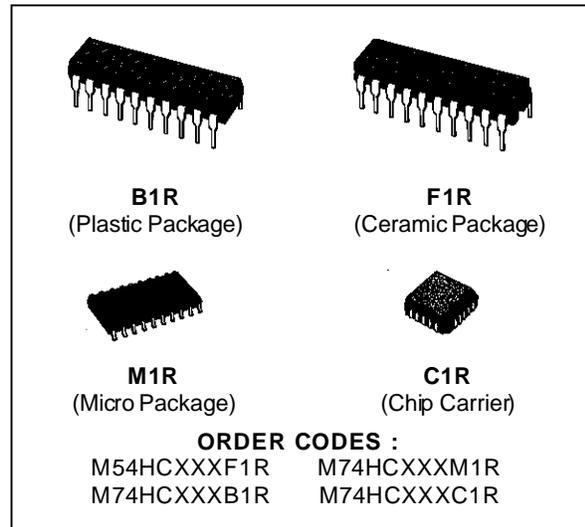
DESCRIPTION

The M54/74HC240, HC241 and HC244 are high speed CMOS OCTAL BUS BUFFERs fabricated in silicon gate C^2MOS technology.

They have the same high speed performance of LSTTL combined with true CMOS low power consumption.

The designer has a choise of select combination of inverting and non-inverting outputs, symmetrical $\overline{G}$ (active low output control) input, and complementary G and $\overline{G}$ inputs. Each control input governs four BUS BUFFERs.

These devices are designed to be used with 3 state memory address drivers, etc. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

PIN CONNECTION (top view)

CHIP CARRIER

HC240   **HC241**   **HC244**
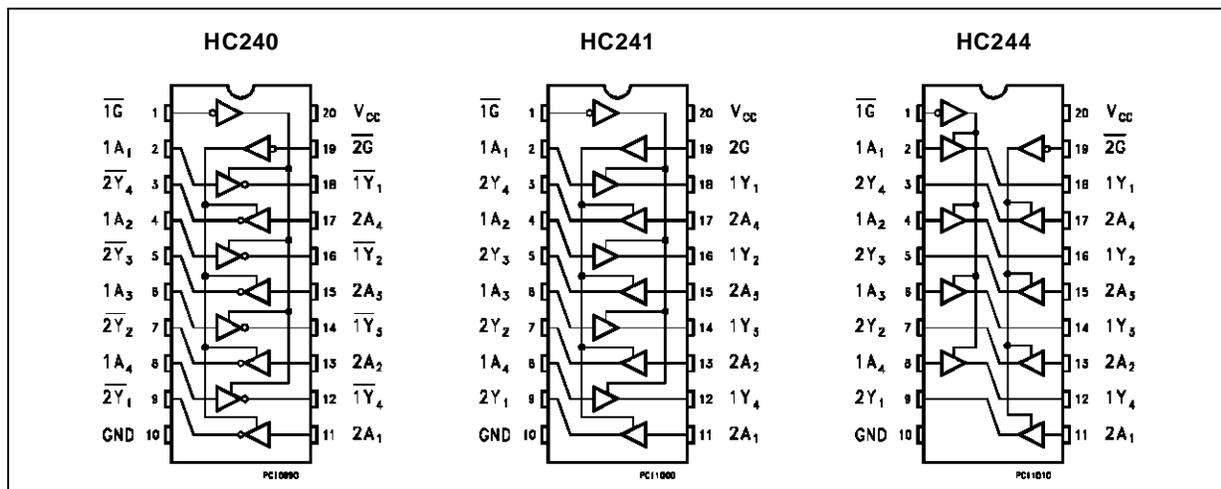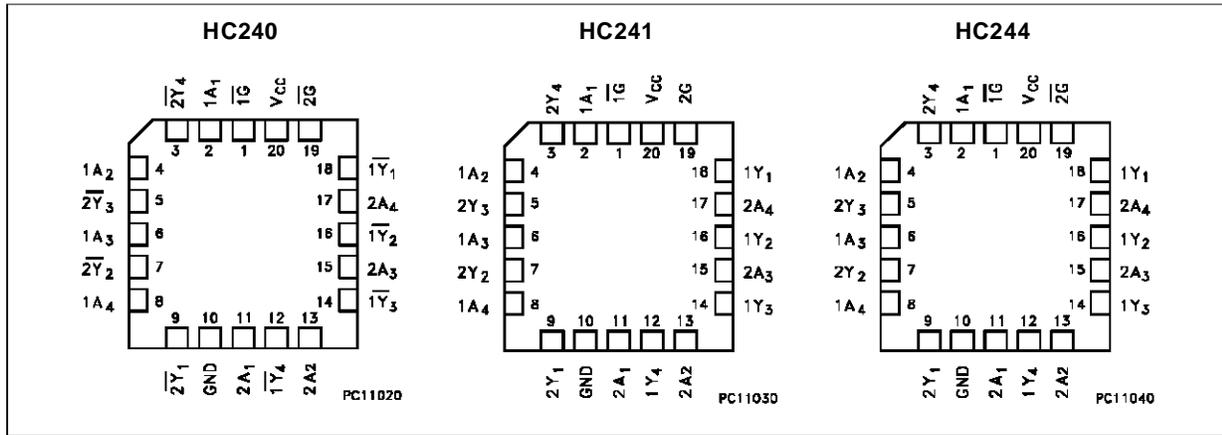
INPUT AND OUTPUT EQUIVALENT CIRCUIT
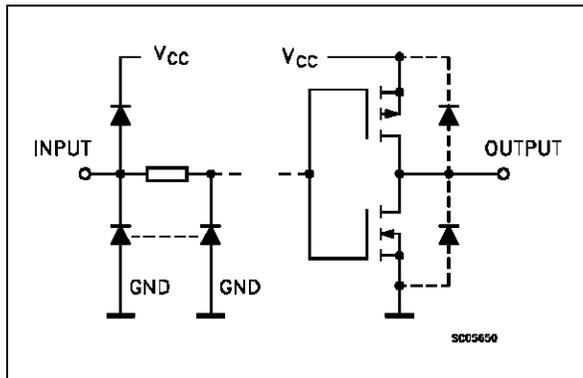
PIN DESCRIPTION (HC240)

PIN No	SYMBOL	NAME AND FUNCTION
1	$\overline{1G}$	Output Enable Input
2, 4, 6, 8	1A1 to 1A4	Data Inputs
9, 7, 5, 3	$\overline{2Y1}$ to $\overline{2Y4}$	Data Outputs
11, 13, 15, 17	2A1 to 2A4	Data Inputs
18, 16, 14, 12	$\overline{1Y1}$ to $\overline{1Y4}$	Data Outputs
19	$\overline{2G}$	Output Enabel Input
10	GND	Ground (0V)
20	V_{CC}	Positive Supply Voltage

PIN DESCRIPTION (HC241)

PIN No	SYMBOL	NAME AND FUNCTION
1	$\overline{1G}$	Output Enable Input
2, 4, 6, 8	1A1 to 1A4	Data Inputs
9, 7, 5, 3	2Y1 to 2Y4	Data Outputs
11, 13, 15, 17	2A1 to 2A4	Data Inputs
18, 16, 14, 12	1Y1 to 1Y4	Data Outputs
19	2G	Output Enabel Input
10	GND	Ground (0V)
20	V_{CC}	Positive Supply Voltage

PIN DESCRIPTION (HC244)

PIN No	SYMBOL	NAME AND FUNCTION
1	$\overline{1G}$	Output Enable Input
2, 4, 6, 8	1A1 to 1A4	Data Inputs
9, 7, 5, 3	2Y1 to 2Y4	Data Outputs
11, 13, 15, 17	2A1 to 2A4	Data Inputs
18, 16, 14, 12	1Y1 to 1Y4	Data Outputs
19	$\overline{2G}$	Output Enabel Input
10	GND	Ground (0V)
20	V_{CC}	Positive Supply Voltage

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IEC LOGIC SYMBOLS

HC240   HC241   HC244
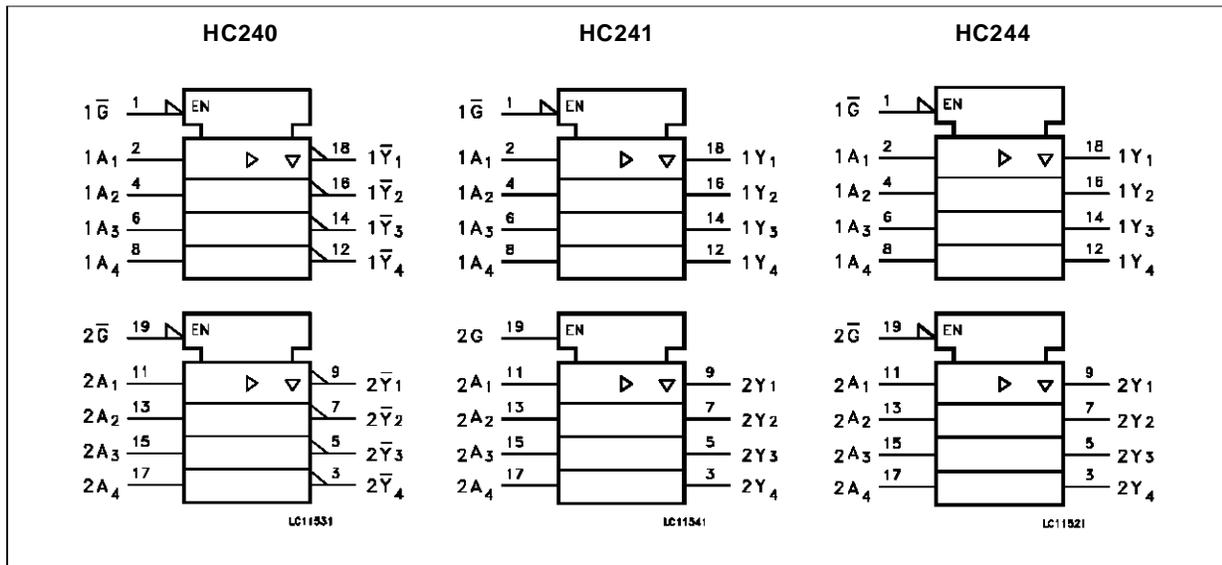
TRUTH TABLE

INPUT			OUTPUT		
$\overline{G}$	G (HC241)	An	$\overline{Yn}$ (HC240)	Yn (HC241)	Yn (HC244)
L	H	L	H	L	L
L	H	H	L	H	H
H	L	X	Z	Z	Z

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

CIRCUIT SCHEMATIC (1/8 PACKAGE)

HC240   HC241/244

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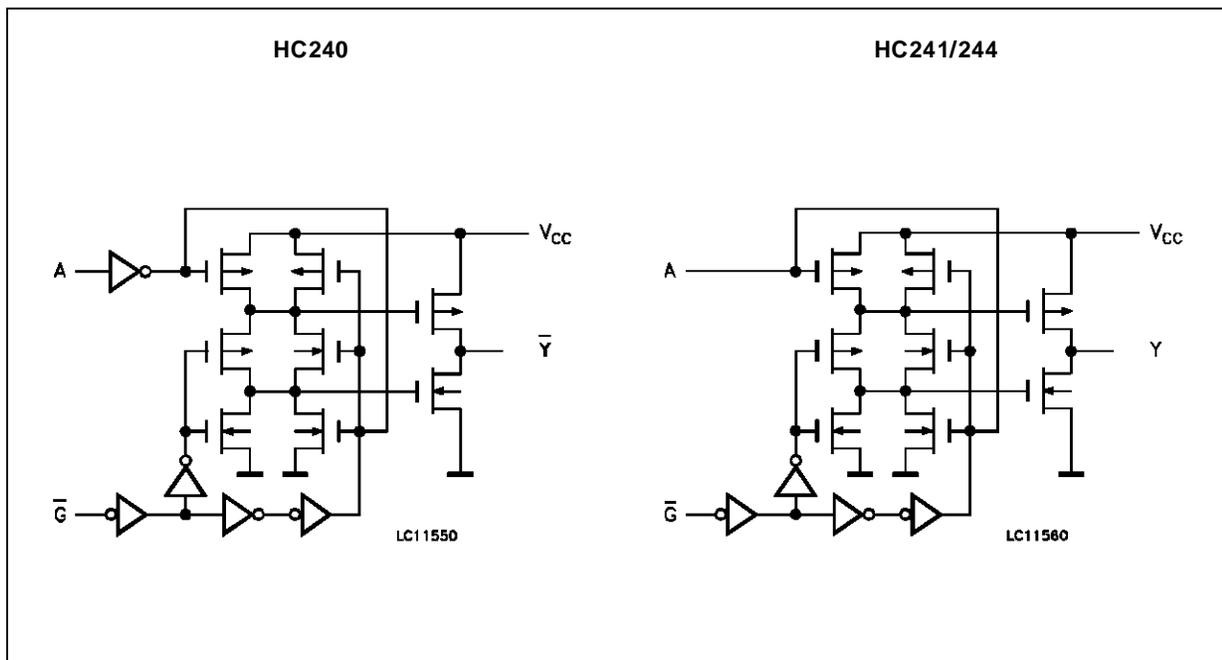
ABSOLUTE MAXIMUM RATINGS

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	^oC
T_L	Lead Temperature (10 sec)	300	^oC

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

(*) 500 mW: $\cong$ 65 ^oC derate to 300 mW by 10mW/^oC: 65 ^oC to 85 ^oC

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	^oC
	M74HC Series		-40 to +85	^oC
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	

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DC SPECIFICATIONS

Symbol	Parameter	Test Conditions Vcc (V)		Value TA = 25 °C 54HC and 74HC Min.	Typ.	Max.	-40 to 85 °C 74HC Min.	Max.	-55 to 125 °C 54HC Min.	Max.	Unit
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		0.40	
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

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

| Symbol	Parameter	Test Conditions			Value							Unit
		V_{CC} (V)	C_L (pF)		$T_A = 25\,^oC$ 54HC and 74HC			-40 to 85 ^oC 74HC		-55 to 125 ^oC 54HC		
					Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t_{TLH} t_{THL}	Output Transition Time	2.0	50			25	60		75		90	ns
		4.5				7	12		19		18	
		6.0				6	10		13		15	
t_{PLH} t_{PHL}	Propagation Delay Time	2.0	50			36	90		115		135	ns
		4.5				12	18		23		27	
		6.0				10	15		20		23	
		2.0	150			51	130		165		195	ns
		4.5				17	26		33		39	
		6.0				14	22		28		33	
t_{PZL} t_{PZH}	Output Enable Time	2.0	50	$R_L = 1K\Omega$		48	125		155		190	ns
		4.5				16	25		31		38	
		6.0				14	21		26		32	
		2.0	150	$R_L = 1K\Omega$		63	165		205		250	ns
		4.5				21	33		41		50	
		6.0				18	28		35		43	
t_{PLZ} t_{PHZ}	Output Disable Time	2.0	50	$R_L = 1K\Omega$		32	125		155		190	ns
		4.5				15	25		31		38	
		6.0				14	21		26		32	
C_{IN}	Input Capacitance					5	10		10		10	pF
C_{OUT}	Output Capacitance					10						pF
C_{PD} (*)	Power Dissipation Capacitance		HC240 HC241/244			31 33						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 operting current can be obtained by the following equation. $I_{CC}(opr) = C_{PD} \bullet V_{CC} \bullet f_{IN} + I_{CC}/8$ (per circuit)

TEST CIRCUIT I_{CC} (Opr.)

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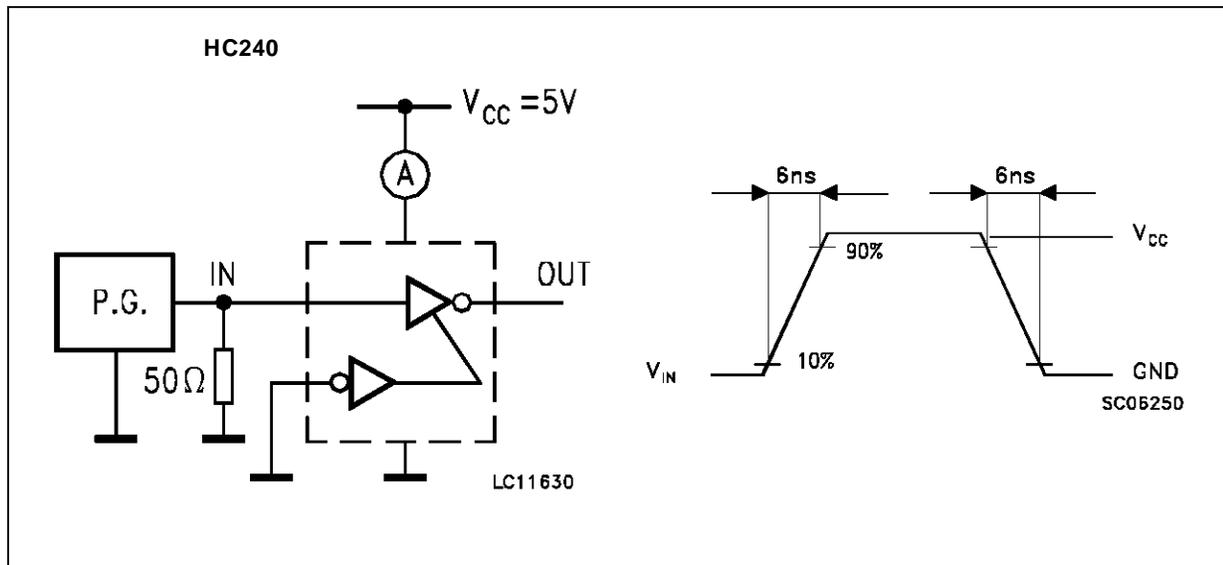
SWITCHING CHARACTERISTICS TEST CIRCUIT

HC240
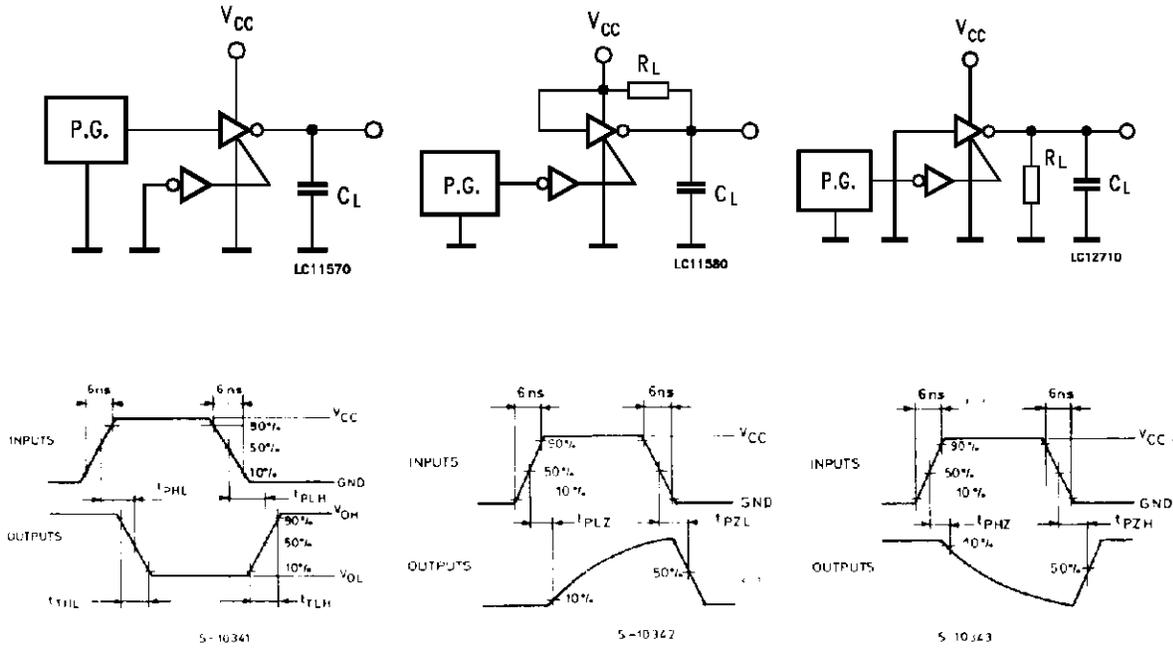
HC241/HC244
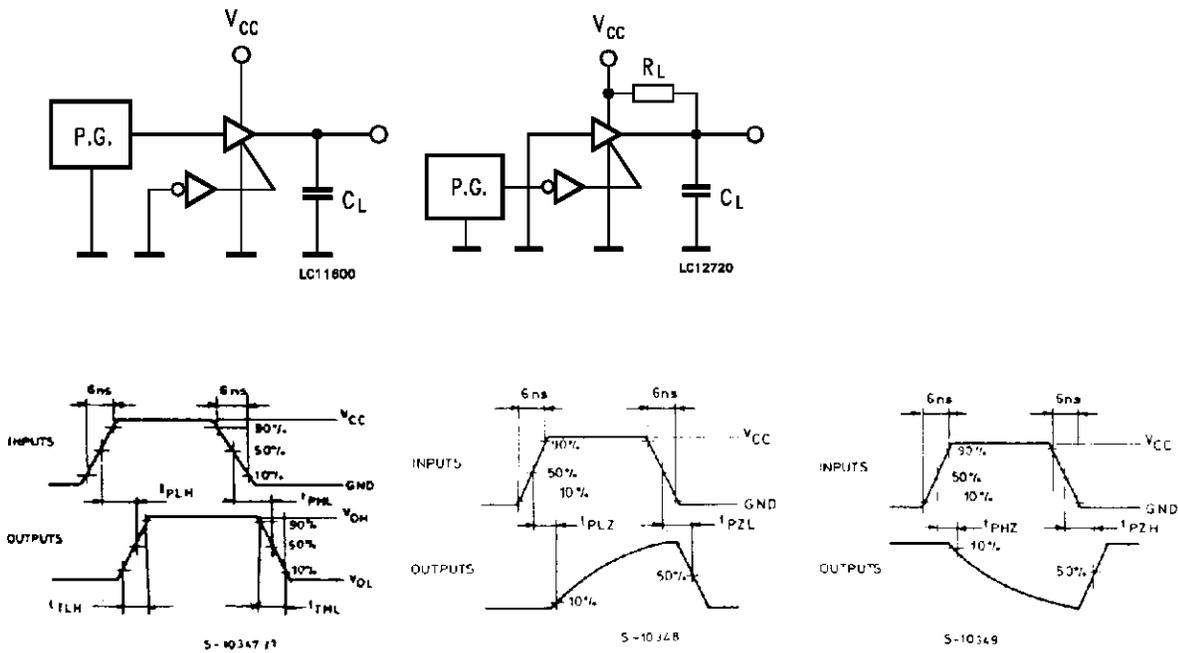
Plastic DIP20 (0.25) MECHANICAL DATA

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

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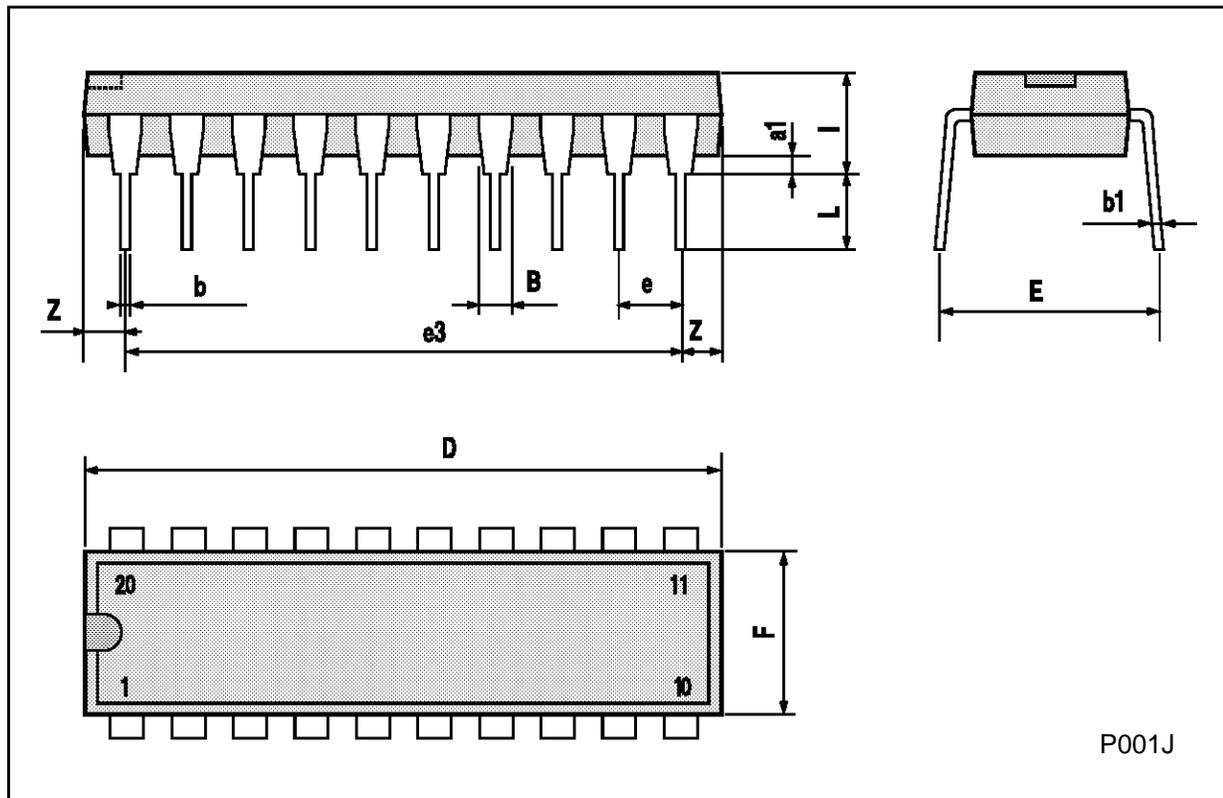
Ceramic DIP20 MECHANICAL DATA

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

P057H

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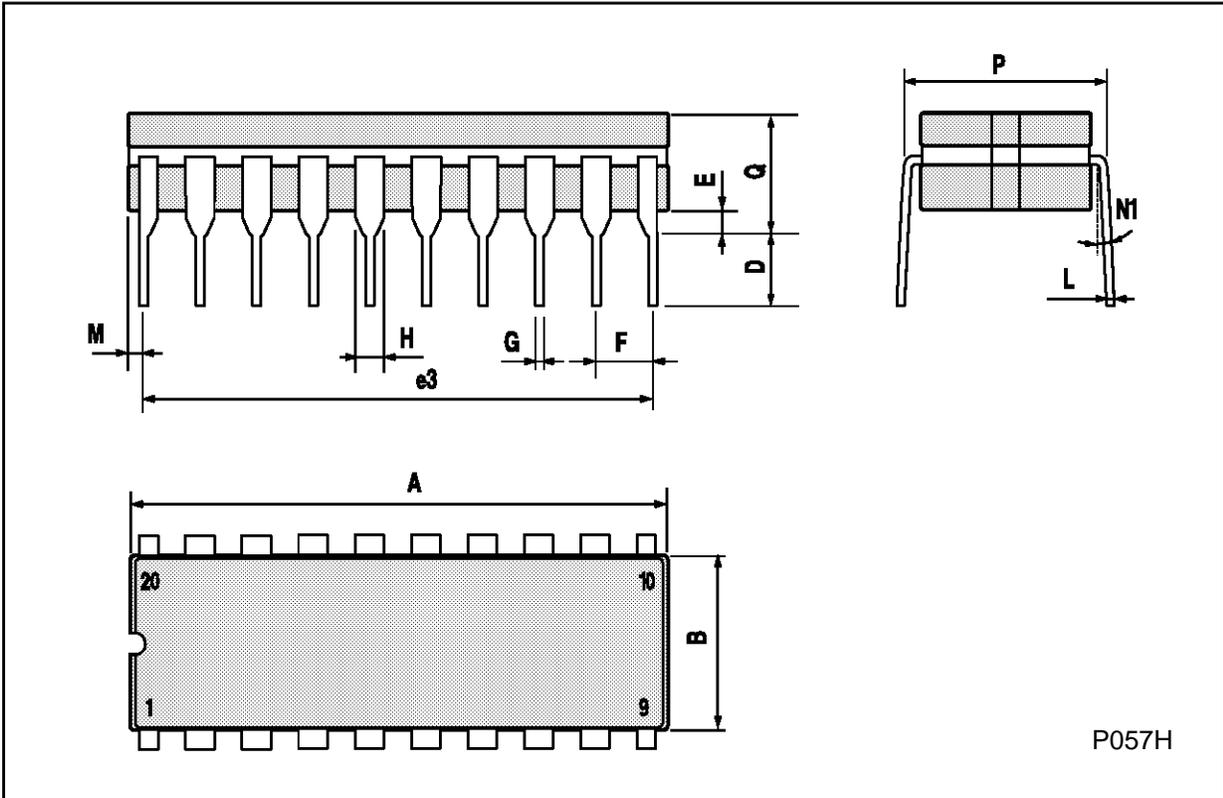
SO20 MECHANICAL DATA

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

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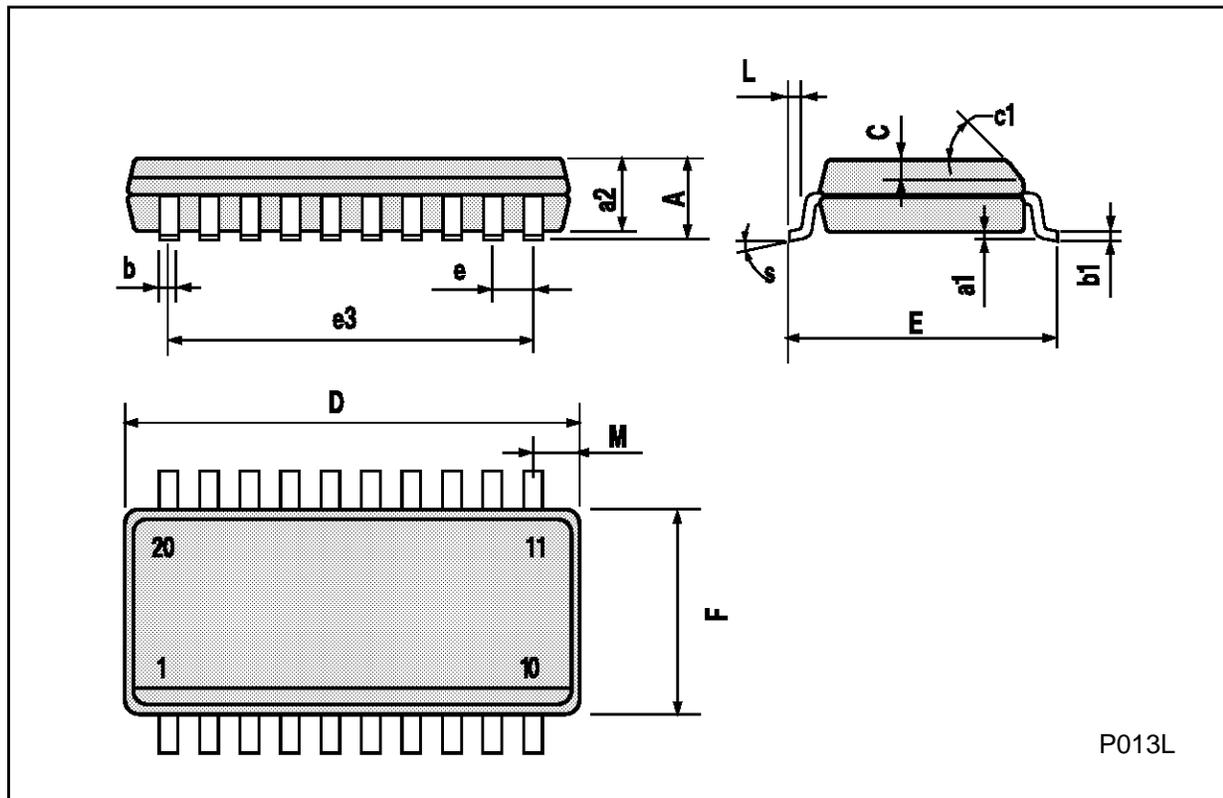
PLCC20 MECHANICAL DATA

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	

P027A

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