



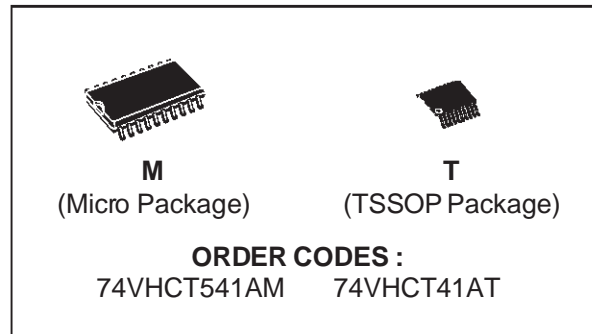
# 74VHCT541A

## OCTAL BUS BUFFER WITH 3 STATE OUTPUTS (NON INVERTED)

- HIGH SPEED:  $t_{PD} = 3.6 \text{ ns}$  (TYP.) at  $V_{CC} = 5V$
- LOW POWER DISSIPATION:  
 $I_{CC} = 4 \mu\text{A}$  (MAX.) at  $T_A = 25^\circ\text{C}$
- COMPATIBLE WITH TTL OUTPUTS:  
 $V_{IH} = 2V$  (MIN),  $V_{IL} = 0.8V$  (MAX)
- POWER DOWN PROTECTION ON INPUTS & OUTPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 8 \text{ mA}$  (MIN)
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC}$  (OPR) = 4.5V to 5.5V
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 541
- IMPROVED LATCH-UP IMMUNITY
- LOW NOISE:  $V_{OLP} = 0.9V$  (Max.)

### DESCRIPTION

The VHCT541A is an advanced high speed CMOS OCTAL BUS BUFFER (3-STATE) fabricated with sub-micron silicon gate and double-layer metal wiring  $C^2\text{MOS}$  technology. The 3 STATE control gate operates as a two

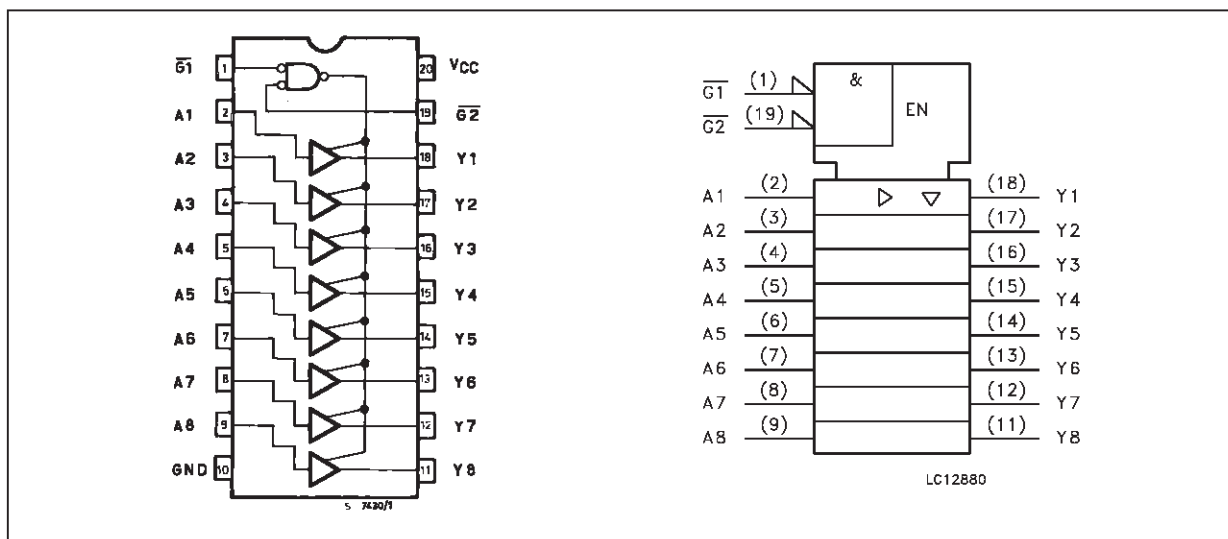


input AND such that if either  $\overline{G1}$  and  $\overline{G2}$  are high, all eight outputs are in the high impedance state. In order to enhance PC board layout, the AC541 offers a pinout having inputs and outputs on opposite sides of the package.

Power down protection is provided on all inputs and outputs and 0 to 7V can be accepted on inputs with no regard to the supply voltage. This device can be used to interface 5V to 3V.

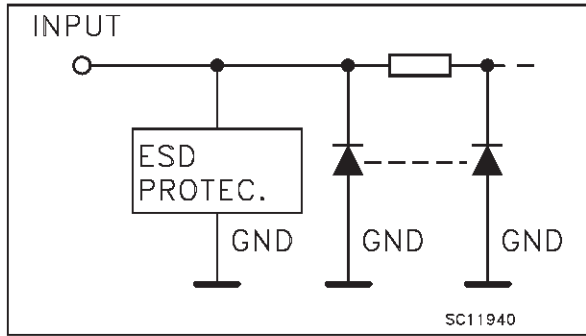
All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

### PIN CONNECTION AND IEC LOGIC SYMBOLS



# 74VHCT541A

## INPUT EQUIVALENT CIRCUIT



## PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
1, 19	$\overline{G1}, \overline{G2}$	Output Enable Input
2, 3, 4, 5, 6, 7, 8, 9	A1 to A8	Data Inputs
18, 17, 16, 15, 14, 13, 12, 11	Y1 to Y8	Data Outputs
10	GND	Ground (0V)
20	V <sub>CC</sub>	Positive Supply Voltage

## TRUTH TABLE

INPUT		OUTPUT	
$\overline{G1}$	$\overline{G2}$	A <sub>n</sub>	Y <sub>n</sub>
H	X	X	Z
X	H	X	Z
L	L	H	H
L	L	L	L

X: "H" or "L"

Z: High impedance

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply Voltage	-0.5 to +7.0	V
V <sub>I</sub>	DC Input Voltage	-0.5 to +7.0	V
V <sub>O</sub>	DC Output Voltage (see note 1)	-0.5 to +7.0	V
V <sub>O</sub>	DC Output Voltage (see note 2)	-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 Current	±25	mA
I <sub>CC</sub> or I <sub>GND</sub>	DC V <sub>CC</sub> or Ground Current	±50	mA
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.

1) Output in OFF State

2) High or Low State

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply Voltage	4.5 to 5.5	V
V <sub>I</sub>	Input Voltage	0 to 5.5	V
V <sub>O</sub>	Output Voltage (see note 1)	0 to 5.5	V
V <sub>O</sub>	Output Voltage (see note 2)	0 to V <sub>CC</sub>	V
T <sub>op</sub>	Operating Temperature	-40 to +85	°C
dt/dv	Input Rise and Fall Time (see note 3) (V <sub>CC</sub> = 5.0 ± 0.5V)	0 to 20	ns/V

1) Output in OFF State

2) High or Low State

3) V<sub>IN</sub> from 0.8V to 2V

## DC SPECIFICATIONS

Symbol	Parameter	Test Conditions		Value					Unit
		V <sub>CC</sub> (V)		T <sub>A</sub> = 25 °C			-40 to 85 °C		
				Min.	Typ.	Max.	Min.	Max.	
V <sub>IH</sub>	High Level Input Voltage	4.5 to 5.5		2			2		V
V <sub>IL</sub>	Low Level Input Voltage	4.5 to 5.5				0.8		0.8	V
V <sub>OH</sub>	High Level Output Voltage	4.5	I <sub>O</sub> = -50 μA	4.4	4.5		4.4		V
		4.5	I <sub>O</sub> = -8 mA	3.94			3.8		
V <sub>OL</sub>	Low Level Output Voltage	4.5	I <sub>O</sub> = 50 μA		0.0	0.1		0.1	V
		4.5	I <sub>O</sub> = 8 mA			0.36		0.44	
I <sub>OZ</sub>	High Impedance Output Leakage Current	4.5 to 5.5	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>O</sub> = 0V to 5.5V			±0.25		±2.5	μA
I <sub>I</sub>	Input Leakage Current	0 to 5.5	V <sub>I</sub> = 5.5V or GND			±0.1		±1.0	μA
I <sub>CC</sub>	Quiescent Supply Current	5.5	V <sub>I</sub> = V <sub>CC</sub> or GND			2		20	μA
ΔI <sub>CC</sub>	Additional Worst Case Supply Current	5.5	One Input at 3.4V, other input at V <sub>CC</sub> or GND			1.35		1.5	mA
I <sub>OPD</sub>	Output Leakage Current	0	V <sub>OUT</sub> = 5.5V			0.5		5.0	μA

AC ELECTRICAL CHARACTERISTICS (Input t<sub>r</sub> = t<sub>f</sub> = 3 ns)

Symbol	Parameter	Test Condition		Value					Unit
		V <sub>CC</sub> (V)	C <sub>L</sub> (pF)	T <sub>A</sub> = 25 °C			-40 to 85 °C		
				Min.	Typ.	Max.	Min.	Max.	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay Time	5.0 <sup>(*)</sup>	15		5.0	6.9	1.0	8.0	ns
		5.0 <sup>(*)</sup>	50		5.5	7.9	1.0	9.0	
t <sub>PLZ</sub> t <sub>PHZ</sub>	Output Disable Time	5.0 <sup>(*)</sup>	15	R <sub>L</sub> = 1KΩ	8.3	11.3	1.0	13.0	ns
		5.0 <sup>(*)</sup>	50		8.8	12.3	1.0	14.0	
t <sub>PZL</sub> t <sub>PZH</sub>	Output Enable Time	5.0 <sup>(*)</sup>	50	R <sub>L</sub> = 1KΩ	9.4	11.9	1.0	13.5	ns

(\*) Voltage range is 5.0V ± 0.5V

**CAPACITIVE CHARACTERISTICS**

Symbol	Parameter	Test Conditions	Value					Unit
			T <sub>A</sub> = 25 °C			-40 to 85 °C		
			Min.	Typ.	Max.	Min.	Max.	
C <sub>IN</sub>	Input Capacitance			4	10		10	pF
C <sub>OUT</sub>	Output Capacitance			9				pF
C <sub>PD</sub>	Power Dissipation Capacitance (note 1)			19				pF

1) 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<sub>CC(OPR)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>IN</sub> + I<sub>CC0</sub>/8 (per Circuit)

**DYNAMIC SWITCHING CHARACTERISTICS**

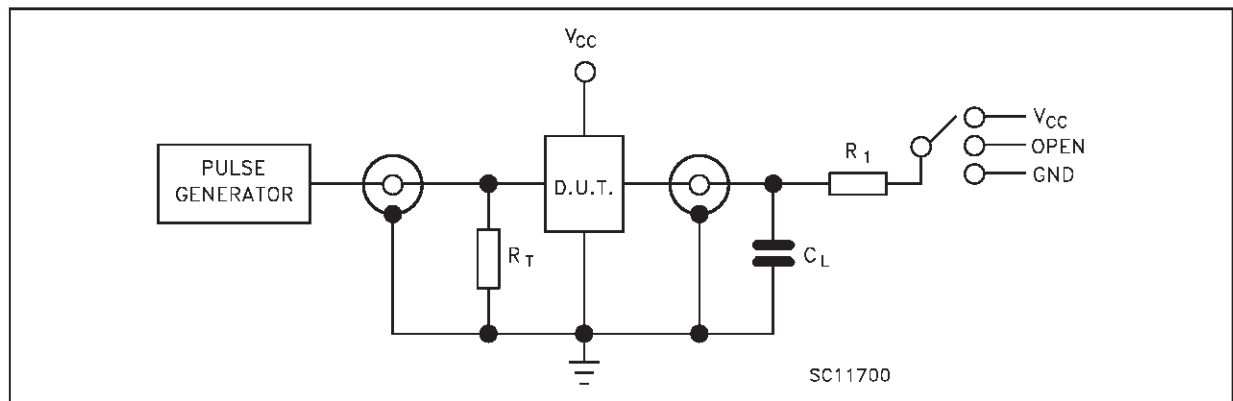
Symbol	Parameter	V <sub>CC</sub> (V)	Test Conditions	Value					Unit
				T <sub>A</sub> = 25 °C			-40 to 85 °C		
				Min.	Typ.	Max.	Min.	Max.	
V <sub>OLP</sub>	Dynamic Low Voltage Quiet Output (note 1, 2)	5.0	C <sub>L</sub> = 50pF		0.9	1.1			V
V <sub>OLV</sub>				-1.1	-0.9				
V <sub>IHD</sub>	Dynamic High Voltage Input (note 1, 3)	5.0		2.0					
V <sub>ILD</sub>	Dynamic Low Voltage Input (note 1, 3)	5.0				0.8			

1) Worst case package.

2) Max number of outputs defined as (n). Data inputs are driven 0V to 5.0V, (n-1) outputs switching and one output at GND.

3) Max number of data inputs (n) switching, (n-1) switching 0V to 5.0V. Inputs under test switching: 5.0V to threshold (V<sub>ILD</sub>), 0V to threshold (V<sub>IHD</sub>), f=1MHz.

**TEST CIRCUIT**

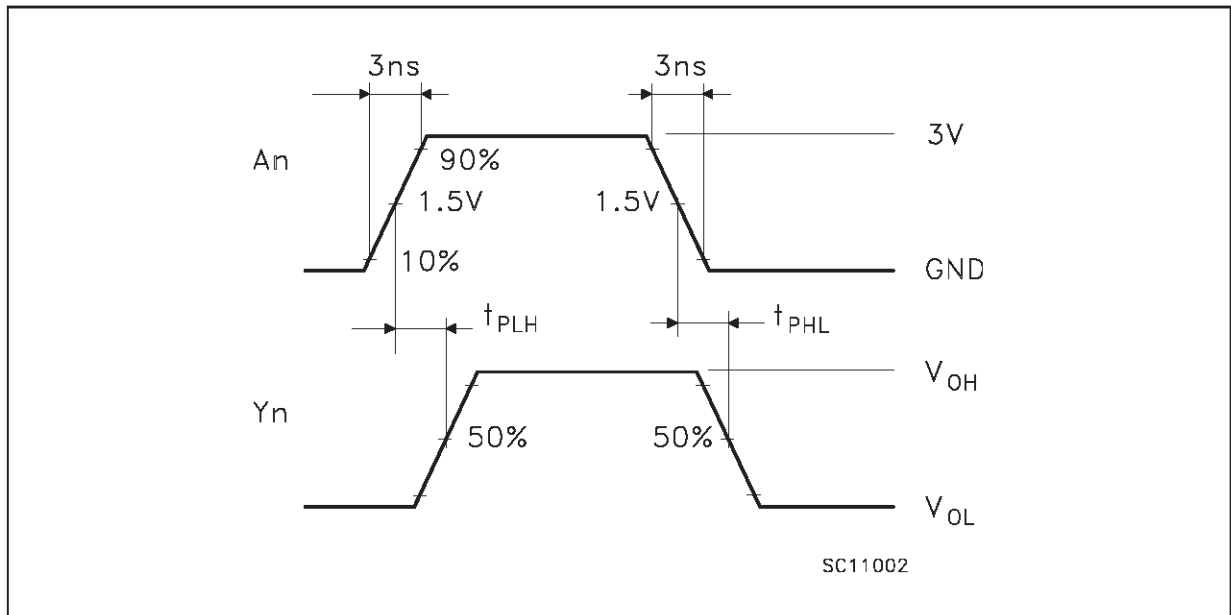
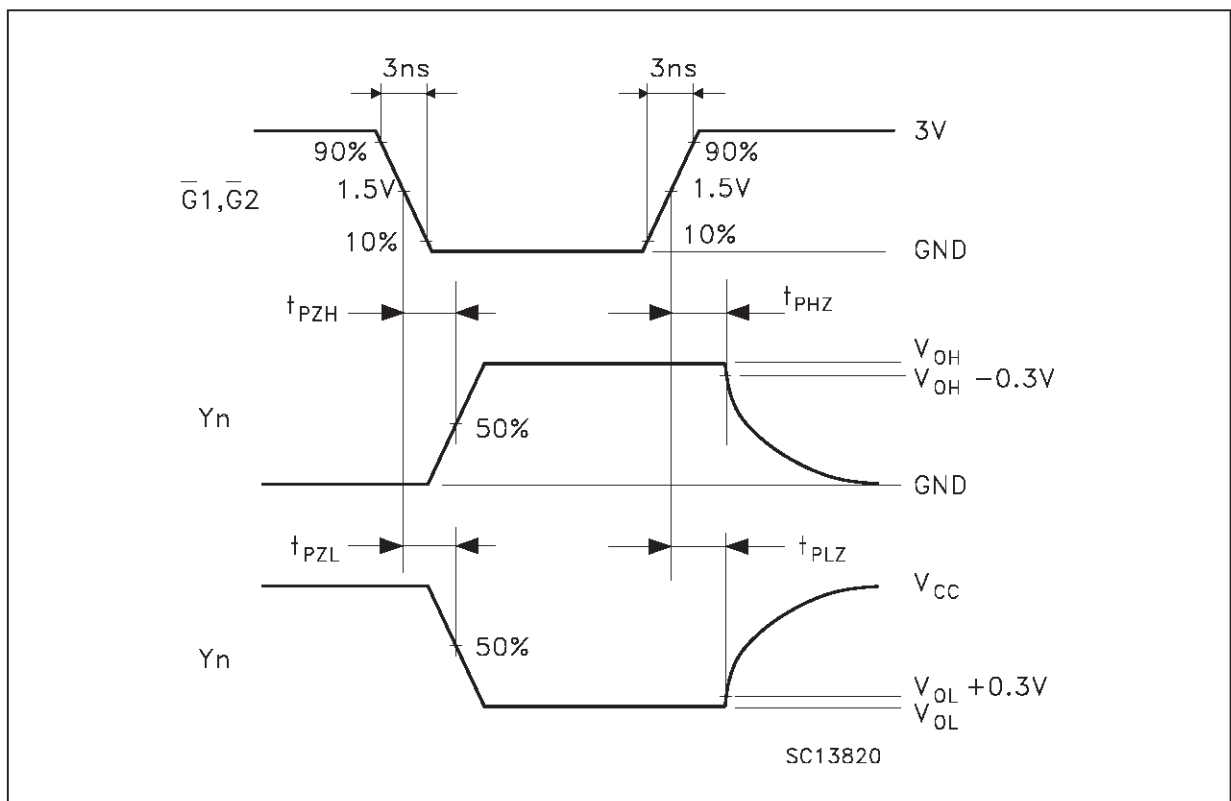


TEST	SWITCH
t <sub>PLH</sub> , t <sub>PHL</sub>	Open
t <sub>PZL</sub> , t <sub>PLZ</sub>	V <sub>CC</sub>
t <sub>PZH</sub> , t <sub>PHZ</sub>	GND

C<sub>L</sub> = 15/50 pF or equivalent (includes jig and probe capacitance)

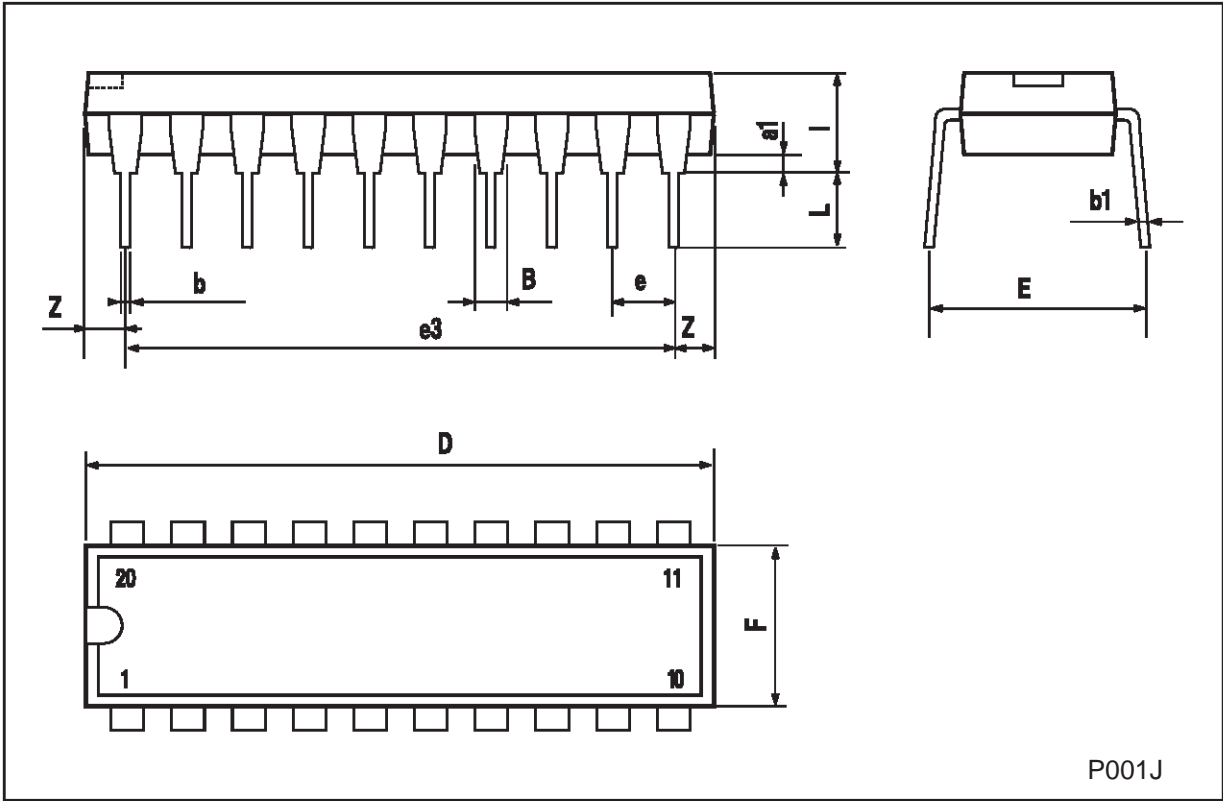
R<sub>L</sub> = R<sub>1</sub> = 1KΩ or equivalent

R<sub>T</sub> = Z<sub>out</sub> of pulse generator (typically 50Ω)

**WAVEFORM 1: PROPAGATION DELAYS** (f=1MHz; 50% duty cycle)**WAVEFORM 2: OUTPUT ENABLE AND DISABLE TIME** (f=1MHz; 50% duty cycle)

**Plastic DIP-20 (0.25) MECHANICAL DATA**

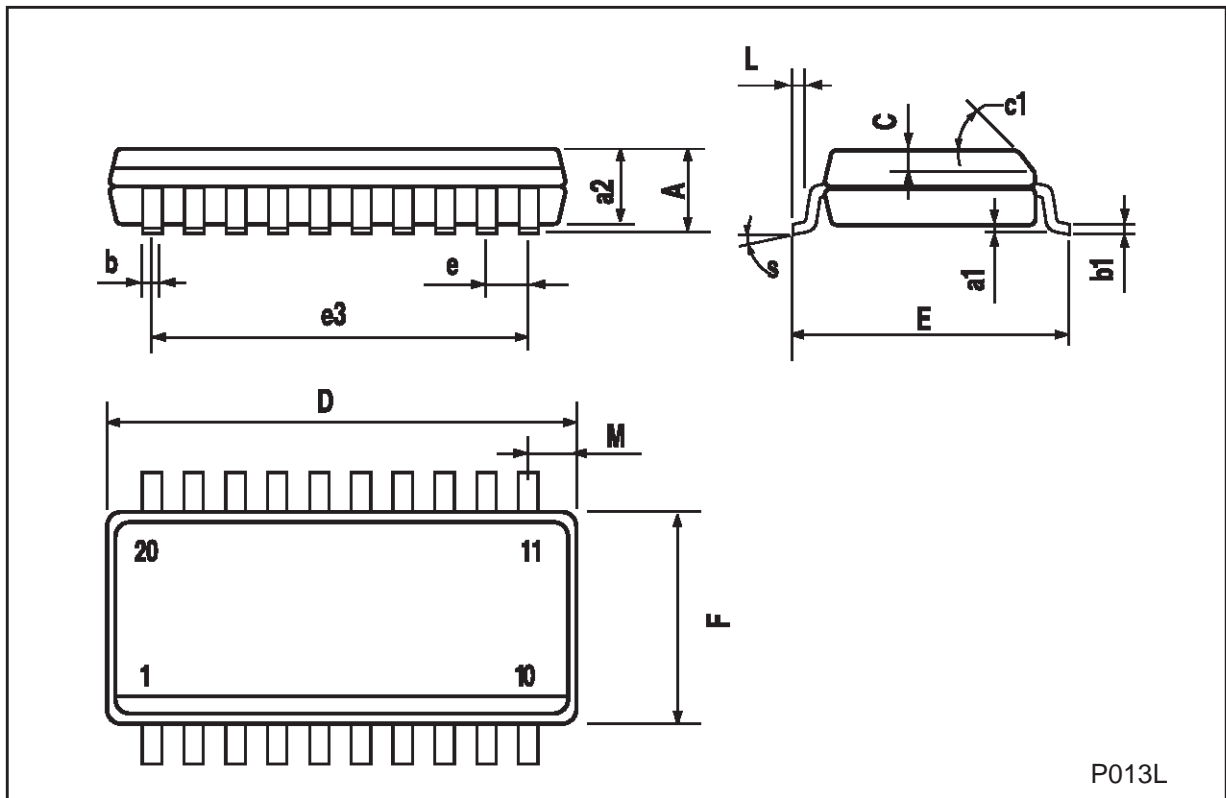
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.254			0.010		
B	1.39		1.65	0.055		0.065
b		0.45			0.018	
b1		0.25			0.010	
D			25.4			1.000
E		8.5			0.335	
e		2.54			0.100	
e3		22.86			0.900	
F			7.1			0.280
l			3.93			0.155
L		3.3			0.130	
Z			1.34			0.053



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## SO-20 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.)					



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