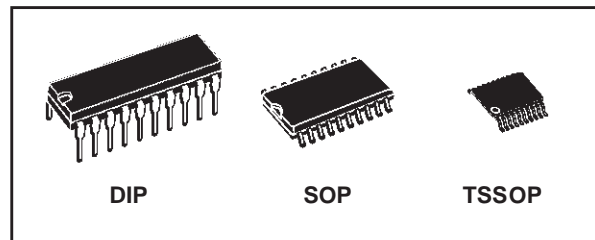




# 74AC541

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

- HIGH SPEED:  $t_{PD} = 4ns$  (TYP.) at  $V_{CC} = 5V$
- LOW POWER DISSIPATION:  
 $I_{CC} = 4\mu A$ (MAX.) at  $T_A = 25^\circ C$
- HIGH NOISE IMMUNITY:  
 $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (MIN.)
- 50Ω TRANSMISSION LINE DRIVING CAPABILITY
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 24mA$  (MIN)
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC}$  (OPR) = 2V to 6V
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 541
- IMPROVED LATCH-UP IMMUNITY



### ORDER CODES

| PACKAGE | TUBE     | T & R      |
|---------|----------|------------|
| DIP     | 74AC541B |            |
| SOP     | 74AC541M | 74AC541MTR |
| TSSOP   |          | 74AC541TTR |

### DESCRIPTION

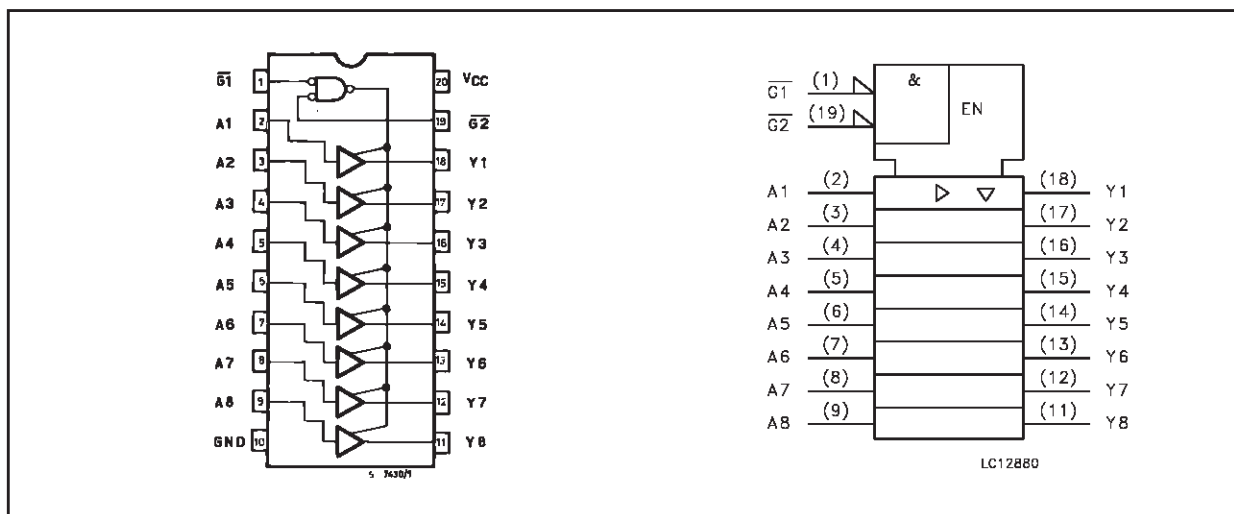
The 74AC541 is an advanced high-speed CMOS OCTAL BUS BUFFER (3-STATE) fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

The 3 STATE control gate operates as two inputs AND such that if either  $\overline{G1}$  and  $\overline{G2}$  are high, all eight outputs are in the high impedance state.

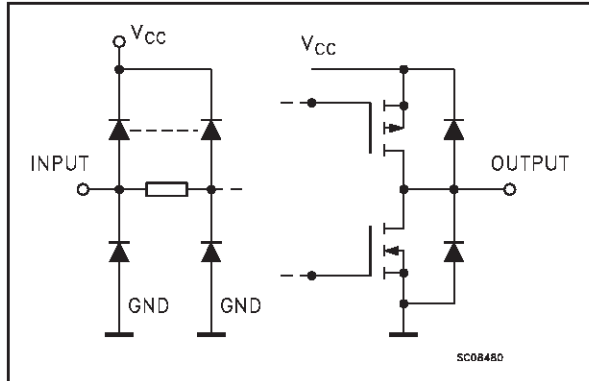
In order to enhance PC board layout, the 74AC541 offers a pinout having inputs and outputs on opposite sides of the package.

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



INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

| PIN No                         | SYMBOL          | NAME AND FUNCTION       |
|--------------------------------|-----------------|-------------------------|
| 1, 19                          | G1, 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        | Data Outputs            |
| 10                             | GND             | Ground (0V)             |
| 20                             | V <sub>CC</sub> | Positive Supply Voltage |

TRUTH TABLE

| INPUTS          |                 |                | 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 : Don't Care  
Z : High Impedance

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 Current                    | ± 50                          | mA   |
| I <sub>CC</sub> or I <sub>GND</sub> | DC V <sub>CC</sub> or Ground Current | ± 400                         | 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 conditions is not implied.

RECOMMENDED OPERATING CONDITIONS

| Symbol          | Parameter  | Value                | Unit |
|-----------------|--|----------------------|------|
| V <sub>CC</sub> | Supply Voltage   | 2 to 6               | V    |
| V <sub>I</sub>  | Input Voltage  | 0 to V <sub>CC</sub> | V    |
| V <sub>O</sub>  | Output Voltage   | 0 to V <sub>CC</sub> | V    |
| T <sub>op</sub> | Operating Temperature  | -55 to 125           | °C   |
| dt/dv           | Input Rise and Fall Time V <sub>CC</sub> = 3.0, 4.5 or 5.5V (note 1) | 8                    | ns/V |

1) V<sub>IN</sub> from 30% to 70% of V<sub>CC</sub>

## DC SPECIFICATIONS

| Symbol           | Parameter                             | Test Condition         |  | Value                 |       |       |             |       |              | Unit |      |
|------------------|---------------------------------------|------------------------|--|-----------------------|-------|-------|-------------|-------|--------------|------|------|
|                  |                                       | V <sub>CC</sub><br>(V) |  | T <sub>A</sub> = 25°C |       |       | -40 to 85°C |       | -55 to 125°C |      |      |
|                  |                                       |                        |  | Min.                  | Typ.  | Max.  | Min.        | Max.  | Min.         |      | Max. |
| V <sub>IH</sub>  | High Level Input Voltage              | 3.0                    | V <sub>O</sub> = 0.1 V or<br>V <sub>CC</sub> -0.1V   | 2.1                   | 1.5   |       | 2.1         |       | 2.1          |      | V    |
|                  |                                       | 4.5                    |  | 3.15                  | 2.25  |       | 3.15        |       | 3.15         |      |      |
|                  |                                       | 5.5                    |  | 3.85                  | 2.75  |       | 3.85        |       | 3.85         |      |      |
| V <sub>IL</sub>  | Low Level Input Voltage               | 3.0                    | V <sub>O</sub> = 0.1 V or<br>V <sub>CC</sub> -0.1V   |                       | 1.5   | 0.9   |             | 0.9   |              | 0.9  | V    |
|                  |                                       | 4.5                    |  |                       | 2.25  | 1.35  |             | 1.35  |              | 1.35 |      |
|                  |                                       | 5.5                    |  |                       | 2.75  | 1.65  |             | 1.65  |              | 1.65 |      |
| V <sub>OH</sub>  | High Level Output Voltage             | 3.0                    | I <sub>O</sub> =-50 μA   | 2.9                   | 2.99  |       | 2.9         |       | 2.9          |      | V    |
|                  |                                       | 4.5                    | I <sub>O</sub> =-50 μA   | 4.4                   | 4.49  |       | 4.4         |       | 4.4          |      |      |
|                  |                                       | 5.5                    | I <sub>O</sub> =-50 μA   | 5.4                   | 5.49  |       | 5.4         |       | 5.4          |      |      |
|                  |                                       | 3.0                    | I <sub>O</sub> =-12 mA   | 2.56                  |       |       | 2.46        |       | 2.4          |      |      |
|                  |                                       | 4.5                    | I <sub>O</sub> =-24 mA   | 3.86                  |       |       | 3.76        |       | 3.7          |      |      |
|                  |                                       | 5.5                    | I <sub>O</sub> =-24 mA   | 4.86                  |       |       | 4.76        |       | 4.7          |      |      |
| V <sub>OL</sub>  | Low Level Output Voltage              | 3.0                    | I <sub>O</sub> =50 μA  |                       | 0.002 | 0.1   |             | 0.1   |              | 0.1  | V    |
|                  |                                       | 4.5                    | I <sub>O</sub> =50 μA  |                       | 0.001 | 0.1   |             | 0.1   |              | 0.1  |      |
|                  |                                       | 5.5                    | I <sub>O</sub> =50 μA  |                       | 0.001 | 0.1   |             | 0.1   |              | 0.1  |      |
|                  |                                       | 3.0                    | I <sub>O</sub> =12 mA  |                       |       | 0.36  |             | 0.44  |              | 0.5  |      |
|                  |                                       | 4.5                    | I <sub>O</sub> =24 mA  |                       |       | 0.36  |             | 0.44  |              | 0.5  |      |
|                  |                                       | 5.5                    | I <sub>O</sub> =24 mA  |                       |       | 0.36  |             | 0.44  |              | 0.5  |      |
| I <sub>I</sub>   | Input Leakage Current                 | 5.5                    | V <sub>I</sub> = V <sub>CC</sub> or GND  |                       |       | ± 0.1 |             | ± 1   |              | ± 1  | μA   |
| I <sub>oz</sub>  | High Impedance Output Leakage Current | 5.5                    | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>V <sub>O</sub> = V <sub>CC</sub> or GND |                       |       | ± 0.3 |             | ± 2.5 |              | ± 5  | μA   |
| I <sub>CC</sub>  | Quiescent Supply Current              | 5.5                    | V <sub>I</sub> = V <sub>CC</sub> or GND  |                       |       | 4     |             | 40    |              | 80   | μA   |
| I <sub>OLD</sub> | Dynamic Output Current (note 1, 2)    | 5.5                    | V <sub>OLD</sub> = 1.65 V max  |                       |       |       |             | 75    |              | 50   | mA   |
| I <sub>OHD</sub> |                                       |                        | V <sub>OHD</sub> = 3.85 V min  |                       |       |       |             | -75   |              | -50  | mA   |

1) Maximum test duration 2ms, one output loaded at a time

2) Incident wave switching is guaranteed on transmission lines with impedances as low as 50Ω

**AC ELECTRICAL CHARACTERISTICS** ( $C_L = 50 \text{ pF}$ ,  $R_L = 500 \Omega$ , Input  $t_r = t_f = 3\text{ns}$ )

| Symbol                | Parameter              | Test Condition  |  | Value                    |      |      |                                    |      |                                     | Unit |      |
|-----------------------|------------------------|-----------------|--|--------------------------|------|------|------------------------------------|------|-------------------------------------|------|------|
|                       |                        | $V_{CC}$<br>(V) |  | $T_A = 25^\circ\text{C}$ |      |      | $-40 \text{ to } 85^\circ\text{C}$ |      | $-55 \text{ to } 125^\circ\text{C}$ |      |      |
|                       |                        |                 |  | Min.                     | Typ. | Max. | Min.                               | Max. | Min.                                |      | Max. |
| $t_{PLH}$ , $t_{PHL}$ | Propagation Delay Time | 3.3(*)          |  | 1.5                      | 5.0  | 8.0  | 1.5                                | 9.0  | 1.5                                 | 9.0  | ns   |
|                       |                        | 5.0(**)         |  | 1.5                      | 4.0  | 6.5  | 1.5                                | 7.0  | 1.5                                 | 7.0  |      |
| $t_{PZL}$ , $t_{PZH}$ | Output Enable Time     | 3.3(*)          |  | 1.5                      | 7.0  | 10.5 | 1.5                                | 11.5 | 1.5                                 | 11.5 | ns   |
|                       |                        | 5.0(**)         |  | 1.5                      | 5.0  | 8.0  | 1.5                                | 8.5  | 1.5                                 | 8.5  |      |
| $t_{PLZ}$ , $t_{PHZ}$ | Output Disable Time    | 3.3(*)          |  | 1.5                      | 7.0  | 10.5 | 1.5                                | 11.5 | 1.5                                 | 11.5 | ns   |
|                       |                        | 5.0(**)         |  | 1.5                      | 5.0  | 9.0  | 1.5                                | 9.5  | 1.5                                 | 9.5  |      |

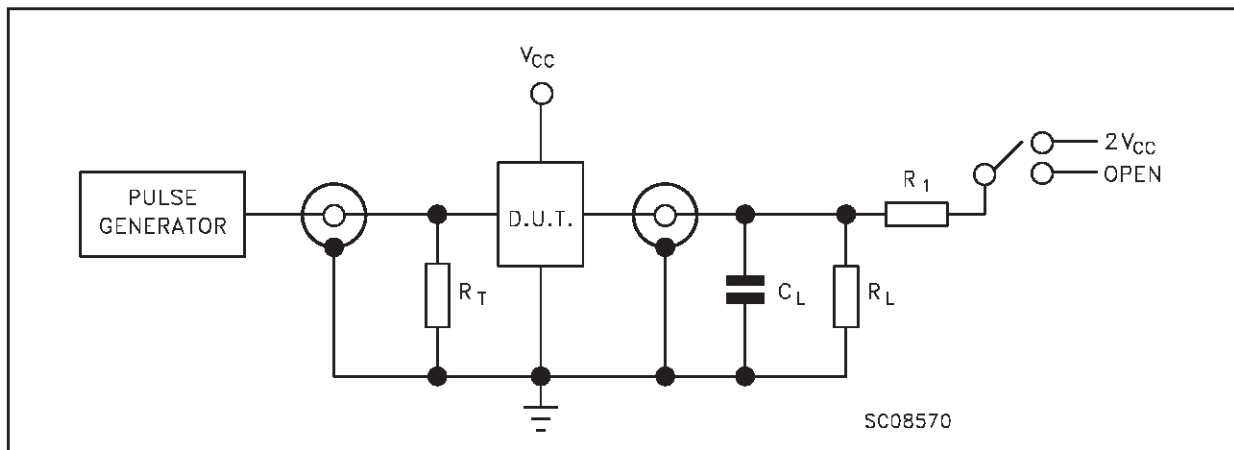
(\*) Voltage range is  $3.3\text{V} \pm 0.3\text{V}$   
 (\*\*) Voltage range is  $5.0\text{V} \pm 0.5\text{V}$

**CAPACITIVE CHARACTERISTICS**

| Symbol    | Parameter                              | Test Condition  |                         | Value                    |      |      |                                    |      |                                     | Unit |      |
|-----------|--|-----------------|-------------------------|--------------------------|------|------|------------------------------------|------|-------------------------------------|------|------|
|           |  | $V_{CC}$<br>(V) |                         | $T_A = 25^\circ\text{C}$ |      |      | $-40 \text{ to } 85^\circ\text{C}$ |      | $-55 \text{ to } 125^\circ\text{C}$ |      |      |
|           |  |                 |                         | Min.                     | Typ. | Max. | Min.                               | Max. | Min.                                |      | Max. |
| $C_{IN}$  | Input Capacitance                      | 5.0             |                         |                          | 5    |      |                                    |      |                                     |      | pF   |
| $C_{OUT}$ | Output Capacitance                     | 5.0             |                         |                          | 11   |      |                                    |      |                                     |      | pF   |
| $C_{PD}$  | Power Dissipation Capacitance (note 1) | 5.0             | $f_{IN} = 10\text{MHz}$ |                          | 30   |      |                                    |      |                                     |      | 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.  $I_{CC(oper)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/8$  (per circuit)

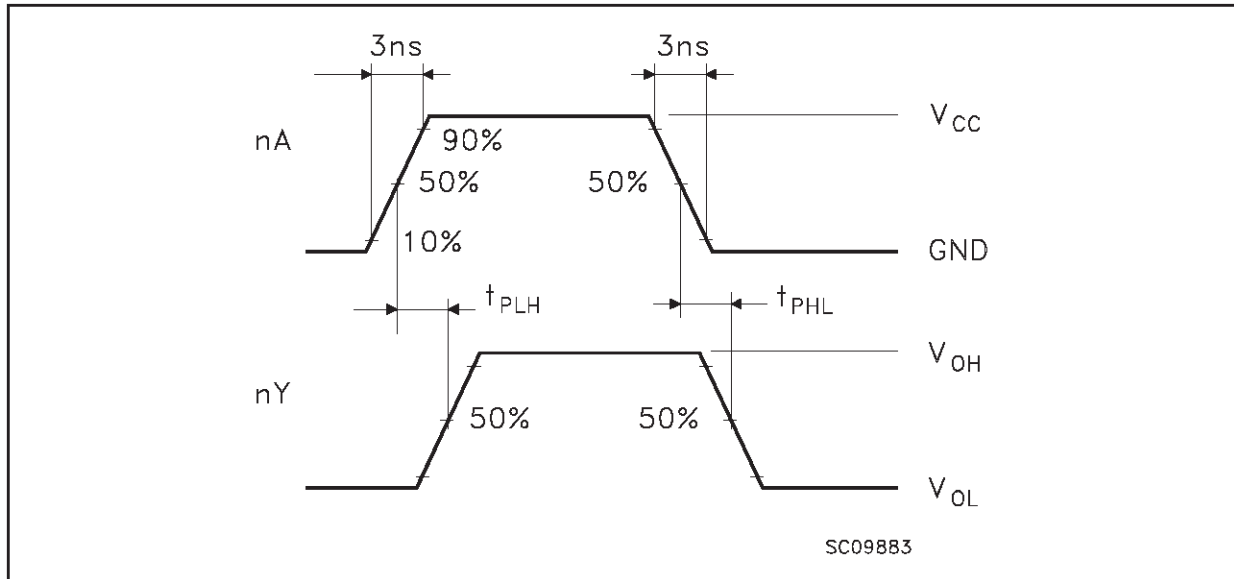
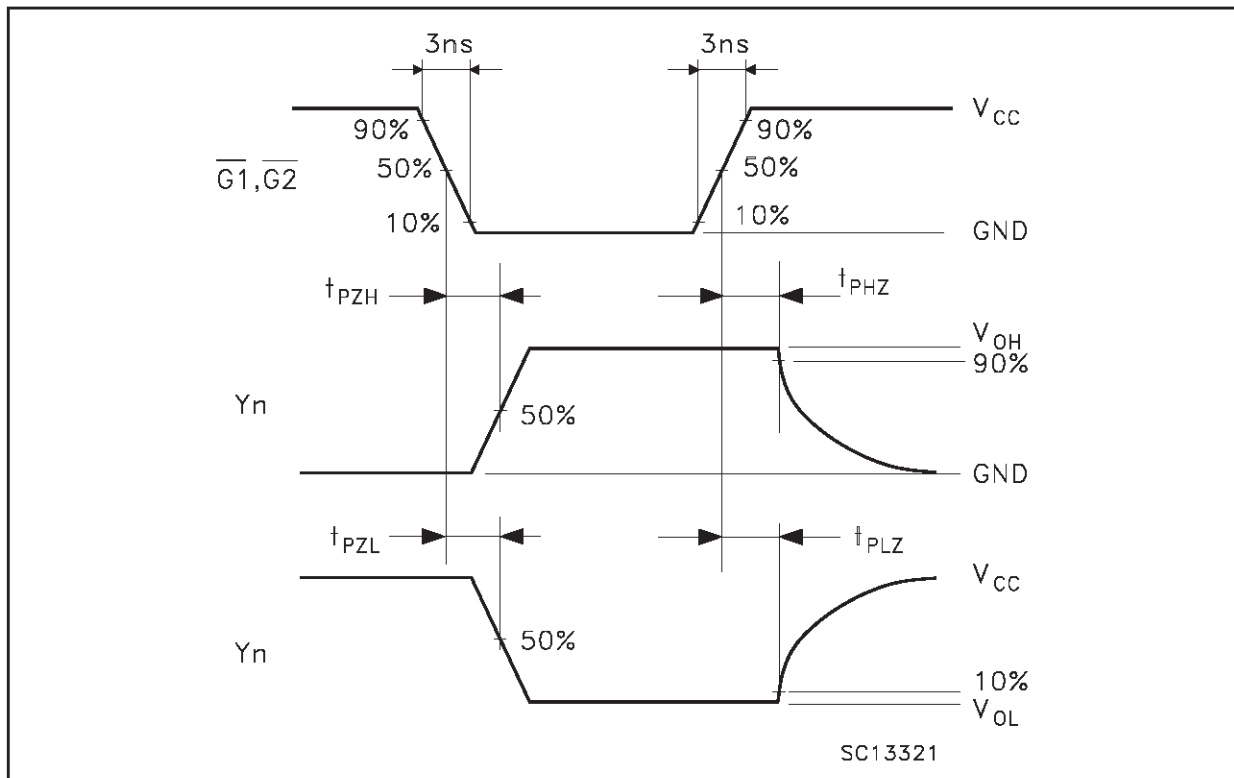
**TEST CIRCUIT**



| TEST                  | SWITCH    |
|-----------------------|-----------|
| $t_{PLH}$ , $t_{PHL}$ | Open      |
| $t_{PZL}$ , $t_{PLZ}$ | $2V_{CC}$ |
| $t_{PZH}$ , $t_{PHZ}$ | Open      |

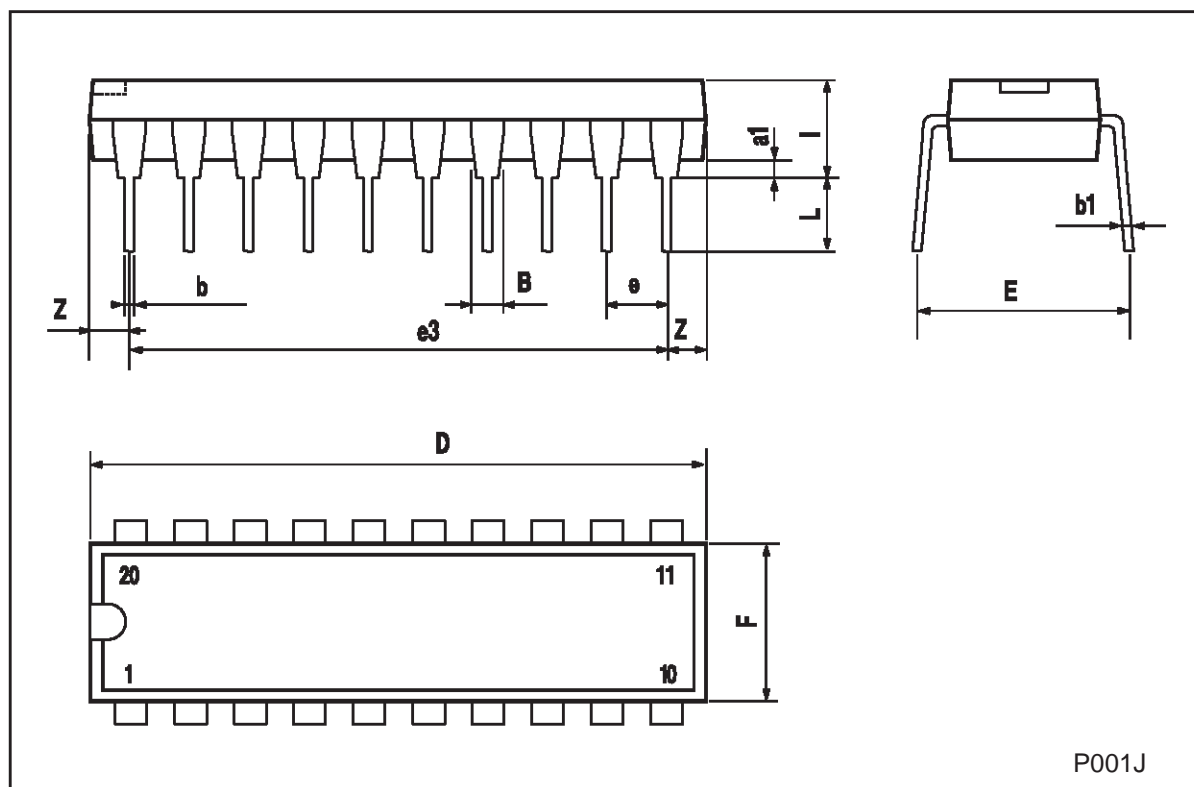
$C_L = 50\text{pF}$  or equivalent (includes jig and probe capacitance)  
 $R_L = R_1 = 500\Omega$  or equivalent  
 $R_T = Z_{OUT}$  of pulse generator (typically  $50\Omega$ )



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

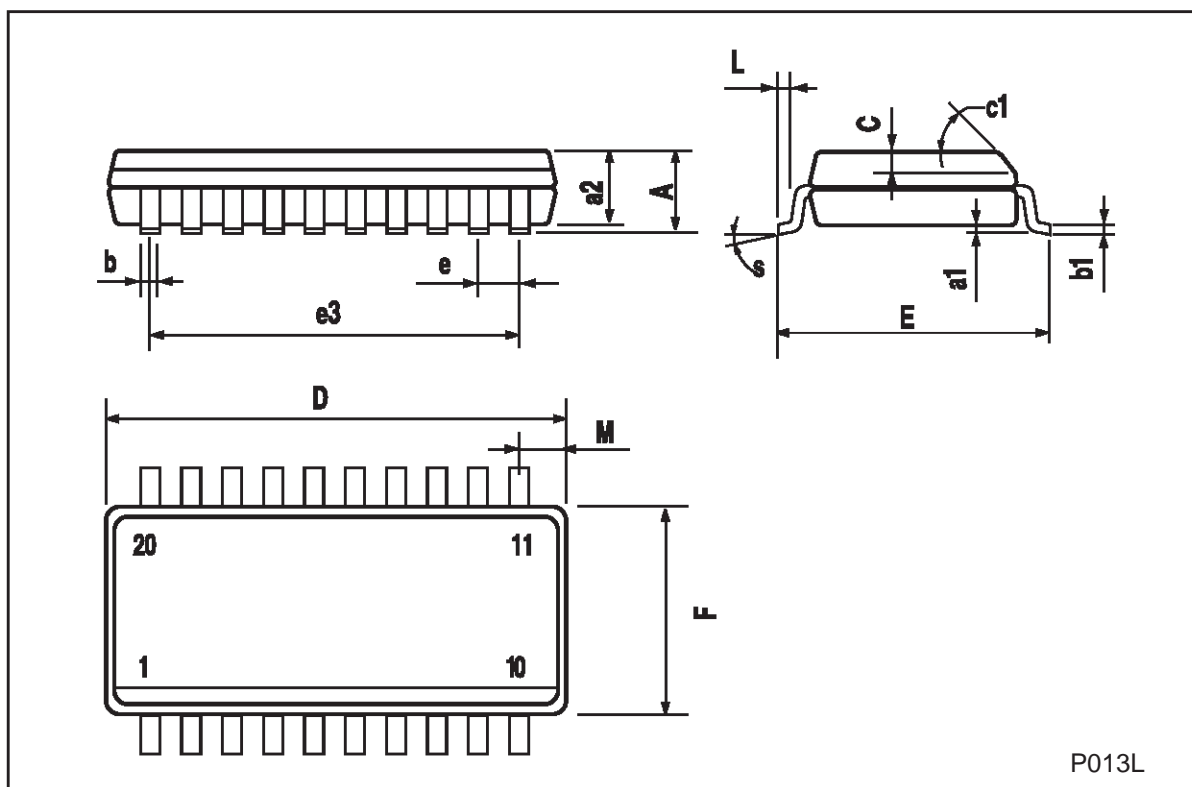
## Plastic DIP-20 (0.25) MECHANICAL DATA

| 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 |



## SO-20 MECHANICAL DATA

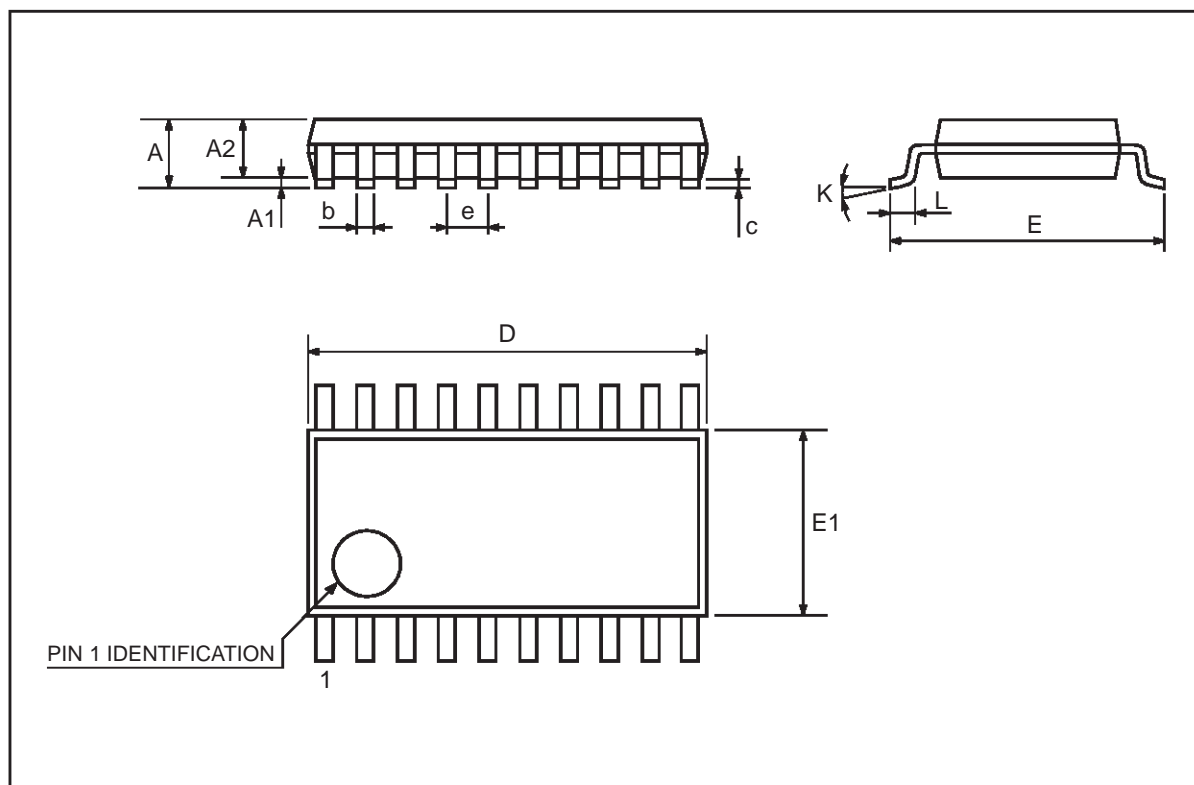
| DIM. | mm        |       |       | inch  |       |       |
|------|-----------|-------|-------|-------|-------|-------|
|      | MIN.      | TYP.  | MAX.  | MIN.  | TYP.  | MAX.  |
| A    |           |       | 2.65  |       |       | 0.104 |
| a1   | 0.10      |       | 0.20  | 0.004 |       | 0.007 |
| 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.)  |       |       |       |       |       |



P013L

## TSSOP20 MECHANICAL DATA

| DIM. | mm   |          |      | inch   |            |        |
|------|------|----------|------|--------|------------|--------|
|      | MIN. | TYP.     | MAX. | MIN.   | TYP.       | MAX.   |
| A    |      |          | 1.1  |        |            | 0.433  |
| A1   | 0.05 | 0.10     | 0.15 | 0.002  | 0.004      | 0.006  |
| A2   | 0.85 | 0.9      | 0.95 | 0.335  | 0.354      | 0.374  |
| b    | 0.19 |          | 0.30 | 0.0075 |            | 0.0118 |
| c    | 0.09 |          | 0.2  | 0.0035 |            | 0.0079 |
| D    | 6.4  | 6.5      | 6.6  | 0.252  | 0.256      | 0.260  |
| E    | 6.25 | 6.4      | 6.5  | 0.246  | 0.252      | 0.256  |
| E1   | 4.3  | 4.4      | 4.48 | 0.169  | 0.173      | 0.176  |
| e    |      | 0.65 BSC |      |        | 0.0256 BSC |        |
| K    | 0°   | 4°       | 8°   | 0°     | 4°         | 8°     |
| L    | 0.50 | 0.60     | 0.70 | 0.020  | 0.024      | 0.028  |





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