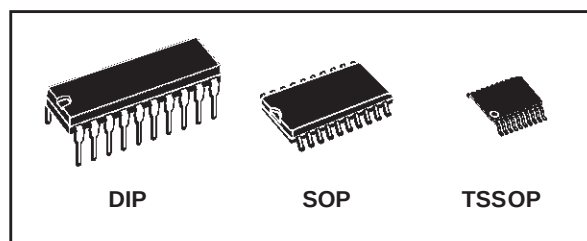




# M74HC541

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

- HIGH SPEED:  
 $t_{PD} = 9ns$  (TYP.) at  $V_{CC} = 6V$
- 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.)
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 6mA$  (MIN)
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \approx t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE:  
 $V_{CC}$  (OPR) = 2V to 6V
- PIN AND FUNCTION COMPATIBLE WITH  
74 SERIES 541



### ORDER CODES

| PACKAGE | TUBE        | T & R          |
|---------|-------------|----------------|
| DIP     | M74HC541B1R |                |
| SOP     | M74HC541M1R | M74HC541RM13TR |
| TSSOP   |             | M74HC541TTR    |

### DESCRIPTION

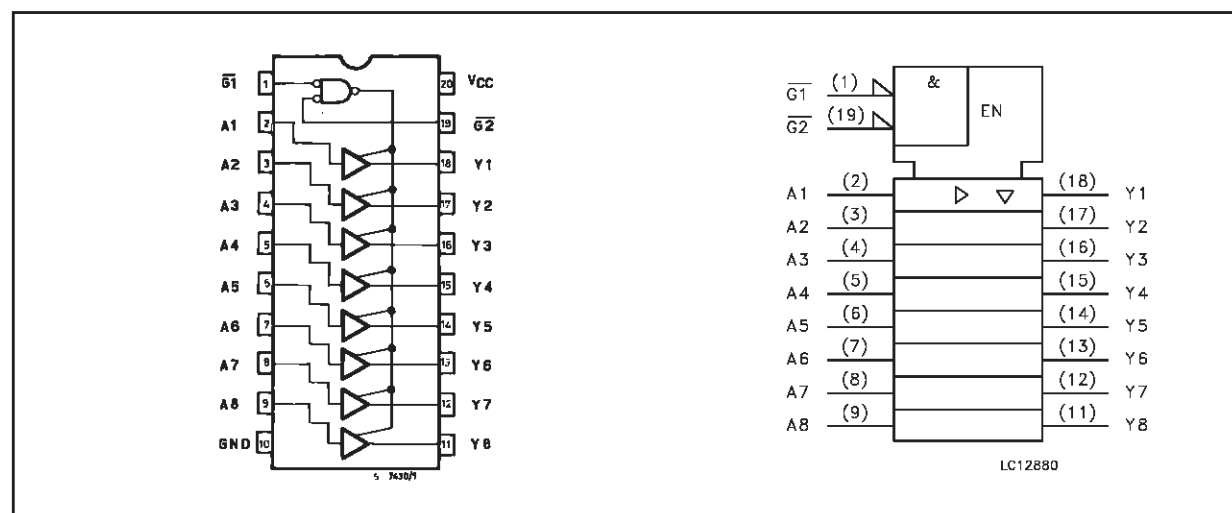
The 74HC541 is an advanced high-speed CMOS OCTAL BUS BUFFER (3-STATE) fabricated with silicon gate C<sup>2</sup>MOS technology. The M74HC541 is a non inverting buffer.

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

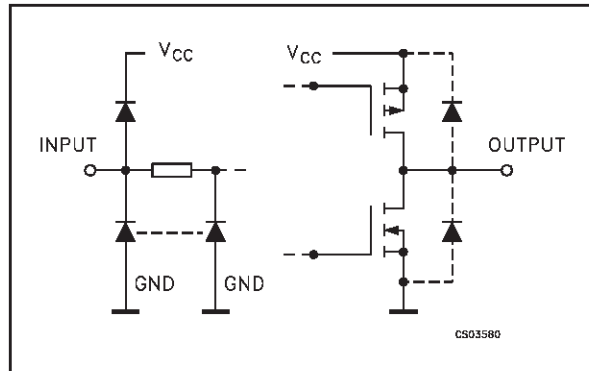
order to enhance PC board layout the M74HC541 offer a pinout having inputs and outputs on opposite sides of the package.

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

### PIN CONNECTION 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        | Bus 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 : 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                    | ± 35                          | mA   |
| I <sub>CC</sub> or I <sub>GND</sub> | DC V <sub>CC</sub> or Ground Current | ± 70                          | 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 conditions is not implied.

(\*) 500mW at 65 °C; derate to 300mW by 10mW/°C from 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    |                 | -55 to 125    | °C   |
| $t_r, t_f$ | Input Rise and Fall Time | $V_{CC} = 2.0V$ | 0 to 1000     | ns   |
|            |                          | $V_{CC} = 4.5V$ | 0 to 500      | ns   |
|            |                          | $V_{CC} = 6.0V$ | 0 to 400      | ns   |

## 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              | 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 <sub>IL</sub> | 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 <sub>OH</sub> | High Level Output Voltage             | 2.0                    | I <sub>O</sub> =-20 μA                                                                         | 1.9                   | 2.0  |       | 1.9         |      | 1.9          |      | V    |  |
|                 |                                       | 4.5                    | I <sub>O</sub> =-20 μA                                                                         | 4.4                   | 4.5  |       | 4.4         |      | 4.4          |      |      |  |
|                 |                                       | 6.0                    | I <sub>O</sub> =-20 μA                                                                         | 5.9                   | 6.0  |       | 5.9         |      | 5.9          |      |      |  |
|                 |                                       | 4.5                    | I <sub>O</sub> =-6.0 mA                                                                        | 4.18                  | 4.31 |       | 4.13        |      | 4.10         |      |      |  |
|                 |                                       | 6.0                    | I <sub>O</sub> =-7.8 mA                                                                        | 5.68                  | 5.8  |       | 5.63        |      | 5.60         |      |      |  |
| V <sub>OL</sub> | Low Level Output Voltage              | 2.0                    | I <sub>O</sub> =20 μA                                                                          |                       | 0.0  | 0.1   |             | 0.1  |              | 0.1  | V    |  |
|                 |                                       | 4.5                    | I <sub>O</sub> =20 μA                                                                          |                       | 0.0  | 0.1   |             | 0.1  |              | 0.1  |      |  |
|                 |                                       | 6.0                    | I <sub>O</sub> =20 μA                                                                          |                       | 0.0  | 0.1   |             | 0.1  |              | 0.1  |      |  |
|                 |                                       | 4.5                    | I <sub>O</sub> =6.0 mA                                                                         |                       | 0.17 | 0.26  |             | 0.33 |              | 0.40 |      |  |
|                 |                                       | 6.0                    | I <sub>O</sub> =7.8 mA                                                                         |                       | 0.18 | 0.26  |             | 0.33 |              | 0.40 |      |  |
| I <sub>I</sub>  | Input Leakage Current                 | 6.0                    | V <sub>I</sub> = V <sub>CC</sub> or GND                                                        |                       |      | ± 0.1 |             | ± 1  |              | ± 1  | μA   |  |
| I <sub>OZ</sub> | High Impedance Output Leakage Current | 6.0                    | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>V <sub>O</sub> = V <sub>CC</sub> or GND |                       |      | ± 0.5 |             | ± 5  |              | ± 10 | μA   |  |
| I <sub>CC</sub> | Quiescent Supply Current              | 6.0                    | V <sub>I</sub> = V <sub>CC</sub> or GND                                                        |                       |      | 4     |             | 40   |              | 80   | μA   |  |

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

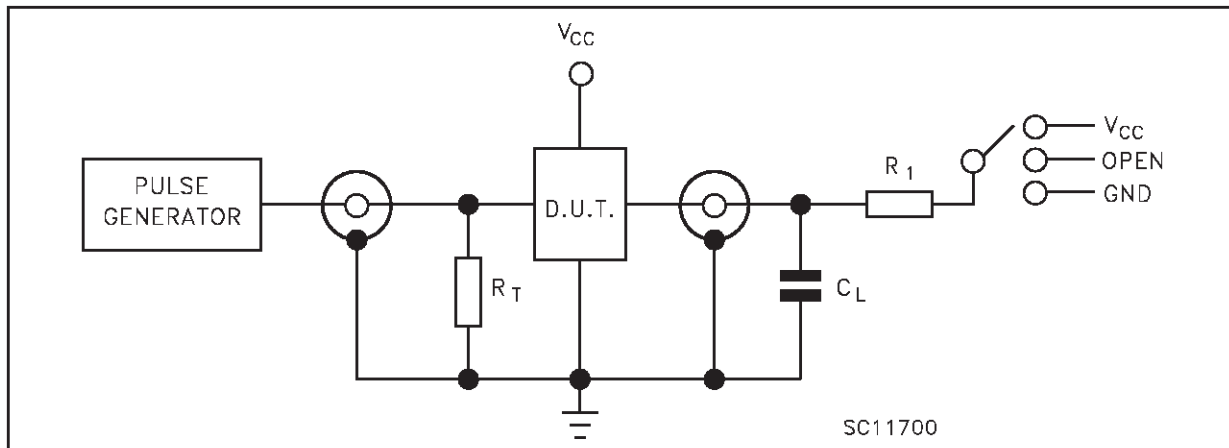
| Symbol                            | Parameter                          | Test Condition         |                        |                       | Value                 |      |      |             |      |              |      |    | Unit |
|-----------------------------------|------------------------------------|------------------------|------------------------|-----------------------|-----------------------|------|------|-------------|------|--------------|------|----|------|
|                                   |                                    | V <sub>CC</sub><br>(V) | C <sub>L</sub><br>(pF) |                       | T <sub>A</sub> = 25°C |      |      | -40 to 85°C |      | -55 to 125°C |      |    |      |
|                                   |                                    |                        |                        |                       | Min.                  | Typ. | Max. | Min.        | Max. | Min.         | Max. |    |      |
| t <sub>TLH</sub> t <sub>THL</sub> | Output Transition Time             | 2.0                    | 50                     |                       |                       | 25   | 60   |             | 75   |              | 90   | ns |      |
|                                   |                                    | 4.5                    |                        |                       |                       | 7    | 12   |             | 19   |              | 18   |    |      |
|                                   |                                    | 6.0                    |                        |                       |                       | 6    | 10   |             | 13   |              | 15   |    |      |
| t <sub>PLH</sub> t <sub>PHL</sub> | Propagation Delay Time             | 2.0                    | 50                     |                       |                       | 40   | 85   |             | 105  |              | 130  | ns |      |
|                                   |                                    | 4.5                    |                        |                       |                       | 10   | 17   |             | 21   |              | 26   |    |      |
|                                   |                                    | 6.0                    |                        |                       |                       | 9    | 14   |             | 18   |              | 22   |    |      |
|                                   |                                    |                        | 150                    |                       |                       | 56   | 115  |             | 145  |              | 175  | ns |      |
|                                   |                                    |                        |                        |                       |                       | 14   | 23   |             | 29   |              | 35   |    |      |
|                                   |                                    |                        |                        |                       |                       | 12   | 20   |             | 25   |              | 30   |    |      |
| t <sub>PZL</sub> t <sub>PZH</sub> | High Impedance Output Enable Time  | 2.0                    | 50                     | R <sub>L</sub> = 1 KΩ |                       | 47   | 110  |             | 140  |              | 165  | ns |      |
|                                   |                                    | 4.5                    |                        |                       |                       | 13   | 22   |             | 28   |              | 33   |    |      |
|                                   |                                    | 6.0                    |                        |                       |                       | 11   | 19   |             | 24   |              | 28   |    |      |
|                                   |                                    |                        | 150                    | R <sub>L</sub> = 1 KΩ |                       | 61   | 135  |             | 170  |              | 205  | ns |      |
|                                   |                                    |                        |                        |                       |                       | 17   | 27   |             | 34   |              | 41   |    |      |
|                                   |                                    |                        |                        |                       |                       | 14   | 23   |             | 29   |              | 35   |    |      |
| t <sub>PLZ</sub> t <sub>PHZ</sub> | High Impedance Output Disable Time | 2.0                    | 50                     | R <sub>L</sub> = 1 KΩ |                       | 52   | 110  |             | 140  |              | 165  | ns |      |
|                                   |                                    | 4.5                    |                        |                       |                       | 15   | 22   |             | 28   |              | 33   |    |      |
|                                   |                                    | 6.0                    |                        |                       |                       | 13   | 19   |             | 24   |              | 28   |    |      |

## CAPACITIVE CHARACTERISTICS

| 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. |
| C <sub>IN</sub> | Input Capacitance                      | 5.0                    |  |  |                       | 5    | 10   |             | 10   |              | 10   | pF   |
| C <sub>PD</sub> | Power Dissipation Capacitance (note 1) | 5.0                    |  |  |                       | 31   |      |             |      |              |      | 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.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/8$  (per circuit)

## TEST CIRCUIT

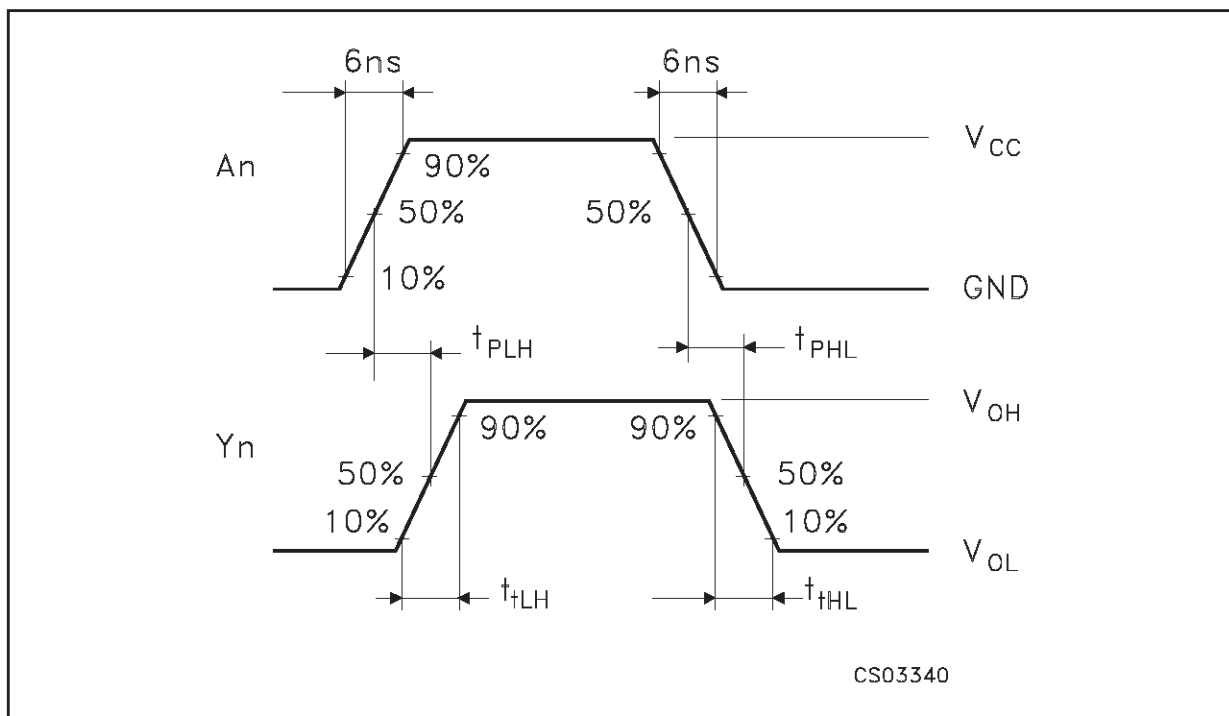


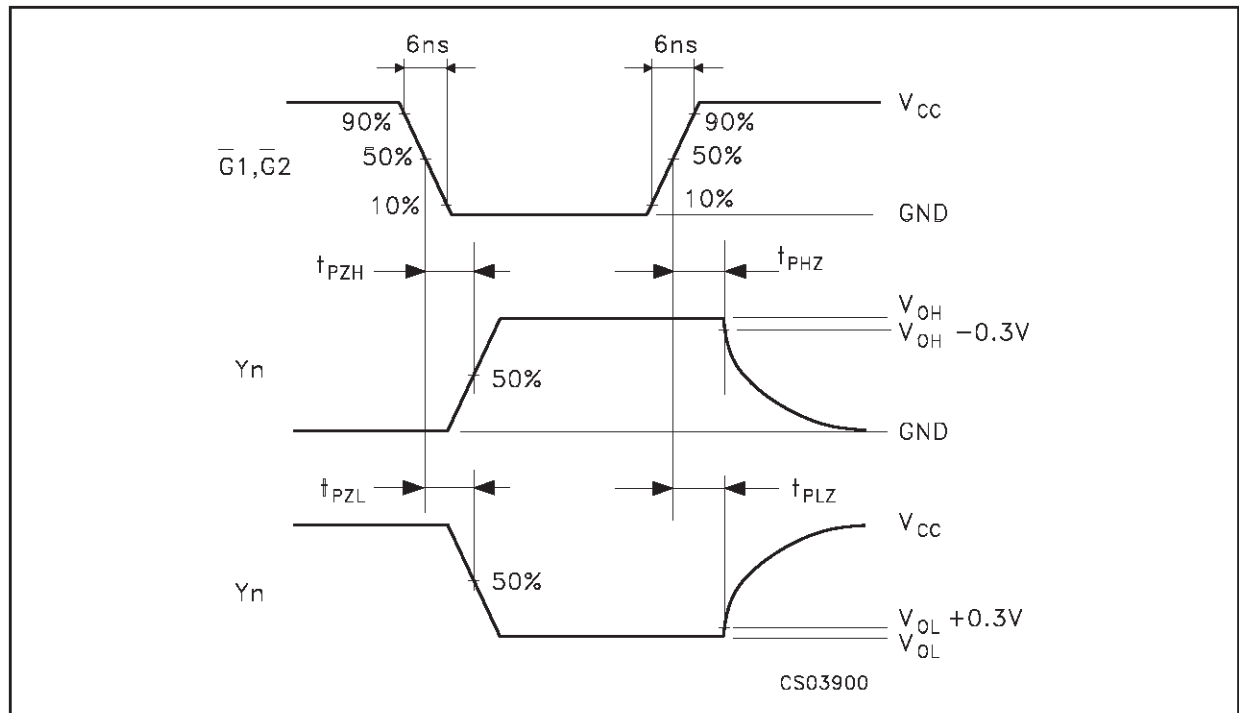
| TEST                  | SWITCH   |
|-----------------------|----------|
| $t_{PLH}$ , $t_{PHL}$ | Open     |
| $t_{PZL}$ , $t_{PLZ}$ | $V_{CC}$ |
| $t_{PZH}$ , $t_{PHZ}$ | GND      |

$C_L = 50\text{pF}/150\text{pF}$  or equivalent (includes jig and probe capacitance)

$R_1 = 1\text{K}\Omega$  or equivalent

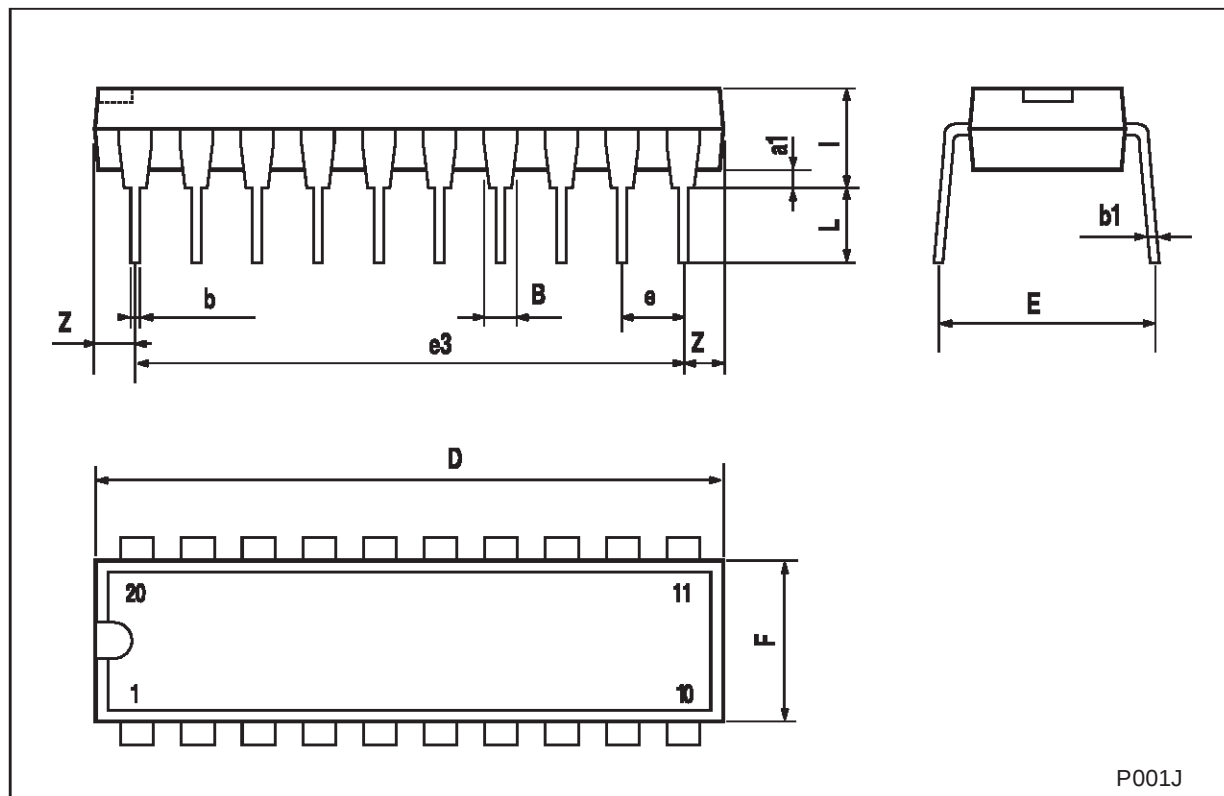
$R_T = Z_{OUT}$  of pulse generator (typically  $50\Omega$ )

WAVEFORM 1: PROPAGATION DELAY TIMES ( $f=1\text{MHz}$ ; 50% duty cycle)

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

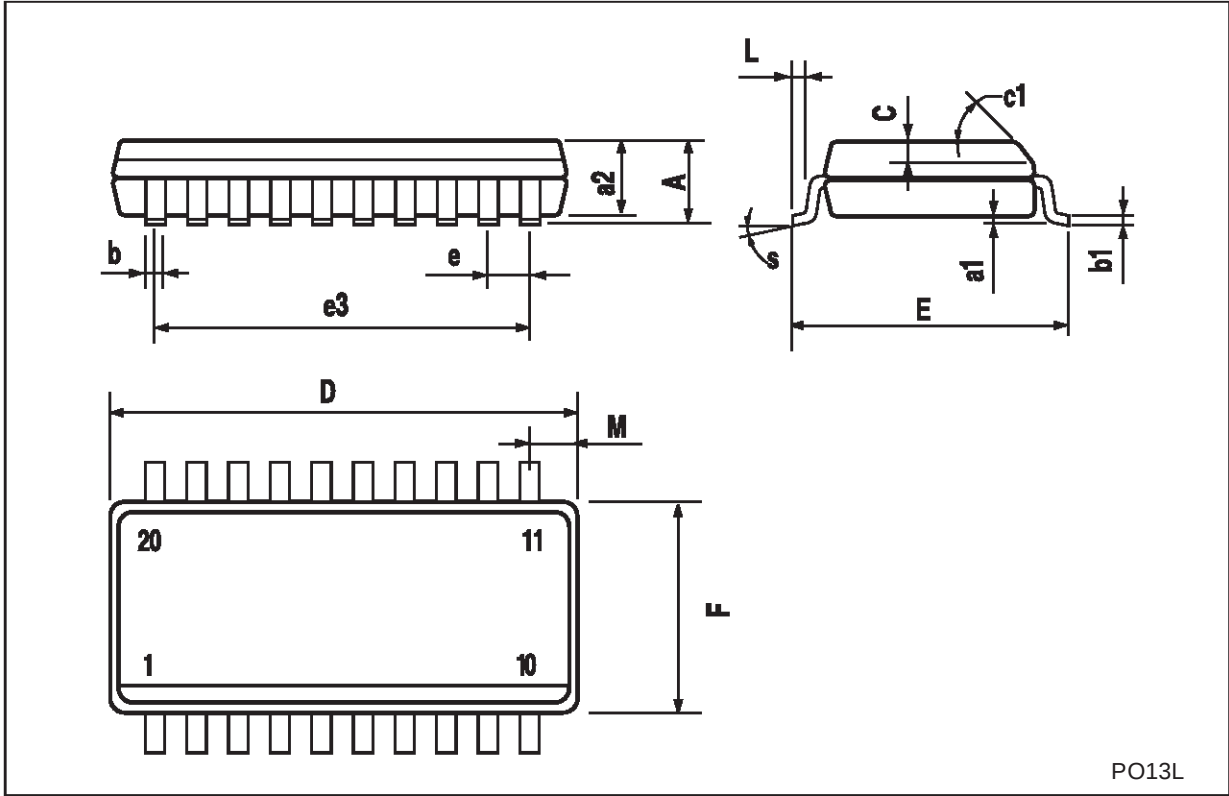
**Plastic DIP-20 (0.25) MECHANICAL DATA**

| 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 |
| I    |       |       | 3.93 |       |       | 0.155 |
| L    |       | 3.3   |      |       | 0.130 |       |
| Z    |       |       | 1.34 |       |       | 0.053 |



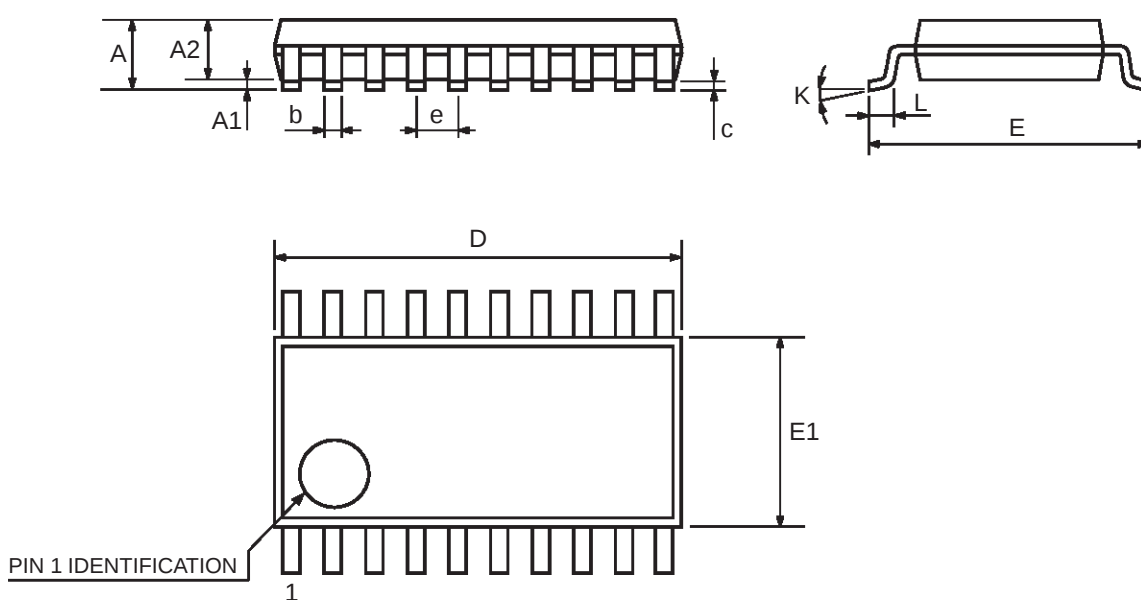
SO-20 MECHANICAL DATA

| DIM. | mm.        |       |       | inch  |       |       |
|------|------------|-------|-------|-------|-------|-------|
|      | MIN.       | TYP   | MAX.  | MIN.  | TYP.  | MAX.  |
| A    |            |       | 2.65  |       |       | 0.104 |
| a1   | 0.1        |       | 0.2   | 0.004 |       | 0.008 |
| a2   |            |       | 2.45  |       |       | 0.096 |
| b    | 0.35       |       | 0.49  | 0.014 |       | 0.019 |
| b1   | 0.23       |       | 0.32  | 0.009 |       | 0.012 |
| C    |            | 0.5   |       |       | 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 |       | 0.300 |
| L    | 0.50       |       | 1.27  | 0.020 |       | 0.050 |
| M    |            |       | 0.75  |       |       | 0.029 |
| S    | 8° (max.)  |       |       |       |       |       |



## TSSOP20 MECHANICAL DATA

| DIM. | mm.  |          |      | inch  |            |        |
|------|------|----------|------|-------|------------|--------|
|      | MIN. | TYP      | MAX. | MIN.  | TYP.       | MAX.   |
| A    |      |          | 1.2  |       |            | 0.047  |
| A1   | 0.05 |          | 0.15 | 0.002 | 0.004      | 0.006  |
| A2   | 0.8  | 1        | 1.05 | 0.031 | 0.039      | 0.041  |
| b    | 0.19 |          | 0.30 | 0.007 |            | 0.012  |
| c    | 0.09 |          | 0.20 | 0.004 |            | 0.0089 |
| D    | 6.4  | 6.5      | 6.6  | 0.252 | 0.256      | 0.260  |
| E    | 6.2  | 6.4      | 6.6  | 0.244 | 0.252      | 0.260  |
| E1   | 4.3  | 4.4      | 4.48 | 0.169 | 0.173      | 0.176  |
| e    |      | 0.65 BSC |      |       | 0.0256 BSC |        |
| K    | 0°   |          | 8°   | 0°    |            | 8°     |
| L    | 0.45 | 0.60     | 0.75 | 0.018 | 0.024      | 0.030  |



0087225C

Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

© The ST logo is a registered trademark of STMicroelectronics

© 2001 STMicroelectronics - Printed in Italy - All Rights Reserved  
STMicroelectronics GROUP OF COMPANIES

Australia - Brazil - China - Finland - France - Germany - Hong Kong - India - Italy - Japan - Malaysia - Malta - Morocco  
Singapore - Spain - Sweden - Switzerland - United Kingdom

© <http://www.st.com>