

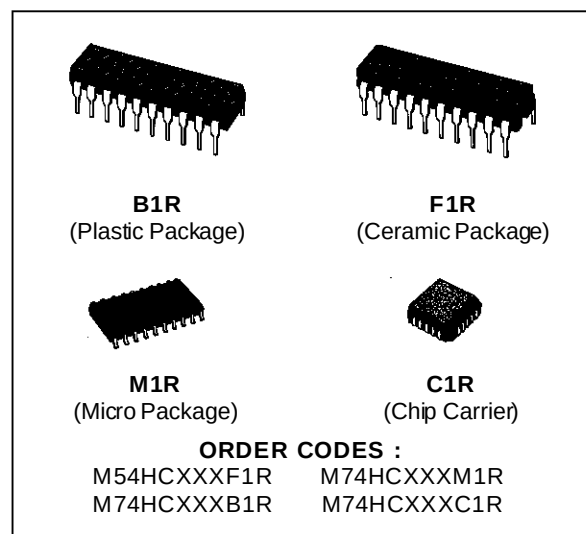
**OCTAL BUS BUFFER WITH 3 STATE OUTPUTS**  
**HC540: INVERTED - HC541 NON INVERTED**

- **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 C<sup>2</sup>MOS 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.

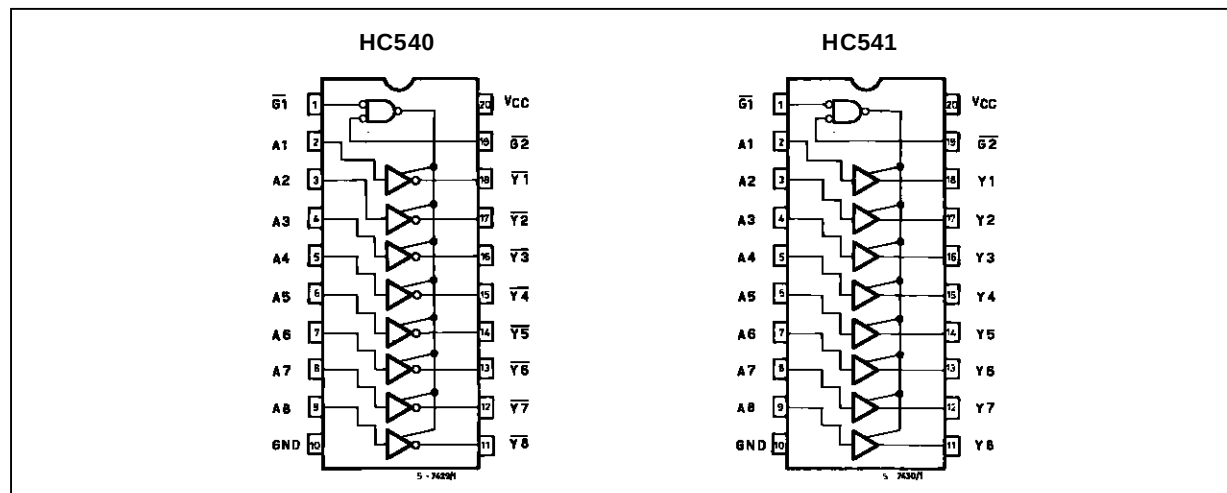
The 3 STATE control gate operates as a two input AND such that if either G1 and G2 are high, all eight output are in the high impedance state. In order to



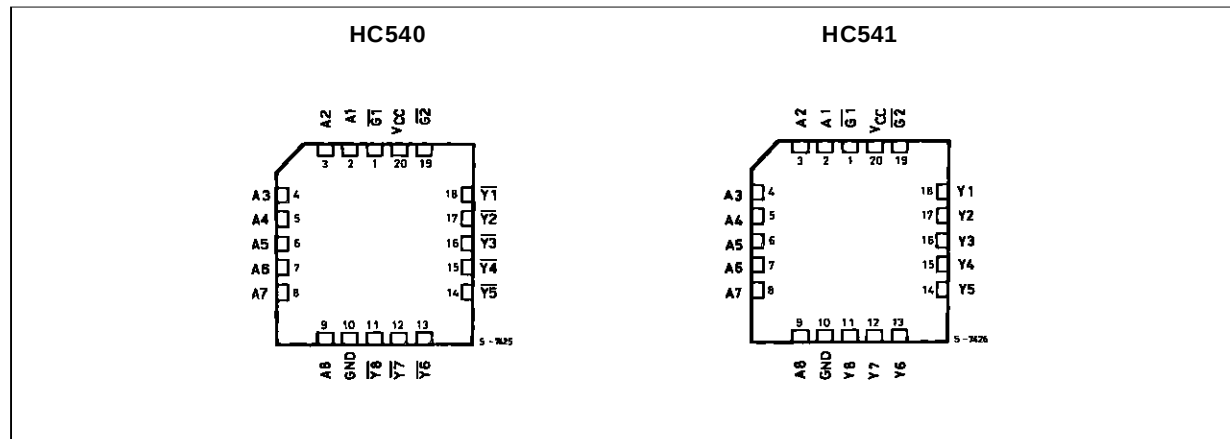
enhance PC board layout, the HC540 and HC541 offers a pinout having inputs and outputs on opposite sides of the package.

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

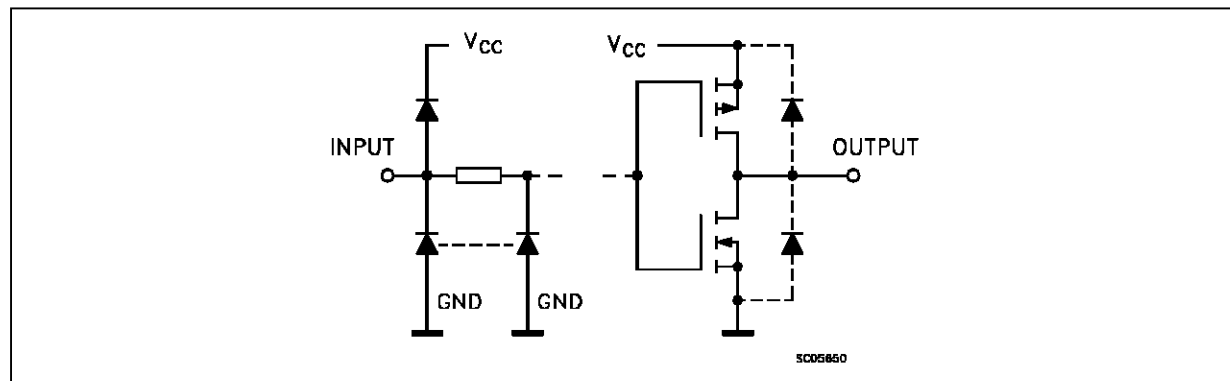
**PIN CONNECTION (top view)**



CHIP CARRIER



INPUT AND OUTPUT EQUIVALENT CIRCUIT



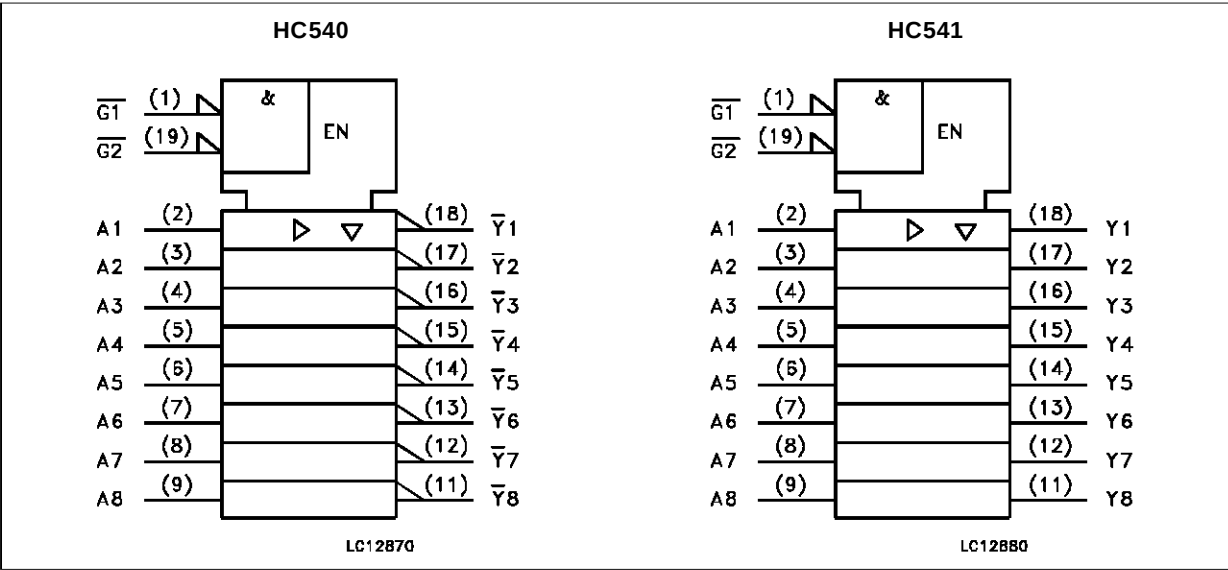
PIN DESCRIPTION (HC540)

| 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 <sub>CC</sub>                    | 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 <sub>CC</sub>                | Positive Supply Voltage |

IEC LOGIC SYMBOLS

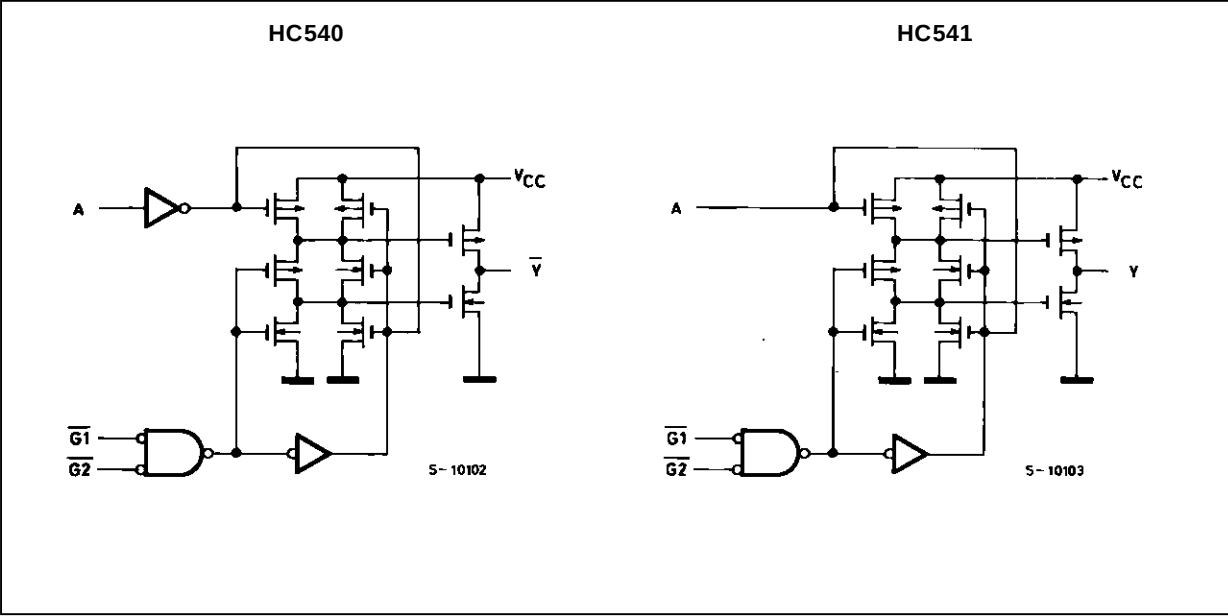


TRUTH TABLE

| 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 <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 Source Sink Current Per Output Pin | ± 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.

(\*) 500 mW: ≡ 65 °C derate to 300 mW by 10mW/°C: 65 °C to 85 °C

**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: <b>M54HC Series</b><br><b>M74HC Series</b> | -55 to +125<br>-40 to +85                                                 | °C<br>°C                          |
| t <sub>r</sub> , t <sub>f</sub> | Input Rise and Fall Time                                          | V <sub>CC</sub> = 2 V<br>V <sub>CC</sub> = 4.5 V<br>V <sub>CC</sub> = 6 V | 0 to 1000<br>0 to 500<br>0 to 400 |

## DC SPECIFICATIONS

| Symbol          | Parameter                        | Test Conditions        |                                                                                                | Value                                   |      |      |                      |      |                       | Unit |      |   |
|-----------------|----------------------------------|------------------------|------------------------------------------------------------------------------------------------|-----------------------------------------|------|------|----------------------|------|-----------------------|------|------|---|
|                 |                                  | V <sub>CC</sub><br>(V) |                                                                                                | T <sub>A</sub> = 25 °C<br>54HC and 74HC |      |      | -40 to 85 °C<br>74HC |      | -55 to 125 °C<br>54HC |      |      |   |
|                 |                                  |                        |                                                                                                | 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                    | V <sub>I</sub> =<br>V <sub>IH</sub><br>or<br>V <sub>IL</sub>                                   | I <sub>O</sub> =-20 μA                  | 1.9  | 2.0  |                      | 1.9  |                       | 1.9  |      | V |
|                 |                                  | 4.4                    |                                                                                                |                                         | 4.5  |      | 4.4                  |      | 4.4                   |      |      |   |
|                 |                                  | 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                    | V <sub>I</sub> =<br>V <sub>IH</sub><br>or<br>V <sub>IL</sub>                                   | I <sub>O</sub> = 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 <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> | 3 State Output Off State 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   |   |

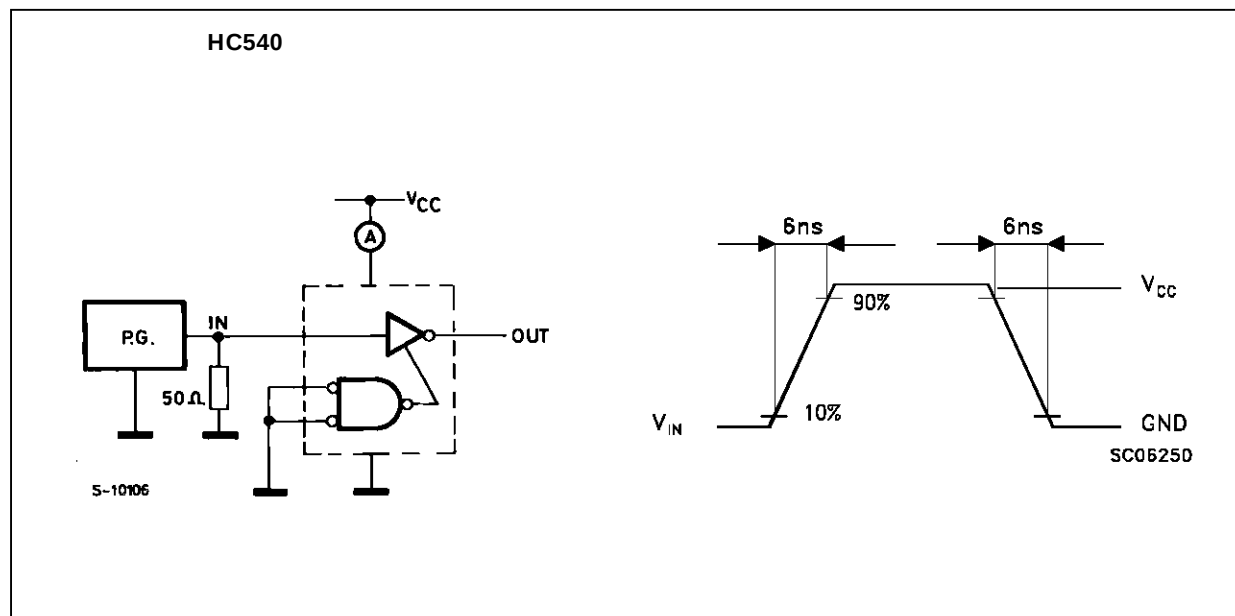
## M54/M74HC540/541

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

| Symbol                               | Parameter                     | Test Conditions                        |                        |                                                      | Value                                   |                                  |                                    |                      |                                    |                       | Unit                               |                  |
|--------------------------------------|-------------------------------|----------------------------------------|------------------------|------------------------------------------------------|-----------------------------------------|----------------------------------|------------------------------------|----------------------|------------------------------------|-----------------------|------------------------------------|------------------|
|                                      |                               | V <sub>CC</sub><br>(V)                 | C <sub>L</sub><br>(pF) |                                                      | T <sub>A</sub> = 25 °C<br>54HC and 74HC |                                  |                                    | -40 to 85 °C<br>74HC |                                    | -55 to 125 °C<br>54HC |                                    |                  |
|                                      |                               |                                        |                        |                                                      | Min.                                    | Typ.                             | Max.                               | Min.                 | Max.                               | Min.                  |                                    | Max.             |
| t <sub>TLH</sub><br>t <sub>THL</sub> | Output Transition Time        | 2.0<br>4.5<br>6.0                      | 50                     |                                                      |                                         | 25<br>7<br>6                     | 60<br>12<br>10                     |                      | 75<br>19<br>13                     |                       | 90<br>18<br>15                     | ns               |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay Time        | 2.0<br>4.5<br>6.0<br>2.0<br>4.5<br>6.0 | 50<br><br><br>150      |                                                      |                                         | 40<br>10<br>9<br>56<br>14<br>12  | 85<br>17<br>14<br>115<br>23<br>20  |                      | 105<br>21<br>18<br>145<br>29<br>25 |                       | 130<br>26<br>22<br>175<br>35<br>30 | ns<br><br><br>ns |
| t <sub>PZL</sub><br>t <sub>PZH</sub> | Output Enable Time            | 2.0<br>4.5<br>6.0<br>2.0<br>4.5<br>6.0 | 50<br><br><br>150      | R <sub>L</sub> = 1KΩ<br><br><br>R <sub>L</sub> = 1KΩ |                                         | 47<br>13<br>11<br>61<br>17<br>14 | 110<br>22<br>19<br>135<br>27<br>23 |                      | 140<br>28<br>24<br>170<br>34<br>29 |                       | 165<br>33<br>28<br>205<br>41<br>35 | ns<br><br><br>ns |
| t <sub>PLZ</sub><br>t <sub>PHZ</sub> | Output Disable Time           | 2.0<br>4.5<br>6.0                      | 50                     | R <sub>L</sub> = 1KΩ                                 |                                         | 52<br>15<br>13                   | 110<br>22<br>19                    |                      | 140<br>28<br>24                    |                       | 165<br>33<br>28                    | ns               |
| C <sub>IN</sub>                      | Input Capacitance             |                                        |                        |                                                      |                                         | 5                                | 10                                 |                      | 10                                 |                       | 10                                 | pF               |
| C <sub>PD</sub> (*)                  | Power Dissipation Capacitance |                                        |                        |                                                      |                                         | 31                               |                                    |                      |                                    |                       |                                    | pF               |

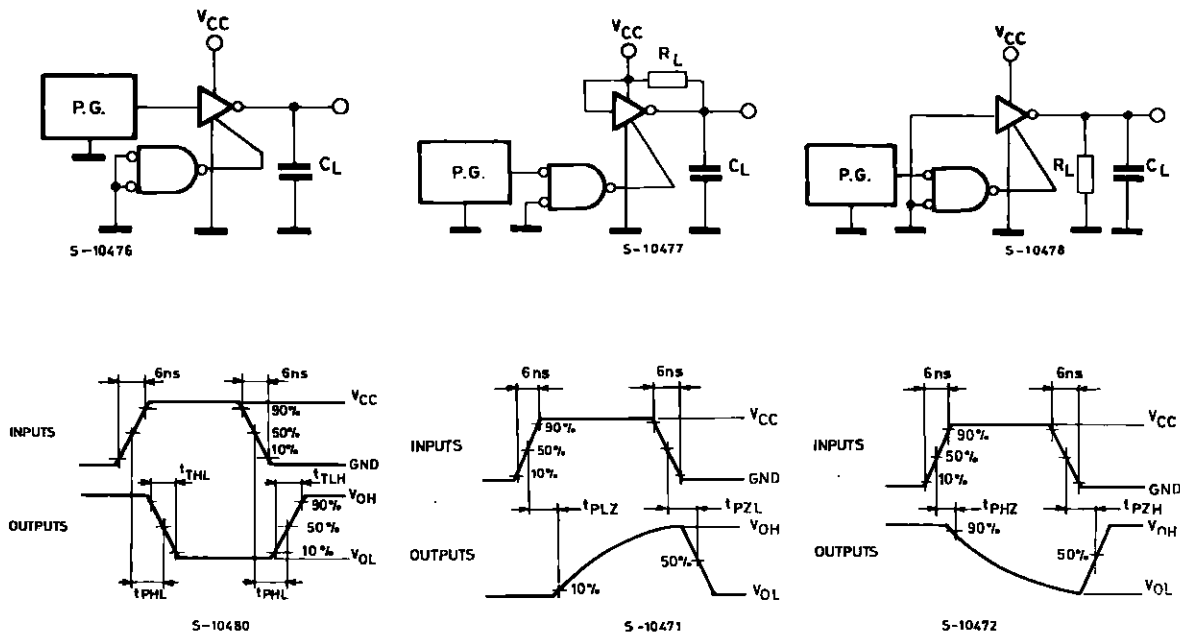
(\*)  $C_{PD}$  is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation.  $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} +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

### TEST CIRCUIT $I_{CC}$ (Opr.)

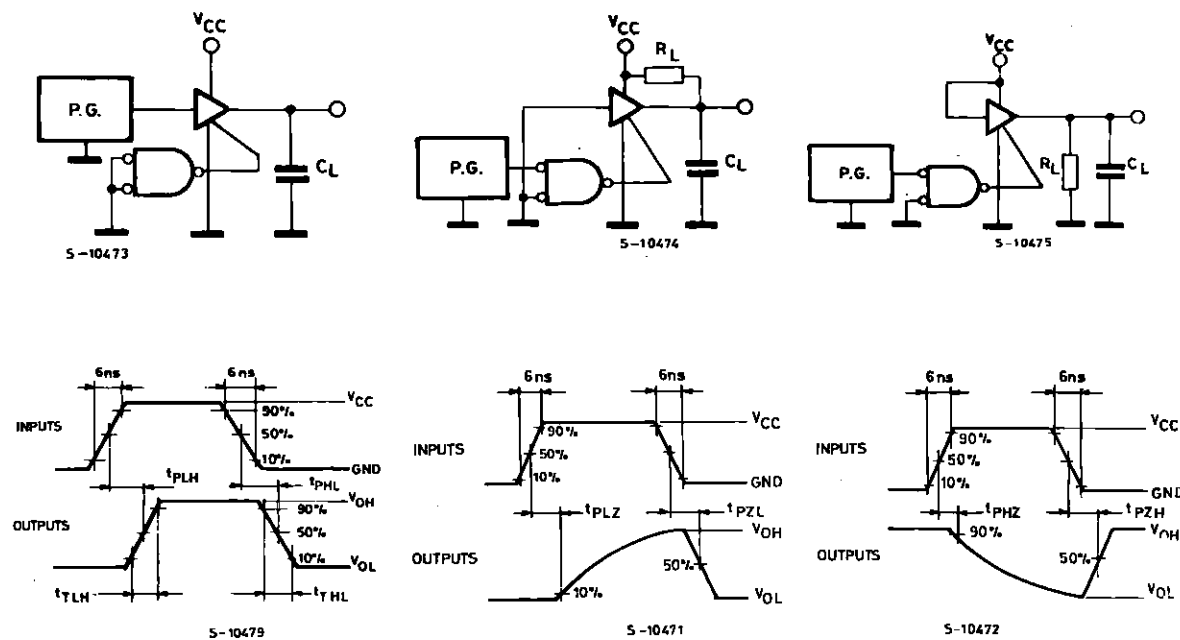


## SWITCHING CHARACTERISTICS TEST CIRCUIT

## HC540

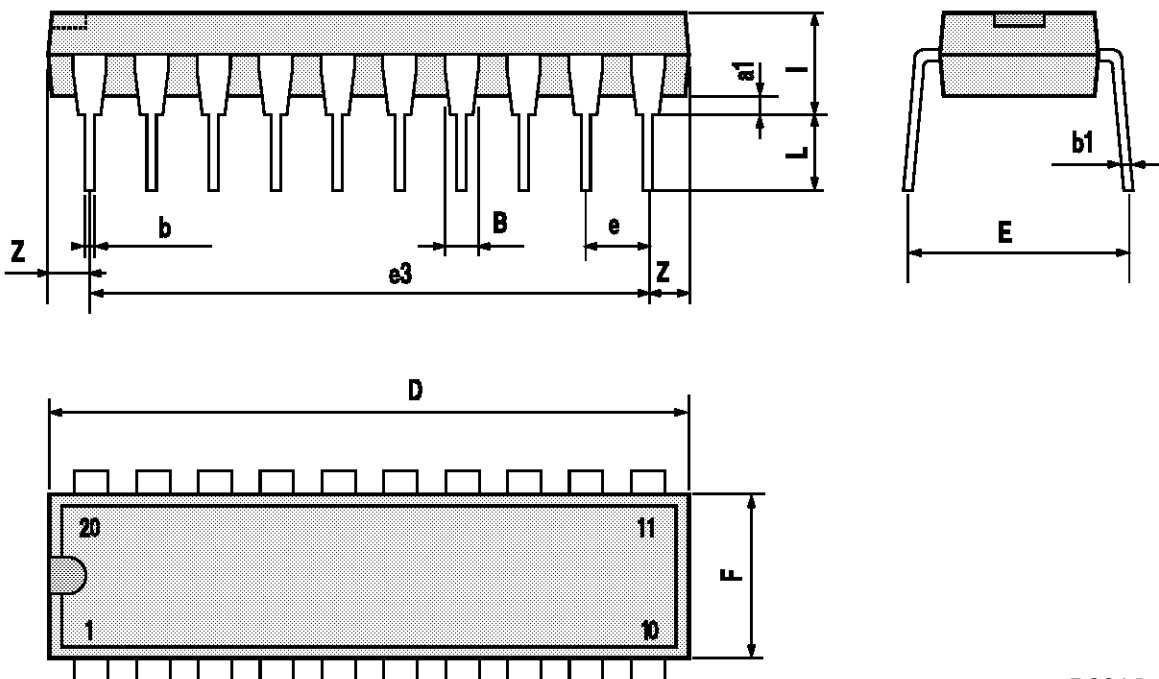


## HC541



## 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 |

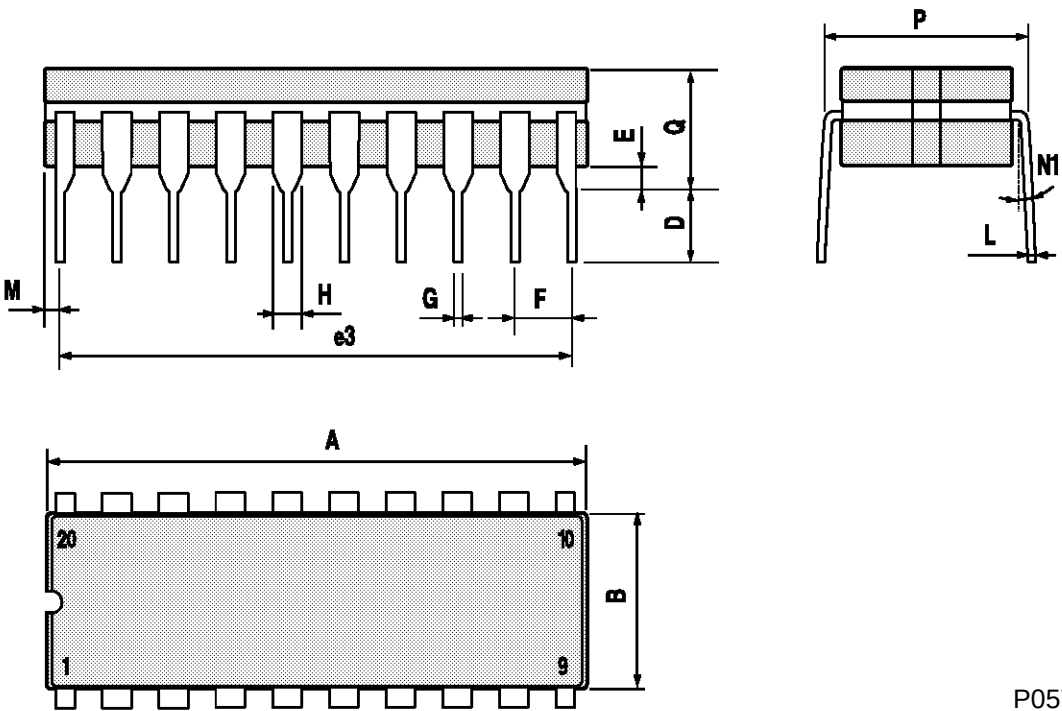


P001J



**Ceramic DIP20 MECHANICAL DATA**

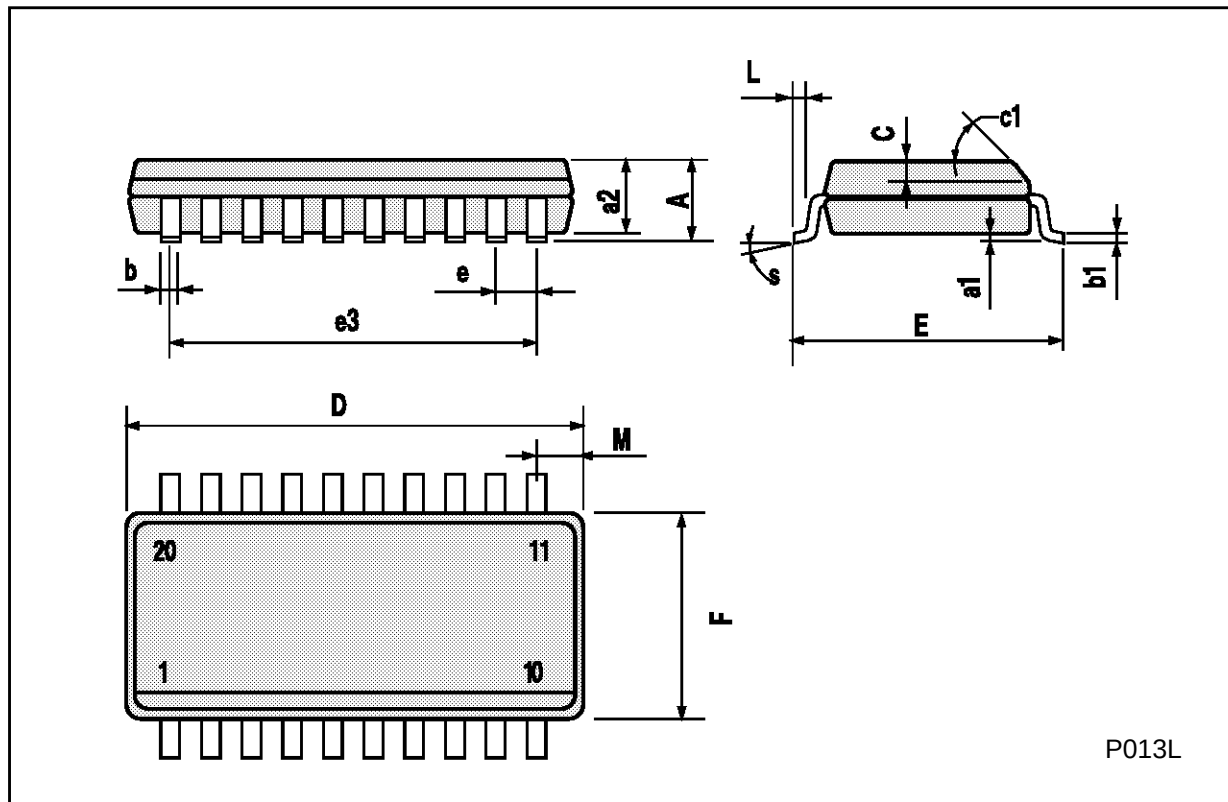
| DIM. | mm                    |       |      | inch  |       |       |
|------|-----------------------|-------|------|-------|-------|-------|
|      | MIN.                  | TYP.  | MAX. | MIN.  | TYP.  | MAX.  |
| A    |                       |       | 25   |       |       | 0.984 |
| B    |                       |       | 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

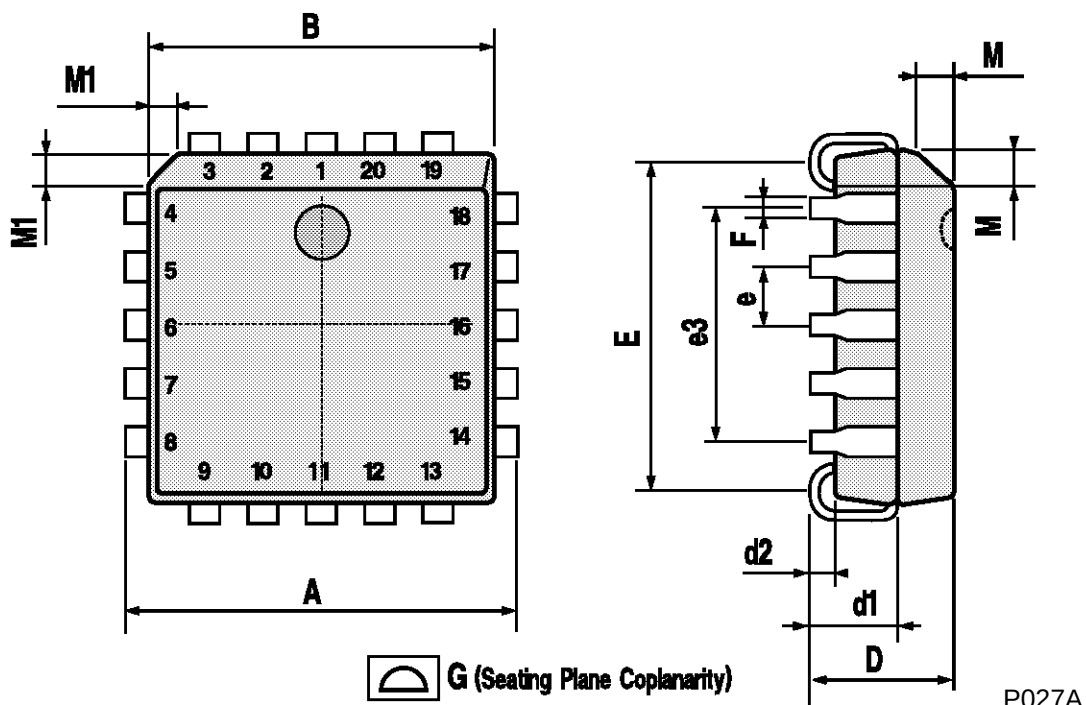
## SO20 MECHANICAL DATA

| 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.)  |       |       |       |       |       |



## 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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