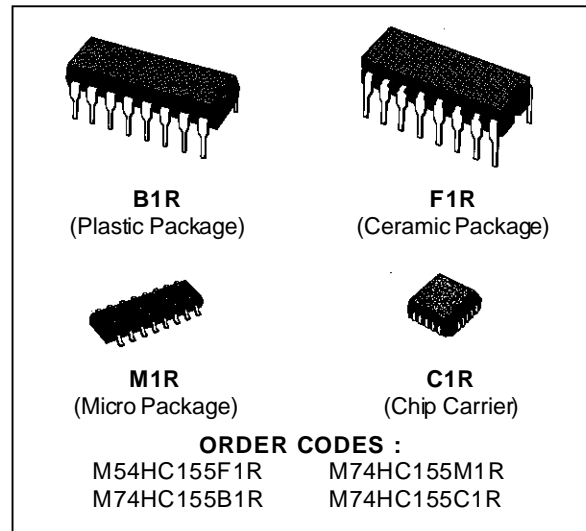


## DUAL 2 TO 4 LINE DECODER 3 TO 8 LINE DECODER

- HIGH SPEED  
 $t_{PD} = 12 \text{ ns (TYP.) AT } V_{CC} = 5 \text{ V}$
- LOW POWER DISSIPATION  
 $I_{CC} = 4 \mu\text{A (MAX.) AT } T_A = 25 \text{ }^\circ\text{C}$
- HIGH NOISE IMMUNITY  
 $V_{NIH} = V_{NIL} = 28 \% V_{CC} \text{ (MIN.)}$
- OUTPUT DRIVE CAPABILITY  
 10 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE  
 $|I_{OH}| = I_{OL} = 4 \text{ mA (MIN.)}$
- BALANCED PROPAGATION DELAYS  
 $t_{PLH} = t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE  
 $V_{CC} \text{ (OPR)} = 2 \text{ V TO } 6 \text{ V}$
- PIN AND FUNCTION COMPATIBLE  
 WITH 54/74LS155



### DESCRIPTION

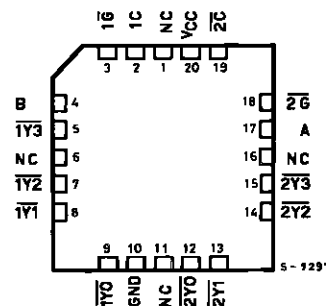
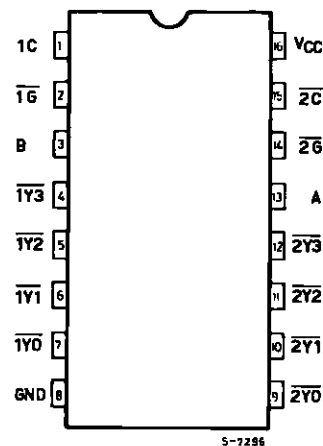
The M54/74HC155 is a high speed CMOS DUAL 2-TO-4 LINE DECODER fabricated in silicon gate C<sup>2</sup>MOS technology.

It has the same high speed performance of LSTTL combined with true CMOS low power consumption. It features dual 1-TO-4 line demultiplexers with individual strobe inputs (1G and 2G), individual data inputs (1C and 2C) and common binary address inputs (A and B).

When both decoders are enabled by the strobes, the inverted output of 1C data and non-inverted output of 2C data will be brought to the select output pins of each sections. A 1-TO-8 line demultiplexer can also be easily built up by providing a data signal to both 1C and 2C inputs ; the output order from the msb is 1Y3, 1Y2, 1Y1, 1Y0, 2Y3, 2Y2, 2Y1, 2Y0. This device can be used as a 2-to-4 line decoder or a 3-to-8 line decoder when 1C is held high and 2C is held low.

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

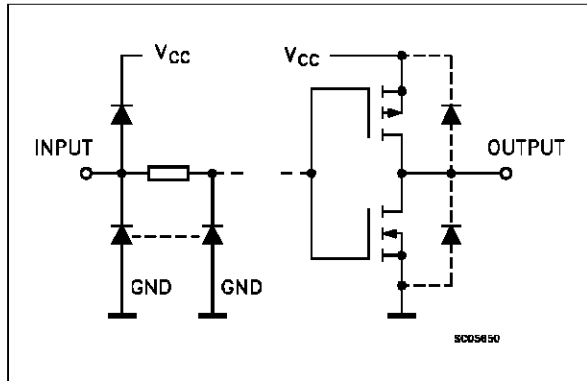
### PIN CONNECTIONS (top view)



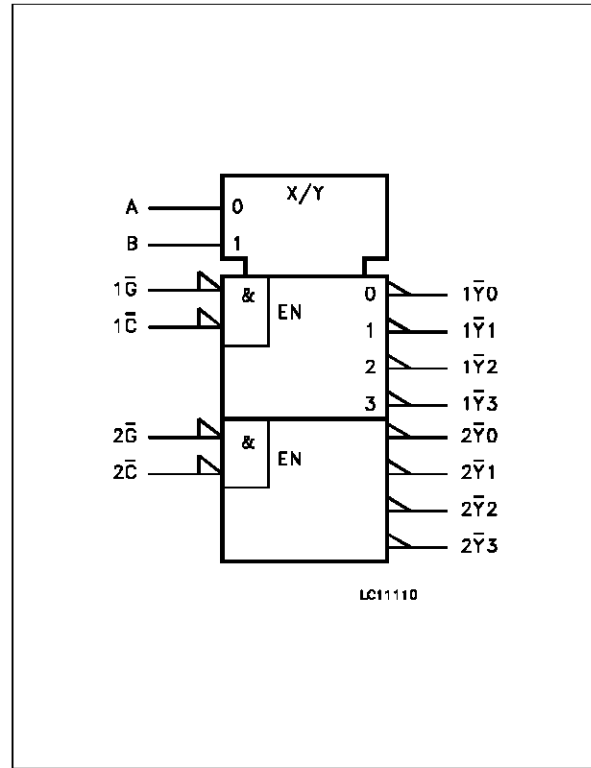
NC =  
No Internal  
Connection

# M54/M74HC155

## INPUT AND OUTPUT EQUIVALENT CIRCUIT



## IEC LOGIC SYMBOL



## PIN DESCRIPTION

| PIN No        | SYMBOL          | NAME AND FUNCTION       |
|---------------|-----------------|-------------------------|
| 1, 15         | 1C, 2C          | Data Inputs             |
| 2, 14         | 1G, 2G          | Strobe Inputs           |
| 3, 13         | B, A            | Common Data Inputs      |
| 7, 6, 5, 4    | 1Y0 to 1Y3      | Outputs                 |
| 9, 10, 11, 12 | 2Y0 to 2Y3      | Outputs                 |
| 8             | GND             | Ground (0V)             |
| 16            | V <sub>CC</sub> | Positive Supply Voltage |

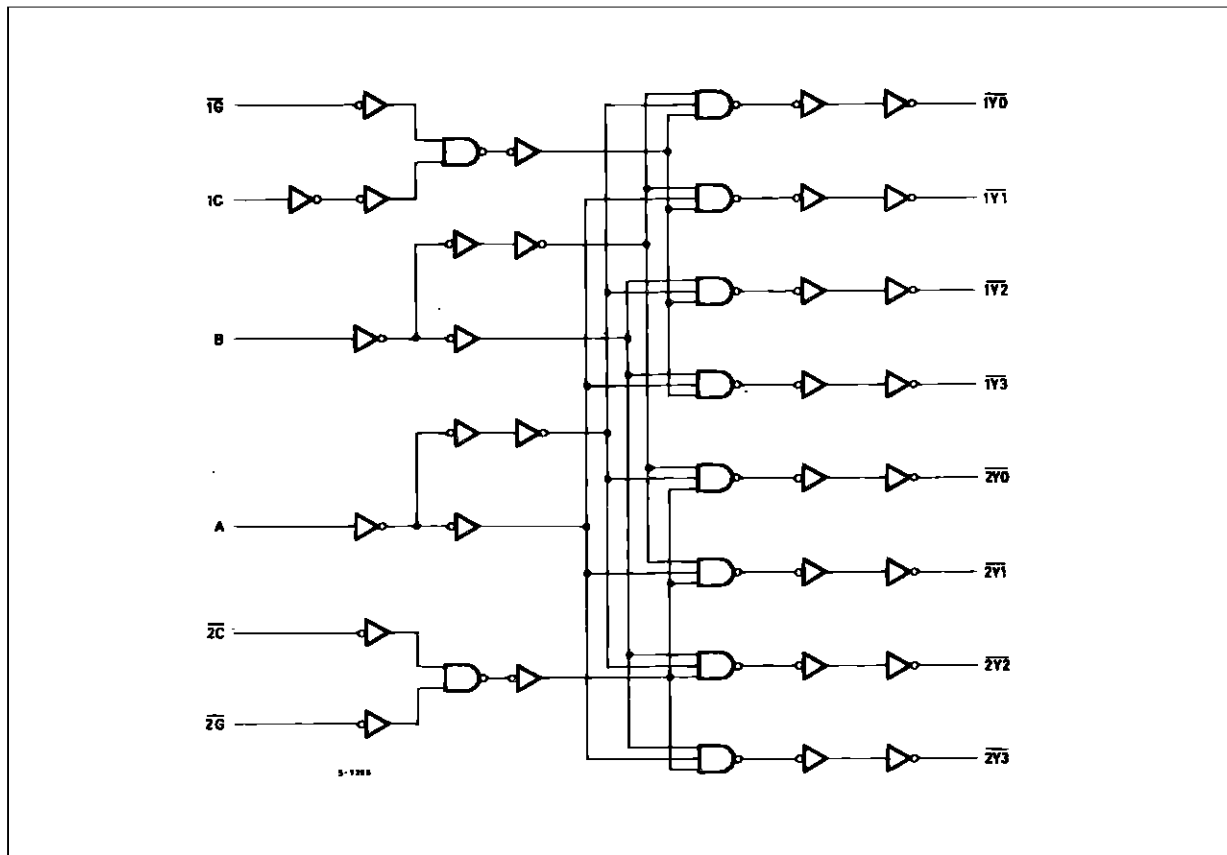
## TRUTH TABLE

| INPUTS |   |    |    | OUTPUTS |     |     |     |
|--------|---|----|----|---------|-----|-----|-----|
| B      | A | 1G | 1C | 1Y0     | 1Y1 | 1Y2 | 1Y3 |
| X      | X | H  | X  | H       | H   | H   | H   |
| L      | L | L  | H  | L       | H   | H   | H   |
| L      | H | L  | H  | H       | L   | H   | H   |
| H      | L | L  | H  | H       | H   | L   | H   |
| H      | H | L  | H  | H       | H   | H   | L   |
| X      | X | X  | L  | H       | H   | H   | H   |

## TRUTH TABLE

| INPUTS |   |    |    | OUTPUTS |     |     |     |
|--------|---|----|----|---------|-----|-----|-----|
| B      | A | 2G | 2C | 2Y0     | 2Y1 | 2Y2 | 2Y3 |
| X      | X | H  | X  | H       | H   | H   | H   |
| L      | L | L  | L  | L       | H   | H   | H   |
| L      | H | L  | L  | H       | L   | H   | H   |
| H      | L | L  | L  | H       | H   | L   | H   |
| H      | H | L  | L  | H       | H   | H   | L   |
| X      | X | X  | H  | H       | H   | H   | H   |

## LOGIC CIRCUIT



## 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                       | $\pm 20$               | mA          |
| $I_{OK}$              | DC Output Diode Current                      | $\pm 20$               | mA          |
| $I_O$                 | DC Output Source Sink Current Per Output Pin | $\pm 25$               | mA          |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current                | $\pm 50$               | mA          |
| $P_D$                 | Power Dissipation                            | 500 (*)                | mW          |
| $T_{stg}$             | Storage Temperature                          | -65 to +150            | $^{\circ}C$ |
| $T_L$                 | Lead Temperature (10 sec)                    | 300                    | $^{\circ}C$ |

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.  
 (\*) 500 mW:  $\approx 65^{\circ}C$  derate to 300 mW by 10mW/ $^{\circ}C$ : 65  $^{\circ}C$  to 85  $^{\circ}C$

## M54/M74HC155

### 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: <b>M54HC Series</b><br><b>M74HC Series</b> | -55 to +125<br>-40 to +85 | °C<br>°C  |    |
| $t_r, t_f$ | Input Rise and Fall Time  | $V_{CC} = 2\text{ V}$     | 0 to 1000 | ns |
|            |   | $V_{CC} = 4.5\text{ V}$   | 0 to 500  |    |
|            |   | $V_{CC} = 6\text{ V}$     | 0 to 400  |    |

### DC SPECIFICATIONS

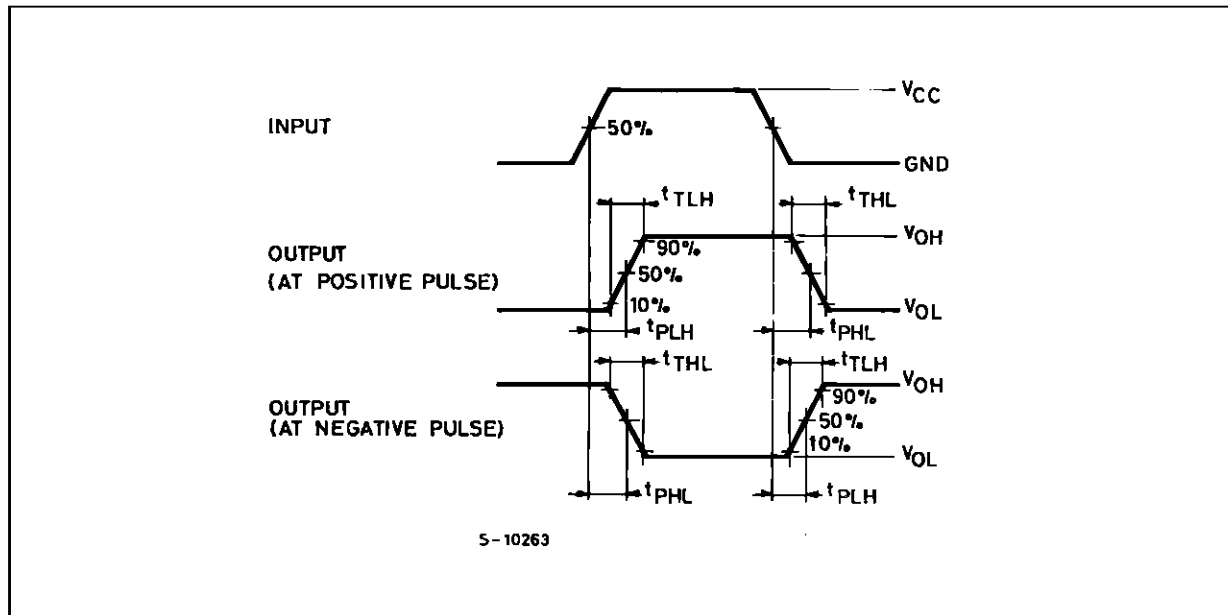
| Symbol   | Parameter                 | Test Conditions |                                  | Value                                 |      |                        |                                      |         |                                       | Unit    |               |   |      |
|----------|---------------------------|-----------------|----------------------------------|---------------------------------------|------|------------------------|--------------------------------------|---------|---------------------------------------|---------|---------------|---|------|
|          |                           |                 |                                  | $T_A = 25\text{ °C}$<br>54HC and 74HC |      |                        | $-40\text{ to }85\text{ °C}$<br>74HC |         | $-55\text{ to }125\text{ °C}$<br>54HC |         |               |   |      |
|          |                           |                 |                                  | Min.                                  | Typ. | Max.                   | Min.                                 | Max.    | Min.                                  |         | Max.          |   |      |
| $V_{IH}$ | 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             | $V_I = V_{IH}$<br>or<br>$V_{IL}$ | $I_O = -20\text{ }\mu\text{A}$        | 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             |                                  | 4.18                                  | 4.31 |                        | 4.13                                 |         | 4.10                                  |         |               |   |      |
|          |                           | 6.0             |                                  |                                       |      | $I_O = -5.2\text{ mA}$ |                                      | 5.68    |                                       | 5.8     |               |   | 5.63 |
| $V_{OL}$ | Low Level Output Voltage  | 2.0             | $V_I = V_{IH}$<br>or<br>$V_{IL}$ | $I_O = 20\text{ }\mu\text{A}$         |      | 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             |                                  | 4.0                                   | mA   |                        | 0.17                                 | 0.26    |                                       | 0.33    |               |   | 0.40 |
|          |                           | 6.0             |                                  |                                       |      | $I_O = 5.2\text{ mA}$  |                                      | 0.18    | 0.26                                  |         | 0.33          |   |      |
| $I_I$    | Input Leakage Current     | 6.0             | $V_I = V_{CC}$ or GND            |                                       |      | $\pm 0.1$              |                                      | $\pm 1$ |                                       | $\pm 1$ | $\mu\text{A}$ |   |      |
| $I_{CC}$ | Quiescent Supply Current  | 6.0             | $V_I = V_{CC}$ or GND            |                                       |      | 4                      |                                      | 40      |                                       | 80      | $\mu\text{A}$ |   |      |

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

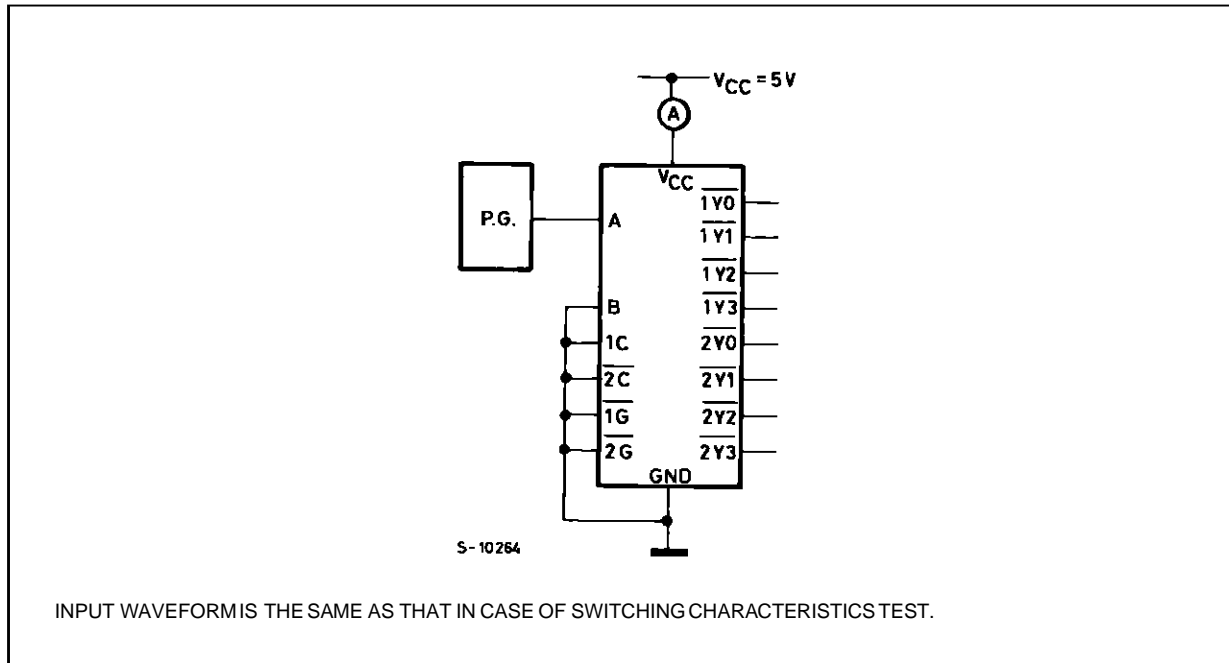
| Symbol                 | Parameter                     | Test Conditions |  | Value  |      |      |   |      |  | Unit |      |
|------------------------|-------------------------------|-----------------|--|--|------|------|---|------|--|------|------|
|                        |                               | $V_{CC}$<br>(V) |  | $T_A = 25 \text{ }^\circ\text{C}$<br>54HC and 74HC |      |      | $-40 \text{ to } 85 \text{ }^\circ\text{C}$<br>74HC |      | $-55 \text{ to } 125 \text{ }^\circ\text{C}$<br>54HC |      |      |
|                        |                               |                 |  | Min.   | Typ. | Max. | Min.  | Max. | Min.   |      | Max. |
| $t_{TLH}$<br>$t_{THL}$ | Output Transition Time        | 2.0             |  |  | 30   | 75   |   | 95   |  | 110  | ns   |
|                        |                               | 4.5             |  |  | 8    | 15   |   | 19   |  | 22   |      |
|                        |                               | 6.0             |  |  | 7    | 13   |   | 16   |  | 19   |      |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay Time        | 2.0             |  |  | 45   | 130  |   | 165  |  | 195  | ns   |
|                        |                               | 4.5             |  |  | 15   | 26   |   | 33   |  | 39   |      |
|                        |                               | 6.0             |  |  | 13   | 22   |   | 28   |  | 33   |      |
| $C_{IN}$               | Input Capacitance             |                 |  |  | 5    | 10   |   | 10   |  | 10   | pF   |
| $C_{PD} (*)$           | Power Dissipation Capacitance |                 |  |  | 53   |      |   |      |  |      | 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.  $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$

**SWITCHING CHARACTERISTICS TEST WAVEFORM**



TEST WAVEFORM  $I_{CC}$  (Opr.)



## Plastic DIP16 (0.25) MECHANICAL DATA

| DIM. | mm   |       |      | inch  |       |       |
|------|------|-------|------|-------|-------|-------|
|      | MIN. | TYP.  | MAX. | MIN.  | TYP.  | MAX.  |
| a1   | 0.51 |       |      | 0.020 |       |       |
| B    | 0.77 |       | 1.65 | 0.030 |       | 0.065 |
| b    |      | 0.5   |      |       | 0.020 |       |
| b1   |      | 0.25  |      |       | 0.010 |       |
| D    |      |       | 20   |       |       | 0.787 |
| E    |      | 8.5   |      |       | 0.335 |       |
| e    |      | 2.54  |      |       | 0.100 |       |
| e3   |      | 17.78 |      |       | 0.700 |       |
| F    |      |       | 7.1  |       |       | 0.280 |
| I    |      |       | 5.1  |       |       | 0.201 |
| L    |      | 3.3   |      |       | 0.130 |       |
| Z    |      |       | 1.27 |       |       | 0.050 |



**Ceramic DIP16/1 MECHANICAL DATA**

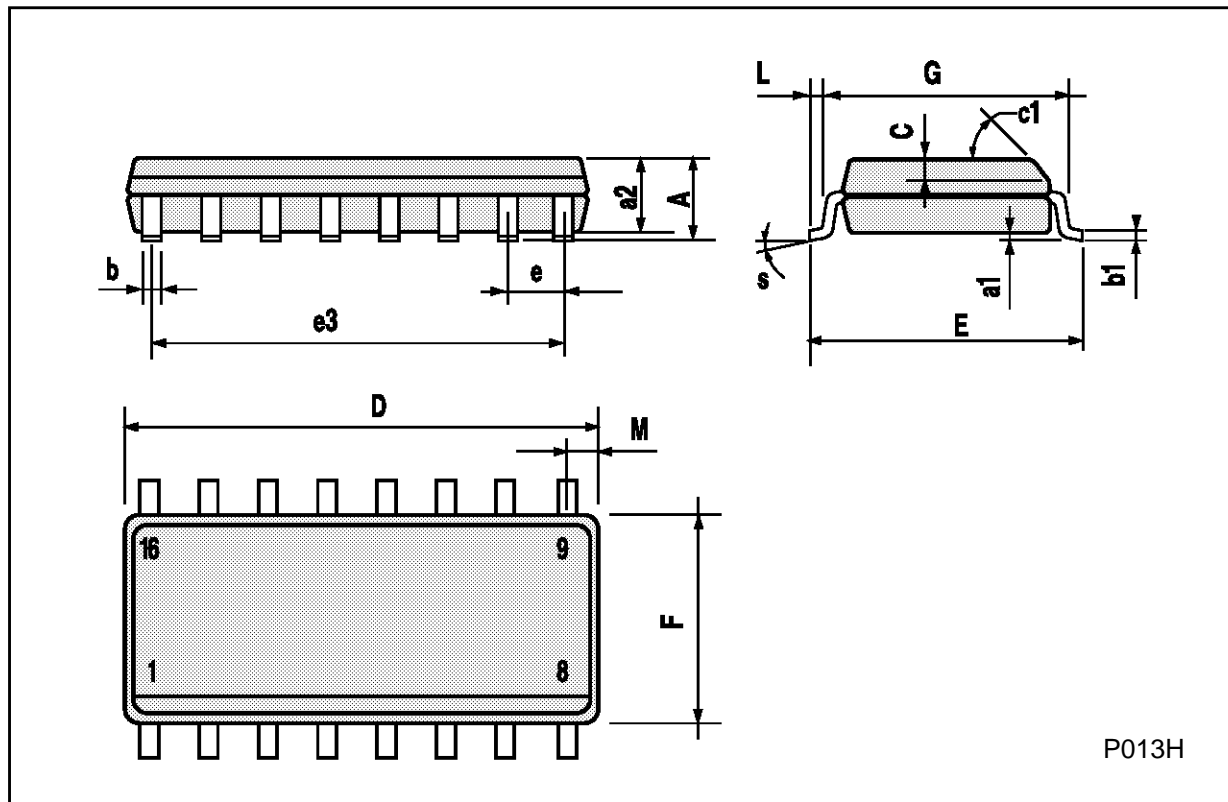
| DIM. | mm   |       |      | inch  |       |       |
|------|------|-------|------|-------|-------|-------|
|      | MIN. | TYP.  | MAX. | MIN.  | TYP.  | MAX.  |
| A    |      |       | 20   |       |       | 0.787 |
| B    |      |       | 7    |       |       | 0.276 |
| D    |      | 3.3   |      |       | 0.130 |       |
| E    | 0.38 |       |      | 0.015 |       |       |
| e3   |      | 17.78 |      |       | 0.700 |       |
| F    | 2.29 |       | 2.79 | 0.090 |       | 0.110 |
| G    | 0.4  |       | 0.55 | 0.016 |       | 0.022 |
| H    | 1.17 |       | 1.52 | 0.046 |       | 0.060 |
| L    | 0.22 |       | 0.31 | 0.009 |       | 0.012 |
| M    | 0.51 |       | 1.27 | 0.020 |       | 0.050 |
| N    |      |       | 10.3 |       |       | 0.406 |
| P    | 7.8  |       | 8.05 | 0.307 |       | 0.317 |
| Q    |      |       | 5.08 |       |       | 0.200 |





## SO16 (Narrow) MECHANICAL DATA

| DIM. | mm         |      |      | inch  |       |       |
|------|------------|------|------|-------|-------|-------|
|      | MIN.       | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    |            |      | 1.75 |       |       | 0.068 |
| a1   | 0.1        |      | 0.2  | 0.004 |       | 0.007 |
| a2   |            |      | 1.65 |       |       | 0.064 |
| b    | 0.35       |      | 0.46 | 0.013 |       | 0.018 |
| b1   | 0.19       |      | 0.25 | 0.007 |       | 0.010 |
| C    |            | 0.5  |      |       | 0.019 |       |
| c1   | 45° (typ.) |      |      |       |       |       |
| D    | 9.8        |      | 10   | 0.385 |       | 0.393 |
| E    | 5.8        |      | 6.2  | 0.228 |       | 0.244 |
| e    |            | 1.27 |      |       | 0.050 |       |
| e3   |            | 8.89 |      |       | 0.350 |       |
| F    | 3.8        |      | 4.0  | 0.149 |       | 0.157 |
| G    | 4.6        |      | 5.3  | 0.181 |       | 0.208 |
| L    | 0.5        |      | 1.27 | 0.019 |       | 0.050 |
| M    |            |      | 0.62 |       |       | 0.024 |
| S    | 8° (max.)  |      |      |       |       |       |



P013H

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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