



## M54/M74HCT367 M54/M74HCT368

### HEX BUS BUFFER (3-STATE) HCT367 NON INVERTING, HCT368 INVERTING

- HIGH SPEED  
 $t_{PD} = 11 \text{ ns (TYP.) AT } V_{CC} = 5 \text{ V}$
- LOW POWER DISSIPATION  
 $I_{CC} = 4 \mu\text{A (MAX.) AT } T_A = 25^\circ\text{C}$
- COMPATIBLE WITH TTL OUTPUTS  
 $V_{IH} = 2\text{V (MIN.) } V_{IL} = 0.8\text{V (MAX.)}$
- OUTPUT DRIVE CAPABILITY  
15 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE  
 $|I_{OH}| = I_{OL} = 6 \text{ mA (MIN.)}$
- BALANCED PROPAGATION DELAYS  
 $t_{PLH} = t_{PHL}$
- PIN AND FUNCTION COMPATIBLE WITH  
54/74LS367/368

#### DESCRIPTION

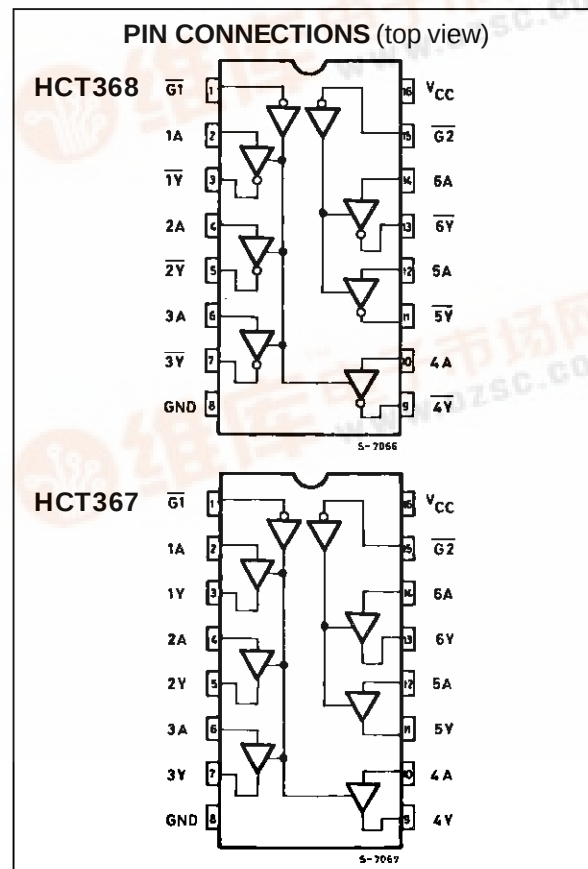
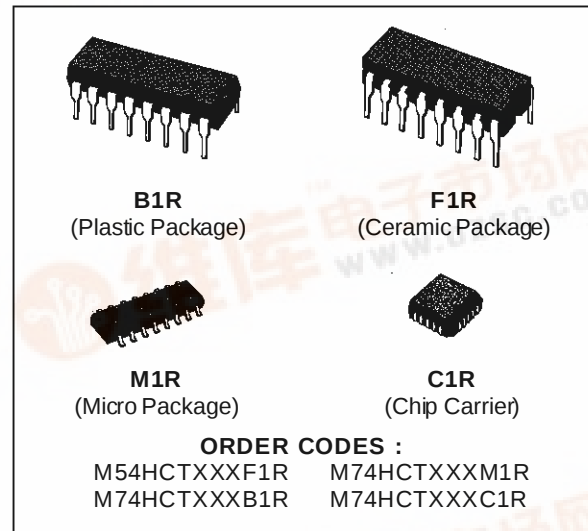
The M54/74HCT367 and the M54/74HCT368 are high speed CMOS HEX BUS BUFFER (3-STATE) fabricated in silicon gate C<sup>2</sup>MOS technology. They have the same high speed performance of LSTTL combined with true CMOS low power consumption. These devices contain six buffers, four buffers are controlled by an enable input ( $\overline{G1}$ ) and the other two buffers are controlled by the other enable input ( $\overline{G2}$ ); the outputs of each buffer group are enabled when  $\overline{G1}$  and/or  $\overline{G2}$  inputs are held low, and when held high these outputs are disabled to be high-impedance.

These outputs are capable of driving up to 15 LSTTL loads. The designer has a choice of non-inverting outputs (HCT367) and inverting outputs (HCT368).

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

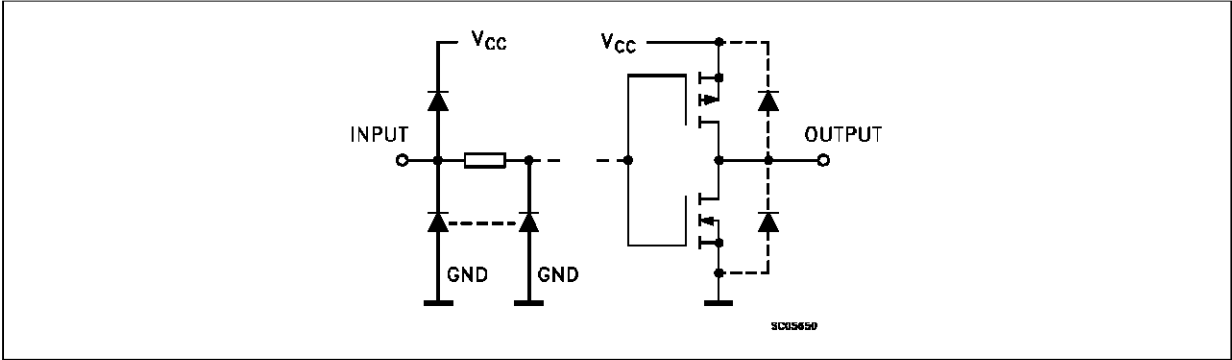
This integrated circuit has input and output characteristics that are fully compatible with 54/74 LSTTL logic families. M54/74HCT devices are designed to directly interface HSC<sup>2</sup>MOS systems with TTL and NMOS components. They are also plug in replacements for LSTTL devices giving a reduction of power consumption.

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

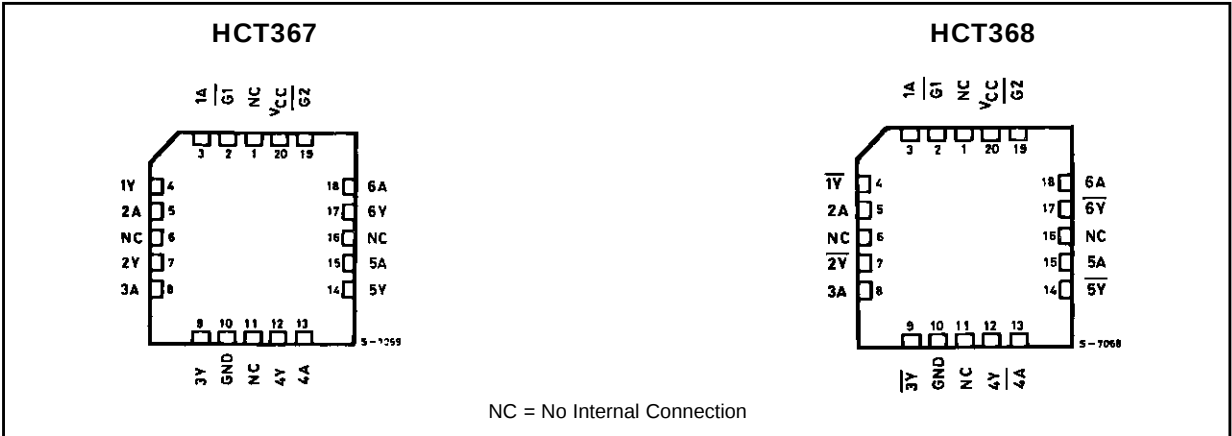


M54/M74HCT367/368

INPUT AND OUTPUT EQUIVALENT CIRCUIT



CHIP CARRIER



TRUTH TABLE

| INPUTS         |       | OUTPUTS     |                        |
|----------------|-------|-------------|------------------------|
| $\overline{G}$ | $A_n$ | $Y_n$ (367) | $\overline{Y_n}$ (368) |
| L              | L     | L           | H                      |
| L              | H     | H           | L                      |
| H              | X     | Z           | Z                      |

X = DON'T CARE    Z = HIGH IMPEDANCE

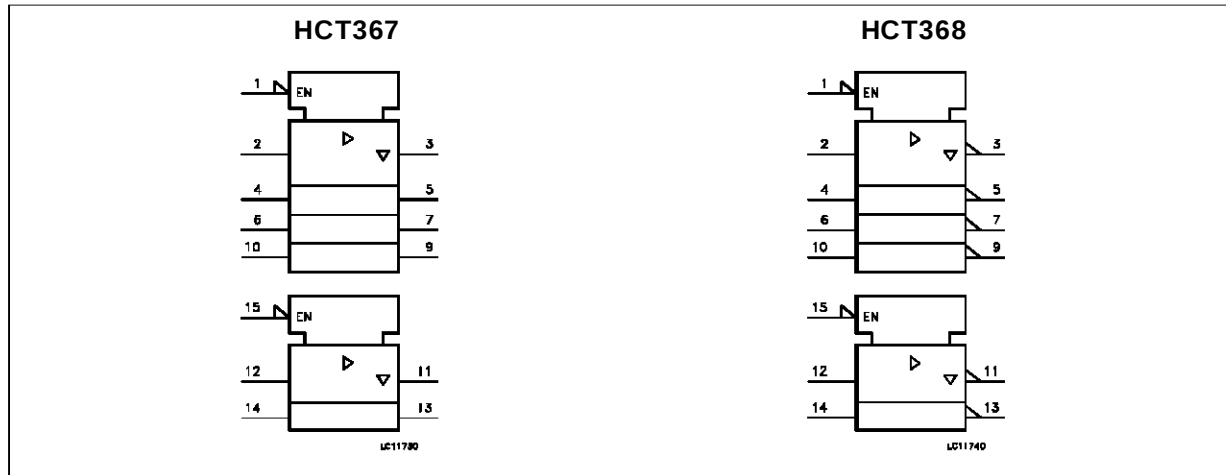
PIN DESCRIPTION (HCT367)

| PIN No              | SYMBOL                         | NAME AND FUNCTION       |
|---------------------|--------------------------------|-------------------------|
| 1, 15               | $\overline{G1}, \overline{G2}$ | Output Enable Inputs    |
| 2, 4, 6, 10, 12, 14 | 1A to 6A                       | Data Inputs             |
| 3, 5, 7, 9, 11, 13  | 1Y to 6Y                       | Data Outputs            |
| 8                   | GND                            | Ground (0V)             |
| 16                  | Vcc                            | Positive Supply Voltage |

PIN DESCRIPTION (HCT368)

| PIN No              | SYMBOL                             | NAME AND FUNCTION       |
|---------------------|------------------------------------|-------------------------|
| 1, 15               | $\overline{G1}, \overline{G2}$     | Output Enable Inputs    |
| 2, 4, 6, 10, 12, 14 | 1A to 6A                           | Data Inputs             |
| 3, 5, 7, 9, 11, 13  | $\overline{1Y}$ to $\overline{6Y}$ | Data Outputs            |
| 8                   | GND                                | Ground (0V)             |
| 16                  | Vcc                                | Positive Supply Voltage |

## IEC LOGIC SYMBOL



## 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 | $\pm 35$               | mA                 |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current                | $\pm 70$               | mA                 |
| $P_D$                 | Power Dissipation                            | 500 (*)                | mW                 |
| $T_{stg}$             | Storage Temperature                          | -65 to +150            | $^{\circ}\text{C}$ |
| $T_L$                 | Lead Temperature (10 sec)                    | 300                    | $^{\circ}\text{C}$ |

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

(\*) 500 mW:  $\equiv 65^{\circ}\text{C}$  derate to 300 mW by 10mW/ $^{\circ}\text{C}$ :  $65^{\circ}\text{C}$  to  $85^{\circ}\text{C}$

## RECOMMENDED OPERATING CONDITIONS

| Symbol     | Parameter                                                         | Value                     | Unit                                     |
|------------|-------------------------------------------------------------------|---------------------------|------------------------------------------|
| $V_{CC}$   | Supply Voltage                                                    | 4.5 to 5.5                | 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 | $^{\circ}\text{C}$<br>$^{\circ}\text{C}$ |
| $t_r, t_f$ | Input Rise and Fall Time ( $V_{CC} = 4.5$ to $5.5\text{V}$ )      | 0 to 500                  | ns                                       |

## RECOMMENDED OPERATING CONDITIONS

## M54/M74HCT367/368

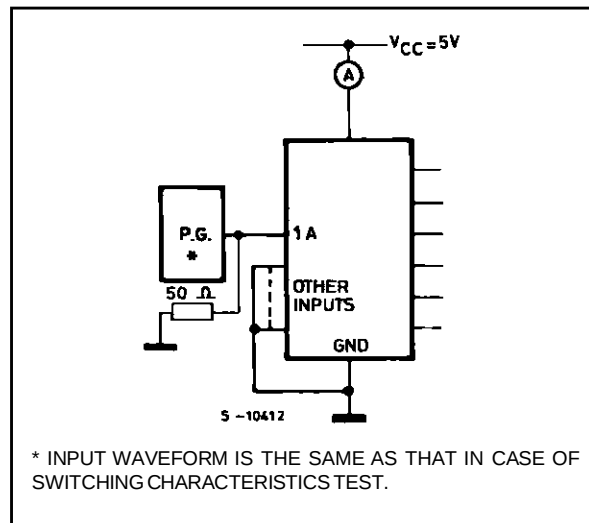
### DC SPECIFICATIONS

| 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             | 4.5 to 5.5             |                                                                                                                                       |                         | 2.0                                     |       |      | 2.0                  |      | 2.0                   |      | V    |
| V <sub>IL</sub>  | Low Level Input Voltage              | 4.5 to 5.5             |                                                                                                                                       |                         |                                         |       | 0.8  |                      | 0.8  |                       | 0.8  | V    |
| V <sub>OH</sub>  | High Level Output Voltage            | 4.5                    | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                                                   | I <sub>O</sub> =-20 μA  | 4.4                                     | 4.5   |      | 4.4                  |      | 4.4                   |      | V    |
|                  |                                      |                        |                                                                                                                                       | I <sub>O</sub> =-6.0 mA | 4.18                                    | 4.31  |      | 4.13                 |      | 4.10                  |      |      |
| V <sub>OL</sub>  | Low Level Output Voltage             | 4.5                    | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                                                   | I <sub>O</sub> = 20 μA  |                                         | 0.0   | 0.1  |                      | 0.1  |                       | 0.1  | V    |
|                  |                                      |                        |                                                                                                                                       | I <sub>O</sub> = 6.0 mA |                                         | 0.17  | 0.26 |                      | 0.33 |                       | 0.4  |      |
| 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>CC</sub>  | Quiescent Supply Current             | 5.5                    | V <sub>I</sub> = V <sub>CC</sub> or GND                                                                                               |                         |                                         |       | 4    |                      | 40   |                       | 80   | μA   |
| ΔI <sub>CC</sub> | Additional worst case supply current | 5.5                    | Per Input pin<br>V <sub>I</sub> = 0.5V or<br>V <sub>I</sub> = 2.4V<br>Other Inputs at<br>V <sub>CC</sub> or GND<br>I <sub>O</sub> = 0 |                         |                                         |       | 2.0  |                      | 2.9  |                       | 3.0  | mA   |

**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                    | 50                       |  |                                         | 7        | 12   |                      | 15   |                       | 18   | ns   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay Time<br>(for HCT367 only) | 2.0                    | 50                       |  |                                         | 14       | 22   |                      | 28   |                       | 33   | ns   |
|                                      |                                             | 2.0                    | 150                      |  |                                         | 18       | 28   |                      | 35   |                       | 42   |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay Time<br>(for HCT368 only) | 2.0                    | 50                       |  |                                         | 15       | 24   |                      | 30   |                       | 36   | ns   |
|                                      |                                             | 2.0                    | 150                      |  |                                         | 19       | 30   |                      | 38   |                       | 45   |      |
| t <sub>PZL</sub><br>t <sub>PZH</sub> | Output Enable Time                          | 2.0                    | 50                       |  |                                         | 16       | 25   |                      | 31   |                       | 38   | ns   |
|                                      |                                             | 2.0                    | 150                      |  |                                         | 20       | 31   |                      | 39   |                       | 47   |      |
| t <sub>PLZ</sub><br>t <sub>PHZ</sub> | Output Disable Time                         | 2.0                    | 50                       |  |                                         | 18       | 25   |                      | 31   |                       | 38   | ns   |
| C <sub>IN</sub>                      | Input Capacitance                           |                        |                          |  |                                         | 5        | 10   |                      | 10   |                       | 10   | pF   |
| C <sub>PD</sub> (*)                  | Power Dissipation Capacitance               |                        | fot HCT367<br>for HCT368 |  |                                         | 47<br>55 |      |                      |      |                       |      | 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.  $I_{CC(opr)} = C_{PD} \bullet V_{CC} \bullet f_{IN} + I_{CC}/6$  (per Channel)

**TEST CIRCUIT  $I_{CC}$  (Opr.)** **$C_{PD}$  CALCULATION**

$C_{PD}$  is to be calculated with the following formula by using the measured value of  $I_{CC} (opr.)$  in the test circuit opposite.

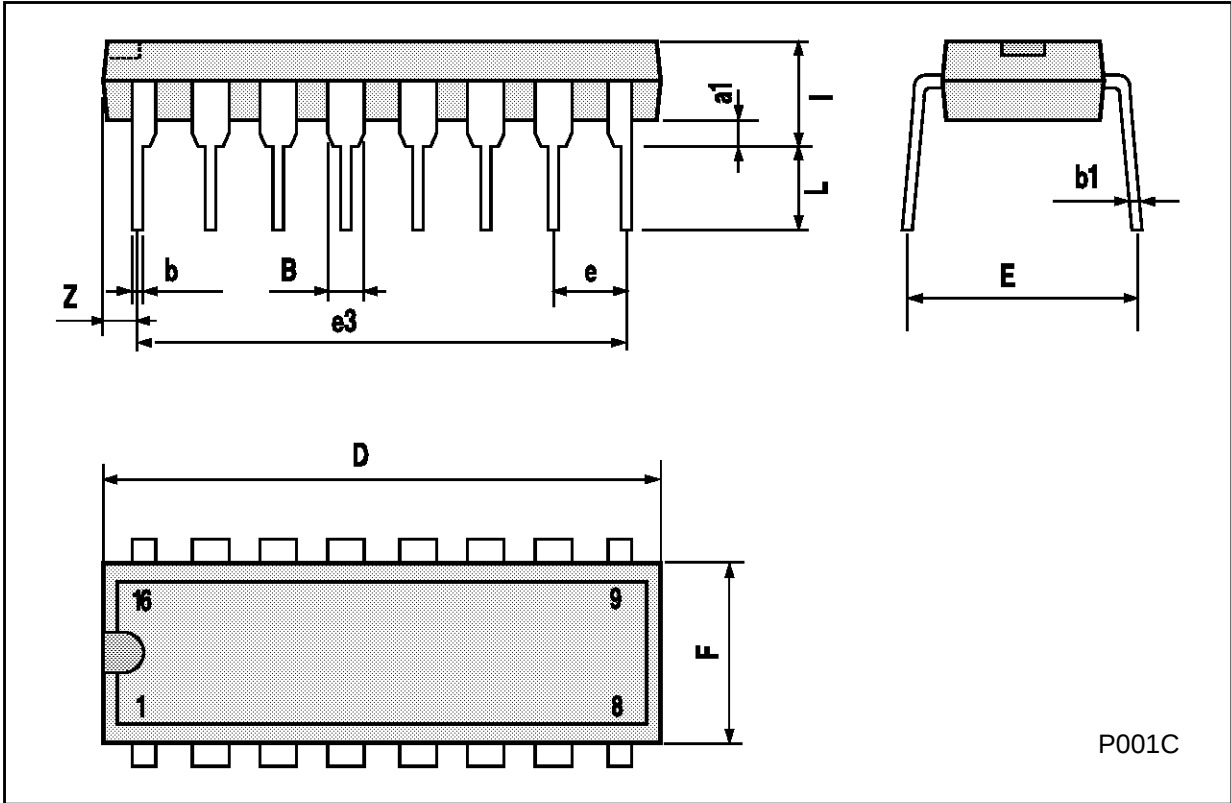
$$C_{PD} = \frac{I_{CC} (opr)}{f_{IN} \times V_{CC}}$$

In determining the typical value of  $C_{PD}$ , a relatively high frequency of 1 MHz was applied to  $f_{IN}$ , in order to eliminate any error caused by the quiescent supply current.



Plastic DIP16 (0.25) MECHANICAL DATA

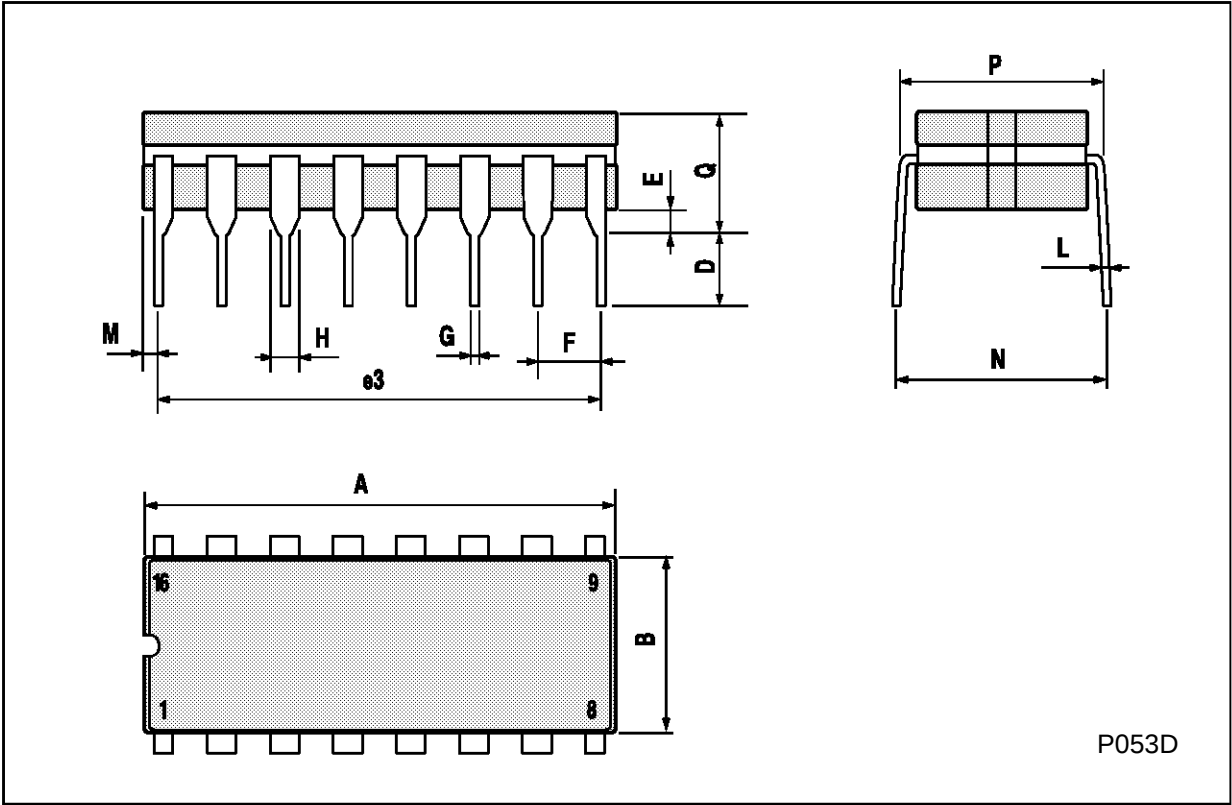
| DIM. | mm   |       |      | inch  |       |       |
|------|------|-------|------|-------|-------|-------|
|      | MIN. | TYP.  | MAX. | MIN.  | TYP.  | MAX.  |
| a1   | 0.51 |       |      | 0.020 |       |       |
| B    | 0.77 |       | 1.65 | 0.030 |       | 0.065 |
| b    |      | 0.5   |      |       | 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 |



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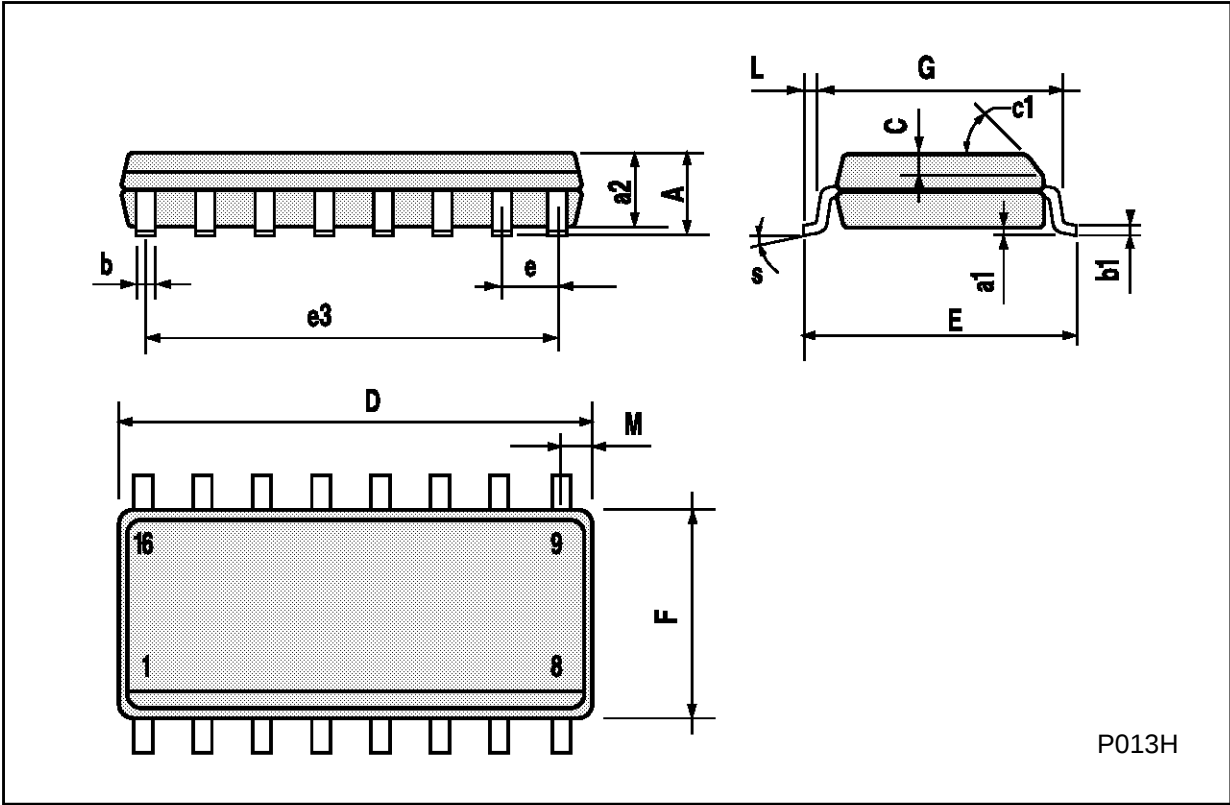
Ceramic DIP16/1 MECHANICAL DATA

| 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.)  |      |      |       |       |       |

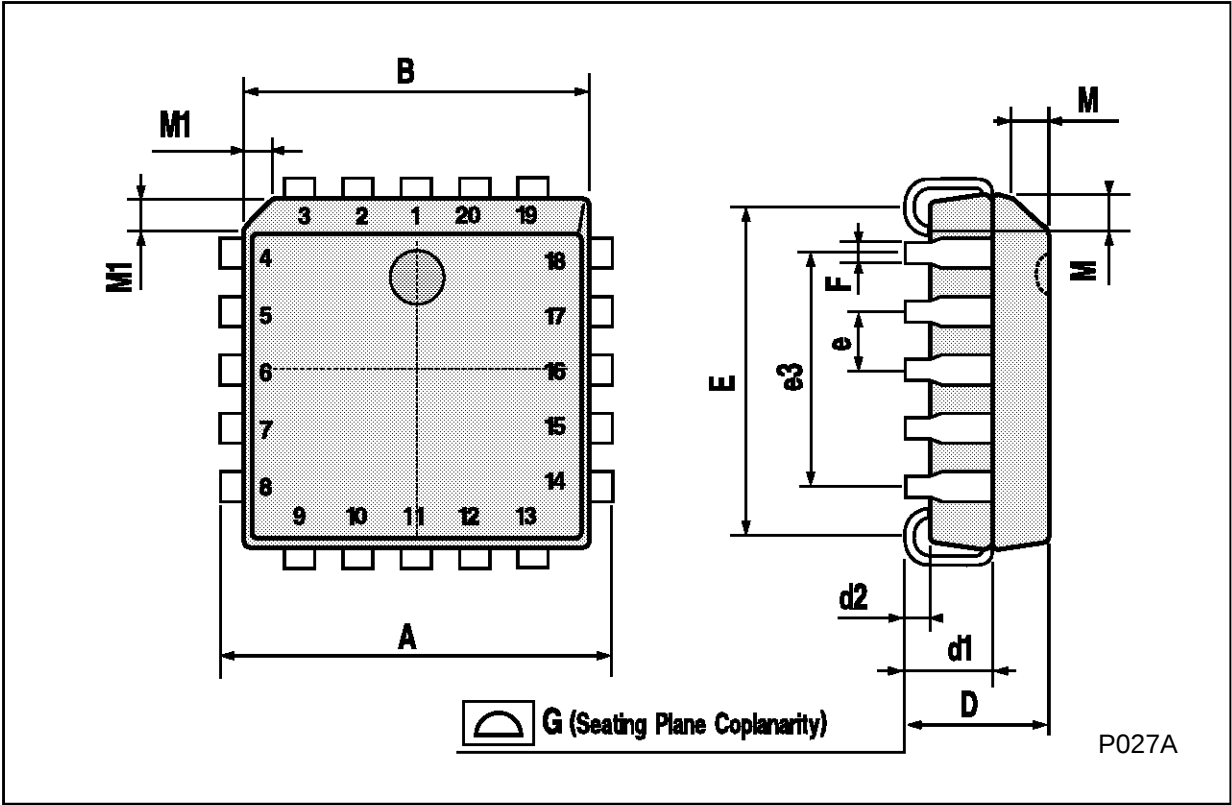


P013H

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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 |       |



## **M54/M74HCT367/368**

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