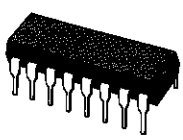
SGS-THOMSON MICROELECTRONICS

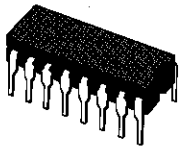
# M54/M74HC365
# M54/M74HC366

## HEX BUS BUFFER (3-STATE)
## HC365 NON INVERTING - HC366 INVERTING

- HIGH SPEED
  $t_{PD}$ = 9 ns (TYP) AT $V_{CC}$ = 5 V
- LOW POWER DISSIPATION
  $I_{CC}$ = 4 µA (MAX.) AT $T_A$ = 25 °C
- HIGH NOISE IMMUNITY
  $V_{NIH} = V_{NIL}$ = 28 % $V_{CC}$ (MIN.)
- OUTPUT DRIVE CAPABILITY
  15 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE
  $|I_{OH}| = I_{OL}$ = 6 mA (MIN.)
- BALANCED PROPAGATION DELAYS
  $t_{PLH} = t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE
  $V_{CC}$ (OPR) = 2 V TO 6 V
- PIN AND FUNCTION COMPATIBLE WITH 54/74LS365/366



**B1R**
(Plastic Package)



**F1R**
(Ceramic Package)

**M1R**
(Micro Package)

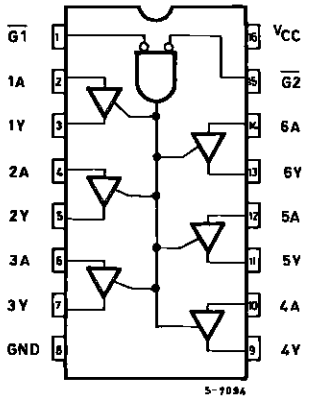
**C1R**
(Chip Carrier)

**ORDER CODES :**

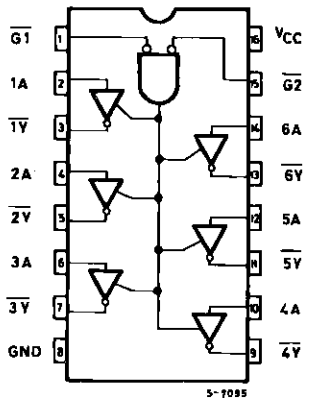
M54HCXXXF1R M74HCXXXM1R
M74HCXXXB1R M74HCXXXC1R

**PIN CONNECTIONS** (top view)

**HC365**




**HC366**



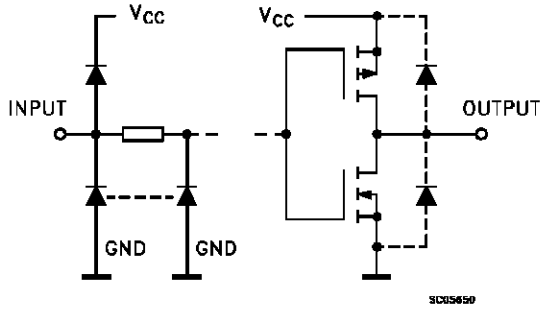

### DESCRIPTION

The M54/74HC365 and the M54/74HC366 are high speed CMOS HEX BUS BUFFER fabricated in silicon gate $C^2MOS$ technology. They have the same high speed performance of LSTTL combined with true CMOS low power consumption.

All six buffers are controlled by the combination of two enable inputs ($\overline{G1}$ and $\overline{G2}$) ; all outputs of these buffers are enabled only when both $\overline{G1}$ and $\overline{G2}$ inputs are held low, under all other conditions these output are disabled to be high-impedance.

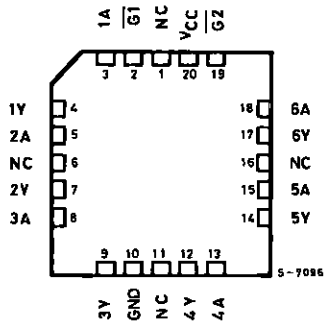
These outputs are capable of driving up to 15 LSTTL loads. The designer has a choice of non-inverting outputs (HC365) and inverting outputs (HC366). All inputs are equipped with protection circuits against static discharge and transient excess voltage.

## INPUT AND OUTPUT EQUIVALENT CIRCUIT

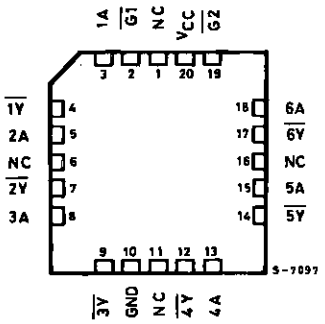



## CHIP CARRIER

**HC365**




**HC366**




NC = No Internal Connection

## TRUTH TABLE

| INPUTS | | | OUTPUTS | |
|---|---|---|---|---|
| $\overline{G1}$ | $\overline{G2}$ | An | Y (365) | $\overline{Y}$ (366) |
| L | L | L | L | H |
| L | L | H | H | L |
| H | X | X | Z | Z |
| X | H | X | Z | Z |

X = DON'T CARE Z = HIGH IMPEDANCE

## PIN DESCRIPTION (HC365)

| 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 | $V_{CC}$ | Positive Supply Voltage |

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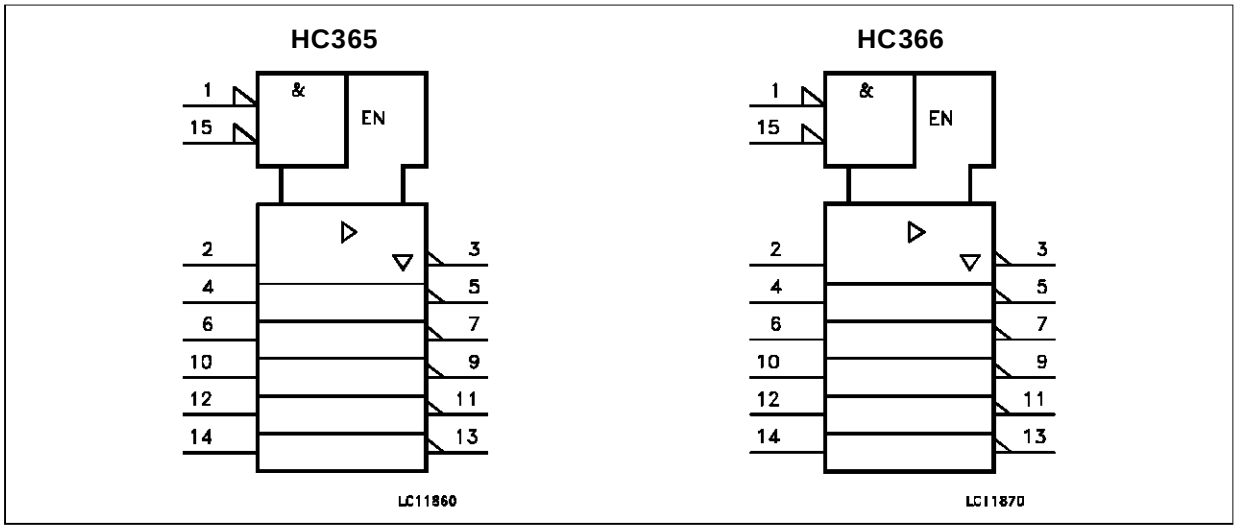
## IEC LOGIC SYMBOL




## 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 | ± 20 | mA |
| $I_{OK}$ | DC Output Diode Current | ± 20 | mA |
| $I_O$ | DC Output Source Sink Current Per Output Pin | ± 35 | mA |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current | ± 70 | mA |
| $P_D$ | Power Dissipation | 500 (*) | mW |
| $T_{stg}$ | Storage Temperature | -65 to +150 | °C |
| $T_L$ | Lead Temperature (10 sec) | 300 | °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: ≅ 65 °C derate to 300 mW by 10mW/°C: 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: **M54HC** Series<br>**M74HC** Series | | -55 to +125<br>-40 to +85 | °C<br>°C |
| $t_r$, $t_f$ | Input Rise and Fall Time | $V_{CC}$ = 2 V | 0 to 1000 | ns |
| | | $V_{CC}$ = 4.5 V | 0 to 500 | |
| | | $V_{CC}$ = 6 V | 0 to 400 | |

## DC SPECIFICATIONS

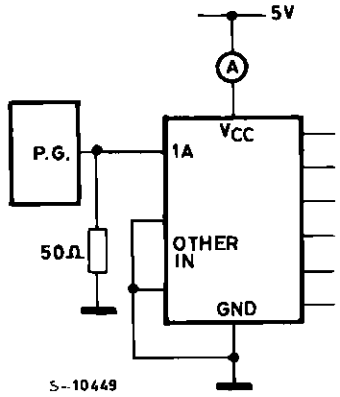
| Symbol | Parameter | Test Conditions | | | Value | | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $V_{CC}$ (V) | | | $T_A$ = 25 °C 54HC and 74HC | | | -40 to 85 °C 74HC | | -55 to 125 °C 54HC | | |
| | | | | | Min. | Typ. | Max. | Min. | Max. | Min. | Max. | |
| $V_{IH}$ | 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 | $V_I$ = $V_{IH}$ or $V_{IL}$ | $I_O$=-20 µA | 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 | | $I_O$=-6.0 mA | 4.18 | 4.31 | | 4.13 | | 4.10 | | |
| | | 6.0 | | $I_O$=-7.8 mA | 5.68 | 5.8 | | 5.63 | | 5.60 | | |
| $V_{OL}$ | Low Level Output Voltage | 2.0 | $V_I$ = $V_{IH}$ or $V_{IL}$ | $I_O$= 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 | | $I_O$= 6.0 mA | | 0.17 | 0.26 | | 0.33 | | 0.40 | |
| | | 6.0 | | $I_O$= 7.8 mA | | 0.18 | 0.26 | | 0.33 | | 0.40 | |
| $I_I$ | Input Leakage Current | 6.0 | $V_I$ = $V_{CC}$ or GND | | | | ±0.1 | | ±1 | | ±1 | µA |
| $I_{OZ}$ | 3 State Output Off State Current | 6.0 | $V_I$ = $V_{IH}$ or $V_{IL}$ $V_O$ = $V_{CC}$ or GND | | | | ±0.5 | | ±5 | | ±10 | µA |
| $I_{CC}$ | Quiescent Supply Current | 6.0 | $V_I$ = $V_{CC}$ or GND | | | | 4 | | 40 | | 80 | µA |

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

| Symbol | Parameter | Test Conditions | | | Value | | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $V_{CC}$ (V) | $C_L$ (pF) | | $T_A$ = 25 °C 54HC and 74HC | | | -40 to 85 °C 74HC | | -55 to 125 °C 54HC | | |
| | | | | | Min. | Typ. | Max. | Min. | Max. | Min. | Max. | |
| $t_{TLH}$ $t_{THL}$ | Output Transition Time | 2.0 | 50 | | | 25 | 60 | | 75 | | 90 | ns |
| | | 4.5 | | | | 7 | 12 | | 15 | | 18 | |
| | | 6.0 | | | | 6 | 10 | | 13 | | 15 | |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay Time | 2.0 | 50 | | | 38 | 90 | | 115 | | 135 | ns |
| | | 4.5 | | | | 12 | 18 | | 23 | | 27 | |
| | | 6.0 | | | | 10 | 15 | | 20 | | 23 | |
| | | 2.0 | 150 | | | 51 | 130 | | 165 | | 195 | ns |
| | | 4.5 | | | | 17 | 26 | | 33 | | 39 | |
| | | 6.0 | | | | 14 | 22 | | 28 | | 33 | |
| $t_{PZL}$ $t_{PZH}$ | Output Enable Time | 2.0 | 50 | $R_L$ = 1 KΩ | | 64 | 130 | | 165 | | 195 | ns |
| | | 4.5 | | | | 16 | 26 | | 33 | | 39 | |
| | | 6.0 | | | | 14 | 22 | | 28 | | 33 | |
| | | 2.0 | 150 | $R_L$ = 1 KΩ | | 76 | 150 | | 190 | | 225 | ns |
| | | 4.5 | | | | 19 | 30 | | 38 | | 45 | |
| | | 6.0 | | | | 16 | 26 | | 32 | | 38 | |
| $t_{PLZ}$ $t_{PHZ}$ | Output Disable Time | 2.0 | 50 | $R_L$ = 1 KΩ | | 42 | 130 | | 165 | | 195 | ns |
| | | 4.5 | | | | 18 | 26 | | 33 | | 39 | |
| | | 6.0 | | | | 15 | 22 | | 28 | | 33 | |
| $C_{IN}$ | Input Capacitance | | | | | 5 | 10 | | 10 | | 10 | pF |
| $C_{PD}$ (*) | Power Dissipation Capacitance | | for HC365 for HC366 | | | 27 25 | | | | | | 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 operting current can be obtained by the following equation. $I_{CC}(opr) = C_{PD} \bullet V_{CC} \bullet f_{IN} + I_{CC}/6$ (per Gate)

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




INPUT WAVEFORM IS THE SAME AS THAT IN CASE OF SWITCHING CHARACTERISTICS TEST.

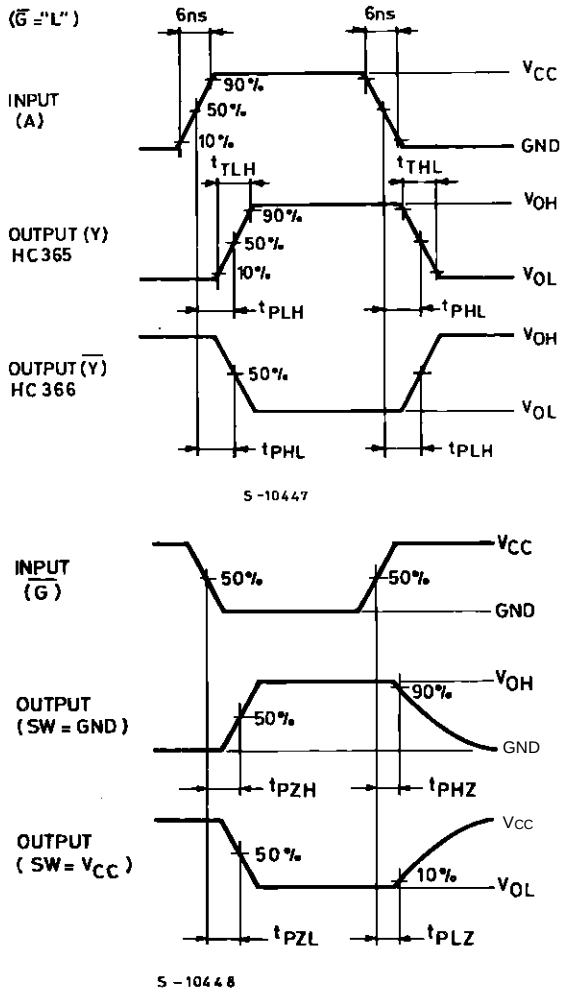
### $C_{PD}$ CALCULATION

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

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

In determining the typical value of CPD a relatvely high frequency of 1 MHz was applied to fIN, in order to eliminate any error caused by the quiescent supply current.

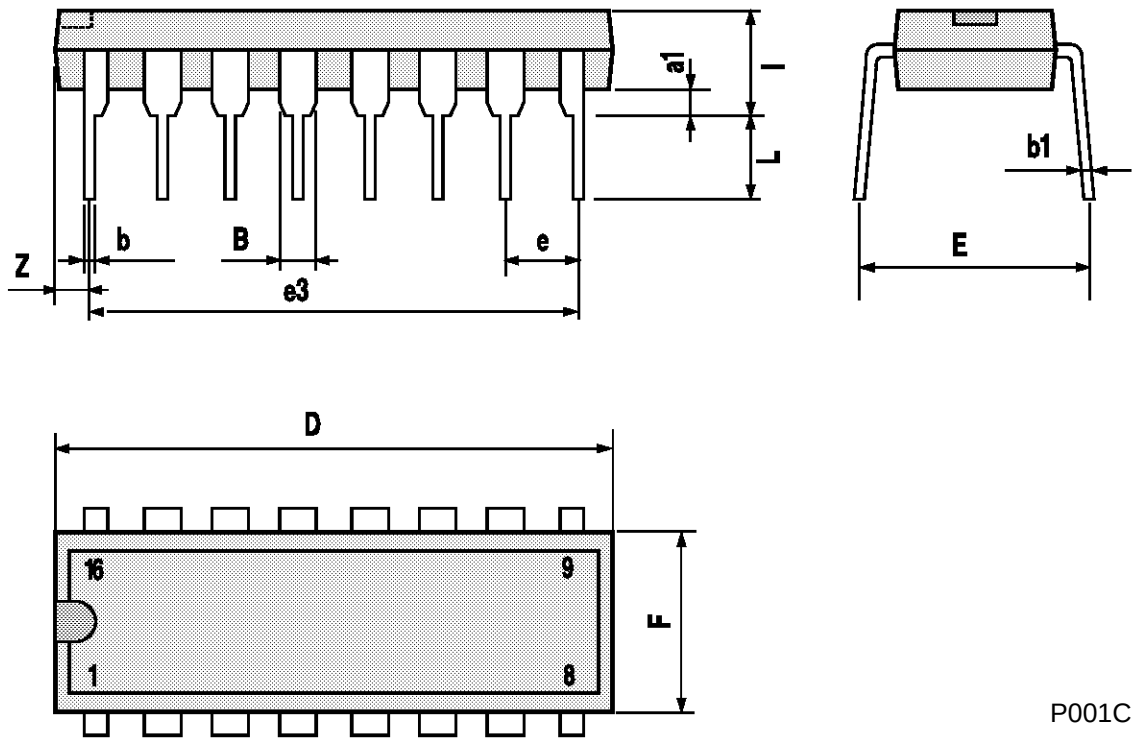
## SWITCHING CHARACTERISTICS TEST WAVEFORM




**Note :** Such a logic level shall be applied to each input that the output voltage stays in the apposite side to the switch connection level, when the output is enable.

## Plastic DIP16 (0.25) MECHANICAL DATA

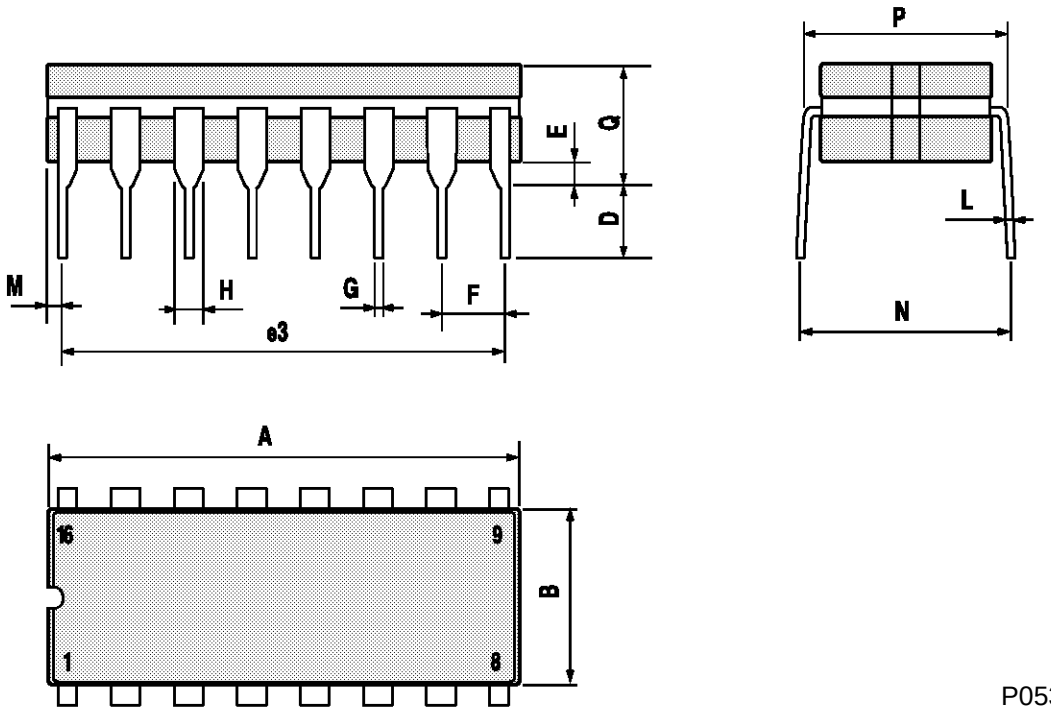
| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| a1 | 0.51 | | | 0.020 | | |
| B | 0.77 | | 1.65 | 0.030 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 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 |




P001C

## Ceramic DIP16/1 MECHANICAL DATA

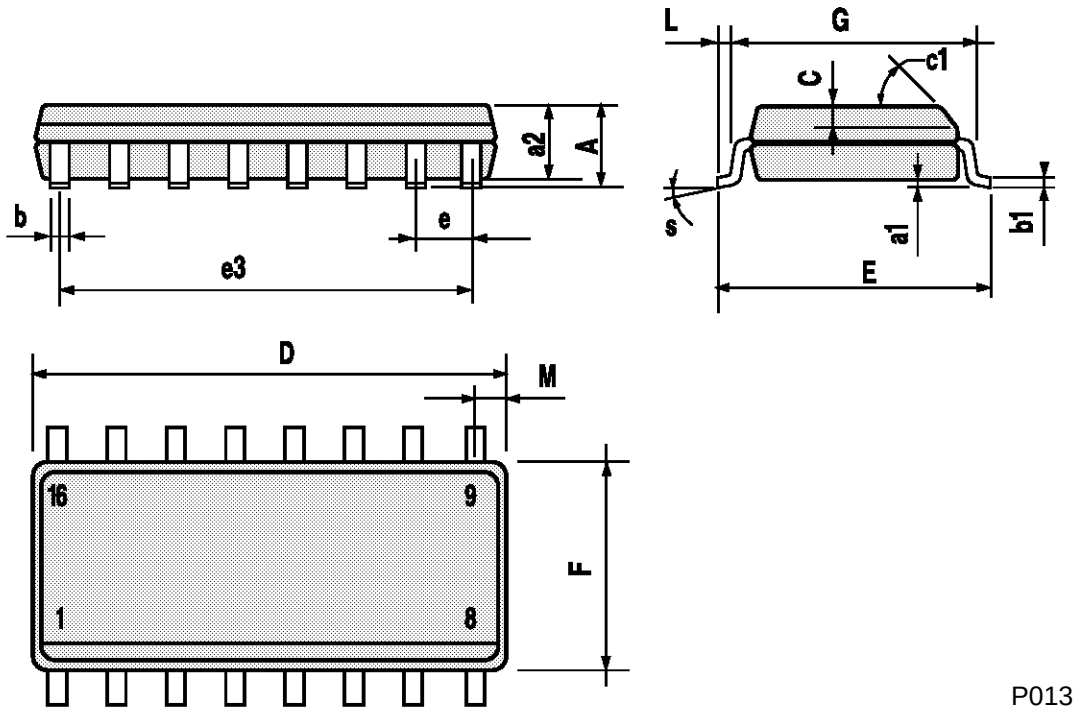
| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 20 | | | 0.787 |
| B | | | 7 | | | 0.276 |
| D | | 3.3 | | | 0.130 | |
| E | 0.38 | | | 0.015 | | |
| e3 | | 17.78 | | | 0.700 | |
| F | 2.29 | | 2.79 | 0.090 | | 0.110 |
| G | 0.4 | | 0.55 | 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 |




P053D

## SO16 (Narrow) MECHANICAL DATA

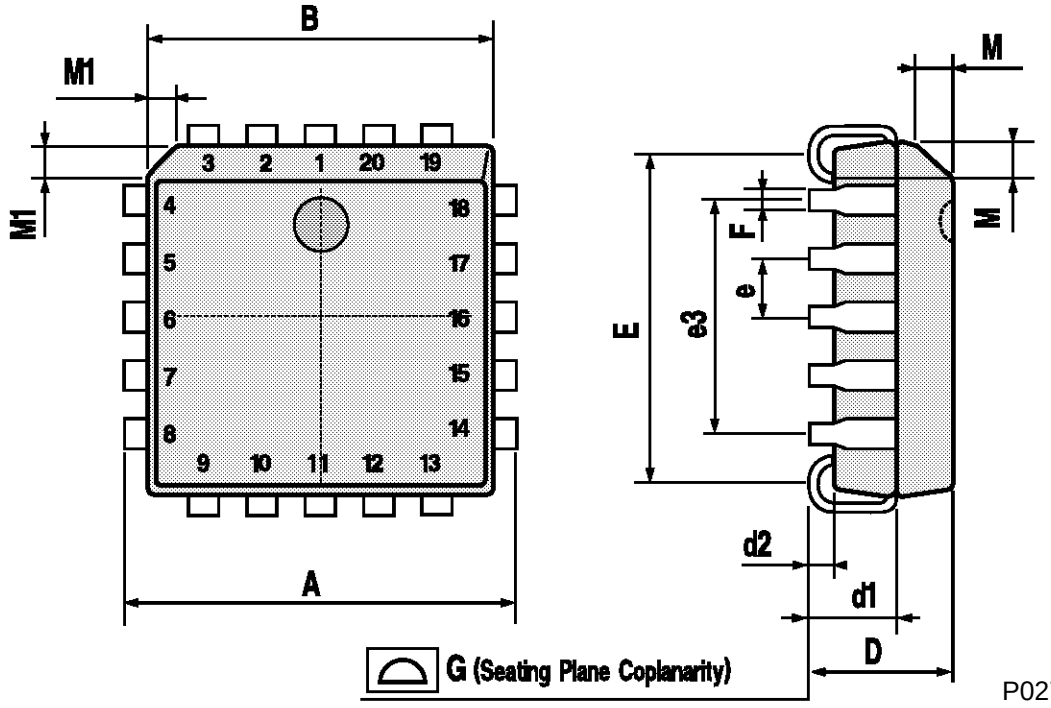
| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.068 |
| a1 | 0.1 | | 0.2 | 0.004 | | 0.007 |
| a2 | | | 1.65 | | | 0.064 |
| b | 0.35 | | 0.46 | 0.013 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | | 0.5 | | | 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 | |




P027A