**SGS-THOMSON**
**MICROELECTRONICS**

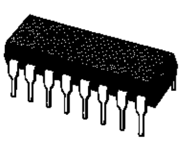
# M54HC251
# M74HC251

## 8 BIT SIPO SHIFT REGISTER

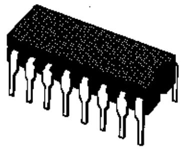
- HIGH SPEED
  $t_{PD}$ = 14 ns (TYP.) AT $V_{CC}$ = 5 V
- LOW POWER DISSIPATION
  $I_{CC}$ = 4 μA (MAX.) AT $T_A$ = 25 °C 6 V
- HIGH NOISE IMMUNITY
  $V_{NIH} = V_{NIL}$ = 28 % $V_{CC}$ (MIN.)
- OUTPUT DRIVE CAPABILITY
  10 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE
  $|I_{OH}| = I_{OL}$ = 4 mA (MIN.)
- BALANCED PROPAGATION DELAYS
  $t_{PLH} = t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE
  $V_{CC}$ (OPR) = 2 V TO 6 V
- PIN AND FUNCTION COMPATIBLE WITH 54/74LS251

### DESCRIPTION

The M54/74HC251 is a high speed CMOS 8-CHANNEL MULTIPLEXER (3-STATE) fabricated in silicon gate $C^2$MOS technology. It has the same high speed performance of LSTTL combined with true CMOS low power consumption. This multiplexer features both true (Y) and complement (W) outputs as well as $\overline{\text{STROBE}}$ input. The $\overline{\text{STROBE}}$ must be a low logic level to enable this device. When the $\overline{\text{STROBE}}$ input is high, both outputs are in the high impedance state. When enabled, address information on the data select inputs determines which data input is routed to Y and W. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

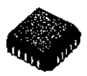


**B1R**
(Plastic Package)



**F1R**
(Ceramic Package)

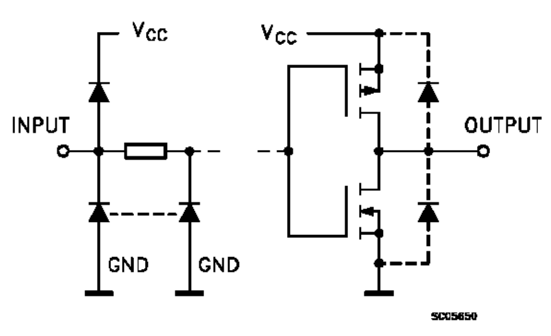
**M1R**
(Micro Package)



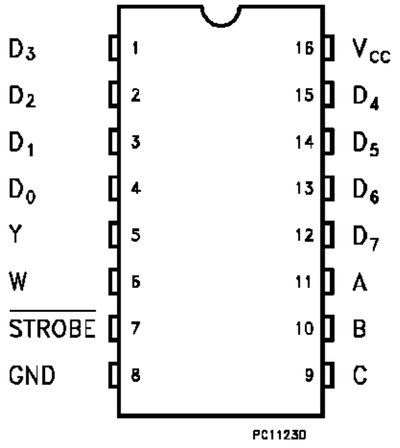
**C1R**
(Chip Carrier)

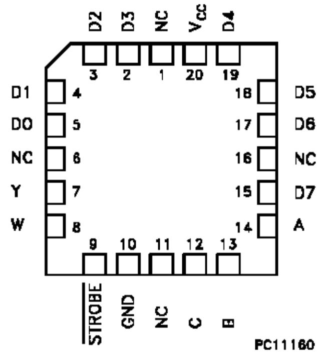
**ORDER CODES :**
M54HC251F1R M74HC251M1R
M74HC251B1R M74HC251C1R

### INPUT AND OUTPUT EQUIVALENT CIRCUIT



**PIN CONNECTIONS** (top view)





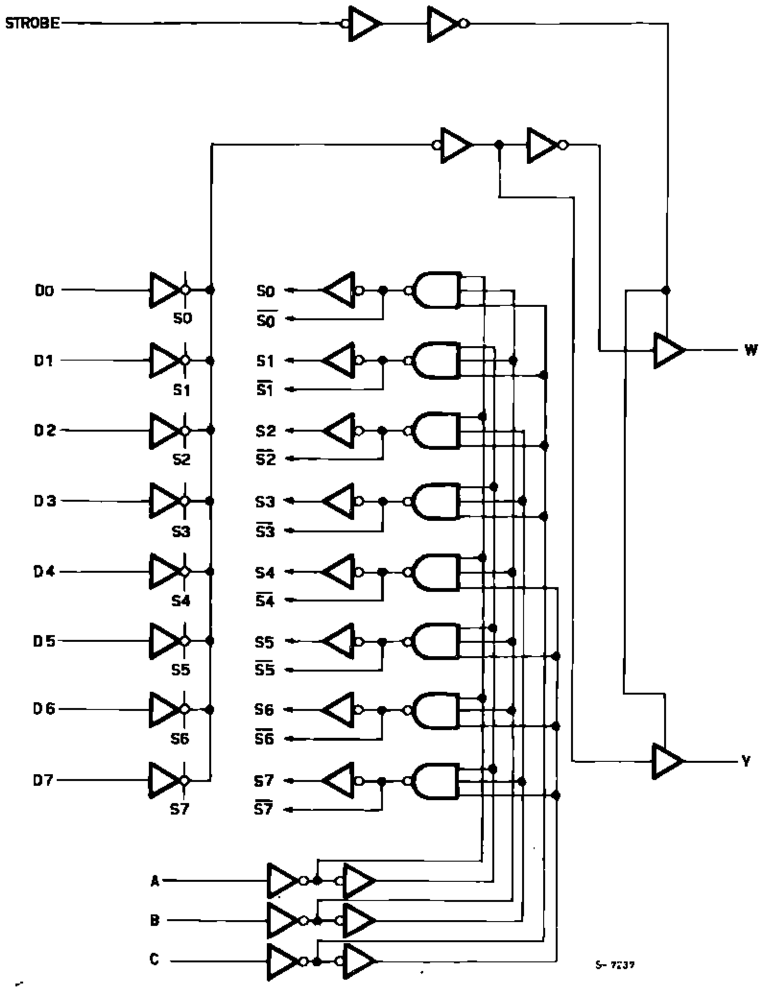
NC =
No Internal
Connection

## TRUTH TABLE

| INPUTS | | | | OUTPUS | |
|---|---|---|---|---|---|
| | | | $\overline{\text{STROBE}}$ | Y | W |
| C | B | A | $\overline{S}$ | | |
| X | X | X | H | Z | Z |
| L | L | L | L | D0 | $\overline{D0}$ |
| L | L | H | L | D1 | $\overline{D1}$ |
| L | H | L | L | D2 | $\overline{D2}$ |
| L | H | H | L | D3 | $\overline{D3}$ |
| H | L | L | L | D4 | $\overline{D4}$ |
| H | L | H | L | D5 | $\overline{D5}$ |
| H | H | L | L | D6 | $\overline{D6}$ |
| H | H | H | L | D7 | $\overline{D7}$ |

X: Don't Care Z: HIGH Impedance

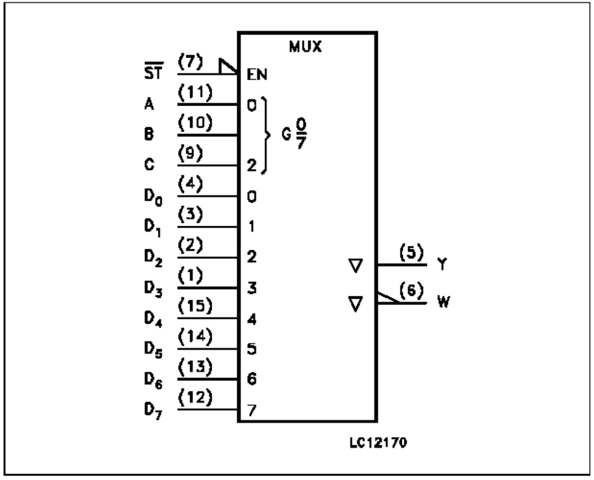
## LOGIC DIAGRAM



## PIN DESCRIPTION

| PIN No | SYMBOL | NAME AND FUNCTION |
|---|---|---|
| 4, 3, 2, 1, 15, 14, 13, 12 | D0 to D7 | Multiplexer Inputs |
| 5 | Y | Multiplexer Output |
| 6 | W | Complementary Multiplexer Output |
| 7 | $\overline{\text{STROBE}}$ | 3 State Output Enable Input |
| 11, 10, 9 | A, B, C | Select Inputs |
| 8 | GND | Ground (0V) |
| 16 | $V_{CC}$ | 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 | ± 20 | mA |
| $I_{OK}$ | DC Output Diode Current | ± 20 | mA |
| $I_O$ | DC Output Source Sink Current Per Output Pin | ± 25 | mA |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current | ± 50 | mA |
| $P_D$ | Power Dissipation | 500 (*) | mW |
| $T_{stg}$ | Storage Temperature | -65 to +150 | $^oC$ |
| $T_L$ | Lead Temperature (10 sec) | 300 | $^oC$ |

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 $^oC$ derate to 300 mW by 10mW/$^oC$: 65 $^oC$ to 85 $^oC$

## 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 | $^oC$<br>$^oC$ |
| $t_r$, $t_f$ | 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

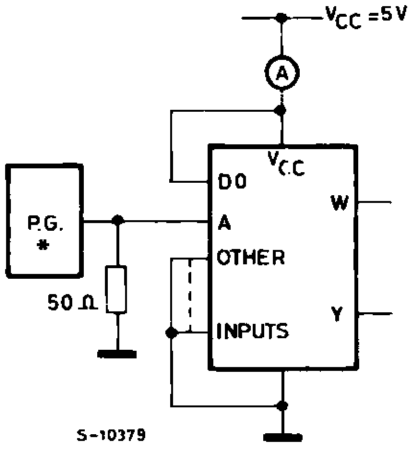
| Symbol | Parameter | Test Conditions | | | Value | | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $V_{CC}$ (V) | | | $T_A$ = 25 °C 54HC and 74HC | | | -40 to 85 °C 74HC | | -55 to 125 °C 54HC | | |
| | | | | | Min. | Typ. | Max. | Min. | Max. | Min. | Max. | |
| $V_{IH}$ | 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 | | $I_O$=-4.0 mA | 4.18 | 4.31 | | 4.13 | | 4.10 | | |
| | | 6.0 | | $I_O$=-5.2 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 | | $I_O$= 4.0 mA | | 0.17 | 0.26 | | 0.33 | | 0.40 | |
| | | 6.0 | | $I_O$= 5.2 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 $V_{IL}$<br>$V_O$ = $V_{CC}$ or GND | | | | ±0.5 | | ±5.0 | | ±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) | | $T_A$ = 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 | | | 30 | 75 | | 95 | | 110 | ns |
| | | 4.5 | | | 8 | 15 | | 19 | | 22 | |
| | | 6.0 | | | 7 | 13 | | 16 | | 19 | |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay Time (D - Y, W) | 2.0 | | | 64 | 130 | | 165 | | 195 | ns |
| | | 4.5 | | | 16 | 26 | | 33 | | 39 | |
| | | 6.0 | | | 14 | 22 | | 28 | | 33 | |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay Time (A, B, C - Y, W) | 2.0 | | | 80 | 160 | | 200 | | 240 | ns |
| | | 4.5 | | | 20 | 32 | | 40 | | 48 | |
| | | 6.0 | | | 17 | 27 | | 34 | | 41 | |
| $t_{PZL}$ $t_{PZH}$ | Output Enable Time | 2.0 | $R_L$ = 1 KΩ | | 36 | 90 | | 115 | | 135 | ns |
| | | 4.5 | | | 11 | 18 | | 23 | | 27 | |
| | | 6.0 | | | 9 | 15 | | 20 | | 23 | |
| $t_{PLZ}$ $t_{PHZ}$ | Output Disable Time | 2.0 | $R_L$ = 1 KΩ | | 26 | 85 | | 105 | | 130 | ns |
| | | 4.5 | | | 13 | 17 | | 21 | | 26 | |
| | | 6.0 | | | 11 | 14 | | 18 | | 22 | |
| $C_{IN}$ | Input Capacitance | | | | 5 | 10 | | 10 | | 10 | pF |
| $C_{PD}$ (*) | Power Dissipation Capacitance | | | | 62 | | | | | | pF |

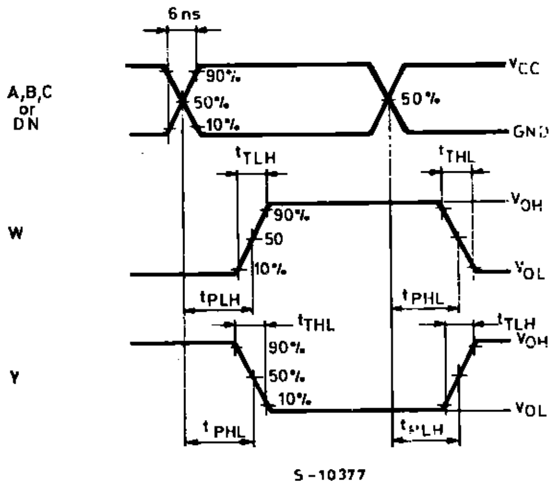
(*) $C_{PD}$ is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operting current can be obtained by the following equation. $I_{CC}(opr) = C_{PD} \bullet V_{CC} \bullet f_{IN} +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

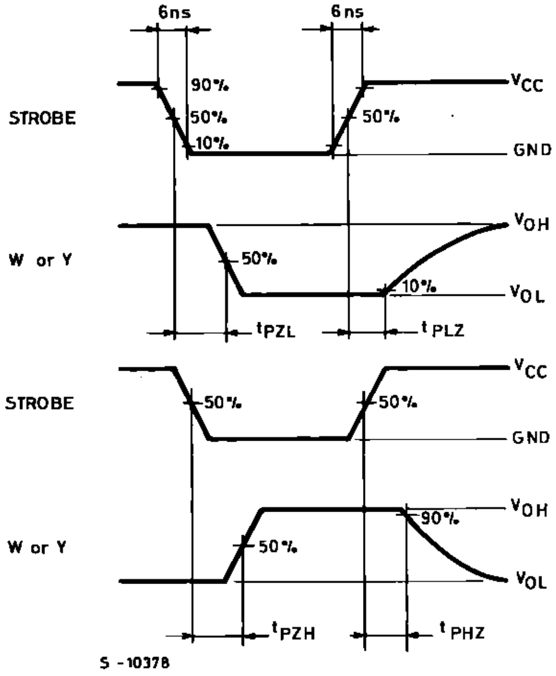
## TEST WAVEFORM $I_{CC}$ (Opr.)



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

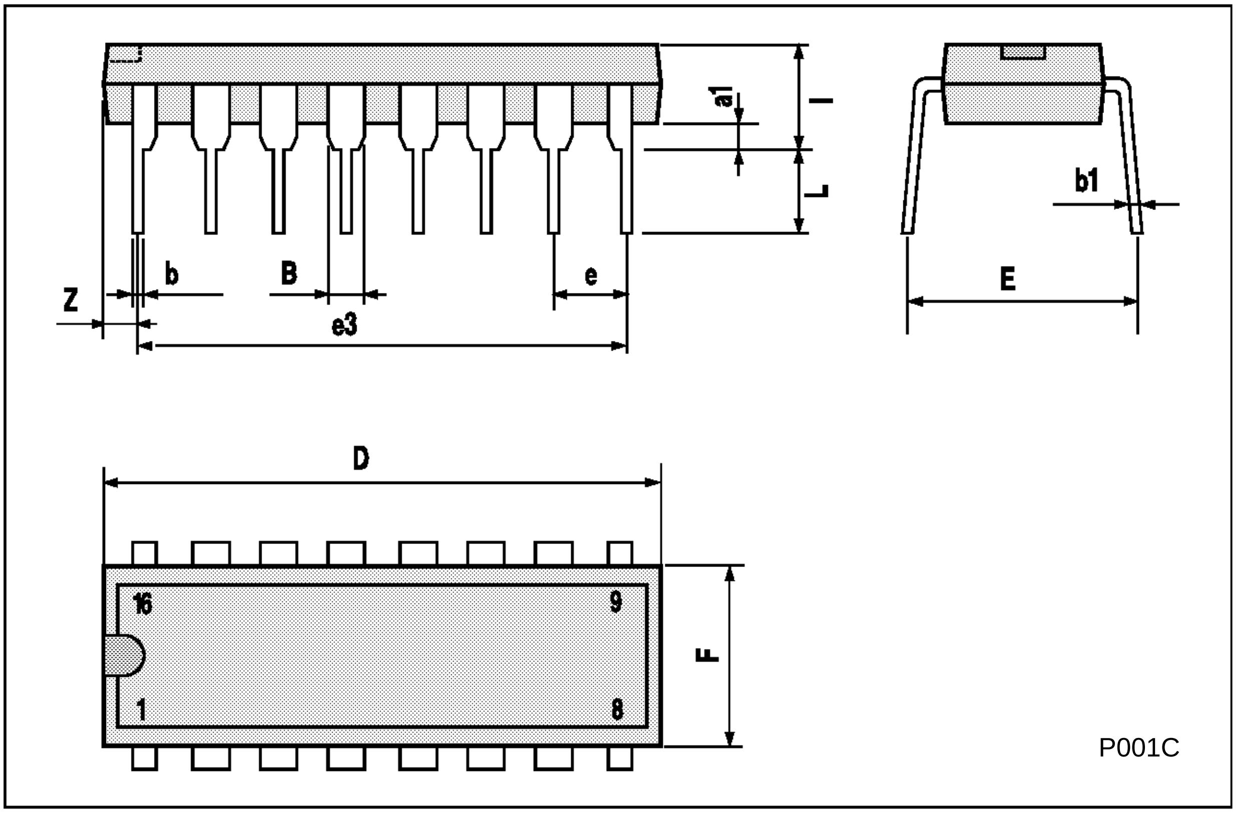
## SWITCHING CHARACTERISTICS TEST WAVEFORM





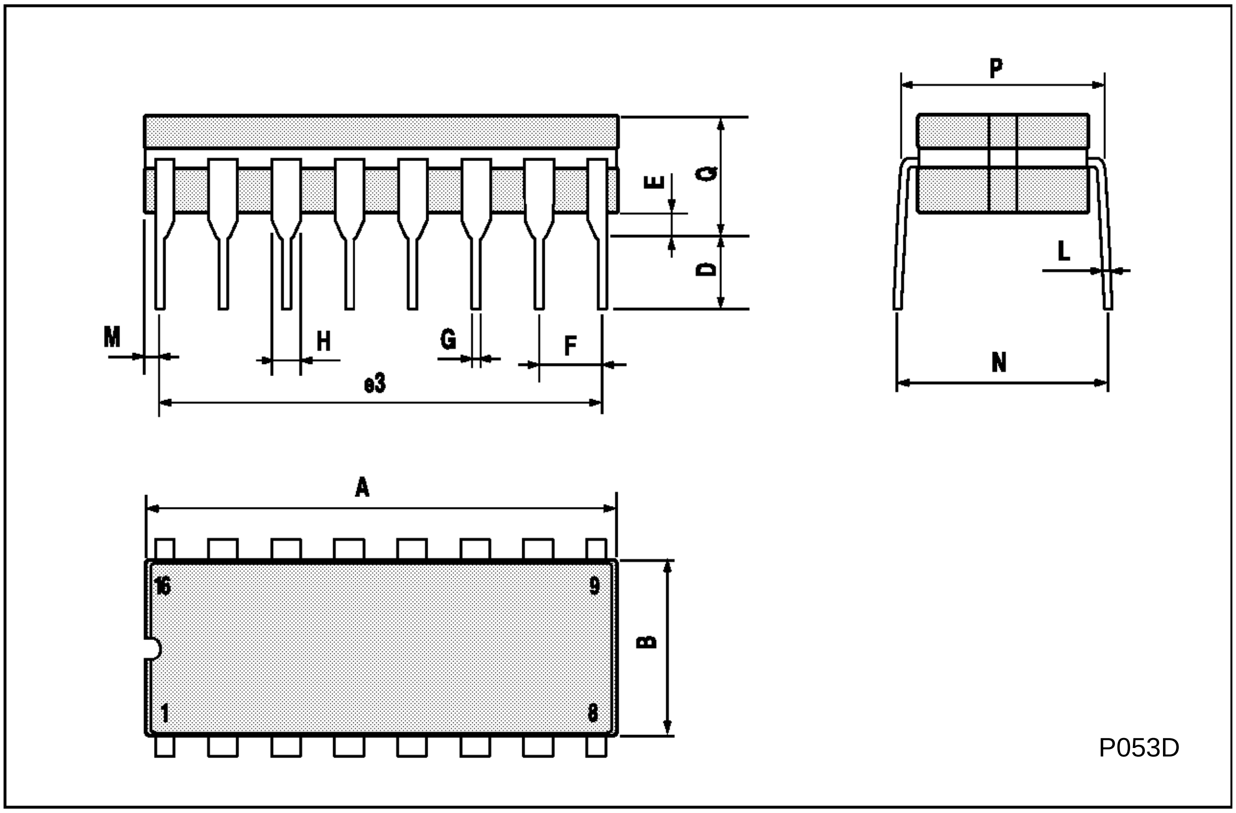
## Plastic DIP16 (0.25) MECHANICAL DATA

| 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 |



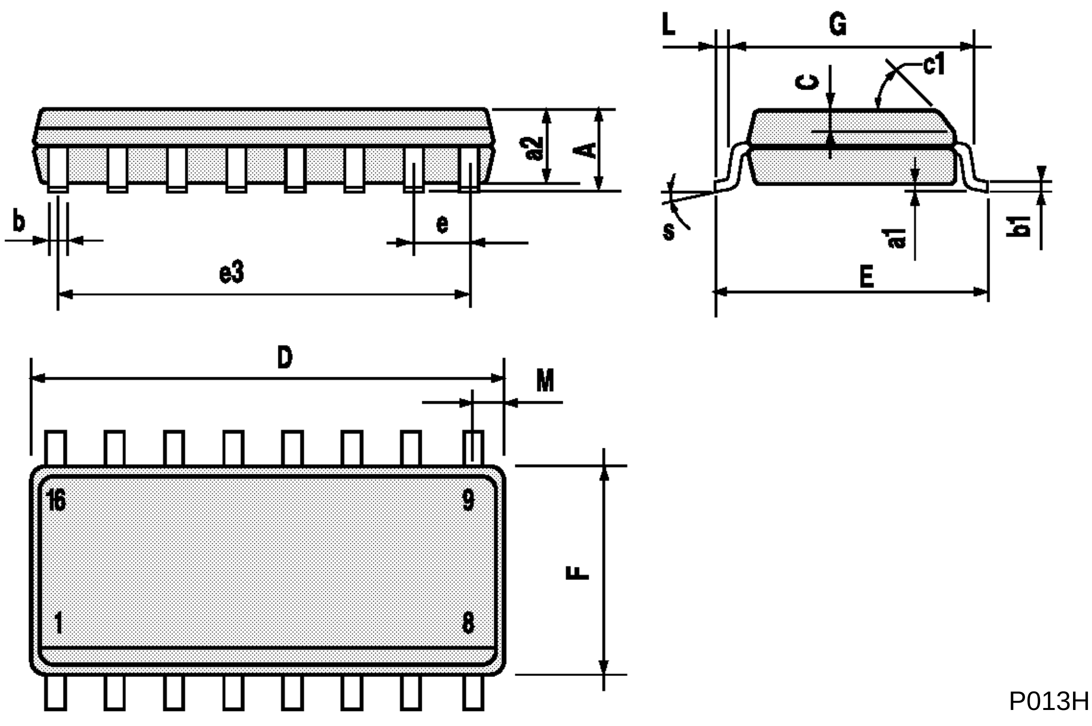
## Ceramic DIP16/1 MECHANICAL DATA

| 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 |



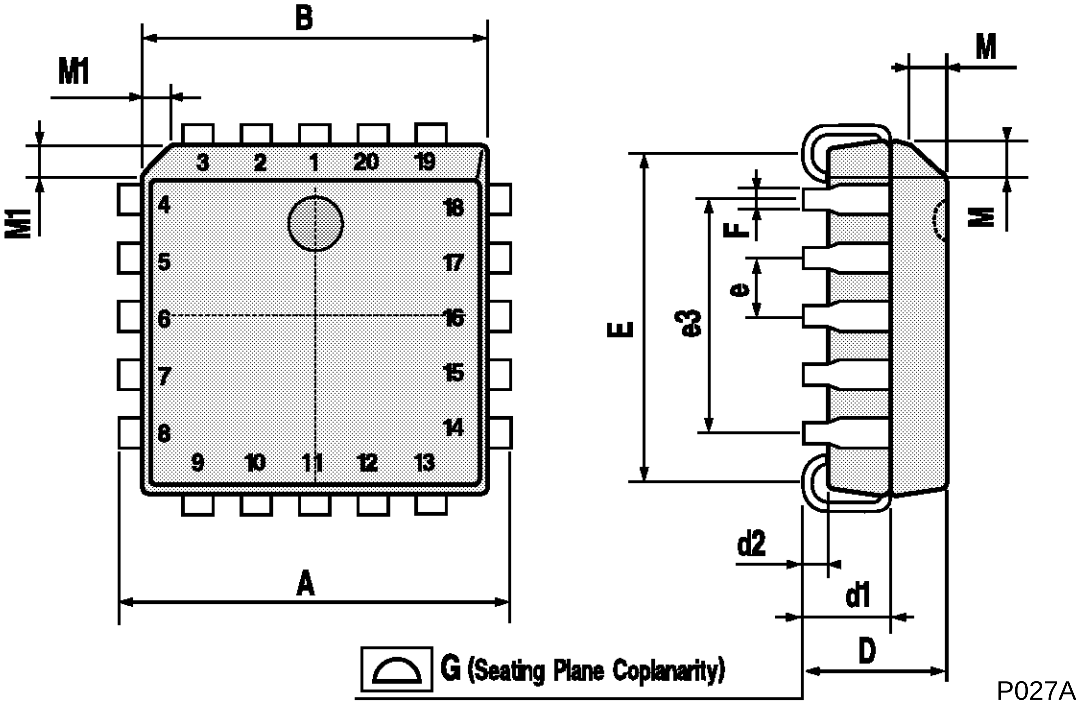
## SO16 (Narrow) MECHANICAL DATA

| 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.) | | | | | |



## 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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