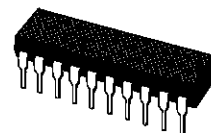
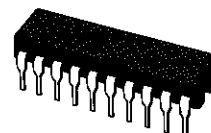


## 8 BIT EQUALITY COMPARATOR

- HIGH SPEED  
 $t_{PD} = 17 \text{ ns (TYP.) AT } V_{CC} = 5 \text{ V}$
- LOW POWER DISSIPATION  
 $I_{CC} = 4 \mu\text{A (MAX.) AT } T_A = 25^\circ\text{C}$
- 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 54/74LS688



**B1R**  
(Plastic Package)



**F1R**  
(Ceramic Package)



**M1R**  
(Micro Package)



**C1R**  
(Chip Carrier)

**ORDER CODES :**

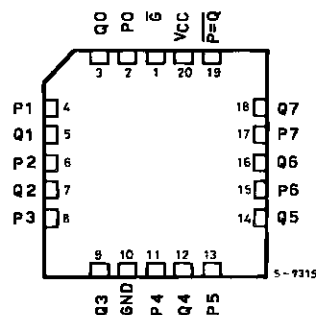
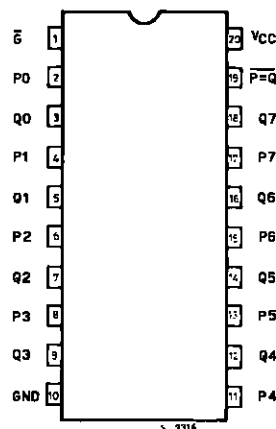
M54HC688F1R  
M74HC688B1R

M74HC688M1R  
M74HC688C1R

### DESCRIPTION

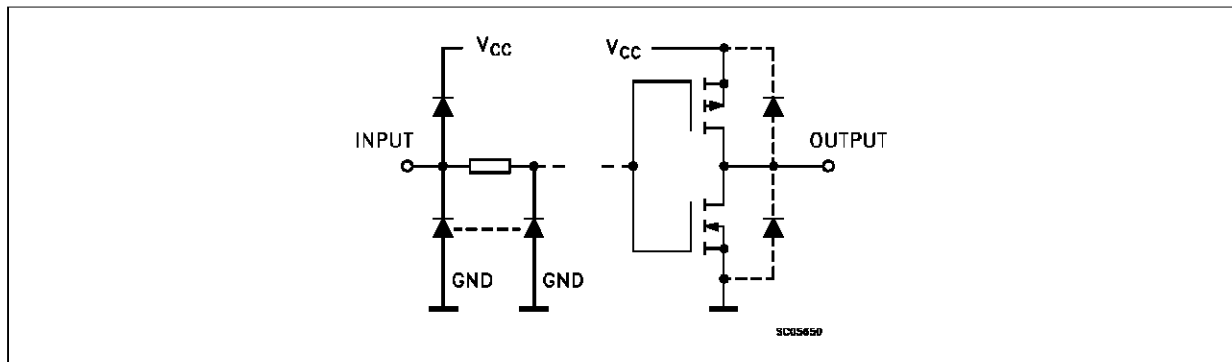
The M54/74HC688 utilizes silicon gate C<sup>2</sup>MOS technology to achieve operating speeds equivalent to LSTTL devices. Along with the low power dissipation and high noise immunity of standard C<sup>2</sup>MOS integrated circuit, it possesses the driving capability of 10 LSTTL load. The M54/74HC688 compares bit for bit two 8-bit words applied on inputs P0 - P7 and inputs Q0 - Q7 and indicates whether or not they are equal. A single active low enable is provided to facilitate cascading several packages to enable comparison of words greater than 8 bits. All inputs are equipped with protection circuit against static discharge and transient excess voltage.

### PIN CONNECTIONS (top view)



NC =  
No Internal  
Connection

# INPUT AND OUTPUT EQUIVALENT CIRCUIT

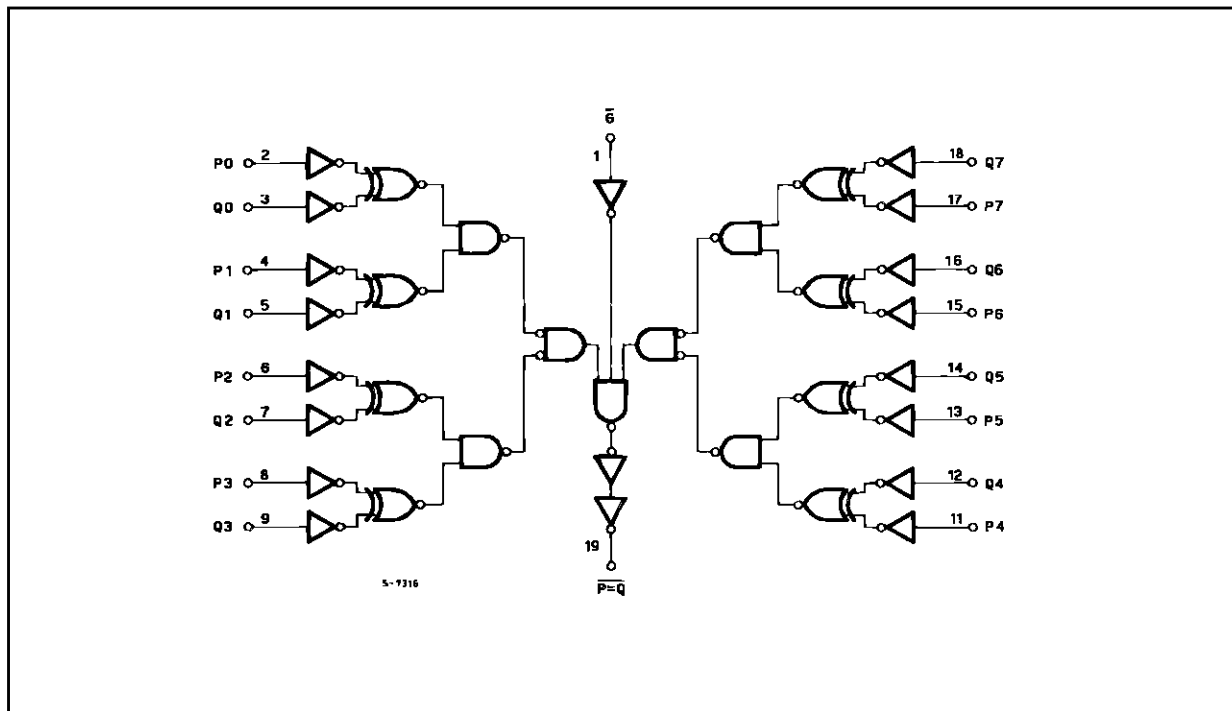


# TRUTH TABLE

| INPUT      |                | OUTPUT             |
|------------|----------------|--------------------|
| P, Q       | $\overline{G}$ | $\overline{P = Q}$ |
| P = Q      | L              | L                  |
| P $\neq$ Q | L              | H                  |
| X          | H              | H                  |

X: DON'T CARE

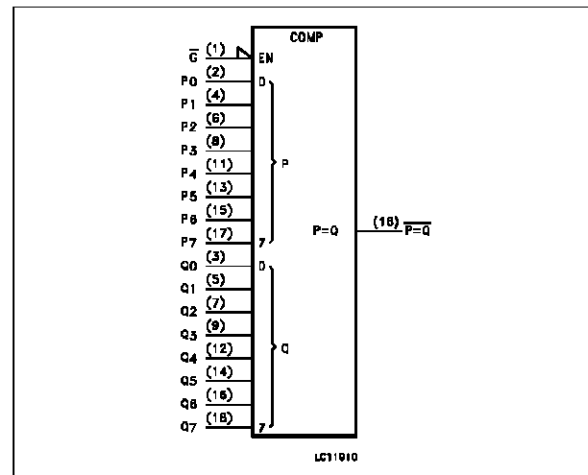
# LOGIC DIAGRAM



## PIN DESCRIPTION

| PIN No                     | SYMBOL             | NAME AND FUNCTION         |
|----------------------------|--------------------|---------------------------|
| 1                          | $\overline{G}$     | Enable Input (Active LOW) |
| 2, 4, 6, 8, 11, 13, 15, 17 | P0 to P7           | Word Inputs               |
| 3, 5, 7, 9, 12, 14, 16, 18 | Q0 to Q7           | Word Outputs              |
| 19                         | $\overline{P = Q}$ | Equal to Output           |
| 10                         | GND                | Ground (0V)               |
| 20                         | V <sub>CC</sub>    | Positive Supply Voltage   |

## IEC LOGIC SYMBOL



## 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 | ± 25                          | mA   |
| I <sub>CC</sub> or I <sub>GND</sub> | DC V <sub>CC</sub> or Ground Current         | ± 50                          | 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 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 <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>0 to 1000<br>V <sub>CC</sub> = 4.5 V<br>0 to 500<br>V <sub>CC</sub> = 6 V<br>0 to 400 | ns       |

**DC SPECIFICATIONS**

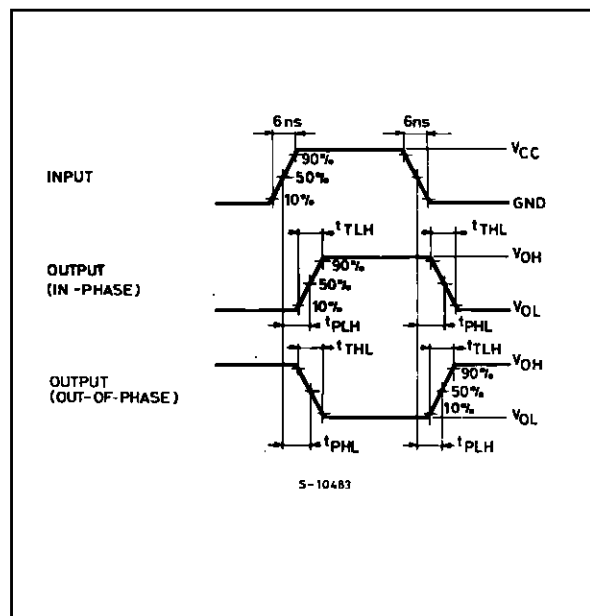
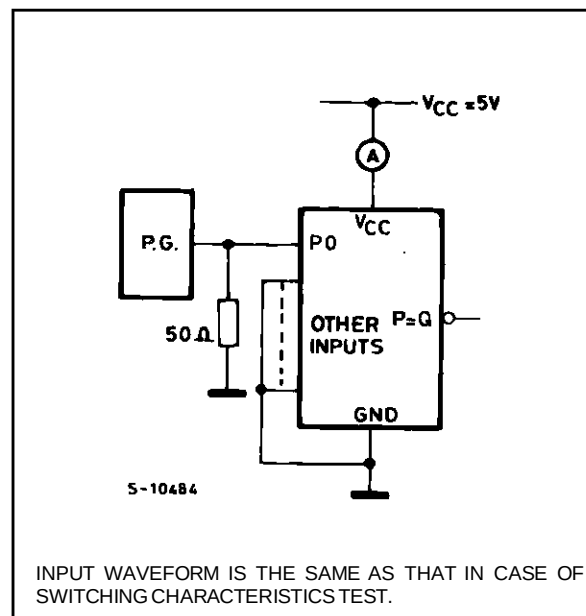
| Symbol          | Parameter                 | Test Conditions        |                                                              | Value                                   |      |      |                      |      |                       | Unit |      |   |
|-----------------|---------------------------|------------------------|--------------------------------------------------------------|-----------------------------------------|------|------|----------------------|------|-----------------------|------|------|---|
|                 |                           | 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 |
|                 |                           | 4.5                    |                                                              |                                         | 4.4  | 4.5  |                      | 4.4  |                       | 4.4  |      |   |
|                 |                           | 6.0                    |                                                              |                                         | 5.9  | 6.0  |                      | 5.9  |                       | 5.9  |      |   |
|                 |                           | 4.5                    |                                                              | I <sub>O</sub> =-4.0 mA                 | 4.18 | 4.31 |                      | 4.13 |                       | 4.10 |      |   |
|                 |                           | 6.0                    |                                                              | I <sub>O</sub> =-5.2 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> = 4.0 mA                 |      | 0.17 | 0.26                 |      | 0.33                  |      | 0.40 |   |
|                 |                           | 6.0                    |                                                              | I <sub>O</sub> = 5.2 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>CC</sub> | Quiescent Supply Current  | 6.0                    | V <sub>I</sub> = V <sub>CC</sub> 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 <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. |
| t <sub>TLH</sub><br>t <sub>THL</sub> | Output Transition Time                                              | 2.0                    |  |                                         | 30   | 75   |                      | 95   |                       | 110  | ns   |
|                                      |                                                                     | 4.5                    |  |                                         | 8    | 15   |                      | 19   |                       | 22   |      |
|                                      |                                                                     | 6.0                    |  |                                         | 7    | 13   |                      | 16   |                       | 19   |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay Time<br>(P <sub>n</sub> , Q <sub>n</sub> - P = Q) | 2.0                    |  |                                         | 60   | 170  |                      | 215  |                       | 255  | ns   |
|                                      |                                                                     | 4.5                    |  |                                         | 21   | 34   |                      | 43   |                       | 51   |      |
|                                      |                                                                     | 6.0                    |  |                                         | 17   | 29   |                      | 37   |                       | 43   |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay Time<br>(G - P = Q)                               | 2.0                    |  |                                         | 40   | 110  |                      | 140  |                       | 165  | ns   |
|                                      |                                                                     | 4.5                    |  |                                         | 13   | 22   |                      | 28   |                       | 33   |      |
|                                      |                                                                     | 6.0                    |  |                                         | 10   | 19   |                      | 24   |                       | 28   |      |
| C <sub>IN</sub>                      | Input Capacitance                                                   |                        |  |                                         | 5    | 10   |                      | 10   |                       | 10   | pF   |
| C <sub>PD</sub> (*)                  | Power Dissipation Capacitance                                       |                        |  |                                         | 32   |      |                      |      |                       |      | pF   |

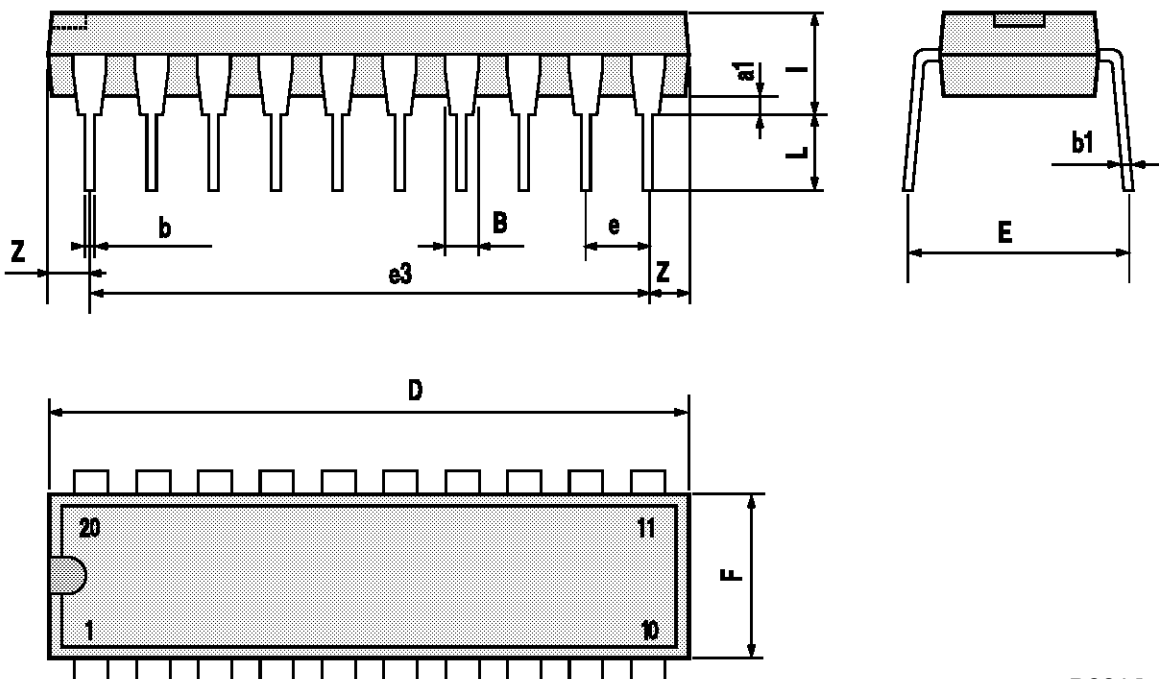
(\*)  $C_{PD}$  is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation.  $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} +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

## SWITCHING CHARACTERISTICS TEST WAVEFORM

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

## Plastic DIP20 (0.25) MECHANICAL DATA

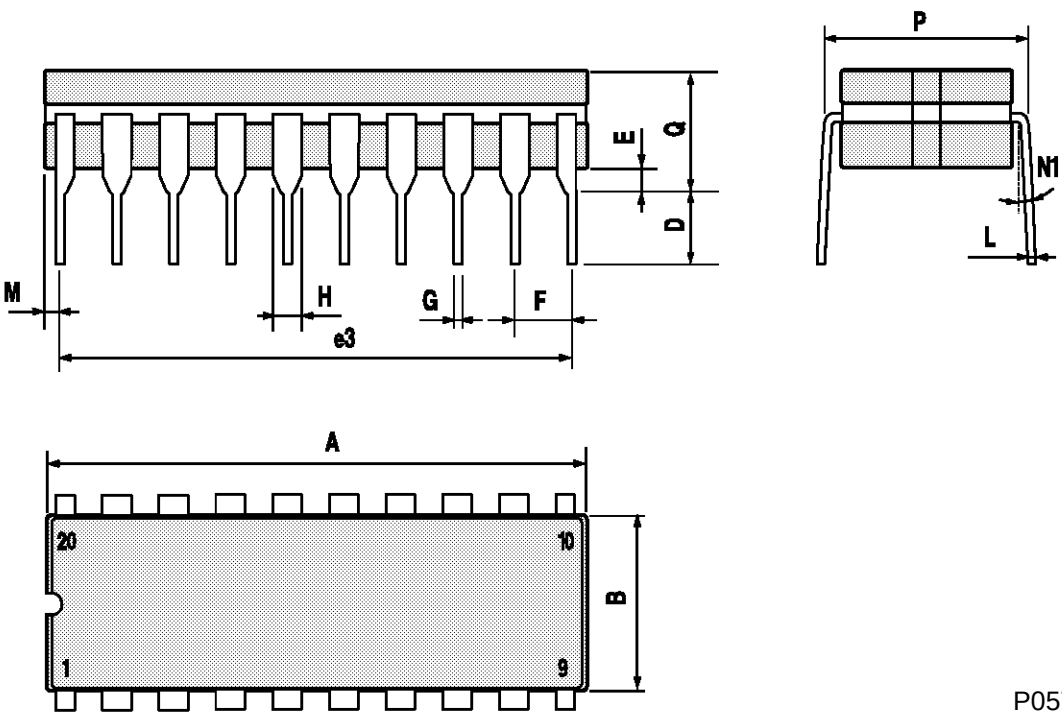
| DIM. | mm    |       |      | inch  |       |       |
|------|-------|-------|------|-------|-------|-------|
|      | MIN.  | TYP.  | MAX. | MIN.  | TYP.  | MAX.  |
| a1   | 0.254 |       |      | 0.010 |       |       |
| B    | 1.39  |       | 1.65 | 0.055 |       | 0.065 |
| b    |       | 0.45  |      |       | 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

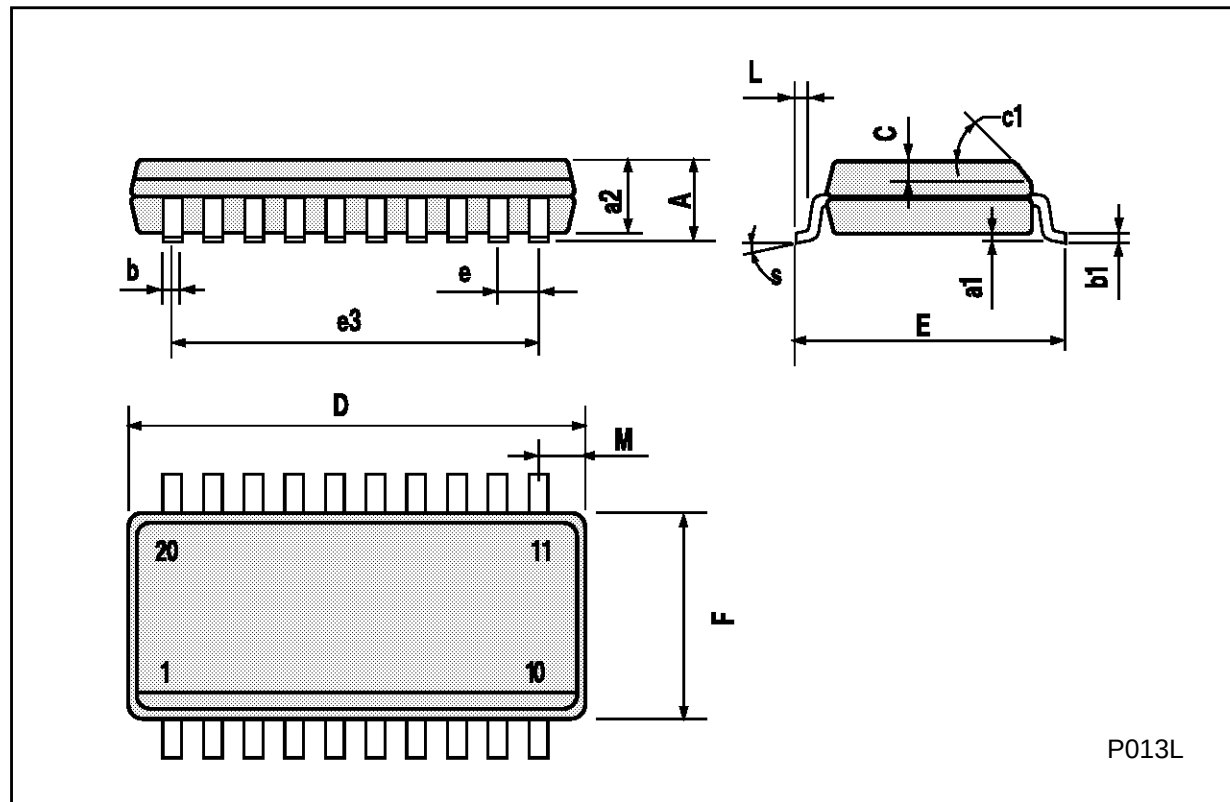
| DIM. | mm                    |       |      | inch  |       |       |
|------|-----------------------|-------|------|-------|-------|-------|
|      | MIN.                  | TYP.  | MAX. | MIN.  | TYP.  | MAX.  |
| A    |                       |       | 25   |       |       | 0.984 |
| B    |    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

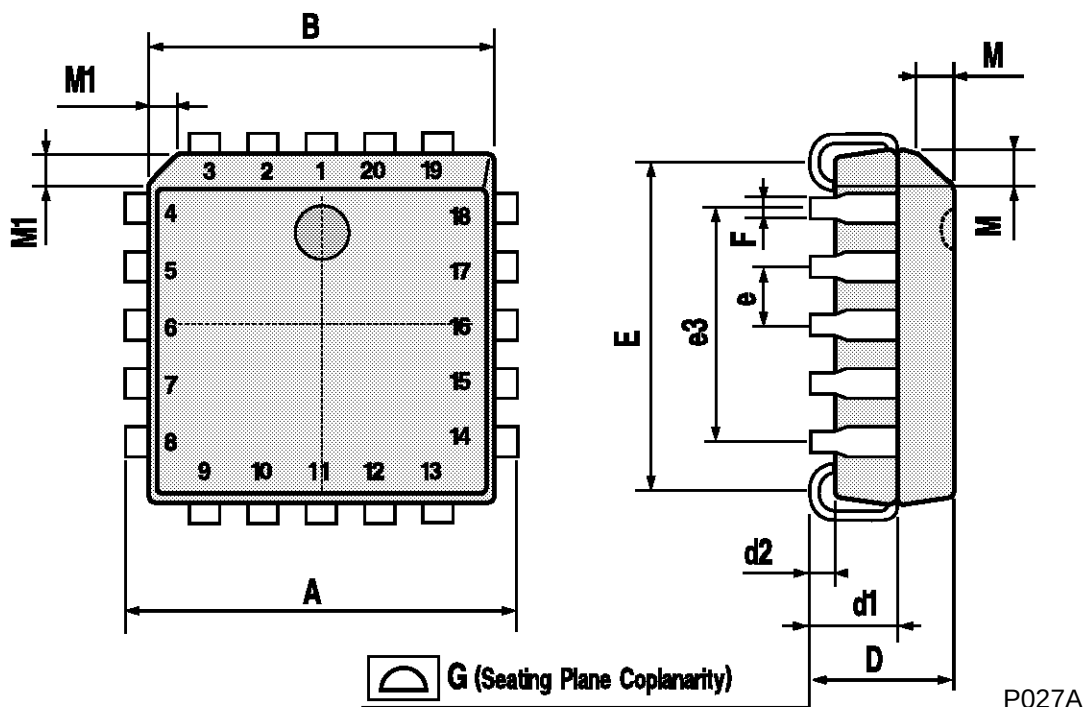
| DIM. | mm         |       |       | inch  |       |       |
|------|------------|-------|-------|-------|-------|-------|
|      | MIN.       | TYP.  | MAX.  | MIN.  | TYP.  | MAX.  |
| A    |            |       | 2.65  |       |       | 0.104 |
| a1   | 0.10       |       | 0.20  | 0.004 |       | 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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