

## OCTAL D TYPE FLIP FLOP WITH CLEAR

- HIGH SPEED  
 $f_{MAX} = 67 \text{ MHz (TYP.) AT } V_{CC} = 5 \text{ V}$
- 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  
 54/74LS273

### DESCRIPTION

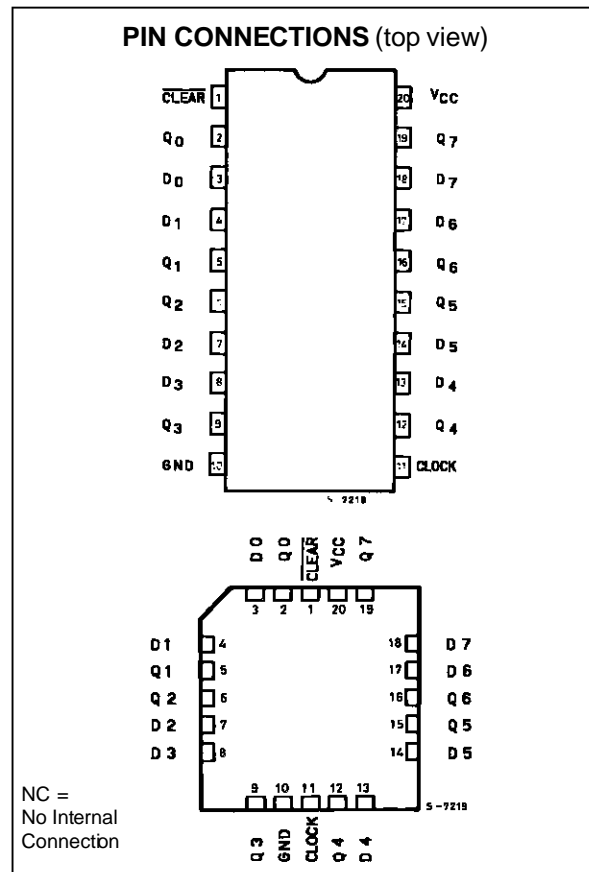
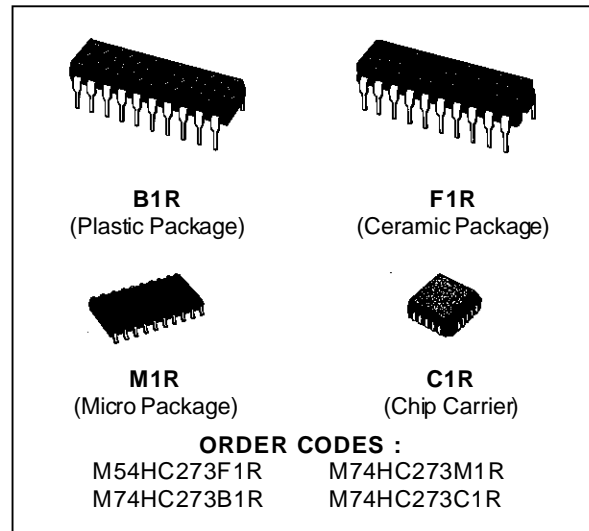
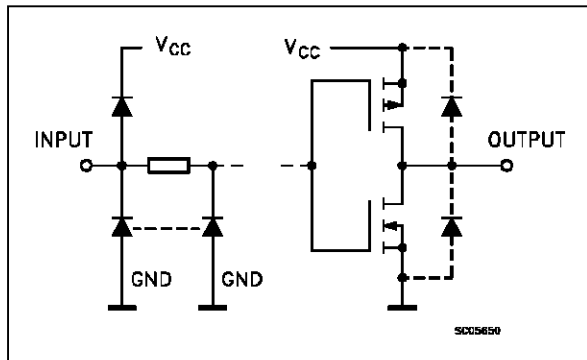
The M54/74HC273 is a high speed CMOS OCTAL D-TYPE FLIP FLOP WITH CLEAR fabricated in silicon gate C<sup>2</sup>MOS technology. It has the same high speed performance of LSTTL combined with true CMOS low power consumption.

Information signals applied to D inputs are transferred to the Q outputs on the positive-going edge of the clock pulse.

When the  $\overline{\text{CLEAR}}$  input is held low, the Q output are in the low logic level independent of the other inputs.

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

### INPUT AND OUTPUT EQUIVALENT CIRCUIT

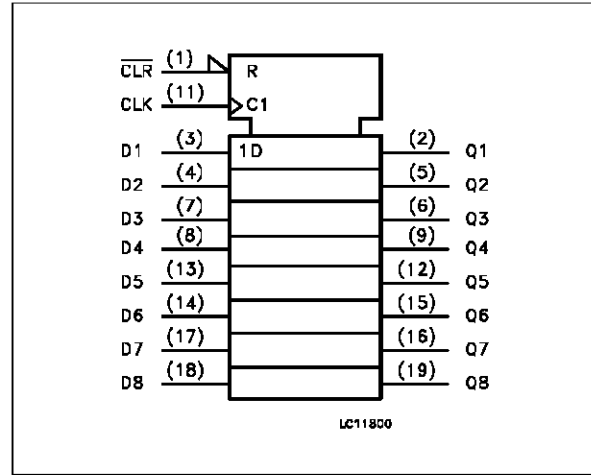


# M54/M74HC273

## PIN DESCRIPTION

| PIN No                     | SYMBOL   | NAME AND FUNCTION                         |
|----------------------------|----------|---|
| 1                          | CLEAR    | Master Reset Input (Active LOW)           |
| 2, 5, 6, 9, 12, 15, 16, 19 | Q0 to Q7 | Flip Flop Outputs                         |
| 3, 4, 7, 8, 13, 14, 17, 18 | D0 to D7 | Data Inputs                               |
| 11                         | CLOCK    | Clock Input (LOW to HIGH, Edge Triggered) |
| 10                         | GND      | Ground (0V)                               |
| 20                         | Vcc      | Positive Supply Voltage                   |

## IEC LOGIC SYMBOL

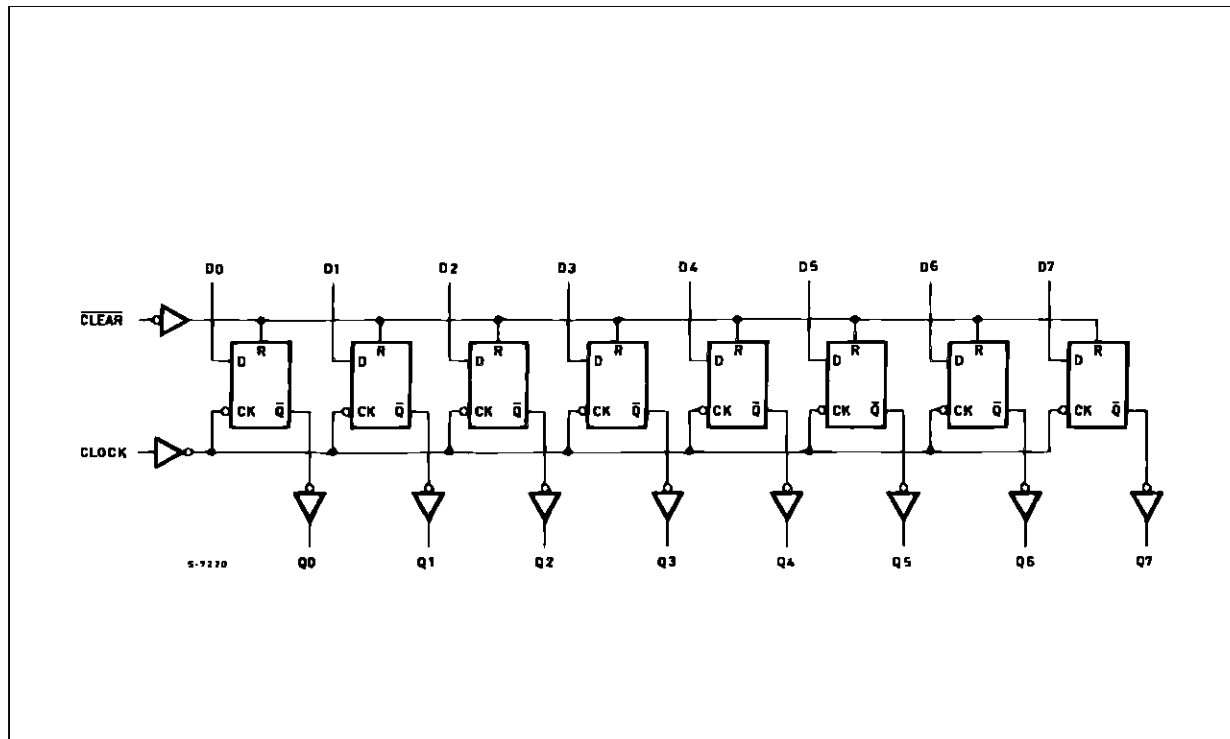


## TRUTH TABLE

| CLEAR | INPUTS |   | OUTPUTS | FUNCTION  |
|-------|--------|---|---------|-----------|
|       | CLOCK  | D | Q       |           |
| L     | X      | X | L       | CLEAR     |
| H     |        | L | L       |           |
| H     |        | H | H       |           |
| H     |        | X | Qn      | NO CHANGE |

X: Don't Care

## LOGIC DIAGRAM



**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>V <sub>CC</sub> = 4.5 V<br>V <sub>CC</sub> = 6 V | 0 to 1000<br>0 to 500<br>0 to 400 | ns |

**DC SPECIFICATIONS**

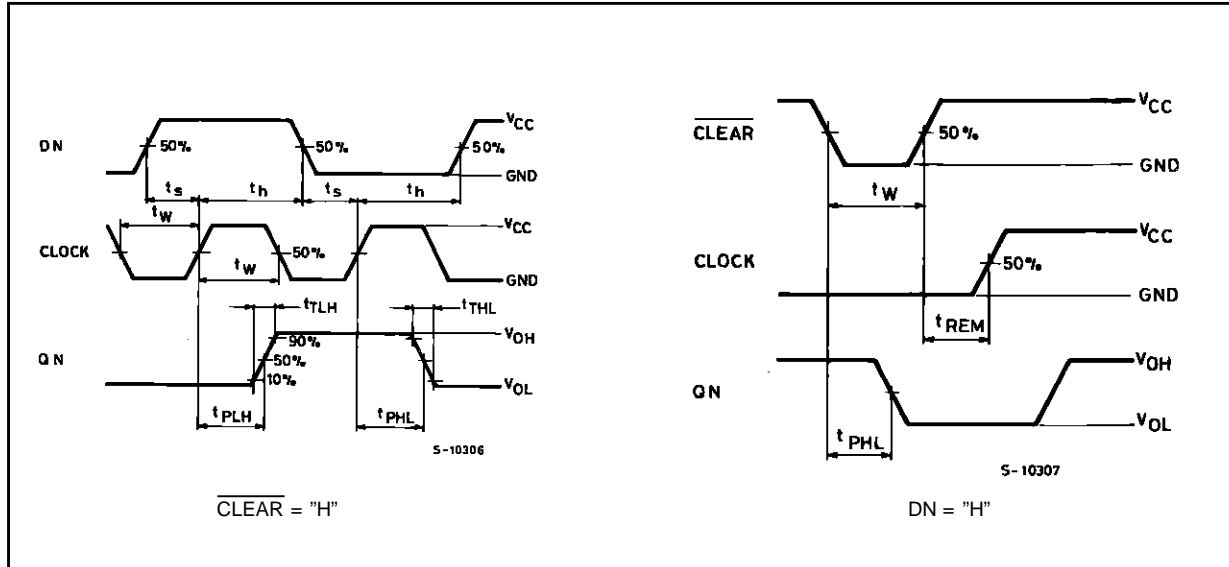
| Symbol          | Parameter                 | Test Conditions        |  | Value                                   |                         |      |                      |      |                       | Unit |      |   |
|-----------------|---------------------------|------------------------|--|---|-------------------------|------|----------------------|------|-----------------------|------|------|---|
|                 |                           | 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 |      |   |
| 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)

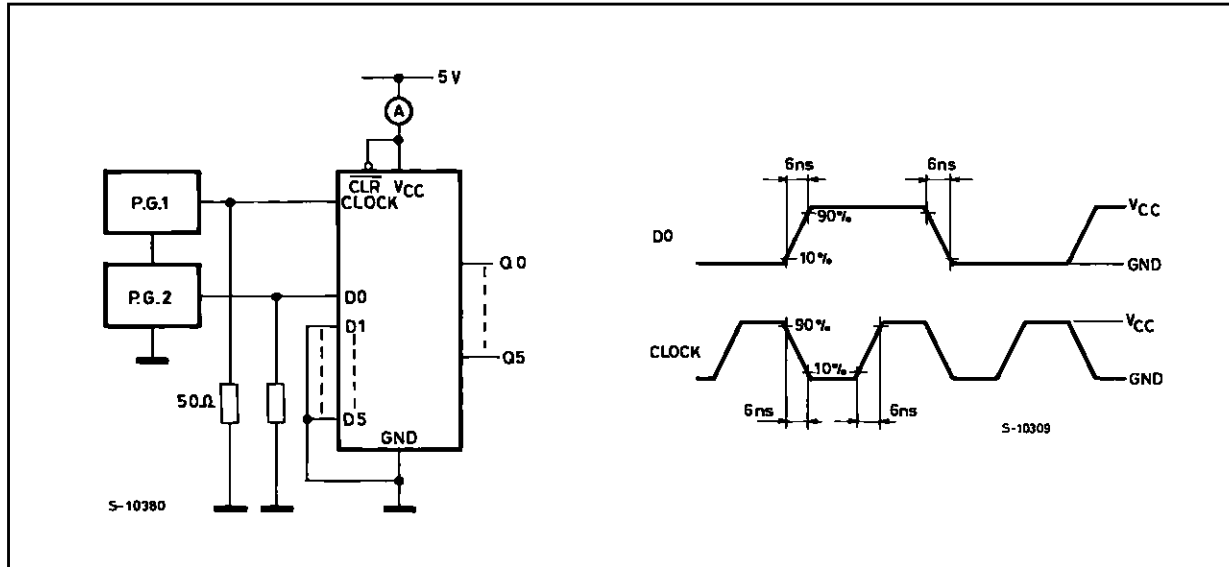
| Symbol                                 | Parameter                          | Test Conditions        |  | Value                                   |      |      |                      |      |                       | Unit |      |
|--|------------------------------------|------------------------|--|---|------|------|----------------------|------|-----------------------|------|------|
|  |                                    | 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                    |  |   | 25   | 75   |                      | 95   |                       | 110  | ns   |
|  |                                    | 4.5                    |  |   | 7    | 15   |                      | 19   |                       | 22   |      |
|  |                                    | 6.0                    |  |   | 6    | 13   |                      | 16   |                       | 19   |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub>   | Propagation Delay Time (CLOCK - Q) | 2.0                    |  |   | 54   | 145  |                      | 180  |                       | 220  | ns   |
|  |                                    | 4.5                    |  |   | 18   | 29   |                      | 36   |                       | 44   |      |
|  |                                    | 6.0                    |  |   | 15   | 25   |                      | 31   |                       | 37   |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub>   | Propagation Delay Time (CLEAR - Q) | 2.0                    |  |   | 60   | 160  |                      | 200  |                       | 240  | ns   |
|  |                                    | 4.5                    |  |   | 20   | 32   |                      | 40   |                       | 48   |      |
|  |                                    | 6.0                    |  |   | 17   | 27   |                      | 34   |                       | 41   |      |
| f <sub>MAX</sub>                       | Maximum Clock Frequency            | 2.0                    |  | 6                                       | 18   |      | 4.8                  |      | 4                     |      | MHz  |
|  |                                    | 4.5                    |  | 30                                      | 56   |      | 24                   |      | 20                    |      |      |
|  |                                    | 6.0                    |  | 35                                      | 66   |      | 28                   |      | 24                    |      |      |
| t <sub>W(H)</sub><br>t <sub>W(L)</sub> | Minimum Pulse Width (CLOCK)        | 2.0                    |  |   | 28   | 75   |                      | 95   |                       | 110  | ns   |
|  |                                    | 4.5                    |  |   | 7    | 15   |                      | 19   |                       | 22   |      |
|  |                                    | 6.0                    |  |   | 6    | 13   |                      | 16   |                       | 19   |      |
| t <sub>W(L)</sub>                      | Minimum Pulse Width (CLEAR)        | 2.0                    |  |   | 28   | 75   |                      | 95   |                       | 110  | ns   |
|  |                                    | 4.5                    |  |   | 7    | 15   |                      | 19   |                       | 22   |      |
|  |                                    | 6.0                    |  |   | 6    | 13   |                      | 16   |                       | 19   |      |
| t <sub>s</sub>                         | Minimum Set-up Time                | 2.0                    |  |   | 20   | 75   |                      | 95   |                       | 110  | ns   |
|  |                                    | 4.5                    |  |   | 4    | 15   |                      | 19   |                       | 22   |      |
|  |                                    | 6.0                    |  |   | 3    | 13   |                      | 16   |                       | 19   |      |
| t <sub>h</sub>                         | Minimum Hold Time                  | 2.0                    |  |   |      | 0    |                      | 0    |                       | 0    | ns   |
|  |                                    | 4.5                    |  |   |      | 0    |                      | 0    |                       | 0    |      |
|  |                                    | 6.0                    |  |   |      | 0    |                      | 0    |                       | 0    |      |
| t <sub>REM</sub>                       | Minimum Removal Time (CLEAR)       | 2.0                    |  |   | 16   | 50   |                      | 65   |                       | 75   | ns   |
|  |                                    | 4.5                    |  |   | 4    | 10   |                      | 13   |                       | 15   |      |
|  |                                    | 6.0                    |  |   | 3    | 9    |                      | 11   |                       | 13   |      |
| C <sub>IN</sub>                        | Input Capacitance                  |                        |  |   | 5    | 10   |                      | 10   |                       | 10   | pF   |
| C <sub>PD</sub> (*)                    | Power Dissipation Capacitance      |                        |  |   | 43   |      |                      |      |                       |      | pF   |

(\*) C<sub>PD</sub> 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.  $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8$  (per Flip FLop), and the total CPD when n pcs of Flip Flop operate can be gained by the following equations:  $CPD (total) = 32 + 11 \times n$

SWITCHING CHARACTERISTICS TEST WAVEFORM

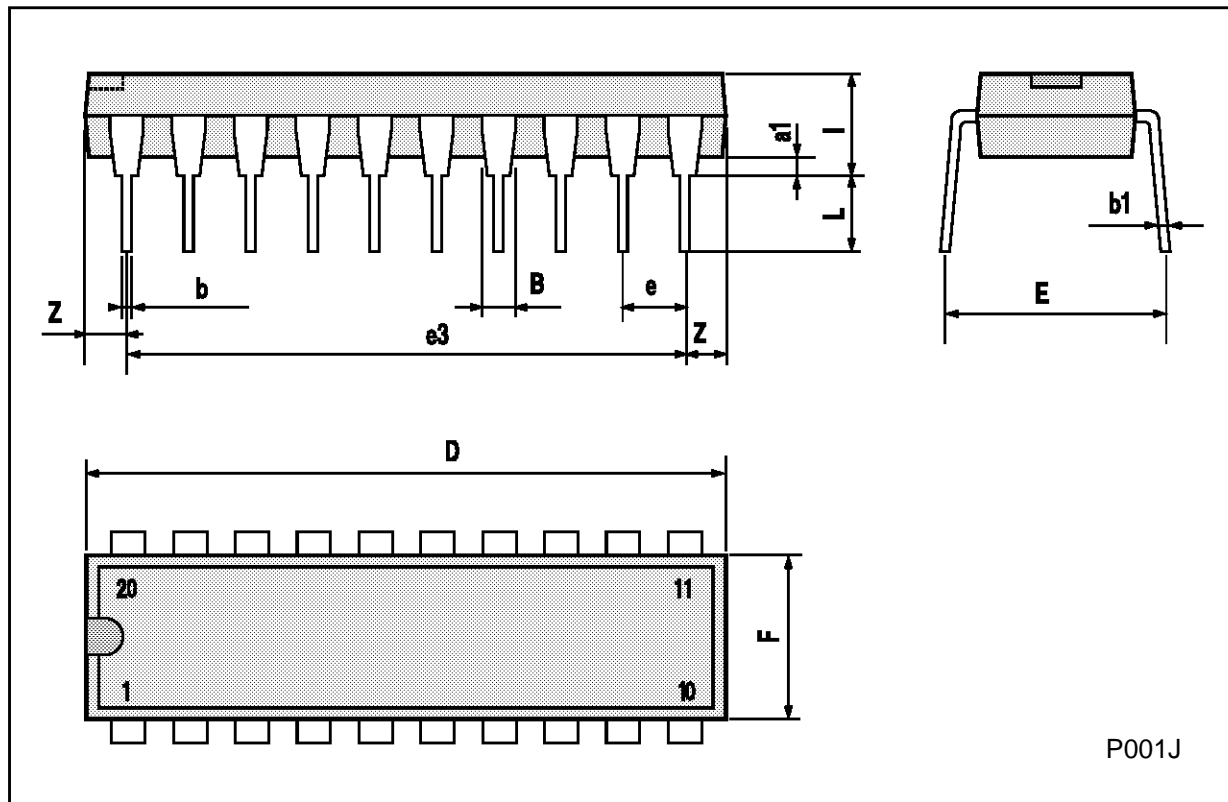


TEST CIRCUIT  $I_{cc}$  (Opr.)



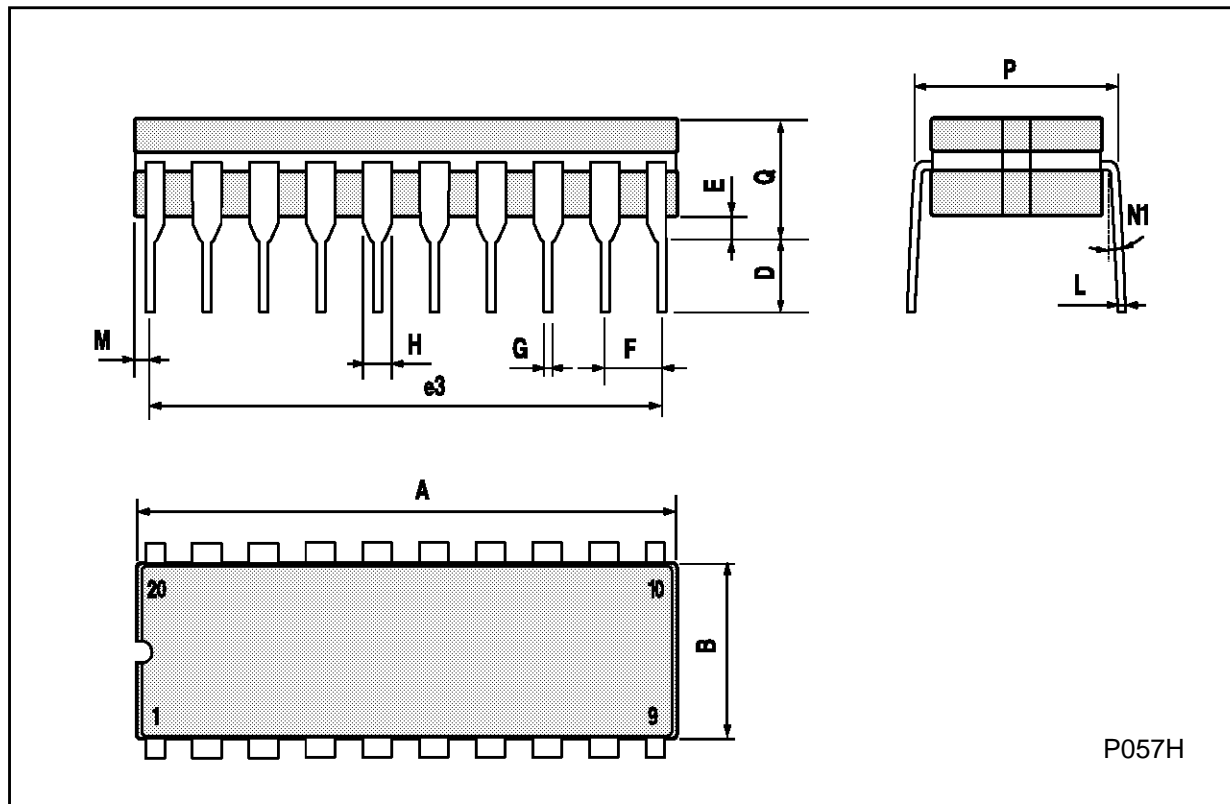
## Plastic DIP20 (0.25) MECHANICAL DATA

| 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 |



Ceramic DIP20 MECHANICAL DATA

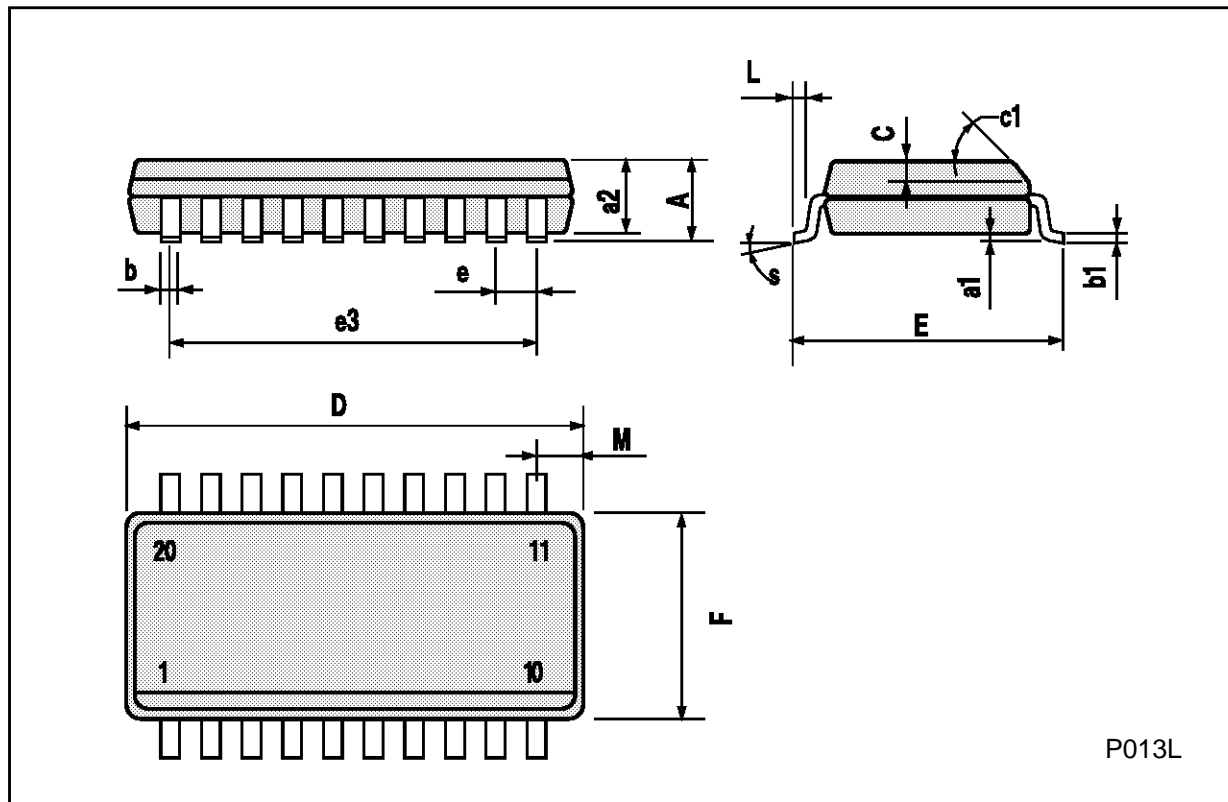
| DIM. | mm                    |       |      | inch  |       |       |
|------|-----------------------|-------|------|-------|-------|-------|
|      | MIN.                  | TYP.  | MAX. | MIN.  | TYP.  | MAX.  |
| A    |                       |       | 25   |       |       | 0.984 |
| B    |    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





## 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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