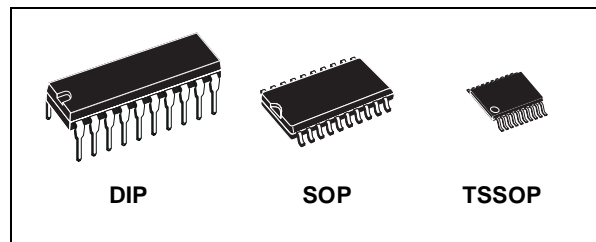


## OCTAL D TYPE FLIP FLOP WITH CLEAR

- HIGH SPEED :  
 $f_{MAX} = 66 \text{ MHz (TYP.) at } V_{CC} = 6V$
- LOW POWER DISSIPATION:  
 $I_{CC} = 4\mu\text{A (MAX.) at } T_A = 25^\circ\text{C}$
- HIGH NOISE IMMUNITY:  
 $V_{NIH} = V_{NIL} = 28 \% V_{CC} \text{ (MIN.)}$
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 4\text{mA (MIN)}$
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \approx t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE:  
 $V_{CC} \text{ (OPR)} = 2V \text{ to } 6V$
- PIN AND FUNCTION COMPATIBLE WITH  
 74 SERIES 273



### ORDER CODES

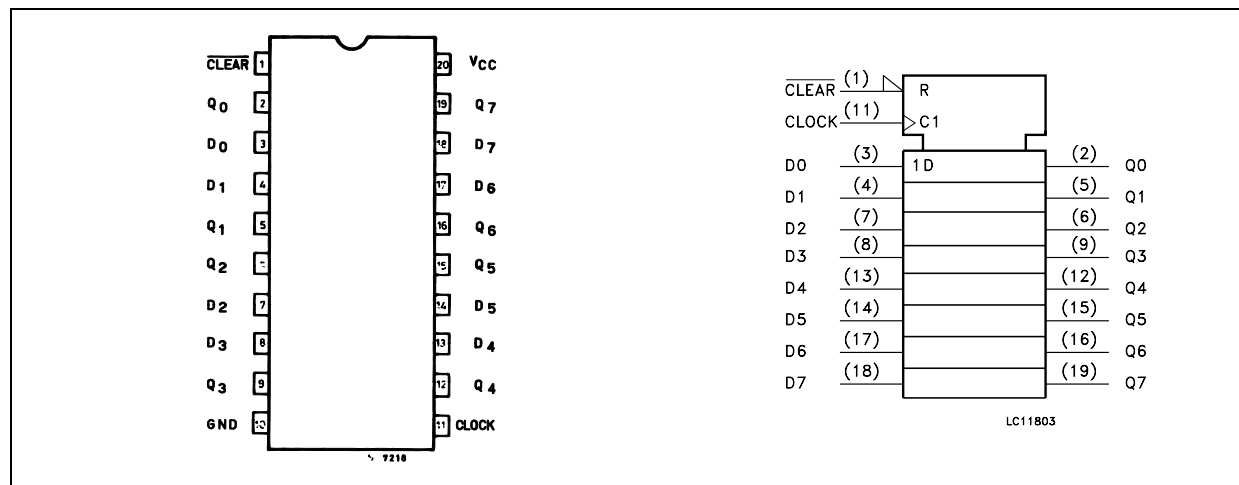
| PACKAGE | TUBE        | T & R          |
|---------|-------------|----------------|
| DIP     | M74HC273B1R |                |
| SOP     | M74HC273M1R | M74HC273RM13TR |
| TSSOP   |             | M74HC273TTR    |

### DESCRIPTION

The M74HC273 is an high speed CMOS OCTAL D TYPE FLIP FLOP WITH CLEAR fabricated with silicon gate C<sup>2</sup>MOS technology. Information signals applied to D inputs are transferred to the Q outputs on the positive-going edge of the clock pulse.

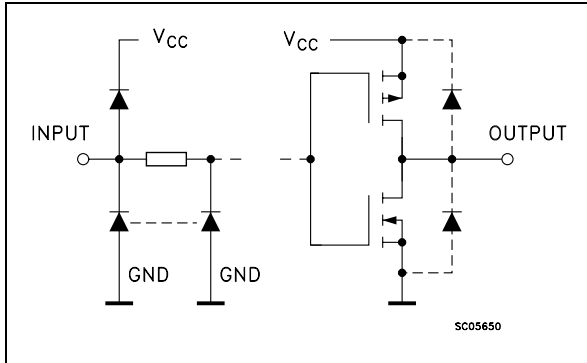
When the  $\overline{\text{CLEAR}}$  input is held low, the Q output are in the low logic level independent of the other inputs. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

### PIN CONNECTION AND IEC LOGIC SYMBOLS



# M74HC273

## INPUT AND OUTPUT EQUIVALENT CIRCUIT



## PIN DESCRIPTION

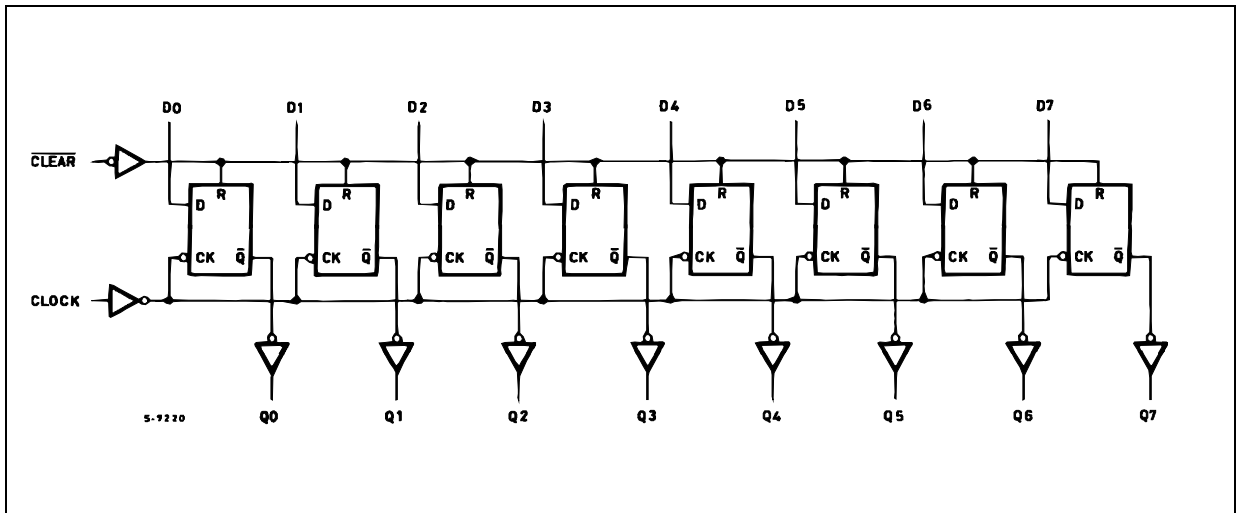
| PIN No                     | SYMBOL                    | NAME AND FUNCTION                         |
|----------------------------|---------------------------|-------------------------------------------|
| 1                          | $\overline{\text{CLEAR}}$ | Master Reset Input (Active LOW)           |
| 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                   |

## TRUTH TABLE

| INPUTS                    |       |   | OUTPUTS | FUNCTION  |
|---------------------------|-------|---|---------|-----------|
| $\overline{\text{CLEAR}}$ | 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



This logic diagram has not been used to estimate propagation delays

**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 Current             | $\pm 25$               | mA   |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current | $\pm 50$               | 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 conditions is not implied

(\*) 500mW at 65 °C; derate to 300mW by 10mW/°C from 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    | -55 to 125      | °C        |    |
| $t_r, t_f$ | Input Rise and Fall Time | $V_{CC} = 2.0V$ | 0 to 1000 | ns |
|            |                          | $V_{CC} = 4.5V$ | 0 to 500  | ns |
|            |                          | $V_{CC} = 6.0V$ | 0 to 400  | ns |

## DC SPECIFICATIONS

| Symbol          | Parameter                 | Test Conditions        |                                         | Value                 |      |       |             |      |              | Unit |      |
|-----------------|---------------------------|------------------------|-----------------------------------------|-----------------------|------|-------|-------------|------|--------------|------|------|
|                 |                           | V <sub>CC</sub><br>(V) |                                         | T <sub>A</sub> = 25°C |      |       | -40 to 85°C |      | -55 to 125°C |      |      |
|                 |                           |                        |                                         | 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                    | I <sub>O</sub> =-20 μA                  | 1.9                   | 2.0  |       | 1.9         |      | 1.9          |      | V    |
|                 |                           | 4.5                    | I <sub>O</sub> =-20 μA                  | 4.4                   | 4.5  |       | 4.4         |      | 4.4          |      |      |
|                 |                           | 6.0                    | I <sub>O</sub> =-20 μA                  | 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                    | I <sub>O</sub> =20 μA                   |                       | 0.0  | 0.1   |             | 0.1  |              | 0.1  | V    |
|                 |                           | 4.5                    | I <sub>O</sub> =20 μA                   |                       | 0.0  | 0.1   |             | 0.1  |              | 0.1  |      |
|                 |                           | 6.0                    | I <sub>O</sub> =20 μA                   |                       | 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 ( $C_L = 50 \text{ pF}$ , Input  $t_r = t_f = 6 \text{ ns}$ )

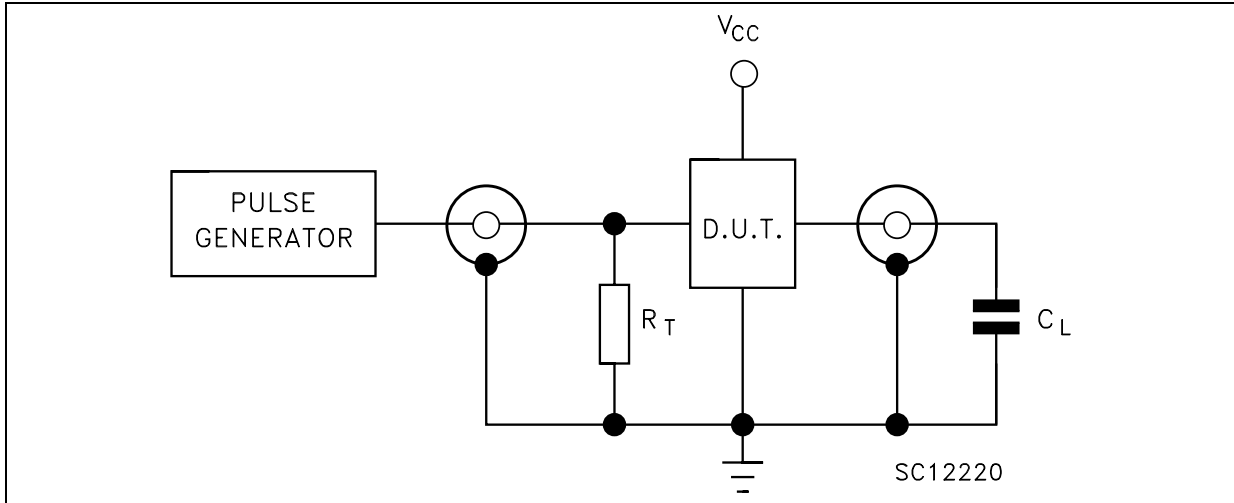
| Symbol                | Parameter                             | Test Conditions |  | Value                    |      |      |                                    |      |                                     | Unit |      |
|-----------------------|---------------------------------------|-----------------|--|--------------------------|------|------|------------------------------------|------|-------------------------------------|------|------|
|                       |                                       | $V_{CC}$<br>(V) |  | $T_A = 25^\circ\text{C}$ |      |      | $-40 \text{ to } 85^\circ\text{C}$ |      | $-55 \text{ to } 125^\circ\text{C}$ |      |      |
|                       |                                       |                 |  | Min.                     | Typ. | Max. | Min.                               | Max. | Min.                                |      | Max. |
| $t_{TLH} \ t_{THL}$   | Output Transition Time                | 2.0             |  |                          | 25   | 75   |                                    | 95   |                                     | 110  | ns   |
|                       |                                       | 4.5             |  |                          | 7    | 15   |                                    | 19   |                                     | 22   |      |
|                       |                                       | 6.0             |  |                          | 6    | 13   |                                    | 16   |                                     | 19   |      |
| $t_{PLH} \ t_{PHL}$   | Propagation Delay Time<br>(CLOCK - Q) | 2.0             |  |                          | 54   | 145  |                                    | 180  |                                     | 220  | ns   |
|                       |                                       | 4.5             |  |                          | 18   | 29   |                                    | 36   |                                     | 44   |      |
|                       |                                       | 6.0             |  |                          | 15   | 25   |                                    | 31   |                                     | 37   |      |
| $t_{PHL}$             | Propagation Delay Time<br>(CLEAR - Q) | 2.0             |  |                          | 60   | 160  |                                    | 200  |                                     | 240  | ns   |
|                       |                                       | 4.5             |  |                          | 20   | 32   |                                    | 40   |                                     | 48   |      |
|                       |                                       | 6.0             |  |                          | 17   | 27   |                                    | 34   |                                     | 41   |      |
| $f_{MAX}$             | Maximum Clock Frequency               | 2.0             |  | 6                        | 18   |      | 4.8                                |      | 4                                   |      | MHz  |
|                       |                                       | 4.5             |  | 30                       | 56   |      | 24                                 |      | 20                                  |      |      |
|                       |                                       | 6.0             |  | 35                       | 66   |      | 28                                 |      | 24                                  |      |      |
| $t_{W(H)} \ t_{W(L)}$ | Minimum Pulse Width (CLOCK)           | 2.0             |  |                          | 28   | 75   |                                    | 95   |                                     | 110  | ns   |
|                       |                                       | 4.5             |  |                          | 7    | 15   |                                    | 19   |                                     | 22   |      |
|                       |                                       | 6.0             |  |                          | 6    | 13   |                                    | 16   |                                     | 19   |      |
| $t_{W(L)}$            | Minimum Pulse Width (CLEAR)           | 2.0             |  |                          | 28   | 75   |                                    | 95   |                                     | 110  | ns   |
|                       |                                       | 4.5             |  |                          | 7    | 15   |                                    | 19   |                                     | 22   |      |
|                       |                                       | 6.0             |  |                          | 6    | 13   |                                    | 16   |                                     | 19   |      |
| $t_s$                 | Minimum Set-up Time                   | 2.0             |  |                          | 20   | 75   |                                    | 95   |                                     | 110  | ns   |
|                       |                                       | 4.5             |  |                          | 4    | 15   |                                    | 19   |                                     | 22   |      |
|                       |                                       | 6.0             |  |                          | 3    | 13   |                                    | 16   |                                     | 19   |      |
| $t_h$                 | Minimum Hold Time                     | 2.0             |  |                          |      | 0    |                                    | 0    |                                     | 0    | ns   |
|                       |                                       | 4.5             |  |                          |      | 0    |                                    | 0    |                                     | 0    |      |
|                       |                                       | 6.0             |  |                          |      |      | 0                                  |      | 0                                   |      |      |
| $t_{REM}$             | Minimum Removal Time (CLEAR)          | 2.0             |  |                          | 16   | 50   |                                    | 65   |                                     | 75   | ns   |
|                       |                                       | 4.5             |  |                          | 4    | 10   |                                    | 13   |                                     | 15   |      |
|                       |                                       | 6.0             |  |                          | 3    | 9    |                                    | 11   |                                     | 13   |      |

## CAPACITIVE CHARACTERISTICS

| Symbol   | Parameter                              | Test Condition  |  | Value                    |      |      |                                    |      |                                     | Unit |      |
|----------|----------------------------------------|-----------------|--|--------------------------|------|------|------------------------------------|------|-------------------------------------|------|------|
|          |                                        | $V_{CC}$<br>(V) |  | $T_A = 25^\circ\text{C}$ |      |      | $-40 \text{ to } 85^\circ\text{C}$ |      | $-55 \text{ to } 125^\circ\text{C}$ |      |      |
|          |                                        |                 |  | Min.                     | Typ. | Max. | Min.                               | Max. | Min.                                |      | Max. |
| $C_{IN}$ | Input Capacitance                      | 5.0             |  |                          | 5    | 10   |                                    | 10   |                                     | 10   | pF   |
| $C_{PD}$ | Power Dissipation Capacitance (note 1) | 5.0             |  |                          | 43   |      |                                    |      |                                     |      | pF   |

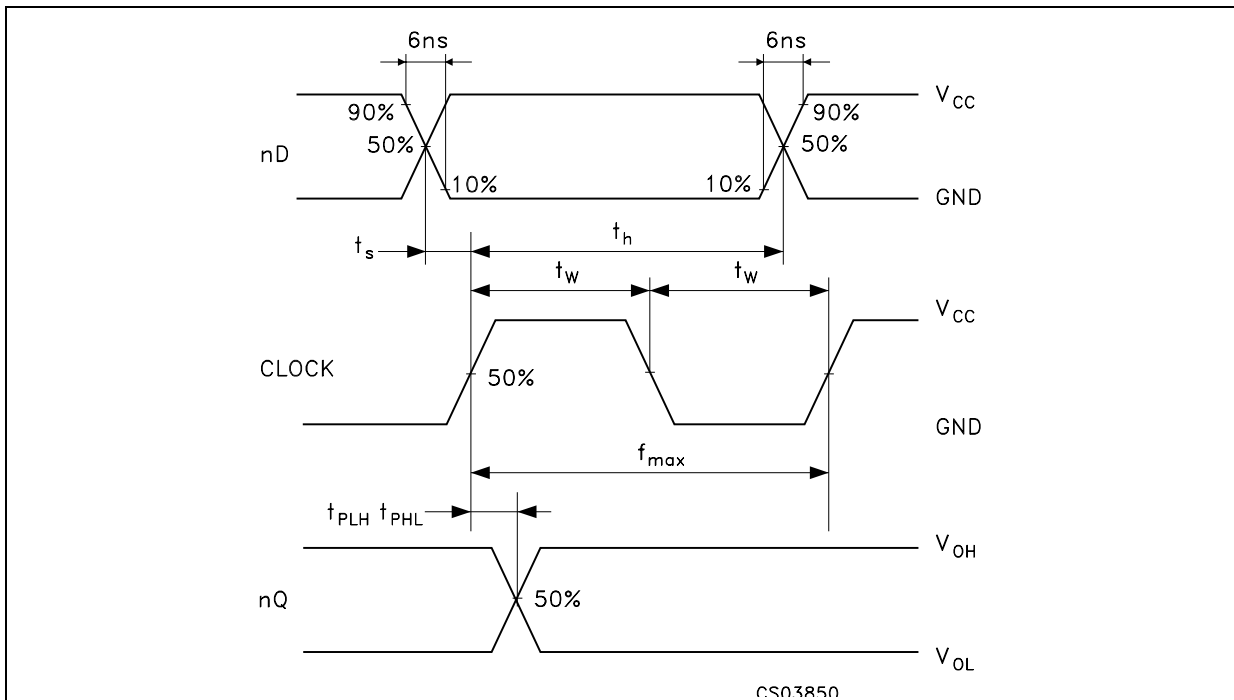
1)  $C_{PD}$  is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/8$  (per FLIP FLOP), and the total CPD when n pcs of FLIP FLOP operate can be gained by the following equations:  $CPD \text{ (total)} = 32 + 11 \times n$

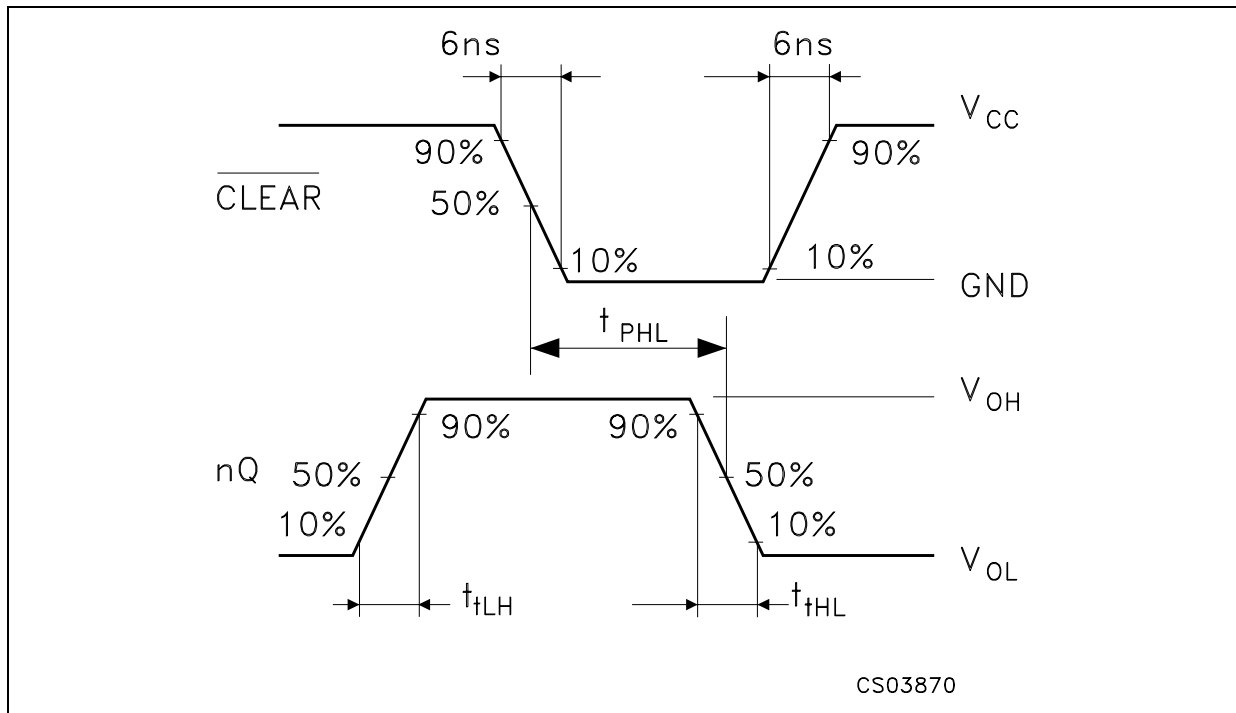
TEST CIRCUIT



$C_L = 50\text{pF}$  or equivalent (includes jig and probe capacitance)  
 $R_T = Z_{OUT}$  of pulse generator (typically  $50\Omega$ )

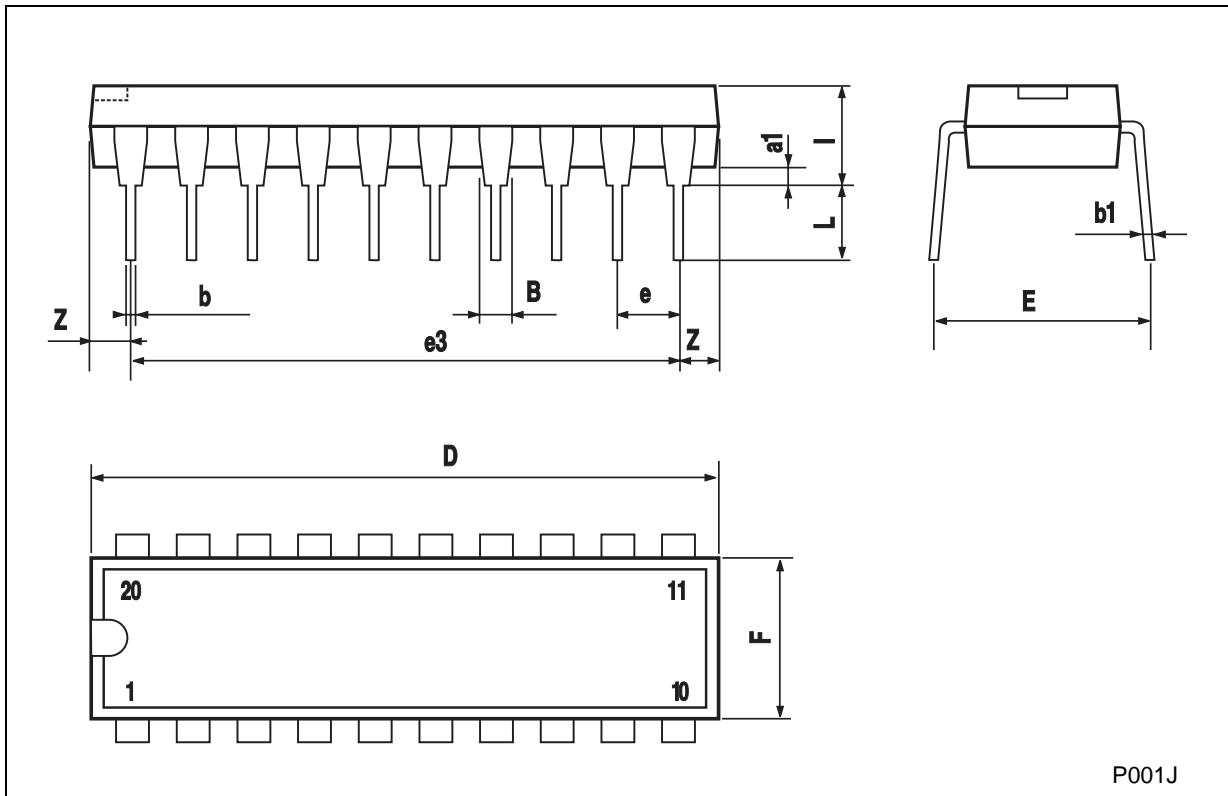
WAVEFORM 1: PROPAGATION DELAYS, SETUP AND HOLD TIMES ( $f=1\text{MHz}$ ; 50% duty cycle)



WAVEFORM 2 :PROPAGATION DELAY TIME( $f=1\text{MHz}$ ; 50% duty cycle)

**Plastic DIP-20 (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 |

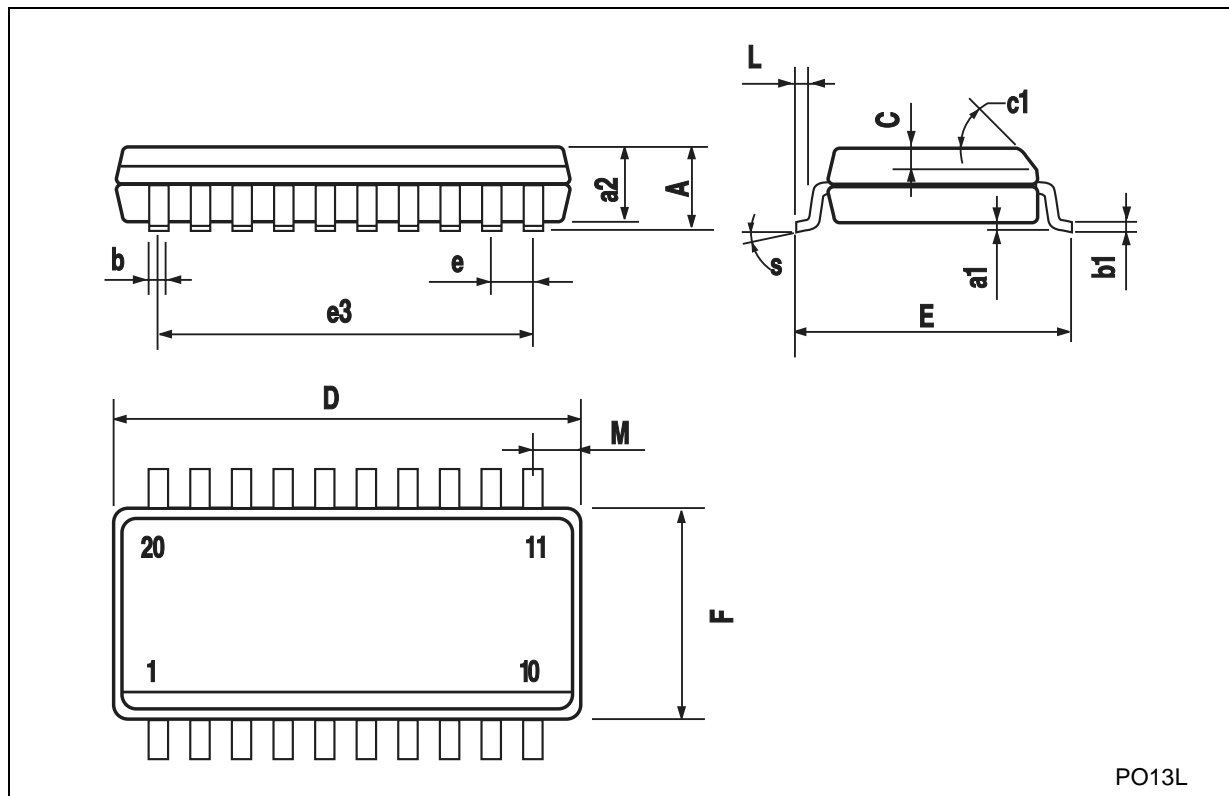


P001J



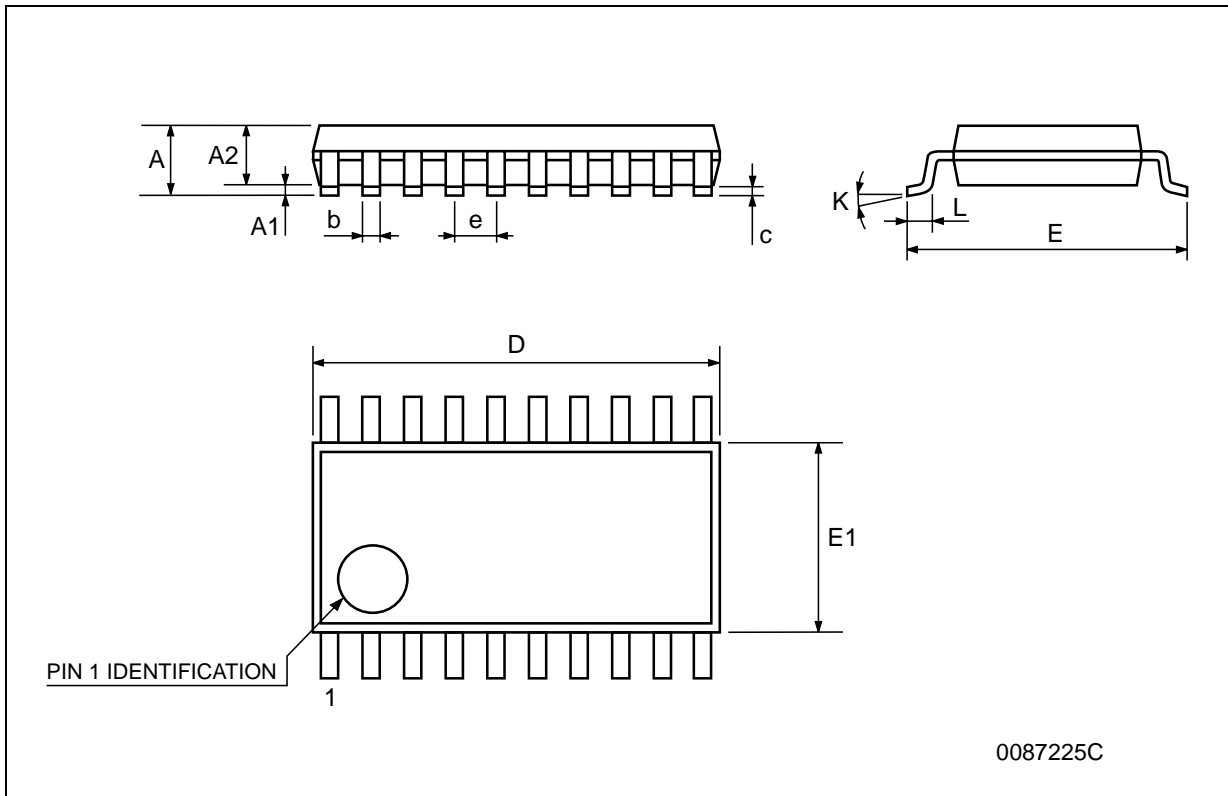
## SO-20 MECHANICAL DATA

| DIM. | mm.        |       |       | inch  |       |       |
|------|------------|-------|-------|-------|-------|-------|
|      | MIN.       | TYP.  | MAX.  | MIN.  | TYP.  | MAX.  |
| A    |            |       | 2.65  |       |       | 0.104 |
| a1   | 0.1        |       | 0.2   | 0.004 |       | 0.008 |
| a2   |            |       | 2.45  |       |       | 0.096 |
| b    | 0.35       |       | 0.49  | 0.014 |       | 0.019 |
| b1   | 0.23       |       | 0.32  | 0.009 |       | 0.012 |
| C    |            | 0.5   |       |       | 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 |       | 0.300 |
| L    | 0.50       |       | 1.27  | 0.020 |       | 0.050 |
| M    |            |       | 0.75  |       |       | 0.029 |
| S    | 8° (max.)  |       |       |       |       |       |



**TSSOP20 MECHANICAL DATA**

| DIM. | mm.  |          |      | inch  |            |        |
|------|------|----------|------|-------|------------|--------|
|      | MIN. | TYP      | MAX. | MIN.  | TYP.       | MAX.   |
| A    |      |          | 1.2  |       |            | 0.047  |
| A1   | 0.05 |          | 0.15 | 0.002 | 0.004      | 0.006  |
| A2   | 0.8  | 1        | 1.05 | 0.031 | 0.039      | 0.041  |
| b    | 0.19 |          | 0.30 | 0.007 |            | 0.012  |
| c    | 0.09 |          | 0.20 | 0.004 |            | 0.0089 |
| D    | 6.4  | 6.5      | 6.6  | 0.252 | 0.256      | 0.260  |
| E    | 6.2  | 6.4      | 6.6  | 0.244 | 0.252      | 0.260  |
| E1   | 4.3  | 4.4      | 4.48 | 0.169 | 0.173      | 0.176  |
| e    |      | 0.65 BSC |      |       | 0.0256 BSC |        |
| K    | 0°   |          | 8°   | 0°    |            | 8°     |
| L    | 0.45 | 0.60     | 0.75 | 0.018 | 0.024      | 0.030  |



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