



**THE DATASHEET OF  
M74HC298B1R**

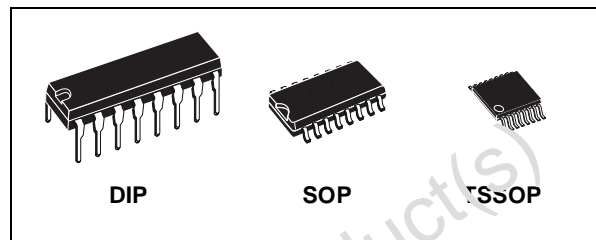




# M74HC298

## QUAD 2 CHANNEL MULTIPLEXER/REGISTER

- HIGH SPEED:  
 $f_{MAX} = 79 \text{ MHz (TYP.) at } V_{CC} = 6\text{V}$
- LOW POWER DISSIPATION:  
 $I_{CC} = 4\mu\text{A (MAX.) at } T_A = 25^\circ\text{C}$
- HIGH NOISE IMMUNITY:  
 $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (MIN.)}$
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 4\text{mA (MIN.)}$
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \approx t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE:  
 $V_{CC} \text{ (OPR)} = 2\text{V to } 6\text{V}$
- PIN AND FUNCTION COMPATIBLE WITH  
 74 SERIES 298



### ORDER CODES

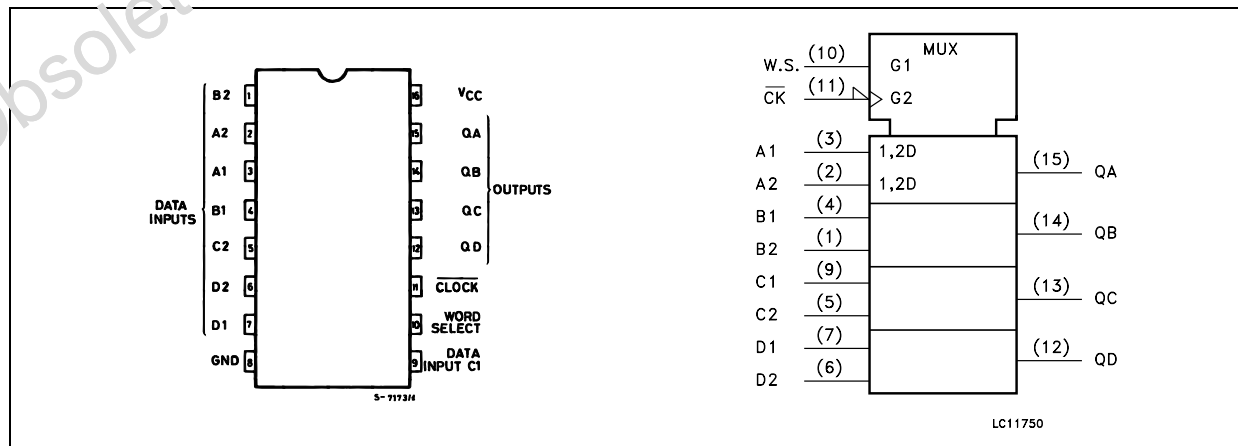
| PACKAGE | TUBE        | T & R          |
|---------|-------------|----------------|
| DIP     | M74HC298B1R |                |
| SOP     | M74HC298M1R | M74HC298RM13TR |
| TSOP    |             | M74HC298TTR    |

### DESCRIPTION

The M74HC298 is an high speed CMOS QUAD 2 CHANNEL MULTIPLEXER/REGISTER fabricated with silicon gate C<sup>2</sup>MOS technology. These circuits are controlled by the signals WORD SELECT and CLOCK. When the WORD SELECT input is taken low Word 1 (A1, B1, C1 and D1) is presented to the input of the flip-flops, and when

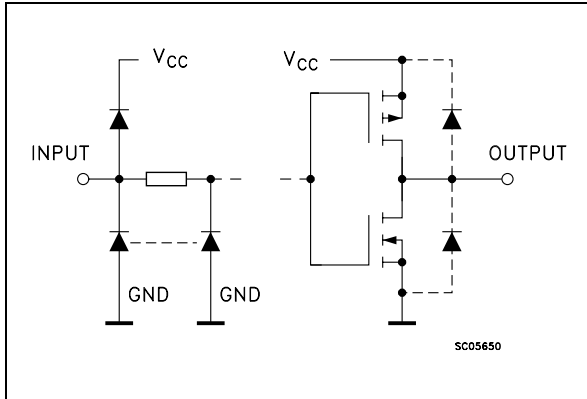
WORD SELECT is high Word 2 (A2, B2, C2 and D2) is presented to the inputs of the flip-flops. The select word is clocked to the output terminals on the negative edge of the clock pulse. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

### PIN CONNECTION AND IEC LOGIC SYMBOLS



# M74HC298

## INPUT AND OUTPUT EQUIVALENT CIRCUIT



## PIN DESCRIPTION

| PIN No     | SYMBOL          | NAME AND FUNCTION                         |
|------------|-----------------|---|
| 1, 2, 5, 6 | A2, B2, C2, D2  | Word 2 Data Inputs                        |
| 3, 4, 7, 9 | A1, B1, C1, D1  | Word 1 Data Inputs                        |
| 12 to 15   | QA to QD        | Outputs                                   |
| 10         | WORD SELECT     | Word Select Input                         |
| 11         | CLOCK           | Clock Input (LOW to HIGH, Edge-triggered) |
| 8          | GND             | Ground (0V)                               |
| 16         | V <sub>CC</sub> | Positive Supply Voltage                   |

## TRUTH TABLE

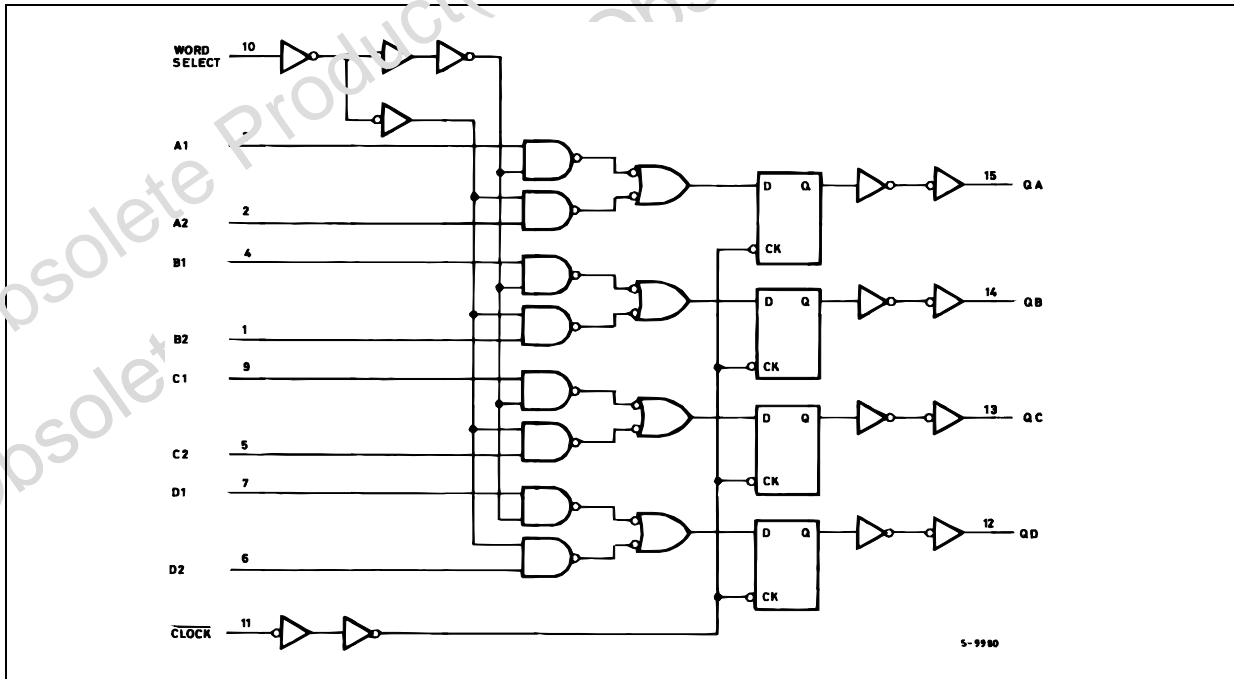
| INPUTS      |       | OUTPUTS |     |     |     |
|-------------|-------|---------|-----|-----|-----|
| WORD SELECT | CLOCK | QA      | QB  | QC  | QD  |
| L           |       | a1      | b1  | c1  | d1  |
| H           |       | a2      | b2  | c2  | d2  |
| X           |       | QA0     | QB0 | QC0 | QD0 |

X : Don't Care

a1, a2, ETC. : The level of steady state input at a1, a2, etc.

QA0, QB0, ETC. : The level of QA, QB, ETC entered on the most recent negative transition of the clock input.

## 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 Condition         |   | 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  $t_r = t_f = 6 \text{ ns}$ )

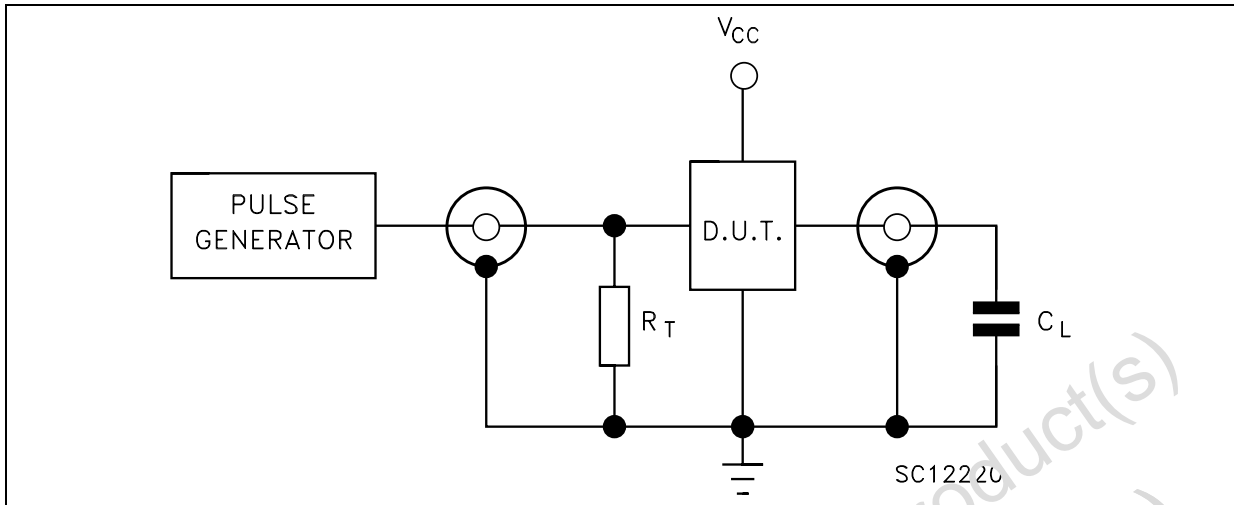
| Symbol                   | Parameter                                 | Test Condition  |  | Value                    |      |      |                                    |      |                                     | Unit |      |
|--------------------------|---|-----------------|--|--------------------------|------|------|------------------------------------|------|-------------------------------------|------|------|
|                          |   | $V_{CC}$<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. |
| $t_{TLH}$ $t_{THL}$      | 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 (CLOCK - Q)        | 2.0             |  |                          | 45   | 125  |                                    | 155  |                                     | 190  | ns   |
|                          |   | 4.5             |  |                          | 15   | 25   |                                    | 31   |                                     | 38   |      |
|                          |   | 6.0             |  |                          | 13   | 21   |                                    | 26   |                                     | 32   |      |
| $f_{MAX}$                | Maximum Clock Frequency                   | 2.0             |  | 7                        | 22   |      | 5.6                                |      | 4.6                                 | MHz  |      |
|                          |   | 4.5             |  | 35                       | 67   |      | 28                                 |      | 23                                  |      |      |
|                          |   | 6.0             |  | 41                       | 79   |      | 33                                 |      | 25                                  |      |      |
| $t_{W(H)}$<br>$t_{W(L)}$ | Minimum Pulse Width (CLOCK)               | 2.0             |  |                          | 18   | 75   |                                    | 95   |                                     | 110  | ns   |
|                          |   | 4.5             |  |                          | 6    | 15   |                                    | 19   |                                     | 22   |      |
|                          |   | 6.0             |  |                          | 6    | 13   |                                    | 16   |                                     | 19   |      |
| $t_S$                    | Minimum Set-up Time (A, B, C, D to CLOCK) | 2.0             |  |                          | 12   | 50   |                                    | 65   |                                     | 75   | ns   |
|                          |   | 4.5             |  |                          | 3    | 11   |                                    | 13   |                                     | 15   |      |
|                          |   | 6.0             |  |                          | 2    | 9    |                                    | 11   |                                     | 13   |      |
| $t_S$                    | Minimum Set-up Time (W. S. to CLOCK)      | 2.0             |  |                          | 30   | 75   |                                    | 95   |                                     | 110  | ns   |
|                          |   | 4.5             |  |                          | 8    | 15   |                                    | 19   |                                     | 22   |      |
|                          |   | 6.0             |  |                          | 6    | 13   |                                    | 16   |                                     | 19   |      |
| $t_H$                    | Minimum Hold Time (A, B, C, D to CLOCK)   | 2.0             |  |                          |      | 25   |                                    | 30   |                                     | 40   | ns   |
|                          |   | 4.5             |  |                          |      | 5    |                                    | 6    |                                     | 8    |      |
|                          |   | 6.0             |  |                          |      | 4    |                                    | 5    |                                     | 7    |      |
| $t_H$                    | Minimum Hold Time (W. S. to CLOCK)        | 2.0             |  |                          |      | 0    |                                    | 0    |                                     | 0    | ns   |
|                          |   | 4.5             |  |                          |      | 0    |                                    | 0    |                                     | 0    |      |
|                          |   | 6.0             |  |                          |      | 0    |                                    | 0    |                                     | 0    |      |

## 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             |  |                          | 39   |      |                                    |      |                                     |      | 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.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/4$  (per BIT), and the CPD for operating current can be obtained by the following equation :  $CPD = 27 + 12 \times n$

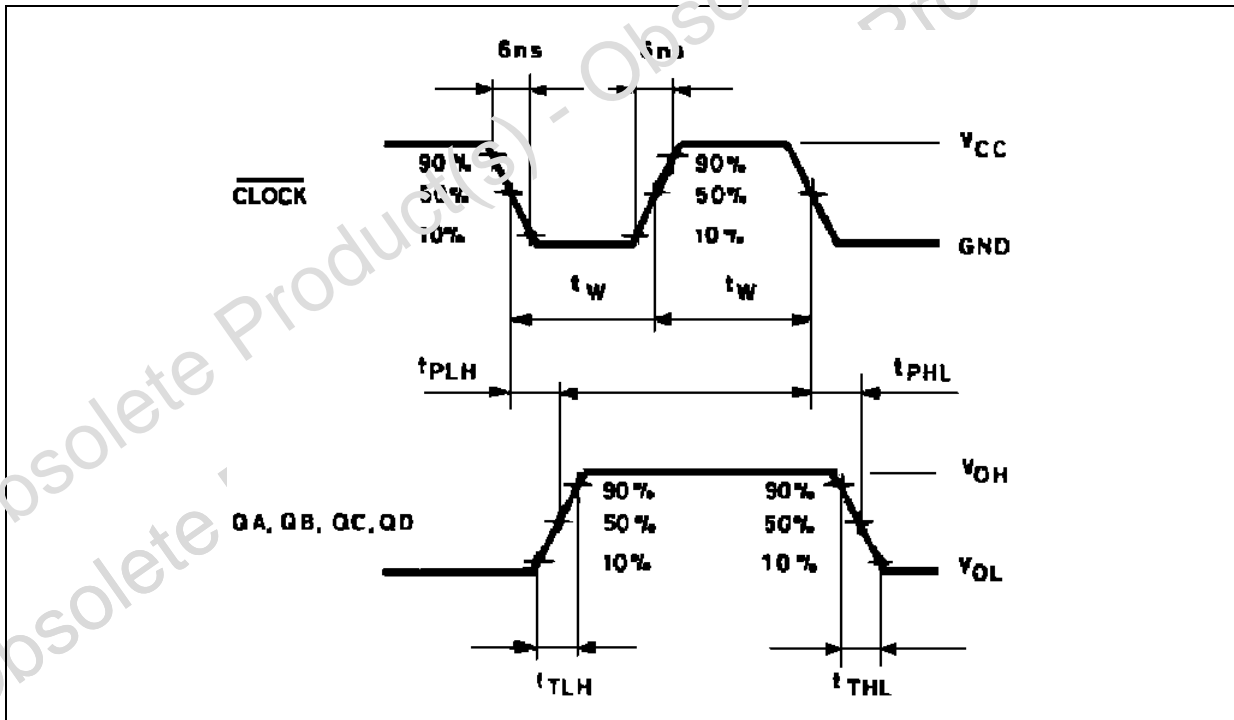
TEST CIRCUIT

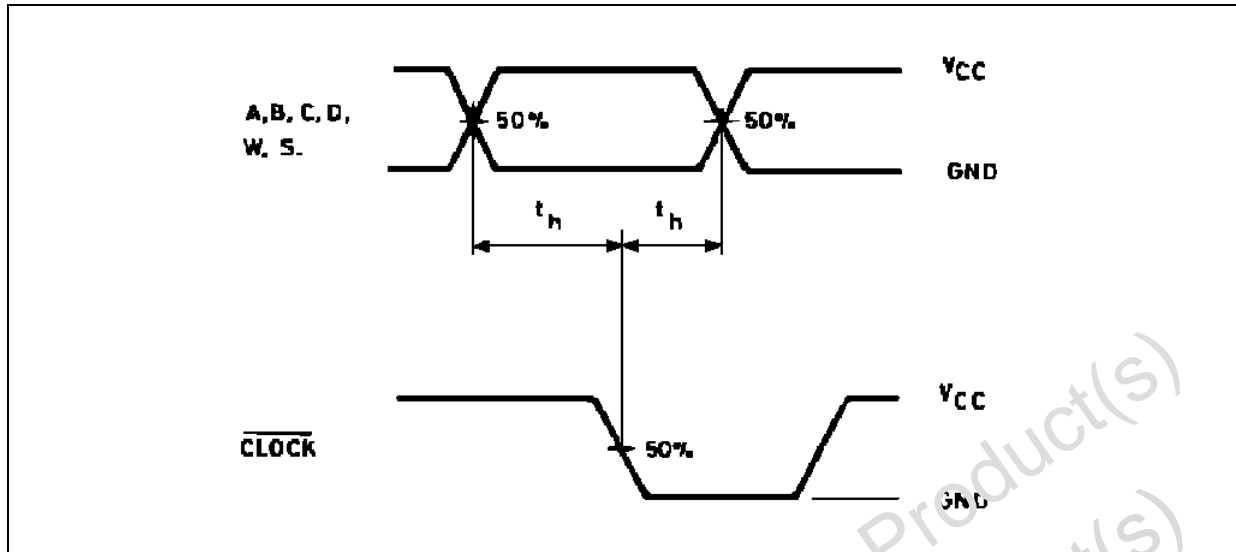


$C_L = 50\text{pF}$  or equivalent (includes jig and probe capacitance)  
 $R_T = Z_{OUT}$  of pulse generator (typically  $50\Omega$ )

WAVEFORM 1 : PROPAGATION DELAY TIME, MINIMUM PULSE WIDTH (CLOCK)

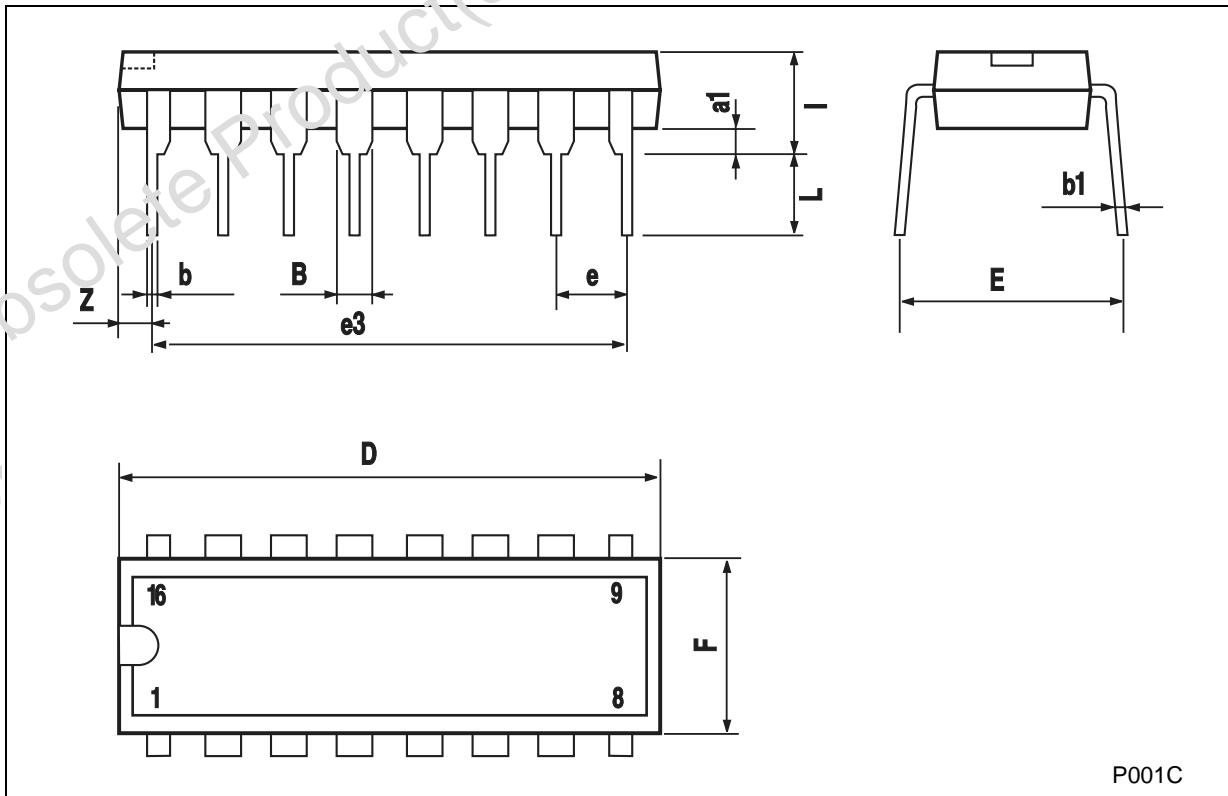
$f=1\text{MHz}$ ; 50% duty cycle)



WAVEFORM 2 : MINIMUM SETUP AND HOLD TIME ( $f=1\text{MHz}$ ; 50% duty cycle)

**Plastic DIP-16 (0.25) MECHANICAL DATA**

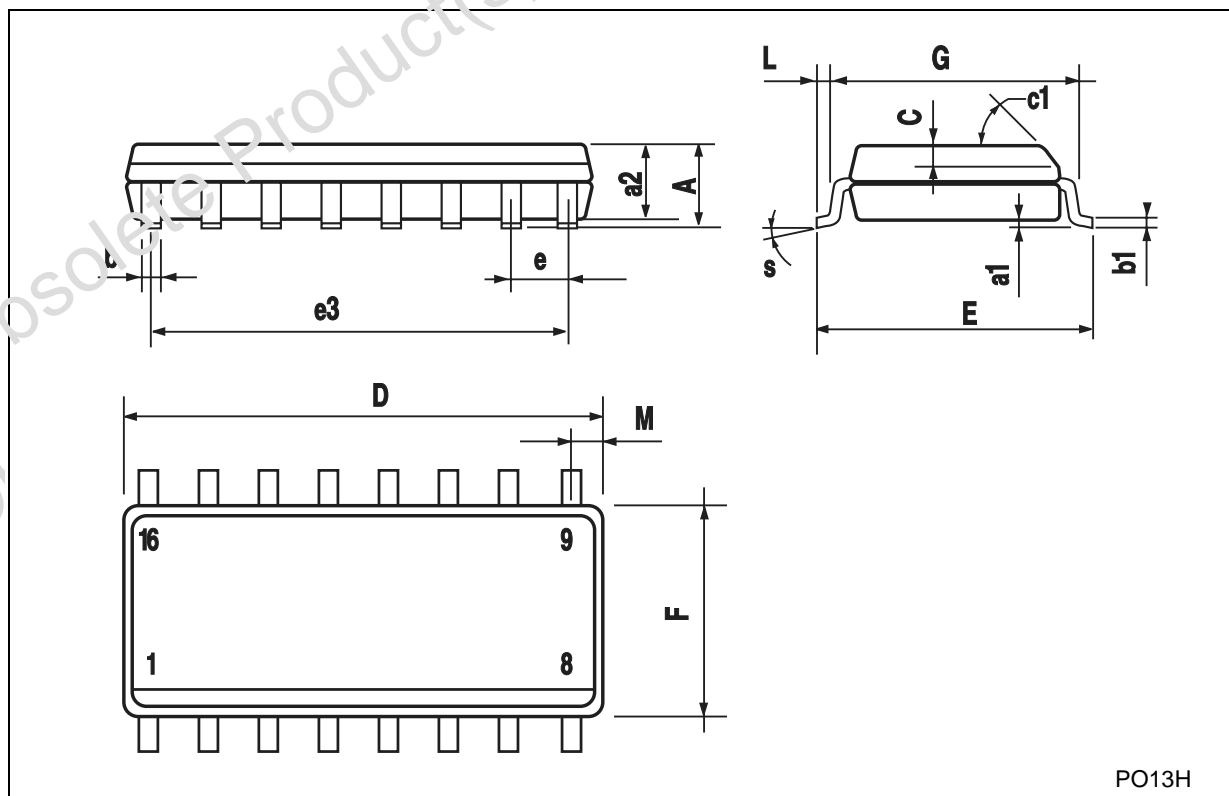
| DIM. | mm.  |       |      | inch  |       |       |
|------|------|-------|------|-------|-------|-------|
|      | MIN. | TYP   | MAX. | MIN.  | TYP.  | MAX.  |
| a1   | 0.51 |       |      | 0.020 |       |       |
| B    | 0.77 |       | 1.65 | 0.030 |       | 0.065 |
| b    |      | 0.5   |      |       | 0.020 |       |
| b1   |      | 0.25  |      |       | 0.010 |       |
| D    |      |       | 20   |       |       | 0.787 |
| E    |      | 8.5   |      |       | 0.333 |       |
| 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

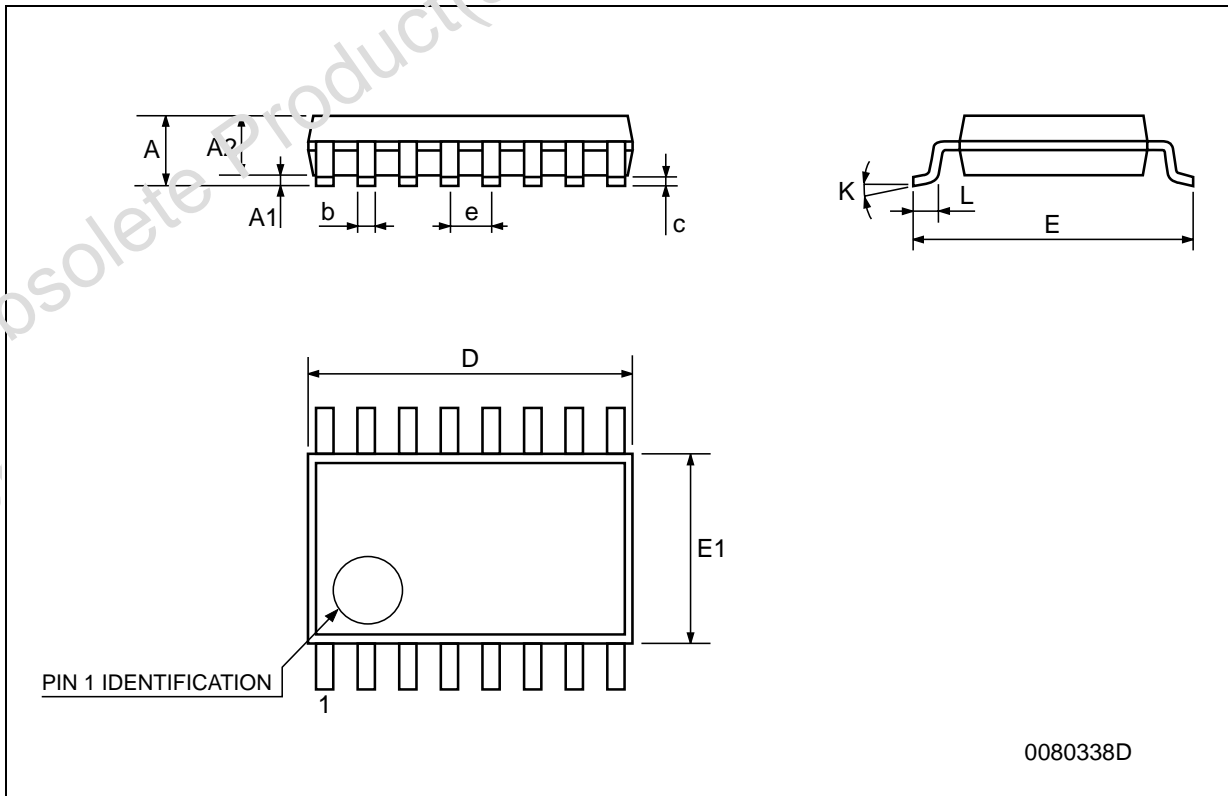
## SO-16 MECHANICAL DATA

| DIM. | mm.        |      |      | inch  |       |       |
|------|------------|------|------|-------|-------|-------|
|      | MIN.       | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    |            |      | 1.75 |       |       | 0.068 |
| a1   | 0.1        |      | 0.2  | 0.003 |       | 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.)  |      |      |       |       |       |



**TSSOP16 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    | 4.9  | 5        | 5.1  | 0.193 | 0.197      | 0.201  |
| 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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