



# M74HC139

## DUAL 2 TO 4 DECODER/DEMULTIPLEXER

- HIGH SPEED:  
 $t_{PD} = 13\text{ns}$  (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:  
 $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (MIN.)
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 4\text{mA}$  (MIN)
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \approx t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE:  
 $V_{CC}$  (OPR) = 2V to 6V
- PIN AND FUNCTION COMPATIBLE WITH  
 74 SERIES 139



### ORDER CODES

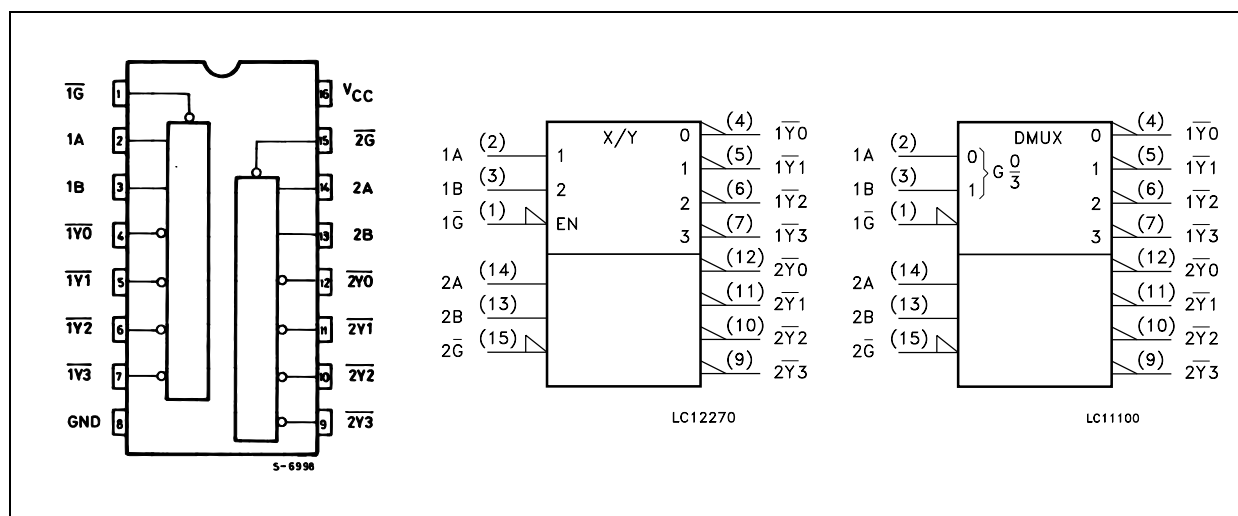
| PACKAGE | TUBE        | T & R          |
|---------|-------------|----------------|
| DIP     | M74HC139B1R |                |
| SOP     | M74HC139M1R | M74HC139RM13TR |
| TSSOP   |             | M74HC139TTR    |

### DESCRIPTION

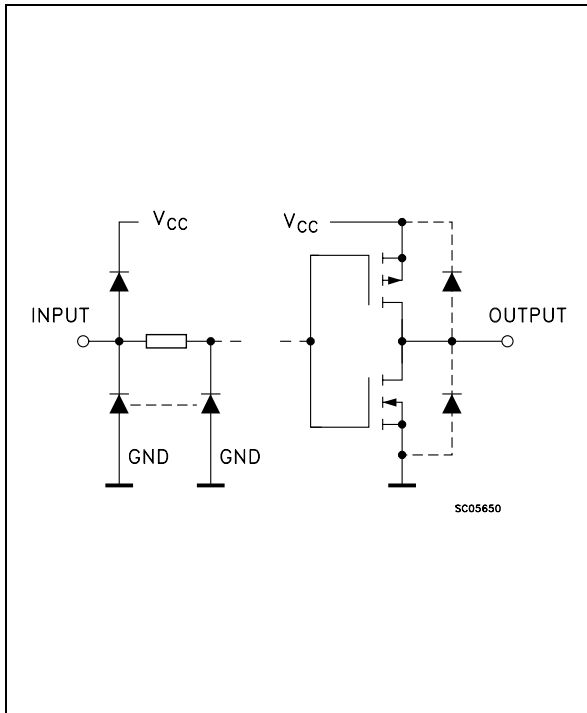
The M74HC139 is an high speed CMOS QUAD 2-INPUT NAND GATE fabricated with silicon gate C<sup>2</sup>MOS technology.  
 The active low enable input can be used for gating or as a data input for demultiplexing applications.

While the enable input is held high, all four outputs are high independently of the other inputs.  
 All inputs are equipped with protection circuits against static discharge and transient excess voltage.

### PIN CONNECTION AND IEC LOGIC SYMBOLS



INPUT AND OUTPUT EQUIVALENT CIRCUIT



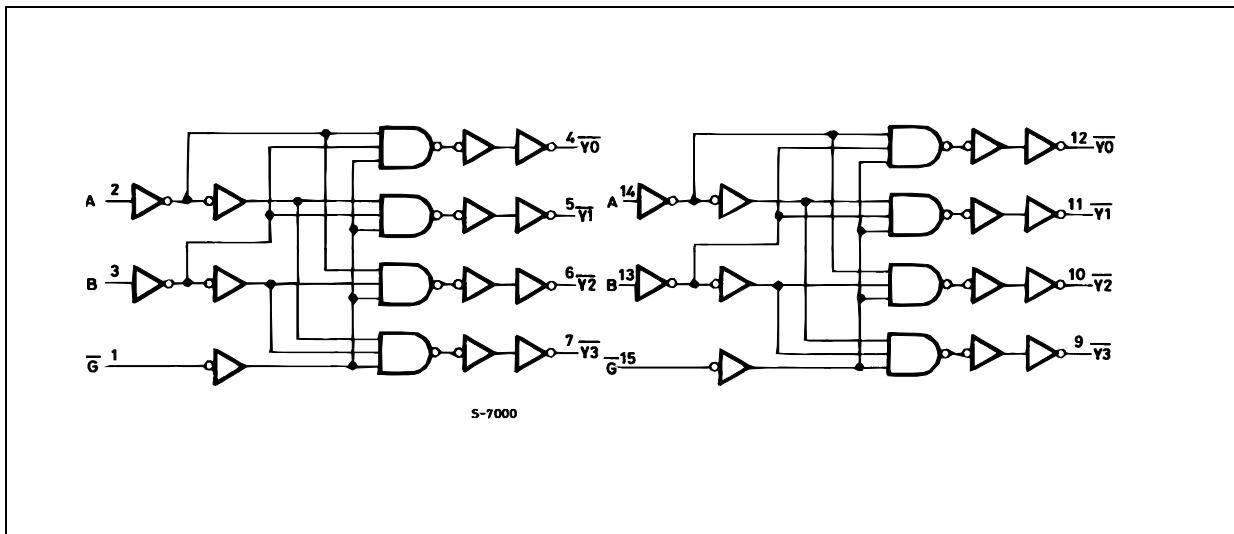
PIN DESCRIPTION

| PIN No        | SYMBOL                             | NAME AND FUNCTION       |
|---------------|------------------------------------|-------------------------|
| 1, 15         | 1G, 2G                             | Enable Inputs           |
| 2, 3          | 1A, 1B                             | Address Inputs          |
| 4, 5, 6, 7    | 1Y <sub>0</sub> TO 1Y <sub>3</sub> | Outputs                 |
| 12, 11, 10, 9 | 2Y <sub>0</sub> TO 2Y <sub>3</sub> | Outputs                 |
| 14, 13        | 2A, 2B                             | Address Inputs          |
| 8             | GND                                | Ground (0V)             |
| 16            | V <sub>CC</sub>                    | Positive Supply Voltage |

TRUTH TABLE

| INPUTS    |        |   | OUTPUTS     |             |             |             | SELECTED OUTPUT |
|-----------|--------|---|-------------|-------------|-------------|-------------|-----------------|
| ENABLE    | SELECT |   | $\bar{Y}_0$ | $\bar{Y}_1$ | $\bar{Y}_2$ | $\bar{Y}_3$ |                 |
| $\bar{G}$ | B      | A |             |             |             |             |                 |
| H         | X      | X | H           | H           | H           | H           | NONE            |
| L         | L      | L | L           | H           | H           | H           | Y <sub>0</sub>  |
| L         | L      | H | H           | L           | H           | H           | Y <sub>1</sub>  |
| L         | H      | L | H           | H           | L           | H           | Y <sub>2</sub>  |
| L         | H      | H | H           | H           | H           | L           | Y <sub>3</sub>  |

LOGIC DIAGRAM



This logic diagram has not be 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> (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<sub>L</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 6ns)

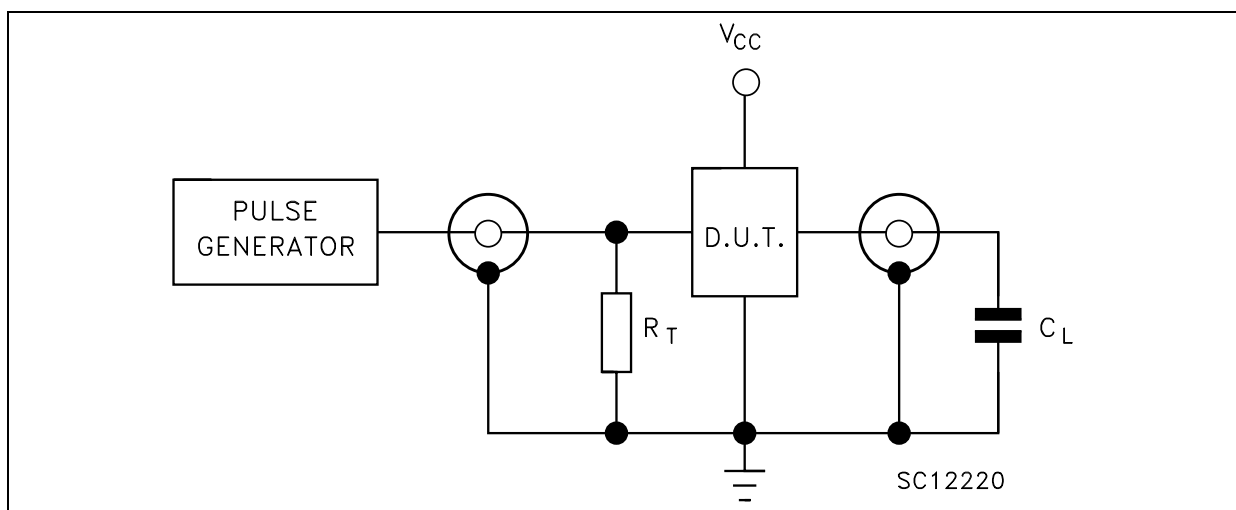
| Symbol                            | Parameter                        | Test Condition      |  | Value                 |      |      |             |      |              | Unit |      |
|-----------------------------------|----------------------------------|---------------------|--|-----------------------|------|------|-------------|------|--------------|------|------|
|                                   |                                  | V <sub>CC</sub> (V) |  | T <sub>A</sub> = 25°C |      |      | -40 to 85°C |      | -55 to 125°C |      |      |
|                                   |                                  |                     |  | Min.                  | Typ. | Max. | Min.        | Max. | Min.         |      | Max. |
| t <sub>TLH</sub> 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> t <sub>PHL</sub> | Propagation Delay Time (A, B -Y) | 2.0                 |  |                       | 45   | 130  |             | 165  |              | 195  | ns   |
|                                   |                                  | 4.5                 |  |                       | 15   | 26   |             | 33   |              | 39   |      |
|                                   |                                  | 6.0                 |  |                       | 13   | 22   |             | 28   |              | 33   |      |
| t <sub>PLH</sub> t <sub>PHL</sub> | Propagation Delay Time (G -Y)    | 2.0                 |  |                       | 39   | 110  |             | 140  |              | 165  | ns   |
|                                   |                                  | 4.5                 |  |                       | 13   | 22   |             | 28   |              | 33   |      |
|                                   |                                  | 6.0                 |  |                       | 11   | 19   |             | 24   |              | 28   |      |

**CAPACITIVE CHARACTERISTICS**

| Symbol          | Parameter                              | Test Condition      |  | Value                 |      |      |             |      |              | Unit |      |
|-----------------|--|---------------------|--|-----------------------|------|------|-------------|------|--------------|------|------|
|                 |  | V <sub>CC</sub> (V) |  | T <sub>A</sub> = 25°C |      |      | -40 to 85°C |      | -55 to 125°C |      |      |
|                 |  |                     |  | Min.                  | Typ. | Max. | Min.        | Max. | Min.         |      | Max. |
| C <sub>IN</sub> | Input Capacitance                      | 5.0                 |  |                       | 5    | 10   |             | 10   |              | 10   | pF   |
| C <sub>PD</sub> | Power Dissipation Capacitance (note 1) | 5.0                 |  |                       | 46   |      |             |      |              |      | pF   |

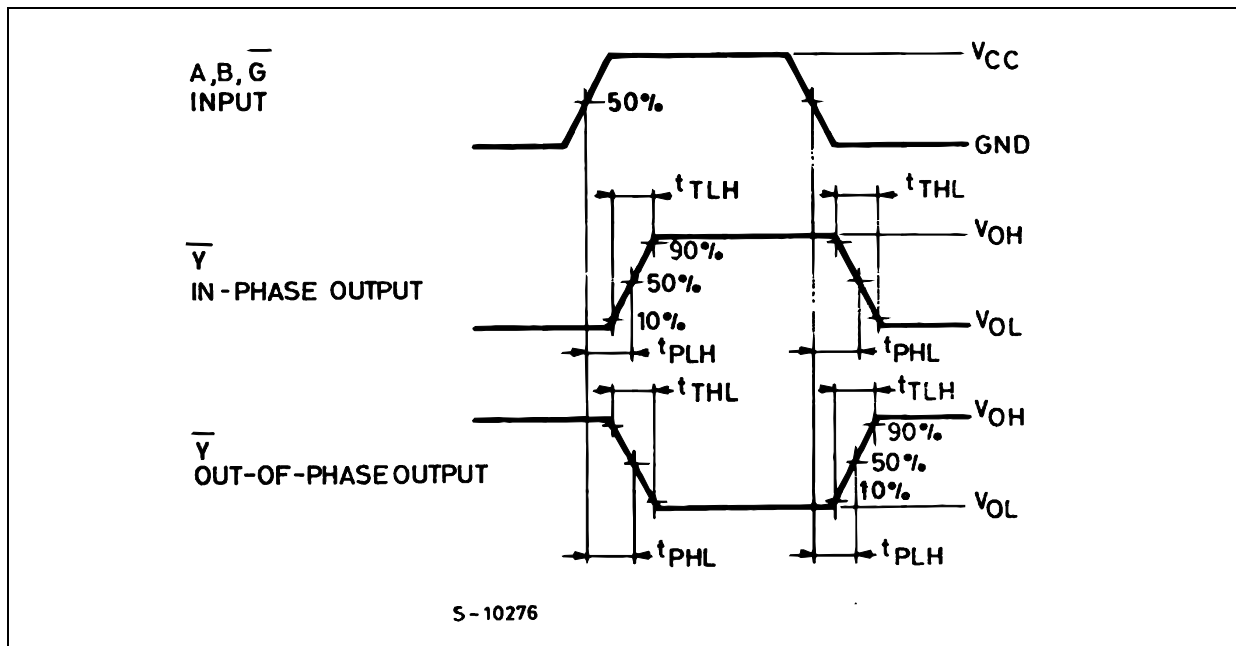
1) C<sub>PD</sub> is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. I<sub>CC(opr)</sub> = C<sub>PD</sub> × V<sub>CC</sub> × f<sub>IN</sub> + I<sub>CC</sub>/2 (per circuit)

**TEST CIRCUIT**



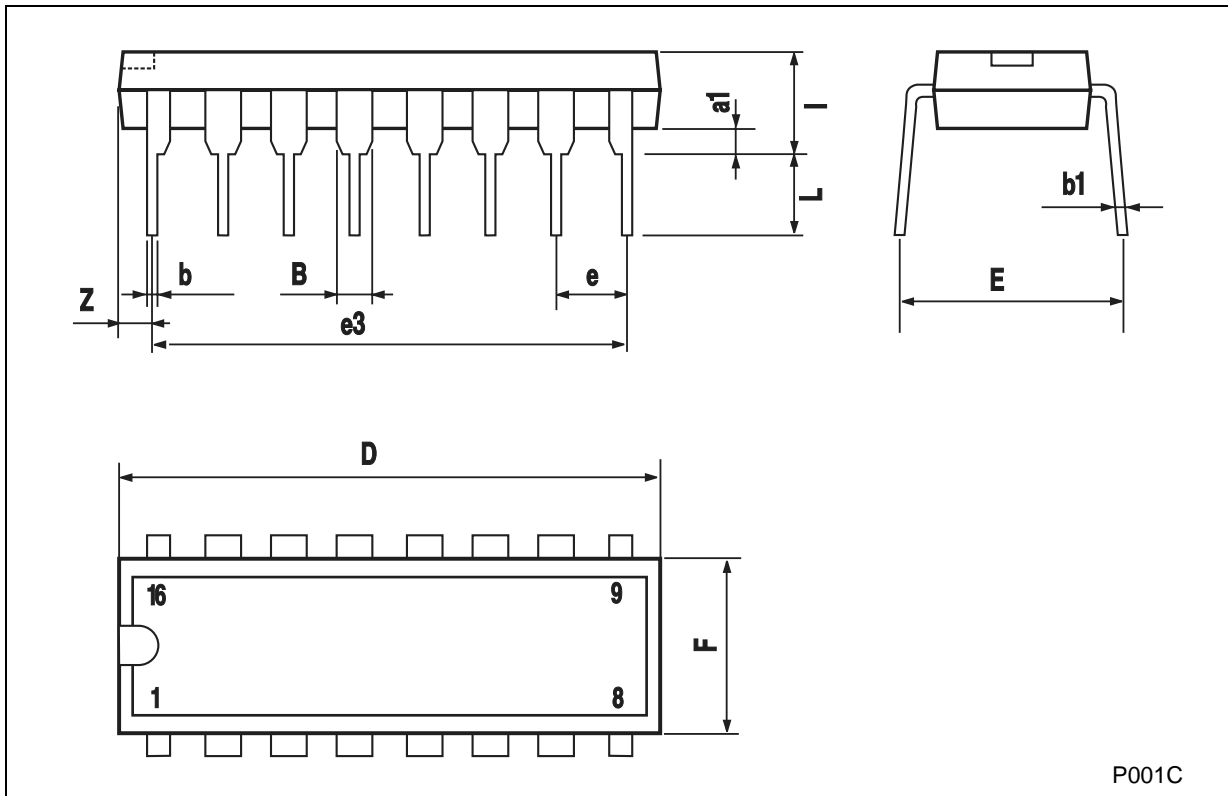
C<sub>L</sub> = 50pF or equivalent (includes jig and probe capacitance)  
 R<sub>T</sub> = Z<sub>OUT</sub> of pulse generator (typically 50Ω)

**WAVEFORM : PROPAGATION DELAY TIMES (f=1MHz; 50% duty cycle)**



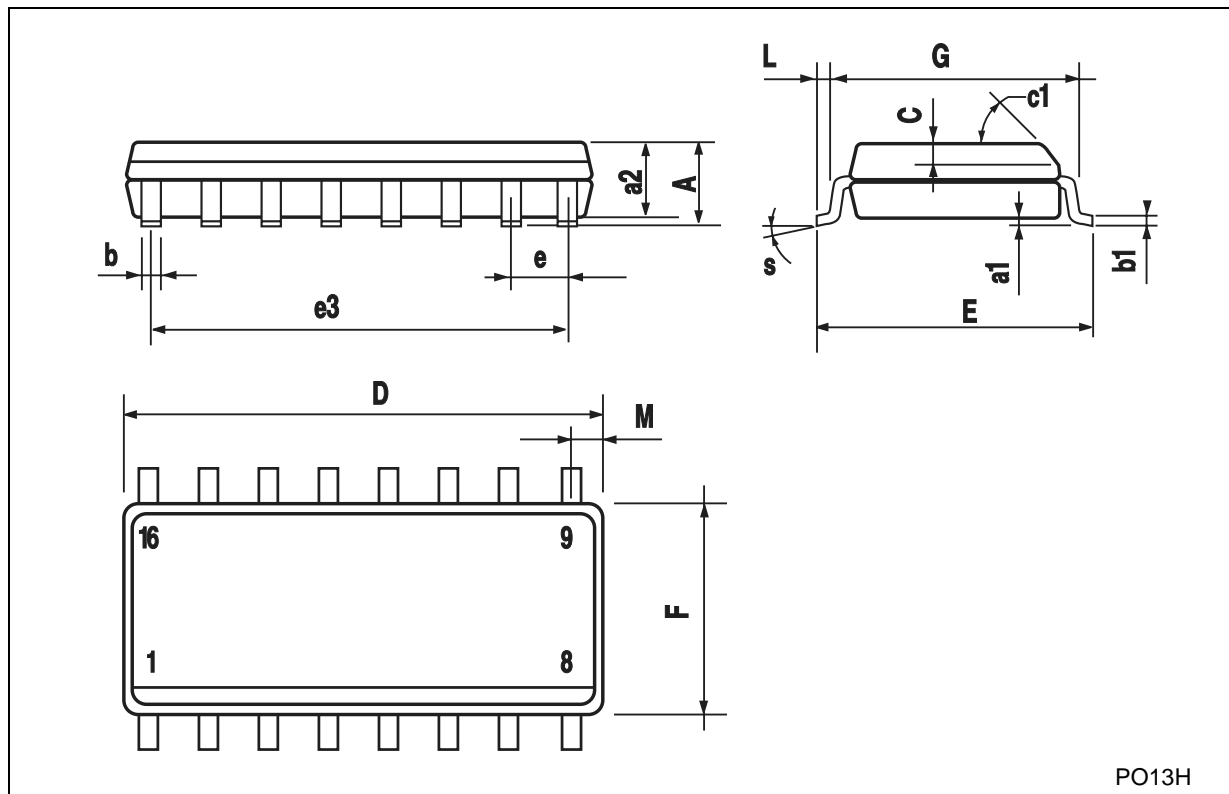
**Plastic DIP-16 (0.25) MECHANICAL DATA**

| 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   |      |       | 0.335 |       |
| 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 |



## 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.)  |      |      |       |       |       |



PO13H

**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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