



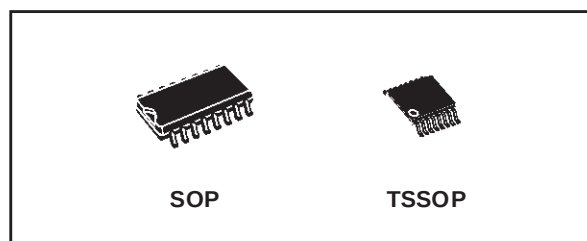
## 74LCX139

### LOW VOLTAGE CMOS DUAL 2 TO 4 DECODER/DEMULTIPLEXER

- 5V TOLERANT INPUTS
- HIGH SPEED :  
 $t_{PD} = 6.2\text{ns}$  (MAX.) at  $V_{CC} = 3\text{V}$
- POWER DOWN PROTECTION ON INPUTS AND OUTPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 24\text{mA}$  (MIN) at  $V_{CC} = 3\text{V}$
- PCI BUS LEVELS GUARANTEED AT 24 mA
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \approx t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC}(\text{OPR}) = 2.0\text{V}$  to  $3.6\text{V}$  (1.5V Data Retention)
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 139
- LATCH-UP PERFORMANCE EXCEEDS 500mA (JESD 17)
- ESD PERFORMANCE:  
HBM > 2000V (MIL STD 883 method 3015);  
MM > 200V

#### DESCRIPTION

The 74LCX139 is a low voltage CMOS DUAL 2 TO 4 LINE DECODER/DEMULTIPLEXER fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology. It is ideal for low power and high speed 3.3V applications; it can be interfaced to 5V signal environment for inputs.



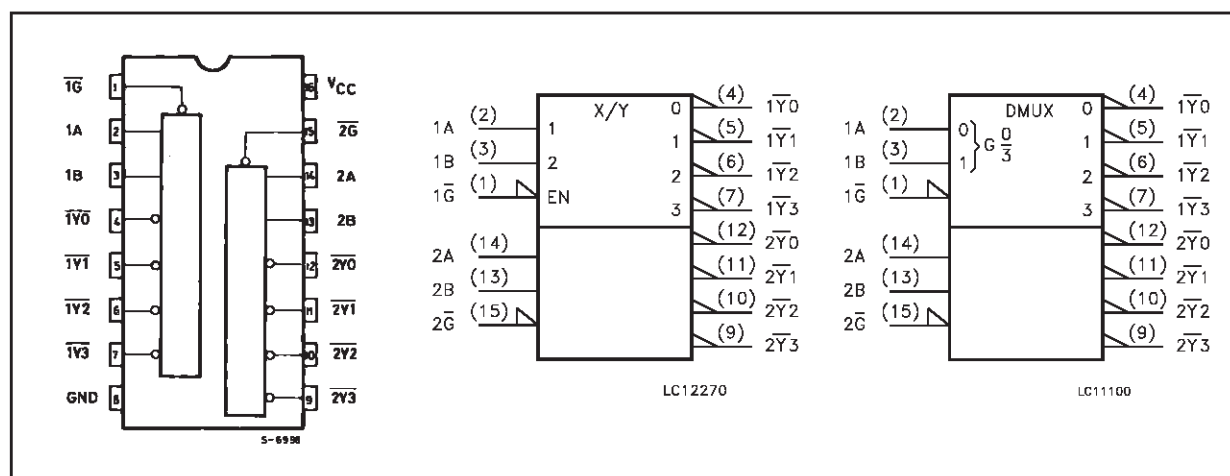
#### ORDER CODES

| PACKAGE | TUBE      | T & R       |
|---------|-----------|-------------|
| SOP     | 74LCX139M | 74LCX139MTR |
| TSSOP   |           | 74LCX139TTR |

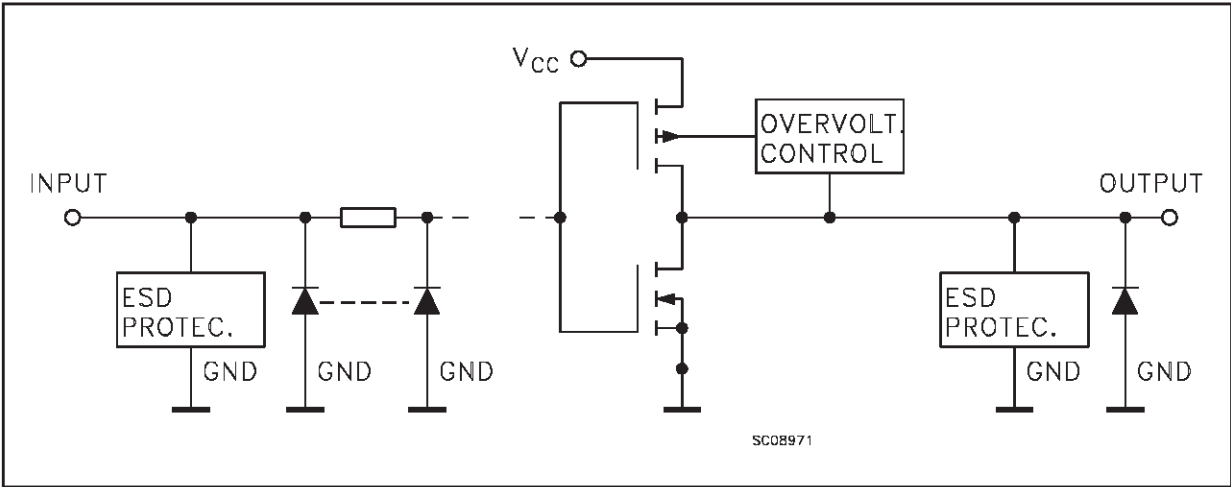
The active low enable input can be used for gating or as a data input for demultiplexing applications. While the enable input is held high, all four outputs are high independently of the other inputs. It has same speed performance at 3.3V than 5V AC/ACT family, combined with a lower power consumption.

All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

#### PIN CONNECTION AND IEC LOGIC SYMBOLS



INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

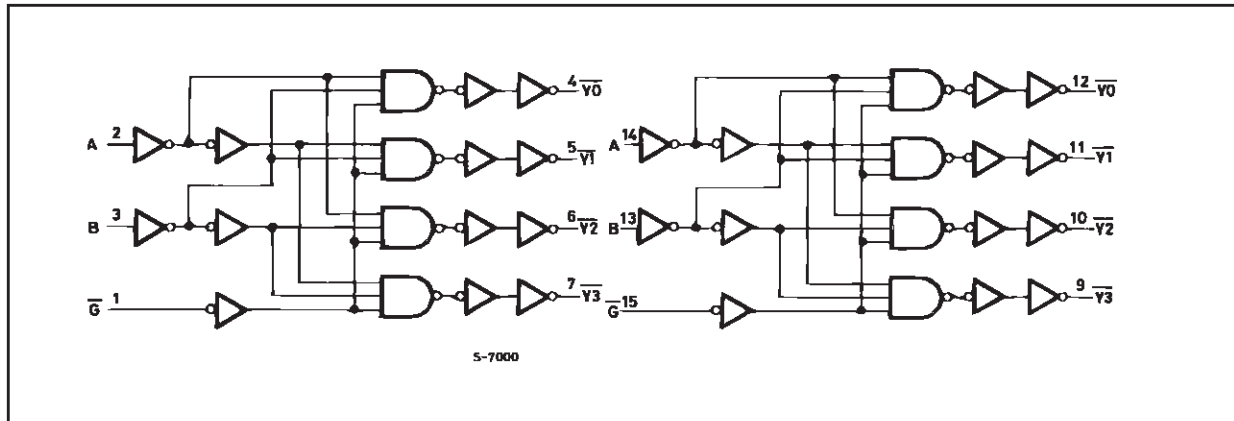
| PIN No        | SYMBOL                            | NAME AND FUNCTION       |
|---------------|-----------------------------------|-------------------------|
| 1, 15         | $\overline{1G}$ , $\overline{2G}$ | Enable Inputs           |
| 2, 3          | 1A, 1B                            | Address Inputs          |
| 4, 5, 6, 7    | 1Y0 to 1Y3                        | Outputs                 |
| 12, 11, 10, 9 | 2Y0 to 2Y3                        | Outputs                 |
| 14, 13        | 2A, 2B                            | Address Inputs          |
| 8             | GND                               | Ground (0V)             |
| 16            | V <sub>CC</sub>                   | Positive Supply Voltage |

TRUTH TABLE

| INPUTS         |        |   | OUTPUTS         |                 |                 |                 |
|----------------|--------|---|-----------------|-----------------|-----------------|-----------------|
| ENABLE         | SELECT |   |                 |                 |                 |                 |
| $\overline{G}$ | B      | A | $\overline{Y0}$ | $\overline{Y1}$ | $\overline{Y2}$ | $\overline{Y3}$ |
| H              | X      | X | H               | H               | H               | H               |
| L              | L      | L | L               | H               | H               | H               |
| L              | L      | H | H               | L               | H               | H               |
| L              | H      | L | H               | H               | L               | H               |
| L              | H      | H | H               | H               | H               | L               |

X : Don't Care

## 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 +7.0           | V    |
| $V_I$     | DC Input Voltage                               | -0.5 to +7.0           | V    |
| $V_O$     | DC Output Voltage ( $V_{CC} = 0V$ )            | -0.5 to +7.0           | V    |
| $V_O$     | DC Output Voltage (High or Low State) (note 1) | -0.5 to $V_{CC} + 0.5$ | V    |
| $I_{IK}$  | DC Input Diode Current                         | - 50                   | mA   |
| $I_{OK}$  | DC Output Diode Current (note 2)               | - 50                   | mA   |
| $I_O$     | DC Output Current                              | $\pm 50$               | mA   |
| $I_{CC}$  | DC Supply Current per Supply Pin               | $\pm 100$              | mA   |
| $I_{GND}$ | DC Ground Current per Supply Pin               | $\pm 100$              | mA   |
| $T_{stg}$ | 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

1)  $I_O$  absolute maximum rating must be observed

2)  $V_O < GND$

## RECOMMENDED OPERATING CONDITIONS

| Symbol           | Parameter                                                     | Value         | Unit |
|------------------|---------------------------------------------------------------|---------------|------|
| $V_{CC}$         | Supply Voltage (note 1)                                       | 2.0 to 3.6    | V    |
| $V_I$            | Input Voltage                                                 | 0 to 5.5      | V    |
| $V_O$            | Output Voltage ( $V_{CC} = 0V$ )                              | 0 to 5.5      | V    |
| $V_O$            | Output Voltage (High or Low State)                            | 0 to $V_{CC}$ | V    |
| $I_{OH}, I_{OL}$ | High or Low Level Output Current ( $V_{CC} = 3.0$ to $3.6V$ ) | $\pm 24$      | mA   |
| $I_{OH}, I_{OL}$ | High or Low Level Output Current ( $V_{CC} = 2.7V$ )          | $\pm 12$      | mA   |
| $T_{op}$         | Operating Temperature                                         | -55 to 125    | °C   |
| $dt/dv$          | Input Rise and Fall Time (note 2)                             | 0 to 10       | ns/V |

1) Truth Table guaranteed: 1.5V to 3.6V

2)  $V_{IN}$  from 0.8V to 2V at  $V_{CC} = 3.0V$

## DC SPECIFICATIONS

| Symbol           | Parameter                       | Test Condition         |                                                | Value                |      |                      |      | Unit |
|------------------|---------------------------------|------------------------|------------------------------------------------|----------------------|------|----------------------|------|------|
|                  |                                 | V <sub>CC</sub><br>(V) |                                                | -40 to 85 °C         |      | -55 to 125 °C        |      |      |
|                  |                                 |                        |                                                | Min.                 | Max. | Min.                 | Max. |      |
| V <sub>IH</sub>  | High Level Input Voltage        | 2.7 to 3.6             |                                                | 2.0                  |      | 2.0                  |      | V    |
| V <sub>IL</sub>  | Low Level Input Voltage         |                        |                                                |                      | 0.8  |                      | 0.8  | V    |
| V <sub>OH</sub>  | High Level Output Voltage       | 2.7 to 3.6             | I <sub>O</sub> =-100 μA                        | V <sub>CC</sub> -0.2 |      | V <sub>CC</sub> -0.2 |      | V    |
|                  |                                 | 2.7                    | I <sub>O</sub> =-12 mA                         | 2.2                  |      | 2.2                  |      |      |
|                  |                                 | 3.0                    | I <sub>O</sub> =-18 mA                         | 2.4                  |      | 2.4                  |      |      |
|                  |                                 |                        | I <sub>O</sub> =-24 mA                         | 2.2                  |      | 2.2                  |      |      |
| V <sub>OL</sub>  | Low Level Output Voltage        | 2.7 to 3.6             | I <sub>O</sub> =100 μA                         |                      | 0.2  |                      | 0.2  | V    |
|                  |                                 | 2.7                    | I <sub>O</sub> =12 mA                          |                      | 0.4  |                      | 0.4  |      |
|                  |                                 | 3.0                    | I <sub>O</sub> =16 mA                          |                      | 0.4  |                      | 0.4  |      |
|                  |                                 |                        | I <sub>O</sub> =24 mA                          |                      | 0.55 |                      | 0.55 |      |
| I <sub>I</sub>   | Input Leakage Current           | 2.7 to 3.6             | V <sub>I</sub> = 0 to 5.5V                     |                      | ± 5  |                      | ± 5  | μA   |
| I <sub>off</sub> | Power Off Leakage Current       | 0                      | V <sub>I</sub> or V <sub>O</sub> = 5.5V        |                      | 10   |                      | 10   | μA   |
| I <sub>CC</sub>  | Quiescent Supply Current        | 2.7 to 3.6             | V <sub>I</sub> = V <sub>CC</sub> or GND        |                      | 10   |                      | 10   | μA   |
|                  |                                 |                        | V <sub>I</sub> or V <sub>O</sub> = 3.6 to 5.5V |                      | ± 10 |                      | ± 10 |      |
| ΔI <sub>CC</sub> | I <sub>CC</sub> incr. per Input | 2.7 to 3.6             | V <sub>IH</sub> = V <sub>CC</sub> - 0.6V       |                      | 500  |                      | 500  | μA   |

## DYNAMIC SWITCHING CHARACTERISTICS

| Symbol           | Parameter                               | Test Condition         |                                                                       | Value                  |      |      | Unit |
|------------------|-----------------------------------------|------------------------|-----------------------------------------------------------------------|------------------------|------|------|------|
|                  |                                         | V <sub>CC</sub><br>(V) |                                                                       | T <sub>A</sub> = 25 °C |      |      |      |
|                  |                                         |                        |                                                                       | Min.                   | Typ. | Max. |      |
| V <sub>OLP</sub> | Dynamic Low Level Quiet Output (note 1) | 3.3                    | C <sub>L</sub> = 50pF<br>V <sub>IL</sub> = 0V, V <sub>IH</sub> = 3.3V |                        | 0.8  |      | V    |
| V <sub>OLV</sub> |                                         |                        |                                                                       |                        | -0.8 |      |      |

1) Number of outputs defined as "n". Measured with "n-1" outputs switching from HIGH to LOW or LOW to HIGH. The remaining output is measured in the LOW state.

## AC ELECTRICAL CHARACTERISTICS

| Symbol                                 | Parameter                             | Test Condition         |                        |                       |                                         | Value        |      |               |      | Unit |
|----------------------------------------|---------------------------------------|------------------------|------------------------|-----------------------|-----------------------------------------|--------------|------|---------------|------|------|
|                                        |                                       | V <sub>CC</sub><br>(V) | C <sub>L</sub><br>(pF) | R <sub>L</sub><br>(Ω) | t <sub>s</sub> = t <sub>r</sub><br>(ns) | -40 to 85 °C |      | -55 to 125 °C |      |      |
|                                        |                                       |                        |                        |                       |                                         | Min.         | Max. | Min.          | Max. |      |
| t <sub>PLH</sub> t <sub>PHL</sub>      | Propagation Delay Time A, B to Y      | 2.7                    | 50                     | 500                   | 2.5                                     |              | 7.3  |               | 7.3  | ns   |
|                                        |                                       | 3.0 to 3.6             |                        |                       |                                         | 1.0          | 6.2  | 1.0           | 6.2  |      |
| t <sub>PLH</sub> t <sub>PHL</sub>      | Propagation Delay Time G to Y         | 2.7                    | 50                     | 500                   | 2.5                                     |              | 5.8  |               | 5.8  | ns   |
|                                        |                                       | 3.0 to 3.6             |                        |                       |                                         | 1.0          | 5.3  | 1.0           | 5.3  |      |
| t <sub>OSLH</sub><br>t <sub>OSHL</sub> | Output To Output Skew Time (note1, 2) | 3.0 to 3.6             | 50                     | 500                   | 2.5                                     |              | 1.0  |               | 1.0  | ns   |

1) Skew is defined as the absolute value of the difference between the actual propagation delay for any two outputs of the same device switching in the same direction, either HIGH or LOW (t<sub>OSLH</sub> = |t<sub>PLHm</sub> - t<sub>PLHn</sub>|, t<sub>OSHL</sub> = |t<sub>PLHm</sub> - t<sub>PLHn</sub>|)

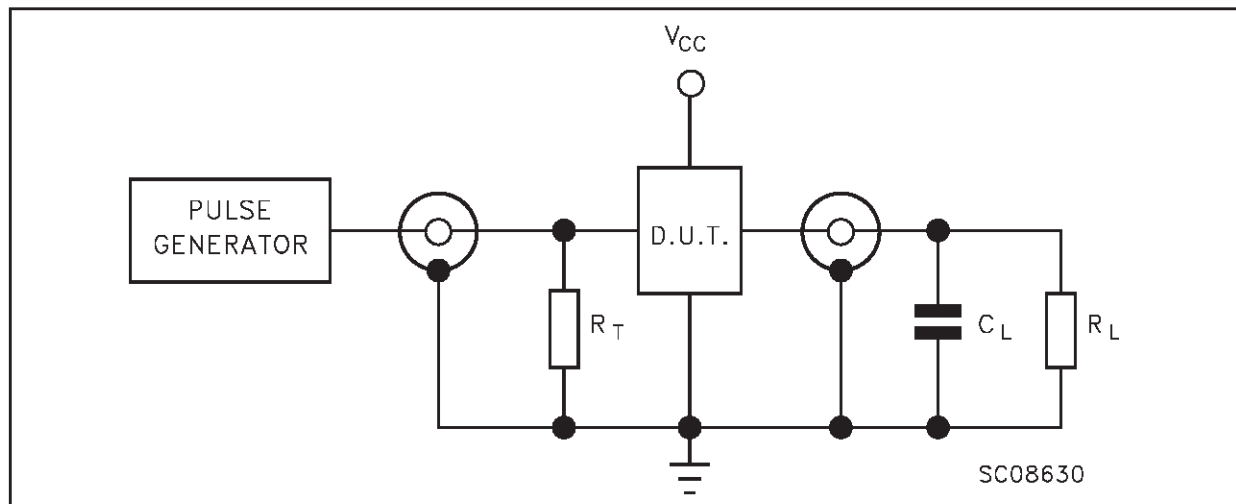
2) Parameter guaranteed by design

## CAPACITIVE CHARACTERISTICS

| Symbol          | Parameter                                 | Test Condition         |                                                                   | Value                  |      |      | Unit |
|-----------------|-------------------------------------------|------------------------|-------------------------------------------------------------------|------------------------|------|------|------|
|                 |                                           | V <sub>CC</sub><br>(V) |                                                                   | T <sub>A</sub> = 25 °C |      |      |      |
|                 |                                           |                        |                                                                   | Min.                   | Typ. | Max. |      |
| C <sub>IN</sub> | Input Capacitance                         | 3.3                    | V <sub>IN</sub> = 0 to V <sub>CC</sub>                            |                        | 6    |      | pF   |
| C <sub>PD</sub> | Power Dissipation Capacitance<br>(note 1) | 3.3                    | f <sub>IN</sub> = 10MHz<br>V <sub>IN</sub> = 0 or V <sub>CC</sub> |                        | 26   |      | 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.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/2$  (per gate)

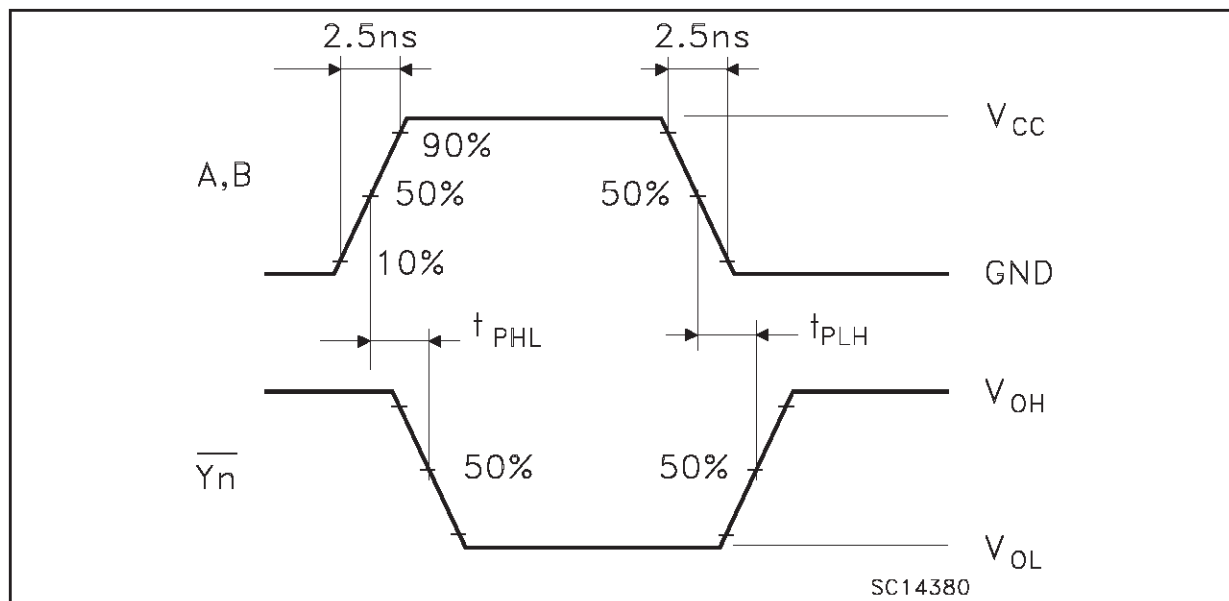
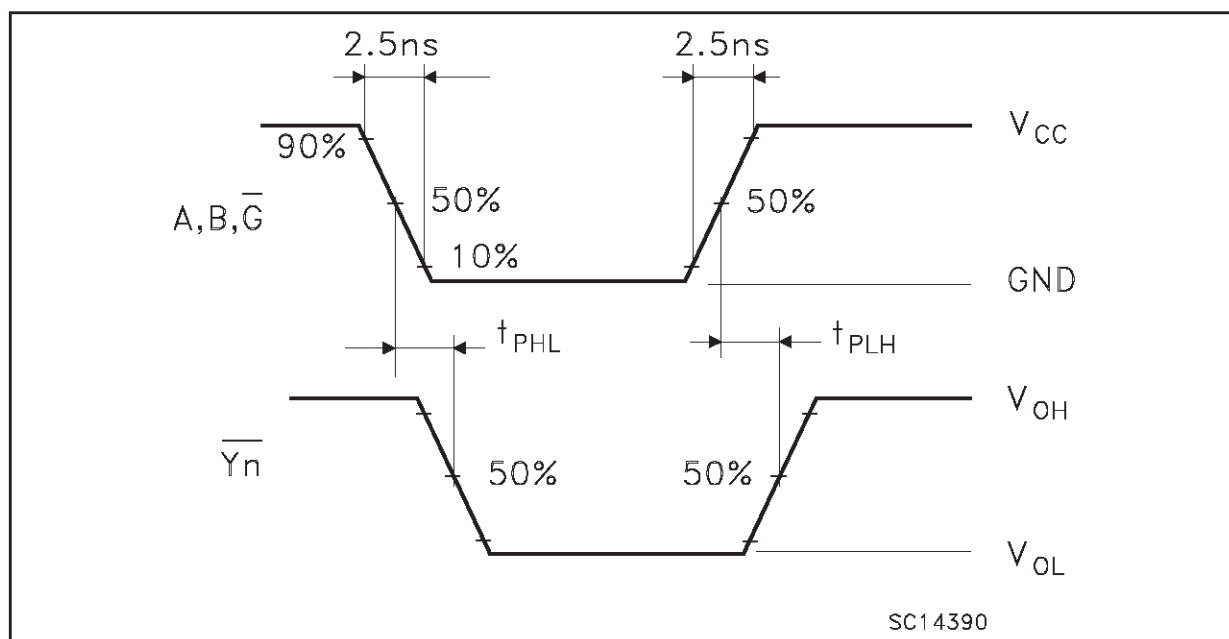
## TEST CIRCUIT



C<sub>L</sub> = 50 pF or equivalent (includes jig and probe capacitance)

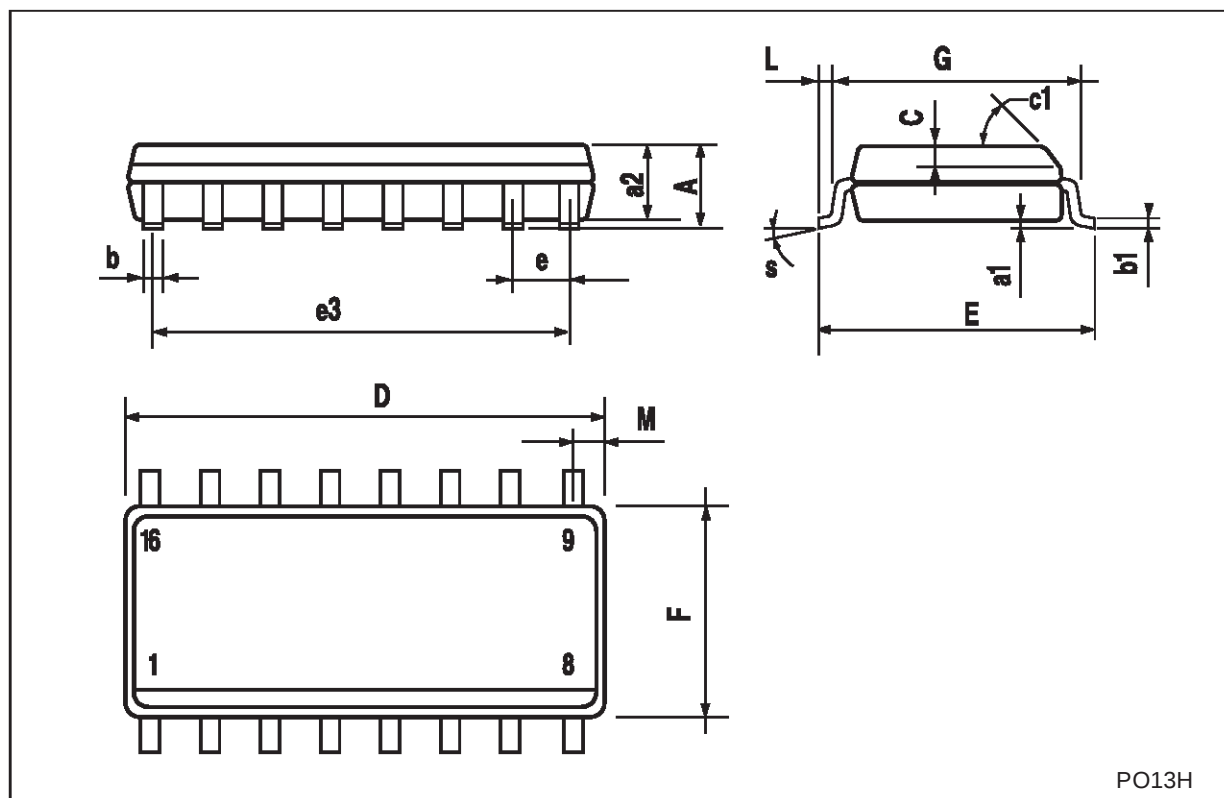
R<sub>L</sub> = 500Ω or equivalent

R<sub>T</sub> = Z<sub>OUT</sub> of pulse generator (typically 50Ω)

**WAVEFORM 1: PROPAGATION DELAYS FOR INVERTING OUTPUTS** ( $f=1\text{MHz}$ ; 50% duty cycle)**WAVEFORM 2: PROPAGATION DELAYS FOR NON-INVERTING OUTPUTS** ( $f=1\text{MHz}$ ; 50% duty cycle)

## SO-16 MECHANICAL DATA

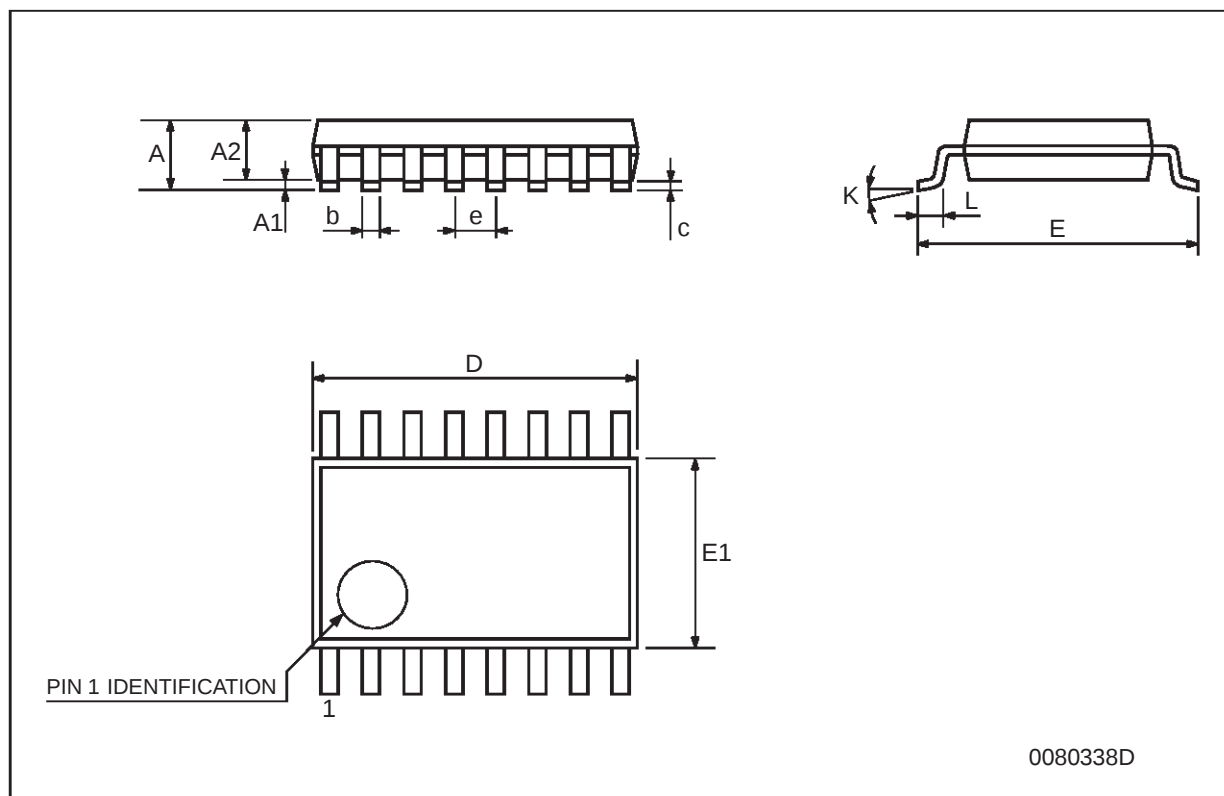
| DIM. | mm.        |      |      | inch  |       |       |
|------|------------|------|------|-------|-------|-------|
|      | MIN.       | TYP  | MAX. | MIN.  | TYP.  | MAX.  |
| A    |            |      | 1.75 |       |       | 0.068 |
| a1   | 0.1        |      | 0.2  | 0.003 |       | 0.007 |
| 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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