

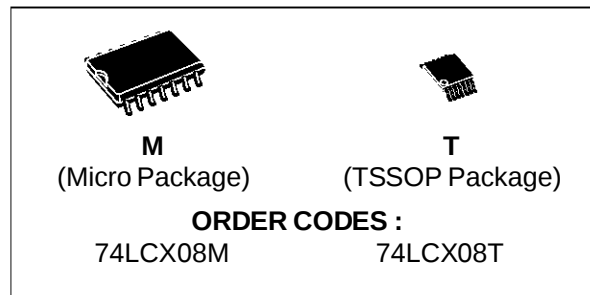
## LOW VOLTAGE CMOS QUAD 2-INPUT AND GATE WITH 5V TOLERANT INPUTS

### PRELIMINARY DATA

- 5V TOLERANT INPUTS
- HIGH SPEED:  
 $t_{PD} = 5.5 \text{ ns (MAX.) at } V_{CC} = 3V$
- POWER-DOWN PROTECTION ON INPUTS AND OUTPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 24 \text{ mA (MIN)}$
- PCI BUS LEVELS GUARANTEED AT 24mA
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \equiv t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC} \text{ (OPR)} = 2.0V \text{ to } 3.6V \text{ (1.5V Data Retention)}$
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 08
- LATCH-UP PERFORMANCE EXCEEDS 500mA
- ESD PERFORMANCE:  
 $HBM > 2000V$ ;  $MM > 200V$

### DESCRIPTION

The LCX08 is a low voltage CMOS QUAD 2-INPUT AND GATE fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS

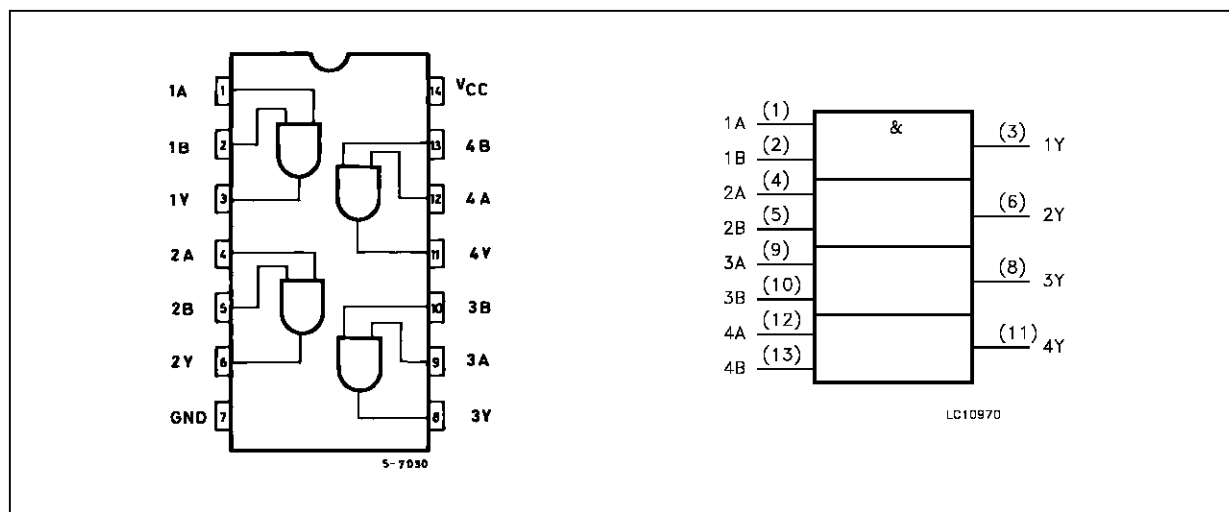


technology. It is ideal for low power and high speed 3.3V applications; it can be interfaced to 5V signal environment for inputs.

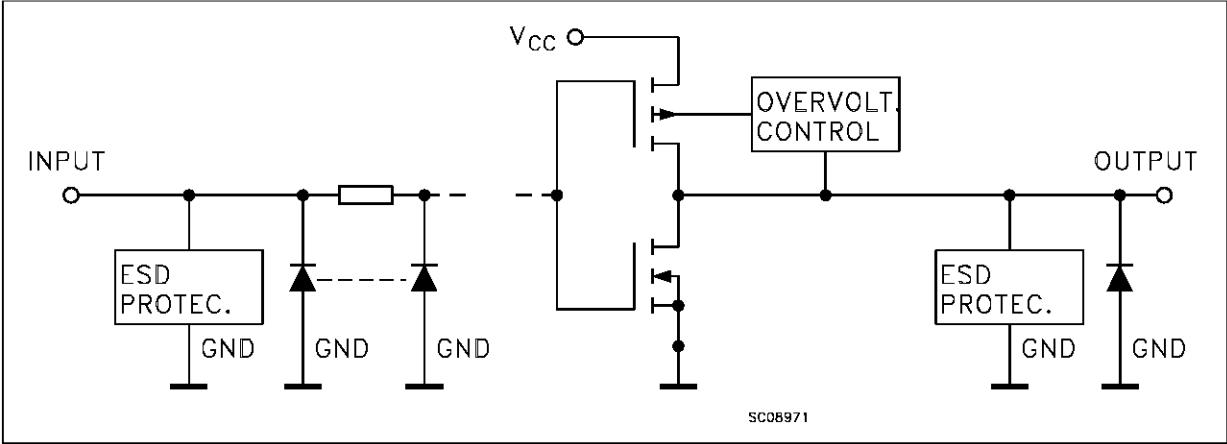
It has same speed performance at 3.3V than 5V, AC/ACT family, combined with a lower power consumption.

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, 4, 9, 12  | 1A to 4A        | Data Inputs             |
| 2, 5, 10, 13 | 1B to 4B        | Data Inputs             |
| 3, 6, 8, 11  | 1Y to 4Y        | Data Outputs            |
| 7            | GND             | Ground (0V)             |
| 14           | V <sub>CC</sub> | Positive Supply Voltage |

TRUTH TABLE

| A | B | Y |
|---|---|---|
| L | L | L |
| L | H | L |
| H | L | L |
| H | H | H |

ABSOLUTE MAXIMUM RATINGS

| Symbol           | Parameter                                     | Value                         | Unit |
|------------------|-----------------------------------------------|-------------------------------|------|
| V <sub>CC</sub>  | Supply Voltage                                | -0.5 to + 7.0                 | V    |
| V <sub>I</sub>   | DC Input Voltage                              | -0.5 to + 7.0                 | V    |
| V <sub>O</sub>   | DC Output Voltage (V <sub>CC</sub> =0V)       | -0.5 to + 7.0                 | V    |
| V <sub>O</sub>   | DC Output Voltage (High or Low State) (note1) | -0.5 to V <sub>CC</sub> + 0.5 | V    |
| I <sub>IK</sub>  | DC Input Diode Current                        | - 50                          | mA   |
| I <sub>OK</sub>  | DC Output Diode Current (note2)               | ± 50                          | mA   |
| I <sub>O</sub>   | DC Output Source/Sink Current                 | ± 50                          | mA   |
| I <sub>CC</sub>  | DC Supply Current per Supply Pin              | ± 100                         | mA   |
| I <sub>GND</sub> | DC Ground Current per Supply Pin              | ± 100                         | mA   |
| 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.

1) I<sub>O</sub> absolute maximum rating must be observed

2) V<sub>O</sub> < GND, V<sub>O</sub> > V<sub>CC</sub>

## RECOMMENDED OPERATING CONDITIONS

| Symbol                            | Parameter                                                            | Value                | Unit |
|-----------------------------------|----------------------------------------------------------------------|----------------------|------|
| V <sub>CC</sub>                   | Supply Voltage (note 1)                                              | 2.0 to 3.6           | V    |
| V <sub>I</sub>                    | Input Voltage                                                        | 0 to 5.5             | V    |
| V <sub>O</sub>                    | Output Voltage (V <sub>CC</sub> =0V)                                 | 0 to 5.5             | V    |
| V <sub>O</sub>                    | Output Voltage (High or Low State)                                   | 0 to V <sub>CC</sub> | V    |
| I <sub>OH</sub> , I <sub>OL</sub> | High or Low Level Output Current (V <sub>CC</sub> = 3.0 to 3.6V)     | ± 24                 | mA   |
| I <sub>OH</sub> , I <sub>OL</sub> | High or Low Level Output Current (V <sub>CC</sub> = 2.7 to 3.0V)     | ± 12                 | mA   |
| T <sub>op</sub>                   | Operating Temperature:                                               | -40 to +85           | °C   |
| dt/dv                             | Input Transition Rise or Fall Rate (V <sub>CC</sub> = 3.0V) (note 2) | 0 to 10              | ns/V |

1) Truth Table guaranteed: 1.5V to 3.6V

2) V<sub>IN</sub> from 0.8V to 2.0V

## DC SPECIFICATIONS

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

## DYNAMIC SWITCHING CHARACTERISTICS

| Symbol           | Parameter                                    | Test Conditions        |                                                                           | Value                  |      |      | Unit |
|------------------|----------------------------------------------|------------------------|---------------------------------------------------------------------------|------------------------|------|------|------|
|                  |                                              | V <sub>CC</sub><br>(V) |                                                                           | T <sub>A</sub> = 25 °C |      |      |      |
|                  |                                              |                        |                                                                           | Min.                   | Typ. | Max. |      |
| V <sub>OLP</sub> | Dynamic Low Voltage Quiet Output<br>(note 1) | 3.3                    | C <sub>L</sub> = 50 pF<br>V <sub>IL</sub> = 0 V<br>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** ( $C_L = 50 \text{ pF}$ ,  $R_L = 500 \Omega$ , Input  $t_r = t_f = 2.5 \text{ ns}$ )

| Symbol                                 | Parameter                              | Test Condition         |          | Value        |            | Unit |
|----------------------------------------|----------------------------------------|------------------------|----------|--------------|------------|------|
|                                        |                                        | V <sub>CC</sub><br>(V) | Waveform | -40 to 85 °C |            |      |
|                                        |                                        |                        |          | Min.         | Max.       |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub>   | Propagation Delay Time                 | 2.7<br>3.0 to 3.6      | 1        | <br>1.0      | 6.2<br>5.5 | ns   |
| t <sub>OSLZ</sub><br>t <sub>OSHL</sub> | Output to Output Skew Time (note 1, 2) | 3.0 to 3.6             |          |              | 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 ( $t_{OSLH} = |t_{PLHm} - t_{PLHn}|$ ,  $t_{OSHL} = |t_{PHLm} - t_{PHLn}|$ )

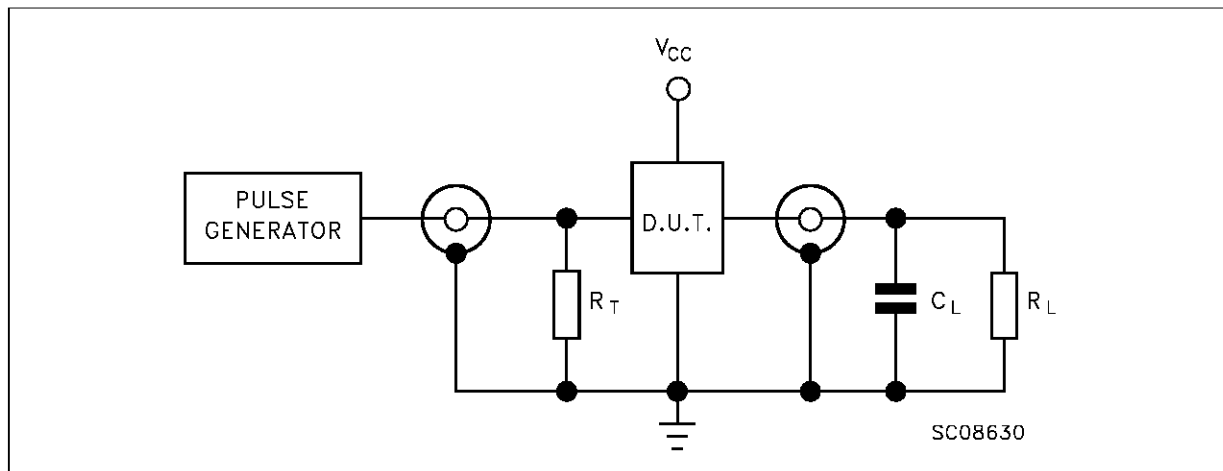
2) Parameter guaranteed by design

**CAPACITIVE CHARACTERISTICS**

| Symbol          | Parameter                              | Test Conditions        |                                                                   | 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 (note 1) | 3.3                    | f <sub>IN</sub> = 10MHz<br>V <sub>IN</sub> = 0 or V <sub>CC</sub> |                        | 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. Average operating current can be obtained by the following equation.  $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CCD}/n$  (per circuit)

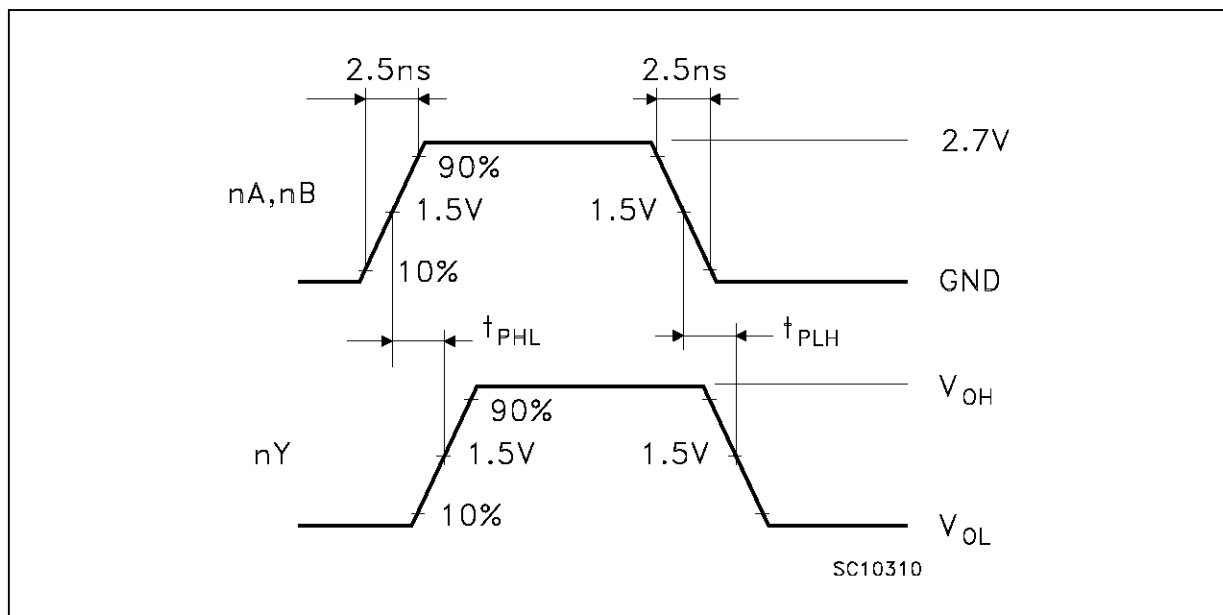
## TEST CIRCUIT



$C_L$  = 50 pF or equivalent (includes jig and probe capacitance)

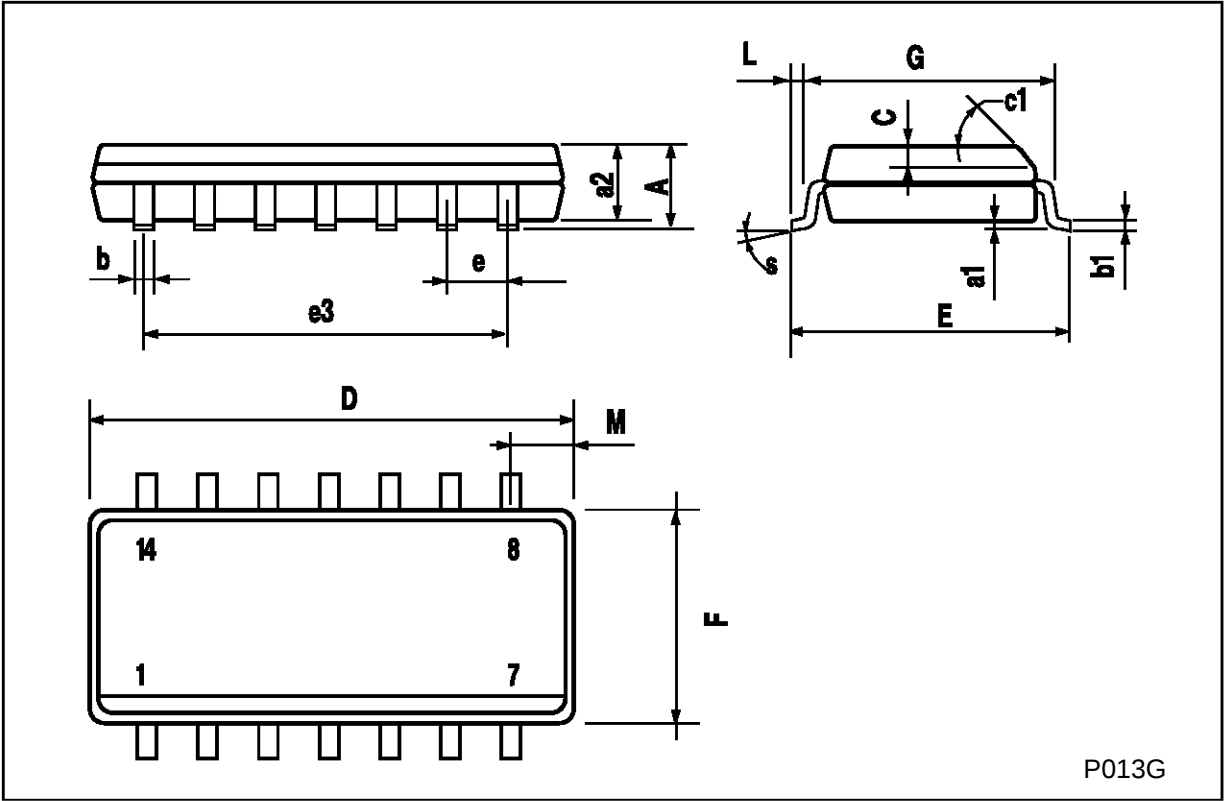
$R_L$  = 500 $\Omega$  or equivalent

$R_T$  =  $Z_{OUT}$  of pulse generator (typically 50 $\Omega$ )

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

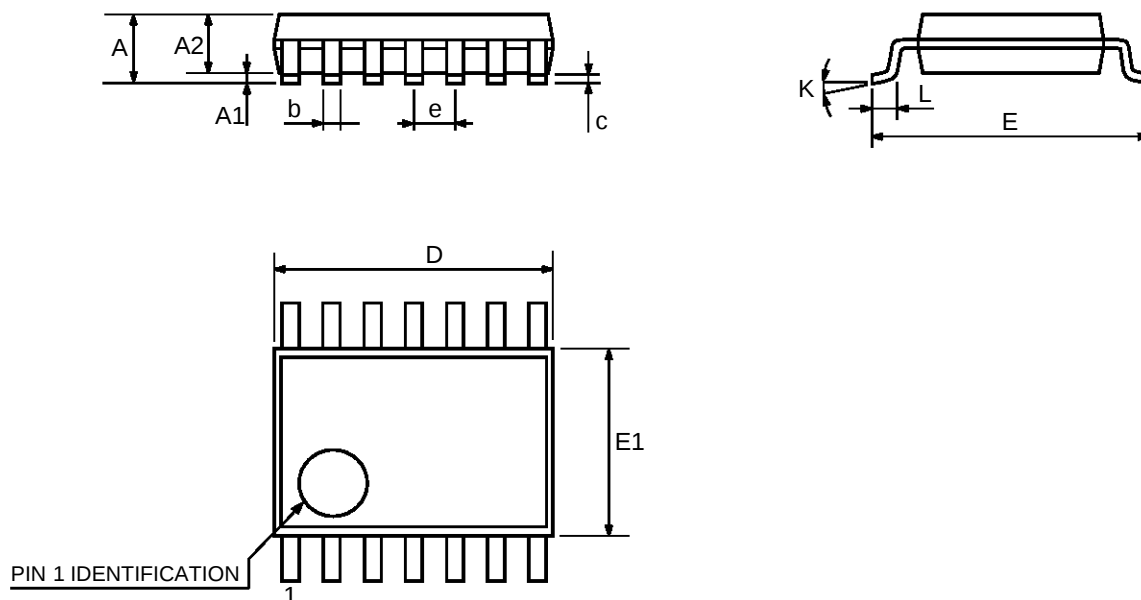
SO14 MECHANICAL DATA

| 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    | 8.55      |      | 8.75 | 0.336 |       | 0.344 |
| E    | 5.8       |      | 6.2  | 0.228 |       | 0.244 |
| e    |           | 1.27 |      |       | 0.050 |       |
| e3   |           | 7.62 |      |       | 0.300 |       |
| 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    |           |      | 0.68 |       |       | 0.026 |
| S    | 8 (max.)  |      |      |       |       |       |



## TSSOP14 MECHANICAL DATA

| DIM. | mm   |          |      | inch   |            |        |
|------|------|----------|------|--------|------------|--------|
|      | MIN. | TYP.     | MAX. | MIN.   | TYP.       | MAX.   |
| A    |      |          | 1.1  |        |            | 0.433  |
| A1   | 0.05 | 0.10     | 0.15 | 0.002  | 0.004      | 0.006  |
| A2   | 0.85 | 0.9      | 0.95 | 0.335  | 0.354      | 0.374  |
| b    | 0.19 |          | 0.30 | 0.0075 |            | 0.0118 |
| c    | 0.09 |          | 0.20 | 0.0035 |            | 0.0079 |
| D    | 4.9  | 5        | 5.1  | 0.193  | 0.197      | 0.201  |
| E    | 6.25 | 6.4      | 6.5  | 0.246  | 0.252      | 0.256  |
| E1   | 4.3  | 4.4      | 4.48 | 0.169  | 0.173      | 0.176  |
| e    |      | 0.65 BSC |      |        | 0.0256 BSC |        |
| K    | 0°   | 4°       | 8°   | 0°     | 4°         | 8°     |
| L    | 0.50 | 0.60     | 0.70 | 0.020  | 0.024      | 0.028  |



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