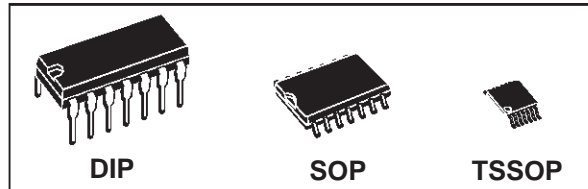


## QUAD 2-INPUT NOR GATE

- HIGH SPEED:  $t_{PD} = 5 \text{ ns}$  (TYP.) at  $V_{CC} = 5V$
- LOW POWER DISSIPATION:  
 $I_{CC} = 4 \mu\text{A}$  (MAX.) at  $T_A = 25^\circ\text{C}$
- COMPATIBLE WITH TTL OUTPUTS  
 $V_{IH} = 2V$  (MIN),  $V_{IL} = 0.8V$  (MAX)
- $50\Omega$  TRANSMISSION LINE DRIVING CAPABILITY
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 24 \text{ mA}$  (MIN)
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC}$  (OPR) = 4.5V to 5.5V
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 02
- IMPROVED LATCH-UP IMMUNITY

### DESCRIPTION

The ACT02 is an advanced high-speed CMOS QUAD 2-INPUT NOR GATE fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology. It is ideal for low power applications maintaining high speed operation similar to equivalent Bipolar Schottky TTL.



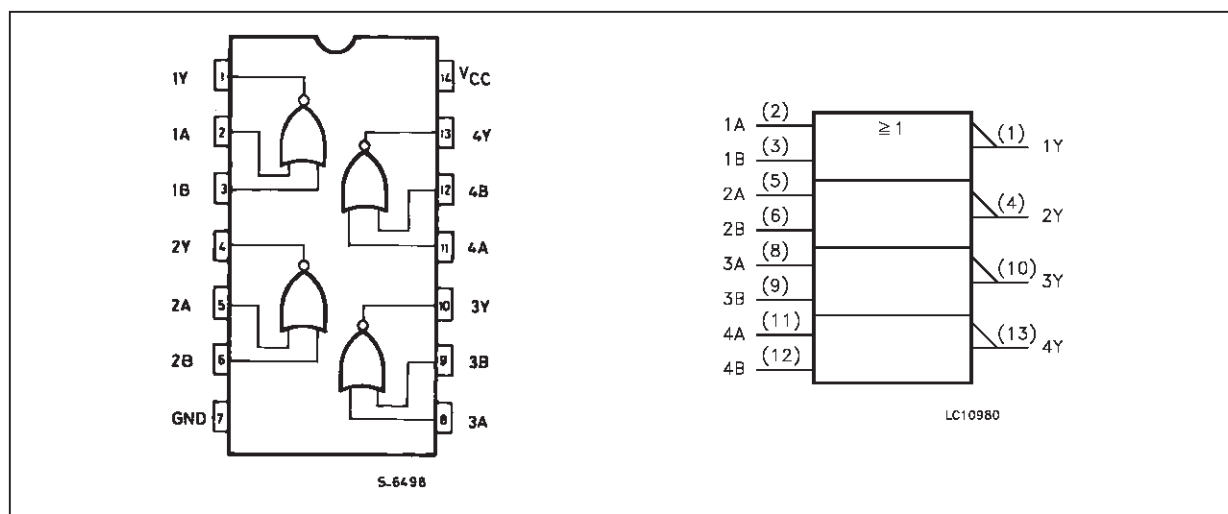
| ORDER CODES |           |             |
|-------------|-----------|-------------|
| PACKAGE     | TUBE      | T & R       |
| DIP         | M74ACT02B |             |
| SOP         | M74ACT02M | M74ACT02MTR |
| TSSOP       |           | M74ACT02TTR |

The internal circuit is composed of 3 stages including buffer output, which enables high noise immunity and stable output.

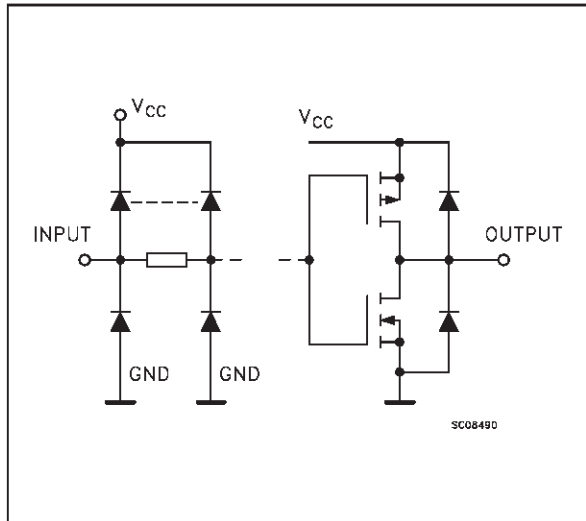
The device is designed to interface directly High Speed CMOS systems with TTL, NMOS and CMOS output voltage levels.

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       |
|--------------|----------|-------------------------|
| 2, 5, 8, 11  | 1A to 4A | Data Inputs             |
| 3, 6, 9, 12  | 1B to 4B | Data Inputs             |
| 1, 4, 10, 12 | 1Y to 4Y | Data Outputs            |
| 7            | GND      | Ground (0V)             |
| 14           | VCC      | Positive Supply Voltage |

**TRUTH TABLE**

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

**ABSOLUTE MAXIMUM RATINGS**

| Symbol                              | Parameter                            | Value                         | Unit |
|-------------------------------------|--------------------------------------|-------------------------------|------|
| V <sub>CC</sub>                     | Supply Voltage                       | -0.5 to +7                    | V    |
| V <sub>I</sub>                      | DC Input Voltage                     | -0.5 to V <sub>CC</sub> + 0.5 | V    |
| V <sub>O</sub>                      | DC Output Voltage                    | -0.5 to V <sub>CC</sub> + 0.5 | V    |
| I <sub>IK</sub>                     | DC Input Diode Current               | ± 20                          | mA   |
| I <sub>OK</sub>                     | DC Output Diode Current              | ± 20                          | mA   |
| I <sub>O</sub>                      | DC Output Current                    | ± 50                          | mA   |
| I <sub>CC</sub> or I <sub>GND</sub> | DC V <sub>CC</sub> or Ground Current | ± 200                         | 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.

**RECOMMENDED OPERATING CONDITIONS**

| Symbol          | Parameter   | Value                | Unit |
|-----------------|---|----------------------|------|
| V <sub>CC</sub> | Supply Voltage  | 4.5 to 5.5           | V    |
| V <sub>I</sub>  | Input Voltage   | 0 to V <sub>CC</sub> | V    |
| V <sub>O</sub>  | Output Voltage  | 0 to V <sub>CC</sub> | V    |
| T <sub>op</sub> | Operating Temperature:  | -40 to +85           | °C   |
| dt/dv           | Input Rise and Fall Time V <sub>CC</sub> = 4.5 to 5.5V (note 1) | 8                    | ns/V |

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

## DC SPECIFICATIONS

| Symbol             | Parameter                             | Test Conditions |  | Value                  |      |       |              |      | Unit |
|--------------------|---------------------------------------|-----------------|--|------------------------|------|-------|--------------|------|------|
|                    |                                       |                 |  | T <sub>A</sub> = 25 °C |      |       | -40 to 85 °C |      |      |
|                    |                                       |                 |  | V <sub>CC</sub> (V)    | Min. | Typ.  | Max.         | Min. |      |
| V <sub>IH</sub>    | High Level Input Voltage              | 4.5             | V <sub>O</sub> = 0.1 V or<br>V <sub>CC</sub> - 0.1 V                     | 2.0                    | 1.5  |       | 2.0          |      | V    |
|                    |                                       | 5.5             |  | 2.0                    | 1.5  |       | 2.0          |      |      |
| V <sub>IL</sub>    | Low Level Input Voltage               | 4.5             | V <sub>O</sub> = 0.1 V or<br>V <sub>CC</sub> - 0.1 V                     |                        | 1.5  | 0.8   |              | 0.8  | V    |
|                    |                                       | 5.5             |  |                        | 1.5  | 0.8   |              | 0.8  |      |
| V <sub>OH</sub>    | High Level Output Voltage             | 4.5             | V <sub>I</sub> <sup>(*)</sup> =<br>V <sub>IH</sub> or<br>V <sub>IL</sub> | I <sub>O</sub> =-50 μA | 4.4  | 4.49  |              | 4.4  | V    |
|                    |                                       | 5.5             |  | I <sub>O</sub> =-50 μA | 5.4  | 5.49  |              | 5.4  |      |
|                    |                                       | 4.5             |  | I <sub>O</sub> =-24 mA | 3.86 |       |              | 3.76 |      |
|                    |                                       | 5.5             |  | I <sub>O</sub> =-24 mA | 4.86 |       |              | 4.76 |      |
| V <sub>OL</sub>    | Low Level Output Voltage              | 4.5             | V <sub>I</sub> <sup>(*)</sup> =<br>V <sub>IH</sub> or<br>V <sub>IL</sub> | I <sub>O</sub> =50 μA  |      | 0.001 | 0.1          | 0.1  | V    |
|                    |                                       | 5.5             |  | I <sub>O</sub> =50 mA  |      | 0.001 | 0.1          | 0.1  |      |
|                    |                                       | 4.5             |  | I <sub>O</sub> =24 mA  |      |       | 0.36         | 0.44 |      |
|                    |                                       | 5.5             |  | I <sub>O</sub> =24 mA  |      |       | 0.36         | 0.44 |      |
| I <sub>I</sub>     | Input Leakage Current                 | 5.5             | V <sub>I</sub> = V <sub>CC</sub> or GND                                  |                        |      | ±0.1  |              | ±1   | μA   |
| I <sub>CC(T)</sub> | Max I <sub>CC</sub> /Input            | 5.5             | V <sub>I</sub> = V <sub>CC</sub> -2.1 V                                  |                        | 0.6  |       |              | 1.5  | mA   |
| I <sub>CC</sub>    | Quiescent Supply Current              | 5.5             | V <sub>I</sub> = V <sub>CC</sub> or GND                                  |                        |      | 4     |              | 40   | μA   |
| I <sub>OLD</sub>   | Dynamic Output Current<br>(note 1, 2) | 5.5             | V <sub>OLD</sub> = 1.65 V max  |                        |      |       |              | 75   | mA   |
| I <sub>OHD</sub>   |                                       |                 | V <sub>OHD</sub> = 3.85 V min  |                        |      |       |              | -75  | mA   |

1) Maximum test duration 2ms, one output loaded at time

2) Incident wave switching is guaranteed on transmission lines with impedances as low as 50 Ω.

(\*) All outputs loaded.

AC ELECTRICAL CHARACTERISTICS (C<sub>L</sub> = 50 pF, R<sub>L</sub> = 500 Ω, Input t<sub>r</sub> = t<sub>f</sub> = 3 ns)

| Symbol                               | Parameter              | Test Condition     |  | Value                  |      |      |              |      | Unit |
|--------------------------------------|------------------------|--------------------|--|------------------------|------|------|--------------|------|------|
|                                      |                        |                    |  | T <sub>A</sub> = 25 °C |      |      | -40 to 85 °C |      |      |
|                                      |                        |                    |  | V <sub>CC</sub> (V)    | Min. | Typ. | Max.         | Min. |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay Time | 5.0 <sup>(*)</sup> |  | 1.5                    | 5.0  | 8.0  | 1.0          | 9.0  | ns   |

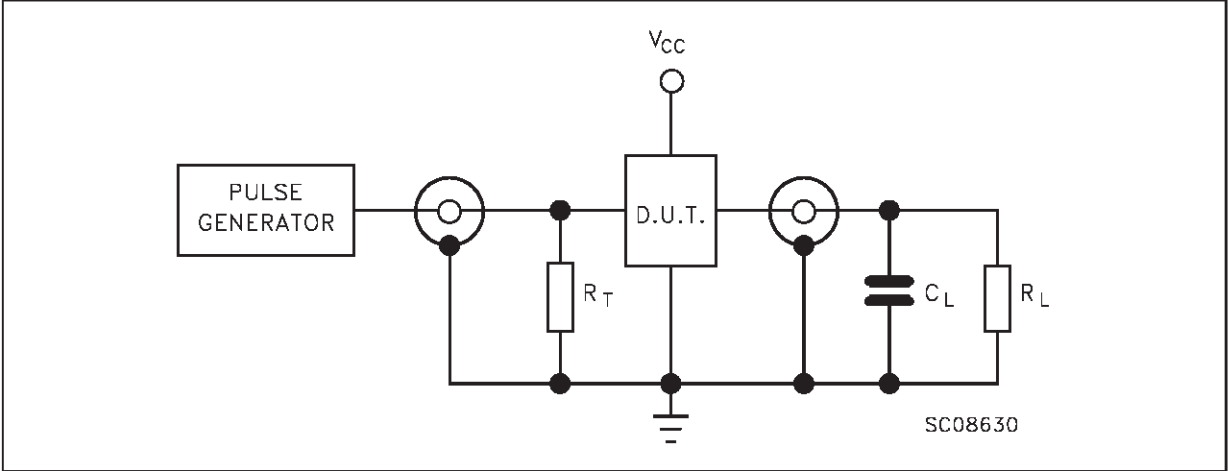
(\*) Voltage range is 5V ± 0.5V

## CAPACITIVE CHARACTERISTICS

| Symbol          | Parameter                              | Test Conditions |  | Value                  |      |      |              |      | Unit |
|-----------------|--|-----------------|--|------------------------|------|------|--------------|------|------|
|                 |  |                 |  | T <sub>A</sub> = 25 °C |      |      | -40 to 85 °C |      |      |
|                 |  |                 |  | V <sub>CC</sub> (V)    | Min. | Typ. | Max.         | Min. |      |
| C <sub>IN</sub> | Input Capacitance                      | 5.0             |  |                        | 4    |      |              |      | pF   |
| C <sub>PD</sub> | Power Dissipation Capacitance (note 1) | 5.0             |  |                        | 47   |      |              |      | pF   |

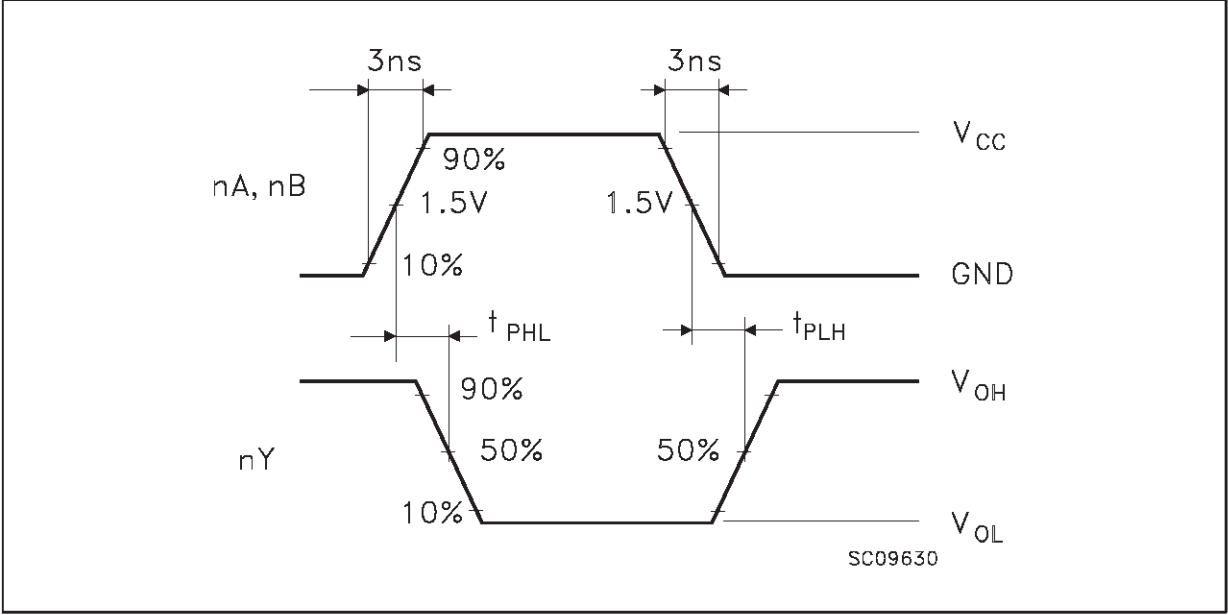
1) C<sub>PD</sub> is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. I<sub>CC(oper)</sub> = C<sub>PD</sub> • V<sub>CC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

TEST CIRCUIT



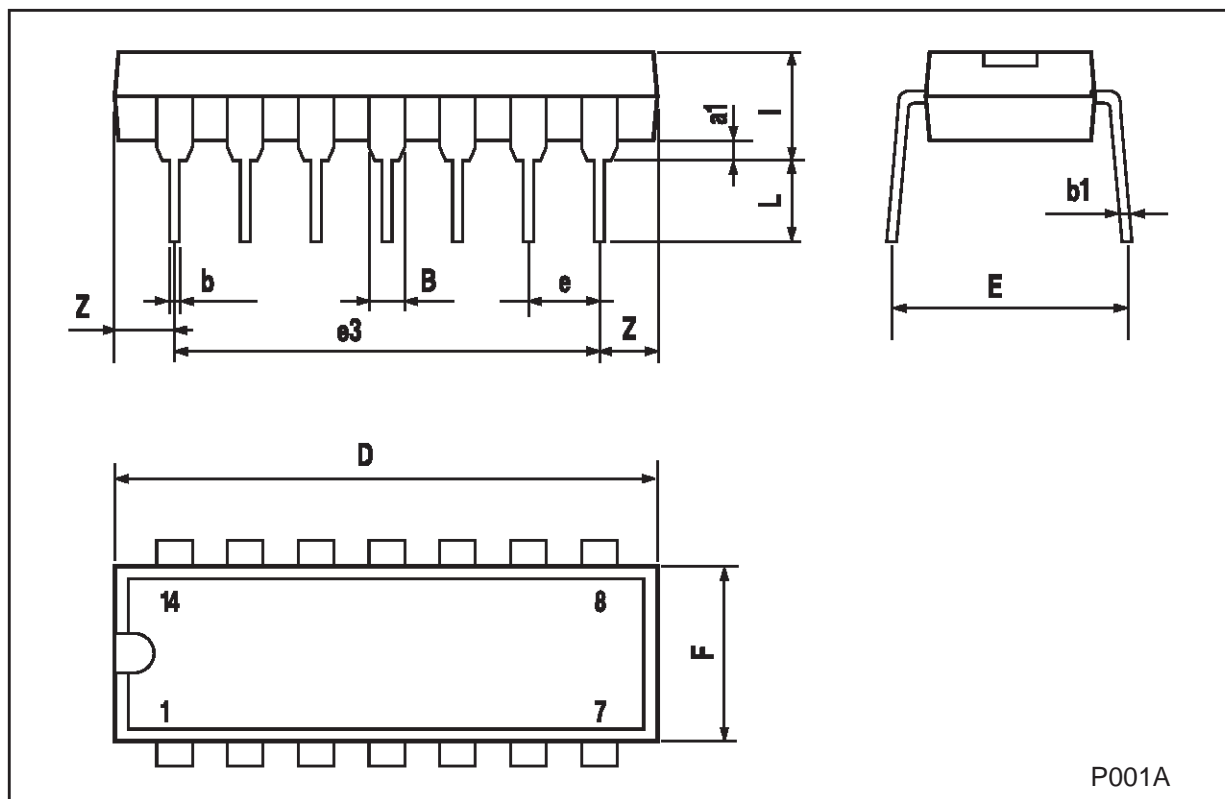
$C_L = 50\text{ pF}$  or equivalent (includes jig and probe capacitance)  
 $R_L = R_T = 500\Omega$  or equivalent  
 $R_T = Z_{out}$  of pulse generator (typically  $50\Omega$ )

WAVEFORM: PROPAGATION DELAYS (f=1MHz; 50% duty cycle)



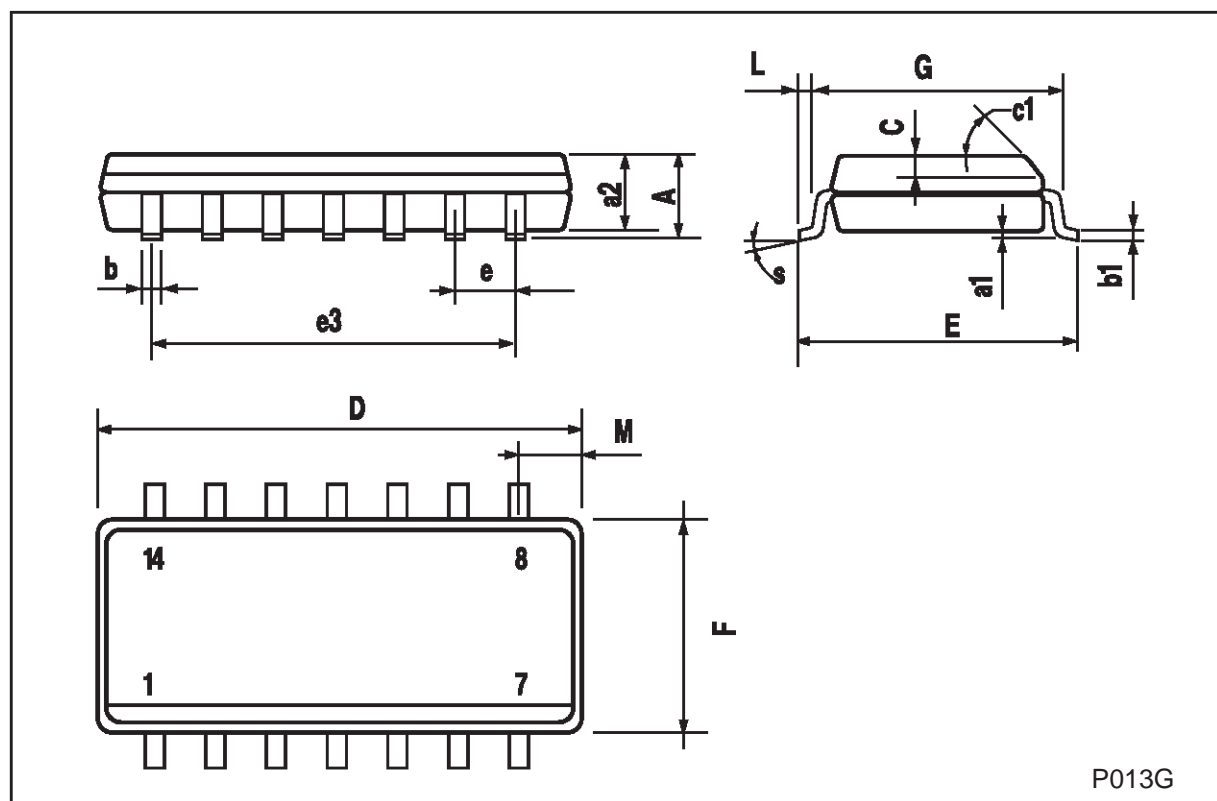
### Plastic DIP-14 MECHANICAL DATA

| DIM. | mm   |       |      | inch  |       |       |
|------|------|-------|------|-------|-------|-------|
|      | MIN. | TYP.  | MAX. | MIN.  | TYP.  | MAX.  |
| a1   | 0.51 |       |      | 0.020 |       |       |
| B    | 1.39 |       | 1.65 | 0.055 |       | 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   |      | 15.24 |      |       | 0.600 |       |
| F    |      |       | 7.1  |       |       | 0.280 |
| I    |      |       | 5.1  |       |       | 0.201 |
| L    |      | 3.3   |      |       | 0.130 |       |
| Z    | 1.27 |       | 2.54 | 0.050 |       | 0.100 |



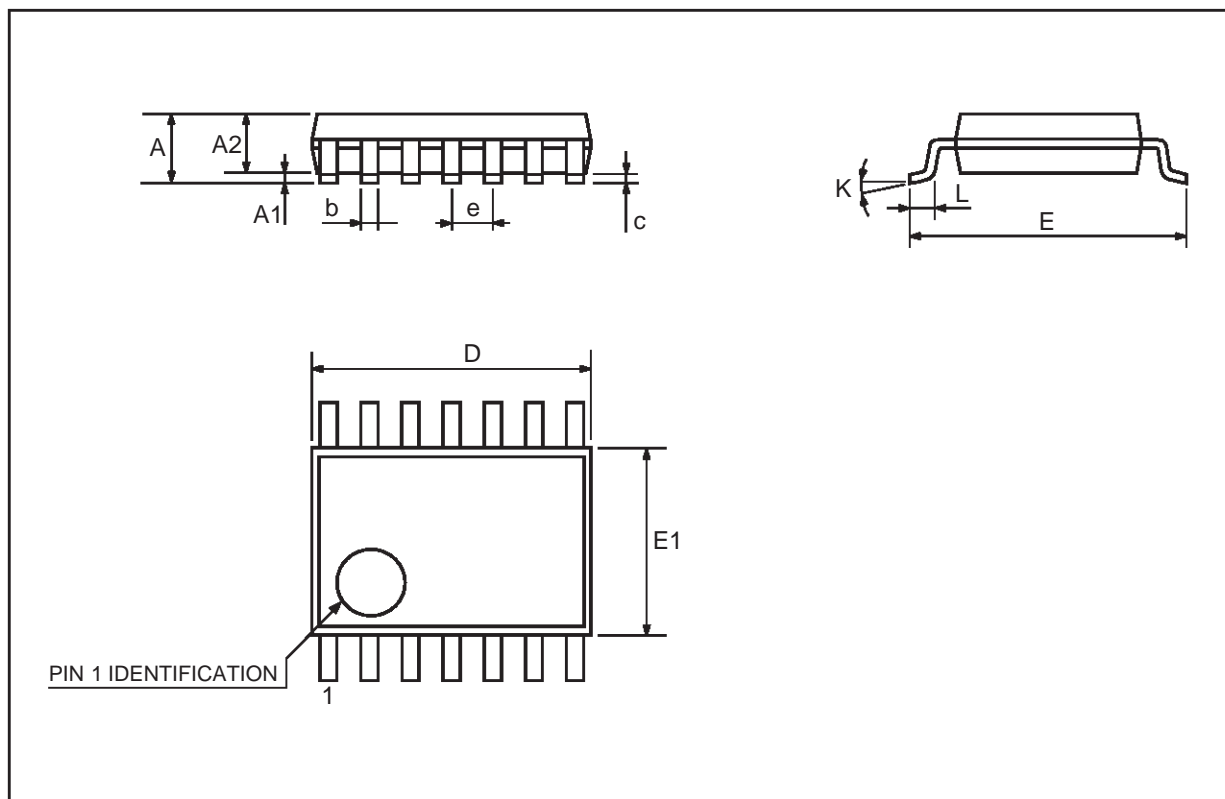
## SO-14 MECHANICAL DATA

| 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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