

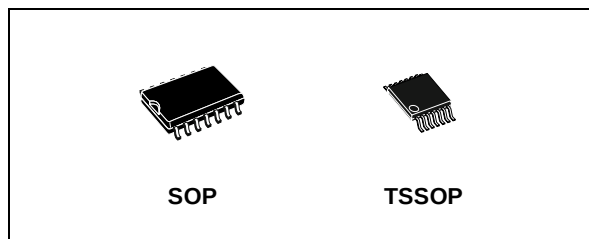
## QUAD 2-INPUT OR GATE

- HIGH SPEED:  $t_{PD} = 5 \text{ ns}$  (TYP.) at  $V_{CC} = 5V$
- LOW POWER DISSIPATION:  
 $I_{CC} = 2 \mu A$  (MAX.) at  $T_A = 25^\circ C$
- COMPATIBLE WITH TTL OUTPUTS:  
 $V_{IH} = 2V$  (MIN.),  $V_{IL} = 0.8V$  (MAX)
- POWER DOWN PROTECTION ON INPUTS & OUTPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 8 \text{ mA}$  (MIN)
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC(OPR)} = 4.5V \text{ to } 5.5V$
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 32
- IMPROVED LATCH-UP IMMUNITY
- LOW NOISE:  $V_{OLP} = 0.8V$  (MAX.)

### DESCRIPTION

The 74VHCT32A is an advanced high-speed CMOS QUAD 2-INPUT OR GATE fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

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



**Table 1: Order Codes**

| PACKAGE | T & R        |
|---------|--------------|
| SOP     | 74VHCT32AMTR |
| TSSOP   | 74VHCT32ATTR |

Power down protection is provided on all inputs and outputs and 0 to 7V can be accepted on inputs with no regard to the supply voltage. This device can be used to interface 5V to 3V since all inputs are equipped with TTL threshold.

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

**Figure 1: Pin Connection And IEC Logic Symbols**

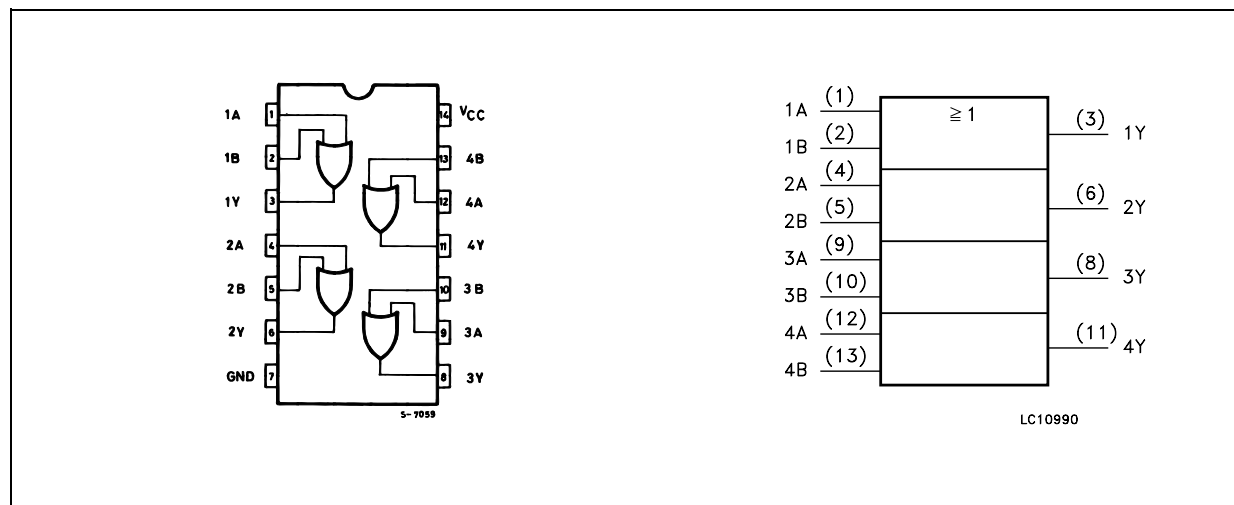


Figure 2: Input Equivalent Circuit

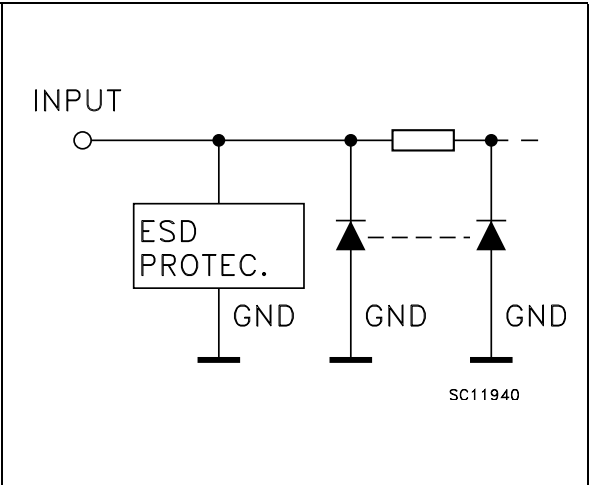


Table 2: Pin Description

| PIN N°       | 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 |

Table 3: Truth Table

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

Table 4: 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 (see note 1)       | -0.5 to +7.0                  | V    |
| V <sub>O</sub>                      | DC Output Voltage (see note 2)       | -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                    | ± 25                          | mA   |
| I <sub>CC</sub> or I <sub>GND</sub> | DC V <sub>CC</sub> or Ground Current | ± 50                          | 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 conditions is not implied  
1) V<sub>CC</sub> = 0V  
2) High or Low State

Table 5: 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 5.5             | V    |
| V <sub>O</sub>  | Output Voltage (see note 1)                                          | 0 to 5.5             | V    |
| V <sub>O</sub>  | Output Voltage (see note 2)                                          | 0 to V <sub>CC</sub> | V    |
| T <sub>op</sub> | Operating Temperature                                                | -55 to 125           | °C   |
| dt/dv           | Input Rise and Fall Time (see note 3) (V <sub>CC</sub> = 5.0 ± 0.5V) | 0 to 20              | ns/V |

1) V<sub>CC</sub> = 0V  
2) High or Low State  
3) V<sub>IN</sub> from 0.8V to 2V

Table 6: 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             | 4.5 to 5.5             |                                                          | 2                     |      |       | 2           |       | 2            |       | V    |
| V <sub>IL</sub>  | Low Level Input Voltage              | 4.5 to 5.5             |                                                          |                       |      | 0.8   |             | 0.8   |              | 0.8   | V    |
| V <sub>OH</sub>  | High Level Output Voltage            | 4.5                    | I <sub>O</sub> =-50 μA                                   | 4.4                   | 4.5  |       | 4.4         |       | 4.4          |       | V    |
|                  |                                      | 4.5                    | I <sub>O</sub> =-8 mA                                    | 3.94                  |      |       | 3.8         |       | 3.7          |       |      |
| V <sub>OL</sub>  | Low Level Output Voltage             | 4.5                    | I <sub>O</sub> =50 μA                                    |                       | 0.0  | 0.1   |             | 0.1   |              | 0.1   | V    |
|                  |                                      | 4.5                    | I <sub>O</sub> =8 mA                                     |                       |      | 0.36  |             | 0.44  |              | 0.55  |      |
| I <sub>I</sub>   | Input Leakage Current                | 0 to 5.5               | V <sub>I</sub> = 5.5V or GND                             |                       |      | ± 0.1 |             | ± 1.0 |              | ± 1.0 | μA   |
| I <sub>CC</sub>  | Quiescent Supply Current             | 5.5                    | V <sub>I</sub> = V <sub>CC</sub> or GND                  |                       |      | 2     |             | 20    |              | 20    | μA   |
| +I <sub>CC</sub> | Additional Worst Case Supply Current | 5.5                    | One Input at 3.4V, other input at V <sub>CC</sub> or GND |                       |      | 1.35  |             | 1.5   |              | 1.5   | mA   |
| I <sub>OPD</sub> | Output Leakage Current               | 0                      | V <sub>OUT</sub> = 5.5V                                  |                       |      | 0.5   |             | 5.0   |              | 5.0   | μA   |

Table 7: AC Electrical Characteristics (Input t<sub>r</sub> = t<sub>f</sub> = 3ns)

| Symbol           | Parameter              | Test Condition             |                        |  | Value                 |      |      |             |      |              | Unit |      |
|------------------|------------------------|----------------------------|------------------------|--|-----------------------|------|------|-------------|------|--------------|------|------|
|                  |                        | V <sub>CC</sub> (*)<br>(V) | C <sub>L</sub><br>(pF) |  | T <sub>A</sub> = 25°C |      |      | -40 to 85°C |      | -55 to 125°C |      |      |
|                  |                        |                            |                        |  | Min.                  | Typ. | Max. | Min.        | Max. | Min.         |      | Max. |
| t <sub>PLH</sub> | Propagation Delay Time | 5.0                        | 15                     |  |                       | 5.0  | 7.0  | 1.0         | 8.0  | 1.0          | 8.0  | ns   |
| t <sub>PHL</sub> |                        | 5.0                        | 50                     |  |                       | 5.5  | 8.0  | 1.0         | 9.0  | 1.0          | 9.0  |      |

(\*) Voltage range is 5.0V ± 0.5V

Table 8: Capacitive Characteristics

| Symbol          | Parameter                              | Test Condition | Value                 |      |      |             |      |              |      |    | Unit |
|-----------------|----------------------------------------|----------------|-----------------------|------|------|-------------|------|--------------|------|----|------|
|                 |                                        |                | 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                      |                |                       | 4    | 10   |             | 10   |              | 10   | pF |      |
| C <sub>PD</sub> | Power Dissipation Capacitance (note 1) |                |                       | 18   |      |             |      |              |      | pF |      |

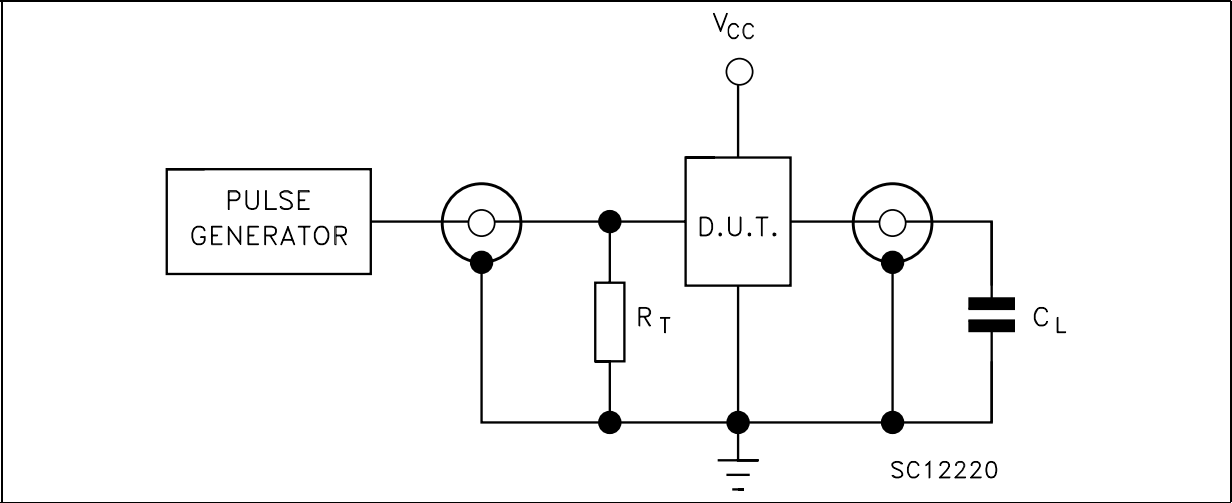
1) C<sub>PD</sub> is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. I<sub>CC(opr)</sub> = C<sub>PD</sub> × V<sub>CC</sub> × f<sub>IN</sub> + I<sub>CC</sub>/4 (per gate)

Table 9: Dynamic Switching Characteristics

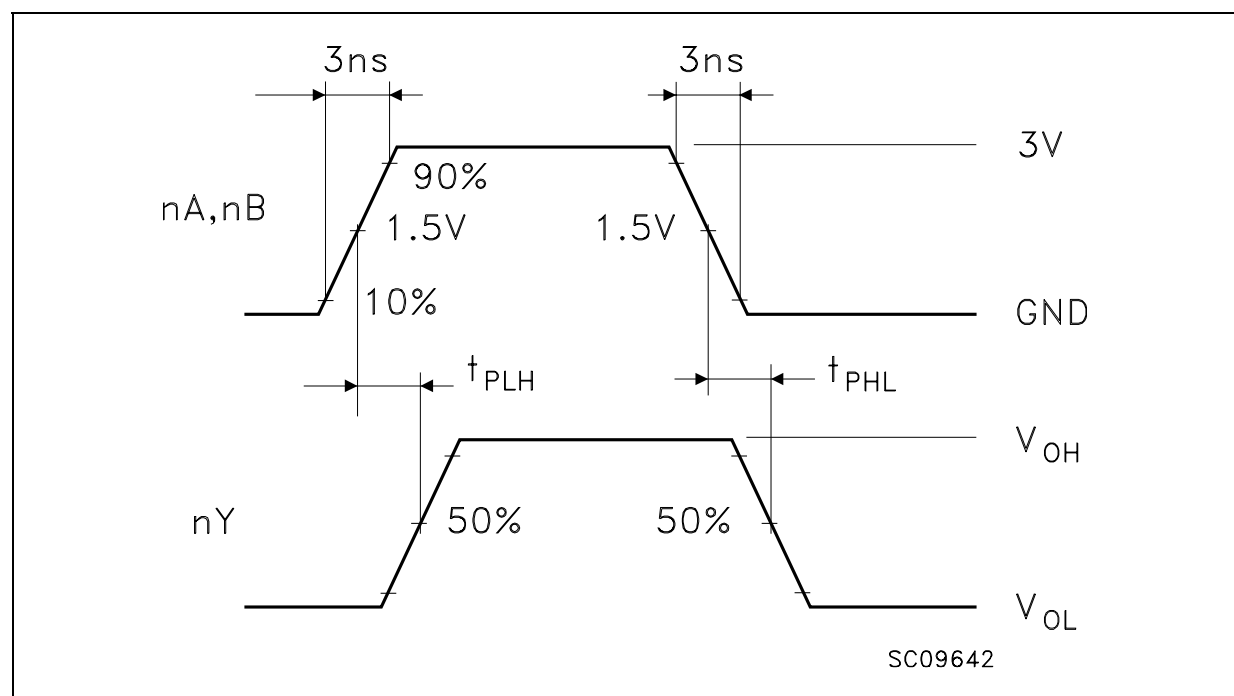
| Symbol           | Parameter                                    | Test Condition         |                        | Value                 |      |      |             |      |              |      |   | Unit |
|------------------|----------------------------------------------|------------------------|------------------------|-----------------------|------|------|-------------|------|--------------|------|---|------|
|                  |                                              | 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>OLP</sub> | Dynamic Low Voltage Quiet Output (note 1, 2) | 5.0                    | C <sub>L</sub> = 50 pF |                       | 0.3  | 0.8  |             |      |              |      | V |      |
| V <sub>OLV</sub> |                                              |                        |                        | -0.8                  | -0.3 |      |             |      |              |      |   |      |
| V <sub>IHD</sub> | Dynamic High Voltage Input (note 1, 3)       | 5.0                    |                        | 2.0                   |      |      |             |      |              |      |   |      |
| V <sub>ILD</sub> | Dynamic Low Voltage Input (note 1, 3)        | 5.0                    |                        |                       |      | 0.8  |             |      |              |      |   |      |

1) Worst case package.  
2) Max number of outputs defined as (n). Data inputs are driven 0V to 3.0V, (n-1) outputs switching and one output at GND.  
3) Max number of data inputs (n) switching. (n-1) switching 0V to 3.0V. Inputs under test switching: 3.0V to threshold (V<sub>ILD</sub>), 0V to threshold (V<sub>IHD</sub>), f=1MHz.

Figure 3: Test Circuit



C<sub>L</sub> =15/50pF or equivalent (includes jig and probe capacitance)  
R<sub>T</sub> = Z<sub>OUT</sub> of pulse generator (typically 50Ω)

**Figure 4: Waveform: Propagation Delays** ( $f=1\text{MHz}$ ; 50% duty cycle)

SO-14 MECHANICAL DATA

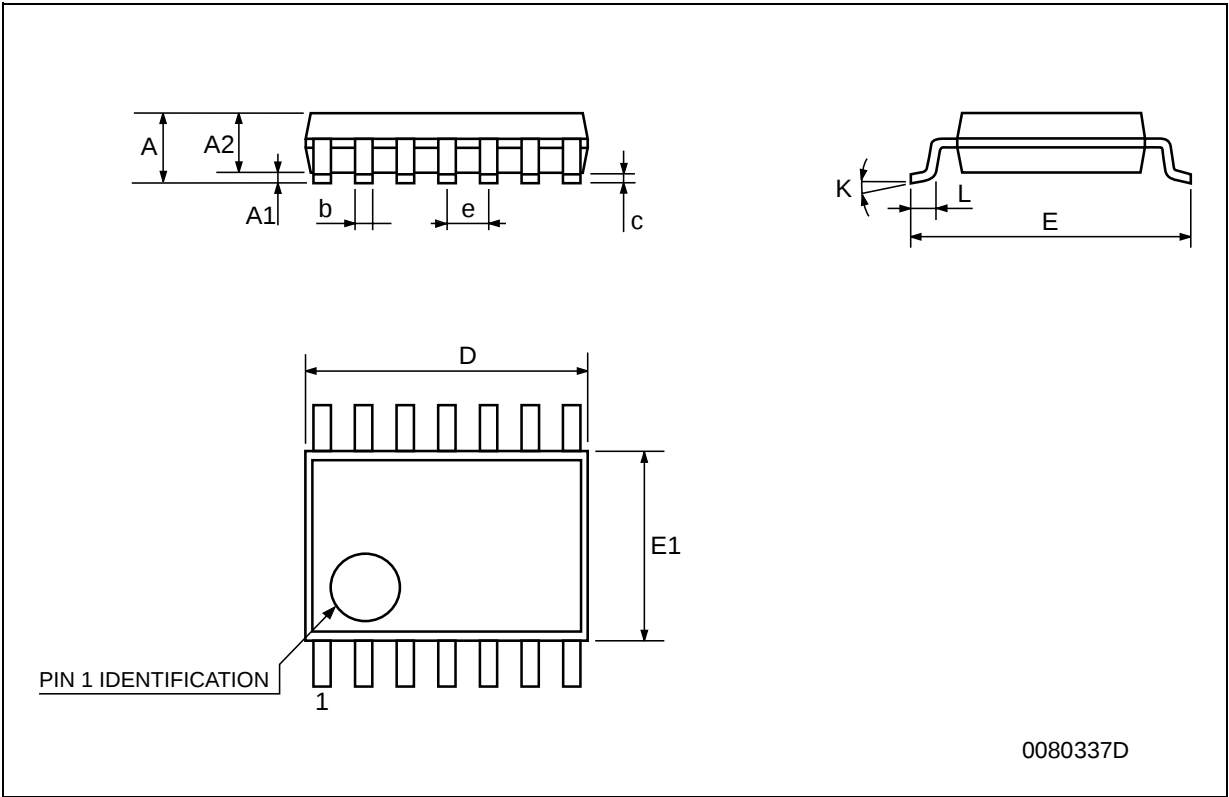
| DIM. | mm.  |      |       | inch  |       |       |
|------|------|------|-------|-------|-------|-------|
|      | MIN. | TYP  | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 1.35 |      | 1.75  | 0.053 |       | 0.069 |
| A1   | 0.1  |      | 0.25  | 0.004 |       | 0.010 |
| A2   | 1.10 |      | 1.65  | 0.043 |       | 0.065 |
| B    | 0.33 |      | 0.51  | 0.013 |       | 0.020 |
| C    | 0.19 |      | 0.25  | 0.007 |       | 0.010 |
| D    | 8.55 |      | 8.75  | 0.337 |       | 0.344 |
| E    | 3.8  |      | 4.0   | 0.150 |       | 0.157 |
| e    |      | 1.27 |       |       | 0.050 |       |
| H    | 5.8  |      | 6.2   | 0.228 |       | 0.244 |
| h    | 0.25 |      | 0.50  | 0.010 |       | 0.020 |
| L    | 0.4  |      | 1.27  | 0.016 |       | 0.050 |
| k    | 0°   |      | 8°    | 0°    |       | 8°    |
| ddd  |      |      | 0.100 |       |       | 0.004 |



0016019D

TSSOP14 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  |



Tape & Reel SO-14 MECHANICAL DATA

| DIM. | mm.  |     |      | inch  |      |        |
|------|------|-----|------|-------|------|--------|
|      | MIN. | TYP | MAX. | MIN.  | TYP. | MAX.   |
| A    |      |     | 330  |       |      | 12.992 |
| C    | 12.8 |     | 13.2 | 0.504 |      | 0.519  |
| D    | 20.2 |     |      | 0.795 |      |        |
| N    | 60   |     |      | 2.362 |      |        |
| T    |      |     | 22.4 |       |      | 0.882  |
| Ao   | 6.4  |     | 6.6  | 0.252 |      | 0.260  |
| Bo   | 9    |     | 9.2  | 0.354 |      | 0.362  |
| Ko   | 2.1  |     | 2.3  | 0.082 |      | 0.090  |
| Po   | 3.9  |     | 4.1  | 0.153 |      | 0.161  |
| P    | 7.9  |     | 8.1  | 0.311 |      | 0.319  |



# Tape & Reel TSSOP14 MECHANICAL DATA

| DIM. | mm.  |     |      | inch  |      |        |
|------|------|-----|------|-------|------|--------|
|      | MIN. | TYP | MAX. | MIN.  | TYP. | MAX.   |
| A    |      |     | 330  |       |      | 12.992 |
| C    | 12.8 |     | 13.2 | 0.504 |      | 0.519  |
| D    | 20.2 |     |      | 0.795 |      |        |
| N    | 60   |     |      | 2.362 |      |        |
| T    |      |     | 22.4 |       |      | 0.882  |
| Ao   | 6.7  |     | 6.9  | 0.264 |      | 0.272  |
| Bo   | 5.3  |     | 5.5  | 0.209 |      | 0.217  |
| Ko   | 1.6  |     | 1.8  | 0.063 |      | 0.071  |
| Po   | 3.9  |     | 4.1  | 0.153 |      | 0.161  |
| P    | 7.9  |     | 8.1  | 0.311 |      | 0.319  |



**Table 10: Revision History**

| <b>Date</b> | <b>Revision</b> | <b>Description of Changes</b>  |
|-------------|-----------------|--------------------------------|
| 16-Dec-2004 | 4               | Order Codes Revision - pag. 1. |

Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

The ST logo is a registered trademark of STMicroelectronics

All other names are the property of their respective owners

© 2004 STMicroelectronics - All Rights Reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

[www.st.com](http://www.st.com)