

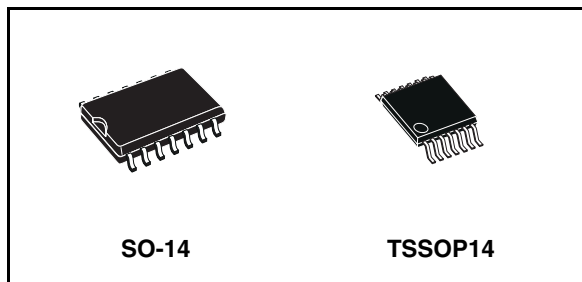


## 74LCX125

### Low voltage CMOS quad bus buffer (3-State) with 5V tolerant inputs and outputs

#### Features

- 5V tolerant inputs and outputs
- High speed:
  - $t_{PD} = 5.2\text{ns}$  (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 24mA
- Balanced propagation delays:
  - $t_{PLH} \cong t_{PHL}$
- Operating voltage range:
  - $V_{CC}(\text{Opr}) = 2.0\text{V}$  to  $3.6\text{V}$
- Pin and function compatible with 74 series 125
- Latch-up performance exceeds 500mA (JESD 17)
- ESD performance:
  - HBM > 2000V (MIL STD 883 method 3015); MM > 200V



#### Description

The 74LCX125 is a low voltage CMOS quad bus buffer 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 both inputs and outputs.

The device requires the 3-STATE control input  $\overline{G}$  to be set high to place the output in to the high impedance state.

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.

#### Order codes

| Part number | Package | Packaging     |
|-------------|---------|---------------|
| 74LCX125MTR | SO-14   | Tape and reel |
| 74LCX125TTR | TSSOP14 | Tape and reel |

# Contents

|          |                                                 |           |
|----------|-------------------------------------------------|-----------|
| <b>1</b> | <b>Logic symbols and I/O equivalent circuit</b> | <b>3</b>  |
| <b>2</b> | <b>Pin settings</b>                             | <b>4</b>  |
| 2.1      | Pin connection                                  | 4         |
| 2.2      | Pin description                                 | 4         |
| 2.3      | Truth table                                     | 4         |
| <b>3</b> | <b>Maximum rating</b>                           | <b>5</b>  |
| 3.1      | Recommended operating conditions                | 5         |
| <b>4</b> | <b>Electrical characteristics</b>               | <b>6</b>  |
| <b>5</b> | <b>Test circuit</b>                             | <b>8</b>  |
| <b>6</b> | <b>Waveforms</b>                                | <b>9</b>  |
| <b>7</b> | <b>Package mechanical data</b>                  | <b>10</b> |
| <b>8</b> | <b>Revision history</b>                         | <b>15</b> |

# 1 Logic symbols and I/O equivalent circuit

Figure 1. IEC logic symbols

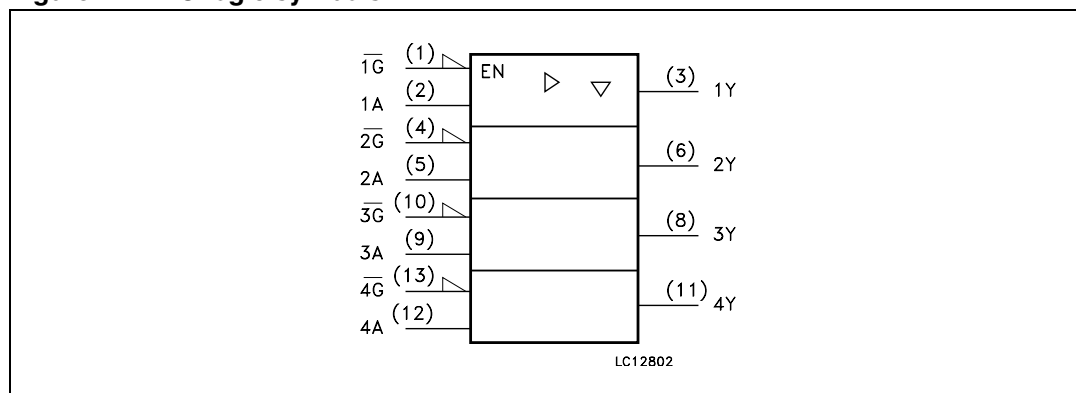
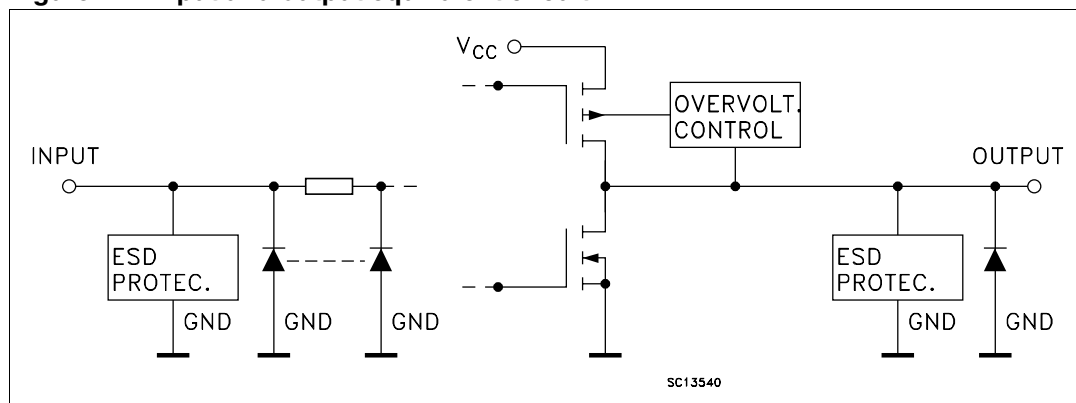


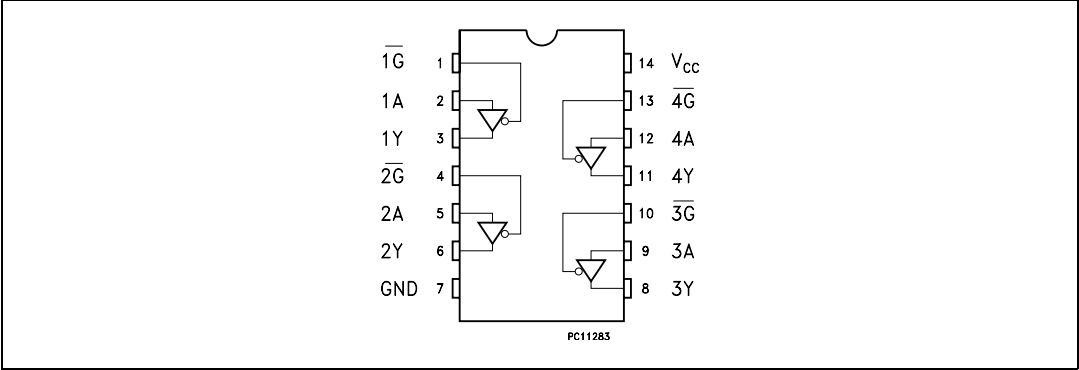
Figure 2. Input and output equivalent circuit



## 2 Pin settings

### 2.1 Pin connection

Figure 3. Pin connection (top through view)



### 2.2 Pin description

Table 1. Pin description

| Pin N°       | Symbol                             | Name and function       |
|--------------|------------------------------------|-------------------------|
| 1, 4, 10, 13 | $1\overline{G}$ TO $4\overline{G}$ | Output enable input     |
| 2, 5, 9, 12  | 1A TO 4A                           | Data inputs             |
| 3, 6, 8, 11  | 1Y TO 4Y                           | Data outputs            |
| 7            | GND                                | Ground (0V)             |
| 14           | $V_{CC}$                           | Positive supply voltage |

### 2.3 Truth table

Table 2. Truth table

| Inputs           |                | Outputs          |
|------------------|----------------|------------------|
| A                | $\overline{G}$ | Y                |
| X <sup>(1)</sup> | H              | Z <sup>(2)</sup> |
| L                | L              | L                |
| H                | L              | H                |

1. Do not care

2. High impedance

### 3 Maximum rating

stressing the device above the rating listed in the “absolute maximum ratings” table may cause permanent damage to the device. these are stress ratings only and operation of the device at these or any other conditions above those indicated in the operating sections of this specification is not implied. exposure to absolute maximum rating conditions for extended periods may affect device reliability. refer also to the STMicroelectronics sure program and other relevant quality documents.

**Table 3. 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) <sup>(1)</sup> | -0.5 to $V_{CC} + 0.5$ | V    |
| $I_{IK}$  | DC input diode current                               | -50                    | mA   |
| $I_{OK}$  | DC output diode current <sup>(2)</sup>               | -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   |

1.  $I_O$  absolute maximum rating must be observed

2.  $V_O < GND$

#### 3.1 Recommended operating conditions

**Table 4. Recommended operating conditions**

| Symbol           | Parameter                                                     | Value         | Unit |
|------------------|---------------------------------------------------------------|---------------|------|
| $V_{CC}$         | Supply voltage <sup>(1)</sup>                                 | 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                                         | -40 to 85     | °C   |
| dt/dv            | Input Rise and Fall Time <sup>(2)</sup>                       | 0 to 10       | ns/V |

1. Truth table guaranteed: 1.5V to 3.6V

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

## 4 Electrical characteristics

Table 5. DC specifications

| Symbol           | Parameter                             | Test condition         |                                                                                              | 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             | 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             | 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  |      |
|                  |                                       |                        | 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 5.5V                                                                   |                      | ±5   | μA   |
| I <sub>off</sub> | Power OFF leakage current             | 0                      | V <sub>I</sub> or V <sub>O</sub> = 5.5V                                                      |                      | 10   | μA   |
| I <sub>OZ</sub>  | High Impedance Output Leakage Current | 2.7 to 3.6             | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>V <sub>O</sub> = 0 to V <sub>CC</sub> |                      | ±5   | 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> = 3.6 to 5.5V                                               |                      | ±10  |      |
| ΔI <sub>CC</sub> | I incr. per Input                     | 2.7 to 3.6             | V <sub>IH</sub> = V <sub>CC</sub> - 0.6V                                                     |                      | 500  | μA   |

Table 6. 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 <sup>(1)</sup> | 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.

Table 7. 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 |     |      |
|                                        |                                                          |                        |                        |                       |                                         | Min          | Max |      |
| t <sub>PLH</sub> t <sub>PHL</sub>      | Propagation delay time                                   | 2.7                    | 50                     | 500                   | 2.5                                     |              | 6.0 | ns   |
|                                        |                                                          | 3.0 to 3.6             |                        |                       |                                         | 1.0          | 5.2 |      |
| t <sub>PZL</sub> t <sub>PZH</sub>      | Output enable time to HIGH and LOW level                 | 2.7                    | 50                     | 500                   | 2.5                                     | 1.0          | 6.0 | ns   |
|                                        |                                                          | 3.0 to 3.6             |                        |                       |                                         | 1.0          | 5.0 |      |
| t <sub>PLZ</sub> t <sub>PHZ</sub>      | Output disable time to HIGH and LOW level                | 2.7                    | 50                     | 500                   | 2.5                                     | 1.0          | 6.0 | ns   |
|                                        |                                                          | 3.0 to 3.6             |                        |                       |                                         | 1.0          | 5.0 |      |
| t <sub>OSLH</sub><br>t <sub>OSHL</sub> | Output to output skew time <sup>(1)</sup> <sup>(2)</sup> | 3.0 to 3.6             | 50                     | 500                   | 2.5                                     |              | 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

Table 8. 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>                            |                        | 5   |     | pF   |
| C <sub>OUT</sub> | Output capacitance                           | 3.3                    | V <sub>IN</sub> = 0 to V <sub>CC</sub>                            |                        | 10  |     | pF   |
| C <sub>PD</sub>  | Power dissipation capacitance <sup>(1)</sup> | 3.3                    | f <sub>IN</sub> = 10MHz<br>V <sub>IN</sub> = 0 or V <sub>CC</sub> |                        | 37  |     | 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.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/4$  (per gate)

# 5 Test circuit

Figure 4. Test circuit

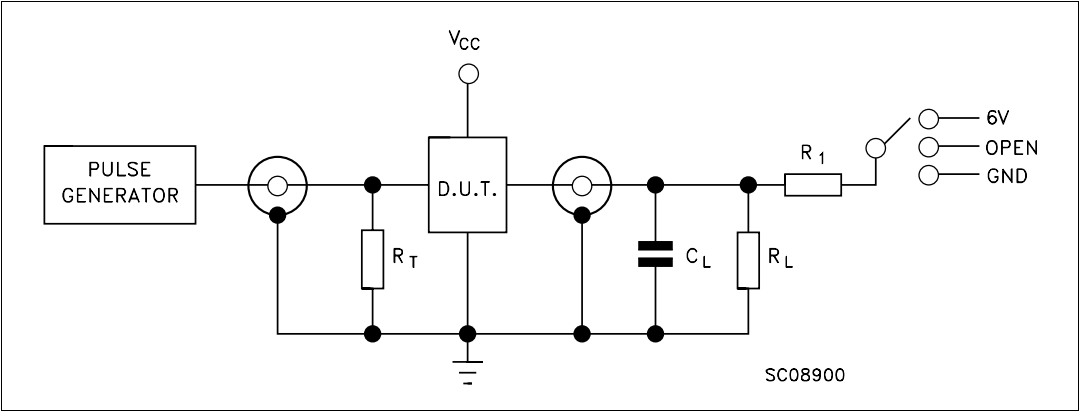


Table 9. Test Circuit

| Test                  | Switch |
|-----------------------|--------|
| $t_{PLH}$ , $t_{PHL}$ | Open   |
| $t_{PZL}$ , $t_{PLZ}$ | 6V     |
| $t_{PZH}$ , $t_{PHZ}$ | GND    |

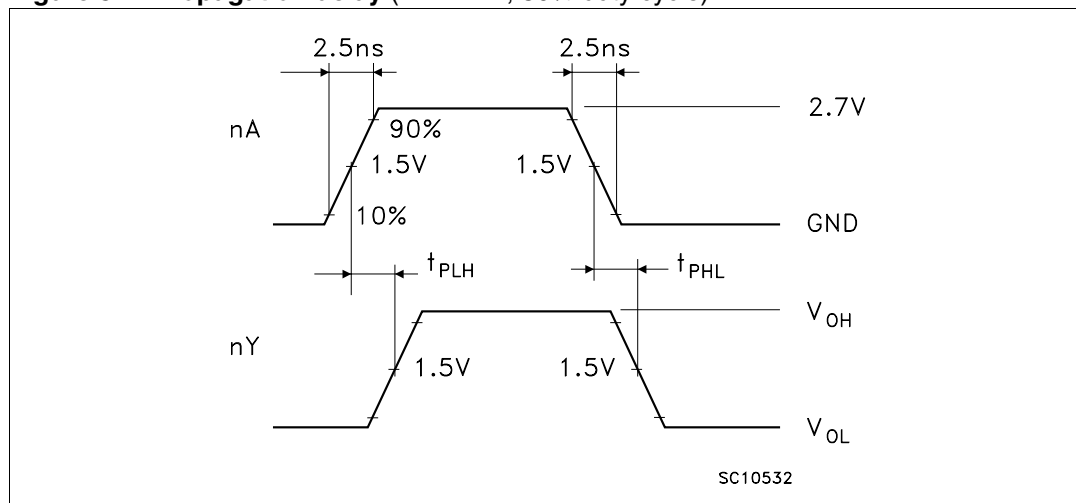
$C_L = 50\text{pF}$  or equivalent (includes jig and probe capacitance)

$R_L = 500\Omega$  or equivalent

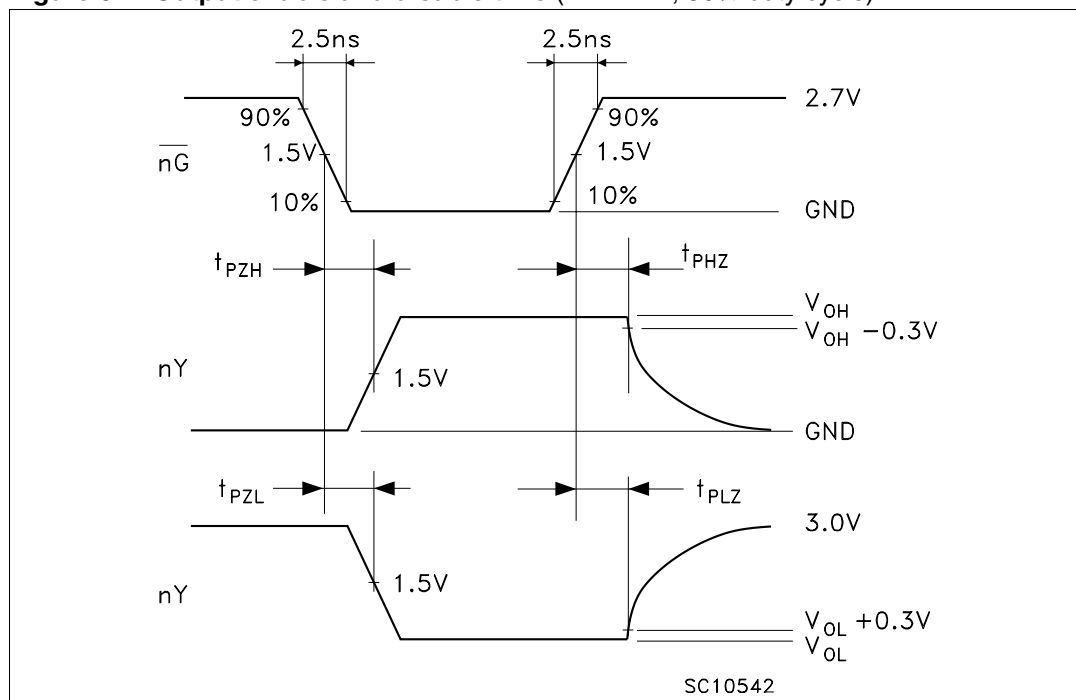
$R_T = Z_{OUT}$  of pulse generator (typically  $50\Omega$ )

## 6 Waveforms

**Figure 5. Propagation delay ( $f = 1\text{MHz}$ ; 50% duty cycle)**



**Figure 6. Output enable and disable time ( $f = 1\text{MHz}$ ; 50% duty cycle)**



## 7 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)

| 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 |

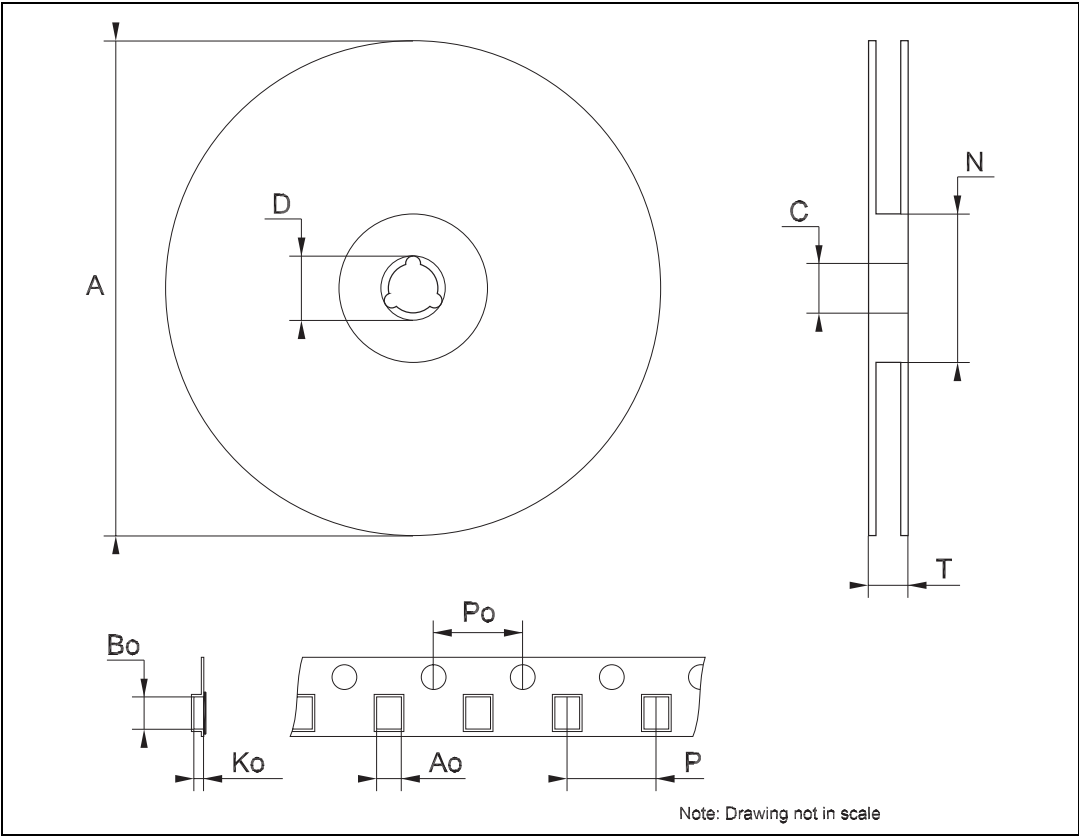
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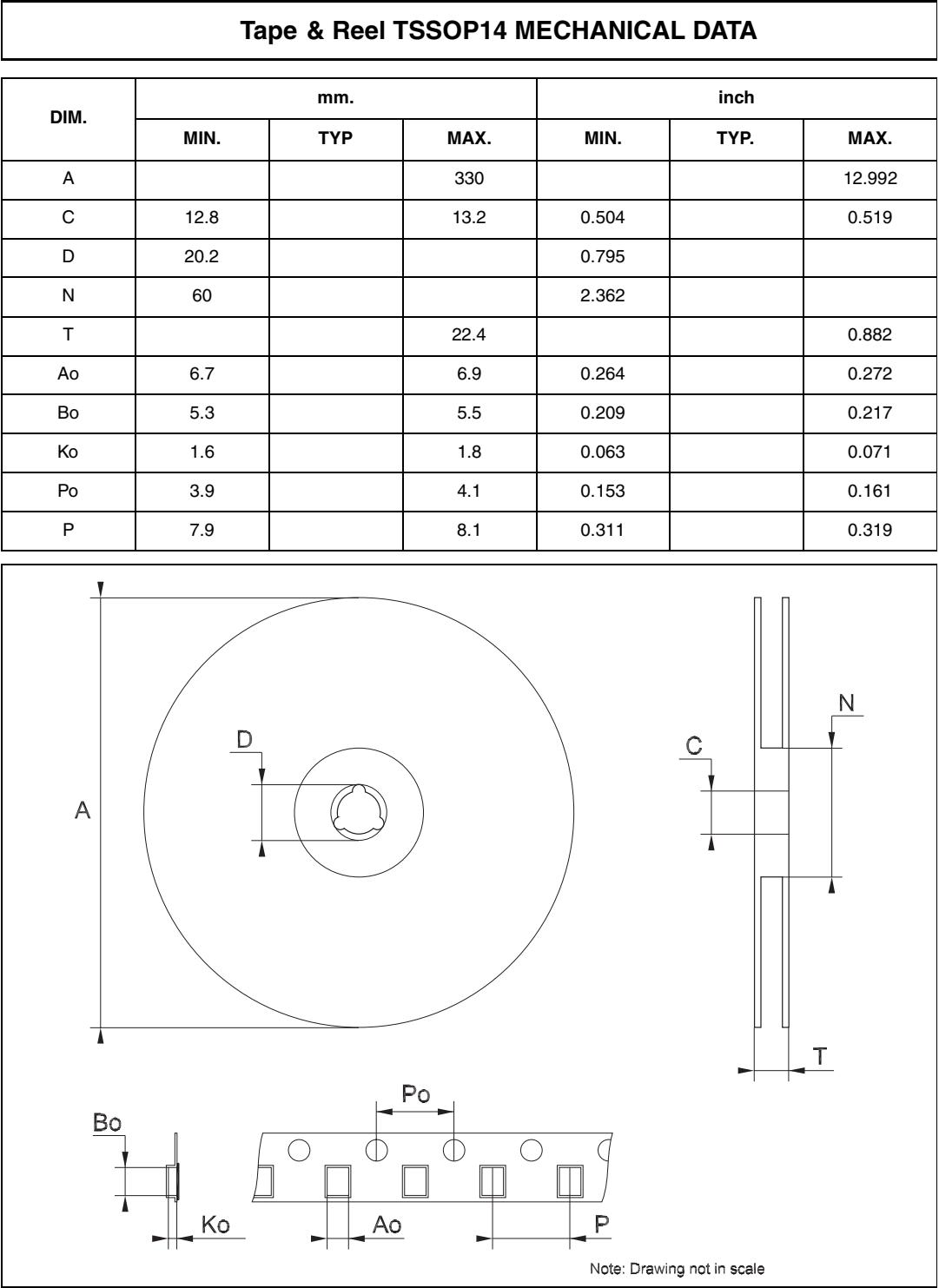
| TSSOP14 MECHANICAL DATA |      |          |      |       |            |        |
|-------------------------|------|----------|------|-------|------------|--------|
| DIM.                    | mm.  |          |      | inch  |            |        |
|                         | MIN. | TYP      | MAX. | 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  |

The diagram illustrates the mechanical specifications of the TSSOP14 package. It includes three views: a top view showing the package footprint with dimensions D (width) and E1 (height), a side view showing the package profile with dimensions A (total height), A1 (lead height), A2 (lead length), b (lead width), c (lead thickness), and E (package width), and a pin 1 identification view showing the location of pin 1. The pin 1 identification is marked with a circle and the number 1. The package is labeled with the part number 0080337D.

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  |





## 8 Revision history

**Table 10. Revision history**

| Date        | Revision | Changes                                  |
|-------------|----------|------------------------------------------|
| 15-Sep-2004 | 5        | Ordering codes revision - pag. 1.        |
| 13-Jul-2006 | 6        | New template, temperature ranges updated |

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