

## SINGLE 2-INPUT OPEN DRAIN NAND GATE

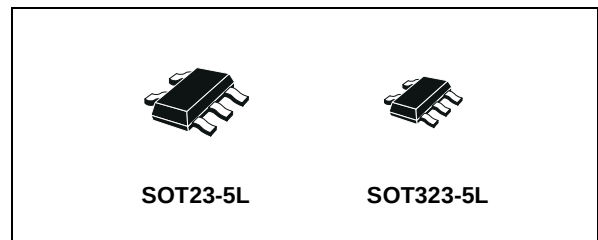
- 5V TOLERANT INPUTS
- HIGH SPEED:  $t_{PD} = 4.2ns$  (MAX.) at  $V_{CC} = 3V$
- LOW POWER DISSIPATION:  
 $I_{CC} = 1\mu A$  (MAX.) at  $T_A = 25^\circ C$
- POWER DOWN PROTECTION ON INPUTS AND OUTPUTS
- OPERATING VOLTAGE RANGE:  
 $V_{CC}(OPR) = 1.65V$  to  $5.5V$   
(1.2V Data Retention)
- IMPROVED LATCH-UP IMMUNITY

### DESCRIPTION

The 74LX1G03 is a low voltage CMOS SINGLE 2-INPUT OPEN DRAIN NAND 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 provide high noise immunity and stable output.

The device can, with an external pull-up resistor, be used in wired AND configuration. This device can also be used as a led driver in any other application requiring current sink.



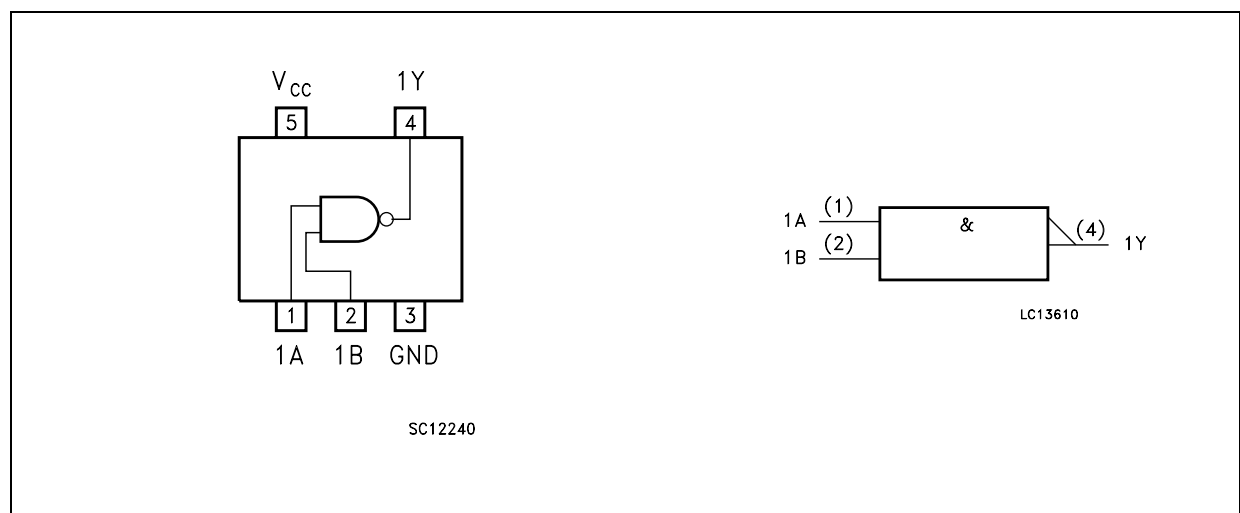
### ORDER CODES

| PACKAGE   | T & R       |
|-----------|-------------|
| SOT23-5L  | 74LX1G03STR |
| SOT323-5L | 74LX1G03CTR |

Power down protection is provided on all inputs 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.

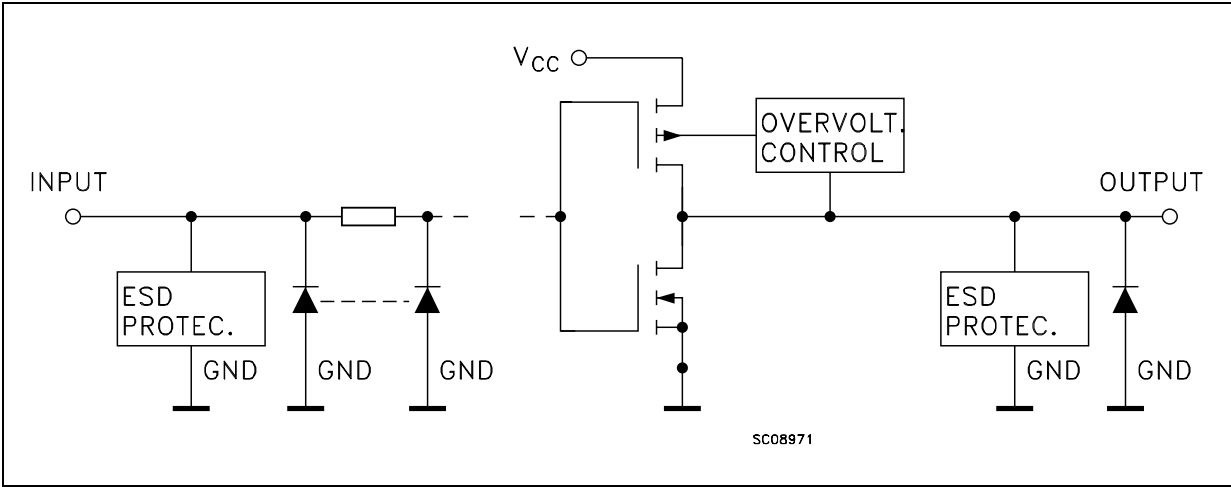
All inputs and outputs are equipped with protection circuits against static discharge.

### PIN CONNECTION AND IEC LOGIC SYMBOLS



74LX1G03

INPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

| PIN No | SYMBOL          | NAME AND FUNCTION       |
|--------|-----------------|-------------------------|
| 1      | 1A              | Data Input              |
| 2      | 1B              | Data Input              |
| 4      | 1Y              | Data Output             |
| 3      | GND             | Ground (0V)             |
| 5      | V <sub>CC</sub> | Positive Supply Voltage |

TRUTH TABLE

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

Z: High Impedance

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) (note 1)      | -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 (note 2)                    | - 50                          | 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 per Supply Pin | ± 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) 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 |
|----------|----------------------------------------------------------------|---------------|------|
| $V_{CC}$ | Supply Voltage (note 1)                                        | 1.65 to 5.5   | 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    |
| $I_{OL}$ | High or Low Level Output Current ( $V_{CC} = 4.5$ to $5.5V$ )  | + 32          | mA   |
| $I_{OL}$ | High or Low Level Output Current ( $V_{CC} = 3.0$ to $3.6V$ )  | + 24          | mA   |
| $I_{OL}$ | High or Low Level Output Current ( $V_{CC} = 2.7$ to $3.0V$ )  | + 12          | mA   |
| $I_{OL}$ | High or Low Level Output Current ( $V_{CC} = 2.3$ to $2.7V$ )  | + 8           | mA   |
| $I_{OL}$ | High or Low Level Output Current ( $V_{CC} = 1.65$ to $2.3V$ ) | + 4           | 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: 1.2V 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              | 1.65 to 1.95           |                                                | 0.75V <sub>CC</sub> |                     | 0.75V <sub>CC</sub> |                     | V    |
|                  |                                       | 2.3 to 2.7             |                                                | 0.7V <sub>CC</sub>  |                     | 0.7V <sub>CC</sub>  |                     |      |
|                  |                                       | 3.0 to 5.5             |                                                | 0.7V <sub>CC</sub>  |                     | 0.7V <sub>CC</sub>  |                     |      |
| V <sub>IL</sub>  | Low Level Input Voltage               | 1.65 to 1.95           |                                                |                     | 0.25V <sub>CC</sub> |                     | 0.25V <sub>CC</sub> | V    |
|                  |                                       | 2.3 to 2.7             |                                                |                     | 0.3V <sub>CC</sub>  |                     | 0.3V <sub>CC</sub>  |      |
|                  |                                       | 3.0 to 5.5             |                                                |                     | 0.3V <sub>CC</sub>  |                     | 0.3V <sub>CC</sub>  |      |
| V <sub>OL</sub>  | Low Level Output Voltage              | 1.65 to 4.5            | I <sub>O</sub> =100 μA                         |                     | 0.1                 |                     | 0.1                 | V    |
|                  |                                       | 1.65                   | I <sub>O</sub> =4 mA                           |                     | 0.45                |                     | 0.45                |      |
|                  |                                       | 2.3                    | I <sub>O</sub> =8 mA                           |                     | 0.3                 |                     | 0.3                 |      |
|                  |                                       | 3.0                    | I <sub>O</sub> =16 mA                          |                     | 0.4                 |                     | 0.4                 |      |
|                  |                                       |                        | I <sub>O</sub> =24 mA                          |                     | 0.55                |                     | 0.55                |      |
|                  |                                       | 4.5                    | I <sub>O</sub> =32 mA                          |                     | 0.55                |                     | 0.55                |      |
| I <sub>OZ</sub>  | High Impedance Output Leakage Current | 3.6                    | V <sub>I</sub> = 0 to 5.5V                     |                     | ± 10                |                     | ± 10                | μA   |
| I <sub>I</sub>   | Input Leakage Current                 | 1.65 to 5.5            | V <sub>I</sub> = 0 to 5.5V                     |                     | ± 10                |                     | ± 10                | 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              | 1.65 to 5.5            | V <sub>I</sub> = V <sub>CC</sub> or GND        |                     | 10                  |                     | 10                  | μA   |
|                  |                                       | 3.6                    | V <sub>I</sub> or V <sub>O</sub> = 3.6 to 5.5V |                     | ± 10                |                     | ± 10                |      |

## AC ELECTRICAL CHARACTERISTICS

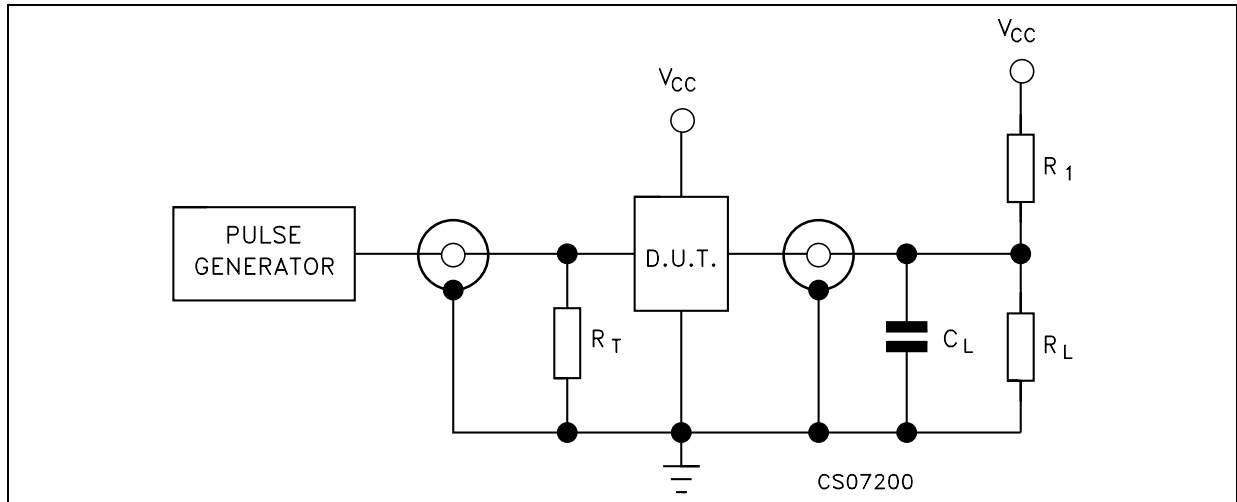
| Symbol           | Parameter              | Test Condition         |                        |                       |                                         | Value        |      |               |      | Unit |
|------------------|------------------------|------------------------|------------------------|-----------------------|-----------------------------------------|--------------|------|---------------|------|------|
|                  |                        | 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>PLZ</sub> | Propagation Delay Time | 1.65 to 1.95           | 30                     | 1000                  | 2.0                                     | 2.4          | 8.3  | 2.4           | 8.3  | ns   |
|                  |                        | 2.3 to 2.7             | 30                     | 500                   | 2.0                                     | 1.0          | 5.5  | 1.0           | 5.5  |      |
|                  |                        | 2.7                    | 50                     | 500                   | 2.5                                     | 1.0          | 5.5  | 1.0           | 5.5  |      |
|                  |                        | 3.0 to 3.6             | 50                     | 500                   | 2.5                                     | 1.5          | 4.2  | 1.5           | 4.2  |      |
|                  |                        | 4.5 to 5.5             | 50                     | 500                   | 2.5                                     | 1            | 3.5  | 1             | 3.5  |      |
| t <sub>PZL</sub> | Propagation Delay Time | 1.65 to 1.95           | 30                     | 1000                  | 2.0                                     | 2.4          | 8.3  | 2.4           | 8.3  | ns   |
|                  |                        | 2.3 to 2.7             | 30                     | 500                   | 2.0                                     | 1.0          | 5.5  | 1.0           | 5.5  |      |
|                  |                        | 2.7                    | 50                     | 500                   | 2.5                                     | 1.0          | 5.5  | 1.0           | 5.5  |      |
|                  |                        | 3.0 to 3.6             | 50                     | 500                   | 2.5                                     | 1.5          | 4.2  | 1.5           | 4.2  |      |
|                  |                        | 4.5 to 5.5             | 50                     | 500                   | 2.5                                     | 1            | 3.5  | 1             | 3.5  |      |

## 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                         |                        | V <sub>IN</sub> = 0 or V <sub>CC</sub> |                        | 4    |      | pF   |
| C <sub>OUT</sub> | Output Capacitance                        |                        | V <sub>IN</sub> = 0 or V <sub>CC</sub> |                        | 5    | 10   | pF   |
| C <sub>PD</sub>  | Power Dissipation Capacitance<br>(note 1) | 1.8                    | f <sub>IN</sub> = 10MHz                |                        | 21   |      | pF   |
|                  |                                           | 2.5                    |                                        |                        | 24   |      |      |
|                  |                                           | 3.3                    |                                        |                        | 26   |      |      |

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.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}$

## TEST CIRCUIT

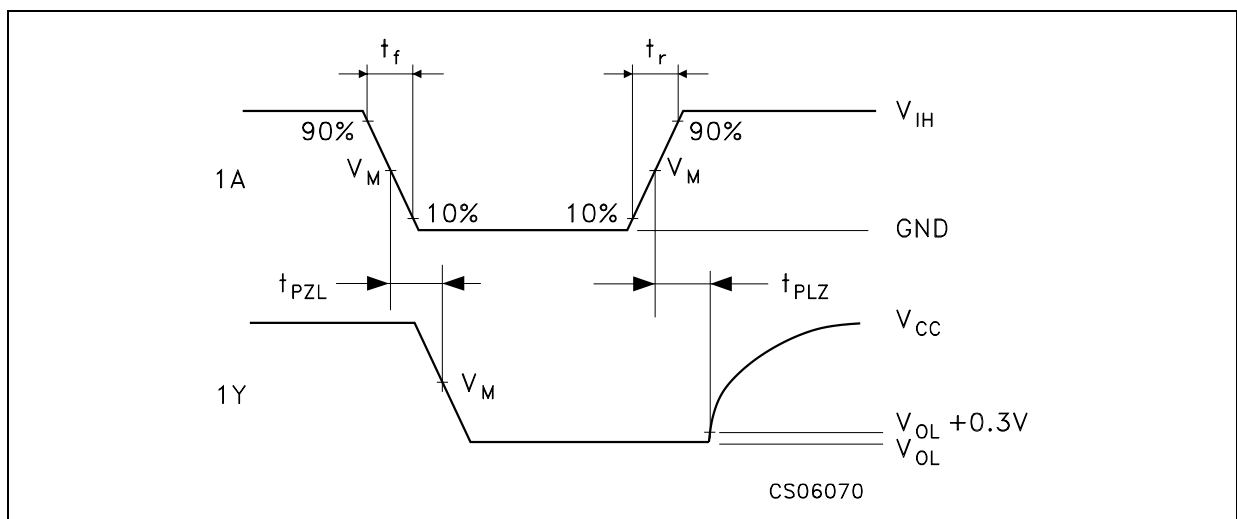


$R_T = Z_{OUT}$  of pulse generator (typically 50Ω)

## TEST CIRCUIT AND WAVEFORM SYMBOL VALUE

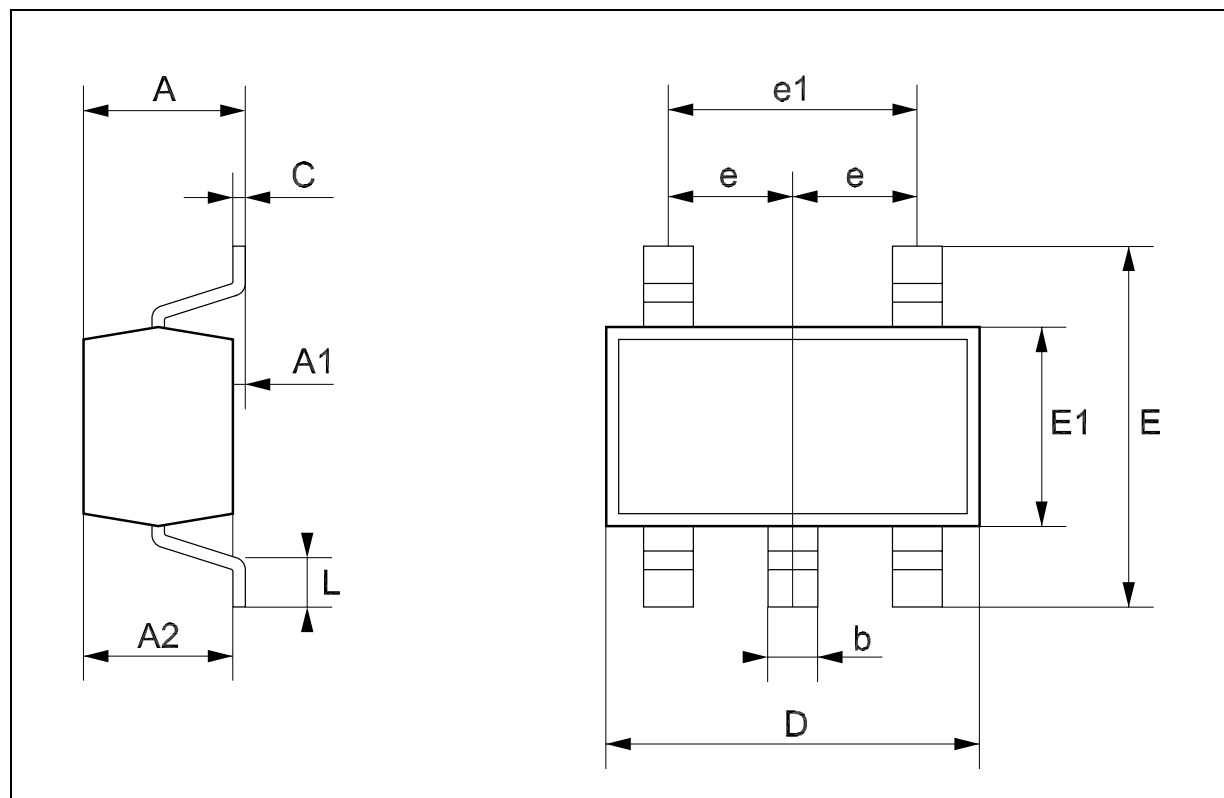
| Symbol      | $V_{CC}$      |             |             |
|-------------|---------------|-------------|-------------|
|             | 1.65 to 1.95V | 2.3 to 2.7V | 2.7 to 5.5V |
| $C_L$       | 30pF/50pF     | 30pF/50pF   | 50pF        |
| $R_L = R_1$ | 1000Ω         | 500Ω        | 500Ω        |
| $V_{IH}$    | $V_{CC}$      | $V_{CC}$    | $V_{CC}$    |
| $V_M$       | $V_{CC}/2$    | $V_{CC}/2$  | $V_{CC}/2$  |
| $t_r = t_f$ | <2.0ns        | <2.0ns      | <2.5ns      |

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



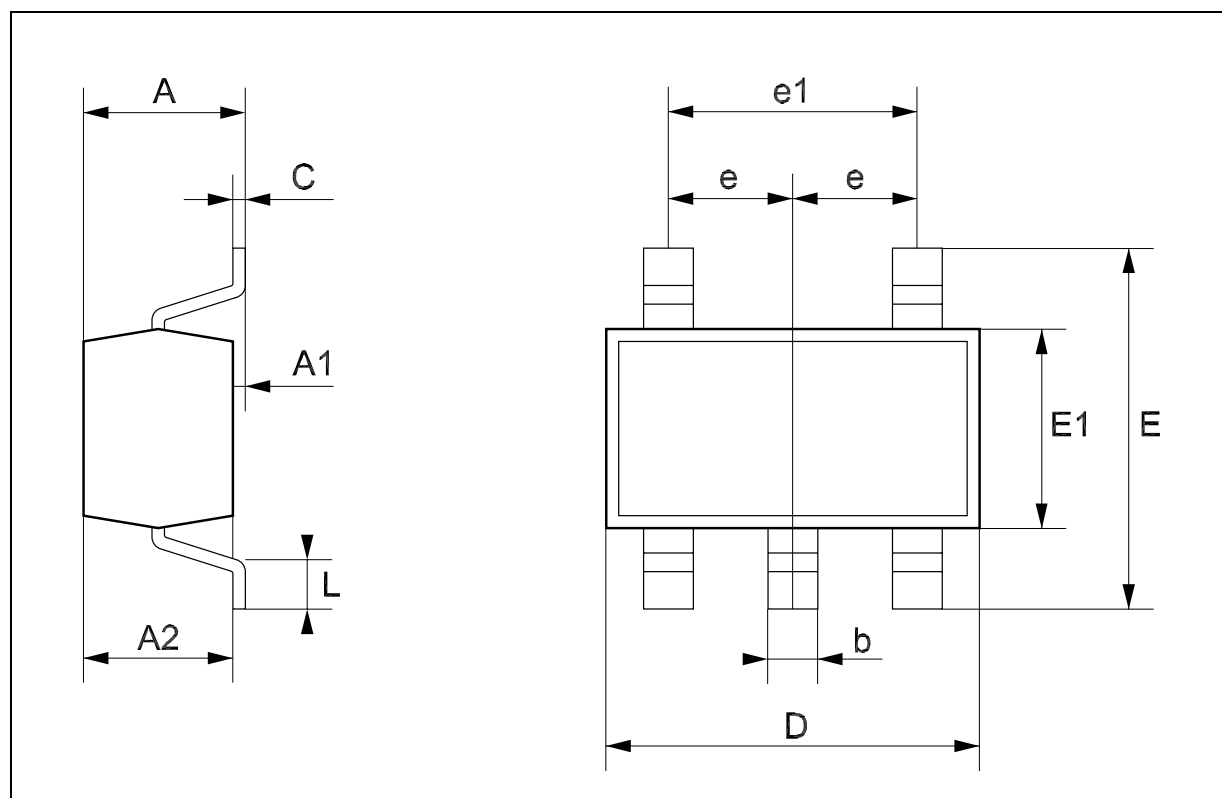
## SOT23-5L MECHANICAL DATA

| DIM. | mm.  |      |      | mils  |      |       |
|------|------|------|------|-------|------|-------|
|      | MIN. | TYP  | MAX. | MIN.  | TYP. | MAX.  |
| A    | 0.90 |      | 1.45 | 35.4  |      | 57.1  |
| A1   | 0.00 |      | 0.15 | 0.0   |      | 5.9   |
| A2   | 0.90 |      | 1.30 | 35.4  |      | 51.2  |
| b    | 0.35 |      | 0.50 | 13.7  |      | 19.7  |
| C    | 0.09 |      | 0.20 | 3.5   |      | 7.8   |
| D    | 2.80 |      | 3.00 | 110.2 |      | 118.1 |
| E    | 2.60 |      | 3.00 | 102.3 |      | 118.1 |
| E1   | 1.50 |      | 1.75 | 59.0  |      | 68.8  |
| e    |      | 0.95 |      |       | 37.4 |       |
| e1   |      | 1.9  |      |       | 74.8 |       |
| L    | 0.35 |      | 0.55 | 13.7  |      | 21.6  |



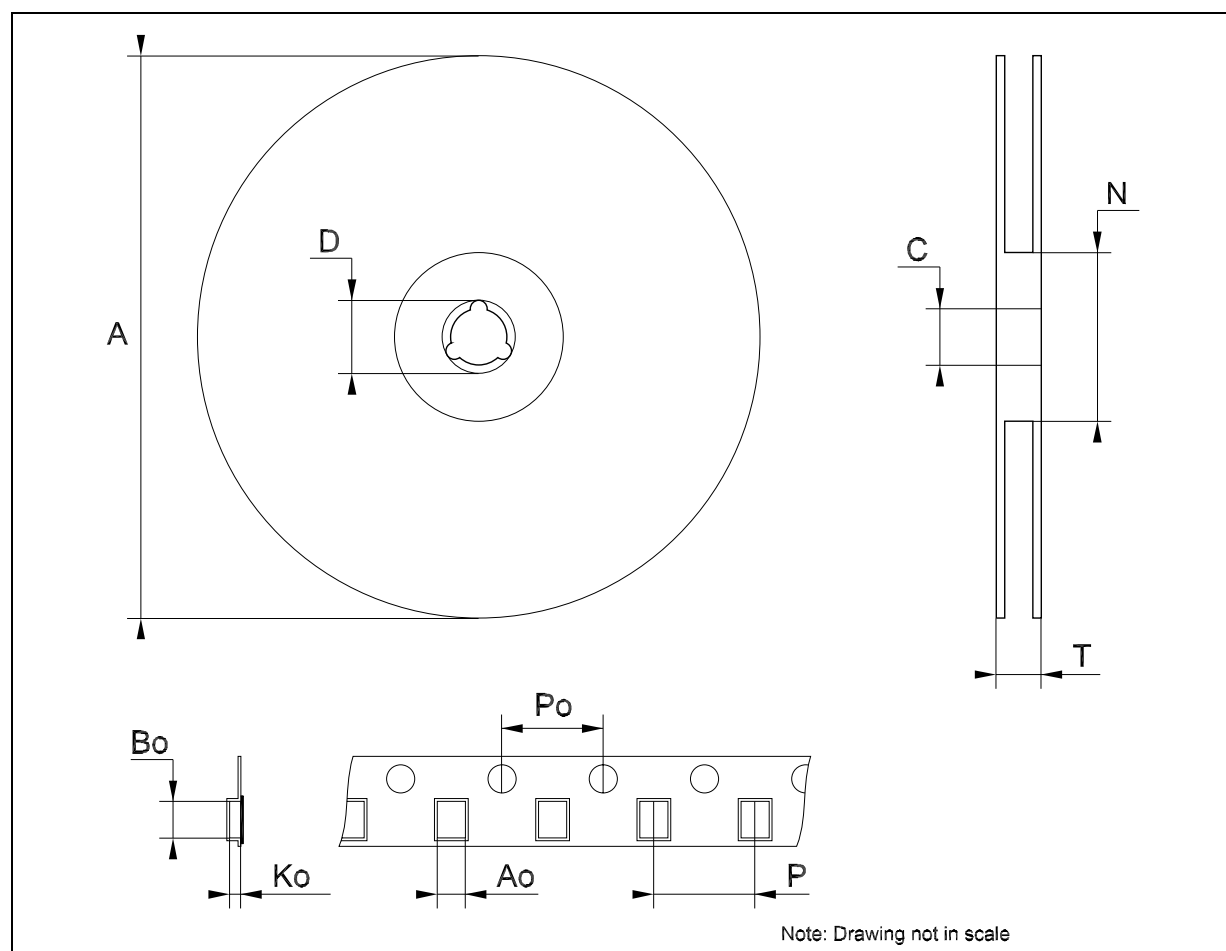
## SOT323-5L MECHANICAL DATA

| DIM. | mm.  |      |      | mils |      |      |
|------|------|------|------|------|------|------|
|      | MIN. | TYP  | MAX. | MIN. | TYP. | MAX. |
| A    | 0.80 |      | 1.10 | 31.5 |      | 43.3 |
| A1   | 0.00 |      | 0.10 | 0.0  |      | 3.9  |
| A2   | 0.80 |      | 1.00 | 31.5 |      | 39.4 |
| b    | 0.15 |      | 0.30 | 5.9  |      | 11.8 |
| C    | 0.10 |      | 0.18 | 3.9  |      | 7.1  |
| D    | 1.80 |      | 2.20 | 70.9 |      | 86.6 |
| E    | 1.80 |      | 2.40 | 70.9 |      | 94.5 |
| E1   | 1.15 |      | 1.35 | 45.3 |      | 53.1 |
| e    |      | 0.65 |      |      | 25.6 |      |
| e1   |      | 1.3  |      |      | 51.2 |      |
| L    | 0.10 |      | 0.30 | 3.9  |      | 11.8 |



## Tape &amp; Reel SOT23-xL MECHANICAL DATA

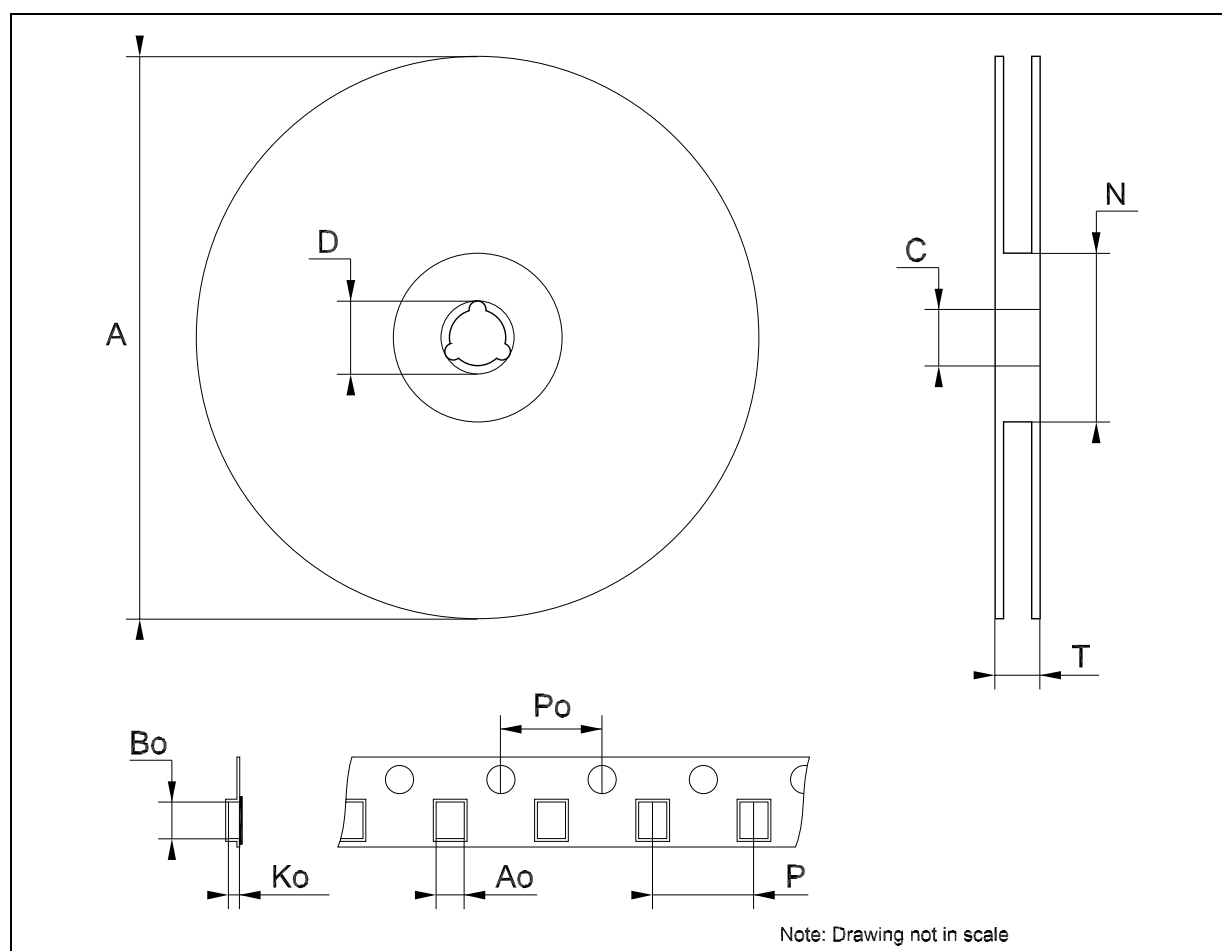
| DIM. | mm.  |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP  | MAX. | MIN.  | TYP.  | MAX.  |
| A    |      |      | 180  |       |       | 7.086 |
| C    | 12.8 | 13.0 | 13.2 | 0.504 | 0.512 | 0.519 |
| D    | 20.2 |      |      | 0.795 |       |       |
| N    | 60   |      |      | 2.362 |       |       |
| T    |      |      | 14.4 |       |       | 0.567 |
| Ao   | 3.13 | 3.23 | 3.33 | 0.123 | 0.127 | 0.131 |
| Bo   | 3.07 | 3.17 | 3.27 | 0.120 | 0.124 | 0.128 |
| Ko   | 1.27 | 1.37 | 1.47 | 0.050 | 0.054 | 0.058 |
| Po   | 3.9  | 4.0  | 4.1  | 0.153 | 0.157 | 0.161 |
| P    | 3.9  | 4.0  | 4.1  | 0.153 | 0.157 | 0.161 |





# Tape & Reel SOT323-xL MECHANICAL DATA

| DIM. | mm.  |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP  | MAX. | MIN.  | TYP.  | MAX.  |
| A    | 175  | 180  | 185  | 6.889 | 7.086 | 7.283 |
| C    | 12.8 | 13   | 13.2 | 0.504 | 0.512 | 0.519 |
| D    | 20.2 |      |      | 0.795 |       |       |
| N    | 59.5 | 60   | 60.5 |       | 2.362 |       |
| T    |      |      | 14.4 |       |       | 0.567 |
| Ao   |      | 2.25 |      |       | 0.088 |       |
| Bo   |      | 2.7  |      |       | 0.106 |       |
| Ko   |      | 1.2  |      |       | 0.047 |       |
| Po   | 3.98 | 4    | 4.2  | 0.156 | 0.157 | 0.165 |
| P    | 3.98 | 4    | 4.2  | 0.156 | 0.157 | 0.165 |



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