



# 74LX1G14

## LOW VOLTAGE CMOS SINGLE SCHMITT INVERTER WITH 5V TOLERANT INPUT

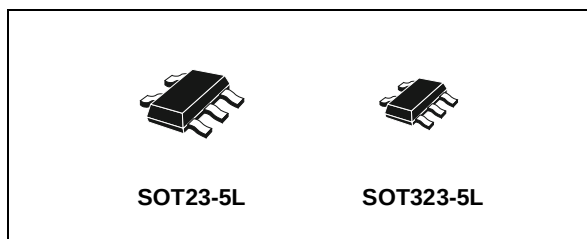
- 5V TOLERANT INPUTS
- HIGH SPEED:  $t_{PD} = 7.5ns$  (MAX.) at  $V_{CC} = 3V$
- LOW POWER DISSIPATION:  
 $I_{CC} = 1\mu A$  (MAX.) at  $T_A = 25^\circ C$
- TYPICAL HYSTERESIS:  $V_h = 1V$  at  $V_{CC} = 4.5V$
- POWER DOWN PROTECTION ON INPUTS AND OUTPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 24mA$  (MIN) at  $V_{CC} = 3V$
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \approx t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC}(OPR) = 1.65V$  to  $5.5V$   
(1.2V Data Retention)
- IMPROVED LATCH-UP IMMUNITY

### DESCRIPTION

The 74LX1G14 is a low voltage CMOS SINGLE SCHMITT INVERTER fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

It is ideal for 1.65 to 5.5  $V_{CC}$  operations and low power and low noise applications. The internal circuit is composed of 3 stages including buffer output, which provide high noise immunity and stable output.

Power down protection is provided on input and output and 0 to 7V can be accepted on inputs with



### ORDER CODES

| PACKAGE   | T & R       |
|-----------|-------------|
| SOT23-5L  | 74LX1G14STR |
| SOT323-5L | 74LX1G14CTR |

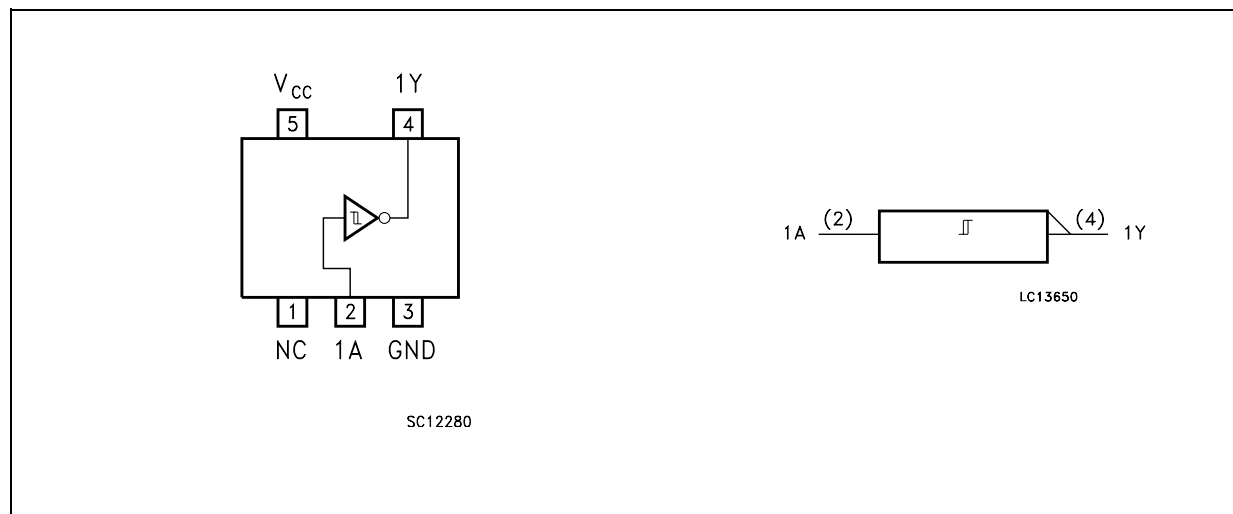
no regard to the supply voltage. It can be interfaced to 5V signal environment for inputs in mixed 3.3/5V system.

Pin configuration and function are the same as those of the 74LX1G04 but the 74LX1G14 has hysteresis.

This together with its schmitt trigger function allows it to be used on line receivers with slow rise/fall input signals.

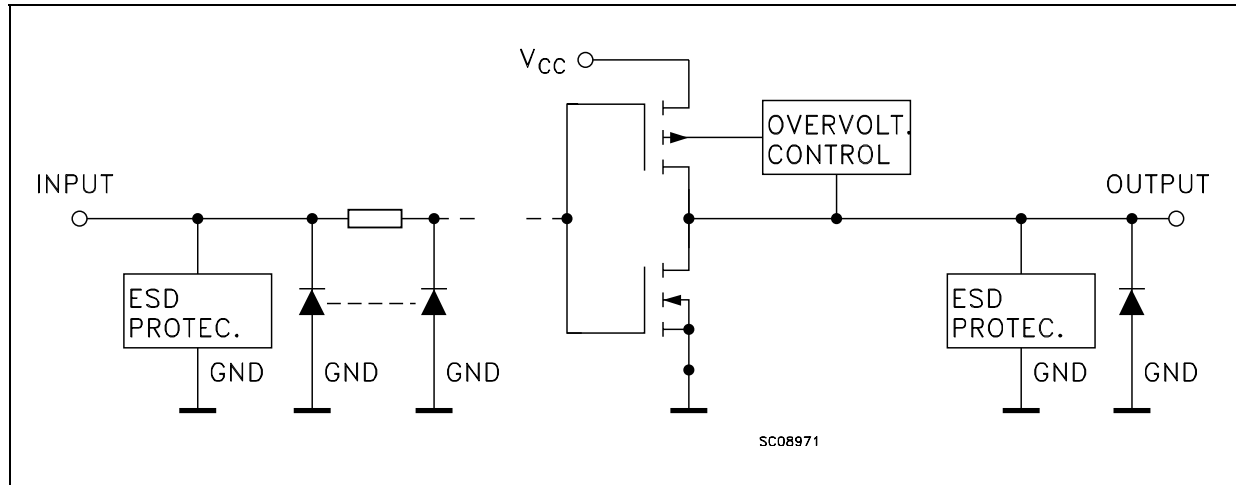
The input is equipped with protection circuits against static discharge, giving it ESD immunity and transient excess voltage.

### PIN CONNECTION AND IEC LOGIC SYMBOLS



## 74LX1G14

### INPUT AND OUTPUT EQUIVALENT CIRCUIT



### PIN DESCRIPTION

| PIN N° | SYMBOL          | NAME AND FUNCTION       |
|--------|-----------------|-------------------------|
| 1      | NC              | Not Connected           |
| 2      | 1A              | Data Input              |
| 4      | 1Y              | Data Output             |
| 3      | GND             | Ground (0V)             |
| 5      | V <sub>CC</sub> | Positive Supply Voltage |

### TRUTH TABLE

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

### 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) Truth Table guaranteed: 1.2V to 3.6V

2) V<sub>IN</sub> from 0.8V to 2V at V<sub>CC</sub> = 3.0V

## 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    |
| $I_{OH}, I_{OL}$ | High or Low Level Output Current ( $V_{CC} = 4.5$ to $5.5V$ )  | $\pm 32$      | mA   |
| $I_{OH}, I_{OL}$ | 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 ( $V_{CC} = 2.7$ to $3.0V$ )  | $\pm 12$      | mA   |
| $I_{OH}, I_{OL}$ | High or Low Level Output Current ( $V_{CC} = 2.3$ to $2.7V$ )  | $\pm 8$       | mA   |
| $I_{OH}, I_{OL}$ | High or Low Level Output Current ( $V_{CC} = 1.65$ to $2.3V$ ) | $\pm 4$       | mA   |
| $T_{op}$         | Operating Temperature                                          | -55 to 125    | °C   |

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>T+</sub>  | Positive Input threshold  | 1.65                   |                                         | 0.79                 | 1.16 | 0.79                 | 1.16 | V    |
|                  |                           | 2.3                    |                                         | 1.11                 | 1.56 | 1.11                 | 1.56 |      |
|                  |                           | 3                      |                                         | 1.5                  | 1.87 | 1.5                  | 1.87 |      |
|                  |                           | 4.5                    |                                         | 2.16                 | 2.74 | 2.16                 | 2.74 |      |
|                  |                           | 5.5                    |                                         | 2.61                 | 3.33 | 2.61                 | 3.33 |      |
| V <sub>T-</sub>  | Negative Input threshold  | 1.65                   |                                         | 0.39                 | 0.62 | 0.39                 | 0.62 | V    |
|                  |                           | 2.3                    |                                         | 0.58                 | 0.87 | 0.58                 | 0.87 |      |
|                  |                           | 3                      |                                         | 0.84                 | 1.14 | 0.84                 | 1.14 |      |
|                  |                           | 4.5                    |                                         | 1.41                 | 1.79 | 1.41                 | 1.79 |      |
|                  |                           | 5.5                    |                                         | 1.87                 | 2.29 | 1.87                 | 2.29 |      |
| V <sub>OH</sub>  | High Level Output Voltage | 1.65 to 4.5            | I <sub>O</sub> =-100 μA                 | V <sub>CC</sub> -0.1 |      | V <sub>CC</sub> -0.1 |      | V    |
|                  |                           | 1.65                   | I <sub>O</sub> =-4 mA                   | 1.2                  |      | 1.2                  |      |      |
|                  |                           | 2.3                    | I <sub>O</sub> =-8 mA                   | 1.9                  |      | 1.9                  |      |      |
|                  |                           | 3.0                    | I <sub>O</sub> =-16 mA                  | 2.4                  |      | 2.4                  |      |      |
|                  |                           |                        | I <sub>O</sub> =-24 mA                  | 2.2                  |      | 2.2                  |      |      |
|                  |                           | 4.5                    | I <sub>O</sub> =-32 mA                  | 3.8                  |      | 3.8                  |      |      |
| 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 |      |
| V <sub>H</sub>   | Hysteresis Voltage        | 1.65                   |                                         | 0.37                 | 0.62 | 0.37                 | 0.62 | V    |
|                  |                           | 2.3                    |                                         | 0.48                 | 0.77 | 0.48                 | 0.77 |      |
|                  |                           | 3                      |                                         | 0.56                 | 0.87 | 0.56                 | 0.87 |      |
|                  |                           | 4.5                    |                                         | 0.71                 | 1.04 | 0.71                 | 1.04 |      |
|                  |                           | 5.5                    |                                         | 0.71                 | 1.11 | 0.71                 | 1.11 |      |
| 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   |

## 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>PLH</sub> t <sub>PHL</sub> | Propagation Delay Time | 1.65 to 1.95           | 15                     | 1MΩ                   | 3.0                                     | 2            | 15.6 | 2             | 15.6 | ns   |
|                                   |                        | 2.3 to 2.7             |                        |                       |                                         | 1            | 9.5  | 1             | 9.5  |      |
|                                   |                        | 3.0 to 3.6             |                        |                       |                                         | 1            | 6.5  | 1             | 6.5  |      |
|                                   |                        | 4.5 to 5.5             |                        |                       |                                         | 0.5          | 5.5  | 0.5           | 5.5  |      |
|                                   |                        | 1.65 to 1.95           | 30                     | 1000                  | 2.0                                     | 1.5          | 10   | 1.5           | 10   |      |
|                                   |                        | 2.3 to 2.7             | 30                     | 500                   | 2.0                                     | 2            | 5.5  | 2             | 5.5  |      |
|                                   |                        | 2.7                    | 50                     | 500                   | 2.5                                     | 1.5          | 5.5  | 1.5           | 5.5  |      |
|                                   |                        | 3.0 to 3.6             | 50                     | 500                   | 2.5                                     | 1.5          | 7.5  | 1.5           | 7.5  |      |
|                                   |                        | 4.5 to 5.5             | 50                     | 500                   | 2.5                                     | 0.8          | 6.2  | 0.8           | 6.2  |      |

(\*) Voltage range is 3.3V ± 0.3V

(\*\*) Voltage range is 5.0V ± 0.5V

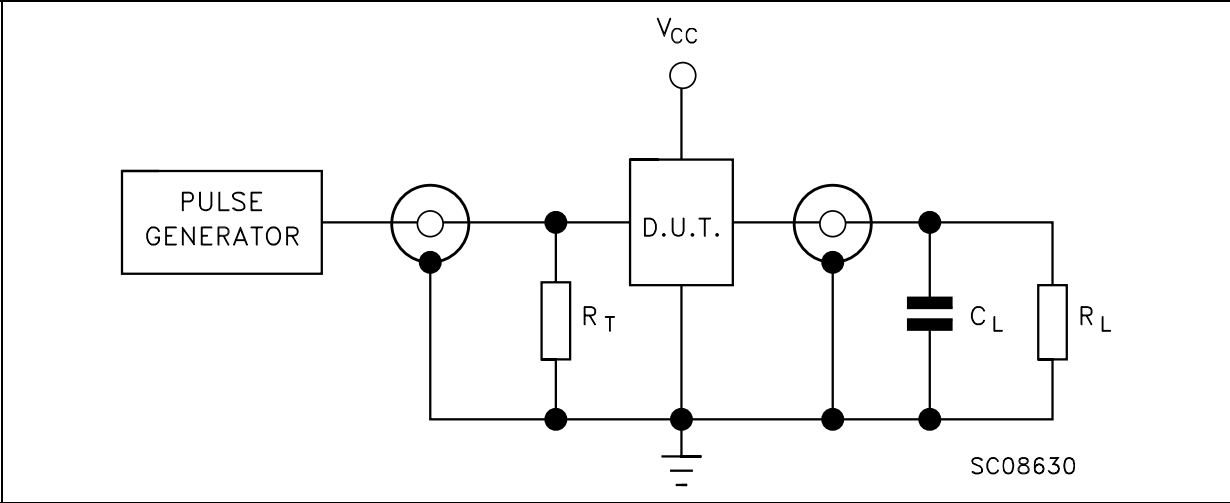
## CAPACITIVE CHARACTERISTICS

| 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                         | 0                      |                         |                        | 4    |      | pF   |
| C <sub>PD</sub> | Power Dissipation Capacitance<br>(note 1) | 1.8                    | f <sub>IN</sub> = 10MHz |                        | 12   |      | pF   |
|                 |                                           | 2.5                    |                         |                        | 18   |      |      |
|                 |                                           | 3.3                    |                         |                        | 24   |      |      |

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

74LX1G14

TEST CIRCUIT

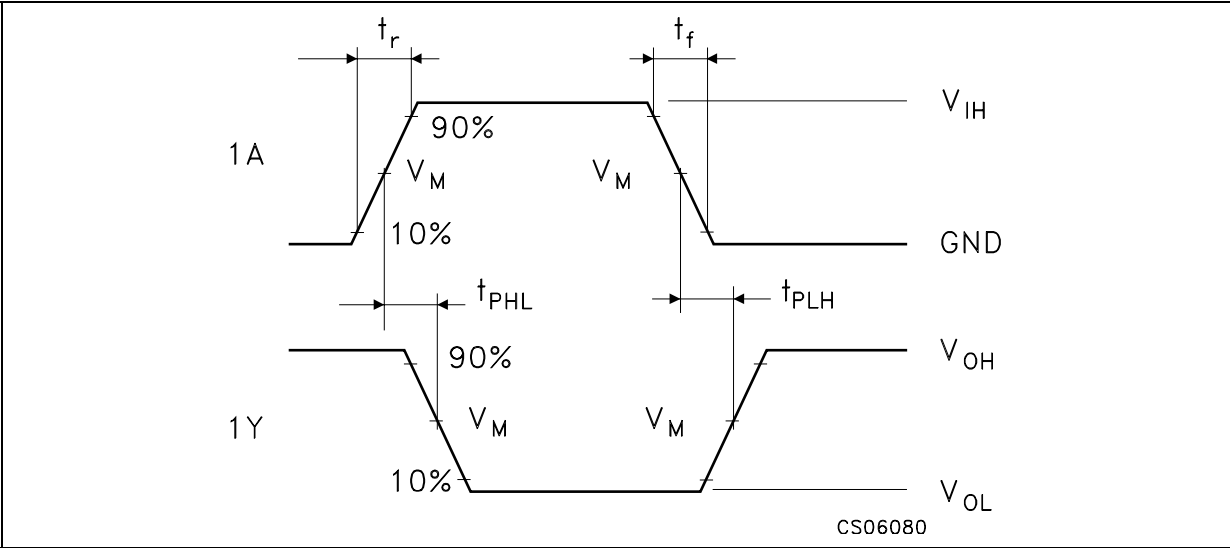


$R_T = Z_{OUT}$  of pulse generator (typically 50 $\Omega$ )

TEST CIRCUIT AND WAVEFORM SYMBOL VALUE

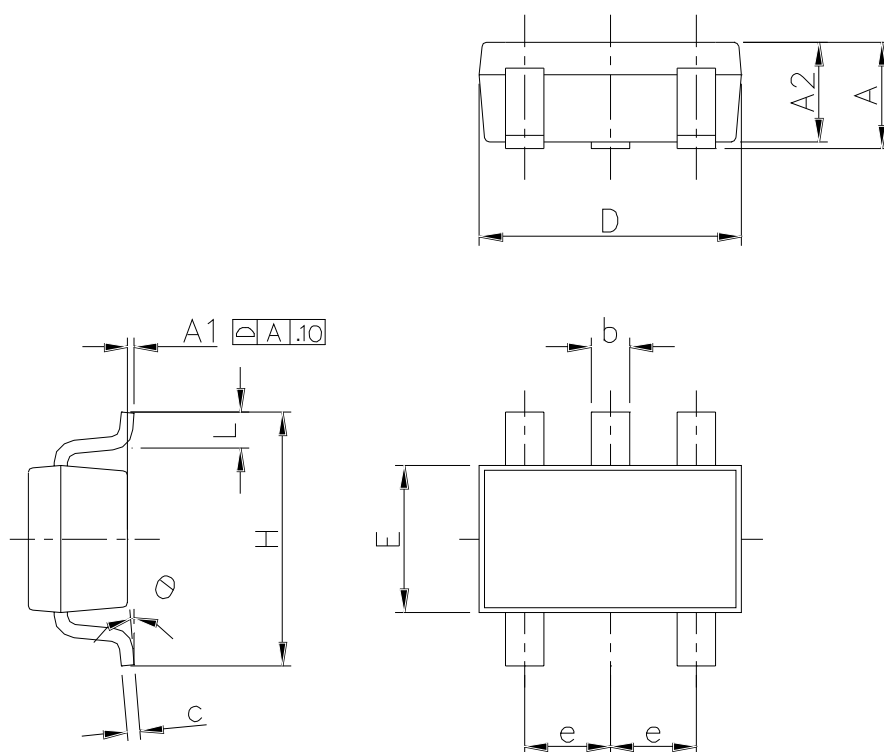
| Symbol      | $V_{CC}$                   |                           |                           |
|-------------|----------------------------|---------------------------|---------------------------|
|             | 1.65 to 1.95V              | 2.3 to 2.7V               | 2.7 to 5.5V               |
| $C_L$       | 15pF/30pF                  | 15pF/30pF                 | 15pF/50pF                 |
| $R_L$       | 1M $\Omega$ /1000 $\Omega$ | 1M $\Omega$ /500 $\Omega$ | 1M $\Omega$ /500 $\Omega$ |
| $V_{IH}$    | $V_{CC}$                   | $V_{CC}$                  | $V_{CC}$                  |
| $V_M$       | $V_{CC}/2$                 | $V_{CC}/2$                | $V_{CC}/2$                |
| $t_r = t_f$ | <2.0ns                     | <2.0ns                    | <2.5ns                    |

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



# SOT23-5L MECHANICAL DATA

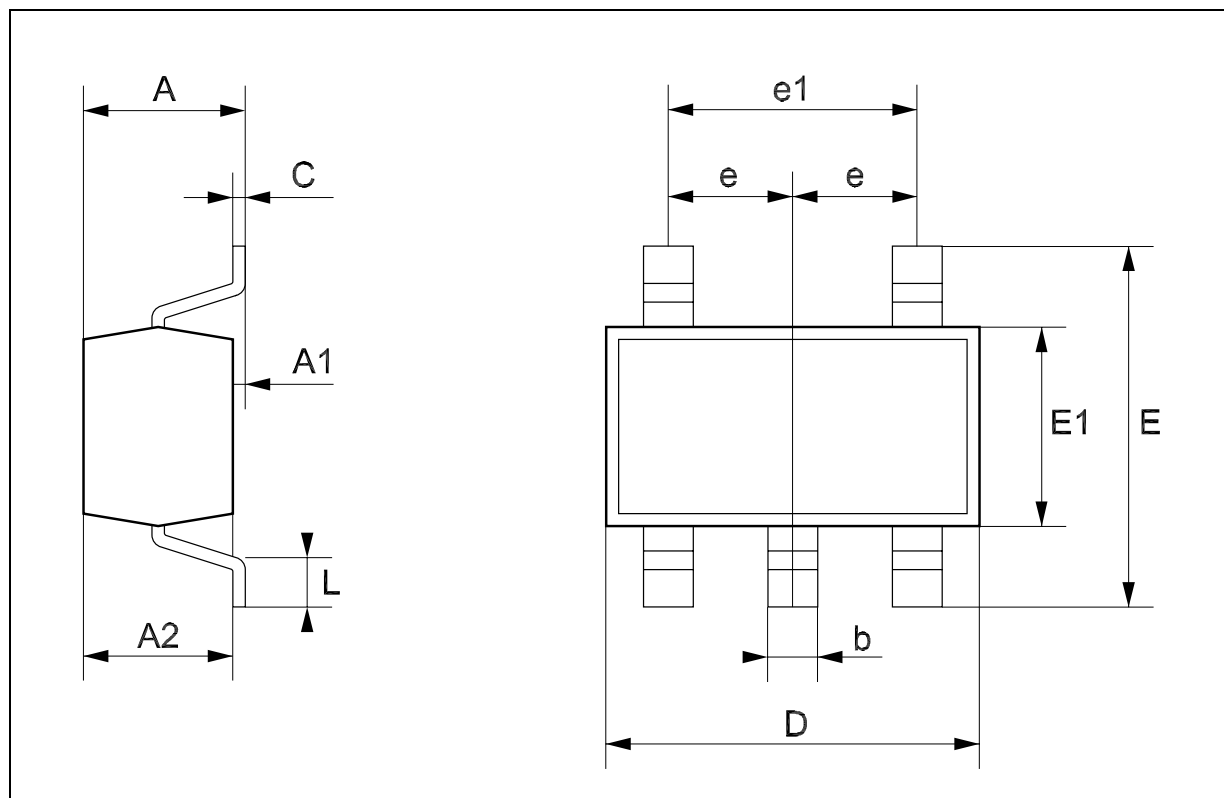
| DIM. | mm.  |      |      | mils  |      |       |
|------|------|------|------|-------|------|-------|
|      | MIN. | TYP  | MAX. | MIN.  | TYP. | MAX.  |
| A    | 0.90 |      | 1.45 | 35.4  |      | 57.1  |
| A1   | 0.00 |      | 0.10 | 0.0   |      | 3.9   |
| A2   | 0.90 |      | 1.30 | 35.4  |      | 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    | 1.50 |      | 1.75 | 59.0  |      | 68.8  |
| e    |      | 0.95 |      |       | 37.4 |       |
| H    | 2.60 |      | 3.00 | 102.3 |      | 118.1 |
| L    | 0.10 |      | 0.60 | 3.9   |      | 23.6  |



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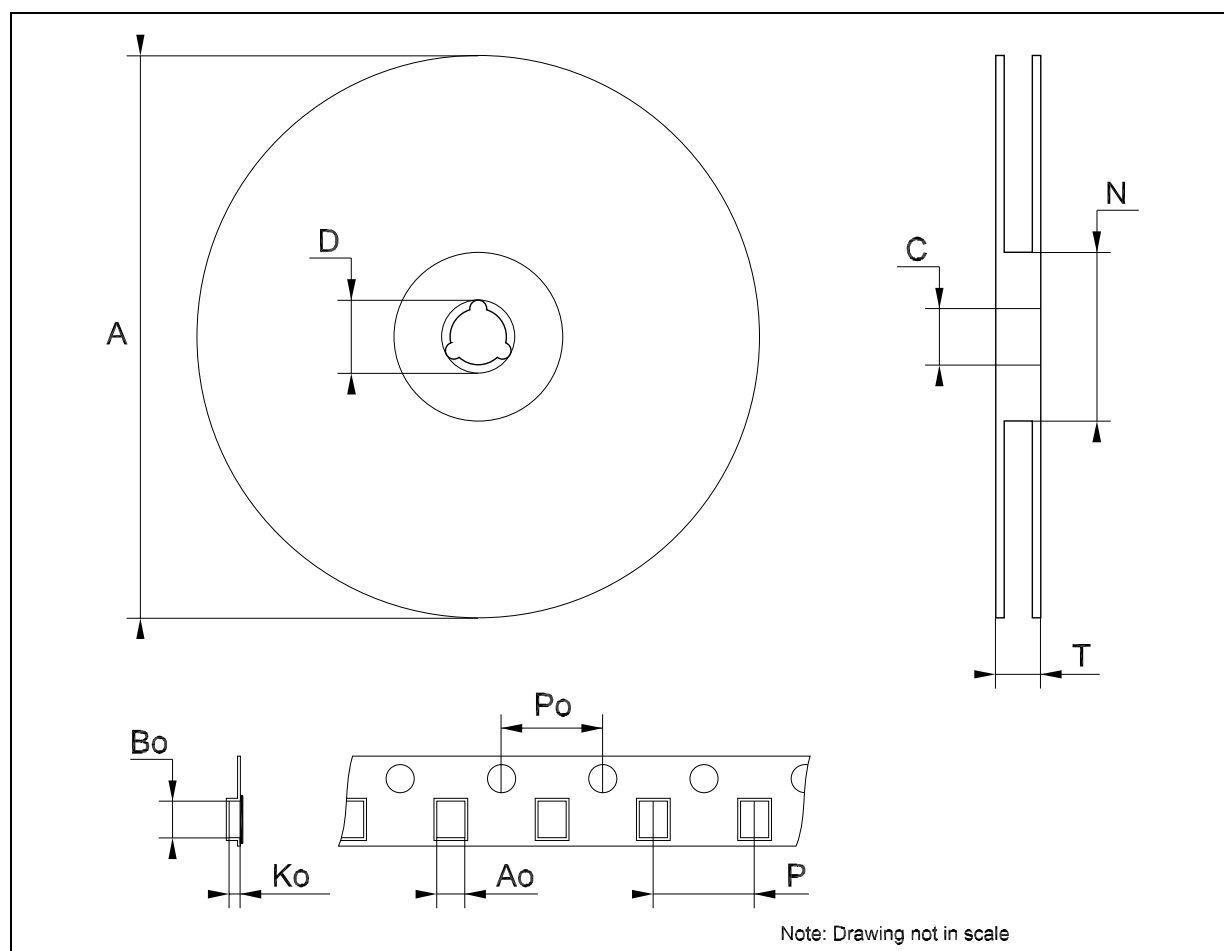
## SOT323-5L MECHANICAL DATA

| 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 |



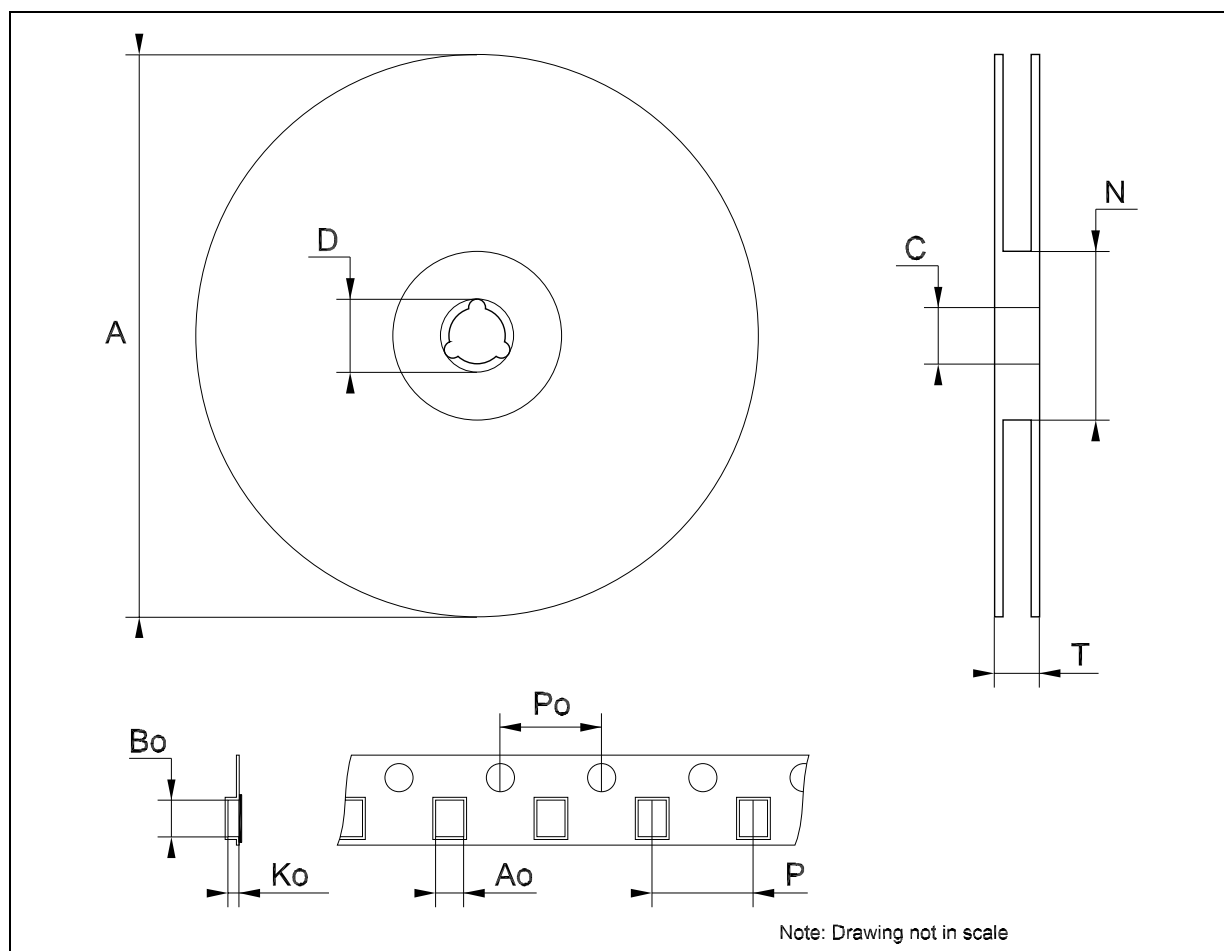
## Tape &amp; Reel SOT23-xL MECHANICAL DATA

| 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 &amp; 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   | 3.9  | 4    | 4.1  | 0.153 | 0.157 | 0.161 |
| P    | 3.8  | 4    | 4.2  | 0.149 | 0.157 | 0.165 |



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