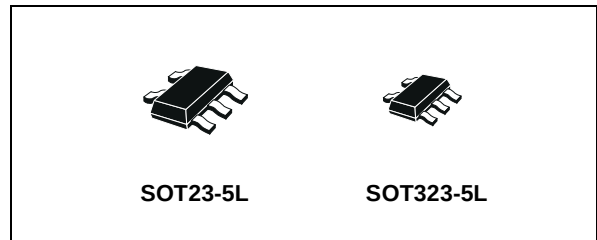


## SINGLE D-TYPE LATCH

- HIGH SPEED:  $t_{PD} = 4.7ns$  (TYP.) at  $V_{CC} = 5V$
- LOW POWER DISSIPATION:  
 $I_{CC} = 1\mu A$  (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
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 8mA$  (MIN) at  $V_{CC} = 4.5V$
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC}(OPR) = 4.5V$  to  $5.5V$
- IMPROVED LATCH-UP IMMUNITY



### ORDER CODES

| PACKAGE   | T & R      |
|-----------|------------|
| SOT23-5L  | 74V1T77STR |
| SOT323-5L | 74V1T77CTR |

### DESCRIPTION

The 74V1T77 is an advanced high-speed CMOS SINGLE D-TYPE LATCH fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology. It is designed to operate from 4.5V to 5.5V, making this device ideal for portable applications.

The single D-Type latch is controlled by an Latch Enable Input (LE). While the LE input is held at a high level, the Q output will follow the data input precisely. When the LE input is taken low the Q

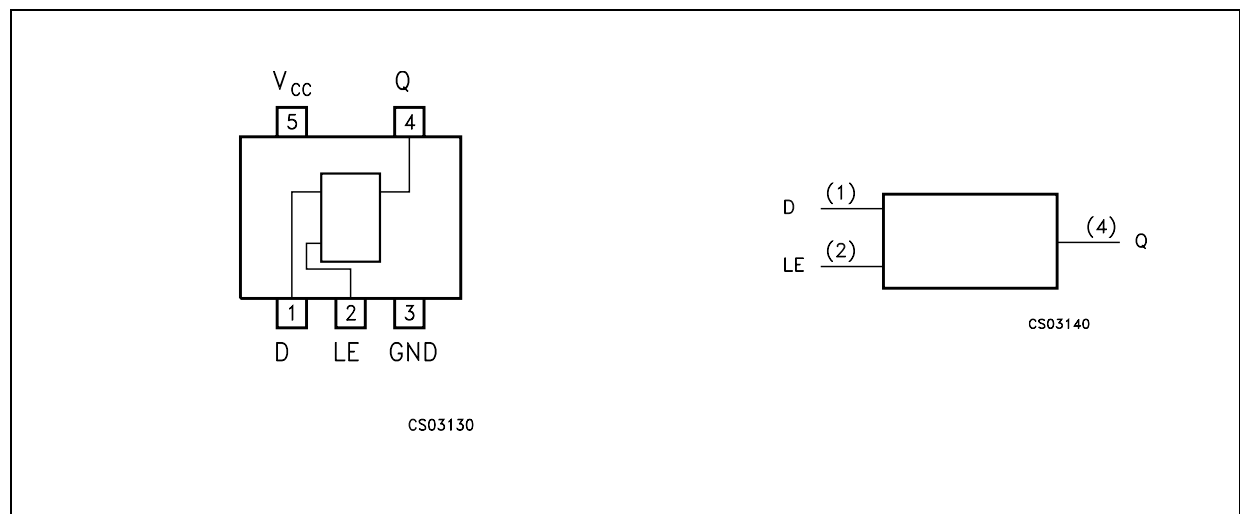
output is latched precisely at the logic level of D data input.

Power down protection is provided on 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.

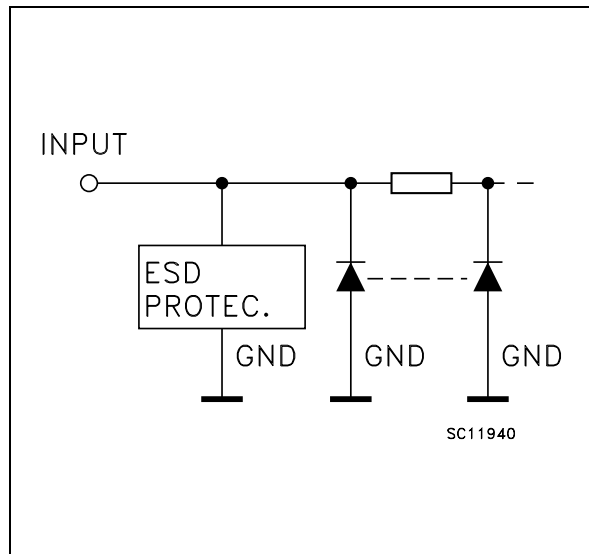
It's available in the commercial and extended temperature range.

All inputs and output are equipped with protection circuits against static discharge, giving them 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       |
|--------|-----------------|-------------------------|
| 1      | D               | Data Input              |
| 2      | LE              | Latch Enable Input      |
| 4      | Q               | Data Output             |
| 3      | GND             | Ground (0V)             |
| 5      | V <sub>CC</sub> | Positive Supply Voltage |

## TRUTH TABLE

| D | LE | Q           |
|---|----|-------------|
| L | L  | No Change * |
| H | L  | No Change * |
| L | H  | L           |
| H | H  | H           |

(\*) Q output is latched at the time when the LE input is taken low logic level.

## 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                    | -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

## 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                                                   | 0 to V <sub>CC</sub> | V    |
| T <sub>op</sub> | Operating Temperature                                            | -55 to 125           | °C   |
| dt/dv           | Input Rise and Fall Time (note 1) (V <sub>CC</sub> = 5.0 ± 0.5V) | 0 to 20              | ns/V |

1) V<sub>IN</sub> from 0.8V to 2V

## 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                  |                       |      | 1     |             | 10    |              | 20    | μA   |
| Δ 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   |

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> t <sub>PHL</sub> | Propagation Delay Time LE to Q  | 5.0 (*)                | 15                     |  |                       | 4.4  | 6.5  | 1.0         | 7.5  | 1.0          | 8.5  | ns   |
|                                   |                                 | 5.0 (*)                | 50                     |  |                       | 4.8  | 7.0  | 1.0         | 8.0  | 1.0          | 9.0  |      |
| t <sub>PLH</sub> t <sub>PHL</sub> | Propagation Delay Time D to Q   | 5.0 (*)                | 15                     |  |                       | 4.7  | 6.5  | 1.0         | 7.5  | 1.0          | 8.5  | ns   |
|                                   |                                 | 5.0 (*)                | 50                     |  |                       | 5.3  | 7.0  | 1.0         | 8.0  | 1.0          | 9.0  |      |
| t <sub>W</sub>                    | LE Pulse Width, HIGH            | 5.0 (*)                |                        |  | 3.0                   |      |      | 3.0         |      | 3.0          |      | ns   |
| t <sub>s</sub>                    | Setup Time D to LE, HIGH or LOW | 5.0 (*)                |                        |  | 2.0                   |      |      | 2.0         |      | 2.0          |      | ns   |
| t <sub>h</sub>                    | Hold Time D to LE, HIGH or LOW  | 5.0 (*)                |                        |  | 1.0                   |      |      | 1.0         |      | 1.0          |      | ns   |

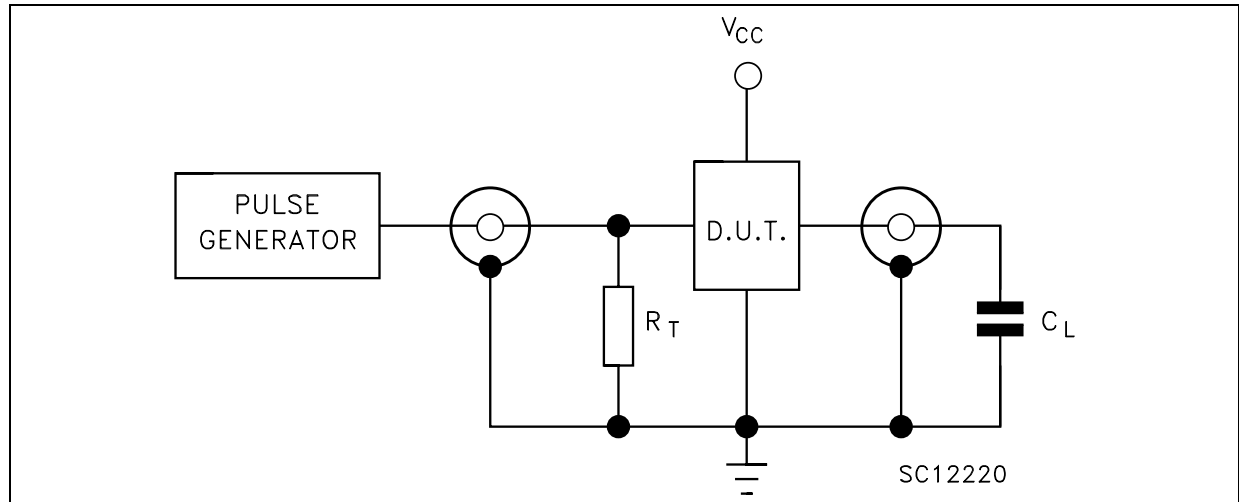
(\*) Voltage range is 5.0V ± 0.5V

## 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) |                |                       | 8    |      |             |      |              |      | pF |      |

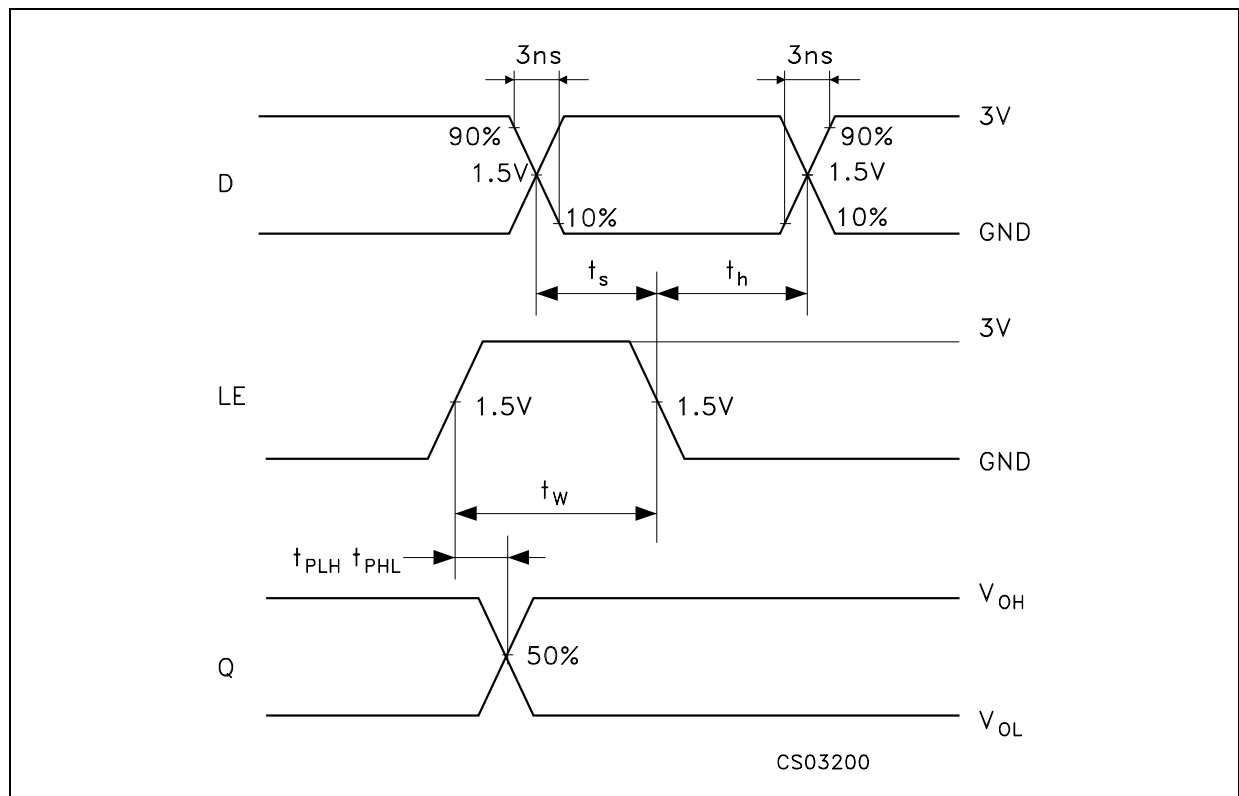
1) C<sub>PD</sub> is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. I<sub>CC(opr)</sub> = C<sub>PD</sub> × V<sub>CC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

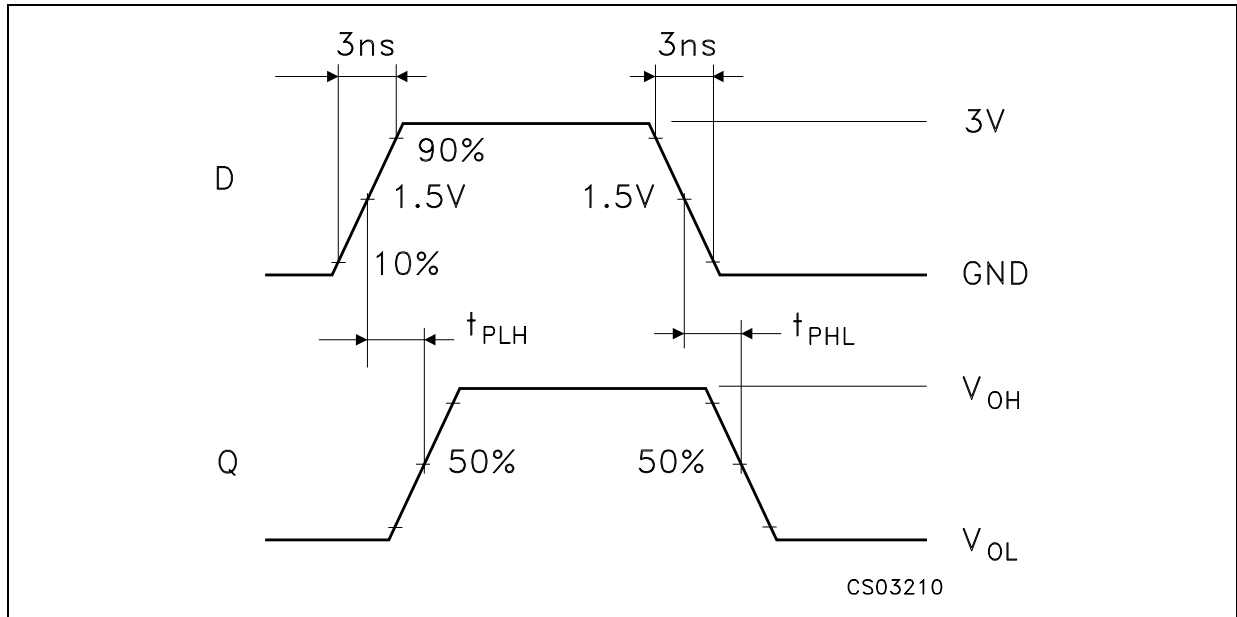
## TEST CIRCUIT



$C_L = 15/50\text{pF}$  or equivalent (includes jig and probe capacitance)  
 $R_T = Z_{OUT}$  of pulse generator (typically  $50\Omega$ )

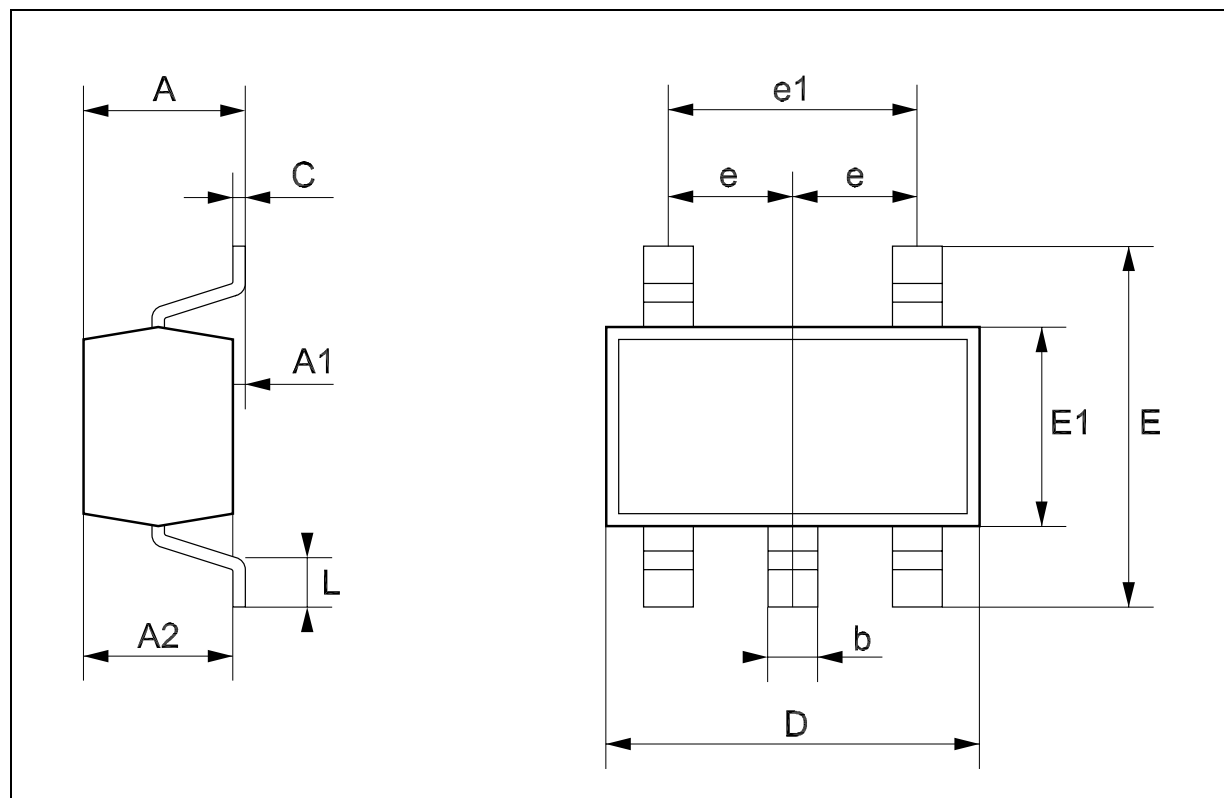
**WAVEFORM 1: LE TO Qn PROPAGATION DELAYS, LE MINIMUM PULSE WIDTH, Dn TO LE SETUP AND HOLD TIMES ( $f=1\text{MHz}$ ; 50% duty cycle)**



**WAVEFORM 2: PROPAGATION DELAY TIME** ( $f=1\text{MHz}$ ; 50% duty cycle)

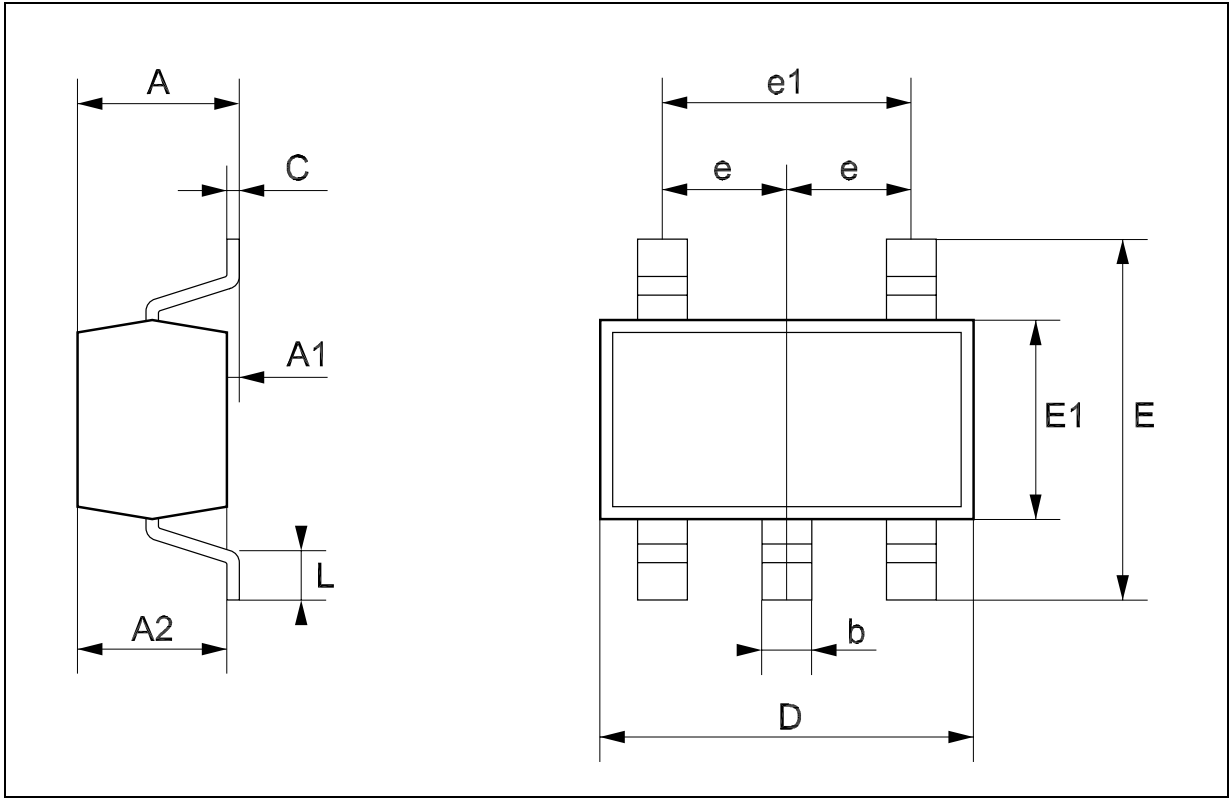
## SOT23-5L MECHANICAL DATA

| 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  |



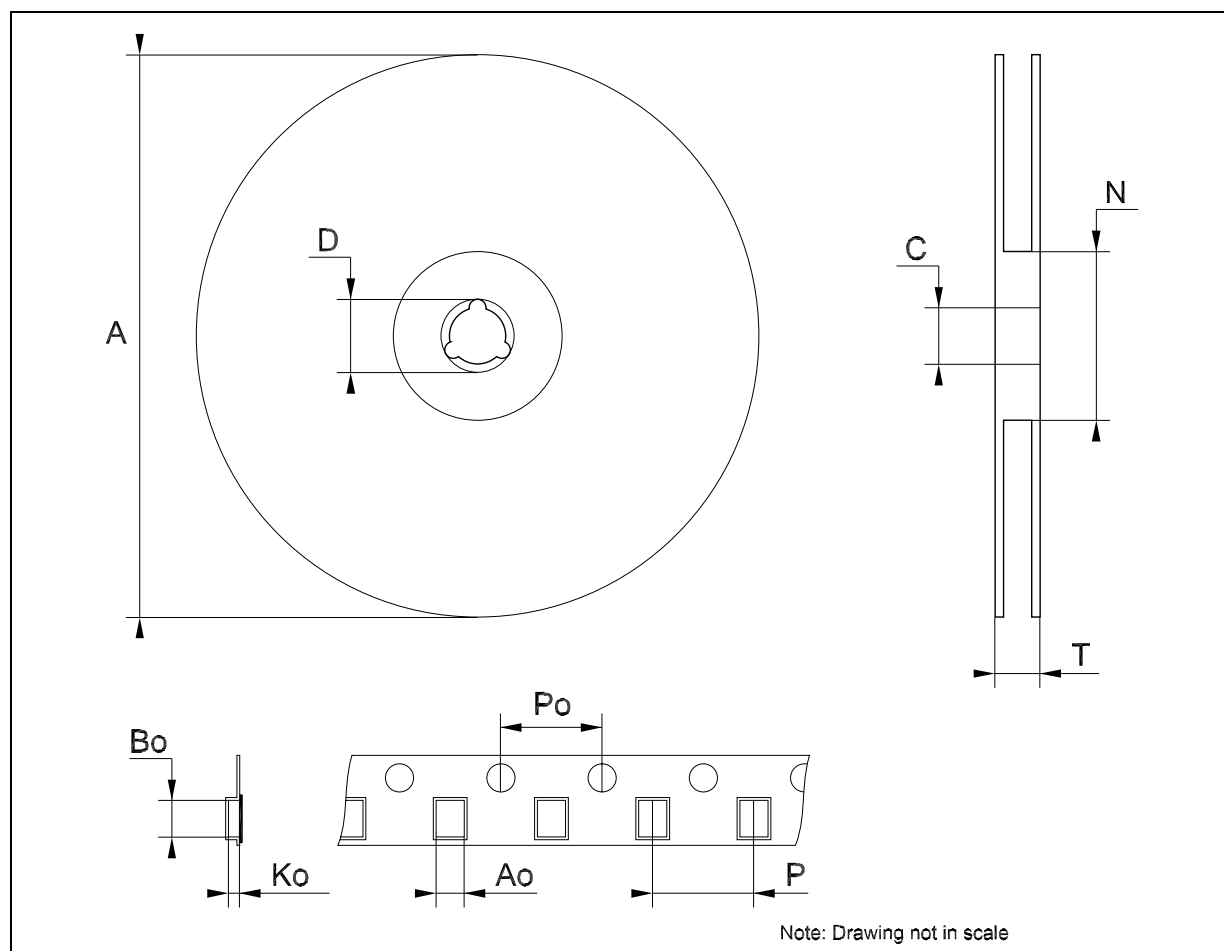
SOT323-5L MECHANICAL DATA

| 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 & Reel SOT23-xL MECHANICAL DATA

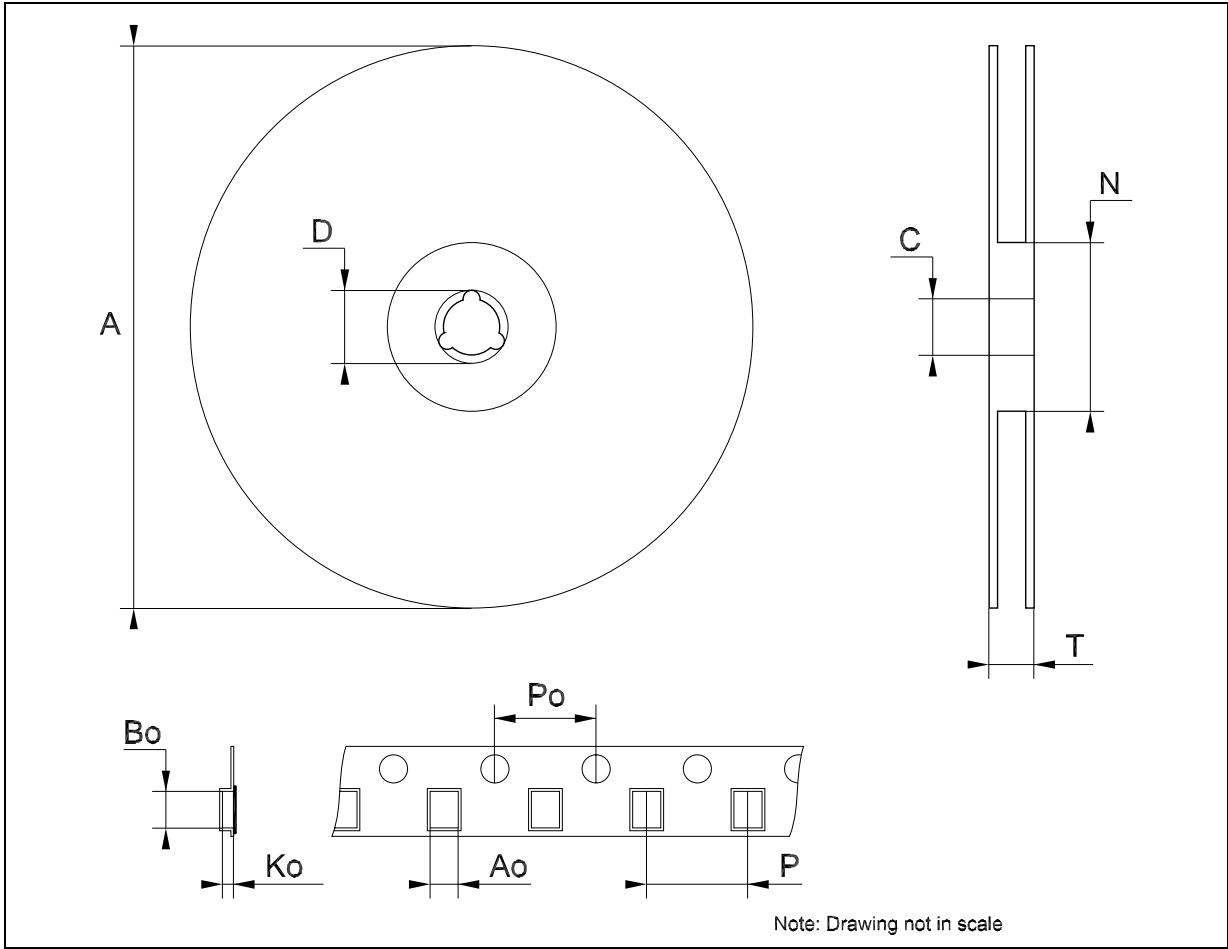
| DIM. | mm.  |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP  | MAX. | MIN.  | TYP.  | MAX.  |
| A    |      |      | 180  |       |       | 7.086 |
| C    | 12.8 | 13.0 | 13.2 | 0.504 | 0.512 | 0.519 |
| D    | 20.2 |      |      | 0.795 |       |       |
| 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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