

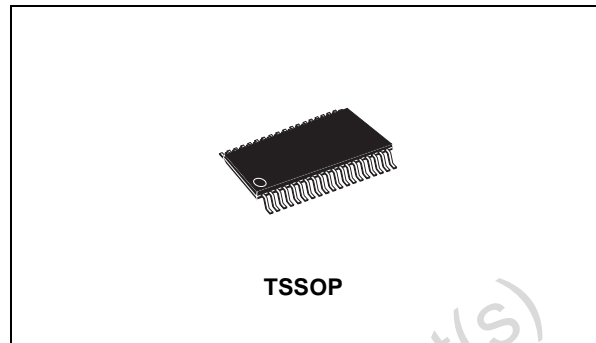
## MULTIPLE RS-232 DRIVERS AND RECEIVERS

- MEETS AND EXCEEDS THE REQUIREMENTS OF EIA/TIA-232-E AND ITUV.28 STANDARD
- SINGLE CHIP WITH EASY INTERFACE BETWEEN UART AND SERIAL PORT CONNECTOR OF IBM PC/AT™ AND COMPATIBLES
- DESIGNED TO SUPPORT DATA RATES UP TO 120 Kbps

### DESCRIPTION

The ST75285 contains six drivers and ten receivers. The pinout matches the DB9S connector design in order to decrease the part count, reduce the board space required and allow easy interconnection of the UART and serial port connector of IBM PC/AT™ and compatibles. The bipolar circuits and processing of the ST75285 provides a rugged low-cost solution for this function at the expense of quiescent power and external passive components relative to the ST75C185.

The ST75285 complies with the requirements of the EIA/TIA 232-E and ITU (formally CCITT) v.28 standards. These standards are for data interchange between a host computer and



peripheral at signalling rates up to 20k-bits/s. The switching speeds of the ST75285 are fast enough to support rates up to 120K-bits/s with lower capacitive loads (shorter cables). Interoperability at the higher signalling rates cannot be assured unless the designer has design control of the cable and the interface circuits at the both ends. For interoperability at signalling rates to 120 K-bits/s, use of EIA/ITA-423-B (ITU v.10) and EIA/ITA-422-B (ITU v.11) standards are recommended. It allows space saving in applications where two ST75185 are needed.

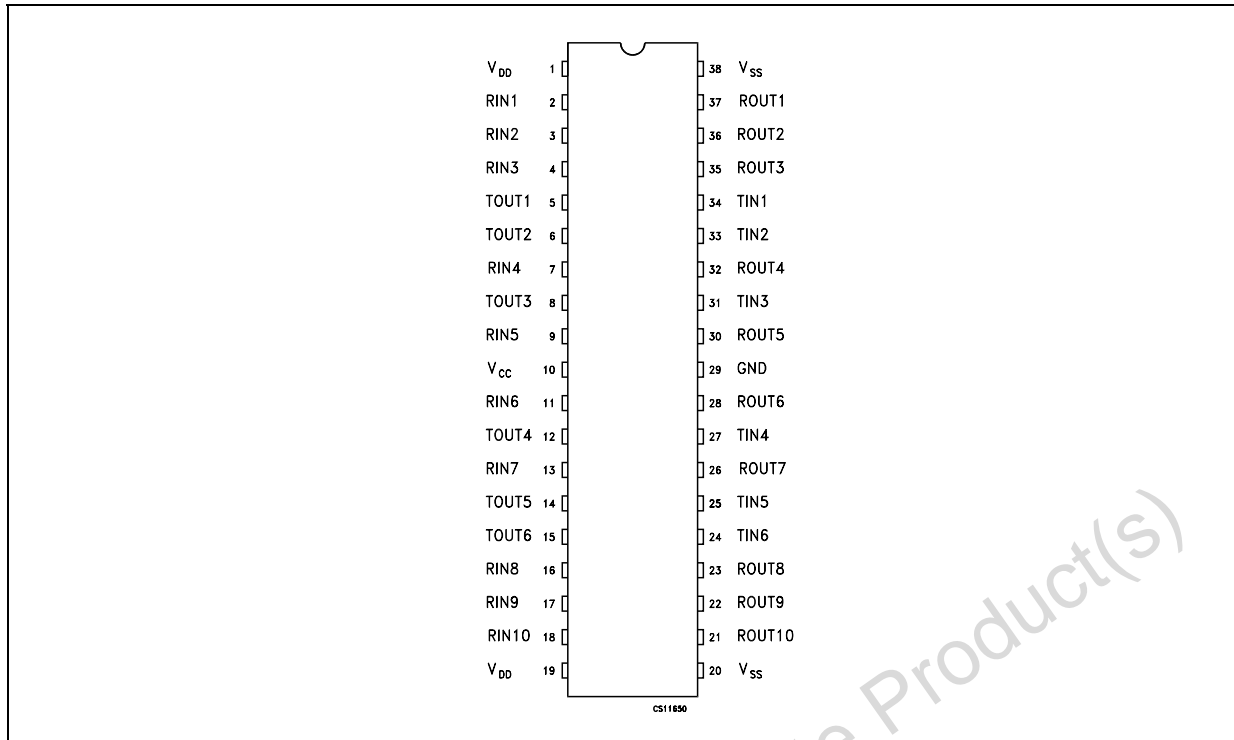
### ORDERING CODES

| Type       | Temperature Range | Package               | Comments            |
|------------|-------------------|-----------------------|---------------------|
| ST75285CTR | 0 to 70 °C        | TSSOP38 (Tape & Reel) | 2500 parts per reel |

## PIN DESCRIPTION

| PIN N° | SYMBOL          | NAME AND FUNCTION      |
|--------|-----------------|------------------------|
| 1      | V <sub>DD</sub> | Supply Voltage (+12V)  |
| 2      | RIN1            | First Receiver Input   |
| 3      | RIN2            | Second Receiver Input  |
| 4      | RIN3            | Third Receiver Input   |
| 5      | TOUT1           | First Driver Output    |
| 6      | TOUT2           | Second Driver Output   |
| 7      | RIN4            | Fourth Receiver Input  |
| 8      | TOUT3           | Third Driver Output    |
| 9      | RIN5            | Fifth Receiver Input   |
| 10     | V <sub>CC</sub> | Supply Voltage (-12V)  |
| 11     | RIN6            | Sixth Receiver Input   |
| 12     | TOUT4           | Fourth Driver Output   |
| 13     | RIN7            | Seventh Receiver Input |
| 14     | TOUT5           | Fifth Driver Output    |
| 15     | TOUT6           | Sixth Driver Output    |
| 16     | RIN8            | Eighth Receiver Input  |
| 17     | RIN9            | Nineth Receiver Input  |
| 18     | RIN10           | Tenth Receiver Input   |
| 19     | V <sub>DD</sub> | Supply Voltage (-12V)  |
| 20     | V <sub>SS</sub> | Supply Voltage (+5V)   |
| 21     | ROUT10          | Tenth Receiver Ouput   |
| 22     | ROUT9           | Nineth Receiver Ouput  |
| 23     | ROUT8           | Eighth Receiver Ouput  |
| 24     | TIN6            | Sixth Driver Input     |
| 25     | TIN5            | Fifth Driver Input     |
| 26     | ROUT7           | Seventh Receiver Ouput |
| 27     | TIN4            | Fourth Driver Input    |
| 28     | ROUT6           | Sixth Receiver Output  |
| 29     | GND             | Ground                 |
| 30     | ROUT5           | Fifth Receiver Output  |
| 31     | TIN3            | Third Driver Input     |
| 32     | ROUT4           | Fourth Receiver Output |
| 33     | TIN2            | Second Driver Input    |
| 34     | TIN1            | First Driver Input     |
| 35     | ROUT3           | Third Receiver Ouput   |
| 36     | ROUT2           | Second Receiver Ouput  |
| 37     | ROUT1           | First Receiver Ouput   |
| 38     | V <sub>SS</sub> | Supply Voltage (+5V)   |

## PIN CONNECTION IEC LOGIC SYMBOL AND LOGIC DIAGRAM



## ABSOLUTE MAXIMUM RATINGS OVER OPERATING FREE-AIR TEMPERATURE RANGE

| Symbol    | Parameter                                   | Value                        | Unit |
|-----------|---|------------------------------|------|
| $V_{DD}$  | Supply Voltage (Note 1)                     | -0.3 to 15                   | V    |
| $V_{SS}$  | Supply Voltage (Note 1)                     | 0.3 to -15                   | V    |
| $V_{CC}$  | Supply Voltage (Note 1)                     | -0.3 to 10                   | V    |
| $V_I$     | Input Voltage Range (DRIVER)                | -15 to 7                     | V    |
| $V_I$     | Input Voltage Range (RECEIVER)              | -30 to 30                    | V    |
| $V_O$     | Output Voltage Range (DRIVER)               | -15 to 15                    | V    |
| $I_O$     | Receiver Low Level Output Current           | 20                           | mA   |
| $P_D$     | Continuous Total Power Dissipation          | See dissipation Rating Table |      |
| $T_A$     | Operating Free-Air Temperature Range        | 0 to 70                      | °C   |
| $T_{stg}$ | Storage Temperature Range                   | -65 to + 150                 | °C   |
| ESD       | Human Body Model                            | >2                           | kV   |
| $T_L$     | Lead Temperature 1.6mm from case for 10 sec | 260                          | °C   |

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

NOTE 1: All voltage are with respect to the network ground terminal.

## DISSIPATION RATING TABLE

| Package   | Power Rating at $T_A \leq 25^\circ\text{C}$ | Derating Factor above $T_A = 25^\circ\text{C}$ (*) | Power Rating at $T_A \leq 85^\circ\text{C}$ |
|-----------|---|--|---|
| TSSOP (T) | 1277 mW                                     | 10.2 mW/°C   | 644 mW                                      |

(\*) This is the reverse of the traditional junction-case thermal resistance  $R_{j-c}$

## RECOMMENDED OPERATING CONDITIONS

| Symbol          | Parameter                      | Min      | Max             | Unit |
|-----------------|--------------------------------|----------|-----------------|------|
| V <sub>DD</sub> | Supply Voltage                 | 7.5      | 15              | V    |
| V <sub>SS</sub> | Supply Voltage                 | -7.5     | -15             | V    |
| V <sub>CC</sub> | Supply Voltage                 | 4.5      | 5.5             | V    |
| V <sub>I</sub>  | Driver Input Voltage           | 0        | V <sub>CC</sub> | V    |
| I <sub>OH</sub> | High Level Output Current      | DRIVER   | -6              | mA   |
|                 |                                | RECEIVER | -0.5            |      |
| I <sub>OL</sub> | Low Level Output Current       | DRIVER   | 6               | mA   |
|                 |                                | RECEIVER | 16              |      |
| T <sub>A</sub>  | Operating Free-Air Temperature | 0        | 70              | °C   |

## SUPPLY CURRENTS

| Symbol          | Parameter                           | Test Conditions                                   |                 |                                   | Value |                                   |      | Unit |      |    |
|-----------------|-------------------------------------|---|-----------------|-----------------------------------|-------|-----------------------------------|------|------|------|----|
|                 |                                     | V <sub>DD</sub>                                   | V <sub>SS</sub> |                                   | Min.  | Typ.                              | Max. |      |      |    |
| I <sub>DD</sub> | Supply Current from V <sub>DD</sub> | 9   | -9              | No load.<br>All inputs at<br>1.9V |       |                                   | 22   | mA   |      |    |
|                 |                                     | 12  | -12             |                                   |       |                                   | 28   |      |      |    |
|                 |                                     | 15  | -15             |                                   |       |                                   | 32   |      |      |    |
|                 |                                     |   |                 | 9                                 | -9    | No load.<br>All inputs at<br>0.8V |      |      | 9    | mA |
|                 |                                     |   |                 | 12                                | -12   |                                   |      |      | 11   |    |
|                 |                                     |   |                 | 15                                | -15   |                                   |      |      | 12   |    |
| I <sub>SS</sub> | Supply Current from V <sub>SS</sub> | 9   | -9              | No load.<br>All inputs at<br>1.9V |       |                                   | -22  | mA   |      |    |
|                 |                                     | 12  | -12             |                                   |       |                                   | -28  |      |      |    |
|                 |                                     | 15  | -15             |                                   |       |                                   | -32  |      |      |    |
|                 |                                     |   |                 | 9                                 | -9    | No load.<br>All inputs at<br>0.8V |      |      | -6.4 | mA |
|                 |                                     |   |                 | 12                                | -12   |                                   |      |      | -6.4 |    |
|                 |                                     |   |                 | 15                                | -15   |                                   |      |      | -6.4 |    |
| I <sub>CC</sub> | Supply Current from V <sub>CC</sub> | No load. All inputs at 5V<br>V <sub>CC</sub> = 5V |                 |                                   |       |                                   | 60   | mA   |      |    |

DRIVER ELECTRICAL CHARACTERISTICS OVER OPERATING FREE-AIR TEMPERATURE RANGE (V<sub>DD</sub> = 9V, V<sub>SS</sub> = -9V, V<sub>CC</sub> = 5V, unless otherwise specified)

| Symbol             | Parameter  | Test Conditions  | Value |      |       | Unit |
|--------------------|--|--|-------|------|-------|------|
|                    |  |  | Min.  | Typ. | Max.  |      |
| V <sub>OH</sub>    | High Level Output Voltage                        | V <sub>IL</sub> = 0.8 V R <sub>L</sub> = 3KΩ (See Figure 1)                                      | 6     | 7.5  |       | V    |
| V <sub>OL</sub>    | Low Level Output Voltage (Note 3)                | V <sub>IH</sub> = 1.9 V R <sub>L</sub> = 3KΩ (See Figure 1)                                      |       | -7.5 | -6    | V    |
| I <sub>IH</sub>    | High Level Input Current                         | V <sub>I</sub> = 5 V (See Figure 2)  |       |      | 10    | μA   |
| I <sub>IL</sub>    | Low Level Input Current                          | V <sub>I</sub> = 0 V (See Figure 2)  |       |      | -1.6  | mA   |
| I <sub>OS(H)</sub> | High Level Short Circuit Output Current (Note 4) | V <sub>IL</sub> = 0.8 V V <sub>O</sub> = 0 V (See Figure 1)                                      | -4.5  | -12  | -19.5 | mA   |
| I <sub>OS(L)</sub> | Low Level Short Circuit Output Current           | V <sub>IH</sub> = 2 V V <sub>O</sub> = 0 V (See Figure 1)  | 4.5   | 12   | 19.5  | mA   |
| R <sub>O</sub>     | Output Resistance                                | V <sub>DD</sub> = V <sub>SS</sub> = V <sub>CC</sub> = 0 V<br>V <sub>O</sub> = -2 to 2 V (Note 5) | 300   |      |       | Ω    |

NOTE 3: The algebraic convention, where the more positive (less negative) limits designated as maximum, is used in this datasheet for logic levels only (e.g. if -10V is a maximum, the typical value is a more negative voltage).

NOTE 4: Output short circuit conditions must maintain the total power dissipation below absolute maximum ratings.

NOTE 5: Test conditions are those specified by EIA-232-E and as listed above.

**DRIVER SWITCHING CHARACTERISTICS** ( $V_{DD} = 12V$ ,  $V_{SS} = -12V$ ,  $V_{CC} = 5V$ ,  $T_A = 25\text{ }^\circ\text{C}$ )

| Symbol    | Parameter  | Test Conditions  | Value |      |      | Unit          |
|-----------|--|--|-------|------|------|---------------|
|           |  |  | Min.  | Typ. | Max. |               |
| $t_{PLH}$ | Propagation Delay Time, Low to High Level Output | $R_L = 3 \text{ to } 7 \text{ K}\Omega$ $C_L = 15 \text{ pF}$<br>(See Figure 3, 4)           |       | 200  | 400  | ns            |
| $t_{PHL}$ | Propagation Delay Time, High to Low Level Output | $R_L = 3 \text{ to } 7 \text{ K}\Omega$ $C_L = 15 \text{ pF}$<br>(See Figure 3, 4)           |       | 50   | 100  | ns            |
| $t_{TLH}$ | Transition Time Low to High Level Output         | $R_L = 3 \text{ to } 7 \text{ K}\Omega$ $C_L = 15 \text{ pF}$<br>(See Figure 3, 4)           |       | 60   | 100  | ns            |
|           |  | $R_L = 3 \text{ to } 7 \text{ K}\Omega$ $C_L = 2500 \text{ pF}$<br>(Note 6, See Figure 3, 4) |       | 1.7  | 2.5  | $\mu\text{s}$ |
| $t_{THL}$ | Transition Time High to Low Level Output         | $R_L = 3 \text{ to } 7 \text{ K}\Omega$ $C_L = 15 \text{ pF}$<br>(See Figure 3, 4)           |       | 50   | 100  | ns            |
|           |  | $R_L = 3 \text{ to } 7 \text{ K}\Omega$ $C_L = 2500 \text{ pF}$<br>(Note 6, See Figure 3, 4) |       | 1.5  | 2.5  | $\mu\text{s}$ |

NOTE 6: Measured between -3V and 3V points of output waveform (EIA-232-E conditions), all unused inputs are tied.

**RECEIVER ELECTRICAL CHARACTERISTICS OVER OPERATING CONDITIONS**

| Symbol    | Parameter                              | Test Conditions   | Value |      |      | Unit |
|-----------|--|---|-------|------|------|------|
|           |  |   | Min.  | Typ. | Max. |      |
| $V_{T+}$  | Positive Going Threshold Voltage       | (See Figure 6)  |       | 2.2  | 2.4  | V    |
| $V_{T-}$  | Negative Going Threshold Voltage       | $T_A = 25\text{ }^\circ\text{C}$ (See Figure 6)           | 0.75  | 0.97 |      | V    |
| $V_{hys}$ | Input Hysteresis ( $V_{T+} - V_{T-}$ ) |   | 0.5   |      |      | V    |
| $V_{OH}$  | High Level Output Voltage              | $I_{OH} = -0.5\text{mA}$ $V_{IH} = 0.75 \text{ V}$        | 2.6   | 4    | 5    | V    |
|           |  | Inputs Open   | 2.6   |      |      |      |
| $V_{OL}$  | Low Level Output Voltage               | $V_I = 3 \text{ V}$ $I_{OL} = 10 \text{ mA}$              |       | 0.2  | 0.45 | V    |
| $I_{IH}$  | High Level Input Current               | $V_I = 25 \text{ V}$ (See Figure 6)                       | 3.6   |      | 8.3  | mA   |
|           |  | $V_I = 3 \text{ V}$ (See Figure 6)                        | 0.43  |      |      |      |
| $I_{IL}$  | Low Level Input Current                | $V_I = -25 \text{ V}$ (See Figure 6)                      | -3.6  |      | -8.3 | mA   |
|           |  | $V_I = -3 \text{ V}$ (See Figure 6)                       | -0.43 |      |      |      |
| $I_{OS}$  | Short-Circuit Output Current           | $V_I = 0 \text{ V}$ $V_O = 0 \text{ V}$<br>(See Figure 5) |       | -3.4 | -12  | mA   |

All typical values are at  $T_A = 25\text{ }^\circ\text{C}$ ,  $V_{CC} = 5V$ ,  $V_{DD} = 9V$  and  $V_{SS} = -9V$

**RECEIVER SWITCHING CHARACTERISTICS** ( $V_{DD} = 12V$ ,  $V_{SS} = -12V$ ,  $V_{CC} = 5V$ ,  $T_A = 25\text{ }^\circ\text{C}$ )

| Symbol    | Parameter                                       | Test Conditions   | Value |      |      | Unit |
|-----------|---|---|-------|------|------|------|
|           |   |   | Min.  | Typ. | Max. |      |
| $t_{PLH}$ | Propagation Delay Time Low to High Level Output | $R_L = 5 \text{ K}\Omega$ $C_L = 50 \text{ pF}$<br>(See Figure 6) |       | 200  | 500  | ns   |
| $t_{PHL}$ | Propagation Delay Time High to Low Level Output | $R_L = 5 \text{ K}\Omega$ $C_L = 50 \text{ pF}$<br>(See Figure 6) |       | 60   | 120  | ns   |
| $t_{TLH}$ | Transition Time Low to High Level Output        | $R_L = 5 \text{ K}\Omega$ $C_L = 50 \text{ pF}$<br>(See Figure 6) |       | 200  | 525  | ns   |
| $t_{THL}$ | Transition Time High to Low Level Output        | $R_L = 5 \text{ K}\Omega$ $C_L = 50 \text{ pF}$<br>(See Figure 6) |       | 20   | 60   | ns   |

Figure 1 : Driver Test Circuit for  $V_{OH}$ ,  $I_{SO(H)}$  and  $I_{SO(L)}$

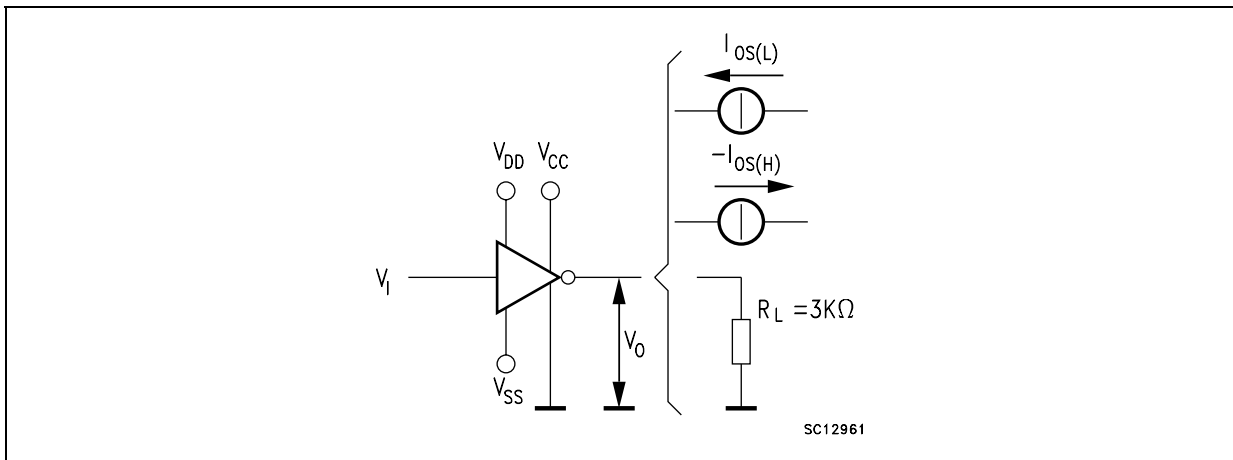


Figure 2 : Driver Test Circuit for  $I_{IH}$  and  $I_{IL}$

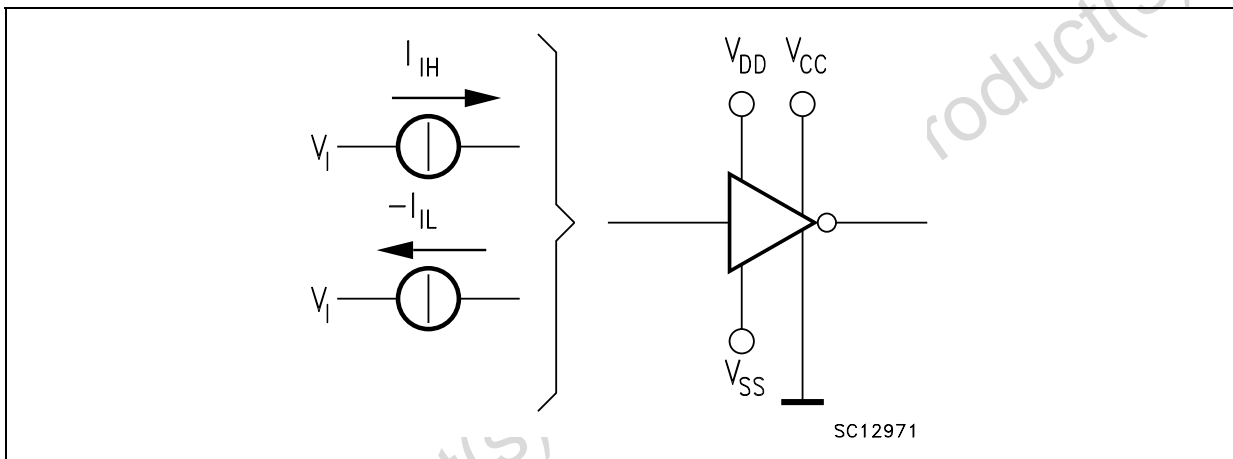


Figure 3 : Driver Test Circuit

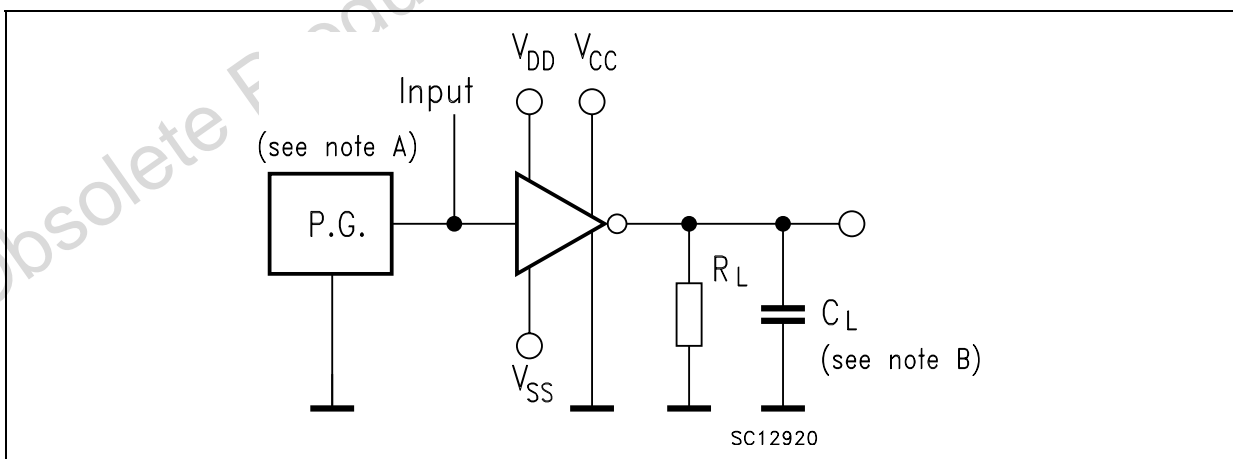


Figure 4 : Driver Voltage Waveforms

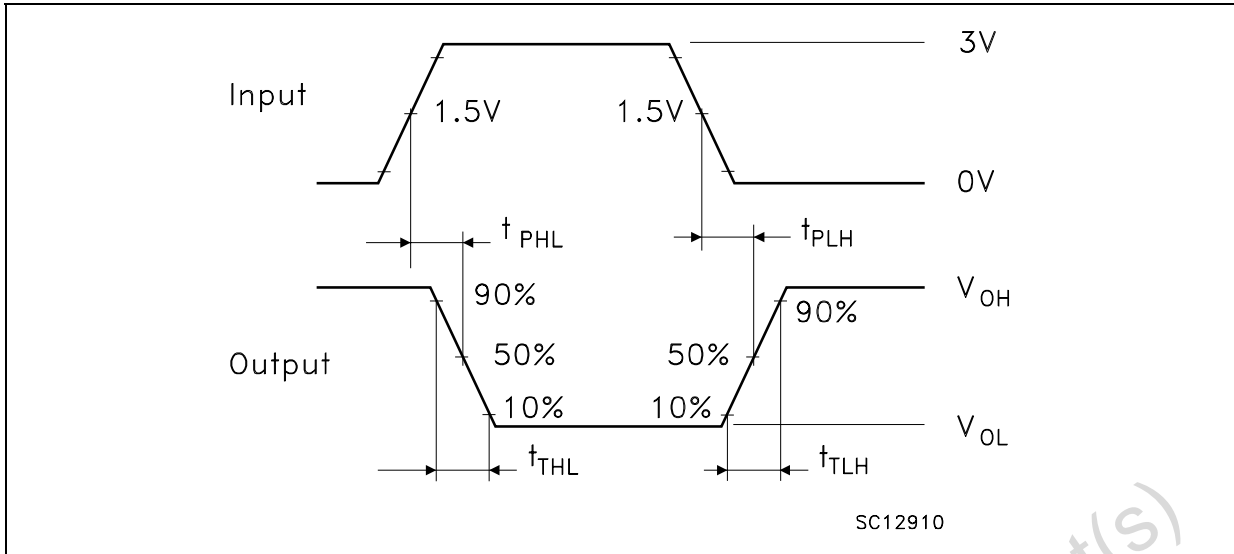


Figure 5 : Receiver Test Circuit for  $I_{OS}$

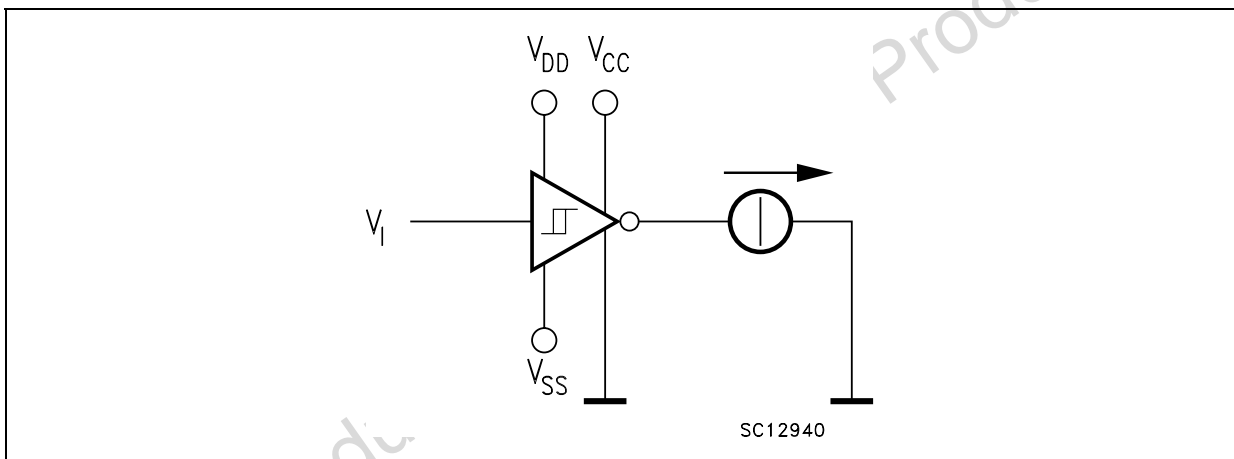


Figure 6 : Receiver Test Circuit for  $V_T$ ,  $V_{OH}$ ,  $V_{OL}$

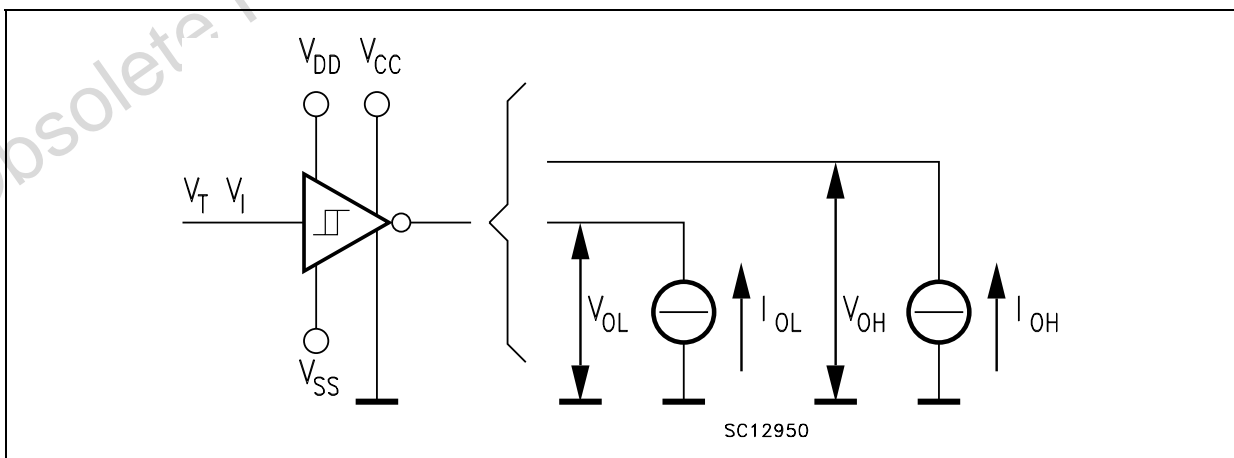


Figure 7 : Receiver Test Circuit

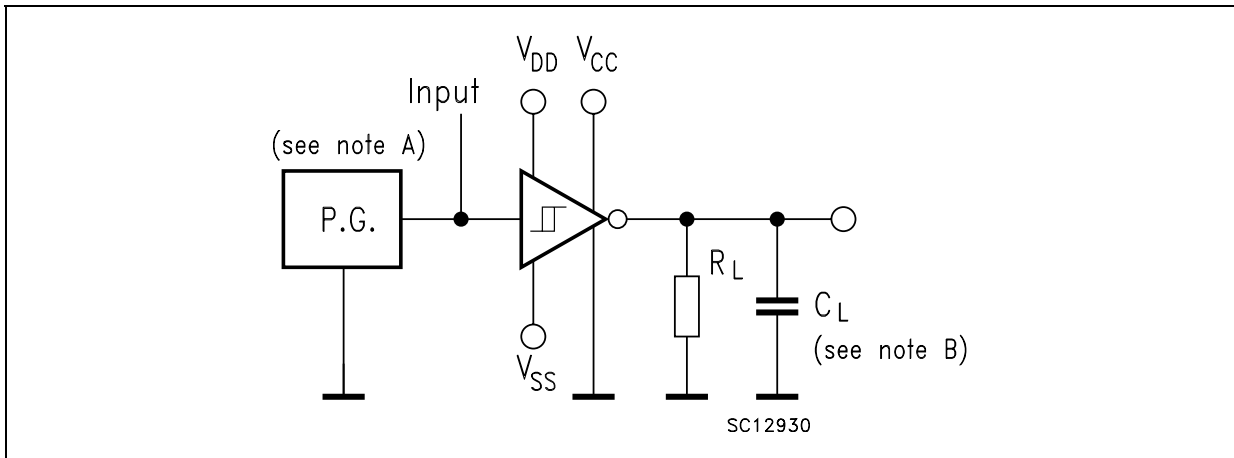
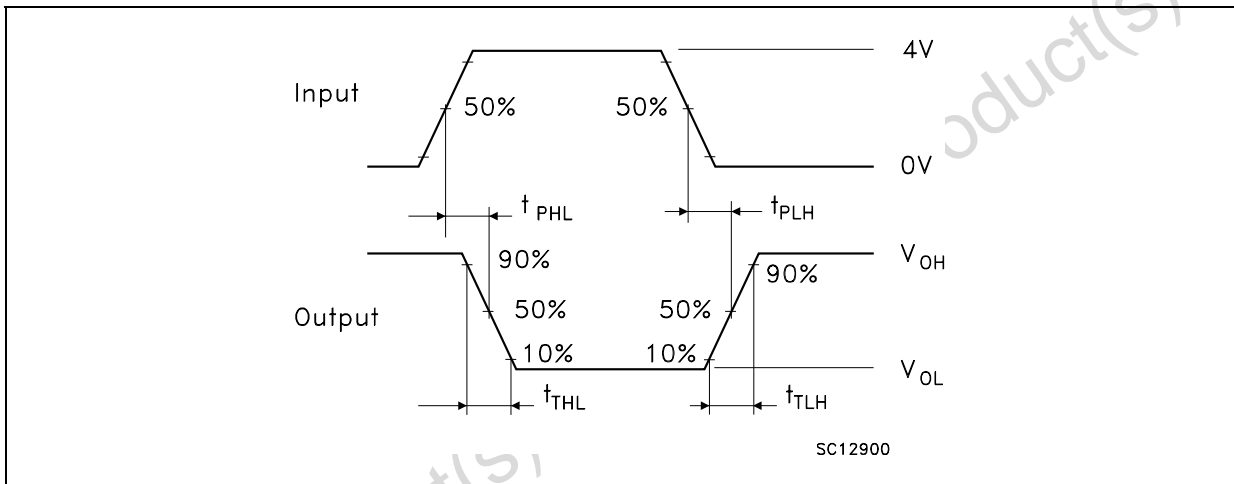


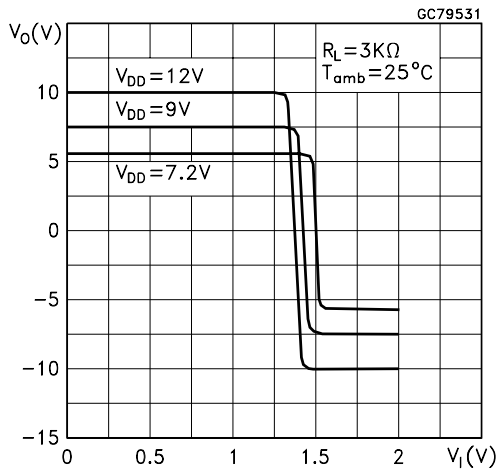
Figure 8 : Receiver Voltage Waveforms



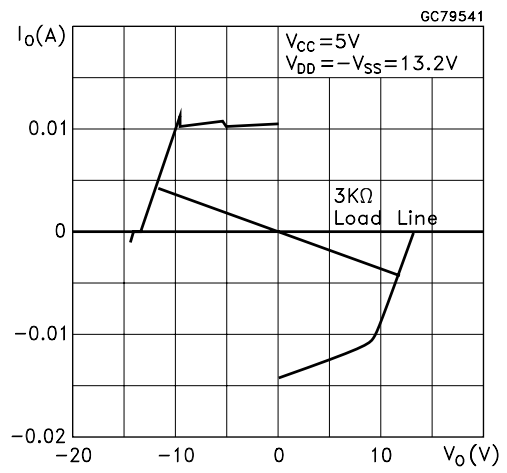
NOTE A: The pulse generator has the following characteristics:  $t_W = 25\mu s$ ,  $PRR = 20KHz$ ,  $Z_O = 50 \Omega$ ,  $t_r = t_f < 50ns$   
 NOTE B:  $C_L$  includes probe and jig capacitance.



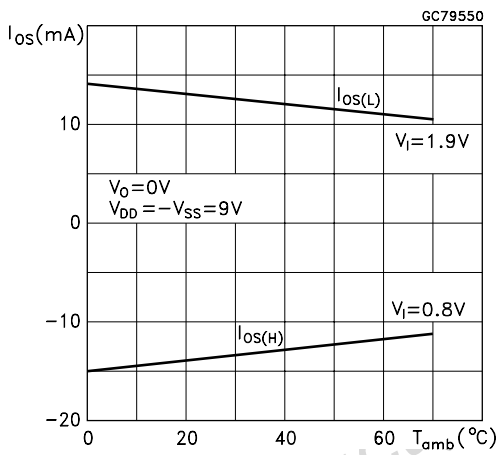
**Figure 9 : Driver Voltage Transfer Characteristics**



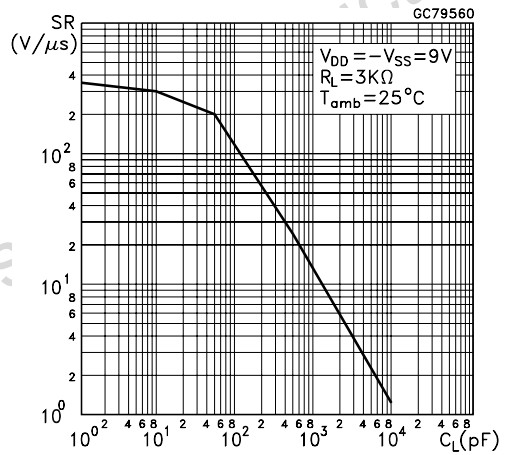
**Figure 12 : Driver Output Current vs Output Voltage**



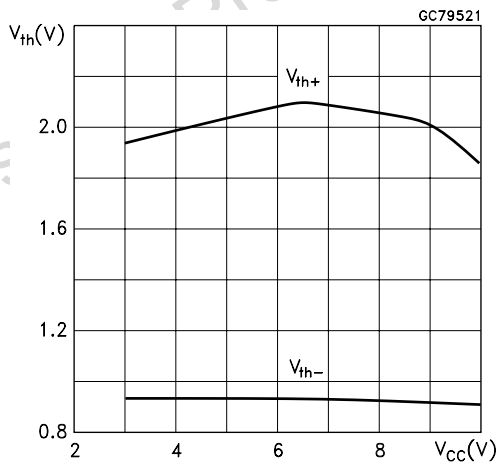
**Figure 10 : Driver Short Circuit Output Current vs Free-Air Temperature**



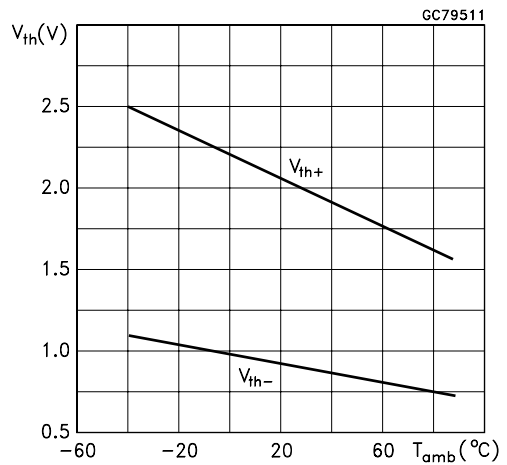
**Figure 13 : Driver Output Slew Rate vs Load Capacitance**



**Figure 11 : Receiver Threshold vs Supply Voltage**

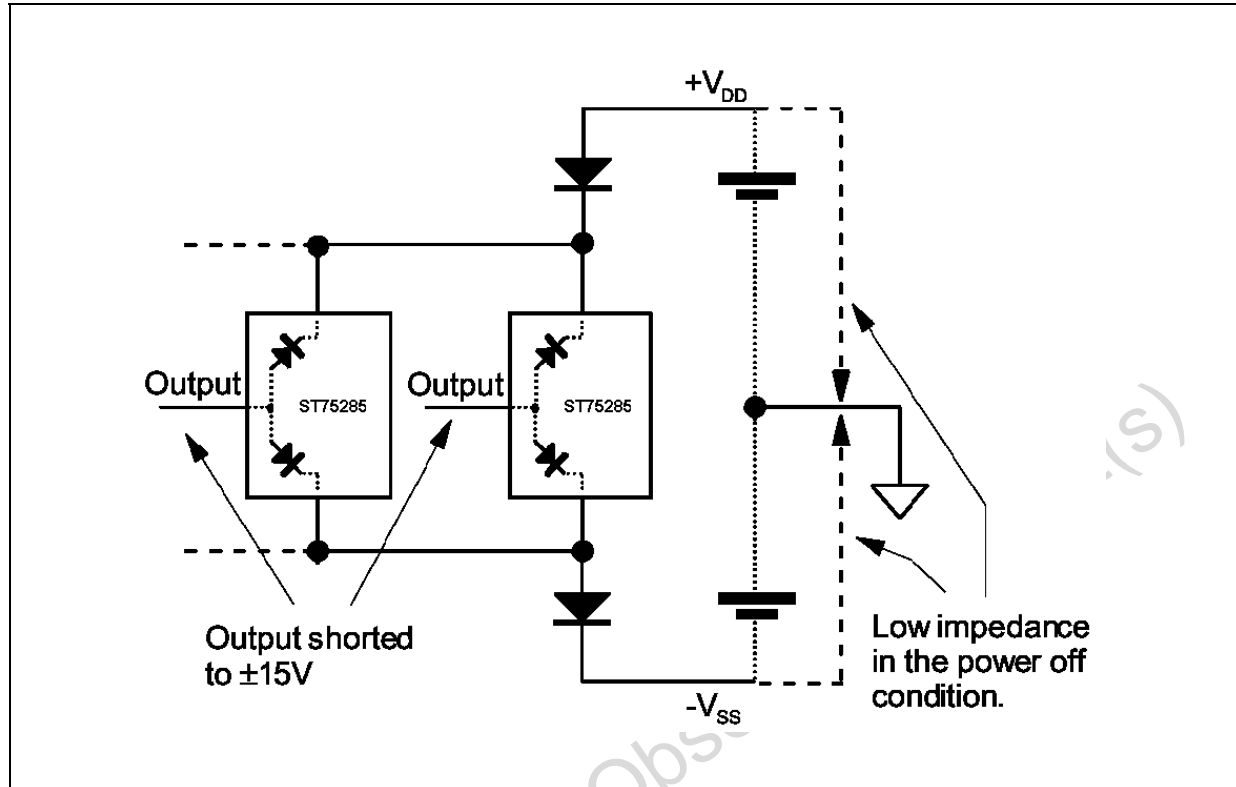


**Figure 14 : Receiver Threshold vs Temperature**



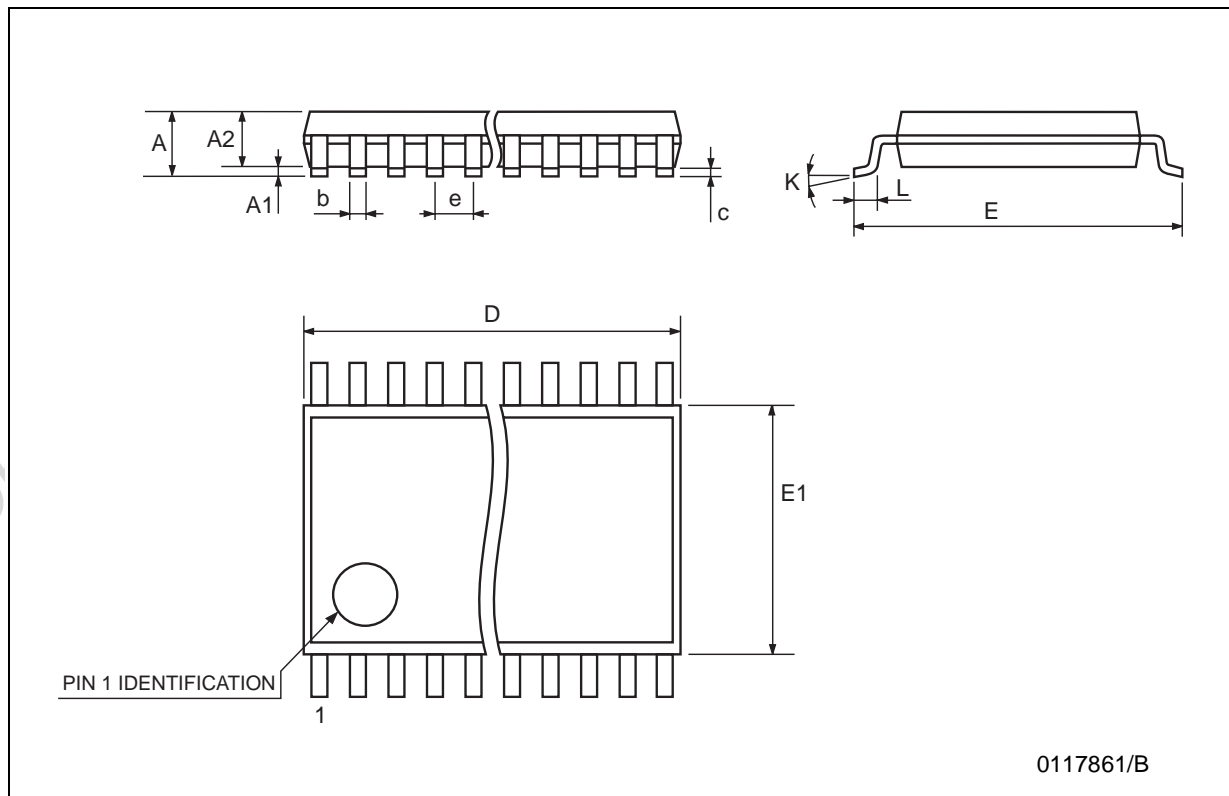
**APPLICATION INFORMATION: DIODES ON POWER SUPPLY**

Diodes placed in series with the VDD and VSS leads protect the ST75185 in the fault condition in which the devices output are shorted to  $\pm 15\text{V}$  and the power supplies are at low state and provide low-impedance path to ground (see Figure below).



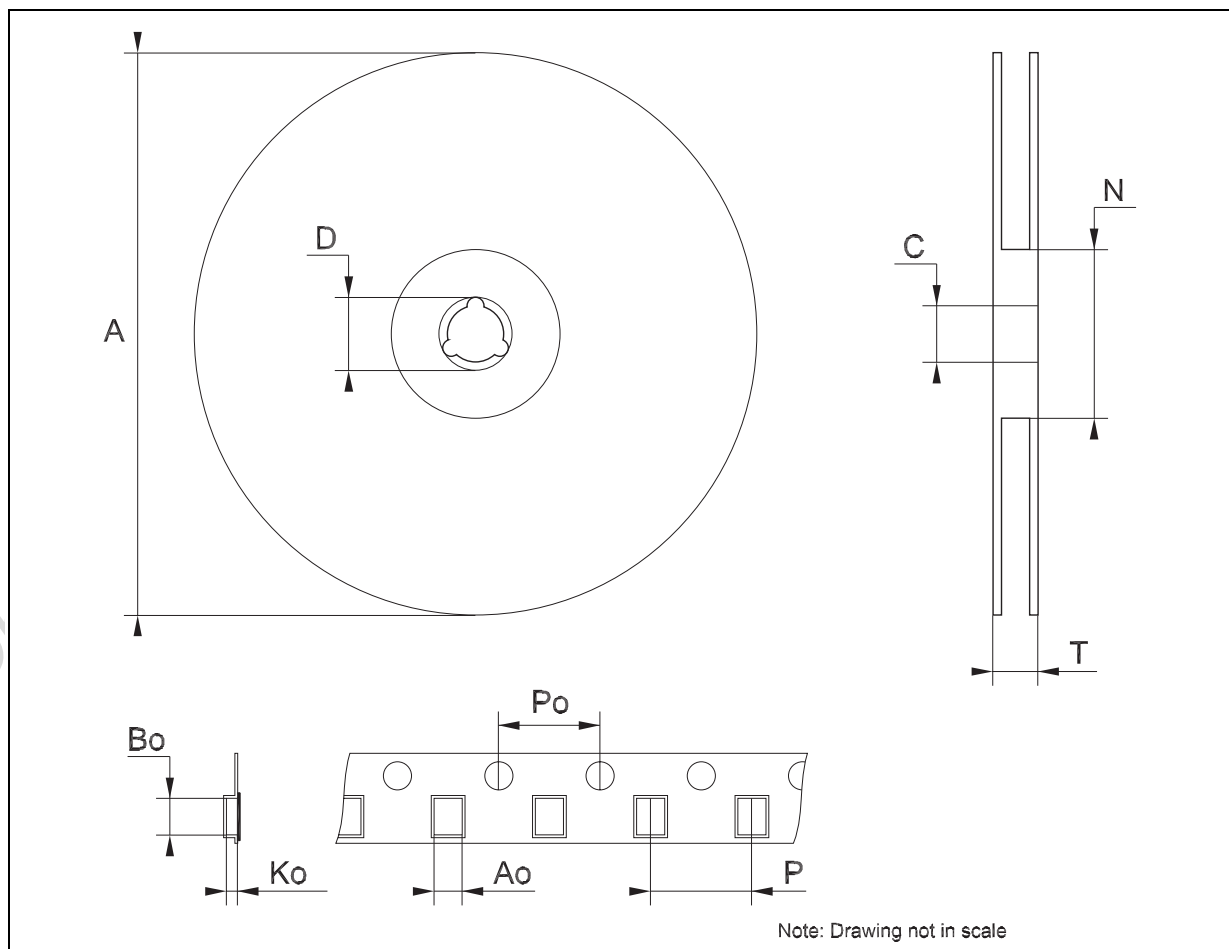
## TSSOP38 MECHANICAL DATA

| DIM. | mm.  |      |      | inch   |        |        |
|------|------|------|------|--------|--------|--------|
|      | MIN. | TYP. | MAX. | MIN.   | TYP.   | MAX.   |
| A    |      |      | 1.2  |        |        | 0.047  |
| A1   | 0.05 |      | 0.15 | 0.002  |        | 0.006  |
| A2   | 0.8  | 1    | 1.05 | 0.031  | 0.039  | 0.041  |
| b    | 0.17 |      | 0.27 | 0.0067 |        | 0.011  |
| c    | 0.09 |      | 0.20 | 0.0035 |        | 0.0079 |
| D    | 9.6  | 9.7  | 9.8  | 0.378  | 0.381  | 0.385  |
| E    | 6.2  | 6.4  | 6.6  | 0.244  | 0.252  | 0.260  |
| E1   | 4.3  | 4.4  | 4.5  | 0.169  | 0.173  | 0.177  |
| e    |      | 0.5  |      |        | 0.0197 |        |
| K    | 0°   |      | 8°   | 0°     |        | 8°     |
| L    | 0.50 | 0.6  | 0.75 | 0.020  | 0.023  | 0.030  |



**Tape & Reel TSSOP38 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   | 6.8  |     | 7    | 0.268 |      | 0.276  |
| Bo   | 10.1 |     | 10.3 | 0.398 |      | 0.406  |
| Ko   | 1.7  |     | 1.9  | 0.067 |      | 0.075  |
| Po   | 3.9  |     | 4.1  | 0.153 |      | 0.161  |
| P    | 11.9 |     | 12.1 | 0.468 |      | 0.476  |



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