



ST202EB - ST202EC ST232EB - ST232EC

± 15 kV ESD protected 5 V RS-232 transceiver

Features

- ESD protection for RS-232 I/O pins:
- ± 15 kV human body model
- Guaranteed 230 kbps data rate
- Guaranteed slew rate range 3 to 30 V/ms
- Operate from a single 5 V power supply

Description

The ST202E/ST232E are a 2 driver 2 receiver devices designed for RS-232 and V.28 communications in harsh environments. Each transmitter output and receiver input is protected against ± 15 kV electrostatic discharge (ESD) shocks. The drivers meet all EIA/TIA-232E and CCITT V.28 specifications at data rates up to 230 kbps, when loaded in accordance with the EIA/TIA-232E specification. The ST202E/232E use a single 5 V supply voltage.

The ST232E operates with four 1 µF capacitors, while the ST202E operates with four 0.1 µF capacitors, further reducing cost and board space.

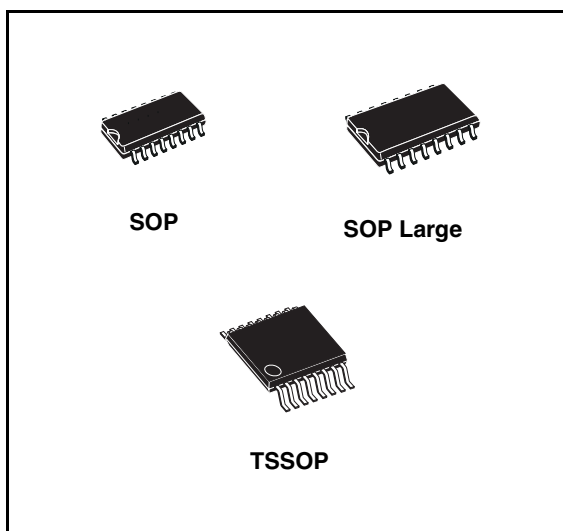


Table 1. Device summary

| Order codes | | Temperature range | Packages | Packaging |
|-------------|-----------|-------------------|---------------------------|---------------------|
| ST202ECDR | ST232ECDR | 0 to 70 °C | SO-16 (tape & reel) | 2500 parts per reel |
| ST202EBDR | ST232EBDR | -40 to 85 °C | SO-16 (tape & reel) | 2500 parts per reel |
| | ST232ECWR | 0 to 70 °C | SO-16 large (tape & reel) | 1000 parts per reel |
| ST202EBWR | | -40 to 85 °C | SO-16 large (tape & reel) | 1000 parts per reel |
| ST202ECTR | ST232ECTR | 0 to 70 °C | TSSOP16 (tape & reel) | 2500 parts per reel |
| ST202EBTR | ST232EBTR | -40 to 85 °C | TSSOP16 (tape & reel) | 2500 parts per reel |

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1 Pin configuration

Figure 1. Pin connections (top view)

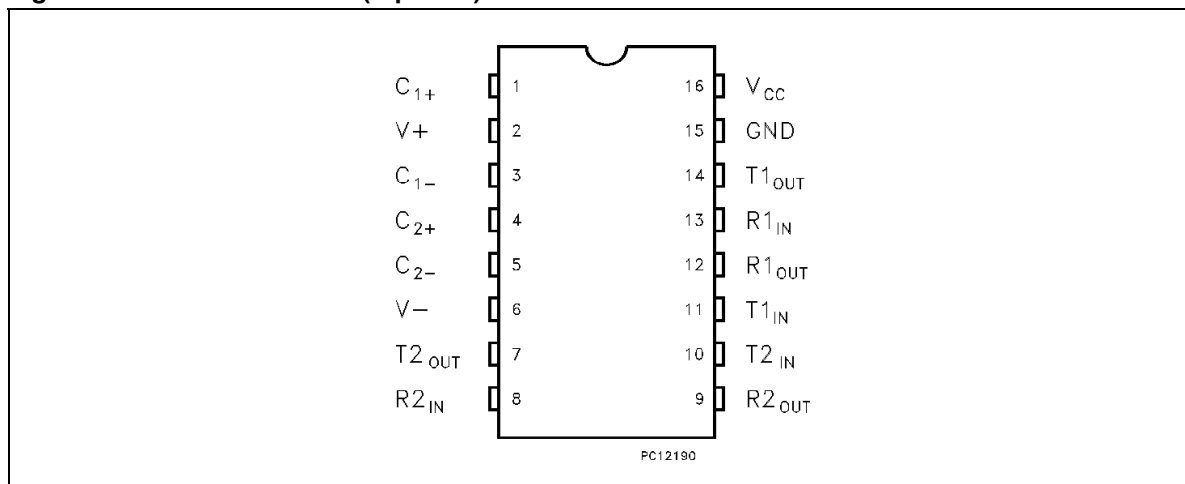


Table 2. Pin description

| Pin n° | Symbol | Note |
|--------|-------------------|--|
| 1 | C ₁₊ | Positive terminal for the first charge pump capacitor |
| 2 | V+ | Doubled voltage terminal |
| 3 | C ₁₋ | Negative terminal for the first charge pump capacitor |
| 4 | C ₂₊ | Positive terminal for the second charge pump capacitor |
| 5 | C ₂₋ | Negative terminal for the second charge pump capacitor |
| 6 | V- | Inverted voltage terminal |
| 7 | T2 _{OUT} | Second transmitter output voltage |
| 8 | R2 _{IN} | Second receiver input voltage |
| 9 | R2 _{OUT} | Second receiver output voltage |
| 10 | T2 _{IN} | Second transmitter input voltage |
| 11 | T1 _{IN} | First transmitter input voltage |
| 12 | R1 _{OUT} | First receiver output voltage |
| 13 | R1 _{IN} | First receiver input voltage |
| 14 | T1 _{OUT} | First transmitter output voltage |
| 15 | GND | Ground |
| 16 | V _{CC} | Supply voltage |

2 Maximum ratings

Table 3. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|--------------|-------------------------------------|--------------------------------|------|
| V_{CC} | Supply voltage | -0.3 to 6 | V |
| V_+ | Extra positive voltage | $(V_{CC} - 0.3)$ to 14 | V |
| V_- | Extra negative voltage | -14 to 0.3 | V |
| T_{IN} | Transmitter input voltage range | -0.3 to $(V_+ + 0.3)$ | V |
| R_{IN} | Receiver input voltage range | ± 30 | V |
| T_{OUT} | Transmitter output voltage range | $(V_- - 0.3)$ to $(V_+ + 0.3)$ | V |
| R_{OUT} | Receiver output voltage range | -0.3 to $(V_{CC} + 0.3)$ | V |
| T_{SCTOUT} | Short circuit duration on T_{OUT} | infinite | |
| T_{STG} | Storage temperature range | -65 to 150 | °C |

Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

3 Electrical characteristics

Table 4. ESD performance: transmitter outputs, receiver inputs

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|--------|------------------------|----------------------------------|------|------|------|------|
| ESD | ESD protection voltage | Human Body Model | ± 15 | | | kV |
| ESD | ESD protection voltage | IEC 1000-4-2 (Contact Discharge) | ± 6 | | | kV |
| ESD | ESD protection voltage | IEC 1000-4-2 (Air Discharge) | ± 8 | | | kV |

Note: All test versus GND.

Table 5. Electrical characteristics

($C_1 - C_4 = 0.1 \mu\text{F}$ for ST202E, $C_1 - C_4 = 0.1 \mu\text{F}$ for ST232E, $V_{CC} = 5 \text{ V} \pm 10 \%$, $T_A = -40$ to $125 \text{ }^\circ\text{C}$, unless otherwise specified. Typical values are referred to $T_A = 25 \text{ }^\circ\text{C}$).

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|---------------------|-------------------------------|--|------|------|------|------|
| I_{SUPPLY} | V_{CC} power supply current | No Load, $T_A = 25 \text{ }^\circ\text{C}$ | | 5 | 10 | mA |

Table 6. Transmitter electrical characteristics

($C_1 - C_4 = 0.1 \mu\text{F}$, $V_{CC} = 5 \text{ V} \pm 10 \%$, $T_A = -40$ to $85 \text{ }^\circ\text{C}$, unless otherwise specified. Typical values are referred to $T_A = 25 \text{ }^\circ\text{C}$).

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|-------------------|--|--|------|------|------|------------------------|
| V_{TOUT} | Output voltage swing | All Transmitter outputs are loaded with $3 \text{ k}\Omega$ to GND | ± 5 | ± 9 | | V |
| I_{TIL} | Input leakage current | | | | ± 10 | μA |
| V_{TIL} | Input logic threshold low | | 0.8 | | | V |
| V_{TIH} | Input logic threshold high | | | | 2 | V |
| SR_T | Transition slew rate | $T_A = 25 \text{ }^\circ\text{C}$, $V_{CC} = 5 \text{ V}$ $R_L = 3$ to $7 \text{ k}\Omega$, $C_L = 50$ to 1000 pF ⁽¹⁾ | 3 | 6 | 30 | $\text{V}/\mu\text{s}$ |
| D_R | Data rate | $R_L = 3$ to $7 \text{ k}\Omega$, $C_L = 50$ to 1000 pF one transmitter switching | 230 | 400 | | kbits/s |
| R_{TOUT} | Transmitter output resistance | $V_{CC} = V_+ = V_- = 0\text{V}$ $V_{\text{OUT}} = \pm 2 \text{ V}$ | 300 | | | Ω |
| I_{SC} | Transmitter output short circuit current | | | ± 10 | ± 60 | mA |
| t_{DT} | Transmitter propagation delay | $R_L = 3$ to $7 \text{ k}\Omega$, $C_L = 50$ to 2500 pF All transmitter loaded | | 2 | | μs |

1. Measured from 3 V to -3 V or from -3 V to 3 V
2. One transmitter output is loaded with $R_L = 3 \text{ k}\Omega$ to $7 \text{ k}\Omega$, $C_L = 50$ to 1000 pF

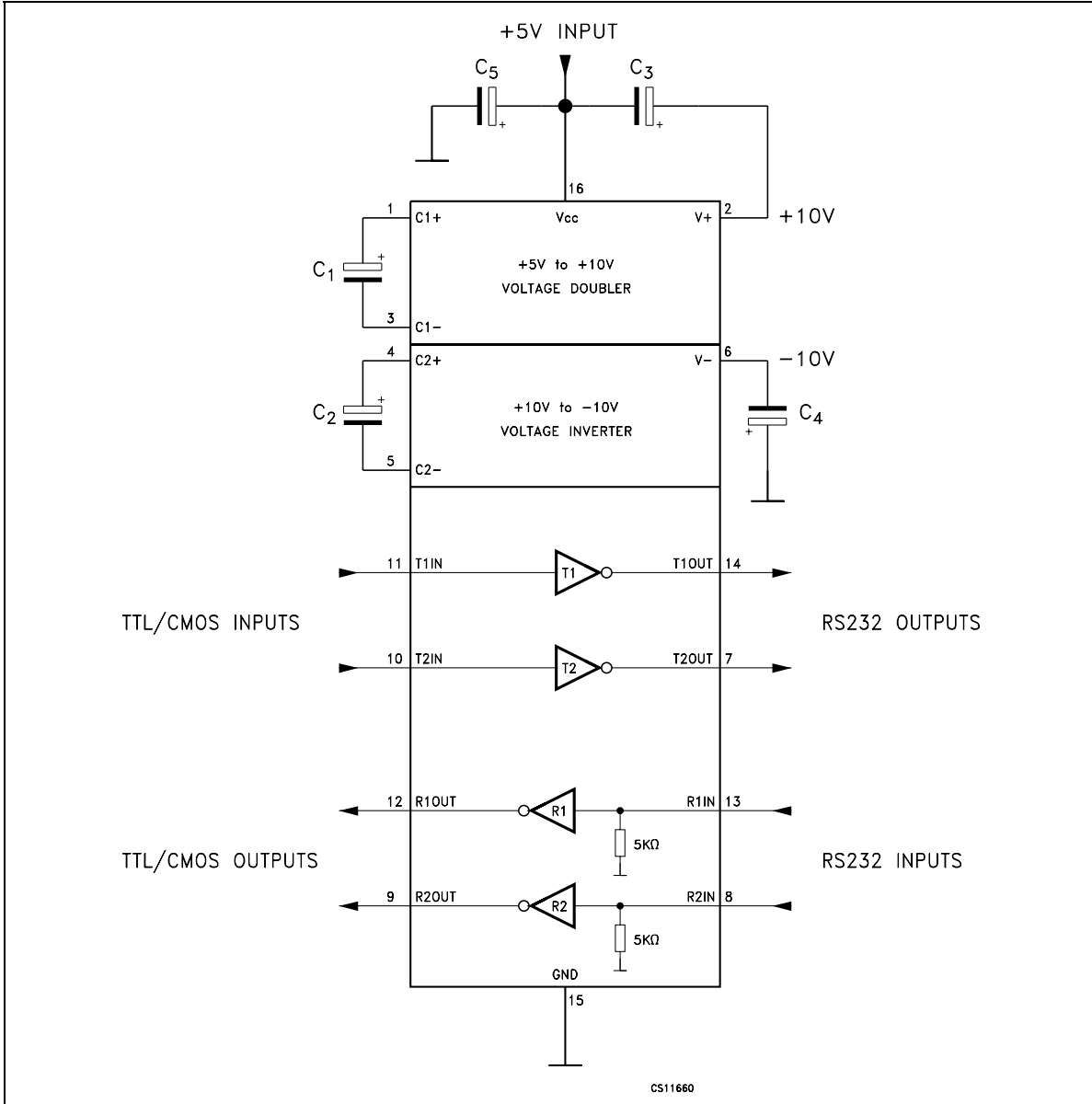
Table 7. Receiver electrical characteristics

($C_1 - C_4 = 0.1 \mu\text{F}$, $V_{CC} = 5 \text{ V} \pm 10 \%$, $T_A = -40$ to $85 \text{ }^\circ\text{C}$, unless otherwise specified. Typical values are referred to $T_A = 25 \text{ }^\circ\text{C}$).

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|-------------|--|---|------|--------------|------|------------------|
| V_{RIN} | Receiver input voltage operating range | | -30 | | 30 | V |
| R_{RIN} | RS-232 input resistance | $T_A = 25^\circ\text{C}$, $V_{CC} = 5 \text{ V}$ | 3 | 5 | 7 | $\text{k}\Omega$ |
| V_{RIL} | RS-232 input logic threshold low | $T_A = 25^\circ\text{C}$, $V_{CC} = 5 \text{ V}$ | 0.8 | 1.2 | | V |
| V_{RIH} | RS-232 input logic threshold high | $T_A = 25^\circ\text{C}$, $V_{CC} = 5 \text{ V}$ | | 1.7 | 2.4 | V |
| V_{RIHYS} | RS-232 input hysteresis | $V_{CC} = 5 \text{ V}$ | 0.2 | 0.5 | 1 | V |
| V_{ROL} | TTL/CMOS output voltage low | $I_{OUT} = 3.2 \text{ mA}$ | | | 0.4 | V |
| V_{ROH} | TTL/CMOS output voltage high | $I_{OUT} = -1 \text{ mA}$ | 3.5 | $V_{CC}-0.4$ | | V |
| t_{DR} | Receiver propagation delay | $C_L = 150 \text{ pF}$ | | 0.5 | 10 | μs |

4 Typical application

Figure 2. Application circuit (1) (2)



1. C₁₋₄ capacitors can even be 1μF ones
2. C₁₋₄ can be common or biased capacitors

Table 8. Capacitance value (μF)

| Devices | C2 | C3 | C4 | C5 | C5 |
|---------|-----|-----|-----|-----|-----|
| ST202E | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| ST232E | 1 | 1 | 1 | 1 | 1 |

5 Typical performance characteristics

(Unless otherwise specified $T_J = 25\text{ }^\circ\text{C}$)

Figure 3. Supply current vs temperature

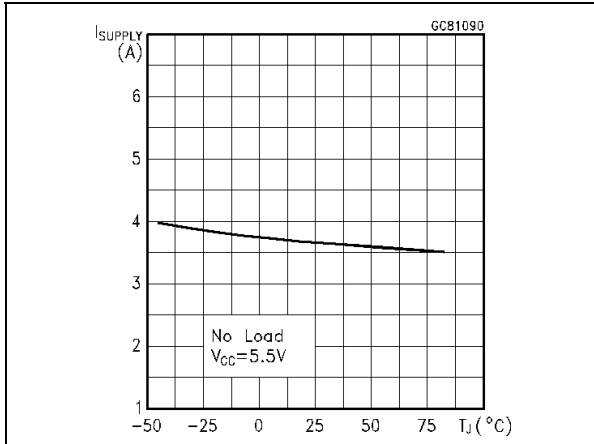


Figure 4. Data rate vs temperature

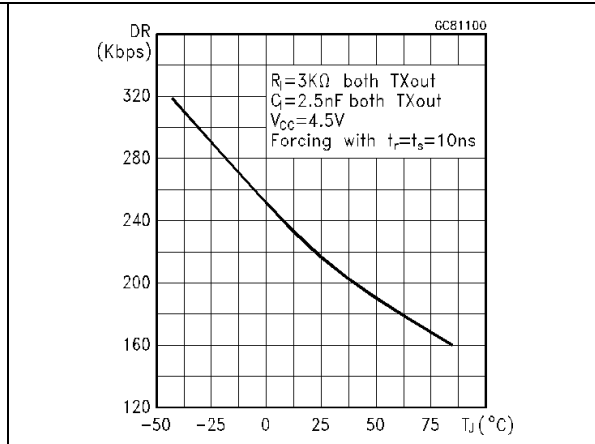


Figure 5. Receiver propagation delay

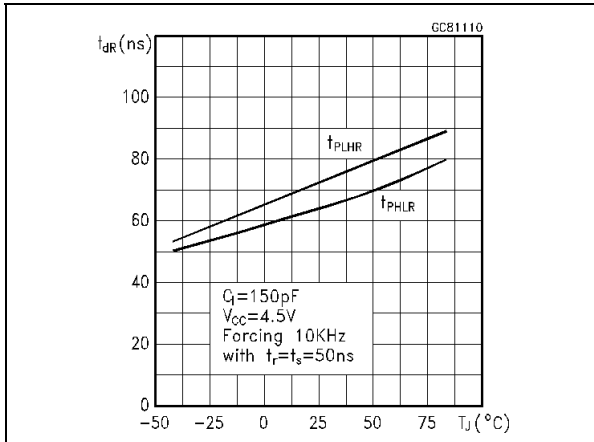


Figure 6. Driver propagation delay

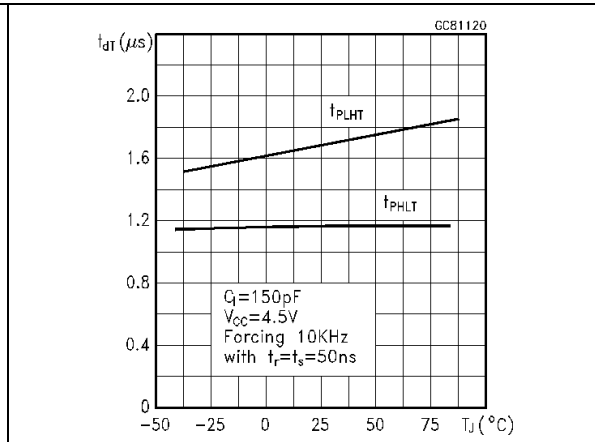


Figure 7. High level output voltage swing vs temperature

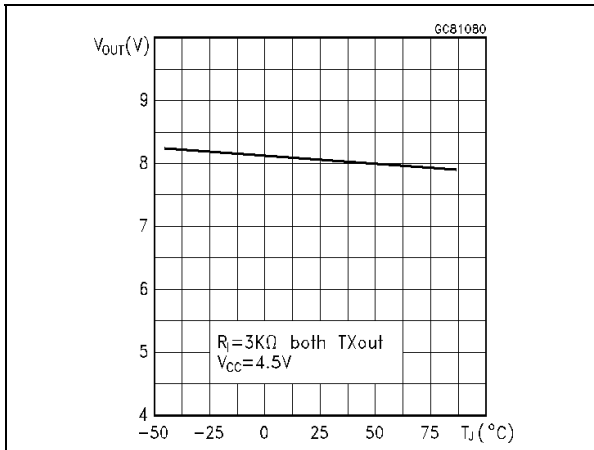


Figure 8. Low level output voltage swing vs temperature

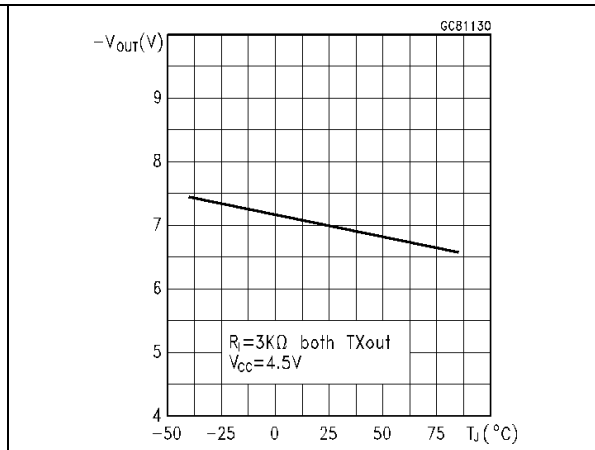


Figure 9. High level transmitter output short circuit current vs temperature

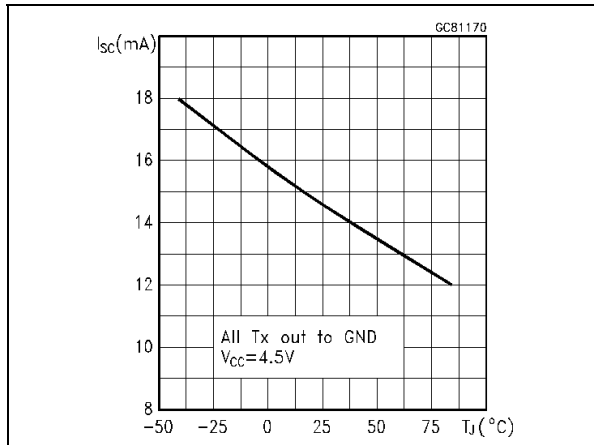


Figure 10. Low level transmitter output short circuit current vs temperature

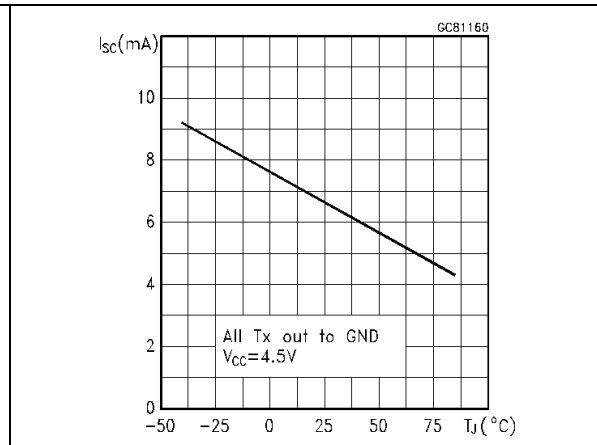


Figure 11. High level receiver output short circuit current vs temperature

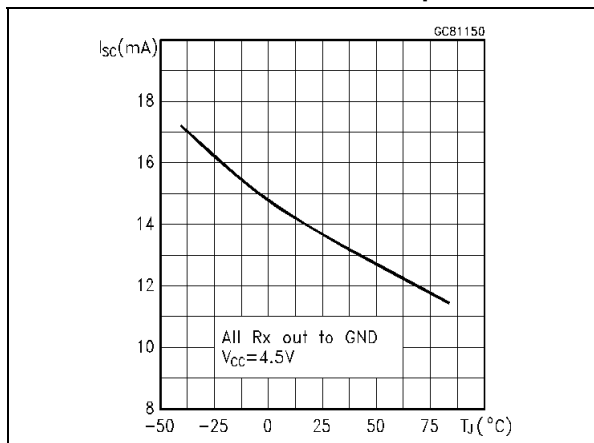
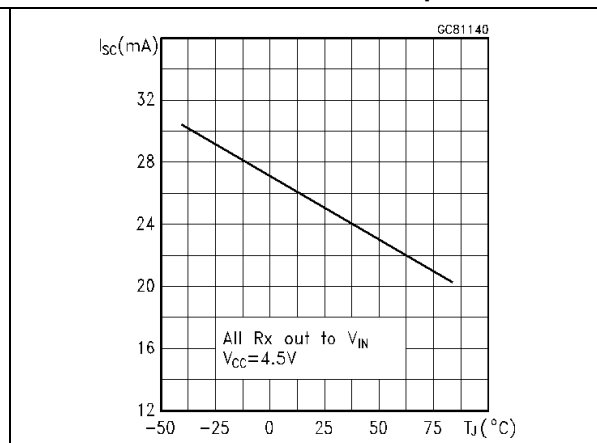


Figure 12. Low level receiver output short circuit current vs temperature

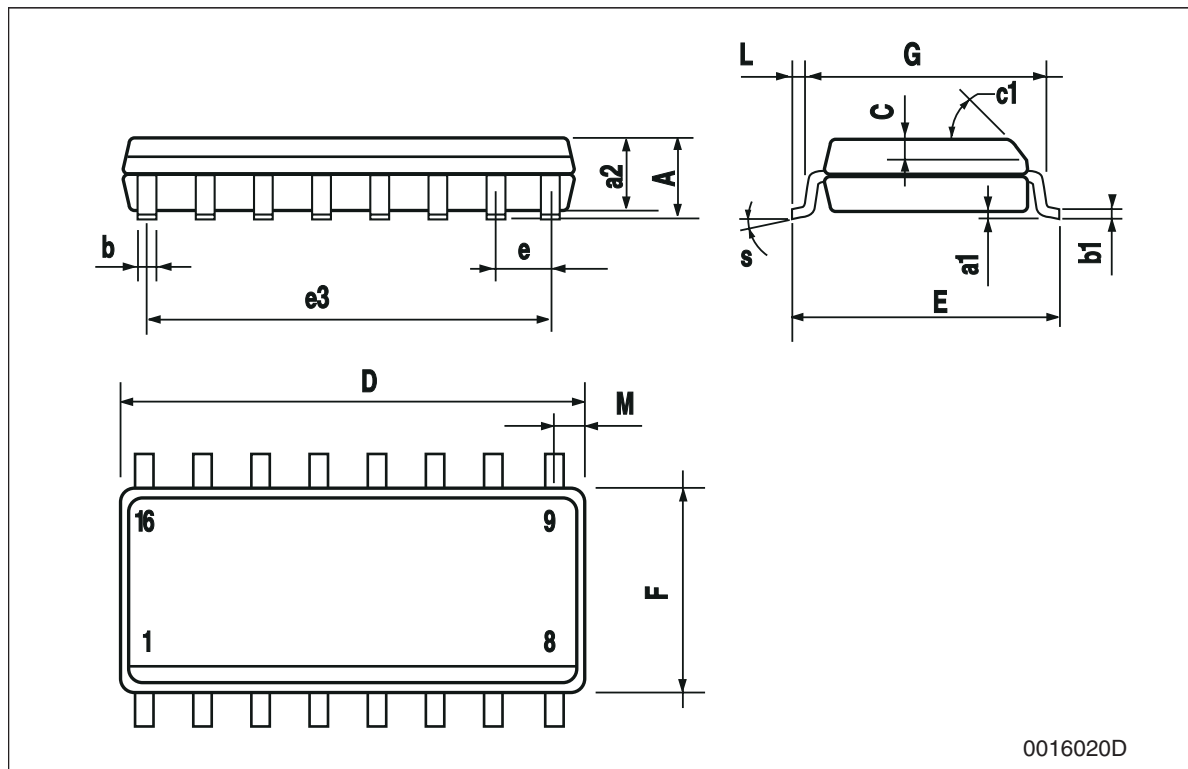


6 Package mechanical data

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.

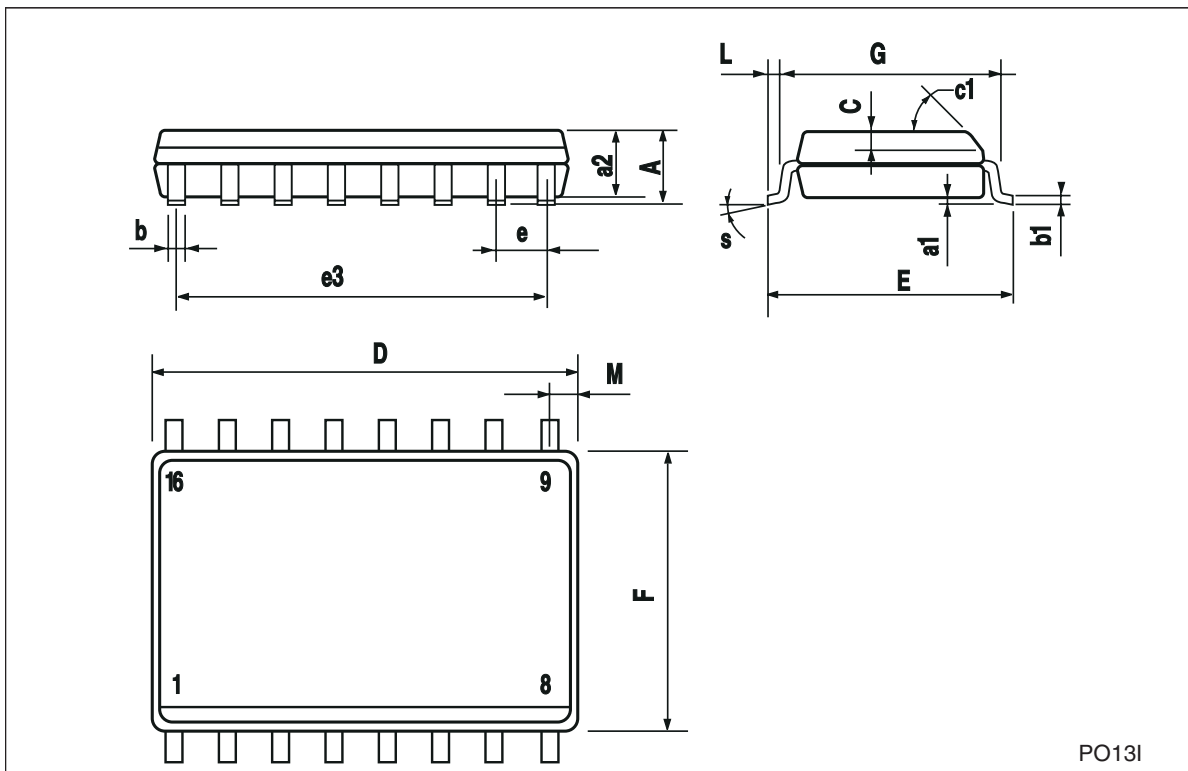
SO-16 mechanical data

| Dim. | mm. | | | inch. | | |
|------|------------|------|------|-------|-------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 1.75 | | | 0.068 |
| a1 | 0.1 | | 0.25 | 0.004 | | 0.010 |
| a2 | | | 1.64 | | | 0.063 |
| b | 0.35 | | 0.46 | 0.013 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | | 0.5 | | | 0.019 | |
| c1 | 45° (typ.) | | | | | |
| D | 9.8 | | 10 | 0.385 | | 0.393 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 8.89 | | | 0.350 | |
| F | 3.8 | | 4.0 | 0.149 | | 0.157 |
| G | 4.6 | | 5.3 | 0.181 | | 0.208 |
| L | 0.5 | | 1.27 | 0.019 | | 0.050 |
| M | | | 0.62 | | | 0.024 |
| S | 8° (max.) | | | | | |



SO-16L mechanical data

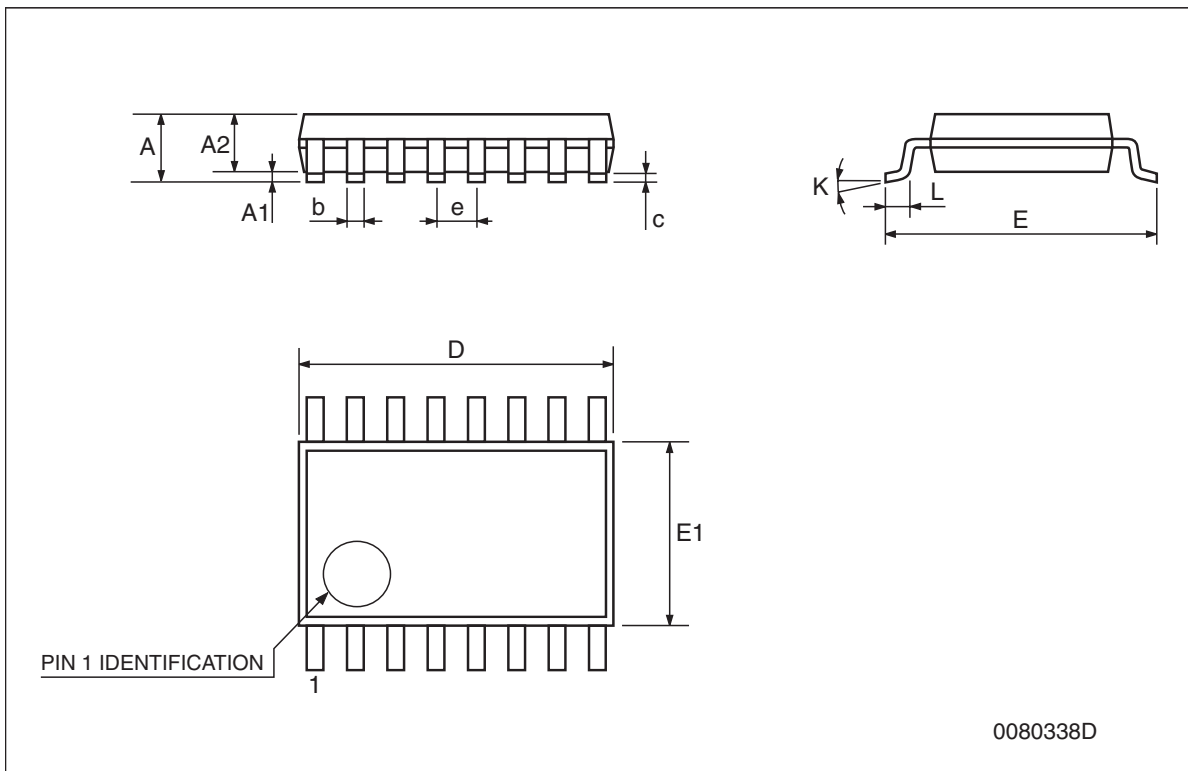
| Dim. | mm. | | | inch. | | |
|------|------------|------|-------|-------|-------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 2.65 | | | 0.104 |
| a1 | 0.1 | | 0.2 | 0.004 | | 0.008 |
| a2 | | | 2.45 | | | 0.096 |
| b | 0.35 | | 0.49 | 0.014 | | 0.019 |
| b1 | 0.23 | | 0.32 | 0.009 | | 0.012 |
| C | | 0.5 | | | 0.020 | |
| c1 | 45° (typ.) | | | | | |
| D | 10.1 | | 10.5 | 0.397 | | 0.413 |
| E | 10.0 | | 10.65 | 0.393 | | 0.419 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 8.89 | | | 0.350 | |
| F | 7.4 | | 7.6 | 0.291 | | 0.300 |
| G | | | | | | |
| L | 0.5 | | 1.27 | 0.020 | | 0.050 |
| M | | | 0.75 | | | 0.029 |
| S | 8° (max.) | | | | | |



PO131

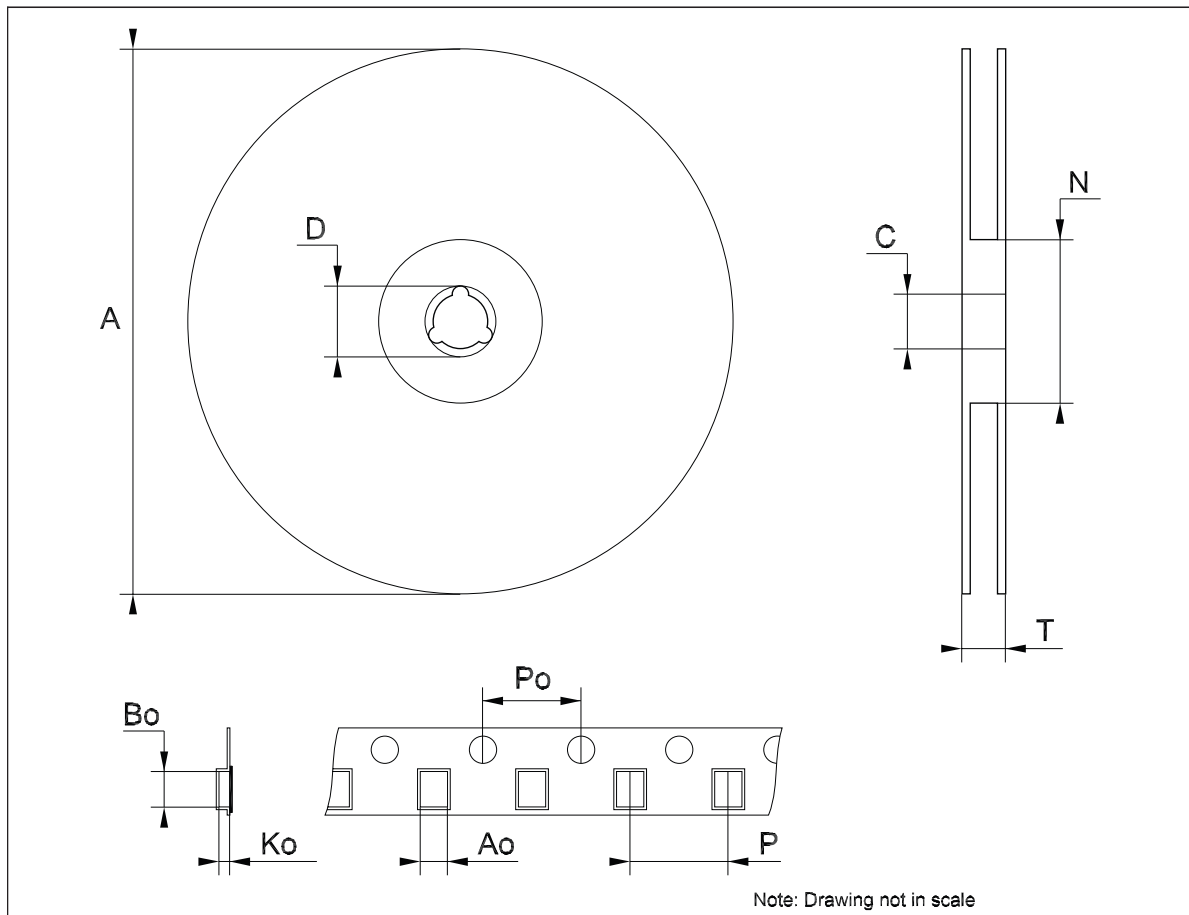
TSSOP16 mechanical data

| 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 | | 0.0079 |
| 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 |



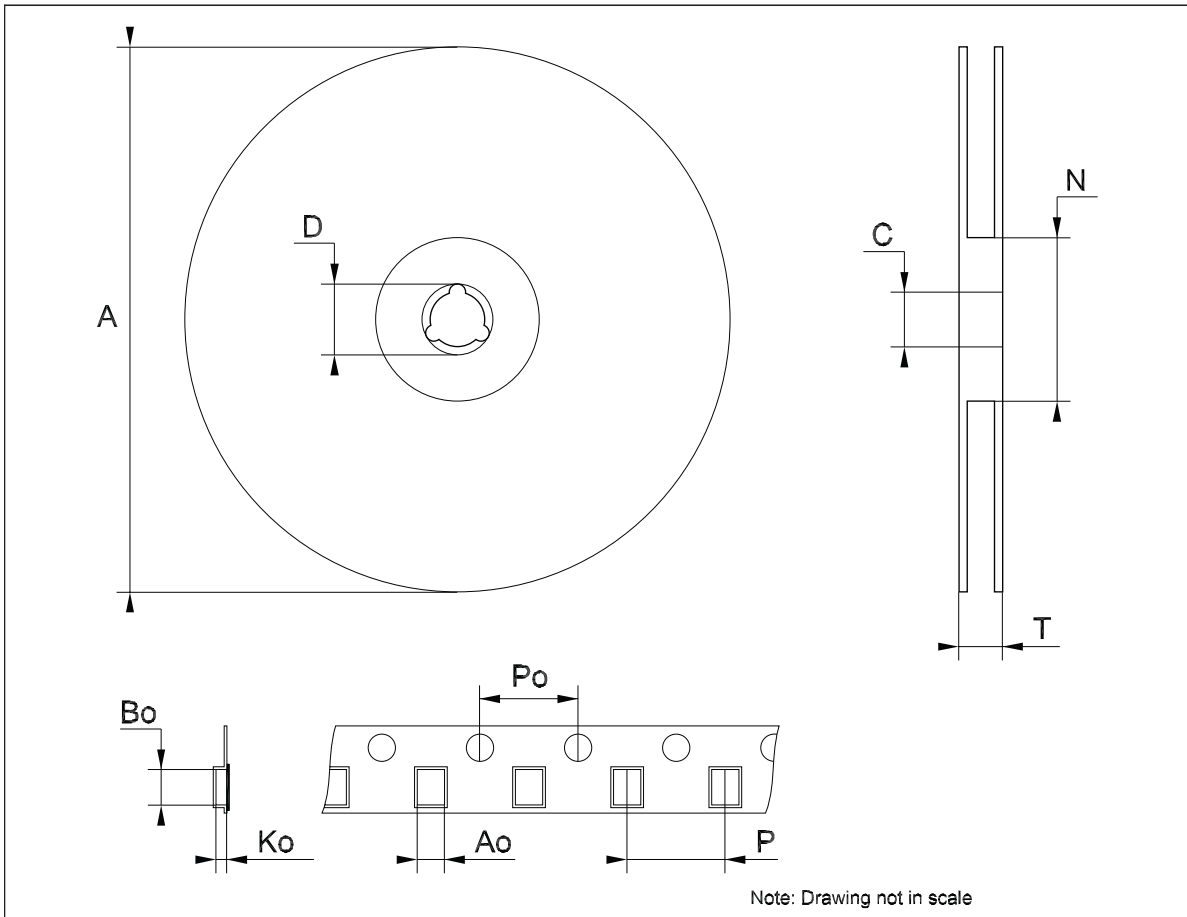
Tape & reel SO-16 mechanical data

| 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 | 6.45 | | 6.65 | 0.254 | | 0.262 |
| Bo | 10.3 | | 10.5 | 0.406 | | 0.414 |
| 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 |



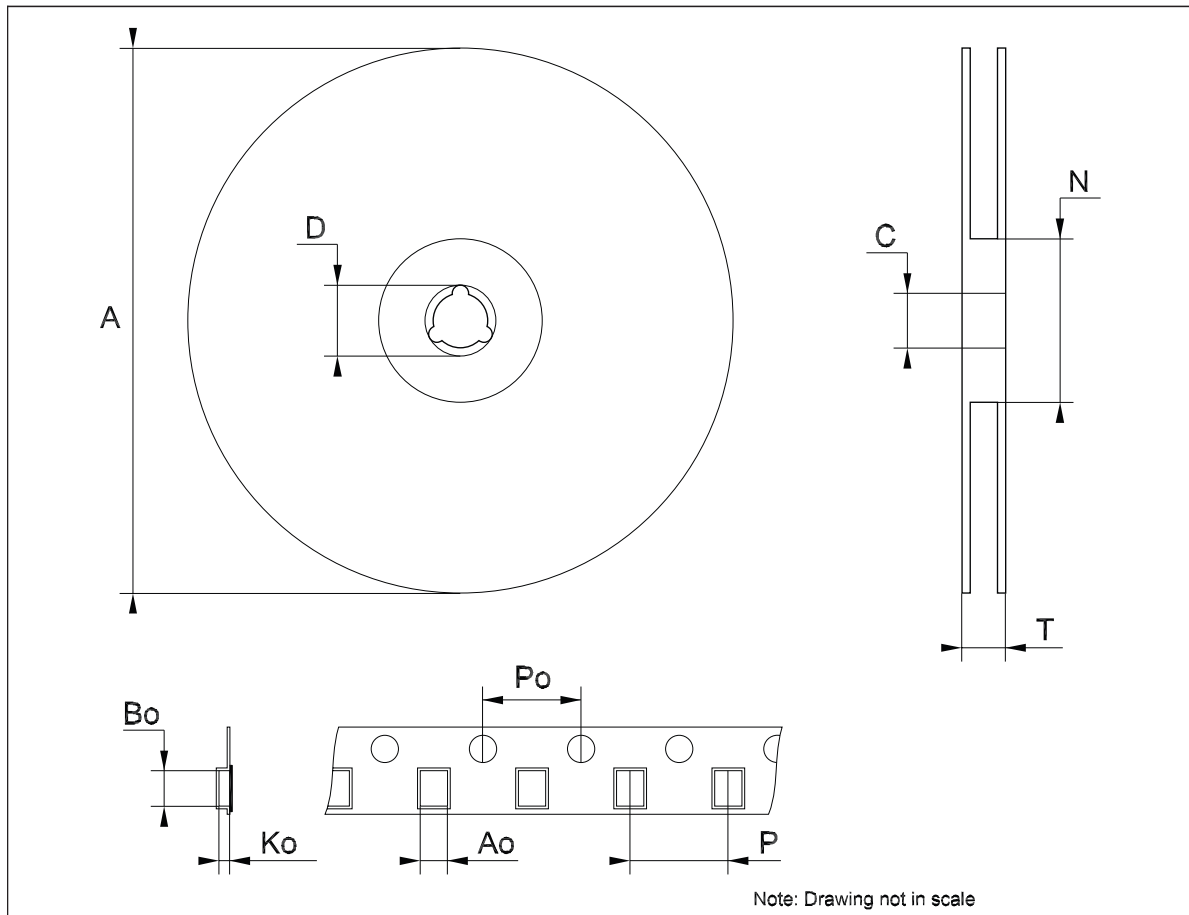
Tape & reel SO-16L mechanical data

| 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 | 10.8 | | 11.0 | 0.425 | | 0.433 |
| Bo | 10.7 | | 10.9 | 0.421 | | 0.429 |
| Ko | 2.9 | | 3.1 | 0.114 | | 0.122 |
| Po | 3.9 | | 4.1 | 0.153 | | 0.161 |
| P | 11.9 | | 12.1 | 0.468 | | 0.476 |



Tape & reel TSSOP16 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 | 6.7 | | 6.9 | 0.264 | | 0.272 |
| Bo | 5.3 | | 5.5 | 0.209 | | 0.217 |
| Ko | 1.6 | | 1.8 | 0.063 | | 0.071 |
| Po | 3.9 | | 4.1 | 0.153 | | 0.161 |
| P | 7.9 | | 8.1 | 0.311 | | 0.319 |



7 Revision history

Table 9. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 21-Feb-2006 | 12 | Change value of I_{TIL} on transmitter characteristics, $\pm 1\mu A \Rightarrow \pm 10\mu A$. |
| 14-Mar-2006 | 13 | Order codes has been updated and new template. |
| 27-Aug-2007 | 14 | Added Table 1 in cover page. |
| 13-Nov-2007 | 15 | Modified: Table 1 . |
| 08-feb-2008 | 16 | Modified: Table 1 on page 1 . |

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