



THE DATASHEET OF ST202EAN





ST202E ST232E

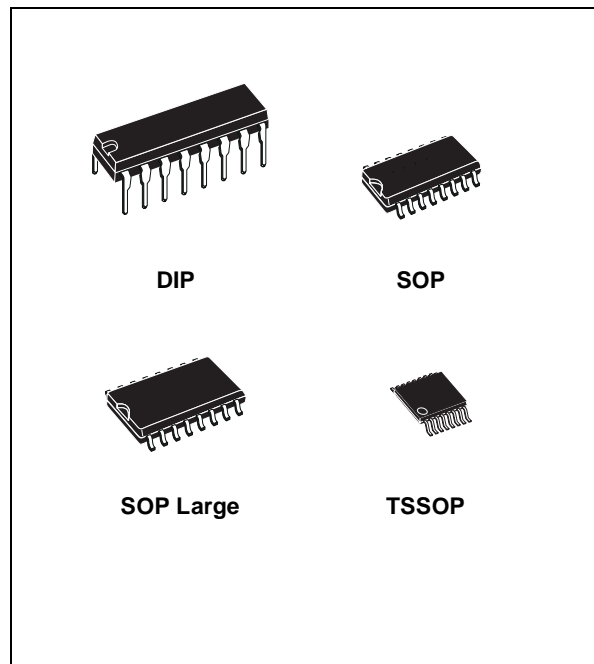
± 15KV ESD PROTECTED 5V RS-232 TRANSCEIVER

- ESD PROTECTION FOR RS-232 I/O PINS:
± 15KV HUMAN BODY MODEL
- GUARANTEED 230Kbps DATA RATE
- GUARANTEED SLEW RATE RANGE 3 to 30V/μs
- OPERATE FROM A SINGLE 5V 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 ± 15KV electrostatic discharge (ESD) shocks. The drivers meet all EIA/TIA-232E and CCITT V.28 specifications at data rates up to 230Kbps, when loaded in accordance with the EIA/TIA-232E specification. The ST202E/232E use a single 5V supply voltage.

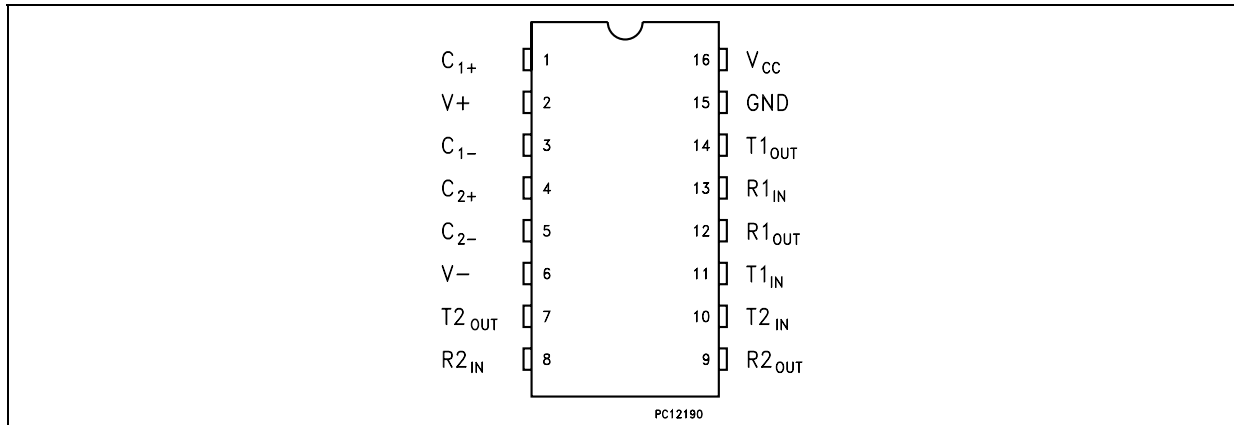
The ST232E operates with four 1μF capacitors, while the ST202E operates with four 0.1μF capacitors, further reducing cost and board space.



ORDERING CODES

| Type | | Temperature Range | Package | Comments |
|-----------|-----------|-------------------|---------------------------|-------------------------------------|
| ST202ECN | ST232ECN | 0 to 70 °C | DIP-16 | 25 parts per tube / 40 tube per box |
| ST202EBN | ST232EBN | -40 to 85 °C | DIP-16 | 25 parts per tube / 40 tube per box |
| ST202EAN | ST232EAN | -40 to 125 °C | DIP-16 | 25 parts per tube / 40 tube per box |
| ST202ECD | ST232ECD | 0 to 70 °C | SO-16 (Tube) | 50 parts per tube / 20 tube per box |
| ST202EBD | ST232EBD | -40 to 85 °C | SO-16 (Tube) | 50 parts per tube / 20 tube per box |
| ST202EAD | ST232EAD | -40 to 125 °C | SO-16 (Tube) | 50 parts per tube / 20 tube per box |
| 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 |
| ST202EADR | ST232EADR | -40 to 125 °C | SO-16 (Tape & Reel) | 2500 parts per reel |
| ST202ECW | ST232ECW | 0 to 70 °C | SO-16 Large (Tube) | 49 parts per tube / 25 tube per box |
| ST202EBW | ST232EBW | -40 to 85 °C | SO-16 Large (Tube) | 49 parts per tube / 25 tube per box |
| ST202EAW | ST232EAW | -40 to 125 °C | SO-16 Large (Tube) | 49 parts per tube / 25 tube per box |
| ST202ECWR | ST232ECWR | 0 to 70 °C | SO-16 Large (Tape & Reel) | 1000 parts per reel |
| ST202EBWR | ST232EBWR | -40 to 85 °C | SO-16 Large (Tape & Reel) | 1000 parts per reel |
| ST202EAWR | ST232EAWR | -40 to 125 °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 |
| ST202EATR | ST232EATR | -40 to 125 °C | TSSOP16 (Tape & Reel) | 2500 parts per reel |

PIN CONFIGURATION



PIN DESCRIPTION

| PIN N° | SYMBOL | NAME AND FUNCTION |
|--------|-------------------|--|
| 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 | T _{2OUT} | Second Transmitter Output Voltage |
| 8 | R _{2IN} | Second Receiver Input Voltage |
| 9 | R _{2OUT} | Second Receiver Output Voltage |
| 10 | T _{2IN} | Second Transmitter Input Voltage |
| 11 | T _{1IN} | First Transmitter Input Voltage |
| 12 | R _{1OUT} | First Receiver Output Voltage |
| 13 | R _{1IN} | First Receiver Input Voltage |
| 14 | T _{1OUT} | First Transmitter Output Voltage |
| 15 | GND | Ground |
| 16 | V _{CC} | Supply Voltage |

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 |

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

ESD PERFORMANCE: TRANSMITTER OUTPUTS, RECEIVER INPUTS

| Symbol | Parameter | Test Conditions | 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.

ELECTRICAL CHARACTERISTICS

($C_1 - C_4 = 0.1\mu\text{F}$ for ST202E, $C_1 - C_4 = 1\mu\text{F}$ for ST232E, $V_{CC} = 5V \pm 10\%$, $T_A = -40$ to 125°C , unless otherwise specified. Typical values are referred to $T_A = 25^\circ\text{C}$)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------------|-------------------------------|-----------------------------------|------|------|------|------|
| I_{SUPPLY} | V_{CC} Power Supply Current | No Load, $T_A = 25^\circ\text{C}$ | | 5 | 10 | mA |

TRANSMITTER ELECTRICAL CHARACTERISTICS

($C_1 - C_4 = 0.1\mu\text{F}$ for ST202E, $C_1 - C_4 = 1\mu\text{F}$ for ST232E, $V_{CC} = 5V \pm 10\%$, $T_A = -40$ to 125°C , unless otherwise specified. Typical values are referred to $T_A = 25^\circ\text{C}$)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|------------|--|--|------|------|------|------------------------|
| V_{TOUT} | Output Voltage Swing | All Transmitter outputs are loaded with $3K\Omega$ to GND | ± 5 | ± 9 | | V |
| I_{TIL} | Input Leakage Current | | | | ± 1 | μA |
| V_{TIL} | Input Logic Threshold Low | | 0.8 | | | V |
| V_{TIH} | Input Logic Threshold High | | | | 2 | V |
| SR_T | Transition Slew Rate | $T_A = 25^\circ\text{C}$, $V_{CC} = 5V$ $R_L = 3$ to $7K\Omega$, $C_L = 50$ to 1000pF (Note1) | 3 | 6 | 30 | $\text{V}/\mu\text{s}$ |
| D_R | Data Rate | $R_L = 3$ to $7K\Omega$, $C_L = 50$ to 1000pF one transmitter switching | 230 | 400 | | Kbits/s |
| R_{TOUT} | Transmitter Output Resistance | $V_{CC} = V_+ = V_- = 0V$ $V_{OUT} = \pm 2V$ | 300 | | | Ω |
| I_{SC} | Transmitter Output Short Circuit Current | | | ±10 | ±60 | mA |
| t_{DT} | Transmitter Propagation Delay | $R_L = 3$ to $7K\Omega$, $C_L = 50$ to 2500pF All transmitter loaded | | 2 | | μA |

Note 1: Measured from 3V to -3V or from -3V to 3V.

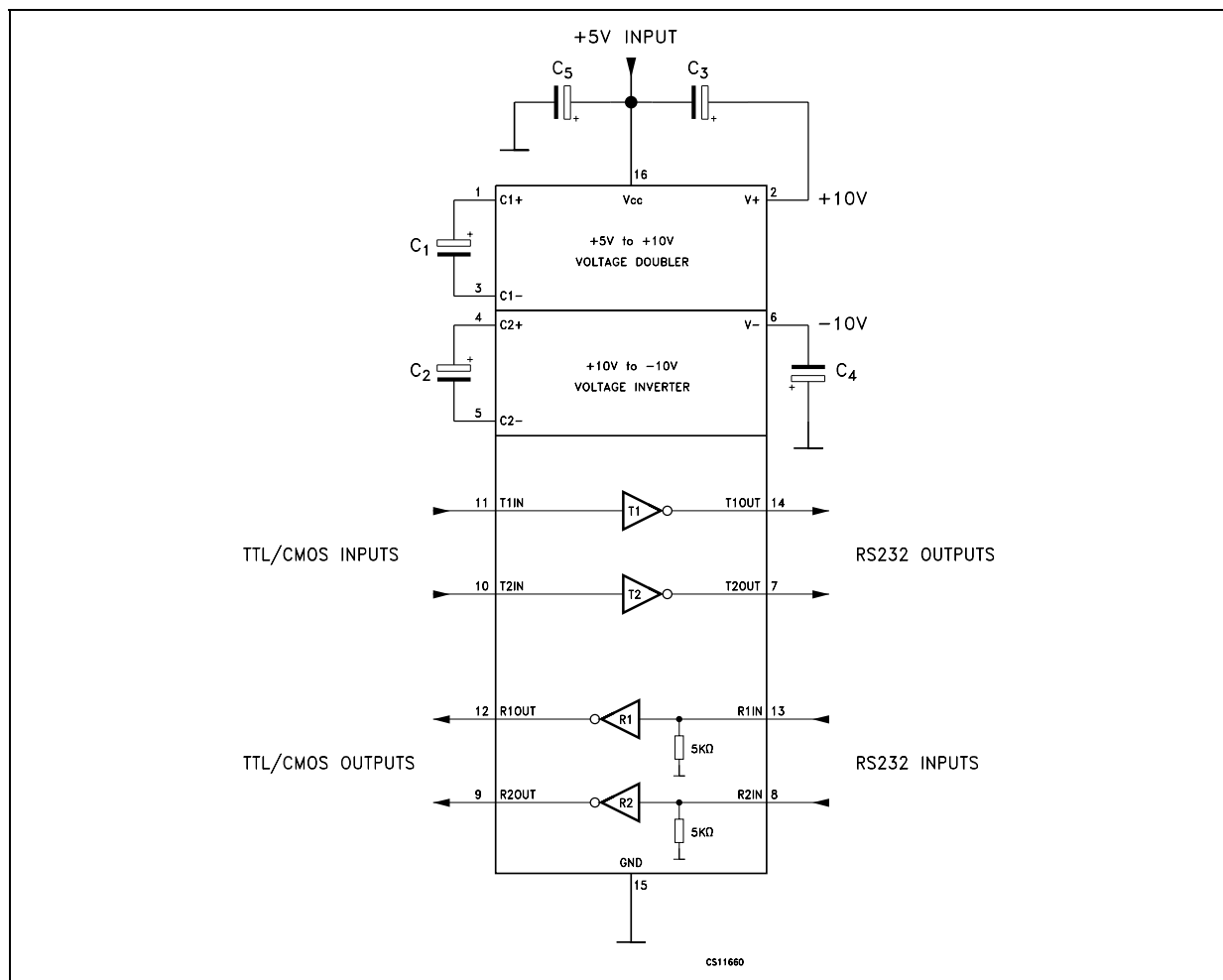
Note2: One transmitter output is loaded with $R_L = 3K\Omega$ to $7K\Omega$, $C_L = 50$ to 1000pF

RECEIVER ELECTRICAL CHARACTERISTICS

($C_1 - C_4 = 0.1\mu\text{F}$ for ST202E, $C_1 - C_4 = 1\mu\text{F}$ for ST232E, $V_{CC} = 5\text{V} \pm 10\%$, $T_A = -40$ to 125°C , unless otherwise specified. Typical values are referred to $T_A = 25^\circ\text{C}$)

| Symbol | Parameter | Test Conditions | 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 |

APPLICATION CIRCUITS (note 1, note 2)



Note 1: C_{1-4} capacitors can even be $1\mu\text{F}$ ones.
 Note 2: C_{1-4} can be common or biased capacitors.

CAPACITANCE VALUE (μF)

| DEVICES | C1 | C2 | C3 | C4 | C5 |
|---------|-----|-----|-----|-----|-----|
| ST202E | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| ST232E | 1 | 1 | 1 | 1 | 1 |

TYPICAL PERFORMANCE CHARACTERISTICS (unless otherwise specified $T_j = 25^\circ\text{C}$)

Figure 1 : Supply Current vs Temperature

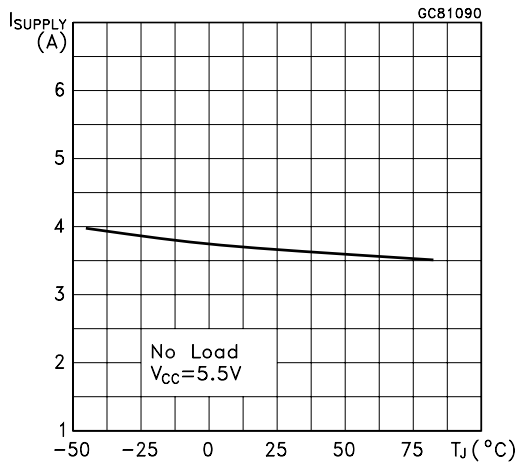


Figure 2 : Data Rate vs Temperature

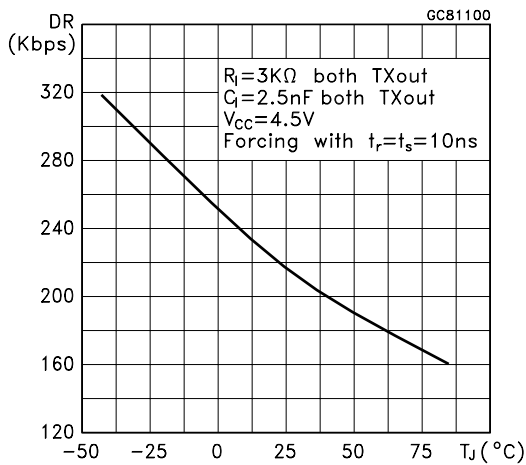


Figure 3 : Receiver Propagation Delay

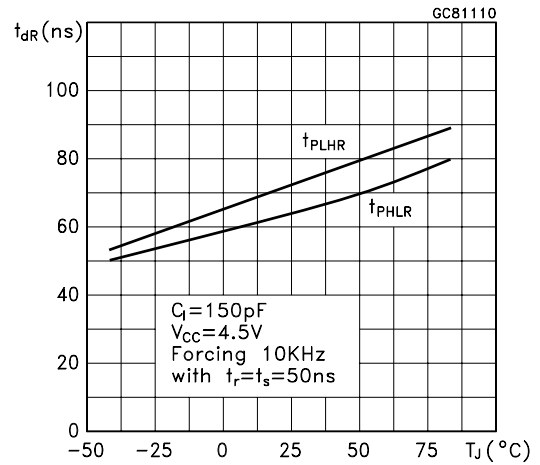


Figure 4 : Driver Propagation Delay

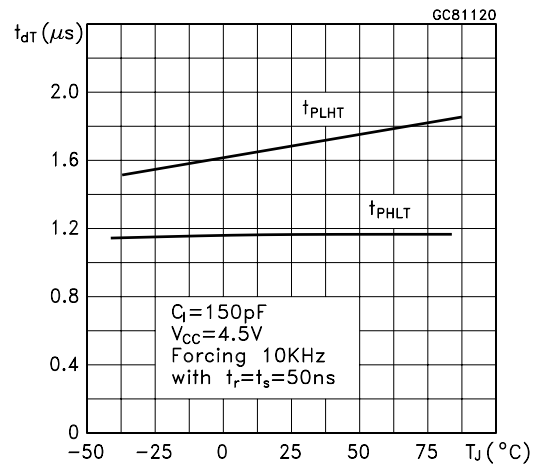


Figure 5 : High Level Output Voltage Swing vs Temperature

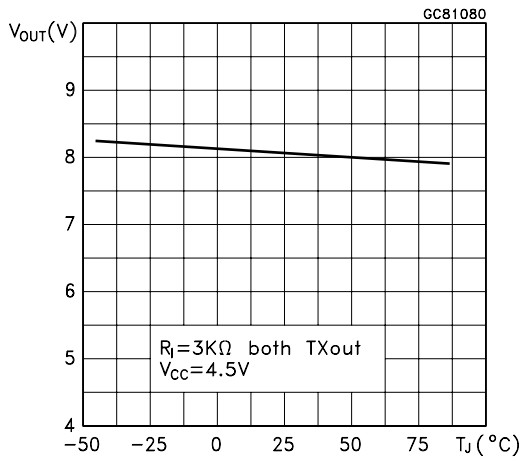


Figure 8 : Low Level Transmitter Output Short Circuit Current vs Temperature

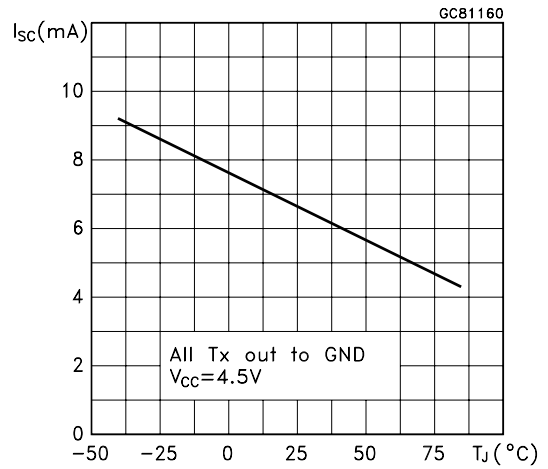


Figure 6 : Low Level Output Voltage Swing vs Temperature

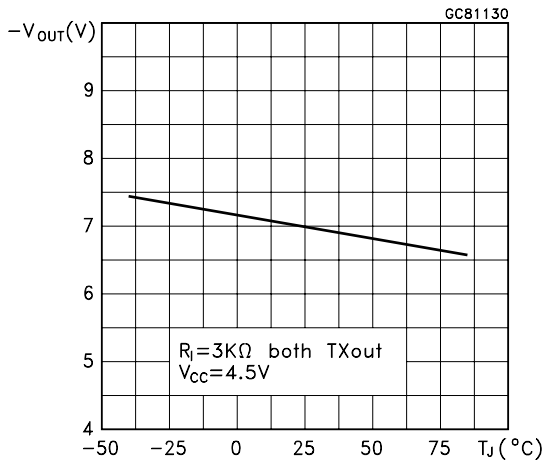


Figure 9 : High Level Receiver Output Short Circuit Current vs Temperature

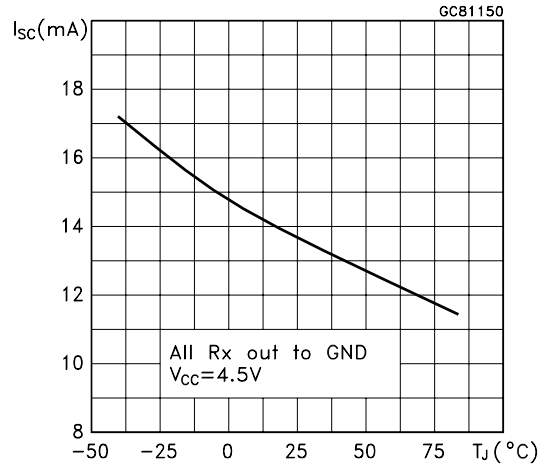


Figure 7 : High Level Transmitter Output Short Circuit Current vs Temperature

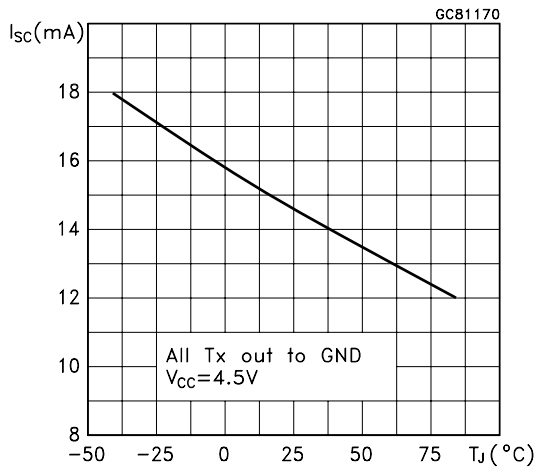
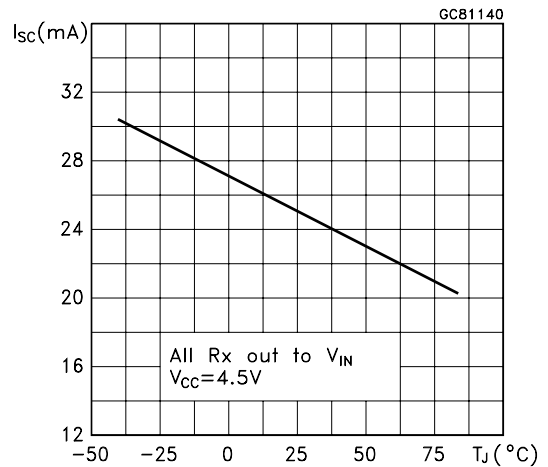
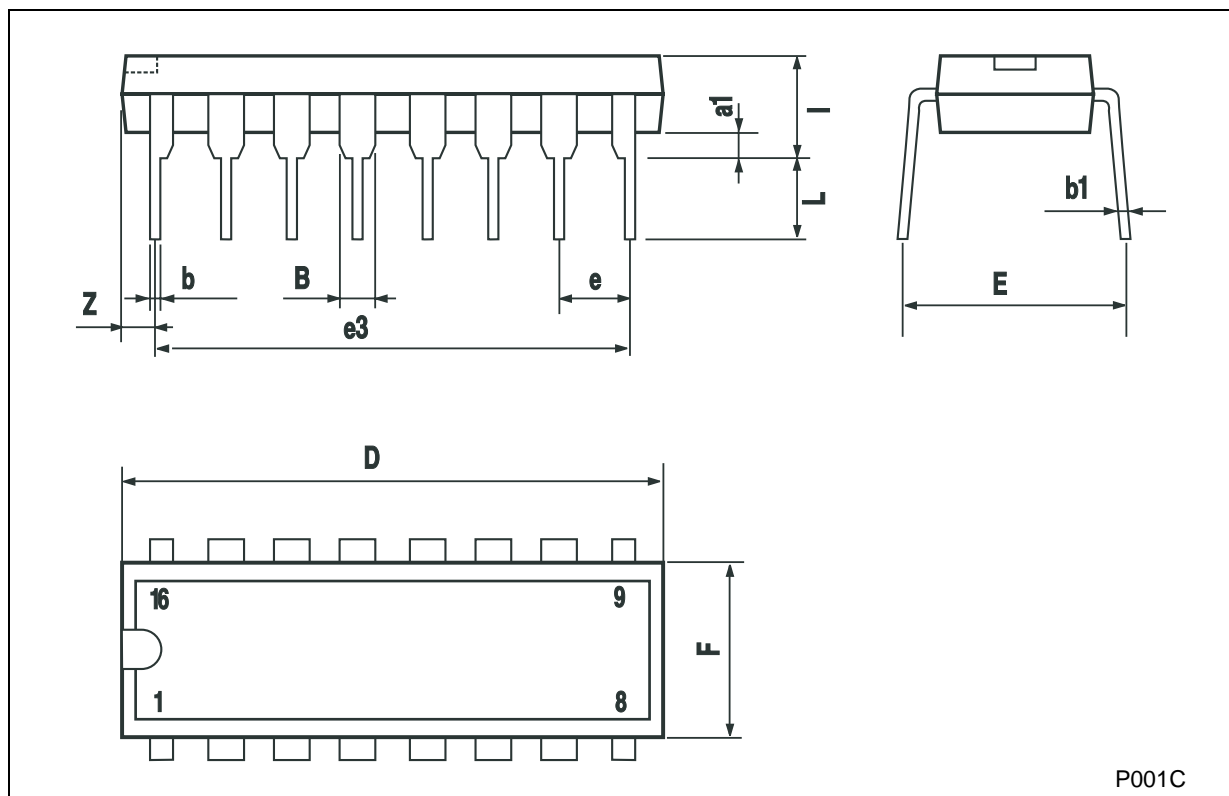


Figure 10 : Low Level Receiver Output Short Circuit Current vs Temperature



Plastic DIP-16 (0.25) MECHANICAL DATA

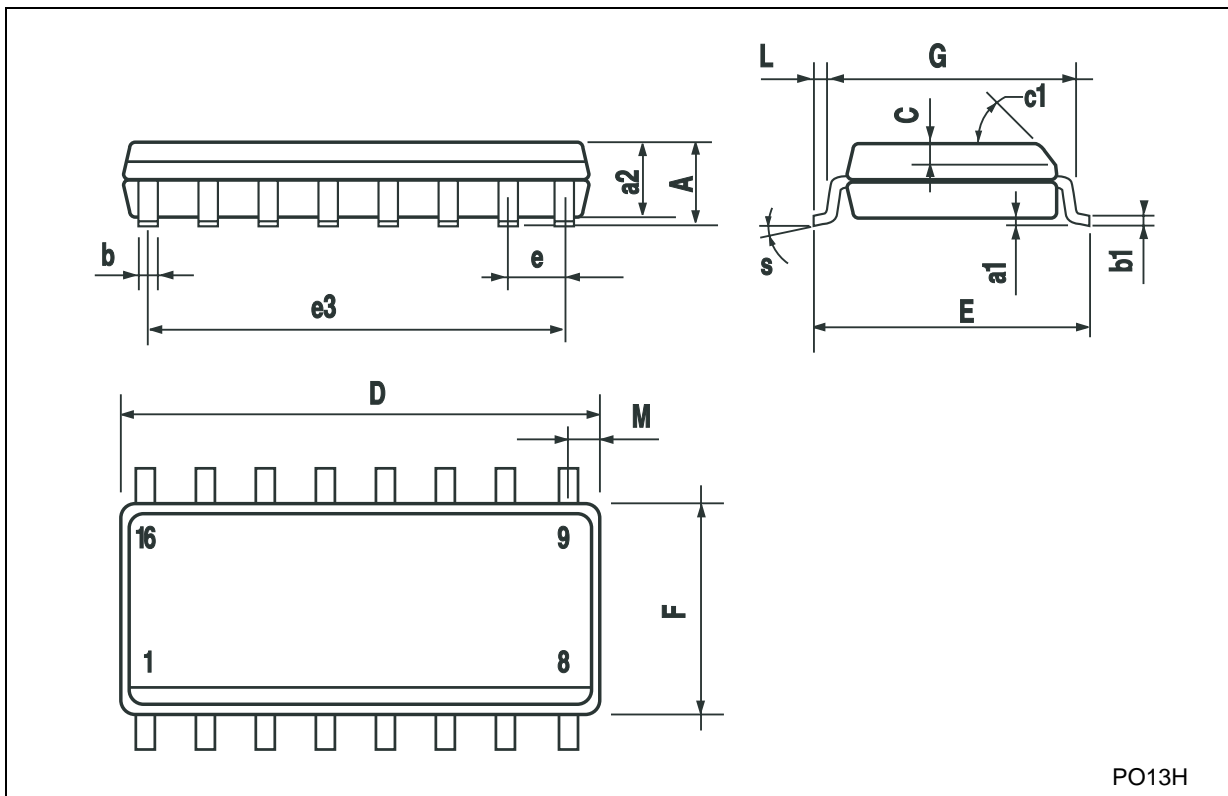
| DIM. | mm. | | | inch | | |
|------|------|-------|------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| a1 | 0.51 | | | 0.020 | | |
| B | 0.77 | | 1.65 | 0.030 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 0.100 | |
| e3 | | 17.78 | | | 0.700 | |
| F | | | 7.1 | | | 0.280 |
| I | | | 5.1 | | | 0.201 |
| L | | 3.3 | | | 0.130 | |
| Z | | | 1.27 | | | 0.050 |



P001C

SO-16 MECHANICAL DATA

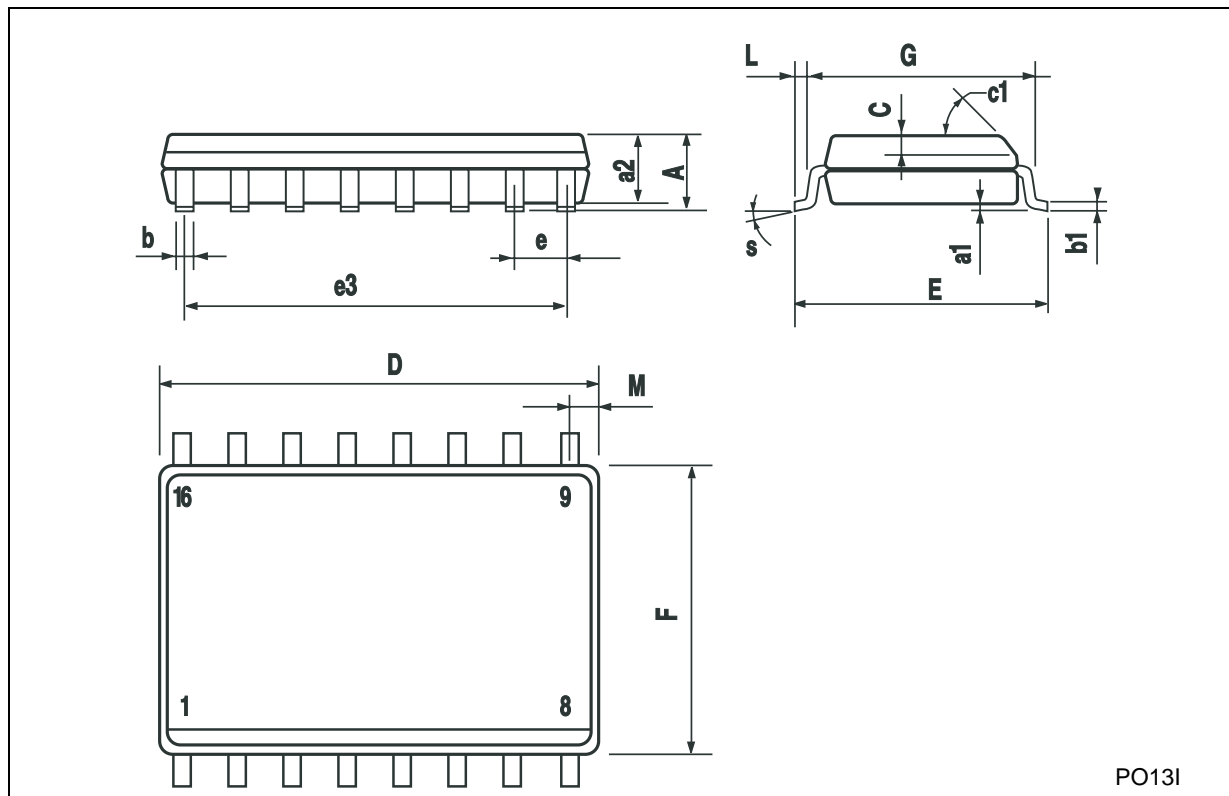
| DIM. | mm. | | | inch | | |
|------|------------|------|------|----------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.068 |
| a1 | 0.1 | | 0.2 | 0.004 | | 0.008 |
| a2 | | | 1.65 | | | 0.064 |
| b | 0.35 | | 0.46 | 0.013 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 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.) | | |



PO13H

SO-16L MECHANICAL DATA

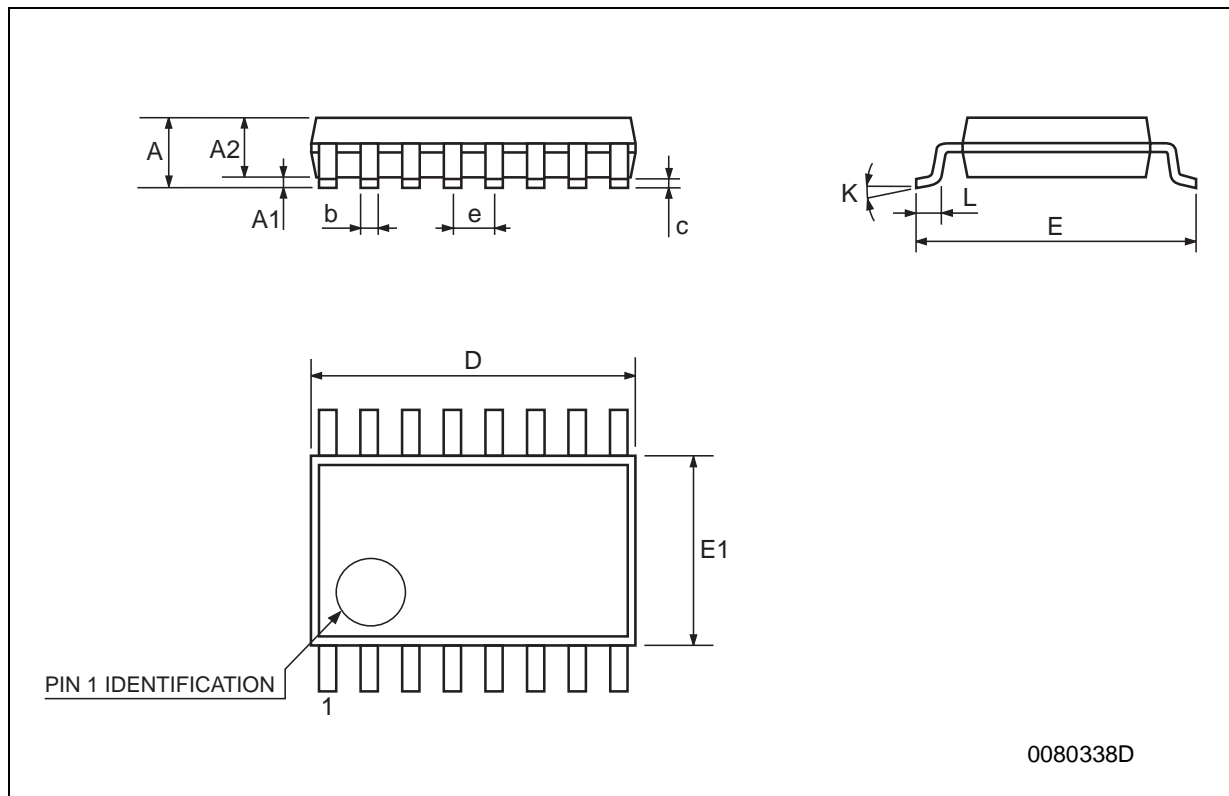
| DIM. | mm. | | | inch | | |
|------|------------|------|-------|----------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 2.65 | | | 0.104 |
| a1 | 0.1 | | 0.2 | 0.004 | | 0.008 |
| a2 | | | 2.45 | | | 0.096 |
| b | 0.35 | | 0.49 | 0.014 | | 0.019 |
| b1 | 0.23 | | 0.32 | 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

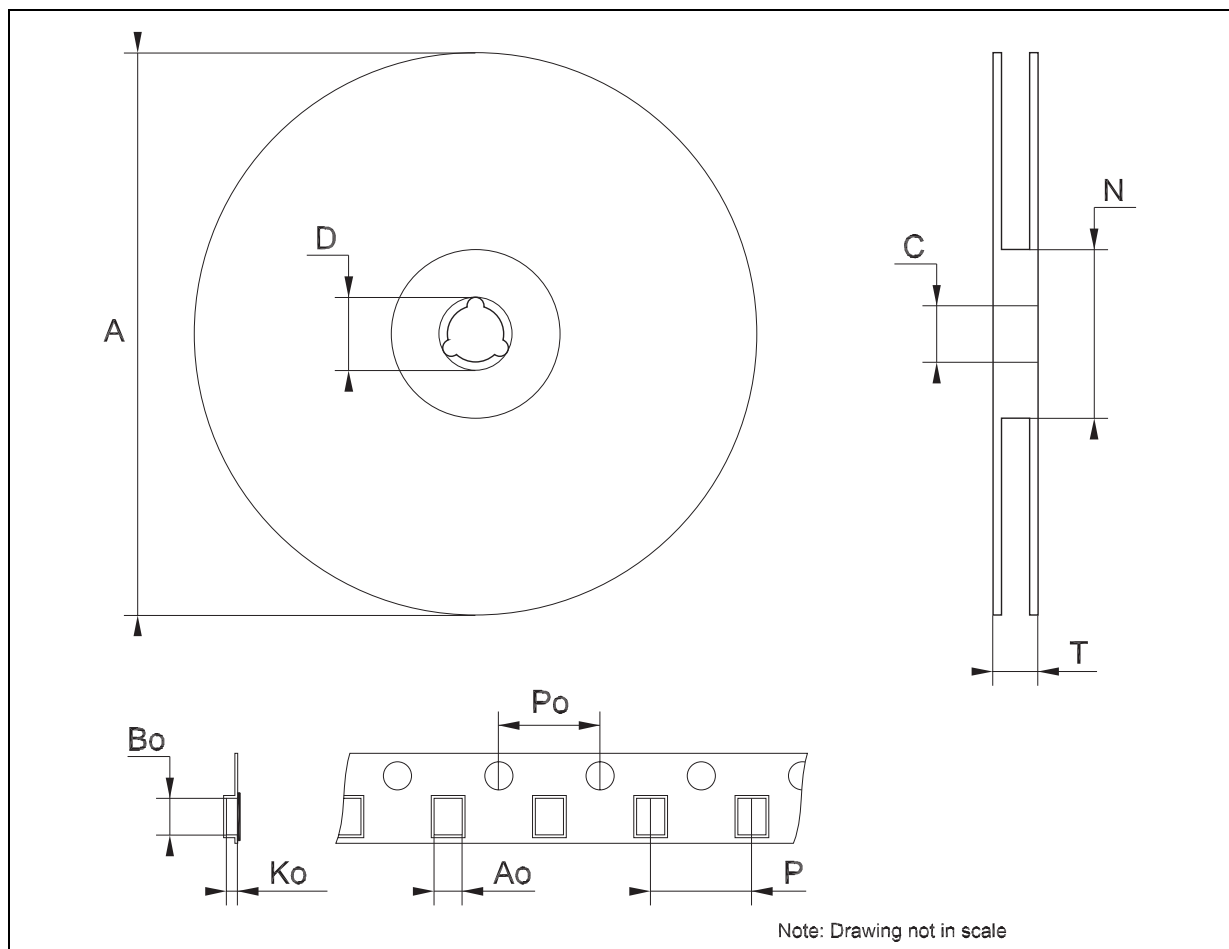
| DIM. | mm. | | | inch | | |
|------|------|----------|------|-------|------------|--------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.2 | | | 0.047 |
| A1 | 0.05 | | 0.15 | 0.002 | 0.004 | 0.006 |
| A2 | 0.8 | 1 | 1.05 | 0.031 | 0.039 | 0.041 |
| b | 0.19 | | 0.30 | 0.007 | | 0.012 |
| 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 |



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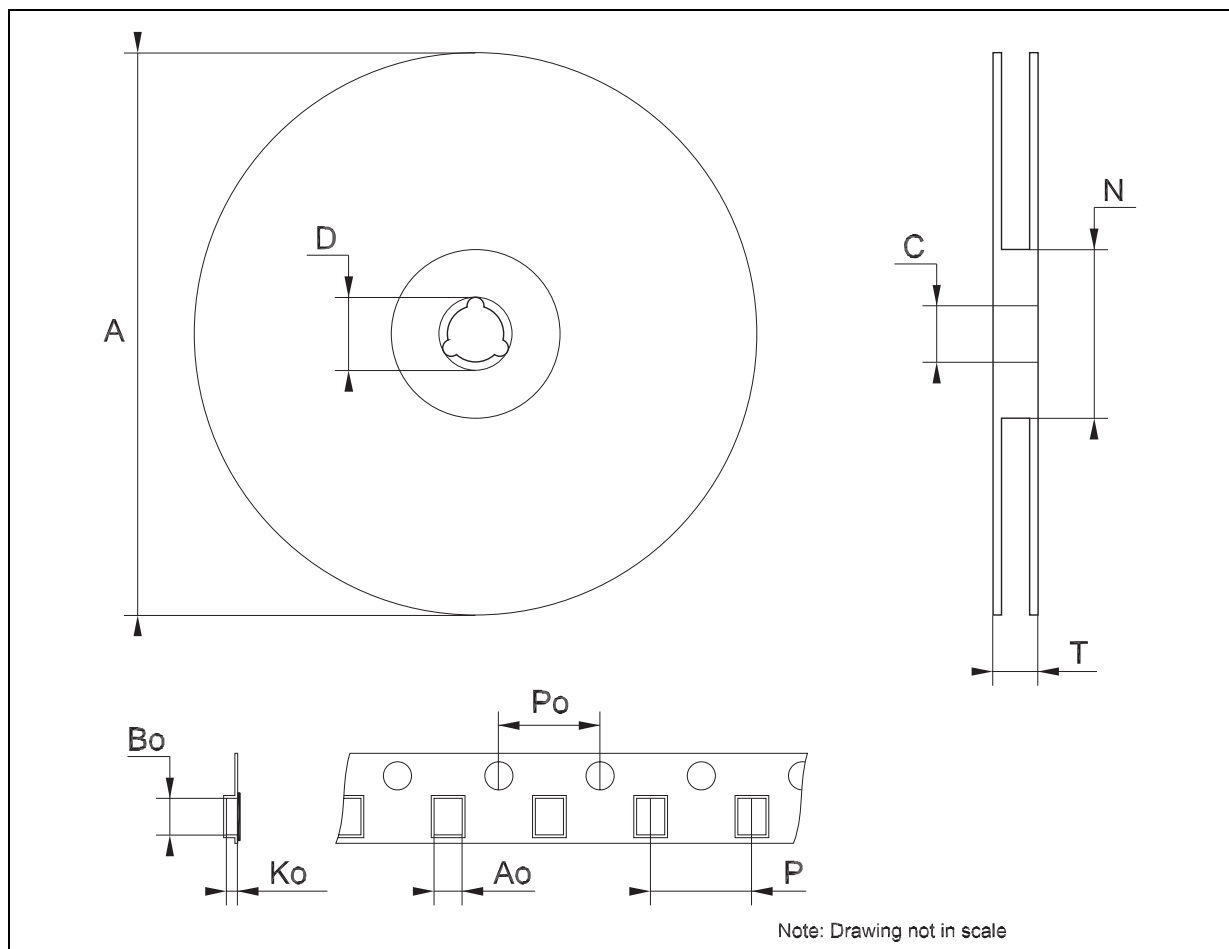
Tape & Reel SO-16 MECHANICAL DATA

| 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 |



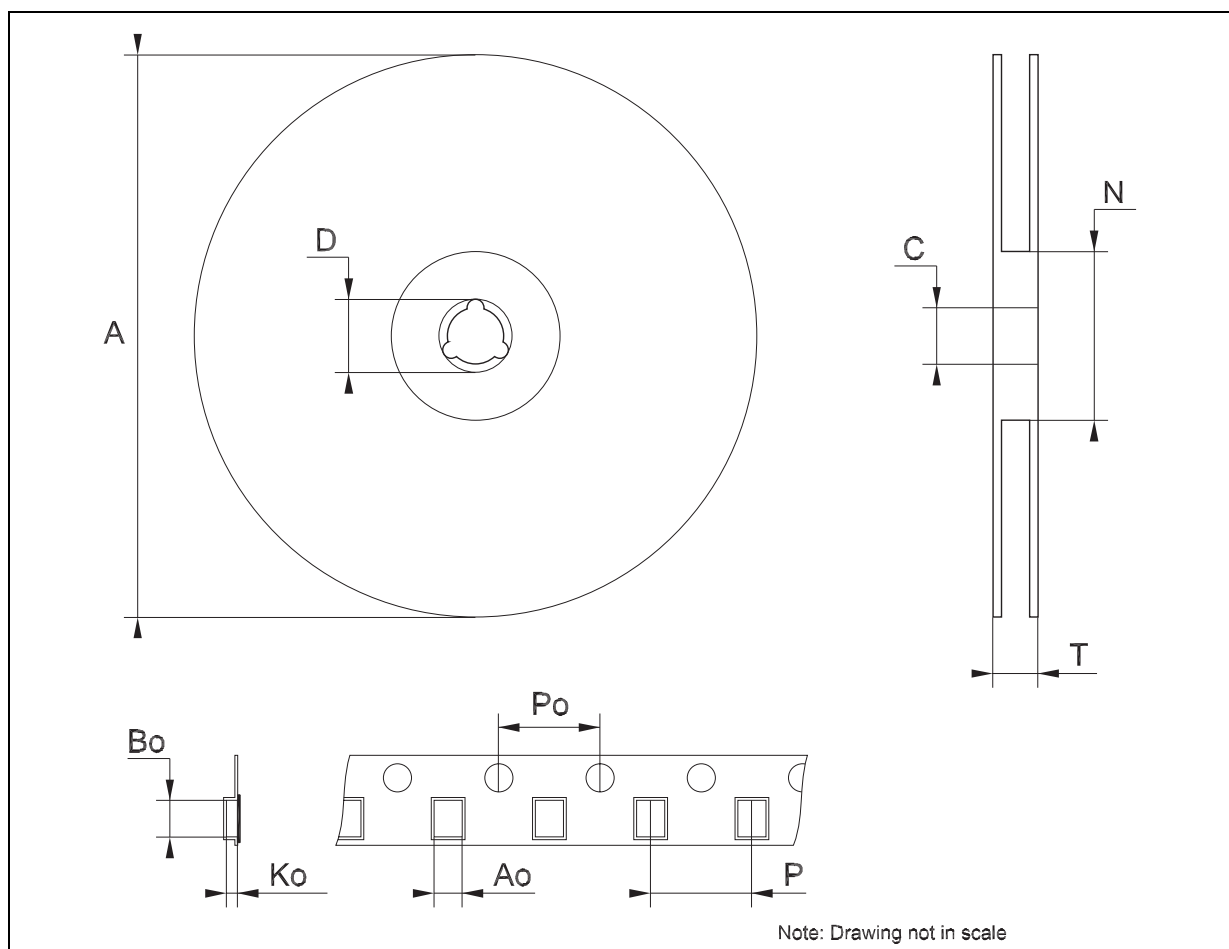
Tape & Reel SO-16L MECHANICAL DATA

| 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 |



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