

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/μs
- Operates from a single 5 V power supply

Description

The ST202EB, ST202EC, ST232EB, and ST232EC are two-driver, two-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 ST202EB, ST202EC, ST232EB, and ST232EC use a single 5 V supply voltage.

The ST232EB and ST232EC operate with four 1 μF capacitors, while the ST202EB and ST202EC operate with four 0.1 μF capacitors, further reducing cost and board space.

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1 Pinout information

Figure 1: Pin connections (top view)

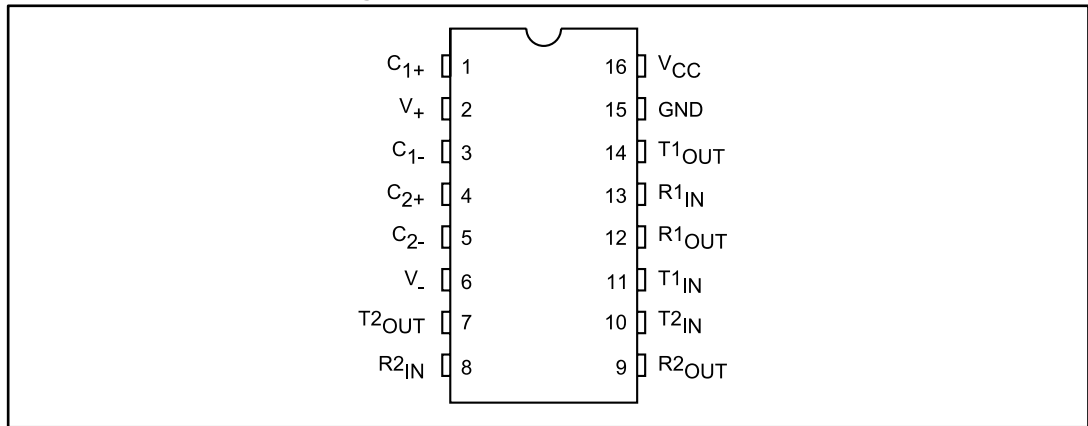


Table 1: Pin description

| 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 ₂ OUT | Second transmitter output voltage |
| 8 | R ₂ IN | Second receiver input voltage |
| 9 | R ₂ OUT | Second receiver output voltage |
| 10 | T ₂ IN | Second transmitter input voltage |
| 11 | T ₁ IN | First transmitter input voltage |
| 12 | R ₁ OUT | First receiver output voltage |
| 13 | R ₁ IN | First receiver input voltage |
| 14 | T ₁ OUT | First transmitter output voltage |
| 15 | GND | Ground |
| 16 | V _{CC} | Supply voltage |

2 Absolute maximum ratings

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

Table 2: 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- | Extra negative voltage | -14 to 0.3 | |
| T _{IN} | Transmitter input voltage range | -0.3 to (V ₊ + 0.3) | |
| R _{IN} | Receiver input voltage range | ± 30 | |
| T _{OUT} | Transmitter output voltage range | (V ₋ - 0.3) to (V ₊ + 0.3) | |
| R _{OUT} | Receiver output voltage range | -0.3 to (V _{CC} + 0.3) | |
| T _{SCTOUT} | Short circuit duration on T _{OUT} | Infinite | |
| T _{STG} | Storage temperature range | -65 to 150 | °C |

3 Electrical characteristics

Table 3: ESD performance: transmitter outputs, receiver inputs

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------|------------------------|----------------------------------|------|------|------|------|
| ESD | ESD protection voltage | Human body model | ± 15 | — | — | kV |
| | | IEC 1000-4-2 (contact discharge) | ± 6 | | | |
| | | IEC 1000-4-2 (air discharge) | ± 8 | | | |

Table 4: Electrical characteristics, C1 - C4 = 0.1 µF, V_{CC} = 5 V ± 10 %, T_A = -40 to 125 °C, unless otherwise specified, typical values are referred to T_A = 25 °C

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------------|--------------------------------------|---------------------------------|------|------|------|------|
| I _{SUPPLY} | V _{CC} power supply current | No load, T _A = 25 °C | — | 5 | 10 | mA |

Table 5: Transmitter electrical characteristics, C1 - C4 = 0.1 µF, V_{CC} = 5 V ± 10 %, T_A = -40 to 85 °C, unless otherwise specified, typical values are referred to T_A = 25 °C

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-------------------|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|------|------|------|---------|
| V _{TOUT} | Output voltage swing | All transmitter outputs are loaded with 3 kΩ 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 | |
| SR _T | Transition slew rate | T _A = 25 °C, V _{CC} = 5 V, R _L = 3 to 7 kΩ, C _L = 50 to 1000 pF ⁽¹⁾ | 3 | 6 | 30 | V/µs |
| D _R | Data rate | R _L = 3 to 7 kΩ, C _L = 50 to 1000 pF, one transmitter switching | 230 | 400 | | kbits/s |
| R _{TOUT} | Transmitter output resistance | V _{CC} = V ₊ = V ₋ = 0 V, V _{OUT} = ± 2 V | 300 | | | Ω |
| I _{SC} | Transmitter output short circuit current | | | ± 10 | ± 60 | mA |
| t _{DT} | Propagation delay time | R _L = 3 to 7 kΩ, C _L = 50 to 2500 pF, all transmitters loaded | | 2 | | µA |

Notes:

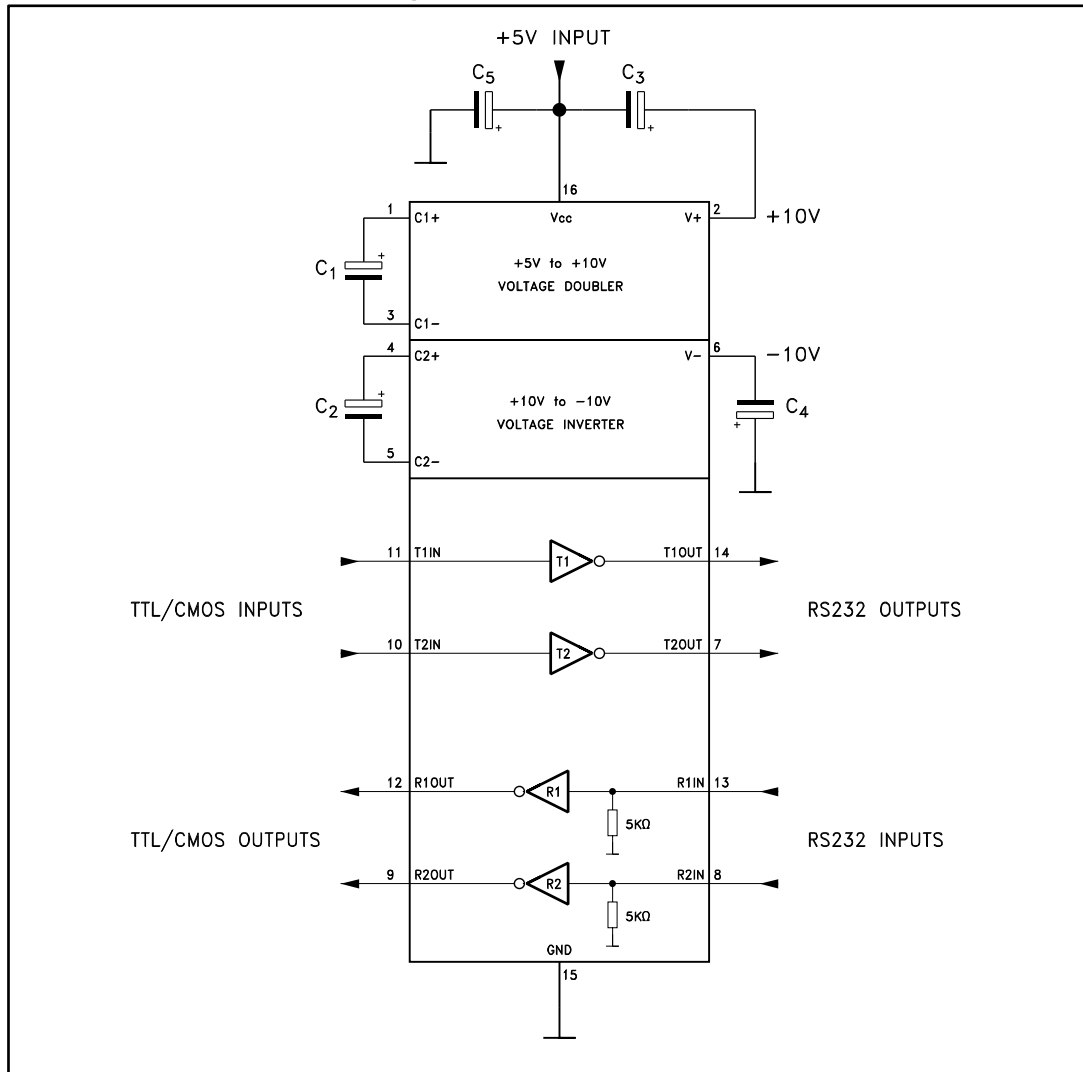
⁽¹⁾Measured from 3 V to -3 V or from -3 V to 3 V

Table 6: Receiver electrical characteristics, C1 - C4 = 0.1 μ F, V_{CC} = 5 V \pm 10 %, T_A = -40 to 85 °C, unless otherwise specified, typical values are referred to T_A = 25 °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 °C, V _{CC} = 5 V | 3 | 5 | 7 | k Ω |
| V _{RIL} | RS-232 input logic threshold low | | 0.8 | 1.2 | | V |
| V _{RIH} | RS-232 input logic threshold high | | | 1.7 | 2.4 | |
| V _{RIHYS} | RS-232 input hysteresis | V _{CC} = 5 V | 0.2 | 0.5 | 1 | |
| V _{ROL} | TTL/CMOS output voltage low | I _{OUT} = 3.2 mA | | | 0.4 | |
| V _{ROH} | TTL/CMOS output voltage high | I _{OUT} = -1 mA | 3.5 | V _{CC} - 0.4 | | |
| t _{DR} | Propagation delay time | C _L = 150 pF | | 0.5 | 10 | μ s |

4 Typical application

Figure 2: Application circuit



1. C₁₋₄ can be replaced by the 1 μF capacitors
2. C₁₋₄ can be common or biased capacitors

Table 7: Capacitance value (μF)

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

5 Typical performance characteristics

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

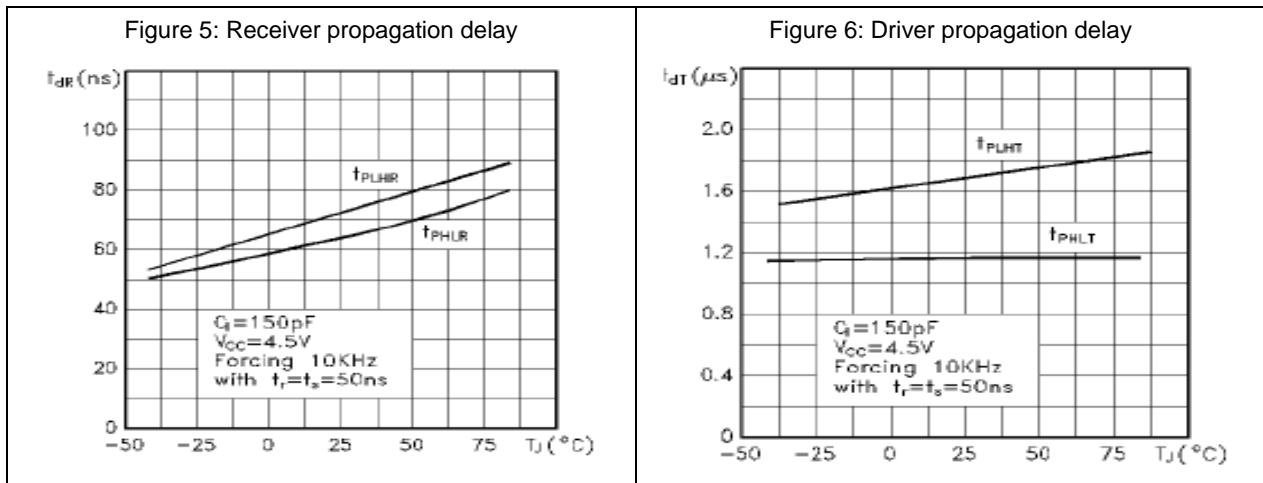
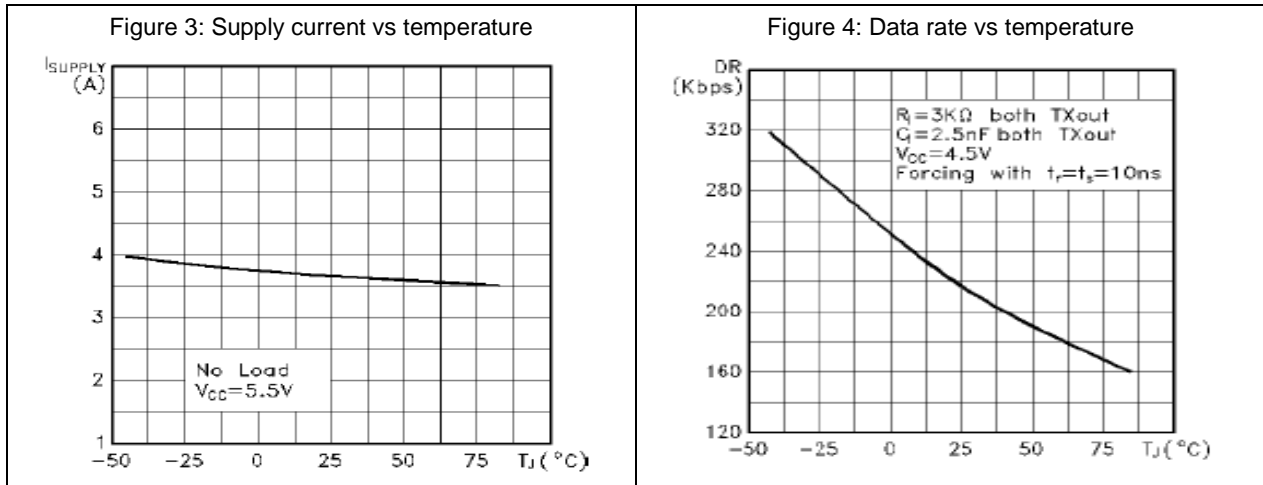


Figure 7: High level output voltage swing vs temperature

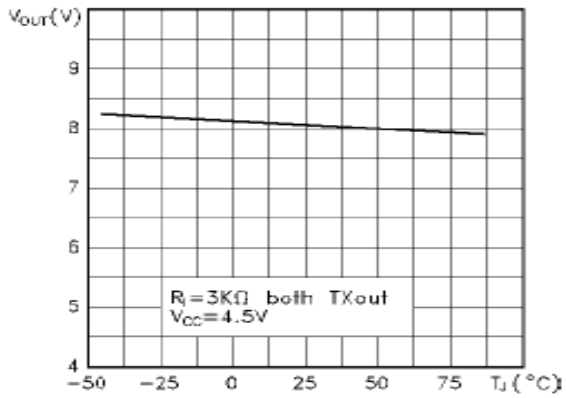


Figure 8: Low level output voltage swing vs temperature

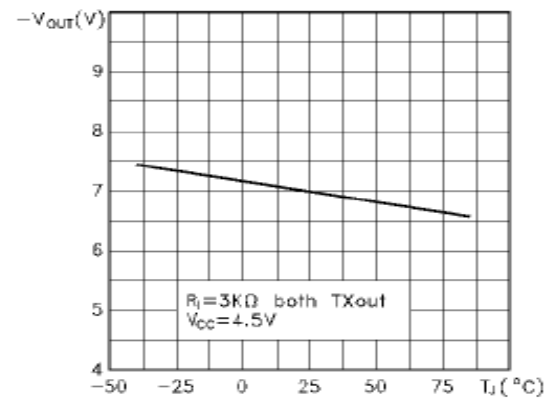


Figure 9: High level transmitter output short circuit current vs temperature

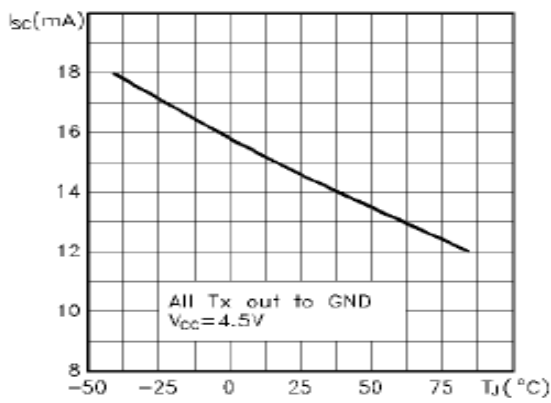


Figure 10: Low level transmitter output short circuit current vs temperature

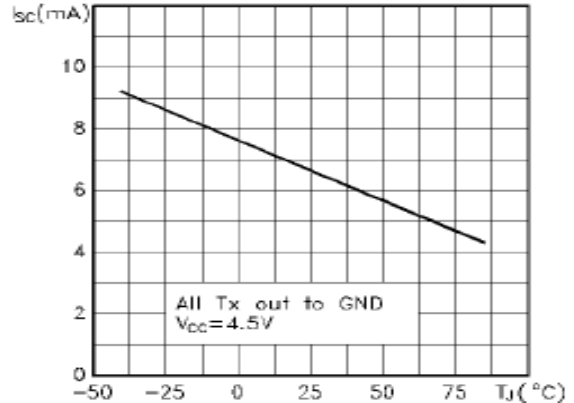


Figure 11: High level receiver output short circuit current vs temperature

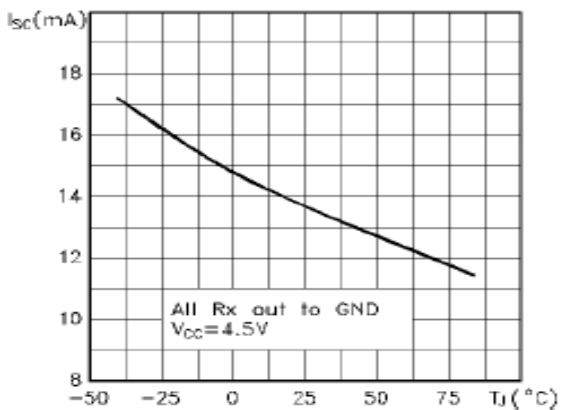
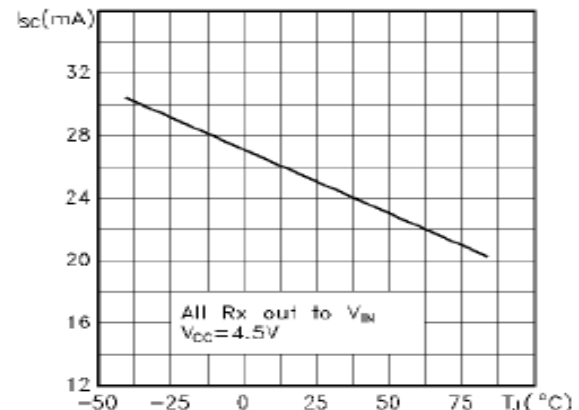


Figure 12: Low level receiver output short circuit current vs temperature



6 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

6.1 SO16 package information

Figure 13: SO16 package outline

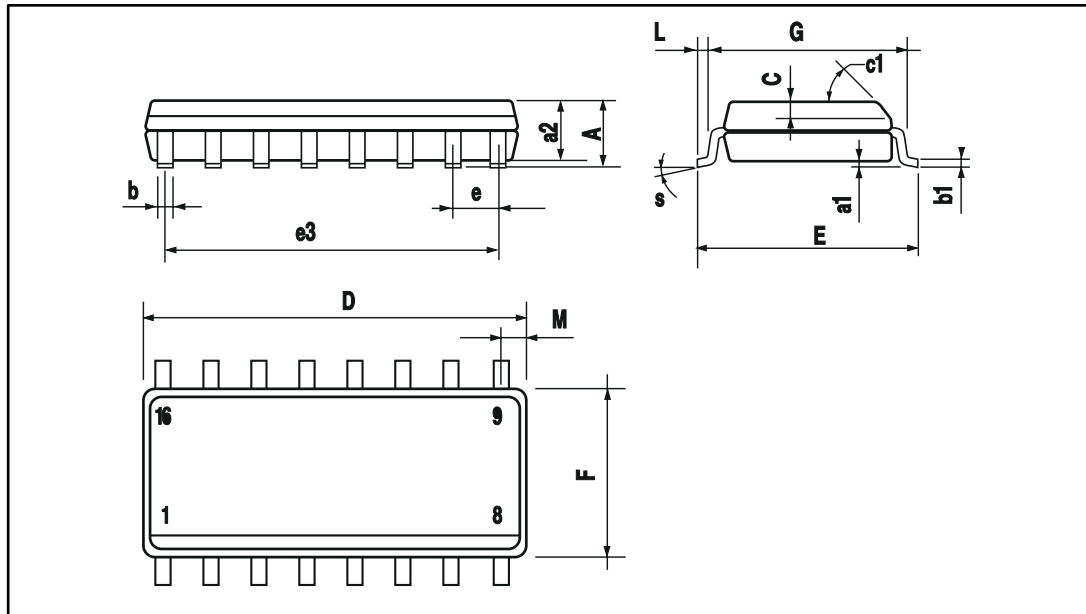


Table 8: SO16 mechanical data

| Ref | Dimensions | | | | | |
|-----|-------------|------|------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | 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 ° | | | 45 ° | |
| 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 ° | | | 8 ° |

6.2 TSSOP16 package information

Figure 14: TSSOP16 package outline

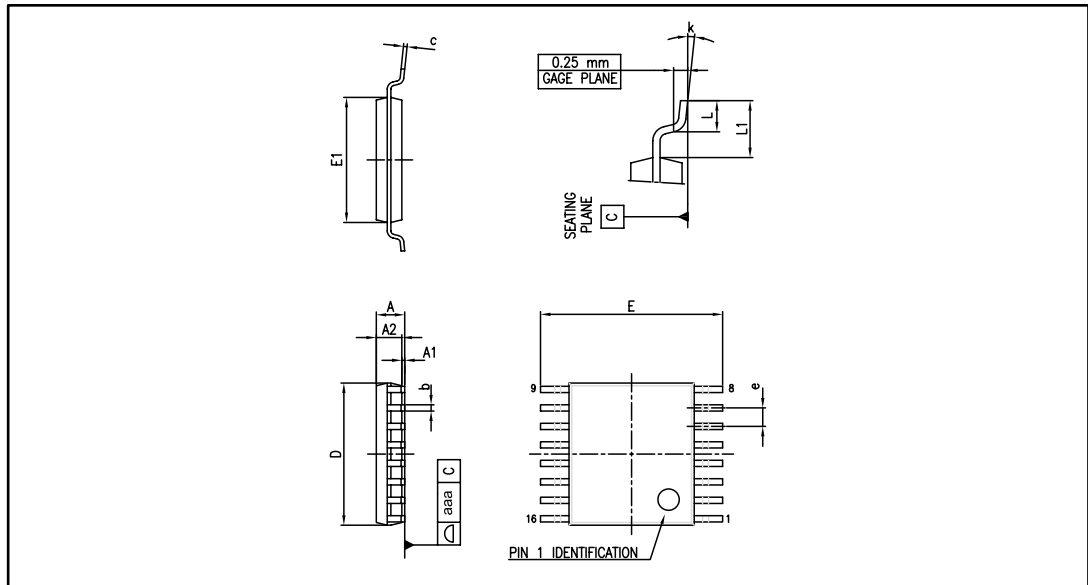
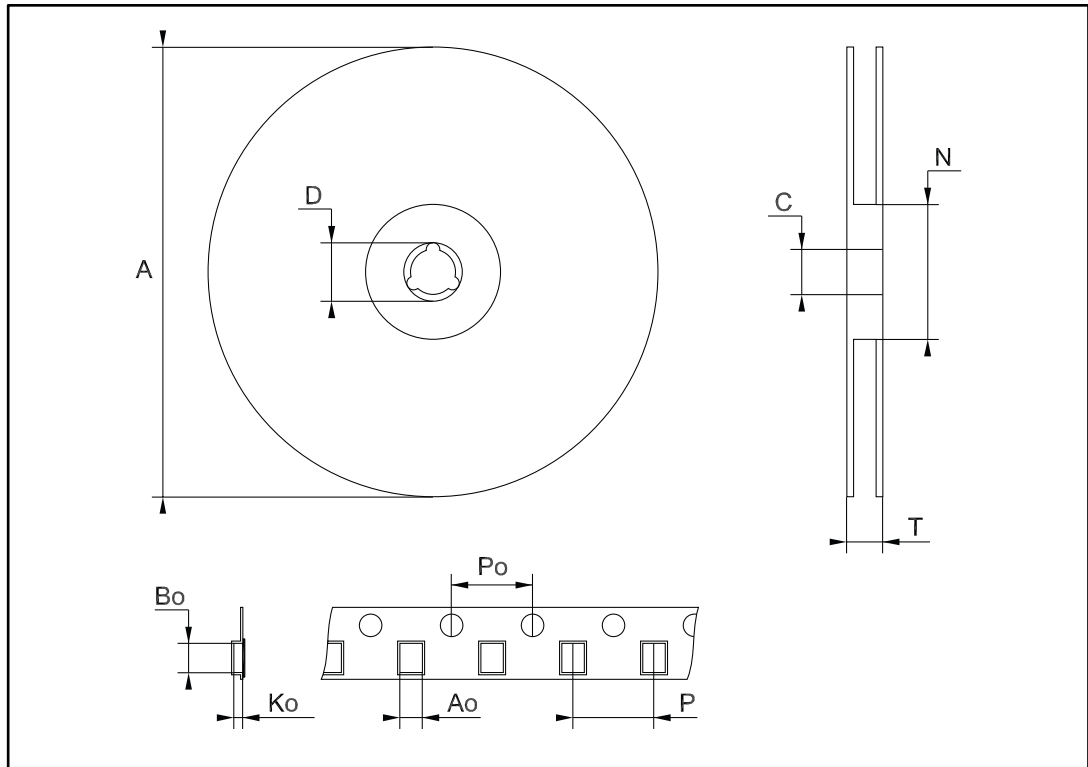


Table 9: TSSOP16 mechanical data

| Ref | Dimensions | | | | | |
|-----|-------------|------|------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min | Typ | Max | Min | Typ | Max |
| A | | | 1.20 | | | 0.047 |
| A1 | 0.05 | | 0.15 | 0.002 | | 0.006 |
| A2 | 0.80 | 1.00 | 1.05 | 0.031 | 0.039 | 0.041 |
| b | 0.19 | | 0.30 | 0.007 | | 0.012 |
| c | 0.09 | | 0.20 | 0.004 | | 0.008 |
| D | 4.90 | 5.00 | 5.10 | 0.193 | 0.197 | 0.201 |
| E | 6.20 | 6.40 | 6.60 | 0.244 | 0.252 | 0.260 |
| E1 | 4.30 | 4.40 | 4.50 | 0.169 | 0.173 | 0.177 |
| e | | 0.65 | | | 0.026 | |
| k | 0° | | 8° | 0° | | 8° |
| L | 0.45 | 0.60 | 0.75 | 0.018 | 0.024 | 0.030 |
| L1 | | 1.00 | | | 0.039 | |
| aaa | | | 0.10 | | | 0.004 |

6.3 SO16 tape and reel package information

Figure 15: SO16 tape and reel package outline



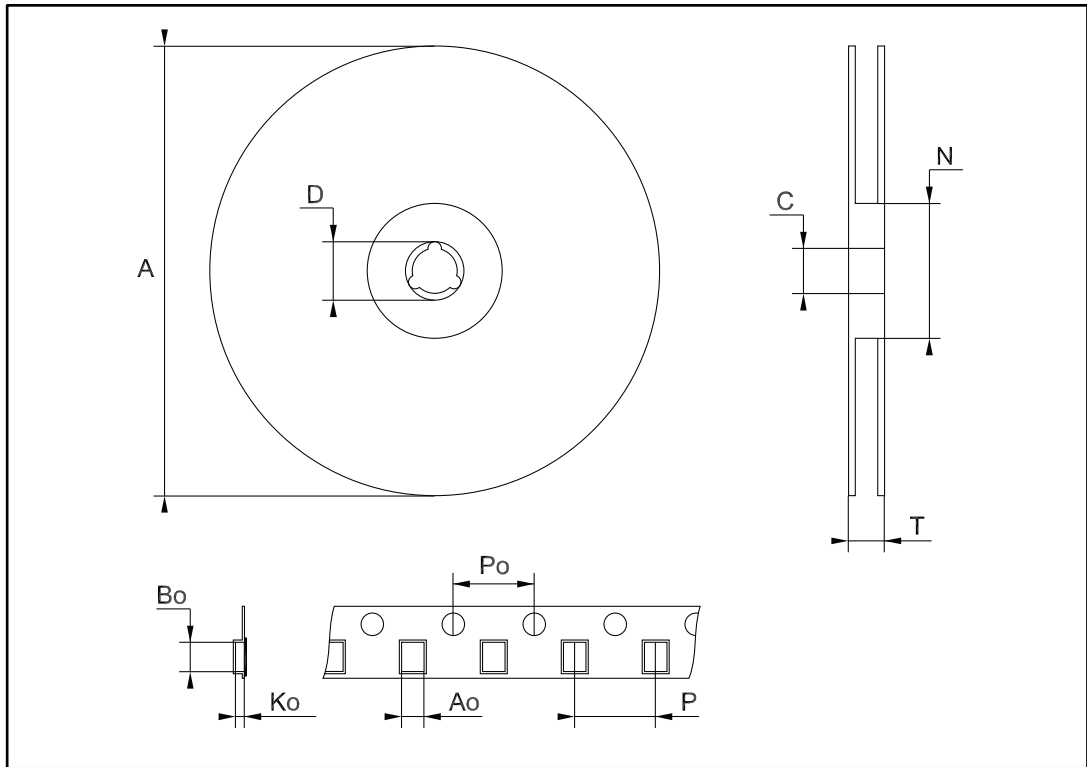
1. Drawing not to scale

Table 10: SO16 tape and reel mechanical data

| Ref | Dimensions | | | | | |
|-----|-------------|------|------|--------|------|--------|
| | Millimeters | | | Inches | | |
| | 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 |

6.4 TSSOP16 tape and reel package information

Figure 16: TSSOP16 tape and reel package outline



1. Drawing not to scale

Table 11: TSSOP16 tape and reel mechanical data

| Ref | Dimensions | | | | | |
|-----|-------------|------|------|--------|------|--------|
| | Millimeters | | | Inches | | |
| | 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 |

6.5 Thermal characteristics

Table 12: Absolute maximum ratings

| Package | Symbol | Value | Board type | Unit |
|---------|----------------------------------|-------|---------------|------|
| SO16 | R _{thja} ⁽¹⁾ | 115 | 1-layer board | °C/W |
| | | 80 | 4-layer board | |
| | R _{thjc} ⁽²⁾ | 30 | 1-layer board | |
| TSSOP16 | R _{thja} ⁽¹⁾ | 140 | 1-layer board | |
| | | 95 | 2-layer board | |
| | R _{thjc} ⁽²⁾ | 25 | | |

Notes:

⁽¹⁾R_{thja} is the package junction-to-ambient thermal resistance in °C/W

⁽²⁾R_{thjc} is the package junction-to-case thermal resistance in °C/W

7 Ordering information

Table 13: Order codes

| Order code | | Temperature range | Package | Packaging | Marking |
|------------|-----------|-------------------|----------------------------|---------------------|---------|
| ST202EBDR | ST232EBDR | -40 to 85 °C | S016 (tape and reel) | 2500 parts per reel | ST202B |
| ST202ECDR | ST232ECDR | 0 to 70 °C | | | ST202C |
| ST202EBTR | ST232EBTR | -40 to 85 °C | TSSOP16 (tape and reel) | | ST202B |
| ST202ECTR | ST232ECTR | 0 to 70 °C | | | ST202C |

8 Revision history

Table 14: Document revision history

| Date | Revision | Changes |
|-------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 21-Feb-2006 | 12 | Change value of I _{TIL} on transmitter characteristics, ±1μA ==> ±10μA. |
| 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. |
| 15-Jan-2014 | 17 | Updated ECOPACK® information Added Section 6.1: Package thermal characteristics Updated disclaimer |
| 08-Mar-2017 | 18 | Removed SO16L package <i>Features</i> : updated units of guaranteed slew rate range from V/ms to V/μs. Moved "Device summary" table to <i>Section 7: "Ordering information"</i> . Removed obsolete order codes ST202EBWR and ST232ECWR from this table and added "Marking". <i>Section 6.2: "TSSOP16 package information"</i> : added dimensions "L1" and "aaa", and replaced dimension "K" with "k". |

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