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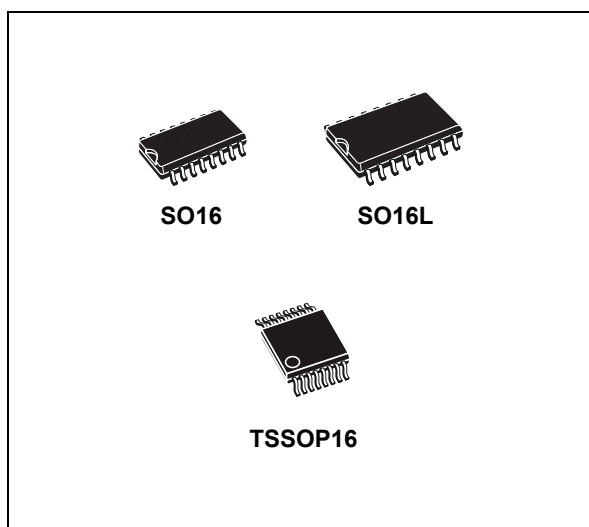
sales@integrated-circuit.com



ST202EB, ST202EC ST232EB, ST232EC

±15 kV ESD-protected 5 V RS-232 transceiver

Datasheet - production data



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.

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

Table 1. Device summary

| Order codes | | Temperature range | Package | Packing |
|-------------|-----------|-------------------|----------------------------|---------------------|
| ST202ECDR | ST232ECDR | 0 to 70 °C | SO16 (tape and reel) | 2500 parts per reel |
| ST202EBDR | ST232EBDR | -40 to 85 °C | | |
| - | ST232ECWR | 0 to 70 °C | SO16 large (tape and reel) | 1000 parts per reel |
| ST202EBWR | - | -40 to 85 °C | | |
| ST202ECTR | ST232ECTR | 0 to 70 °C | TSSOP16 (tape and reel) | 2500 parts per reel |
| ST202EBTR | ST232EBTR | -40 to 85 °C | | |

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1 Pin configuration

Figure 1. Pin connections (top view)

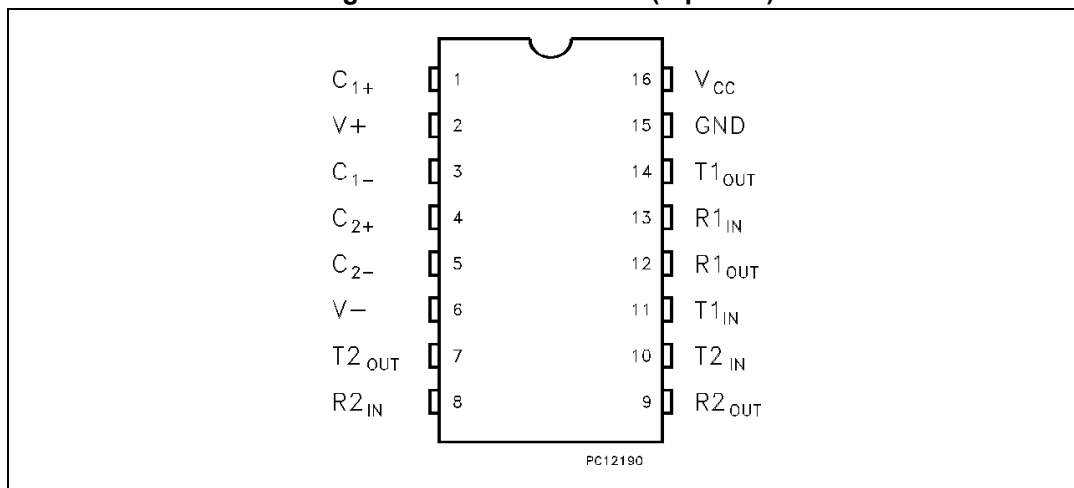


Table 2. Pin description

| 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 | 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 |

Maximum ratings

ST202EB, ST202EC, ST232EB, ST232EC

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- | 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 |

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 |
| | | IEC 1000-4-2 (contact discharge) | ± 6 | | | |
| | | IEC 1000-4-2 (air discharge) | ± 8 | | | |

Note: All tests 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 | |
| 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 | V/ μs |
| 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 | | μA |

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

Electrical characteristics

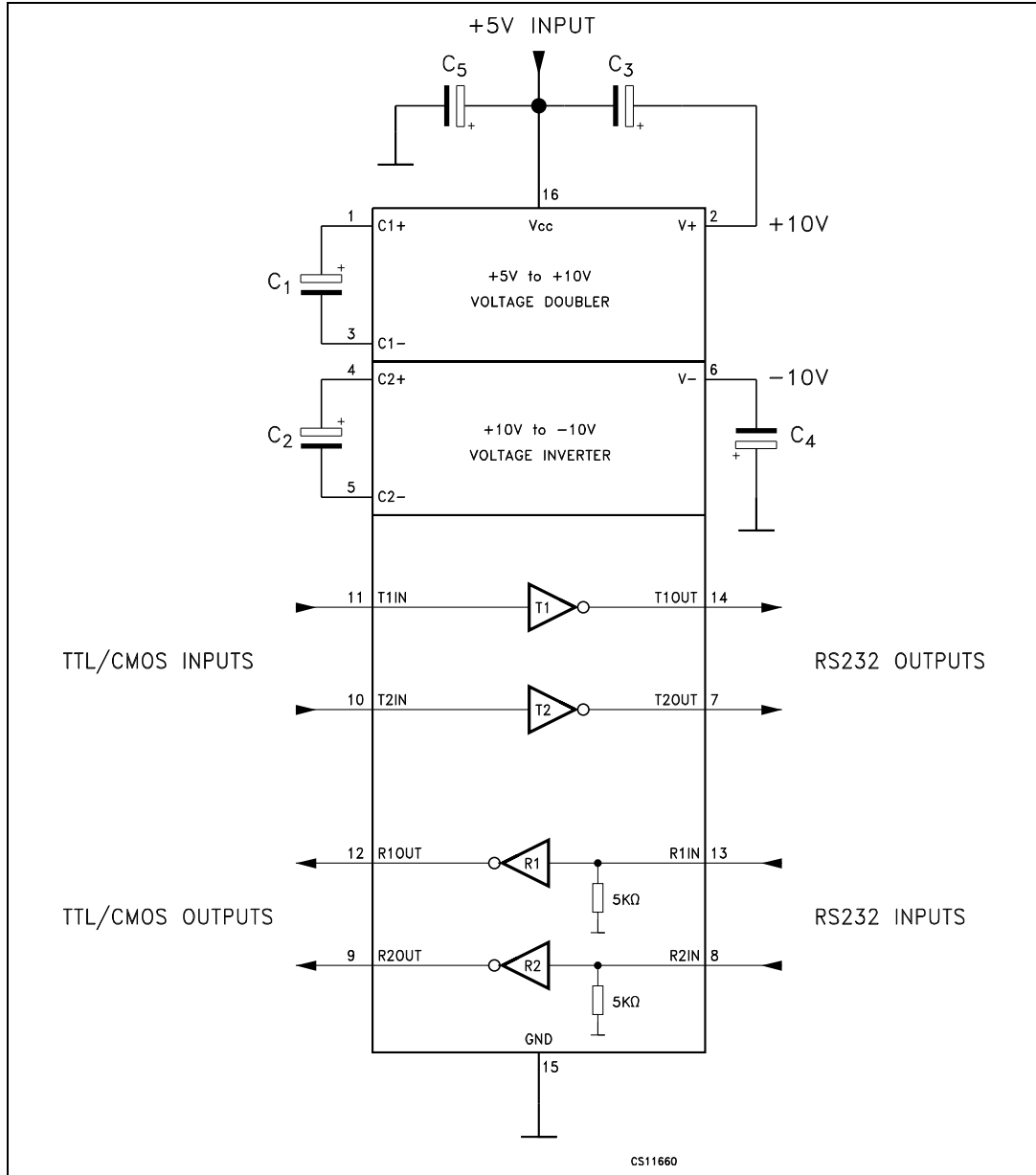
ST202EB, ST202EC, ST232EB, ST232EC

Table 7. Receiver electrical characteristics
 ($C_1 - C_4 = 0.1 \mu\text{F}$, $V_{CC} = 5 \text{ V} \pm 10 \%$, $T_A = -40 \text{ to } 85 \text{ }^\circ\text{C}$, 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 | $T_A = 25 \text{ }^\circ\text{C}$, $V_{CC} = 5 \text{ V}$ | 3 | 5 | 7 | k Ω |
| V_{RIL} | RS-232 input logic threshold low | $T_A = 25 \text{ }^\circ\text{C}$, $V_{CC} = 5 \text{ V}$ | 0.8 | 1.2 | | V |
| V_{RIH} | RS-232 input logic threshold high | $T_A = 25 \text{ }^\circ\text{C}$, $V_{CC} = 5 \text{ V}$ | | 1.7 | 2.4 | |
| V_{RIHYS} | RS-232 input hysteresis | $V_{CC} = 5 \text{ V}$ | 0.2 | 0.5 | 1 | |
| V_{ROL} | TTL/CMOS output voltage low | $I_{OUT} = 3.2 \text{ mA}$ | | | 0.4 | |
| V_{ROH} | TTL/CMOS output voltage high | $I_{OUT} = -1 \text{ mA}$ | 3.5 | $V_{CC}-0.4$ | | |
| t_{DR} | Receiver propagation delay | $C_L = 150 \text{ pF}$ | | 0.5 | 10 | μs |

4 Typical application

Figure 2. Application circuit



1. C₁₋₄ capacitors can be 1μF
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

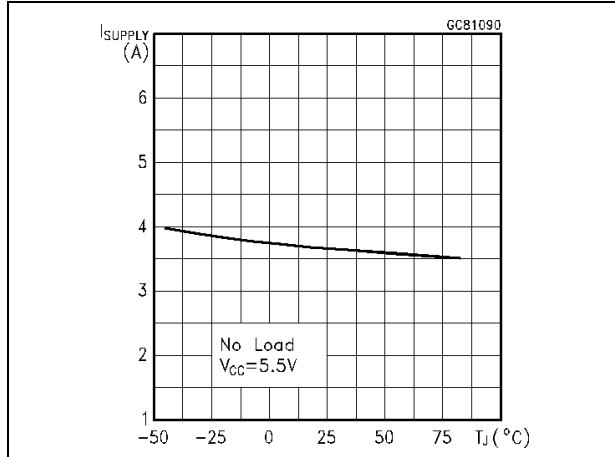


Figure 4. Data rate vs temperature

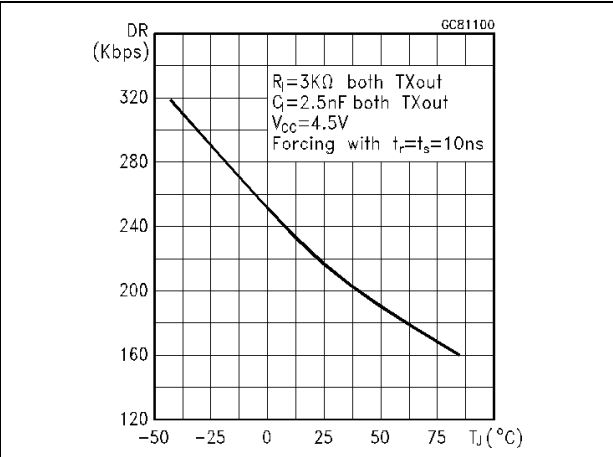


Figure 5. Receiver propagation delay

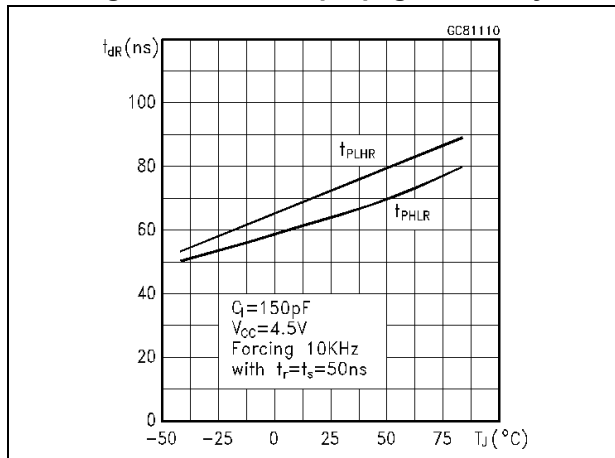
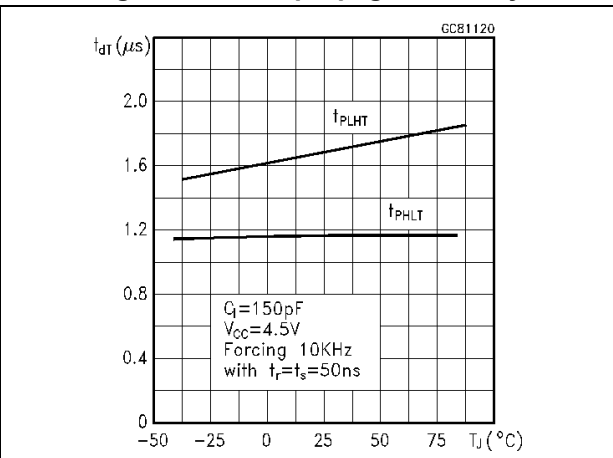


Figure 6. Driver propagation delay



ST202EB, ST202EC, ST232EB, ST232EC

Typical performance characteristics

Figure 7. High level output voltage swing vs temperature

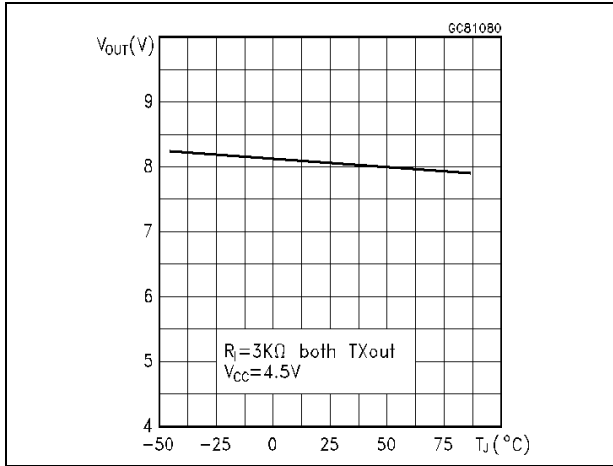


Figure 8. Low level output voltage swing vs temperature

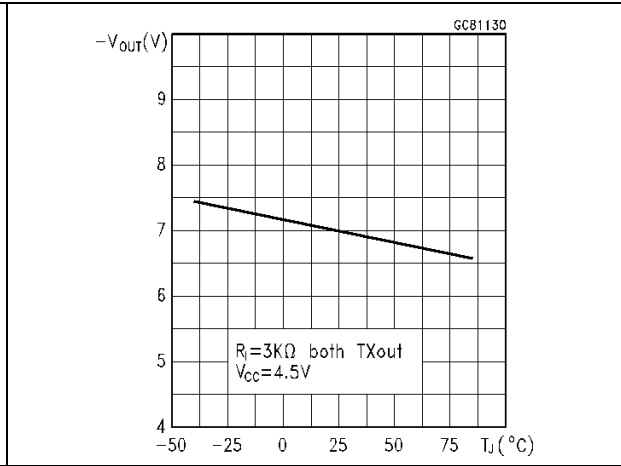


Figure 9. High level transmitter output short circuit current vs temperature

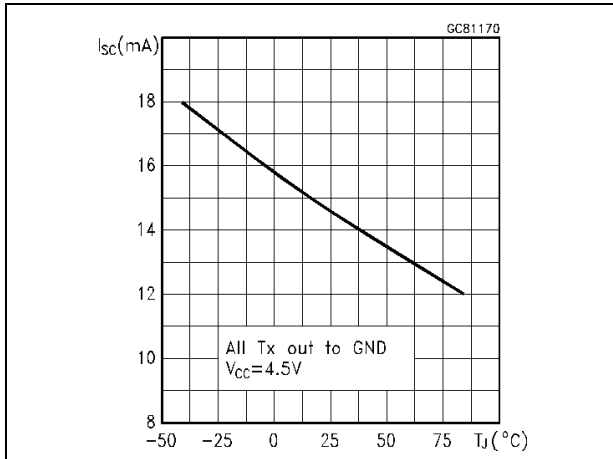


Figure 10. Low level transmitter output short circuit current vs temperature

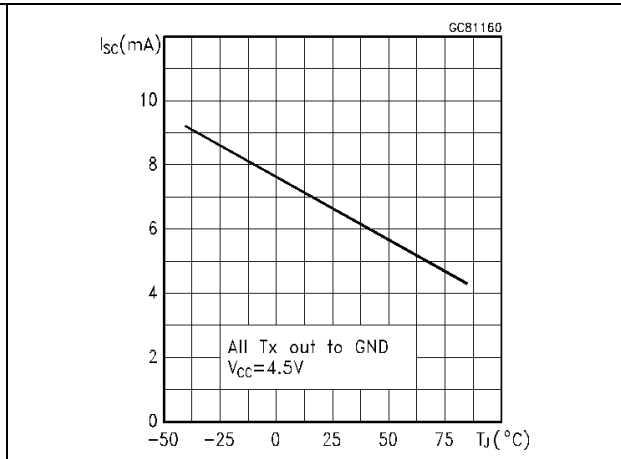


Figure 11. High level receiver output short circuit current vs temperature

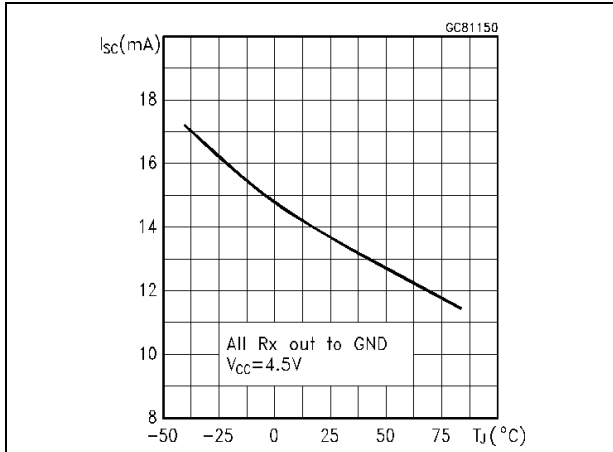
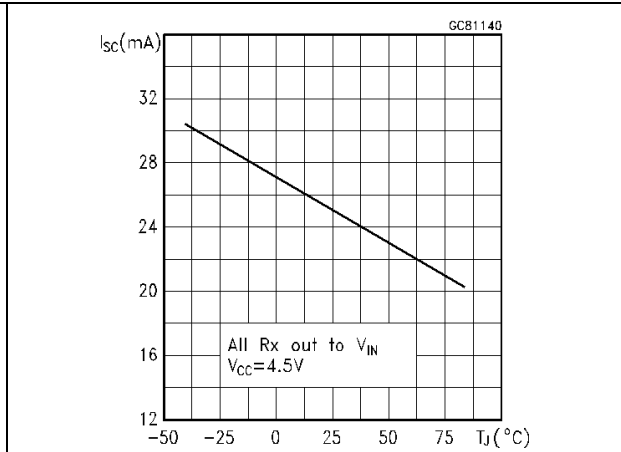


Figure 12. Low level receiver output short circuit current vs temperature



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 Package thermal characteristics

Table 9. Thermal characteristics

| Package | Symbol | Value | Board type | Unit |
|---------|---------------------|-------|---------------|------|
| SO16 | $\Theta_{JA}^{(1)}$ | 115 | 1-layer board | °C/W |
| | | 80 | 4-layer board | |
| | $\Theta_{JC}^{(2)}$ | 30 | 1-layer board | |
| SO16L | $\Theta_{JA}^{(1)}$ | 95 | 1-layer board | |
| | $\Theta_{JC}^{(2)}$ | 30 | 1-layer board | |
| TSSOP16 | $\Theta_{JA}^{(1)}$ | 140 | 1-layer board | |
| | | 95 | 2-layer board | |
| | $\Theta_{JC}^{(2)}$ | 25 | 2-layer board | |

1. Θ_{JA} is the package junction-to-ambient thermal resistance in °C/W

2. Θ_{JC} is the package junction-to-case thermal resistance in °C/W

6.2 SO16 package information

Figure 13. SO16 package outline

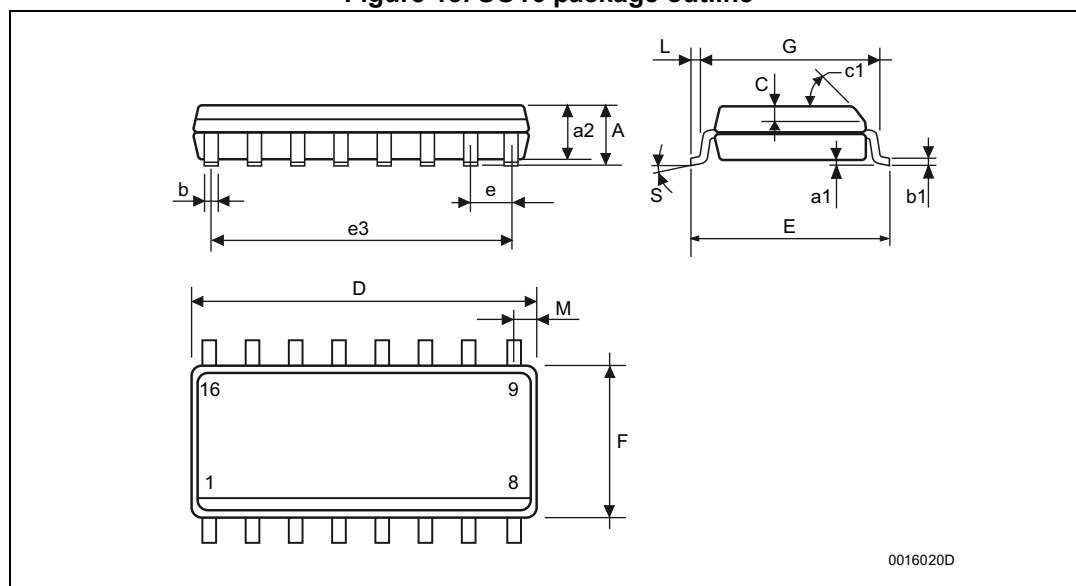


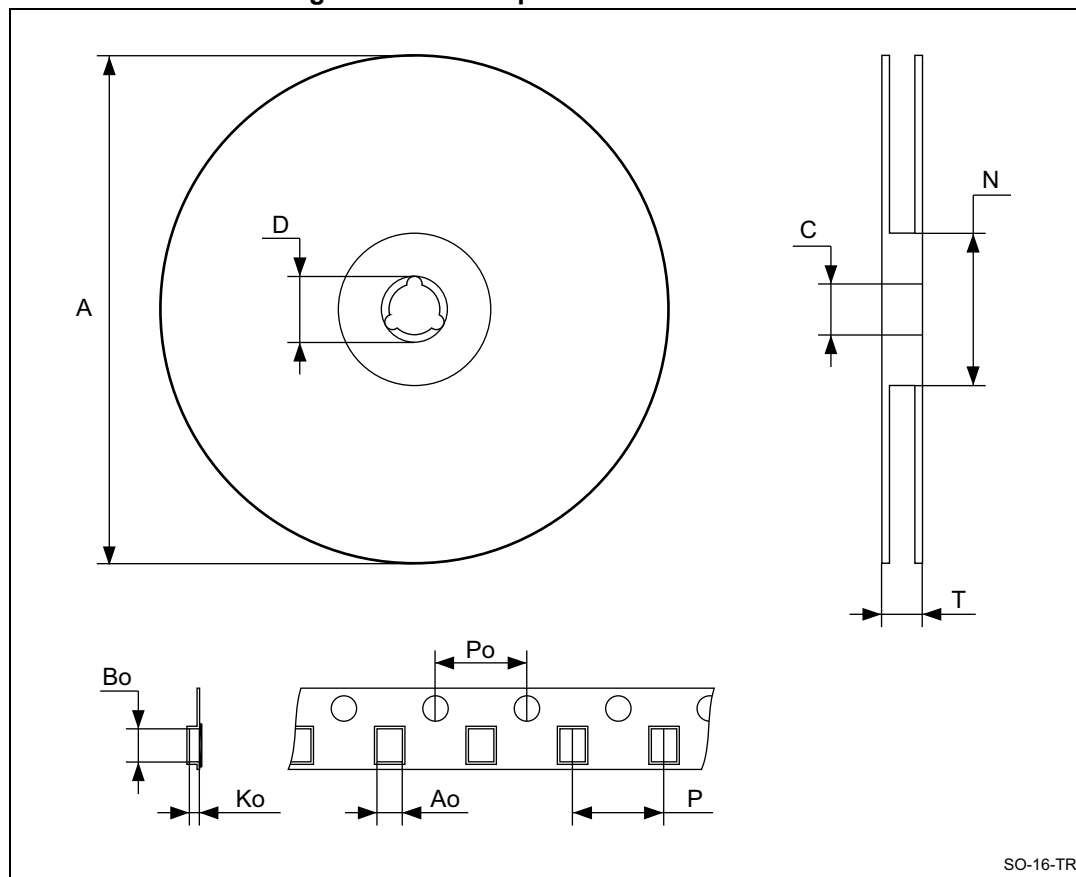
Table 10. SO16 package mechanical data

| Symbol | Dimensions | | | | | |
|--------|------------|------|------|-------|-------|-------|
| | 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.) | | | | | |

Package information

ST202EB, ST202EC, ST232EB, ST232EC

Figure 14. SO16 tape and reel information



SO-16-TR

1. Drawing is not to scale.

Table 11. SO16 tape and reel information

| Symbol | Dimensions | | | | | |
|--------|------------|------|------|-------|------|--------|
| | 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 |

6.3 SO16L package information

Figure 15. SO16L package outline

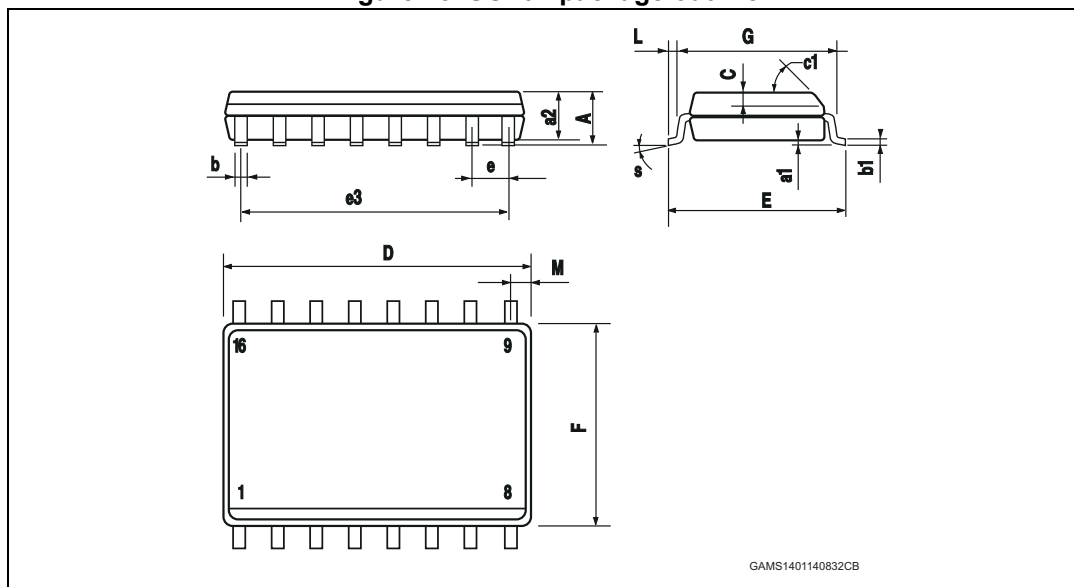


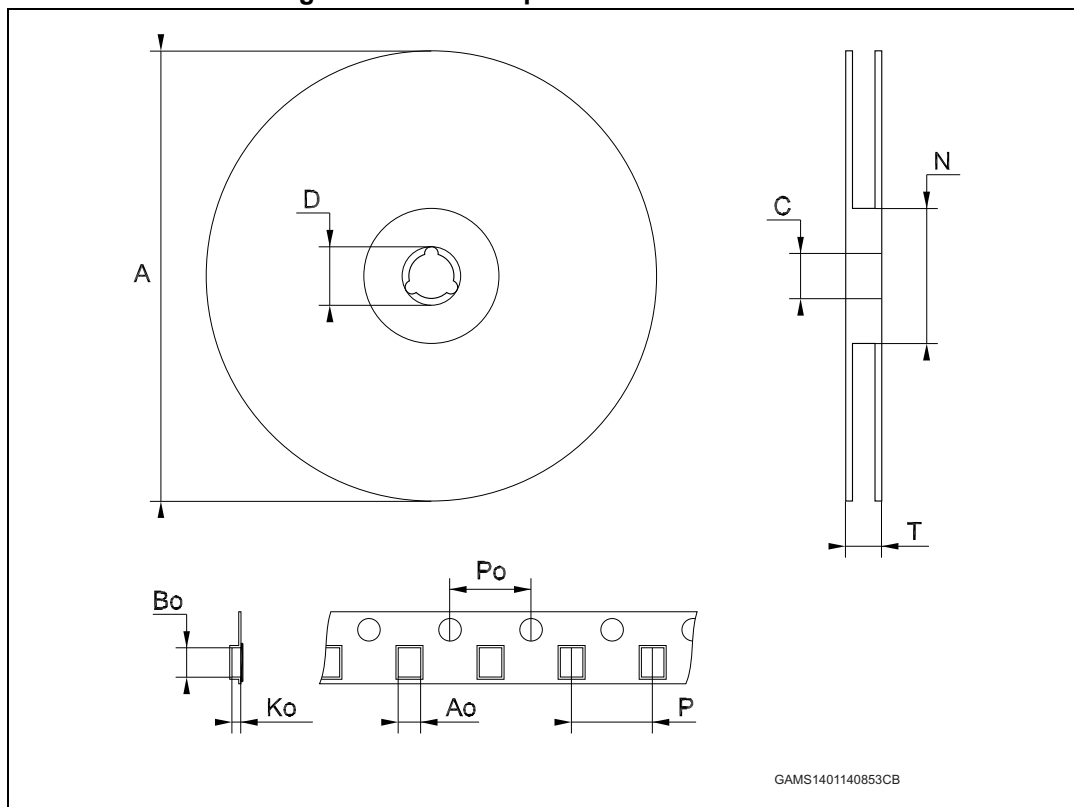
Table 12. SO16L package mechanical data

| Symbol | Dimensions | | | | | |
|--------|------------|------|-------|-------|-------|-------|
| | 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.) | | | | | |

Package information

ST202EB, ST202EC, ST232EB, ST232EC

Figure 16. SO16L tape and reel information



GAMS1401140853CB

1. Drawing is not to scale.

Table 13. SO16L tape and reel information

| Symbol | Dimensions | | | | | |
|--------|------------|------|------|-------|------|--------|
| | 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 |

6.4 TSSOP16 package information

Figure 17. TSSOP16 package outline

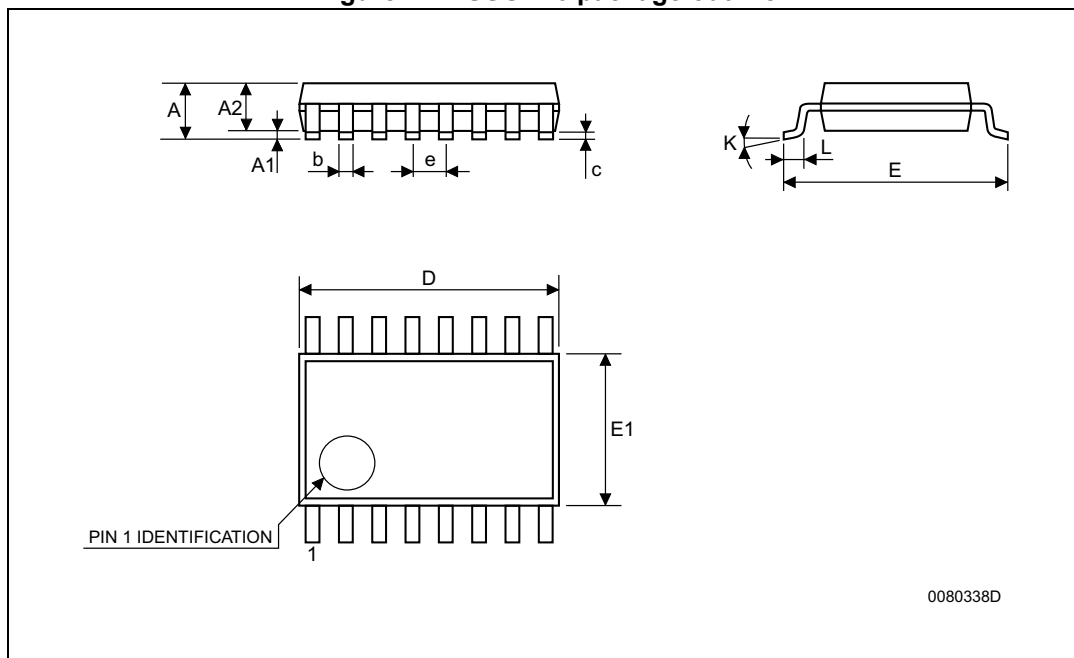


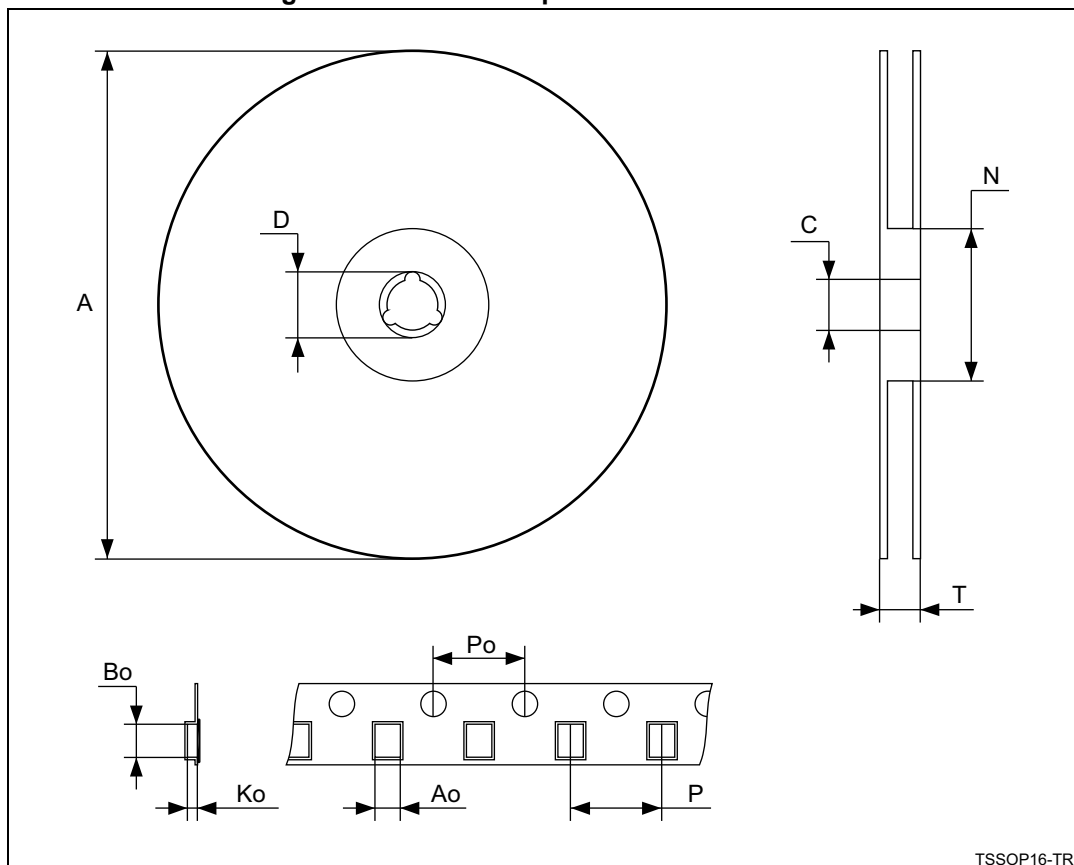
Table 14. TSSOP16 package mechanical data

| Symbol | Dimensions | | | | | |
|--------|------------|------|------|-------|--------|--------|
| | 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 | | | 0.0256 | |
| K | 0° | | 8° | 0° | | 8° |
| L | 0.45 | 0.60 | 0.75 | 0.018 | 0.024 | 0.030 |

Package information

ST202EB, ST202EC, ST232EB, ST232EC

Figure 18. TSSOP16 tape and reel information



TSSOP16-TR

1. Drawing is not in scale.

Table 15. TSSOP16 tape and reel information

| Symbol | Dimensions | | | | | |
|--------|------------|------|------|-------|------|--------|
| | 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 16. 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 . |
| 15-Jan-2014 | 17 | Updated ECOPACK [®] information Added Section 6.1: Package thermal characteristics Updated disclaimer |

ST202EB, ST202EC, ST232EB, ST232EC

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