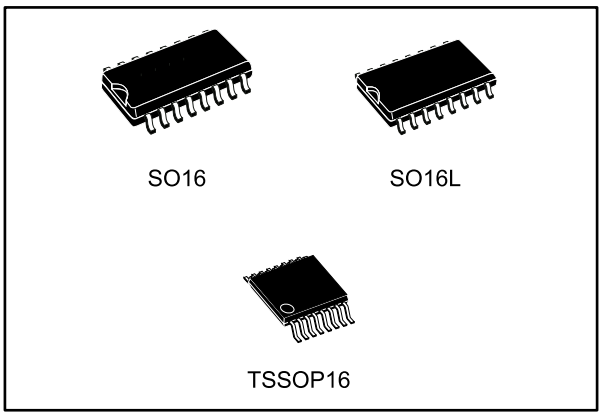
# ST3232B, ST3232C

## 3 to 5.5 V, low-power, up to 400 kbs RS-232 drivers and receivers

Datasheet - production data




## Features

- 300 µA supply current
- 300 kbps minimum guaranteed data rate
- 6 V/µs minimum guaranteed slew rate
- Meets EIA/TIA-232 specifications down to 3 V
- Available in SO16, SO16L, and TSSOP16 packages

## Description

The ST3232B and ST3232C devices are 3 V powered EIA/TIA-232 and V.28/V.24 communication interfaces with low power requirements and high data-rate capabilities.

These devices have a proprietary low dropout transmitter output stage providing true RS-232 performance from 3 to 5.5 V supplies. The devices require only four small 0.1 mF standard external capacitors for operation from a 3 V supply.

The ST3232B and ST3232C have two receivers and two drivers.

The devices are guaranteed to run at data rates of 250 kbps while maintaining RS-232 output levels. Typical applications are notebooks, subnotebooks and palmtop computers, battery-powered equipment, hand-held equipment, peripherals, and printers.

**Table 1: Device summary**

| Order code | Temp. range | Package | Packaging |
|---|---|---|---|
| ST3232CDR | 0 to 70 °C | SO16 (tape and reel) | 2500 parts per reel |
| ST3232BDR | -40 to 85 °C | | |
| ST3232CWR | 0 to 70 °C | SO16L (tape and reel) | 1000 parts per reel |
| ST3232BWR | -40 to 85 °C | | |
| ST3232CTR | 0 to 70 °C | TSSOP16 (tape and reel) | 2500 parts per reel |
| ST3232BTR | -40 to 85 °C | | |



This is information on a product in full production.



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# 1 Pin configuration

**Figure 1: Pin connections**

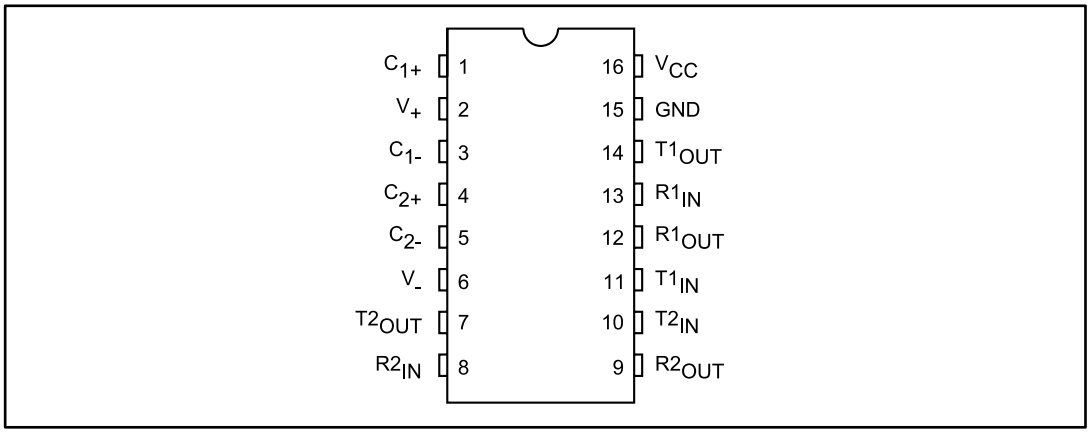



**Table 2: Pin description**

| 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 | $T2_{OUT}$ | 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 |



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# 2 Absolute maximum ratings

**Table 3: Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CC}$ | Supply voltage | -0.3 to 6 | V |
| V+ | Doubled voltage terminal | ($V_{CC}$ - 0.3) to 7 | |
| V- | Inverted voltage terminal | 0.3 to -7 | |
| V+ + \|V-\| | | 13 | |
| $T_{IN}$ | Transmitter input voltage range | -0.3 to 6 | |
| $R_{IN}$ | Receiver input voltage range | ±25 | |
| $T_{OUT}$ | Transmitter output voltage range | ±13.2 | |
| $R_{OUT}$ | Receiver output voltage range | -0.3 to ($V_{CC}$ + 0.3) | |
| $t_{SHORT}$ | Transmitter output short to gnd time | Continuous | |
| $T_{stg}$ | Storage temperature | -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.

Externally applied V+ and V- can have a maximum magnitude of +7 V, but their absolute addition can not exceed 13 V.

Running on internal charge pump, intrinsic self limitation allows exceeding those values without any damage.

Startup voltage sequence ($V_{CC}$, then V+, then V-) is critical, therefore it is not recommended to use this device using externally applied voltage to V+ and V-.



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# 3 Electrical characteristics

**Table 4: Electrical characteristics (C1 - C4 = 0.1 µF, VCC = 3 V to 5.5 V, TA = -40 to 85 °C, unless otherwise specified. Typical values are referred to TA = 25 °C)**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SUPPLY}$ | $V_{CC}$ power supply current | No load, $V_{CC}$ = 3 V ± 10 %, $T_A$ = 25 °C | | 0.3 | 1 | mA |
| | | No load, $V_{CC}$ = 5 V ± 10 %, $T_A$ = 25 °C | | 1 | 2 | |

**Table 5: Logic input (C1 - C4 = 0.1 µF, VCC = 3 V to 5.5 V, TA = -40 to 85 °C, unless otherwise specified. Typical values are referred to TA = 25 °C)**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{TIL}$ | Input logic threshold low | T-IN (1) | | | 0.8 | V |
| $V_{TIH}$ | Input logic threshold high | $V_{CC}$ = 3.3 V | 2 | | | |
| | | $V_{CC}$ = 5 V | 2.4 | | | |
| $I_{IL}$ | Input leakage current | T-IN | | ±0.01 | ±1 | µA |

**Notes:**

(1)Transmitter input hysteresis is typically 250 mV.

**Table 6: Transmitter (C1 - C4 = 0.1 µF tested at 3.3 V ±10 %, VCC = 3 V to 5.5 V, TA = -40 to 85 °C, unless otherwise specified. Typical values are referred to TA = 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 | ±5.4 | | V |
| $R_{TOUT}$ | Transmitter output resistance | $V_{CC}$ = V+ = V- = 0 V, $V_{OUT}$ = ±2 V | 300 | 10 M | | Ω |
| $I_{TSC}$ | Output short circuit current | $V_{CC}$ = 3 V or 5 V, $V_{OUT}$ = ±12 | | | ± 60 | mA |

**Table 7: Receiver (C1 - C4 = 0.1 µF tested at 3.3 V ±10 %, VCC = 3 V to 5.5 V, TA = -40 to 85 °C, unless otherwise specified. Typical values are referred to TA = 25 °C)**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{RIN}$ | Receiver input voltage operating range | | -25 | | 25 | V |
| $V_{RIL}$ | RS-232 Input threshold low | $T_A$ = 25 °C, $V_{CC}$ = 3.3 V | 0.6 | 1.1 | | |
| | | $T_A$ = 25 °C, $V_{CC}$ = 5 V | 0.8 | 1.5 | | |
| $V_{RIH}$ | RS-232 Input threshold high | $T_A$ = 25 °C, $V_{CC}$ = 3.3 V | | 1.5 | 2.4 | |
| | | $T_A$ = 25 °C, $V_{CC}$ = 5 V | | 1.8 | 2.4 | |
| $V_{RIHYS}$ | Input hysteresis | | | 0.3 | | |
| $R_{RIN}$ | Input resistance | $T_A$ = 25 °C | 3 | 5 | 7 | kΩ |
| $V_{ROL}$ | TTL/CMOS output voltage low | $I_{OUT}$ = 1.6 mA | | | 0.4 | V |
| $V_{ROH}$ | TTL/CMOS output voltage high | $I_{OUT}$ = -1 mA | $V_{CC}$ - 0.6 | $V_{CC}$ - 0.1 | | |



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**Table 8: Timing characteristics (C1 - C4 = 0.1 µF tested at 3.3 V ±10 %, VCC = 3 V to 5.5 V, TA = -40 to 85 °C, unless otherwise specified. Typical values are referred to TA = 25 °C)**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $D_R$ | Data transfer rate | $R_L$ = 3 kΩ, $C_{L2}$ = 1000 pF one transmitter switching | 300 | 400 | | kbps |
| $t_{PHLR}$, $t_{PLHR}$ | Propagation delay input to output | $R_{XIN} = R_{XOUT}$, $C_L$ = 150 pF | | 0.2 | | µs |
| $\lvert t_{PHLT} - t_{THL} \rvert$ | Transmitter propagation delay difference | See (1) | | 100 | | ns |
| $\lvert t_{PHLR} - t_{THR} \rvert$ | Receiver propagation delay difference | | | 50 | | |
| $S_{RT}$ | Transition slew rate | $T_A$ = 25 °C, $R_L$ = 3 kΩ to 7 kΩ, $V_{CC}$ = 3.3 V measured from 3 V to -3 V or -3 V to 3 V, $C_L$ = 150 pF to 1000 pF | 6 | | 30 | V/µs |
| | | $T_A$ = 25 °C, $R_L$ = 3 kΩ to 7 kΩ, $V_{CC}$ = 3.3 V measured from 3 V to -3 V or -3 V to 3 V, $C_L$ = 150 pF to 2500 pF | 4 | | 30 | |

**Notes:**

(1)Transmitter skew is measured at the transmitter zero cross points



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# 4 Application information

**Figure 2: Application circuits**

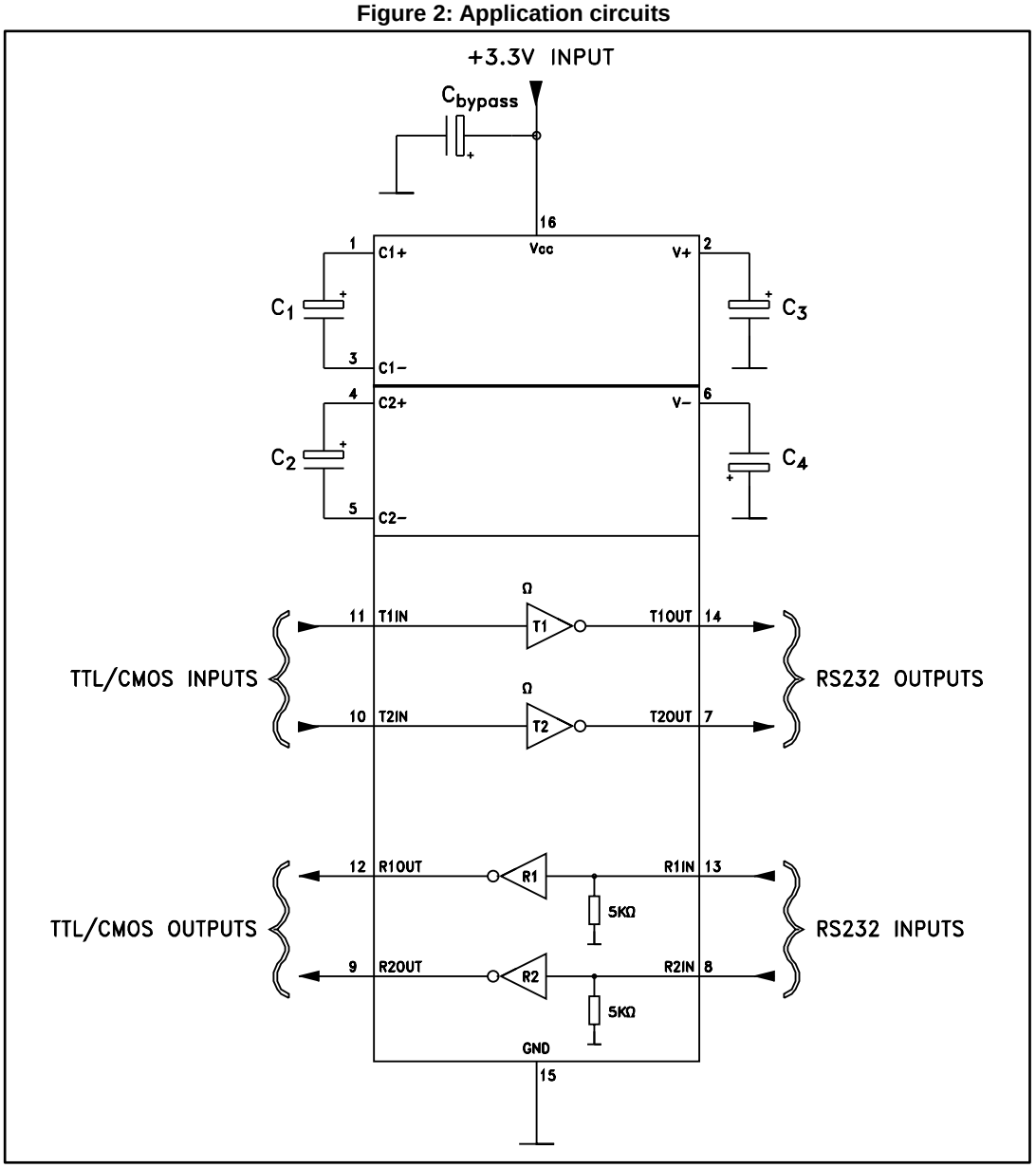



**Table 9: Capacitance value (µF)**

| $V_{CC}$ | C1 | C2 | C3 | C4 | Cbypass |
|---|---|---|---|---|---|
| 3.0 to 3.6 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 4.5 to 5.5 | 0.047 | 0.33 | 0.33 | 0.33 | 0.33 |



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# 5 Typical performance characteristics

Unless otherwise specified $T_J$ = 25 °C

Figure 3: Driver voltage transfer characteristics for transmitter inputs

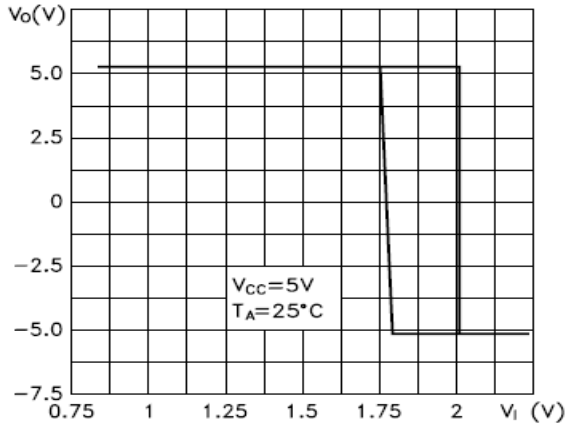



Figure 4: Driver voltage transfer characteristics for receiver inputs

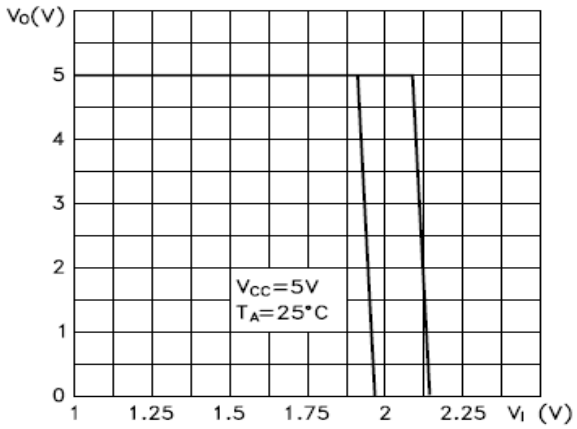



Figure 5: Output current vs output low voltage at VCC = 5.5 V

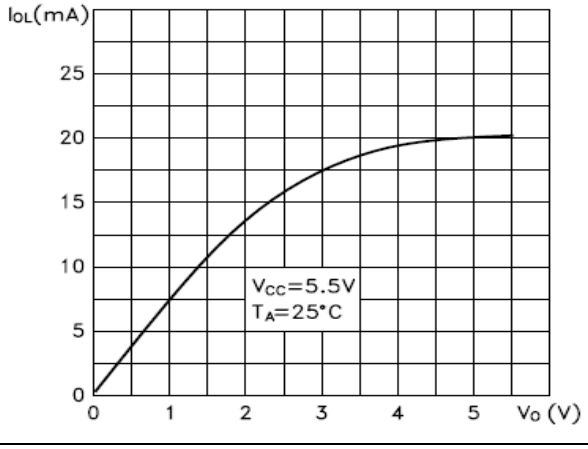
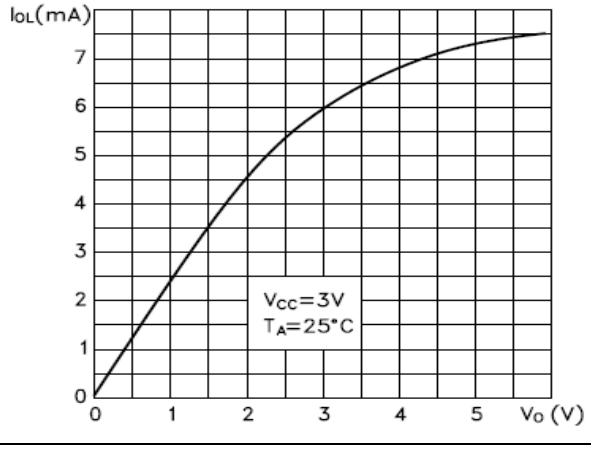



Figure 6: Output current vs output low voltage at VCC = 3 V






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Figure 7: Output current vs output high voltage at VCC = 5.5 V

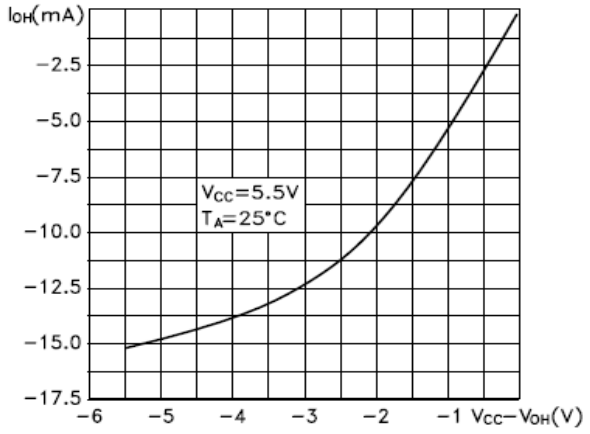



Figure 8: Output current vs output high voltage at VCC = 3 V

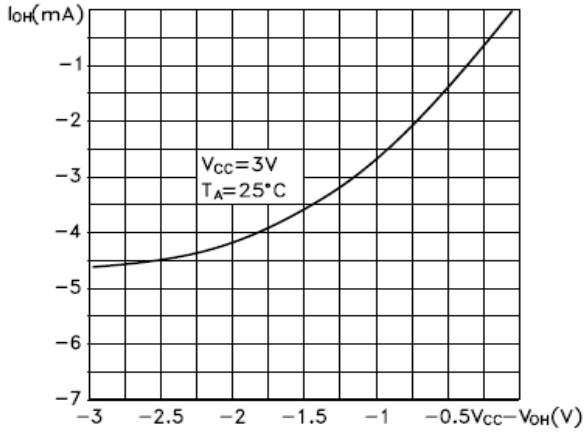
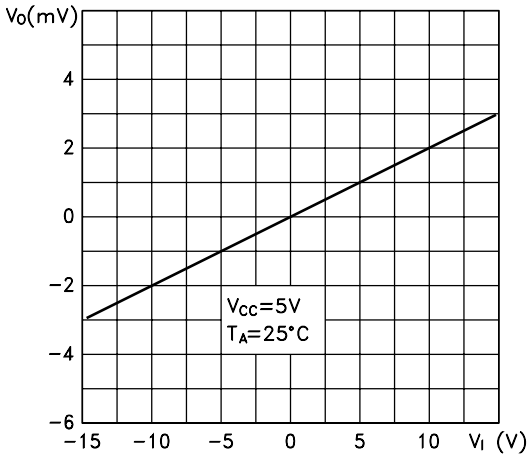



Figure 9: Receiver input resistance






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# 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.



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## 6.1 SO16 package information

**Figure 10: SO16 package outline**

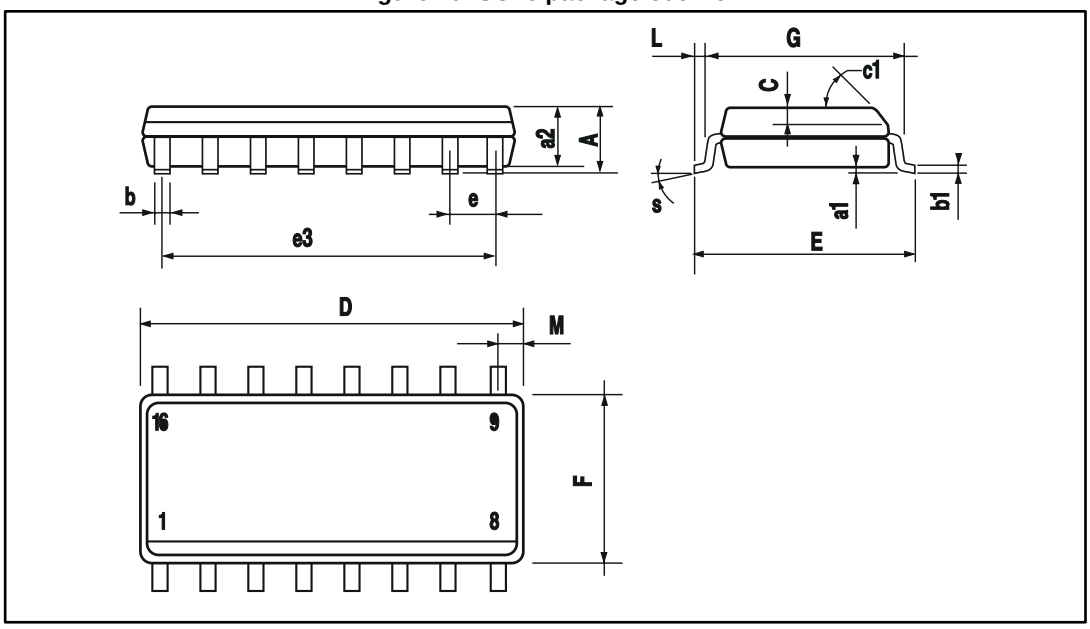



**Table 10: SO16 mechanical data**

| 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 ° |



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## 6.2 SO16L package information

**Figure 11: SO16L package outline**

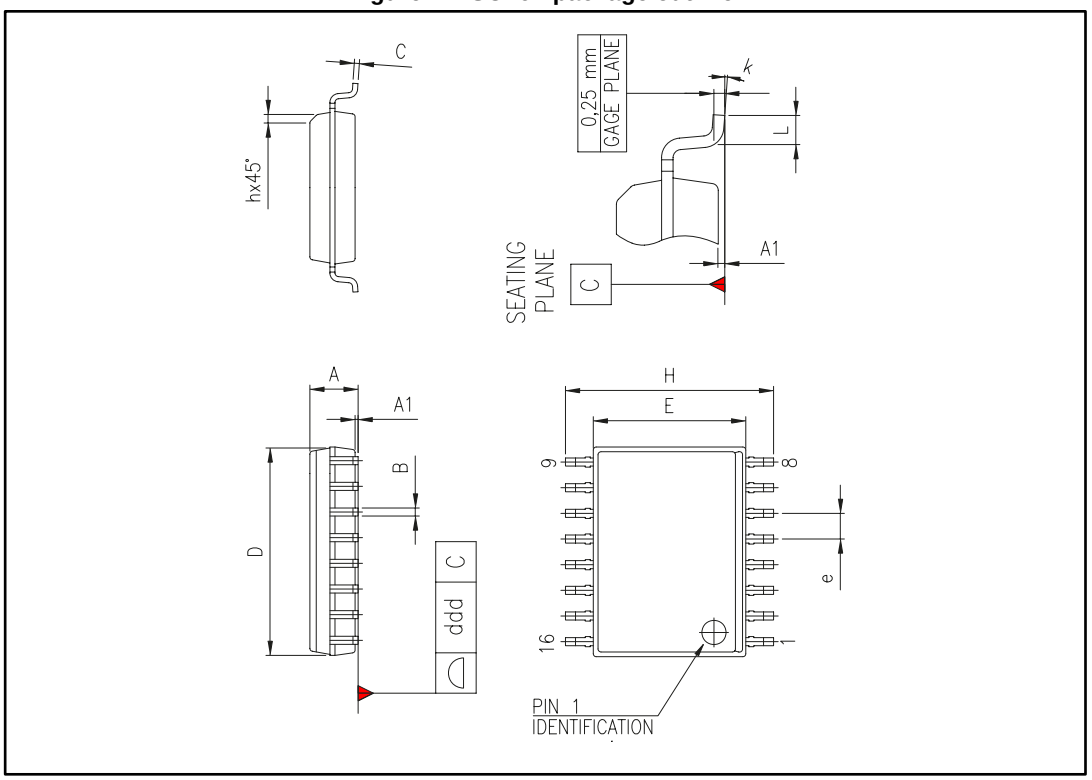



**Table 11: SO16L mechanical data**

| Ref | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max | Min. | Typ. | Max. |
| A | 2.35 | | 2.65 | 0.093 | | 0.104 |
| A1 | 0.1 | | 0.3 | 0.004 | | 0.012 |
| B | 0.33 | | 0.51 | 0.013 | | 0.02 |
| C | 0.23 | | 0.32 | 0.009 | | 0.013 |
| D | 10.1 | | 10.5 | 0.398 | | 0.413 |
| E | 7.4 | | 7.6 | 0.291 | | 0.299 |
| e | | 1.27 | | | 0.05 | |
| H | 10 | | 10.65 | 0.394 | | 0.419 |
| h | 0.25 | | 0.75 | 0.01 | | 0.03 |
| L | 0.4 | | 1.27 | 0.016 | | 0.05 |
| k | 0 ° | | 8 ° | 0 ° | | 8 ° |
| ddd | | | 0.1 | | | 0.004 |



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## 6.3 TSSOP16 package information

**Figure 12: TSSOP16 package outline**

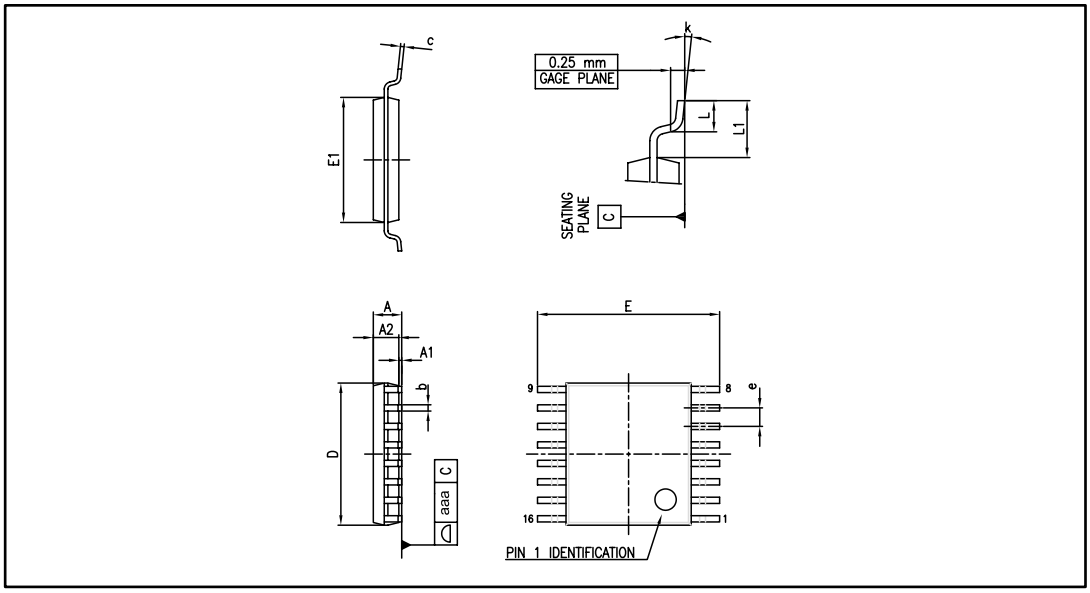



**Table 12: TSSOP16 mechanical data**

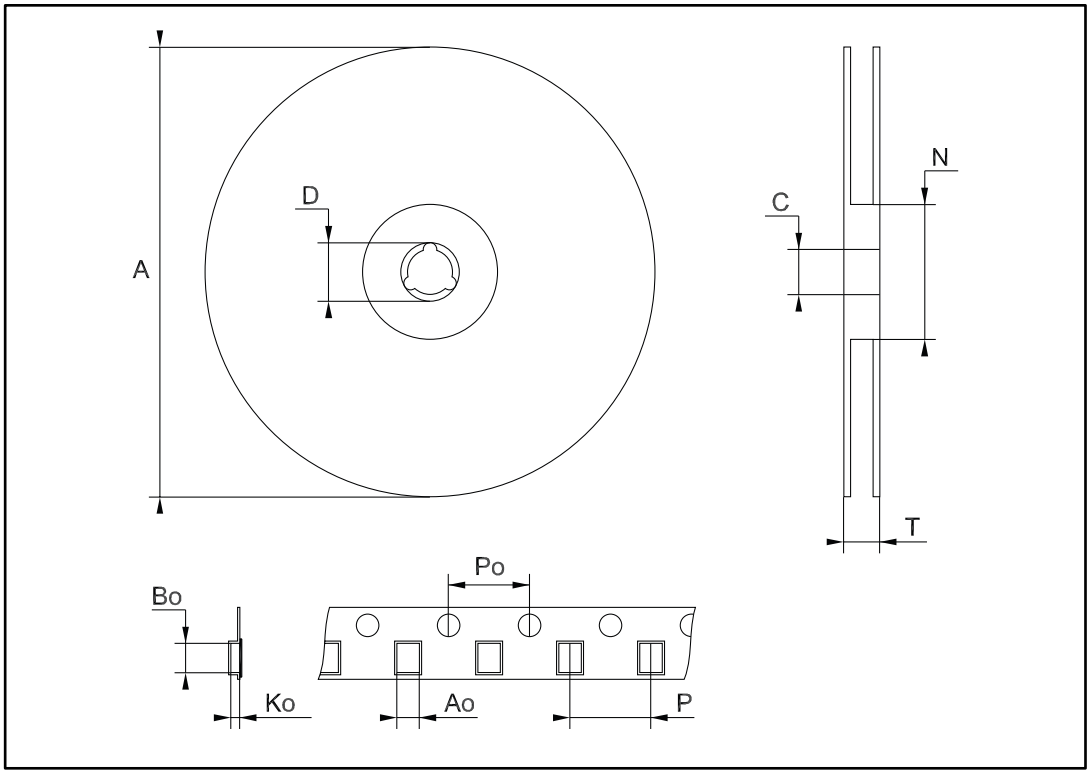
| Ref | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches | | |
| | Min | Typ | Max | Min | Typ | Max |
| A | | | 1.20 | | | 0.047 |
| A1 | 0.05 | | 0.15 | 0.002 | | 0.006 |
| A2 | 0.80 | 1.00 | 1.05 | 0.031 | 0.039 | 0.041 |
| b | 0.19 | | 0.30 | 0.007 | | 0.012 |
| c | 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 |



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## 6.4 SO16 tape and reel package information

**Figure 13: SO16 tape and reel package outline**




1. Drawing not to scale

**Table 13: SO16 tape and reel mechanical data**

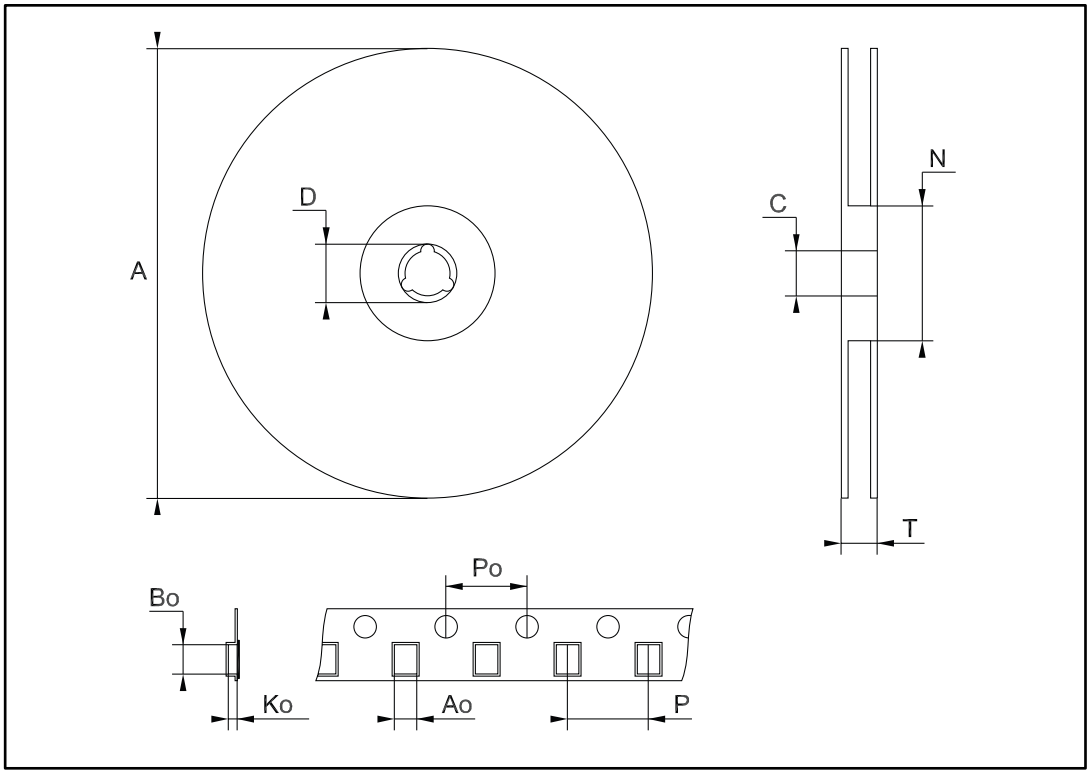
| Ref | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max | Min. | Typ. | Max. |
| A | | — | 330 | | — | 12.992 |
| C | 12.8 | | 13.2 | 0.504 | | 0.519 |
| D | 20.2 | | | 0.795 | | |
| N | 60 | | | 2.362 | | |
| T | | | 22.4 | | | 0.882 |
| 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 |



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## 6.5 SO16L tape and reel package information

**Figure 14: SO16L tape and reel package outline**




1. Drawing not to scale

**Table 14: SO16L tape and reel mechanical data**

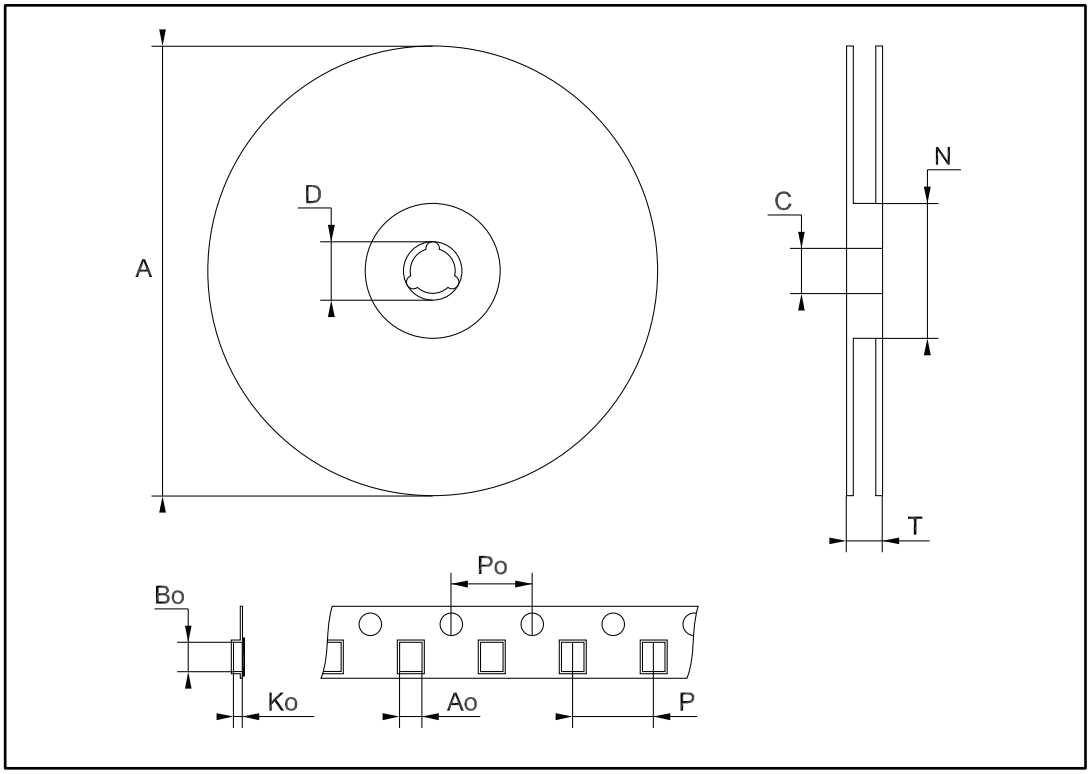
| Ref | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max | Min. | Typ. | Max. |
| A | | — | 330 | | — | 12.992 |
| C | 12.8 | | 13.2 | 0.504 | | 0.519 |
| D | 20.2 | | | 0.795 | | |
| N | 60 | | | 2.362 | | |
| T | | | 22.4 | | | 0.882 |
| Ao | 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 |



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## 6.6 TSSOP16 tape and reel package information

**Figure 15: TSSOP16 tape and reel package outline**




1. Drawing not to scale

**Table 15: 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 |



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# 7 Revision history

Table 16: Document revision history

| Date | Revision | Changes |
|---|---|---|
| 06-Sep-2006 | 8 | Order codes has been updated and new template. |
| 25-Oct-2006 | 9 | Order codes has been updated. |
| 21-Jan-2008 | 10 | Added note on Table 3. |
| 08-Feb-2008 | 11 | Modified: Table 1 on page 1. |
| 25-Jan-2016 | 12 | Updated document layout<br>*Table 3: "Absolute maximum ratings"*: added $T_{stg}$<br>Updated titles of *Figure 5*, *Figure 6*, *Figure 7*, and *Figure 8*<br>*Section 6.2*: replaced SO16L package outline and mechanical data<br>*Section 6.3*: removed A1 (typ: inches), updated E1 (max: mm and inches), added L1 and aaa. |



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