

### 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  $\pm 15$  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  $1 \mu\text{F}$  capacitors, while the ST202EB and ST202EC operate with four  $0.1 \mu\text{F}$  capacitors, further reducing cost and board space.

### Features

- ESD protection for RS-232 I/O pins:  $\pm 15$  kV human body model
- Guaranteed 230 kbps data rate
- Guaranteed slew rate range 3 to 30 V/ $\mu\text{s}$
- Operates from a single 5 V power supply

**Contents**

**1 Pinout information..... 3**

**2 Absolute maximum ratings..... 4**

**3 Electrical characteristics ..... 5**

**4 Typical application ..... 7**

**5 Typical performance characteristics ..... 8**

**6 Package information ..... 10**

    6.1 SO16 package information..... 11

    6.2 TSSOP16 package information..... 12

    6.3 SO16 tape and reel package information ..... 13

    6.4 TSSOP16 tape and reel package information ..... 14

    6.5 Thermal characteristics ..... 15

**7 Ordering information..... 16**

**8 Revision history ..... 17**



# 1 Pinout information

Figure 1: Pin connections (top view)

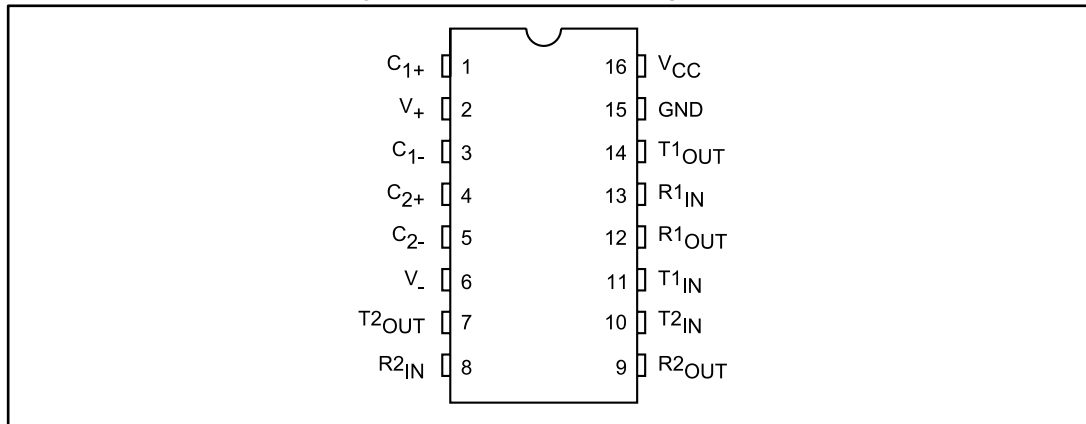


Table 1: Pin description

Pin n°	Symbol	Name and function
1	C <sub>1+</sub>	Positive terminal for the first charge pump capacitor
2	V <sub>+</sub>	Doubled voltage terminal
3	C <sub>1-</sub>	Negative terminal for the first charge pump capacitor
4	C <sub>2+</sub>	Positive terminal for the second charge pump capacitor
5	C <sub>2-</sub>	Negative terminal for the second charge pump capacitor
6	V <sub>-</sub>	Inverted voltage terminal
7	T <sub>2OUT</sub>	Second transmitter output voltage
8	R <sub>2IN</sub>	Second receiver input voltage
9	R <sub>2OUT</sub>	Second receiver output voltage
10	T <sub>2IN</sub>	Second transmitter input voltage
11	T <sub>1IN</sub>	First transmitter input voltage
12	R <sub>1OUT</sub>	First receiver output voltage
13	R <sub>1IN</sub>	First receiver input voltage
14	T <sub>1OUT</sub>	First transmitter output voltage
15	GND	Ground
16	V <sub>CC</sub>	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 <sub>CC</sub>	Supply voltage	-0.3 to 6	V
V+	Extra positive voltage	(V <sub>CC</sub> - 0.3) to 14	
V-	Extra negative voltage	-14 to 0.3	
T <sub>IN</sub>	Transmitter input voltage range	-0.3 to (V <sub>+</sub> + 0.3)	
R <sub>IN</sub>	Receiver input voltage range	± 30	
T <sub>OUT</sub>	Transmitter output voltage range	(V <sub>-</sub> - 0.3) to (V <sub>+</sub> + 0.3)	
R <sub>OUT</sub>	Receiver output voltage range	-0.3 to (V <sub>CC</sub> + 0.3)	
T <sub>SCTOUT</sub>	Short circuit duration on T <sub>OUT</sub>	Infinite	
T <sub>STG</sub>	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<sub>CC</sub> = 5 V ± 10 %, T<sub>A</sub> = -40 to 125 °C, unless otherwise specified, typical values are referred to T<sub>A</sub> = 25 °C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I <sub>SUPPLY</sub>	V <sub>CC</sub> power supply current	No load, T <sub>A</sub> = 25 °C	—	5	10	mA

Table 5: Transmitter electrical characteristics, C1 - C4 = 0.1 µF, V<sub>CC</sub> = 5 V ± 10 %, T<sub>A</sub> = -40 to 85 °C, unless otherwise specified, typical values are referred to T<sub>A</sub> = 25 °C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>TOUT</sub>	Output voltage swing	All transmitter outputs are loaded with 3 kΩ to GND	± 5	± 9		V
I <sub>TIL</sub>	Input leakage current				± 10	µA
V <sub>TIL</sub>	Input logic threshold low		0.8			V
V <sub>TIH</sub>	Input logic threshold high				2	
SR <sub>T</sub>	Transition slew rate	T <sub>A</sub> = 25 °C, V <sub>CC</sub> = 5 V, R <sub>L</sub> = 3 to 7 kΩ, C <sub>L</sub> = 50 to 1000 pF <sup>(1)</sup>	3	6	30	V/µs
D <sub>R</sub>	Data rate	R <sub>L</sub> = 3 to 7 kΩ, C <sub>L</sub> = 50 to 1000 pF, one transmitter switching	230	400		kbits/s
R <sub>TOUT</sub>	Transmitter output resistance	V <sub>CC</sub> = V <sub>+</sub> = V <sub>-</sub> = 0 V, V <sub>OUT</sub> = ± 2 V	300			Ω
I <sub>SC</sub>	Transmitter output short circuit current			± 10	± 60	mA
t <sub>DT</sub>	Propagation delay time	R <sub>L</sub> = 3 to 7 kΩ, C <sub>L</sub> = 50 to 2500 pF, all transmitters loaded		2		µA

**Notes:**

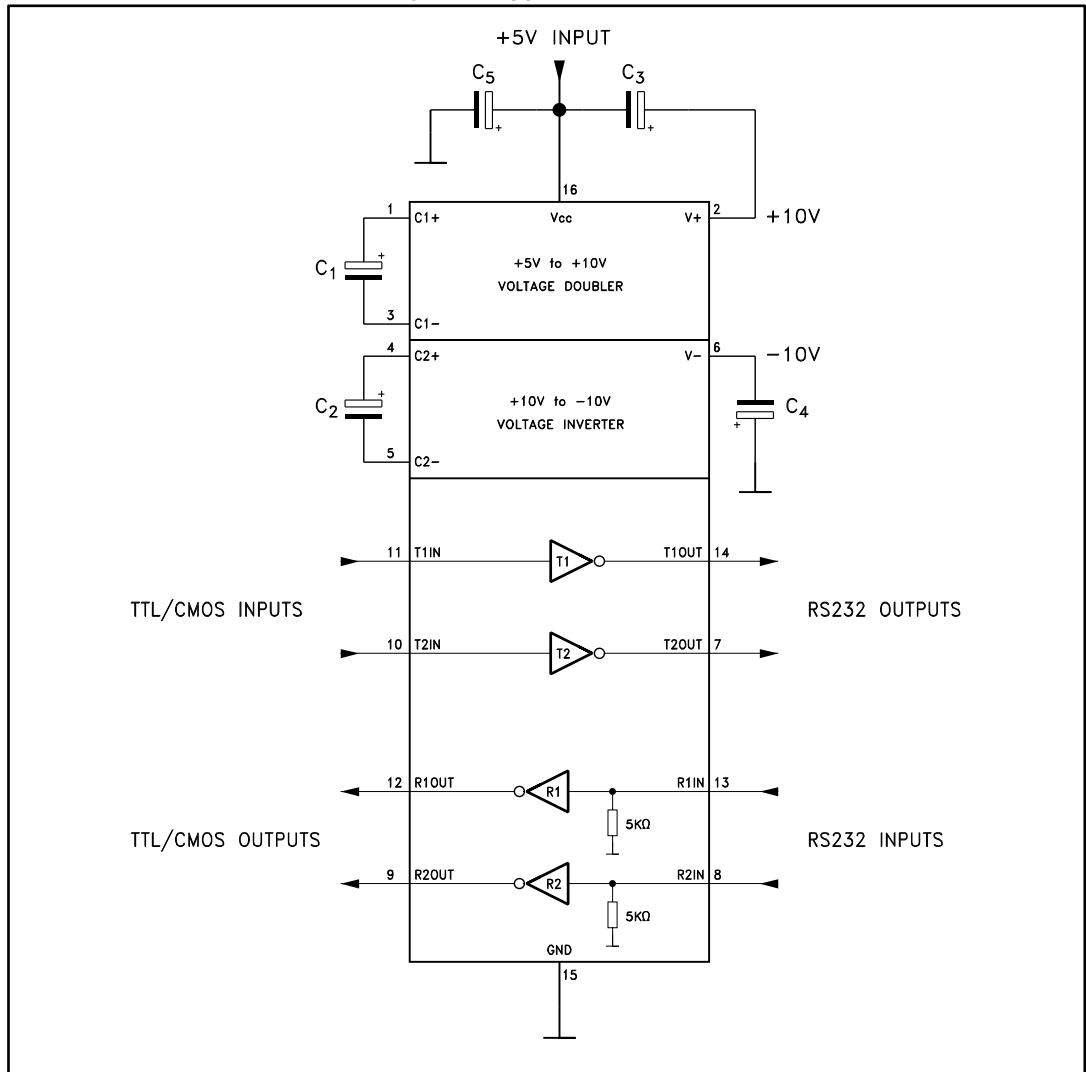
<sup>(1)</sup>Measured from 3 V to -3 V or from -3 V to 3 V

**Table 6: Receiver electrical characteristics, C1 - C4 = 0.1  $\mu$ F, V<sub>CC</sub> = 5 V  $\pm$  10 %, T<sub>A</sub> = -40 to 85 °C, unless otherwise specified, typical values are referred to T<sub>A</sub> = 25 °C**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>RIN</sub>	Receiver input voltage operating range		-30		30	V
R <sub>RIN</sub>	RS-232 input resistance	T <sub>A</sub> = 25 °C, V <sub>CC</sub> = 5 V	3	5	7	k $\Omega$
V <sub>RIL</sub>	RS-232 input logic threshold low		0.8	1.2		V
V <sub>RIH</sub>	RS-232 input logic threshold high			1.7	2.4	
V <sub>RIHYS</sub>	RS-232 input hysteresis	V <sub>CC</sub> = 5 V	0.2	0.5	1	
V <sub>ROL</sub>	TTL/CMOS output voltage low	I <sub>OUT</sub> = 3.2 mA			0.4	
V <sub>ROH</sub>	TTL/CMOS output voltage high	I <sub>OUT</sub> = -1 mA	3.5	V <sub>CC</sub> - 0.4		
t <sub>DR</sub>	Propagation delay time	C <sub>L</sub> = 150 pF		0.5	10	$\mu$ s

# 4 Typical application

Figure 2: Application circuit



1. C<sub>1-4</sub> can be replaced by the 1 μF capacitors
2. C<sub>1-4</sub> 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  $T_J = 25\text{ }^\circ\text{C}$

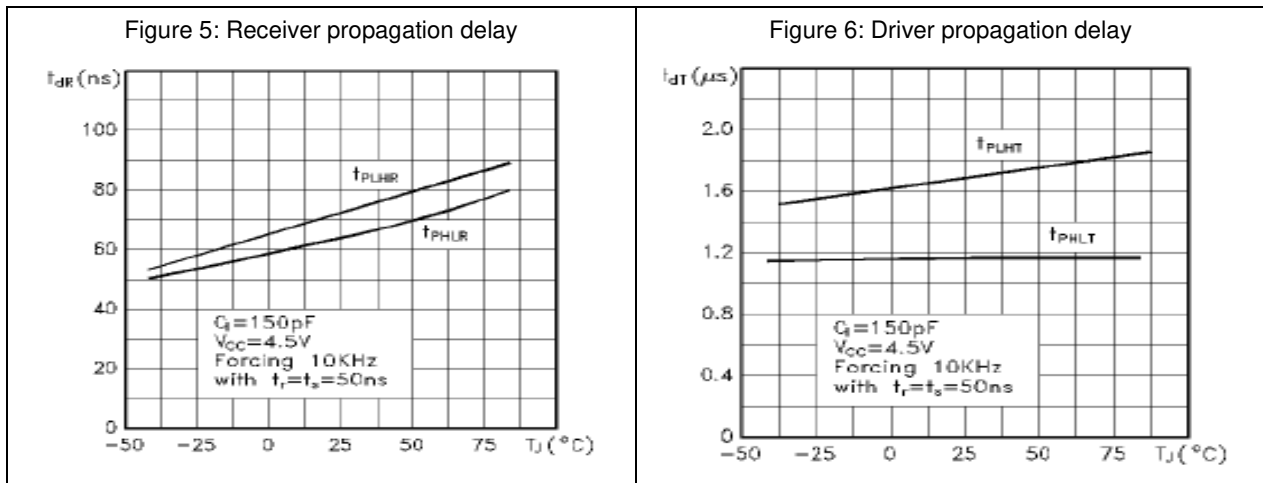
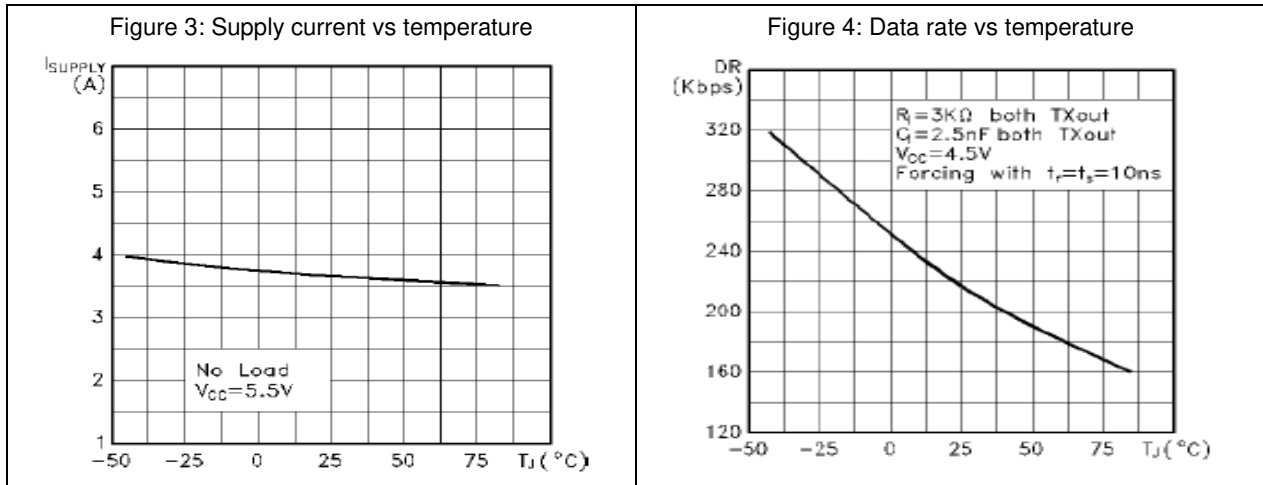




Figure 7: High level output voltage swing vs temperature

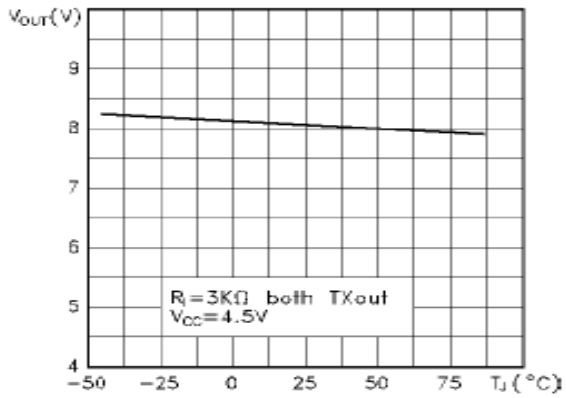


Figure 8: Low level output voltage swing vs temperature

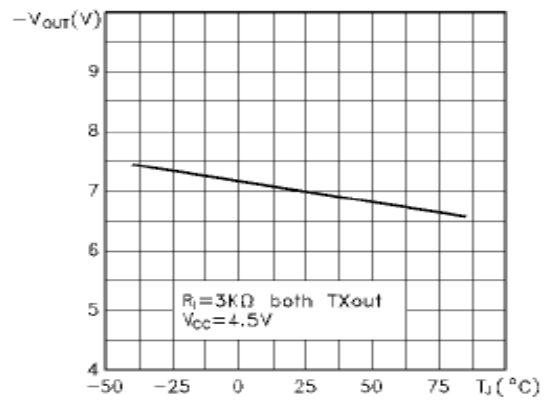


Figure 9: High level transmitter output short circuit current vs temperature

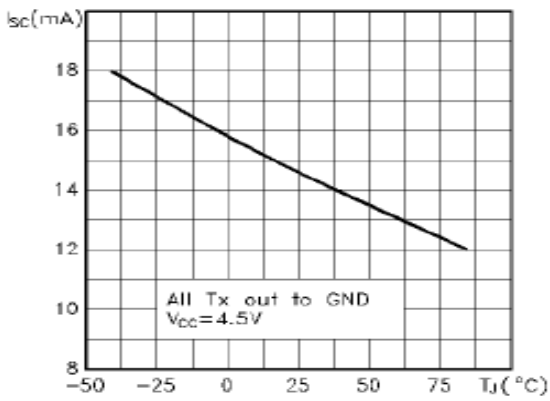


Figure 10: Low level transmitter output short circuit current vs temperature

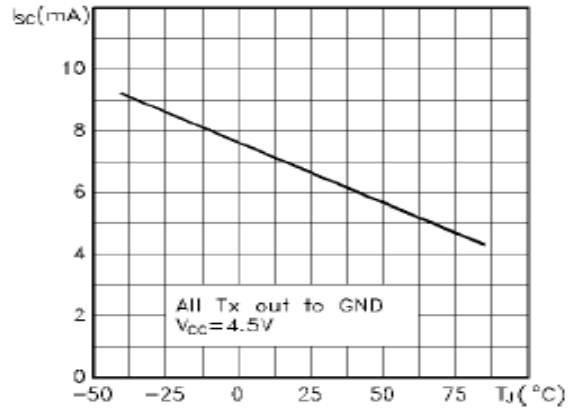


Figure 11: High level receiver output short circuit current vs temperature

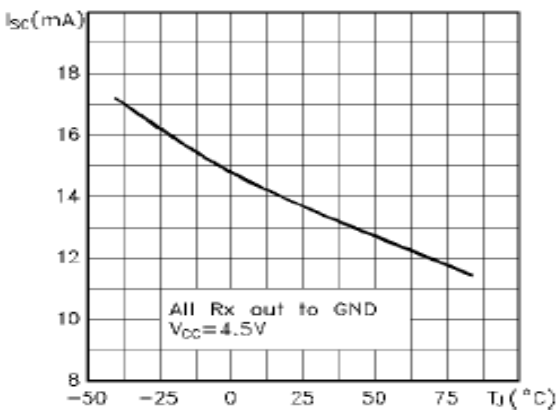
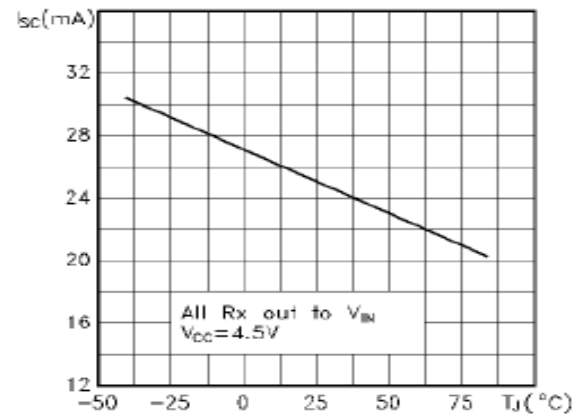


Figure 12: Low level receiver output short circuit current vs temperature



## 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](http://www.st.com). ECOPACK® is an ST trademark.

## 6.1 SO16 package information

Figure 13: SO16 package outline

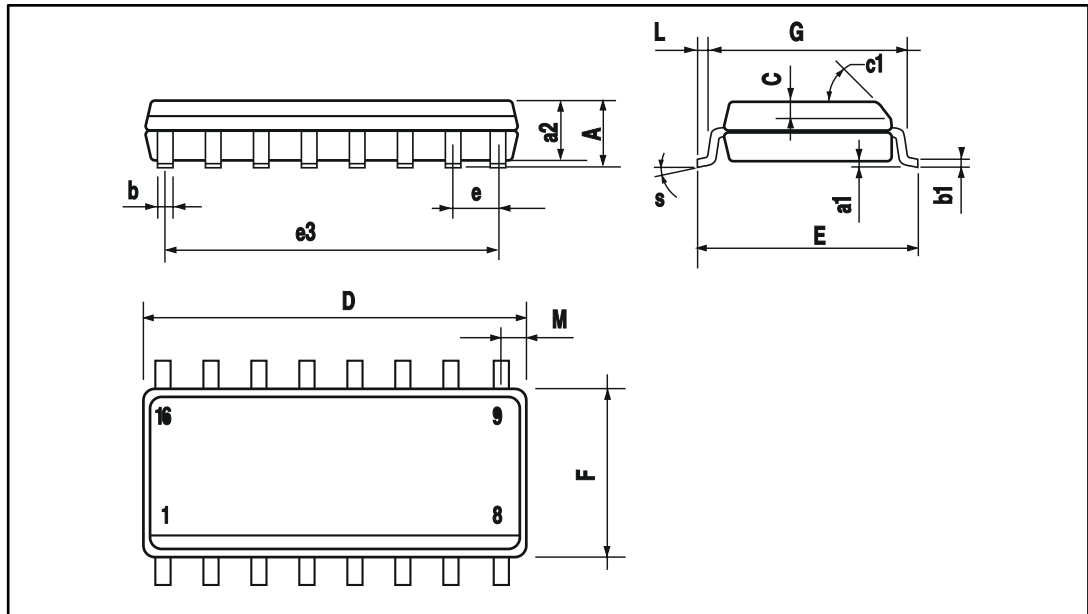


Table 8: SO16 mechanical data

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

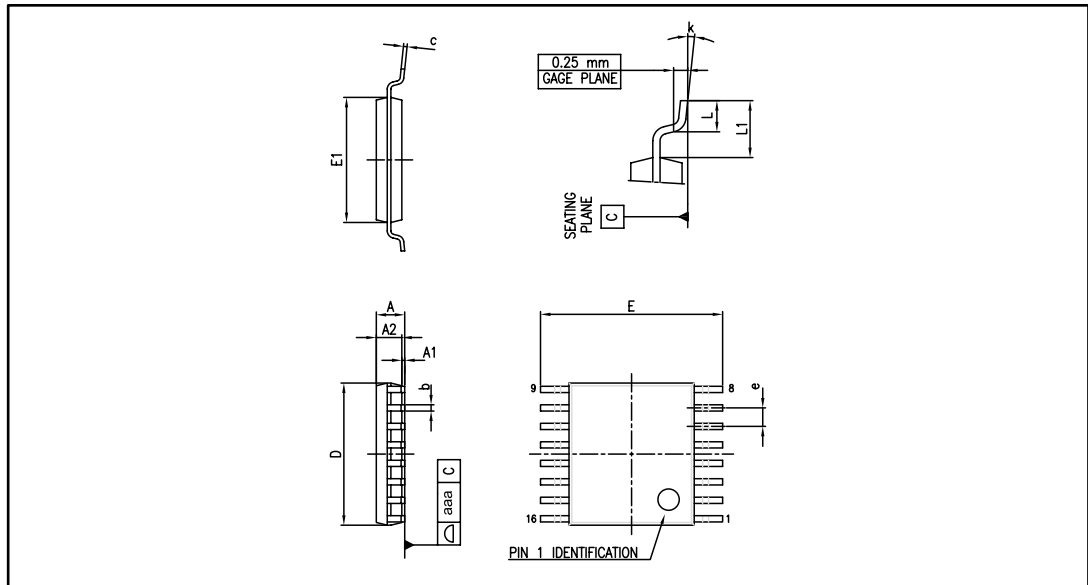
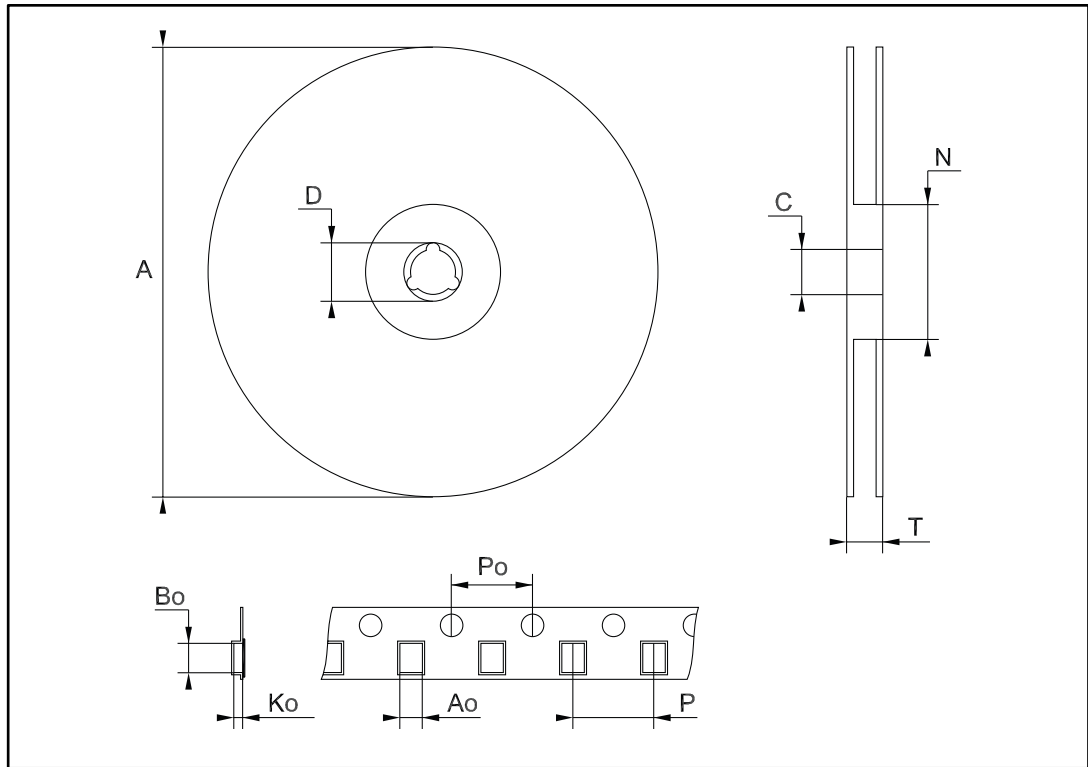


Table 9: TSSOP16 mechanical data

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



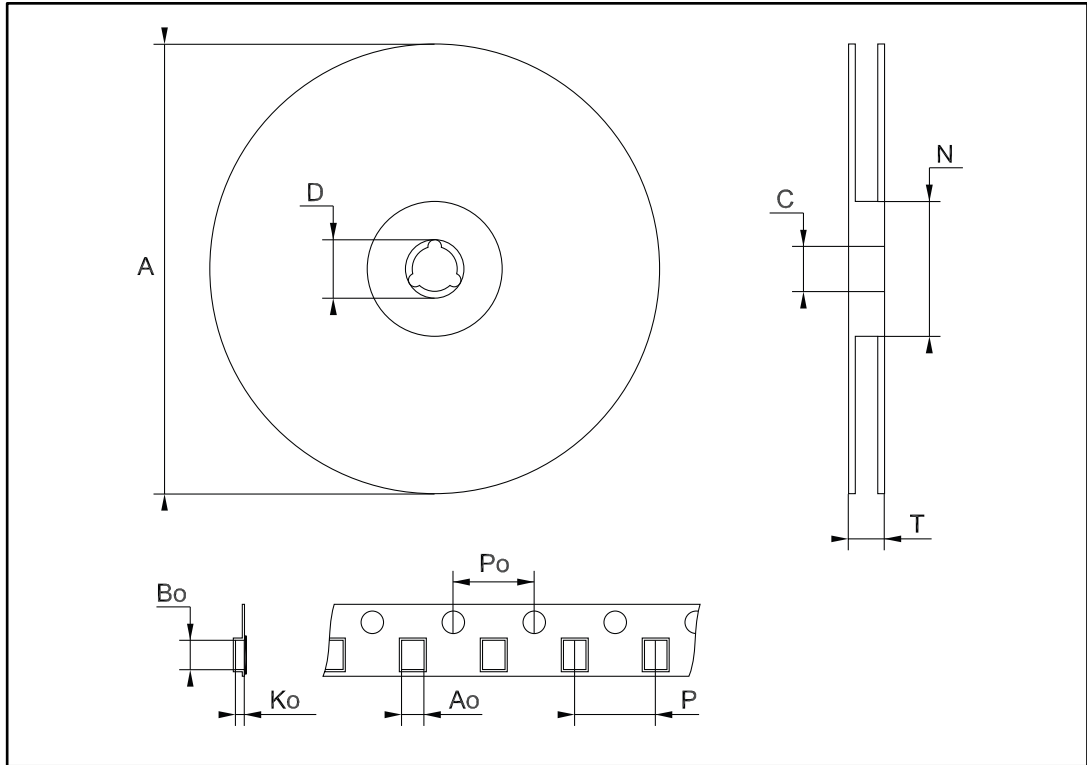
1. Drawing not to scale

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 <sub>thja</sub> <sup>(1)</sup>	115	1-layer board	°C/W
		80	4-layer board	
	R <sub>thjc</sub> <sup>(2)</sup>	30	1-layer board	
TSSOP16	R <sub>thja</sub> <sup>(1)</sup>	140	1-layer board	
		95	2-layer board	
	R <sub>thjc</sub> <sup>(2)</sup>	25		

**Notes:**

<sup>(1)</sup>R<sub>thja</sub> is the package junction-to-ambient thermal resistance in °C/W

<sup>(2)</sup>R<sub>thjc</sub> 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, $\pm 1\mu A \Rightarrow \pm 10\mu A$ .
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
08-Mar-2017	18	Removed SO16L package <i>Features</i> : updated units of guaranteed slew rate range from V/ms to V/ $\mu$ s. 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".

**IMPORTANT NOTICE – PLEASE READ CAREFULLY**

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2017 STMicroelectronics – All rights reserved