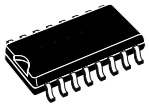
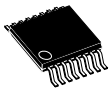
ST202EB, ST202EC, ST232EB, ST232EC

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

Datasheet - production data



SO16



TSSOP16

Features

- ESD protection for RS-232 I/O pins: ± 15 kV human body model
- Guaranteed 230 kbps date 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.

Contents

1 Pinout information

Figure 1: Pin connections (top view)

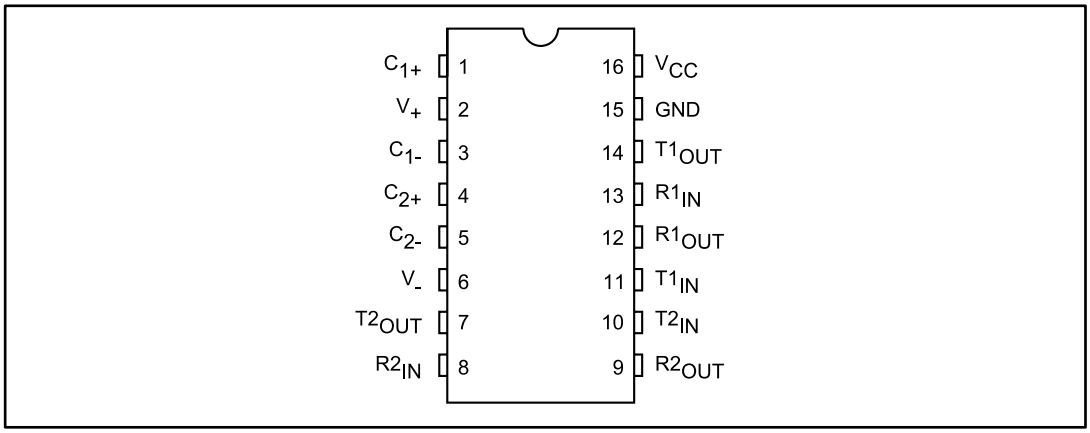


Table 1: Pin description

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	$T2_{OUT}$	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

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:

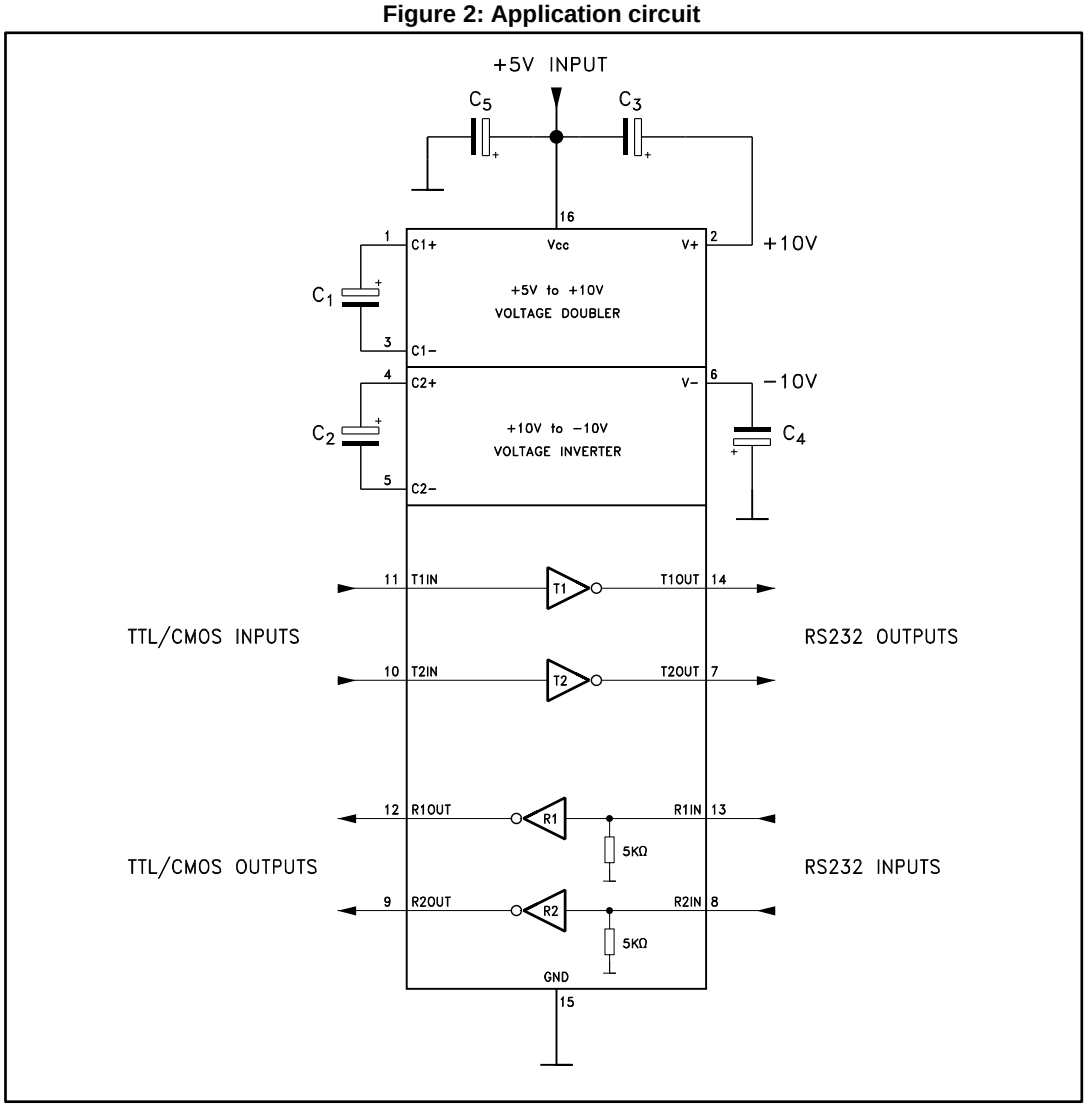
(1)Measured from 3 V to -3 V or from -3 V to 3 V

Table 6: Receiver electrical characteristics, C1 - C4 = 0.1 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_{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	kΩ
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	µs

4 Typical application

Figure 2: Application circuit



1. $C_{1\text{-}4}$ can be replaced by the 1 µF capacitors
2. $C_{1\text{-}4}$ 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 °C

Figure 3: Supply current vs temperature

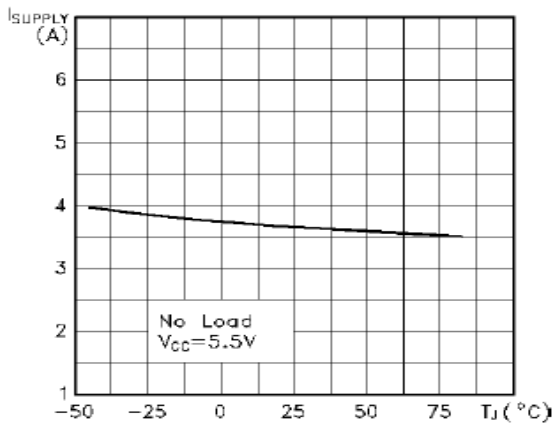


Figure 4: Data rate vs temperature

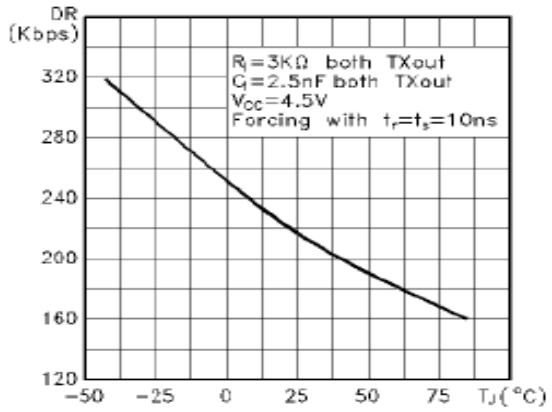


Figure 5: Receiver propagation delay

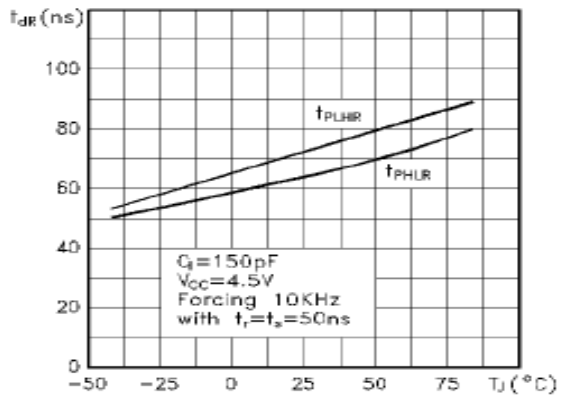


Figure 6: Driver propagation delay

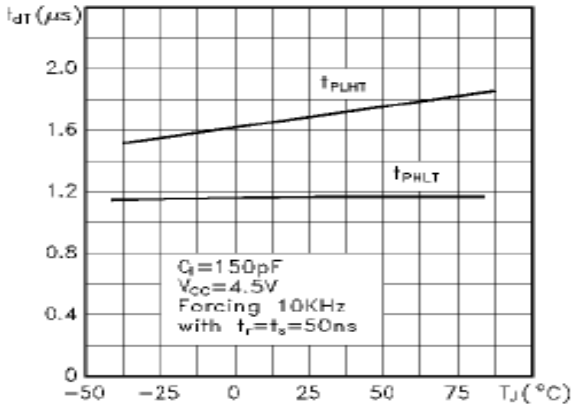


Figure 7: High level output voltage swing vs temperature

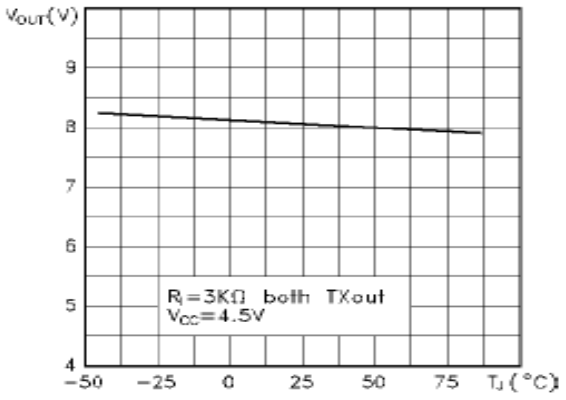


Figure 8: Low level output voltage swing vs temperature

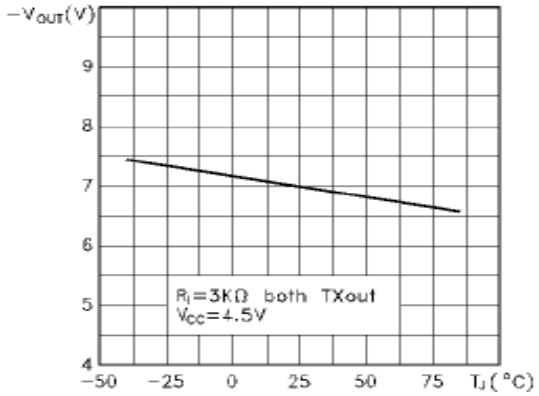


Figure 9: High level transmitter output short circuit current vs temperature

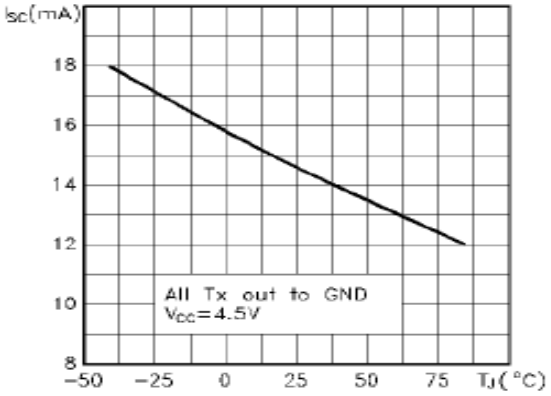


Figure 10: Low level transmitter output short circuit current vs temperature

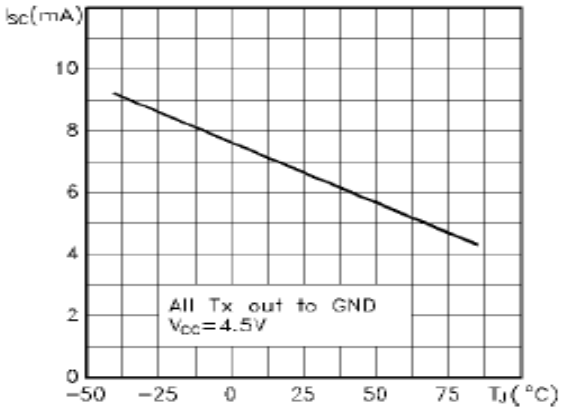


Figure 11: High level receiver output short circuit current vs temperature

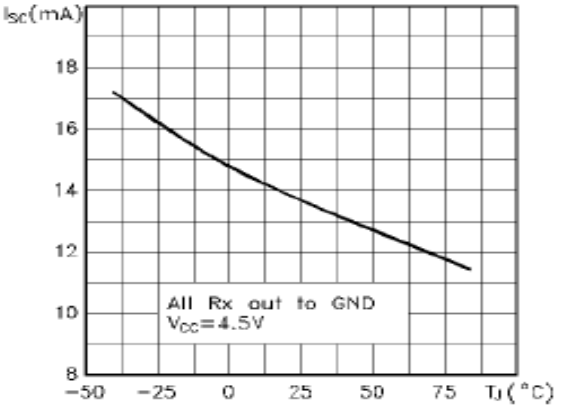
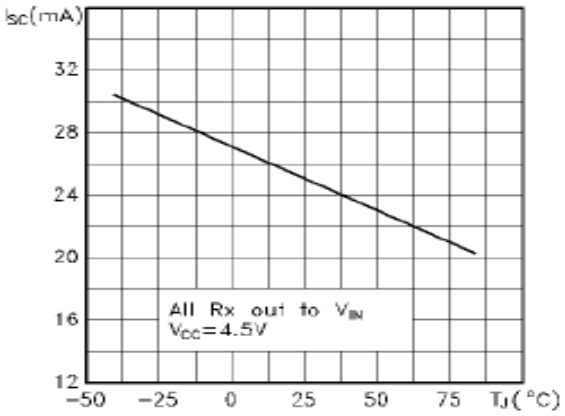


Figure 12: Low level receiver output short circuit current vs temperature



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

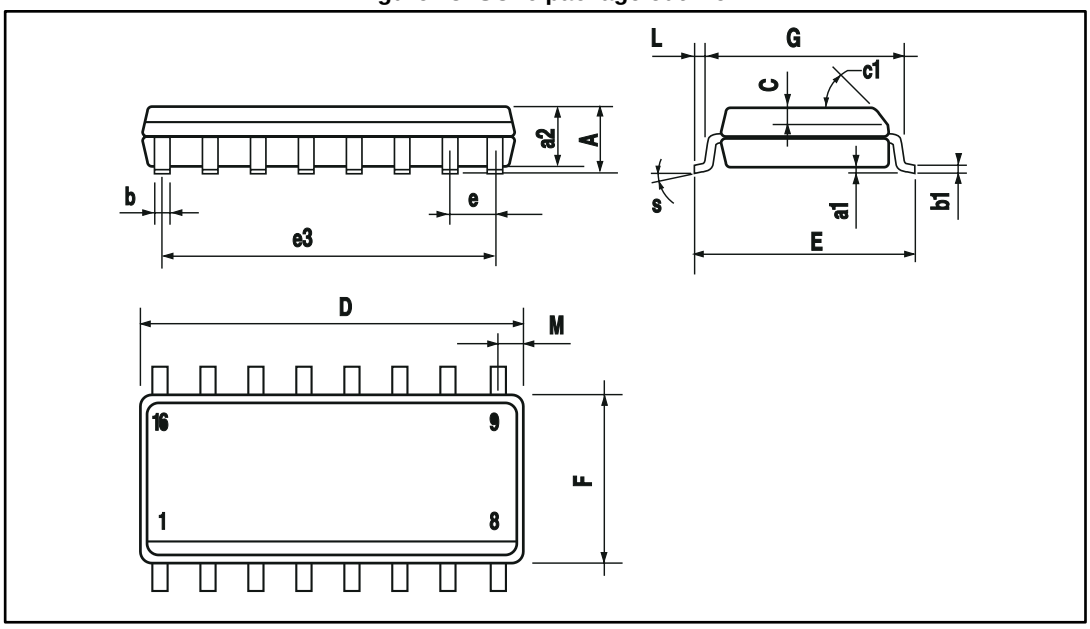


Table 8: SO16 mechanical data

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

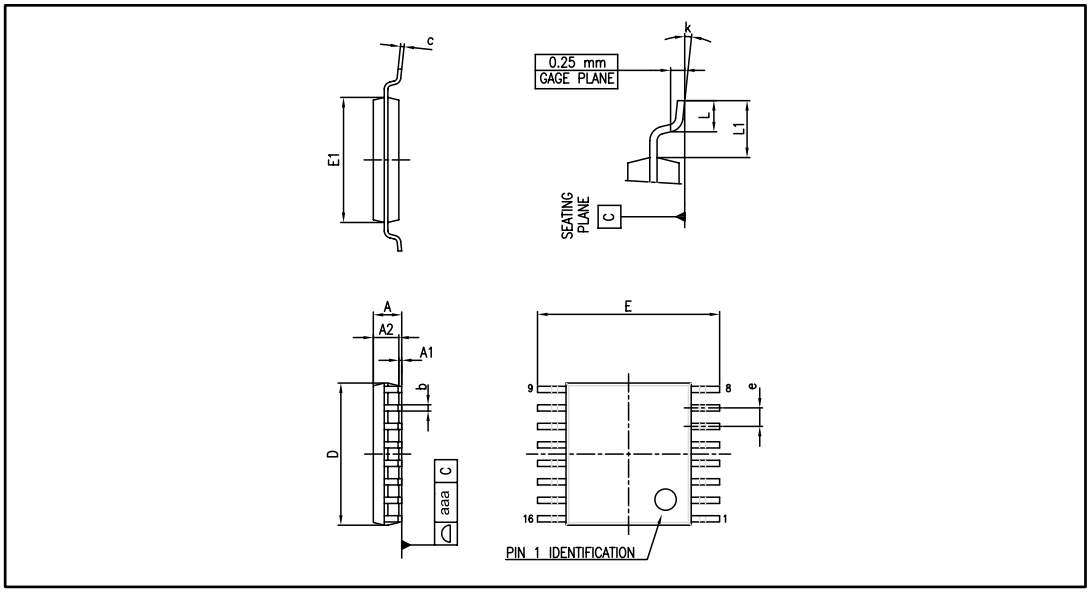
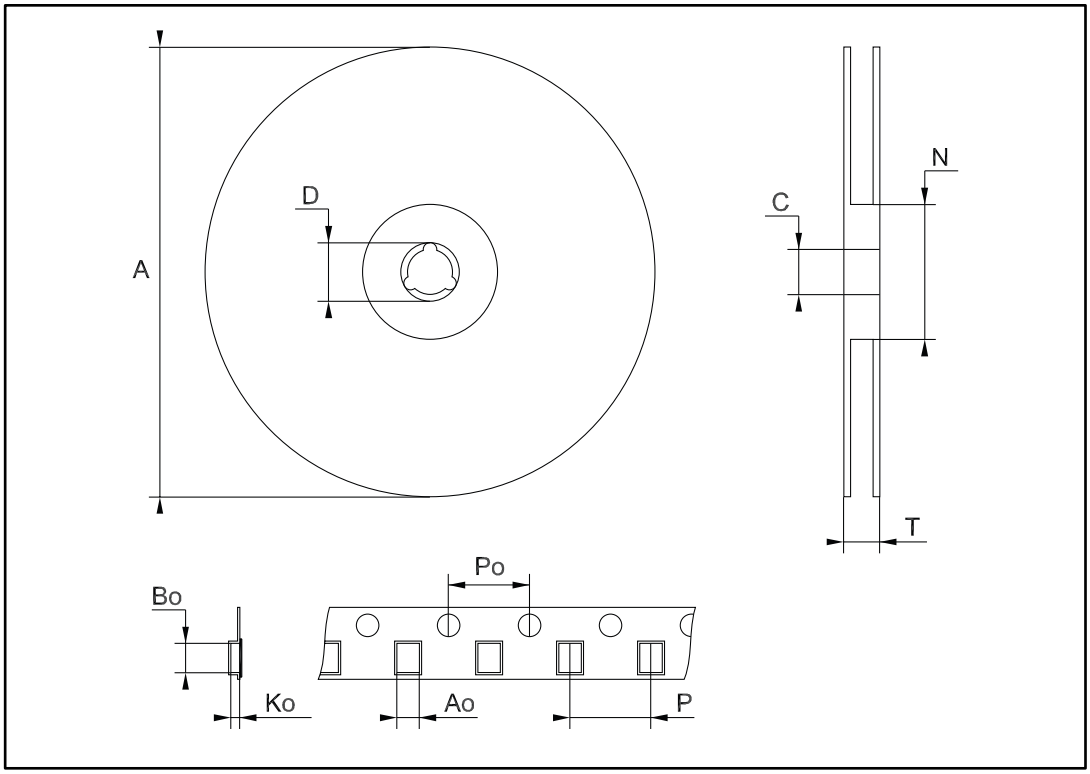


Table 9: TSSOP16 mechanical data

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



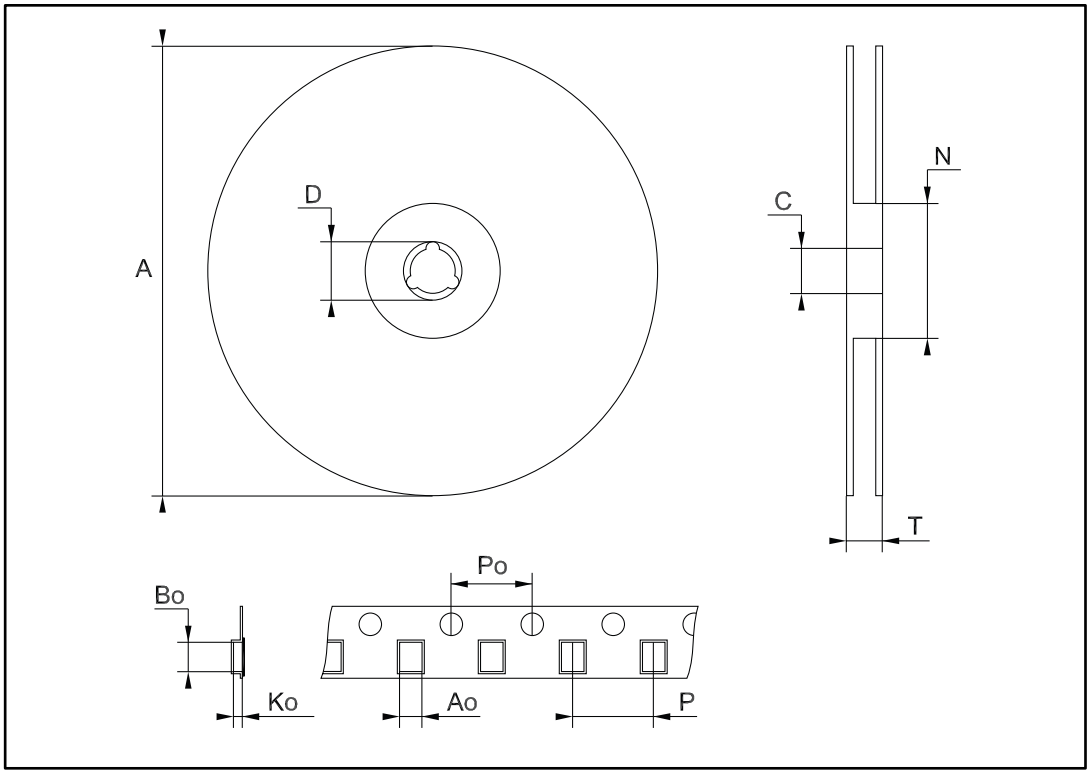
1. Drawing not to scale

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 *Features*: updated units of guaranteed slew rate range from V/ms to V/µs. Moved “Device summary” table to *Section 7: "Ordering information"*. Removed obsolete order codes ST202EBWR and ST232ECWR from this table and added “Marking”. *Section 6.2: "TSSOP16 package information"*: added dimensions “L1” and “aaa”, and replaced dimension “K” with “k”.

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