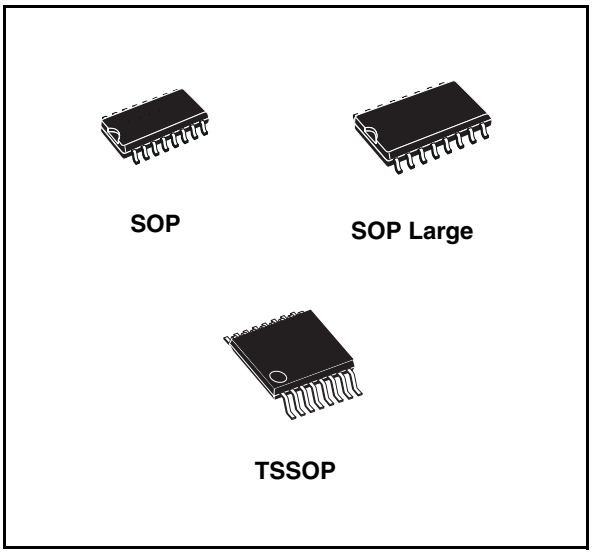
ST202EB - ST202EC
ST232EB - ST232EC

± 15 kV ESD protected 5 V RS-232 transceiver

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/ms
- Operate from a single 5 V power supply



Description

The ST202E/ST232E are a 2 driver 2 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 ST202E/232E use a single 5 V supply voltage.

The ST232E operates with four 1 µF capacitors, while the ST202E operates with four 0.1 µF capacitors, further reducing cost and board space.

Table 1. Device summary

Order codes		Temperature range	Packages	Packaging
ST202ECDR	ST232ECDR	0 to 70 °C	SO-16 (tape & reel)	2500 parts per reel
ST202EBDR	ST232EBDR	-40 to 85 °C	SO-16 (tape & reel)	2500 parts per reel
	ST232ECWR	0 to 70 °C	SO-16 large (tape & reel)	1000 parts per reel
ST202EBWR		-40 to 85 °C	SO-16 large (tape & reel)	1000 parts per reel
ST202ECTR	ST232ECTR	0 to 70 °C	TSSOP16 (tape & reel)	2500 parts per reel
ST202EBTR	ST232EBTR	-40 to 85 °C	TSSOP16 (tape & reel)	2500 parts per reel

Contents

1 Pin configuration

Figure 1. Pin connections (top view)

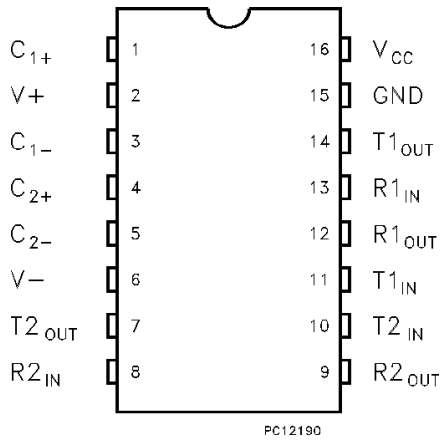


Table 2. Pin description

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	$T2_{OUT}$	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 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
V-	Extra negative voltage	-14 to 0.3	V
T_{IN}	Transmitter input voltage range	-0.3 to (V_+ + 0.3)	V
R_{IN}	Receiver input voltage range	±30	V
T_{OUT}	Transmitter output voltage range	(V_- - 0.3) to (V_+ + 0.3)	V
R_{OUT}	Receiver output voltage range	-0.3 to (V_{CC} + 0.3)	V
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
ESD	ESD protection voltage	IEC 1000-4-2 (Contact Discharge)	±6			kV
ESD	ESD protection voltage	IEC 1000-4-2 (Air Discharge)	±8			kV

Note: All test versus GND.

Table 5. Electrical characteristics
(C_1 - C_4 = 0.1 µF for ST202E, C_1 - C_4 = 0.1 µF for ST232E, 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 condition	Min.	Typ.	Max.	Unit
I_{SUPPLY}	V_{CC} power supply current	No Load, T_A = 25°C		5	10	mA

Table 6. Transmitter electrical characteristics
(C_1 - 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 condition	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	V
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- = 0V V_{OUT} = ±2 V	300			Ω
I_{SC}	Transmitter output short circuit current			±10	±60	mA
t_{DT}	Transmitter propagation delay	R_L = 3 to 7 kΩ, 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
2. One transmitter output is loaded with R_L = 3 kΩ to 7 kΩ, C_L = 50 to 1000 pF

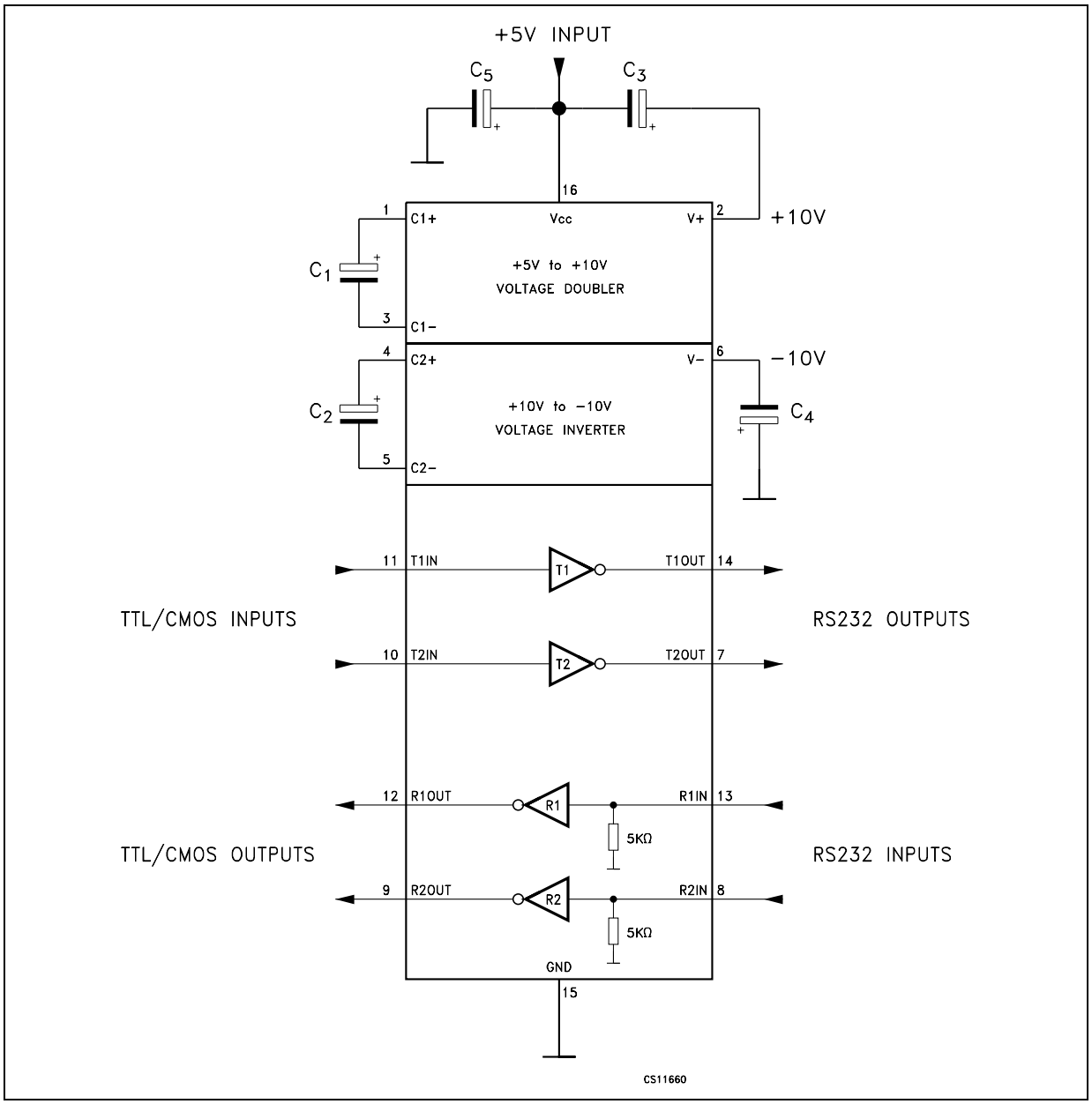
Table 7. Receiver electrical characteristics

(C_1 - 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 condition	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	T_A = 25°C, V_{CC} = 5 V	0.8	1.2		V
V_{RIH}	RS-232 input logic threshold high	T_A = 25°C, V_{CC} = 5 V		1.7	2.4	V
V_{RIHYS}	RS-232 input hysteresis	V_{CC} = 5 V	0.2	0.5	1	V
V_{ROL}	TTL/CMOS output voltage low	I_{OUT} = 3.2 mA			0.4	V
V_{ROH}	TTL/CMOS output voltage high	I_{OUT} = -1 mA	3.5	V_{CC}-0.4		V
t_{DR}	Receiver propagation delay	C_L = 150 pF		0.5	10	µs

4 Typical application

Figure 2. Application circuit (1) (2)



1. $C_{1\text{-}4}$ capacitors can even be 1µF ones
2. $C_{1\text{-}4}$ 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 °C)

Figure 3. Supply current vs temperature

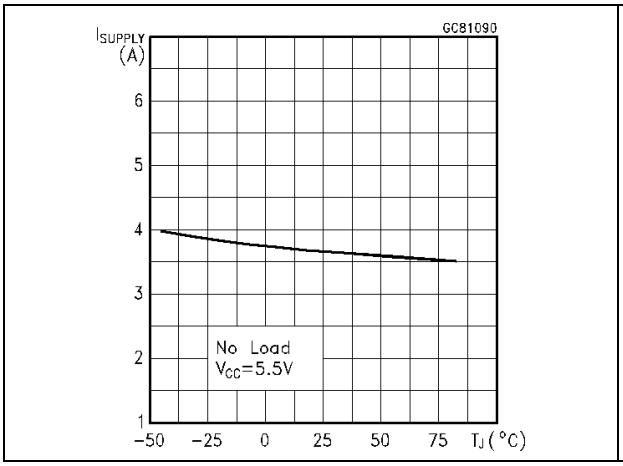


Figure 4. Data rate vs temperature

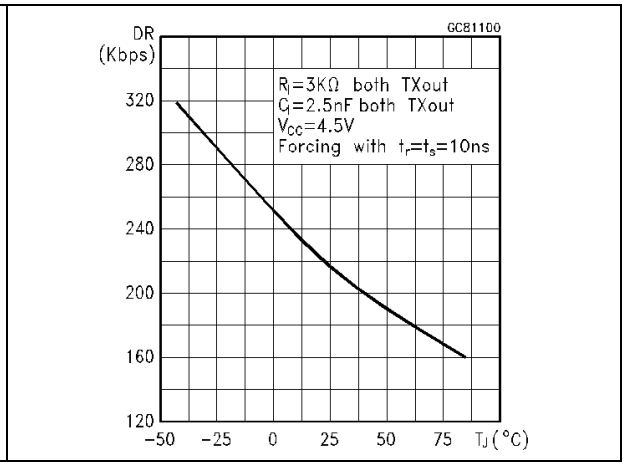


Figure 5. Receiver propagation delay

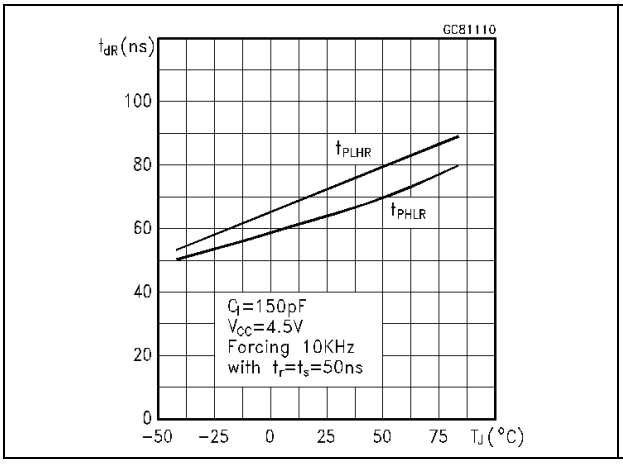


Figure 6. Driver propagation delay

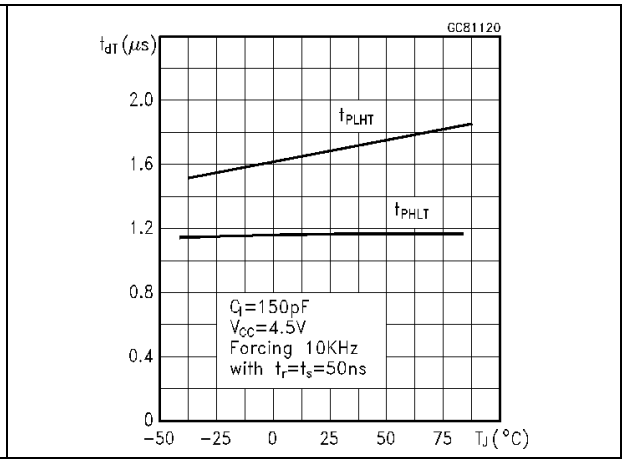


Figure 7. High level output voltage swing vs temperature

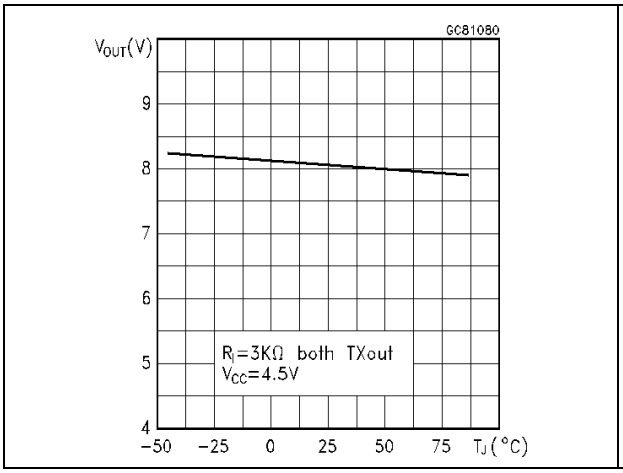


Figure 8. Low level output voltage swing vs temperature

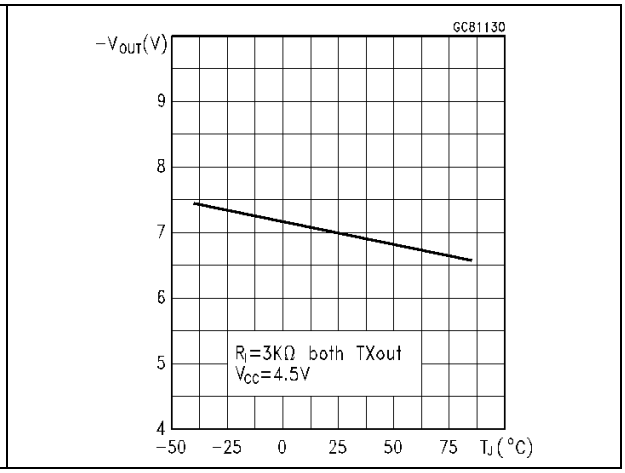


Figure 9. High level transmitter output short circuit current vs temperature

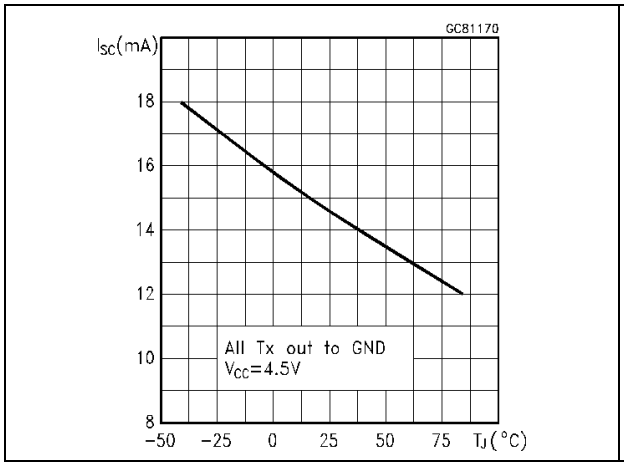


Figure 10. Low level transmitter output short circuit current vs temperature

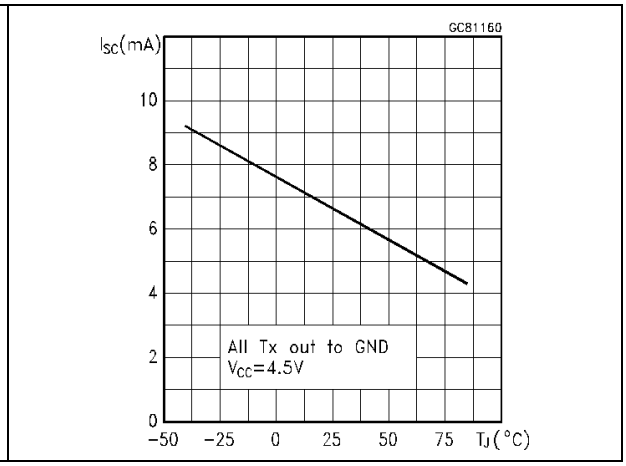


Figure 11. High level receiver output short circuit current vs temperature

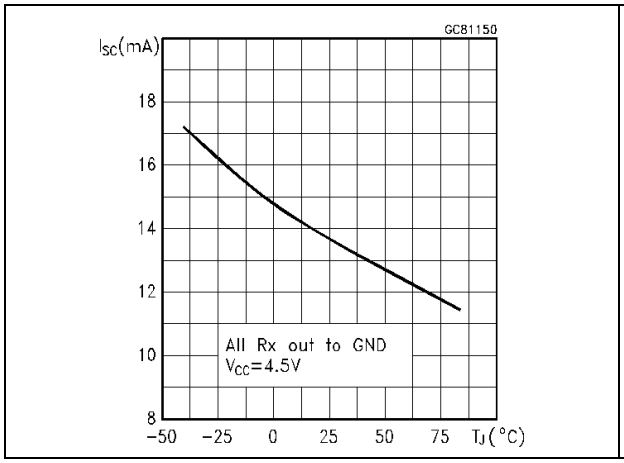
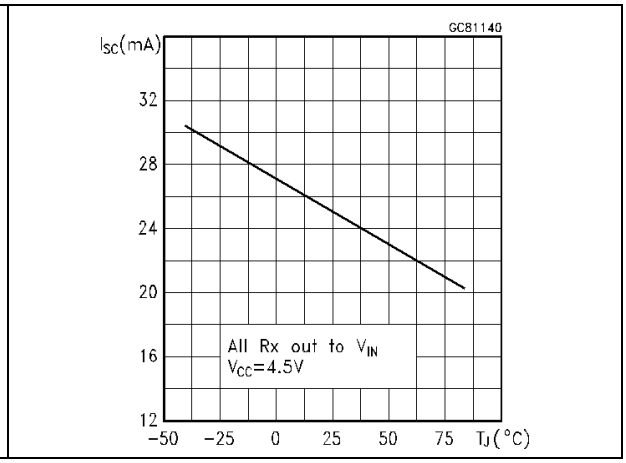


Figure 12. Low level receiver output short circuit current vs temperature

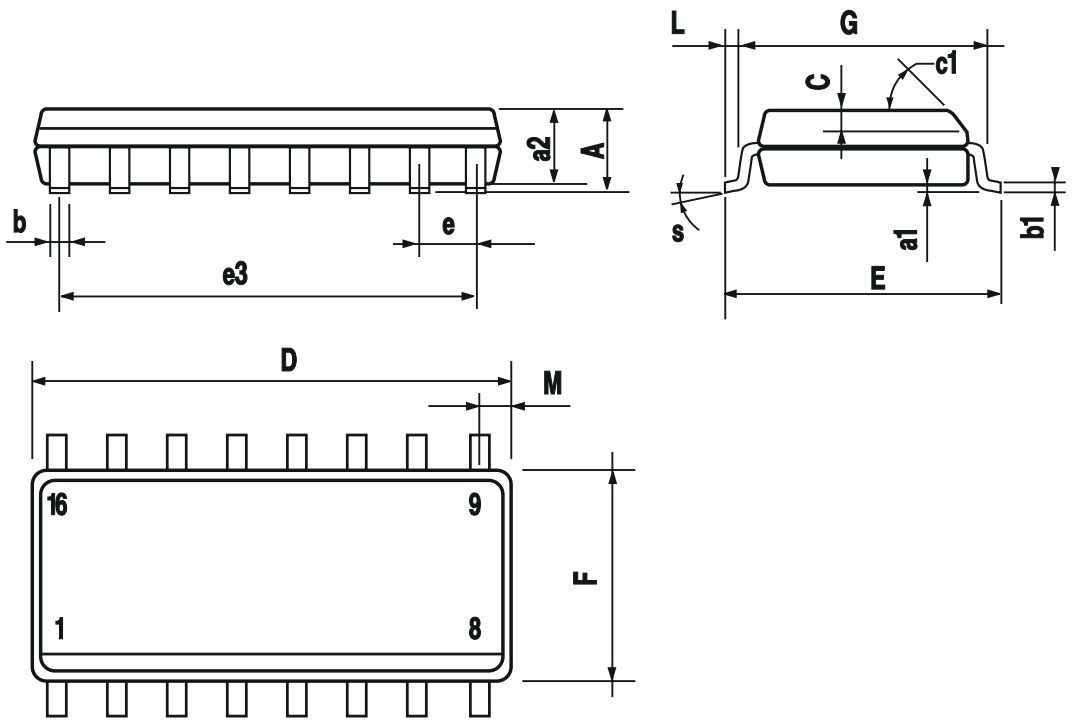


6 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

SO-16 mechanical data

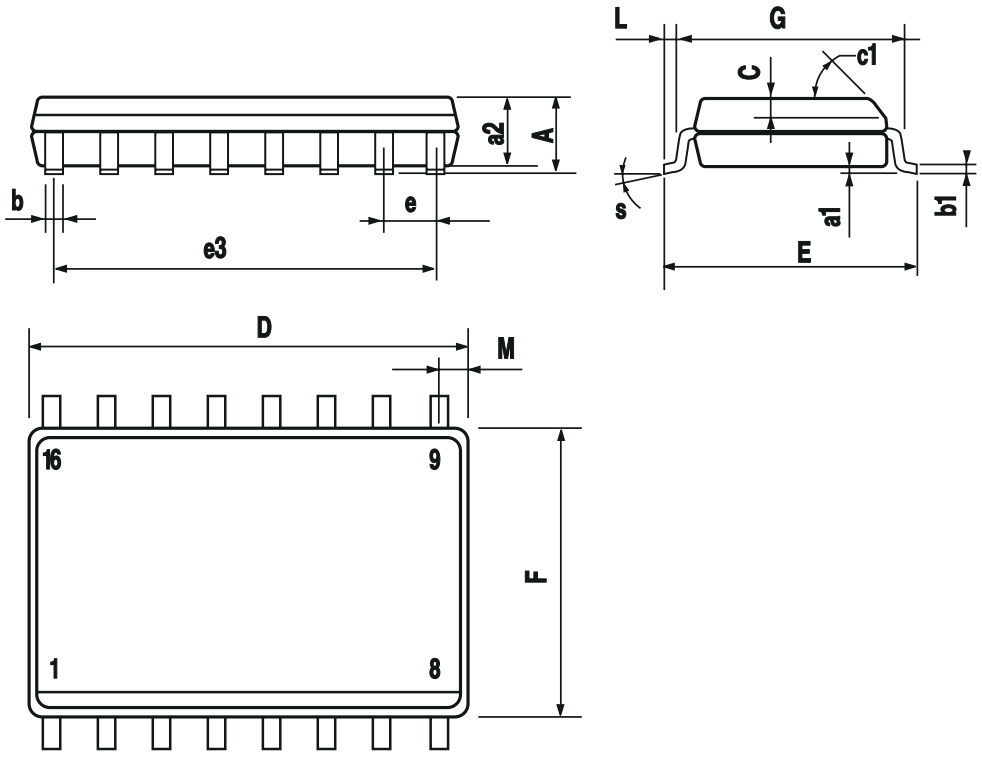
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.068
a1	0.1		0.25	0.004		0.010
a2			1.64			0.063
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157
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.)					



0016020D

SO-16L mechanical data

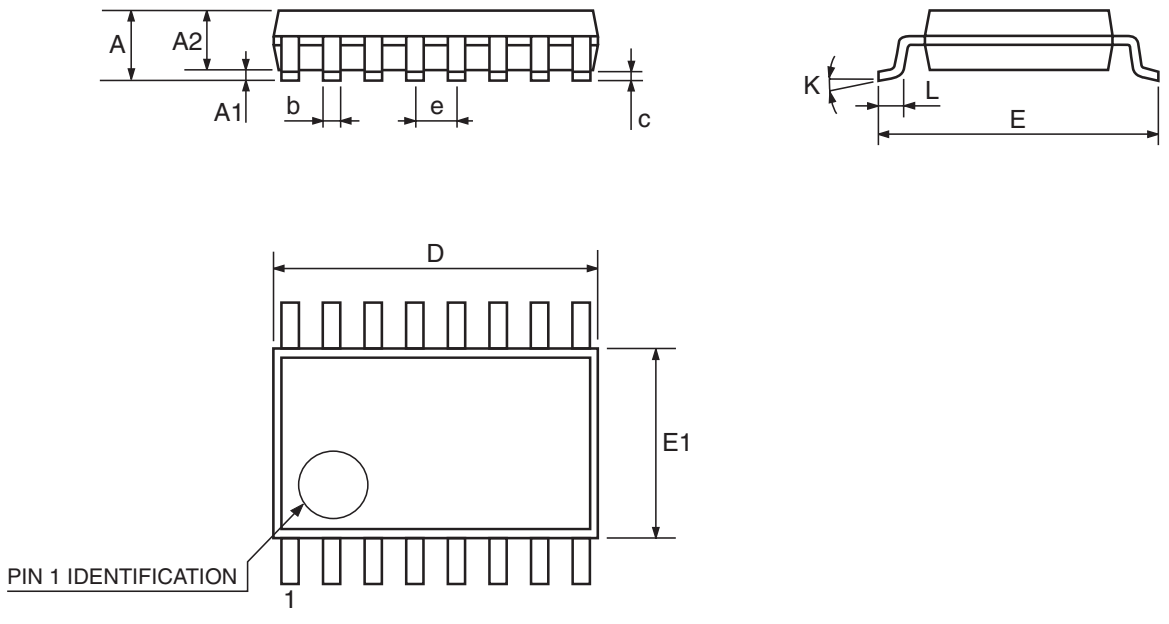
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			2.65			0.104
a1	0.1		0.2	0.004		0.008
a2			2.45			0.096
b	0.35		0.49	0.014		0.019
b1	0.23		0.32	0.009		0.012
C		0.5			0.020	
c1	45° (typ.)					
D	10.1		10.5	0.397		0.413
E	10.0		10.65	0.393		0.419
e		1.27			0.050	
e3		8.89			0.350	
F	7.4		7.6	0.291		0.300
G						
L	0.5		1.27	0.020		0.050
M			0.75			0.029
S	8° (max.)					



PO13I

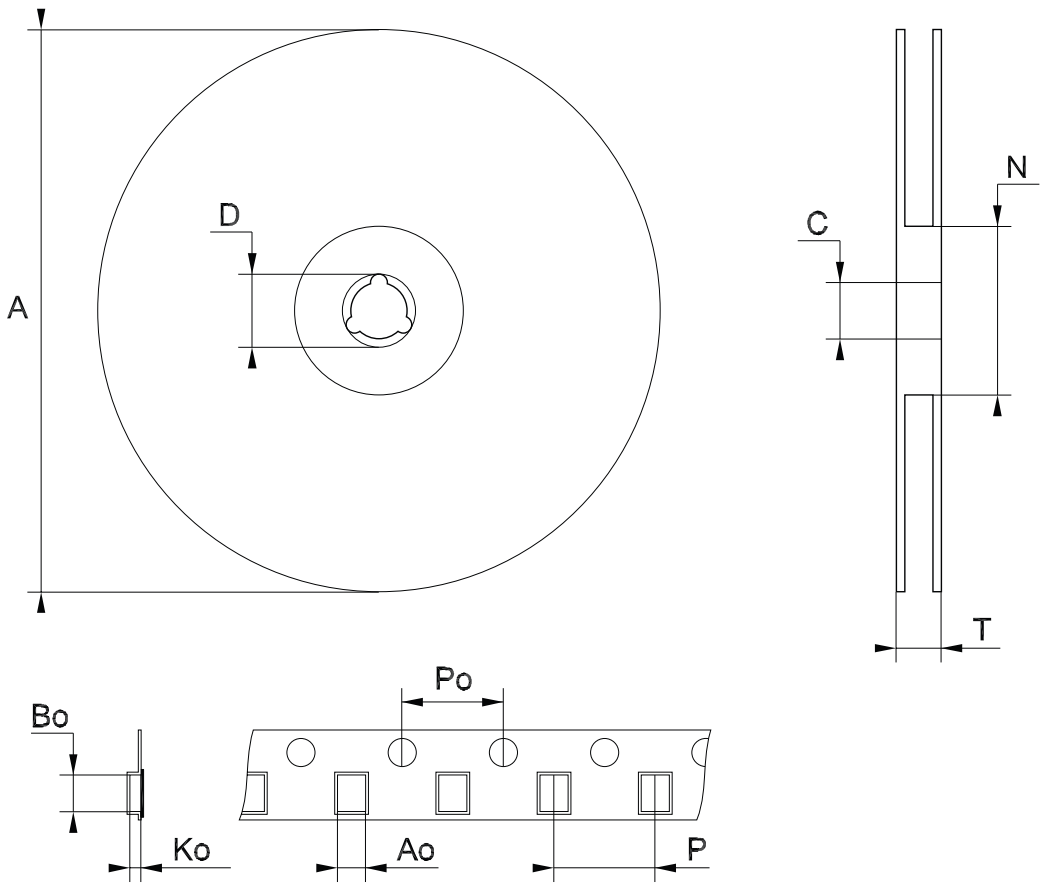
TSSOP16 mechanical data

Dim.	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 BSC			0.0256 BSC	
K	0°		8°	0°		8°
L	0.45	0.60	0.75	0.018	0.024	0.030



Tape & reel SO-16 mechanical data

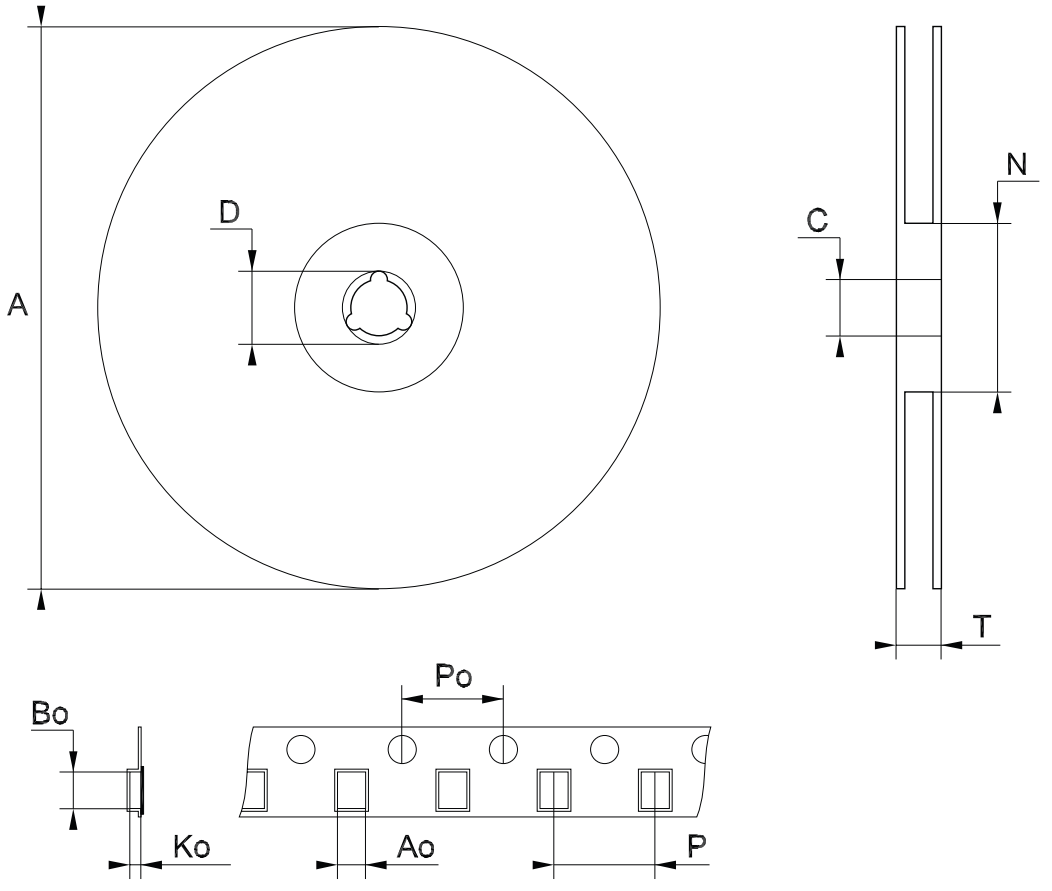
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	6.45		6.65	0.254		0.262
Bo	10.3		10.5	0.406		0.414
Ko	2.1		2.3	0.082		0.090
Po	3.9		4.1	0.153		0.161
P	7.9		8.1	0.311		0.319



Note: Drawing not in scale

Tape & reel SO-16L mechanical data

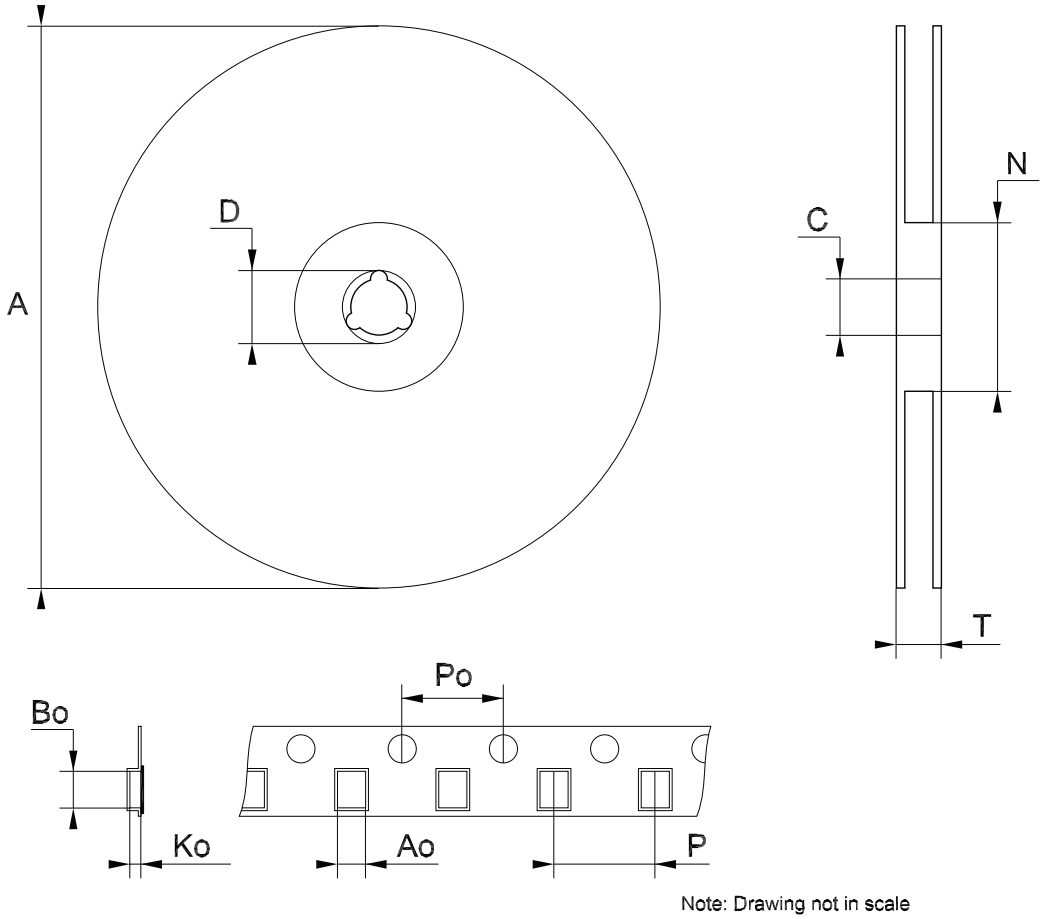
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	10.8		11.0	0.425		0.433
Bo	10.7		10.9	0.421		0.429
Ko	2.9		3.1	0.114		0.122
Po	3.9		4.1	0.153		0.161
P	11.9		12.1	0.468		0.476



Note: Drawing not in scale

Tape & reel TSSOP16 mechanical data

Dim.	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



Note: Drawing not in scale

7 Revision history

Table 9. 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*.