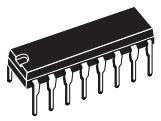
ST232B
ST232C

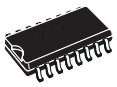
5 V powered multi-channel RS-232 drivers and receivers

Features

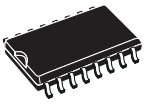
- Supply voltage range: 4.5 to 5.5 V
- Supply current no load (typ.): 5 mA
- Transmitter output voltage swing (typ): ±7.8 V
- Controlled output slew rate
- Receiver input voltage range: ± 30 V
- Data rate (typ.): 220 kbps
- Operating temperature range:
  - -40 ° to 85 °C
  - 0 ° to 70 °C
- Compatible with MAX232 and MAX202



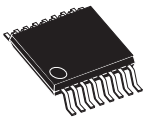
DIP



SOP



SOP Large



TSSOP

Description

The ST232 is a 2 driver, 2 receiver device following EIA/TIA-232 and V.28 communication standard. It is particularly suitable for applications where ±12 V is not available. The ST232 uses a single 5 V power supply and only four external capacitors (0.1 µF). Typical applications are in: portable computers, low power modems, interfaces translation, battery powered RS-232 system, multi-drop RS-232 networks.

Table 1. Device summary

Order code	Temperature range	Package	Packaging
ST232CN	0 to 70 °C	DIP-16	25 parts per tube / 40 tube per box
ST232CDR	0 to 70 °C	SO-16 (tape and reel)	2500 parts per reel
ST232BDR	-40 to 85 °C	SO-16 (tape and reel)	2500 parts per reel
ST232CWR	0 to 70 °C	SO-16 Large (tape and reel)	1000 parts per reel
ST232BWR	-40 to 85 °C	SO-16 Large (tape and reel)	1000 parts per reel
ST232CTR	0 to 70 °C	TSSOP16 (tape and reel)	2500 parts per reel
ST232BTR	-40 to 85 °C	TSSOP16 (tape and reel)	2500 parts per reel

Contents

1 Pin configuration 3

2 Maximum ratings 4

3 Electrical characteristics 5

4 Typical application 7

5 Typical performance characteristics 8

6 Package mechanical data 10

7 Revision history 18

1 Pin configuration

Figure 1. Pin connections (top view)

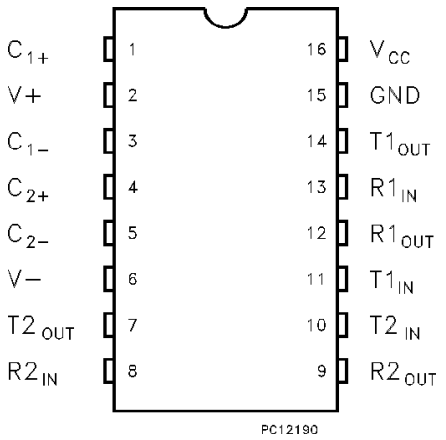


Table 2. Pin description

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
T_{IN}	Transmitter input voltage range	-0.3 to (V_{CC} + 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	

Note: 1 Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

2 No external supply can be applied to V+ terminal and V- terminal.

3 Electrical characteristics

Table 4. Electrical characteristics

(C_1 - C_4 = 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
I_{SUPPLY}	V_{CC} Power supply current	No Load, T_A = 25°C		5	10	mA

Table 5. Transmitter electrical characteristics

(C_1 - C_4 = 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 3kΩ to GND	±5	±7.8		V
I_{TIL}	Input leakage current				±40	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} = 5V R_L = 3 to 7kΩ, C_L = 50 to 2500pF (1)		7	30	V/µs
D_R	Data rate	(2)	120	220		kbits/s
R_{TOUT}	Transmitter output resistance	V_{CC} = V+ = V- = 0V V_{OUT} = ±2V	300			Ω
I_{SC}	Transmitter output short circuit current	One T_{XOUT} to GND		±10	±60	mA

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 6. Receiver electrical characteristics

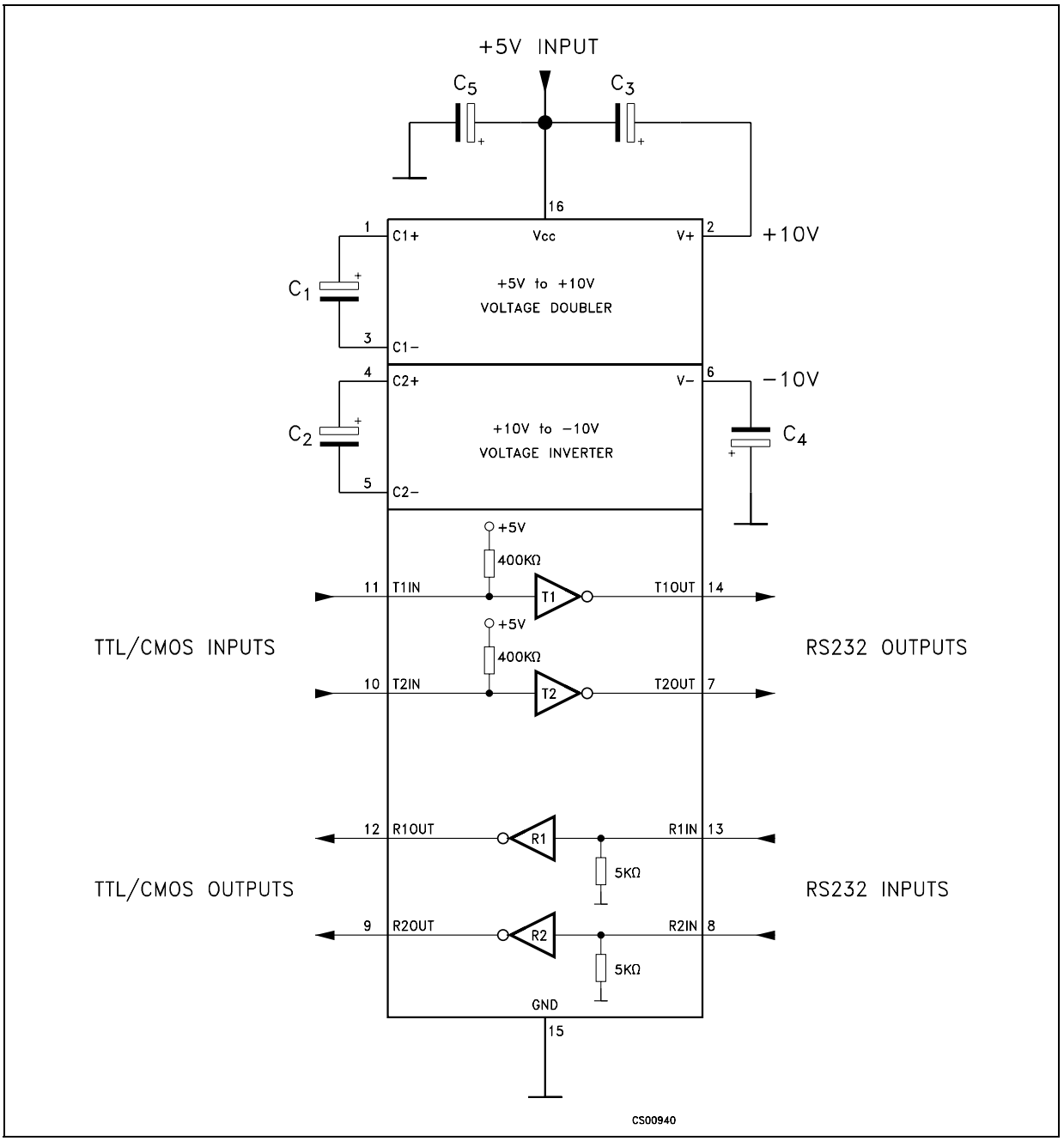
(C_1 - C_4 = 0.1 µF, V_{CC} = 5 V ± 10 %, T_A = -40 to 85 °C, unless otherwise specified. Typical values are referred to T_A = 25 °C).

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, V_{RIN} = 5V	3	5	7	kΩ
V_{RIL}	RS-232 input threshold low	T_A = 25°C, V_{CC} = 5 V	0.8	1.2		V
V_{RIH}	RS-232 input threshold high	T_A = 25°C, V_{CC} = 5 V		1.7	2.4	V
V_{RIHYS}	RS-232 input hysteresis	V_{CC} = 5V	0.2	0.5	1	V
V_{ROL}	TTL/CMOS output voltage low	I_{OUT} = 3.2mA (to V_{CC})			0.4	V
V_{ROH}	TTL/CMOS output voltage high	I_{OUT} = -1mA (to GND)	3.5	V_{CC}-0.4		V
I_{SCR}	Receiver output short circuit current			±10		mA
t_{DR}	Receiver propagation delay	C_L = 150pF (1)		0.3	1	µs

1. RS-232 in to TTL-CMOS out (from 50% to 50%)

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 7. Capacitance value (µF)

C1	C2	C3	C4	C5
0.1	0.1	0.1	0.1	0.1

5 Typical performance characteristics

(Unless otherwise specified T_J = 25 °C)

Figure 3. Supply current vs temperature

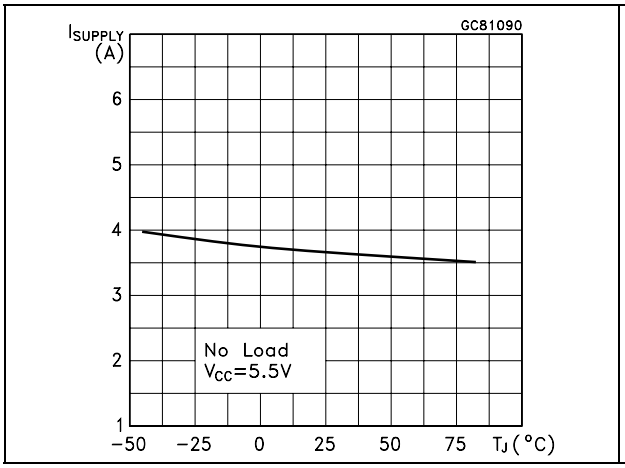


Figure 4. Data rate vs temperature

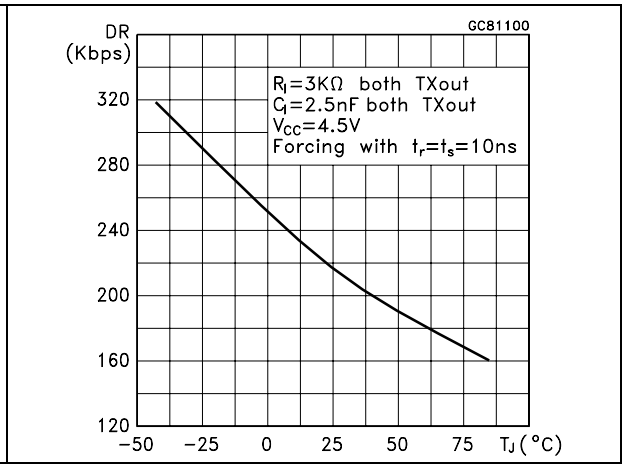


Figure 5. Receiver propagation delay

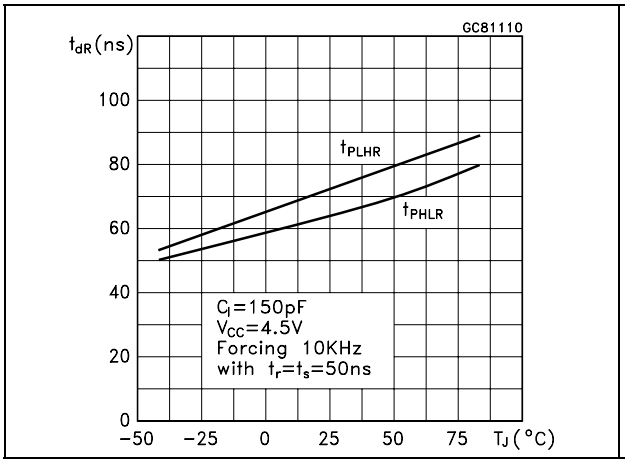


Figure 6. Driver propagation delay

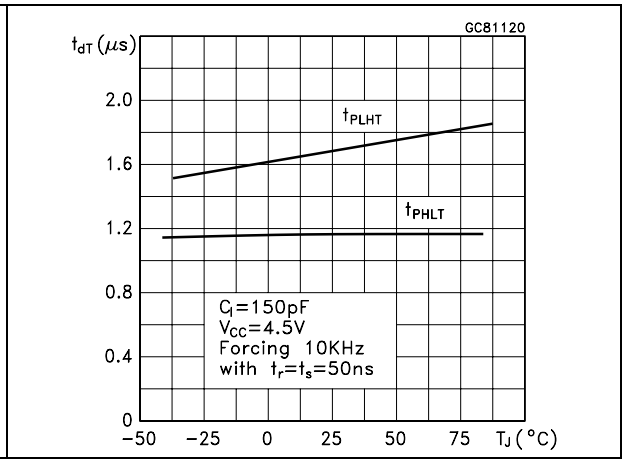


Figure 7. High level output voltage swing vs temperature

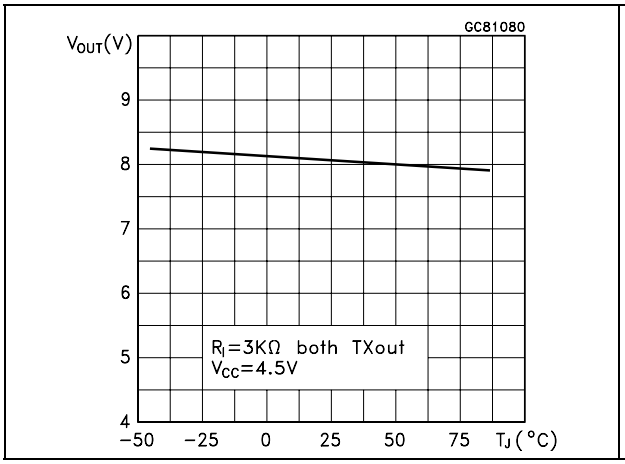


Figure 8. Low level output voltage swing vs temperature

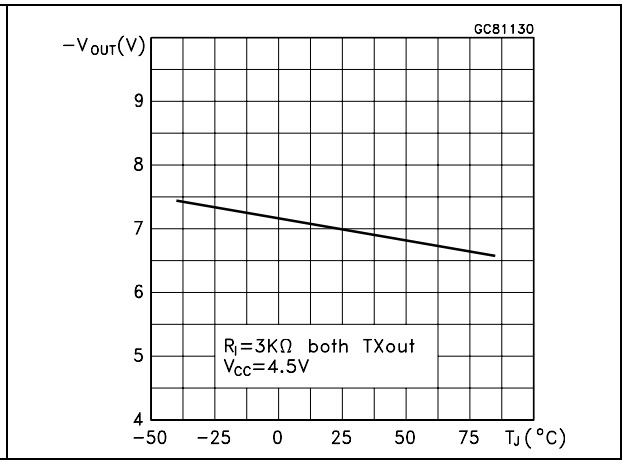


Figure 9. High level transmitter output short circuit current vs temperature

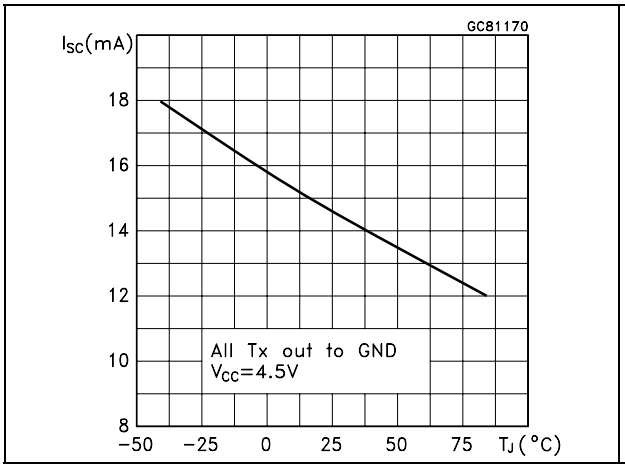


Figure 10. Low level transmitter output short circuit current vs temperature

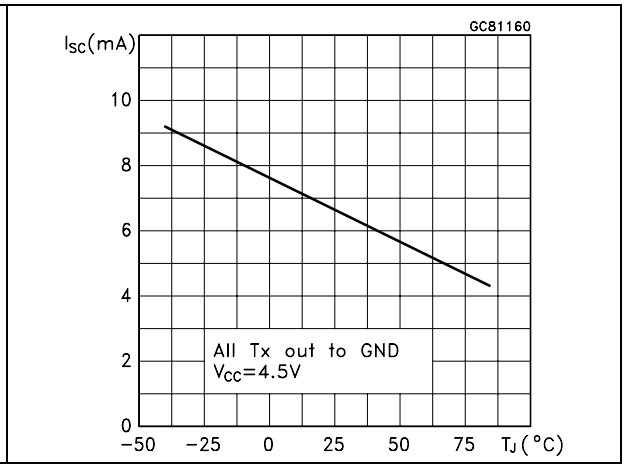


Figure 11. High level receiver output short circuit current vs temperature

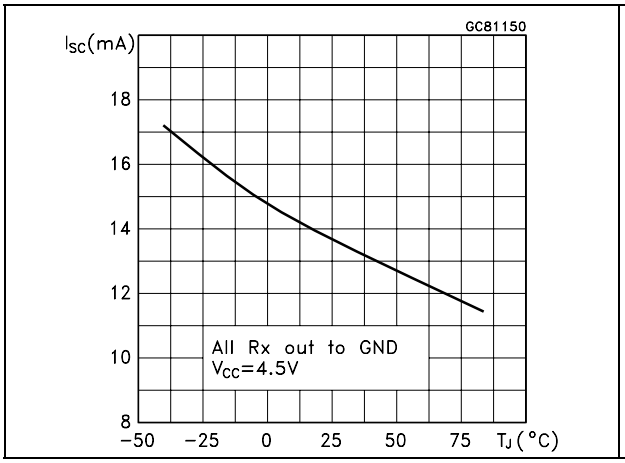
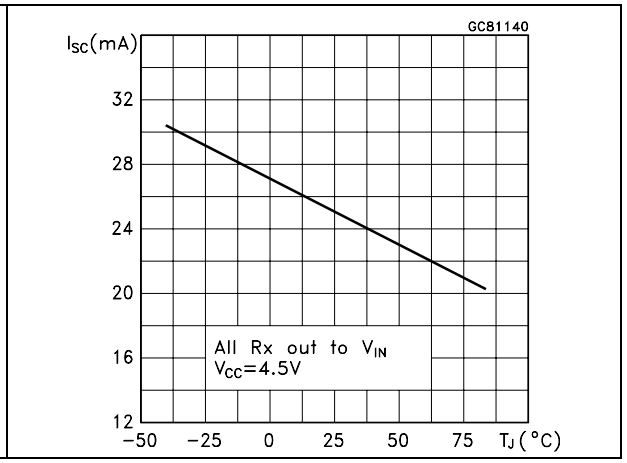


Figure 12. Low level receiver output short circuit current vs temperature

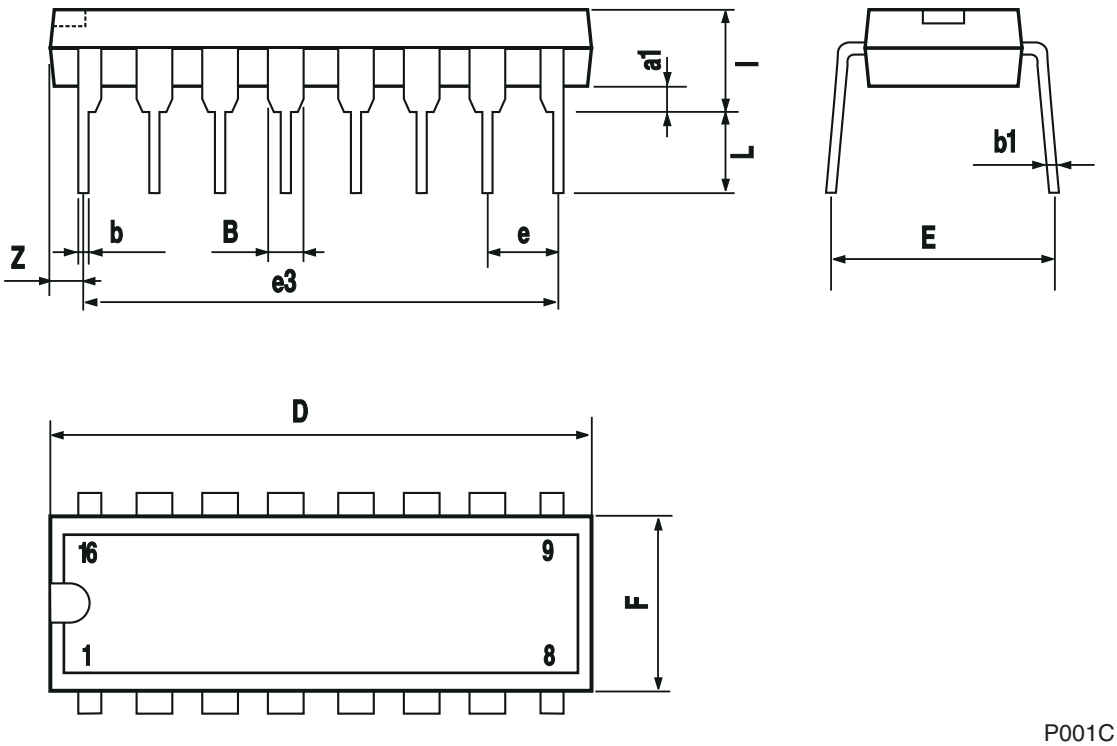


6 Package mechanical data

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.

Plastic DIP-16 (0.25) mechanical data

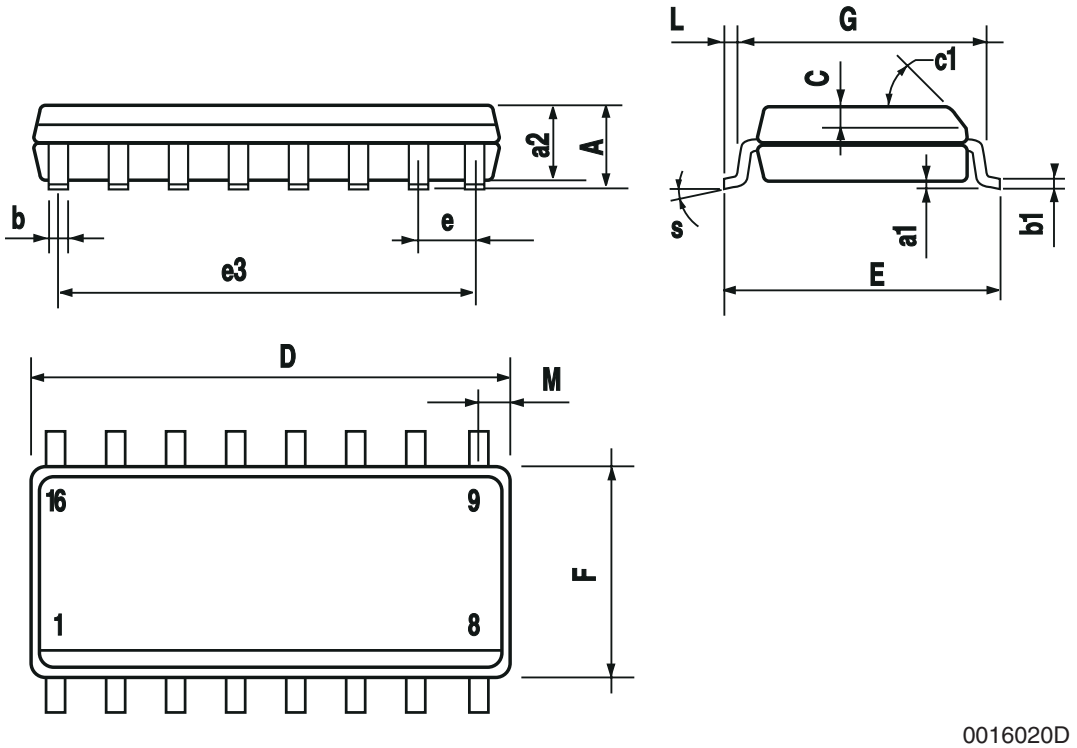
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

SO-16 mechanical data

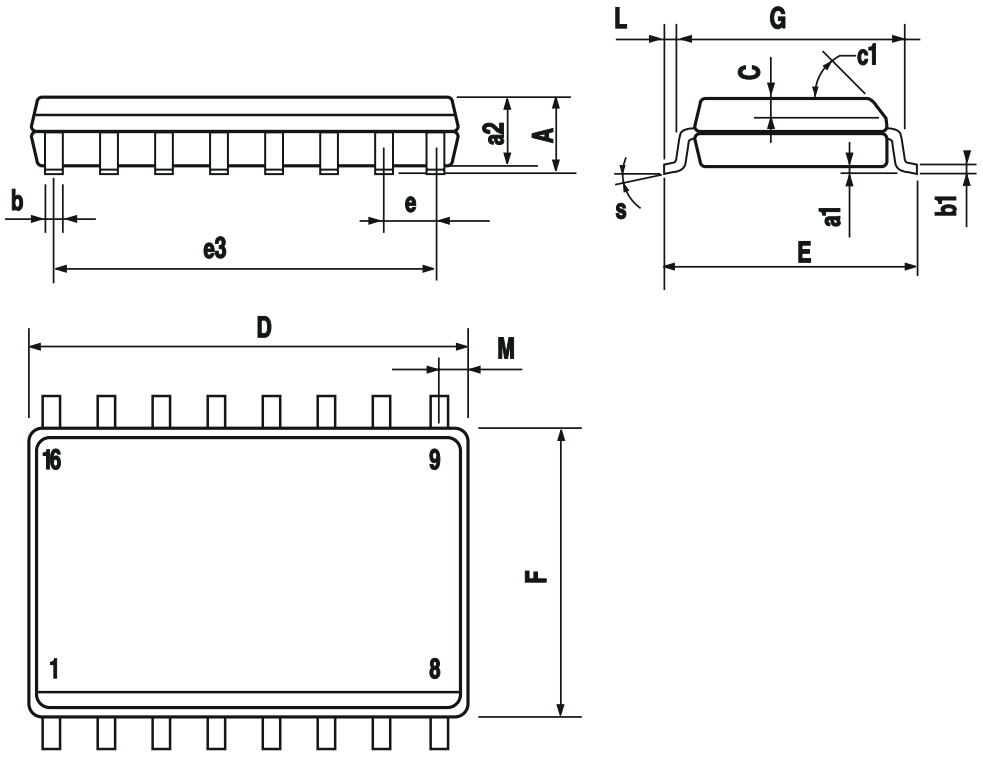
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.068
a1	0.1		0.25	0.004		0.010
a2			1.64			0.063
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157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

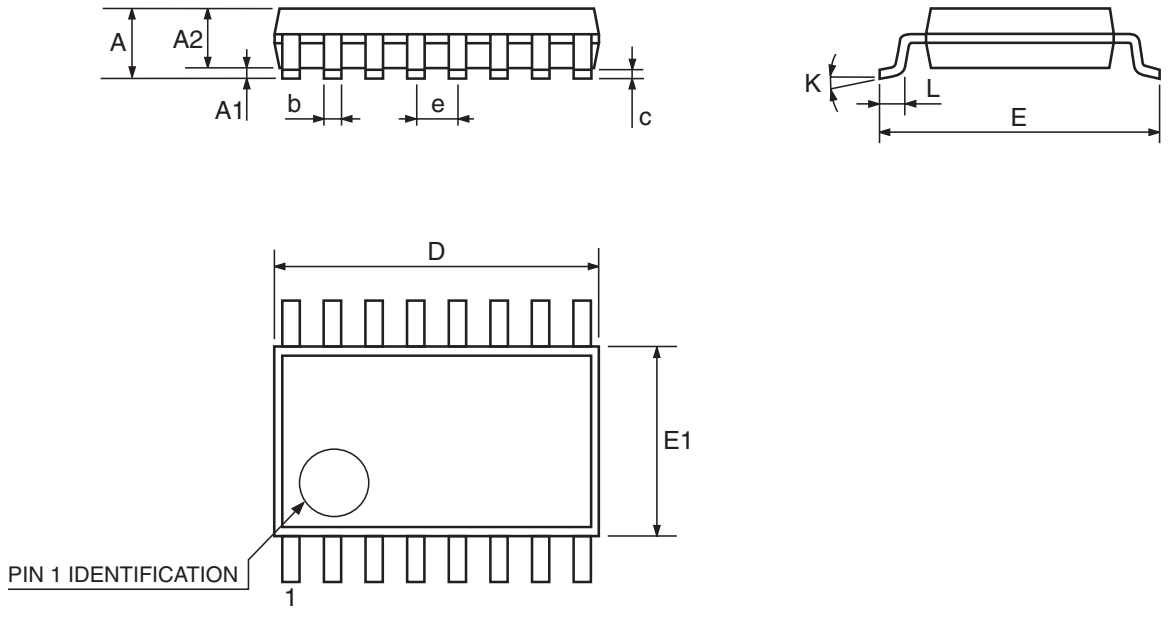
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			2.65			0.104
a1	0.1		0.2	0.004		0.008
a2			2.45			0.096
b	0.35		0.49	0.014		0.019
b1	0.23		0.32	0.009		0.012
C		0.5			0.020	
c1	45° (typ.)					
D	10.1		10.5	0.397		0.413
E	10.0		10.65	0.393		0.419
e		1.27			0.050	
e3		8.89			0.350	
F	7.4		7.6	0.291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



PO13I

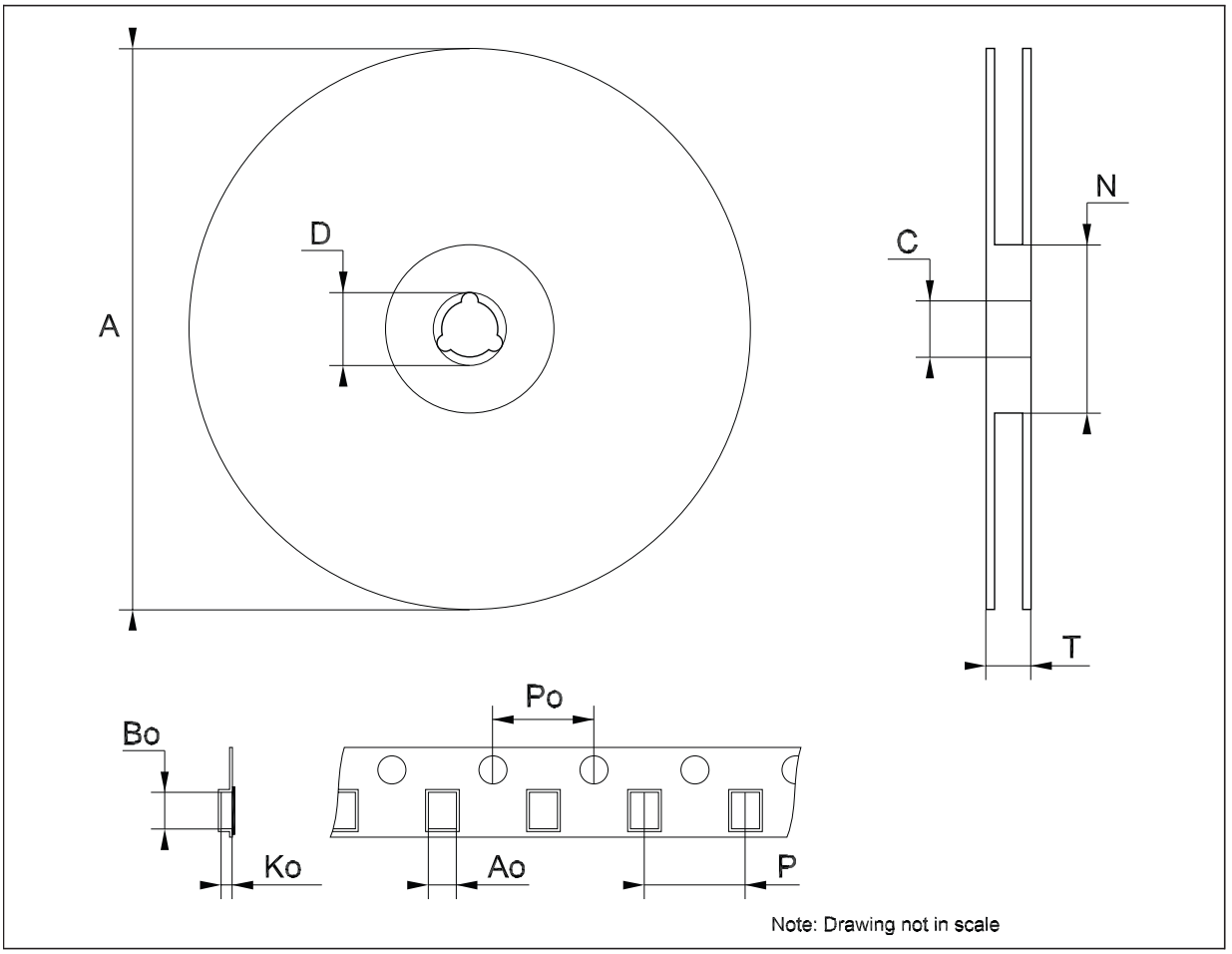
TSSOP16 mechanical data

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

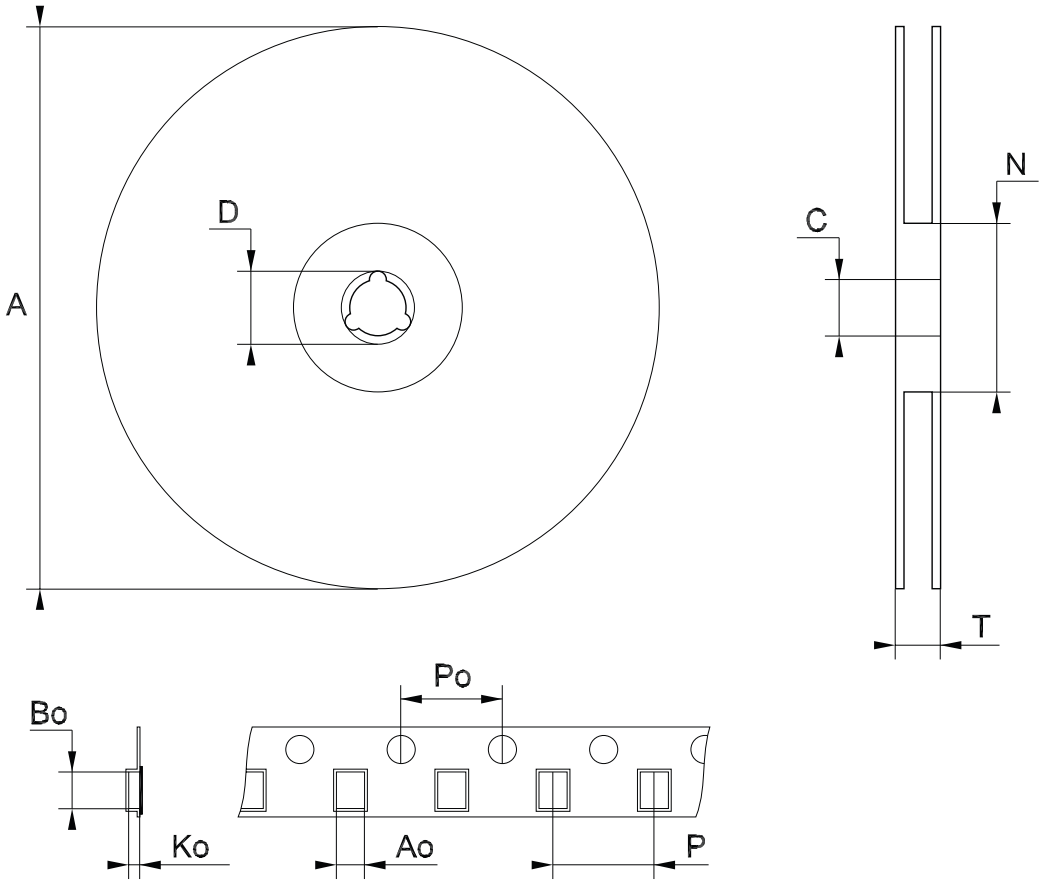
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	6.45		6.65	0.254		0.262
Bo	10.3		10.5	0.406		0.414
Ko	2.1		2.3	0.082		0.090
Po	3.9		4.1	0.153		0.161
P	7.9		8.1	0.311		0.319



Note: Drawing not in scale

Tape & reel SO-16L mechanical data

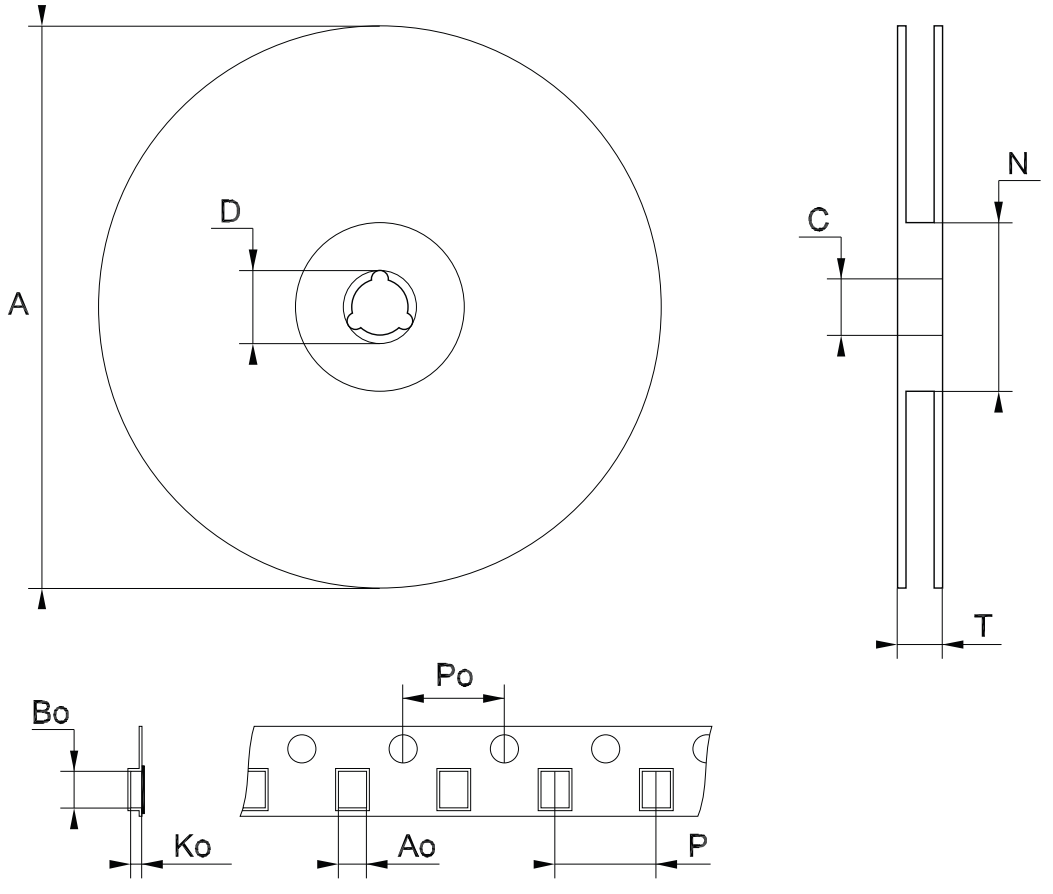
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	10.8		11.0	0.425		0.433
Bo	10.7		10.9	0.421		0.429
Ko	2.9		3.1	0.114		0.122
Po	3.9		4.1	0.153		0.161
P	11.9		12.1	0.468		0.476



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 8. Document revision history

Date	Revision	Changes
02-Sep-2005	11	Mistake I_{TIL} max. on table 5.
27-Oct-2006	12	Order codes updated.
14-Nov-2007	13	Added *Table 1*.
08-Feb-2008	14	Modified: *Table 1 on page 1*.

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