

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 μ F capacitors, while the ST202EB and ST202EC operate with four 0.1 μ F capacitors, further reducing cost and board space.

Features

- ESD protection for RS-232 I/O pins:
- ± 15 kV human body model
- Guaranteed 230 kbps data rate
- Guaranteed slew rate range 3 to 30 V/ms
- Operate from a single 5 V power supply

Table 1. Device summary

Order codes		Temperature range	Package	Packing
ST202ECDR	ST232ECDR	0 to 70 °C	SO16 (tape and reel)	2500 parts per reel
ST202EBDR	ST232EBDR	-40 to 85 °C		
-	ST232ECWR	0 to 70 °C	SO16 large (tape and reel)	1000 parts per reel
ST202EBWR	-	-40 to 85 °C		
ST202ECTR	ST232ECTR	0 to 70 °C	TSSOP16 (tape and reel)	2500 parts per reel
ST202EBTR	ST232EBTR	-40 to 85 °C		

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1 Pin configuration

Figure 1. Pin connections (top view)

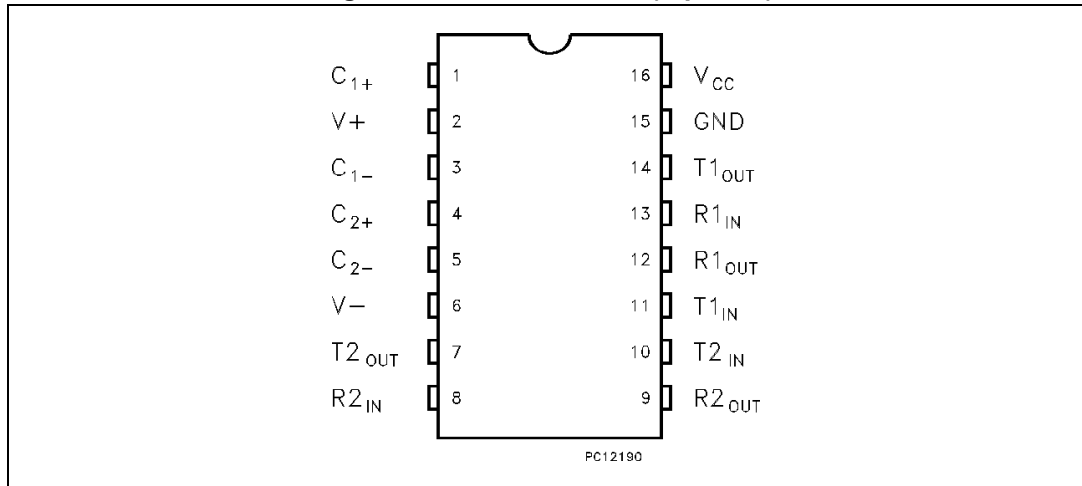


Table 2. Pin description

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_-	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

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
		IEC 1000-4-2 (contact discharge)	± 6			
		IEC 1000-4-2 (air discharge)	± 8			

Note: All tests versus GND.

Table 5. Electrical characteristics

($C_1 - C_4 = 0.1 \mu\text{F}$ for ST202E, $C_1 - C_4 = 0.1 \mu\text{F}$ for ST232E, $V_{CC} = 5 \text{ V} \pm 10 \%$,
 $T_A = -40$ to $125 \text{ }^\circ\text{C}$, unless otherwise specified; typical values are referred to $T_A = 25 \text{ }^\circ\text{C}$)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
I_{SUPPLY}	V_{CC} power supply current	No Load, $T_A = 25 \text{ }^\circ\text{C}$		5	10	mA

Table 6. Transmitter electrical characteristics

($C_1 - C_4 = 0.1 \mu\text{F}$, $V_{CC} = 5 \text{ V} \pm 10 \%$, $T_A = -40$ to $85 \text{ }^\circ\text{C}$, unless otherwise specified;
 typical values are referred to $T_A = 25 \text{ }^\circ\text{C}$)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_{TOUT}	Output voltage swing	All transmitter outputs are loaded with $3 \text{ k}\Omega$ 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	$T_A = 25 \text{ }^\circ\text{C}$, $V_{CC} = 5 \text{ V}$ $R_L = 3$ to $7 \text{ k}\Omega$ $C_L = 50$ to 1000 pF ⁽¹⁾	3	6	30	V/ μs
D_R	Data rate	$R_L = 3$ to $7 \text{ k}\Omega$ $C_L = 50$ to 1000 pF one transmitter switching	230	400		kbits/s
R_{TOUT}	Transmitter output resistance	$V_{CC} = V_+ = V_- = 0 \text{ V}$ $V_{OUT} = \pm 2 \text{ V}$	300			Ω
I_{SC}	Transmitter output short circuit current			± 10	± 60	mA
t_{DT}	Transmitter propagation delay	$R_L = 3$ to $7 \text{ k}\Omega$ $C_L = 50$ to 2500 pF All transmitter loaded		2		μA

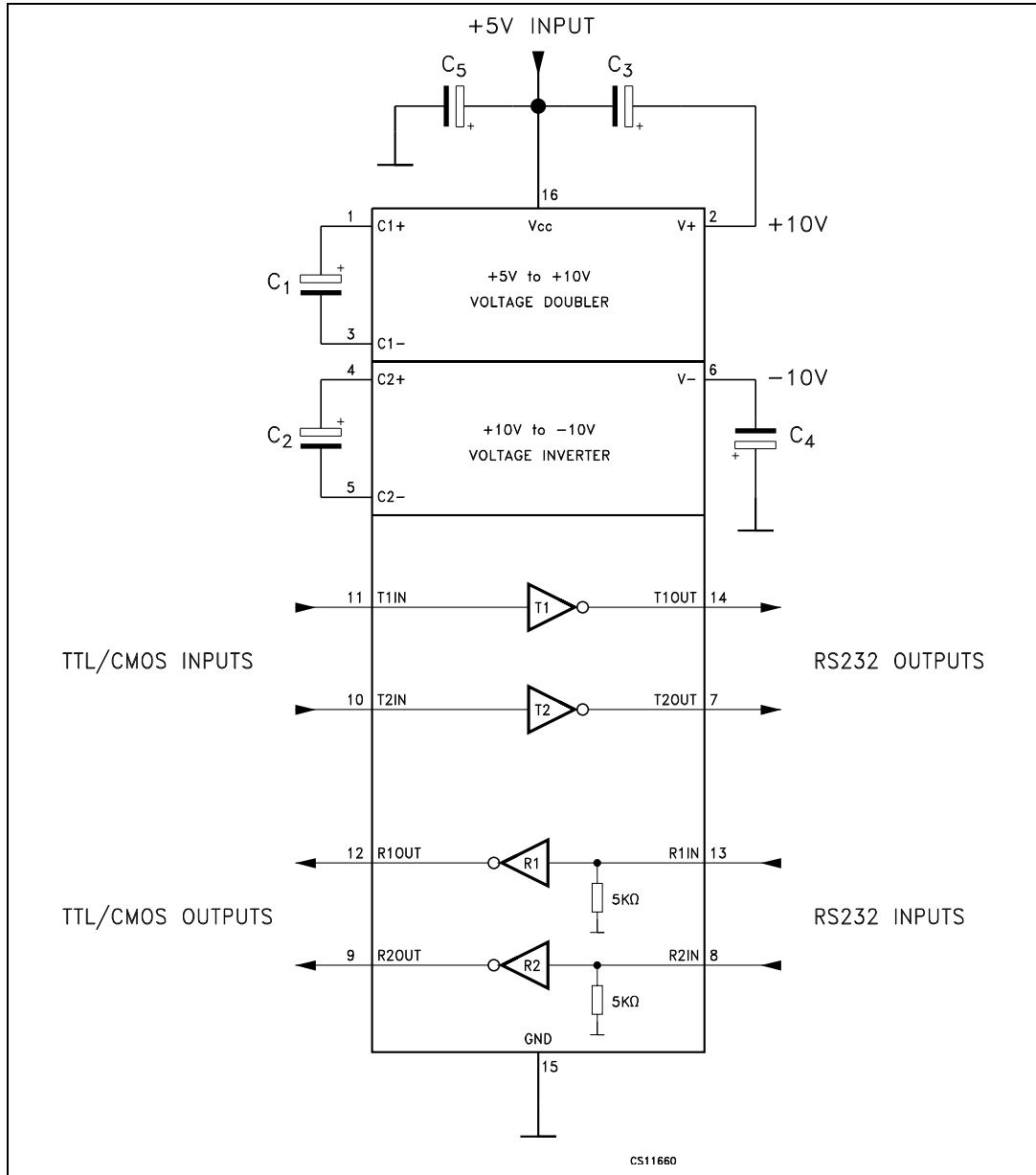
1. Measured from 3 V to -3 V or from -3 V to 3 V

Table 7. 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 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 _{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}	Receiver propagation delay	C _L = 150 pF		0.5	10	μs

4 Typical application

Figure 2. Application circuit



1. C₁₋₄ capacitors can be 1μF
2. C₁₋₄ 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 $T_J = 25\text{ }^\circ\text{C}$)

Figure 3. Supply current vs temperature

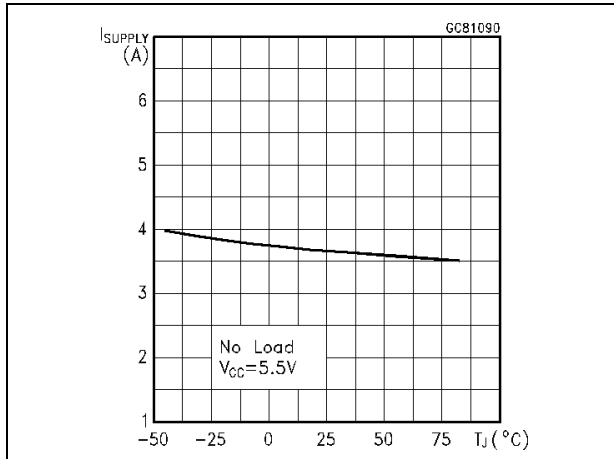


Figure 4. Data rate vs temperature

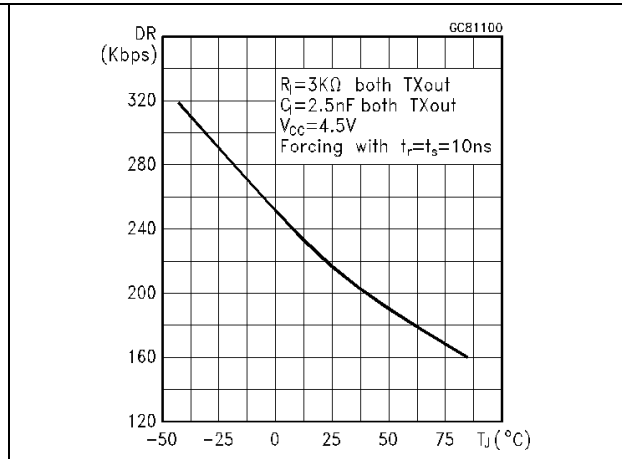


Figure 5. Receiver propagation delay

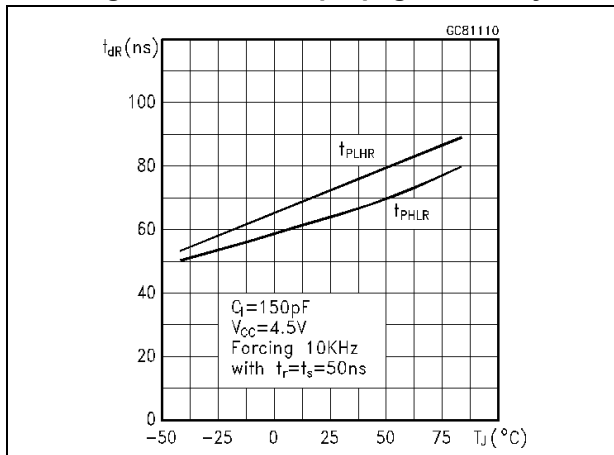


Figure 6. Driver propagation delay

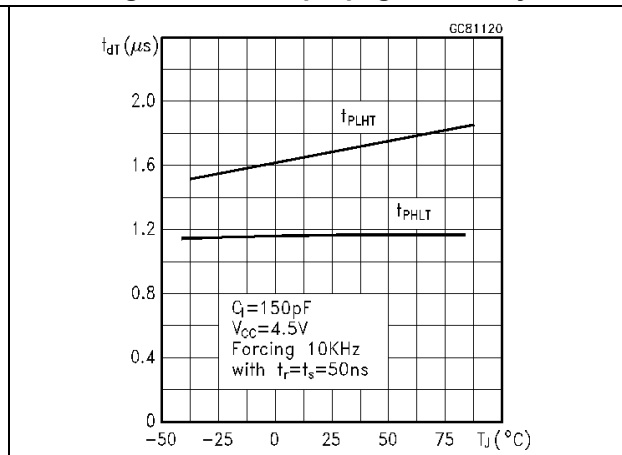


Figure 7. High level output voltage swing vs temperature

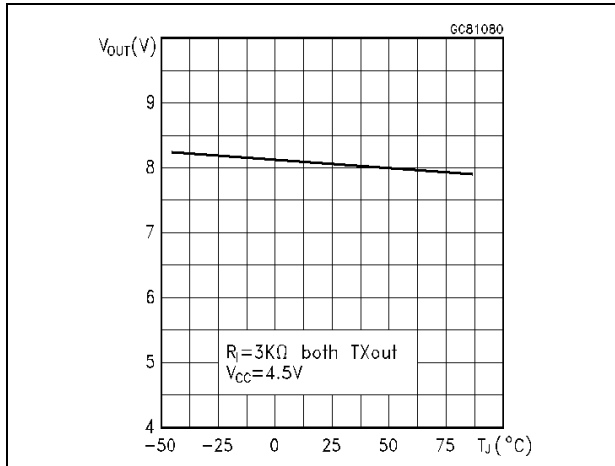


Figure 8. Low level output voltage swing vs temperature

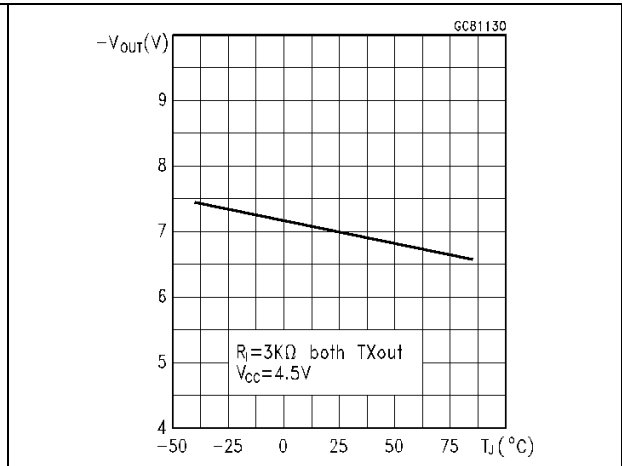


Figure 9. High level transmitter output short circuit current vs temperature

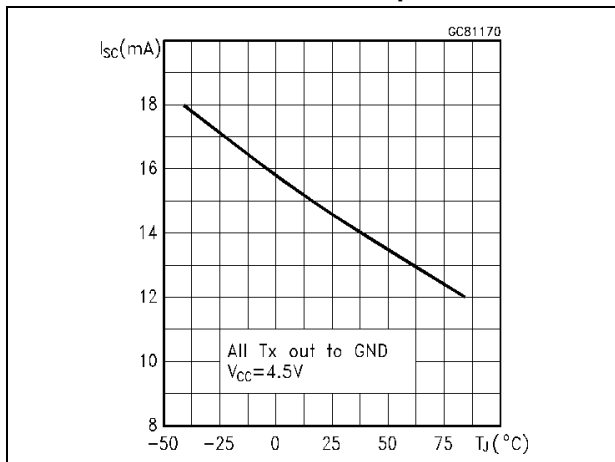


Figure 10. Low level transmitter output short circuit current vs temperature

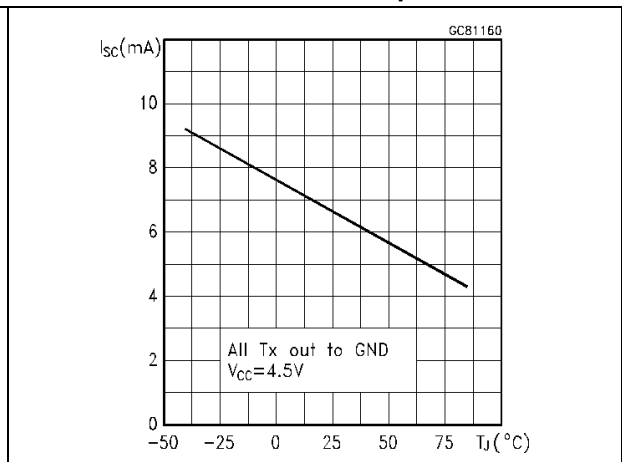


Figure 11. High level receiver output short circuit current vs temperature

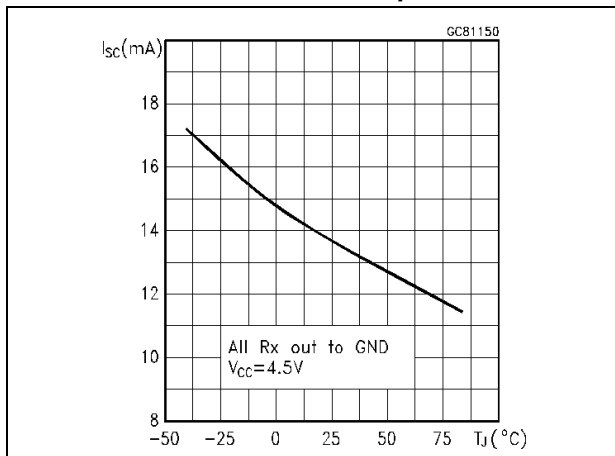
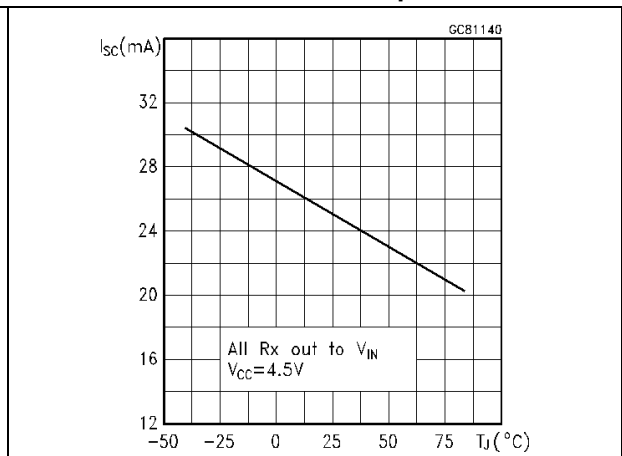


Figure 12. Low level receiver output short circuit current vs temperature



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 Package thermal characteristics

Table 9. Thermal characteristics

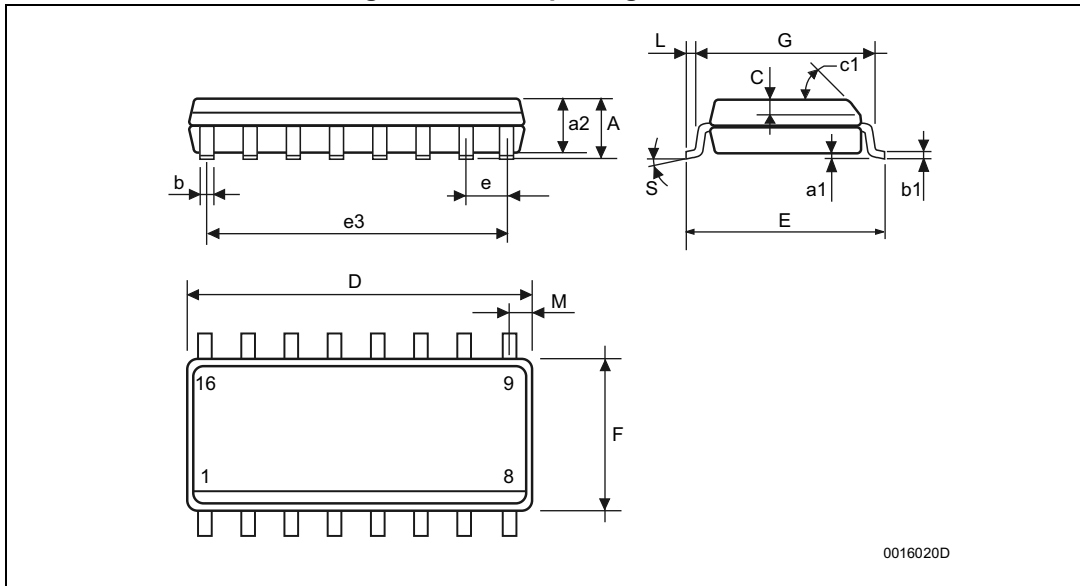
Package	Symbol	Value	Board type	Unit
SO16	$\Theta_{JA}^{(1)}$	115	1-layer board	°C/W
		80	4-layer board	
	$\Theta_{JC}^{(2)}$	30	1-layer board	
SO16L	$\Theta_{JA}^{(1)}$	95	1-layer board	
	$\Theta_{JC}^{(2)}$	30	1-layer board	
TSSOP16	$\Theta_{JA}^{(1)}$	140	1-layer board	
		95	2-layer board	
	$\Theta_{JC}^{(2)}$	25	2-layer board	

1. Θ_{JA} is the package junction-to-ambient thermal resistance in °C/W

2. Θ_{JC} is the package junction-to-case thermal resistance in °C/W

6.2 SO16 package information

Figure 13. SO16 package outline

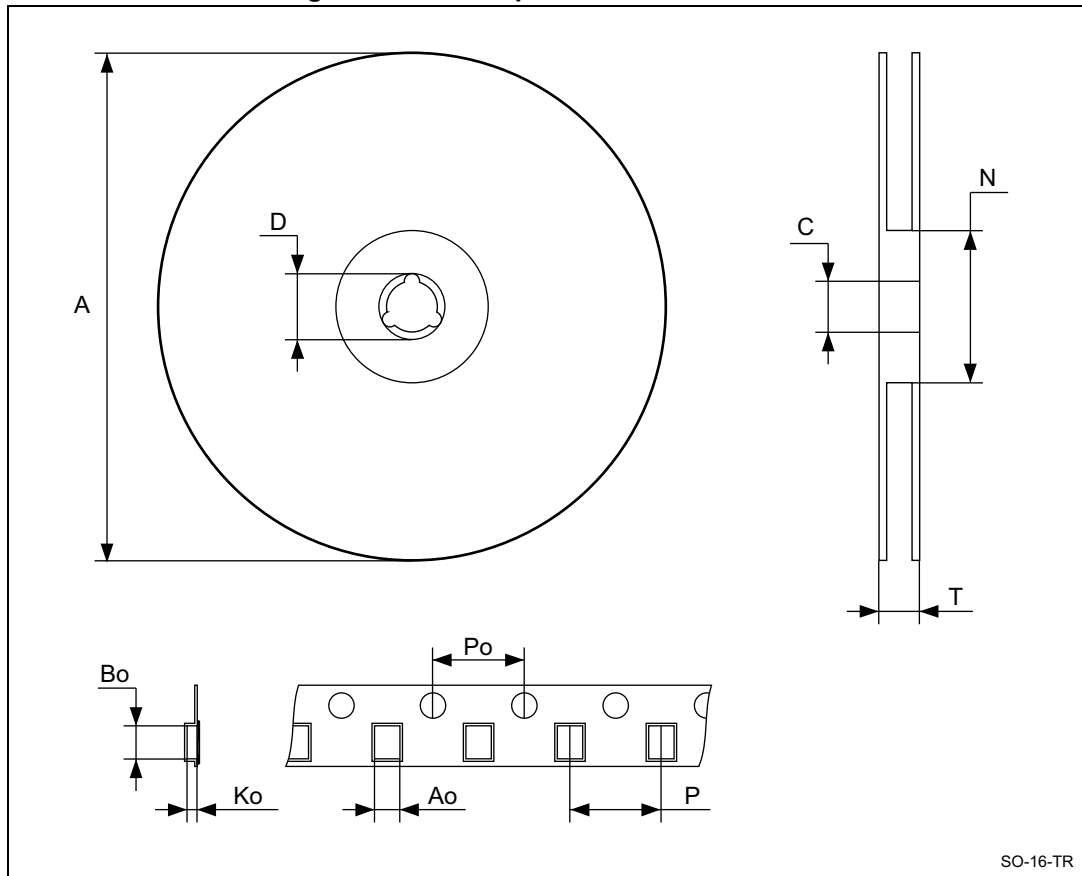


0016020D

Table 10. SO16 package mechanical data

Symbol	Dimensions					
	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.)					

Figure 14. SO16 tape and reel information



1. Drawing is not to scale.

Table 11. SO16 tape and reel information

Symbol	Dimensions					
	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

6.3 SO16L package information

Figure 15. SO16L package outline

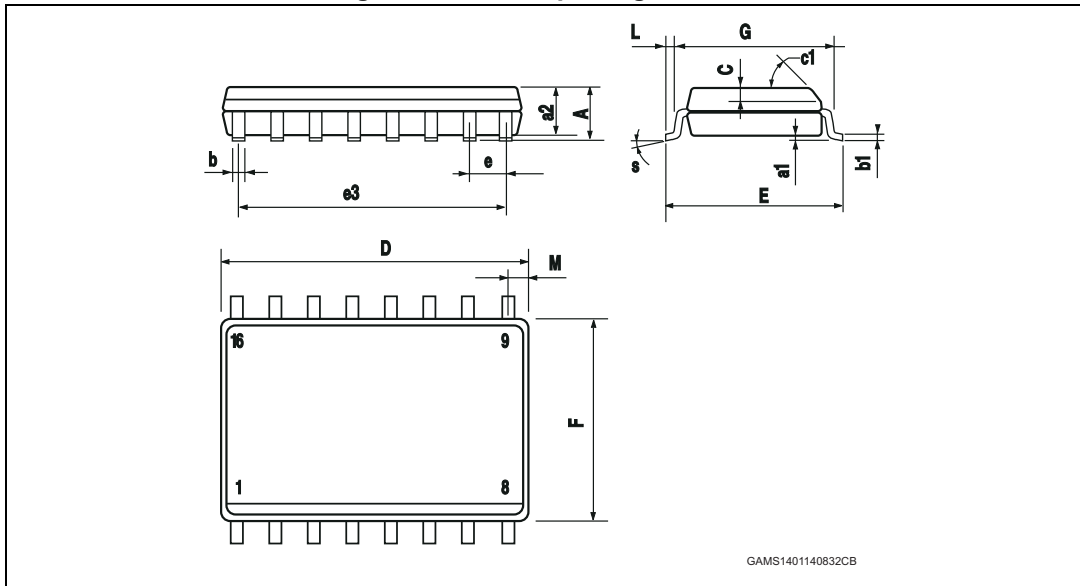
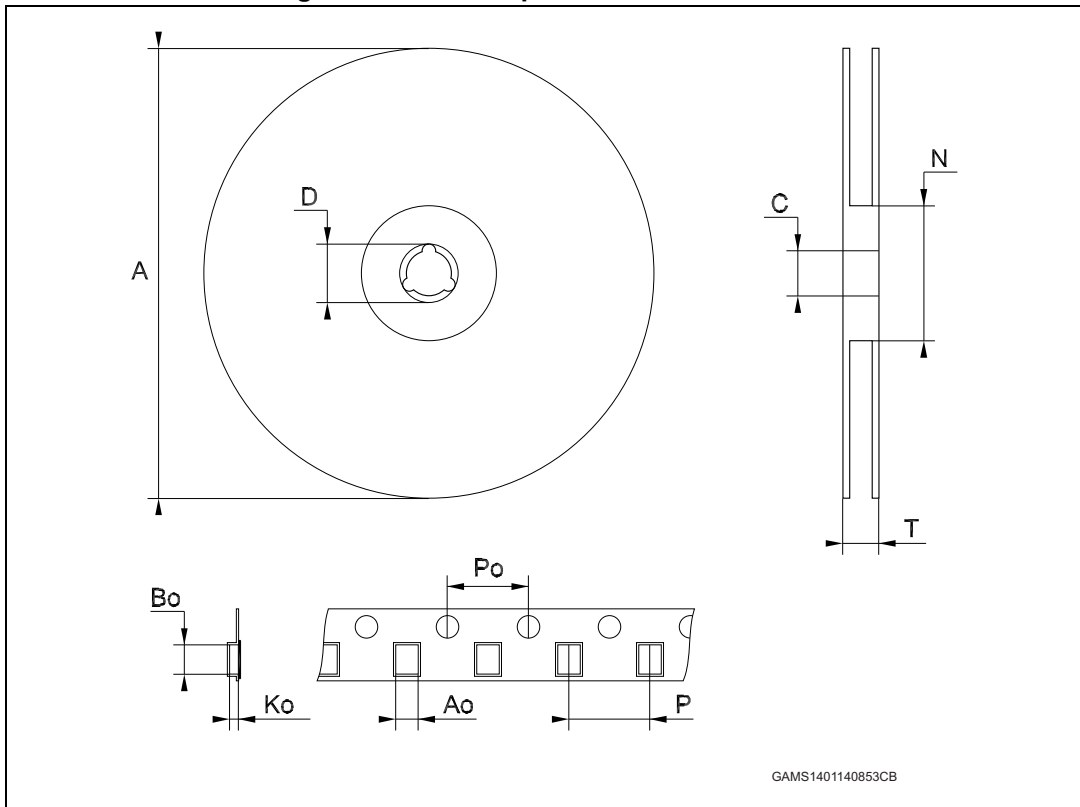


Table 12. SO16L package mechanical data

Symbol	Dimensions					
	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.)					

Figure 16. SO16L tape and reel information



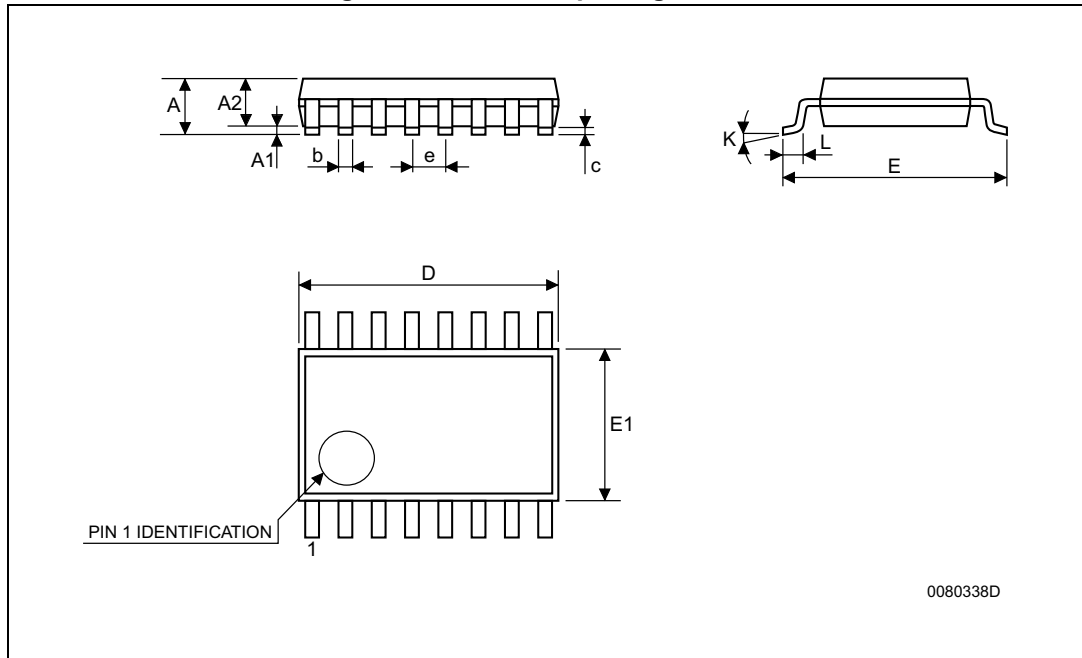
1. Drawing is not to scale.

Table 13. SO16L tape and reel information

Symbol	Dimensions					
	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

6.4 TSSOP16 package information

Figure 17. TSSOP16 package outline

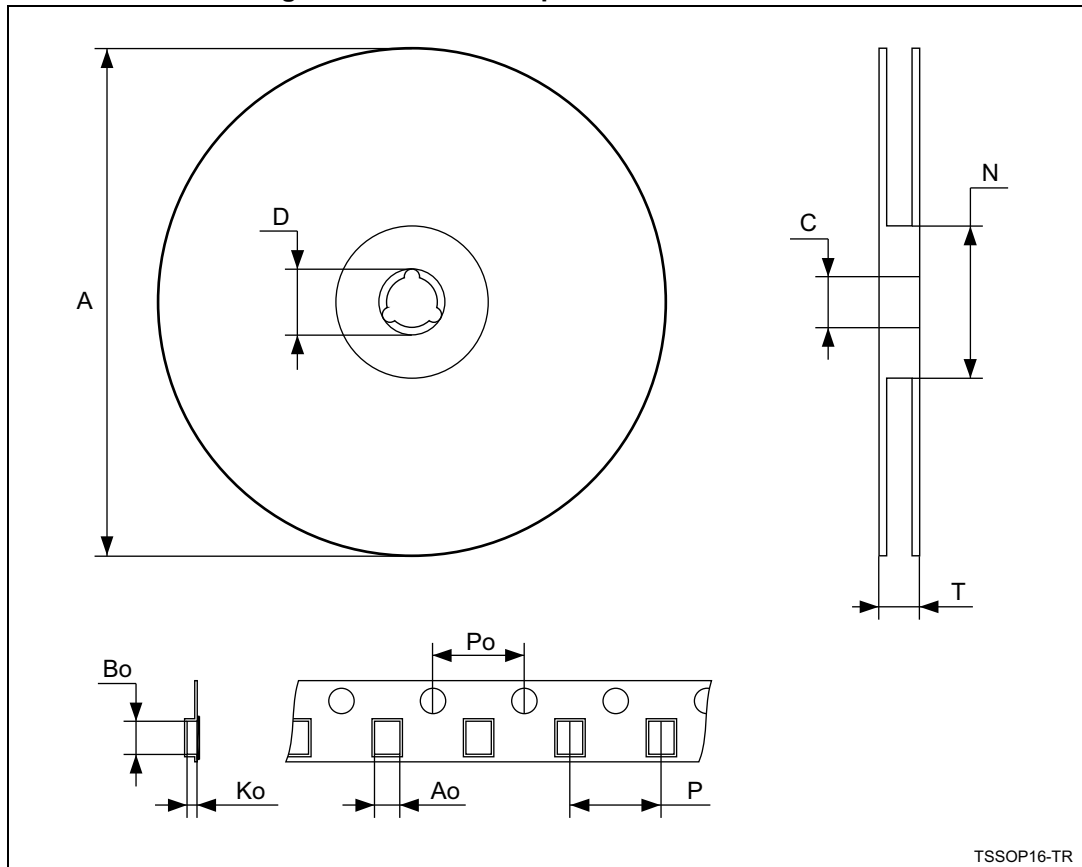


0080338D

Table 14. TSSOP16 package mechanical data

Symbol	Dimensions					
	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			0.0256	
K	0°		8°	0°		8°
L	0.45	0.60	0.75	0.018	0.024	0.030

Figure 18. TSSOP16 tape and reel information



TSSOP16-TR

1. Drawing is not in scale.

Table 15. TSSOP16 tape and reel information

Symbol	Dimensions					
	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

7 Revision history

Table 16. 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

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