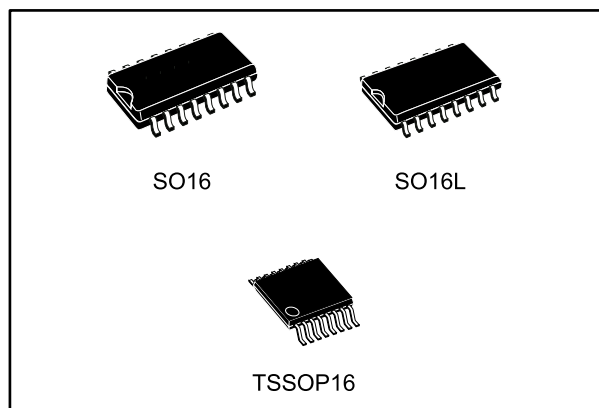


## 3 to 5.5 V, low-power, up to 400 kbs RS-232 drivers and receivers

Datasheet - production data



The ST3232B and ST3232C have two receivers and two drivers.

The devices are guaranteed to run at data rates of 250 kbps while maintaining RS-232 output levels. Typical applications are notebooks, subnotebooks and palmtop computers, battery-powered equipment, hand-held equipment, peripherals, and printers.

**Table 1: Device summary**

Order code	Temp. range	Package	Packaging
ST3232CDR	0 to 70 °C	SO16 (tape and reel)	2500 parts per reel
ST3232BDR	-40 to 85 °C		
ST3232CWR	0 to 70 °C	SO16L (tape and reel)	1000 parts per reel
ST3232BWR	-40 to 85 °C		
ST3232CTR	0 to 70 °C	TSSOP16 (tape and reel)	2500 parts per reel
ST3232BTR	-40 to 85 °C		

### Features

- 300  $\mu$ A supply current
- 300 kbps minimum guaranteed data rate
- 6 V/ $\mu$ s minimum guaranteed slew rate
- Meets EIA/TIA-232 specifications down to 3 V
- Available in SO16, SO16L, and TSSOP16 packages

### Description

The ST3232B and ST3232C devices are 3 V powered EIA/TIA-232 and V.28/V.24 communication interfaces with low power requirements and high data-rate capabilities.

These devices have a proprietary low dropout transmitter output stage providing true RS-232 performance from 3 to 5.5 V supplies. The devices require only four small 0.1 mF standard external capacitors for operation from a 3 V supply.

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# 1 Pin configuration

Figure 1: Pin connections

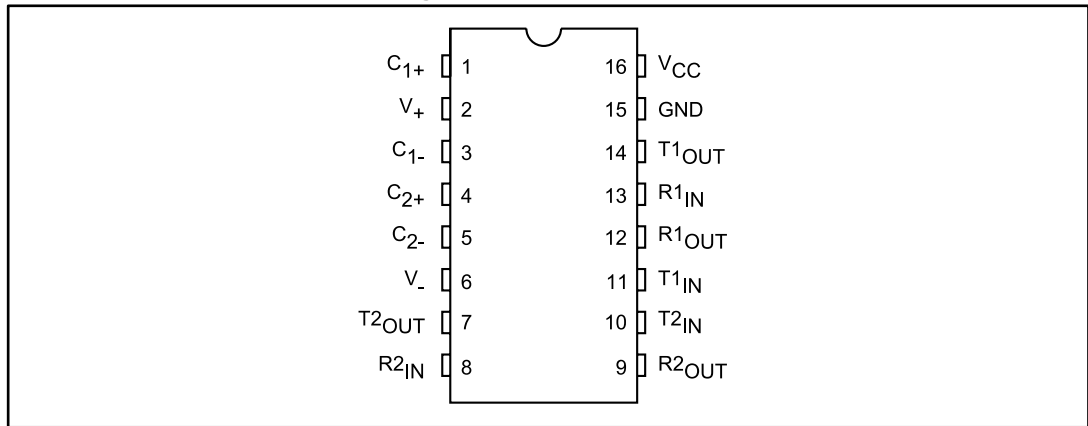


Table 2: Pin description

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>2</sub> OUT	Second transmitter output voltage
8	R <sub>2</sub> IN	Second receiver input voltage
9	R <sub>2</sub> OUT	Second receiver output voltage
10	T <sub>2</sub> IN	Second transmitter input voltage
11	T <sub>1</sub> IN	First transmitter input voltage
12	R <sub>1</sub> OUT	First receiver output voltage
13	R <sub>1</sub> IN	First receiver input voltage
14	T <sub>1</sub> OUT	First transmitter output voltage
15	GND	Ground
16	V <sub>CC</sub>	Supply voltage

## 2 Absolute maximum ratings

Table 3: Absolute maximum ratings

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply voltage	-0.3 to 6	V
V+	Doubled voltage terminal	$(V_{CC} - 0.3)$ to 7	
V-	Inverted voltage terminal	0.3 to -7	
$V+ +  V- $		13	
$T_{IN}$	Transmitter input voltage range	-0.3 to 6	
$R_{IN}$	Receiver input voltage range	$\pm 25$	
$T_{OUT}$	Transmitter output voltage range	$\pm 13.2$	
$R_{OUT}$	Receiver output voltage range	-0.3 to $(V_{CC} + 0.3)$	
$t_{SHORT}$	Transmitter output short to gnd time	Continuous	
$T_{stg}$	Storage temperature	-65 to 150	$^{\circ}C$



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

Externally applied V+ and V- can have a maximum magnitude of +7 V, but their absolute addition can not exceed 13 V.

Running on internal charge pump, intrinsic self limitation allows exceeding those values without any damage.

Startup voltage sequence ( $V_{CC}$ , then V+, then V-) is critical, therefore it is not recommended to use this device using externally applied voltage to V+ and V-.

### 3 Electrical characteristics

**Table 4: Electrical characteristics (C1 - C4 = 0.1  $\mu$ F, VCC = 3 V to 5.5 V, TA = -40 to 85 °C, unless otherwise specified. Typical values are referred to TA = 25 °C)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I <sub>SUPPLY</sub>	V <sub>CC</sub> power supply current	No load, V <sub>CC</sub> = 3 V $\pm$ 10 %, T <sub>A</sub> = 25 °C		0.3	1	mA
		No load, V <sub>CC</sub> = 5 V $\pm$ 10 %, T <sub>A</sub> = 25 °C		1	2	

**Table 5: Logic input (C1 - C4 = 0.1  $\mu$ F, VCC = 3 V to 5.5 V, TA = -40 to 85 °C, unless otherwise specified. Typical values are referred to TA = 25 °C)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>TIL</sub>	Input logic threshold low	T-IN <sup>(1)</sup>			0.8	V
V <sub>TIH</sub>	Input logic threshold high	V <sub>CC</sub> = 3.3 V	2			
		V <sub>CC</sub> = 5 V	2.4			
I <sub>IL</sub>	Input leakage current	T-IN		$\pm$ 0.01	$\pm$ 1	$\mu$ A

**Notes:**

<sup>(1)</sup>Transmitter input hysteresis is typically 250 mV.

**Table 6: Transmitter (C1 - C4 = 0.1  $\mu$ F tested at 3.3 V  $\pm$ 10 %, VCC = 3 V to 5.5 V, TA = -40 to 85 °C, unless otherwise specified. Typical values are referred to TA = 25 °C)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>TOUT</sub>	Output voltage swing	All transmitter outputs are loaded with 3 k $\Omega$ to GND	$\pm$ 5	$\pm$ 5.4		V
R <sub>TOUT</sub>	Transmitter output resistance	V <sub>CC</sub> = V <sub>+</sub> = V <sub>-</sub> = 0 V, V <sub>OUT</sub> = $\pm$ 2 V	300	10 M		$\Omega$
I <sub>TSC</sub>	Output short circuit current	V <sub>CC</sub> = 3 V or 5 V, V <sub>OUT</sub> = $\pm$ 12			$\pm$ 60	mA

**Table 7: Receiver (C1 - C4 = 0.1  $\mu$ F tested at 3.3 V  $\pm$ 10 %, VCC = 3 V to 5.5 V, TA = -40 to 85 °C, unless otherwise specified. Typical values are referred to TA = 25 °C)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>RIN</sub>	Receiver input voltage operating range		-25		25	V
V <sub>RIL</sub>	RS-232 Input threshold low	T <sub>A</sub> = 25 °C, V <sub>CC</sub> = 3.3 V	0.6	1.1		
		T <sub>A</sub> = 25 °C, V <sub>CC</sub> = 5 V	0.8	1.5		
V <sub>RIH</sub>	RS-232 Input threshold high	T <sub>A</sub> = 25 °C, V <sub>CC</sub> = 3.3 V		1.5	2.4	
		T <sub>A</sub> = 25 °C, V <sub>CC</sub> = 5 V		1.8	2.4	
V <sub>RIHYS</sub>	Input hysteresis			0.3		
R <sub>RIN</sub>	Input resistance	T <sub>A</sub> = 25 °C	3	5	7	k $\Omega$
V <sub>ROL</sub>	TTL/CMOS output voltage low	I <sub>OUT</sub> = 1.6 mA			0.4	V
V <sub>ROH</sub>	TTL/CMOS output voltage high	I <sub>OUT</sub> = -1 mA	V <sub>CC</sub> - 0.6	V <sub>CC</sub> - 0.1		

**Table 8: Timing characteristics (C1 - C4 = 0.1  $\mu$ F tested at 3.3 V  $\pm$ 10 %, VCC = 3 V to 5.5 V, TA = -40 to 85  $^{\circ}$ C, unless otherwise specified. Typical values are referred to TA = 25  $^{\circ}$ C)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
D <sub>R</sub>	Data transfer rate	R <sub>L</sub> = 3 k $\Omega$ , C <sub>L2</sub> = 1000 pF one transmitter switching	300	400		kbps
t <sub>PHLR</sub> , t <sub>PLHR</sub>	Propagation delay input to output	R <sub>XIN</sub> = R <sub>XOUT</sub> , C <sub>L</sub> = 150 pF		0.2		$\mu$ s
t <sub>PHLT</sub> - t <sub>THL</sub>	Transmitter propagation delay difference	See <sup>(1)</sup>		100		ns
t <sub>PHLR</sub> - t <sub>THR</sub>	Receiver propagation delay difference			50		
S <sub>RT</sub>	Transition slew rate	T <sub>A</sub> = 25 $^{\circ}$ C, R <sub>L</sub> = 3 k $\Omega$ to 7 k $\Omega$ , V <sub>CC</sub> = 3.3 V measured from 3 V to -3 V or -3 V to 3 V, C <sub>L</sub> = 150 pF to 1000 pF	6		30	V/ $\mu$ s
		T <sub>A</sub> = 25 $^{\circ}$ C, R <sub>L</sub> = 3 k $\Omega$ to 7 k $\Omega$ , V <sub>CC</sub> = 3.3 V measured from 3 V to -3 V or -3 V to 3 V, C <sub>L</sub> = 150 pF to 2500 pF	4		30	

**Notes:**

<sup>(1)</sup> Transmitter skew is measured at the transmitter zero cross points

## 4 Application information

Figure 2: Application circuits

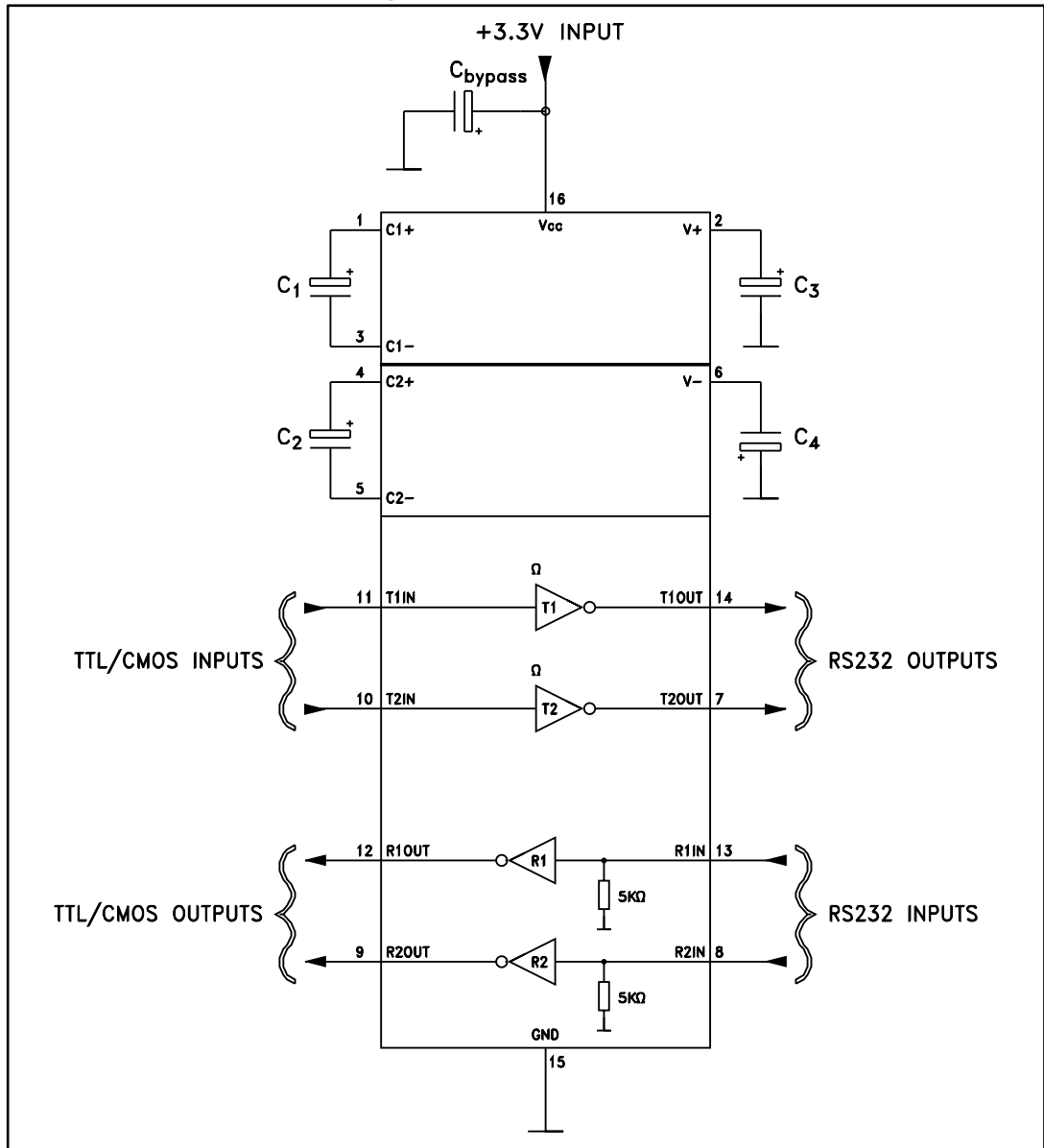


Table 9: Capacitance value ( $\mu\text{F}$ )

$V_{CC}$	C1	C2	C3	C4	$C_{bypass}$
3.0 to 3.6	0.1	0.1	0.1	0.1	0.1
4.5 to 5.5	0.047	0.33	0.33	0.33	0.33

## 5 Typical performance characteristics



Unless otherwise specified  $T_J = 25\text{ }^\circ\text{C}$

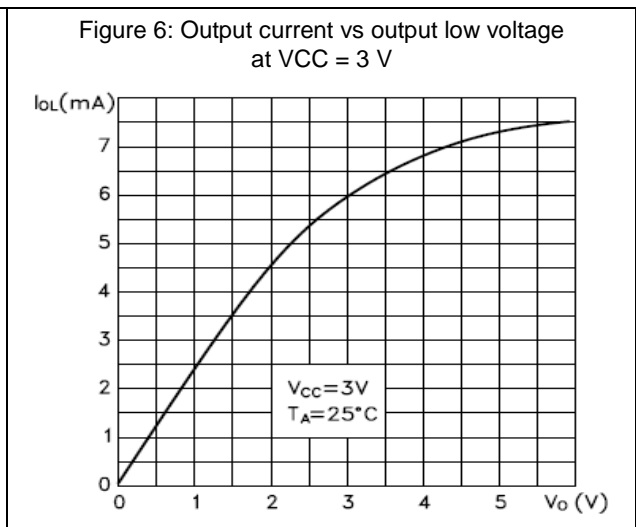
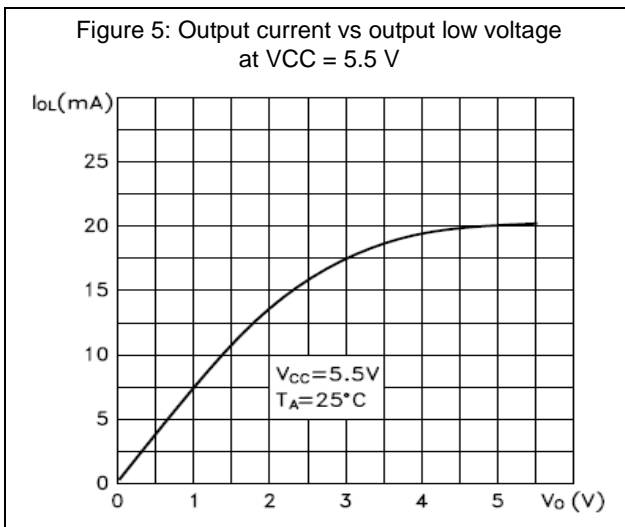
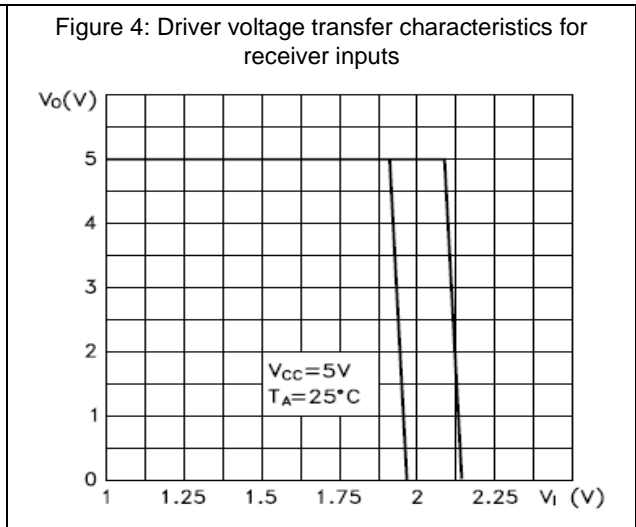
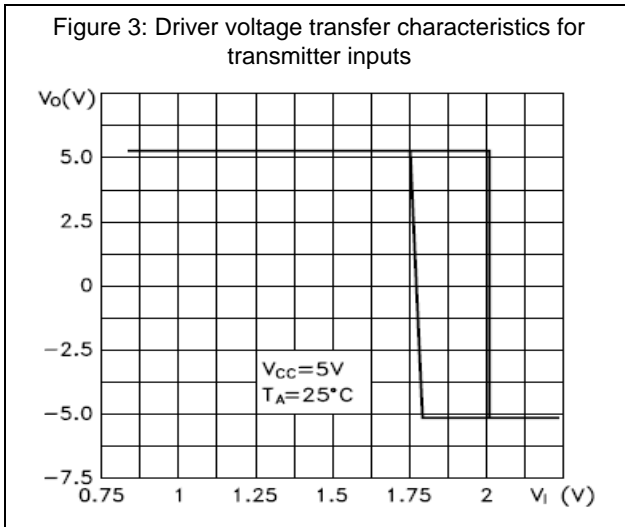




Figure 7: Output current vs output high voltage at VCC = 5.5 V

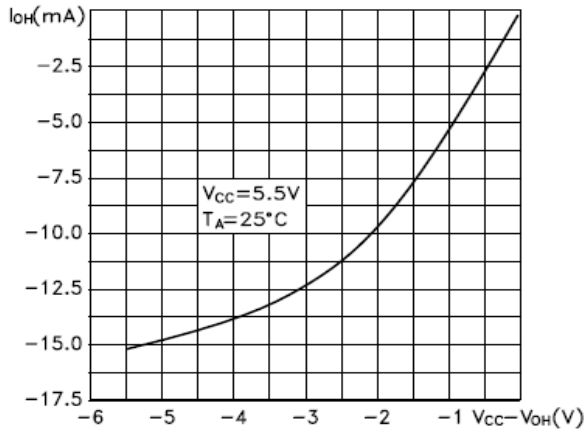


Figure 8: Output current vs output high voltage at VCC = 3 V

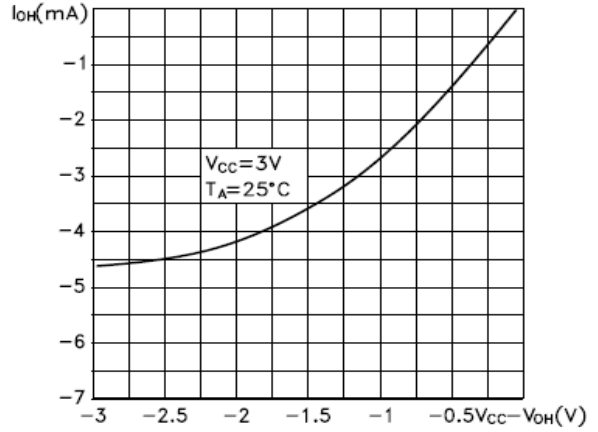
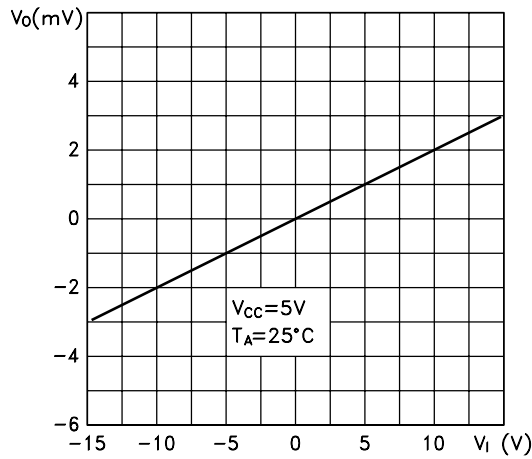


Figure 9: Receiver input resistance



## 6 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

## 6.1 SO16 package information

Figure 10: SO16 package outline

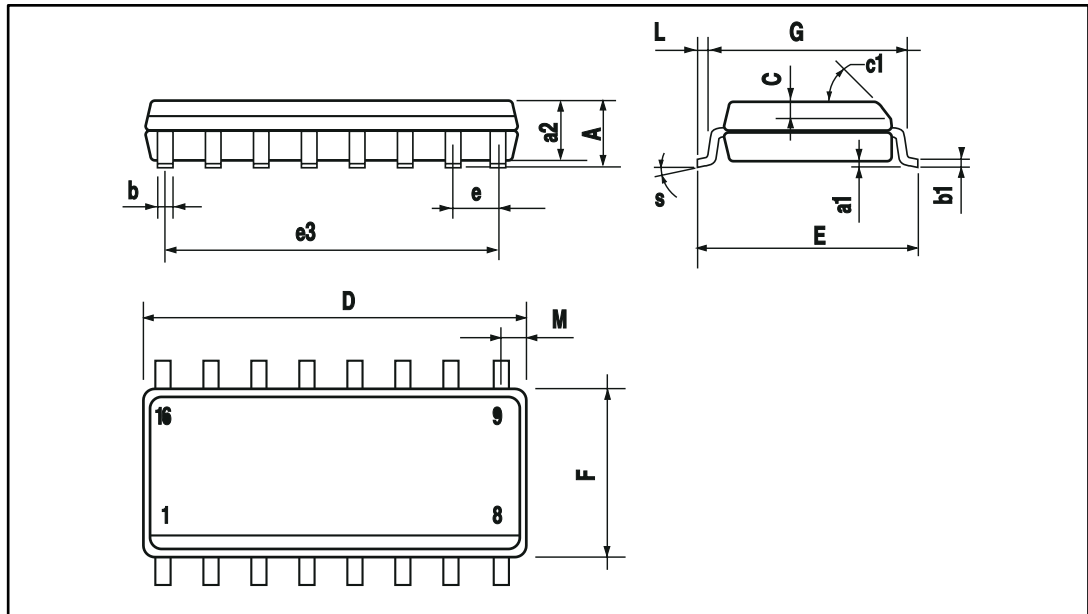


Table 10: SO16 mechanical data

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 SO16L package information

Figure 11: SO16L package outline

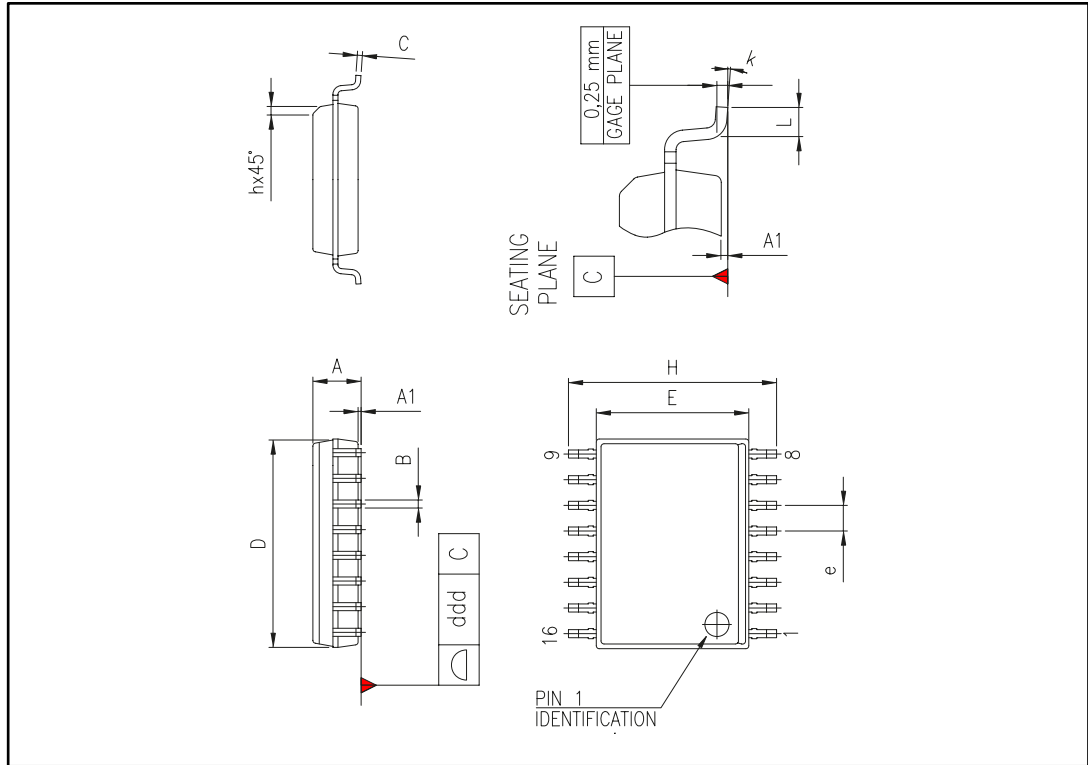


Table 11: SO16L mechanical data

Ref	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max	Min.	Typ.	Max.
A	2.35		2.65	0.093		0.104
A1	0.1		0.3	0.004		0.012
B	0.33		0.51	0.013		0.02
C	0.23		0.32	0.009		0.013
D	10.1		10.5	0.398		0.413
E	7.4		7.6	0.291		0.299
e		1.27			0.05	
H	10		10.65	0.394		0.419
h	0.25		0.75	0.01		0.03
L	0.4		1.27	0.016		0.05
k	0 °		8 °	0 °		8 °
ddd			0.1			0.004

### 6.3 TSSOP16 package information

Figure 12: TSSOP16 package outline

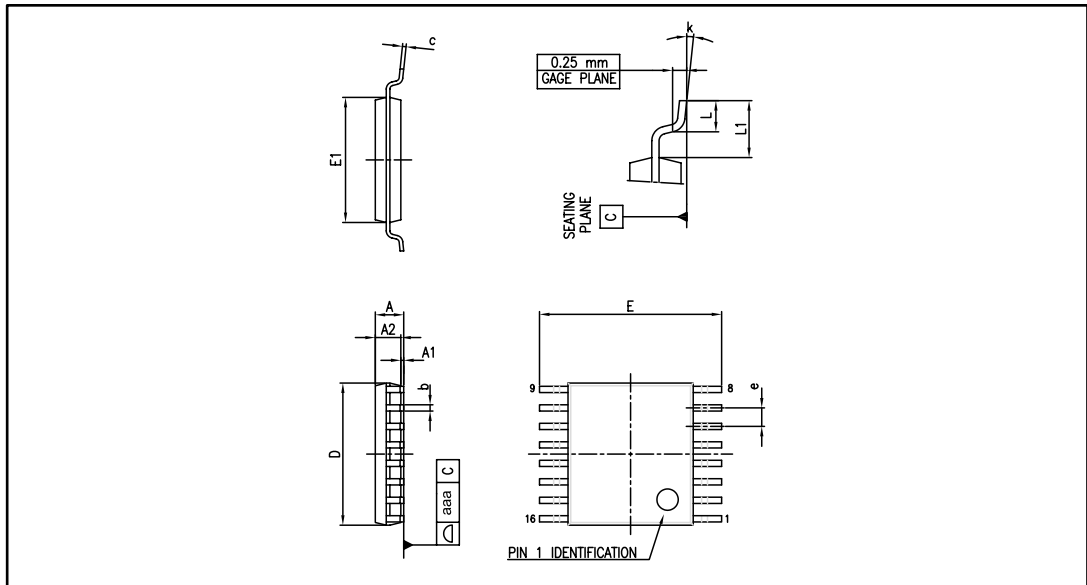
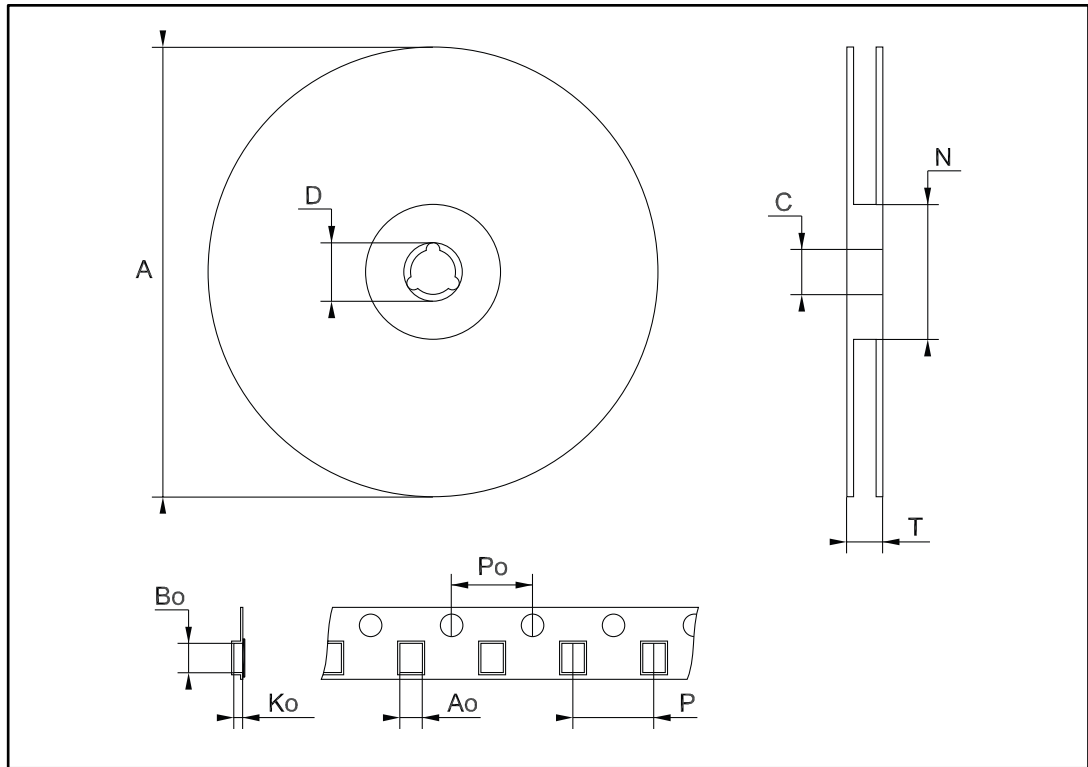


Table 12: TSSOP16 mechanical data

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

### 6.4 SO16 tape and reel package information

Figure 13: SO16 tape and reel package outline



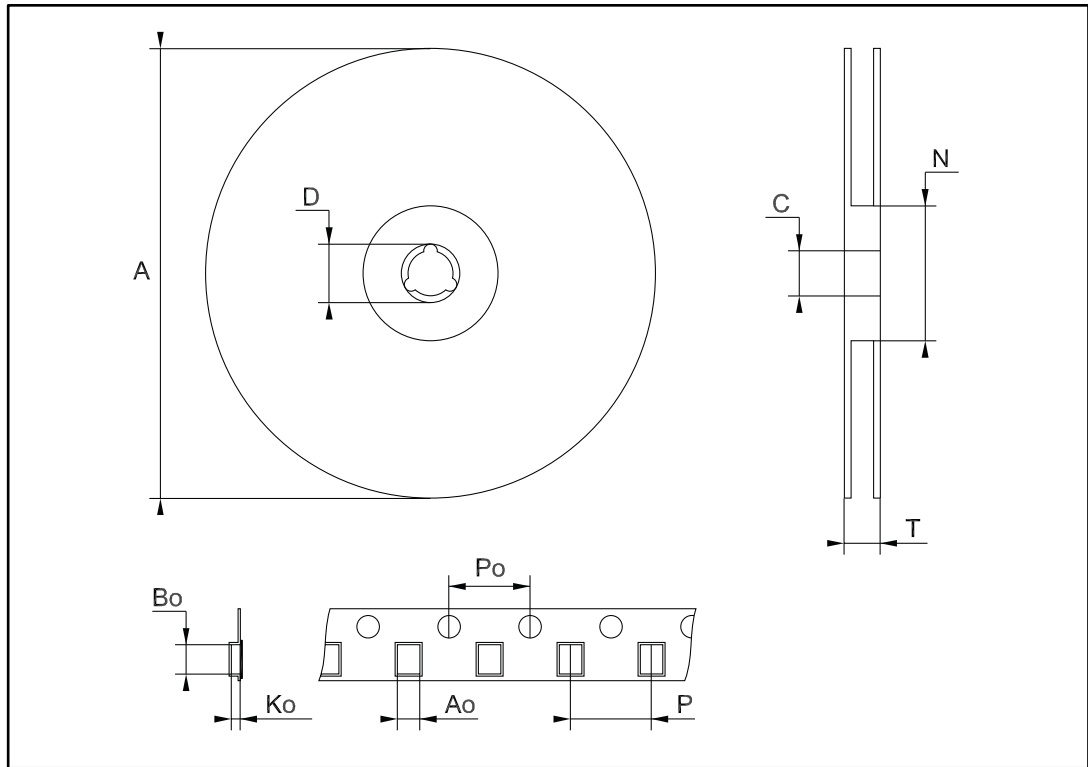
1. Drawing not to scale

Table 13: 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

### 6.5 SO16L tape and reel package information

Figure 14: SO16L tape and reel package outline



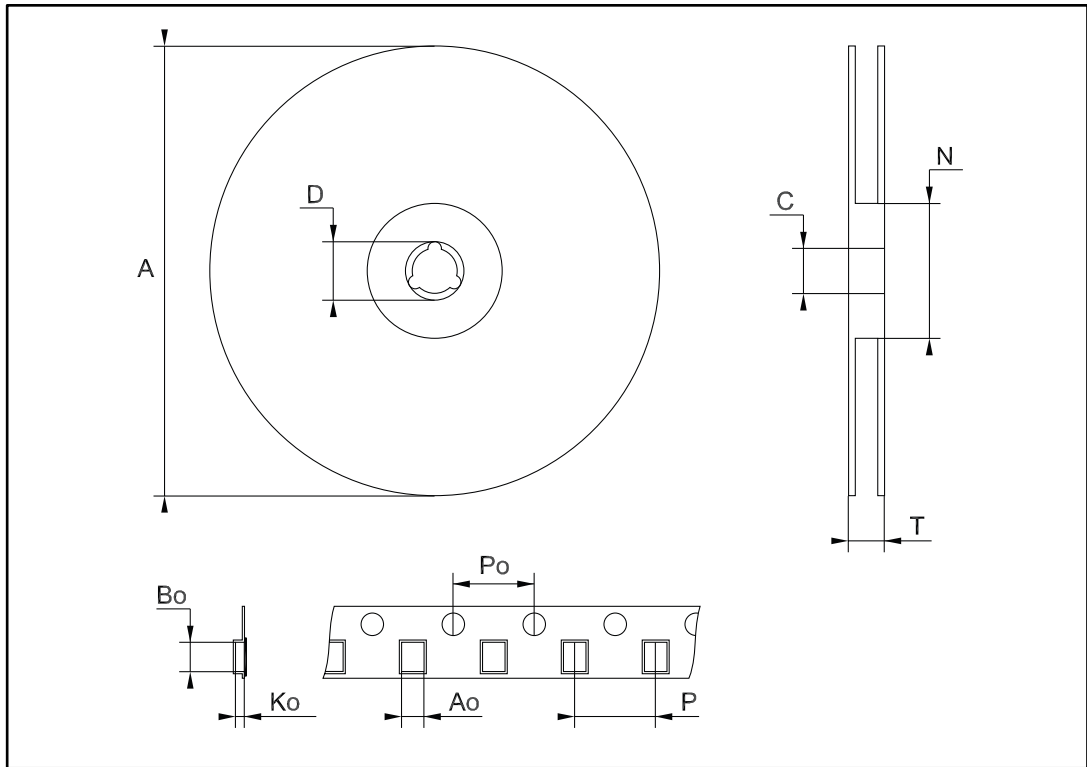
1. Drawing not to scale

Table 14: SO16L 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	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

### 6.6 TSSOP16 tape and reel package information

Figure 15: TSSOP16 tape and reel package outline



1. Drawing not to scale

Table 15: 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



## 7 Revision history

**Table 16: Document revision history**

Date	Revision	Changes
06-Sep-2006	8	Order codes has been updated and new template.
25-Oct-2006	9	Order codes has been updated.
21-Jan-2008	10	Added note on Table 3.
08-Feb-2008	11	Modified: Table 1 on page 1.
25-Jan-2016	12	Updated document layout <i>Table 3: "Absolute maximum ratings"</i> : added $T_{stg}$ Updated titles of <i>Figure 5</i> , <i>Figure 6</i> , <i>Figure 7</i> , and <i>Figure 8</i> <i>Section 6.2</i> : replaced SO16L package outline and mechanical data <i>Section 6.3</i> : removed A1 (typ: inches), updated E1 (max: mm and inches), added L1 and aaa.

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