



# ST3232EB ST3232EC

± 15 kV ESD protection 3 to 5.5 V low power,  
up to 250 kbps, RS-232 drivers and receivers

## Features

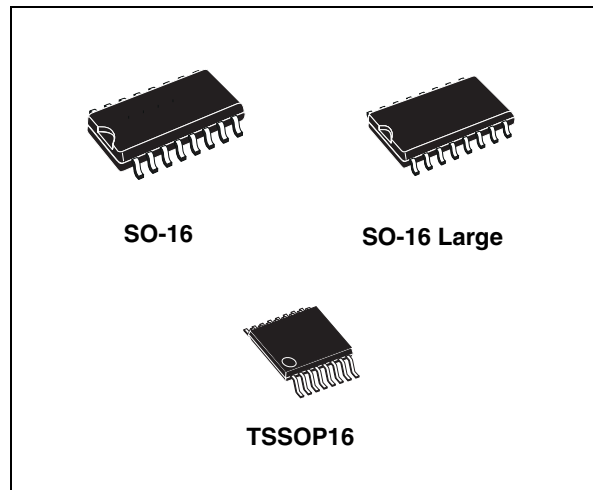
- ESD protection for RS-232 I/O pins
- ±15 kV human body model
- ±8 kV IEC 1000-4-2 contact discharge
- 300 µA supply current
- 250 kbps minimum guaranteed data rate
- 6 V/µs minimum guaranteed slew rate
- Meet EIA/TIA-232 specifications down to 3 V
- Available in SO-16, SO-16 large and TSSOP16

## Applications

- Notebook, subnotebook and palmtop computers
- Battery powered equipment
- Hand-held equipment
- Peripherals and printers

## Description

The ST3232E is a 3 V powered EIA/TIA-232 and V.28/V.24 communication interfaces with low power requirements, high data-rate capabilities and enhanced electrostatic discharge (ESD) protection to ± 8 kV using IEC1000-4-2 contact discharge and ± 15 kV using the human body model. ST3232E has a proprietary low dropout transmitter output stage providing true RS-232 performance from 3 to 5 V supplies with a dual charge pump. The charge pump requires only four



small 0.1 µF standard external capacitors for operations from 3 V supply.

The ST3232E has two receivers and two drivers.

The device is guaranteed to run at data rates of 250 kbps while maintaining RS-232 output levels.

Table 1. Device summary

Order codes	Temperature range	Packages	Packaging
ST3232ECDR	0 to 70 °C	SO-16 (tape and reel)	2500 parts per reel
ST3232EBDR	-40 to 85 °C	SO-16 (tape and reel)	2500 parts per reel
ST3232ECTR	0 to 70 °C	TSSOP16 (tape and reel)	2500 parts per reel
ST3232EBTR	-40 to 85 °C	TSSOP16 (tape and reel)	2500 parts per reel

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# 1 Pin configuration

Figure 1. Pin connection

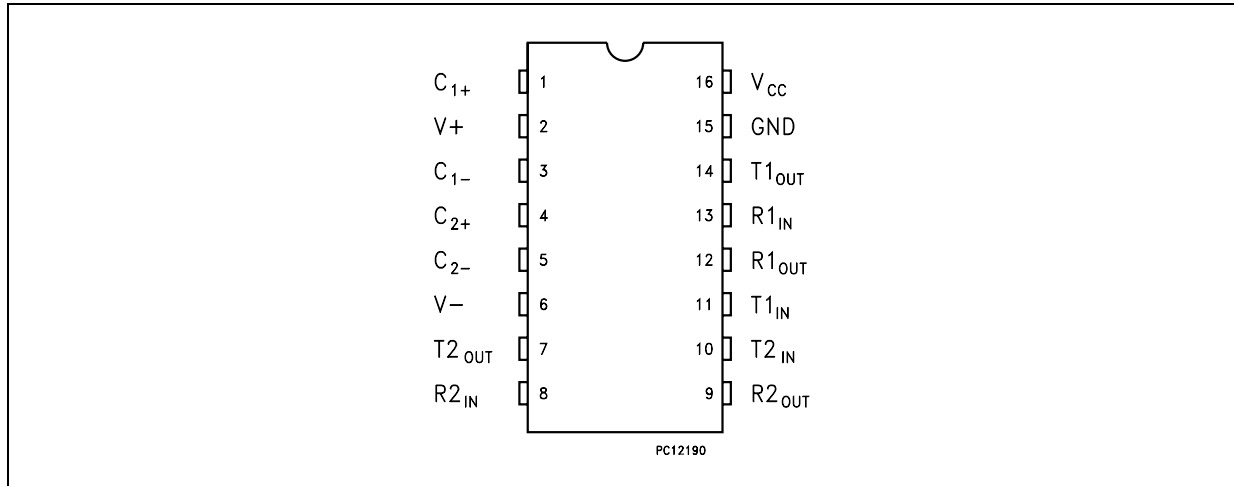


Table 2. Pin description

Pin n°	Symbol	Name and function
1	C <sub>1+</sub>	Positive terminal for the first charge pump capacitor
2	V+	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-	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
$V-$	Inverted voltage terminal	0.3 to -7	V
$V+ + V- $		13	V
$T_{IN}$	Transmitter input voltage range	-0.3 to 6	V
$R_{IN}$	Receiver input voltage range	$\pm 25$	V
$T_{OUT}$	Transmitter output voltage range	$\pm 13.2$	V
$R_{OUT}$	Receiver output voltage range	-0.3 to $(V_{CC} + 0.3)$	V
$t_{SHORT}$	Transmitter output short to gnd time	Continuous	

*Note: 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  $V-$ .*

**Figure 2. ESD performance: transmitter outputs, receiver inputs**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
ESD	ESD protection voltage	Human body model	$\pm 15$			kV
ESD	ESD protection voltage	IEC-1000-4-2	$\pm 8$			kV

### 3 Electrical characteristics

$C_1 - C_4 = 0.1 \mu\text{F}$ ,  $V_{\text{CC}} = 3 \text{ V to } 5.5 \text{ V}$ ,  $T_A = -40 \text{ to } 85 \text{ }^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25 \text{ }^\circ\text{C}$ .

**Table 4. Electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{\text{SUPPLY}}$	$V_{\text{CC}}$ Power supply current	No Load, $V_{\text{CC}} = 3\text{V or } 5\text{V}$ , $T_A = 25^\circ\text{C}$		0.3	1	mA

$C_1 - C_4 = 0.1 \mu\text{F}$ ,  $V_{\text{CC}} = 3 \text{ V to } 5.5 \text{ V}$ ,  $T_A = -40 \text{ to } 85 \text{ }^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25 \text{ }^\circ\text{C}$ .

**Table 5. Logic input**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{\text{TIL}}$	Input logic threshold low	T-IN			0.8	V
$V_{\text{HYS}}$	Transmitter input hysteresis			0.25		V
$V_{\text{TIH}}$	Input logic threshold high	$V_{\text{CC}} = 3.3\text{V}$	2			V
		$V_{\text{CC}} = 5\text{V}$	2.4			
$I_{\text{IL}}$	Input leakage current	T-IN		$\pm 0.01$	$\pm 1$	$\mu\text{A}$

$C_1 - C_4 = 0.1 \mu\text{F}$  tested at  $3.3 \text{ V} \pm 10 \%$ ,  $V_{\text{CC}} = 3 \text{ V to } 5.5 \text{ V}$ ,  $T_A = -40 \text{ to } 85 \text{ }^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25 \text{ }^\circ\text{C}$ .

**Table 6. Transmitter**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{\text{TOUT}}$	Output voltage swing	All transmitter outputs are loaded with $3\text{k}\Omega$ to GND	$\pm 5$	$\pm 5.4$		V
$R_{\text{TOUT}}$	Transmitter output resistance	$V_{\text{CC}} = 0\text{V}$ , $V_{\text{OUT}} = \pm 2\text{V}$	300	10M		$\Omega$
$I_{\text{SC}}$	Output short circuit current			$\pm 60$		mA
$I_{\text{TOL}}$	Output leakage current	$V_{\text{CC}} = 0\text{V or } 3.3\text{V to } 5.5\text{V}$ $V_{\text{OUT}} = \pm 12\text{V}$ Transmitters disable			$\pm 25$	$\mu\text{A}$

C<sub>1</sub> - C<sub>4</sub> = 0.1 μF tested at 3.3 V ± 10 %, V<sub>CC</sub> = 3 V to 5.5 V, T<sub>A</sub> = -40 to 85 °C, unless otherwise specified. Typical values are referred to T<sub>A</sub> = 25 °C.

**Table 7. Receiver**

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> = 3.3V	0.6	1.1		V
		T <sub>A</sub> = 25°C, V <sub>CC</sub> = 5V	0.8	1.5		
V <sub>RIH</sub>	RS-232 Input threshold high	T <sub>A</sub> = 25°C, V <sub>CC</sub> = 3.3V		1.4	2.4	V
		T <sub>A</sub> = 25°C, V <sub>CC</sub> = 5V		1.8	2.4	
V <sub>RIHYS</sub>	Input hysteresis			0.5		V
R <sub>RIN</sub>	Input resistance	T <sub>A</sub> = 25°C	3	5	7	kΩ
V <sub>ROL</sub>	TTL/CMOS Output voltage low	I <sub>OUT</sub> = 1.6mA			0.4	V
V <sub>ROH</sub>	TTL/CMOS Output voltage high	I <sub>OUT</sub> = -1mA	V <sub>CC</sub> -0.6	V <sub>CC</sub> -0.1		V

C<sub>1</sub> - C<sub>4</sub> = 0.1 μF tested at 3.3 V ± 10 %, V<sub>CC</sub> = 3 V to 5.5 V, T<sub>A</sub> = -40 to 85 °C, unless otherwise specified. Typical values are referred to T<sub>A</sub> = 25 °C

**Table 8. Timing characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
D <sub>R</sub>	Data transfer rate	R <sub>L</sub> = 3kΩ, C <sub>L2</sub> = 1000pF one transmitter switching	250			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> = 150pF		0.15		μs
t <sub>OER</sub>	Receiver output enable time	Normal Operation		50		ns
t <sub>ODR</sub>	Receiver output disable time	Normal Operation		50		ns
t <sub>PHLT</sub> - t <sub>THL</sub>	Transmitter propagation delay difference	(1)		200		ns
t <sub>PHLR</sub> - t <sub>THR</sub>	Receiver propagation delay difference			50		ns
S <sub>RT</sub>	Transition slew rate	T <sub>A</sub> = 25°C R <sub>L</sub> = 3kΩ to 7kΩ V <sub>CC</sub> = 3.3V measured from +3V to -3V or -3V to +3V C <sub>L</sub> = 150pF to 1000pF C <sub>L</sub> = 150pF to 2500pF	6 4		30 30	V/μs V/μs

1. Transmitter skew is measured at the transmitter zero cross points.

# 4 Application

Figure 3. Application circuits

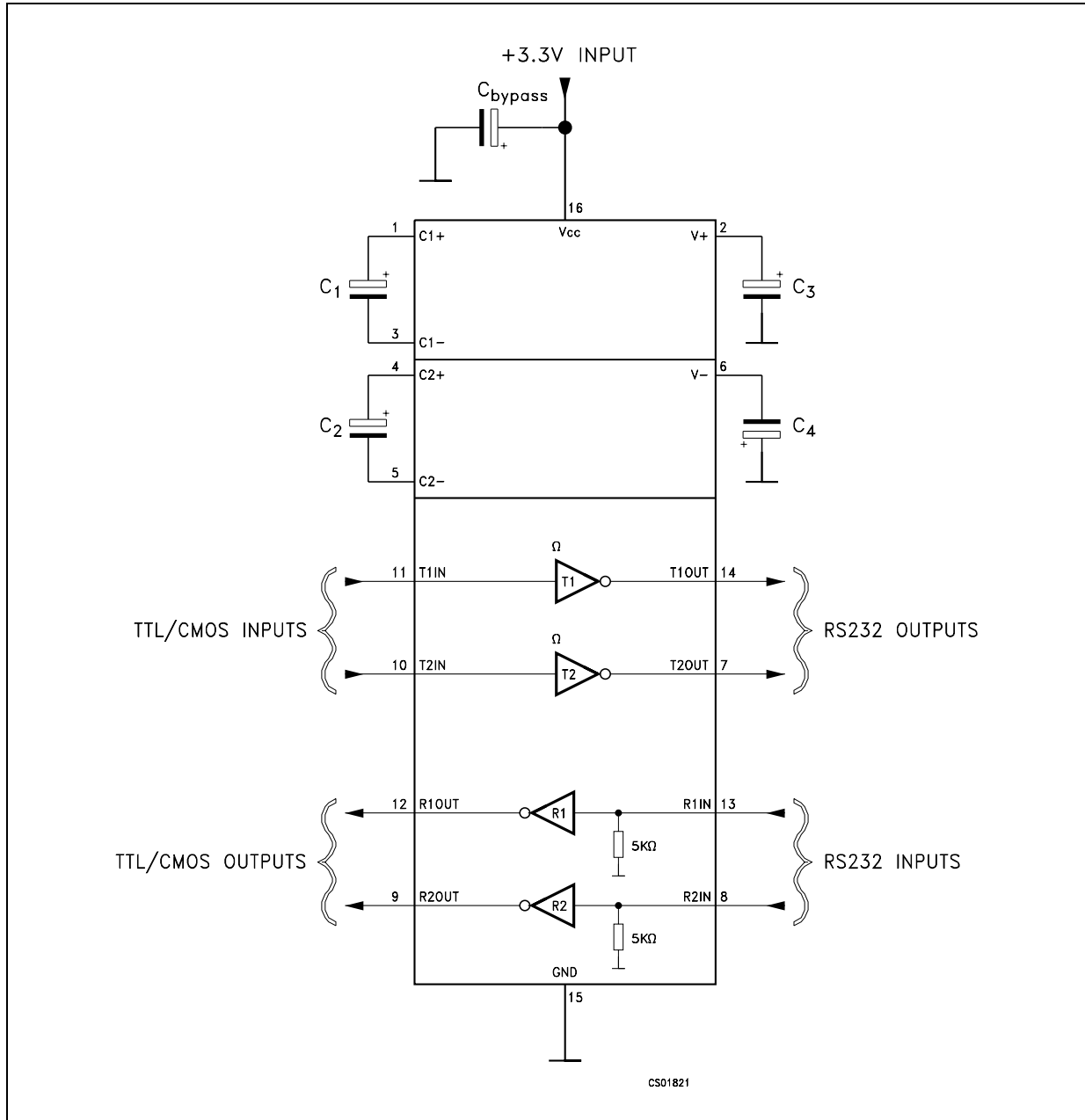


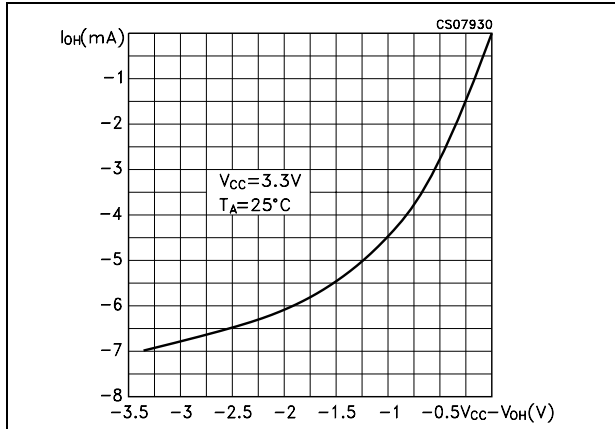
Table 9. Capacitance value (μF)

V <sub>CC</sub>	C1	C2	C3	C4	C <sub>bypass</sub>
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	0.1
3.0 to 5.5	0.1	0.47	0.47	0.47	0.1

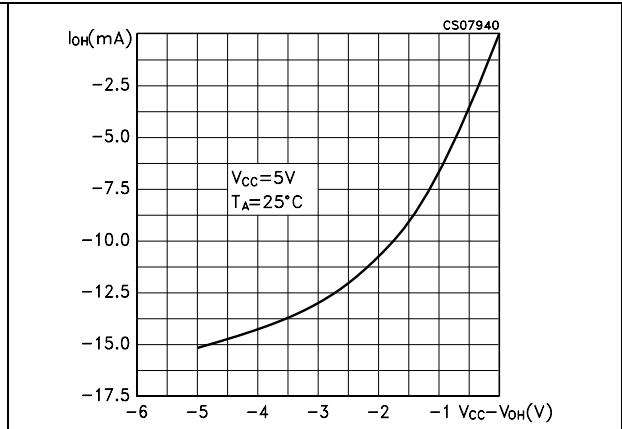
## 5 Typical performance characteristics

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

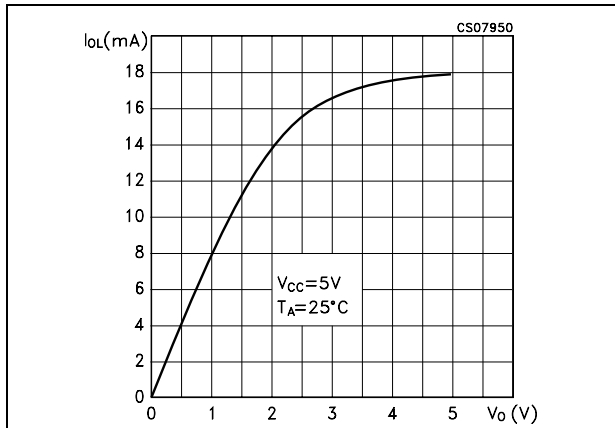
**Figure 4. Output current vs. output high voltage**



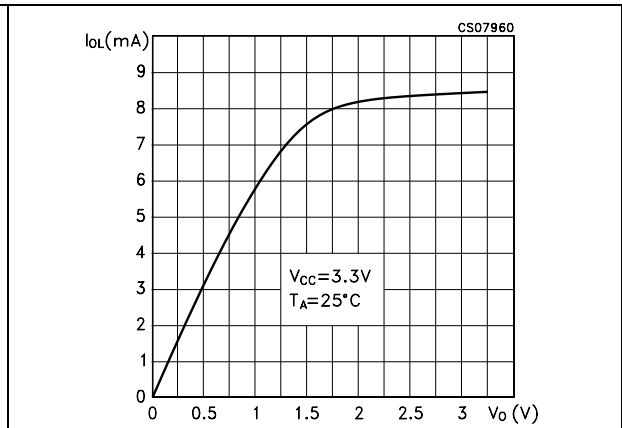
**Figure 5. Output current vs. output high voltage**



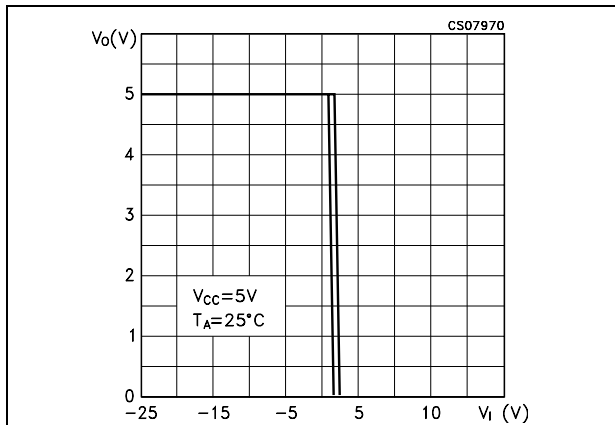
**Figure 6. Output current vs. output low voltage**



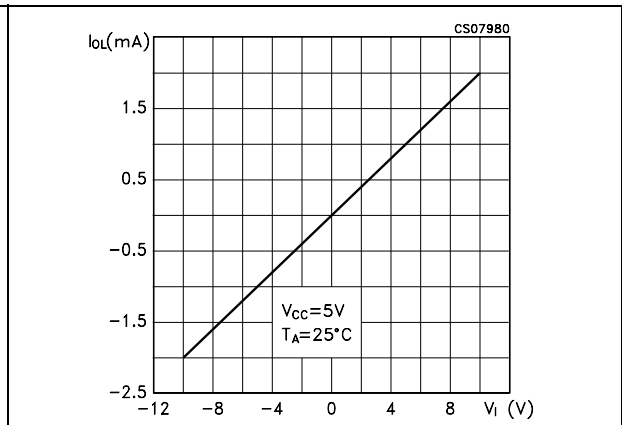
**Figure 7. Output current vs. output low voltage**



**Figure 8. Voltage transfer characteristics for transmitter inputs**



**Figure 9. Receiver input resistance**



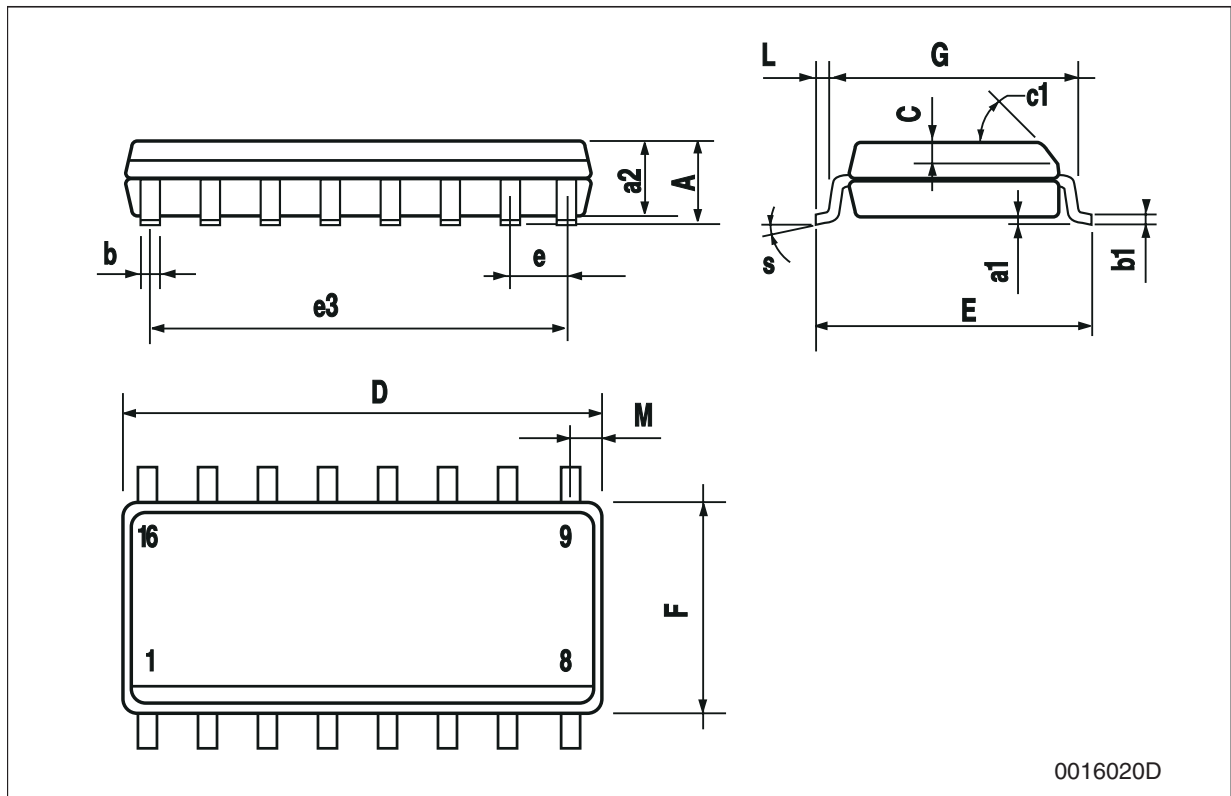


## 6 Package mechanical data

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.

**SO-16 mechanical data**

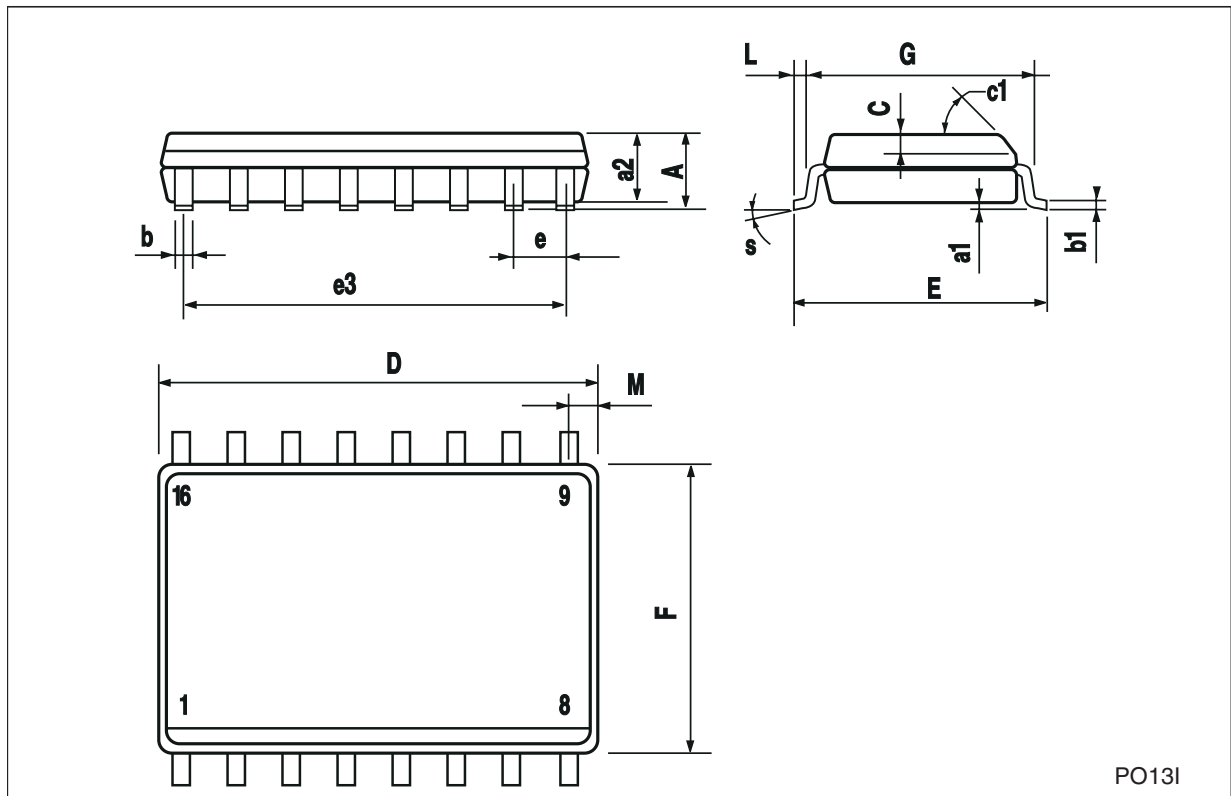
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.068
a1	0.1		0.25	0.004		0.010
a2			1.64			0.063
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157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

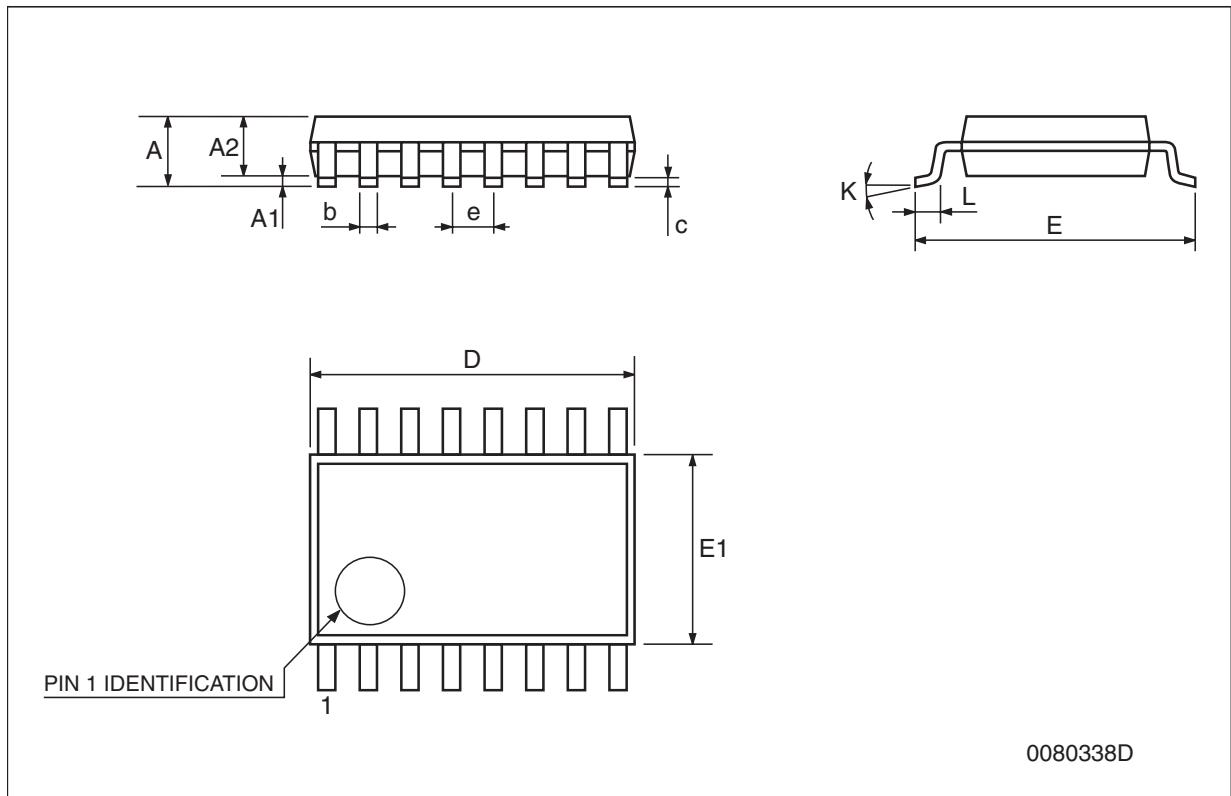
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			2.65			0.104
a1	0.1		0.2	0.004		0.008
a2			2.45			0.096
b	0.35		0.49	0.014		0.019
b1	0.23		0.32	0.009		0.012
C		0.5			0.020	
c1	45° (typ.)					
D	10.1		10.5	0.397		0.413
E	10.0		10.65	0.393		0.419
e		1.27			0.050	
e3		8.89			0.350	
F	7.4		7.6	0.291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



PO131

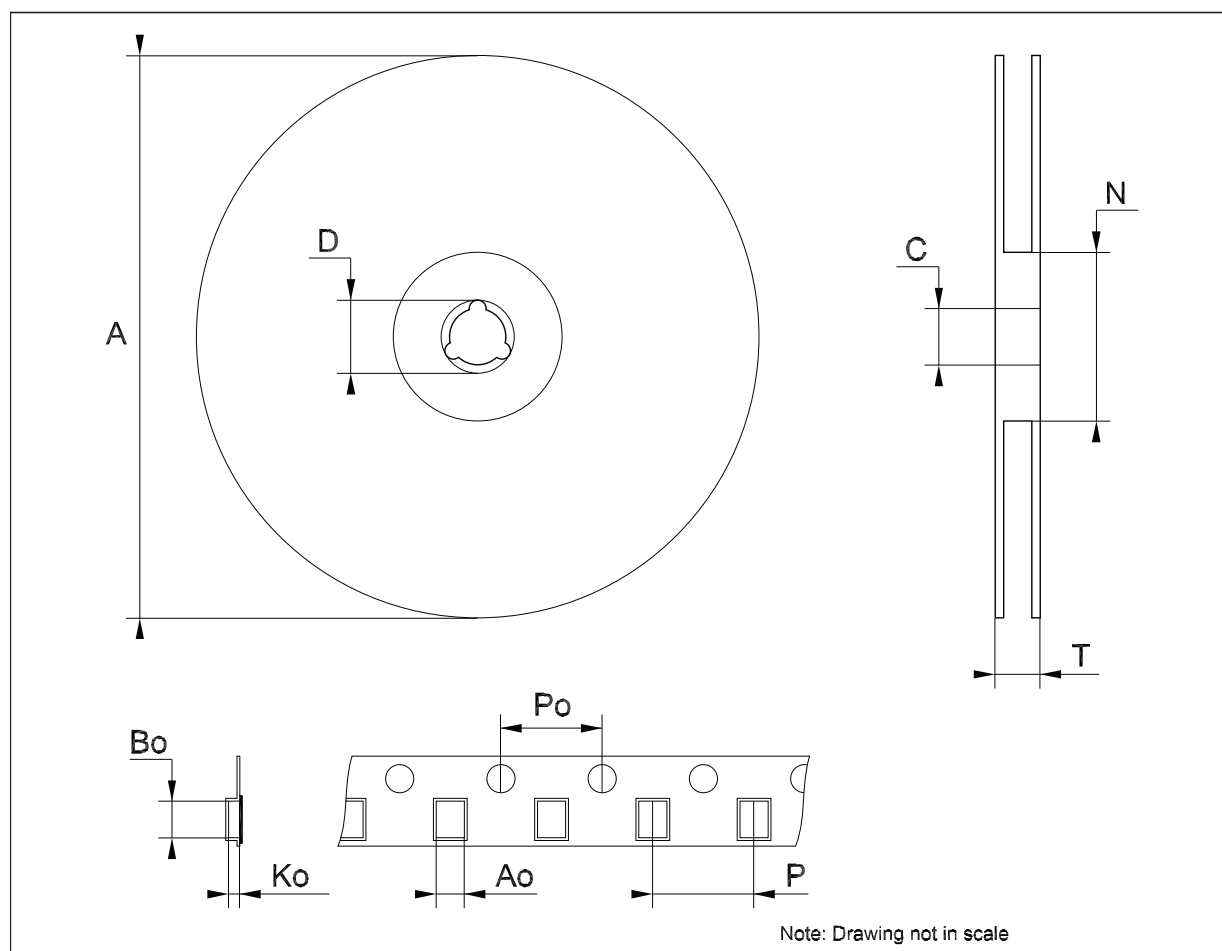
**TSSOP16 mechanical data**

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



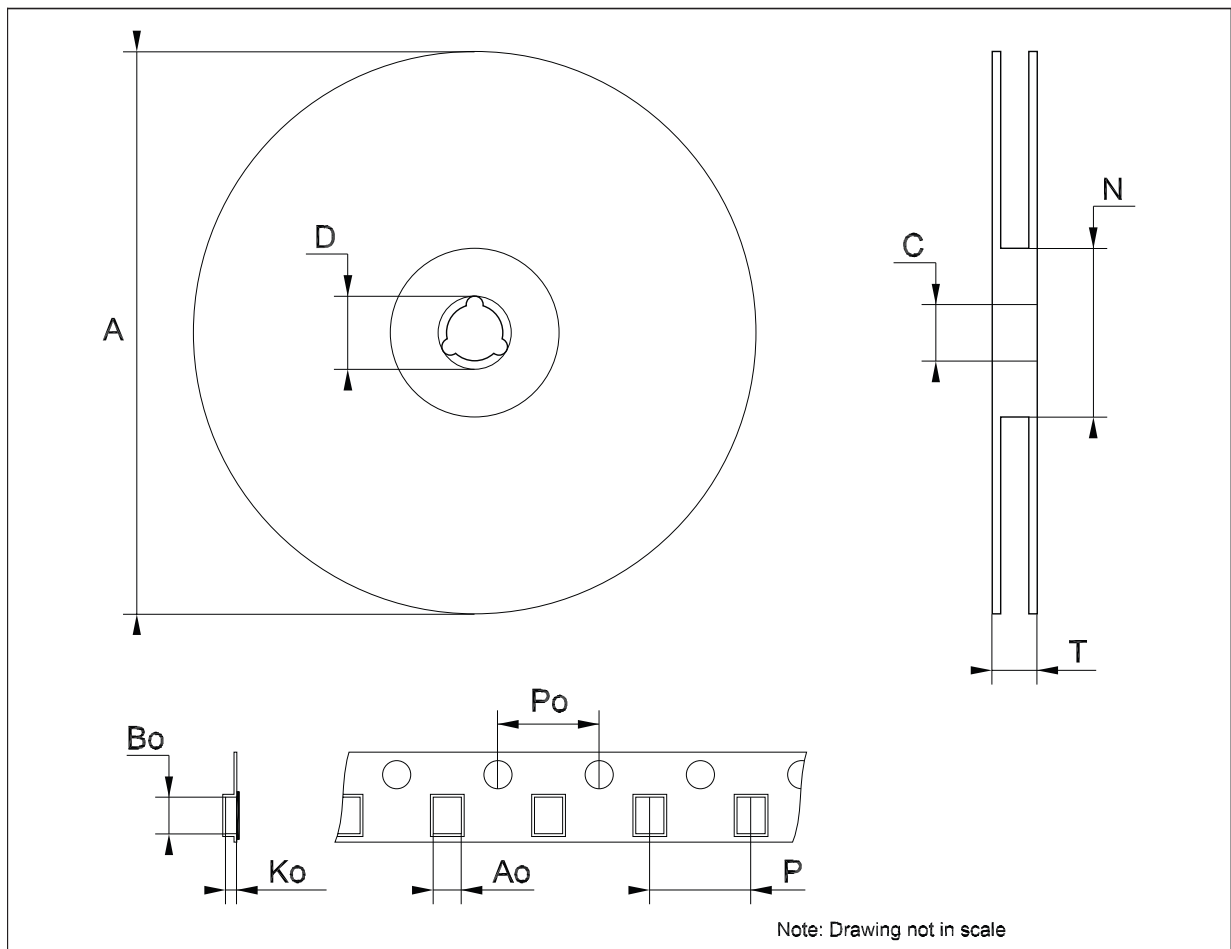
## Tape &amp; reel SO-16 mechanical data

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



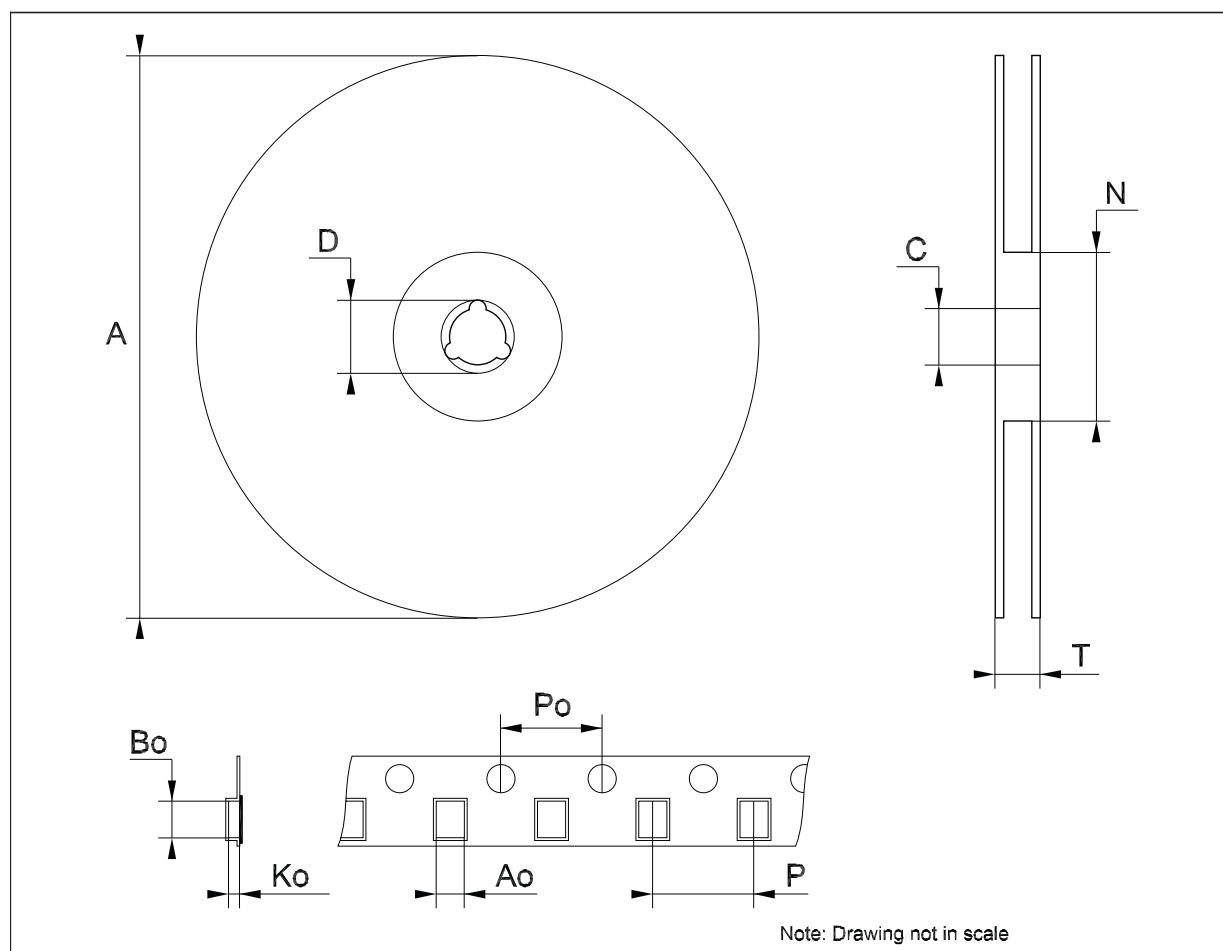
**Tape & reel SO-16L mechanical data**

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



## Tape &amp; 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



## 7 Revision history

**Table 10. Document revision history**

Date	Revision	Changes
06-Sep-2006	3	Order codes updated.
21-Jan-2008	4	Added: <a href="#">Table 1</a> and note on <a href="#">Table 3</a> .
08-Feb-2008	5	Modified: <a href="#">Table 1 on page 1</a> .
05-Jan-2010	6	Modified: <a href="#">Table 1 on page 1</a> .



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