

### Features

- 300  $\mu$ A supply current
- 300 kbps minimum guaranteed data rate
- 6 V/ $\mu$ s minimum guaranteed slew rate
- Meet EIA/TIA-232 specifications down to 3 V
- Available in SO-16, SO-16 large and TSSOP16

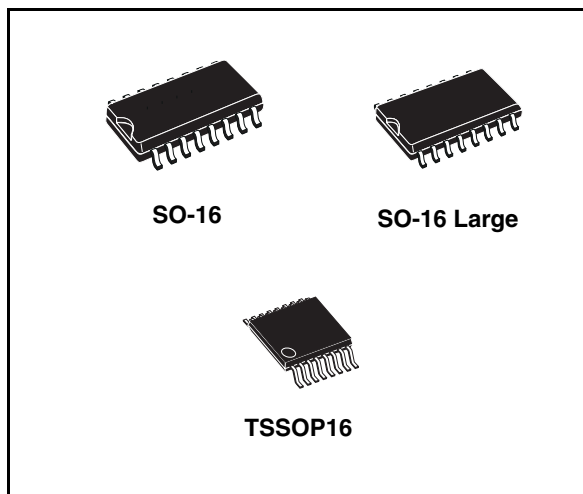
### Description

The ST3232 is a 3 V powered EIA/TIA-232 and V.28/V.24 communication interface with low power requirements, high data-rate capabilities.

ST3232 has a proprietary low dropout transmitter output stage providing true RS-232 performance from 3 to 5.5 V supplies. The device requires only four small 0.1 mF standard external capacitors for operations from 3 V supply.

The ST3232 has two receivers and two drivers.

The device is guaranteed to run at data rates of 250 kbps while maintaining RS-232 output levels. Typical applications are Notebook, Subnotebook and Palmtop Computers, Battery Powered



Equipment, Hand-Held Equipment, Peripherals and Printers.

**Table 1. Device summary**

Order codes	Temp. range	Package	Packaging
ST3232CDR	0 to 70 °C	SO-16 (tape and reel)	2500 parts per reel
ST3232BDR	-40 to 85 °C	SO-16 (tape and reel)	2500 parts per reel
ST3232CWR	0 to 70 °C	SO-16 Large (tape and reel)	1000 parts per reel
ST3232BWR	-40 to 85 °C	SO-16 Large (tape and reel)	1000 parts per reel
ST3232CTR	0 to 70 °C	TSSOP16 (tape and reel)	2500 parts per reel
ST3232BTR	-40 to 85 °C	TSSOP16 (tape and reel)	2500 parts per reel

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# 1 Pin configuration

Figure 1. Pin connection

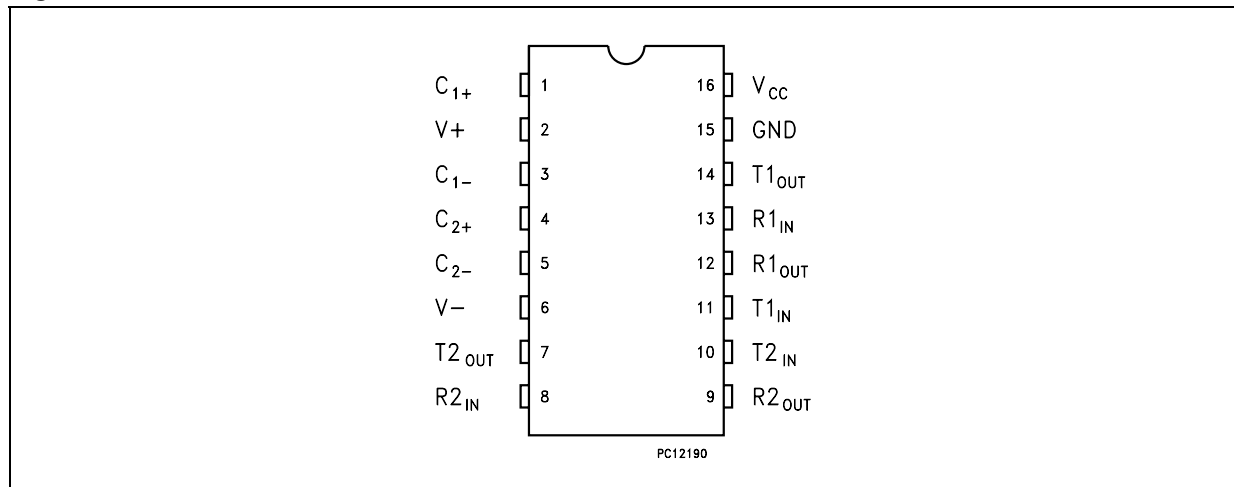


Table 2. Pin description

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  $V-$ .*

### 3 Electrical characteristics

**Table 4. Electrical characteristics** ( $C_1 - C_4 = 0.1 \mu\text{F}$ ,  $V_{CC} = 3 \text{ V to } 5.5 \text{ V}$ ,  $T_A = -40 \text{ to } 85 \text{ }^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25 \text{ }^\circ\text{C}$ )

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{\text{SUPPLY}}$	$V_{CC}$ Power supply current	No Load, $V_{CC} = 3\text{V} \pm 10\%$ , $T_A = 25^\circ\text{C}$		0.3	1	mA
		No Load, $V_{CC} = 5\text{V} \pm 10\%$ , $T_A = 25^\circ\text{C}$		1	2	mA

**Table 5. Logic input** ( $C_1 - C_4 = 0.1 \mu\text{F}$ ,  $V_{CC} = 3 \text{ V to } 5.5 \text{ V}$ ,  $T_A = -40 \text{ to } 85 \text{ }^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25 \text{ }^\circ\text{C}$ )

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

1. Transmitter input hysteresis is typically 250mV.

**Table 6. Transmitter** ( $C_1 - C_4 = 0.1 \mu\text{F}$  tested at  $3.3 \text{ V} \pm 10 \%$ ,  $V_{CC} = 3 \text{ V to } 5.5 \text{ V}$ ,  $T_A = -40 \text{ to } 85 \text{ }^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25 \text{ }^\circ\text{C}$ )

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	$V_{CC} = V_+ = V_- = 0\text{V}$ , $V_{\text{OUT}} = \pm 2\text{V}$	300	10M		$\Omega$
$I_{\text{TSC}}$	Output short circuit current	$V_{CC} = 3\text{V}$ or $5\text{V}$ , $V_{\text{OUT}} = \pm 12$			$\pm 60$	mA

**Table 7. Receiver** ( $C_1 - C_4 = 0.1 \mu\text{F}$  tested at  $3.3 \text{ V} \pm 10 \%$ ,  $V_{CC} = 3 \text{ V to } 5.5 \text{ V}$ ,  $T_A = -40 \text{ to } 85 \text{ }^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25 \text{ }^\circ\text{C}$ )

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{\text{RIN}}$	Receiver input voltage operating range		-25		25	V
$V_{\text{RIL}}$	RS-232 Input threshold low	$T_A = 25^\circ\text{C}$ , $V_{CC} = 3.3\text{V}$	0.6	1.1		V
		$T_A = 25^\circ\text{C}$ , $V_{CC} = 5\text{V}$	0.8	1.5		
$V_{\text{RIH}}$	RS-232 Input threshold high	$T_A = 25^\circ\text{C}$ , $V_{CC} = 3.3\text{V}$		1.5	2.4	V
		$T_A = 25^\circ\text{C}$ , $V_{CC} = 5\text{V}$		1.8	2.4	
$V_{\text{RIHYS}}$	Input hysteresis			0.3		V
$R_{\text{RIN}}$	Input resistance	$T_A = 25^\circ\text{C}$	3	5	7	$\text{k}\Omega$
$V_{\text{ROL}}$	TTL/CMOS Output voltage low	$I_{\text{OUT}} = 1.6\text{mA}$			0.4	V
$V_{\text{ROH}}$	TTL/CMOS Output voltage high	$I_{\text{OUT}} = -1\text{mA}$	$V_{CC}-0.6$	$V_{CC}-0.1$		V

**Table 8. Timing characteristics** ( $C_1 - C_4 = 0.1 \mu\text{F}$  tested at  $3.3 \text{ V} \pm 10 \%$ ,  $V_{CC} = 3 \text{ V}$  to  $5.5 \text{ V}$ ,  $T_A = -40$  to  $85 \text{ }^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25 \text{ }^\circ\text{C}$ )

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$D_R$	Data transfer rate	$R_L = 3\text{k}\Omega$ $C_{L2} = 1000\text{pF}$ one transmitter switching	300	400		kbps
$t_{PHLR}$ $t_{PLHR}$	Propagation delay input to output	$R_{XIN} = R_{XOUT}$ , $C_L = 150\text{pF}$		0.2		$\mu\text{s}$
$ t_{PHLT} - t_{THL} $	Transmitter propagation delay difference	(Note 1)		100		ns
$ t_{PHLR} - t_{THR} $	Receiver propagation delay difference			50		ns
$S_{RT}$	Transition slew rate	$T_A = 25^\circ\text{C}$ $R_L = 3\text{k}\Omega$ to $7\text{k}\Omega$ $V_{CC} = 3.3\text{V}$ measured from $+3\text{V}$ to $-3\text{V}$ or $-3\text{V}$ to $+3\text{V}$ $C_L = 150\text{pF}$ to $1000\text{pF}$ $C_L = 150\text{pF}$ to $2500\text{pF}$	6 4		30 30	$\text{V}/\mu\text{s}$ $\text{V}/\mu\text{s}$

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

# 4 Application

Figure 2. Application circuits

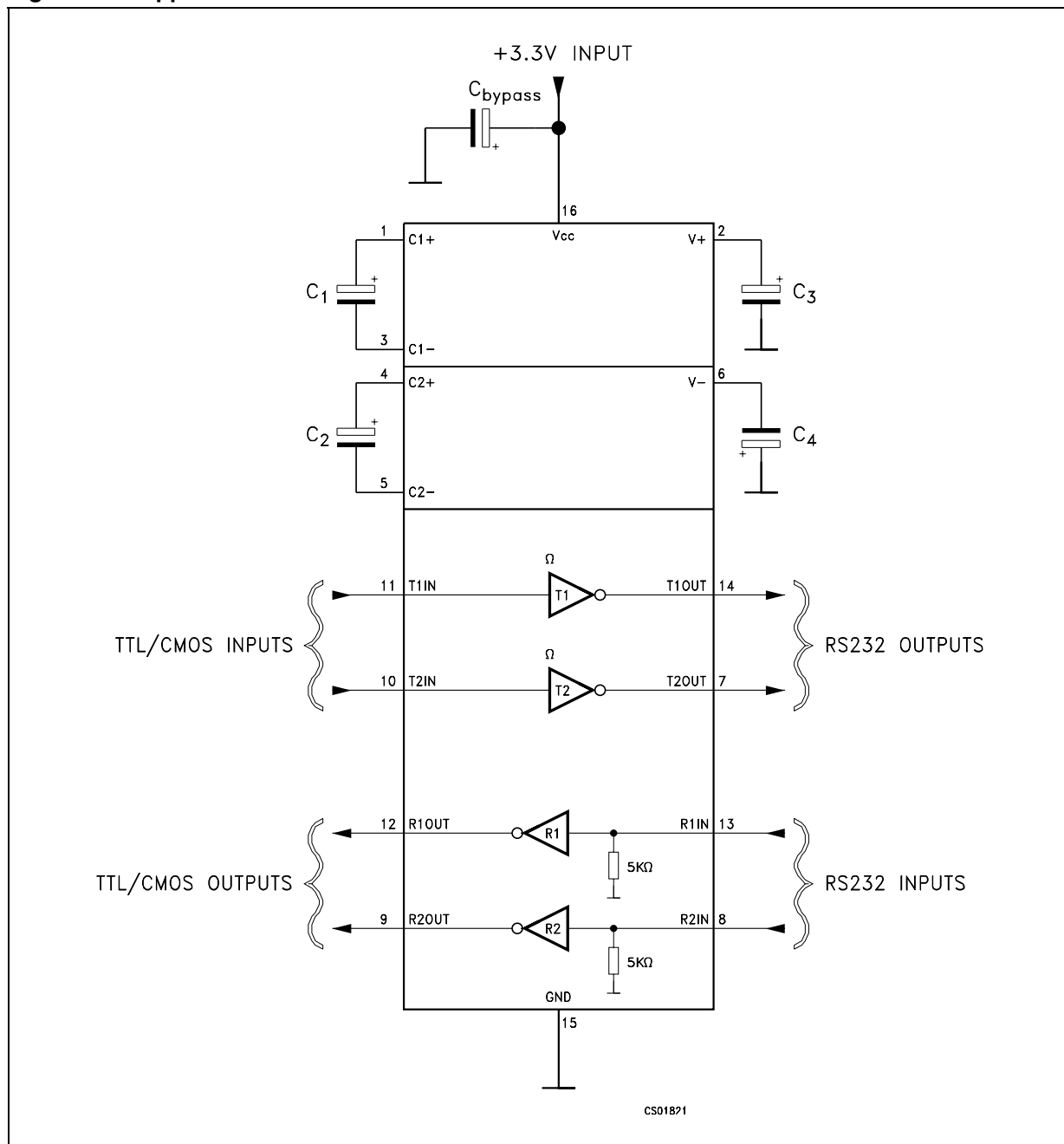


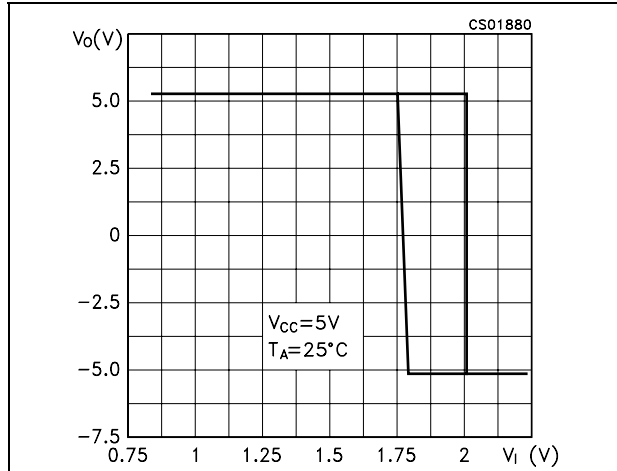
Table 9. Capacitance value ( $\mu F$ )

$V_{CC}$	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

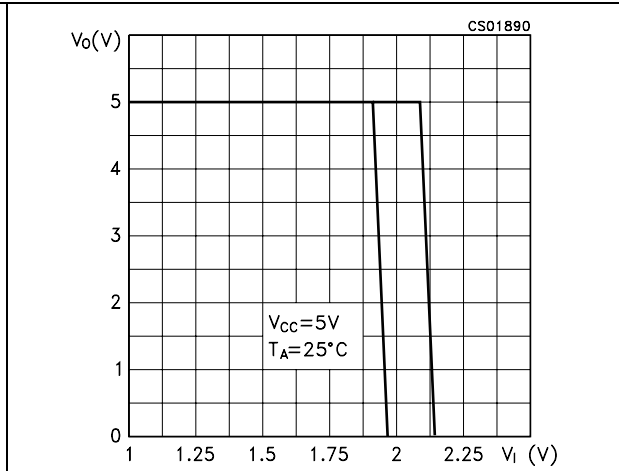
# 5 Typical performance characteristics

(unless otherwise specified  $T_J = 25\text{ }^\circ\text{C}$ )

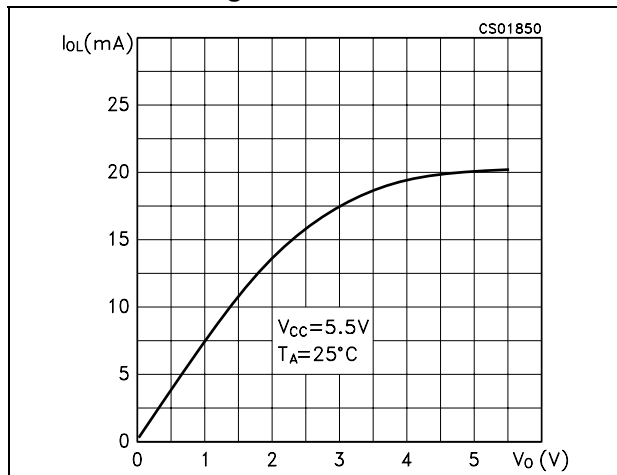
**Figure 3. Driver voltage transfer characteristics for transmitter input**



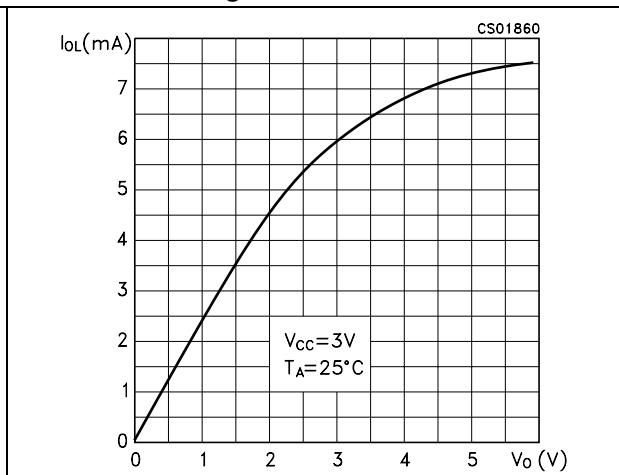
**Figure 4. Driver voltage transfer characteristics for receiver inputs**



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

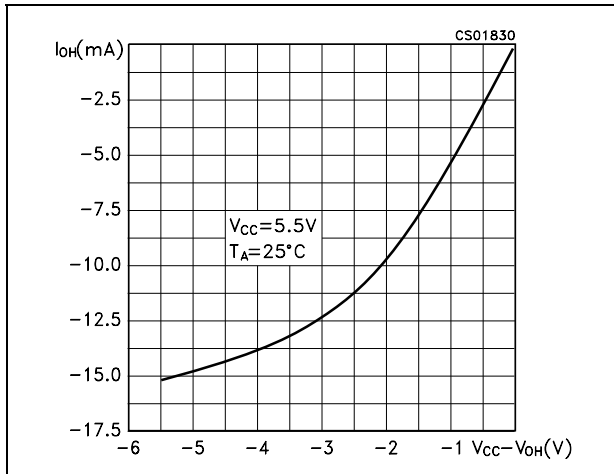


**Figure 6. Output current vs output low voltage**

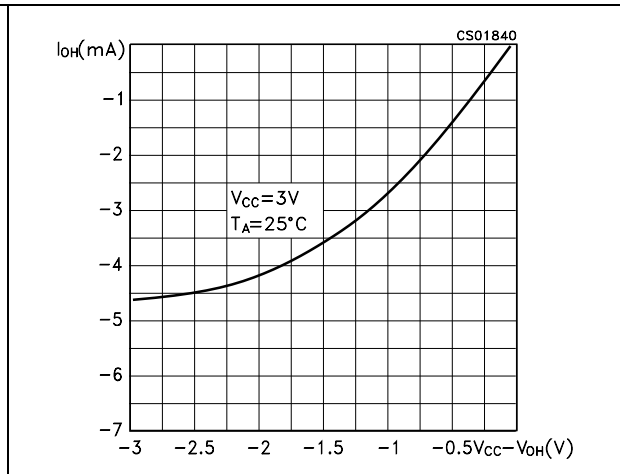




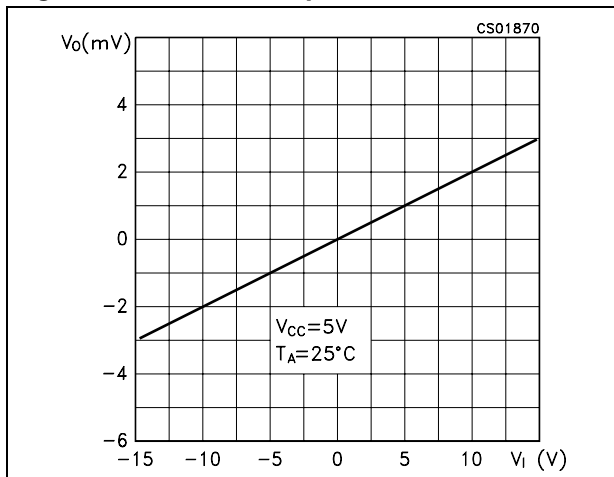
**Figure 7. Output current vs output high voltage**



**Figure 8. Output current vs output high voltage**



**Figure 9. Receiver input resistance**

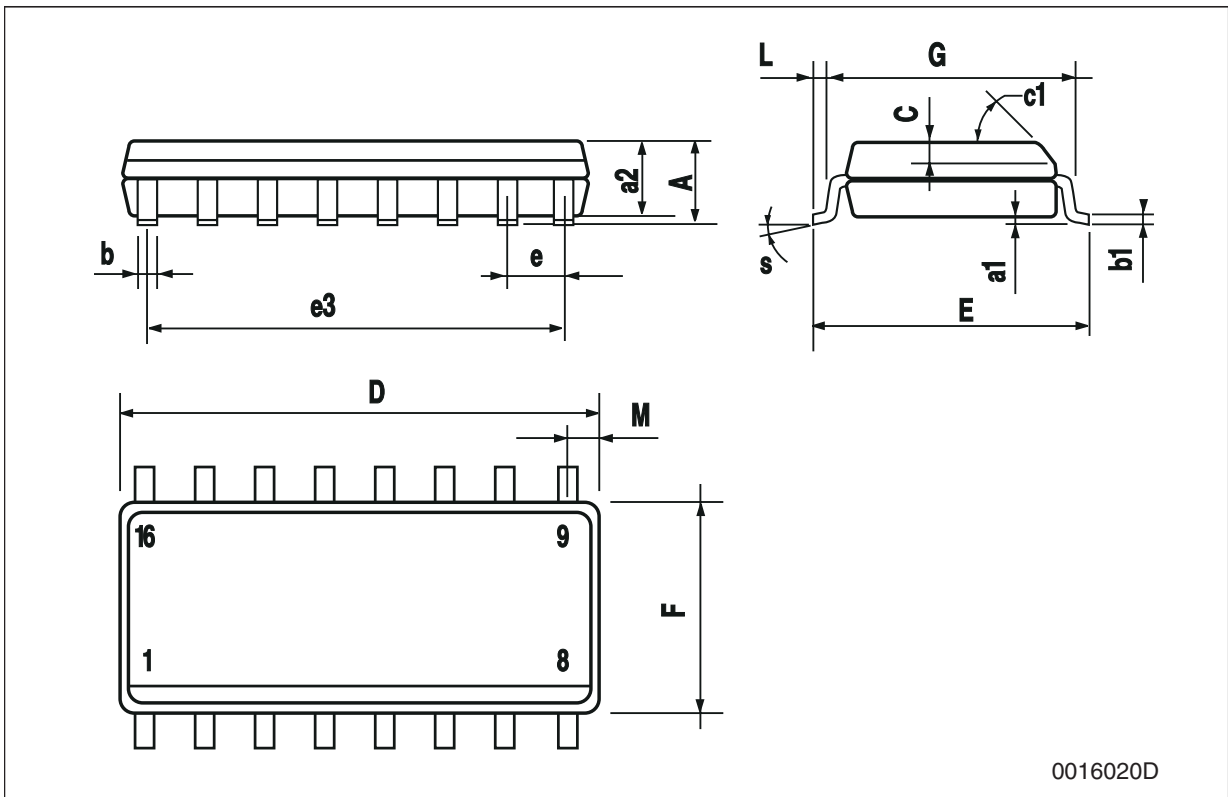


## 6 Package mechanical data

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](http://www.st.com).

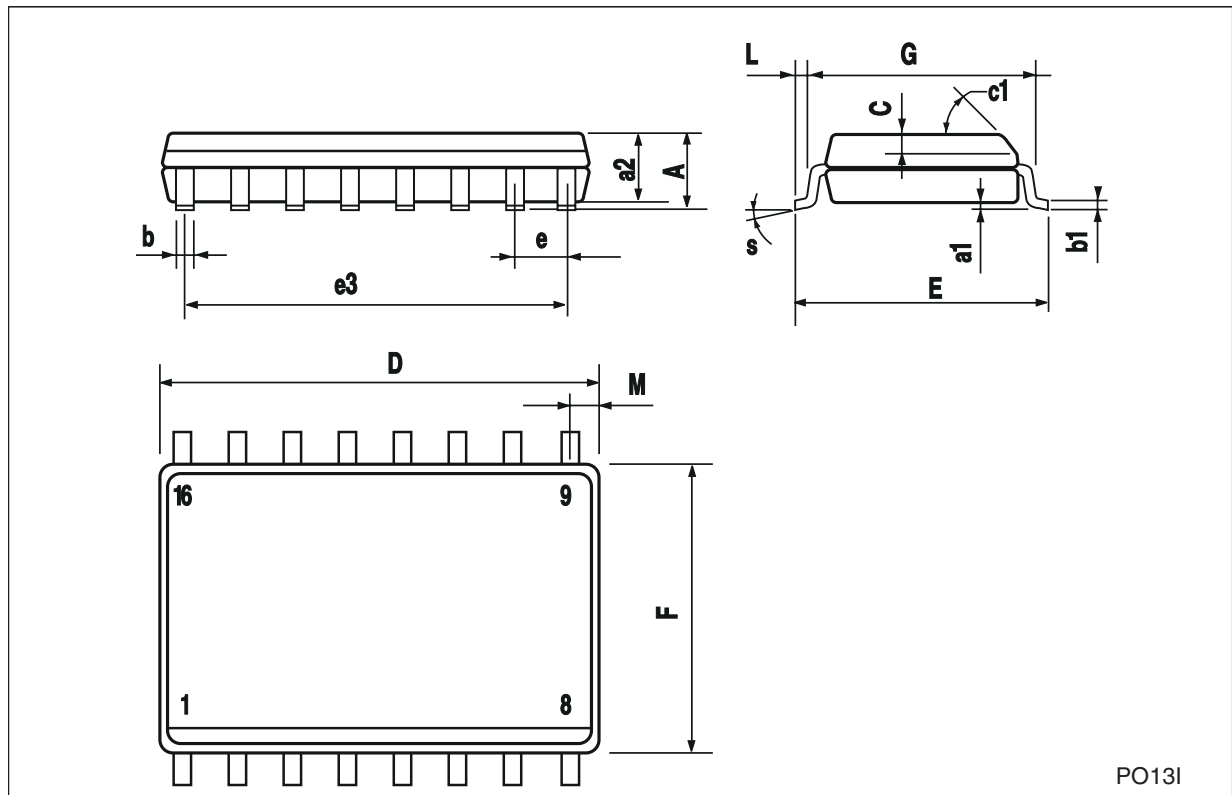
**SO-16 mechanical data**

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.)					



**SO-16L mechanical data**

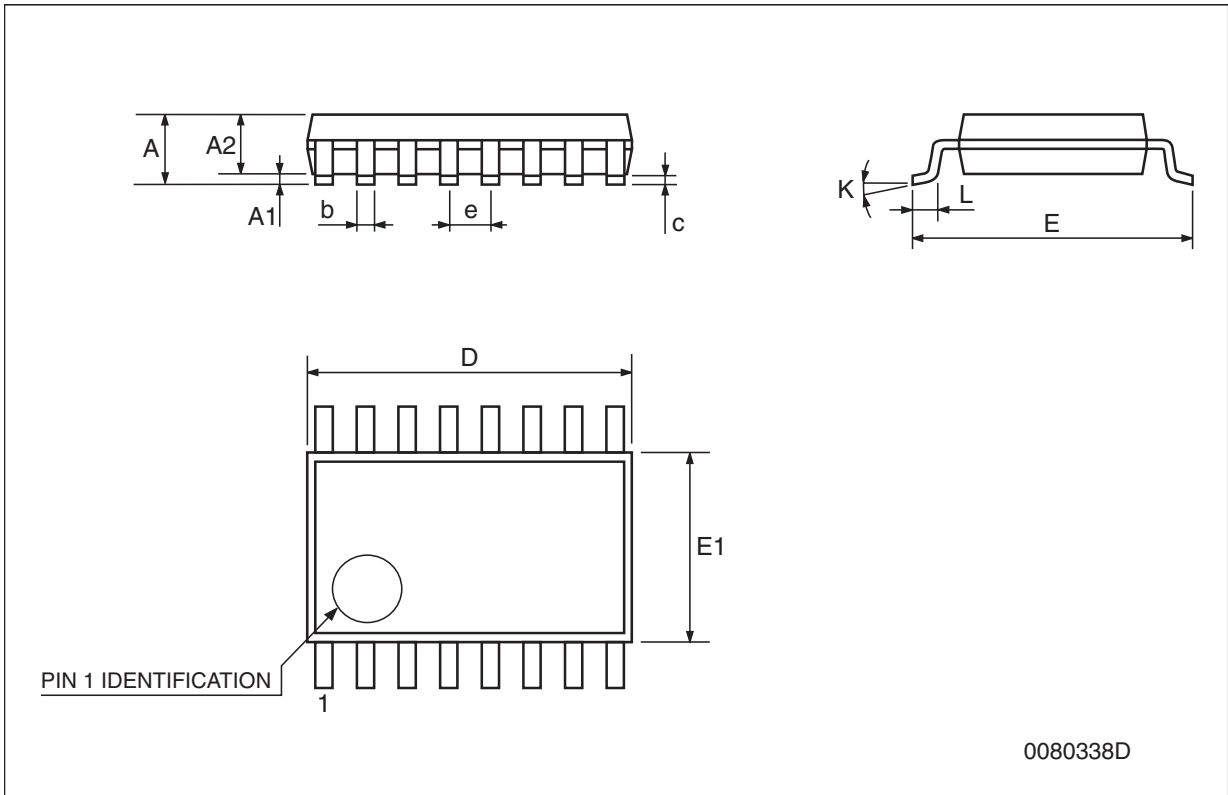
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			2.65			0.104
a1	0.1		0.2	0.004		0.008
a2			2.45			0.096
b	0.35		0.49	0.014		0.019
b1	0.23		0.32	0.009		0.012
C		0.5			0.020	
c1	45° (typ.)					
D	10.1		10.5	0.397		0.413
E	10.0		10.65	0.393		0.419
e		1.27			0.050	
e3		8.89			0.350	
F	7.4		7.6	0.291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



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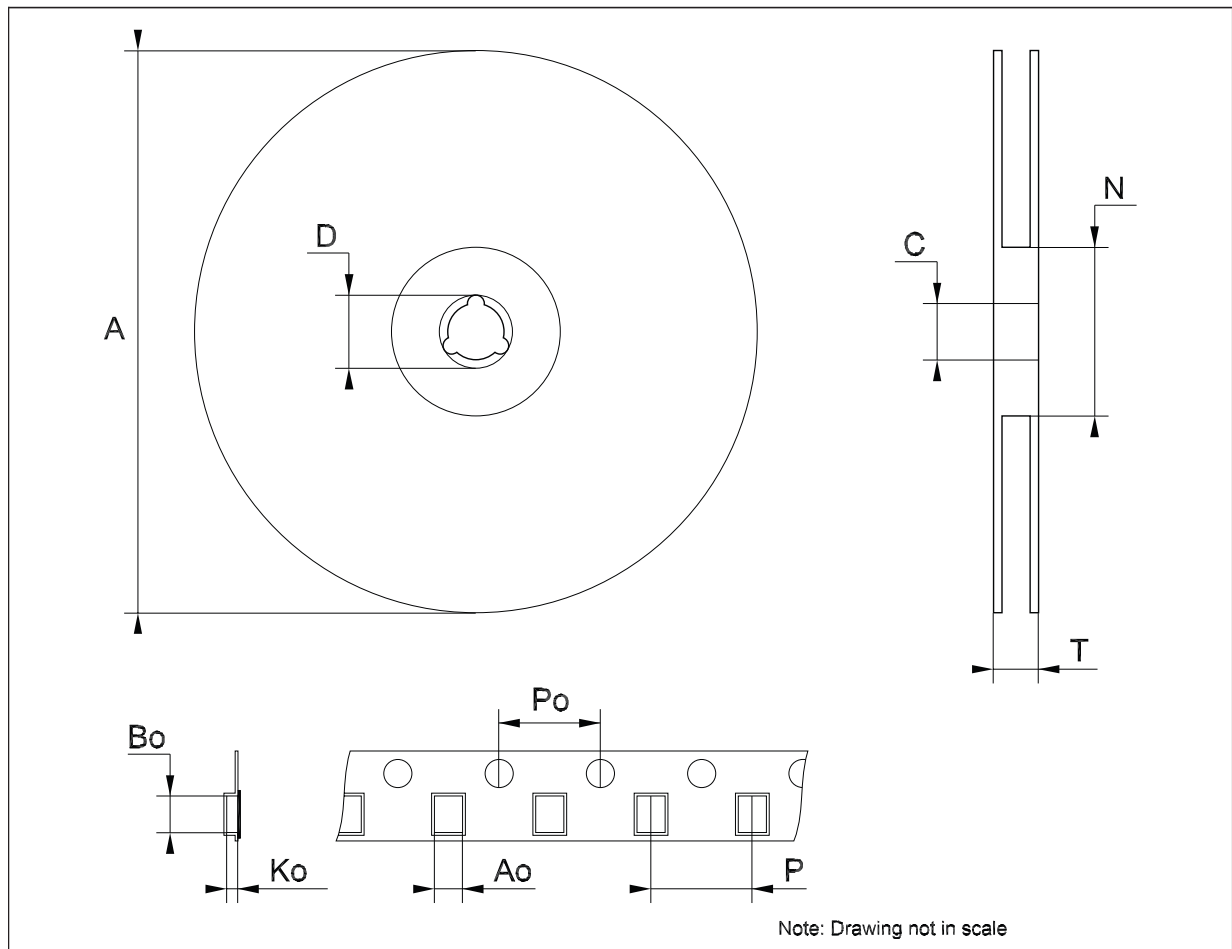
**TSSOP16 mechanical data**

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



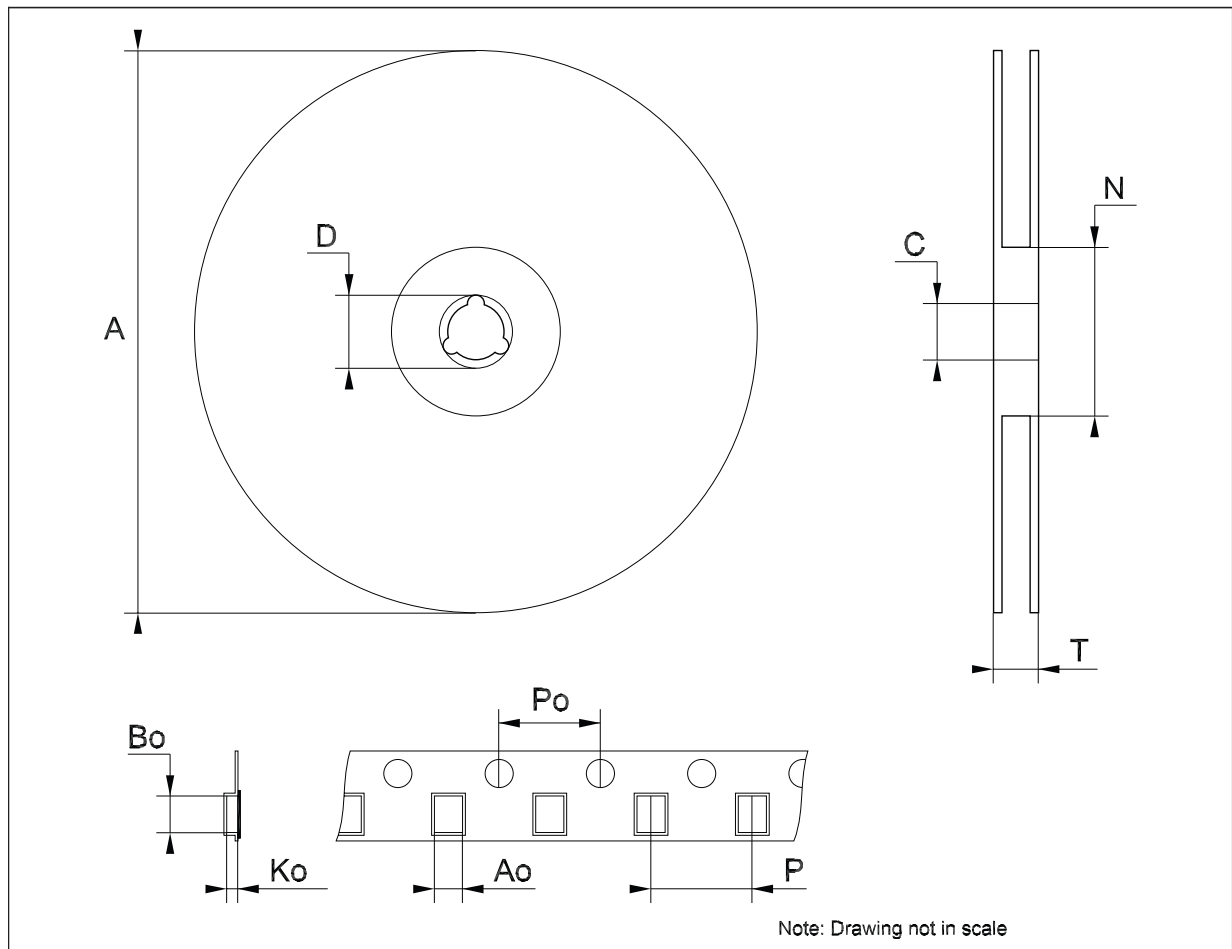
**Tape & reel SO-16 mechanical data**

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



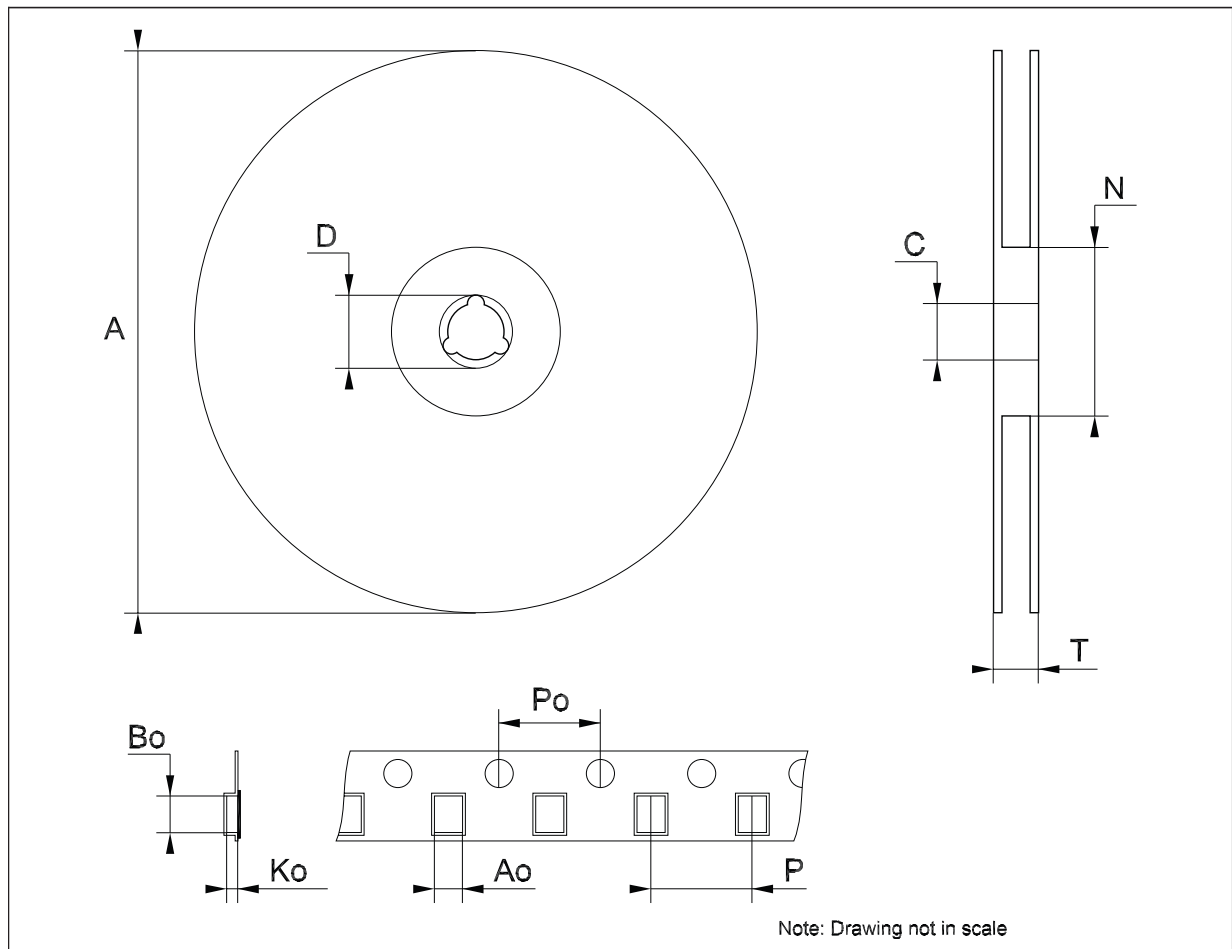
**Tape & reel SO-16L mechanical data**

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 & 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	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 <a href="#">Table 3</a> .
08-Feb-2008	11	Modified: <a href="#">Table 1 on page 1</a> .

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