



ST3232E

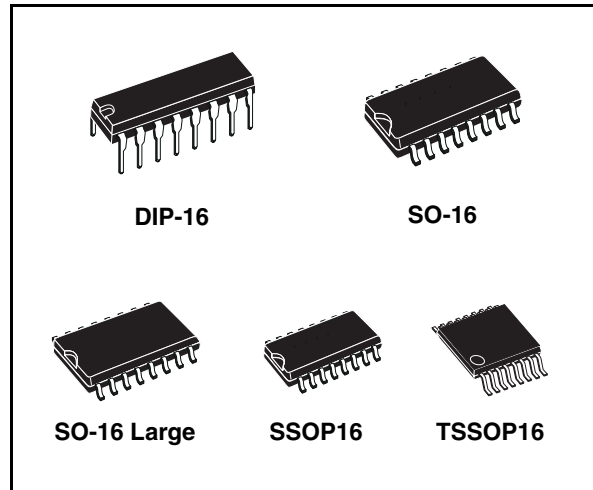
$\pm 15\text{kV}$ ESD-Protection, 3 to 5.5V, low power,
up to 250KBPS, RS-232 drivers and receivers

Feature summary

- ESD protection for RS-232 I/O pins
- $\pm 15\text{kV}$ human body model
- $\pm 8\text{kV}$ IEC 1000-4-2 contact discharge
- $300\mu\text{A}$ supply current
- 250Kbps minimum guaranteed data rate
- $6\text{V}/\mu\text{s}$ minimum guaranteed slew rate
- Meet EIA/TIA-232 specifications down to 3V
- Available in DIP-16, SO-16, SO-16 large SSOP16 and TSSOP16

Description

The ST3232E is a 3V 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 $\pm 8\text{kV}$ using IEC1000-4-2 Contact Discharge and $\pm 15\text{kV}$ using the Human Body Model. ST3232E has a proprietary low dropout transmitter output stage providing true RS-232 performance from 3 to 5V supplies with a dual charge pump. The charge pump requires only four



small $0.1\mu\text{F}$ standard external capacitors for operations from 3V supply.

The ST3232E has two receivers and two drivers.

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

Typical applications are Notebook, Subnotebook and Palmtop Computers, Battery Powered Equipment, Hand-Held Equipment, Peripherals and Printers..

Order code

Part number	Temp. range	Package	Packaging
ST3232ECN	0 to 70 °C	DIP-16	25parts per tube / 40tube per box
ST3232EBN	-40 to 85 °C	DIP-16	25parts per tube / 40tube per box
ST3232ECDR	0 to 70 °C	SO-16 (Tape & Reel)	2500 parts per reel
ST3232EBDR	-40 to 85 °C	SO-16 (Tape & Reel)	2500 parts per reel
ST3232ECWR	0 to 70 °C	SO-16 Large (Tape & Reel)	1000 parts per reel
ST3232EBWR	-40 to 85 °C	SO-16 Large (Tape & Reel)	1000 parts per reel
ST3232ECPR	0 to 70 °C	SSOP16 (Tape & Reel)	1350 parts per reel
ST3232EBPR	-40 to 85 °C	SSOP16 (Tape & Reel)	1350 parts per reel
ST3232ECTR	0 to 70 °C	TSSOP16 (Tape & Reel)	2500 parts per reel
ST3232EBTR	-40 to 85 °C	TSSOP16 (Tape & Reel)	2500 parts per reel

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1 Pin configuration

Figure 1. Pin connection

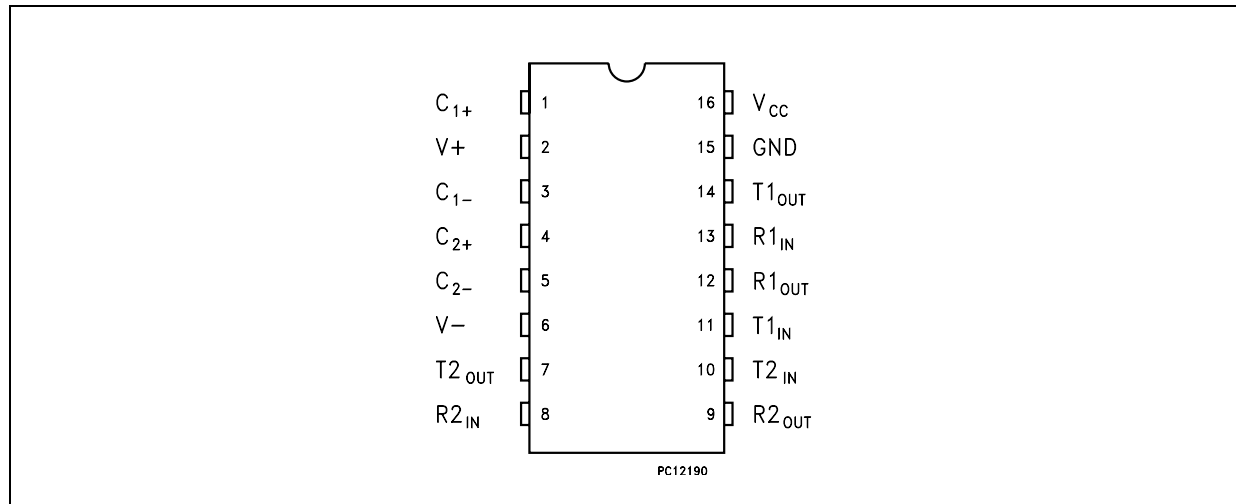


Table 1. Pin description

Pin N°	Symbol	Name and function
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	T _{2OUT}	Second transmitter output voltage
8	R _{2IN}	Second receiver input voltage
9	R _{2OUT}	Second receiver output voltage
10	T _{2IN}	Second transmitter input voltage
11	T _{1IN}	First transmitter input voltage
12	R _{1OUT}	First receiver output voltage
13	R _{1IN}	First receiver input voltage
14	T _{1OUT}	First transmitter output voltage
15	GND	Ground
16	V _{CC}	Supply voltage

2 Absolute maximum ratings

Table 2. 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	± 25	V
T_{OUT}	Transmitter output voltage range	± 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. V_+ and V_- can have a maximum magnitude of +7V, but their absolute addition can not exceed 13 V.

Figure 2. ESD performance: transmitter outputs, receiver inputs

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

3 Electrical characteristics

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

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

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

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

Table 5. Transmitter ($C_1 - C_4 = 0.1\mu\text{F}$ tested at $3.3\text{V} \pm 10\%$, $V_{CC} = 3\text{V}$ to 5.5V , $T_A = -40$ to 85°C , unless otherwise specified. Typical values are referred to $T_A = 25^\circ\text{C}$)

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

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

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{RIN}	Receiver input voltage operating range		-25		25	V
V_{RIL}	RS-232 Input threshold low	$T_A = 25^\circ\text{C}$, $V_{\text{CC}} = 3.3\text{V}$	0.6	1.1		V
		$T_A = 25^\circ\text{C}$, $V_{\text{CC}} = 5\text{V}$	0.8	1.5		
V_{RIH}	RS-232 Input threshold high	$T_A = 25^\circ\text{C}$, $V_{\text{CC}} = 3.3\text{V}$		1.4	2.4	V
		$T_A = 25^\circ\text{C}$, $V_{\text{CC}} = 5\text{V}$		1.8	2.4	
V_{RIHYS}	Input hysteresis			0.5		V
R_{RIN}	Input resistance	$T_A = 25^\circ\text{C}$	3	5	7	k Ω
V_{ROL}	TTL/CMOS Output voltage low	$I_{\text{OUT}} = 1.6\text{mA}$			0.4	V
V_{ROH}	TTL/CMOS Output voltage high	$I_{\text{OUT}} = -1\text{mA}$	$V_{\text{CC}}-0.6$	$V_{\text{CC}}-0.1$		V

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

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	250			Kbps
t_{PHLR} t_{PLHR}	Propagation delay input to output	$R_{\text{XIN}} = R_{\text{XOUT}}$, $C_L = 150\text{pF}$		0.15		μs
t_{OER}	Receiver output enable time	Normal Operation		50		ns
t_{ODR}	Receiver output disable time	Normal Operation		50		ns
$ t_{\text{PHLT}} - t_{\text{THL}} $	Transmitter propagation delay difference	(Note 1)		200		ns
$ t_{\text{PHLR}} - t_{\text{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 $7\text{k}\Omega$ $V_{\text{CC}} = 3.3\text{V}$ measured from $+3\text{V}$ to -3V or -3V to $+3\text{V}$ $C_L = 150\text{pF}$ to 1000pF $C_L = 150\text{pF}$ to 2500pF	6		30	V/ μs
			4		30	V/ μs

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

4 Application

Figure 3. Application circuits

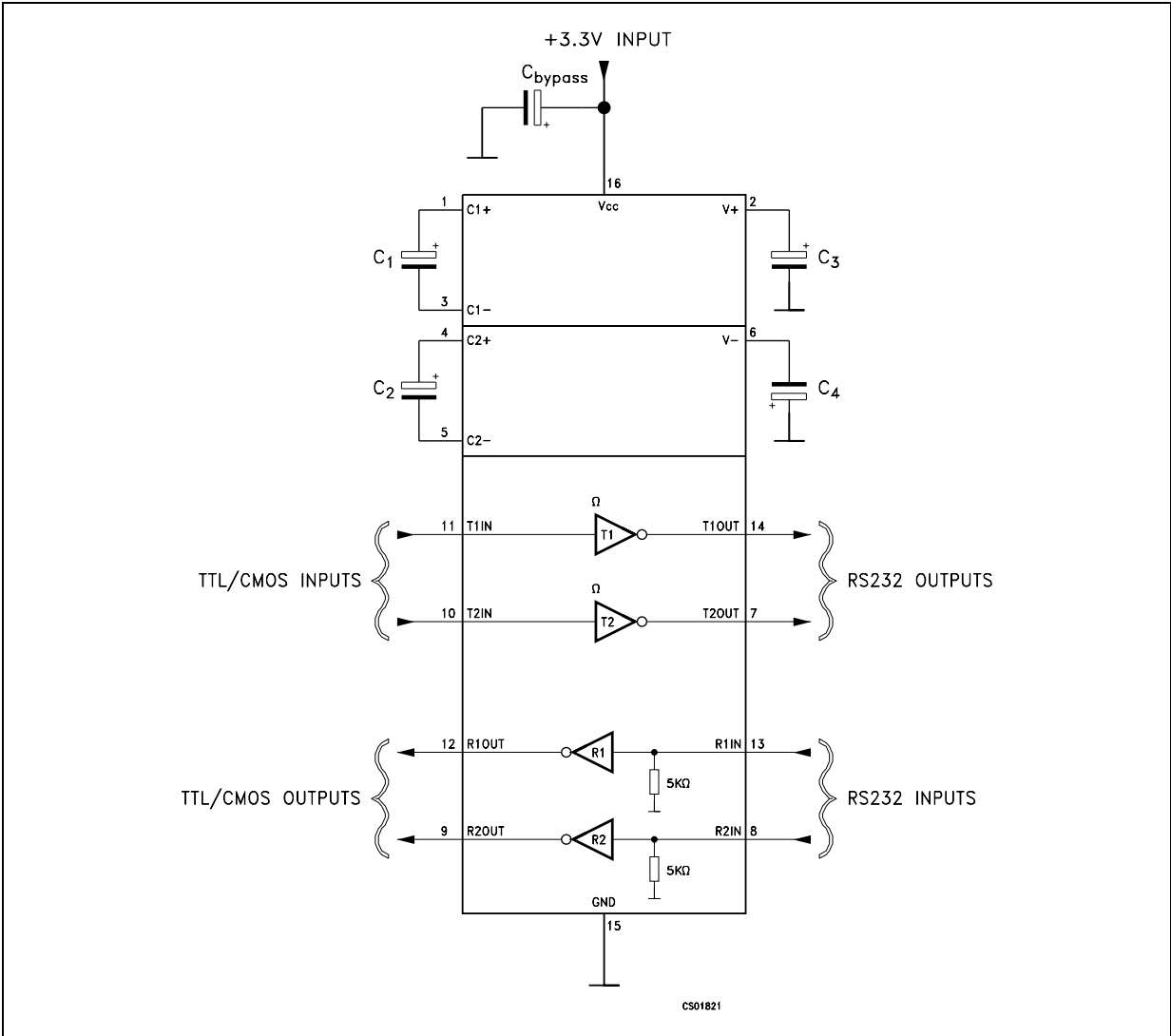


Table 8. Capacitance value (μF)

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	0.1
3.0 to 5.5	0.1	0.47	0.47	0.47	0.1

5 Typical performance characteristics

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

Figure 4. Output current vs output high voltage

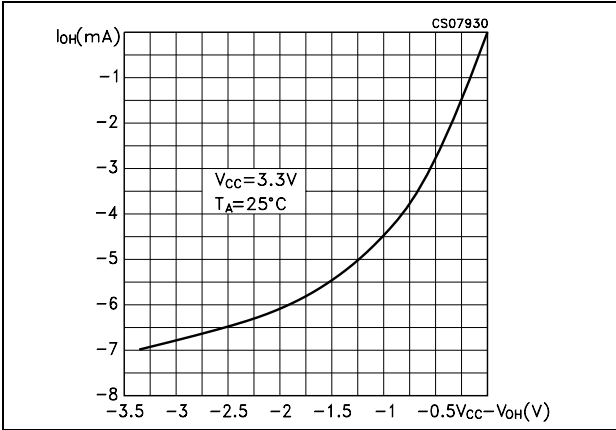


Figure 5. Output current vs output high voltage

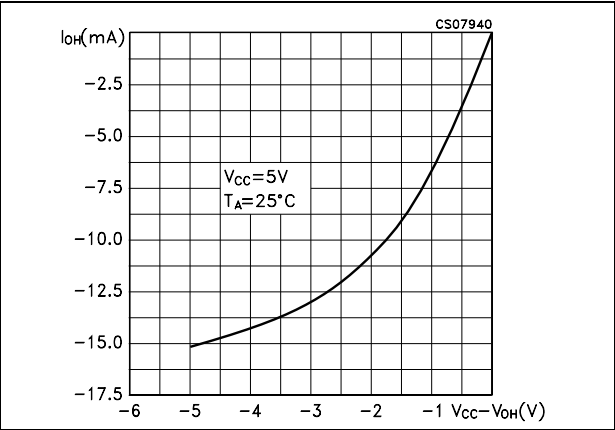


Figure 6. Output current vs output low voltage

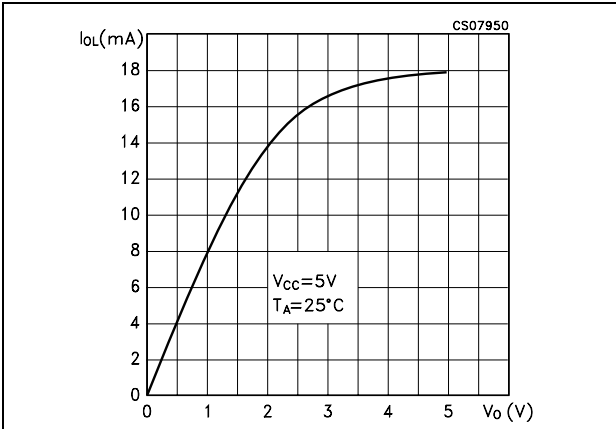


Figure 7. Output current vs output low voltage

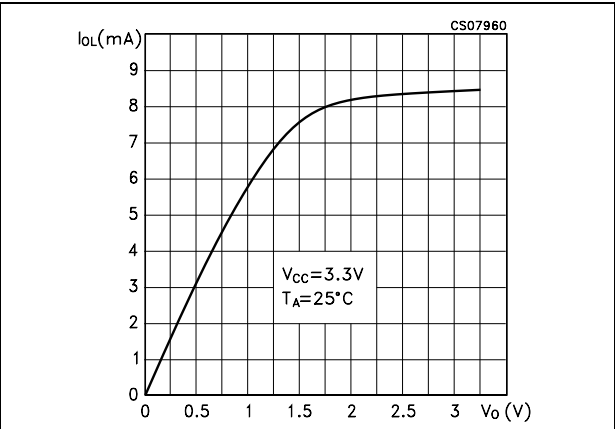


Figure 8. Voltage transfer characteristics for transmitter inputs

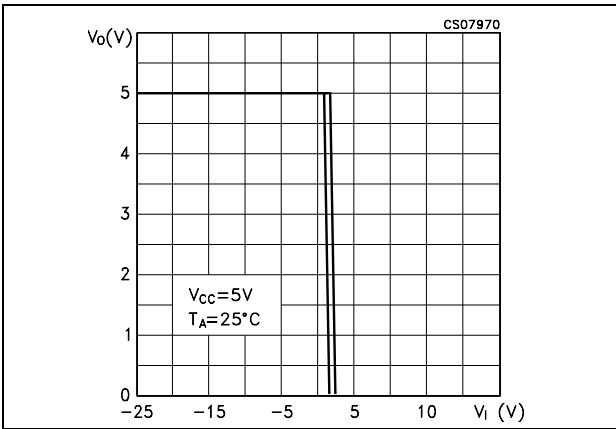
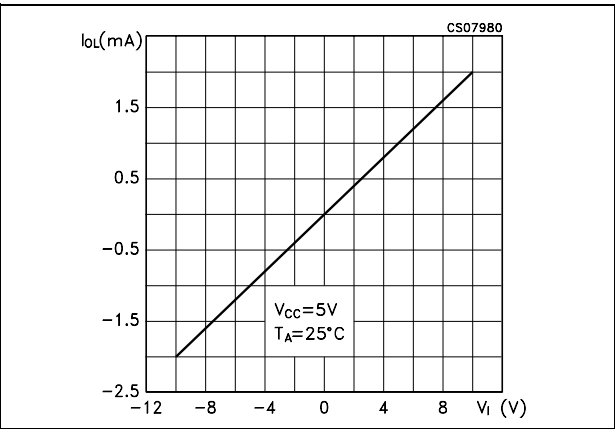


Figure 9. Receiver input resistance

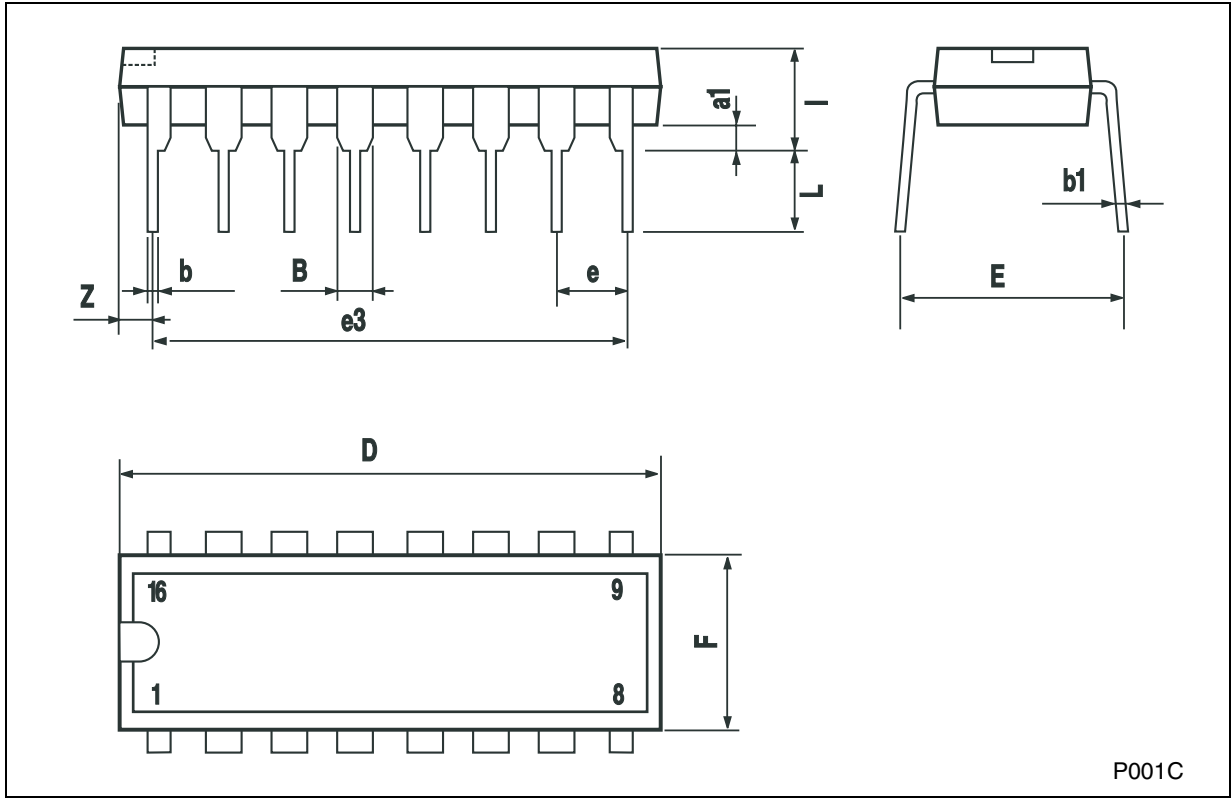


6 Package mechanical data

In order to meet environmental requirements, ST offers these devices in 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.

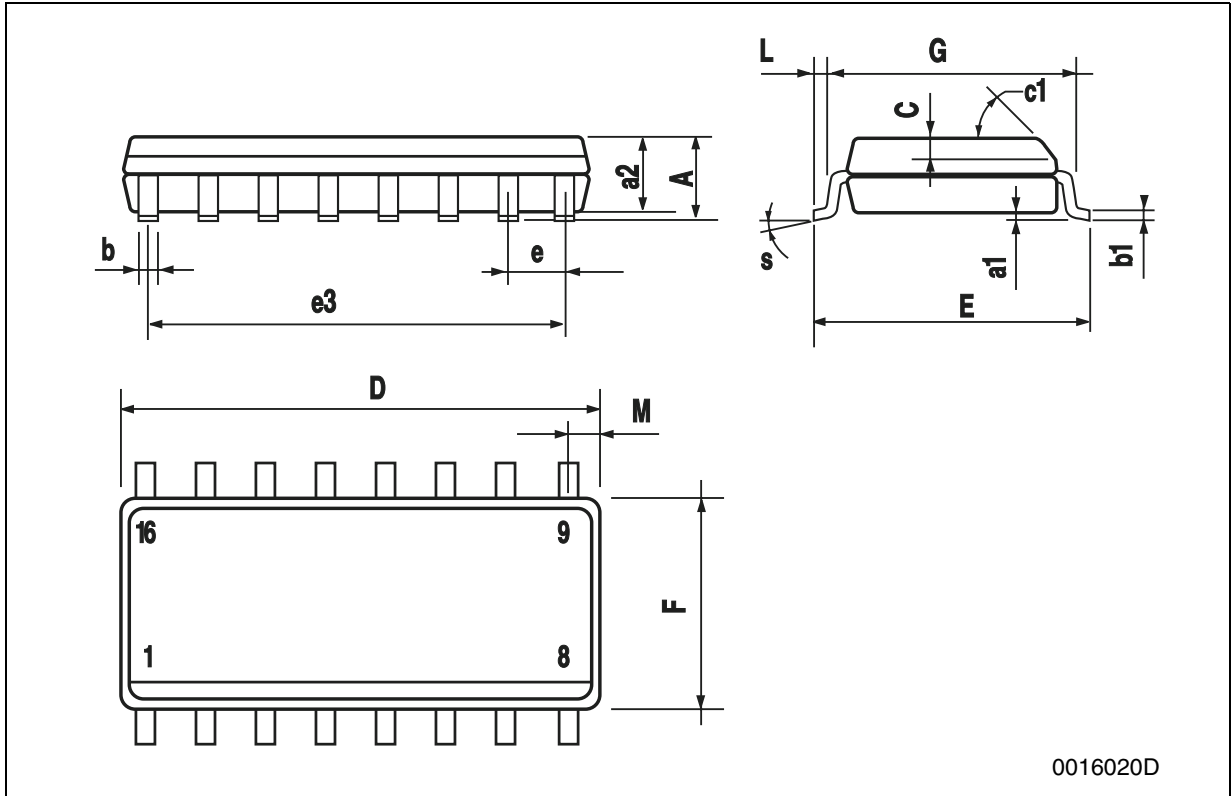
Plastic DIP-16 (0.25) MECHANICAL DATA

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



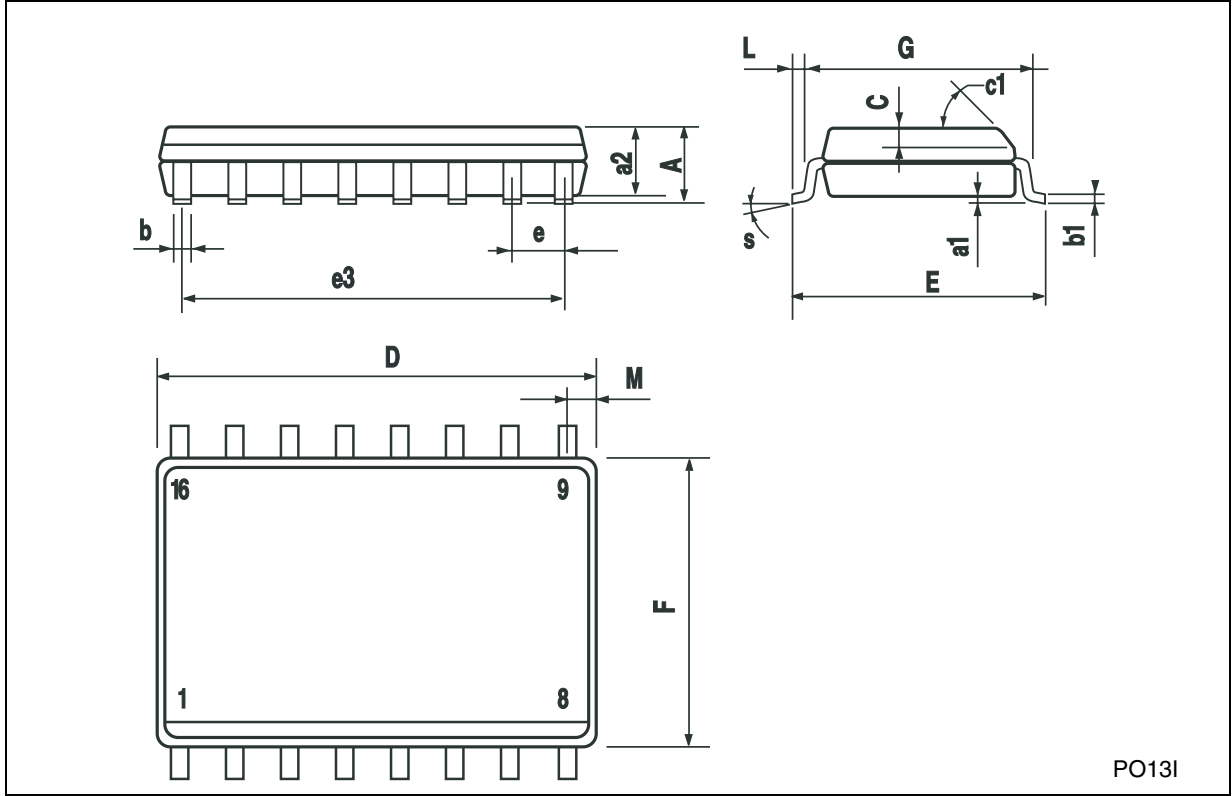
SO-16 MECHANICAL DATA

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

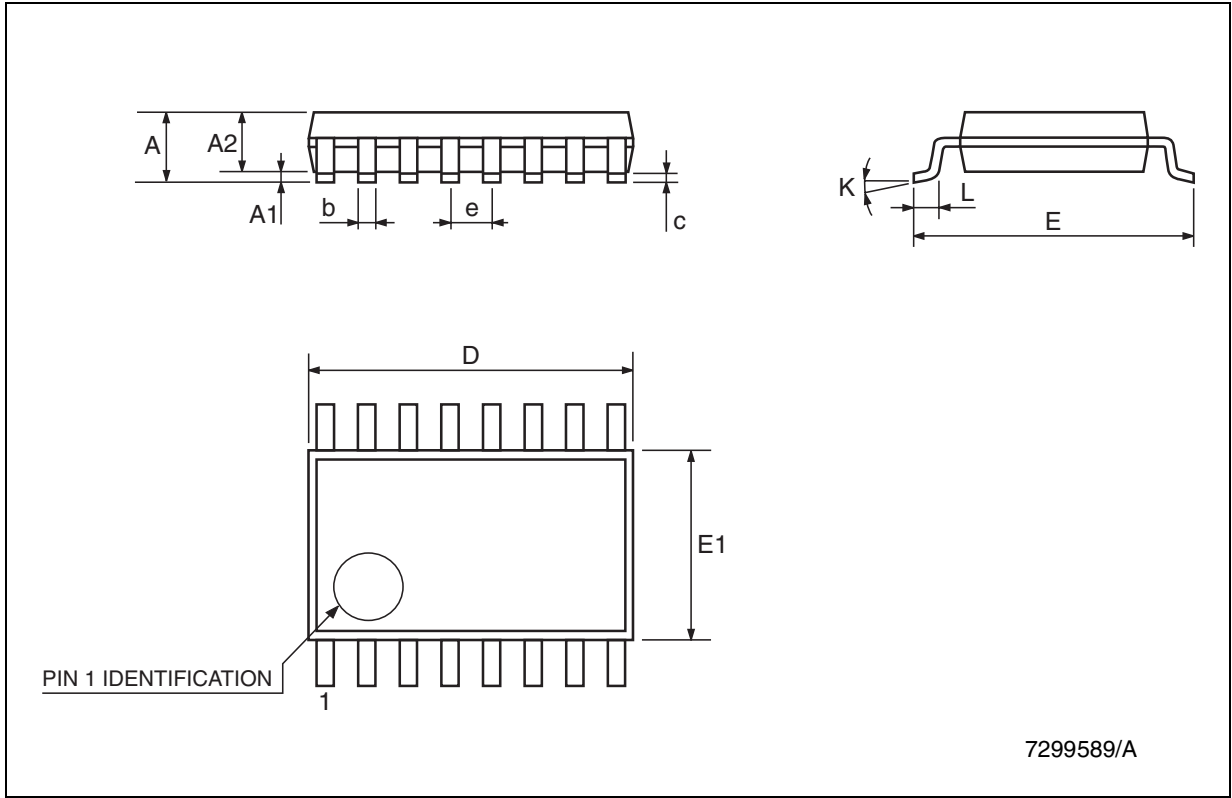
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			2.65			0.104
a1	0.1		0.2	0.004		0.008
a2			2.45			0.096
b	0.35		0.49	0.014		0.019
b1	0.23		0.32	0.009		0.012
C		0.5			0.020	
c1	45° (typ.)					
D	10.1		10.5	0.397		0.413
E	10.0		10.65	0.393		0.419
e		1.27			0.050	
e3		8.89			0.350	
F	7.4		7.6	0.291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



PO13I

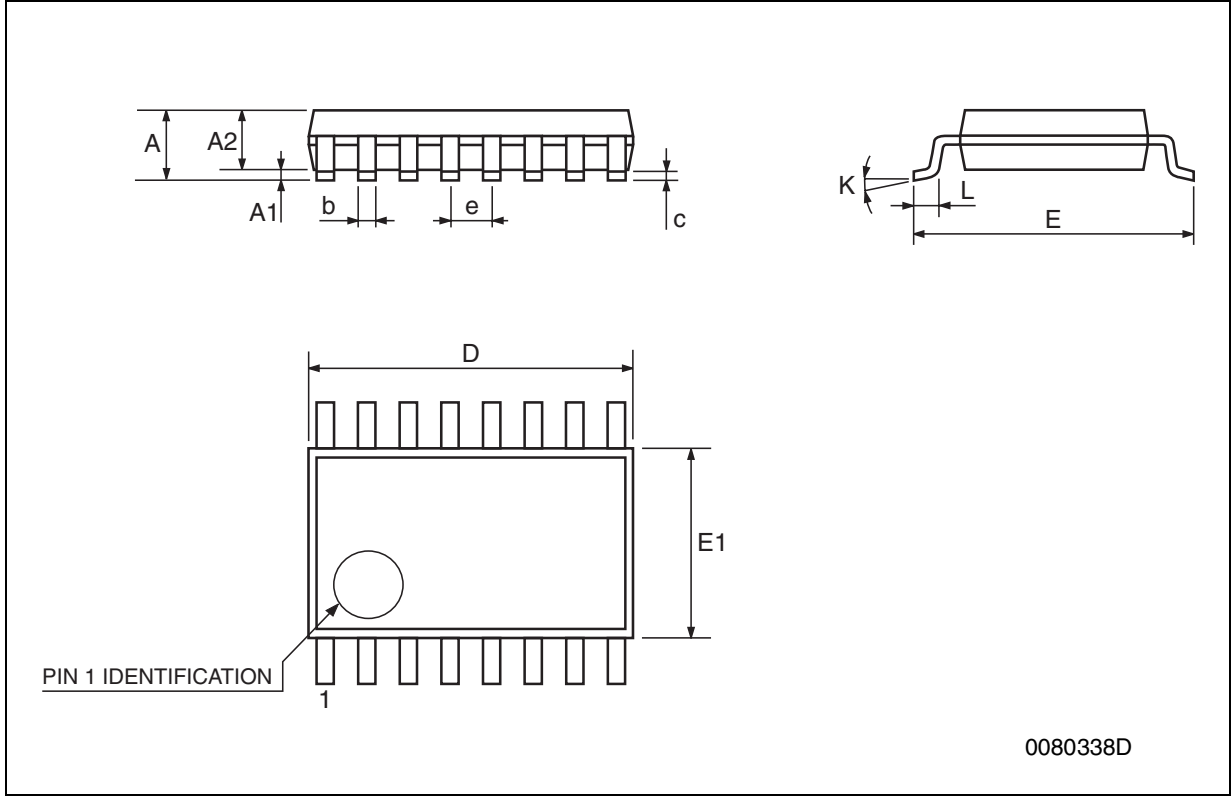
SSOP16 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			2			0.079
A1	0.05		0.21	0.002		0.008
A2	1.65		1.85	0.065		0.073
b	0.22		0.38	0.009		0.015
c	0.09		0.25	0.0035		0.0098
D	5.9		6.5	0.232		0.256
E	7.4		8.2	0.291		0.323
E1	5.3	5	5.6	0.197	0.209	0.220
e		0.65			0.0256	
K	0°		8°	0°		8°
L	0.55		0.95	0.022		0.037



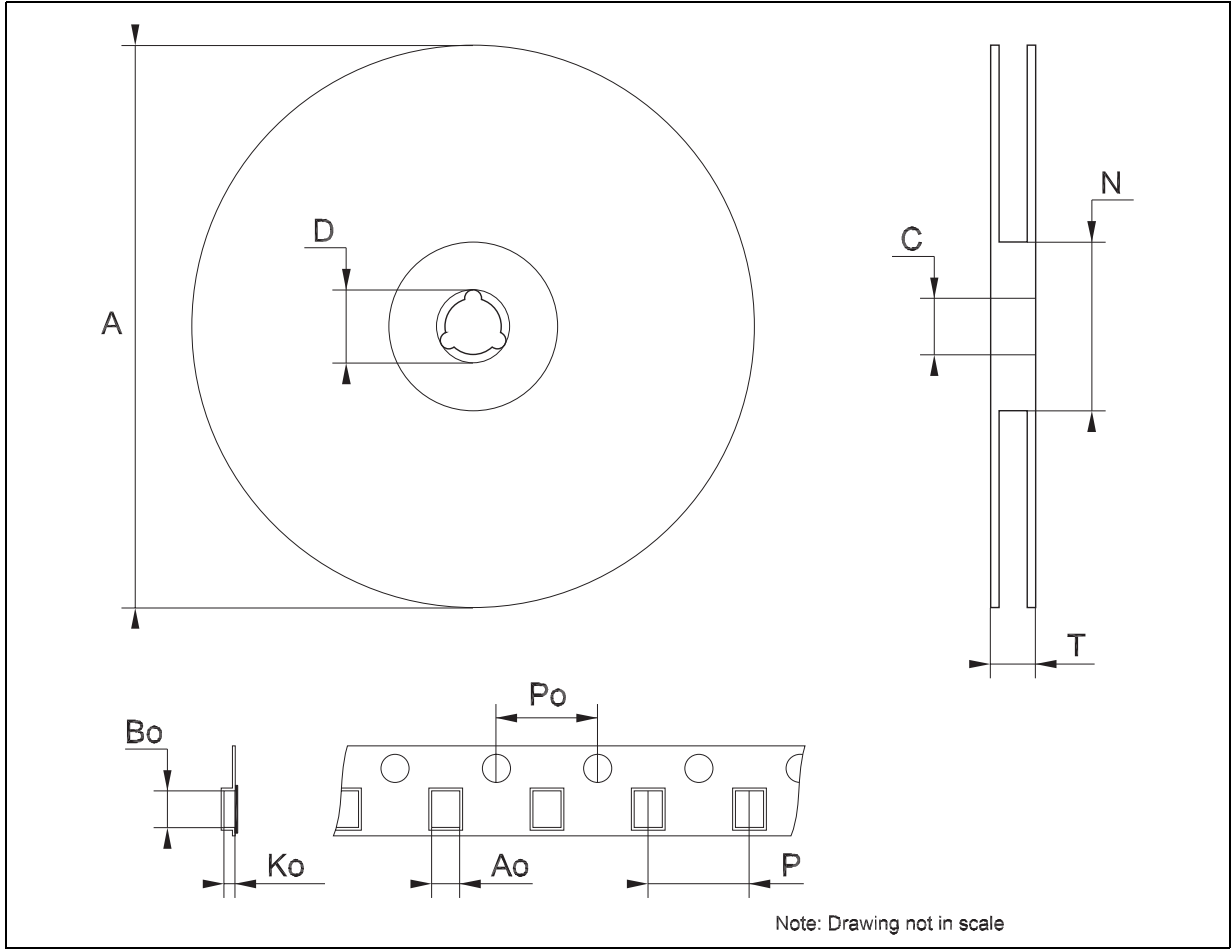
TSSOP16 MECHANICAL DATA

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



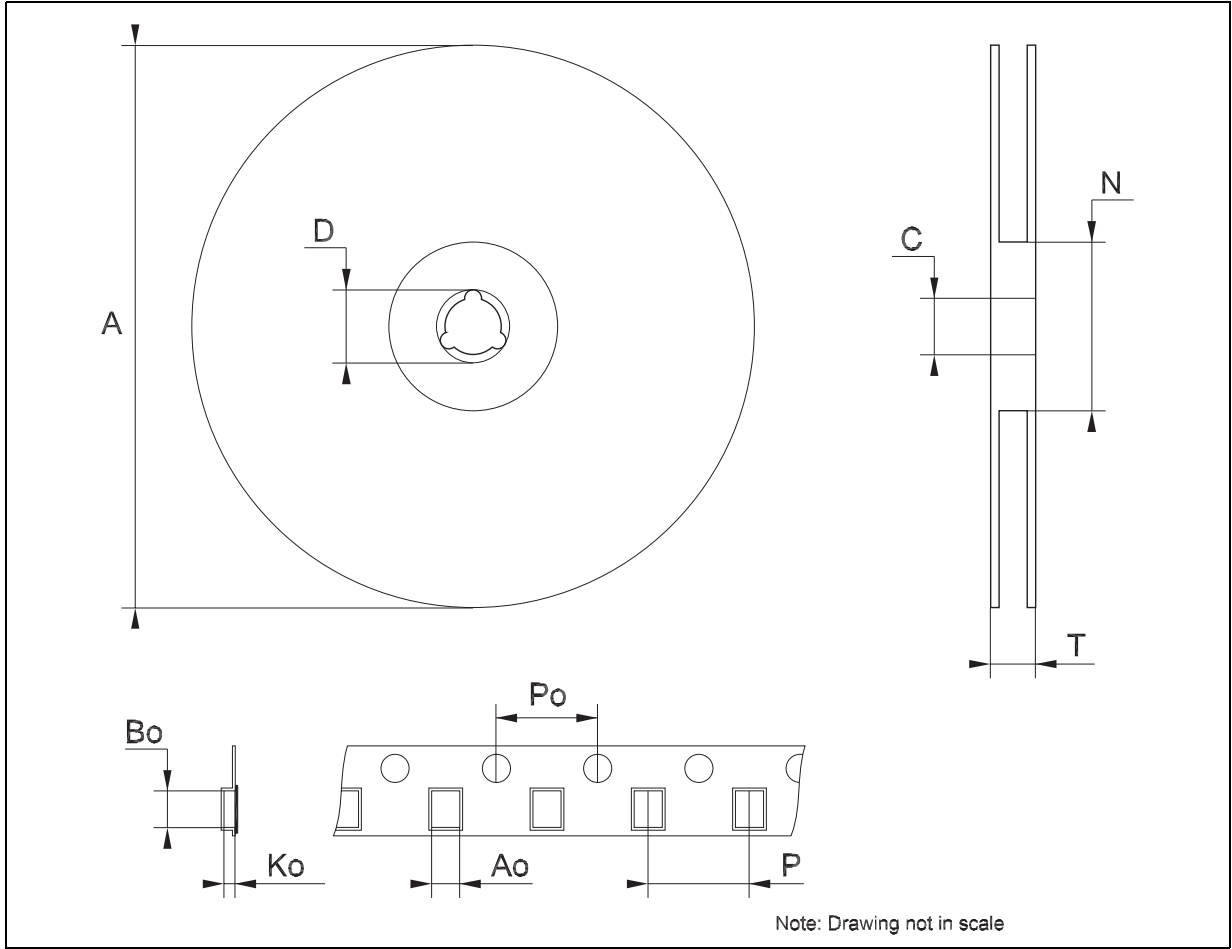
Tape & Reel SO-16 MECHANICAL DATA

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



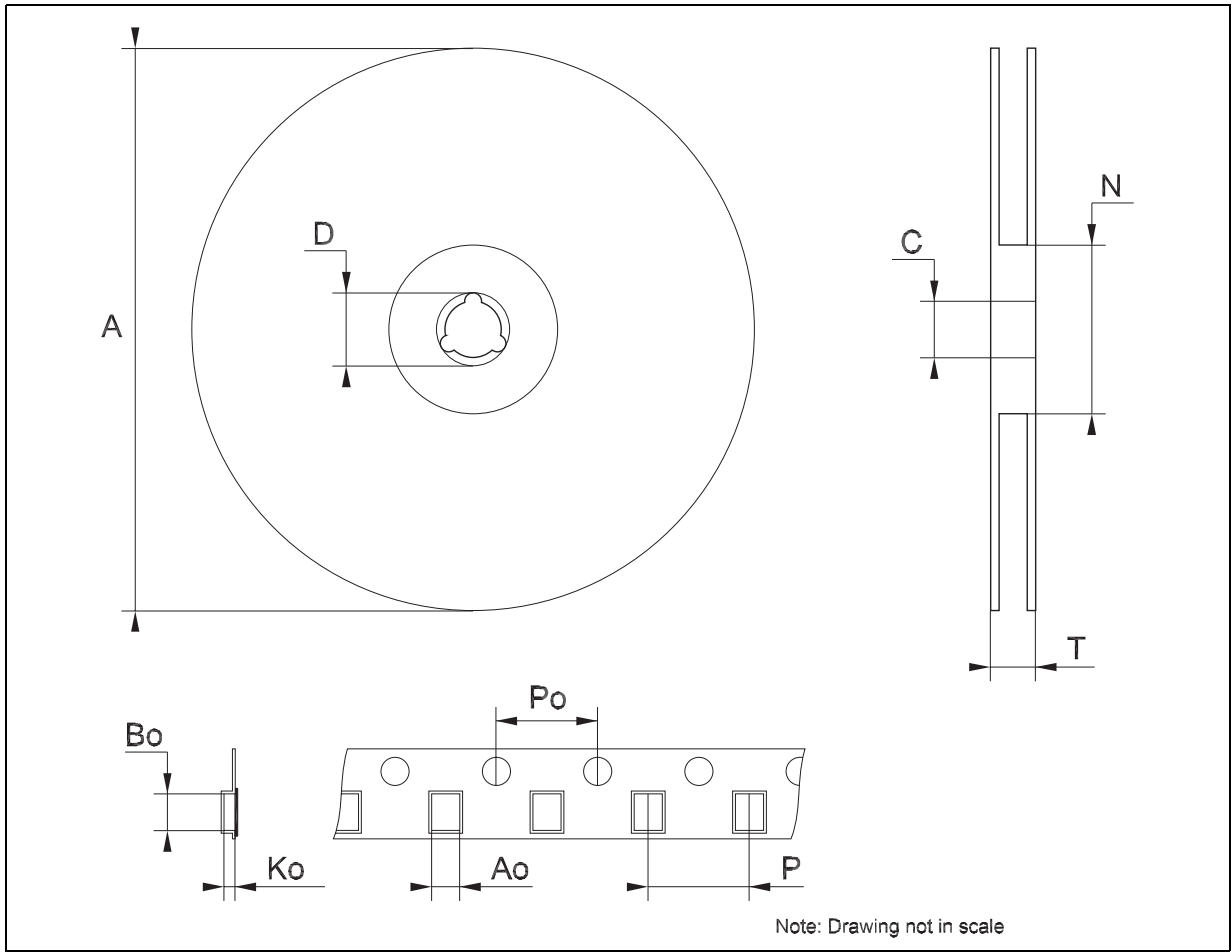
Tape & Reel SO-16L MECHANICAL DATA

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



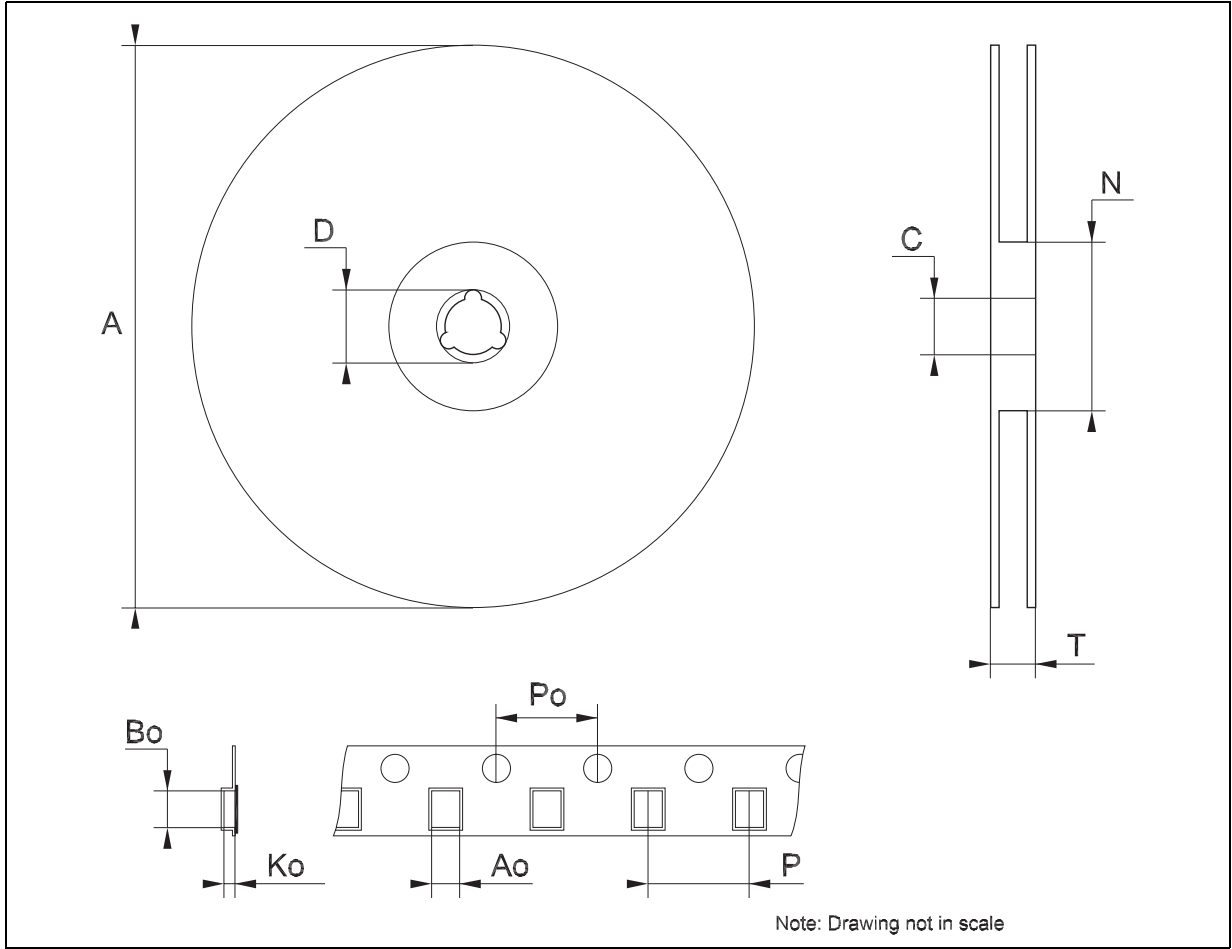
Tape & Reel SSOP16 MECHANICAL DATA

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	8.4		8.6	0.331		0.339
Bo	6.7		6.9	0.264		0.272
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 9. Revision history

Date	Revision	Changes
06-Sep-2006	3	Order codes has been updated and new template.

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