

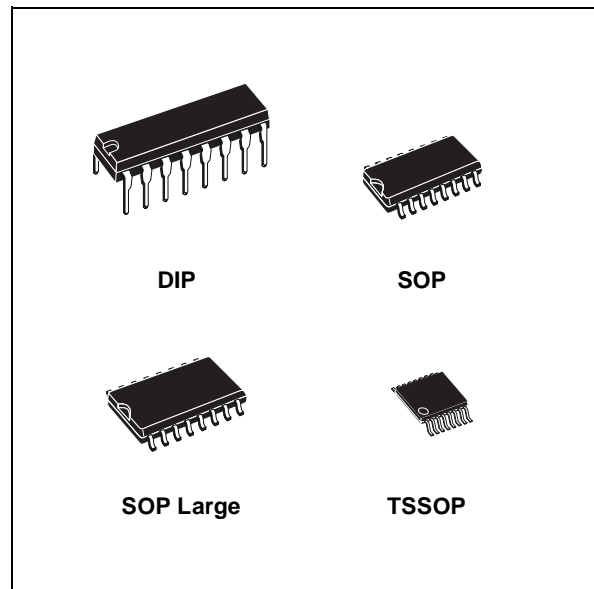


## 5V POWERED MULTI-CHANNEL RS-232 DRIVERS AND RECEIVERS

- SUPPLY VOLTAGE RANGE: 4.5 TO 5.5V
- SUPPLY CURRENT NO LOAD (TYP): 5mA
- TRANSMITTER OUTPUT VOLTAGE SWING (TYP):  $\pm 7.8V$
- CONTROLLED OUTPUT SLEW RATE
- RECEIVER INPUT VOLTAGE RANGE:  $\pm 30V$
- DATA RATE (TYP): 220Kbps
- OPERATING TEMPERATURE RANGE:  
-40 TO 85°C, 0 TO 70°C
- COMPATIBLE WITH MAX232 AND MAX202

### DESCRIPTION

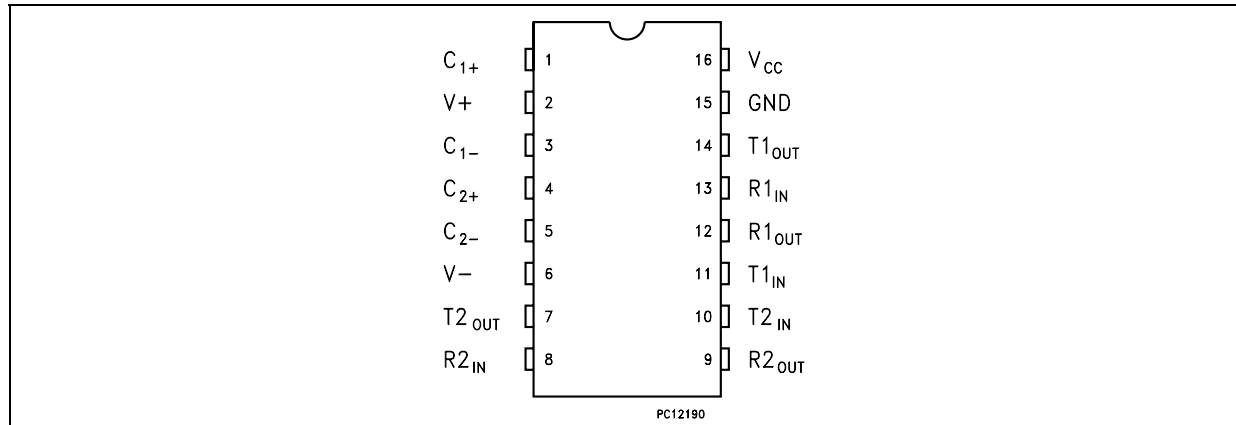
The ST232 is a 2 driver, 2 receiver device following EIA/TIA-232 and V.28 communication standard. It is particularly suitable for applications where  $\pm 12V$  is not available. The ST232 uses a single 5V power supply and only four external capacitors (0.1 $\mu F$ ). Typical applications are in: Portable Computers, Low Power Modems, Interfaces Translation, Battery Powered RS-232 System, Multi-Drop RS-232 Networks.



### ORDERING CODES

Type	Temperature Range	Package	Comments
ST232CN	0 to 70 °C	DIP-16	25parts per tube / 40tube per box
ST232BN	-40 to 85 °C	DIP-16	25parts per tube / 40tube per box
ST232CD	0 to 70 °C	SO-16 (Tube)	50parts per tube / 20tube per box
ST232BD	-40 to 85 °C	SO-16 (Tube)	50parts per tube / 20tube per box
ST232CDR	0 to 70 °C	SO-16 (Tape & Reel)	2500 parts per reel
ST232BDR	-40 to 85 °C	SO-16 (Tape & Reel)	2500 parts per reel
ST232CW	0 to 70 °C	SO-16 Large (Tube)	49 parts per tube / 25 tube per box
ST232BW	-40 to 85 °C	SO-16 Large (Tube)	49 parts per tube / 25 tube per box
ST232CWR	0 to 70 °C	SO-16 Large (Tape & Reel)	1000 parts per reel
ST232BWR	-40 to 85 °C	SO-16 Large (Tape & Reel)	1000 parts per reel
ST232CT	0 to 70 °C	TSSOP16 (Tube)	only for samples
ST232BT	-40 to 85 °C	TSSOP16 (Tube)	only for samples
ST232CTR	0 to 70 °C	TSSOP16 (Tape & Reel)	2500 parts per reel
ST232BTR	-40 to 85 °C	TSSOP16 (Tape & Reel)	2500 parts per reel

**PIN CONFIGURATION**



**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_OUT</sub>	Second Transmitter Output Voltage
8	R <sub>2_IN</sub>	Second Receiver Input Voltage
9	R <sub>2_OUT</sub>	Second Receiver Output Voltage
10	T <sub>2_IN</sub>	Second Transmitter Input Voltage
11	T <sub>1_IN</sub>	First Transmitter Input Voltage
12	R <sub>1_OUT</sub>	First Receiver Output Voltage
13	R <sub>1_IN</sub>	First Receiver Input Voltage
14	T <sub>1_OUT</sub>	First Transmitter Output Voltage
15	GND	Ground
16	V <sub>CC</sub>	Supply Voltage

**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply Voltage	-0.3 to 6	V
T <sub>IN</sub>	Transmitter Input Voltage Range	-0.3 to (V <sub>CC</sub> + 0.3)	V
R <sub>IN</sub>	Receiver Input Voltage Range	± 30	V
T <sub>OUT</sub>	Transmitter Output Voltage Range	(V <sub>+</sub> + 0.3) to (V <sub>-</sub> - 0.3)	V
R <sub>OUT</sub>	Receiver Output Voltage Range	-0.3 to (V <sub>CC</sub> + 0.3)	V
T <sub>SCTOUT</sub>	Short Circuit Duration on T <sub>OUT</sub>	infinite	
T <sub>stg</sub>	Storage Temperature Range	-65 to + 150	°C

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

Note 1: No external supply can be applied to V+ terminal and V- terminal.

**ELECTRICAL CHARACTERISTICS**

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{\text{SUPPLY}}$	$V_{CC}$ Power Supply Current	No Load, $T_A = 25^\circ\text{C}$		5	10	mA

**TRANSMITTER ELECTRICAL CHARACTERISTICS**

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

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	$\pm 5$	$\pm 7.8$		V
$I_{\text{TIL}}$	Input Leakage Current				$\pm 1$	$\mu\text{A}$
$V_{\text{TIL}}$	Input Logic Threshold Low		0.8			V
$V_{\text{TIH}}$	Input Logic Threshold High				2	V
$\text{SR}_{\text{T}}$	Transition Slew Rate	$T_A = 25^\circ\text{C}$ , $V_{CC} = 5\text{V}$ $R_L = 3$ to $7\text{K}\Omega$ , $C_L = 50$ to $2500\text{pF}$ (Note 1)		7	30	$\text{V}/\mu\text{s}$
$D_{\text{R}}$	Data Rate	(Note 2)	120	220		Kbits/s
$R_{\text{TOUT}}$	Transmitter Output Resistance	$V_{CC} = V_+ = V_- = 0\text{V}$ $V_{\text{OUT}} = \pm 2\text{V}$	300			$\Omega$
$I_{\text{SC}}$	Transmitter Output Short Circuit Current	One $T_{\text{XOUT}}$ to GND		$\pm 10$	$\pm 60$	mA

Note 1: Measured from  $3\text{V}$  to  $-3\text{V}$  or from  $-3\text{V}$  to  $3\text{V}$ .

Note 2: One transmitter output is loaded with  $R_L = 3\text{K}\Omega$  to  $7\text{K}\Omega$ ,  $C_L = 50$  to  $1000\text{pF}$

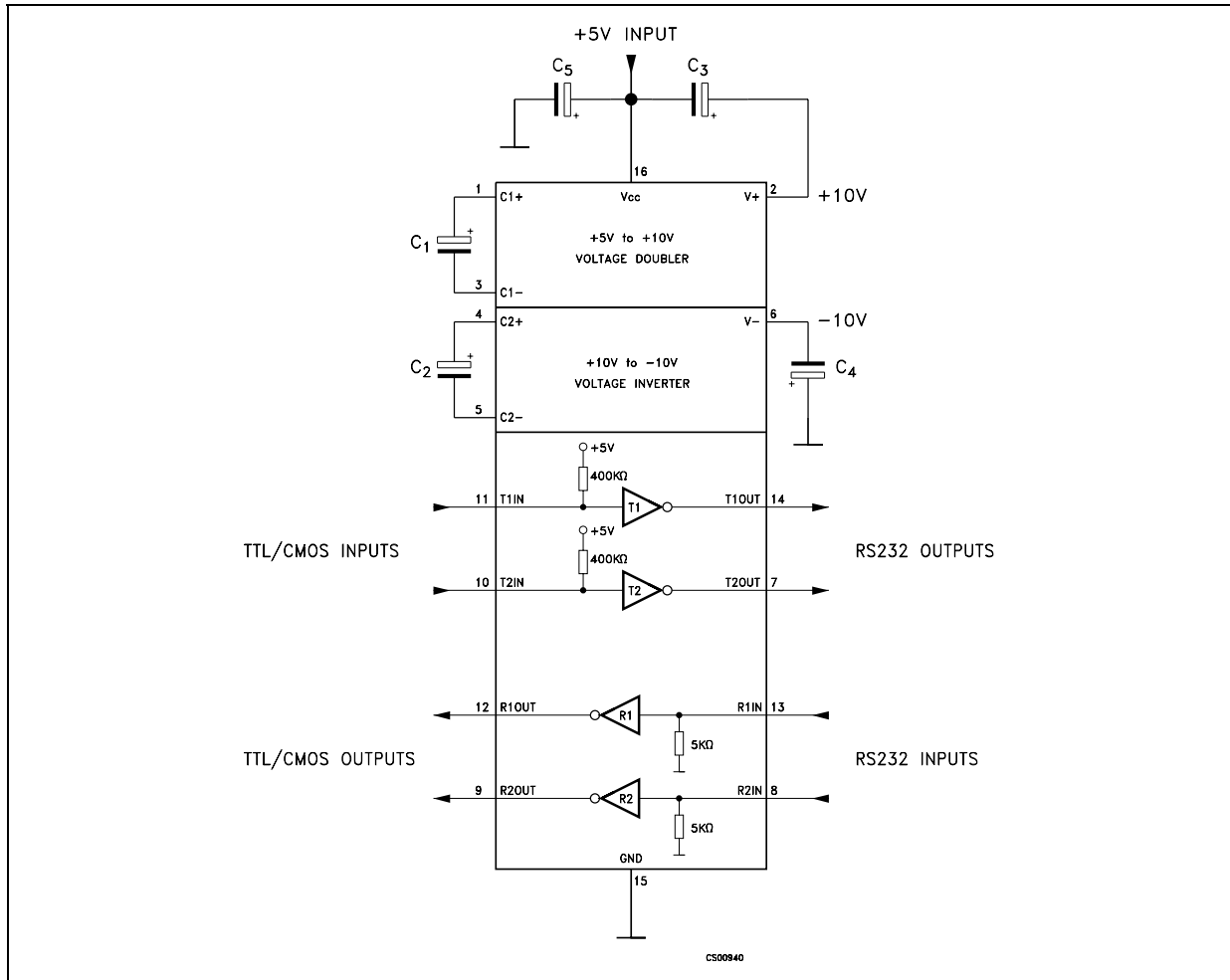
**RECEIVER ELECTRICAL CHARACTERISTICS**

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{\text{RIN}}$	Receiver Input Voltage Operating Range		-30		30	V
$R_{\text{RIN}}$	RS-232 Input Resistance	$T_A = 25^\circ\text{C}$ , $V_{CC} = 5\text{V}$ , $V_{\text{RIN}} = 5\text{V}$	3	5	7	$\text{K}\Omega$
$V_{\text{RIL}}$	RS-232 Input Logic Threshold Low	$T_A = 25^\circ\text{C}$ , $V_{CC} = 5\text{V}$	0.8	1.2		V
$V_{\text{RIH}}$	RS-232 Input Logic Threshold High	$T_A = 25^\circ\text{C}$ , $V_{CC} = 5\text{V}$		1.7	2.4	V
$V_{\text{RIHYS}}$	RS-232 Input Hysteresis	$V_{CC} = 5\text{V}$	0.2	0.5	1	V
$V_{\text{ROL}}$	TTL/CMOS Output Voltage Low	$I_{\text{OUT}} = 3.2\text{mA}$ (to $V_{CC}$ )			0.4	V
$V_{\text{ROH}}$	TTL/CMOS Output Voltage High	$I_{\text{OUT}} = -1\text{mA}$ (to GND)	3.5	$V_{CC}-0.4$		V
$t_{\text{DR}}$	Receiver Propagation Delay	$C_L = 150\text{pF}$ (Note 1)		0.3	1	$\mu\text{s}$
$I_{\text{SCR}}$	Receiver Output Short Circuit Current			$\pm 10$		mA

Note 1: RS-232 IN to TTL-CMOS OUT (from 50% to 50%)

APPLICATION CIRCUITS (note 1, note 2)



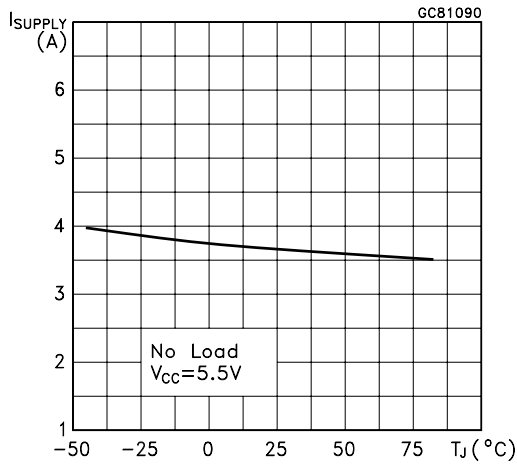
Note 1: C<sub>1-4</sub> capacitors can even be 1μF ones.  
 Note 2: C<sub>1-4</sub> can be common or biased capacitors.

CAPACITANCE VALUE (μF)

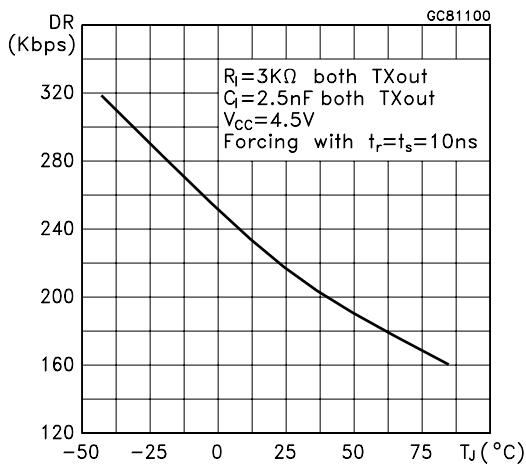
C1	C2.	C3	C4	C5
0.1	0.1	0.1	0.1	0.1

**TYPICAL PERFORMANCE CHARACTERISTICS** (unless otherwise specified  $T_j = 25^\circ\text{C}$ )

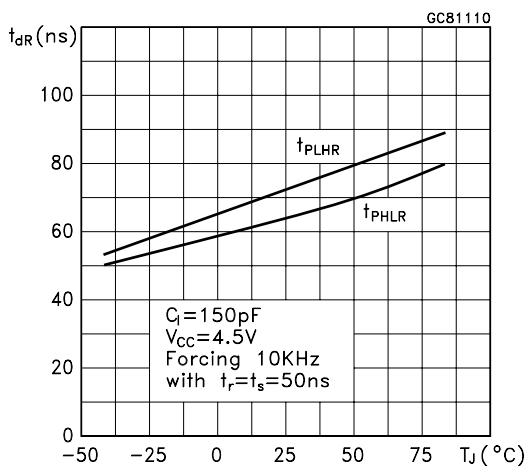
**Figure 1 : Supply Current vs Temperature**



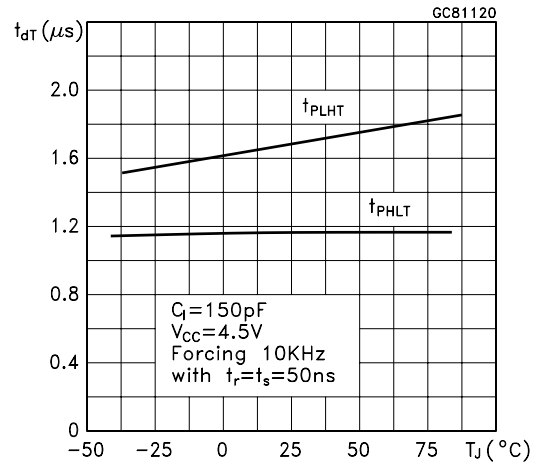
**Figure 2 : Data Rate vs Temperature**



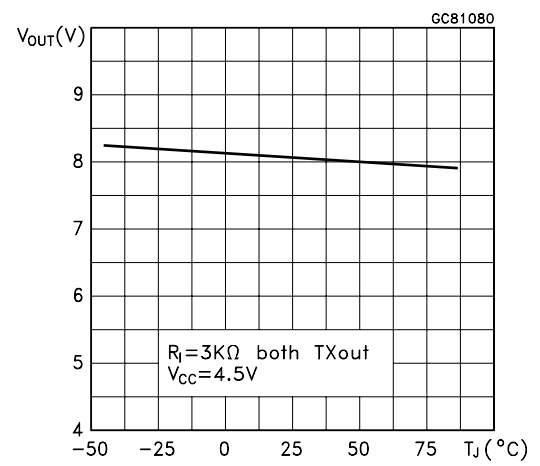
**Figure 3 : Receiver Propagation Delay**



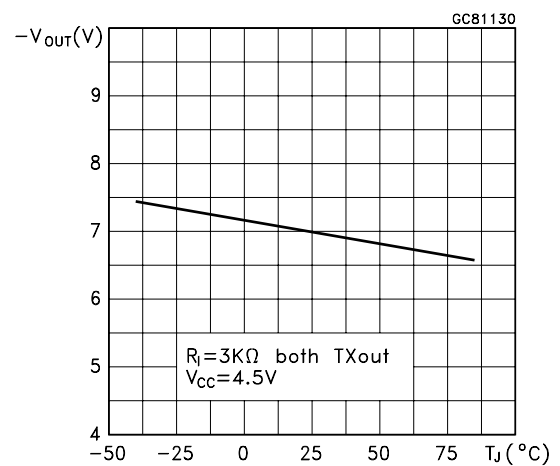
**Figure 4 : Driver Propagation Delay**



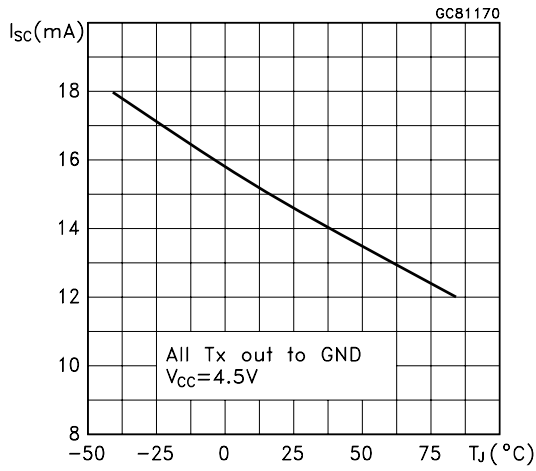
**Figure 5 : High Level Output Voltage Swing vs Temperature**



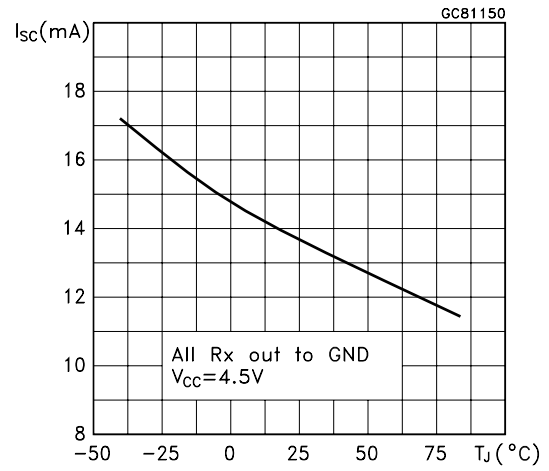
**Figure 6 : Low Level Output Voltage Swing vs Temperature**



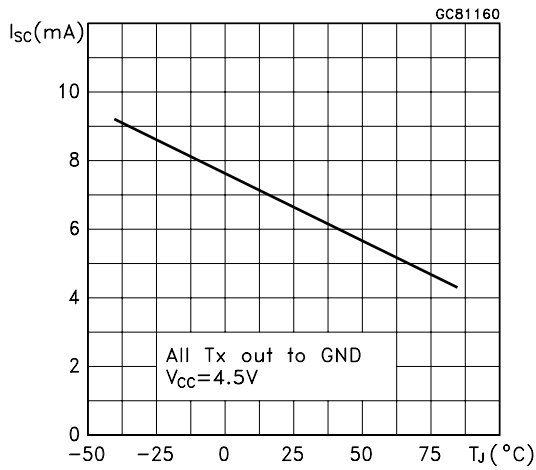
**Figure 7 : High Level Transmitter Output Short Circuit Current vs Temperature**



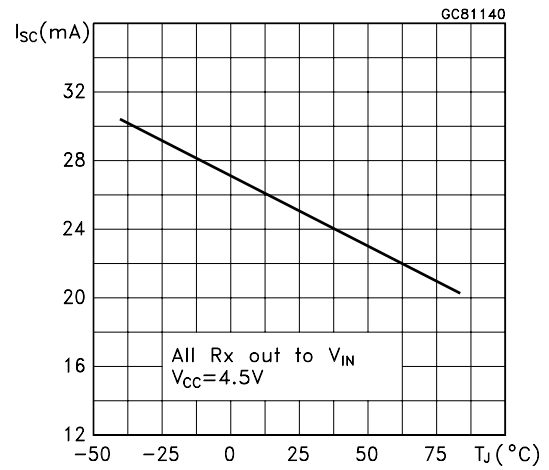
**Figure 9 : High Level Receiver Output Short Circuit Current vs Temperature**



**Figure 8 : Low Level Transmitter Output Short Circuit Current vs Temperature**

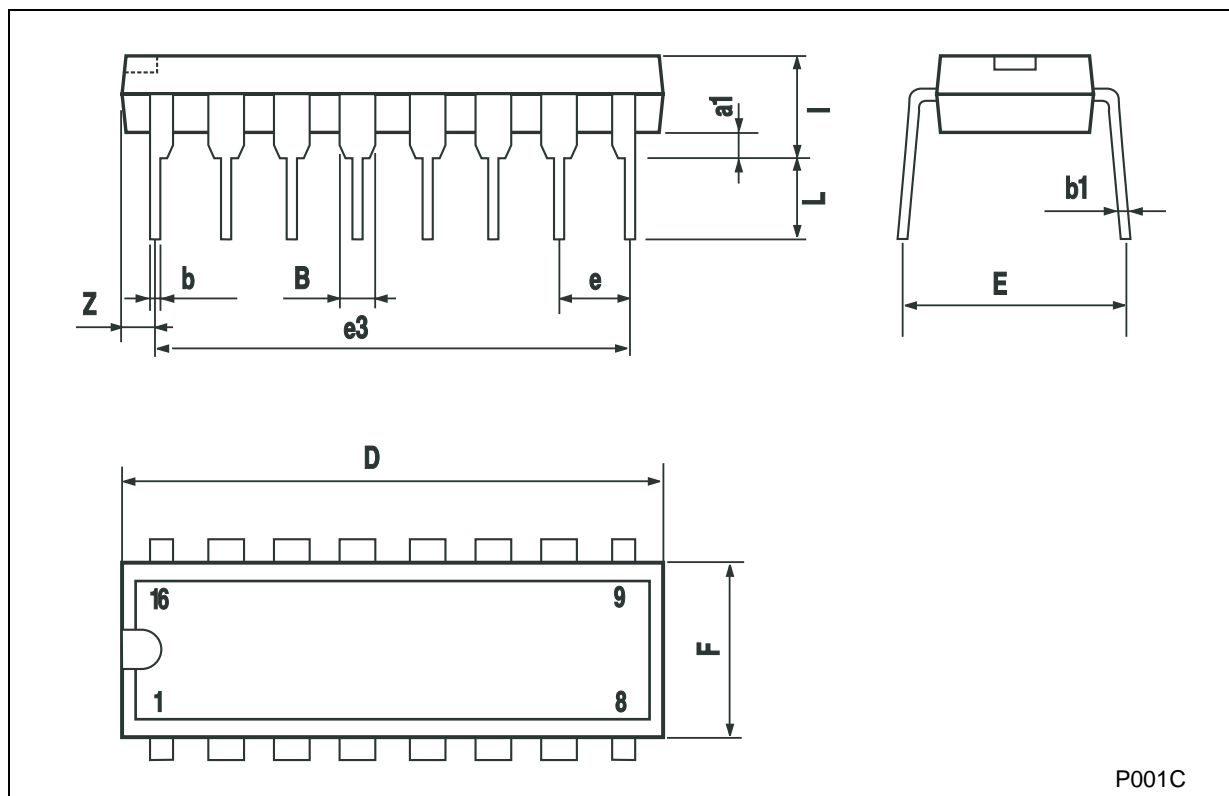


**Figure 10 : Low Level Receiver Output Short Circuit Current vs Temperature**



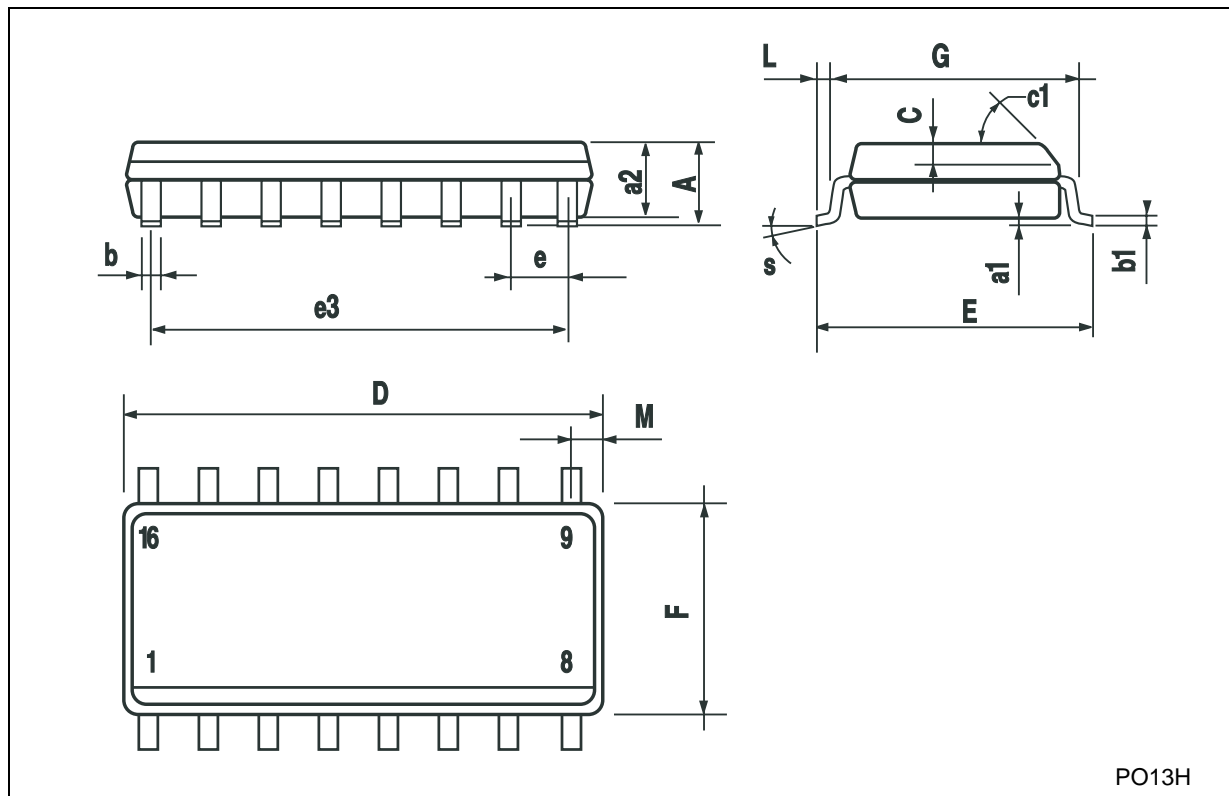
### Plastic DIP-16 (0.25) MECHANICAL DATA

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

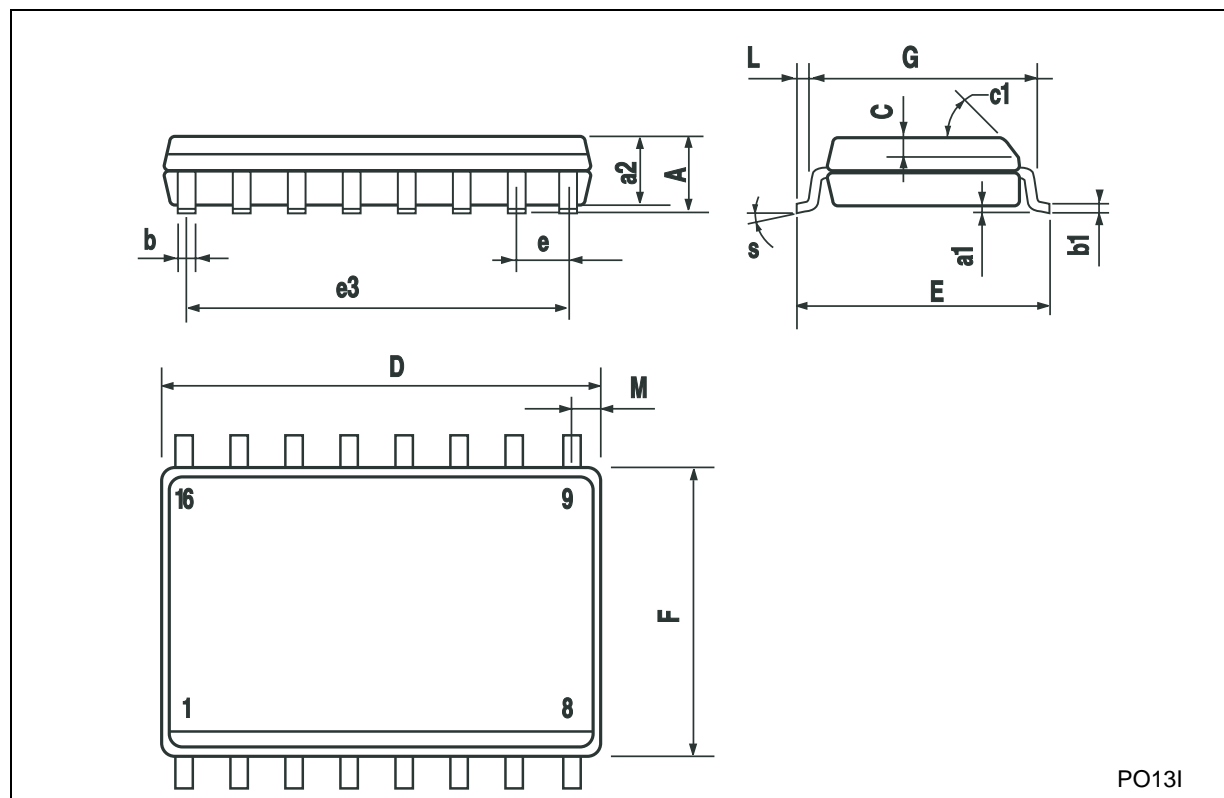
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.004		0.008
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157
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.)		





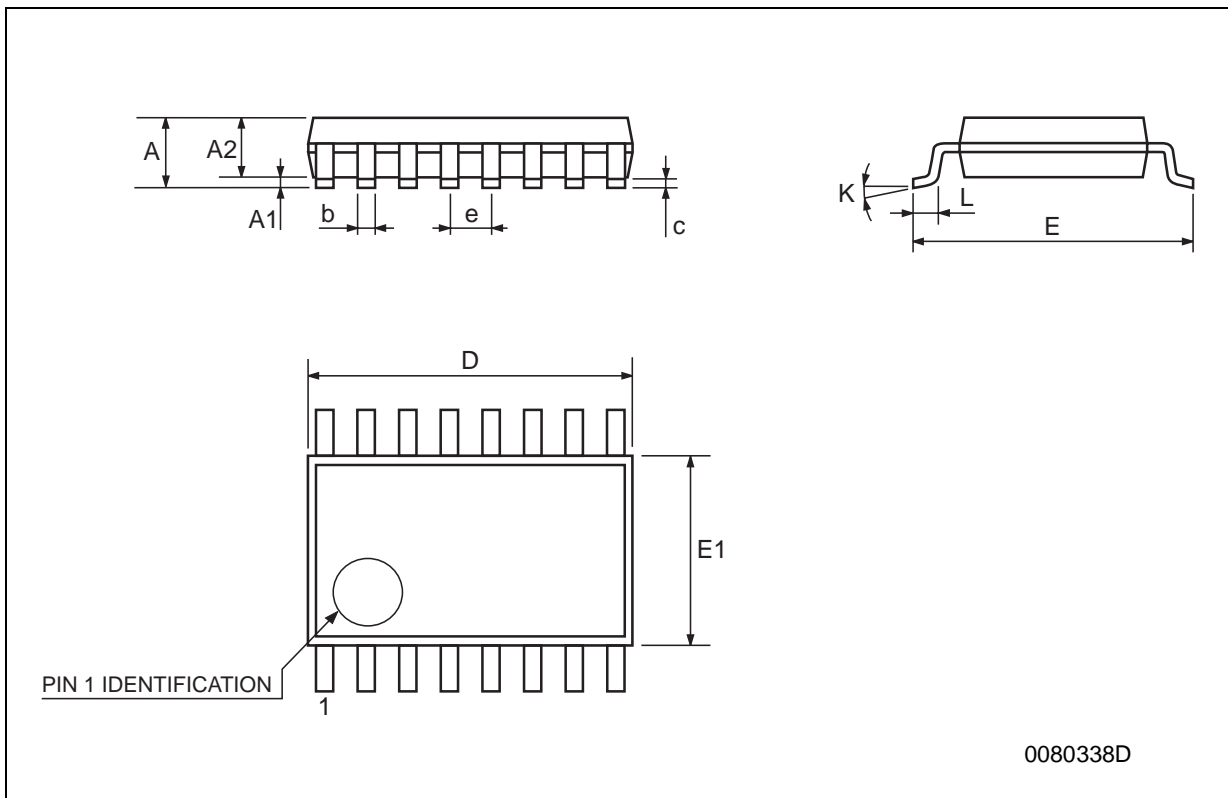
## SO-16L MECHANICAL DATA

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.)		



**TSSOP16 MECHANICAL DATA**

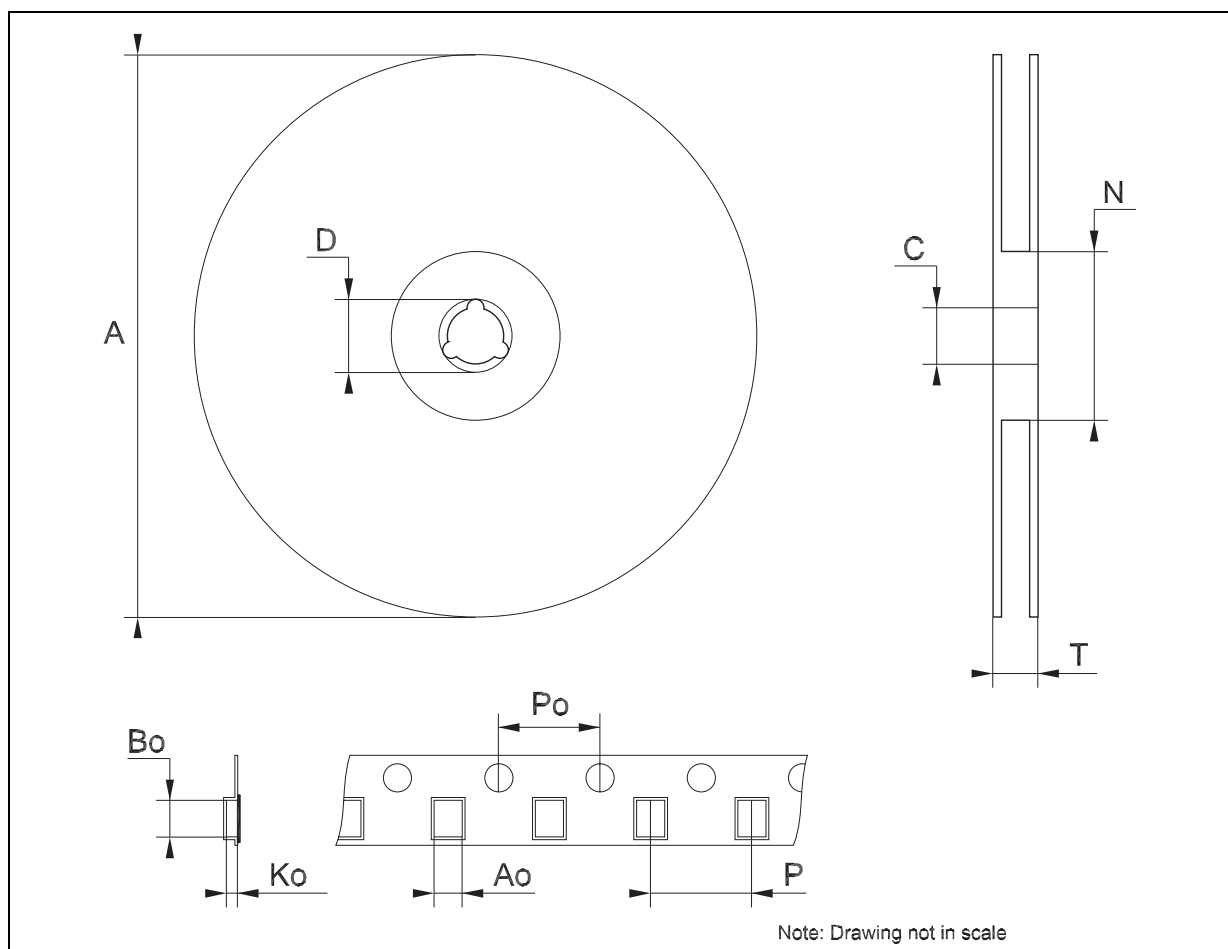
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.2			0.047
A1	0.05		0.15	0.002	0.004	0.006
A2	0.8	1	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.012
c	0.09		0.20	0.004		0.0079
D	4.9	5	5.1	0.193	0.197	0.201
E	6.2	6.4	6.6	0.244	0.252	0.260
E1	4.3	4.4	4.48	0.169	0.173	0.176
e		0.65 BSC			0.0256 BSC	
K	0°		8°	0°		8°
L	0.45	0.60	0.75	0.018	0.024	0.030



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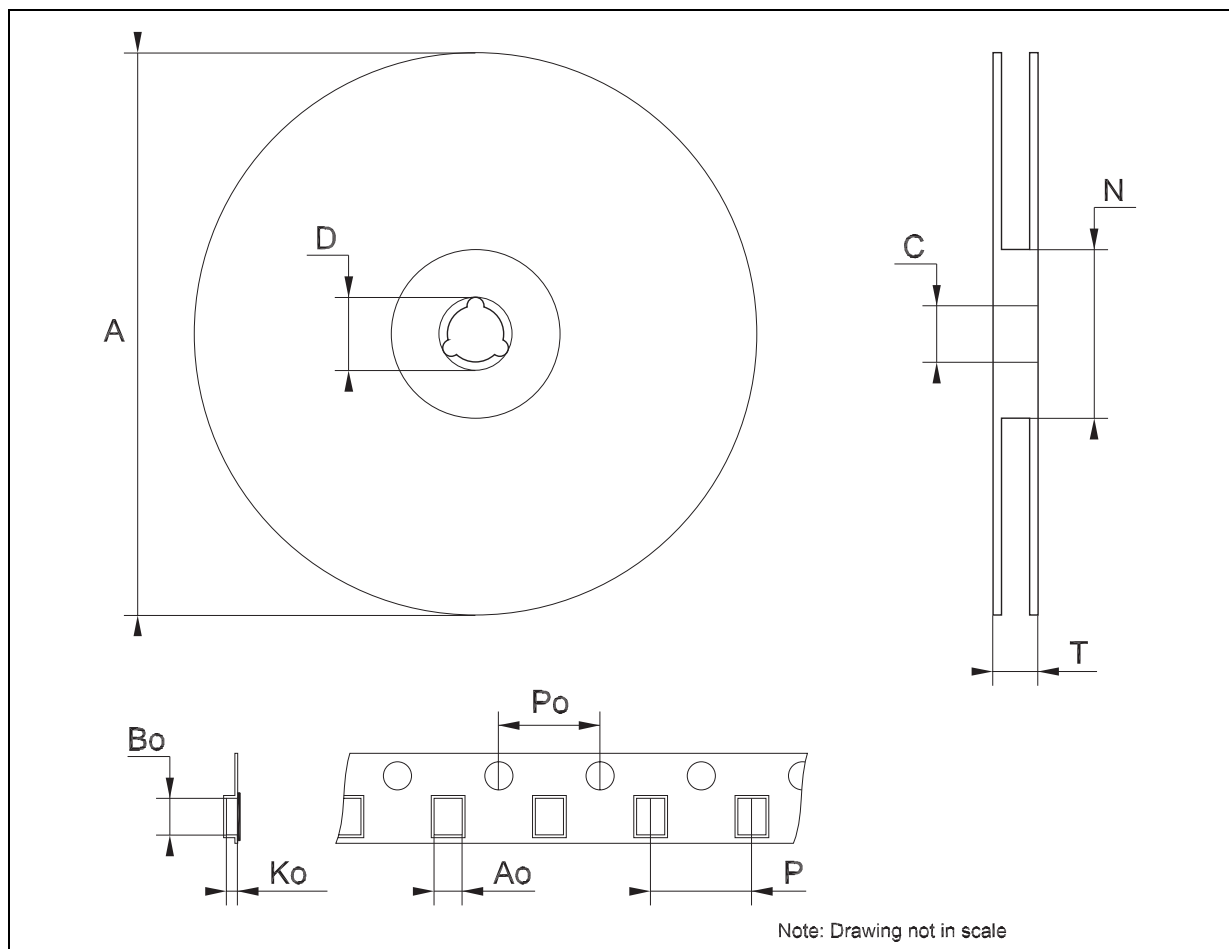
## Tape &amp; Reel SO-16 MECHANICAL DATA

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



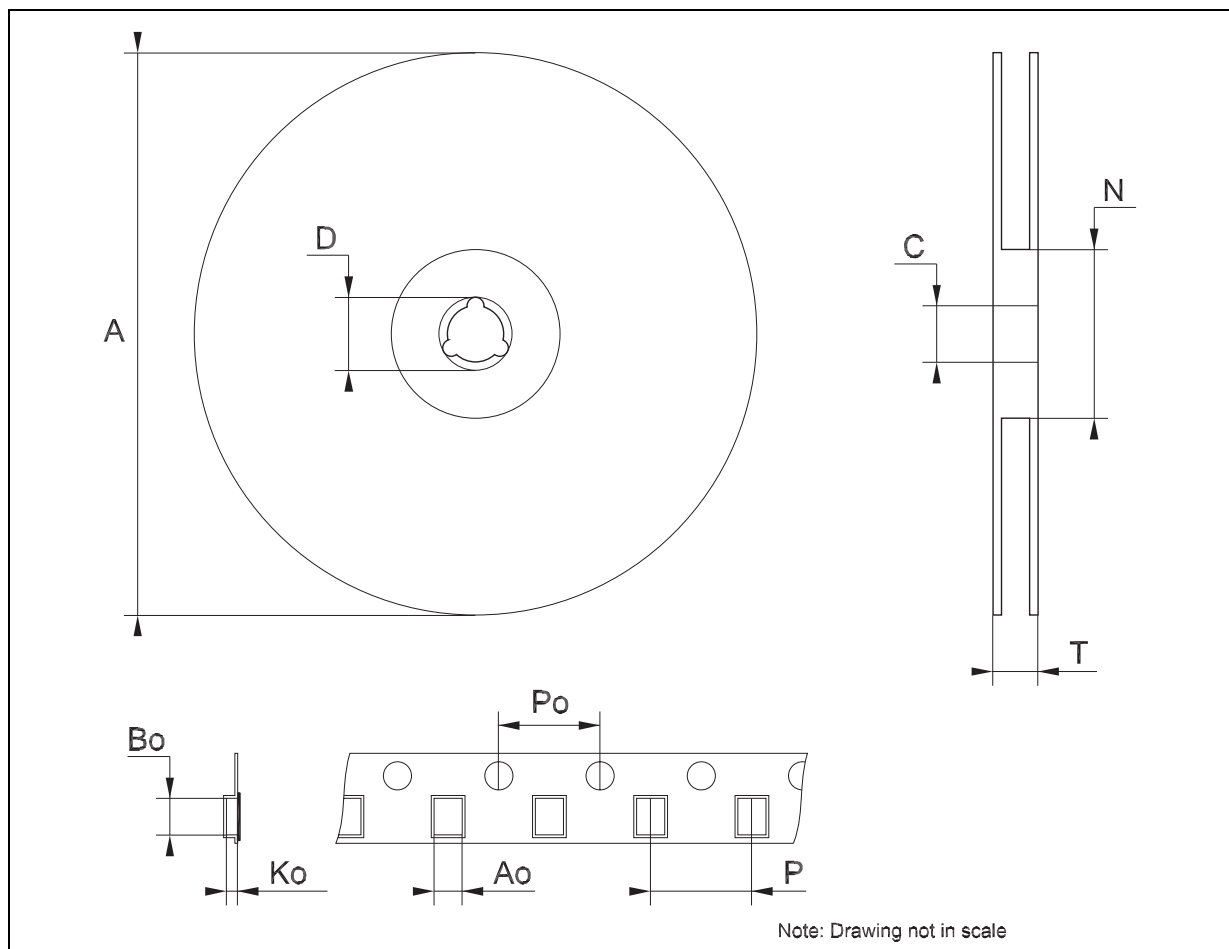
**Tape & Reel SO-16L MECHANICAL DATA**

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 & 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



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