



# ST202E ST232E

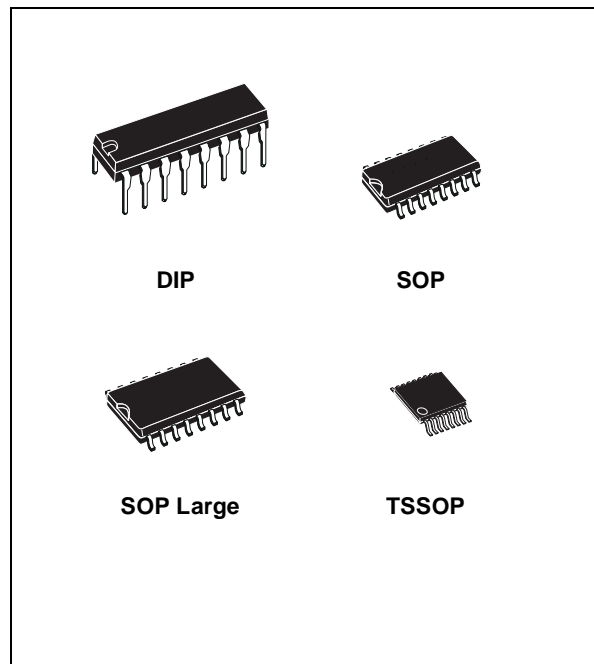
## ± 15KV ESD PROTECTED 5V RS-232 TRANSCEIVER

- ESD PROTECTION FOR RS-232 I/O PINS:  
± 15KV HUMAN BODY MODEL
- GUARANTEED 230Kbps DATA RATE
- GUARANTEED SLEW RATE RANGE 3 to 30V/μs
- OPERATE FROM A SINGLE 5V POWER SUPPLY

### DESCRIPTION

The ST202E/ST232E are a 2 driver 2 receiver devices designed for RS-232 and V.28 communications in harsh environments. Each transmitter output and receiver input is protected against ± 15KV electrostatic discharge (ESD) shocks. The drivers meet all EIA/TIA-232E and CCITT V.28 specifications at data rates up to 230Kbps, when loaded in accordance with the EIA/TIA-232E specification. The ST202E/232E use a single 5V supply voltage.

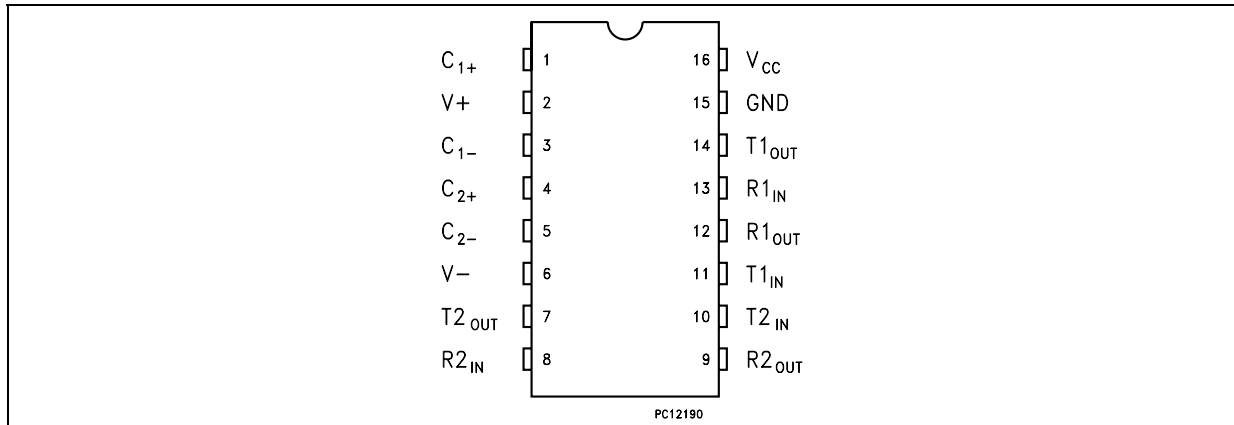
The ST232E operates with four 1μF capacitors, while the ST202E operates with four 0.1μF capacitors, further reducing cost and board space.



### ORDERING CODES

Type		Temperature Range	Package	Comments
ST202ECN	ST232ECN	0 to 70 °C	DIP-16	25 parts per tube / 40 tube per box
ST202EBN	ST232EBN	-40 to 85 °C	DIP-16	25 parts per tube / 40 tube per box
ST202EAN	ST232EAN	-40 to 125 °C	DIP-16	25 parts per tube / 40 tube per box
ST202ECD	ST232ECD	0 to 70 °C	SO-16 (Tube)	50 parts per tube / 20 tube per box
ST202EBD	ST232EBD	-40 to 85 °C	SO-16 (Tube)	50 parts per tube / 20 tube per box
ST202EAD	ST232EAD	-40 to 125 °C	SO-16 (Tube)	50 parts per tube / 20 tube per box
ST202ECDR	ST232ECDR	0 to 70 °C	SO-16 (Tape & Reel)	2500 parts per reel
ST202EBDR	ST232EBDR	-40 to 85 °C	SO-16 (Tape & Reel)	2500 parts per reel
ST202EADR	ST232EADR	-40 to 125 °C	SO-16 (Tape & Reel)	2500 parts per reel
ST202ECW	ST232ECW	0 to 70 °C	SO-16 Large (Tube)	49 parts per tube / 25 tube per box
ST202EBW	ST232EBW	-40 to 85 °C	SO-16 Large (Tube)	49 parts per tube / 25 tube per box
ST202EAW	ST232EAW	-40 to 125 °C	SO-16 Large (Tube)	49 parts per tube / 25 tube per box
ST202ECWR	ST232ECWR	0 to 70 °C	SO-16 Large (Tape & Reel)	1000 parts per reel
ST202EBWR	ST232EBWR	-40 to 85 °C	SO-16 Large (Tape & Reel)	1000 parts per reel
ST202EAWR	ST232EAWR	-40 to 125 °C	SO-16 Large (Tape & Reel)	1000 parts per reel
ST202ECTR	ST232ECTR	0 to 70 °C	TSSOP16 (Tape & Reel)	2500 parts per reel
ST202EBTR	ST232EBTR	-40 to 85 °C	TSSOP16 (Tape & Reel)	2500 parts per reel
ST202EATR	ST232EATR	-40 to 125 °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	T2 <sub>OUT</sub>	Second Transmitter Output Voltage
8	R2 <sub>IN</sub>	Second Receiver Input Voltage
9	R2 <sub>OUT</sub>	Second Receiver Output Voltage
10	T2 <sub>IN</sub>	Second Transmitter Input Voltage
11	T1 <sub>IN</sub>	First Transmitter Input Voltage
12	R1 <sub>OUT</sub>	First Receiver Output Voltage
13	R1 <sub>IN</sub>	First Receiver Input Voltage
14	T1 <sub>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
V+	Extra Positive Voltage	(V <sub>CC</sub> - 0.3) to 14	V
V-	Extra Negative Voltage	-14 to 0.3	V
T <sub>IN</sub>	Transmitter Input Voltage Range	-0.3 to (V <sub>+</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.

**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 (Contact Discharge)	± 6			KV
ESD	ESD Protection Voltage	IEC 1000-4-2 (Air Discharge)	± 8			KV

Note: All test versus GND.

**ELECTRICAL CHARACTERISTICS**

( $C_1 - C_4 = 0.1\mu\text{F}$  for ST202E,  $C_1 - C_4 = 1\mu\text{F}$  for ST232E,  $V_{CC} = 5V \pm 10\%$ ,  $T_A = -40$  to  $125^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25^\circ\text{C}$ )

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

**TRANSMITTER ELECTRICAL CHARACTERISTICS**

( $C_1 - C_4 = 0.1\mu\text{F}$  for ST202E,  $C_1 - C_4 = 1\mu\text{F}$  for ST232E,  $V_{CC} = 5V \pm 10\%$ ,  $T_A = -40$  to  $125^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25^\circ\text{C}$ )

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{TOUT}$	Output Voltage Swing	All Transmitter outputs are loaded with $3K\Omega$ to GND	± 5	± 9		V
$I_{TIL}$	Input Leakage Current				± 1	$\mu\text{A}$
$V_{TIL}$	Input Logic Threshold Low		0.8			V
$V_{TIH}$	Input Logic Threshold High				2	V
$SR_T$	Transition Slew Rate	$T_A = 25^\circ\text{C}$ , $V_{CC} = 5V$ $R_L = 3$ to $7K\Omega$ , $C_L = 50$ to $1000\text{pF}$ (Note1)	3	6	30	$\text{V}/\mu\text{s}$
$D_R$	Data Rate	$R_L = 3$ to $7K\Omega$ , $C_L = 50$ to $1000\text{pF}$ one transmitter switching	230	400		Kbits/s
$R_{TOUT}$	Transmitter Output Resistance	$V_{CC} = V_+ = V_- = 0V$ $V_{OUT} = \pm 2V$	300			$\Omega$
$I_{SC}$	Transmitter Output Short Circuit Current			±10	±60	mA
$t_{DT}$	Transmitter Propagation Delay	$R_L = 3$ to $7K\Omega$ , $C_L = 50$ to $2500\text{pF}$ All transmitter loaded		2		$\mu\text{A}$

Note 1: Measured from 3V to -3V or from -3V to 3V.

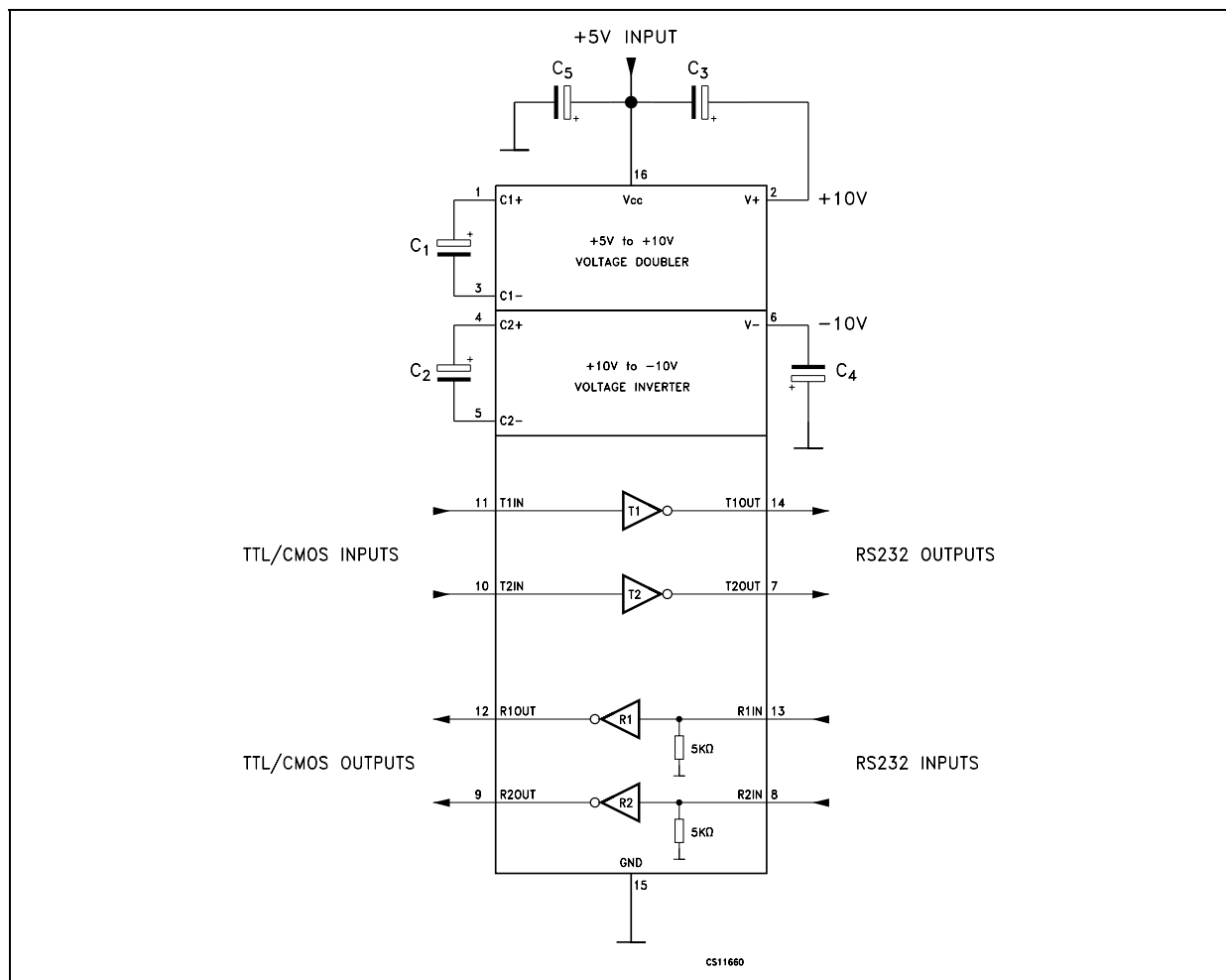
Note2: One transmitter output is loaded with  $R_L = 3K\Omega$  to  $7K\Omega$ ,  $C_L = 50$  to  $1000\text{pF}$

**RECEIVER ELECTRICAL CHARACTERISTICS**

( $C_1 - C_4 = 0.1\mu\text{F}$  for ST202E,  $C_1 - C_4 = 1\mu\text{F}$  for ST232E,  $V_{CC} = 5\text{V} \pm 10\%$ ,  $T_A = -40$  to  $125^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25^\circ\text{C}$ )

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

**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 ( $\mu\text{F}$ )

DEVICES	C1	C2	C3	C4	C5
ST202E	0.1	0.1	0.1	0.1	0.1
ST232E	1	1	1	1	1

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

Figure 1 : Supply Current vs Temperature

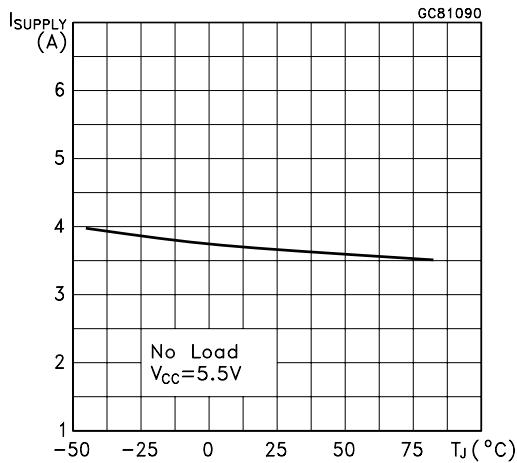


Figure 2 : Data Rate vs Temperature

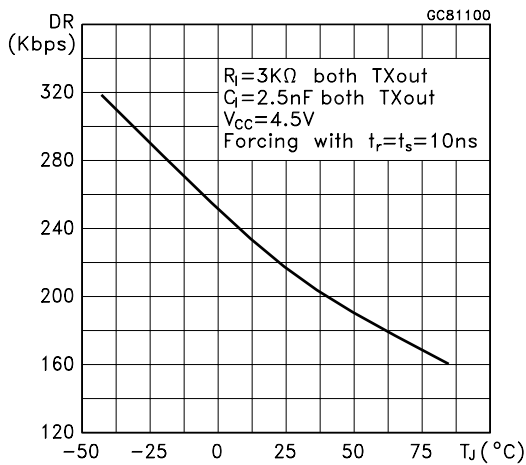


Figure 3 : Receiver Propagation Delay

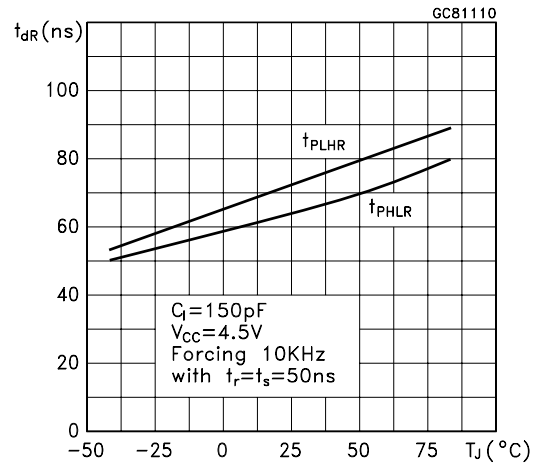
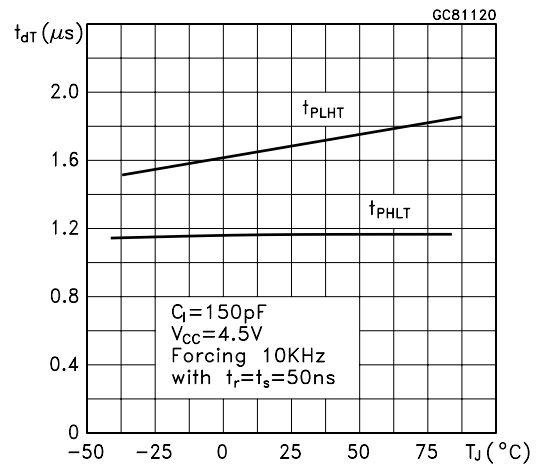
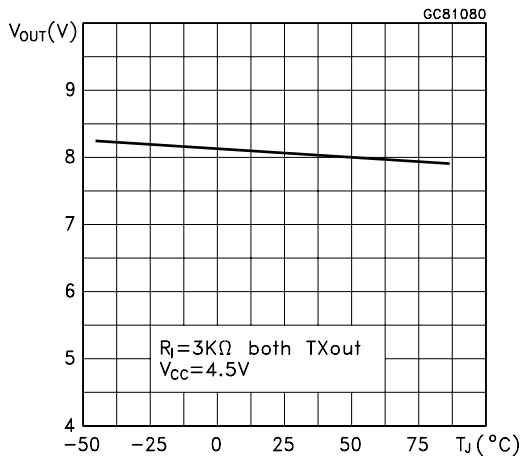


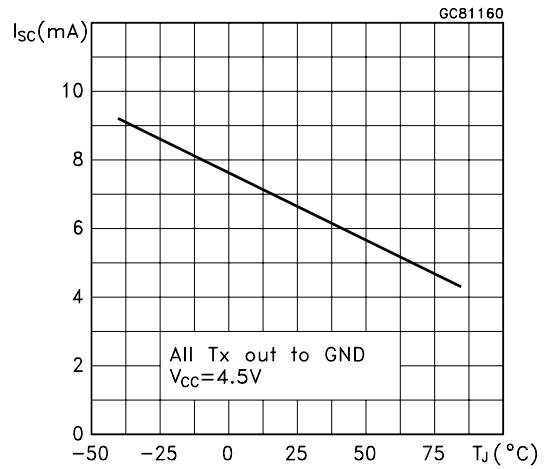
Figure 4 : Driver Propagation Delay



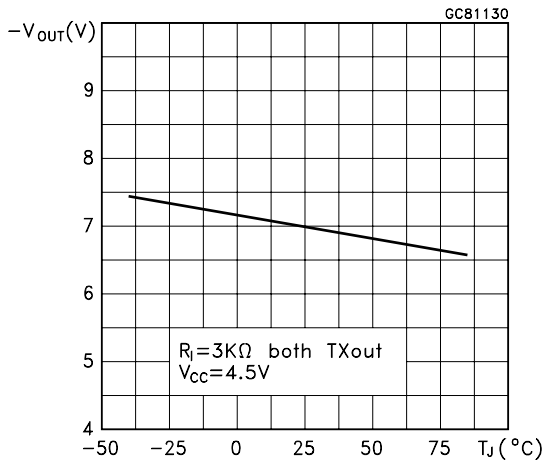
**Figure 5 : High Level Output Voltage Swing vs Temperature**



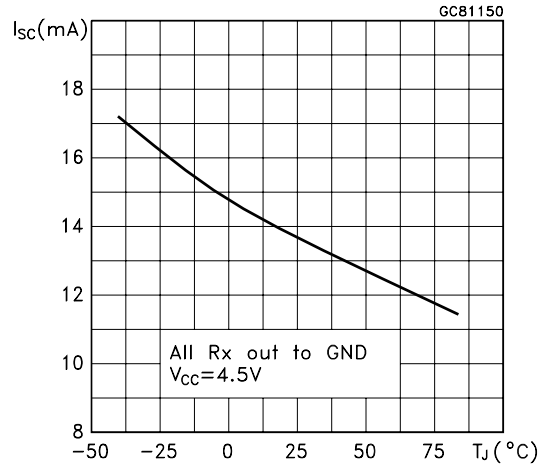
**Figure 8 : Low Level Transmitter Output Short Circuit Current vs Temperature**



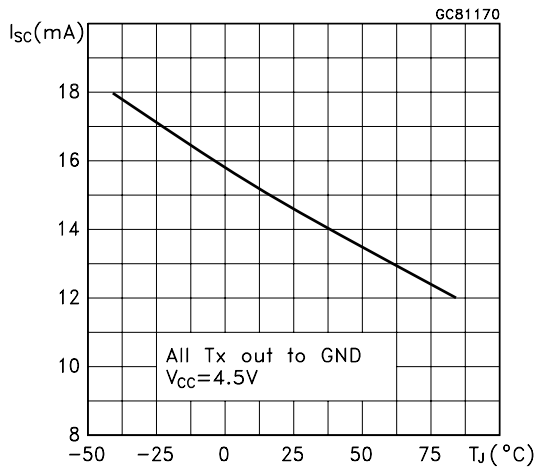
**Figure 6 : Low Level Output Voltage Swing vs Temperature**



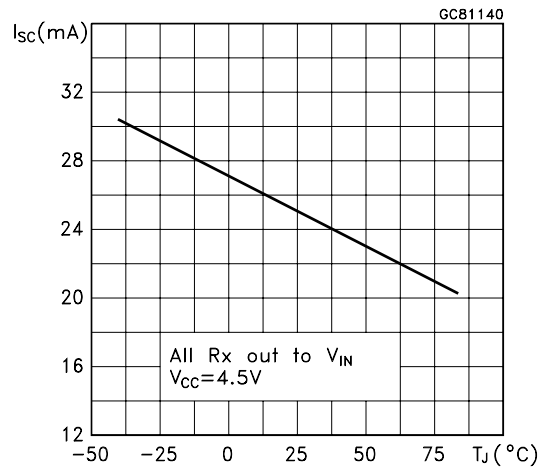
**Figure 9 : High Level Receiver Output Short Circuit Current vs Temperature**



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

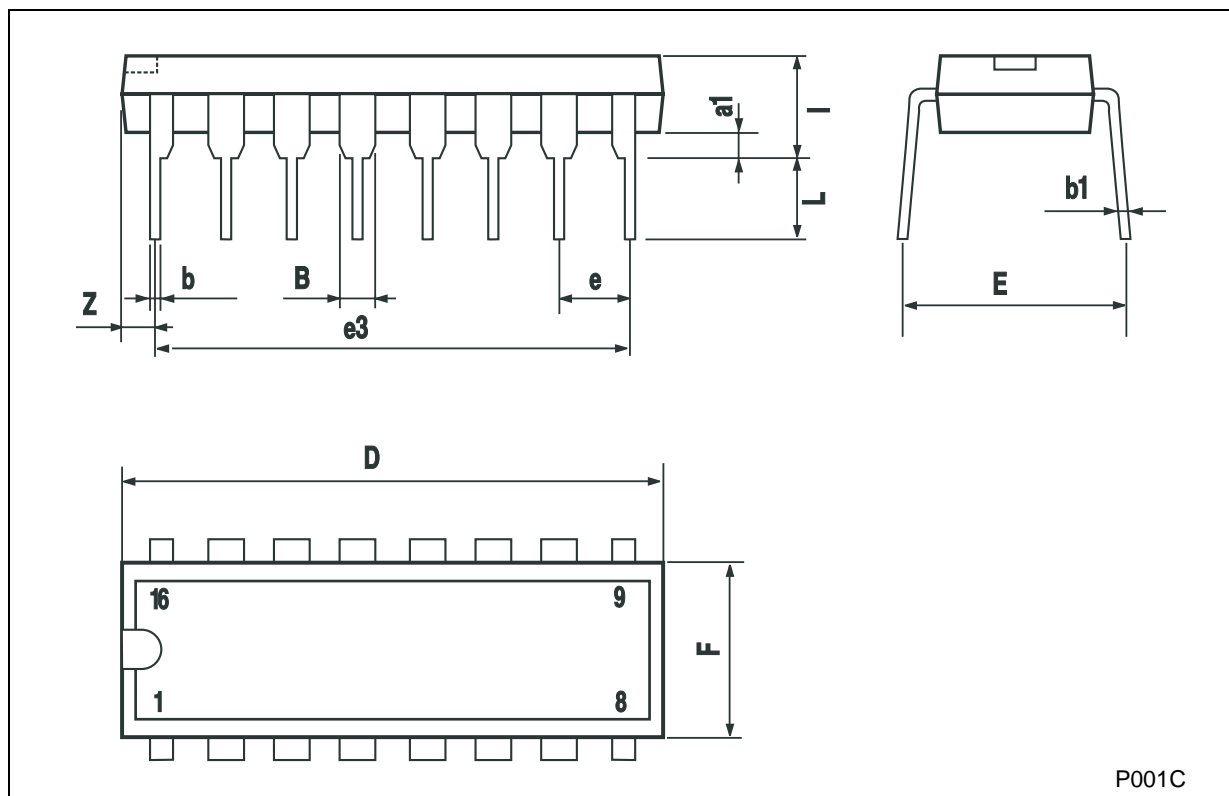


**Figure 10 : Low Level Receiver Output Short Circuit Current vs Temperature**



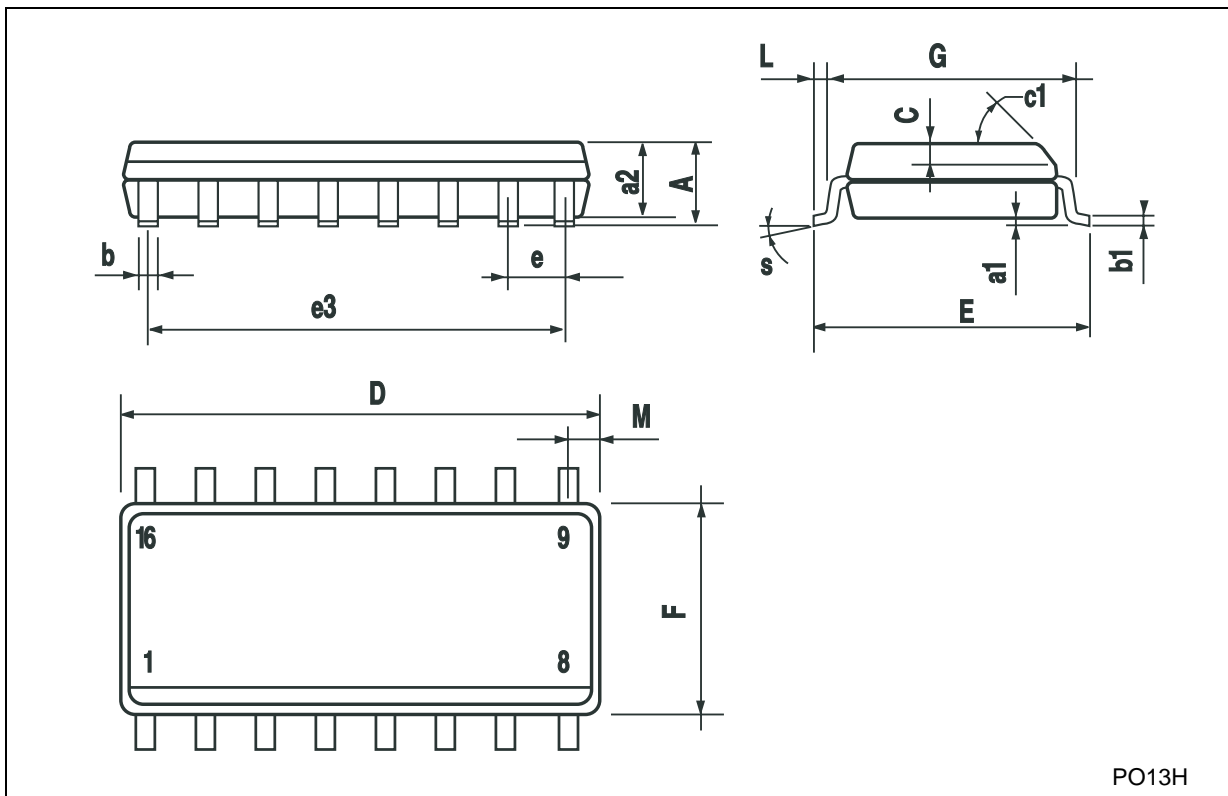
### Plastic DIP-16 (0.25) MECHANICAL DATA

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.)		

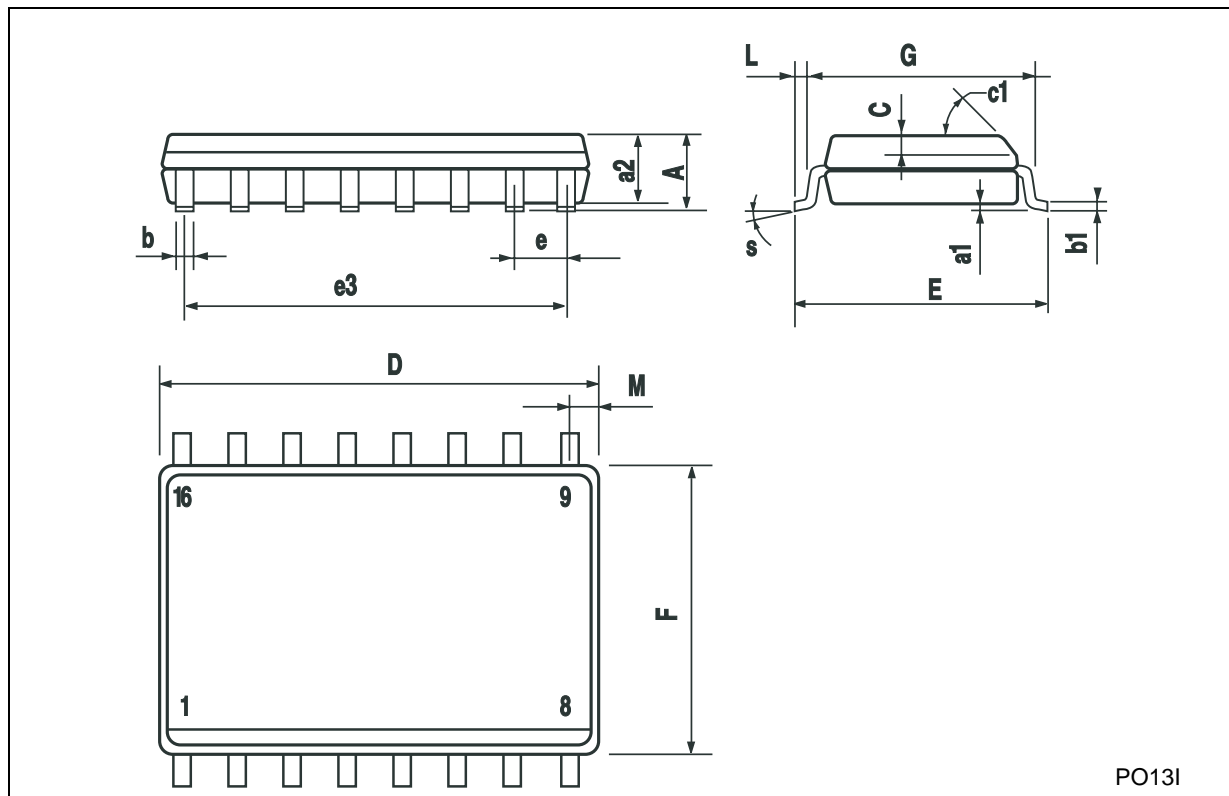


PO13H



## SO-16L MECHANICAL DATA

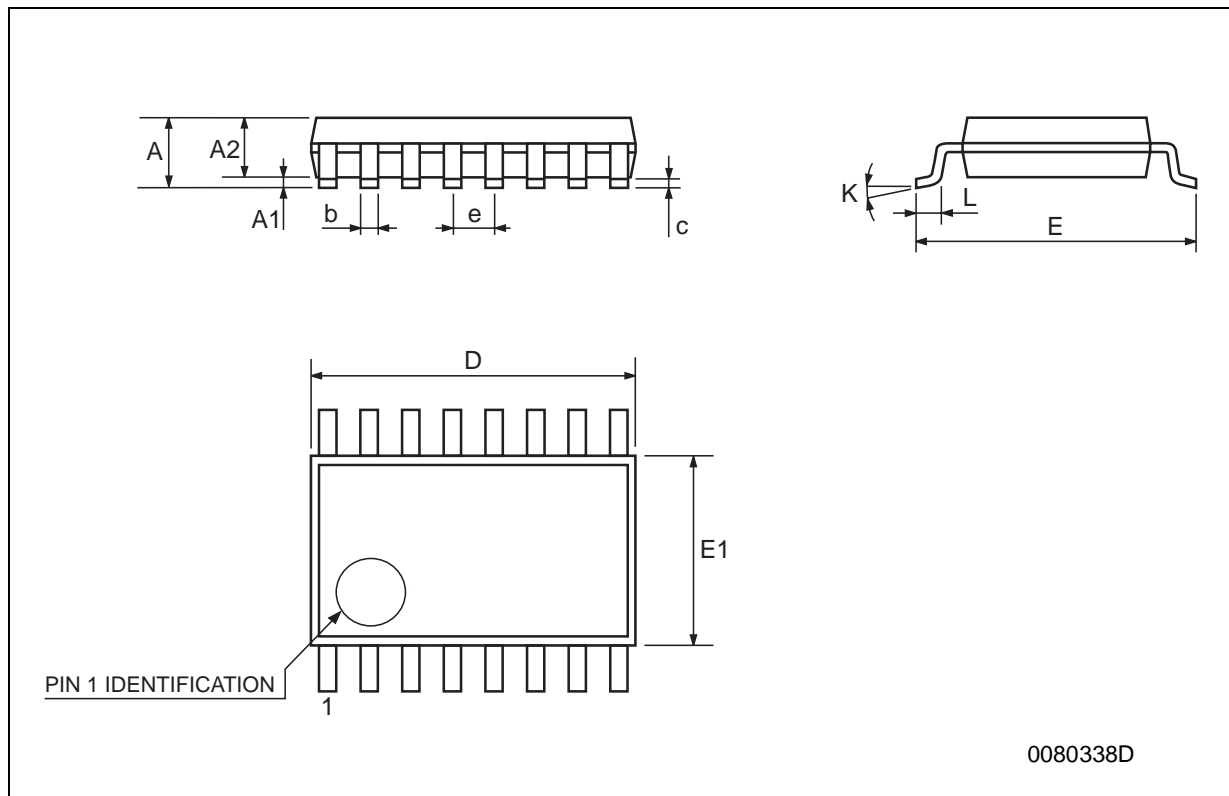
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			2.65			0.104
a1	0.1		0.2	0.004		0.008
a2			2.45			0.096
b	0.35		0.49	0.014		0.019
b1	0.23		0.32	0.009		0.012
C		0.5			0.020	
c1	45° (typ.)					
D	10.1		10.5	0.397		0.413
E	10.0		10.65	0.393		0.419
e		1.27			0.050	
e3		8.89			0.350	
F	7.4		7.6	0.291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



PO131

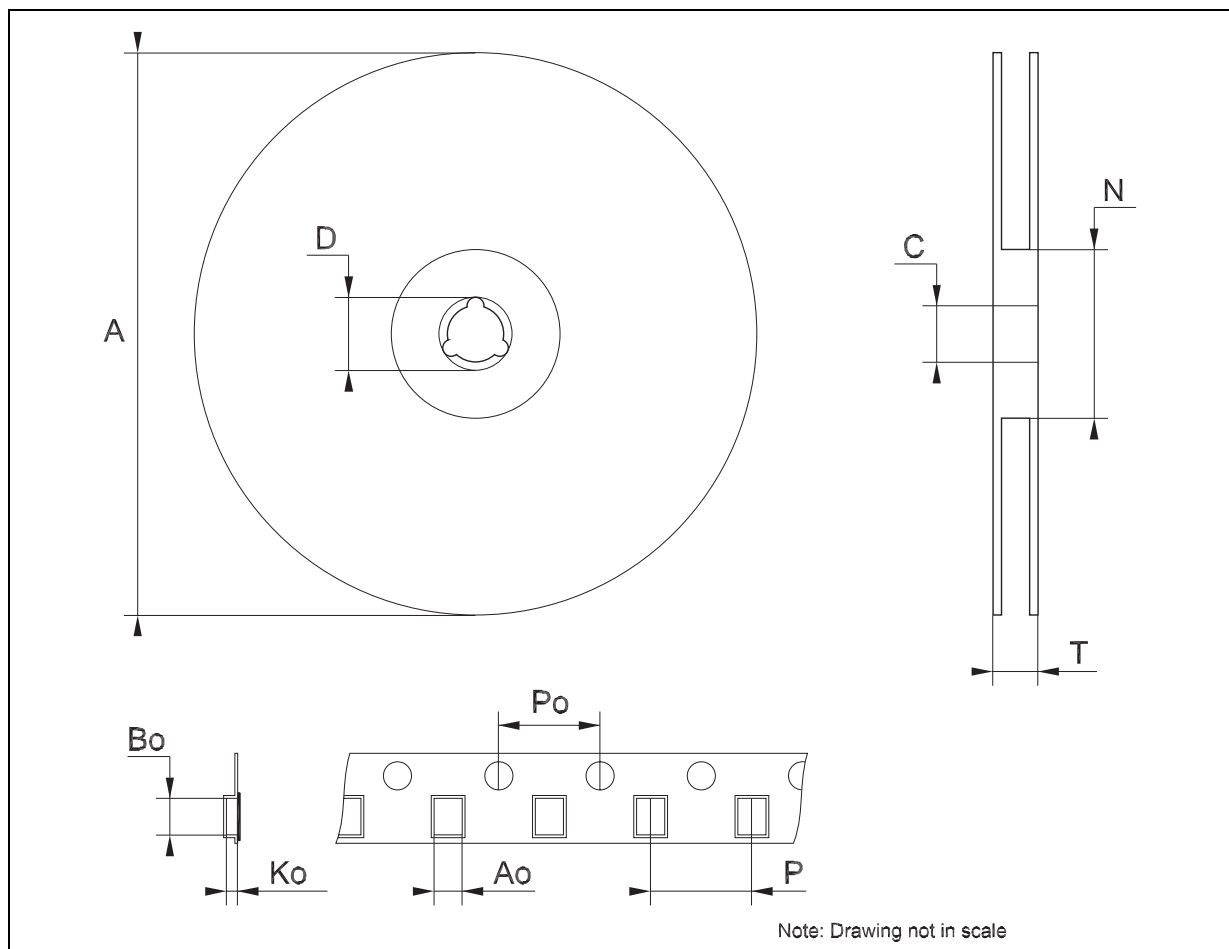
**TSSOP16 MECHANICAL DATA**

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



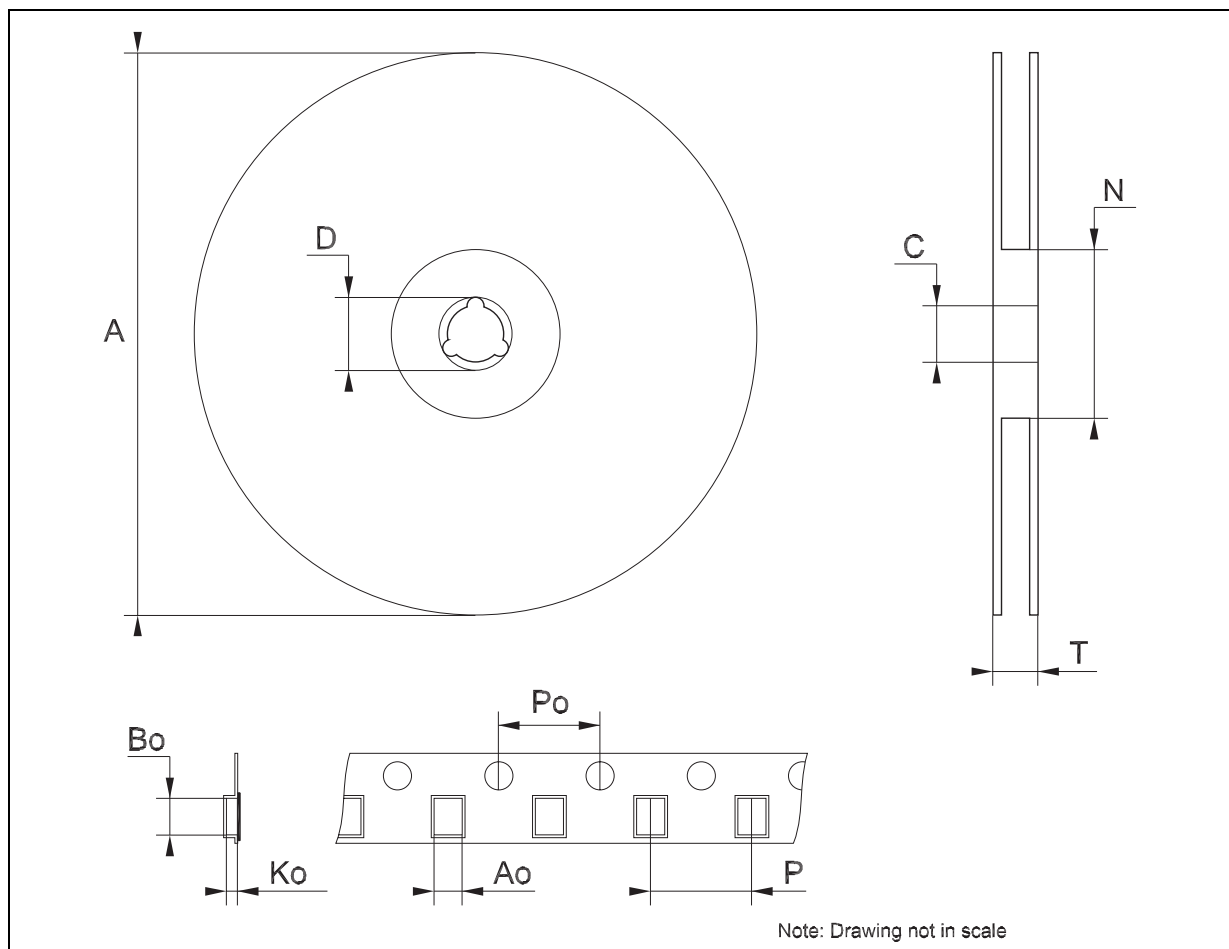
## Tape &amp; Reel SO-16 MECHANICAL DATA

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



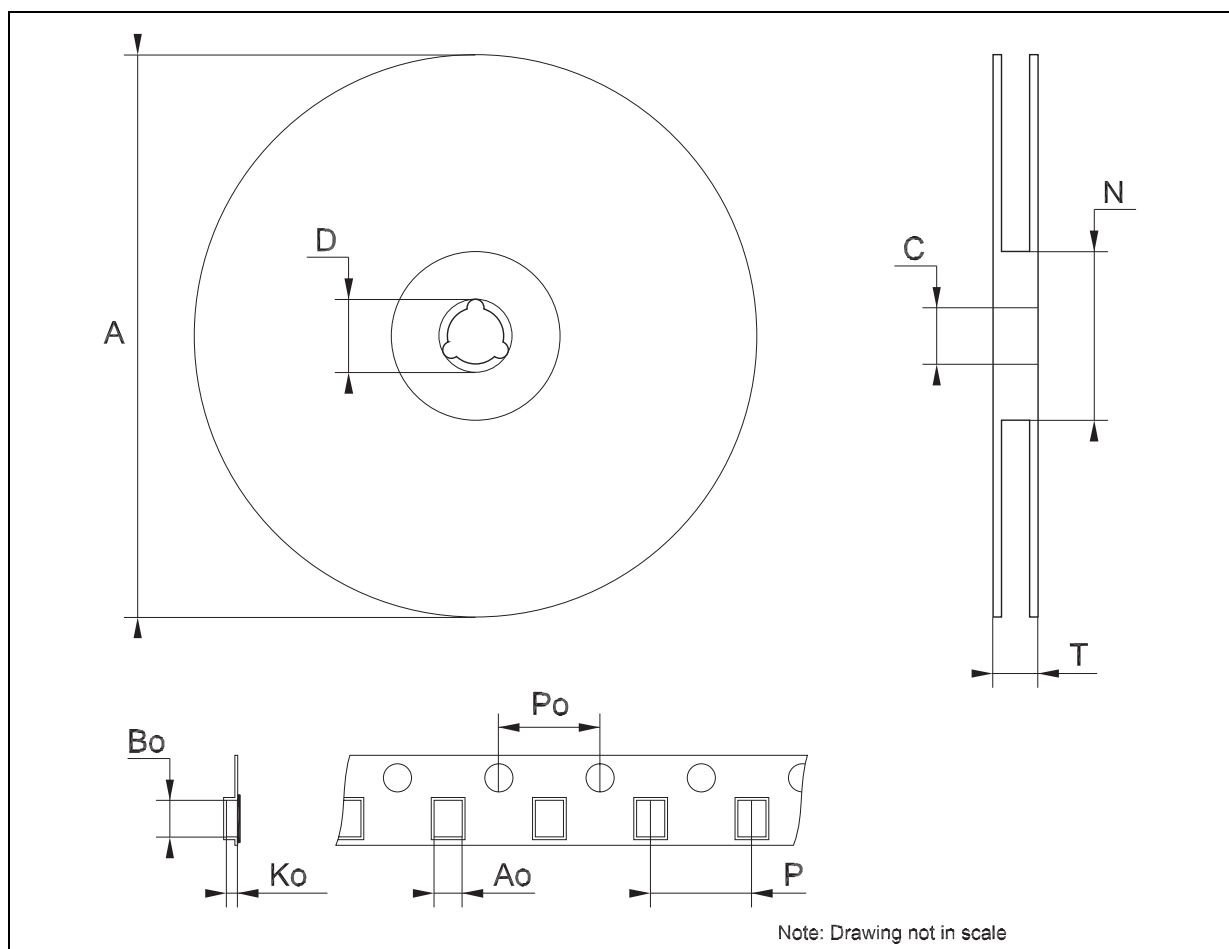
**Tape & Reel SO-16L MECHANICAL DATA**

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



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