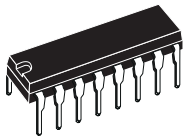
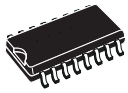
ST202E
ST232E

± 15KV ESD PROTECTED 5V RS-232 TRANSCEIVER

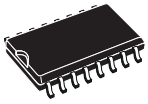
- ESD PROTECTION FOR RS-232 I/O PINS: ± 15KV HUMAN BODY MODEL
- GUARANTEED 230kbps DATE RATE
- GUARANTEED SLEW RATE RANGE 3 to 30V/µs
- OPERATE FROM A SINGLE 5V POWER SUPPLY



DIP



SOP



SOP Large



TSSOP

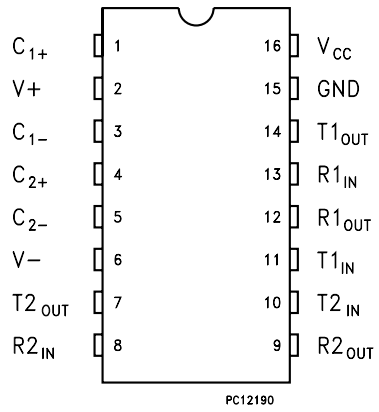
DESCRIPTION

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_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	$T2_{OUT}$	Second Transmitter Output Voltage
8	$R2_{IN}$	Second Receiver Input Voltage
9	$R2_{OUT}$	Second Receiver Output Voltage
10	$T2_{IN}$	Second Transmitter Input Voltage
11	$T1_{IN}$	First Transmitter Input Voltage
12	$R1_{OUT}$	First Receiver Output Voltage
13	$R1_{IN}$	First Receiver Input Voltage
14	$T1_{OUT}$	First Transmitter Output Voltage
15	GND	Ground
16	V_{CC}	Supply Voltage

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	-0.3 to 6	V
V+	Extra Positive Voltage	(V_{CC} - 0.3) to 14	V
V-	Extra Negative Voltage	-14 to 0.3	V
T_{IN}	Transmitter Input Voltage Range	-0.3 to (V_+ + 0.3)	V
R_{IN}	Receiver Input Voltage Range	± 30	V
T_{OUT}	Transmitter Output Voltage Range	(V_- - 0.3) to (V_+ + 0.3)	V
R_{OUT}	Receiver Output Voltage Range	-0.3 to (V_{CC} + 0.3)	V
T_{SCTOUT}	Short Circuit Duration on T_{OUT}	infinite	
T_{stg}	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 = 0.1µF for ST202E, C_1 - C_4 = 1µF for ST232E, V_{CC} = 5V ± 10%, T_A = -40 to 125°C, unless otherwise specified. Typical values are referred to T_A = 25°C)

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

TRANSMITTER ELECTRICAL CHARACTERISTICS

(C_1 - C_4 = 0.1µF for ST202E, C_1 - C_4 = 1µF for ST232E, V_{CC} = 5V ± 10%, T_A = -40 to 125°C, unless otherwise specified. Typical values are referred to T_A = 25°C)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{TOUT}	Output Voltage Swing	All Transmitter outputs are loaded with 3KΩ to GND	± 5	± 9		V
I_{TIL}	Input Leakage Current				± 1	µA
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°C, V_{CC} = 5V R_L = 3 to 7KΩ, C_L = 50 to 1000pF (Note1)	3	6	30	V/µs
D_R	Data Rate	R_L = 3 to 7KΩ, C_L = 50 to 1000pF one transmitter switching	230	400		Kbits/s
R_{TOUT}	Transmitter Output Resistance	V_{CC} = V+ = V- = 0V V_{OUT} = ± 2V	300			Ω
I_{SC}	Transmitter Output Short Circuit Current			±10	±60	mA
t_{DT}	Transmitter Propagation Delay	R_L = 3 to 7KΩ, C_L = 50 to 2500pF All transmitter loaded		2		µA

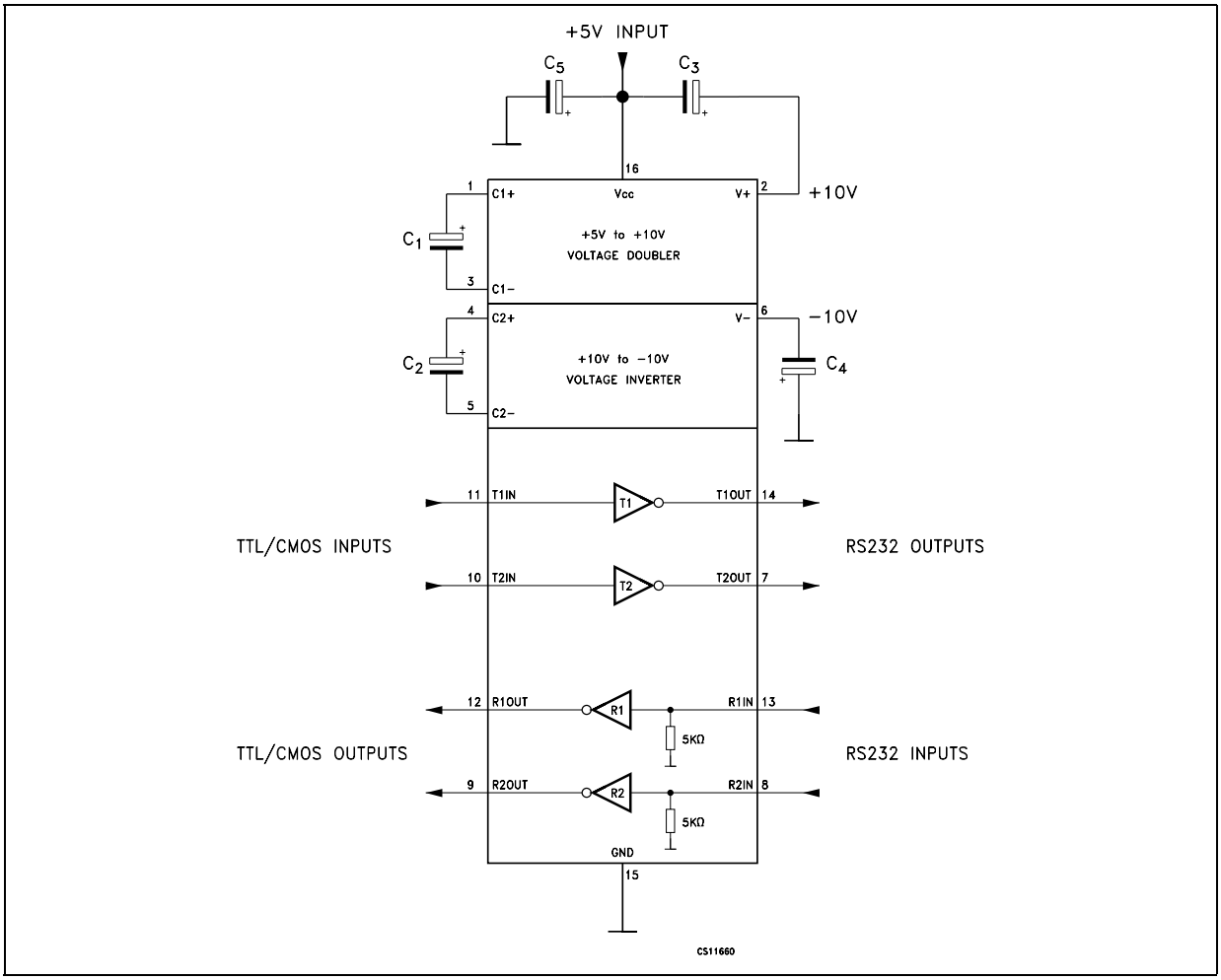
Note 1: Measured from 3V to -3V or from -3V to 3V.
Note2: One transmitter output is loaded with R_L = 3KΩ to 7KΩ, C_L = 50 to 1000pF

RECEIVER ELECTRICAL CHARACTERISTICS

(C_1 - C_4 = 0.1µF for ST202E, C_1 - C_4 = 1µF for ST232E, V_{CC} = 5V ± 10%, T_A = -40 to 125°C, unless otherwise specified. Typical values are referred to T_A = 25°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°C, V_{CC} = 5 V	3	5	7	KΩ
V_{RIL}	RS-232 Input Logic Threshold Low	T_A = 25°C, V_{CC} = 5 V	0.8	1.2		V
V_{RIH}	RS-232 Input Logic Threshold High	T_A = 25°C, V_{CC} = 5 V		1.7	2.4	V
V_{RIHYS}	RS-232 Input Hysteresis	V_{CC} = 5V	0.2	0.5	1	V
V_{ROL}	TTL/CMOS Output Voltage Low	I_{OUT} = 3.2mA			0.4	V
V_{ROH}	TTL/CMOS Output Voltage High	I_{OUT} = -1mA	3.5	V_{CC}-0.4		V
t_{DR}	Receiver Propagation Delay	C_L = 150pF		0.5	10	µs

APPLICATION CIRCUITS (note 1, note 2)



Note 1: C_{1-4} capacitors can even be 1µF ones.
Note 2: C_{1-4} can be common or biased capacitors.

CAPACITANCE VALUE (μF)

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°C)

Figure 1 : Supply Current vs Temperature

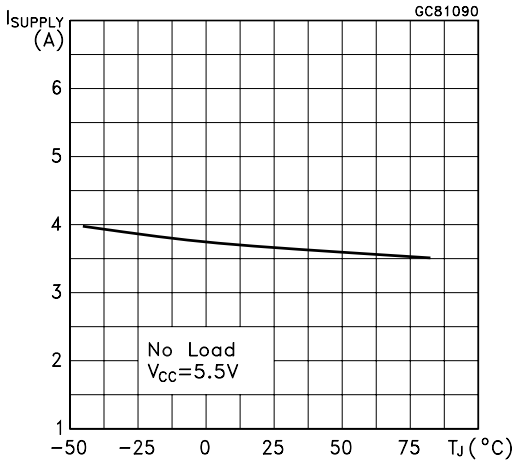


Figure 2 : Data Rate vs Temperature

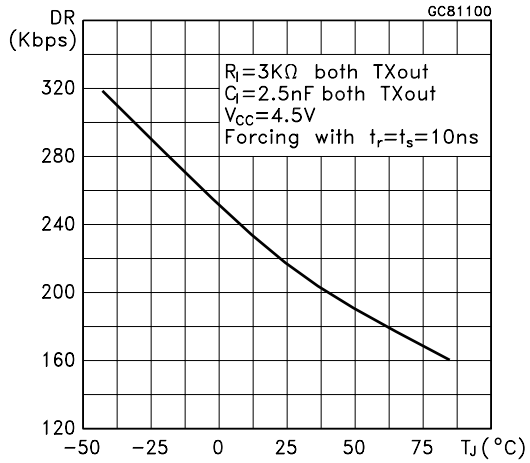


Figure 3 : Receiver Propagation Delay

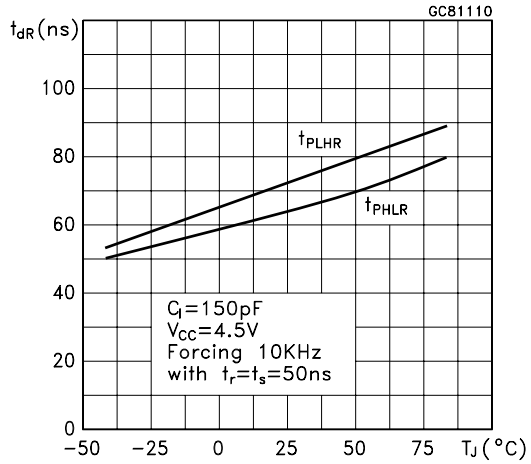


Figure 4 : Driver Propagation Delay

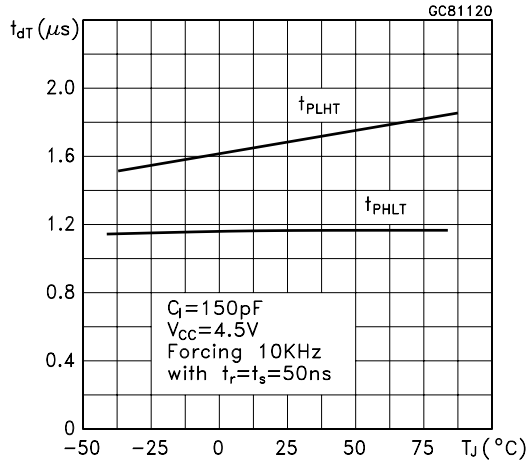


Figure 5 : High Level Output Voltage Swing vs Temperature

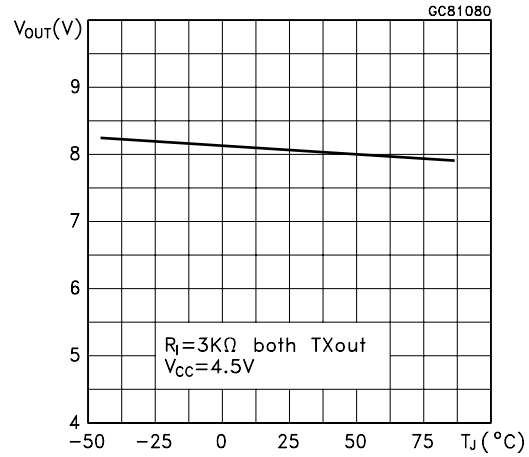


Figure 6 : Low Level Output Voltage Swing vs Temperature

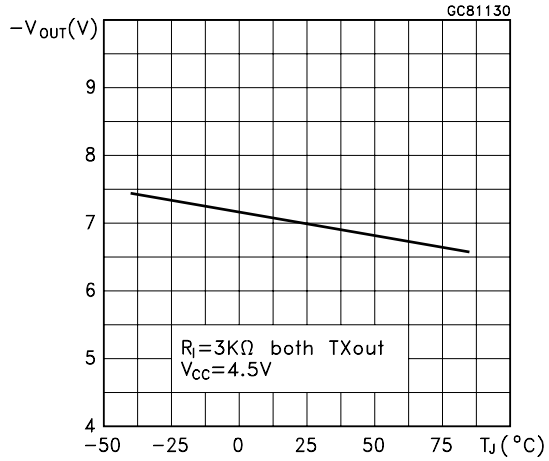


Figure 7 : High Level Transmitter Output Short Circuit Current vs Temperature

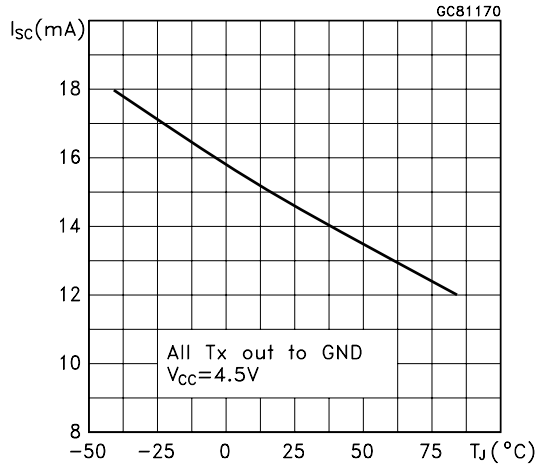


Figure 8 : Low Level Transmitter Output Short Circuit Current vs Temperature

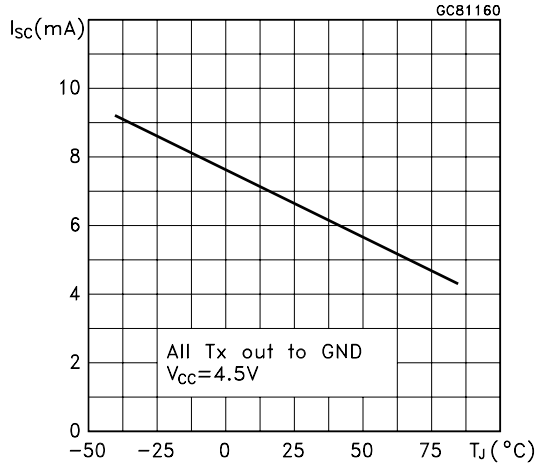


Figure 9 : High Level Receiver Output Short Circuit Current vs Temperature

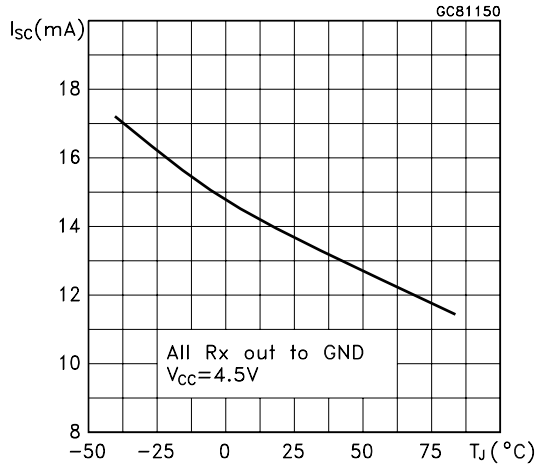
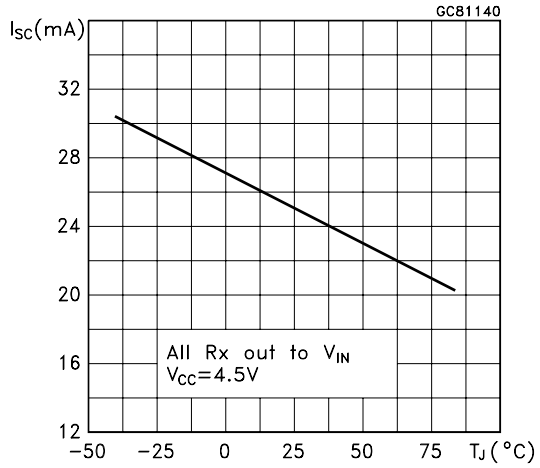
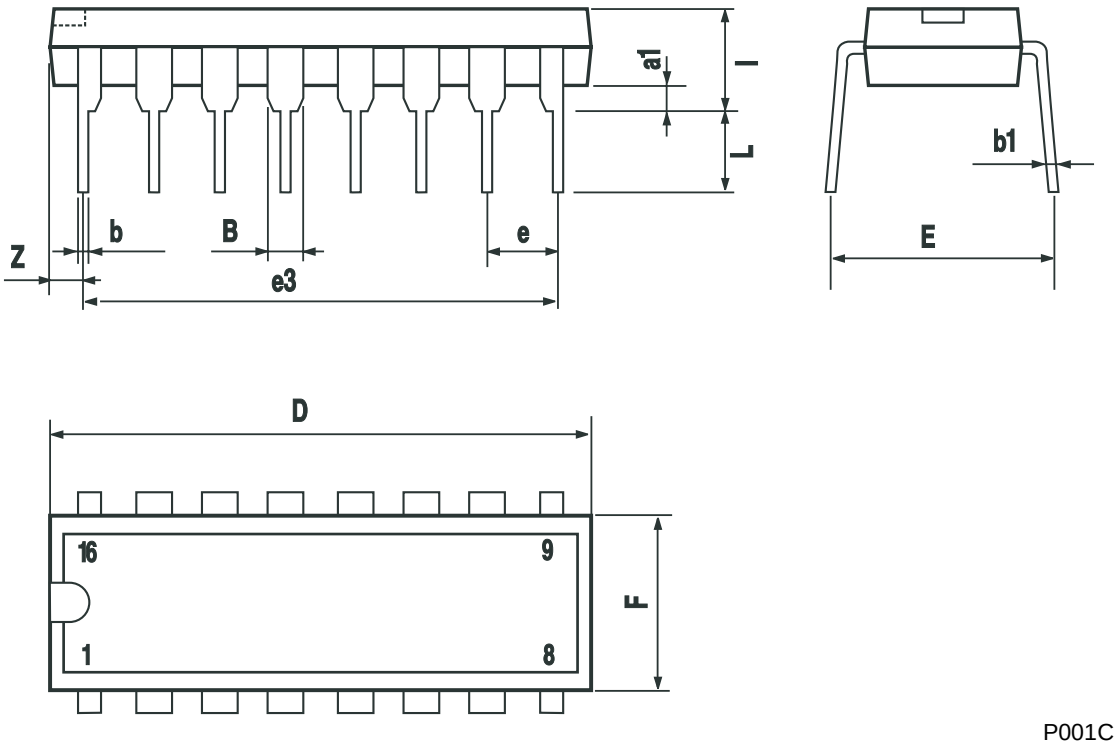


Figure 10 : Low Level Receiver Output Short Circuit Current vs Temperature



Plastic DIP-16 (0.25) MECHANICAL DATA

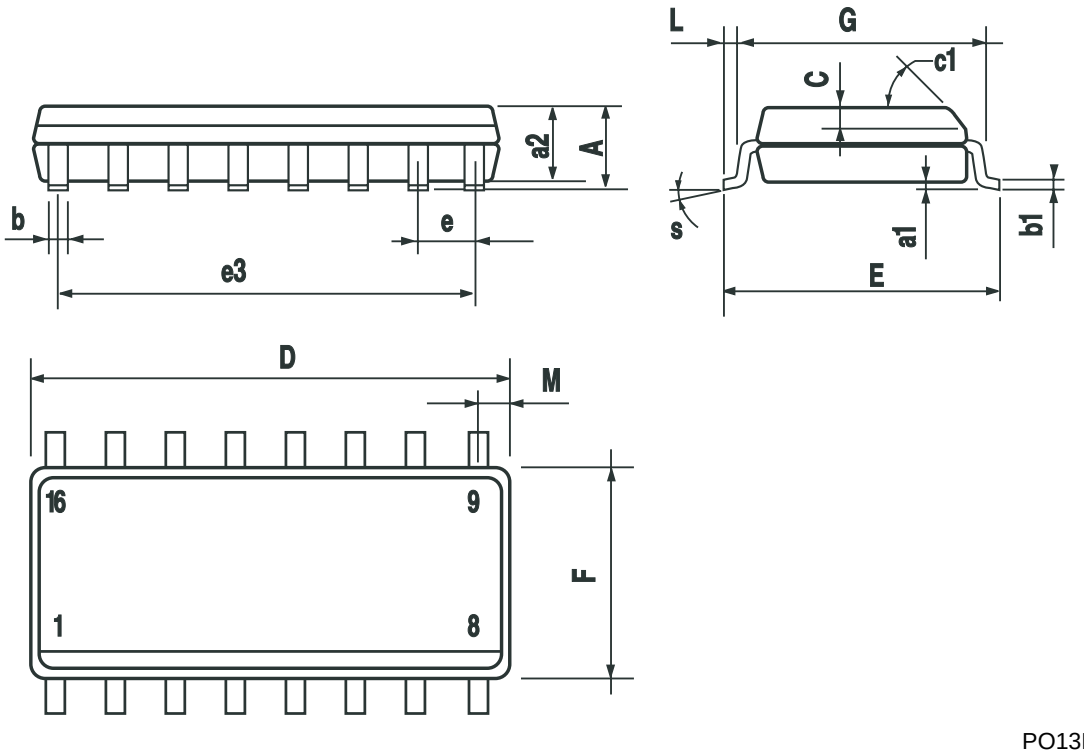
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

SO-16 MECHANICAL DATA

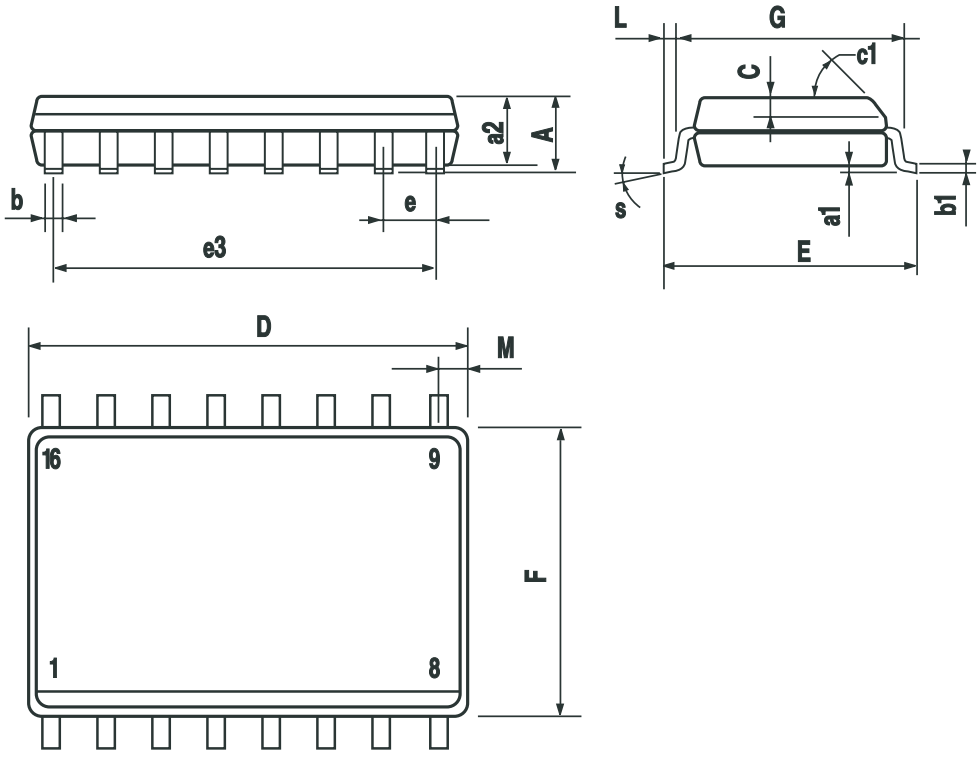
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.004		0.008
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157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

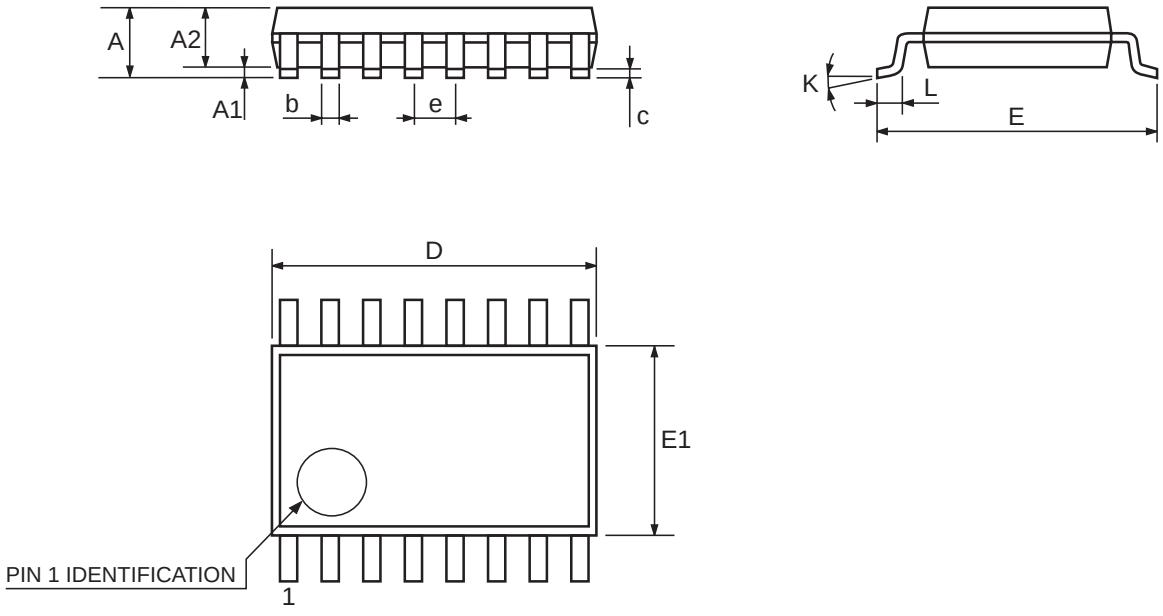
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			2.65			0.104
a1	0.1		0.2	0.004		0.008
a2			2.45			0.096
b	0.35		0.49	0.014		0.019
b1	0.23		0.32	0.009		0.012
C		0.5			0.020	
c1	45° (typ.)					
D	10.1		10.5	0.397		0.413
E	10.0		10.65	0.393		0.419
e		1.27			0.050	
e3		8.89			0.350	
F	7.4		7.6	0.291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



PO13I

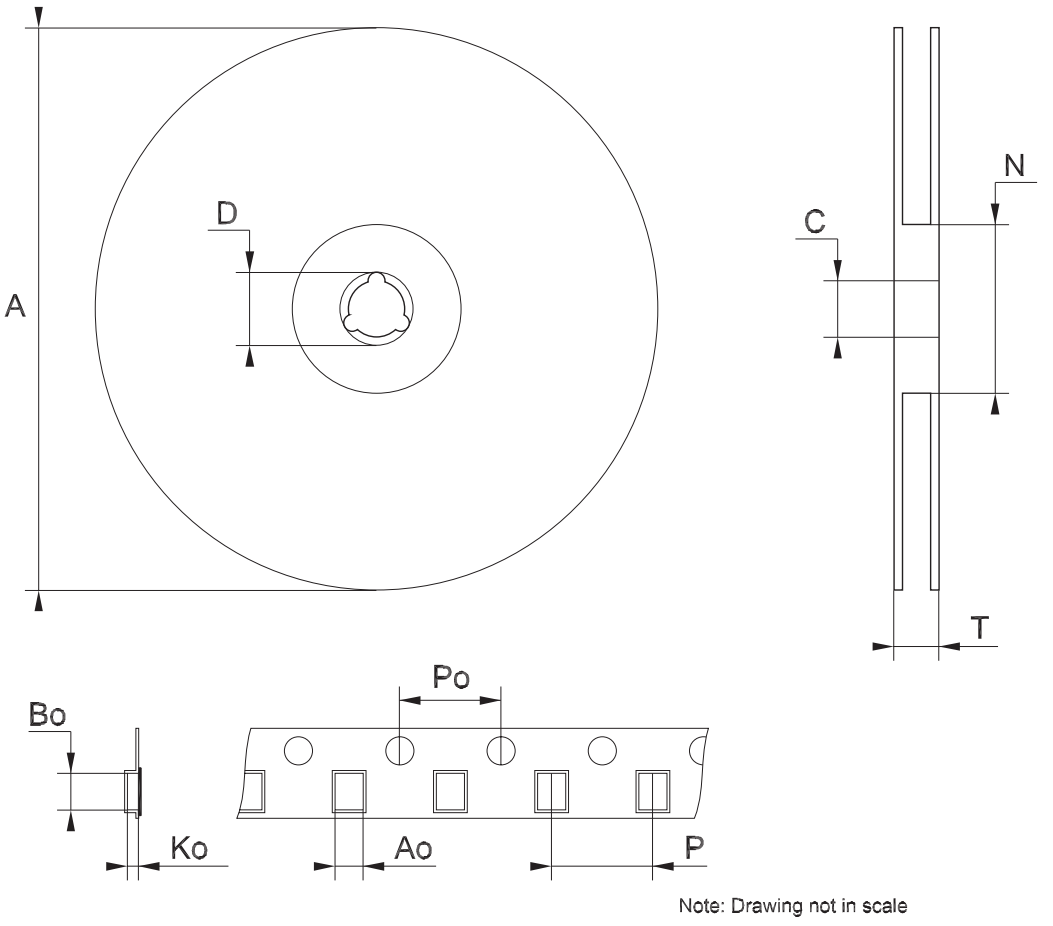
TSSOP16 MECHANICAL DATA

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

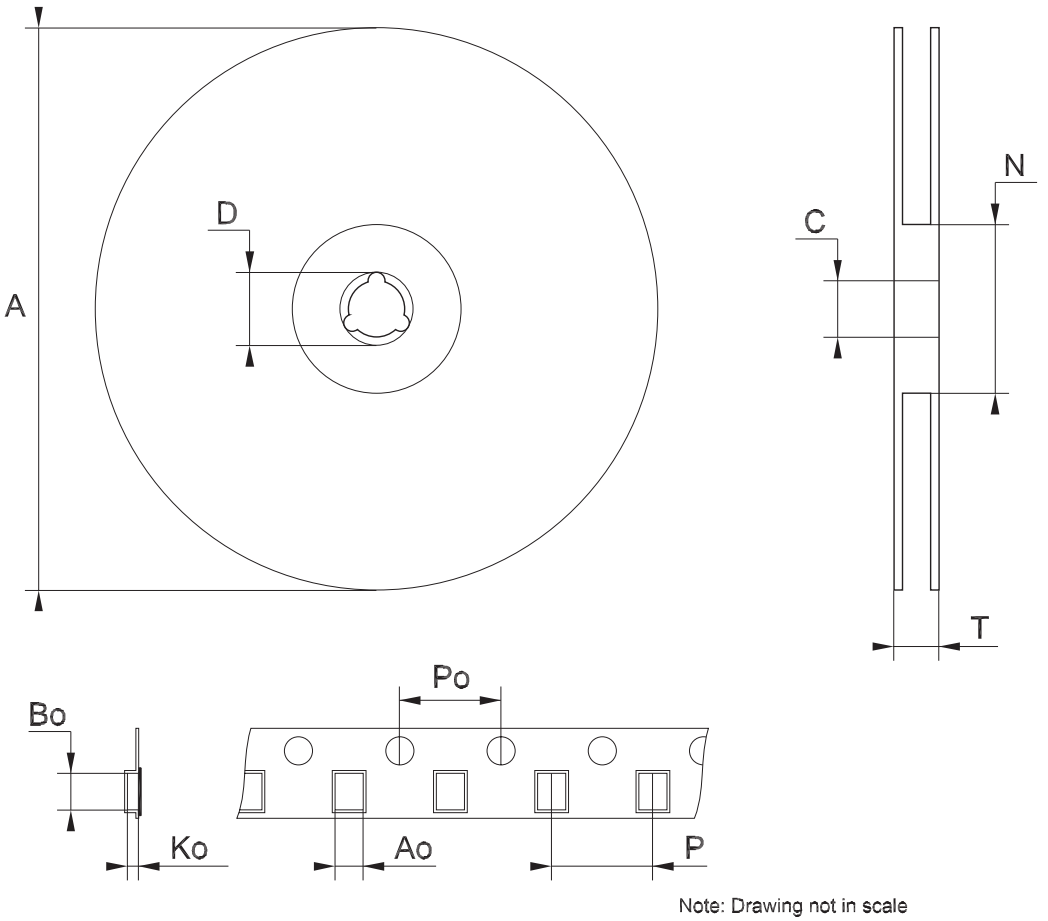
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	6.45		6.65	0.254		0.262
Bo	10.3		10.5	0.406		0.414
Ko	2.1		2.3	0.082		0.090
Po	3.9		4.1	0.153		0.161
P	7.9		8.1	0.311		0.319



Note: Drawing not in scale

Tape & Reel SO-16L MECHANICAL DATA

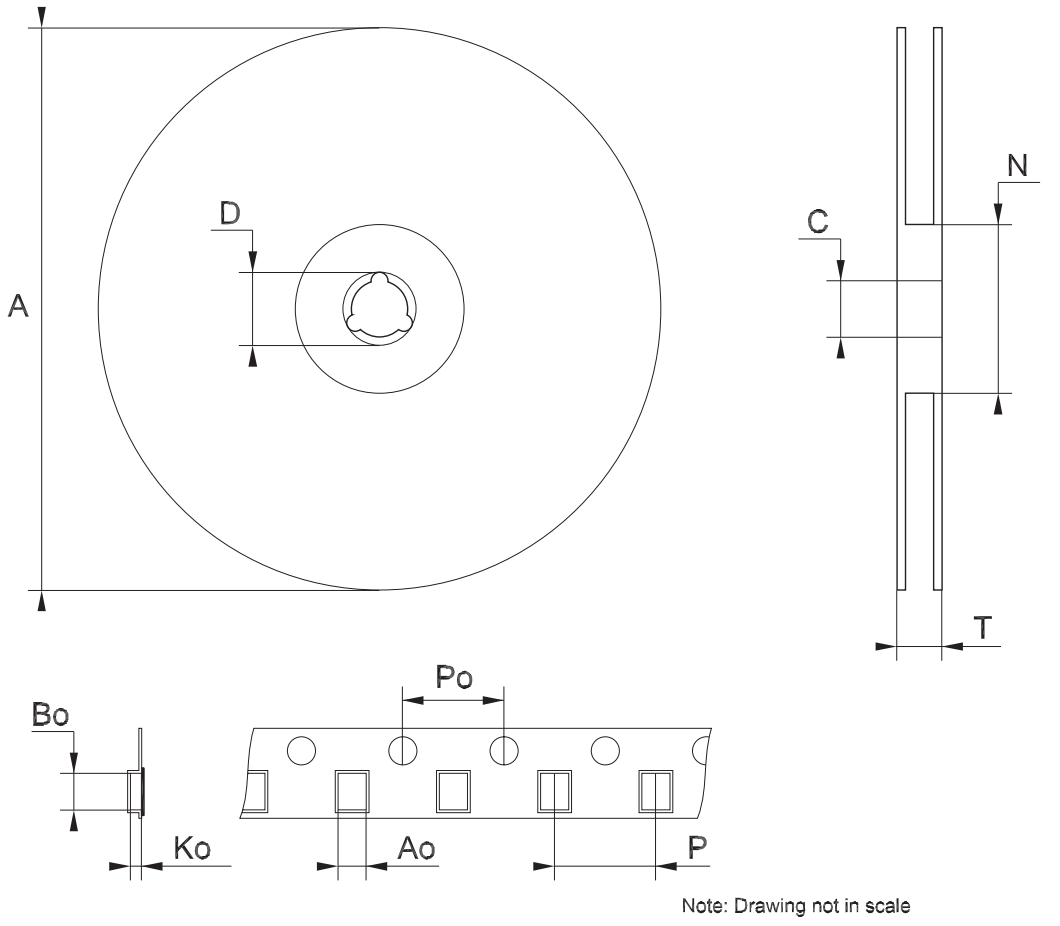
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	10.8		11.0	0.425		0.433
Bo	10.7		10.9	0.421		0.429
Ko	2.9		3.1	0.114		0.122
Po	3.9		4.1	0.153		0.161
P	11.9		12.1	0.468		0.476



Note: Drawing not in scale

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



Note: Drawing not in scale

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