



## ST3232E

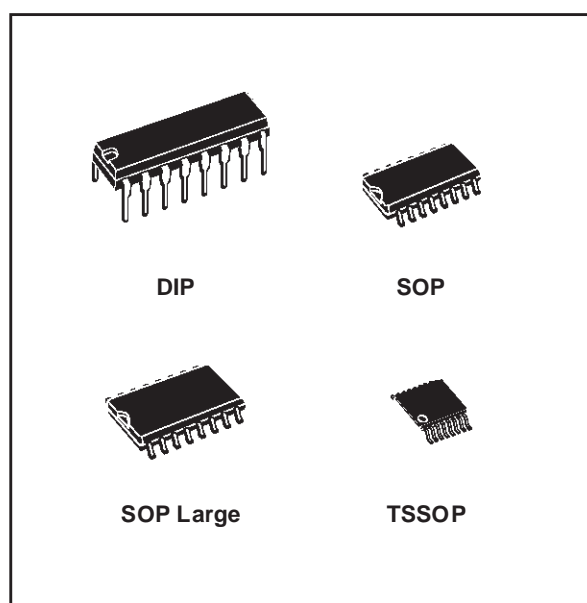
### ±15KV ESD-PROTECTED, 3 TO 5.5V, LOW POWER, UP TO 250KBPS, RS-232 DRIVERS AND RECEIVERS

- ESD PROTECTION FOR RS-232 I/O PINS  
±15KV HUMAN BODY MODEL  
±8KV IEC 1000-4-2 CONTACT DISCHARGE
- 300µA SUPPLY CURRENT
- 250Kbps MINIMUM GUARENTEED DATA RATE
- 6V/µs MINIMUM GUARANTEED SLEW RATE
- MEET EIA/TIA-232 SPECIFICATIONS DOWN TO 3V
- AVAILABLE IN DIP-16, SO-16, SO-16 LARGE 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 ±8kV using IEC1000-4-2 Contact Discharge and ±15kV 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 0.1µF standard external capacitors for operations from 3V supply.

The ST3232E has two receivers and two drivers.

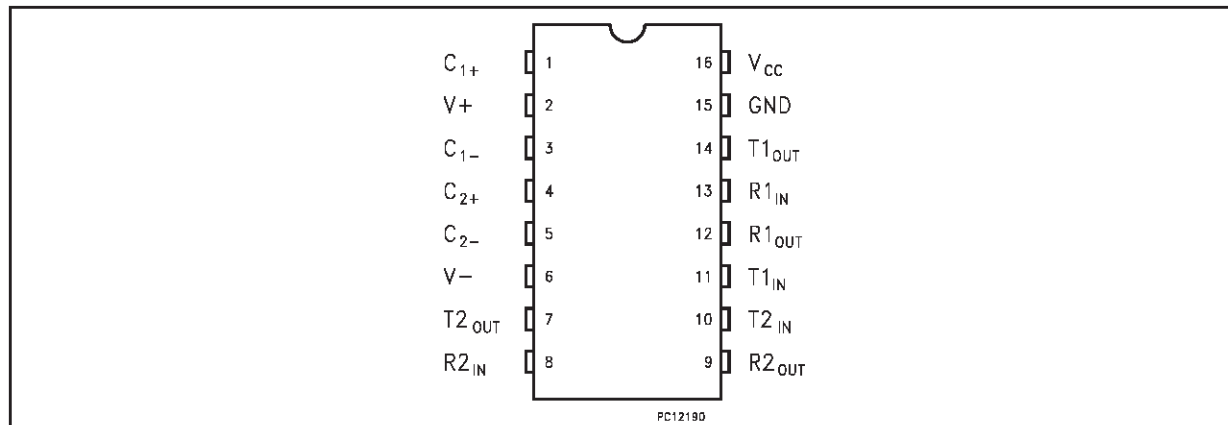


The device is guaranteed to run at data rates of 250Kbps while maintaining RS-232 output levels. Typical applications are Notebook, Subnotebook and Palmtop Computers, Battery Powered Equipment, Hand-Held Equipment, Peripherals and Printers.

#### ORDERING CODES

Type	Temperature Range	Package	Comments
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
ST3232ECD	0 to 70 °C	SO-16 (Tube)	50parts per tube / 20tube per box
ST3232EBD	-40 to 85 °C	SO-16 (Tube)	50parts per tube / 20tube 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
ST3232ECW	0 to 70 °C	SO-16 Large (Tube)	50parts per tube / 20tube per box
ST3232EBW	-40 to 85 °C	SO-16 Large (Tube)	50parts per tube / 20tube per box
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
ST3232ECTR	0 to 70 °C	TSSOP16 (Tape & Reel)	2500 parts per reel
ST3232EBTR	-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</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

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply Voltage	-0.3 to 6	V
V+	Doubled Voltage Terminal	(V <sub>CC</sub> - 0.3) to 7	V
V-	Inverted Voltage Terminal	0.3 to -7	V
V+ +  V-		13	V
T <sub>IN</sub>	Transmitter Input Voltage Range	-0.3 to 6	V
R <sub>IN</sub>	Receiver Input Voltage Range	± 25	V
T <sub>OUT</sub>	Transmitter Output Voltage Range	± 13.2	V
R <sub>OUT</sub>	Receiver Output Voltage Range	-0.3 to (V <sub>CC</sub> + 0.3)	V
t <sub>SHORT</sub>	Transmitter Output Short to GND Time	Continuous	

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.

**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

**ELECTRICAL CHARACTERISTICS**

( $C_1 - C_4 = 0.1\mu\text{F}$ ,  $V_{\text{CC}} = 3\text{V}$  to  $5.5\text{V}$ ,  $T_A = -40$  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
$I_{\text{SUPPLY}}$	$V_{\text{CC}}$ Power Supply Current	No Load $V_{\text{CC}} = 3\text{V}$ or $5\text{V}$ $T_A = 25^\circ\text{C}$		0.3	1	mA

**LOGIC INPUT ELECTRICAL CHARACTERISTICS**

( $C_1 - C_4 = 0.1\mu\text{F}$ ,  $V_{\text{CC}} = 3\text{V}$  to  $5.5\text{V}$ ,  $T_A = -40$  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
$V_{\text{TIL}}$	Input Logic Threshold Low	T-IN			0.8	V
$V_{\text{HYS}}$	Transmitter Input Histeresys			0.25		V
$V_{\text{TIH}}$	Input Logic Threshold High	$V_{\text{CC}} = 3.3\text{V}$	2			V
		$V_{\text{CC}} = 5\text{V}$	2.4			
$I_{\text{IL}}$	Input Leakage Current	T-IN		±0.01	±1	μA

**TRANSMITTER ELECTRICAL CHARACTERISTICS**

( $C_1 - C_4 = 0.1\mu\text{F}$  tested at  $V_{\text{CC}} = 3\text{V}$  to  $5.5\text{V}$ ,  $T_A = -40$  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	±5	±5.4		V
$R_{\text{TOUT}}$	Transmitter Output Resistance	$V_{\text{CC}} = V_+ = V_- = 0\text{V}$ $V_{\text{OUT}} = \pm 2\text{V}$	300	10M		Ω
$I_{\text{TSC}}$	Output Short Circuit Current			±60		mA
$I_{\text{TOL}}$	Output Leakage Current	$V_{\text{CC}} = 0\text{V}$ or $3\text{V}$ to $5.5\text{V}$ $V_{\text{OUT}} = \pm 12\text{V}$ Transmitters Disable			±25	μA

**RECEIVER ELECTRICAL CHARACTERISTICS**

( $C_1 - C_4 = 0.1\mu\text{F}$  tested at  $V_{CC} = 3\text{V}$  to  $5.5\text{V}$ ,  $T_A = -40$  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
$V_{RIN}$	Receiver Input Voltage Operating Range		-25		25	V
$V_{RIL}$	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		
$V_{RIH}$	RS-232 Input Threshold High	$T_A = 25^\circ\text{C}$ $V_{CC} = 3.3\text{V}$		1.4	2.4	V
		$T_A = 25^\circ\text{C}$ $V_{CC} = 5\text{V}$		1.8	2.4	
$V_{RIHYS}$	Input Hysteresis			0.5		V
$R_{RIN}$	Input Resistance	$T_A = 25^\circ\text{C}$	3	5	7	$\text{K}\Omega$
$V_{ROL}$	TTL/CMOS Output Voltage Low	$I_{OUT} = 1.6\text{mA}$			0.4	V
$V_{ROH}$	TTL/CMOS Output Voltage High	$I_{OUT} = -1\text{mA}$	$V_{CC}-0.6$	$V_{CC}-0.1$		V

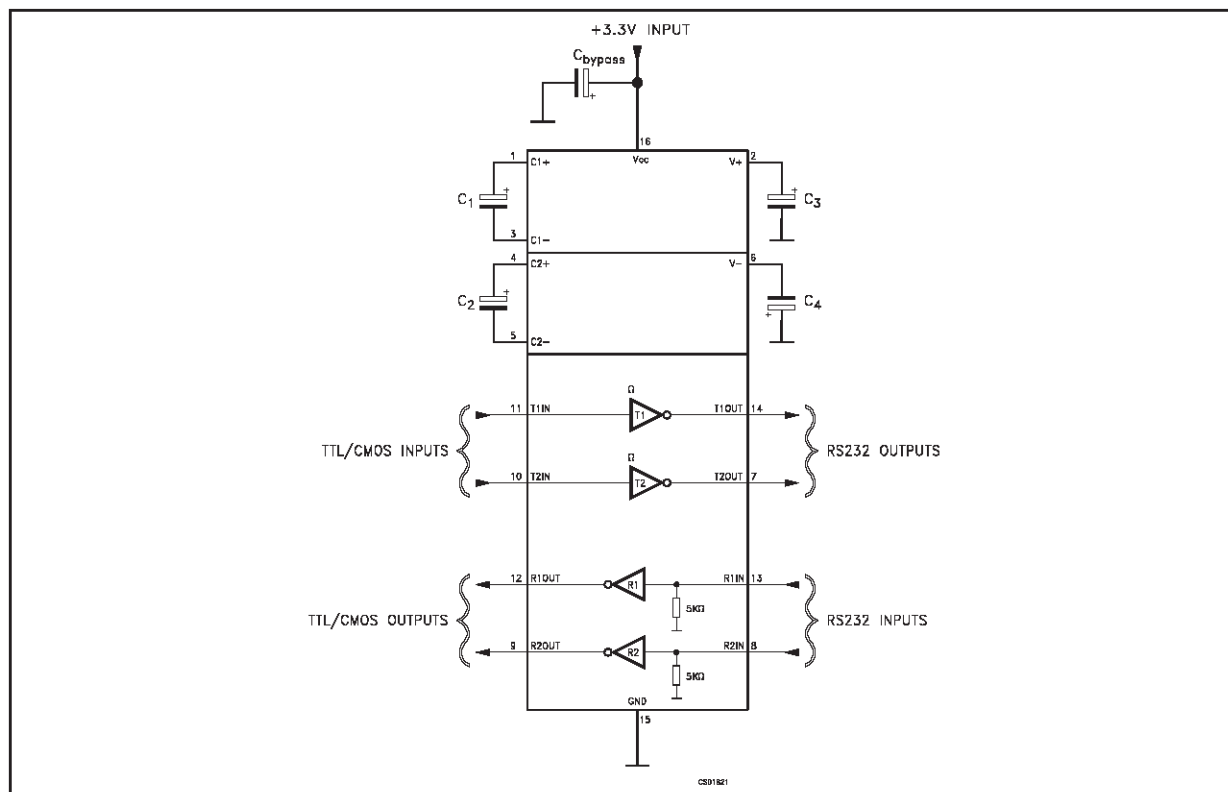
**TIMING CHARACTERISTICS**

( $C_1 - C_4 = 0.1\mu\text{F}$ ,  $V_{CC} = 3\text{V}$  to  $5.5\text{V}$ ,  $T_A = -40$  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
$D_R$	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	$R_{XIN} = R_{XOUT}$ $C_L = 150\text{pF}$		0.15		$\mu\text{s}$
$t_{OER}$	Receiver Output Enable Time	Normal Operation		50		ns
$t_{ODR}$	Receiver Output Disable Time	Normal Operation		50		ns
$ t_{PHLT} - t_{THL} $	Transmitter Propagation Delay Difference	(Note 1)		200		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 $1000\text{pF}$	6		30	$\text{V}/\mu\text{s}$
		$C_L = 150\text{pF}$ to $2500\text{pF}$	4		30	$\text{V}/\mu\text{s}$

Transmitter Skew is measured at the transmitter zero cross points

## APPLICATION CIRCUITS

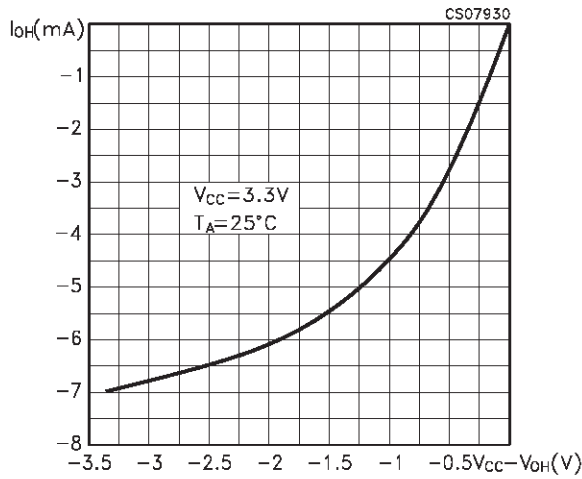


## CAPACITANCE VALUE (μF)

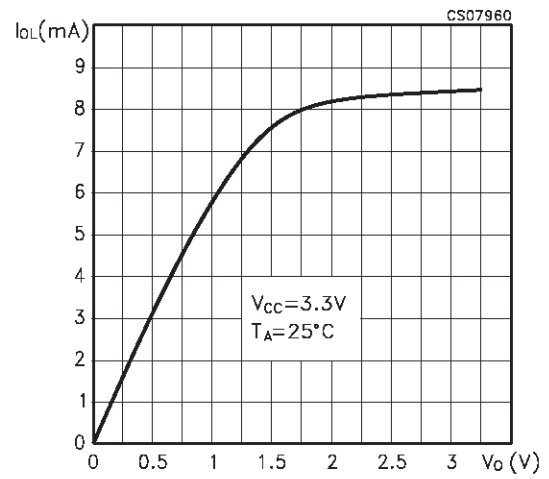
V <sub>CC</sub>	C1	C2	C3	C4	C <sub>bypass</sub>
3.0 to 3.6	0.1	0.1	0.1	0.1	0.1
4.5 to 5.5	0.047	0.33	0.33	0.33	0.1
3.0 to 5.5	0.1	0.47	0.47	0.47	0.1

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

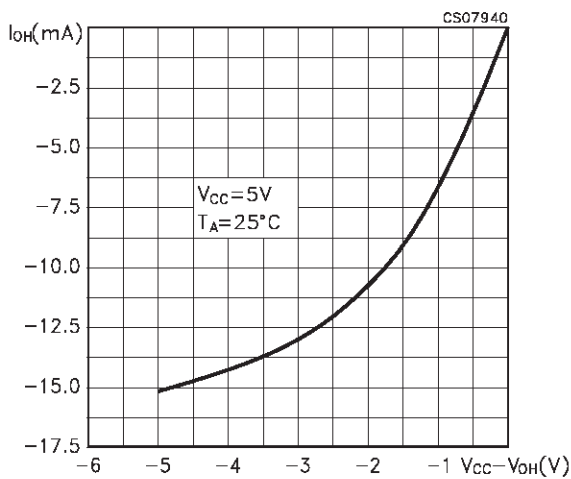
**Figure 1** : Output Current vs Output High Voltage



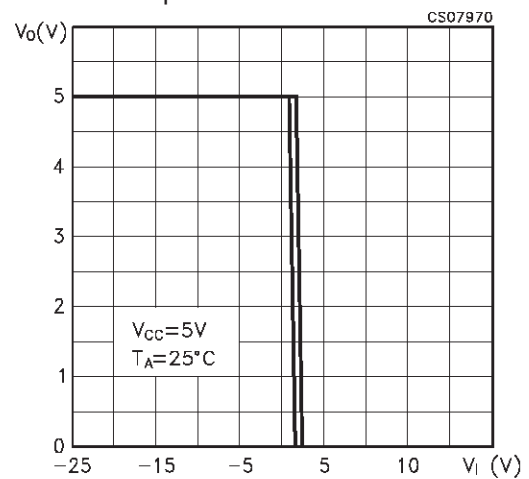
**Figure 4** : Output Current vs Output Low Voltage



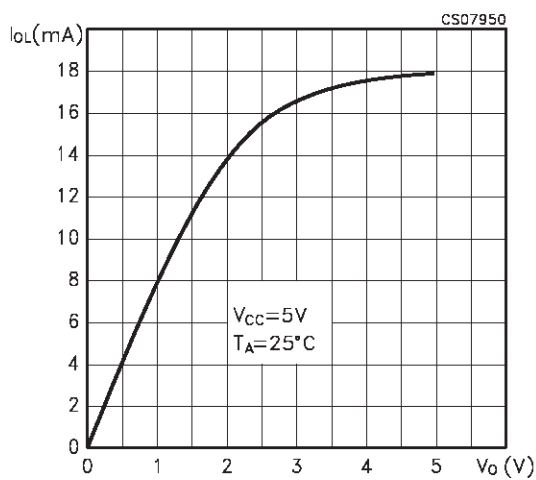
**Figure 2** : Output Current vs Output High Voltage



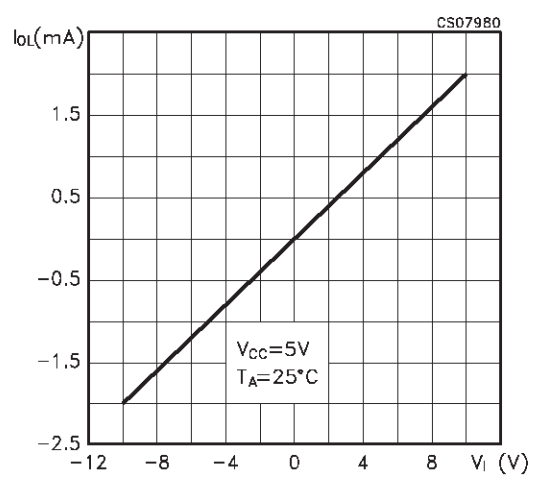
**Figure 5** : Voltage Transfer Characteristics for Transmitter Inputs



**Figure 3** : Output Current vs Output Low Voltage

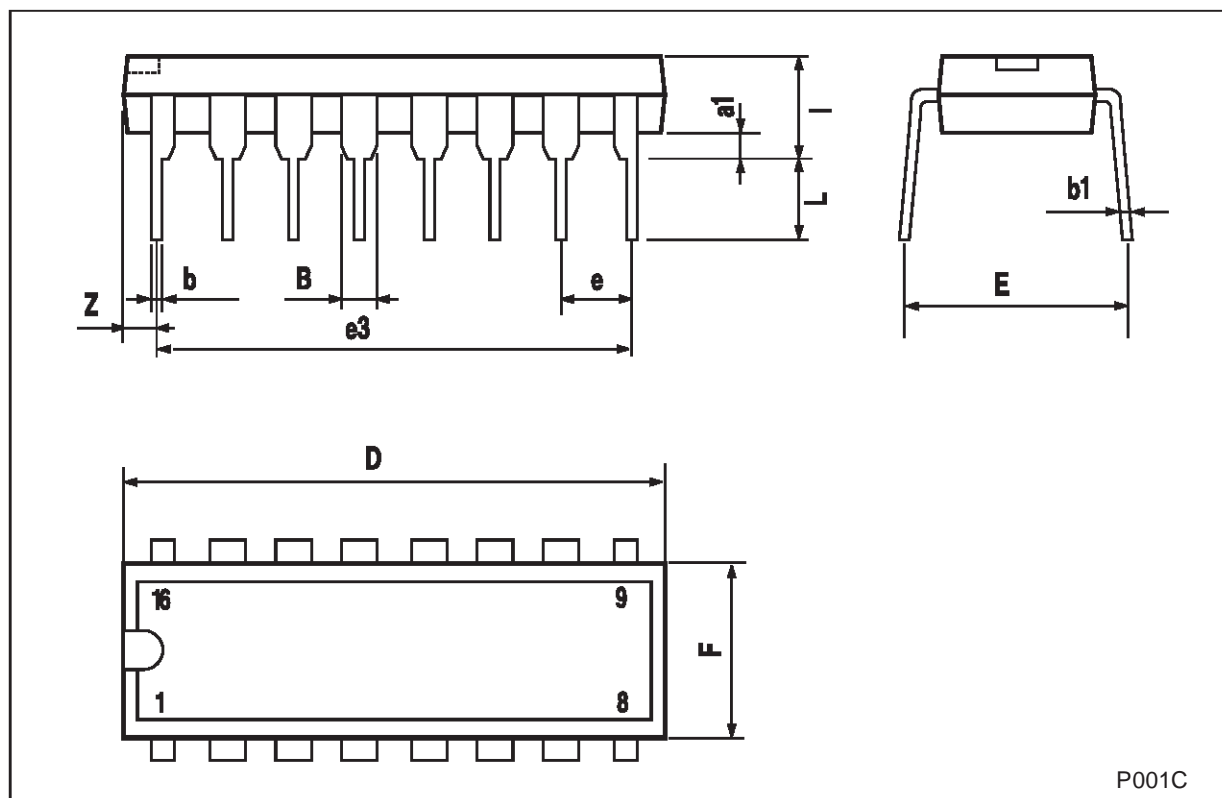


**Figure 6** : Receiver Input Resistance



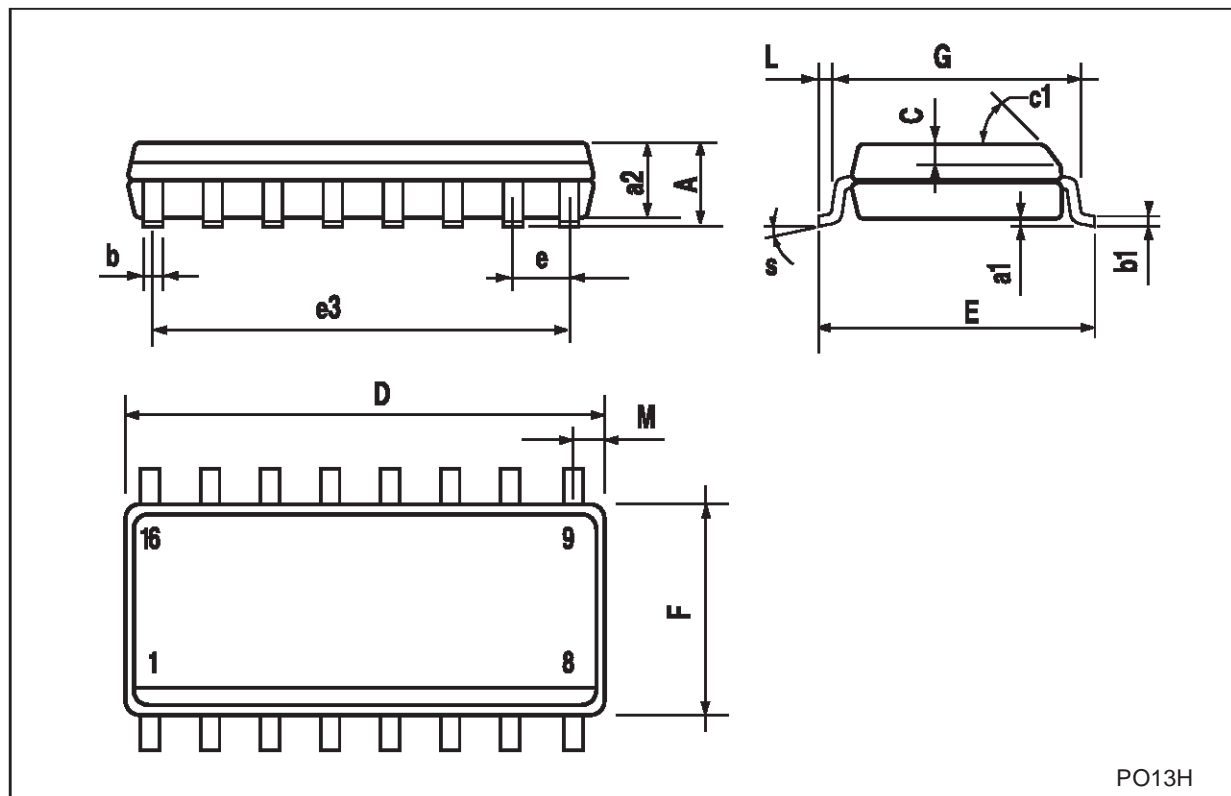
### Plastic DIP-16 (0.25) MECHANICAL DATA

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	0.003		0.007
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.)					

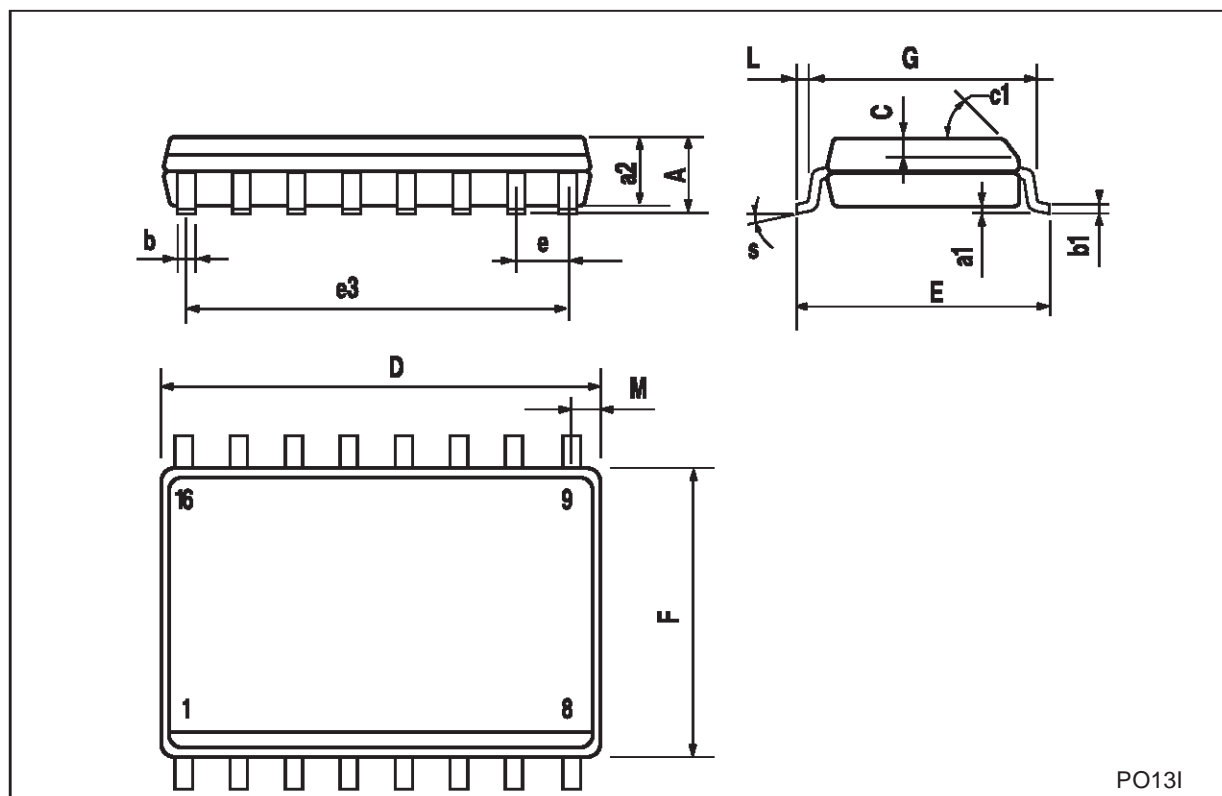


PO13H



## SO-16L MECHANICAL DATA

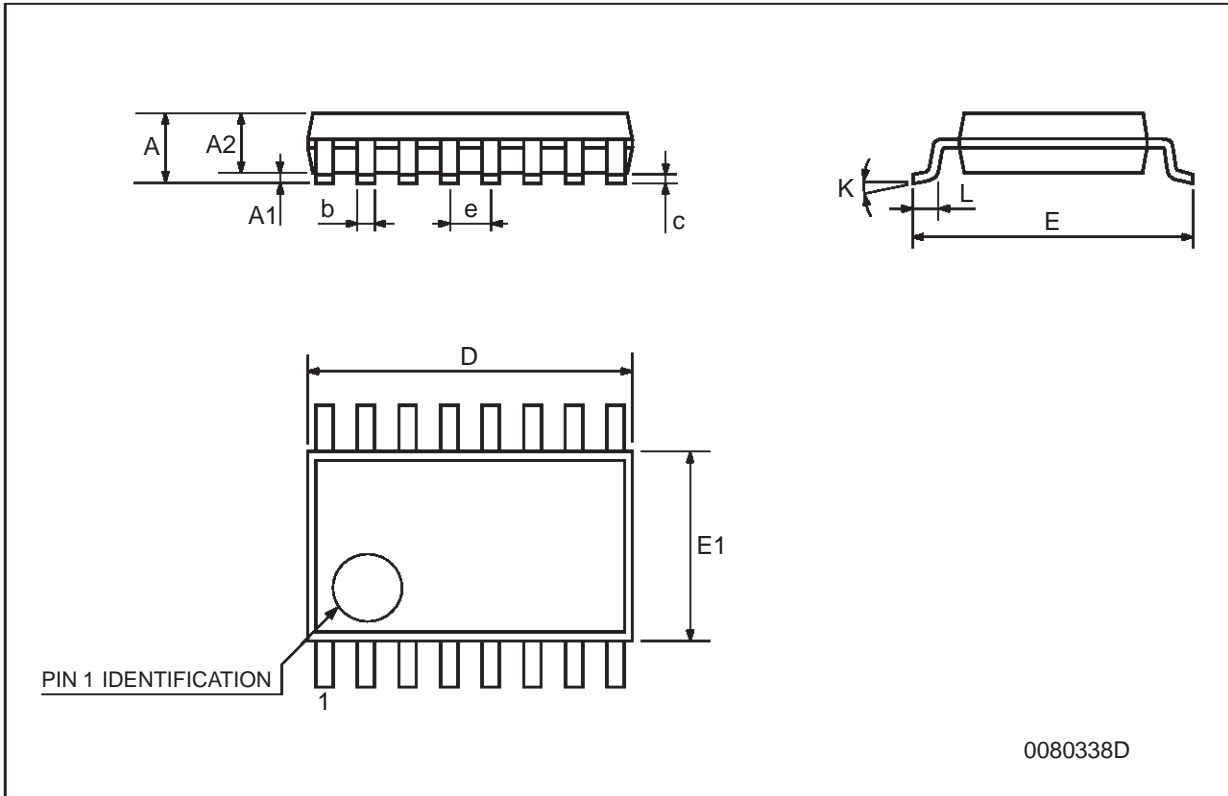
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			2.65			0.104
a1	0.1		0.2	0.004		0.008
a2			2.45			0.096
b	0.35		0.49	0.014		0.019
b1	0.23		0.32	0.009		0.012
C		0.5			0.020	
c1	45° (typ.)					
D	10.1		10.5	0.397		0.413
E	10.0		10.65	0.393		0.419
e		1.27			0.050	
e3		8.89			0.350	
F	7.4		7.6	0.291		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		0.0089
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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