



## ST3222E

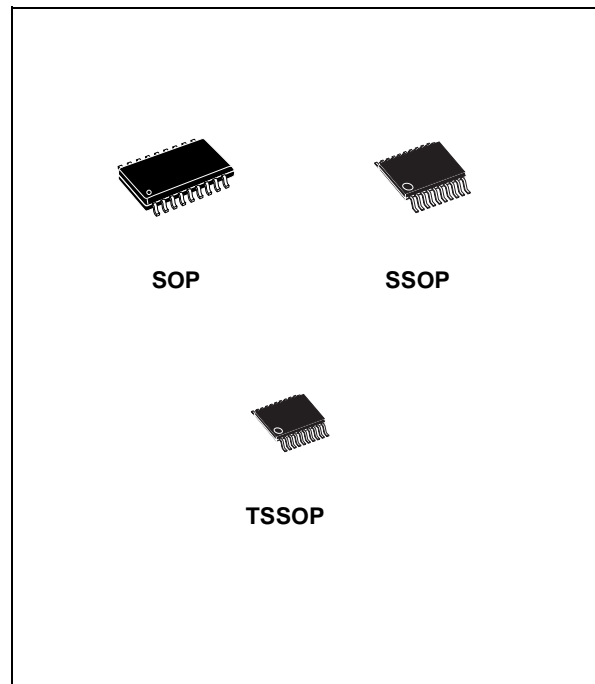
### ±15KV ESD-PROTECTED, 3 TO 5.5V, LOW POWER, UP TO 250KBPS, RS-232 DRIVERS AND RECEIVERS

- 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 SO-18, SSOP20 AND TSSOP20

#### DESCRIPTION

The ST3222E is a 3V powered EIA/TIA-232 and V.28/V.24 communications interface 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. ST3222E 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 0.1mF external capacitors for operation from 3V supply.

The device has two receivers and two drivers. The ST3222E features a 1µA shutdown mode that reduces power consumption and extends battery life in portable systems. Its receivers can remain active in shutdown mode, allowing external



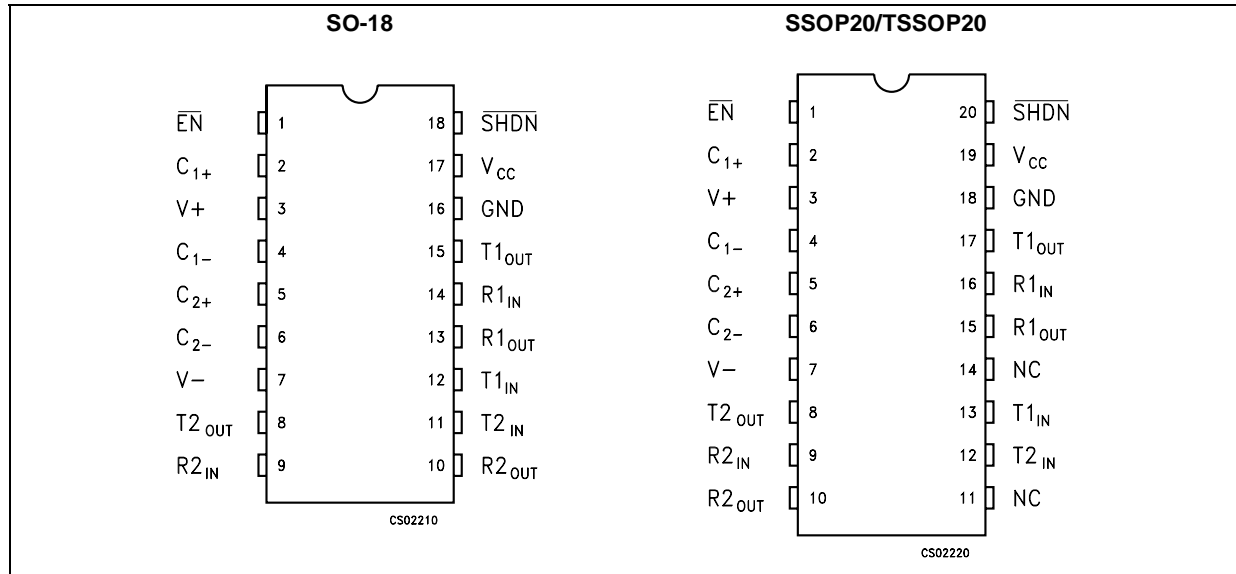
devices such as modems to be monitored using only 1µA supply current.

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
ST3222ECD	0 to 70 °C	SO-18 (Tube)	50parts per tube / 20tube per box
ST3222EBD	-40 to 85 °C	SO-18 (Tube)	50parts per tube / 20tube per box
ST3222ECDR	0 to 70 °C	SO-18 (Tape & Reel)	1000 parts per reel
ST3222EBDR	-40 to 85 °C	SO-18 (Tape & Reel)	1000 parts per reel
ST3222ECPR	0 to 70 °C	SSOP20 (Tape & Reel)	1350 parts per reel
ST3222EBPR	-40 to 85 °C	SSOP20 (Tape & Reel)	1350 parts per reel
ST3222ECTR	0 to 70 °C	TSSOP20 (Tape & Reel)	2500 parts per reel
ST3222EBTR	-40 to 85 °C	TSSOP20 (Tape & Reel)	2500 parts per reel

**PIN CONFIGURATION**



**PIN DESCRIPTION**

PIN N° (SO-18)	PIN N° (SSOP20 TSSOP20)	SYMBOL	NAME AND FUNCTION
1	1	EN	Receiver Enable Control. Drive low for normal operation. Drive high to force the receivers outputs (R_OUT) into a high-impedance state.
2	2	C <sub>1+</sub>	Positive Terminal for the first Charge Pump Capacitor
3	3	V+	5.5V Generated By The Charge Pump.
4	4	C <sub>1-</sub>	Negative Terminal for the first Charge Pump Capacitor
5	5	C <sub>2+</sub>	Positive Terminal for the second Charge Pump Capacitor
6	6	C <sub>2-</sub>	Negative Terminal for the second Charge Pump Capacitor
7	7	V-	-5.5V Generated By The Charge Pump.
8	8	T <sub>2</sub> OUT	Second Transmitter Output Voltage
9	9	R <sub>2</sub> IN	Second Receiver Input Voltage
10	10	R <sub>2</sub> OUT	Second Receiver Output Voltage
	11	NC	Not Connected
11	12	T <sub>2</sub> IN	Second Transmitter Input Voltage
12	13	T <sub>1</sub> IN	First Transmitter Input Voltage
	14	NC	Not Connected
13	15	R <sub>1</sub> OUT	First Receiver Output Voltage
14	16	R <sub>1</sub> IN	First Receiver Input Voltage
15	17	T <sub>1</sub> OUT	First Transmitter Output Voltage
16	18	GND	Ground
17	19	V <sub>CC</sub>	Supply Voltage
18	20	SHDN	Active Low Shutdown Control Input. Drive Low To Shut-down Transmitters And Charge Pump

## 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
SHDN	Transmitter Input Voltage Range	-0.3 to 6	V
$R_{IN}$	Receiver Input Voltage Range	$\pm 25$	V
$T_{OUT}$	Transmitter Output Voltage Range	$\pm 13.2$	V
$R_{OUT}$	Receiver Output Voltage Range	-0.3 to $(V_{CC} + 0.3)$	V
$t_{SHORT}$	Transmitter Output Short to GND Time	Continuous	

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.

## SHUTDOWN AND ENABLE CONTROL TRUTH TABLE

$\overline{SHDN}$	$\overline{EN}$	T-OUT	R-OUT
0	0	High Z	Active
0	1	High Z	High Z
1	0	Active	Active
1	1	Active	High Z

## ESD PERFORMANCE: TRANSMITTER OUTPUTS, RECEIVER INPUTS

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
ESD	ESD Protection Voltage	Human Body Model	$\pm 15$			kV
ESD	ESD Protection Voltage	IEC-1000-4-2	$\pm 8$			kV

## ELECTRICAL CHARACTERISTICS

( $C_1 - C_4 = 0.1\mu F$ ,  $V_{CC} = 3V$  to  $5.5V$ ,  $T_A = -40$  to  $85^\circ C$ , unless otherwise specified.

Typical values are referred to  $T_A = 25^\circ C$ )

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SUPPLY}$	$V_{CC}$ Power Supply Current	No Load $\overline{SHDN}=V_{CC} T_A = 25^\circ C$		0.3	1	mA
$I_{SHDN}$	SHUTDOWN Supply Current	No Load $\overline{SHDN}=V_{CC} T_A = 25^\circ C$		1	10	$\mu A$

## LOGIC INPUT ELECTRICAL CHARACTERISTICS

( $C_1 - C_4 = 0.1\mu F$ ,  $V_{CC} = 3V$  to  $5.5V$ ,  $T_A = -40$  to  $85^\circ C$ , unless otherwise specified.

Typical values are referred to  $T_A = 25^\circ C$ )

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{IL}$	Input Logic Threshold Low	T-IN, EN, SHDN (Note 1)			0.8	V
$V_{IH}$	Input Logic Threshold High	$V_{CC} = 3.3V$	2			V
		$V_{CC} = 5V$	2.4			
$V_{HYS}$	Transmitter Input Histeresys			0.25		V
$I_{IL}$	Input Leakage Current	T-IN, EN, SHDN		$\pm 0.01$	$\pm 1$	$\mu A$

Note 1: Transmitter input hysteresis is typically 250mV

**TRANSMITTER ELECTRICAL CHARACTERISTICS**

( $C_1 - C_4 = 0.1\mu\text{F}$ ,  $V_{CC} = 3\text{V to } 5.5\text{V}$ ,  $T_A = -40 \text{ to } 85^\circ\text{C}$ , 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 3K $\Omega$ to GND	$\pm 5$	$\pm 5.4$		V
$R_{\text{TOUT}}$	Transmitter Output Resistance	$V_{CC} = V_+ = V_- = 0\text{V}$ $V_{\text{OUT}} = \pm 2\text{V}$	300	10M		$\Omega$
$I_{\text{TSC}}$	Output Short Circuit Current			$\pm 60$		mA
$I_{\text{TOL}}$	Output Leakage Current	$V_{CC} = 0\text{V or } 3\text{V to } 3.6\text{V}$ $V_{\text{OUT}} = \pm 12\text{V}$ Transmitters Disable			$\pm 25$	$\mu\text{A}$

**RECEIVER ELECTRICAL CHARACTERISTICS**

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{\text{OL}}$	Output Leakage Current	R-OUT, EN = $V_{CC}$ , Receiver Disabled		$\pm 0.05$	$\pm 10$	$\mu\text{A}$
$V_{\text{RIN}}$	Receiver Input Voltage Operating Range		-25		25	V
$V_{\text{RIL}}$	Input Threshold Low	$T_A = 25^\circ\text{C}$ $V_{CC} = 3.3\text{V}$	0.6	1.2		V
		$T_A = 25^\circ\text{C}$ $V_{CC} = 5\text{V}$	0.8	1.5		
$V_{\text{RIH}}$	Input Threshold High	$T_A = 25^\circ\text{C}$ $V_{CC} = 3.3\text{V}$		1.5	2.4	V
		$T_A = 25^\circ\text{C}$ $V_{CC} = 5\text{V}$		1.8	2.4	
$V_{\text{RIHYS}}$	Input Hysteresis			0.5		V
$R_{\text{RIN}}$	Input Resistance	$T_A = 25^\circ\text{C}$	3	5	7	K $\Omega$
$V_{\text{ROL}}$	Output Voltage Low	$I_{\text{OUT}} = 1.6\text{mA}$			0.4	V
$V_{\text{ROH}}$	Output Voltage High	$I_{\text{OUT}} = -1\text{mA}$	$V_{CC}-0.6$	$V_{CC}-0.1$		V

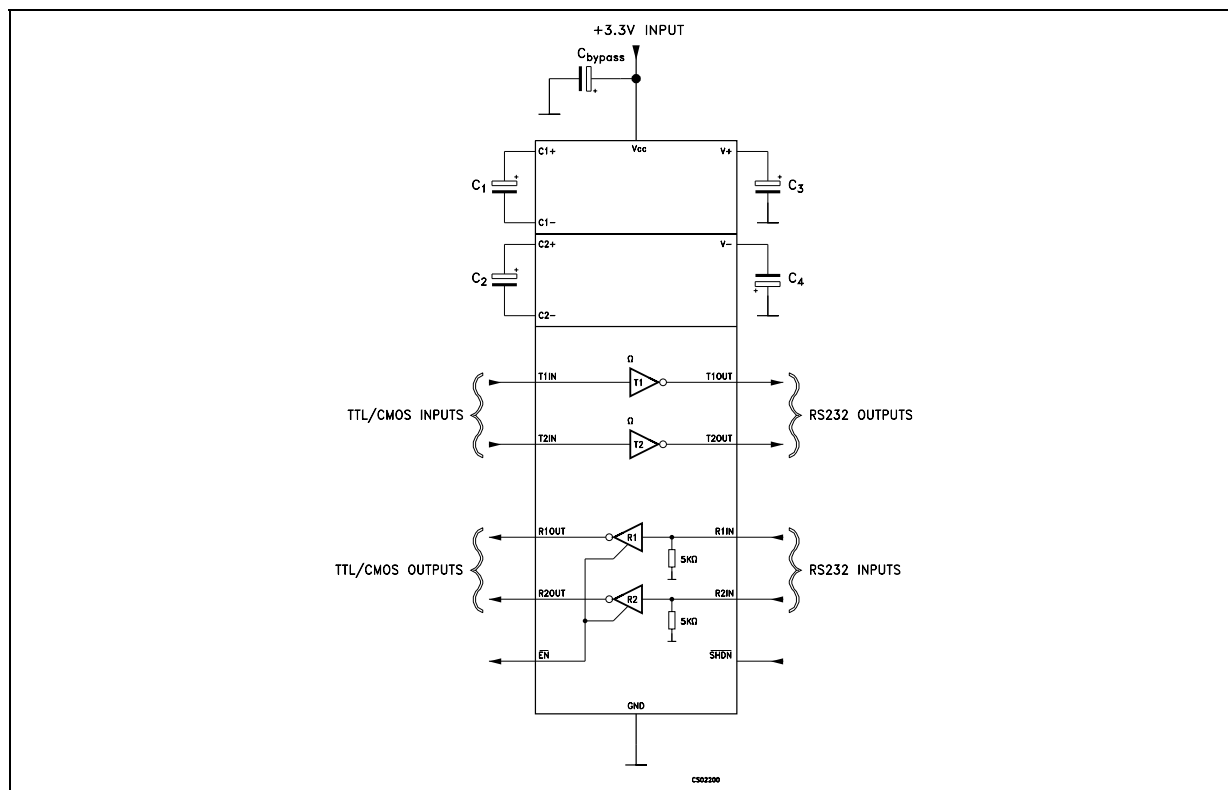
**TIMING CHARACTERISTICS**

( $C_1 - C_4 = 0.1\mu\text{F}$ ,  $V_{CC} = 3\text{V to } 5.5\text{V}$ ,  $T_A = -40 \text{ to } 85^\circ\text{C}$ , 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
$t_{\text{PHLR}}$ $t_{\text{PLHR}}$	Propagation Delay Input to Output	$R_{\text{XIN}}$ to $R_{\text{XOUT}}$ $C_L = 150\text{pF}$		0.15		$\mu\text{s}$
$ t_{\text{PHLT}} - t_{\text{THL}} $	Transmitter Propagation Delay Difference	(Note 1)		200		ns
$t_{\text{OER}}$	Receiver Output Enable Time	Normal Operation		50		ns
$t_{\text{ODR}}$	Receiver Output Disable Time	Normal Operation		50		ns
$ t_{\text{PHLR}} - t_{\text{THR}} $	Receiver Propagation Delay Difference			50		ns
$S_{\text{RT}}$	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 +3V to -3V or -3V to +3V $C_L = 150\text{pF}$ to $1000\text{pF}$ $C_L = 150\text{pF}$ to $2500\text{pF}$	6		30	V/ $\mu\text{s}$ V/ $\mu\text{s}$
			4		30	

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

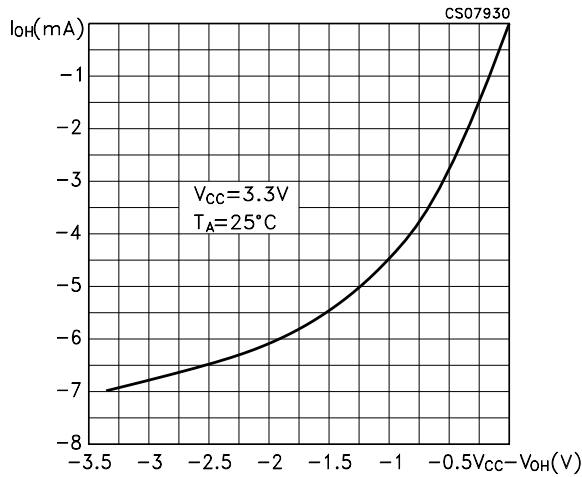
## APPLICATION CIRCUITS

CAPACITANCE VALUE ( $\mu\text{F}$ )

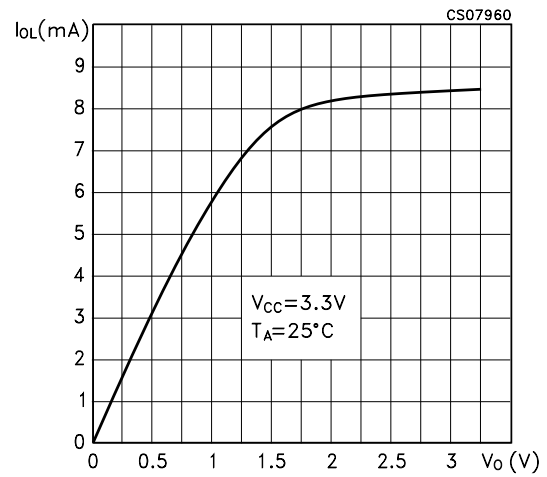
V <sub>CC</sub>	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>bypass</sub>
3.0 to 3.6	0.1	0.1	0.1	0.1	0.1
4.5 to 5.5	0.047	0.33	0.33	0.33	0.1
3.0 to 5.5	0.1	0.47	0.47	0.47	0.1

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

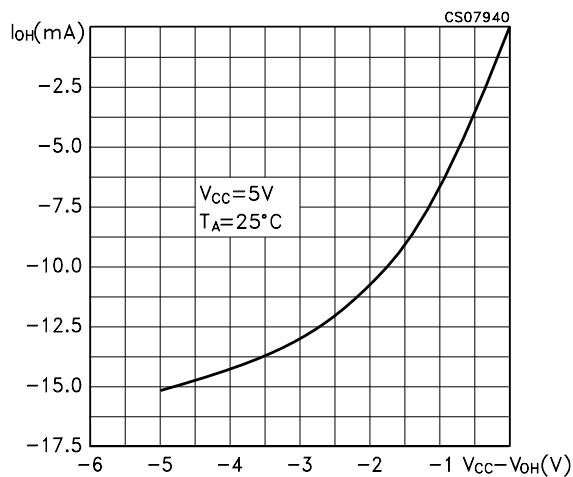
**Figure 1** : Output Current vs Output High Voltage



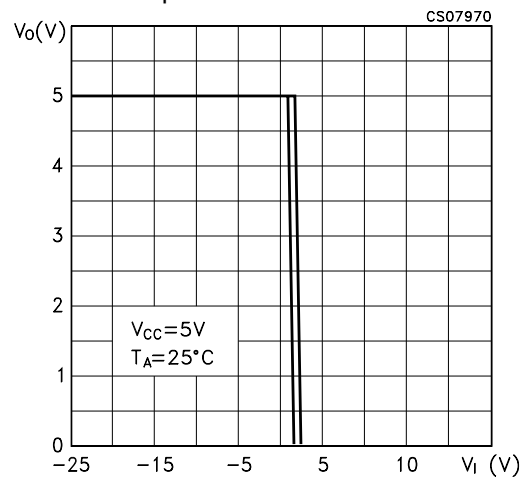
**Figure 4** : Output Current vs Output Low Voltage



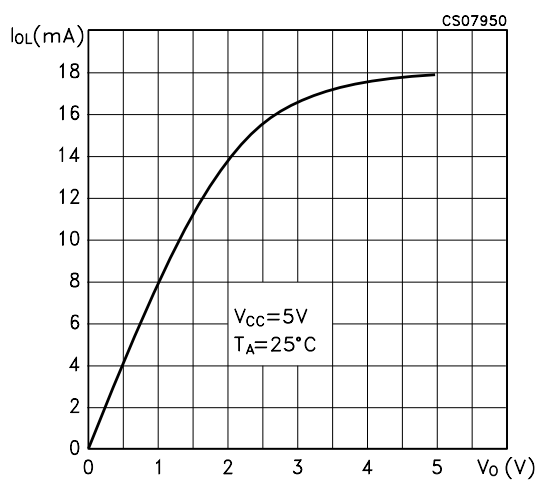
**Figure 2** : Output Current vs Output High Voltage



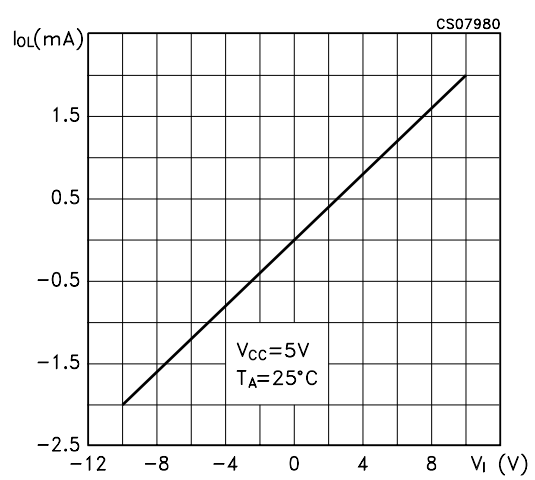
**Figure 5** : Voltage Transfer Characteristics for Transmitter Inputs



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

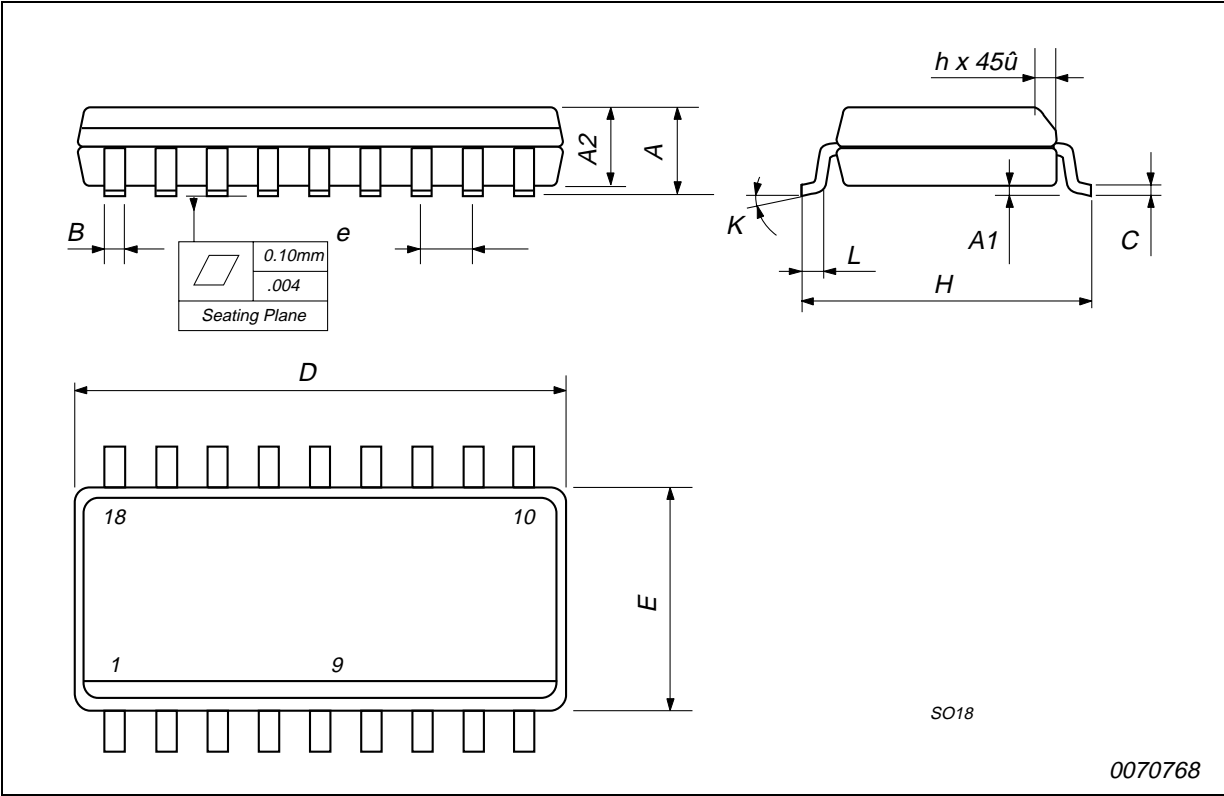


**Figure 6** : Receiver Input Resistance



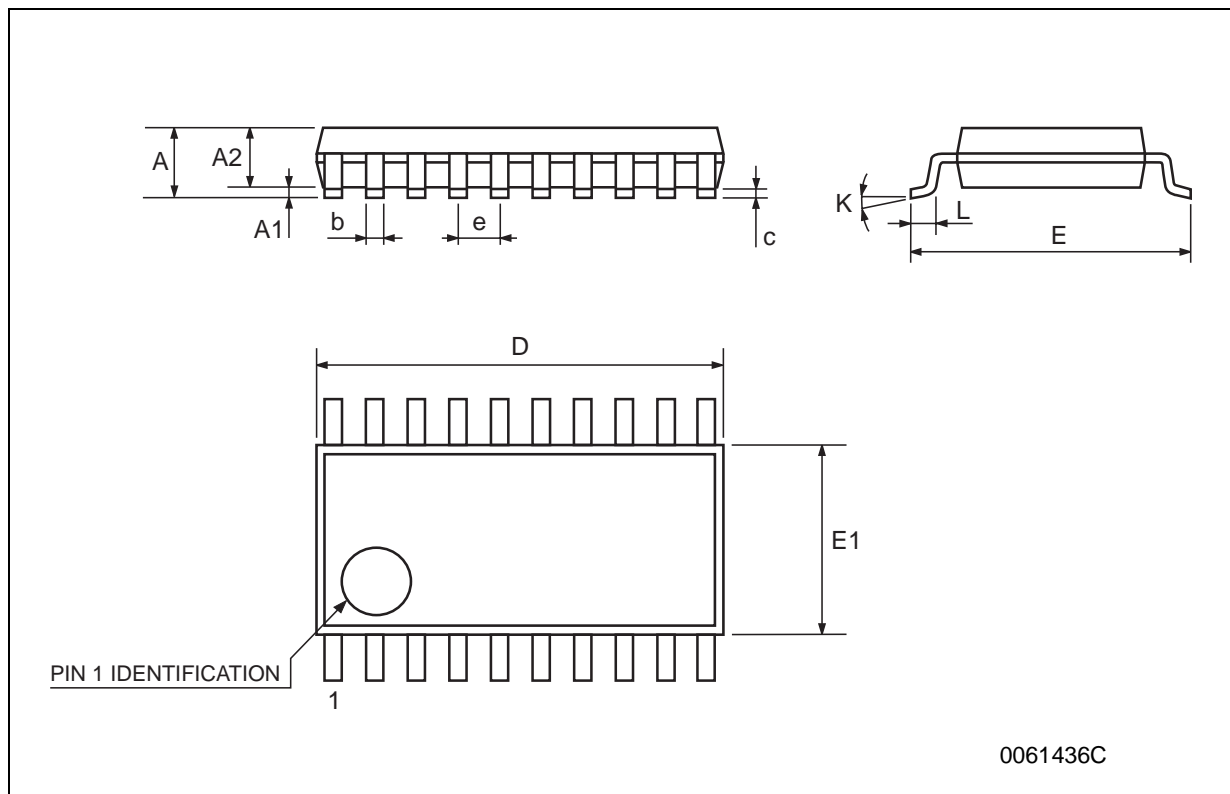
**SO-18 MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	2.35		2.65	0.092		0.104
A1	0.1		0.3	0.004		0.012
A2			2.55			0.100
B	0.33		0.51	0.013		0.020
C	0.23		0.32	0.009		0.012
D	11.35		11.75	0.447		0.462
E	7.4		7.6	0.291		0.299
e		1.27			0.050	
H	10.00		10.65	0.393		0.419
h	0.25		0.75	0.010		0.029
k	8 ° (max.)					
L	0.4		1.27	0.016		0.050



## SSOP20 MECHANICAL DATA

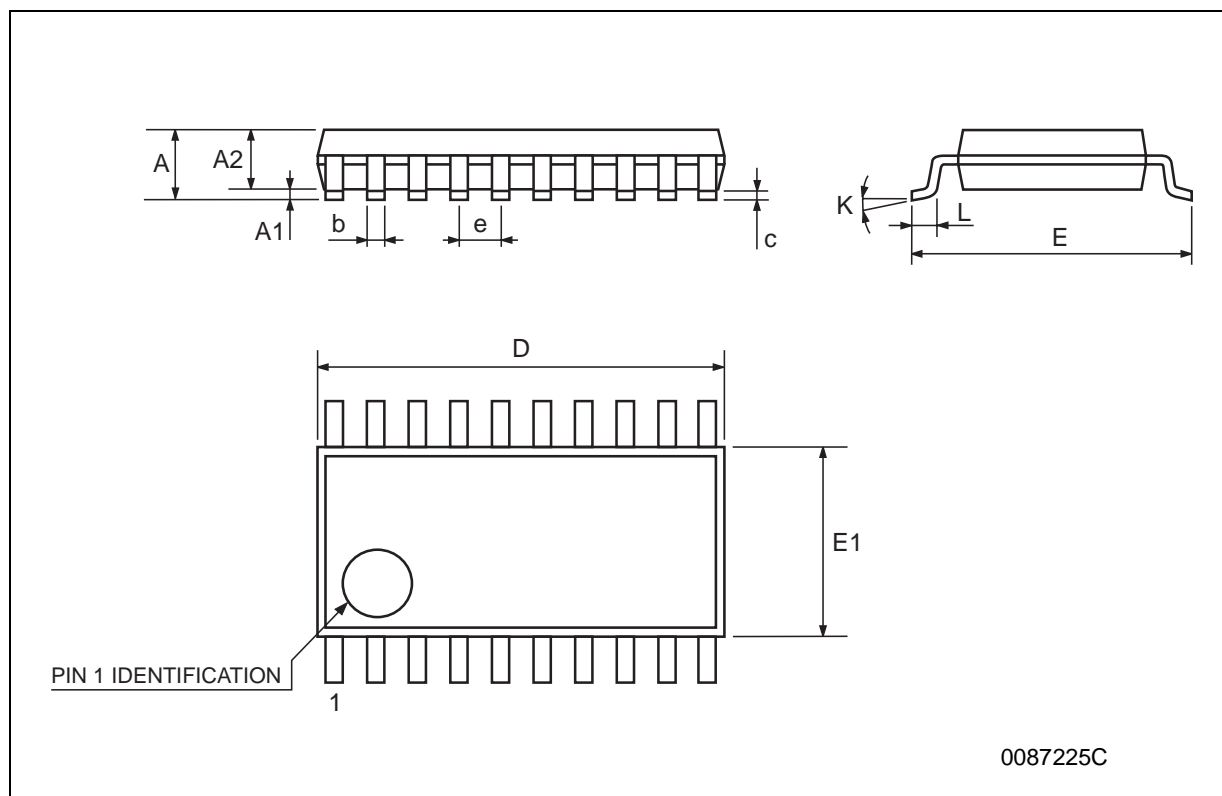
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			2			0.079
A1	0.05			0.002		
A2	1.65	1.75	1.85	0.065	0.069	0.073
b	0.22		0.38	0.009		0.015
c	0.09		0.25	0.004		0.010
D	6.9	7.2	7.5	0.272	0.283	0.295
E	7.4	7.8	8.2	0.291	0.307	0.323
E1	5	5.3	5.6	0.197	0.209	0.220
e		0.65 BSC			0.0256 BSC	
K	0°	4°	8°	0°	4°	8°
L	0.55	0.75	0.95	0.022	0.030	0.037





## TSSOP20 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	6.4	6.5	6.6	0.252	0.256	0.260
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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