

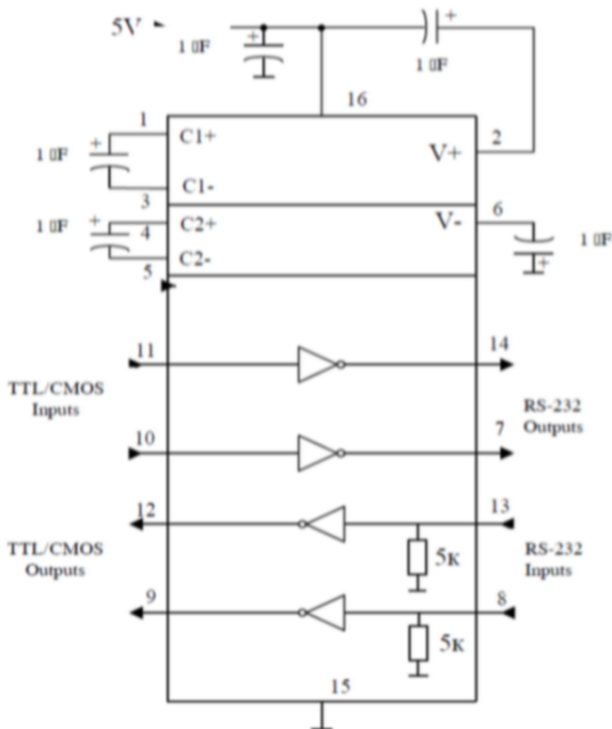
**+5 V-Powered, Multi-Channel RS-232 Drivers/Receivers**

The MAX232 have two drives and two receivers. The drivers and receivers meet all EIA/TIA-232 and CCITT V.28 specifications at data rates up to 120 kbps when loaded in accordance with the EIA/TIA-232 specification

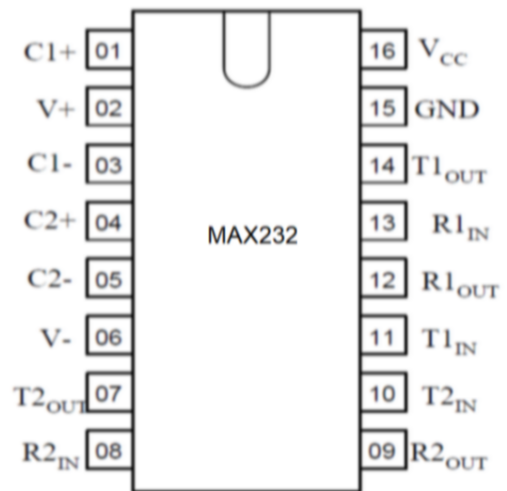
- Operate from Single +5 V Power Supply;
- Guaranteed 120 kbps Data Rate;
- Latchup Free;
- ESD Protection  $\pm 2\text{kV}$



**Typical Operating Circuit**



**Pin configuration**



**+5 V-Powered, Multi-Channel RS-232 Drivers/Receivers**

**Pin descriptions**

Pin No	Symbol	Function
01	C1+	Terminal for positive charge-pump capacitor
02	V+	+2 V <sub>CC</sub> voltage generated by the charge-pump
03	C1-	Terminal for positive charge-pump capacitor
04	C2+	Terminal for negative charge-pump capacitor
05	C2-	Terminal for negative charge-pump capacitor
06	V-	-2 V <sub>CC</sub> voltage generated by the charge-pump
07	T2 <sub>OUT</sub>	RS – 232 Driver Output
08	R2 <sub>IN</sub>	RS – 232 Receiver Input
09	R2 <sub>OUT</sub>	RS – 232 Receiver Output
10	T2 <sub>IN</sub>	RS – 232 Driver Input
11	T1 <sub>IN</sub>	RS – 232 Driver Input
12	R1 <sub>OUT</sub>	RS – 232 Receiver Output
13	R1 <sub>IN</sub>	RS – 232 Receiver Input
14	T1 <sub>OUT</sub>	RS – 232 Driver Output
15	GND	Ground
16	V <sub>CC</sub>	+ 4.5 V to 5.5 V Supply Voltage Input

**Absolute maximum conditions**

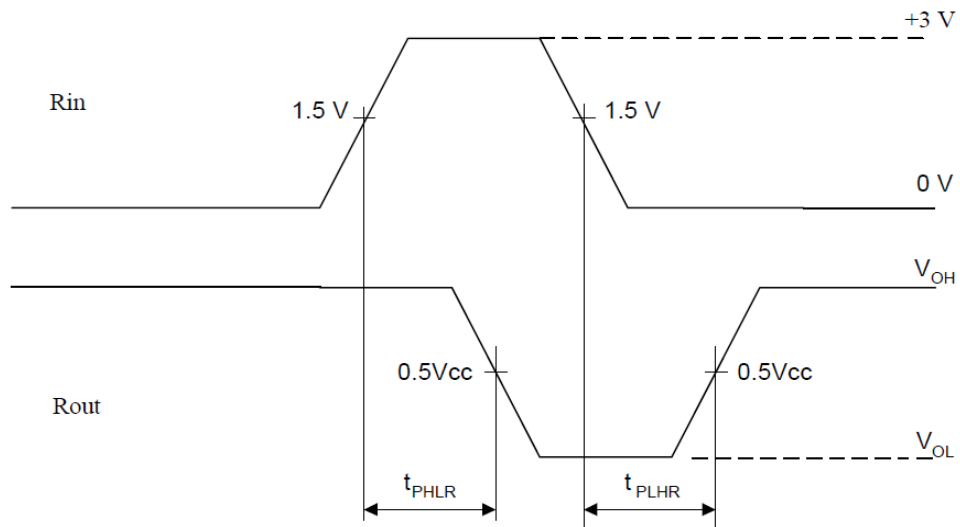
Symbol	Parameter	Rate		Unit
		min	max	
V <sub>CC</sub>	Supply voltage	-0.3	6.0	V
V+	Transmitter high output voltage	V <sub>CC</sub> – 0.3	14	V
V-	Transmitter low output voltage	-14	+0.3	
V <sub>TIN</sub>	Transmitter input voltage	-0.3	V <sub>CC</sub> +0.3	
V <sub>RIN</sub>	Receiver input voltage	-30	30	
V <sub>TOUT</sub>	Output voltages (transmitters)	V <sub>-</sub> -0.3	V <sub>+</sub> +0.3	
V <sub>ROUT</sub>	Output voltages (receivers)	-0.3	V <sub>CC</sub> +0.3	V
P <sub>D</sub>	Power dissipation DIP – package (derate 10.53 mW/°C above 70 °C) SO – package (derate 9.52 mW/°C above 70 °C)	-	842 762	mW
I <sub>SC</sub>	Short-Circuit Duration (T <sub>out</sub> )	-	Continu- ous	
T <sub>stg</sub>	Storage temperature	-60	150	°C
T <sub>A</sub>	Operating voltage range	0	70	°C

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**ELECTRICAL CHARACTERISTICS**

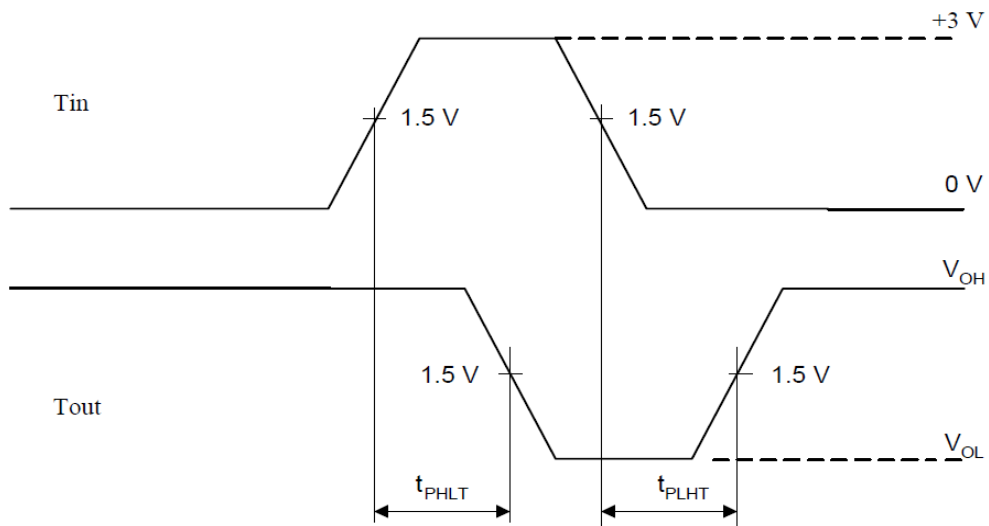
 (V<sub>CC</sub> = 4.5V to 5.5V, C1-C4 = 1μF; T<sub>A</sub> = -40 to +85°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Max	Units
<b>DC CHARACTERISTICS</b>					
V <sub>CC</sub>	Operating Voltage Range	V <sub>IL</sub> =0V	4.5	5.5	V
I <sub>CC</sub>	V <sub>CC</sub> Supply Current	No load, T <sub>A</sub> = 25°C		10.0	mA
<b>LOGIC</b>					
I <sub>I</sub>	Input Leakage Current	T <sub>IN</sub> = 0V to V <sub>CC</sub>	0.2	±10	μA
V <sub>IL</sub>	Input Threshold Low	T <sub>IN</sub>		0.8	V
V <sub>IH</sub>	Input Threshold High	T <sub>IN</sub>	2.0		V
V <sub>OL</sub>	Output Voltage Low	R <sub>OUT</sub> ; I <sub>OUT</sub> = 3.2mA		0.4	V
V <sub>OH</sub>	Output Voltage High	R <sub>OUT</sub> ; I <sub>OUT</sub> = -1.0mA	3.5		V
<b>RECEIVER INPUTS</b>					
V <sub>RIN</sub>	Input Voltage Range	All parts, normal operation	-30	+30	V
V <sub>ff</sub>	Input Threshold Low	T <sub>A</sub> = +25°C, V <sub>CC</sub> =5V	0.8		V
I <sub>on</sub>	Input Threshold High	T <sub>A</sub> = +25°C, V <sub>CC</sub> =5V	-	2.4	V
V <sub>h</sub>	Input Hysteresis	V <sub>CC</sub> = 5 V	0.2	1.0	V
R <sub>I</sub>	Input Resistance	T <sub>A</sub> = +25°C, V <sub>CC</sub> =5V	3	7	kΩ
<b>TRANSMITTER OUTPUTS</b>					
Δ V <sub>O</sub>	Output Voltage Swing	All driver inputs loaded with 3kΩ to ground	±5.0		V
R <sub>O</sub>	Output resistance	V <sub>CC</sub> =V+=V-=0V; V <sub>OUT</sub> =±2V	300		Ω
I <sub>SC</sub>	Output Short-Circuit Current			±60	mA
<b>TIMING CHARACTERISTICS</b>					
ST	Maximum Data Rate	R <sub>L</sub> =3.0kΩ to 7 kΩ, C <sub>L</sub> =50pF to 1000pF, one transmitter switching	120		kbps
t <sub>PLHR</sub> , t <sub>PHLR</sub>	Receiver Propagation Delay	C <sub>L</sub> = 150pF All parts, normal operation (Fig. 1)		10	μS
t <sub>PLHT</sub> , t <sub>PHLT</sub>	Transmitter Propagation Delay	R <sub>L</sub> =3.0kΩ, C <sub>L</sub> =2500pF, all transmitters loaded (Fig. 2)		6.0	μS
SR	Transition-Region Slew Rate	T <sub>A</sub> = 25°C, V <sub>CC</sub> = 5V, R <sub>L</sub> =3.0kΩ to 7 kΩ, C <sub>L</sub> =50pF to 2500pF, measured from -3V to +3V or +3V to -3V (Fig. 3)	3	30	V/μS

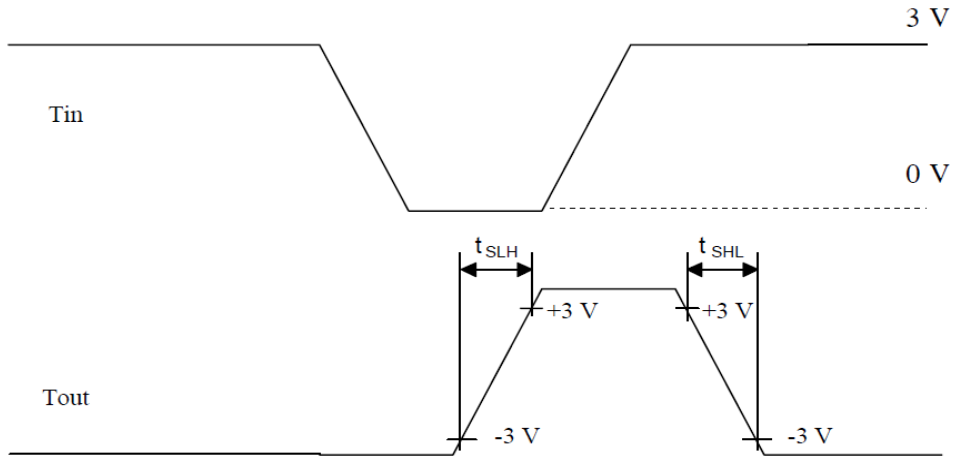
**Timing diagram**



**Figure 1**



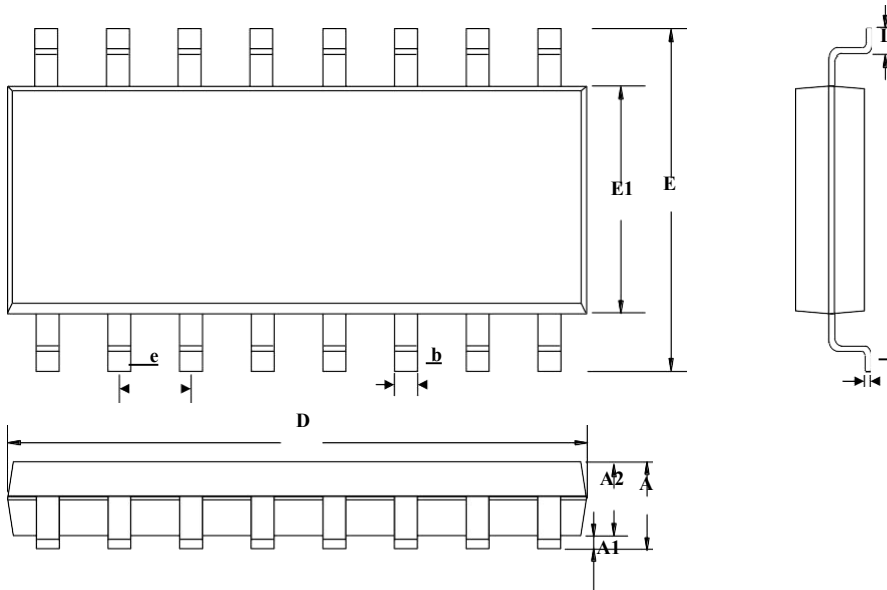
**Figure 2**



**Figure 3**

**PACKAGE OUTLINE**

SOP-16  
UNIT:mm



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.80
A1	0.10	0.15	0.25
A2	1.25	1.45	1.65
b	0.33	—	0.51
c	0.17	—	0.25
D	9.50	—	10.20
E	5.80	6.00	6.20
E1	3.70	—	4.10
e	1.27BSC		
L	0.45	0.60	0.80

**Ordering information**

Order code	Package	Baseqty	Deliverymode	Operating temperature range
MAX232ACSE	SOP-16	2500	Tape and reel	0°C - +70°C