

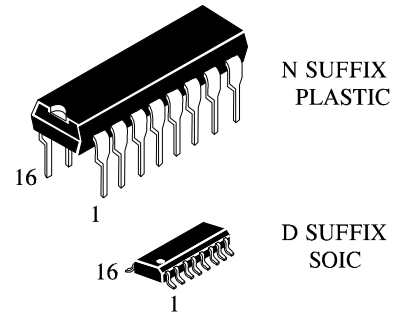
### +5V-Powered, Multichannel RS-232

### Drivers / Receivers

MAX232 is purposed for application in high-performance information processing systems and control devices of wide application.

Input voltage levels are compatible with standard CMOS levels.

- Output voltage levels are compatible with input levels of K-MOS, N-MOS and TTL integrated circuits.
- Supply voltage : 5V
- Low input current: 1.0  $\mu\text{A}$ ; 0.1  $\mu\text{A}$  at T = 25 °C.
- Output current 24 mA.
- Latching current not less than 450 mA at T = 25°C
- The transmitter outputs and receiver inputs are protected to  $\pm 15\text{kV}$  Air ESD.



#### ORDERING INFORMATION

MAX232CPE Plastic DIP

MAX232CSE SOIC

MAX232CWE SOIC

T<sub>A</sub>MAX232CWE<sup>o</sup> C

For all packages

#### Truth table

Inputs	Outputs
R <sub>IN</sub> , T <sub>IN</sub>	R <sub>OUT</sub> , T <sub>OUT</sub>
H	L
L	H
Note - H – voltage high level; L – low voltage level	

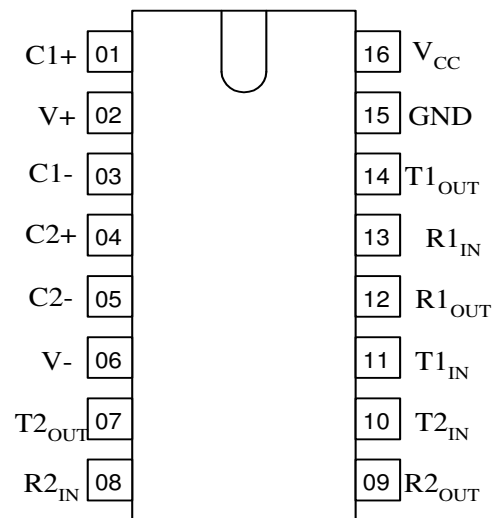


Table of pin description

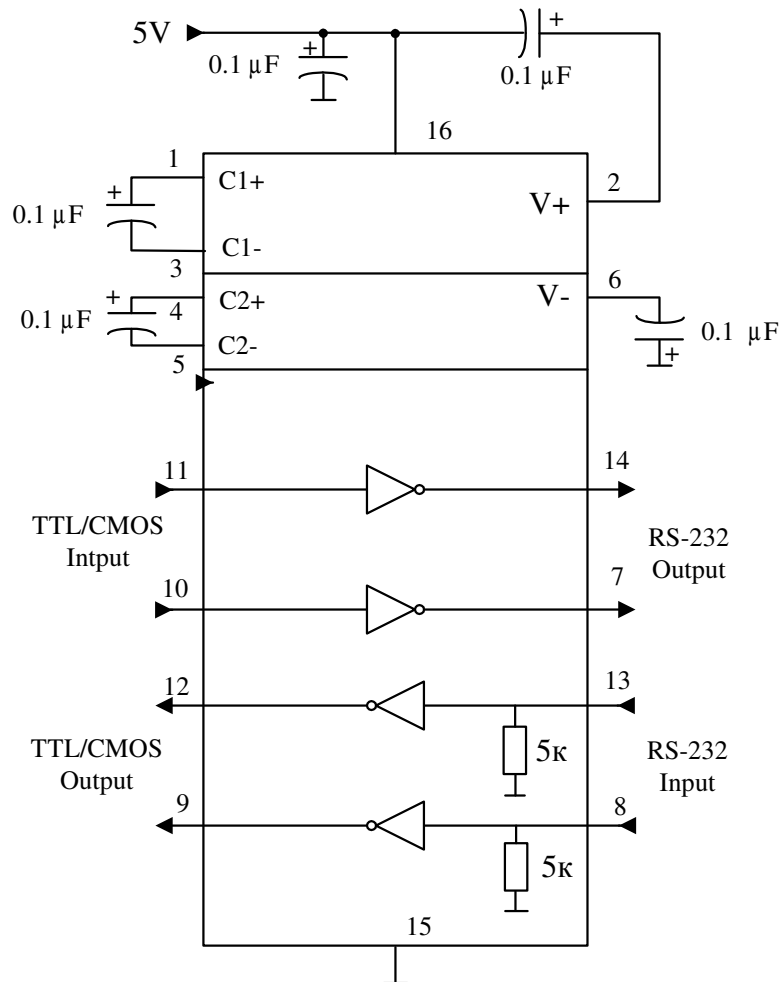
Pin No.	Symbol	Pin name
01	C1+	Output of external capacitance of positive voltage multiplier unit
02	V+	Output of positive voltage of multiplier unit
03	C1-	Output of external capacitance of positive voltage multiplier unit
04	C2+	Output of external capacitance of negative voltage multiplier unit
05	C2-	Output of external capacitance of negative voltage multiplier unit
06	V-	Output of negative voltage of multiplier unit
07	T2 <sub>OUT</sub>	Output of transmitter data (levels RS – 232)
08	R2 <sub>IN</sub>	Input of receiver data (levels RS – 232)
09	R2 <sub>OUT</sub>	Output of receiver data (levels TTL/KMOS)
10	T2 <sub>IN</sub>	Input of transmitter data (levels TTL/KMOS)
11	T1 <sub>IN</sub>	Input of transmitter data (levels TTL/KMOS)
12	R1 <sub>OUT</sub>	Output of receiver data (levels TTL/KMOS)
13	R1 <sub>IN</sub>	Input of receiver data (levels RS – 232)
14	T1 <sub>OUT</sub>	Output of transmitter data (levels RS – 232)
15	GND	Common output
16	V <sub>CC</sub>	Supply output of voltage source

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-	Transmitter low output voltage	-0.3	-14	
V <sub>TIN</sub>	Transmitter input voltage	-0.3	V+ +0.3	
V <sub>RIN</sub>	Receiver input voltage	-30	30	
P <sub>D</sub>	Dissipated power	-	842	mW
	DIP – package			
	SO - package		762	
I <sub>SC</sub>	Output current of transmitter short circuit	-	Continuously	mA
T <sub>a</sub>	Ambient temperature	-60	150	°C

**Recommended Operating Conditions**

Symbol	Parameter	Rate		Unit
		min	max	
V <sub>CC</sub>	Supply voltage	4.5	5.5	V
V+	Transmitter output high voltage	5.0	-	
V-	Transmitter output low voltage	-5.0	-	
V <sub>TIN</sub>	Transmitter input voltage	0	V <sub>CC</sub>	
V <sub>RIN</sub>	Receiver input voltage	-30	30	
I <sub>SC</sub>	Transmitter short circuit output current	-	±60	mA
T <sub>a</sub>	Ambient temperature	-40	85	°C



**Static parameters**

Symbol	Parameter	Test conditions	Rate				Unit
			25°C		-40 °C to 85 °C		
			min	max	min	max	
$I_{CC}$	Consumption current static	$V_{CC}=5.0\text{ V}$ $V_{IL}=0\text{ V}$	-	10.0	-	14.0*	mA

**Receiver electrical parameters**

$V_h$	Hysteresis voltage	$V_{CC}=5.0\text{ V}$	0.2	0.9	0.2	1.0	V
$V_{On}$	On (operation) voltage	$V_O \leq 0.1\text{ V}$ $I_{OL} \leq 20\text{ uA}$	-	2.4	-	2.3	
$V_{off}$	Off (dropout) voltage	$V_O \geq V_{CC}-0.1\text{ V}$ $I_{OH} \leq -20\text{ uA}$	0.8	-	0.9	-	
$V_{OL}$	Output low voltage	$I_{OL} = 3.2\text{ mA}$ $V_{CC} = 4.5\text{ V}$ $V_{IH} = 2.4\text{ V}$	-	0.3	-	0.4	
$V_{OH}$	Output high voltage	$I_{OH} = -1.0\text{ mA}$ $V_{CC} = 4.5\text{ V}$ $V_{IL} = 0.8\text{ V}$	3.6	-	3.5	-	
$R_I$	Input resistance	$V_{CC} = 5.0\text{ V}$	3.0	7.0	3.0	7.0	kOhm

**Transmitter electrical parameters**

$V_{OL}$	Output low voltage	$V_{CC} = 4.5\text{ V}$ $V_{IH} = 2.0\text{ V}$ $R_L = 3.0\text{ kOhm}$	-	-5.2	-	-5.0	V
$V_{OH}$	Output high voltage	$V_{CC} = 4.5\text{ V}$ $V_{IL} = 0.8\text{ V}$ $R_L = 3.0\text{ kOhm}$	5.2	-	5.0	-	
$I_{IL}$	Input low current	$V_{CC}=5.5\text{ V}$ $V_{IL}=0\text{ V}$	-	-1.0	-	-10.0	uA
$I_{IH}$	Input high current	$V_{CC}=5.5\text{ V}$ $V_{IH}=V_{CC}$		1.0		10.0	
SR	Speed of output front change	$V_{CC}=5.0\text{ V}$ $C_L=50 - 1000\text{ pF}$ $R_L=3.0 - 7.0\text{ kOhm}$	3.0	30	2.7	27	V/ $\mu$ s
$R_O$	Output resistance	$V_{CC} = V_+ = V_- = 0\text{ V}$ $V_O = \pm 2\text{ V}$	350	-	300	-	Ohm
$I_{SC}$	Short circuit output current	$V_{CC}=5.5\text{ V}$ $V_O=0\text{ V}$ $V_I=V_{CC}$ $V_I=0\text{ V}$		-50 50		-60 60	mA
ST	Speed of information transmission	$V_{CC}=4.5\text{ V}$ $C_L=1000\text{ pF}$ $R_L=3.0\text{ kOhm}$ $t_w=7\text{ us}$ (for extreme $-t_w=8\text{ us}$ )	140	-	120	-	

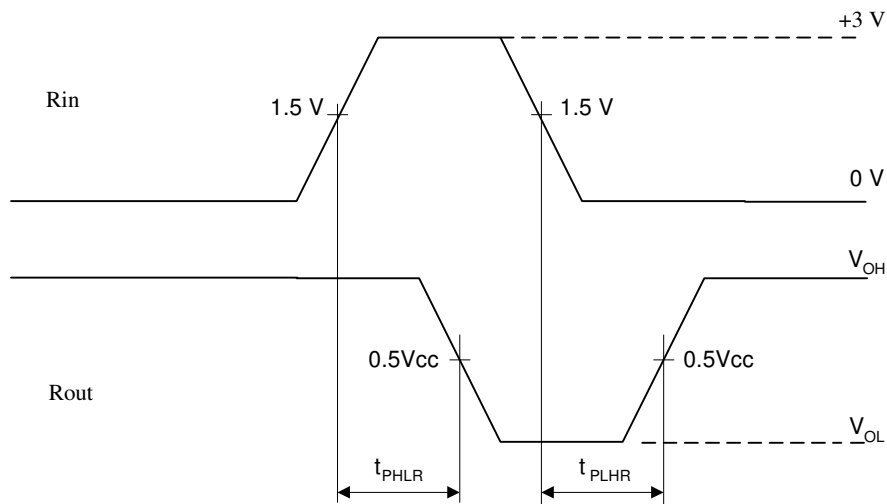
**Dynamic parameters**

Symbol	Parameter	Test conditions	Rate				Unit
			25 °C		from -40 °C to 85 °C		
			min	max	min	max	
$t_{PHLR}$ ( $t_{PLHR}$ )	Signal propagation delay time when switching on (off)	$V_{CC} = 4.5\text{ V}$ $C_L = 150\text{ pF}$ $V_{IL} = 0\text{ V}$ $V_{IH} = 3.0\text{ V}$ $t_{LH} = t_{HL} \leq 10\text{ ns}$	-	9.7	-	10	us
$t_{PHLT}$ ( $t_{PLHT}$ )	Signal propagation delay time when switching on (off)	$V_{CC} = 4.5\text{ V}$ $C_L = 2500\text{ pF}$ $V_{IL} = 0\text{ V}$ $V_{IH} = 3.0\text{ V}$ $R_L = 3\text{ kOhm}$ $t_{LH} = t_{HL} \leq 10\text{ ns}$		5.0*		6.0*	

**Capacitance**

Symbol	Parameter	$V_{CC}$	Rate	Unit
$C_{IN}$	Input capacitance	5.0	9.0	pF
$C_{PD}$	Dynamic capacitance		90	

Timing diagram when measuring IC dynamic parameters



**Figure 3**

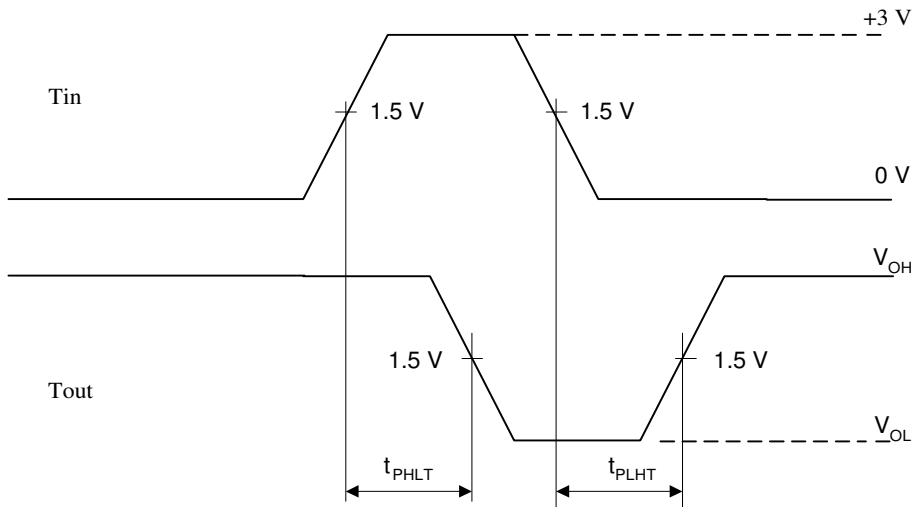


Figure 4

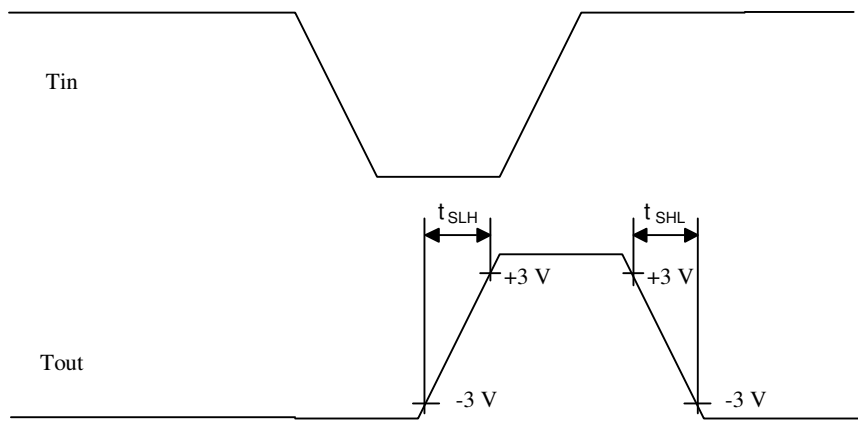


Figure 5

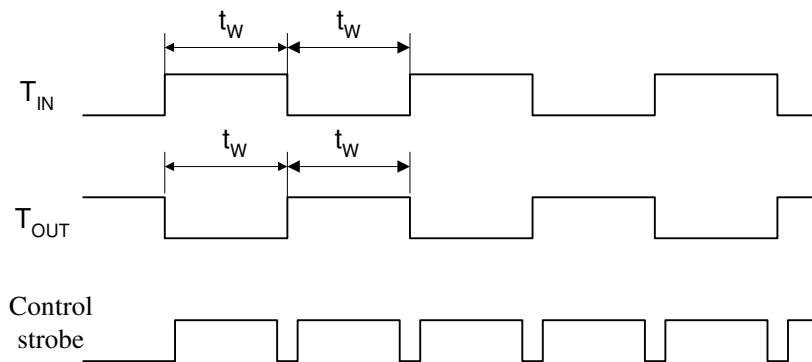
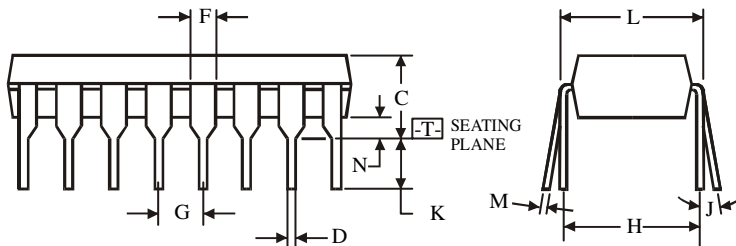
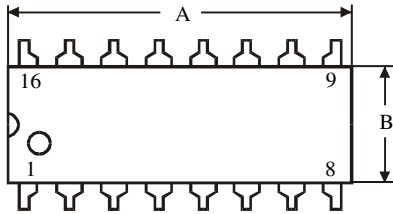
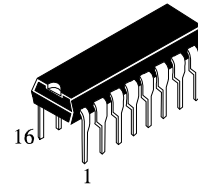


Figure 6

**N SUFFIX PLASTIC DIP  
(MS - 001BB)**



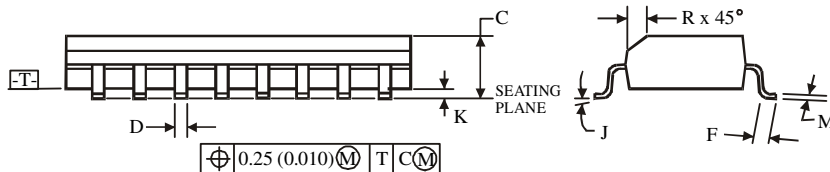
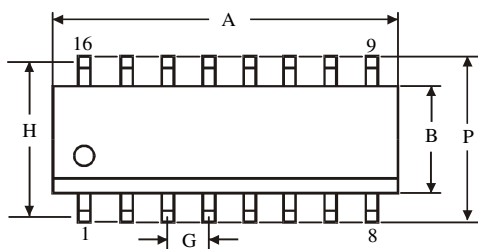
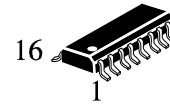
$\oplus 0.25 (0.010) \text{ (M) T}$

**NOTES:**

- Dimensions "A", "B" do not include mold flash or protrusions.  
Maximum mold flash or protrusions 0.25 mm (0.010) per side.

Dimension, mm		
Symbol	MIN	MAX
A	18.67	19.69
B	6.1	7.11
C		5.33
D	0.36	0.56
F	1.14	1.78
G	2.54	
H	7.62	
J	0°	10°
K	2.92	3.81
L	7.62	8.26
M	0.2	0.36
N	0.38	

**D SUFFIX SOIC  
(MS - 012AC)**



$\oplus 0.25 (0.010) \text{ (M) T (C) (M)}$

**NOTES:**

- Dimensions A and B do not include mold flash or protrusion.
- Maximum mold flash or protrusion 0.15 mm (0.006) per side  
for A; for B - 0.25 mm (0.010) per side.

Dimension, mm		
Symbol	MIN	MAX
A	9.8	10
B	3.8	4
C	1.35	1.75
D	0.33	0.51
F	0.4	1.27
G	1.27	
H	5.72	
J	0°	8°
K	0.1	0.25
M	0.19	0.25
P	5.8	6.2
R	0.25	0.5