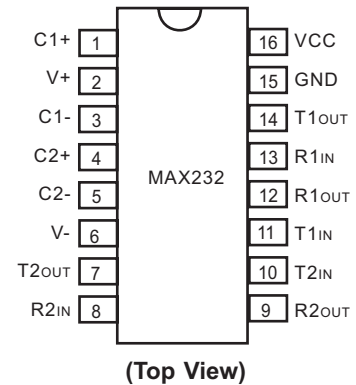# Single Supply Voltage, RS-232 Transceiver

DESCRIPTION

MAX232 is compatible with RS-232 standard, and consists of dual transceiver. Each receiver converts TIA/EIA-232-E levels into 5V TTL/CMOS levels. Each driver converts TTL/COMS levels into TIA/EIA-232-E levels. The MAX232 is characterized for operation from -40°C to +85°C for all packages.

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

PIN CONFIGURATION

	MAX232	
C1+ 1		16 VCC
V+ 2		15 GND
C1- 3		14 T1$_{OUT}$
C2+ 4		13 R1$_{IN}$
C2- 5		12 R1$_{OUT}$
V- 6		11 T1$_{IN}$
T2$_{OUT}$ 7		10 T2$_{IN}$
R2$_{IN}$ 8		9 R2$_{OUT}$

(Top View)

FEATURES

- Input voltage levels are compatible with standard CMOS levels
- Output voltage levels are compatible with EIA/TIA-232-E levels
- Single Supply voltage: 5V
- Low input current: 0.1μA at T_A= 25 °C
- Output current: 24mA
- Latching current not less than 450mA at T_A= 25°C
- The transmitter outputs and receiver inputs are protected to ±15kV Air ESD

APPLICATION

- Battery-Powered RS232 Systems
- Terminals
- Modems
- Computers

ORDERING INFORMATION

Temperature Range	Package		Orderable Device	Package Qty
-40°C to +85°C	SOP16L	Pb-Free	MAX232D	50Units/Tube
			MAX232DR	3000Units/R&T
	DIP16L		MAX232N	25Units/Tube

PIN DESCRIPTION

No.	Name	Function
1	C1+	External capacitance of positive voltage multiplier unit
2	V+	Output of positive voltage of multiplier unit
3	C1-	External capacitance of positive voltage multiplier unit
4	C2+	External capacitance of negative voltage multiplier unit
5	C2-	External capacitance of negative voltage multiplier unit
6	V-	Output of negative voltage of multiplier unit
7	T2$_{OUT}$	Output of transmitter data (levels RS – 232)
8	R2$_{IN}$	Input of receiver data (levels RS – 232)
9	R2$_{OUT}$	Output of receiver data (levels TTL/CMOS)
10	T2$_{IN}$	Input of transmitter data (levels TTL/CMOS)
11	T1$_{IN}$	Input of transmitter data (levels TTL/CMOS)
12	R1$_{OUT}$	Output of receiver data (levels TTL/CMOS)
13	R1$_{IN}$	Input of receiver data (levels RS – 232)
14	T1$_{OUT}$	Output of transmitter data (levels RS – 232)
15	GND	Ground
16	V$_{CC}$	Supply voltage

ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Min	Max	Unit
Supply voltage		V$_{CC}$	-0.3	6.0	V
Transmitter high output voltage		V+	V$_{CC}$ -0.3	14	V
Transmitter low output voltage		V-	-0.3	-14	V
Transmitter input voltage		V$_{TIN}$	-0.3	(V+) + 0.3	V
Receiver input voltage		V$_{RIN}$	-30	30	V
Dissipated power	DIP package	P$_D$		842	mW
	SOP package			762	
Output current of transmitter short circuit		I$_{SC}$		Continuously	mA
Storage temperature ranges		T$_{stg}$	-60	150	°C

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min	Max	Unit
Supply voltage	V$_{CC}$	4.5	5.5	V
Transmitter output high voltage	V+	5.0		V
Transmitter output low voltage	V-	-5.0		V
Transmitter input voltage	V$_{TIN}$	0	V$_{CC}$	V
Receiver input voltage	V$_{RIN}$	-30	30	V
Transmitter short circuit output current	I$_{SC}$		±60	mA

DC ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Test Conditions	25°C		-40°C to +85°C		Unit
			Min	Max	Min	Max	
Supply Current	I_{CC}	V_{CC} =5.0V, V_{IL} = 0V		10.0		14.0	mA
Receiver							
Hysteresis voltage	V_h	V_{CC} =5.0V	0.2	0.9	0.2	1.0	V
On (operation) voltage	V_{on}	V_O ≤ 0.1V, I_{OL} ≤ 20 mA		2.4		2.3	V
Off (dropout) voltage	V_{off}	V_O ≥ V_{CC} -0.1 V, I_{OH} ≤ -20 mA	0.8		0.9		V
Output low voltage	V_{OL}	I_{OL} = 3.2mA, V_{CC} = 4.5V, V_{IH} = 2.4V		0.3		0.4	V
Output high voltage	V_{OH}	I_{OH} = -1.0mA, V_{CC} = 4.5V, V_{IL} = 0.8V	3.6		3.5		V
Input resistance	R_I	V_{CC} =5.0V	3.0	7.0	3.0	7.0	kΩ
Transmitter							
Output low voltage	V_{OL}	V_{CC} = 4.5V, V_{IH} = 2.0V, R_L = 3.0kΩ		-5.2		-5.0	V
Output high voltage	V_{OH}	V_{CC} = 4.5V, V_{IL} = 2.0V, R_L = 3.0kΩ	5.2		5.0		V
Input low current	I_{IL}	V_{CC} =5.5V, V_{IL} = 0V		-1.0		-10.0	µA
Input high current	I_{IH}	V_{CC} =5.5V, V_{IH} = V_{CC}		1.0		10.0	µA
Speed of output front change	SR	V_{CC} =5.0V, C_L =50 ~ 1000pF R_L = 3.0 ~ 7.0kΩ	3.0	30	2.7	27	V/µs
Output resistance	R_O	V_{CC} = V+ = V- = 0 V, V_O = ±2V	350		300		Ω
Short circuit output current	I_{SC}	V_{CC} =5.5V V_O = 0V — V_I = V_{CC}		-50		-60	mA
		V_I = 0 V		50		60	
Speed of information transmission	ST	V_{CC} =4.5V, C_L = 1000pF R_L = 3.0kΩ, t_W = 7ms (for extreme t_W = 8ms)	140		120		kbits/s

AC ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Test Conditions	25°C		-40°C to +85°C		Unit
			Min	Max	Min	Max	
Signal propagation delay time when switching on (off)	t_{PHLR} (t_{PLHR})	V_{CC} = 4.5V, C_L = 150pF V_{IL} = 0V, V_{IH} = 3.0V t_{LH} = t_{HL} ≤ 10ns		9.7		10	ms
Signal propagation delay time when switching on (off)	t_{PHLT} (t_{PLHT})	V_{CC} = 4.5V, C_L = 150pF V_{IL} = 0V, V_{IH} = 3.0V t_{LH} = t_{HL} ≤ 10 ns		5.0		6.0	ms

CAPACITANCE

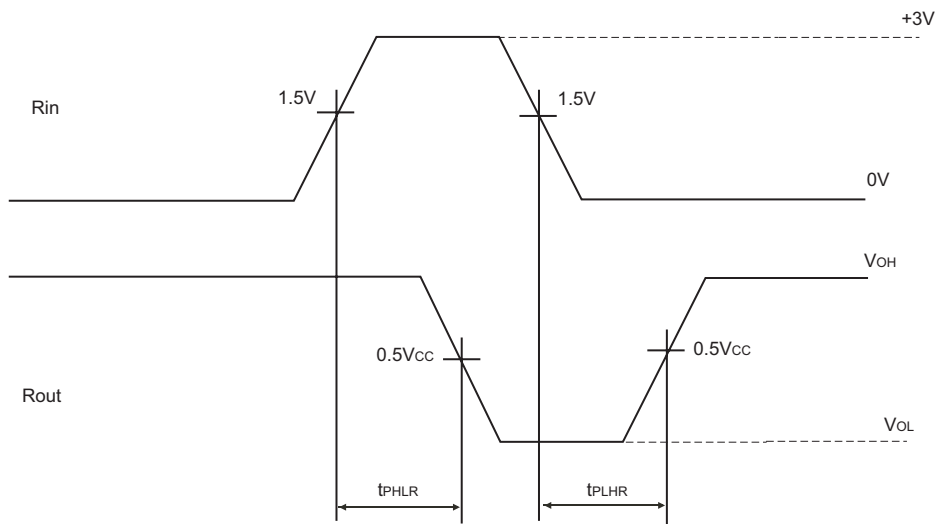| Parameter	Symbol	Test Conditions	Value	Unit
Input capacitance	C_{IN}	$V_{CC}=5.0V$	9.0	pF
Dynamic capacitance	C_{PD}		90	pF

TIMING DIAGRAM

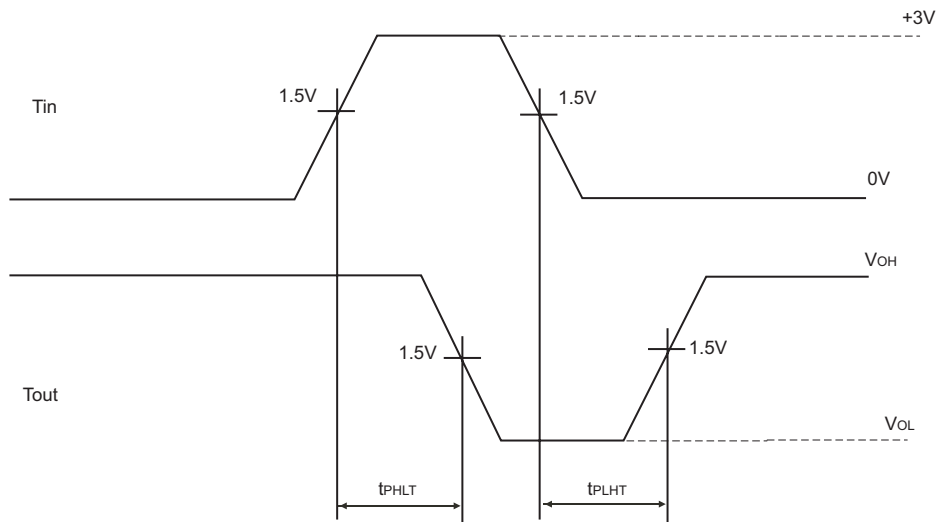Figure 1. Waveforms for t_{PHLR} and t_{PLHR} Measurement

Figure 2. Waveforms for t_{PHLT} and t_{PLHT} Measurement
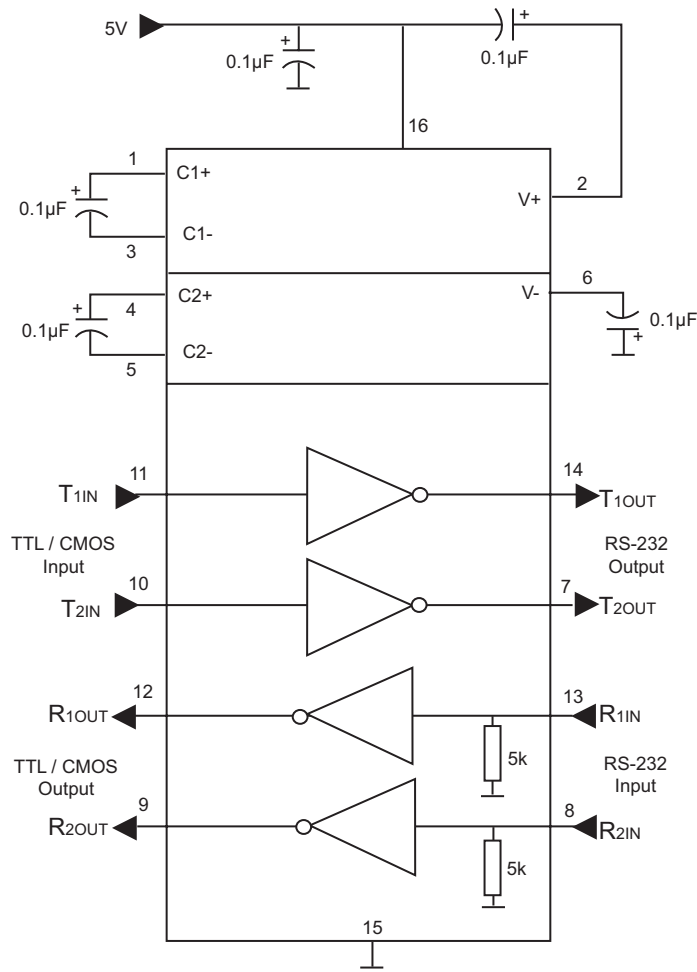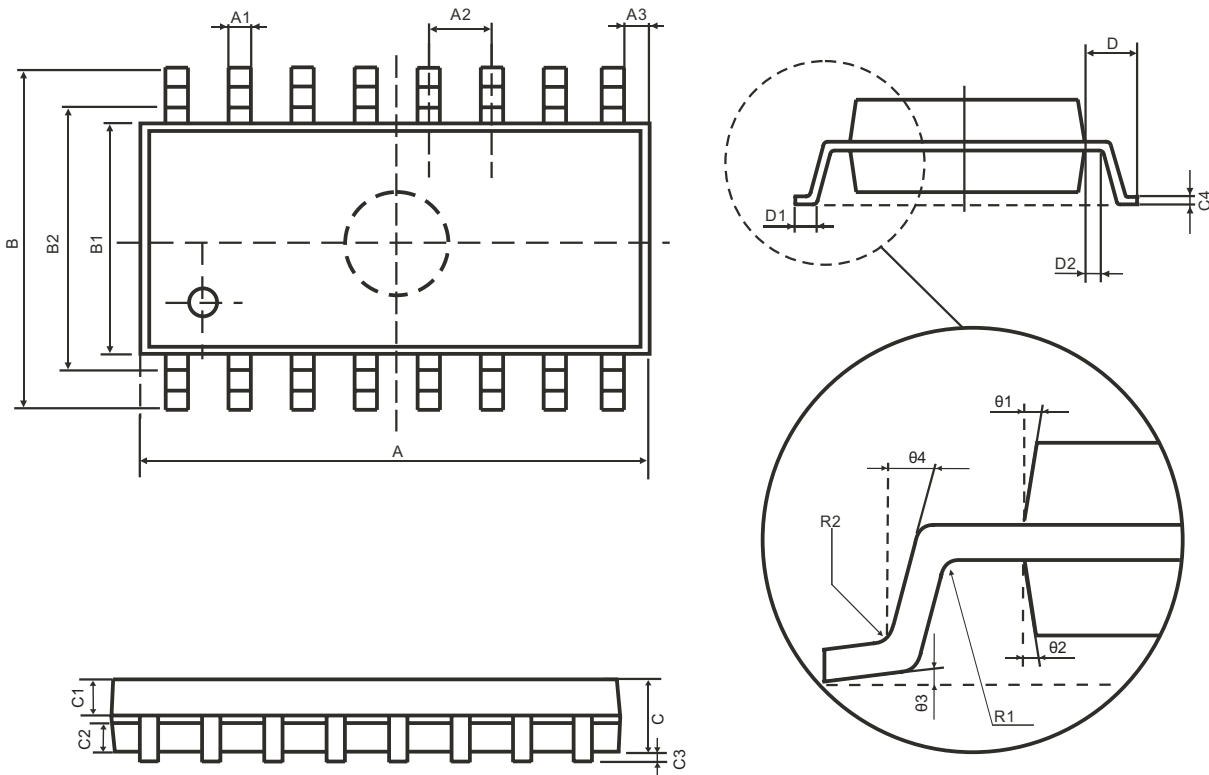
TYPICAL APPLICATION

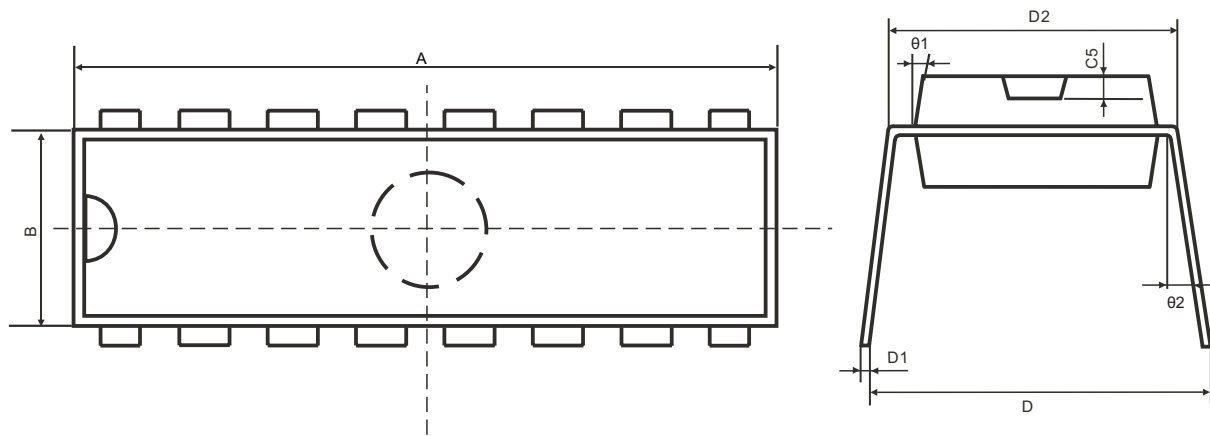**Figure 4. Application circuit**

PHYSICAL DIMENSIONS
SOP16L

Symbol	Dimension(mm)		Symbol	Dimension(mm)	
	Min	**Max**		**Min**	**Max**
A	9.90	10.10	C4	0.20(TYP)	
A1	0.36	0.46	D	1.05(TYP)	
A2	1.27(TYP)		D1	0.40	0.70
A3	0.35(TYP)		D2	0.22	0.42
B	5.84	6.24	R1	0.15(TYP)	
B1	3.84	4.04	R2	0.15(TYP)	
B2	5.00(TYP)		θ1	8˚(TYP)	
C	1.35	1.55	θ2	8˚(TYP)	
C1	0.61	0.71	θ3	4˚(TYP)	
C2	0.54	0.64	θ4	15˚(TYP)	
C3	0.10	0.25			

DIP16L

Symbol	Dimension(mm)		Symbol	Dimension(mm)	
	Min	**Max**		**Min**	**Max**
A	19.05	19.45	C3	3.00	3.60
A1	1.52(TYP)		C4	3.85	4.45
A2	0.46(TYP)		C5	0.80(TYP)	
A3	2.54(TYP)		D	8.10	8.60
A4	0.51(TYP)		D1	0.20	0.35
A5	0.99(TYP)		D2	7.62(TYP)	
B	6.20	6.60	θ1	8º(TYP)	
C1	3.30	3.70	θ2	5º(TYP)	
C2	0.51(TYP)				