

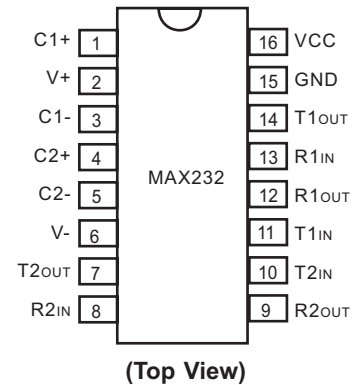
Single Supply Voltage, RS-232 Transceiver

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



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: 0.1 μ A at $T_A = 25^\circ\text{C}$
- Output current: 24mA
- Latching current not less than 450mA at $T_A = 25^\circ\text{C}$
- The transmitter outputs and receiver inputs are protected to $\pm 15\text{kV}$ 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

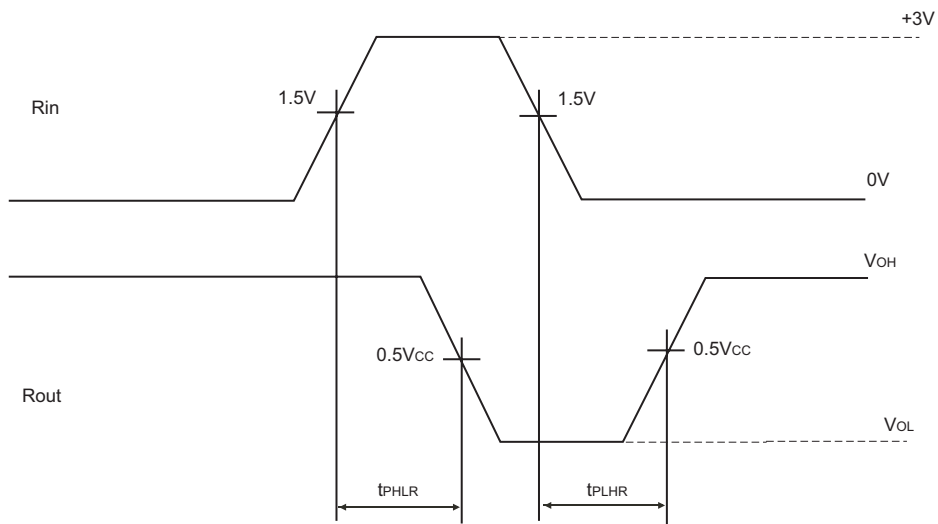


Figure 1. Waveforms for t_{PHLR} and t_{PLHR} Measurement

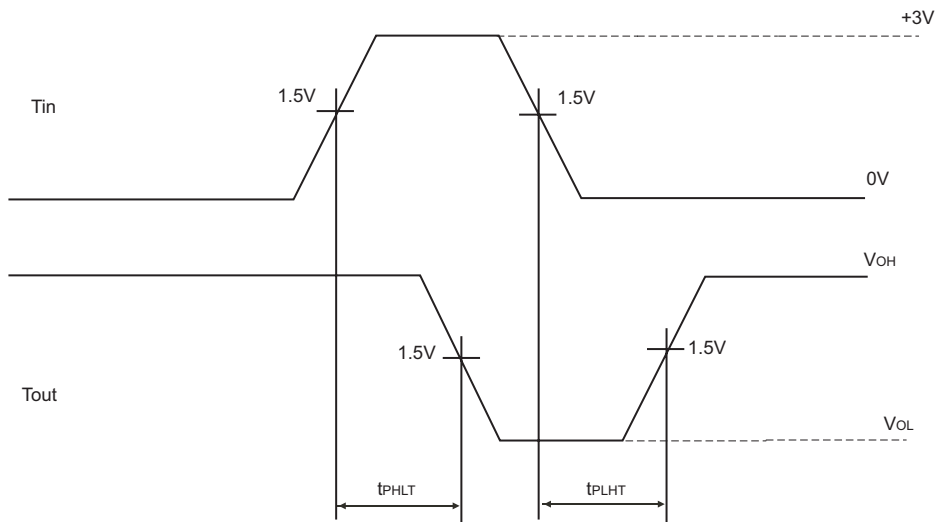


Figure 2. Waveforms for t_{PHLT} and t_{PLHT} Measurement



TYPICAL APPLICATION

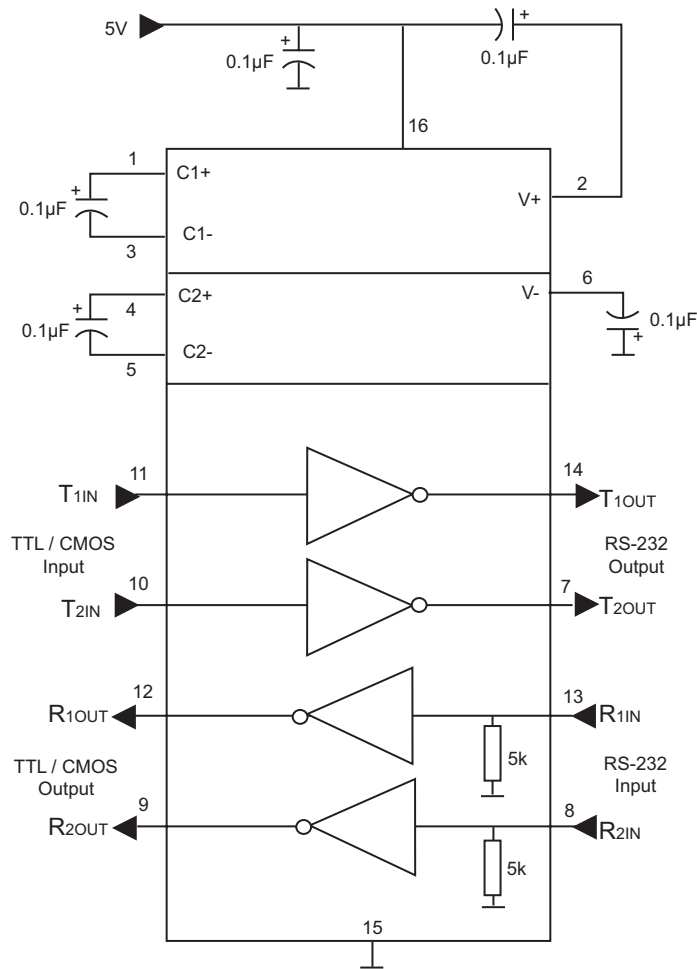
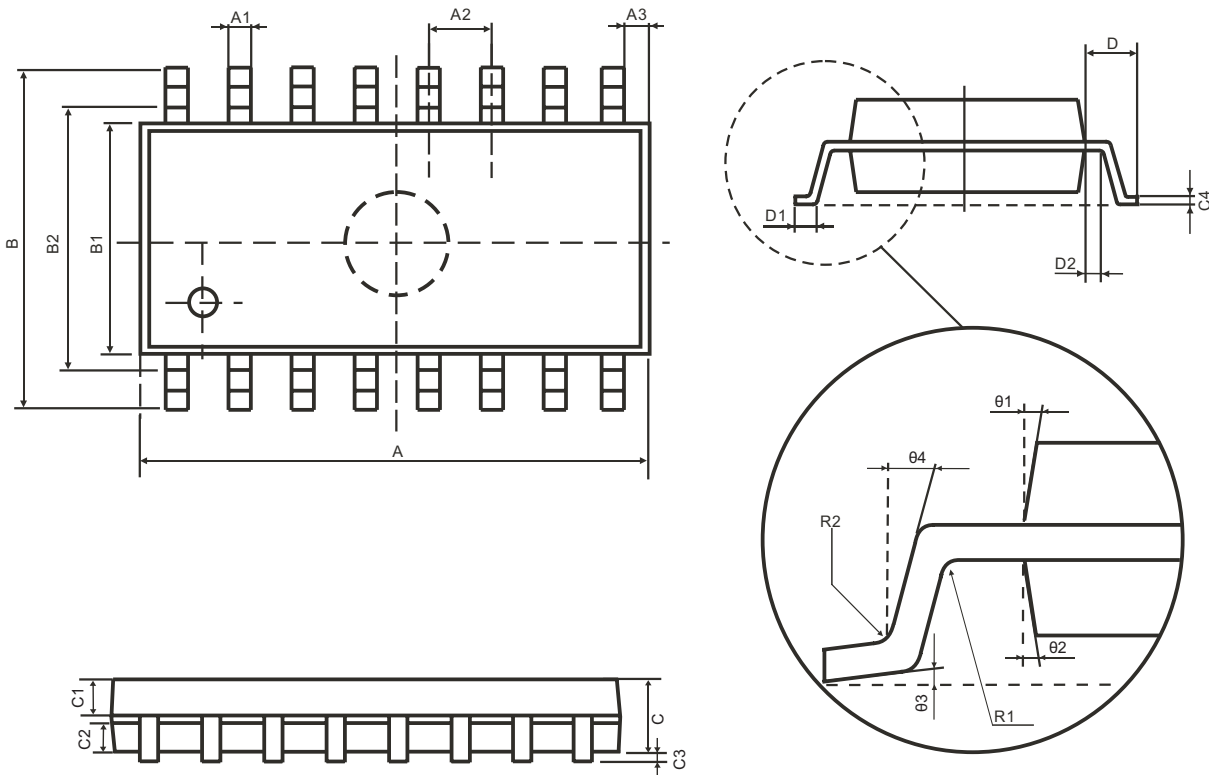


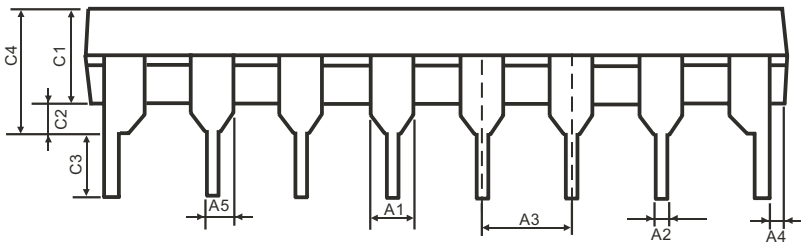
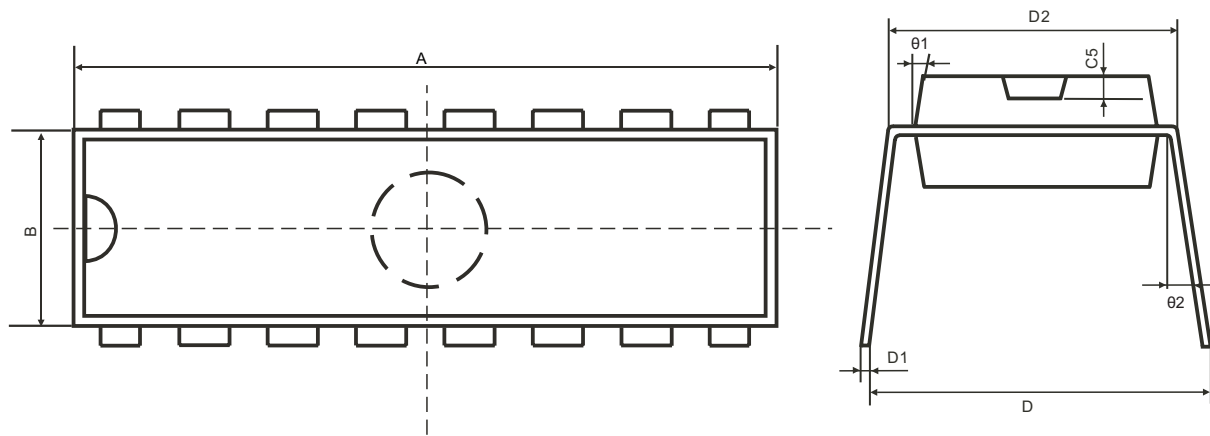
Figure 4. Application circuit

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)		theta1	8°(TYP)	
C	1.35	1.55	theta2	8°(TYP)	
C1	0.61	0.71	theta3	4°(TYP)	
C2	0.54	0.64	theta4	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	8°(TYP)	
C1	3.30	3.70	θ2	5°(TYP)	
C2	0.51(TYP)				