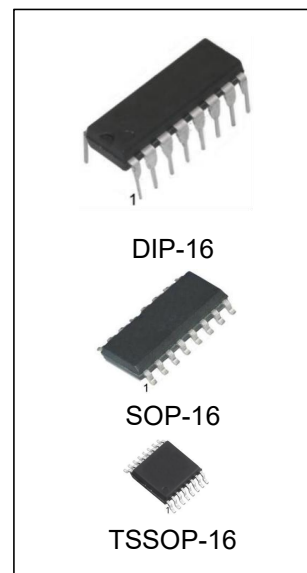


INTERFACE TRANSCEIVER OF RS-232 STANDARD WITH ONE SUPPLY VOLTAGE

DESCRIPTION

IC 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 C-MOS, N-MOS and TTL integrated circuits.
- Low input current: 1.0 mA; 0.1 mA at Ta= 25°C
- Output current 24 mA.
- Latching current not less than 450 mA at Ta= 25°C
- Tolerable value of static potential not less than 2000V



Ordering Information

DEVICE	Package Type	MARKING	Packing	Packing Qty
MAX232CPE/HG	DIP-16	MAX232C	TUBE	1000pcs/box
MAX232CSE/HG	SOP-16	MAX232C	REEL	2500pcs/reel
MAX232CUE/HG	TSSOP-16	X232C	REEL	2500pcs/reel
MAX232EPE/HG	DIP-16	MAX232E	TUBE	1000pcs/box
MAX232ESE/HG	SOP-16	MAX232E	REEL	2500pcs/reel
MAX232EUE/HG	TSSOP-16	X232E	REEL	2500pcs/reel

Pin symbols in package

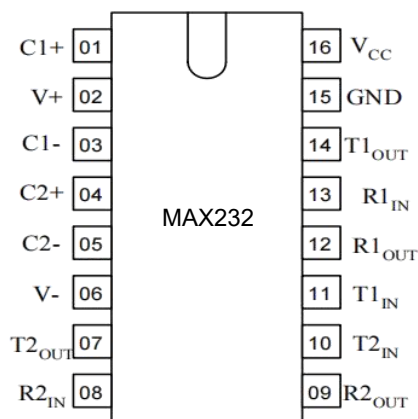


Table of pin description

	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 _{OUT}	Output of transmitter data (levels RS – 232)
08	R2 _{IN}	Input of receiver data (levels RS – 232)
09	R2 _{OUT}	Output of receiver data (levels TTL/KMOS)
10	T2 _{IN}	Input of transmitter data (levels TTL/KMOS)
11	T1 _{IN}	Input of transmitter data (levels TTL/KMOS)
12	R1 _{OUT}	Output of receiver data (levels TTL/KMOS)
13	R1 _{IN}	Input of receiver data (levels RS – 232)
14	T1 _{OUT}	Output of transmitter data (levels RS – 232)
15	GND	Common output
16	V _{CC}	Supply output of voltage source

Truth table

Inputs	Outputs
R _{IN} , T _{IN}	R _{OUT} , T _{OUT}
H	L
L	H

Note -H – voltage high level; L – low voltage level

Maximum conditions

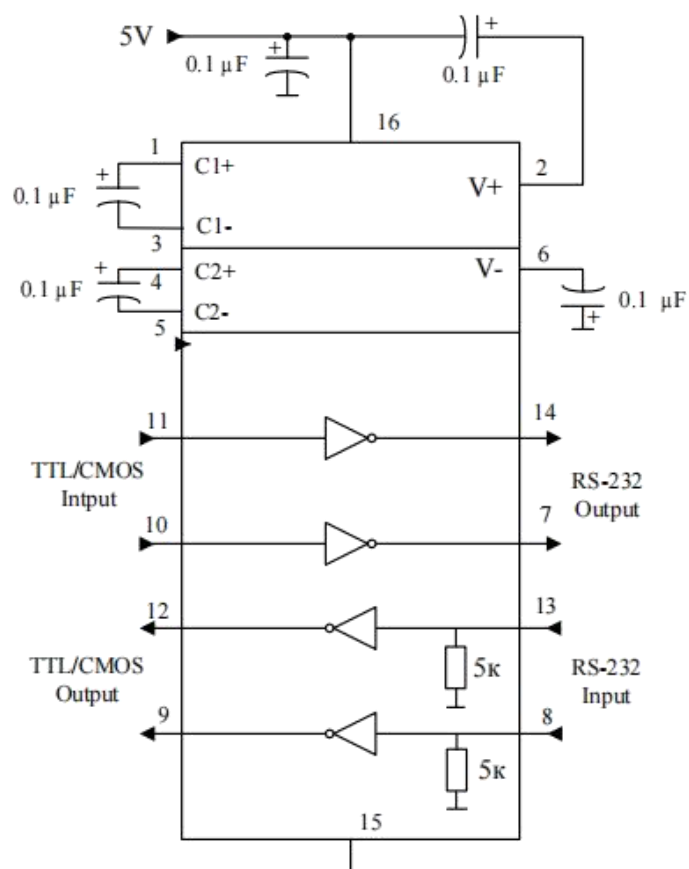
Symbol	Parameter	Rate		Unit
		min	max	
V _{CC}	Supply voltage	-0.3	6.0	V
V ₊	Transmitter high output voltage	V _{CC} -0.3	14	
V ₋	Transmitter low output voltage	-0.3	-14	
V _{TIN}	Transmitter input voltage	-0.3	V ₊ +0.3	
V _{RIN}	Receiver input voltage	-30	30	
P _D	Dissipated power	-		mW
	DIP – package		842	
	SOP - package		762	
I _{SC}	Output current of transmitter short circuit	-	Continu-ously	mA
T _a	Ambient temperature	-60	150	°C
T _L	Lead Temperature (Soldering, 10 seconds)	-	260	°C

Note: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not ensured.

Recommended Operating Conditions

Symbol	Parameter		Rate		Unit
			min	max	
V _{CC}	Supply voltage		4.5	5.5	V
V ₊	Transmitter output high voltage		5.0	-	
V ₋	Transmitter output low voltage		-5.0	-	
V _{TIN}	Transmitter input voltage		0	V _{CC}	
V _{RIN}	Receiver input voltage		-30	30	
I _{SC}	Transmitter short circuit output current		-	±60	mA
T _a	Ambient temperature	MAX232C	0	70	°C
		MAX232E	-40	85	

Typical Application



Electrical Characteristics

Symbol	Parameter	Test conditions	Rate				Unit
			25°C		-40°C to 85°C		
			min	max	min	max	
I _{CC}	Consumptioncurrent static	V _{CC} =5.5 V V _{IL} = 0 V	-	10.0	-	14.0	mA
Receiver electrical parameters							
V _h	Hysteresis voltage	V _{CC} =5.0 V	0.2	0.9	0.2	1.0	V
V _{On}	On (operation)voltage	V _O ≤ 0.1 V I _{OL} ≤ 20 mA	-	2.4	-	2.3	
V _{off}	Off (dropout) voltage	V _O ≥ V _{CC} -0.1 V I _{OH} ≤ 20 mA	0.8	-	0.9	-	
V _{OL}	Output low voltage	I _{OL} = 3.2 mA V _{CC} = 4.5 V V _{IH} = 2.4 V	-	0.3	-	0.4	
V _{OH}	Output high voltage	I _{OH} = -1.0 mA V _{CC} = 4.5 V V _{IL} = 0.8 V	3.6	-	3.5	-	
R _i	Input resistance	V _{CC} = 5.0 V	3.0	7.0	3.0	7.0	kOhm
Transmitter electrical parameters							
V _{OL}	Output low voltage	V _{CC} = 4.5 V V _{IH} = 2.0 V R _L = 3.0 kOhm	-	-5.2	-	-5.0	V
V _{OH}	Output high voltage	V _{CC} = 4.5 V V _{IL} = 0.8 V R _L = 3.0 kOhm	5.2	-	5.0	-	
I _{IL}	Input low current	V _{CC} =5.5 V V _{IL} = 0 V	-	-1.0	-	-10.0	mA
I _{IH}	Input high current	V _{CC} =5.5 V V _{IH} = V _{CC}		1.0		10.0	
SR	Speed of outputfront change	V _{CC} =5.0 V C _L =50 - 1000 pF R _L = 3.0 - 7.0 kOhm	3.0	30	2.7	27	V/mks
R _O	Output resistance	V _{CC} = V ₊ = V ₋ = 0V V _O = 2 V	350	-	300	-	Ohm
I _{SC}	Short circuit output current	V _{CC} =5.5 V V _O = 0V V _I = V _{CC} V _I = 0V		-50 50		-60 60	mA
ST	Speed of information transmission	V _{CC} =4.5 V C _L = 1000pF R _L = 3.0 kOhm t _W = 7mks (for extreme -t _W = 8mks)	140	-	120	-	

Symbol	Parameter	Test conditions	Rate				Unit
			25°C		-40°C to 85°C		
			min	max	min	max	
tPHLR (tPLHR)	Signal propagation delay time when switching on (off)	V _{CC} = 4.5 V C _L = 150 pF V _{IL} = 0 V V _{IH} = 3.0 V t _{LH} = t _{HL} ≤ 10 ns	-	9.7	-	10	mks
tPHLT (tPLHT)	Signal propagation delay time when switching on (off)	V _{CC} = 4.5 V C _L = 2500 pF V _{IL} = 0 V V _{IH} = 3.0 V R _L = 3 kOhm t _{LH} = t _{HL} ≤ 10 ns		5.0*		6.0*	

Capacitance

Symbol	Parameter	V _{CC} , V	Rate	Unit
C _{IN}	Input capacitance	5.0	9.0	pF
CPD	Dynamic capacitance		90	

Timing diagram when measuring IC dynamic parameters

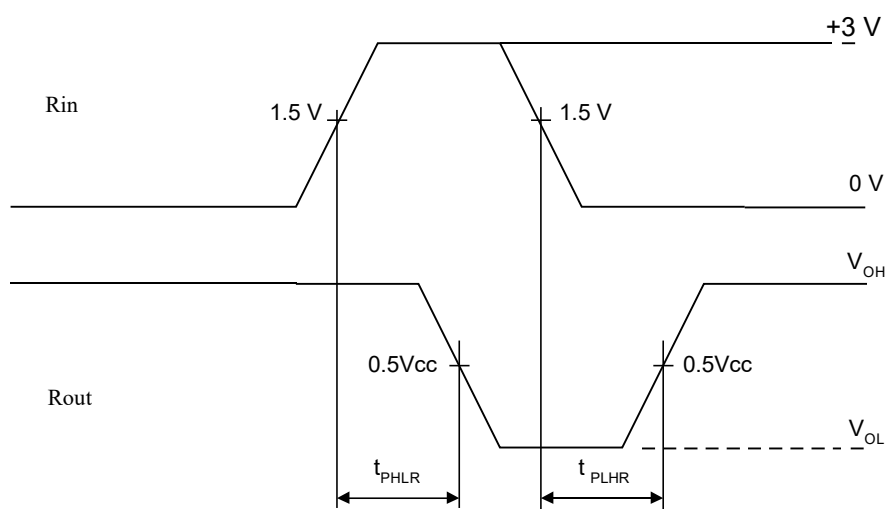


Figure 3

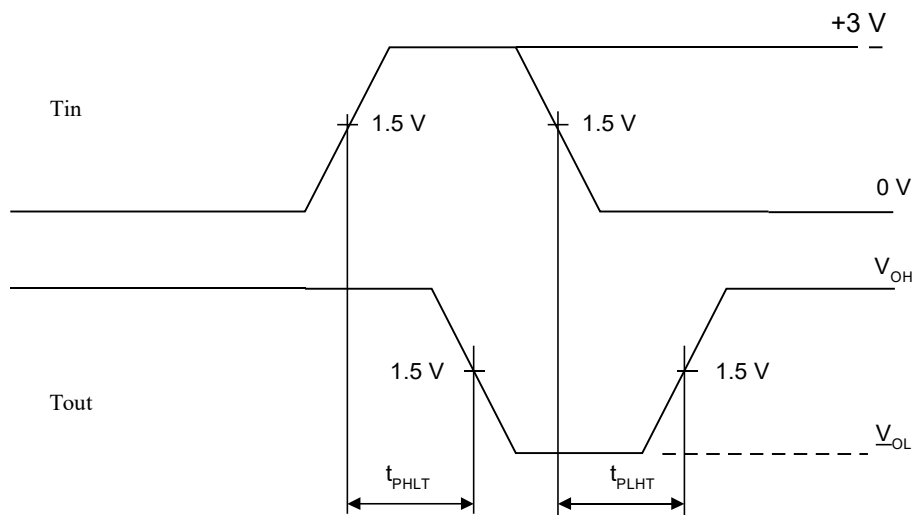


Figure 4

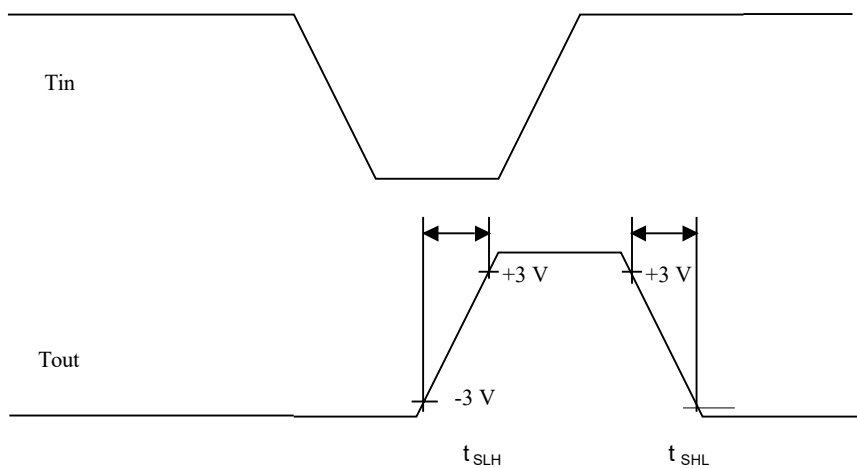


Figure 5

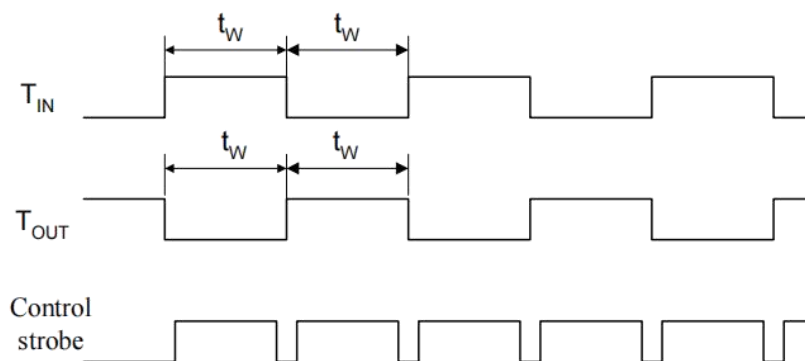
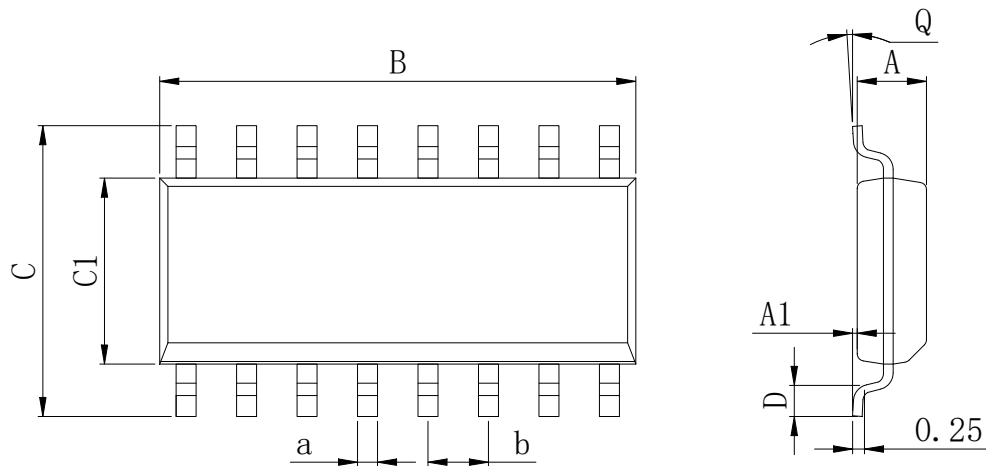


Figure 6

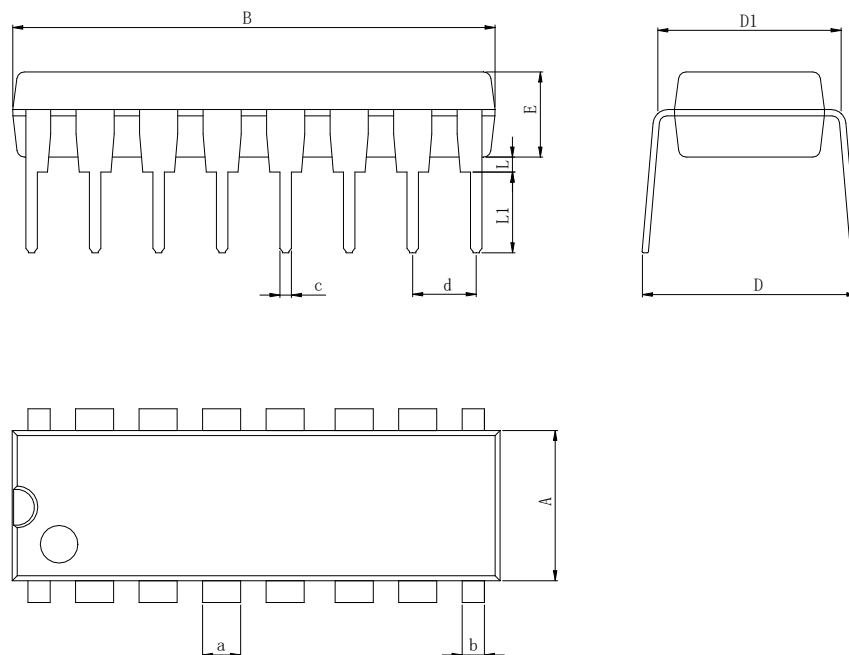
Physical Dimensions

SOP-16



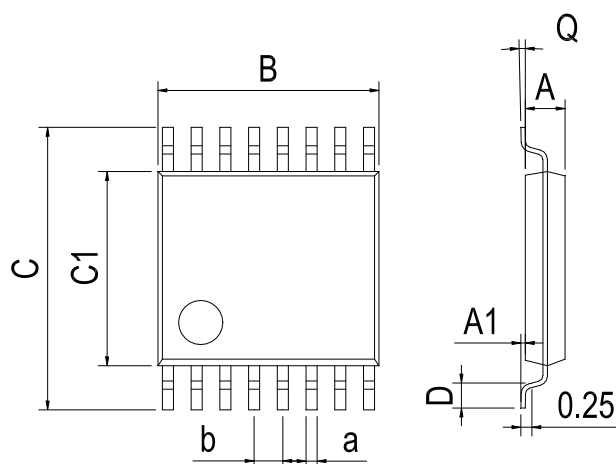
Dimensions In Millimeters(SOP-16)									
Symbol:	A	A1	B	C	C1	D	Q	a	b
Min:	1.35	0.05	9.80	5.80	3.80	0.40	0°	0.35	1.27 BSC
Max:	1.55	0.20	10.0	6.20	4.00	0.80	8°	0.45	

DIP-16



Dimensions In Millimeters(DIP-16)											
Symbol:	A	B	D	D1	E	L	L1	a	b	c	d
Min:	6.10	18.94	8.10	7.42	3.10	0.50	3.00	1.50	0.85	0.40	2.54 BSC
Max:	6.68	19.56	10.9	7.82	3.55	0.70	3.60	1.55	0.90	0.50	

TSSOP-16



Dimensions In Millimeters(TSSOP-16)									
Symbol:	A	A1	B	C	C1	D	Q	a	b
Min:	0.85	0.05	4.90	6.20	4.30	0.40	0°	0.20	0.65 BSC
Max:	0.95	0.20	5.10	6.60	4.50	0.80	8°	0.25	

Revision History

REVISION NUMBER	DATE	REVISION	PAGE
V1.0	2018-8	New	1-11
V1.1	2019-9	Update encapsulation、 Add annotation for Maximum Ratings.	1、 3
V1.2	2024-11	Update Lead Temperature	1、 3

IMPORTANT STATEMENT:

Huaguan Semiconductor reserves the right to change products and services offered without prior notice. Customers should obtain the latest relevant information before placing orders and verify that such information is current and complete. Huaguan Semiconductor assumes no responsibility or liability for altered documents.

Customers are responsible for complying with safety standards and implementing safety measures when using Huaguan Semiconductor products in system design and end-product manufacturing. You assume full responsibility for: selecting the appropriate Huaguan Semiconductor products for your application; designing, validating, and testing your application; and ensuring that your application complies with applicable standards and all other safety, security, or other requirements. This is to prevent potential risks that may lead to personal injury or property damage.

Huaguan Semiconductor products are not approved for use in life support, military, aerospace, or other high-risk applications. Huaguan products are neither intended nor warranted for use in such systems or equipment. Any failure or malfunction may lead to personal injury or severe property damage. Such applications are deemed "Unsafe Use." Unsafe Use includes, but is not limited to: surgical and medical equipment, nuclear energy control equipment, aircraft or spacecraft instruments, control or operation of vehicle power, braking, or safety systems, traffic signal instruments, all types of safety devices, and any other applications intended to support or sustain life. Huaguan Semiconductor shall not be liable for consequences resulting from Unsafe Use in these fields. Users must independently evaluate and assume all risks. Any issues, liabilities, or losses arising from the use of products beyond their approved applications shall be solely borne by the user. Users may not claim any compensation from Huaguan Semiconductor based on these terms. If any third party claims against Huaguan Semiconductor due to such Unsafe Use, the user shall compensate Huaguan Semiconductor for all resulting damages and liabilities.

Huaguan Semiconductor provides technical and reliability data (including datasheets), design resources (including reference designs), application or other design advice, web tools, safety information, and other resources for its semiconductor products. However, no guarantee is made that these resources are free from defects, and no express or implied warranties are provided. The use of testing and other quality control techniques is limited to Huaguan Semiconductor's quality assurance scope. Not all parameters of each device are tested.

Huaguan Semiconductor's documentation authorizes you to use these resources only for developing applications related to the products described herein. You are not granted rights to any other intellectual property of Huaguan Semiconductor or any third party. Any other reproduction or display of these resources is strictly prohibited. You shall fully indemnify Huaguan Semiconductor and its agents against any claims, damages, costs, losses, and liabilities arising from your use of these resources. Huaguan Semiconductor shall not be held responsible.