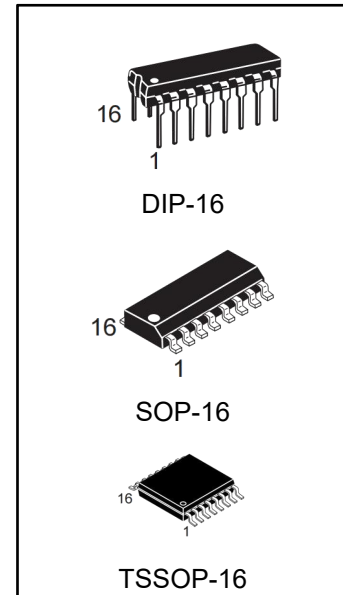


## INTERFACE TRANSCEIVER OF RS-232 STANDARD WITH ONE SUPPLY VOLTAGE

### DESCRIPTION

IC HGX232 is purposed for application in high-performance information processing systems and control devices of wide application.

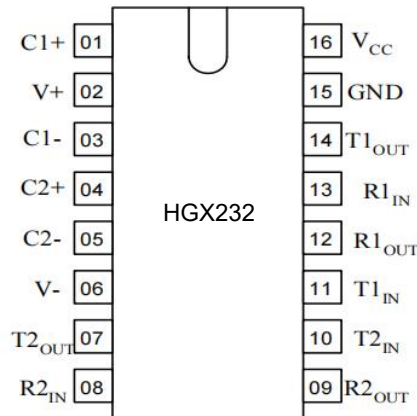
- Input voltage levels are compatible with standard CMOS levels.
- Output voltage levels are compatible with input levels of C-MOS, N-MOS and TTL integrated circuits.
- Supply voltage range from 2.0 to 6.0 V.
- Low input current: 1.0 mA; 0.1 mA at Ta= 25°C
- Output current 24 mA.
- Latching current not 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
HGX232ECN	DIP-16	HGX232EC	TUBE	1000pcs/box
HGX232ECM/TR	SOP-16	HGX232EC	REEL	2500pcs/reel
HGX232ECMT/TR	TSSOP-16	X232EC	REEL	2500pcs/reel
HGX232EIN	DIP-16	HGX232EI	TUBE	1000pcs/box
HGX232EIM/TR	SOP-16	HGX232EI	REEL	2500pcs/reel
HGX232EIMT/TR	TSSOP-16	X232EI	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	T2OUT	Output of transmitter data (levels RS – 232)
08	R2IN	Input of receiver data (levels RS – 232)
09	R2OUT	Output of receiver data (levels TTL/KMOS)
10	T2IN	Input of transmitter data (levels TTL/KMOS)
11	T1IN	Input of transmitter data (levels TTL/KMOS)
12	R1OUT	Output of receiver data (levels TTL/KMOS)
13	R1IN	Input of receiver data (levels RS – 232)
14	T1OUT	Output of transmitter data (levels RS – 232)
15	GND	Common output
16	VCC	Supply output of voltage source

## 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

## Maximum conditions

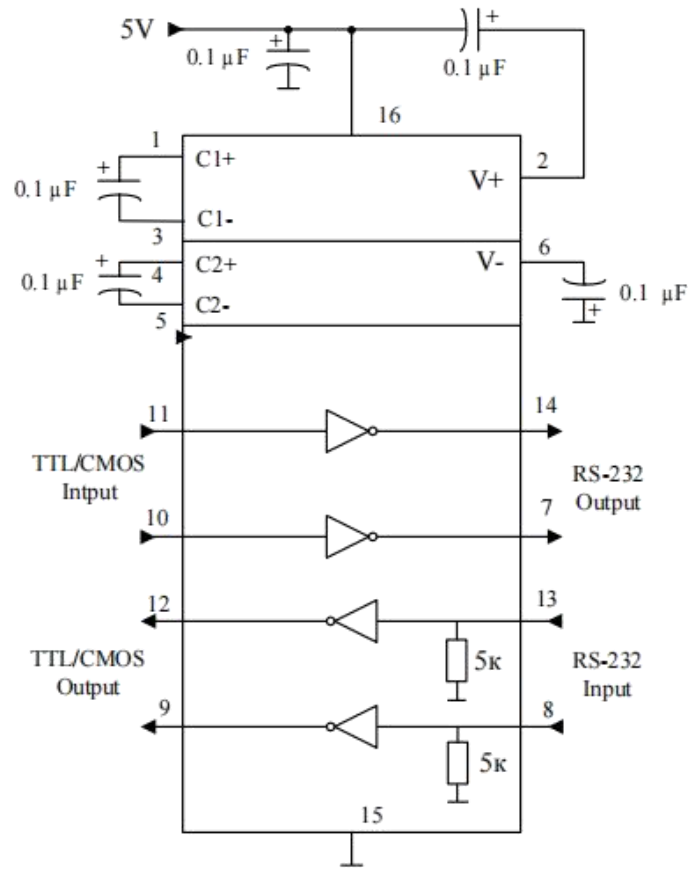
Symbol	Parameter	Rate		Unit
		min	max	
V <sub>CC</sub>	Supply voltage	-0.3	6.0	V
V <sub>+</sub>	Transmitter high output voltage	V <sub>CC</sub> -0.3	14	
V <sub>-</sub>	Transmitter low output voltage	-0.3	-14	
V <sub>TIN</sub>	Transmitter input voltage	-0.3	V <sub>+</sub> +0.3	
V <sub>RIN</sub>	Receiver input voltage	-30	30	
P <sub>D</sub>	Dissipated power	-		mW
	DIP – package		842	
	SOP - package		762	
I <sub>SC</sub>	Output current of transmitter short circuit	-	Continu-ously	mA
T <sub>a</sub>	Ambient temperature	-60	150	°C
T <sub>L</sub>	Lead Temperature (Soldering, 10 seconds)	-	245	°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 <sub>CC</sub>	Supply voltage	4.5	5.5	V	
V <sub>+</sub>	Transmitter output high voltage	5.0	-		
V <sub>-</sub>	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	HGX232EC	0	70	°C
		HGX232EI	-40	85	

Typical Application



**Electrical Characteristics**

Symbol	Parameter	Test conditions	Rate				Unit
			25°C		-40°C to 85°C		
			min	max	min	max	
ICC	Consumption current static	$V_{CC} = 5.5 V, V_{IL} = 0 V$	-	10.0	-	14.0	mA
<b>Receiver electrical parameters</b>							
V <sub>h</sub>	Hysteresis voltage	$V_{CC} = 5.0 V$	0.2	0.9	0.2	1.0	V
V <sub>On</sub>	On (operation) voltage	$V_O \leq 0.1 V$ $I_{OL} \leq 20 \text{ mA}$	-	2.4	-	2.3	
V <sub>off</sub>	Off (dropout) voltage	$V_O \geq V_{CC} - 0.1 V$ $I_{OH} \leq 20 \text{ mA}$	0.8	-	0.9	-	
V <sub>OL</sub>	Output low voltage	$I_{OL} = 3.2 \text{ mA}$ $V_{CC} = 4.5 V$ $V_{IH} = 2.4 V$	-	0.3	-	0.4	
V <sub>OH</sub>	Output high voltage	$I_{OH} = -1.0 \text{ mA}$ $V_{CC} = 4.5 V$ $V_{IL} = 0.8 V$	3.6	-	3.5	-	
R <sub>i</sub>	Input resistance	$V_{CC} = 5.0 V$	3.0	7.0	3.0	7.0	kOhm
<b>Transmitter electrical parameters</b>							
V <sub>OL</sub>	Output low voltage	$V_{CC} = 4.5 V$ $V_{IH} = 2.0 V$ $R_L = 3.0 \text{ kOhm}$	-	-5.2	-	-5.0	V
V <sub>OH</sub>	Output high voltage	$V_{CC} = 4.5 V$ $V_{IL} = 0.8 V$ $R_L = 3.0 \text{ kOhm}$	5.2	-	5.0	-	
I <sub>IL</sub>	Input low current	$V_{CC} = 5.5 V$ $V_{IL} = 0 V$	-	-1.0	-	-10.0	mA
I <sub>IH</sub>	Input high current	$V_{CC} = 5.5 V$ $V_{IH} = V_{CC}$		1.0		10.0	
SR	Speed of output front change	$V_{CC} = 5.0 V$ $C_L = 50 - 1000 \text{ pF}$ $R_L = 3.0 - 7.0 \text{ kOhm}$	3.0	30	2.7	27	V/mks
R <sub>O</sub>	Output resistance	$V_{CC} = V_+ = V_- = 0 V$ $V_O = 2 V$	350	-	300	-	Ohm
I <sub>SC</sub>	Short circuit output current	$V_{CC} = 5.5 V$ $V_O = 0 V$ $V_I = V_{CC}$ $V_I = 0 V$		-50 50		-60 60	mA
ST	Speed of information transmission	$V_{CC} = 4.5 V$ $C_L = 1000 \text{ pF}$ $R_L = 3.0 \text{ kOhm}$ $t_W = 7 \text{ mks}$ (for extreme $-t_W = 8 \text{ mks}$ )	140	-	120	-	

Symbol	Parameter	Test conditions	Rate				Unit
			25°C		-40°C to 85°C		
			min	max	min	max	
t <sub>PHLR</sub> (t <sub>PLHR</sub> )	Signal propagation delay time when switching on (off)	V <sub>CC</sub> = 4.5 V C <sub>L</sub> = 150 pF V <sub>IL</sub> = 0 V V <sub>IH</sub> = 3.0 V t <sub>LH</sub> = t <sub>HL</sub> ≤ 10 ns	-	9.7	-	10	mks
t <sub>PHLT</sub> (t <sub>PLHT</sub> )	Signal propagation delay time when switching on (off)	V <sub>CC</sub> = 4.5 V C <sub>L</sub> = 2500 pF V <sub>IL</sub> = 0 V V <sub>IH</sub> = 3.0 V R <sub>L</sub> = 3 kOhm t <sub>LH</sub> = t <sub>HL</sub> ≤ 10 ns	-	5.0*	-	6.0*	

### Capacitance

Symbol	Parameter	V <sub>CC</sub> , V	Rate	Unit
C <sub>IN</sub>	Input capacitance	5.0	9.0	pF
CPD	Dynamic capacitance		90	

### Timing diagram when measuring IC dynamic parameters

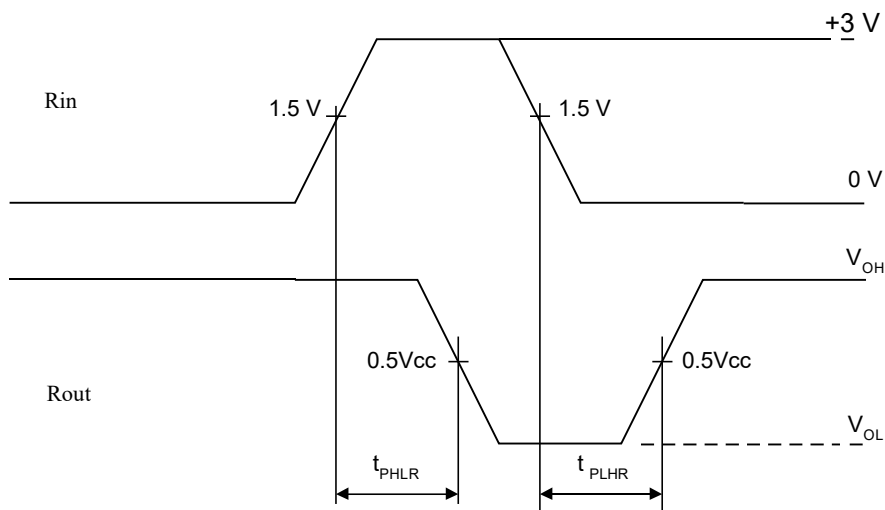


Figure 3

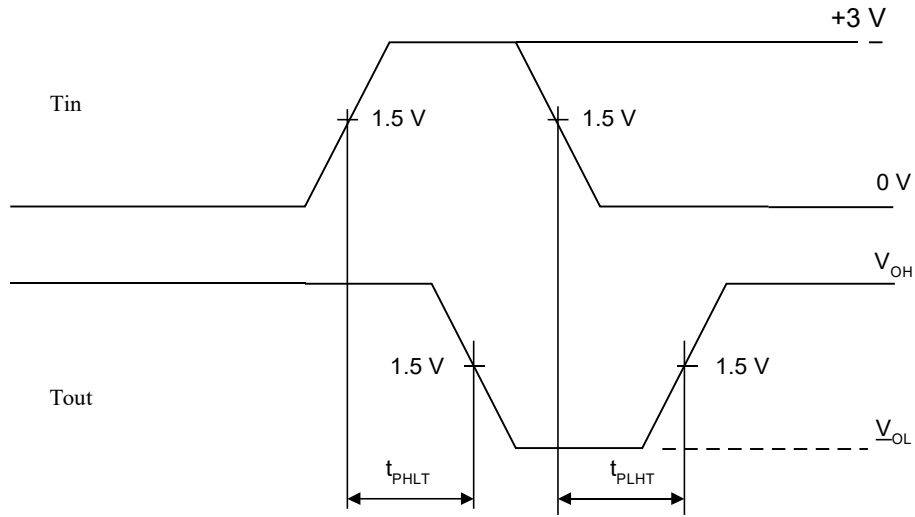


Figure 4

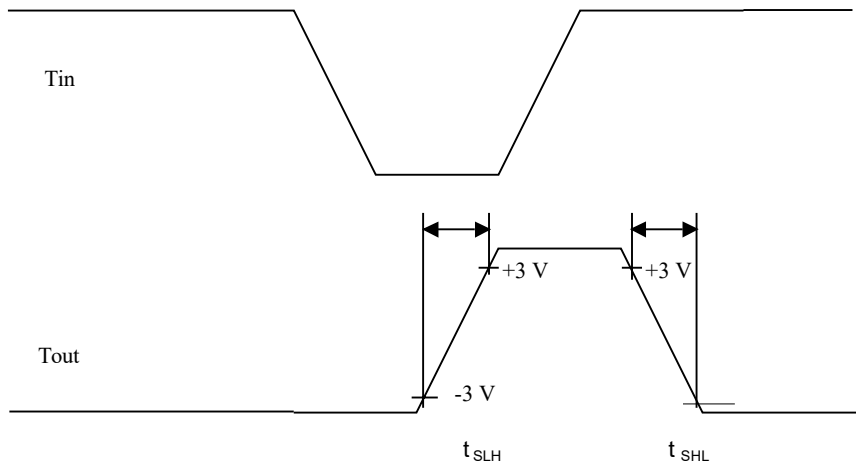


Figure 5

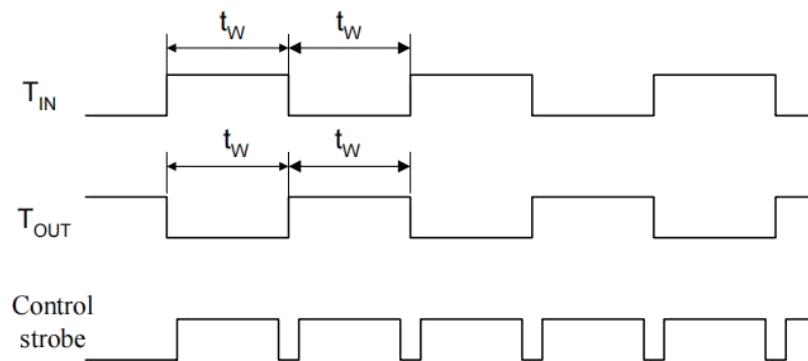
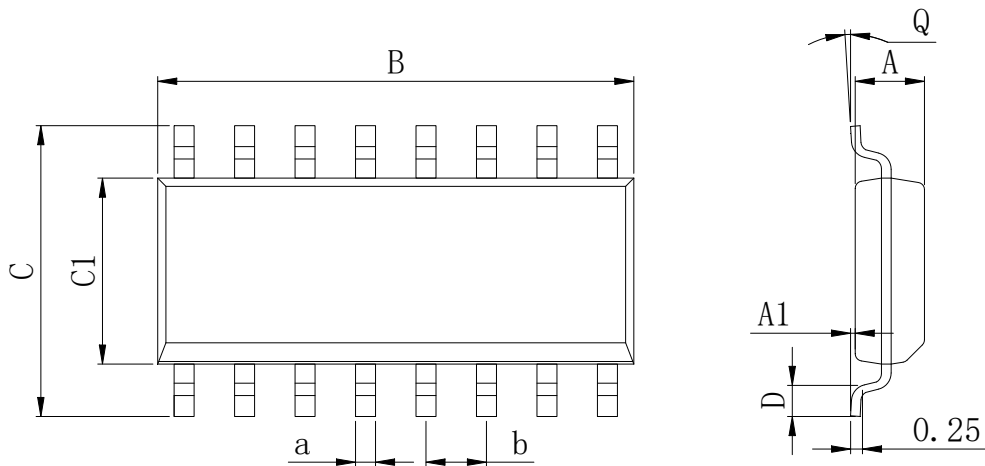


Figure 6

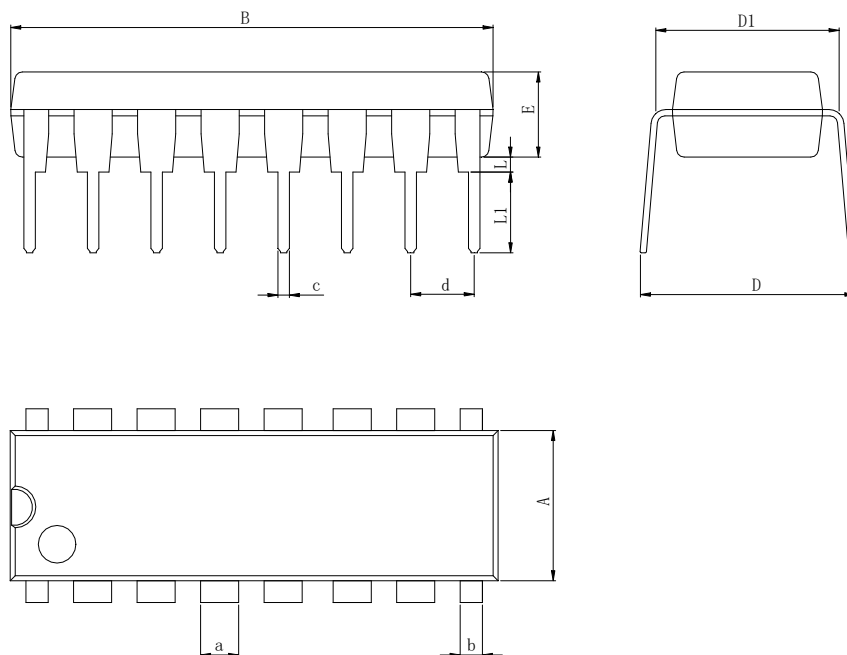
## Physical Dimensions

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	

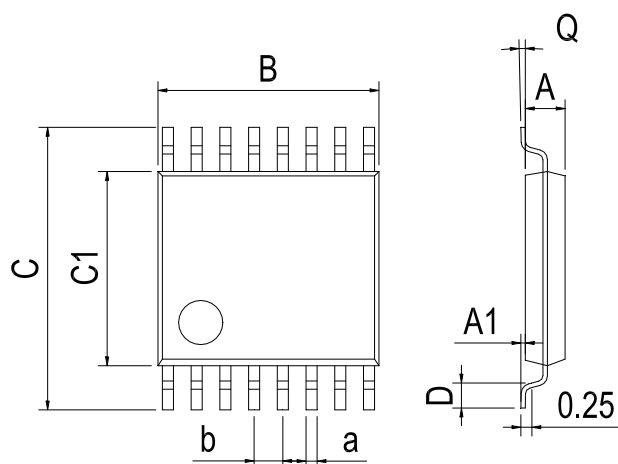
DIP-16



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

DATE	REVISION	PAGE
2018-8-9	New	1-11
2023-9-13	Update package size diagram TSSOP-16 , Update encapsulation 、 Update Lead Temperature、 Updated DIP-16 dimension、 Add annotation for Maximum Ratings.	1、 3、 8、 9

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