

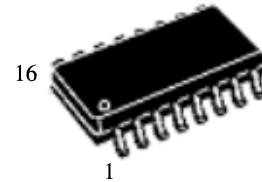


## DESCRIPTION

IC HMAX232DR 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.

## APPLICATIONS

- Portable Computers
- Battery-Powered RS-232 Systems
- Interface Translation
- Low-Power Modems
- Terminals



SOP-16

## FEATURES

- 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 T = 25 °C.
- Output current 24 mA.
- Latching current not less than 450 mA at T = 25°C
- Tolerable value of static potential not less than 2000V

## FUNCTION TABLE

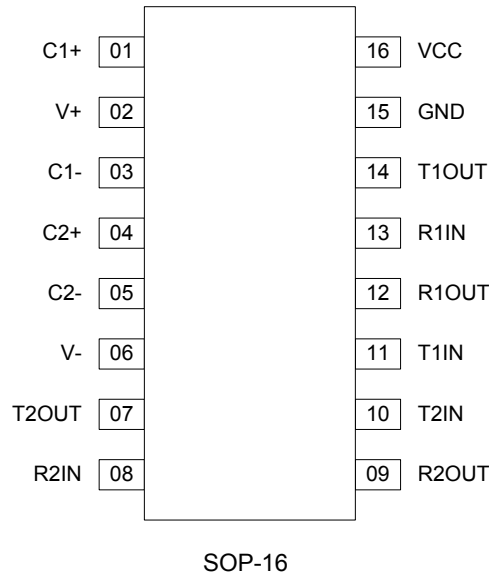
INPUT (RIN, TIN)	OUTPUT (ROUT, TOUT)
L (Low Level)	H (High Level)
H (High Level)	L (Low Level)

## 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
Voltage Applied to Transmitter Output	$V_{TOUT}$	$V_- - 0.3$	$V_++0.3$	V
Voltage Applied to Receiver Output	$V_{ROUT}$	-0.3	$V_{CC}+0.3$	V
Storage Temperature Range	$T_{STG}$	-65	150	°C



## PIN CONFIGURATION



## PIN DESCRIPTION

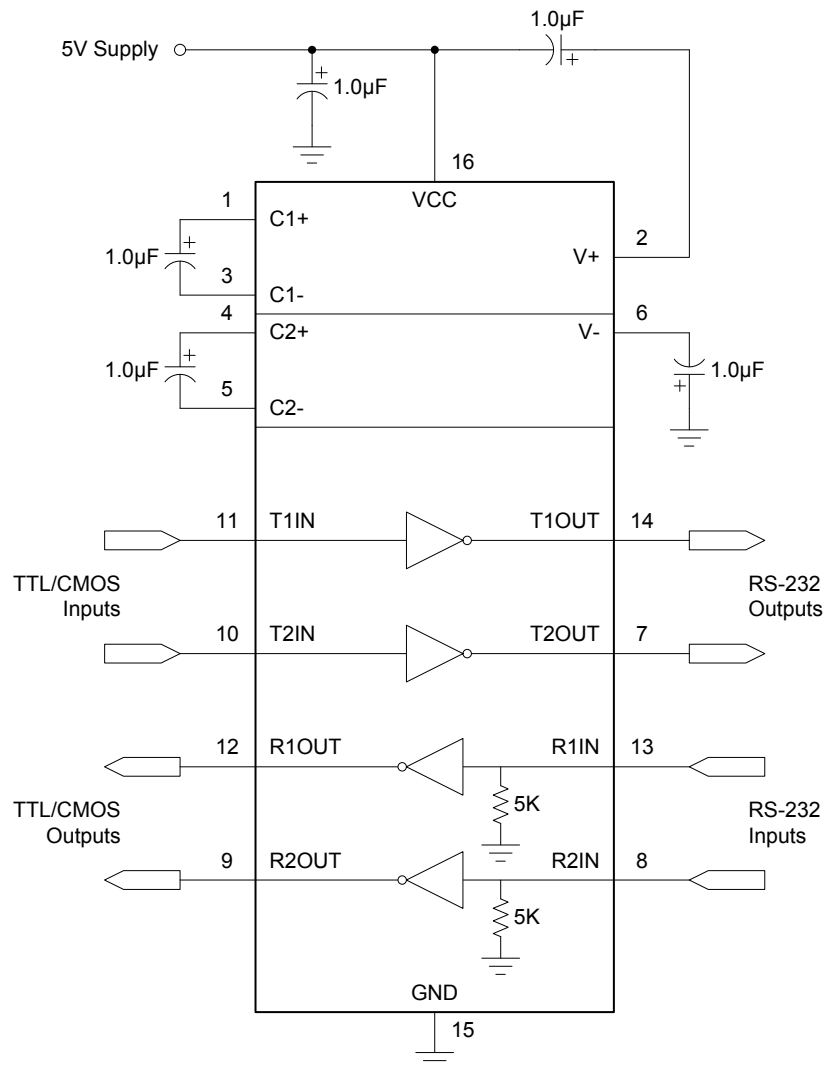
Pin No.	Pin Name	Pin Description
1	C1+	Terminal for Positive Charge-Pump C1 Capacitor
2	V+	Positive Voltage Generated by the Charge-Pump
3	C1-	Terminal for Negative Charge-Pump C1 Capacitor
4	C2+	Terminal for Positive Charge-Pump C2 Capacitor
5	C2-	Terminal for Negative Charge-Pump C2 Capacitor
6	V-	Negative Voltage Generated by the Charge-Pump
7	T2OUT	RS-232 Driver Output (Levels RS-232)
8	R2IN	RS-232 Receiver Input (Levels RS-232)
9	R2OUT	RS-232 Receiver Output (Levels TTL/CMOS)
10	T2IN	RS-232 Driver Input (Levels TTL/CMOS)
11	T1IN	RS-232 Driver Input (Levels TTL/CMOS)
12	R1OUT	RS-232 Receiver Output (Levels TTL/CMOS)
13	R1IN	RS-232 Receiver Input (Levels RS-232)
14	T1OUT	RS-232 Driver Output (Levels RS-232)
15	GND	Ground
16	VCC	Supply Voltage Input



## RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Supply Voltage	$V_{CC}$	4.5	5.5	V
Transmitter Input Voltage	$V_{TIN}$	0	$V_{CC}$	V
Receiver Input Voltage	$V_{RIN}$	-30	30	V
Output Current of Transmitter Short Circuit	$I_{SC}$	-	$\pm 60$	mA
Ambient Temperature Range	$T_A$	-40	+85	$^{\circ}C$

## TYPICAL APPLICATION CIRCUIT





## ELECTRICAL CHARACTERISTICS

(Limits in standard typeface are for  $T_A=25^\circ\text{C}$ , and the limits in boldface type apply over full operating temperature range.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT	
Supply Current	$I_{CC}$	$V_{CC} = 5.5\text{V}$ $V_{IL} = 0\text{V}$	-	-	10.0 <b>14.0</b>	mA	
<b>Receiver Parameters</b>							
Hysteresis Voltage	$V_h$	$V_{CC} = 5.0\text{V}$	0.2 <b>0.2</b>	-	0.9 <b>1.0</b>	V	
On (Operation) Voltage	$V_{on}$	$V_O \leq 0.1\text{V}$ , $I_{OL} \leq 20\mu\text{A}$	-	-	2.4 <b>2.3</b>	V	
Off (Dropout) Voltage	$V_{off}$	$V_O \geq V_{CC} - 0.1\text{V}$ $I_{OH} \leq -20\mu\text{A}$	0.8 <b>0.9</b>	-	-	V	
Output Low Voltage	$V_{OL}$	$I_L = 3.2\text{mA}$ , $V_{CC} = 4.5\text{V}$ , $V_{IH} = 2.4\text{V}$	-	-	0.3 <b>0.4</b>	V	
Output High Voltage	$V_{OH}$	$I_{OH} = -1.0\text{mA}$ , $V_{CC} = 4.5\text{V}$ , $V_{IL} = 0.8\text{V}$	3.6 <b>3.5</b>	-	-	V	
Input Resistance	$R_i$	$V_{CC} = 5.0\text{V}$	3.0 <b>3.0</b>	-	7.0 <b>7.0</b>	k $\Omega$	
<b>Transmitter Parameters</b>							
Output Low Voltage	$V_{OL}$	$V_{CC} = 4.5\text{V}$ , $V_{IH} = 2.0\text{V}$ , $R_L = 3.0\text{k}\Omega$	-	-	-5.2 <b>-5.0</b>	V	
Output High Voltage	$V_{OH}$	$V_{CC} = 4.5\text{V}$ , $V_{IL} = 0.8\text{V}$ , $R_L = 3.0\text{k}\Omega$	5.2 <b>5.0</b>	-	-	V	
Input Low Current	$I_{IL}$	$V_{CC} = 5.5\text{V}$ , $V_{IL} = 0\text{V}$	-	-	-1.0 <b>-10.0</b>	$\mu\text{A}$	
Input High Current	$I_{IH}$	$V_{CC} = 5.5\text{V}$ , $V_{IH} = V_{CC}$	-	-	1.0 <b>10.0</b>	$\mu\text{A}$	
Speed Of Output Front Charge	SR	$V_{CC} = 5.0\text{V}$ , $C_L = 50 - 1000\text{pF}$ , $R_L = 3.0 - 7.0\text{k}\Omega$	3.0 <b>2.7</b>	-	30 <b>27</b>	V/ $\mu\text{s}$	
Output Resistance	$R_O$	$V_{CC} = V_+ = V_- = 0\text{V}$ $V_O = \pm 2\text{V}$	350 <b>300</b>	-	-	$\Omega$	
Short Circuit Output Current	$I_{SC}$	$V_{CC} = 5.5\text{V}$ $V_O = 0\text{V}$	$V_I = V_{CC}$	-	-	-50 <b>-60</b>	mA
			$V_I = 0$	-	-	50 <b>60</b>	
Speed Of Information Transmission	ST	$V_{CC} = 4.5\text{V}$ , $C_L = 1000\text{pF}$ , $R_L = 3.0\text{k}\Omega$ , $t_w = 7\mu\text{s}$ (for extreme, $t_w = 8\mu\text{s}$ )	140 <b>120</b>	-	-	kbit/s	
<b>Dynamic Parameters</b>							
Signal Propagation Delay Time When Switching On (Off)	$t_{PHLR}$ ( $t_{PLHR}$ )	$V_{CC} = 4.5\text{V}$ , $C_L = 150\text{pF}$ , $V_{IL} = 0\text{V}$ , $V_{IH} = 3.0\text{V}$ , $t_{LH} = t_{HL} \leq 10\text{ns}$	-	-	9.7 <b>10.0</b>	$\mu\text{s}$	
Signal Propagation Delay Time When Switching On (Off)	$t_{PHLT}$ ( $t_{PLHT}$ )	$V_{CC} = 4.5\text{V}$ , $C_L = 2500\text{pF}$ , $V_{IL} = 0\text{V}$ , $V_{IH} = 3.0\text{V}$ , $R_L = 3\text{k}\Omega$ , $t_{LH} = t_{HL} \leq 10\text{ns}$	-	-	5.0 <b>6.0</b>	$\mu\text{s}$	



### Capacitance

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

### Timing diagram when measuring IC dynamic parameters

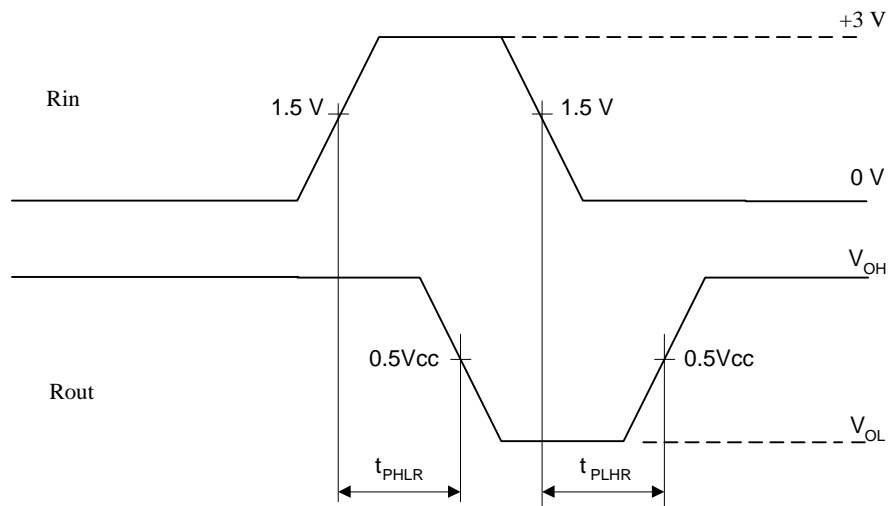


Figure 1

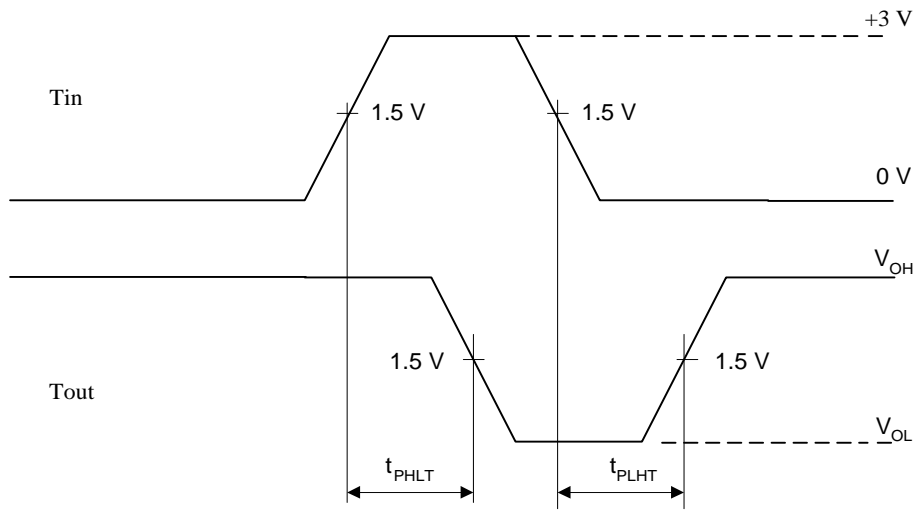


Figure 2

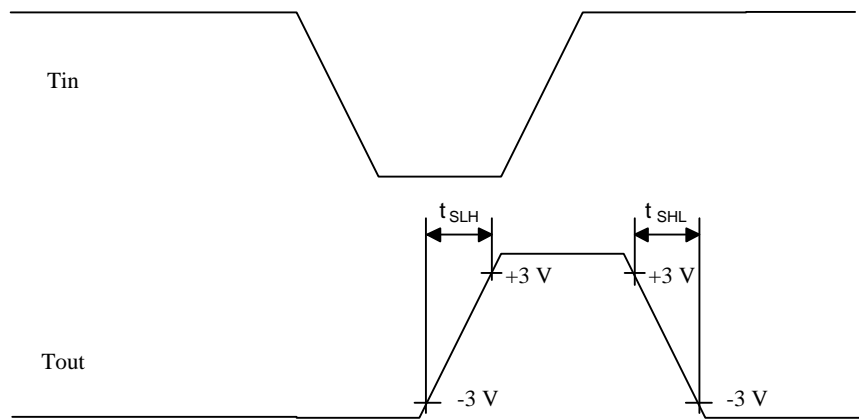


Figure 3

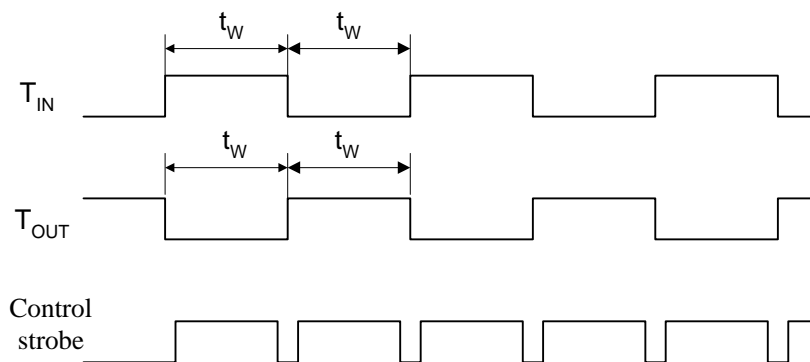
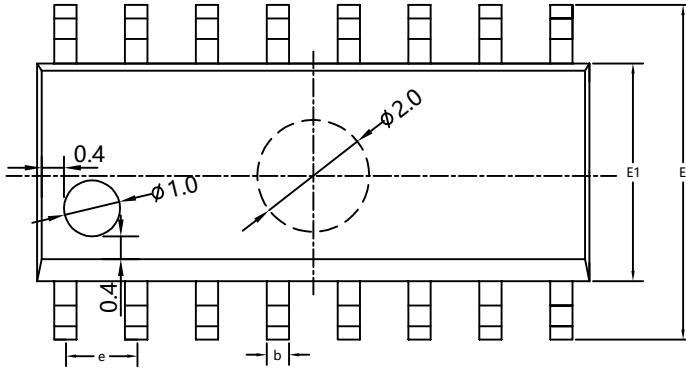
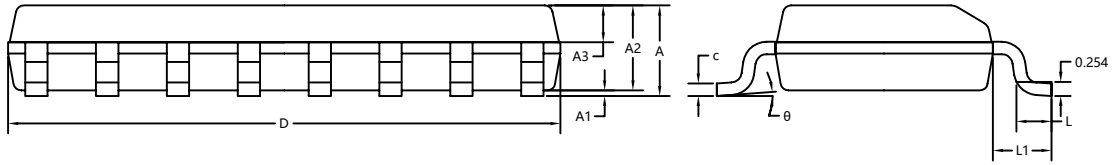


Figure 4



**PACKAGE OUTLINE DIMENSIONS**  
**SOP-16**



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	1.50	1.60	1.70
A1	0.10	0.15	0.25
A2	1.40	1.45	1.50
A3	0.60	0.65	0.70
b	0.30	0.40	0.50
c	0.15	0.20	0.25
D	9.80	9.90	10.00
E	5.80	6.00	6.20
E1	3.85	3.90	3.95
e	1.27BSC		
L	0.50	0.60	0.70
L1	1.05BSC		
theta	0°	4°	8°



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