

# IN145403 IN145404 IN145405 IN145408

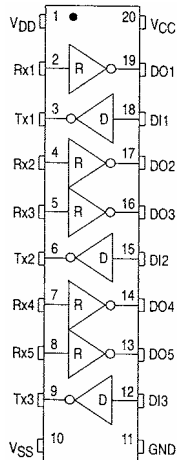
## DRIVERS/RECEIVERS RS-232-E

These devices are silicon gate CMOS ICs that combine both the transmitter and receiver to fulfill the electrical specifications of EIA Standard 232-E and CCITT V.28. The drivers feature true TTL input compatibility, slew rate limiting outputs, 300  $\Omega$  power-off source impedance, and output typically switching to within 25% of the supply rails. The receivers can handle up to  $\pm 25V$  while presenting 3 to 7 k $\Omega$  impedance. Hysteresis in the receivers aid in the reception of noisy signals. By combining both drivers and receivers in a single CMOS chip, these devices provide efficient, low-power solutions for both EIA-232-E and V.28 applications. These devices offer the following performance features:

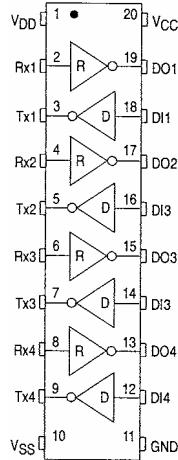
<b>DRIVERS</b>	<b>RECEIVERS</b>
<ul style="list-style-type: none"> <li>• <math>\pm 5</math> to <math>\pm 12</math> V Supply Range</li> <li>• 300 <math>\Omega</math> Power-Off Source Impedance</li> <li>• Output Current Limiting</li> <li>• TTL and CMOS Compatible Inputs</li> <li>• Driver Slew Rate Range Limited to 30 V/<math>\mu</math>s Maximum</li> </ul>	<ul style="list-style-type: none"> <li>• <math>\pm 25V</math> Input Range</li> <li>• 3 to 7 k<math>\Omega</math> Input Impedance</li> <li>• 0.8V of Hysteresis for Enhanced Noise Immunity</li> <li>• TTL and CMOS Compatible Outputs</li> <li>• Available Driver/Receiver Combinations</li> </ul>

Device	Drivers	Receivers	Figure	No. of Pins
IN145403	3	5	1	20
IN145404	4	4	2	20
IN145405	5	3	3	20
IN145408	5	5	4	24

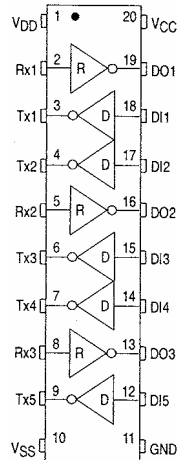
**IN145403**  
3 DRIVERS/5 RECEIVERS



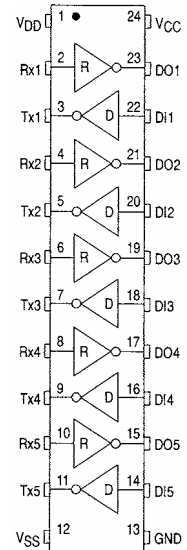
**IN145404**  
4 DRIVERS/4 RECEIVERS



**IN145405**  
5 DRIVERS/3 RECEIVERS

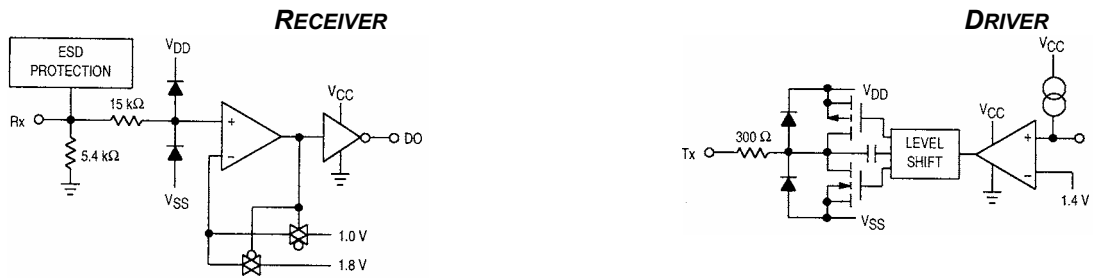


**IN145408**  
5 DRIVERS/5 RECEIVERS



# IN145403 IN145404 IN145405 IN145408

## FUNCTIONAL DIAGRAM



## ABSOLUTE MAXIMUM RATINGS (Voltages referenced to GND, except where noted)

Rating	Symbol	Value	Unit
DC Supply Voltage ( $V_{DD} \geq V_{CC}$ )	$V_{DD}$	-0.5 to +13.5	V
	$V_{SS}$	+0.5 to -13.5	
	$V_{CC}$	-0.5 to +6.0	
Input Voltage Range Rx1 - Rxn DI1 - DIIn	$V_{IR}$	$V_{GG} - 15 \text{ to } V_{DO} + 15$	V
DC Current Drain per Pin	I	$\pm 00$	mA
Power Dissipation	$P_D$	1	W
Operating Temperature Range	$T_A$	-40 to +85	$^{\circ}\text{C}$
Storage Temperature Range	$T_{stg}$	-85 to +150	$^{\circ}\text{C}$

This device contains circuitry to protect the inputs and outputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions be taken to avoid applications of any voltage higher than maximum rated voltages to this high impedance circuit.

For proper operation it is recommended that  $V_{out}$  and  $V_{in}$  be constrained to the ranges described as follows: Digital I/O:

Driver Inputs (DI):

$(GND \leq V_{DI} \leq V_{CC})$

Receiver Outputs (DO):

$(GND \leq V_{DO} \leq V_{CC})$

EIA-232 I/O: Driver Outputs (Tx):

$(V_{SS} \leq V_{Tx1-Txn} \leq V_{DD})$

Receiver Inputs (Rx):

$(V_{SS} - 15V \leq V_{Rx1-Rxn} \leq V_{DD} + 15V)$

Reliability of operation is enhanced if unused outputs are tied off to an appropriate logic voltage level (e.g., either GND or  $V_{CC}$  for DI, and GND for Rx).

## DC ELECTRICAL CHARACTERISTICS (All polarities referenced to GND=0V, $T_A = -40$ to $+85^{\circ}\text{C}$ )

Parameter	Symbol	Min	Typ	Max	Unit
DC Supply Voltage	$V_{DD}$	4.5	5 to 12	13.2	V
	$V_{SS}$	-4.5	-5 to -12	-13.2	
	$V_{CC}$	4.5	5	5.5	
Quiescent Supply Current (Outputs Unloaded, Inputs Low)	$I_{DD}$	-	425	635	nA
	$I_{SS}$	-	-400	-600	
	$I_{CC}$	-	110	200	
	$V_{DD} = +12V$ $V_{SS} = -12V$ $V_{CC} = +5V$				

# IN145403 IN145404 IN145405 IN145408

## RECEIVER ELECTRICAL SPECIFICATIONS (Voltage polarities referenced to GND=0V, $V_{DD}=+12V$ , $V_{SS}=-12V$ , $T_A=-40$ to $+85^\circ C$ , $V_{CC}=+5V \pm 10\%$ )

Characteristic	Symbol	Min	Typ	Max	Unit
Input Turn-On Threshold Rx1 - Rxn $V_{DD}=V_{OL}$	$V_{on}$	1.35	1.8	2.35	V
Input Turn-Off Threshold Rx1 - Rxn $V_{DD}=V_{OH}$	$V_{off}$	0.75	1	1.25	V
Input Threshold Hysteresis $\Delta=V_{on}-V_{off}$	$V_{hys}$	0.6	0.8	—	V
Input Resistance ( $V_{SS}=-15V$ ) $\leq V_{Rx1}$ - $R_{Xn} \leq (V_{DD}+15V)$	$R_{in}$	3	5.4	7	k $\Omega$
High Level Output Voltage $V_{Rx}=-3$ to $-25V^*$ (D01-D0n) $I_{out}=-20 \mu A$ $I_{out}=-1.0mA$	$V_{OH}$	4.9 3.8	4.9 4.3	- -	V
Low Level Output Voltage $V_{Rx}=+3$ to $+25V$ (D01 - D0n) $I_{out}=+2mA$ $I_{out}=+4 mA$	$V_{OL}$	- -	0.02 0.5	0.5 0.7	V

\* This is the range of input voltages as specified by EIA-232-E to cause a receiver to be in the high or low.

## DRIVER ELECTRICAL SPECIFICATIONS (Voltage Polarities Referenced to GND =0V, $V_{DD}=+12V$ , $V_{SS}=-12V$ , $T_A=-40$ to $+85^\circ C$ , $V_{CC}=+5V \pm 10\%$ )

Characteristic	Symbol	Min	Typ	Max	Unit
Digital Input Voltage Logic 0 Logic 1	DII-DIn $V_{IL}$ $V_{IH}$	- 2	- -	0.8 -	V
Input Current $V_{DI}=GND$ $V_{DI}=V_{CC}$	DII - DIn $I_{IL}$ $I_{IH}$	- -	7 -	- $\pm 1.0$	nA
Output High Voltage $V_{DI}=Logic\ 0$ , $R_L=3k\Omega$ $V_{DD}=+5.0V$ , $V_{SS}=-5.0V$ $V_{DD}=+6.0V$ , $V_{SS}=-6.0V$ $V_{DD}=+12.0V$ , $V_{SS}=-12.0V$	Txl-Txn $V_{OH}$	3.5 4.3 9.2	3.9 4.7 9.5	- - -	V
Output Low Voltage* $V_{DI}=Logic\ 1$ , $R_L=3k\Omega$ $V_{DD}=+5.0V$ , $V_{SS}=-5.0V$ $V_{DD}=+6.0V$ , $V_{SS}=-6.0V$ $V_{DD}=+12.0V$ , $V_{SS}=-12.0V$	Txl - Txn $V_{OL}$	-4 -4.5 -10	-4.3 -5.2 -10.3	- - -	V
Output Short Circuit Current $V_{DD}=+12V$ , $V_{SS}=-12V$ Tx Shorted to GND Tx Shorted to $\pm 15V$	Txl-Txn $I_{SC}$	-	$\pm 22 \pm 60$	$\pm 60 \pm 100$	mA

\* Voltage specifications are in terms of absolute values.

## SWITCHING CHARACTERISTICS ( $V_{CC}=+5V \pm 10\%$ , $V_{DD}=+12V$ , $V_{SS}=-12V$ , $T_A=-40$ to $+85^\circ C$ ; See Figures 2 and 3)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>Drivers</b>					
Propagation Delay Time Tx Low-to-High $R_L=3k\Omega$ , $C_L=50 pF$ High-to-Low $R_L=3k\Omega$ , $C_L=50pF$	$t_{PLH}$ $t_{PHL}$	- -	500 700	1000 1000	ns
Output Slew Rate Minimum Load $R_L=7k\Omega$ , $C_L=0 pF$ ( $V_{DD}=6$ to $12V$ , $V_{SS}=-6$ to $-12V$ ) Maximum Load $R_L=3k\Omega$ , $C_L=2500 pF$ ( $V_{DD}=12V$ , $V_{SS}=-12V$ , $V_{CC}=5V$ )	SR	- 4	$\pm 6$ -	$\pm 30$ -	V/ps
<b>Receivers (<math>C_L=50 pF</math>)</b>					
Propagation Delay Time Low-to-High High-to-Low	$t_{PLH}$ $t_{PHL}$	— -	360 130	610 610	ns
Output Rise Time	$t_r$	-	250	400	ns
Output Fall Time	$t_f$	-	40	100	ns