

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 Ω 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 Ω 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:

DRIVERS

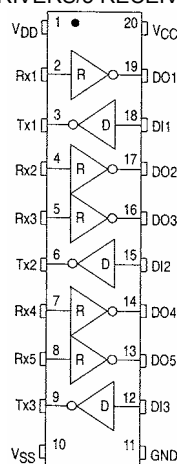
- ± 5 to ± 12 V Supply Range
- 300 Ω Power-Off Source Impedance
- Output Current Limiting
- TTL and CMOS Compatible Inputs
- Driver Slew Rate Range Limited to 30 V/ μ s Maximum

RECEIVERS

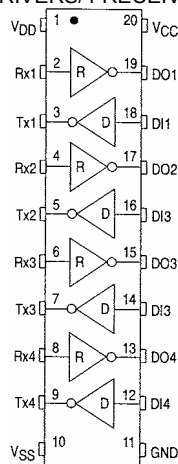
- $\pm 25V$ Input Range
- 3 to 7 k Ω Input Impedance
- 0.8V of Hysteresis for Enhanced Noise Immunity
- TTL and CMOS Compatible Outputs
- Available Driver/Receiver Combinations

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

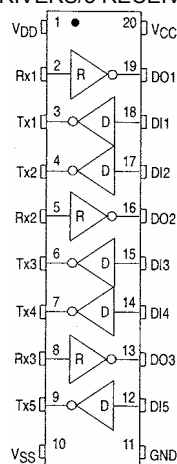
IN145403
3 DRIVERS/5 RECEIVERS



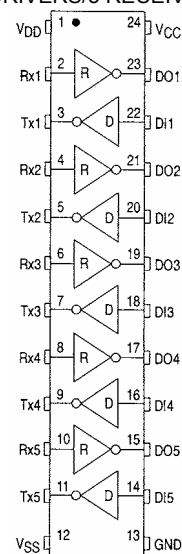
IN145404
4 DRIVERS/4 RECEIVERS



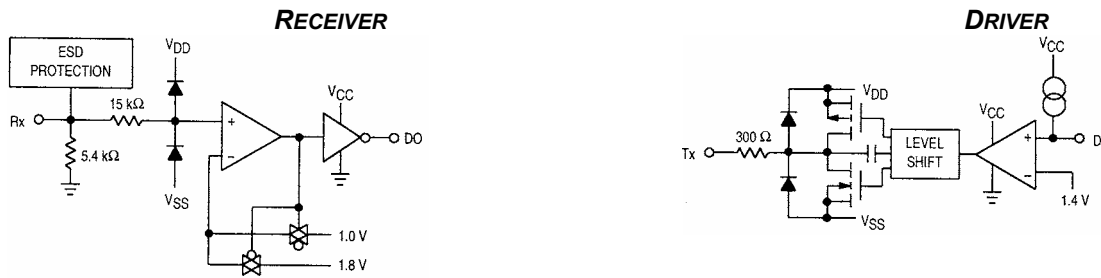
IN145405
5 DRIVERS/3 RECEIVERS



IN145408
5 DRIVERS/5 RECEIVERS



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} V_{SS} V_{CC}	-0.5 to +13.5 +0.5 to -13.5 - 0.5 to + 6.0	V
Input Voltage Range Rx1 - Rxn DI1 -DIIn	V_{IR}	$V_{GG}-15 \text{ to } V_{DO} + 15 \text{ to } V_{CC}+15$	V
DC Current Drain per Pin	I	± 00	mA
Power Dissipation	P_D	1	W
Operating Temperature Range	T_A	-40 to +85	°C
Storage Temperature Range	T_{stg}	-85 to +150	°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):

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

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

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 $R_{x1} - R_{xn}$ $V_{DD}=V_{OL}$	V_{on}	1.35	1.8	2.35	V
Input Turn-Off Threshold $R_{x1} - R_{xn}$ $V_{DD}=V_{OH}$	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 Ω
High Level Output Voltage $I_{out} = -20 \mu A$ $V_{Rx} = -3$ to $-25V$ * (D01-D0n) $I_{out} = -1.0mA$	V_{OH}	4.9 3.8	4.9 4.3	- -	V
Low Level Output Voltage $I_{out} = +2mA$ $V_{Rx} = +3$ to $+25V$ (D01 - D0n) $I_{out} = +4 mA$	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	V_{IL} V_{IH}	- 2	- -	0.8 -	V
Input Current $V_{DI}=GND$ $V_{DI}=V_{CC}$	I_{IL} I_{IH}	- -	7 -	- ± 1.0	nA
Output High Voltage $V_{DI}=Logic\ 0$, $R_L = 3k\Omega$ $V_{DD}=+5.0V$, $V_{SS}=-5.0V$ $V_{DD}=+6.0V$, $V_{SS}=-6.0V$ $V_{DD}=+12.0V$, $V_{SS}=-12.0V$	V_{OH}	3.5 4.3 9.2	3.9 4.7 9.5	- - -	V
Output Low Voltage* $V_{DI} = Logic\ 1$, $R_L = 3k\Omega$ $V_{DD}=+5.0V$, $V_{SS}=-5.0V$ $V_{DD}=+6.0V$, $V_{SS}=-6.0V$ $V_{DD}=+12.0V$, $V_{SS}=-12.0V$	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 $\pm 15V$	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
Drivers					
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	± 6 -	± 30 -	V/ps
Receivers ($C_L = 50 pF$)					
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