



### RS232C LINE DRIVER/RECEIVER

#### ■ GENERAL DESCRIPTION

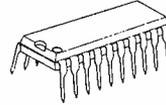
The NJU6401B is a RS232C line driver/receiver composed of 3 drivers and 5 receivers.

The drivers convert the input of TTL level signals into RS232C level signals and limit the slew rate below 30V/μs.

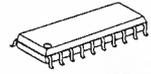
The receivers accept the input levels both of RS-232C standard minimum requirement level(±3V) and TTL level.

Furthermore, the hysteresis circuit and noise filter incorporated on each receiver ensures noise-free operation.

#### ■ PACKAGE OUTLINE



NJU6401BD

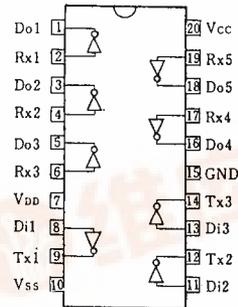


NJU6401BM

#### ■ FEATURES

- Based on the RS232C Standard
- 3 Drivers and 5 Receivers
- Low Operating Current
- Driver Output Voltage --- ±25V
- Receiver Input Voltage --- ±27V
- Output Impedance at Power-off (Driver) --- 300Ω (Min)
- Slew Rate (Driver) --- 30V/μs (Max)
- TTL-compatible Input (Driver)
- TTL-compatible Input/Output (Receiver)
- Hysteresis Input (Receiver)
- Noise Filter On-chip (Receiver)
- Package Outline --- DIP/DMP 20
- C-MOS Technology

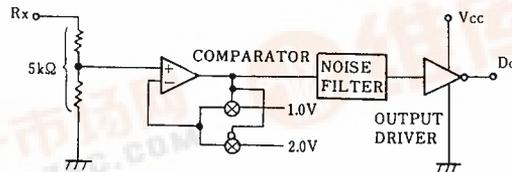
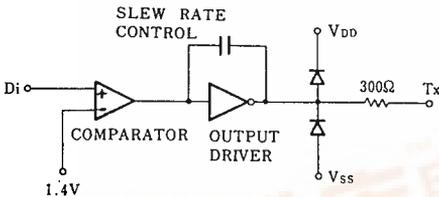
#### ■ PIN CONFIGURATION



#### ■ BLOCK DIAGRAM

(1) Driver Section ( 1-circuit )

(2) Receiver Section ( 1-circuit )



**■ TERMINAL DESCRIPTION**

NO.	SYMBOL	F U N C T I O N	NO.	SYMBOL	F U N C T I O N
1	Do1	Receiver Output 1	11	Di2	Driver Input 2
2	Rx1	Receiver Input 1	12	Tx2	Driver Output 2
3	Do2	Receiver Output 2	13	Di3	Driver Input 3
4	Rx2	Receiver Input 2	14	Tx3	Driver Output 3
5	Do3	Receiver Output 3	15	GND	Ground
6	Rx3	Receiver Input 3	16	Do4	Receiver Output 4
7	V <sub>DD</sub>	Driver Positive Voltage Supply(+12V)	17	Rx4	Receiver Input 4
8	Di1	Driver Input 1	18	Do5	Receiver Output 5
9	Tx1	Driver Output 1	19	Rx5	Receiver Input 5
10	V <sub>SS</sub>	Driver Negative Voltage Supply(-12V)	20	V <sub>CC</sub>	Logic Operating Voltage Supply(+5V)

**7**
**■ FUNCTIONAL DESCRIPTION**
**(1) Driver Section**

The drivers output the RS-232C standard signals which are converted from the TTL level signal to RS-232C standard level by the level shifter and limit the slew rate below  $30V/\mu s(6V/\mu s \text{ typ})$ , to the RS-232C lines.

The each driver incorporate series resistance to keep the output impedance to  $300\Omega$  or more during the power-off. This series resistance also protect the internal circuits against the overvoltage of  $\pm 25V$  impressed from outside.

**(2) Receiver Section**

The input of each receiver incorporate the resistor(TYP: $5k\Omega$ ) as the drivers load. This resistor also protect the internal circuits against the overvoltage of  $\pm 27V$ . The receiver accept the both of  $\pm 3V$  of RS-232C standard minimum requirement level and TTL level as the threshold voltage of input comparators are adjusted for both input levels.

The noise less than  $1V_{P-P}$  and spike noise below  $3\mu s$  pulse width are eliminated by the hysteresis circuits and noise filter.

The output signals are TTL compatible and capable of 8-LSTTL driving.

**■ ABSOLUTE MAXIMUM RATINGS**

(Ta=25°C)

PARAMETER		SYMBOL	RATINGS	UNIT
Supply Voltage		V <sub>CC</sub> V <sub>DD</sub> V <sub>SS</sub>	-0.3 ~ +6 V <sub>CC</sub> ~ +14 (Note1) +0.3 ~ -14	V
Receiver	Input Voltage Output Voltage	V <sub>RI</sub> V <sub>RO</sub>	±27 -0.3 ~ V <sub>CC</sub> +0.3	V
Driver	Input Voltage Output Voltage Output Current	V <sub>DI</sub> V <sub>TX</sub> I <sub>TX</sub>	-0.3 ~ V <sub>CC</sub> +0.3 ±25 ±60	V V mA
Power Dissipation		P <sub>D</sub>	DIP 500	mW
Operating Temperature		T <sub>OP</sub>	-20 ~ +75	°C
Storage Temperature		T <sub>STG</sub>	-65 ~ +150	°C

Note1) The V<sub>DD</sub> level must be maintained higher than V<sub>CC</sub> level. If the V<sub>CC</sub> rise up before V<sub>DD</sub> supply when the power is turned on, the latch-up may occur because of the reverse current flows from V<sub>CC</sub> to V<sub>DD</sub>. If there are possibilities of early V<sub>CC</sub> supply, the diode connect to V<sub>DD</sub> and V<sub>SS</sub> terminals shown in application circuits are required.

**■ ELECTRICAL CHARACTERISTICS**

(Ta=25°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Quiescent Current	I <sub>CC</sub> I <sub>DD</sub> I <sub>SS</sub>	V <sub>CC</sub> =5.5V V <sub>DD</sub> =12V V <sub>SS</sub> =-12V			1 1 1	mA
Operating Voltage	V <sub>CC</sub> V <sub>DD</sub> V <sub>SS</sub>		4.5 4.5 -12		5.5 12 -4.5	V

**■ DRIVER ELECTRICAL CHARACTERISTICS**

 (Ta=25°C, 4.5 ≤ V<sub>CC</sub> ≤ 5.5V, V<sub>DD</sub>=4.5~12V, V<sub>SS</sub>=-4.5V~-12V, GND=0V)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Input Voltage H Level L Level	V <sub>IH</sub> V <sub>IL</sub>			2.0		0.8	V
Maximum Input Current	I <sub>IL</sub> , I <sub>IH</sub>	V <sub>IN</sub> =GND or V <sub>DD</sub>		-10		10	μA
H Level Output Voltage	V <sub>OH</sub>	V <sub>IN</sub> =V <sub>IL</sub> R <sub>L</sub> =3kΩ	V <sub>DD</sub> =+4.5V, V <sub>SS</sub> =-4.5V V <sub>DD</sub> =+9V, V <sub>SS</sub> =-9V V <sub>DD</sub> =+12V, V <sub>SS</sub> =-12V	3.0 6.5 9.0			V
L Level Output Voltage	V <sub>OL</sub>	V <sub>IN</sub> =V <sub>IH</sub> R <sub>L</sub> =3kΩ	V <sub>DD</sub> =+4.5V, V <sub>SS</sub> =-4.5V V <sub>DD</sub> =+9V, V <sub>SS</sub> =-9V V <sub>DD</sub> =+12V, V <sub>SS</sub> =-12V			-3.0 -6.5 -9.0	V
Output Short Current (Note 2)	I <sub>OS</sub> <sup>+</sup>	V <sub>OUT</sub> =GND, V <sub>DD</sub> =+12V				45	mA
	I <sub>OS</sub> <sup>-</sup>	V <sub>SS</sub> =-12V				-45	
Output Impedance	R <sub>OUT</sub>	V <sub>CC</sub> =V <sub>DD</sub> =V <sub>SS</sub> =0V, -2V ≤ V <sub>OUT</sub> ≤ +2V		300			Ω

Note 2) The output short current is specified by 1 output terminal. If plural outputs short at once, the NJU6401B may destroy due to the power over the package power dissipation.

**■ DRIVER AC CHARACTERISTICS**

 (Ta=25°C, 4.5 ≤ V<sub>CC</sub> ≤ 5.5V, V<sub>DD</sub>=4.5~12V, V<sub>SS</sub>=-4.5V~-12V, GND=0V, R<sub>L</sub>=3kΩ, C<sub>L</sub>=50pF) (Note 3,4)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Propagation Delay Time	t <sub>odi</sub>	V <sub>DD</sub> =+4.5V, V <sub>SS</sub> =-4.5V V <sub>DD</sub> =+9V, V <sub>SS</sub> =-9V V <sub>DD</sub> =+12V, V <sub>SS</sub> =-12V			6.0 5.0 4.0	μs
Propagation Delay Time	t <sub>odo</sub>	V <sub>DD</sub> =+4.5V, V <sub>SS</sub> =-4.5V V <sub>DD</sub> =+9V, V <sub>SS</sub> =-9V V <sub>DD</sub> =+12V, V <sub>SS</sub> =-12V			6.0 5.0 4.0	μs
Rise/Fall Time (Note 5)	t <sub>r</sub> /t <sub>f</sub>		0.2			μs
Delay Time Skew	t <sub>ak</sub>	V <sub>DD</sub> =+12V, V <sub>SS</sub> =-12V		400		ns
Slew Rate (Note 5)	S <sub>R</sub>	R <sub>L</sub> =3 to 7kΩ, 15pF ≤ C <sub>L</sub> ≤ 2.5nF		6	30	v/μs

 Note 3) AC input waveform: t<sub>r</sub>=t<sub>f</sub> ≤ 20ns, V<sub>IH</sub>=2.0V, V<sub>IL</sub>=0.8V

Note 4) Input Rise/Fall time are less than 5μs.

Note 5) Output slew rate, output rise time and fall time are specified output waveform changing time either from +3V to -3V or -3V to +3V.

7

**■ RECEIVER ELECTRICAL CHARACTERISTICS**

 (Ta=25°C, 4.5 ≤ V<sub>CC</sub> ≤ 5.5V, V<sub>DD</sub>=4.5~12V, V<sub>SS</sub>=-4.5V~-12V, GND=0V)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage H Level L Level	V <sub>P</sub> V <sub>N</sub>		1.3 0.5	2.0 1.0	2.5 1.7	V
Hysteresis Voltage	V <sub>H</sub>			1.0		V
Input Impedance	R <sub>IN</sub>	V <sub>IN</sub> =±3V~±12V	3	5	7	kΩ
Output Voltage H Level L Level	V <sub>OH</sub> V <sub>OL</sub>	V <sub>IN</sub> =V <sub>N</sub> (Min.), I <sub>OUT</sub> =-3.2mA V <sub>IN</sub> =V <sub>P</sub> (Max.), I <sub>OUT</sub> =+3.2mA	2.8		0.4	V

**■ RECEIVER AC CHARACTERISTICS**

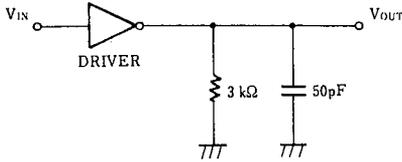
 (Ta=25°C, 4.5 ≤ V<sub>CC</sub> ≤ 5.5V, V<sub>DD</sub>=4.5~12V, V<sub>SS</sub>=-4.5V~-12V, GND=0V, C<sub>L</sub>=50pF) (Note 6)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Propagation Delay Time	t <sub>PLH</sub> , t <sub>PHL</sub>	Input Pulse Width ≥ 10μs			6.5	μs
Delay Time Skew	t <sub>SK</sub>			400		ns
Output Rise Time	t <sub>r</sub>				300	ns
Output Fall Time	t <sub>f</sub>				300	ns

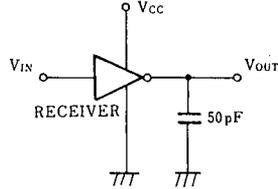
 Note 6) AC input waveform t<sub>r</sub>=t<sub>f</sub>=200ns, V<sub>IH</sub>=+3V, V<sub>IL</sub>=-3V, f=20kHz.

■ MEASUREMENT CIRCUITS

(1) Driver AC Characteristics

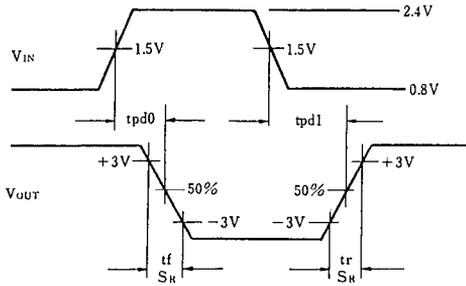


(2) Receiver AC Characteristics

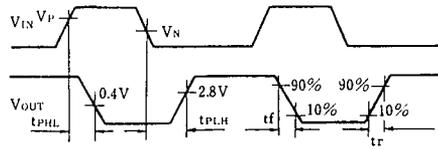


■ MEASUREMENT WAVEFORM

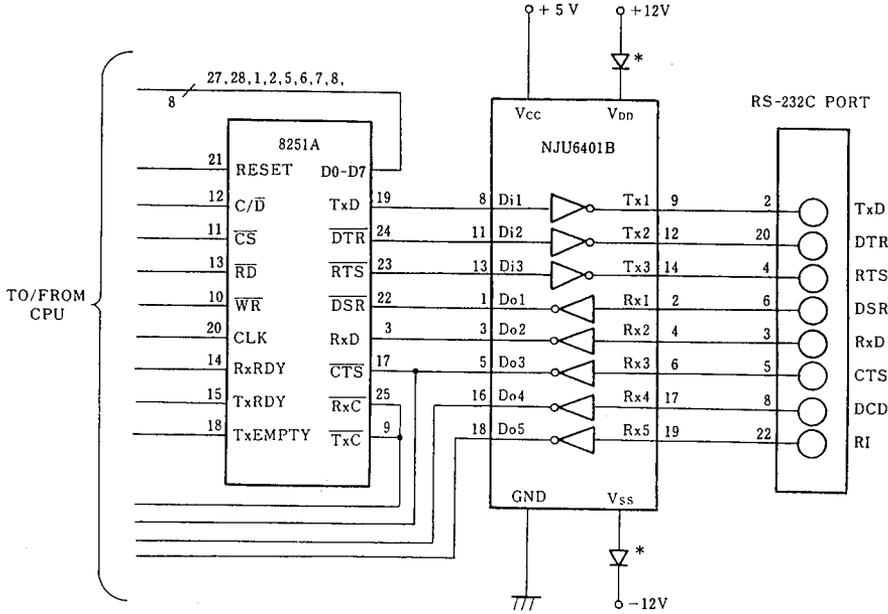
(1) Driver AC Characteristics



(2) Receiver AC Characteristics



■ APPLICATION CIRCUIT



RS-232C port

\* External diode for protective use.  
 Protection of in case +5V voltage supplied before  
 than +12V and overvoltage stress.

# NJU6401B

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## MEMO

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