

# RS232C LINE DRIVER/RECEIVER

## GENERAL DESCRIPTION

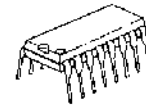
The NJU6402B is a RS232C line driver/receiver composed of 3 drivers and 3 receivers.

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

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

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

## PACKAGE OUTLINE



NJU6402BD

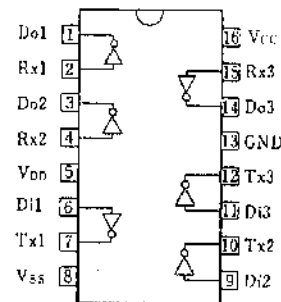


NJU6402BM

## FEATURES

- Based on the RS232C Standard
- 3 Drivers and 3 Receivers
- Low Operating Current
- Driver Output Voltage ---  $\pm 25V$
- Receiver Input Voltage ---  $\pm 27V$
- Output Impedance at Power-off (Driver) ---  $300\Omega$  (Min)
- Slew Rate (Driver) ---  $30V/\mu s$  (Max)
- TTL-compatible Input (Driver)
- TTL-compatible Input/Output (Receiver)
- Hysteresis Input (Receiver)
- Noise Filter On-chip (Receiver)
- Package Outline --- DIP/DMP 16
- C-MOS Technology

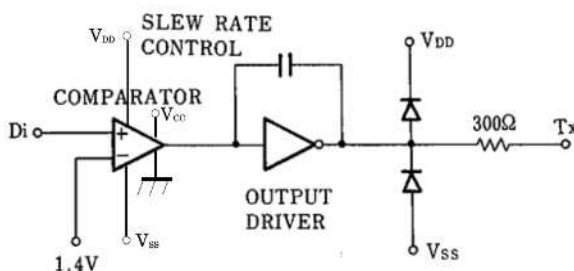
## PIN CONFIGURATION



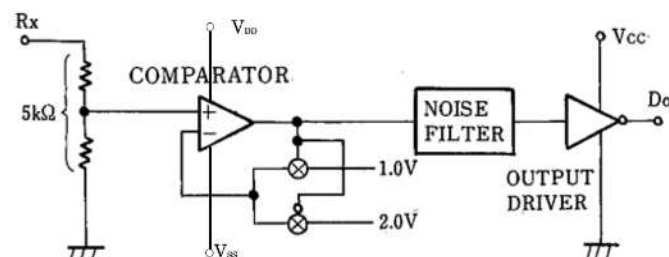
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## BLOCK DIAGRAM

(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	9	Di2	Driver Input 2
2	Rx1	Receiver Input 1	10	Tx2	Driver Output 2
3	Do2	Receiver Output 2	11	Di3	Driver Input 3
4	Rx2	Receiver Input 2	12	Tx3	Driver Output 3
5	V <sub>DD</sub>	Positive Voltage Supply (+12V)	13	GND	Ground
6	Di1	Driver Input 1	14	Do3	Receiver Output 3
7	Tx1	Driver Output 1	15	Rx3	Receiver Input 3
8	V <sub>SS</sub>	Negative Voltage Supply (-12V)	16	V <sub>CC</sub>	Logic Operating Voltage Supply(+5V)

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## ■ 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	V <sub>RI</sub>	±27	V
	Output Voltage	V <sub>DO</sub>	-0.3 ~ V <sub>CC</sub> +0.3	V
Driver	Input Voltage	V <sub>DI</sub>	-0.3 ~ V <sub>CC</sub> +0.3	V
	Output Voltage	V <sub>TX</sub>	±25	V
	Output Current	I <sub>TX</sub>	±60	mA
Power Dissipation		P <sub>D</sub>	DIP 500	mW
Operating Temperature		T <sub>opr</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.

Furthermore, the V<sub>SS</sub> must be maintained less than -4.5V for the normal operating.

# ELECTRICAL CHARACTERISTICS

(Ta=25°C)

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

# 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>			2.0			V
	V <sub>IL</sub>					0.8	
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>	V <sub>DD</sub> =+4.5V, V <sub>SS</sub> =-4.5V	3.0			V
		R <sub>L</sub> =3kΩ	V <sub>DD</sub> =+9V, V <sub>SS</sub> =-9V	6.5			
			V <sub>DD</sub> =+12V, V <sub>SS</sub> =-12V	9.0			
L Level Output Voltage	V <sub>OL</sub>	V <sub>IN</sub> =V <sub>IH</sub>	V <sub>DD</sub> =+4.5V, V <sub>SS</sub> =-4.5V			-3.0	V
		R <sub>L</sub> =3kΩ	V <sub>DD</sub> =+9V, V <sub>SS</sub> =-9V			-6.5	
			V <sub>DD</sub> =+12V, V <sub>SS</sub> =-12V			-9.0	
Output Short Current (Note 2)	I <sub>OS</sub> <sup>+</sup>	V <sub>OUT</sub> =GND, V <sub>DD</sub> =+12V	V <sub>IN</sub> =V <sub>IL</sub>			+45	mA
	I <sub>OS</sub> <sup>-</sup>	V <sub>SS</sub> =-12V	V <sub>IN</sub> =V <sub>IH</sub>	-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 NJU6402B may destroy due to the power over the package power dissipation.

## ■ DRIVER AC CHARACTERISTICS

( $T_a=25^\circ\text{C}$ ,  $4.5 \leq V_{CC} \leq 5.5\text{V}$ ,  $V_{DD}=4.5 \sim 12\text{V}$ ,  $V_{SS}=-4.5\text{V} \sim -12\text{V}$ ,  $GND=0\text{V}$ ,  $R_L=3\text{k}\Omega$ ,  $C_L=50\text{pF}$ ) (Note 3,4)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Propagation Delay Time	$t_{odl}$	$V_{DD}=+4.5\text{V}$ , $V_{SS}=-4.5\text{V}$ $V_{DD}=+9\text{V}$ , $V_{SS}=-9\text{V}$ $V_{DD}=+12\text{V}$ , $V_{SS}=-12\text{V}$			6.0 5.0 4.0	$\mu\text{s}$
Propagation Delay Time	$t_{odo}$	$V_{DD}=+4.5\text{V}$ , $V_{SS}=-4.5\text{V}$ $V_{DD}=+9\text{V}$ , $V_{SS}=-9\text{V}$ $V_{DD}=+12\text{V}$ , $V_{SS}=-12\text{V}$			6.0 5.0 4.0	$\mu\text{s}$
Rise/Fall Time (Note 5)	$t_r/t_f$		0.2			$\mu\text{s}$
Delay Time Skew	$t_{sk}$	$V_{DD}=+12\text{V}$ , $V_{SS}=-12\text{V}$		400		ns
Slew Rate (Note 5)	$S_R$	$R_L=3$ to $7\text{k}\Omega$ , $15\text{pF} \leq C_L \leq 2.5\text{nF}$		6	30	$\text{V}/\mu\text{s}$

Note 3) AC input waveform:  $t_r=t_f \leq 20\text{ns}$ ,  $V_{IH}=2.0\text{V}$ ,  $V_{IL}=0.8\text{V}$

Note 4) Input Rise/Fall time are less than  $5\mu\text{s}$ .

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

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## ■ RECEIVER ELECTRICAL CHARACTERISTICS

( $T_a=25^\circ\text{C}$ ,  $4.5 \leq V_{CC} \leq 5.5\text{V}$ ,  $V_{DD}=4.5 \sim 12\text{V}$ ,  $V_{SS}=-4.5\text{V} \sim -12\text{V}$ ,  $GND=0\text{V}$ )

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage H Level L Level	$V_P$ $V_N$		1.3 0.5	2.0 1.0	2.5 1.7	V
Hysteresis Voltage	$V_{H1}$			1.0		V
Input Impedance	$R_{IN}$	$V_{IN}=\pm 3\text{V} \sim \pm 12\text{V}$	3	5	7	$\text{k}\Omega$
Output Voltage H Level L Level	$V_{OH}$ $V_{OL}$	$V_{IN}=V_N(\text{Min.})$ , $I_{OUT}=-3.2\text{mA}$ $V_{IN}=V_P(\text{Max.})$ , $I_{OUT}=+3.2\text{mA}$	2.8		0.4	V

## ■ RECEIVER AC CHARACTERISTICS

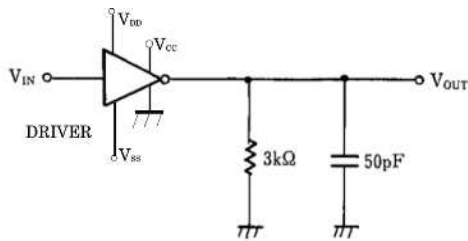
( $T_a=25^\circ\text{C}$ ,  $4.5 \leq V_{CC} \leq 5.5\text{V}$ ,  $V_{DD}=4.5 \sim 12\text{V}$ ,  $V_{SS}=-4.5\text{V} \sim -12\text{V}$ ,  $GND=0\text{V}$ ,  $C_L=50\text{pF}$ ) (Note 6)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Propagation Delay Time	$t_{PLH}$ , $t_{PHL}$	Input Pulse Width $\geq 10\mu\text{s}$			6.5	$\mu\text{s}$
Delay Time Skew	$t_{sk}$			400		ns
Output Rise Time	$t_r$				300	ns
Output Fall Time	$t_f$				300	ns

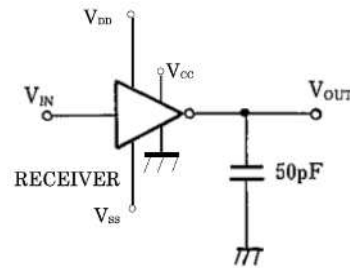
Note 6) AC input waveform  $t_r=t_f=200\text{ns}$ ,  $V_{IH}=+3\text{V}$ ,  $V_{IL}=-3\text{V}$ ,  $f=20\text{kHz}$ .

## MEASUREMENT CIRCUITS

### (1) Driver AC Characteristics

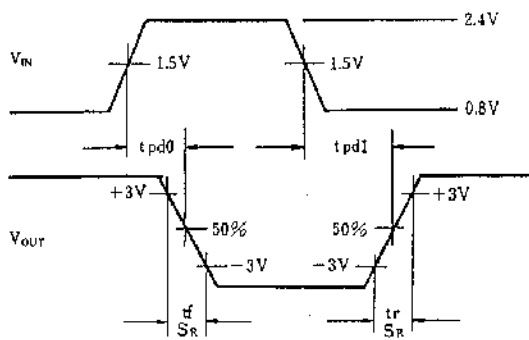


### (2) Receiver AC Characteristics

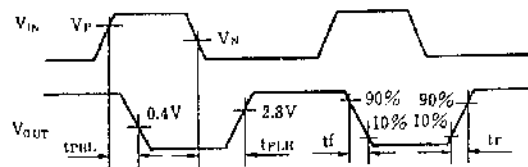


## MEASUREMENT WAVEFORM

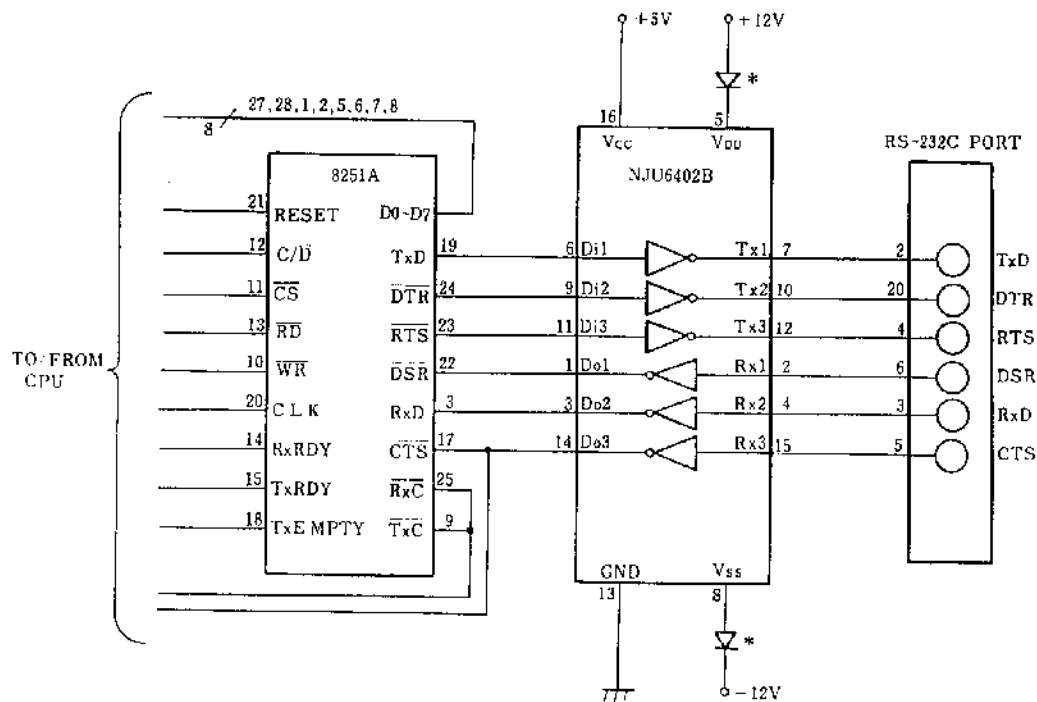
### (1) Driver AC Characteristics



### (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.

MEMO

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