

RS232C LINE DRIVER/RECEIVER

■ GENERAL DESCRIPTION

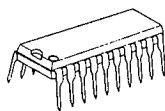
The NJU6401B is a RS232C line driver/receiver composed of 3 drivers and 5 receivers.

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

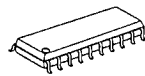
The receivers accept the input levels both of RS-232C standard minimum requirement level ($\pm 3V$) and TTL level.

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

■ PACKAGE OUTLINE



NJU6401BD

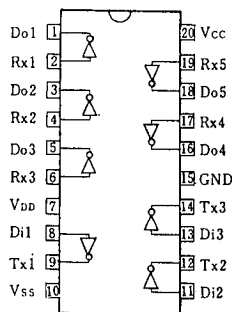


NJU6401BM

■ FEATURES

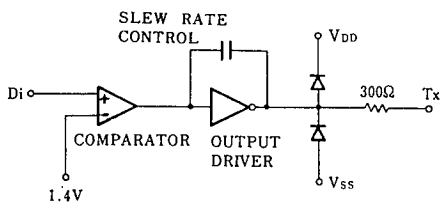
- Based on the RS232C Standard
- 3 Drivers and 5 Receivers
- Low Operating Current
- Driver Output Voltage --- $\pm 25V$
- Receiver Input Voltage --- $\pm 27V$
- Output Impedance at Power-off (Driver) --- 300Ω (Min)
- Slew Rate (Driver) --- $30V/\mu s$ (Max)
- TTL-compatible Input (Driver)
- TTL-compatible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

■ PIN CONFIGURATION

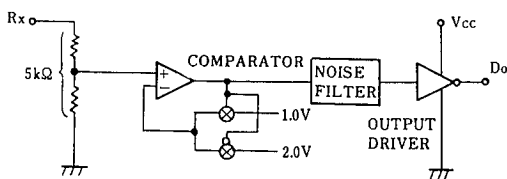


■ BLOCK DIAGRAM

(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 _{DD}	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 _{SS}	Driver Negative Voltage Supply(-12V)	20	V _{CC}	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 $30V/\mu s$ ($6V/\mu s$ typ), to the RS-232C lines.

The each driver incorporate series resistance to keep the output impedance to 300Ω 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 _{CC} V _{DD} V _{SS}	-0.3 ~ +6 V _{CC} ~ +14 (Note1) +0.3 ~ -14	V
Receiver	Input Voltage Output Voltage	V _{RI} V _{DO}	±27 -0.3 ~ V _{CC} +0.3	V
Driver	Input Voltage Output Voltage Output Current	V _{DI} V _{TX} I _{TX}	-0.3 ~ V _{CC} +0.3 ±25 ±60	V V mA
Power Dissipation		P _D	DIP 500	mW
Operating Temperature		T _{opr}	- 20 ~ + 75	°C
Storage Temperature		T _{stg}	- 65 ~ + 150	°C

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

ELECTRICAL CHARACTERISTICS

(Ta=25°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Quiescent Current	I _{CC} I _{DD} I _{SS}	V _{CC} =5.5V V _{DD} =12V V _{SS} =-12V			1 1 1	mA
Operating Voltage	V _{CC} V _{DD} V _{SS}		4.5 4.5 -12		5.5 12 -4.5	V

DRIVER ELECTRICAL CHARACTERISTICS

(Ta=25°C, 4.5≤V_{CC}≤5.5V, V_{DD}=4.5~12V, V_{SS}=-4.5V~-12V, GND=0V)

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

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

P A R A M E T E R	S Y M B O L	C O N D I T I O N S	M I N	T Y P	M A X	U N I T
Propagation Delay Time	t_{odi}	$V_{DD}=+4.5\text{V}$, $V_{SS}=-4.5\text{V}$ $V_{DD}=+9\text{V}$, $V_{SS}=-9\text{V}$ $V_{DD}=+12\text{V}$, $V_{SS}=-12\text{V}$			6.0 5.0 4.0	μs
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	μs
Rise/Fall Time (Note 5)	t_r/t_f		0.2			μs
Delay Time Skew	t_{ak}	$V_{DD}=+12\text{V}$, $V_{SS}=-12\text{V}$		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 -3V or -3V to $+3\text{V}$.

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■ RECEIVER ELECTRICAL CHARACTERISTICS

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

P A R A M E T E R	S Y M B O L	C O N D I T I O N S	M I N	T Y P	M A X	U N I T
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_H			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

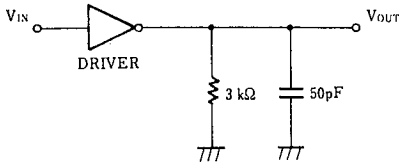
($T_a=25^{\circ}\text{C}$, $4.5 \leq V_{CC} \leq 5.5\text{V}$, $V_{DD}=4.5 \sim 12\text{V}$, $V_{SS}=-4.5\text{V} \sim -12\text{V}$, $\text{GND}=0\text{V}$, $C_L=50\text{pF}$) (Note 6)

P A R A M E T E R	S Y M B O L	C O N D I T I O N S	M I N	T Y P	M A X	U N I T
Propagation Delay Time	t_{PLH} , t_{PHL}	Input Pulse Width $\geq 10\mu\text{s}$			6.5	μs
Delay Time Skew	t_{SK}			400		ns
Output Rise Time	t_r				300	ns
Output Fall Time	t_f				300	ns

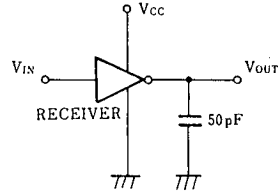
Note 6) AC input waveform $t_r=t_f=200\text{ns}$, $V_{IH}=+3\text{V}$, $V_{IL}=-3\text{V}$, $f=20\text{kHz}$.

MEASUREMENT CIRCUITS

(1) Driver AC Characteristics

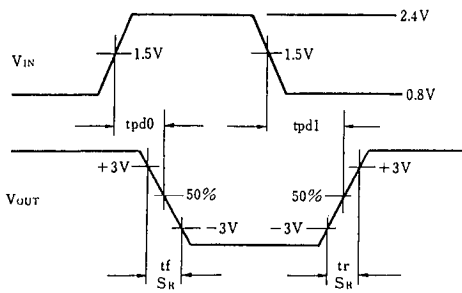


(2) Receiver AC Characteristics

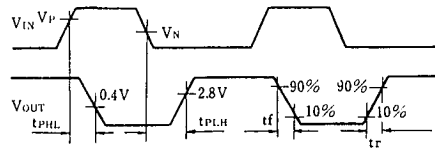


MEASUREMENT WAVEFORM

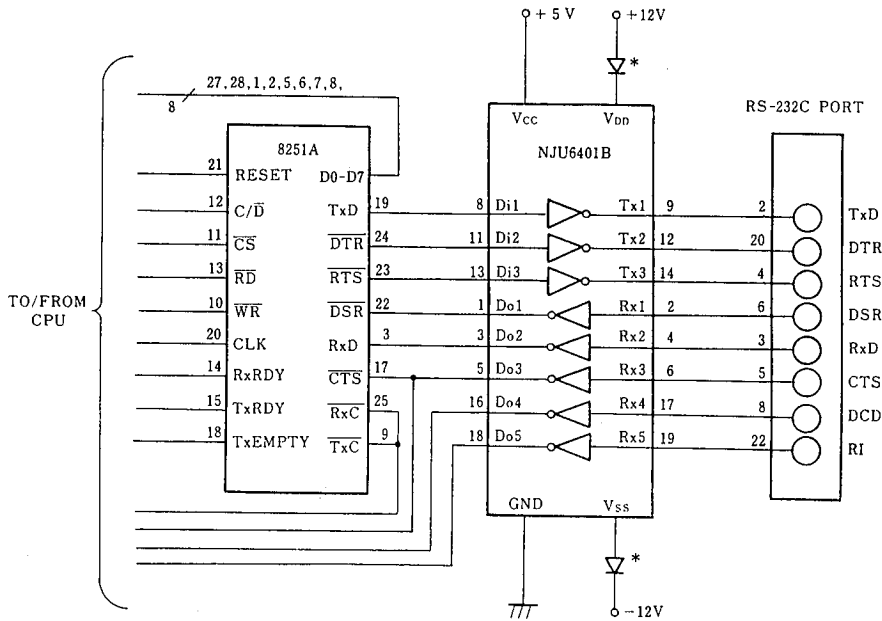
(1) Driver AC Characteristics



(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

[CAUTION]

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