

RS232C LINE DRIVER/RECEIVER

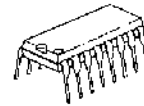
■ GENERAL DESCRIPTION

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


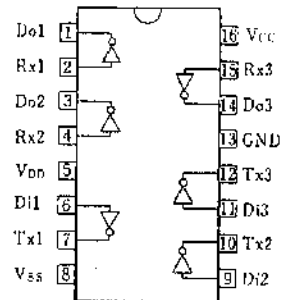
NJU6402BD



NJU6402BM

■ FEATURES

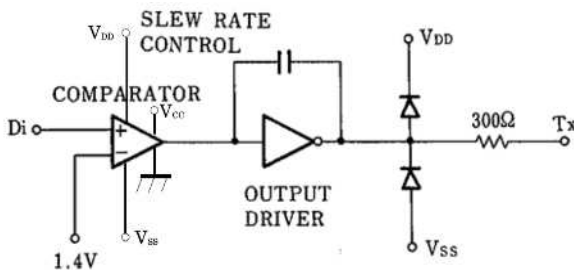
- Based on the RS232C Standard
- 3 Drivers and 3 Receivers
- Low Operating Current
- Driver Output Voltage --- $\pm 25V$
- Receiver Input Voltage --- $\pm 27V$
- Output Impedance at Power-off (Driver) --- 300Ω (Min)
- Slew Rate (Driver) --- $30V/\mu s$ (Max)
- TTL-compatible Input (Driver)
- TTL-compatible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

■ PIN CONFIGURATION


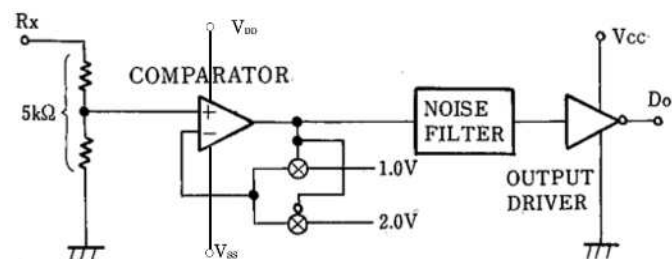
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■ BLOCK DIAGRAM

(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 _{DD} | 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 _{SS} | Negative Voltage Supply (-12V) | 16 | 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 | V _{RI} | ±27 | V |
| | Output Voltage | V _{DO} | -0.3 ~ V _{CC} +0.3 | |
| Driver | Input Voltage | V _{DI} | -0.3 ~ V _{CC} +0.3 | V |
| | Output Voltage | V _{TX} | ±25 | V |
| | Output Current | I _{TX} | ±60 | 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. Furthermore, the V_{SS} must be maintained less than -4.5V for the normal operating.

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■ ELECTRICAL CHARACTERISTICS

(Ta=25°C)

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

■ 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} | | | 2.0 | | | V |
| | V _{IL} | | | | | 0.8 | |
| 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 | 3.0 | | | V |
| | | | V _{DD} =+9V, V _{SS} =-9V | 6.5 | | | |
| | | | V _{DD} =+12V, V _{SS} =-12V | 9.0 | | | |
| L Level Output Voltage | V _{OL} | V _{IN} =V _{IH} R _L =3kΩ | V _{DD} =+4.5V, V _{SS} =-4.5V | | | -3.0 | V |
| | | | V _{DD} =+9V, V _{SS} =-9V | | | -6.5 | |
| | | | V _{DD} =+12V, V _{SS} =-12V | | | -9.0 | |
| 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 NJU6402B may destroy due to the power over the package power dissipation.

DRIVER AC CHARACTERISTICS

 (Ta=25°C, 4.5 ≤ V_{CC} ≤ 5.5V, V_{DD}=4.5~12V, V_{SS}=-4.5V~-12V, GND=0V, R_L=3kΩ, C_L=50pF) (Note 3,4)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|-------------------------|--------------------------------|--|-----|-----|-------------------|------|
| Propagation Delay Time | t _{odl} | V _{DD} =+4.5V, V _{SS} =-4.5V V _{DD} =+9V, V _{SS} =-9V V _{DD} =+12V, V _{SS} =-12V | | | 6.0 5.0 4.0 | μs |
| Propagation Delay Time | t _{od0} | V _{DD} =+4.5V, V _{SS} =-4.5V V _{DD} =+9V, V _{SS} =-9V V _{DD} =+12V, V _{SS} =-12V | | | 6.0 5.0 4.0 | μs |
| Rise/Fall Time (Note 5) | t _r /t _f | | 0.2 | | | μs |
| Delay Time Skew | t _{sk} | V _{DD} =+12V, V _{SS} =-12V | | 400 | | ns |
| Slew Rate (Note 5) | S _R | R _L =3 to 7kΩ, 15pF ≤ C _L ≤ 2.5nF | | 6 | 30 | V/μs |

 Note 3) AC input waveform: t_r=t_f ≤ 20ns, V_{IH}=2.0V, V_{IL}=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.

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RECEIVER 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 _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} =±3V~±12V | 3 | 5 | 7 | kΩ |
| Output Voltage H Level L Level | V _{OH} V _{OL} | V _{IN} =V _N (Min.), I _{OUT} =-3.2mA V _{IN} =V _P (Max.), I _{OUT} =+3.2mA | 2.8 | | 0.4 | V |

RECEIVER AC CHARACTERISTICS

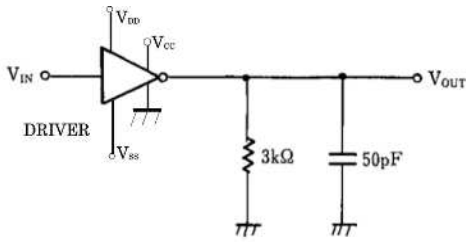
 (Ta=25°C, 4.5 ≤ V_{CC} ≤ 5.5V, V_{DD}=4.5~12V, V_{SS}=-4.5V~-12V, GND=0V, C_L=50pF) (Note 6)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|------------------------|-------------------------------------|--------------------------|-----|-----|-----|------|
| Propagation Delay Time | t _{PLH} , t _{PHL} | Input Pulse Width ≥ 10μs | | | 6.5 | μs |
| Delay Time Skew | t _{SK} | | | 400 | | ns |
| Output Rise Time | t _r | | | | 300 | ns |
| Output Fall Time | t _f | | | | 300 | ns |

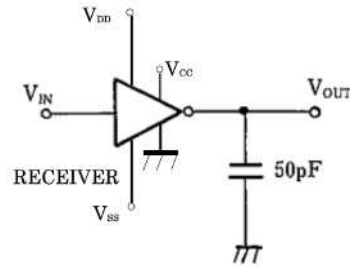
 Note 6) AC input waveform t_r=t_f=200ns, V_{IH}=+3V, V_{IL}=-3V, f=20kHz.

■ MEASUREMENT CIRCUITS

(1) Driver AC Characteristics

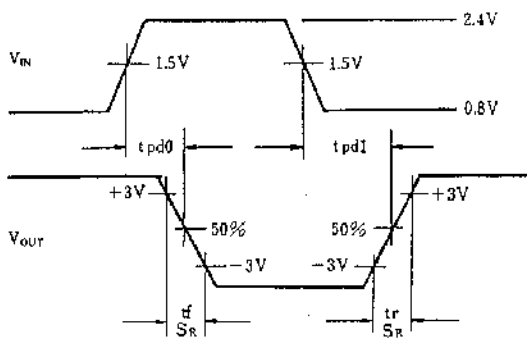


(2) Receiver AC Characteristics

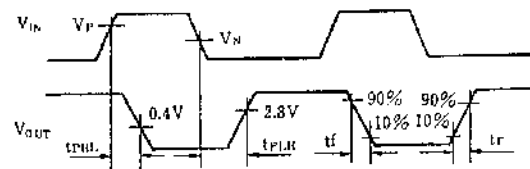


■ MEASUREMENT WAVEFORM

(1) Driver AC Characteristics

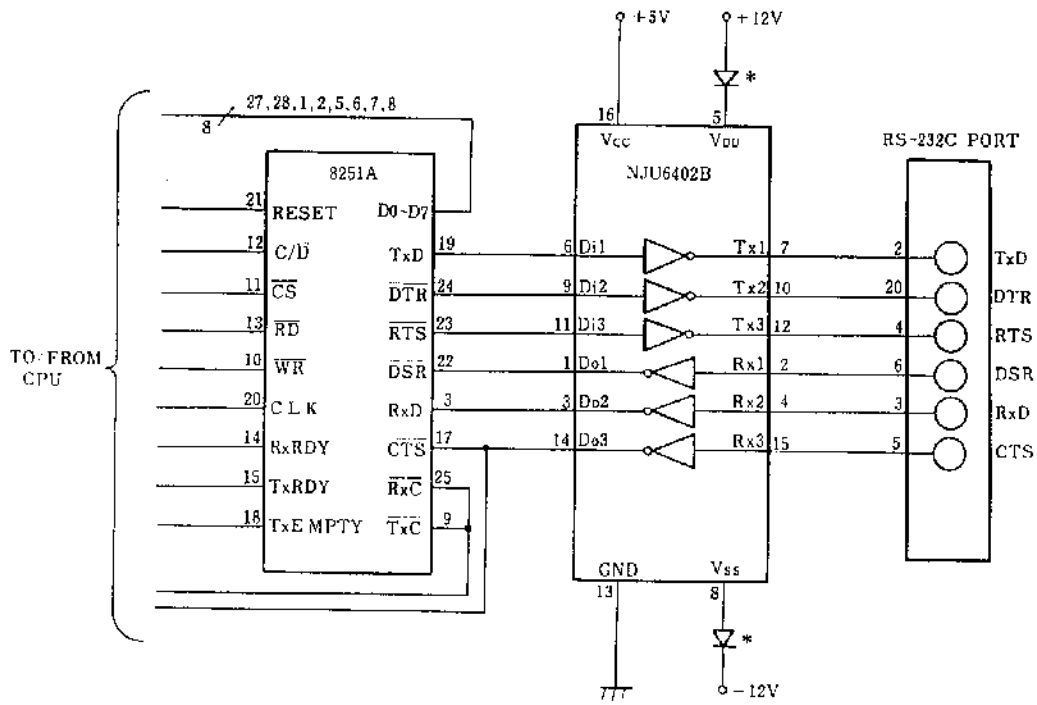


(2) Receiver AC Characteristics



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■ APPLICATION CIRCUIT



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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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