

SINGLE SUPPLY RS232C LINE DRIVER/RECEIVER

■ GENERAL DESCRIPTION

The NJU6413A is a single power supply RS232C line driver/receiver composed of DC-DC converter, 2 drivers and 2 receivers.

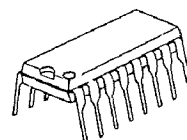
The DC-DC converter is a capacitive type converter and generates RS232C voltage from single 5V supply.

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

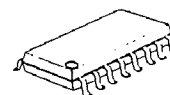
The receiver accepts the input levels both of RS-232C standard minimum requirement level ($\pm 3V$) and TTL level.

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

■ PACKAGE OUTLINE



NJU6413AD

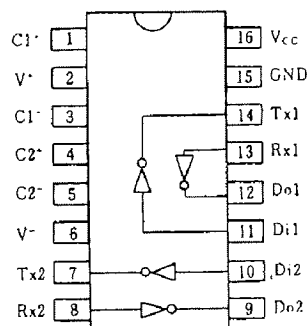


NJU6413AM

■ FEATURES

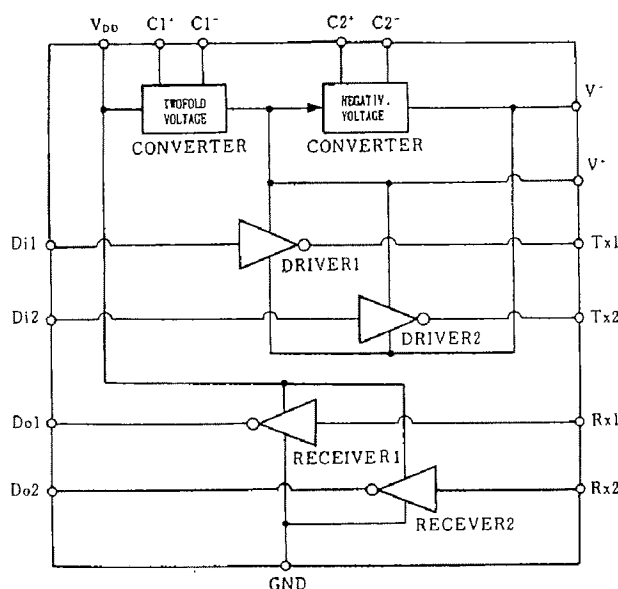
- Based on the RS232C Standard
- DC-DC Converter On-chip
- 2 Drivers and 2 Receivers
- Low Operating Current
- Driver Output Voltage --- $\pm 25V$
- Receiver Input Voltage --- $\pm 27V$
- Output Impedance at Power-off (Driver) --- 300Ω (Min)
- Slew Rate (Driver) --- $30V/\mu s$ (Max)
- TTL-compatible Input (Driver)
- TTL-compatible Input/Output (Receiver)
- Hysteresis Input (Receiver)
- Noise Filter On-chip
- Package Outline --- DIP 16/DMP 16
- C-MOS Technology

■ PIN CONFIGURATION



NJU6413AD/AM

■ BLOCK DIAGRAM



TERMINAL DESCRIPTION

PIN No.	SYMBOL	F U N C T I O N	PIN No.	SYMBOL	F U N C T I O N
1	V1 ⁺	External Capacitor 1(+)	7, 14	Tx2, Tx1	Driver Output
2	V ⁺	DC/DC Converter Positive Voltage Output	8, 13	Rx2, Rx1	Receiver Input
3	V1 ⁻	External Capacitor 1(-)	9, 12	Do2, Do1	Receiver Output
4	C2 ⁺	External Capacitor 2(+)	10, 11	Di2, Di1	Driver Input
5	C2 ⁻	External Capacitor 2(-)	15	GND	Ground
6	V ⁻	DC/DC Converter Negative Voltage Output	16	V _{CC}	Voltage Supply (+5V)

FUNCTIONAL DESCRIPTION

(1) DC-DC Converter Section

The NJU6413A built in a DC-DC converter (required 5 external capacitors). Therefor, the NJU6413A outputs RS-232C voltage though the single 5V supply.

(2) Driver Section

The drivers output the RS-232C standrd 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 duaring the power-off. This series resistance also protect the internal circuits against the overvoltage of $\pm 25V$ impressed from outside.

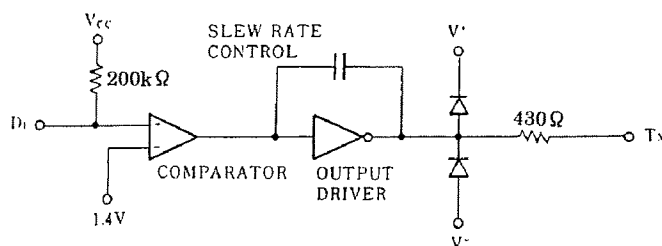
(3) Receiver Section

The inputs of each receiver incorporate the resister (TYP: $5k\Omega$) as the drivers load. This resister 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 comparaters are adjusted for both input levels.

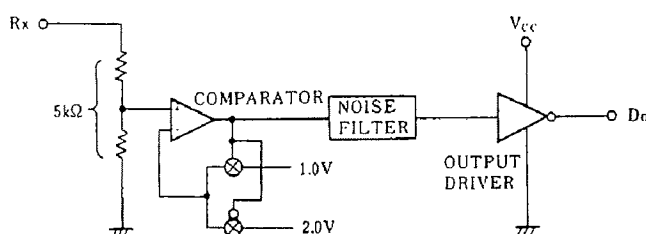
The noise less than $1V_{P-P}$ and spike noise below $3\mu s$ pulse width are eliminated by the hysteresis circuits and noise filter.

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

DRIVER SECTION



RECEIVER SECTION



ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER		SYMBOL	RATINGS	UNIT
Supply Voltage		V _{CC}	-0.3 ~ +6	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	
Power Dissipation		P _D	500 (DIP) 300 (DMP)	mW
Operating Temperature		T _{opr}	-20 ~ +75	°C
Storage Temperature		T _{stg}	-65 ~ +150	°C

Note1) External power supply to V₊, V₋ is prohibited.

ELECTRICAL CHARACTERISTICS

(Ta=25°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Operating Voltage	V _{CC}		4.5		5.5	V
Quiescent Current	I _{CC}	V _{CC} =5.5V, No load		5	10	mA
DC-DC Converter Positive Output Voltage	V ⁺	V _{CC} =4.5V, I _{LV} ⁺ =6mA	6.0			V
DC-DC Converter Negative Output Voltage	V ⁻	V _{CC} =4.5V, I _{LV} ⁻ =-6mA	-6.0			

DRIVER ELECTRICAL CHARACTERISTICS

(Ta=25°C, 4.5 ≤ V_{CC} ≤ 5.5V, I_{LV}⁺=I_{LV}⁻=0mA, GND=0V)

PARAMETER		SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage	H Level	V _{IH}		2.0			V
	L Level	V _{IL}				0.8	
Maximum Input Current		I _{IL}	V _{IN} =GND		15	200	μA
Output Voltage	H Level	V _{OH}	V _{IN} =V _{IL} , R _L =3kΩ	6.0			V
	L Level	V _{OL}	V _{IN} =V _{IH} , R _L =3kΩ			-5.7	
Output Short Current (Note 2)	H Level	I _{OS} ⁺	V _{IN} =V _{IL} , V _{OUT} =GND			45	mA
	L Level	I _{OS} ⁻	V _{IN} =V _{IH} , V _{OUT} =GND			45	
Output Impedance		R _{OUT}	V _{CC} =V ⁺ =V ⁻ =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 NJU6413A may destroy due to the power over the package power dissipation.

DRIVER AC CHARACTERISTICS

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

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Propagation Delay Time	t_{pdl}				5.0	μs
	t_{pdo}				5.0	
Output Rise/Fall Time (Note 5)	t_r		0.2			μs
	t_f		0.2			
Delay Time Skew	t_{sk}			400		ns
Slew Rate (Note 5)	S_R	$R_L=3 \text{ to } 7\text{k}\Omega$, $15\text{pF} \leq C_L \leq 2.5\text{nF}$		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 $+3\text{V}$.

RECEIVER ELECTRICAL CHARACTERISTICS

($T_a=25^{\circ}\text{C}$, $4.5 \leq V_{CC} \leq 5.5\text{V}$, $I_{LV}^+ = I_{LV}^- = 0\text{mA}$, $\text{GND}=0\text{V}$)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage	H Level	V_P	1.3	2.0	2.5	V
	L Level	V_N	0.5	1.0	1.7	
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	$V_{OH}=V_N(\text{Min.})$, $I_{OUT}=-3.2\text{mA}$	2.8			V
	L Level	$V_{OL}=V_P(\text{Max.})$, $I_{OUT}=+3.2\text{mA}$			0.4	

RECEIVER AC CHARACTERISTICS

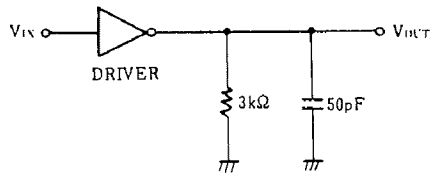
($T_a=25^{\circ}\text{C}$, $4.5 \leq V_{CC} \leq 5.5\text{V}$, $I_{LV}^+ = I_{LV}^- = 0\text{mA}$, $\text{GND}=0\text{V}$, $C_L=50\text{pF}$) (Note 6)

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

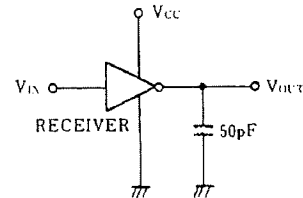
Note 6) AC input waveform $t_r=t_f=200\text{ns}$, $V_{IH}=+3\text{V}$, $V_{IL}=-3\text{V}$, $f=20\text{kHz}$.

MEASUREMENT CIRCUITS

(1) Driver AC Characteristics

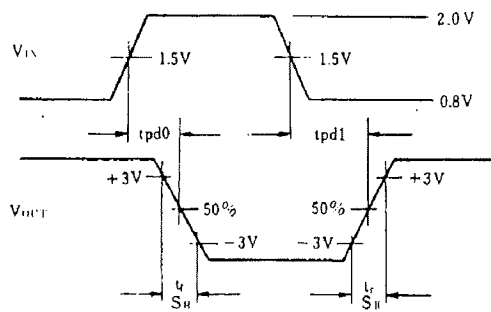


(2) Receiver AC Characteristics

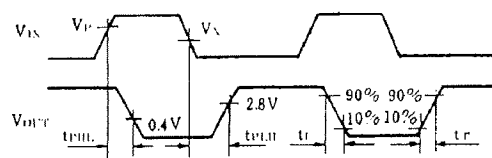


MEASUREMENT WAVEFORMS

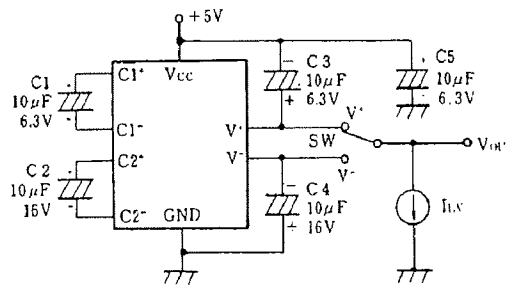
(1) Driver AC Characteristics



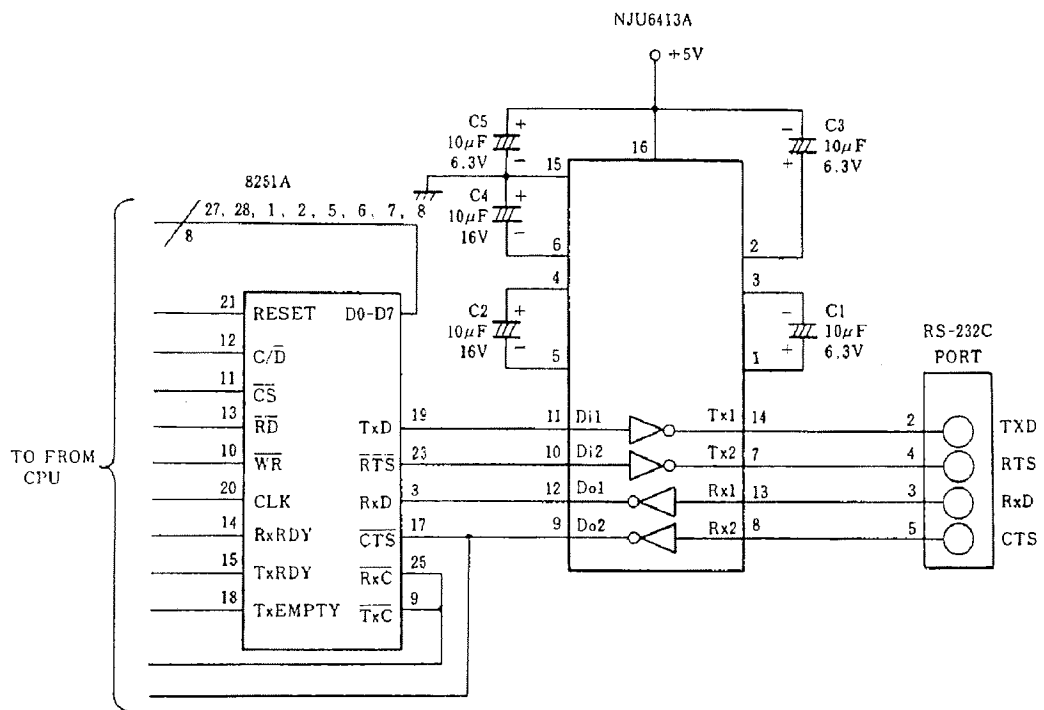
(2) Receiver AC Characteristics



DC/DC CONVERTER OUTPUT VOLTAGE MEASUREMENT CIRCUITS



APPLICATION CIRCUIT



RS-232C port

* For keeping the high power conversion rate, short wiring for C₁ to C₄ required.

NJU6413A

MEMO

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