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.

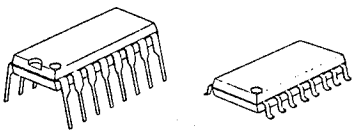
The DC-DC converter is a capacitive type converter and generates RS232C voltage from single 5V supply.

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

The receiver accepts 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

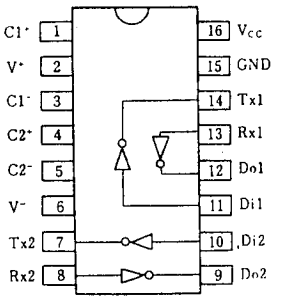


NJU6413AD NJU6413AM

■ FEATURES

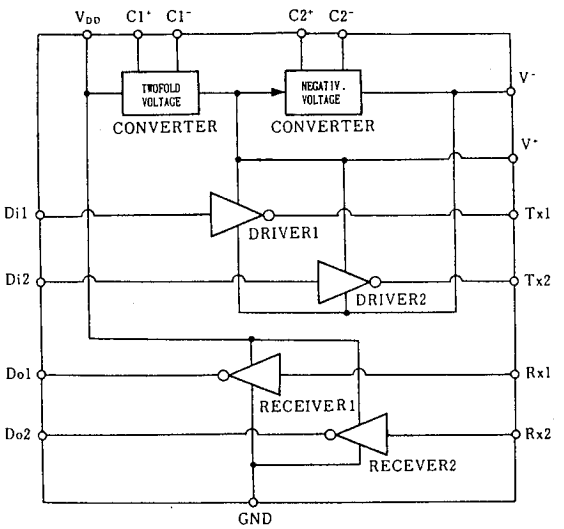
- Based on the RS232C Standard
- DC-DC Converter On-chip
- 2 Drivers snd 2 Receivers
- Low Operating Current
- Driver Output Voltage --- ±25V
- Receiver Input Voltage --- ±27V
- Output Impedance at Power-off (Driver) --- 300Ω (Min)
- Slew Rate (Driver) --- 30V/μs (Max)
- TTL-compatible Input (Driver)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

■ PIN CONFIGURATION



NJU6413AD/AM

■ BLOCK DIAGRAM



■ TERMINAL DESCRIPTION

PIN No.	SYMBOL	FUNCTION	PIN No.	SYMBOL	FUNCTION
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 (reqired 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/μs(6V/μs 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 ±25V impressed from outside.

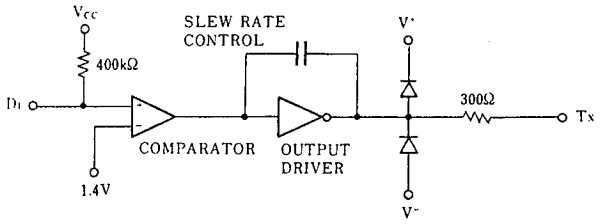
(3) Receiver Section

The inputs of each receiver incorporate the resister(TYP:5kΩ) as the drivers load. This resister also protect the internal circuits against the overvoltage of ±27V. The receiver accept the both of ±3V of RS-232C standard minimum requirement level and TTL level as the threshold voltage of input comparaters are adjusted for both input levels.

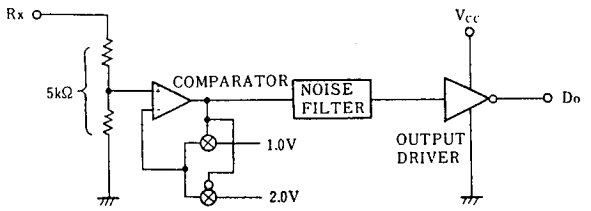
The noise less than $1V_{P-P}$ and spike noise below 3μs pulse width are eliminated by the hysteresis circuits and noise filter.

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

■ DRIVER SECTION



■ RECEIVER SECTION



■ **ABSOLUTE MAXIMUM RATINGS** (Ta=25℃)

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		Topr	- 20 ～ + 75	℃
Storage Temperature		Tstg	- 65 ～ + 150	℃

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

■ **ELECTRICAL CHARACTERISTICS** (Ta=25℃)

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℃, 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

(Ta=25°C, 4.5≦V_{CC}≦5.5V, I_{LV}^+=I_{LV}^-=0mA, GND=0V, R_L=3kΩ, C_L=50pF) (Note 3, 4)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Propagation Delay Time	t_{pdI}				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 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.

■ RECEIVER 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_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}=±3V～±12V	3	5	7	kΩ
Output Voltage	H Level	V_{OH}	V_{IN}=V_N(Min.), I_{OUT}=-3.2mA	2.8			V
	L Levl	V_{OL}	V_{IN}=V_P(Max.), I_{OUT}=+3.2mA			0.4	

■ RECEIVER AC CHARACTERISTICS

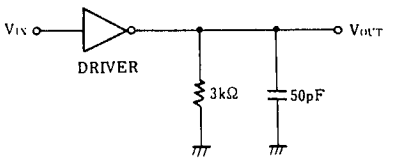
(Ta=25°C, 4.5≦V_{CC}≦5.5V, I_{LV}^+=I_{LV}^-=0mA, GND=0V, CL=50pF) (Note 6)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Propagation Delay Time	t_{PLH}	Input Pulse Width≧10μs			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

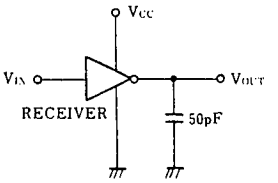
Note 6) AC input waveform tr=tf=200ns, V_{IH}=+3V, V_{IL}=-3V, f=20kHz.

■ MEASUREMENT CIRCUITS

(1) Driver AC Characteristics

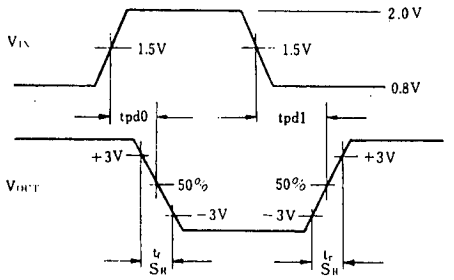


(2) Receiver AC Characteristics

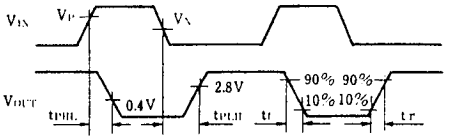


■ MEASUREMENT WAVEFORMS

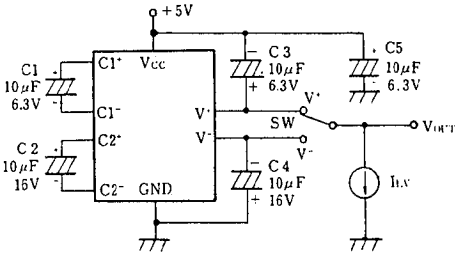
(1) Driver AC Characteristics



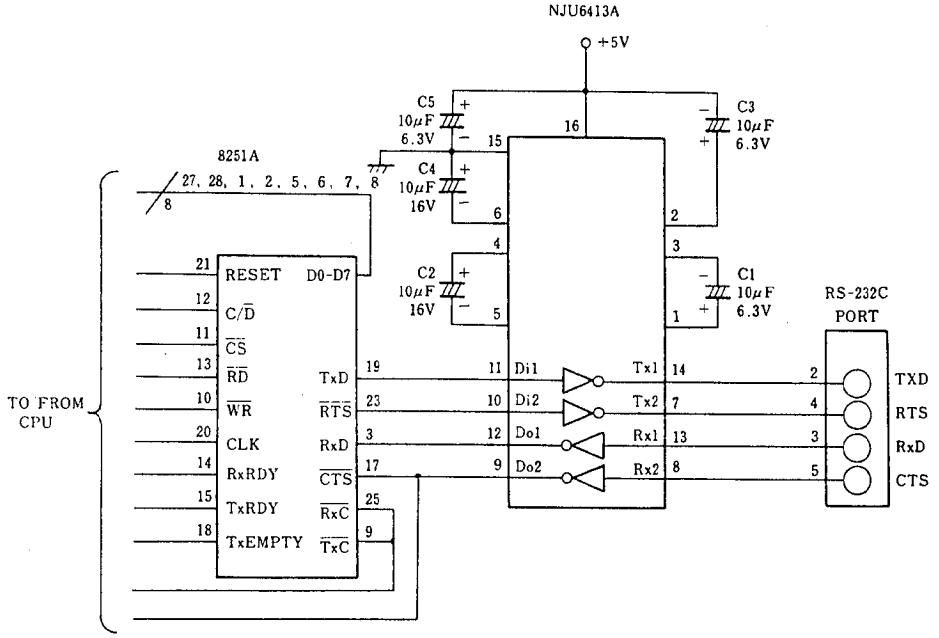
(2) Receiver AC Characteristics



■ DC/DC CONVERTER OUTPUT VOLTAGE MEASUREMENT CIRCUITS



■ APPLICATION CIRCUIT



RS-232C port

* For keeping the high power conversion rate, short wiring for C_1 to C_4 required.

MEMO