

Input/Output Full-Swing High Output Current Quad C-MOS Operational Amplifier

■ GENERAL DESCRIPTION

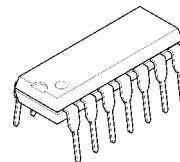
The NJU7044 is a quad C-MOS operational amplifier permitting a full-swing input and output in full-swing under high load.

Based on C-MOS technology, there are excellent features such as high output current, low current consumption, low operating voltage, and very high input impedance.

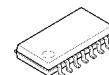
■ FEATURES

- Operating Voltage: 2.2V to 5.5V
- Input/Output Full-Swing
- High Output Current: 40mA at $V_O=0V$
- Input Offset Voltage: $V_{IO}=10mV$ max.
- Wide Input Common Mode Voltage Range: V_{SS} to V_{DD}
- Operating Current: $I_{DD}=1.4mA$ typ. (at $V_{DD}=3V$)
- High Input Impedance: $1T\Omega$ Typ.
- Low Input Bias Current: $I_{IB}=1pA$ typ.
- Ground Sensing
- Tiny Package: DIP14, DMP14, SSOP14

■ PACKAGE OUTLINE



NJU7044D

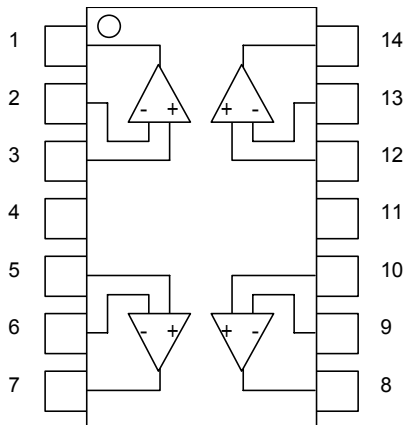


NJU7044M



NJU7044V

■ PIN CONFIGURATION



NJU7044D
NJU7044M
NJU7044V

Pin Function

- | | |
|-------------|--------------|
| 1. OUTPUT 1 | 8. OUTPUT 3 |
| 2. -INPUT 2 | 9. -INPUT 3 |
| 3. +INPUT 2 | 10. +INPUT 3 |
| 4. V_{DD} | 11. V_{SS} |
| 5. +INPUT 2 | 12. +INPUT 4 |
| 6. -INPUT 2 | 13. -INPUT 4 |
| 7. OUTPUT 2 | 14. OUTPUT 4 |

■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V_{DD}	7	V
Common Mode Input Voltage Range	V_{ICM}	0 to 7 (Note 1)	V
Differential Input Voltage Range	V_{ID}	± 7	V
Power Dissipation	P_D	700 [DIP14] 300 [DMP14] 500 [DMP14] (Note 2) 660 [DMP14] (Note 3) 300 [SSOP14] 450 [SSOP14] (Note 2) 570 [SSOP14] (Note 3)	mW
Output Sink/Source Current for each one output terminal	I_{oport}	± 75 [DIP14, DMP14, SSOP14]	mA
Sum total of Output Sink/Source Current of all output terminal	I_{ototal}	180 [DIP14, DMP14, SSOP14] (Note 4)	mA
Operating Temperature Range	T_{opr}	-40 to +85	$^{\circ}\text{C}$
Storage Temperature Range	T_{stg}	-55 to +125	$^{\circ}\text{C}$

(Note 1) For supply voltage less than 7V, the absolute maximum input voltage is equal to the supply voltage.

(Note 2) On the PCB " EIA/JEDEC (76.2x11.43x1.6mm, two layers, FR-4) "

(Note 3) On the PCB " EIA/JEDEC (76.2x11.43x1.6mm, four layers, FR-4) "

(Note 4) It individually takes the absolute value of the sink current and the source current of each output terminal, and it is assumed the sum total.

Calculation type: $I_{ototal} = |I_{oport1}| + |I_{oport2}| + |I_{oport3}| + |I_{oport4}|$

(Note 5) Do not exceed "Power dissipation: P_D " in which power dissipation in IC is shown by the absolute maximum rating.

Refer to following Figure 1 and Figure 2 for a permissible loss when ambient temperature (T_a) is $T_a \geq 25^{\circ}\text{C}$.

Figure 1 : Power Dissipation - Ambient Temperature

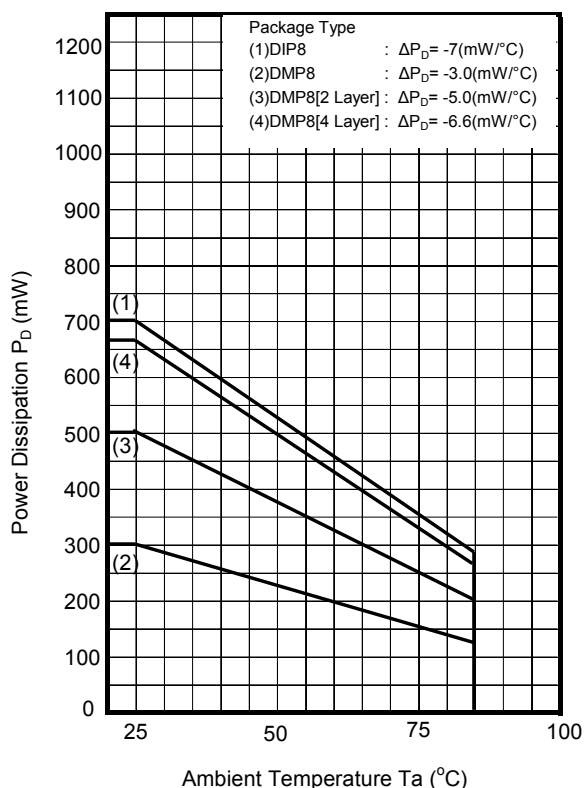
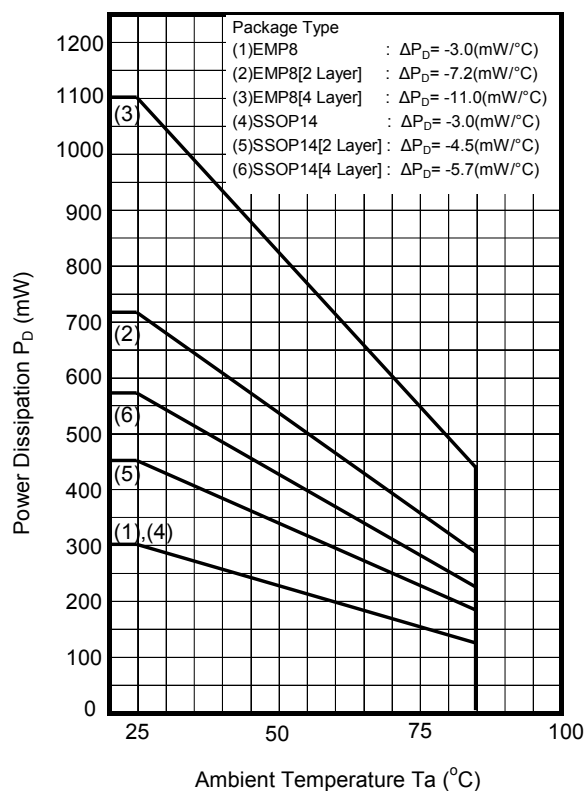


Figure 2 : Power Dissipation - Ambient Temperature



■ OPERATING VOLTAGE ($T_a = 25^{\circ}\text{C}$)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V_{DD}	2.2 to 5.5	V

■ ELECTRICAL CHARACTERISTICS

●DC CHARACTERISTICS

(V_{DD}=5V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I _{DD}	No Signal Apply	-	1.8	2.8	mA
Input Offset Voltage	V _{IO}		-	-	10	mV
Input Bias Current	I _B		-	1	-	pA
Input Offset Current	I _{IO}		-	1	-	pA
Large Signal Voltage Gain	A _V	R _L =10kΩ to 2.5V, V _O =2.5V±2.4V	70	90	-	dB
Common Mode Rejection Ratio	CMR	CMR+: 2.5V ≤ V _{CM} ≤ 5V CMR-: 0V ≤ V _{CM} ≤ 2.5V (Note 6)	44	60	-	dB
Supply Voltage Rejection Ratio	SVR	4.0V ≤ V _{DD} ≤ 5.5V, V _{CM} =V _{DD} /2	55	85	-	dB
Output Voltage1	V _{OH1}	R _L =10kΩ to 2.5V	4.95	-	-	V
	V _{OL1}	R _L =10kΩ to 2.5V	-	-	0.05	V
Output Voltage2	V _{OH2}	R _L =600Ω to 2.5V	4.85	-	-	V
	V _{OL2}	R _L =600Ω to 2.5V	-	-	0.15	V
Output Source Current	I _{SOURCE}	V _O =3.5V (Note 7)	50	-	-	mA
Output Sink Current	I _{SINK}	V _O =1.5V (Note 7)	50	-	-	mA
Input Common Mode Voltage Range	V _{ICM}	CMR ≥ 44dB	0	-	5	V

(Note 6) CMR is represented by either CMR+ or CMR- has lower value.

(Note 7) Please note the output current value to exceed neither I_{oport} nor I_{ototal} the absolute maximum rating.

●AC CHARACTERISTICS

(V_{DD}=5V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Unity Gain Bandwidth	GB	R _L =10kΩ to 2.5V	-	0.8	-	MHz
Total Harmonic Distortion	THD	f=1kHz, V _{IN} =1Vpp, A _V =0dB	-	0.05	-	%
Equivalent Input Noise Voltage	V _{NI}	f=1kHz	-	40	-	nV/√Hz
Amp to Amp Separation	CS	f=1kHz, V _O =3Vpp R _L =10kΩ to 2.5V	-	TBD	-	dB

●TRANSIENT CHARACTERISTICS

(V_{DD}=5V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Slew Rate	SR	R _L =10kΩ to 2.5V	-	0.8	-	V/μs

■ ELECTRICAL CHARACTERISTICS

●DC CHARACTERISTICS

(V_{DD}=3V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I _{DD}	No Signal Apply	-	1.4	2.4	mA
Input Offset Voltage	V _{IO}		-	-	10	mV
Input Bias Current	I _B		-	1	-	pA
Input Offset Current	I _{IO}		-	1	-	pA
Large Signal Voltage Gain	A _V	R _L =10kΩ to 1.5V, V _O =1.5V±1.4V	70	90	-	dB
Common Mode Rejection Ratio	CMR	CMR+: 1.5V ≤ V _{CM} ≤ 3V CMR-: 0V ≤ V _{CM} ≤ 1.5V (Note 8)	42	60	-	dB
Supply Voltage Rejection Ratio	SVR	2.7V ≤ V _{DD} ≤ 4.0V, V _{CM} =V _{DD} /2	50	80	-	dB
Output Voltage1	V _{OH1}	R _L =10kΩ to 1.5V	2.95	-	-	V
	V _{OL1}	R _L =10kΩ to 1.5V	-	-	0.05	V
Output Voltage2	V _{OH2}	R _L =600Ω to 1.5V	2.9	-	-	V
	V _{OL2}	R _L =600Ω to 1.5V	-	-	0.1	V
Output Source Current	I _{SOURCE}	V _O =1.5V	30	40	-	mA
Output Sink Current	I _{SINK}	V _O =1.5V	30	40	-	mA
Input Common Mode Voltage Range	V _{ICM}	CMR ≥ 42dB	0	-	3	V

(Note 8) CMR is represented by either CMR+ or CMR- has lower value.

●AC CHARACTERISTICS

(V_{DD}=3V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Unity Gain Bandwidth	GB	R _L =10kΩ to 1.5V	-	0.8	-	MHz
Total Harmonic Distortion	THD	f=1kHz, V _{IN} =1Vpp, A _V =0dB	-	0.05	-	%
Equivalent Input Noise Voltage	V _{NI}	f=1kHz	-	40	-	nV/√Hz
Amp to Amp Separation	CS	f=1kHz, V _O =1.8Vpp R _L =10kΩ to 1.5V	-	TBD	-	dB

●TRANSIENT CHARACTERISTICS

(V_{DD}=3V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Slew Rate	SR	R _L =10kΩ to 1.5V	-	0.7	-	V/μs

●DC CHARACTERISTICS

($V_{DD}=2.2V$, $T_a=25^{\circ}C$)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I_{DD}	No Signal Apply	-	1.2	2	mA
Input Offset Voltage	V_{IO}		-	-	10	mV
Input Bias Current	I_B		-	1	-	pA
Input Offset Current	I_{IO}		-	1	-	pA
Large Signal Voltage Gain	A_V	$R_L=10k\Omega$ to 1.1V, $V_O=1.1V\pm 1.0V$	70	90	-	dB
Common Mode Rejection Ratio	CMR	CMR+: $1.1V \leq V_{CM} \leq 2.2V$ CMR-: $0V \leq V_{CM} \leq 1.1V$ (Note 9)	30	60	-	dB
Supply Voltage Rejection Ratio	SVR	$2.2V \leq V_{DD} \leq 2.7V$, $V_{CM}=V_{DD}/2$	45	70	-	dB
Output Voltage1	V_{OH1}	$R_L=10k\Omega$ to 1.1V	2.15	-	-	V
	V_{OL1}	$R_L=10k\Omega$ to 1.1V	-	-	0.05	V
Output Voltage2	V_{OH2}	$R_L=600\Omega$ to 1.1V	2.1	-	-	V
	V_{OL2}	$R_L=600\Omega$ to 1.1V	-	-	0.1	V
Output Source Current	I_{SOURCE}	$V_O=1.1V$	10	15	-	mA
Output Sink Current	I_{SINK}	$V_O=1.1V$	10	15	-	mA
Input Common Mode Voltage Range	V_{ICM}	CMR $\geq 30dB$	0	-	2.2	V

(Note 9) CMR is represented by either CMR+ or CMR- has lower value.

●AC CHARACTERISTICS

($V_{DD}=2.2V$, $T_a=25^{\circ}C$)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Unity Gain Bandwidth	GB	$R_L=10k\Omega$ to 1.1V	-	0.8	-	MHz
Total Harmonic Distortion	THD	$f=1kHz$, $V_{IN}=1V_{pp}$, $A_V=0dB$	-	0.05	-	%
Equivalent Input Noise Voltage	V_{NI}	$f=1kHz$	-	40	-	nV/ $\sqrt{Hz}$
Amp to Amp Separation	CS	$f=1kHz$, $V_O=1.2V_{pp}$ $R_L=2k\Omega$ to 1.1V	-	TBD	-	dB

●TRANSIENT CHARACTERISTICS

($V_{DD}=2.2V$, $T_a=25^{\circ}C$)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Slew Rate	SR	$R_L=10k\Omega$ to 1.1V	-	0.6	-	V/ μs

[CAUTION]

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