

## LOW-POWER DUAL C-MOS OPERATIONAL AMPLIFIER

### ■ GENERAL DESCRIPTION

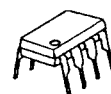
The NJU7014, 15 and 16 are dual C-MOS operational amplifiers operated on a single-power-supply, low voltage and low operating current.

The input bias current is as low as than 1pA, consequently very small signal around the ground level can be amplified.

The minimum operating voltage is 1V and the output stage permits output signal to swing between both of the supply rails.

Furthermore, this series is packaged with a various small one therefore it can be especially applied to portable items.

### ■ PACKAGE OUTLINE



NJU701XD



NJU701XM



NJU701XV

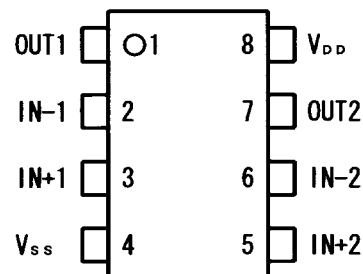


NJU701XR

### ■ FEATURES

- Single-Power-Supply
- Wide Operating Voltage  $V_{DD}=1\sim 5.5V$
- Wide Output Swing Range  $V_{OM}=2.9V$  min @3.0V
- Low Operating Current
- Low Bias Current  $I_{IB}=1pA$  typ
- Compensation Capacitor Incorporated
- Package Outline DIP-8/DMP-8/SSOP-8/VSP-8
- C-MOS Technology

### ■ PIN CONFIGURATION

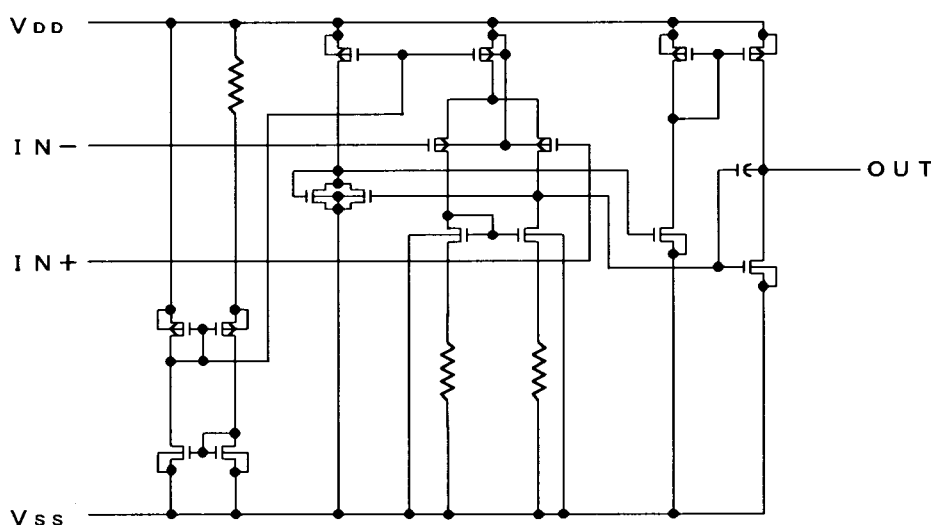


### ■ LINE-UP

( $T_a=25^\circ C$ ,  $V_{DD}=3.0V$ , Per Circuit)

PARAMETER	NJU7014	NJU7015	NJU7016	UNIT
Operating Current	15	80	200	$\mu A$ (typ)
Slew Rate	0.1	1.0	2.4	V/ $\mu s$ (typ)
Unity Gain Bandwidth	0.2	1.0	1.0	MHz (typ)

### ■ EQUIVALENT CIRCUIT



## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	$V_{DD}$	7	V
Differential Input Voltage	$V_{ID}$	$\pm 7$ Note1	V
Common Mode Input Voltage	$V_{IC}$	- 0.3 ~ 7	V
Power Dissipation	$P_D$	500 (DIP-8) 300 (DMP-8) 250 (SSOP-8) 320 (VSP-8)	mW
Operating Temperature	$T_{opr}$	- 40 ~ + 85	°C
Storage Temperature	$T_{stg}$	- 55 ~ +125	°C

Note1) If the supply voltage ( $V_{DD}$ ) is less than 7V, the input voltage must not over the  $V_{DD}$  level though 7V is limit specified.

Note2) Decoupling capacitor should be connected between  $V_{DD}$  and  $V_{SS}$  due to the stabilized operation for the circuit.

## ■ ELECTRICAL CHARACTERISTICS

NJU7014

(Ta=25°C,  $V_{DD}=3.0V$ ,  $R_L=\infty$ )

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Input Offset Voltage	$V_{IO}$	$V_{IN}=1/2V_{DD}$	—	—	10	mV
Input Offset Current	$I_{IO}$		—	1	—	pA
Input Bias Current	$I_{IB}$		—	1	—	pA
Input Impedance	$R_{IN}$		—	1	—	TΩ
Large Signal Voltage Gain	$A_{VD}$		60	70	—	dB
Input Common Mode Voltage Range	$V_{ICM}$		0~2.5	—	—	V
Maximum Output Swing Voltage	$V_{OM1}$ $V_{OM2}$	$R_L=1M\Omega$ $R_L=1M\Omega$	$V_{DD}-0.1$ —	— —	— $V_{SS}+0.1$	V V
Common Mode Rejection Ratio	CMR	$V_{IN}=1/2V_{DD}$	55	65	—	dB
Supply Voltage Rejection Ratio	SVR	$V_{DD}=1.5\sim 5.5V$	60	70	—	dB
Operating Current	$I_{DD}$	Per Circuit	—	15	25	μA
Slew Rate	SR		—	0.1	—	V/μs
Unity Gain Bandwidth	Ft	$A_v=40dB$ , $C_L=10pF$	—	0.2	—	MHz

Note3) The source current is less than 2.9μA (at  $V_{OM}/R_L=2.9V/1M\Omega$ ).

NJU7015

(Ta=25°C, V<sub>DD</sub>=3.0V, R<sub>L</sub>=∞)

P A R A M E T E R	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Input Offset Voltage	V <sub>IO</sub>	V <sub>IN</sub> =1/2V <sub>DD</sub>	—	—	10	mV
Input Offset Current	I <sub>IO</sub>		—	1	—	pA
Input Bias Current	I <sub>IB</sub>		—	1	—	pA
Input Impedance	R <sub>IN</sub>		—	1	—	TΩ
Large Signal Voltage Gain	A <sub>VD</sub>		60	70	—	dB
Input Common Mode Voltage Range	V <sub>ICM</sub>		0~2.5	—	—	V
Maximum Output Swing Voltage	V <sub>OM1</sub>	R <sub>L</sub> =100kΩ	V <sub>DD</sub> -0.1	—	—	V
	V <sub>OM2</sub>	R <sub>L</sub> =100kΩ	—	—	V <sub>SS</sub> +0.1	V
Common Mode Rejection Ratio	CMR	V <sub>IN</sub> =1/2V <sub>DD</sub>	55	65	—	dB
Supply Voltage Rejection Ratio	SVR	V <sub>DD</sub> =1.5~5.5V	60	70	—	dB
Operating Current	I <sub>DD</sub>	Per Circuit	—	80	160	μA
Slew Rate	SR		—	1.0	—	V/μs
Unity Gain Bandwidth	F <sub>t</sub>	A <sub>v</sub> =40dB, C <sub>L</sub> =10pF	—	1.0	—	MHz

Note4) The source current is less than 29μA (at V<sub>OM</sub>/R<sub>L</sub>=2.9V/100kΩ).

NJU7016

(Ta=25°C, V<sub>DD</sub>=3.0V, R<sub>L</sub>=∞)

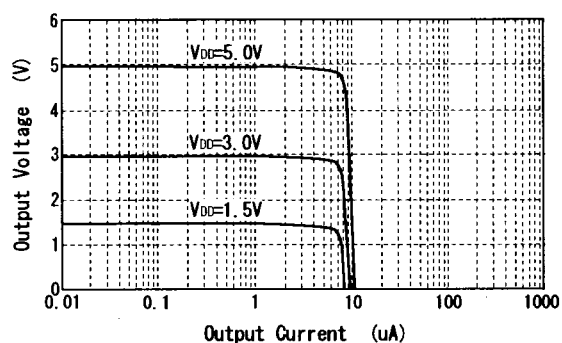
P A R A M E T E R	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Input Offset Voltage	V <sub>IO</sub>	V <sub>IN</sub> =1/2V <sub>DD</sub>	—	—	10	mV
Input Offset Current	I <sub>IO</sub>		—	1	—	pA
Input Bias Current	I <sub>IB</sub>		—	1	—	pA
Input Impedance	R <sub>IN</sub>		—	1	—	TΩ
Large Signal Voltage Gain	A <sub>VD</sub>		60	70	—	dB
Input Common Mode Voltage Range	V <sub>ICM</sub>		0~2.5	—	—	V
Maximum Output Swing Voltage	V <sub>OM1</sub>	R <sub>L</sub> =50kΩ	V <sub>DD</sub> -0.1	—	—	V
	V <sub>OM2</sub>	R <sub>L</sub> =50kΩ	—	—	V <sub>SS</sub> +0.1	V
Common Mode Rejection Ratio	CMR	V <sub>IN</sub> =1/2V <sub>DD</sub>	55	65	—	dB
Supply Voltage Rejection Ratio	SVR	V <sub>DD</sub> =1.5~5.5V	60	70	—	dB
Operating Current	I <sub>DD</sub>	Per Circuit	—	200	400	μA
Slew Rate	SR		—	1.0	—	V/μs
Unity Gain Bandwidth	F <sub>t</sub>	A <sub>v</sub> =40dB, C <sub>L</sub> =10pF	—	1.0	—	MHz

Note5) The source current is less than 58μA (at V<sub>OM</sub>/R<sub>L</sub>=2.9V/50kΩ).

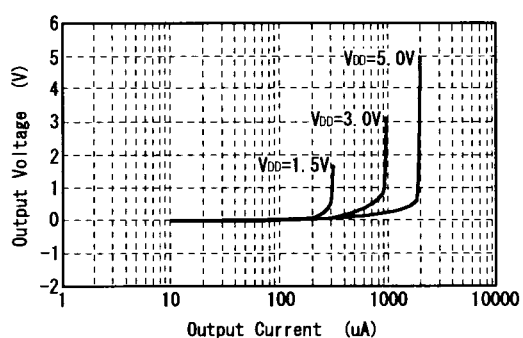
## ■ TYPICAL CHARACTERISTICS

(1) NJU7014

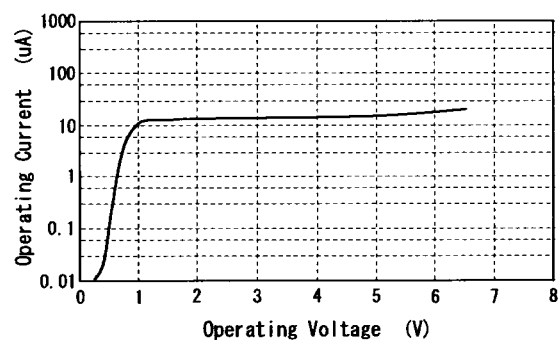
Output Voltage vs. Output Current (SOURCE)



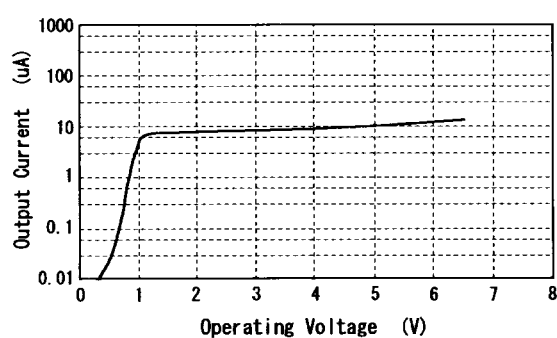
Output Voltage vs. Output Current (SINK)



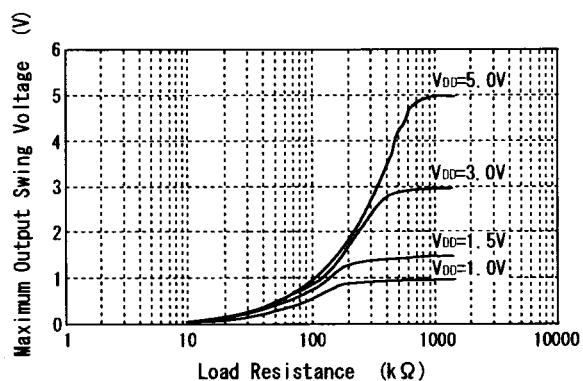
Operating Current vs. Operating Voltage

 $V_{IN}=0.1V$ 

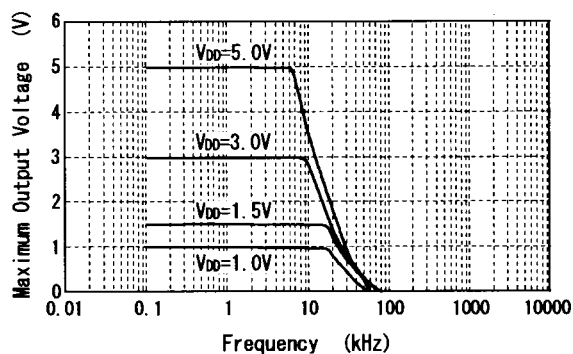
Output Current vs. Operating Voltage

 $V_{IN}=0.1V$ 

Maximum Output Swing Voltage vs. Load Resistance

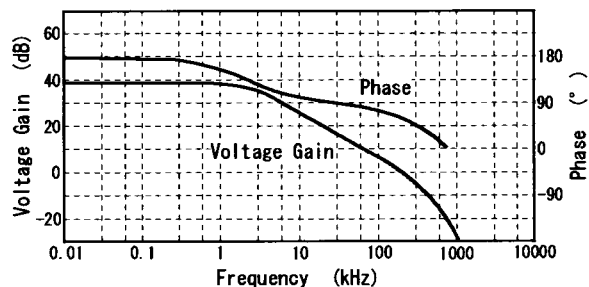


Maximum Output Swing Voltage vs. Frequency



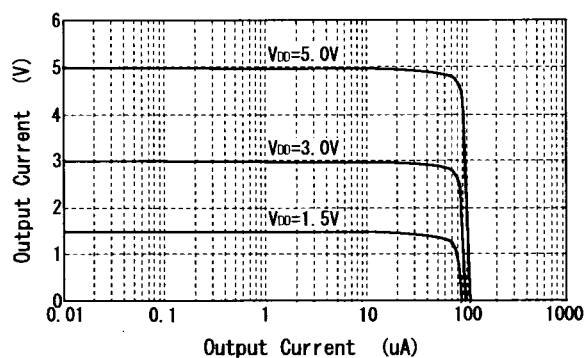
Voltage Gain-Phase vs. Frequency

V<sub>DD</sub>=3V, R<sub>s</sub>=1kΩ, A<sub>v</sub>=40dB

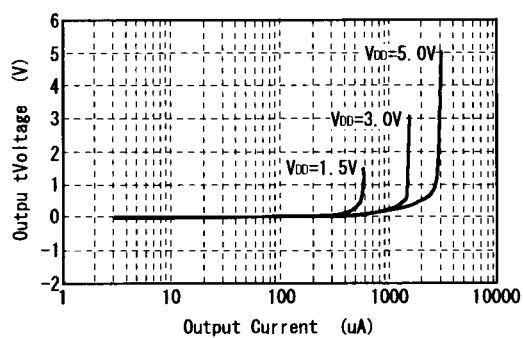


(2) NJU7015

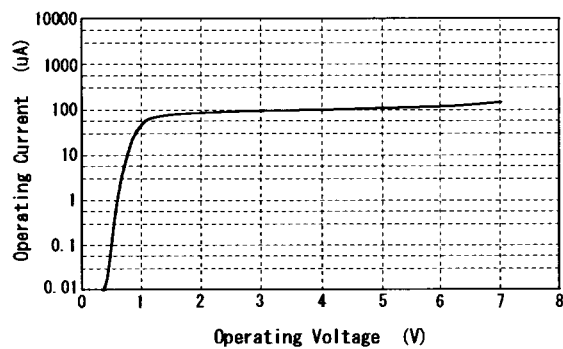
Output Voltage vs. Output Current (SOURCE)



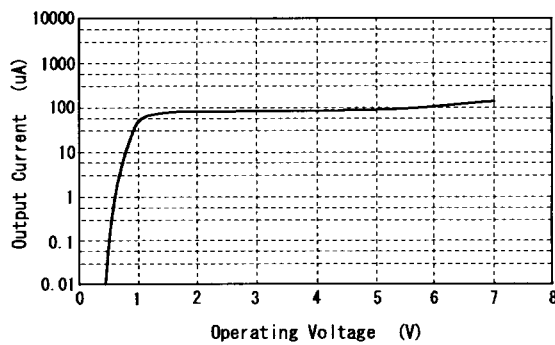
Output Voltage vs. Output Current (SINK)



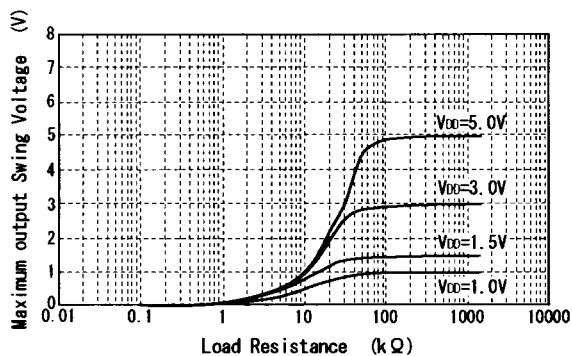
Operating Current vs. Operating Voltage

 $V_{IN}=0.1V$ 

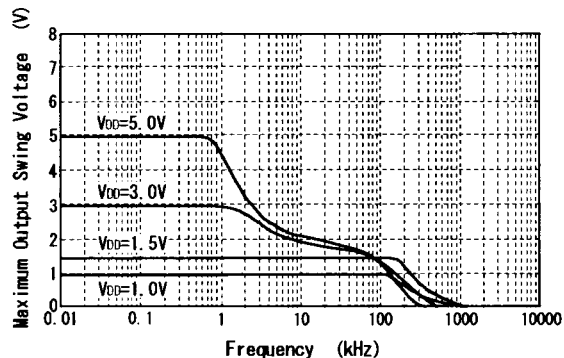
Output Current vs. Operating Voltage

 $V_{IN}=0.1V$ 

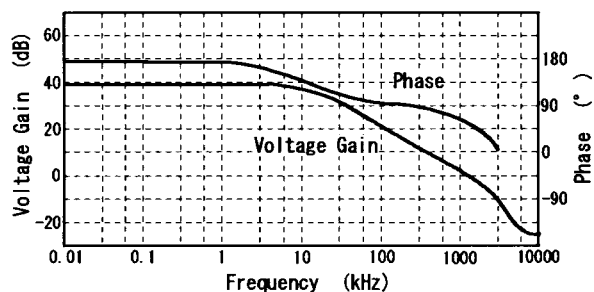
Maximum Output Swing Voltage vs. Load Resistance



Maximum Output Swing Voltage vs. Frequency

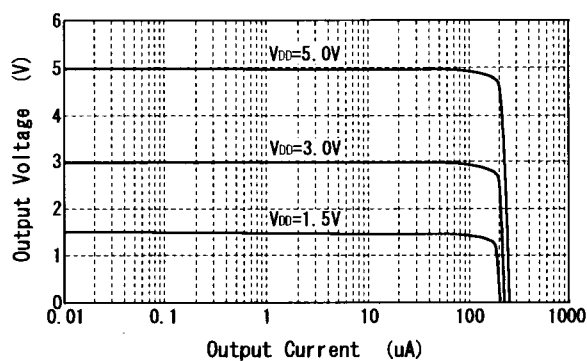


Voltage Gain-Phase vs. Frequency

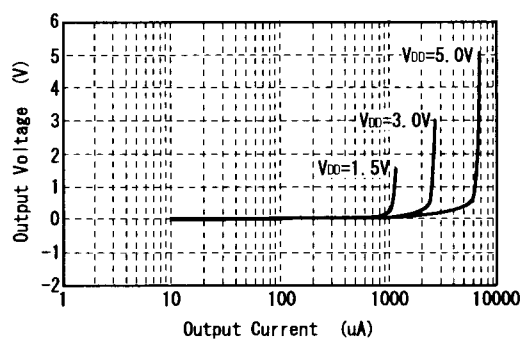
V<sub>DD</sub>=3V, R<sub>S</sub>=1kΩ, A<sub>v</sub>=40dB

## (3) NJU7016

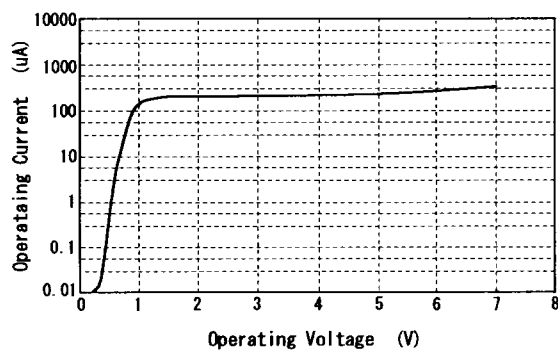
Output Voltage vs. Output Current (SOURCE)



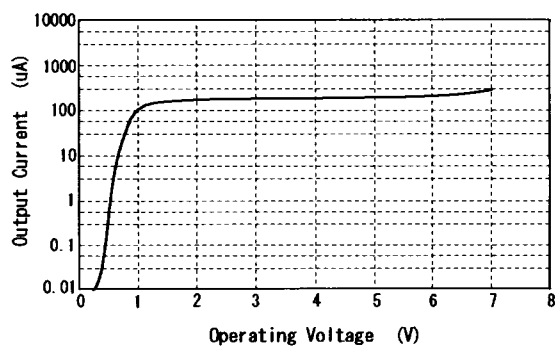
Output Voltage vs. Output Current (SINK)



Operating Current vs. Operating Voltage

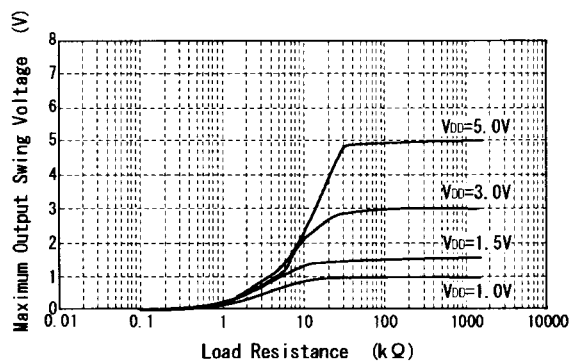
 $V_{IN}=0.1V$ 

Output Current vs. Operating Voltage

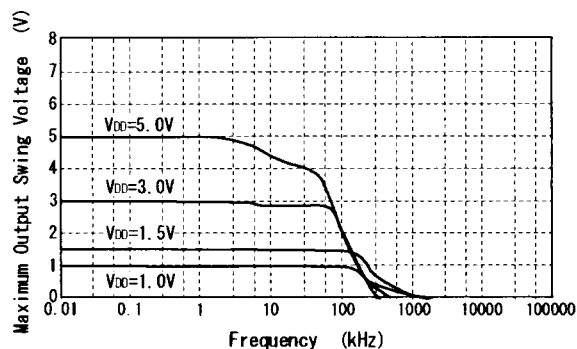
 $V_{IN}=0.1V$ 



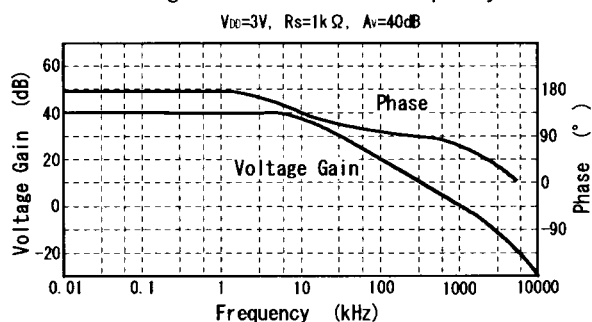
Maximum Output Swing Voltage vs. Load Resistance



Maximum Output Swing Voltage vs. Frequency



Voltage Gain-Phase vs. Frequency



## [CAUTION]

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