

## LOW-POWER DUAL C-MOS OPERATIONAL AMPLIFIER

### ■ GENERAL DESCRIPTION

The NJU7014/7015/7016 are single supply dual C-MOS operational amplifiers featuring a low operating voltage from 1V and low operating current of 15 $\mu$ A/circuit (7014 typ.), 80 $\mu$ A/circuit (7015 typ.), 200 $\mu$ A/circuit (7016 typ.).

They also have a low input bias current of 1pA (typ.) and input voltage range from ground, which can provide a ground sensing, and rail-to-rail output swing in both rails.

The NJU7014/7015/7016 are available in a wide variety of 8-lead packages, dual-in-line DIP8, surface-mount SOP8 (DMP8), SSOP8, MSOP8 (VSP8), MSOP8 (TVSP8). The combination of these specifications makes them ideal for a variety of portable devices.

### ■ PACKAGE OUTLINE



NJU7015D  
NJU7016D  
(DIP8)



NJU7014M  
NJU7015M  
NJU7016M  
(DMP8)



NJU7014V  
NJU7015V  
NJU7016V  
(SSOP8)



NJU7014R  
NJU7015R  
NJU7016R  
(MSOP8(VSP8))



NJU7014RB1  
NJU7015RB1  
NJU7016RB1  
(MSOP8(TVSP8))

### ■ FEATURES

- Single Power Supply
- Wide Operating Voltage  $V_{DD}=1\sim 5.5V$
- Wide Output Swing Range  $V_{OM}=2.9V$  min. (@  $V_{DD}=3.0V$ )
- Low Operating Current
- Low Bias Current  $I_B=1pA$  typ.
- Compensation Capacitor Incorporated
- C-MOS Technology
- Package Outline

NJU7015D, NJU7016D : DIP8

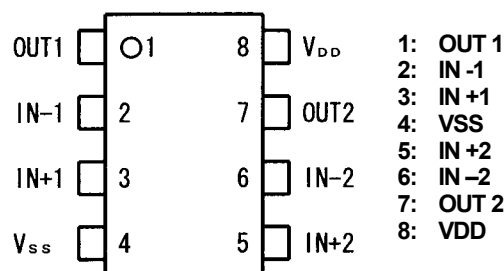
NJU7014M, NJU7015M, NJM7016M : DMP8

NJU7014V, NJU7015V, NJM7016V : SSOP8

NJU7014R, NJU7015R, NJM7016R : MSOP8(VSP8) MEET JEDEC MO-187-DA

NJU7014RB1, NJU7015RB1, NJM7016RB1 : MSOP8(VSP8) MEET JEDEC MO-187-DA / THIN TYPE

### ■ PIN CONFIGURATION



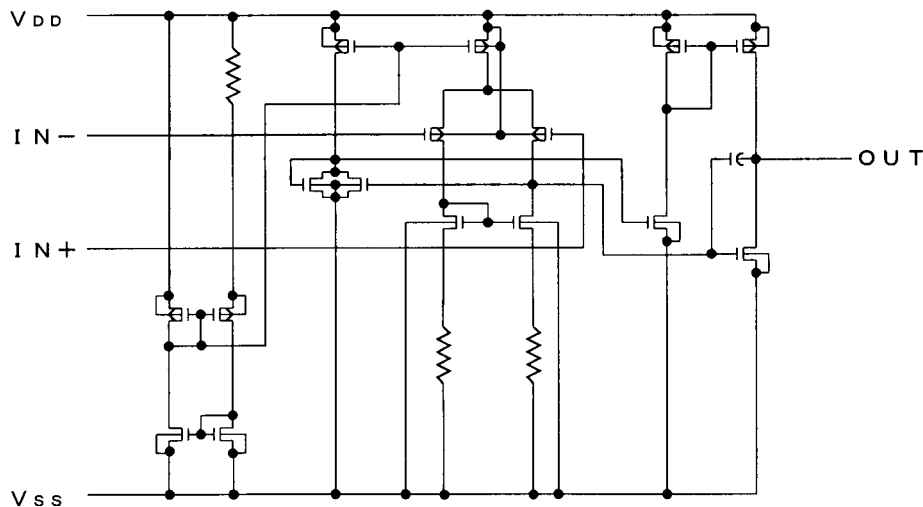
### ■ LINE-UP

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

# NJU7014/15/16

## ■ EQUIVALENT CIRCUIT



## ■ ABSOLUTE MAXIMUM RATINGS

( Ta=25°C )

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V <sub>DD</sub>	7	V
Differential Input Voltage	V <sub>ID</sub>	±7 (note1)	V
Common Mode Input Voltage	V <sub>IC</sub>	-0.3~7	V
Power Dissipation	P <sub>D</sub>	( DIP8 ) 500 ( DMP8 ) 300 ( SSOP8 ) 250 ( MSOP8(VSP8) ) 320 ( MSOP8(TVSP8) ) 320	mW
Operating Temperature Range	T <sub>opr</sub>	-40~+85	°C
Storage Temperature Range	T <sub>stg</sub>	-55~+125	°C

(note1) If the supply voltage ( V<sub>DD</sub> ) is less than 7V, the input voltage must not over the V<sub>DD</sub> level though 7V is limit specified.

(note2) Decoupling capacitor should be connected between V<sub>DD</sub> and V<sub>SS</sub> due to the stabilized operation for the circuit.

## ■ ELECTRICAL CHARACTERISTICS

### NJU7014

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

PARAMETER	SYMBOL	TEST CONDITION	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> =1MΩ	V <sub>DD</sub> -0.1	-	-	V
	V <sub>OM2</sub>	R <sub>L</sub> =1MΩ	-	-	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	-	15	25	μA
Slew Rate	SR		-	0.1	-	V/μs
Unity Gain Bandwidth	F <sub>T</sub>	A <sub>V</sub> =40dB, C <sub>L</sub> =10pF	-	0.2	-	MHz

(note3) The source current is less than 2.9μA ( at V<sub>OM</sub>/R<sub>L</sub>=2.9V/1MΩ ).

## NJU7015

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

PARAMETER	SYMBOL	TEST CONDITION	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>=∞ )

PARAMETER	SYMBOL	TEST CONDITION	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)

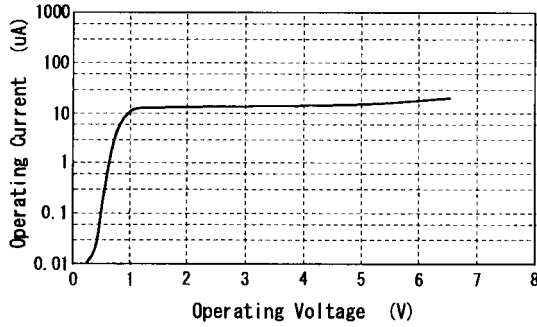


Output Voltage vs. Output Current (SINK)



Operating Current vs. Operating Voltage

V<sub>IN</sub>=0.1V



Output Current vs. Operating Voltage

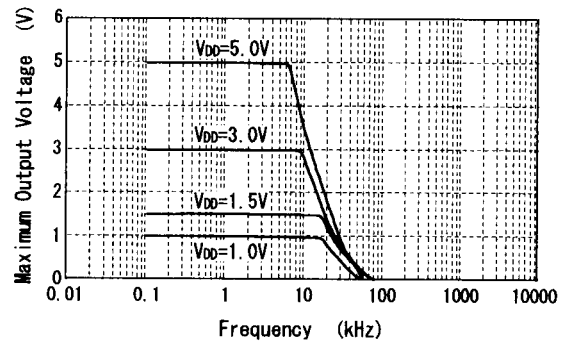
V<sub>IN</sub>=0.1V



Maximum Output Swing Voltage vs. Load Resistance



Maximum Output Swing Voltage vs. Frequency

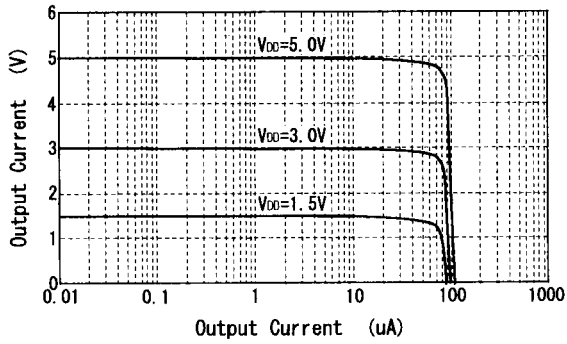


Voltage Gain-Phase vs. Frequency

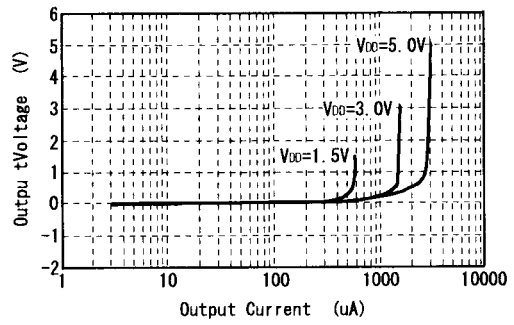


(2) NJU7015

Output Voltage vs. Output Current (SOURCE)

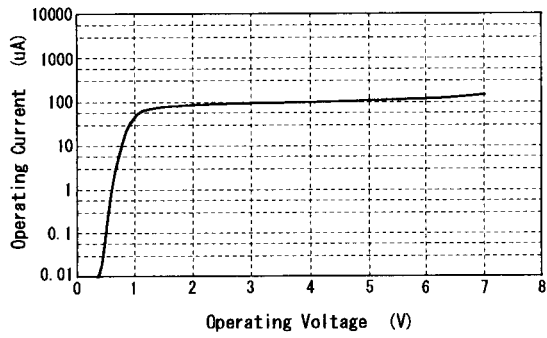


Output Voltage vs. Output Current (SINK)



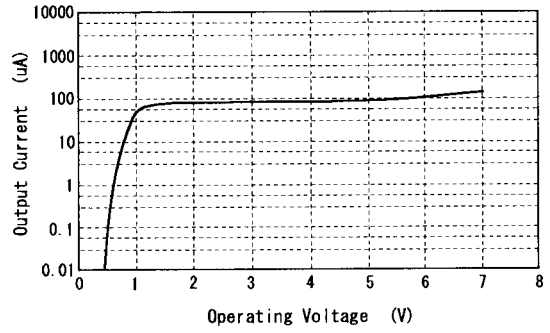
Operating Current vs. Operating Voltage

V<sub>IN</sub>=0.1V



Output Current vs. Operating Voltage

V<sub>IN</sub>=0.1V



Maximum Output Swing Voltage vs. Load Resistance



Maximum Output Swing Voltage vs. Frequency



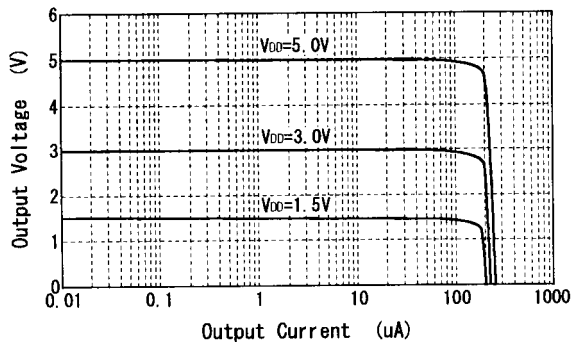
Voltage Gain-Phase vs. Frequency

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

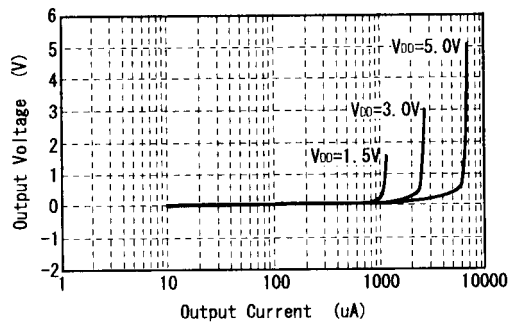


(3) NJU7016

Output Voltage vs. Output Current (SOURCE)

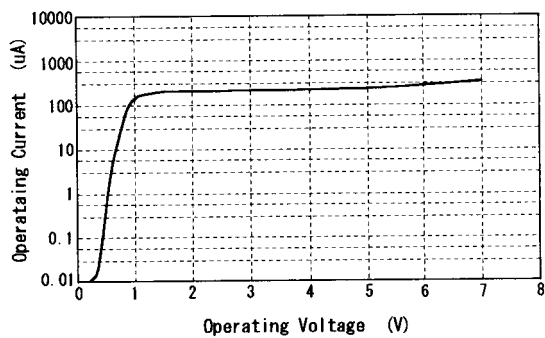


Output Voltage vs. Output Current (SINK)



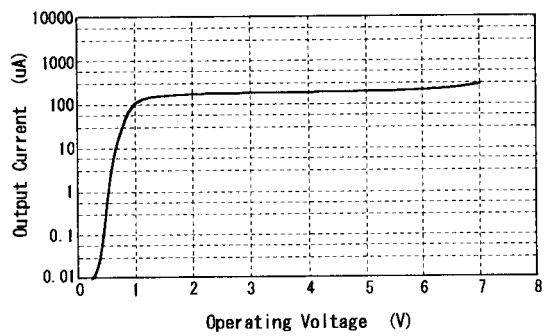
Operating Current vs. Operating Voltage

V<sub>IN</sub>=0.1V



Output Current vs. Operating Voltage

V<sub>IN</sub>=0.1V

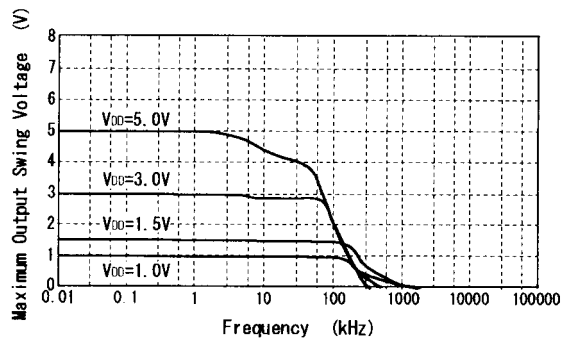




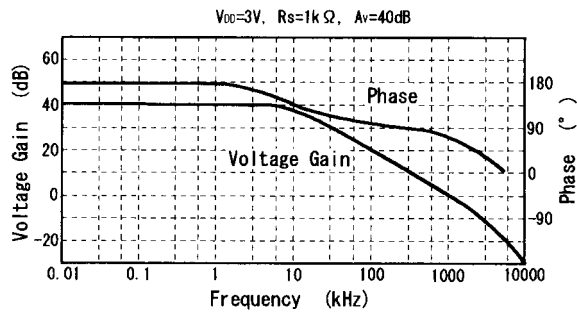
Maximum Output Swing Voltage vs. Load Resistance



Maximum Output Swing Voltage vs. Frequency



Voltage Gain·Phase vs. Frequency



[CAUTION]

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