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 15μA/circuit (7014 typ.), 80μA/circuit (7015 typ.), 200μA/circit (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 theses 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))

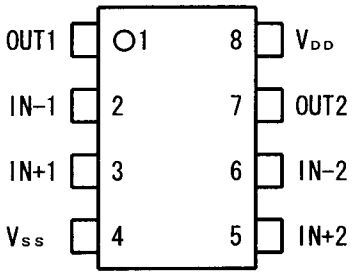
NJU7014RB1
NJU7015RB1
NJU7016RB1
(MSOP8(TVSP8))

■ FEATURES

- Single Power Supply
- Wide Operating Voltage V_{DD}=1~5.5V
- Wide Output Swing Range V_{OM}=2.9V min. (@ VDD=3.0V)
- Low Operating Current
- Low Bias Current I_{IB}=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



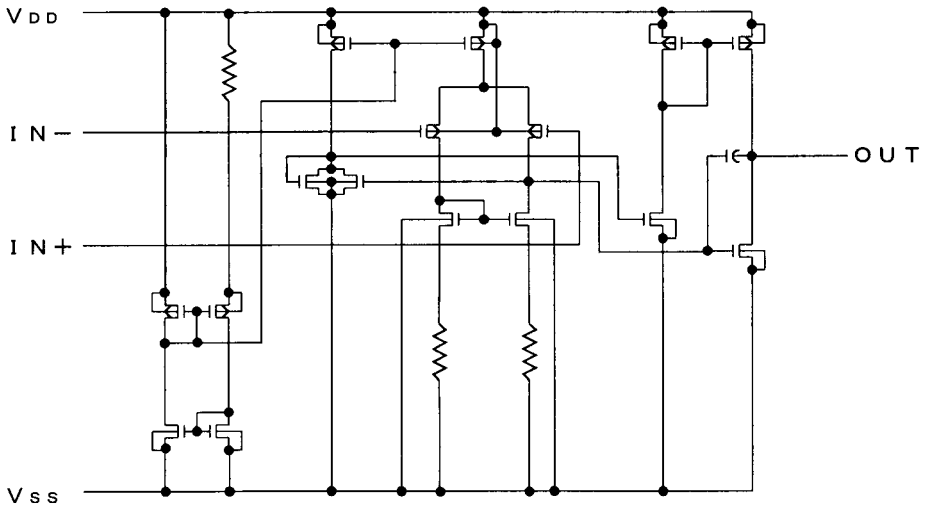
1: OUT 1
2: IN -1
3: IN +1
4: VSS
5: IN +2
6: IN –2
7: OUT 2
8: VDD

■ LINE-UP

(Ta=25°C,V_{DD}=3.0V,Per Circuit)

PARAMETER	NJU7014	NJU7015	NJU7016	UNIT
Operating Current	15	80	200	μA (typ)
Slew Rate	0.1	1.0	2.4	V/μs (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}	±7 (note1)	V
Common Mode Input Voltage	V_{IC}	-0.3~7	V
Power Dissipation	P_D	(DIP8) 500 (DMP8) 300 (SSOP8) 250 (MSOP8(VSP8))320 (MSOP8(TVSP8))320	mW
Operating Temperature Range	T_{opr}	-40~+85	˚C
Storage Temperature Range	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=∞)

PARAMETER	SYMBOL	TEST CONDITION	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}	R_L=1MΩ	V_{DD}-0.1	-	-	V
	V_{OM2}	R_L=1MΩ	-	-	V_{SS}+0.1	V
Common Mode Rejection Ratio	CMR	V_{IN}=1/2V_{DD}	55	65	-	dB
Supply Voltage Rejection Ratio	SVR	V_{DD}=1.5~5.5V	60	70	-	dB
Operating Current	I_{DD}	Per Circuit	-	15	25	μA
Slew Rate	SR		-	0.1	-	V/μs
Unity Gain Bandwidth	F_t	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/1MΩ).

NJU7015 (Ta=25˚C, V_{DD}=3.0V, R_L=∞)

PARAMETER	SYMBOL	TEST CONDITION	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}	R_L=100kΩ	V_{DD}-0.1	-	-	V
	V_{OM2}	R_L=100kΩ	-	-	V_{SS}+0.1	V
Common Mode Rejection Ratio	CMR	V_{IN}=1/2V_{DD}	55	65	-	dB
Supply Voltage Rejection Ratio	SVR	V_{DD}=1.5~5.5V	60	70	-	dB
Operating Current	I_{DD}	Per Circuit	-	80	160	μA
Slew Rate	SR		-	1.0	-	V/μs
Unity Gain Bandwidth	F_t	A_V=40dB, C_L=10pF	-	1.0	-	MHz

(note4) The source current is less than 29μA (at V_{OM}/R_L=2.9V/100kΩ).

NJU7016 (Ta=25˚C, V_{DD}=3.0V, R_L=∞)

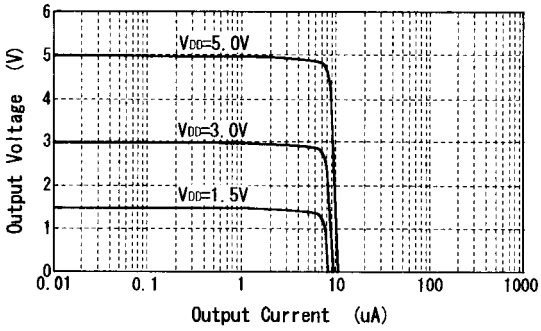
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Offset Voltage	V_{IO}	V_{IN}=1/2V_{DD}	-	-	10	mV
Input Offset Current	I_{IO}		-	1	-	pA
Input Bias Current	I_{IB}		-	1	-	pA
Input Impedance	R_{IN}		-	1	-	TΩ
Large Signal Voltage Gain	A_{VD}		60	70	-	dB
Input Common Mode Voltage Range	V_{ICM}		0~2.5	-	-	V
Maximum Output Swing Voltage	V_{OM1}	R_L=50kΩ	V_{DD}-0.1	-	-	V
	V_{OM2}	R_L=50kΩ	-	-	V_{SS}+0.1	V
Common Mode Rejection Ratio	CMR	V_{IN}=1/2V_{DD}	55	65	-	dB
Supply Voltage Rejection Ratio	SVR	V_{DD}=1.5~5.5V	60	70	-	dB
Operating Current	I_{DD}	Per Circuit	-	200	400	μA
Slew Rate	SR		-	1.0	-	V/μs
Unity Gain Bandwidth	F_t	A_V=40dB, C_L=10pF	-	1.0	-	MHz

(note5) The source current is less than 58μA (at V_{OM}/R_L=2.9V/50kΩ).

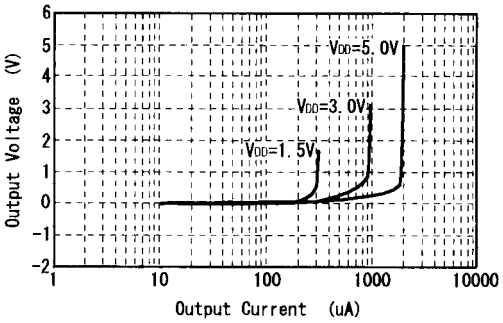
■ TYPICAL CHARACTERISTICS

(1) NJU7014

Output Voltage vs. Output Current (SOURCE)

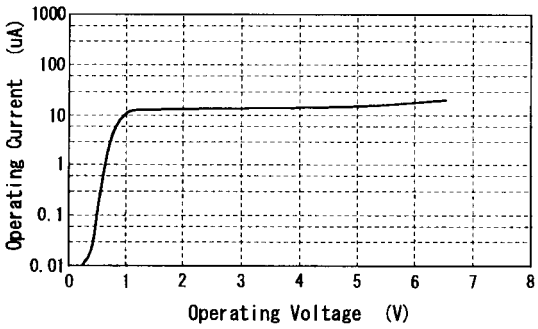


Output Voltage vs. Output Current (SINK)



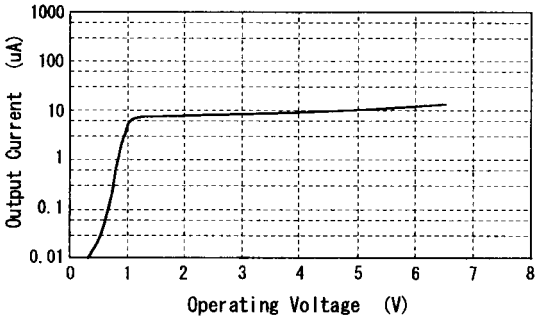
Operating Current vs. Operating Voltaga

VIN=0.1V

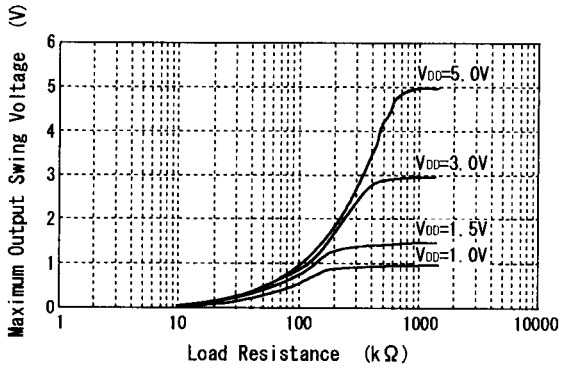


Output Current vs. Operating Voltage

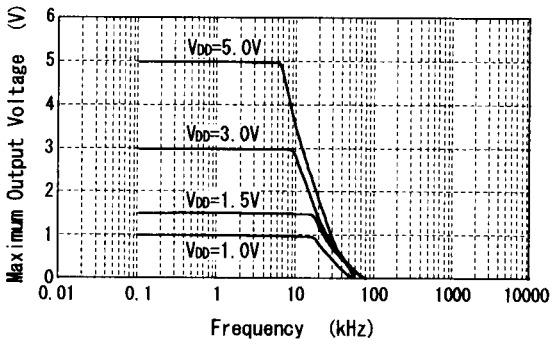
VIN=0.1V



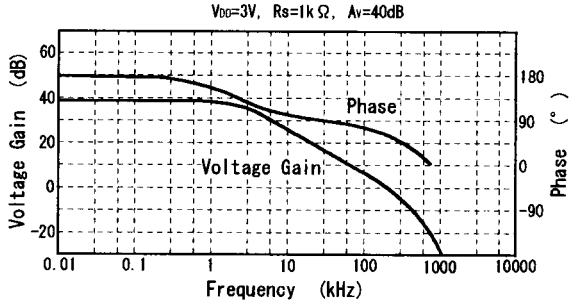
Maximum Output Swing Voltage vs. Load Resistance



Maximum Output Swing Voltage vs. Frequency

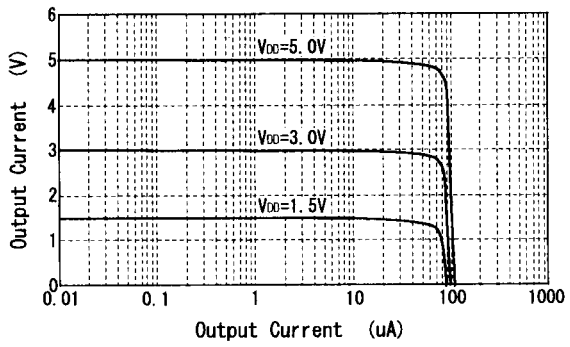


Voltage Gain·Phase vs. Frequency

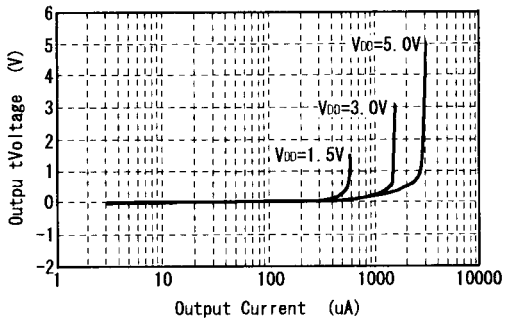


(2) NJU7015

Output Voltage vs. Output Current (SOURCE)

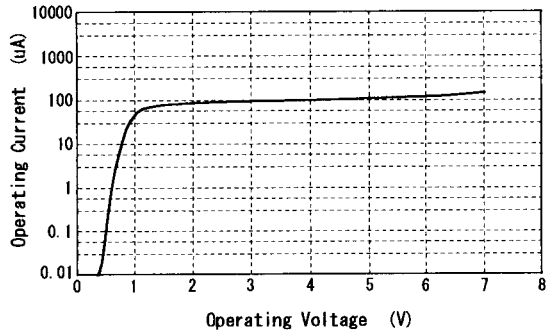


Output Voltage vs. Output Current (SINK)



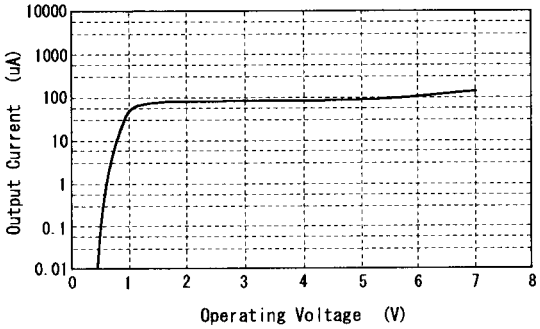
Operating Current vs. Operating Voltage

VIN=0.1V

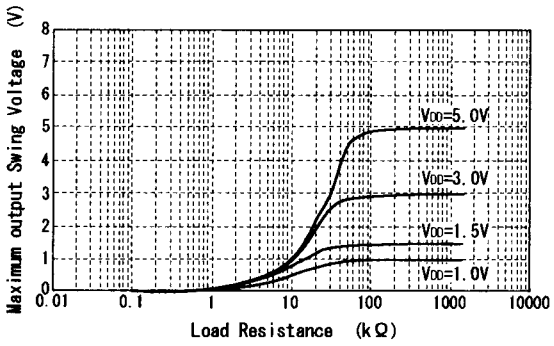


Output Current vs. Operating Voltage

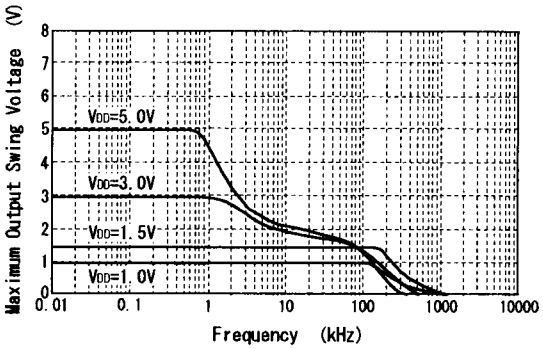
VIN=0.1V



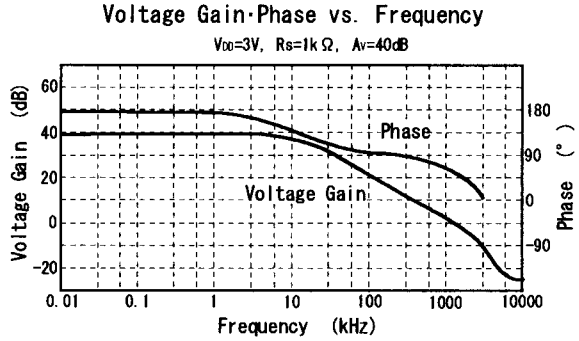
Maximum Output Swing Voltage vs. Load Resistance



Maximum Output Swing Voltage vs. Frequency

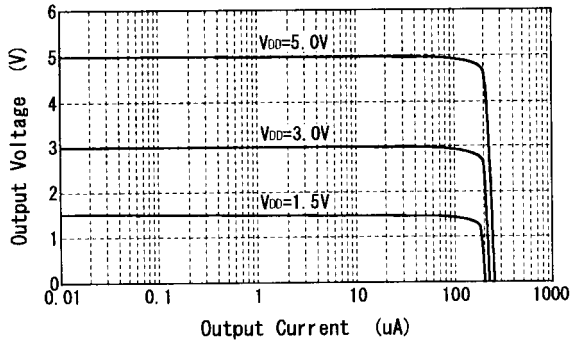


Voltage Gain·Phase vs. Frequency

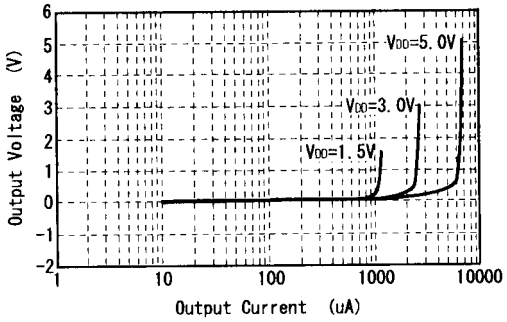


(3) NJU7016

Output Voltage vs. Output Current (SOURCE)

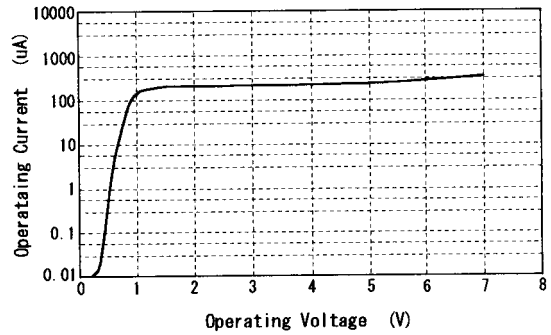


Output Voltage vs. Output Current (SINK)



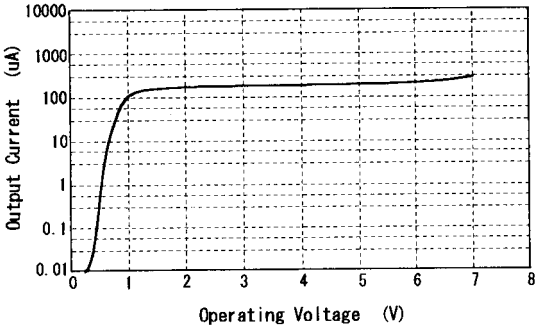
Operating Current vs. Operating Voltage

VIN=0.1V

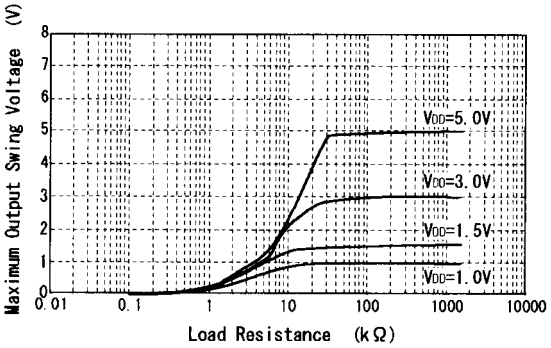


Output Current vs. Operating Voltage

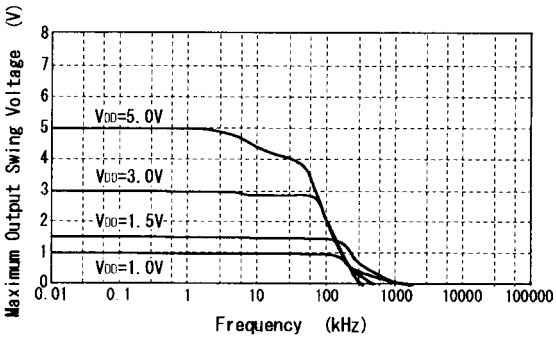
VIN=0.1V



Maximum Output Swing Voltage vs. Load Resistance

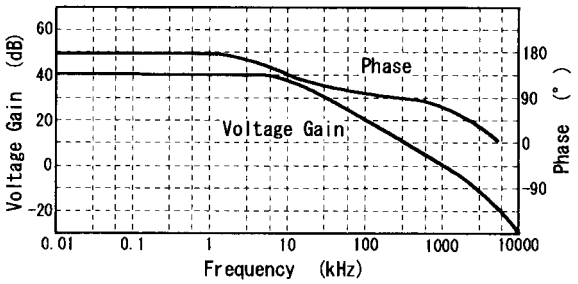


Maximum Output Swing Voltage vs. Frequency



Voltage Gain·Phase vs. Frequency

VDD=3V, Rs=1kΩ, Av=40dB



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