

## LOW VOLTAGE C-MOS OPERATIONAL AMPLIFIER

### ■ GENERAL DESCRIPTION

The NJU7021,22 and 24 are single, dual and quad C-MOS Operational Amplifiers operated on a single-power-supply, low voltage and low operating current.

The minimum operating voltage is 3V and the output stage permits output signals to swing between both of the supply rails.

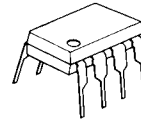
The input bias current is as low as less than 1pA, consequently the very small signal around the ground level can be amplified.

Furthermore, the operating current is also as low as 150 $\mu$ A ( typ ) per circuit, therefore it can be applied especially to battery operated items.

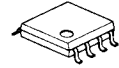
### ■ FEATURES

- Single-Power-Supply
- Wide Operating Voltage (  $V_{DD}=3\sim 16V$  )
- Wide Output Swing Range (  $V_{OM}=9.98V$  typ. @  $V_{DD}=10V$  )
- Low Operating Current ( 150 $\mu$ A/circuit )
- Low Bias Current (  $I_B=1pA$  typ. )
- Internal Compensation Capacitor
- External Offset Null Adjustment ( Only NJU7021 )
- Package Outline
  - DMP/SSOP8 ( NJU7021 )
  - DIP/DMP8 ( NJU7022 )
  - DIP/DMP/SSOP14 ( NJU7024 )
- C-MOS Technology

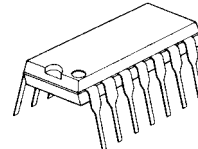
### ■ PACKAGE OUTLINE



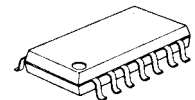
NJU7022D



NJU7021M  
NJU7022M



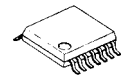
NJU7024D



NJU7024M

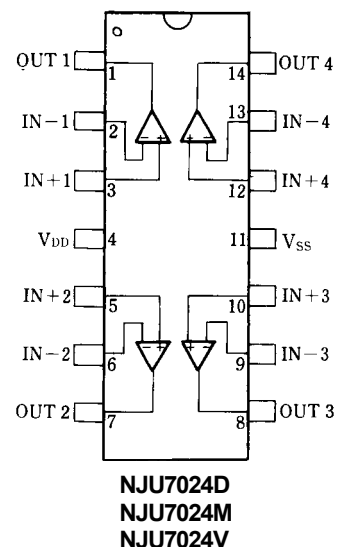
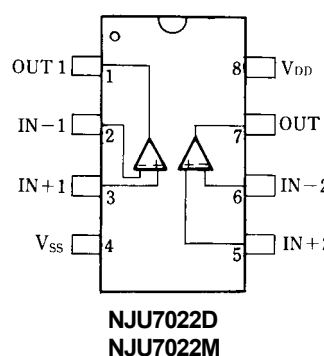
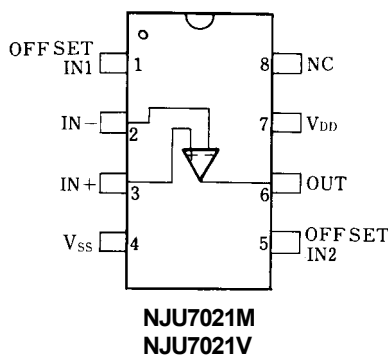


NJU7021V



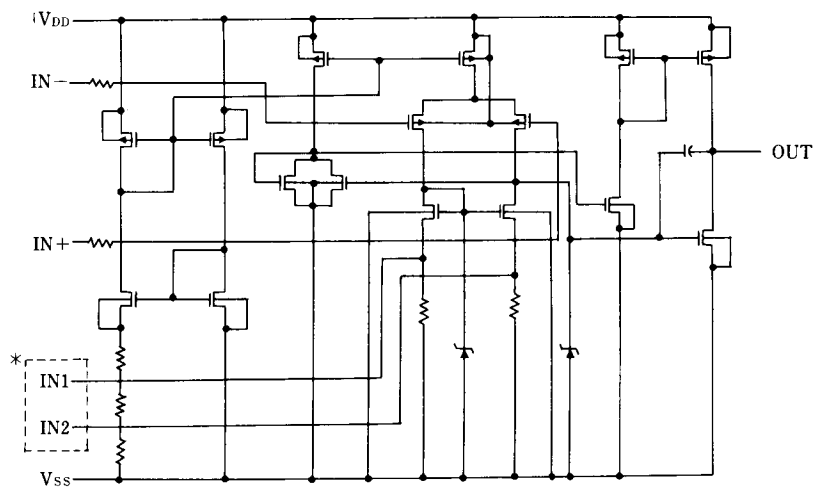
NJU7024V

### ■ PIN CONFIGURATION



# NJU7021/22/24

## ■ EQUIVALENT CIRCUIT



\* IN1, IN2 are only for NJU7021 ( NJU7022/24 don't have these terminals ).

## ■ ABSOLUTE MAXIMUM RATINGS

( Ta=25°C )

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V <sub>DD</sub>	18	V
Differential Input Voltage	V <sub>ID</sub>	± 18 ( note1 )	V
Common Mode Input Voltage	V <sub>IC</sub>	-0.3~18	V
Power Dissipation	P <sub>D</sub>	( DIP14 ) 700 ( DIP8 ) 500 ( DMP8,14 ) 300 ( SSOP14 ) 300 ( SSOP8 ) 250	mW
Operating Temperature Range	T <sub>opr</sub>	-20~+75	°C
Storage Temperature Range	T <sub>stg</sub>	-40~+125	°C

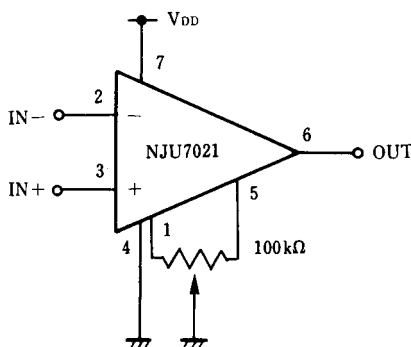
( note1 ) For supply voltage less than 18V, the absolute maximum input voltage is equal to the supply voltage.

## ■ ELECTRICAL CHARACTERISTICS

( Ta=25°C, V<sub>DD</sub>=10V, R<sub>L</sub>=∞ )

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Offset Voltage	V <sub>IO</sub>	R <sub>S</sub> =50Ω	-	-	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>V</sub>		80	95	-	dB
Input Common Mode Voltage Range	V <sub>ICM</sub>		0~9	-	-	V
Maximum Output Swing Voltage	V <sub>OM</sub>	R <sub>L</sub> =1MΩ	9.80	9.98	-	V
Common Mode Rejection Ratio	CMR		60	75	-	dB
Supply Voltage Rejection Ratio	SVR		60	75	-	dB
Operating Current/Circuit	I <sub>DD</sub>		-	150	300	μA
Slew Rate	SR		-	0.40	-	V/μs
Unity Gain Bandwidth	F <sub>T</sub>	A <sub>V</sub> =40dB, C <sub>L</sub> =10pF	-	0.4	-	MHz

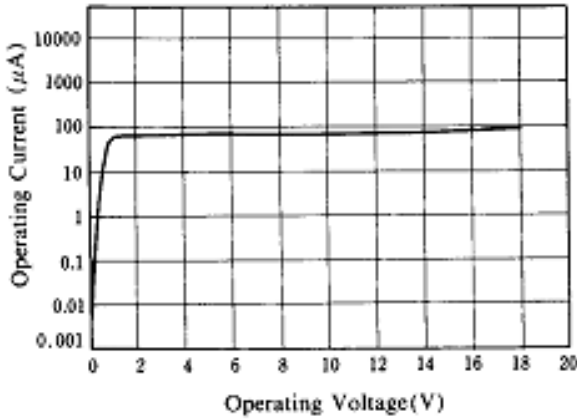
## ■ OFFSET ADJUSTMENT CIRCUIT ( Only For NJU7021 )



## ■ TYPICAL CHARACTERISTICS

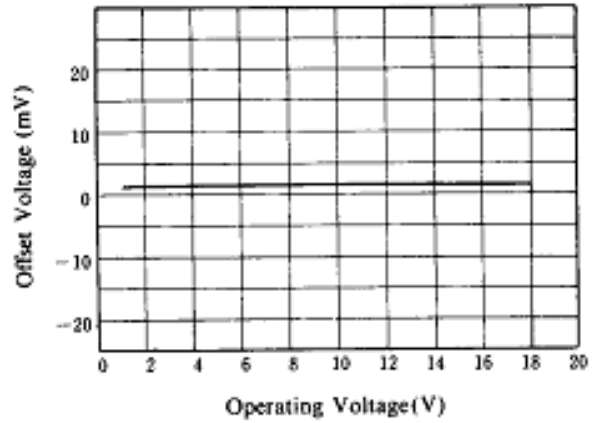
**Operating Current vs. Operating Voltage**

$V_{IN}=0.1V$



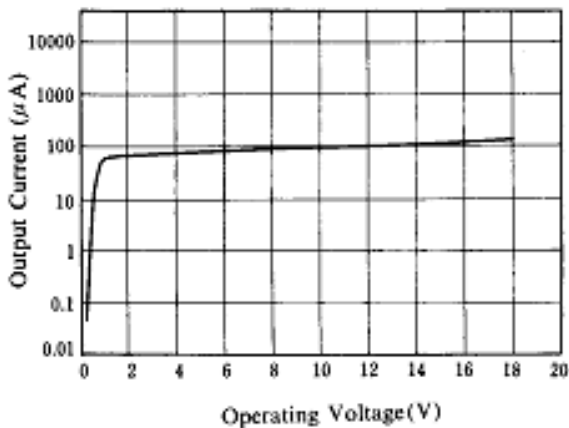
**Offset Voltage vs. Operating Voltage**

$V_{IN}=0.1V$

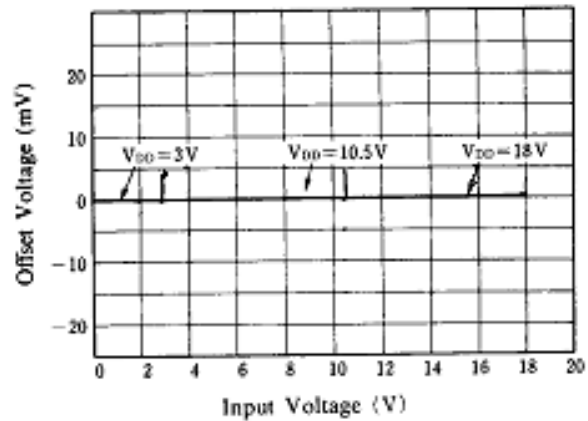


**Output Current vs. Operating Voltage**

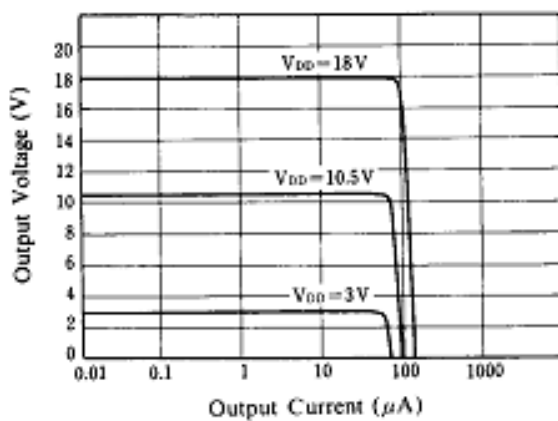
$V_{IN}=0.1V$



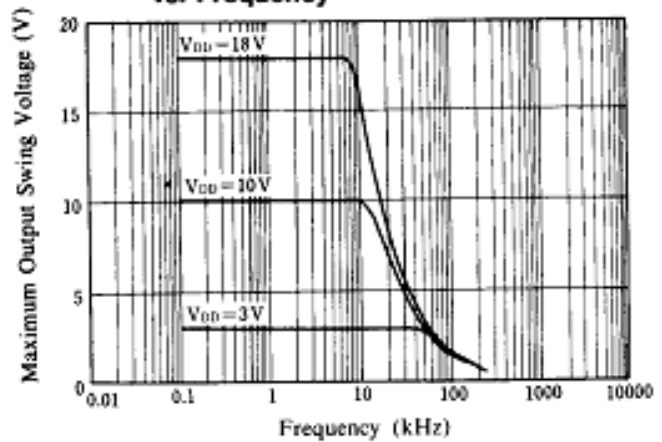
**Offset Voltage vs. Input Voltage**



**Output Voltage vs. Output Current**

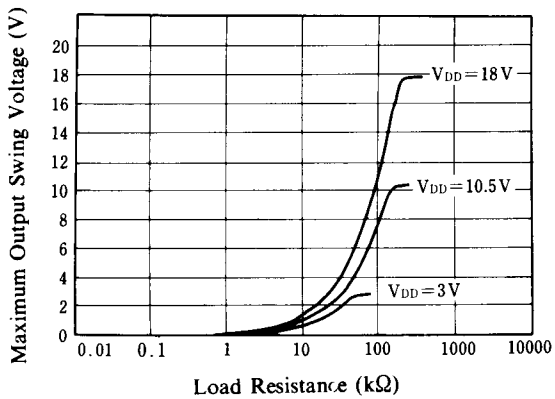


**Maximum Output Swing Voltage vs. Frequency**

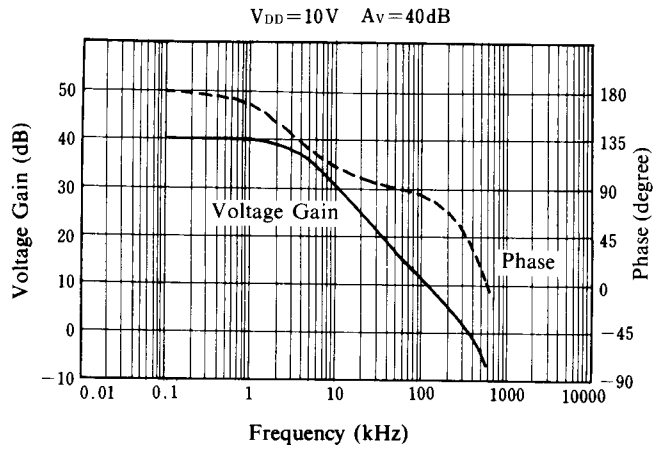


## ■ TYPICAL CHARACTERISTICS

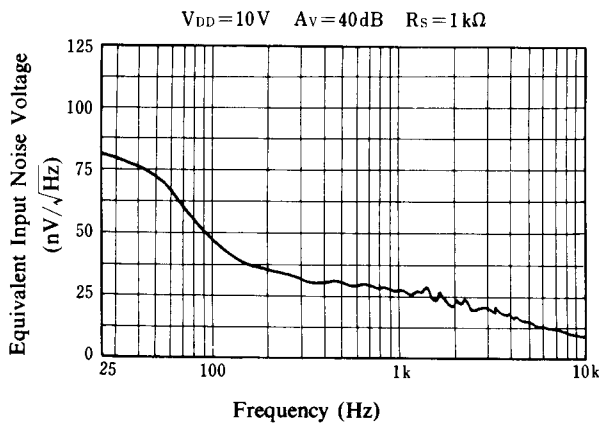
**Maximum Output Swing Voltage vs. Frequency**



**Voltage Gain · Phase vs. Frequency**





**Equivalent Input Noise Voltage vs. Frequency**



**[CAUTION]**  
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