PRELIMINARY

# LOW-VOLTAGE OPERATION C-MOS DUAL 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 minimum operating voltage is 1V 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, this series is packaged with a various small one therefore it can be especially applied to portable items.

## ■ PACKAGE OUTLINE

NJU701XD

NJU701XM

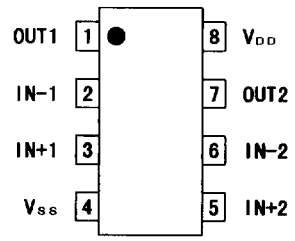
NJU701XV

NJU701XR

## ■ FEATURES

- Single-Power-Supply
- Wide Operating Voltage ( $V_{DD}$=1～5.5V )
- Wide Output Swing Range ( $V_{OM}$≧2.9V min. at $V_{DD}$=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



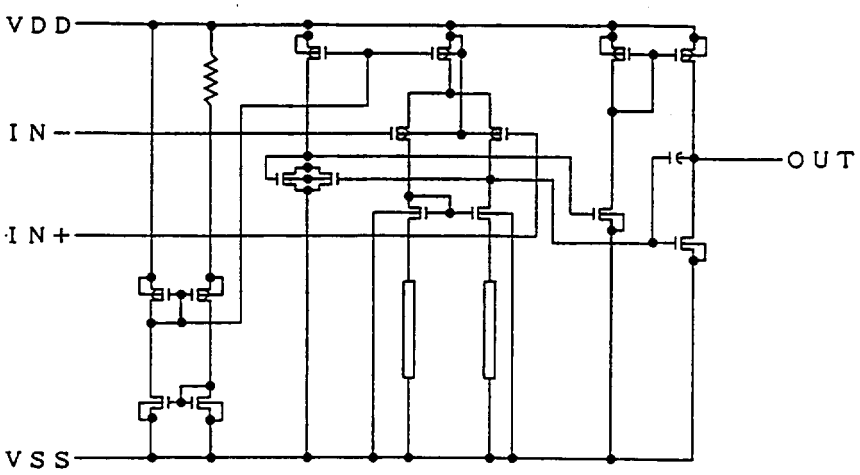

## ■ LINE-UP

($V_{DD}$=3.0V)

| | 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.) |

(Per a circuit)

■ EQUIVALENT CIRCUIT



## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25℃)

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|---|---|---|
| Supply Voltage | $V_{DD}$ | 6.5 | V |
| Differential Input Voltage | $V_{ID}$ | ±6.5 Note1 | V |
| Common Mode Input Voltage | $V_{IC}$ | - 0.3～6.5 | V |
| Power Dissipation | $P_D$ | (DIP-8) 500<br>(DSP-8) 300<br>(SSOP-8) 300<br>(VSP-8) 320 | mW |
| Operating Temperature | Topr | - 40～+ 85 | ℃ |
| Storage Temperature | Tstg | - 55～+125 | ℃ |

Note1) If the supply voltage ($V_{DD}$) is less than 6.5V, the input voltage must not over the $V_{DD}$ level though 6.5V 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℃, $V_{DD}$=3.0V, $R_L$=∞)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Input Offset Voltage | $V_{IO}$ | $V_{IN}$=1/2$V_{DD}$ | | | 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 | $A_V$ | | 60 | 70 | | dB |
| Input Common Mode Voltage Range | $V_{ICM}$ | | 0～2.5 | | | V |
| Maximum Output Swing Voltage | $V_{OM1}$ | $R_L$=1MΩ | VDD-0.1 | | | V |
| | $V_{OM2}$ | $R_L$=1MΩ | | | VSS+0.1 | |
| Common Mode Rejection Ratio | CMR | VIN=0～2.5V | 55 | 65 | | dB |
| Supply Voltage Rejection Ratio | SVR | VDD=1.5～5.5V | 60 | 70 | | dB |
| Operating Current(Per a circuit) | $I_{DD}$ | | | 15 | 25 | μA |
| Slew Rate | SR | | | 0.1 | | V/μs |
| Unity Gain Bandwidth | $F_t$ | $A_V$=40dB<br>$C_L$=10pF | | 0.2 | | MHz |

NOTE3) The source current is required less than 2.9μA. (at VDD-0.1V)

NJU7015 (Ta=25°C, $V_{DD}$=3.0V, $R_L$=∞)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Input Offset Voltage | $V_{IO}$ | $V_{IN}$=1/2$V_{DD}$ | | | 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 | $A_V$ | | 60 | 70 | | dB |
| Input Common Mode Voltage Range | $V_{ICM}$ | | 0～2.5 | | | V |
| Maximum Output Swing Voltage | $V_{OM1}$ | $R_L$=100kΩ | VDD-0.1 | | | V |
| | $V_{OM2}$ | $R_L$=100kΩ | | | VSS+0.1 | |
| Common Mode Rejection Ratio | CMR | VIN=0～2.5V | 55 | 65 | | dB |
| Supply Voltage Rejection Ratio | SVR | VDD=1.5～5.5V | 60 | 70 | | dB |
| Operating Current(Per a circuit) | $I_{DD}$ | | | 80 | 160 | μA |
| Slew Rate | SR | | | 1.0 | | V/μs |
| Unity Gain Bandwidth | $F_t$ | $A_V$=40dB<br>$C_L$=10pF | | 1.0 | | MHz |

NOTE4) The source current is required less than 29μA. (at VDD-0.1V)

NJU7016 (Ta=25°C, $V_{DD}$=3.0V, $R_L$=∞)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Input Offset Voltage | $V_{IO}$ | $V_{IN}$=1/2$V_{DD}$ | | | 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 | $A_V$ | | 60 | 70 | | dB |
| Input Common Mode Voltage Range | $V_{ICM}$ | | 0～2.5 | | | V |
| Maximum Output Swing Voltage | $V_{OM1}$ | $R_L$=50kΩ | VDD-0.1 | | | V |
| | $V_{OM2}$ | $R_L$=50kΩ | | | VSS+0.1 | |
| Common Mode Rejection Ratio | CMR | VIN=0～2.5V | 55 | 65 | | dB |
| Supply Voltage Rejection Ratio | SVR | VDD=1.5～5.5V | 60 | 70 | | dB |
| Operating Current(Per a circuit) | $I_{DD}$ | | | 200 | 400 | μA |
| Slew Rate | SR | | | 2.4 | | V/μs |
| Unity Gain Bandwidth | $F_t$ | $A_V$=40dB<br>$C_L$=10pF | | 1.0 | | MHz |

NOTE5) The source current is required less than 58μA. (at VDD-0.1V)