

# ULTRA-LOW OFFSET VOLTAGE, LOW DRIFT OPERATIONAL AMPLIFIER

## ■ GENERAL DESCRIPTION

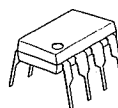
The NJM OP-07 is ultra-low input offset voltage and bias current, low drift and high gain operational amplifier with internal frequency compensation.

The NJM OP-07 is suitable for a high accurate instrumental amplifier.

## ■ FEATURES

- Ultra-Low  $V_{io}$   $60 \mu V$
- Ultra-Low  $I_b$   $1.8 nA$
- Ultra-Low Drift  
unnull  $0.5 \mu V/^\circ C$   
null  $0.4 \mu V/^\circ C$
- Ultra-Stable  $0.4 \mu V/M_o$
- Wide Operating Voltage  $\pm 3V \sim \pm 22V$
- Package Outline DIP8, DMP8
- Bipolar Technology

## ■ PACKAGE OUTLINE

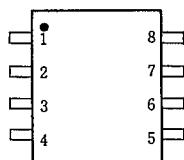


NJMOP-07D



NJMOP-07M

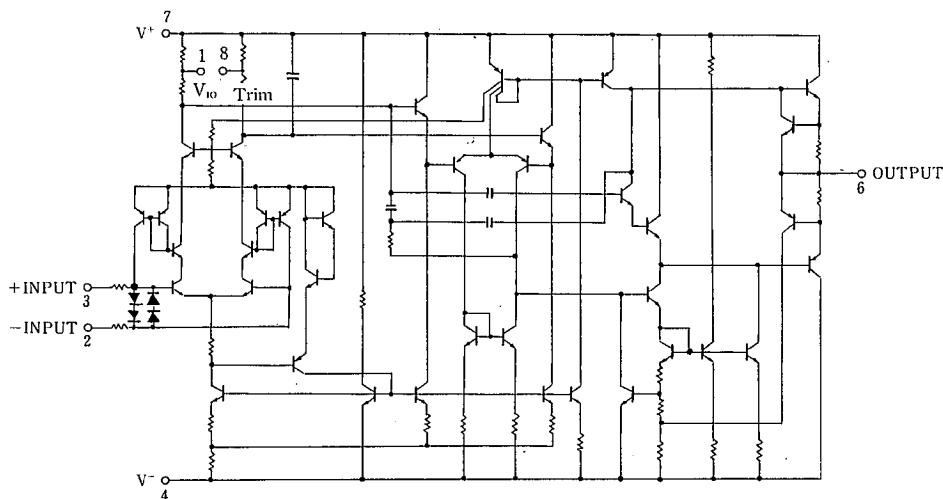
## ■ PIN CONFIGURATION

NJMOP-07D  
NJMOP-07M

### PIN FUNCTION

1.  $V_{io}$  Trim
2. -INPUT
3. +INPUT
4.  $V^-$
5. NC
6. OUTPUT
7.  $V^+$
8.  $V_{io}$  Trim

## ■ EQUIVALENT CIRCUIT



## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

| PARAMETER                   | SYMBOL                         | RATINGS     | UNIT |
|-----------------------------|--------------------------------|-------------|------|
| Supply Voltage              | V <sup>+</sup> /V <sup>-</sup> | ±22         | V    |
| Input Voltage               | V <sub>I</sub>                 | ±22(note 1) | V    |
| Differential Input Voltage  | V <sub>ID</sub>                | ±30         | V    |
| Power Dissipation           | P <sub>D</sub>                 | (DIP8) 500  | mW   |
|                             |                                | (DMP8) 300  | mW   |
| Storage Temperature Range   | T <sub>stg</sub>               | -40~+125    | °C   |
| Operating Temperature Range | T <sub>opr</sub>               | -40~+85     | °C   |
| Output Current              |                                | continuous  |      |

(note) For supply voltage less than ±22V, the absolute maximum input voltage is equal to the supply voltage.

## ■ ELECTRICAL CHARACTERISTICS

(Ta=+25°C, V<sup>+</sup>/V<sup>-</sup>=±15V)

| PARAMETER                        | SYMBOL           | TEST CONDITION                                                                   | MIN.  | TYP.  | MAX. | UNIT              |
|----------------------------------|------------------|----------------------------------------------------------------------------------|-------|-------|------|-------------------|
| Input Offset Voltage             | V <sub>IO</sub>  |                                                                                  | —     | 60    | 150  | μV                |
| Long Term Stability              |                  | (note 1,2)                                                                       | —     | 0.4   | 2    | μV/Mo             |
| Input Offset Current             | I <sub>IO</sub>  |                                                                                  | —     | 0.8   | 6    | nA                |
| Input Bias Current               | I <sub>B</sub>   |                                                                                  | —     | ±1.8  | ±7   | nA                |
| Open Loop Output Resistance      | R <sub>O</sub>   | V <sub>O</sub> =0, I <sub>O</sub> =0                                             | —     | 60    | —    | Ω                 |
| Input Resistance                 | R <sub>ID</sub>  | (Differential Mode)                                                              | 8     | 33    | —    | MΩ                |
| Input Resistance                 | R <sub>IC</sub>  | (Common Mode)                                                                    | —     | 120   | —    | GΩ                |
| Input Common Mode Voltage Range  | V <sub>ICM</sub> |                                                                                  | ±13   | ±14   | —    | V                 |
| Common Mode Rejection Ratio      | CMR              | V <sub>CM</sub> =±13V                                                            | 100   | 120   | —    | dB                |
| Supply Voltage Rejection Ratio   | SVR              | V <sup>+</sup> /V <sup>-</sup> =±3V~±18V                                         | 90    | 104   | —    | dB                |
| Large Signal Voltage Gain 1      | AV <sub>1</sub>  | R <sub>L</sub> ≥2kΩ, V <sub>O</sub> =±10V                                        | 101.5 | 112.0 | —    | dB                |
| Large Signal Voltage Gain 2      | AV <sub>2</sub>  | R <sub>L</sub> =500Ω, V <sub>O</sub> =±0.5V, V <sup>+</sup> /V <sup>-</sup> =±3V | 100.0 | 112.0 | —    | dB                |
| Maximum Output Voltage 1         | V <sub>OM1</sub> | R <sub>L</sub> ≥10kΩ                                                             | ±12   | ±13   | —    | V                 |
| Maximum Output Voltage 2         | V <sub>OM2</sub> | R <sub>L</sub> >2kΩ                                                              | ±11.5 | ±12.8 | —    | V                 |
| Maximum Output Voltage 3         | V <sub>OM3</sub> | R <sub>L</sub> >1kΩ                                                              | —     | ±12   | —    | V                 |
| Slew Rate                        | SR               | R <sub>L</sub> ≥2kΩ                                                              | —     | 0.17  | —    | V/μS              |
| Unity Gain Bandwidth             | f <sub>T</sub>   | A <sub>VCL</sub> =1                                                              | —     | 0.5   | —    | MHz               |
| Operating Current 1              | I <sub>CC1</sub> | V <sup>+</sup> /V <sup>-</sup> =±15V                                             | —     | 2.7   | 5.0  | mA                |
| Operating Current 2              | I <sub>CC2</sub> | V <sup>+</sup> /V <sup>-</sup> =±3V                                              | —     | 0.67  | 1.3  | mA                |
| Offset Adjustment Range          |                  | R <sub>P</sub> =20kΩ                                                             | —     | ±4    | —    | mV                |
| Equivalent Input Noise Voltage   | V <sub>NI</sub>  | 0.1Hz~10Hz (note 2)                                                              | —     | 0.38  | 0.65 | μV <sub>p-p</sub> |
| Equivalent Input Noise Voltage 1 | e <sub>n1</sub>  | f <sub>O</sub> =10Hz (note 2)                                                    | —     | 10.5  | 20   | nV/√Hz            |
| Equivalent Input Noise Voltage 2 | e <sub>n2</sub>  | f <sub>O</sub> =100Hz (note 2)                                                   | —     | 10.2  | 13.5 | nV/√Hz            |
| Equivalent Input Noise Voltage 3 | e <sub>n3</sub>  | f <sub>O</sub> =1kHz (note 2)                                                    | —     | 9.8   | 11.5 | nV/√Hz            |
| Equivalent Input Noise Current   | I <sub>NI</sub>  | 0.1Hz~10Hz (note 2)                                                              | —     | 15    | 35   | pA <sub>p-p</sub> |
| Equivalent Input Noise Current 1 | i <sub>n1</sub>  | f <sub>O</sub> =10Hz (note 2)                                                    | —     | 0.35  | 0.9  | pA/√Hz            |
| Equivalent Input Noise Current 2 | i <sub>n2</sub>  | f <sub>O</sub> =100Hz (note 2)                                                   | —     | 0.15  | 0.27 | pA/√Hz            |
| Equivalent Input Noise Current 3 | i <sub>n3</sub>  | f <sub>O</sub> =1kHz (note 2)                                                    | —     | 0.13  | 0.18 | pA/√Hz            |

■ ELECTRICAL CHARACTERISTICS

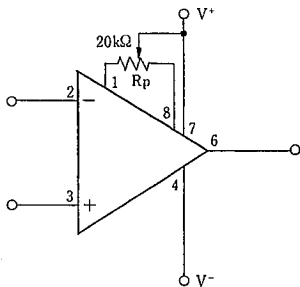
(0℃≦Ta≦70℃, V<sup>+</sup>/V<sup>-</sup>=±15V)

| PARAMETER                              | SYMBOL           | TEST CONDITION                            | MIN. | TYP.  | MAX. | UNIT  |
|----------------------------------------|------------------|-------------------------------------------|------|-------|------|-------|
| Input Offset Voltage                   | V <sub>IO</sub>  |                                           | —    | 85    | 250  | μV    |
| Average V <sub>IO</sub> Drift (unnull) |                  |                                           | —    | 0.5   | 1.8  | μV/°C |
| Average V <sub>IO</sub> Drift (null)   |                  | R <sub>P</sub> =20kΩ                      | —    | 0.4   | 1.6  | μV/°C |
| Input Offset Current                   | I <sub>IO</sub>  |                                           | —    | 1.6   | 8    | nA    |
| Average I <sub>IO</sub> Drift          |                  |                                           | —    | 12    | 50   | pA/°C |
| Input Bias Current                     | I <sub>IB</sub>  |                                           | —    | ±2.2  | ±9   | nA    |
| Average I <sub>IB</sub> Drift          |                  |                                           | —    | 18    | 50   | pA/°C |
| Input Common Mode Voltage Range        | V <sub>ICM</sub> |                                           | ±13  | ±13.5 | —    | V     |
| Common Mode Rejection Ratio            | CMR              | V <sub>CM</sub> =±13V                     | 97   | 120   | —    | dB    |
| Supply Voltage Rejection Ratio         | SVR              | V <sup>+</sup> /V <sup>-</sup> =±3V~±8V   | 86   | 120   | —    | dB    |
| Voltage Gain                           | A <sub>V</sub>   | R <sub>L</sub> ≧2kΩ, V <sub>O</sub> =±10V | 100  | 400   | —    | V/mV  |
| Maximum Output Voltage                 | V <sub>OM</sub>  | R <sub>L</sub> ≧2kΩ                       | ±11  | ±12.6 | —    | V     |

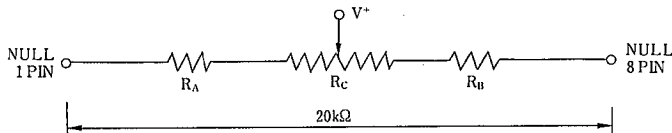
(note 1) Long Term Stability refers to the average trend line of V<sub>IO</sub> vs. time over extended periods after the first 30 days of operation.

(note 2) According to the evaluation by NJRC, more than 90% of all these products can be guaranteed.

■ OFFSET ADJUSTMENT METHOD



For making low sensitivity of change in the input offset voltage against resistance regulation of potentiometer (Easy case of offset adjustment)

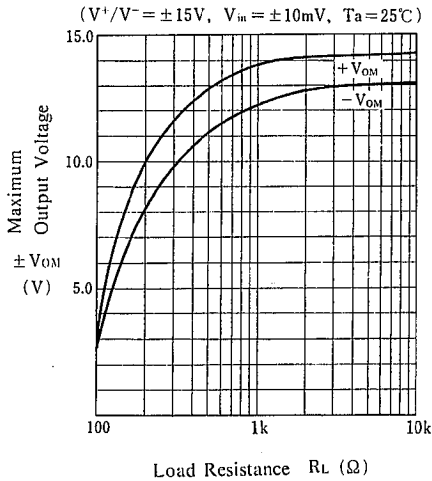


※R<sub>A</sub>, R<sub>B</sub> Fixed 7.5kΩ, R<sub>C</sub> adjustable 5.0kΩ

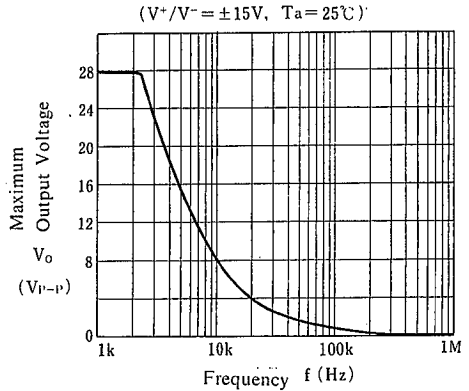
※R<sub>A</sub>, R<sub>B</sub>, R<sub>C</sub> are metalfilm resistors, R<sub>C</sub> is more than 10 times winding.

## TYPICAL CHARACTERISTICS

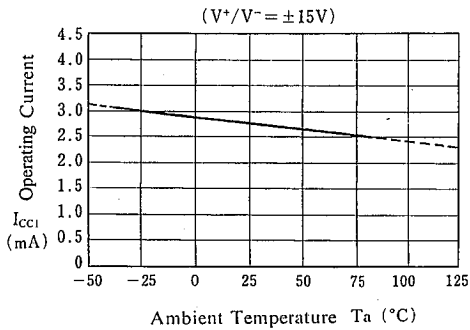
**Maximum Output Voltage vs. Load Resistance**



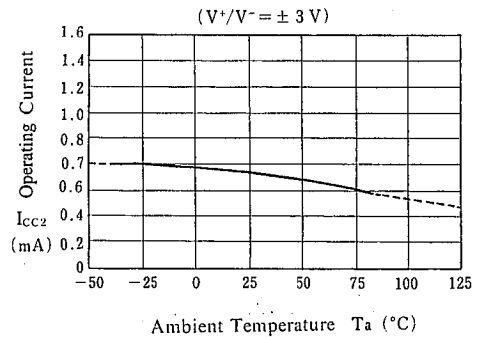
**Maximum Output Voltage Swing vs. Frequency**



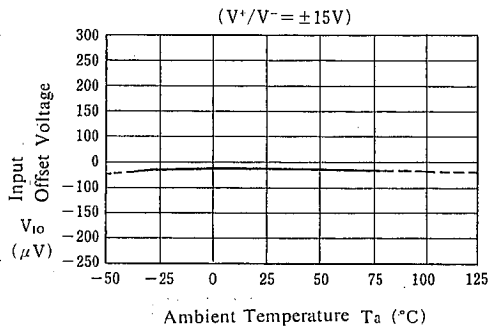
**Operating Current vs. Temperature**



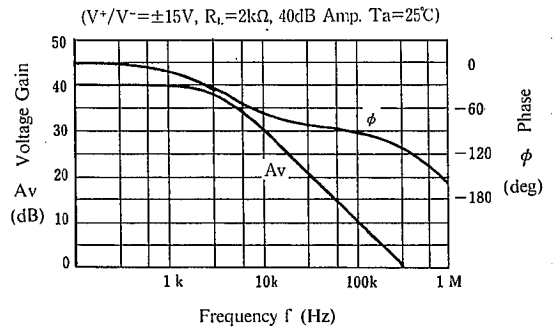
**Operating current vs. Temperature**



**Input Offset Voltage vs. Temperature**

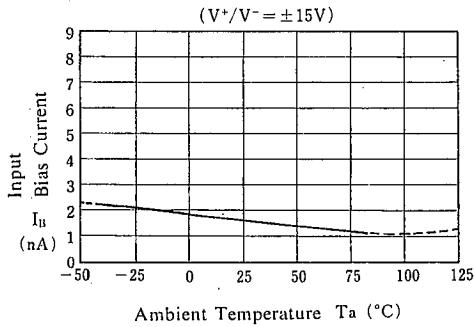


**Voltage Gain, Phase vs. Frequency**

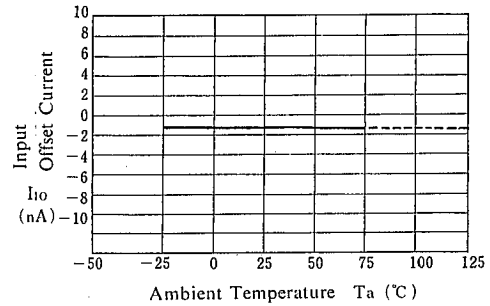


■ TYPICAL CHARACTERISTICS

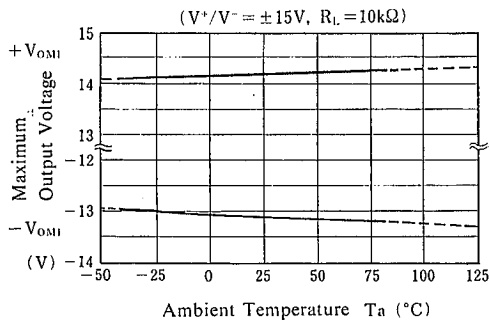
Input Bias Current vs. Temperature



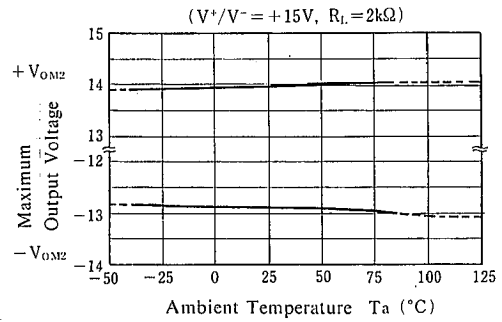
Input Offset Current vs. Temperature



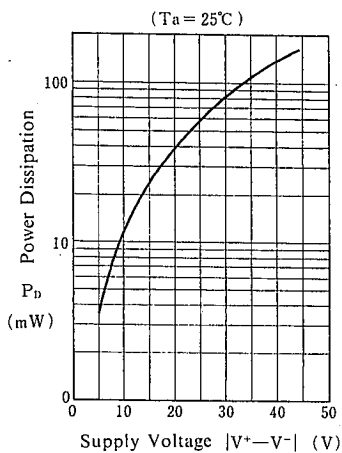
Maximum Output Voltage vs. Temperature



Maximum Output Voltage vs. Temperature



Power Dissipation vs. Supply Voltage



## MEMO

**[CAUTION]**

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