

## LOW OFFSET VOLTAGE, LOW DRIFT OPERATIONAL AMPLIFIER

### ■ GENERAL DESCRIPTION

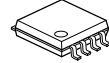
The NJM OP-07 is ultra-low input offset voltage and bias current, low drift and high gain operational amplifier with internal frequency compensation.

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

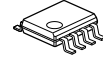
### ■ PACKAGE OUTLINE



NJMOP-07D



NJMOP-07M

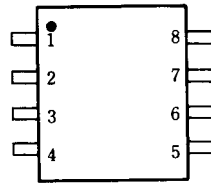


NJMOP-07E

### ■ FEATURES

- Low  $V_{IO}$  (60 $\mu$ V typ.)
- Low  $I_B$  (1.8nA typ.)
- Low Drift (unnull 0.5 $\mu$ V/ $^{\circ}$ C typ.)  
(null 0.4 $\mu$ V/ $^{\circ}$ C typ.)  
(0.4 $\mu$ V/ $M_o$  typ.)
- Wide Operating Voltage ( $\pm$ 3V~ $\pm$ 22V)
- Package Outline DIP8, DMP8, SOP8 JEDEC 150mil
- Bipolar Technology

### ■ PIN CONFIGURATION



NJMOP-07D

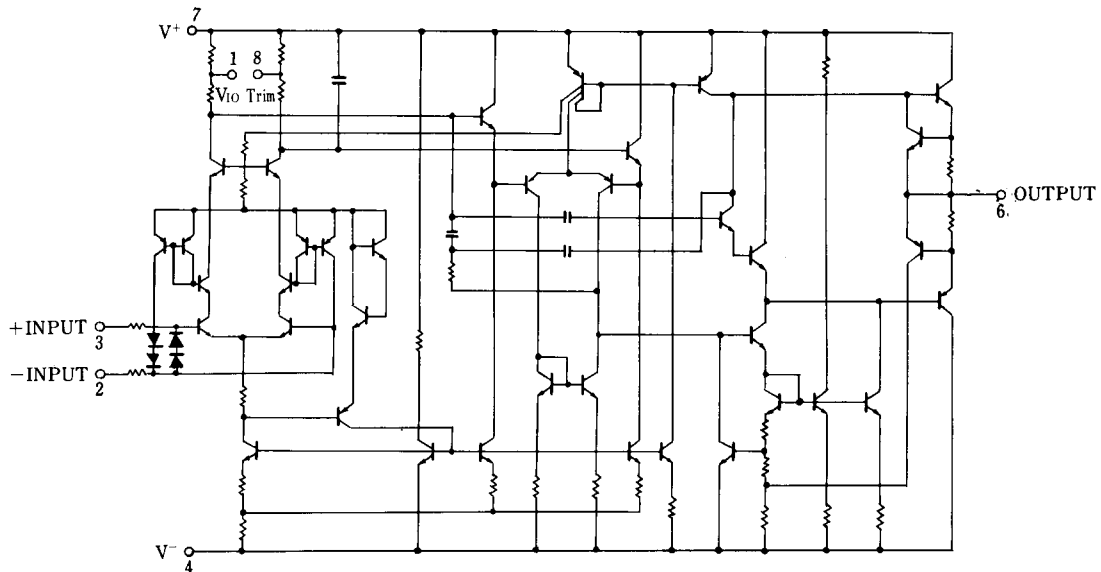
NJMOP-07M

NJMOP-07E

#### PIN FUNCTION

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

### ■ EQUIVALENT CIRCUIT



# NJMOP-07

## ■ ABSOLUTE MAXIMUM RATINGS

( Ta=25°C )

| PARAMETER                   | SYMBOL      | RATINGS  | UNIT |
|-----------------------------|-------------|--|------|
| Supply Voltage              | $V^+ / V^-$ | $\pm 22$   | V    |
| Input Voltage               | $V_1$       | $\pm 22$ ( note1 )   | V    |
| Differential Input Voltage  | $V_{ID}$    | $\pm 30$   | V    |
| Power Dissipation           | $P_D$       | ( DIP8 ) 500( note2 )<br>( DMP8 ) 300( note2 ) / 430( note3 )<br>( SOP8 ) 300 ( note2 ) / 640( note3 ) | mW   |
| Storage Temperature Range   | $T_{stg}$   | -40~+125   | °C   |
| Operating Temperature Range | $T_{opr}$   | -40~+85  | °C   |
| Output Current              |             | continuous   |      |

( note1 ) For supply voltage less than  $\pm 22V$ , the absolute maximum input voltage is equal to the supply voltage.

( note2 ) Device itself.

( note3 ) Mounted on the EIA/JEDEC standard board (76.2×114.3×1.6mm, two layer, FR-4).

## ■ ELECTRICAL CHARACTERISTICS

( Ta=+25°C,  $V^+ / V^- = \pm 15V$  )

| PARAMETER                        | SYMBOL    | TEST CONDITION  | MIN.       | TYP.       | MAX.    | UNIT            |
|----------------------------------|-----------|---|------------|------------|---------|-----------------|
| Input Offset Voltage             | $V_{IO}$  |   | -          | 60         | 150     | $\mu V$         |
| Long Term Stability              |           | ( note4,5 )   | -          | 0.4        | 2       | $\mu V / M_0$   |
| Input Offset Current             | $I_{IO}$  |   | -          | 0.8        | 6       | nA              |
| Input Bias Current               | $I_B$     |   | -          | $\pm 1.8$  | $\pm 7$ | nA              |
| Open Loop Output Resistance      | $R_O$     | $V_O=0, I_O=0$  | -          | 60         | -       | $\Omega$        |
| Input Resistance                 | $R_{ID}$  | ( Differential Mode )                                 | 8          | 33         | -       | M $\Omega$      |
| Input Resistance                 | $R_{IC}$  | ( Common Mode )                                       | -          | 120        | -       | G $\Omega$      |
| Input Common Mode Voltage Range  | $V_{ICM}$ |   | $\pm 13$   | $\pm 14$   | -       | V               |
| Common Mode Rejection Ratio      | CMR       | $V_{CM} = \pm 13V$                                    | 100        | 120        | -       | dB              |
| Supply Voltage Rejection Ratio   | SVR       | $V^+ / V^- = \pm 3V \sim \pm 18V$                     | 90         | 104        | -       | dB              |
| Large Signal Voltage Gain 1      | $AV_1$    | $R_L \geq 2k\Omega, V_O = \pm 10V$                    | 101.5      | 112.0      | -       | dB              |
| Large Signal Voltage Gain 2      | $AV_2$    | $R_L = 500\Omega, V_O = \pm 0.5V, V^+ / V^- = \pm 3V$ | 100.0      | 112.0      | -       | dB              |
| Maximum Output Voltage 1         | $V_{OM1}$ | $R_L \geq 10k\Omega$                                  | $\pm 12$   | $\pm 13$   | -       | V               |
| Maximum Output Voltage 2         | $V_{OM2}$ | $R_L > 2k\Omega$                                      | $\pm 11.5$ | $\pm 12.8$ | -       | V               |
| Maximum Output Voltage 3         | $V_{OM3}$ | $R_L > 1k\Omega$                                      | -          | $\pm 12$   | -       | V               |
| Slew Rate                        | SR        | $R_L \geq 2k\Omega$                                   | -          | 0.17       | -       | V/ $\mu S$      |
| Unity Gain Bandwidth             | $f_T$     | $A_{VCL} = 1$   | -          | 0.5        | -       | MHz             |
| Operating Current 1              | $I_{CC1}$ | $V^+ / V^- = \pm 15V$                                 | -          | 2.7        | 5.0     | mA              |
| Operating Current 2              | $I_{CC2}$ | $V^+ / V^- = \pm 3V$                                  | -          | 0.67       | 1.3     | mA              |
| Offset Adjustment Range          |           | $R_P = 20k\Omega$                                     | -          | $\pm 4$    | -       | mV              |
| Equivalent Input Noise Voltage   | $V_{NI}$  | 0.1Hz~10Hz ( note5 )                                  | -          | 0.38       | 0.65    | $\mu V_{P-P}$   |
| Equivalent Input Noise Voltage 1 | $e_{n1}$  | $f_0 = 10Hz$ ( note5 )                                | -          | 10.5       | 20      | nV/ $\sqrt{Hz}$ |
| Equivalent Input Noise Voltage 2 | $e_{n2}$  | $f_0 = 100Hz$ ( note5 )                               | -          | 10.2       | 13.5    | nV/ $\sqrt{Hz}$ |
| Equivalent Input Noise Voltage 3 | $e_{n3}$  | $f_0 = 1kHz$ ( note5 )                                | -          | 9.8        | 11.5    | nV/ $\sqrt{Hz}$ |
| Equivalent Input Noise Current   | $I_{NI}$  | 0.1Hz~10Hz ( note5 )                                  | -          | 15         | 35      | pA $\sqrt{Hz}$  |
| Equivalent Input Noise Current 1 | $i_{n1}$  | $f_0 = 10Hz$ ( note5 )                                | -          | 0.35       | 0.9     | pA/ $\sqrt{Hz}$ |
| Equivalent Input Noise Current 2 | $i_{n2}$  | $f_0 = 100Hz$ ( note5 )                               | -          | 0.15       | 0.27    | pA/ $\sqrt{Hz}$ |
| Equivalent Input Noise Current 3 | $i_{n3}$  | $f_0 = 1kHz$ ( note5 )                                | -          | 0.13       | 0.18    | pA/ $\sqrt{Hz}$ |

## ■ ELECTRICAL CHARACTERISTICS

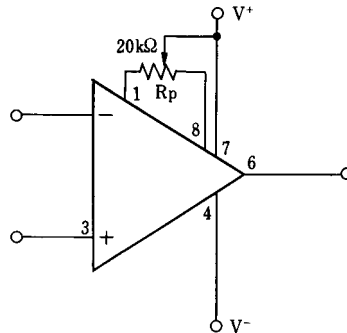
(  $0^{\circ}\text{C} \leq T_a \leq 70^{\circ}\text{C}, V^+ / V^- = \pm 15\text{V}$  )

| PARAMETER                         | SYMBOL    | TEST CONDITION                                   | MIN.     | TYP.       | MAX.    | UNIT                           |
|-----------------------------------|-----------|--|----------|------------|---------|--------------------------------|
| Input Offset Voltage              | $V_{IO}$  |  | -        | 85         | 250     | $\mu\text{V}$                  |
| Average $V_{IO}$ Drift ( unnull ) |           | ( note5 )  | -        | 0.5        | 1.8     | $\mu\text{V}/^{\circ}\text{C}$ |
| Average $V_{IO}$ Drift ( null )   |           | $R_p = 20\text{k}\Omega$ , ( note5 )             | -        | 0.4        | 1.6     | $\mu\text{V}/^{\circ}\text{C}$ |
| Input Offset Current              | $I_{IO}$  |  | -        | 1.6        | 8       | nA                             |
| Average $I_{IO}$ Drift            |           | ( note5 )  | -        | 12         | 50      | $\text{pA}/^{\circ}\text{C}$   |
| Input Bias Current                | $I_{IB}$  |  | -        | $\pm 2.2$  | $\pm 9$ | nA                             |
| Average $I_{IB}$ Drift            |           | ( note5 )  | -        | 18         | 50      | $\text{pA}/^{\circ}\text{C}$   |
| Input Common Mode Voltage Range   | $V_{ICM}$ |  | $\pm 13$ | $\pm 13.5$ | -       | V                              |
| Common Mode Rejection Ratio       | CMR       | $V_{CM} = \pm 13\text{V}$                        | 97       | 120        | -       | dB                             |
| Supply Voltage Rejection Ratio    | SVR       | $V^+ / V^- = \pm 3\text{V} \sim \pm 18\text{V}$  | 86       | 120        | -       | dB                             |
| Voltage Gain                      | $A_V$     | $R_L \geq 2\text{k}\Omega, V_O = \pm 10\text{V}$ | 100      | 400        | -       | V/mV                           |
| Maximum Output Voltage            | $V_{OM}$  | $R_L \geq 2\text{k}\Omega$                       | $\pm 11$ | $\pm 12.6$ | -       | V                              |

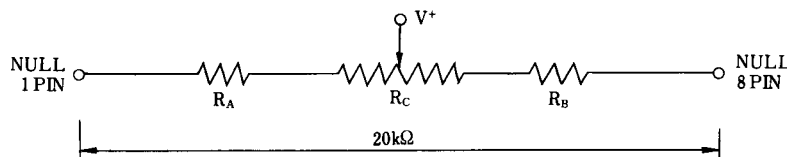
( note 4 ) Long Term Stability refers to the average trend line of  $V_{IO}$  vs. time over extended periods after the first 30 days of operation.

( note 5 ) According to the evaluation by NJRC, more than 90% of all these products can be guaranteed.

## ■ OFFSET ADJUSTMENT METHOD



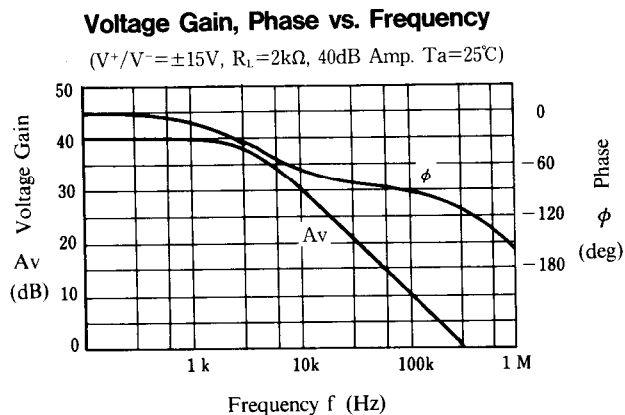
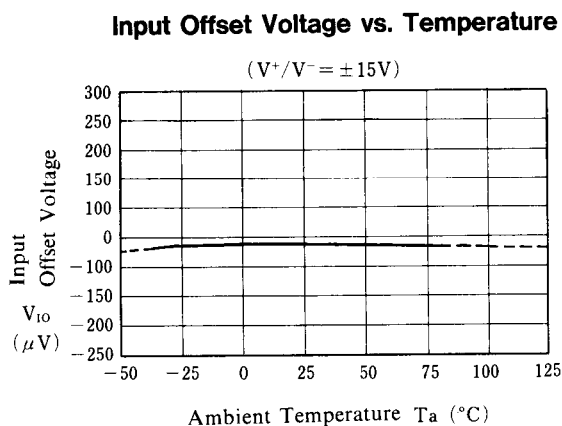
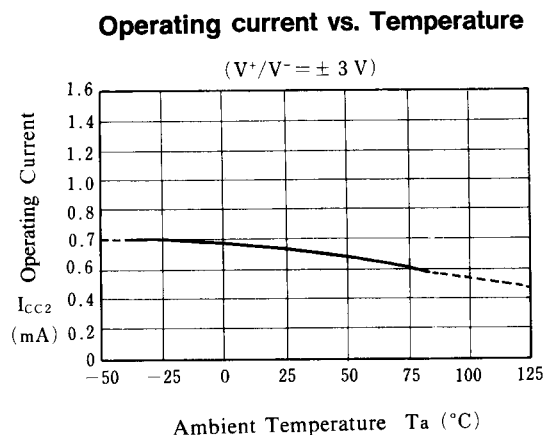
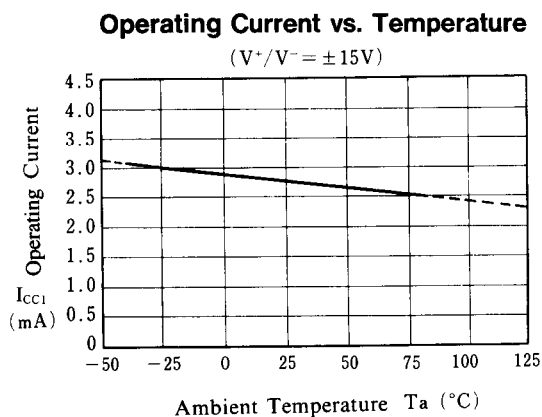
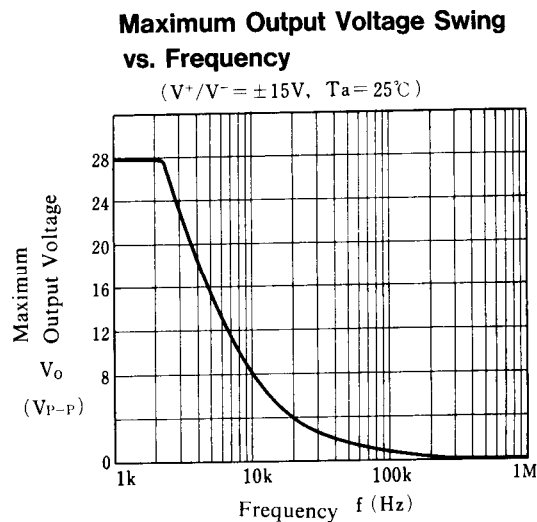
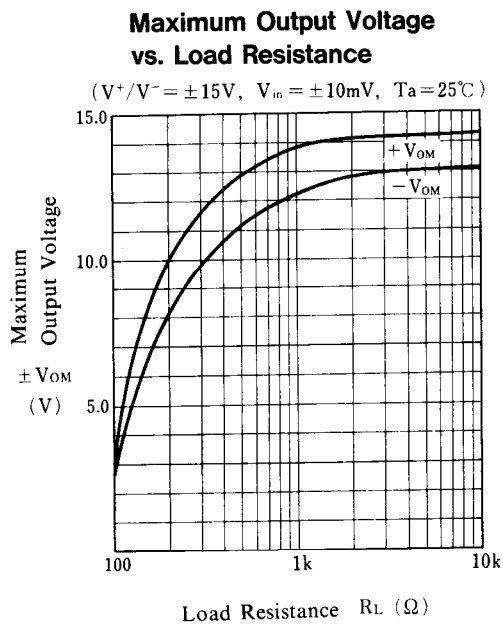
For making low sensitivity of change in the input offset voltage against resistance regulation of potentiometer  
( Easy case of offset adjustment )



\*  $R_A, R_B$  Fixed  $7.5\text{k}\Omega, R_C$  adjustable  $5.0\text{k}\Omega$

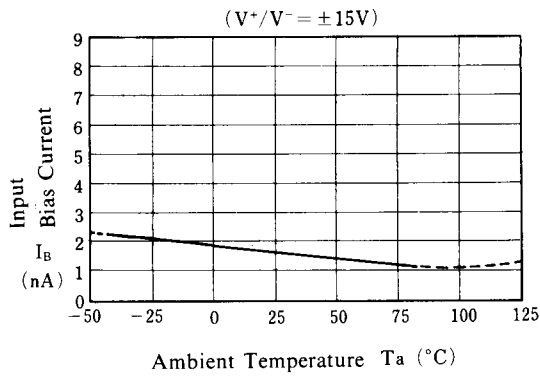
\*  $R_A, R_B, R_C$  are metalfilm resistors,  $R_C$  is more than 10 times winding.

## ■ TYPICAL CHARACTERISTICS

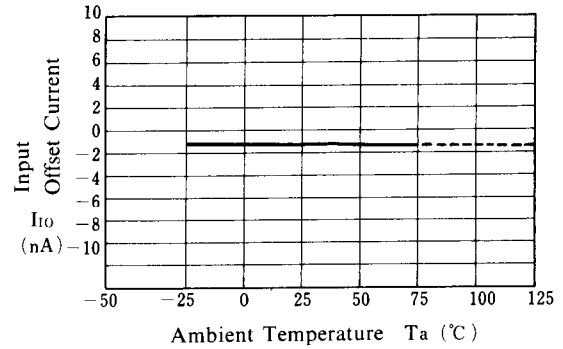


## ■ TYPICAL CHARACTERISTICS

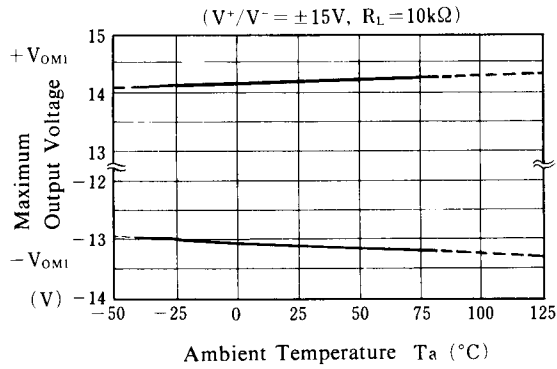
### Input Bias Current vs. Temperature



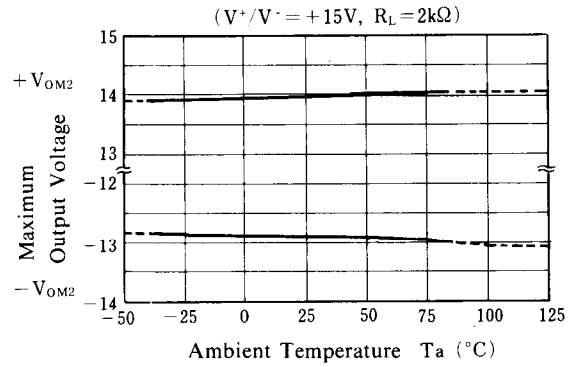
### Input Offset Current vs. Temperature



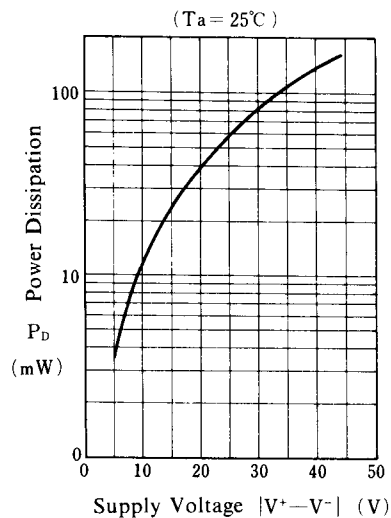
### Maximum Output Voltage vs. Temperature



### Maximum Output Voltage vs. Temperature



### Power Dissipation vs. Supply Voltage



**[CAUTION]**

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