

## LOW OFFSET VOLTAGE, LOW DRIFT OPERATIONAL AMPLIFIER

### ■ GENERAL DESCRIPTION

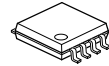
The NJM OP-07 is ultra-low input offset voltage and bias current, low drift and high gain operational amplifier with internal frequency compensation.

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

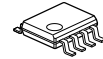
### ■ PACKAGE OUTLINE



NJMOP-07D



NJMOP-07M

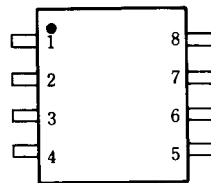


NJMOP-07E

### ■ 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 $\sim$  $\pm$ 22V)
- Package Outline DIP8, DMP8, SOP8 JEDEC 150mil
- Bipolar Technology

### ■ PIN CONFIGURATION



NJMOP-07D

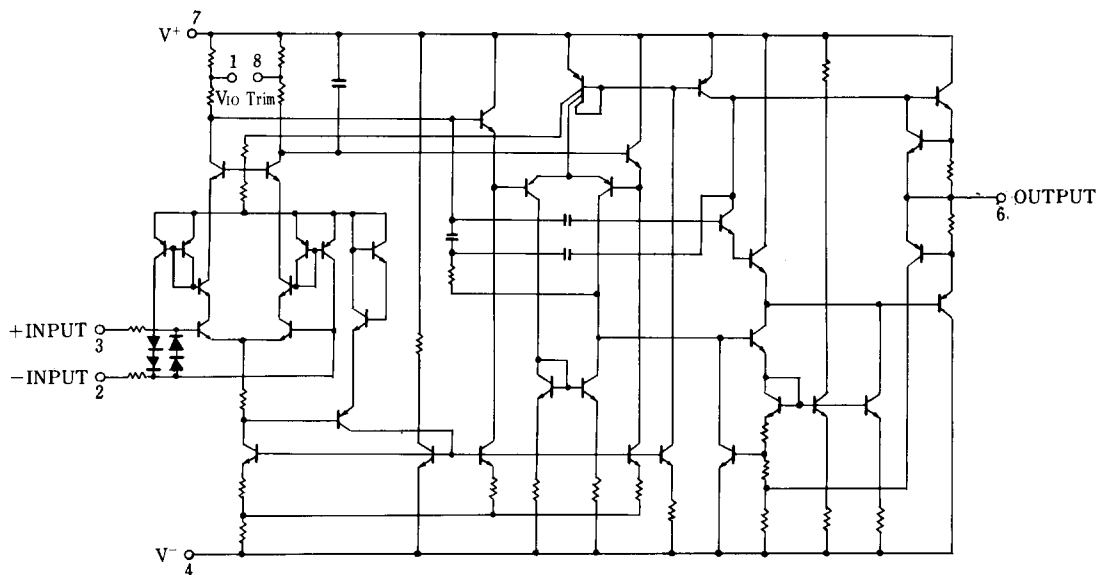
NJMOP-07M

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 ) ( DMP8 ) 300( note2 ) / 430( note3 ) ( 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

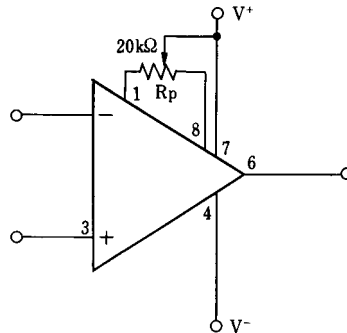
(  $0^{\circ}\text{C} \leq T_a \leq 70^{\circ}\text{C}, V^+ / V^- = \pm 15\text{V}$  )

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

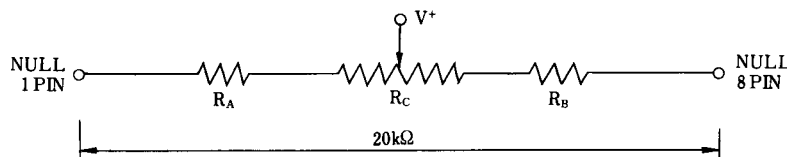
( note 4 ) Long Term Stability refers to the average trend line of  $V_{IO}$  vs. time over extended periods after the first 30 days of operation.

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

## ■ OFFSET ADJUSTMENT METHOD



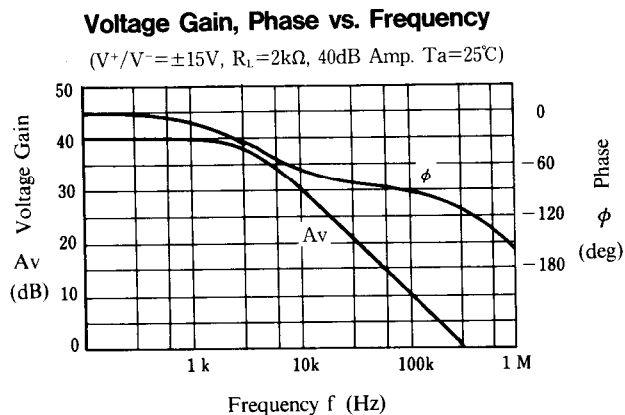
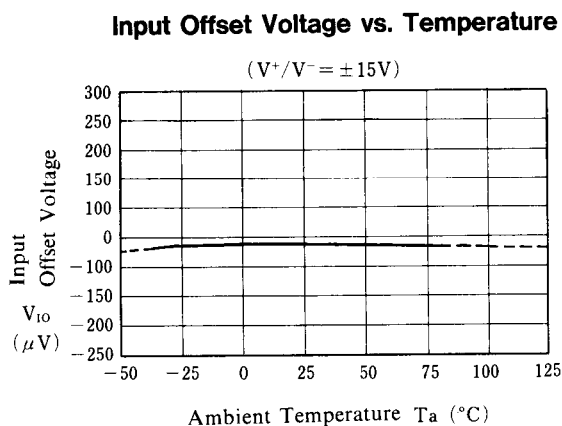
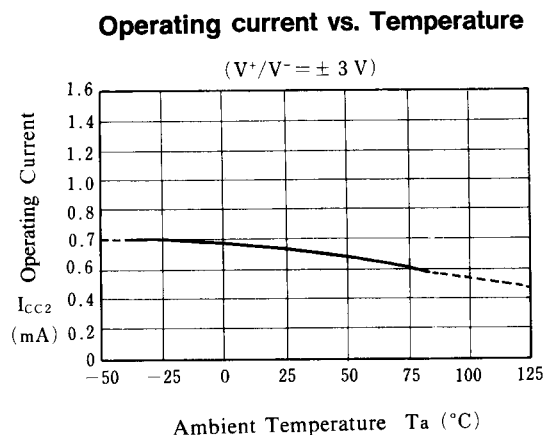
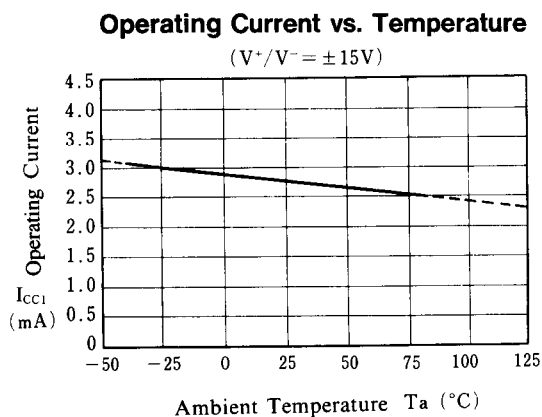
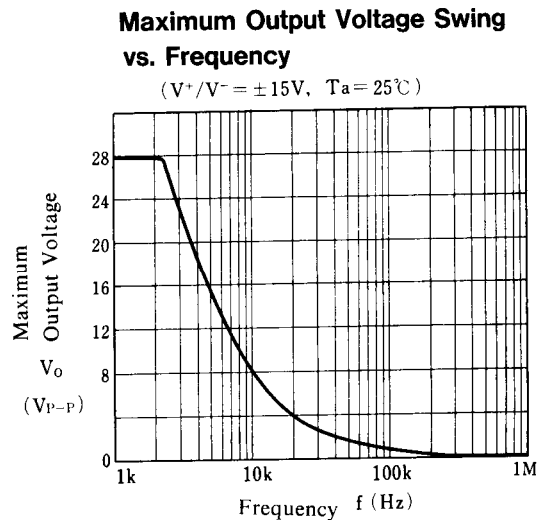
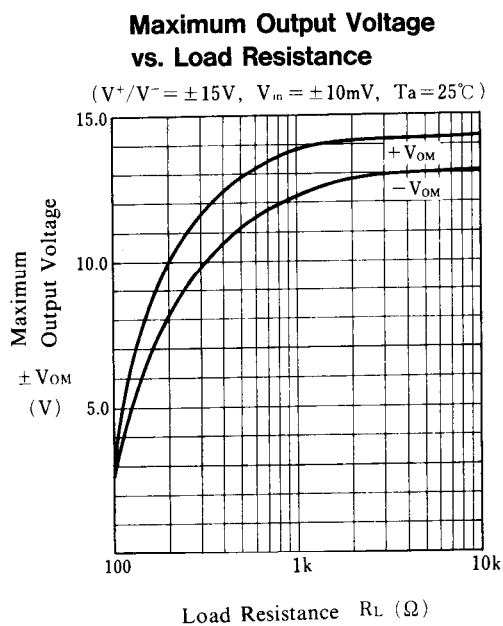
For making low sensitivity of change in the input offset voltage against resistance regulation of potentiometer  
( Easy case of offset adjustment )



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

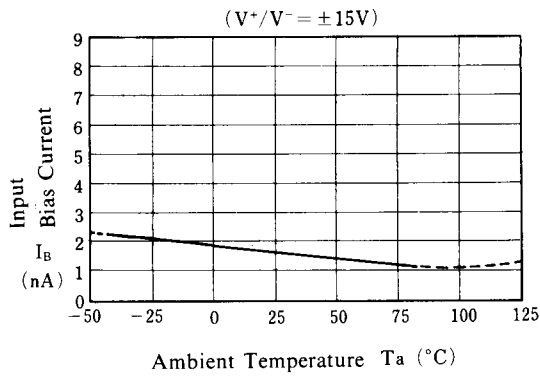
\*  $R_A, R_B, R_C$  are metalfilm resistors,  $R_C$  is more than 10 times winding.

## ■ TYPICAL CHARACTERISTICS

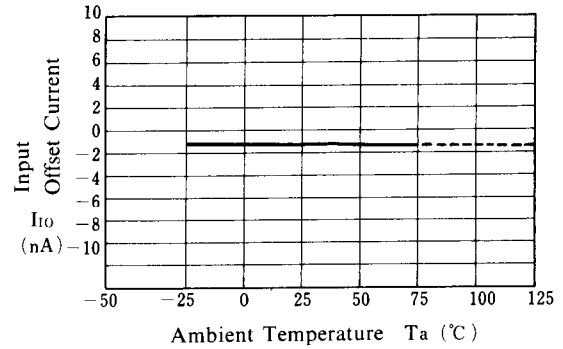


## ■ TYPICAL CHARACTERISTICS

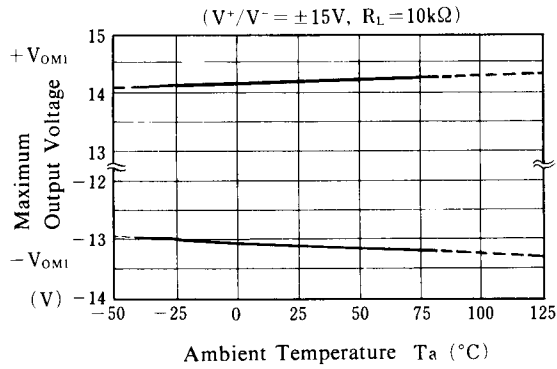
**Input Bias Current vs. Temperature**



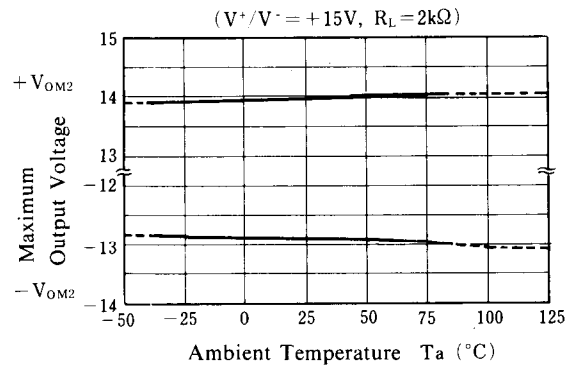
**Input Offset Current vs. Temperature**



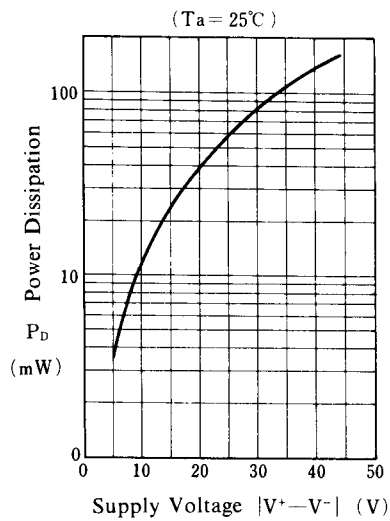
**Maximum Output Voltage vs. Temperature**



**Maximum Output Voltage vs. Temperature**



**Power Dissipation vs. Supply Voltage**



**[CAUTION]**

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