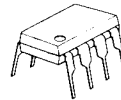# μ-POWER OPERATIONAL AMPLIFIER

## NJM4250

The NJM4250 is extremely versatile programmable monolithic operational amplifiers. A single external master bias current setting resistor programs the input bias current, input offset current, quiescent power consumption, slew rate, input noise, and the gain-bandwidth product. The device is a truly general purpose operational amplifier.

### ■ Package Outline

NJM4250D    NJM4250M

NJM4250E

### ■ Absolute Maximum Ratings (Ta=25°C)

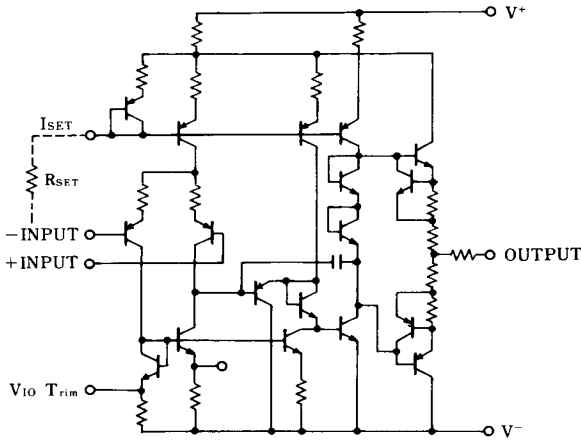| Parameter | Symbol | Value |
|---|---|---|
| Supply Voltage | $V^+/V^-$ | $\pm18V$ |
| Differential Input Voltage | $V_{ID}$ | $\pm30V$ |
| Input Voltage(note) | $V_{IC}$ | $\pm15V$ |
| Power Dissipation | $P_D$(D-Type) | 500mW |
|  | (M,E-Type) | 300mW |
| Set Current | $I_{SET}$ | 150μA |
| Operating Temperature Range | $T_{opr}$ | $-20\sim+75°C$ |
| Storage Temperature Range | $T_{stg}$ | $-40\sim+125°C$ |

(note)  For supply voltage less than $\pm15V$, the absolute maximum input voltage is equal to the supply voltage.

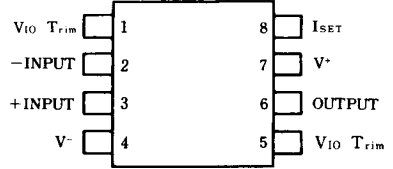### ■ Electrical Characteristics (Ta=25°C , V⁺/V⁻ = ± 15V)

| Parameter | Symbol | Test Condition | $I_{SET}=1\mu A$ Min. | $I_{SET}=1\mu A$ Max. | $I_{SET}=10\mu A$ Min. | $I_{SET}=10\mu A$ Max. | Unit |
|---|---|---|---|---|---|---|---|
| Input Offset Voltage 1 | $V_{IO}$ 1 | $R_S\leq100k\Omega$ | — | 5 | — | 6 | mV |
| Input Offset Voltage 2 | $V_{IO}$ 2 | $V^+/V^- = \pm1.5V, R_S\leq100k\Omega$ | — | 5 | — | 6 | mV |
| Input Offset Current | $I_{IO}$ |  | — | 6 | — | 20 | nA |
| Input Bias Current 1 | $I_B$ 1 |  | — | 10 | — | 75 | nA |
| Input Bias Current 2 | $I_B$ 2 | $V^+/V^- = \pm1.5V$ | — | 10 | — | 75 | nA |
| Large Signal Voltage Gain 1 | Av 1 | $V_o=\pm10V, R_I\geq100k\Omega$ | 96 | — | — | — | dB |
| Large Signal Voltage Gain 2 | Av 2 | $V_o=\pm10V, R_L\geq10k\Omega$ | — | — | 96 | — | dB |
| Supply Current 1 | $I_{CC}$ 1 |  | — | 11 | — | 100 | μA |
| Supply Current 2 | $I_{CC}$ 2 | $V^+/V^- = \pm1.5V$ | — | 8 | — | 90 | μA |
| Input Common Mode Voltage Range 1 | $V_{ICM}$ 1 |  | $\pm13.5$ | — | $\pm13.5$ | — | V |
| Input Common Mode Voltage Range 2 | $V_{ICM}$ 2 | $V^+/V^- = \pm1.5V$ | $\pm0.6$ | — | $\pm0.6$ | — | V |
| Maximum Output Voltage Swing 1 | $V_{OM}$ 1 | $R_1\geq100k\Omega$ | $\pm12$ | — | — | — | V |
| Maximum Output Voltage Swing 2 | $V_{OM}$ 2 | $V^+/V^- = \pm1.5V, R_L\geq100k\Omega$ | $\pm0.6$ | — | — | — | V |
| Maximum Output Voltage Swing 3 | $V_{OM}$ 3 | $R_L\geq10k\Omega$ | — | — | $\pm12$ | — | V |
| Maximum Output Voltage Swing 4 | $V_{OM}$ 4 | $V^+/V^- = \pm1.5V, R_L\geq10k\Omega$ | — | — | $\pm0.6$ | — | V |
| Common Mode Rejection Ratio | CMR | $R_S\leq10k\Omega$ | 70 | — | 70 | — | dB |
| Supply Voltage Rejection Ratio | SVR | $R_S\leq10k\Omega$ | 74 | — | 74 | — | dB |

# NJM4250

■ **Equivalent Circuit**



■ **Connection Diagram**

(D,M,E-Type)
(Top View)

| | | |
|---|---|---|
| $V_{IO}$ T$_{rim}$ | 1 | 8 | $I_{SET}$ |
| −INPUT | 2 | 7 | $V^+$ |
| +INPUT | 3 | 6 | OUTPUT |
| $V^-$ | 4 | 5 | $V_{IO}$ T$_{rim}$ |

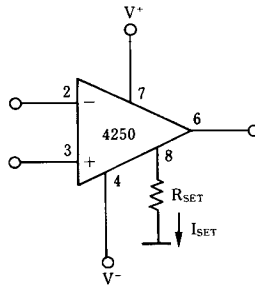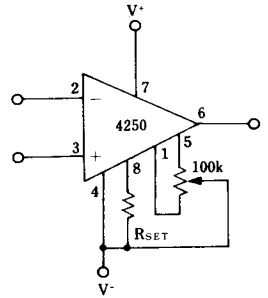■ **Typical Applications** ($I_{SET}$, $V_{IO}$ Adjustment)
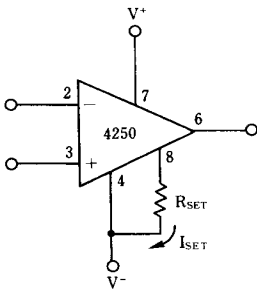


$$I_{SET} = \frac{V^+ + |V^-| - 0.5}{R_{SET}}$$
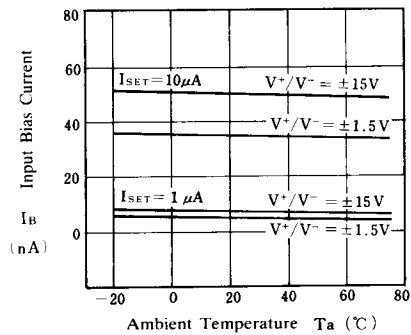
$$I_{SET} = \frac{V^+ - 0.5}{R_{SET}}$$

Offset Adjustment

■ **Typical Characteristics**

### Input Bias Current vs. Set Current
(Ta = 25℃)



Input Bias Current
$V^+/V^- = \pm 15V$
$V^+/V^- = \pm 1.5V$
10.0
$I_B$ (nA)
0.1     1.0     10.0
Set Current $I_{SET}$ (μA)
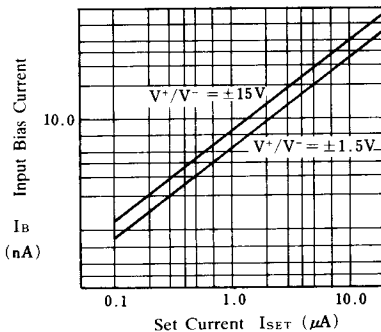
### Input Bias Current vs. Ambient Temperature



Input Bias Current
80
60   $I_{SET} = 10\mu A$     $V^+/V^- = \pm 15V$
40                           $V^+/V^- = \pm 1.5V$
20   $I_{SET} = 1\mu A$       $V^+/V^- = \pm 15V$
0                            $V^+/V^- = \pm 1.5V$
$I_B$ (nA)
−20    0    20   40   60   80
Ambient Temperature Ta (℃)

■ **Typical Characteristics**

**Input Offset Current**
**vs.**
**Ambient Temperature**
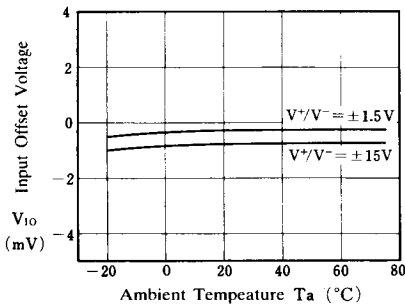$(I_{SET}=10\mu A, \pm 1.5V \leqq V^+/V^- \leqq \pm 15V)$
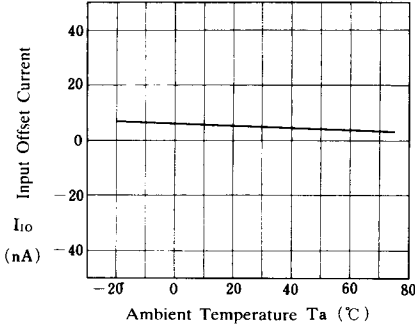


**Input Offset Voltage**
**vs.**
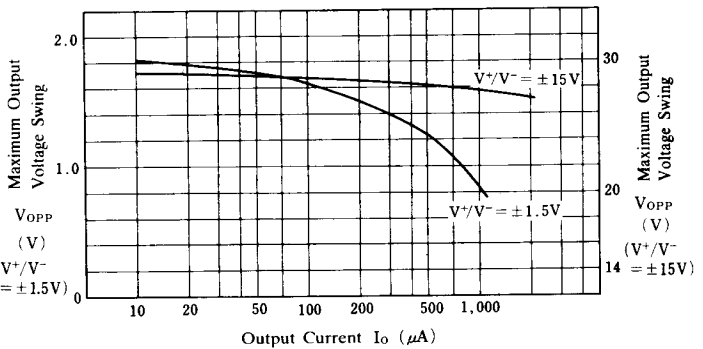**Set Current**
$(\pm 1.5V \leqq V^+/V^- \leqq \pm 15V, Ta=25℃)$
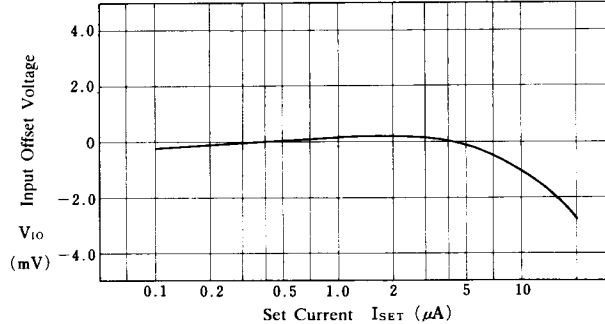


**Input Offset Voltage**
**vs.**
**Ambient Temperature**
$(I_{SET}=10\mu A)$



**Maximum Output Voltage Swing**
**vs.**
**Output Current**
$(I_{SET}=10\mu A, Ta=25℃)$



**Maximum Output Voltage Swing**
**vs.**
**Supply Voltage**
$(1\mu A \leqq I_{SET} \leqq 10\mu A, R_L=10k\Omega, Ta=25℃)$
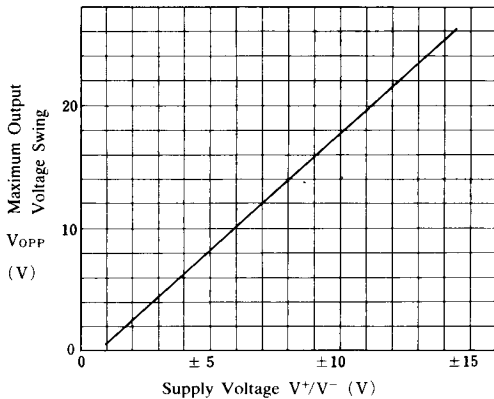


**Supply Current**
**vs.**
**Set Current**
$(Ta=25℃)$

# NJM4250

**2**

■ **Typical Characteristics**

### Supply Current vs. Ambient Temperature
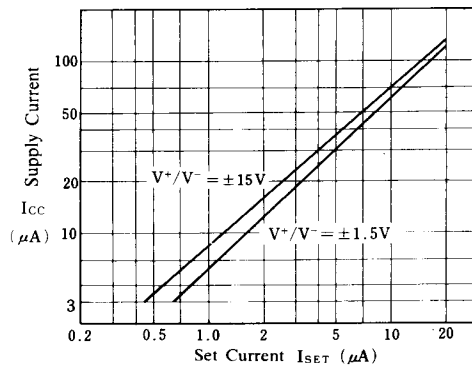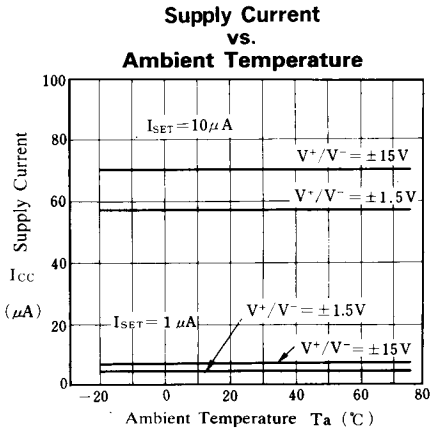


### Open Loop Voltage Gain vs. Set Current
( $R_L$ = 10kΩ, Ta = 25℃ )
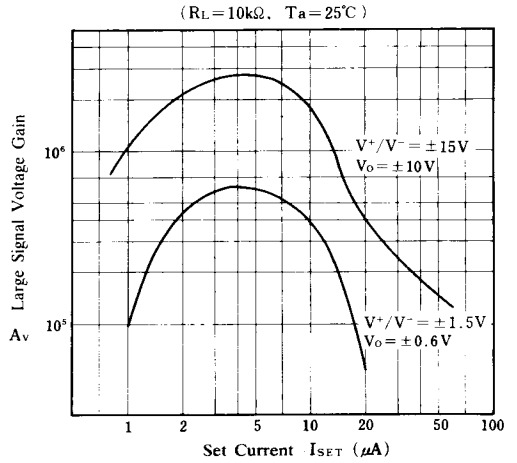


### Gain Bnadwidth Product vs. Set Current
( Ta = 25℃ )
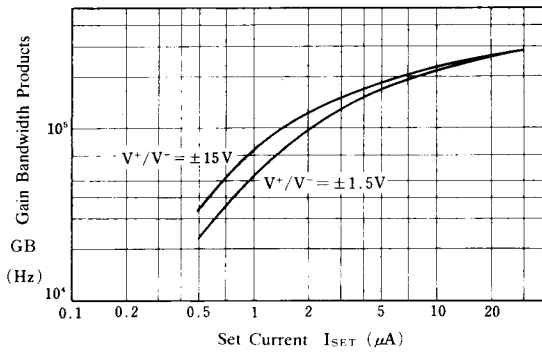


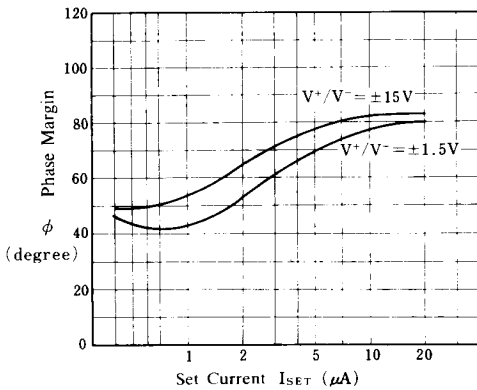### Slew Rate vs. Set Current
( $R_L$ = 10kΩ, Ta = 25℃ )
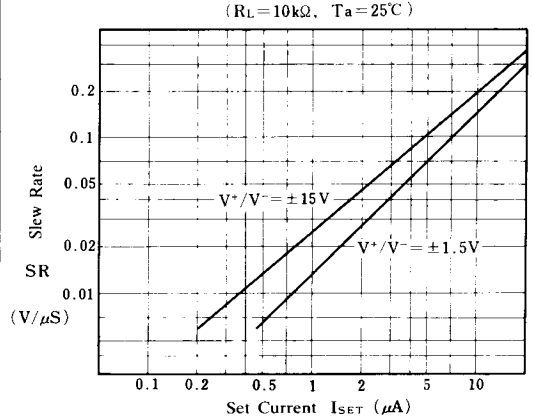


### Phase Margin vs. Set Current



■ **Typical Applications**

500nW 10times Inverting Amplifier