1. Absolute Maximum Ratings of Operational Amplifier

1-1 Supply Voltage : V^+/V^-, V_{DD}

Specify absolute maximum supply voltage of the positive and negative supply voltage (Dual power supply) and positive supply voltage (Single power supply).

1-2 Differential Input Voltage : V_{ID}

Specify absolute maximum voltage gap between the inverting and non-inverting input terminals.
The differential input voltage is specified with the plus and minus (±) description because the polarity of the input voltage stay on the opposite direction by assignment of the reference terminal.

1-3 Common Mode Input Voltage : V_{IC}

Specify absolute maximum input voltage to the inverting and non-inverting input terminals.
Operation limit is specified as the common mode voltage range (V_{ICM}) in the each electrical characteristics.

1-4 Power Dissipation : P_D

Specify absolute maximum power dissipation. The P_D is limited by the power consumption of IC chip and the package heat resistance. The power consumption of IC chip is calculated based on the quiescent current and the load current. The allowable power consumption is mentioned follwing formula.

$P_D - I_{CC}(V^+ - V^-)$

2. Terms and Definition of Operational Amplifier

2-1 Input offset voltage : V_{IO}

The voltage that must be applied between the two input terminals to obtain the output voltage to Zero.

2-2 Input offset current : I_{IO}

The differential source or sink input current flows between the two input terminals when the output voltage is zero.

$I_{IO} = | I_B^- - I_B^+ |$

2-3 Input Bias Current : I_B

The average source or sink input current of the two input terminals.

$I_B = (I_B^- - I_B^+)/2$

2-4 Common Mode Input Voltage Range : V_{ICM}

The range of common mode voltage input to the inverting and non-inverting terminals.

2-5 Common Mode Signal Rejection Ratio : CMR

The rejection ratio of the common mode voltage input change.

2-6 Supply Voltage Rejection Ratio : SVR

The rejection ratio of the supply voltage change.

2-7 Maximum Output Voltage : V_{OM}

The peak output voltage without output waveform clipping.

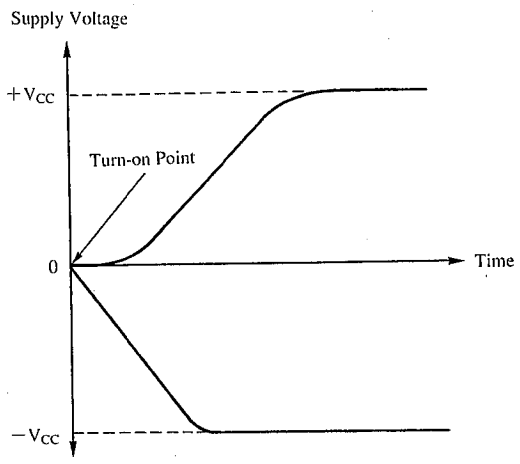
2-8 Supply Current: I_{CC}

The current flown on the power supply terminal in no load condition.

2-9 Large Signal Voltage Gain : A_V

Differential Voltage gain in open loop condition at DC.

■ ATTENTION FOR POWER ON SEQUENCE



It is necessary that the IC is always used in the condition of no floating GND terminal. Therefore, it is necessary to be noted on using the dual power supply as follows;

1)When the power turns on, V^- power supply should be turned on before or just same with the V^+ power supply.

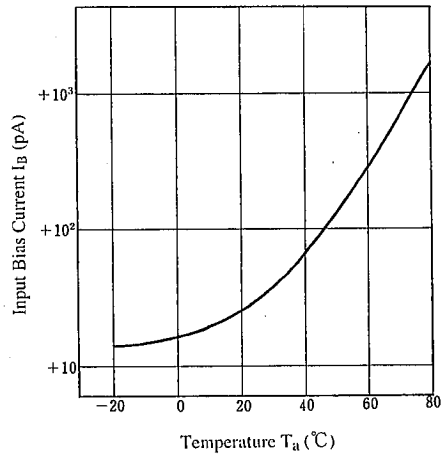
2)When the power turns off, V^+ power supply should be turned off before or just same with the V^- power supply.

■ SPECIAL ATTENTION FOR J-FET OPERATIONAL AMPLIFIER

1. Temperature Characteristics of the Input Bias Current

The input bias current of J-FET operational amplifier is the PN junction leakage current of the gate, channel and gate, and substrate. Therefore, the temperature dependence is increased exponentially by the temperature just like as the general PN junction.

J-FET operational amplifier that has often been applied for the high input impedance circuit of which the special precaution must be taken for the I_B increase by the temperature rise. For instance, when it is about 30 pA in the room temperature, however to be increased up to InA when the temperature rises up to 80°C



Comparison Between J-FET and Bipolar Operational Amplifier

Type	Input Bias Current Max. (pA)	Slew Rate Typical (V/ μs)	Offset Voltage Max. (mV)	Bandwidth Typical (MHz)
MJM072B (BIFET)	200	13	10	3
MJM082B (BIFET)	400	13	15	3
NJM4558 (BIPOLAR)	500,000	1	6	4
NJM2043 (BIPOLAR)	1,000,000	6	3	14
NJM2904 (BIPOLAR)	250,000	0.5	7	0.2

2. Input Capacitance

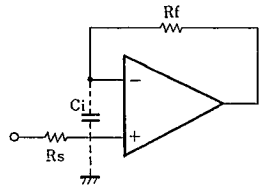
The input capacitance of 082 type is about 10 pF though the bipolar transistor input operational amplifier, 741 type of the NPN transistor input for instance, the input capacitance is 1 to 2 pF, the lateral PNP transistor input on the 4558 type is 3 to 4 pF.

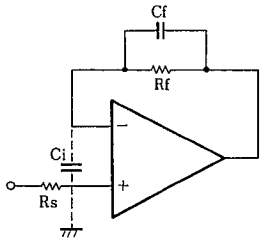
Therefore, in the case of voltage follower by using 082, the pole is made by the input capacitance (Ci) and feed back resistor (Rf) within fT (~3 MHz). Then the phase margin to be decreased.

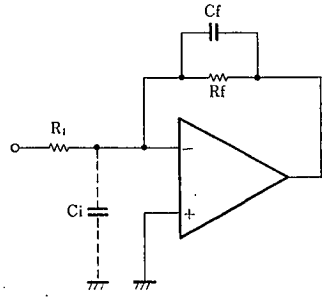
Add the Cf to keep the relation of Cf > Ci maintaining stabilized operation.

In case of inverting amplifier, influence by the input capacitance is eliminated by adding the Cf mentioned below.

$$Cf = \frac{R_I}{R_f} Ci$$







■ OTHERS

a)Comparison of Single Power Supply Operational Amplifier

Type No.	Operating Current	Cross Over Distortion	Maximum Output Current(mA)
NJM 2902	Small	Yes	20
NJM 2904	Small	Yes	20
NJM3403A	Large	No	20
NJM3404A	Large	No	20
NJM3414A	Large	No	70

b)Comparison of Operational Amplifier Characteristics (Ta=25℃)

		NJM4558	NJM4559	NJM4560	NJM4562	NJM4556A	NJM2041	NJM2043
Input Offset Voltage [mV]		0.5	0.5	0.5	0.5	0.5	0.3	0.3
Input Bias Current [nA]		50	50	40	220	180	200	400
Equivalent Input Noise Voltage [$\mu V/_{rms}$]	RIAA+IHF, Rg=10Ω	0.55	0.55	0.45	0.29	0.5	0.21	0.16
	FLAT+IHF A, Rg=300Ω	1.2	1.2	0.8	0.63	1.0	0.48	0.4
Slew Rate [V/μs]		1	2	4	7	3	3	6
Gain Bandwidth Product [MHz]		4	5.5	10	15	8	7	14
Maximum Output Current [mA]		13	13	25	13	70	13	25

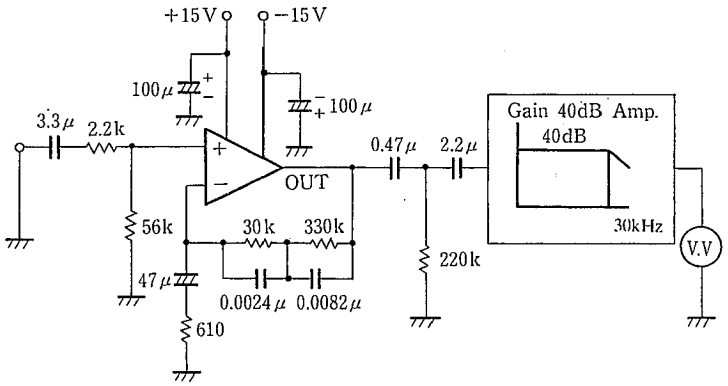
■ ATTENTION FOR THE TYPICAL CHARACTERISTICS

The typical characteristics mentioned in each data sheet are representative for each device typical characteristics. But these are only technical data and it does not guarantee any characteristics and its application.

Especially for the characteristics of the power, it should be designed within its maximum limit.

■ NOISE VOLTAGE MEASUREMENT CIRCUIT

Noise Voltage (RIAA) measurement Circuit



Noise Voltage (Flat+JIS A) measurement Circuit