# M5220L, P, FP

## DUAL LOW-NOISE OPERATIONAL AMPLIFIERS(DUAL POWER SUPPLY TYPE)

## DESCRIPTION

The M5220 is a semiconductor integrated circuit designed for a preamplifier in audio equipment of stereo and cassette tape decks.

Two low-noise operational amplifier circuits displaying internal phase-compensated high gain and low distortion are contained in a 8-pin SIP, DIP or FP, suitable for application as an equalizer and tone control amplifier of stereo equipment and cassette tape decks. The unit can also be used as a general-purpose amplifier in portable equipment such as a stereo cassette tape recorder of a single power supply type as it operates at a low supply voltage.

## FEATURES

- Low noise ····· $V_{NI}$=0.75$\mu$Vrms typ.($R_g$=2.2k$\Omega$, RIAA)
  S/N=83dB typ.(Shorted input, IHF-A network, RIAA, PHONO=2.5mVrms)
- High voltage ····· $V_{CC}$=±25V(50V)
- Low PHONO maximum input voltage
  ····· $V_i$=235mVrms(typ.)
  ($V_{CC}$=±22.5V, f=1kHz)
- High gain, low distortion
  ····· $G_{VO}$=113dB, THD=0.001%(typ.)
- High slew rate ····· SR=6.5V/$\mu$s(typ.)
- High load current, high power dissipation
  ····· $I_{LP}$=±50mA, $P_d$=800mW(SIP)
  $P_d$=625mW(DIP)
  $P_d$=440mW(FP)

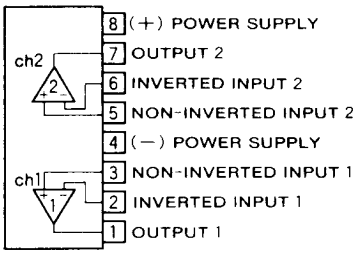
## APPLICATION

General-purpose preamplifier in stereo equipment, tape decks and radio stereo cassette recorders.

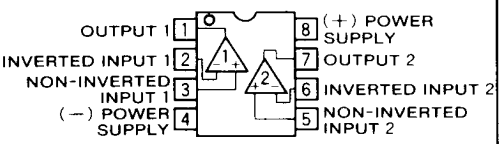
## RECOMMENDED OPERATING CONDITIONS

Supply voltage range ····· ±2~±22.5V
Rated supply voltage ····· ±22.5V

## PIN CONFIGURATION (TOP VIEW)

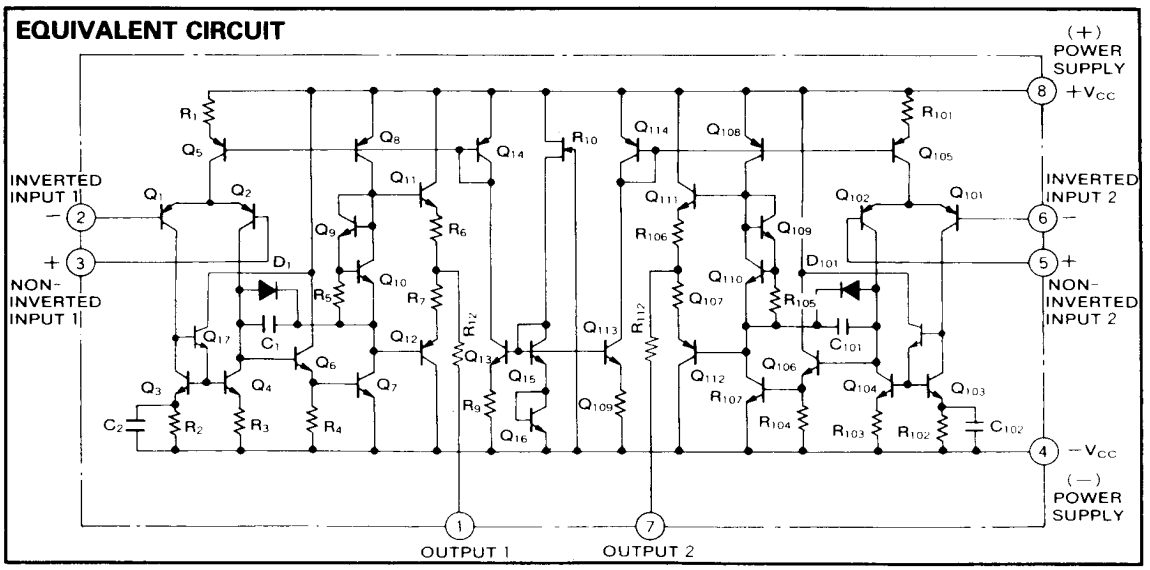



Outline 8P5 (M5220L)




Outline 8P4 (M5220P)
8P2S (M5220FP)

## EQUIVALENT CIRCUIT



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### ABSOLUTE MAXIMUM RATINGS ($T_a$=25℃, unless otherwise noted)

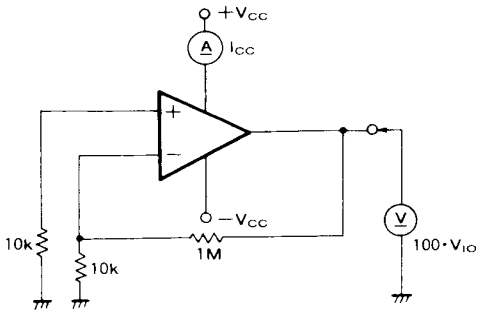
| Symbol | Parameter | Conditions | Ratings | Unit |
|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | | ±25(50) | V |
| $I_{LP}$ | Load current | | ±50 | mA |
| $V_{id}$ | Differential input voltage | | ±30 | V |
| $V_{ic}$ | Common input voltage | | ±22.5 | V |
| $P_d$ | Power dissipation | | 800(SIP)/625(DIP)/440(FP) | mW |
| $K_\theta$ | Thermal derating | $T_a$≧25℃ | 8(SIP)/6.25(DIP)/4.4(FP) | mW/℃ |
| $T_{opr}$ | Ambient temperature | | −20～+75 | ℃ |
| $T_{stg}$ | Storage temperature | | −55～+125 | ℃ |

### ELECTRICAL CHARACTERISTICS ($T_a$=25℃, $V_{CC}$=±22.5V)

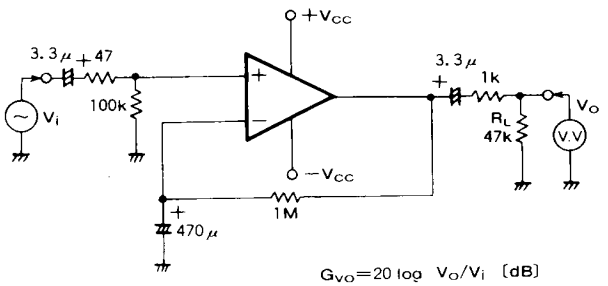
| Symbol | Parameter | Test conditions | Limits | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| $I_{CC}$ | Circuit current | $V_{in}$=0 | | 4.0 | 8.0 | mA |
| $V_{IO}$ | Input offset voltage | $R_S$≦10kΩ | | 0.5 | 3.0 | mV |
| $I_{IB}$ | Input bias current | | | 0.7 | | μA |
| $G_{VO}$ | Open loop voltage gain | f=100Hz, $R_L$=47kΩ, $C_{NF}$=470μF | 90 | 113 | | dB |
| $V_{OM}$ | Maximum output voltage | f=1kHz, THD=0.1%, $R_L$=47kΩ, RIAA | 12.5 | 14.2 | | Vrms |
| THD | Total harmonic distortion | f=1kHz, $V_O$=5Vrms, $R_L$=47kΩ, RIAA | | 0.001 | 0.03 | % |
| $V_{NI}$ | Input referred noise voltage | Rg=2.2kΩ, BW=10Hz～30kHz, RIAA | | 0.75 | 1.8 | μVrms |
| S/N | Signal-to-noise ratio | Shorted input (Rg=47Ω), IHF-A network PHONO=2.5mVrms, RIAA | | 83 | | dB |

### TEST CIRCUITS

(a) $I_{CC}$, $V_{IO}$

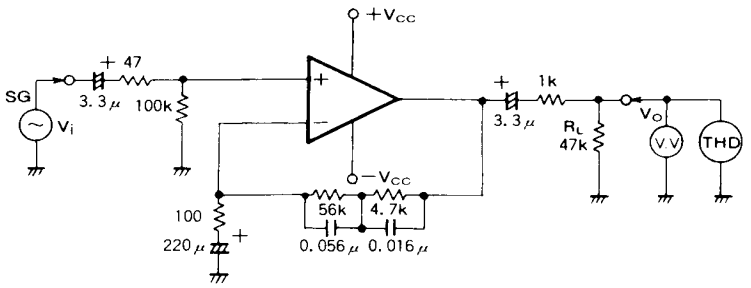



(b) $G_{VO}$




$G_{VO}$=20 log $V_O/V_i$ [dB]

(c) $V_{OM}$, THD




Unit Resistance : Ω
Capacitance : F



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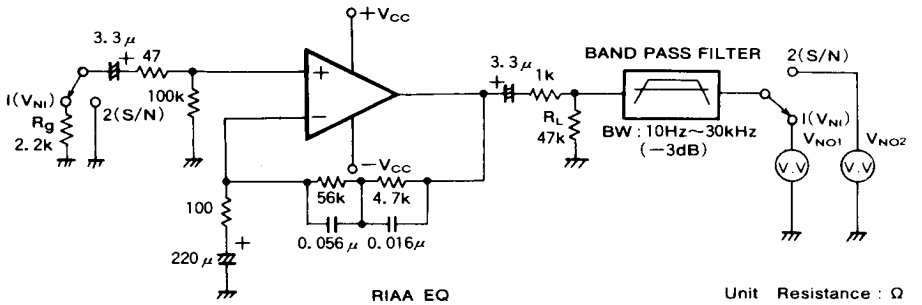
### TEST CIRCUIT

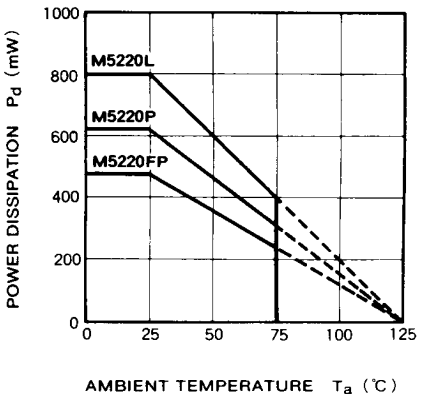
(d) $V_{NI}$, S/N



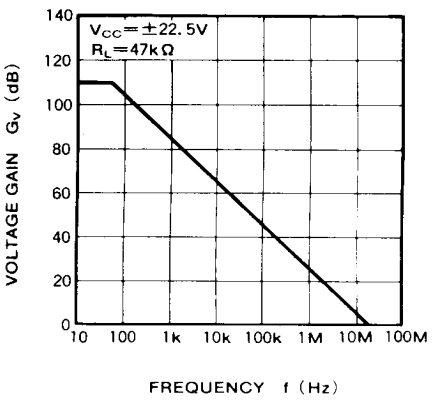

1. $V_{NI}=V_{NO1}/60(\mu Vrms)$
2. $S/N=20 \log [2.5mVrms/(V_{NO2/60})]$ (dB)
   * An AC voltmeter V.V with a built-in IHF-A network filter should be used for measuring the S/N ratio.

### TYPICAL CHARACTERISTICS

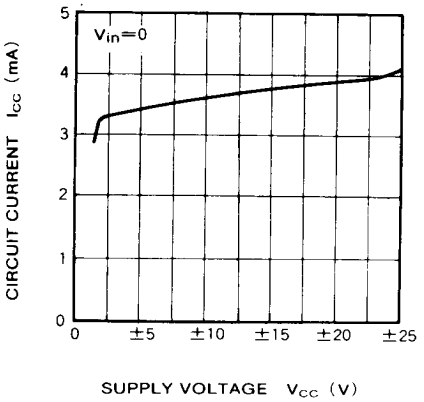
**THERMAL DERATING (MAXIMUM RATING)**



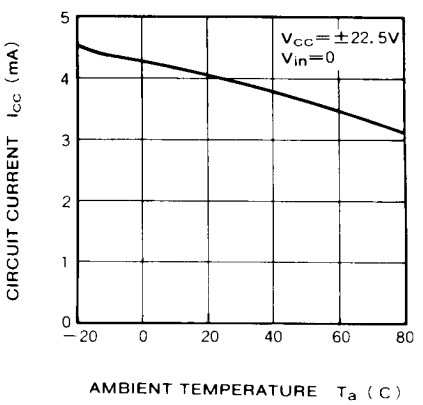

**VOLTAGE GAIN VS. FREQUENCY RESPONSE**




**CIRCUIT CURRENT VS. SUPPLY VOLTAGE**



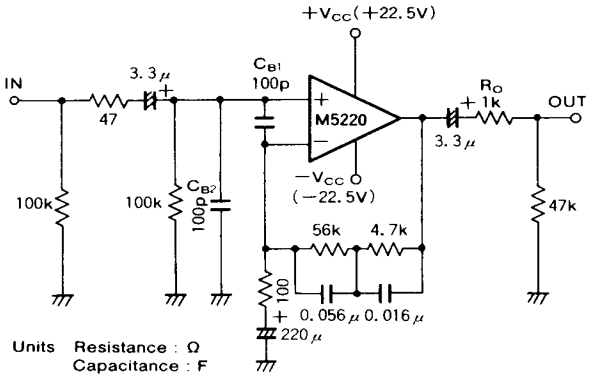

**CIRCUIT CURRENT VS. AMBIENT TEMPERATURE**



## DUAL LOW-NOISE OPERATIONAL AMPLIFIERS(DUAL POWER SUPPLY TYPE)

## APPLICATION EXAMPLES

**(1) Stereo equalizer amplifier circuit**

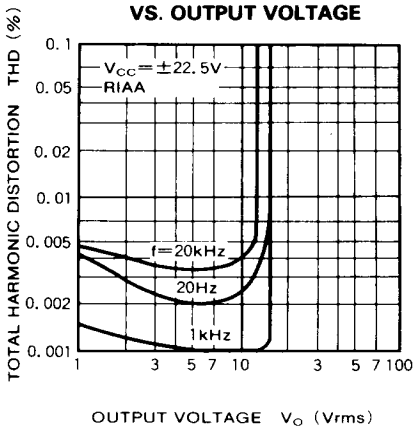



**TYPICAL CHARACTERISTICS** ($V_{CC}$=±22.5V, RIAA)

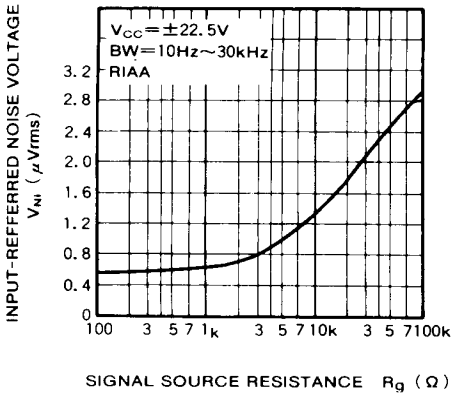
- $G_V$=35.6dB(f=1kHz)
- $V_{NI}$=0.75μVrms($R_g$=2.2kΩ, BW=10Hz~30kHz)
- S/N=83dB (IHF-A network, shorted input, 2.5mVrms input sensitivity)
- THD=0.001%(f=1kHz, $V_O$=5Vrms)

$L_{ch}$ circuit constants are identical to those of $R_{ch}$
$C_{B1}$, $C_{B2}$ : Capacitors for buzz prevention, use if required.
$R_O$ : Resistor used to prevent parasitic oscillation for capacitive loads and current limiting with shorted and other abnormal load conditions.

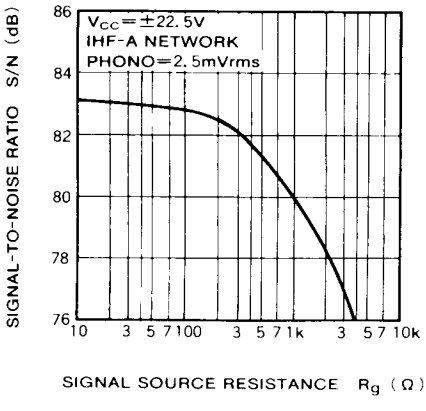
**TOTAL HARMONIC DISTORTION VS. OUTPUT VOLTAGE**



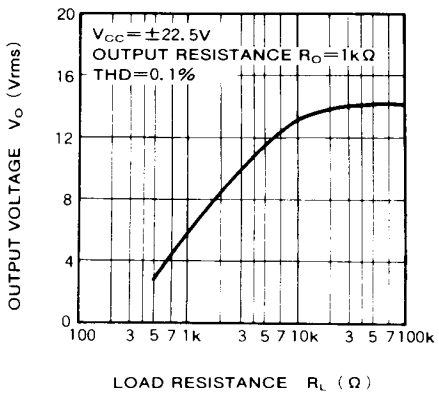

**INPUT-REFERRED NOISE VOLTAGE VS. SIGNAL SOURCE RESISTANCE**




**SIGNAL-TO-NOISE RATIO VS. SIGNAL SOURCE RESISTANCE**




**OUTPUT VOLTAGE VS. LOAD RESISTANCE**



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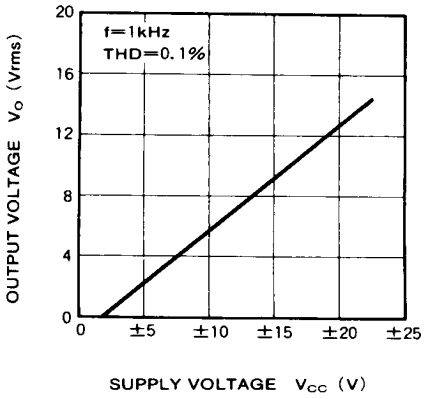
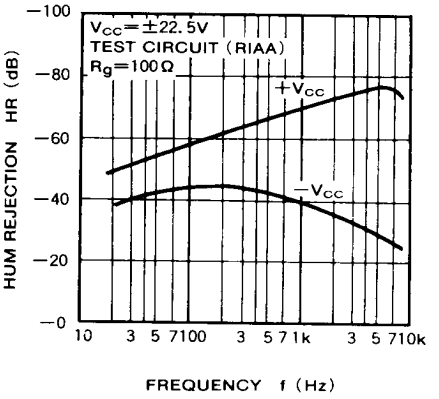
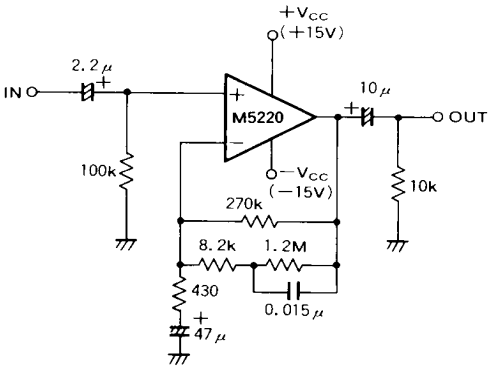
**OUTPUT VOLTAGE VS. SUPPLY VOLTAGE**




**HUM REJECTION VS. FREQUENCY**




**(2) Tape deck equalizer amplifier circuit**



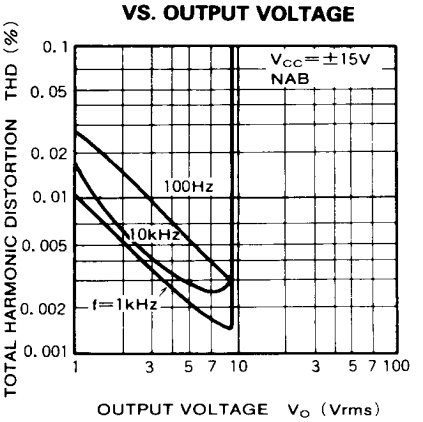

Units Resistance : Ω
Capacitance : F

$L_{ch}$ circuit constants are identical to those of $R_{ch}$.

**TYPICAL CHARACTERISTICS** ($V_{CC}$=±15V, NAB)

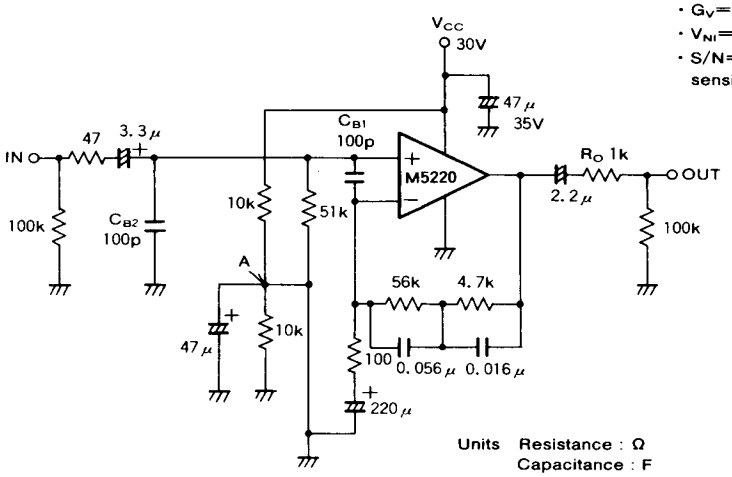
- $G_V$=29.9dB(f=1kHz)
- $V_{NI}$=1.0μVrms($R_g$=2.2kΩ, BW=20Hz~15kHz) (−120dBv)

**TOTAL HARMONIC DISTORTION VS. OUTPUT VOLTAGE**



### (3) Typical single power supply application

**PHONO EQUALIZER AMPLIFIER (RIAA)**




- → Point A is the $V_{CC}/2$ point in DC terms (virtual ground) when the device is used as a single power supply type.
- $C_{B1}$, $C_{B2}$ : Capacitor for buzz prevention, used if required.
- $R_O$ : Resistor used to prevent parasitic oscillation for capacitive loads and current limiting with shorted and other abnormal conditions.

**TYPICAL CHARACTERISTICS** ($V_{CC}$=+30V, RIAA)

- $G_V$=35.6dB(f=1kHz)
- $V_{NI}$=0.75μVrms($R_g$=2.2kΩ, BW=10Hz~30kHz)
- S/N=83dB (IHF-A network, shorted input, 2.5μVrms input sensitivity)

**TOTAL HARMONIC DISTORTION VS. OUTPUT VOLTAGE**