

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

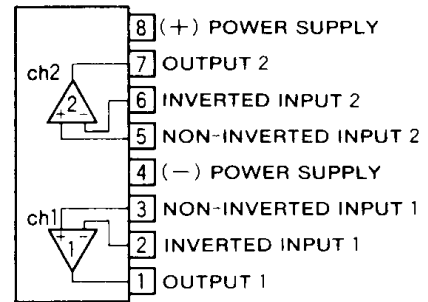
### APPLICATION

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

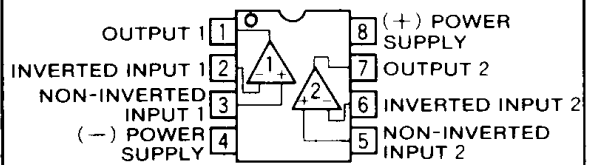
### RECOMMENDED OPERATING CONDITIONS

- Supply voltage range .....  $\pm 2\sim\pm 22.5\text{V}$
- Rated supply voltage .....  $\pm 22.5\text{V}$

### PIN CONFIGURATION (TOP VIEW)

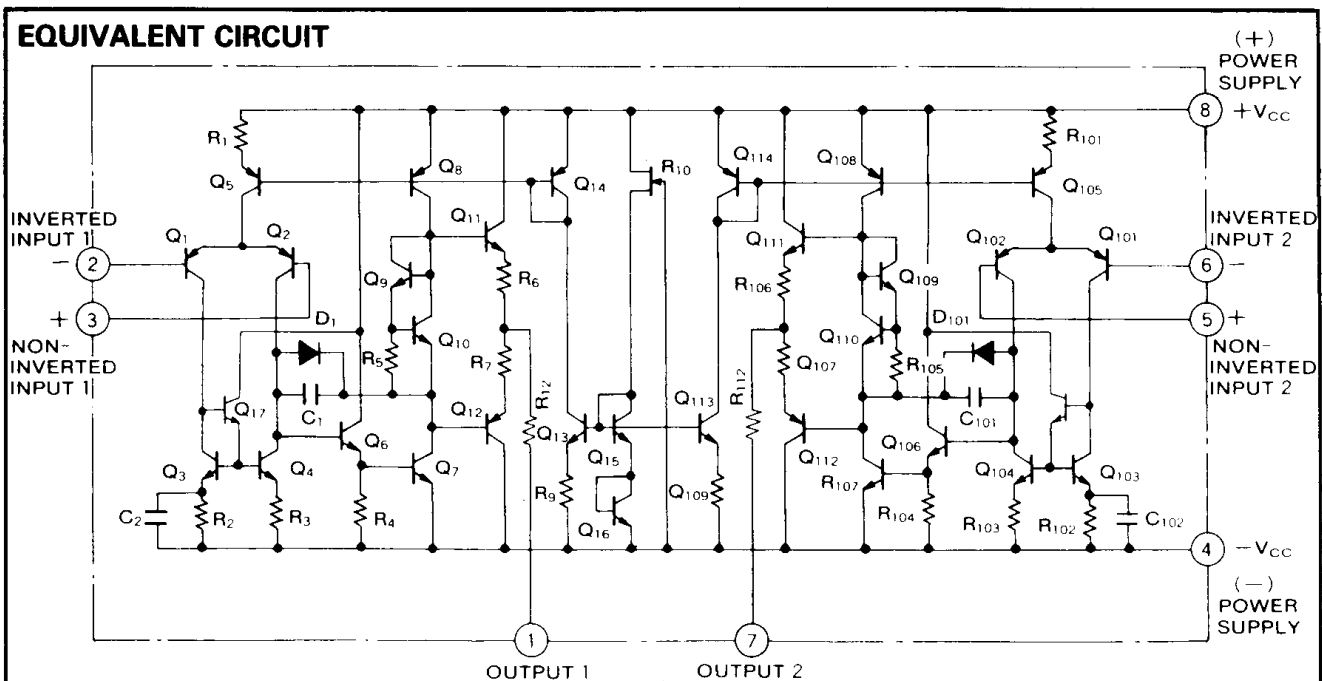


Outline 8P5 (M5220L)



Outline 8P4 (M5220P)  
8P2S (M5220FP)

### EQUIVALENT CIRCUIT



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

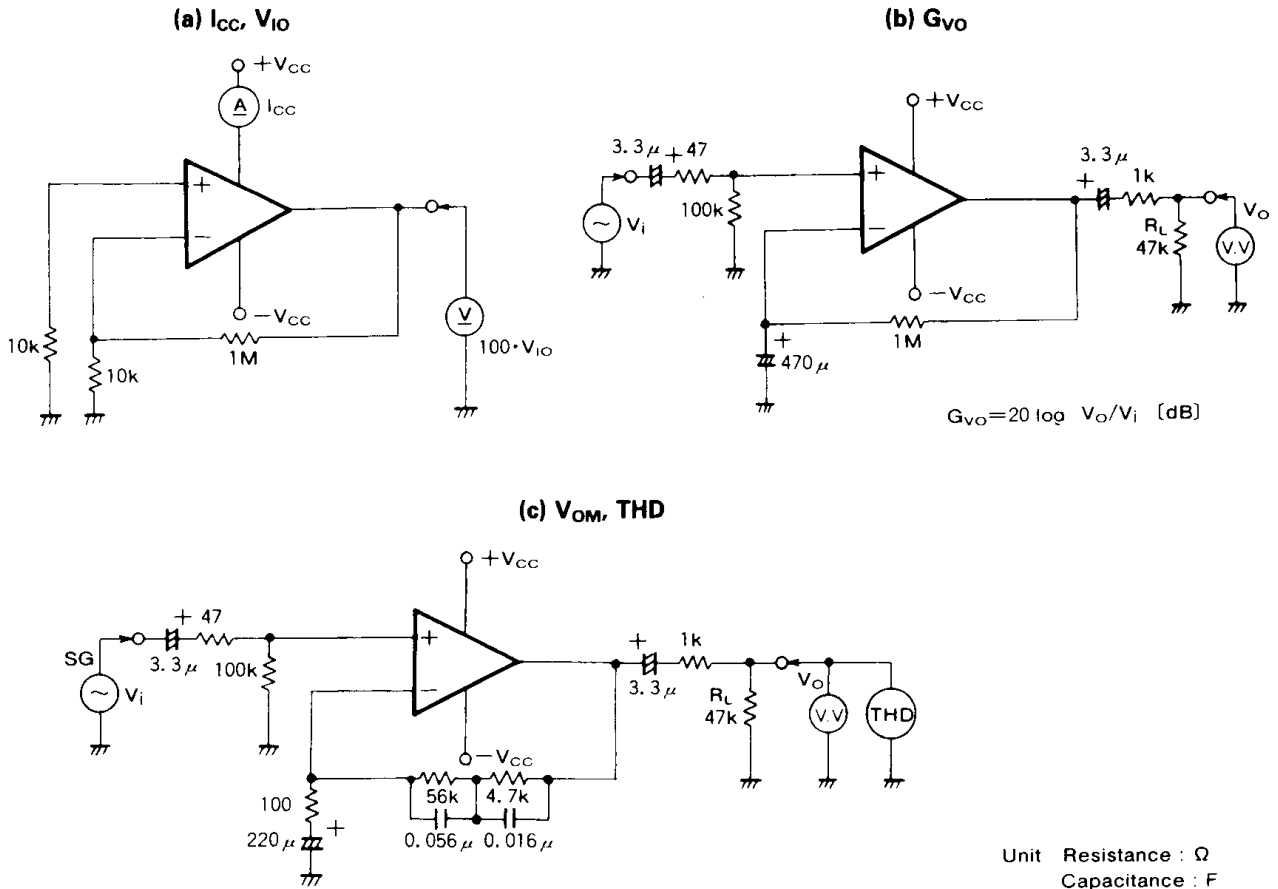
**ABSOLUTE MAXIMUM RATINGS** ( $T_a=25^\circ\text{C}$ , unless otherwise noted)

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

**ELECTRICAL CHARACTERISTICS** ( $T_a=25^\circ\text{C}$ ,  $V_{CC}=\pm 22.5\text{V}$ )

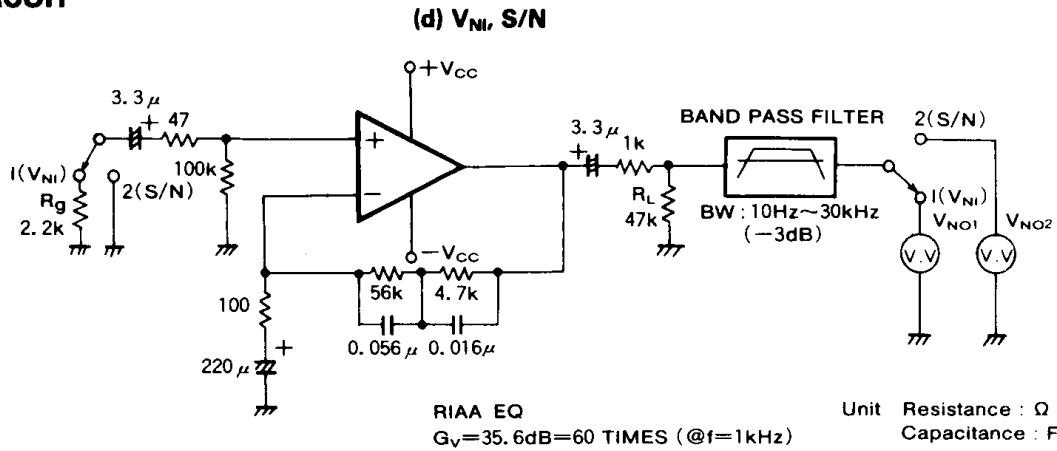
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$I_{CC}$	Circuit current	$V_{in}=0$		4.0	8.0	mA
$V_{IO}$	Input offset voltage	$R_S \leq 10\text{k}\Omega$		0.5	3.0	mV
$I_{IB}$	Input bias current			0.7		$\mu\text{A}$
$G_{VO}$	Open loop voltage gain	$f=100\text{Hz}$ , $R_L=47\text{k}\Omega$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

**TEST CIRCUITS**



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

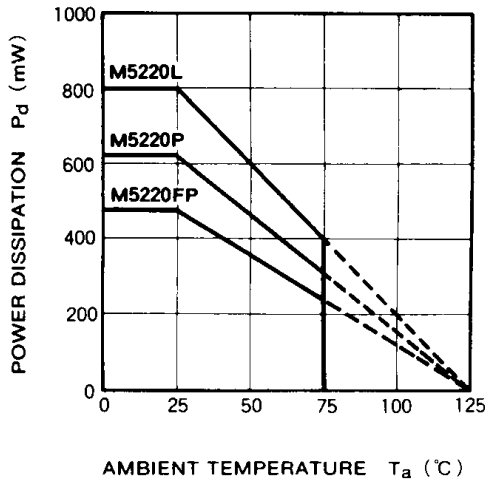
**TEST CIRCUIT**



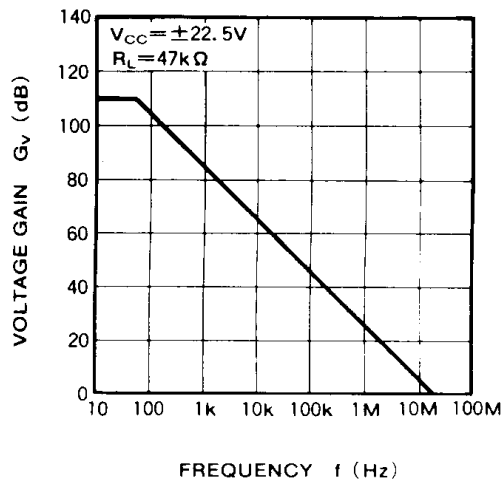
1.  $V_{Ni} = V_{NO1} / 60 (\mu\text{Vrms})$
  2.  $S/N = 20 \log [2.5\text{mVrms} / (V_{NO2}/60)] \text{ (dB)}$
- \* An AC voltmeter V.V with a built-in IHF-A network filter should be used for measuring the S/N ratio.

**TYPICAL CHARACTERISTICS**

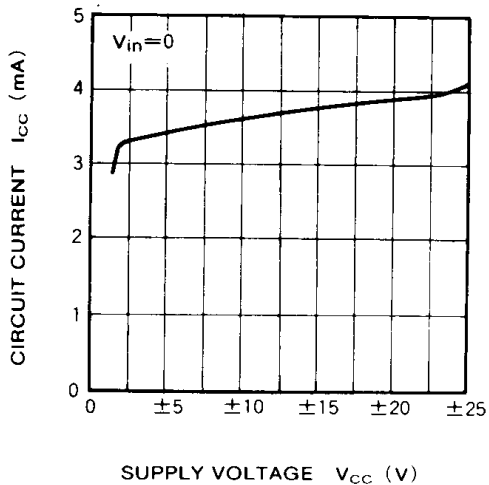
**THERMAL DERATING  
 (MAXIMUM RATING)**



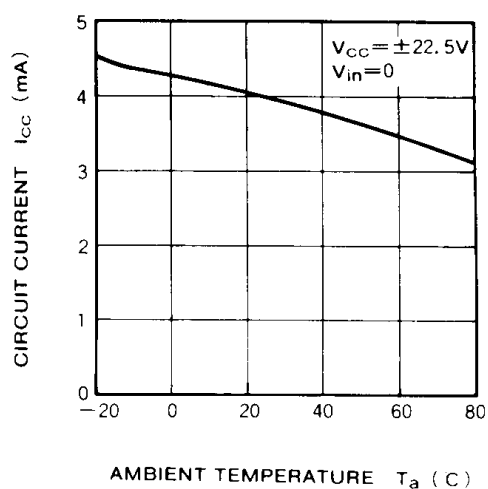
**VOLTAGE GAIN VS.  
 FREQUENCY RESPONSE**



**CIRCUIT CURRENT VS.  
 SUPPLY VOLTAGE**



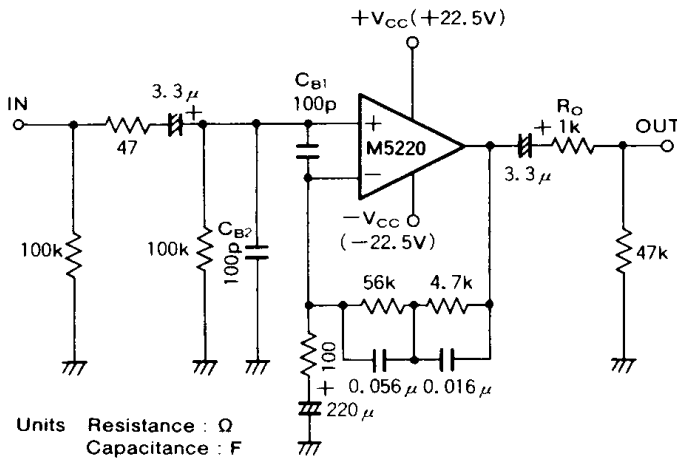
**CIRCUIT CURRENT VS.  
 AMBIENT TEMPERATURE**



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

**APPLICATION EXAMPLES**

**(1) Stereo equalizer amplifier circuit**

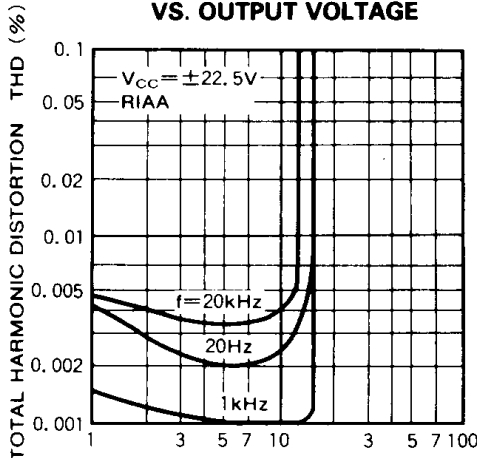


**TYPICAL CHARACTERISTICS** ( $V_{CC} = \pm 22.5V$ , RIAA)

- $G_v = 35.6dB$  ( $f = 1kHz$ )
- $V_{NI} = 0.75 \mu V_{rms}$  ( $R_g = 2.2k\Omega$ ,  $BW = 10Hz \sim 30kHz$ )
- $S/N = 83dB$  (IHF-A network, shorted input,  $2.5mV_{rms}$  input sensitivity)
- $THD = 0.001\%$  ( $f = 1kHz$ ,  $V_o = 5V_{rms}$ )

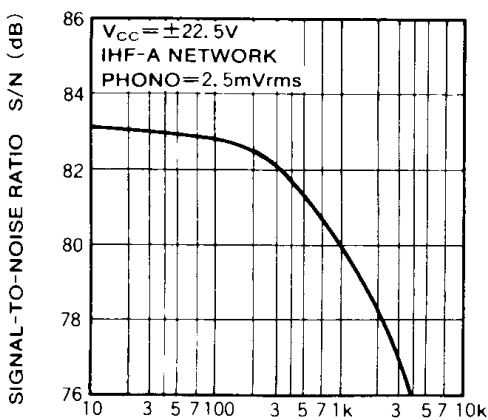
$L_{ch}$  circuit constants are identical to those of  $R_{ch}$   
 $C_{B1}$ ,  $C_{B2}$ : Capacitors for buzz prevention, use if required.  
 $R_O$ : Resistor used to prevent parasitic oscillation for capacitive loads and current limiting with shorted and other abnormal load conditions.

**TOTAL HARMONIC DISTORTION VS. OUTPUT VOLTAGE**



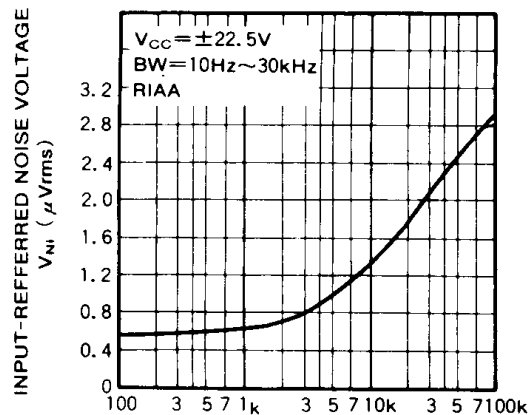
OUTPUT VOLTAGE  $V_o$  ( $V_{rms}$ )

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



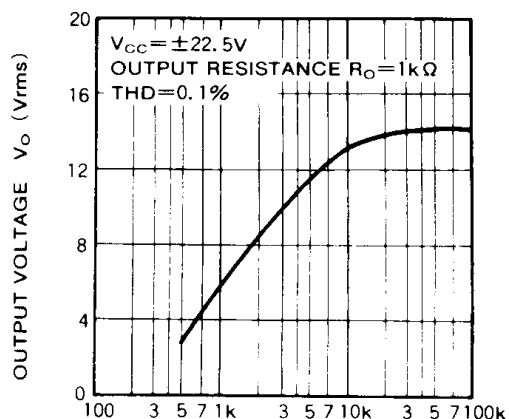
SIGNAL SOURCE RESISTANCE  $R_g$  ( $\Omega$ )

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



SIGNAL SOURCE RESISTANCE  $R_g$  ( $\Omega$ )

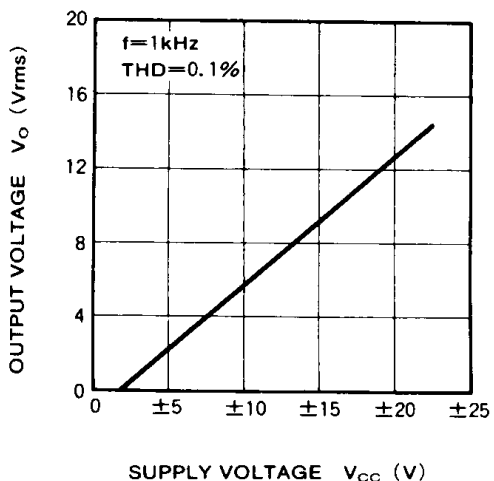
**OUTPUT VOLTAGE VS. LOAD RESISTANCE**



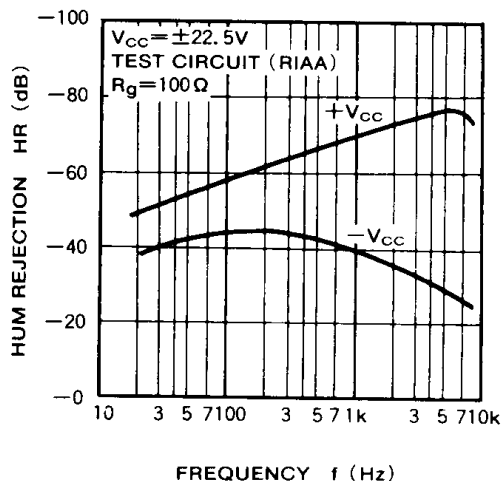
LOAD RESISTANCE  $R_L$  ( $\Omega$ )

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

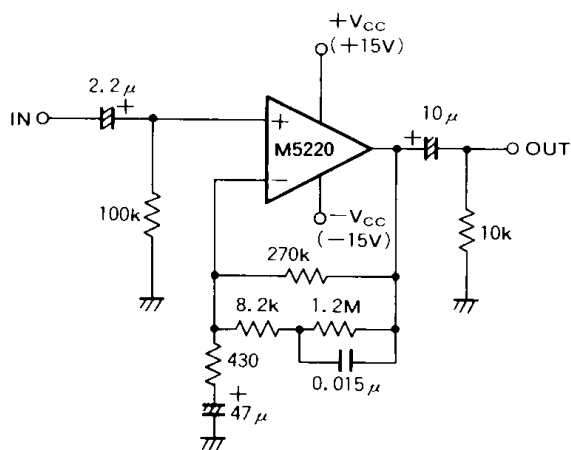
**OUTPUT VOLTAGE VS. SUPPLY VOLTAGE**



**HUM REJECTION VS. FREQUENCY**



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



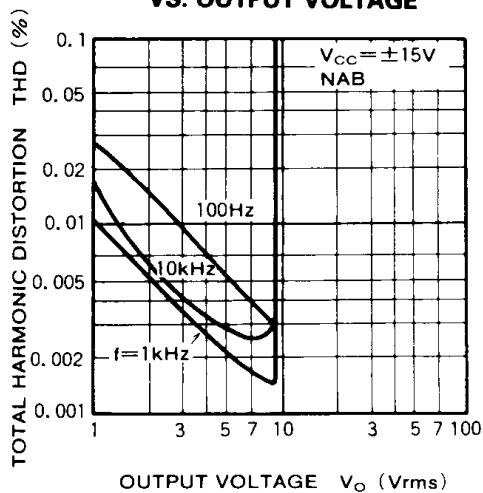
Units Resistance :  $\Omega$   
 Capacitance : F

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

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

- $G_V=29.9dB(f=1kHz)$
- $V_{NI}=1.0\mu V_{rms}(R_g=2.2k\Omega, BW=20Hz\sim 15kHz)$   
 ( $-120dBv$ )

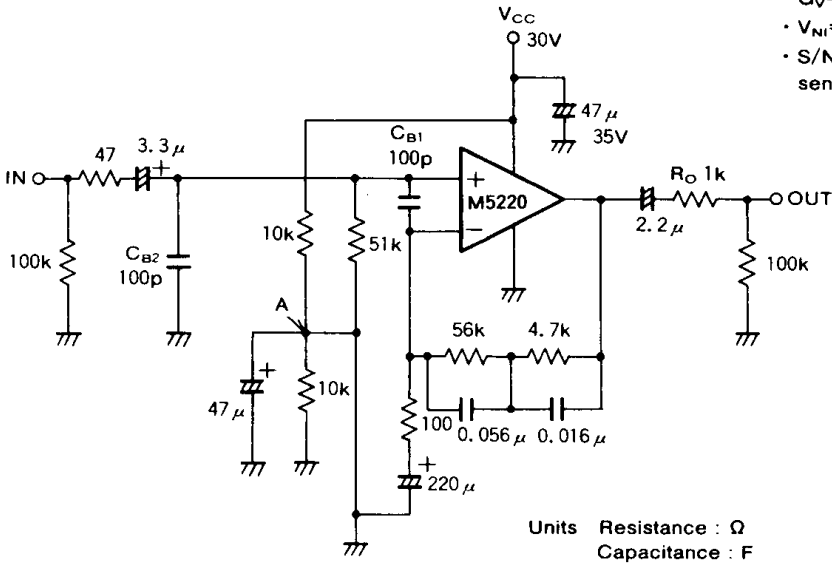
**TOTAL HARMONIC DISTORTION VS. OUTPUT VOLTAGE**



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

**(3) Typical single power supply application**

**PHONO EQUALIZER AMPLIFIER (RIAA)**

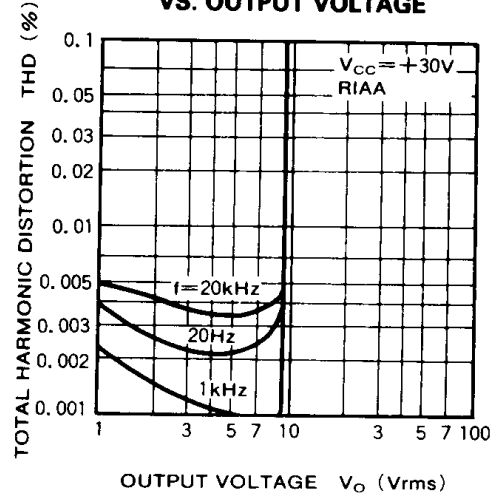


Units Resistance :  $\Omega$   
 Capacitance : F

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

- $G_V=35.6\text{dB}(f=1\text{kHz})$
- $V_{NI}=0.75\mu\text{Vrms}(R_G=2.2\text{k}\Omega, \text{BW}=10\text{Hz}\sim 30\text{kHz})$
- $S/N=83\text{dB}$  (IHF-A network, shorted input,  $2.5\mu\text{Vrms}$  input sensitivity)

**TOTAL HARMONIC DISTORTION VS. OUTPUT VOLTAGE**



- → 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.