

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

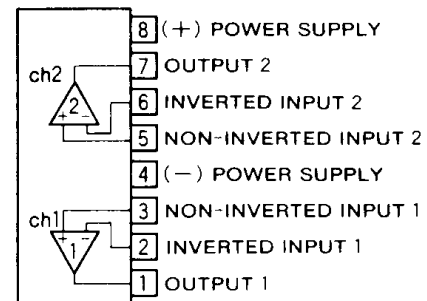
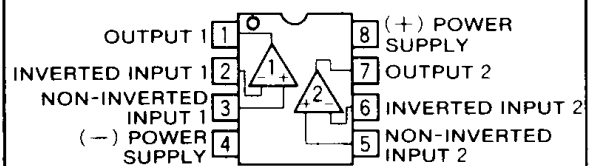
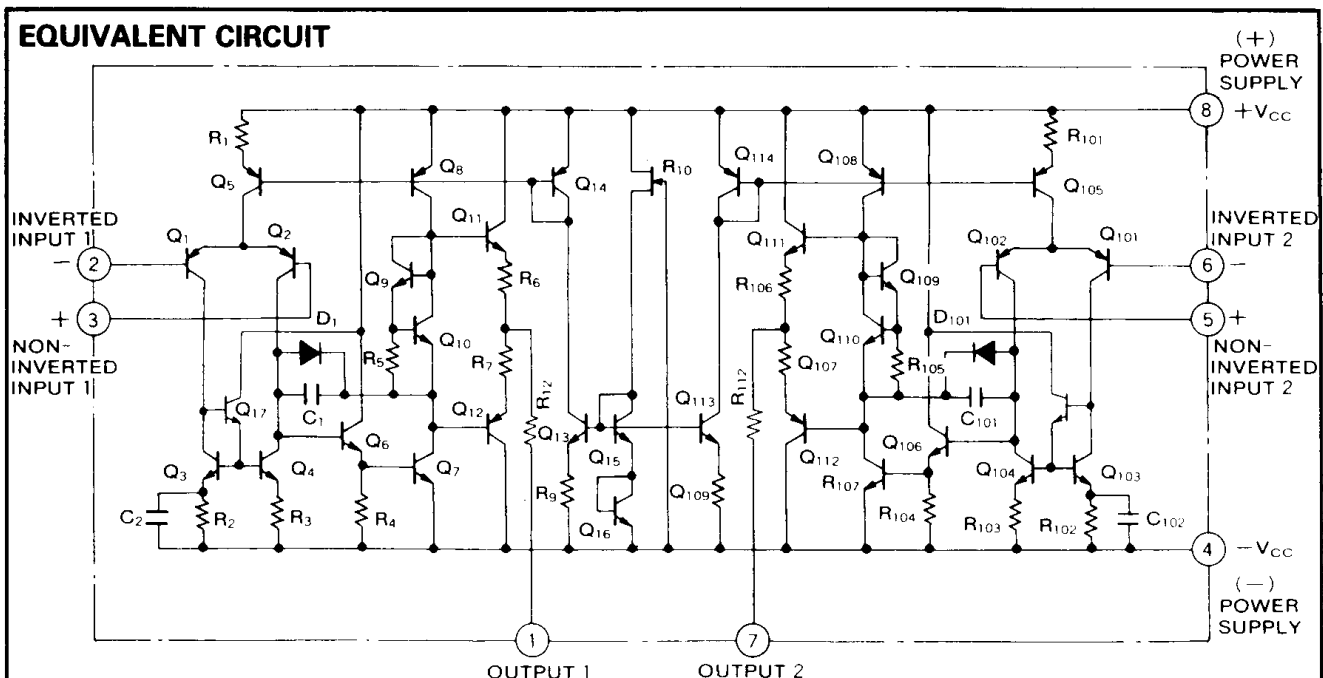
- Low noise $V_{NI}=0.75\mu\text{Vrms typ.}(R_g=2.2\text{k}\Omega, \text{RIAA})$
 $S/N=83\text{dB typ.}(\text{Shorted input, IHF-A network, RIAA, PHONO}=2.5\text{mVrms})$
- High voltage $V_{CC}=\pm 25\text{V}(50\text{V})$
- Low PHONO maximum input voltage $V_i=235\text{mVrms}(typ.)$
 $(V_{CC}=\pm 22.5\text{V},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

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		± 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_θ	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		$-55 \sim +125$	$^\circ\text{C}$

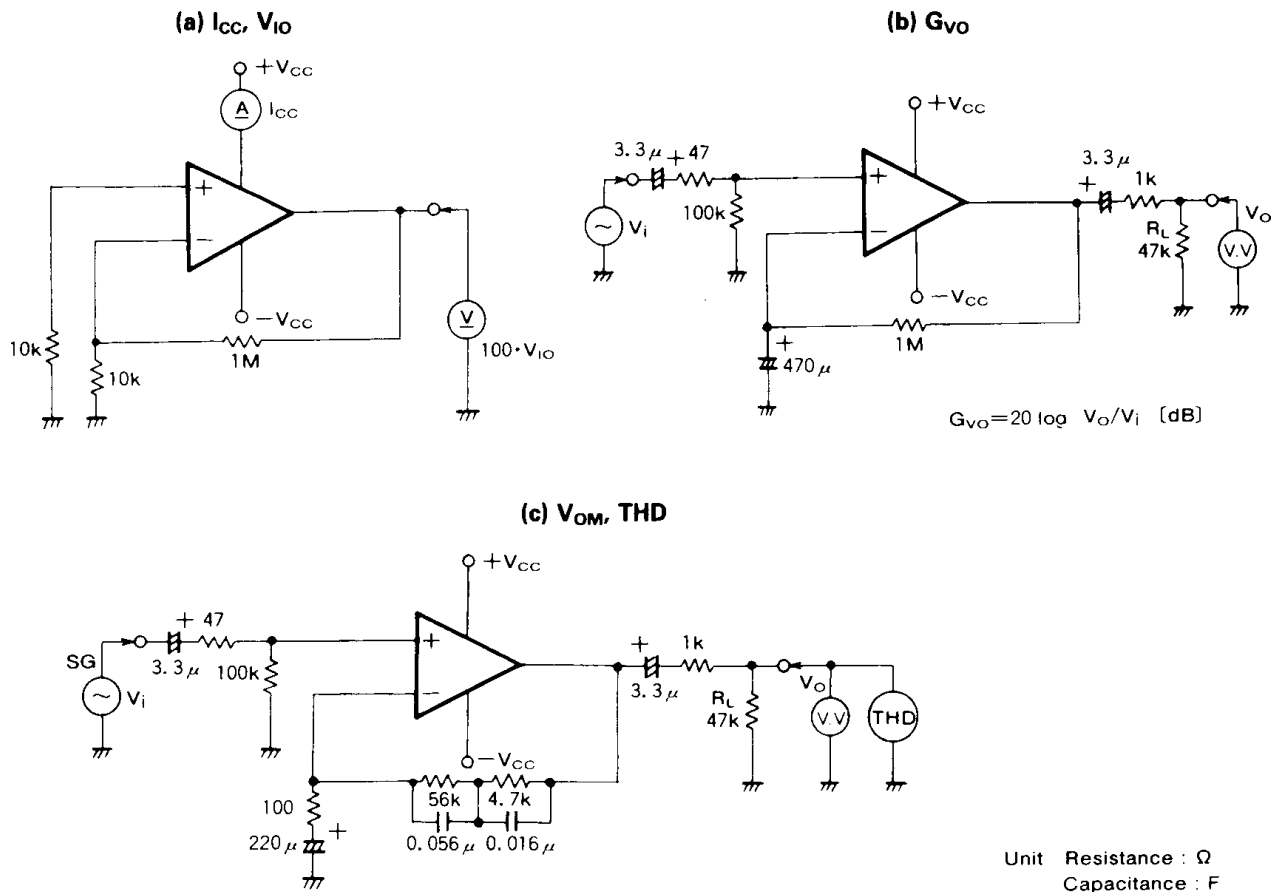
ELECTRICAL CHARACTERISTICS ($T_a=25^\circ\text{C}$, $V_{CC}=\pm 22.5\text{V}$)

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		μA
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		V _{rms}
THD	Total harmonic distortion	$f=1\text{kHz}$, $V_O=5\text{V}_{rms}$, $R_L=47\text{k}\Omega$, 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	μV_{rms}
S/N	Signal-to-noise ratio	Shorted input ($R_g=47\Omega$), IHF-A network PHONO=2.5mV _{rms} , RIAA		83		dB

TEST CIRCUITS

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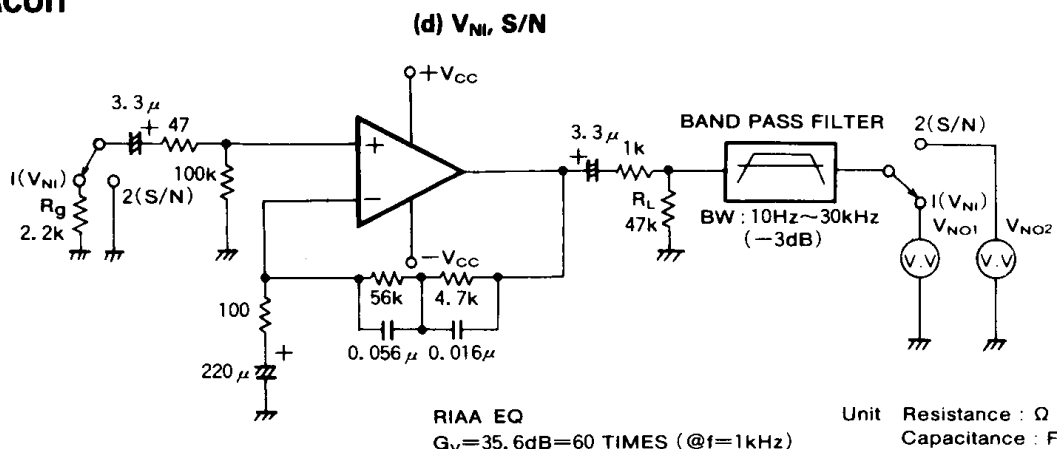


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DUAL LOW-NOISE OPERATIONAL AMPLIFIERS(DUAL POWER SUPPLY TYPE)

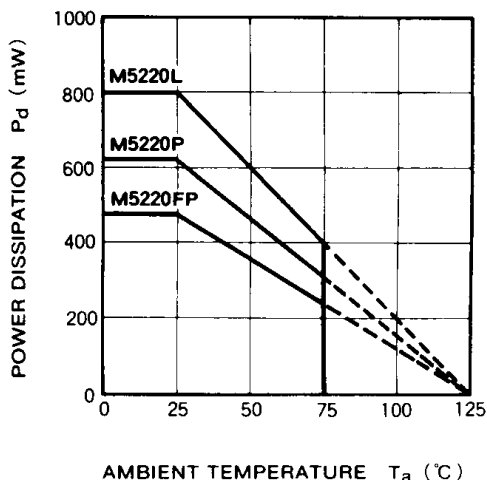
TEST CIRCUIT



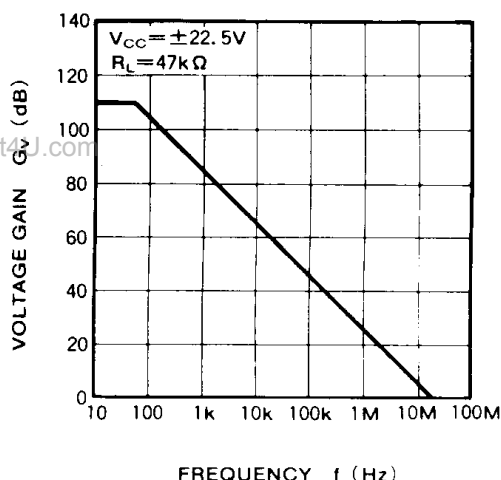
1. $V_{Ni} = V_{NO1} / 60 (\mu\text{Vrms})$
 2. $S/N = 20 \log [2.5\text{mVrms} / (V_{NO2}/60)] \text{ (dB)}$
- * An AC voltmeter V.V with a built-in IHF-A network filter should be used for measuring the S/N ratio.

TYPICAL CHARACTERISTICS

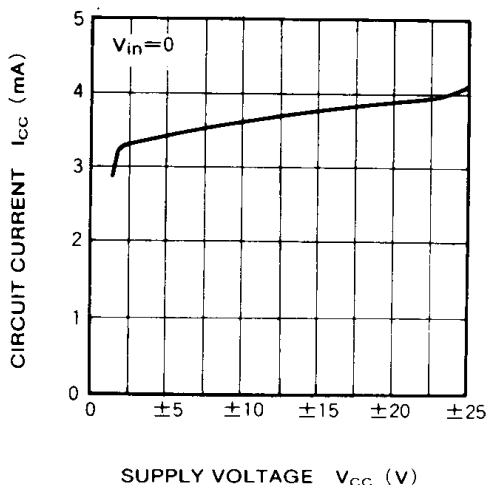
**THERMAL DERATING
 (MAXIMUM RATING)**



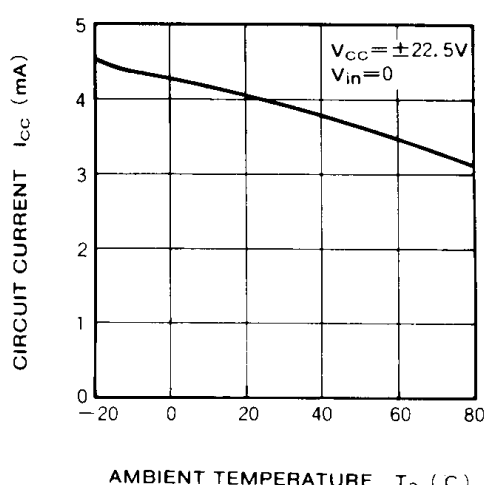
**VOLTAGE GAIN VS.
 FREQUENCY RESPONSE**



**CIRCUIT CURRENT VS.
 SUPPLY VOLTAGE**



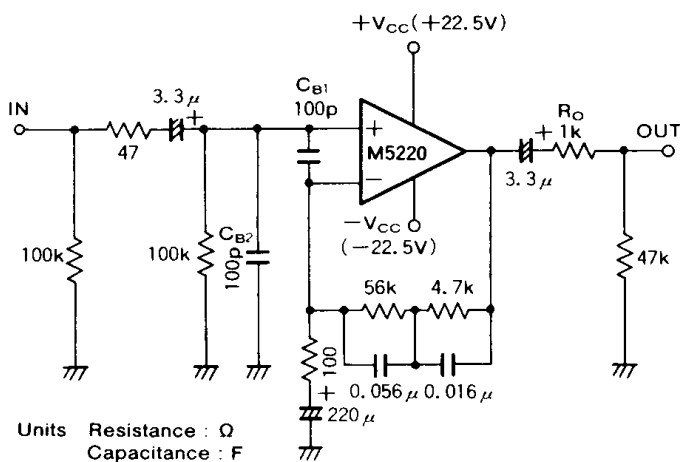
**CIRCUIT CURRENT VS.
 AMBIENT TEMPERATURE**



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

APPLICATION EXAMPLES

(1) Stereo equalizer amplifier circuit

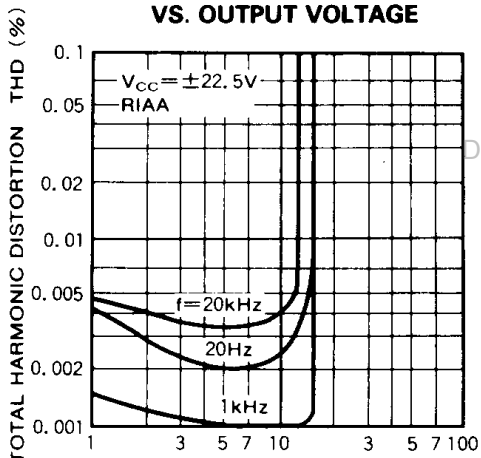


TYPICAL CHARACTERISTICS (V_{CC}=±22.5V, RIAA)

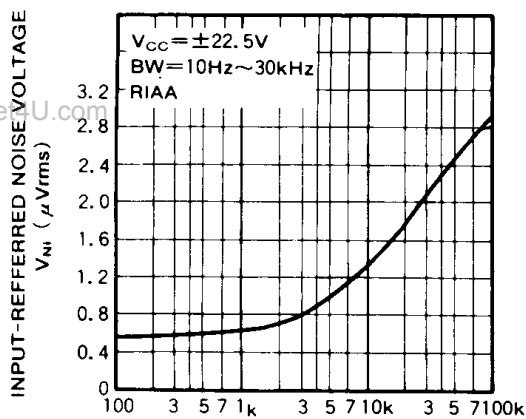
- G_v=35.6dB(f=1kHz)
- V_{NI}=0.75μVrms(R_g=2.2kΩ, BW=10Hz~30kHz)
- S/N=83dB (IHF-A network, shorted input, 2.5mVrms input sensitivity)
- THD=0.001%(f=1kHz, V_o=5Vrms)

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

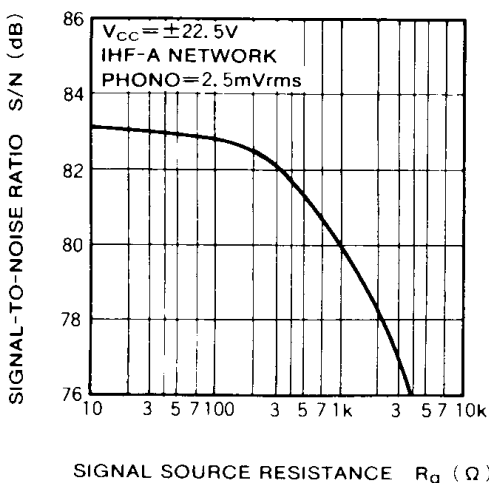


INPUT-REFERRED NOISE VOLTAGE VS. SIGNAL SOURCE RESISTANCE



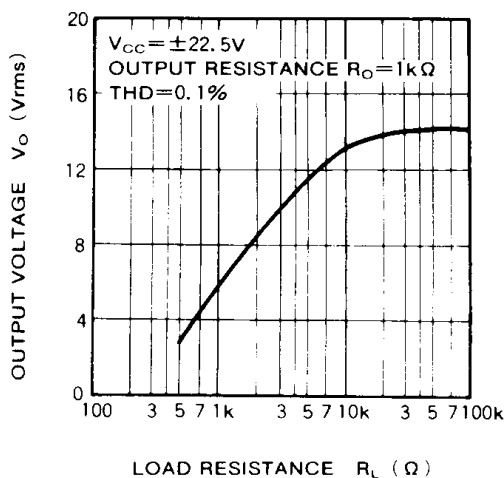
OUTPUT VOLTAGE V_o (Vrms)

SIGNAL-TO-NOISE RATIO VS. SIGNAL SOURCE RESISTANCE



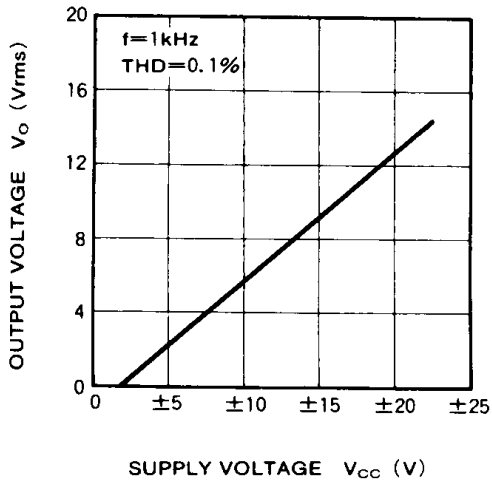
SIGNAL SOURCE RESISTANCE R_g (Ω)

OUTPUT VOLTAGE VS. LOAD RESISTANCE

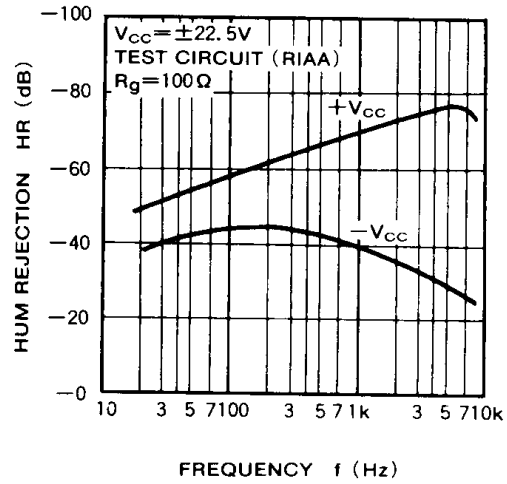


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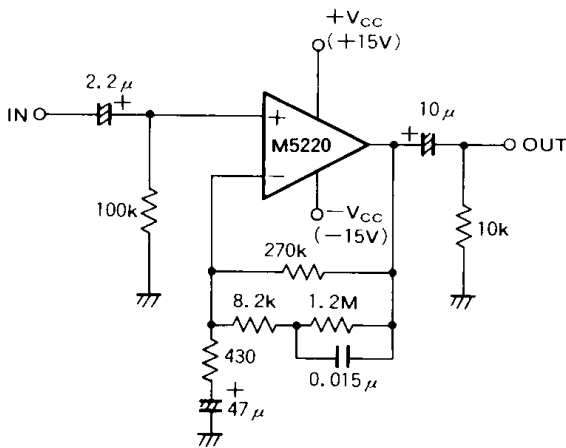
OUTPUT VOLTAGE VS. SUPPLY VOLTAGE



HUM REJECTION VS. FREQUENCY



(2) Tape deck equalizer amplifier circuit



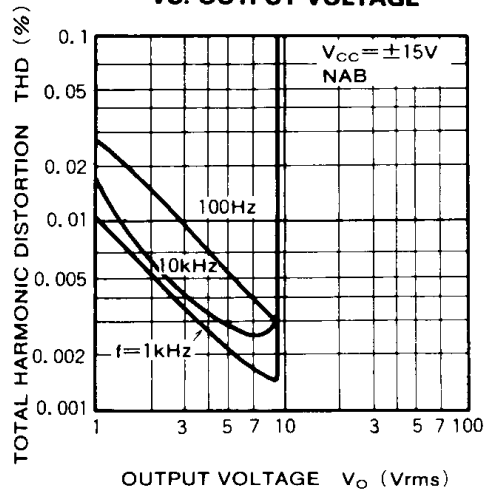
Units Resistance : Ω
 Capacitance : F

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

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

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

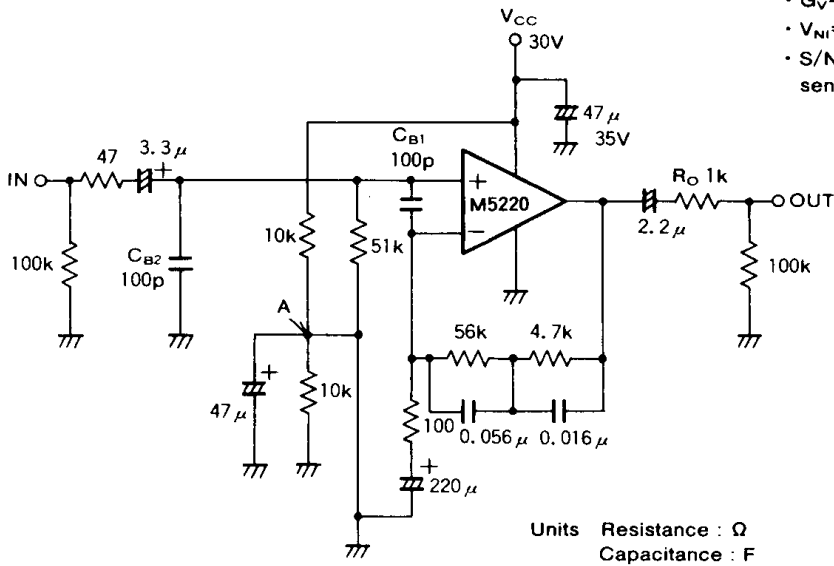
TOTAL HARMONIC DISTORTION VS. OUTPUT VOLTAGE



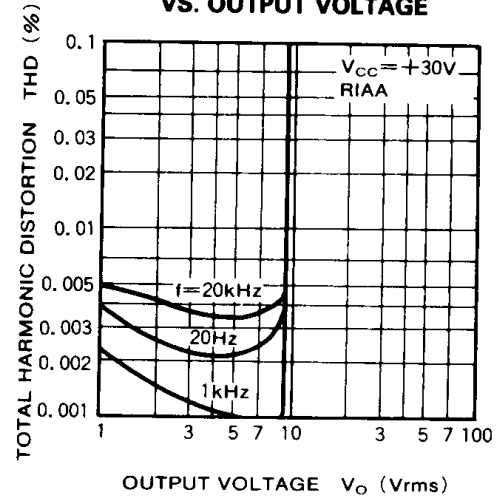
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DUAL LOW-NOISE OPERATIONAL AMPLIFIERS(DUAL POWER SUPPLY TYPE)
(3) Typical single power supply application
PHONO EQUALIZER AMPLIFIER (RIAA)

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


- \rightarrow 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.