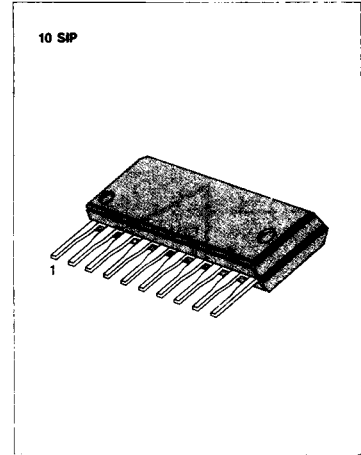


DUAL EQUALIZER PRE-AMPLIFIER WITH ALC

The KA22242 is a monolithic integrated circuit consisting of a dual equalizer amplifier with ALC and Mute function, and it is suitable for stereo radio cassette tape recorders.

FEATURES

- Dual equalizer amplifier with ALC circuit
- Direct coupling system of input circuit
- High open loop voltage gain ($G_{VO} = 85\text{dB}$ at $f = 1\text{KHz}$)
- Wide operating supply voltage range ($V_{CC} = 4\text{V} \sim 12\text{V}$)
- Low noise ($V_M = 1.0\mu\text{V}$ at $R_G = 2.2\text{K}\Omega$)
- Ripple rejection filter
- High input impedance ($R_i = 62\text{K}\Omega$)



ORDERING INFORMATION

Device	Package	Operating Temperature
KA22242	10 SIP	$-20^{\circ}\text{C} \sim +75^{\circ}\text{C}$

BLOCK DIAGRAM

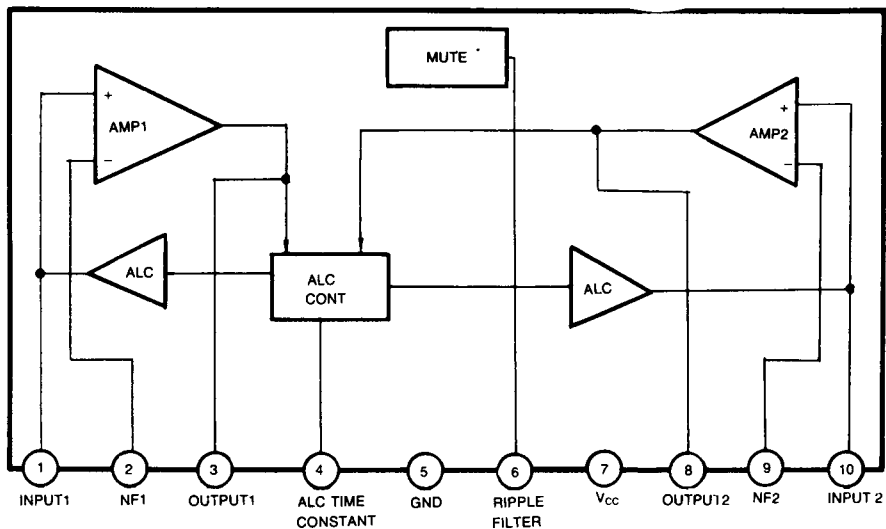


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	14	V
Power Dissipation	P_D	550	mW
Operating Temperature	T_{OPR}	-20 ~ +75	$^\circ\text{C}$
Storage Temperature	T_{STG}	-55 ~ +125	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 8\text{V}$, $f = 1\text{KHz}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CCO}		2.5	3.3	4.0	mA
Open-loop Voltage Gain	G_{VO}	$V_O = 1\text{V}$	75	85		dB
Total Harmonic Distortion	THD	$V_O = 0.3\text{V}$		0.5	1.0	%
Output Voltage	V_O	THD = 1%	1.9	2.2		V
Equivalent Input Noise Voltage	V_{NI}	$R_G = 2.2\text{K}\Omega$		1.0	2.5	μV
Input Resistance	R_i			62		$\text{K}\Omega$
Cross Talk	CT	$R_G = 2.2\text{K}\Omega$, $V_O = 1\text{V}$	45	55		dB
ALC Range	ΔV_{ALC}	$V_i = -52\text{dBm}$, 3dB up	40	45		dB
ALC Balance	CB_{ALC}	$V_i = -45\text{dB}$		0	2.0	dB
ALC Distortion	THD_{ALC}	$V_i = -45\text{dB}$		0.2	0.6	%
ALC Output Voltage	$V_{O(ALC)}$	$V_i = -45\text{dB}$	0.6	0.7	0.85	V

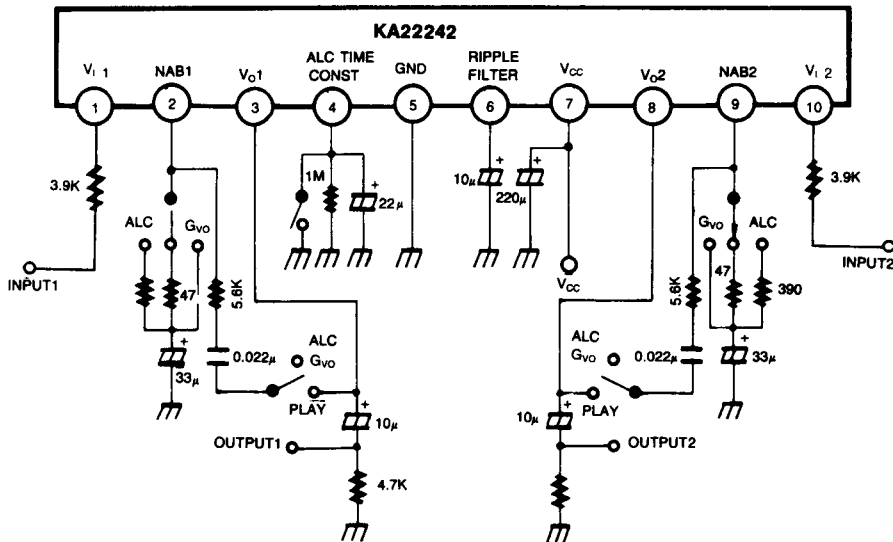
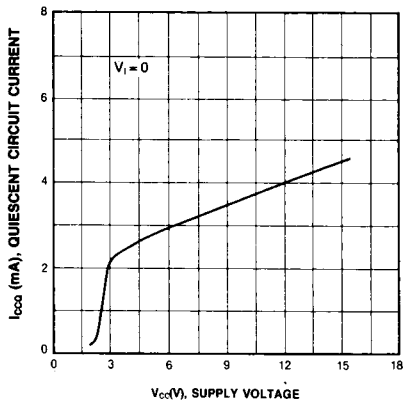
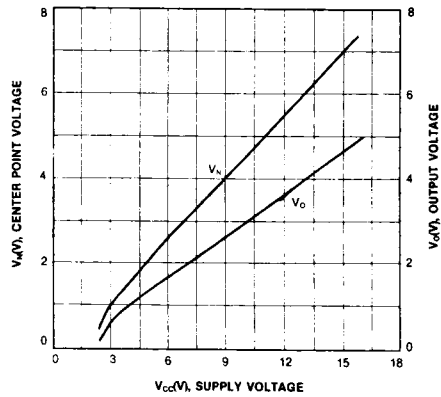


Fig. 2.

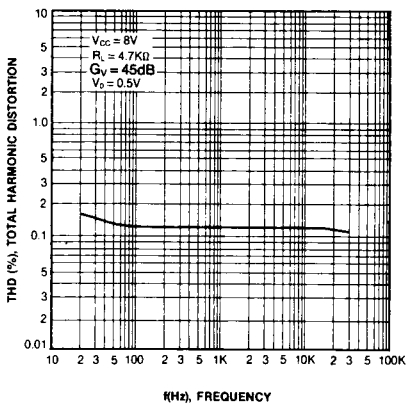
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



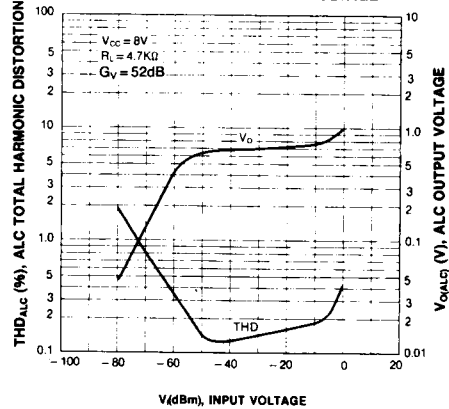
CENTER POINT VOLTAGE
OUTPUT VOLTAGE-SUPPLY VOLTAGE



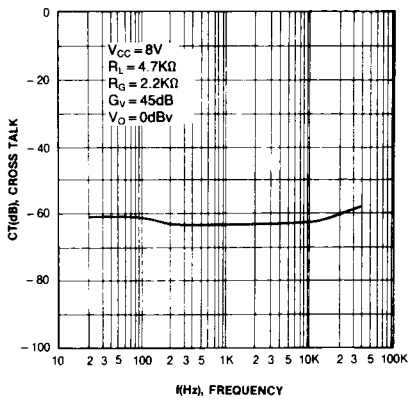
TOTAL HARMONIC DISTORTION-FREQUENCY



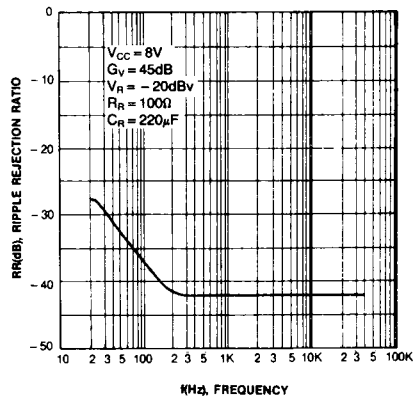
ALC OUTPUT VOLTAGE ALC TOTAL
HARMONIC DISTORTION-INPUT VOLTAGE



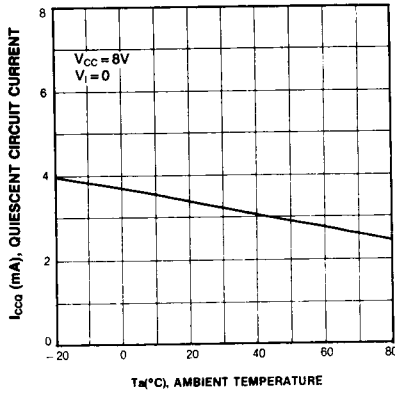
CROSS TALK-FREQUENCY



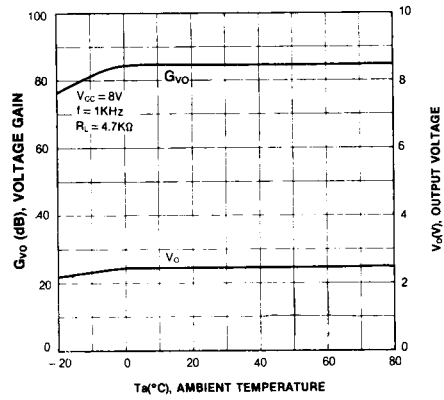
RIPPLE REJECTION RATIO-FREQUENCY



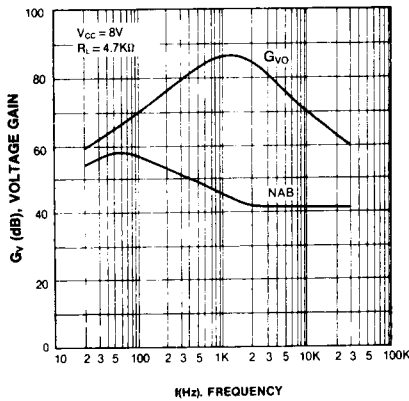
QUIESCENT CIRCUIT CURRENT-AMBIENT TEMPERATURE



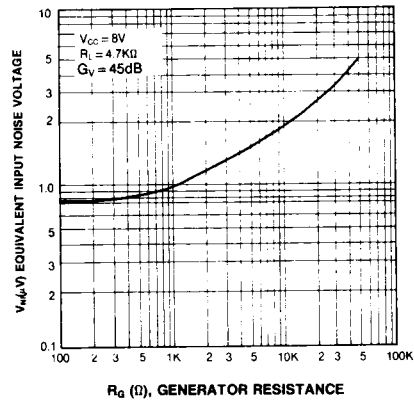
VOLTAGE GAIN OUTPUT VOLTAGE-AMBIENT TEMPERATURE



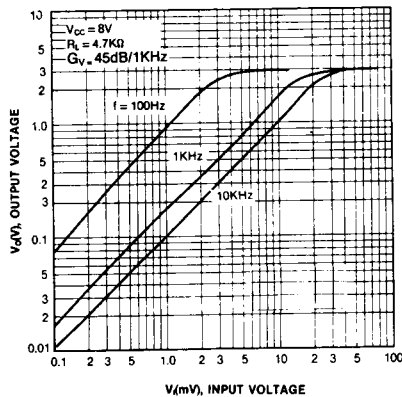
VOLTAGE GAIN-FREQUENCY



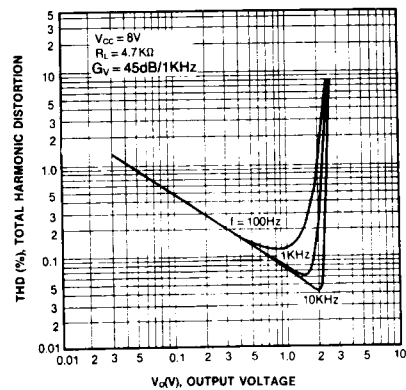
EQUIVALENT INPUT NOISE VOLTAGE-GENERATOR RESISTANCE



OUTPUT VOLTAGE-INPUT VOLTAGE



TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



APPLICATION INFORMATION

DESCRIPTION OF KA22242

The KA22242 has a simple package, 10-pin and built-in ALC detector, mute circuit and ripple rejection filter developed for cassette tape recorders. To provide a stereo function, it has been developed into a 2-channel pre-amplifier for recording and playback. Also to provide high speed dubbing and recording gain, its gain is high ($f = 1\text{KHz}$, $G_{VO} = 85\text{dB}$) and the total harmonic distortion is low ($f = 1\text{KHz}$, $\text{THD} = 0.5\%$). An input circuit is used as a direct coupling system to eliminate the input coupling capacitor and prevent tape head magnetization and pop noise. A built-in ripple circuit (ripple rejection transistor) improves the ripple rejection ratio. And the ALC circuit can achieve a wide dynamic range by simply attaching a time-constant circuit.

1. Playback Amplifier

To use the playback mode, the KA22242 can be applied for an NAB equalizer amplifier. The NAB characteristic is obtained by installing a NAB circuit in the Negative Feedback section (between Pins 2 and 3). In this case, Pin 4 is connected with the GND to eliminate the ALC effect.

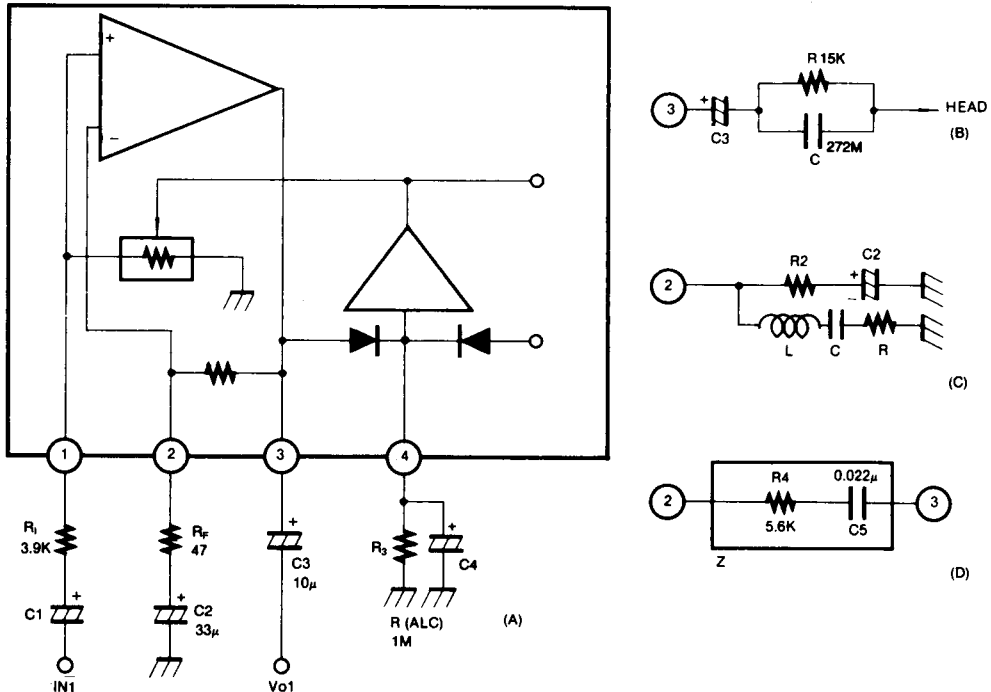


Fig. 3

2. Recording Amplifier (Figure 3 (A))

The recording amplifier's voltage gain is determined by the ratio of the internal $150\text{K}\Omega$ to R_2

$$G_V = 150\text{K}\Omega/R_2$$

The recording amplifier requires a compensation circuit to correct loss at high frequencies. The compensation circuit may be either CR or LC resonance. The frequency response of the resonance circuit is fixed at 1–4KHz. An example using a CR is shown in Figure 3 (B), and one using LC resonance is shown in Figure 3 (C).

3. ALC Circuit

For the dynamic range, the ALC circuit uses the simple time-constant circuit. ALC operation of the KA22242 is accomplished with a signal rectifier and electronic volume control. The signal rectifier uses the comparator circuit and the comparator circuit compares the DC voltage of the output signal with the reference voltage. If the output voltage is higher than the reference voltage, the comparator turns on to charge smoothing capacitor C4. For the dynamic range, a turn-off level $(0.7V_{rms}) + 6\text{dB}$ is ensured at $V_{CC} = 6\text{V}$. When the peak voltage of the output signal is $0.7V_{rms}$, the comparator comes on and the electronic volume control is connected between the input line and GND. The input signal is attenuated by the ratio of the external resistance R_1 to the electronic volume control resistance and ALC circuit is operated. The ALC range can be varied by changing R_1 . If R_1 is too large, the S/N ratio may degrade, so several Kohm is proper. The ALC attack time and recovery time are set at Pin 4 by C4 and R3. Note that the greater the time constant (C4, R3), the longer the recovery time, and the greater C4, the shorter the attack time.

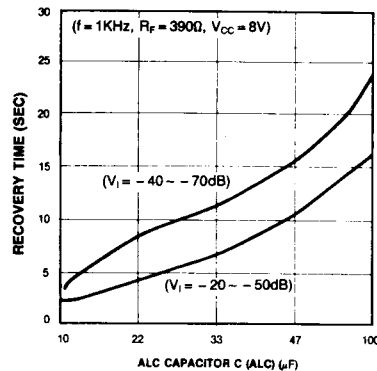


Fig. 4

Figure 4 is a ALC Time graph of the KA22242 at $R_F = 390\text{ohm}$.

At $R_F = 390\text{ohm}$, $V_1 = -40\text{dB}$,

ALC recovery time is about 8 seconds and when the ALC capacitor is increased, it is increased also. And it is can be adjusted to fix the design point. But as the recovery time varies by the input level, the value of this capacitor must be considered when the set is designed.

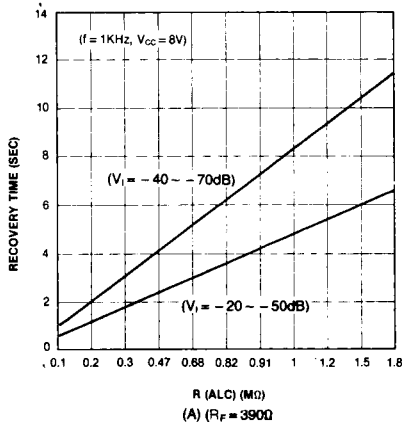


Fig. 5

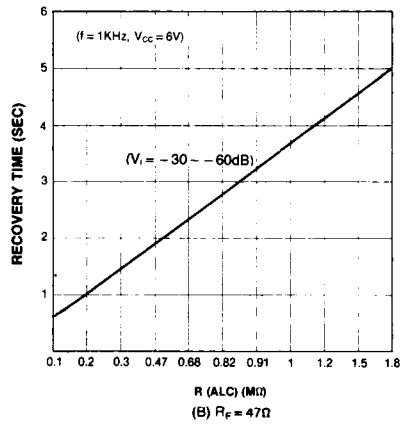


Fig. 6

As the Figure 3, because the R_F range is $47 \sim 100$ ohm normally at the set application, the matching between R_3 and C_4 occurs.

4. Mute Function

The KA22242 has a mute function to mute at the power switch on/off. To prevent a malfunction of the ALC circuit, the KA22242 is muted at this time. If the ALC is not muted, the supply voltage charges the ALC capacitor and generates error-operations. The muting time is varied by the time-constant of the ripple filter. $C_3 * R$ internal (15K)

If C_3 is too large, the rise time gets too slow and pop noises occur when other IC begins to operate faster than the KA22242 in some application circuit. In this case, if the combination with resistance is about 1Kohm, the DC voltage (V_{ODC}) at the output terminal is nearly constant.

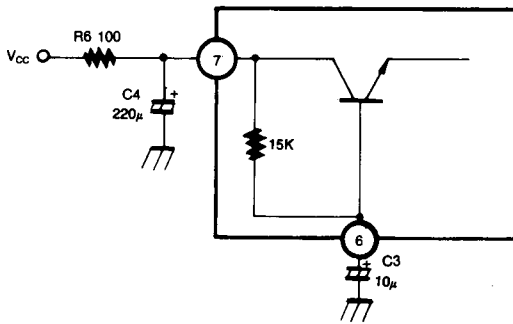


Fig. 7

APPLICATION CIRCUIT

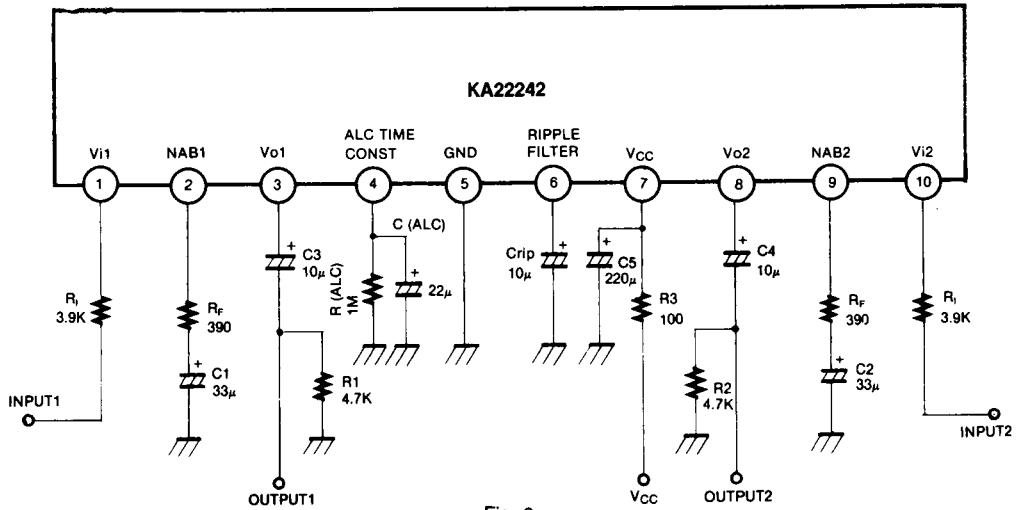


Fig. 8



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