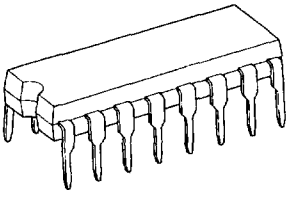
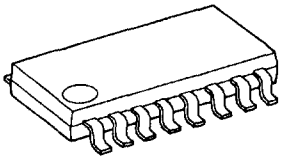
VOICE SIGNAL PROCESSING IC FOR ANSWERING TELEPHONE SET (FOR SINGLE CASSETTE)

TA31081P



DIP16-P-300A

TA31081F



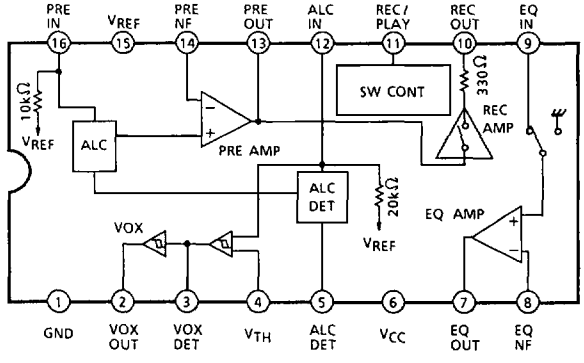
SSOP16-P-225A

Weight DIP16-P-300A : 1.1g (Typ.)
SSOP16-P-225A : 0.16g (Typ.)

FEATURES

- Built-in pre-amplifier with ALC.
  (Short attack time.)
- Built-in recording amplifier for ICM.
  (DC coupling capacitor is not required.)
- The recording system can be applied either to the DC bias method or the AC bias method through the external circuit.
- Built-in equalizer amplifier for tape playback.
- The device can be used as an automatic answering telephone using either single cassette and a LSI for voice recording.
- Built-in detecting circuit for voice signal and DTMF signal.
- Signal detection level can be varied by external resistance.
- Operating power supply voltage range : $V_{CC} = 3.8 \sim 8V$
- Recommendable power supply voltage : $V_{CC} = 5.0V$
- Quiescent current : $I_{CCQ} = 4.5mA$ (Typ.) at $V_{CC} = 5.0V$

BLOCK DIAGRAM



PIN FUNCTION

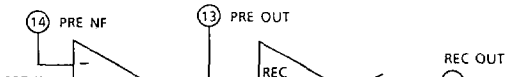
PIN No.	PIN NAME	FUNCTION
1	GND	[GND]
2	VOX OUT	[Signal detection output] The voltage level of this pin changes from V_{CC} to low level, when this pin detects the signal from PRE AMP. For open collector output, connect to V_{CC} through a resistance.
3	VOX DET	[Signal detection] Connect a resistance and a capacitor for detection.
4	V_{TH}	[Signal detection level adjustment] Connect to GND through a resistance. Signal detection level is variable according to value of a resistance.
5	ALC DET	[ALC detection] ALC attack time and recovery time is decided by the value of a resistance and a capacitor.
6	V_{CC}	[Power supply voltage]
7	EQ OUT	[EQ AMP. output] The gain of EQ AMP. is variable according to value of external parts.
8	EQ NF	[EQ AMP. negative feedback] This pin gets negative feedback from EQ AMP. output (pin 7).
9	EQ IN	[EQ AMP. input] PLAY mode : This pin inputs the signal (from head) to EQ AMP. REC mode : This pin supplies DC bias current to head.
10	REC OUT	[REC output] This pin inputs the signal (from PRE AMP.) to head through REC AMP.
11	REC/PLAY	[Recording/Playing selection] Connect to CPU through the resistance 4.7kΩ. PLAY mode : Low level REC mode : Open
12	ALC IN	[ALC detection input] This pin is input pin of detection circuit for ALC, and input pin of VOX circuit. Connect to PRE AMP. output through the capacitor (0.1μF).
13	PRE OUT	[PRE AMP. output] The gain of PRE AMP. is variable according to value of external parts.
14	PRE NF	[PRE AMP. negative feedback] This pin gets negative feedback from PRE OUT (pin 13).

PIN No.	PIN NAME	FUNCTION
15	V_{REF}	[Reference voltage] The reference voltage is around 1.5V for each amplifier. Don't use for external Supply voltage.
16	PRE IN	[PRE AMP. input] This pin inputs the followings signal to PRE AMP. ; Signal from MIC through the capacitor, signal from the telephone line by connecting to speech network or line transformer through attenuator.

OPERATING INSTRUCTIONS

1. Gain distribution

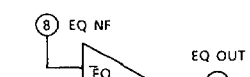
(1) Recording system



PRE AMP. GAIN	REC AMP. GAIN
50 + 10dB	0dB

※ PRE AMP. has about 10dB gain in itself.

(2) Playing system



EQ AMP. GAIN
45dB

※ The gain of PRE AMP. is the value when ALC OFF.
※※ The values in this chart are approximate.

2. Switch condition

HEAD CONDITION	REC / PLAY MODE (pin 11)	REC AMP. SWITCH	EQ IN SWITCH
REC	REC. mode by CPU	ON	GND
PLAY	PLAY mode by CPU	OFF	ON

3. PRE AMP.

The signal (message signal from opposite or message signal to transmit to opposite) to be input to PRE IN (pin 16) is amplified or limited (by ALC), and transmits to head for tape.
PRE OUT (pin 13) is also used for detecting a remote control signal from opposite with ALC circuit.

4. ALC DET

ALC attack time is decided by the value of a capacitor (at pin 5), and recovery time is decided by the value of a capacitor and a resistor.

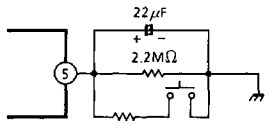
Attack time : around 20ms

Recovery time : around 4.0s

Regarding the other ALC characteristics, refer to the attached data.

The reset on ALC operation is to connect the resistance and push switch between pin 5 and GND (see below).

The reset of ALC operation is to turn ON push switch.



The ALC operation stop is to open circuit at PRE IN (pin 16). In this case VOX circuit is un-operating.

5. VOX circuit

The VOX circuit detects voice, busy tone and dial tone.

(The distinction of each signals is to use CPU.)

The signal detection level is variable according to the value of external resistance at V_{TH} (pin 4).

Result of detection output to VOX OUT (pin 2).

Connect to V_{CC} through a resistance because of open collector output in VOX OUT (pin 2).

The VOX OUT (pin 2) gets the following conditions ;

Signal detecting : Low level

No signal : Open condition

6. How to vary DC bias current (to REC head)

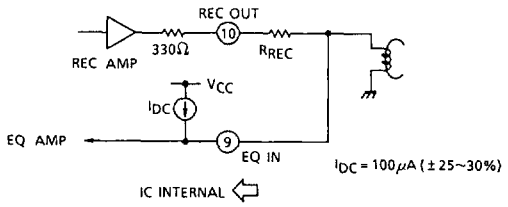
The bias current to REC/PLAY head (through REC AMP.) is variable according to the value of a resistance to be connected between PRE NF (pin 14) and GND (pin 1). For the resistance, off-set voltage is appeared in PRE AMP. and REC OUT (pin 10) (The switch of REC AMP. should be ON condition). The off-set voltage gets the current to the REC/PLAY head.

7. DC bias current decision

(1) DC bias current

$$\text{DC bias current } I_{BIAS} = \frac{V_{PDC}}{330 + R_{REC} + R_{HDC}} + I_{DC}$$

R_{HDC} ····· Head DC resistance
V_{PDC} ····· PRE AMP. DC output voltage



(2) Recording current

$$\text{Recording current } I_{REC} = \frac{V_{PALC}}{330 + R_{REC} + R_{HAC}}$$

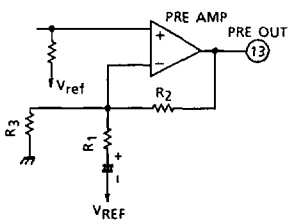
R_{HAC} ····· Head AC impedance
V_{PALC} ····· PRE AMP. DC output voltage (on ALC operation)

If $R_{REC} \gg R_{HAC}$, it is constant current recording.

(3) PRE AMP. DC output voltage adjustment

PRE AMP. DC output voltage (V_{PDC}) is increased by additional resistance between pin 14 and GND.

$$V_{PDC} = V_{REF} \times \frac{R_3 + R_2}{R_3}$$

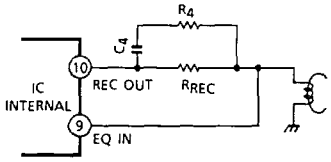


If, no connection of R_3, $V_{PDC} = V_{REF}$.
The gain of PRE AMP. is variable according to the value of R_3.
DC bias current is as follows.
If $R_3 = \infty$ on the application circuit,

$$I_{BIAS} = \frac{1.5V}{330\Omega + 10 \times 10^3\Omega + 300\Omega} + 100\mu A \fallingdotseq 240\mu A$$

$(R_{HDC} = 300\Omega)$

DC bias current decreasing is to enlarge resistance (R_{REC}) value.
In this case, the recording current will be decreasing. But, by connection DC cut capacitor (C_4, 1μF around) and resistance (R_4), it is available recording current (for flowing current in R_{REC} and R_4).



When the resistance R_3 and DC bias current is varied, recording current is unvaried.
(But if R_{REC} is varied, recording current is varied.)

OTHER BIPOLAR ICs FOR TELEPHONE SET

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Power Supply Voltage		V_{CC}	15	V
Power Dissipation	TA31081P	P_D	1000	mW
	TA31081F		370	
Operating Temperature		T_{opr}	−35~85	°C
Storage Temperature		T_{stg}	−55~150	°C

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, V_{CC} = 5V, f_{IN} = 1kHz, R_3 = 20kΩ, Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Quiescent Current	I_{CCQ}	1	PLAY mode	—	4.5	6.2	mA
Internal Reference Voltage	V_{REF}	2	—	—	1.56	—	V

PRE AMP.

Closed Loop Voltage Gain	G_{VP}	3	ALC OFF, V_{IN} = −62.2dBV R_3 = 20kΩ	58	60	62	dB
Output Noise Voltage	V_{NP}	4	PLAY, R_g = 600Ω	—	1.5	3.0	mV_{rms}
Total Harmonic Distortion	THD_P	3	V_{IN} = −37.2dBV	—	0.1	1.0	%
Maximum Input Level	$V_{IN\ PM}$	3	THD = 1%	−15.2	−13.2	—	dBV
Input Impedance	$R_{IN\ P}$	—	—	7.5	10	12.5	kΩ
ALC ON Output Voltage	V_{ALC}	3	V_{IN} = −37.2dBV, PLAY	600	690	780	mV_{rms}
ALC Effect	ALC1	3	V_{IN} = −57.2~−17.2dBV, PLAY	—	2.9	4.5	dB
ALC Range	ALC2	3	THD ≦ 1%, PLAY mode	55	64	—	dB

REC AMP.

Output Impedance	RO_R	—		—	330	—	Ω

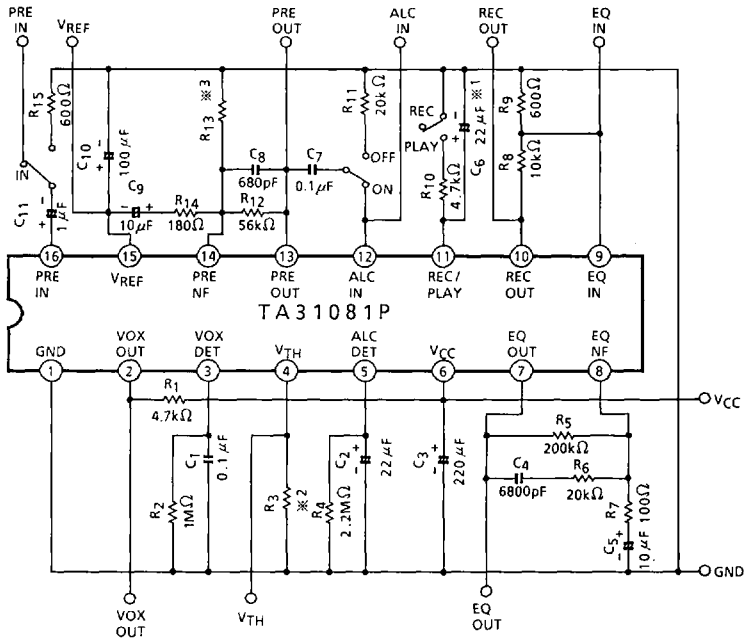
EQ AMP.

EQ Open Loop Voltage Gain	G_{VOE}	5	V_O = −22.2dBV, R_3 = 20kΩ, PLAY	75	—	—	dB
Output Noise Voltage 1	V_{NEP}	7	PLAY mode	—	1.1	2.4	mV_{rms}
Output Noise Voltage 2	V_{NER}	7	REC. mode	—	1.1	2.4	mV_{rms}
Total Harmonic Distortion	THD_E	6	V_{IN} = −60.2dBV	—	0.6	1.2	%

VOX

Minimum Detection Level	V_{XL}	8	f_{IN} = 400Hz	—	—	−18.7	dBV
Maximum Sink Current	I_S	—	$V_{VOX\ (MIN.)}$ = 0.3V	2.5	6	—	mA

TEST CIRCUIT (TA31081P)



※1 The C_6 is the capacitor for preventing the click sound at switching.

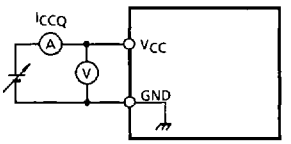
※2 The detection sensitivity can be varied through R_3.
(The detection sensitivity is the maximum at open.)

※3 The R_{13} is resistance for adjusting the DC bias current.

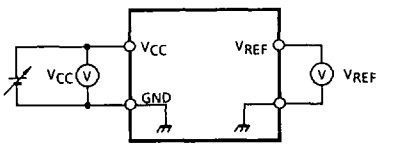
TEST CIRCUIT

Unless otherwise specified, the switch state is "INPUT ON, ALC ON, PLAY".

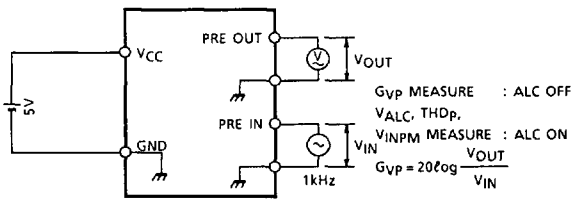
(1) I_{CCQ}



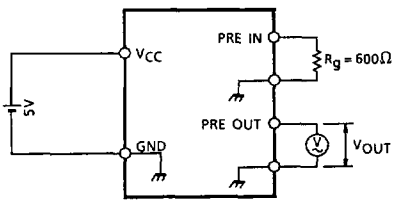
(2) V_{REF}



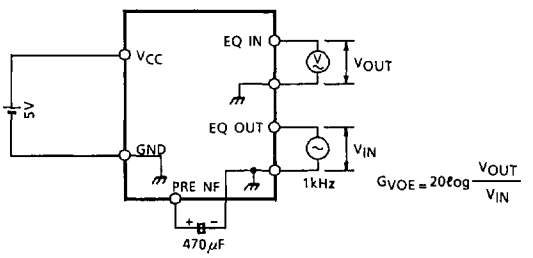
(3) G_{VP}, V_{ALC}
THD_P, V_{INPM}



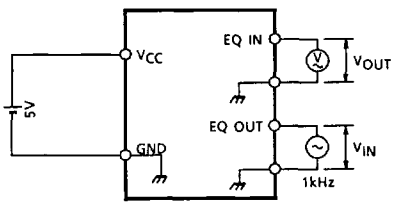
(4) V_{NP}



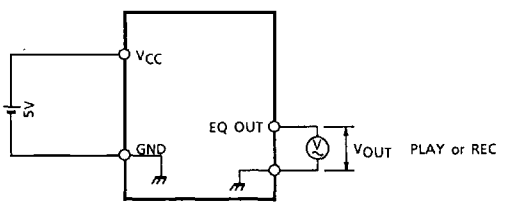
(5) G_{VOE}



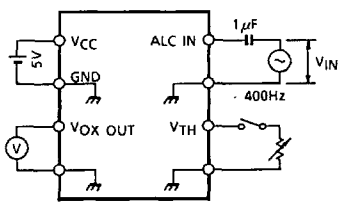
(6) THD_E



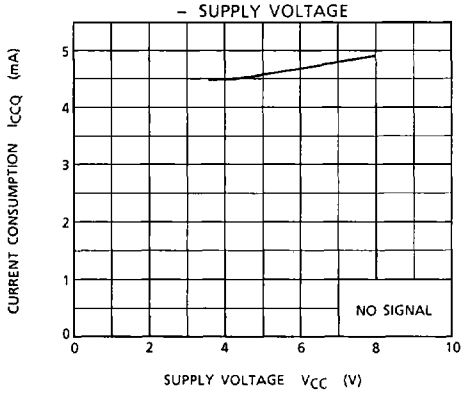
(7) V_{NEP}, V_{NER}



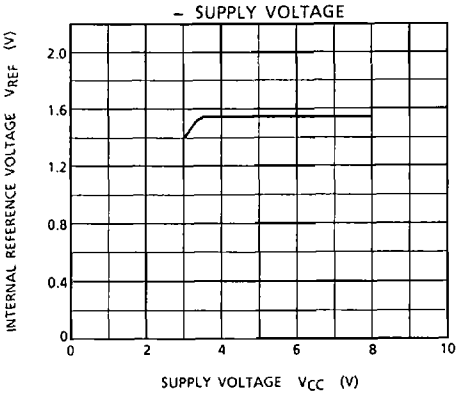
(8) V_{XL}



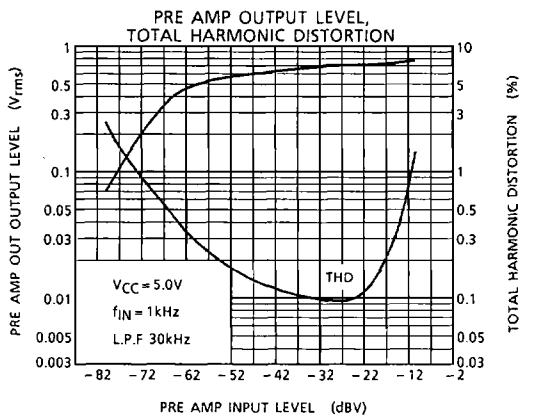
CURRENT CONSUMPTION
– SUPPLY VOLTAGE



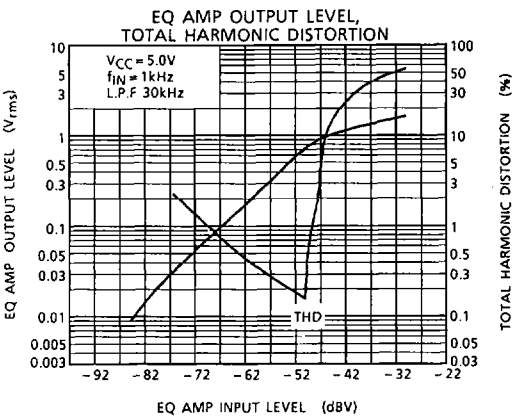
INTERNAL REFERENCE VOLTAGE
– SUPPLY VOLTAGE



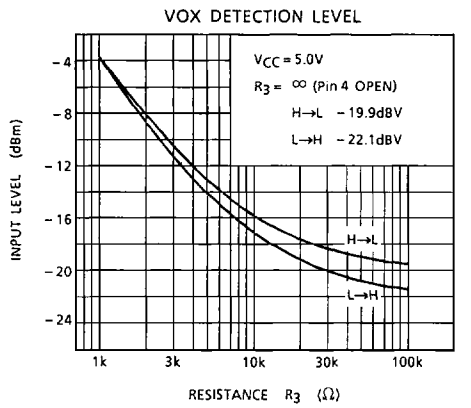
PRE AMP OUTPUT LEVEL,
TOTAL HARMONIC DISTORTION



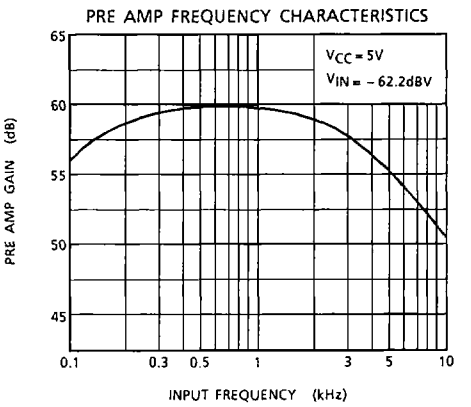
EQ AMP OUTPUT LEVEL,
TOTAL HARMONIC DISTORTION

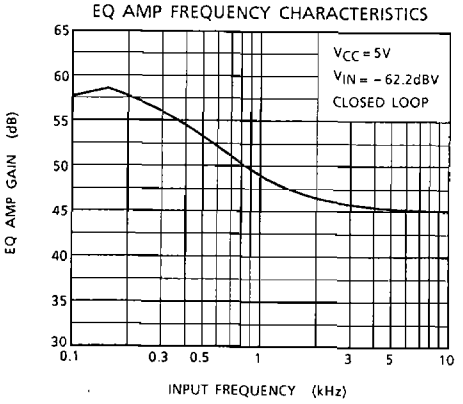


VOX DETECTION LEVEL

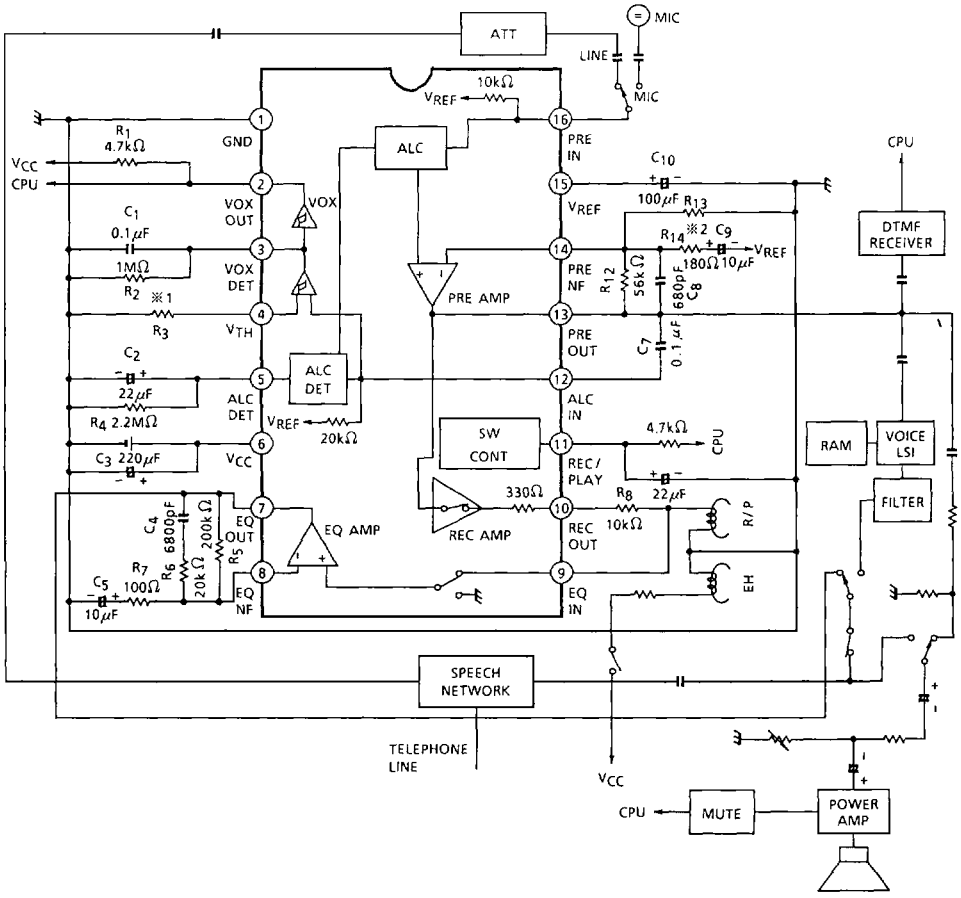


PRE AMP FREQUENCY CHARACTERISTICS



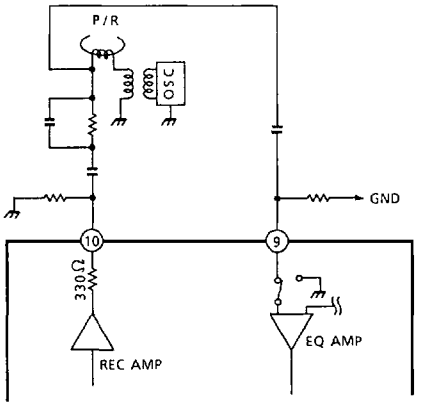

EQ AMP FREQUENCY CHARACTERISTICS
V_{CC} = 5V
V_{IN} = −62.2dBV
CLOSED LOOP
EQ AMP GAIN (dB)
65
60
55
50
45
40
35
30
0.1
0.3
0.5
1
3
5
10
INPUT FREQUENCY (kHz)

APPLICATION CIRCUIT



※ 1. The resistance for adjusting the detection sensitivity.
(The detection sensitivity is the maximum at open.)
2. The resistance for adjusting the DC bias current.

AC bias usage



- The recording system is for not only DC bias method but also AC bias method.
- Use AC frequency (for bias) to be more than 5 times of recording maximum frequency so that the recording current frequency and higher harmonic frequency is uncrossed.