

9097247 TOSHIBA, ELECTRONIC

02E 17479 D

TA7658P

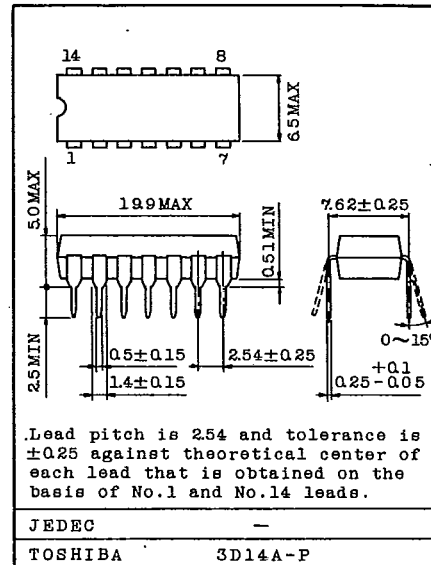
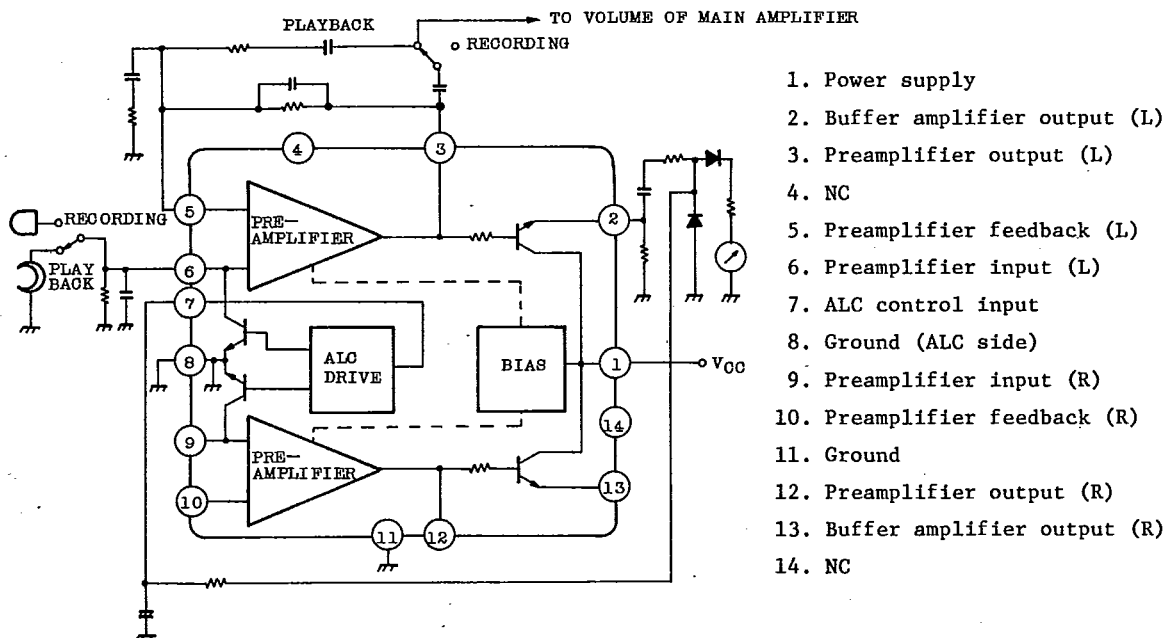
T-77-2.1

DUAL PREAMPLIFIER FOR TAPE RECORDER

The TA7658P is a dual preamplifier with ALC (Automatic Level Control) designed for use in a record/playback amplifier of tape recorder. It is suitable for a stereo set and a radio-cassette recorder.

- DIP 14 PIN (Dual In-Line Package)
- Built-in Buffer Amplifier (It permits meter drive and ALC to be easily performed)
- No Input Coupling Capacitor
- Quick Stabilization at Power ON.
- Wide Supply Voltage Range: $V_{CC}=3\sim 16V$

Unit in mm

**BLOCK DIAGRAM****TOSHIBA**

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MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	VCC	16	V
Output Current (Buffer amplifier Pin 2, Pin 13)	I ₂ , I ₁₃	3	mA
Output Current (Preamplifier Pin 6, Pin 9)	I ₆ , I ₉	2	mA
Power Dissipation (Note)	P _D	625	mW
Operating Temperature	T _{opr}	-25 ~ 75	°C
Storage Temperature	T _{stg}	-55 ~ 150	°C

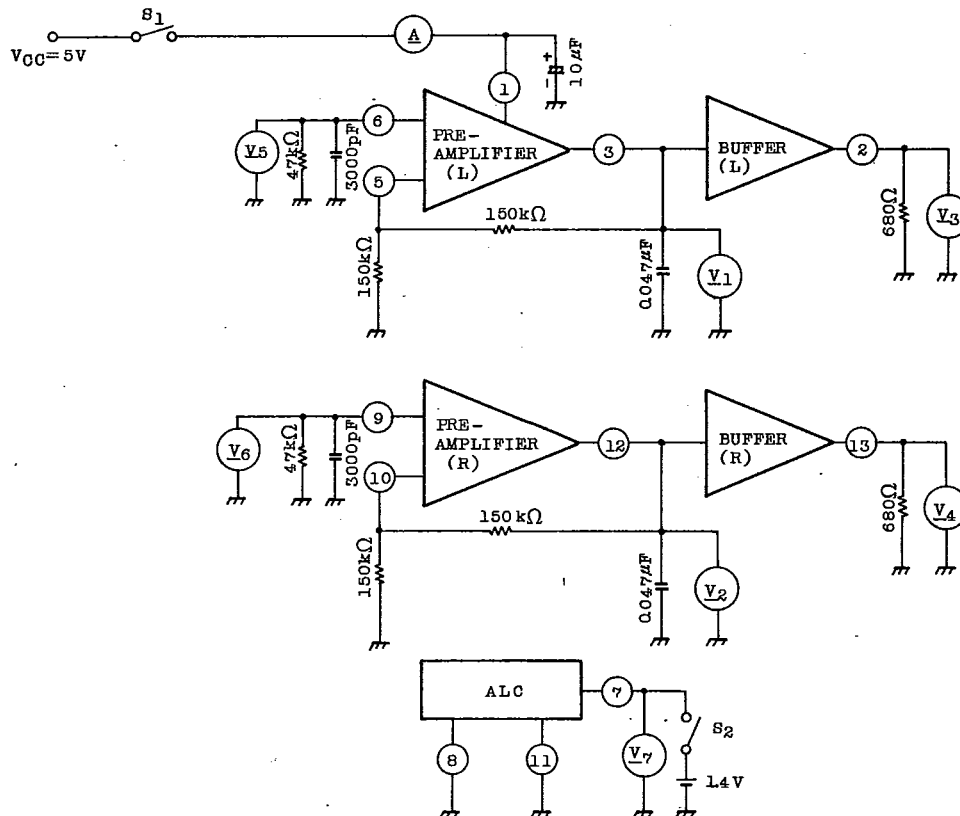
Note: Derated above Ta=25°C in the proportion of 5mW/°C.

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified Ta=25°C, VCC=5V, f=1kHz)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Quiescent Current	I _{CCQ}	1	-	6	10	15	mA
Input Terminal DC Voltage	V ₆ , V ₉	1	-	-	15	50	mV
Output Terminal DC Voltage	V ₃ , V ₁₂	1	-	2.2	2.5	2.8	V
Buffer Output DC Voltage	V ₂ , V ₁₃	1	-	1.4	1.6	2	V
ALC Bias Voltage	V ₇	1	-	0.4	0.55	0.7	V
ALC ON Voltage	V _{IN} (ALC)	1	V ₇ =1.4V	-	5	30	mV
ALC Range	R _{ALC}	2	V _{IN} =-60dBm	35	40	-	dB
ALC Level	V _{OUT} (ALC)	2	V _{IN} =-20dBm	-3	-1	1	dBm
Total Harmonic Distortion (ALC)	THD (ALC)	2	V _{IN} =-20dBm	-	0.6	2	%
ALC Balance	B _{ALC}	2	-	-	0	2	dB
Max. Output Voltage	V _{OM}	2	THD=1%	1.3	1.7	-	V _{rms}
Channel Crosstalk	CT	2	R _g =2.2kΩ, V _{OUT} =0dBm	40	50	-	dB
Open Loop Voltage Gain	G _{VO}	2	V _{IN} =-80dBm	67	75	-	dB
Equivalent Input Noise Voltage	V _{NI}	2	R _g =2.2kΩ	-	1.3	2.7	μV _{rms}

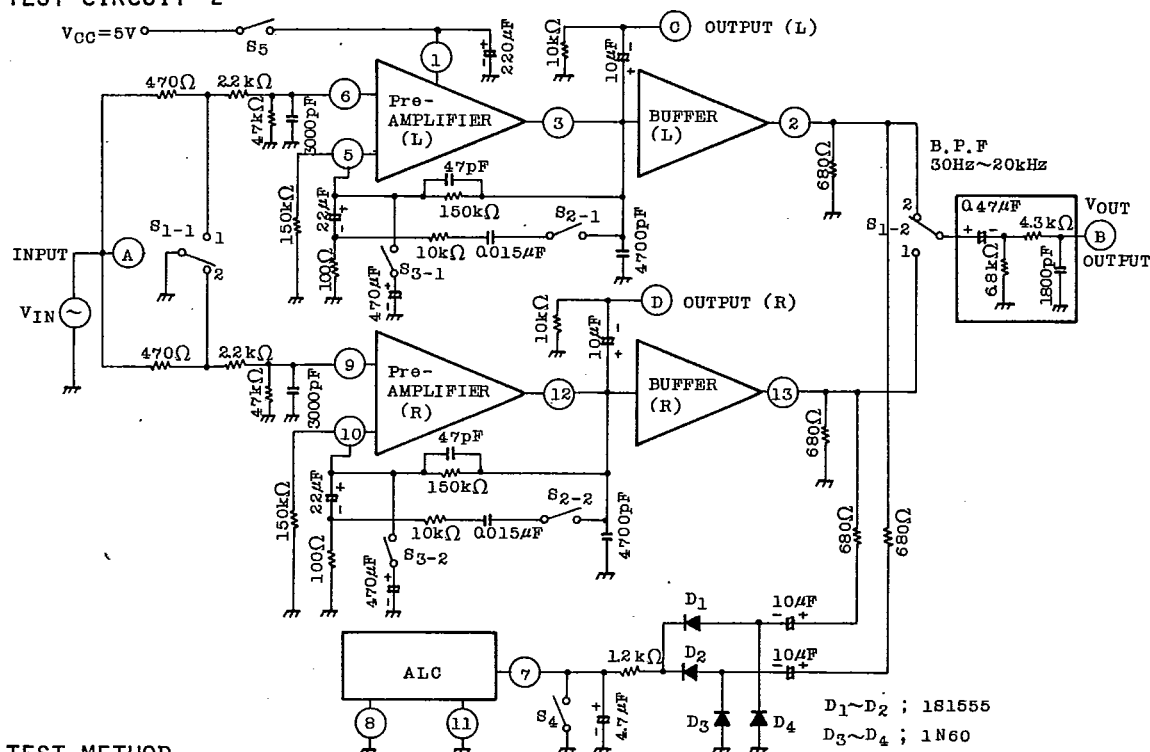
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TA7658P**TEST CIRCUIT 1****TEST METHOD**

SYMBOL	S ₁	S ₂	TEST POINT	TEST PROCEDURE
I _{CCQ}	ON	OFF	A	Read ammeter
V ₆ , V ₉	ON	OFF	V ₅ , V ₆	Read voltmeter
V ₃ , V ₁₂	ON	OFF	V ₁ , V ₂	Read voltmeter
V ₂ , V ₁₃	ON	OFF	V ₃ , V ₄	Read voltmeter
V ₇	ON	OFF	V ₇	Read voltmeter
V _{IN} (ALC)	ON	ON	V ₅ , V ₆	Measure the voltage on pin 6 and pin 9 when 1.4V is applied to pin 7

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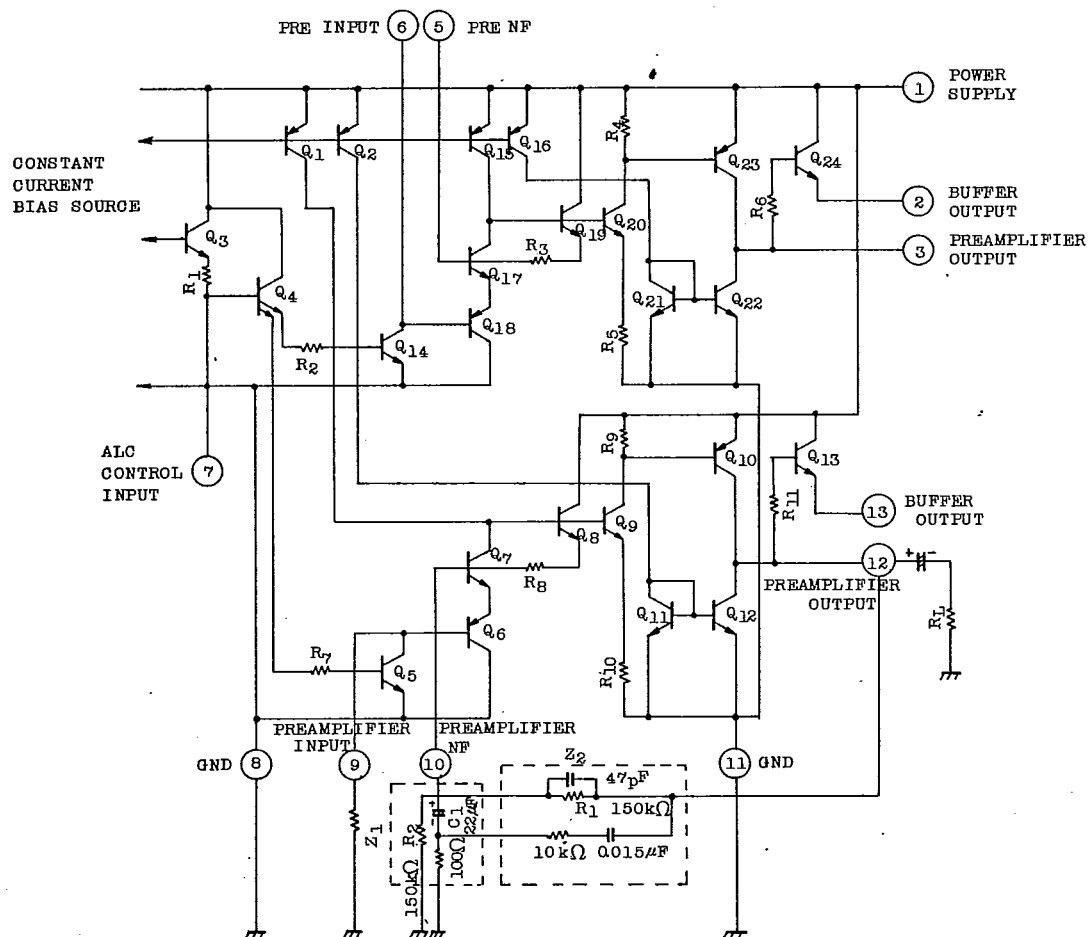
TEST CIRCUIT 2



TEST METHOD

SYMBOL	S1		S2	S3	S4	S5	TEST POINTS	TEST PROCEDURE
	L	R						
GVO	1	2	OFF	ON	ON	ON	A,C,D	GVO is obtained by $GVO=20 \log V_{OUT}/V_{IN}$ (dB). If input voltage is V_{IN} and output voltage is V_{OUT}
$V_{OUT}(ALC)$	1	2	OFF	OFF	OFF	ON	B	Output voltage V_{OUT} is measured with a VTVM when input voltage $V_{IN}=-20dBm$ is applied.
THD(ALC)	1	2	OFF	OFF	OFF	ON	B	Output voltage V_{OUT} is measured with a distortion meter when input voltage $V_{IN}=-20dB$ is applied.
VNI	$S1-1=1$ $S1-2=2$	$S1-1=2$ $S1-2=2$	ON	OFF	ON	ON	B	Output voltage V_{OUT} at $R_g=2.2k\Omega$ is measured with a VTVM, and is converted by the gain of 1kHz.
V_{OM}	1	2	ON	OFF	ON	ON	C,D	Measure output voltage V_{OUT} at total harmonic distortion $THD=1\%$ is measured with a VTVM.
CT	1	2	ON	OFF	ON	ON	B	Crosstalk between(L) and (R) at output voltage $V_{OUT}=0dBm$ is measured.
R_{ALC}	1	2	OFF	OFF	OFF	ON	B	Input voltage range from $V_{IN}=-60dBm$ to output voltage V_{OUT} 3dB UP.
B_{ALC}	1	2	OFF	OFF	OFF	ON	B	Level difference between output voltages V_{OUT} (L) and (R) at the time when input voltage $V_{IN}=-20dBm$ is applied.

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TA7658P**EQUIVALENT CIRCUIT**

TA7658P**DESCRIPTION OF EQUIVALENT CIRCUIT****1) BIAS CIRCUIT**

The constant current circuit formed by Q₁ and Q₂ is connected to the constant current bias source composed of being free from power supply variation for the purpose of obtaining a bias source of higher power supply ripple suppression ratio. Therefore, the operating current of the first stage transistor Q₆ is not affected by the power supply variation, and the ripple suppression ratio shows a good characteristic since the operating electric potential of the first stage (Q₇ collector) is stabilized, thus requiring no decoupling at the first stage.

2) AMPLIFIER

The first stage is a complimentary differential stage of Q₆ and Q₇, the input terminal voltage (Q₆ base) is about "0"V, and the playback head can be directly coupled without a chemical capacitor.

Q₁ not only sets the first stage current, but also functions as an active load. The medium stage Q₉ is approximately a phase inverter and level shift stage for the gain 1. The output stage Q₁₀ is the emitter ground stage changing Q₁₂ to an active load. The current is defined by Q₁₁ and Q₁₂ as $I(Q_{10}) \approx 1.6\text{mA}$.

At the back of the output stage, the emitter follower Q₁₃ is directly coupled in IC for buffering. Q₁₃ is an open emitter, and the operating current can be arbitrarily selected by an external resistor.

3) ALC CIRCUIT

The transistor Q₅ for ALC (Automatic Level Control) is DC-coupled to the input terminal. Therefore, Q₆ bias resistor is connected in parallel between the collector and emitter of Q₅. ALC control terminal ⑦ (Q₄ base) is DC-biased in about 0.55V by Q₃. Consequently, attack time can be shortened since the smoothing capacitor for ALC has been biased in 0.05V from the beginning.

4) VOLTAGE GAIN

◦ Open Loop Voltage Gain G_{V0} (1kHz) in Amplifier

$$G_{V0}(1\text{kHz}) = \frac{1}{2r_{e(Q6)} \cdot R_{10}} \times h_{FE}(Q_{10}) \times R_L \text{ is obtained.}$$

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$$\text{IF } \left. \begin{aligned} \frac{1}{h_{oe}(Q_1)} &= 50k\Omega \\ h_{FE}(Q_{10}) &= 20 \\ R_L &= 10k\Omega \\ 2r_e(Q_6) &= 1k\Omega \\ R_{10} &= 1.8k\Omega \end{aligned} \right\}$$

is given, $G_{V0} \approx 5.5 \times 10^3 \approx 74.9\text{dB}$
is realized.

$$\left(\begin{array}{l} \frac{1}{h_{oe}(Q_1)} \dots\dots Q_1 \text{ output impedance} \\ 2r_e(Q_6) \dots\dots Q_6 \text{ emitter junction resistance} \end{array} \right)$$

o Close Loop Voltage Gain $G_V(1\text{kHz})$

$$G_V(1\text{kHz}) = \frac{G_{V0}}{1 + \beta \cdot G_{V0}} \dots\dots\dots (1) \quad (\beta = \text{Feedback ratio})$$

$$\beta = \frac{Z_1}{Z_1 + Z_2} \dots\dots\dots (2) \quad \text{is made.}$$

$$\text{If } \left. \begin{aligned} G_{V0} &= 75\text{dB} \\ Z_1 &= 100\Omega \\ Z_2 &= 13.3k\Omega \end{aligned} \right\} \text{ are given, put the equation (1) into the equation (2),}$$

$$G_V(1\text{kHz}) = 1.32 \times 10^2 = 42.4\text{dB} \text{ is obtained.}$$

o Selection of External Resistors R_1 and R_2

R_1 and R_2 in the internal equivalent circuit should be appropriately selected to obtain output as much as possible. Output terminals (L) = pin 3 and (R) = pin 12 can obtain the maximum output at the time of $1/2 V_{CC}$. Therefore, the values of R_1 and R_2 may be selected according to the following equations.

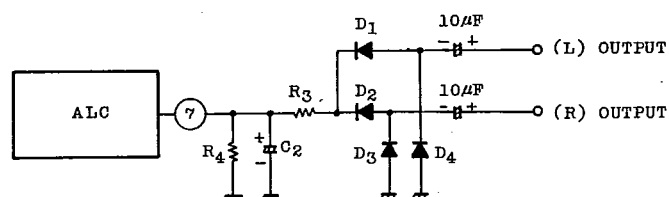
$$V_{12}(V_3) = \frac{V_{CC}}{2} = \frac{R_1 + R_2}{R_2} \times V_{10}(V_5) \quad V_{10}(V_5) = 1.1 \sim 1.2\text{V}$$

L channel is shown in (V3).

Graph "VOM, R_2 -VCC" shows the relation between V_{CC} and the maximum output at the time when $R_1 = 150k\Omega$ as parameter R_2 . The value of R_2 should be selected by taking the characteristics at decreasing voltage into due consideration.

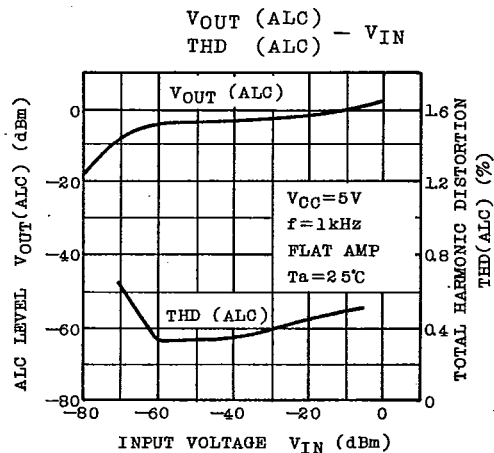
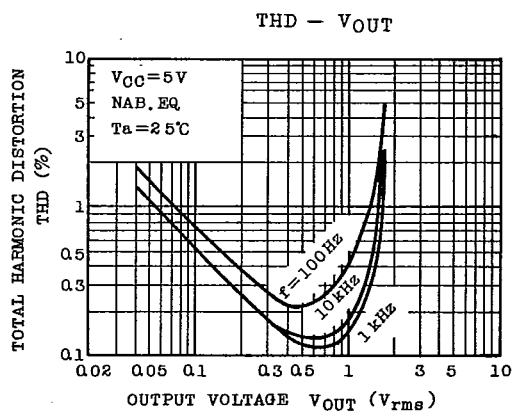
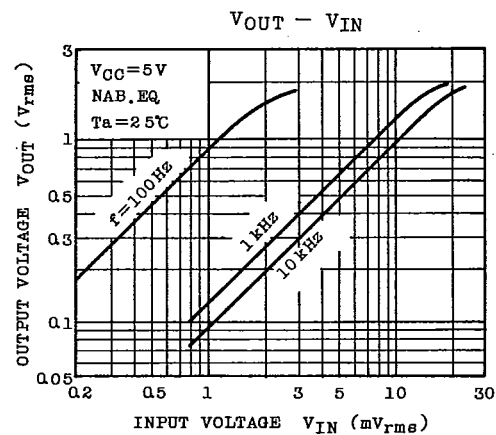
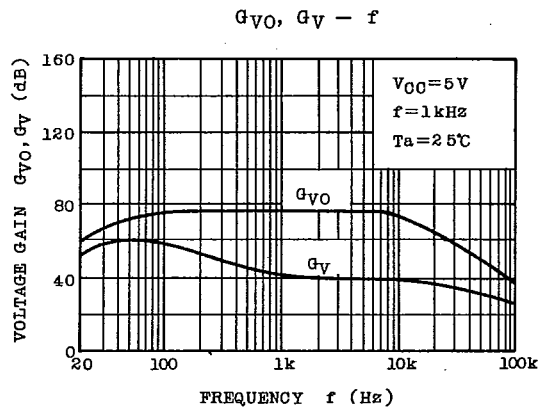
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5) ALC ATTACK TIME AND RECOVERY TIME SETTING



The attack time from the application of the input signal to the starting of ALC can be adjusted by the time constants of R_3 and C_2 , while the recovery time from no application of the input signal to the restoration of amplifier gain can be adjusted by the time constants of R_4 and C_2 . In addition, silicon diode should be used for D_1 and D_2 , while germanium diode for D_3 and D_4 . A capacitor of $47\mu\text{F}$ or more should be used for C_2 .

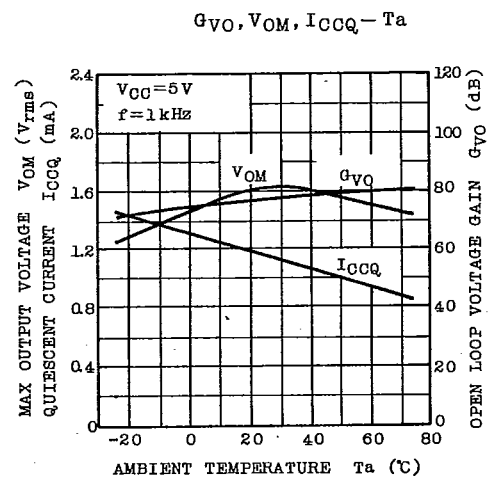
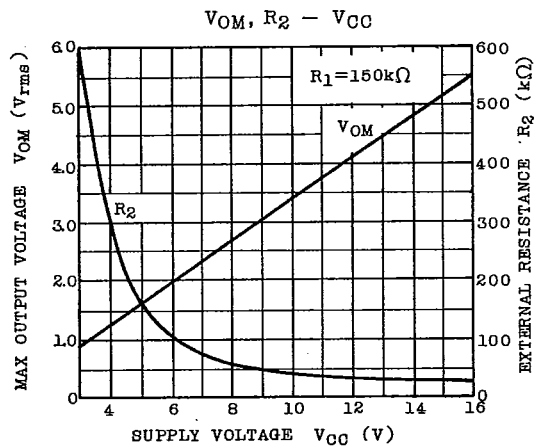
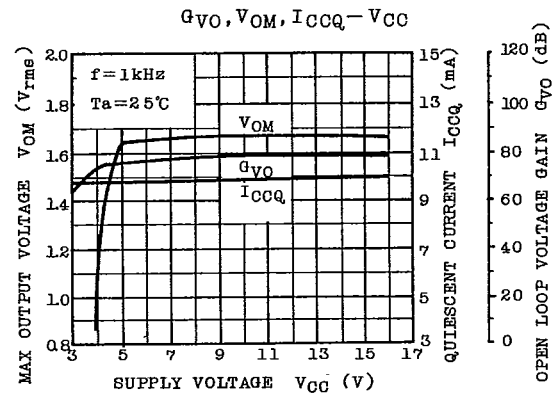
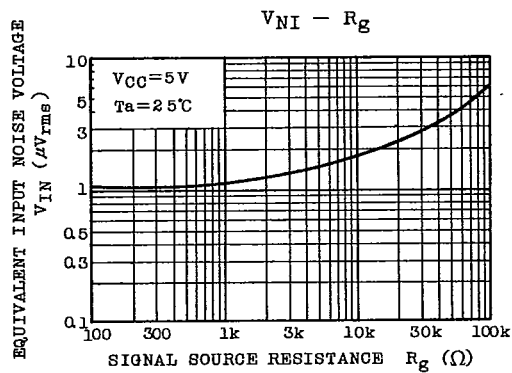
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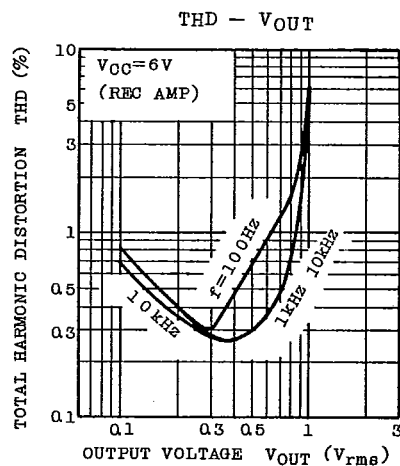
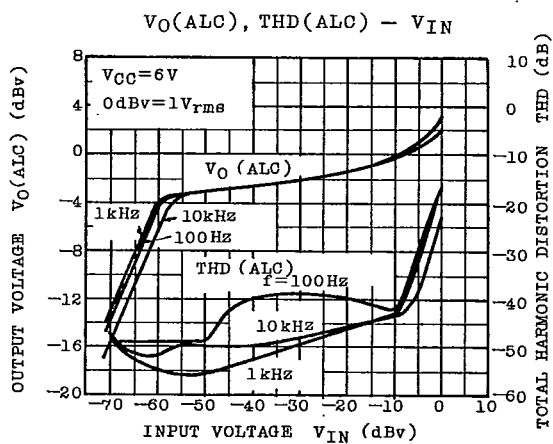
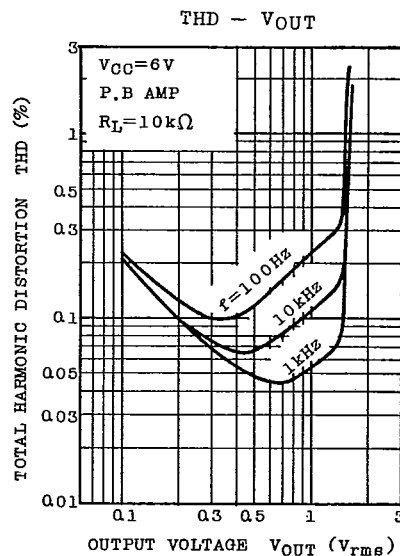
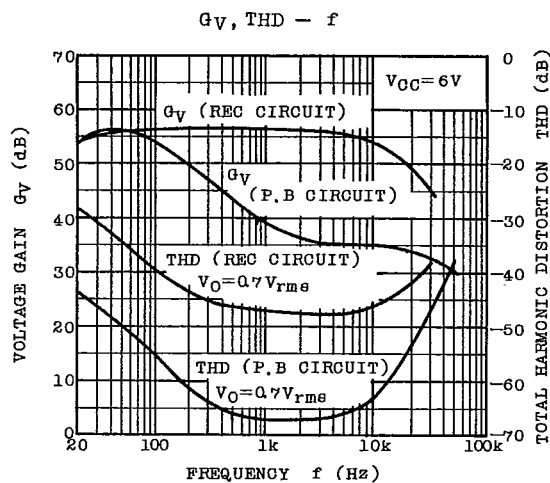
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DATA OF APPLICATION CIRCUIT



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