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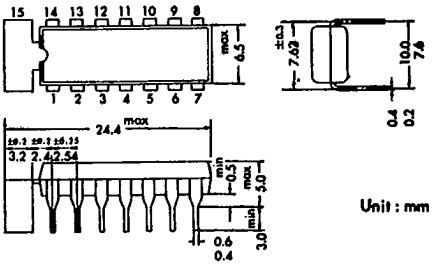
ECG1095

1-WATT AUDIO AMPLIFIER

GENERAL DESCRIPTION

The ECG1095 is a linear integrated circuit designed for use in portable and fixed sound systems and servo control systems. This circuit performs preamplifier, driver, and power-output functions. The circuit is packaged in a 14-lead plastic dual-in-line package with a fin for a heat sink. The tape recorder using ECG1095 needs no external transistors except transistors for the AC bias circuit. The built-in AGC circuit provides excellent automatic level control.



Unit : mm

FEATURES

- High Power Output..... 1 W Typ. at V_{CC} = 7.5 W
- High Voltage Gain.. Preamp.: 55 dB Typ. Driver and Power Amp.: 65 dB Typ.
- Low Zero-signal Current .... 15 mA Typ. (Adjustable)
- Single-power-supply Operation from 4.5 to 12 Volts
- Built-in AGC Circuit
- 14-lead Plastic Dual-in-line Package with a Fin

APPLICATIONS

Tape Players/Recorders, Phonographs, Stereos, Movie Projectors, Servo Amplifiers

RECOMMENDED OPERATING CONDITIONS

Supply Voltage..... V_{CC} = 7.5 V
Maximum Power Output ..... Po = 1 W
Operating Temperature Range
..... Topg = -10 to +50°C

ELECTRICAL CHARACTERISTICS (Ta = +25°C)

PARAMETERS	SYMBOLS	TEST CONDITIONS			LIMITS			UNITS	NOTES
		FREQUENCY f	SUPPLY VOLTAGE Vcc	TEST CIRCUITS					
		(kHz)	(V)	FIG.	MIN.	TYP.	MAX.		
Zero-Signal Supply Current									
(Preamp. Driver)	I_{CC1}		6	1	2.0	3.0 *	4.0	mA	
(Power Amp.)	I_{CC2}		7.5	2	–	12 **			
Voltage Gain									
(Preamp.)	G_{V1}	1	6	5	50	55 ***	–	dB	(R_{NF} = ∞)
(Driver, Power Amp.)	G_{V2}	1	7.5	10	50	65	–		
Input Resistance									
(Preamp.)	R_{i1}	1	6	15	–	30	–	kΩ	
(Driver)	R_{i2}	1	6	16	–	30	–		
Maximum Power Output	P_O	1	6	17	–	0.8	–	W	THD = 10%
		1	7.5		0.7	1.0	–		
		1	9		–	1.5	–		
Distortion	THD	1	7.5	17	–	0.5	–	%	P_O = 0.3W
Efficiency	η	1	7.5	17	–	45	–	%	P_O = 1W
Noise Level (referred to the input)	N_i	0.1 ~ 9	7.5	17	–	0.6	3	μV	R_g = 1kΩ

* Nominal lead current flowing into terminal ③ is 1 mA.

** This value is adjustable by an external resistor.

*** These values are obtained by using the following transformers

Driver Transformer Primary: 4kΩ Secondary: 2kΩ

Output Transformer Primary: 60Ω Secondary: 8Ω

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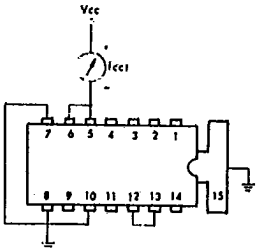


Fig.1 I_{CC1} Test Circuit

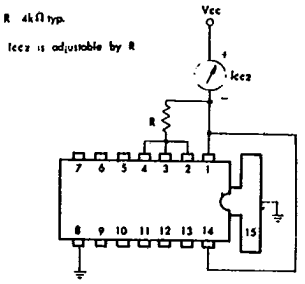


Fig.2 I_{CC2} Test Circuit

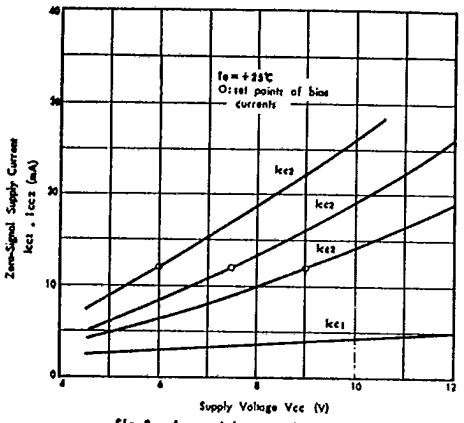


Fig.3 I_{CC1} and I_{CC2} vs. Supply Voltage

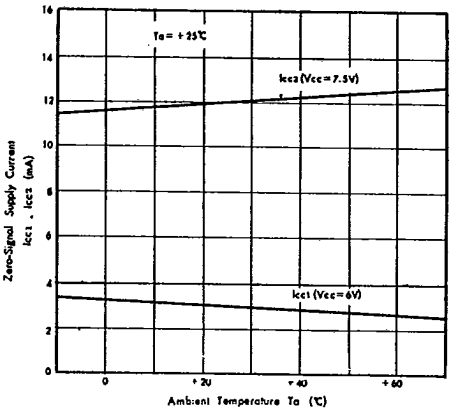
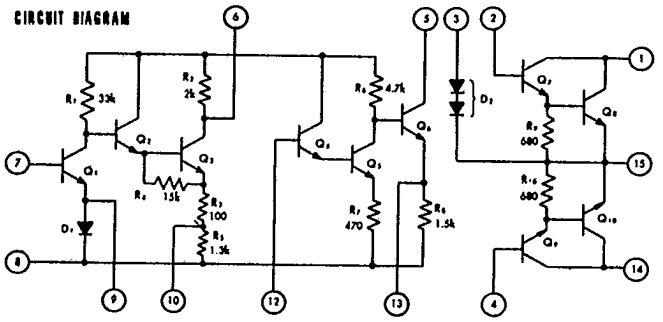


Fig.4 I_{CC1} and I_{CC2} vs. Ambient Temperature

CIRCUIT DIAGRAM



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ECG1095

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ABSOLUTE MAXIMUM RATINGS (Ta = +25°C)

PARAMETERS		SYMBOLS	LIMITS	UNITS
Supply Voltage		Vcc	12	V
Input Voltage Between Terminals 7 and 8		V_i	±3	V
Circuit Current		I cc	500	mA
Power Dissipation	(Ambient at +25°C)	P_d	0.7	W
	(Derate above +25°C)	$K_{//}$	7	mW / °C
	(Fin at +25°C)	P_{dF}	1.3	W
	(Derate above +25°C)	$K_{//F}$	13	mW / °C
Operating Temperature Range		T_{opg}	−10 to +75	°C
Storage Temperature Range		T_{stg}	−40 to +125	°C

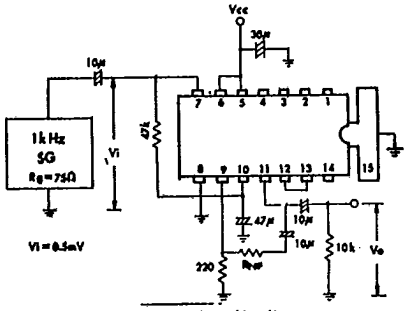

Fig.5 Gv Test Circuit

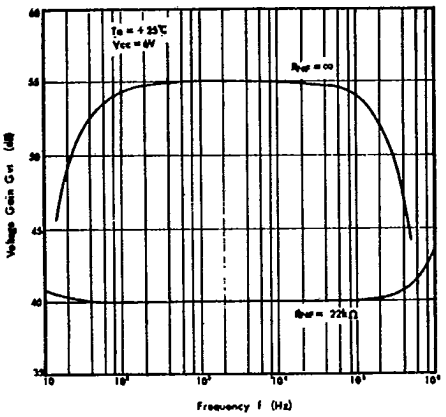

Fig.6 Gv vs. Frequency

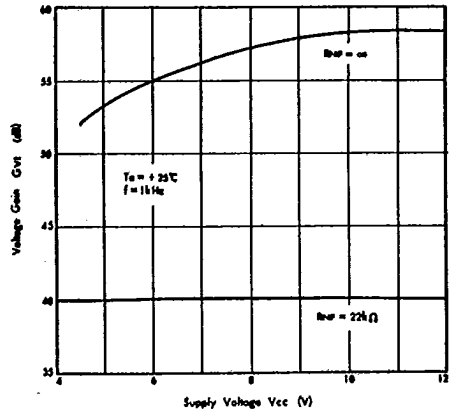

Fig.7 G_{vi} vs. Supply Voltage

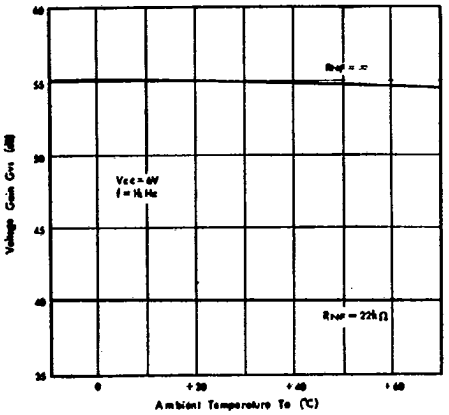

Fig.8 G_{vi} vs. Ambient Temperature

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ABSOLUTE MAXIMUM VOLTAGE AND CURRENT RATINGS (Ta=+25°C)

Indicated voltage and current limits for each terminal can be applied under the specified conditions for other terminals. All voltages are with respect to ground (Terminals ⑧, ⑮)

TERMINAL	VOLTAGE OR CURRENT LIMITS		CONDITIONS AT OTHER TERMINALS													
	NEGATIVE	POSITIVE	1	2	3	4	5	6	7	8.15	9	10	11	12	13	14
1	0V	+12V +20V	+7.5V (Except terminal(1))	Open Ground	+1.5mA (Except terminal(3))	Connect to terminal(4) (Except terminal ⑭)	+7.5V (Except terminal(5))	+6V (Except terminal(6))	Connect to terminal ⑯ through 47kΩ	Ground	External DC voltage is not normally applied	Connect to terminal(7) through 47 kΩ	External DC voltage is not normally applied	Connect to terminal ⑫ through 47 kΩ	Connect to terminal ⑫ through 47 kΩ	+7.5V (Except terminal ⑫)
2	Do not apply external voltage except terminal 3			Connect to terminal(3) (Except terminal(1))												
3	0mA	+5mA														
4	Do not apply external voltage except terminal(3															
5	0V	+12V *														
6	0V	+10V														
7	0mA	+2mA														
8.15	Ground															
9	−1mA	+1mA														
10	0V	+4V														
11	0V	+10V														
12	−6V	+6V														
13	0V	+4V														
14	0V	+12V +20V				Open Ground										

Note: * This is the limit when applied DC voltage to this terminal. The limit of the instantaneous value is 20 volts.

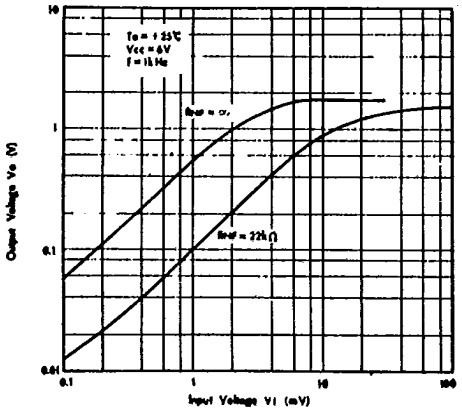

Fig. 9 Output Characteristics of Preamplifier

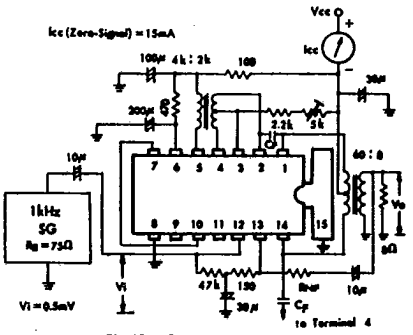

Fig. 10 Rw Test Circuit

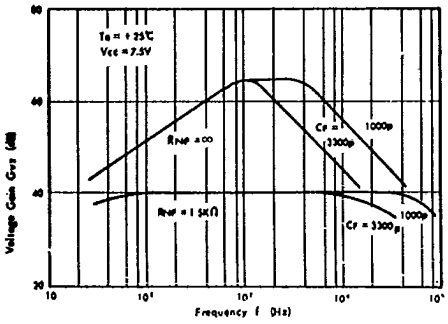

Fig.11 G_{V2} vs. Frequency

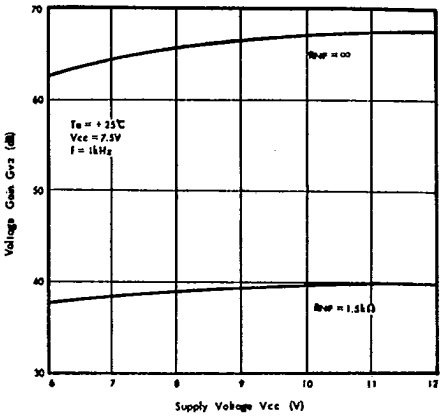

Fig.12 G_{V2} vs. Supply Voltage

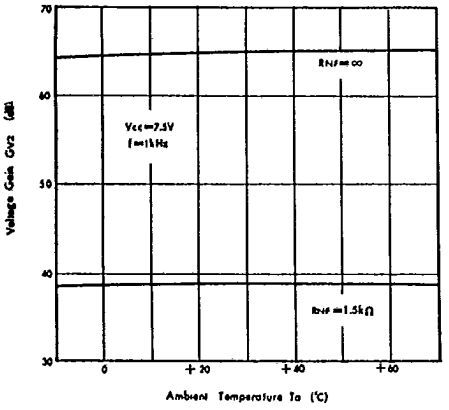

Fig.13 G_{V2} vs. Ambient Temperature

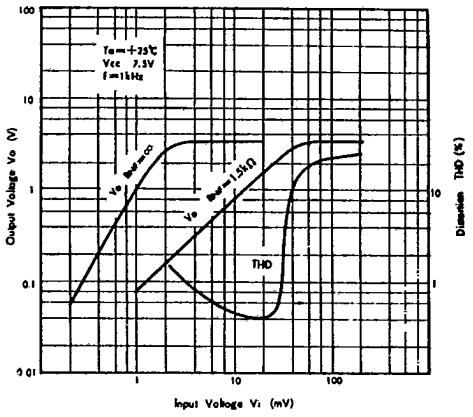

Fig.14 Output and Distortion Characteristics of Power Amplifier

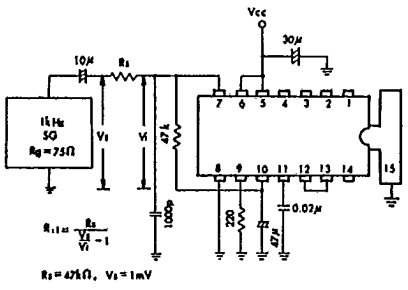

Fig.15 R_{I1} Test Circuit

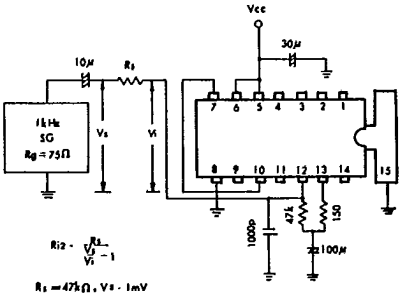

Fig.16 R_{I2} Test Circuit

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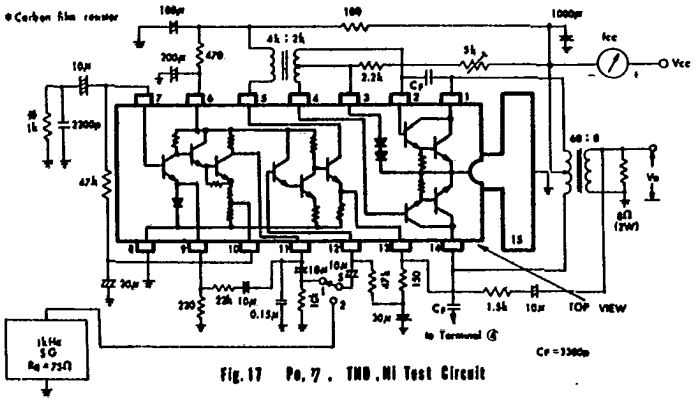

Fig. 17 Po, η, THD, Ni Test Circuit

PROCEDURES OF TESTS

1 Maximum Power Output Po:

1) Place switch S in position "2"

2) Record output voltage Vo at distortion = 10%

3) Calculate Power Output Po from

$$Po = \frac{Vo^2}{8} (W)$$

2 Efficiency η:

1) Place switch S in position "2"

2) Record supply current Icc (max) at Po = 1W

3) Calculate Efficiency η from

$$\eta = \frac{100}{Vcc \times Icc(max)} (\%)$$

3 Distortion THD:

1) Place switch S in position "2"

2) Record Distortion K at Vo = 1.55V (Po = 0.3W)

4 Noise level Ni (referred to the input)

1) Place switch S in position "1".

2) Record noise voltage No in the output.

3) Calculate Noise Level Ni from

$$Ni = \frac{No}{Gv}$$

Gv = Overall voltage gain : 78.6dB typ.

Frequency response (−3dB) : 100 Hz to 9 kHz

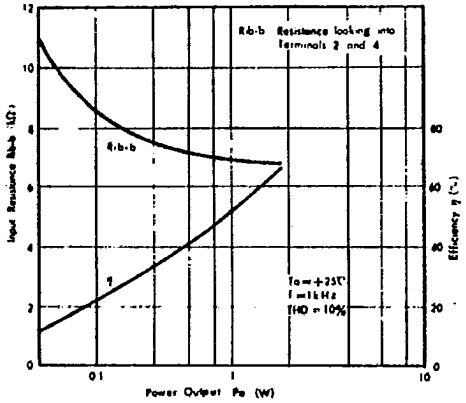

Fig. 18 Input Resistance and Efficiency of Driver and Power Amplifier vs. Power Output

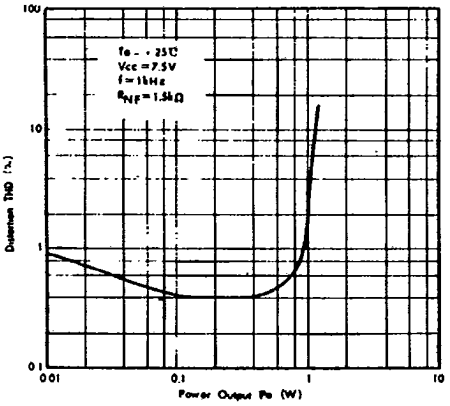

Fig. 19 Distortion vs. Power Output

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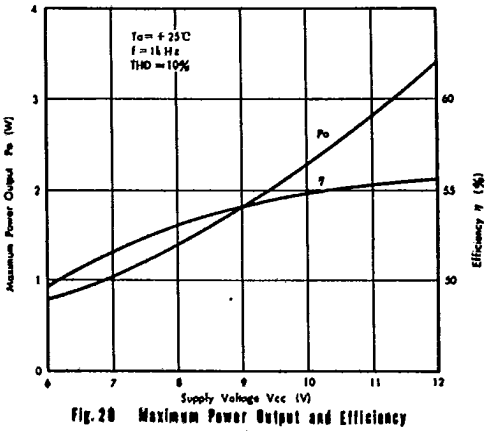

Fig. 20 Maximum Power Output and Efficiency vs. Supply Voltage

11 APPLICATIONS

11.1 A Tape Recorder --- Cassette Type

Fig.21 shows a circuit configuration for a tape recorder using the **ECG1095** The circuit needs no external transistors except transistors of AC bias circuit and can deliver an output of 1 watt to the 8-ohm speaker.

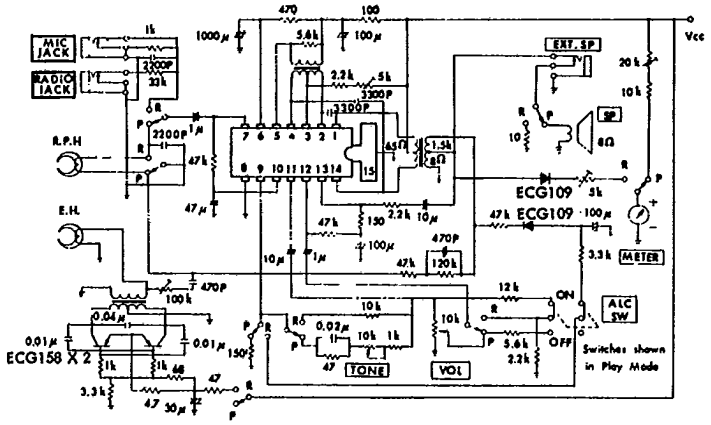

Fig. 21 A Tape Recorder --- Cassette Type

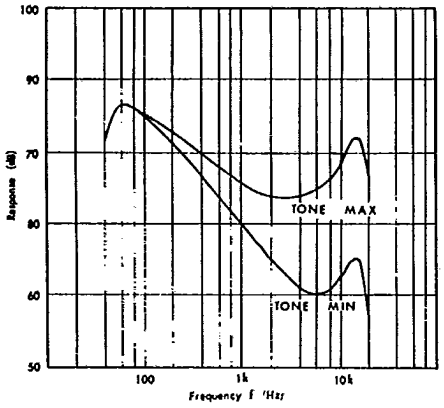

Fig. 22 Frequency Characteristic (Play Mode)

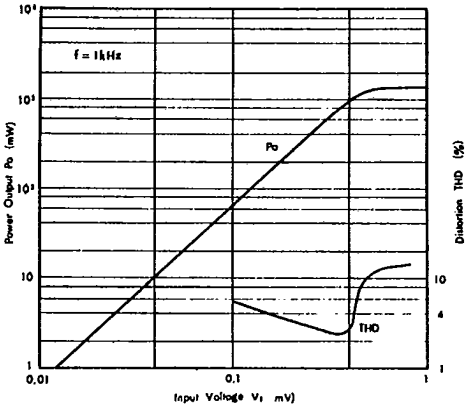

Fig. 23 Output and Distortion Characteristics (Play Mode)

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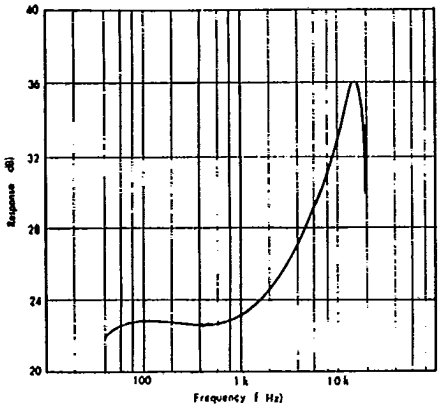


Fig. 24 Frequency Characteristic (Record Mode)

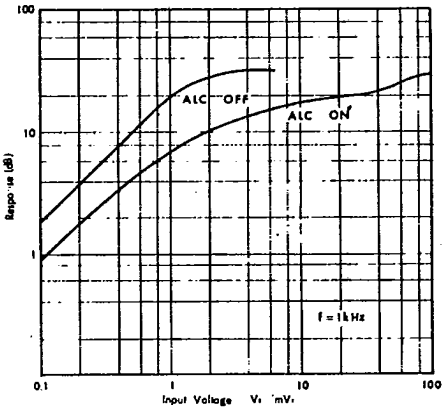
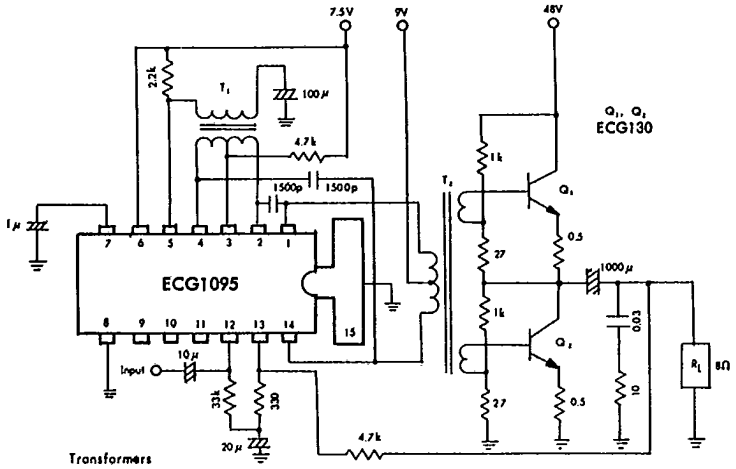


Fig. 25 Output Characteristic (Record Mode)

20-Watt Single-Ended Class B Audio Power Amplifier

Fig.26 shows a class B audio power amplifier in which the **ECG1095** is used with a driver transformer and two **ECG130** power transistors in a single-ended output stage.



Transformers

T_1 ···Primary: 4kΩ Secondary: 2kΩ

T_2 ·····Primary: 100Ω Secondaries: 10Ω ⌿ 2

Fig. 26 20-Watt Single-Ended Class B Audio Power Amplifier

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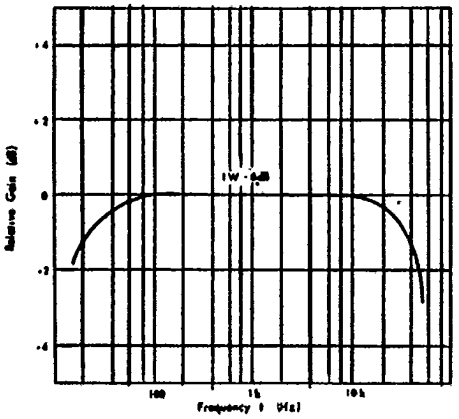

Fig. 27 FREQUENCY CHARACTERISTIC

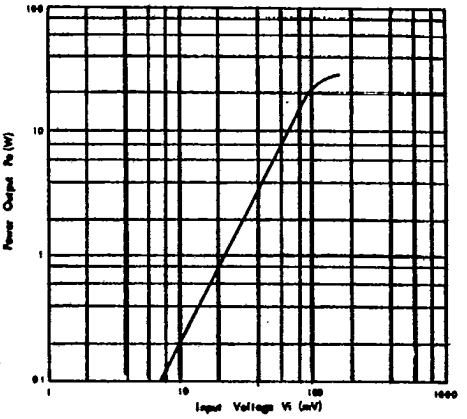

Fig. 28 OUTPUT CHARACTERISTIC

OPERATION OF AGC CIRCUIT

The AGC circuit built in ECG1095 is shown in Fig. 29. The output-signal is rectified by a diode D and converted into negative DC voltage. This DC voltage controls the bias current to a diode D_1, thus the dynamic resistance of D_1 which limits the gain varies in proportion to the input-signal.

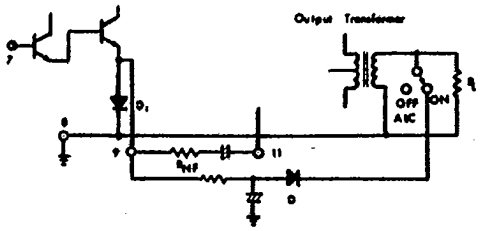

Fig. 29 AGC CIRCUIT