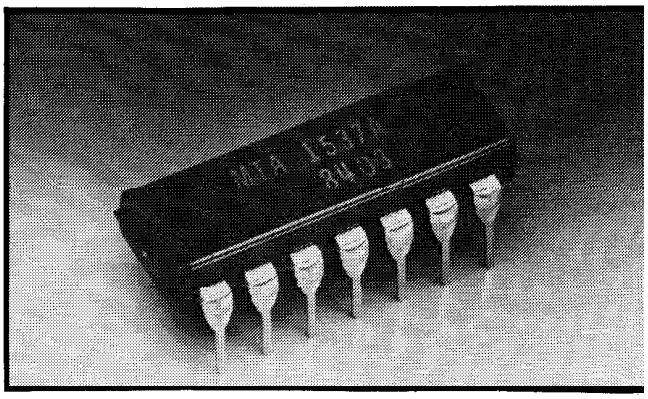
APHEX SYSTEMS LTD.

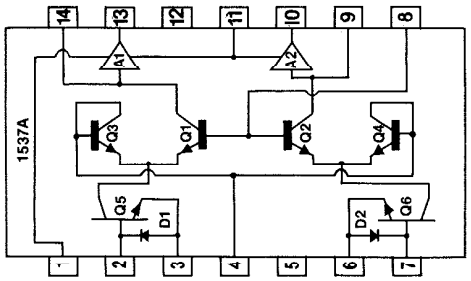
1537A
PRECISION AGC / VOLTAGE CONTROLLED ATTENUATOR



The 1537A is a junction isolated, high precision AGC/Voltage controlled attenuator featuring a proprietary supermatched gain cell structure.

This large geometry structure allows an 18dB improvement in noise performance, a 30dB reduction in 2nd order distortion products and a 60dB reduction in 3rd order distortion products. The supermatching also reduces control feedthrough by an order of magnitude in balanced configurations.

The 1537A is especially suited to high speed precision control of level, dynamic range, phase and amplitude equalization.



TOP VIEW

1. GROUND	8. CONTROL PORT
2. BASE 5	9. COLLECTOR 2
3. EMITTER 5	10. OUTPUT 2
4. GROUND	11. + SUPPLY
5. N/C	12. N/C
6. EMITTER 6	13. OUTPUT 1
7. BASE 6	14. COLLECTOR 1

Typical Specifications

- 110 dB dynamic range
- 120 dB attenuation
- Extremely low distortion (~.005% THD)
- Extremely low control feedthrough (~2mV)
- Wide bandwidth (F_T= 200 MHz)
- Excellent long term stability

Typical Applications

- High quality audio controllers
- Analog computation
- Precision oscillators
- Robotics
- Auto calibrating test equipment
- Video effects generators
- Servo control
- Precision phase detectors

STANDARD PACKAGE: 14 PIN DUAL IN LINE PLASTIC.
CERAMIC AND SO PACKAGES AVAILABLE ON REQUEST.
U.S. PATENT 4,155,047 FOREIGN PATENTS PENDING

SC SOUND

SC SOUND ApS
MALERVEJ 2 . DK 2630 TAASTRUP . TELEFON (02) 99 88 77

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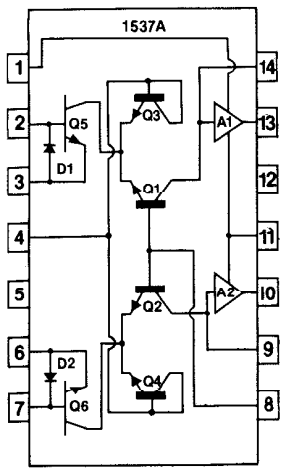
—Typical Specifications —

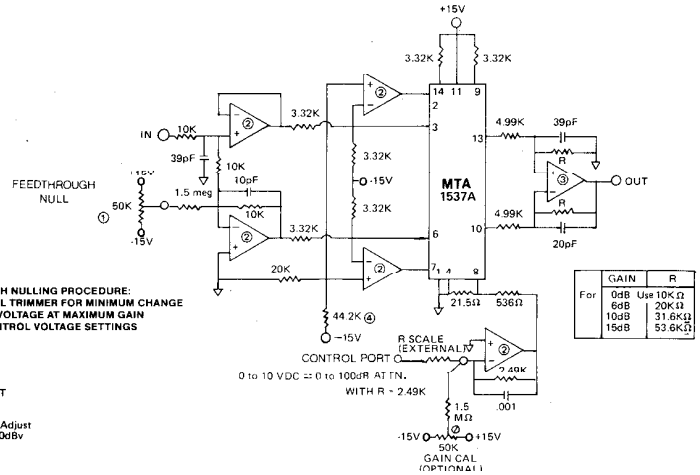
SPECIFICATION	FIG.2&3	FIG. 1	UNITS
MAXIMUM INPUT LEVEL	7.75 (+20)	7.75 (+20)	VOLTS RMS (dB re 0.775V) rms
MAXIMUM OUTPUT LEVEL	7.75 (+20)	7.75 (+20)	VOLTS RMS (dB re 0.775V) rms
MAXIMUM ATTENUATION	> 100	> 100	dB (DC-200 KHz) [layout dependent at high frequencies]
INPUT IMPEDANCE	8.25K FIG.3 10K FIG.2	20K	OHMS
CONTROL FEEDTHROUGH	FIG.2 <150 FIG.3 <10	FIG.1 <6	mv OVER 100dB ATTENUATION
OUTPUT NOISE[4] OdB GAIN	-84	-90	dB re 0.77 5Vrms
OUTPUT NOISE[4] -20 dB GAIN	-91	-97	dB re 0.77 5Vrms
OUTPUT NOISE[4] -100 dB GAIN	-94	-100	dB re 0.77 5Vrms
SLEW RATE	13	13	V/μ SEC [limited only by support circuitry]
OVER SHOOT AND RINGING	NONE	NONE	
CONTROL LAW	$A=\frac{1}{1+EXP\ (V_C/V_T)}$ $V_T \equiv KT/q$ (FIG 1&2) $V_C \equiv$ CONTROL VOLTAGE		$A=\frac{1}{EXP\ (V_C/V_T)}$ (FIG 3)
MAXIMUM[4] MODULATION NOISE	6.5	6.5	dB
TYPICAL[2] THD@—OdB	~0.10	~0.005	%
TYPICAL[2] THD @-20 dB	0.025	~0.005	%

1. 20 KHz BANDWIDTH
2. ANY INPUT LEVEL ≤ 7.75 V RMS AT ANY FREQUENCY ≤ 20KHz
3. INPUT VOLTAGE 7.75 V RMS
4. BW ≡ 20kHz

ABSOLUTE MAXIMUM RATINGS MAX (DIP) POWER DISSIPATION: 500 mw		
MAXIMUM	TYP @ 15V OPERATION	PIN
0 V	0 V	1
-15 V	-6.8 V	2
-15 V	-7.5 V	3
-5 V	OV	4
—	—	5
-15 V	-7.5 V	6
-15 V	-6.8 V	7
+1/-5 V	±0.7 V	8
15 V	7.5 V [NO ATTN]	9
15 V	6.8 V [NO ATTN]	10
18 V	15 V	11
—	—	12
15 V	6.8 V [NO ATTN]	13
15 V	7.5 V [NO ATTN]	14



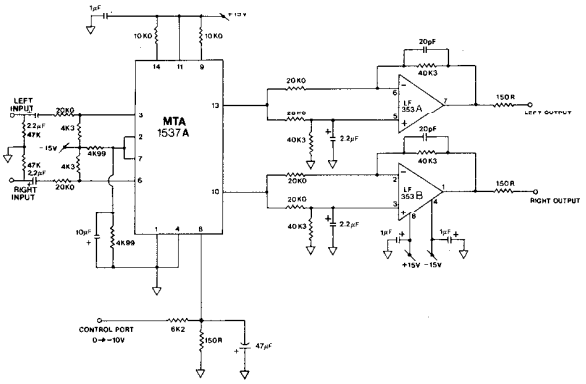
HIGH PERFORMANCE FULL IMPLEMENTATION ATTENUATOR · FIGURE 1



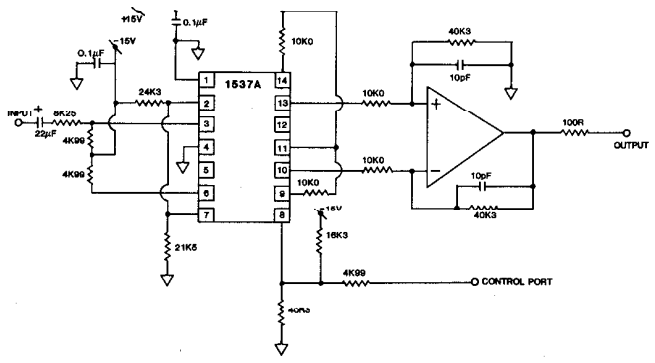
	GAIN	R
For	0dB	Use 10KΩ
	6dB	20KΩ
	10dB	31.6KΩ
	15dB	53.6KΩ

1. CONTROL FEEDTHROUGH NULLING PROCEDURE: SET FEEDTHROUGH NULL TRIMMER FOR MINIMUM CHANGE IN OUTPUT QUIESCENT VOLTAGE AT MAXIMUM GAIN AND MINIMUM GAIN CONTROL VOLTAGE SETTINGS
2. SUGGESTED OP AMP LF 353 OR EQUIVALENT
3. NE 5534 OR OTHER LOW NOISE EQUIVALENT RECOMMENDED
4. Value is supply dependent. Adjust slightly for min. THD at +20dBv input.

COST EFFECTIVE CONSUMER STEREO ATTENUATOR · FIGURE 2



MONAURAL CONSUMER VCA · FIGURE 3



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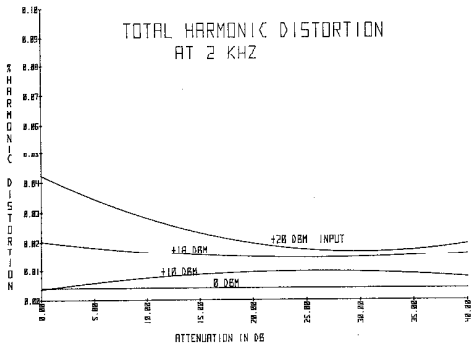
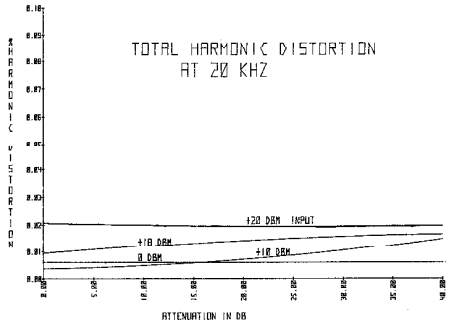
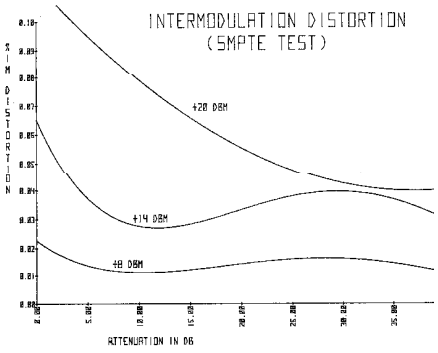
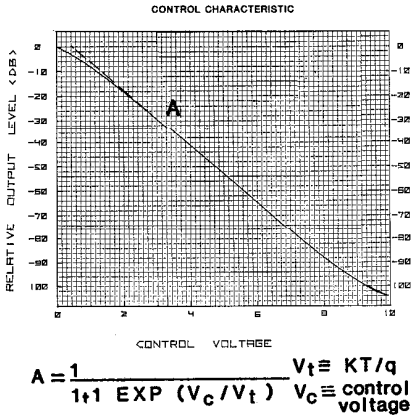
PERFORMANCE DATA: FIGURE 1

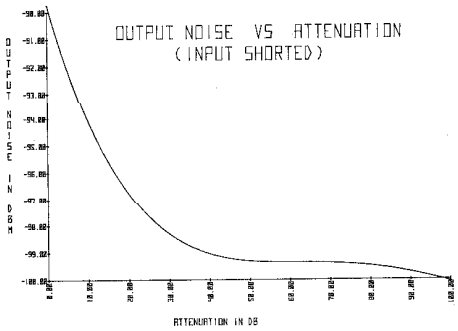


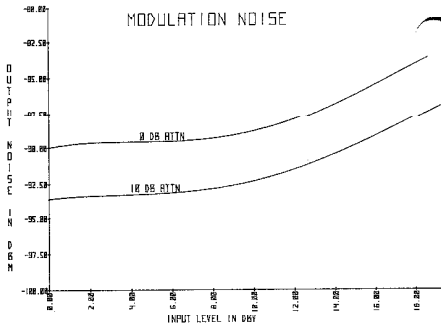


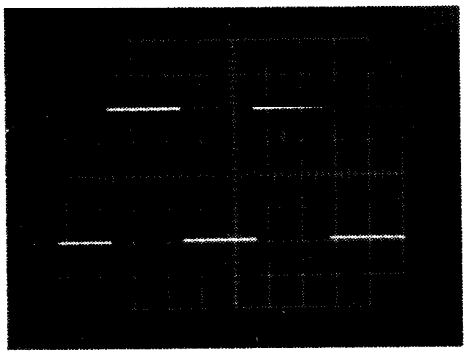




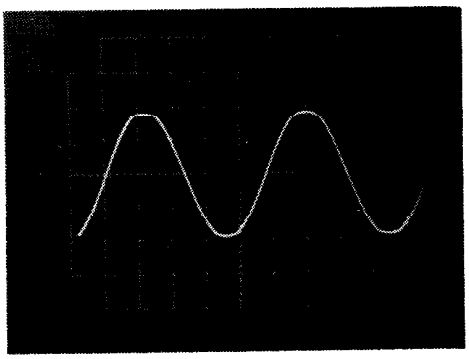
$$A = \frac{1}{1+1\ EXP\ (V_c/V_t)} \qquad V_t \equiv KT/q \quad V_c \equiv \text{control voltage}$$







2kHz Square Wave at 20V P-P showing transient response, freedom from overshoot & ringing



2kHz Sine Wave at +21 dBm showing soft clipping which is much less noticeable and less irritating

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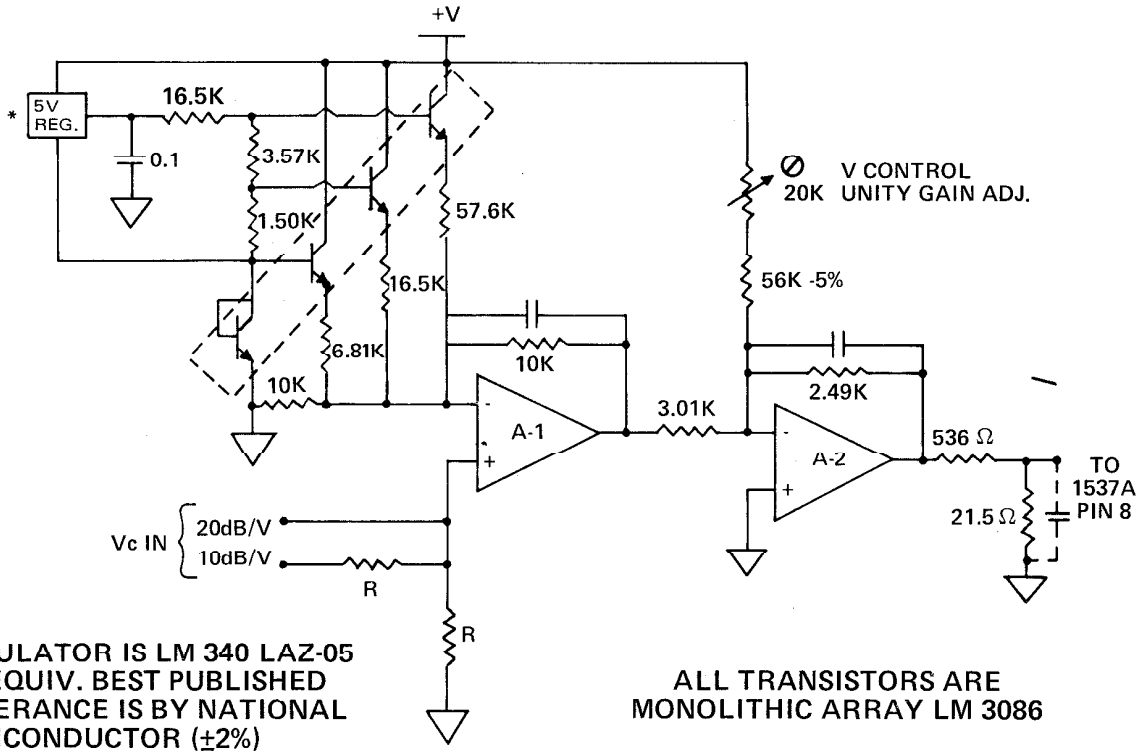
APPLICATION NOTE

1537A

THIS CIRCUIT WILL GIVE ABSOLUTE dB/VOLT CONTROL OF THE 1537A (±0.2dB FROM 0 TO >-80dB)

CONTROL LAW: $A(dB) = 20 \log [1/EXP(Vc/VT)$



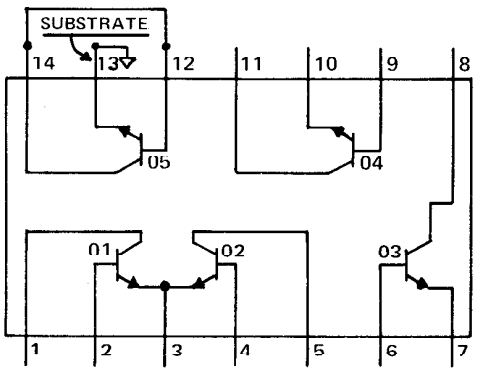
*REGULATOR IS LM 340 LAZ-05 OR EQUIV. BEST PUBLISHED TOLERANCE IS BY NATIONAL SEMICONDUCTOR (±2%)

ALL TRANSISTORS ARE MONOLITHIC ARRAY LM 3086

LM 3086 SCHEMATIC & CONNECTION DIAGRAM

schematic and connection diagram LM 3086

Dual-In Line Package



TOP VIEW

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APPLICATION:

1. All resistors + 1%, execpt as noted.

2. In connecting the LM 3086 (see diagram), transistor Q5 (pins 12, 13, 14) must be used as the diode, since its emitter is connected to the substrate of the device.

One transistor of the differential pair (Q1 and Q2) is used and the base and collector (pins 1 and 2 or pins 4 and 5) of the unused transistor are shorted to the joined emitters (pin 3).

3. Alignment:
   A. VCA must warm up for at least ten minutes before aligning and measuring. This allows all turn-on thermal gradients to normalize.

   B. Put a sine wave into the VCA at exactly 0dBv (0.775v rms), measured at the VCA input. (Allow for any loading by the measuring device).

   C. Set V control for unity gain (Normally Vc=0) and adjust 20K trimmer for unity gain.

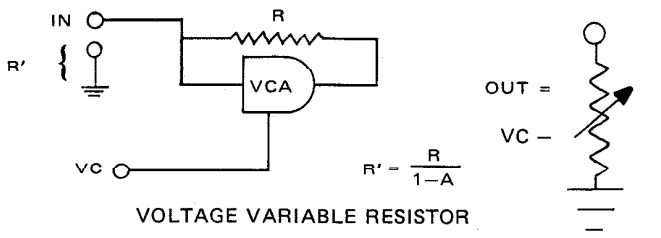
4. The impedance at the control port is kept very low (21.5 as shown) to avoid unwanted control port modulation and resulting distortion. Larger resistor values may be used for the pad at the output of this circuit. This will reduce the load on the control amp.

   A. The resistive ratio shown must be retained using 1% resistors.

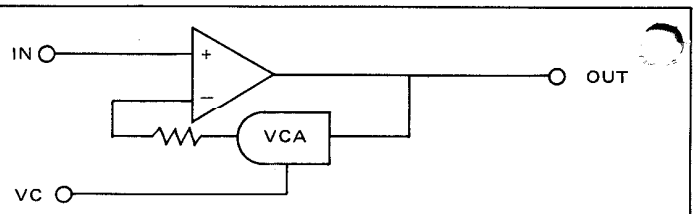
   B. When using larger values, a capacitor should be used from pin 8 of the 1537A I.C. to ground to maintain low A.C. impedance. The capacitor value should be calculated to define the control port time constant (typically 25ms for studio applications).

APPLICATIONS

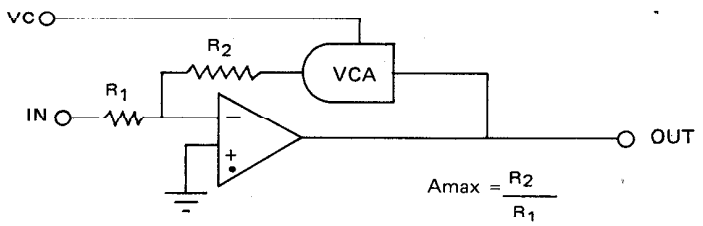
1537A



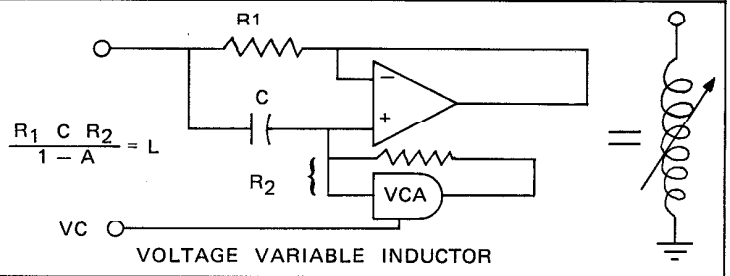
VOLTAGE VARIABLE RESISTOR



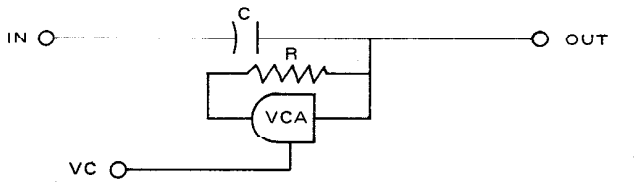
NON-INVERTING
VOLTAGE VARIABLE GAIN AMP



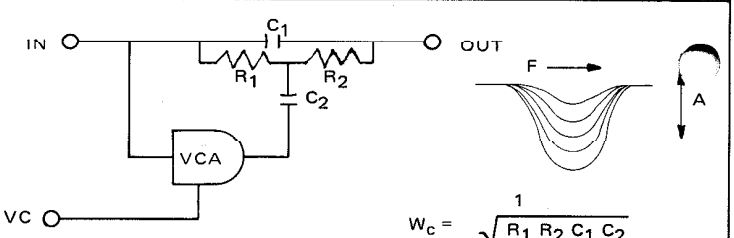
INVERTING VARIABLE GAIN AMP



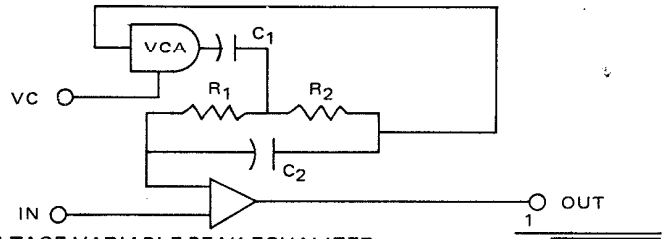
VOLTAGE VARIABLE INDUCTOR



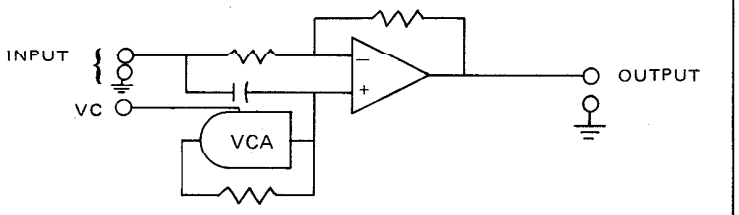
VOLTAGE TUNABLE HI PASS FILTER



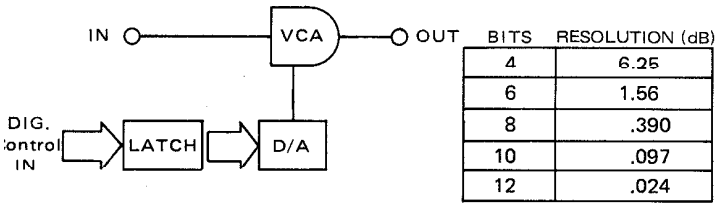
VOLTAGE CONTROLLED BAND REJECT FILTER



VOLTAGE VARIABLE PEAK EQUALIZER

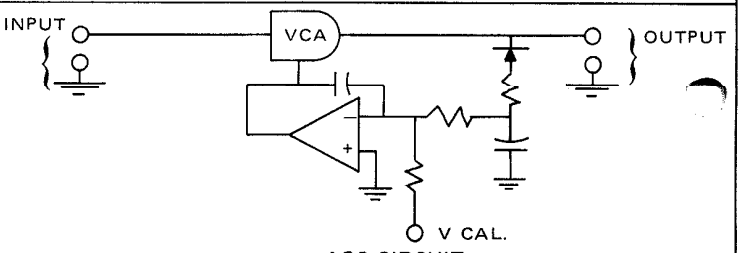


VOLTAGE CONTROLLED ALL PASS NETWORK

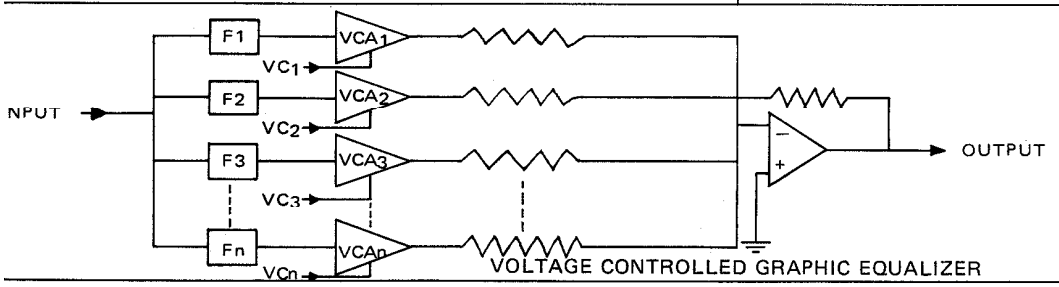


BITS	RESOLUTION (dB)
4	6.25
6	1.56
8	.390
10	.097
12	.024

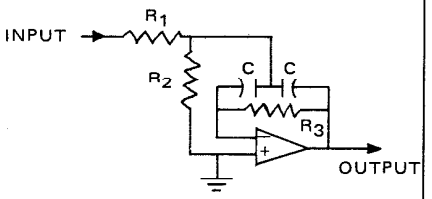
DIGITALLY CONTROLLED GAIN (>100 dB RANGE)



AGC CIRCUIT



VOLTAGE CONTROLLED GRAPHIC EQUALIZER



SUGGESTED FILTER CIRCUIT
FOR GRAPHIC EQUALIZER

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