

# MC1490

## RF/IF/Audio Amplifier

The MC1490 is an integrated circuit featuring wide-range AGC for use in RF/IF amplifiers and audio amplifiers over the temperature range,  $-40^{\circ}$  to  $+85^{\circ}\text{C}$ .

- High Power Gain: 50 dB Typ at 10 MHz  
45 dB Typ at 60 MHz  
35 dB Typ at 100 MHz
- Wide Range AGC: 60 dB Min, DC to 60 MHz
- 6.0 V to 15 V Operation, Single Polarity Supply
- See MC1350D for Surface Mount

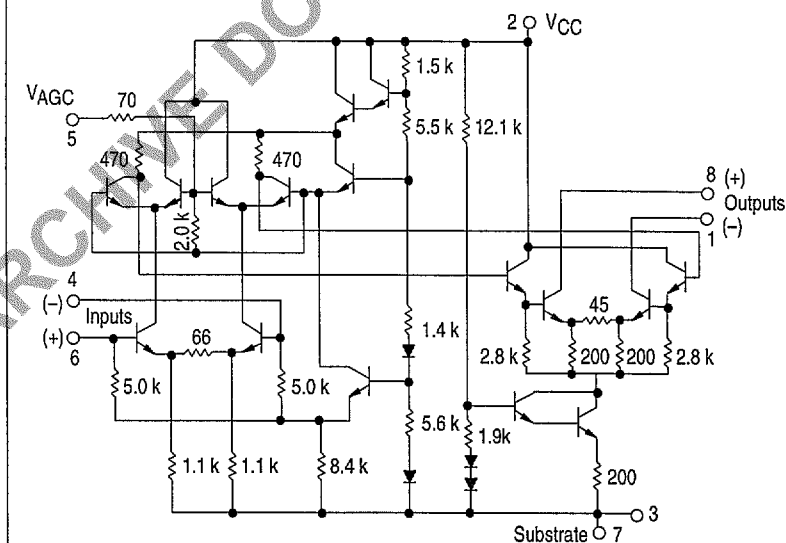
### MAXIMUM RATINGS ( $T_A = +25^{\circ}\text{C}$ , unless otherwise noted.)

Rating	Symbol	Value	Unit
Power Supply Voltage	$V_{CC}$	+18	Vdc
AGC Supply	$V_{AGC}$	$V_{CC}$	Vdc
Input Differential Voltage	$V_{ID}$	5.0	Vdc
Operating Temperature Range	$T_A$	$-40$ to $+85$	$^{\circ}\text{C}$
Storage Temperature Range	$T_{stg}$	$-65$ to $+150$	$^{\circ}\text{C}$
Junction Temperature	$T_J$	+150	$^{\circ}\text{C}$

### ORDERING INFORMATION

Device	Operating Temperature Range	Package
MC1490P	$T_A = -40^{\circ}$ to $+85^{\circ}\text{C}$	Plastic

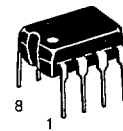
### Representative Schematic Diagram



Pins 3 and 7 should both be connected to circuit ground.

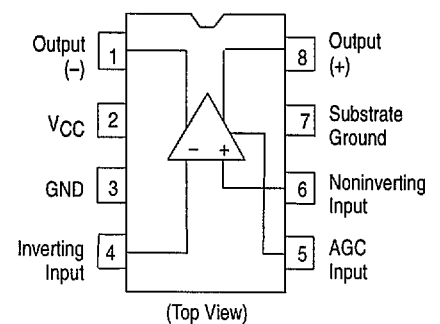
## WIDEBAND AMPLIFIER WITH AGC

### SEMICONDUCTOR TECHNICAL DATA



**P SUFFIX**  
PLASTIC PACKAGE  
CASE 626

### PIN CONNECTIONS



### SCATTERING PARAMETERS

( $V_{CC} = +12\text{ Vdc}$ ,  $T_A = +25^{\circ}\text{C}$ ,  $Z_0 = 50\ \Omega$ )

Parameter	Symbol	f = MHz Typ		Unit
		30	60	
Input Reflection Coefficient	$IS_{11}$ $\theta_{11}$	0.95 -7.3	0.93 -16	- deg
Output Reflection Coefficient	$IS_{22}$ $\theta_{22}$	0.99 -3.0	0.98 -5.5	- deg
Forward Transmission Coefficient	$IS_{21}$ $\theta_{21}$	16.8 128	14.7 64.3	- deg
Reverse Transmission Coefficient	$S_{12}$ $\theta_{12}$	0.00048 84.9	0.00092 79.2	- deg

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## ELECTRICAL CHARACTERISTICS ( $V_{CC} = 12 \text{ Vdc}$ , $f = 60 \text{ MHz}$ , $BW = 1.0 \text{ MHz}$ , $T_A = 25^\circ\text{C}$ )

Characteristic	Figure	Symbol	Min	Typ	Max	Unit
Power Supply Current Drain	–	$I_{CC}$	–	–	17	mA
AGC Range (AGC) 5.0 V Min to 7.0 V Max	19	$M_{AGC}$	–60	–	–	dB
Output Stage Current (Sum of Pins 1 and 8)	–	$I_O$	4.0	–	7.5	mA
Single-Ended Power Gain $R_S = R_L = 50 \Omega$	19	$G_p$	40	–	–	dB
Noise Figure $R_S = 50 \text{ Ohms}$	19	NF	–	6.0	–	dB
Power Dissipation	–	PD	–	168	204	mW

Figure 1. Unneutralized Power Gain versus Frequency (Tuned Amplifier, See Figure 19)

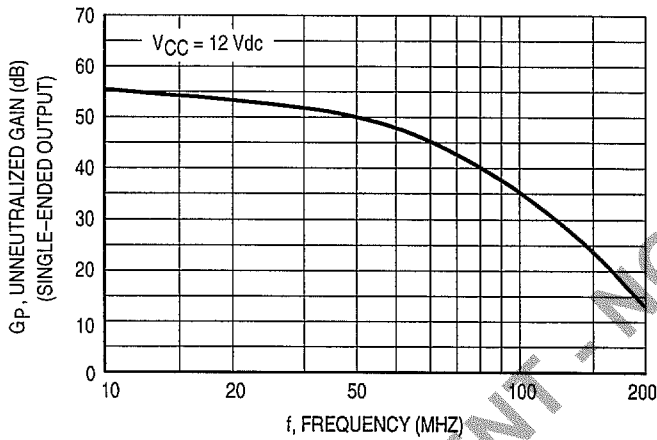


Figure 2. Voltage Gain versus Frequency (Video Amplifier, See Figure 20)

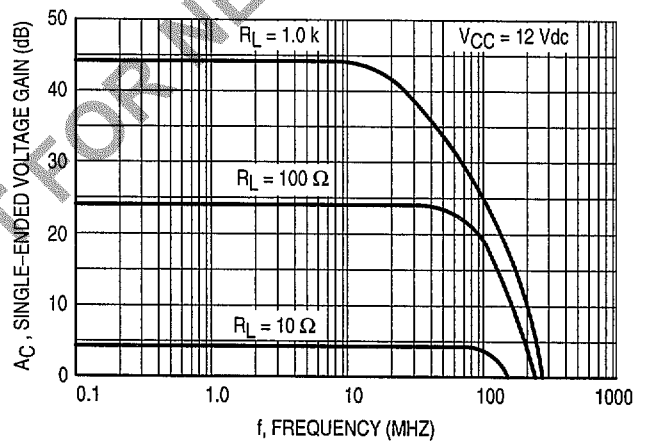


Figure 3. Dynamic Range: Output Voltage versus Input Voltage (Video Amplifier, See Figure 20)

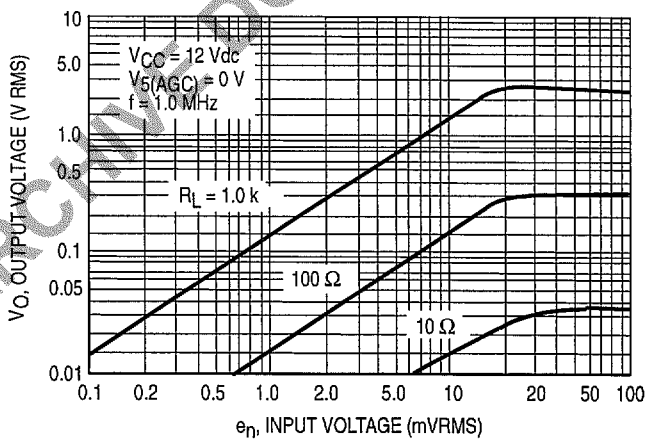
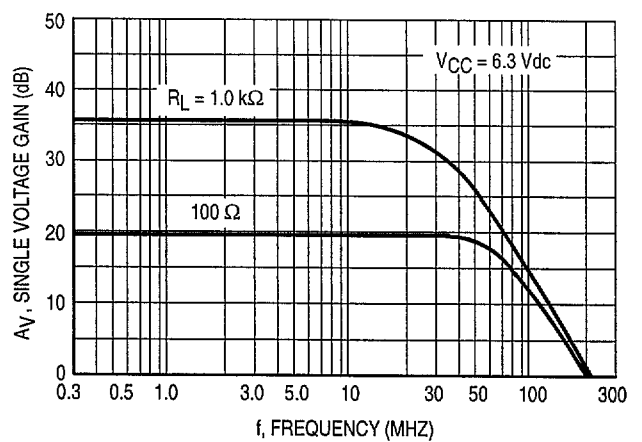
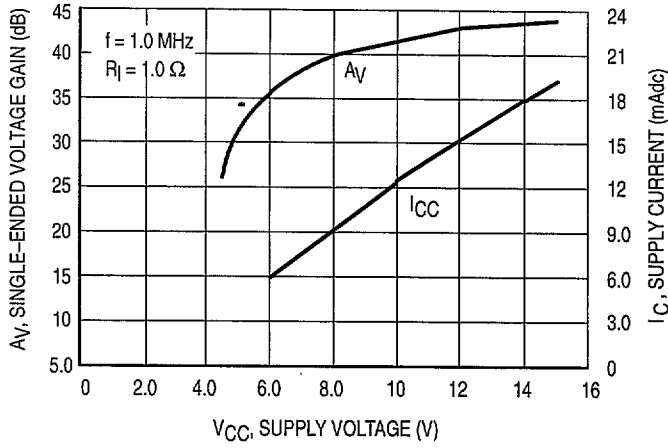


Figure 4. Voltage Gain versus Frequency (Video Amplifier, See Figure 20)

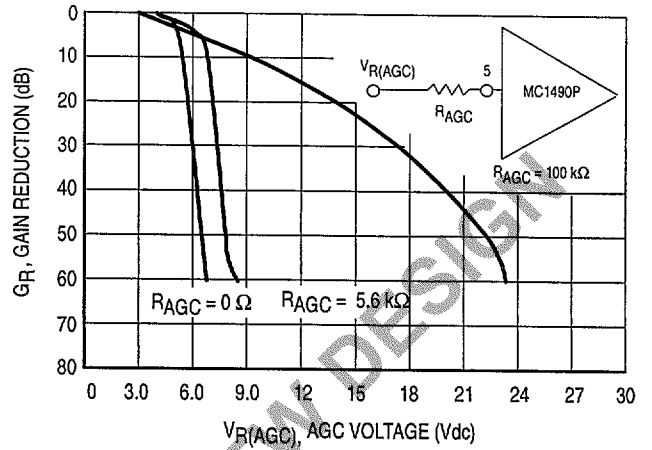


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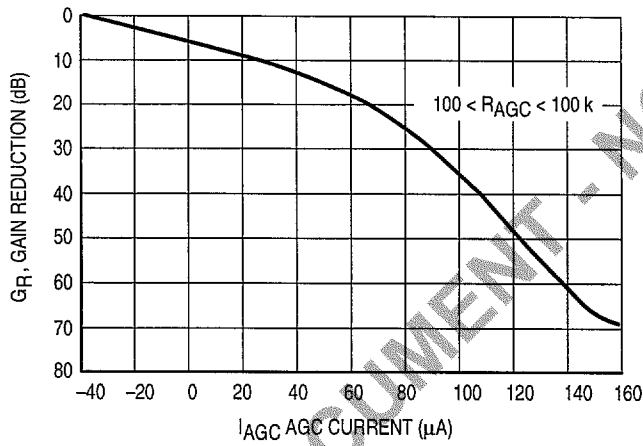
**Figure 5. Voltage Gain and Supply Current versus Supply Voltage (Video Amplifier, See Figure 20)**



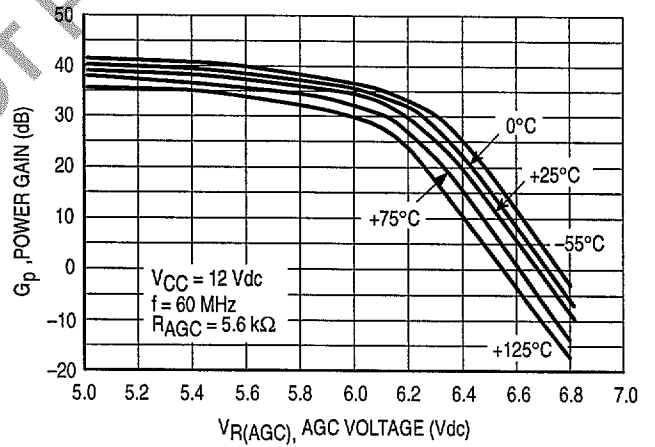
**Figure 6. Typical Gain Reduction versus AGC Voltage**



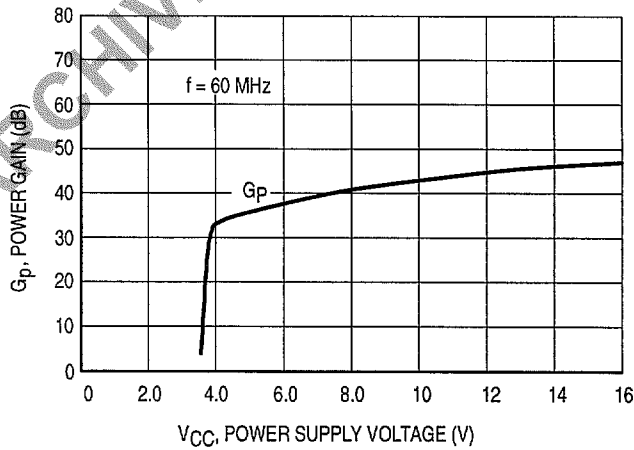
**Figure 7. Typical Gain Reduction versus AGC Current**



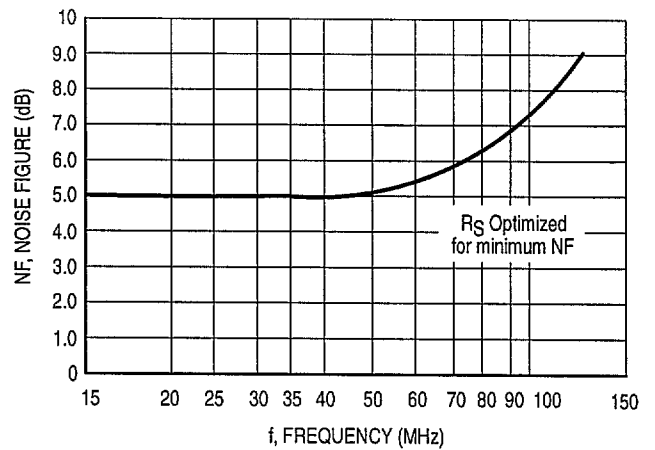
**Figure 8. Fixed Tuned Power Gain Reduction versus Temperature (See Test Circuit, Figure 19)**



**Figure 9. Power Gain versus Supply Voltage (See Test Circuit, Figure 19)**

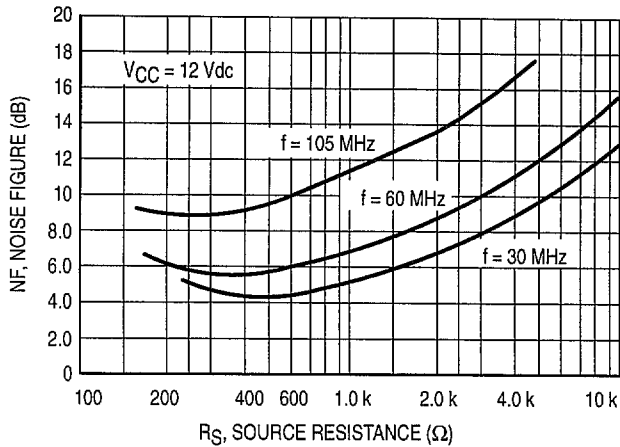


**Figure 10. Noise Figure versus Frequency**

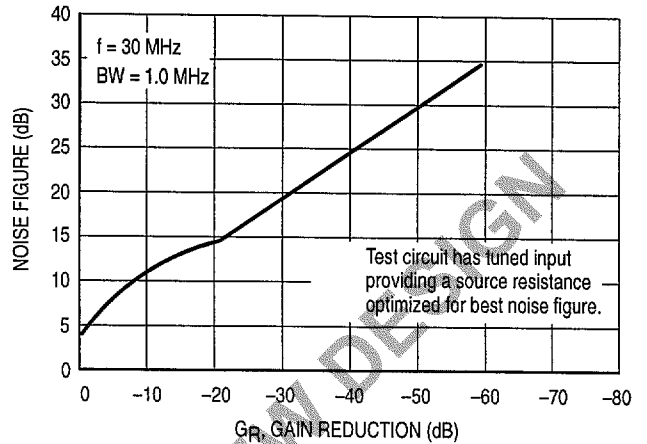


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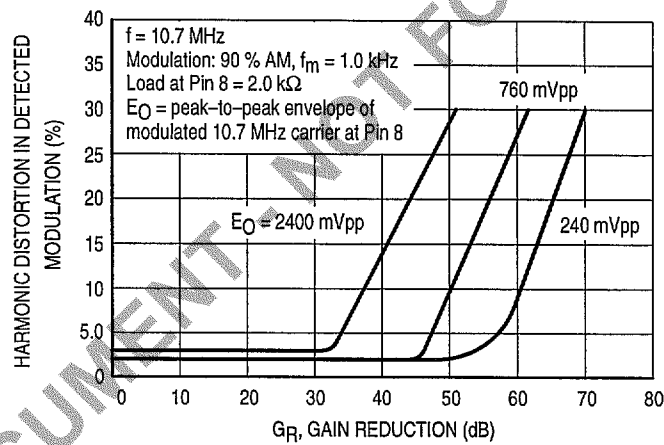
**Figure 11. Noise Figure versus Source Resistance**



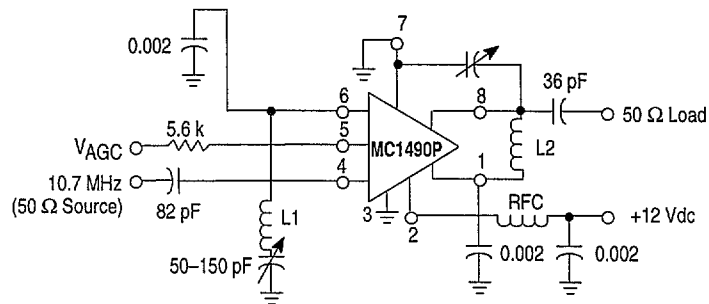
**Figure 12. Noise Figure versus AGC Gain Reduction**



**Figure 13. Harmonic Distortion versus AGC Gain Reduction for AM Carrier (For Test Circuit, See Figure 14)**



**Figure 14. 10.7 MHz Amplifier Gain = 55 dB, BW = 100 kHz**



L1 = 24 turns, #22 AWG wire on a T12-44 micro metal Toroid core (~124 pF)

L2 = 20 turns, #22 AWG wire on a T12-44 micro metal Toroid core (~100 pF)

Figure 15.  $S_{11}$  and  $S_{22}$ , Input and Output Reflection Coefficient

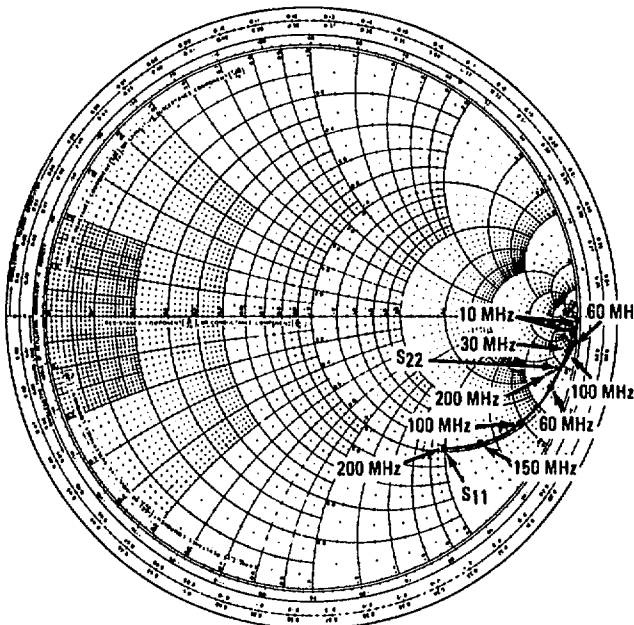


Figure 16.  $S_{11}$  and  $S_{22}$ , Input and Output Reflection Coefficient

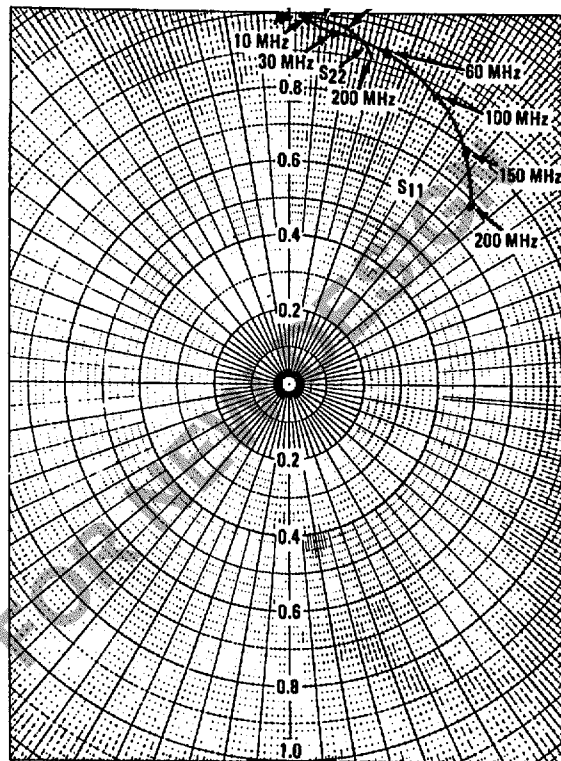


Figure 17.  $S_{21}$ , Forward Transmission Coefficient (Gain)

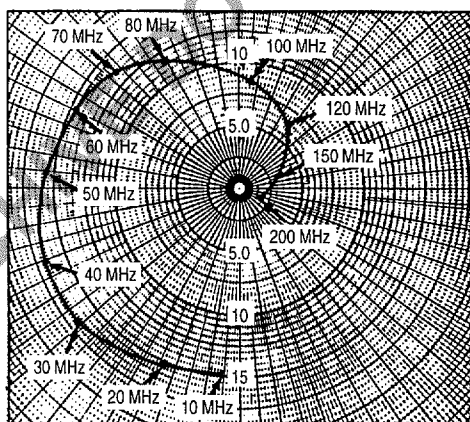
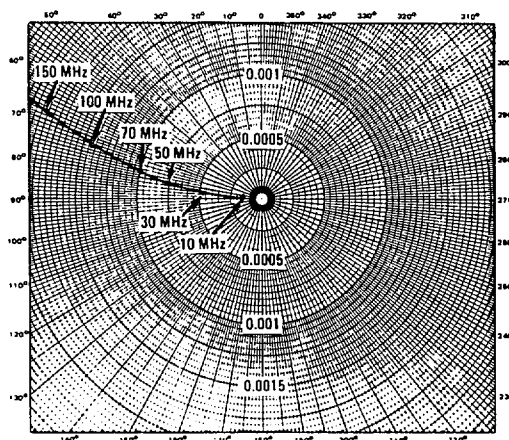
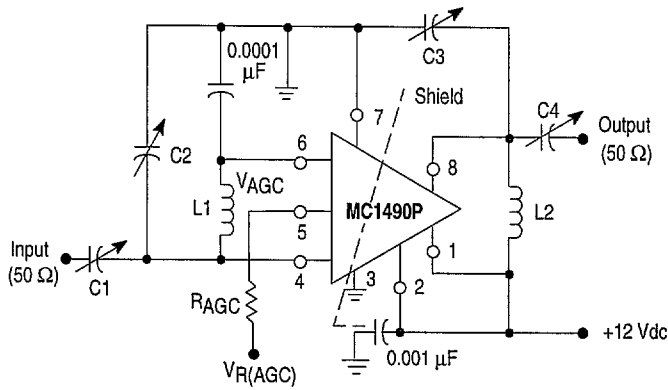


Figure 18.  $S_{12}$ , Reverse Transmission Coefficient (Feedback)



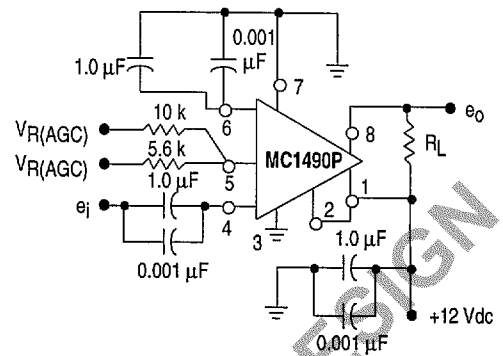
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**Figure 19. 60 MHz Power Gain Test Circuit**

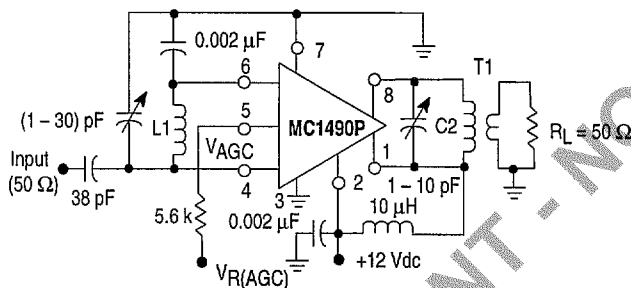


L1 = 7 turns, #20 AWG wire, 5/16" Dia., 5/8" long  
 L2 = 6 turns, #14 AWG wire, 9/16" Dia., 3/4" long  
 C1, C2, C3 = (1-30) pF  
 C4 = (1-10) pF

**Figure 20. Video Amplifier**

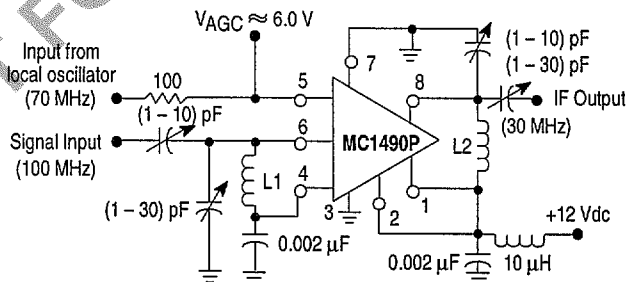


**Figure 21. 30 MHz Amplifier  
 (Power Gain = 50 dB, BW ≈ 1.0 MHz)**



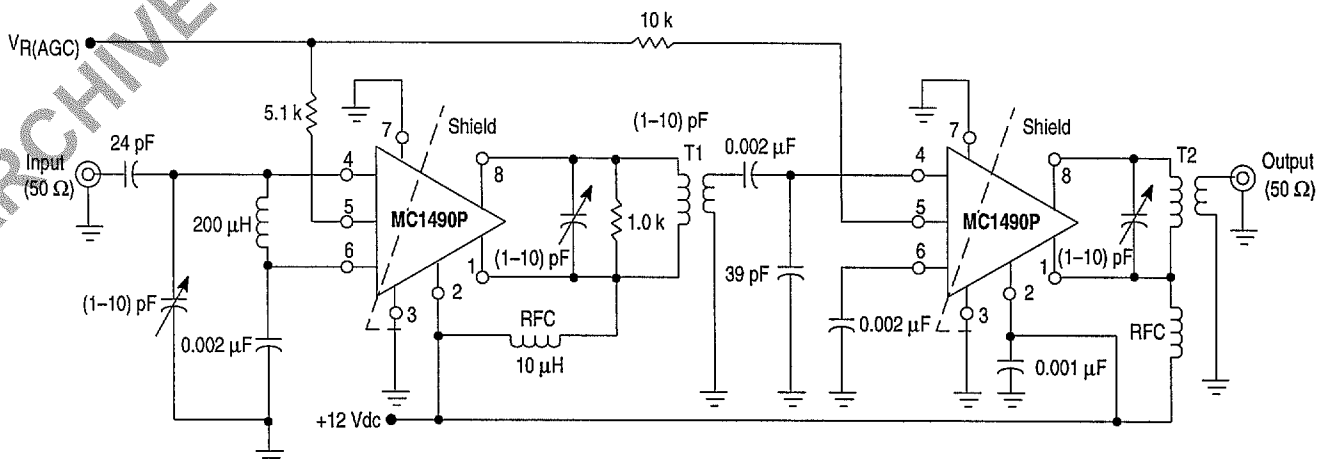
L1 = 12 turns, #22 AWG wire on a Toroid core,  
 (T37-6 micro metal or equiv).  
 T1: Primary = 17 turns, #20 AWG wire on a Toroid core, (T44-6).  
 Secondary = 2 turns, #20 AWG wire.

**Figure 22. 100 MHz Mixer**



L1 = 5 turns, #16 AWG wire, 1/4", ID Dia., 5/8" long  
 L2 = 16 turns, #20 AWG wire on a Toroid core, (T44-6).

**Figure 23. Two-Stage 60 MHz IF Amplifier (Power Gain ≈ 80 dB, BW ≈ 1.5 MHz)**



T1: Primary Winding = 15 turns, #22 AWG wire, 1/4" ID Air Core  
 Secondary Winding = 4 turns, #22 AWG wire,  
 Coefficient of Coupling ≈ 1.0

T2: Primary Winding = 10 turns, #22 AWG wire, 1/4" ID Air Core  
 Secondary Winding = 2 turns, #22 AWG wire,  
 Coefficient of Coupling ≈ 1.0

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## DESCRIPTION OF SPEECH COMPRESSOR

The amplifier drives the base of a PNP transistor operating common-emitter with a voltage gain of approximately 20. The control R1 varies the quiescent Q point of this transistor so that varying amounts of signal exceed the level  $V_r$ . Diode D1 rectifies the positive peaks of Q1's output only when these peaks are greater than  $V_r \approx 7.0$  V. The resulting output is filtered by  $C_x$ ,  $R_x$ .

$R_x$  controls the charging time constant or attack time.  $C_x$  is involved in both charge and discharge. R2 (the 150 k $\Omega$  and input resistance of the emitter-follower Q2) controls the decay time. Making the decay long and attack short is accomplished by making  $R_x$  small and R2 large. (A Darlington emitter-follower may be needed if extremely slow decay times are required.)

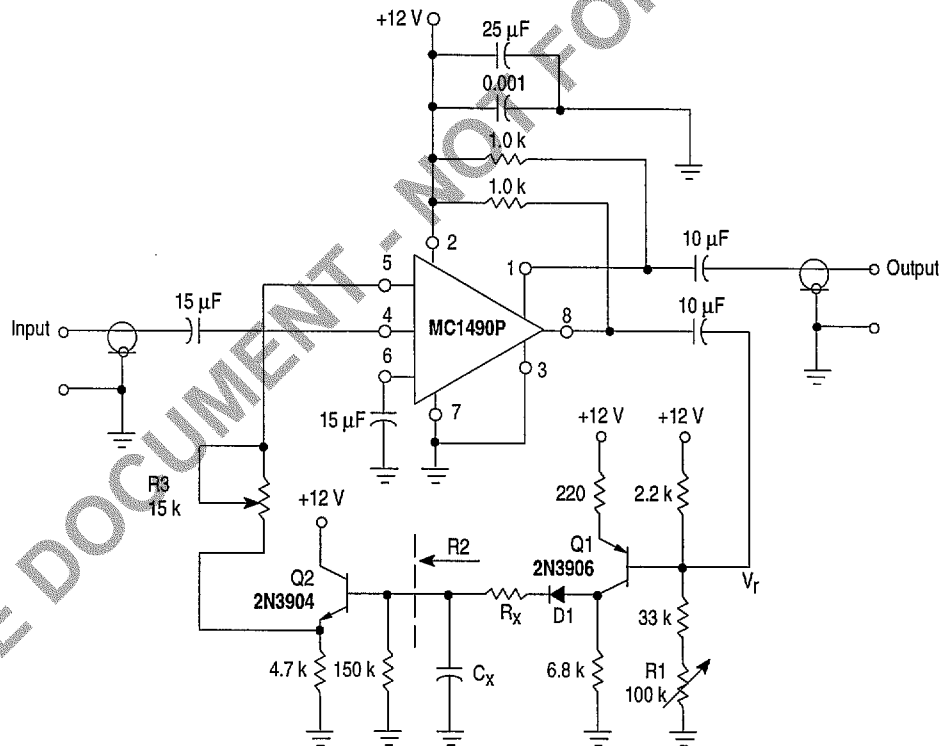
The emitter-follower Q2 drives the AGC Pin 5 of the MC1490P and reduces the gain. R3 controls the slope of signal compression.

Table 1. Distortion versus Frequency

Frequency	Distortion		Distortion	
	10 mV $e_i$	100 mV $e_i$	10 mV $e_i$	100 mV $e_i$
100 Hz	3.5%	12%	15%	27%
300 Hz	2%	10%	6%	20%
1.0 kHz	1.5%	8%	3%	9%
10 kHz	1.5%	8%	1%	3%
100 kHz	1.5%	8%	1%	3%
	Notes 1 and 2		Notes 3 and 4	

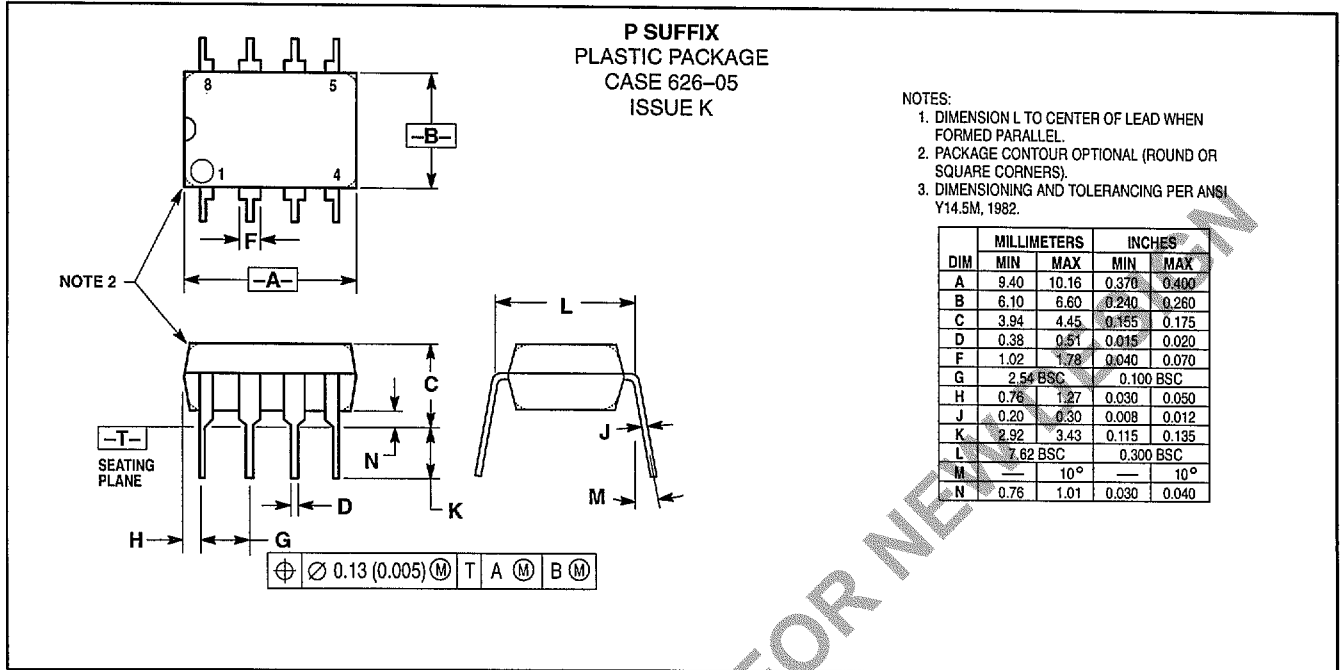
- Notes: (1) Decay = 300 ms  
Attack = 20 ms  
(2)  $C_x = 7.5 \mu\text{F}$   
 $R_x = 0$  (Short)
- (3) Decay = 20 ms  
Attack = 3.0 ms  
(4)  $C_x = 0.68 \mu\text{F}$   
 $R_x = 1.5 \text{ k}\Omega$

Figure 24. Speech Compressor



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## OUTLINE DIMENSIONS



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