MOTOROLA

MC1490

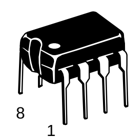
RF/IF/Audio Amplifier

The MC1490 is an integrated circuit featuring wide–range AGC for use in RF/IF amplifiers and audio amplifiers over the temperature range, –40° to +85°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

WIDEBAND AMPLIFIER WITH AGC

SEMICONDUCTOR TECHNICAL DATA



P SUFFIX
PLASTIC PACKAGE
CASE 626

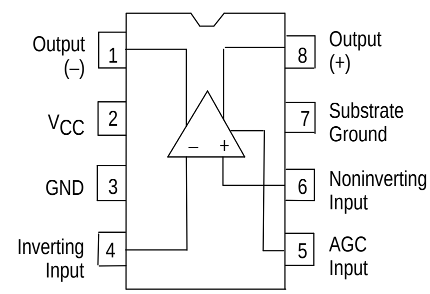
MAXIMUM RATINGS (T_A = +25°C, unless otherwise noted.)

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	°C
Storage Temperature Range	T_{stg}	–65 to +150	°C
Junction Temperature	T_J	+150	°C

ORDERING INFORMATION

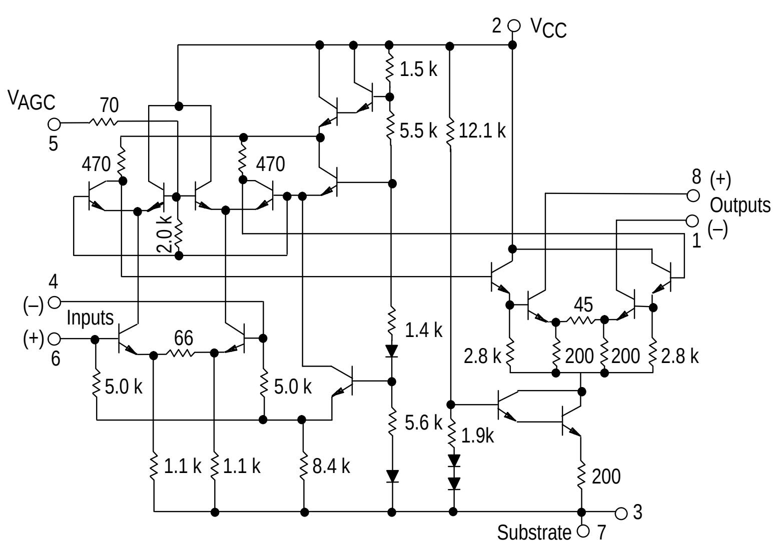
Device	Operating Temperature Range	Package
MC1490P	T_A = –40° to +85°C	Plastic

PIN CONNECTIONS



(Top View)

Representative Schematic Diagram



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

SCATTERING PARAMETERS
(V_{CC} = +12 Vdc, T_A = +25°C, Z_o = 50 Ω)

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

ELECTRICAL CHARACTERISTICS (V_{CC} = 12 Vdc, f = 60 MHz, BW = 1.0 MHz, T_A = 25°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 Ohms	19	NF	–	6.0	–	dB
Power Dissipation	–	P_D	–	168	204	mW

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

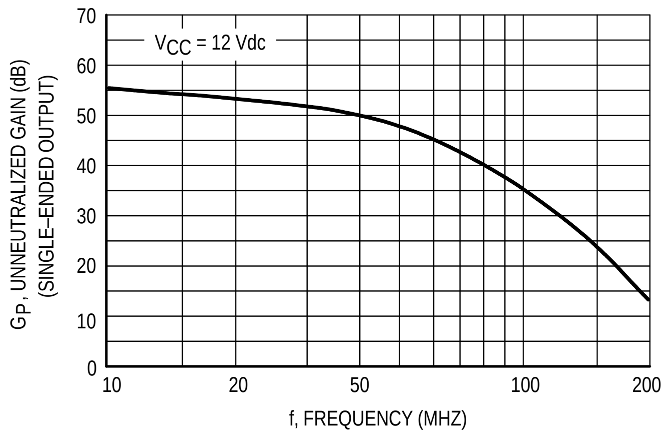


Figure 2. Voltage Gain versus Frequency (Video Amplifier, See Figure 20)

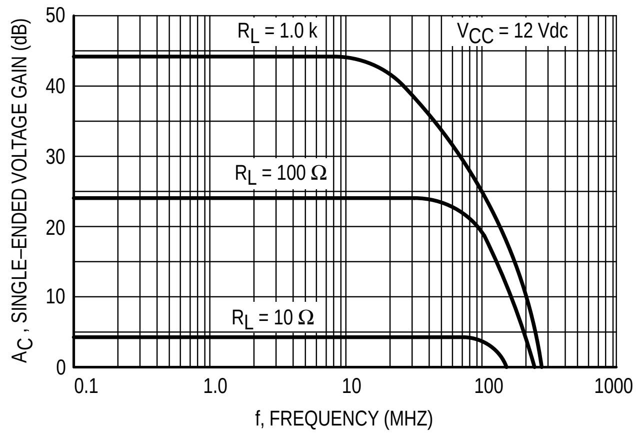


Figure 3. Dynamic Range: Output Voltage versus Input Voltage (Video Amplifier, See Figure 20)

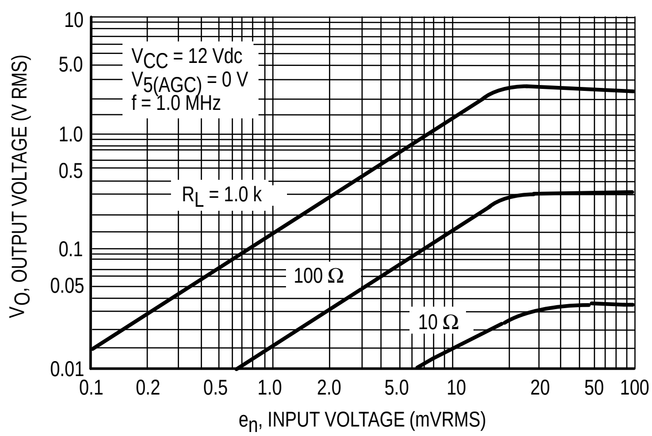


Figure 4. Voltage Gain versus Frequency (Video Amplifier, See Figure 20)

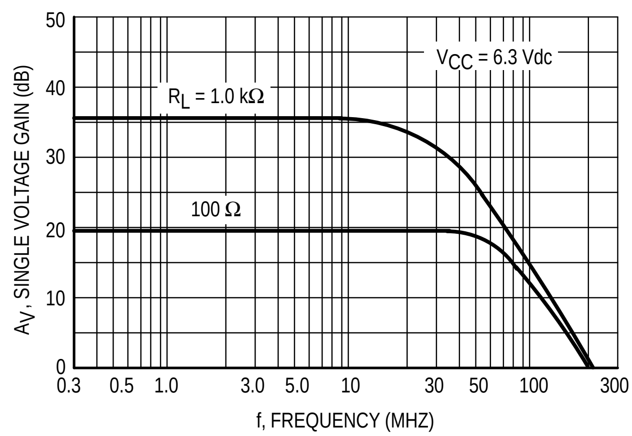


Figure 5. Voltage Gain and Supply Current versus Supply Voltage (Video Amplifier, See Figure 20)

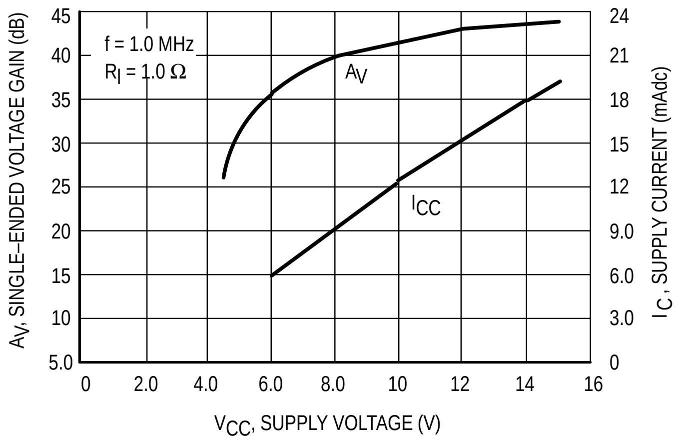


Figure 6. Typical Gain Reduction versus AGC Voltage

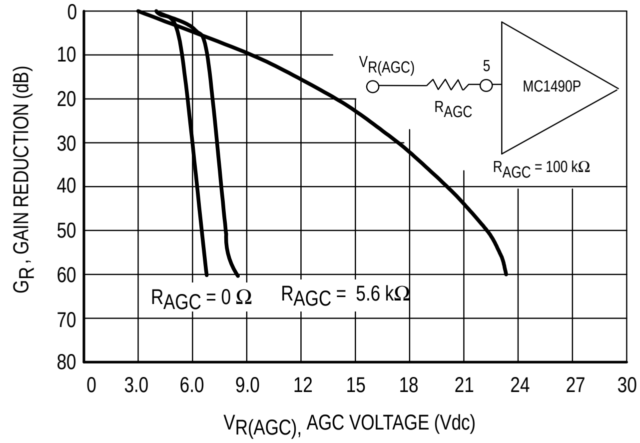


Figure 7. Typical Gain Reduction versus AGC Current

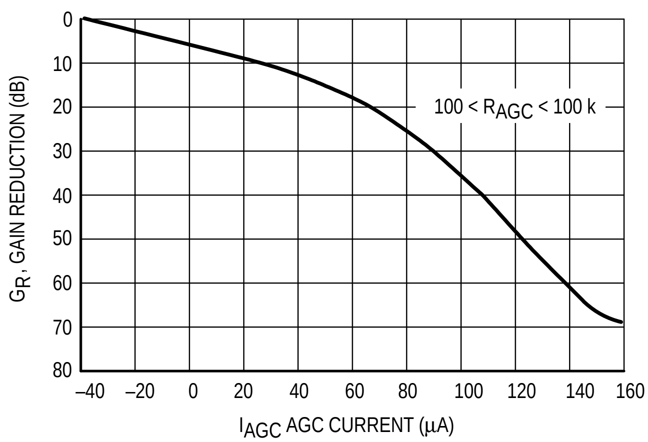


Figure 8. Fixed Tuned Power Gain Reduction versus Temperature (See Test Circuit, Figure 19)

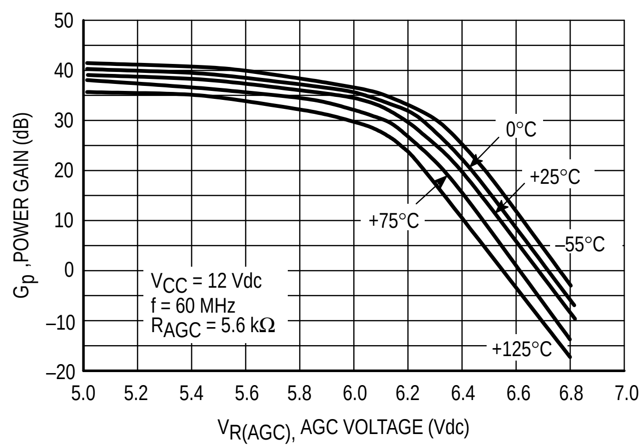


Figure 9. Power Gain versus Supply Voltage (See Test Circuit, Figure 19)

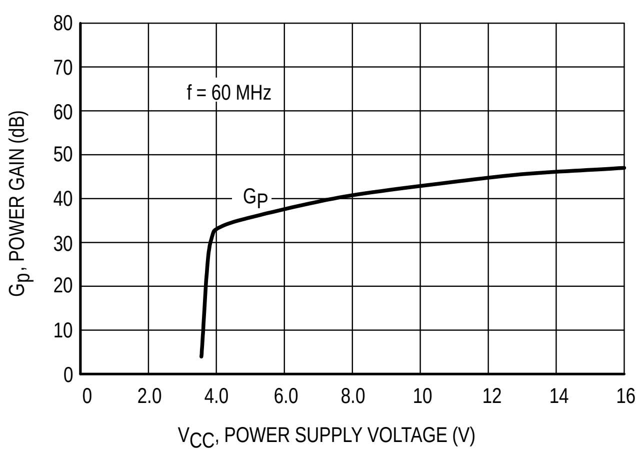


Figure 10. Noise Figure versus Frequency

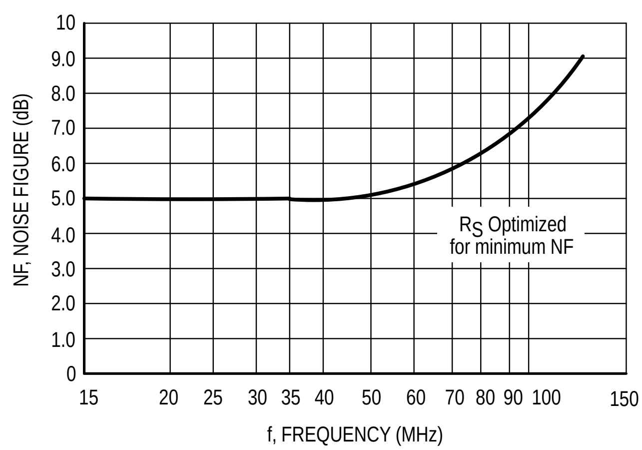


Figure 11. Noise Figure versus Source Resistance

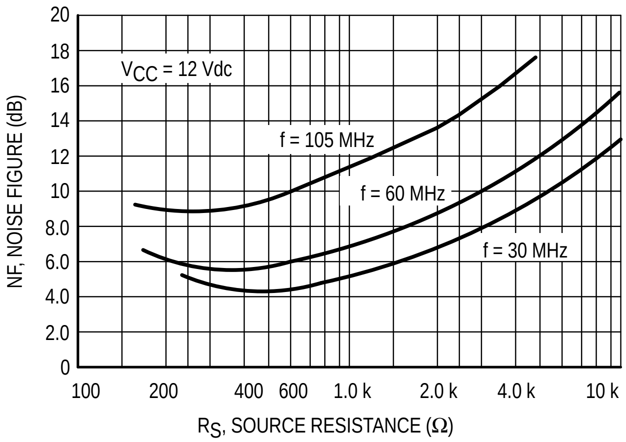


Figure 12. Noise Figure versus AGC Gain Reduction

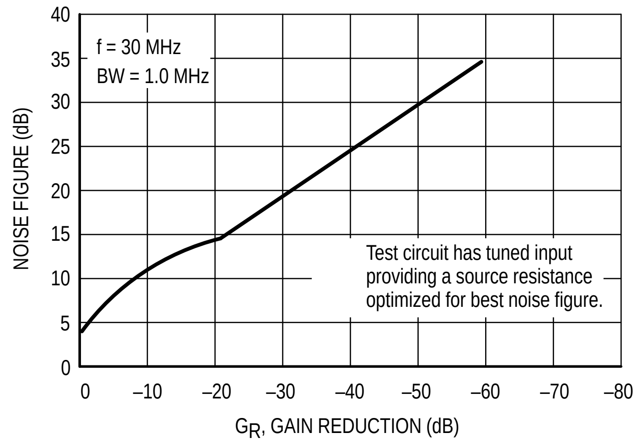


Figure 13. Harmonic Distortion versus AGC Gain Reduction for AM Carrier (For Test Circuit, See Figure 14)

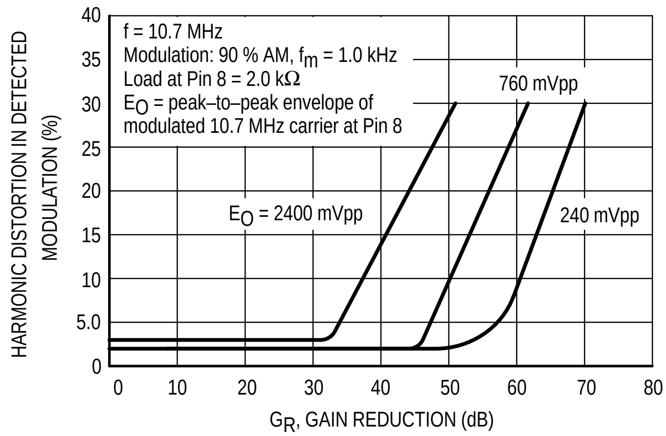
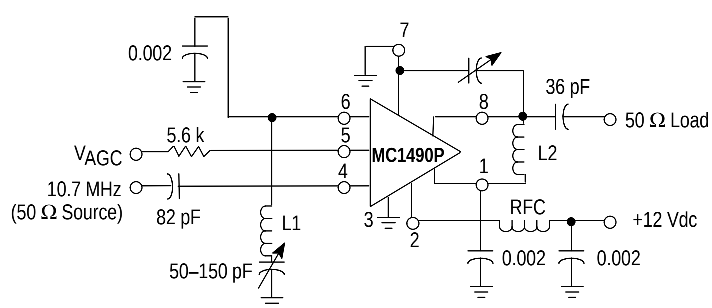


Figure 14. 10.7 MHz Amplifier Gain ≃ 55 dB, BW ≃ 100 kHz



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

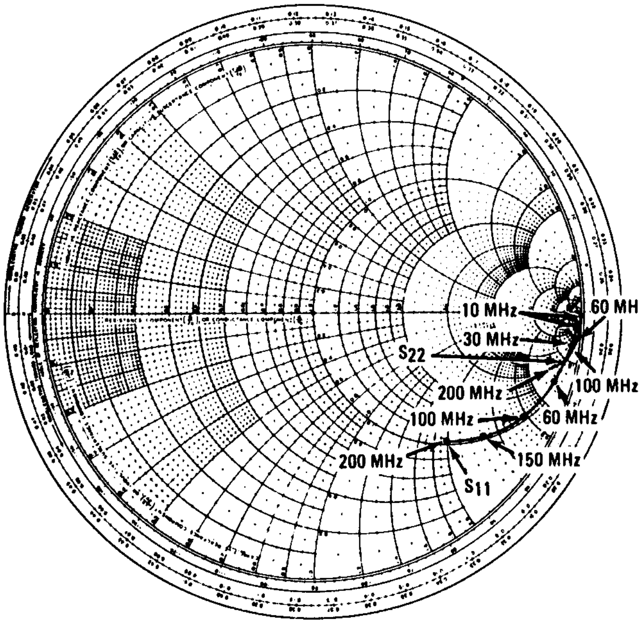


Figure 16. S_{11} and S_{22}, Input and Output Reflection Coefficient

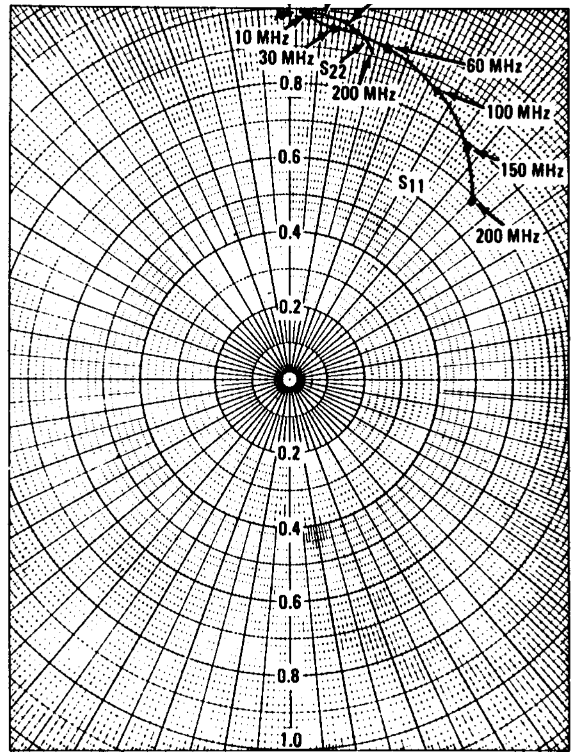


Figure 17. S_{21}, Forward Transmission Coefficient (Gain)

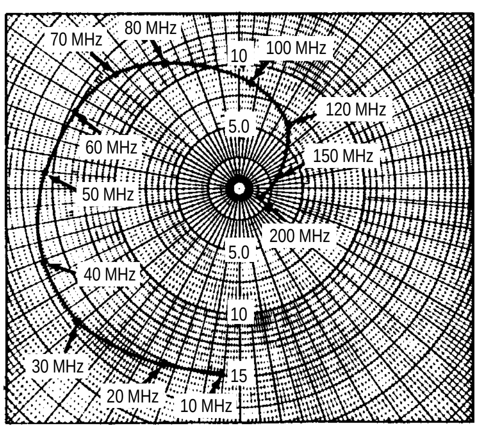


Figure 18. S_{12}, Reverse Transmission Coefficient (Feedback)

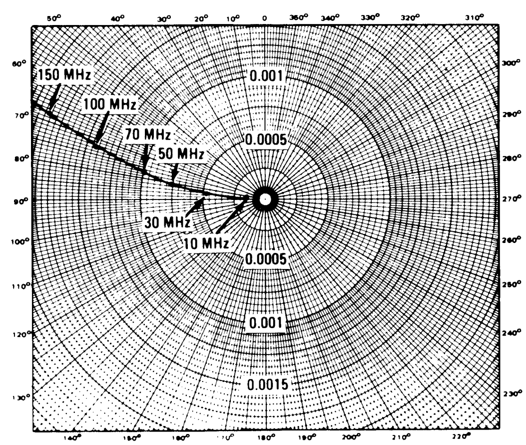
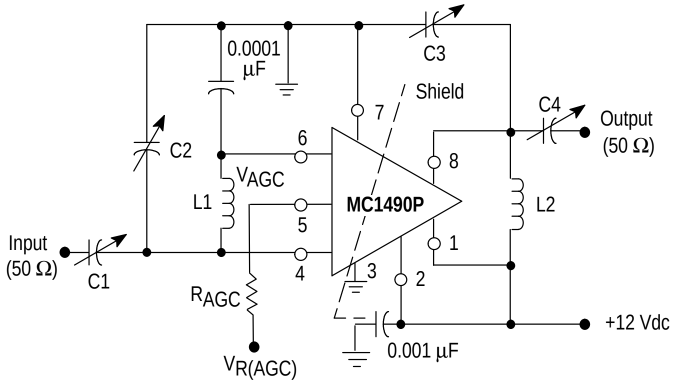


Figure 19. 60 MHz Power Gain Test Circuit



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

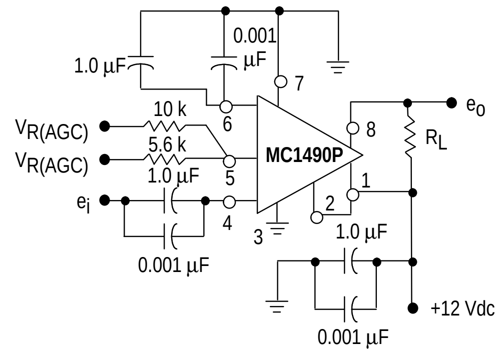
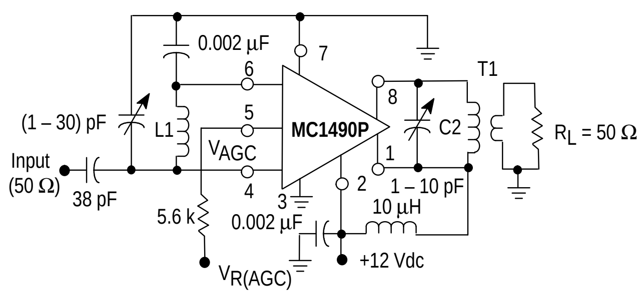
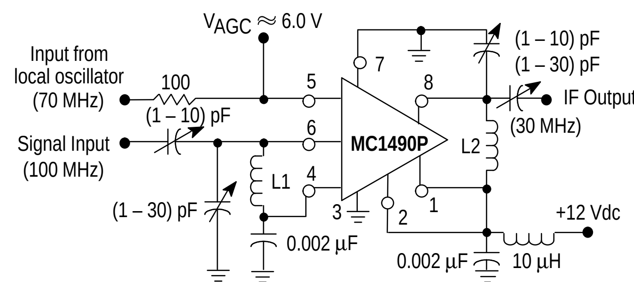


Figure 21. 30 MHz Amplifier (Power Gain = 50 dB, BW ≈ 1.0 MHz)



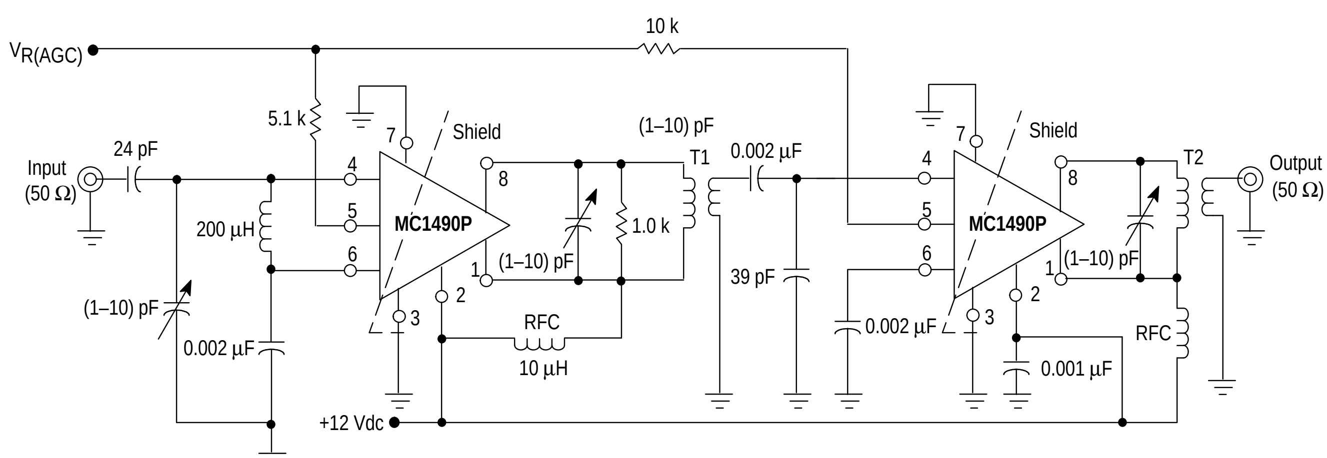
L1 = 12 turns, #22 AWG wire on a Toroid core,
(T37–6 micro metal or equiv).
T1: Primary = 17 turns, #20 AWG wire on a Toroid core, (T44–6).
Secondary = 2 turns, #20 AWG wire.

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

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 $V_r \simeq 7.0$ 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 kΩ 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.)

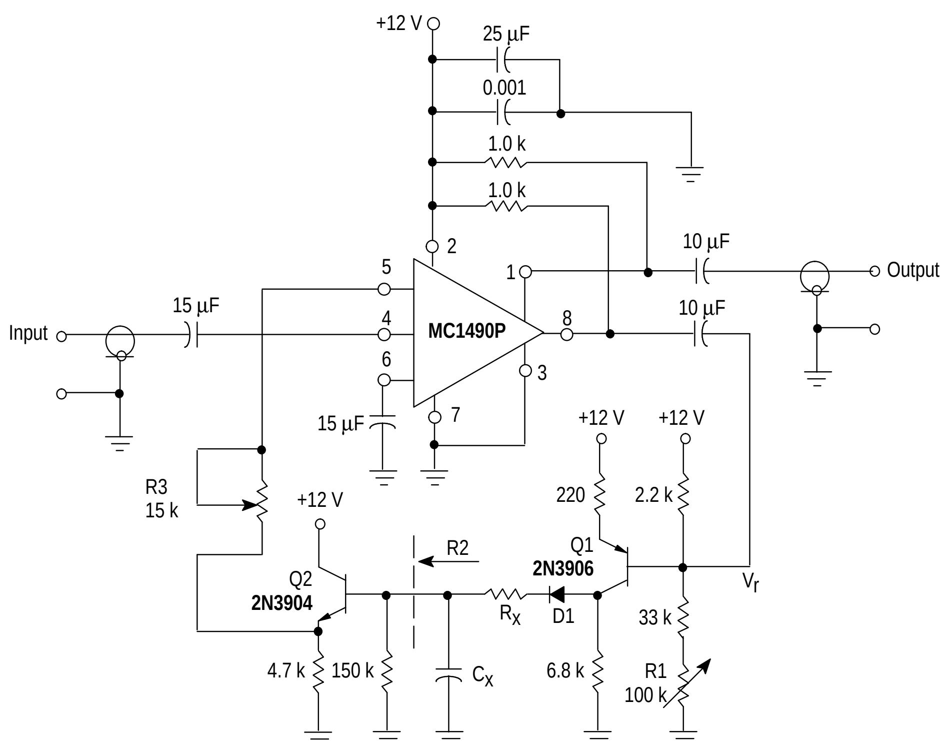
The emitter–follower Q2 drives the AGC Pin 5 of the MC1490P and reduces the gain. R3 controls the slope of signal compression.

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	

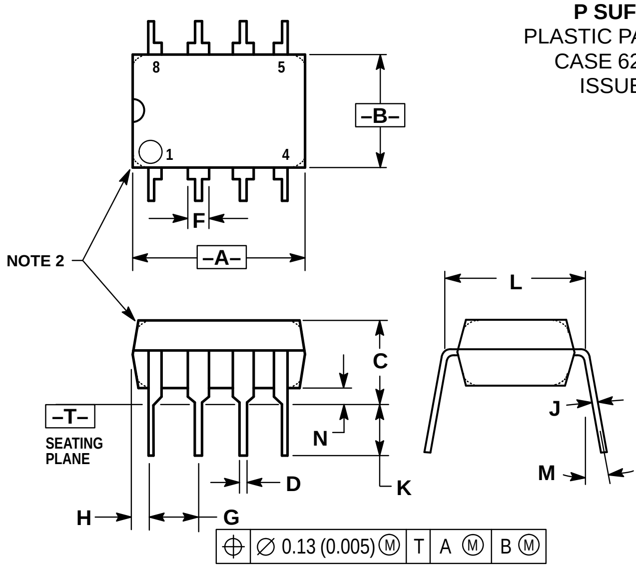
Notes:
(1) Decay = 300 ms
Attack = 20 ms
(2) C_X = 7.5 μF
R_X = 0 (Short)
(3) Decay = 20 ms
Attack = 3.0 ms
(4) C_X = 0.68 μF
R_X = 1.5 kΩ

Figure 24. Speech Compressor



OUTLINE DIMENSIONS

P SUFFIX
PLASTIC PACKAGE
CASE 626–05
ISSUE K



NOTES:
1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	0.76	1.27	0.030	0.050
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	—	10°	—	10°
N	0.76	1.01	0.030	0.040

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INTERNET: http://Design–NET.com

JAPAN: Nippon Motorola Ltd.; Tatsumi–SPD–JLDC, 6F Seibu–Butsuryu–Center, 3–14–2 Tatsumi Koto–Ku, Tokyo 135, Japan. 03–81–3521–8315

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