MC1590G

HIGH-FREQUENCY CIRCUITS

MONOLITHIC RF/IF/AUDIO AMPLIFIER

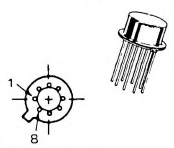
. . . an integrated circuit featuring wide-range AGC for use in RF/IF amplifiers and audio amplifiers over the temperature range, -55 to +125°C. (See application note AN 513 for design details.)

- 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
- Low Reverse Transfer Admittance – <10 μmhos typ at 60 MHz
- 6.0 to 15-Volt Operation, Single-Polarity Power Supply

WIDEBAND AMPLIFIER WITH AGC

SILICON
EPITAXIAL PASSIVATED

METAL PACKAGE
CASE 601
TO-99



(bottom view)

FIGURE 1 – UNNEUTRALIZED POWER GAIN versus FREQUENCY
(Tuned Amplifier, see Figure 16)

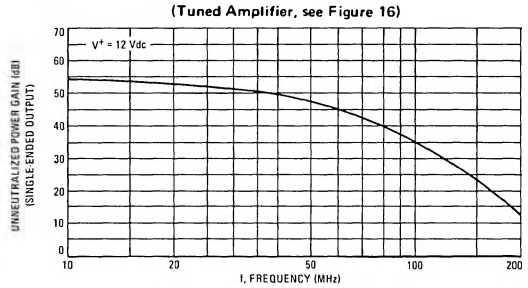
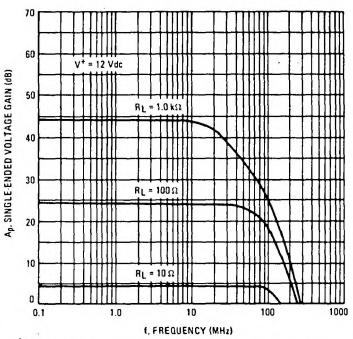


FIGURE 2 – VOLTAGE GAIN versus FREQUENCY
(Untuned Amplifier, see Figure 17)



CIRCUIT SCHEMATIC

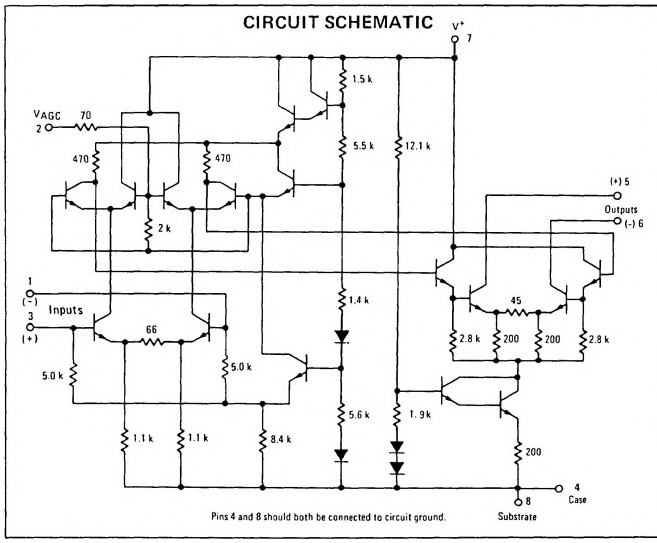
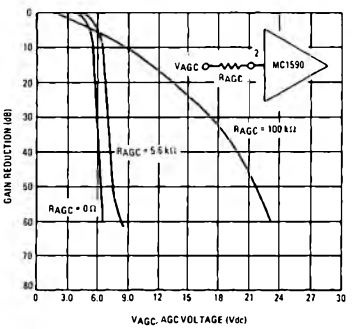


FIGURE 3 – TYPICAL GAIN REDUCTION
versus AGC VOLTAGE



See Packaging Information Section for outline dimensions.

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

Rating	Symbol	Value	Unit
Power Supply Voltage	V^+	+18	Vdc
Output Supply	V_5, V_6	+18	Vdc
AGC Supply	V_{AGC}	V^+	Vdc
Differential Input Voltage	V_{in}	5.0	Vdc
Power Dissipation (Package Limitation) Derate above T_A = +25°C	P_D	680 4.6	mW mW/°C
Operating Temperature Range	T_A	-55 to +125	°C
Storage Temperature Range	T_{stg}	-65 to +150	°C

ELECTRICAL CHARACTERISTICS (V^+ = +12 Vdc, f = 60 MHz, BW = 1.0 MHz, T_A = +25°C unless otherwise noted, see Figure 16 for test circuit.)

Characteristic	Symbol	Min	Typ	Max	Unit
AGC Range, V_2 = 5.0 Vdc to 7.0 Vdc		60	68	–	dB
Single-Ended Power Gain	A_p	40	45	–	dB
Noise Figure (R_s = 50 ohms)	N_f	–	6.0	–	dB
Output Voltage Swing (Pin 5)	V_5				V_{p-p}
Differential Output – 0 dB AGC		–	14	–	
-30 dB AGC		–	6.0	–	
Single-Ended Output – 0 dB AGC		–	7.0	–	
-30 dB AGC		–	3.0	–	
Output Stage Current (Pins 5 and 6)	$I_5 + I_6$	–	5.6	–	mA
Total Supply Power Current (V_{out} = 0)	I_D	–	14	17	mAdc
Power Dissipation (V_{in} = 0)	P_D	–	168	200	mW

ADMITTANCE PARAMETERS (V^+ = 12 Vdc, T_A = +25°C)

Parameter	Symbol	Typ f = 30 MHz	Typ f = 60 MHz	Unit
Single-Ended Input Admittance	g_{11} b_{11}	0.4 1.2	0.75 3.4	mmhos
Single-Ended Output Admittance	g_{22} b_{22}	0.05 0.50	0.1 1.0	mmho
Forward Transfer Admittance (Pin 1 to Pin 5)	$\lvert Y_{21}\rvert$ θ_{21}	150 -45	150 -105	mmhos degrees
Reverse Transfer Admittance*	g_{12} b_{12}	-0 -5.0	-0 -10	μmhos

*The value of Reverse Transfer Admittance includes the feedback admittance of the test circuit used in the measurement. The total feedback capacitance (including test circuit) is 0.025 pF and is a more practical value for design calculations than the internal feedback of the device alone. (See Figure 6)

SCATTERING PARAMETERS (V^+ = +12 Vdc, T_A = +25°C, Z_o = 50 Ω)

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

TYPICAL CHARACTERISTICS

(V^+ = 12 Vdc, T_A = +25°C unless otherwise noted)

FIGURE 4 – FIXED TUNED POWER GAIN versus TEMPERATURE (See test circuit, Figure 16)

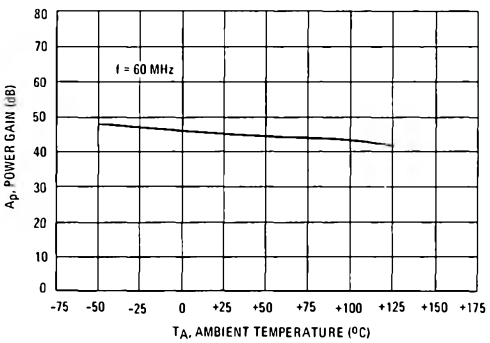


FIGURE 5 – POWER GAIN versus SUPPLY VOLTAGE (See test circuit, Figure 16)

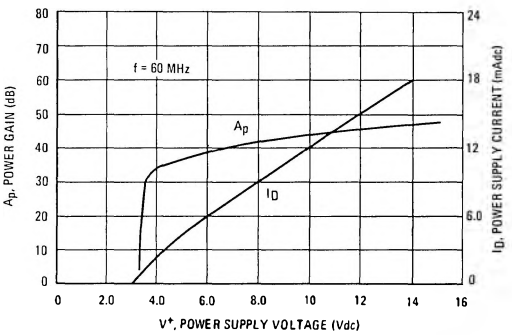


FIGURE 6 – REVERSE TRANSFER ADMITTANCE versus FREQUENCY (See Parameter Table, page 2 of MC1590 specification)

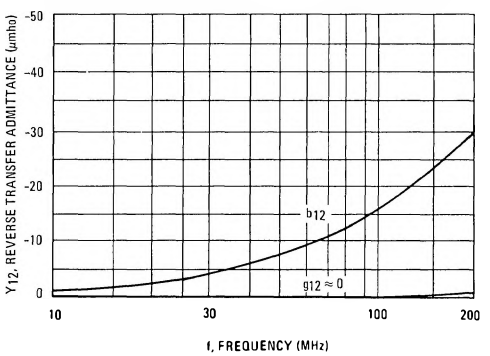


FIGURE 7 – NOISE FIGURE versus FREQUENCY

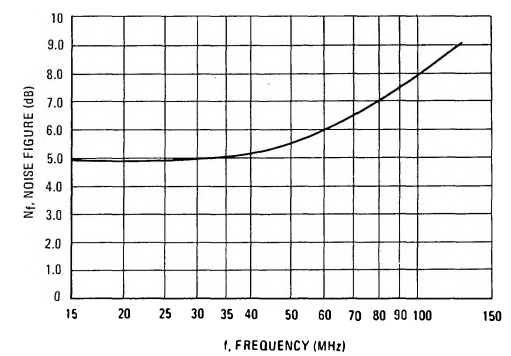


FIGURE 8 – SINGLE-ENDED OUTPUT ADMITTANCE

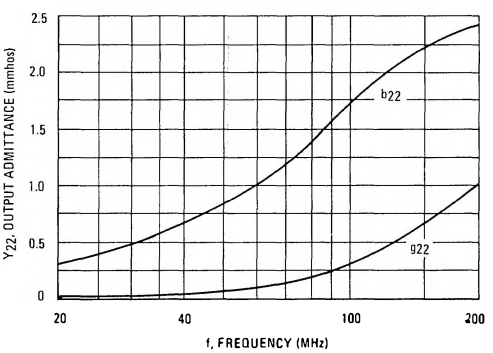
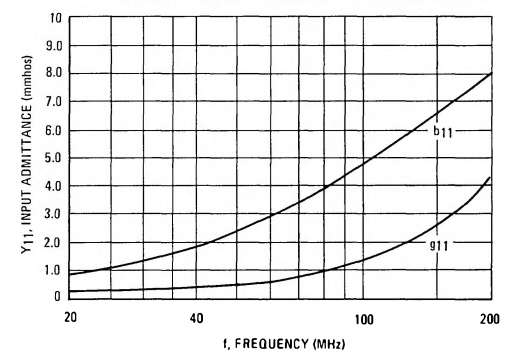


FIGURE 9 – SINGLE-ENDED INPUT ADMITTANCE



TYPICAL CHARACTERISTICS (continued)

FIGURE 10 – Y_{21}, FORWARD TRANSFER ADMITTANCE, RECTANGULAR FORM

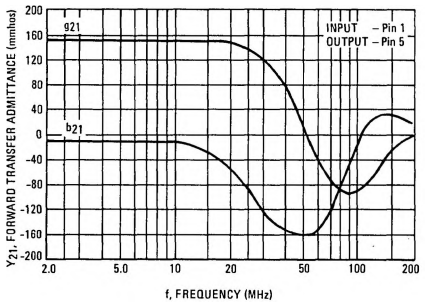


FIGURE 11 – Y_{21}, FORWARD TRANSFER ADMITTANCE, POLAR FORM

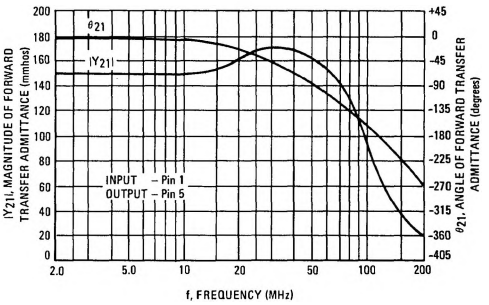


FIGURE 12 – S_{11} and S_{22}, INPUT AND OUTPUT REFLECTION COEFFICIENT

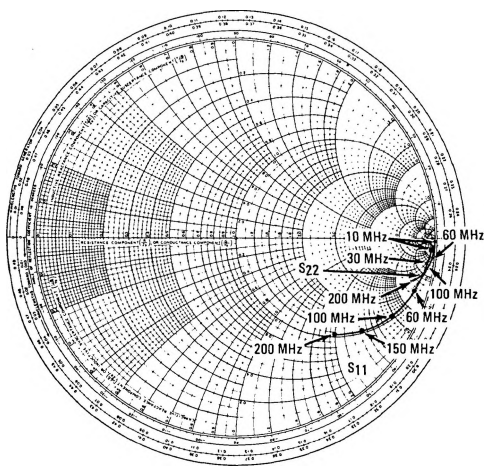
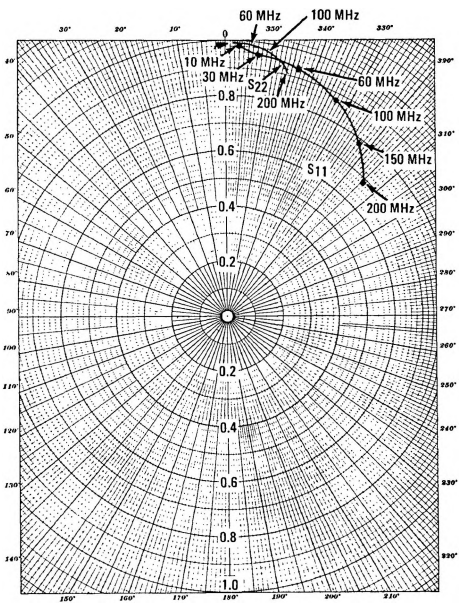


FIGURE 13 – S_{11}, and S_{22}, INPUT AND OUTPUT REFLECTION COEFFICIENT



TYPICAL CHARACTERISTICS (continued)

FIGURE 14 – S_{21}, FORWARD TRANSMISSION COEFFICIENT (GAIN)

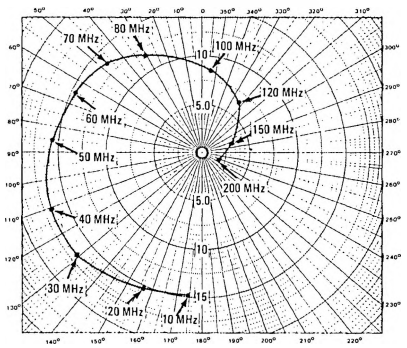
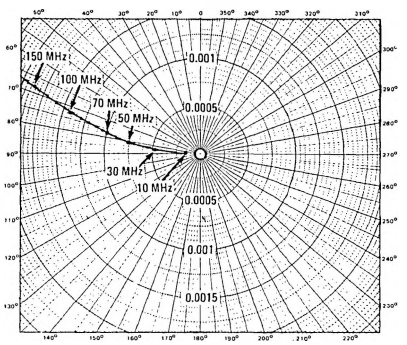
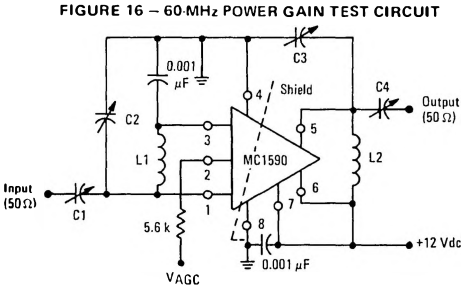


FIGURE 15 – S_{12}, REVERSE TRANSMISSION COEFFICIENT (FEEDBACK)



TYPICAL APPLICATIONS

FIGURE 16 – 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 17 – VIDEO AMPLIFIER

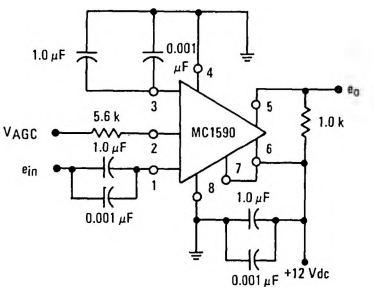
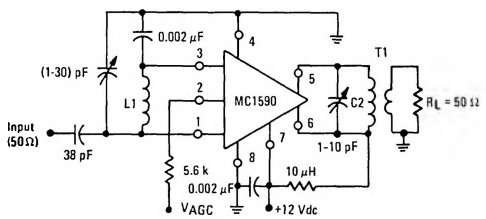
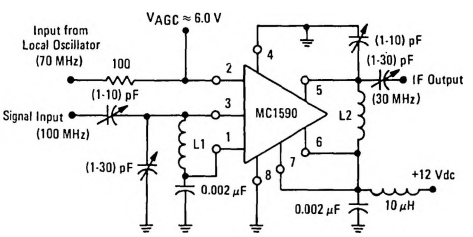


FIGURE 18 – 30-MHz AMPLIFIER
(Power Gain = 50 dB, BW ≈ 1.0 MHz)



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 Micro Metal or Equiv)
Secondary = 2 Turns #20 AWG Wire

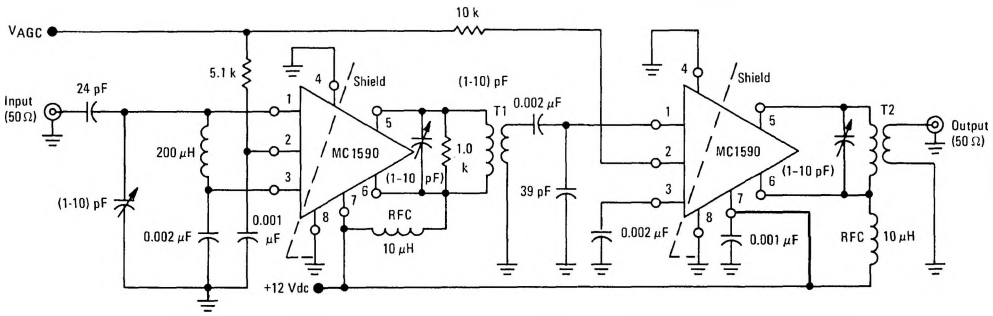
FIGURE 19 – 100-MHz MIXER



L1 = 5 Turns, #16 AWG Wire, 1/4" ID, 5/8" Long
L2 = 16 Turns, #20 AWG Wire on a Toroid Core, (T44-6 Micro Metal or Equiv)

TYPICAL APPLICATIONS (continued)

FIGURE 20 – 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

FIGURE 21 – SPEECH COMPRESSOR