ORDERING INFORMATION

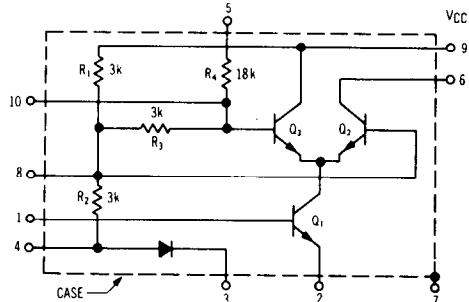| Device	Temperature Range	Package
MC1550F	−55°C to +125°C	Ceramic Flat
MC1550G	−55°C to +125°C	Metal Can

RF – IF AMPLIFIER

. . . a versatile, common-emitter, common-base cascode circuit for use in communications applications. See Application Note AN-215A for additional information.

- Constant Input Impedance over entire AGC range
- Extremely Low y_{12} − 4.3 μmhos at 60 MHz
- High Power Gain − 30 dB @ 60 MHz (0.5 MHz BW)
- Good Noise Figure − 5 dB @ 60 MHz

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

Rating	Symbol	Value	Unit
Power Supply Voltage, Pin 9	V_{CC}	20	Vdc
AGC Supply Voltage	V_{AGC}	20	Vdc
Input Differential Voltage, Pin 1 to Pin 4 (R_S = 500 ohms)	V_{ID}	±5.0	V(rms)
Power Dissipation (Package Limitation)	P_D		
Metal Can		680	mW
Derate above T_A = +25°C		4.6	mW/°C
Flat Package		500	mW
Derate above T_A = +25°C		3.3	mW/°C
Operating Ambient Temperature Range	T_A	−55 to +125	°C
Storage Temperature Range	T_{stg}	−65 to +150	°C

MC1550G

RF – IF AMPLIFIER
SILICON MONOLITHIC
INTEGRATED CIRCUIT

G SUFFIX
METAL PACKAGE
CASE 603B

ELECTRICAL CHARACTERIS

Characteristic
DC CHARACTERISTICS
Output Voltage
Test Voltage
Supply Drain Current
AGC Supply Drain Current

SMALL-SIGNAL CHARACTERISTIC

Small-Signal Voltage Gain
Bandwidth
Transducer Power Gain

FIGURE 1 – DC CHARACT
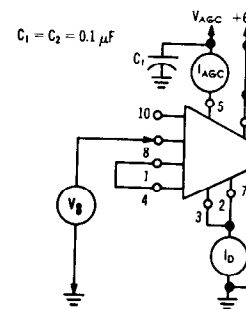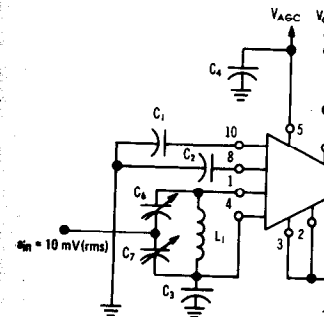
$C_1 = C_2 = 0.1 \mu F$

FIGURE 3 – POWER GAIN T

e_{in} = 10 mV(rms)

CIRCUIT SCHEMATIC
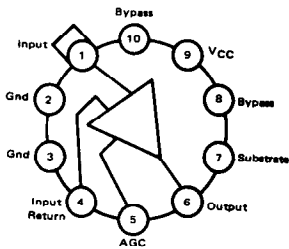
CIRCUIT DESCRIPTION

The MC1550 is built with monolithic fabrication techniques utilizing diffused resistors and small–geometry transistors. Excellent AGC performance is obtained by shunting the signal through the AGC transistor Q_3, maintaining the operating point of the input transistor Q_1. This keeps the input impedance constant over the entire AGC range.
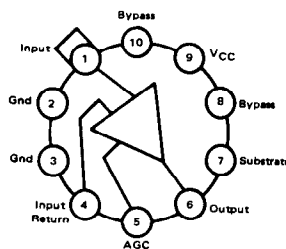
The amplifier is intended to be used in a common-emitter, common-base configuration (Q_1 and Q_2) with Q_3 acting as an AGC transistor. The input signal is applied between pins 1 and 4, where pin 4 is ac-coupled to ground. DC source resistance between pins 1 and 4 should be small (less than 100 ohms). Pins 2 and 3 should be connected together and grounded. Pins 8 and 10 should be bypassed to ground. The positive supply voltage is applied at pin 9 and at higher frequencies, pin 9 should also be bypassed to ground. The output is taken between pins 6 and 9. The substrate is connected to pin 7 and should be grounded. AGC voltage is applied to pin 5.

MC1550G

RF – IF AMPLIFIER

SILICON MONOLITHIC INTEGRATED CIRCUIT

G SUFFIX
METAL PACKAGE
CASE 603B

Bypass
Input
10
1
9   Vcc
Gnd   2   8   Bypass
Gnd   3   7   Substrate
Input   4   5   6   Output
Return   AGC

ELECTRICAL CHARACTERISTICS (V$^+$ = +6 Vdc, T$_A$ = +25°C)

Characteristic	Conditions	Figure	Symbol	Min	Typ	Max	Unit
DC CHARACTERISTICS							
Output Voltage	V$_{AGC}$ = 0 Vdc	1	V$_O$	3.80	–	4.65	Vdc
	V$_{AGC}$ = +6 Vdc			5.90	–	6.00	
Test Voltage	V$_{AGC}$ = 0 Vdc	1	V8	2.85	–	3.40	Vdc
	V$_{AGC}$ = +6 Vdc			3.25	–	3.80	
Supply Drain Current	V$_{AGC}$ = 0 Vdc	1	I$_D$	–	–	2.2	mAdc
	V$_{AGC}$ = +6 Vdc			–	–	2.5	
AGC Supply Drain Current	V$_{AGC}$ = 0 Vdc	1	I$_{AGC}$	–	–	–0.2	mAdc
	V$_{AGC}$ = +6 Vdc			–	–	0.18	
SMALL-SIGNAL CHARACTERISTICS							
Small-Signal Voltage Gain	f = 500 kHz	2	A$_V$	22	–	29	dB
Bandwidth	–3.0 dB	2	BW	22	–	–	MHz
Transducer Power Gain	f = 60 MHz, BW = 6 MHz	3	A$_P$	–	25	–	dB
	f = 100 MHz, BW = 6 MHz			–	21	–	

TYPICAL CHARACTERISTICS
(V$_{CC}$ = 6.0 Vdc, T$_A$ = +25°C unless otherwise noted.)
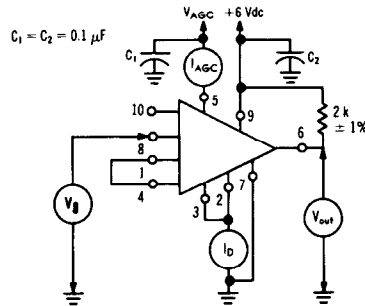
FIGURE 1 – DC CHARACTERISTICS TEST CIRCUIT

C$_1$ = C$_2$ = 0.1 μF

FIGURE 2 – VOLTAGE GAIN AND BANDWIDTH TEST CIRCUIT

R$_1$ = 50 Ω
R$_2$ = 620 Ω
C$_1$ thru C$_6$ = 0.1 μF

e$_{in}$ = 10 mV(rms)

C$_L$ < 5 pF

FIGURE 3 – POWER GAIN TEST CIRCUIT @ 60 MHz

e = 10 mV(rms)

R$_1$ = 50 Ω
C$_1$, C$_2$ and C$_3$ = 0.001 μF
C$_4$ and C$_5$ = 0.1 μF
C$_6$ and C$_9$ = 9-35 pF
C$_7$ = 9-180 pF
C$_8$ = 25-280 pF
L$_1$ = 0.22 μH
L$_2$ = 0.26 μH
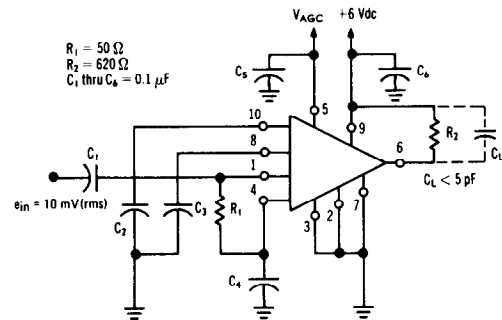
FIGURE 4 – DRAIN CURRENT TEMPERATURE CHARACTERISTICS

V$_{CC}$ = 6 V
V$_{AGC}$ = 0 V

CURRENT RATIO, I$_2$/I$_3$

T$_A$, AMBIENT TEMPERATURE (°C)

CIRCUIT DESCRIPTION

1550 is built with monolithic fabrication techniques
ffused resistors and small–geometry transistors.
GC performance is obtained by shunting the signal
AGC transistor Q$_2$, maintaining the operating point
t transistor Q$_1$. This keeps the input impedance
er the entire AGC range.

lifier is intended to be used in a common-emitter,
se configuration (Q$_1$ and Q$_3$) with Q$_2$ acting as an
tor. The input signal is applied between pins 1 and
n 4 is ac-coupled to ground. DC source resistance
is 1 and 4 should be small (less than 100 ohms).
3 should be connected together and grounded. Pins
hould be bypassed to ground. The positive supply
applied at pin 9 and at higher frequencies, pin 9
be bypassed to ground. The output is taken be-
6 and 9. The substrate is connected to pin 7 and
rounded. AGC voltage is applied to pin 5.

TYPICAL CHARACTERISTICS (continued)

FIGURE 5 – INPUT RESISTANCE AND CAPACITANCE
versus FREQUENCY

$V_{CC} = 6$ V
$V_{AGC} = 0$ V

R_{in}, INPUT RESISTANCE (OHMS)

C_{in}, INPUT CAPACITANCE (pF)

C_{in}

R_{in}
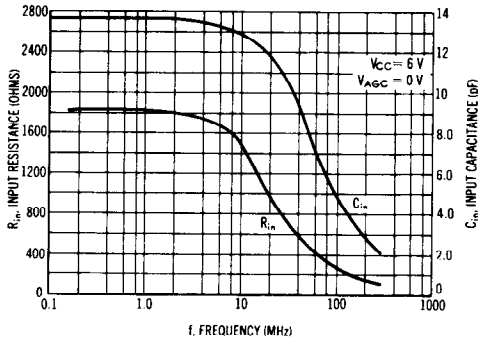
f, FREQUENCY (MHz)

FIGURE 6 – INPUT RESISTANCE AND
CAPACITANCE versus AGC VOLTAGE

R_{in}, INPUT RESISTANCE (OHMS)

C_{in}, INPUT CAPACITANCE (pF)

R_{in}

30 MHz

C_{in}

R_{in}

60 MHz

C_{in}

V_{AGC}, AGC VOLTAGE (VOLTS)

FIGURE

$f_o = 60$ MHz

A_p, TRANSDUCER POWER GAIN (dB)
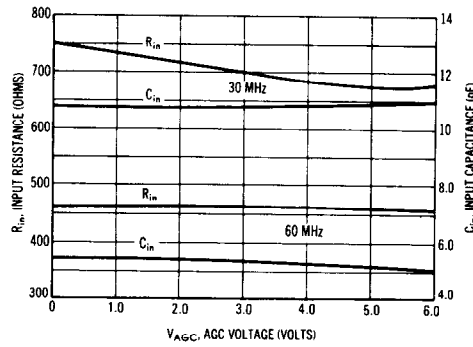
FIGURE 7 – OUTPUT RESISTANCE AND CAPACITANCE
versus FREQUENCY

R_{out}, OUTPUT RESISTANCE (OHMS)

C_{out}, OUTPUT CAPACITANCE (pF)

R_{out}

$V_{AGC} = 0$ V

$V_{AGC} = 6$ V

$V_{AGC} = 0$ and 6 V

C_{out}
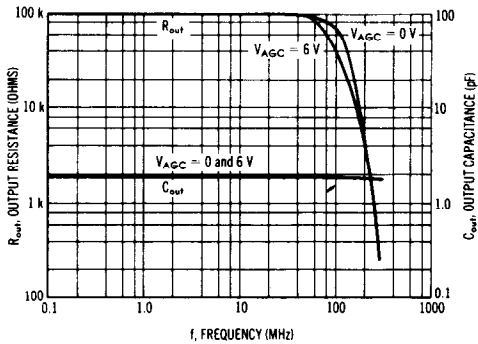
f, FREQUENCY (MHz)

FIGURE 8 – OUTPUT RESISTANCE AND
CAPACITANCE versus AGC VOLTAGE

R_{out}, OUTPUT RESISTANCE (kΩ)

C_{out}, OUTPUT CAPACITANCE (pF)

R_{out} @ 30 MHz

C_{out} @ 30 and 60 MHz

R_{out} @ 60 MHz

V_{AGC}, AGC VOLTAGE (VOLTS)

FIGURE 12 – NOISE FIGURE A
RESISTANCE versus F

NF, NOISE FIGURE (dB)
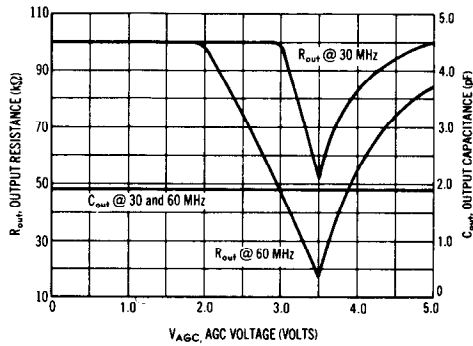
f, FREQUENCY (MH

FIGURE 9 – MAXIMUM TRANSDUCER POWER GAIN
versus FREQUENCY

$V_{AGC} = 0$
BW – 6 MHz

A_p, TRANSDUCER POWER GAIN (dB)
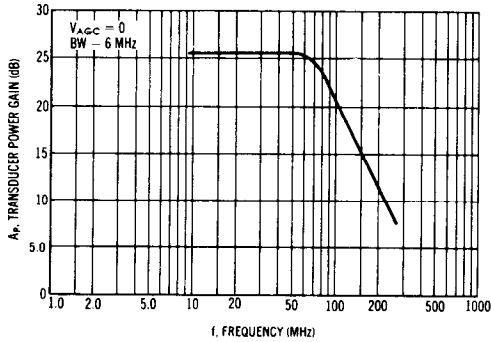
f, FREQUENCY (MHz)

FIGURE 10 – TRANSDUCER POWER GAIN
versus TEMPERATURE

$f_o = 60$ MHz
BW = 6 MHz

A_p, TRANSDUCER POWER GAIN (dB)

T_A, AMBIENT TEMPERATURE (°C)
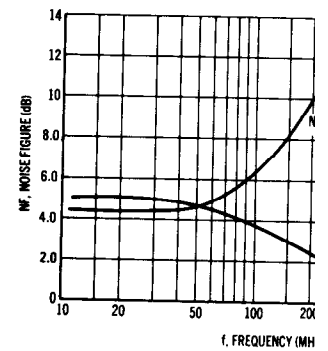
FIGURE 14 – y_{21}, FORWARD-TRAN
versus FREQUENC

y_{21}, FORWARD-TRANSFER ADMITTANCE (mmhos)

g_{21}, -b

$V_{CC} = 6$ Vdc

f, FREQUENCY (MH.
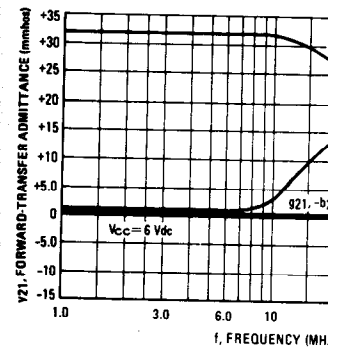
TYPICAL CHARACTERISTICS (continued)

INPUT RESISTANCE AND ...CE versus AGC VOLTAGE
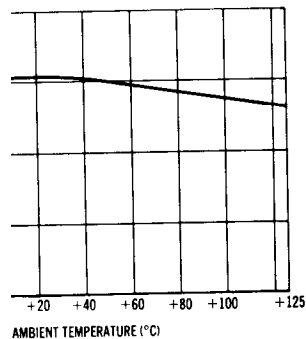
FIGURE 11 — TRANSDUCER POWER BANDWIDTH versus AGC VOLTAGE

OUTPUT RESISTANCE AND ...NCE versus AGC VOLTAGE

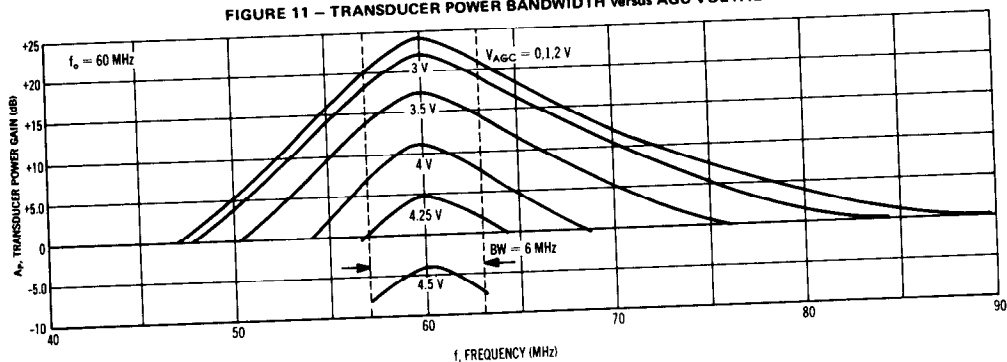**FIGURE 12 — NOISE FIGURE AND OPTIMUM SOURCE RESISTANCE versus FREQUENCY**
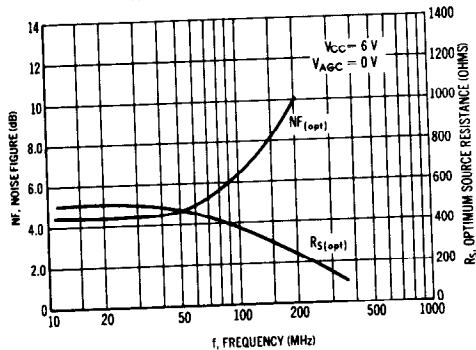
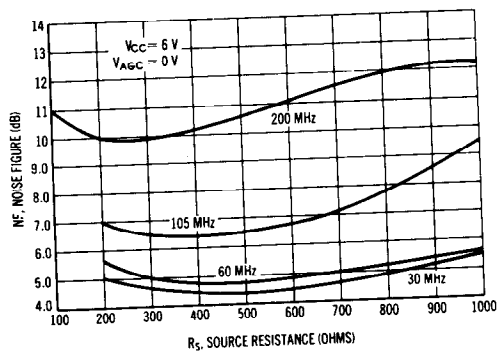**FIGURE 13 — NOISE FIGURE versus SOURCE RESISTANCE**

TRANSDUCER POWER GAIN ...s TEMPERATURE

FIGURE 14 — Y_{21}, FORWARD-TRANSFER ADMITTANCE versus FREQUENCY
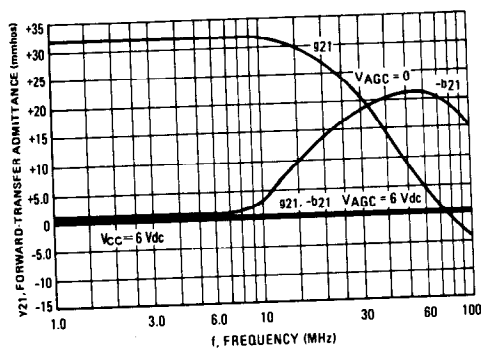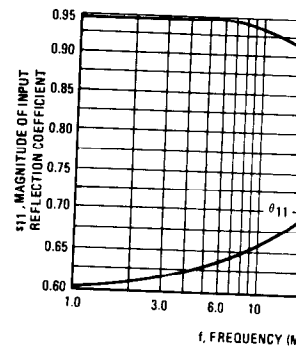

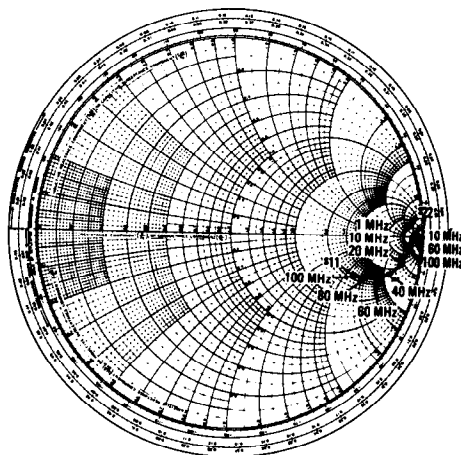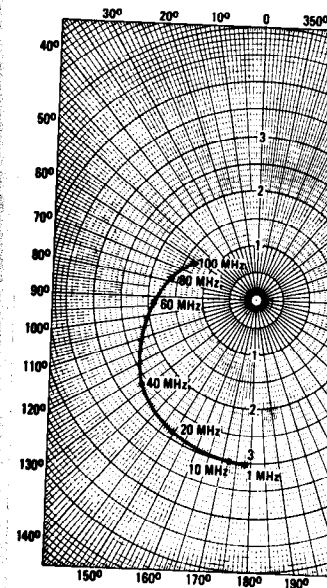**FIGURE 15 — Y_{21}, FORWARD-TRANSFER ADMITTANCE versus AGC VOLTAGE**
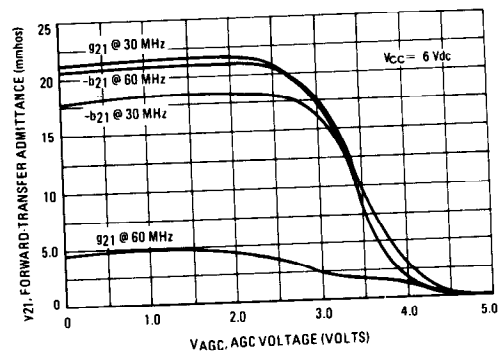
TYPICAL CHARACTERISTICS
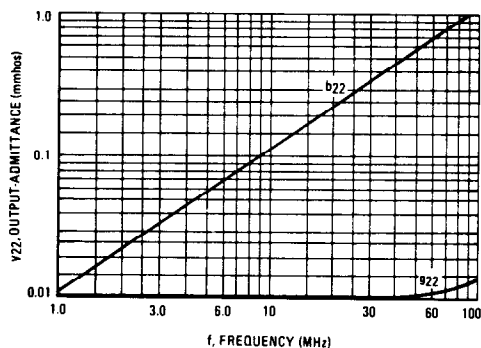
(V_CC = 6.0-Vdc, T_A = +25°C unless otherwise noted.)

FIGURE 16 – y_12, REVERSE TRANSFER-ADMITTANCE versus FREQUENCY
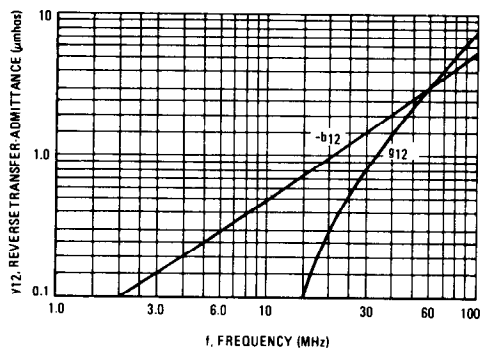
FIGURE 17 – y_11, INPUT-ADMITTANCE versus FREQUENCY

FIGURE 20 – s_11, INPUT
COEFFICIENT versus

The y_12 shown in Figure 16 illustrates the extremely low feedback of the MC1550 with no contribution from the external mounting circuitry. However, in many cases the external circuitry may contribute as much or more to the total feedback than does the MC1550.
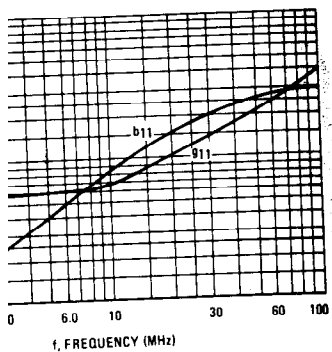
To perform more accurate design calculations of gain, stability, and input – output impedances it is recommended that the designer first determine the total feedback of device plus circuitry.

This can be done in one of two ways:

(1) Measure the total y_12 or s_12 of the MC1550 installed in its mounting circuitry, or

(2) Measure the y_12 of the circuitry alone (without the MC1550 installed) and add the circuit y_12 to the y_12 for the MC1550 given in Figure 16.

FIGURE 19 – s_11 AND s_22, INPUT AND OUTPUT
REFLECTION COEFFICIENT

FIGURE 22 – s_21, FORWARD
COEFFICIENT

FIGURE 18 – y_22, OUTPUT-ADMITTANCE versus FREQUENCY

TYPICAL CHARACTERISTICS (continued)
(V_{CC} = 6.0 Vdc, T_A = +25°C unless otherwise noted.)

NPUT-ADMITTANCE versus FREQUENCY

FIGURE 20 – s_{11}, INPUT REFLECTION COEFFICIENT versus FREQUENCY

FIGURE 21 – s_{22}, OUTPUT REFLECTION COEFFICIENT versus FREQUENCY

9 – s_{11} AND s_{22}, INPUT AND OUTPUT REFLECTION COEFFICIENT
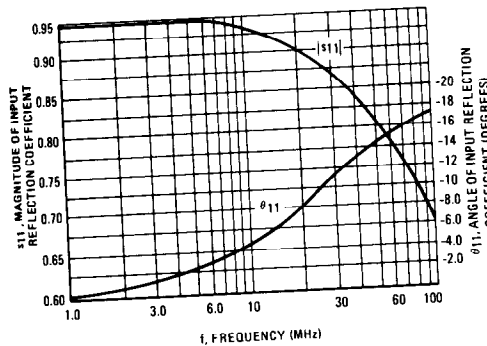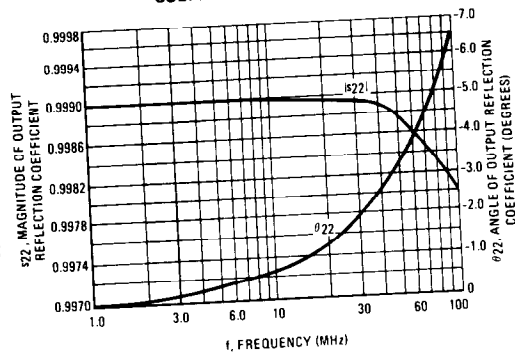
FIGURE 22 – s_{21}, FORWARD TRANSMISSION COEFFICIENT (GAIN)

FIGURE 23 – s_{12}, REVERSE TRANSMISSION COEFFICIENT (FEEDBACK)