

Features

- DC to 3000 MHz
- 19.5 dB Gain at 1000 MHz
- 18.5 dB Gain at 2000 MHz
- 19 dBm Output P1dB at 1000 MHz
- 18.5 dBm Output P1dB at 2000 MHz
- 34 dBm Output IP3 at 1000 MHz
- 4.3 dB Noise Figure at 2000 MHz

Applications

- Broadband Gain Blocks
- High Linearity Amplifiers

Packages Available

- (-C) 85 Mil Micro-X
- (-B) SOT-89

Description

The ECG005 is a high reliability, high linearity, low cost broadband amplifier, optimized for commercial communications. The device is manufactured using in-house developed, advanced Indium Gallium Phosphide Heterojunction Bipolar Transistor (InGaP HBT) technology and is designed for use as a 50 Ohm gain block. The amplifier features excellent VSWR, low noise figure and highly linear performance. Typical OIP3 is +34dBm at 1000MHz. The ECG005 operates from a single voltage supply and requires only two DC-blocking capacitors, a bias resistor and an inductor for operation. The device is ideal for wireless applications and is available in a low cost, surface-mountable plastic 85 mil Micro-X and SOT-89 packages.

Electrical Specifications

Test Conditions: $I_c = 65 \text{ mA}$, $T_a = 25^\circ\text{C}$

SYMBOL	PARAMETER		LIMITS			UNIT	TEST CONDITION
			MIN.	TYP.	MAX.		
F	Frequency		DC		3000	MHz	
G	Gain (Small Signal)	f = 1000MHz f = 2000MHz f = 3000MHz	16.5	19.5 18.5 17.3		dB	
P _{1dB}	Output Power @ 1dB Compression	f = 1000MHz f = 2000MHz f = 3000MHz	16.5	19.0 18.5 17.5		dBm	
P _{sat}	Saturated Output Power	f = 1000MHz f = 2000MHz f = 3000MHz		20.0 20.0 20.0		dBm	
OIP3	Output Third Order Intercept	f = 1000MHz f = 2000MHz	30.0	34.0 33.0		dBm	Note 1
RL _{in}	Input Return Loss, 50 Ohm	f = 2000MHz		16.0		dB	
RL _{out}	Output Return Loss, 50 Ohm	f = 2000MHz		15.0		dB	
NF	Noise Figure	f = 2000MHz		4.3		dB	
V _{de}	Device Voltage		4.2	4.8	5.3	V	

Note 1: $OIP3 = P_{out} \text{ (by power meter, total 2-tone power)} + (IM3(dB))/2 - 3dB$



CAUTION!
SENSITIVE ELECTRONIC DEVICE

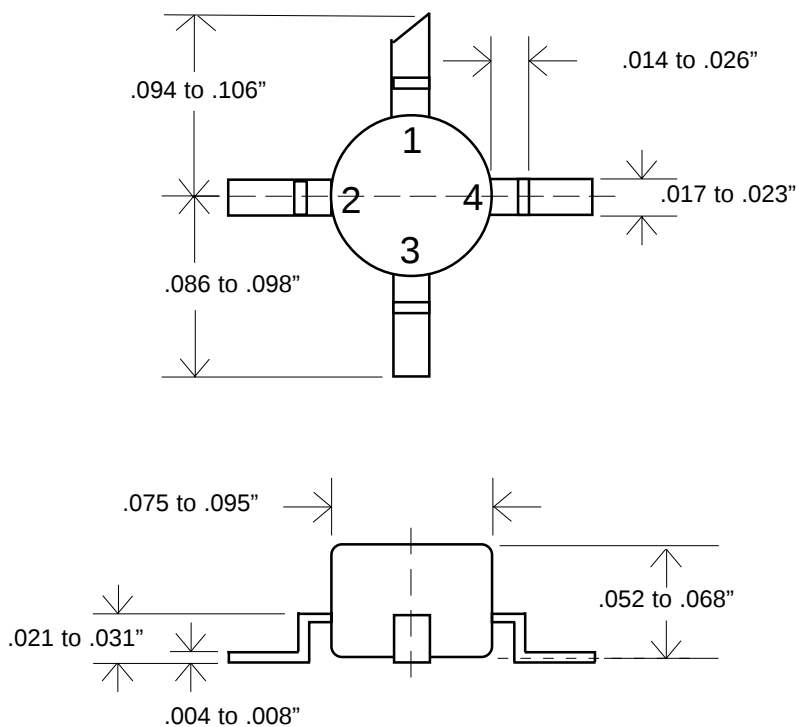
Absolute Maximum Ratings

Device Current	130	mA
RF Power Input	12	dBm
Operating Temperature	-40 to +85	°C
Storage Temperature	-65 to +150	°C
Junction Temperature	+200	°C

Note: Exceeding any of the absolute maximum ratings may cause permanent damage to the device.

Micro-X Package Outline

(all units are in inches)

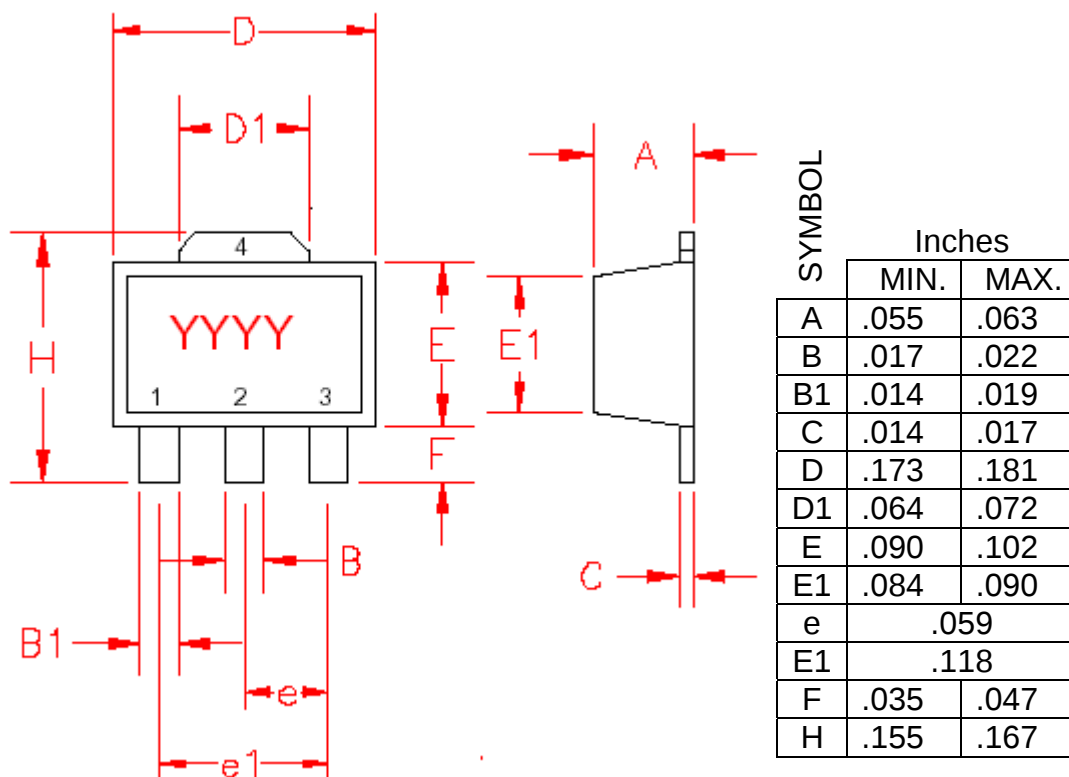


Pin Definitions

Pin #	Pin	Definition
1	RFin	This pin has a nominal 50 ohm input impedance. It requires a DC blocking capacitor large enough to handle the lowest frequency used.
2, 4	Gnd	The two ground connections should be directly connected together to the ground plane on the PCB. The ground connection also serves as a heatsink.
3	RFout	This pin has a nominal 50 ohm output impedance. It requires a DC bias of 65mA through a series inductor and a resistor. A bypass capacitor (1.0 micro Farad) on the DC side of the inductor is recommended for providing instantaneous current during a modulated RF signal. Use a DC blocking capacitor on the output with similar requirements as the input side.

SOT-89 Package Outline

(all units are in inches)



Pin Definitions

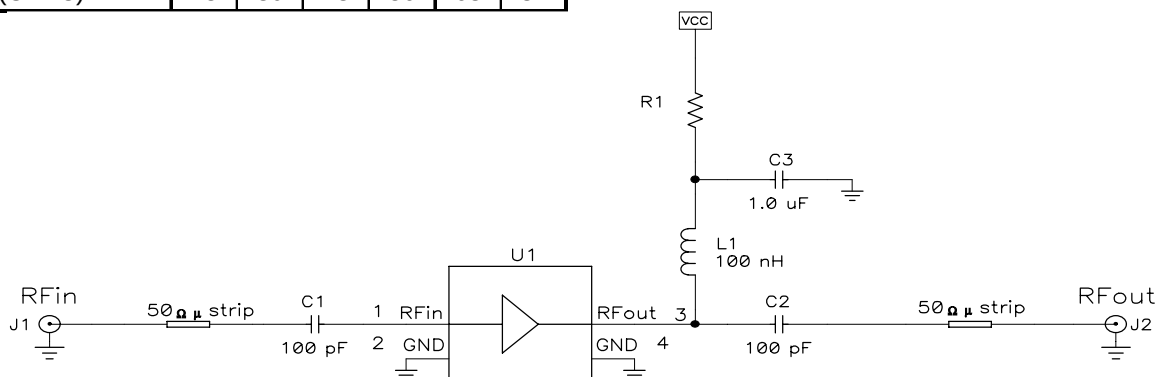
Pin #	Pin	Definition
1	RFin	This pin has a nominal 50 ohm input impedance. It requires a DC blocking capacitor large enough to handle the lowest frequency used.
2, 4	Gnd	The two ground connections should be directly connected together to the ground plane on the PCB. The ground connection also serves as a heatsink.
3	RFout	This pin has a nominal 50 ohm output impedance. It requires a DC bias of 65mA through a series inductor and a resistor. A bypass capacitor (1.0 micro Farad) on the DC side of the inductor is recommended for providing instantaneous current during a modulated RF signal. Use a DC blocking capacitor on the output with similar requirements as the input side.

**Evaluation Board Schematic
85 Mil Micro-X and SOT-89**

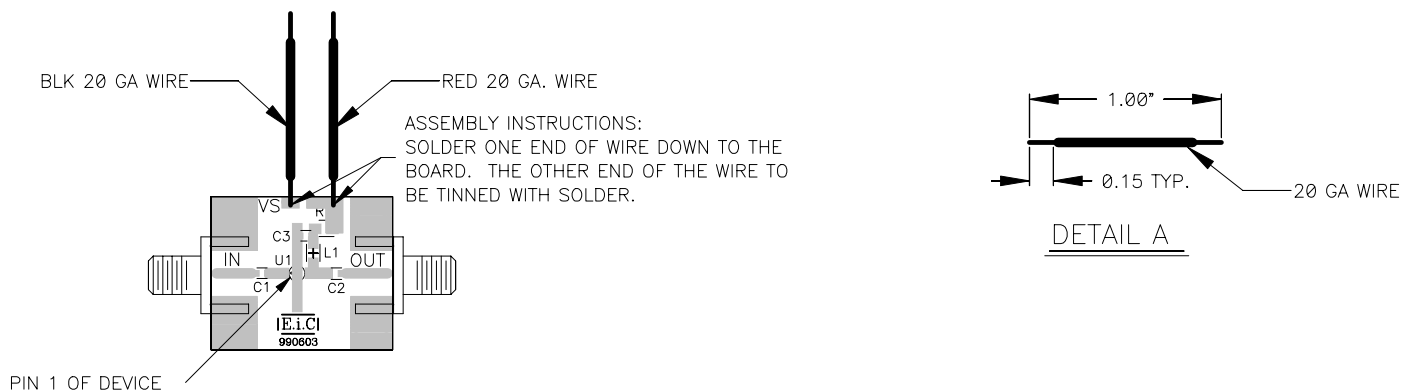
Recommended Bias Resistor Values

$$R = (V_{cc} - V_{de}) / I_{cc} = (V_{cc} - 5.0) / 0.070$$

Supply Voltage (V_{cc})	6	7	8	9	10	11
R1 (Ohms)	15	30	43	56	68	82



Evaluation Board Layout



Evaluation Board Materials

MANUFACTURER	PART NUMBER	QTY.	DESCRIPTION	VALUE	DESIGNATORS
MARU	CE103K1NR	2	Capacitor (0603)	100 pF	C1, C2
MARU	CE105K1NR	1	Capacitor (0603)	1.0 uF	C3
ROHM	Various	1	Resistor (0805)	Depends on V_{cc} (See Table)	R1
DIGI-KEY	TKS2386CT-ND	1	Inductor (0603)	100 nH	L1
EF Johnson	142-0701-881	2	SMA Connector	-	J1, J2
EiC Corp	ECG005	1	Amplifier	-	U1
---	60-000009-003	1	Printed Circuit Board	-	---

NOTE 1. EiC RECOMMENDED COMPONENTS ARE SHOWN.
EQUIVALENT COMPONENTS MAY BE USED.
NOTE UNLESS OTHERWISE SPECIFIED

Figure 1

Small Signal Gain vs. Frequency
IC Tested on Eval Board (micro-x pkg)

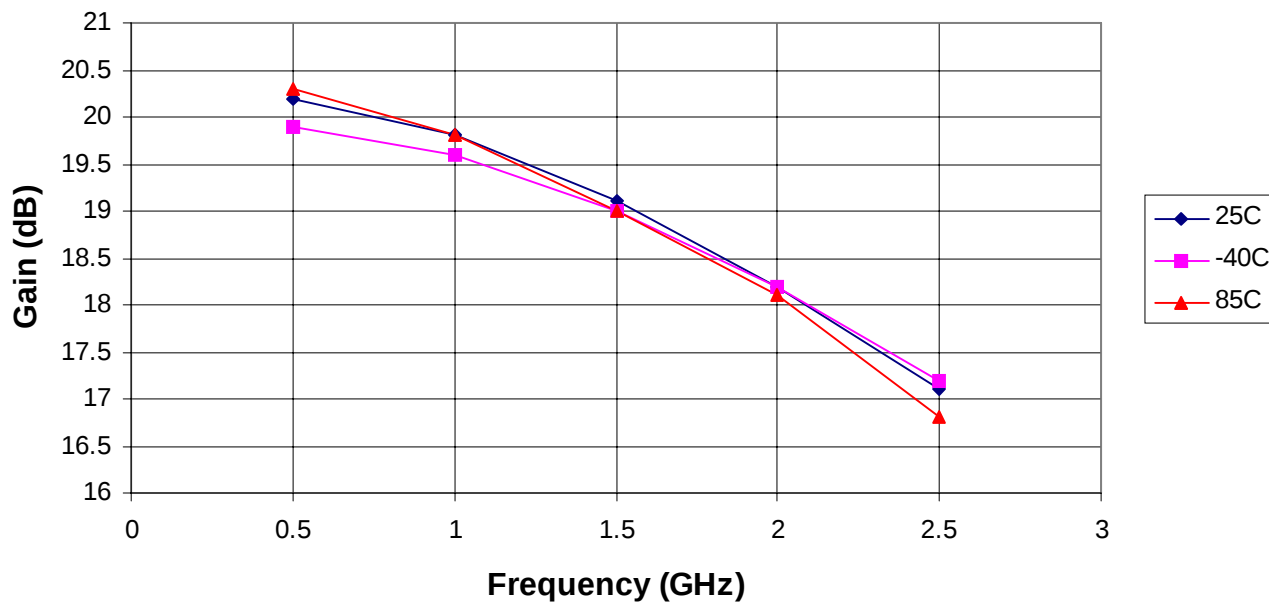


Figure 2

P1dB vs. Frequency
IC Tested on Eval Board

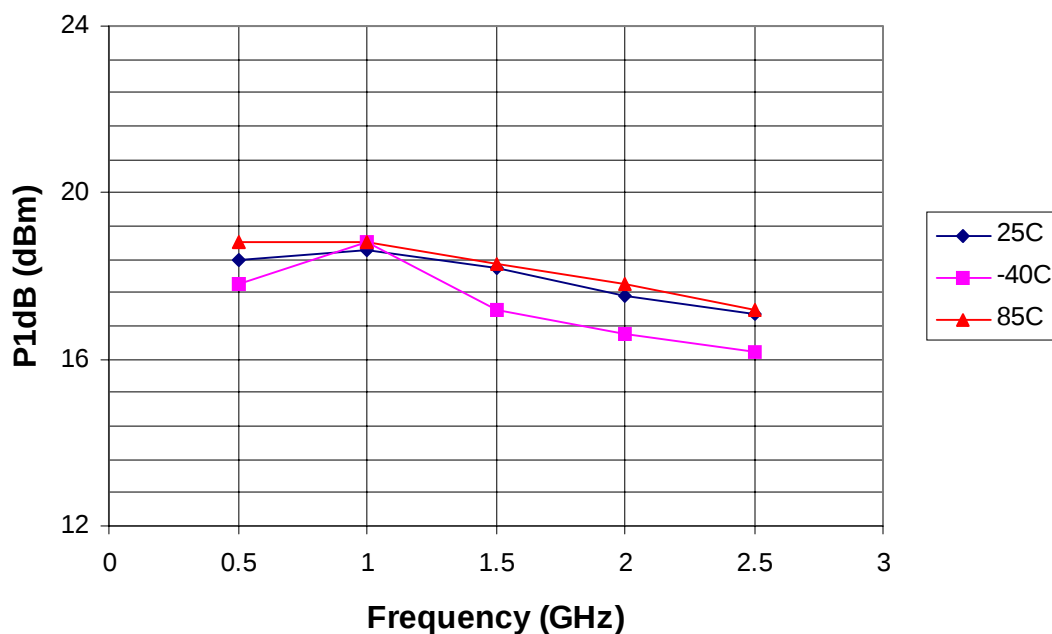


Figure 3

OIP3 vs. Frequency
IC Tested on Eval Board

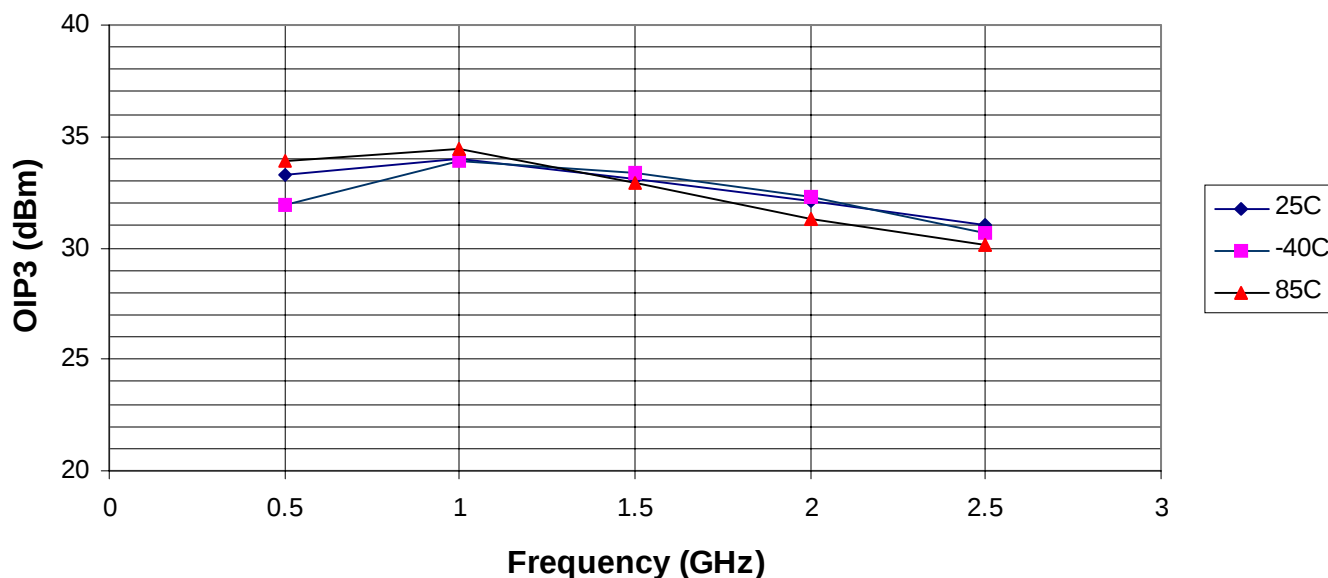


Figure 4

Icc vs Vde
IC Tested on Eval Board

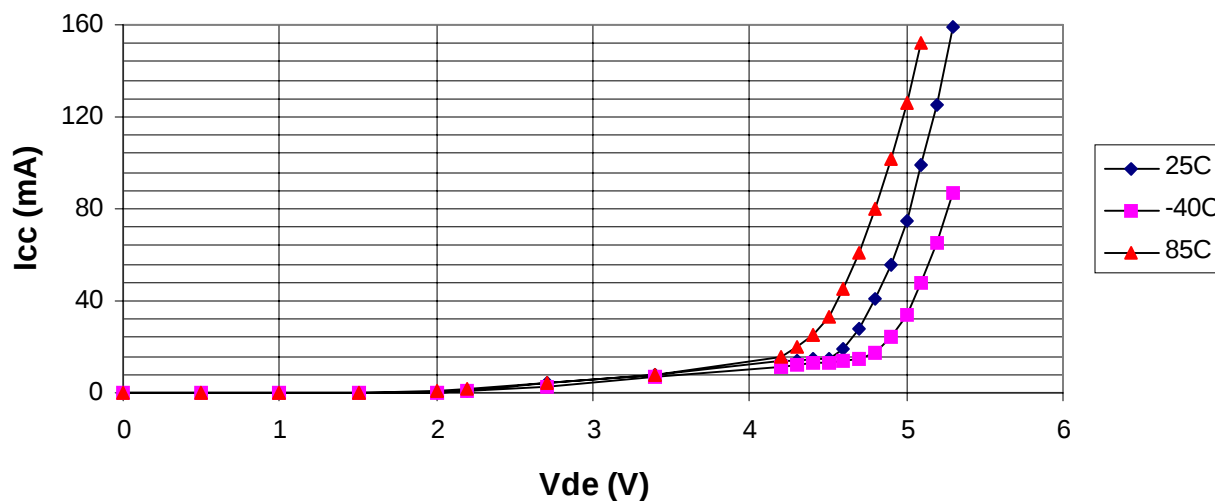
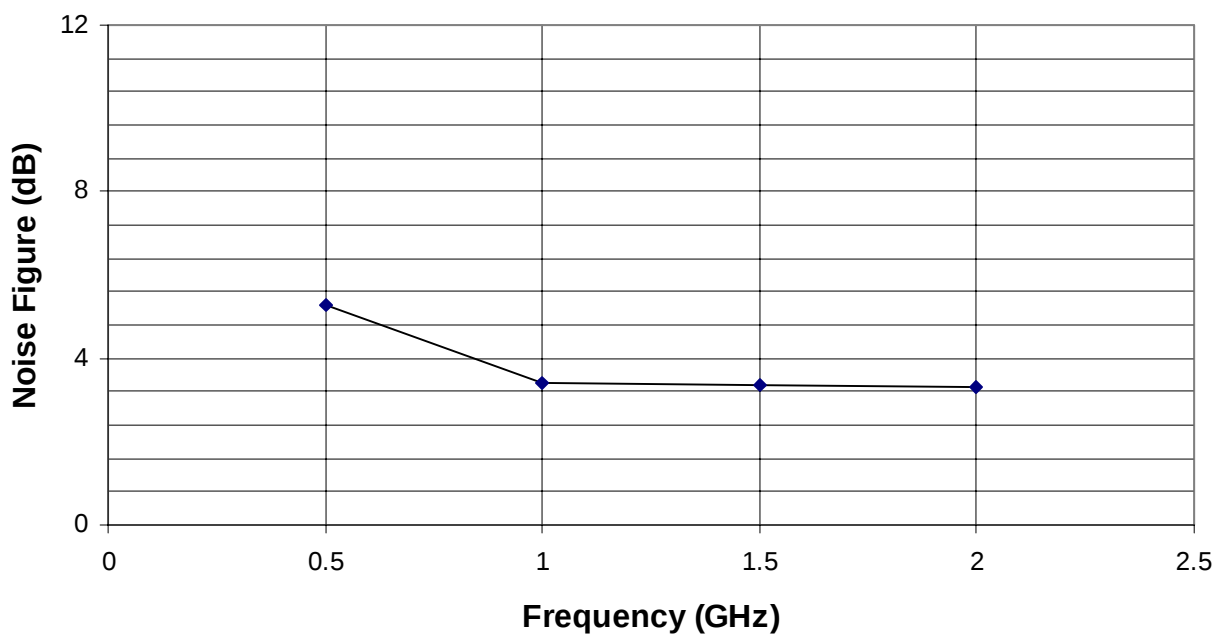


Figure 5

Noise Figure vs. Frequency, T=25°C



Typical S Parameters**V_{cc}=6v I_c=65mA**

FREQ GHz	MAG S11	ANG S11	MAG S21	ANG S21	MAG S12	ANG S12	MAG S22	ANG S22
0.0500	-19.111	0.061	21.002	178.054	-23.129	0.031	-15.801	-5.511
0.0950	-18.654	-0.952	21.244	176.705	-23.115	-0.196	-15.937	-8.457
0.2000	-18.419	-3.648	21.235	172.569	-23.113	0.687	-15.464	-14.155
0.3950	-18.635	-4.097	20.840	161.973	-23.134	1.124	-15.523	-25.247
0.6050	-18.504	-6.045	20.483	151.994	-23.068	1.263	-15.097	-29.382
0.8000	-18.016	-8.555	20.597	143.759	-23.087	2.323	-16.121	-43.140
1.0100	-18.011	-14.221	20.076	135.766	-23.104	3.127	-17.098	-53.749
1.2050	-18.398	-23.443	19.812	127.407	-23.034	3.548	-16.885	-68.961
1.4000	-19.224	-30.775	18.961	122.898	-22.934	4.261	-16.215	-84.974
1.5950	-20.207	-38.286	18.353	112.129	-22.982	4.781	-15.764	-90.698
1.8050	-21.207	-43.762	18.237	105.321	-22.866	5.821	-15.173	-94.762
2.0000	-22.185	-49.574	18.122	101.051	-22.743	6.110	-16.138	-103.190
2.1950	-24.077	-54.402	17.439	98.288	-22.650	7.685	-16.942	-109.706
2.4050	-27.393	-62.176	16.423	91.530	-22.498	8.035	-16.958	-124.459
2.6000	-31.788	-69.244	15.934	85.759	-22.318	8.489	-16.446	-136.462
2.7950	-38.749	-67.815	15.759	81.608	-22.267	7.460	-16.242	-145.372
3.0050	-44.749	41.012	15.879	81.894	-22.023	8.690	-15.450	-151.781
3.2000	-34.847	67.306	15.621	79.211	-21.789	9.545	-15.336	-159.780
3.3950	-30.204	66.403	15.795	73.786	-21.629	10.798	-15.066	-166.936
3.6050	-27.544	60.556	15.645	66.377	-21.494	10.048	-14.791	-176.285
3.8000	-26.018	52.383	15.638	61.034	-21.180	8.735	-14.281	175.540
3.9950	-24.856	44.125	15.451	57.412	-20.864	9.264	-13.492	167.994
4.2050	-24.065	35.036	15.219	53.938	-20.655	9.309	-12.629	163.270
4.4000	-23.619	25.695	15.041	50.251	-20.454	9.584	-12.026	160.708
4.5950	-24.034	11.736	15.293	43.681	-20.275	8.090	-11.684	156.213
4.8050	-25.160	-6.156	15.386	36.663	-20.032	7.766	-10.982	150.056
5.0000	-27.008	-30.304	15.353	29.374	-19.720	6.005	-10.413	145.580
5.1950	-27.925	-67.090	15.140	23.931	-19.417	4.898	-9.765	140.703
5.4050	-26.720	-108.841	14.736	16.528	-19.173	4.356	-9.027	138.092
5.6000	-24.469	-139.067	14.464	9.598	-19.062	3.827	-8.340	135.288
5.7950	-22.318	-160.435	14.375	4.633	-18.823	2.026	-7.979	133.229
6.0050	-18.936	-179.664	13.935	-0.397	-18.507	0.557	-7.390	128.323