EiC Corp.
Excellence in Communications

DATA SHEET

SCG002

HIGH LINEARITY BROADBAND AMPLIFIER

DC - 6000 MHz

Features

- DC to 6000 MHz
- 20 dB Gain at 1000 MHz
- 15 dBm Output P1dB at 1000 MHz
- 29 dBm Output IP3 at 1000 MHz
- 3.8 dB Noise Figure at 2000 MHz

Applications

- Broadband Gain Blocks
- High Linearity Amplifiers

Packages Available

(-B) SOT-89
(-BL) SOT-89 (Lead Free)

Description

The SCG002B 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 +29dBm at 1000MHz. The SCG002B 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 SOT-89 packages. The SCG002B is designed in the Darlington configuration with direct feed back. Its operation frequency at low end is limited only by the dc blocking capacitor and the RF choke inductor (large values are required in both cases).

Electrical Specifications

Test Conditions: Ic = 45 mA, Ta = 25°C

SYMBOL	PARAMETER		LIMITS			UNIT	TEST CONDITION
			MIN.	TYP.	MAX.		
F	Frequency		DC		6000	MHz	
G	Gain (Small Signal)	f = 1000MHz		20.0		dB	
		f = 2000MHz	19.0	20.0			
		f = 3000MHz		17.0			
		f = 6000MHz		13.0			
G	Gain (Large Signal)	f = 2000MHz		18.0		dB	Note 2
P_{1dB}	Output Power @ 1dB Compression	f = 1000MHz		15.5		dBm	
		f = 2000MHz		15.0			
		f = 3000MHz		15.0			
		f = 6000MHz		7.2			
OIP3	Output Third Order Intercept	f = 1000MHz		29.0		dBm	Note 1
		f = 2000MHz		29.0			
		f = 3000MHz		29.0			
RL_{in}	Input Return Loss, 50 Ohm	f = 2000MHz		14.0		dB	
RL_{out}	Output Return Loss, 50 Ohm	f = 2000MHz		20.0		dB	
NF	Noise Figure	f = 2000MHz		3.8		dB	
Vde	Device Voltage		3.5	3.9	4.3	V	

Note 1: OIP3 = Pout (by power meter, total 2-tone power) + (IM3(dB))/2) - 3dB

Note 2: Pin= -3dBm (Gain at 1dB compression)

CAUTION!
SENSITIVE ELECTRONIC DEVICE

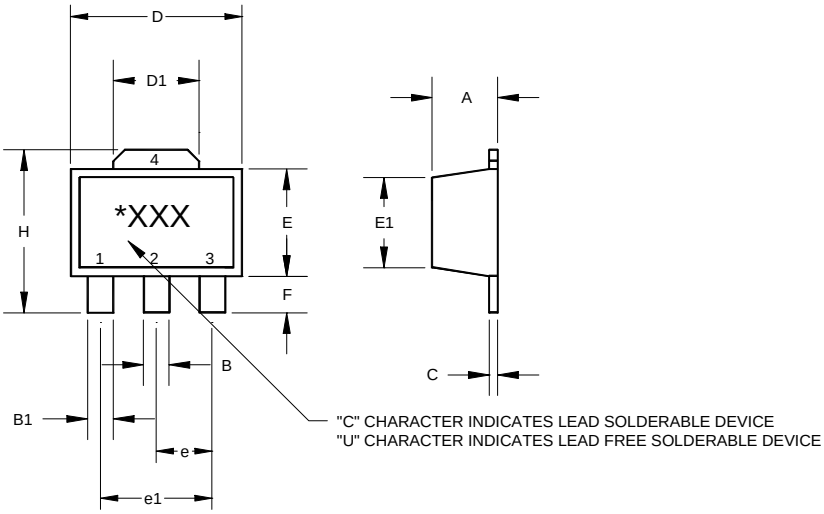
Absolute Maximum Ratings

Device Current	150	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.

SOT-89 Package Outline

(all units are in inches)



Symbol	Inches	
	MIN.	MAX.
A	.055	.063
B	.017	.022
B1	.014	.019
C	.014	.017
D	.173	.181
D1	.064	.072
E	.090	.102
E1	.084	.090
e	.059	
e1	.118	
F	.035	.047
H	.155	.167

Device Marking: SCG002
Second line:
C: Part number (contains Pb)
U: Part number (Pb Free pkg.)
XXX: Lot number

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 45mA 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.

Thermal Specifications

Thermal resistance, Rth SOT 89 pkg. 120°C/W ΔTj 23°C

The thermal resistance is referenced from the junction to bottom of the ground of the package.

Reliability and Burn-In Test

EiC performs burn-in for selected lots on a regular basis to monitor and guarantee consistent product quality and reliability. The burn-in process consists of pre-conditioning (JESD22-A113-B), pre and post RF tests, and bias life (JESD22-A108-A).

The table is based on the following parameters and conditions:
Activation Energy: 1.85eV
Junction to Ambient Temperature Difference: +23°C

Confidence levels of 60% and 90% are used to calculate FIT (Failure In Time), for the nominal operating ambient temperature at +25°C.

Test Temp	Hours Completed	Quantity Tested	Quantity Failed
+145°C	1000	80	0
+125°C	1000	20	0
Cumulative FIT @ 60% Confidence Level (Tj=65°C)			<1
Cumulative MTTF @ 60% Confidence Level (FIT <1)			2.49.E+11 Hours
Cumulative FIT @ 90% Confidence Level (Tj=65°C)			<1
Cumulative MTTF @ 90% Confidence Level (FIT <1)			9.88.E+10 Hours

EiC will update the burn-in and cumulative FIT results periodically. Please check the website at www.eiccorp.com

ESD / MSL Information

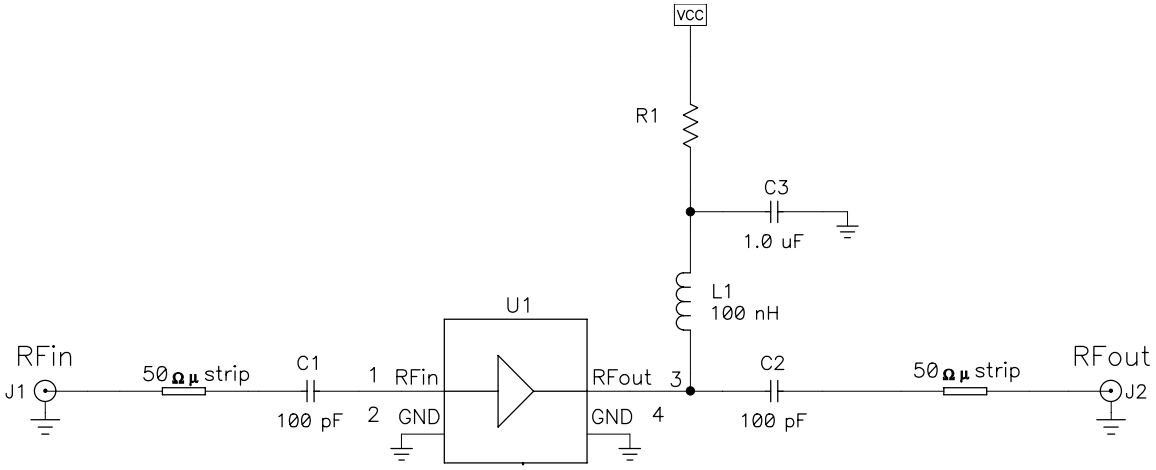
ESD Rating: Class 1B
Value: Passes > 500V
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

MSL Rating: Level III at 240°C convection reflow
Standard: JEDEC Standard J-STD-020A

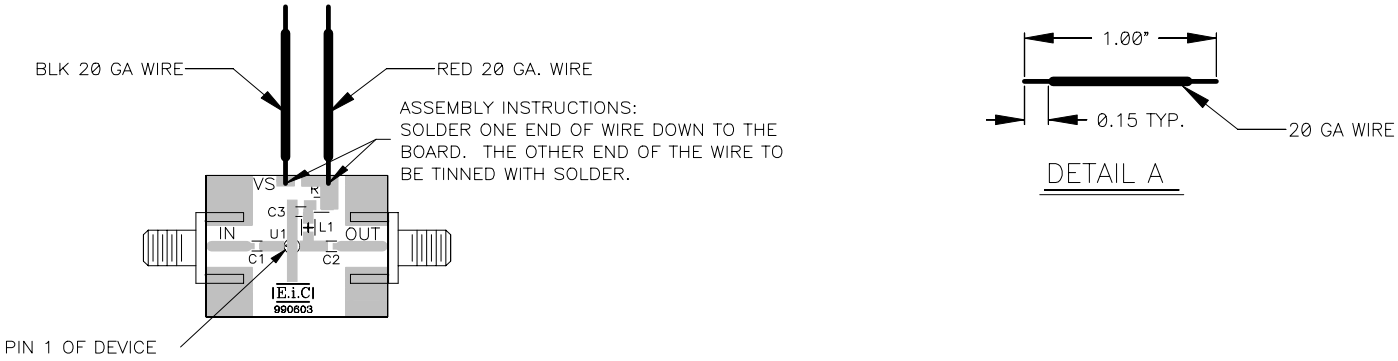
Evaluation Board Schematic
SOT-89, Micro-X

Recommended Bias Resistor Values
R = (Vcc-Vde)/Icc = (Vcc-3.9)/0.045

Approximate Supply Voltage (V_{cc}) based on standard values for R1	5	6	7	8	9	10
R1 (Ohms)	24	47	68	91	110	130



Evaluation Board Layout SOT-89 and Micro-X



Evaluation Board Materials

QTY	DESIGNATOR	VALUE	DESCRIPTION	MANUFACTURER &P/N	
2	C1, C2	100pF	CAPACITOR, 0603	MARUWA CE101J1NO	NOTE 1
1	C3	1.0uF	CAPACITOR, 0603	MARUWA CE105K1NR	NOTE 1
1	R1	47 Ω	RESISTOR, 0603	ROHM MCR03J470	NOTE 1
1	L1	100 nH	INDUCTOR, 0805	TOKO LL2012-FR10K	NOTE 1
2	J1, J2		SMA CONNECTOR	EF JOHNSON 142-0701-881	NOTE 1
1		---	IC, SCG002B, C	EiC Corp	
RED		---	20 GA, WIRE 1.0”	ANY	SEE DETAIL A
BLACK		---	20 GA, WIRE 1.0”	ANY	SEE DETAIL A
		---	PCB	EiC Corp 60-000009-003B	

1. EiC RECOMMENDED COMPONENTS ARE SHOWN. EQUIVALENT COMPONENTS MAY BE USED.
2. LARGER VALUES GIVE BETTER LOW FREQUENCY RESPONSE(<500MHz)
NOTES: UNLESS OTHERWISE SPECIFIED

Figure 1

Vde vs. Icc

(IC Tested on Eval Board)

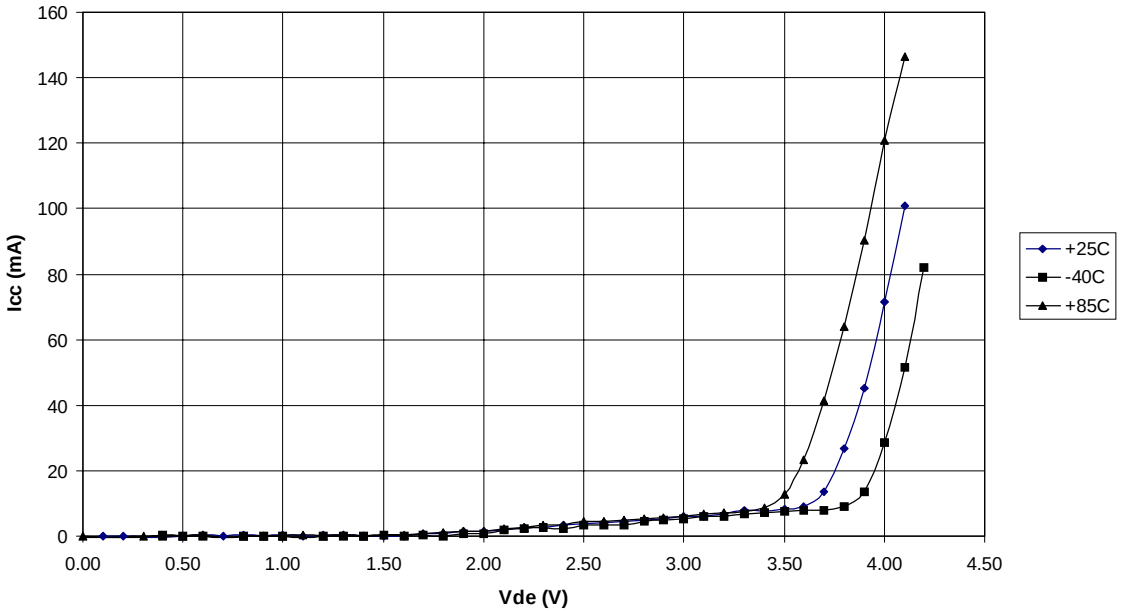


Figure 2

P1dB vs. Frequency

(IC Tested on Eval Board)

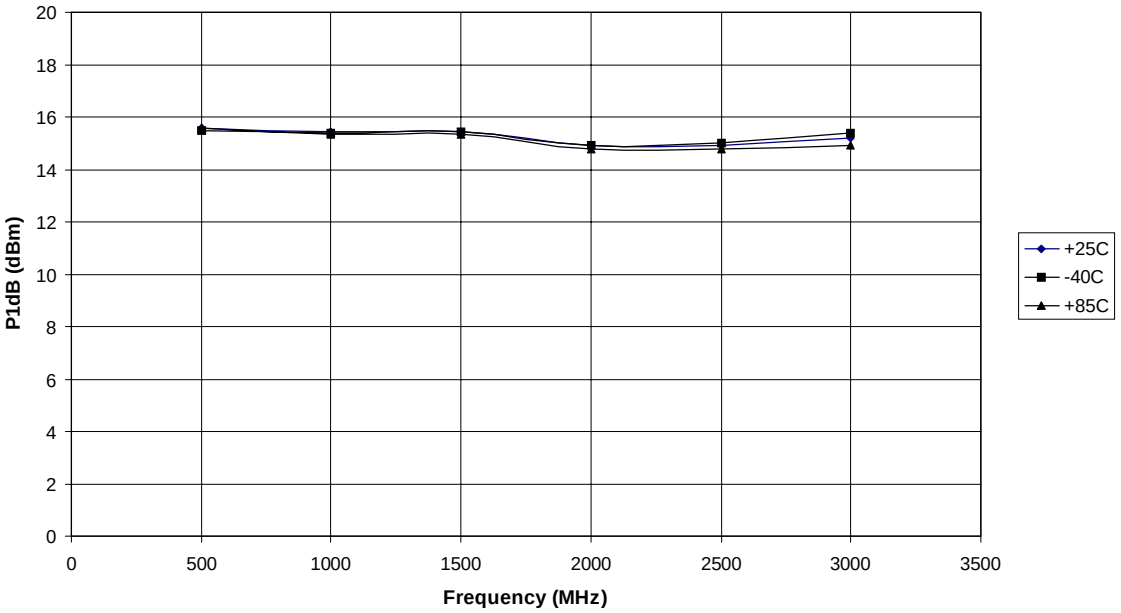


Figure 3

Gain vs. Frequency
(IC Tested on Eval Board)

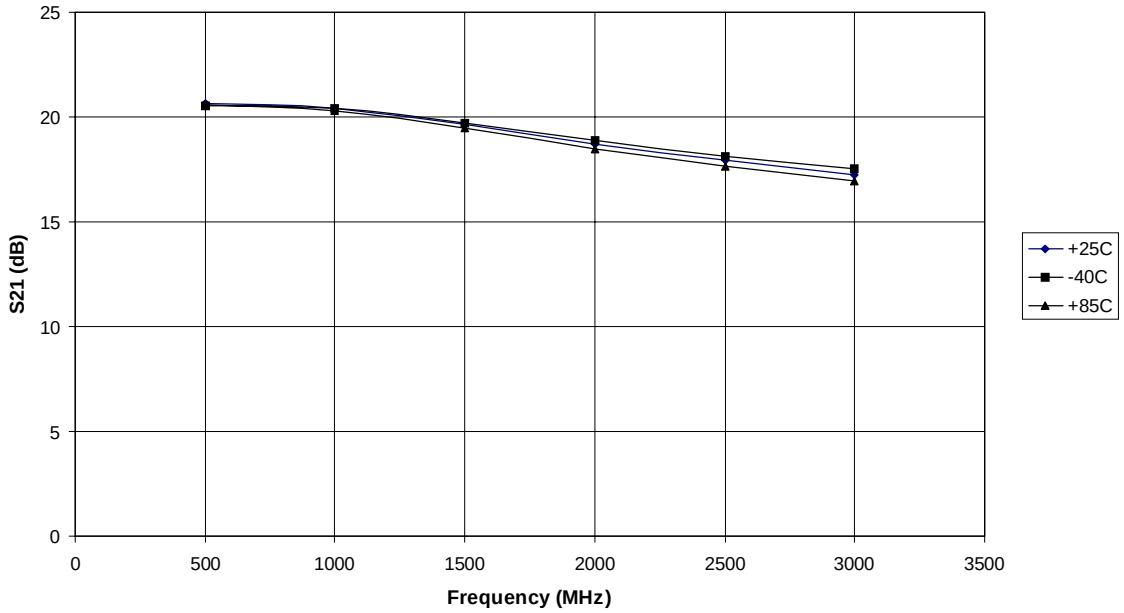


Figure 4

Gain vs. Frequency, T=25 degree C
(IC Tested in a 50 Ohm Fixture)

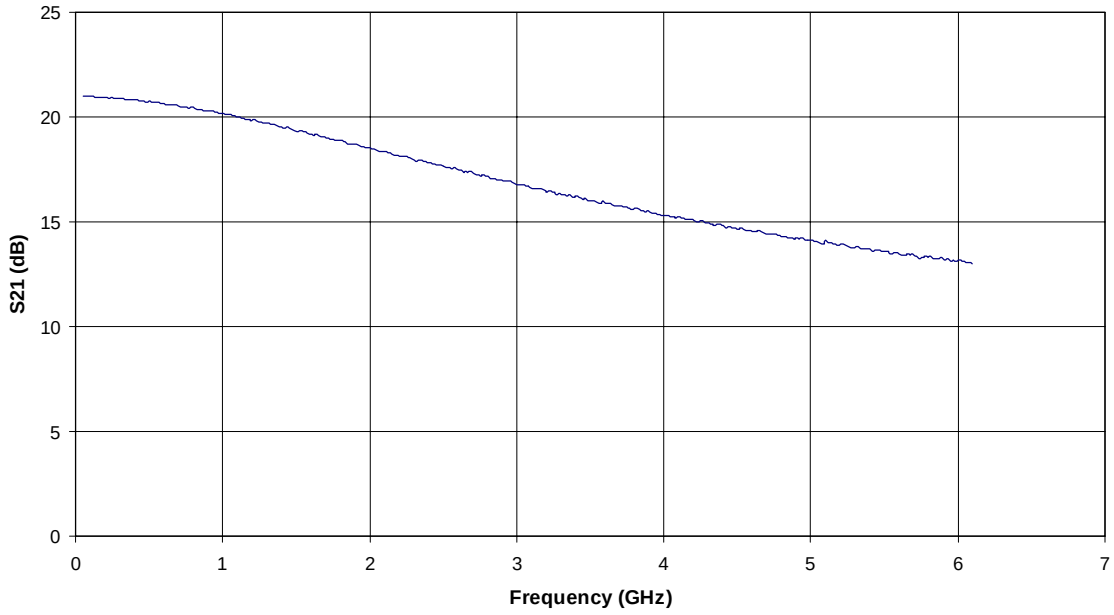


Figure 5

S11, S22 vs. Frequency, T=25 degree C

(IC Tested in a 50 Ohm Fixture)

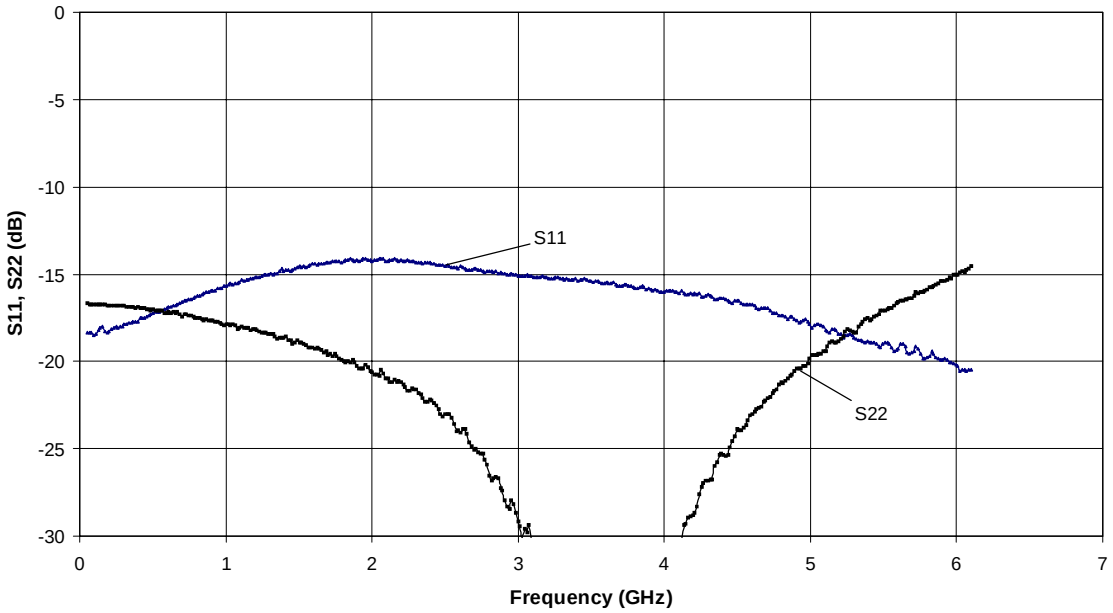


Figure 6

Reverse Isolation vs. Frequency, T=25 degree C

(IC Tested in a 50 Ohm Fixture)

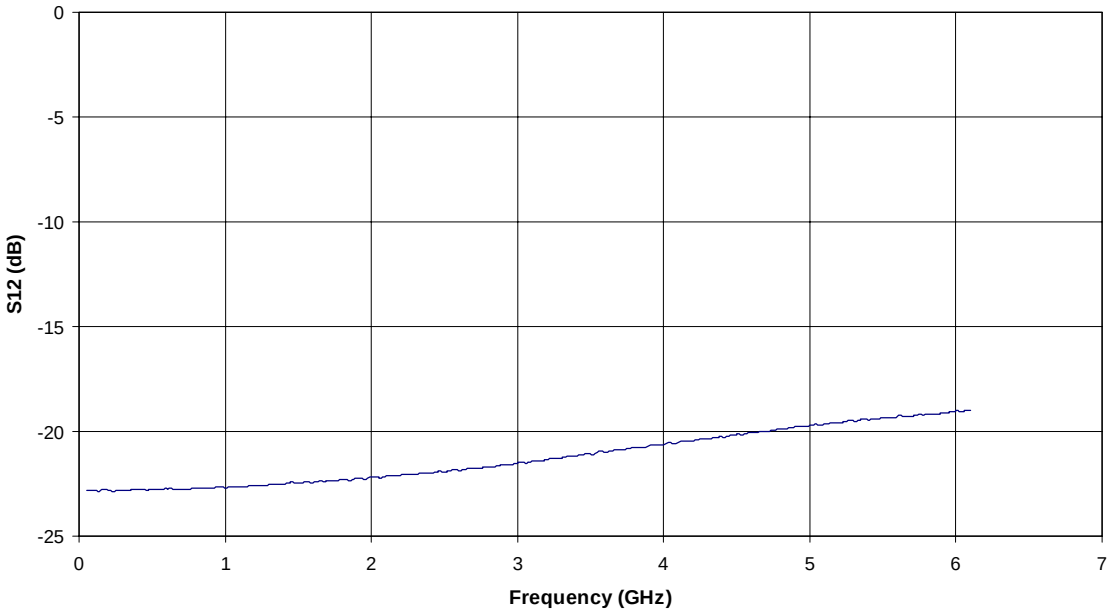


Figure 7

OIP3 vs. Frequency
(IC Tested on Eval Board)

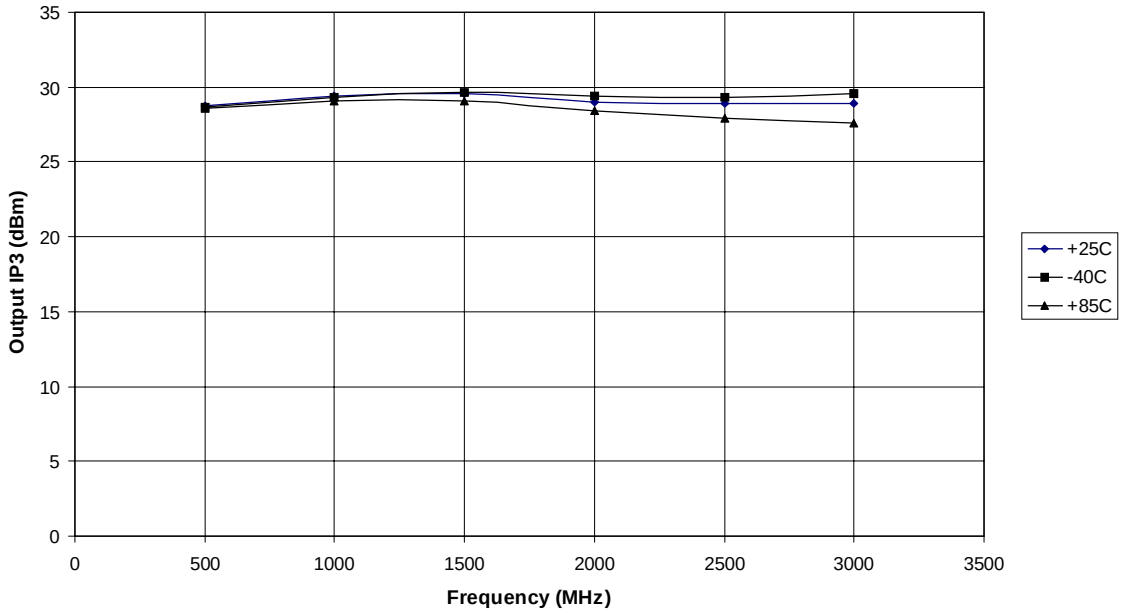
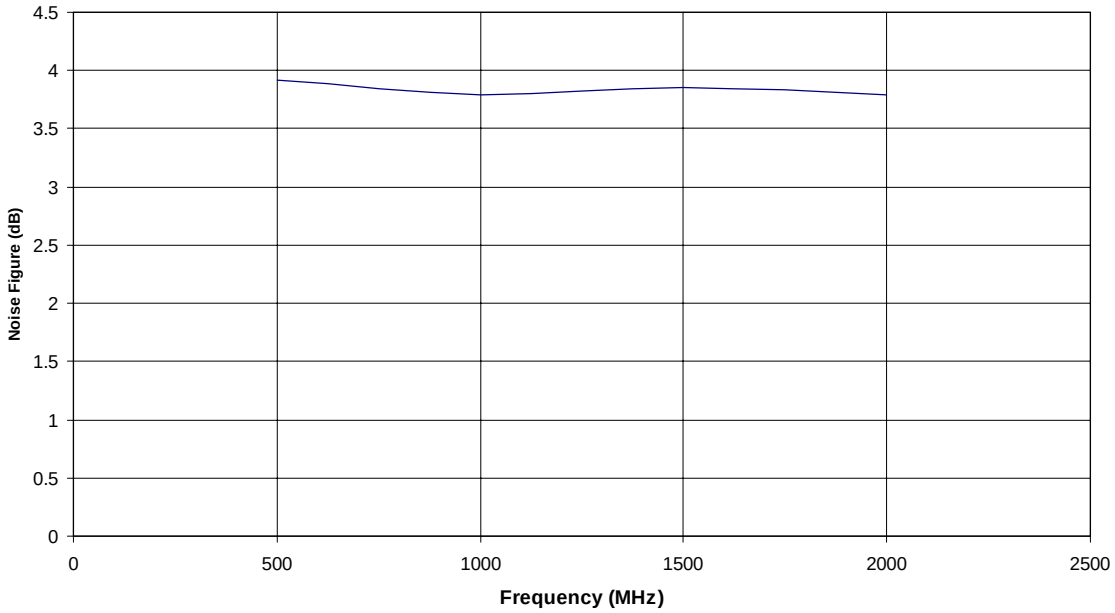


Figure 8

Noise Figure vs. Frequency
(IC Tested on Eval Board)



Typical performance from DC to 6GHz. Both gain and power can be improved by the choice of the bias inductor and the DC blocking capacitors for a particular frequency range.

		500MHz	1000MHz	1500MHz	2000MHz	2500MHz	3000MHz	4000MHz	5000MHz	6000MHz
SCG002	SSg	20.6	20.0	20.0	20.0	17.9	17.0	15.3	14.1	13
	P1dB	15.6	15.5	15.5	15.0	14.9	15.0	13.9	11.4	7.2

APPLICATION NOTES

Please visit our website at www.eiccorp.com to view or download the following documents.
You may also call our Customer Service to request a hardcopy.

Document #	Description
AP-000192-000	Discussion of Technology and Reliability Enhancements
AP-000194-000	Biasing and Performance Enhancements
AP-000487-000	Tape and Reel Specifications and Package Drawings
AP-000515-000	Voltage Spike Suppression
AP-000516-000	Application Note Index

ORDERING INFORMATION

	PKG. TYPE	REEL QTY.
SCG002B	SOT89	BULK
SCG002B-500	SOT89	500
SCG002B-1000	SOT89	1000
SCG002BL	SOT89	BULK (Lead free)
SCG002BL-500	SOT89	500 (Lead free)
SCG002BL-1000	SOT89	1000 (Lead free)