EiC Corp.
Excellence in Communications

PRODUCTION DATA SHEET

EC-1078

HIGH LINEARITY BROADBAND AMPLIFIER

DC - 6 GHz

Features

- DC to 6 GHz
- 19.5 dB Gain at 1000 MHz
- 21 dBm Output P1dB at 1000 MHz
- 37 dBm Output IP3 at 1000 MHz
- 4.4 dB Noise Figure at 2000 MHz

Applications

- ISM Band, 900 MHz to 2.4 GHz
- Broadband Gain Blocks
- High Linearity Amplifiers
- Cellular, PCS Base Stations

Packages Available

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

Description

The EC-1078 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 +37dBm at 1000MHz. The EC-1078 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 low cost, surface-mountable plastic SOT-89 and Micro-X packages.

Electrical Specifications

Test Conditions: Ic = 96mA, Ta = 25°C

SYMBOL	PARAMETER		LIMITS			UNIT	TEST CONDITION
			MIN.	TYP.	MAX.		
F	Frequency		DC		6000	MHz	
G	Gain	f = 1000 MHz f = 2000 MHz f = 3000 MHz		19.5 17.0 14.5		dB	
P_{1dB}	Output Power @ 1 dB Compression	f = 1000 MHz f = 2000 MHz f = 3000 MHz	 14.7 13.0	18.5 16.0 14.0		dBm	
P_{sat}	Saturated Output Power	f = 1000 MHz f = 2000 MHz f = 3000 MHz		22.5 22.5 20.5		dBm	
OIP3	Output Third Order Intercept	f = 1000 MHz f = 2000 MHz f = 3000 MHz		37 33 31		dBm	NOTE 1
$VSWR_{IN}$	Input Return Loss, 50 Ohm	f = 2000 MHz		12.0		dB	
$VSWR_{OUT}$	Output Return Loss, 50 Ohm	f = 2000 MHz		8.0		dB	
NF	Noise Figure	f = 2000 MHz		4.4		dB	
Icc	Bias Current			96.0		mA	
Vde	Device Voltage		5.3	5.6	5.9	Volts	
NOTE 1: OIP3 = Pout (by power meter, total 2-tone power) + (IM3 (dB)) / 2 - 3 dB							

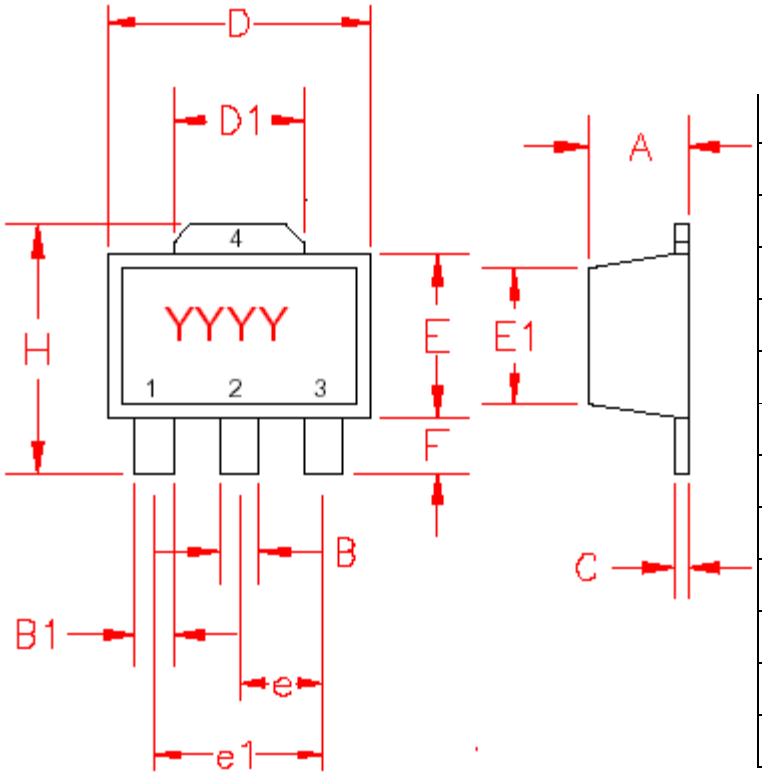
CAUTION!
SENSITIVE ELECTRONIC DEVICE

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.

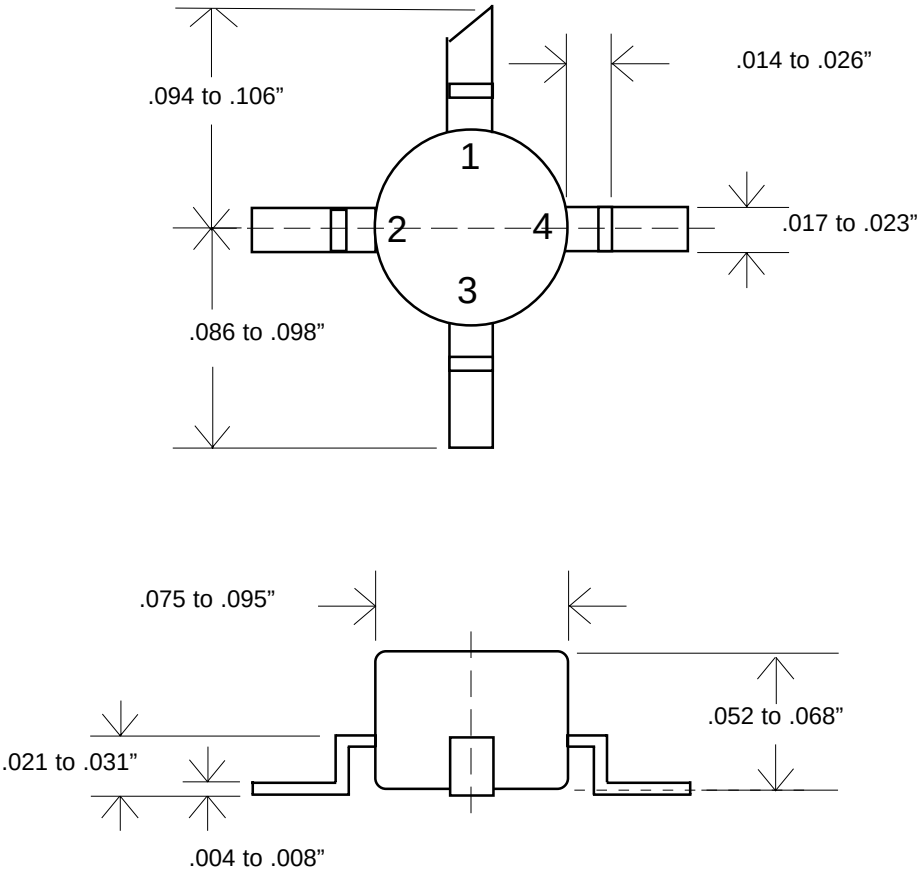
SOT-89 Package Outline



Symbol	Inches MIN.	Inches 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

Pin #	Pin	Definition
1	RF in	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	RF out	This pin has a nominal 50 ohm output impedance. It requires a DC bias of 96mA 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.

Micro-X Package Outline



Pin Definitions

Pin #	Pin	Definition
1	RF in	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	RF out	This pin has a nominal 50 ohm output impedance. It requires a DC bias of 96mA 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.

Typical S-Parameters: Vde = 5.8V, Icc = 96mA, Temperature = 25°C

Frequency (MHz)	S11 (Mag)	S11 (Ang)	S21 (Mag)	S21 (Ang)	S12 (Mag)	S12 (Ang)	S22 (Mag)	S22 (Ang)
100	0.3017	-6.493	11.3476	173.827	0.0613	0.903	0.3514	-9.12
250	0.3018	-16.131	11.1882	164.706	0.0620	3.996	0.3510	-22.388
500	0.2954	-32.112	10.7848	149.716	0.0657	7.055	0.3512	-44.341
1000	0.2779	-62.817	9.7589	122.603	0.0757	9.239	0.3562	-83.509
1500	0.2591	-92.099	8.5624	97.999	0.0879	6.603	0.3655	-117.157
2000	0.2516	-120.954	7.5458	75.506	0.1009	1.289	0.3835	-147.067
2500	0.2487	-147.911	6.6131	54.74	0.1116	-5.864	0.4010	-172.478
3000	0.2508	-173.882	5.8311	35.757	0.1219	-13.967	0.4243	164.255
3500	0.2647	158.404	5.1811	16.632	0.1313	-23.67	0.4529	141.964
4000	0.2896	131.904	4.6415	-1.454	0.1384	-33.847	0.4891	121.386
4500	0.3329	105.992	4.1183	-19.694	0.1435	-44.845	0.5299	101.879
5000	0.3928	82.314	3.6389	-37.586	0.1452	-56.707	0.5776	82.996
5500	0.4626	62.485	3.1701	-55.211	0.1433	-68.752	0.6206	65.913
6000	0.5302	45.585	2.7487	-71.258	0.1387	-80.22	0.6581	50.361

Please follow the link on website page “http://eiccorp.com/products/gain.htm” for detailed s-parameter to 6.1 GHz.

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 pre-condition (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: 65°C

Confidence levels of 60% and 90% are used to calculate FIT (Failure In Time), for the nominal operating ambient temperature at +40°C.

Test Temp	Hours Completed	Quantity Tested	Quantity Failed
+145°C	1000	80	1
+145°C	1000	80	0
+125°C	1000	20	0
+125°C	1000	20	0
Cumulative FIT @ 60% Confidence Level			22
Cumulative MTTF @ 60% Confidence Level (FIT 22)			4.50E+07 Hours
Cumulative FIT @ 90% Confidence Level			43
Cumulative MTTF @ 90% Confidence Level (FIT 43)			2.34E+07 Hours

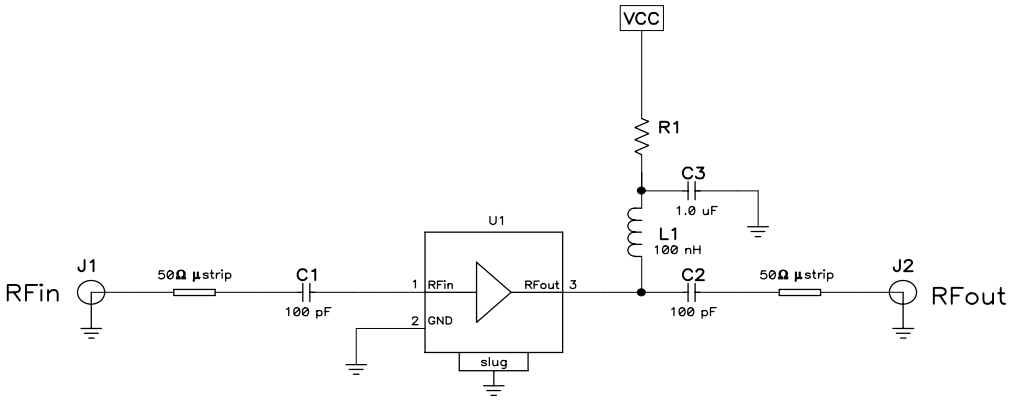
EiC will update the burn-in and cumulative FIT results periodically. Please check the website at www.eiccorp.com

Evaluation Board Schematic

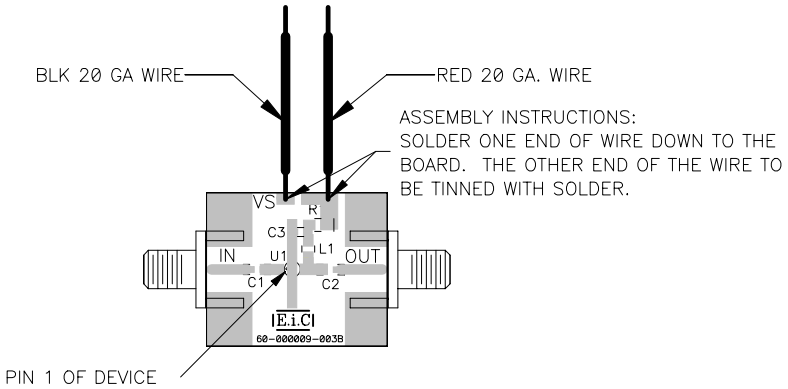
Recommended Bias Resistor Values

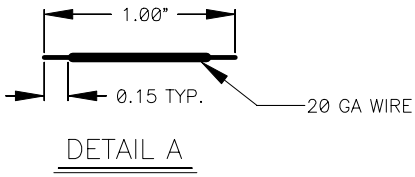
R = (Vcc-Vde)/Icc = (Vcc-5.8)/0.096

Supply Voltage (V)	7	8	9	10	11	12
R1 (ohms)	13	23	33	44	54	65



Evaluation Board Layout





Evaluation Board Materials

MANUFACTURER	PART NUMBER	QTY.	DESCRIPTION	VALUE	DESIGNATORS
MARU	CE101J1NO	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	EC-1078	1	Amplifier	-	U1
---	60-000009-003B	1	Printed Circuit Board	-	---

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

Figure 1

Icc vs. Vde

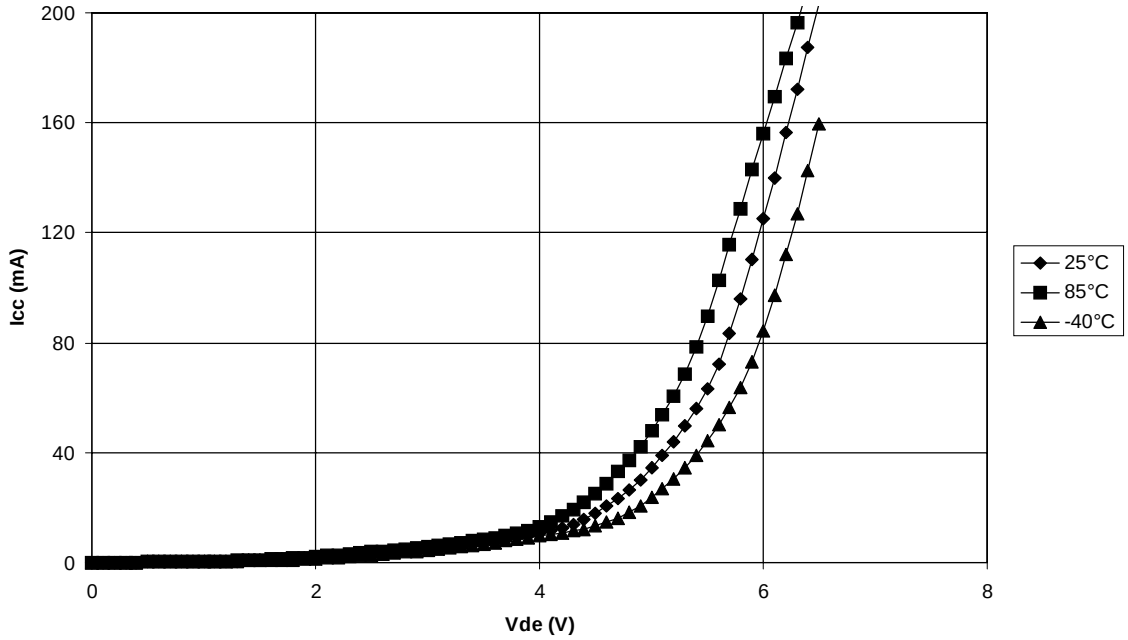


Figure 2

P1dB vs. Frequency

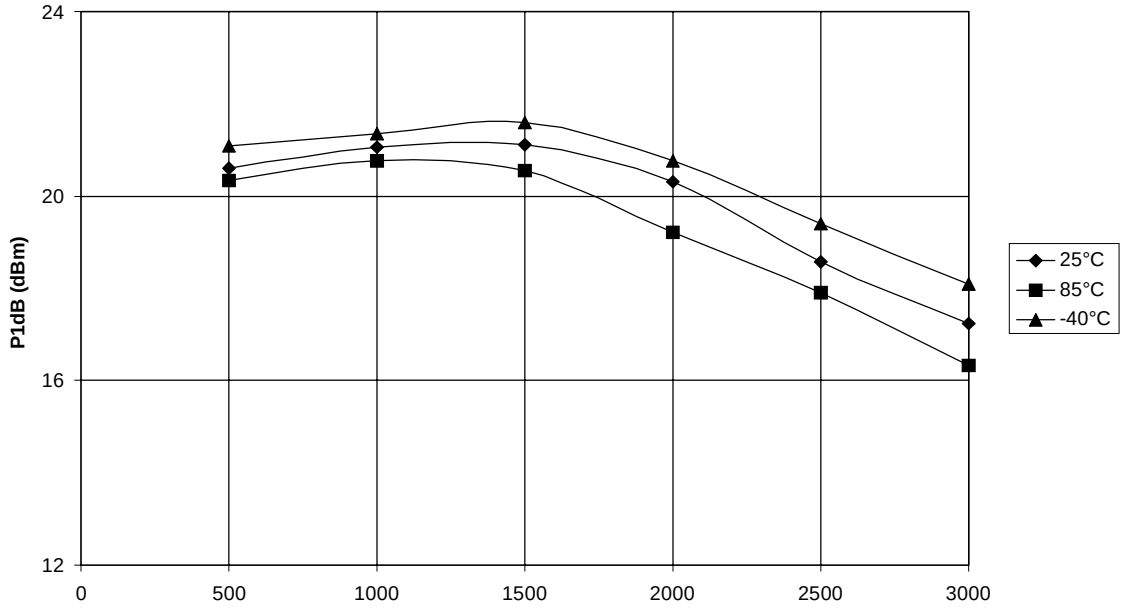


Figure 3

Gain vs. Frequency, T=25°C

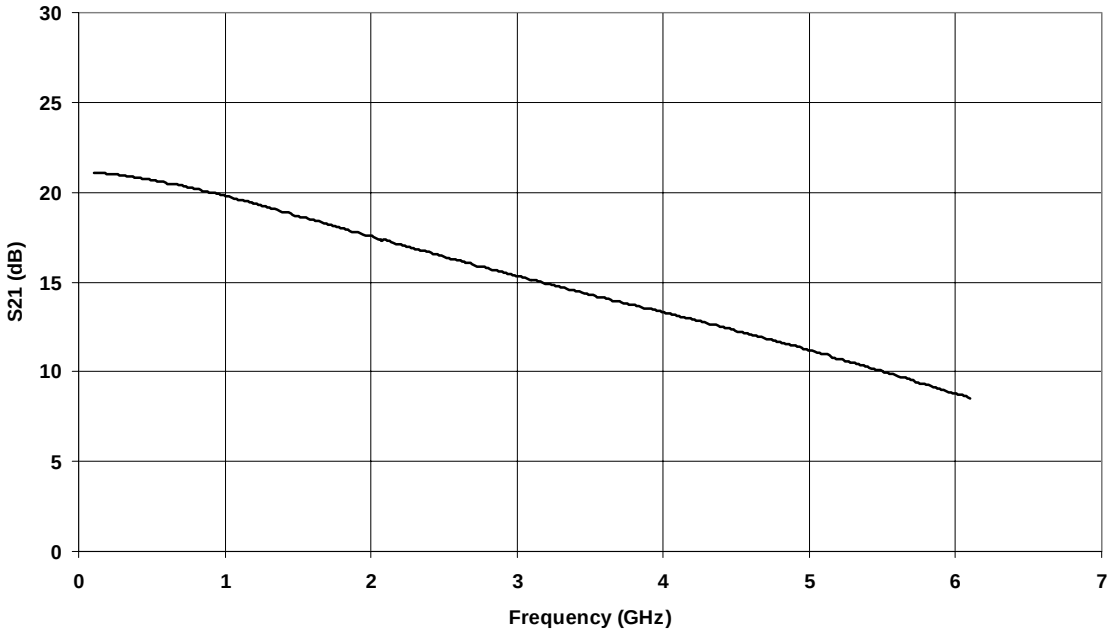


Figure 4

S11, S22 vs. Frequency, T=25°C

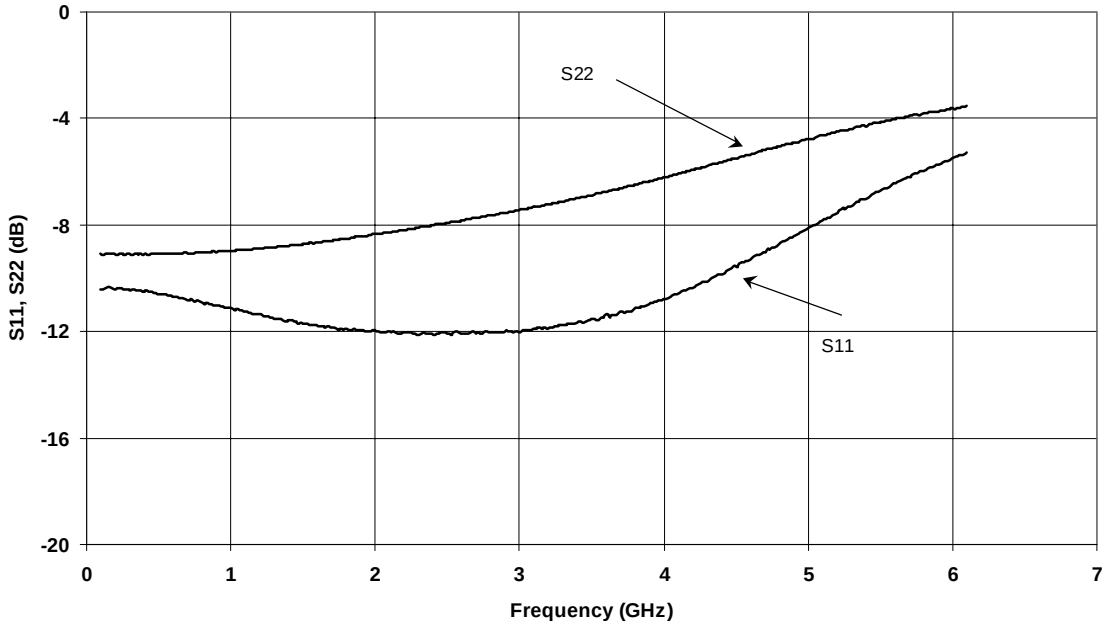


Figure 5

Reverse Isolation vs. Frequency, T=25°C

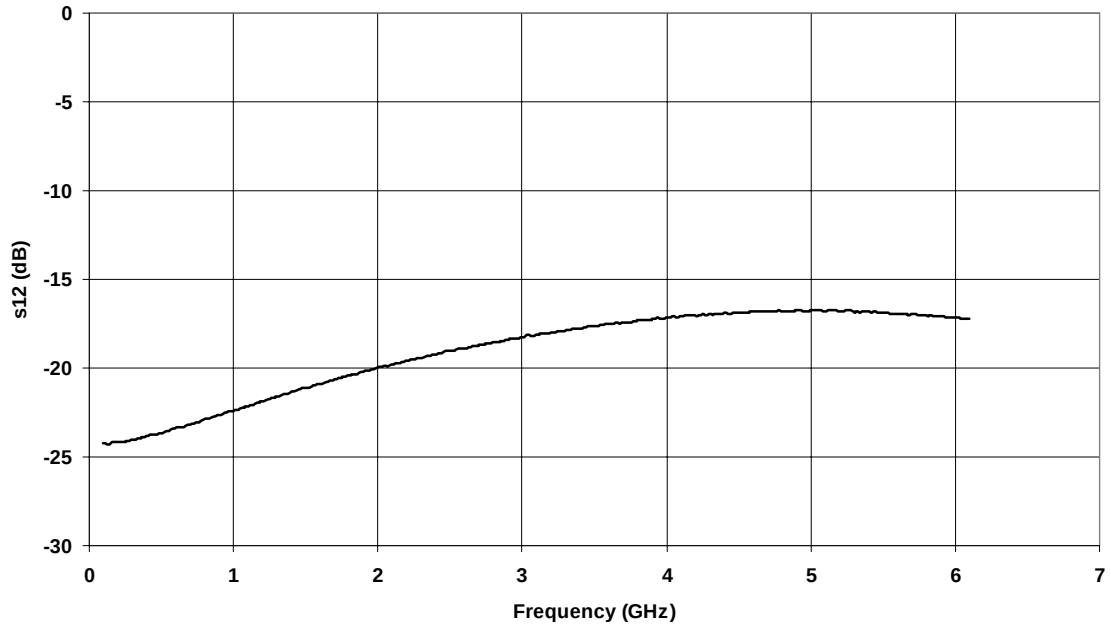


Figure 6

S11, S22 vs. Frequency, T=25°C

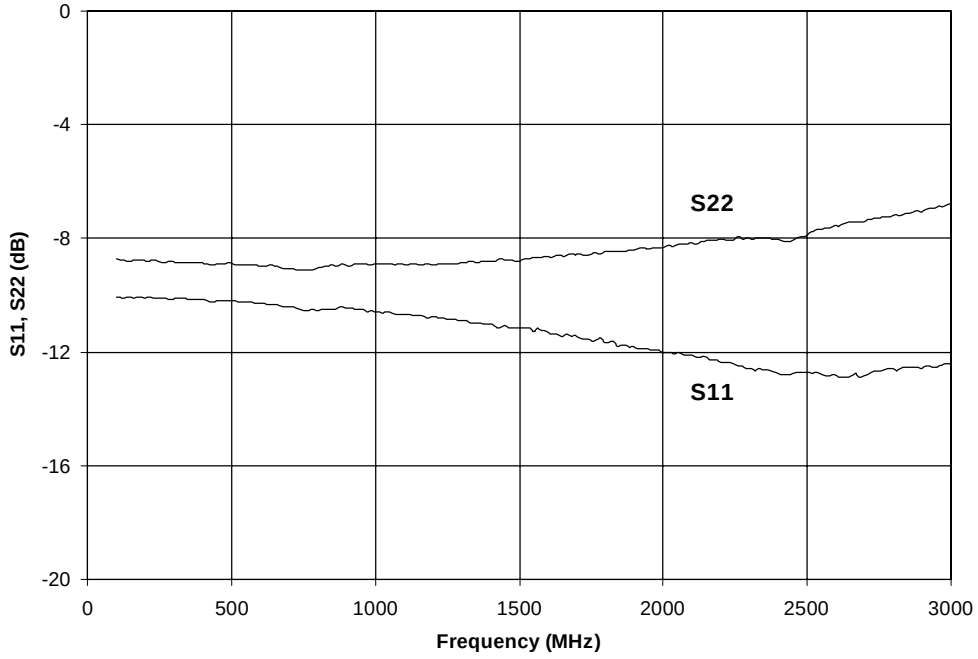
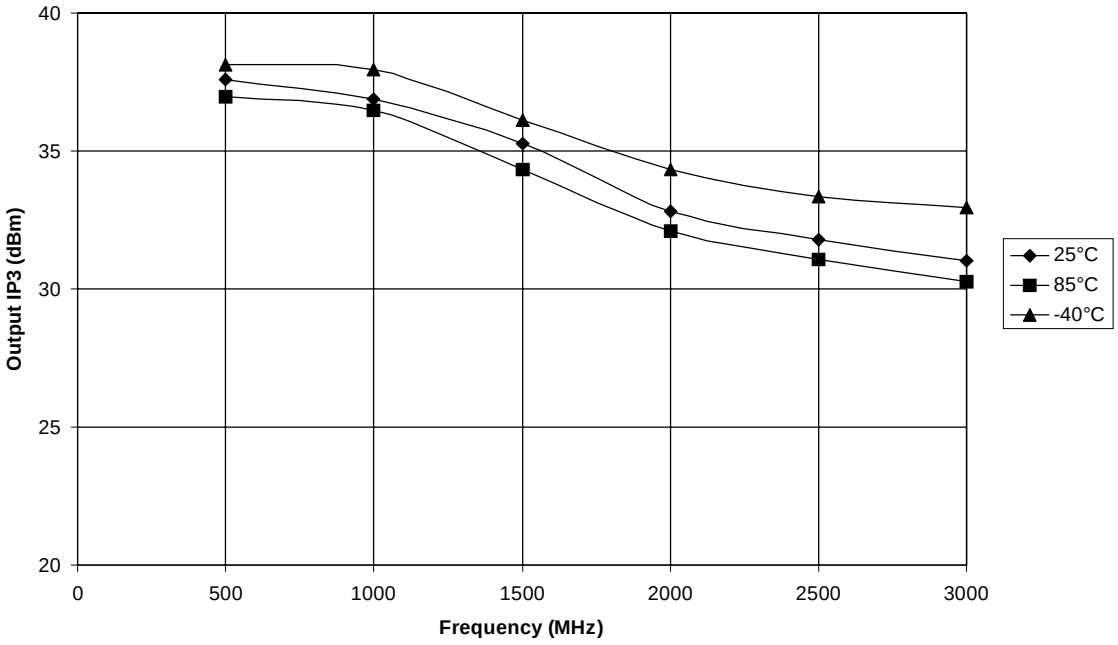


Figure 7

OIP3 vs. Frequency



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