

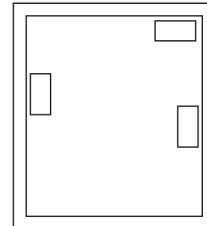
# *Ultra Linear Low Noise* **Monolithic Amplifier Die**

**PGA-103-D+**

**50Ω    0.05 to 4 GHz**

## **The Big Deal**

- Ultra High IP3
- Broadband High Dynamic Range



## **Product Overview**

PGA-103-D+ (RoHS compliant) is an advanced wideband amplifier die fabricated using E-PHEMT technology and offers extremely high dynamic range over a broad frequency range and with low noise figure. In addition, the PGA-103-D+ has good input and output return loss over a broad frequency range without the need for external matching components and has demonstrated excellent reliability.

## **Key Features**

Feature	Advantages
Broad Band: 0.05 to 4.0 GHz	Broadband covering primary wireless communications bands: Cellular, PCS, LTE, WiMAX
Ultra High IP3 Versus DC power Consumption: 42 dBm typical at 2 GHz at +5.0V Supply Voltage and only 97mA	The PGA-103-D+ provides excellent IP3 performance relative to device size and power consumption. The combination of the design and E-PHEMT Structure provides enhanced linearity over a broad frequency range as evidence in the IP3 being typically 20 dB above the P 1dB point. This feature makes this amplifier ideal for use in: <ul style="list-style-type: none"><li>• Driver amplifiers for complex waveform up converter paths</li><li>• Drivers in linearized transmit systems</li><li>• Secondary amplifiers in ultra High Dynamic range receivers</li></ul>
Low Noise Figure: 0.6 dB up to 1.0 GHz	A unique feature of the PGA-103-D+ which separates this design from all competitors is the low noise figure performance in combination with the high dynamic range.

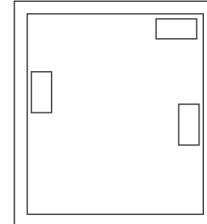
# *Ultra Linear Low Noise* **Monolithic Amplifier Die**

**PGA-103-D+**

**50Ω    0.05 to 4 GHz**

## **Product Features**

- 5V/3V operation
- High IP3, 42 dBm typ. at 2 GHz, Vd=5V
- Low Noise Figure, 0.6 at 1 GHz; 0.8 dB at 2 GHz
- Gain, 11.3 dB typ. at 2 GHz
- P1dB 22.3 dBm typ. at 2 GHz at Vd=5V
- Protected under US Patent 8,803,612



### **+RoHS Compliant**

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

## **Typical Applications**

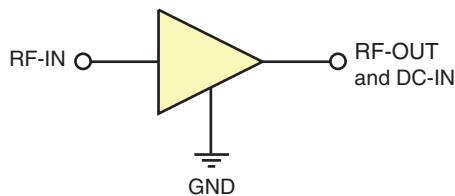
- Base station infrastructure
- Portable Wireless
- CATV & DBS
- MMDS & Wireless LAN
- LTE

*Ordering Information: Refer to Last Page*

## **General Description**

PGA-103-D+ (RoHS compliant) is an advanced wideband amplifier fabricated using E-PHEMT technology and offers extremely high dynamic range over a broad frequency range and with low noise figure. In addition, the PGA-103-D+ has good input and output return loss over a broad frequency range without the need for external matching components.

### **Simplified Schematic and Pad description**



<b>Pad</b>	<b>Description</b>
RF IN	RF input pad. This pad requires the use of an external DC blocking capacitor chosen for the frequency of operation.
RF-OUT and DC-IN	RF output and bias pad. DC voltage is present on this pad; therefore a DC blocking capacitor is necessary for proper operation. An RF choke is needed to feed DC bias without loss of RF signal due to the bias connection, as shown in "Recommended Application Circuit", Fig. 2
GND	Connections to ground.

Note: 1. Bond Pad material - Gold  
2. Bottom of Die - Gold plated

**Electrical Specifications<sup>1</sup> at 25°C, 50Ω unless noted**

Parameter	Condition (GHz)	Vd=5.0V			Vd=3V Typ.	Units
		Min.	Typ.	Max.		
Frequency range		0.05		4.0	0.05-4.0	GHz
Gain	0.05		26.7		26.1	
	0.4		22.3		21.8	
	1.0		16.5		16.1	
	2.0		11.3		10.8	
	3.0		8.1		7.7	
	4.0		6.1		5.6	
Noise figure	0.05		0.4		0.3	
	0.4		0.7		0.7	
	1.0		0.6		0.6	
	2.0		0.8		0.8	
	3.0		1.4		1.4	
	4.0		1.6		1.5	
Input return loss	0.05		6.8		6.1	
	0.8		11.5		10.4	
	2.0		14.0		12.8	
	3.0		14.5		13.1	
	4.0		12.1		11.2	
	6.0		11.5		10.7	
Output return loss	0.05		13.8		13.4	
	0.8		20.0		21.9	
	2.0		16.8		20.7	
	3.0		16.0		20.1	
	4.0		19.1		22.5	
	6.0		18.6		19.7	
Reverse isolation	2.0		21.4			dB
Output power @ 1dB compression <sup>2</sup>	0.05		19.1		14.8	dBm
	0.8		21.1		17.9	
	2.0		21.5		18.8	
	3.0		22.3		19.5	
	4.0		22.2		19.9	
	6.0		22.8		20.5	
Output IP3	0.05		35.8		31.1	dBm
	0.8		38.0		32.6	
	2.0		40.3		33.4	
	3.0		41.6		34.2	
	4.0		42.2		33.1	
	6.0		42.8		32.4	
Device operating voltage			5.0		3.0	V
Device operating current		72	97	120	60	mA
Device current variation vs voltage				0.035	0.018	mA/mV
Thermal resistance, junction-to-ground lead				32	32	°C/W

1. Measured on Mini-Circuits Die Characterization test board. See Characterization Test Circuit (Fig. 1)

2. Current increases at P1dB

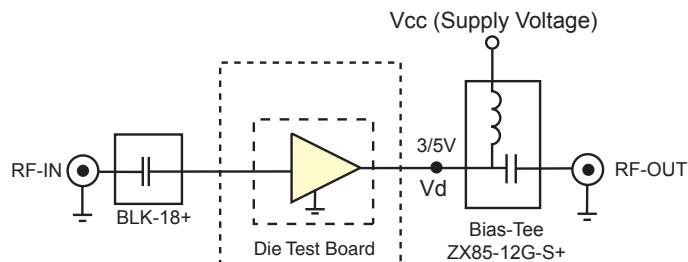
**Absolute Maximum Ratings<sup>3</sup>**

Parameter	Ratings
Operating Temperature (ground lead)	-40°C to 85°C
Operating Current at 5.0V	200 mA
Power Dissipation at 5.0V	1W
Input Power (CW)	+21 dBm (50 to 2000 MHz) +26 dBm (2000 to 4000 MHz)
DC Voltage on RF-OUT & DC-IN	6V

3. Permanent damage may occur if any of these limits are exceeded.

Electrical maximum ratings are not intended for continuous normal operation.  
Measured in industry standard SOT-89 package.

## Characterization Test Circuit

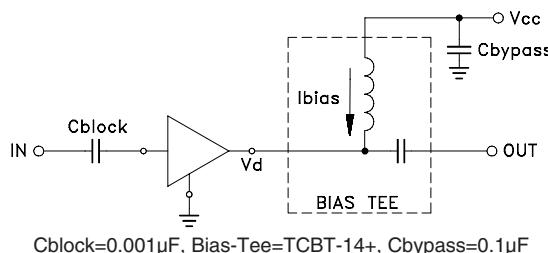


**Fig 1.** Block Diagram of Test Circuit used for characterization. Gain, Return loss, Output power at 1dB compression (P1 dB) , output IP3 (OIP3) and noise figure measured using Agilent's N5242A PNA-X microwave network analyzer.

### Conditions:

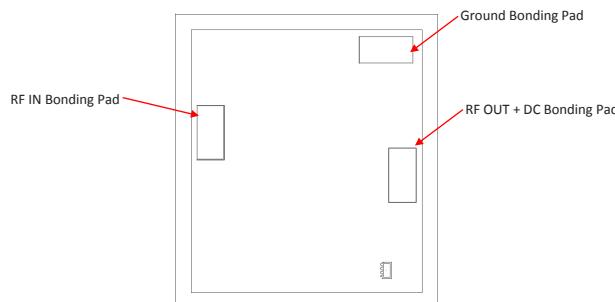
1. Gain and Return loss: Pad= -25dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 5 dBm/tone at output.

## Recommended Application Circuit



**Fig 2a.** Simplified

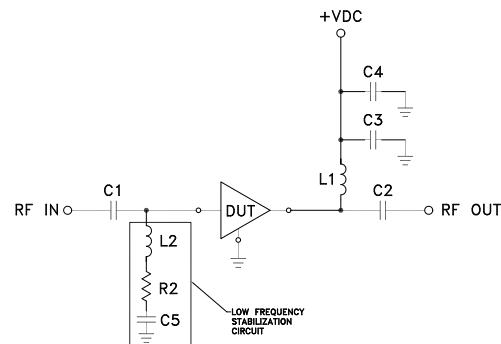
## Die Layout



**Fig 3.** Die Layout

## Critical Dimensions

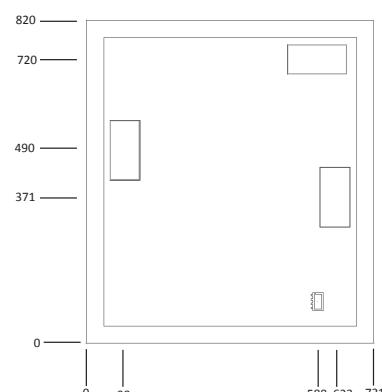
Parameter	Values
Die Thickness, µm	100
Die Width, µm	820
Die Length, µm	731
Bond Pad Size, µm	150 x 75



**Fig 2b.** Unconditionally stable (see note AN-60-064)

SEQ	Manufacturer P/N / Value	Size
A1	PGA-103-D+ in industry standard SOT-89	—
C1, C2	.01 uF	0805
C3	0.33 uF	1206
C4	10 uF	1206
C5	330 pF	0603
L1	TCCH-80+	—
L2	620 nH	.115X.110
R2	150 Ohm	0603

## Bonding Pad Position (Dimensions in µm, Typical)



**Fig 4.** Bonding Pad Positions

# Monolithic E-PHEMT MMIC Amplifier Die

## Assembly and Handling Procedure

### 1. Storage

Dice should be stored in a dry nitrogen purged desiccators or equivalent.

### 2. ESD

MMIC E-PHEMPT amplifier dice are susceptible to electrostatic and mechanical damage. Die are supplied in antistatic protected material, which should be opened in clean room conditions at an appropriately grounded anti-static workstation. Devices need careful handling using correctly designed collets, vacuum pickup tips or sharp antistatic tweezers to deter ESD damage to dice.

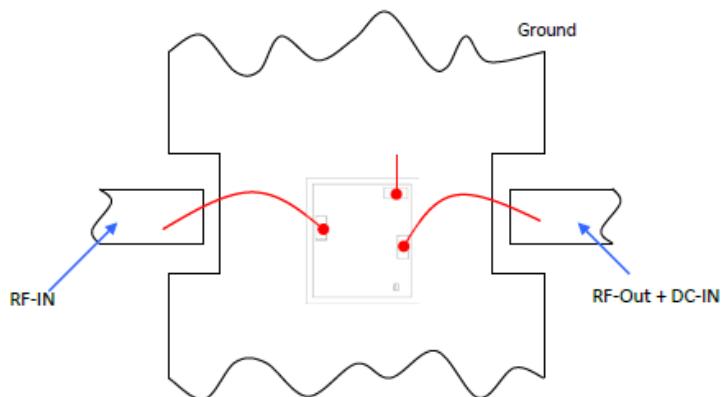
### 3. Die Attach

The die mounting surface must be clean and flat. Using conductive silver filled epoxy, recommended epoxies are DieMat DM6030HK-PT/H579 or Ablestik 84-1LMISR4. Apply sufficient epoxy to meet required epoxy bond line thickness, epoxy fillet height and epoxy coverage around total die periphery. Parts shall be cured in a nitrogen filled atmosphere per manufacturer's cure condition. It is recommended to use antistatic die pick up tools only.

### 4. Wire Bonding

Bond pad openings in the surface passivation above the bond pads are provided to allow wire bonding to the dice gold bond pads. Thermosonic bonding is used with minimized ultrasonic content. Bond force, time, ultrasonic power and temperature are all critical parameters. Suggested wire is pure gold, 1 mil diameter. Bonds must be made from the bond pads on the die to the package or substrate. All bond wires should be kept as short as reasonable to minimize performance degradation due to undesirable series inductance.

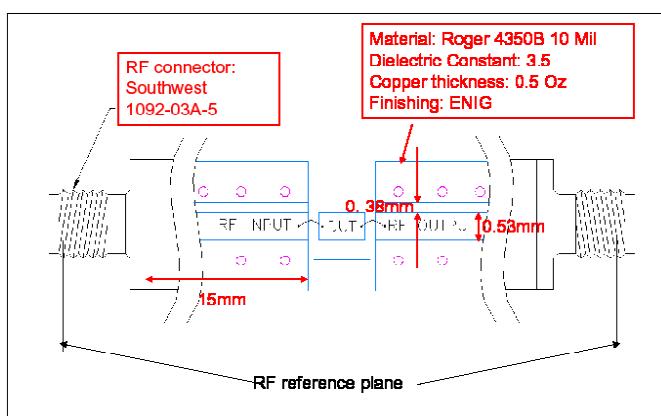
## Assembly Diagram



## Recommended Wire Length, Typical

Wire	Wire Length (mm)	Wire Loop Height (mm)
RF-IN, RF-OUT + DC-IN	0.6	0.15
GROUND	0.3	0.15

## RF Reference Plane - No port extension



<b>Additional Detailed Technical Information</b> <i>additional information is available on our dash board.</i>		
<b>Performance Data</b>	Data Table	
	Swept Graphs	
	S-Parameter (S2P Files) Data Set with and without port extension(.zip file)	
<b>Case Style</b>	Die	
<b>Die Ordering and packaging information</b>	Quantity, Package Small, Gel - Pak: 10,50,100 KGD* Medium <sup>†</sup> , Partial wafer: KGD*<1975 Large <sup>†</sup> , Full Wafer	Model No. PGA-103-DG+ PGA-103-DP+ PGA-103-DF+
	<p><sup>†</sup>Available upon request contact sales representative Refer to <a href="#">AN-60-067</a></p>	
<b>Environmental Ratings</b>	ENV-80	

\*Known Good Dice ("KGD") means that the dice in question have been subjected to Mini-Circuits DC test performance criteria and measurement instructions and that the parametric data of such dice fall within a predefined range. While DC testing is not definitive, it does help to provide a higher degree of confidence that dice are capable of meeting typical RF electrical parameters specified by Mini-Circuits.

## ESD Rating\*\*

Human Body Model (HBM): Class 1A (250 to <500V) in accordance with ANSI/ESD STM 5.1 - 2001

\*\* Tested in industry standard SOT-89 package.

## Additional Notes

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# MMIC Amplifier Die

# PGA-103-D+

## Typical Performance Data

### Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 3.00V, Id = 56mA @Temperature = +25°C

FREQ.	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
50	26.25	30.61	6.29	13.66	0.89	0.83	31.22	14.88	0.33
100	25.46	29.55	7.94	18.00	0.97	0.76	31.60	14.91	0.46
200	24.36	28.43	9.07	21.23	1.00	0.74	31.79	16.77	0.49
400	21.89	26.16	10.62	24.05	1.04	0.72	32.65	18.08	0.68
500	20.72	25.06	11.23	24.71	1.05	0.72	32.87	18.19	0.68
600	19.65	24.08	11.72	24.87	1.06	0.72	33.00	18.46	0.69
700	18.67	23.14	12.15	24.91	1.07	0.71	33.15	18.50	0.67
800	17.77	22.28	12.50	24.80	1.08	0.71	33.22	18.57	0.60
900	16.94	21.50	12.81	24.56	1.08	0.71	33.43	18.69	0.58
1000	16.17	20.73	13.10	24.28	1.08	0.71	33.56	18.87	0.60
1100	15.47	20.06	13.33	24.15	1.09	0.71	33.57	18.90	0.61
1200	14.82	19.40	13.55	23.83	1.09	0.71	33.72	18.90	0.63
1300	14.21	18.80	13.73	23.60	1.09	0.70	33.95	18.97	0.65
1400	13.65	18.26	13.86	23.53	1.09	0.71	33.97	19.07	0.67
1500	13.12	17.71	13.95	23.40	1.09	0.70	34.12	19.17	0.69
1600	12.63	17.22	13.99	23.42	1.09	0.70	34.07	19.35	0.71
1700	12.16	16.74	14.01	23.54	1.09	0.70	34.28	19.41	0.73
1800	11.72	16.28	13.96	23.88	1.09	0.70	34.38	19.49	0.74
1900	11.30	15.85	13.90	24.27	1.09	0.70	34.36	19.49	0.75
2000	10.92	15.44	13.79	24.59	1.09	0.70	34.30	19.59	0.77
2100	10.54	15.06	13.67	25.10	1.09	0.70	34.38	19.70	0.78
2200	10.19	14.69	13.53	25.71	1.09	0.70	34.20	19.84	0.81
2300	9.85	14.33	13.36	26.30	1.09	0.70	34.24	19.84	0.85
2400	9.53	13.98	13.20	26.87	1.08	0.70	33.96	19.84	0.90
2500	9.22	13.65	13.03	27.39	1.08	0.70	33.86	19.85	0.97
2600	8.92	13.34	12.88	27.78	1.08	0.70	33.89	19.93	1.04
2700	8.64	13.04	12.71	27.72	1.08	0.70	33.86	19.97	1.13
2800	8.37	12.76	12.60	27.50	1.08	0.70	33.61	20.08	1.19
2900	8.10	12.47	12.49	26.90	1.07	0.70	33.30	20.07	1.22
3000	7.85	12.22	12.43	26.19	1.07	0.70	33.31	20.03	1.24
3200	7.38	11.69	12.36	24.61	1.07	0.69	33.35	20.22	1.21
3300	7.16	11.45	12.34	24.07	1.07	0.69	33.14	20.39	1.21
3400	6.94	11.21	12.37	23.36	1.07	0.69	33.18	20.37	1.23
3500	6.73	10.99	12.42	22.78	1.07	0.68	32.98	20.39	1.26
3600	6.53	10.76	12.51	22.20	1.06	0.68	32.92	20.32	1.30
3700	6.35	10.55	12.60	21.57	1.06	0.68	32.92	20.43	1.35
3800	6.16	10.33	12.73	21.05	1.06	0.67	32.97	20.52	1.38
4000	5.81	9.96	12.95	20.19	1.06	0.66	32.94	20.63	1.47



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IF/RF MICROWAVE COMPONENTS



REV. OR

PGA-103-D+

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# MMIC Amplifier Die

PGA-103-D+

## Typical Performance Data

### Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 2.70V, Id = 50mA @Temperature = +25°C

FREQ.	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
50	26.04	30.66	6.09	13.65	0.89	0.86	30.18	14.88	0.36
100	25.25	29.38	7.68	17.61	0.96	0.78	30.29	14.91	0.49
200	24.16	28.24	8.78	20.55	0.99	0.75	30.53	16.77	0.51
400	21.70	25.89	10.29	23.38	1.02	0.73	30.98	18.08	0.69
500	20.53	24.80	10.88	24.33	1.04	0.72	31.22	18.19	0.69
600	19.47	23.80	11.34	24.94	1.05	0.72	31.43	18.46	0.72
700	18.49	22.87	11.76	25.49	1.06	0.72	31.58	18.50	0.68
800	17.59	22.01	12.09	25.75	1.07	0.71	31.68	18.57	0.62
900	16.76	21.22	12.41	25.88	1.07	0.71	31.81	18.69	0.59
1000	16.00	20.49	12.67	25.98	1.08	0.71	31.92	18.87	0.62
1100	15.29	19.80	12.89	25.98	1.08	0.71	32.00	18.90	0.63
1200	14.64	19.15	13.09	25.86	1.08	0.71	32.10	18.90	0.65
1300	14.04	18.57	13.26	25.78	1.09	0.71	32.18	18.97	0.67
1400	13.48	18.01	13.40	25.87	1.09	0.70	32.29	19.07	0.70
1500	12.95	17.46	13.47	25.81	1.09	0.70	32.45	19.17	0.71
1600	12.46	16.97	13.51	26.03	1.09	0.70	32.56	19.35	0.73
1700	11.99	16.49	13.51	26.17	1.09	0.70	32.67	19.41	0.74
1800	11.55	16.05	13.47	26.70	1.09	0.70	32.70	19.49	0.75
1900	11.14	15.61	13.41	27.17	1.09	0.70	32.78	19.49	0.76
2000	10.75	15.21	13.30	27.56	1.09	0.70	32.79	19.59	0.78
2100	10.38	14.82	13.19	28.19	1.08	0.70	32.81	19.70	0.79
2200	10.02	14.45	13.05	28.77	1.08	0.70	32.77	19.84	0.81
2300	9.68	14.10	12.88	29.08	1.08	0.70	32.68	19.84	0.85
2400	9.36	13.76	12.74	29.28	1.08	0.70	32.56	19.84	0.91
2500	9.05	13.43	12.57	29.14	1.08	0.70	32.56	19.85	0.98
2600	8.76	13.12	12.43	28.61	1.08	0.69	32.46	19.93	1.06
2700	8.48	12.83	12.27	27.84	1.07	0.69	32.40	19.97	1.13
2800	8.20	12.54	12.18	27.01	1.07	0.69	32.30	20.08	1.20
2900	7.94	12.26	12.06	26.06	1.07	0.69	32.22	20.07	1.23
3000	7.69	12.00	12.02	25.16	1.07	0.69	32.15	20.03	1.25
3200	7.22	11.49	11.94	23.61	1.07	0.69	31.95	20.22	1.25
3300	7.00	11.25	11.94	23.07	1.07	0.68	31.94	20.39	1.24
3400	6.78	11.02	11.97	22.42	1.06	0.68	31.86	20.37	1.28
3500	6.58	10.79	12.02	21.97	1.06	0.68	31.81	20.39	1.30
3600	6.38	10.57	12.11	21.46	1.06	0.67	31.77	20.32	1.34
3700	6.19	10.36	12.20	20.95	1.06	0.67	31.79	20.43	1.37
3800	6.01	10.15	12.34	20.59	1.06	0.67	31.75	20.52	1.41
4000	5.66	9.75	12.58	19.93	1.06	0.66	31.71	20.63	1.44



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IF/RF MICROWAVE COMPONENTS



REV. OR

PGA-103-D+

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# MMIC Amplifier Die

# PGA-103-D+

## Typical Performance Data

### Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 3.30V, Id = 62mA @Temperature = +25°C

FREQ.	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
50	26.43	30.18	6.42	13.96	0.88	0.77	32.38	15.50	0.35
100	25.63	29.65	8.16	18.32	0.97	0.75	32.63	16.02	0.48
200	24.52	28.59	9.33	21.71	1.01	0.72	33.19	17.44	0.51
400	22.04	26.34	10.93	24.06	1.05	0.72	34.20	18.61	0.69
500	20.87	25.31	11.54	24.28	1.06	0.72	34.64	18.83	0.69
600	19.80	24.30	12.05	23.95	1.07	0.72	34.96	18.99	0.71
700	18.82	23.38	12.49	23.65	1.08	0.71	35.26	19.16	0.67
800	17.91	22.50	12.84	23.28	1.08	0.71	35.42	19.18	0.60
900	17.08	21.71	13.17	22.92	1.09	0.71	35.68	19.30	0.59
1000	16.32	20.97	13.46	22.52	1.09	0.71	35.84	19.45	0.63
1100	15.61	20.29	13.71	22.27	1.10	0.71	36.03	19.50	0.64
1200	14.95	19.64	13.93	21.93	1.10	0.71	36.19	19.50	0.66
1300	14.35	19.03	14.12	21.73	1.10	0.71	36.37	19.55	0.68
1400	13.78	18.46	14.26	21.55	1.10	0.71	36.56	19.63	0.71
1500	13.25	17.93	14.34	21.41	1.10	0.71	36.70	19.69	0.72
1600	12.76	17.44	14.39	21.44	1.10	0.70	36.73	19.83	0.75
1700	12.29	16.95	14.42	21.45	1.10	0.70	36.77	19.93	0.76
1800	11.85	16.50	14.37	21.73	1.10	0.70	36.95	20.02	0.76
1900	11.44	16.06	14.30	21.98	1.09	0.70	37.05	20.04	0.77
2000	11.05	15.66	14.18	22.28	1.09	0.70	37.00	20.09	0.78
2100	10.67	15.26	14.07	22.67	1.09	0.70	37.02	20.21	0.79
2200	10.31	14.90	13.92	23.21	1.09	0.70	37.18	20.30	0.81
2300	9.98	14.53	13.74	23.74	1.09	0.70	37.24	20.24	0.85
2400	9.66	14.19	13.58	24.26	1.09	0.70	37.23	20.23	0.90
2500	9.35	13.86	13.38	24.79	1.08	0.70	37.30	20.24	0.97
2600	9.05	13.55	13.22	25.32	1.08	0.70	37.32	20.33	1.04
2700	8.77	13.24	13.06	25.63	1.08	0.70	37.17	20.37	1.11
2800	8.49	12.94	12.94	25.92	1.08	0.70	36.92	20.41	1.18
2900	8.23	12.67	12.82	25.85	1.08	0.70	36.84	20.44	1.21
3000	7.98	12.40	12.77	25.51	1.08	0.70	36.58	20.37	1.23
3200	7.51	11.89	12.68	24.48	1.07	0.70	36.24	20.52	1.24
3300	7.28	11.64	12.65	24.02	1.07	0.70	36.24	20.61	1.23
3400	7.07	11.40	12.69	23.38	1.07	0.69	36.16	20.57	1.27
3500	6.86	11.17	12.73	22.84	1.07	0.69	36.15	20.59	1.31
3600	6.66	10.94	12.81	22.25	1.07	0.69	36.07	20.58	1.35
3700	6.47	10.73	12.90	21.59	1.06	0.68	36.09	20.81	1.37
3800	6.28	10.52	13.05	21.08	1.06	0.68	36.05	20.88	1.41
4000	5.94	10.13	13.26	20.20	1.06	0.67	36.00	20.96	1.43



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# MMIC Amplifier Die

# PGA-103-D+

## Typical Performance Data

### Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 5V, Id = 91mA @Temperature = +25°C

FREQ. (MHz)	Gain (dB)	Isolation (dB)	Input Return Loss (dB)	Output Return Loss (dB)	Stability		IP-3 Output (dBm)	1dB Comp. Output (dBm)	Noise Figure (dB)
50	26.90	30.89	6.94	13.94	0.91	0.77	35.84	19.28	0.40
100	26.07	29.98	8.81	19.12	0.99	0.71	36.13	19.53	0.51
200	24.94	29.04	10.05	22.43	1.03	0.70	36.86	20.45	0.53
400	22.41	26.94	11.72	21.92	1.08	0.71	38.04	21.16	0.71
500	21.22	25.91	12.36	21.22	1.09	0.71	38.45	21.22	0.71
600	20.14	24.92	12.87	20.39	1.10	0.71	39.04	21.48	0.72
700	19.14	24.01	13.34	19.76	1.10	0.72	39.74	21.54	0.70
800	18.23	23.12	13.70	19.27	1.11	0.72	39.96	21.57	0.63
900	17.39	22.31	14.06	18.85	1.11	0.72	40.06	21.74	0.60
1000	16.62	21.57	14.35	18.47	1.11	0.72	40.73	21.65	0.63
1100	15.91	20.89	14.61	18.21	1.11	0.72	41.23	21.73	0.64
1200	15.25	20.22	14.85	17.93	1.11	0.71	41.10	21.79	0.66
1300	14.64	19.63	15.05	17.74	1.11	0.71	41.49	21.84	0.68
1400	14.07	19.07	15.20	17.58	1.11	0.71	41.84	21.95	0.70
1500	13.54	18.53	15.29	17.47	1.11	0.71	41.33	22.03	0.72
1600	13.05	18.01	15.35	17.43	1.11	0.71	41.67	22.04	0.75
1700	12.57	17.54	15.37	17.43	1.11	0.71	42.67	22.09	0.77
1800	12.13	17.08	15.31	17.58	1.11	0.71	42.46	22.25	0.78
1900	11.71	16.65	15.23	17.74	1.11	0.71	42.08	22.30	0.79
2000	11.32	16.23	15.11	17.91	1.10	0.71	41.59	22.33	0.81
2100	10.95	15.83	14.97	18.14	1.10	0.71	42.68	22.41	0.82
2200	10.59	15.46	14.80	18.44	1.10	0.71	43.43	22.45	0.84
2300	10.25	15.09	14.60	18.77	1.10	0.71	43.07	22.51	0.89
2400	9.93	14.74	14.42	19.12	1.10	0.72	42.91	22.55	0.94
2500	9.62	14.42	14.22	19.51	1.09	0.72	42.86	22.67	1.01
2600	9.33	14.08	14.04	19.90	1.09	0.72	42.61	22.74	1.09
2700	9.05	13.78	13.85	20.21	1.09	0.72	42.82	22.84	1.17
2800	8.77	13.47	13.71	20.59	1.09	0.72	43.13	22.80	1.24
2900	8.51	13.19	13.56	20.84	1.08	0.72	43.63	22.53	1.28
3000	8.26	12.91	13.51	20.97	1.08	0.72	44.18	22.27	1.30
3200	7.79	12.39	13.39	20.94	1.08	0.71	43.58	22.54	1.29
3300	7.56	12.13	13.36	20.87	1.08	0.71	43.58	22.81	1.30
3400	7.35	11.89	13.38	20.64	1.08	0.71	43.46	22.93	1.33
3500	7.14	11.65	13.43	20.34	1.07	0.70	44.65	22.98	1.36
3600	6.93	11.41	13.52	20.10	1.07	0.70	44.62	22.99	1.40
3700	6.75	11.20	13.60	19.68	1.07	0.70	44.62	23.04	1.45
3800	6.55	10.98	13.75	19.33	1.07	0.69	43.96	23.01	1.49
4000	6.20	10.58	13.98	18.65	1.07	0.68	44.30	22.84	1.57



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# MMIC Amplifier Die

# PGA-103-D+

## Typical Performance Data

### Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 4.75V, Id = 85mA @Temperature = +25°C

FREQ. (MHz)	Gain (dB)	Isolation (dB)	Input Return Loss (dB)	Output Return Loss (dB)	Stability		IP-3 Output (dBm)	1dB Comp. Output (dBm)	Noise Figure (dB)
50	26.87	30.54	6.92	13.76	0.90	0.74	36.67	18.77	0.39
100	26.04	29.93	8.76	19.08	0.99	0.71	36.84	19.06	0.50
200	24.90	28.98	10.01	22.49	1.03	0.70	37.21	20.09	0.52
400	22.37	26.91	11.66	22.21	1.08	0.71	37.70	20.88	0.71
500	21.19	25.84	12.30	21.49	1.09	0.71	38.31	20.98	0.70
600	20.11	24.87	12.82	20.68	1.10	0.71	38.92	21.15	0.73
700	19.12	23.95	13.29	20.07	1.10	0.72	39.36	21.26	0.70
800	18.21	23.10	13.65	19.56	1.11	0.72	39.79	21.33	0.63
900	17.37	22.29	14.00	19.12	1.11	0.72	40.27	21.38	0.60
1000	16.60	21.54	14.30	18.75	1.11	0.72	40.57	21.38	0.64
1100	15.89	20.84	14.56	18.48	1.11	0.72	40.86	21.43	0.64
1200	15.23	20.19	14.79	18.19	1.11	0.71	40.95	21.48	0.66
1300	14.62	19.59	15.00	17.98	1.11	0.71	41.21	21.52	0.68
1400	14.05	19.01	15.13	17.84	1.11	0.71	41.48	21.67	0.71
1500	13.52	18.50	15.23	17.70	1.11	0.71	41.51	21.73	0.72
1600	13.02	17.98	15.28	17.67	1.11	0.71	41.80	21.75	0.75
1700	12.55	17.49	15.29	17.68	1.11	0.71	42.03	21.79	0.77
1800	12.11	17.04	15.25	17.82	1.11	0.71	42.17	21.88	0.78
1900	11.69	16.61	15.17	17.98	1.11	0.71	42.26	22.02	0.79
2000	11.30	16.19	15.05	18.15	1.10	0.71	42.41	22.07	0.81
2100	10.92	15.80	14.90	18.41	1.10	0.71	42.61	22.14	0.83
2200	10.57	15.42	14.74	18.73	1.10	0.71	42.90	22.18	0.85
2300	10.23	15.05	14.54	19.08	1.10	0.71	43.05	22.26	0.88
2400	9.91	14.71	14.37	19.42	1.10	0.72	43.27	22.32	0.94
2500	9.60	14.37	14.16	19.78	1.09	0.72	43.24	22.40	1.01
2600	9.31	14.04	13.97	20.22	1.09	0.72	43.24	22.47	1.09
2700	9.03	13.74	13.79	20.55	1.09	0.72	43.26	22.50	1.17
2800	8.75	13.44	13.66	20.94	1.09	0.72	42.95	22.45	1.23
2900	8.49	13.15	13.51	21.19	1.08	0.72	43.24	22.28	1.26
3000	8.24	12.88	13.46	21.32	1.08	0.72	43.63	22.00	1.28
3200	7.76	12.35	13.35	21.24	1.08	0.71	44.14	22.27	1.28
3300	7.54	12.10	13.31	21.12	1.08	0.71	44.14	22.54	1.28
3400	7.32	11.85	13.33	20.85	1.07	0.71	44.37	22.67	1.32
3500	7.12	11.62	13.37	20.55	1.07	0.70	44.13	22.66	1.36
3600	6.91	11.38	13.47	20.27	1.07	0.70	44.19	22.70	1.40
3700	6.72	11.17	13.56	19.85	1.07	0.70	44.09	22.77	1.43
3800	6.53	10.95	13.70	19.49	1.07	0.69	44.02	22.82	1.47
4000	6.19	10.55	13.92	18.81	1.07	0.68	44.05	22.68	1.54



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# MMIC Amplifier Die

# PGA-103-D+

## Typical Performance Data

### Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 5.25V, Id = 93mA @Temperature = +25°C

FREQ. (MHz)	Gain (dB)	Isolation (dB)	Input Return Loss (dB)	Output Return Loss (dB)	Stability		IP-3 Output (dBm)	1dB Comp. Output (dBm)	Noise Figure (dB)
50	26.92	30.83	6.98	14.23	0.91	0.77	35.70	19.56	0.41
100	26.09	29.93	8.83	19.09	0.99	0.71	35.98	19.76	0.51
200	24.95	29.09	10.06	22.25	1.04	0.70	36.74	20.62	0.53
400	22.42	27.00	11.73	21.70	1.08	0.71	37.99	21.20	0.71
500	21.23	25.94	12.38	20.96	1.09	0.71	38.64	21.32	0.71
600	20.15	24.95	12.90	20.15	1.10	0.71	39.23	21.48	0.73
700	19.15	24.01	13.37	19.55	1.10	0.72	39.68	21.58	0.69
800	18.24	23.16	13.74	19.07	1.11	0.72	40.07	21.60	0.63
900	17.40	22.35	14.09	18.64	1.11	0.72	40.45	21.76	0.62
1000	16.63	21.63	14.38	18.28	1.11	0.72	40.79	21.68	0.65
1100	15.92	20.92	14.65	18.02	1.11	0.72	40.92	21.72	0.66
1200	15.26	20.26	14.88	17.75	1.11	0.72	41.24	21.80	0.68
1300	14.65	19.66	15.08	17.53	1.11	0.72	41.36	21.85	0.70
1400	14.08	19.09	15.25	17.39	1.11	0.71	41.34	21.96	0.73
1500	13.55	18.55	15.33	17.28	1.11	0.71	41.48	22.02	0.74
1600	13.05	18.05	15.38	17.23	1.11	0.71	41.88	22.00	0.76
1700	12.58	17.57	15.40	17.26	1.11	0.71	42.16	22.02	0.78
1800	12.14	17.11	15.34	17.39	1.11	0.71	42.34	22.16	0.79
1900	11.72	16.69	15.26	17.53	1.11	0.71	42.46	22.30	0.80
2000	11.33	16.27	15.14	17.70	1.11	0.71	42.79	22.35	0.82
2100	10.95	15.86	15.00	17.93	1.10	0.71	42.98	22.45	0.84
2200	10.60	15.48	14.83	18.25	1.10	0.72	43.25	22.45	0.85
2300	10.26	15.12	14.63	18.56	1.10	0.72	43.12	22.51	0.90
2400	9.94	14.77	14.45	18.89	1.10	0.72	44.15	22.58	0.96
2500	9.63	14.45	14.25	19.24	1.09	0.72	43.97	22.70	1.03
2600	9.34	14.11	14.06	19.66	1.09	0.72	43.98	22.78	1.11
2700	9.06	13.81	13.86	19.97	1.09	0.72	44.17	22.81	1.19
2800	8.78	13.50	13.74	20.39	1.09	0.72	44.10	22.73	1.26
2900	8.52	13.22	13.58	20.65	1.09	0.72	44.49	22.48	1.29
3000	8.26	12.94	13.53	20.77	1.08	0.72	43.66	22.18	1.31
3200	7.79	12.41	13.42	20.74	1.08	0.71	43.95	22.48	1.31
3300	7.57	12.16	13.37	20.58	1.08	0.71	43.95	22.83	1.31
3400	7.35	11.92	13.40	20.41	1.08	0.71	44.41	23.02	1.34
3500	7.14	11.68	13.44	20.11	1.07	0.71	44.68	23.00	1.38
3600	6.94	11.44	13.55	19.89	1.07	0.70	44.91	23.07	1.42
3700	6.76	11.22	13.63	19.49	1.07	0.70	45.26	23.06	1.46
3800	6.56	11.00	13.76	19.16	1.07	0.69	45.24	23.03	1.50
4000	6.21	10.59	14.01	18.53	1.07	0.69	44.59	22.90	1.59



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# MMIC Amplifier Die

PGA-103-D+

## Typical Performance Data

### Without Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 3.00V, Id = 56mA @Temperature = +25°C

FREQ.	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
50	26.33	29.88	6.29	13.54	0.87	0.76	31.22	14.88	0.33
100	25.52	29.46	7.94	17.99	0.96	0.75	31.60	14.91	0.46
200	24.40	28.38	9.07	21.21	0.99	0.73	31.79	16.77	0.49
400	21.90	26.17	10.62	24.11	1.04	0.72	32.65	18.08	0.68
500	20.71	25.10	11.23	24.79	1.05	0.72	32.87	18.19	0.68
600	19.63	24.09	11.72	24.96	1.06	0.72	33.00	18.46	0.69
700	18.63	23.17	12.15	24.99	1.07	0.72	33.15	18.50	0.67
800	17.72	22.35	12.50	24.92	1.08	0.72	33.22	18.57	0.60
900	16.88	21.57	12.81	24.69	1.09	0.72	33.43	18.69	0.58
1000	16.10	20.84	13.10	24.44	1.10	0.72	33.56	18.87	0.60
1100	15.38	20.15	13.33	24.22	1.10	0.72	33.57	18.90	0.61
1200	14.72	19.52	13.55	23.97	1.10	0.72	33.72	18.90	0.63
1300	14.11	18.92	13.73	23.70	1.11	0.72	33.95	18.97	0.65
1400	13.53	18.36	13.86	23.64	1.11	0.72	33.97	19.07	0.67
1500	12.99	17.85	13.95	23.54	1.11	0.72	34.12	19.17	0.69
1600	12.49	17.35	13.99	23.57	1.11	0.72	34.07	19.35	0.71
1700	12.01	16.87	14.01	23.69	1.11	0.72	34.28	19.41	0.73
1800	11.56	16.43	13.96	24.02	1.11	0.72	34.38	19.49	0.74
1900	11.14	16.02	13.90	24.38	1.11	0.72	34.36	19.49	0.75
2000	10.74	15.61	13.79	24.77	1.11	0.72	34.30	19.59	0.77
2100	10.36	15.23	13.67	25.30	1.11	0.72	34.38	19.70	0.78
2200	9.99	14.88	13.53	25.96	1.11	0.73	34.20	19.84	0.81
2300	9.65	14.54	13.36	26.50	1.11	0.73	34.24	19.84	0.85
2400	9.32	14.20	13.20	27.11	1.11	0.73	33.96	19.84	0.90
2500	9.00	13.88	13.03	27.66	1.11	0.73	33.86	19.85	0.97
2600	8.70	13.58	12.88	28.02	1.11	0.73	33.89	19.93	1.04
2700	8.41	13.29	12.71	28.02	1.11	0.73	33.86	19.97	1.13
2800	8.12	13.01	12.60	27.80	1.11	0.73	33.61	20.08	1.19
2900	7.85	12.73	12.49	27.26	1.11	0.73	33.30	20.07	1.22
3000	7.59	12.49	12.43	26.50	1.11	0.73	33.31	20.03	1.24
3200	7.10	11.98	12.36	24.94	1.11	0.73	33.35	20.22	1.21
3300	6.87	11.76	12.34	24.38	1.11	0.73	33.14	20.39	1.21
3400	6.65	11.52	12.37	23.68	1.10	0.73	33.18	20.37	1.23
3500	6.44	11.30	12.42	23.13	1.10	0.73	32.98	20.39	1.26
3600	6.23	11.08	12.51	22.60	1.10	0.73	32.92	20.32	1.30
3700	6.03	10.87	12.60	21.98	1.10	0.72	32.92	20.43	1.35
3800	5.84	10.68	12.73	21.54	1.10	0.72	32.97	20.52	1.38
4000	5.48	10.29	12.95	20.76	1.10	0.71	32.94	20.63	1.47



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# MMIC Amplifier Die

PGA-103-D+

## Typical Performance Data

### Without Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 2.70V, Id = 50mA @Temperature = +25°C

FREQ.	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
50	26.11	30.26	6.04	13.78	0.87	0.83	30.18	14.88	0.36
100	25.31	29.37	7.62	17.56	0.95	0.77	30.29	14.91	0.49
200	24.20	28.19	8.74	20.50	0.98	0.74	30.53	16.77	0.51
400	21.71	25.85	10.29	23.42	1.02	0.72	30.98	18.08	0.69
500	20.53	24.78	10.89	24.35	1.04	0.72	31.22	18.19	0.69
600	19.44	23.82	11.36	24.94	1.05	0.72	31.43	18.46	0.72
700	18.45	22.91	11.79	25.45	1.06	0.72	31.58	18.50	0.68
800	17.54	22.08	12.13	25.82	1.07	0.72	31.68	18.57	0.62
900	16.70	21.29	12.46	25.97	1.08	0.72	31.81	18.69	0.59
1000	15.92	20.58	12.74	26.02	1.09	0.72	31.92	18.87	0.62
1100	15.21	19.89	12.98	26.03	1.09	0.72	32.00	18.90	0.63
1200	14.55	19.25	13.19	25.93	1.10	0.72	32.10	18.90	0.65
1300	13.93	18.68	13.37	25.82	1.10	0.72	32.18	18.97	0.67
1400	13.36	18.12	13.51	25.91	1.10	0.72	32.29	19.07	0.70
1500	12.82	17.58	13.59	25.94	1.10	0.72	32.45	19.17	0.71
1600	12.32	17.11	13.66	26.10	1.11	0.72	32.56	19.35	0.73
1700	11.84	16.65	13.66	26.30	1.11	0.72	32.67	19.41	0.74
1800	11.40	16.19	13.64	26.79	1.11	0.72	32.70	19.49	0.75
1900	10.98	15.79	13.57	27.28	1.11	0.72	32.78	19.49	0.76
2000	10.57	15.39	13.48	27.71	1.11	0.72	32.79	19.59	0.78
2100	10.19	15.02	13.39	28.28	1.11	0.72	32.81	19.70	0.79
2200	9.83	14.65	13.27	28.85	1.11	0.72	32.77	19.84	0.81
2300	9.48	14.29	13.12	29.28	1.11	0.72	32.68	19.84	0.85
2400	9.15	13.97	12.97	29.46	1.11	0.73	32.56	19.84	0.91
2500	8.83	13.66	12.80	29.38	1.11	0.73	32.56	19.85	0.98
2600	8.53	13.36	12.67	28.88	1.11	0.73	32.46	19.93	1.06
2700	8.24	13.06	12.52	28.15	1.10	0.73	32.40	19.97	1.13
2800	7.96	12.78	12.44	27.30	1.10	0.73	32.30	20.08	1.20
2900	7.69	12.53	12.33	26.29	1.10	0.73	32.22	20.07	1.23
3000	7.43	12.27	12.30	25.44	1.10	0.73	32.15	20.03	1.25
3200	6.94	11.78	12.24	23.87	1.10	0.73	31.95	20.22	1.25
3300	6.71	11.54	12.23	23.35	1.10	0.73	31.94	20.39	1.24
3400	6.49	11.32	12.28	22.74	1.10	0.73	31.86	20.37	1.28
3500	6.28	11.10	12.33	22.28	1.10	0.72	31.81	20.39	1.30
3600	6.07	10.89	12.44	21.77	1.10	0.72	31.77	20.32	1.34
3700	5.88	10.69	12.52	21.26	1.10	0.72	31.79	20.43	1.37
3800	5.68	10.48	12.70	20.93	1.10	0.72	31.75	20.52	1.41
4000	5.32	10.10	12.94	20.27	1.10	0.71	31.71	20.63	1.44



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# MMIC Amplifier Die

PGA-103-D+

## Typical Performance Data

### Without Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 3.30V, Id = 62mA @Temperature = +25°C

FREQ.	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
50	26.50	30.41	6.38	13.96	0.88	0.79	32.38	15.50	0.35
100	25.68	29.59	8.11	18.26	0.97	0.74	32.63	16.02	0.48
200	24.56	28.54	9.29	21.68	1.00	0.72	33.19	17.44	0.51
400	22.04	26.34	10.91	24.03	1.05	0.71	34.20	18.61	0.69
500	20.86	25.30	11.54	24.30	1.06	0.72	34.64	18.83	0.69
600	19.77	24.33	12.07	24.05	1.08	0.72	34.96	18.99	0.71
700	18.78	23.44	12.53	23.70	1.09	0.72	35.26	19.16	0.67
800	17.86	22.54	12.89	23.35	1.09	0.72	35.42	19.18	0.60
900	17.02	21.77	13.23	23.01	1.10	0.72	35.68	19.30	0.59
1000	16.24	21.04	13.52	22.66	1.10	0.72	35.84	19.45	0.63
1100	15.52	20.36	13.79	22.38	1.11	0.72	36.03	19.50	0.64
1200	14.86	19.74	14.03	22.05	1.11	0.72	36.19	19.50	0.66
1300	14.24	19.16	14.22	21.84	1.11	0.72	36.37	19.55	0.68
1400	13.66	18.59	14.36	21.68	1.11	0.72	36.56	19.63	0.71
1500	13.12	18.05	14.47	21.59	1.11	0.72	36.70	19.69	0.72
1600	12.62	17.57	14.53	21.59	1.12	0.72	36.73	19.83	0.75
1700	12.14	17.09	14.56	21.65	1.12	0.72	36.77	19.93	0.76
1800	11.69	16.66	14.53	21.93	1.12	0.73	36.95	20.02	0.76
1900	11.27	16.23	14.46	22.18	1.12	0.73	37.05	20.04	0.77
2000	10.87	15.83	14.36	22.51	1.12	0.73	37.00	20.09	0.78
2100	10.48	15.45	14.26	22.92	1.12	0.73	37.02	20.21	0.79
2200	10.12	15.09	14.11	23.42	1.12	0.73	37.18	20.30	0.81
2300	9.77	14.74	13.94	23.98	1.12	0.73	37.24	20.24	0.85
2400	9.44	14.39	13.79	24.52	1.11	0.73	37.23	20.23	0.90
2500	9.12	14.08	13.61	25.05	1.11	0.73	37.30	20.24	0.97
2600	8.82	13.77	13.46	25.57	1.11	0.74	37.32	20.33	1.04
2700	8.53	13.48	13.30	25.86	1.11	0.74	37.17	20.37	1.11
2800	8.24	13.19	13.20	26.20	1.11	0.74	36.92	20.41	1.18
2900	7.98	12.91	13.07	26.15	1.11	0.74	36.84	20.44	1.21
3000	7.72	12.66	13.03	25.77	1.11	0.74	36.58	20.37	1.23
3200	7.23	12.16	12.96	24.73	1.11	0.74	36.24	20.52	1.24
3300	6.99	11.92	12.93	24.29	1.11	0.74	36.24	20.61	1.23
3400	6.77	11.69	12.99	23.65	1.11	0.73	36.16	20.57	1.27
3500	6.55	11.46	13.04	23.09	1.11	0.73	36.15	20.59	1.31
3600	6.35	11.25	13.14	22.56	1.11	0.73	36.07	20.58	1.35
3700	6.15	11.04	13.23	21.91	1.11	0.73	36.09	20.81	1.37
3800	5.95	10.84	13.38	21.41	1.11	0.73	36.05	20.88	1.41
4000	5.59	10.46	13.61	20.52	1.11	0.72	36.00	20.96	1.43



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# MMIC Amplifier Die

# PGA-103-D+

## Typical Performance Data

### Without Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 5V, Id = 91mA @Temperature = +25°C

FREQ.	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
50	26.97	30.63	6.87	14.12	0.89	0.75	35.84	19.28	0.40
100	26.13	29.91	8.74	19.00	0.98	0.70	36.13	19.53	0.51
200	24.97	29.00	9.99	22.27	1.03	0.69	36.86	20.45	0.53
400	22.41	26.96	11.69	21.82	1.08	0.71	38.04	21.16	0.71
500	21.21	25.90	12.35	21.15	1.09	0.71	38.45	21.22	0.71
600	20.11	24.94	12.89	20.36	1.10	0.72	39.04	21.48	0.72
700	19.10	24.02	13.37	19.74	1.11	0.72	39.74	21.54	0.70
800	18.18	23.17	13.76	19.28	1.11	0.72	39.96	21.57	0.63
900	17.33	22.37	14.11	18.87	1.12	0.72	40.06	21.74	0.60
1000	16.55	21.64	14.42	18.51	1.12	0.73	40.73	21.65	0.63
1100	15.82	20.96	14.70	18.25	1.12	0.73	41.23	21.73	0.64
1200	15.16	20.33	14.94	17.98	1.13	0.73	41.10	21.79	0.66
1300	14.54	19.75	15.15	17.79	1.13	0.73	41.49	21.84	0.68
1400	13.96	19.20	15.31	17.65	1.13	0.73	41.84	21.95	0.70
1500	13.41	18.64	15.42	17.55	1.13	0.73	41.33	22.03	0.72
1600	12.91	18.16	15.49	17.51	1.13	0.73	41.67	22.04	0.75
1700	12.42	17.68	15.51	17.54	1.13	0.73	42.67	22.09	0.77
1800	11.97	17.23	15.47	17.68	1.13	0.73	42.46	22.25	0.78
1900	11.55	16.82	15.39	17.85	1.13	0.73	42.08	22.30	0.79
2000	11.14	16.41	15.28	18.02	1.13	0.74	41.59	22.33	0.81
2100	10.76	16.02	15.15	18.29	1.13	0.74	42.68	22.41	0.82
2200	10.39	15.66	15.00	18.61	1.13	0.74	43.43	22.45	0.84
2300	10.05	15.30	14.81	18.93	1.13	0.74	43.07	22.51	0.89
2400	9.72	14.96	14.63	19.28	1.13	0.74	42.91	22.55	0.94
2500	9.40	14.63	14.43	19.66	1.13	0.75	42.86	22.67	1.01
2600	9.10	14.33	14.27	20.05	1.13	0.75	42.61	22.74	1.09
2700	8.81	14.02	14.07	20.41	1.12	0.75	42.82	22.84	1.17
2800	8.52	13.72	13.96	20.79	1.12	0.75	43.13	22.80	1.24
2900	8.25	13.45	13.83	21.05	1.12	0.75	43.63	22.53	1.28
3000	7.99	13.18	13.78	21.21	1.12	0.75	44.18	22.27	1.30
3200	7.50	12.67	13.68	21.18	1.12	0.75	43.58	22.54	1.29
3300	7.27	12.43	13.65	21.06	1.12	0.75	43.58	22.81	1.30
3400	7.05	12.19	13.69	20.85	1.12	0.75	43.46	22.93	1.33
3500	6.83	11.95	13.73	20.58	1.11	0.75	44.65	22.98	1.36
3600	6.62	11.74	13.85	20.34	1.12	0.74	44.62	22.99	1.40
3700	6.42	11.52	13.93	19.94	1.11	0.74	44.62	23.04	1.45
3800	6.23	11.31	14.09	19.60	1.11	0.74	43.96	23.01	1.49
4000	5.86	10.92	14.34	18.96	1.11	0.73	44.30	22.84	1.57



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# MMIC Amplifier Die

PGA-103-D+

## Typical Performance Data

### Without Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 4.75V, Id = 86mA @Temperature = +25°C

FREQ.	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
50	26.94	30.81	6.84	14.07	0.90	0.77	36.67	18.77	0.39
100	26.10	29.83	8.71	19.04	0.98	0.70	36.84	19.06	0.50
200	24.94	28.95	9.96	22.49	1.03	0.69	37.21	20.09	0.52
400	22.38	26.89	11.66	22.21	1.08	0.71	37.70	20.88	0.71
500	21.18	25.84	12.31	21.53	1.09	0.71	38.31	20.98	0.70
600	20.08	24.89	12.85	20.71	1.10	0.72	38.92	21.15	0.73
700	19.08	23.97	13.32	20.11	1.11	0.72	39.36	21.26	0.70
800	18.16	23.13	13.71	19.64	1.11	0.72	39.79	21.33	0.63
900	17.31	22.35	14.07	19.18	1.12	0.73	40.27	21.38	0.60
1000	16.53	21.62	14.37	18.84	1.12	0.73	40.57	21.38	0.64
1100	15.80	20.94	14.65	18.58	1.12	0.73	40.86	21.43	0.64
1200	15.14	20.28	14.89	18.29	1.12	0.73	40.95	21.48	0.66
1300	14.51	19.69	15.10	18.10	1.13	0.73	41.21	21.52	0.68
1400	13.94	19.13	15.27	17.96	1.13	0.73	41.48	21.67	0.71
1500	13.39	18.60	15.36	17.85	1.13	0.73	41.51	21.73	0.72
1600	12.89	18.11	15.43	17.81	1.13	0.73	41.80	21.75	0.75
1700	12.40	17.64	15.45	17.83	1.13	0.73	42.03	21.79	0.77
1800	11.95	17.19	15.41	17.98	1.13	0.73	42.17	21.88	0.78
1900	11.53	16.77	15.34	18.14	1.13	0.73	42.26	22.02	0.79
2000	11.13	16.37	15.22	18.35	1.13	0.74	42.41	22.07	0.81
2100	10.74	15.98	15.09	18.60	1.13	0.74	42.61	22.14	0.83
2200	10.38	15.63	14.94	18.92	1.13	0.74	42.90	22.18	0.85
2300	10.03	15.26	14.75	19.25	1.13	0.74	43.05	22.26	0.88
2400	9.70	14.91	14.58	19.62	1.13	0.74	43.27	22.32	0.94
2500	9.38	14.58	14.38	20.03	1.12	0.74	43.24	22.40	1.01
2600	9.08	14.28	14.22	20.44	1.12	0.75	43.24	22.47	1.09
2700	8.79	13.97	14.04	20.77	1.12	0.75	43.26	22.50	1.17
2800	8.50	13.68	13.91	21.20	1.12	0.75	42.95	22.45	1.23
2900	8.23	13.41	13.78	21.44	1.12	0.75	43.24	22.28	1.26
3000	7.97	13.14	13.73	21.58	1.12	0.75	43.63	22.00	1.28
3200	7.48	12.64	13.64	21.53	1.12	0.75	44.14	22.27	1.28
3300	7.25	12.39	13.61	21.38	1.12	0.75	44.14	22.54	1.28
3400	7.03	12.15	13.63	21.17	1.12	0.75	44.37	22.67	1.32
3500	6.81	11.92	13.69	20.86	1.11	0.75	44.13	22.66	1.36
3600	6.60	11.70	13.80	20.60	1.11	0.74	44.19	22.70	1.40
3700	6.40	11.48	13.88	20.17	1.11	0.74	44.09	22.77	1.43
3800	6.21	11.28	14.04	19.81	1.11	0.74	44.02	22.82	1.47
4000	5.84	10.89	14.27	19.17	1.11	0.73	44.05	22.68	1.54



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# MMIC Amplifier Die

PGA-103-D+

## Typical Performance Data

### Without Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 5.25V, Id = 93mA @Temperature = +25°C

FREQ.	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
50	26.99	30.20	6.87	13.89	0.89	0.69	35.70	19.56	0.41
100	26.15	29.92	8.77	19.04	0.98	0.70	35.98	19.76	0.51
200	24.99	29.05	10.03	22.24	1.03	0.70	36.74	20.62	0.53
400	22.42	26.97	11.74	21.72	1.08	0.71	37.99	21.20	0.71
500	21.22	25.91	12.39	20.97	1.09	0.71	38.64	21.32	0.71
600	20.12	24.94	12.93	20.19	1.10	0.72	39.23	21.48	0.73
700	19.12	24.05	13.41	19.60	1.11	0.72	39.68	21.58	0.69
800	18.19	23.18	13.79	19.13	1.11	0.72	40.07	21.60	0.63
900	17.34	22.41	14.15	18.70	1.12	0.72	40.45	21.76	0.62
1000	16.56	21.67	14.45	18.37	1.12	0.73	40.79	21.68	0.65
1100	15.83	21.01	14.74	18.13	1.13	0.73	40.92	21.72	0.66
1200	15.17	20.37	14.98	17.84	1.13	0.73	41.24	21.80	0.68
1300	14.55	19.77	15.20	17.66	1.13	0.73	41.36	21.85	0.70
1400	13.97	19.20	15.35	17.52	1.13	0.73	41.34	21.96	0.73
1500	13.42	18.67	15.45	17.42	1.13	0.73	41.48	22.02	0.74
1600	12.92	18.18	15.53	17.38	1.13	0.73	41.88	22.00	0.76
1700	12.43	17.71	15.54	17.41	1.13	0.73	42.16	22.02	0.78
1800	11.98	17.26	15.49	17.54	1.13	0.73	42.34	22.16	0.79
1900	11.56	16.84	15.44	17.70	1.13	0.73	42.46	22.30	0.80
2000	11.15	16.43	15.33	17.89	1.13	0.74	42.79	22.35	0.82
2100	10.77	16.04	15.19	18.13	1.13	0.74	42.98	22.45	0.84
2200	10.40	15.68	15.02	18.45	1.13	0.74	43.25	22.45	0.85
2300	10.06	15.32	14.84	18.77	1.13	0.74	43.12	22.51	0.90
2400	9.73	14.99	14.66	19.12	1.13	0.74	44.15	22.58	0.96
2500	9.41	14.66	14.48	19.48	1.13	0.75	43.97	22.70	1.03
2600	9.11	14.34	14.29	19.89	1.13	0.75	43.98	22.78	1.11
2700	8.82	14.04	14.11	20.22	1.12	0.75	44.17	22.81	1.19
2800	8.53	13.75	13.99	20.60	1.12	0.75	44.10	22.73	1.26
2900	8.26	13.47	13.86	20.87	1.12	0.75	44.49	22.48	1.29
3000	8.00	13.21	13.79	21.02	1.12	0.75	43.66	22.18	1.31
3200	7.51	12.70	13.71	21.01	1.12	0.75	43.95	22.48	1.31
3300	7.28	12.45	13.67	20.92	1.12	0.75	43.95	22.83	1.31
3400	7.06	12.21	13.71	20.74	1.12	0.75	44.41	23.02	1.34
3500	6.84	11.98	13.75	20.45	1.12	0.75	44.68	23.00	1.38
3600	6.63	11.75	13.86	20.19	1.11	0.74	44.91	23.07	1.42
3700	6.44	11.54	13.94	19.81	1.11	0.74	45.26	23.06	1.46
3800	6.24	11.33	14.11	19.49	1.11	0.74	45.24	23.03	1.50
4000	5.87	10.94	14.36	18.86	1.11	0.73	44.59	22.90	1.59



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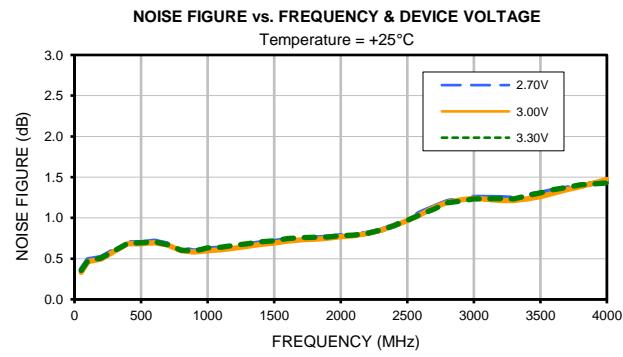
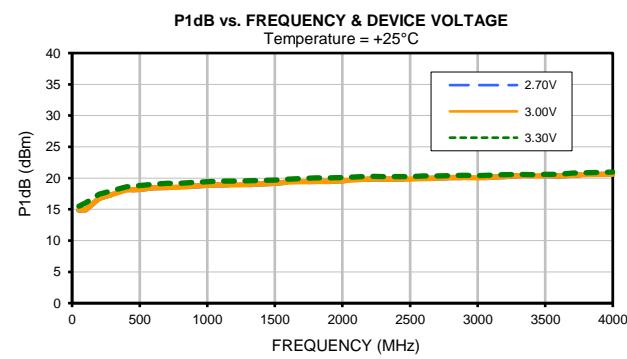
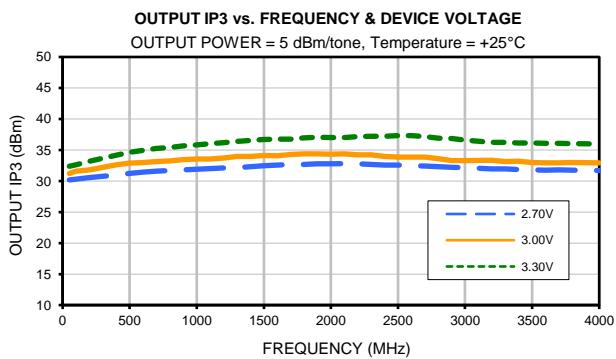
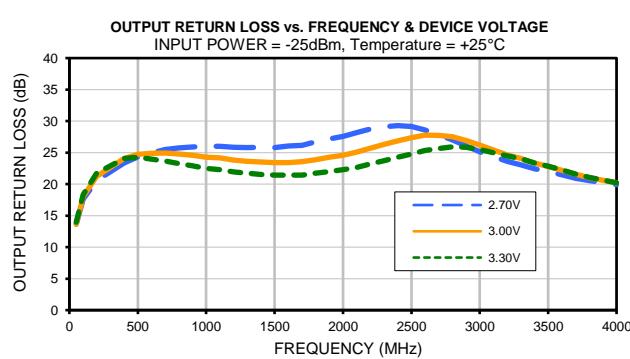
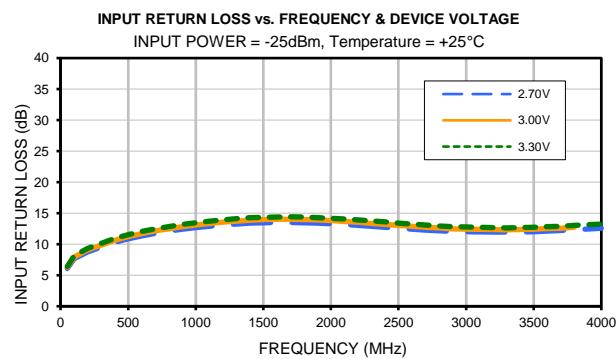
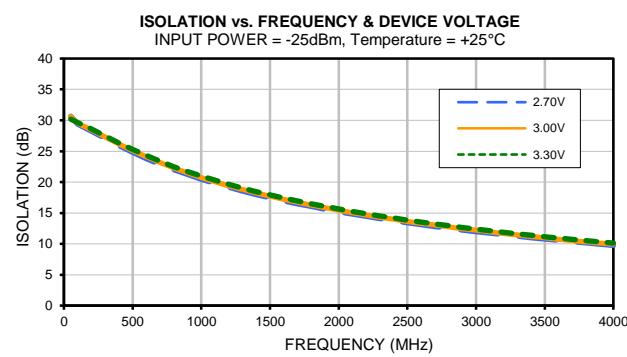
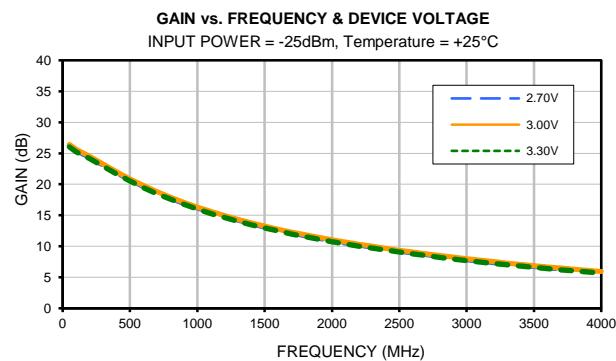
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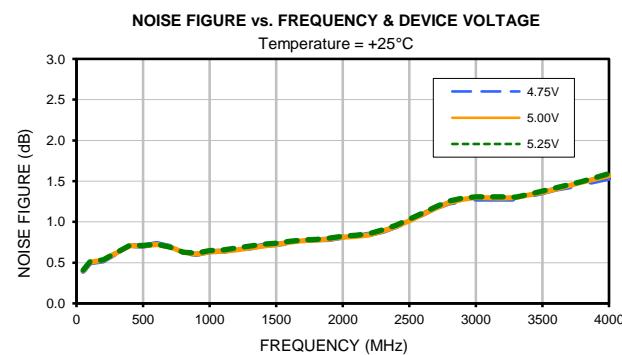
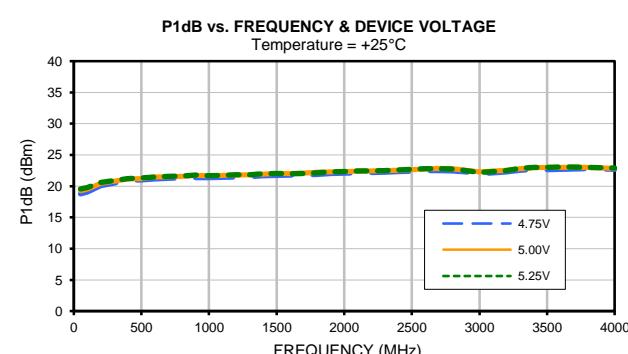
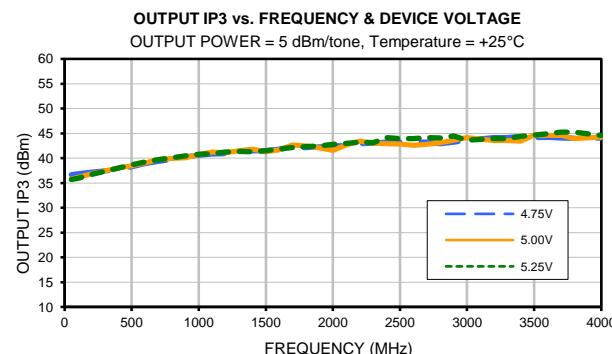
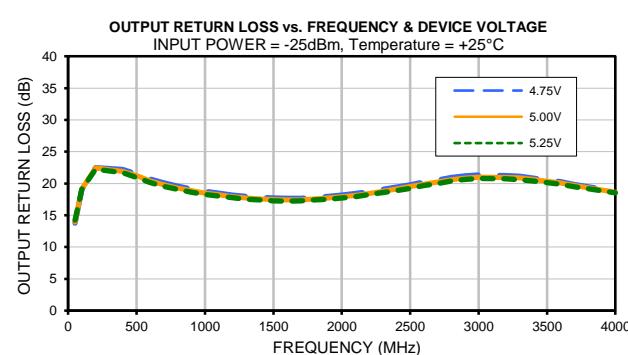
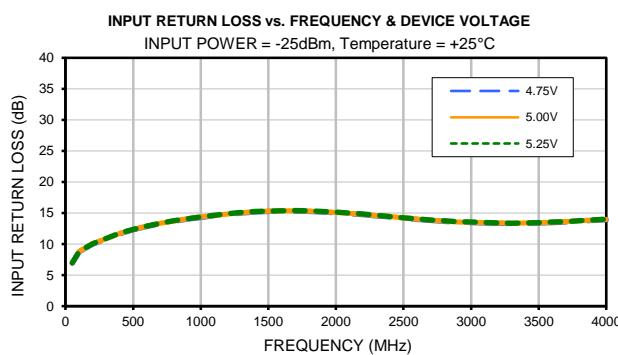
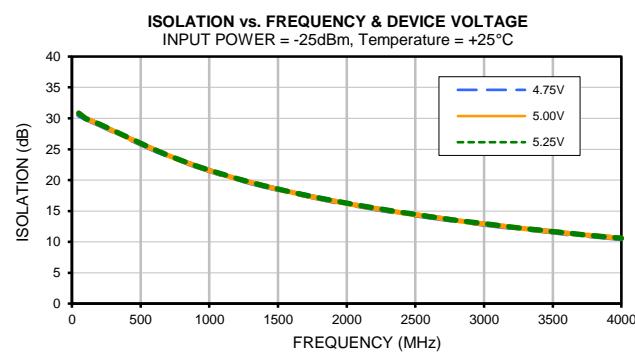
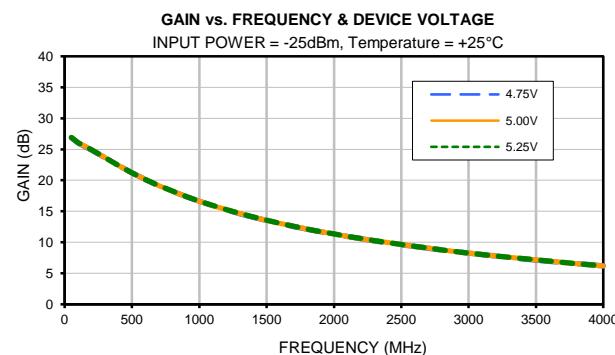
## Typical Performance Curves

### Full 2-Port Extension



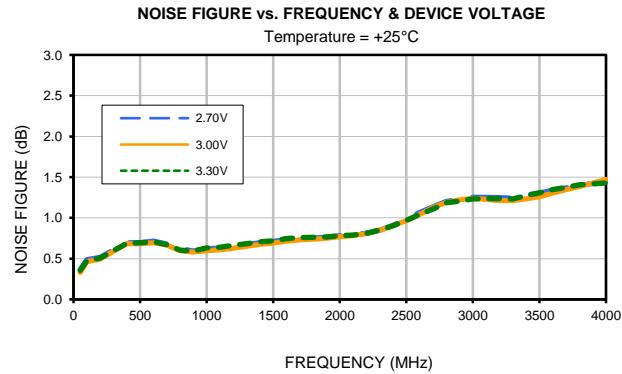
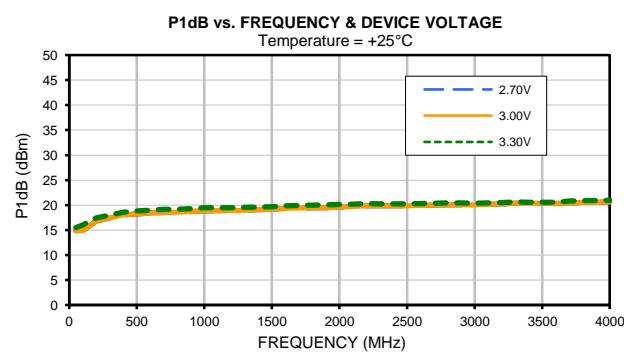
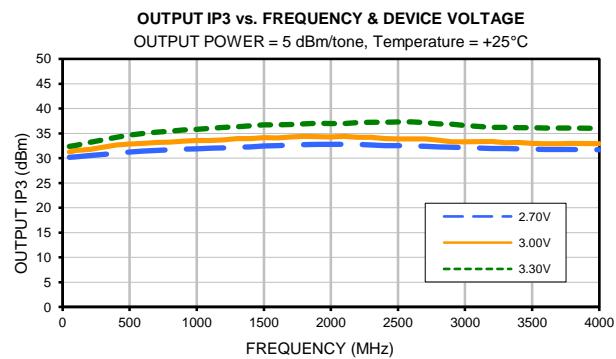
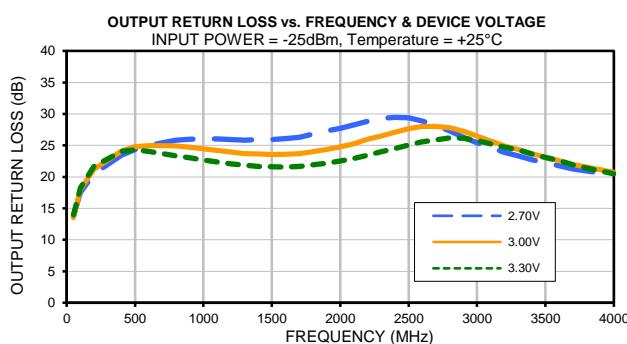
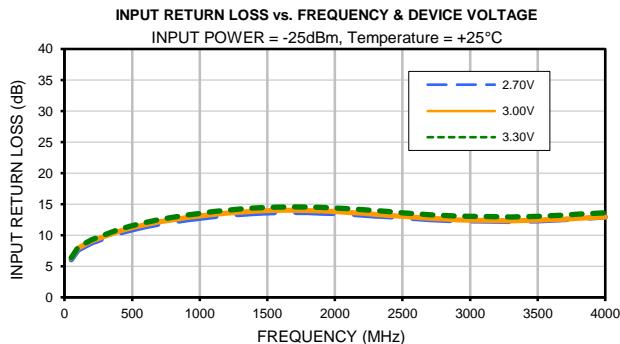
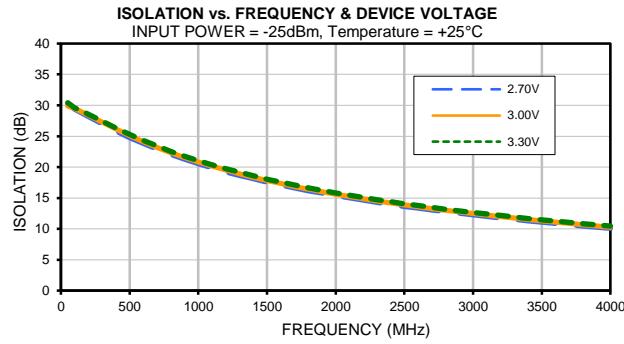
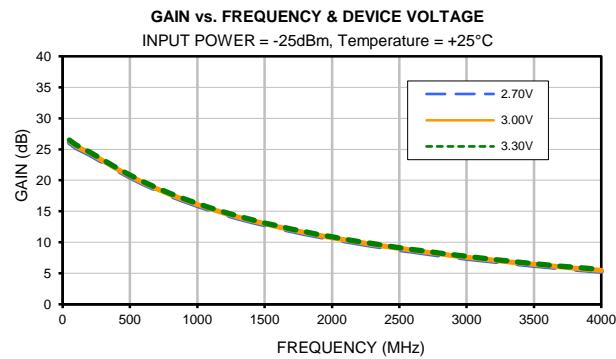
## Typical Performance Curves

### Full 2-Port Extension



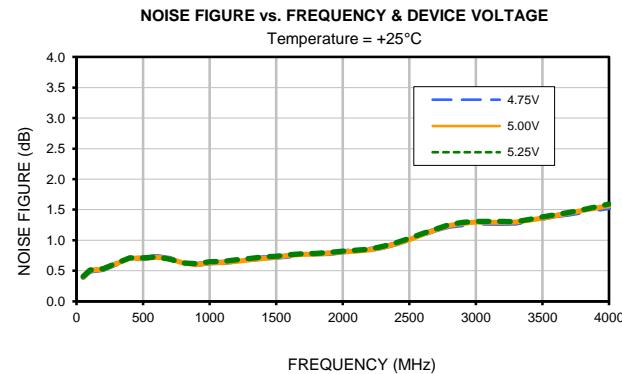
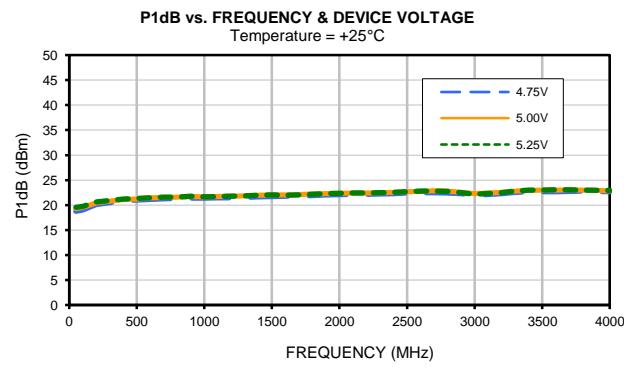
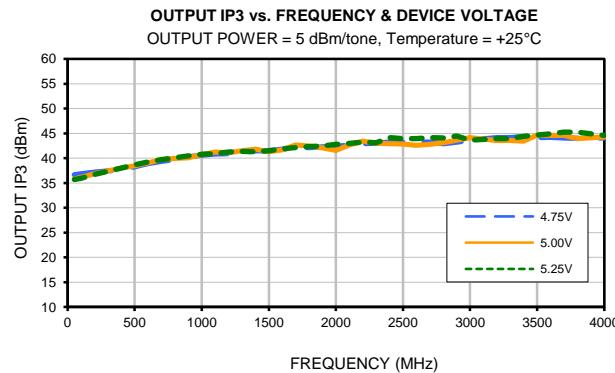
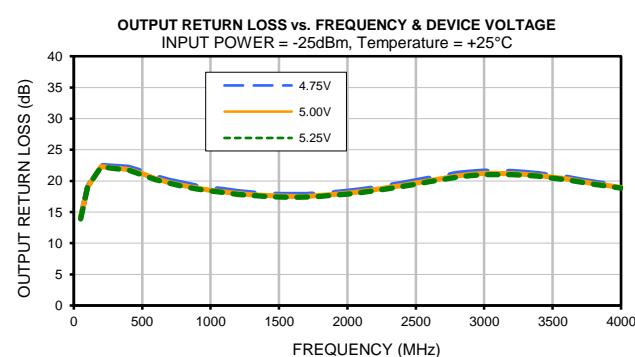
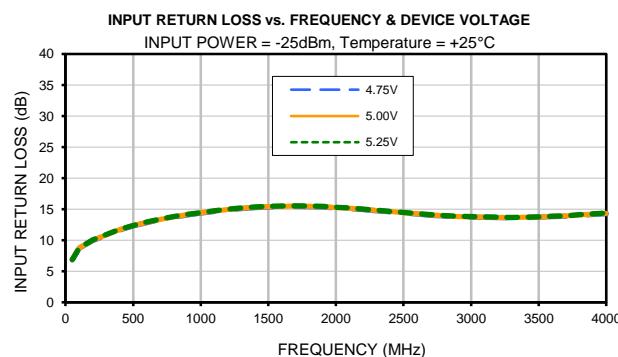
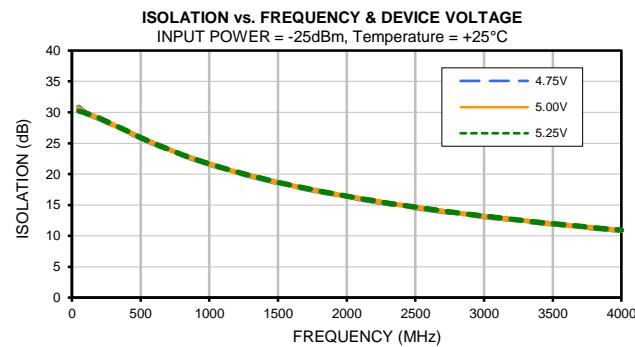
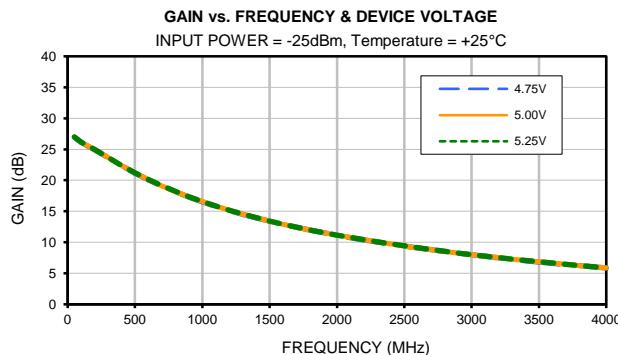
## Typical Performance Curves

### Without Full 2-Port Extension



## Typical Performance Curves

### Without Full 2-Port Extension



**Environmental Specifications****ENV80**

All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

Specification	Test/Inspection Condition	Reference/Spec
Operating Temperature	-40° to 85° C or -40° to 105° C or -55° to 105° C or -45° to 105° C Ambient Environment	Refer to Individual Model Data Sheet
Storage Environment (Die)	-65° to 150°C	Individual Model Data Sheet
Storage Environment(Packaging)	-40° to 70°C and 40 to 60% humidity (In Factory Shipped Package)	