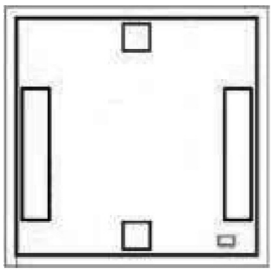
Flat Gain, High IP3

Monolithic Amplifier Die

GVA-62-D+

50Ω 0.01 to 6 GHz



The Big Deal

- Ultra Flat Gain
- Broadband High Dynamic Range without external Matching Components

Product Overview

GVA-62-D+ (RoHS compliant) is an wideband amplifier die fabricated using InGap HBT technology and offers ultra flat gain over a broad frequency range and with high IP3. In addition, the GVA-62-D+, has good input and Output return loss over a broad frequency range without the need for external matching components and has emonstrated excellent reliability. It has repeatable performance from lot to lot has very good thermal performance.

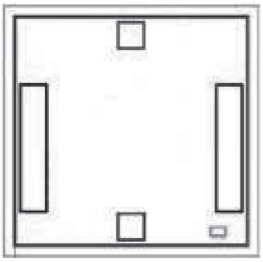
Key Features

Feature	Advantages
Broad Band: 0.01 to 6.0 GHz	Broadband covering primary wireless communications bands: Cellular, PCS, LTE, WiMAX
Ultra Flat Gain ±0.5 dB over 50 to 4000 MHz ±0.20 dB over 700 to 2700 MHz	Eliminates need for gain flattening for most applications
High IP3 vs. DC power Consumption 32 dBm typical at 0.05 GHz 33.8 dBm typical at 0.8 GHz	The GVA-62-D+ matches industry leading IP3 performance relative and power consumption. The combination of the design and InGap HBT Structure provides enhanced linearity over a broad frequency range. This feature makes this amplifier ideal for use in: • Driver amplifiers for complex waveform up converter paths • Drivers in linearized transmit systems
No External Matching Components Required	GVA-62-D+ provides input and Output return loss of 12 to 17 dB up to 3 GHz without the need for external matching components, saving real estate and reducing component count.

Flat Gain, High IP3

Monolithic Amplifier Die GVA-62-D+

50Ω 0.01 to 6 GHz



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

Ordering Information: Refer to Last Page

Product Features

- Excellent Gain flatness, ±0.5 dB over 50-4000 MHz
- Gain, 15.5 dB typ. at 0.8 GHz
- High POUT, P1dB 19.8 dBm typ. at 0.8 GHz
- High IP3, 33.8 dBm typ. at 0.8 GHz
- Excellent ESD protection, Class 1C for HBM
- No external matching components required

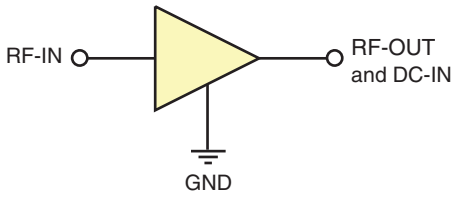
Typical Applications

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

General Description

GVA-62-D+ (RoHS compliant) is an advanced wideband amplifier die fabricated using InGap HBT technology offering high gain, excellent Gain flatness over a broad frequency range and high IP3. In addition, the GVA-62-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



Pad	Description
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.
GND	Connections to ground.

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

Electrical Specifications[1] at 25°C unless noted

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		0.01		6	GHz
Gain	0.05		16.5		dB
	0.8		15.5		
	2.0		15.7		
	3.0		15.9		
	4.0		15.8		
	6.0		13.5		
Gain flatness	0.05-4.0		±0.5		dB
	0.7-2.6		±0.2		
Input return loss	0.05		16.3		dB
	0.8		14.6		
	2.0		15.0		
	3.0		13.8		
	4.0		15.2		
	6.0		11.6		
Output return loss	0.05		12.5		dB
	0.85		16.7		
	2.0		15.2		
	3.0		12.5		
	4.0		9.7		
	6.0		6.9		
Reverse isolation	2.0		21.4		dB
Output power at 1dB compression	0.05		19.1		dBm
	0.8		19.8		
	2.0		19.4		
	3.0		17.9		
	4.0		15.8		
	6.0		12.0		
Output IP3	0.05		32.2		dBm
	0.8		33.8		
	2.0		32.8		
	3.0		29.7		
	4.0		27.2		
	6.0		23.8		
Noise figure	0.05		4.8		dB
	0.8		5.1		
	2.0		5.0		
	3.0		5.4		
	4.0		5.4		
	6.0		5.8		
Supply Operating Voltage (Vcc)			5.0		V
Device Operating Current		72	82	92	mA
Device Current Variation vs. Voltage			0.035		mA/V
Thermal Resistance, junction-to-ground lead			56		°C/W

1. Electrical Specifications are typical measured characteristics in Mini-Circuits die characterization test board. See Figure 1 for Test Circuit.

Absolute Maximum Ratings[2]

Parameter	Ratings
Operating Temperature	-40°C to 85°C
Junction Temperature	150°C
Operating Current at 5V	120 mA
Power Dissipation	0.725 W
Input Power (CW)	+24 dBm
DC Voltage at RF-OUT Pad[3]	6V

2. Permanent damage may occur if any of these limits are exceeded.
   These maximum ratings are not intended for continuous normal operations.
   Die performance measured in industry standard SOT-89 package.
3. For continuous operation, do not exceed 5.2V

Characterization Test Circuit

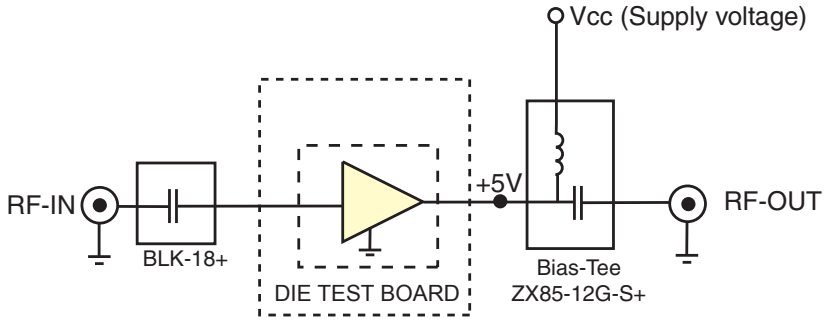


Figure 1: Block Diagram of Test Circuit used for characterization. Gain, Return loss, Output power at 1dB compression (P1 dB), output IP3 (OIP3) and Noise figure measured using Agilent's N5242A PNA-X microwave network analyzer.

Conditions:
1. Gain and Return loss: Pad= -25dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 0 dBm/tone at output.

Die Layout

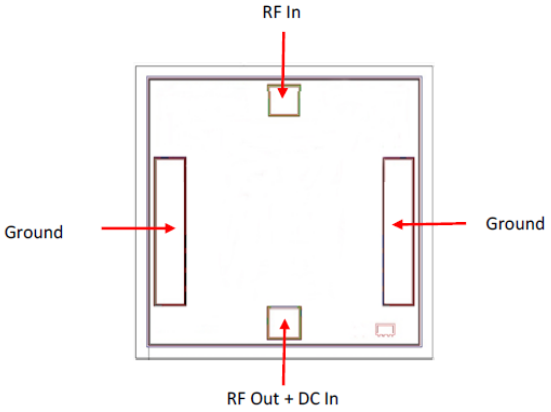


Fig 2. Die Layout

Bonding Pad Position

(Dimensions in µm, Typical)

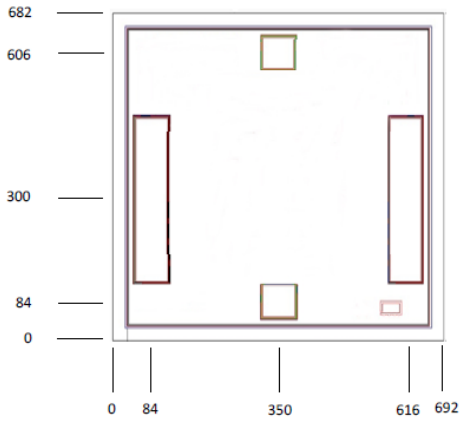


Fig 3. Bonding Pad Positions

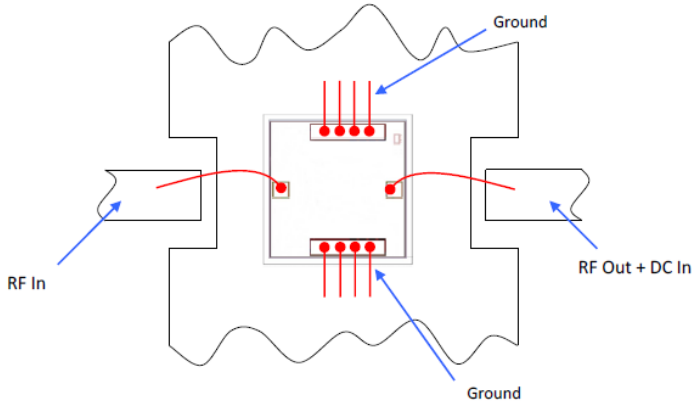
Critical Dimensions

Parameter	Values
Die Thickness, µm	100
Die Width, µm	692
Die Length, µm	682
Bond Pad Size(RF In, RF Out +DC In), µm	75 x 75
Bond Pad Size (Ground pads), µm	75 x 350

Assembly and Handling Procedure

1. Storage
   Dice should be stored in a dry nitrogen purged desiccators or equivalent.
2. ESD
   MMIC Gallium Arsenide (GaAs) 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 worksta tion. 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/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 manufac turer'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 low as reasonable to minimize performance degradation due to undesirable series inductance.

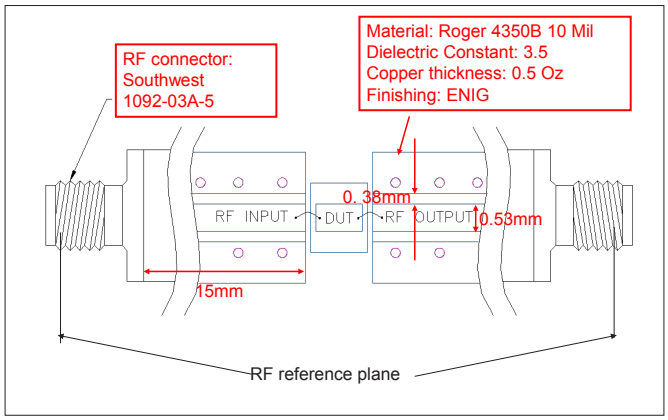
Assembly Diagram



Recommended Wire Length, Typical

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

RF Reference Plane - No port extension



Additional Detailed Technical Information

additional information is available on our dash board.

Performance Data	Data Table	
	Swept Graphs	
	S-Parameter (S2P Files) Data Set with and without port extension(.zip file)	
Case Style	Die	
Die Ordering and packaging information	Quantity, Package	Model No.
	Small, Gel - Pak: 10,50,100 KGD*	GVA-62-DG+
	Medium†, Partial wafer: KGD*<2255	GVA-62-DP+
	Large†, Full Wafer	GVA-62-DF+
	†*Available upon request contact sales representative*	
	Refer to AN-60-067	
Environmental Ratings	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 1C (1000 to <2000V) in accordance with ANSI/ESD STM 5.1 - 2001

** Tested in industry standard SOT-89 package.

Additional Notes

A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.

B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.

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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 = 82mA @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)
10	16.91	22.51	20.84	11.63	1.12	0.69	---	19.21	4.60
30	16.83	22.66	18.10	12.36	1.13	0.73	34.04	19.53	4.60
50	16.47	22.20	16.81	13.12	1.13	0.74	32.18	19.25	4.70
100	16.14	21.87	15.21	15.41	1.14	0.76	35.29	19.87	4.92
200	15.83	21.66	15.15	16.85	1.16	0.77	33.38	19.76	4.89
300	15.70	21.63	14.58	18.42	1.17	0.79	33.75	19.88	5.02
400	15.62	21.68	14.41	17.80	1.18	0.79	33.82	19.80	5.15
500	15.61	21.66	15.01	16.95	1.18	0.79	36.20	19.90	5.12
700	15.54	21.73	15.26	17.47	1.20	0.79	36.47	19.84	5.07
800	15.54	21.75	15.63	16.97	1.20	0.79	37.42	19.79	5.01
1000	15.52	21.78	15.64	17.00	1.20	0.79	37.43	19.89	5.03
1200	15.54	21.81	16.05	16.48	1.20	0.78	34.95	19.59	4.96
1300	15.55	21.83	16.13	16.12	1.20	0.78	34.74	19.71	4.97
1400	15.57	21.84	16.30	16.02	1.20	0.78	33.81	19.85	4.97
1500	15.57	21.85	16.43	16.52	1.21	0.78	36.44	19.71	4.96
1600	15.61	21.84	16.26	15.89	1.20	0.78	35.21	19.63	4.95
1700	15.64	21.82	16.59	16.11	1.20	0.77	34.13	19.63	4.96
1800	15.66	21.85	16.31	16.12	1.20	0.77	34.19	19.64	5.01
1900	15.70	21.84	16.15	16.17	1.20	0.77	33.61	19.43	4.95
2000	15.72	21.83	16.77	16.02	1.20	0.76	32.79	19.40	4.92
2100	15.76	21.86	16.34	16.05	1.20	0.76	32.79	19.44	5.01
2200	15.79	21.84	16.23	15.95	1.19	0.76	32.30	19.33	4.97
2300	15.82	21.84	16.34	15.81	1.19	0.76	31.88	19.16	5.00
2400	15.86	21.82	16.29	15.61	1.19	0.75	31.74	19.03	5.00
2500	15.90	21.79	16.28	14.91	1.17	0.74	32.74	18.93	4.93
2600	15.93	21.83	16.44	14.91	1.18	0.74	31.05	18.84	5.08
2700	15.97	21.79	16.19	14.39	1.17	0.73	30.54	18.76	5.16
2800	16.00	21.79	16.07	13.99	1.16	0.73	30.63	18.41	5.23
2900	16.04	21.73	16.17	13.46	1.15	0.71	30.40	18.39	5.26
3000	16.06	21.70	15.77	13.21	1.14	0.71	30.65	17.92	5.20
3100	16.08	21.66	15.88	12.86	1.14	0.70	30.15	17.82	5.15
3200	16.10	21.66	16.02	12.44	1.13	0.69	29.97	17.59	5.17
3300	16.12	21.67	15.77	12.20	1.13	0.69	29.80	17.31	5.18
3400	16.12	21.65	15.92	11.78	1.12	0.68	29.71	17.07	5.22
3500	16.12	21.59	16.18	11.64	1.12	0.67	29.29	17.05	5.19
3600	16.13	21.60	16.12	11.24	1.11	0.67	29.56	16.75	5.17
3800	16.11	21.53	16.69	10.80	1.10	0.65	28.85	16.32	5.27
4000	16.07	21.44	17.09	10.40	1.09	0.64	28.16	15.81	5.29
4200	16.02	21.32	17.48	9.99	1.08	0.62	27.31	15.62	5.23
4400	15.94	21.23	17.95	9.67	1.08	0.61	26.86	14.85	5.36
4600	15.84	21.09	17.72	9.28	1.06	0.60	26.90	14.43	5.23
4800	15.69	20.98	17.57	9.08	1.06	0.60	25.94	14.22	5.31
5000	15.51	20.85	17.21	8.72	1.06	0.59	26.00	13.59	5.40
5200	15.29	20.75	16.41	8.47	1.05	0.59	25.41	13.42	5.34
5400	15.03	20.61	15.55	8.20	1.05	0.59	25.24	13.01	5.46
5600	14.71	20.56	14.59	7.84	1.06	0.59	25.15	12.72	5.69
5800	14.35	20.48	13.67	7.43	1.06	0.59	24.41	12.65	5.57
6000	13.96	20.44	12.62	7.06	1.07	0.60	24.21	11.96	5.64

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 = 74mA @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)
10	16.87	22.43	21.58	11.53	1.12	0.68	---	18.33	4.53
30	16.79	22.65	18.41	12.28	1.14	0.72	33.46	18.78	4.52
50	16.44	22.21	17.06	12.85	1.13	0.73	33.42	18.37	4.61
100	16.10	21.81	15.35	15.33	1.14	0.76	34.05	19.08	4.83
200	15.79	21.60	15.33	16.70	1.16	0.77	34.97	18.97	4.83
300	15.65	21.59	14.72	18.23	1.18	0.78	33.04	19.09	4.93
400	15.55	21.66	14.62	17.56	1.18	0.79	38.12	19.00	5.07
500	15.52	21.65	15.25	16.81	1.18	0.79	36.65	19.09	5.04
700	15.41	21.77	15.63	17.10	1.21	0.80	36.23	19.04	4.96
800	15.39	21.81	15.96	16.85	1.22	0.80	35.57	19.01	4.93
1000	15.34	21.89	16.00	16.85	1.23	0.80	37.66	19.05	4.94
1200	15.32	21.96	16.54	16.47	1.24	0.80	35.65	18.81	4.91
1300	15.31	21.99	16.56	16.22	1.24	0.80	36.92	18.89	4.88
1400	15.32	21.98	16.78	16.14	1.24	0.80	35.63	18.87	4.87
1500	15.31	22.01	16.89	16.59	1.25	0.80	34.59	18.88	4.87
1600	15.33	22.02	16.67	16.05	1.24	0.80	35.35	18.86	4.82
1700	15.34	22.06	17.13	16.40	1.25	0.80	34.88	18.85	4.89
1800	15.35	22.06	16.72	16.44	1.25	0.80	33.19	18.89	4.93
1900	15.38	22.09	16.55	16.43	1.25	0.80	34.11	18.67	4.88
2000	15.39	22.10	17.21	16.23	1.26	0.79	34.63	18.68	4.82
2100	15.41	22.10	16.62	16.44	1.25	0.79	32.08	18.73	4.91
2200	15.43	22.11	16.64	16.24	1.25	0.79	33.46	18.61	4.89
2300	15.45	22.12	16.78	16.13	1.25	0.79	32.24	18.64	4.89
2400	15.47	22.10	16.75	15.84	1.25	0.78	32.44	18.41	4.90
2500	15.51	22.10	16.80	15.16	1.24	0.78	31.17	18.45	4.85
2600	15.51	22.11	17.06	15.22	1.24	0.78	31.60	18.38	4.99
2700	15.55	22.07	16.83	14.50	1.23	0.77	30.88	18.15	5.10
2800	15.58	22.05	16.67	14.19	1.22	0.76	31.19	17.81	5.12
2900	15.61	22.04	16.81	13.63	1.22	0.75	30.20	17.78	5.17
3000	15.63	22.05	16.27	13.47	1.21	0.75	29.72	17.50	5.09
3100	15.64	22.01	16.37	13.11	1.20	0.75	30.05	17.40	5.05
3200	15.66	22.00	16.57	12.70	1.20	0.74	29.88	17.18	5.05
3300	15.67	21.96	16.23	12.51	1.19	0.73	29.56	16.91	5.10
3400	15.67	21.95	16.30	12.04	1.18	0.73	28.69	16.66	5.10
3500	15.66	21.94	16.69	11.99	1.18	0.72	29.44	16.64	5.11
3600	15.66	21.87	16.55	11.57	1.17	0.71	28.09	16.35	5.07
3800	15.64	21.83	17.21	11.19	1.17	0.70	28.60	15.91	5.14
4000	15.59	21.73	17.62	10.87	1.16	0.69	27.82	15.40	5.17
4200	15.55	21.64	18.13	10.40	1.15	0.68	27.03	15.21	5.13
4400	15.47	21.50	18.58	10.09	1.14	0.67	27.06	14.44	5.27
4600	15.36	21.36	18.25	9.69	1.12	0.66	26.49	14.01	5.12
4800	15.21	21.23	18.11	9.50	1.12	0.65	26.10	13.79	5.20
5000	15.04	21.10	17.69	9.06	1.11	0.64	25.65	13.17	5.32
5200	14.81	20.97	16.79	8.83	1.11	0.64	25.33	12.99	5.22
5400	14.56	20.82	15.91	8.55	1.11	0.64	24.79	12.59	5.39
5600	14.23	20.73	14.97	8.15	1.12	0.64	24.79	12.29	5.57
5800	13.88	20.70	14.03	7.80	1.13	0.64	23.88	12.22	5.47
6000	13.49	20.65	12.92	7.44	1.13	0.65	24.17	11.76	5.52

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 = 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)
10	16.94	22.93	20.55	11.38	1.14	0.71	---	19.92	4.68
30	16.86	22.68	17.86	12.44	1.13	0.73	29.88	20.14	4.67
50	16.53	22.34	16.79	13.31	1.14	0.74	35.56	19.87	4.79
100	16.17	21.89	15.12	15.45	1.14	0.76	35.63	20.51	4.99
200	15.88	21.67	15.02	16.85	1.16	0.77	34.23	20.51	4.98
300	15.76	21.65	14.48	18.26	1.17	0.78	37.74	20.64	5.11
400	15.72	21.64	14.23	17.89	1.17	0.79	39.22	20.56	5.21
500	15.72	21.65	14.84	16.98	1.17	0.78	38.72	20.68	5.20
700	15.69	21.68	14.94	17.74	1.18	0.78	35.65	20.60	5.14
800	15.69	21.68	15.40	17.06	1.18	0.78	37.42	20.54	5.10
1000	15.70	21.66	15.35	17.09	1.18	0.78	35.06	20.66	5.10
1200	15.74	21.70	15.68	16.47	1.18	0.77	35.08	20.25	5.01
1300	15.77	21.70	15.78	16.06	1.17	0.77	35.62	20.38	5.06
1400	15.80	21.65	15.95	15.91	1.16	0.76	36.30	20.38	5.09
1500	15.81	21.69	16.09	16.43	1.17	0.76	33.43	20.38	5.04
1600	15.86	21.67	15.93	15.81	1.16	0.76	35.31	20.12	5.03
1700	15.89	21.66	16.19	15.84	1.16	0.75	34.93	20.13	5.04
1800	15.93	21.65	16.00	15.83	1.16	0.75	35.33	20.11	5.10
1900	15.98	21.62	15.86	15.91	1.15	0.75	35.18	20.03	5.11
2000	16.01	21.63	16.39	15.78	1.16	0.74	34.16	19.84	5.00
2100	16.05	21.63	16.11	15.69	1.15	0.73	33.39	19.88	5.08
2200	16.09	21.60	15.93	15.68	1.15	0.73	30.39	19.79	5.06
2300	16.13	21.62	15.98	15.53	1.15	0.73	32.46	19.58	5.05
2400	16.17	21.59	15.96	15.38	1.14	0.72	32.42	19.42	5.08
2500	16.22	21.55	15.91	14.74	1.13	0.71	31.13	19.33	5.04
2600	16.25	21.54	16.00	14.64	1.13	0.70	32.80	19.25	5.17
2700	16.29	21.53	15.73	14.28	1.12	0.70	30.66	18.99	5.29
2800	16.33	21.50	15.63	13.82	1.11	0.69	30.70	18.63	5.36
2900	16.37	21.49	15.71	13.34	1.11	0.68	29.82	18.61	5.34
3000	16.40	21.44	15.38	13.02	1.10	0.67	30.16	18.31	5.28
3100	16.43	21.43	15.51	12.65	1.09	0.66	30.60	18.22	5.25
3200	16.45	21.44	15.63	12.24	1.09	0.65	29.46	17.99	5.26
3300	16.48	21.38	15.42	11.94	1.08	0.64	29.43	17.71	5.27
3400	16.48	21.37	15.64	11.57	1.07	0.64	29.00	17.48	5.29
3500	16.49	21.34	15.82	11.34	1.07	0.63	28.78	17.26	5.29
3600	16.50	21.31	15.78	11.00	1.06	0.62	28.61	17.17	5.29
3800	16.49	21.24	16.29	10.48	1.05	0.60	27.66	16.73	5.36
4000	16.46	21.17	16.63	10.04	1.04	0.59	27.42	16.23	5.39
4200	16.41	21.08	17.03	9.63	1.04	0.57	27.30	15.84	5.35
4400	16.33	20.98	17.46	9.31	1.03	0.56	27.10	15.28	5.48
4600	16.24	20.87	17.31	8.94	1.02	0.55	26.59	14.85	5.34
4800	16.09	20.75	17.17	8.73	1.02	0.54	25.88	14.64	5.42
5000	15.92	20.63	16.82	8.43	1.01	0.54	25.57	14.02	5.56
5200	15.70	20.50	16.12	8.16	1.01	0.53	25.51	13.63	5.47
5400	15.44	20.40	15.25	7.88	1.01	0.53	24.98	13.22	5.61
5600	15.12	20.32	14.28	7.52	1.01	0.53	24.65	12.92	5.83
5800	14.77	20.28	13.39	7.08	1.01	0.54	24.38	12.86	5.72
6000	14.38	20.27	12.38	6.69	1.01	0.54	24.15	12.40	5.78

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 = 82mA @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)
10	17.01	22.69	20.75	11.48	1.12	0.69	---	19.21	4.60
30	16.89	22.58	17.98	12.33	1.12	0.72	34.04	19.53	4.60
50	16.55	22.00	16.90	13.57	1.11	0.72	32.18	19.25	4.70
100	16.17	21.82	15.19	15.34	1.13	0.76	35.29	19.87	4.92
200	15.84	21.64	14.80	16.98	1.16	0.77	33.38	19.76	4.89
300	15.69	21.65	14.36	18.11	1.17	0.79	33.75	19.88	5.02
400	15.64	21.66	14.57	17.66	1.18	0.79	33.82	19.80	5.15
500	15.59	21.66	15.21	17.13	1.18	0.79	36.20	19.90	5.12
700	15.53	21.75	15.29	17.41	1.20	0.79	36.47	19.84	5.07
800	15.51	21.76	15.40	17.25	1.20	0.79	37.42	19.79	5.01
1000	15.50	21.79	15.85	16.96	1.21	0.79	37.43	19.89	5.03
1200	15.50	21.85	16.26	16.53	1.21	0.79	34.95	19.59	4.96
1300	15.51	21.86	16.22	16.26	1.21	0.79	34.74	19.71	4.97
1400	15.53	21.87	16.32	16.18	1.21	0.78	33.81	19.85	4.97
1500	15.53	21.89	16.65	16.37	1.22	0.78	36.44	19.71	4.96
1600	15.56	21.89	16.50	16.14	1.21	0.78	35.21	19.63	4.95
1700	15.58	21.91	16.57	15.98	1.21	0.78	34.13	19.63	4.96
1800	15.61	21.88	16.45	15.96	1.21	0.78	34.19	19.64	5.01
1900	15.64	21.90	16.53	16.05	1.21	0.78	33.61	19.43	4.95
2000	15.66	21.93	16.86	15.84	1.21	0.77	32.79	19.40	4.92
2100	15.67	21.90	16.54	15.82	1.21	0.77	32.79	19.44	5.01
2200	15.70	21.90	16.62	15.78	1.21	0.77	32.30	19.33	4.97
2300	15.72	21.88	16.38	15.73	1.20	0.76	31.88	19.16	5.00
2400	15.76	21.92	16.45	15.36	1.20	0.76	31.74	19.03	5.00
2500	15.78	21.89	16.63	14.99	1.20	0.75	32.74	18.93	4.93
2600	15.81	21.88	16.37	14.87	1.19	0.75	31.05	18.84	5.08
2700	15.83	21.88	16.40	14.46	1.19	0.74	30.54	18.76	5.16
2800	15.86	21.85	16.29	14.22	1.18	0.74	30.63	18.41	5.23
2900	15.89	21.86	16.16	13.63	1.17	0.73	30.40	18.39	5.26
3000	15.90	21.85	16.07	13.42	1.17	0.73	30.65	17.92	5.20
3100	15.92	21.81	16.09	13.00	1.16	0.72	30.15	17.82	5.15
3200	15.93	21.83	16.22	12.60	1.16	0.72	29.97	17.59	5.17
3300	15.93	21.81	16.21	12.31	1.15	0.71	29.80	17.31	5.18
3400	15.93	21.79	16.34	11.96	1.15	0.70	29.71	17.07	5.22
3500	15.92	21.77	16.46	11.75	1.15	0.70	29.29	17.05	5.19
3600	15.91	21.77	16.55	11.34	1.14	0.69	29.56	16.75	5.17
3800	15.88	21.71	17.00	10.80	1.13	0.68	28.85	16.32	5.27
4000	15.81	21.65	17.61	10.47	1.13	0.67	28.16	15.81	5.29
4200	15.74	21.57	17.92	10.10	1.12	0.66	27.31	15.62	5.23
4400	15.64	21.50	18.11	9.79	1.12	0.65	26.86	14.85	5.36
4600	15.51	21.40	18.13	9.49	1.11	0.65	26.90	14.43	5.23
4800	15.33	21.29	17.86	9.30	1.11	0.65	25.94	14.22	5.31
5000	15.13	21.19	17.53	9.09	1.11	0.65	26.00	13.59	5.40
5200	14.89	21.09	16.96	8.87	1.12	0.65	25.41	13.42	5.34
5400	14.60	21.03	16.11	8.58	1.13	0.65	25.24	13.01	5.46
5600	14.26	20.96	15.02	8.22	1.13	0.65	25.15	12.72	5.69
5800	13.88	20.93	14.16	7.83	1.15	0.65	24.41	12.65	5.57
6000	13.46	20.92	13.32	7.47	1.16	0.66	24.21	11.96	5.64

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 = 74mA @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)
10	16.95	22.91	21.13	10.96	1.13	0.70	---	18.33	4.53
30	16.84	22.56	18.39	12.18	1.12	0.72	33.46	18.78	4.52
50	16.52	22.24	17.16	12.95	1.13	0.73	33.42	18.37	4.61
100	16.16	21.77	15.56	15.02	1.13	0.75	34.05	19.08	4.83
200	15.88	21.56	15.09	16.65	1.15	0.77	34.97	18.97	4.83
300	15.77	21.55	14.56	17.58	1.16	0.78	33.04	19.09	4.93
400	15.73	21.49	14.61	17.25	1.15	0.78	38.12	19.00	5.07
500	15.72	21.51	15.28	16.87	1.16	0.77	36.65	19.09	5.04
700	15.71	21.53	15.34	17.29	1.17	0.77	36.23	19.04	4.96
800	15.71	21.56	15.49	16.98	1.17	0.77	35.57	19.01	4.93
1000	15.73	21.56	15.68	16.59	1.17	0.77	37.66	19.05	4.94
1200	15.75	21.56	16.11	16.17	1.17	0.76	35.65	18.81	4.91
1300	15.77	21.58	16.12	15.84	1.17	0.76	36.92	18.89	4.88
1400	15.80	21.56	16.19	15.82	1.16	0.76	35.63	18.87	4.87
1500	15.81	21.58	16.46	15.95	1.17	0.75	34.59	18.88	4.87
1600	15.83	21.57	16.45	15.76	1.17	0.75	35.35	18.86	4.82
1700	15.87	21.57	16.42	15.53	1.16	0.75	34.88	18.85	4.89
1800	15.90	21.56	16.37	15.49	1.16	0.74	33.19	18.89	4.93
1900	15.93	21.58	16.47	15.53	1.16	0.74	34.11	18.67	4.88
2000	15.96	21.54	16.70	15.44	1.16	0.73	34.63	18.68	4.82
2100	15.99	21.53	16.58	15.27	1.15	0.73	32.08	18.73	4.91
2200	16.02	21.54	16.49	15.32	1.15	0.73	33.46	18.61	4.89
2300	16.05	21.51	16.28	15.23	1.15	0.72	32.24	18.64	4.89
2400	16.09	21.55	16.36	14.87	1.15	0.72	32.44	18.41	4.90
2500	16.12	21.51	16.45	14.58	1.14	0.71	31.17	18.45	4.85
2600	16.14	21.50	16.23	14.38	1.14	0.71	31.60	18.38	4.99
2700	16.16	21.47	16.18	14.07	1.13	0.70	30.88	18.15	5.10
2800	16.19	21.51	16.09	13.75	1.13	0.70	31.19	17.81	5.12
2900	16.21	21.45	15.94	13.26	1.12	0.69	30.20	17.78	5.17
3000	16.23	21.46	15.91	12.97	1.11	0.68	29.72	17.50	5.09
3100	16.24	21.41	15.97	12.60	1.11	0.67	30.05	17.40	5.05
3200	16.24	21.40	16.03	12.20	1.10	0.66	29.88	17.18	5.05
3300	16.25	21.40	16.02	11.86	1.10	0.66	29.56	16.91	5.10
3400	16.24	21.41	16.22	11.56	1.10	0.65	28.69	16.66	5.10
3500	16.24	21.35	16.34	11.27	1.09	0.64	29.44	16.64	5.11
3600	16.22	21.35	16.43	10.93	1.09	0.64	28.09	16.35	5.07
3800	16.18	21.26	16.85	10.39	1.07	0.62	28.60	15.91	5.14
4000	16.11	21.20	17.38	10.04	1.07	0.61	27.82	15.40	5.17
4200	16.03	21.14	17.68	9.67	1.06	0.60	27.03	15.21	5.13
4400	15.92	21.04	17.88	9.39	1.06	0.60	27.06	14.44	5.27
4600	15.78	20.96	17.87	9.14	1.06	0.59	26.49	14.01	5.12
4800	15.60	20.85	17.68	8.95	1.06	0.59	26.10	13.79	5.20
5000	15.40	20.76	17.31	8.77	1.06	0.60	25.65	13.17	5.32
5200	15.16	20.64	16.67	8.53	1.06	0.60	25.33	12.99	5.22
5400	14.88	20.57	15.90	8.26	1.07	0.60	24.79	12.59	5.39
5600	14.55	20.51	14.79	7.90	1.07	0.60	24.79	12.29	5.57
5800	14.17	20.49	13.86	7.50	1.08	0.61	23.88	12.22	5.47
6000	13.76	20.46	13.04	7.15	1.10	0.61	24.17	11.76	5.52

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)

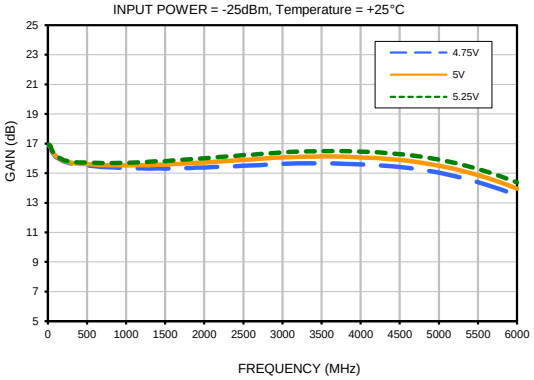
TEST CONDITIONS: Vd = 5.25V, Id = 91mA @Temperature = +25°C

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)
10	17.02	22.90	20.17	11.59	1.13	0.71	---	19.92	4.68
30	16.92	22.58	17.81	12.41	1.12	0.72	29.88	20.14	4.67
50	16.59	22.07	16.62	13.50	1.11	0.73	35.56	19.87	4.79
100	16.20	21.87	14.89	15.54	1.13	0.76	35.63	20.51	4.99
200	15.85	21.68	14.62	17.20	1.16	0.78	34.23	20.51	4.98
300	15.70	21.70	14.25	18.48	1.18	0.79	37.74	20.64	5.11
400	15.61	21.76	14.50	17.99	1.19	0.80	39.22	20.56	5.21
500	15.54	21.76	15.09	17.41	1.19	0.80	38.72	20.68	5.20
700	15.45	21.89	15.30	17.51	1.22	0.80	35.65	20.60	5.14
800	15.40	21.96	15.51	17.40	1.23	0.81	37.42	20.54	5.10
1000	15.35	22.00	15.96	17.22	1.24	0.81	35.06	20.66	5.10
1200	15.32	22.07	16.36	16.91	1.25	0.81	35.08	20.25	5.01
1300	15.32	22.12	16.20	16.61	1.25	0.81	35.62	20.38	5.06
1400	15.33	22.13	16.41	16.48	1.25	0.81	36.30	20.38	5.09
1500	15.32	22.15	16.87	16.71	1.26	0.81	33.43	20.38	5.04
1600	15.33	22.17	16.58	16.46	1.26	0.81	35.31	20.12	5.03
1700	15.35	22.16	16.86	16.33	1.26	0.80	34.93	20.13	5.04
1800	15.36	22.17	16.65	16.40	1.26	0.80	35.33	20.11	5.10
1900	15.38	22.18	16.58	16.51	1.26	0.80	35.18	20.03	5.11
2000	15.40	22.22	16.99	16.26	1.26	0.80	34.16	19.84	5.00
2100	15.43	22.22	16.49	16.36	1.26	0.80	33.39	19.88	5.08
2200	15.44	22.23	16.77	16.21	1.26	0.80	30.39	19.79	5.06
2300	15.46	22.23	16.54	16.16	1.26	0.80	32.46	19.58	5.05
2400	15.49	22.23	16.54	15.81	1.26	0.79	32.42	19.42	5.08
2500	15.51	22.22	16.85	15.39	1.25	0.79	31.13	19.33	5.04
2600	15.54	22.23	16.55	15.32	1.25	0.78	32.80	19.25	5.17
2700	15.56	22.21	16.59	14.83	1.24	0.78	30.66	18.99	5.29
2800	15.59	22.20	16.51	14.66	1.24	0.77	30.70	18.63	5.36
2900	15.62	22.19	16.30	13.99	1.23	0.77	29.82	18.61	5.34
3000	15.63	22.21	16.18	13.82	1.23	0.77	30.16	18.31	5.28
3100	15.65	22.18	16.22	13.37	1.22	0.76	30.60	18.22	5.25
3200	15.65	22.19	16.37	12.97	1.21	0.75	29.46	17.99	5.26
3300	15.66	22.17	16.37	12.73	1.21	0.75	29.43	17.71	5.27
3400	15.66	22.14	16.42	12.33	1.20	0.74	29.00	17.48	5.29
3500	15.65	22.16	16.59	12.20	1.21	0.74	28.78	17.26	5.29
3600	15.65	22.10	16.67	11.73	1.19	0.73	28.61	17.17	5.29
3800	15.62	22.10	17.14	11.17	1.19	0.72	27.66	16.73	5.36
4000	15.56	22.03	17.82	10.90	1.19	0.71	27.42	16.23	5.39
4200	15.50	21.95	18.15	10.55	1.18	0.70	27.30	15.84	5.35
4400	15.41	21.84	18.30	10.18	1.17	0.69	27.10	15.28	5.48
4600	15.30	21.76	18.31	9.82	1.16	0.69	26.59	14.85	5.34
4800	15.13	21.66	17.96	9.64	1.16	0.69	25.88	14.64	5.42
5000	14.95	21.55	17.70	9.39	1.16	0.68	25.57	14.02	5.56
5200	14.71	21.45	17.18	9.18	1.17	0.68	25.51	13.63	5.47
5400	14.45	21.39	16.24	8.87	1.18	0.68	24.98	13.22	5.61
5600	14.11	21.29	15.15	8.50	1.18	0.68	24.65	12.92	5.83
5800	13.74	21.29	14.32	8.11	1.20	0.69	24.38	12.86	5.72
6000	13.34	21.24	13.47	7.77	1.21	0.69	24.15	12.40	5.78

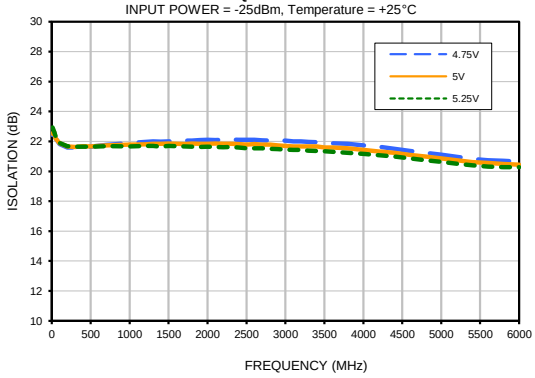
Typical Performance Curves

Full 2-Port Extension

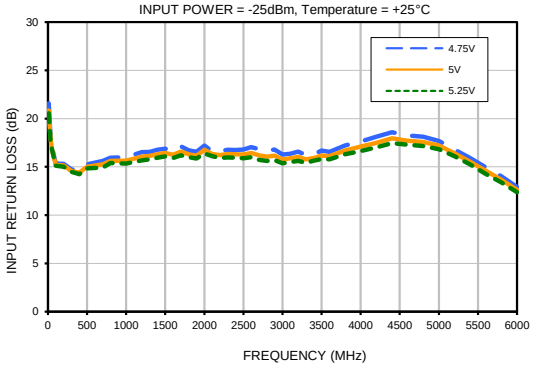
GAIN vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25dBm, Temperature = +25°C



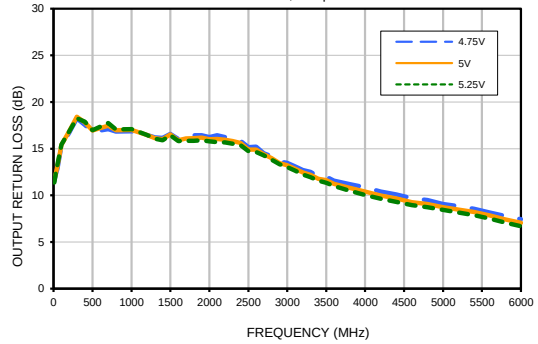
ISOLATION vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25dBm, Temperature = +25°C



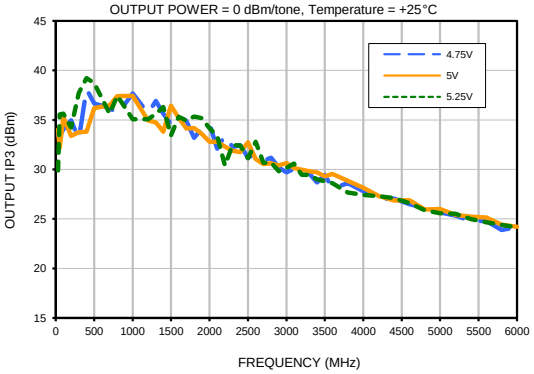
INPUT RETURN LOSS vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25dBm, Temperature = +25°C



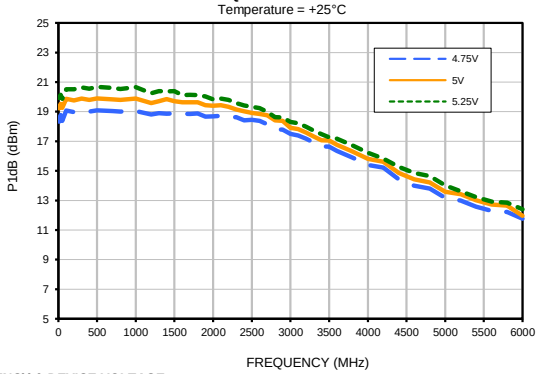
OUTPUT RETURN LOSS vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25dBm, Temperature = +25°C



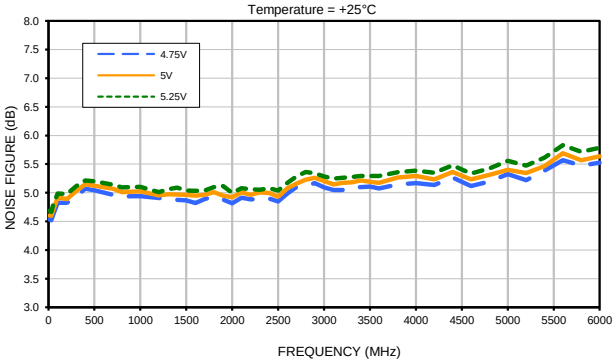
OUTPUT IP3 vs. FREQUENCY & DEVICE VOLTAGE
OUTPUT POWER = 0 dBm/tone, Temperature = +25°C



P1dB vs. FREQUENCY & DEVICE VOLTAGE
Temperature = +25°C



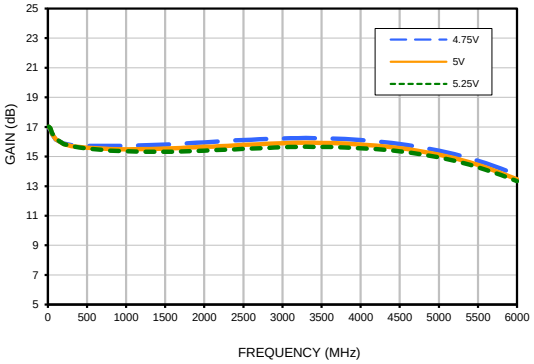
NOISE FIGURE vs. FREQUENCY & DEVICE VOLTAGE
Temperature = +25°C



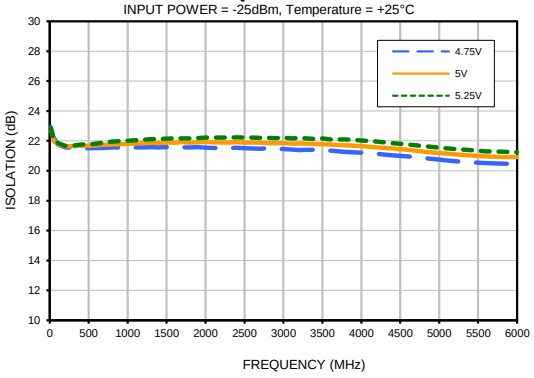
Typical Performance Curves

Without Full 2-Port Extension

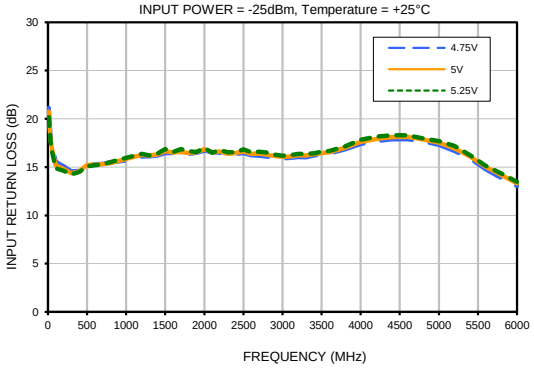
GAIN vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25dBm, Temperature = +25°C



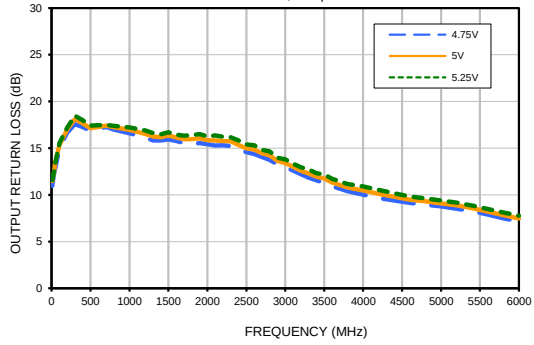
ISOLATION vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25dBm, Temperature = +25°C



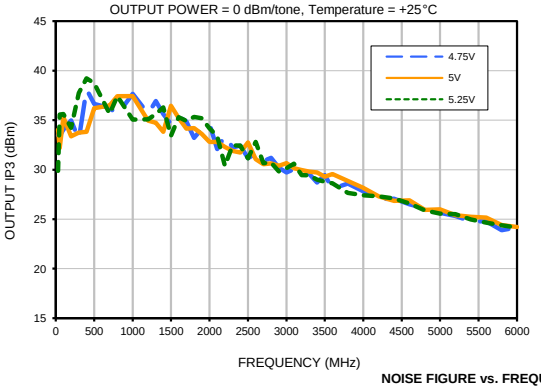
INPUT RETURN LOSS vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25dBm, Temperature = +25°C



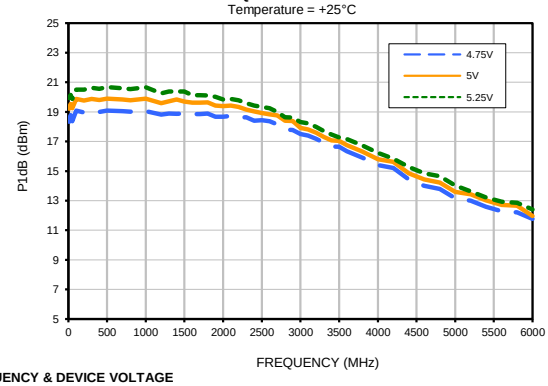
OUTPUT RETURN LOSS vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25dBm, Temperature = +25°C



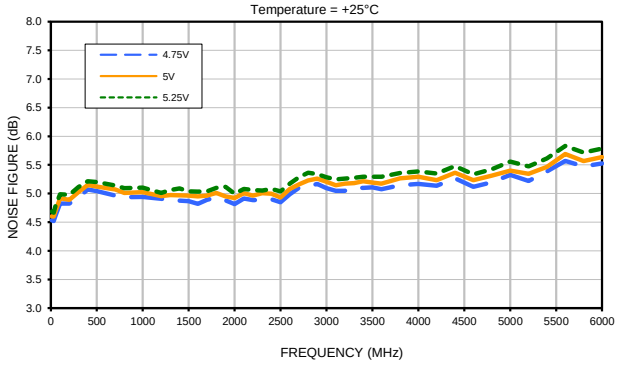
OUTPUT IP3 vs. FREQUENCY & DEVICE VOLTAGE
OUTPUT POWER = 0 dBm/tone, Temperature = +25°C



P1dB vs. FREQUENCY & DEVICE VOLTAGE
Temperature = +25°C



NOISE FIGURE vs. FREQUENCY & DEVICE VOLTAGE
Temperature = +25°C



Mini-Circuits

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)	