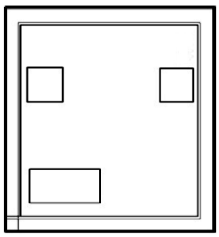
Low Noise, High IP3

Monolithic Amplifier Die

PSA-0012-D+

50Ω 0.05 to 6 GHz



The Big Deal

- Ideal IF Amplifier
  - Low Gain
  - Low Noise Figure, 2.4dB
  - High Output Power
- Wide band

Product Overview

The PSA-0012-D+ is an advanced wide band, high dynamic range, low noise, high IP3, high output power, monolithic amplifier die. Manufactured using E-PHEMT* technology enables it to work with a single positive supply voltage.

Key Features

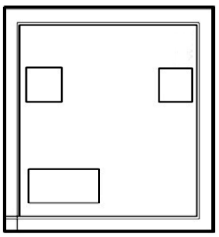
Feature	Advantages
Ideal Combined Performance Low Noise: 2.4 dB High IP3: +35 dBm High P1dB: +22 dBm Low Gain: 15dB	The PSA-0012-D+ design is optimized for use in critical IF Amplifier applications having an ideal combination of Low Gain, Low Noise, and High Output Power.
Wide band operation 50 MHz to 6000 MHz	Operating over a broad frequency range, the PSA-0012-D+ covers a wide range of typical IF bands making this amplifier ideal for use in a variety of applications.
Excellent Return Loss Input: 10 dB at 3.5 GHz Output: 13 dB at 4.5 GHz	With 10 dB input and 13 dB output return loss, the PSA-0012-D+ can be integrated into critical circuits with confidence that VSWR interactions with input and output components will have minimum affect on performance.
Unpackaged Die	Enables user to integrate it directly into hybrids.

Low Noise, High IP3

Monolithic Amplifier Die

PSA-0012-D+

50Ω 0.05 to 6 GHz



Product Features

- Low Noise Figure, 2.4dB typ. at 1 GHz
- High IP3, up to 36 dBm typ. at 1 GHz
- Output Power at 1dB comp., up to +22 dBm typ.
- Gain, 15.6 dB typ. at 1GHz

+RoHS Compliant

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

Ordering Information: Refer to Last Page

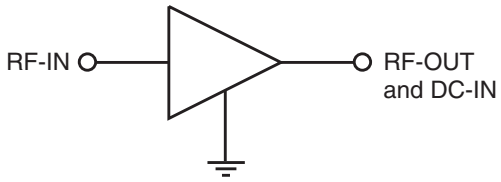
Typical Applications

- Cellular
- ISM
- GSM
- WCDMA
- LTE
- WiMax
- WLAN
- UNII and HIPERLAN

General Description

PSA-0012-D+ is an advanced wideband, high dynamic range, low noise, high IP3, high output power, monolithic amplifier die. Manufactured using E-PHEMT* technology enables it to work with a single positive supply voltage.

Simplified Schematic and Pad description



Pad	Description
RF-IN	RF input pad
RF-OUT & DC-IN	RF output pad
GROUND	Connections to ground

* Enhancement mode pseudomorphic High Electron Mobility Transistor.

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

Electrical Specifications[1] at 25°C, Zo=50Ω

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency range		0.05		6.0	GHz
DC current (Id)			92		mA
at DC Volts (Vd)			5.0		V
Noise figure	0.05		2.4		dB
	0.5		2.5		
	1.0		2.4		
	2.0		2.4		
	3.0		2.7		
	4.0		2.9		
	5.0		3.3		
	6.0		3.7		
Gain	0.05		18.0		dB
	0.5		16.2		
	1.0		15.6		
	2.0		14.2		
	3.0		12.7		
	4.0		11.2		
	5.0		9.9		
	6.0		8.4		
Input return loss	0.05		9.8		dB
	3.0		10.1		
	6.0		6.0		
Output return loss	0.05		11.2		dB
	3.0		13.9		
	6.0		8.4		
Output IP3	0.05		33.9		dBm
	0.5		35.5		
	1.0		35.7		
	2.0		35.7		
	3.0		35.8		
	4.0		35.2		
	5.0		35.4		
	6.0		33.8		
Output power @1dB compression[2]	0.05		20.2		dBm
	0.5		21.8		
	1.0		22.2		
	2.0		22.1		
	3.0		21.9		
	4.0		21.9		
	5.0		21.7		
	6.0		21.0		
Thermal resistance			69		°C/W

1. Measured in Mini-Circuits die characterization test board. See Figure 1 for Test Circuit.
2. Current increases at P1dB

Absolute Maximum Ratings[3]

Parameter	Ratings
Operating temperature	-40°C to 85°C
DC voltage (Pad RF-OUT & DC-IN)	6V
Device current (Pad RF-OUT & DC-IN)	130 mA
Power dissipation	650 mW
Input power (CW)	0.05-3GHz, 14dBm 3-6GHz, 19dBm

3. Permanent damage may occur if any of these limits are exceeded.
These ratings are not intended for continuous normal operation.
Die performance measured in industry standard SOT-363 package.

Characterization Test Circuit

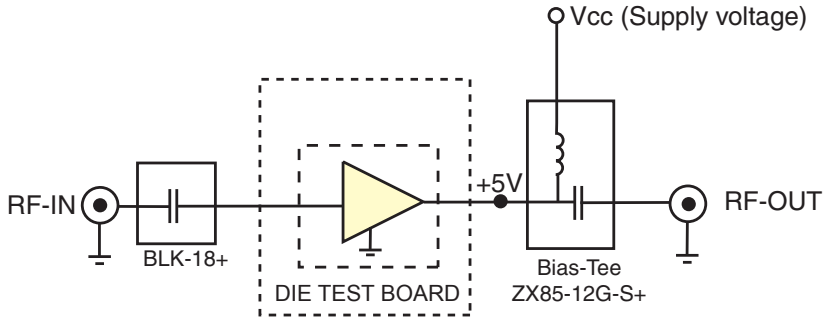


Figure 1. Block Diagram of Test Circuit used for characterization. Gain, Return loss, Output power at 1dB compression (P1 dB), output IP3 (OIP3) and noise figure measured using Agilent's N5242A PNA-X microwave network analyzer.

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

Die Layout

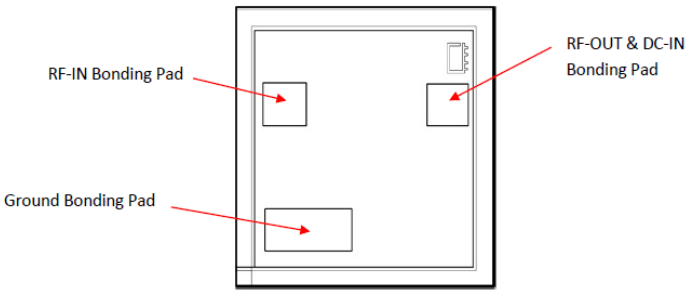


Fig 2. Die Layout

Bonding Pad Position

(Dimensions in µm, Typical)

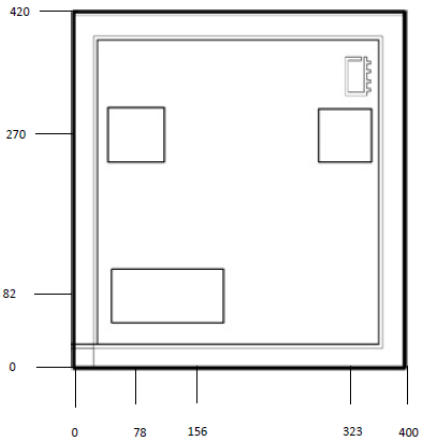


Fig 3. Bonding Pad Positions

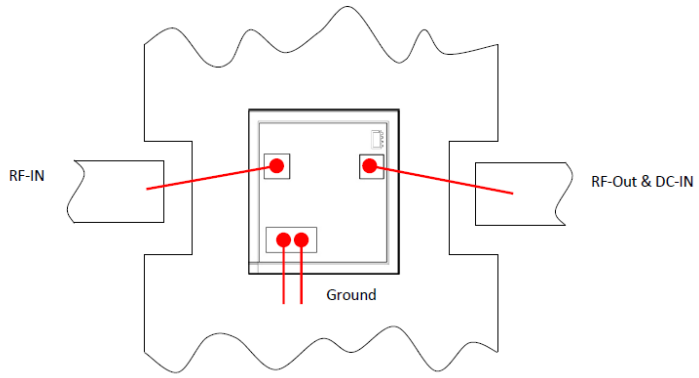
Critical Dimensions

Parameter	Values
Die Thickness, µm	100
Die Width, µm	400
Die Length, µm	420
Bond Pad Size, µm	75 x 75
Ground Bond Pad Size	75 X 150

Assembly and Handling Procedure

1. Storage
   Dice should be stored in a dry nitrogen purged desiccators or equivalent.
2. ESD
   MMIC EPHEMPT 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 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 low as reasonable to minimize performance degradation due to undesirable series inductance.

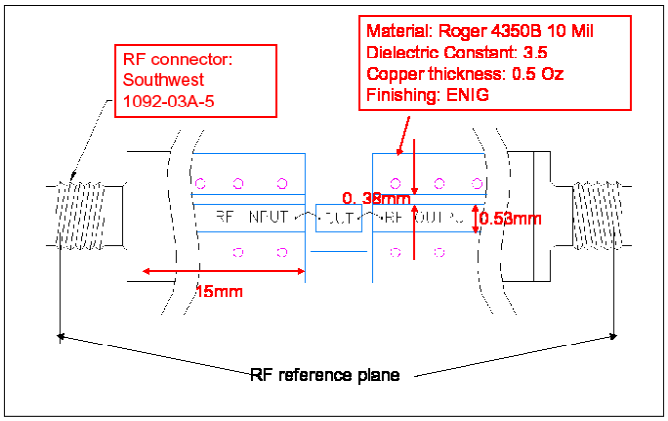
Assembly Diagram



Recommended Wire Length, Typical

Wire	Wire Length (mm)	Wire Loop Height (mm)
Ground	0.50	0.15
RF-IN, RF-OUT & DC-IN	0.70	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 (Note 4)	Quantity, Package	Model No.
	Small, Gel - Pak: 10,50,100	PSA-0012-DG+
	Medium†, Partial wafer: <3660	PSA-0012-DP+
	Large†, Full Wafer	PSA-0012-DF+
	†*Available upon request contact sales representative*	
	Refer to AN-60-067	
Environmental Ratings	ENV-80	

Note 4. Dice taken from PCM good wafer, No RF or DC test performed.

ESD Rating**

Human Body Model (HBM): Class 0 (<250V) in accordance with ANSI/ESD STM 5.1 - 2001; passes 150V

** Tested in industry standard SOT-363 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.

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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 = 5.00V, 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	18.05	25.62	9.84	11.24	1.27	0.79	34.85	20.52	2.40
100	17.55	24.45	10.90	12.62	1.21	0.79	35.20	22.22	2.27
200	16.90	23.19	12.98	15.01	1.20	0.78	35.63	21.89	2.27
300	16.58	22.75	14.01	16.42	1.20	0.78	35.92	21.61	2.40
500	16.23	22.33	14.48	17.27	1.20	0.77	36.40	21.83	2.51
600	16.12	22.17	14.45	17.34	1.19	0.77	35.99	21.85	2.48
800	15.89	21.92	14.17	17.10	1.18	0.78	35.94	22.10	2.36
1000	15.63	21.62	13.81	16.77	1.17	0.78	35.77	22.23	2.36
1200	15.38	21.29	13.50	16.57	1.16	0.78	35.83	22.04	2.38
1400	15.11	20.94	13.32	16.53	1.15	0.78	35.80	22.06	2.35
1600	14.84	20.55	13.21	16.58	1.13	0.78	35.97	22.18	2.44
1700	14.70	20.36	13.17	16.65	1.13	0.78	35.90	22.19	2.39
1900	14.42	19.98	13.07	16.90	1.12	0.78	36.08	22.19	2.42
2100	14.15	19.57	12.92	17.20	1.11	0.78	36.00	22.20	2.45
2300	13.87	19.23	12.76	17.33	1.10	0.78	36.00	22.13	2.50
2500	13.59	18.86	12.43	17.36	1.09	0.78	36.14	22.12	2.52
2700	13.29	18.49	11.96	17.16	1.08	0.78	36.10	22.15	2.64
2900	12.99	18.17	11.45	16.67	1.07	0.78	35.87	22.04	2.71
3000	12.84	18.02	11.22	16.42	1.07	0.78	35.85	21.98	2.74
3200	12.53	17.71	10.74	15.92	1.06	0.78	36.17	21.60	2.74
3400	12.23	17.40	10.34	15.31	1.05	0.78	35.79	21.89	2.79
3600	11.93	17.13	9.94	14.79	1.04	0.79	35.90	21.96	2.83
3800	11.63	16.87	9.63	14.45	1.04	0.79	36.15	22.09	2.87
4000	11.33	16.60	9.40	14.14	1.04	0.79	35.66	22.01	2.91
4100	11.20	16.46	9.30	13.98	1.04	0.79	35.53	22.07	3.01
4300	10.92	16.20	9.13	13.74	1.03	0.79	36.31	21.75	3.00
4500	10.65	15.94	8.94	13.49	1.03	0.79	36.12	21.92	3.09
4700	10.39	15.69	8.78	13.16	1.03	0.78	36.08	22.06	3.14
4900	10.13	15.44	8.63	12.72	1.03	0.77	35.82	22.01	3.24
5100	9.86	15.21	8.43	12.26	1.03	0.77	35.87	21.80	3.28
5300	9.60	15.00	8.12	11.71	1.03	0.76	35.47	21.54	3.41
5400	9.45	14.91	7.98	11.38	1.03	0.75	35.37	21.29	3.38
5600	9.17	14.73	7.66	10.70	1.03	0.74	34.98	21.13	3.56
5800	8.87	14.56	7.31	10.03	1.03	0.74	34.55	21.16	3.64
6000	8.58	14.43	6.94	9.42	1.02	0.73	34.36	21.23	3.73
6200	8.25	14.30	6.56	8.87	1.02	0.73	34.41	20.77	3.77
6400	7.95	14.18	6.26	8.43	1.01	0.72	34.55	20.76	3.89
6600	7.65	14.05	6.01	8.03	1.01	0.72	34.98	20.78	3.93
6800	7.36	13.94	5.79	7.80	1.00	0.73	34.38	21.03	4.10
7000	7.09	13.82	5.61	7.67	1.00	0.74	34.53	20.97	4.23

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 = 83mA @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	17.92	26.06	9.86	11.60	1.32	0.82	34.86	19.16	2.13
100	17.43	24.40	10.92	12.57	1.22	0.80	35.07	21.71	2.18
200	16.77	23.13	13.00	14.95	1.20	0.78	35.13	21.29	2.24
300	16.45	22.61	14.05	16.30	1.20	0.77	35.64	21.05	2.36
500	16.11	22.23	14.54	17.20	1.20	0.78	35.09	21.28	2.48
600	15.99	22.11	14.50	17.28	1.20	0.78	35.87	21.30	2.47
800	15.76	21.83	14.22	17.04	1.19	0.78	35.93	21.54	2.32
1000	15.51	21.52	13.86	16.69	1.17	0.78	35.42	21.66	2.34
1200	15.26	21.22	13.55	16.49	1.16	0.79	35.48	21.48	2.41
1400	14.99	20.85	13.35	16.45	1.15	0.78	35.57	21.50	2.34
1600	14.73	20.46	13.25	16.50	1.13	0.78	35.50	21.56	2.43
1700	14.59	20.29	13.19	16.61	1.13	0.78	35.17	21.57	2.40
1900	14.32	19.88	13.08	16.84	1.12	0.78	35.40	21.62	2.39
2100	14.05	19.50	12.95	17.10	1.11	0.78	35.93	21.59	2.43
2300	13.76	19.13	12.77	17.25	1.10	0.78	35.58	21.58	2.48
2500	13.49	18.79	12.43	17.27	1.09	0.78	35.59	21.57	2.49
2700	13.19	18.42	11.97	17.06	1.08	0.78	35.22	21.60	2.57
2900	12.90	18.10	11.50	16.58	1.07	0.78	36.20	21.50	2.70
3000	12.75	17.95	11.25	16.30	1.07	0.78	36.41	21.48	2.70
3200	12.44	17.64	10.76	15.84	1.06	0.78	36.21	21.12	2.72
3400	12.15	17.35	10.34	15.21	1.05	0.78	35.86	21.33	2.73
3600	11.84	17.06	9.95	14.71	1.05	0.79	36.63	21.46	2.77
3800	11.54	16.80	9.62	14.35	1.04	0.79	36.58	21.52	2.82
4000	11.25	16.53	9.38	14.04	1.04	0.79	35.95	21.51	2.88
4100	11.11	16.41	9.29	13.89	1.04	0.79	36.66	21.50	2.94
4300	10.83	16.13	9.12	13.64	1.03	0.79	36.05	21.20	2.94
4500	10.56	15.89	8.94	13.39	1.03	0.79	36.38	21.36	3.03
4700	10.30	15.64	8.77	13.06	1.03	0.78	36.20	21.50	3.05
4900	10.04	15.38	8.62	12.62	1.03	0.77	36.21	21.44	3.17
5100	9.78	15.15	8.42	12.16	1.03	0.77	36.39	21.31	3.21
5300	9.52	14.95	8.12	11.61	1.03	0.76	35.98	21.05	3.32
5400	9.38	14.87	7.98	11.29	1.03	0.75	35.36	20.75	3.32
5600	9.09	14.68	7.65	10.63	1.03	0.74	35.28	20.66	3.46
5800	8.80	14.52	7.31	9.96	1.03	0.74	35.33	20.68	3.53
6000	8.51	14.38	6.93	9.35	1.02	0.73	34.76	20.68	3.65
6200	8.18	14.27	6.57	8.81	1.02	0.73	35.21	20.24	3.67
6400	7.88	14.15	6.25	8.38	1.01	0.72	34.89	20.29	3.80
6600	7.58	14.02	6.02	7.98	1.01	0.72	35.19	20.24	3.86
6800	7.30	13.90	5.80	7.73	1.00	0.73	34.52	20.55	4.00
7000	7.02	13.79	5.62	7.64	1.00	0.74	34.73	20.43	4.12

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 = 101mA @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	18.15	25.88	9.92	11.44	1.28	0.80	33.81	21.09	2.24
100	17.64	24.47	10.97	12.71	1.21	0.79	35.07	22.74	2.21
200	16.98	23.26	13.07	15.15	1.20	0.78	35.77	22.36	2.25
300	16.67	22.80	14.10	16.56	1.20	0.77	35.70	22.12	2.38
500	16.32	22.41	14.61	17.46	1.20	0.77	35.76	22.34	2.49
600	16.21	22.27	14.56	17.52	1.19	0.78	35.92	22.31	2.47
800	15.97	21.99	14.29	17.27	1.18	0.78	35.76	22.58	2.35
1000	15.72	21.66	13.91	16.95	1.17	0.78	35.60	22.77	2.36
1200	15.46	21.34	13.62	16.73	1.16	0.78	35.72	22.57	2.39
1400	15.20	20.97	13.42	16.70	1.14	0.78	35.92	22.59	2.34
1600	14.92	20.61	13.31	16.72	1.13	0.78	36.03	22.72	2.41
1700	14.79	20.45	13.26	16.84	1.13	0.78	35.83	22.67	2.38
1900	14.51	20.03	13.13	17.10	1.12	0.78	36.02	22.72	2.39
2100	14.23	19.65	13.03	17.38	1.11	0.77	35.76	22.73	2.44
2300	13.95	19.27	12.84	17.51	1.10	0.77	35.93	22.65	2.49
2500	13.67	18.91	12.52	17.55	1.09	0.77	35.82	22.64	2.51
2700	13.37	18.54	12.04	17.33	1.08	0.77	36.37	22.67	2.59
2900	13.07	18.21	11.53	16.84	1.07	0.77	35.65	22.55	2.70
3000	12.92	18.06	11.29	16.59	1.07	0.78	35.61	22.51	2.70
3200	12.61	17.76	10.80	16.11	1.06	0.78	36.11	22.05	2.73
3400	12.31	17.45	10.39	15.45	1.05	0.78	35.71	22.36	2.74
3600	12.00	17.17	9.98	14.91	1.04	0.78	35.26	22.49	2.80
3800	11.70	16.90	9.66	14.58	1.04	0.79	35.88	22.57	2.86
4000	11.41	16.62	9.43	14.26	1.04	0.79	35.52	22.55	2.91
4100	11.27	16.51	9.35	14.09	1.04	0.79	35.63	22.55	2.98
4300	10.99	16.23	9.17	13.82	1.04	0.78	36.14	22.21	2.97
4500	10.72	15.97	9.00	13.55	1.03	0.78	35.50	22.39	3.05
4700	10.46	15.71	8.83	13.23	1.03	0.78	35.75	22.54	3.10
4900	10.20	15.49	8.67	12.79	1.03	0.77	36.04	22.48	3.19
5100	9.93	15.24	8.46	12.33	1.03	0.76	35.43	22.33	3.24
5300	9.67	15.03	8.15	11.78	1.03	0.76	34.80	21.99	3.36
5400	9.52	14.93	8.02	11.43	1.03	0.75	35.31	21.68	3.34
5600	9.24	14.76	7.68	10.78	1.03	0.74	34.80	21.65	3.51
5800	8.95	14.59	7.33	10.08	1.02	0.73	34.12	21.62	3.59
6000	8.65	14.45	6.96	9.45	1.02	0.73	34.14	21.69	3.71
6200	8.32	14.33	6.59	8.93	1.02	0.72	34.10	21.23	3.72
6400	8.02	14.21	6.28	8.51	1.01	0.72	34.11	21.22	3.83
6600	7.72	14.08	6.03	8.08	1.01	0.72	34.46	21.23	3.90
6800	7.43	13.95	5.82	7.85	1.00	0.73	34.37	21.56	4.04
7000	7.17	13.83	5.64	7.74	1.00	0.74	34.34	21.43	4.18

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 = 5.00V, 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	18.09	25.90	9.79	11.54	1.29	0.81	34.85	20.52	2.40
100	17.59	24.42	10.87	12.59	1.21	0.79	35.20	22.22	2.27
200	16.92	23.20	12.97	15.00	1.19	0.78	35.63	21.89	2.27
300	16.58	22.74	14.01	16.38	1.20	0.77	35.92	21.61	2.40
500	16.22	22.37	14.51	17.29	1.20	0.78	36.40	21.83	2.51
600	16.09	22.27	14.49	17.36	1.20	0.78	35.99	21.85	2.48
800	15.84	21.98	14.24	17.15	1.19	0.78	35.94	22.10	2.36
1000	15.56	21.69	13.89	16.84	1.18	0.79	35.77	22.23	2.36
1200	15.28	21.37	13.60	16.64	1.17	0.79	35.83	22.04	2.38
1400	15.00	21.05	13.45	16.62	1.17	0.79	35.80	22.06	2.35
1600	14.71	20.66	13.35	16.71	1.15	0.79	35.97	22.18	2.44
1700	14.56	20.52	13.31	16.77	1.15	0.80	35.90	22.19	2.39
1900	14.26	20.11	13.24	17.04	1.14	0.79	36.08	22.19	2.42
2100	13.98	19.78	13.13	17.36	1.14	0.80	36.00	22.20	2.45
2300	13.67	19.42	12.98	17.49	1.13	0.80	36.00	22.13	2.50
2500	13.38	19.06	12.67	17.53	1.12	0.80	36.14	22.12	2.52
2700	13.06	18.74	12.22	17.34	1.12	0.80	36.10	22.15	2.64
2900	12.75	18.42	11.74	16.88	1.11	0.80	35.87	22.04	2.71
3000	12.59	18.28	11.51	16.62	1.11	0.81	35.85	21.98	2.74
3200	12.26	17.99	11.05	16.16	1.10	0.81	36.17	21.60	2.74
3400	11.94	17.69	10.66	15.55	1.10	0.81	35.79	21.89	2.79
3600	11.62	17.45	10.29	15.05	1.10	0.82	35.90	21.96	2.83
3800	11.31	17.20	10.00	14.72	1.09	0.82	36.15	22.09	2.87
4000	11.00	16.94	9.79	14.43	1.09	0.82	35.66	22.01	2.91
4100	10.85	16.82	9.71	14.28	1.09	0.82	35.53	22.07	3.01
4300	10.56	16.57	9.55	14.03	1.09	0.83	36.31	21.75	3.00
4500	10.27	16.30	9.39	13.80	1.09	0.82	36.12	21.92	3.09
4700	9.99	16.08	9.24	13.48	1.10	0.82	36.08	22.06	3.14
4900	9.72	15.85	9.10	13.05	1.10	0.82	35.82	22.01	3.24
5100	9.44	15.62	8.93	12.62	1.10	0.81	35.87	21.80	3.28
5300	9.15	15.44	8.64	12.07	1.10	0.81	35.47	21.54	3.41
5400	9.00	15.35	8.52	11.76	1.10	0.80	35.37	21.29	3.38
5600	8.71	15.19	8.20	11.07	1.10	0.80	34.98	21.13	3.56
5800	8.39	15.05	7.88	10.41	1.10	0.79	34.55	21.16	3.64
6000	8.08	14.91	7.52	9.83	1.10	0.79	34.36	21.23	3.73
6200	7.74	14.81	7.18	9.28	1.10	0.78	34.41	20.77	3.77
6400	7.43	14.70	6.88	8.84	1.10	0.78	34.55	20.76	3.89
6600	7.11	14.60	6.65	8.47	1.10	0.79	34.98	20.78	3.93
6800	6.81	14.49	6.45	8.25	1.10	0.79	34.38	21.03	4.10
7000	6.52	14.38	6.29	8.13	1.10	0.80	34.53	20.97	4.23

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 = 83mA @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	17.97	25.46	9.86	11.23	1.26	0.79	34.86	19.16	2.13
100	17.46	24.34	10.90	12.56	1.21	0.79	35.07	21.71	2.18
200	16.79	23.12	12.99	14.94	1.20	0.78	35.13	21.29	2.24
300	16.46	22.67	14.04	16.34	1.20	0.78	35.64	21.05	2.36
500	16.09	22.27	14.58	17.22	1.21	0.78	35.09	21.28	2.48
600	15.96	22.14	14.55	17.29	1.20	0.78	35.87	21.30	2.47
800	15.71	21.88	14.29	17.10	1.20	0.79	35.93	21.54	2.32
1000	15.44	21.58	13.95	16.78	1.19	0.79	35.42	21.66	2.34
1200	15.16	21.28	13.66	16.58	1.18	0.79	35.48	21.48	2.41
1400	14.88	20.97	13.50	16.57	1.17	0.80	35.57	21.50	2.34
1600	14.59	20.58	13.40	16.62	1.16	0.80	35.50	21.56	2.43
1700	14.45	20.43	13.35	16.73	1.16	0.80	35.17	21.57	2.40
1900	14.16	20.07	13.27	16.99	1.15	0.80	35.40	21.62	2.39
2100	13.87	19.67	13.16	17.28	1.14	0.80	35.93	21.59	2.43
2300	13.57	19.33	13.01	17.44	1.13	0.80	35.58	21.58	2.48
2500	13.27	18.99	12.69	17.47	1.13	0.80	35.59	21.57	2.49
2700	12.96	18.67	12.25	17.26	1.12	0.80	35.22	21.60	2.57
2900	12.65	18.34	11.79	16.80	1.11	0.80	36.20	21.50	2.70
3000	12.50	18.19	11.56	16.51	1.11	0.80	36.41	21.48	2.70
3200	12.17	17.90	11.08	16.05	1.10	0.81	36.21	21.12	2.72
3400	11.85	17.62	10.68	15.45	1.10	0.81	35.86	21.33	2.73
3600	11.53	17.37	10.31	14.98	1.10	0.82	36.63	21.46	2.77
3800	11.22	17.14	10.00	14.61	1.09	0.82	36.58	21.52	2.82
4000	10.91	16.86	9.78	14.30	1.09	0.82	35.95	21.51	2.88
4100	10.77	16.78	9.70	14.18	1.10	0.83	36.66	21.50	2.94
4300	10.47	16.49	9.54	13.94	1.09	0.82	36.05	21.20	2.94
4500	10.18	16.25	9.39	13.71	1.10	0.82	36.38	21.36	3.03
4700	9.91	16.03	9.23	13.38	1.10	0.82	36.20	21.50	3.05
4900	9.64	15.80	9.11	12.95	1.10	0.82	36.21	21.44	3.17
5100	9.36	15.59	8.92	12.52	1.10	0.81	36.39	21.31	3.21
5300	9.08	15.40	8.64	11.98	1.10	0.81	35.98	21.05	3.32
5400	8.93	15.33	8.52	11.65	1.11	0.80	35.36	20.75	3.32
5600	8.63	15.15	8.20	11.01	1.11	0.80	35.28	20.66	3.46
5800	8.32	15.01	7.88	10.36	1.11	0.79	35.33	20.68	3.53
6000	8.01	14.88	7.53	9.75	1.10	0.79	34.76	20.68	3.65
6200	7.67	14.78	7.17	9.22	1.11	0.78	35.21	20.24	3.67
6400	7.36	14.67	6.88	8.80	1.11	0.78	34.89	20.29	3.80
6600	7.05	14.58	6.67	8.42	1.10	0.78	35.19	20.24	3.86
6800	6.75	14.45	6.46	8.19	1.10	0.79	34.52	20.55	4.00
7000	6.46	14.35	6.29	8.09	1.11	0.80	34.73	20.43	4.12

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 = 101mA @Temperature = +25°C

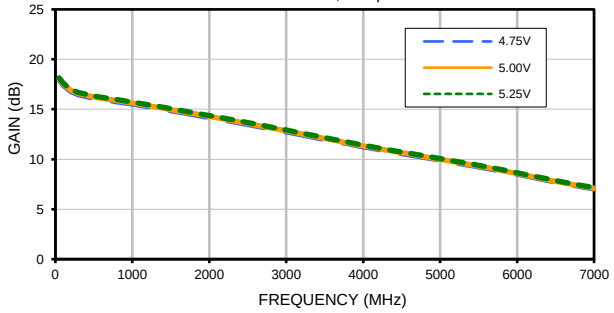
FREQ.	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
50	18.20	25.84	9.82	11.51	1.28	0.80	33.81	21.09	2.24
100	17.68	24.43	10.91	12.67	1.20	0.79	35.07	22.74	2.21
200	17.00	23.23	13.04	15.12	1.19	0.78	35.77	22.36	2.25
300	16.68	22.77	14.07	16.51	1.19	0.77	35.70	22.12	2.38
500	16.31	22.40	14.62	17.48	1.20	0.77	35.76	22.34	2.49
600	16.18	22.30	14.59	17.54	1.20	0.78	35.92	22.31	2.47
800	15.92	22.02	14.33	17.33	1.19	0.78	35.76	22.58	2.35
1000	15.65	21.74	13.98	17.02	1.18	0.79	35.60	22.77	2.36
1200	15.37	21.42	13.71	16.80	1.17	0.79	35.72	22.57	2.39
1400	15.09	21.08	13.54	16.78	1.16	0.79	35.92	22.59	2.34
1600	14.79	20.74	13.45	16.84	1.16	0.79	36.03	22.72	2.41
1700	14.65	20.55	13.41	16.98	1.15	0.79	35.83	22.67	2.38
1900	14.35	20.23	13.31	17.19	1.15	0.80	36.02	22.72	2.39
2100	14.06	19.83	13.23	17.53	1.14	0.79	35.76	22.73	2.44
2300	13.75	19.46	13.05	17.67	1.13	0.79	35.93	22.65	2.49
2500	13.45	19.12	12.75	17.72	1.12	0.79	35.82	22.64	2.51
2700	13.14	18.76	12.31	17.54	1.12	0.80	36.37	22.67	2.59
2900	12.82	18.48	11.81	17.06	1.11	0.80	35.65	22.55	2.70
3000	12.67	18.31	11.58	16.79	1.11	0.80	35.61	22.51	2.70
3200	12.34	18.02	11.11	16.35	1.10	0.81	36.11	22.05	2.73
3400	12.02	17.75	10.72	15.70	1.10	0.81	35.71	22.36	2.74
3600	11.70	17.49	10.34	15.18	1.10	0.81	35.26	22.49	2.80
3800	11.38	17.24	10.04	14.84	1.09	0.82	35.88	22.57	2.86
4000	11.07	16.97	9.83	14.54	1.09	0.82	35.52	22.55	2.91
4100	10.93	16.86	9.76	14.38	1.09	0.82	35.63	22.55	2.98
4300	10.63	16.59	9.59	14.12	1.09	0.82	36.14	22.21	2.97
4500	10.34	16.35	9.44	13.87	1.10	0.82	35.50	22.39	3.05
4700	10.06	16.12	9.30	13.56	1.10	0.82	35.75	22.54	3.10
4900	9.79	15.89	9.15	13.12	1.10	0.81	36.04	22.48	3.19
5100	9.51	15.67	8.96	12.67	1.10	0.81	35.43	22.33	3.24
5300	9.23	15.47	8.67	12.14	1.10	0.80	34.80	21.99	3.36
5400	9.07	15.39	8.56	11.78	1.10	0.80	35.31	21.68	3.34
5600	8.78	15.21	8.22	11.15	1.10	0.79	34.80	21.65	3.51
5800	8.47	15.07	7.90	10.48	1.10	0.79	34.12	21.62	3.59
6000	8.16	14.94	7.55	9.86	1.10	0.78	34.14	21.69	3.71
6200	7.81	14.85	7.20	9.34	1.10	0.78	34.10	21.23	3.72
6400	7.50	14.73	6.90	8.93	1.10	0.79	34.11	21.22	3.83
6600	7.18	14.62	6.67	8.51	1.10	0.78	34.46	21.23	3.90
6800	6.88	14.50	6.48	8.30	1.10	0.79	34.37	21.56	4.04
7000	6.60	14.40	6.32	8.21	1.10	0.80	34.34	21.43	4.18

Typical Performance Curves

Full 2-Port Extension

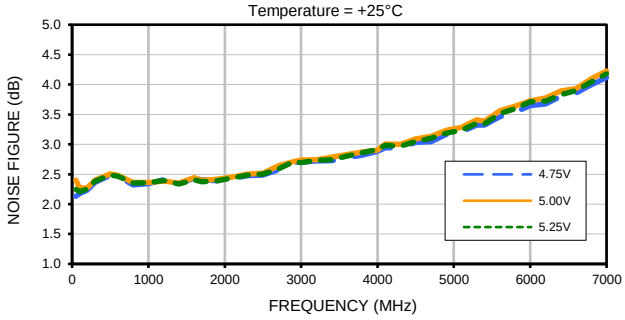
GAIN vs. FREQUENCY & DEVICE VOLTAGE

INPUT POWER = -25dBm, Temperature = +25°C



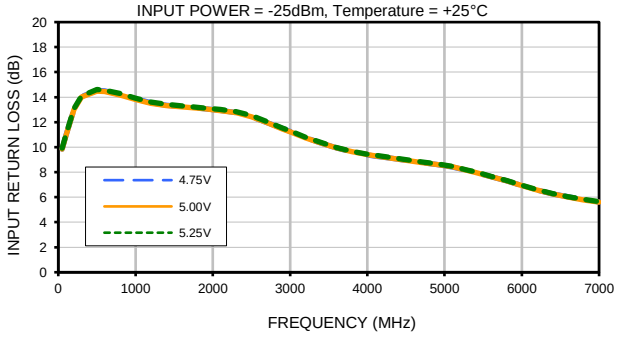
NOISE FIGURE vs. FREQUENCY & DEVICE VOLTAGE

Temperature = +25°C



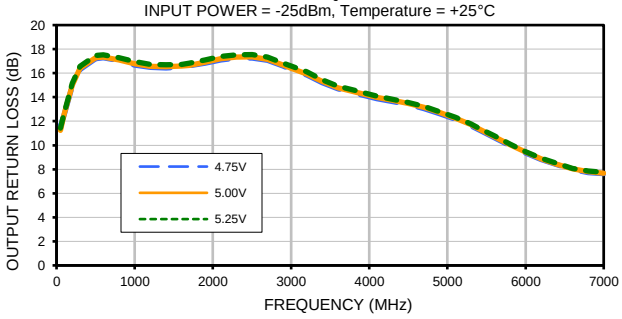
INPUT RETURN LOSS vs. FREQUENCY & DEVICE VOLTAGE

INPUT POWER = -25dBm, Temperature = +25°C



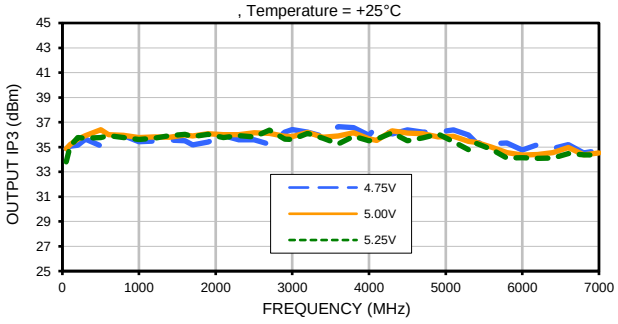
OUTPUT RETURN LOSS vs. FREQUENCY & DEVICE VOLTAGE

INPUT POWER = -25dBm, Temperature = +25°C



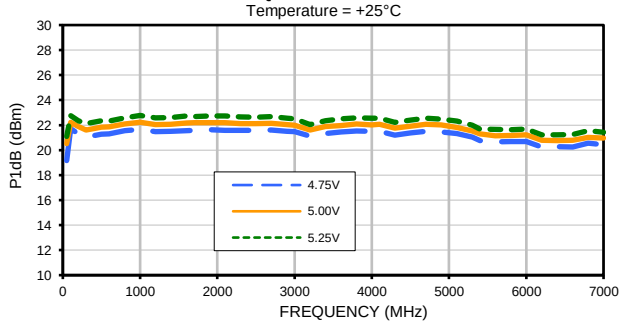
OUTPUT IP3 vs. FREQUENCY & DEVICE VOLTAGE

, Temperature = +25°C



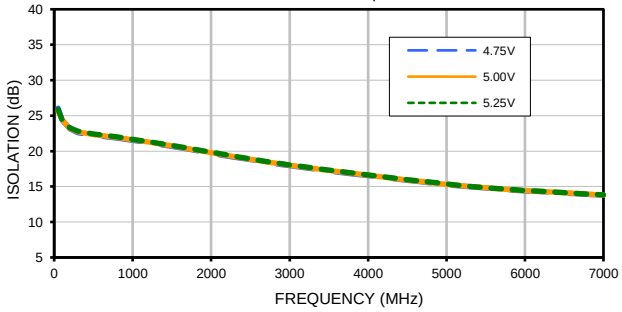
P1dB vs. FREQUENCY & DEVICE VOLTAGE

Temperature = +25°C



ISOLATION vs. FREQUENCY & DEVICE VOLTAGE

INPUT POWER = -25dBm, Temperature = +25°C

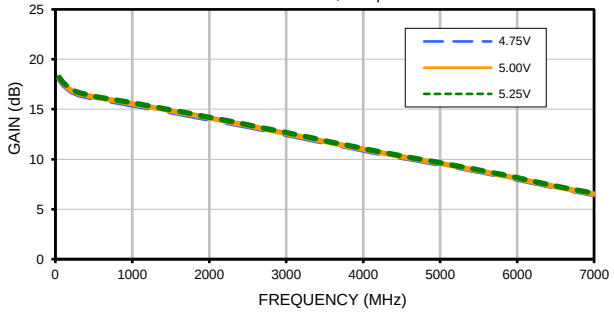


Typical Performance Curves

Without Full 2-Port Extension

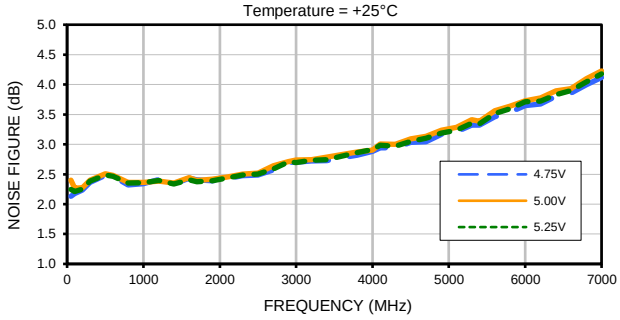
GAIN vs. FREQUENCY & DEVICE VOLTAGE

INPUT POWER = -25dBm, Temperature = +25°C



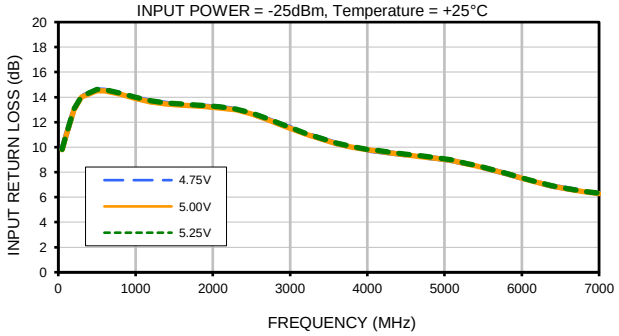
NOISE FIGURE vs. FREQUENCY & DEVICE VOLTAGE

Temperature = +25°C



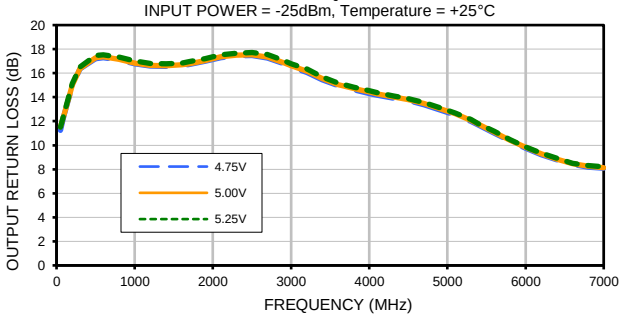
INPUT RETURN LOSS vs. FREQUENCY & DEVICE VOLTAGE

INPUT POWER = -25dBm, Temperature = +25°C



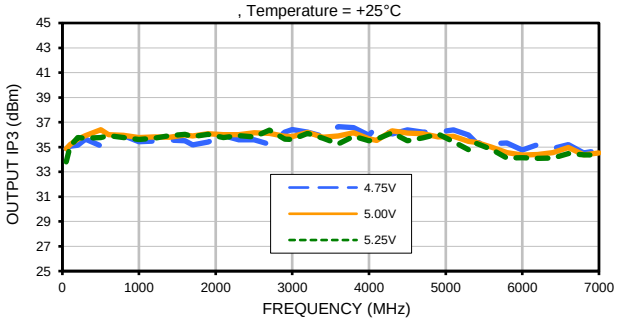
OUTPUT RETURN LOSS vs. FREQUENCY & DEVICE VOLTAGE

INPUT POWER = -25dBm, Temperature = +25°C



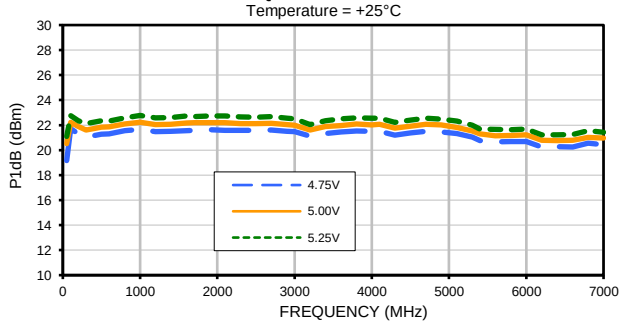
OUTPUT IP3 vs. FREQUENCY & DEVICE VOLTAGE

, Temperature = +25°C



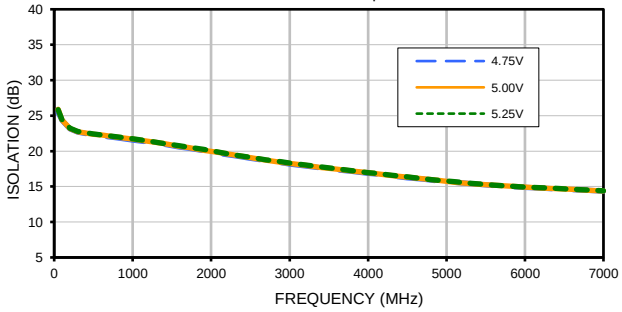
P1dB vs. FREQUENCY & DEVICE VOLTAGE

Temperature = +25°C



ISOLATION vs. FREQUENCY & DEVICE VOLTAGE

INPUT POWER = -25dBm, 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)	

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