



HIGH DIRECTIVITY

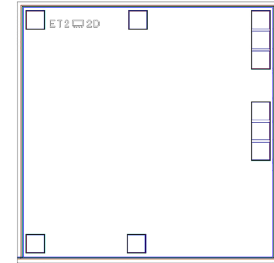
# Monolithic Amplifier Die

# MNA-6A-D+

50Ω 0.5 to 5.5 GHz

## THE BIG DEAL

- Choice of supply voltage, +2.8V to +5V
- Internal DC blocking at RF input and output
- High directivity, 13-22 dB typ.
- Low Noise figure, 2.7 dB typ. at 2 GHz
- Output power, up to +20 dBm typ.



**+RoHS Compliant**  
 The +Suffix identifies RoHS Compliance.  
 See our website for methodologies and qualifications

## APPLICATIONS

- Buffer amplifier
- Cellular infrastructure
- Communications satellite
- Defense

SEE ORDERING INFORMATION ON THE LAST PAGE

## PRODUCT OVERVIEW

MNA-6A-D+ is a wideband PHEMT based MMIC amplifier die with high active Directivity. MNA integrates the entire matching network and majority of the bias circuit inside the die, reducing the need for complicated external circuits. This approach makes the MNA amplifier die extremely straightforward to use. This design operates on a single 2.8 to 5V supply, is well matched for 50Ω. [MNA series models are available in Die and packaged form.](#)

## KEY FEATURES

Features	Advantages
Excellent Active Directivity (Isolation- Gain) 13-22 dB	Ideal for use as a buffer amplifier minimizing interaction of adjacent circuits
Integrates DC blocks and RF choke	Minimizes external components, component count and circuit area.
Single +2.8 to +5V operation	Amplifier can be used at low voltage such as +3V or standard +5V. +5V operation results in higher P1dB and OIP3.
Unpackaged die	Enables the user to integrate the amplifier directly into hybrids.

REV. B  
 ECO-015286  
 MNA-6A-D+  
 MCL NY  
 221007





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# Monolithic Amplifier Die

# MNA-6A-D+

50Ω 0.5 to 5.5 GHz

## ELECTRICAL SPECIFICATIONS<sup>1</sup> AT 25°C

Parameter	Condition (GHz)	Vs=5V			Vs=2.8V	Units
		Min.	Typ.	Max.	Typ.	
Frequency Range		0.5		5.5	0.5-5.5	GHz
Gain	0.5		22.3		20.4	dB
	1.0		25.0		22.3	
	2.0		24.8		21.6	
	2.5		23.2		20.4	
	4.0		16.5		14.8	
	5.5		10.7		9.7	
Input Return Loss	0.5		6.3		6.9	dB
	1.0		14.2		13.9	
	2.0		17.6		17.5	
	2.5		14.9		15.4	
	4.0		8.2		8.8	
	5.5		5.2		5.6	
Output Return Loss	0.5		10.9		9.8	dB
	1.0		27.2		14.9	
	2.0		19.5		14.8	
	2.5		19.4		15.2	
	4.0		21.8		22.0	
	5.5		14.4		12.7	
Output Power at P1dB	0.5		20.3		11.1	dBm
	1.0		20.2		11.9	
	2.0		19.4		12.2	
	2.5		19.2		12.5	
	4.0		18.2		13.6	
	5.5		15.4		12.3	
Output IP3	0.5		33.2		22.8	dBm
	1.0		32.4		23.7	
	2.0		30.4		23.8	
	2.5		30.0		24.1	
	4.0		29.7		25.4	
	5.5		27.6		23.7	
Noise Figure (dB)	0.5		3.1		3.2	dB
	1.0		2.6		2.7	
	2.0		2.7		2.7	
	2.5		2.7		2.8	
	4.0		3.3		3.3	
	5.5		4.4		4.5	
Directivity (Isolation-Gain)	0.5		22.1		24.9	dB
	1.0		18.7		19.2	
	2.0		13.3		13.6	
	2.5		13.2		13.0	
	4.0		17.7		16.3	
	5.5		22.6		20.5	
DC Current			99	110	92	mA
Device Current Variation vs. Temperature <sup>(2)</sup>			41		37	μA/°C
Device Current Variation vs Voltage			0.0017 <sup>(3)</sup>		0.0044 <sup>(4)</sup>	mA/mV
Thermal resistance at 85°C (Junction to Lead)			46		46	°C/W

1. Measured on Mini-Circuits characterization test board. Die packaged in 3x3 mm MCLP package and soldered on test board TB-186+

2. (Current at 85°C -Current at -45°C)/130

3. (Current at 5.25V-Current at 3.9V)/1.35

4. (Current at 3.9V-Current at 2.66V)/1.24





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# Monolithic Amplifier Die

# MNA-6A-D+

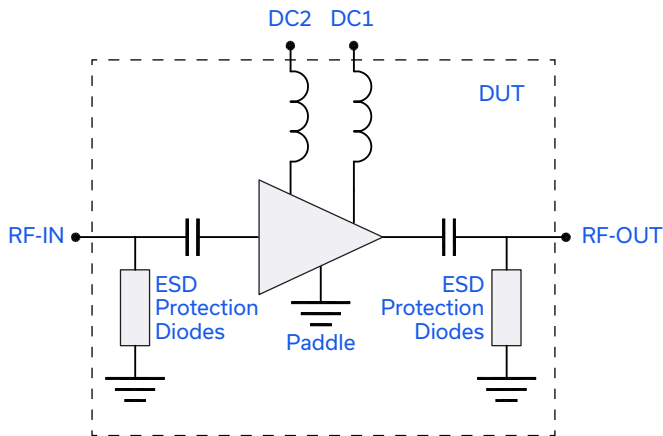
50Ω 0.5 to 5.5 GHz

### MAXIMUM RATINGS<sup>1,5</sup>

Parameter	Ratings
Operating Temperature	-40°C to 85°C
DC Voltage	7V at DC1 (DC2 connected to DC1 via 33.2Ω) 1V at RF IN & RF OUT
Power Dissipation	970 mW
Input Power	+10 dBm (continuous operation) +26 dBm (5 minutes max)

5. Permanent damage may occur if any of these limits are exceeded. These ratings are not intended for continuous normal operation.

### SIMPLIFIED SCHEMATIC AND PAD DESCRIPTION



Function	Description
RF IN	RF input pad.
RF-OUT	RF output pad
DC1 & DC2	DC Supply pad. Connect DC2 to DC1 via 33.2Ω resistor

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



### CHARACTERIZATION CIRCUIT

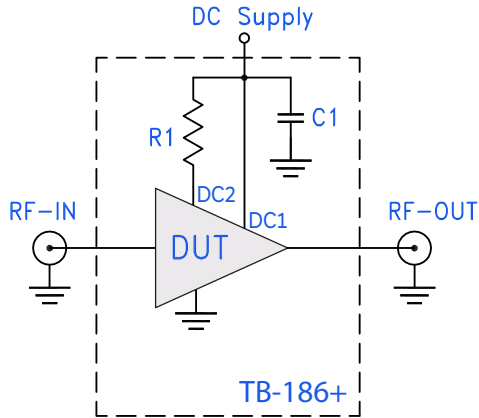


Fig 1. Block Diagram of Test Circuit used for characterization. (Die packaged in 3x3 mm MCLP package and soldered on Mini-Circuits Characterization test board TB-186+) Gain, Return loss, Output power at 1dB compression (P1 dB) , output IP3 (OIP3) and noise figure measured using Agilent's N5242A PNA-X microwave network analyzer.

Conditions:

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

Component	Size	Value	Units
R1	0805	33.2	Ω
C1	0402	1000	ρF

### RECOMMENDED APPLICATION CIRCUIT

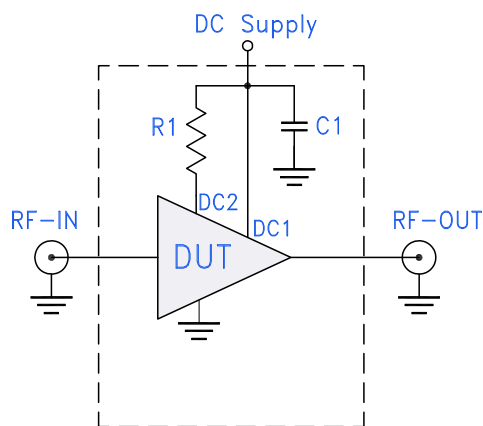


Fig 2. Test Board includes case, connectors, and components soldered to PCB

Component	Value	Units
R1	33.2	Ω
C1	1000	ρF



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### DIE LAYOUT

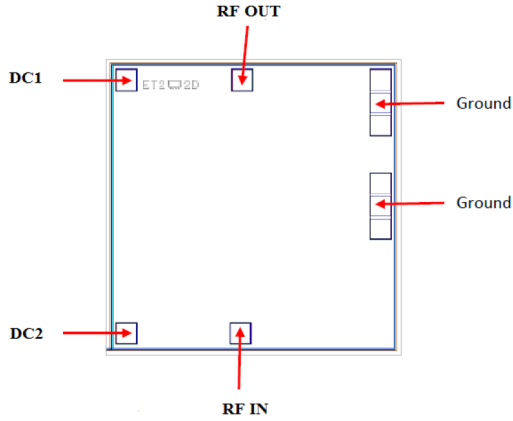


Fig 3. Die Layout

### BONDING PAD POSITION

(Dimensions in μm, Typical)

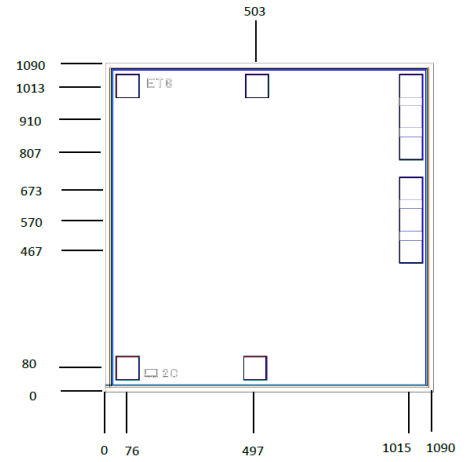


Fig 4. Bonding Pad Positions

### CRITICAL DIMENSIONS

Parameter	Values
Die Thickness, μm	100
Die Width, μm	1090
Die Length, μm	1090
Bond Pad Size (RF In, RF Out, DC), μm	80 x 80
Bond Pad Size (Ground pad), μm	80 x 246



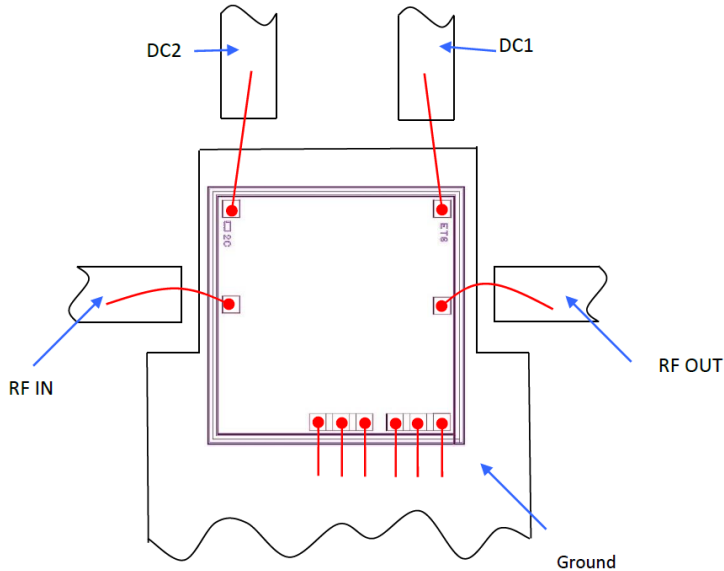
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# Monolithic Amplifier Die

MNA-6A-D+

50Ω 0.5 to 5.5 GHz

## ASSEMBLY DIAGRAM




Note: Ground bond wires are optional.

## RECOMMENDED WIRE LENGTH, TYPICAL

Wire	Wire Length (mm)	Wire Loop Height (mm)
Ground	0.25	0.15
DC	0.50	0.15
RF In, RF Out	1.00	0.15

## ASSEMBLY PROCEDURE

- Storage**  
Die should be stored in a dry nitrogen purged desiccators or equivalent.
-  **ESD**  
MMIC PHEMT amplifier Die are susceptible to electrostatic and mechanical damage. Die are supplied in antistatic protected material, which should be open in clean room conditions at an appropriately grounded anti-static workstation.
- Die Handling and Attachment**  
Devices need careful handling using correctly designed collets, it is recommended to handle the chip along the edges with a custom design collet. The die mounting surface must be clean and flat. Using conductive silver filled epoxy, recommended epoxies are Ablestik 84-1 LMISR4 or equivalents. Apply sufficient epoxy to meet required epoxy bond line thickness, epoxy fillet height and epoxy coverage around total periphery. Parts shall be cured in a nitrogen filled atmosphere per manufacturer's cure condition. The surface of the chip has exposed air bridges and should not be touched with vacuum collet, tweezers or fingers.
- Wire Bonding**  
Bond pad openings in the surface passivation above the bond pads are provided to allow wire bonding to the Die gold bond pads. Thermo-sonic bonding is used with minimized ultrasonic content. Bond force, time, ultrasonic power and temperature are all critical parameters. Suggested wire is pure gold, 1mil diameter. Bonds must be made from the bond pads on the die to the packaged or substrate. All bond wire length and bond wire height should be kept as short as possible unless specified by the Assembly Drawing to minimize performance degradation due to undesirable series inductance.





HIGH DIRECTIVITY

# Monolithic Amplifier Die

**MNA-6A-D+**

50Ω 0.5 to 4.5 GHz

**ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD.**

<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: 5,10,50,100 KGD* Medium†, Partial wafer: KGD*<1295 Large†, Full Wafer Model No. MNA-6A-DG+ MNA-6A-DP+ MNA-6A-DF+ †Available upon request contact sales representative Refer to <a href="#">AN-60-067</a>
<b>Environmental Ratings</b>	ENV-80

\*Known Good Die ('KGD') means that the die in question have been subjected to Mini-Circuits DC test performance criteria and measurement instructions and that the parametric data of such die fall within a predefined range. While DC testing is not definitive, it does provide a higher degree of confidence that die are capable of meeting typical RF electrical performance 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 \_x\_ xxL MCLP Package

**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*

**NOTE: Use PDF Bookmarks to view DATA at required conditions**

**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 = 98.44 mA @ Temperature = +25degC

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
					K	Measure			
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
200	6.80	47.63	3.29	2.72	13.17	0.69	26.62	13.25	6.49
300	15.41	44.15	3.57	5.80	5.33	1.08	32.17	18.67	4.23
400	20.00	43.81	4.64	8.44	4.17	1.18	33.66	20.20	3.52
500	22.35	45.60	6.26	10.90	4.99	1.15	34.08	20.62	4.27
600	23.55	45.89	8.24	13.59	5.28	1.11	33.58	20.72	3.02
700	24.23	45.95	10.03	16.60	5.37	1.08	34.36	20.63	2.93
800	24.63	45.37	11.69	19.86	5.05	1.05	33.67	20.58	2.71
1000	25.08	44.26	14.22	28.77	4.43	1.03	33.11	20.57	2.61
1100	25.21	43.65	15.21	38.39	4.11	1.02	32.98	20.48	2.61
1200	25.31	42.76	16.09	38.52	3.70	1.01	32.15	20.28	2.61
1300	25.37	42.02	16.84	30.16	3.40	1.00	32.28	20.19	2.60
1400	25.40	41.49	17.44	26.45	3.21	0.99	32.25	20.13	2.56
1500	25.38	40.89	18.09	23.86	3.01	0.98	31.81	20.08	2.59
1600	25.44	40.28	17.67	21.84	2.79	0.98	31.65	19.97	2.68
1700	25.32	39.80	18.07	21.50	2.69	0.97	31.61	20.00	2.64
1800	25.19	39.30	18.29	20.98	2.58	0.97	31.35	19.73	2.65
1900	25.06	38.98	18.25	20.11	2.52	0.96	31.08	19.76	2.62
2000	24.89	38.50	18.14	19.16	2.44	0.96	31.07	19.76	2.61
2100	24.64	37.79	17.67	19.77	2.32	0.96	30.72	19.67	2.54
2200	24.41	37.49	17.55	19.27	2.30	0.96	30.42	19.33	2.62
2300	24.18	37.33	17.42	18.72	2.31	0.96	30.64	19.47	2.70
2400	23.82	36.78	16.58	19.40	2.26	0.96	30.47	19.44	2.78
2500	23.38	37.07	15.15	20.92	2.43	0.98	30.61	19.49	2.67
2600	23.21	36.88	15.69	18.96	2.42	0.97	30.28	19.44	2.75
2700	22.55	36.26	14.01	22.47	2.42	0.99	30.49	19.32	2.80
2800	22.23	35.93	13.70	21.33	2.41	0.99	30.41	19.36	2.91
2900	21.86	35.49	13.43	20.77	2.38	0.99	30.42	19.25	2.95
3000	21.12	36.30	12.19	25.83	2.79	1.02	30.50	19.22	2.87
3100	20.82	35.31	11.93	23.05	2.57	1.02	30.25	19.10	2.90
3200	20.28	35.45	11.04	23.95	2.73	1.04	29.97	18.98	2.89
3300	19.96	34.58	10.95	22.68	2.57	1.03	30.15	19.09	2.93
3400	19.19	35.59	10.24	28.81	3.07	1.07	30.41	19.01	3.00
3500	19.03	34.41	9.83	23.46	2.73	1.06	30.03	18.85	2.97
3600	18.55	34.40	9.62	23.80	2.85	1.07	30.01	18.77	2.99
3700	18.06	34.67	9.25	24.41	3.06	1.09	30.29	18.66	3.05
3800	17.47	35.38	8.78	26.02	3.48	1.11	30.36	18.65	3.20
3900	17.19	34.74	8.63	23.49	3.33	1.11	29.97	18.50	3.18
4000	16.82	34.73	8.18	22.36	3.41	1.12	29.51	18.30	3.20
4100	16.27	34.73	7.75	25.56	3.56	1.15	29.63	18.16	3.27
4200	16.03	33.97	7.72	23.36	3.35	1.14	29.82	17.95	3.30
4300	15.67	34.39	7.47	22.70	3.61	1.15	29.52	17.93	3.34
4400	15.26	34.35	6.95	22.84	3.66	1.18	29.37	17.74	3.40
4500	15.02	34.70	6.66	21.45	3.84	1.19	29.12	17.78	3.45
4600	14.71	33.86	6.64	19.46	3.62	1.18	28.94	17.80	3.54
4700	14.35	33.24	6.53	19.41	3.49	1.18	29.32	17.58	3.60
4800	14.03	34.20	5.98	20.10	3.88	1.22	29.10	17.49	3.66
4900	13.64	33.38	6.07	18.62	3.71	1.21	28.60	17.12	3.72
5000	13.47	33.76	5.67	17.90	3.82	1.23	28.42	16.92	3.76
5100	12.94	32.25	5.73	18.09	3.45	1.22	28.30	16.57	3.88
5200	12.58	33.37	5.57	17.68	4.00	1.23	28.47	16.50	3.94
5300	12.06	33.76	5.55	16.69	4.41	1.23	28.16	15.96	4.11
5400	11.72	33.68	5.39	15.79	4.46	1.24	27.70	15.66	4.17
5500	11.14	34.54	5.40	14.25	5.18	1.22	26.96	15.45	4.36





*Typical Performance Data*

**Definitions:**

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 3.9V, Id =96.61 mA @ Temperature = +25degC

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
					K	Measure			
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
200	6.63	47.66	3.30	2.75	13.58	0.70	24.82	11.82	6.52
300	15.13	44.28	3.60	5.74	5.60	1.08	28.89	16.31	4.26
400	19.61	44.82	4.72	8.25	4.94	1.16	30.12	17.61	3.56
500	21.87	46.36	6.42	10.63	5.80	1.13	30.51	18.05	4.39
600	22.98	45.90	8.41	12.99	5.64	1.09	30.26	18.20	3.05
700	23.59	46.00	10.18	15.43	5.78	1.07	30.54	18.12	2.94
800	23.94	44.79	11.78	17.71	5.07	1.05	30.34	18.11	2.74
1000	24.31	43.47	14.14	21.56	4.37	1.02	30.48	18.41	2.63
1100	24.41	43.04	15.03	22.82	4.16	1.02	30.35	18.18	2.62
1200	24.47	41.61	15.73	23.48	3.55	1.01	29.92	17.94	2.63
1300	24.49	41.31	16.40	23.35	3.43	1.00	30.15	18.02	2.64
1400	24.49	40.60	16.98	22.70	3.19	0.99	30.30	18.13	2.59
1500	24.45	40.11	17.57	22.19	3.04	0.99	29.88	18.08	2.60
1600	24.48	39.49	17.08	20.42	2.82	0.98	29.92	18.00	2.74
1700	24.35	38.77	17.41	20.66	2.65	0.98	29.81	18.06	2.60
1800	24.21	38.34	17.68	20.60	2.57	0.97	29.85	18.15	2.67
1900	24.08	37.95	17.73	20.05	2.50	0.97	30.00	18.19	2.64
2000	23.91	37.35	17.59	19.62	2.39	0.96	29.79	18.14	2.64
2100	23.68	36.77	17.09	20.04	2.29	0.96	29.60	18.04	2.65
2200	23.47	36.56	16.95	20.05	2.29	0.96	29.63	18.02	2.71
2300	23.26	36.39	16.89	19.61	2.30	0.96	29.65	18.09	2.68
2400	22.93	35.91	16.18	20.40	2.26	0.97	29.70	18.15	2.72
2500	22.54	35.75	14.83	20.80	2.29	0.98	29.56	18.01	2.76
2600	22.39	35.80	15.14	19.53	2.34	0.98	29.48	17.87	2.79
2700	21.78	34.95	13.65	23.71	2.27	0.99	29.70	18.12	2.83
2800	21.50	34.78	13.39	23.06	2.29	1.00	29.62	18.03	2.79
2900	21.17	34.44	13.17	22.50	2.28	1.00	29.69	17.98	2.86
3000	20.49	35.11	11.99	27.99	2.61	1.03	29.71	17.80	2.87
3100	20.21	34.21	11.64	26.10	2.42	1.03	29.49	17.82	2.90
3200	19.72	34.09	10.81	27.58	2.49	1.05	29.53	17.85	2.88
3300	19.42	33.47	10.81	26.60	2.40	1.04	29.47	17.76	2.89
3400	18.72	34.30	10.23	28.85	2.80	1.07	29.74	17.81	2.98
3500	18.55	33.57	9.76	29.33	2.61	1.07	29.60	17.70	2.94
3600	18.11	33.15	9.48	28.90	2.60	1.08	29.35	17.63	2.96
3700	17.65	33.39	9.17	30.93	2.78	1.09	29.70	17.68	3.03
3800	17.09	33.95	8.82	40.18	3.10	1.11	29.57	17.62	3.17
3900	16.85	33.26	8.69	28.21	2.94	1.11	29.36	17.47	3.13
4000	16.49	33.29	8.28	25.64	3.02	1.12	28.99	17.20	3.18
4100	15.95	33.38	7.80	28.45	3.17	1.14	29.06	17.24	3.24
4200	15.73	32.77	7.77	24.92	3.04	1.14	29.22	17.12	3.30
4300	15.40	32.92	7.60	24.02	3.18	1.15	29.13	17.07	3.30
4400	15.01	32.93	7.14	22.90	3.24	1.17	28.62	16.76	3.40
4500	14.79	33.36	6.82	21.73	3.43	1.18	28.78	16.84	3.47
4600	14.49	32.31	6.74	19.00	3.13	1.17	28.66	16.93	3.51
4700	14.13	32.01	6.61	18.54	3.12	1.17	29.27	16.81	3.57
4800	13.83	32.52	6.11	19.34	3.32	1.21	28.75	16.58	3.65
4900	13.48	31.95	6.26	17.53	3.26	1.19	28.12	16.21	3.67
5000	13.31	32.09	5.83	16.97	3.27	1.21	27.95	15.96	3.76
5100	12.79	30.94	5.82	16.67	3.05	1.20	28.23	15.85	3.81
5200	12.46	31.75	5.63	16.56	3.40	1.22	28.24	15.80	3.90
5300	11.98	32.15	5.63	16.02	3.75	1.22	27.62	15.18	4.08
5400	11.65	32.08	5.54	15.26	3.81	1.21	26.97	14.84	4.14
5500	11.10	32.65	5.56	14.07	4.29	1.20	27.26	14.72	4.25



## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

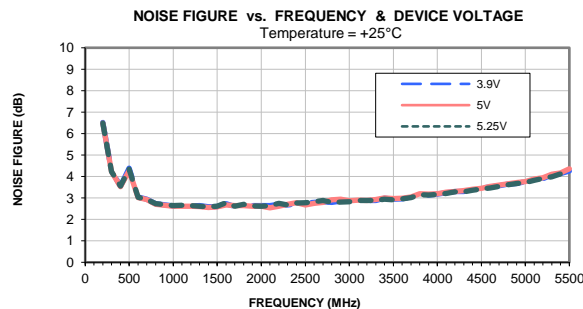
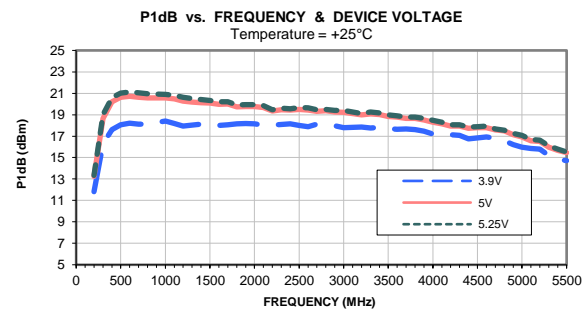
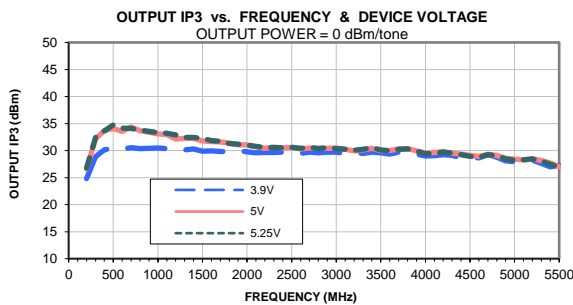
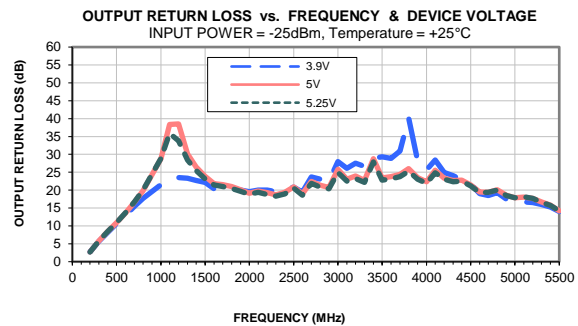
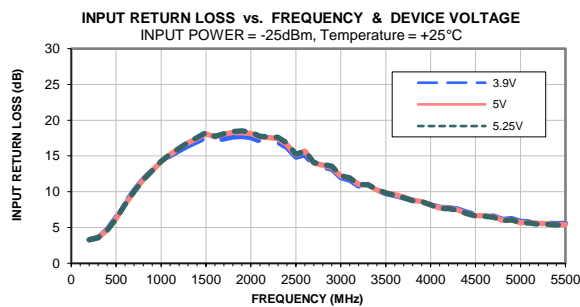
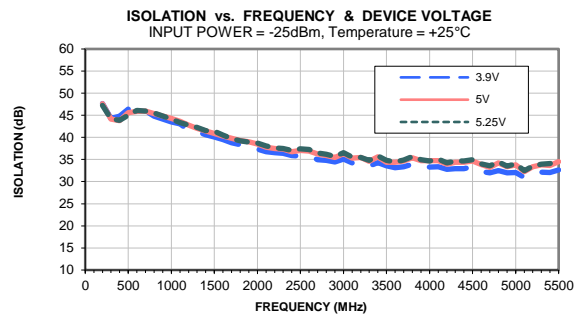
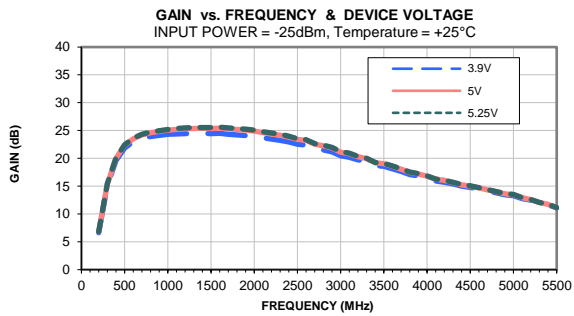
Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 5.25V, Id = 98.63 mA @ Temperature = +25degC

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
					K	Measure			
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
200	6.82	47.24	3.28	2.71	12.49	0.69	26.76	13.34	6.49
300	15.45	44.21	3.55	5.80	5.32	1.09	32.45	19.03	4.23
400	20.06	43.85	4.61	8.46	4.15	1.18	33.60	20.59	3.56
500	22.43	45.03	6.23	10.94	4.62	1.15	34.74	21.01	4.34
600	23.64	46.12	8.21	13.63	5.36	1.11	34.16	21.12	3.03
700	24.33	45.95	9.99	16.68	5.31	1.08	34.12	21.05	2.93
800	24.74	45.55	11.67	20.02	5.09	1.05	33.79	20.97	2.74
1000	25.20	44.13	14.24	28.89	4.30	1.02	33.35	20.89	2.64
1100	25.35	43.33	15.24	35.88	3.91	1.01	33.18	20.82	2.66
1200	25.45	42.79	16.07	33.78	3.66	1.00	32.91	20.62	2.64
1300	25.52	42.24	16.88	28.47	3.43	1.00	32.41	20.51	2.61
1400	25.55	41.51	17.59	25.50	3.16	0.99	32.43	20.41	2.59
1500	25.54	41.38	18.27	23.12	3.12	0.98	32.23	20.34	2.61
1600	25.61	40.52	17.76	21.44	2.81	0.98	31.82	20.22	2.78
1700	25.50	39.75	18.11	20.98	2.62	0.97	31.75	20.22	2.61
1800	25.36	39.26	18.41	20.46	2.52	0.96	31.32	19.90	2.71
1900	25.23	38.96	18.51	19.68	2.48	0.96	31.21	19.94	2.63
2000	25.05	38.69	18.31	18.84	2.44	0.96	30.99	19.95	2.62
2100	24.81	38.04	17.76	19.39	2.34	0.96	30.80	19.84	2.64
2200	24.57	37.63	17.67	18.80	2.30	0.95	30.60	19.46	2.75
2300	24.34	37.52	17.60	18.31	2.32	0.95	30.56	19.62	2.67
2400	23.97	37.06	16.81	18.97	2.29	0.96	30.56	19.56	2.76
2500	23.52	37.41	15.26	20.60	2.48	0.98	30.58	19.66	2.78
2600	23.34	37.29	15.71	18.61	2.50	0.97	30.42	19.65	2.82
2700	22.67	36.48	14.06	21.93	2.45	0.99	30.57	19.45	2.89
2800	22.35	36.18	13.81	20.79	2.45	0.99	30.38	19.50	2.79
2900	21.97	35.68	13.58	20.38	2.41	0.99	30.51	19.41	2.81
3000	21.22	36.57	12.24	24.97	2.84	1.02	30.36	19.40	2.83
3100	20.91	35.53	11.92	22.53	2.61	1.02	30.23	19.26	2.89
3200	20.37	35.46	11.01	23.28	2.71	1.04	30.07	19.10	2.88
3300	20.04	34.80	11.01	22.14	2.61	1.03	30.27	19.25	2.89
3400	19.27	35.85	10.31	27.89	3.14	1.07	30.55	19.17	2.94
3500	19.09	34.81	9.85	22.83	2.83	1.06	30.14	18.98	2.92
3600	18.61	34.46	9.54	23.19	2.85	1.07	29.97	18.91	2.96
3700	18.12	34.89	9.17	23.75	3.11	1.09	30.25	18.77	3.01
3800	17.53	35.66	8.75	25.28	3.56	1.11	30.29	18.77	3.15
3900	17.25	34.93	8.63	23.03	3.38	1.11	29.86	18.65	3.14
4000	16.86	34.64	8.17	21.90	3.36	1.12	29.43	18.47	3.16
4100	16.30	35.07	7.66	24.87	3.66	1.15	29.47	18.31	3.21
4200	16.06	34.26	7.63	23.03	3.44	1.14	29.71	18.06	3.28
4300	15.71	34.64	7.43	22.35	3.69	1.15	29.51	18.05	3.28
4400	15.29	34.68	6.95	22.55	3.78	1.18	29.21	17.85	3.36
4500	15.06	34.95	6.63	21.16	3.93	1.19	28.93	17.87	3.42
4600	14.73	34.01	6.56	19.35	3.65	1.18	28.77	17.93	3.47
4700	14.36	33.57	6.41	19.36	3.59	1.19	29.23	17.67	3.54
4800	14.04	34.44	5.92	20.02	3.95	1.23	29.07	17.56	3.61
4900	13.67	33.50	6.06	18.54	3.75	1.21	28.44	17.24	3.67
5000	13.49	34.01	5.65	17.87	3.92	1.23	28.25	17.07	3.72
5100	12.94	32.46	5.64	18.12	3.50	1.23	28.27	16.69	3.82
5200	12.58	33.53	5.46	17.74	4.03	1.24	28.44	16.62	3.91
5300	12.07	33.92	5.46	16.62	4.44	1.24	28.03	16.09	3.99
5400	11.73	34.12	5.37	15.71	4.66	1.24	27.48	15.79	4.12
5500	11.16	34.87	5.39	14.18	5.35	1.22	27.00	15.52	4.28

## Typical Performance Curves



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)	