Low Noise, Wideband, High IP3

Monolithic Amplifier Die

PMA2-153LN-D+

50Ω 0.5 to 15 GHz

The Big Deal

- Ultra wideband, 0.5 to 15 GHz
- Flat gain over wideband, 16.7 dB with ±3.3 dB
- Low noise figure, 2.6 dB at 8 GHz
- High IP3, up to +28 dBm

Product Overview

The PMA2-153LN-D+ is a PHEMT based wideband, low noise, flat gain MMIC amplifier die with a unique combination of low noise, high IP3, and flat gain over wideband making it ideal for sensitive, high-dynamic-range receiver applications. This design operates on a single 5V or 6V supply, is well matched for 50Ω.

Key Features

Feature	Advantages
Low noise • 2.2 dB at 2 GHz • 2.6 dB at 8 GHz	Enables lower system noise figure performance.
High IP3 • +27.7 dBm at 2 GHz • +26.8 dBm at 8 GHz	Combination of low noise and high IP3 makes this MMIC amplifier die ideal for use in low noise receiver front end (RFE) as it gives the user advantages of sensitivity and two-tone IM performance at both ends of the dynamic range.
Low operating voltage, 5V/6V.	Achieves high IP3 using low voltage.
Wide bandwidth with flat gain • ±0.1 dB over 0.5 to 2 GHz • ±0.7 dB over 0.5 to 6 GHz • ±1.2 dB over 0.5 to 8 GHz • ±3.3 dB over 0.5 to 15 GHz	Enables usage in applications without external gain flattening networks.
Unpackaged die	Enables users to integrate amplifier die directely into hybrids.

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PMA2-153LN-D+

50Ω 0.5 to 15 GHz

Product Features

- Low Noise figure, 2.6 dB at 8 GHz
- High IP3, up to +28 dBm
- Excellent Gain flatness, ±3.3 dB over 0.5 to 15 GHz at 6V

Typical Applications

- WiFi
- WLAN
- UMTS
- LTE
- WiMAX
- S-band Radar
- C-band Satcom

+RoHS Compliant

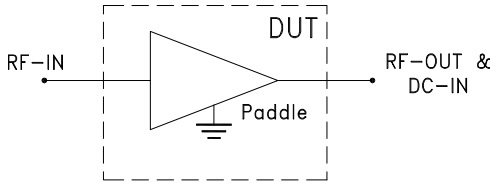
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

Ordering Information: Refer to Last Page

General Description

The PMA2-153LN-D+ is a PHEMT based wideband, low noise, flat gain MMIC amplifier die with a unique combination of low noise, high IP3, and flat gain over wideband making it ideal for sensitive, high-dynamic range receiver applications. This design operates on a single 5V or 6V supply, is well matched for 50Ω.

Simplified Schematic and Pad Description



Pad Function	Description *(See Figure 2)*
RF-IN	Connects to RF input via C1
RF-OUT & DC-IN	Connects to RF out and V_{DD} via Bias-Tee
Ground	Connects 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)	V_{DD}=6.0			V_{DD}=5.0			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Frequency Range		0.5		15.0	0.5		15.0	GHz
Noise Figure	0.5		2.3			2.2		dB
	2.0		2.3			2.1		
	8.0		2.6			2.5		
	10.0		2.8			2.7		
	15.0		3.8			3.7		
Gain	0.5		19.0			18.1		dB
	2.0		18.9			18.0		
	8.0		16.8			16.0		
	10.0		16.0			15.3		
	15.0		12.5			11.7		
Input Return Loss	0.5		9.3			8.4		dB
	2.0		10.2			9.2		
	8.0		9.7			9.1		
	10.0		8.7			8.2		
	15.0		4.2			4.2		
Output Return Loss	0.5		13.5			11.7		dB
	2.0		13.0			11.6		
	8.0		22.9			21.0		
	10.0		17.4			17.1		
	15.0		6.9			6.2		
Output Power at 1dB Compression[2]	0.5		15.3			14.2		dBm
	2.0		15.2			14.0		
	8.0		14.8			13.2		
	10.0		14.8			13.2		
	15.0		11.2			10.5		
Output IP3	0.5		27.3			24.7		dBm
	2.0		27.7			24.9		
	8.0		26.8			24.4		
	10.0		26.7			24.7		
	15.0		24.0			21.9		
Device Operating Voltage (V_{DD})			6.0			5.0		V
Device Operating Current (I_{DD})		—	66	85	—	50	—	mA
Device Current Variation vs. Temperature[3]			-5.3			12.5		µA/°C
Device Current Variation vs. Voltage			0.0187			0.0187		mA/mV
Thermal Resistance, junction-to-ground lead			107			107		°C/W

1. Measured on Mini-Circuits Characterization Test Board. Die packaged in 2x2mm 8-lead MCLP package and soldered on MB-014-1. See Characterization Test Circuit (Fig. 1)
2. Current increases at P1dB up to 10mA typ. at 5Volts V_{DD}
3. (Current at 85°C - Current at -45°C)/130

Absolute Maximum Ratings[4]

Parameter	Ratings
Operating Temperature (ground lead)	-40°C to 85°C
Junction Temperature	160
Total Power Dissipation	0.7W
Input Power (CW), Vd=5,6V[5]	+20 dBm (0.7 - 7.75 GHz) 5 minutes max. +22 dBm (7.75 - 15 GHz) 5 minutes max. +8 dBm (continuous)
DC Voltage	7V

4. Permanent damage may occur if any of these limits are exceeded. Electrical maximum ratings are not intended for continuous normal operation.
5. Measured on Mini-Circuits Characterization Test Board, MB-014-1

Characterization Test Circuit

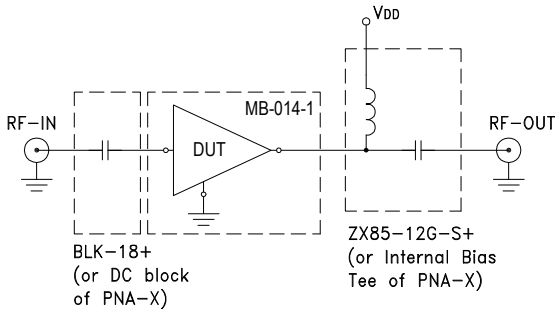
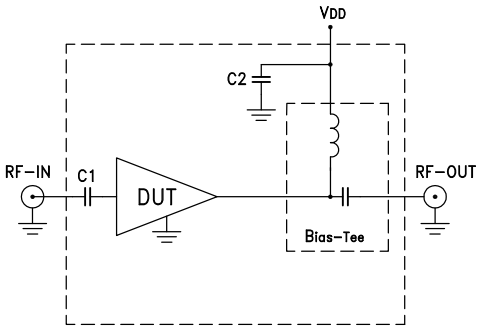


Fig 1. Characterization Circuit
Note: This block diagram is used for characterization. (DUT soldered on Mini-Circuits Characterization test board MB-014-1) Gain, Return loss, Output power at 1dB compression (P1 dB), output IP3 (OIP3) and noise figure measured using Agilent's N5242A PNA-X microwave network analyzer.

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

Recommended Application Circuit



Component	Size	Value
C1	0402	0.1μF
C2	0603	0.01μF

Fig 2. Application Circuit

Die Layout

Ground: bottom of die

Fig 3. Die Layout

Bonding Pad Position

(Dimensions in µm, Typical)

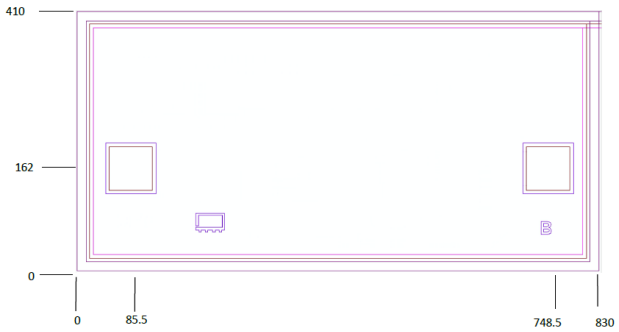


Fig 4. Bonding Pad Positions

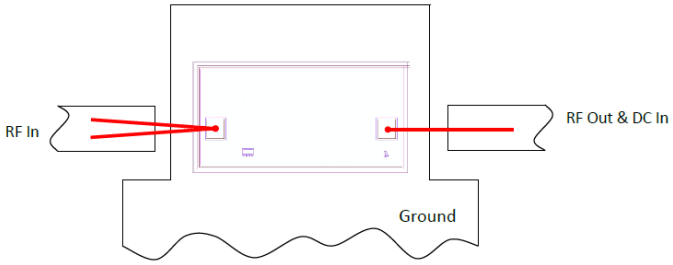
Critical Dimensions

Parameter	Values
Die Thickness, µm	100
Die Width, µm	410
Die Length, µm	830
Bond Pad Size	70 x 70

Assembly and Handling Procedure

1. Storage
   Dice should be stored in a dry nitrogen purged desiccators or equivalent.
2. ESD
   MMIC PHEMPT amplifier dice are susceptible to electrostatic and mechanical damage. Die are supplied in antistatic protected mate rial, which should be opened in clean room conditions at an appropri ately 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 low as reasonable to minimize performance degradation due to undesirable series inductance.

Assembly Diagram



Note: Ground bond wires are optional.

Recommended Wire Length, Typical

Wire	Wire Length (mm)	Wire Loop Height (mm)
RF-IN,	0.60	0.15
RF-OUT & DC-IN	1.00	0.30

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: 5,10,50,100 KGD*	PMA2-153LN-DG+
	Medium†, Partial wafer: KGD*<2580	PMA2-153LN-DP+
	Large†, Full Wafer	PMA2-153LN-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 1A (250 to <500V) in accordance with ANSI/ESD STM 5.1 - 2001

** Tested in industry standard 2x2mm, 8-lead MCLP 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

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 = 49.38 mA @ Temperature = +25degC

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)
100	16.12	27.82	3.79	10.24	1.34	1.11	26.75	14.96	4.14
200	17.63	26.16	6.40	11.82	1.27	0.92	26.03	14.73	2.60
300	18.00	25.65	7.63	12.33	1.25	0.85	25.75	14.68	2.50
400	18.13	25.38	8.27	12.44	1.23	0.82	26.81	14.68	2.38
500	18.19	25.24	8.62	12.38	1.23	0.80	26.19	14.67	2.28
1000	18.23	24.90	9.21	12.05	1.21	0.75	25.39	14.84	2.12
1500	18.16	24.89	9.32	11.91	1.21	0.75	26.34	14.79	2.08
2000	18.04	24.98	9.20	11.84	1.23	0.76	26.19	14.62	2.12
2500	17.92	25.16	9.19	12.00	1.25	0.79	25.83	14.48	2.02
3000	17.84	25.22	9.37	12.65	1.27	0.80	25.80	14.41	2.03
3500	17.80	25.26	9.81	13.88	1.29	0.82	25.88	14.46	2.08
4000	17.75	25.28	10.18	15.24	1.31	0.84	25.39	14.37	2.09
4500	17.68	25.36	10.61	16.89	1.33	0.86	25.34	14.34	2.10
5000	17.60	25.41	11.04	18.98	1.35	0.87	26.26	14.69	2.08
5500	17.46	25.52	11.53	22.12	1.39	0.89	25.37	14.44	2.13
6000	17.26	25.64	11.65	25.73	1.42	0.91	25.91	14.46	2.25
6500	17.00	25.86	11.24	29.10	1.47	0.94	25.32	14.40	2.27
7000	16.73	26.08	10.52	34.01	1.51	0.97	24.84	14.28	2.31
7500	16.48	26.33	9.89	44.97	1.56	1.00	24.30	14.07	2.42
8000	16.25	26.55	9.23	33.50	1.59	1.03	24.77	14.03	2.51
8500	16.06	26.68	8.67	26.61	1.60	1.06	24.83	14.02	2.58
9000	15.94	26.78	8.18	22.96	1.59	1.08	24.79	13.98	2.66
9500	15.86	26.88	7.88	20.21	1.58	1.09	25.09	14.02	2.65
10000	15.79	26.85	7.82	17.95	1.56	1.10	25.09	13.99	2.69
10500	15.62	27.02	8.14	16.25	1.61	1.09	25.14	13.99	2.72
11000	15.33	27.21	8.58	14.60	1.69	1.07	25.15	13.76	2.75
11500	15.04	27.52	8.74	13.15	1.77	1.06	25.03	13.67	2.81
12000	14.69	27.81	8.55	11.73	1.83	1.06	24.61	13.36	2.94
12500	14.27	28.20	7.86	10.44	1.87	1.07	24.29	12.96	3.11
13000	13.82	28.69	6.90	9.40	1.89	1.09	24.21	12.69	3.27
13500	13.36	29.03	5.95	8.55	1.85	1.11	23.99	12.33	3.47
14000	12.91	29.41	5.14	7.80	1.79	1.13	23.70	12.30	3.63
14500	12.52	29.72	4.55	7.20	1.74	1.14	23.57	12.04	3.75
15000	12.10	30.11	4.09	6.67	1.72	1.14	22.52	11.54	3.81
15500	11.58	30.52	3.79	6.28	1.76	1.13	21.26	10.92	3.86
16000	10.90	31.07	3.56	5.84	1.89	1.11	20.30	10.52	4.00
16500	10.17	31.66	3.35	5.43	2.04	1.08	19.87	10.21	4.30
17000	9.45	32.09	3.15	5.10	2.15	1.06	20.81	9.98	4.66
17500	8.86	32.50	3.05	4.72	2.25	1.03	20.81	9.50	4.89
18000	8.28	32.73	3.04	4.38	2.35	0.99	19.49	8.89	5.26

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 = 6V, Id = 67.41 mA @ Temperature = +25degC

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)
100	16.84	28.59	3.71	9.47	1.33	1.09	29.92	16.19	4.32
200	18.50	26.74	6.57	12.15	1.25	0.91	28.85	15.80	2.75
300	18.91	26.23	8.07	13.36	1.23	0.84	28.72	15.70	2.57
400	19.07	25.97	8.90	13.88	1.22	0.81	29.62	15.87	2.47
500	19.14	25.81	9.40	14.03	1.22	0.79	28.92	15.92	2.40
1000	19.21	25.42	10.31	13.88	1.20	0.75	28.40	16.10	2.18
1500	19.15	25.38	10.51	13.72	1.20	0.74	29.44	16.20	2.13
2000	19.03	25.47	10.38	13.58	1.21	0.76	29.34	16.11	2.20
2500	18.90	25.58	10.37	13.69	1.23	0.77	29.19	16.12	2.13
3000	18.80	25.69	10.58	14.39	1.25	0.79	29.26	16.16	2.10
3500	18.73	25.75	11.07	15.81	1.27	0.81	29.15	16.32	2.15
4000	18.65	25.82	11.50	17.39	1.30	0.83	28.66	16.20	2.15
4500	18.55	25.89	11.95	19.15	1.32	0.84	28.53	16.27	2.19
5000	18.44	26.02	12.40	21.05	1.35	0.86	28.94	16.70	2.17
5500	18.27	26.12	12.85	23.05	1.38	0.87	28.15	16.36	2.24
6000	18.05	26.27	12.85	23.51	1.42	0.89	28.23	16.52	2.33
6500	17.79	26.49	12.22	23.34	1.47	0.91	27.71	16.37	2.35
7000	17.52	26.76	11.33	23.63	1.52	0.94	27.31	16.20	2.45
7500	17.27	27.04	10.59	24.47	1.57	0.98	26.82	15.94	2.51
8000	17.05	27.15	9.87	26.27	1.58	1.00	26.93	15.94	2.60
8500	16.86	27.39	9.22	26.57	1.61	1.04	26.93	15.93	2.70
9000	16.73	27.49	8.69	25.20	1.61	1.06	26.76	15.83	2.75
9500	16.64	27.57	8.33	22.36	1.60	1.08	26.77	15.80	2.73
10000	16.55	27.73	8.24	19.65	1.62	1.08	26.87	15.66	2.77
10500	16.37	27.87	8.53	17.58	1.67	1.08	26.76	15.75	2.82
11000	16.09	28.09	8.94	15.66	1.76	1.06	26.76	15.43	2.87
11500	15.82	28.45	9.03	14.08	1.85	1.06	26.58	15.26	2.96
12000	15.49	28.74	8.76	12.60	1.91	1.06	26.16	14.88	3.07
12500	15.09	29.21	7.96	11.29	1.97	1.08	25.99	14.37	3.23
13000	14.66	29.67	6.94	10.23	1.98	1.11	25.90	14.00	3.43
13500	14.20	29.99	5.97	9.36	1.94	1.14	25.70	13.60	3.63
14000	13.76	30.50	5.14	8.53	1.92	1.16	25.32	13.47	3.80
14500	13.38	30.72	4.54	7.86	1.84	1.17	25.09	13.20	3.94
15000	12.96	31.27	4.08	7.24	1.84	1.17	24.38	12.43	4.06
15500	12.45	31.59	3.77	6.78	1.87	1.17	23.26	11.72	4.06
16000	11.78	32.20	3.54	6.26	2.00	1.15	22.42	11.23	4.24
16500	11.05	32.75	3.35	5.78	2.14	1.12	21.99	10.91	4.53
17000	10.32	33.19	3.16	5.39	2.27	1.10	22.81	10.69	4.86
17500	9.71	33.39	3.08	4.95	2.32	1.06	22.56	10.17	5.15
18000	9.11	33.39	3.07	4.55	2.35	1.01	21.34	9.51	5.49

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 = 4.75V, Id =45.55 mA @ Temperature = +25degC

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)
100	15.80	27.58	3.81	10.46	1.35	1.12	25.57	14.42	4.16
200	17.26	25.88	6.30	11.53	1.27	0.92	24.86	14.20	2.65
300	17.61	25.41	7.43	11.80	1.25	0.85	24.57	14.13	2.51
400	17.74	25.21	8.00	11.81	1.24	0.82	25.51	14.12	2.41
500	17.79	25.03	8.32	11.72	1.23	0.80	25.01	14.08	2.32
1000	17.83	24.76	8.82	11.37	1.22	0.76	24.21	14.27	2.13
1500	17.76	24.71	8.91	11.24	1.22	0.75	24.97	14.17	2.09
2000	17.63	24.84	8.79	11.18	1.24	0.77	24.97	13.98	2.14
2500	17.52	24.94	8.80	11.36	1.26	0.78	24.62	13.84	2.05
3000	17.44	25.04	8.97	11.98	1.28	0.81	24.54	13.71	2.07
3500	17.42	25.07	9.38	13.10	1.30	0.83	24.65	13.78	2.14
4000	17.38	25.12	9.73	14.35	1.32	0.85	24.16	13.65	2.13
4500	17.32	25.18	10.15	15.84	1.34	0.86	24.14	13.63	2.15
5000	17.25	25.21	10.58	17.76	1.36	0.88	25.13	13.87	2.13
5500	17.13	25.26	11.06	20.59	1.39	0.90	24.18	13.67	2.21
6000	16.94	25.40	11.23	23.98	1.42	0.92	24.94	13.67	2.29
6500	16.68	25.61	10.86	27.25	1.47	0.94	24.28	13.61	2.32
7000	16.42	25.78	10.21	31.99	1.51	0.97	23.75	13.51	2.39
7500	16.16	26.06	9.62	36.52	1.55	1.01	23.20	13.34	2.45
8000	15.94	26.21	9.02	29.63	1.57	1.03	23.75	13.26	2.57
8500	15.75	26.39	8.46	24.56	1.59	1.06	23.85	13.30	2.65
9000	15.62	26.53	7.98	21.37	1.58	1.08	23.88	13.20	2.70
9500	15.55	26.47	7.67	19.09	1.54	1.10	24.28	13.26	2.71
10000	15.49	26.51	7.62	17.23	1.53	1.10	24.17	13.26	2.72
10500	15.33	26.65	7.96	15.76	1.58	1.09	24.35	13.29	2.77
11000	15.04	26.82	8.41	14.25	1.66	1.07	24.30	13.08	2.77
11500	14.74	27.12	8.59	12.82	1.74	1.06	24.17	12.98	2.88
12000	14.39	27.53	8.43	11.44	1.81	1.06	23.76	12.71	2.99
12500	13.96	27.78	7.78	10.17	1.83	1.06	23.33	12.34	3.16
13000	13.52	28.27	6.86	9.17	1.84	1.08	23.29	12.07	3.34
13500	13.04	28.65	5.93	8.30	1.81	1.10	23.03	11.74	3.51
14000	12.59	29.09	5.13	7.53	1.76	1.12	22.71	11.71	3.67
14500	12.19	29.25	4.53	6.88	1.67	1.12	22.58	11.47	3.84
15000	11.76	29.68	4.05	6.35	1.64	1.12	21.39	10.98	3.91
15500	11.25	30.08	3.74	6.03	1.69	1.11	20.04	10.43	3.96
16000	10.60	30.66	3.51	5.65	1.81	1.10	19.07	10.14	4.08
16500	9.89	31.21	3.32	5.31	1.96	1.07	18.68	9.81	4.33
17000	9.16	31.77	3.13	4.98	2.11	1.05	19.69	9.63	4.67
17500	8.53	32.11	3.03	4.57	2.19	1.01	19.76	9.04	4.97
18000	7.90	32.40	2.99	4.19	2.29	0.97	18.41	8.46	5.33

Typical Performance Data

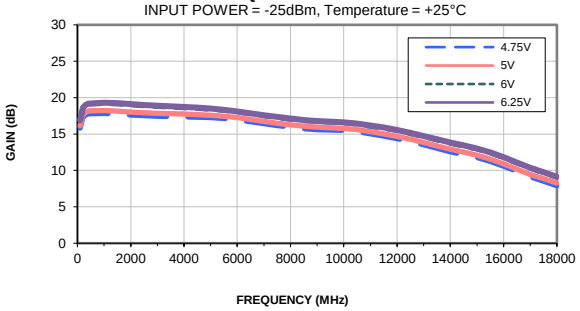
Definitions:
Input Return Loss = -S11 (dB)
Gain(Power Gain) = S21 (dB)
Reverse Isolation = -S12 (dB)
Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 6.25V, Id = 72.23 mA @ Temperature = +25degC

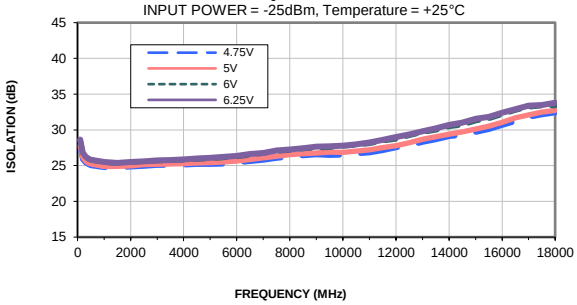
FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
100	16.90	28.65	3.71	9.41	1.33	1.08	29.87	16.25	4.40
200	18.57	26.79	6.58	12.17	1.25	0.91	28.70	15.83	2.82
300	18.98	26.29	8.10	13.47	1.23	0.85	28.32	15.74	2.63
400	19.14	26.01	8.95	14.03	1.22	0.81	29.17	15.89	2.54
500	19.22	25.84	9.46	14.21	1.21	0.79	28.72	15.97	2.44
1000	19.30	25.49	10.44	14.10	1.20	0.75	28.34	16.14	2.21
1500	19.24	25.38	10.68	13.94	1.19	0.74	29.15	16.26	2.17
2000	19.12	25.52	10.56	13.76	1.21	0.76	29.36	16.19	2.26
2500	19.00	25.62	10.54	13.87	1.23	0.77	29.27	16.24	2.15
3000	18.89	25.74	10.75	14.55	1.25	0.79	29.25	16.33	2.14
3500	18.82	25.80	11.27	15.94	1.27	0.81	29.19	16.49	2.20
4000	18.74	25.88	11.69	17.47	1.30	0.83	28.79	16.36	2.18
4500	18.63	25.99	12.15	19.21	1.32	0.84	28.68	16.49	2.22
5000	18.51	26.09	12.59	20.89	1.35	0.86	29.06	16.89	2.21
5500	18.35	26.21	13.03	22.53	1.38	0.87	28.36	16.57	2.24
6000	18.13	26.38	12.99	22.71	1.43	0.89	28.49	16.73	2.35
6500	17.86	26.64	12.34	22.56	1.48	0.91	27.86	16.62	2.41
7000	17.59	26.77	11.42	22.72	1.51	0.94	27.49	16.42	2.47
7500	17.35	27.12	10.68	23.53	1.57	0.97	27.00	16.15	2.55
8000	17.12	27.26	9.93	25.42	1.59	1.00	27.18	16.14	2.66
8500	16.94	27.45	9.28	26.36	1.62	1.03	27.07	16.14	2.75
9000	16.80	27.66	8.74	25.53	1.63	1.06	26.94	16.05	2.79
9500	16.71	27.71	8.36	22.83	1.62	1.08	26.97	16.00	2.80
10000	16.62	27.81	8.26	20.09	1.63	1.08	27.13	15.83	2.82
10500	16.44	27.98	8.55	17.97	1.68	1.08	26.98	15.88	2.87
11000	16.17	28.25	8.94	15.99	1.78	1.06	26.87	15.58	2.89
11500	15.90	28.62	9.02	14.38	1.87	1.06	26.68	15.43	3.02
12000	15.57	29.01	8.73	12.86	1.95	1.06	26.16	15.01	3.11
12500	15.17	29.35	7.93	11.52	1.99	1.08	25.95	14.43	3.31
13000	14.73	29.82	6.91	10.43	2.01	1.11	25.86	14.07	3.50
13500	14.27	30.22	5.94	9.52	1.99	1.14	25.59	13.63	3.71
14000	13.83	30.70	5.12	8.66	1.96	1.17	25.18	13.46	3.87
14500	13.44	31.00	4.51	7.96	1.89	1.18	24.87	13.18	4.01
15000	13.02	31.54	4.05	7.31	1.89	1.18	24.10	12.47	4.06
15500	12.50	31.83	3.75	6.84	1.91	1.17	22.89	11.75	4.13
16000	11.83	32.40	3.50	6.29	2.02	1.15	22.07	11.31	4.31
16500	11.09	32.90	3.33	5.81	2.17	1.12	21.66	10.89	4.58
17000	10.36	33.39	3.15	5.41	2.31	1.10	22.48	10.56	4.95
17500	9.74	33.48	3.07	4.95	2.33	1.06	22.21	10.13	5.25
18000	9.13	33.79	3.07	4.54	2.46	1.01	21.05	9.38	5.60

Typical Performance Curves

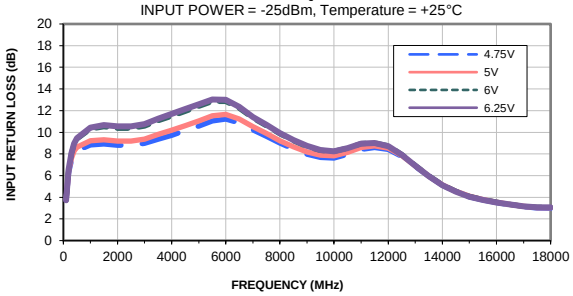
GAIN vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25dBm, Temperature = +25°C



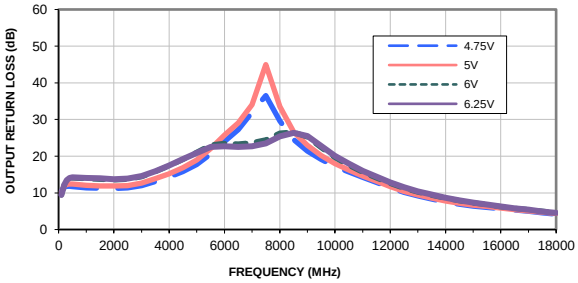
ISOLATION vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25dBm, Temperature = +25°C



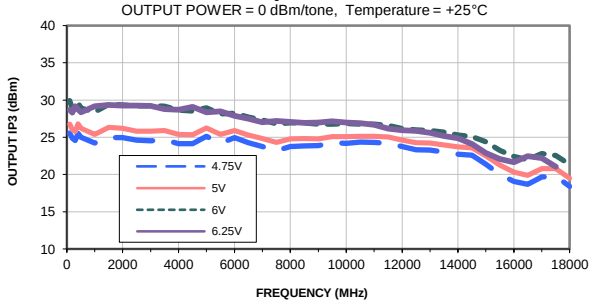
INPUT RETURN LOSS vs. FREQUECNY & DEVICE VOLTAGE
INPUT POWER = -25dBm, Temperature = +25°C



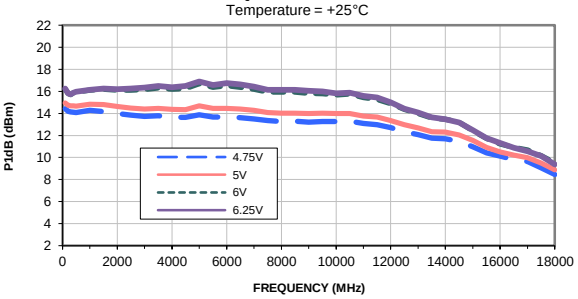
OUTPUT RETURN LOSS vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25dBm, Temperature = +25°C



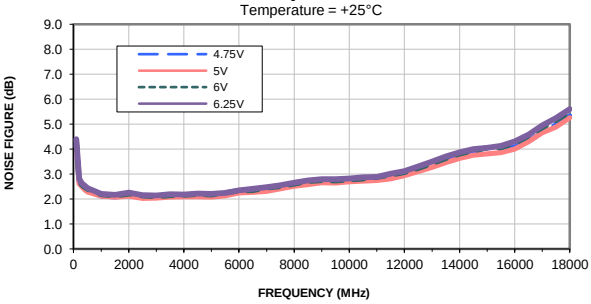
OUTPUT IP3 vs. FREQUENCY & DEVICE VOLTAGE
OUTPUT POWER = 0 dBm/tone, Temperature = +25°C



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)	