

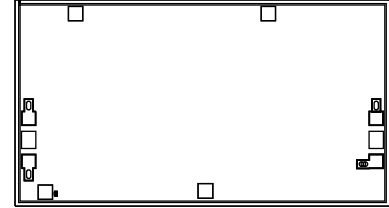


THE BIG DEAL

- Wideband, 2 to 18 GHz
- Flat Gain 16.6±0.7 dB from 2 to 18 GHz
- P1dB, +19.6 dBm Typ. at 10 GHz.
- OIP3, +27.4 dBm Typ. at 10 GHz.

APPLICATIONS

- 5G MIMO and Back Haul Radio Systems
- Satellite Communications
- Test and Measurement Equipment
- Radar, EW, and ECM Defense Systems



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

SEE ORDERING INFORMATION ON THE LAST PAGE

PRODUCT OVERVIEW

The AVA-2183-D+ is an amplifier die that operates from 2 to 18 GHz that is fabricated on a GaAs PHEMT MMIC process. The Amplifier provides 16.6 dB of Gain, +27.6 dBm OIP3 and +19.7 dBm Output Power at 1 dB Compression point with 16 dB typical Return Loss while requiring +4V and 210 mA DC power. Gain flatness is +/- 0.7 dB across the operating bandwidth. The Amplifier is ideal for use in very wideband ECM, Test & Measurement and Microwave communications systems.

KEY FEATURES

Feature	Advantages
Wideband: 2 to 18 GHz <ul style="list-style-type: none"> • 16 dB Gain Typ. at 2 GHz • 17 dB Gain Typ. at 18 GHz 	Suitable for wide bandwidth defense and test and measurement application as well as narrow band performance driven applications.
Good P1dB & OIP3 <ul style="list-style-type: none"> • +19.6 dBm P1dB Typ. at 10 GHz • +27.4 dBm OIP3 Typ. at 10 GHz 	Suitable as a driver amplifier in receiver/transmitter chains.
High Reverse Isolation	Isolates adjacent circuitry without need for an external expensive isolator.
Input and Output Return Loss	Eliminates need for external matching circuit providing published Return Loss.
Unpackaged Die	Suitable for chip and wire hybrid assemblies.

**ELECTRICAL SPECIFICATIONS¹ AT 25°C, VDD=+4V, IDD=210mA & Zo=50Ω UNLESS NOTED OTHERWISE**

Parameter	Condition (GHz)	VDD=+4V			Units
		Min.	Typ.	Max.	
Frequency Range		2		18	GHz
Gain	2		15.9		dB
	5		16.1		
	10		17.2		
	15		16.7		
	18		16.9		
Input Return Loss	2		12		dB
	5		16		
	10		14		
	15		11		
	18		14		
Output Return Loss	2		18		dB
	5		20		
	10		19		
	15		16		
	18		15		
Reverse Isolation	2 - 18		47.4		dB
Output Power at 1dB Compression	2		18.9		dBm
	5		19.3		
	10		19.6		
	15		18.2		
	18		17.6		
Output Third-Order Intercept (Pout = 0 dBm/Tone)	2		31.2		dBm
	5		29.1		
	10		27.4		
	15		25.2		
	18		23.7		
Noise Figure	2		6.8		dB
	5		6.4		
	10		5.5		
	15		4.7		
	18		5.1		
Device Operating Voltage (VDD)			+4		V
Device Operating Current (IDD)			210		mA
Device Gate Voltage (VGG)			-0.46		V
Device Gate Current (IGG)			-0.2		μA
Thermal Resistance, Junction-to-Ground Lead (ΘJC)			38.8		°C/W

1. Die is soldered and measured on Mini-Circuits die characterization board. See characterization circuit (Fig. 1).



MMIC DIE

Wideband Amplifier

AVA-2183-D+

Mini-Circuits

50Ω 2 to 18 GHz

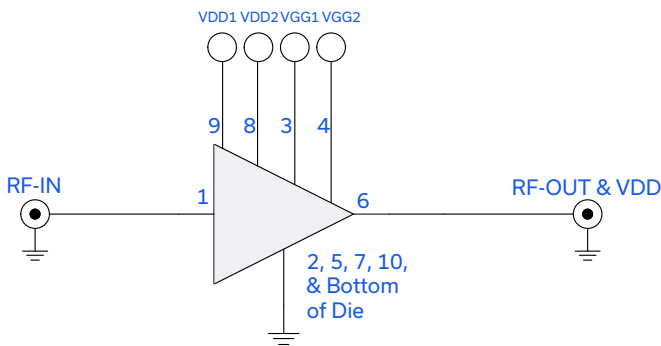
MAXIMUM RATINGS²

Parameter	Ratings
Operating Temperature (ground lead)	-40°C to +85°C
Junction Temperature	+150°C ³
Power Dissipation	1.7W
Input Power (CW)	+23 dBm (5 minute max) +14 dBm (continuous)
DC voltage on RF-OUT	+7V
Current I _{GG}	-5mA to 0mA
Current I _{DD}	320mA
DC Voltage on V _{DD} (V _{DD1} & V _{DD2})	+7V
DC Voltage on V _{GG} (V _{GG1} & V _{GG2})	-1.5 V to -0.2 V

2. Permanent damage may occur in any of these limits are exceeded. Electrical maximum ratings are not intended for continuous normal operation.

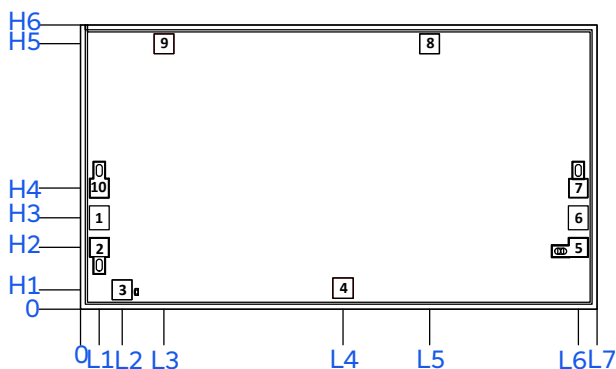
3. $T_j = +85°C + (V_{DD}) \cdot (I_{DD}) \cdot (\theta_{JC}) = +117°C$. Keeping T_j below +117°C will ensure MTTF > 100 Years.

SIMPLIFIED SCHEMATIC AND PAD DESCRIPTION



Function	Pad Number	Description
RF-IN	1	RF Input Pad
GROUND	2, 5, 7, 10, & Bottom of die	The bond pads are connected to backside through vias and do not require wire-bond connections to ground.
VGG1	3	Gate Bias Pad #1
VGG2	4	Gate Bias Pad #2
RF-OUT	6	RF Output Pad
VDD2	8	Drain Bias Pad #2
VDD1	9	Drain Bias Pad #1

BONDING PAD POSITION



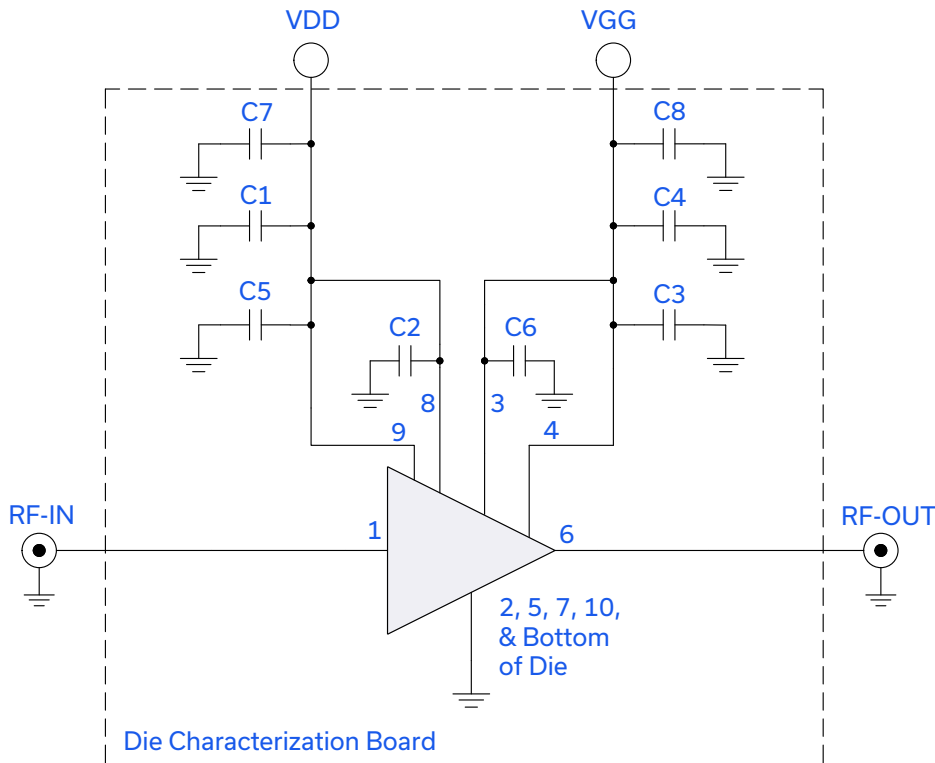
DIMENSION IN μM, TYP.

L1	L2	L3	L4	L5	L6	L7
95	211	422	1328	1767	2519	2614
H1	H2	H3	H4	H5	H6	
98	312	462	612	1343	1438	
Thickness	Die size	Pad size 1 & 6	Pad size 2,3,5,7,8,9 & 10	Pad size 4		
100	2614 x 1438	93 x 113	93 x 93	96 x 96		

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CHARACTERIZATION & APPLICATION CIRCUIT



Component	Size	Value	Part Number	Manufacturer
C2, C3, C5 & C6	100pF	22x22mil	MA4M3100	MACOM
C1 & C4	0.1uF	0402	GRM155R71A474KE01D	Murata
C7 & C8	10uF	1206	CL31B106KBHNNNE	Samsung

Fig.1: Characterization & Application Circuit

Note: This block diagram is used for characterization (Die is attached and wire-bonded on a die characterization test board). Gain, Return Loss, Output Power at 1dB Compression (P1dB), Output IP3 (OIP3) and Noise Figure are measured using Agilent's N5242A PNA-X Microwave Network Analyzer.

Conditions:

1. VDD = +4V
2. VG is set to obtain desired IDD as shown in specification table.
3. Gain and Return Loss: Pin = -25 dBm
4. Output IP3 (OIP3): Two Tones, spaced 1 MHz apart, 0 dBm/Tone at Output.

Power ON Sequence:

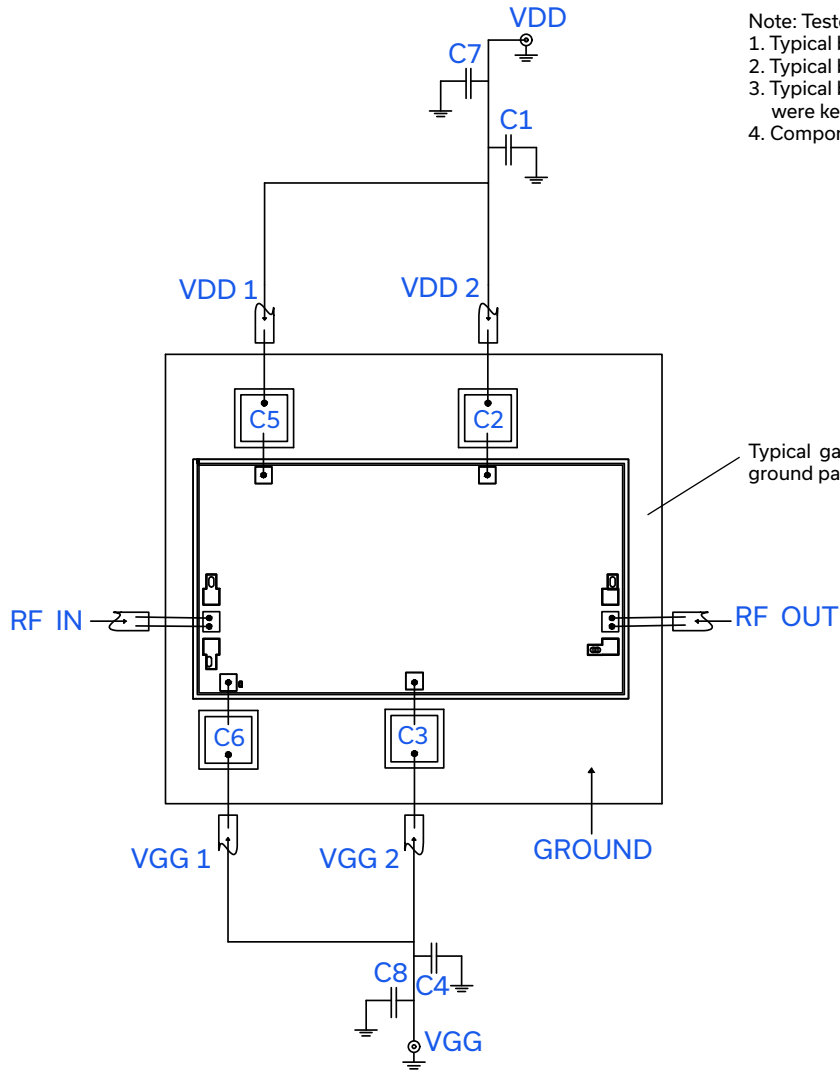
- 1) Set VGG = -1.3V. Apply VGG.
- 2) Set VDD = +4V. Apply VDD.
- 3) Increase VGG to obtain desired IDD as shown in specification table.
- 4) Apply RF Signal

Power OFF Sequence:

- 1) Turn off RF Signal.
- 2) Adjust VGG down to -1.3V.
- 3) Turn off VDD.
- 4) Turn off VGG.



ASSEMBLY DIAGRAM




Note: Tested on die characterization board with following bond lengths:

1. Typical bond length for RF-IN: 280μm (11mils)
2. Typical bond length for RF-OUT: 280μm (11mils)
3. Typical bond lengths from die, capacitor, VDD1, VDD2, VGG1, and VGG2 were kept as short as possible
4. Component list given in Figure 1.

Typical gap of 76μm (3mils) between the edge of the die and edge of the ground pad.

ASSEMBLY AND HANDLING PROCEDURE

1. **Storage**
Die should be stored in a dry nitrogen purged desiccators or equivalent.
2.  **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.
3. **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.
4. **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.

**ADDITIONAL DETAILED TECHNICAL 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. Gel - Pak: 5,10,50,100 KGD* AVA-2183-DG+ Medium†, Partial wafer: KGD*<570 AVA-2183-DP+ Full wafer AVA-2183-DF+ †Available upon request contact sales representative Refer to AN-60-067
Die Marking	EL-AMP-11-2
Environmental Ratings	ENV80

*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 parameters specified by Mini-Circuits.

NOTES

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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 = 4.00V, Id = 210.04mA @ Temperature = +25°C

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)
1000	6.20	68.98	7.30	4.63	367.19	0.78	22.73	13.16	8.75
1500	14.92	75.14	9.82	11.97	430.62	1.03	30.97	18.37	6.87
2000	15.47	72.42	11.65	17.83	322.77	1.05	31.25	18.96	6.83
2500	15.33	69.68	13.07	20.45	245.60	1.04	30.86	19.00	6.80
3000	15.30	68.34	14.23	21.48	214.45	1.03	30.36	19.22	6.70
3500	15.34	67.29	15.22	21.83	190.64	1.02	29.78	19.07	6.64
4000	15.42	67.16	15.98	21.67	186.97	1.02	29.72	19.38	6.52
4500	15.52	66.64	16.58	21.38	174.59	1.01	29.37	19.11	6.45
5000	15.65	66.79	16.81	21.18	175.10	1.01	29.16	19.37	6.34
5500	15.93	67.68	16.81	21.15	187.81	1.01	28.88	19.12	6.28
6000	16.10	68.36	16.70	20.97	198.96	1.01	28.65	19.39	6.18
6500	16.21	68.13	16.39	21.00	191.25	1.01	28.81	19.01	6.06
7000	16.30	67.72	15.91	21.32	180.24	1.02	28.43	19.29	5.97
7500	16.42	66.54	15.31	21.90	154.63	1.02	28.53	19.34	5.88
8000	16.53	66.68	14.69	22.44	154.54	1.03	28.14	19.43	5.80
8500	16.58	66.73	14.09	22.69	153.82	1.03	28.05	19.55	5.64
9000	16.60	67.93	13.53	22.54	174.99	1.04	27.85	19.65	5.60
9500	16.62	67.81	13.16	22.18	171.48	1.04	27.66	19.58	5.51
10000	16.60	66.92	12.85	21.39	154.34	1.04	27.19	19.72	5.43
10500	16.56	66.24	12.67	20.50	142.78	1.04	26.98	19.60	5.38
11000	16.49	66.56	12.46	19.56	148.76	1.04	26.63	19.77	5.26
11500	16.39	65.87	12.28	18.85	138.23	1.05	26.43	19.09	5.12
12000	16.32	64.33	12.02	18.09	116.04	1.05	25.98	19.29	5.04
12500	16.24	62.53	11.77	17.37	94.50	1.05	25.61	19.27	4.92
13000	16.17	61.16	11.58	16.77	80.95	1.05	25.51	19.37	4.87
13500	16.13	60.25	11.43	16.30	72.92	1.05	25.29	18.63	4.75
14000	16.10	59.21	11.26	15.96	64.53	1.05	25.03	18.43	4.78
14500	16.12	58.27	11.14	15.76	57.55	1.05	24.97	18.37	4.71
15000	16.15	57.02	11.16	15.71	49.73	1.05	24.88	18.36	4.68
15500	16.20	55.69	11.37	15.51	42.49	1.04	24.94	18.30	4.68
16000	16.23	54.79	11.61	15.31	38.30	1.04	24.68	18.54	4.67
16500	16.23	54.46	12.04	15.17	37.07	1.03	24.42	18.64	4.72
17000	16.25	54.61	12.75	15.25	38.07	1.02	24.03	18.01	4.70
17500	16.31	54.17	13.61	15.55	36.37	1.01	23.76	18.02	4.84
18000	16.42	54.38	14.68	16.16	37.27	1.01	23.46	17.88	4.94
18500	16.51	54.82	15.73	16.70	39.18	1.01	23.19	17.81	5.00
19000	16.56	55.39	16.16	17.34	41.83	1.01	22.95	17.69	5.14
19500	16.50	56.81	15.56	17.90	49.55	1.01	22.75	17.69	5.19
20000	16.32	58.50	14.24	18.61	61.03	1.02	22.52	17.97	5.41

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 = 3.75V, Id = 212.00mA @ Temperature = +25°C

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)
1000	6.62	69.20	7.33	4.63	360.16	0.78	21.08	12.54	8.66
1500	15.32	75.61	9.88	11.97	434.01	1.03	27.89	17.52	6.84
2000	15.87	72.54	11.74	17.83	312.43	1.05	28.08	18.13	6.80
2500	15.75	69.44	13.20	20.47	228.08	1.04	27.78	18.18	6.76
3000	15.72	68.23	14.39	21.52	202.04	1.03	27.58	18.43	6.65
3500	15.77	67.64	15.44	21.87	189.19	1.02	27.19	18.25	6.60
4000	15.85	67.15	16.24	21.71	178.02	1.02	27.26	18.60	6.47
4500	15.96	66.69	16.89	21.42	167.17	1.01	27.23	18.25	6.42
5000	16.09	67.12	17.17	21.24	173.30	1.01	27.15	18.59	6.27
5500	16.39	67.55	17.20	21.21	176.10	1.01	27.14	18.27	6.24
6000	16.56	68.47	17.11	21.01	191.50	1.01	27.10	18.58	6.11
6500	16.68	68.44	16.80	21.00	188.08	1.01	27.14	18.13	6.04
7000	16.77	67.70	16.33	21.30	170.53	1.02	27.06	18.43	5.96
7500	16.91	66.60	15.72	21.90	147.58	1.02	27.08	18.45	5.85
8000	17.02	66.86	15.08	22.46	149.49	1.03	27.05	18.56	5.77
8500	17.08	66.91	14.45	22.69	148.63	1.03	26.93	18.68	5.63
9000	17.12	68.21	13.89	22.48	170.95	1.03	26.86	18.77	5.58
9500	17.14	68.24	13.52	22.11	170.33	1.04	26.73	18.69	5.47
10000	17.14	67.85	13.19	21.36	162.12	1.04	26.46	18.84	5.41
10500	17.11	67.02	12.99	20.51	147.33	1.04	26.39	18.66	5.32
11000	17.04	66.65	12.76	19.54	141.57	1.04	26.15	18.86	5.21
11500	16.95	66.09	12.57	18.73	133.60	1.04	25.97	18.12	5.09
12000	16.88	64.53	12.28	17.92	111.76	1.04	25.71	18.30	5.01
12500	16.81	62.48	11.99	17.23	88.31	1.04	25.52	18.24	4.88
13000	16.73	61.23	11.77	16.69	76.65	1.04	25.61	18.34	4.82
13500	16.69	60.31	11.59	16.28	68.97	1.04	25.35	17.59	4.72
14000	16.67	59.20	11.38	15.95	60.50	1.04	25.23	17.40	4.74
14500	16.68	58.25	11.22	15.67	53.91	1.05	25.31	17.34	4.64
15000	16.71	57.09	11.19	15.45	46.96	1.04	25.41	17.38	4.62
15500	16.76	55.68	11.35	15.16	39.72	1.04	25.44	17.34	4.63
16000	16.79	54.80	11.51	14.95	35.81	1.04	25.13	17.61	4.61
16500	16.80	54.61	11.89	14.93	35.21	1.03	25.07	17.70	4.66
17000	16.83	54.71	12.54	15.09	35.86	1.02	24.74	17.07	4.64
17500	16.90	54.20	13.38	15.40	33.93	1.02	24.63	17.05	4.78
18000	17.05	54.31	14.44	15.98	34.29	1.01	24.41	16.91	4.85
18500	17.19	54.85	15.59	16.55	36.32	1.01	24.22	16.85	4.90
19000	17.29	55.28	16.38	17.32	38.04	1.00	24.08	16.74	5.02
19500	17.29	56.51	16.14	18.07	43.91	1.01	23.91	16.76	5.10
20000	17.16	57.99	15.05	18.95	52.61	1.02	23.69	17.03	5.29

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 = 4.25V, Id = 211.61mA @ Temperature = +25°C

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)
1000	5.93	69.09	7.29	4.62	383.36	0.78	23.10	13.41	8.87
1500	14.66	75.09	9.80	11.97	440.59	1.03	29.96	18.93	6.96
2000	15.21	72.36	11.61	17.86	329.81	1.05	30.79	19.50	6.91
2500	15.07	69.55	13.01	20.52	249.30	1.04	30.60	19.53	6.88
3000	15.03	68.15	14.13	21.57	216.14	1.03	30.23	19.66	6.78
3500	15.08	67.44	15.09	21.91	199.79	1.02	29.57	19.58	6.71
4000	15.15	67.13	15.85	21.74	192.01	1.02	29.29	19.79	6.59
4500	15.25	66.66	16.41	21.46	180.36	1.02	28.96	19.65	6.53
5000	15.37	66.91	16.63	21.28	183.38	1.01	28.62	19.81	6.42
5500	15.65	67.29	16.61	21.25	185.41	1.01	28.25	19.65	6.38
6000	15.82	68.21	16.49	21.07	201.89	1.01	27.91	19.83	6.24
6500	15.92	68.31	16.19	21.07	201.58	1.02	27.81	19.61	6.14
7000	16.00	67.35	15.70	21.41	178.37	1.02	27.47	19.84	6.07
7500	16.12	66.43	15.10	22.05	157.81	1.02	27.37	19.91	5.96
8000	16.23	66.64	14.49	22.66	159.08	1.03	27.17	19.99	5.90
8500	16.27	66.24	13.89	22.92	150.42	1.04	27.00	20.11	5.74
9000	16.29	67.87	13.36	22.71	179.99	1.04	26.77	20.17	5.68
9500	16.30	68.02	12.99	22.34	181.89	1.04	26.58	20.13	5.58
10000	16.28	66.83	12.70	21.58	158.33	1.05	26.25	20.22	5.51
10500	16.24	66.17	12.51	20.73	146.85	1.05	25.91	20.15	5.46
11000	16.16	66.44	12.31	19.76	152.12	1.05	25.67	20.28	5.33
11500	16.06	65.77	12.15	18.92	141.75	1.05	25.40	19.73	5.20
12000	15.98	64.27	11.90	18.12	119.62	1.05	25.07	19.91	5.12
12500	15.91	62.52	11.66	17.46	97.98	1.05	24.76	19.85	5.00
13000	15.84	61.13	11.49	16.98	83.67	1.05	24.59	19.90	4.96
13500	15.80	60.20	11.36	16.60	75.23	1.05	24.44	19.28	4.87
14000	15.78	59.12	11.22	16.30	66.33	1.05	24.06	19.08	4.86
14500	15.80	58.28	11.11	16.02	59.85	1.05	24.01	19.04	4.77
15000	15.83	56.95	11.17	15.78	51.23	1.05	23.86	19.01	4.75
15500	15.87	55.70	11.41	15.48	44.23	1.04	23.81	18.93	4.78
16000	15.90	54.69	11.67	15.30	39.36	1.04	23.64	19.11	4.78
16500	15.90	54.38	12.14	15.33	38.26	1.03	23.32	19.22	4.83
17000	15.92	54.51	12.88	15.52	39.18	1.02	22.87	18.63	4.80
17500	15.96	54.02	13.77	15.82	37.30	1.01	22.70	18.61	4.96
18000	16.06	54.38	14.80	16.30	38.91	1.01	22.33	18.46	5.06
18500	16.13	54.96	15.67	16.71	41.59	1.01	22.02	18.38	5.11
19000	16.14	55.57	15.89	17.28	44.72	1.01	21.78	18.24	5.27
19500	16.05	56.98	15.10	17.85	53.02	1.01	21.54	18.23	5.34
20000	15.85	58.95	13.74	18.64	67.47	1.03	21.30	18.47	5.55

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 = 4.00V, Id = 210.70mA @ Temperature = -45°C

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)
1000	7.94	68.88	7.47	4.39	291.59	0.75	18.42	10.20	7.30
1500	17.07	75.03	10.07	11.58	331.62	1.02	25.00	16.53	5.76
2000	17.63	72.75	11.98	17.50	262.16	1.04	25.36	16.62	5.77
2500	17.50	69.39	13.45	19.98	185.94	1.03	25.17	16.46	5.77
3000	17.47	68.59	14.70	21.33	172.50	1.03	25.07	16.52	5.68
3500	17.54	67.69	16.13	21.88	155.82	1.02	24.87	16.50	5.64
4000	17.65	67.52	17.63	21.90	152.02	1.01	24.93	16.61	5.54
4500	17.76	66.73	18.06	20.98	137.18	1.01	24.87	16.70	5.52
5000	17.89	67.06	17.94	20.91	140.20	1.01	24.81	16.65	5.40
5500	18.22	67.30	18.02	20.69	138.74	1.01	24.81	16.69	5.39
6000	18.43	68.20	18.31	20.13	150.16	1.00	24.79	16.70	5.23
6500	18.58	67.10	18.29	20.04	130.09	1.00	24.91	16.96	5.17
7000	18.70	66.50	17.61	20.30	119.35	1.01	24.81	16.96	5.10
7500	18.87	65.59	16.86	21.35	105.30	1.01	24.88	17.15	5.01
8000	19.03	65.24	16.47	22.47	99.30	1.02	24.84	17.10	4.90
8500	19.14	64.85	16.12	22.44	93.51	1.02	24.82	17.21	4.78
9000	19.21	65.29	15.52	21.15	97.13	1.02	24.80	17.20	4.73
9500	19.27	65.47	15.00	20.47	98.03	1.02	24.80	17.24	4.63
10000	19.30	64.69	14.39	20.63	88.76	1.03	24.73	17.21	4.58
10500	19.35	64.02	14.05	20.37	81.52	1.03	24.55	17.23	4.49
11000	19.32	63.62	14.01	19.23	77.83	1.03	24.53	17.15	4.41
11500	19.22	63.11	13.46	16.52	73.03	1.02	24.51	17.28	4.31
12000	19.14	62.43	12.65	15.48	67.13	1.02	24.26	17.18	4.19
12500	19.04	61.67	11.96	15.14	61.49	1.03	24.14	17.07	4.10
13000	19.01	60.56	11.70	15.89	54.30	1.04	24.26	17.02	4.02
13500	19.04	59.65	11.82	16.86	49.13	1.04	24.40	17.09	3.87
14000	19.05	58.79	11.99	16.92	44.62	1.04	24.14	17.03	3.89
14500	19.05	57.88	11.90	14.91	39.63	1.03	24.17	17.03	3.76
15000	18.97	57.30	11.43	12.88	36.38	1.02	24.27	16.98	3.78
15500	18.98	56.63	10.82	12.23	32.97	1.02	24.32	16.94	3.74
16000	19.04	55.76	10.72	12.50	29.67	1.02	24.21	16.95	3.72
16500	19.21	55.27	11.61	13.90	28.42	1.02	24.34	17.08	3.74
17000	19.37	55.05	13.04	15.47	28.12	1.02	24.01	16.92	3.69
17500	19.48	54.38	13.82	15.73	25.96	1.01	23.98	16.88	3.72
18000	19.47	53.89	13.12	14.25	24.14	1.01	23.72	16.68	3.79
18500	19.54	53.78	12.63	14.22	23.48	1.01	23.40	16.53	3.88
19000	19.85	53.62	13.32	15.69	22.66	1.02	23.09	16.29	3.93
19500	20.21	53.84	14.95	18.04	22.90	1.02	22.66	16.20	3.97
20000	20.33	54.73	17.58	19.88	25.53	1.01	22.45	16.10	4.12

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 = 3.75V, Id = 210.30mA @ Temperature = -45°C

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)
1000	8.24	68.88	7.51	4.40	281.83	0.75	17.78	9.56	7.25
1500	17.37	75.35	10.12	11.57	332.74	1.02	23.02	15.83	5.76
2000	17.94	72.28	12.07	17.49	240.07	1.04	24.86	15.95	5.77
2500	17.81	69.63	13.57	19.97	184.61	1.03	24.85	15.83	5.75
3000	17.78	68.27	14.87	21.36	160.56	1.03	24.88	15.86	5.67
3500	17.86	67.36	16.36	21.90	144.88	1.02	24.59	15.82	5.61
4000	17.97	67.32	17.93	21.93	143.36	1.01	24.76	15.84	5.49
4500	18.08	66.84	18.39	21.00	133.98	1.01	24.67	15.91	5.50
5000	18.22	67.12	18.33	20.95	136.17	1.01	24.66	15.92	5.38
5500	18.56	67.55	18.44	20.74	137.49	1.01	24.63	15.96	5.36
6000	18.77	67.86	18.77	20.16	139.02	1.00	24.67	15.91	5.25
6500	18.93	67.44	18.78	20.08	130.12	1.00	24.72	16.13	5.17
7000	19.06	66.65	18.10	20.30	116.79	1.01	24.64	16.13	5.09
7500	19.23	65.58	17.32	21.40	101.17	1.01	24.73	16.31	5.01
8000	19.40	65.50	16.92	22.48	98.33	1.01	24.74	16.37	4.89
8500	19.52	64.89	16.57	22.51	90.21	1.02	24.73	16.49	4.74
9000	19.59	65.58	15.97	21.14	96.35	1.02	24.72	16.49	4.71
9500	19.65	65.65	15.44	20.48	96.00	1.02	24.78	16.52	4.64
10000	19.70	65.07	14.81	20.64	88.89	1.02	24.63	16.45	4.57
10500	19.75	64.28	14.44	20.39	80.38	1.03	24.48	16.45	4.47
11000	19.73	63.93	14.42	19.27	77.26	1.02	24.37	16.37	4.39
11500	19.64	63.31	13.83	16.48	71.51	1.02	24.41	16.56	4.33
12000	19.56	62.82	12.97	15.44	67.11	1.02	24.31	16.48	4.20
12500	19.46	61.81	12.25	15.10	59.77	1.03	24.23	16.37	4.12
13000	19.44	60.75	11.97	15.86	53.07	1.04	24.30	16.35	4.00
13500	19.47	59.80	12.03	16.85	47.69	1.04	24.32	16.36	3.88
14000	19.47	58.91	12.22	16.88	43.17	1.04	24.17	16.29	3.88
14500	19.47	57.92	12.10	14.82	38.02	1.03	24.24	16.38	3.77
15000	19.39	57.42	11.59	12.74	35.18	1.01	24.27	16.32	3.76
15500	19.39	56.77	10.89	12.07	31.91	1.01	24.33	16.28	3.75
16000	19.44	55.71	10.76	12.35	28.16	1.02	24.20	16.27	3.71
16500	19.60	55.31	11.60	13.74	27.25	1.02	24.24	16.38	3.72
17000	19.76	55.06	12.96	15.30	26.83	1.02	24.11	16.27	3.66
17500	19.87	54.50	13.67	15.52	25.11	1.01	24.02	16.25	3.70
18000	19.84	53.97	12.93	14.00	23.23	1.01	23.77	16.07	3.78
18500	19.91	53.81	12.40	13.96	22.44	1.01	23.48	15.93	3.84
19000	20.25	53.58	12.98	15.41	21.44	1.02	23.07	15.68	3.89
19500	20.65	53.82	14.74	17.83	21.66	1.02	22.67	15.58	3.91
20000	20.83	54.48	17.85	19.64	23.44	1.01	22.45	15.46	4.03

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 = 4.25V, Id = 211.41mA @ Temperature = -45°C

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)
1000	7.47	69.06	7.45	4.38	313.13	0.75	19.59	11.51	7.43
1500	16.62	75.44	10.01	11.57	365.71	1.02	25.64	17.39	5.82
2000	17.18	72.73	11.89	17.48	274.98	1.05	26.00	17.51	5.81
2500	17.04	69.61	13.30	19.91	200.60	1.04	25.62	17.40	5.80
3000	17.01	68.28	14.52	21.30	175.38	1.03	25.63	17.42	5.73
3500	17.07	67.59	15.88	21.82	162.29	1.02	25.34	17.44	5.68
4000	17.18	67.15	17.30	21.85	153.74	1.01	25.47	17.54	5.58
4500	17.28	66.70	17.66	20.89	144.27	1.01	25.37	17.62	5.57
5000	17.40	66.69	17.54	20.85	141.95	1.01	25.33	17.59	5.46
5500	17.73	67.12	17.57	20.63	143.54	1.01	25.31	17.68	5.42
6000	17.93	67.54	17.81	20.04	147.14	1.01	25.30	17.67	5.29
6500	18.07	66.99	17.78	20.00	135.98	1.01	25.41	17.94	5.21
7000	18.19	66.37	17.09	20.24	124.61	1.01	25.33	18.01	5.14
7500	18.35	65.35	16.36	21.38	108.54	1.02	25.38	18.20	5.04
8000	18.50	65.02	15.94	22.46	102.66	1.02	25.30	18.15	4.95
8500	18.60	64.66	15.63	22.47	97.08	1.02	25.32	18.25	4.83
9000	18.67	64.96	15.05	21.12	99.19	1.02	25.28	18.26	4.74
9500	18.71	65.31	14.53	20.51	102.27	1.03	25.22	18.30	4.67
10000	18.74	64.55	13.94	20.70	92.90	1.03	25.02	18.28	4.63
10500	18.77	64.01	13.63	20.44	86.65	1.03	24.95	18.29	4.51
11000	18.73	63.40	13.61	19.28	80.91	1.03	24.80	18.22	4.44
11500	18.62	62.95	13.05	16.48	76.48	1.03	24.83	18.46	4.35
12000	18.54	62.37	12.27	15.47	71.07	1.03	24.58	18.31	4.25
12500	18.43	61.63	11.65	15.20	65.33	1.04	24.40	18.15	4.15
13000	18.42	60.54	11.45	16.07	57.85	1.04	24.54	18.19	4.05
13500	18.45	59.71	11.56	17.12	52.73	1.05	24.53	18.12	3.90
14000	18.46	58.50	11.79	17.16	46.00	1.04	24.40	17.97	3.92
14500	18.47	57.91	11.73	15.00	42.41	1.03	24.43	18.01	3.85
15000	18.40	57.35	11.30	12.91	39.04	1.02	24.55	18.00	3.79
15500	18.42	56.65	10.69	12.28	35.17	1.02	24.57	17.93	3.80
16000	18.48	55.77	10.70	12.63	31.71	1.02	24.52	17.96	3.76
16500	18.66	55.19	11.70	14.17	30.11	1.03	24.36	18.05	3.79
17000	18.83	54.88	13.20	15.87	29.45	1.02	24.20	17.88	3.74
17500	18.94	54.37	13.99	16.13	27.68	1.01	24.07	17.82	3.80
18000	18.92	53.83	13.37	14.54	25.65	1.01	23.80	17.62	3.87
18500	18.98	53.77	12.98	14.48	25.16	1.01	23.60	17.44	3.95
19000	19.26	53.64	13.57	15.97	24.41	1.02	23.33	17.21	4.04
19500	19.55	54.00	14.97	18.32	25.16	1.02	22.90	17.20	4.07
20000	19.61	55.03	16.99	20.04	28.63	1.01	22.76	17.12	4.23

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 = 4.00V, Id = 209.98mA @ Temperature = +85°C

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)
1000	5.09	69.27	7.19	4.81	438.38	0.80	24.97	13.13	10.10
1500	13.55	75.06	9.77	12.39	501.59	1.04	26.67	18.24	7.93
2000	14.08	72.11	11.65	18.41	365.86	1.05	26.60	18.79	7.86
2500	13.96	69.59	13.07	21.23	285.43	1.04	26.53	18.86	7.82
3000	13.93	68.13	14.21	22.26	245.49	1.03	26.49	19.05	7.70
3500	13.96	67.31	15.26	22.67	224.39	1.02	26.12	18.90	7.61
4000	14.04	67.16	15.95	22.23	219.35	1.02	26.05	19.25	7.49
4500	14.13	66.56	16.48	21.89	203.14	1.02	25.74	18.90	7.42
5000	14.26	66.99	16.66	21.55	210.46	1.01	25.65	19.24	7.28
5500	14.52	67.73	16.60	21.61	222.02	1.01	25.30	18.92	7.26
6000	14.68	68.13	16.41	21.60	228.10	1.02	25.20	19.29	7.07
6500	14.77	67.72	15.89	21.44	214.66	1.02	24.89	18.80	7.01
7000	14.84	66.89	15.33	21.62	193.15	1.02	24.71	19.14	6.91
7500	14.94	66.35	14.66	21.80	178.51	1.03	24.56	19.15	6.79
8000	15.04	65.90	14.07	22.86	166.81	1.03	24.46	19.31	6.70
8500	15.08	66.10	13.45	23.33	169.02	1.04	24.37	19.40	6.56
9000	15.08	67.10	12.94	24.15	188.62	1.05	24.23	19.55	6.49
9500	15.08	67.08	12.70	24.09	187.74	1.05	24.02	19.45	6.41
10000	15.05	66.32	12.58	23.10	172.02	1.05	23.84	19.63	6.33
10500	14.99	65.87	12.56	22.34	164.21	1.05	23.64	19.56	6.28
11000	14.91	65.30	12.35	21.27	154.57	1.05	23.45	19.71	6.15
11500	14.82	65.10	12.33	21.97	152.76	1.05	23.21	19.01	6.05
12000	14.75	63.68	12.39	21.08	130.73	1.05	22.99	19.34	5.96
12500	14.70	62.38	12.46	19.98	113.11	1.05	22.77	19.38	5.82
13000	14.61	61.03	12.28	18.18	97.03	1.04	22.61	19.42	5.79
13500	14.51	60.21	11.80	16.82	88.23	1.04	22.44	18.69	5.74
14000	14.44	59.12	11.16	15.80	77.10	1.05	22.21	18.54	5.76
14500	14.42	58.19	10.80	15.66	68.81	1.05	22.06	18.40	5.67
15000	14.48	57.14	10.95	16.52	61.10	1.06	21.74	18.34	5.64
15500	14.54	55.98	11.55	16.71	53.72	1.05	21.60	18.31	5.67
16000	14.58	55.16	12.02	16.79	49.03	1.04	21.31	18.49	5.65
16500	14.54	54.96	12.21	15.70	47.99	1.03	21.22	18.69	5.76
17000	14.48	54.86	12.41	14.75	47.58	1.02	20.76	18.00	5.74
17500	14.46	54.48	12.83	14.81	45.95	1.02	20.44	18.03	5.97
18000	14.53	54.57	13.84	15.46	46.79	1.01	20.03	17.91	6.06
18500	14.60	55.23	15.31	16.69	51.02	1.01	19.84	17.99	6.11
19000	14.57	56.20	16.32	17.01	57.71	1.00	19.53	17.89	6.27
19500	14.43	57.62	15.77	18.00	69.15	1.01	19.31	17.90	6.30
20000	14.19	59.59	13.82	17.86	87.81	1.02	19.19	18.17	6.54

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 = 3.75V, Id = 211.35mA @ Temperature = +85°C

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)
1000	5.34	69.38	7.20	4.81	431.87	0.80	24.94	13.19	9.96
1500	13.78	75.42	9.80	12.37	509.38	1.04	28.20	17.69	7.84
2000	14.32	72.09	11.69	18.34	355.22	1.05	28.12	18.24	7.79
2500	14.20	69.46	13.13	21.12	273.35	1.04	28.16	18.33	7.73
3000	14.17	68.43	14.29	22.14	247.04	1.03	27.99	18.61	7.63
3500	14.21	67.60	15.36	22.56	225.38	1.02	27.69	18.39	7.55
4000	14.29	67.26	16.09	22.11	215.72	1.02	27.55	18.80	7.40
4500	14.39	66.81	16.63	21.79	203.06	1.01	27.21	18.33	7.34
5000	14.52	67.25	16.83	21.42	210.49	1.01	27.07	18.75	7.20
5500	14.79	67.67	16.76	21.47	214.28	1.01	26.80	18.35	7.14
6000	14.95	68.12	16.57	21.44	221.06	1.01	26.57	18.79	7.01
6500	15.04	67.77	16.08	21.25	209.46	1.02	26.23	18.20	6.92
7000	15.11	66.99	15.49	21.41	189.39	1.02	26.06	18.56	6.81
7500	15.22	66.28	14.82	21.55	171.69	1.03	25.96	18.56	6.71
8000	15.32	66.07	14.24	22.58	164.83	1.03	25.84	18.74	6.64
8500	15.37	66.15	13.61	22.97	164.71	1.04	25.68	18.82	6.48
9000	15.37	67.41	13.09	23.77	189.39	1.04	25.48	19.00	6.42
9500	15.38	67.24	12.83	23.70	185.02	1.05	25.23	18.86	6.31
10000	15.35	66.43	12.71	22.75	168.62	1.05	25.04	19.09	6.26
10500	15.30	66.19	12.68	22.01	164.79	1.05	24.82	19.01	6.17
11000	15.22	65.65	12.46	20.94	155.40	1.05	24.55	19.17	6.07
11500	15.13	65.11	12.45	21.65	147.75	1.05	24.31	18.36	5.93
12000	15.06	63.84	12.49	20.74	128.64	1.05	24.01	18.72	5.85
12500	15.01	62.25	12.57	19.70	107.57	1.04	23.75	18.79	5.69
13000	14.92	61.10	12.37	17.93	94.49	1.04	23.59	18.88	5.69
13500	14.82	60.13	11.89	16.61	84.33	1.04	23.38	18.05	5.64
14000	14.75	59.21	11.20	15.58	75.20	1.05	23.17	17.92	5.65
14500	14.74	58.13	10.82	15.44	65.89	1.05	22.89	17.73	5.58
15000	14.80	57.08	10.95	16.30	58.43	1.05	22.63	17.71	5.54
15500	14.86	55.96	11.55	16.44	51.58	1.05	22.46	17.72	5.56
16000	14.91	55.16	11.98	16.53	47.18	1.04	22.16	17.97	5.56
16500	14.87	54.91	12.14	15.47	45.81	1.03	22.06	18.18	5.64
17000	14.82	54.93	12.34	14.56	46.00	1.02	21.60	17.44	5.61
17500	14.81	54.48	12.77	14.66	44.02	1.02	21.29	17.50	5.83
18000	14.90	54.66	13.83	15.38	45.25	1.01	20.82	17.43	5.95
18500	15.01	55.24	15.51	16.69	48.82	1.01	20.53	17.51	5.98
19000	15.00	56.03	16.74	17.01	54.00	1.00	20.34	17.46	6.10
19500	14.87	57.38	16.26	18.11	64.12	1.01	20.14	17.46	6.16
20000	14.66	59.16	14.26	17.97	79.50	1.02	19.98	17.76	6.35

Typical Performance Data

Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

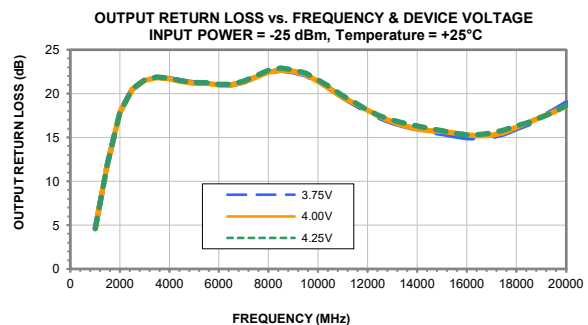
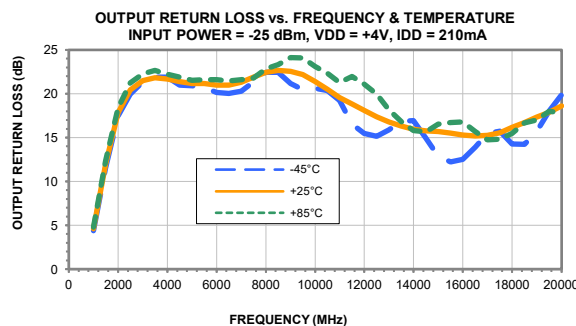
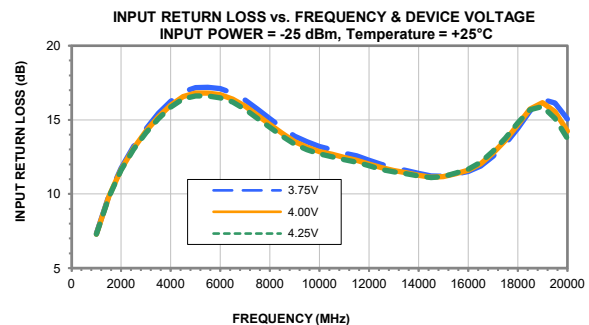
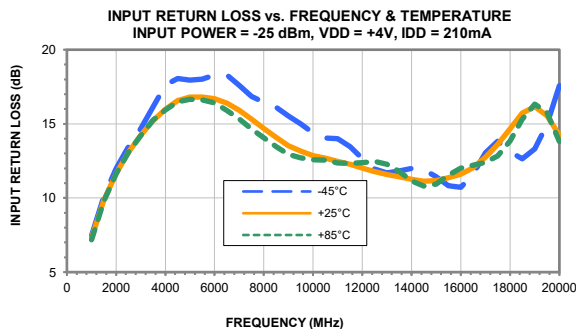
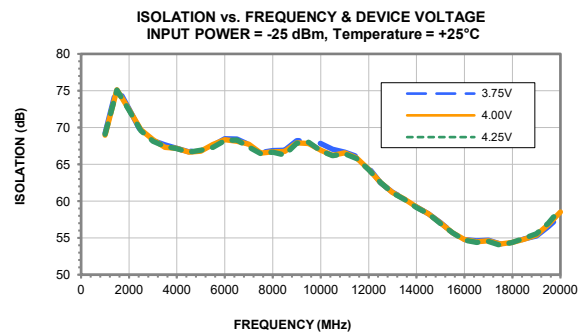
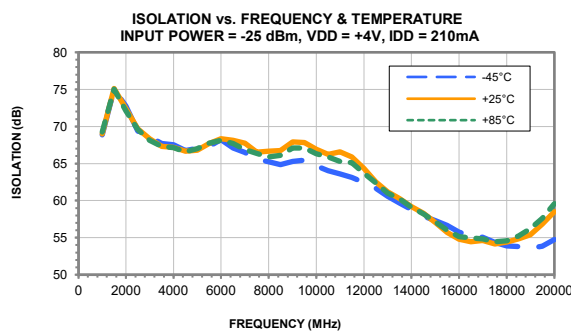
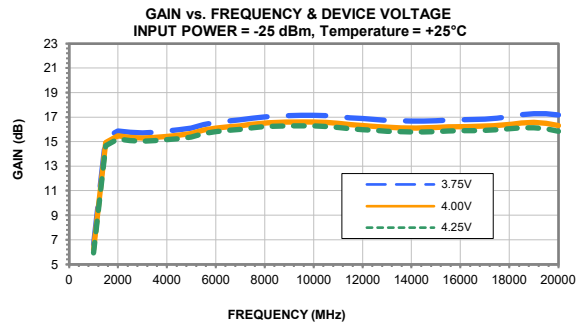
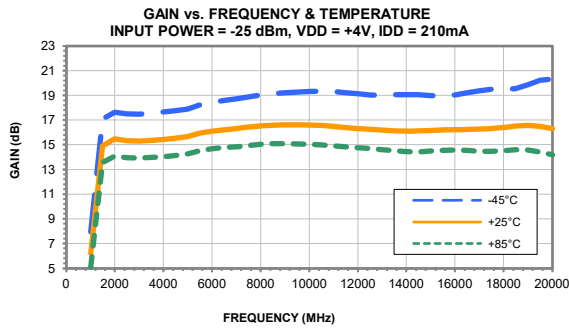
Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

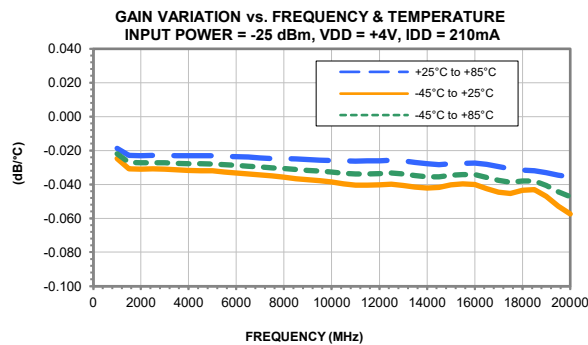
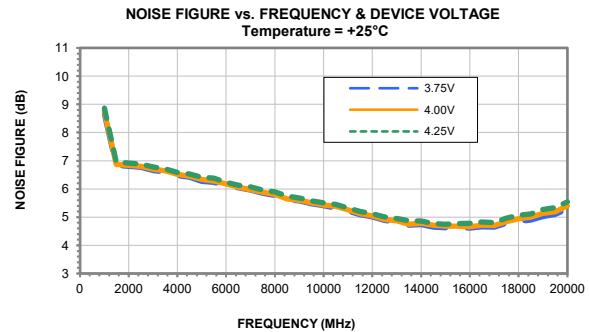
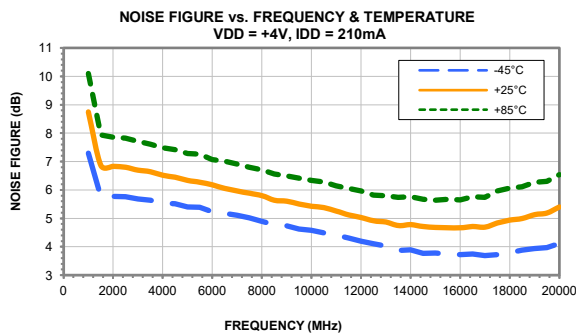
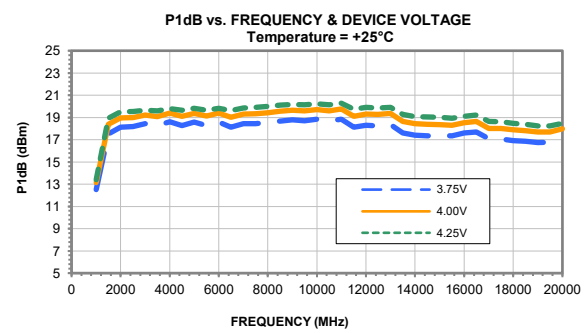
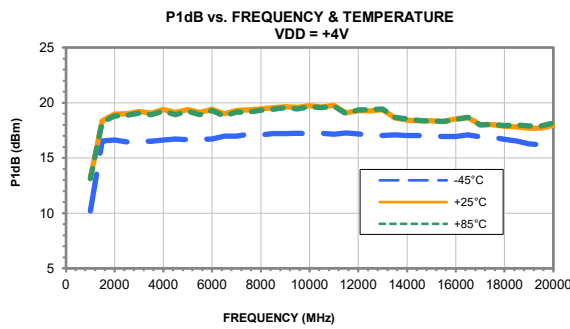
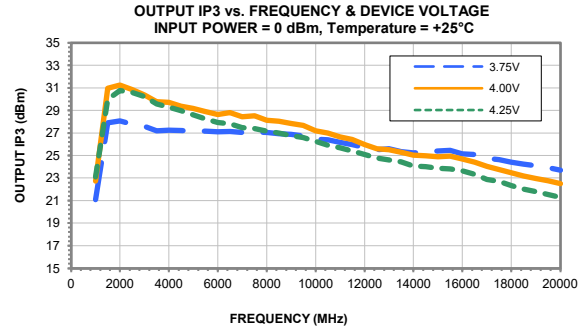
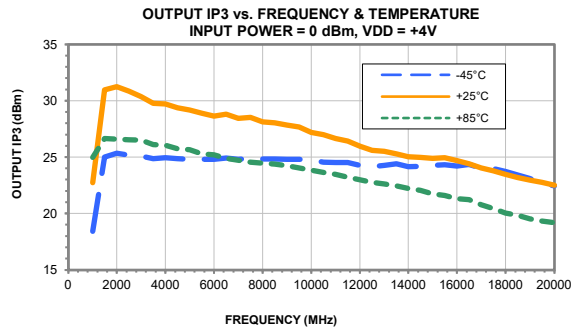
TEST CONDITIONS: Vd = 4.25V, Id = 209.58mA @ Temperature = +85°C

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)
1000	4.78	69.24	7.17	4.81	452.35	0.80	25.08	13.30	10.18
1500	13.24	75.15	9.74	12.40	524.72	1.04	25.39	18.77	8.00
2000	13.78	72.11	11.60	18.41	378.46	1.05	25.44	19.29	7.91
2500	13.65	69.61	13.00	21.25	296.01	1.04	25.35	19.33	7.85
3000	13.61	68.39	14.10	22.26	261.88	1.03	25.23	19.47	7.76
3500	13.64	67.51	15.11	22.69	237.79	1.03	24.78	19.39	7.67
4000	13.71	66.96	15.81	22.21	222.58	1.02	24.84	19.64	7.56
4500	13.80	66.45	16.30	21.91	207.93	1.02	24.43	19.42	7.46
5000	13.92	66.87	16.45	21.52	215.40	1.02	24.40	19.67	7.32
5500	14.18	67.58	16.37	21.59	226.76	1.02	24.05	19.44	7.26
6000	14.33	68.12	16.15	21.60	236.91	1.02	23.89	19.73	7.13
6500	14.42	67.72	15.65	21.43	223.45	1.02	23.66	19.38	7.04
7000	14.47	66.78	15.09	21.63	198.37	1.02	23.46	19.68	6.96
7500	14.57	65.84	14.44	21.79	175.40	1.03	23.32	19.70	6.85
8000	14.66	65.92	13.87	22.92	174.43	1.04	23.29	19.86	6.75
8500	14.69	65.77	13.24	23.33	169.68	1.04	23.18	19.95	6.61
9000	14.68	66.82	12.74	24.19	190.77	1.05	23.02	20.08	6.59
9500	14.68	67.05	12.50	24.12	195.32	1.05	22.91	19.99	6.45
10000	14.64	66.28	12.40	23.10	179.04	1.05	22.73	20.15	6.38
10500	14.58	65.82	12.38	22.39	170.89	1.05	22.57	20.10	6.34
11000	14.49	65.57	12.17	21.27	166.96	1.05	22.39	20.23	6.20
11500	14.40	65.01	12.20	22.11	158.43	1.05	22.19	19.64	6.08
12000	14.32	63.80	12.26	21.11	139.03	1.05	22.05	19.93	5.99
12500	14.27	62.19	12.36	20.08	115.96	1.05	21.83	19.96	5.87
13000	14.18	61.21	12.20	18.25	103.98	1.04	21.69	19.96	5.83
13500	14.08	60.30	11.76	16.93	93.57	1.04	21.52	19.35	5.79
14000	14.01	59.09	11.10	15.87	80.70	1.05	21.29	19.22	5.82
14500	14.00	58.15	10.77	15.75	71.97	1.05	21.11	19.05	5.73
15000	14.05	57.03	10.95	16.67	63.45	1.06	20.86	18.97	5.74
15500	14.11	55.92	11.63	16.80	56.20	1.05	20.67	18.90	5.73
16000	14.14	55.18	12.13	16.95	51.85	1.04	20.45	19.05	5.75
16500	14.09	54.87	12.32	15.83	50.17	1.03	20.25	19.23	5.80
17000	14.01	54.86	12.52	14.84	50.38	1.02	19.85	18.56	5.80
17500	13.96	54.40	12.86	14.86	48.21	1.02	19.53	18.57	6.03
18000	14.00	54.71	13.73	15.44	50.41	1.01	19.16	18.45	6.18
18500	14.05	55.42	15.02	16.62	55.43	1.01	18.88	18.50	6.21
19000	13.99	56.35	15.89	16.81	62.60	1.00	18.70	18.41	6.37
19500	13.81	57.83	15.22	17.86	75.83	1.01	18.52	18.42	6.42
20000	13.54	59.89	13.31	17.64	97.29	1.03	18.31	18.67	6.64

Typical Performance Curves



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)	