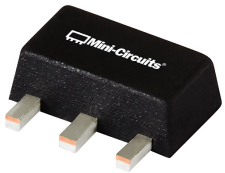
ULTRA HIGH DYNAMIC RANGE

Monolithic Amplifier PHA-23HLN+

50Ω 30 MHz to 2000 MHz

THE BIG DEAL

- High IP3, Typ. +44.4 dBm
- High P1dB, Typ. +28.4 dBm
- Low Noise Figure, Typ. 1.4 dB
- High Gain, Typ. 21.3 dB



Generic photo used for illustration purposes only

CASE STYLE: DF782

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

APPLICATIONS

- Base Station Infrastructure
- CATV
- Cellular

PRODUCT OVERVIEW

PHA-23HLN+ (RoHS compliant) is an advanced wideband amplifier fabricated using E-pHEMT technology and offers extremely high dynamic range with low noise figure. In addition, the PHA-23HLN+ is well matched over a broad frequency range. PHA-23HLN+ is enclosed in a SOT-89 package and has very good thermal performance.

KEY FEATURES

Feature	Advantages
Broadband: 30 to 2000 MHz	Broadband covering primary wireless communications bands: VHF, UHF, Cellular
High IP3 +40.9 dBm Typical at 30 MHz +44.4 dBm Typical at 1000 MHz	The PHA-23HLN+ matches industry leading IP3 performance relative to device size and power consumption. The combination of the circuit design and E-pHEMT structure provides enhanced linearity over a broad frequency range resulting in an IP3 approximately 14-17 dB above the P1dB point. This feature makes this amplifier ideal for use in: • Driver amplifiers for complex waveform upconverter paths • Drivers in linearized transmit systems • Secondary amplifiers in ultra-high dynamic range receivers
Low Noise Figure 1.4 dB at 1000 MHz	Enables lower system noise figure performance
High P1dB +28.4 dBm at 1000 MHz	High P1dB provides high headroom, preventing amplifier saturation under strong interfering signals. It can also be used to drive mixers requiring high drive levels.

REV. B
ECO-010399
PHA-23HLN+
MCL NY
250904

ELECTRICAL SPECIFICATIONS[1] AT +25°C, 50Ω, UNLESS NOTED OTHERWISE

Parameter	Condition (MHz)	V_d= +8 V[1] Min.	Typ.	Max.	Units
Frequency Range		30		2000	MHz
Gain	30		23.2		dB
	500		22.1		
	1000	19.2	21.3	23.5	
	1500	18.5	20.6	22.6	
	2000		19.5		
Input Return Loss	30		11.9		dB
	500		11.7		
	1000		9.9		
	1500		10.3		
	2000		9.5		
Output Return Loss	30		14.8		dB
	500		14.5		
	1000		14.2		
	1500		10.6		
	2000		8.2		
Isolation	1000		27.5		dB
Output Power @ 1 dB Compression (P1dB)	30		+26.2		dBm
	500		+28.1		
	1000		+28.4		
	1500		+28.0		
	2000		+27.8		
Output IP3[2]	30		+40.9		dBm
	500		+43.6		
	1000		+44.4		
	1500		+45.8		
	2000		+42.5		
Noise Figure	30		1.3		dB
	500		1.2		
	1000		1.4		
	1500		1.5		
	2000		1.9		
Device Operating Voltage			+8.0		V
Device Operating Current			235	273	mA
Device Current Variation vs. Temperature[3]			-209.8		µA/°C
Device Current Variation vs. Voltage			0.0254		mA/mV
Thermal Resistance, Junction-to-Ground Lead at +85°C Stage Temperature			23.3		°C/W

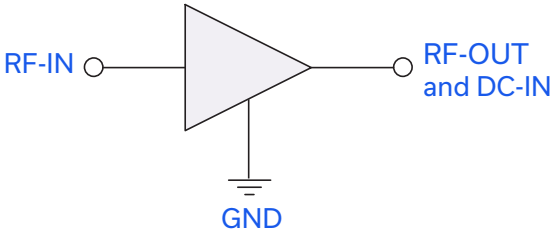
1. Measured on Mini-Circuits Characterization test board TB-951+. See Characterization Test Circuit (Fig. 1).
2. Tested at P_{OUT}= 0 dBm/tone.
3. (Current at +95°C - Current at +40°C)/135

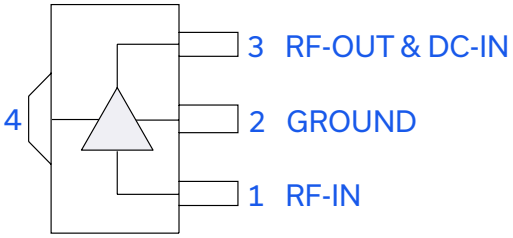
ABSOLUTE MAXIMUM RATINGS[4]

Parameter	Ratings
Operating Temperature (Ground Lead)	-40°C to +95°C
Storage Temperature	-65°C to +150°C
Power Dissipation[5]	3.3 W
Input Power (CW)	+22 dBm (5 minutes max)[6] +11 dBm (continuous) for 0.03-1 GHz +18 dBm (continuous) for 1-2 GHz
DC Voltage on Pin 3	+10 V

4. Permanent damage may occur if any of these limits are exceeded. Electrical maximum ratings are not intended for continuous normal operation.
5. Up to +85°C, derate linearly to 3 W at +95°C.
6. Up to +85°C, derate linearly to +19 dBm at +95°C.

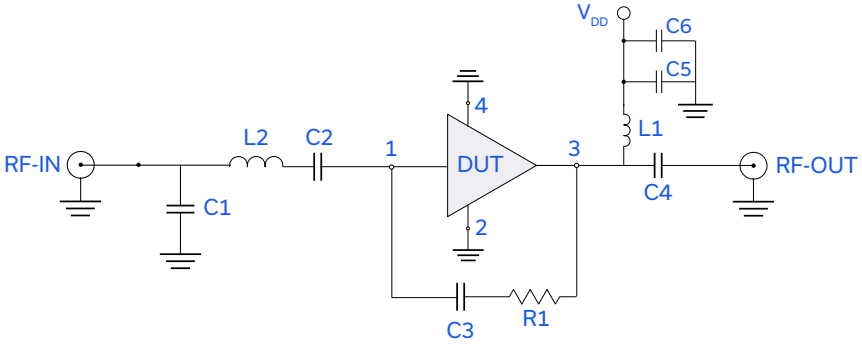
SIMPLIFIED SCHEMATIC AND PIN DESCRIPTION





Function	Pin Number	Description
RF IN	1	RF Input
RF-OUT and DC-IN	3	RF Output and DC Bias
GND	2,4	Connections to ground.

CHARACTERIZATION TEST AND RECOMMENDED APPLICATION CIRCUIT

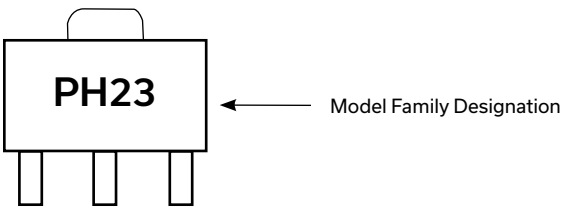


Component	Size	Value	Manufacturer	P/N
C1	0402	1.2pF	Murata	GRM1555C1H1R2WA01D
C2,C3,C6		0.1uF		GRM155R71C104KA88D
C4		0.001uF		GRM1555C1H102JA01D
C5		0.01uF		GRM155R71E103KA01D
R1		1.21KOhm	KOA	RK73H1ETTP1211F
L1	0805	0.68uH	Coilcraft	0805LS-681XJLB
L2	0402	1nH		0402CS-1N0XJLW

Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization test board TB-951+) Gain, Return Loss, Output Power at 1 dB Compression (P1dB), Output IP3 (OIP3) and Noise Figure measured using Agilent's N5242A PNA-X microwave network analyzer.

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

PRODUCT MARKING



Marking may contain other features or characters for internal lot control.

ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASHBOARD. CLICK HERE

Performance Data	Data Table Swept Graphs S-Parameter (S2P Files) Data Set (.zip file)
Case Style	DF782 (SOT 89) Plastic package, exposed paddle Lead Finish: Matte-Tin
Tape & Reel **Standard Quantities Available on Reel**	F55 7" Reels with 20, 50, 100, 200, 500, or 1000 devices
Suggested Layout for PCB Design	PL-523
Evaluation Board	TB-951+
Environmental Ratings	ENV08T9

ESD RATING
Human Body Model (HBM): Class 1B (Pass 500 V) in accordance with ANSI/ESD STM 5.1 - 2001

MSL RATING
Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020D

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.
C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the standard terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/terms/viewterm.html

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 = 8.00V, Id = 237.09mA @ 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)
20	23.67	26.69	10.58	14.62	1.02	0.49	41.79	25.95	1.40
30	23.31	26.22	11.50	14.37	1.02	0.46	43.87	25.94	1.33
40	23.07	26.00	11.87	13.73	1.03	0.45	44.26	27.63	1.26
50	22.92	25.88	12.15	13.36	1.03	0.44	43.82	27.42	1.20
60	22.82	25.83	12.29	13.16	1.03	0.44	44.08	27.35	1.27
70	22.75	25.79	12.36	13.02	1.04	0.44	44.25	27.16	1.21
80	22.71	25.76	12.45	12.94	1.04	0.44	44.57	28.04	1.19
90	22.67	25.74	12.45	12.87	1.04	0.44	45.00	27.72	1.20
100	22.65	25.73	12.49	12.83	1.04	0.44	45.03	27.54	1.24
150	22.57	25.73	12.50	12.80	1.04	0.45	44.37	27.63	1.22
200	22.51	25.76	12.40	12.90	1.05	0.46	44.29	27.80	1.20
250	22.46	25.80	12.27	13.02	1.05	0.47	44.06	27.92	1.25
300	22.41	25.85	12.12	13.18	1.05	0.49	44.84	27.91	1.28
350	22.36	25.92	11.97	13.38	1.06	0.50	44.27	28.02	1.27
400	22.30	26.00	11.78	13.56	1.06	0.52	44.67	27.98	1.25
450	22.24	26.08	11.62	13.82	1.07	0.54	45.11	28.08	1.24
500	22.18	26.18	11.42	14.03	1.07	0.56	44.64	28.02	1.29
550	22.12	26.28	11.27	14.27	1.08	0.59	45.64	27.99	1.31
600	22.05	26.39	11.07	14.47	1.09	0.61	45.94	28.12	1.32
650	21.97	26.52	10.89	14.66	1.10	0.63	46.16	27.94	1.33
700	21.89	26.65	10.71	14.78	1.11	0.65	46.00	28.12	1.25
750	21.81	26.79	10.59	14.88	1.12	0.67	46.38	28.15	1.36
800	21.73	26.95	10.46	14.90	1.13	0.70	46.69	28.17	1.29
850	21.65	27.10	10.37	14.90	1.14	0.72	48.23	27.91	1.34
900	21.58	27.25	10.24	14.83	1.15	0.73	48.71	27.98	1.37
950	21.51	27.41	10.12	14.69	1.17	0.75	47.77	28.31	1.30
1000	21.43	27.58	10.01	14.47	1.18	0.77	45.44	28.20	1.35
1100	21.27	27.94	9.93	13.86	1.21	0.79	48.58	27.88	1.40
1200	21.11	28.33	9.92	13.16	1.25	0.82	48.83	27.96	1.46
1300	20.95	28.74	10.00	12.42	1.29	0.83	50.43	28.13	1.43
1400	20.79	29.16	10.16	11.68	1.33	0.85	53.49	27.76	1.51
1500	20.63	29.60	10.39	10.99	1.38	0.86	50.19	27.69	1.55
1600	20.46	30.06	10.61	10.35	1.43	0.87	51.48	27.70	1.60
1700	20.29	30.52	10.71	9.77	1.48	0.88	50.27	27.50	1.62
1800	20.08	31.01	10.58	9.25	1.53	0.89	52.70	27.54	1.65
1900	19.83	31.55	10.13	8.78	1.59	0.91	52.98	27.58	1.77
2000	19.54	32.11	9.33	8.34	1.64	0.94	49.49	27.40	1.86
2100	19.18	32.66	8.32	7.95	1.68	0.97	48.95	27.29	2.01
2200	18.74	33.27	7.23	7.58	1.72	1.00	47.60	27.13	2.14
2300	18.23	33.84	6.16	7.26	1.75	1.04	49.87	26.90	2.33
2400	17.66	34.42	5.22	6.93	1.76	1.08	48.62	26.53	2.61
2500	17.01	34.98	4.41	6.64	1.77	1.12	51.59	26.84	2.84

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 = 7.60V, Id = 227.04mA @ 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)
20	23.67	26.68	10.58	14.58	1.02	0.48	42.07	25.55	1.32
30	23.31	26.20	11.52	14.33	1.02	0.46	43.44	25.61	1.26
40	23.07	25.98	11.89	13.69	1.03	0.45	44.27	27.19	1.18
50	22.92	25.89	12.17	13.33	1.03	0.44	43.89	27.07	1.14
60	22.82	25.81	12.34	13.12	1.03	0.44	44.16	26.97	1.17
70	22.75	25.76	12.41	12.98	1.03	0.44	44.36	26.84	1.15
80	22.71	25.74	12.49	12.91	1.04	0.44	45.15	27.59	1.11
90	22.67	25.73	12.51	12.83	1.04	0.44	44.59	27.33	1.12
100	22.65	25.72	12.54	12.80	1.04	0.44	45.12	27.19	1.14
150	22.57	25.71	12.56	12.77	1.04	0.44	44.81	27.24	1.10
200	22.51	25.73	12.47	12.88	1.05	0.45	44.63	27.40	1.10
250	22.46	25.78	12.33	13.00	1.05	0.47	44.55	27.53	1.15
300	22.41	25.83	12.18	13.18	1.05	0.48	45.14	27.51	1.21
350	22.36	25.90	12.02	13.40	1.06	0.50	44.77	27.63	1.19
400	22.30	25.98	11.83	13.59	1.06	0.52	46.04	27.58	1.17
450	22.24	26.06	11.66	13.87	1.07	0.54	45.59	27.68	1.18
500	22.18	26.15	11.45	14.09	1.07	0.56	45.35	27.61	1.21
550	22.11	26.26	11.31	14.37	1.08	0.59	46.38	27.56	1.22
600	22.05	26.37	11.10	14.59	1.09	0.61	46.32	27.71	1.23
650	21.97	26.49	10.90	14.82	1.10	0.63	46.85	27.50	1.21
700	21.89	26.63	10.73	14.96	1.11	0.65	47.17	27.70	1.18
750	21.81	26.77	10.61	15.10	1.12	0.68	48.57	27.73	1.27
800	21.72	26.92	10.47	15.14	1.13	0.70	47.99	27.74	1.24
850	21.65	27.07	10.38	15.16	1.14	0.72	50.84	27.46	1.26
900	21.58	27.22	10.25	15.10	1.15	0.74	51.44	27.52	1.26
950	21.50	27.38	10.12	14.97	1.16	0.75	50.11	27.89	1.28
1000	21.43	27.55	10.01	14.75	1.18	0.77	46.29	27.83	1.31
1100	21.27	27.91	9.93	14.13	1.21	0.80	51.85	27.43	1.33
1200	21.10	28.29	9.91	13.40	1.25	0.82	50.37	27.57	1.36
1300	20.94	28.69	9.99	12.63	1.28	0.84	51.40	27.73	1.39
1400	20.78	29.10	10.14	11.87	1.33	0.85	48.58	27.33	1.41
1500	20.62	29.53	10.37	11.15	1.37	0.86	48.18	27.31	1.48
1600	20.46	29.99	10.60	10.50	1.43	0.87	48.09	27.31	1.51
1700	20.28	30.44	10.70	9.91	1.47	0.88	46.99	27.12	1.52
1800	20.08	30.89	10.59	9.38	1.52	0.89	47.25	27.12	1.57
1900	19.83	31.43	10.14	8.91	1.58	0.91	47.10	27.17	1.67
2000	19.53	31.96	9.35	8.47	1.63	0.94	47.05	27.01	1.76
2100	19.17	32.51	8.34	8.08	1.67	0.97	47.66	26.92	1.89
2200	18.74	33.09	7.24	7.71	1.70	1.01	46.46	26.77	2.04
2300	18.22	33.65	6.18	7.39	1.73	1.05	46.42	26.48	2.18
2400	17.65	34.23	5.23	7.07	1.74	1.09	44.59	26.13	2.47
2500	17.00	34.79	4.41	6.78	1.75	1.13	46.66	26.43	2.70

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 = 8.40V, Id = 248.49mA @ 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)
20	23.66	26.71	10.61	14.67	1.03	0.49	41.25	26.31	1.47
30	23.30	26.23	11.49	14.45	1.02	0.47	42.11	26.25	1.38
40	23.05	26.02	11.86	13.80	1.03	0.46	43.01	28.04	1.28
50	22.91	25.89	12.03	13.43	1.03	0.45	43.25	27.72	1.23
60	22.81	25.85	12.23	13.22	1.03	0.45	43.17	27.69	1.31
70	22.74	25.80	12.32	13.08	1.04	0.44	44.26	27.47	1.26
80	22.69	25.78	12.39	13.01	1.04	0.44	43.43	28.45	1.21
90	22.66	25.77	12.39	12.93	1.04	0.44	44.00	28.06	1.24
100	22.64	25.76	12.42	12.90	1.04	0.44	44.16	27.89	1.26
150	22.55	25.75	12.43	12.86	1.04	0.45	43.60	28.00	1.29
200	22.50	25.78	12.35	12.95	1.05	0.46	43.84	28.16	1.22
250	22.45	25.82	12.22	13.06	1.05	0.48	43.61	28.28	1.25
300	22.40	25.88	12.05	13.22	1.05	0.49	44.20	28.27	1.27
350	22.35	25.94	11.91	13.41	1.06	0.51	43.68	28.39	1.30
400	22.29	26.02	11.72	13.57	1.06	0.53	44.32	28.34	1.28
450	22.23	26.10	11.58	13.82	1.07	0.55	44.19	28.44	1.29
500	22.17	26.20	11.38	14.01	1.08	0.57	44.25	28.40	1.32
550	22.11	26.30	11.22	14.23	1.08	0.59	45.13	28.38	1.33
600	22.04	26.42	11.03	14.40	1.09	0.61	44.74	28.49	1.32
650	21.96	26.54	10.85	14.57	1.10	0.63	44.94	28.33	1.32
700	21.88	26.68	10.68	14.66	1.11	0.65	45.33	28.49	1.28
750	21.80	26.82	10.55	14.74	1.12	0.68	45.66	28.53	1.39
800	21.72	26.97	10.42	14.73	1.13	0.70	45.59	28.56	1.34
850	21.64	27.12	10.35	14.72	1.14	0.72	46.38	28.33	1.36
900	21.57	27.28	10.21	14.63	1.16	0.73	46.66	28.39	1.40
950	21.50	27.44	10.10	14.48	1.17	0.75	46.46	28.68	1.37
1000	21.42	27.61	10.00	14.25	1.18	0.77	44.83	28.54	1.34
1100	21.26	27.98	9.92	13.65	1.21	0.79	46.29	28.27	1.43
1200	21.10	28.38	9.91	12.96	1.25	0.82	46.72	28.30	1.45
1300	20.94	28.79	10.00	12.23	1.29	0.83	46.74	28.48	1.45
1400	20.78	29.22	10.15	11.51	1.34	0.85	47.83	28.13	1.51
1500	20.62	29.66	10.38	10.83	1.39	0.86	47.33	28.04	1.58
1600	20.45	30.14	10.60	10.21	1.44	0.87	47.18	28.05	1.63
1700	20.27	30.62	10.70	9.64	1.49	0.88	47.14	27.84	1.65
1800	20.07	31.11	10.56	9.13	1.54	0.89	47.75	27.87	1.69
1900	19.82	31.67	10.10	8.66	1.60	0.91	47.53	27.93	1.79
2000	19.52	32.23	9.30	8.22	1.66	0.93	46.48	27.73	1.90
2100	19.16	32.80	8.29	7.83	1.70	0.96	46.25	27.64	2.04
2200	18.72	33.42	7.20	7.46	1.74	1.00	45.95	27.42	2.19
2300	18.21	33.99	6.14	7.13	1.76	1.04	46.59	27.26	2.33
2400	17.64	34.59	5.21	6.80	1.78	1.08	47.63	26.90	2.67
2500	16.99	35.15	4.39	6.51	1.78	1.11	50.61	27.18	2.91

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 = 8.00V, Id = 248.79mA @ Temperature = -45°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)
20	23.80	26.63	10.37	14.52	1.02	0.46	49.75	26.41	1.26
30	23.43	26.17	11.44	14.29	1.02	0.44	51.26	26.20	1.09
40	23.19	25.96	11.88	13.68	1.02	0.43	51.29	28.16	0.97
50	23.05	25.81	12.14	13.35	1.02	0.42	50.63	28.05	0.92
60	22.95	25.78	12.42	13.19	1.03	0.42	48.14	27.79	0.94
70	22.88	25.73	12.55	13.11	1.03	0.42	51.31	27.49	0.90
80	22.84	25.70	12.69	13.08	1.03	0.42	48.93	28.57	0.87
90	22.81	25.68	12.77	13.06	1.03	0.42	48.54	28.26	0.85
100	22.79	25.67	12.86	13.07	1.03	0.42	49.12	27.90	0.88
150	22.72	25.65	13.08	13.17	1.04	0.42	48.09	28.07	0.93
200	22.67	25.67	12.99	13.20	1.04	0.43	48.60	28.27	0.83
250	22.61	25.73	12.71	13.09	1.04	0.44	47.51	28.41	0.90
300	22.56	25.79	12.37	13.00	1.05	0.46	46.54	28.34	0.90
350	22.50	25.86	12.12	13.03	1.05	0.47	46.87	28.47	0.93
400	22.45	25.93	11.92	13.15	1.05	0.49	46.50	28.40	0.94
450	22.40	26.00	11.82	13.44	1.06	0.51	46.92	28.53	0.92
500	22.35	26.09	11.69	13.72	1.06	0.53	45.95	28.45	0.96
550	22.30	26.17	11.59	14.03	1.07	0.55	45.71	28.34	0.96
600	22.24	26.27	11.45	14.30	1.08	0.57	46.00	28.56	1.01
650	22.18	26.38	11.29	14.54	1.08	0.59	45.32	28.33	1.01
700	22.11	26.51	11.16	14.68	1.09	0.61	45.41	28.61	0.89
750	22.04	26.63	11.06	14.77	1.10	0.64	45.36	28.63	1.00
800	21.96	26.78	10.93	14.71	1.11	0.66	44.30	28.61	0.95
850	21.88	26.92	10.86	14.66	1.12	0.67	43.92	28.30	1.00
900	21.83	27.06	10.72	14.61	1.13	0.69	43.86	28.37	0.99
950	21.76	27.20	10.62	14.55	1.14	0.71	44.12	28.89	1.00
1000	21.70	27.35	10.55	14.45	1.15	0.72	43.92	28.99	1.02
1100	21.57	27.68	10.57	14.06	1.18	0.75	43.09	28.43	1.05
1200	21.43	28.05	10.55	13.50	1.21	0.78	43.15	28.75	1.09
1300	21.28	28.43	10.57	12.83	1.25	0.80	42.95	28.90	1.10
1400	21.14	28.83	10.75	12.15	1.29	0.82	42.58	28.41	1.13
1500	20.99	29.24	10.96	11.51	1.33	0.83	42.43	28.53	1.19
1600	20.84	29.69	11.18	10.86	1.37	0.84	42.18	28.51	1.26
1700	20.69	30.14	11.40	10.25	1.42	0.85	42.10	28.42	1.24
1800	20.51	30.59	11.38	9.71	1.46	0.87	41.99	28.31	1.28
1900	20.29	31.13	10.91	9.23	1.52	0.89	41.98	28.39	1.34
2000	20.02	31.69	10.02	8.77	1.56	0.92	41.94	28.39	1.44
2100	19.70	32.24	8.91	8.39	1.60	0.95	41.60	28.36	1.57
2200	19.32	32.86	7.74	8.00	1.64	0.99	41.44	28.31	1.67
2300	18.85	33.46	6.62	7.62	1.66	1.03	41.15	27.95	1.76
2400	18.33	34.09	5.62	7.24	1.68	1.07	41.21	27.55	2.03
2500	17.72	34.69	4.73	6.91	1.69	1.11	41.19	27.89	2.23

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 = 7.60V, Id = 234.34mA @ Temperature = -45°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)
20	23.78	26.62	10.43	14.56	1.02	0.46	47.99	25.97	1.21
30	23.42	26.15	11.46	14.34	1.02	0.44	51.52	25.88	1.05
40	23.17	25.94	11.93	13.73	1.02	0.43	48.19	27.69	0.94
50	23.03	25.79	12.13	13.40	1.02	0.42	50.20	27.67	0.87
60	22.93	25.76	12.48	13.24	1.03	0.42	48.73	27.39	0.91
70	22.87	25.71	12.62	13.15	1.03	0.42	50.45	27.14	0.88
80	22.83	25.68	12.75	13.13	1.03	0.42	48.92	28.09	0.84
90	22.80	25.66	12.84	13.10	1.03	0.42	48.63	27.85	0.84
100	22.78	25.65	12.93	13.12	1.03	0.42	48.75	27.52	0.86
150	22.71	25.63	13.15	13.23	1.04	0.42	48.03	27.66	0.82
200	22.66	25.65	13.06	13.26	1.04	0.43	48.43	27.86	0.83
250	22.60	25.70	12.76	13.14	1.04	0.44	47.35	28.00	0.88
300	22.54	25.76	12.42	13.05	1.05	0.46	47.75	27.93	0.85
350	22.48	25.83	12.16	13.09	1.05	0.47	46.41	28.05	0.91
400	22.43	25.91	11.97	13.21	1.05	0.49	46.75	27.97	0.91
450	22.38	25.98	11.86	13.51	1.06	0.51	46.43	28.09	0.91
500	22.33	26.06	11.71	13.79	1.06	0.53	45.98	28.01	0.92
550	22.28	26.15	11.62	14.10	1.07	0.55	46.04	27.90	0.94
600	22.22	26.25	11.46	14.37	1.08	0.57	45.72	28.12	0.95
650	22.16	26.36	11.31	14.62	1.08	0.59	45.71	27.87	0.96
700	22.10	26.48	11.17	14.76	1.09	0.62	45.71	28.15	0.92
750	22.02	26.61	11.06	14.84	1.10	0.64	45.31	28.17	1.03
800	21.94	26.76	10.93	14.78	1.11	0.66	44.67	28.16	0.96
850	21.87	26.91	10.86	14.73	1.12	0.67	44.30	27.83	0.96
900	21.81	27.04	10.72	14.68	1.13	0.69	44.10	27.91	0.99
950	21.75	27.18	10.61	14.62	1.14	0.71	44.10	28.43	0.97
1000	21.69	27.33	10.54	14.52	1.15	0.72	43.98	28.54	1.01
1100	21.56	27.67	10.55	14.12	1.18	0.75	43.17	27.95	1.03
1200	21.41	28.03	10.51	13.54	1.21	0.78	43.25	28.29	1.07
1300	21.26	28.41	10.54	12.87	1.25	0.80	43.24	28.45	1.08
1400	21.12	28.81	10.71	12.18	1.29	0.82	42.75	27.94	1.10
1500	20.97	29.22	10.93	11.53	1.33	0.83	42.67	28.08	1.18
1600	20.82	29.67	11.14	10.88	1.37	0.84	42.60	28.05	1.19
1700	20.67	30.11	11.36	10.26	1.42	0.86	42.48	27.97	1.22
1800	20.49	30.57	11.35	9.72	1.46	0.87	42.19	27.85	1.24
1900	20.27	31.10	10.90	9.24	1.51	0.89	42.21	27.93	1.33
2000	20.00	31.65	10.01	8.78	1.56	0.92	41.96	27.94	1.39
2100	19.68	32.21	8.91	8.40	1.60	0.95	41.73	27.90	1.51
2200	19.30	32.82	7.74	8.02	1.64	0.99	41.63	27.87	1.63
2300	18.84	33.42	6.62	7.64	1.66	1.04	41.48	27.47	1.71
2400	18.31	34.06	5.62	7.26	1.68	1.08	41.40	27.05	2.00
2500	17.70	34.66	4.72	6.93	1.68	1.12	41.40	27.40	2.18

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 = 8.40V, Id = 262.78mA @ Temperature = -45°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)
20	23.81	26.67	10.41	14.49	1.02	0.47	45.00	26.79	1.33
30	23.44	26.19	11.41	14.25	1.02	0.44	50.04	26.50	1.11
40	23.20	25.98	11.83	13.64	1.02	0.43	51.00	28.59	1.00
50	23.06	25.87	12.06	13.32	1.02	0.42	48.65	28.39	0.95
60	22.96	25.80	12.37	13.16	1.03	0.42	49.19	28.15	0.97
70	22.89	25.75	12.51	13.07	1.03	0.42	48.59	27.81	0.92
80	22.85	25.73	12.64	13.05	1.03	0.42	47.03	29.01	0.87
90	22.82	25.71	12.71	13.02	1.03	0.42	48.90	28.64	0.87
100	22.80	25.70	12.79	13.03	1.03	0.42	49.51	28.27	0.90
150	22.73	25.67	13.00	13.13	1.04	0.42	48.38	28.45	0.87
200	22.68	25.70	12.92	13.16	1.04	0.43	47.61	28.64	0.85
250	22.62	25.75	12.63	13.05	1.04	0.44	48.25	28.79	0.89
300	22.56	25.81	12.32	12.96	1.05	0.46	48.72	28.73	0.98
350	22.51	25.88	12.06	12.99	1.05	0.47	47.07	28.85	0.94
400	22.46	25.96	11.87	13.11	1.05	0.49	46.93	28.79	0.91
450	22.41	26.03	11.78	13.39	1.06	0.51	46.24	28.92	0.95
500	22.36	26.11	11.64	13.66	1.06	0.53	45.66	28.86	0.97
550	22.31	26.20	11.54	13.96	1.07	0.55	45.80	28.76	0.97
600	22.25	26.30	11.40	14.23	1.08	0.57	45.87	28.97	0.98
650	22.19	26.41	11.26	14.47	1.08	0.59	45.41	28.75	0.97
700	22.12	26.53	11.13	14.61	1.09	0.62	45.13	29.03	0.93
750	22.05	26.66	11.04	14.69	1.10	0.64	44.96	29.06	1.02
800	21.97	26.80	10.92	14.63	1.11	0.66	44.70	29.05	0.97
850	21.89	26.95	10.84	14.58	1.12	0.67	43.92	28.73	1.01
900	21.83	27.08	10.71	14.53	1.13	0.69	43.73	28.81	1.01
950	21.77	27.23	10.61	14.48	1.14	0.71	43.91	29.32	1.01
1000	21.71	27.37	10.55	14.38	1.15	0.72	43.94	29.40	1.03
1100	21.58	27.71	10.58	14.00	1.18	0.75	43.07	28.88	1.05
1200	21.44	28.07	10.55	13.43	1.21	0.78	43.04	29.15	1.08
1300	21.29	28.45	10.58	12.78	1.25	0.80	43.10	29.30	1.10
1400	21.14	28.85	10.75	12.11	1.29	0.82	42.41	28.84	1.15
1500	21.00	29.27	10.97	11.47	1.33	0.83	42.20	28.94	1.22
1600	20.85	29.73	11.18	10.83	1.38	0.84	42.16	28.92	1.23
1700	20.69	30.17	11.40	10.22	1.42	0.85	42.00	28.81	1.25
1800	20.52	30.63	11.37	9.68	1.47	0.87	41.74	28.71	1.28
1900	20.29	31.17	10.89	9.20	1.52	0.89	41.66	28.79	1.35
2000	20.02	31.74	10.01	8.74	1.57	0.92	41.69	28.78	1.43
2100	19.71	32.29	8.90	8.36	1.61	0.95	41.39	28.74	1.55
2200	19.32	32.91	7.73	7.97	1.64	0.99	41.14	28.68	1.67
2300	18.85	33.51	6.62	7.59	1.67	1.03	41.05	28.37	1.80
2400	18.33	34.14	5.61	7.21	1.69	1.07	40.94	27.97	2.05
2500	17.73	34.74	4.72	6.87	1.69	1.11	40.90	28.32	2.24

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 = 8.00V, Id = 212.81mA @ Temperature = +95°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)
20	23.09	26.80	11.06	14.74	1.05	0.56	36.10	24.81	1.92
30	22.77	26.31	11.98	14.71	1.05	0.54	37.39	25.24	1.80
40	22.55	26.09	12.36	14.10	1.05	0.52	38.07	26.44	1.70
50	22.42	25.95	12.45	13.70	1.05	0.51	38.22	26.22	1.66
60	22.32	25.91	12.67	13.44	1.06	0.51	38.62	26.34	1.75
70	22.26	25.87	12.70	13.25	1.06	0.51	38.90	26.45	1.71
80	22.21	25.84	12.72	13.13	1.06	0.51	39.33	26.63	1.70
90	22.18	25.84	12.65	13.00	1.06	0.51	39.40	26.61	1.76
100	22.15	25.83	12.62	12.91	1.06	0.51	39.89	26.63	1.74
150	22.05	25.84	12.35	12.67	1.07	0.51	39.65	26.68	1.71
200	21.99	25.88	12.11	12.71	1.07	0.53	39.77	26.78	1.67
250	21.94	25.92	11.95	12.96	1.07	0.54	39.60	26.85	1.74
300	21.89	25.98	11.83	13.35	1.08	0.56	39.83	26.90	1.68
350	21.84	26.04	11.70	13.80	1.08	0.58	39.92	26.96	1.76
400	21.79	26.12	11.53	14.20	1.09	0.60	39.89	26.94	1.78
450	21.72	26.21	11.35	14.61	1.10	0.62	39.91	26.97	1.74
500	21.65	26.31	11.10	14.92	1.10	0.64	40.00	26.95	1.73
550	21.58	26.43	10.85	15.18	1.11	0.67	40.55	27.01	1.79
600	21.51	26.55	10.59	15.41	1.12	0.69	40.43	27.02	1.72
650	21.42	26.69	10.35	15.60	1.13	0.71	40.69	26.91	1.72
700	21.34	26.84	10.15	15.75	1.14	0.73	40.70	26.95	1.76
750	21.25	26.99	9.98	15.85	1.16	0.75	40.97	26.97	1.85
800	21.16	27.15	9.83	15.86	1.17	0.77	40.99	27.02	1.81
850	21.09	27.30	9.71	15.76	1.18	0.79	41.38	26.90	1.83
900	21.01	27.46	9.59	15.59	1.20	0.80	41.68	26.94	1.84
950	20.93	27.63	9.46	15.34	1.21	0.82	41.31	26.97	1.83
1000	20.86	27.80	9.37	15.02	1.23	0.83	40.35	26.69	1.86
1100	20.71	28.18	9.31	14.24	1.26	0.85	41.60	26.66	1.86
1200	20.56	28.56	9.32	13.41	1.30	0.87	41.56	26.52	1.88
1300	20.41	28.96	9.42	12.60	1.35	0.88	41.82	26.72	1.95
1400	20.28	29.36	9.57	11.83	1.39	0.89	42.35	26.50	1.98
1500	20.14	29.77	9.80	11.10	1.44	0.90	41.67	26.25	2.03
1600	19.99	30.23	10.01	10.43	1.49	0.90	41.91	26.26	2.10
1700	19.82	30.68	10.04	9.80	1.54	0.91	41.60	26.04	2.14
1800	19.62	31.14	9.85	9.22	1.58	0.92	42.50	26.14	2.20
1900	19.36	31.68	9.37	8.70	1.64	0.94	42.73	26.19	2.32
2000	19.04	32.23	8.63	8.21	1.69	0.96	41.84	25.92	2.45
2100	18.66	32.77	7.71	7.77	1.72	0.99	42.24	25.84	2.61
2200	18.20	33.35	6.71	7.36	1.76	1.02	41.78	25.62	2.79
2300	17.67	33.90	5.76	7.00	1.77	1.05	42.56	25.49	2.96
2400	17.07	34.45	4.91	6.68	1.78	1.09	42.36	25.19	3.34
2500	16.40	34.96	4.16	6.40	1.79	1.12	43.24	25.41	3.61

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 = 7.60V, Id = 204.70mA @ Temperature = +95°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)
20	23.08	26.79	11.03	14.55	1.05	0.56	36.54	24.36	1.81
30	22.77	26.30	12.02	14.51	1.05	0.53	37.68	24.90	1.72
40	22.55	26.08	12.42	13.91	1.05	0.52	38.35	26.00	1.64
50	22.41	25.96	12.62	13.53	1.05	0.51	38.36	25.90	1.57
60	22.32	25.90	12.80	13.28	1.06	0.51	38.86	26.00	1.68
70	22.25	25.86	12.84	13.09	1.06	0.51	39.26	26.10	1.65
80	22.21	25.83	12.84	12.97	1.06	0.50	39.54	26.27	1.63
90	22.17	25.82	12.79	12.84	1.06	0.50	39.68	26.26	1.72
100	22.15	25.81	12.75	12.76	1.06	0.50	40.02	26.26	1.68
150	22.05	25.82	12.47	12.54	1.06	0.51	40.07	26.31	1.68
200	21.99	25.86	12.22	12.58	1.07	0.52	40.10	26.42	1.60
250	21.93	25.91	12.03	12.84	1.07	0.54	39.66	26.50	1.66
300	21.89	25.96	11.88	13.23	1.08	0.56	40.24	26.54	1.66
350	21.84	26.02	11.74	13.70	1.08	0.58	40.06	26.61	1.70
400	21.78	26.10	11.57	14.11	1.09	0.60	40.14	26.58	1.68
450	21.72	26.19	11.36	14.55	1.10	0.62	40.41	26.63	1.69
500	21.65	26.29	11.10	14.89	1.10	0.64	40.27	26.60	1.68
550	21.58	26.41	10.84	15.19	1.11	0.66	40.83	26.64	1.70
600	21.50	26.53	10.57	15.47	1.12	0.69	40.93	26.67	1.72
650	21.42	26.66	10.32	15.71	1.13	0.71	41.02	26.55	1.70
700	21.34	26.81	10.12	15.91	1.14	0.73	40.98	26.61	1.69
750	21.25	26.96	9.95	16.06	1.15	0.75	41.38	26.63	1.80
800	21.17	27.11	9.80	16.12	1.17	0.77	41.41	26.68	1.74
850	21.09	27.27	9.69	16.06	1.18	0.79	41.97	26.53	1.76
900	21.02	27.43	9.56	15.92	1.19	0.81	42.20	26.58	1.76
950	20.94	27.59	9.43	15.68	1.21	0.82	41.78	26.65	1.76
1000	20.87	27.76	9.35	15.37	1.22	0.84	40.75	26.39	1.80
1100	20.72	28.12	9.29	14.58	1.26	0.86	42.14	26.31	1.80
1200	20.58	28.49	9.29	13.71	1.30	0.87	41.85	26.21	1.87
1300	20.44	28.88	9.39	12.87	1.34	0.89	42.14	26.40	1.87
1400	20.30	29.27	9.55	12.06	1.38	0.89	42.43	26.14	1.90
1500	20.17	29.66	9.78	11.30	1.42	0.90	41.79	25.94	2.00
1600	20.01	30.10	9.99	10.61	1.47	0.90	42.01	25.94	2.03
1700	19.84	30.53	10.04	9.97	1.52	0.91	41.62	25.72	2.07
1800	19.64	30.97	9.84	9.38	1.56	0.92	42.41	25.80	2.13
1900	19.38	31.48	9.38	8.86	1.61	0.94	42.54	25.84	2.23
2000	19.06	32.02	8.64	8.37	1.66	0.96	41.96	25.60	2.36
2100	18.68	32.54	7.72	7.93	1.69	0.99	42.21	25.51	2.54
2200	18.22	33.11	6.73	7.52	1.72	1.03	41.54	25.33	2.71
2300	17.69	33.65	5.76	7.17	1.74	1.06	42.00	25.15	2.90
2400	17.08	34.19	4.91	6.85	1.75	1.10	41.48	24.83	3.27
2500	16.40	34.71	4.17	6.58	1.76	1.13	42.56	25.09	3.50

Typical Performance Data

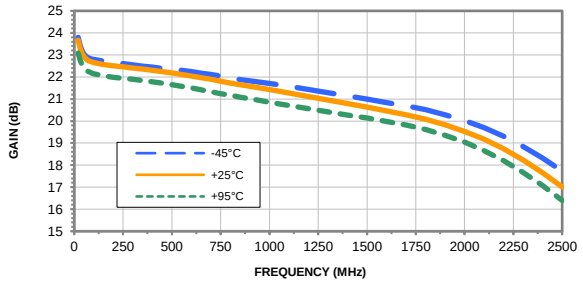
Definitions:
Input Return Loss = -S11 (dB)
Gain(Power Gain) = S21 (dB)
Reverse Isolation = -S12 (dB)
Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 8.40V, Id = 220.01mA @ Temperature = +95°C

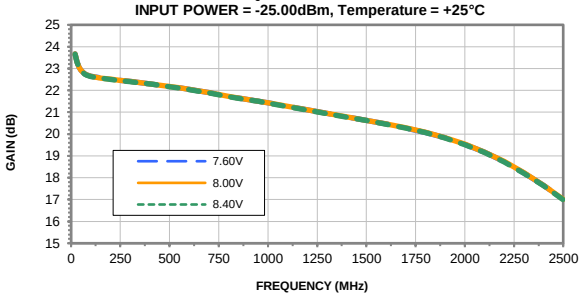
FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
20	23.03	26.84	11.15	14.81	1.06	0.57	35.82	25.11	2.04
30	22.72	26.35	12.01	14.82	1.05	0.55	37.28	25.51	1.91
40	22.50	26.13	12.36	14.20	1.06	0.53	37.52	26.78	1.79
50	22.37	26.01	12.59	13.80	1.06	0.52	37.80	26.41	1.74
60	22.27	25.95	12.62	13.55	1.06	0.52	38.13	26.62	1.85
70	22.21	25.91	12.64	13.35	1.06	0.52	38.60	26.62	1.79
80	22.17	25.88	12.65	13.22	1.06	0.52	38.88	26.92	1.79
90	22.13	25.87	12.60	13.09	1.06	0.52	39.09	26.88	1.89
100	22.11	25.87	12.56	13.00	1.07	0.52	39.43	26.93	1.83
150	22.01	25.88	12.28	12.76	1.07	0.52	39.45	26.97	1.74
200	21.95	25.92	12.03	12.80	1.07	0.54	39.45	27.07	1.76
250	21.89	25.96	11.89	13.03	1.08	0.55	39.19	27.13	1.80
300	21.85	26.02	11.75	13.41	1.08	0.57	39.46	27.20	1.83
350	21.80	26.08	11.63	13.86	1.09	0.59	39.29	27.25	1.83
400	21.74	26.16	11.48	14.24	1.09	0.61	39.64	27.23	1.82
450	21.68	26.25	11.28	14.62	1.10	0.63	39.66	27.26	1.84
500	21.61	26.35	11.04	14.91	1.11	0.65	39.74	27.24	1.84
550	21.54	26.47	10.80	15.14	1.12	0.67	40.25	27.32	1.86
600	21.46	26.60	10.54	15.33	1.13	0.69	40.14	27.30	1.82
650	21.38	26.73	10.29	15.49	1.14	0.72	40.28	27.21	1.89
700	21.30	26.88	10.11	15.61	1.15	0.74	40.44	27.23	1.84
750	21.21	27.03	9.95	15.67	1.16	0.76	40.60	27.24	1.94
800	21.13	27.19	9.80	15.65	1.18	0.78	40.55	27.31	1.86
850	21.05	27.35	9.69	15.52	1.19	0.79	40.84	27.21	1.89
900	20.98	27.51	9.57	15.33	1.20	0.81	41.13	27.26	1.91
950	20.90	27.68	9.45	15.07	1.22	0.82	40.82	27.24	1.88
1000	20.83	27.85	9.36	14.75	1.23	0.83	40.06	26.93	1.91
1100	20.68	28.23	9.31	13.98	1.27	0.85	41.08	26.96	1.93
1200	20.53	28.61	9.32	13.16	1.31	0.87	40.99	26.78	1.96
1300	20.39	29.02	9.42	12.37	1.35	0.88	41.34	26.98	1.99
1400	20.25	29.43	9.59	11.61	1.40	0.89	41.82	26.78	2.04
1500	20.12	29.86	9.80	10.90	1.45	0.89	41.22	26.50	2.12
1600	19.96	30.32	10.01	10.24	1.50	0.90	41.51	26.52	2.18
1700	19.79	30.79	10.03	9.62	1.55	0.91	41.28	26.29	2.22
1800	19.59	31.28	9.83	9.05	1.60	0.92	41.97	26.41	2.28
1900	19.33	31.83	9.35	8.53	1.66	0.93	42.27	26.46	2.41
2000	19.01	32.41	8.61	8.04	1.71	0.95	41.62	26.17	2.52
2100	18.63	32.97	7.68	7.61	1.75	0.98	41.95	26.09	2.71
2200	18.17	33.56	6.69	7.20	1.78	1.01	41.57	25.88	2.89
2300	17.63	34.13	5.74	6.84	1.80	1.05	42.28	25.76	3.08
2400	17.03	34.67	4.89	6.51	1.81	1.08	42.28	25.47	3.42
2500	16.36	35.17	4.15	6.23	1.81	1.11	43.32	25.69	3.70

Typical Performance Curves

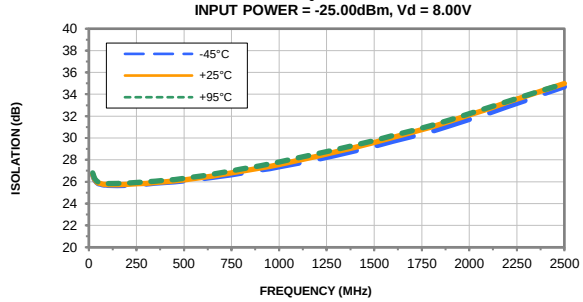
GAIN vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25.00dBm, Vd = 8.00V



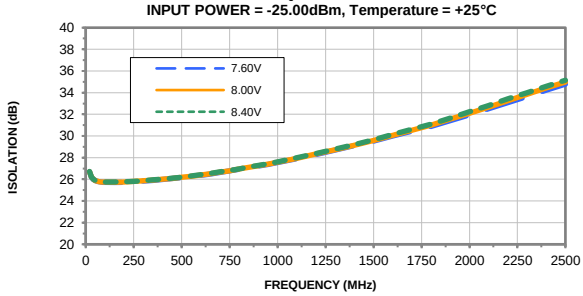
GAIN vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25.00dBm, Temperature = +25°C



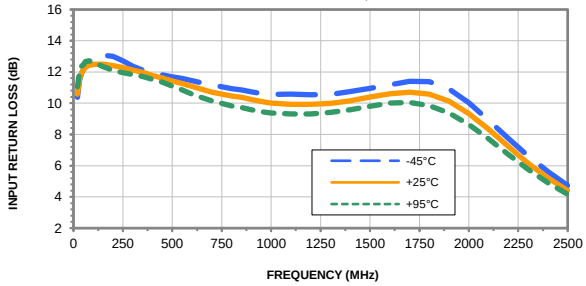
ISOLATION vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25.00dBm, Vd = 8.00V



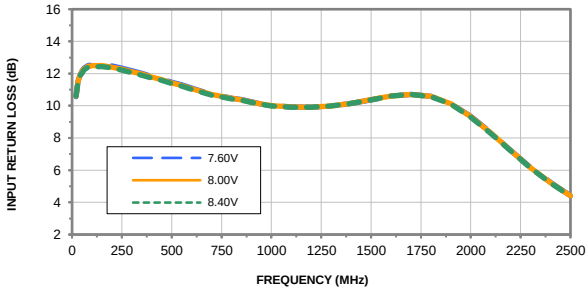
ISOLATION vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25.00dBm, Temperature = +25°C



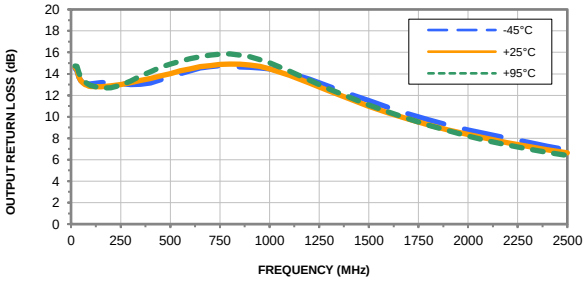
INPUT RETURN LOSS vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25.00dBm, Vd = 8.00V



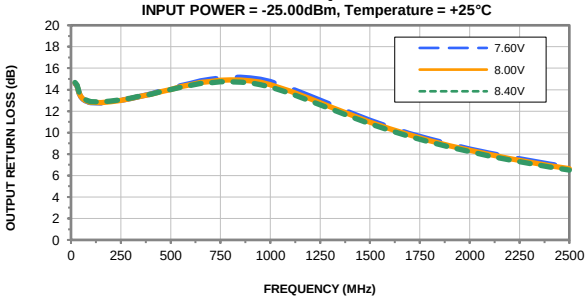
INPUT RETURN LOSS vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25.00dBm, Temperature = +25°C



OUTPUT RETURN LOSS vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25.00dBm, Vd = 8.00V

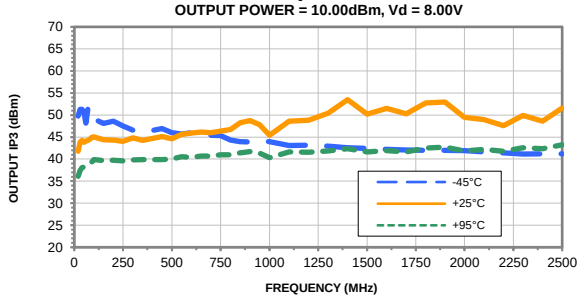


OUTPUT RETURN LOSS vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25.00dBm, Temperature = +25°C

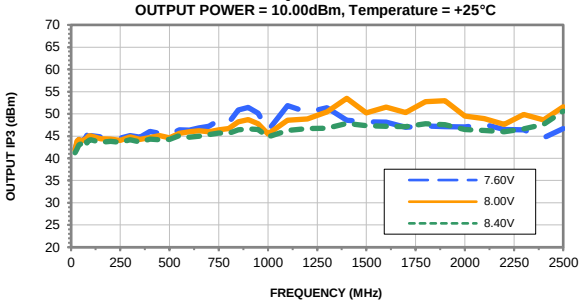


Typical Performance Curves

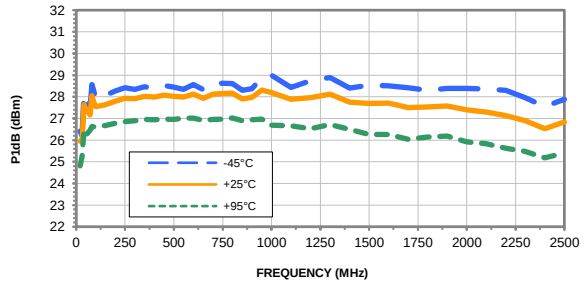
OUTPUT IP3 vs. FREQUENCY & TEMPERATURE
OUTPUT POWER = 10.00dBm, Vd = 8.00V



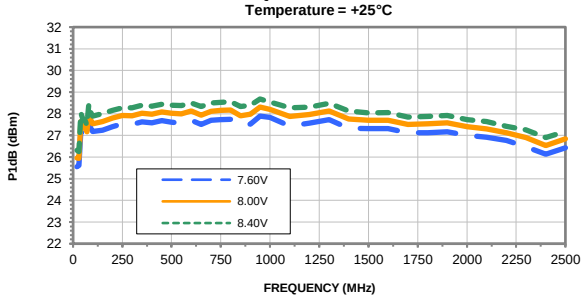
OUTPUT IP3 vs. FREQUENCY & DEVICE VOLTAGE
OUTPUT POWER = 10.00dBm, Temperature = +25°C



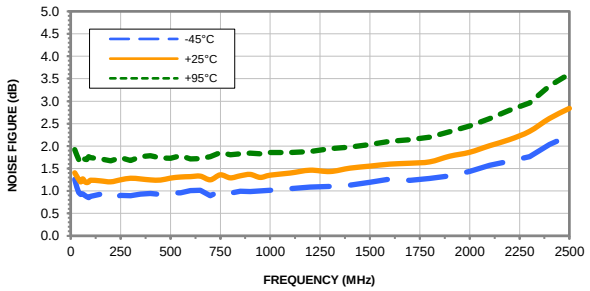
P1dB vs. FREQUENCY & TEMPERATURE
Vd = 8.00V



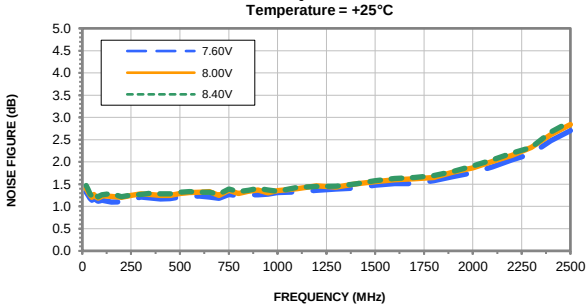
P1dB vs. FREQUENCY & DEVICE VOLTAGE
Temperature = +25°C



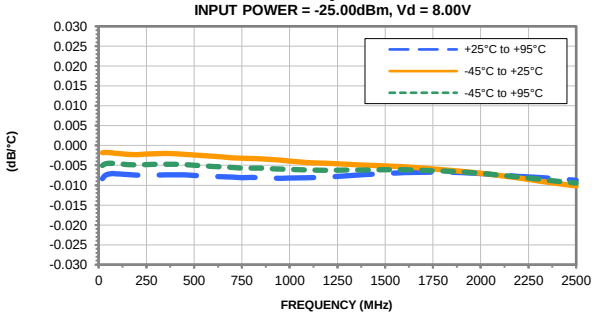
NOISE FIGURE vs. FREQUENCY & TEMPERATURE
Vd = 8.00V



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



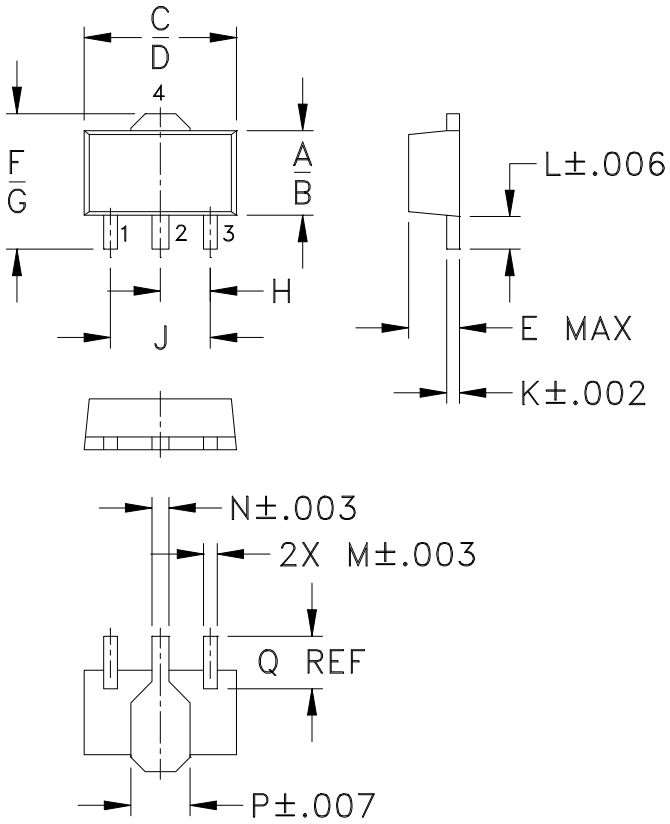
GAIN VARIATION vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25.00dBm, Vd = 8.00V



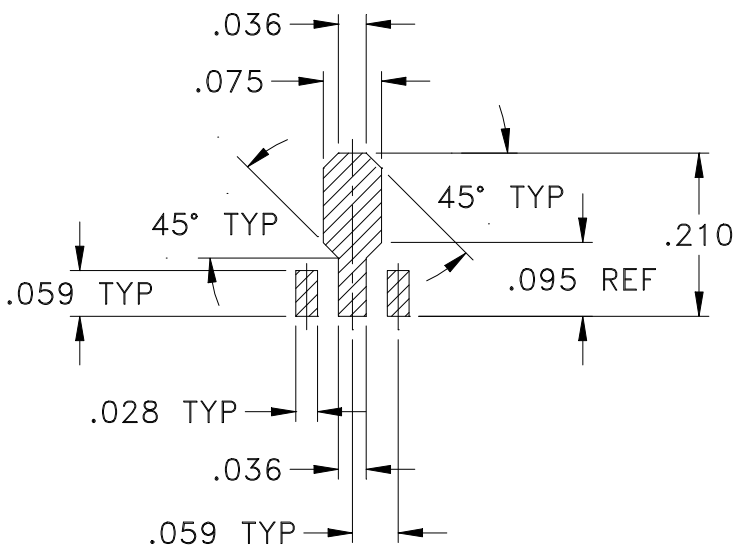
Case Style DF

DF782

Outline Dimensions



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

CASE #	A	B	C	D	E	F	G	H	J	K	L	M
DF782	.102 (2.59)	.090 (2.29)	.181 (4.60)	.173 (4.39)	.063 (1.60)	.167 (4.24)	.155 (3.94)	.059 (1.50)	.118 (3.00)	.015 (0.38)	.041 (1.04)	.016 (0.41)

CASE #	N	P	Q	WT. GRAM
DF782	.019 (0.48)	.065 (1.65)	.062 (1.57)	.2

Dimensions are in inches (mm). Tolerances: 2 Pl. ± .01; 3Pl. ± .005

Notes:

1. Case material: Plastic.
2. Termination finish:
   For RoHS Case Styles: Tin-Silver alloy plate over Nickel barrier or Matte-Tin.
   All models, (+) suffix. See model Data sheet.
   For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.

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INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
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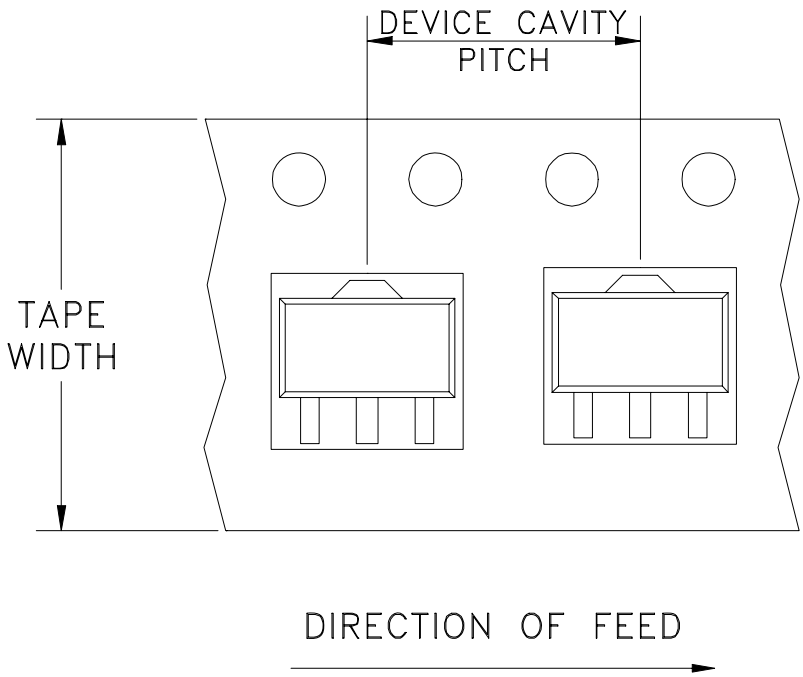
Tape & Reel Packaging TR-F55

DEVICE ORIENTATION IN T&R



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel	
12	8	7	Small quantity standard (see note)	20
				50
				100
				200
				500
			Standard	1000

Note: Please consult individual model data sheet to determine device per reel availability.

Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

Go to: www.minicircuits.com/pages/pdfs/tape.pdf

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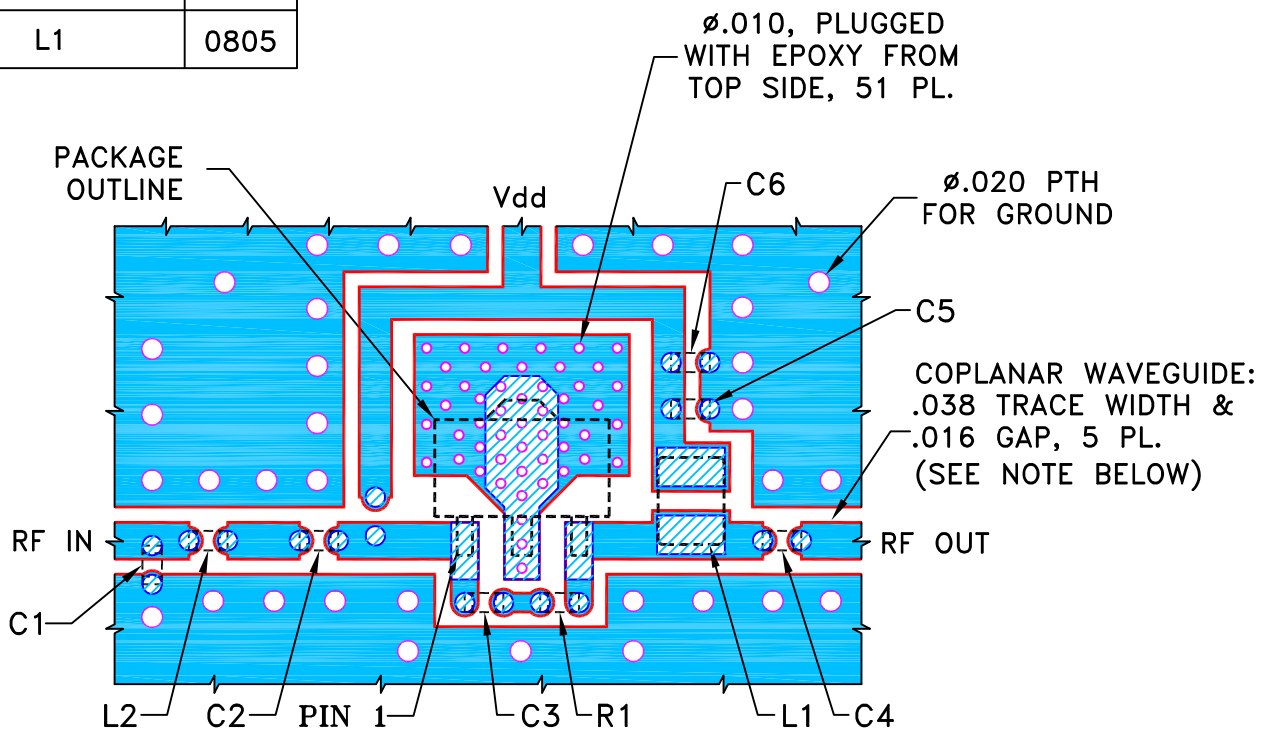
THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M161405	NEW RELEASE	04/19/17	GF	RS

SUGGESTED MOUNTING CONFIGURATION FOR DF782 CASE STYLE, "04AM03" PIN CONNECTION

COMPONENT	SIZE
R1,L2,C1–C6	0402
L1	0805



NOTES:

1. TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .020"±.0015". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.
2. CHIP COMPONENT FOOT PRINTS SHOWN FOR REFERENCE. FOR COMPONENT VALUES REFER TO TB–951+.
3. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

UNLESS OTHERWISE SPECIFIED		INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN	GF	03/09/17
TOLERANCES ON:	CHECKED	IL	04/19/17
2 PL DECIMALS ±	APPROVED	RS	04/19/17
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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ASHEETA1.DWG REV:A DATE:01/12/95

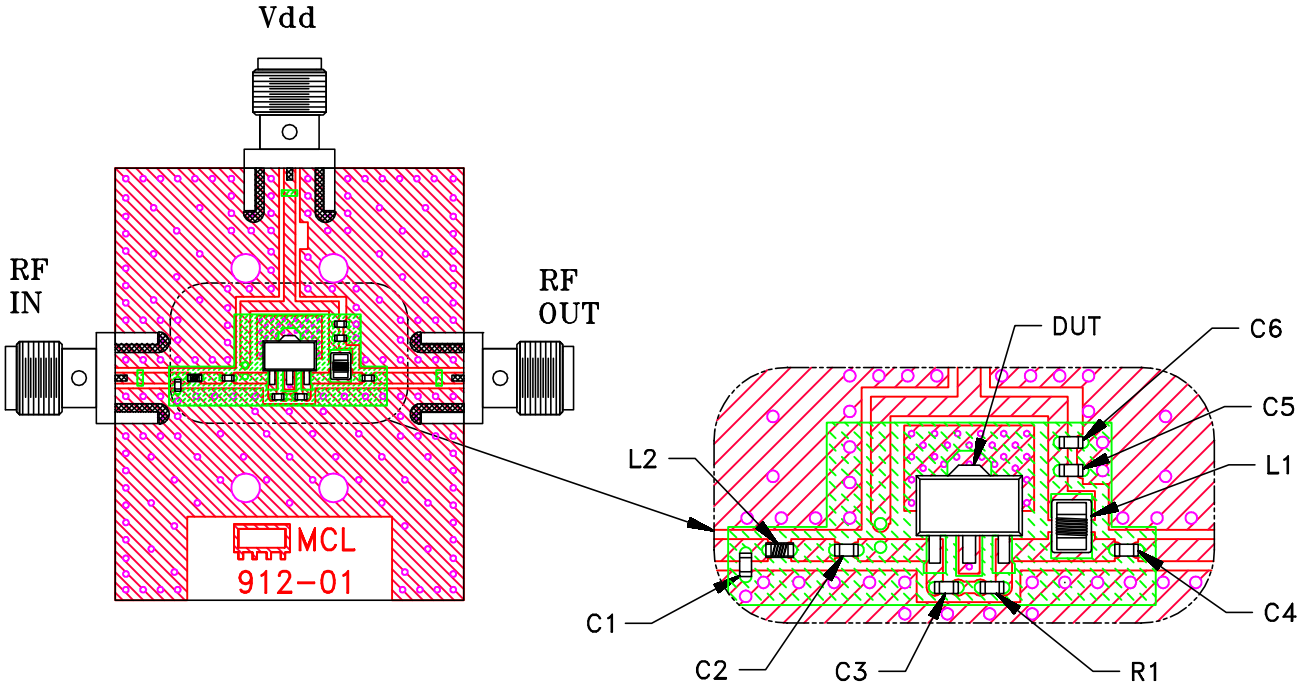
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, 04AM03, DF782, PHA-23HLN+, TB-951+

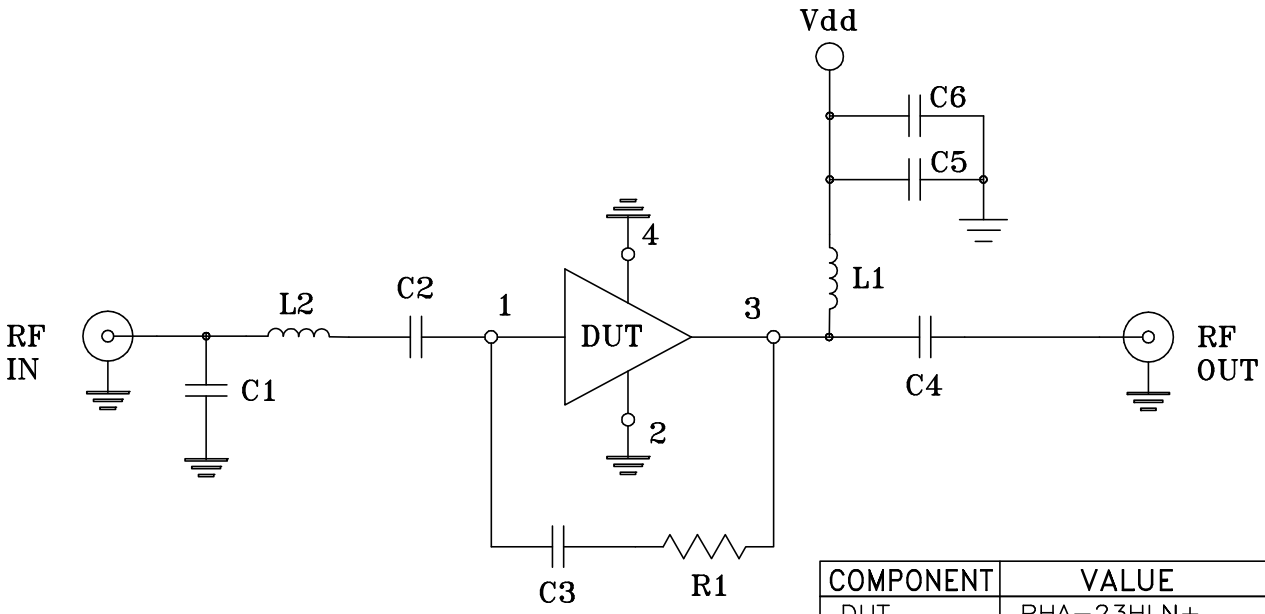
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-512	OR

FILE:	SCALE:	SHEET:
98PL512	5:1	1 OF 1

Evaluation Board and Circuit



TB-951+



Schematic Diagram

COMPONENT	VALUE	SIZE
DUT	PHA-23HLN+	SOT-89
C1	Capacitor 1.2 pF	0402
C2,C3,C6	Capacitor 0.1 uF	
C4	Capacitor 0.001 uF	
C5	Capacitor 0.01 uF	
R1	Resistor 1.21 KOhm	
L1	Inductor 0.680 uH	0805
L2	Inductor 1.0 nH	0402

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: RO4350 or equivalent, Dielectric Constant=3.5, Thickness=.020 inch.

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Environmental Specifications **ENV08T9**

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 95° C / 105° C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° C or -65° to 150° Ambient Environment	Individual Model Data Sheet
Thermal Shock	-55° to 100°C, 100 cycles	MIL-STD-202, Method 107, Condition A-3, except +100°C
Mechanical Shock	1.5Kg, 0.5 ms, 5 shock pulses, Y1 direction only	MIL-STD-883, Method 2002, Condition B, except Y1 direction only
Vibration (Variable Frequency)	50g peak	MIL-STD-883, Method 2007, Condition B
Autoclave	15 psig, 100% RH, 121°C, 96 hours	JESD22-A102-C, Condition C
HAST	130°C, 85% RH, 96 hours	JESD22-A110
Solderability	10X Magnification	J-STD-002, Para 4.2.5, Test S, 95% Coverage
Solder Reflow Heat	Sn-Pb Eutetic Process: 240°C peak Pb-Free Process: 260°C peak	J-STD-020C, Table 4-1, 4-2 and 5-2; Figure 5-1
Moisture Sensitivity: Level 1	Bake at 125°C for 24 hours. Soak at 85°C/85%RH for 168 hours Reflow 3 cycles at 260°C peak	J-STD-020
Marking Resistance to Solvents	Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C; distilled water + proylene glycol monomethyl ether +	MIL-STD-202, Method 215

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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
	monoethanolamine at 63°C to 70°C	

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