

Ultra High Dynamic Range

# Monolithic Amplifier

PHA-202+

50Ω 0.03 to 2.7 GHz

## The Big Deal

- Ultra High IP3, +46.1 dBm
- Broadband High Dynamic Range without external Matching Components
- Medium power, 1W
- Excellent return loss over 15 dB



CASE STYLE: DL1636

## Product Overview

The PHA-202+ (RoHS compliant) is a medium power amplifier fabricated using E-PHEMT technology and offers extremely high dynamic range over a broad frequency range and with low noise figure. In addition, the PHA-202+ has good input and output return loss over a broad frequency range without the need for external matching components and has demonstrated excellent reliability. It has repeatable performance from lot to lot and is enclosed in a 5mm x 6mm, 8 lead package for very good thermal performance.

## Key Features

Feature	Advantages
Broad Band: 0.03 to 2.7 GHz	Broadband covering primary wireless communications bands: Cellular, PCS, LTE
Extremely High IP3 Versus DC power Consumption 46 dBm typical at 1.0 GHz	The PHA-202+ matches industry leading IP3 performance relative to device size and power consumption. The combination of the design and E-PHEMT Structure provides enhanced linearity over a broad frequency range as evidence in the IP3 being typically 14-23 dB above the P1dB point. This feature makes this amplifier ideal for use in: <ul style="list-style-type: none"><li>• Driver amplifiers for complex waveform up converter paths</li><li>• Drivers in linearized transmit systems</li><li>• Secondary amplifiers in ultra High Dynamic range receivers</li></ul>
No External Matching Components Required	Unlike competing products, Mini-Circuits PHA-202+ provides Input and Output Return Loss of over 15 dB up to 2 GHz without the need for any external matching components



Ultra High Dynamic Range

# Monolithic Amplifier

0.03-2.7 GHz

## Product Features

- High IP3, 46.1 dBm typ. at 1 GHz
- Gain, 17.0 dB typ. at 1 GHz
- High Pout, P1dB 30.4 dBm typ. at 1 GHz
- No external matching components required



Generic photo used for illustration purposes only

CASE STYLE: DL1636

## PHA-202+

**+RoHS Compliant**

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

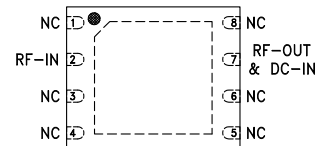
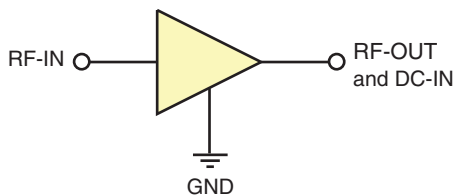
## Typical Applications

- Base station infrastructure
- CATV
- LTE

## General Description

The PHA-202+ (RoHS compliant) is a medium power amplifier fabricated using E-PHEMT technology and offers extremely high dynamic range over a broad frequency range and with low noise figure. In addition, the PHA-202+ has good input and output return loss over a broad frequency range without the need for external matching components and has demonstrated excellent reliability. It has repeatable performance from lot to lot and is enclosed in a 5mm x 6mm, 8 lead package for very good thermal performance.

### simplified schematic and pin description



Function	Pin Number	Description
RF-IN	2	RF input
RF-OUT and DC-IN	7	RF output and DC input
GND	Paddle	Ground
NC	1,3-6,8	No connection

Electrical Specifications at 25°C, 50 ohms, unless noted

Parameter	Condition (MHz)	Vd=11V <sup>1</sup>			Vd=11V <sup>2</sup>	Units
		Min.	Typ.	Max.	Typ.	
Frequency range		0.03		2.7	0.03-2.7	GHz
Gain	30	—	18.3	—	18.3	dB
	500	—	17.9	—	17.7	
	1000	—	17.0	—	16.8	
	2000	13.2	14.7	16.1	14.3	
	2700	—	12.7	—	12.1	
Input return loss	30		21.2		20.5	dB
	500		21.7		25.5	
	1000		19.5		28.6	
	2000		20.3		17.7	
	2700		14.9		12.0	
Output return loss	30		15.1		15.5	dB
	500		16.4		15.2	
	1000		19.4		15.7	
	2000		22.5		19.1	
	2700		9.8		9.4	
Reverse isolation	2000		23		23.3	dB
Output power @ 1dB compression	30		28.4		29.2	dBm
	500		30.2		29.8	
	1000		30.4		29.8	
	2000		28.1		27.0	
	2700		25.7		25.2	
Output IP3 <sup>3</sup>	30		51.0		50.3	dBm
	500		48.5		48.8	
	1000		46.1		46.2	
	2000		43.2		41.7	
	2700		39.4		38.8	
Noise figure	30		3.2		3.0	dB
	500		3.3		3.0	
	1000		3.5		3.3	
	2000		4.4		4.3	
	2700		5.4		5.2	
Device operating voltage			11		11	V
Device operating current		—	350	416	335	mA
Device current variation vs. temperature <sup>4</sup>			188.6		188.6	μA/°C
Device current variation vs voltage <sup>5</sup>			0.0485		0.0485	mA/mV
Thermal Resistance, junction-to-ground lead at 85°C stage temp.			16.1		16.1	°C/W

1. Measured on Mini-Circuits Characterization test board MB018. See Characterization Test Circuit (Fig. 1)
2. Measured on Mini-Circuits Application test board TB-962+. See Characterization Test Circuit (Fig. 2)
3. Tested at Pout=16dBm / tone.
4. (Current at 85°C — Current at -45°C)/130
5. (Current at 11.5V-current - Current at 10.5V)/1000

Absolute Maximum Ratings<sup>6</sup>

Parameter	Ratings
Operating Temperature (ground lead)	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Junction Temperature	179°C
Power Dissipation	5.8W
Input Power (CW)	+24 dBm (5 minutes max.) +19 dBm (continuous)
DC Voltage on Pin 7	14V

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

**Characterization Test Circuit**

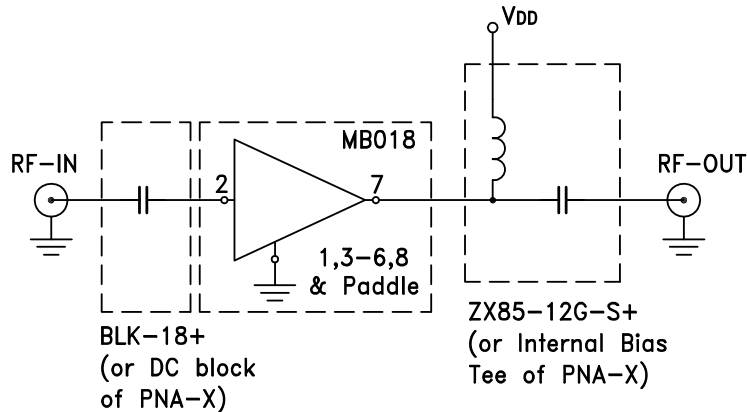


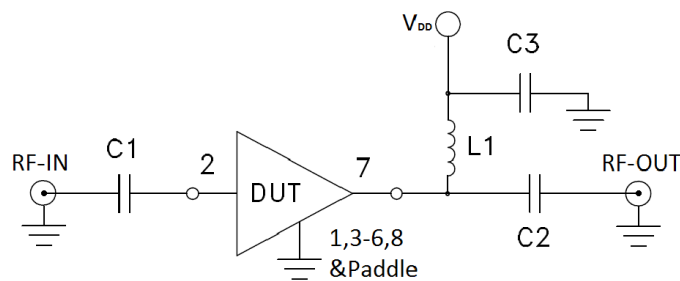
Fig 1. Characterization Circuit

Note: This block diagram is used for characterization. (DUT soldered on Mini-Circuits Characterization test board MB018)  
 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, 16 dBm/tone at output.

**Recommended Application Circuit**



Component	P/N	SUPPLIER	Value	Size
C1, C2, C3	GRM155R71E103KA01D	MURATA	0.01uF	0402
L1	WA8514-AE	COILCRAFT	5.6uH	1708

Fig 2. Application Circuit

Note: (DUT soldered on Mini-Circuits Application test board TB-962+)  
 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, 16 dBm/tone at output.

**Product Marking**



Marking may contain other features or characters for internal lot control

<b>Additional Detailed Technical Information</b> <i>additional information is available on our dash board. To access this information <a href="#">click here</a></i>	
<b>Performance Data</b>	Data Table
	Swept Graphs
	S-Parameter (S2P Files) Data Set (.zip file)
<b>Case Style</b>	DL1636 <i>Plastic package, exposed paddle lead finish: Matte Tin</i>
<b>Tape &amp; Reel</b> Standard quantities available on reel	F68 <i>7" reels with 20, 50, 100, 200, 500 or 1K devices 13" reels with 2K, 3K, 4K devices</i>
<b>Suggested Layout for PCB Design</b>	PL-522
<b>Evaluation Board</b>	TB-962+
<b>Environmental Ratings</b>	ENV08T1

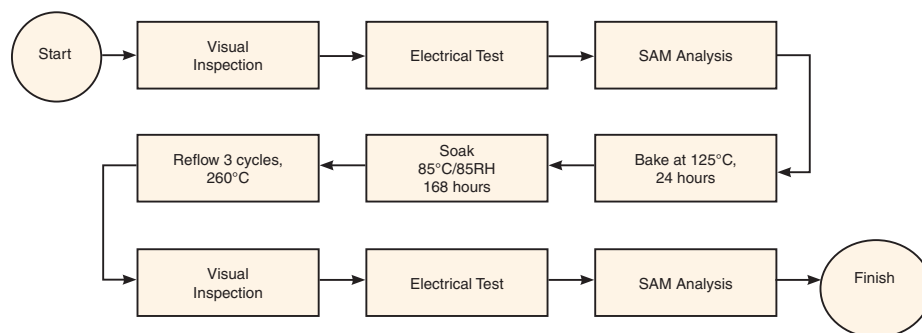
**ESD Rating**

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

**MSL Rating**

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

**MSL Test Flow Chart**



**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.
- 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/MCLStore/terms.jsp](http://www.minicircuits.com/MCLStore/terms.jsp)

## 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 = 11V, Id = 348.23 mA @ Temperature = +25degC

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
					K	Measure			
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
30	18.34	23.27	21.98	15.44	1.12	0.67	51.27	28.39	3.07
50	18.26	23.16	22.96	15.54	1.12	0.67	51.70	30.30	2.94
100	18.24	23.10	23.04	15.66	1.12	0.66	51.48	29.68	3.04
150	18.22	23.10	23.17	15.74	1.12	0.67	50.11	29.77	3.09
200	18.18	23.09	22.87	15.84	1.13	0.67	50.24	29.97	3.06
250	18.14	23.11	22.85	15.94	1.13	0.67	50.33	30.23	3.07
300	18.10	23.09	22.53	16.08	1.13	0.68	49.61	30.37	3.12
350	18.05	23.06	22.34	16.25	1.13	0.68	48.97	30.31	3.11
400	17.99	23.04	22.14	16.39	1.14	0.68	48.79	30.20	3.11
450	17.93	23.05	21.87	16.64	1.14	0.69	48.56	30.19	3.14
500	17.87	23.01	21.63	16.83	1.15	0.69	48.45	30.15	3.17
550	17.80	23.02	21.33	17.09	1.15	0.70	47.81	30.41	3.21
600	17.73	23.03	21.12	17.35	1.16	0.71	47.55	30.39	3.24
650	17.65	23.02	20.80	17.68	1.16	0.71	47.18	30.38	3.25
700	17.56	23.01	20.57	18.00	1.17	0.72	46.90	30.34	3.28
750	17.48	23.00	20.33	18.34	1.18	0.72	46.61	30.27	3.31
800	17.39	22.98	20.12	18.71	1.18	0.73	46.35	30.15	3.33
850	17.29	22.99	19.99	19.07	1.19	0.74	46.08	30.40	3.35
900	17.19	22.96	19.72	19.52	1.20	0.74	46.19	30.32	3.39
950	17.09	22.95	19.63	19.96	1.21	0.75	45.71	30.00	3.41
1000	16.99	22.95	19.46	20.52	1.22	0.76	45.95	30.38	3.43
1050	16.89	22.94	19.35	20.97	1.23	0.76	45.35	30.12	3.48
1100	16.78	22.95	19.30	21.55	1.24	0.77	45.45	30.10	3.52
1150	16.67	22.92	19.26	22.15	1.25	0.78	45.12	29.91	3.57
1200	16.56	22.92	19.22	22.79	1.26	0.78	45.24	30.19	3.62
1250	16.45	22.90	19.23	23.54	1.27	0.79	44.97	29.58	3.66
1300	16.33	22.90	19.27	24.29	1.28	0.79	45.07	29.93	3.71
1350	16.22	22.91	19.31	25.22	1.29	0.80	44.98	29.41	3.76
1400	16.11	22.89	19.34	26.20	1.30	0.80	44.65	29.60	3.80
1450	15.99	22.88	19.44	27.15	1.31	0.81	44.93	29.83	3.84
1500	15.87	22.86	19.58	28.23	1.32	0.81	44.59	29.54	3.88
1550	15.76	22.90	19.69	29.41	1.34	0.82	44.61	29.50	3.94
1600	15.64	22.88	19.84	30.36	1.35	0.82	44.25	29.12	3.98
1650	15.52	22.87	20.02	30.97	1.36	0.83	43.97	28.74	4.03
1700	15.41	22.85	20.15	30.86	1.38	0.83	43.44	28.38	4.07
1750	15.29	22.87	20.41	30.07	1.39	0.84	43.67	28.64	4.22
1800	15.17	22.90	20.63	28.83	1.41	0.84	43.48	28.52	4.13
1850	15.06	22.93	20.76	27.45	1.42	0.85	43.85	29.08	4.21
1900	14.94	22.92	20.87	25.87	1.44	0.85	43.23	28.41	4.21
1950	14.82	22.92	21.03	24.46	1.45	0.85	42.96	28.10	4.26
2000	14.70	22.95	21.13	22.86	1.47	0.86	42.96	28.06	4.31
2100	14.45	22.97	21.01	20.49	1.49	0.86	42.71	27.66	4.38
2200	14.20	23.07	20.67	18.42	1.53	0.87	41.85	27.26	4.48
2300	13.95	23.10	20.00	16.53	1.55	0.87	40.95	26.63	4.59
2400	13.69	23.26	19.19	14.83	1.59	0.88	40.49	26.47	4.71
2500	13.41	23.38	18.23	13.30	1.62	0.88	39.26	25.63	4.85
2600	13.11	23.50	17.18	11.86	1.65	0.88	38.72	25.24	5.00
2700	12.78	23.73	16.05	10.53	1.68	0.87	38.98	25.75	5.18

## 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 = 10.5V, Id = 322.53 mA @ Temperature = +25degC

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
					K	Measure			
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
30	18.32	23.24	21.77	15.52	1.12	0.66	51.15	28.02	3.02
50	18.25	23.12	22.82	15.62	1.12	0.66	51.93	29.82	2.89
100	18.24	23.10	22.85	15.72	1.12	0.66	49.91	29.28	2.99
150	18.21	23.08	22.96	15.80	1.12	0.67	50.26	29.39	3.03
200	18.18	23.06	22.68	15.91	1.12	0.67	50.05	29.51	3.01
250	18.13	23.06	22.65	16.00	1.13	0.67	49.87	29.77	3.01
300	18.09	23.07	22.37	16.15	1.13	0.68	48.57	29.91	3.07
350	18.04	23.06	22.17	16.31	1.13	0.68	48.82	29.85	3.07
400	17.98	23.04	21.98	16.48	1.14	0.68	47.94	29.74	3.07
450	17.92	23.02	21.71	16.68	1.14	0.69	47.63	29.74	3.10
500	17.86	23.02	21.48	16.92	1.15	0.69	47.20	29.75	3.13
550	17.78	23.03	21.21	17.15	1.15	0.70	47.00	30.00	3.15
600	17.72	23.03	20.93	17.46	1.16	0.71	46.64	29.92	3.17
650	17.63	23.00	20.63	17.75	1.16	0.71	46.32	29.92	3.19
700	17.55	23.01	20.48	18.07	1.17	0.72	46.08	29.87	3.23
750	17.46	22.97	20.21	18.44	1.18	0.72	45.57	29.81	3.22
800	17.37	22.99	20.01	18.79	1.19	0.73	45.31	29.77	3.28
850	17.27	22.96	19.87	19.16	1.19	0.74	45.27	29.94	3.29
900	17.17	22.95	19.64	19.62	1.20	0.74	45.09	29.94	3.35
950	17.07	22.95	19.54	20.09	1.21	0.75	44.52	29.55	3.37
1000	16.97	22.94	19.36	20.63	1.22	0.76	44.93	29.90	3.40
1050	16.86	22.92	19.30	21.13	1.23	0.76	44.33	29.73	3.43
1100	16.75	22.94	19.18	21.69	1.24	0.77	44.40	29.64	3.47
1150	16.64	22.92	19.21	22.24	1.25	0.78	44.00	29.45	3.50
1200	16.53	22.91	19.14	22.94	1.26	0.78	44.15	29.73	3.55
1250	16.42	22.92	19.17	23.68	1.27	0.79	43.65	29.22	3.61
1300	16.30	22.88	19.21	24.39	1.28	0.79	43.81	29.55	3.64
1350	16.18	22.93	19.24	25.23	1.30	0.80	43.58	29.05	3.68
1400	16.08	22.89	19.27	26.19	1.30	0.81	43.36	29.22	3.74
1450	15.95	22.87	19.37	27.09	1.31	0.81	43.75	29.43	3.78
1500	15.83	22.84	19.53	27.93	1.32	0.81	43.26	29.14	3.83
1550	15.72	22.87	19.61	28.90	1.34	0.82	43.24	29.10	3.87
1600	15.59	22.88	19.81	29.38	1.36	0.83	42.82	28.74	3.93
1650	15.47	22.92	19.98	29.59	1.37	0.83	42.44	28.37	3.94
1700	15.36	22.88	20.12	29.29	1.38	0.83	41.96	28.02	3.99
1750	15.24	22.90	20.36	28.51	1.40	0.84	42.21	28.27	4.05
1800	15.12	22.89	20.57	27.39	1.41	0.84	41.99	28.15	4.08
1850	15.00	22.91	20.70	26.20	1.43	0.85	42.52	28.68	4.14
1900	14.88	22.90	20.82	24.88	1.44	0.85	41.79	28.03	4.14
1950	14.76	22.91	20.99	23.65	1.45	0.85	41.47	27.73	4.17
2000	14.62	22.94	21.07	21.98	1.47	0.86	41.58	27.68	4.22
2100	14.37	22.96	20.91	19.82	1.50	0.86	41.03	27.28	4.30
2200	14.12	23.05	20.59	17.93	1.53	0.87	40.46	26.97	4.41
2300	13.87	23.13	19.93	16.14	1.56	0.87	39.45	26.25	4.51
2400	13.60	23.21	19.11	14.55	1.59	0.88	39.12	26.08	4.61
2500	13.31	23.34	18.16	13.06	1.62	0.88	37.64	25.34	4.77
2600	13.01	23.51	17.14	11.70	1.66	0.88	37.04	24.86	4.92
2700	12.68	23.73	16.03	10.41	1.69	0.87	37.95	25.36	5.10

## 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 = 11.5V, Id = 371.94 mA @ Temperature = +25degC

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
					K	Measure			
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
30	18.36	23.27	22.03	15.31	1.12	0.67	50.91	28.70	3.12
50	18.27	23.20	23.17	15.36	1.12	0.67	51.62	30.67	3.00
100	18.26	23.13	23.22	15.61	1.12	0.66	50.36	30.07	3.08
150	18.23	23.10	23.43	15.65	1.12	0.66	51.67	30.09	3.12
200	18.19	23.08	23.09	15.76	1.12	0.67	50.33	30.31	3.10
250	18.15	23.10	23.07	15.86	1.13	0.67	50.51	30.58	3.11
300	18.12	23.09	22.75	16.01	1.13	0.67	49.24	30.72	3.16
350	18.06	23.09	22.49	16.18	1.14	0.68	49.55	30.65	3.16
400	18.01	23.08	22.34	16.34	1.14	0.68	49.10	30.58	3.18
450	17.95	23.06	22.04	16.56	1.14	0.69	48.82	30.52	3.19
500	17.89	23.04	21.83	16.73	1.15	0.69	48.59	30.54	3.22
550	17.82	23.04	21.47	16.99	1.15	0.70	48.10	30.80	3.24
600	17.75	23.06	21.27	17.25	1.16	0.70	48.18	30.72	3.28
650	17.67	23.04	20.92	17.57	1.16	0.71	47.62	30.72	3.30
700	17.59	23.01	20.70	17.89	1.17	0.72	47.30	30.67	3.33
750	17.51	23.02	20.48	18.22	1.18	0.72	47.09	30.60	3.36
800	17.42	22.99	20.22	18.60	1.18	0.73	46.88	30.55	3.37
850	17.32	23.01	20.10	18.92	1.19	0.74	46.80	30.73	3.39
900	17.23	22.97	19.83	19.38	1.20	0.74	46.69	30.73	3.45
950	17.13	22.98	19.73	19.81	1.21	0.75	46.28	30.32	3.47
1000	17.03	22.95	19.58	20.34	1.21	0.75	46.50	30.71	3.52
1050	16.93	22.94	19.44	20.81	1.22	0.76	46.26	30.44	3.54
1100	16.82	22.94	19.40	21.33	1.23	0.77	46.05	30.42	3.57
1150	16.71	22.93	19.36	21.94	1.24	0.77	45.90	30.23	3.62
1200	16.60	22.94	19.35	22.53	1.25	0.78	45.81	30.52	3.68
1250	16.49	22.92	19.32	23.30	1.26	0.78	45.89	29.89	3.72
1300	16.38	22.92	19.36	24.04	1.28	0.79	45.99	30.24	3.76
1350	16.27	22.92	19.39	25.03	1.29	0.80	45.39	29.72	3.81
1400	16.16	22.90	19.45	25.94	1.30	0.80	45.99	29.92	3.87
1450	16.05	22.90	19.53	26.98	1.31	0.81	45.77	30.15	3.91
1500	15.93	22.89	19.63	28.22	1.32	0.81	45.55	29.86	3.95
1550	15.82	22.89	19.80	29.57	1.33	0.82	45.67	29.83	3.99
1600	15.70	22.87	19.94	30.99	1.35	0.82	45.15	29.43	4.08
1650	15.58	22.89	20.12	32.25	1.36	0.83	44.99	29.04	4.10
1700	15.47	22.86	20.28	32.95	1.37	0.83	44.55	28.59	4.12
1750	15.36	22.92	20.52	32.29	1.39	0.83	44.69	28.95	4.16
1800	15.24	22.92	20.72	30.78	1.40	0.84	44.53	28.74	4.22
1850	15.13	22.91	20.90	29.08	1.42	0.84	44.83	29.41	4.29
1900	15.01	22.87	20.94	27.31	1.42	0.84	44.28	28.71	4.29
1950	14.90	22.92	21.10	25.59	1.44	0.85	43.96	28.41	4.33
2000	14.74	23.00	21.15	23.62	1.47	0.86	44.12	28.37	4.36
2100	14.51	22.98	21.04	21.01	1.49	0.86	43.40	27.97	4.45
2200	14.26	23.06	20.67	18.76	1.52	0.87	43.26	27.57	4.55
2300	14.01	23.14	20.01	16.79	1.55	0.87	41.99	26.86	4.67
2400	13.75	23.22	19.20	15.02	1.58	0.88	41.79	26.69	4.77
2500	13.47	23.37	18.24	13.43	1.61	0.88	40.36	25.94	4.93
2600	13.17	23.52	17.19	11.96	1.64	0.87	39.75	25.46	5.10
2700	12.85	23.75	16.07	10.60	1.68	0.87	40.85	25.99	5.27



## 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 = 11V, Id = 332.89 mA @ Temperature = -45degC

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)
30	18.19	23.19	22.27	15.42	1.12	0.67	51.72	28.40	2.59
50	18.30	23.11	22.50	15.79	1.12	0.66	53.25	30.37	2.43
100	18.29	23.14	22.30	15.99	1.12	0.67	51.91	29.80	2.51
150	18.26	23.09	22.30	16.12	1.12	0.67	51.39	29.85	2.56
200	18.23	23.09	22.04	16.22	1.12	0.67	51.59	30.05	2.53
250	18.19	23.09	22.20	16.25	1.13	0.67	50.90	30.34	2.54
300	18.15	23.05	22.15	16.27	1.13	0.67	50.61	30.48	2.58
350	18.10	23.06	22.09	16.37	1.13	0.68	50.45	30.42	2.57
400	18.04	23.08	21.97	16.48	1.14	0.68	49.97	30.35	2.57
450	17.99	23.07	21.69	16.70	1.14	0.69	49.26	30.35	2.59
500	17.92	23.04	21.44	16.91	1.14	0.69	49.25	30.22	2.61
550	17.85	23.01	21.16	17.17	1.15	0.70	48.70	30.58	2.66
600	17.78	23.03	20.97	17.41	1.15	0.70	48.61	30.48	2.65
650	17.71	22.99	20.77	17.62	1.16	0.71	48.02	30.47	2.68
700	17.62	23.02	20.67	17.87	1.17	0.72	47.98	30.41	2.69
750	17.54	23.00	20.49	18.13	1.17	0.72	47.50	30.26	2.73
800	17.45	22.97	20.26	18.48	1.18	0.72	47.44	30.21	2.74
850	17.36	22.94	20.18	18.77	1.18	0.73	47.37	30.49	2.78
900	17.27	22.95	19.96	19.17	1.19	0.74	47.06	30.39	2.79
950	17.17	22.94	19.91	19.53	1.20	0.74	46.65	29.98	2.81
1000	17.07	22.92	19.81	19.94	1.21	0.75	46.97	30.37	2.84
1050	16.97	22.91	19.73	20.34	1.21	0.76	46.58	30.20	2.86
1100	16.86	22.94	19.69	20.78	1.23	0.76	46.65	30.11	2.89
1150	16.75	22.92	19.65	21.24	1.24	0.77	46.39	30.01	2.93
1200	16.65	22.90	19.63	21.78	1.25	0.77	46.56	30.31	2.95
1250	16.54	22.89	19.64	22.38	1.25	0.78	46.17	29.68	3.01
1300	16.43	22.89	19.68	22.88	1.27	0.79	46.19	30.04	3.05
1350	16.32	22.88	19.75	23.49	1.28	0.79	46.11	29.52	3.09
1400	16.22	22.89	19.80	24.12	1.29	0.80	45.86	29.72	3.12
1450	16.10	22.85	19.92	24.70	1.30	0.80	46.35	29.97	3.17
1500	15.99	22.84	20.04	25.29	1.31	0.81	45.94	29.70	3.21
1550	15.88	22.84	20.19	25.88	1.32	0.81	46.04	29.65	3.25
1600	15.76	22.85	20.35	26.26	1.33	0.82	45.41	29.37	3.29
1650	15.64	22.84	20.60	26.54	1.35	0.82	45.08	28.90	3.34
1700	15.54	22.84	20.79	26.58	1.36	0.82	44.50	28.54	3.36
1750	15.42	22.85	21.08	26.41	1.37	0.83	44.72	28.91	3.41
1800	15.31	22.83	21.36	25.89	1.38	0.83	44.59	28.70	3.42
1850	15.20	22.84	21.58	25.27	1.40	0.83	45.06	29.38	3.48
1900	15.09	22.84	21.73	24.56	1.41	0.84	44.38	28.69	3.48
1950	14.97	22.83	22.01	23.62	1.42	0.84	43.94	28.39	3.51
2000	14.86	22.86	22.33	22.27	1.43	0.84	44.03	28.35	3.54
2100	14.63	22.92	22.47	20.47	1.47	0.85	43.32	27.98	3.60
2200	14.40	22.89	22.31	18.74	1.48	0.86	43.09	27.60	3.71
2300	14.17	22.96	21.86	17.12	1.51	0.86	41.84	26.90	3.78
2400	13.93	23.03	21.11	15.56	1.54	0.86	41.66	26.76	3.87
2500	13.68	23.13	20.09	14.10	1.56	0.87	39.97	25.93	4.02
2600	13.42	23.28	19.03	12.71	1.60	0.87	39.28	25.44	4.15
2700	13.13	23.45	17.81	11.40	1.62	0.86	40.59	25.97	4.30

## 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 = 10.5V, Id = 305.28 mA @ Temperature = -45degC

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)
30	18.19	23.11	22.08	15.43	1.12	0.67	52.07	28.02	2.53
50	18.29	23.18	22.25	15.76	1.12	0.67	52.69	29.94	2.39
100	18.28	23.10	22.13	16.07	1.12	0.67	50.95	29.37	2.49
150	18.25	23.06	22.10	16.23	1.12	0.67	53.63	29.48	2.51
200	18.21	23.06	21.85	16.33	1.12	0.67	50.89	29.62	2.49
250	18.17	23.07	21.96	16.35	1.13	0.67	51.58	29.90	2.50
300	18.13	23.08	21.89	16.41	1.13	0.68	50.16	30.04	2.54
350	18.08	23.06	21.89	16.48	1.13	0.68	50.31	30.02	2.53
400	18.02	23.05	21.76	16.59	1.14	0.68	49.51	29.91	2.53
450	17.97	23.02	21.53	16.80	1.14	0.69	48.58	29.91	2.55
500	17.90	23.02	21.31	17.01	1.14	0.69	48.84	29.85	2.57
550	17.83	23.04	21.04	17.23	1.15	0.70	48.19	30.13	2.61
600	17.77	23.04	20.87	17.48	1.16	0.71	48.12	30.02	2.63
650	17.69	22.97	20.65	17.72	1.16	0.71	47.42	30.02	2.63
700	17.60	22.98	20.57	17.95	1.16	0.71	47.25	29.95	2.65
750	17.52	22.96	20.36	18.23	1.17	0.72	46.87	29.82	2.70
800	17.43	22.98	20.18	18.56	1.18	0.73	46.71	29.85	2.70
850	17.34	23.00	20.07	18.87	1.19	0.74	46.56	30.04	2.72
900	17.24	22.94	19.87	19.26	1.19	0.74	46.46	30.04	2.75
950	17.14	22.96	19.84	19.65	1.20	0.75	45.90	29.64	2.77
1000	17.05	22.91	19.72	20.08	1.21	0.75	46.24	30.01	2.79
1050	16.94	22.91	19.65	20.45	1.22	0.76	45.87	29.76	2.81
1100	16.84	22.92	19.59	20.89	1.23	0.76	45.82	29.76	2.84
1150	16.73	22.90	19.60	21.37	1.24	0.77	45.46	29.66	2.90
1200	16.62	22.90	19.54	21.90	1.25	0.78	45.61	29.87	2.90
1250	16.51	22.88	19.53	22.48	1.26	0.78	45.16	29.35	2.97
1300	16.40	22.88	19.58	23.02	1.27	0.79	45.30	29.70	3.00
1350	16.29	22.88	19.65	23.62	1.28	0.79	44.95	29.20	3.04
1400	16.18	22.85	19.73	24.22	1.29	0.80	44.92	29.39	3.08
1450	16.07	22.84	19.82	24.72	1.30	0.80	45.26	29.61	3.12
1500	15.95	22.84	20.00	25.22	1.31	0.81	44.80	29.34	3.15
1550	15.84	22.81	20.08	25.80	1.32	0.81	44.88	29.30	3.20
1600	15.72	22.83	20.24	26.10	1.34	0.82	44.25	29.04	3.23
1650	15.60	22.83	20.45	26.25	1.35	0.82	43.84	28.67	3.26
1700	15.50	22.83	20.69	26.24	1.36	0.82	43.23	28.24	3.30
1750	15.38	22.83	20.95	25.93	1.37	0.83	43.54	28.60	3.35
1800	15.27	22.85	21.22	25.36	1.39	0.83	43.30	28.49	3.37
1850	15.15	22.79	21.46	24.75	1.40	0.83	43.91	29.03	3.42
1900	15.04	22.81	21.60	23.98	1.41	0.84	43.11	28.39	3.42
1950	14.92	22.81	21.86	23.13	1.42	0.84	42.72	28.10	3.43
2000	14.80	22.86	22.15	21.76	1.44	0.85	42.80	27.99	3.48
2100	14.57	22.86	22.30	20.03	1.46	0.85	42.15	27.61	3.55
2200	14.34	22.92	22.06	18.35	1.49	0.86	41.72	27.23	3.63
2300	14.10	22.97	21.69	16.78	1.52	0.86	40.47	26.54	3.72
2400	13.86	23.03	20.90	15.29	1.54	0.87	40.30	26.39	3.81
2500	13.61	23.11	19.97	13.85	1.57	0.87	38.46	25.65	3.99
2600	13.34	23.27	18.89	12.52	1.60	0.87	37.80	25.17	4.08
2700	13.05	23.41	17.71	11.24	1.62	0.86	39.19	25.68	4.22

## 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 = 11.5V, Id = 357.91 mA @ Temperature = -45degC

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)
30	18.18	23.10	22.38	15.41	1.12	0.67	52.20	28.73	2.64
50	18.33	23.18	22.80	15.50	1.12	0.66	53.46	30.75	2.48
100	18.32	23.14	22.52	15.87	1.12	0.66	52.47	30.15	2.55
150	18.29	23.12	22.50	15.98	1.12	0.66	52.34	30.17	2.59
200	18.25	23.10	22.22	16.11	1.12	0.67	51.72	30.41	2.56
250	18.21	23.10	22.36	16.13	1.12	0.67	51.63	30.70	2.57
300	18.18	23.08	22.32	16.17	1.13	0.67	51.36	30.88	2.61
350	18.12	23.08	22.23	16.25	1.13	0.68	50.57	30.81	2.61
400	18.07	23.05	22.18	16.34	1.13	0.68	50.37	30.70	2.60
450	18.02	23.07	21.89	16.57	1.14	0.68	49.75	30.69	2.63
500	17.95	23.06	21.69	16.74	1.14	0.69	49.34	30.63	2.65
550	17.88	23.06	21.42	16.99	1.15	0.70	48.98	30.93	2.68
600	17.82	23.04	21.23	17.20	1.15	0.70	48.99	30.81	2.70
650	17.74	23.02	21.01	17.42	1.16	0.70	48.35	30.80	2.72
700	17.66	23.02	20.88	17.67	1.16	0.71	48.20	30.73	2.74
750	17.58	23.03	20.68	17.95	1.17	0.72	47.83	30.57	2.74
800	17.49	22.98	20.49	18.25	1.17	0.72	47.59	30.52	2.77
850	17.40	22.99	20.41	18.54	1.18	0.73	47.72	30.81	2.81
900	17.31	22.98	20.15	18.93	1.19	0.74	47.42	30.71	2.83
950	17.21	22.98	20.13	19.28	1.20	0.74	47.01	30.29	2.85
1000	17.12	22.97	20.00	19.71	1.21	0.75	47.46	30.69	2.88
1050	17.01	22.96	19.90	20.07	1.21	0.75	47.12	30.51	2.89
1100	16.91	22.94	19.89	20.50	1.22	0.76	47.03	30.42	2.94
1150	16.80	22.92	19.84	21.02	1.23	0.77	46.96	30.32	2.97
1200	16.70	22.92	19.82	21.50	1.24	0.77	47.14	30.63	3.00
1250	16.59	22.89	19.80	22.12	1.25	0.78	46.80	29.89	3.06
1300	16.49	22.88	19.87	22.60	1.26	0.78	47.01	30.34	3.09
1350	16.37	22.89	19.91	23.26	1.27	0.79	46.70	29.72	3.13
1400	16.27	22.90	19.97	23.91	1.28	0.79	47.05	30.03	3.18
1450	16.16	22.87	20.06	24.52	1.29	0.80	47.17	30.29	3.21
1500	16.04	22.86	20.18	25.19	1.31	0.80	46.87	30.02	3.25
1550	15.94	22.85	20.32	25.87	1.32	0.81	47.04	29.96	3.29
1600	15.82	22.86	20.48	26.41	1.33	0.81	46.49	29.59	3.32
1650	15.71	22.84	20.72	26.79	1.34	0.82	46.09	29.19	3.38
1700	15.60	22.85	20.93	27.02	1.35	0.82	45.59	28.74	3.39
1750	15.49	22.86	21.19	26.97	1.37	0.83	45.88	29.11	3.45
1800	15.38	22.85	21.45	26.65	1.38	0.83	45.70	28.91	3.46
1850	15.27	22.82	21.73	26.02	1.39	0.83	46.12	29.70	3.53
1900	15.16	22.82	21.87	25.31	1.40	0.84	45.44	28.90	3.52
1950	15.05	22.88	22.14	24.37	1.42	0.84	45.04	28.60	3.55
2000	14.91	22.86	22.42	22.73	1.43	0.84	45.23	28.56	3.60
2100	14.68	22.86	22.61	20.91	1.45	0.85	44.35	28.19	3.67
2200	14.45	22.93	22.39	19.06	1.48	0.86	44.23	27.81	3.75
2300	14.22	22.96	21.97	17.38	1.51	0.86	42.93	27.12	3.84
2400	13.99	23.04	21.19	15.79	1.54	0.86	42.79	26.98	3.93
2500	13.74	23.14	20.20	14.27	1.56	0.87	41.19	26.14	4.09
2600	13.47	23.28	19.10	12.86	1.59	0.87	40.56	25.66	4.20
2700	13.20	23.43	17.92	11.52	1.62	0.86	41.68	26.28	4.36

## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 11V, Id = 350.92mA @ Temperature = +85degC

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)
30	18.30	23.23	22.25	15.26	1.13	0.67	48.57	28.35	3.50
50	18.15	23.03	22.97	15.59	1.12	0.67	48.67	30.10	3.37
100	18.13	23.06	23.07	15.85	1.13	0.67	48.04	29.54	3.47
150	18.10	23.04	23.27	15.89	1.13	0.67	47.71	29.64	3.50
200	18.07	23.05	22.93	16.02	1.13	0.67	47.64	29.81	3.49
250	18.03	23.04	22.89	16.14	1.13	0.68	47.70	30.02	3.53
300	17.99	23.02	22.53	16.30	1.14	0.68	47.24	30.15	3.56
350	17.93	23.03	22.27	16.53	1.14	0.69	46.87	30.08	3.58
400	17.88	23.03	22.02	16.70	1.15	0.69	46.67	30.01	3.55
450	17.82	22.98	21.67	16.98	1.15	0.69	46.29	30.01	3.60
500	17.75	23.01	21.44	17.18	1.16	0.70	46.08	29.99	3.62
550	17.68	22.98	21.08	17.48	1.16	0.71	45.89	30.21	3.63
600	17.61	22.97	20.82	17.78	1.16	0.71	45.73	30.14	3.68
650	17.52	22.96	20.49	18.14	1.17	0.72	45.32	30.13	3.73
700	17.44	22.98	20.24	18.50	1.18	0.73	45.08	30.16	3.73
750	17.35	22.95	20.02	18.89	1.18	0.73	44.82	30.04	3.74
800	17.26	22.93	19.74	19.33	1.19	0.74	44.63	30.00	3.76
850	17.16	22.96	19.61	19.73	1.20	0.74	44.62	30.20	3.86
900	17.07	22.93	19.31	20.25	1.21	0.75	44.57	30.15	3.88
950	16.96	22.94	19.21	20.76	1.22	0.76	44.08	29.96	3.90
1000	16.86	22.90	19.03	21.38	1.23	0.76	44.48	30.11	3.94
1050	16.75	22.91	18.88	22.00	1.24	0.77	43.95	29.94	3.98
1100	16.64	22.91	18.82	22.63	1.25	0.78	43.98	29.84	4.01
1150	16.53	22.90	18.81	23.36	1.26	0.78	43.66	29.72	4.08
1200	16.42	22.88	18.76	24.14	1.27	0.79	43.79	29.87	4.12
1250	16.30	22.91	18.74	25.14	1.28	0.80	43.38	29.40	4.13
1300	16.19	22.91	18.78	26.07	1.29	0.80	43.53	29.70	4.22
1350	16.07	22.91	18.78	27.41	1.31	0.81	43.23	29.22	4.26
1400	15.96	22.91	18.81	28.85	1.32	0.81	43.30	29.36	4.36
1450	15.84	22.88	18.91	30.76	1.33	0.82	43.52	29.48	4.39
1500	15.72	22.91	18.98	33.18	1.35	0.82	43.20	29.17	4.41
1550	15.60	22.92	19.12	36.50	1.36	0.83	43.14	29.24	4.50
1600	15.47	22.92	19.22	41.72	1.38	0.83	42.69	28.75	4.50
1650	15.35	22.95	19.36	44.32	1.39	0.84	42.32	28.49	4.58
1700	15.24	22.93	19.48	38.08	1.40	0.84	41.80	28.03	4.61
1750	15.12	22.95	19.63	33.49	1.42	0.85	42.07	28.27	4.67
1800	14.99	22.95	19.77	30.42	1.43	0.85	41.85	28.15	4.70
1850	14.87	22.98	19.88	27.94	1.45	0.85	42.48	28.64	4.77
1900	14.75	22.99	19.87	25.91	1.47	0.86	41.68	28.00	4.78
1950	14.62	23.01	19.96	24.17	1.48	0.86	41.39	27.69	4.84
2000	14.48	23.03	19.98	22.48	1.50	0.87	41.44	27.65	4.91
2100	14.22	23.14	19.79	19.84	1.54	0.88	40.99	27.25	4.97
2200	13.95	23.18	19.33	17.64	1.57	0.88	40.43	26.91	5.11
2300	13.68	23.29	18.67	15.73	1.61	0.88	39.45	26.27	5.19
2400	13.39	23.42	17.83	14.01	1.64	0.89	39.13	26.08	5.33
2500	13.07	23.57	16.89	12.45	1.68	0.88	37.85	25.32	5.50
2600	12.75	23.78	15.89	11.03	1.72	0.88	37.38	24.84	5.65
2700	12.38	24.00	14.83	9.73	1.75	0.87	37.93	25.33	5.85

## 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 = 10.5V, Id = 327.21 mA @ Temperature = +85degC

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)
30	18.28	23.13	22.07	15.29	1.12	0.67	48.76	27.94	3.40
50	18.14	23.13	22.94	15.64	1.13	0.67	48.87	29.63	3.29
100	18.13	23.03	22.91	15.89	1.13	0.67	48.29	29.17	3.40
150	18.10	23.03	23.09	15.93	1.13	0.67	47.85	29.26	3.44
200	18.06	23.03	22.78	16.05	1.13	0.67	47.67	29.36	3.42
250	18.02	23.05	22.70	16.17	1.14	0.68	47.76	29.57	3.44
300	17.98	23.03	22.34	16.34	1.14	0.68	47.07	29.69	3.48
350	17.92	23.00	22.04	16.56	1.14	0.69	46.95	29.63	3.47
400	17.87	23.01	21.86	16.74	1.14	0.69	46.38	29.57	3.46
450	17.81	22.97	21.52	17.02	1.15	0.69	46.20	29.57	3.50
500	17.74	22.99	21.27	17.23	1.15	0.70	45.81	29.54	3.54
550	17.67	22.97	20.96	17.52	1.16	0.71	45.85	29.76	3.59
600	17.59	22.97	20.69	17.84	1.17	0.71	45.41	29.69	3.59
650	17.51	22.96	20.36	18.22	1.17	0.72	45.21	29.74	3.62
700	17.42	22.97	20.13	18.58	1.18	0.73	44.84	29.71	3.64
750	17.34	22.96	19.89	18.98	1.19	0.73	44.55	29.65	3.71
800	17.24	22.96	19.61	19.44	1.19	0.74	44.29	29.62	3.71
850	17.14	22.94	19.50	19.82	1.20	0.75	44.24	29.75	3.73
900	17.04	22.91	19.22	20.38	1.21	0.75	44.12	29.69	3.79
950	16.94	22.90	19.09	20.92	1.22	0.76	43.58	29.50	3.81
1000	16.83	22.90	18.93	21.55	1.23	0.76	44.04	29.72	3.84
1050	16.72	22.91	18.81	22.13	1.24	0.77	43.45	29.56	3.88
1100	16.61	22.90	18.75	22.81	1.25	0.78	43.52	29.46	3.92
1150	16.50	22.86	18.71	23.61	1.26	0.78	43.09	29.27	3.98
1200	16.39	22.89	18.70	24.38	1.27	0.79	43.34	29.42	4.02
1250	16.27	22.90	18.64	25.42	1.28	0.80	42.78	29.03	4.08
1300	16.15	22.89	18.70	26.38	1.30	0.80	42.92	29.25	4.12
1350	16.03	22.88	18.74	27.76	1.31	0.81	42.71	28.85	4.17
1400	15.92	22.90	18.75	29.29	1.32	0.81	42.57	28.91	4.22
1450	15.80	22.91	18.84	31.14	1.34	0.82	42.93	29.10	4.26
1500	15.67	22.89	18.94	33.41	1.35	0.82	42.53	28.72	4.30
1550	15.55	22.90	19.05	36.18	1.36	0.83	42.40	28.78	4.36
1600	15.43	22.92	19.15	38.72	1.38	0.84	41.97	28.38	4.43
1650	15.31	22.92	19.32	38.19	1.39	0.84	41.53	28.04	4.45
1700	15.19	22.93	19.44	34.90	1.41	0.84	40.96	27.68	4.50
1750	15.06	22.93	19.59	31.72	1.42	0.85	41.30	27.91	4.54
1800	14.94	22.91	19.70	29.25	1.44	0.85	41.03	27.78	4.60
1850	14.82	22.95	19.85	27.07	1.45	0.86	41.73	28.19	4.65
1900	14.69	22.98	19.84	25.20	1.47	0.86	40.84	27.64	4.68
1950	14.57	22.94	19.92	23.64	1.48	0.86	40.55	27.33	4.71
2000	14.41	22.99	19.96	21.87	1.50	0.87	40.66	27.28	4.75
2100	14.15	23.10	19.77	19.46	1.54	0.88	40.00	26.87	4.86
2200	13.88	23.13	19.27	17.36	1.57	0.88	39.57	26.53	4.96
2300	13.60	23.26	18.63	15.54	1.61	0.88	38.49	25.89	5.09
2400	13.31	23.39	17.80	13.88	1.65	0.89	38.30	25.69	5.19
2500	12.99	23.52	16.87	12.36	1.68	0.89	36.81	24.94	5.33
2600	12.66	23.73	15.87	10.98	1.72	0.88	36.26	24.46	5.53
2700	12.30	23.99	14.81	9.70	1.76	0.87	37.29	24.94	5.70

## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

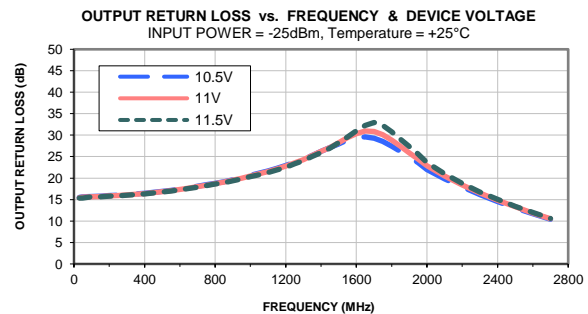
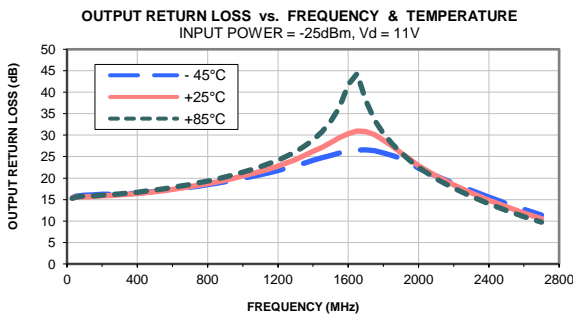
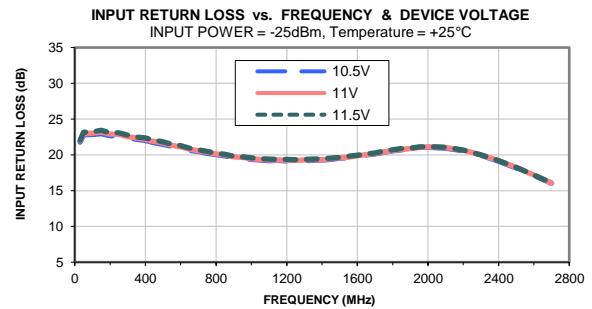
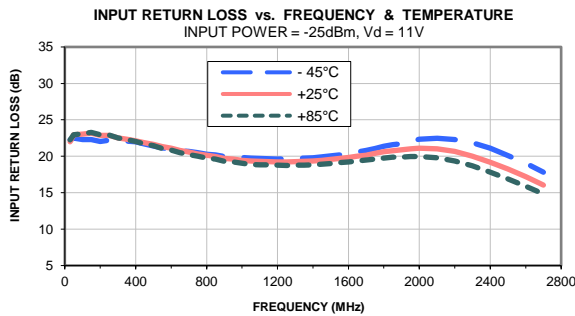
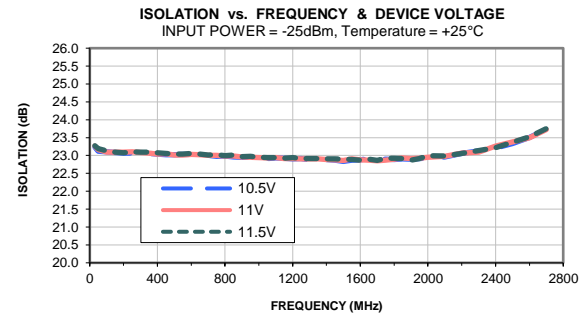
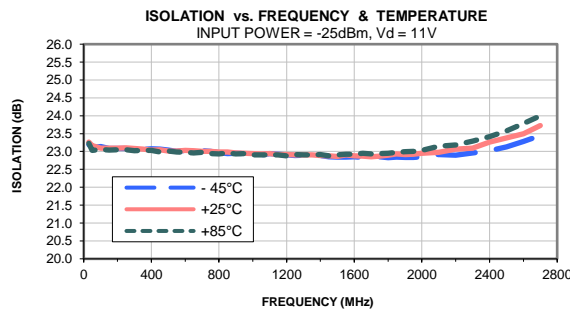
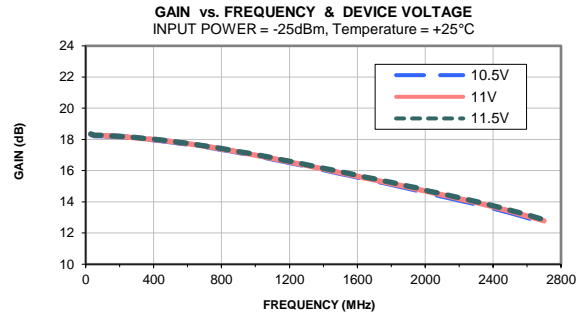
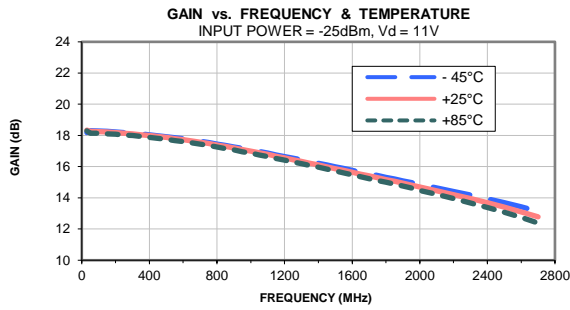
Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

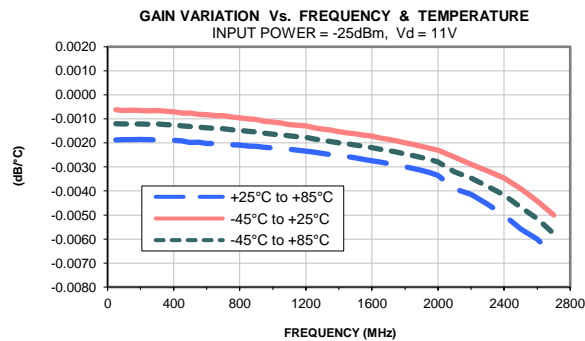
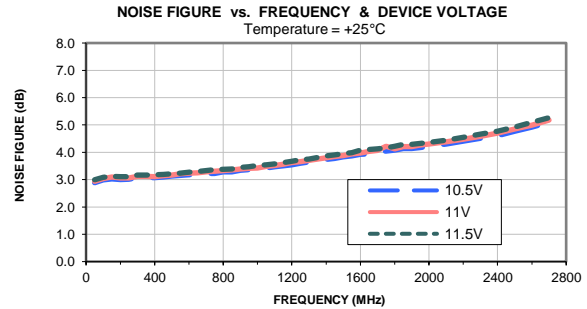
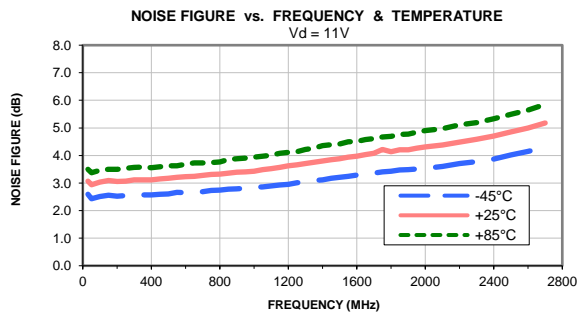
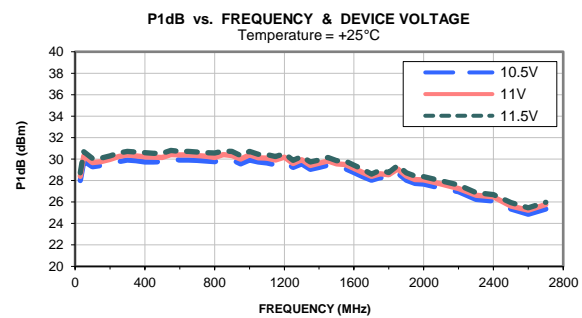
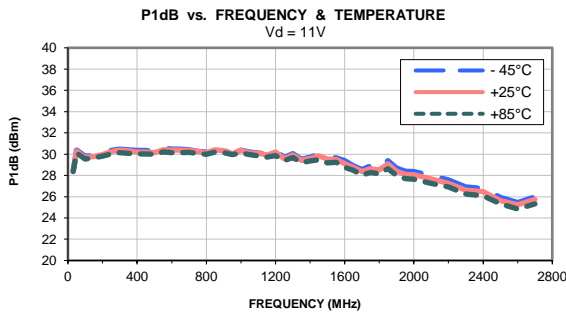
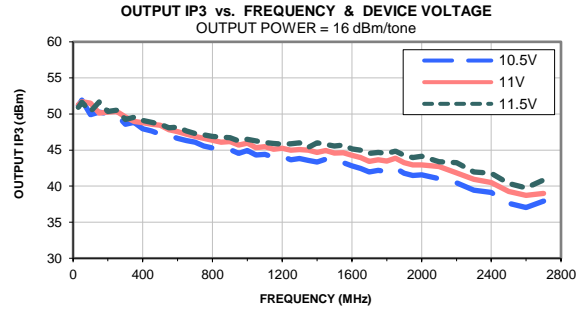
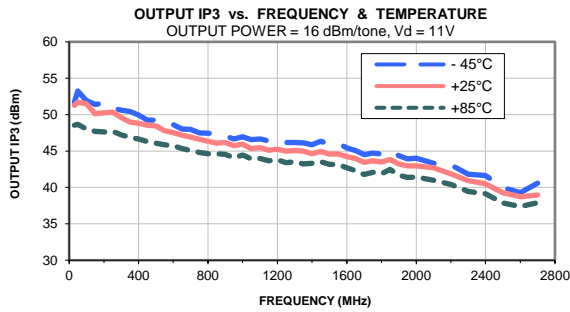
TEST CONDITIONS: Vd = 11.5V, Id = 371.66 mA @ Temperature = +85degC

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)
30	18.30	23.20	22.39	15.21	1.12	0.67	48.11	28.66	3.61
50	18.14	23.04	23.14	15.72	1.12	0.67	47.81	30.46	3.49
100	18.13	23.05	23.22	15.87	1.13	0.67	47.30	29.92	3.59
150	18.10	23.03	23.41	15.91	1.13	0.67	47.41	29.95	3.62
200	18.07	23.03	23.10	16.03	1.13	0.67	47.04	30.14	3.60
250	18.03	23.04	23.04	16.15	1.14	0.68	47.17	30.39	3.62
300	17.99	23.06	22.67	16.32	1.14	0.68	46.57	30.51	3.67
350	17.93	23.03	22.36	16.53	1.14	0.69	46.71	30.44	3.68
400	17.88	23.00	22.15	16.69	1.14	0.69	46.30	30.34	3.68
450	17.82	22.99	21.77	16.98	1.15	0.69	45.97	30.34	3.71
500	17.76	22.98	21.55	17.17	1.15	0.70	45.89	30.31	3.74
550	17.68	23.00	21.19	17.46	1.16	0.71	45.79	30.54	3.79
600	17.62	22.99	20.92	17.76	1.17	0.71	45.54	30.47	3.81
650	17.53	22.96	20.59	18.12	1.17	0.72	45.39	30.52	3.82
700	17.45	22.98	20.33	18.44	1.18	0.72	45.13	30.48	3.85
750	17.37	22.93	20.09	18.85	1.18	0.73	44.73	30.43	3.85
800	17.27	22.93	19.84	19.27	1.19	0.74	44.66	30.39	3.92
850	17.18	22.98	19.66	19.66	1.20	0.74	44.49	30.53	3.93
900	17.08	22.96	19.39	20.22	1.21	0.75	44.51	30.47	3.99
950	16.98	22.94	19.26	20.71	1.22	0.76	44.05	30.28	4.01
1000	16.88	22.94	19.05	21.31	1.23	0.76	44.51	30.50	4.06
1050	16.78	22.96	18.93	21.88	1.24	0.77	44.00	30.26	4.10
1100	16.67	22.95	18.88	22.51	1.25	0.78	44.10	30.15	4.13
1150	16.55	22.92	18.81	23.25	1.26	0.78	43.73	30.03	4.20
1200	16.45	22.90	18.80	23.95	1.27	0.79	43.88	30.18	4.23
1250	16.33	22.94	18.75	24.92	1.28	0.79	43.58	29.70	4.30
1300	16.22	22.90	18.79	25.83	1.29	0.80	43.66	30.01	4.34
1350	16.10	22.91	18.80	27.11	1.30	0.80	43.55	29.52	4.40
1400	16.00	22.92	18.83	28.55	1.32	0.81	43.36	29.67	4.46
1450	15.87	22.93	18.89	30.26	1.33	0.82	43.76	29.79	4.49
1500	15.75	22.94	18.99	32.66	1.35	0.82	43.40	29.40	4.54
1550	15.64	22.91	19.10	35.63	1.36	0.82	43.31	29.48	4.60
1600	15.51	22.93	19.21	41.76	1.37	0.83	42.96	29.04	4.63
1650	15.39	22.92	19.36	56.57	1.39	0.83	42.60	28.71	4.71
1700	15.28	22.94	19.47	40.90	1.40	0.84	42.14	28.33	4.74
1750	15.16	22.95	19.62	34.99	1.42	0.84	42.40	28.57	4.83
1800	15.04	22.98	19.75	31.46	1.43	0.85	42.23	28.37	4.82
1850	14.92	22.98	19.84	28.56	1.45	0.85	42.79	28.87	4.89
1900	14.80	23.00	19.86	26.35	1.46	0.86	42.08	28.30	4.93
1950	14.68	23.07	19.95	24.59	1.49	0.86	41.79	27.91	4.97
2000	14.52	23.04	20.00	22.83	1.50	0.87	41.95	27.95	5.01
2100	14.26	23.14	19.81	20.07	1.54	0.87	41.46	27.55	5.12
2200	14.00	23.20	19.32	17.83	1.57	0.88	40.82	27.13	5.22
2300	13.73	23.32	18.64	15.83	1.61	0.88	39.95	26.49	5.37
2400	13.44	23.42	17.81	14.07	1.64	0.88	39.57	26.31	5.48
2500	13.13	23.58	16.87	12.48	1.67	0.88	38.47	25.55	5.65
2600	12.80	23.80	15.85	11.05	1.71	0.88	38.01	25.07	5.81
2700	12.44	24.04	14.80	9.73	1.74	0.87	38.30	25.57	6.01

## Typical Performance Curves

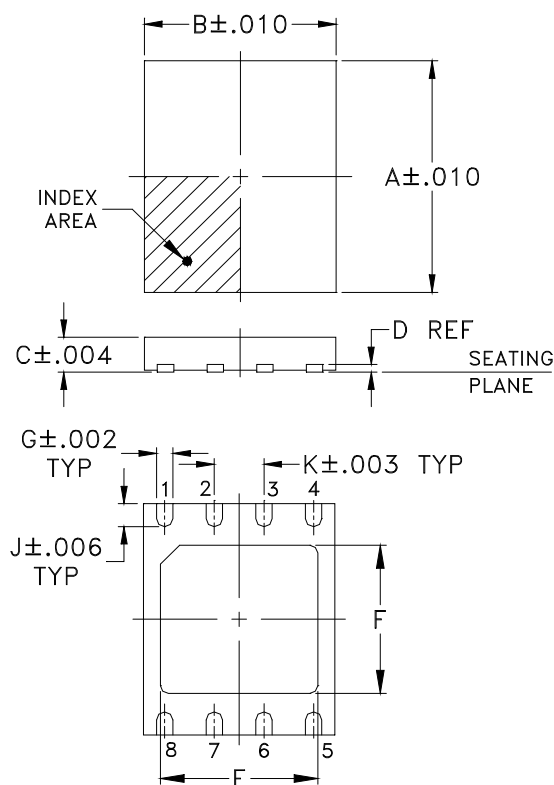


## Typical Performance Curves

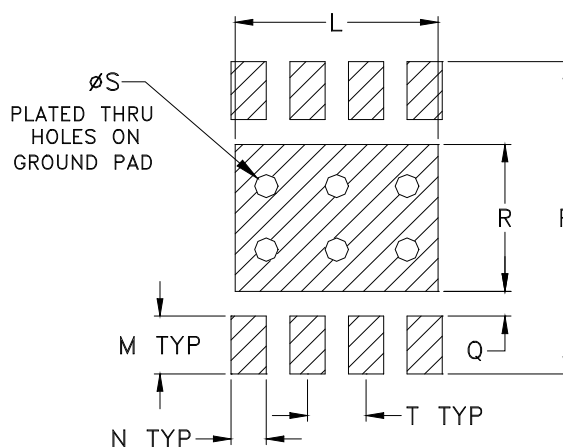




### Outline Dimensions



### PCB Land Pattern



Suggested Layout,  
Tolerance to be within  $\pm .002$

CASE #	A	B	C	D	E	F	G	H	J	K	L	M	N
DL1636	.236 (6.00)	.193 (4.90)	.035 (0.90)	.008 (0.20)	.160 (4.05)	.153 (3.89)	.017 (0.42)	-- --	.024 (0.60)	.050 (1.27)	.162 (4.11)	.040 (1.02)	.020 (0.51)

CASE #	P	Q	R	S	T	WT. GRAM
DL1636	.257 (6.53)	.011 (0.28)	.155 (3.94)	.020 (0.51)	.050 (1.27)	.08

Dimensions are in inches (mm). Tolerances: 3Pl.  $\pm .004$ , unless otherwise specified.

#### Notes:

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



P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site

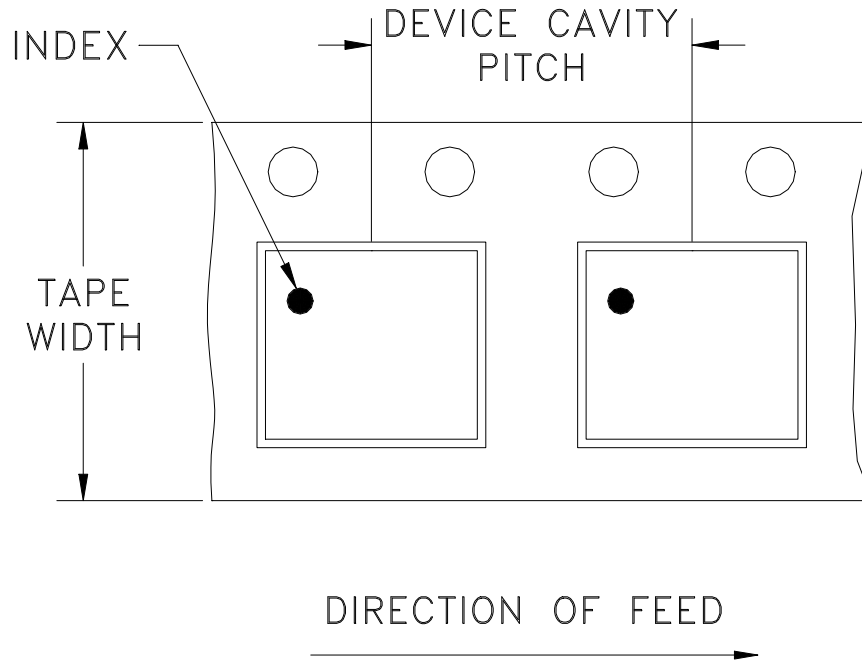


The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: [www.minicircuits.com](http://www.minicircuits.com)

RF/IF MICROWAVE COMPONENTS

# Tape & Reel Packaging TR-F68

## DEVICE ORIENTATION IN T&R



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note	
12	8	7	Small quantity standard	20
				50
				100
				200
				500
		7	Standard	1000
		13	Standard	2000
				3000
4000				

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](http://www.minicircuits.com/pages/pdfs/tape.pdf)

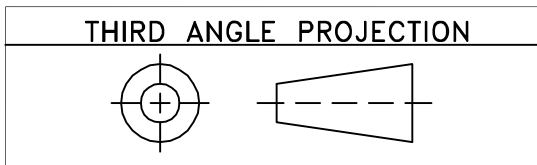


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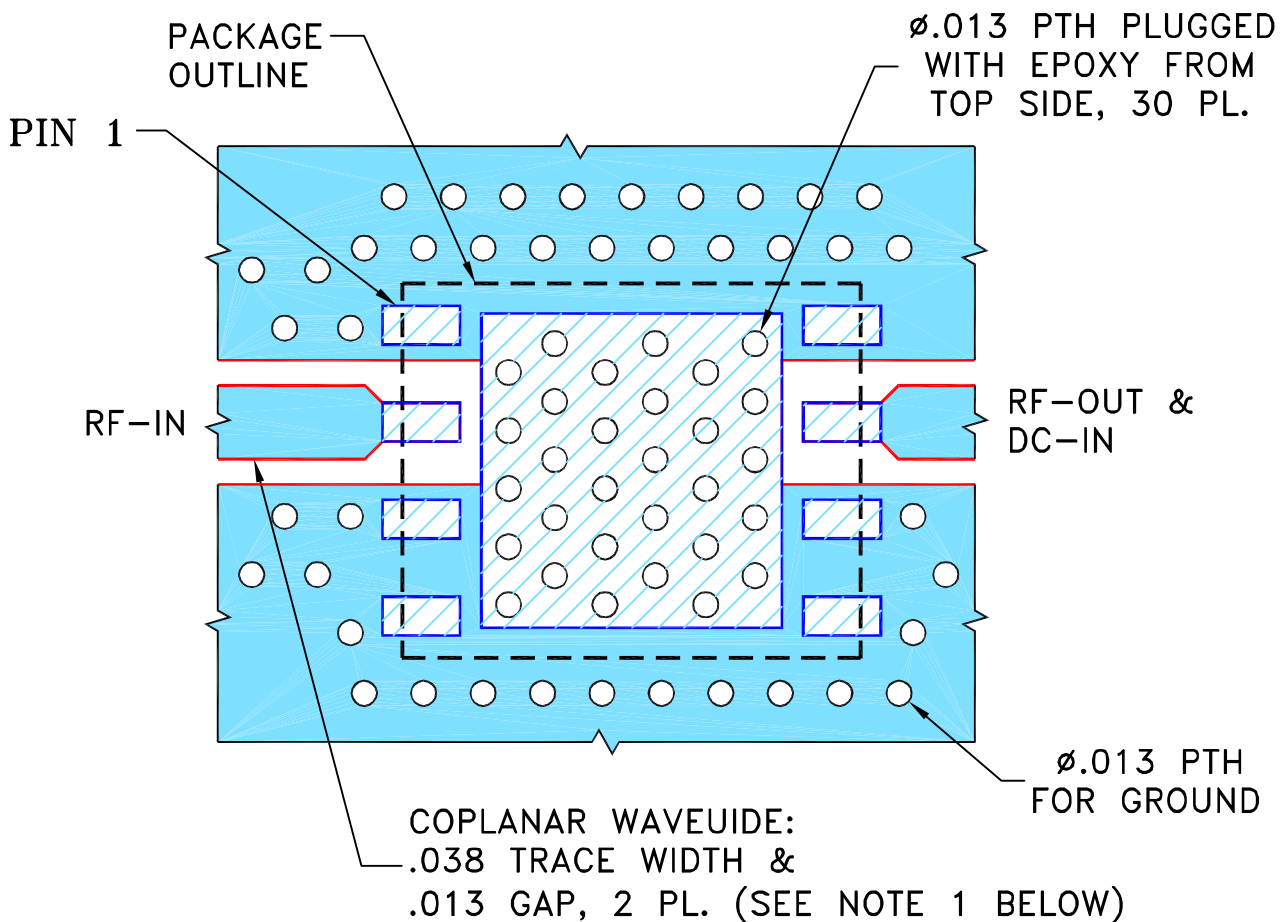
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REVISIONS					
REV OR	ECN No.	DESCRIPTION	DATE	DR	AUTH
	M163284	NEW RELEASE	08/11/17	CA	RS

SUGGESTED MOUNTING CONFIGURATION FOR DL1636 CASE STYLE, "08AM09" PIN CONNECTION



**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 AND GAP MAY NEED TO BE MODIFIED.
2. 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 CA	08/09/17
TOLERANCES ON:	CHECKED ITG	08/11/17
2 PL DECIMALS ±	APPROVED RS	08/11/17
3 PL DECIMALS ± .005		
ANGLES ±		
FRACTIONS ±		

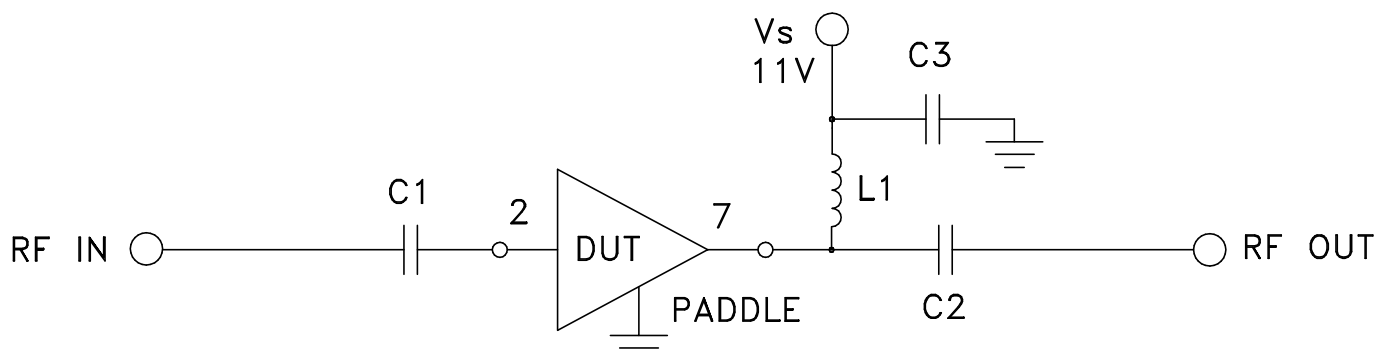
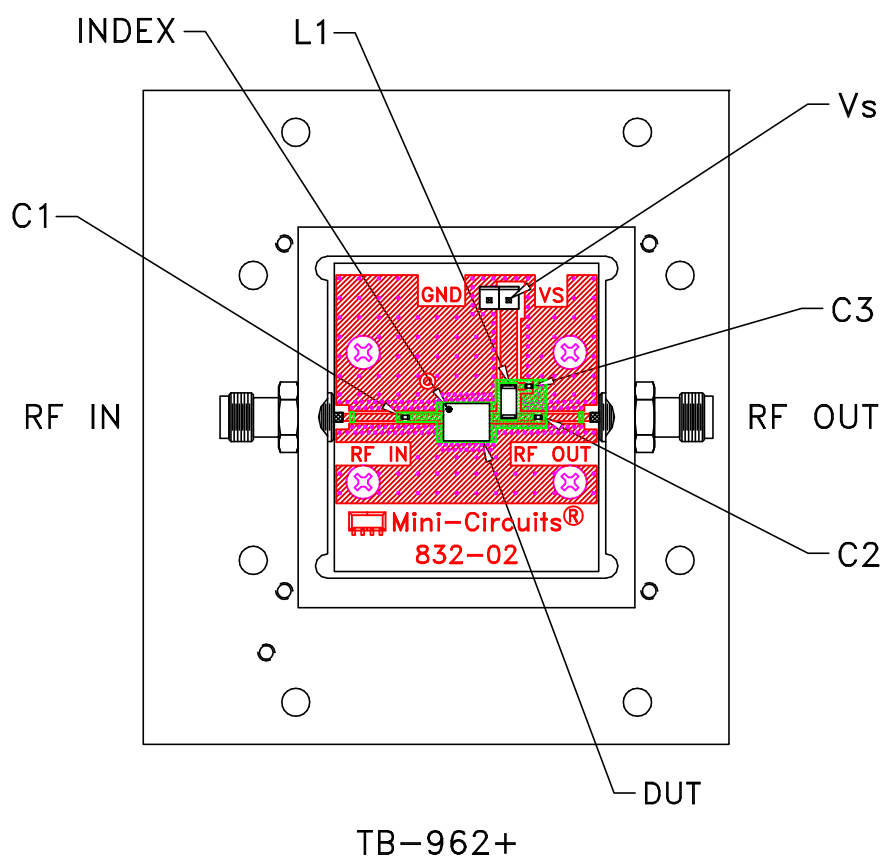
**Mini-Circuits®** 13 Neptune Avenue  
Brooklyn NY 11235

PL, 08AM09, DL1636, TB-962+

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SIZE A	CODE IDENT 15542	DRAWING NO: 98-PL-522	REV: OR
FILE: 98PL522	SCALE: 10:1	SHEET: 1 OF 1	

# Evaluation Board and Circuit



PINS 1,3-6 & 8 ARE NOT CONNECTED.

## Schematic Diagram

COMPONENT	VALUE	SIZE
DUT	PHA-202+	.236X.193"
C1,C2,C3	0.01uF	0.04X0.02"
L1	5.6 uH	0.17X.0.078"

### NOTES:

1. PCB material: Roger R04350B or equivalent, Dielectric constant=3.5, Thickness=.020inch
2. 50 ohm Female SMA connectors.



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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
Operating Temperature	-40° to 85°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, 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-020, 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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Specification	Test/Inspection Condition	Reference/Spec
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monoethanolamine at 63°C to 70°C