



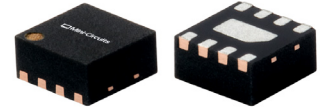
LOW NOISE, WIDEBAND, LOW CURRENT

# Monolithic Amplifier PMA2-123LN5+

50Ω 0.5 to 12 GHz

## THE BIG DEAL

- Ultra wideband, 0.5 to 12 GHz
- Excellent noise figure, 1.8 dB at 12GHz
- Low Current, 30mA
- Usable up to 18 GHz



Generic photo used for illustration purposes only

CASE STYLE: MC1631-1

### +RoHS Compliant

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

## APPLICATIONS

- WiFi / LTE
- Satellite Communications
- Military and Commercial Radar applications
- Point-to-Point Radio applications

## PRODUCT OVERVIEW

The PMA2-123LN5+ is a E-PHEMT based wideband, low noise MMIC amplifier with a unique combination of low noise, high IP3, and low current making it ideal for sensitive, high-dynamic-range receiver applications. This design operates on a single +5V supply, is well matched for 50Ω and comes in a tiny, low profile package (2 x 2 mm, 8 lead MCLP), accommodating dense circuit board layouts.

## KEY FEATURES

Feature	Advantages
Excellent Noise Figure up to 18 GHz <ul style="list-style-type: none"> <li>• 1.8 dB typ. at 12 GHz</li> <li>• 2.4 dB typ. at 18 GHz</li> </ul>	Industry leading combination of low noise and wideband frequency enables lower system noise figure performance.
High IP3 <ul style="list-style-type: none"> <li>• +24 dBm at 0.5 GHz</li> <li>• +24.1 dBm at 12 GHz</li> </ul>	Combination of low noise figure and high IP3 makes this MMIC amplifier ideal for use in low noise receiver front end (RFE) as it gives the user advantages of sensitivity and two-tone IM performance at both ends of the dynamic range.
Low operating voltage & current +5V & 30mA	Low voltage & current consumption is ideal for use in amplifier chain.
2 x 2mm 8-lead MCLP package	Tiny footprint saves space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB.

REV B  
ECO-023615  
PMA2-123LN5+  
MCLNY  
241127





LOW NOISE, WIDEBAND, LOW CURRENT

# Monolithic Amplifier PMA2-123LN5+

50Ω 0.5 to 12 GHz

## ELECTRICAL SPECIFICATIONS<sup>1</sup> AT 25°C, V<sub>DD</sub>= +5V UNLESS NOTED OTHERWISE

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		0.5		12	GHz
Noise Figure	0.5		1.4		dB
	5		1.2		
	10		1.6		
	12		1.8		
	18		2.4		
Gain	0.5	16.0	17.7	19.5	dB
	5	—	15.1	—	
	10	9.7	11.6	13.4	
	12	9.0	10.7	12.5	
	18	—	7.6	—	
Reverse Isolation	10	—	24.4	—	dB
Input Return Loss	0.5		6		dB
	5		10		
	10		10		
	12		10		
	18		7		
Output Return Loss	0.5		12		dB
	5		17		
	10		12		
	12		11		
	18		6		
Output Power at 1dB Compression	0.5		+12.3		dBm
	5		+12.2		
	10		+11.6		
	12		+11.5		
	18		+9.6		
Output IP3	0.5		+24.0		dBm
	5		+23.4		
	10		+23.5		
	12		+24.1		
	18		+21.6		
Device Operating Voltage (V <sub>DD</sub> )			+5		V
Device Operating Current (I <sub>DD</sub> )		—	30	47	mA
Device Current Variation vs. Temperature <sup>2</sup>			7.69		μA/°C
Device Current Variation vs. Voltage			0.008		mA/mV
Thermal Resistance, junction-to-case			69.8		°C/W

1. Measured on Mini-Circuits Characterization Test Board TB-PMA2-123LN5+. See Characterization Test Circuit (Fig. 1) and de-embedded to the device reference plane.

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

## ABSOLUTE MAXIMUM RATINGS<sup>3</sup>

Parameter	Ratings
Operating Temperature (ground lead)	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Junction Temperature	150 °C
Total Power Dissipation	0.65 W
Input Power (CW), V <sub>d</sub> =+5V	+24 dBm (5 minutes max.) +7 dBm (continuous)
DC Voltage	+7 V

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



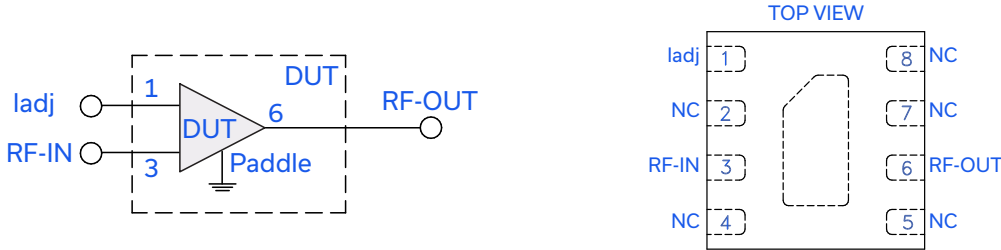


LOW NOISE, WIDEBAND, LOW CURRENT

# Monolithic Amplifier PMA2-123LN5+

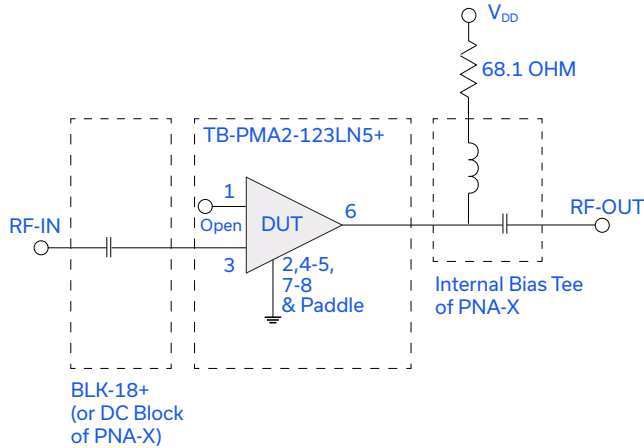
50Ω 0.5 to 12 GHz

## SIMPLIFIED SCHEMATIC & PAD DESCRIPTION



Function	Pad Number	Description (See Figure 1)
RF-IN	3	Connects to RF input via a blocking capacitor.
RF-OUT & DC-IN	6	Connects to RF out and $V_{DD}$ via Bias-Tee & 68.1 Ohm resistor
Ground	Paddle	Connects to ground
No Connection	2,4,5,7,8	Not used internally. Connected to ground on Test Board.
ladj	1	Current adjust pad. Open on test board.

## CHARACTERIZATION TEST CIRCUIT



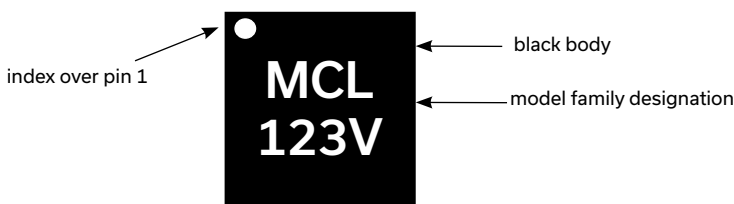
**Fig 1. Characterization Circuit**

Note: This block diagram is used for characterization. (DUT soldered on Mini-Circuits Characterization test board TB-PMA2-123LN5+) 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, -5dBm/tone at output.

## PRODUCT MARKING



Marking may contain other features or characters for internal lot control





LOW NOISE, WIDEBAND, LOW CURRENT

# Monolithic Amplifier **PMA2-123LN5+**

50Ω 0.5 to 12 GHz

ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD. TO ACCESS [CLICK HERE](#)

<b>Performance Data</b>	Data Table Swept Graphs S-Parameter (S2P Files) Data Set (.zip file)
<b>Case Style</b>	MC1631-1 Plastic package, exposed paddle, lead finish: Matte-Tin
<b>Tape &amp; Reel</b>	F66
<b>Standard quantities available on reel</b>	7" reels with 20, 50, 100, 200, 500, 1K, 2K or 3K devices
<b>Suggested Layout for PCB Design</b>	PL-626
<b>Evaluation Board</b>	TB-PMA2123LN5E+ (Includes all components for turn-key evaluation across 0.5 to 12 GHz)
<b>Environmental Ratings</b>	ENV08T1

## ESD RATING

Human Body Model (HBM): Class 1A (250 to <500V) in accordance with ANSI/ESD STM 5.1 - 2001

### 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-Circuits' 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](http://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 = 5.00V, Id = 30mA @ 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)			(dBm)	(dBm)	(dB)
200	14.83	28.54	2.47	7.48	1.23	1.13	25.97	12.75	2.65
400	17.27	25.37	4.92	10.80	1.13	0.95	25.51	12.56	1.56
600	17.85	24.56	6.49	13.43	1.12	0.88	24.74	12.49	1.37
800	18.00	24.25	7.43	15.42	1.12	0.85	24.52	12.54	1.25
1000	18.01	24.09	8.03	16.92	1.13	0.84	24.17	12.33	1.14
1200	17.95	23.98	8.41	18.00	1.14	0.83	24.28	12.29	1.18
1400	17.84	23.91	8.66	18.76	1.14	0.84	24.52	12.41	1.21
1600	17.72	23.85	8.86	19.30	1.15	0.84	23.84	12.50	1.20
1800	17.58	23.79	8.98	19.63	1.16	0.84	23.92	12.21	1.16
2000	17.43	23.76	9.05	19.81	1.18	0.85	24.76	12.14	1.12
2200	17.26	23.71	9.11	19.84	1.19	0.85	23.49	12.18	1.14
2400	17.10	23.69	9.15	19.75	1.20	0.86	24.42	12.55	1.11
2600	16.94	23.65	9.18	19.61	1.21	0.86	23.53	12.01	1.21
2800	16.78	23.62	9.22	19.32	1.22	0.87	24.49	12.24	1.19
3000	16.62	23.59	9.26	19.02	1.23	0.87	23.99	12.08	1.09
4000	15.88	23.44	9.71	17.87	1.30	0.88	24.11	12.09	1.22
5000	15.16	23.38	10.47	17.60	1.38	0.89	23.96	12.34	1.21
6000	14.40	23.65	10.32	17.41	1.50	0.93	24.34	12.28	1.29
7000	13.62	23.79	9.62	17.62	1.61	0.97	24.50	12.08	1.42
8000	12.88	23.98	9.07	16.65	1.71	1.00	23.91	12.09	1.51
9000	12.24	24.13	9.18	14.46	1.83	1.00	24.84	12.16	1.53
10000	11.69	24.19	9.86	12.98	1.95	0.97	23.64	11.76	1.61
11000	11.12	24.54	10.88	12.10	2.17	0.95	23.46	11.63	1.91
12000	10.86	24.81	9.91	11.10	2.20	0.96	24.33	11.57	1.70
13000	10.36	24.90	9.21	10.59	2.28	0.97	24.24	11.27	1.73
14000	9.85	25.13	8.50	10.51	2.40	0.99	23.79	11.02	1.93
15000	9.34	25.45	7.99	10.27	2.56	1.01	23.82	11.11	2.18
16000	8.74	25.97	7.79	9.00	2.77	0.99	23.18	10.29	2.40
17000	8.19	26.67	8.02	7.25	2.99	0.91	22.05	10.05	2.62
18000	7.72	27.09	7.50	6.18	3.07	0.86	21.99	9.78	2.29
19000	7.22	27.79	7.34	5.62	3.35	0.82	22.89	9.41	2.55
20000	6.56	28.87	6.91	5.24	3.86	0.81	21.25	8.93	3.06

## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 4.75V, Id = 28mA @ 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)
200	14.72	28.39	2.48	7.63	1.23	1.14	25.22	12.14	2.66
400	17.14	25.24	4.90	10.98	1.13	0.95	24.17	11.94	1.58
600	17.70	24.49	6.44	13.62	1.12	0.89	23.86	11.86	1.35
800	17.85	24.18	7.35	15.60	1.13	0.86	24.08	11.90	1.29
1000	17.85	24.01	7.91	17.09	1.13	0.85	23.62	11.69	1.16
1200	17.79	23.90	8.28	18.16	1.14	0.84	23.40	11.77	1.18
1400	17.69	23.83	8.52	18.91	1.15	0.84	23.64	11.77	1.21
1600	17.56	23.77	8.71	19.43	1.16	0.85	23.11	11.85	1.20
1800	17.42	23.73	8.82	19.74	1.17	0.85	23.17	11.69	1.17
2000	17.27	23.69	8.90	19.90	1.18	0.86	23.85	11.62	1.12
2200	17.11	23.65	8.95	19.90	1.19	0.86	22.75	11.66	1.13
2400	16.94	23.60	8.99	19.79	1.20	0.86	23.65	11.90	1.12
2600	16.78	23.55	9.02	19.63	1.21	0.87	22.57	11.38	1.23
2800	16.62	23.54	9.05	19.32	1.22	0.87	23.59	11.60	1.24
3000	16.46	23.50	9.09	19.02	1.23	0.88	23.09	11.44	1.11
4000	15.73	23.37	9.54	17.91	1.30	0.89	23.59	11.46	1.25
5000	15.02	23.30	10.29	17.74	1.39	0.90	23.19	11.71	1.19
6000	14.27	23.56	10.16	17.62	1.51	0.93	23.72	11.65	1.33
7000	13.48	23.72	9.48	17.83	1.61	0.98	23.71	11.57	1.43
8000	12.74	23.94	8.93	16.75	1.72	1.01	22.91	11.58	1.53
9000	12.10	24.09	9.02	14.50	1.84	1.00	24.45	11.53	1.57
10000	11.55	24.13	9.69	13.01	1.96	0.98	23.13	11.01	1.64
11000	10.98	24.52	10.69	12.11	2.19	0.96	22.80	10.88	1.91
12000	10.72	24.75	9.73	11.11	2.21	0.97	23.87	10.93	1.79
13000	10.22	24.88	9.05	10.60	2.29	0.98	23.07	10.63	1.78
14000	9.71	25.14	8.36	10.52	2.43	1.00	22.92	10.50	1.96
15000	9.20	25.42	7.86	10.27	2.58	1.02	22.81	10.47	2.21
16000	8.60	25.99	7.67	8.99	2.80	0.99	22.30	9.64	2.48
17000	8.05	26.64	7.92	7.24	3.01	0.91	21.11	9.41	2.64
18000	7.59	27.08	7.42	6.18	3.09	0.86	21.08	9.14	2.27
19000	7.09	27.77	7.28	5.62	3.38	0.83	21.91	8.78	2.58
20000	6.43	28.80	6.86	5.23	3.87	0.81	20.40	8.19	3.01

## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 5.25, Id = 32mA @ 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)			(dBm)	(dBm)	(dB)
200	14.92	28.63	2.46	7.34	1.23	1.12	27.01	13.33	2.65
400	17.39	25.47	4.93	10.63	1.13	0.94	25.69	13.05	1.57
600	17.98	24.68	6.54	13.26	1.12	0.87	25.33	13.00	1.34
800	18.14	24.33	7.51	15.24	1.12	0.84	25.26	13.05	1.24
1000	18.15	24.17	8.13	16.73	1.13	0.83	25.02	12.84	1.15
1200	18.08	24.05	8.52	17.83	1.13	0.83	24.78	12.79	1.15
1400	17.98	23.97	8.78	18.61	1.14	0.83	25.03	12.91	1.19
1600	17.86	23.91	8.99	19.15	1.15	0.83	24.37	13.00	1.19
1800	17.72	23.89	9.12	19.51	1.16	0.83	24.89	12.71	1.16
2000	17.56	23.84	9.20	19.72	1.17	0.84	25.10	12.64	1.09
2200	17.40	23.79	9.26	19.76	1.18	0.84	24.40	12.68	1.12
2400	17.24	23.75	9.30	19.67	1.20	0.85	25.34	13.05	1.10
2600	17.08	23.73	9.33	19.56	1.21	0.85	24.35	12.51	1.20
2800	16.92	23.72	9.36	19.29	1.22	0.86	25.24	12.62	1.20
3000	16.76	23.68	9.41	18.98	1.23	0.86	24.36	12.58	1.10
4000	16.02	23.54	9.88	17.81	1.30	0.87	25.01	12.59	1.22
5000	15.28	23.45	10.64	17.47	1.38	0.88	24.50	12.83	1.18
6000	14.52	23.70	10.45	17.21	1.50	0.92	25.77	12.77	1.29
7000	13.74	23.84	9.74	17.43	1.60	0.96	25.10	12.56	1.42
8000	13.00	24.04	9.20	16.53	1.71	1.00	24.65	12.58	1.48
9000	12.37	24.16	9.33	14.42	1.82	0.99	26.08	12.65	1.55
10000	11.82	24.22	10.03	12.97	1.94	0.97	24.63	12.13	1.61
11000	11.24	24.56	11.06	12.09	2.15	0.95	24.22	12.00	1.90
12000	10.98	24.80	10.07	11.09	2.18	0.96	25.47	12.06	1.76
13000	10.48	24.94	9.35	10.56	2.27	0.97	24.53	11.88	1.73
14000	9.97	25.14	8.62	10.49	2.38	0.99	24.62	11.63	1.93
15000	9.46	25.46	8.11	10.27	2.54	1.01	24.33	11.61	2.17
16000	8.86	25.99	7.88	9.01	2.75	0.98	23.92	10.79	2.43
17000	8.31	26.65	8.10	7.26	2.96	0.91	22.85	10.55	2.53
18000	7.84	27.11	7.57	6.19	3.05	0.86	22.80	10.28	2.28
19000	7.34	27.81	7.40	5.62	3.33	0.82	23.60	9.91	2.51
20000	6.67	28.89	6.95	5.24	3.83	0.81	22.42	9.42	2.97

## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 5.00V, Id = 29mA @ 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)
200	15.09	28.86	2.44	7.17	1.23	1.11	26.27	12.78	2.18
400	17.61	25.59	4.92	10.41	1.12	0.92	24.79	12.54	1.25
600	18.21	24.78	6.59	13.02	1.11	0.85	24.39	12.49	1.08
800	18.39	24.47	7.63	15.00	1.12	0.83	24.55	12.54	0.99
1000	18.41	24.26	8.28	16.48	1.12	0.81	24.07	12.34	0.84
1200	18.35	24.15	8.72	17.56	1.13	0.81	24.07	12.31	0.88
1400	18.26	24.07	9.01	18.40	1.13	0.81	24.30	12.32	0.86
1600	18.14	23.99	9.21	18.98	1.14	0.81	23.79	12.40	0.85
1800	18.00	23.96	9.33	19.33	1.15	0.82	23.76	12.22	0.84
2000	17.85	23.93	9.42	19.56	1.16	0.82	24.33	12.03	0.85
2200	17.70	23.88	9.47	19.60	1.17	0.83	23.51	12.08	0.81
2400	17.54	23.85	9.51	19.49	1.18	0.83	23.79	12.46	0.81
2600	17.38	23.82	9.53	19.30	1.20	0.84	23.16	11.92	0.88
2800	17.23	23.78	9.58	19.03	1.21	0.84	23.84	12.15	0.91
3000	17.08	23.73	9.65	18.71	1.22	0.84	23.54	12.00	0.77
4000	16.36	23.59	10.26	17.72	1.28	0.85	23.91	12.04	0.84
5000	15.64	23.50	10.97	17.37	1.36	0.87	23.83	12.29	0.80
6000	14.91	23.71	10.81	16.84	1.46	0.90	24.32	12.22	0.93
7000	14.15	23.84	10.03	17.03	1.55	0.94	24.40	12.06	0.98
8000	13.43	23.99	9.38	16.58	1.65	0.98	23.77	12.07	1.05
9000	12.82	24.11	9.65	14.16	1.75	0.97	24.72	12.00	1.06
10000	12.29	24.13	10.51	12.87	1.86	0.95	23.76	11.54	1.05
11000	11.71	24.42	11.52	12.25	2.04	0.94	23.50	11.53	1.36
12000	11.47	24.68	10.39	11.23	2.07	0.94	24.31	11.44	1.19
13000	11.00	24.82	9.59	10.77	2.15	0.96	23.74	11.18	1.21
14000	10.48	25.04	8.68	10.56	2.25	0.98	23.67	10.95	1.45
15000	9.97	25.34	8.24	10.08	2.39	0.99	23.76	10.99	1.55
16000	9.42	25.77	8.08	9.02	2.56	0.97	22.89	10.21	1.69
17000	8.87	26.47	8.25	7.36	2.77	0.90	22.12	10.02	1.97
18000	8.43	26.91	7.68	6.27	2.84	0.85	22.46	9.78	1.68
19000	7.97	27.52	7.48	5.70	3.05	0.82	22.90	9.37	1.83
20000	7.24	28.69	6.83	5.19	3.49	0.80	21.53	8.82	2.10



## 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 = 4.75, Id = 27mA @ 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)
200	14.98	28.64	2.44	7.34	1.22	1.12	24.96	12.16	2.14
400	17.47	25.48	4.91	10.61	1.12	0.93	24.49	11.90	1.22
600	18.07	24.67	6.54	13.24	1.11	0.86	23.76	11.83	1.02
800	18.24	24.31	7.55	15.21	1.12	0.83	23.73	11.89	0.93
1000	18.25	24.16	8.18	16.69	1.12	0.82	23.39	11.69	0.90
1200	18.20	24.06	8.58	17.78	1.13	0.82	23.14	11.65	0.86
1400	18.10	23.98	8.86	18.60	1.14	0.82	23.73	11.65	0.90
1600	17.98	23.92	9.06	19.16	1.15	0.82	22.95	11.74	0.90
1800	17.84	23.87	9.17	19.48	1.15	0.82	23.09	11.56	0.85
2000	17.69	23.84	9.25	19.67	1.17	0.83	23.53	11.50	0.83
2200	17.54	23.82	9.31	19.67	1.18	0.84	22.58	11.54	0.80
2400	17.38	23.78	9.34	19.52	1.19	0.84	23.56	11.79	0.83
2600	17.23	23.74	9.36	19.30	1.20	0.84	22.62	11.26	0.86
2800	17.07	23.69	9.41	19.02	1.21	0.85	23.58	11.49	0.84
3000	16.92	23.66	9.47	18.70	1.22	0.85	22.83	11.34	0.76
4000	16.21	23.50	10.07	17.76	1.28	0.86	23.20	11.39	0.87
5000	15.50	23.42	10.77	17.48	1.36	0.87	23.00	11.64	0.80
6000	14.77	23.63	10.64	17.02	1.46	0.91	23.58	11.57	0.96
7000	14.02	23.78	9.88	17.21	1.56	0.95	23.61	11.41	0.96
8000	13.29	23.97	9.24	16.64	1.66	0.99	22.83	11.42	1.07
9000	12.67	24.11	9.47	14.15	1.77	0.98	23.84	11.48	1.06
10000	12.15	24.12	10.31	12.84	1.87	0.95	22.82	10.89	1.09
11000	11.57	24.44	11.29	12.23	2.07	0.94	22.59	10.88	1.38
12000	11.33	24.69	10.20	11.20	2.09	0.95	23.79	10.91	1.20
13000	10.86	24.84	9.42	10.76	2.17	0.96	23.09	10.66	1.28
14000	10.34	25.09	8.53	10.55	2.28	0.99	22.84	10.29	1.38
15000	9.82	25.37	8.10	10.06	2.42	1.00	22.89	10.20	1.68
16000	9.28	25.76	7.96	8.99	2.58	0.97	22.18	9.55	1.76
17000	8.73	26.55	8.16	7.33	2.82	0.90	21.33	9.35	2.07
18000	8.30	26.94	7.61	6.25	2.87	0.85	21.47	9.13	1.66
19000	7.84	27.55	7.43	5.68	3.09	0.82	21.98	8.60	1.86
20000	7.11	28.68	6.80	5.18	3.53	0.80	20.42	8.29	2.34

## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 5.25V, Id = 31mA @ 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)
200	15.17	28.96	2.42	7.03	1.22	1.10	26.37	13.26	2.18
400	17.72	25.68	4.93	10.23	1.12	0.92	25.08	13.04	1.20
600	18.34	24.86	6.63	12.83	1.11	0.85	25.14	13.00	1.05
800	18.52	24.53	7.70	14.80	1.11	0.82	25.19	13.06	0.93
1000	18.54	24.36	8.38	16.26	1.12	0.81	24.72	12.85	0.88
1200	18.48	24.24	8.83	17.35	1.13	0.80	24.76	12.82	0.89
1400	18.39	24.17	9.13	18.16	1.13	0.80	24.95	12.95	0.91
1600	18.27	24.12	9.34	18.76	1.14	0.81	24.36	13.03	0.88
1800	18.14	24.05	9.47	19.14	1.15	0.81	24.53	12.73	0.88
2000	17.99	23.98	9.56	19.40	1.16	0.81	24.94	12.67	0.82
2200	17.83	23.97	9.62	19.49	1.17	0.82	24.11	12.72	0.87
2400	17.67	23.94	9.65	19.40	1.18	0.83	24.92	13.09	0.79
2600	17.52	23.90	9.67	19.23	1.19	0.83	23.84	12.43	0.85
2800	17.37	23.86	9.73	18.99	1.21	0.83	24.40	12.66	0.84
3000	17.21	23.82	9.80	18.68	1.22	0.84	24.08	12.51	0.79
4000	16.49	23.64	10.42	17.68	1.28	0.85	24.82	12.67	0.86
5000	15.76	23.55	11.12	17.25	1.35	0.86	24.26	12.79	0.78
6000	15.02	23.77	10.95	16.67	1.45	0.89	25.02	12.83	0.87
7000	14.27	23.88	10.14	16.86	1.54	0.94	25.06	12.68	0.99
8000	13.55	24.02	9.51	16.51	1.64	0.97	24.20	12.57	1.06
9000	12.94	24.12	9.80	14.16	1.74	0.96	25.48	12.63	1.04
10000	12.41	24.12	10.69	12.89	1.84	0.94	24.41	12.03	1.07
11000	11.82	24.40	11.71	12.28	2.02	0.93	24.30	12.02	1.34
12000	11.58	24.72	10.56	11.23	2.07	0.94	25.56	12.07	1.19
13000	11.11	24.81	9.74	10.78	2.13	0.95	24.56	11.68	1.20
14000	10.59	25.02	8.80	10.57	2.23	0.98	24.33	11.57	1.39
15000	10.08	25.32	8.35	10.09	2.37	0.99	24.42	11.62	1.51
16000	9.54	25.74	8.18	9.04	2.53	0.97	23.85	10.84	1.84
17000	8.99	26.48	8.34	7.37	2.75	0.90	22.92	10.64	1.83
18000	8.55	26.90	7.74	6.28	2.81	0.85	22.95	10.29	1.59
19000	8.09	27.54	7.53	5.71	3.04	0.82	23.72	9.87	1.75
20000	7.35	28.68	6.85	5.19	3.46	0.80	22.23	9.44	2.10

## 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 = 5.00V, Id = 30mA @ 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)			(dBm)	(dBm)	(dB)
200	14.64	28.20	2.50	7.78	1.23	1.15	25.68	12.42	3.06
400	17.02	25.11	4.91	11.14	1.13	0.96	24.63	12.18	1.89
600	17.57	24.36	6.43	13.74	1.12	0.89	24.26	12.08	1.63
800	17.71	24.05	7.32	15.68	1.13	0.86	24.12	12.12	1.57
1000	17.71	23.90	7.87	17.10	1.13	0.85	23.78	11.90	1.43
1200	17.65	23.80	8.23	18.07	1.14	0.85	23.50	11.83	1.45
1400	17.54	23.72	8.46	18.76	1.15	0.85	24.08	11.96	1.48
1600	17.41	23.67	8.64	19.21	1.16	0.85	23.38	12.04	1.46
1800	17.27	23.63	8.76	19.46	1.17	0.85	23.63	11.75	1.43
2000	17.11	23.58	8.84	19.59	1.18	0.86	24.18	11.67	1.36
2200	16.95	23.56	8.90	19.59	1.19	0.86	23.22	11.71	1.40
2400	16.78	23.54	8.93	19.47	1.21	0.87	24.25	12.09	1.39
2600	16.61	23.52	8.94	19.33	1.22	0.88	23.11	11.56	1.47
2800	16.45	23.48	8.98	19.08	1.23	0.88	24.35	11.78	1.54
3000	16.29	23.46	9.00	18.76	1.24	0.88	23.54	11.61	1.41
4000	15.54	23.34	9.39	17.58	1.31	0.90	24.00	11.60	1.51
5000	14.82	23.28	10.18	17.39	1.40	0.90	23.51	11.85	1.50
6000	14.07	23.57	10.04	17.47	1.53	0.94	24.32	11.92	1.62
7000	13.27	23.76	9.37	17.48	1.64	0.98	23.98	11.70	1.77
8000	12.52	24.00	8.88	16.27	1.77	1.01	23.53	11.70	1.85
9000	11.87	24.20	8.94	14.48	1.90	1.01	24.92	11.76	1.98
10000	11.28	24.29	9.47	12.91	2.03	0.99	23.59	11.22	2.00
11000	10.71	24.71	10.37	11.62	2.26	0.96	23.14	11.08	2.31
12000	10.45	24.95	9.63	10.74	2.30	0.96	24.16	11.15	2.16
13000	9.94	25.12	8.96	10.28	2.40	0.98	23.52	10.85	2.25
14000	9.42	25.31	8.36	10.11	2.53	0.99	23.28	10.61	2.40
15000	8.93	25.62	7.96	10.09	2.71	1.01	23.56	10.74	2.67
16000	8.31	26.22	7.66	9.01	2.96	1.00	22.81	10.03	2.99
17000	7.74	26.91	7.76	7.14	3.17	0.92	21.70	9.79	3.20
18000	7.23	27.39	7.36	6.06	3.29	0.86	21.64	9.46	2.92
19000	6.69	28.14	7.27	5.49	3.63	0.82	22.40	8.93	3.13
20000	6.02	29.19	6.91	5.04	4.15	0.80	21.03	8.57	3.58

## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 4.75V, Id = 29mA @ 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)
200	14.53	28.16	2.50	7.94	1.24	1.16	25.09	11.93	3.06
400	16.89	25.02	4.89	11.31	1.13	0.96	23.99	11.66	1.89
600	17.42	24.26	6.37	13.90	1.12	0.89	23.40	11.57	1.66
800	17.56	23.97	7.22	15.81	1.13	0.87	23.63	11.61	1.57
1000	17.56	23.81	7.76	17.21	1.13	0.86	23.16	11.39	1.47
1200	17.49	23.71	8.09	18.16	1.14	0.85	23.03	11.44	1.47
1400	17.38	23.66	8.32	18.83	1.15	0.86	23.28	11.44	1.46
1600	17.26	23.58	8.50	19.25	1.16	0.86	22.71	11.52	1.46
1800	17.11	23.54	8.61	19.49	1.17	0.86	22.97	11.36	1.46
2000	16.95	23.50	8.69	19.59	1.18	0.87	23.33	11.28	1.40
2200	16.79	23.47	8.74	19.57	1.19	0.87	22.61	11.20	1.43
2400	16.62	23.46	8.77	19.44	1.21	0.88	23.29	11.58	1.39
2600	16.46	23.44	8.79	19.28	1.22	0.88	22.31	11.05	1.50
2800	16.30	23.41	8.82	19.04	1.23	0.89	23.11	11.27	1.55
3000	16.13	23.37	8.84	18.72	1.24	0.89	22.73	11.22	1.42
4000	15.39	23.28	9.22	17.60	1.32	0.90	23.18	11.09	1.50
5000	14.68	23.19	10.00	17.51	1.40	0.91	22.91	11.35	1.51
6000	13.93	23.48	9.90	17.66	1.53	0.95	23.84	11.30	1.66
7000	13.13	23.68	9.24	17.67	1.64	0.99	23.76	11.21	1.76
8000	12.38	23.96	8.74	16.38	1.78	1.02	22.83	11.20	1.87
9000	11.73	24.15	8.79	14.52	1.91	1.02	24.03	11.26	1.94
10000	11.14	24.26	9.31	12.93	2.05	1.00	22.95	10.72	2.03
11000	10.57	24.67	10.20	11.63	2.28	0.96	22.37	10.59	2.35
12000	10.32	24.92	9.45	10.75	2.32	0.97	23.81	10.65	2.20
13000	9.81	25.05	8.82	10.31	2.41	0.98	22.85	10.34	2.25
14000	9.29	25.28	8.24	10.13	2.55	1.00	22.32	10.11	2.47
15000	8.79	25.60	7.84	10.11	2.73	1.02	22.71	10.23	2.56
16000	8.17	26.20	7.55	9.01	2.98	1.00	22.08	9.51	3.07
17000	7.61	26.82	7.67	7.13	3.17	0.92	20.91	9.16	3.22
18000	7.10	27.34	7.28	6.06	3.30	0.86	20.93	8.95	2.91
19000	6.56	28.09	7.21	5.49	3.65	0.82	21.68	8.54	3.15
20000	5.89	29.17	6.87	5.04	4.19	0.80	19.87	7.95	3.73

## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

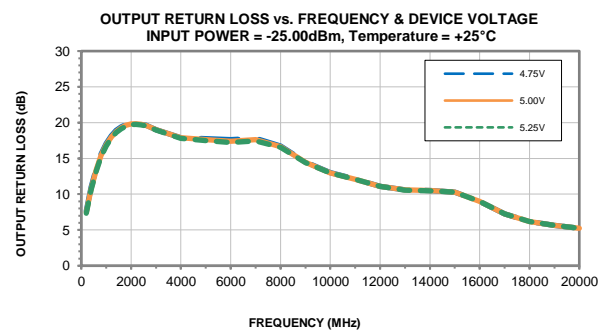
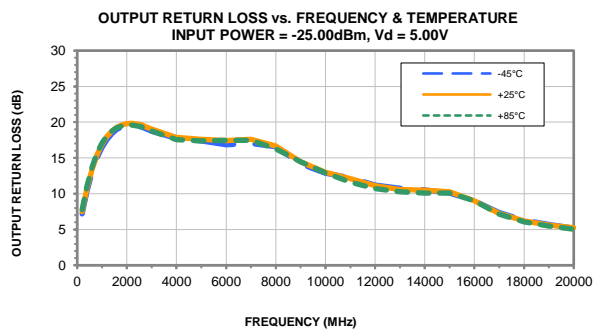
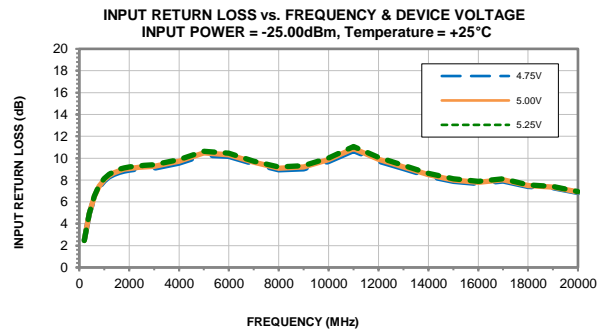
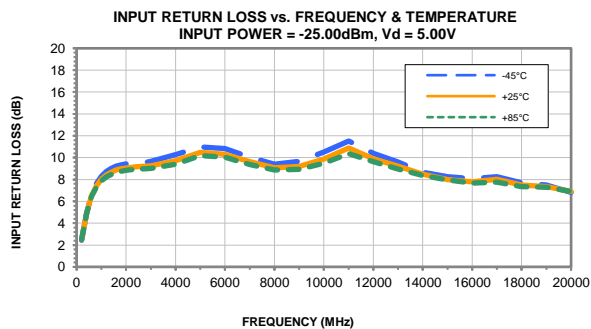
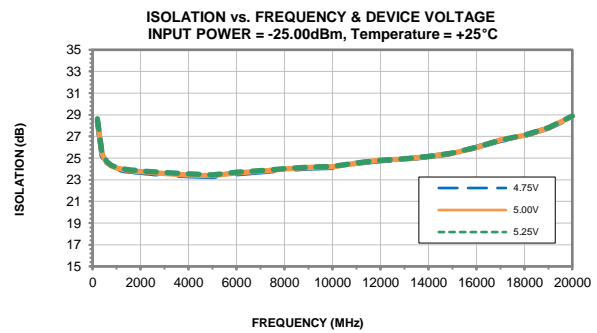
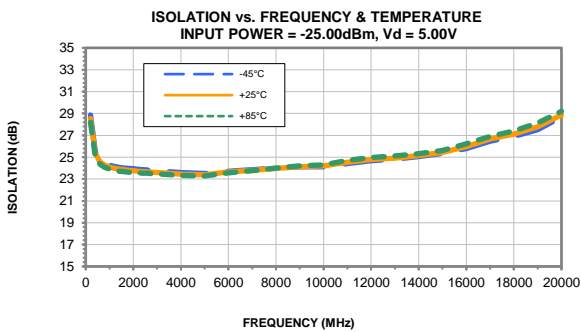
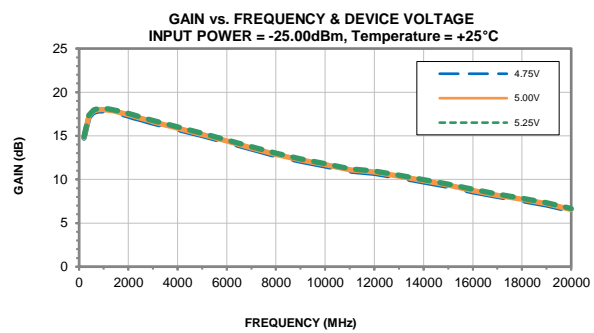
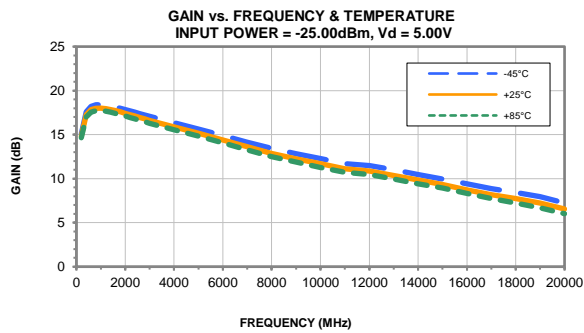
Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

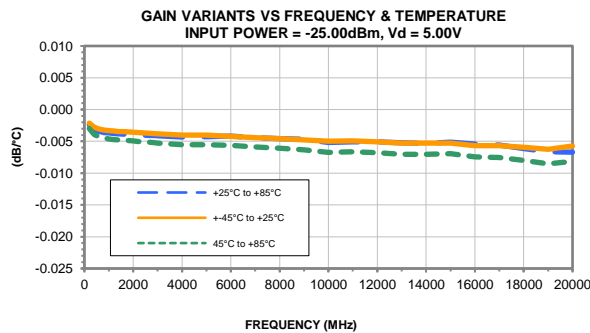
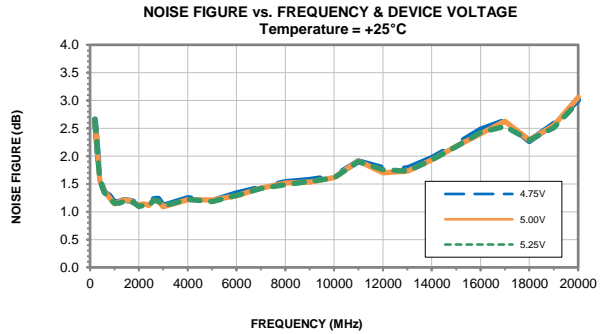
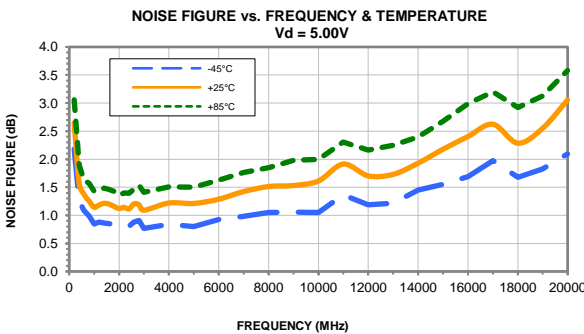
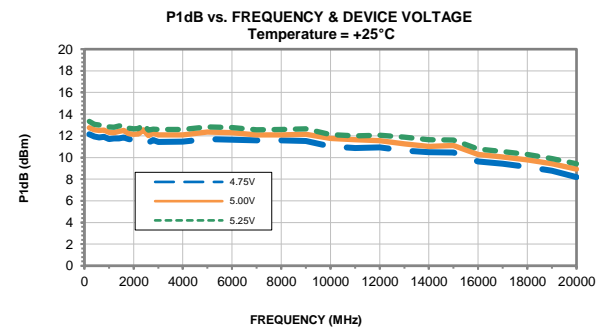
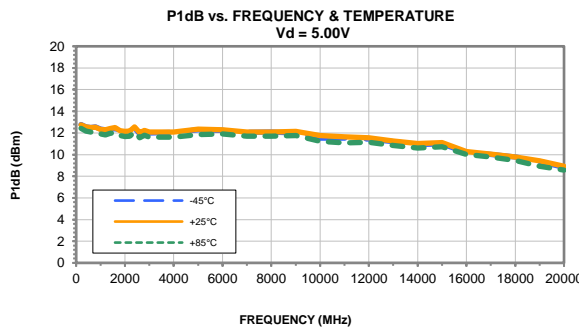
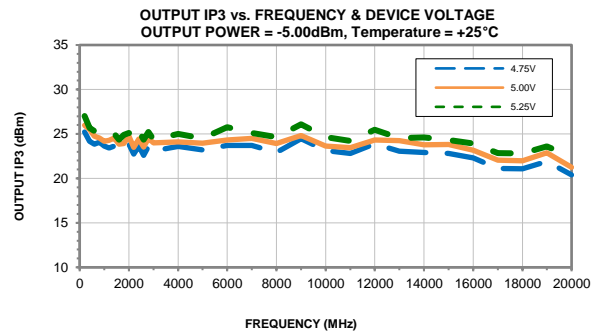
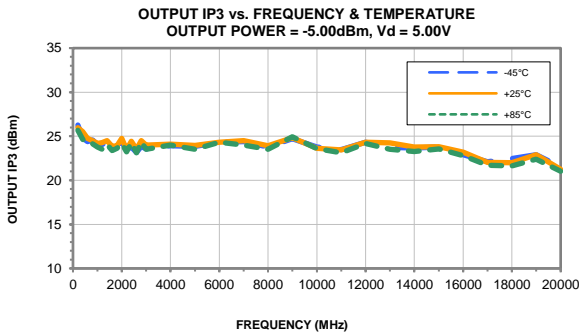
TEST CONDITIONS: Vd = 5.25V, Id = 32mA @ Temperature = +85°C

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)
200	14.73	28.32	2.49	7.65	1.23	1.14	26.06	12.99	3.05
400	17.14	25.19	4.93	10.99	1.13	0.95	25.29	12.65	1.87
600	17.70	24.42	6.48	13.60	1.12	0.88	24.87	12.56	1.65
800	17.85	24.13	7.40	15.54	1.13	0.85	24.72	12.60	1.55
1000	17.85	23.96	7.98	16.98	1.13	0.84	24.41	12.37	1.41
1200	17.78	23.87	8.34	17.98	1.14	0.84	24.47	12.31	1.47
1400	17.67	23.79	8.59	18.67	1.15	0.84	24.40	12.43	1.45
1600	17.55	23.74	8.78	19.14	1.16	0.84	23.97	12.51	1.45
1800	17.40	23.70	8.89	19.40	1.17	0.84	24.45	12.22	1.44
2000	17.25	23.65	8.98	19.55	1.18	0.85	24.44	12.15	1.37
2200	17.08	23.62	9.04	19.55	1.19	0.86	23.70	12.19	1.40
2400	16.92	23.60	9.07	19.45	1.20	0.86	24.72	12.56	1.36
2600	16.75	23.57	9.09	19.32	1.22	0.87	23.48	11.91	1.43
2800	16.59	23.54	9.12	19.07	1.23	0.87	24.84	12.25	1.49
3000	16.42	23.53	9.14	18.76	1.24	0.88	23.98	12.08	1.40
4000	15.67	23.41	9.53	17.53	1.31	0.89	24.35	12.07	1.47
5000	14.94	23.35	10.33	17.28	1.40	0.90	24.27	12.31	1.50
6000	14.19	23.64	10.17	17.28	1.53	0.94	24.88	12.26	1.65
7000	13.39	23.82	9.48	17.31	1.64	0.98	24.89	12.16	1.73
8000	12.64	24.06	9.00	16.17	1.76	1.01	24.07	12.04	1.87
9000	11.99	24.24	9.07	14.42	1.89	1.00	25.59	12.10	1.92
10000	11.40	24.33	9.61	12.88	2.02	0.98	24.30	11.56	2.03
11000	10.83	24.78	10.53	11.60	2.26	0.96	23.89	11.54	2.33
12000	10.57	24.97	9.76	10.72	2.29	0.96	24.92	11.62	2.23
13000	10.06	25.14	9.09	10.26	2.39	0.97	24.04	11.31	2.21
14000	9.54	25.36	8.48	10.08	2.52	0.99	24.02	11.20	2.41
15000	9.05	25.66	8.07	10.07	2.70	1.01	24.30	11.21	2.72
16000	8.42	26.23	7.76	9.02	2.94	0.99	23.55	10.50	2.99
17000	7.86	26.93	7.84	7.15	3.15	0.91	22.53	10.14	3.12
18000	7.35	27.40	7.43	6.06	3.27	0.86	22.54	9.93	2.89
19000	6.81	28.16	7.33	5.49	3.61	0.82	23.24	9.52	3.10
20000	6.13	29.29	6.96	5.03	4.16	0.79	21.64	9.04	3.60

## Typical Performance Curves



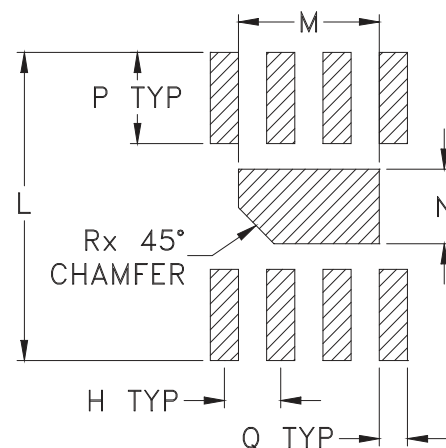
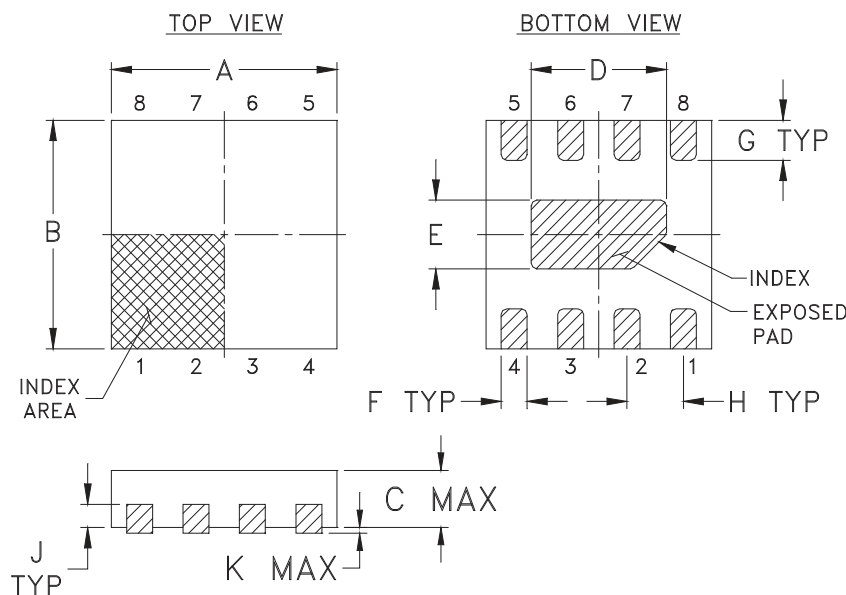
## Typical Performance Curves





### Outline Dimensions

### PCB Land Pattern



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

SE #.	A	B	C	D	E	F	G	H	J	K	L	M	N	P
MC1631-1	.079 (2.00)	.079 (2.00)	.039 (1.00)	.047 (1.20)	.024 (.60)	.009 (.23)	.014 (.35)	.020 (.50)	.008 (.20)	.002 (.05)	.106 (2.70)	.049 (1.25)	.026 (.65)	.031 (.80)

CASE #.	Q	R	WT, GRAM
MC1631-1	.010 (.25)	.012 (.30)	.006

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

#### Notes:

- Case material: Plastic.
- Termination finish:  
For RoHS Case Styles: Tin-Silver over Nickel plated or Matte-Tin Plated (See Data sheet).  
All models, (+) suffix.
- Lead #1 identifier shall be located in the cross-hatched area shown.  
Identifier may be either a molded or marked feature.



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

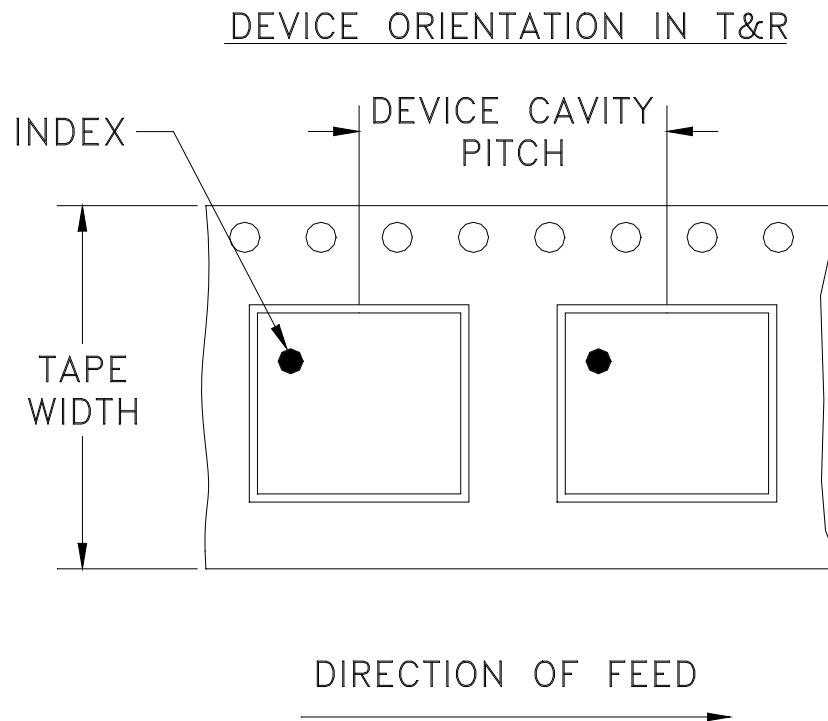


The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: [www.minicircuits.com](http://www.minicircuits.com)

RF/IF MICROWAVE COMPONENTS



# Tape & Reel Packaging TR-F66



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note	
8	4	7	Small quantity standard	20
				50
				100
				200
				500
		7	Standard	1000, 2000, 3000

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

**Mini-Circuits®**

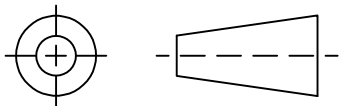
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THIRD ANGLE PROJECTION

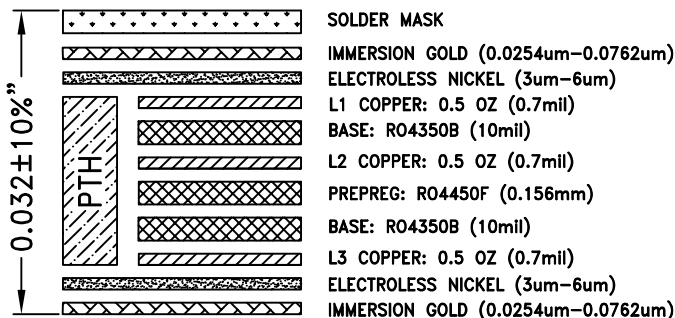


REVISIONS

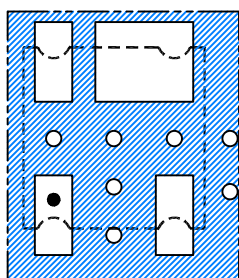
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-015833	NEW RELEASE	11/23/22	ITG	IL

SUGGESTED MOUNTING CONFIGURATION FOR MC1631-1 CASE STYLE

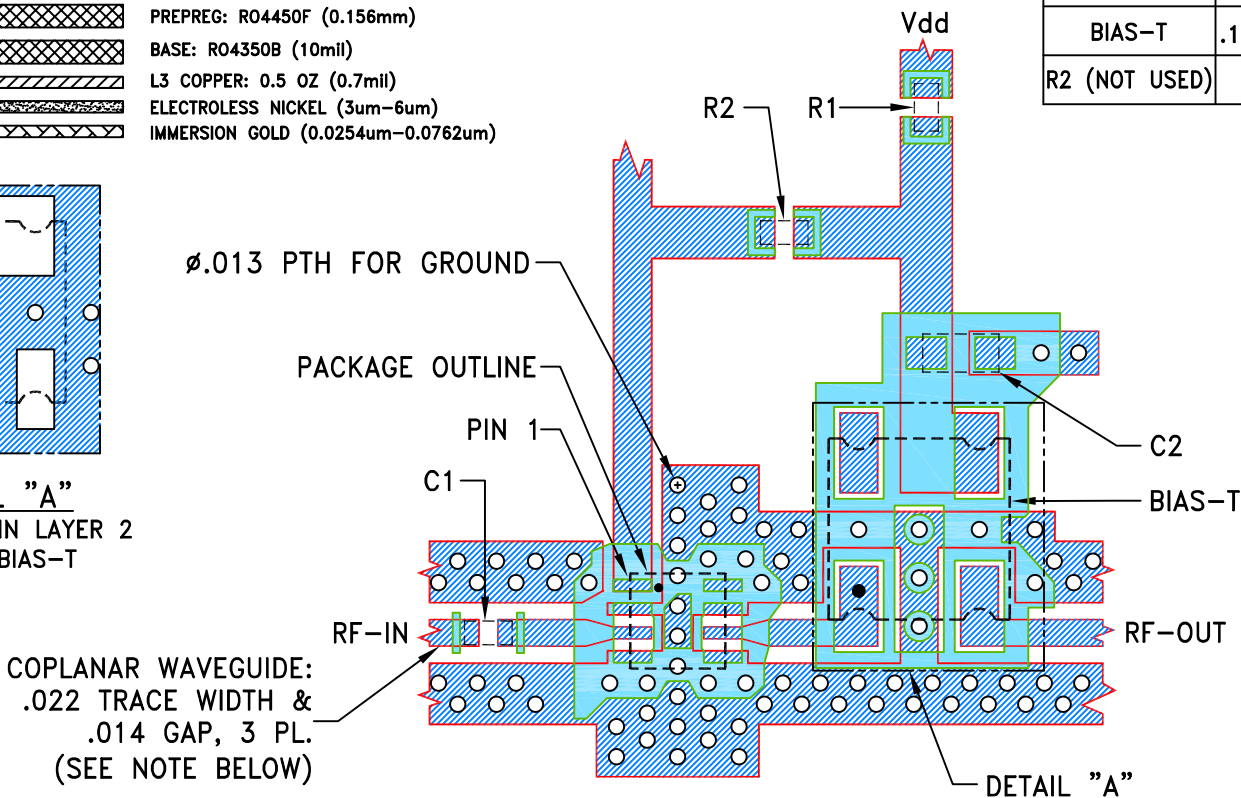
3 LAYER STACK-UP DETAIL



COMPONENT	SIZE
C1	0402
C2	0603
R1	0402
BIAS-T	.15X.15"
R2 (NOT USED)	0402



DETAIL "A"  
SCRATCHES IN LAYER 2  
UNDER BIAS-T

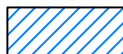


NOTES:

1. PCB IS MULTILAYER PCB, SEE STACK-UP DIAGRAM.
2. TRACE WIDTH & GAP ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .010".  
COPPER: 1/2 OZ. EACH LAYER. FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.
3. CHIP COMPONENT FOOT PRINTS SHOWN FOR REFERENCE, FOR COMPONENT VALUES REFER TO TB-PMA2123LN5E+.
4. LAYER 2 OF PCB IS CONTINUOUS GROUND PLANE EXCEPT SCRATCHES (SEE DETAIL "A").
5. LAYER 3 OF 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	ITG	11/22/22
TOLERANCES ON:	GF	11/22/22
2 PL DECIMALS ±	IL	11/23/22
3 PL DECIMALS ± .005		
ANGLES ±		
FRACTIONS ±		

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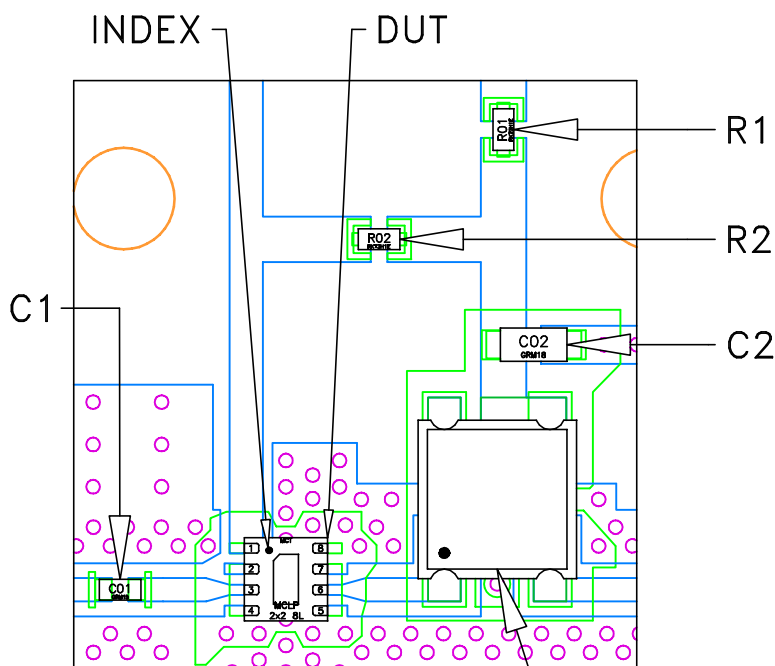
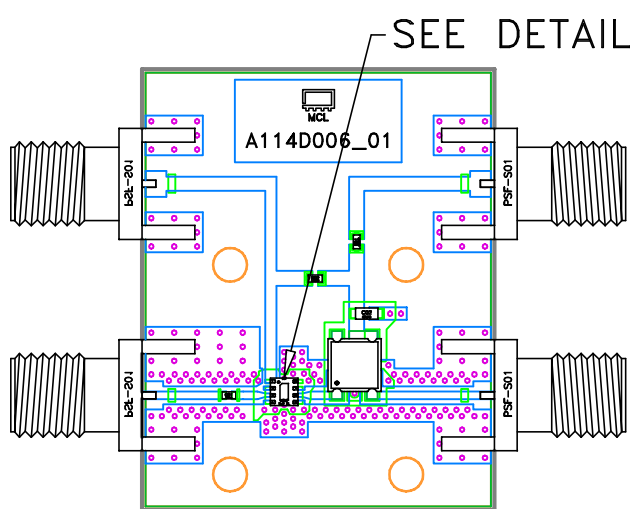
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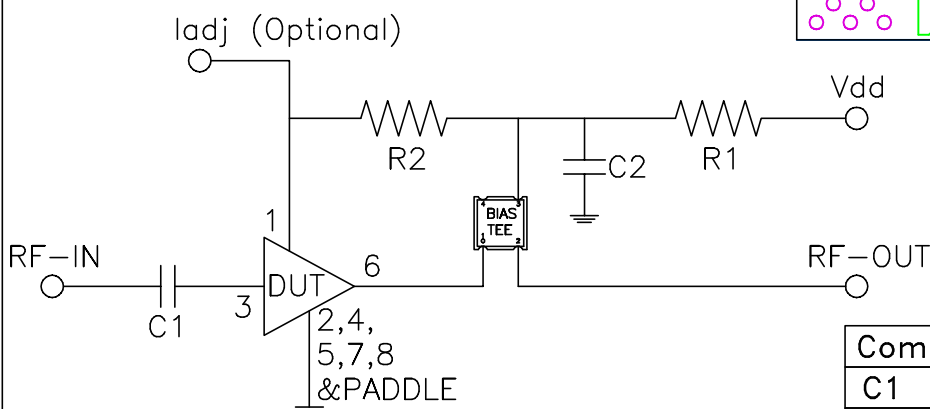
PL, MC1631-1, TB-PMA2123LN5E+

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-745	OR
FILE:	98PL745	SCALE: 6:1	SHEET: 1 OF 1

# Evaluation Board and Circuit



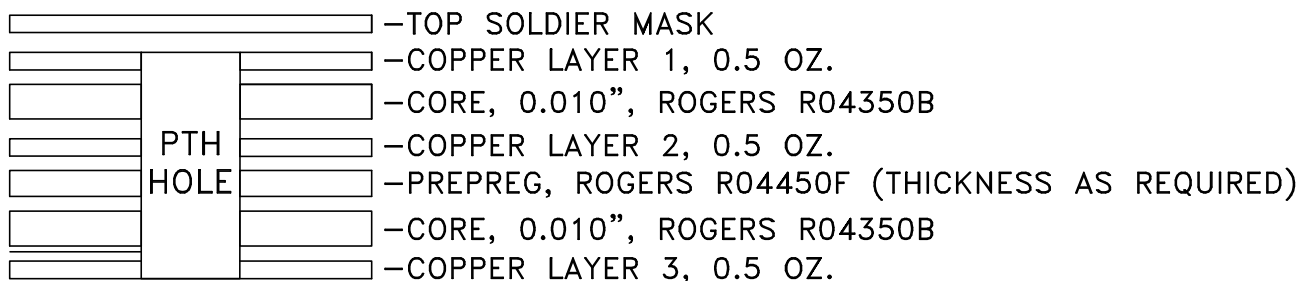
DETAIL "A" BIAS TEE LOCATION OF COMPONENT ON THE PCB (SCALE 3:1)



Schematic Diagram

Component	Size	Description
C1	0402	0.1uF
C2	0603	0.01uF
R1	0402	68ohm
BIAS TEE	.15"x.15"	TCBT-123+
R2 (Not used)	0402	For current adjust purpose, refer to datasheet.

## STACK-UP DIAGRAM



## NOTES:

- 50 Ohm SMA Female Connectors.
- PCB Material: Roger R04350B or equivalent, Dielectric constant=3.5, Thickness=0.032 inch

Mini-Circuits®

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 -45° to 85° C or -55° to 105° C or -40° to 105° C or -40° to 95° C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° C or -65° to 150° Ambient Environment	Individual Model Data Sheet
HTOL	1000 hours at 125°C	MIL-STD-883, Method 1005, Condition B
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

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.

<b>Specification</b>	<b>Test/Inspection Condition</b>	<b>Reference/Spec</b>
Marking Resistance to Solvents	Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C; distilled water + proylene glycol monomethyl ether + monoethanolamine at 63°C to 70°C	MIL-STD-202, Method 215