

Low Noise, High IP3

Monolithic Amplifier

PMA-5453+

50Ω 0.05 to 6 GHz



3mm x 3mm MCLP Pkg

The Big Deal

- Ultra Low Noise Figure, 0.6 dB
- High IP3/Low Current, 60mA
- Wideband, up to 6 GHz

Product Overview

Mini-Circuits PMA-5453+ is a E-PHEMT based Ultra-Low Noise MMIC Amplifier operating from 50 MHz to 6 GHz with a unique combination of low noise and high IP3 making this amplifier ideal for sensitive receiver applications. This design operates on a single 3V supply at only 60 mA and is internally matched to 50 Ohms.

Key Features

Feature	Advantages
Ultra Low Noise, 0.6 dB	Outstanding Noise Figure, measured in a 50 Ohm environment without any external matching
High IP3, 35 dBm	Combining Low Noise and High IP3 makes this MMIC amplifier ideal for Low Noise Receiver Front End (RFE) because it gives the user advantages at both ends of the dynamic range: sensitivity & two-tone spur-free dynamic range
Low Current, 60 mA	At only 60mA, the PMA-5453+ is ideal for remote applications with limited available power or densely packed applications where thermal management is critical.
Broad Band	Operating over a broadband the PMA-5453+ covers the primary wireless communications bands: Cellular, PCS, LTE, WiMAX
Internally Matched	No external matching elements required to achieve the advertised noise and output power over the full band
MCLP Package	Low Inductance, repeatable transitions, excellent thermal pad
Max Input Power, +20 dBm	Ruggedized design operates up to input powers of +20dBm without the need of an external limiter
High Reliability	Low, small signal operating current of 60 mA nominal maintains junction temperatures typically below 110°C at 85°C ground lead temperature

Notes

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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



Low Noise, High IP3

Monolithic Amplifier

0.05-6 GHz

Product Features

- Single Positive Supply Voltage, 3V, $I_d=60\text{mA}$
- Ultra Low Noise Figure, 0.6 dB typ. at 0.5 GHz
- High IP3, 35 dBm typ. 1GHz
- Gain, 19 dB typ. at 1 GHz
- Output Power, up to +19.5dBm typ.
- Micro-miniature size - 3mm x 3mm
- Aqueous washable

Typical Applications

- Cellular
- ISM
- GSM
- WCDMA
- LTE
- WiMAX
- WLAN
- UNII and HIPERLAN



PMA-5453+

CASE STYLE: DQ849

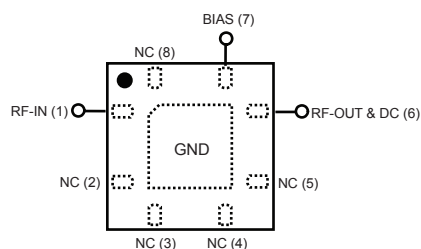
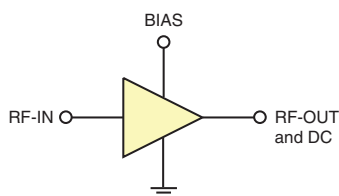
+RoHS Compliant

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

General Description

PMA-5453+ is a high dynamic range, low noise, high IP3, high output power, monolithic amplifier. Manufactured using E-PHEMT* technology enables it to work with a single positive supply voltage.

simplified schematic and pad description



Function	Pad Number	Description (See Application Circuit, Fig. 3)
RF-IN	1	RF input pad
RF-OUT & DC	6	RF output pad (connected to RF-OUT via blocking external cap C2, and Supply voltage Vs via RF Choke L1)
BIAS	7	Bias pad (connected to Vs via Rbias)
GND	paddle in center of bottom	Connected to ground
NOT USED	2,3,4,5,8	No internal connection; recommended use: per PCB Layout PL-299

*Enhancement mode Pseudomorphic High Electron Mobility Transistor.

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PMA-5453+
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Electrical Specifications⁽¹⁾ at 25°C, Z_o=50Ω, (refer to characterization circuit, Fig. 1)

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		0.05		6.0	GHz
DC Voltage (V _d)			3.0		V
DC Current (I _d) ⁽⁶⁾		40	60	71	mA
DC Current (I _{Rbias})			4.0		mA
Noise Figure	0.05		1.2	—	dB
	0.5		0.6	—	
	1.0		0.7	—	
	2.0		0.9	1.3	
	3.0		1.3	—	
	4.0		1.5	—	
	5.0		1.8	—	
	6.0		2.2	—	
Gain	0.05	—	25.8	—	dB
	0.5	—	23.0	—	
	1.0	—	19.3	—	
	2.0	12.8	14.3	15.6	
	3.0	—	11.1	—	
	4.0	—	9.0	—	
	5.0	—	7.2	—	
	6.0	—	5.7	—	
Input Return Loss	0.05-0.5		10.0		dB
	0.5-6		7.0		
Output Return Loss	0.05-0.1		16.0		dB
	0.1-6		18.0		
Output IP3	0.05		32.1		dBm
	0.5		33.1		
	1.0		35.0		
	2.0		36.8		
	3.0		37.4		
	4.0		38.8		
	5.0		39.0		
	6.0		39.0		
Output Power @ 1 dB compression ⁽²⁾	0.05		19.4		dBm
	0.5		19.2		
	1.0		19.1		
	2.0		19.4		
	3.0		19.6		
	4.0		19.8		
	5.0		19.9		
	6.0		20.0		
DC Current Variation vs. Temperature ⁽³⁾			-0.033		mA/°C
Thermal Resistance			128		°C/W

Absolute Maximum Ratings⁽⁴⁾

Parameter	Ratings
Operating Temperature ⁽⁵⁾	-40°C to 85°C
Storage Temperature	-55°C to 100°C
Channel Temperature	150°C
DC Voltage (Pad 6)	5V
Power Dissipation	500mW
DC Current (Pad 6)	130mA
Bias Current (Pad 7)	10mA
Input Power ⁽⁷⁾	20dBm

⁽¹⁾ Measured on Mini-Circuits Characterization test board TB-502+
See Characterization Test Circuit (Fig. 1)

⁽²⁾ P1dB specified with external current limiting of 70mA;
Capable of higher P1dB at higher current (see Fig. 2)

⁽³⁾ (Current at 85°C - Current at -45°C)/130

⁽⁴⁾ Permanent damage may occur if any of these limits are exceeded.
These maximum ratings are not intended for continuous normal operation.

⁽⁵⁾ Defined with reference to ground pad temperature.

⁽⁶⁾ Specified DC current consumption is under small signal conditions.
Current will increase with input RF Power. To maintain maximum current consumption, external DC current limiting circuits are required on Vd line.

⁽⁷⁾ Maximum input power is specified based upon external Vd current limiting of 80 mA.
Maximum input power will degrade without external current limiting.

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Characterization Test Circuit

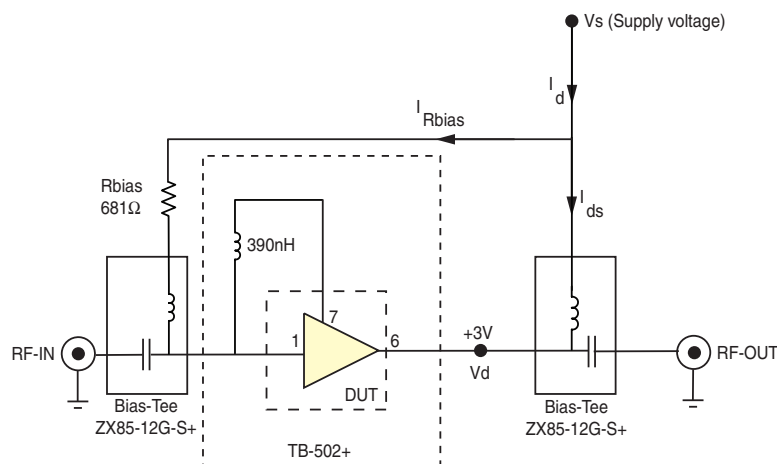


Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization Test Board TB-502+) Gain, Output power at 1dB compression (P1dB), Output IP3 (OIP3) and Noise Figure measured using Agilent's N5242A PNA-X Microwave network analyzer.

Conditions:

1. Gain: Pin=-25 dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 5 dBm/tone at output.
3. Vs adjusted for 3V at device (Vd), compensating loss of bias tee.

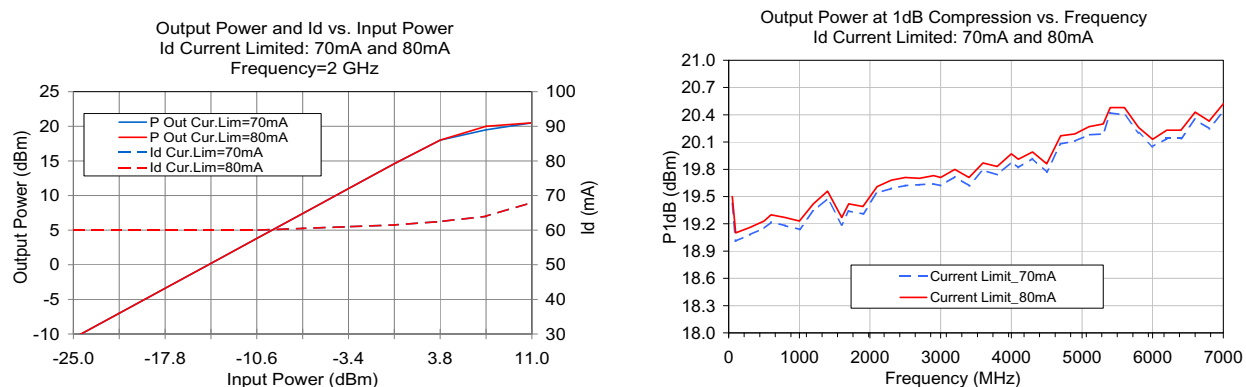


Fig 2. Output Power and Id vs. Input Power and Frequency. Performance measured on Mini-Circuits Characterization test board TB-502+. See Characterization Test Circuit (Fig. 1) Measurements performed with current (Id) limited as noted.

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Recommended Application Circuit

(refer to evaluation board for PCB Layout and component values)

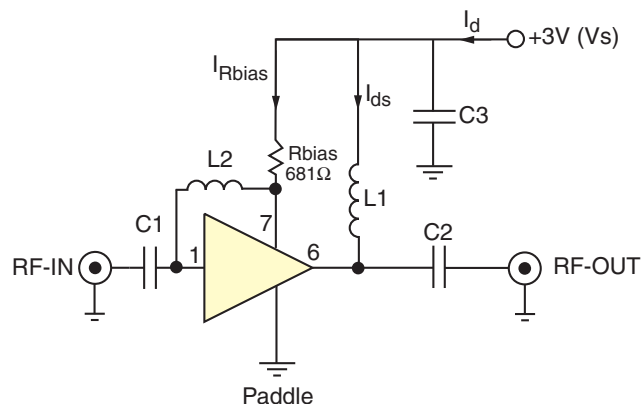


Fig 3. Recommended Application Circuit
Note: Resistance of L1, 0.1-0.2Ω typically

Typical Current (I_d) as a function of R_{bias}
($V_d = 3V$)

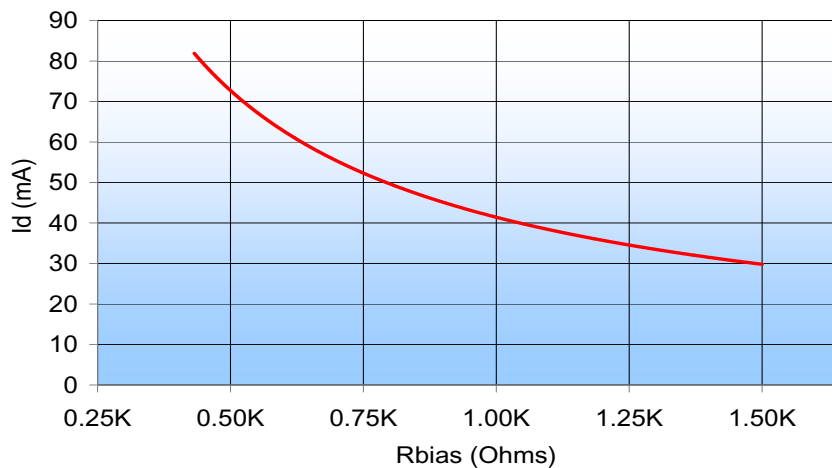


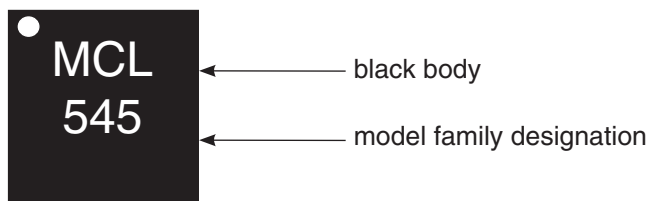
Fig 4. I_d varies as a function of R_{bias} . The I_d current range is defined based upon the specific R_{bias} value noted in the Application Circuit (Fig 3). R_{bias} may be adjusted to optimize I_d for a customers' application. RF performance will vary accordingly.

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Product Marking



Marking may contain other features or characters for internal lot control

Additional Detailed Technical Information

Additional information is available on our web site www.minicircuits.com. To access this information enter the model number on our web site home page.

Performance data, graphs, s-parameter data set (.zip file)

Case Style: DQ849

Plastic package, exposed paddle, lead finish: tin-silver over nickel

Tape & Reel: F104

Standard quantities available on reel: 7" reels with 20, 50, 100, 200, 500, 1K, or 2K devices.

Suggested Layout for PCB Design: PL-299

Evaluation Board: TB-501-3+ (50-5000 MHz)

Environmental Ratings: ENV08T1

ESD Rating

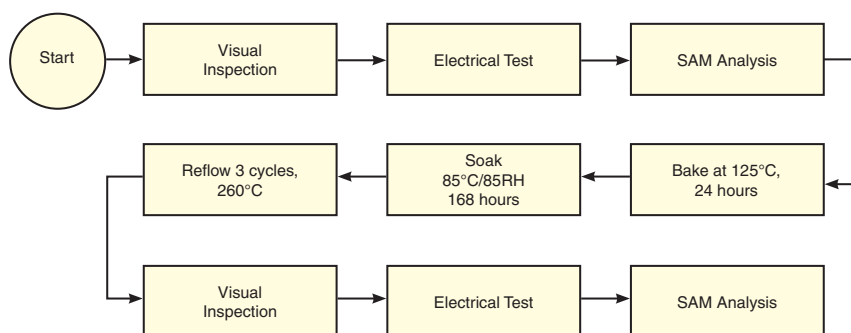
Human Body Model (HBM): Class 1A (250V to <500V) in accordance with ANSI/ESD STM 5.1 - 2001

Machine Model (MM): Class M1 (<100V) in accordance with ANSI/ESD STM5.2-1999; passes 40V

MSL Rating

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

MSL Test Flow Chart



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Typical Performance Data

NOTE: Use PDF Bookmarks to view DATA at required conditions

Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 3V, Rbias=681 ohms, Id=58 mA @ Temperature = +25degC

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output (1)		Noise Figure
								Current Limit 70mA	Current Limit 80mA	
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)		(dB)
50.0	25.89	31.85	11.02	12.12	1.10	0.77	32.39	19.42	19.50	1.02
100.0	25.73	30.72	11.15	17.30	1.07	0.76	32.51	19.01	19.10	0.74
300.0	24.58	29.70	9.67	23.49	1.06	0.82	33.21	19.08	19.16	0.58
500.0	23.00	28.53	8.32	23.92	1.05	0.88	33.21	19.15	19.23	0.55
600.0	22.19	27.89	7.87	23.63	1.05	0.90	34.12	19.22	19.30	0.62
800.0	20.63	26.78	7.23	23.33	1.06	0.94	34.77	19.18	19.27	0.64
1000.0	19.23	25.63	6.85	22.77	1.07	0.96	35.05	19.14	19.23	0.78
1200.0	17.97	24.66	6.53	22.21	1.08	0.99	36.10	19.34	19.42	0.79
1400.0	16.86	23.72	6.36	21.85	1.09	1.00	36.04	19.48	19.56	0.84
1600.0	15.85	22.87	6.18	21.31	1.10	1.01	36.64	19.19	19.27	0.90
1700.0	15.38	22.47	6.10	21.38	1.10	1.02	36.58	19.34	19.42	0.88
1900.0	14.56	21.67	6.10	21.19	1.10	1.01	37.15	19.31	19.39	0.85
2100.0	13.78	20.93	6.01	20.98	1.10	1.02	37.31	19.54	19.61	0.86
2300.0	13.10	20.28	6.02	21.21	1.10	1.02	37.56	19.59	19.68	0.99
2500.0	12.40	19.72	6.29	22.06	1.13	1.01	37.22	19.62	19.71	1.02
2700.0	11.68	19.16	5.94	20.70	1.12	1.04	37.74	19.63	19.70	1.32
2900.0	11.30	18.46	6.14	21.54	1.11	1.01	38.22	19.64	19.73	1.13
3000.0	11.05	18.20	6.25	21.86	1.11	1.01	38.35	19.62	19.71	1.08
3200.0	10.56	17.67	6.32	22.05	1.11	1.00	38.54	19.72	19.80	1.07
3400.0	10.13	17.16	6.56	22.79	1.12	0.99	38.65	19.62	19.71	1.21
3600.0	9.71	16.68	6.74	22.91	1.12	0.98	39.03	19.79	19.87	1.20
3800.0	9.33	16.19	6.89	23.20	1.12	0.97	38.90	19.74	19.83	1.26
4000.0	8.96	15.77	7.14	23.15	1.13	0.96	38.77	19.88	19.97	1.23
4100.0	8.74	15.60	7.18	22.57	1.13	0.96	38.59	19.82	19.91	1.18
4300.0	8.32	15.26	7.31	21.87	1.15	0.96	38.32	19.92	19.99	1.54
4500.0	7.97	14.84	7.54	21.18	1.15	0.94	39.16	19.77	19.86	1.47
4700.0	7.50	14.60	7.82	20.01	1.19	0.93	39.14	20.08	20.17	1.75
4900.0	7.27	14.20	7.27	19.83	1.15	0.94	40.33	20.11	20.19	1.56
5100.0	7.06	13.81	7.09	19.47	1.13	0.94	40.09	20.18	20.27	1.57
5300.0	6.78	13.49	6.89	18.84	1.12	0.94	40.15	20.19	20.30	1.70
5400.0	6.64	13.36	6.81	18.42	1.12	0.94	40.50	20.42	20.48	1.69
5600.0	6.34	13.09	6.67	17.49	1.12	0.93	40.24	20.40	20.48	1.85
5800.0	6.05	12.87	6.48	16.72	1.12	0.94	40.93	20.20	20.26	2.02
6000.0	5.76	12.62	6.22	16.02	1.11	0.94	40.19	20.05	20.13	2.11
6200.0	5.47	12.44	5.97	15.35	1.11	0.95	41.08	20.14	20.23	2.11
6400.0	5.19	12.24	5.74	14.83	1.10	0.95	40.38	20.14	20.23	2.18
6600.0	4.88	12.08	5.56	14.11	1.11	0.96	39.92	20.35	20.43	2.18
6800.0	4.52	11.99	5.38	13.53	1.12	0.97	41.21	20.25	20.33	2.72
7000.0	4.02	12.05	5.75	12.83	1.18	0.96	40.88	20.43	20.52	2.83

(1) Current is externally limited during P1dB measurements. Unit is capable of higher output power if current is not limited.

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 = 3V, Rbias=681 ohms, Id=60 mA @ Temperature = -45degC

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dB)
50.0	26.04	31.43	12.43	11.81	1.06	0.73	32.91	0.82
100.0	25.69	30.27	12.99	16.48	1.05	0.71	33.40	0.54
300.0	24.58	29.52	10.94	21.01	1.07	0.77	34.00	0.43
500.0	23.10	28.57	9.11	21.26	1.08	0.83	33.97	0.40
600.0	22.33	28.06	8.51	21.29	1.09	0.86	34.70	0.45
800.0	20.85	26.82	7.71	21.04	1.09	0.89	35.18	0.48
1000.0	19.48	25.76	7.19	20.62	1.09	0.92	35.75	0.58
1200.0	18.25	24.72	6.81	20.22	1.09	0.94	36.54	0.53
1400.0	17.16	23.72	6.58	20.02	1.09	0.95	36.56	0.66
1600.0	16.16	22.84	6.36	19.58	1.09	0.96	37.09	0.55
1700.0	15.71	22.41	6.27	19.68	1.09	0.97	37.24	0.83
1900.0	14.89	21.60	6.22	19.46	1.09	0.97	37.61	0.58
2100.0	14.12	20.84	6.11	19.49	1.09	0.98	37.54	0.60
2300.0	13.46	20.14	6.12	19.56	1.08	0.97	38.10	0.75
2500.0	12.74	19.63	6.39	20.23	1.11	0.97	37.83	0.76
2700.0	11.93	19.16	6.01	19.58	1.11	1.01	38.02	1.09
2900.0	11.67	18.31	6.18	20.09	1.08	0.97	38.85	0.78
3000.0	11.42	18.01	6.29	20.33	1.09	0.97	39.08	0.78
3200.0	10.95	17.47	6.41	20.79	1.08	0.96	39.10	0.79
3400.0	10.51	16.96	6.61	21.33	1.09	0.95	39.28	0.79
3600.0	10.11	16.46	6.81	21.83	1.09	0.94	39.04	0.82
3800.0	9.73	16.00	6.93	22.12	1.09	0.93	39.16	1.01
4000.0	9.38	15.56	7.21	22.39	1.09	0.92	39.42	0.92
4100.0	9.15	15.37	7.24	21.97	1.10	0.92	39.48	1.14
4300.0	8.73	15.03	7.32	21.01	1.11	0.91	39.28	1.01
4500.0	8.40	14.61	7.54	20.65	1.11	0.90	39.44	0.64
4700.0	7.95	14.35	7.74	19.09	1.13	0.89	39.67	1.30
4900.0	7.58	14.06	7.38	18.59	1.13	0.90	40.58	1.38
5100.0	7.45	13.61	7.05	18.22	1.10	0.89	40.36	1.13
5300.0	7.17	13.31	6.83	17.90	1.09	0.89	39.74	1.12
5400.0	7.01	13.16	6.71	17.14	1.09	0.89	40.48	1.18
5600.0	6.73	12.89	6.61	16.63	1.09	0.89	40.68	1.59
5800.0	6.43	12.65	6.42	15.85	1.08	0.89	40.32	1.37
6000.0	6.17	12.43	6.21	15.47	1.08	0.90	40.37	1.47
6200.0	5.86	12.22	5.90	14.67	1.07	0.90	40.63	1.35
6400.0	5.59	12.03	5.69	14.28	1.07	0.91	40.86	1.61
6600.0	5.29	11.86	5.45	13.43	1.07	0.91	41.12	1.63
6800.0	4.98	11.75	5.23	13.14	1.07	0.92	40.73	2.17
7000.0	4.53	11.74	5.35	12.24	1.11	0.92	40.63	1.78

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 = 3V, Rbias=681 ohms, Id=56 mA @ Temperature = +85degC

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dB)
50.0	25.62	31.37	9.83	11.69	1.09	0.74	31.90	1.30
100.0	25.62	30.69	9.65	16.37	1.06	0.77	31.80	1.90
300.0	24.47	29.65	8.69	21.43	1.03	0.85	32.52	0.71
500.0	22.84	28.27	7.69	22.88	1.01	0.91	32.65	0.71
600.0	22.01	27.68	7.36	23.29	1.01	0.94	33.50	0.77
800.0	20.41	26.59	6.88	23.60	1.03	0.98	34.08	0.78
1000.0	19.00	25.57	6.59	23.92	1.05	1.00	34.42	0.77
1200.0	17.73	24.59	6.34	23.58	1.07	1.02	35.40	0.98
1400.0	16.62	23.72	6.21	23.47	1.08	1.03	35.39	1.00
1600.0	15.60	22.88	6.06	22.95	1.09	1.04	35.85	1.33
1700.0	15.12	22.48	5.99	23.00	1.10	1.05	36.16	1.18
1900.0	14.29	21.71	5.99	22.80	1.10	1.05	36.46	1.07
2100.0	13.51	21.01	5.92	22.60	1.11	1.05	36.78	1.14
2300.0	12.83	20.37	5.95	22.67	1.11	1.05	37.08	1.23
2500.0	12.13	19.82	6.18	23.57	1.14	1.05	37.11	1.30
2700.0	11.41	19.32	5.90	21.87	1.14	1.07	37.19	1.58
2900.0	11.01	18.60	6.09	22.81	1.13	1.05	37.81	1.48
3000.0	10.75	18.33	6.19	23.07	1.13	1.04	38.16	1.47
3200.0	10.26	17.83	6.28	23.28	1.14	1.04	37.98	1.47
3400.0	9.81	17.36	6.52	24.04	1.15	1.03	38.12	1.47
3600.0	9.40	16.85	6.69	23.86	1.15	1.01	38.28	1.66
3800.0	9.01	16.38	6.85	23.93	1.15	1.01	38.23	1.77
4000.0	8.64	15.98	7.07	23.68	1.16	1.00	38.44	1.79
4100.0	8.41	15.81	7.11	22.99	1.17	0.99	38.25	1.93
4300.0	7.98	15.48	7.26	22.28	1.18	0.99	37.72	1.86
4500.0	7.65	15.07	7.46	21.77	1.19	0.98	38.95	1.90
4700.0	7.20	14.84	7.71	20.77	1.22	0.97	38.46	2.13
4900.0	6.95	14.42	7.29	20.62	1.19	0.97	39.83	2.18
5100.0	6.74	14.04	7.04	20.23	1.17	0.97	39.78	2.16
5300.0	6.46	13.71	6.85	19.54	1.16	0.97	39.74	2.24
5400.0	6.33	13.56	6.81	19.30	1.15	0.97	39.80	2.27
5600.0	6.04	13.28	6.67	18.28	1.15	0.97	39.73	2.55
5800.0	5.74	13.05	6.43	17.40	1.15	0.98	40.22	2.47
6000.0	5.45	12.79	6.23	16.52	1.14	0.98	39.96	2.65
6200.0	5.16	12.61	6.00	16.03	1.14	0.99	40.20	2.62
6400.0	4.89	12.43	5.79	15.50	1.13	0.99	40.25	2.71
6600.0	4.57	12.26	5.61	14.76	1.14	1.00	39.59	2.80
6800.0	4.23	12.18	5.46	14.19	1.15	1.00	40.34	3.19
7000.0	3.76	12.19	5.72	13.33	1.21	0.99	41.07	3.27

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 = 3V, Id=40mA @ Temperature = +25degC (1)

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output (2)		FREQ	Noise Figure
								Current Limit 70mA	Current Limit 80mA		
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)		(MHz)	(dB)
50.0	25.04	30.64	10.27	10.94	1.09	0.70	29.36	19.42	19.50	50.0	1.02
100.0	25.02	30.24	10.20	15.66	1.08	0.76	29.45	19.01	19.10	100.0	0.74
300.0	24.04	29.05	8.95	21.17	1.03	0.82	29.85	19.08	19.16	400.0	0.64
500.0	22.59	27.97	7.82	23.62	1.02	0.90	30.42	19.15	19.23	600.0	0.66
600.0	21.82	27.37	7.38	24.57	1.01	0.93	30.80	19.22	19.30	800.0	0.73
800.0	20.32	26.35	6.77	25.94	1.02	0.98	31.43	19.18	19.27	1100.0	0.79
1000.0	18.95	25.42	6.40	26.46	1.04	1.01	31.69	19.14	19.23	1300.0	0.84
1200.0	17.71	24.49	6.14	26.14	1.05	1.03	32.80	19.34	19.42	1600.0	0.91
1400.0	16.61	23.64	5.96	25.71	1.06	1.05	32.51	19.48	19.56	1800.0	1.04
1600.0	15.63	22.83	5.84	25.07	1.07	1.06	33.04	19.19	19.27	2000.0	0.86
1700.0	15.17	22.45	5.78	24.93	1.08	1.06	33.82	19.34	19.42	2300.0	0.97
1900.0	14.34	21.73	5.75	24.28	1.09	1.06	33.16	19.31	19.39	2500.0	0.99
2100.0	13.59	21.01	5.74	24.23	1.09	1.06	32.84	19.54	19.61	2700.0	1.54
2300.0	12.92	20.33	5.76	24.37	1.09	1.06	33.46	19.59	19.68	3000.0	1.11
2500.0	12.31	19.68	5.87	24.60	1.10	1.05	33.85	19.62	19.71	3200.0	1.17
2700.0	11.44	19.36	5.72	22.78	1.12	1.09	33.87	19.63	19.70	3400.0	1.31
2900.0	11.20	18.52	5.91	23.65	1.10	1.05	34.01	19.64	19.73	3700.0	1.24
3000.0	10.97	18.24	5.99	23.82	1.10	1.04	34.31	19.62	19.71	3900.0	1.39
3200.0	10.53	17.71	6.12	24.04	1.10	1.03	33.96	19.72	19.80	4100.0	1.57
3400.0	10.10	17.15	6.27	24.09	1.10	1.02	35.06	19.62	19.71	4400.0	1.60
3600.0	9.71	16.67	6.39	24.04	1.10	1.01	34.88	19.79	19.87	4600.0	1.64
3800.0	9.32	16.21	6.53	23.80	1.10	1.00	34.79	19.74	19.83	4900.0	2.01
4000.0	8.94	15.79	6.60	23.11	1.10	0.99	33.95	19.88	19.97	5100.0	1.75
4100.0	8.74	15.60	6.63	22.59	1.10	0.99	34.68	19.82	19.91	5300.0	1.76
4300.0	8.34	15.25	6.59	21.24	1.10	0.99	33.55	19.92	19.99	5600.0	1.88
4500.0	8.01	14.88	6.56	20.24	1.10	0.98	34.89	19.77	19.86	5800.0	2.06
4700.0	7.65	14.57	6.64	19.32	1.12	0.97	34.46	20.08	20.17	6000.0	2.19
4900.0	7.11	14.40	6.91	18.34	1.16	0.97	34.84	20.11	20.19	6400.0	2.26
5100.0	7.01	13.89	6.14	18.17	1.09	0.98	34.68	20.18	20.27	6600.0	2.49
5300.0	6.74	13.58	5.92	17.45	1.08	0.98	35.34	20.19	20.30	6800.0	2.70
5400.0	6.60	13.42	5.84	17.10	1.08	0.98	34.10	20.42	20.48	7000.0	2.90
5600.0	6.30	13.16	5.67	16.44	1.07	0.98	34.97	20.40	20.48		
5800.0	6.01	12.92	5.49	15.81	1.07	0.98	36.20	20.20	20.26		
6000.0	5.70	12.72	5.38	15.25	1.07	0.99	35.53	20.05	20.13		
6200.0	5.43	12.49	5.16	14.76	1.06	0.99	34.63	20.14	20.23		
6400.0	5.16	12.26	4.98	14.29	1.05	1.00	35.17	20.14	20.23		
6600.0	4.88	12.09	4.83	13.83	1.05	1.00	35.99	20.35	20.43		
6800.0	4.59	11.93	4.71	13.43	1.06	1.00	34.91	20.25	20.33		
7000.0	4.23	11.86	4.68	12.89	1.08	1.00	34.78	20.43	20.52		

(1) External Rbias resistor is adjusted to obtain desired current

(2) Current is externally limited during P1dB measurements. Unit is capable of higher output power if current is not limited.

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 = 3V, Id=60mA @ Temperature = +25degC (1)

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output (2)		FREQ	Noise Figure
								Current Limit 70mA	Current Limit 80mA		
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)		(MHz)	(dB)
50.0	25.84	31.27	10.85	12.05	1.07	0.73	32.14	19.42	19.50	50.0	1.00
100.0	25.71	30.72	11.23	17.28	1.07	0.76	32.28	19.01	19.10	100.0	0.74
300.0	24.61	29.59	9.57	24.26	1.05	0.81	32.83	19.08	19.16	400.0	0.61
500.0	23.07	28.57	8.18	25.73	1.05	0.88	33.45	19.15	19.23	600.0	0.66
600.0	22.26	27.93	7.68	25.65	1.04	0.91	33.88	19.22	19.30	800.0	0.70
800.0	20.71	26.75	7.02	25.09	1.05	0.95	34.54	19.18	19.27	1100.0	0.78
1000.0	19.31	25.74	6.60	24.22	1.06	0.98	35.20	19.14	19.23	1300.0	0.82
1200.0	18.05	24.75	6.33	23.42	1.07	1.00	35.99	19.34	19.42	1600.0	0.90
1400.0	16.93	23.83	6.14	22.81	1.08	1.01	35.87	19.48	19.56	1800.0	0.98
1600.0	15.94	22.95	6.02	22.28	1.09	1.02	36.19	19.19	19.27	2000.0	0.87
1700.0	15.48	22.49	5.96	22.13	1.09	1.02	36.22	19.34	19.42	2300.0	1.00
1900.0	14.64	21.71	5.93	21.75	1.09	1.02	36.25	19.31	19.39	2500.0	1.05
2100.0	13.89	20.96	5.92	21.70	1.09	1.02	36.63	19.54	19.61	2700.0	1.53
2300.0	13.21	20.25	5.95	21.89	1.09	1.02	37.19	19.59	19.68	3000.0	1.09
2500.0	12.59	19.59	6.06	22.21	1.09	1.01	36.86	19.62	19.71	3200.0	1.04
2700.0	11.72	19.29	5.91	21.38	1.12	1.05	37.28	19.63	19.70	3400.0	1.27
2900.0	11.47	18.41	6.09	21.68	1.09	1.00	37.35	19.64	19.73	3700.0	1.24
3000.0	11.24	18.09	6.18	21.87	1.09	1.00	37.53	19.62	19.71	3900.0	1.40
3200.0	10.79	17.55	6.32	22.20	1.09	0.99	37.73	19.72	19.80	4100.0	1.41
3400.0	10.36	17.02	6.47	22.45	1.09	0.98	37.66	19.62	19.71	4400.0	1.59
3600.0	9.97	16.52	6.60	22.51	1.09	0.97	37.54	19.79	19.87	4600.0	1.60
3800.0	9.57	16.05	6.73	22.42	1.09	0.96	37.76	19.74	19.83	4900.0	1.87
4000.0	9.18	15.63	6.81	21.98	1.09	0.95	38.42	19.88	19.97	5100.0	1.78
4100.0	8.99	15.43	6.83	21.57	1.09	0.95	37.91	19.82	19.91	5300.0	1.80
4300.0	8.59	15.09	6.79	20.39	1.09	0.95	38.32	19.92	19.99	5600.0	2.18
4500.0	8.25	14.73	6.76	19.41	1.10	0.94	37.97	19.77	19.86	5800.0	2.04
4700.0	7.89	14.41	6.84	18.54	1.11	0.93	39.10	20.08	20.17	6000.0	2.16
4900.0	7.34	14.25	7.09	17.53	1.15	0.93	38.58	20.11	20.19	6400.0	2.17
5100.0	7.24	13.71	6.32	17.38	1.08	0.93	39.00	20.18	20.27	6600.0	2.50
5300.0	6.97	13.41	6.09	16.76	1.07	0.94	38.70	20.19	20.30	6800.0	2.57
5400.0	6.82	13.28	6.00	16.43	1.07	0.94	39.49	20.42	20.48	7000.0	3.00
5600.0	6.53	13.01	5.83	15.79	1.07	0.94	39.05	20.40	20.48		
5800.0	6.23	12.77	5.64	15.20	1.06	0.94	37.76	20.20	20.26		
6000.0	5.92	12.56	5.52	14.69	1.06	0.94	38.39	20.05	20.13		
6200.0	5.65	12.33	5.30	14.20	1.05	0.95	39.65	20.14	20.23		
6400.0	5.38	12.11	5.12	13.77	1.05	0.95	38.93	20.14	20.23		
6600.0	5.10	11.94	4.96	13.33	1.05	0.95	38.41	20.35	20.43		
6800.0	4.80	11.81	4.84	12.93	1.05	0.96	38.83	20.25	20.33		
7000.0	4.44	11.73	4.81	12.40	1.07	0.96	40.47	20.43	20.52		

(1) External Rbias resistor is adjusted to obtain desired current

(2) Current is externally limited during P1dB measurements. Unit is capable of higher output power if current is not limited.

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 = 3V, Id=74mA @ Temperature = +25degC (1)

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output (2)		FREQ	Noise Figure
								Current Limit 70mA	Current Limit 80mA		
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)		(MHz)	(dB)
50.0	26.23	32.45	11.22	12.41	1.13	0.78	33.92	19.42	19.50	50.0	1.01
100.0	26.05	30.99	11.81	17.65	1.07	0.75	34.02	19.01	19.10	100.0	0.73
300.0	24.89	30.07	9.91	24.02	1.07	0.81	34.24	19.08	19.16	400.0	0.60
500.0	23.31	28.87	8.38	24.72	1.06	0.87	34.71	19.15	19.23	600.0	0.66
600.0	22.49	28.25	7.84	24.44	1.06	0.90	35.11	19.22	19.30	800.0	0.71
800.0	20.92	27.02	7.14	23.72	1.07	0.94	35.46	19.18	19.27	1100.0	0.77
1000.0	19.50	25.95	6.72	22.91	1.08	0.96	35.86	19.14	19.23	1300.0	0.84
1200.0	18.23	24.87	6.44	22.20	1.08	0.98	35.93	19.34	19.42	1600.0	0.91
1400.0	17.10	23.85	6.24	21.69	1.08	0.99	36.16	19.48	19.56	1800.0	1.03
1600.0	16.11	22.98	6.13	21.24	1.09	1.00	35.90	19.19	19.27	2000.0	0.89
1700.0	15.64	22.54	6.07	21.14	1.09	1.00	35.33	19.34	19.42	2300.0	0.95
1900.0	14.80	21.75	6.02	20.85	1.09	1.00	36.07	19.31	19.39	2500.0	1.07
2100.0	14.05	20.97	6.02	20.83	1.09	1.00	36.31	19.54	19.61	2700.0	1.50
2300.0	13.37	20.25	6.05	21.04	1.09	1.00	36.48	19.59	19.68	3000.0	1.11
2500.0	12.75	19.58	6.17	21.35	1.09	0.99	36.01	19.62	19.71	3200.0	1.21
2700.0	11.86	19.25	6.01	20.85	1.12	1.03	36.32	19.63	19.70	3400.0	1.14
2900.0	11.62	18.37	6.20	20.95	1.09	0.98	36.69	19.64	19.73	3700.0	1.32
3000.0	11.39	18.07	6.29	21.18	1.09	0.98	36.51	19.62	19.71	3900.0	1.40
3200.0	10.94	17.49	6.43	21.53	1.08	0.97	36.70	19.72	19.80	4100.0	1.32
3400.0	10.51	16.96	6.58	21.81	1.08	0.95	35.90	19.62	19.71	4400.0	1.58
3600.0	10.11	16.45	6.72	21.94	1.08	0.94	35.92	19.79	19.87	4600.0	1.62
3800.0	9.71	16.00	6.86	21.95	1.08	0.93	36.27	19.74	19.83	4900.0	1.99
4000.0	9.32	15.58	6.92	21.54	1.09	0.93	37.11	19.88	19.97	5100.0	1.80
4100.0	9.12	15.39	6.94	21.20	1.09	0.93	36.11	19.82	19.91	5300.0	1.89
4300.0	8.72	15.03	6.91	20.13	1.09	0.93	37.20	19.92	19.99	5600.0	2.20
4500.0	8.39	14.66	6.87	19.18	1.09	0.92	36.06	19.77	19.86	5800.0	2.19
4700.0	8.02	14.35	6.95	18.30	1.10	0.91	36.45	20.08	20.17	6000.0	2.23
4900.0	7.48	14.18	7.20	17.26	1.14	0.91	36.50	20.11	20.19	6400.0	2.42
5100.0	7.37	13.67	6.41	17.11	1.08	0.91	37.01	20.18	20.27	6600.0	2.54
5300.0	7.10	13.36	6.18	16.52	1.07	0.92	36.21	20.19	20.30	6800.0	2.55
5400.0	6.95	13.22	6.10	16.19	1.07	0.91	37.49	20.42	20.48	7000.0	2.91
5600.0	6.65	12.96	5.91	15.58	1.06	0.92	36.51	20.40	20.48		
5800.0	6.36	12.72	5.72	15.02	1.06	0.92	35.34	20.20	20.26		
6000.0	6.05	12.50	5.61	14.50	1.06	0.92	35.99	20.05	20.13		
6200.0	5.78	12.28	5.39	14.04	1.05	0.93	36.73	20.14	20.23		
6400.0	5.51	12.07	5.20	13.59	1.05	0.93	36.02	20.14	20.23		
6600.0	5.22	11.89	5.05	13.15	1.05	0.93	35.69	20.35	20.43		
6800.0	4.93	11.75	4.91	12.76	1.05	0.94	36.26	20.25	20.33		
7000.0	4.57	11.68	4.88	12.23	1.07	0.94	36.78	20.43	20.52		

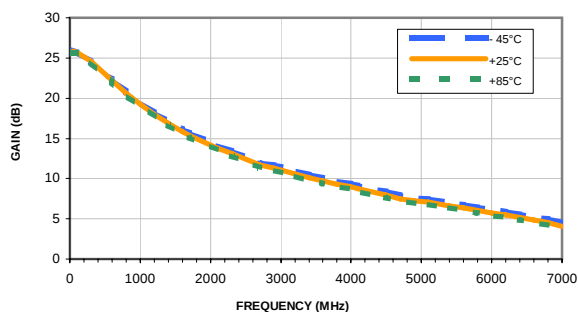
(1) External Rbias resistor is adjusted to obtain desired current

(2) Current is externally limited during P1dB measurements. Unit is capable of higher output power if current is not limited.

Typical Performance Curves

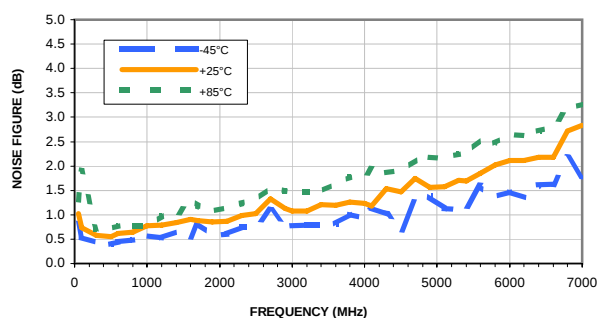
GAIN vs. FREQUENCY & TEMPERATURE

Vd = 3V, Rbias=681 ohms



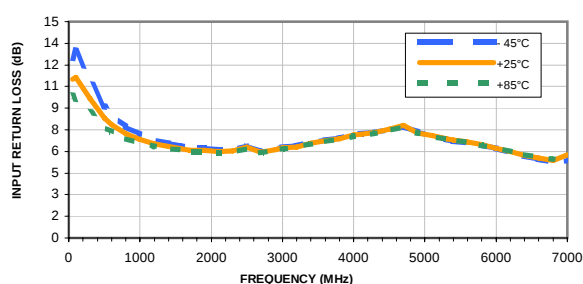
NOISE FIGURE vs. FREQUENCY & TEMPERATURE

Vd = 3V, Rbias=681 ohms



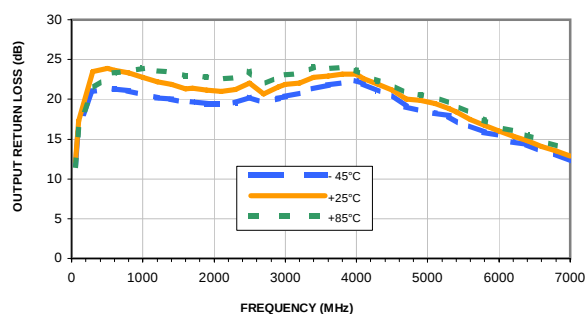
INPUT RETURN LOSS vs. FREQUENCY & TEMPERATURE

Vd = 3V, Rbias=681 ohms



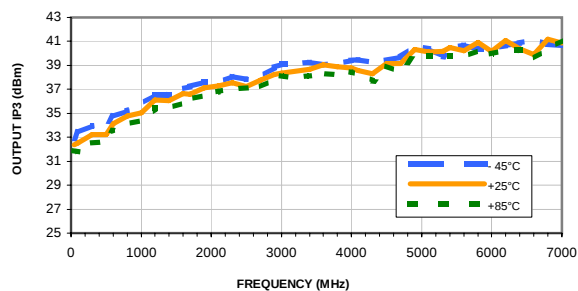
OUTPUT RETURN LOSS vs. FREQUENCY & TEMPERATURE

Vd = 3V, Rbias=681 ohms



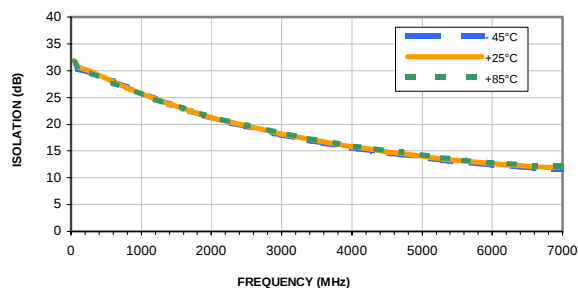
OUTPUT IP3 vs. FREQUENCY & TEMPERATURE

Vd = 3V, Rbias=681 ohms

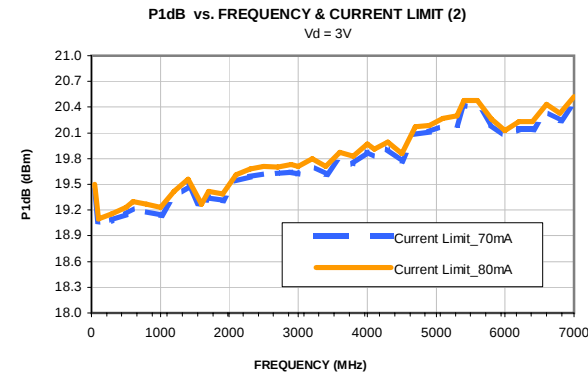
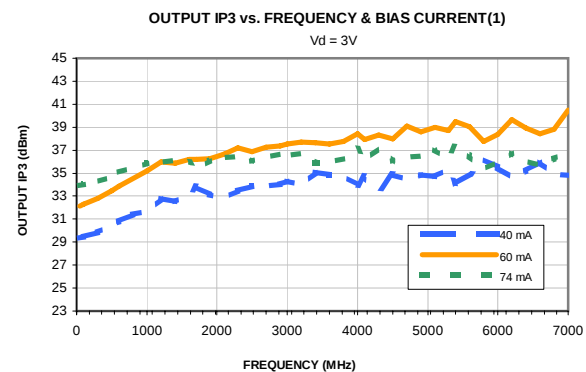
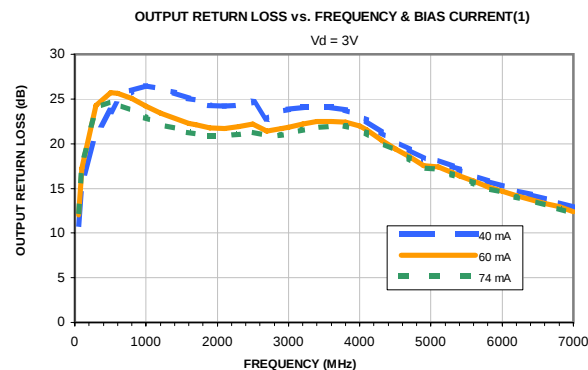
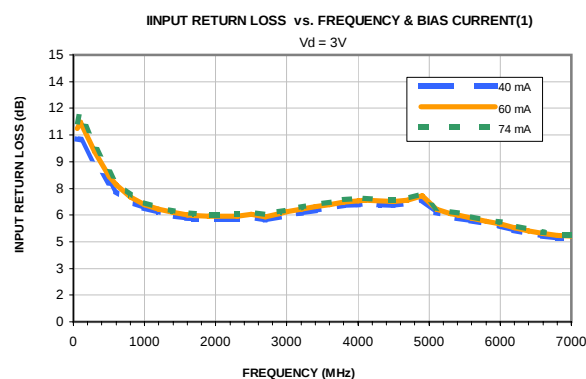
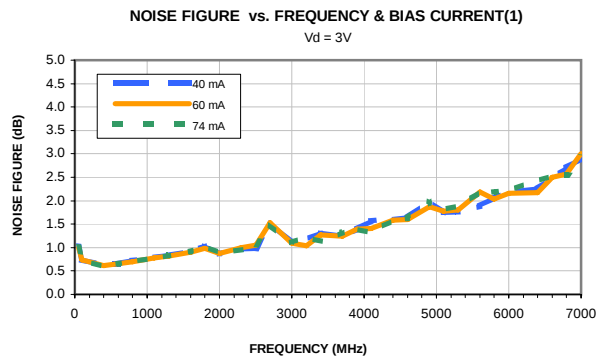
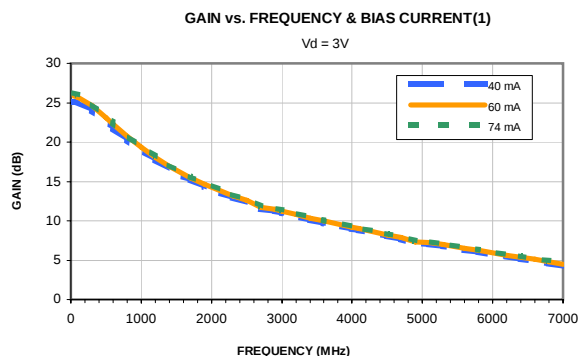


ISOLATION vs. FREQUENCY & TEMPERATURE

Vd = 3V, Rbias=681 ohms



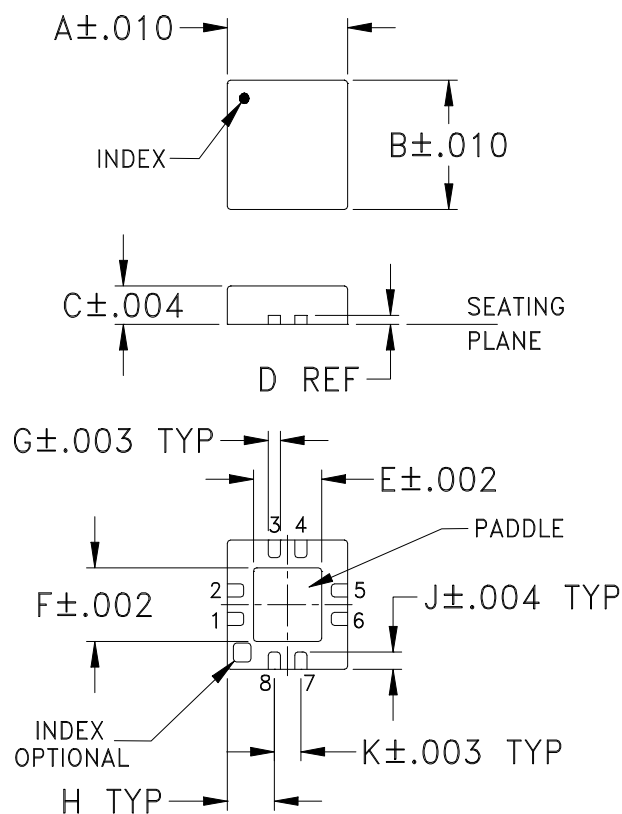
Typical Performance Curves



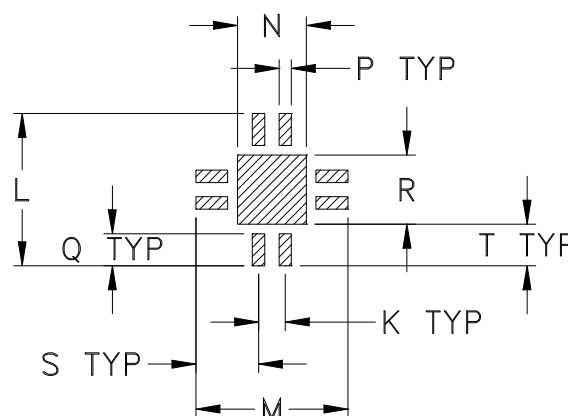
(1) External Rbias resistor is adjusted to obtain desired current

(2) Current is externally limited during P1dB measurements. Unit is capable of higher output power if current is not limited.

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
DQ849	.118 (3.00)	.118 (3.00)	.035 (0.89)	.008 (0.20)	.067 (1.70)	.067 (1.70)	.012 (0.30)	.046 (1.17)	.016 (0.41)	.026 (0.66)	.148 (3.76)	.148 (3.76)	.067 (1.70)

CASE #	P	Q	R	S	T	WT. GRAM
DQ849	.012 (0.30)	.031 (0.79)	.067 (1.70)	.061 (1.55)	.041 (1.04)	.02

Dimensions are in inches (mm). Tolerances: 2Pl. $\pm.01$; 3 Pl. $\pm.004$

Notes:

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



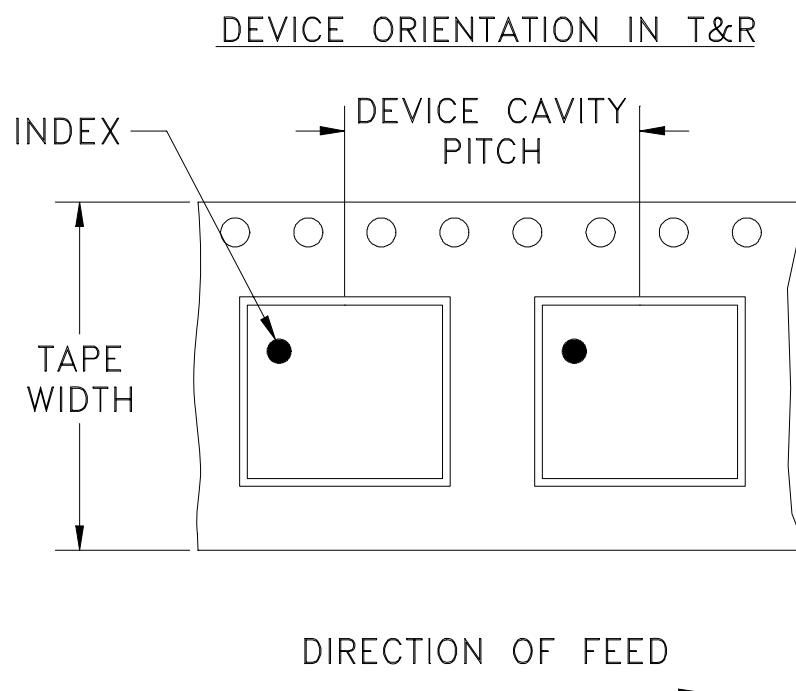
INTERNET <http://www.minicircuits.com>

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

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Tape & Reel Packaging TR-F104



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

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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REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M121752	NEW RELEASE	03/05/09	PW	TH
A	M129864	ADDED DIMENSIONS	12/14/10	MMG	MM
B	M137913	REMOVED COMPONENT VALUES	07/10/12	GF	DJ

Top view of the PCB layout for the 100MHz 100V 100W GaN HEMT. The layout shows the package outline, PIN 1, and various components including capacitors C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43, C44, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C58, C59, C60, C61, C62, C63, C64, C65, C66, C67, C68, C69, C70, C71, C72, C73, C74, C75, C76, C77, C78, C79, C80, C81, C82, C83, C84, C85, C86, C87, C88, C89, C90, C91, C92, C93, C94, C95, C96, C97, C98, C99, C100. Dimensions are given in inches. The layout includes a 45-degree angle and a 0.044 inch trace width. The package outline is shown in blue, and the components are shown in red. The layout is labeled with dimensions and component values.

NOTES:

1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .020" ± .0015"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. R1, L1 AND C1 FOOTPRINTS SHOWN FOR REFERENCE ONLY.
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 TOLERANCES ON: 2 PL DECIMALS ± 3 PL DECIMALS ± .005 ANGLES ± 1° FRACTIONS ±	DRAWN	PW	02/28/09
	CHECKED	IL	03/04/09
	APPROVED	TH	03/05/09

11

Mini-Circuits® 13 Neptune Avenue
Brooklyn NY 11235

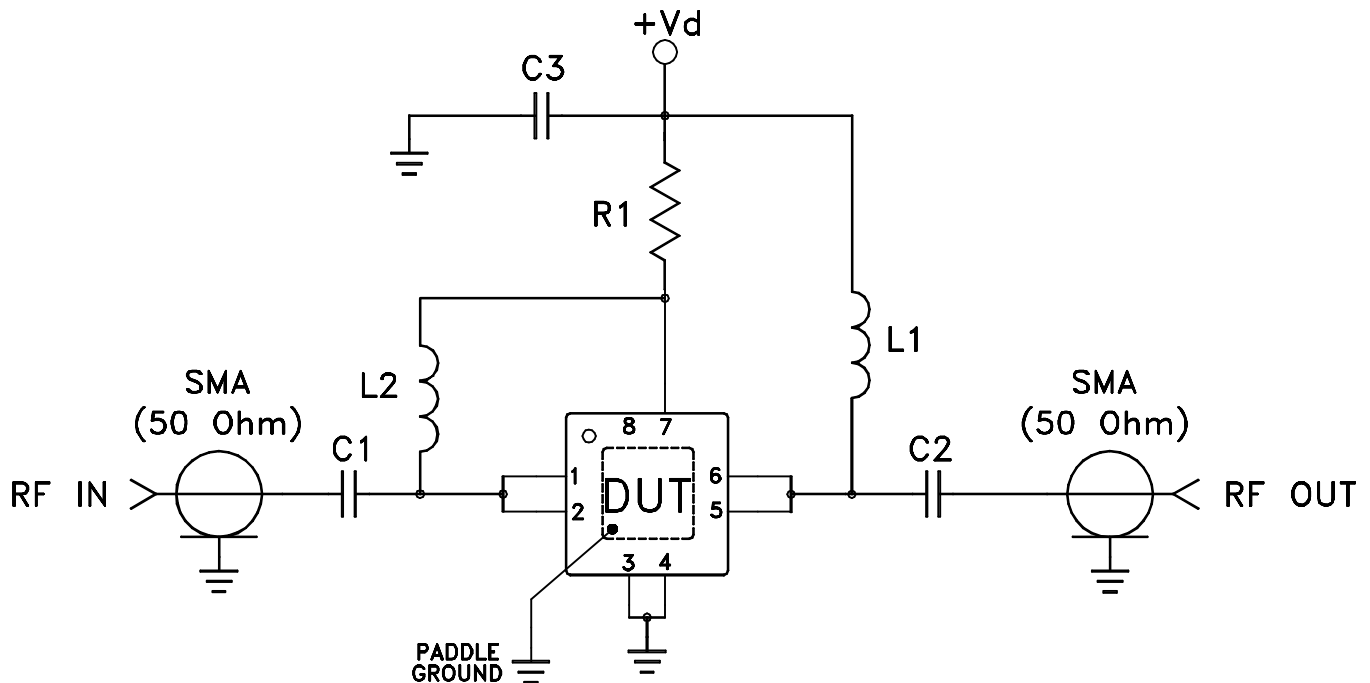
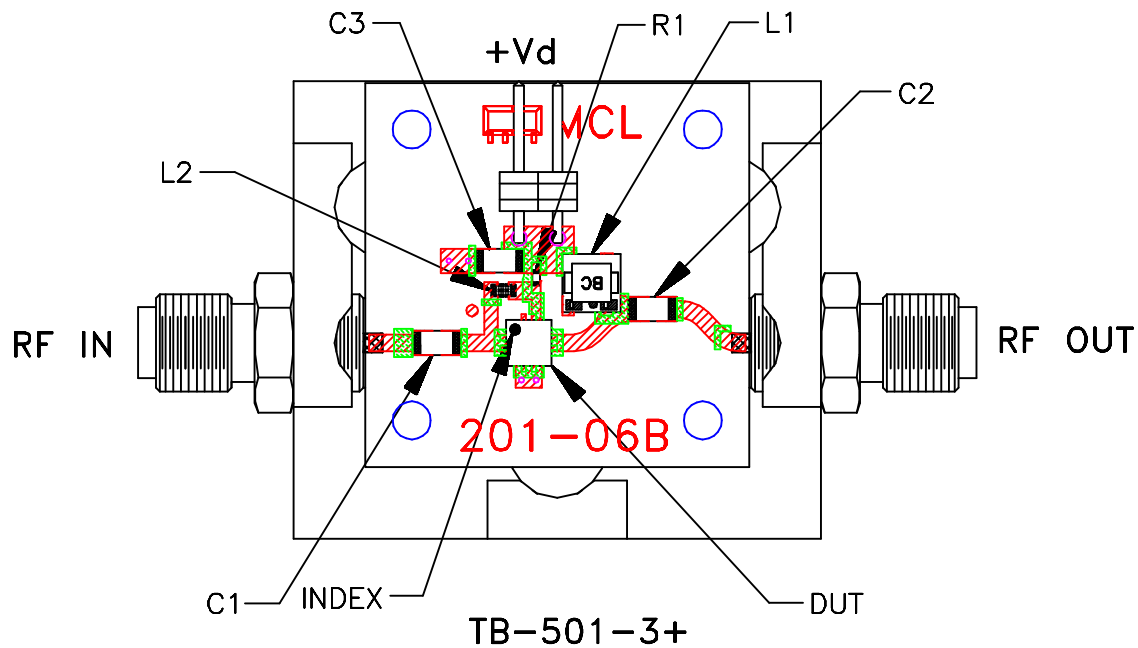
PL, 08AM01, DQ849, TB-501(-X)+

SIZE A	CODE IDENT 15542	DRAWING NO: 98-PL-299		REV: B
FILE: 98PL299		SCALE: 8:1	SHEET: 1 OF 1	

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

Evaluation Board and Circuit



COMPONENT	VALUE/PART NUMBER
DUT	Mini-Circuits PMA-5453+
C1, C2, C3	0.1 uF
L1	Mini-Circuits TCCH-80+
L2	390 nH
R1	681 Ohm

Notes:

- 50 Ohm SMA Female connectors.
- PCB Material: R04350 or equivalent,
Dielectric Constant=3.5, Thickness=.020 inch.

Schematic Diagram

 **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 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



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	