

Low Noise, High IP3

# Monolithic Amplifier

PSA-5451+

50Ω      0.05 to 4 GHz



CASE STYLE: CA1389

## The Big Deal

- Ultra Low Noise Figure, 0.7 dB
- High IP3/Low Current, 30mA at 3V
- Wideband, up to 4 GHz

## Product Overview

Mini-Circuits PSA-5451+ is a E-PHEMT based Ultra-Low Noise MMIC Amplifier operating from 50 MHz to 4 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 30mA and is internally matched to 50 ohms.

## Key Features

Feature	Advantages
Ultra Low Noise, 0.7 dB	Outstanding Noise Figure, measured in a 50 Ohm environment without any external matching
High IP3, 29 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, 30mA	At only 30mA, the PSA-5451+ 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 PSA-5451+ 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
SOT-363 Package	Small size, industry standard package
Max Input Power, +15dBm	Ruggedized design operates up to input powers of +15dBm without the need of an external limiter
High Reliability	Low, small signal operating current of 30 mA nominal maintains junction temperatures typically below 100°C at 85°C ground lead temperature

### Notes

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Low Noise, High IP3

# Monolithic Amplifier

PSA-5451+

50Ω 0.05 to 4 GHz

## Product Features

- Single Positive Supply Voltage, +3V, Id=30mA
- Ultra Low Noise Figure, 0.7 dB typ. at 0.5GHz
- High IP3, 29 dBm typ. 1GHz
- Gain, 18.8 dB typ. at 1GHz
- Output Power, up to +16.7 dBm typ.
- Micro-miniature size SOT-363 package
- Aqueous washable



Generic photo used for illustration purposes only

CASE STYLE: CA1389

## Typical Applications

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

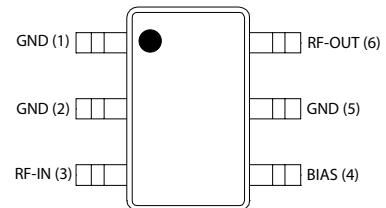
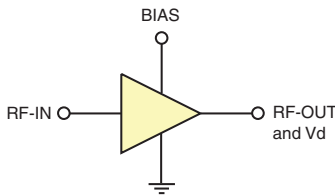
**+RoHS Compliant**

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

## General Description

PSA-5451+ is an advanced wideband, 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 pin description



Function	Pin Number	Description (See Application Circuit, Fig. 3)
RF IN	3	RF input pin (connect to RF-IN via blocking cap C1 and Pin 4 via L2)
RF-OUT & Vd	6	RF output pin (connected to RF-out via blocking cap C2 and supply voltage Vd via RF Choke L1)
BIAS	4	Connected to Vs via Rbias. (Connect to ground via C4 & R1)
GND	1,2,5	Connections to ground

\* Enhancement mode pseudomorphic High Electron Mobility Transistor.

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M151107  
PSA-5451+  
TH/RS/CP/AM  
200428  
Page 2 of 6

**Electrical Specifications<sup>(1)</sup> at 25°C, Zo=50Ω, (refer to characterization circuit, Fig. 1)**

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		0.05		4.0	GHz
DC Voltage (V <sub>d</sub> )			3.0		V
DC Current (I <sub>d</sub> ) <sup>(6)</sup>		20	30	40	mA
DC Current (I <sub>Rbias</sub> )			1.6		mA
Noise Figure	0.05		2.1	—	dB
	0.5		0.7	—	
	1.0		0.8	—	
	2.0		1.0	1.3	
	3.0		1.3	—	
	4.0		1.5	—	
Gain	0.05	—	22.6	—	dB
	0.5	—	22.3	—	
	1.0	—	18.8	—	
	2.0	12.6	14.0	15.4	
	3.0	—	11.3	—	
	4.0	—	9.6	—	
Input Return Loss	0.05-0.5		8.8		dB
	0.5-4.0		6.5		
Output Return Loss	0.05-0.5		8.3		dB
	0.5-1.0		17.0		
	1.0-4.0		20.0		
Output IP3	0.05		26.3		dBm
	0.5		28.3		
	1.0		29.1		
	2.0		30.2		
	3.0		30.1		
	4.0		29.8		
Output Power @ 1 dB compression (P1dB) <sup>(2)</sup>	0.05		10.5		dBm
	0.5		16.7		
	1.0		16.8		
	2.0		16.2		
	3.0		16.2		
	4.0		16.7		
DC Current Variation vs. Temperature <sup>(3)</sup>			-0.05		mA/°C
Thermal Resistance			165		°C/W

**Absolute Maximum Ratings<sup>(4)</sup>**

Parameter	Ratings
Operating Temperature <sup>(5)</sup>	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Channel Temperature	150°C
DC Voltage (Pin 6)	5V
Power Dissipation	390 mW
DC Current (Pin 6)	80mA
Bias Current (Pin 4)	10mA
Input Power (CW) <sup>(7)</sup>	15dBm

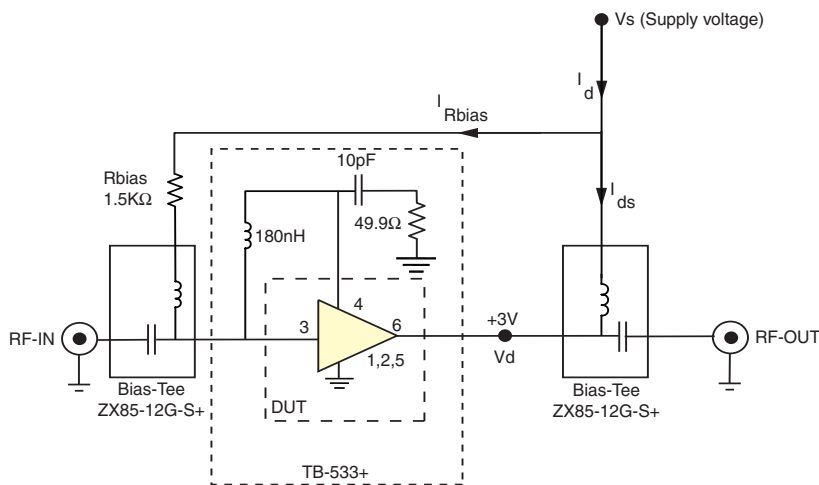
- <sup>(1)</sup> Measured on Mini-Circuits Characterization test board TB-533+. See Characterization Test Circuit (Fig. 1)
- <sup>(2)</sup> P1dB specified with external current limiting of 40 mA; Capable of higher P1dB at higher current (see Fig.2)
- <sup>(3)</sup> (Current at 85°C - Current at -45°C)/130
- <sup>(4)</sup> Permanent damage may occur if any of these limits are exceeded. These maximum ratings are not intended for continuous normal operation.
- <sup>(5)</sup> Defined with reference to ground pad temperature.
- <sup>(6)</sup> 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.
- <sup>(7)</sup> Maximum input power is specified based upon external Vd current limiting of 60 mA. Maximum input power will degrade without external current limiting.

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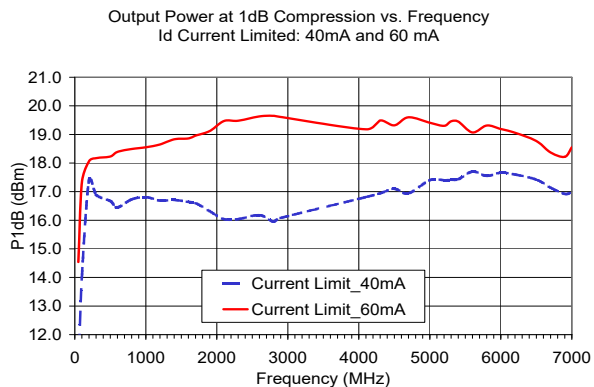
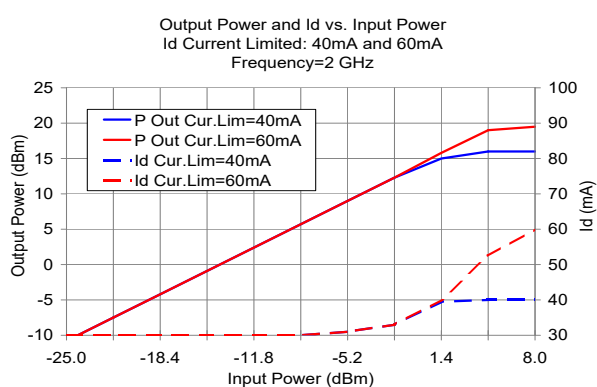
Characterization Test Circuit



**Fig 1.** Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization Test Board TB-533+) Gain, 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: Pin= -25dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 0 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-533+. See Characterization Test Circuit (Fig. 1) Measurements performed with current (Id) limited as noted.

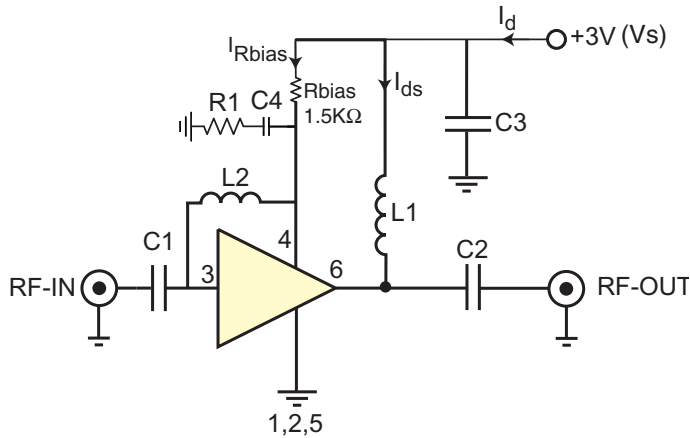
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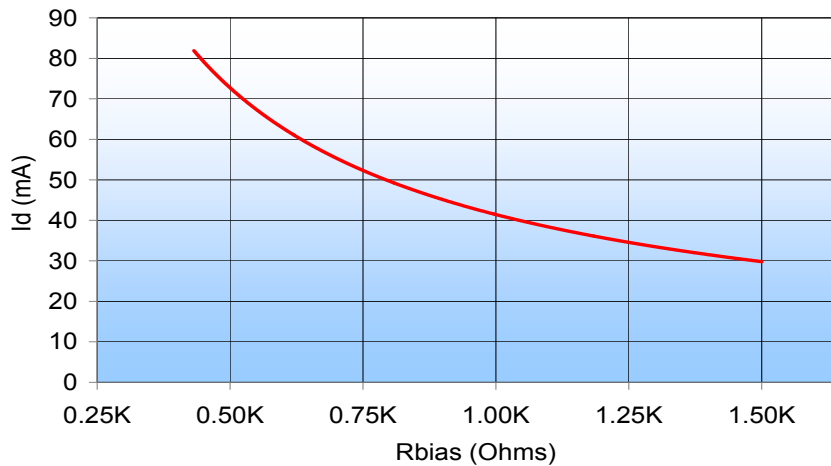
**Recommended Application Circuit**

(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  $R_{bias}$   
 ( $V_s = 3V$ )



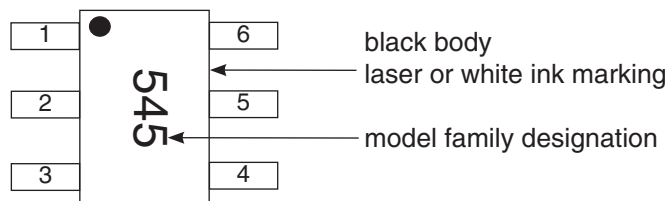
**Fig 4.**  $I_d$  varies as a function of  $R_{bias}$ . The  $I_d$  current range is defined based upon the specific  $R_{bias}$  value noted in the Application Circuit (Fig 3).  $R_{bias}$  may be adjusted to optimize  $I_d$  for a customers' application. RF performance will vary accordingly.

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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](http://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:** CA1389

Plastic molded SOT-363 package, lead finish: matte tin

**Tape & Reel:** F101

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

**Suggested Layout for PCB Design:** PL-311

**Evaluation Board:** TB-534-1+

**Environmental Ratings:** ENV08T2

**ESD Rating**

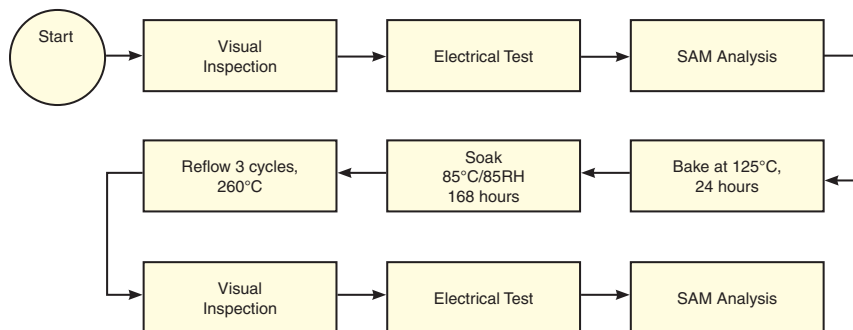
Human Body Model (HBM): Class 1A (250 to <500V) in accordance with ANSI/ESD STM 5.1 - 2001

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=1.5K ohms, Id=30 mA @ Temperature = +25degC

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	Noise Figure	FREQ	1dB Comp. Output (1)	
					K	Measure				Current Limit 40mA	Current Limit 60mA
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dB)	(MHz)	(dBm)	
50.0	22.59	31.62	12.50	8.36	1.40	0.72	26.86	2.00	50.0	10.70	14.54
100.0	23.90	30.16	10.81	11.22	1.16	0.72	26.59	1.13	100.0	14.00	17.31
200.0	24.17	28.93	9.49	14.25	1.03	0.74	27.75	0.74	200.0	17.40	18.06
300.0	23.75	28.38	8.50	15.56	0.98	0.80	28.03	0.70	300.0	16.89	18.17
500.0	22.40	27.41	7.10	16.99	0.93	0.92	28.04	0.66	500.0	16.67	18.23
600.0	21.67	26.99	6.63	17.55	0.92	0.97	28.72	0.68	600.0	16.45	18.39
800.0	20.23	26.18	6.02	18.24	0.92	1.04	29.44	0.71	800.0	16.73	18.49
1000.0	18.91	25.45	5.69	18.73	0.94	1.09	29.23	0.77	1000.0	16.81	18.55
1200.0	17.72	24.74	5.51	19.04	0.96	1.12	29.72	0.83	1200.0	16.69	18.65
1400.0	16.67	24.02	5.42	19.33	0.98	1.13	29.48	0.89	1400.0	16.71	18.83
1600.0	15.73	23.41	5.43	19.54	1.01	1.14	29.74	0.96	1600.0	16.64	18.86
1700.0	15.31	23.04	5.44	19.56	1.02	1.14	29.51	0.97	1700.0	16.60	18.96
1900.0	14.53	22.41	5.52	19.63	1.03	1.14	29.96	1.01	1900.0	16.32	19.12
2100.0	13.82	21.78	5.67	19.50	1.05	1.14	30.09	0.96	2100.0	16.04	19.47
2300.0	13.20	21.10	5.82	19.28	1.05	1.13	30.05	1.05	2300.0	16.04	19.48
2500.0	12.65	20.53	6.03	19.02	1.07	1.11	30.02	1.12	2600.0	16.18	19.63
2700.0	12.14	19.90	6.25	18.73	1.07	1.10	30.13	1.20	2800.0	15.95	19.65
2900.0	11.67	19.30	6.56	18.42	1.08	1.08	29.86	1.18	2900.0	16.08	19.61
3000.0	11.38	19.10	6.63	18.60	1.09	1.08	29.62	1.23	4100.0	16.81	19.18
3200.0	11.06	18.51	6.71	18.46	1.07	1.06	29.42	1.40	4300.0	16.94	19.49
3400.0	10.70	17.97	6.83	18.66	1.07	1.05	29.71	1.50	4500.0	17.10	19.32
3600.0	10.39	17.54	6.87	19.12	1.06	1.04	29.83	1.44	4700.0	16.94	19.60
3800.0	10.10	17.18	6.81	20.14	1.06	1.04	30.71	1.63	5000.0	17.40	19.41
4000.0	9.84	16.87	6.63	21.56	1.06	1.04	30.91	1.55	5200.0	17.40	19.30
4100.0	9.69	16.77	6.61	22.68	1.07	1.04	31.35	1.58	5300.0	17.41	19.46
4300.0	8.98	16.65	7.47	24.21	1.18	1.01	31.81	1.86	5400.0	17.43	19.45
4500.0	8.51	16.62	5.70	24.85	1.13	1.11	31.89	1.66	5600.0	17.70	19.07
4700.0	8.38	16.47	5.11	22.84	1.10	1.13	30.80	1.86	5800.0	17.55	19.31
4900.0	8.01	16.34	4.72	20.07	1.10	1.14	31.12	1.87	6000.0	17.66	19.19
5100.0	7.60	16.21	4.40	17.97	1.10	1.15	31.66	2.05	6200.0	17.60	19.06
5300.0	7.17	16.08	4.06	16.04	1.10	1.16	32.50	2.02	6500.0	17.42	18.77
5400.0	6.96	16.03	3.91	15.14	1.10	1.17	32.16	2.18	6700.0	17.14	18.37
5600.0	6.50	15.92	3.63	13.78	1.10	1.17	33.17	2.42	6900.0	16.92	18.22
5800.0	6.11	15.80	3.38	12.73	1.09	1.18	33.81	2.44	7000.0	16.98	18.55
6000.0	5.68	15.68	3.16	11.71	1.09	1.17	34.30	2.65			
6200.0	5.28	15.56	2.96	10.93	1.09	1.17	34.17	2.70			
6400.0	4.88	15.48	2.81	10.22	1.09	1.17	34.24	2.82			
6600.0	4.50	15.37	2.65	9.62	1.08	1.16	33.23	3.15			
6800.0	4.11	15.27	2.52	9.06	1.08	1.15	33.35	3.03			
7000.0	3.73	15.22	2.39	8.52	1.08	1.14	33.91	3.45			

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

# MMIC Amplifier

# PSA-5451+

## 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=1.5K ohms, Id=36 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	23.42	32.46	13.52	9.55	1.44	0.76	28.14	1.49
100.0	24.48	30.00	13.12	13.12	1.13	0.70	28.26	0.87
200.0	24.60	29.05	11.51	17.29	1.04	0.72	29.45	0.53
300.0	24.17	28.73	10.03	19.14	1.02	0.77	29.84	0.52
500.0	22.85	27.86	8.00	20.26	0.98	0.87	29.91	0.50
600.0	22.14	27.48	7.35	20.54	0.98	0.92	30.65	0.50
800.0	20.74	26.62	6.53	20.74	0.98	0.99	31.44	0.52
1000.0	19.44	25.82	6.08	20.73	0.99	1.03	31.36	0.52
1200.0	18.27	25.02	5.82	21.03	1.00	1.06	31.80	0.62
1400.0	17.23	24.27	5.69	21.24	1.02	1.08	31.55	0.66
1600.0	16.29	23.51	5.66	21.66	1.03	1.09	31.84	0.72
1700.0	15.87	23.14	5.65	21.88	1.03	1.09	31.61	0.69
1900.0	15.09	22.42	5.71	22.18	1.04	1.09	32.09	0.61
2100.0	14.39	21.70	5.91	22.29	1.05	1.08	32.24	0.71
2300.0	13.77	21.01	6.04	22.44	1.05	1.08	32.17	0.73
2500.0	13.21	20.33	6.22	22.25	1.05	1.06	32.07	0.80
2700.0	12.72	19.70	6.52	21.93	1.05	1.04	32.19	0.88
2900.0	12.26	19.09	6.86	21.11	1.06	1.02	31.84	0.95
3000.0	11.92	18.89	7.06	21.32	1.08	1.02	31.67	0.94
3200.0	11.65	18.25	6.99	21.23	1.05	1.01	31.47	0.89
3400.0	11.30	17.68	7.17	20.84	1.04	0.99	31.70	0.93
3600.0	10.97	17.25	7.17	21.71	1.04	0.98	31.76	0.99
3800.0	10.70	16.86	7.07	22.97	1.03	0.97	32.68	0.90
4000.0	10.43	16.53	6.86	24.30	1.03	0.97	32.90	1.08
4100.0	10.29	16.43	6.76	25.18	1.03	0.97	33.36	1.05
4300.0	9.78	16.27	7.38	25.10	1.10	0.95	33.70	1.24
4500.0	9.02	16.31	5.84	21.83	1.09	1.04	34.12	1.48
4700.0	8.95	16.14	5.16	19.68	1.05	1.06	32.73	1.32
4900.0	8.58	16.00	4.75	17.15	1.05	1.06	33.28	1.28
5100.0	8.14	15.88	4.39	15.48	1.05	1.08	33.92	1.46
5300.0	7.73	15.77	4.08	14.16	1.06	1.09	34.95	1.48
5400.0	7.51	15.69	3.89	13.31	1.05	1.09	34.52	1.53
5600.0	7.07	15.58	3.61	12.31	1.05	1.09	35.67	1.66
5800.0	6.64	15.48	3.34	11.33	1.05	1.09	36.53	1.71
6000.0	6.23	15.36	3.12	10.53	1.04	1.09	37.14	1.97
6200.0	5.84	15.21	2.94	9.98	1.04	1.09	37.33	1.94
6400.0	5.43	15.11	2.76	9.26	1.04	1.08	37.61	2.14
6600.0	5.06	15.02	2.60	8.78	1.04	1.08	36.27	2.39
6800.0	4.70	14.90	2.46	8.32	1.03	1.07	36.30	2.63
7000.0	4.33	14.85	2.31	7.80	1.03	1.05	37.03	2.56



## Typical Performance Data

**Definitions:**

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

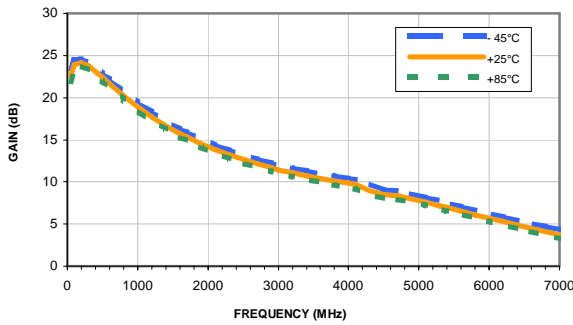
Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 3V, Rbias=1.5K ohms, Id=27 mA @ Temperature = +85degC

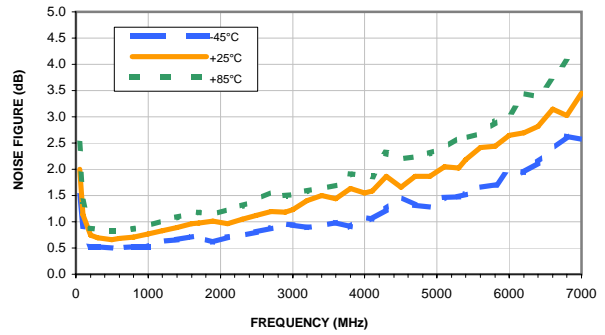
FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	Noise Figure
					K	Measure		
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dB)
50.0	21.85	31.76	11.83	7.36	1.46	0.70	26.03	2.49
100.0	23.34	30.40	9.38	9.57	1.19	0.72	25.52	1.39
200.0	23.75	28.93	8.09	11.81	1.02	0.75	26.59	0.88
300.0	23.33	28.10	7.39	12.82	0.94	0.81	26.86	0.85
500.0	21.98	27.01	6.34	14.14	0.88	0.94	26.76	0.83
600.0	21.24	26.51	6.03	14.76	0.86	0.99	27.44	0.83
800.0	19.80	25.70	5.60	15.59	0.87	1.07	28.18	0.87
1000.0	18.47	25.04	5.36	16.27	0.89	1.12	27.87	0.93
1200.0	17.29	24.41	5.24	16.69	0.92	1.15	28.40	1.03
1400.0	16.23	23.82	5.20	17.00	0.95	1.17	28.15	1.08
1600.0	15.30	23.20	5.23	17.26	0.98	1.17	28.48	1.16
1700.0	14.88	22.93	5.25	17.30	0.99	1.18	28.25	1.18
1900.0	14.09	22.34	5.33	17.38	1.02	1.18	28.71	1.13
2100.0	13.39	21.78	5.50	17.27	1.04	1.17	28.88	1.23
2300.0	12.77	21.16	5.67	17.15	1.06	1.16	28.83	1.31
2500.0	12.22	20.57	5.87	16.93	1.07	1.14	28.88	1.41
2700.0	11.69	19.99	6.06	16.88	1.08	1.13	29.02	1.56
2900.0	11.22	19.46	6.35	16.71	1.09	1.11	28.74	1.50
3000.0	10.96	19.23	6.42	16.83	1.10	1.11	28.51	1.53
3200.0	10.60	18.69	6.47	16.95	1.09	1.10	28.37	1.59
3400.0	10.25	18.16	6.54	17.34	1.09	1.09	28.72	1.63
3600.0	9.92	17.77	6.62	17.77	1.09	1.08	28.82	1.70
3800.0	9.64	17.38	6.56	18.59	1.09	1.08	29.67	1.92
4000.0	9.35	17.11	6.41	20.01	1.09	1.09	29.85	1.88
4100.0	9.19	17.03	6.35	21.09	1.10	1.09	30.30	1.87
4300.0	8.48	16.93	7.16	23.00	1.23	1.06	30.76	2.30
4500.0	8.04	16.89	5.67	25.34	1.18	1.14	30.74	2.20
4700.0	7.90	16.74	5.07	24.65	1.14	1.17	29.79	2.25
4900.0	7.56	16.61	4.70	22.34	1.14	1.19	30.02	2.30
5100.0	7.18	16.47	4.38	19.94	1.14	1.20	30.52	2.40
5300.0	6.76	16.35	4.08	17.75	1.14	1.21	31.24	2.61
5400.0	6.54	16.30	3.91	16.68	1.14	1.22	30.97	2.60
5600.0	6.13	16.19	3.64	15.16	1.14	1.23	31.80	2.68
5800.0	5.72	16.05	3.43	13.82	1.14	1.22	32.46	2.90
6000.0	5.30	15.91	3.21	12.69	1.13	1.23	32.86	3.05
6200.0	4.86	15.83	2.99	11.71	1.13	1.23	32.83	3.45
6400.0	4.46	15.72	2.85	11.02	1.13	1.22	32.79	3.38
6600.0	4.07	15.64	2.70	10.31	1.13	1.22	31.92	3.69
6800.0	3.65	15.57	2.57	9.63	1.13	1.21	32.02	4.04
7000.0	3.26	15.51	2.46	9.05	1.14	1.20	34.37	4.11

## Typical Performance Curves

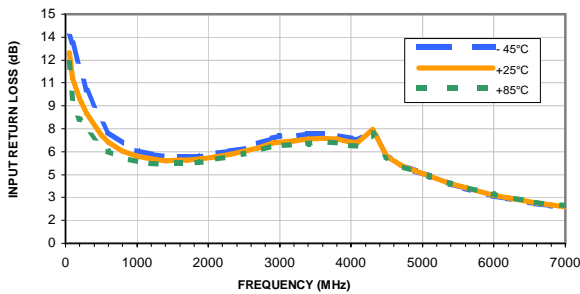
**GAIN vs. FREQUENCY & TEMPERATURE**  
Vd = 3V, Rbias=1.5K Ohms



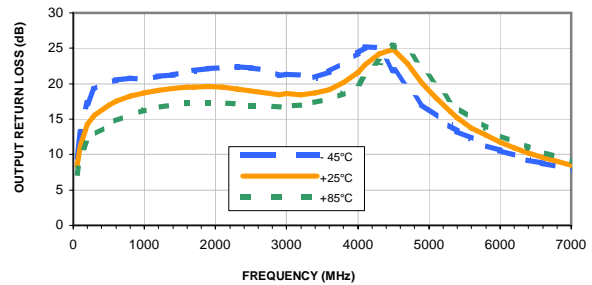
**NOISE FIGURE vs. FREQUENCY & TEMPERATURE**  
Vd = 3V, Rbias=1.5K Ohms



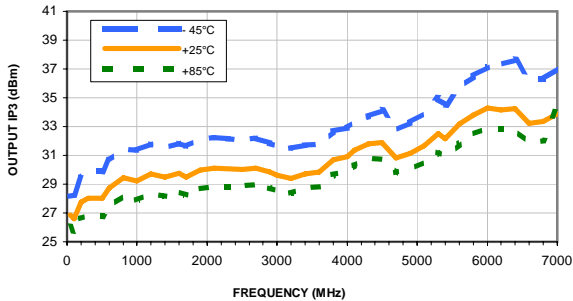
**INPUT RETURN LOSS vs. FREQUENCY & TEMPERATURE**  
Vd = 3V, Rbias=1.5K Ohms



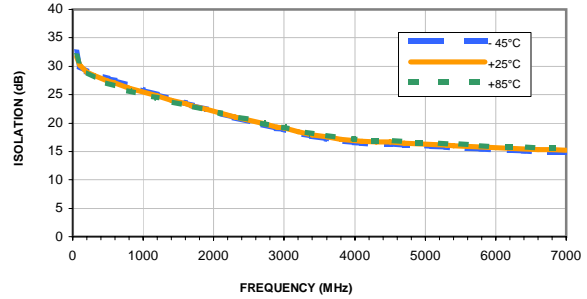
**OUTPUT RETURN LOSS vs. FREQUENCY & TEMPERATURE**  
Vd = 3V, Rbias=1.5K Ohms



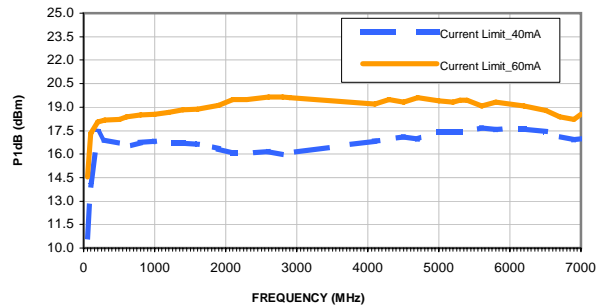
**OUTPUT IP3 vs. FREQUENCY & TEMPERATURE**  
Vd = 3V, Rbias=1.5K Ohms



**ISOLATION vs. FREQUENCY & TEMPERATURE**  
Vd = 3V, Rbias=1.5K Ohms

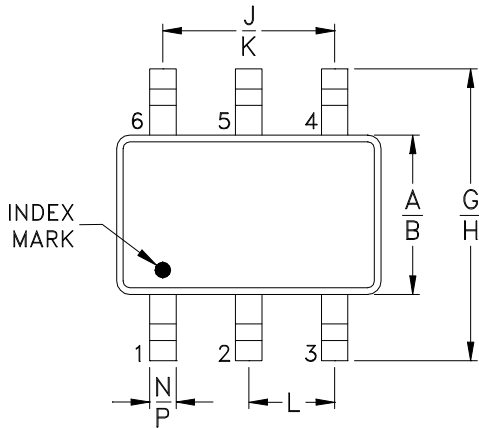


**P1dB vs. FREQUENCY & CURRENT LIMIT (1)**  
Vd = 3V, Rbias=1.5K Ohms

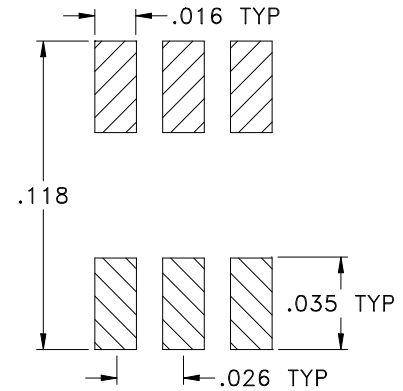


(1) Current is externally limited during P1dB measurements. Unit is capable of higher output power if current is not limited.

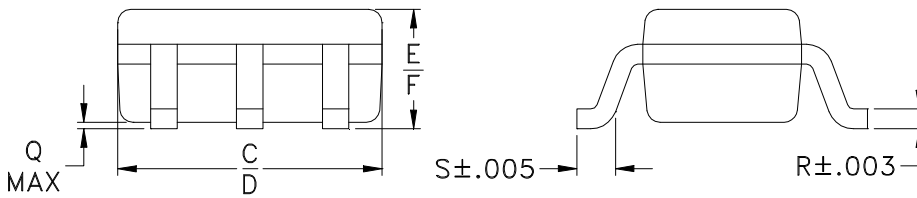
### Outline Dimensions



### PCB Land Pattern



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



CASE #	A	B	C	D	E	F	G	H	J	K
CA1389	.045 (1.15)	.053 (1.35)	.073 (1.85)	.089 (2.25)	.031 (0.80)	.039 (1.00)	.079 (2.00)	.091 (2.30)	.051 (1.30)	.051 (1.30)

CASE #	L	M	N	P	Q	R	S	T	WT. GRAM
CA1389	.026 (0.65)	-	.006 (0.15)	.012 (0.30)	.004 (0.09)	.007 (0.165)	.012 (0.31)	-	.010

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

#### Notes:

- Case material: Plastic.
- Termination finish:  
For RoHS Case Styles: Matte Tin plate.
- Primary dimensions are in millimeters.



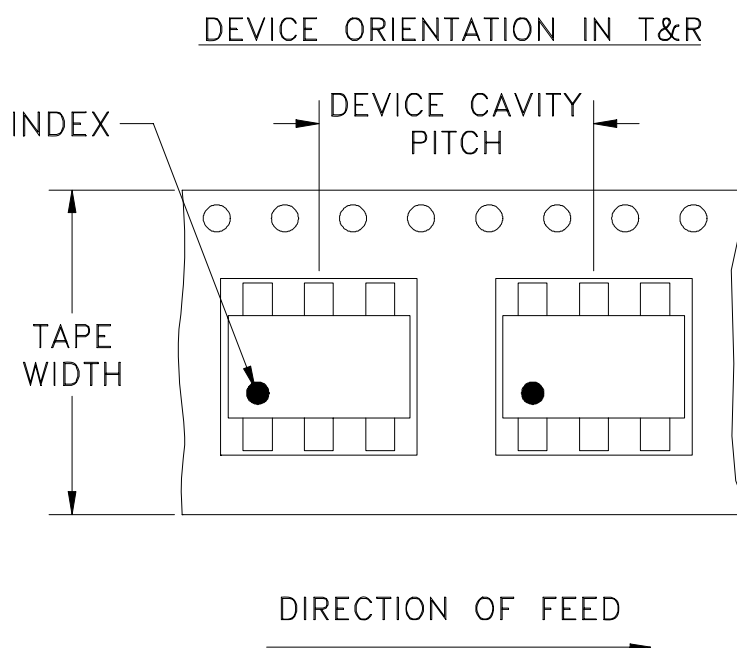
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# Tape & Reel Packaging TR-F101



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

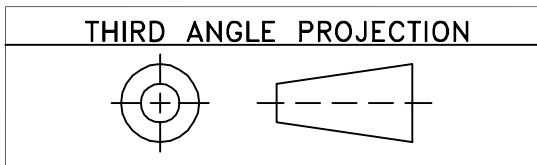


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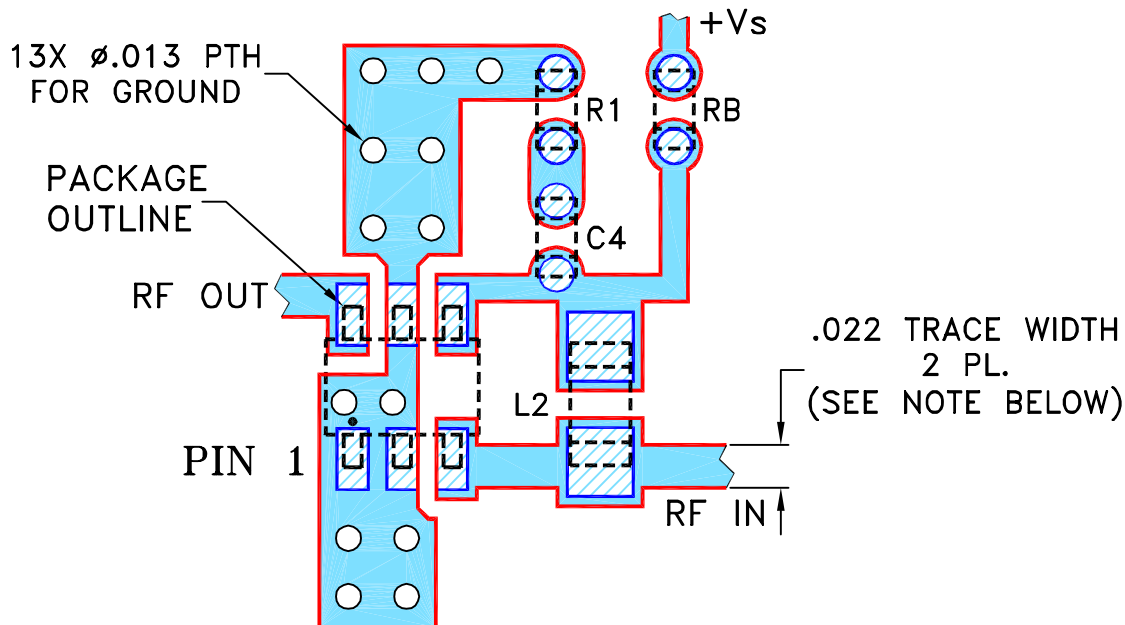
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REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M123889	NEW RELEASE	08/18/09	MMG	DJ
A	M124525	MODIFIED DRAWING, CHG. TB IN TITLE	09/22/09	MMG	DJ

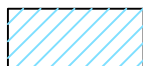
SUGGESTED MOUNTING CONFIGURATION FOR CA1389 CASE STYLE, "06AM01" PIN CODE



- NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS  $.010'' \pm .001''$ ; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. 0402 AND 0603 CHIP COMPONENTS FOOTPRINTS ARE SHOWN FOR REFERENCE. VALUES OF COMPONENTS AS PER TB-534+.
3. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.



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



DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

UNLESS OTHERWISE SPECIFIED	INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN MMG	08/13/09
TOLERANCES ON:	CHECKED AV	08/17/09
2 PL DECIMALS $\pm$	APPROVED DJ	08/18/09
3 PL DECIMALS $\pm$ .005		
ANGLES $\pm$		
FRACTIONS $\pm$		



Mini-Circuits®

13 Neptune Avenue  
Brooklyn NY 11235

PL, 06AM01, CA1389, TB-534+

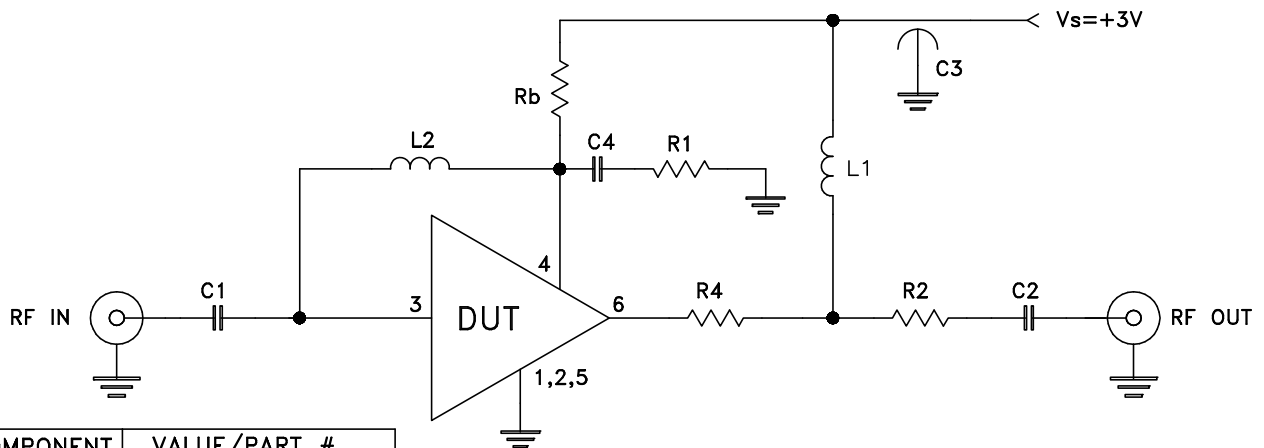
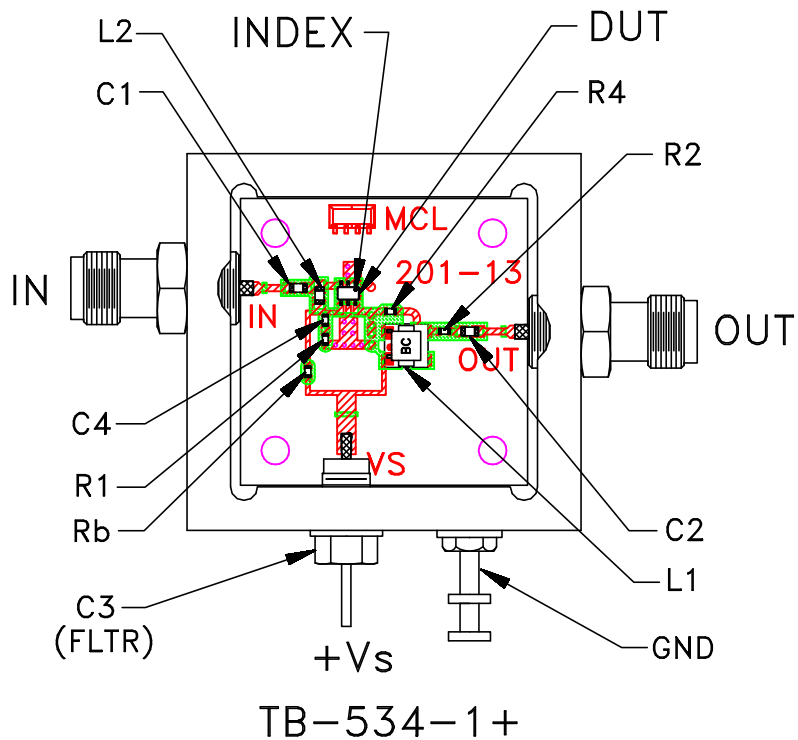
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ASHEETA1.DWG REV:A DATE:01/12/95

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-311	A
FILE:	98PL311	SCALE:	10:1
		SHEET:	1 OF 1

# Evaluation Board and Circuit




COMPONENT	VALUE/PART #
R1	49.9 $\Omega$
R2, R4	0 $\Omega$
Rb	1.5 k $\Omega$
C1, C2	1000 pF
C3 (FLTR)	1500 pF
C4	10 pF
L1	TCCH-80+, MCL
L2	180 nH
DUT	PSA-5451+, MCL

Schematic Diagram

## Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: R04350 or equivalent,  
Dielectric Constant=3.5, Thickness=.010 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	-45° to 85°C or -40° to 85°C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-65° to 150° C 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	