

# Ultra Low Noise MMIC Amplifier

PSA4-5043+

50Ω      0.05 to 4 GHz



CASE STYLE: MMM1362

## The Big Deal

- Ultra Low Noise Figure, 0.75 dB
- High IP3 and Po at low DC power consumption
- May be used as a replacement for SPF5043Z<sup>a,b</sup>
- Class 1B HBM ESD rating (500V)

## Product Overview

Mini-Circuits PSA4-5043+ 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 high dynamic range receiver applications. This design operates on +3 to +5V supply at only 33 mA at 3V and 56mA at +5V, is internally matched to 50 ohms and is supplied in a super small SC-70 (SOT-343) MSL 1 package.

## Key Features

Feature	Advantages
Ultra Low Noise: 0.75 dB at 1 GHz 0.98 dB at 2 GHz	Outstanding Noise Figure, measured in a 50 Ohm environment without any external matching
High IP3, 33.5 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
High Output Power, +21 dBm	The PSA4-5043+ provides up to +21dBm output power at 1dB compression enabling this amplifier to support high linear dynamic range requirements.-
Broad Band, up to 4 GHz	Operating over a broadband from 50 MHz to 4 GHz, the PSA4-5043+ 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-343 Package	Small size, industry standard package
High Reliability	Low, small signal operating current of 53mA nominal maintains junction temperatures typically below 125°C at 85°C ground lead temperature
Class 1B ESD (500V, HBM)	The PSA4-5043+ is a super low noise PHEMT based design. Unlike many other PHEMT designs. Mini-Circuits incorporates ESD protection on die to achieve industry leading ESD performance for a low noise amplifier.

### Notes:

- Suitability for model replacement within a particular system must be determined by and is solely the responsibility of the customer based on, among other things, electrical performance criteria, stimulus conditions, application, compatibility with other components and environmental conditions and stresses.
- The RFMD SPF5043Z part number is used for identification and comparison purposes only.



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Low Noise, High IP3

# Monolithic Amplifier

0.05-4 GHz

## Product Features

- Ultra Low Noise Figure, 0.75 dB typ. at 1 GHz
- Class 1B ESD rating (500V)
- High IP3, up to 33.5 dBm typ. at 1 GHz
- Output Power at 1dB comp., up to +21 dBm typ.
- Gain, 18.4 dB typ. at 1GHz
- Supply Voltage, +3V, Id=33mA, +5V, Id=56mA
- Aqueous washable
- May be used as a replacement for SPF5043Z <sup>a,b</sup>

## Typical Applications

- Cellular
- ISM
- GSM
- WCDMA
- LTE
- WiMax
- WLAN
- GPS

## General Description

PSA4-5043+ is an advanced wide band, 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.



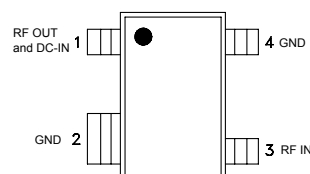
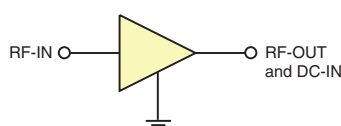
## PSA4-5043+

CASE STYLE: MMM1362  
PRICE: \$2.58 ea. QTY. (20)

**+ RoHS compliant in accordance with EU Directive (2002/95/EC)**

*The +Suffix has been added in order to identify RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications.*

## simplified schematic and pin description



Function	Pin Number	Description (See Application Circuit, Fig. 2)
RF IN	3	RF input pin (connect to RF-IN via DC blocking cap)
RF-OUT & DC-IN	1	RF output pin (connected to RF-out via blocking cap C2 and supply voltage Vd via RF Choke L1)
GND	2,4	Connections to ground: use via holes as shown in "Suggested Layout for PCB Design" to reduce ground path inductance for best performance.

\* Enhancement mode pseudomorphic High Electron Mobility Transistor.

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

Parameter	Condition (GHz)	Vd=5.0V <sup>(1)</sup>			Vd=3.0V <sup>(1)</sup>			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Frequency Range		0.05		4.0	0.05		4.0	GHz
at DC Volts (Vd)			5.0			3.0		V
DC Current (Id)			58	66		33		mA
Noise Figure	0.05		0.73			0.66		dB
	0.5		0.65			0.66		
	1.0		0.75	1.1		0.73		
	2.0		0.98			0.94		
	3.0		1.1			1.1		
	4.0		1.44			1.3		
Gain	0.05		25.4			24.3		dB
	0.5		22.1			21.2		
	1.0	16.5	18.4	20.2		17.5		
	2.0		13.3			12.5		
	3.0		10.2			9.6		
	4.0		8.0			7.2		
Input Return Loss	0.05		7.8			6.5		dB
	0.5		10.5			9.4		
	1.0		11.4			10.6		
	2.0		12.2			11.1		
	3.0		12.8			10.4		
	4.0		11.1			9.2		
Output Return Loss	0.05		13.7			13.2		dB
	0.5		15.0			15.9		
	1.0		13.9			15.1		
	2.0		12.5			14.5		
	3.0		11.7			13.3		
	4.0		12.8			15.7		
Output IP3	0.05		31.0			28.0		dBm
	0.5		32.1			28.0		
	1.0		33.5			28.7		
	2.0		32.7			30.0		
	3.0		33.6			31.0		
	4.0		32.6			31.0		
Output Power @ 1dB compression <sup>(2)</sup>	0.05		18.9			15.8		dBm
	0.5		19.3			16.5		
	1.0		19.8			17.4		
	2.0		20.7			19.0		
	3.0		21.2			19.4		
	4.0		21.5			19.8		
DC Current Variation Vs. Temperature <sup>(3)</sup>			-0.007			-0.007		mA/°C
DC Current Variation Vs. Voltage			0.01			0.01		mA/mV
Thermal Resistance <sup>(5)</sup>			117			117		°C/W

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

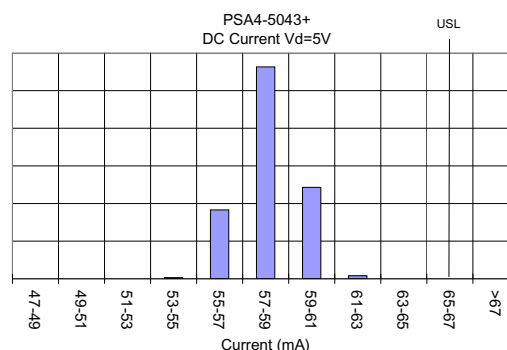
Parameter	Ratings
Operating Temperature <sup>(5)</sup>	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Channel Temperature	150°C
DC Voltage	6V
Device Current	76 mA
Power Dissipation	380 mW
Input Power (CW)	23 dBm (5 minutes max), 17dBm (continuous)

<sup>(1)</sup> Measured on Mini-Circuits Characterization test board TB-471+.

See Characterization Test Circuit (Fig. 1)

<sup>(2)</sup> Current increases at P1dB<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.

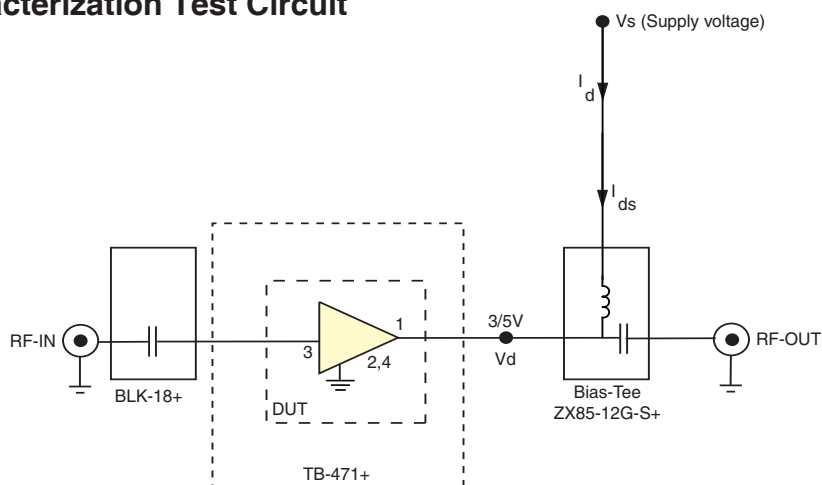
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## Characterization Test Circuit



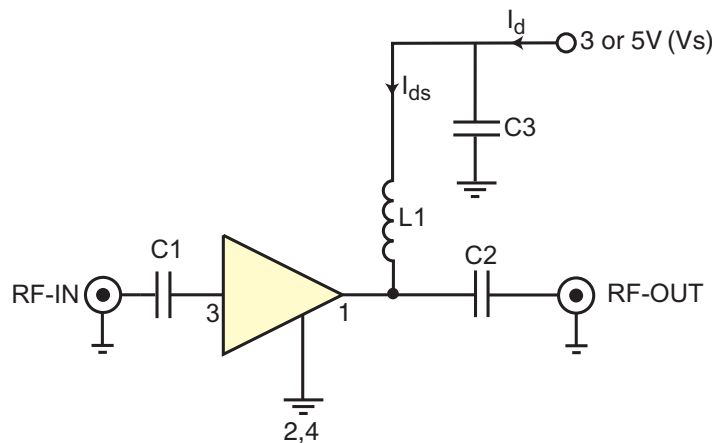
**Fig 1.** Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization Test Board TB-471+) Gain, Return loss, Output power at 1dB compression (P1 dB), Output IP3 (OIP3) and Noise Figure measured using Agilent's N5242A PNA-X microwave network analyzer.

**Conditions:**

1. Gain:  $P_{in} = -25\text{dBm}$
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 5 dBm/tone at output.

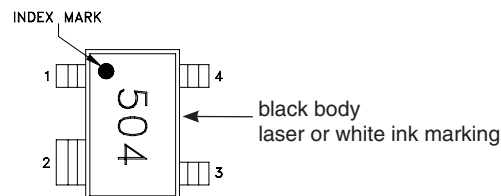
**Recommended Application Circuit**

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



**Fig 2.** Recommended Application Circuit

Note: Resistance of L1, 0.1-0.2Ω typically

**Product Marking**

**Additional Detailed Technical Information**

additional information is available on our dash board. To access this information [click here](#)

<b>Performance Data</b>	Data Table
	Swept Graphs
	S-Parameter (S2P Files) Data Set (.zip file)
<b>Case Style</b>	MMM1362 Plastic molded SOT-343 package, lead finish: matte tin
<b>Tape &amp; Reel</b> Standard quantities available on reel	F90 7" reels with 20, 50, 100, 200, 500 or 1K devices.
<b>Suggested Layout for PCB Design</b>	PL-361
<b>Evaluation Board</b>	TB-653+
<b>Environmental Ratings</b>	ENV08T2

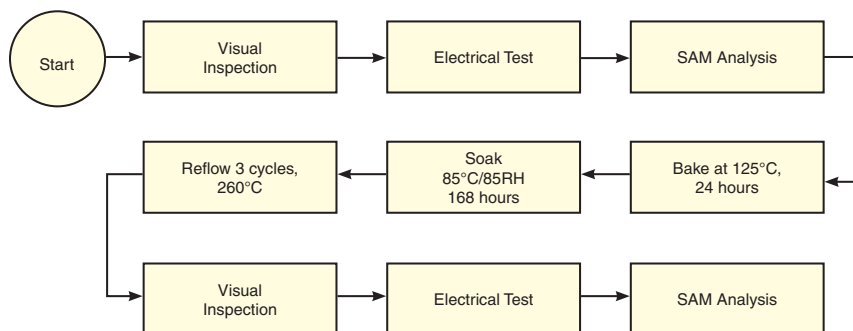
**ESD Rating**

Human Body Model (HBM): Class 1B (500 to <1000V) in accordance with ANSI/ESD STM 5.1 - 2001

Machine Model (MM): Class M1 (pass 35V) in accordance with ANSI/ESD STM5.2-1999; passes 35V

**MSL Rating**

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

**MSL Test Flow Chart**

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