



LOW NOISE, HIGH IP3

Monolithic Amplifier

PSA4-5043+

50Ω 0.05 to 4 GHz

THE BIG DEAL

- Ultra Low Noise Figure, 0.75 dB Typ. at 1 GHz
- High IP3, +33.5 dBm Typ. at 1 GHz
- Class 1B ESD Rating (+500 V)
- Output Power at 1 dB Comp., +19.8 dBm Typ. at 1 GHz
- Gain, 18.4 dB Typ. at 1 GHz
- Supply Voltage, +3 V, $I_D = 33$ mA; +5 V, $I_D = 58$ mA
- Aqueous Washable



Generic photo used for illustration purposes only

CASE STYLE: MMM1362

+RoHS Compliant

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

APPLICATIONS

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

PRODUCT OVERVIEW

Mini-Circuits PSA4-5043+ is an 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 V to +5 V supply at only 33 mA at +3 V and 56 mA at +5 V, is internally matched to 50Ω 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 50Ω environment without any external matching.
High IP3, +33.5 dBm at 1 GHz	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, +19.8 dBm at 1 GHz	The PSA4-5043+ provides a high output power at 1 dB compression enabling this amplifier to support high linear dynamic range requirements.
Broadband, 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 maintains junction temperatures typically below +125°C at +85°C ground lead temperature.
Class 1B ESD (+500 V, 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.

* Enhancement mode pseudomorphic High Electron Mobility Transistor.





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ELECTRICAL SPECIFICATIONS¹ AT +25°C, Z₀ = 50Ω, (REFER TO CHARACTERIZATION CIRCUIT, FIG. 1)

Parameter	Condition (GHz)	V _D = +5.0 V ¹			V _D = +3.0 V ¹			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Frequency Range		0.05		4.0	0.05		4.0	GHz
At DC Volts (V _D)			+5.0			+3.0		V
DC Current (I _D)			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 P _{OUT} = +5 dBm/Tone	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 @ 1 dB Compression ²	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 ³			-0.007			-0.007		mA/°C
DC Current Variation vs. Voltage			0.01			0.01		mA/mV
Thermal Resistance ⁴			117			117		°C/W

1. Measured on Mini-Circuits Characterization test board TB-653+.
See Characterization Test Circuit (Fig. 1).

2. Current increases at P1dB.

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

4. Defined with reference to ground pad temperature.





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50 Ω

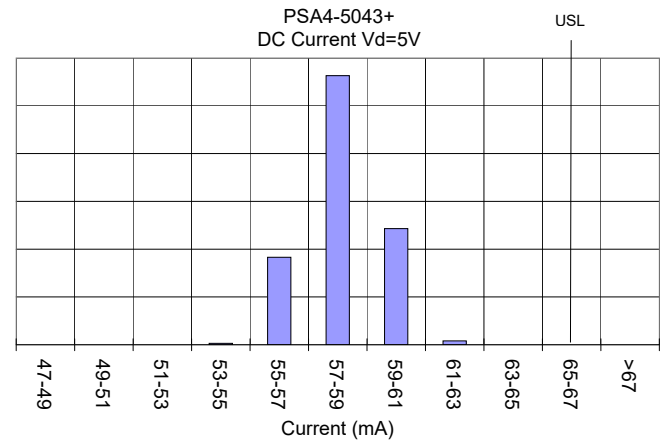
0.05 to 4 GHz

ABSOLUTE MAXIMUM RATINGS⁵

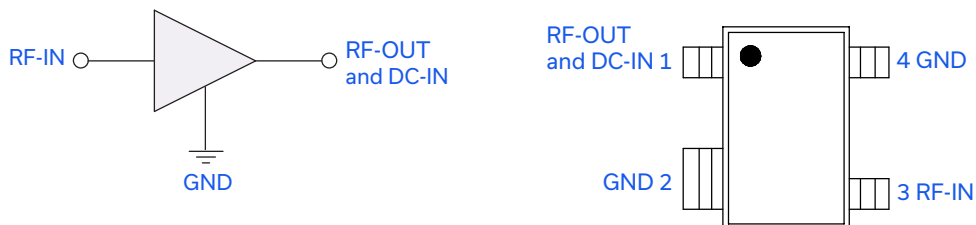
Parameter	Ratings
Operating Temperature ⁶	-45°C to +85°C
Storage Temperature	-65°C to +150°C
Channel Temperature	+150°C
DC Voltage	+6 V
Device Current	76 mA
Power Dissipation	380 mW
Input Power (CW)	+23 dBm (5 minutes max.), +17 dBm (continuous)

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

6. Defined with reference to ground pad temperature.



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 V_D 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.



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CHARACTERIZATION TEST CIRCUIT

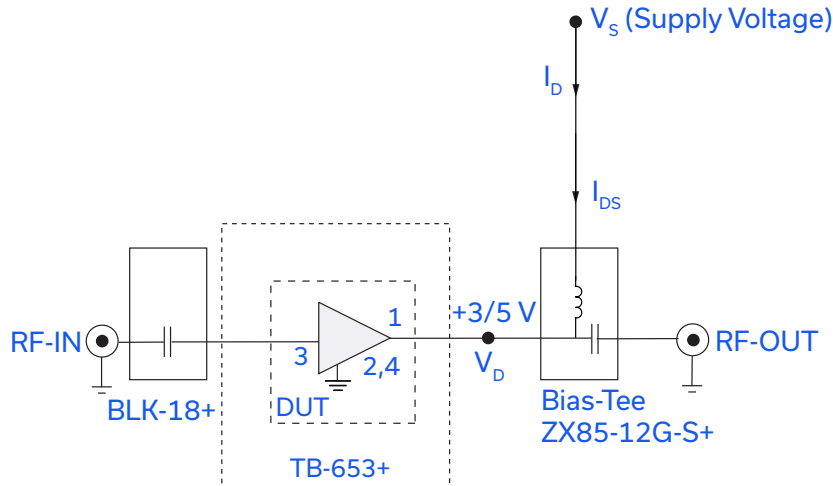


Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization Test Board TB-653+) Gain, Return Loss, Output Power at 1 dB Compression (P1dB), Output IP3 (OIP3) and Noise Figure measured using Agilent's N5242A PNA-X microwave network analyzer.

Conditions:

1. Gain: $P_{IN} = -25$ 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)

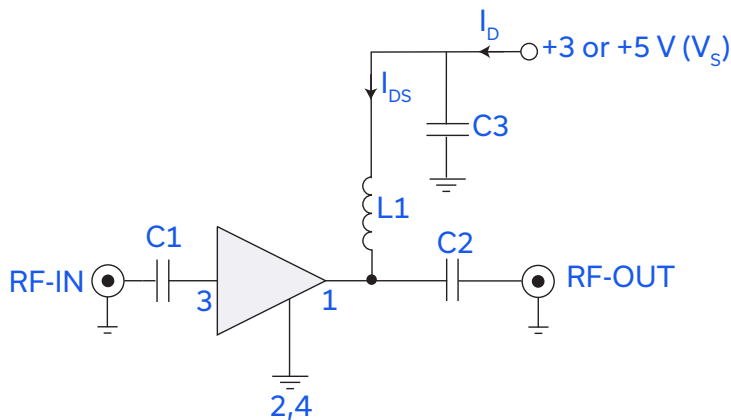
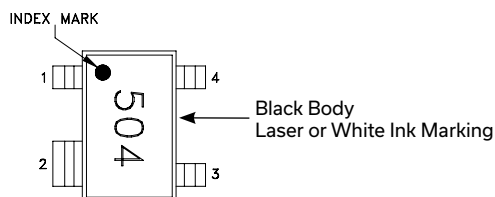


Fig 2. Recommended Application Circuit
Note: Resistance of L1, 0.1-0.2Ω typically

PRODUCT MARKING



Marking may contain other features or characters for internal lot control.

Mini-Circuits



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

Performance Data	Data Table Swept Graphs S-Parameter (S2P Files) Data Set (.zip file)
Case Style	MMM1362 Plastic molded SOT-343 package, Lead Finish: Matte Tin
Tape & Reel Standard Quantities Available on Reel	F90 7" Reels with 20, 50, 100, 200, 500, 1000, 2000, or 3000 devices
Suggested Layout for PCB Design	PL-361
Evaluation Board	TB-653+
Environmental Ratings	ENV08T2

ESD RATING

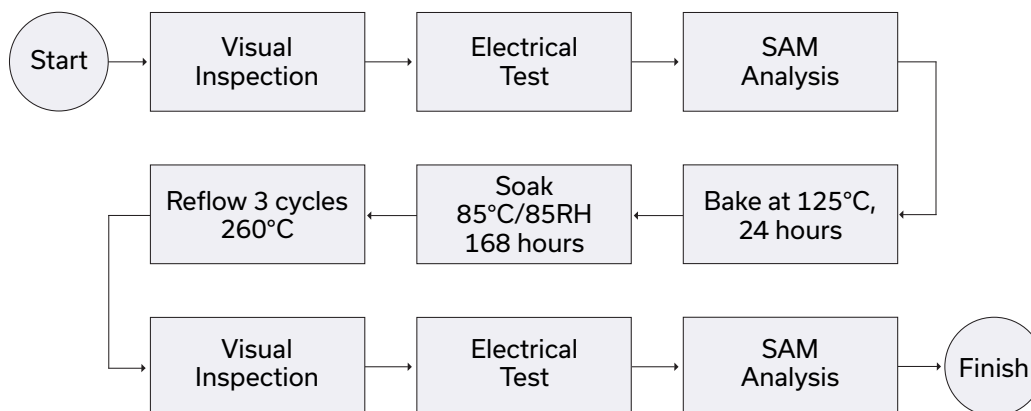
Human Body Model (HBM): Class 1B (500 to <1000 V) in accordance with ANSI/ESD STM 5.1 - 2001

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

MSL RATING

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

MSL TEST FLOW CHART



NOTES

- 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.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- 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

