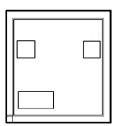
# Low Noise, High IP3 Monolithic Amplifier Die

PSA-0012-D+

 $50\Omega$ 0.05 to 6 GHz

# **The Big Deal**

- Ideal IF Amplifier Low Gain Low Noise Figure, 2.4dB **High Output Power**
- Wide band



## **Product Overview**

The PSA-0012-D+ is an advanced wide band, high dynamic range, low noise, high IP3, high output power, monolithic amplifier die. Manufactured using E-PHEMT\* technology enables it to work with a single positive supply voltage.

# **Key Features**

Feature	Advantages
Ideal Combined Performance Low Noise: 2.4 dB High IP3: +35 dBm High P1dB: +22 dBm Low Gain: 15dB	The PSA-0012-D+ design is optimized for use in critical IF Amplifier applications having an ideal combination of Low Gain, Low Noise, and High Output Power.
Wide band operation 50 MHz to 6000 MHz	Operating over a broad frequency range, the PSA-0012-D+ covers a wide range of typical IF bands making this amplifier ideal for use in a variety of applications.
Excellent Return Loss Input: 10 dB at 3.5 GHz Output: 13 dB at 4.5 GHz	With 10 dB input and 13 dB output return loss, the PSA-0012-D+ can be integrated into critical circuits with confidence that VSWR interactions with input and output components will have minimum affect on performance.
Unpackaged Die	Enables user to integrate it directly into hybrids.

# Low Noise, High IP3 Monolithic Amplifier Die

# PSA-0012-D+

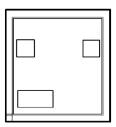
0.05 to 6 GHz  $50\Omega$ 

### **Product Features**

- Low Noise Figure, 2.4dB typ. at 1 GHz
- High IP3, up to 36 dBm typ. at 1 GHz
- Output Power at 1dB comp., up to +22 dBm typ.
- Gain, 15.6 dB typ. at 1GHz

## **Typical Applications**

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



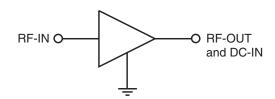
+RoHS Compliant The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

Ordering Information: Refer to Last Page

## **General Description**

PSA-0012-D+ is an advanced wideband, high dynamic range, low noise, high IP3, high output power, monolithic amplifier die. Manufactured using E-PHEMT\* technology enables it to work with a single positive supply voltage.

## Simplified Schematic and Pad description



Pad	Description
RF-IN	RF input pad
RF-OUT & DC-IN	RF output pad
GROUND	Connections to ground

<sup>\*</sup> Enhancement mode pseudomorphic High Electron Mobility Transistor.

## Electrical Specifications<sup>1</sup> at 25°C, Zo=50 $\Omega$

Parameter	Condition (GHz)	Min. Typ.	Max.	Units
Frequency range		0.05	6.0	GHz
DC current (Id)		92		mA
at DC Volts (Vd)		5.0		V
Noise figure	0.05	2.4		dB
	0.5	2.5		
	1.0	2.4		
	2.0	2.4		
	3.0	2.7		
	4.0	2.9		
	5.0	3.3		
	6.0	3.7		
Gain	0.05	18.0		dB
	0.5	16.2		
	1.0	15.6		
	2.0	14.2		
	3.0	12.7		
	4.0	11.2		
	5.0	9.9		
	6.0	8.4		
Input return loss	0.05	9.8		dB
	3.0	10.1		
	6.0	6.0		
Output return loss	0.05	11.2		dB
	3.0	13.9		
	6.0	8.4		
Output IP3	0.05	33.9		dBm
	0.5	35.5		
	1.0	35.7		
	2.0	35.7		
	3.0	35.8		
	4.0	35.2		
	5.0	35.4		
	6.0	33.8		
Output power @1dB compression <sup>2</sup>	0.05	20.2		dBm
	0.5	21.8		
	1.0	22.2		
	2.0	22.1		
	3.0	21.9		
	4.0	21.9		
	5.0	21.7		
	6.0	21.7		
The amount was interested	6.0	<u> </u>		20044
Thermal resistance		69	,	°C/W

Measured in Mini-Circuits die characterization test board. See Figure 1 for Test Circuit.
 Current increases at P1dB

## **Absolute Maximum Ratings<sup>3</sup>**

Parameter	Ratings
Operating temperature	-40°C to 85°C
DC voltage (Pad RF-OUT & DC-IN)	6V
Device current (Pad RF-OUT & DC-IN)	130 mA
Power dissipation	650 mW
Input power (CW)	0.05-3GHz, 14dBm 3-6GHz, 19dBm

Permanent damage may occur if any of these limits are exceeded.
 These ratings are not intended for continuous normal operation.
 Die performance measured in industry standard SOT-363 package.



## **Characterization Test Circuit**

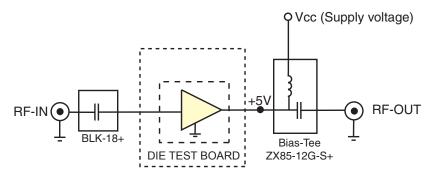


Figure 1. Block Diagram of Test Circuit used for characterization. Gain, Return loss, Output power at 1dB compression (P1 dB), output IP3 (OIP3) and noise figure measured using Agilent's N5242A PNA-X microwave network analyzer.

#### Conditions:

- 1. Gain and Return loss: Pin=-25dBm
- 2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 5 dBm/tone at output.

## **Die Layout**

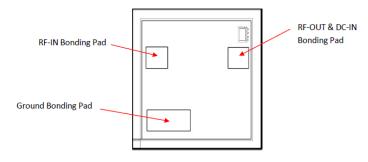


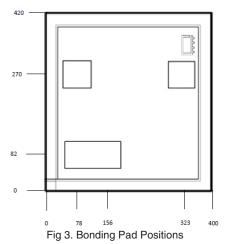
Fig 2. Die Layout

## **Critical Dimensions**

Parameter	Values
Die Thickness, µm	100
Die Width, μm	400
Die Length, µm	420
Bond Pad Size, µm	75 x 75
Ground Bond Pad Size	75 X 150

## **Bonding Pad Position**

(Dimensions in µm, Typical)



## **Assembly and Handling Procedure**

### 1. Storage

Dice should be stored in a dry nitrogen purged desiccators or equivalent.

#### 2. ESD

MMIC EPHEMPT amplifier dice are susceptible to electrostatic and mechanical damage. Die are supplied in antistatic protected material, which should be opened in clean room conditions at an appropriately grounded anti-static worksta tion. Devices need careful handling using correctly designed collets, vacuum pickup tips or sharp antistatic tweezers to deter ESD damage to dice.

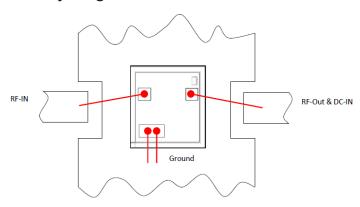
#### 3. Die Attach

The die mounting surface must be clean and flat. Using conductive silver filled epoxy, recommended epoxies are DieMat DM6030HK-PT/H579 or Ablestik 84-1LMISR4. Apply sufficient epoxy to meet required epoxy bond line thickness, epoxy fillet height and epoxy coverage around total die periphery. Parts shall be cured in a nitrogen filled atmosphere per manufacturer's cure condition. It is recommended to use antistatic die pick up tools only.

#### 4. Wire Bonding

Bond pad openings in the surface passivation above the bond pads are provided to allow wire bonding to the dice gold bond pads. Thermosonic bonding is used with minimized ultrasonic content. Bond force, time, ultrasonic power and temperature are all critical parameters. Suggested wire is pure gold, 1 mil diameter. Bonds must be made from the bond pads on the die to the package or substrate. All bond wires should be kept as short as low as reasonable to minimize performance degradation due to undesirable series inductance.

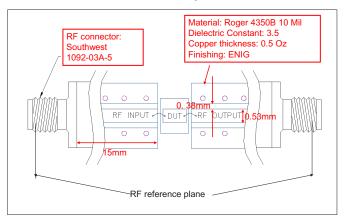
## **Assembly Diagram**



## **Recommended Wire Length, Typical**

Wire	Wire Length (mm)	Wire Loop Height (mm)
Ground	0.50	0.15
RF-IN, RF-OUT & DC-IN	0.70	0.15

## **RF Reference Plane - No port extension**



Additional Detailed Technical Information additional information is available on our dash board.			
	Data Table		
Performance Data	Swept Graphs		
	S-Parameter (S2P Files) Data Set with and without port extension(.zip file)		
Case Style	Die		
	Quantity, Package	Model No.	
	Small, Gel - Pak: 10,50,100	PSA-0012-DG+	
Die Ordering and packaging	Medium <sup>†</sup> , Partial wafer: <5K Large <sup>†</sup> , Full Wafer	PSA-0012-DP+ PSA-0012-DF+	
information (Note 4)	†Available upon request contact sa	. 6 66 . 2 2	
	Refer to <u>AN-60-067</u>		
Environmental Ratings	ENV-80		

Note 4. Dice taken from PCM good wafer, No RF or DC test performed.

## ESD Rating\*\*

Human Body Model (HBM): Class 0 (<250V) in accordance with ANSI/ESD STM 5.1 - 2001; passes 150V

Machine Model (MM): Class M1 (<100V) in accordance with ANSI/ESD STM5.2-1999; passes 25V

## **Additional 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-Circuit's applicable established test performance criteria and measurement instructions.
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<sup>\*\*</sup> Tested in industry standard SOT-363 package.