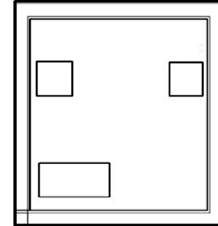
Low Noise, High IP3

Monolithic Amplifier Die

PSA-0012-D+

50Ω 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.

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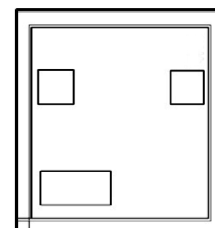


+RoHS Compliant
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

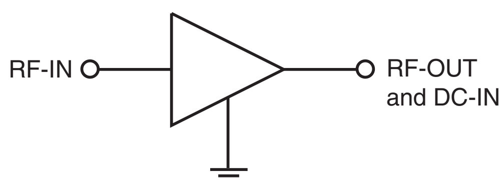
Ordering Information: Refer to Last Page

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

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

* Enhancement mode pseudomorphic High Electron Mobility Transistor.

Note: 1. Bond Pad material - Gold
2. Bottom of Die - Gold plated

Electrical Specifications[1] at 25°C, Zo=50Ω

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[2]	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		21.0		
Thermal resistance			69		°C/W

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

Absolute Maximum Ratings[3]

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

3. 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

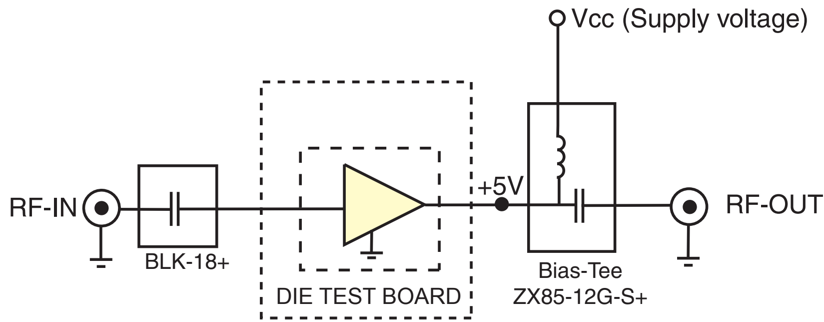


Figure 1. Block Diagram of Test Circuit used for characterization. Gain, Return loss, Output power at 1dB compression (P1 dB), output IP3 (OIP3) and noise figure measured using Agilent's N5242A PNA-X microwave network analyzer.

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

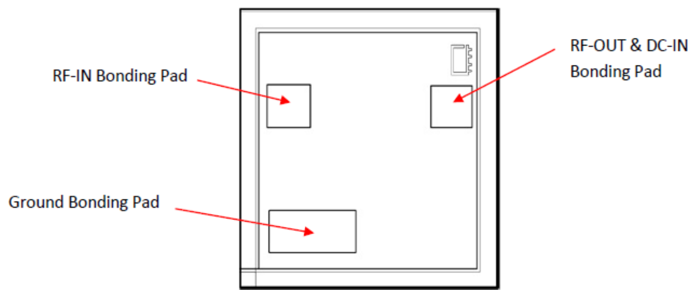


Fig 2. Die Layout

Bonding Pad Position

(Dimensions in μm, Typical)

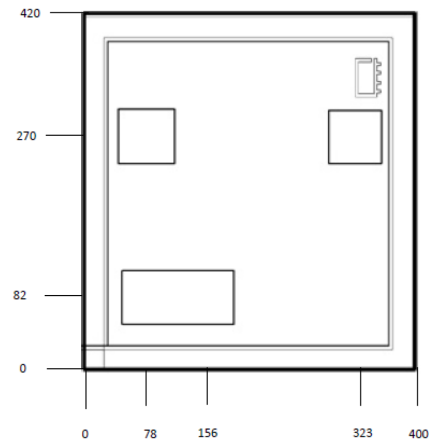


Fig 3. Bonding Pad Positions

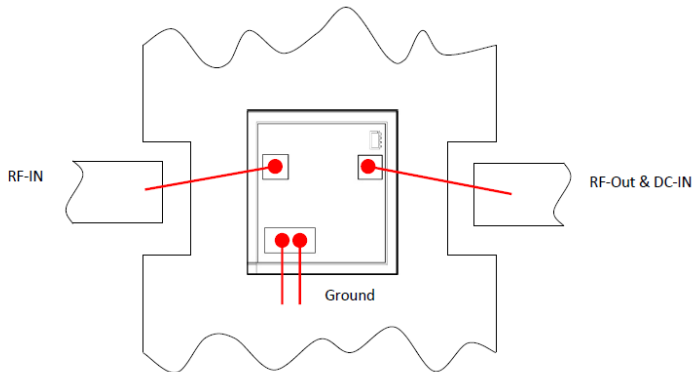
Critical Dimensions

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

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.

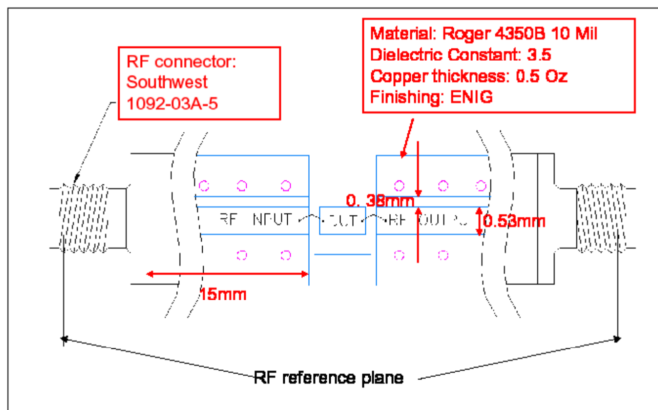
Assembly Diagram



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.

Performance Data	Data Table
	Swept Graphs
	S-Parameter (S2P Files) Data Set with and without port extension(.zip file)
Case Style	Die
Die Ordering and packaging information (Note 4)	Quantity, Package — Model No. Small, Gel - Pak: 10,50,100 — PSA-0012-DG+ Medium†, Partial wafer: <3660 — PSA-0012-DP+ Large†, Full Wafer — PSA-0012-DF+ †*Available upon request contact sales representative* Refer to AN-60-067
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

** Tested in industry standard SOT-363 package.

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.

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