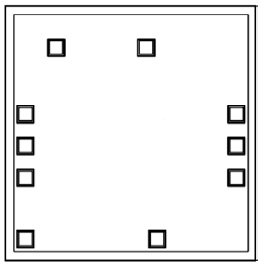
*Wideband, Microwave*

# Monolithic Amplifier Die

# AVA-183A-D+

50Ω 5 to 20 GHz



## The Big Deal

- Ultra-wideband, 5 to 20 GHz
- Integrated matching, DC blocks, bias circuits
- Unpackaged die form

## Product Overview

The AVA-183A-D+ is an ultra-wideband microwave amplifier die fabricated using InGaAs PHEMT technology operating over extremely wide frequency range from 5 to 20 GHz. This model integrates the entire matching network with the majority of the bias circuit, reducing the need for complicated external circuits and simplifying board layouts. These advantages make the AVA-183A-D+ extremely user friendly and enable simple, straightforward use.

## Key Features

| Feature | Advantages |
|---|---|
| Ultra-wideband, 5 to 20 GHz | Very broad frequency range supports a wide array of applications from microwave radio and radar to military communications and countermeasures, among others. |
| Excellent gain flatness, ±1.8 dB | Minimizes the need for external equalizer networks and gain flattening components, making it a great fit for instrumentation and EW applications. |
| High isolation, 32 to 43 dB | With high reverse isolation (20 – 32 dB directivity), the AVA-123A-D+ is an excellent choice for buffering broadband circuits. It is an ideal LO driver amplifier and provides designers system flexibility and margin when integrating cascaded RF components. |
| Single +5V supply | • No hassle associated with amplifiers using dual supply such as power supply sequencing.<br>• Integrated output bias-tee simplifies layout and reduces cost. |
| Unpackaged die | Enables the user to integrate the amplifier directly into hybrids. |

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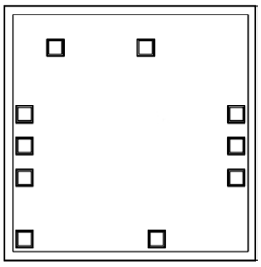
## AVA-183A-D+

### Product Features

- Gain, 13.5 dB typ. & Flatness, ±1.8 dB
- Output Power, up to +19.0 dBm typ.
- Excellent isolation, 39 dB typ. at 12 GHz
- Single Positive Supply Voltage, 5.0V
- Integrated DC blocks, Bias-Tee & Microwave bypass capacitor
- Unconditionally Stable



***+RoHS Compliant***

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

*Ordering Information: Refer to Last Page*

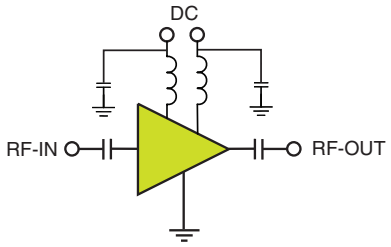
### Typical Applications

- Military EW and Radar
- DBS
- Wideband Isolation amplifier
- Microwave point-to-point radios
- Satellite systems

### General Description

The AVA-183A-D+ is a wideband monolithic amplifier die fabricated using InGaAs PHEMT technology with outstanding gain flatness up to 20 GHz. It is manufactured using PHEMT technology and is unconditionally stable. Its outstanding isolation enables it to be used as a wideband isolation amplifier or buffer amplifier in a variety of microwave systems.

**Simplified Schematic and Pad description**




| Function | Description |
|---|---|
| RF-IN | RF input pad |
| RF-OUT | RF output pad |
| DC ($V_{D1}$, $V_{D2}$) | DC power supply |
| GND | Connected to ground |

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

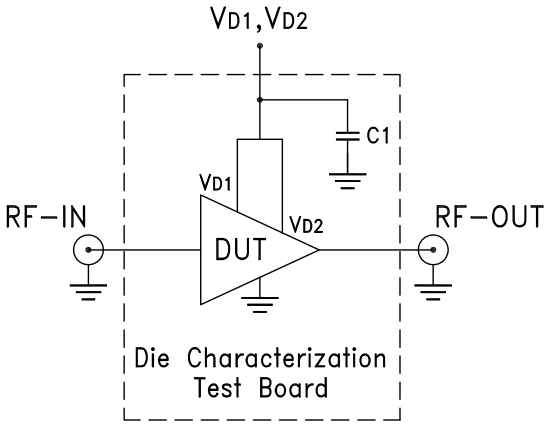
## Electrical Specifications[1] at 25°C, Zo=50Ω, *(refer to characterization circuit, Fig.1)*

| Parameter | Condition (GHz) | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Frequency Range | | 5.0 | | 20.0 | GHz |
| DC Voltage ($V_{D1}$, $V_{D2}$) | | | 5.0 | | V |
| DC Current ($I_{D1}$+$I_{D2}$) | | 104 | 131 | 166 | mA |
| Gain | 5.0 | | 11.4 | | dB |
| | 8.0 | | 15.1 | | |
| | 10.0 | | 14.5 | | |
| | 12.0 | | 13.9 | | |
| | 14.0 | | 13.6 | | |
| | 16.0 | | 13.5 | | |
| | 20.0 | | 12.1 | | |
| Input Return Loss | 5.0 | | 8.2 | | dB |
| | 8.0 | | 17.2 | | |
| | 10.0 | | 12.9 | | |
| | 12.0 | | 12.0 | | |
| | 14.0 | | 12.2 | | |
| | 16.0 | | 12.8 | | |
| | 20.0 | | 9.3 | | |
| Output Return Loss | 5.0 | | 6.2 | | dB |
| | 8.0 | | 15.1 | | |
| | 10.0 | | 11.8 | | |
| | 12.0 | | 10.3 | | |
| | 14.0 | | 9.8 | | |
| | 16.0 | | 9.8 | | |
| | 20.0 | | 14.8 | | |
| Output IP3 [2] | 5.0 | | 25.5 | | dBm |
| | 8.0 | | 28.4 | | |
| | 10.0 | | 27.0 | | |
| | 12.0 | | 25.8 | | |
| | 14.0 | | 34.9 | | |
| | 16.0 | | 25.2 | | |
| | 20.0 | | 27.8 | | |
| Output Power @ 1 dB compression | 5.0 | | 15.2 | | dBm |
| | 8.0 | | 17.9 | | |
| | 10.0 | | 18.2 | | |
| | 12.0 | | 18.3 | | |
| | 14.0 | | 18.9 | | |
| | 16.0 | | 19.2 | | |
| | 20.0 | | 15.8 | | |
| Noise Figure | 5.0 | | 8.0 | | dB |
| | 8.0 | | 4.1 | | |
| | 10.0 | | 4.3 | | |
| | 12.0 | | 4.8 | | |
| | 14.0 | | 5.8 | | |
| | 16.0 | | 6.3 | | |
| | 20.0 | | 6.2 | | |
| Directivity (Isolation-Gain) | 12 | | 25.0 | | dB |
| DC Current Variation vs. Voltage | | | 0.002 | | mA/mV |
| Thermal Resistance | | | 51 | | °C/W |

## Absolute Maximum Ratings[3]

| Parameter | Ratings |
|---|---|
| Operating Temperature | -40°C to 85°C |
| Channel Temperature | 150°C |
| DC Voltage $V_{D1}$, $V_{D2}$ Pad [4] | 5.5 V |
| DC Voltage RF-IN &RF OUT [4] | 10 V |
| Power Dissipation | 980 mW |
| DC Current $V_{D1}$ & $V_{D2}$ | 180 mA |
| Input Power (CW) | 20 dBm |

1. Measured on Mini-Circuits Die Characterization test board
   See Characterization Test Circuit (Fig. 1)
2. At Pout=8 dBm/tone
3. Permanent damage may occur if any of these limits are exceeded.
   These maximum ratings are not intended for continuous normal operation.
   Measured in industry standard 3x3 min 8-lead MCLP package
4. For continuous operation do not exceed 5.2V



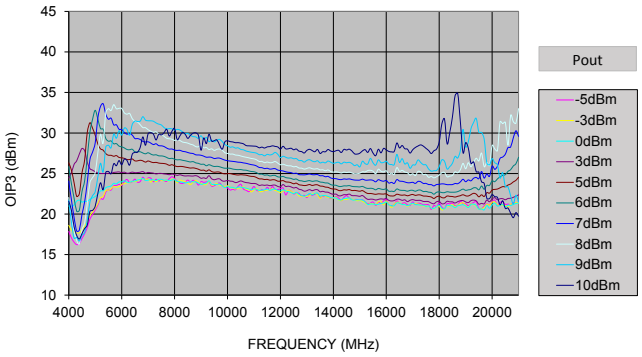




Figure 1: Test Circuit used for characterization. Gain, Return loss, Output power at 1dB compression (P1 dB), output IP3 (OIP3) and noise figure measured using Agilent's N5242A PNA-X microwave network analyzer.

Conditions:
1. Gain and Return loss: Pin= -25dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 8 dBm/tone at output.

## Die Layout

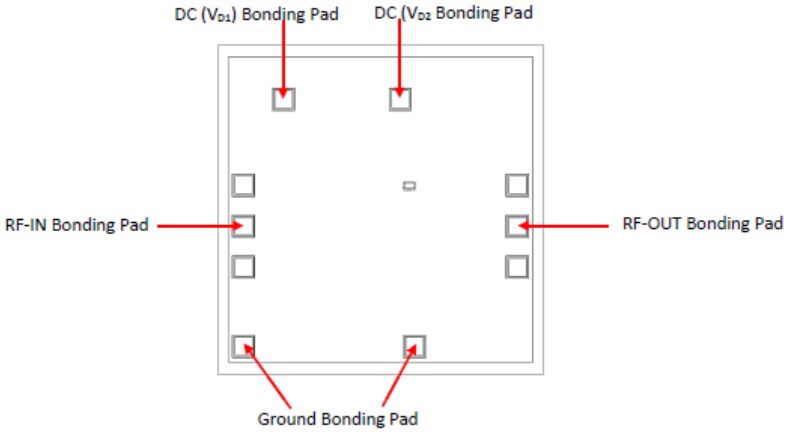



Fig 2. Die Layout

## Bonding Pad Position

(Dimensions in µm, Typical)

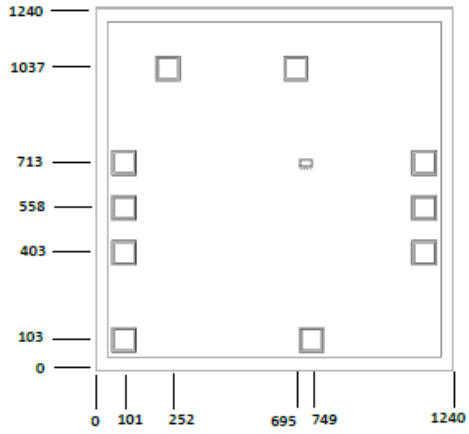



Fig 3. Bonding Pad Positions

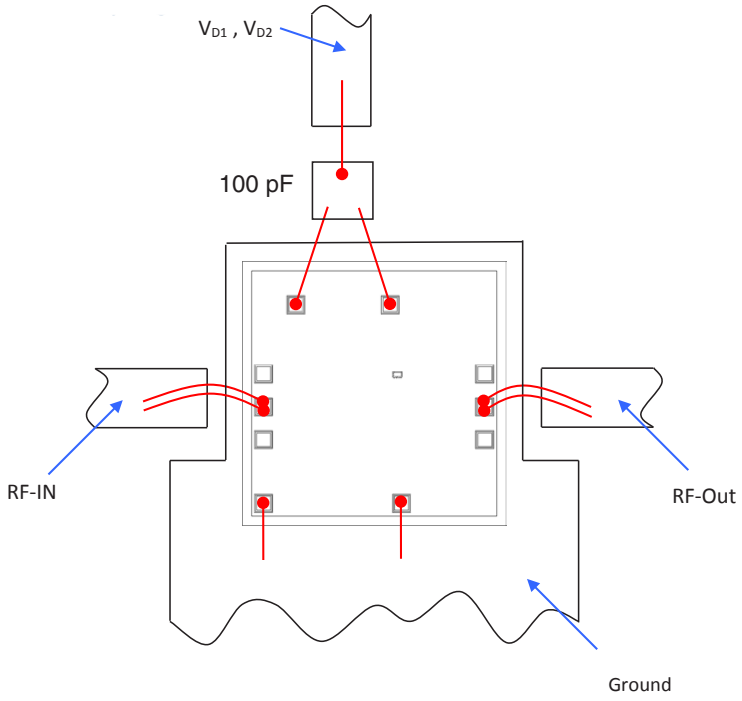
## Critical Dimensions

| Parameter | Values |
|---|---|
| Die Thickness, µm | 100 |
| Die Width, µm | 1240 |
| Die Length, µm | 1240 |
| Bond Pad Size, µm | 80 x 80 |

## Assembly and Handling Procedure

1. Storage
   Dice should be stored in a dry nitrogen purged desiccators or equivalent.
2. ESD
   MMIC PHEMT 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 workstation. 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) |
|---|---|---|
| RF-In, RF-Out | 0.25 | 0.15 |
| VD1, VD2 | 0.50 | 0.15 |
| Ground | 0.25 | 0.15 |

## 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** | Quantity, Package | Model No. |
| | Small, Gel - Pak: 10,50,100 KGD* | AVA-183A-DG+ |
| | Medium†, Partial wafer: KGD*<1085 | AVA-183A-DP+ |
| | Large†, Full Wafer | AVA-183A-DF+ |
| | †*Available upon request contact sales representative* | |
| | Refer to AN-60-067 | |
| **Environmental Ratings** | ENV-80 | |

*Known Good Dice ("KGD") means that the dice in question have been subjected to Mini-Circuits DC test performance criteria and measurement instructions and that the parametric data of such dice fall within a predefined range. While DC testing is not definitive, it does help to provide a higher degree of confidence that dice are capable of meeting typical RF electrical parameters specified by Mini-Circuits.

## ESD Rating**

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

** Tested in industry standard 3x3 mm 8-lead MCLP package.

### Additional Notes

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