

# Wideband Microwave Amplifier

AVA-24+

50Ω

5 to 20 GHz



CASE STYLE: DQ849

## The Big Deal

- Surface Mount Amplifier up to 20 GHz
- Integrated matching, DC Blocks and bias circuits
- High Reverse Isolation

## Product Overview

The Mini-Circuits AVA-24+ is a surface mount, microwave amplifier and fully integrated gain block up to 20 GHz. It is packaged in Mini-Circuits industry standard 3x3 mm MCLP (QFN) package, which provides excellent RF and thermal performance. The AVA-24+ integrates the entire matching network with the majority of the bias circuit inside the package, reducing the need for complicated external circuits. This approach makes the AVA-24+ extremely flexible and enables simple, straightforward use.

## Key Features

| Feature                 | Advantages                                                                                                                                                                                                                                                 |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Wideband, 5 to 20 GHz   | Broad frequency range supports a wide array of applications from microwave radio and radar , to military communications and countermeasures.                                                                                                               |
| Excellent Gain Flatness | Typical $\pm 0.8$ dB gain flatness across the entire frequency range minimizes the need for external equalizer networks making it a great fit for instrumentation and EW applications.                                                                     |
| High Isolation          | With reverse isolation of 37 dB (25 dB directivity), the AVA-24+ 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. |
| Manufacturability       | MSL1 and ESD Class1A (HBM) ratings minimize special handling on production lines.                                                                                                                                                                          |

### Notes

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# Monolithic Amplifier

5-20 GHz

## Product Features

- Gain, 12.3 dB typ. & Flatness,  $\pm 0.8$  dB
- Output Power, up to +18.3 dBm typ.
- Excellent isolation, 37 dB typ.
- Single Positive Supply Voltage, 5V
- Integrated DC blocks, Bias-Tee & Microwave bypass capacitor
- Unconditionally Stable
- Aqueous washable; 3mm x 3mm SMT package



## AVA-24+

CASE STYLE: DQ849

PRICE: \$19.50 ea. QTY. (10)

### +RoHS Compliant

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

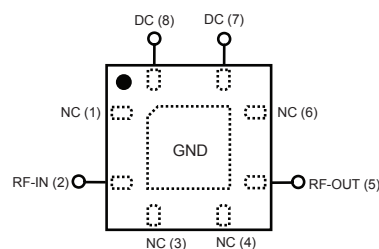
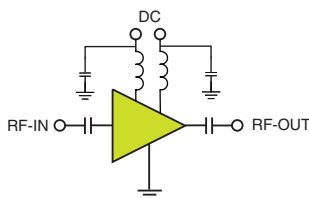
## Typical Applications

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

## General Description

AVA-24+ is a wideband medium power monolithic amplifier 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 | Pad Number                    | Description (See Application Circuit, Fig. 2)                  |
|----------|-------------------------------|----------------------------------------------------------------|
| RF-IN    | 2                             | RF input pad                                                   |
| RF-OUT   | 5                             | RF output pad                                                  |
| DC       | 8( $V_{D1}$ ), 7 ( $V_{D2}$ ) | DC power supply                                                |
| GND      | paddle in center of bottom    | Connected to ground                                            |
| NOT USED | 1,3,4,6                       | No internal connection; recommended use: per PCB Layout PL-328 |

\*Pseudomorphic High Electron Mobility Transistor.

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**Electrical Specifications<sup>(1)</sup> at 25°C,  $Z_0=50\Omega$ , (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 ( $I_{D1}+I_{D2}$ )                      |                 |      | 134    | 145  | mA    |
| Gain                                                | 5.0             |      | 12.4   |      | dB    |
|                                                     | 8.0             | 10.0 | 12.7   |      |       |
|                                                     | 10.0            | 10.0 | 12.4   |      |       |
|                                                     | 12.0            |      | 12.0   |      |       |
|                                                     | 14.0            |      | 11.7   |      |       |
|                                                     | 16.0            |      | 12.6   |      |       |
|                                                     | 18.0            | 10.0 | 12.6   |      |       |
| Input Return Loss                                   | 20.0            | 9.0  | 11.5   |      | dB    |
|                                                     | 5.0             |      | 12.7   |      |       |
|                                                     | 8.0             | 10.0 | 25.7   |      |       |
|                                                     | 10.0            | 10.0 | 17.9   |      |       |
|                                                     | 12.0            |      | 12.4   |      |       |
|                                                     | 14.0            |      | 11.3   |      |       |
|                                                     | 16.0            | 10.0 | 15.8   |      |       |
| Output Return Loss                                  | 18.0            |      | 11.7   |      | dB    |
|                                                     | 20.0            |      | 16.9   |      |       |
|                                                     | 5.0             |      | 30.0   |      |       |
|                                                     | 8.0             | 10.0 | 25.0   |      |       |
|                                                     | 10.0            | 10.0 | 18.6   |      |       |
|                                                     | 12.0            |      | 14.3   |      |       |
|                                                     | 14.0            |      | 13.6   |      |       |
| Output IP3                                          | 16.0            | 10.0 | 20.3   |      | dBm   |
|                                                     | 18.0            |      | 19.0   |      |       |
|                                                     | 20.0            |      | 11.5   |      |       |
|                                                     | 5.0             |      | 26.2   |      |       |
|                                                     | 8.0             |      | 26.3   |      |       |
|                                                     | 10.0            |      | 26.5   |      |       |
|                                                     | 12.0            |      | 26.3   |      |       |
| Output Power @ 1 dB compression                     | 14.0            |      | 26.0   |      | dBm   |
|                                                     | 16.0            |      | 25.4   |      |       |
|                                                     | 18.0            |      | 24.5   |      |       |
|                                                     | 20.0            |      | 23.8   |      |       |
|                                                     | 5.0             |      | 18.8   |      |       |
|                                                     | 8.0             | 16.0 | 18.7   |      |       |
|                                                     | 10.0            |      | 18.6   |      |       |
| Noise Figure                                        | 12.0            |      | 18.7   |      | dB    |
|                                                     | 14.0            |      | 18.5   |      |       |
|                                                     | 16.0            |      | 18.0   |      |       |
|                                                     | 18.0            |      | 17.4   |      |       |
|                                                     | 20.0            |      | 18.6   |      |       |
|                                                     | 5.0             |      | 7.0    |      |       |
|                                                     | 8.0             |      | 6.3    |      |       |
| Directivity (Isolation-Gain)                        | 10.0            |      | 5.6    |      | dB    |
|                                                     | 12.0            |      | 6.5    |      |       |
|                                                     | 14.0            |      | 6.5    |      |       |
|                                                     | 16.0            |      | 6.1    |      |       |
|                                                     | 18.0            |      | 6.1    |      |       |
|                                                     | 20.0            |      | 6.7    |      |       |
|                                                     |                 |      | 25.0   |      |       |
| DC Current Variation vs. Temperature <sup>(2)</sup> |                 |      | -0.087 |      | mA/°C |
| Thermal Resistance                                  |                 |      | 47     |      | °C/W  |

**Absolute Maximum Ratings<sup>(3)</sup>**

| Parameter                            | Ratings        |
|--------------------------------------|----------------|
| Operating Temperature <sup>(4)</sup> | -40°C to 85°C  |
| Storage Temperature                  | -55°C to 100°C |
| Channel Temperature                  | 160°C          |
| DC Voltage (Pad 7,8)                 | 5.5V           |
| Voltage (Pads 2, 5)                  | 10V            |
| Power Dissipation                    | 860 mW         |
| DC Current (Pad 7+8)                 | 160mA          |
| Input Power                          | 20 dBm         |

<sup>(1)</sup> Measured on Mini-Circuits Characterization test fixture TB-547-1+  
See Characterization Test Circuit (Fig. 1)

<sup>(2)</sup> (Current at 85°C - Current at -45°C)/130

<sup>(3)</sup> Permanent damage may occur if any of these limits are exceeded.

These maximum ratings are not intended for continuous normal operation.

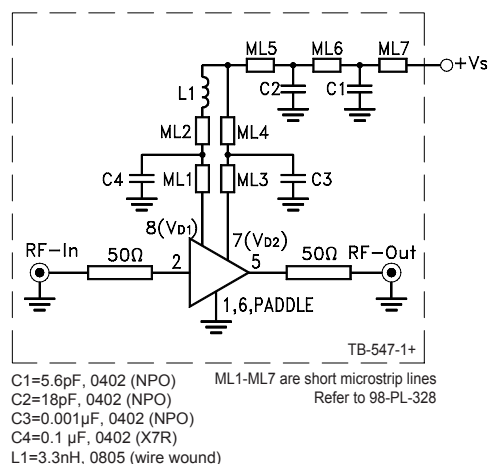
<sup>(4)</sup> Defined with reference to ground pad temperature.

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## Characterization Test Circuit



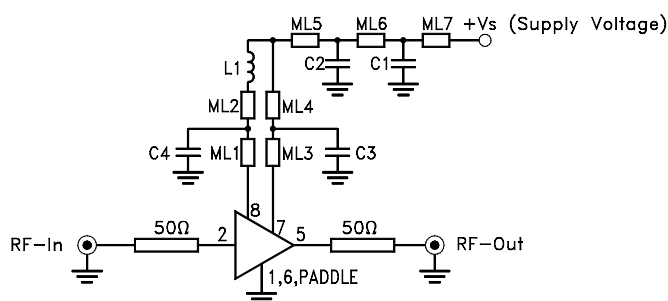
**Fig 1.** Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization Test Board TB-547-1+) Gain, Output power at 1dB compression (P1dB), Noise Figure, Output IP3 (OIP3) are measured using Agilent's N5242A PNA-X microwave network analyzer.

Conditions:

1. Gain: Pin=-25 dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, -10 dBm/tone at output.
3. Vs adjusted for 5V at device ( $V_{D1}$  and  $V_{D2}$ ), compensating loss of bias lines.

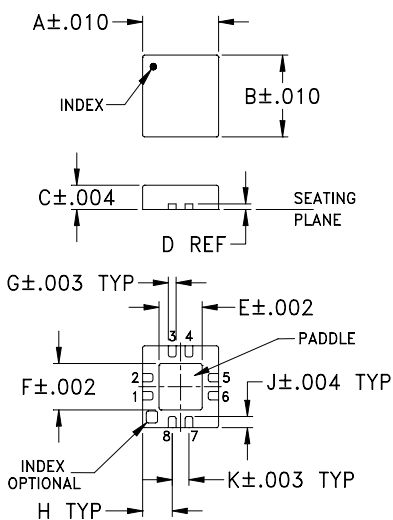
## Recommended Application Circuit

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

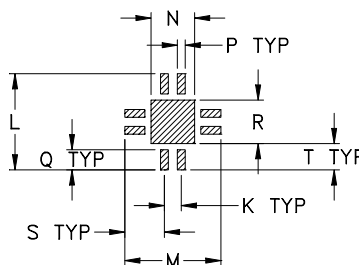


**Fig 2.** Recommended Application Circuit

## Outline Drawing



## PCB Land Pattern



Suggested Layout,  
Tolerance to be within ±.002

## Outline Dimensions (inch mm)

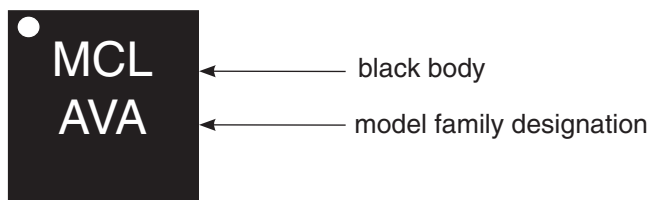
| A    | B    | C    | D    | E    | F    | G    | H    | J    |       |
|------|------|------|------|------|------|------|------|------|-------|
| .118 | .118 | .035 | .008 | .067 | .067 | .012 | .046 | .016 |       |
| 3.00 | 3.00 | 0.89 | 0.20 | 1.70 | 1.70 | 0.30 | 1.17 | 0.41 |       |
| K    | L    | M    | N    | P    | Q    | R    | S    | T    | wt    |
| .026 | .148 | .148 | .067 | .012 | .031 | .067 | .061 | .041 | grams |
| 0.66 | 3.76 | 3.76 | 1.70 | 0.30 | 0.79 | 1.70 | 1.55 | 1.04 | 0.02  |

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## Product Marking



## Additional Detailed Technical Information

Additional information is available on our web site [www.minicircuits.com](http://www.minicircuits.com). To access this information enter the model number on our web site home page.

## Performance data, graphs, s-parameter data set (.zip file)

## Case Style: DQ849

Plastic package, exposed paddle, lead finish: tin silver nickel

## Tape &amp; Reel: F104

Standard quantities available on reel: 7" reels with 10, 20, 50, 100, 200, 500, 1K, 2K

## Suggested Layout for PCB Design: PL-328

## Evaluation Board: TB-547-1+

## Environmental Ratings: ENV08T1

## ESD Rating

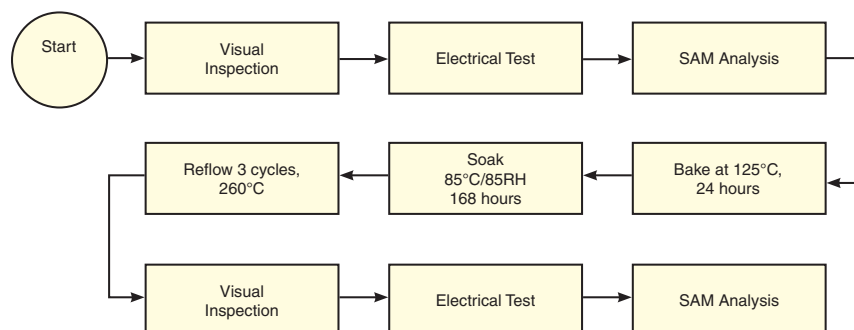
Human Body Model (HBM): 1A (250 to <500V) in accordance with ANSI/ESD STM 5.1 - 2001

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

## MSL Rating

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

## MSL Test Flow Chart



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