

## 1. General Description

The ARF9003 is a GaAs MMIC Power Amplifier operating at 20GHz-25GHz, power supply +6V operation, at 1500 mA working current, can provide 25dB gain, OP1dB 33dBm. The ARF9003 port impedance is 50  $\Omega$ .

## 2. Features

- 25 dB Small Signal Gain
- 33 dBm OP1dB
- 33.5 dBm PSAT
- Bias 1500 mA @ 6 V
- 32 Pin 5X5 mm AQFN Package
- Integrated Power Detector
- RoHS\* Compliant

## 3. Applications

- Point-To-Point radio for cellular backhaul applications
- Radar
- General Purpose Wireless

## 4. Functional Block Diagram

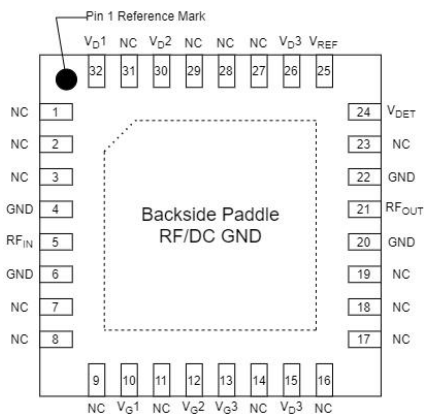


Figure1.

## 5. Order product model

ARF9003

## Directory

|  |    |
|--|----|
| 1. General Description .....                     | 1  |
| 2. Features .....                                | 1  |
| 3. Applications .....                            | 1  |
| 4. Functional Block Diagram .....                | 1  |
| 5. Order product model .....                     | 1  |
| 6. Specifications .....                          | 3  |
| 6.1. Electrical Specifications .....             | 3  |
| 6.2. Handling Ratings .....                      | 3  |
| 7. Absolute Maximum Ratings .....                | 4  |
| 8. Pin Assignments and Description .....         | 5  |
| 9. Typical Performance .....                     | 6  |
| 10. Performance Plots .....                      | 6  |
| 11. Application .....                            | 9  |
| 11.1 Detector Application Schematic .....        | 9  |
| 12. Package Marking and Outline Dimensions ..... | 10 |
| 13. Notice .....                                 | 11 |
| 13.1. Operating protection condition .....       | 11 |
| 13.2. Operate attention .....                    | 11 |
| 13.3. Solderability .....                        | 11 |
| 13.4. RoHS Compliance .....                      | 11 |
| 13.5. Contact Information .....                  | 11 |
| Important Notices and disclaimers .....          | 12 |

## 6. Specifications

### 6.1. Electrical Specifications

Test Conditions: VD=6V, Idq=1500mA, TA=+25°C, (de-embedded data);

Table1. Electrical Specifications

| Parameter          | Symbol | Test Conditions                      | Min | Typ  | Max | Units |
|--------------------|--------|--------------------------------------|-----|------|-----|-------|
| Frequency Range    |        |                                      | 20  |      | 25  | GHz   |
| Input Return Loss  | S11    |                                      |     | -10  |     | dB    |
| Output Return Loss | S22    |                                      |     | -10  |     | dB    |
| Gain               | S21    |                                      |     | 25   |     | dB    |
| P1dB               |        |                                      |     | 33   |     | dBm   |
| Past               |        |                                      |     | 33.5 |     | dBm   |
| IMD3               |        | +20 dBm SCL, $\Delta f=10\text{MHz}$ |     | -47  |     | dBc   |
| Noise Figure       | NF     |                                      |     | 3.5  |     | dB    |

### 6.2. Handling Ratings

Table2. Handling Ratings

| Symbol           | Parameter                  | Min | Typ | Max  | Units |
|------------------|----------------------------|-----|-----|------|-------|
| T <sub>STG</sub> | Storage temperature range  | -65 |     | +150 | °C    |
| V <sub>ESD</sub> | Human body model (HBM)     |     | 250 |      | V     |
|                  | Charged device model (CDM) |     | 250 |      | V     |

Table4.Absolute Maximum Ratings

## 7. Absolute Maximum Ratings

Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device.Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

| Parameter  | Min | Typ | Max | Units       |
|--|-----|-----|-----|-------------|
| DC Supply Voltage ( $V_D$ )                                | 0   | 6   | 7   | V           |
| Gate Voltage ( $V_G$ )                                     | -2  |     | 0   | V           |
| Detector Voltage ( $V_{DET}$ )                             |     |     | 7   | V           |
| Detector Reference Voltage ( $V_{REF}$ )                   |     |     | 7   | V           |
| Operational Frequency Range                                | 20  |     | 25  | GHz         |
| RF Input Power ( $P_{in}$ ), CW, 50ohms, $T_A=25^{\circ}C$ |     |     | 20  | dBm         |
| Operating Temperature                                      | -40 |     | +85 | $^{\circ}C$ |

## 8. Pin Assignments and Description

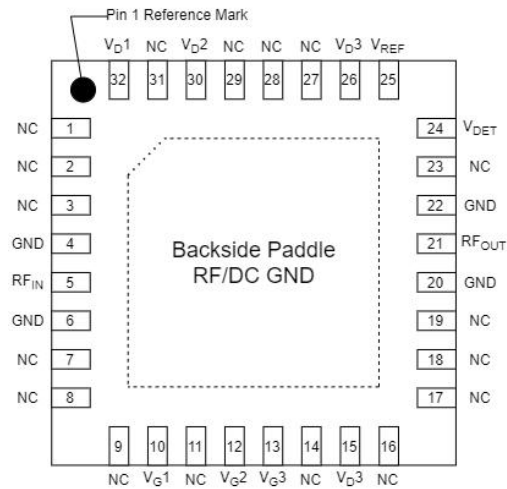


Figure2. Pin Assignments

Table5. Description

| Pin No.  | Mnemonic | Description                          |
|--|----------|--------------------------------------|
| 1,2,3,7,8,9,11,14,16,17,<br>18,19,23,27,28,29,31 | NC       | No Connection                        |
| 4,6,20,22  | GND      | RF Ground and DC power supply Ground |
| 5  | RFIN     | RF Input                             |
| 21   | RFOUT    | RF Output                            |
| 10   | VG1      | Gates 1 Bias                         |
| 12   | VG2      | Gates 2 Bias                         |
| 13   | VG3      | Gates 3 Bias                         |
| 32   | VD1      | Drain 1 Bias                         |
| 30   | VD2      | Drain 2 Bias                         |
| 15,26  | VD3      | Drain 3 Bias                         |
| 25   | VREF     | Pwr Det Ref                          |
| 24   | VDET     | Pwr Det                              |
| Backside Paddle                                  | GND      | RF/DC ground connection.             |

## 9. Typical Performance

Test Conditions: VD=6V, Idq=1500mA, TA=+25°C, (de-embedded data);

Table6. Typical Performance

| Parameter          | Conditions            | Units | Typical |      |      |      |      |      |      |  |
|--------------------|-----------------------|-------|---------|------|------|------|------|------|------|--|
|                    |                       |       | 20      | 21   | 22   | 22.5 | 23   | 24   | 25   |  |
| Freq               | —                     | GHz   | 20      | 21   | 22   | 22.5 | 23   | 24   | 25   |  |
| Small Signal Gain  | —                     | dB    | 24.5    | 25.5 | 25.0 | 25.0 | 25.0 | 24   | 20.0 |  |
| Input Return Loss  | —                     | dB    | -7      | -9   | -10  | -10  | -10  | -11  | -6   |  |
| Output Return Loss | —                     | dB    | -12     | -15  | -15  | -15  | -15  | -10  | -8   |  |
| P1dB               | —                     | dBm   | 32.0    | 32.8 | 33.0 | 33.0 | 32.8 | 32.5 | 32.5 |  |
| PSAT               | —                     | dBm   | 32.8    | 33.5 | 33.8 | 33.5 | 33.5 | 33.0 | 33.3 |  |
| IMD3               | +20 dBm SCL, Δf=10MHz | dBc   | -48     | -47  | -50  | -47  | -47  | -42  | -38  |  |
| Noise Figure       | —                     | dB    | 4.0     | 3.4  | 3.3  | 3.2  | 3.4  | 3.5  | 3.5  |  |

## 10. Performance Plots

Test Conditions: VD=6V, Idq=1500mA, TA=+25°C, (de-embedded data);

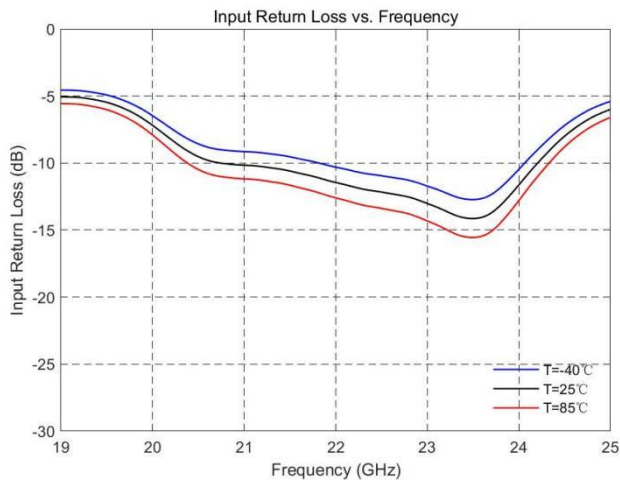


Figure3.

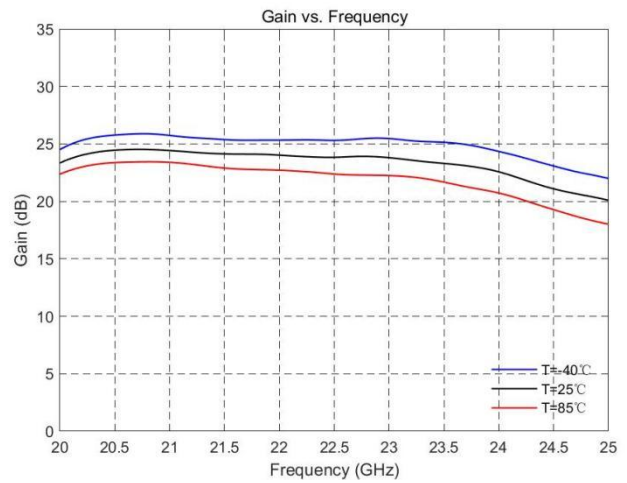


Figure4.

Performance Plots (Cont.)

Test Conditions:  $V_D=6V$ ,  $I_{dq}=1500mA$ ,  $T_A=+25^\circ C$ , (de-embedded data);

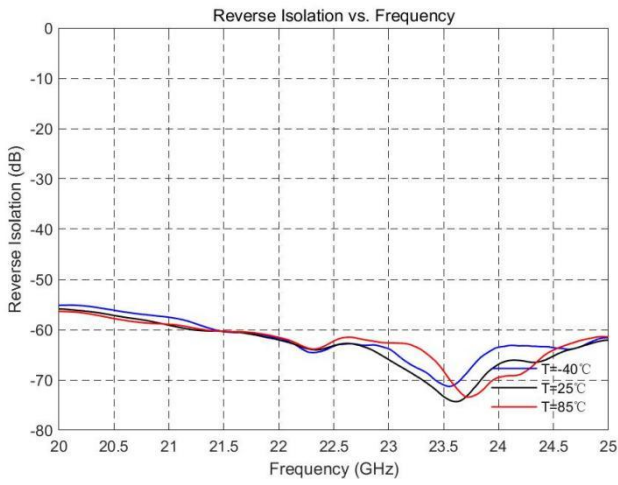


Figure5.

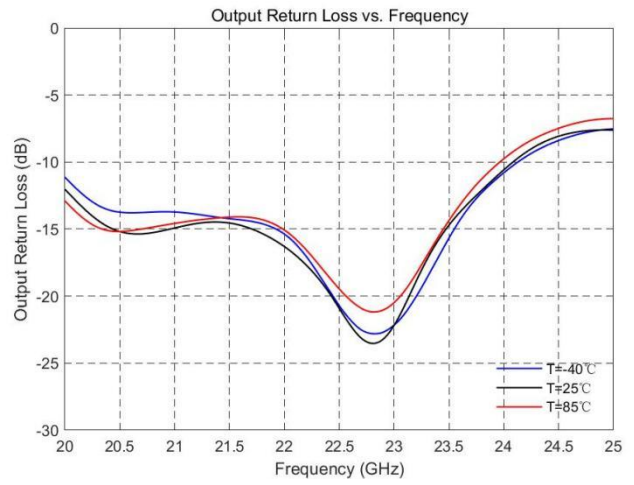


Figure6.

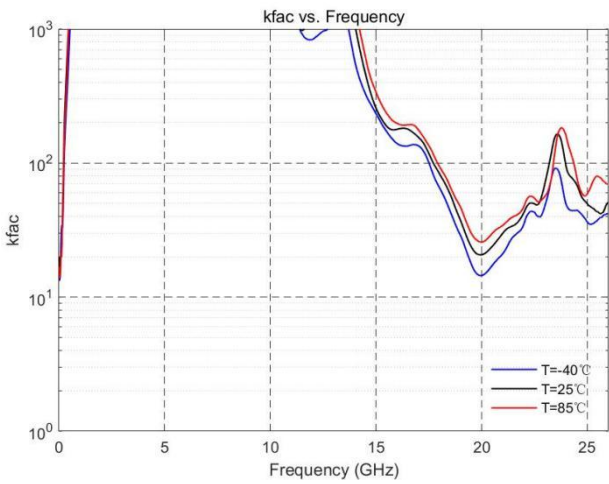


Figure7.

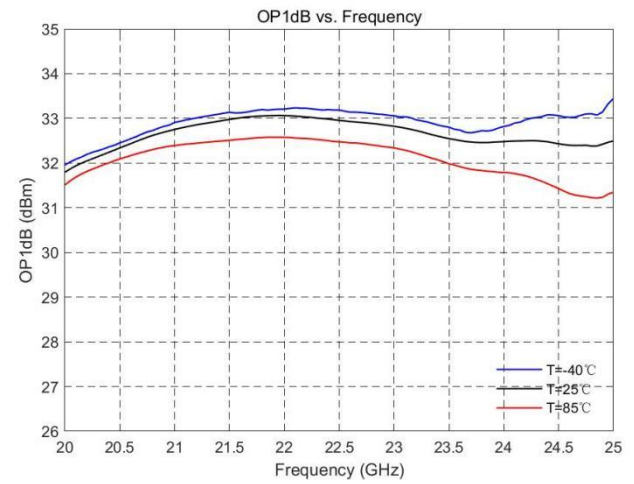


Figure8.

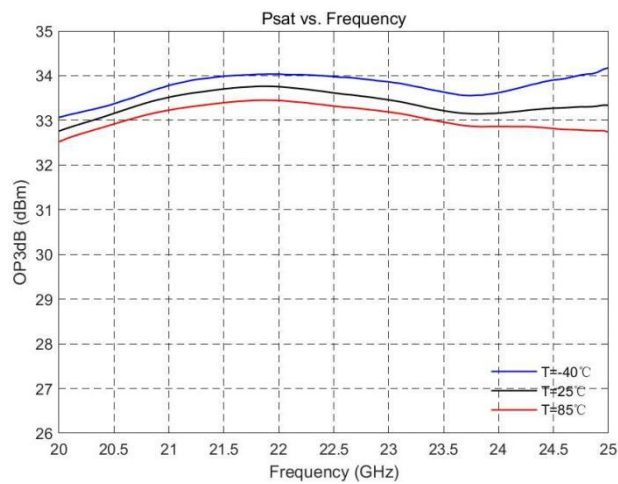


Figure9.

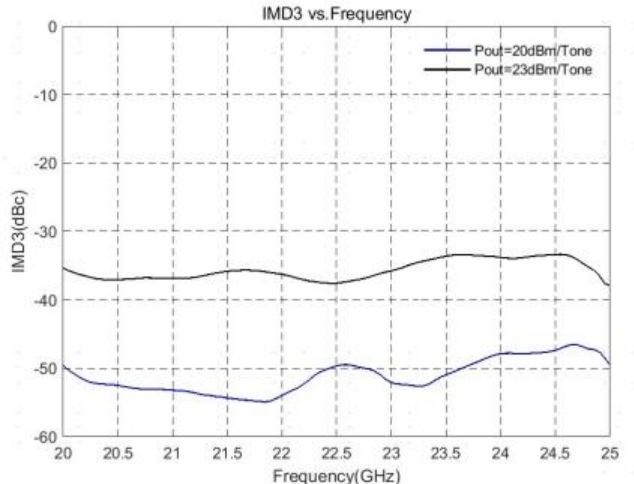


Figure10.

### Performance Plots (Cont.)

Test Conditions:  $V_D=6V$ ,  $I_{dq}=1500mA$ ,  $T_A=+25^\circ C$ , (de-embedded data);

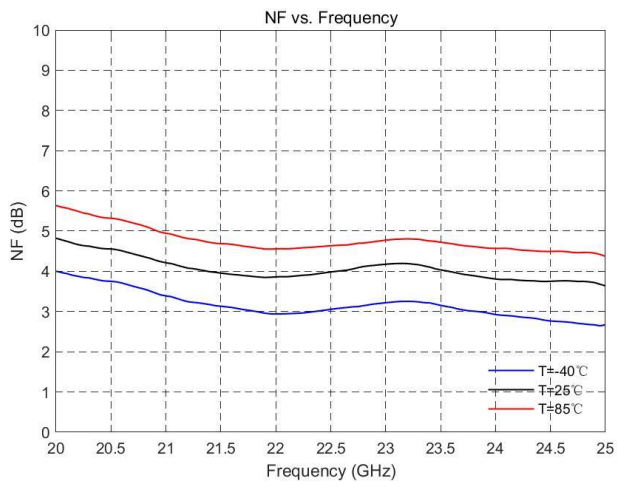


Figure11.



## 11. Application

### 11.1 Detector Application Schematic

As shown in the schematic below, the power detector is implemented by providing 5 V bias and measuring the difference in output voltage. This measure can be achieved by mean of either standard op-amp in a differential mode configuration or analog-to-digital converters.

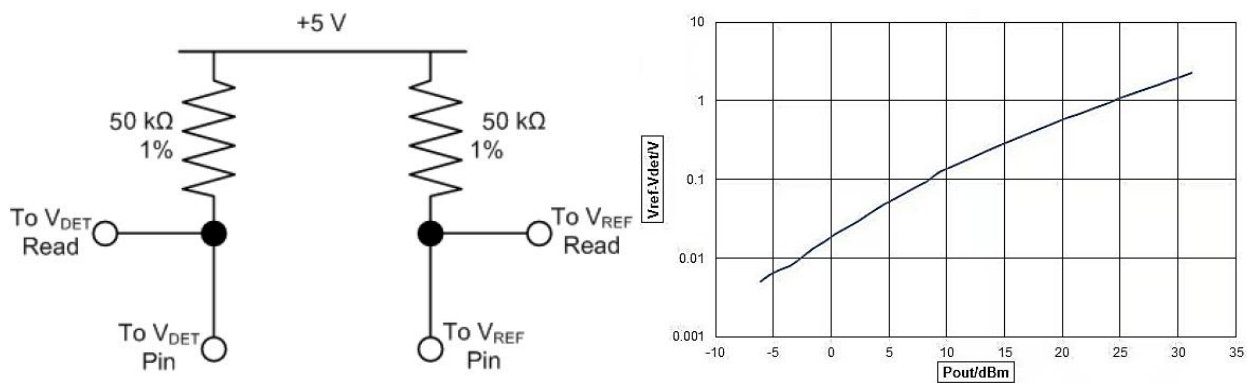


Figure12.

## 12. Package Marking and Outline Dimensions

- 1) All dimensions are in millimeters.
- 2) 32 pin 5x5x1.5mm AQFN Package.
- 3) Marking: Part number – 9003  
Lot code - XXXX
- 4) Coplanarity applies to the exposed heat sink slug as well as the terminals.
- 5) The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

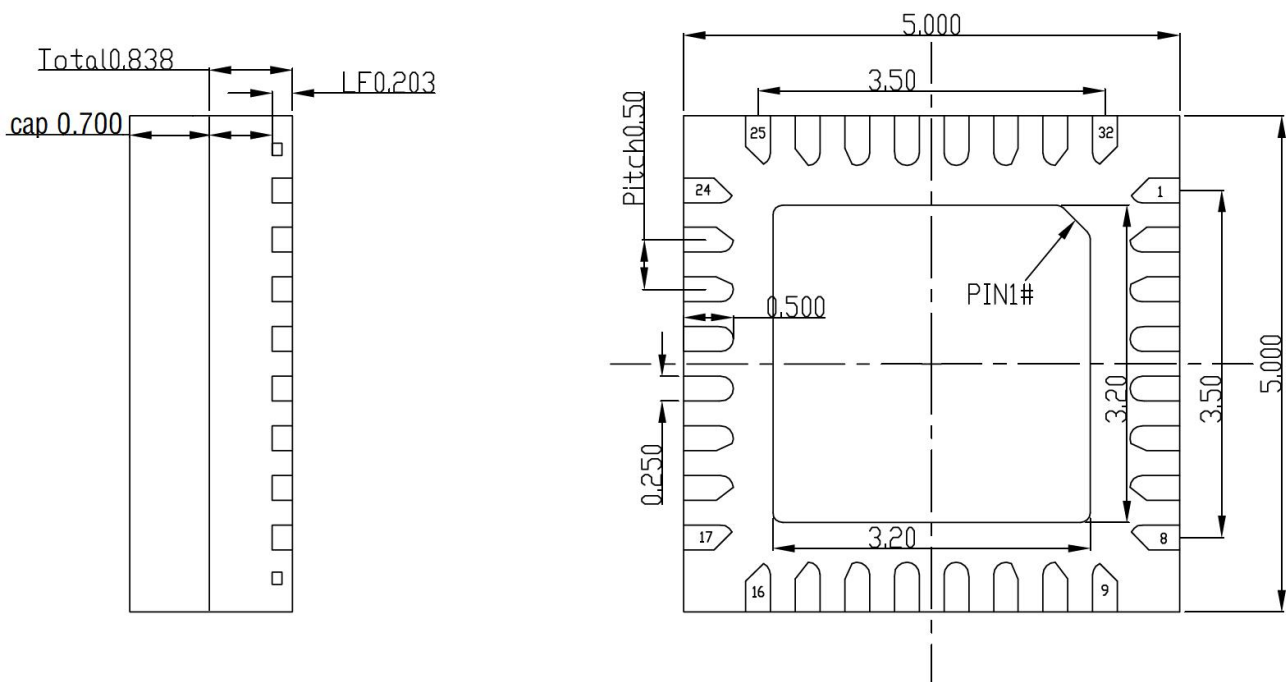


Figure13. Package Marking and Outline Dimensions

## **13. Notice**

### **13.1. Operating protection condition**



Devices and circuit boards may be undetected. Although this product has an ESD protection circuit, the device may be damaged when encountering high energy ESD. Therefore, appropriate ESD prevention measures should be taken to avoid deterioration of device performance or loss of function.

### **13.2. Operate attention**

1. Must be placed in a container with electrostatic protection function, dry environment, conditions permit the best storage nitrogen environment.
2. Please strictly comply with the ESD protection requirements to avoid electrostatic damage.
3. Use vacuum clamps or tweezers to avoid tools or fingers touching the product surface.

### **13.3. Solderability**

Compatible with lead-free (260 °C maximum reflow temperature) soldering processes.

### **13.4. RoHS Compliance**

This product is compliant with the EU RoHs2.0, EU Directive 2015/863.

### **13.5. Contact Information**

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