

## 1. General Description

The ARF2003 is a dual path low noise amplifier operating at 1500MHz-2300MHz, power supply +5V operation, at 110mA working current, can provide 22.5dB gain, P1dB 25dBm, noise figure typical value of 0.65dB. The ARF2003 port impedance is 50 Ω.

## 2. Features

16 Pin 4X4mm QFN Package

1.5GHz to 2.3GHz operation

Zin/Zout=50ohm

## 3. Applications

Communication System

Radar

## 4. Functional Block Diagram

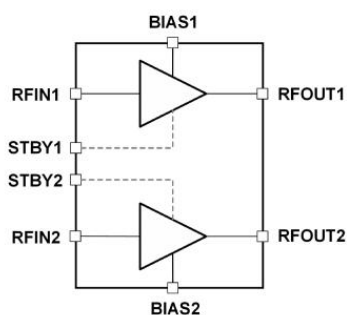


Figure1.

## 5. Order product model

ARF2003

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## 6. Specifications

### 6.1. Electrical Specifications

Test Conditions: 50Ω system, VDD=5V , Temp=+25°C;

Table1. Electrical Specifications

| Parameter          | Symbol            | Test Conditions          | Min | Typ  | Max | Units |
|--------------------|-------------------|--------------------------|-----|------|-----|-------|
| Frequency Range    |                   |                          | 1.5 |      | 2.3 | GHz   |
| Input Return Loss  | Gain              |                          |     | 20   |     | dB    |
| Output Return Loss | IRL               |                          |     | 20   |     | dB    |
| Gain               | ORL               |                          |     | 22.5 |     | dB    |
| Reverse ISO        | ISO               |                          |     | 29   |     | dB    |
| OP1dB              |                   |                          |     | 25   |     | dBm   |
| OIP3               |                   | Pout=5dBm/tone, Δf=1 MHz |     | 37.5 |     | dBm   |
| Noise Figure       | NF                |                          |     | 0.6  |     | dB    |
| Quiescent Current  | I <sub>cc,q</sub> |                          |     | 110  |     | mA    |

### 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)     | TBD |     |      | V     |
|                  | Charged device model (CDM) | TBD |     |      | V     |

### 6.3. Timing Requirements

Table3. Timing Requirements

| Parameter          | Conditions | Min | Typ | Max | Units |
|--------------------|------------|-----|-----|-----|-------|
| Switching Time OFF |            |     | 100 |     | ns    |
| Switching Time ON  |            |     | 100 |     | ns    |

### 6.4. STBY Mode Programming

Table4. STBY Mode Programming

| Path | Pin      | Logical Value | Path power status |
|------|----------|---------------|-------------------|
| 1    | 15/STBY1 | Low           | Path 1 Power On   |
|      |          | High          | Path 1 Standby    |
| 2    | 6/STBY2  | Low           | Path 2 Power On   |
|      |          | High          | Path 2 Standby    |

Table5. 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 (VDD, Venable) |     | 5   | 6   | V     |
| BIAS1                            |     | 1.8 |     | V     |
| BIAS2                            |     | 1.8 |     | V     |
| Operating Temperature            | -40 |     | 105 | °C    |

### 8. Pin Assignments and Description

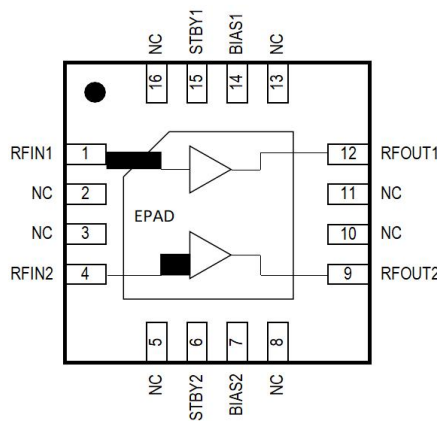


Figure2. Pin Assignments

Table6. Description

| Pin No.             | Mnemonic  | Description  |
|---------------------|-----------|--|
| 1                   | RFIN1     | Path 1 RF input.   |
| 4                   | RFIN2     | Path 2 RF input.   |
| 2,3,5,8,10,11,13,16 | NC        | No internal connection.  |
| 6                   | STBY2     | Standby pin of path 2.   |
| 7                   | BIAS2     | Voltage control for path 2.  |
| 9                   | RFOUT2    | Path 2 RF output.  |
| 12                  | RFOUT1    | Path 1 RF output.  |
| 14                  | BIAS1     | Voltage control for path 1.  |
| 15                  | STBY1     | Standby pin of path 1.   |
| Backside Paddle     | DC/RF GND | Use recommended via pattern to minimize inductance and thermal resistance. |

## 9. Performance Plots

### 9.1. Small Signal Datasheet

Test Conditions: 50Ω system, VDD=5V, Icc = 110mA.

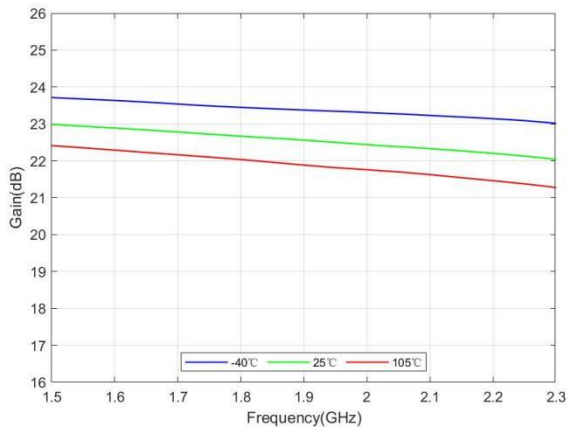


Figure3. Gain vs. frequency vs. Frequency

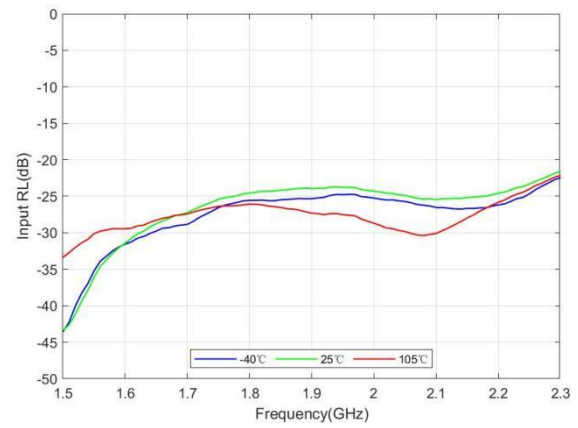


Figure4. Input Return Loss vs. Frequency

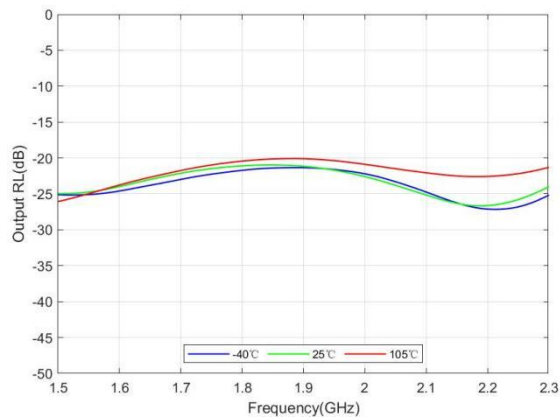


Figure5. Output Return Loss vs. Frequency

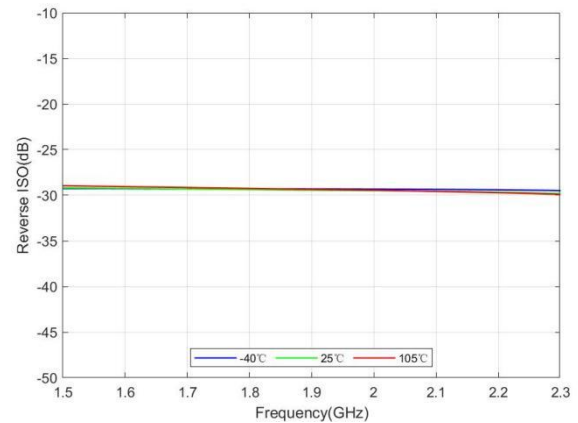


Figure6. Reverse Isolation vs. Frequency

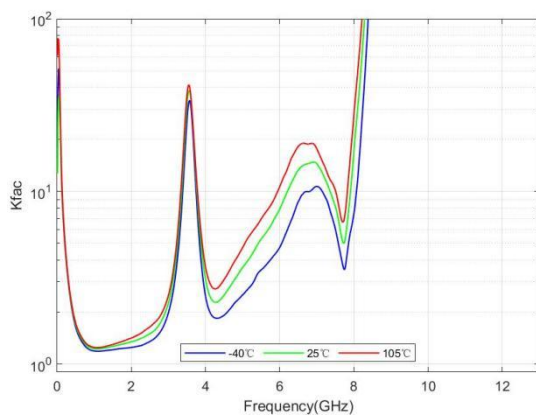


Figure7. Kfac vs. Frequency

### 9.2. Noise Figure

Test Conditions: 50Ω system, VDD=5V, Icc = 110mA.

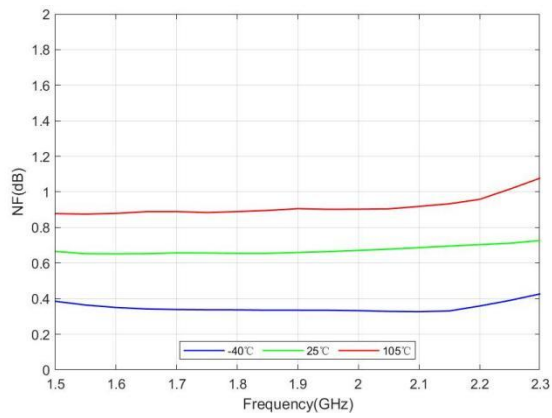


Figure8. Noise Figure vs. Frequency

### 9.3. Power Characteristics

Test Conditions: 50Ω system, VDD=5V, Icc = 110mA.

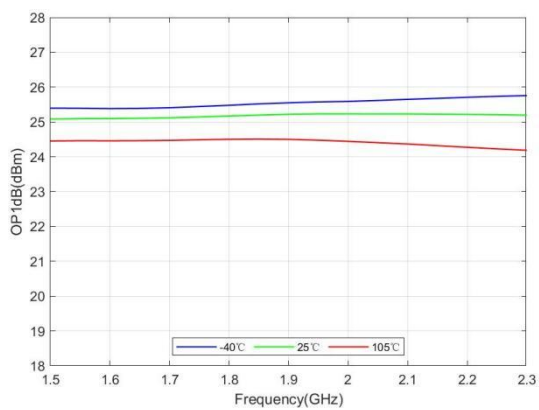


Figure9. OP1dB vs. Frequency

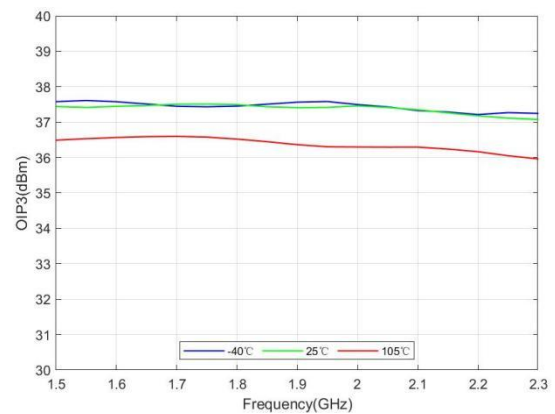


Figure10. OIP3 vs. Frequency

9.4. Switch Time



Figure11. Off state (VD switches from 5V to 0V)



Figure12. On state (VD switches from 0V to 5V)

## 10. Application

### 10.1. PCB Evaluation Board

The ARF2003 device is typically placed in a system like the one shown below Figure13.

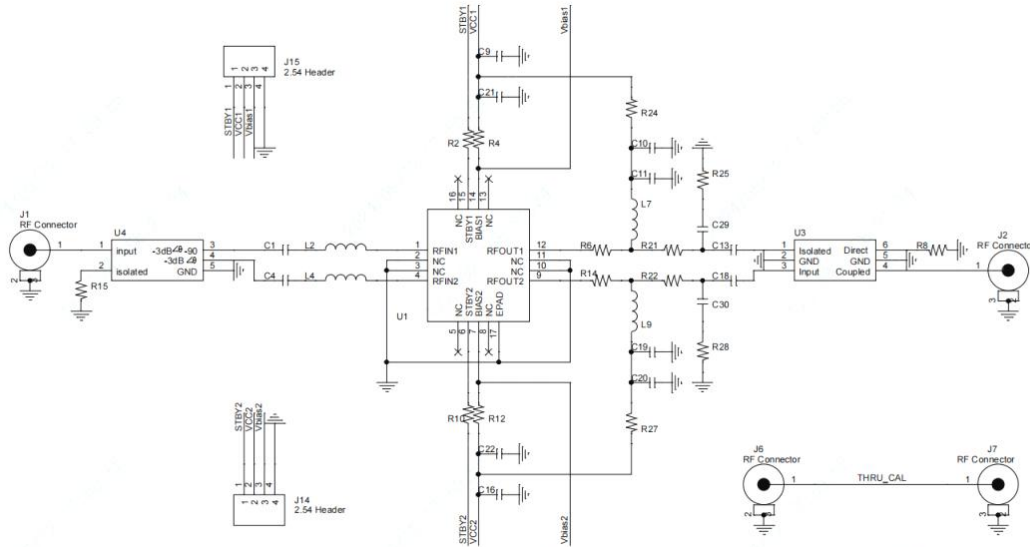


Figure13.

### 10.2. Evaluation Board BOM

| Item   | Conditions | Value | Manuf. | Part Num.          |
|--|------------|-------|--------|--------------------|
| U1   | N/A        | -     | ARF    | ARF2003-EVB        |
| U3   | N/A        | -     | Anaren | C1720J5003AHF      |
| U4   | N/A        | -     | Anaren | X3C19P1-03S        |
| C9, C16  | N/A        | 1uF   | Murata | GRM219R61A105MA01D |
| C10, C20, L2, L4                                 | N/A        | 1uF   | Murata | GRM155R61H105KE05D |
| R21, R22   | N/A        | 15p   | Murata | GJM1555C1H150FB01D |
| C11, C19   | N/A        | 100p  | Murata | GRM1555C1H101JA01D |
| C21, C22   | N/A        | 100nF | Murata | GCM155R71C104JA55D |
| R4, R12  | N/A        | 4.7k  | YAGEO  | RC2512FK-074K7L    |
| R8, R15  | N/A        | 51ohm | YAGEO  | RC2512FK-0751RL    |
| C1, C4, C13, C18, R2, R6<br>, R10, R14, R24, R27 | N/A        | 0ohm  | YAGEO  | RC2512FK-070RL     |
| L7, L9   |            | 22nH  | Murata | LQW18AN22NG00D     |
| C29, C30, R25, R28                               |            | NA    | NA     | NA                 |



## 11. Package Marking and Outline Dimensions

- 1) All dimensions are in millimeters.
- 2) QFN 8 pin 4x4x0.75mm Package.
- 3) Marking: Part number - 2003  
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.

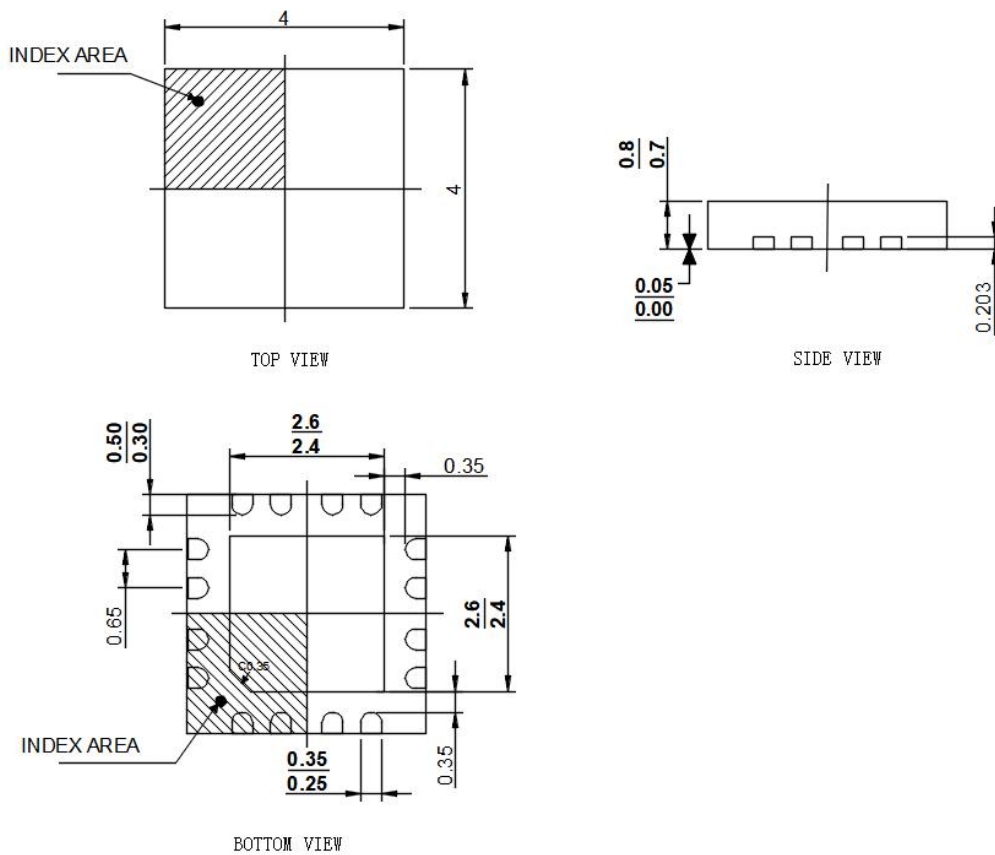


Figure14. Package Marking and Outline Dimensions

## **12. Notice**

### **12.1. 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.

### **12.2. 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.

### **12.3. Solderability**

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

### **12.4. RoHS Compliance**

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

### **12.5. Contact Information**

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