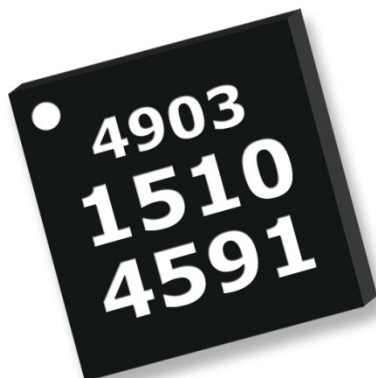
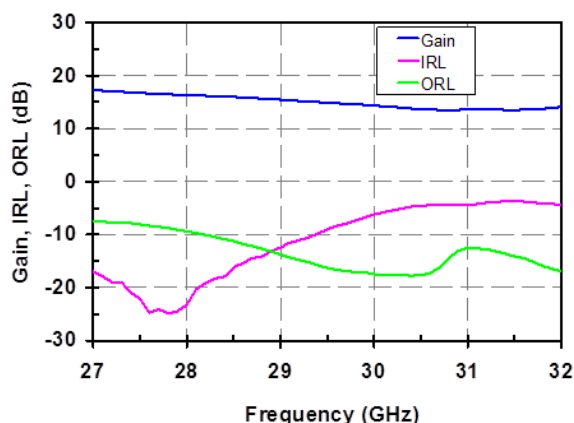
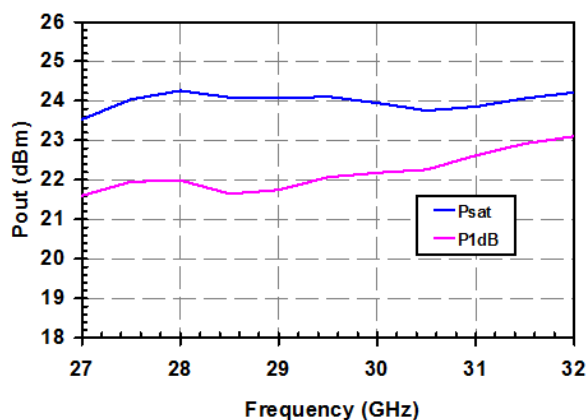


## Ka-Band Medium Power Amplifier



### Measured Performance

Bias conditions:  $V_d = 5\text{ V}$ ,  $I_d = 170\text{ mA}$ ,  $V_g = -0.6\text{ V}$ ,  
Typical



### Key Features

- Frequency Range: 27 - 32 GHz
- Psat: 24 dBm, P1dB: 22 dBm
- Gain: 15 dB
- Return Loss: 10 dB
- Bias:  $V_d = 5\text{ V}$ ,  $I_d = 170\text{ mA}$ ,  $V_g = -0.6\text{ V}$   
Typical
- Package Dimensions: 4 x 4 x 0.85 mm

### Primary Applications

- Vsat and Digital Radio
- Point-to-Multipoint Communications

### Product Description

The TriQuint TGA4903-SM is a Ka-Band packaged medium Power Amplifier. The TGA4903-SM operates from 27-32 GHz and is designed using TriQuint's proven standard pHEMT production process.

The TGA4903-SM typically provides 22 dBm of output power at 1 dB gain compression, with small signal gain of 15 dB.

The TGA4903-SM is ideally suited for VSAT ground terminals, Point-to-Point Radios and Point-to-Multipoint communications.

Evaluation Boards are available.

Lead-free and RoHS compliant.

*Datasheet subject to change without notice.*

**Table I**  
**Absolute Maximum Ratings 1/**

| Symbol   | Parameter                   | Value           | Notes     |
|----------|-----------------------------|-----------------|-----------|
| Vd-Vg    | Drain to Gate Voltage       | 12 V            |           |
| Vd       | Drain Voltage               | 8 V             | <u>2/</u> |
| Vg1      | Gate #1 Voltage Range       | -5 to 0 V       |           |
| Vg2      | Gate #2 Voltage Range       | -5 to 0 V       |           |
| Id1      | Drain #1 Current            | 352 mA          | <u>2/</u> |
| Id2      | Drain #2 Current            | 320 mA          |           |
| Ig1      | Gate #1 Current Range       | -0.9 to 16.5 mA |           |
| Ig2      | Gate #2 Current Range       | -0.8 to 15 mA   |           |
| Pin      | Input Continuous Wave Power | 18 dBm          | <u>2/</u> |
| Tchannel | Channel Temperature         | 200 °C          |           |

1/ These ratings represent the maximum operable values for this device. Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device and / or affect device lifetime. These are stress ratings only, and functional operation of the device at these conditions is not implied.

2/ Combinations of supply voltage, supply current, input power, and output power shall not exceed the maximum power dissipation listed in Table IV.

**Table II**  
**Recommended Operating Conditions**

| Symbol   | Parameter <u>1/</u>          | Value  |
|----------|------------------------------|--------|
| Vd       | Drain Voltage                | 5 V    |
| Id       | Drain Current                | 170 mA |
| Id_Drive | Drain Current under RF Drive | 300 mA |
| Vg       | Gate Voltage                 | -0.6 V |

1/ See Bias Procedures section for bias instructions.

**Table III**  
**RF Characterization Table**

| <b>SYMBOL</b> | <b>PARAMETER</b>               | <b>TEST CONDITIONS</b> | <b>MIN</b> | <b>NOMINAL</b> | <b>UNITS</b> |
|---------------|--------------------------------|------------------------|------------|----------------|--------------|
| Gain          | Small Signal Gain              | f = 27 GHz             | 13         | 16             | dB           |
| Gain          | Small Signal Gain              | f = 28-30 GHz          | 12         | 15             | dB           |
| Gain          | Small Signal Gain              | f = 31-32 GHz          | 11         | 14             | dB           |
| IRL           | Input Return Loss              | f = 27-32 GHz          |            | 10             | dB           |
| ORL           | Output Return Loss             | f = 27-32 GHz          |            | 10             | dB           |
| Psat          | Saturated Output Power         | f = 27-32 GHz          | 22         | 24             | dBm          |
| P1dB          | Output Power @ 1dB Compression | f = 27-32 GHz          |            | 22             | dBm          |
| TOI           | Output TOI                     | f = 27-32 GHz          |            | 27             | dBm          |
| NF            | Noise Figure                   | f = 27-32 GHz          |            | 12             | dB           |

**Table IV**  
**Power Dissipation and Thermal Properties**

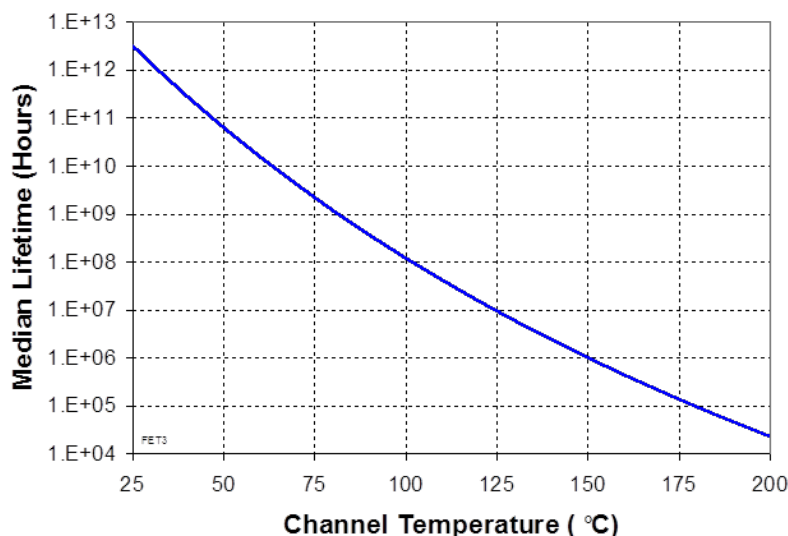
| Parameter                                           | Test Conditions                                                                 | Value                                                              | Notes               |
|-----------------------------------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------------------|---------------------|
| Maximum Power Dissipation                           | Tbaseplate = 70 °C                                                              | Pd = 2.0 W<br>Tchannel = 200 °C<br>Tm = 2.3 E4 Hrs                 | <u>1/</u> <u>2/</u> |
| Thermal Resistance, $\theta_{jc}$                   | Vd = 5 V<br>Id = 170 mA<br>Pd = 0.85 W<br>Tbaseplate = 70 °C                    | $\theta_{jc}$ = 65.2 °C/W<br>Tchannel = 125 °C<br>Tm = 9.13 E6 Hrs |                     |
| Thermal Resistance, $\theta_{jc}$<br>Under RF Drive | Vd = 5 V<br>Id = 300 mA<br>Pout = 24.5 dBm<br>Pd = 1.25 W<br>Tbaseplate = 70 °C | $\theta_{jc}$ = 65.2 °C/W<br>Tchannel = 151 °C<br>Tm = 8.92 E5 Hrs |                     |
| Mounting Temperature                                | 30 Seconds                                                                      | 320 °C                                                             |                     |
| Storage Temperature                                 |                                                                                 | -65 to 150 °C                                                      |                     |

1/ For a median life of 1E+6 hours, Power Dissipation is limited to

$$Pd(max) = (150\text{ °C} - Tbase\text{ °C})/\theta_{jc}.$$

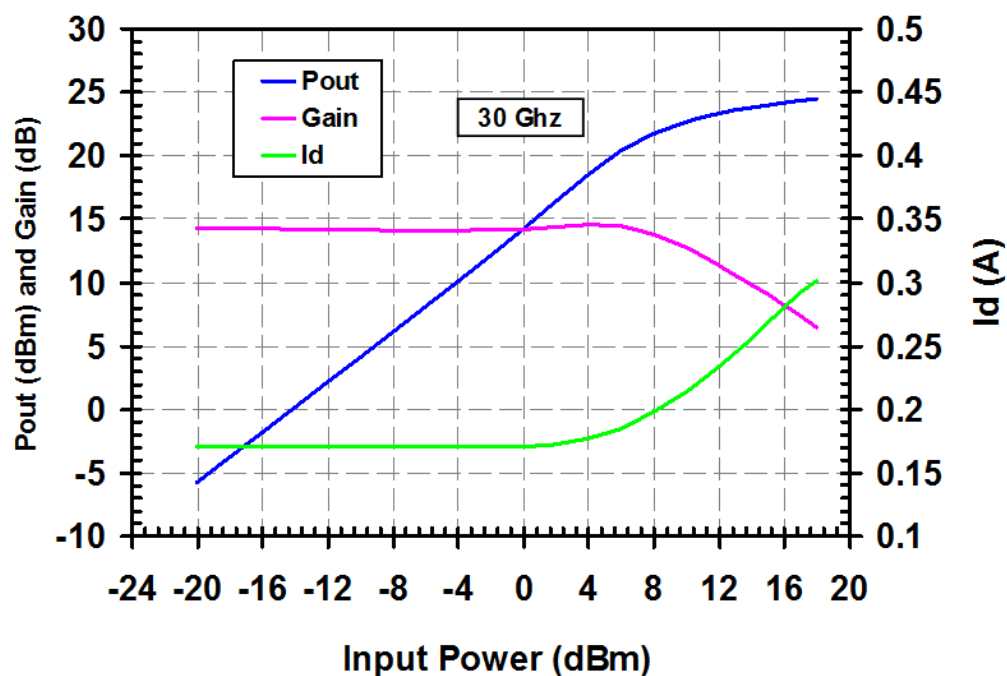
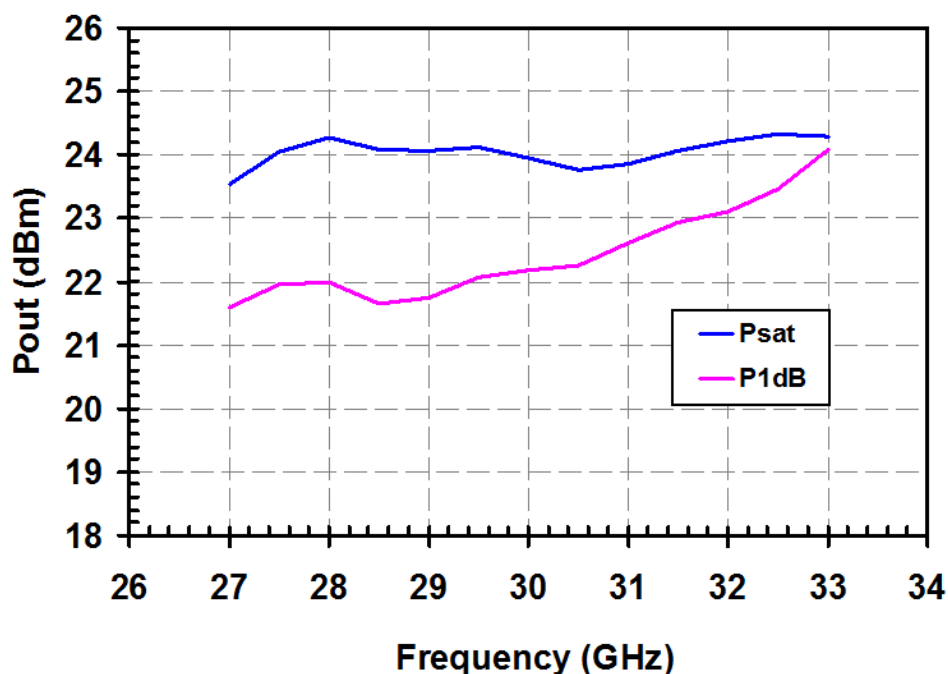
2/ Channel operating temperature will directly affect the device lifetime. For maximum life, it is recommended that channel temperatures be maintained at the lowest possible levels.

## Median Lifetime (Tm) vs. Channel Temperature



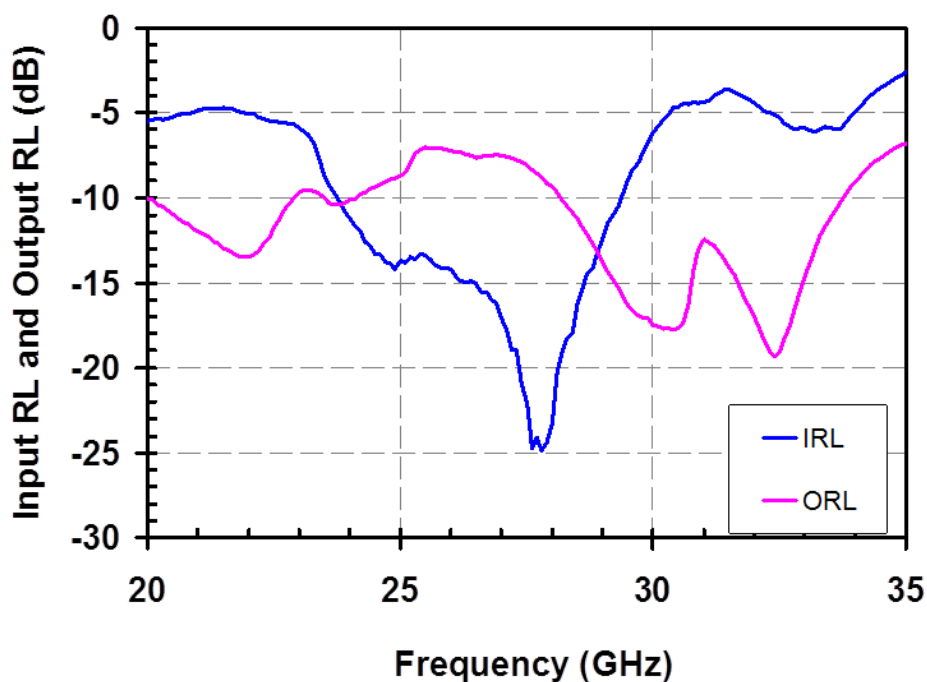
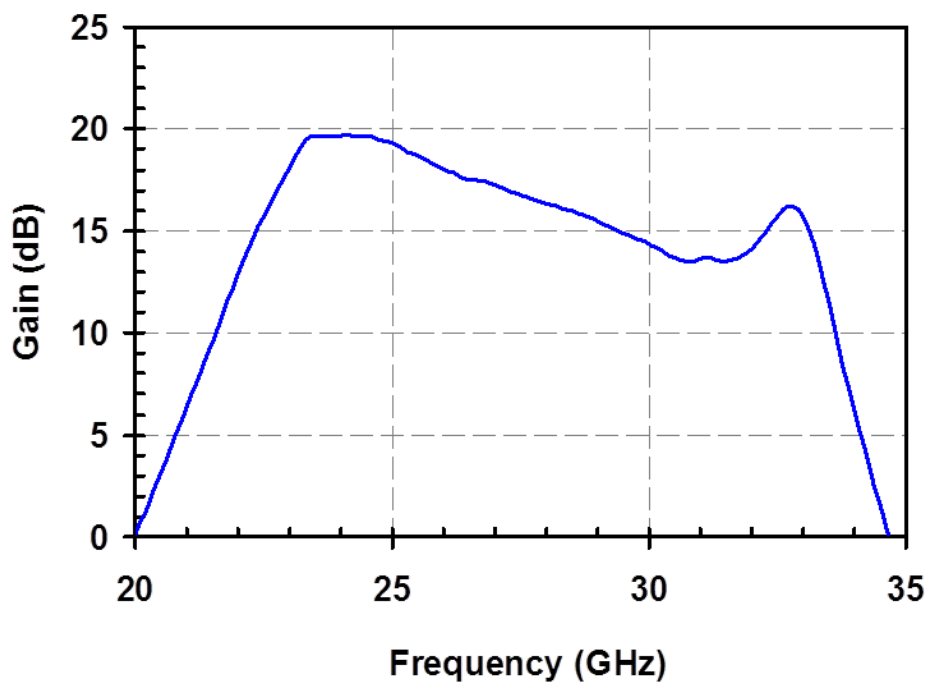
## Measured Data

Bias conditions:  $V_d = 5\text{ V}$ ,  $I_d = 170\text{ mA}$ ,  $V_g = -0.6\text{ V}$  Typical



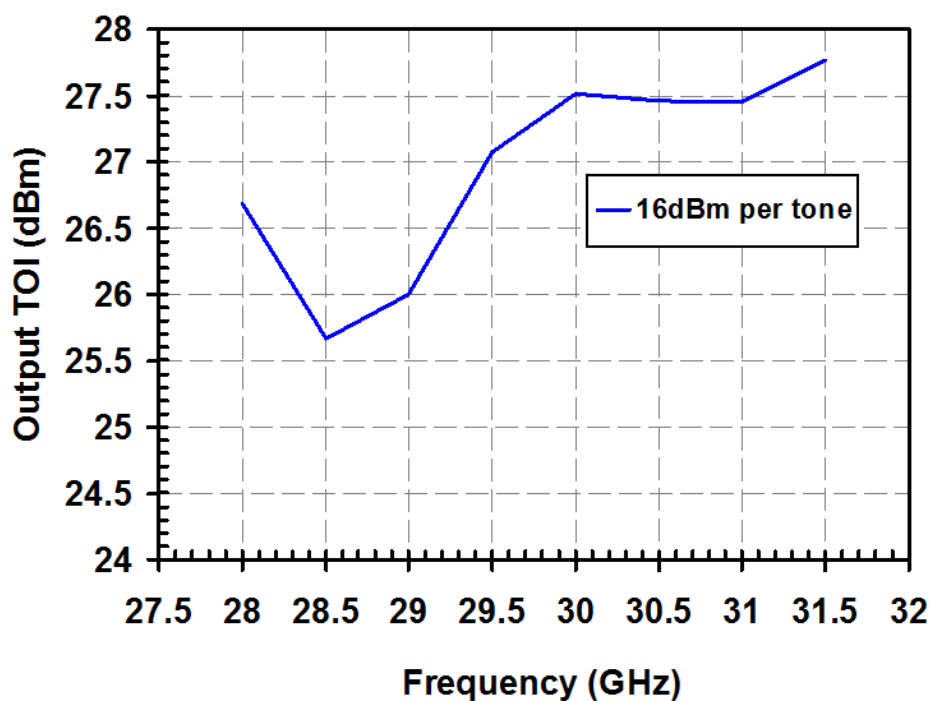
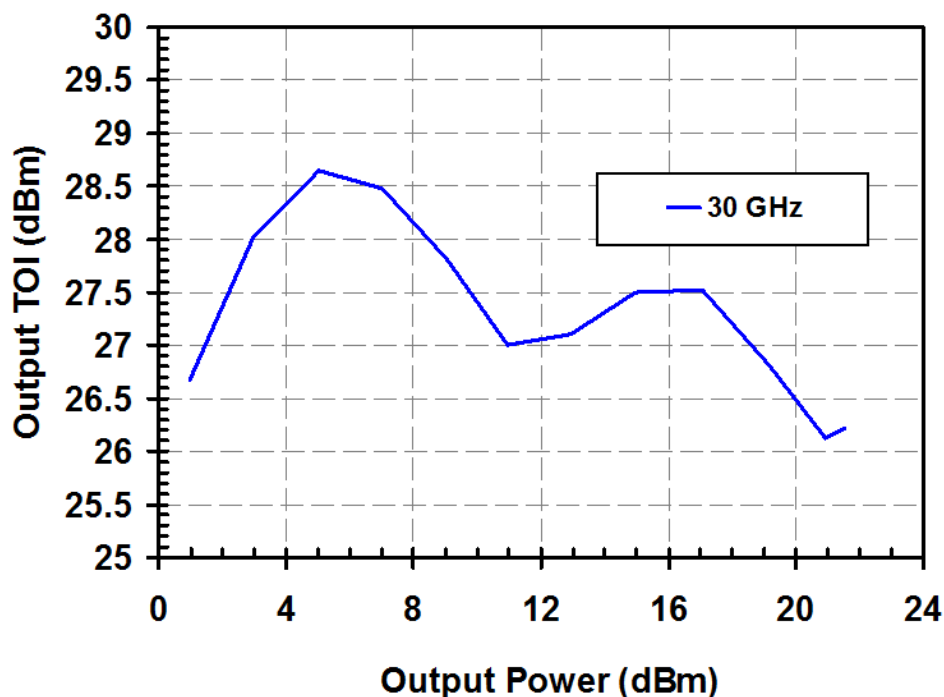
## Measured Data

Bias conditions:  $V_d = 5\text{ V}$ ,  $I_d = 170\text{ mA}$ ,  $V_g = -0.6\text{ V}$  Typical



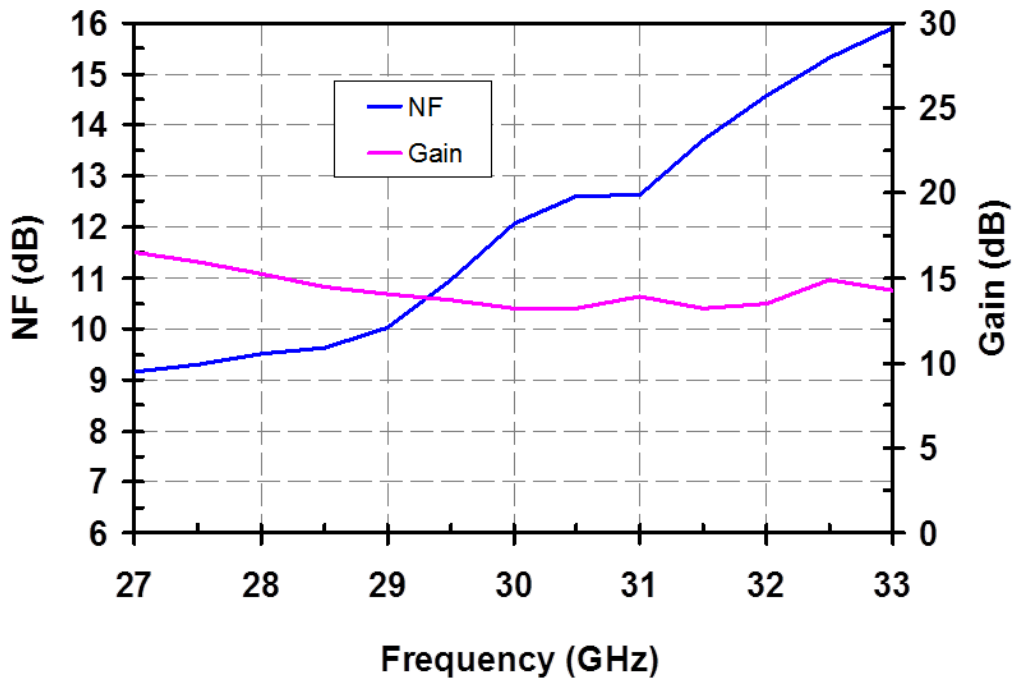
# Measured Data

Bias conditions:  $V_d = 5\text{ V}$ ,  $I_d = 170\text{ mA}$ ,  $V_g = -0.6\text{ V}$  Typical

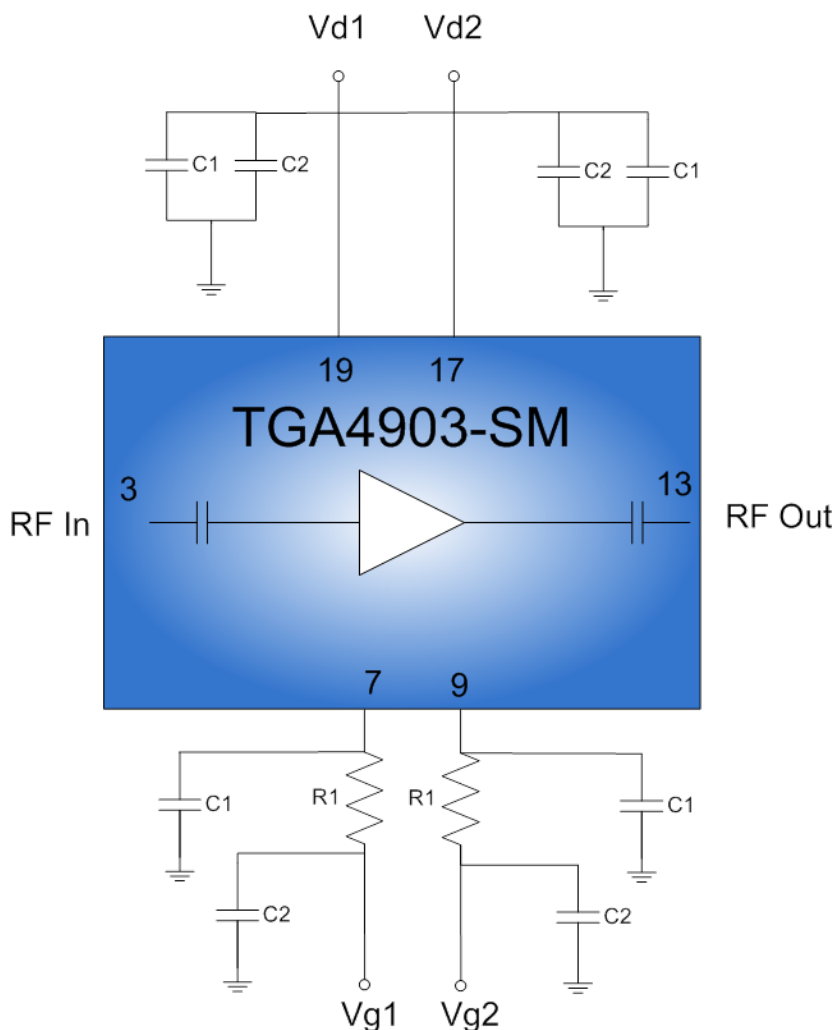


## Measured Data

Bias conditions:  $V_d = 5\text{ V}$ ,  $I_d = 170\text{ mA}$ ,  $V_g = -0.6\text{ V}$  Typical



## Electrical Schematic



## Bias Procedures

### Bias-up Procedure

Connect Vg1 and Vg2 together. ("Vg")  
Connect Vd1 and Vd2 together. ("Vd")

Vg set to -1.5 V

Vd set to +5 V

Adjust Vg more positive until Id is 170 mA. This will be ~ Vg = -0.6 V

Apply RF signal to input

### Bias-down Procedure

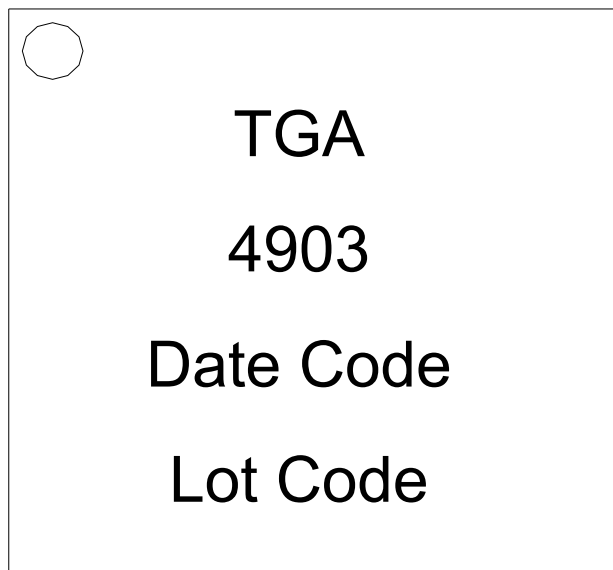
Turn off RF supply

Reduce Vg to -1.5V. Ensure Id ~ 0 mA

Turn Vd to 0 V

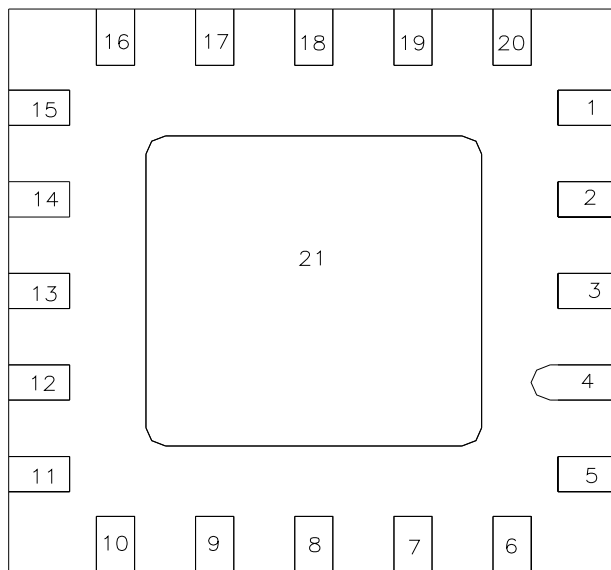
Turn Vg to 0 V

## Package Pinout Diagram



Top View

Dot indicates Pin 1

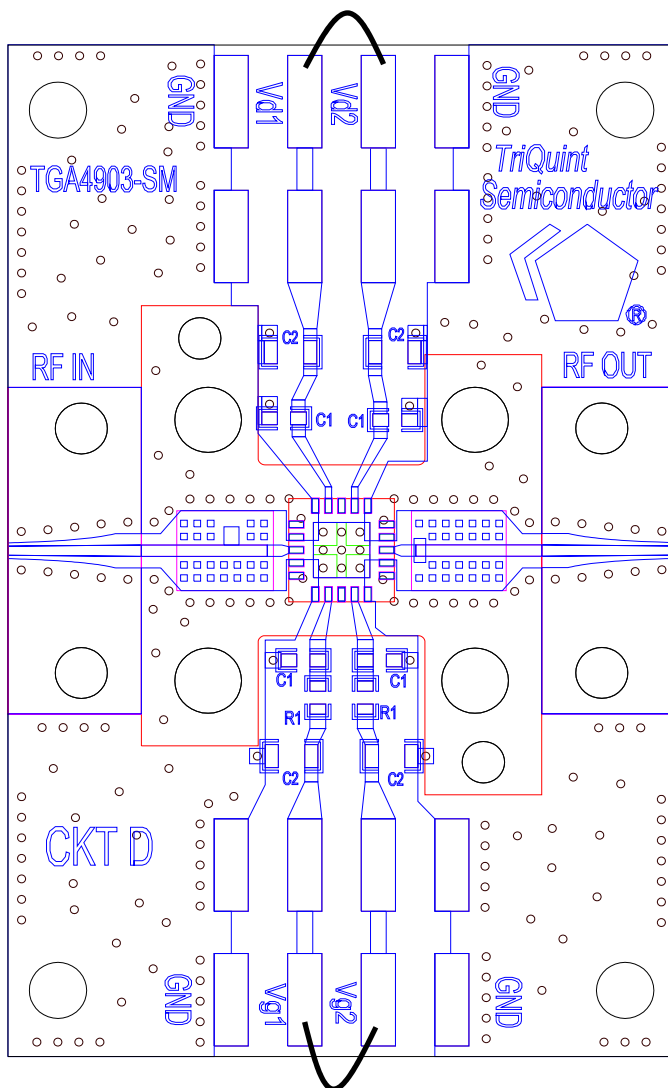


Bottom View

| Pin                                           | Description |
|-----------------------------------------------|-------------|
| 1, 2, 4, 5, 6, 10, 11, 12, 14, 15, 16, 20, 21 | GND         |
| 8, 18                                         | NC          |
| 3                                             | RF Input    |
| 7                                             | Vg1         |
| 9                                             | Vg2         |
| 13                                            | RF Output   |
| 17                                            | Vd2         |
| 19                                            | Vd1         |



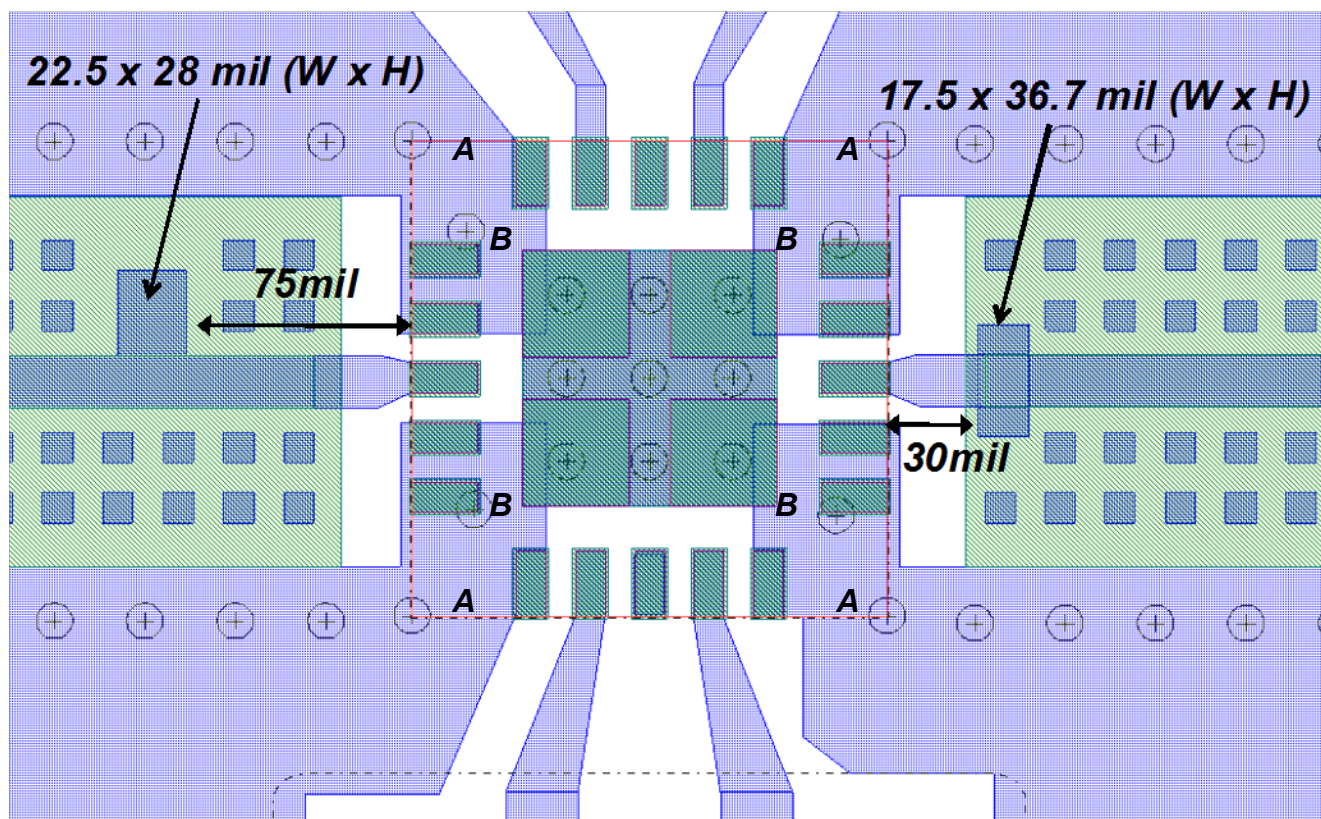
## Recommended Assembly Diagram



- C1: 0402 100pF cap
- C2: 0603 1uF cap
- R1: 0402 10 ohm resistor
- In / Out tuning stubs for gain & power improvements
- Rogers RO4003C 8mil thick with 0.5oz cladding

**GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.**

## Recommended Board Tuning for Maximum Output Power



**NOTE:** Ground vias located at sites A and B, above, and grounded metal pads on PCB top metal, located under the package “GND” pads (see page 10), are critical for RF performance

*GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.*

## Assembly Notes

### Recommended Surface Mount Package Assembly

- Proper ESD precautions must be followed while handling packages.
- Clean the board with alcohol. Allow the circuit to fully dry.
- TriQuint recommends using a conductive solder paste for attachment. Follow solder paste and reflow oven vendors' recommendations when developing a solder reflow profile. Typical solder reflow profiles are listed in the table below.
- Hand soldering is not recommended. Solder paste can be applied using a stencil printer or dot placement. The volume of solder paste depends on PCB and component layout and should be well controlled to ensure consistent mechanical and electrical performance.
- Clean the assembly with alcohol.

| Reflow Profile                       | SnPb                        | Pb Free                     |
|--------------------------------------|-----------------------------|-----------------------------|
| Ramp-up Rate                         | 3 °C/sec                    | 3 °C/sec                    |
| Activation Time and Temperature      | 60 – 120 sec @ 140 – 160 °C | 60 – 180 sec @ 150 – 200 °C |
| Time above Melting Point             | 60 – 150 sec                | 60 – 150 sec                |
| Max Peak Temperature                 | 240 °C                      | 260 °C                      |
| Time within 5 °C of Peak Temperature | 10 – 20 sec                 | 10 – 20 sec                 |
| Ramp-down Rate                       | 4 – 6 °C/sec                | 4 – 6 °C/sec                |

## Ordering Information

| Part       | Package Style         |
|------------|-----------------------|
| TGA4903-SM | QFN 4x4 Surface Mount |

***GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.***