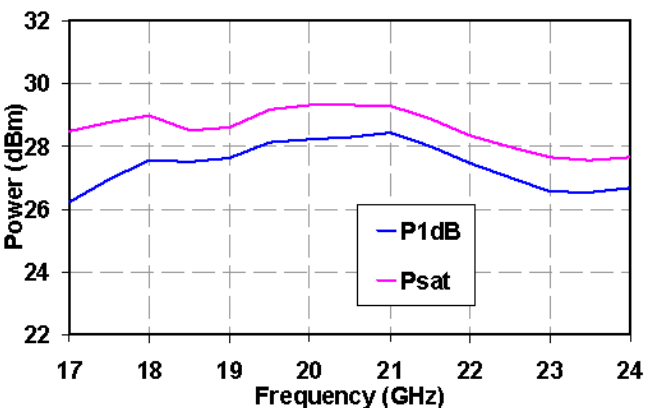
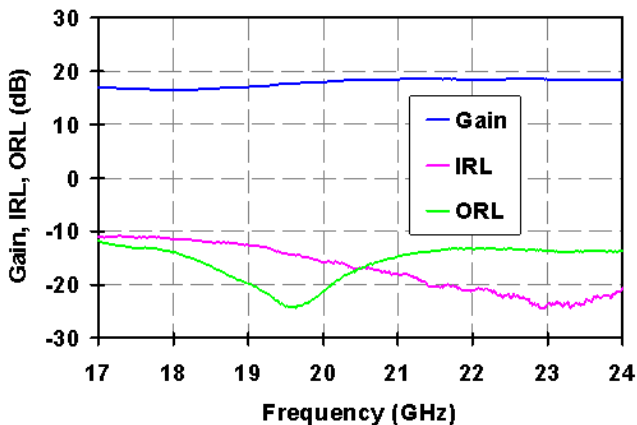


17- 24 GHz Power Amplifier



Measured Performance

Bias conditions: $V_d = 5\text{ V}$, $I_d = 712\text{ mA}$, $V_g = -0.5\text{ V}$ Typical



Key Features

- Frequency Range 17 GHz to 24 GHz.
- 28 dBm Output Psat, 26 dBm P1dB, typical.
- 35 dBm Output TOI.
- 17 dB Typical Gain.
- Integrated power detection with 30 dB dynamic range.
- High ESD tolerance.
- Dimensions: 4.0 x 4.0 x 0.85 mm
- Bias conditions: $V_d = 5\text{ V}$, $I_d = 712\text{ mA}$, $V_g = -0.5\text{ V}$, typical.

Primary Applications

- Point-to-Point Radio
- Point-to-Multipoint Communications

Product Description

The TriQuint TGA2522-SM is a three stage HPA MMIC design using TriQuint's proven 0.25 μm Power pHEMT process. The TGA2522-SM is designed to support a variety of millimeter wave applications including point-to-point digital radio and other K band linear gain applications.

The TGA2522-SM provides 26 dBm nominal output power at 1dB compression across 17-24 GHz. Typical small signal gain is 17 dB at 17 GHz and 18 dB at 24 GHz.

The TGA2522-SM requires minimum off-chip components. Each device is DC and RF tested for key parameters. The device is available in a 4 x 4 mm plastic QFN package.

RoHS and Lead-Free compliant. Evaluation boards available on request.

Datasheet subject to change without notice.

Table I
Absolute Maximum Ratings 1/

| Symbol | Parameter | Value | Notes |
|---------------|-----------------------------|--------------|--------------|
| Vd - Vg | Drain to Gate Voltage | 11 V | |
| Vd1,2 | Drain Voltage | 8 V | <u>2/</u> |
| Vg1,2 | Gate Voltage Range | -5 V to 0 V | |
| Vd3 | Drain Voltage | 8 V | <u>2/</u> |
| Vg3 | Gate Voltage Range | -5 V to 0 V | |
| Id1, 2 | Drain Current | 1750 mA | <u>2/</u> |
| Id3 | Drain Current | 1575 mA | <u>2/</u> |
| Ig1,2 | Gate Current Range | 35 mA | |
| Ig3 | Gate Current Range | 31.5 mA | |
| Pin | Input Continuous Wave Power | 26 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 |
|---------------|------------------------------|--------------|
| Vd1,2, Vd3 | Drain Voltage | 5 V |
| Id1,2, Id3 | Drain Current | 712 mA |
| Id_Drive | Drain Current under RF Drive | 850 mA |
| Vg1,2, Vg3 | Gate Voltage | -0.5 V |

1/ See assembly diagram for bias instructions.

Table III
RF Characterization Table

Bias: Vd = 5 V, Id = 712 mA, Vg = - 0.5 V, Typical

| SYMBOL | PARAMETER | TEST CONDITIONS | MINIMUM | NOMINAL | MAXIMUM | UNITS |
|---------------|-------------------------------|---------------------------------|----------------|----------------|----------------|--------------|
| Gain | Small Signal Gain | f = 17.7-23.6 GHz | 15 | 18 | | dB |
| IRL | Input Return Loss | f = 17.7-23.6 GHz | | 12 | | dB |
| ORL | Output Return Loss | f = 17.7-23.6 GHz | | 13 | | dB |
| Psat | Saturated Output Power | f = 17.7-22 GHz f = 23.6 GHz | 26.5 25.5 | 28 | | dBm |
| P1dB | Output Power @1dB Compression | f = 17.7-22 GHz f = 23.6 GHz | 25 24 | 27 | | dBm |
| TOI | Output TOI | f = 17.7-23.6 GHz | 33 | 36 | | dBm |

Table IV
Power Dissipation and Thermal Properties

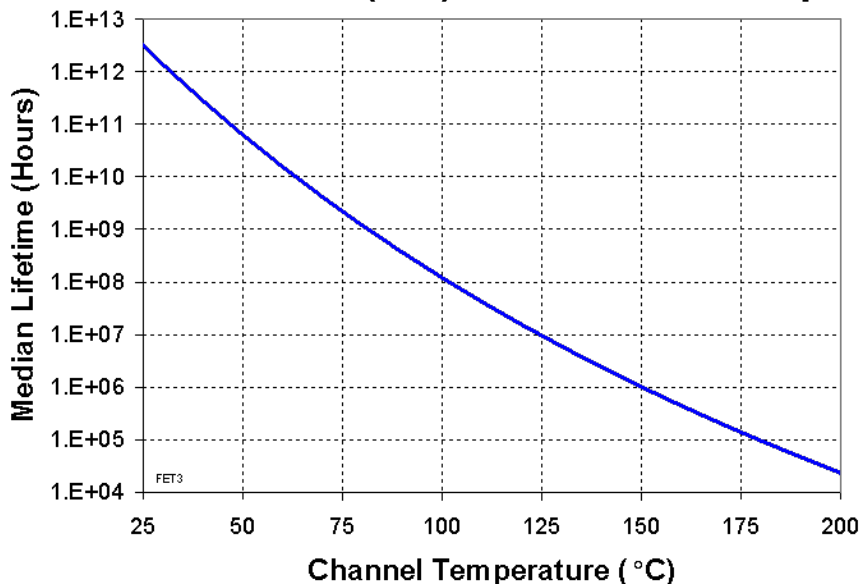
| Parameter | Test Conditions | Value | Notes |
|---|---|---|--------------|
| Maximum Power Dissipation | Tbaseplate = 85 °C | Pd = 8.52 W Tchannel = 200 °C | <u>1/ 2/</u> |
| Thermal Resistance, θ_{JC} | Vd = 5 V Id = 712 A Pd = 3.56 W Tbaseplate = 85 °C | θ_{JC} = 13.5 °C/W Tchannel = 133 °C Tm = 4.5E+6 Hrs | |
| Thermal Resistance, θ_{JC} Under RF Drive | Vd = 5 V Id = 850 mA Pout = 30 dBm Pd = 3.25 W | θ_{JC} = 13.5 °C/W Tchannel = 129 °C Tm = 6.2E+6 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.

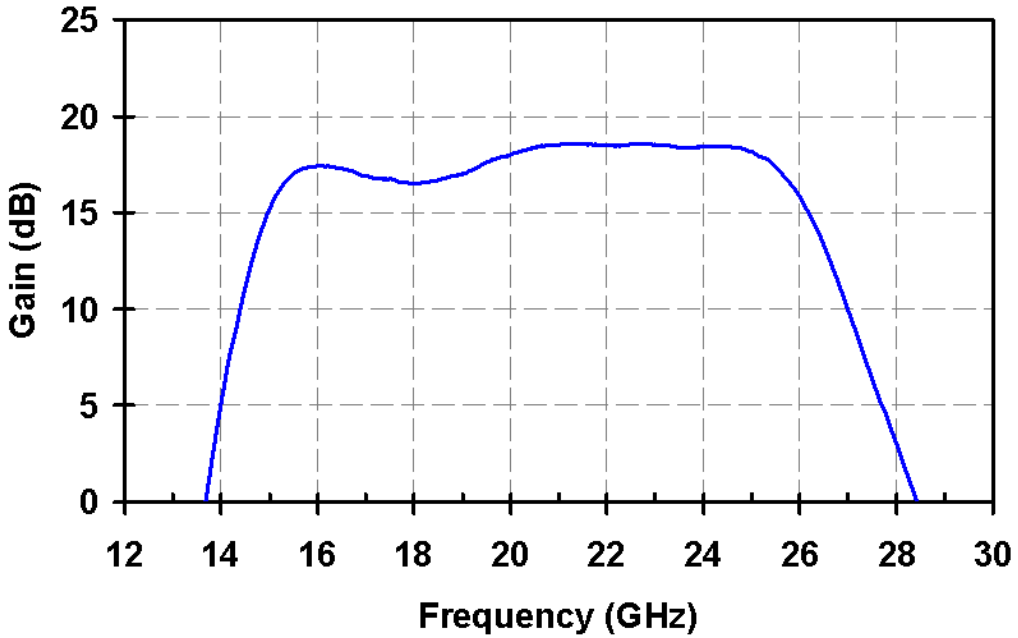
Median Lifetime (Tm) vs. Channel Temperature



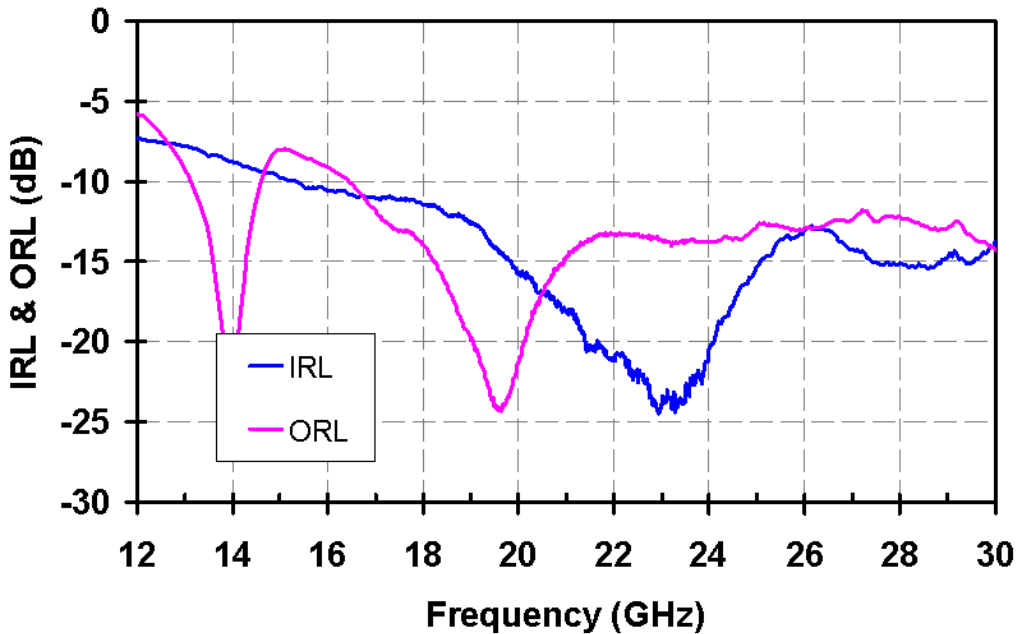
Measured Data

Bias conditions: $V_d = 5\text{ V}$, $I_d = 712\text{ mA}$, $V_g = -0.5\text{ V}$ Typical

TGA2522-SM

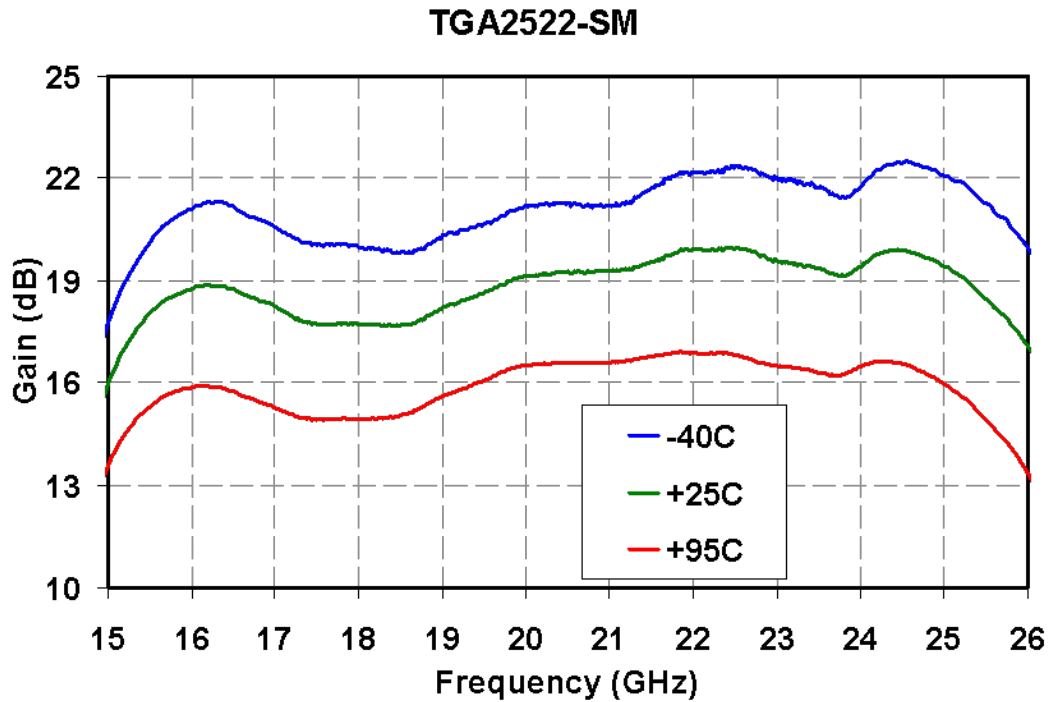


TGA2522-SM



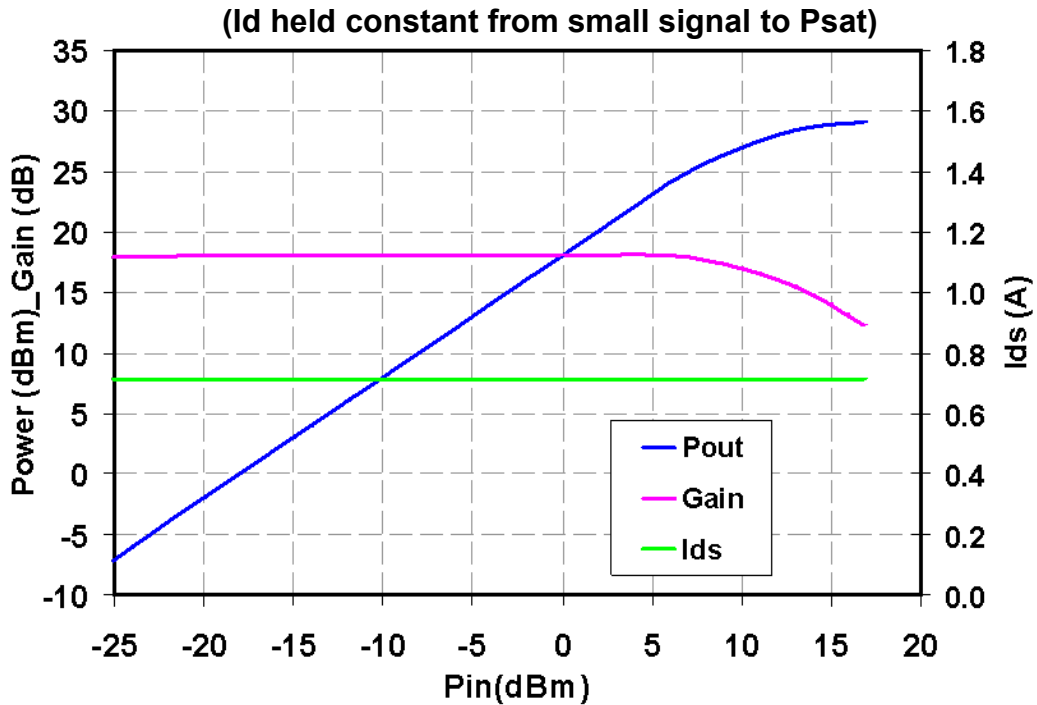
Measured Data

Bias conditions: $V_d = 5\text{ V}$, $I_d = 712\text{ mA}$, $V_g = -0.5\text{ V}$ Typical

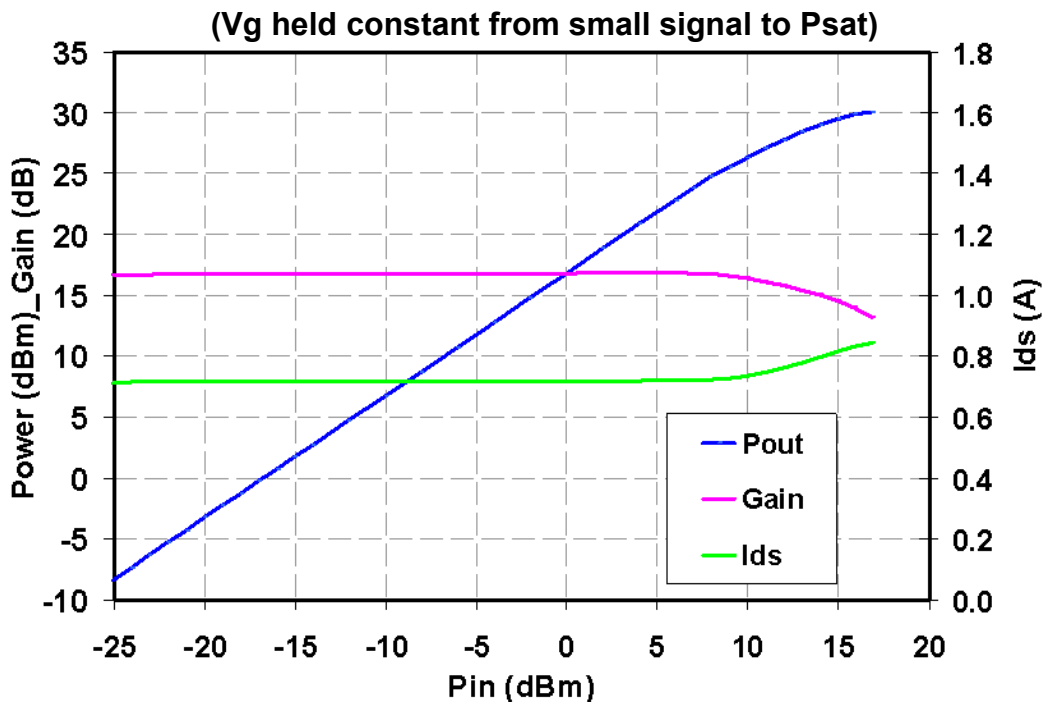


Measured Data

Bias conditions: $V_d = 5\text{ V}$, $I_d = 712\text{ mA}$, $V_g = -0.5\text{ V}$. Frequency = 19 GHz



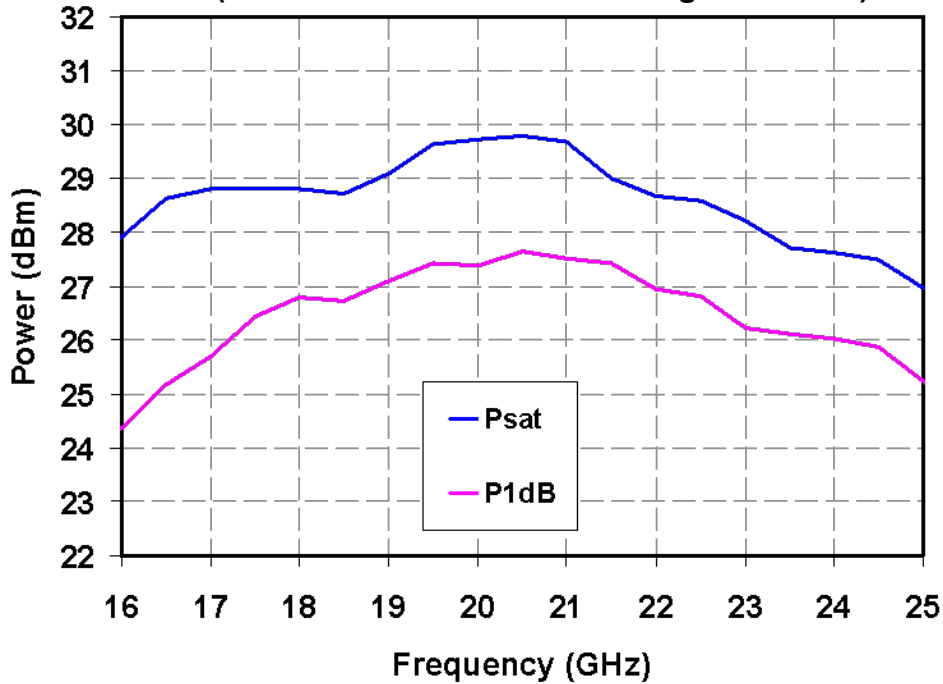
Bias conditions: $V_d = 5\text{ V}$, $I_d = 712\text{ mA}$, $V_g = -0.5\text{ V}$. Frequency = 19 GHz



Measured Data

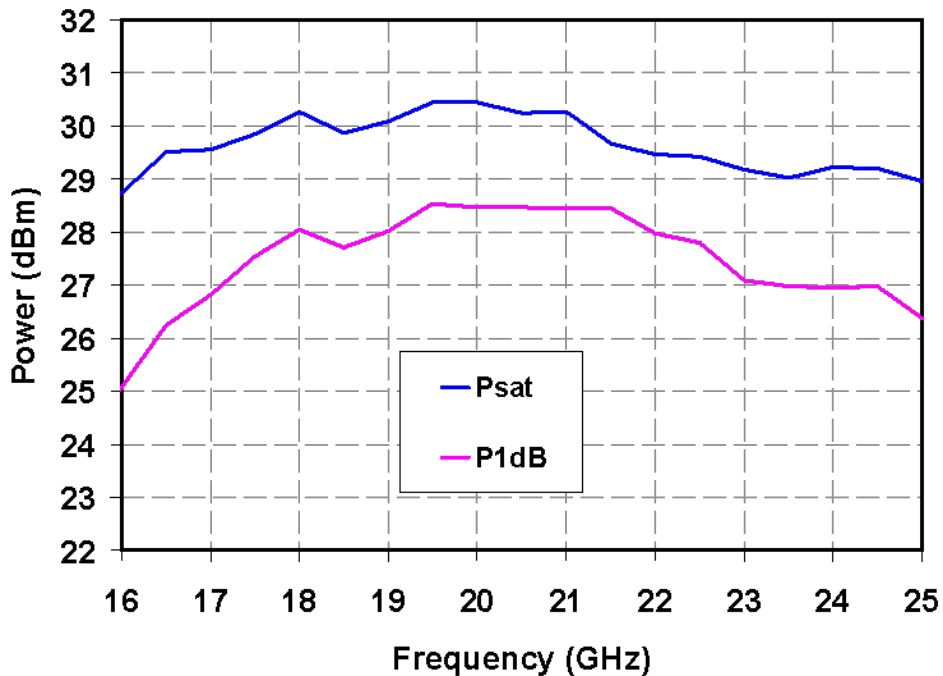
Bias conditions: $V_d = 5\text{ V}$, $I_d = 712\text{ mA}$, $V_g = -0.5\text{ V}$

(I_d held constant from small signal to P_{sat})



Bias conditions: $V_d = 5\text{ V}$, $I_d = 712\text{ mA}$, $V_g = -0.5\text{ V}$

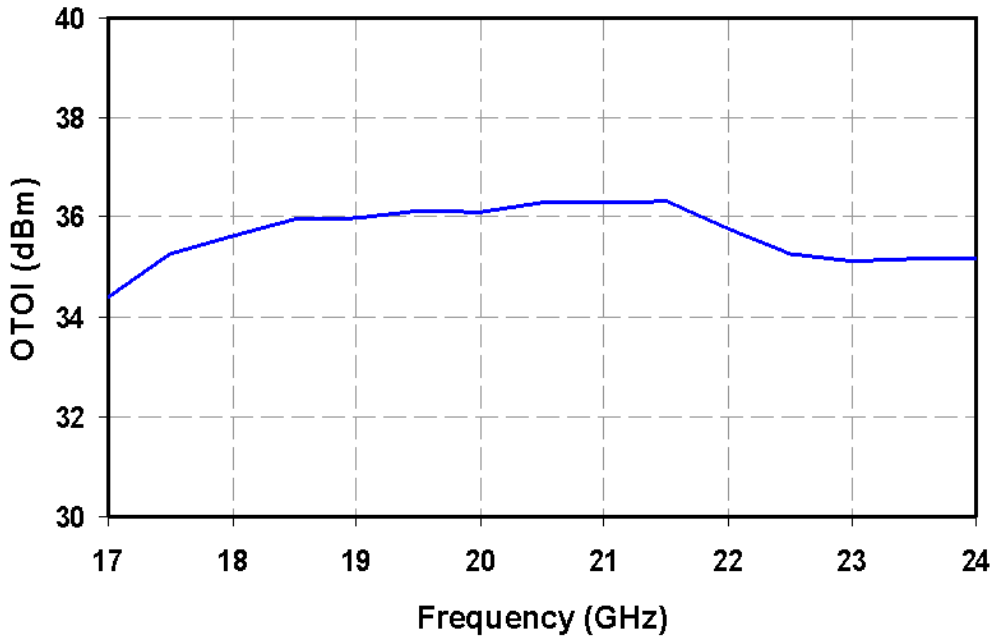
(V_g held constant from small signal to P_{sat})



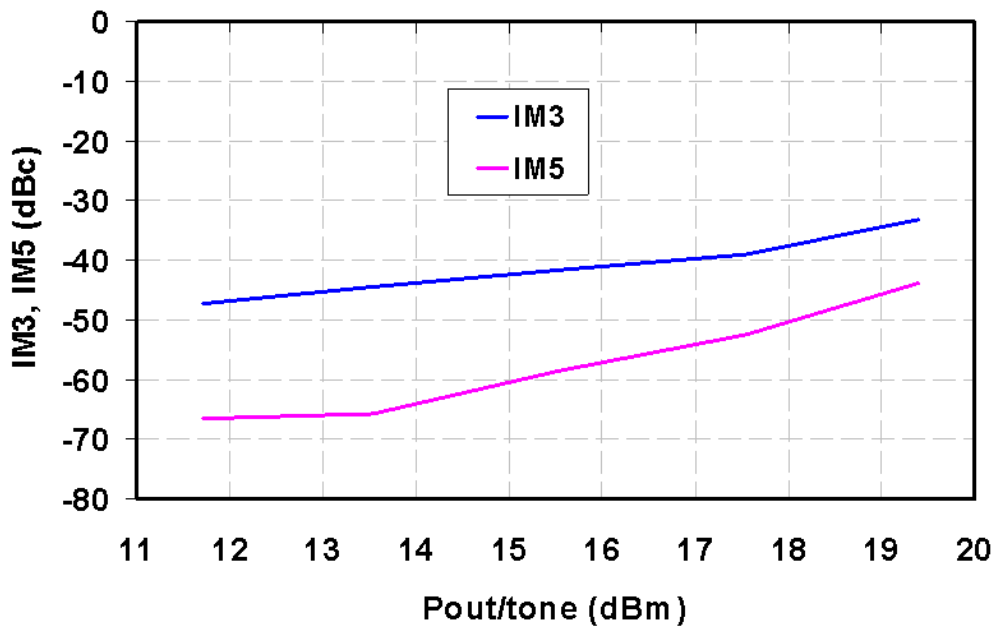
Measured Data

Bias conditions: $V_d = 5\text{ V}$, $I_d = 712\text{ mA}$, $V_g = -0.5\text{ V}$ Typical

TGA2522-SM

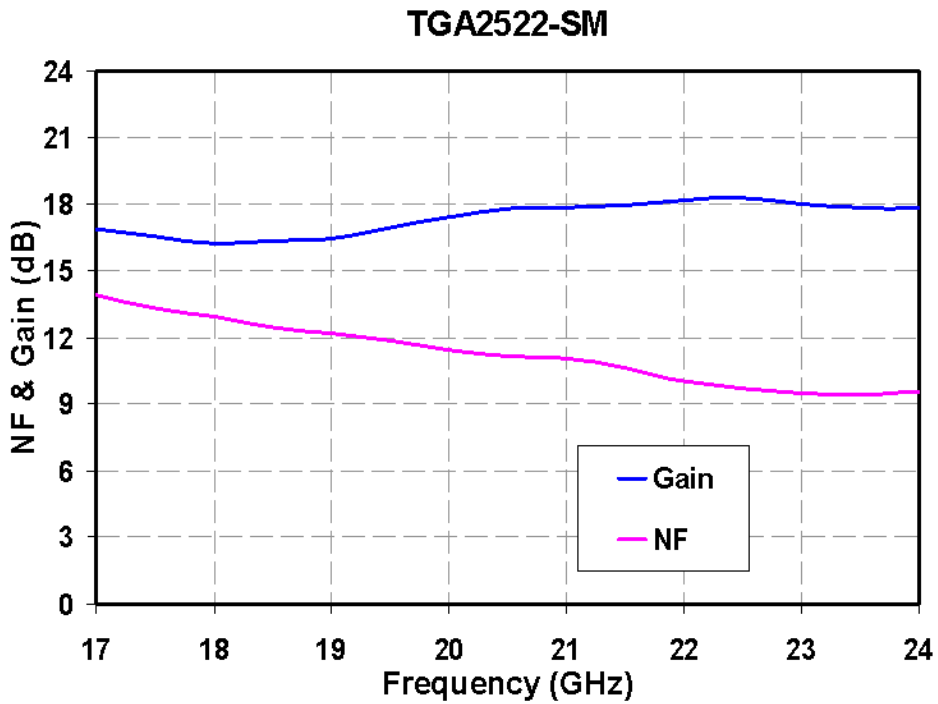


TGA2522-SM

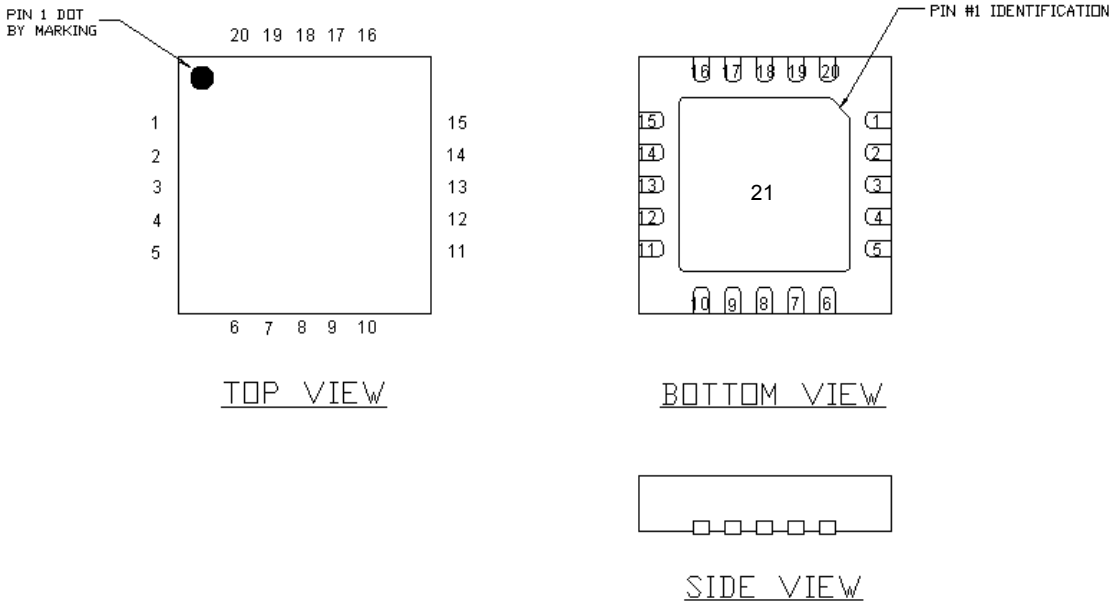


Measured Data

Bias conditions: $V_d = 5\text{ V}$, $I_d = 712\text{ mA}$, $V_g = -0.5\text{ V}$ Typical



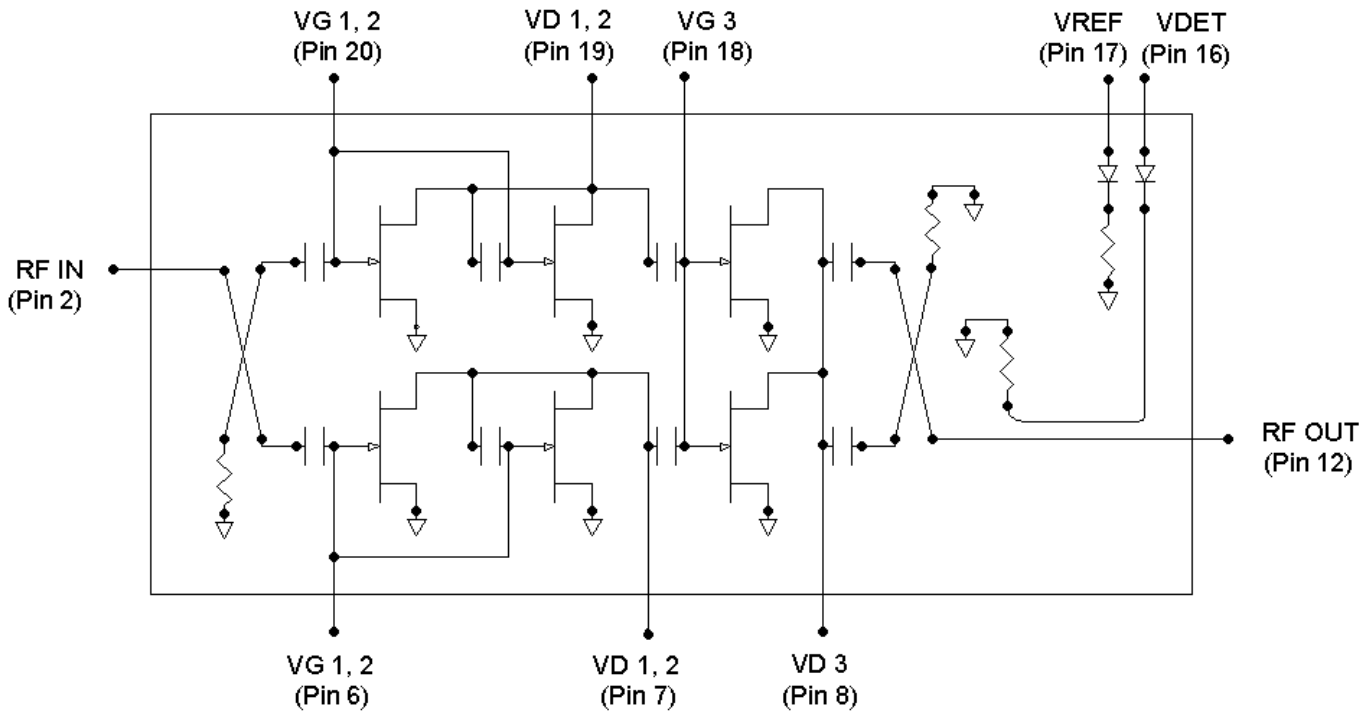
Package Pinout



| Pin | Symbol | Description |
|-----------------|--------|---|
| 2 | RF In | Input, matched to 50 ohms. |
| 12 | RF Out | Output, matched to 50 ohms. |
| 6,20 | Vg1,2 | Gate voltage for amplifier's input and 2 nd stage. Must be biased from both sides. 1/ |
| 18 | Vg3 | Gate voltage for amplifier's final stage. 1/ |
| 7,19 | Vd1,2 | Drain voltage for amplifier's input and 2 nd stage. Must be biased from both sides. 1/ |
| 8 | Vd3 | Drain voltage for amplifier's final stage. 1/ |
| 16 | VDET | Reference diode output voltage. |
| 17 | VREF | Detector diode output voltage. Varies with RF output power. |
| 5,13 | GND | Connected to 21 internally. Must be grounded to the PCB. See 'Recommended Land Pattern'. |
| 1, 3,4,11,14,15 | NC | No internal connection. Must be grounded to the PCB. See 'Recommended Land Pattern'. |
| 9,10 | NC | No internal connection. Can be grounded or left open on the PCB. |
| 21 | GND | Backside paddle. Multiple vias on the PCB should be employed to minimize inductance and thermal resistance. See 'Recommended Land Pattern'. |

1/ Bias network required. See 'Recommended Application Circuit'.

Electrical Schematic



Bias Procedures

Bias-up Procedure

VG 1, 2, VG 3 set to -1.5 V

VD 1, 2, VD 3 set to +5 V

Adjust VG 1, 2, VG 3 more positive until I_d is 712 mA.
This will be ~ -0.5 V

Apply RF signal

Bias-down Procedure

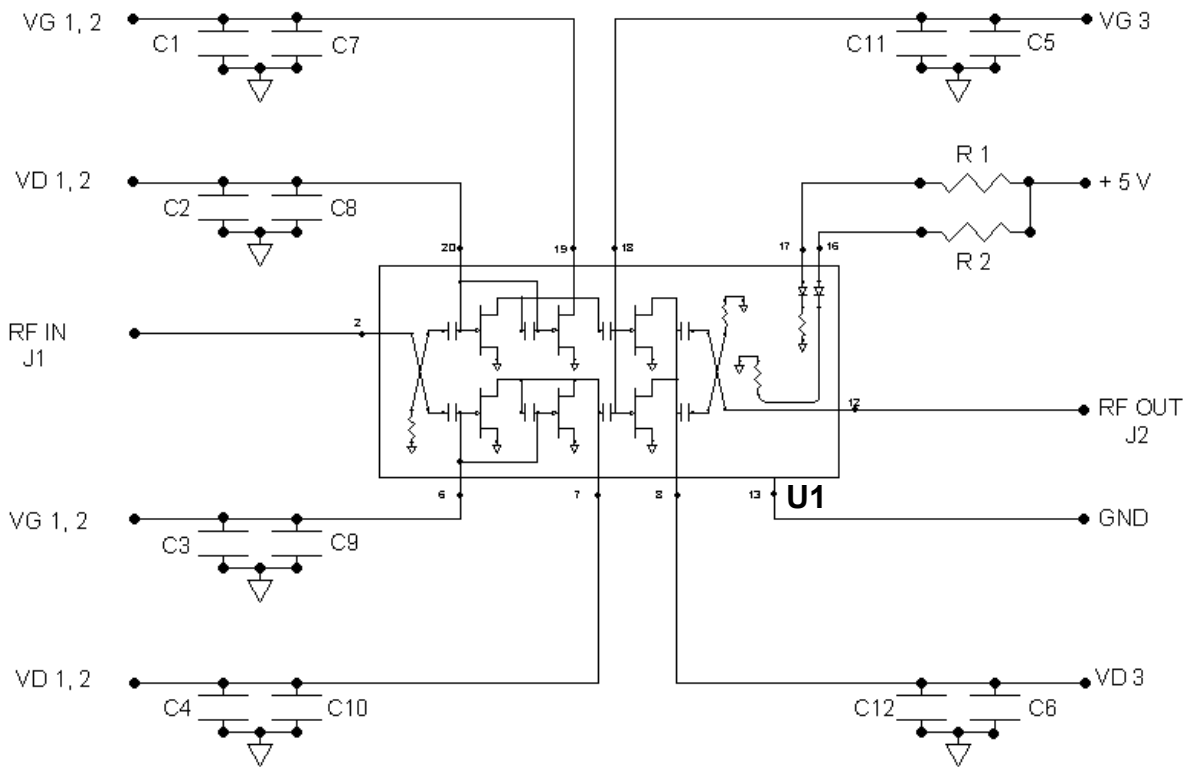
Turn off RF supply

Reduce VG 1, 2, VG3 to -1.5 V.
Ensure $I_d \sim 0$ mA

Turn VD 1, 2, VD 3 to 0 V

Turn VG 1, 2, VG 3 to 0 V

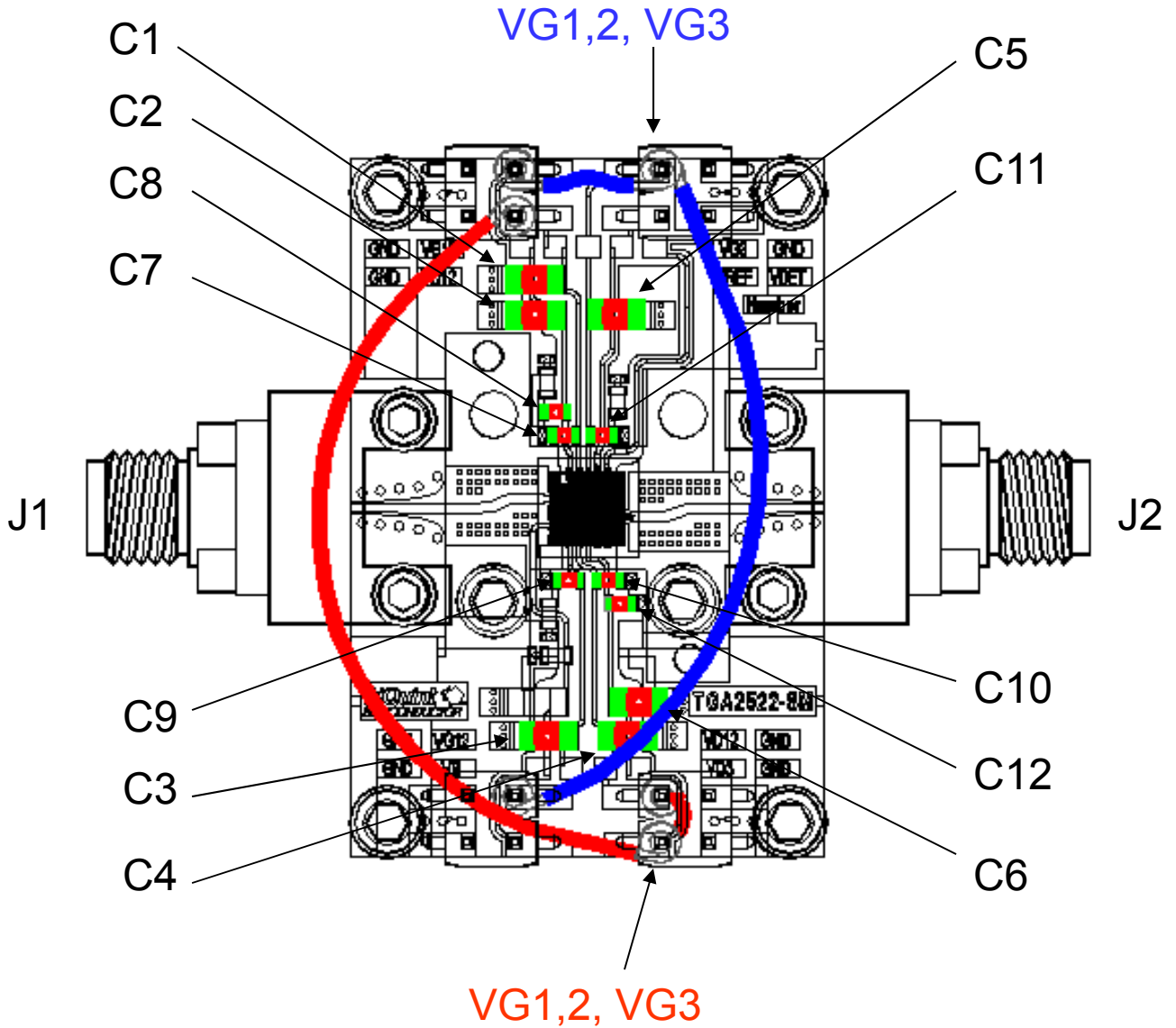
Recommended Application Circuit



| Ref Designator | Value | Description |
|---------------------------|----------------|--|
| U1 | -- | TriQuint TGA2522-SM |
| C1, C2, C3, C4, C5, C6 | 1.0 μ F | 1206 SMT Ceramic Capacitor |
| C7, C8, C9, C10, C11, C12 | 0.01 μ F | 0603 SMT Ceramic Capacitor |
| J1, J2 | 1092-01A-5 | Southwest Microwave End Launch Connector |
| R1, R2 | 240 K Ω | External Resistor |

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

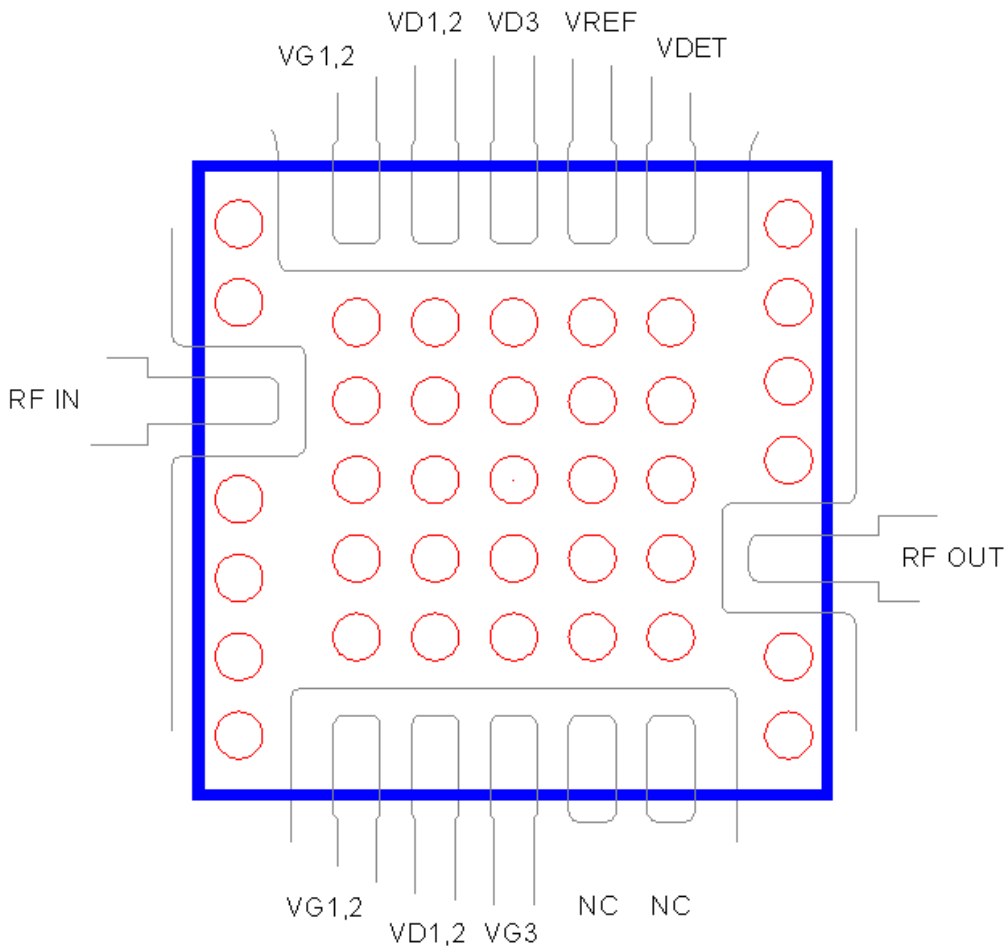
Recommended Evaluation Board



Board Material: 10 mil thick Rogers 4350, $\epsilon_r = 3.5$

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

Recommended Land Pattern



Board Material: 10 mil thick Rogers 4350

Open Plated Vias in Center of Land pattern; Vias are 12 mil Diameter, 20 mil center-to-center spacing

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 acetone. Rinse 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 |
|---------------------------|---|
| TGA2522-SM, TAPE AND REEL | 4 x 4 mm QFN Surface Mount, TAPE AND REEL |

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

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кабельные сборки и микроволновые компоненты:

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