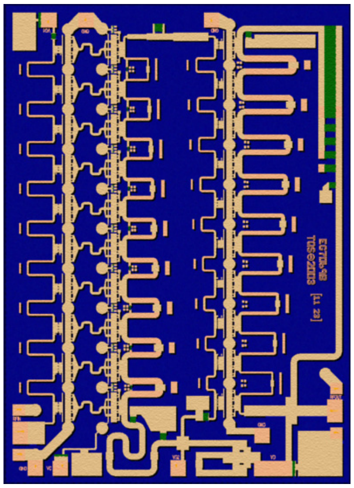
Wideband 1W HPA with AGC



Key Features

- Frequency Range: 2-22 GHz
- 30 dBm Nominal Psat (2-16 GHz)
- >29 dBm Nominal Psat (2-20 GHz)
- >28.5 dBm Output P1dB
- 17 dB Nominal Gain
- > 25 dB AGC Range
- 0.25 um 3MI pHEMT Technology
- Nominal Bias 12 V @ 1.1 A
- Chip Dimensions: 2.30 x 3.20 x 0.10 mm
  (0.091 x 0.126 x 0.004 in)

Primary Applications

- Wideband Gain Block
- Military EW and ECM
- Test Equipment

Product Description

The TriQuint TGA2509 is a compact Wideband High Power Amplifier with AGC. The HPA operates from 2-22 GHz and is designed using TriQuint's proven standard 0.25 um gate pHEMT production process.

The TGA2509 provides >28.5 dBm of output power at 1 dB gain compression with small signal gain of 17 dB. Typical saturated power is 30 dBm from 2-16 GHz.

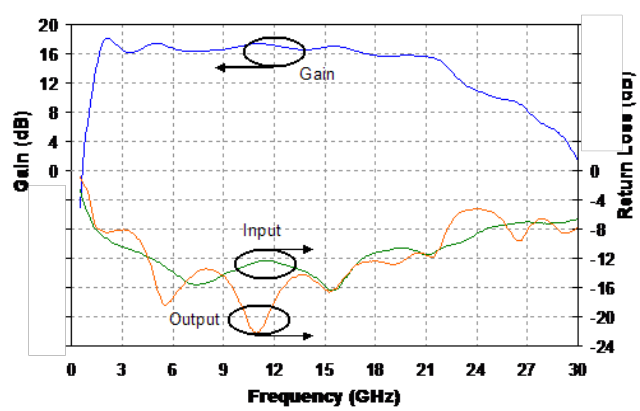
The TGA2509 is suitable for a variety of wideband electronic warfare systems such as radar warning receivers, electronic counter measures,decoys, jammers and phased array systems.

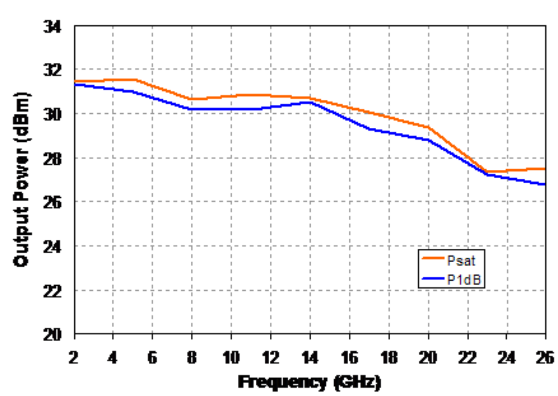
The TGA2509 is 100% DC and RF tested on-wafer to ensure performance compliance.

Lead-free and RoHS compliant

Measured Fixtured Data

Bias Conditions: Vd =12 V, Id= 1.1 A





Datasheet subject to change without notice

TABLE I
MAXIMUM RATINGS 1/

SYMBOL	PARAMETER	VALUE	NOTES
V^+	Positive Supply Voltage	12.5 V	2/
V_{g1}	Gate 1 Supply Voltage Range	-2V TO 0 V	
V_{g2}	Gate 2 Supply Voltage Range	-2V TO 0 V	
V_c	AGC Control Voltage Range	V_c < +5 V $V^+ - V_c$ < 14V	
I^+	Positive Supply Current	1.4 A	2/
$\| I_G \|$	Gate Supply Current	70 mA	
P_{IN}	Input Continuous Wave Power	30 dBm	2/
P_D	Power Dissipation (without using AGC)	17.5 W	2/, 3/
P_D	Power Dissipation (when Vc < +2V)	15.7 W	2/, 3/
T_{CH}	Operating Channel Temperature	200 °C	4/, 5/
	Mounting Temperature (30 Seconds)	320 °C	
T_{STG}	Storage Temperature	-65 to 150 °C	

1/ These ratings represent the maximum operable values for this device.

2/ Current is defined under no RF drive conditions. Combinations of supply voltage, supply current, input power, and output power shall not exceed P_D.

3/ When operated at this power dissipation with a base plate temperature of 70 °C, the median life is 8.2E4 hours (without AGC) or 2.3E4 hours (with AGC).

4/ Junction operating temperature will directly affect the device median time to failure (Tm). For maximum life, it is recommended that junction temperatures be maintained at the lowest possible levels.

5/ These ratings apply to each individual FET.

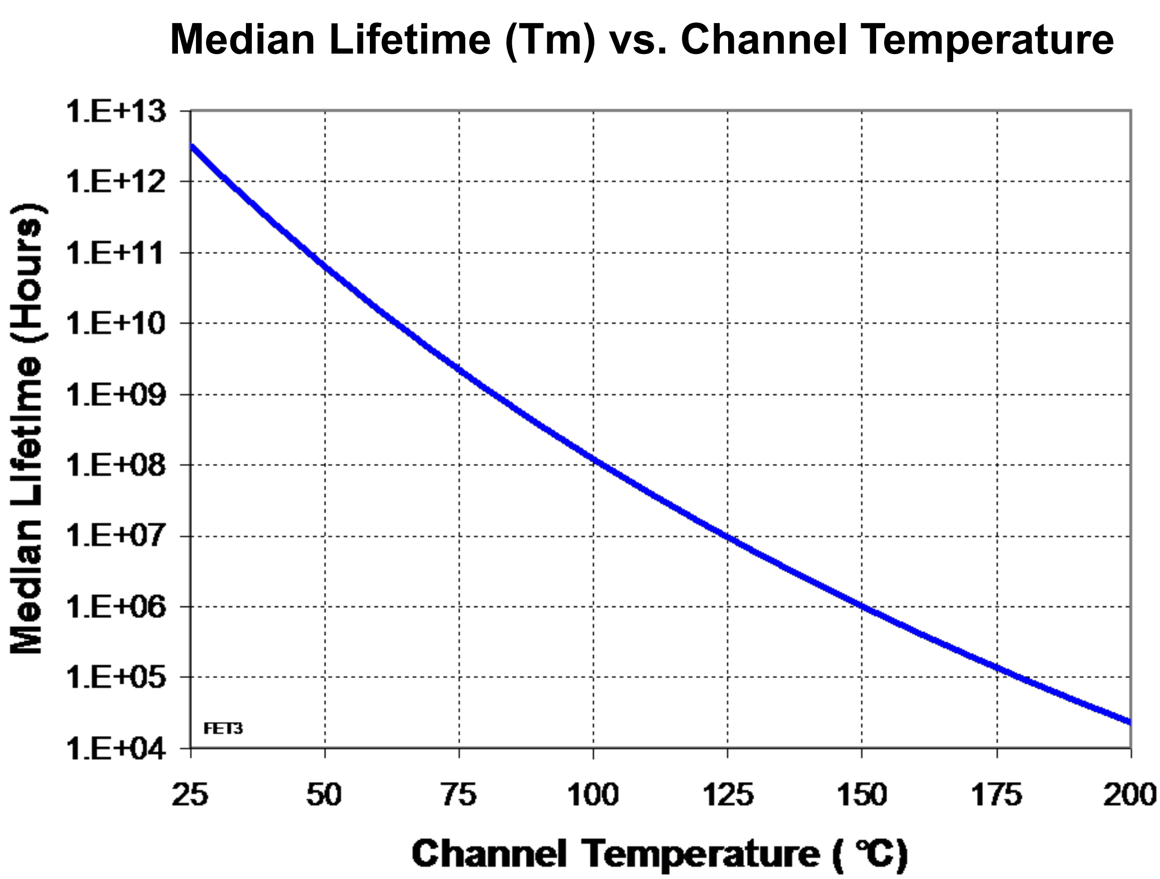
TABLE II
RF CHARACTERIZATION TABLE
(T_A = 25 °C, Nominal)
Vd = 12 V, Id = 1.1 A

SYMBOL	PARAMETER	TEST CONDITION	NOMINAL	UNITS
Gain	Small Signal Gain	f = 2-22 GHz	17	dB
IRL	Input Return Loss	f = 2-22 GHz	12	dB
ORL	Output Return Loss	f = 2-22 GHz	12	dB
Psat	Saturated Power	f = 2-16 GHz f = 2-20 GHz	30 29	dB
P_{1dB}	Output Power @ 1dB Gain Compression	f = 2-20 GHz	28.5	dBm

TABLE III
THERMAL INFORMATION

PARAMETER	TEST CONDITIONS	T_{CH} (°C)	θ_{JC} (°C/W)	Tm (HRS)
θ_{JC} Thermal Resistance (channel to backside of carrier)	Vd = 12 V I_D = 1.1 A Pdiss = 13.2 W (without using AGC)	155	6.4	6.7E+5
θ_{JC} Thermal Resistance (channel to backside of carrier)	Vd = 12 V I_D = 0.88 A Pdiss = 10.6 W (when using AGC)	158	8.3	5.2E+5

Note: Assumes eutectic attach using 1.5 mil 80/20 AuSn mounted to a 20 mil CuMo Carrier at 70 °C baseplate temperature. Worst case is at saturated output power when DC power consumption rises to 15 W with 1 W RF power delivered to load. Power dissipated is 14 W and the temperature rise in the channel is 90 °C.



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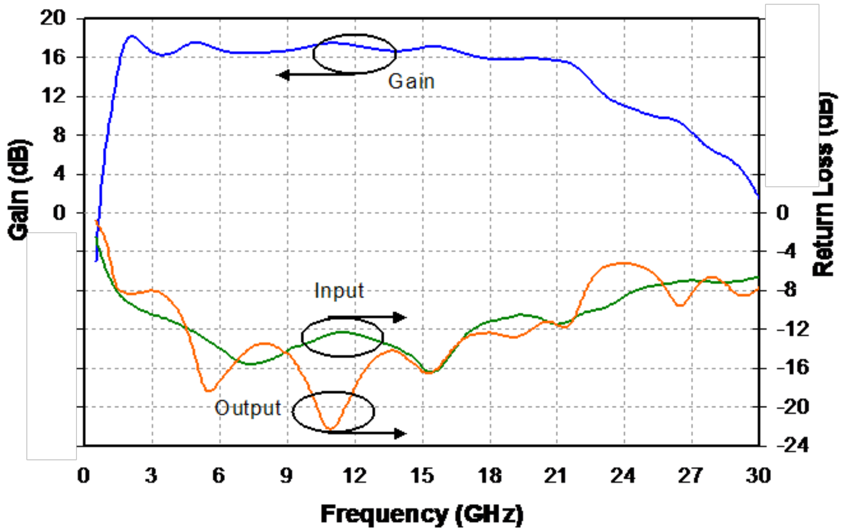
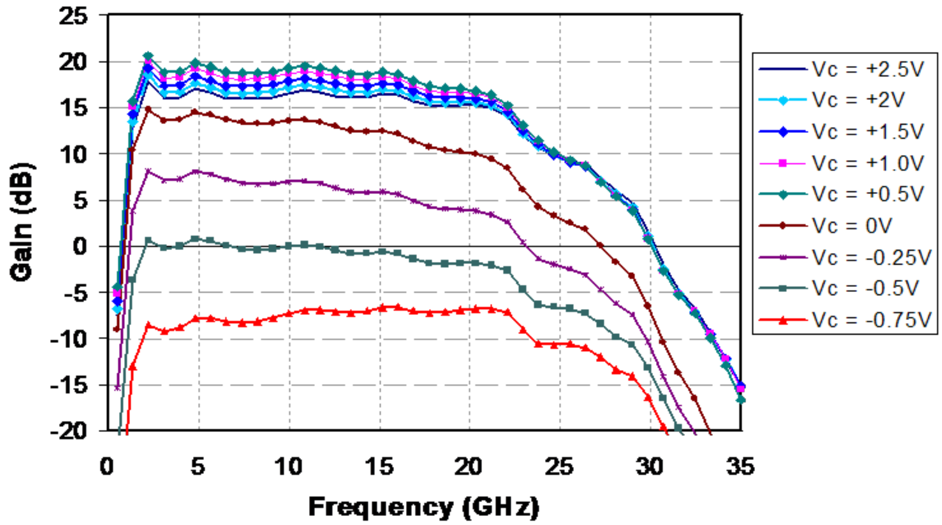
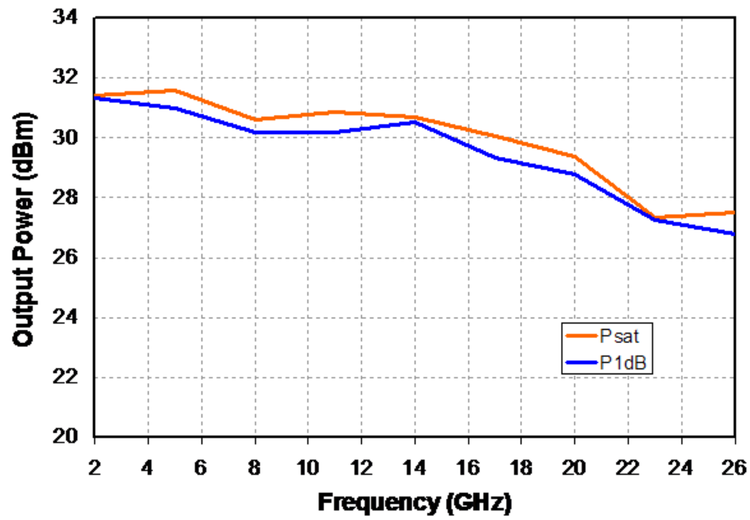
Measured Fixtured Data

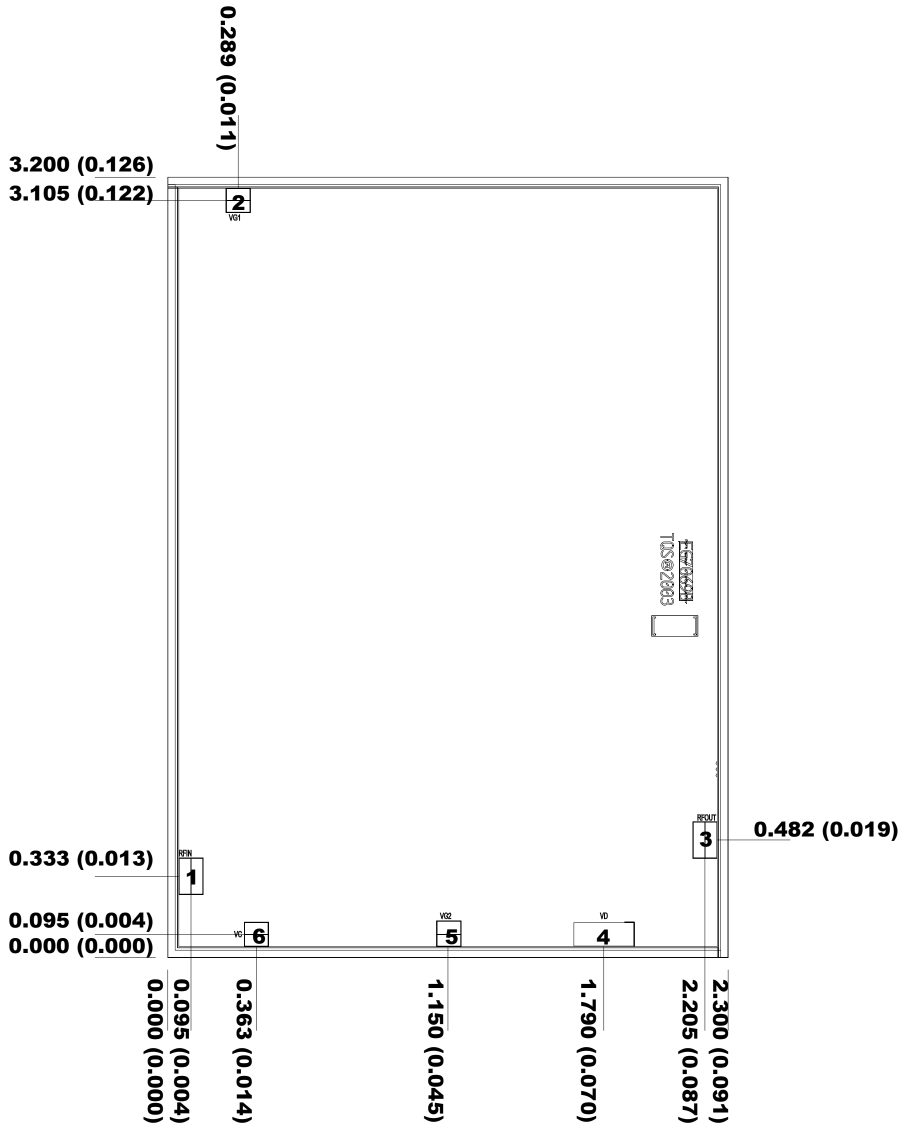
Bias Conditions: Vd =12 V, Id= 1.1 A







Mechanical Characteristics



Units: millimeters (inches)
Thickness: 0.100 (0.004)
Chip edge to bond pad dimensions are shown to center of bond pad
Chip size tolerance: +/- 0.051 (0.002)

GND IS BACKSIDE OF MMIC

Bond pad #1	**(RF In)**	**0.100 x 0.150 (0.004 x 0.006)**
Bond pad #2	**(Vg1)**	**0.100 x 0.100 (0.004 x 0.004)**
Bond pad #3	**(RF Out)**	**0.100 x 0.150 (0.004 x 0.006)**
Bond pad #4	**(Vd)**	**0.250 x 0.100 (0.010 x 0.004)**
Bond pad #5	**(Vg2)**	**0.100 x 0.100 (0.004 x 0.004)**
Bond pad #6	**(VC)**	**0.100 x 0.100 (0.004 x 0.004)**

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

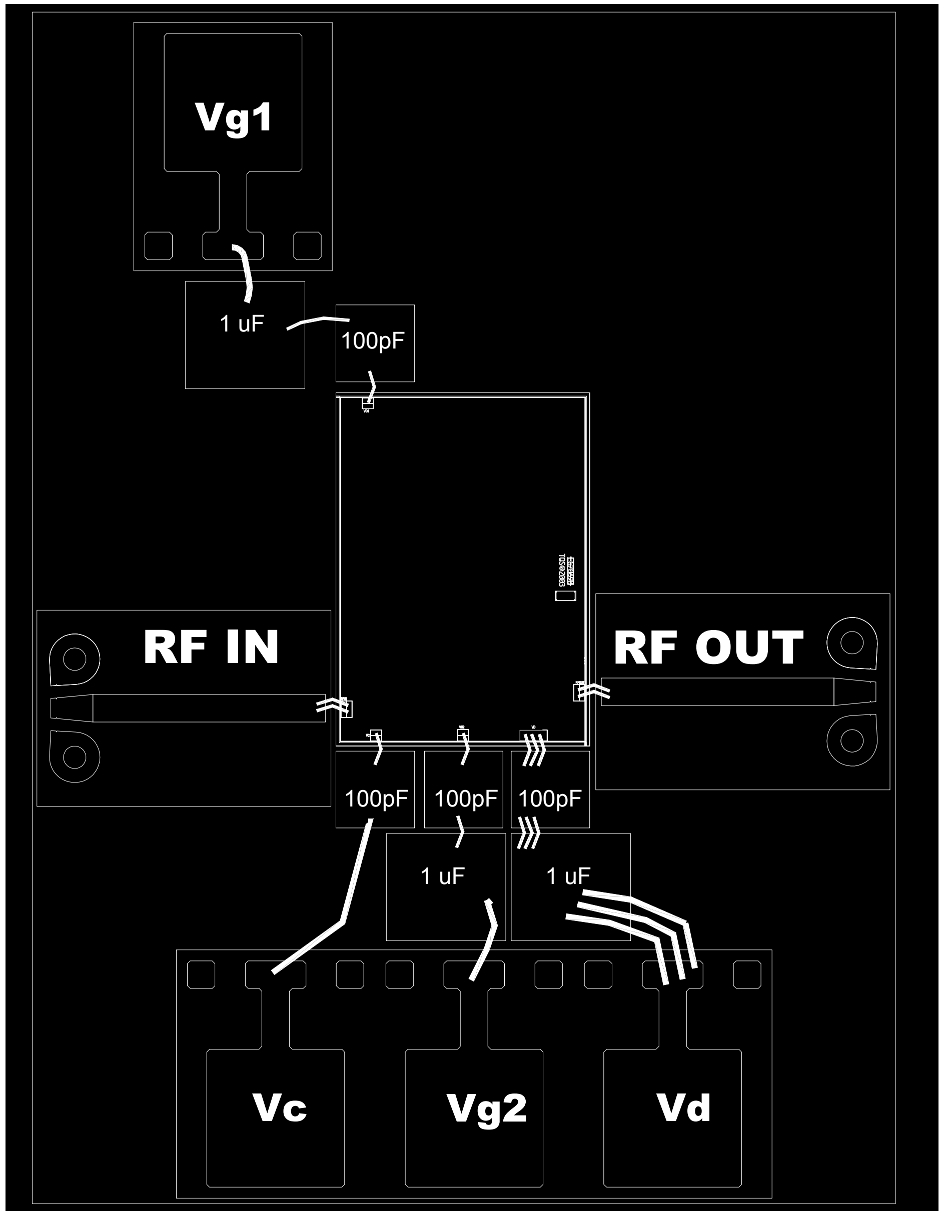
Recommended Assembly Diagram

Bias Procedures:

Vc **bias** connection is optional, but the 100pF cap always needs to be connected.

For biasing without AGC control:
1. Apply -1.2V to Vg1, and -1.2V to Vg2.
2. Apply +12V to Vd.
4. Adjust Vg1 to attain 580 mA drain current (Id)
4. Adjust Vg2 to attain 1080 mA total drain current (Id).

For biasing with AGC control:
1. Apply -1.2V to Vg1 and -1.2V to Vg2
2. Apply +12V to Vd
3. Apply +2.6V to Vc
4. Adjust Vg1 to attain 580 mA drain current (Id)
5. Adjust Vg2 to attain 1080 mA total drain current (Id).
6. Adjust Vc as needed to control gain level.



To ensure low frequency stability, use 1uF surface mount (not leaded) capacitors (on the Vd, Vg1, and Vg2 nodes) that are located close to the MMIC. Contact TriQuint Semiconductor Applications Engineering for more details.

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Assembly Process Notes

Reflow process assembly notes:

- Use AuSn (80/20) solder with limited exposure to temperatures at or above 300 °C for 30 sec
- An alloy station or conveyor furnace with reducing atmosphere should be used.
- No fluxes should be utilized.
- Coefficient of thermal expansion matching is critical for long-term reliability.
- Devices must be stored in a dry nitrogen atmosphere.

Component placement and adhesive attachment assembly notes:

- Vacuum pencils and/or vacuum collets are the preferred method of pick up.
- Air bridges must be avoided during placement.
- The force impact is critical during auto placement.
- Organic attachment can be used in low-power applications.
- Curing should be done in a convection oven; proper exhaust is a safety concern.
- Microwave or radiant curing should not be used because of differential heating.
- Coefficient of thermal expansion matching is critical.

Interconnect process assembly notes:

- Thermosonic ball bonding is the preferred interconnect technique.
- Force, time, and ultrasonics are critical parameters.
- Aluminum wire should not be used.
- Devices with small pad sizes should be bonded with 0.0007-inch wire.
- Maximum stage temperature is 200 °C.

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