

## 2-20 GHz LNA with AGC

## TGA2513-SM



### Product Description

The TriQuint TGA2513-SM is a packaged LNA/Gain Block with > 30 dB AGC via the control gate. The LNA operates from 2-20 GHz and is designed using TriQuint's proven standard 0.15 um gate pHEMT production process.

The TGA2513-SM provides a nominal 16 dBm of output power at 1 dB gain compression with a small signal gain of 17 dB. Typical noise figure is < 3 dB from 2-15 GHz.

The TGA2513-SM is suitable for a variety of wideband electronic warfare systems such as radar warning receivers, electronic counter measures, decoys, jammers and phased array systems.

Evaluation Boards are available upon request.

Lead-free and RoHS compliant

### Key Features

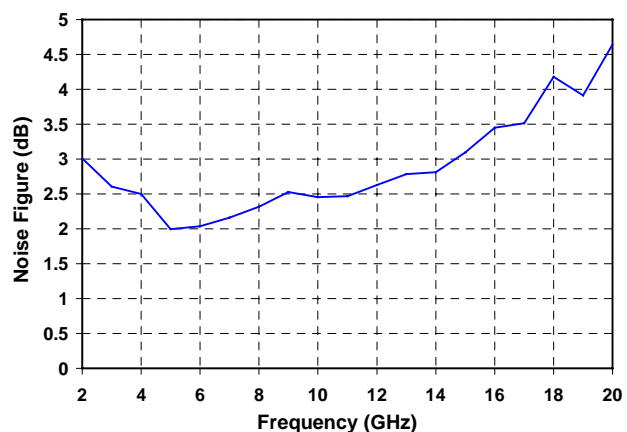
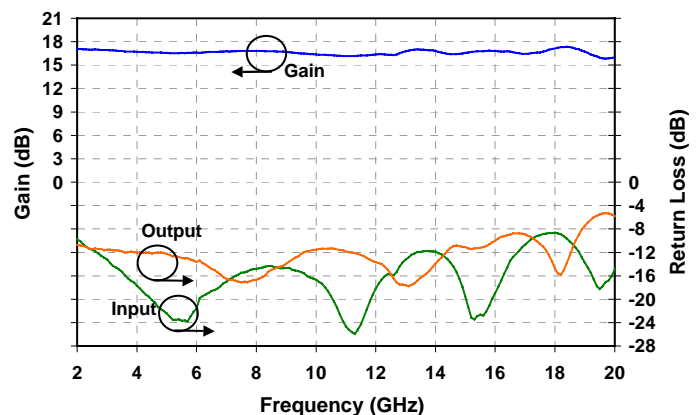
- Frequency Range: 2-20 GHz
- 17 dB Nominal Gain
- > 30 dB Adjustable Gain with Vg2
- 16 dBm Nominal P1dB
- 2.5 dB Midband Noise Figure
- Bias Conditions: Vd=5V, Idq=75 mA, Vg2=2V
- Package Dimensions: 4.0 x 4.0 x 0.9 mm

### Primary Applications

- Wideband Gain Block / LNA
- X-Ku Point to Point Radio
- IF & LO Buffer Applications

### Measured Performance

Bias Conditions: Vd = 5 V, Idq = 75 mA, Vg2 = 2V



*Note: This device is early in the characterization process prior to finalizing all electrical specifications. Specifications are subject to change without notice.*

**TABLE I**  
**MAXIMUM RATINGS 1/**

<b>SYMBOL</b>	<b>PARAMETER</b>	<b>VALUE</b>	<b>NOTES</b>
V <sup>+</sup>	Positive Supply Voltage	7 V	<u>2/</u>
V <sub>g1</sub>	Gate 1 Supply Voltage Range	-2V TO 0 V	
V <sub>g2</sub>	Gate 2 Supply Voltage Range	-0.5 V TO +3.5 V	
I <sup>+</sup>	Positive Supply Current	151 mA	<u>2/</u>
I <sub>G</sub>	Gate Supply Current	10 mA	
P <sub>IN</sub>	Input Continuous Wave Power	21 dBm	<u>2/</u>
P <sub>D</sub>	Power Dissipation	See note 3	<u>2/</u> , <u>3/</u>
T <sub>CH</sub>	Operating Channel Temperature	117 °C	<u>4/</u> , <u>5/</u>
T <sub>M</sub>	Mounting Temperature (30 Seconds)	260 °C	
T <sub>STG</sub>	Storage Temperature	-65 to 117 °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<sub>D</sub>.

3/ For a median life time of 1E+6 hrs, Power dissipation is limited to:  

$$PD(max) = (117\text{ °C} - T_{BASE}\text{ °C}) / 32\text{ (°C/W)}$$

4/ Junction operating temperature will directly affect the device median time to failure (T<sub>M</sub>). 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**

( $T_A = 25\text{ }^\circ\text{C}$ , Nominal)  
 $V_d = 5\text{ V}$ ,  $I_d = 75\text{ mA}$   $V_{g2} = 2\text{ V}$   $V_{g1} = \sim -60\text{ mV}$

SYMBOL	PARAMETER	TEST CONDITION	NOMINAL	UNITS
Gain	Small Signal Gain	f = 2-20 GHz	17	dB
IRL	Input Return Loss	f = 2-20 GHz	12	dB
ORL	Output Return Loss	f = 2-20 GHz	10	dB
NF	Noise Figure	f = 2-20 GHz	3	dB
$P_{1dB}$	Output Power @ 1dB Gain Compression	f = 2-20 GHz	16	dBm

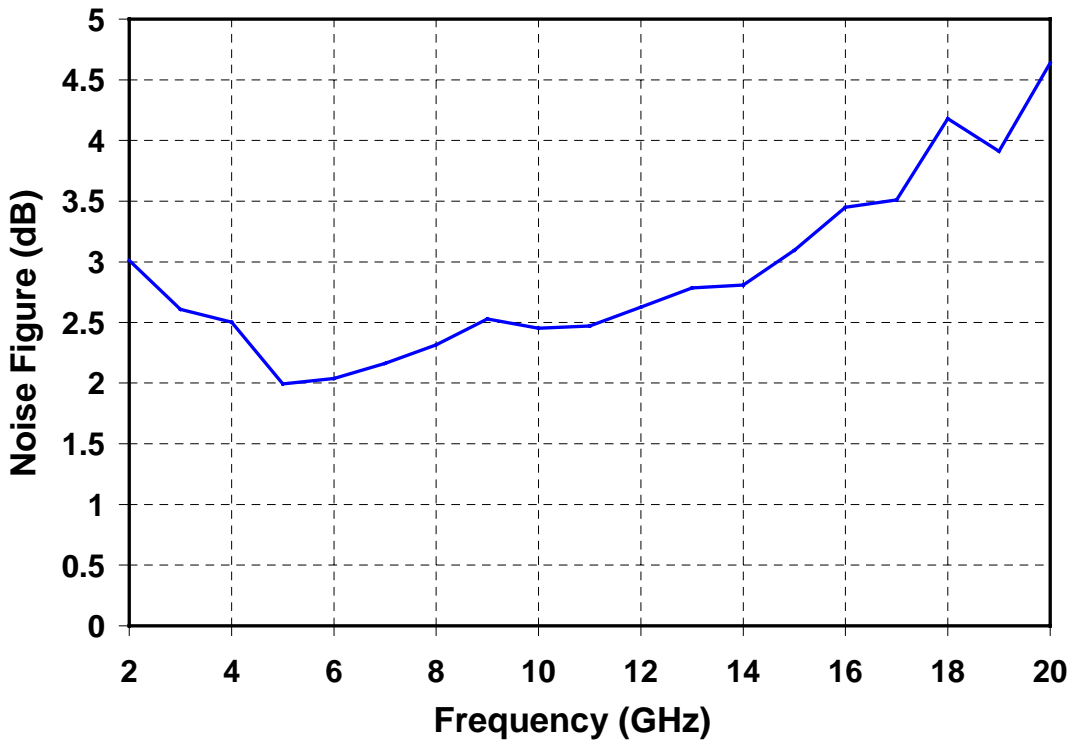
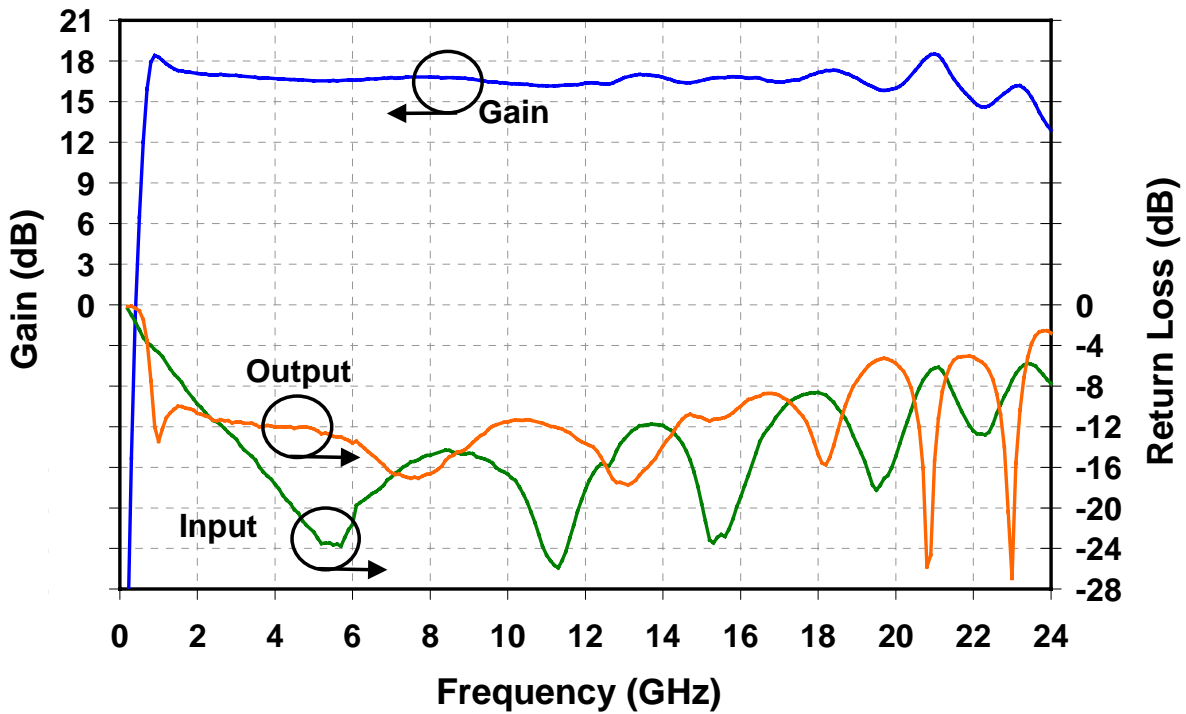
**TABLE III  
THERMAL INFORMATION**

Parameter	Test Conditions	$T_{CH}$ ( $^\circ\text{C}$ )	$\theta_{JC}$ ( $^\circ\text{C/W}$ )	$T_M$ (HRS)
$\theta_{JC}$ Thermal Resistance (channel to backside of carrier)	$V_d = 5\text{ V}$ $I_D = 75\text{ mA}$ $P_{diss} = 0.375\text{ W}$	97	32	8.1 E+6

Note: Worst case condition with no RF applied, 100% of DC power is dissipated. Package temperature @  $85\text{ }^\circ\text{C}$

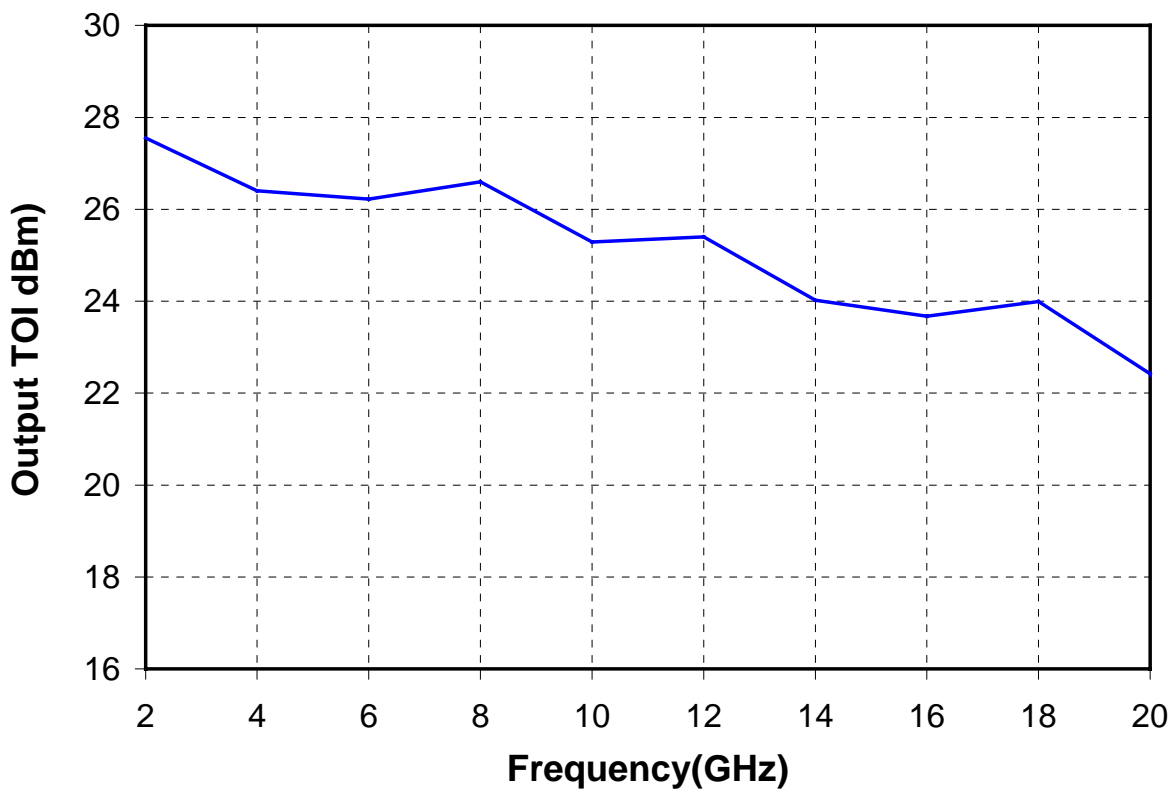
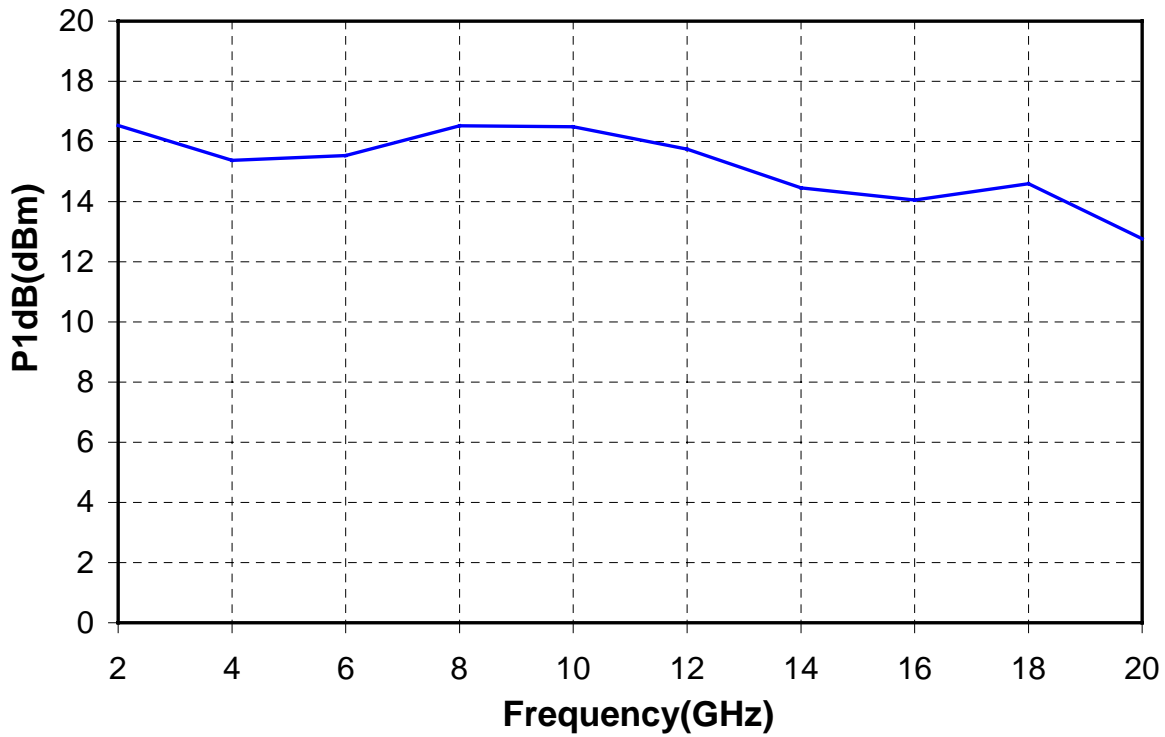
**Measured Performance**

Bias Conditions:  $V_d = 5\text{ V}$ ,  $I_{dq} = 75\text{ mA}$ ,  $V_{g2} = 2\text{ V}$ ,  $V_{g1} = \sim -60\text{ mV}$ , typical



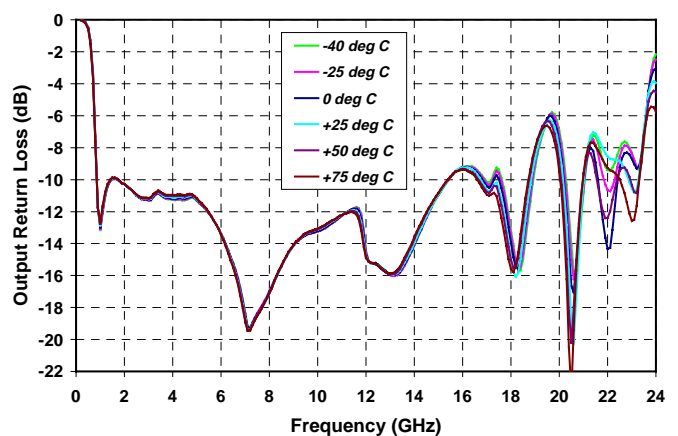
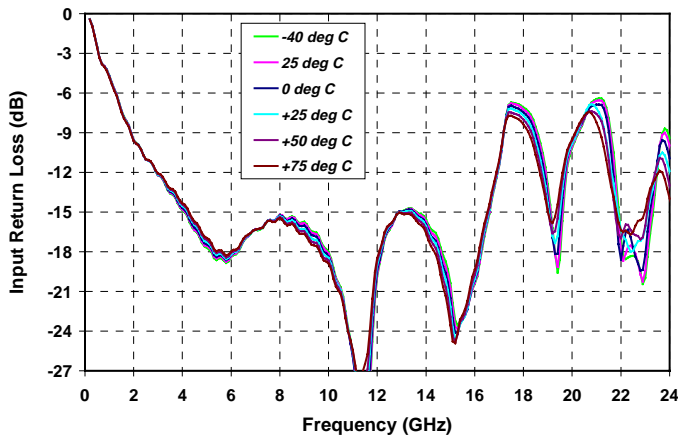
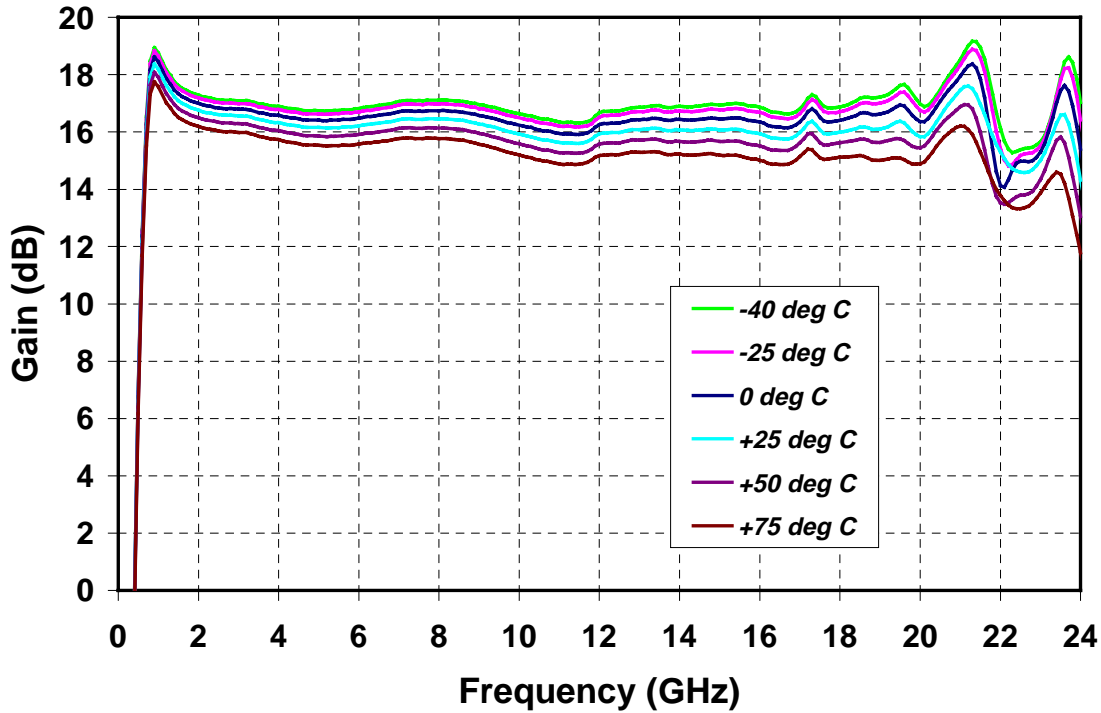
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**Measured Performance \***

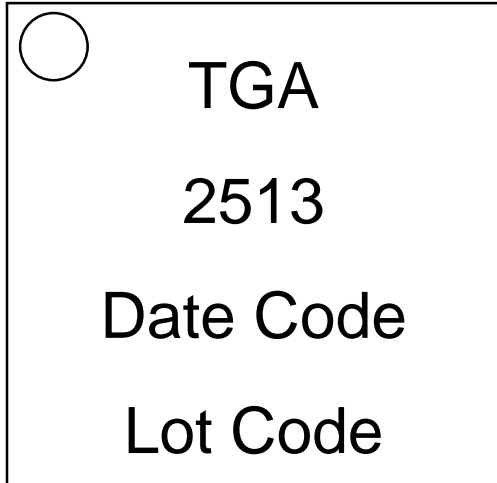
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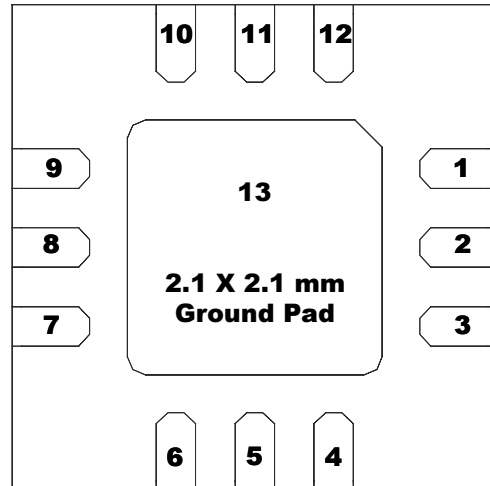
\* Note:

Measured data is taken using connectorized evaluation boards. The reference plane is at RF connectors, and hence connector and board loss has not been de-embedded.

**Package Pinout Diagram**



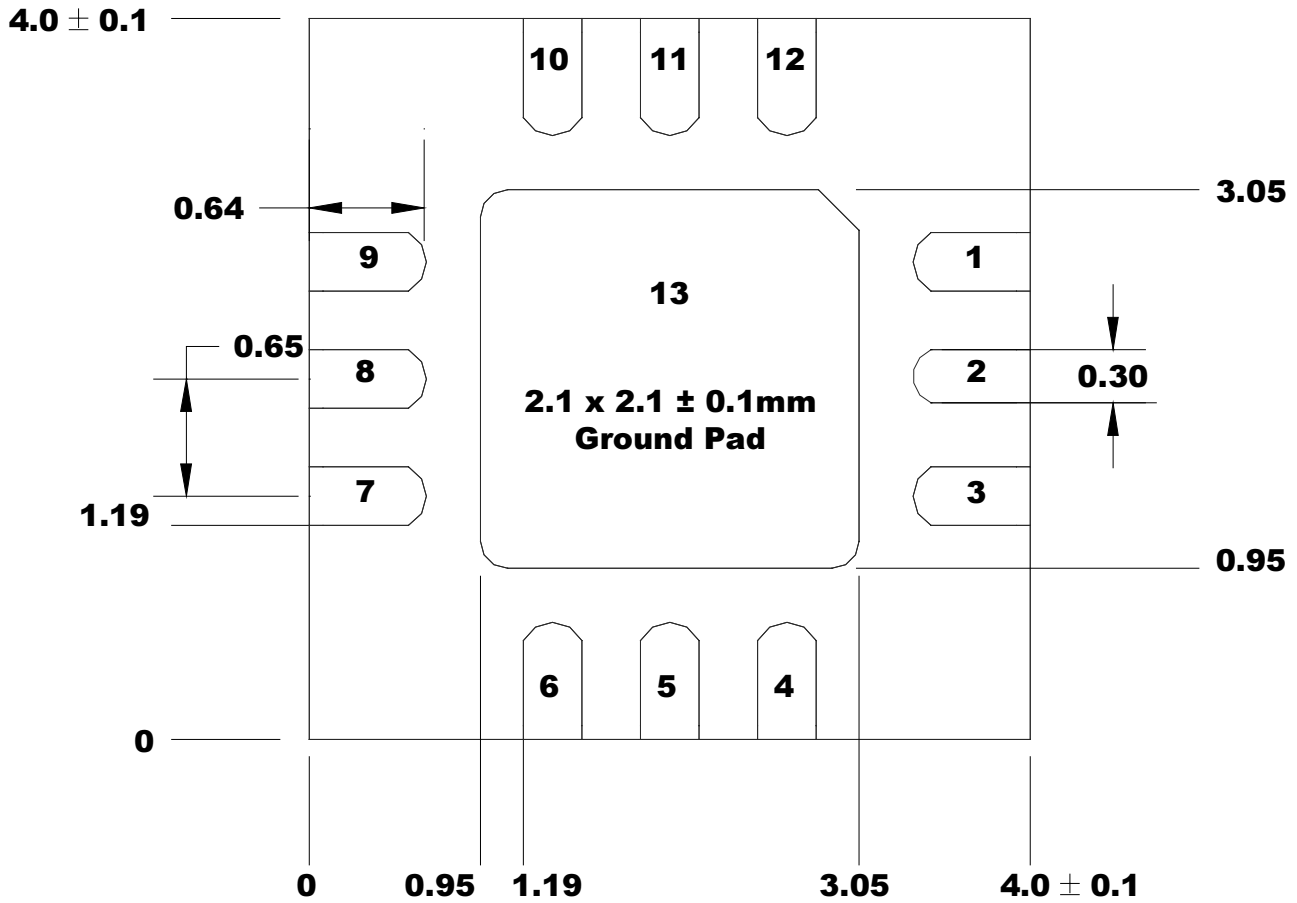
Top View  
Dot indicates Pin 1



Bottom View

Pin	Description
1, 3, 4, 5, 7, 8, 10, 13	Ground
2	RF Input
6	Vg1
9	RF Output
11	Vd
12	Vg2

**Mechanical Drawing**

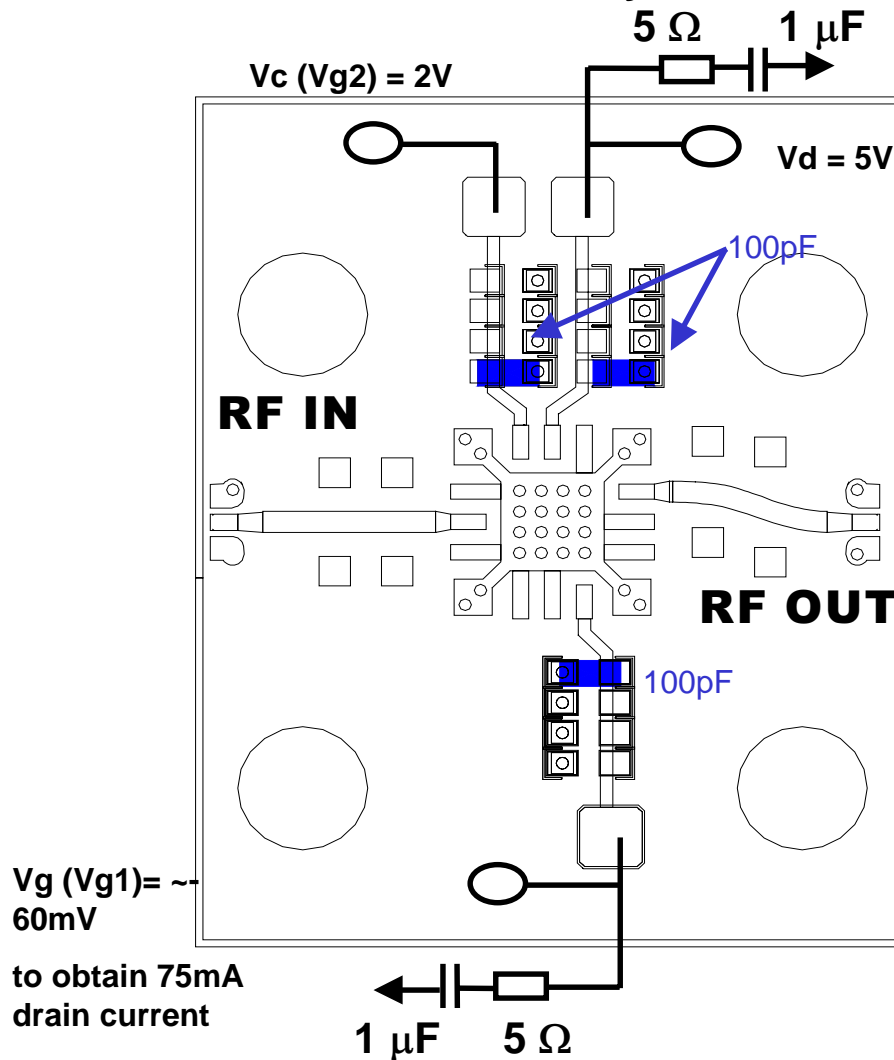


**Bottom View**  
**Tolerance: +/- 0.05**  
**Units: mm**

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



**Recommended Board Layout Assembly \***



**Recommended Bias-up Procedure**

- Ensure no RF power is applied to the device
- Pinch-off device by setting Vg (Vg1) to -1.5V
- Increase Vd to 5V while monitoring gate current
- Increase Vc (Vg2) to 2V
- Increase Vg (Vg1) until drain current reaches 75 mA
- Apply RF Power

**Recommended Bias-Down Procedure**

- Turn off RF power
- Decrease Vg (Vg1) to -1.5V
- Decrease Vc (Vg2) to 0 V
- Decrease Vd to 0 V

\* The layout is a general purpose drawing that needs to be tuned for the specific application. PCB is RO4003 8 mil thickness, 0.5 oz standard copper cladding, with Er = 3.38.

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## 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.

## Typical Solder Reflow Profiles

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
TGA2513-SM	QFN 12L 4x4 Surface Mount

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