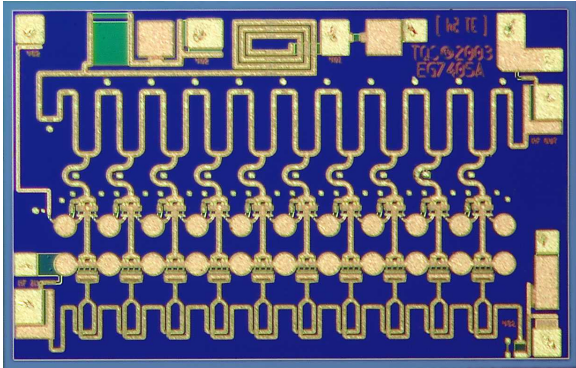


## Wideband LNA with AGC

## TGA2513-EPU



### Product Description

The TriQuint TGA2513-EPU is a compact LNA/Gain Block MMIC with AGC via the control gate. The LNA operates from 2-23 GHz and is designed using TriQuint's proven standard 0.15  $\mu\text{m}$  gate pHEMT production process.

The TGA2513-EPU 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 2-18 GHz.

The TGA2513-EPU 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 TGA2513-EPU is 100% DC and RF tested on-wafer to ensure performance compliance.

### Key Features

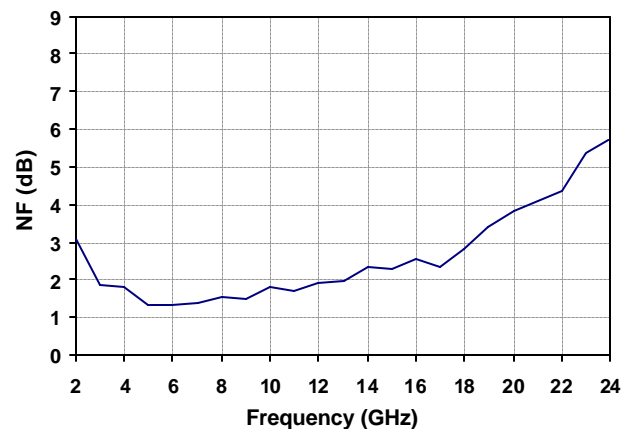
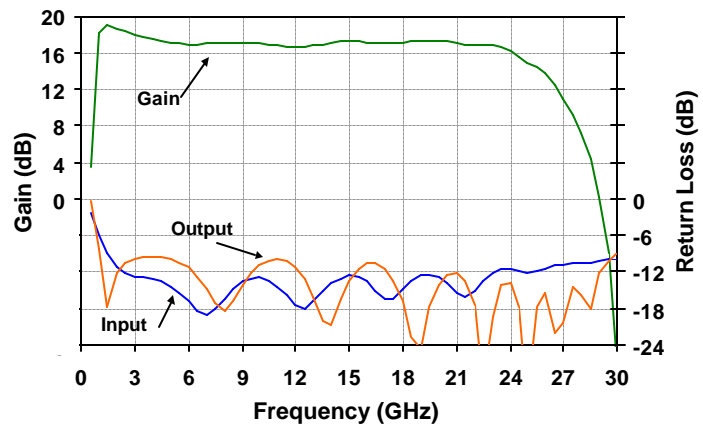
- Frequency Range: 2-23 GHz
- 17 dB Nominal Gain
- > 30 dB Adjustable Gain with  $V_{g2}$
- 16 dBm Nominal P1dB
- < 2 dB Midband Noise Figure
- 0.15  $\mu\text{m}$  3MI pHEMT Technology
- Nominal Bias:  $V_d = 5\text{V}$ ,  $I_d = 75\text{mA}$
- Chip Dimensions: 2.09 x 1.35 x 0.10 mm  
(0.082 x 0.053 x 0.004 in)

### Primary Applications

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

### Measured Fixtured Data

$V_d = 5\text{V}$ ,  $I_d = 75\text{mA}$ ,  $V_{g2} = 2\text{V}$ , Typical  $V_{g1} = -60\text{mV}$



Note: Devices designated as EPU are typically early in their characterization process prior to finalizing all electrical and process specifications. Specifications are subject to change without notice

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

SYMBOL	PARAMETER	VALUE	NOTES
$V^+$	Positive Supply Voltage	7 V	2/
$V_{g1}$	Gate 1 Supply Voltage Range	-2V TO 0 V	
$V_{g2}$	Gate 2 Supply Voltage Range	-0.5 V TO +3.5 V	
$I^+$	Positive Supply Current	151 mA	2/
$ I_G $	Gate Supply Current	10 mA	
$P_{IN}$	Input Continuous Wave Power	21 dBm	2/
$P_D$	Power Dissipation	1.5 W	2/, 3/
$T_{CH}$	Operating Channel Temperature	117 °C	4/, 5/
$T_M$	Mounting Temperature (30 Seconds)	320 °C	
$T_{STG}$	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  $P_D$ .
- 3/ When operated at this power dissipation with a base plate temperature of 70 °C, the median life is 1 E+6 hours.
- 4/ Junction operating temperature will directly affect the device median time to failure ( $T_M$ ). 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**  
**DC PROBE TEST**  
( $T_A = 25$  °C, Nominal)

SYMBOL	PARAMETER	MINIMUM	MAXIMUM	UNIT
$I_{dss, Q1-Q10}$	Saturated Drain Current	--	216	mA
$V_p, Q1-Q10$	Pinch-off Voltage	-1	0	V
$V_{BVGD, Q1-Q10}$	Breakdown Voltage Gate-Drain	-30	-5	V
$V_{BVGS, Q1-Q10}$	Breakdown Voltage Gate-Source	-30	-5	V

Note: Q1-Q10 is a 720um size FET.

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**TABLE III**  
**RF CHARACTERIZATION TABLE**

(T<sub>A</sub> = 25 °C, Nominal)  
V<sub>d</sub> = 5V, I<sub>d</sub> = 75 mA V<sub>g2</sub> = 2V

SYMBOL	PARAMETER	TEST CONDITION	NOMINAL	UNITS
Gain	Small Signal Gain	f = 2-23 GHz	17	dB
IRL	Input Return Loss	f = 2-23 GHz	14	dB
ORL	Output Return Loss	f = 2-23 GHz	14	dB
NF	Noise Figure	f = 3-13 GHz f = 2-18 GHz	2 < 3	dB
P <sub>1dB</sub>	Output Power @ 1dB Gain Compression	f = 2-23 GHz	16	dBm

**TABLE IV**  
**THERMAL INFORMATION\***

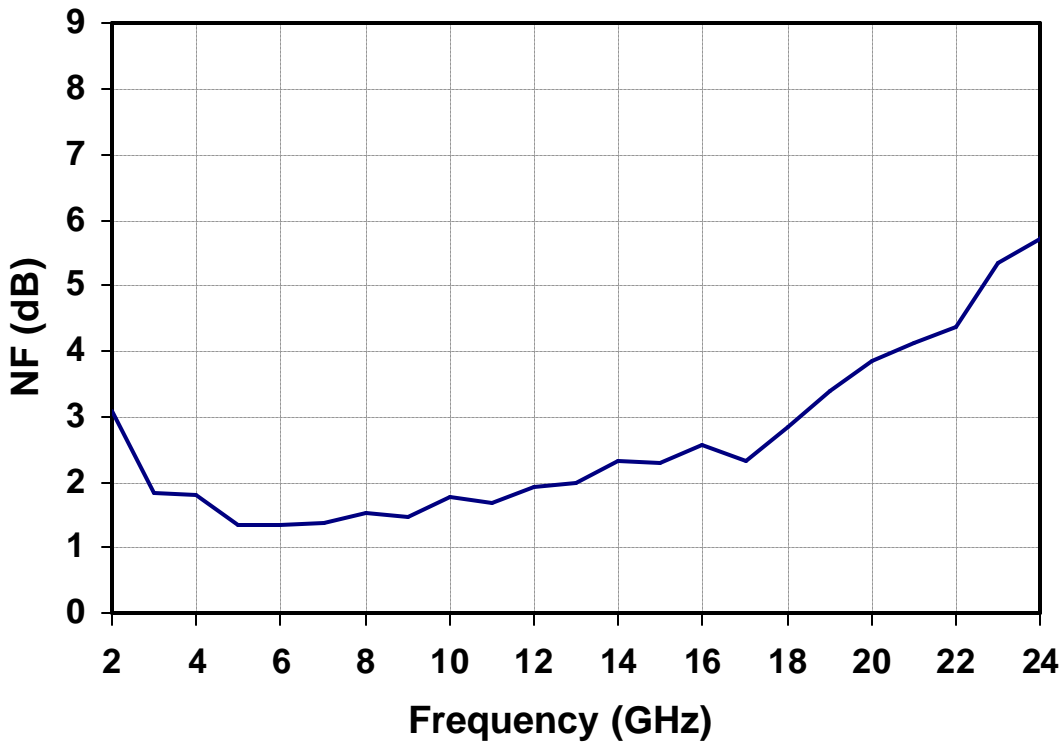
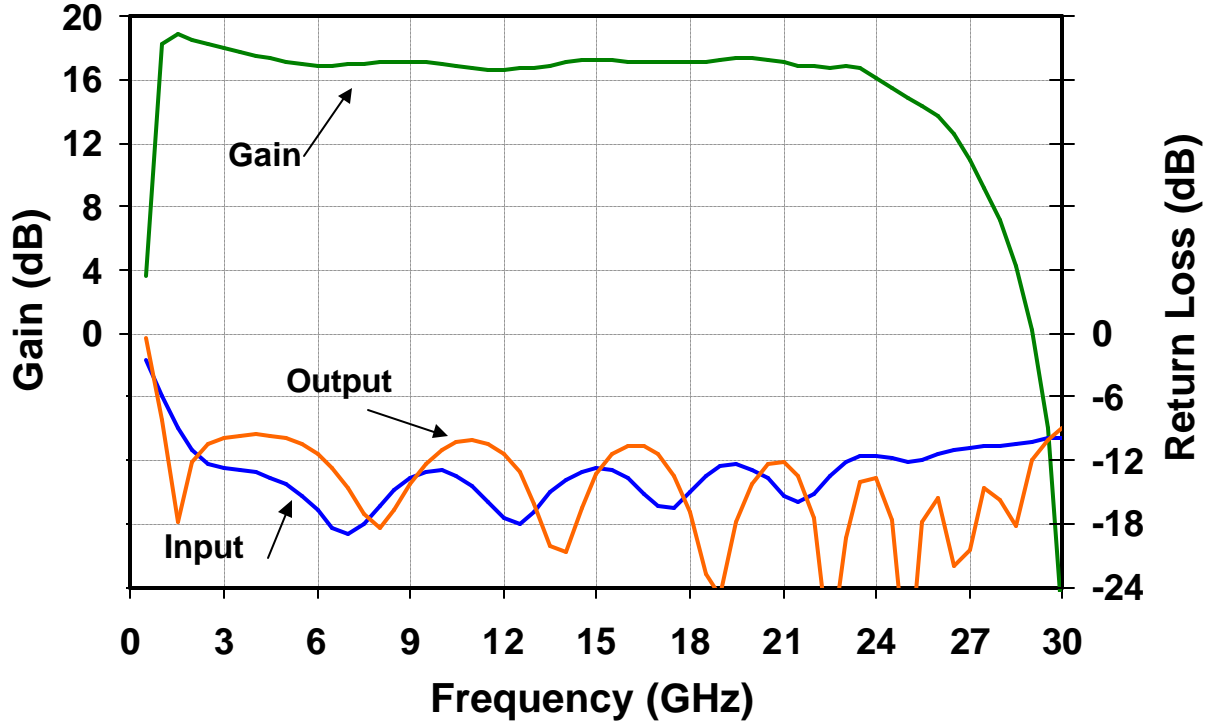
Parameter	Test Conditions	T <sub>CH</sub> (°C)	R <sub>qJC</sub> (°C/W)	T <sub>M</sub> (HRS)
R <sub>θJC</sub> Thermal Resistance (channel to backside of carrier)	V <sub>d</sub> = 5 V I <sub>D</sub> = 75 mA P <sub>diss</sub> = 0.375 W	82	32	4.5 E+7

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 condition with no RF applied, 100% of DC power is dissipated.

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**Measured Fixtured Data**

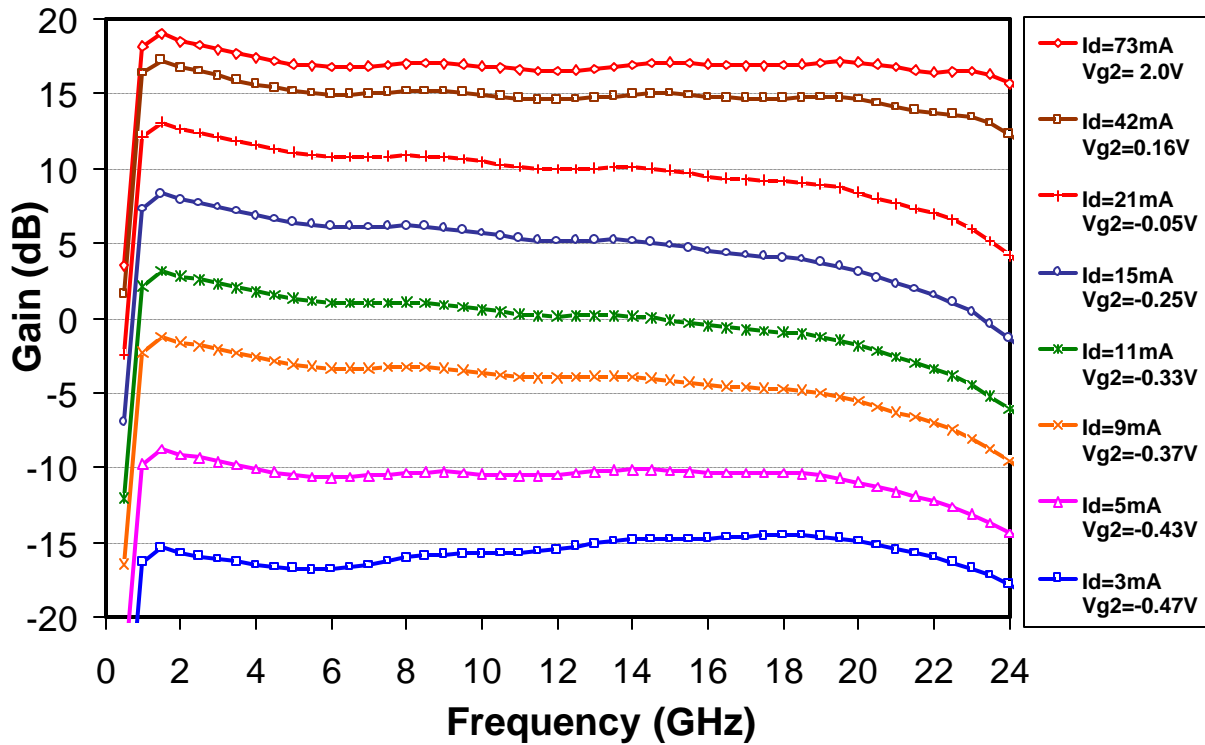
**Vd = 5V, Id = 75mA, Typical Vg1 = -60mV, Vg2 = 2V**



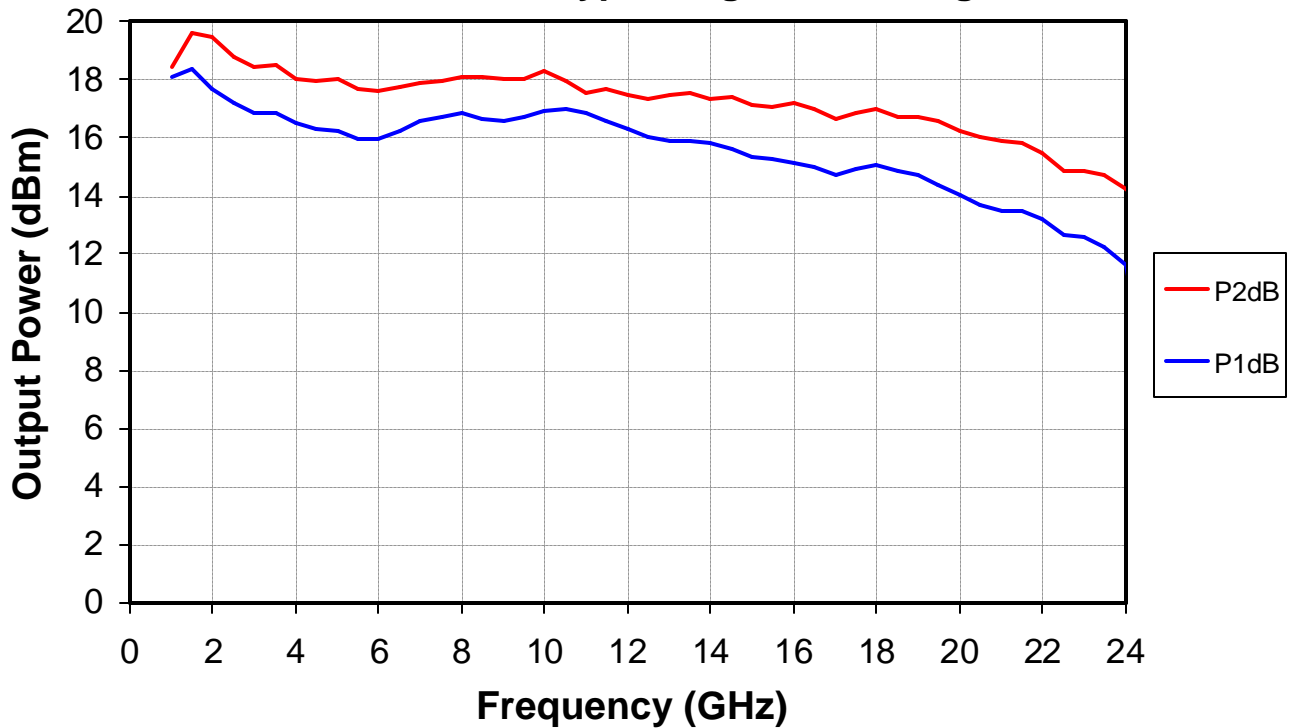
*Note: Devices designated as EPU are typically early in their characterization process prior to finalizing all electrical and process specifications. Specifications are subject to change without notice*

**Measured Fixtured Data**

**Vd = 5V, Typical Vg1 = -60 mV**



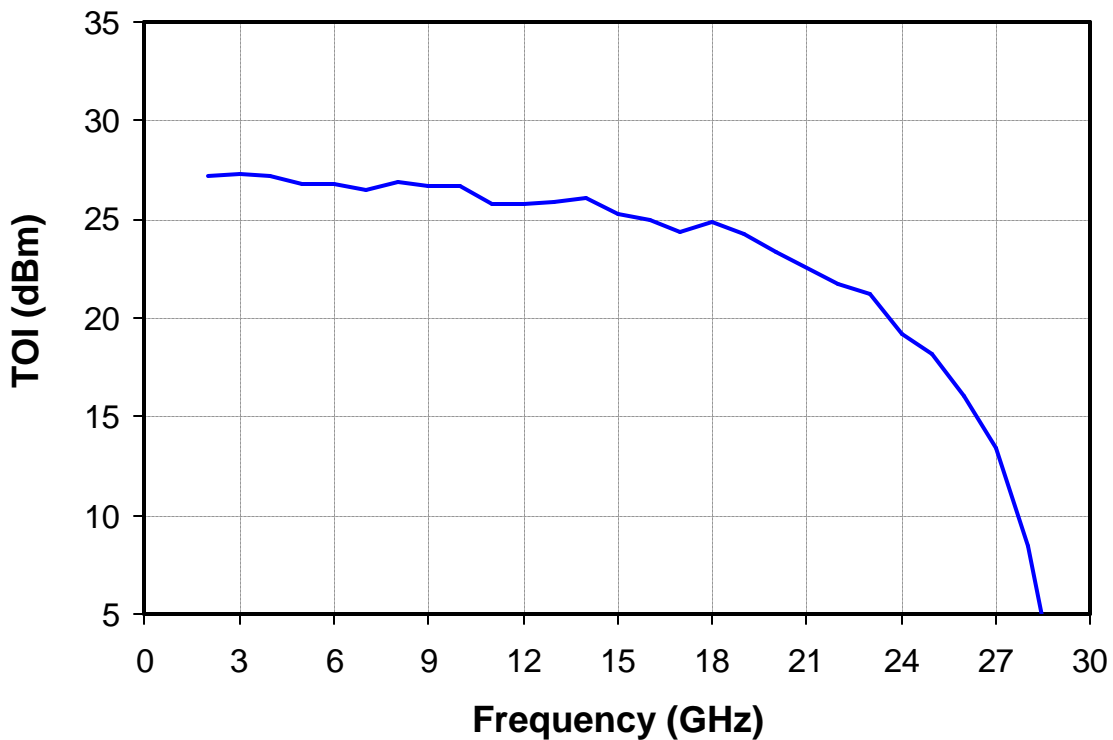
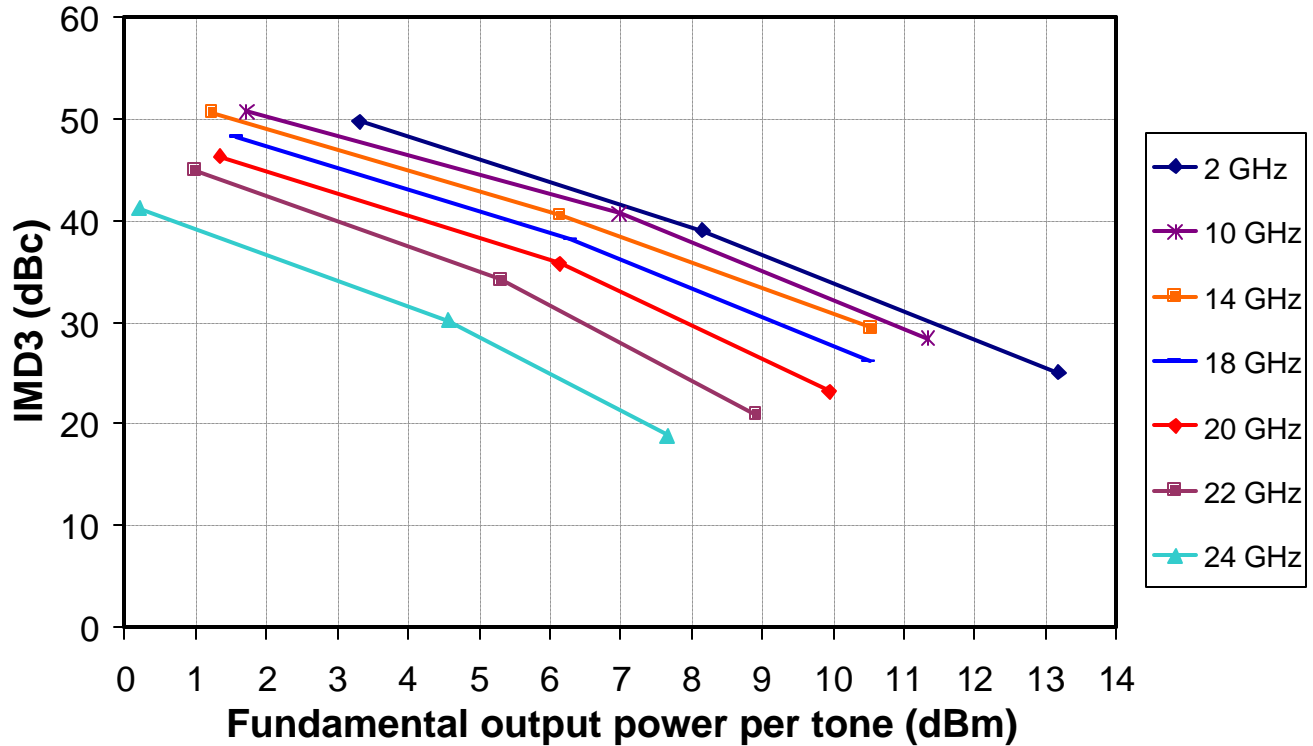
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**Measured Fixtured Data**

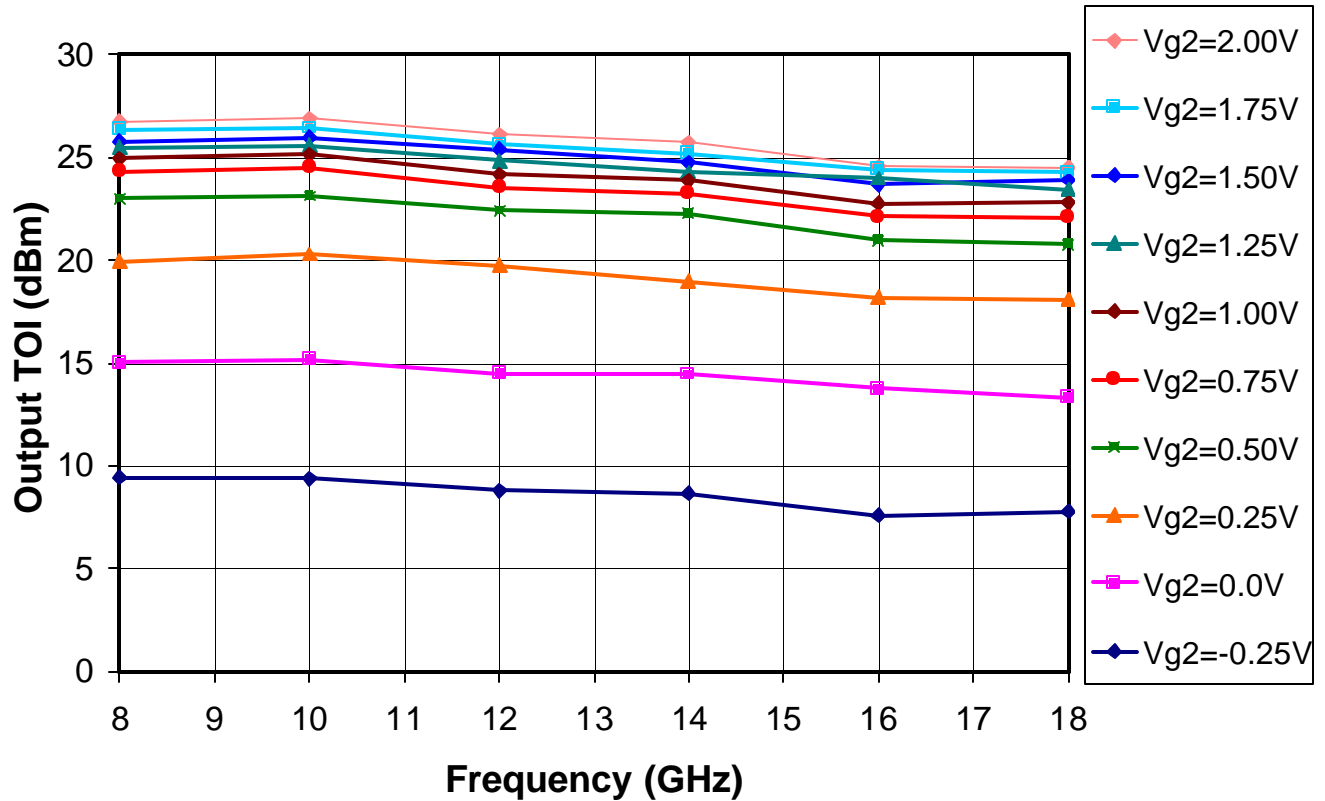
**Vd = 5V, Id = 75mA, Typical Vg1 = -60mV, Vg2 = 2V**



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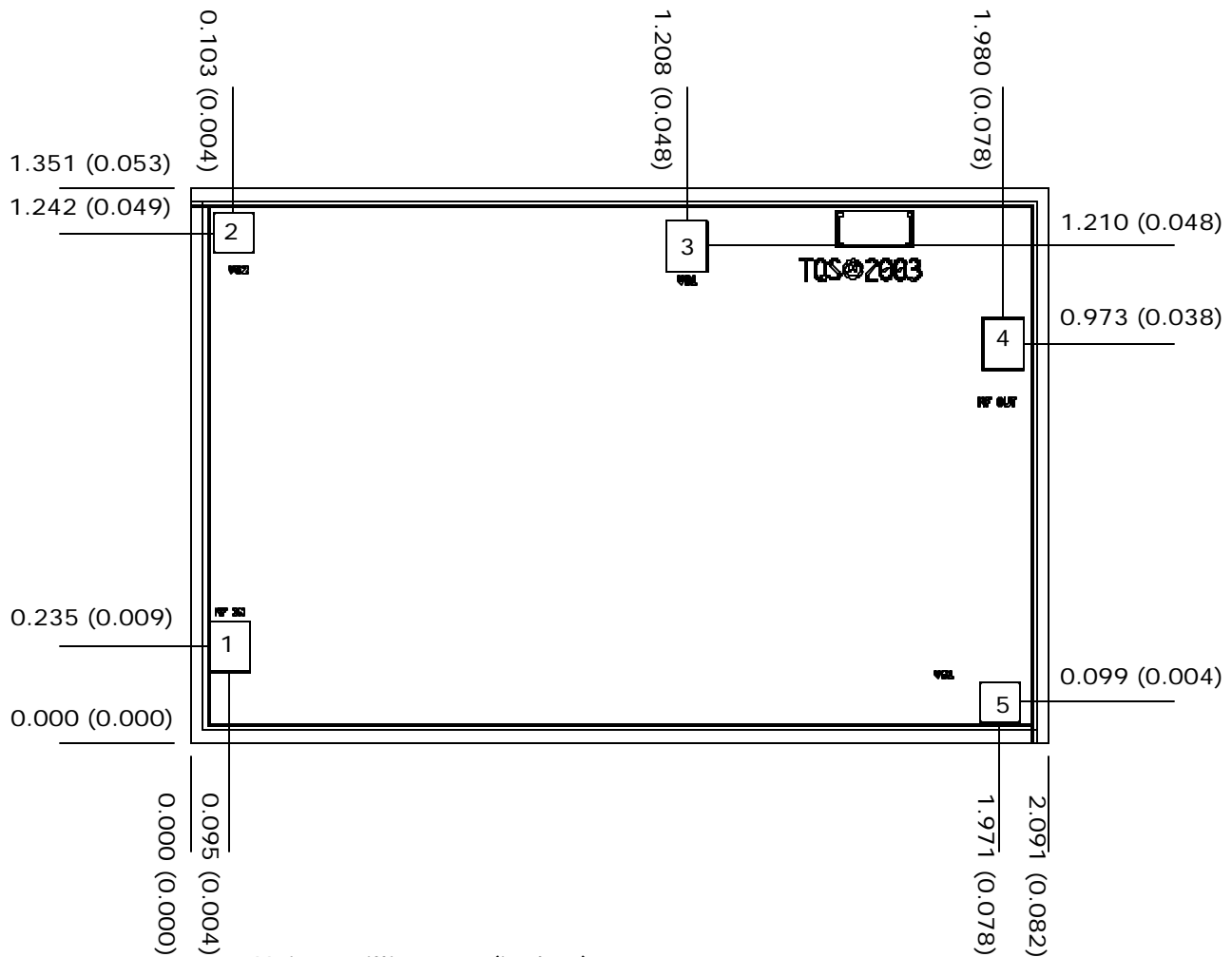
**Measured Fixtured Data**

**Vd = 5V, Id= 75mA, Pin = -10 dBm**



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**Mechanical Characteristics**



Units: millimeters (inches)

Thickness: 0.100 (0.004) (reference only)

Chip edge to bond pad dimensions are shown to center of pad

Chip size tolerance: +/- 0.051 (0.002)

GND IS BACKSIDE OF MMIC

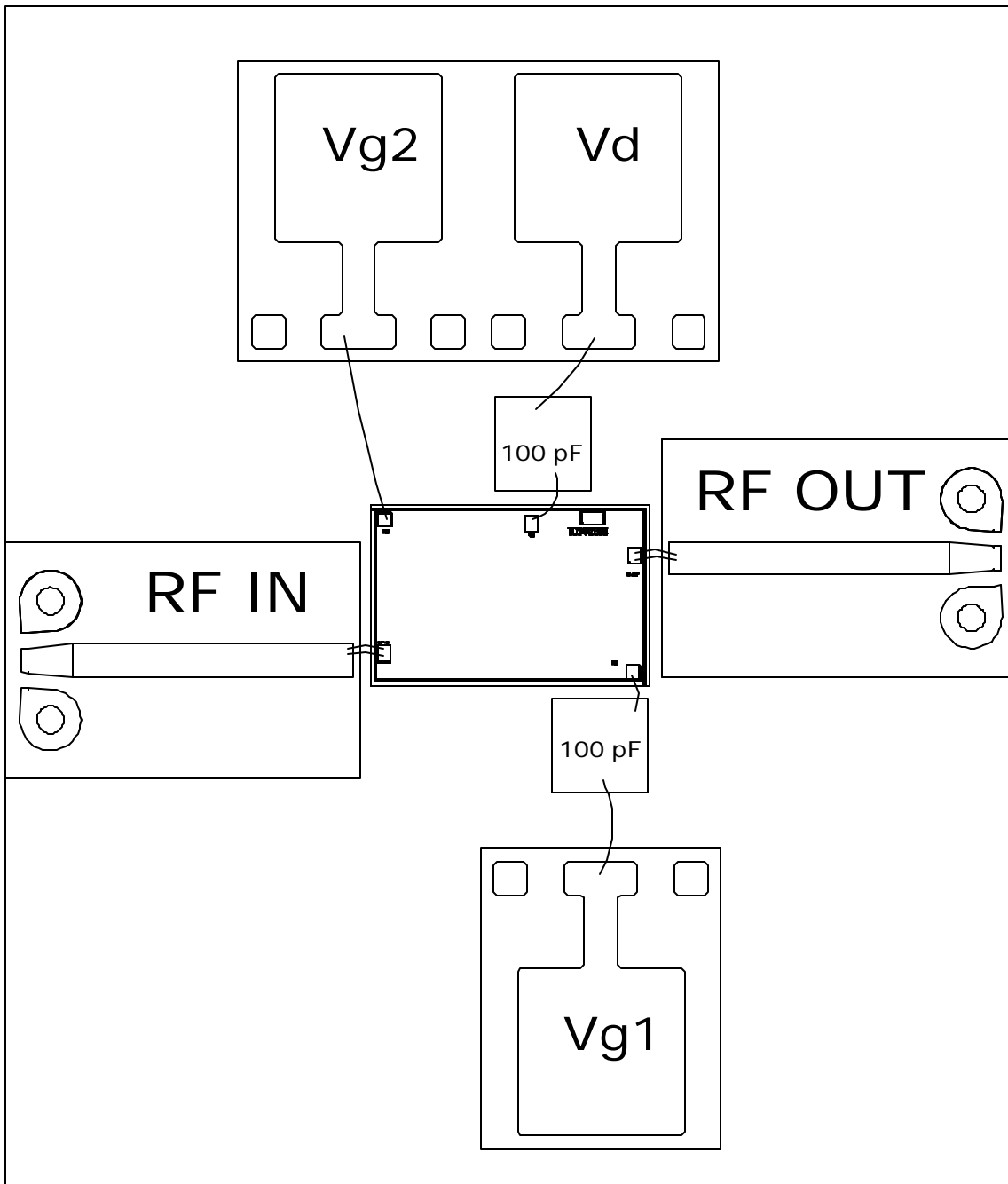
Bond Pad #1:	RF IN	0.100 x 0.125 (0.004 x 0.005)
Bond Pad #2:	VG2	0.100 x 0.100 (0.004 x 0.004)
Bond Pad #3:	VD	0.100 x 0.125 (0.004 x 0.005)
Bond Pad #4:	RF OUT	0.100 x 0.125 (0.004 x 0.005)
Bond Pad #5:	VG1	0.100 x 0.100 (0.004 x 0.004)

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

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**Recommended Assembly Diagram**



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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.

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

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