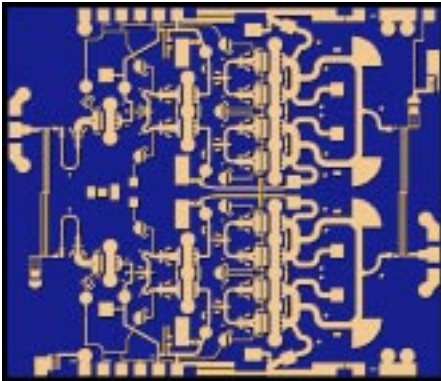


## K-Band High Power Amplifier

## TGA4022



### Key Features

- Frequency Range: 18 - 23 GHz
- 26 dB Nominal Gain
- 32.5 dBm Nominal P1dB
- 15dB Nominal Return Loss
- Bias 7.0 V, 840 mA
- 0.25 um 2MI pHEMT Technology
- Chip Dimensions 3.65 x 3.14 x 0.10 mm  
(0.144 x 0.124 x 0.004 in)

### Primary Applications

- Point-to-Point Radio
- Point-to-Multipoint Communications
- K-Band Sat-Com

### Product Description

The TriQuint TGA4022 is a compact High Power Amplifier MMIC for K-band applications. The part is designed using TriQuint's proven standard 0.25 um power pHEMT production process.

The TGA4022 nominally provides 32.5dBm of Output Power @ 1dB Gain Compression from 18 - 23GHz. The MMIC also provides 26dB Gain and 15dB typical Return Loss.

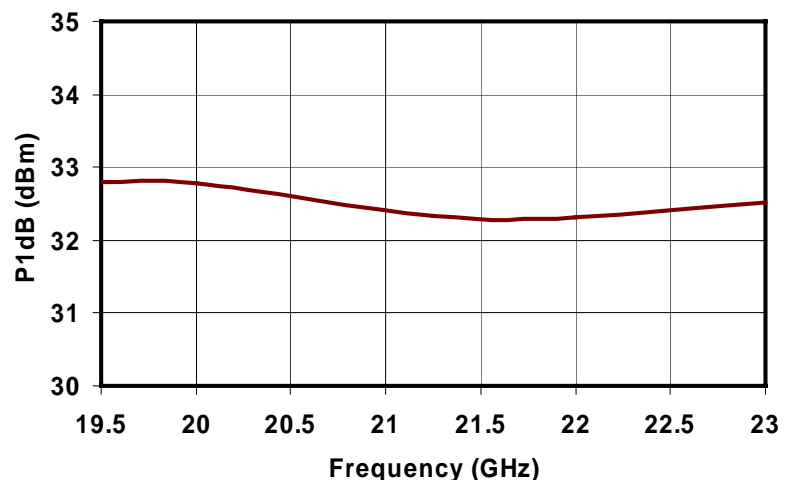
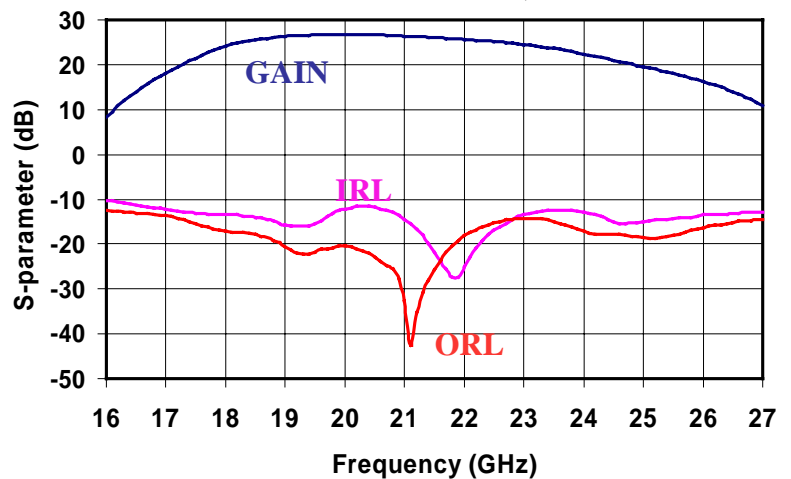
The part is ideally suited for markets such as Point-to-Point Radio, Point-to-Multipoint Communications, and K-Band Satellite Communications both commercial and military.

The TGA4022 is 100% DC and RF tested on-wafer to ensure performance compliance.

Lead-Free & RoHS compliant.

### Measured Fixtured Data

Bias Conditions:  $V_d = 7.0\text{ V}$ ,  $I_d = 840\text{ mA}$



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

**TABLE I**  
**MAXIMUM RATINGS <sup>1/</sup>**

SYMBOL	PARAMETER	VALUE	NOTES
V <sub>d</sub>	Drain Voltage	8 V	<u>2/</u>
V <sub>g</sub>	Gate Voltage Range	-1 TO + 0 V	
I <sub>d</sub>	Drain Current	1.5 A	<u>2/ 3/</u>
I <sub>g</sub>	Gate Current	56 mA	<u>3/</u>
P <sub>IN</sub>	Input Continuous Wave Power	26 dBm	
P <sub>D</sub>	Power Dissipation	7.4 W	<u>2/ 4/</u>
T <sub>CH</sub>	Operating Channel Temperature	150 °C	<u>5/ 6/</u>
T <sub>M</sub>	Mounting Temperature (30 Seconds)	320 °C	
T <sub>STG</sub>	Storage Temperature	-65 to 150 °C	

- 1/ These ratings represent the maximum operable values for this device.
- 2/ Combinations of supply voltage, supply current, input power, and output power shall not exceed P<sub>D</sub>.
- 3/ Total current for the entire MMIC.
- 4/ When operated at this bias condition with a base plate temperature of 70°C, the median life is 1.0E+6 hrs.
- 5/ Junction operating temperature will directly affect the device median time to failure (MTTF). For maximum life, it is recommended that junction temperatures be maintained at the lowest possible levels.
- 6/ These ratings apply to each individual FET.

**TABLE II**  
**DC PROBE TESTS**  
(T<sub>a</sub> = 25 °C, Nominal)

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNITS
I <sub>DSS,Q1</sub>	Saturated Drain Current	60	171	282	mA
G <sub>M,Q1</sub>	Transconductance	132	210	318	mS
V <sub>BVGS,Q1</sub>	Breakdown Voltage Gate_Source	-30	-15	-8	V
V <sub>BVGD,Q1-Q7</sub>	Breakdown Voltage Gate_Drain	-30	-16	-12	V
V <sub>P,Q1-Q14</sub>	Pinch-off Voltage	-1.5	-1	-0.5	V

Q1 is 600 um FET, Q1-Q7 is 2800 um FET, Q1-Q14 is 8400 um FET.

**TABLE III**  
**ELECTRICAL CHARACTERISTICS**

(Ta = 25 °C Nominal)

PARAMETER	TYPICAL	UNITS
Frequency Range	18 - 23	GHz
Drain Voltage, Vd	7.0	V
Drain Current, Id	840	mA
Small Signal Gain, S21	26	dB
Input Return Loss, S11	15	dB
Output Return Loss, S22	20	dB
Pout @ 1dB Gain Compression, P1dB	32.5	dBm

Note: Temperature coefficient on Gain -0.036 dB/°C

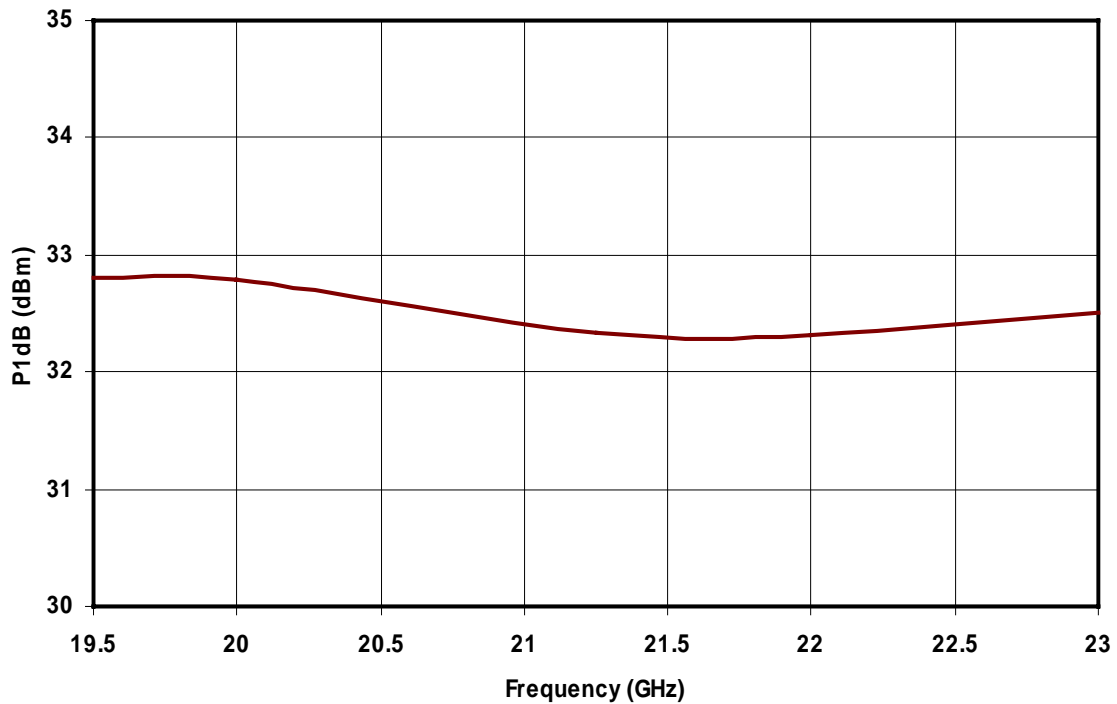
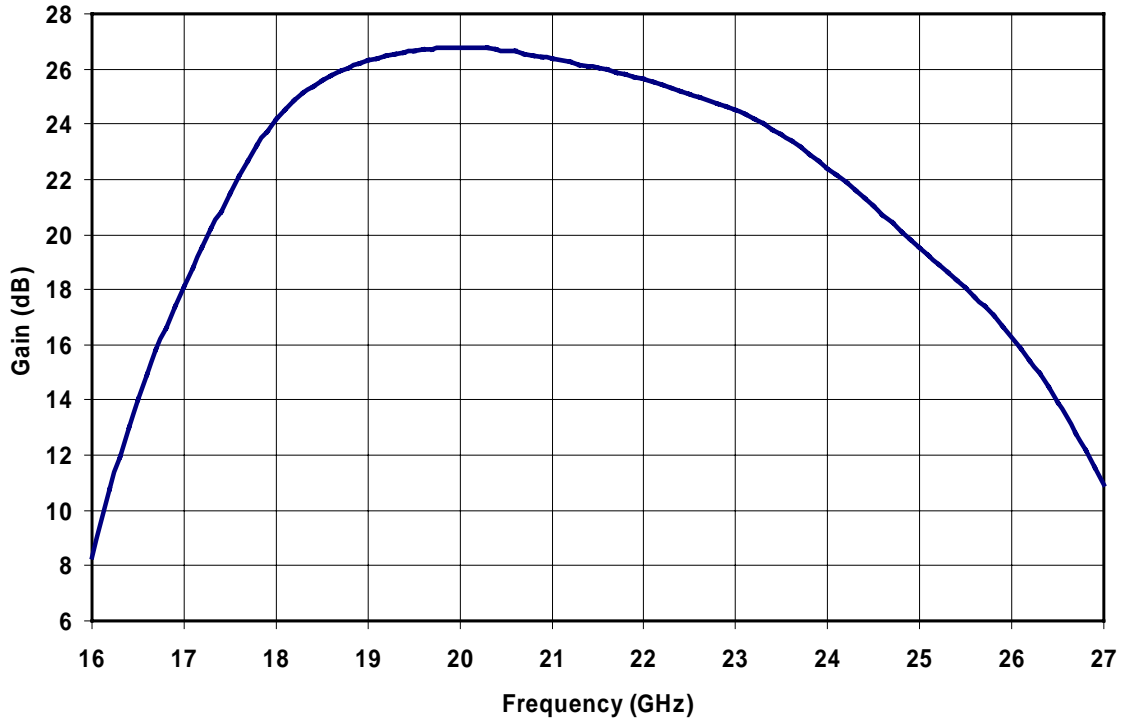
**TABLE IV**  
**THERMAL INFORMATION**

PARAMETER	TEST CONDITIONS	T <sub>CH</sub> (°C)	R <sub>θJC</sub> (°C/W)	T <sub>M</sub> (HRS)
R <sub>θJC</sub> Thermal Resistance (channel to backside of Carrier)	Vd = 7 V Id = 1 A P <sub>diss</sub> = 7 W	146	10.8	1.5 E+6

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.

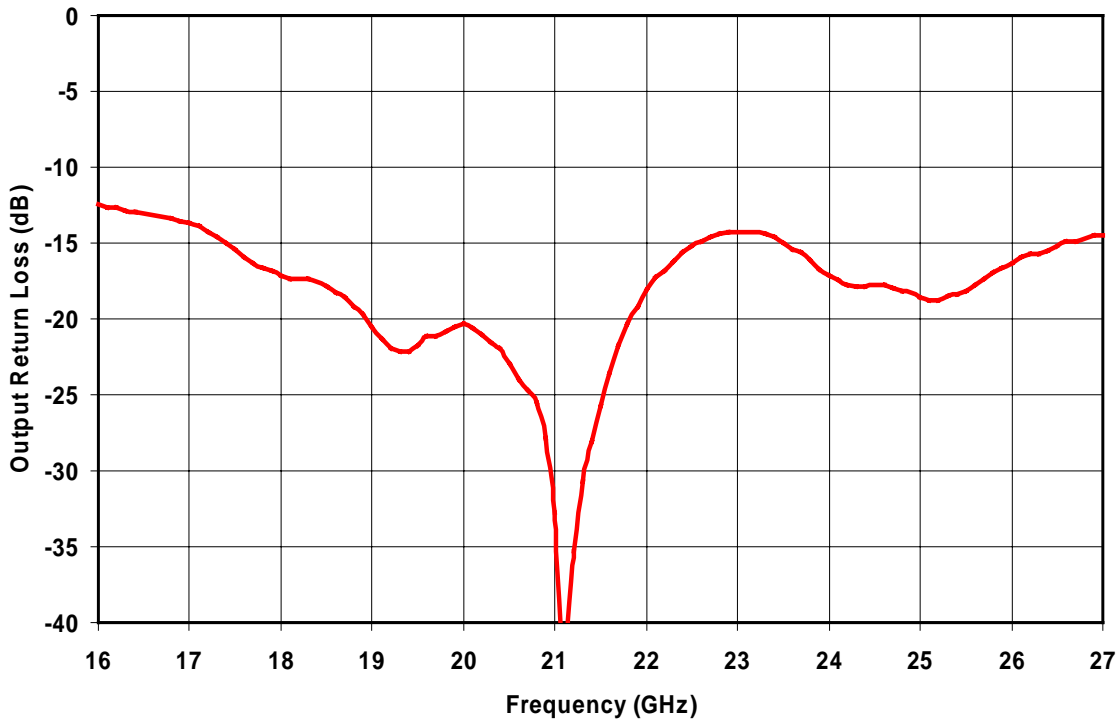
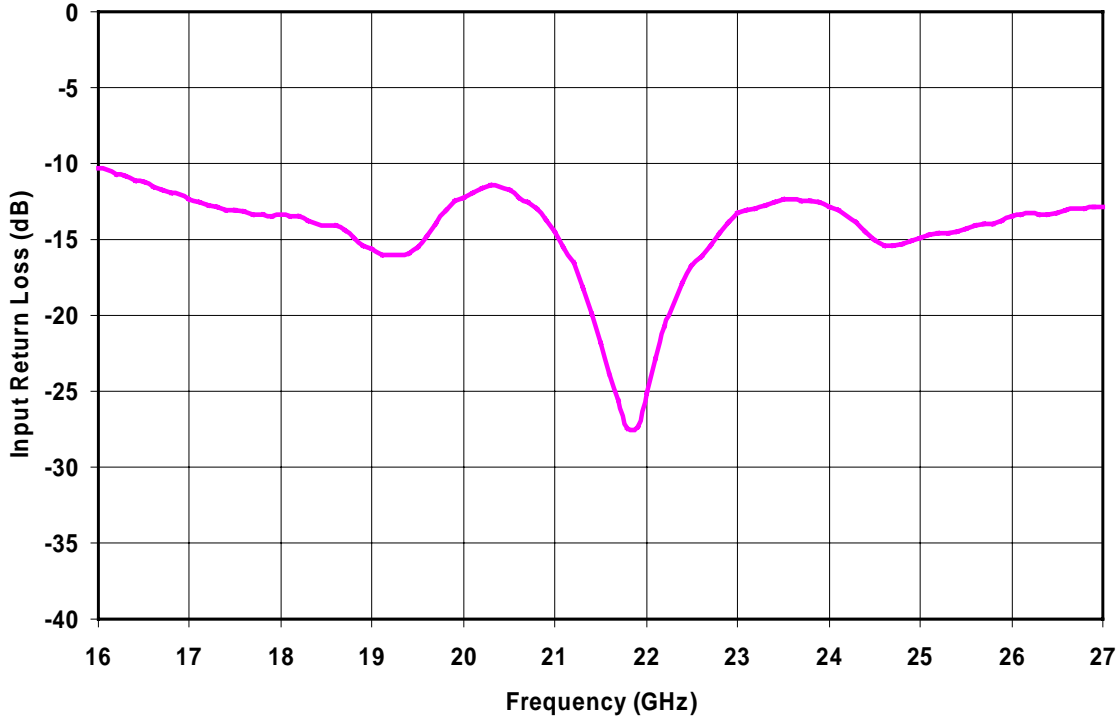
### Preliminary Measured Data

Bias Conditions:  $V_d = 7.0\text{ V}$ ,  $I_d = 840\text{ mA}$ , Room Temperature



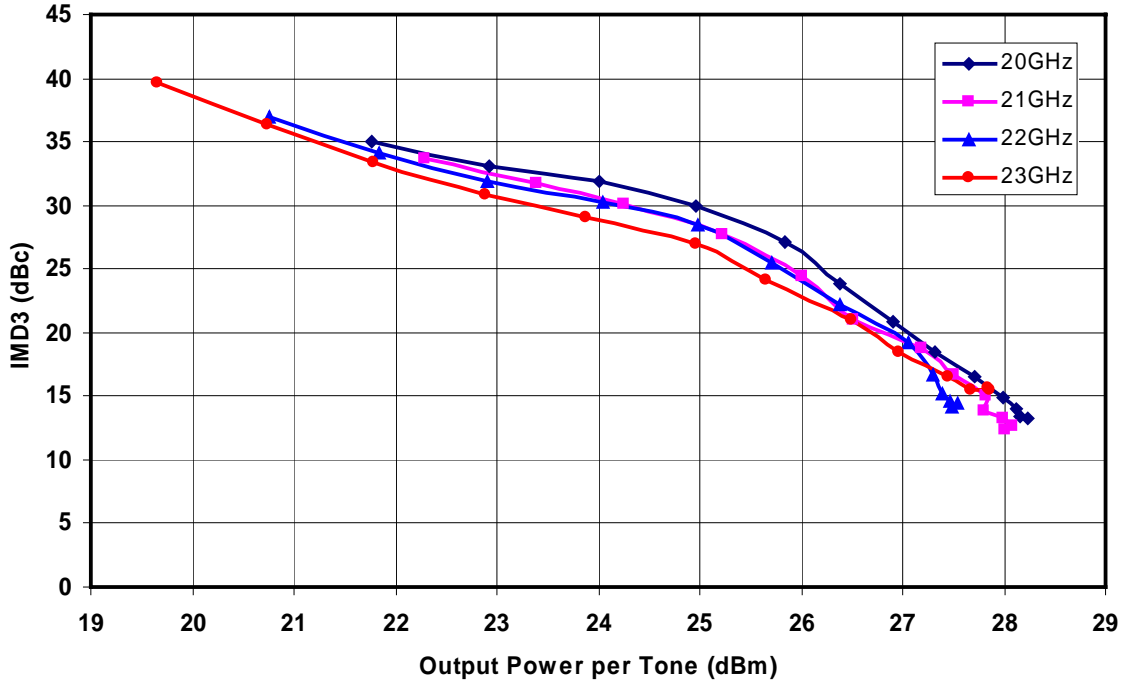
### Preliminary Measured Data

Bias Conditions:  $V_d = 7.0$  V,  $I_d = 840$  mA, Room Temperature

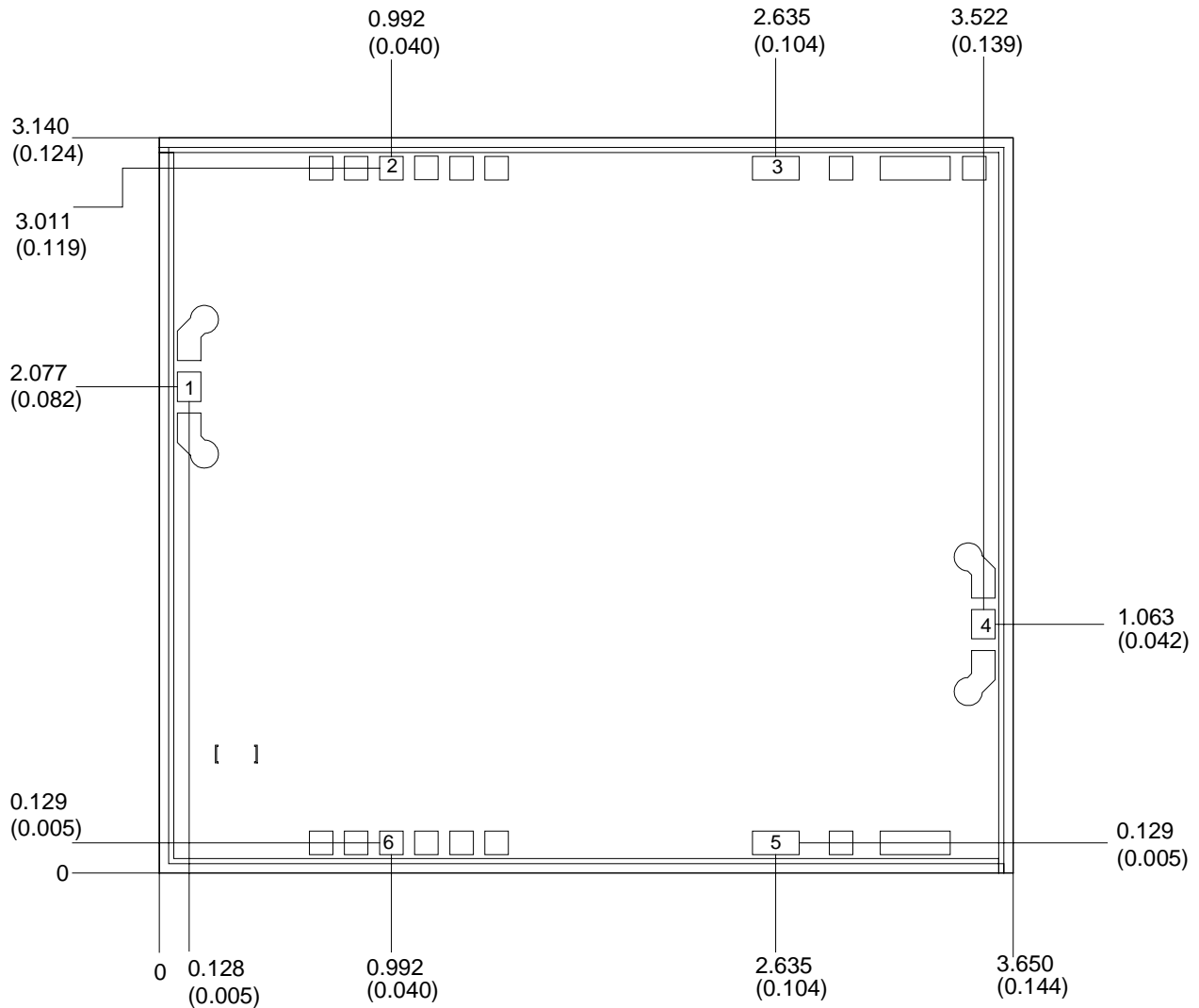


### Preliminary Measured Data

Bias Conditions:  $V_d = 7.0\text{ V}$ ,  $I_d = 840\text{ mA}$ , Room Temperature



**Mechanical Drawing**



Units: Millimeters (inches)

Thickness: 0.100 (0.004)

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

Chip size tolerance: +/- 0.051 (0.002)

RF Ground is backside of MMIC

Bond pad #1: (RF In) 0.100 X 0.125 (0.004 X 0.005)

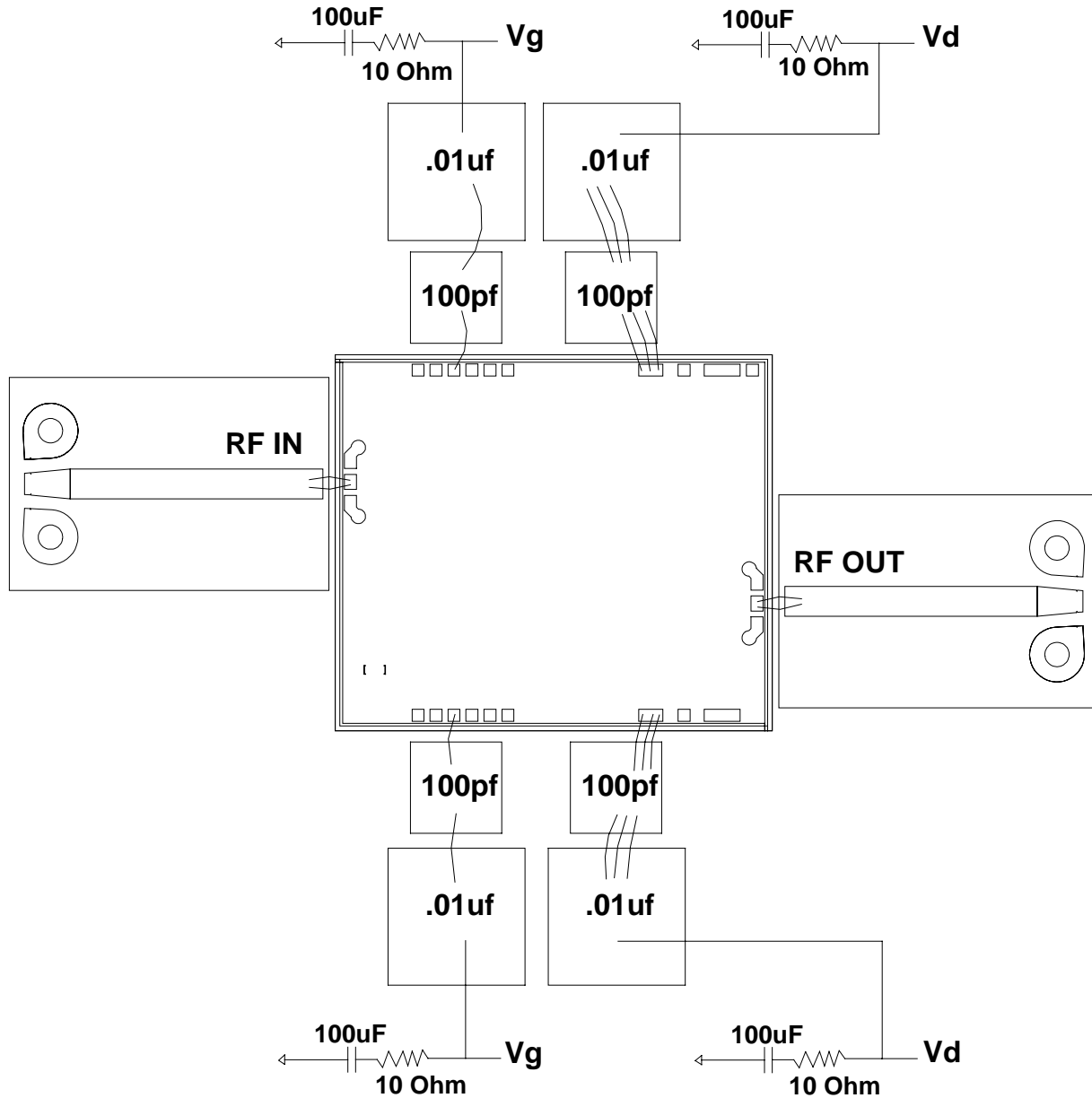
Bond pad #2, #6: (Vg) 0.100 X 0.100 (0.004 X 0.004)

Bond pad #3, #5: (Vd) 0.200 X 0.100 (0.008 X 0.004)

Bond pad #4: (RF Out) 0.100 X 0.125 (0.004 X 0.005)

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

**Recommended Chip Assembly Diagram**



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



## **Assembly Process Notes**

Reflow process assembly notes:

- Use AuSn (80/20) solder with limited exposure to temperatures at or above 300<sup>0</sup>C (30 seconds max).
- 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.
- Maximum stage temperature is 200<sup>0</sup>C.

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