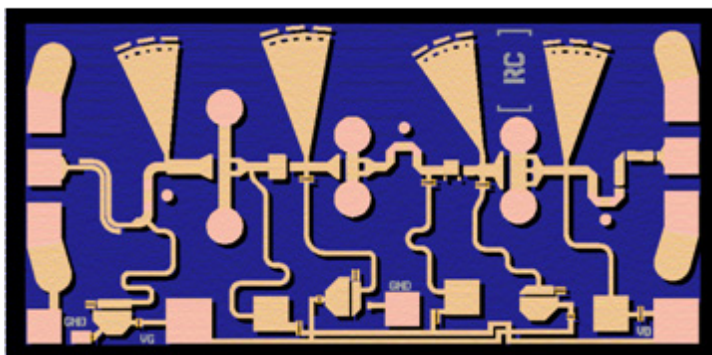


## 60GHz Low Noise Amplifier

## TGA4600

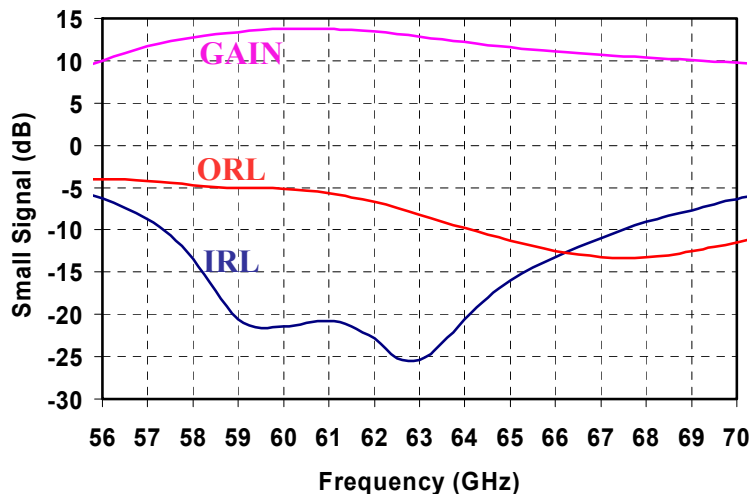


### Key Features

- Typical Frequency Range: 57 - 65 GHz
- 4 dB Nominal Noise Figure
- 13 dB Nominal Gain
- Bias 3.0 V, 41 mA
- 0.15  $\mu$ m 3MI pHEMT Technology
- Chip Dimensions 1.62 x 0.84 x 0.10 mm  
(0.064 x 0.033 x 0.004 in)

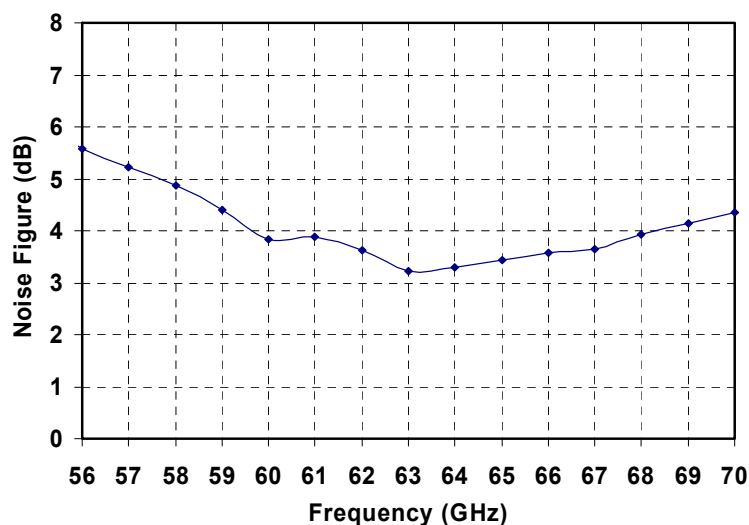
### RF Probe Data

Bias Conditions:  $V_d = 3.0$  V,  $I_d = 41$  mA



### Primary Applications

- Wireless LAN
- Point-to-Point Radio



Note: Datasheet is subject to change without notice.

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

| SYMBOL           | PARAMETER                         | VALUE         | NOTES |
|------------------|-----------------------------------|---------------|-------|
| V <sub>d</sub>   | Drain Voltage                     | 5 V           | 2/    |
| V <sub>g</sub>   | Gate Voltage Range                | -1 TO +0.5 V  |       |
| I <sub>d</sub>   | Drain Current                     | 200 mA        | 2/ 3/ |
| I <sub>g</sub>   | Gate Current                      | 5 mA          | 3/    |
| P <sub>IN</sub>  | Input Continuous Wave Power       | 15 dBm        |       |
| P <sub>D</sub>   | Power Dissipation                 | 0.39W         | 2/ 4/ |
| T <sub>CH</sub>  | Operating Channel Temperature     | 150 °C        | 5/ 6/ |
| 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 |
|--------------------------|-------------------------------|------|------|------|-------|
| V <sub>BVGD, Q1-Q3</sub> | Breakdown Voltage Gate-Source | -30  |      | -5   | V     |
| V <sub>BVGS, Q3</sub>    | Breakdown Voltage Gate-Source | -30  |      | -5   | V     |
| V <sub>P, Q1,2,3</sub>   | Pinch-off Voltage             | -1.0 |      | -0.1 | V     |

Q1 is 100 um FET, Q2 is 100 um FET, Q3 is 210 um FET.

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

(Ta = 25 °C Nominal)

| PARAMETER               | TYPICAL  | UNITS |
|-------------------------|----------|-------|
| Frequency Range         | 57 - 65  | GHz   |
| Drain Voltage, Vd       | 3.0      | V     |
| Drain Current, Id       | 41       | mA    |
| Gate Voltage, Vg        | -0.5 - 0 | V     |
| Small Signal Gain, S21  | 13       | dB    |
| Input Return Loss, S11  | 20       | dB    |
| Output Return Loss, S22 | 6        | dB    |
| Noise Figure, NF        | 4        | dB    |

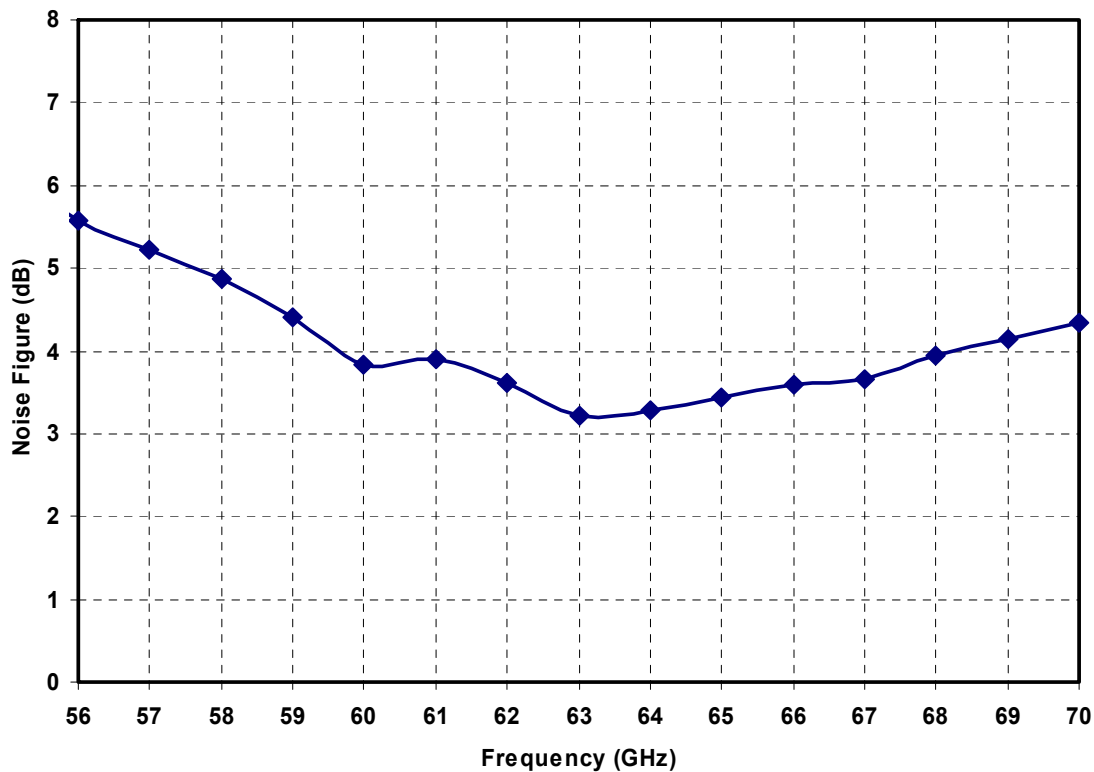
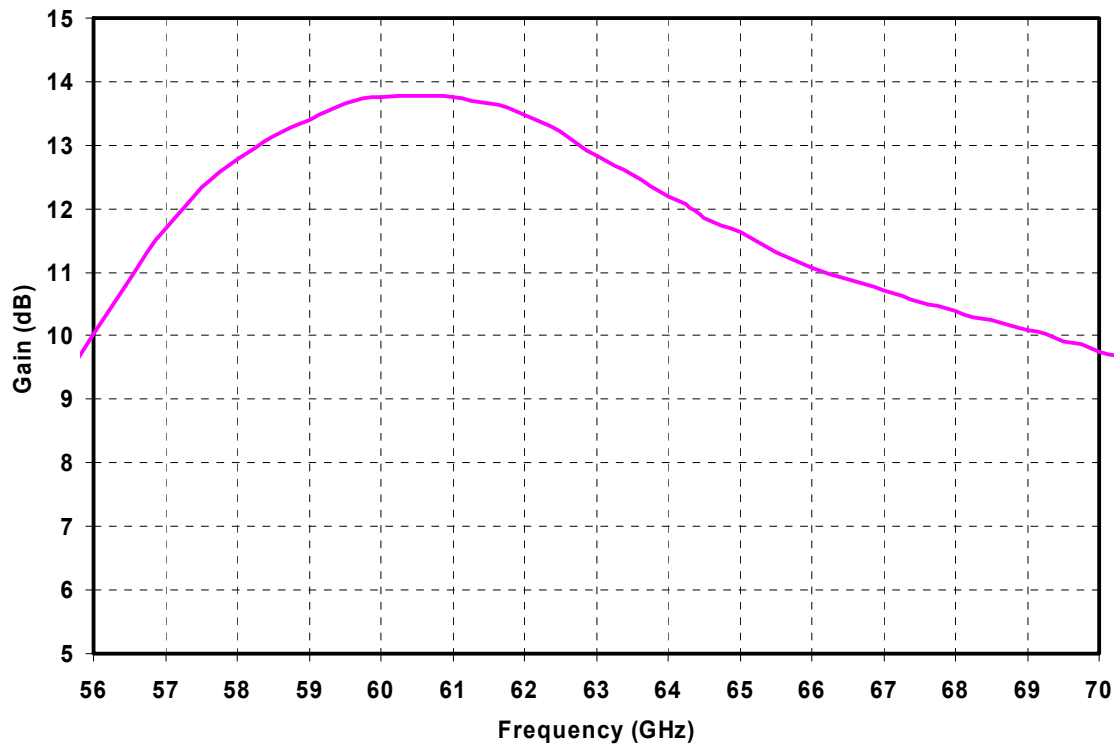
**TABLE IV**  
**THERMAL INFORMATION**

| PARAMETER                                                | TEST CONDITIONS                                      | T <sub>CH</sub><br>(°C) | R <sub>θJC</sub><br>(°C/W) | T <sub>M</sub><br>(HRS) |
|----------------------------------------------------------|------------------------------------------------------|-------------------------|----------------------------|-------------------------|
| R <sub>θJC</sub> Thermal Resistance<br>(channel to Case) | Vd = 3 V<br>Id = 41 mA<br>P <sub>diss</sub> = 0.12 W | 80                      | 83                         | 1.2 E+9                 |

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.

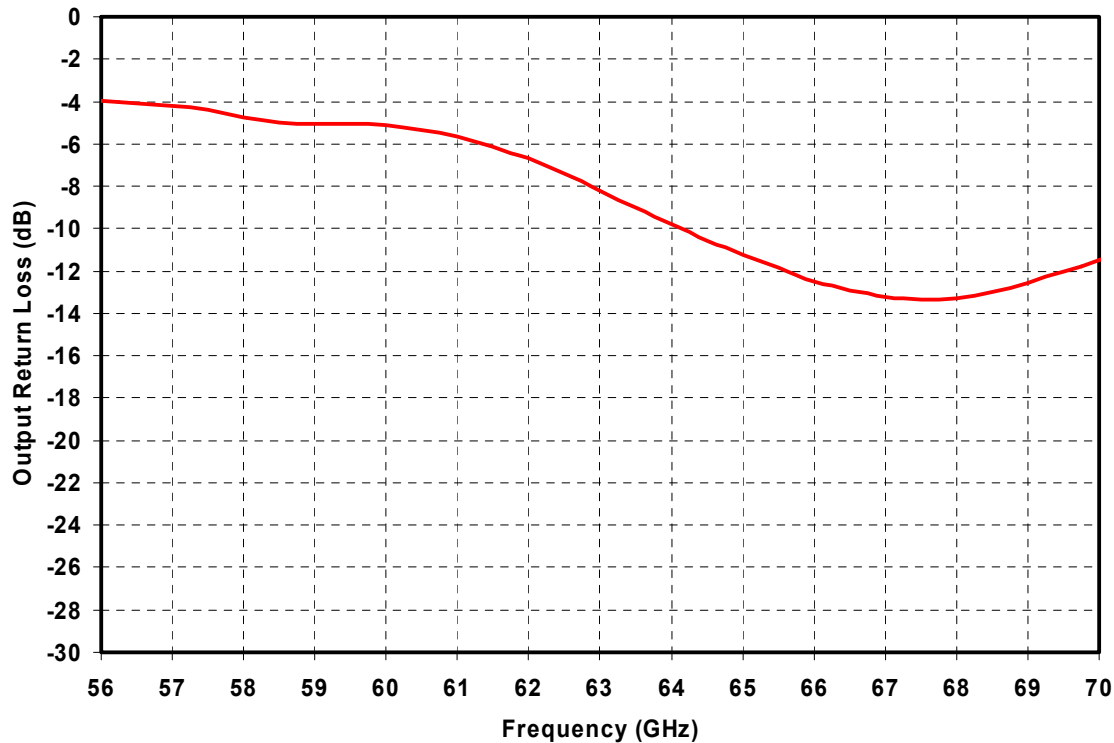
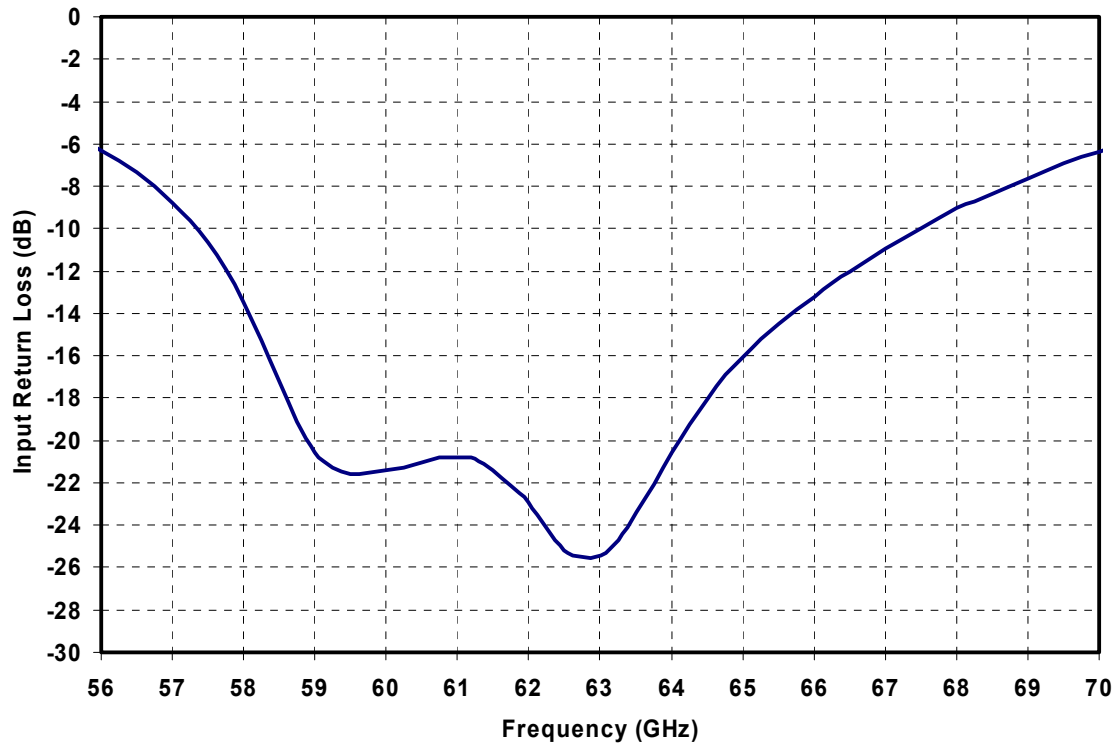
RF Probe Data

Bias Conditions:  $V_d = 3.0\text{ V}$ ,  $I_d = 41\text{ mA}$

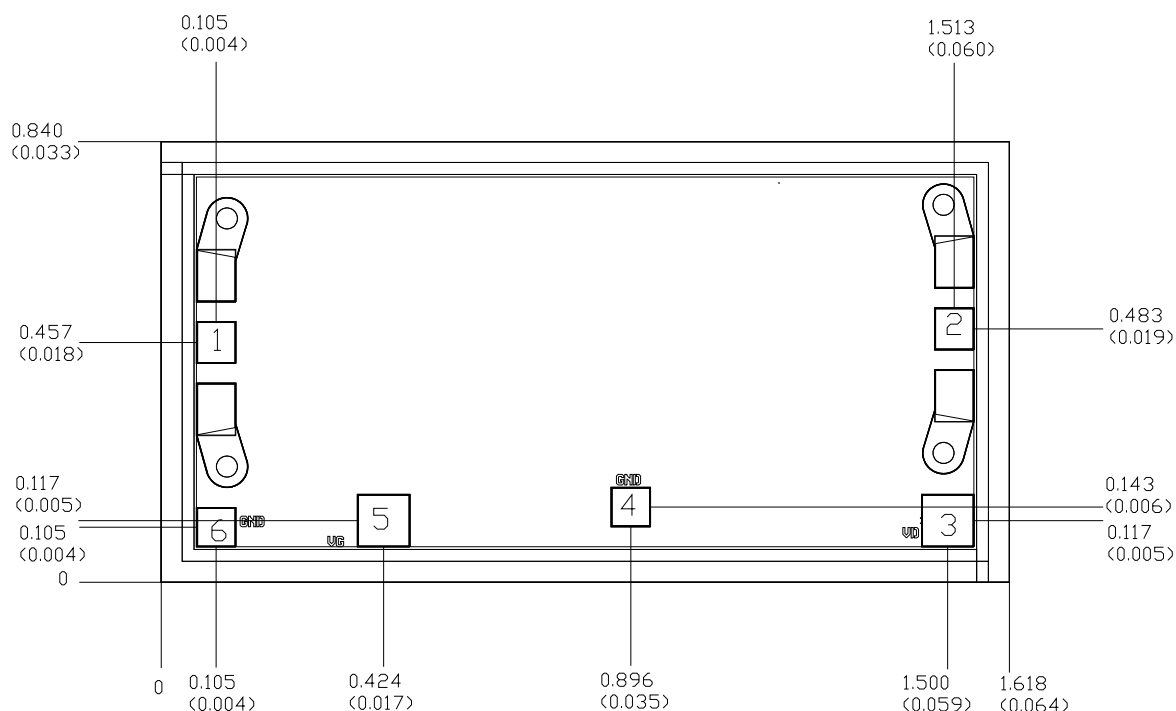


**RF Probe Data**

Bias Conditions:  $V_d = 3.0\text{ V}$ ,  $I_d = 41\text{ mA}$



## Mechanical Drawing



Units: Millimeters (inches)

Thickness: 0.050 (0.002) (reference only)

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

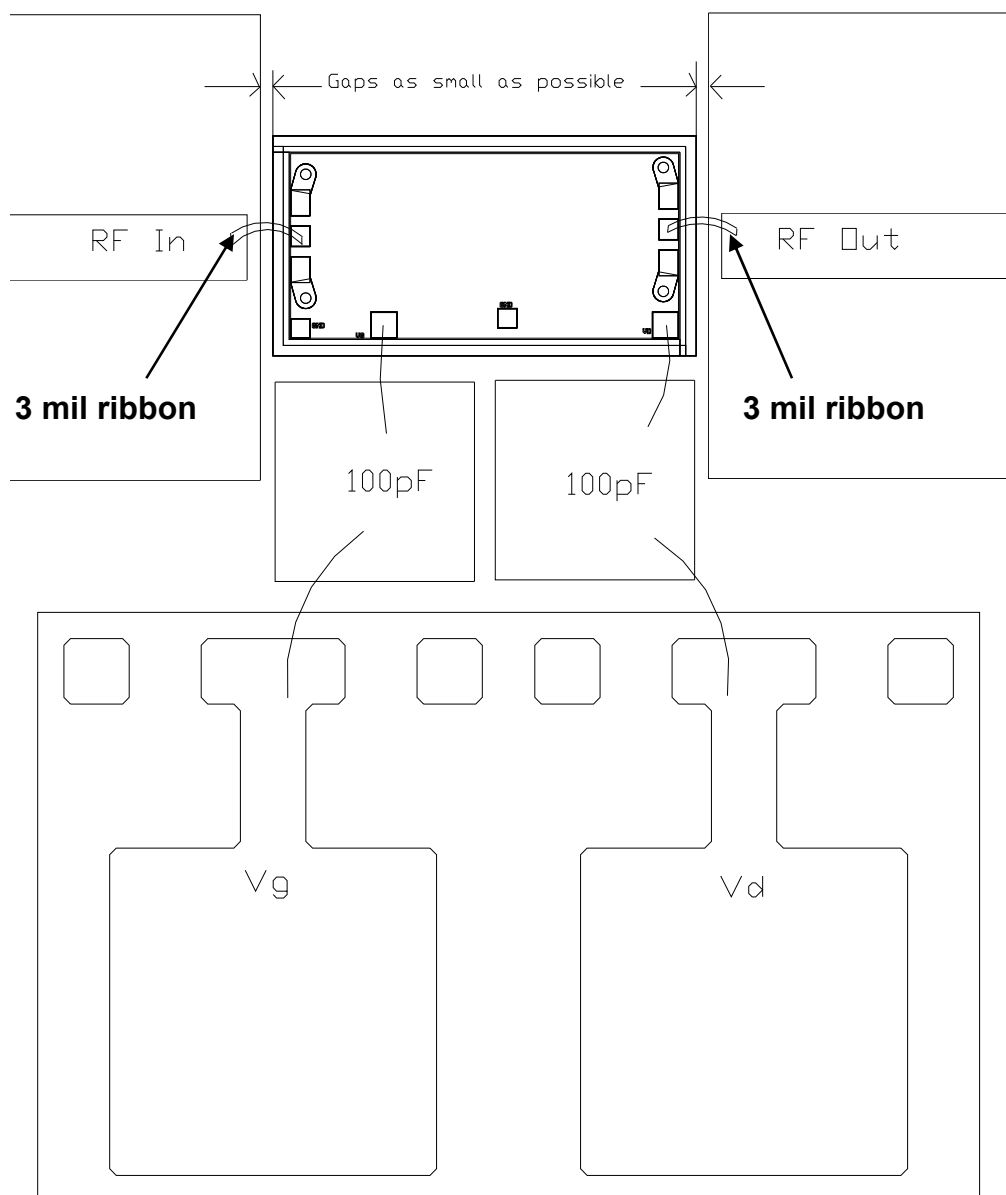
Chip size tolerance:  $\pm 0.051$  (0.002)

RF Ground is backside of MMIC

|                   |            |                               |
|-------------------|------------|-------------------------------|
| Bond pad #1:      | (RF In)    | 0.075 × 0.080 (0.003 × 0.003) |
| Bond pad #2:      | (RF Out)   | 0.075 × 0.080 (0.003 × 0.003) |
| Bond pad #3:      | (Vd)       | 0.100 × 0.100 (0.004 × 0.004) |
| Bond pad #4 & #6: | (GND, N/C) | 0.075 × 0.075 (0.003 × 0.003) |
| Bond pad #5:      | (Vg)       | 0.100 × 0.100 (0.004 × 0.004) |

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

## Recommended Chip Assembly Diagram



**Ribbons as short as possible**

***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.***

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