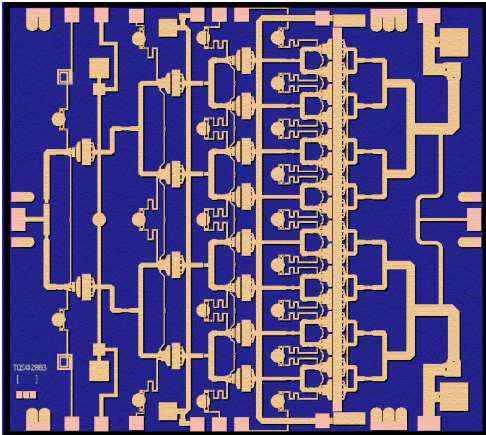


Ka Band Power Amplifier



Key Features

- Frequency Range: 31 - 37 GHz
- 35 dBm Nominal Psat @ Mid-band
- 20 dB Nominal Gain @ Mid-band
- 12 dB Nominal Return Loss
- Bias 5-6 V, 2 A Quiescent
- 0.15 um 3MI pHEMT Technology
- Chip Dimensions 4.35 x 3.90 x 0.05 mm (0.171 x 0.154 x 0.002) in

Primary Applications

- Point-to-Point Radio
- Military Radar Systems
- Ka-Band Sat-Com

Product Description

The TriQuint TGA4517 is a compact High Power Amplifier MMIC for Ka-band applications. The part is designed using TriQuint's 0.15um gate power pHEMT process.

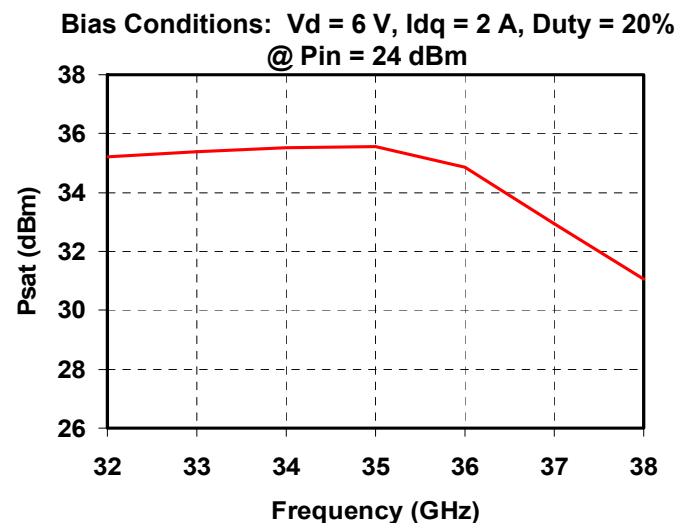
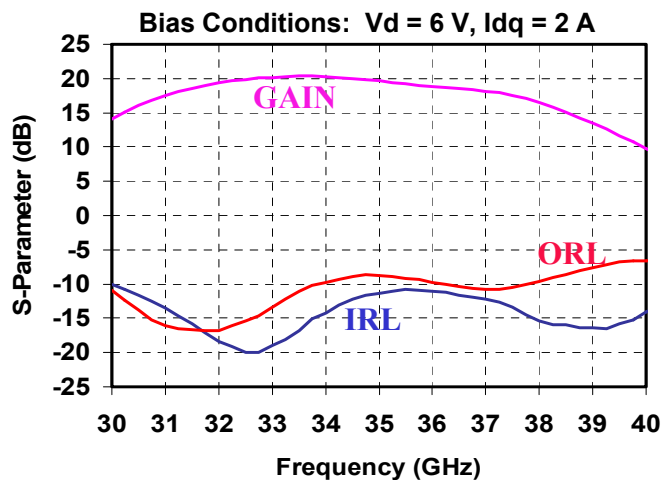
The TGA4517 nominally provides 35dBm of Saturated Output Power, and 20dB small signal gain @ mid-band of 31 - 37GHz. The MMIC also provides 12dB Return Loss.

The part is ideally suited for markets such as Point-to-Point Radio, Military Radar Systems, and Ka-Band Satellite Communications both commercial and military.

The TGA4517 is 100% DC and RF tested on-wafer to ensure performance compliance.

Lead-Free & RoHS compliant.

Measured Fixtured Data



Datasheet subject to change without notice

TABLE I
ABSOLUTE MAXIMUM RATINGS ^{1/}

| SYMBOL | PARAMETER | VALUE | NOTES |
|------------------|-----------------------------------|---------------|--------------|
| V _d | Drain Voltage | 6.5 V | <u>2/</u> |
| V _g | Gate Voltage Range | -3 TO 0 V | |
| I _d | Drain Current (Under RF Drive) | 4 A | <u>2/ 3/</u> |
| I _g | Gate Current | 141 mA | <u>3/</u> |
| P _{IN} | Input Continuous Wave Power | TBD | |
| P _D | Power Dissipation | 26 W | <u>2/ 4/</u> |
| T _{CH} | Operating Channel Temperature | 200 °C | <u>5/ 6/</u> |
| | 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/ Combinations of supply voltage, supply current, input power, and output power shall not exceed P_D.
- 3/ Total current for the entire MMIC.
- 4/ When operated at this bias condition (with RF applied) at a base plate temperature of 70 °C, the median life is 3.5E+4 hrs.
- 5/ 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.
- 6/ These ratings apply to each individual FET.

TABLE II
DC PROBE TESTS
 (T_a = 25 °C, Nominal)

| SYMBOL | PARAMETER | MIN. | TYP. | MAX. | UNITS |
|---------------------------|------------------------------|------|------|------|-------|
| V _{BVGD,Q1-Q2} | Breakdown Voltage Gate-Drain | -30 | -14 | -11 | V |
| V _{BVGD,Q15-Q30} | Breakdown Voltage Gate-Drain | -30 | -14 | -11 | V |
| V _{P,Q15-Q30} | Pinch-Off Voltage | -1.5 | -1 | -0.5 | V |

Each FET Cell is 750um

TABLE III
ELECTRICAL CHARACTERISTICS
 (Ta = 25 °C, Nominal)

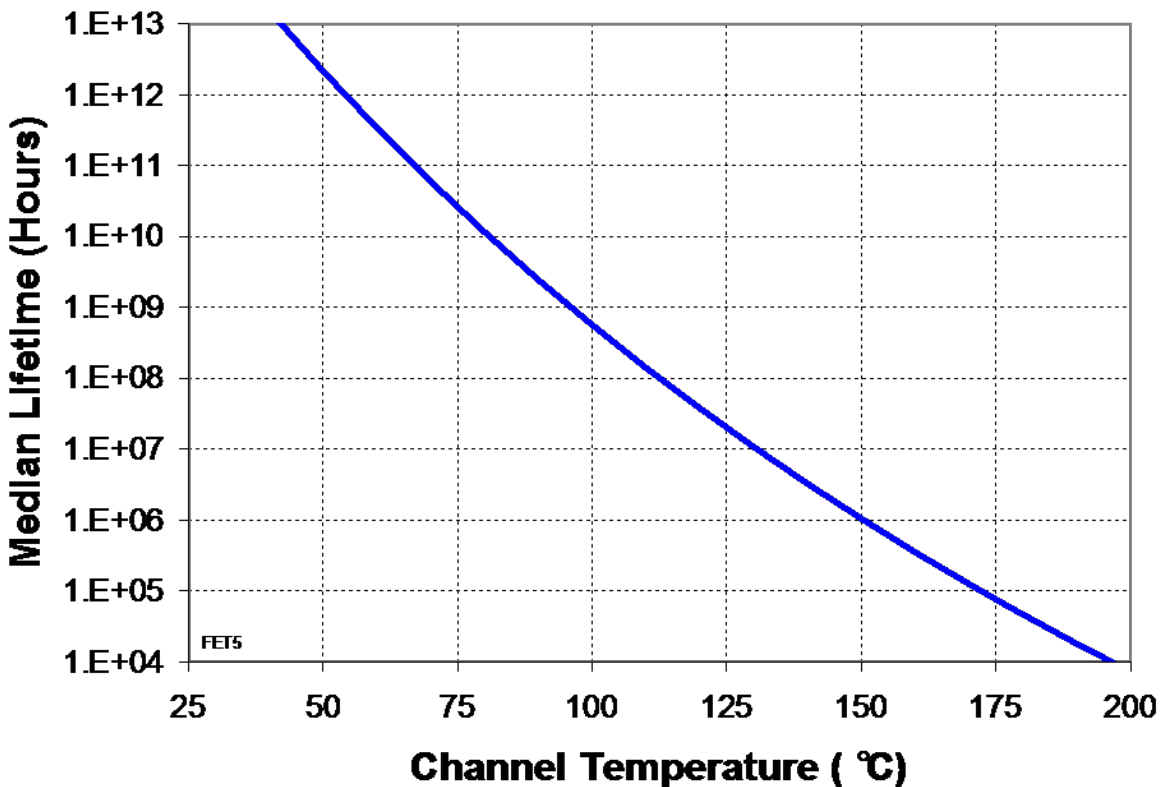
| PARAMETER | TYPICAL | UNITS |
|-----------------------------------|---------|-------|
| Frequency Range | 31 - 37 | GHz |
| Drain Voltage, Vd | 6 | V |
| Drain Current (Quiescent), Idq | 2 | A |
| Gate Voltage, Vg | -0.5 | V |
| Small Signal Gain, S21 @ Mid-band | 20 | dB |
| Input Return Loss, S11 | 14 | dB |
| Output Return Loss, S22 | 12 | dB |
| Output Power, Psat | 35 | dBm |

**TABLE IV
THERMAL INFORMATION**

| PARAMETER | TEST CONDITIONS | T _{CH} (°C) | θ _{JC} (°C/W) | T _m (HRS) |
|---|---|----------------------|------------------------|----------------------|
| θ _{JC} Thermal Resistance (channel to backside of carrier) | V _d = 6 V I _{dq} = 2 A P _{diss} = 12 W | 122.3 | 4.36 | 1.2E+7 |

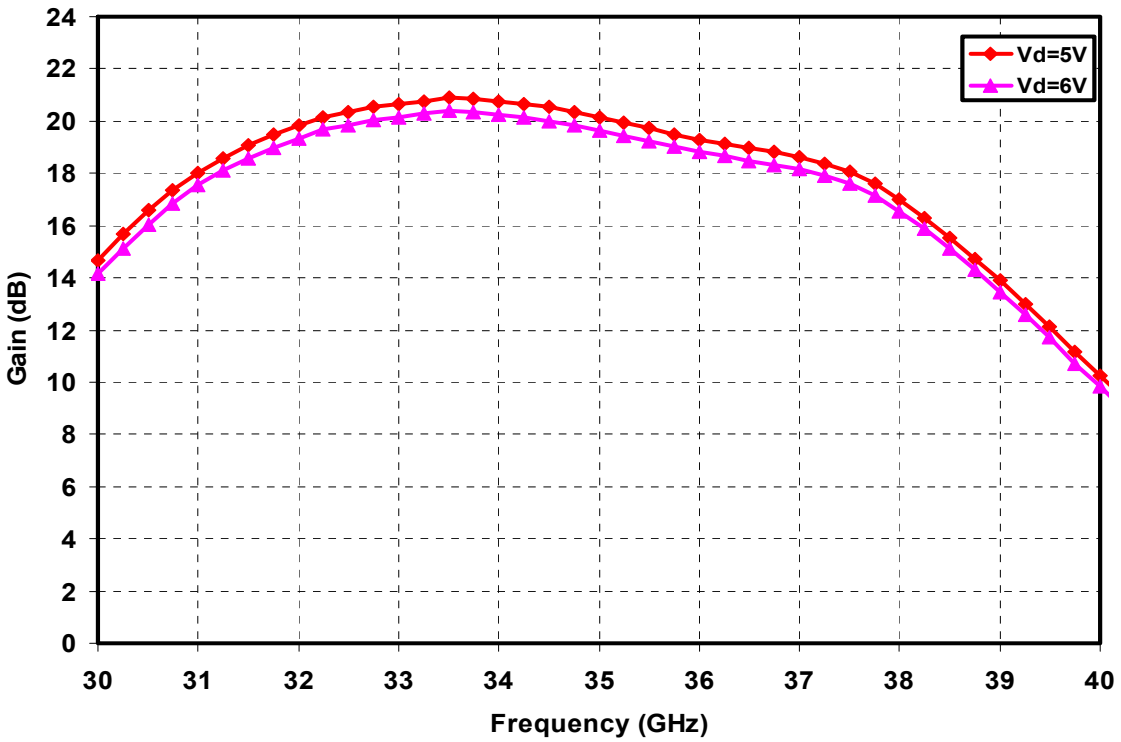
Note: Assumes eutectic attach using 1.5 mil 80/20 AuSn mounted to a 20 mil CuMo Carrier at 70°C baseplate temperature. Worst case condition with no RF applied, 100% of DC power is dissipated.

Median Lifetime (T_m) vs. Channel Temperature

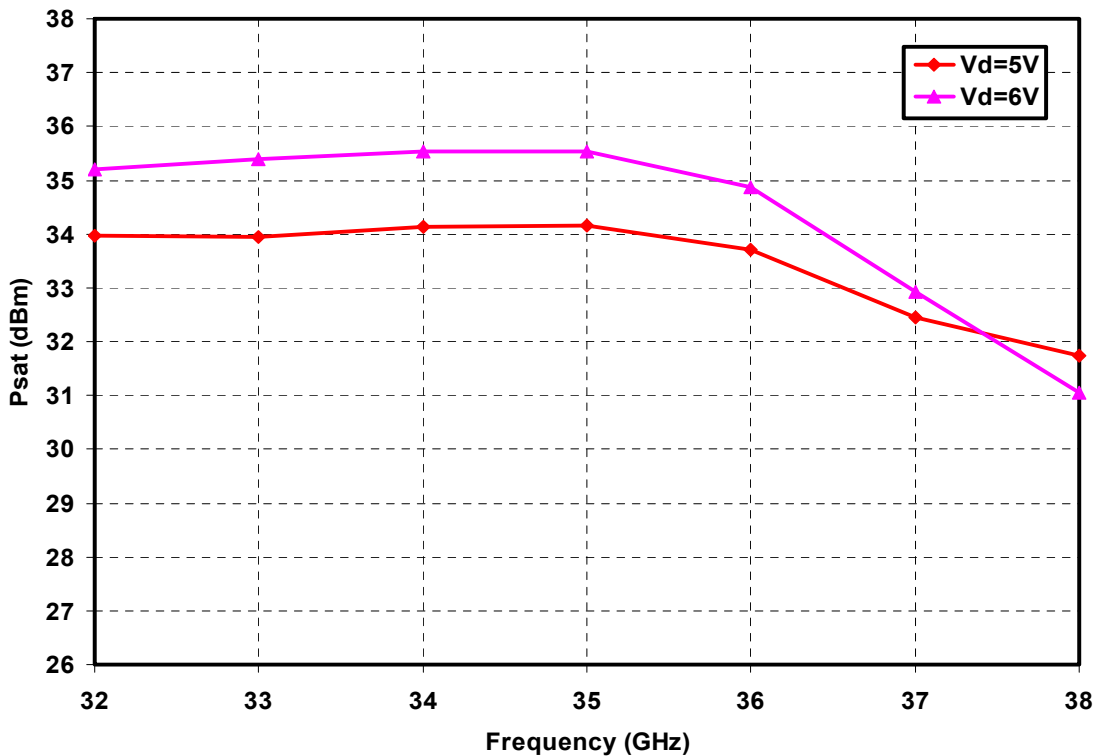


Measured Data

Bias Conditions: $V_d = 5-6\text{ V}$, $I_{dq} = 2\text{ A}$, Room Temp.

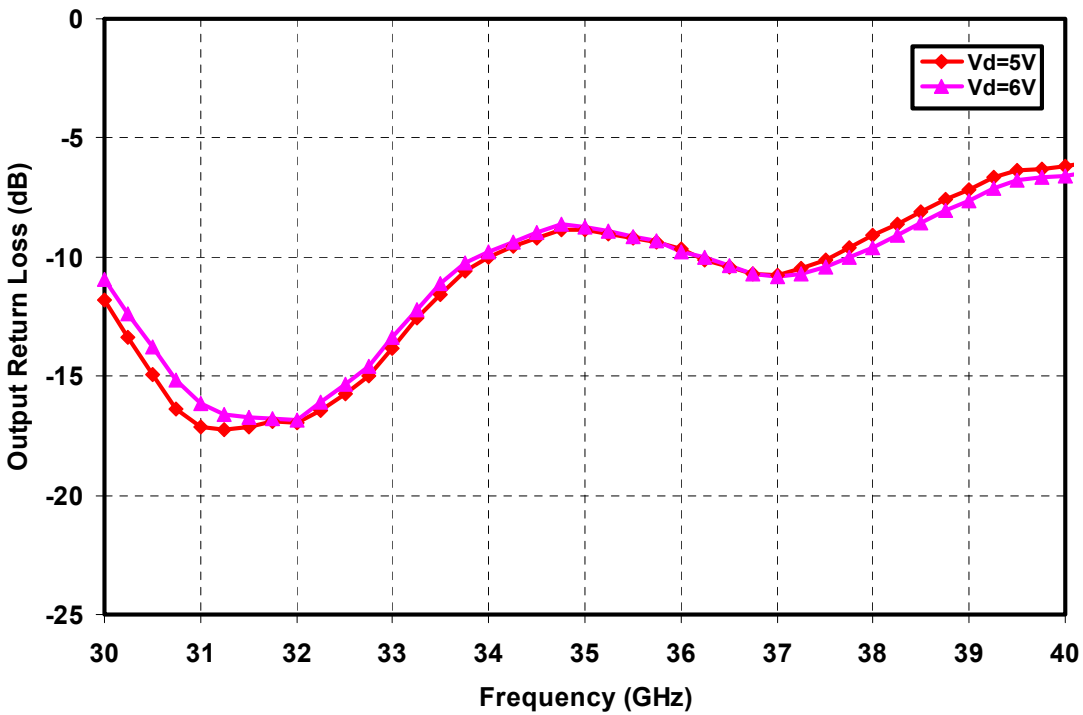
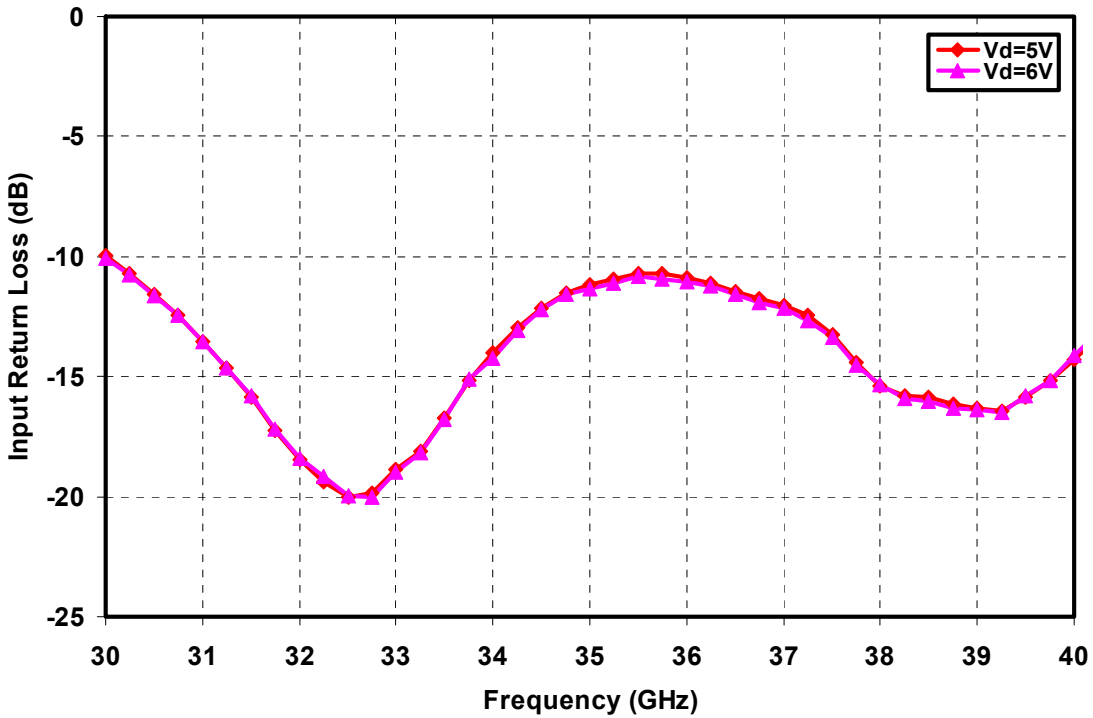


Bias Conditions: $V_d = 5-6\text{ V}$, $I_{dq} = 2\text{ A}$, Duty = 20%, Room Temp.



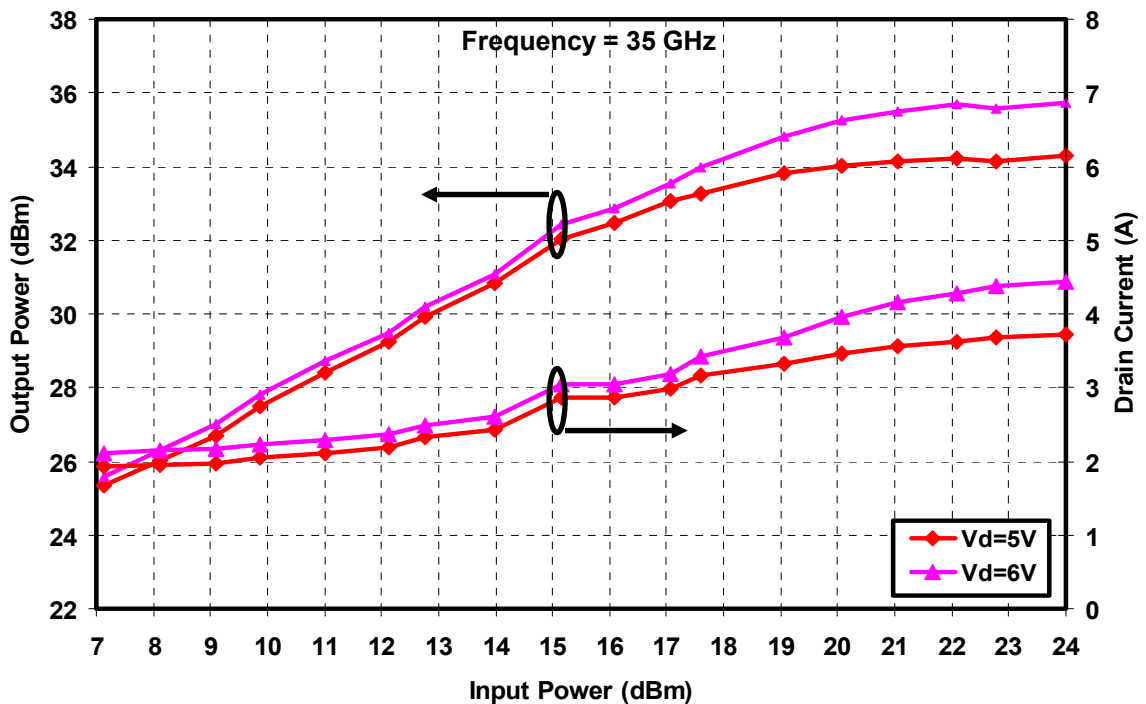
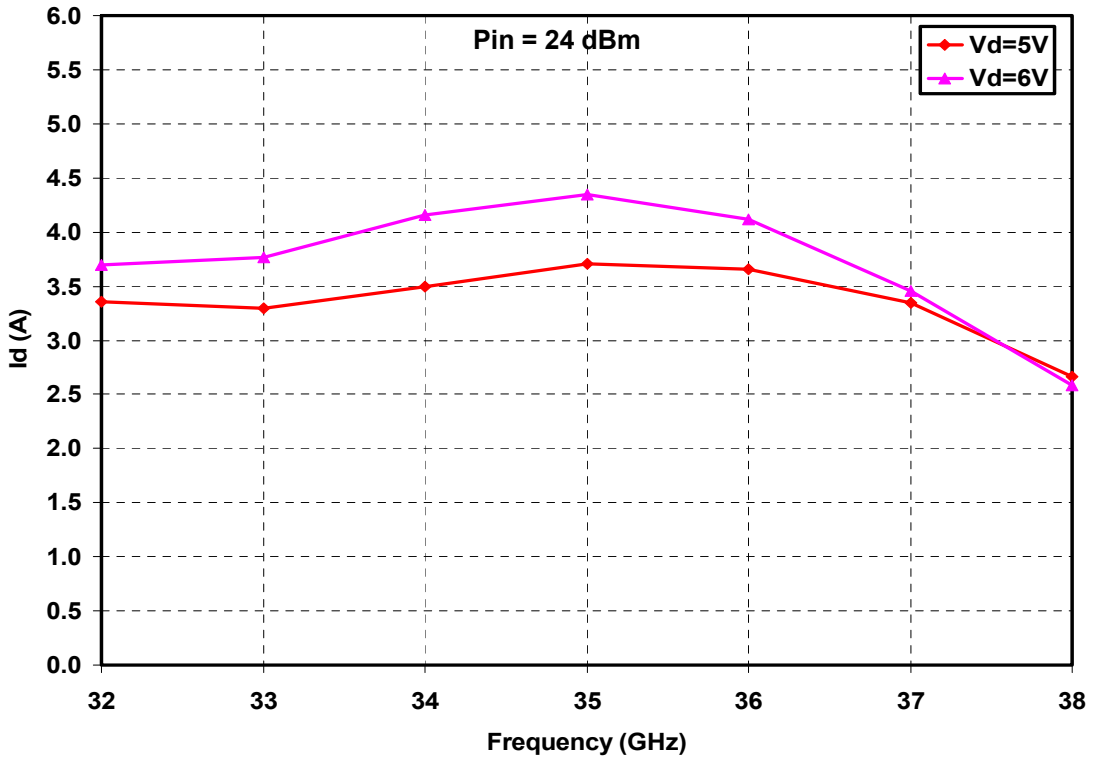
Measured Data

Bias Conditions: $V_d = 5-6\text{ V}$, $I_{dq} = 2\text{ A}$, Room Temp.



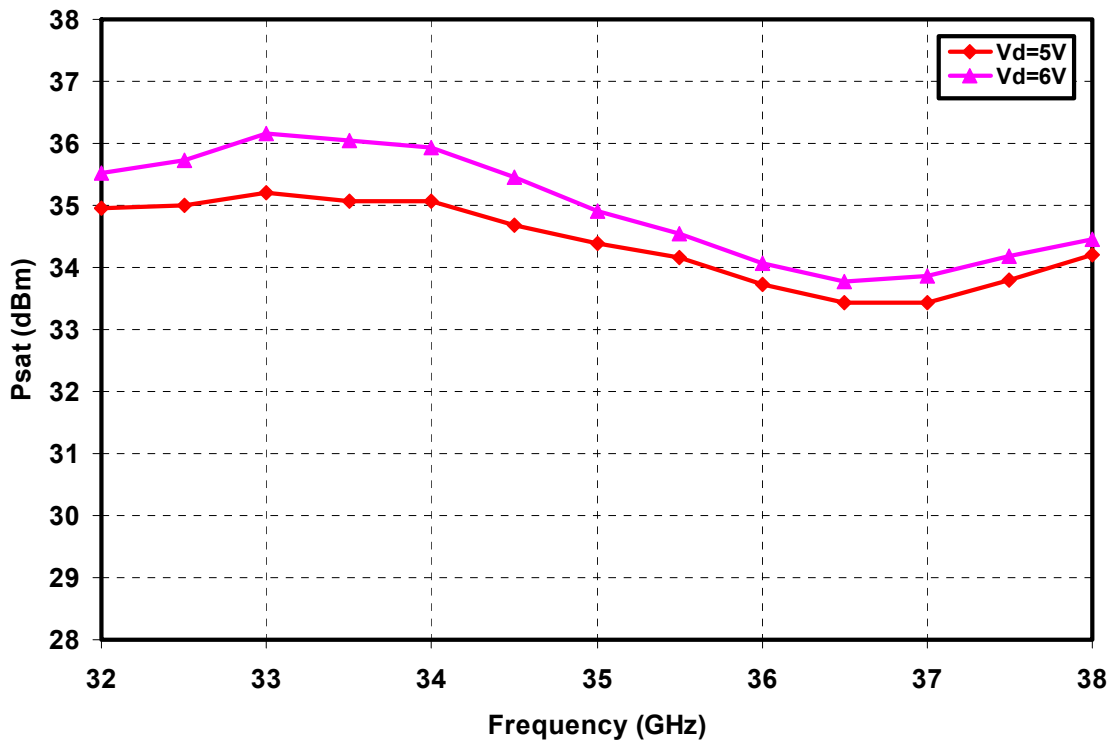
Measured Data

Drain Current vs. Drain Voltage, Duty = 20%, Room Temp.

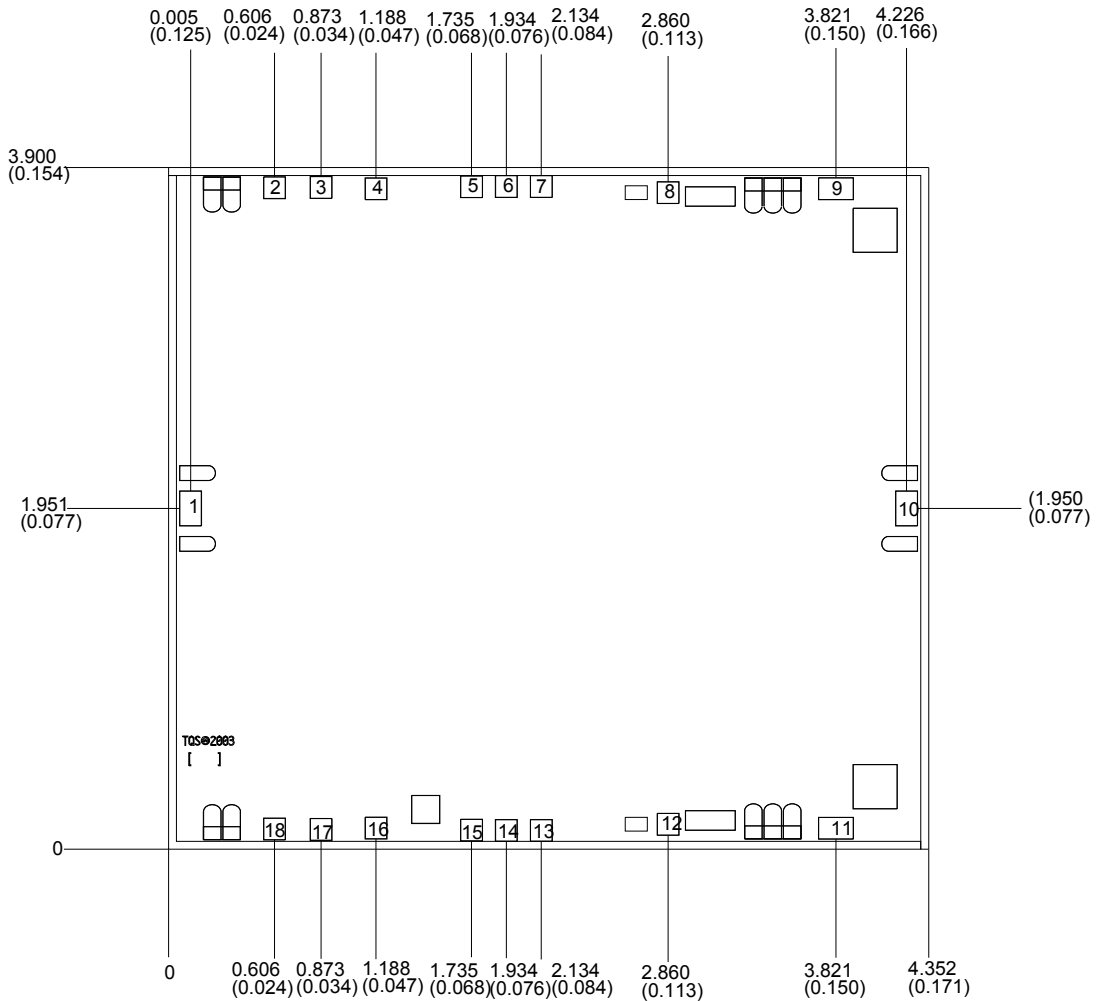


Measured Data

Bias Conditions: $V_d = 5-6\text{ V}$, $I_{dq} = 2\text{ A}$, CW Power @ $P_{in} = 22\text{ dBm}$, Room Temp.



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

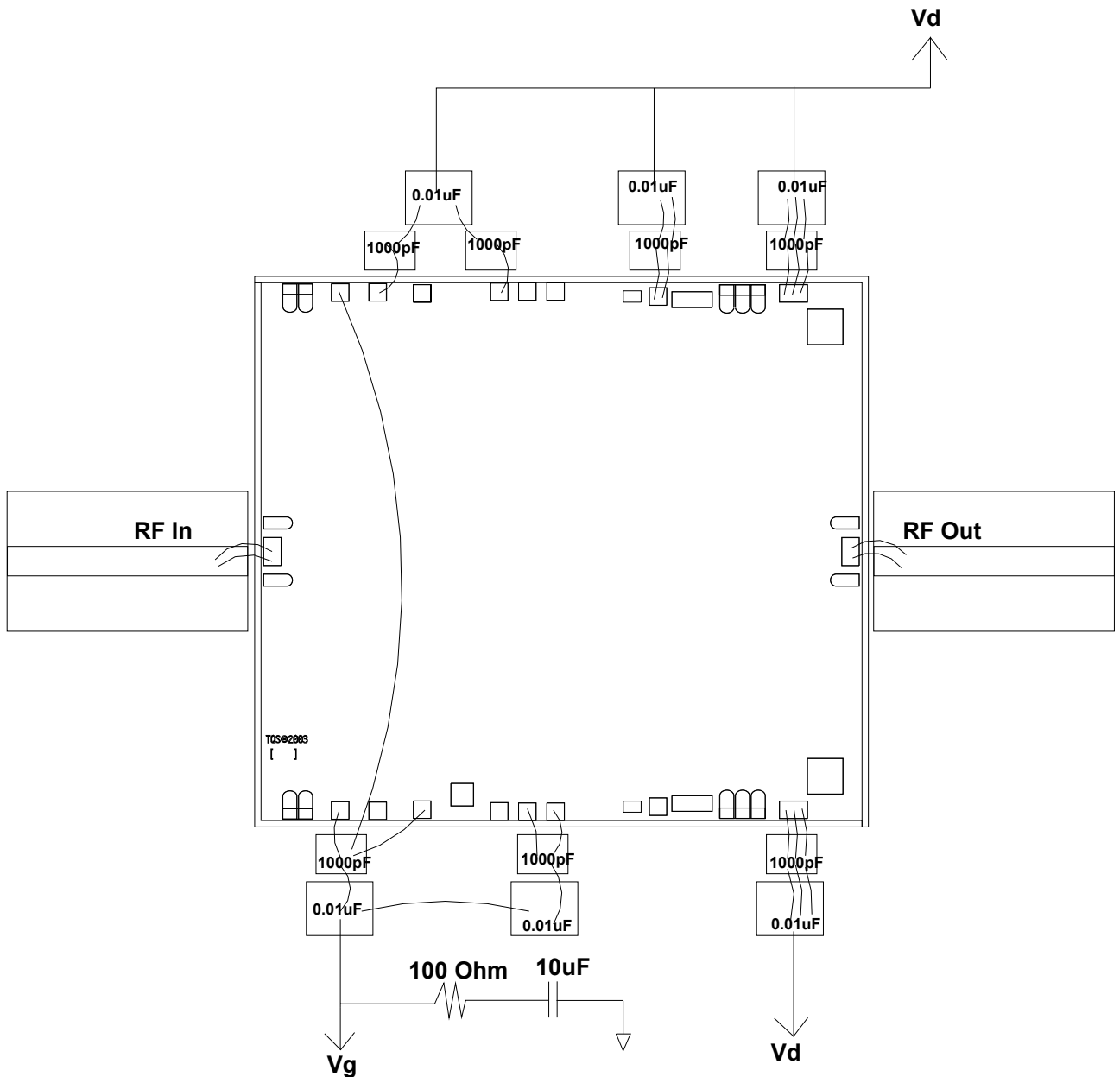
Chip size tolerance: +/- 0.051 (0.002)

RF Ground is backside of MMIC

| | | | |
|-------------------|----------|---------------|-----------------|
| Bond pad # 1: | (RF In) | 0.125 x 0.200 | (0.005 x 0.008) |
| Bond pad # 2, 18: | (Vg1) | 0.125 x 0.125 | (0.005 x 0.005) |
| Bond pad # 3, 17: | (Vd1) | 0.125 x 0.125 | (0.005 x 0.005) |
| Bond pad # 4, 16: | (Vg2) | 0.125 x 0.125 | (0.005 x 0.005) |
| Bond pad # 5, 15: | (Vd2) | 0.125 x 0.125 | (0.005 x 0.005) |
| Bond pad # 6, 14: | (Vg3) | 0.125 x 0.125 | (0.005 x 0.005) |
| Bond pad # 7, 13: | (Vg4) | 0.125 x 0.125 | (0.005 x 0.005) |
| Bond pad # 8, 12: | (Vd3) | 0.125 x 0.125 | (0.005 x 0.005) |
| Bond pad # 9, 11: | (Vd4) | 0.125 x 0.125 | (0.005 x 0.005) |
| Bond pad # 10: | (RF Out) | 0.125 x 0.200 | (0.005 x 0.008) |

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

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 300⁰C (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 200⁰C.

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