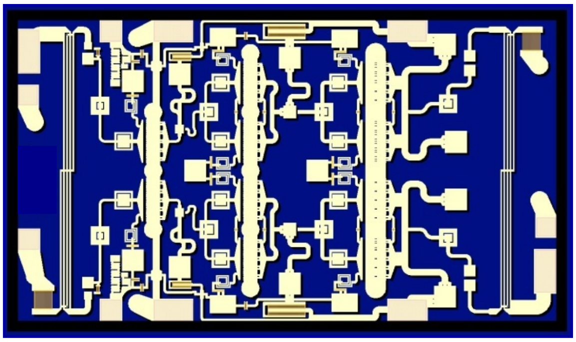
# K-Band High Linearity Power Amplifier

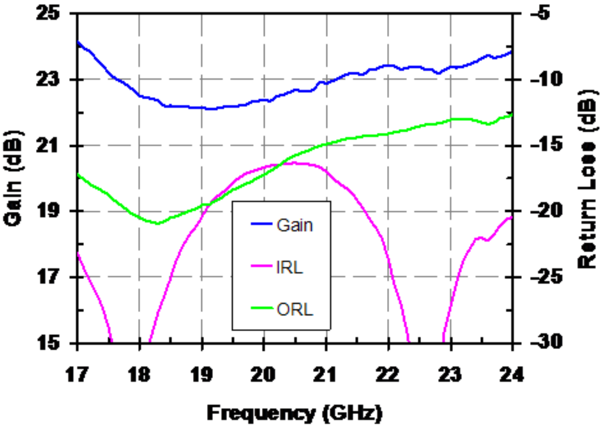


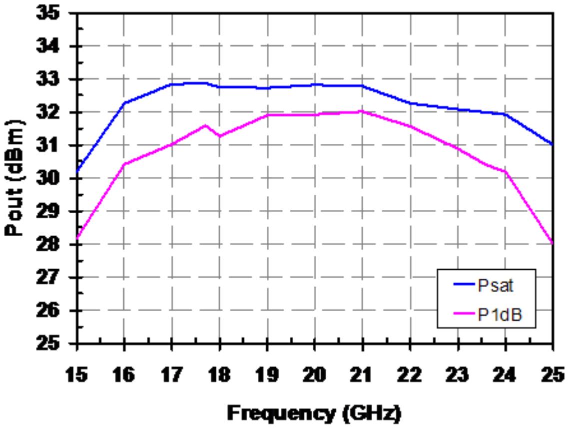
## Key Features

- Frequency Range: 17 - 24 GHz
- Power: 32 dBm Psat, 31 dBm P1dB
- Gain: 23 dB
- TOI: 40 dBm
- NF: 6 dB
- Return Loss: -15 dB
- Bias: Vd = 7 V, Id = 720 mA, Vg = -0.65 V Typical
- Technology: 3MI 0.25 um mmw Power pHEMT
- Chip Dimensions: 2.51 x 1.45 x 0.1 mm

## Measured Performance

Bias conditions: Vd = 7 V, Id = 720 mA, Vg = -0.65 V Typical





## Primary Applications

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

## Product Description

The TriQuint TGA4531 is High Linearity Power Amplifier for K-band applications. The part is designed using TriQuint's proven standard 0.25 um gate Power pHEMT production process.

The TGA4531 provides a nominal 32 dBm of output power at an input power level of 15 dBm with a small signal gain of 23 dB. Nominal TOI is 40 dBm and noise figure is 6 dB.

The part is ideally suited for low cost emerging markets such as Point-to-Point Radio, and K-band Satellite Communications.

## Table I
## Absolute Maximum Ratings 1/

| Symbol | Parameter | Value | Notes |
|---|---|---|---|
| Vd-Vg | Drain to Gate Voltage | 10.5 V | |
| Vd | Drain Voltage | 8 V | 2/ |
| Vg | Gate Voltage Range | -2.5 to 0 V | |
| Id | Drain Current | 1.25 A | 2/ |
| Ig | Gate Current Range | -7 to 32 mA | |
| Pin | Input Continuous Wave Power | 26 dBm | 2/ |
| Tchannel | Channel Temperature | 200 °C | |

1/ These ratings represent the maximum operable values for this device. Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device and / or affect device lifetime. These are stress ratings only, and functional operation of the device at these conditions is not implied.

2/ Combinations of supply voltage, supply current, input power, and output power shall not exceed the maximum power dissipation listed in Table IV.

## Table II
## Recommended Operating Conditions

| Symbol | Parameter 1/ | Value |
|---|---|---|
| Vd | Drain Voltage | 7 V |
| Id | Drain Current | 720 mA |
| Id_Drive | Drain Current under RF Drive | 1.12 A |
| Vg | Gate Voltage | -0.65 V |

1/ See assembly diagram for bias instructions.

# Table III

# RF Characterization Table

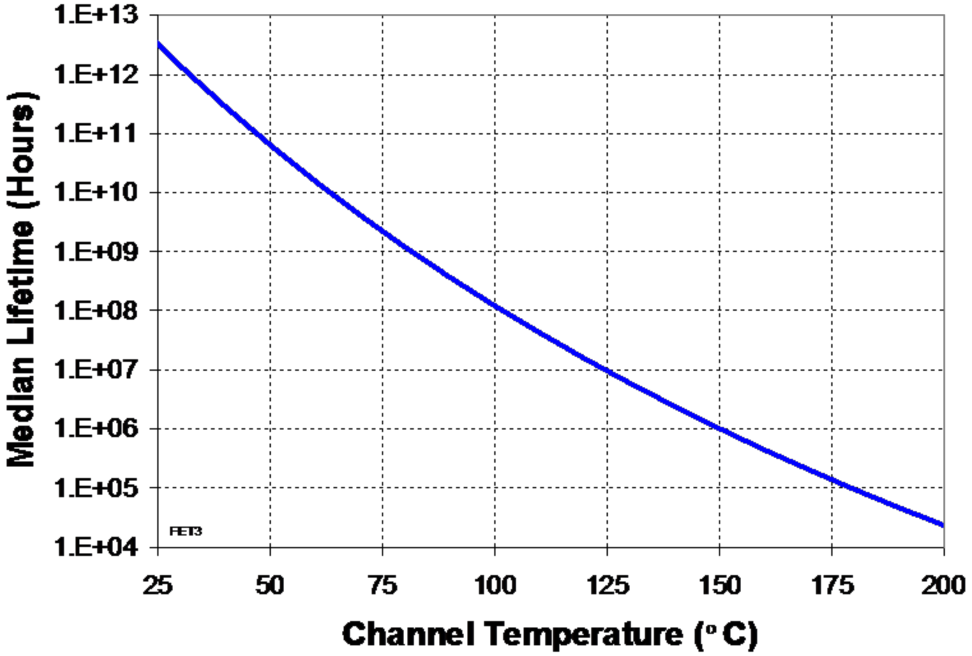
### Bias: Vd = 7 V, Id = 720 mA, Vg = -0.65 V Typical

| SYMBOL | PARAMETER | TEST CONDITIONS | MIN | NOMINAL | MAX | UNITS |
|---|---|---|---|---|---|---|
| Gain | Small Signal Gain | F = 17.7 – 23.6 GHz | 21 | 23 | | dB |
| IRL | Input Return Loss | F = 17.7 – 23.6 GHz | | -15 | -10 | dB |
| ORL | Output Return Loss | F = 17.7 – 23.6 GHz | | -15 | -10 | dB |
| Psat | Saturated Output Power | F = 17.7 – 23.6 GHz | 31 | 32 | | dBm |
| P1dB | Output Power @ 1dB Compression | F = 17.7 – 23.6 GHz | | 31 | | dBm |
| TOI | Output TOI | F = 17.7 – 23.6 GHz | 37 | 40 | | dBm |
| NF | Noise Figure | F = 17.7 – 23.6 GHz | | 6 | | dB |
| | Gain Temperature Coefficient | F = 17.7 – 23.6 GHz | | -0.04 | | dB/°C |

# Table IV
# Power Dissipation and Thermal Properties

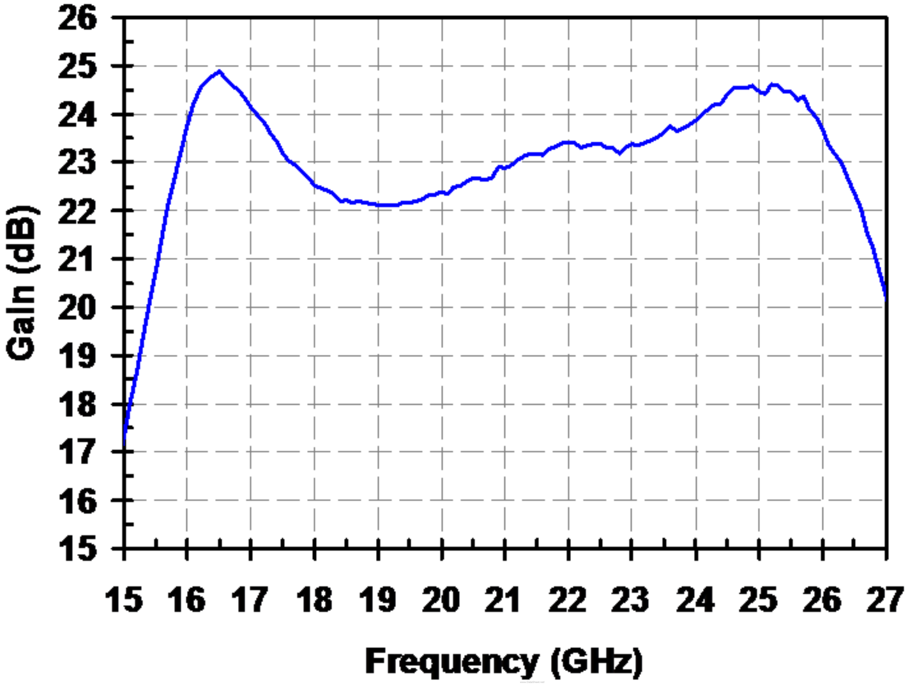
| Parameter | Test Conditions | Value |
|---|---|---|
| Maximum Power Dissipation | Tbaseplate = 70 °C | Pd = 10 W<br>Tchannel = 199 °C |
| Thermal Resistance, θjc | Vd = 7 V<br>Id = 720 mA<br>Pd = 5.04 W<br>Tbaseplate = 70 ºC | θjc = 12.9 °C/W<br>Tchannel = 135 °C<br>Tm = 3.8E+6 Hrs |
| Thermal Resistance, θjc<br>Under RF Drive | Vd = 7 V<br>Id = 1.12 A<br>Pout = 32 dBm<br>Pd = 6.25 W<br>Tbaseplate = 70 ºC | θjc = 12.9 °C/W<br>Tchannel = 150 °C<br>Tm = 1.0E+6 Hrs |
| Mounting Temperature | 30 Seconds | 320 °C |
| Storage Temperature | | -65 to 150 °C |

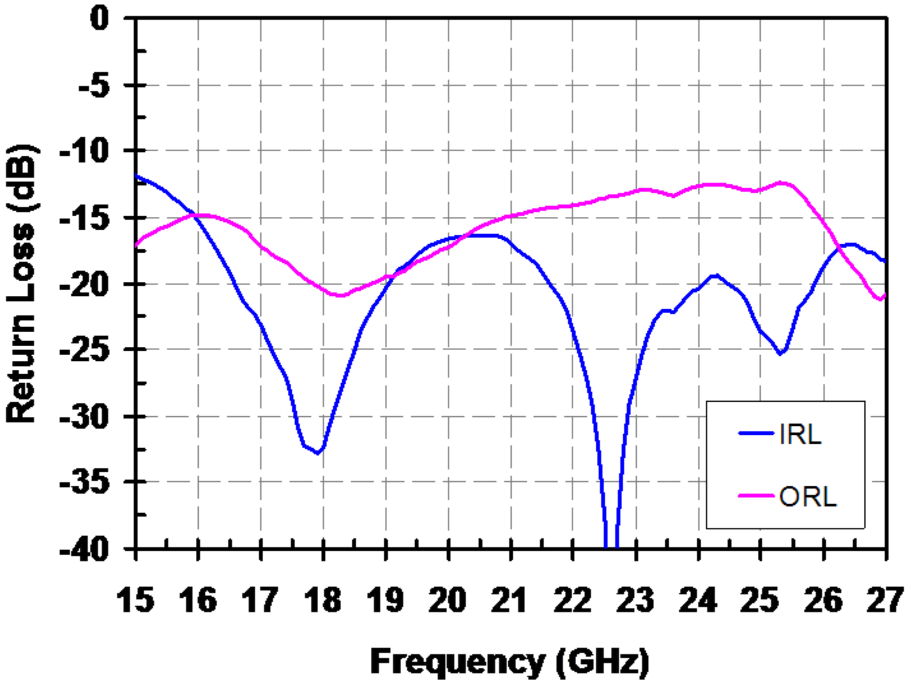
## Median Lifetime (Tm) vs. Channel Temperature



# Measured Data

**Bias conditions: Vd = 7 V, Id = 720 mA, Vg = -0.65 V Typical**





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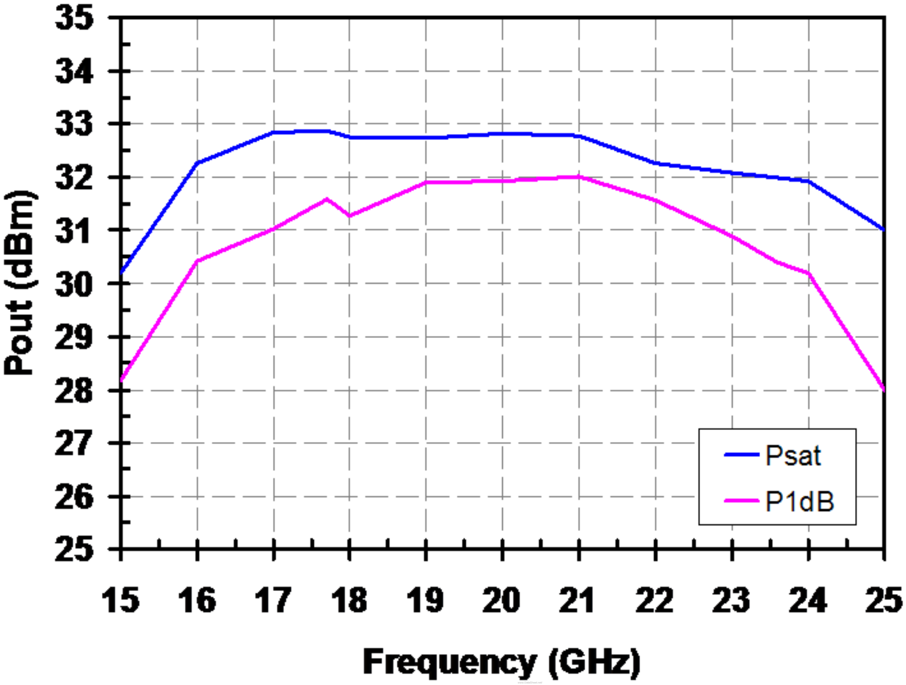

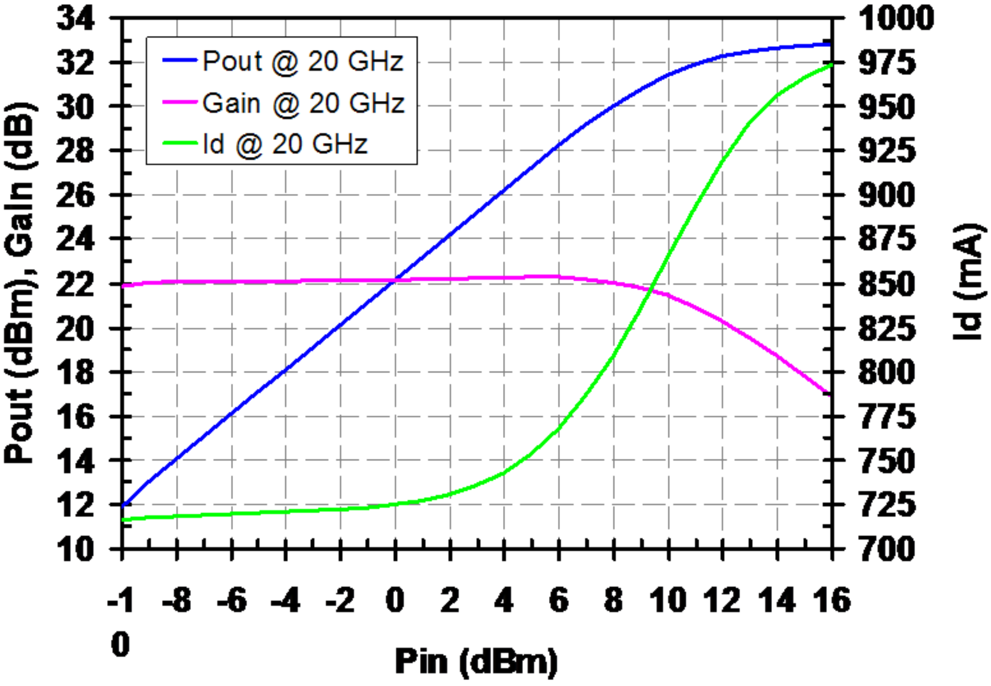

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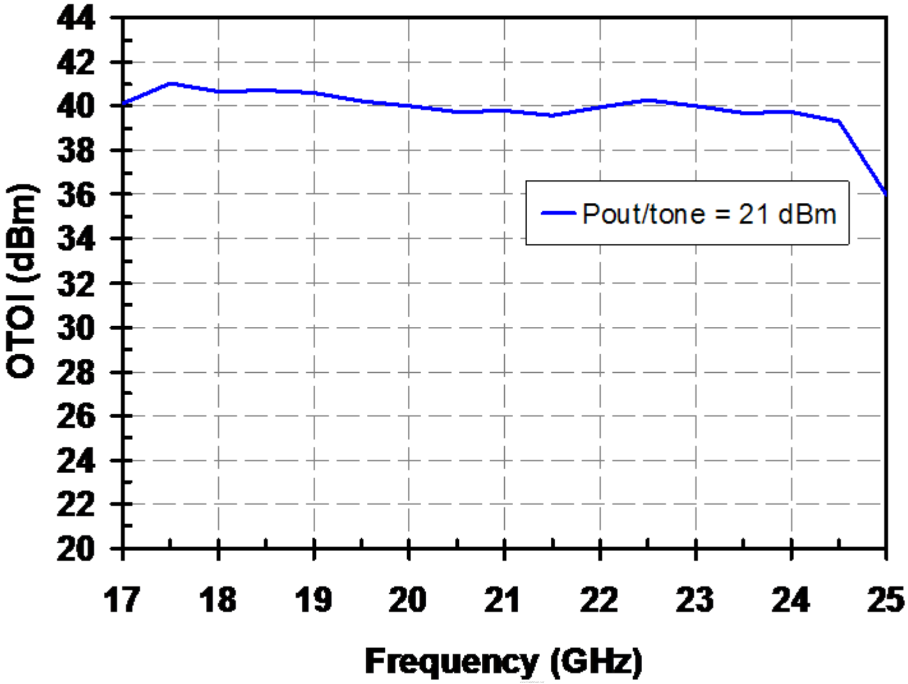

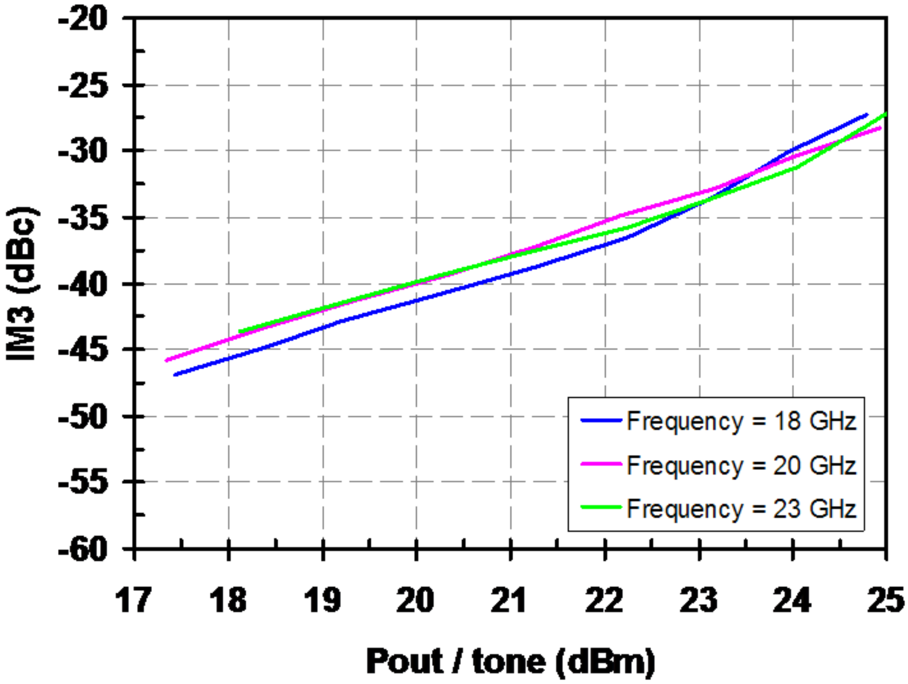

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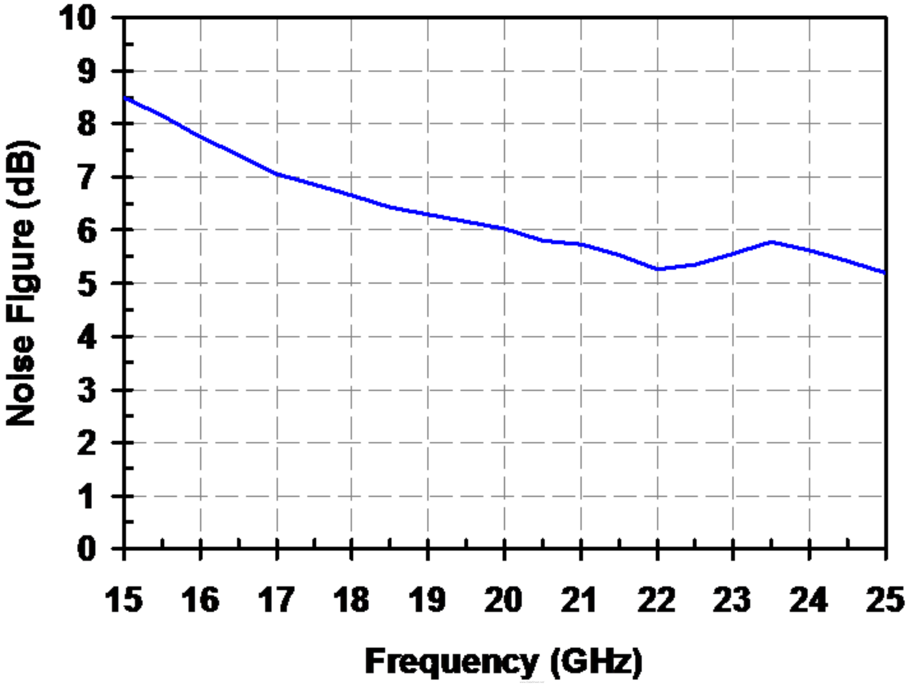

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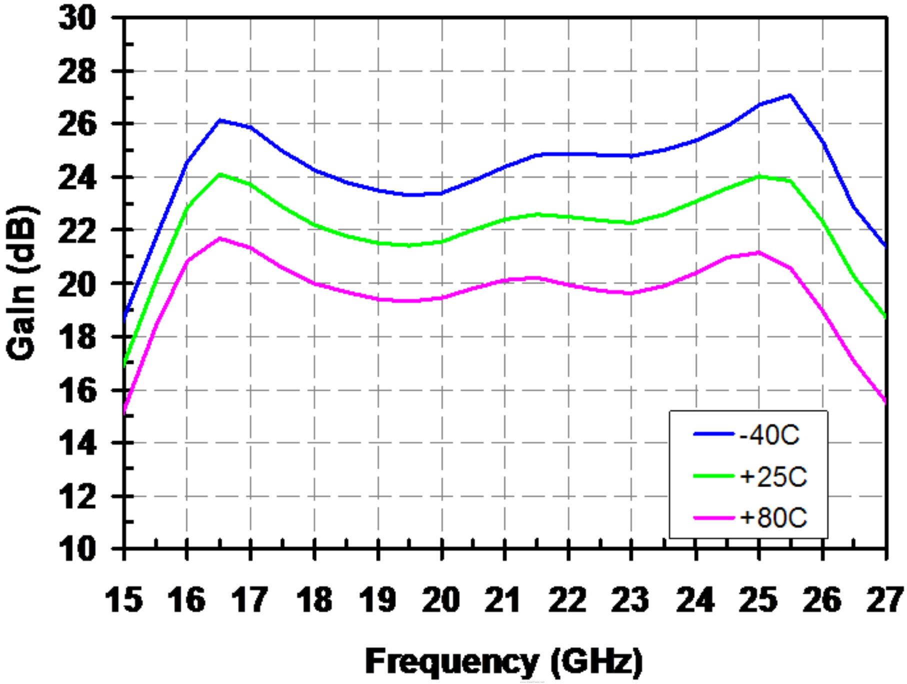

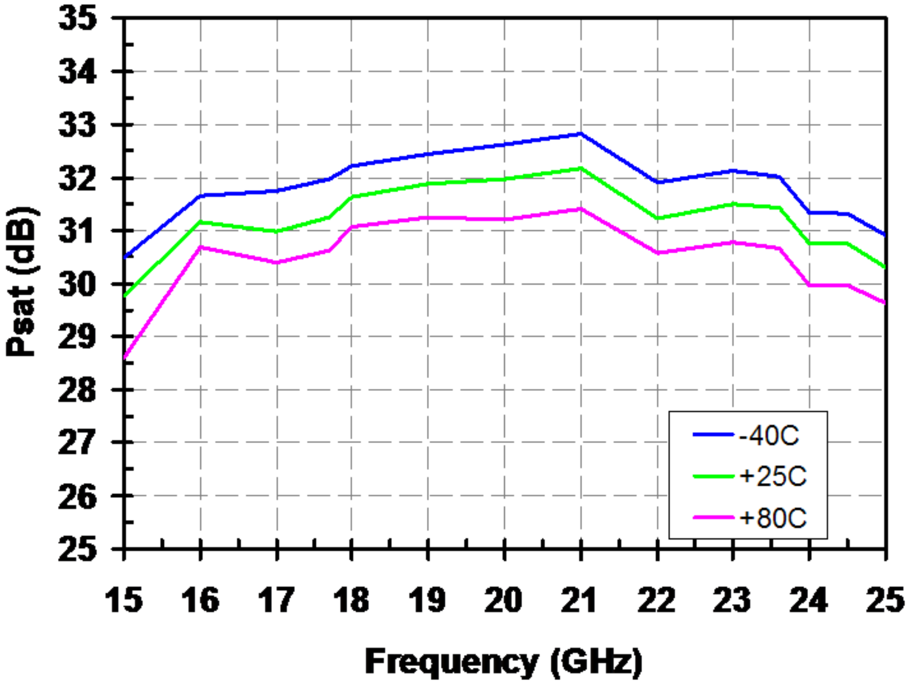

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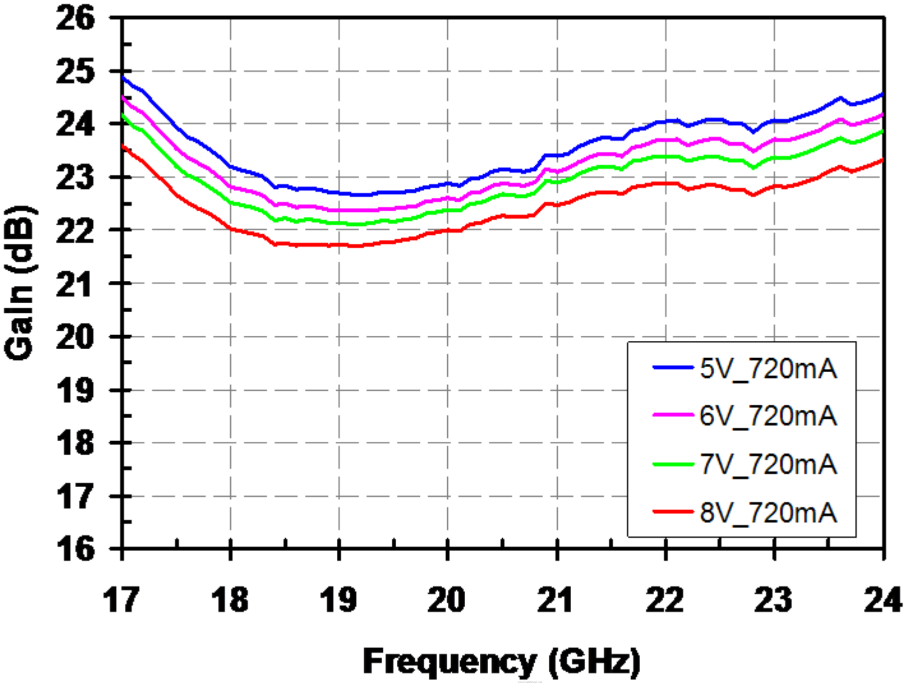
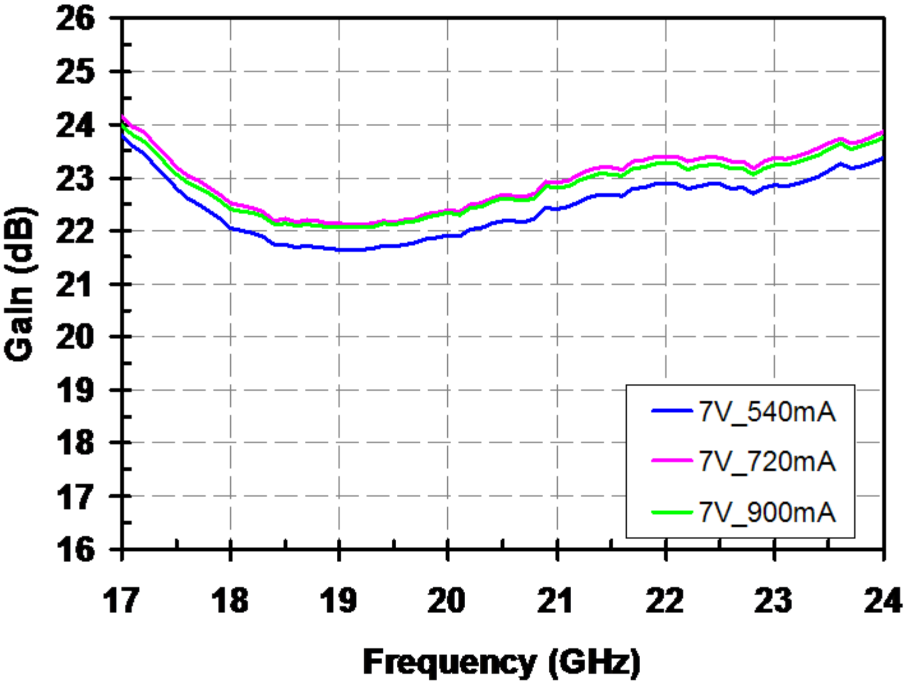
### Bias conditions: Varies





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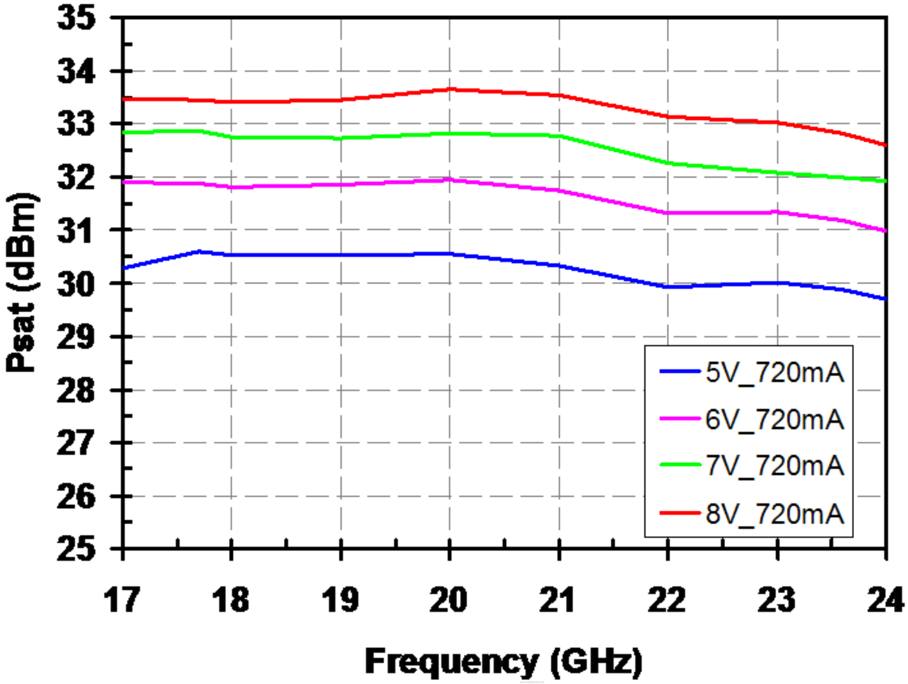
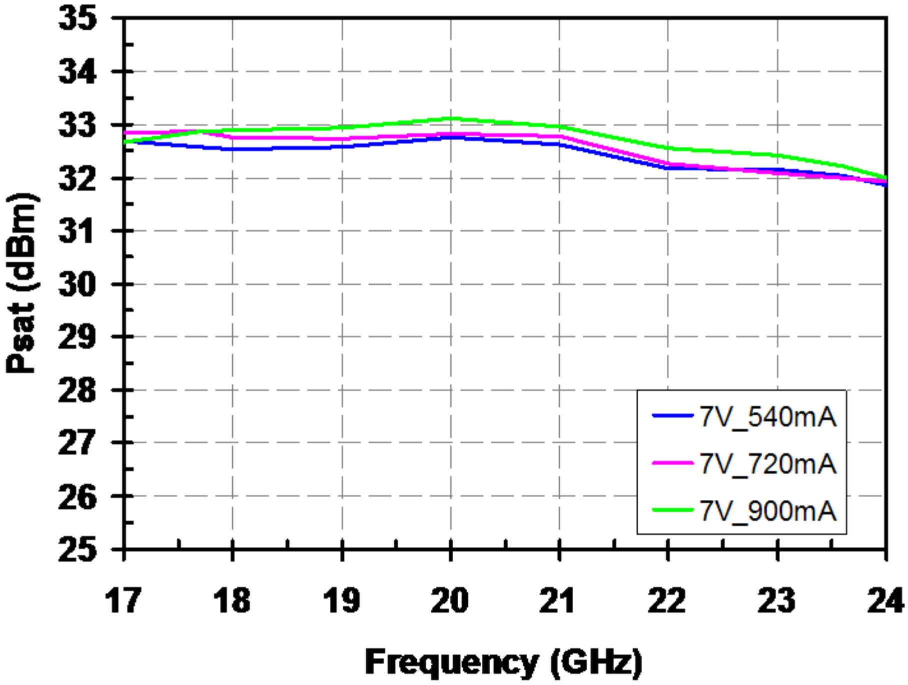
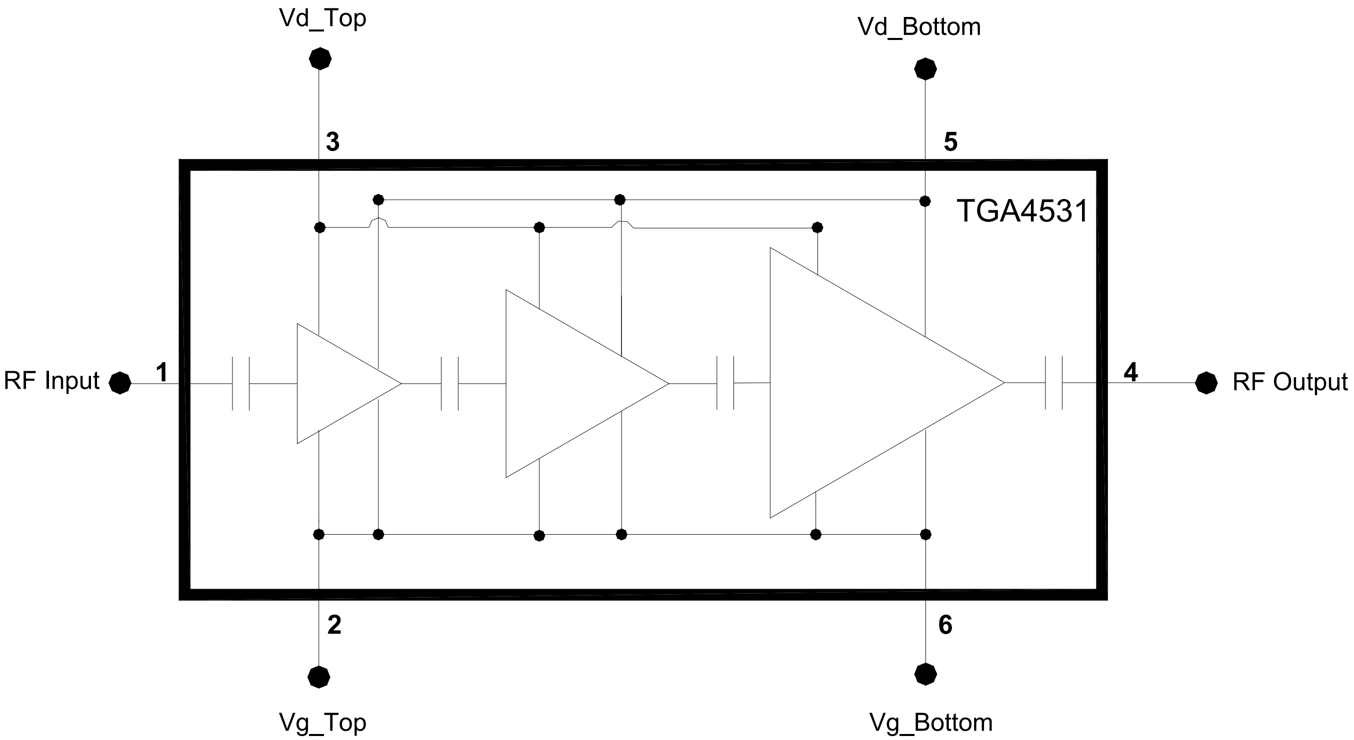




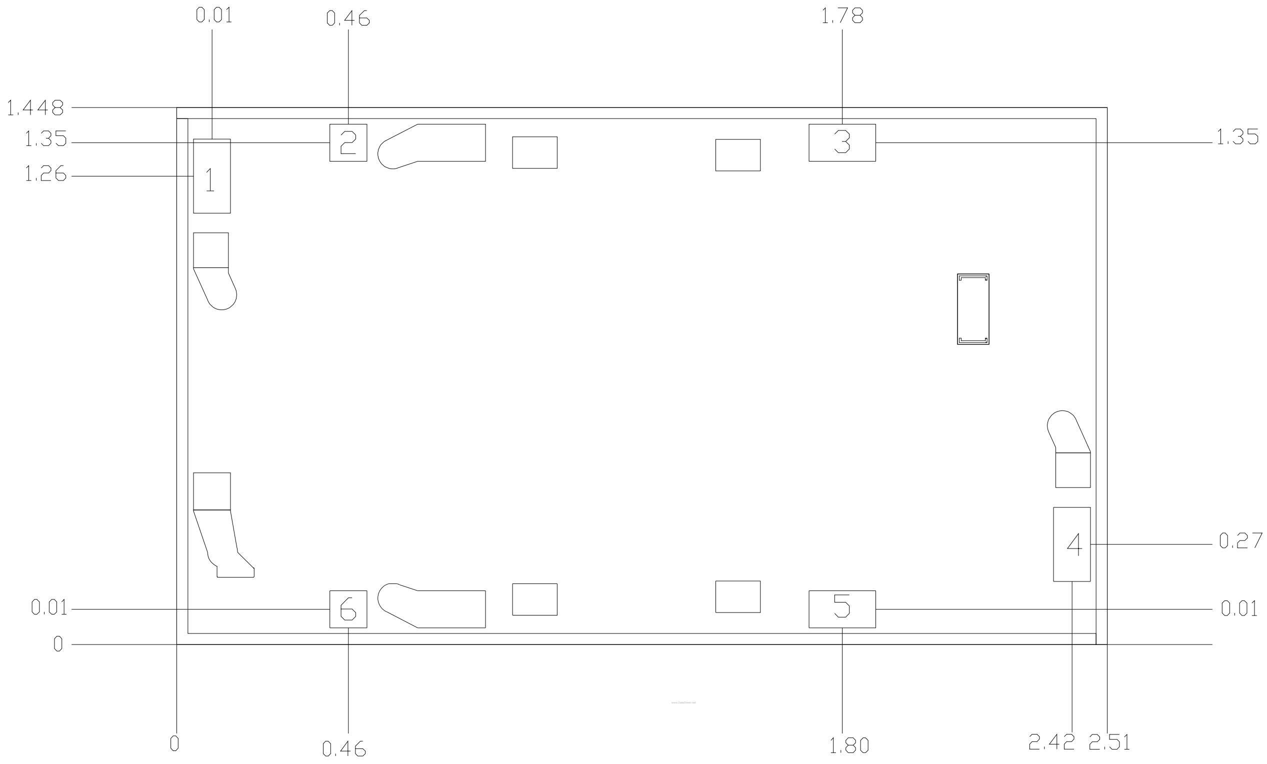
## Electrical Schematic



## Bias Procedures

| **Bias-up Procedure** | **Bias-down Procedure** |
|---|---|
| Vg set to -1.5 V | Turn off RF supply |
| Vd_set to +7 V | Reduce Vg to -1.5V. Ensure Id ~ 0 mA |
| Adjust Vg more positive until quiescent Id is 720 mA.<br>This will be ~ Vg = -0.65 V | Turn Vd to 0 V |
| Apply RF signal to input | Turn Vg to 0 V |

# Mechanical Drawing

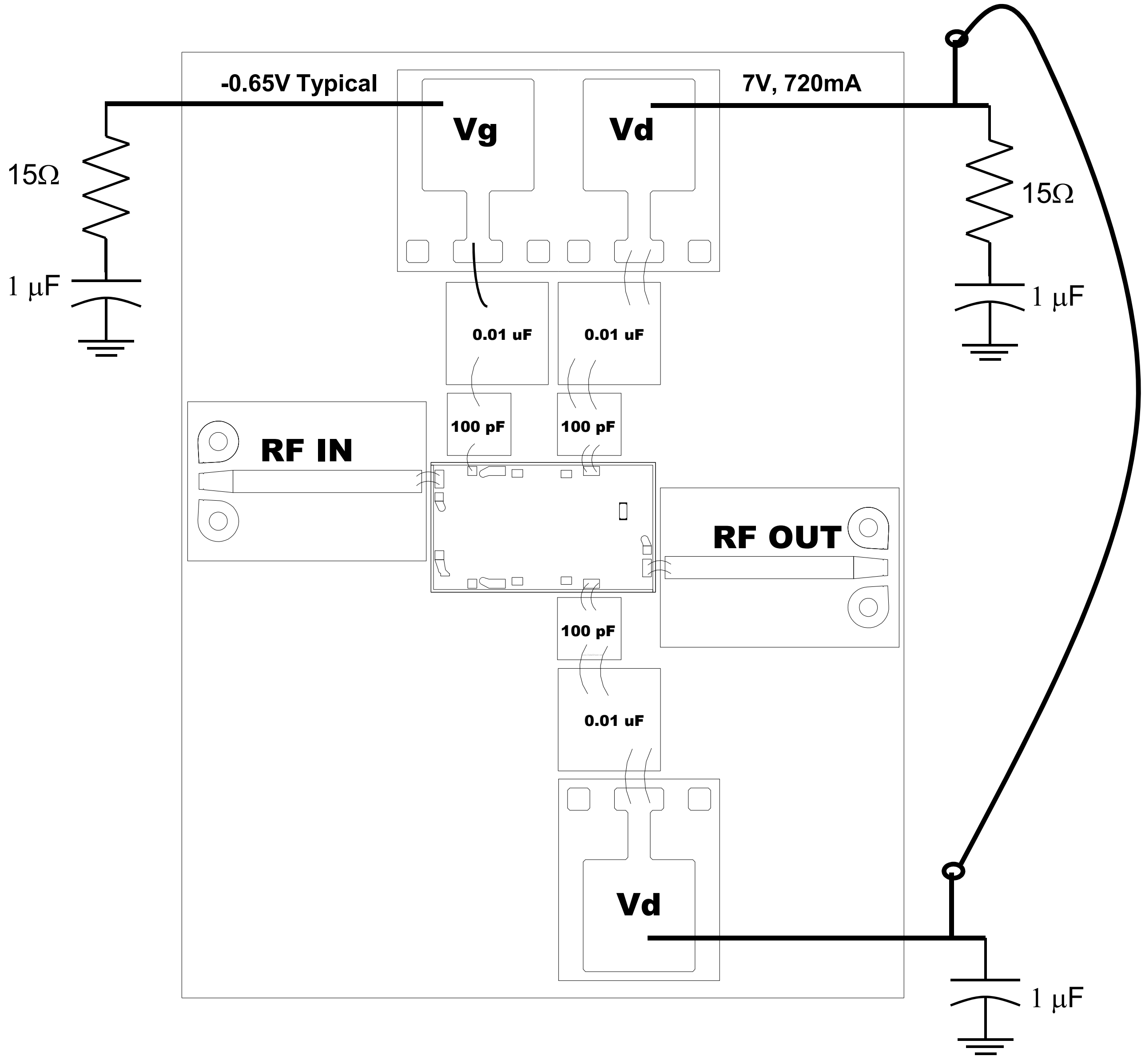


Units: millimeters
Thickness: 0.10
Die x,y size tolerance: +/- 0.050
Chip edge to bond pad dimensions are shown to center of pad
Ground is backside of die

| | | | | | |
|---|---|---|---|---|---|
| Bond Pad #1 | RF In | 0.100 x 0.200 | Bond Pad #4 | RF Out | 0.100 x 0.200 |
| Bond Pad #2 | Vg_Top | 0.100 x 0.100 | Bond Pad #5 | Vd_Bottom | 0.180 x 0.100 |
| Bond Pad #3 | Vd_Top | 0.180 x 0.100 | Bond Pad #6 | Vg_Bottom | 0.100 x 0.100 |

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

# Recommended Assembly Diagram



**Vg can be biased from either side. Vd must be biased from both sides.**

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## Assembly Notes

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 (i.e. epoxy) can be used in low-power applications.
- Curing should be done in a convection oven; proper exhaust is a safety concern.

Reflow process assembly notes:

- Use AuSn (80/20) solder and limit exposure to temperatures above 300°C to 3-4 minutes, maximum.
- An alloy station or conveyor furnace with reducing atmosphere should be used.
- Do not use any kind of flux.
- Coefficient of thermal expansion matching is critical for long-term reliability.
- Devices must be stored in a dry nitrogen atmosphere.

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.

## Ordering Information

| Part | Package Style |
|---|---|
| TGA4531 | GaAs MMIC Die |

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