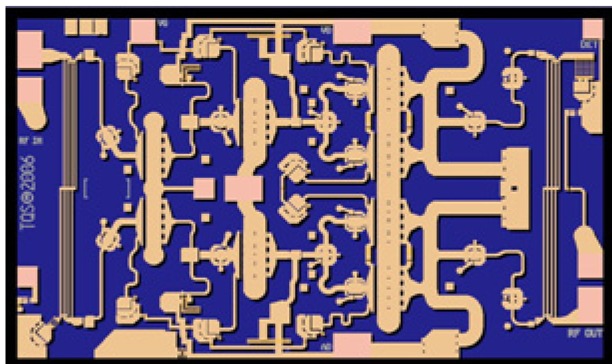
# K Band High Linearity Power Amplifier TGA4530

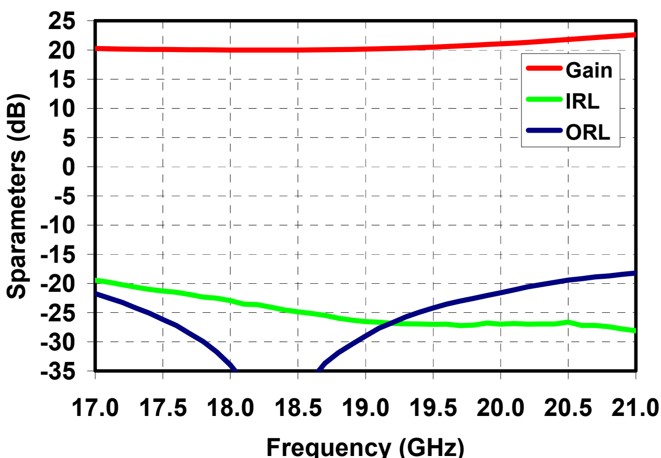


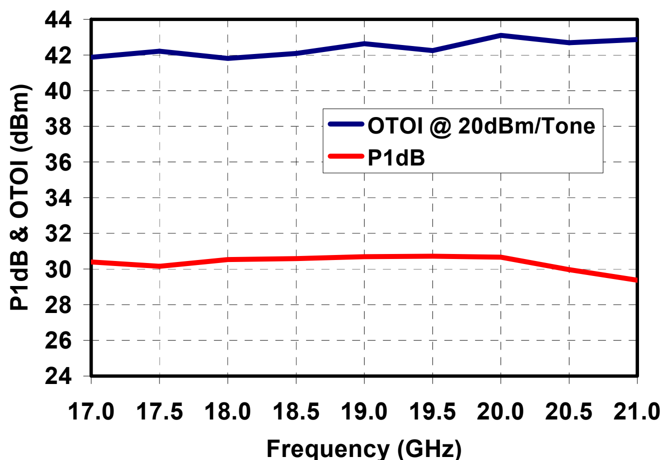
## Key Features

- Frequency Range: 17 - 21 GHz
- 20 dB Gain
- 30 dBm nominal P1dB
- 42dBm nominal OTOI
- 20 dB Return Loss
- Bias 5 - 7 V @ 825 mA
- 0.25 um 3MI pHEMT technology
- Chip Dimensions 2.43 x 1.45 x .1mm

## Measured Fixtured Data

Bias Conditions: Vd = 7V, Id = 825mA




## Primary Applications

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

## Product Description

The TriQuint TGA4530 is a High Power Amplifier MMIC for 17 – 21GHz applications. The part is designed using TriQuint's 0.25um 3MI pHEMT production process.

The TGA4530 nominally provides 30dBm output power @ 1dB gain compression and 42dBm OTOI at a bias of 7V and 825mA. The typical gain is 20dB.

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

The TGA4530 is 100% DC and RF tested on-wafer to ensure performance compliance.

The TGA4530 has a protective surface passivation layer providing environmental robustness.

Lead-Free & RoHS compliant

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

## TABLE I
## MAXIMUM RATINGS 1/

| SYMBOL | PARAMETER | VALUE | NOTES |
|---|---|---|---|
| Vd | Positive Supply Voltage | 8 V | 2/ |
| Vg | Negative Supply Voltage Range | -5V TO 0V | |
| Id | Positive Supply Current | 1.75 A | 2/ |
| $\lvert I_G \rvert$ | Gate Supply Current | 35 mA | |
| $P_{IN}$ | Input Continuous Wave Power | 26 dBm | 2/ |
| $P_D$ | Power Dissipation | 5.8 W | 2/, 3/ |
| $T_{CH}$ | Operating Channel Temperature | 150 °C | 3/, 4/ |
| $T_M$ | 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/ When operated at this power dissipation with a base plate temperature of $65^0$C, the median life is 1.0E+6 hrs.

4/ 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.

## TABLE II
## ELECTRICAL CHARACTERISTICS
(Ta = 25 $^0$C Nominal)

| PARAMETER | TYPICAL | UNITS |
|---|---|---|
| Frequency Range | 17 - 21 | GHz |
| Drain Voltage, Vd | 7 | V |
| Drain Current, Id | 825 | mA |
| Gate Voltage, Vg | -0.45 | V |
| Small Signal Gain, S21 | 20 | dB |
| Input Return Loss, S11 | 20 | dB |
| Output Return Loss, S22 | 20 | dB |
| Saturated Output Power @ Pin = 16dBm, Psat | 32 | dBm |
| Output Power @ 1dB Gain Compression, P1dB | 30 | dBm |
| Output Third Order Intercept, OTOI @ 20dBm/Tone | 42 | dBm |
| Small Signal Gain Temperature Coefficient | -0.03 | dB/$^0$C |
| Noise Figure @ 19GHz | 6 | dB |

## TABLE III
## THERMAL INFORMATION

| PARAMETER | TEST CONDITIONS | $T_{CH}$ ($^O$C) | $\theta_{JC}$ (°C/W) | $T_M$ (HRS) |
|---|---|---|---|---|
| $\theta_{JC}$ Thermal Resistance (channel to Case) | Vd = 7 V<br>Id = 825 mA<br>$P_{diss}$ = 5.78 W<br>Small Signal | 150 | 14.7 | 1.0E+6 |
| $\theta_{JC}$ Thermal Resistance (channel to Case) | Vd = 7 V<br>Id = 1050 mA @ Psat<br>$P_{out}$ = 1.6 W (RF)<br>$P_{diss}$ = 5.75 W | 150 | 14.7 | 1.0E+6 |

Note: Assumes eutectic attach using 1.5 mil 80/20 AuSn mounted to a 20 mil CuMo Carrier at 65$^o$C baseplate temperature.

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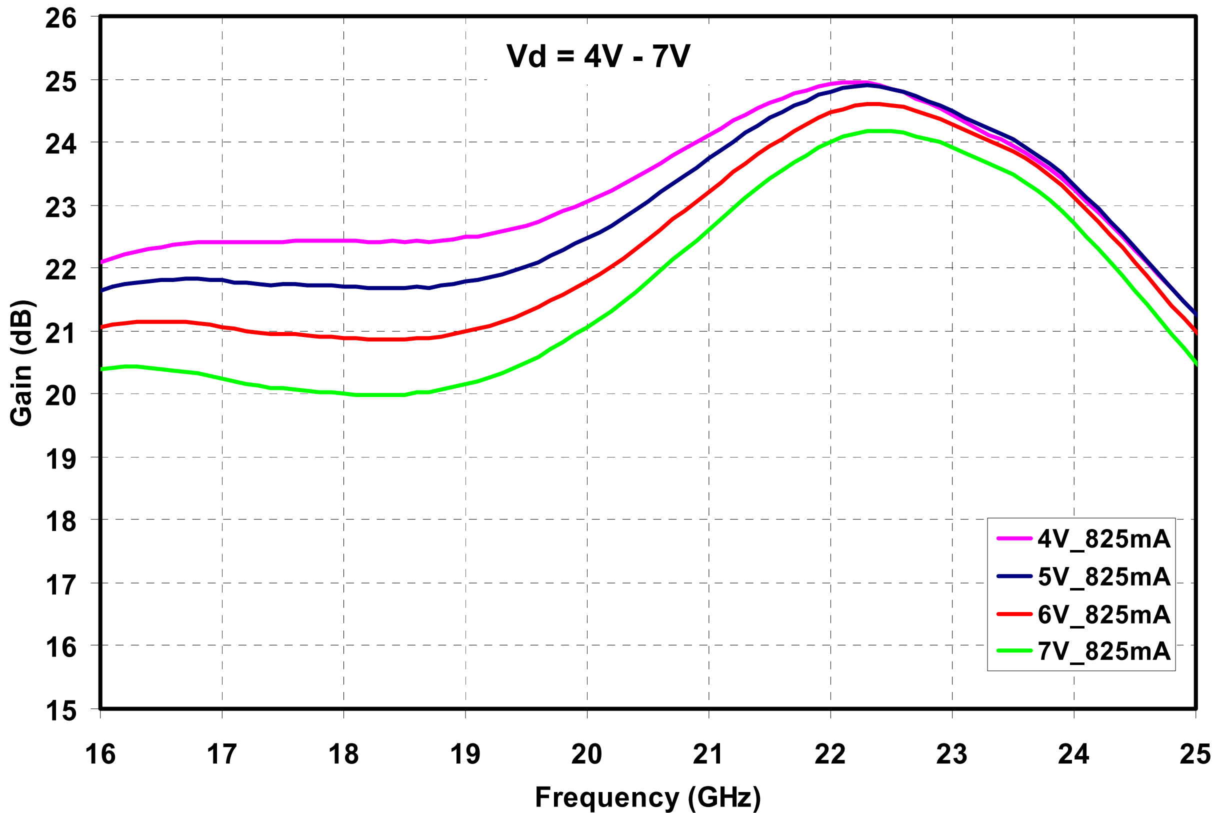
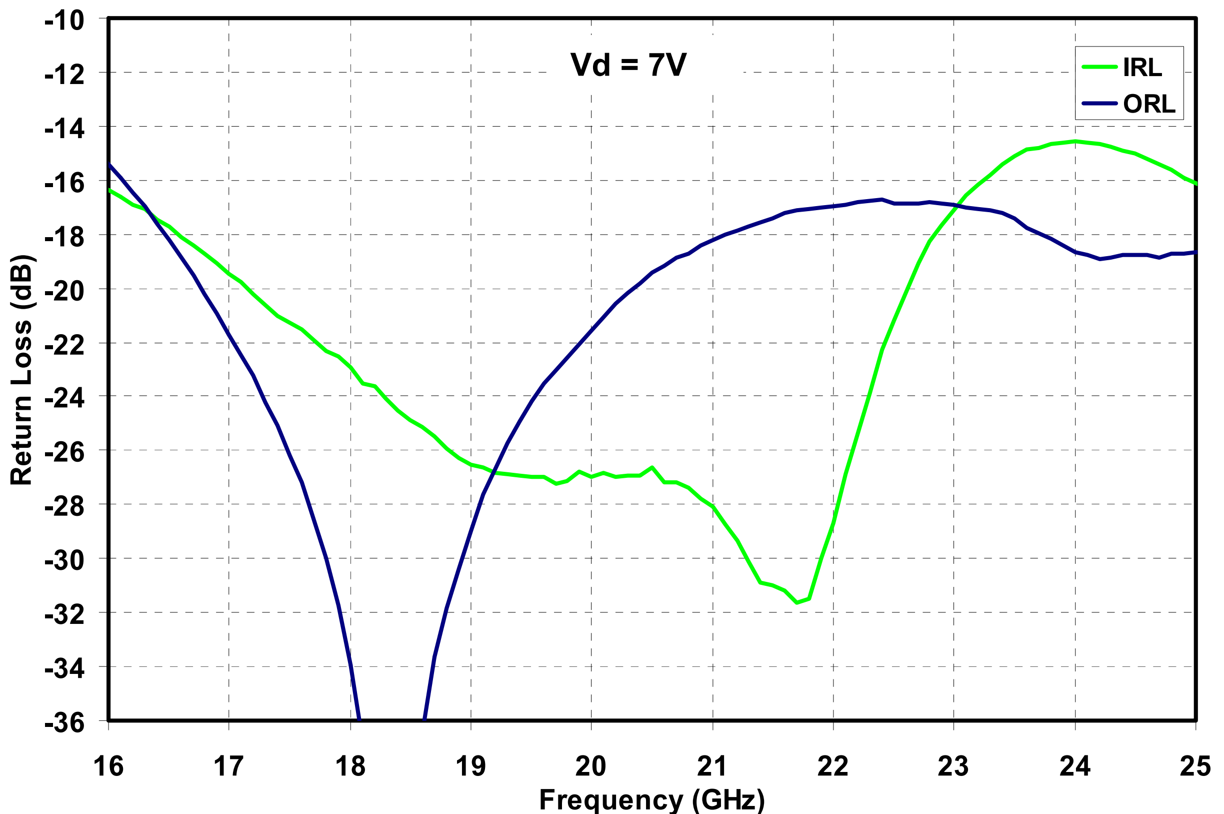
# Measured Data

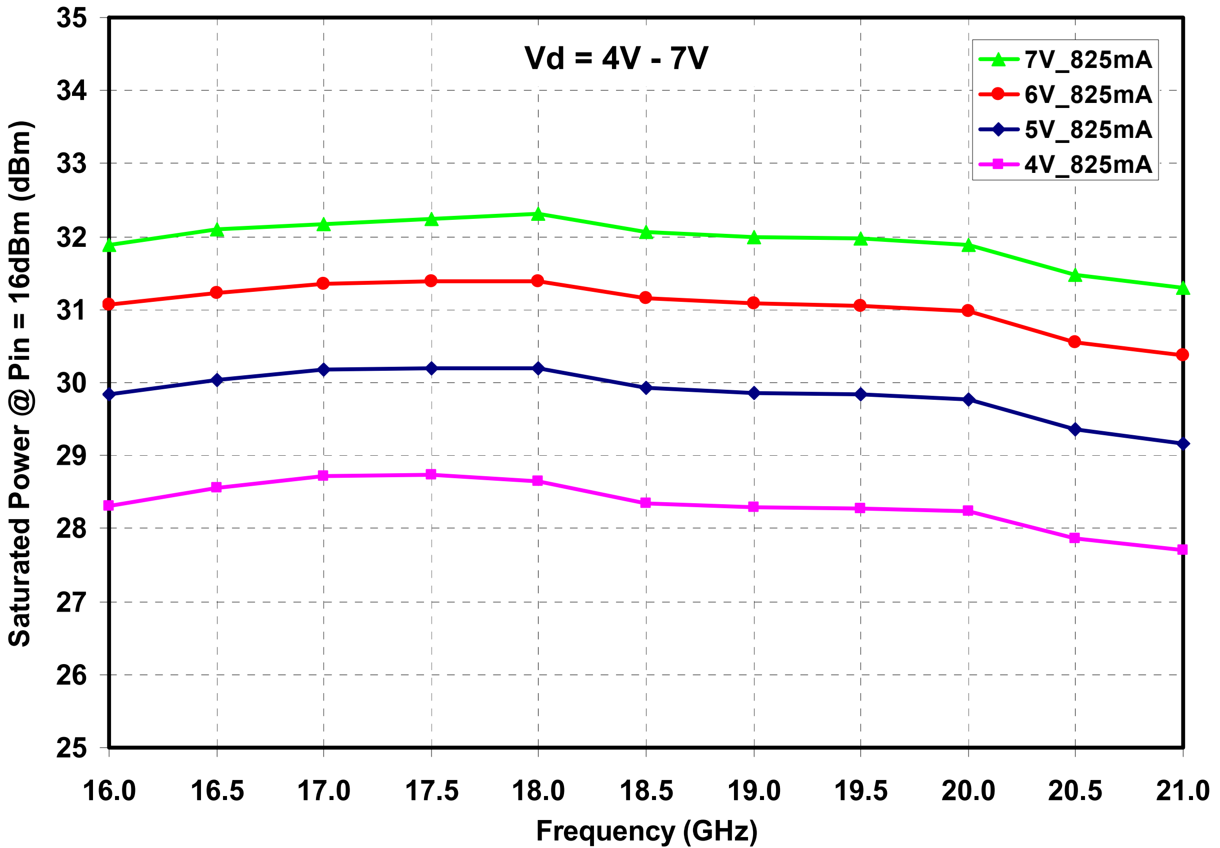
**Bias Conditions: Idq = 825 mA**

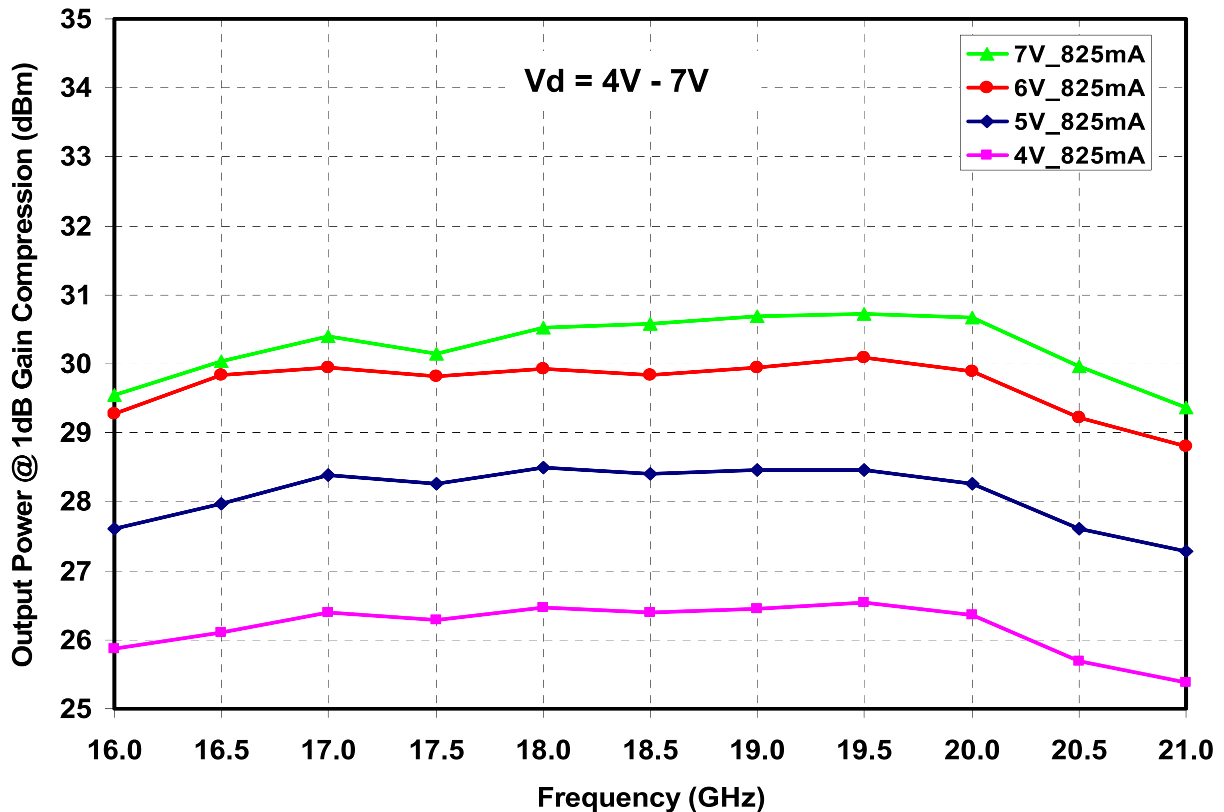


# Measured Data

**Bias Conditions: Vd = 4V - 7V, Idq = 825 mA**



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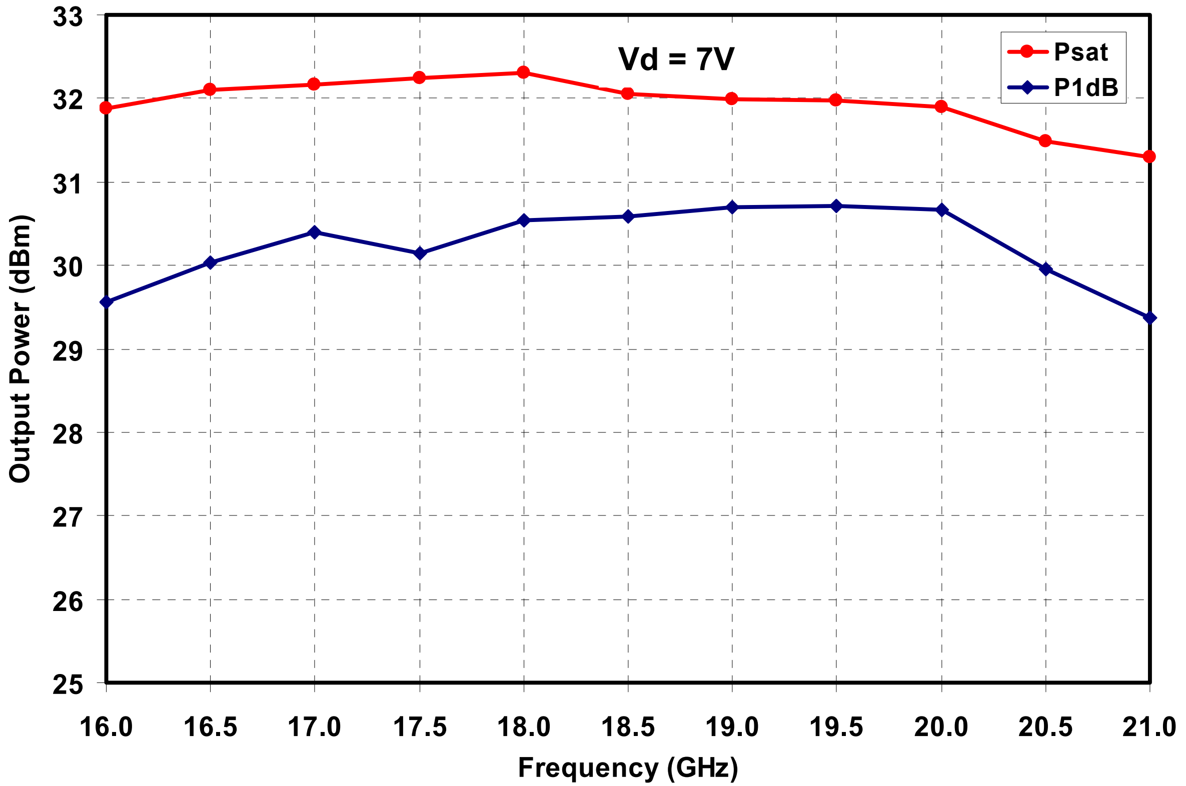
# Measured Data

**Bias Conditions: Vd = 7V, Idq = 825 mA**




Vd = 7V, @ 19GHz

Pout

Gain

Id

Pout (dBm) & Gain (dB)

36 34 32 30 28 26 24 22 20 18 16 14 12 10

Id (mA)

1080 1060 1040 1020 1000 980 960 940 920 900 880 860 840 820

-6 -4 -2 0 2 4 6 8 10 12 14 16 18 20

Pin (dBm)



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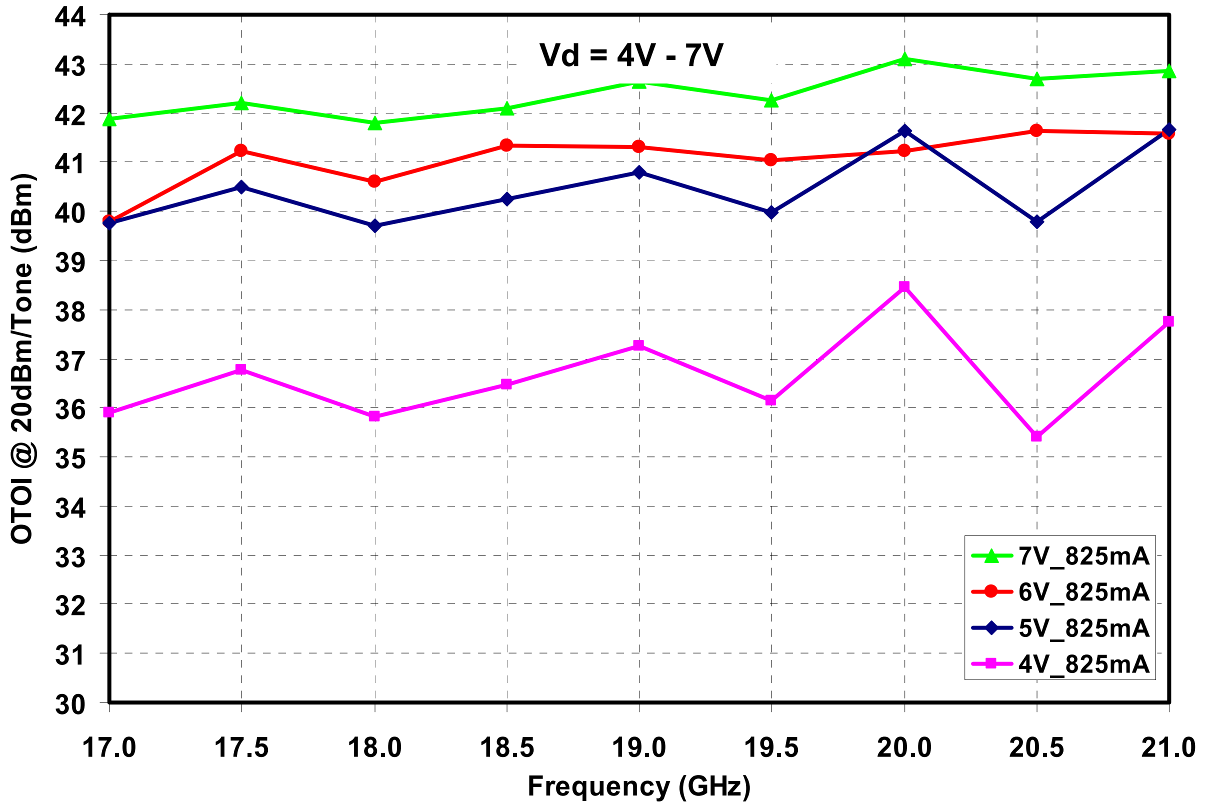
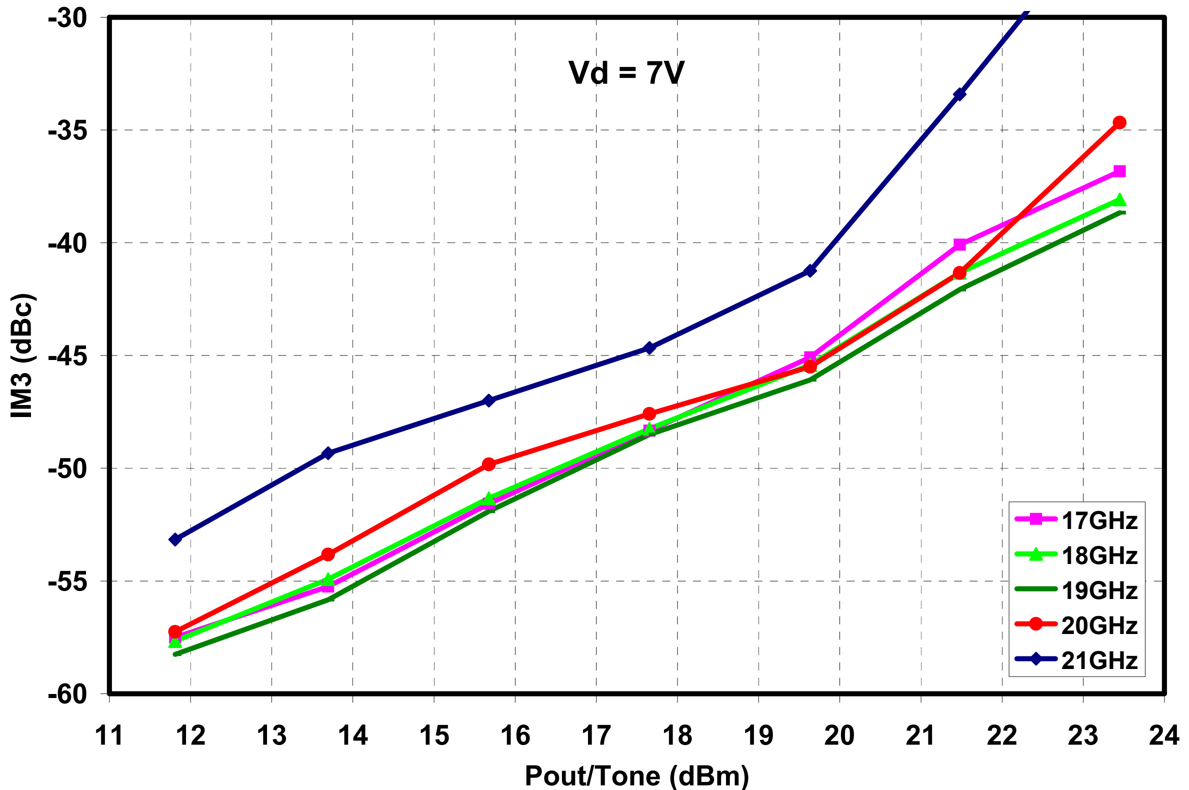
# Measured Data

**Bias Conditions: Vd=4V - 7V, Idq = 825 mA, Δf = 1MHz**



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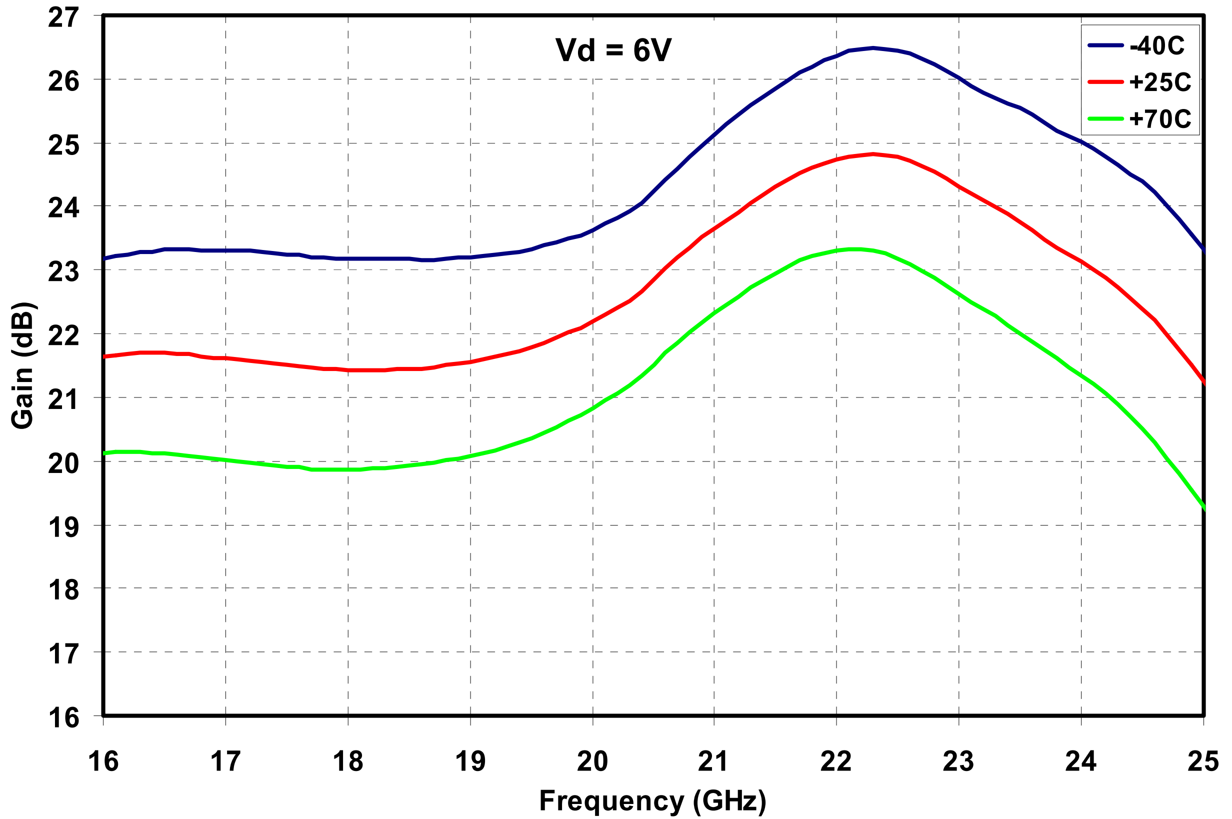
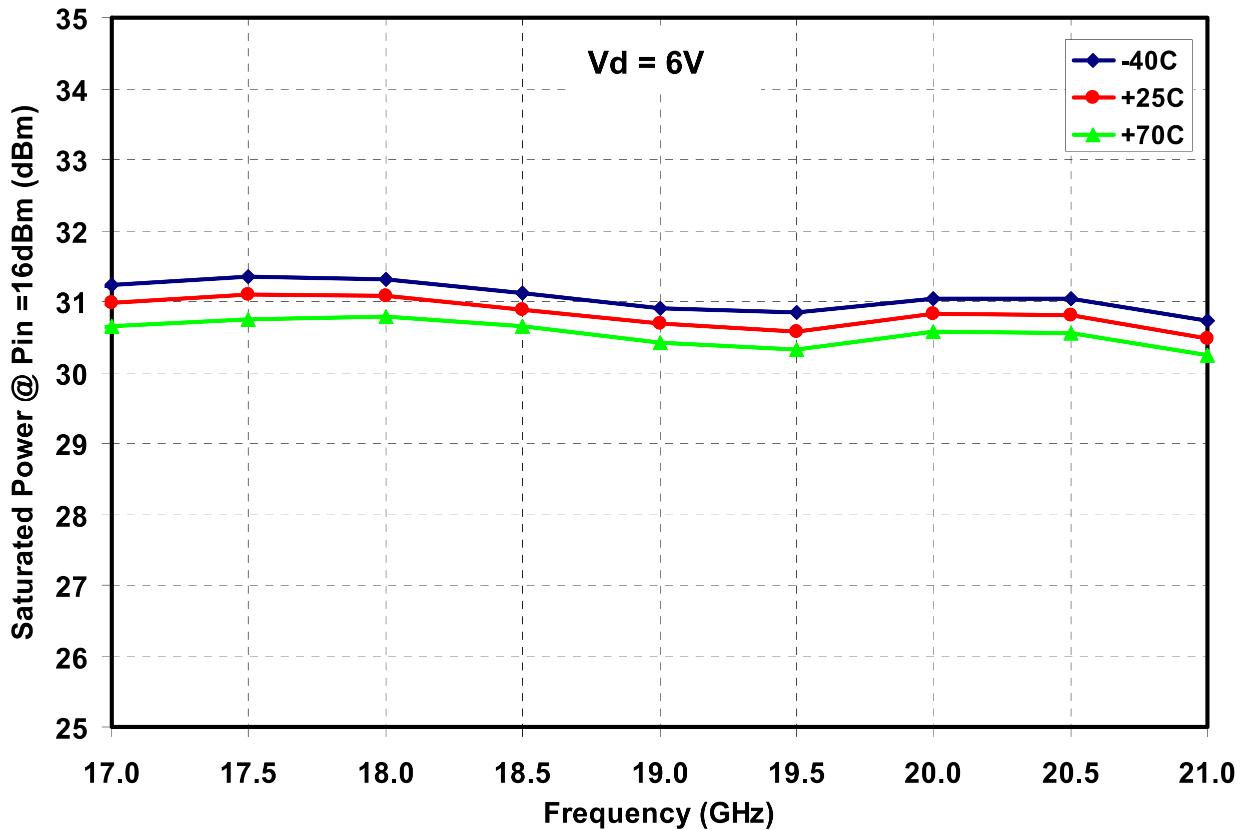
# Measured Data

**Bias Conditions: Vd = 6V, Idq = 825 mA**



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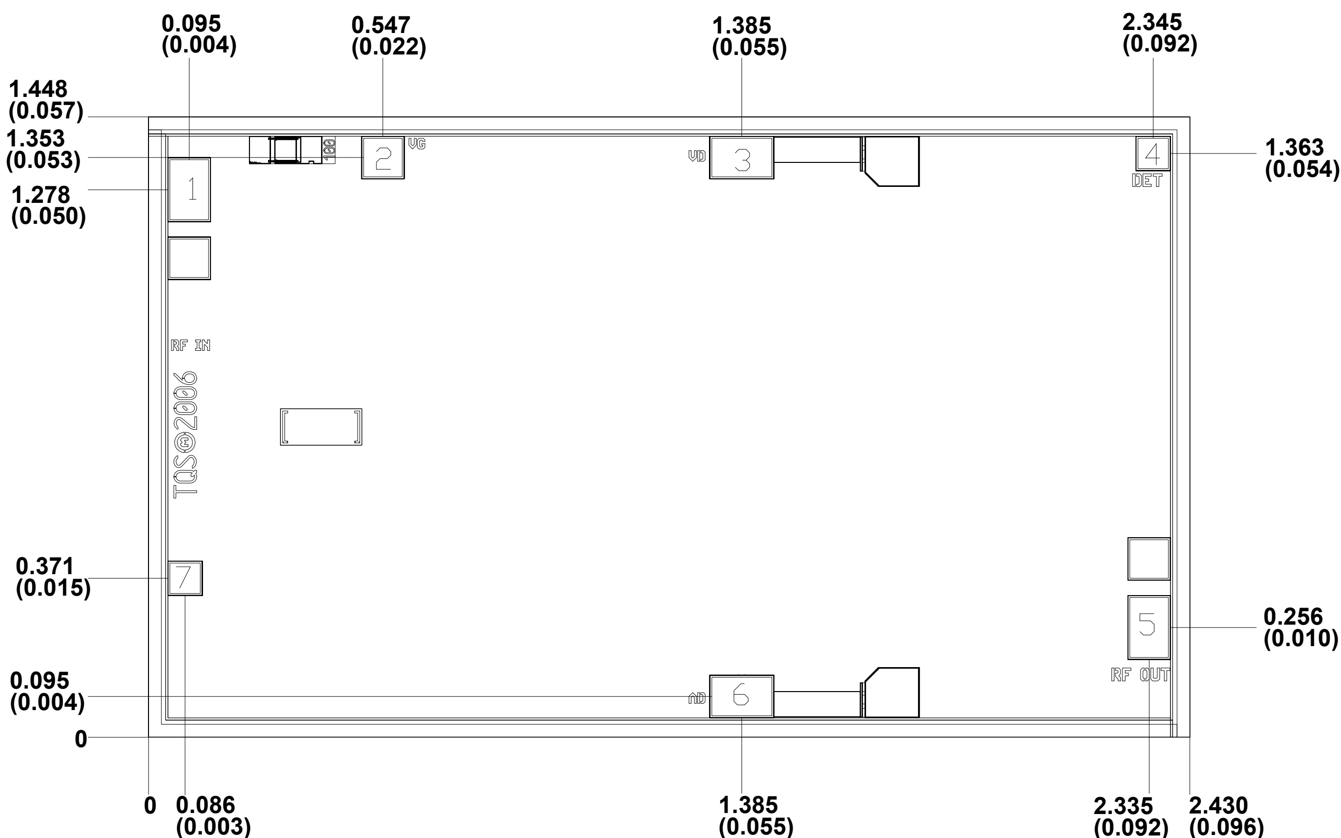
# Mechanical Drawing



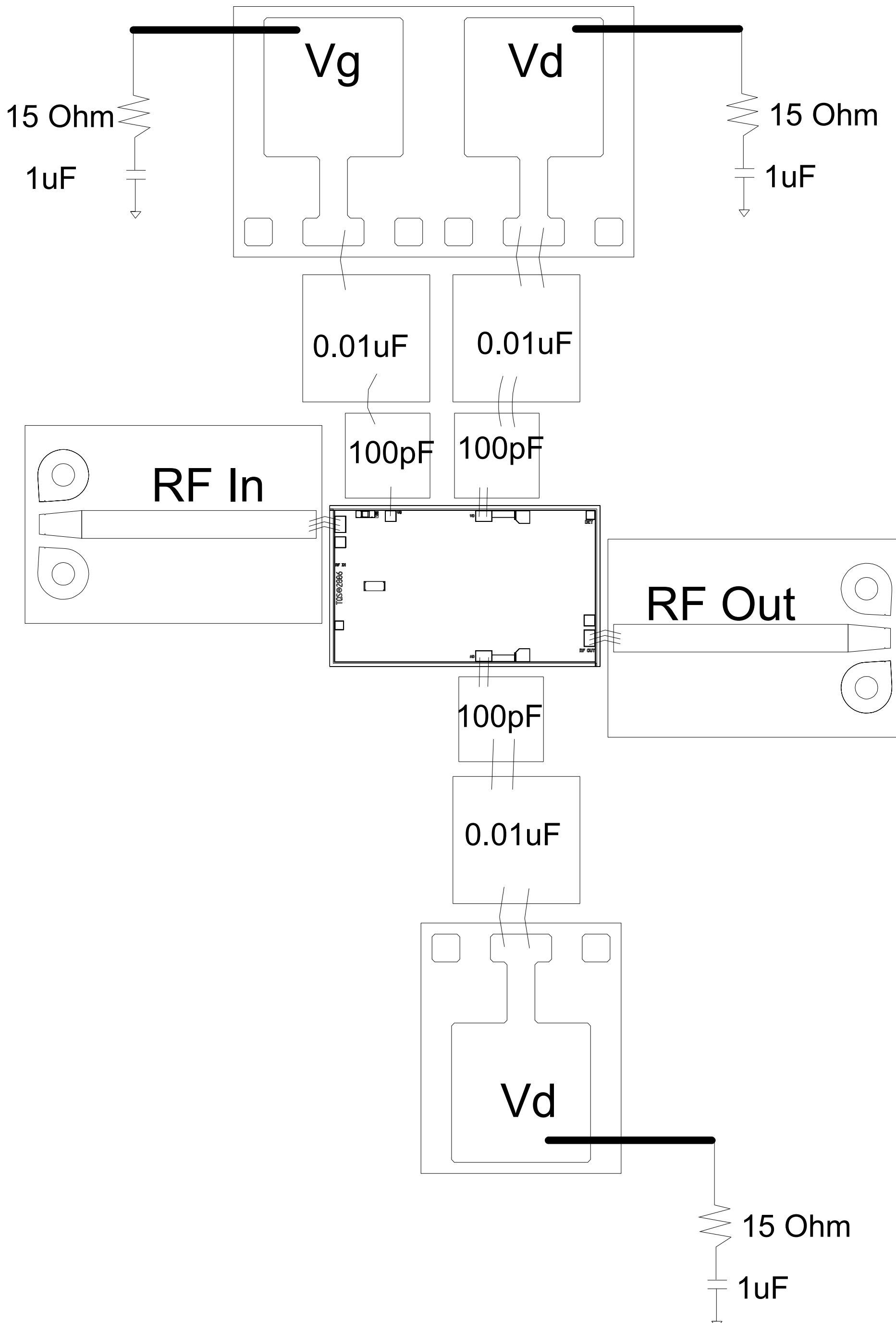

**Units: Millimeters (inches)**
**Thickness: 0.10 (0.004)**
**Chip edge to bond pad dimensions are shown to center of bond pad**
**Chip size tolerance: +/- 0.05 (0.002)**

**GND IS BACKSIDE OF MMIC**

| | | |
|---|---|---|
| **Bond pad # 1** | **(RF Input)** | **0.100 x 0.150 (0.004 x 0.006)** |
| **Bond pad # 2** | **(Vg)** | **0.100 x 0.100 (0.004 x 0.004)** |
| **Bond pad # 3** | **(Vd)** | **0.150 x 0.100 (0.006 x 0.004)** |
| **Bond pad # 4** | **(Vdet)** | **0.081 x 0.081 (0.003 x 0.003)** |
| **Bond pad # 5** | **(RF Out)** | **0.100 x 0.150 (0.004 x 0.006)** |
| **Bond pad # 6** | **(Vd)** | **0.150 x 0.100 (0.006 x 0.004)** |
| **Bond pad # 7** | **(Vref)** | **0.081 x 0.081 (0.003 x 0.003)** |

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

## Recommended Assembly Diagram




**Vd = 5 to 7V**
**Id = 825mA**
**Vg = -0.45V (Typical for 7V Vd bias)**

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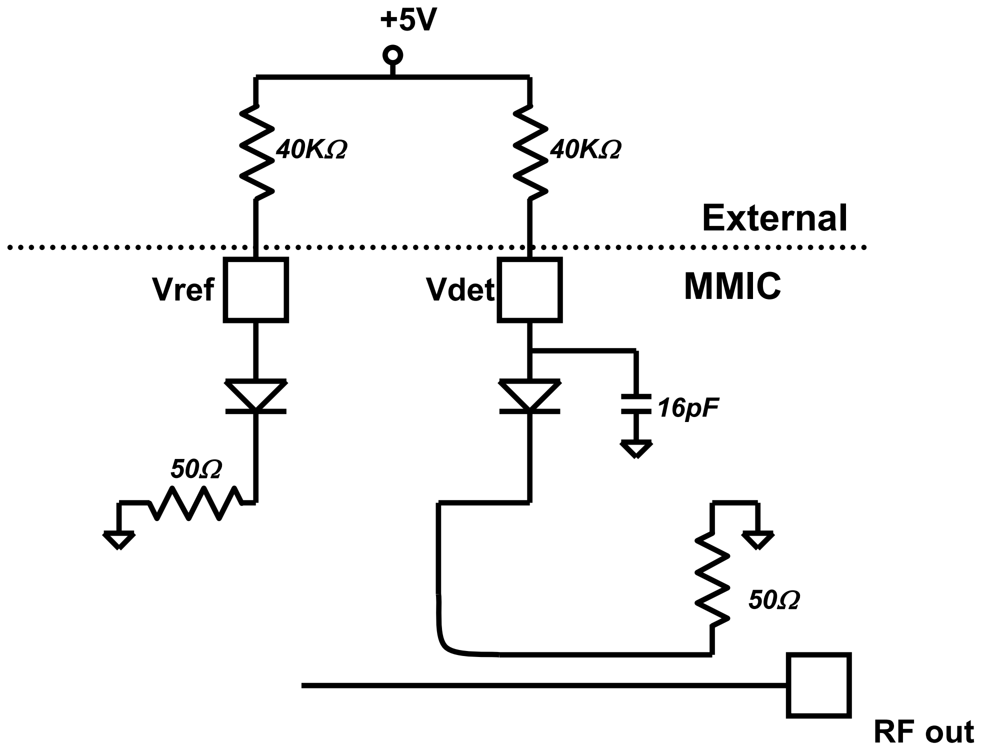
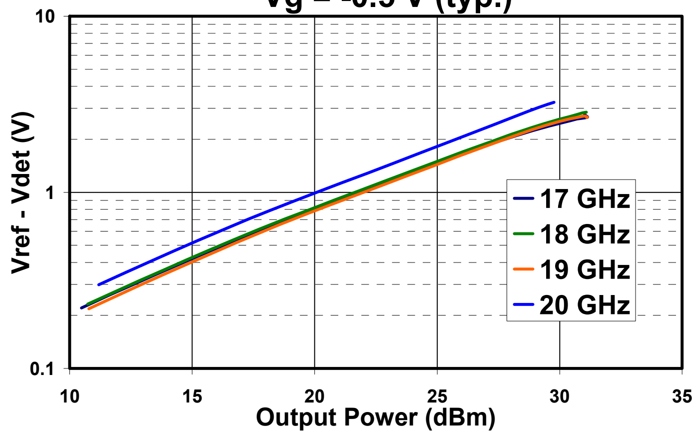
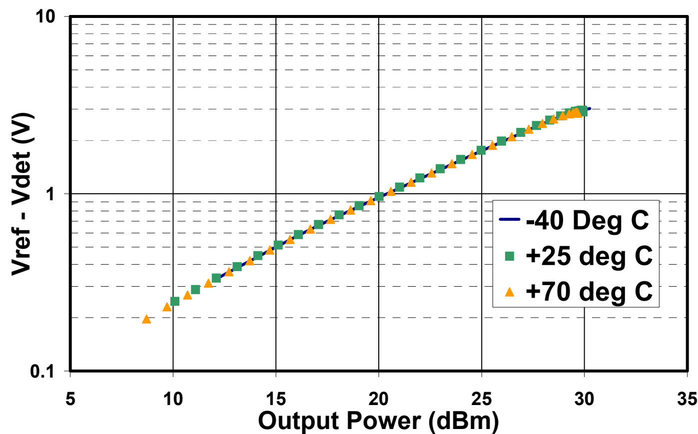
## Power Detector





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# Assembly Process Notes

Reflow process assembly notes:

- Use AuSn (80/20) solder with limited exposure to temperatures at or above $300^0$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 $200^0$C.

# Ordering Information

| Part | Package Style |
|---|---|
| TGA4530 | Chip |

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