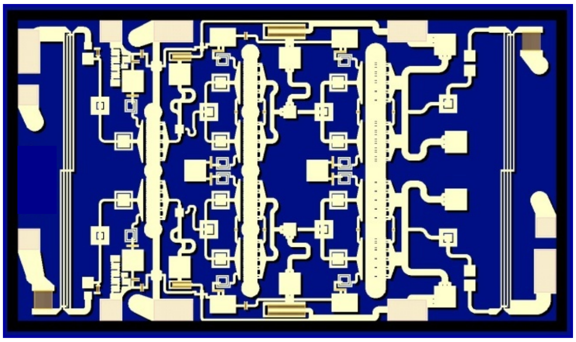
TGA4531

K-Band High Linearity Power Amplifier

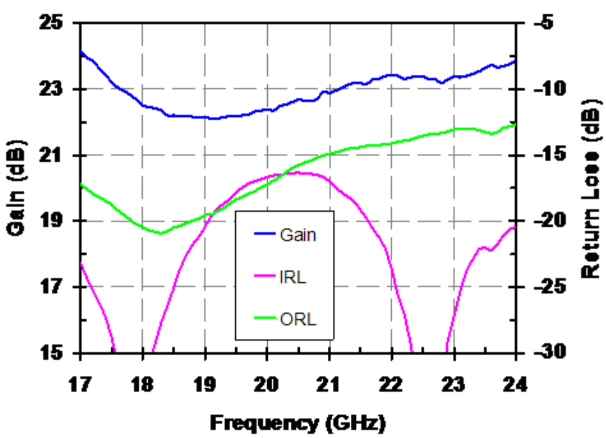


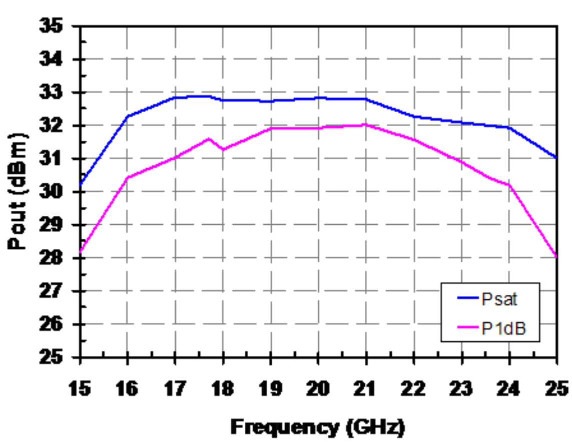
Key Features

- 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.

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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

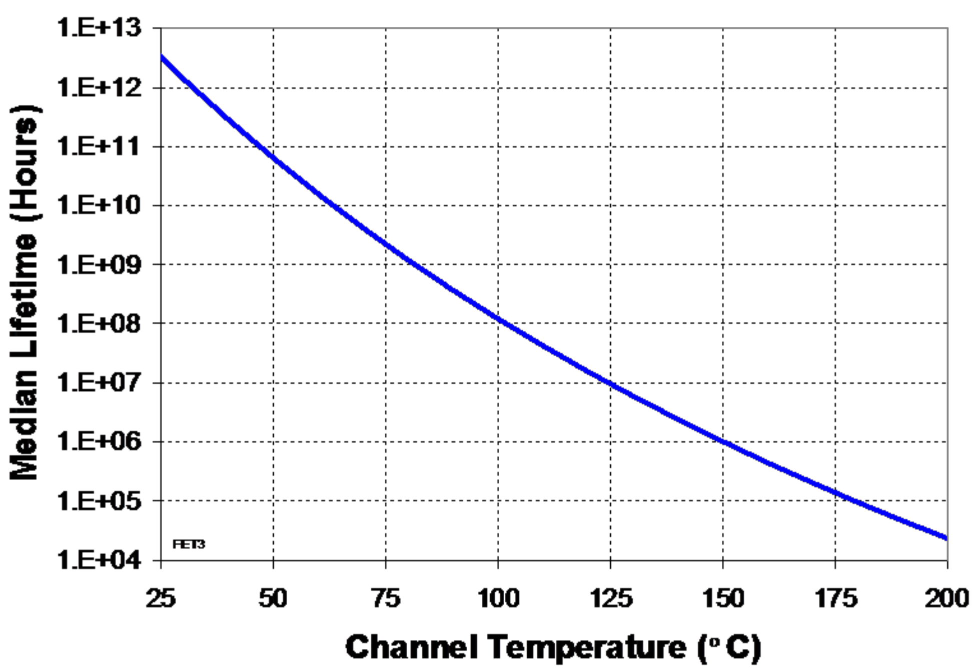
Bias: Vd = 7 V, Id = 720 mA, Vg = -0.65 V Typical

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 Tchannel = 199 °C
Thermal Resistance, θjc	Vd = 7 V Id = 720 mA Pd = 5.04 W Tbaseplate = 70 ºC	θjc = 12.9 °C/W Tchannel = 135 °C Tm = 3.8E+6 Hrs
Thermal Resistance, θjc Under RF Drive	Vd = 7 V Id = 1.12 A Pout = 32 dBm Pd = 6.25 W Tbaseplate = 70 ºC	θjc = 12.9 °C/W Tchannel = 150 °C 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

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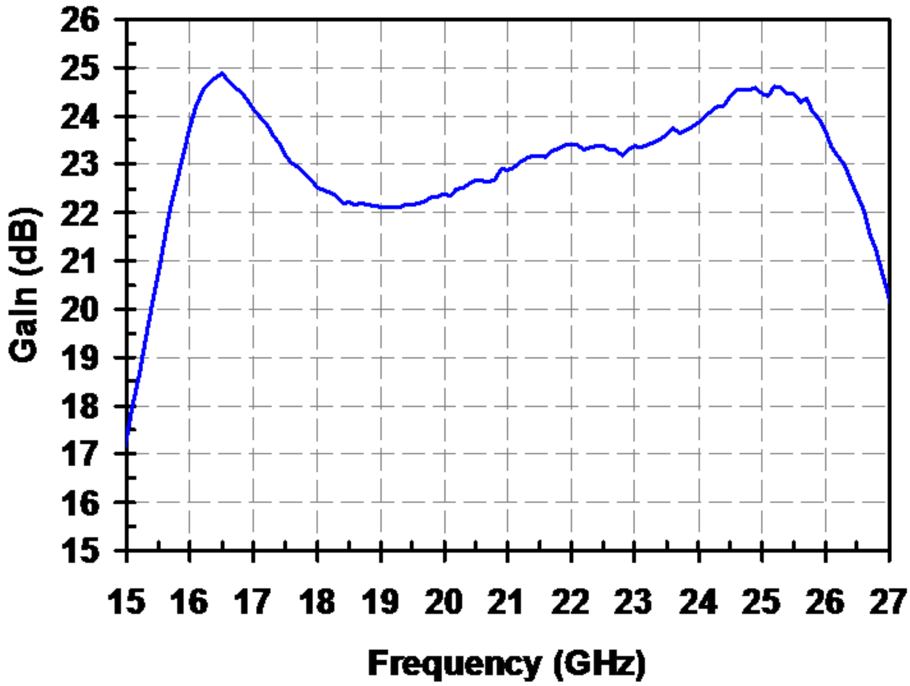

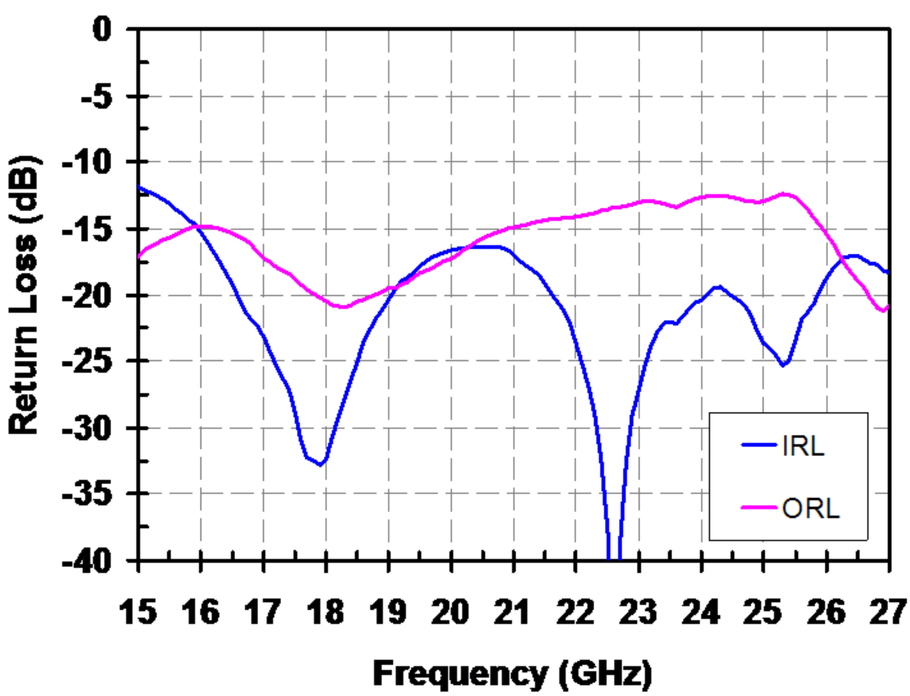

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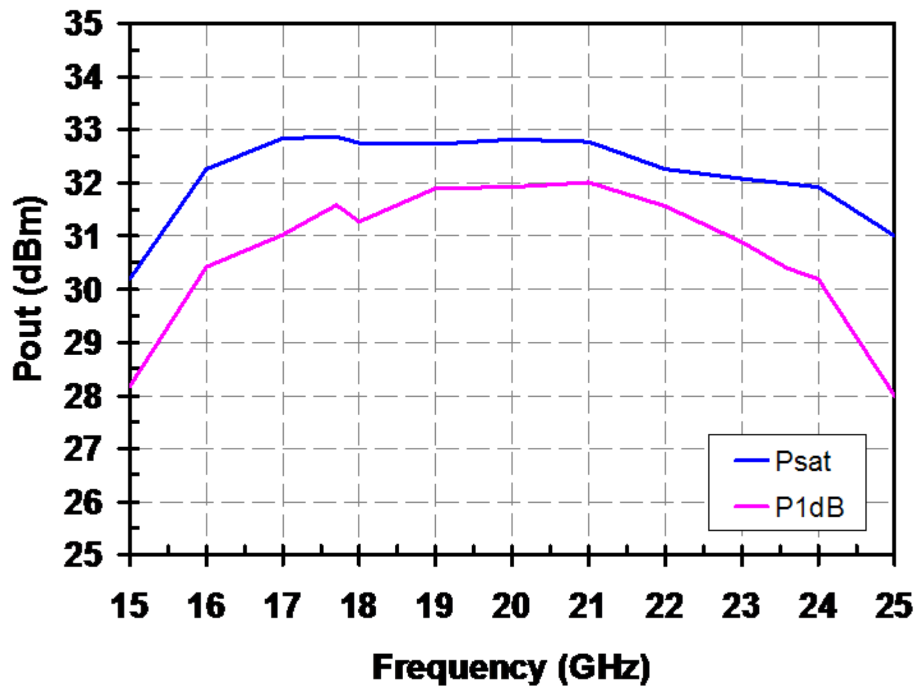

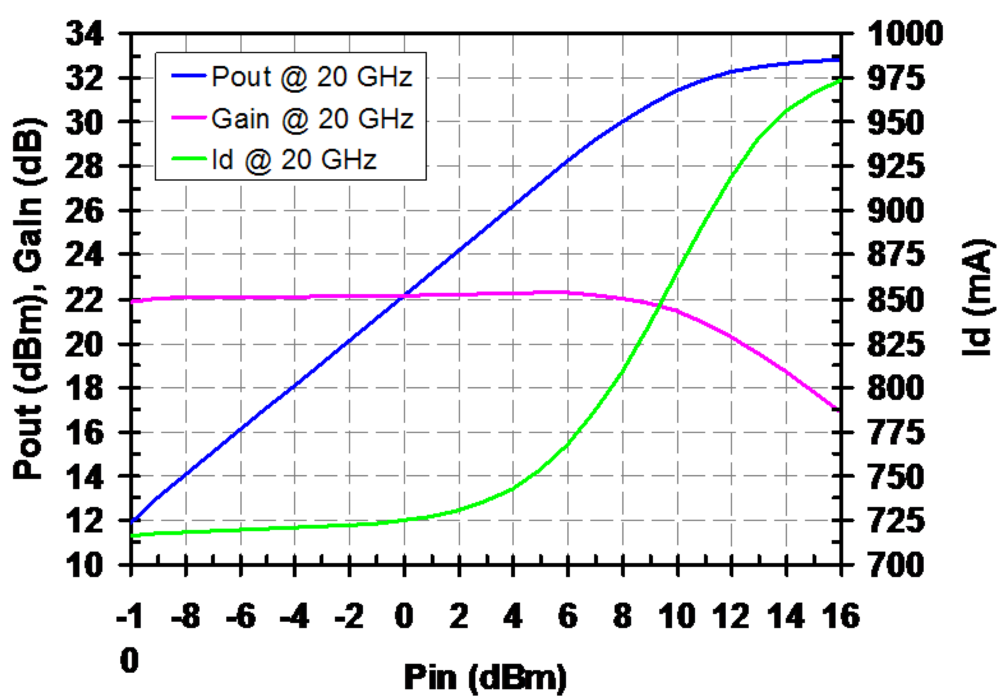

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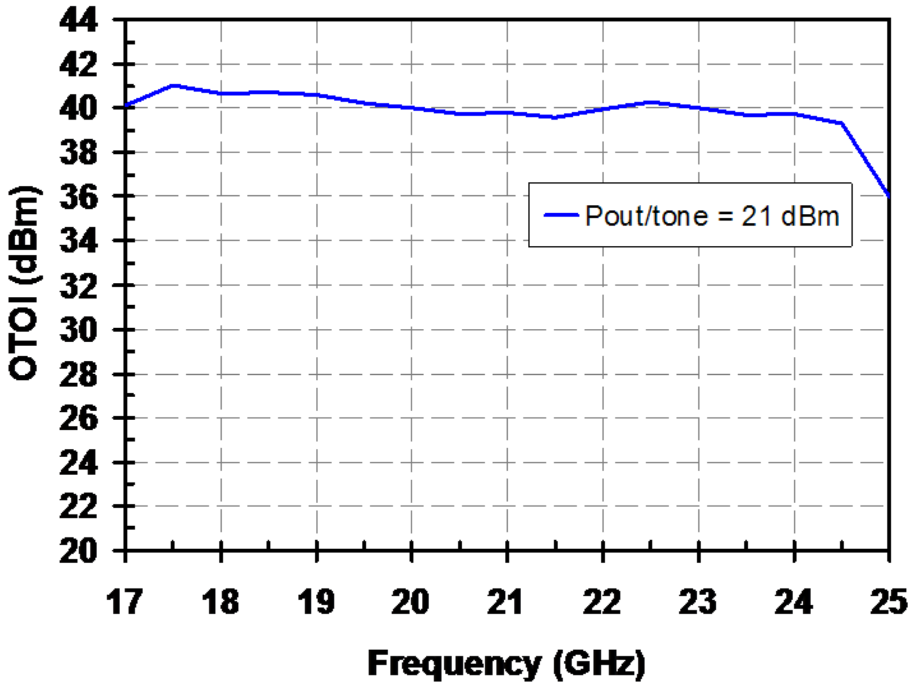

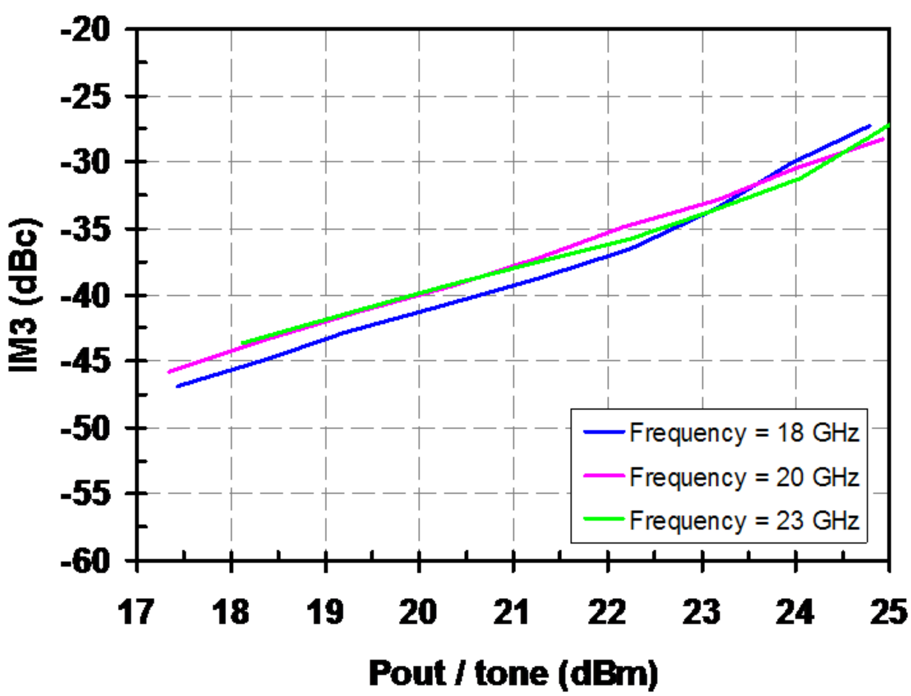

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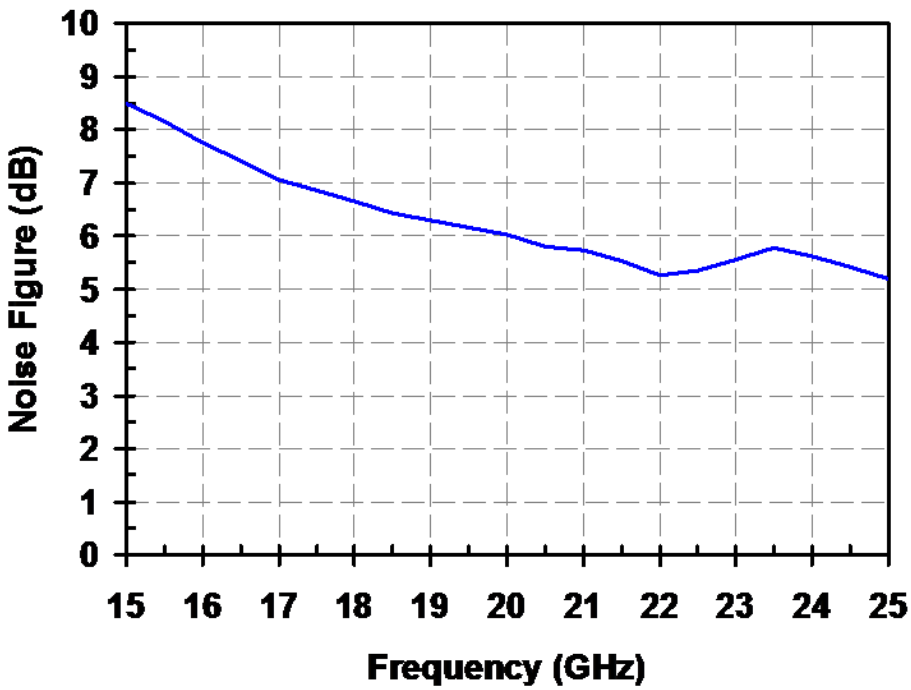

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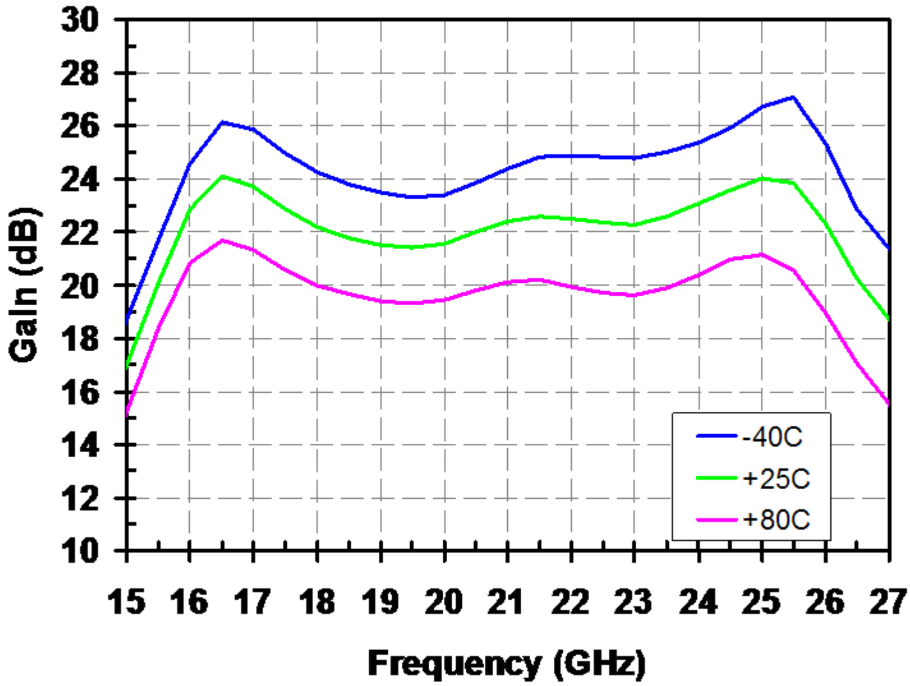
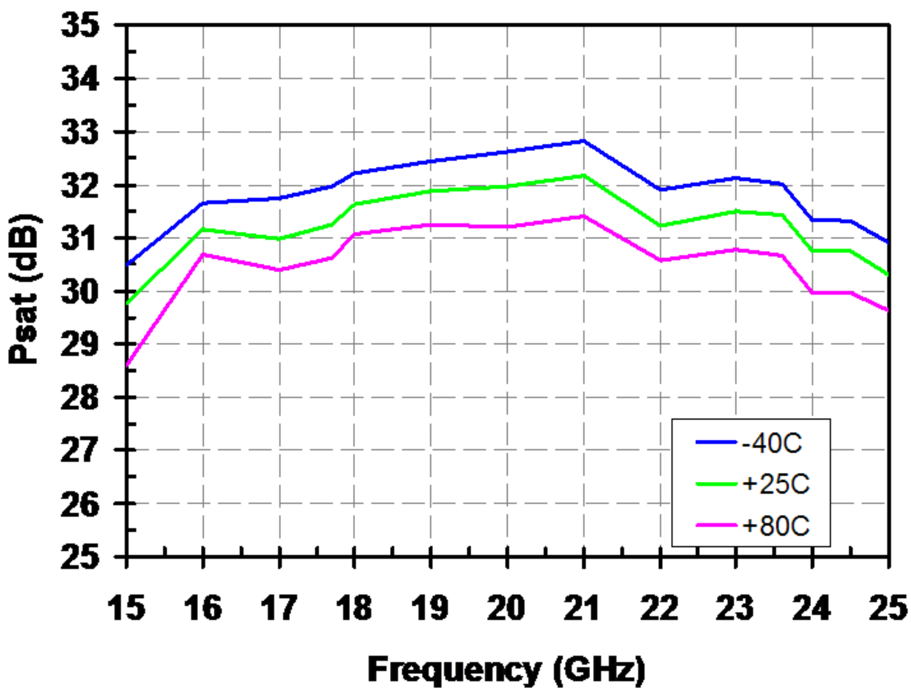
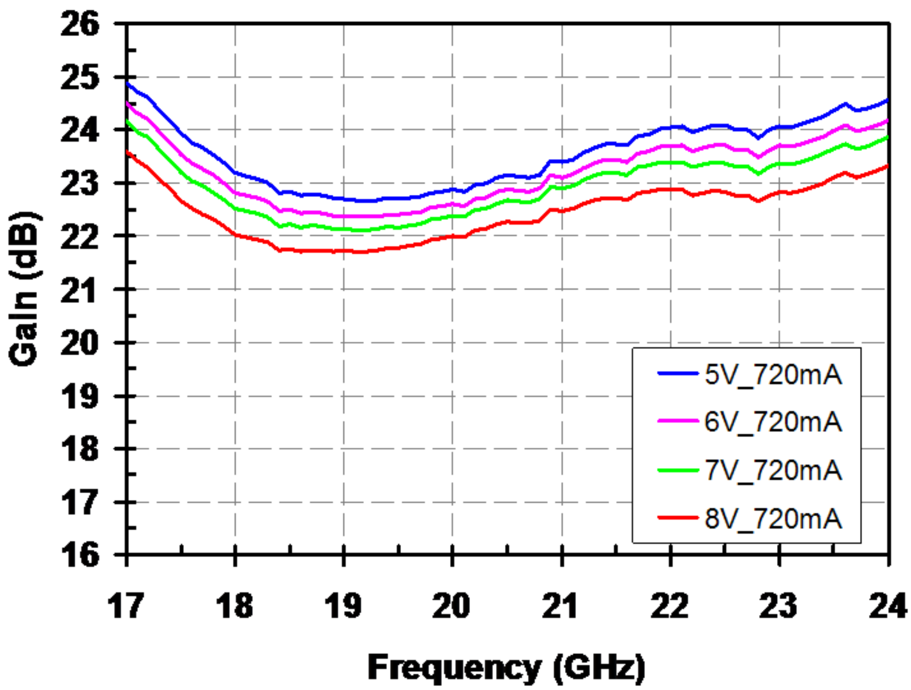
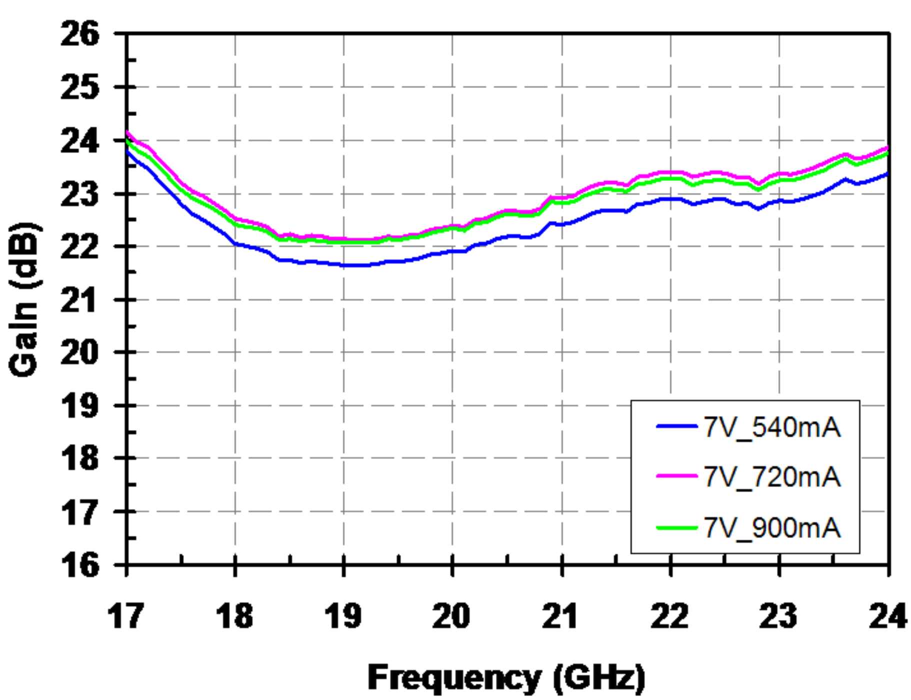




Measured Data

Bias conditions: Varies





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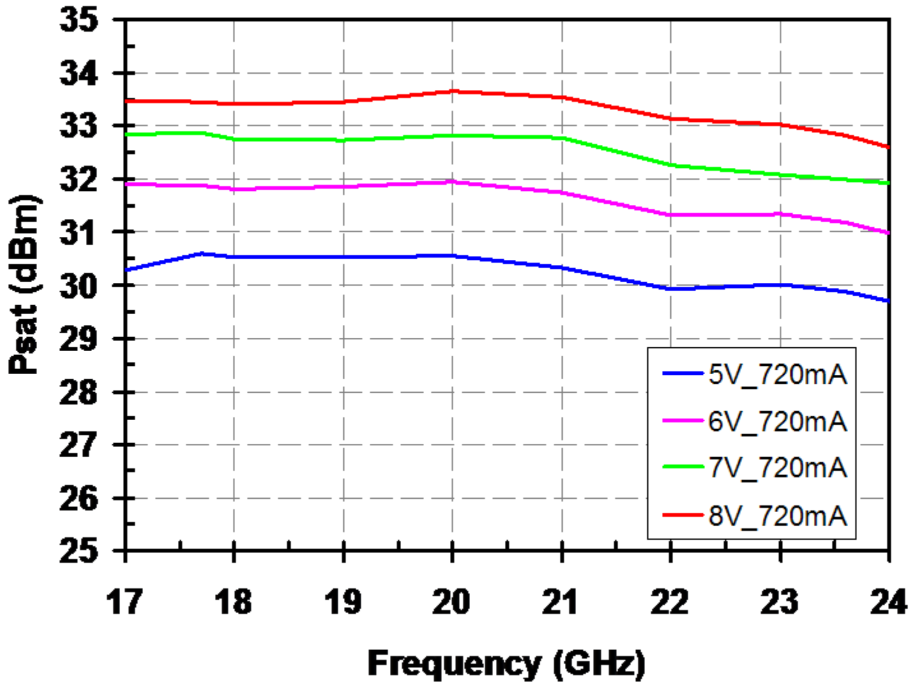
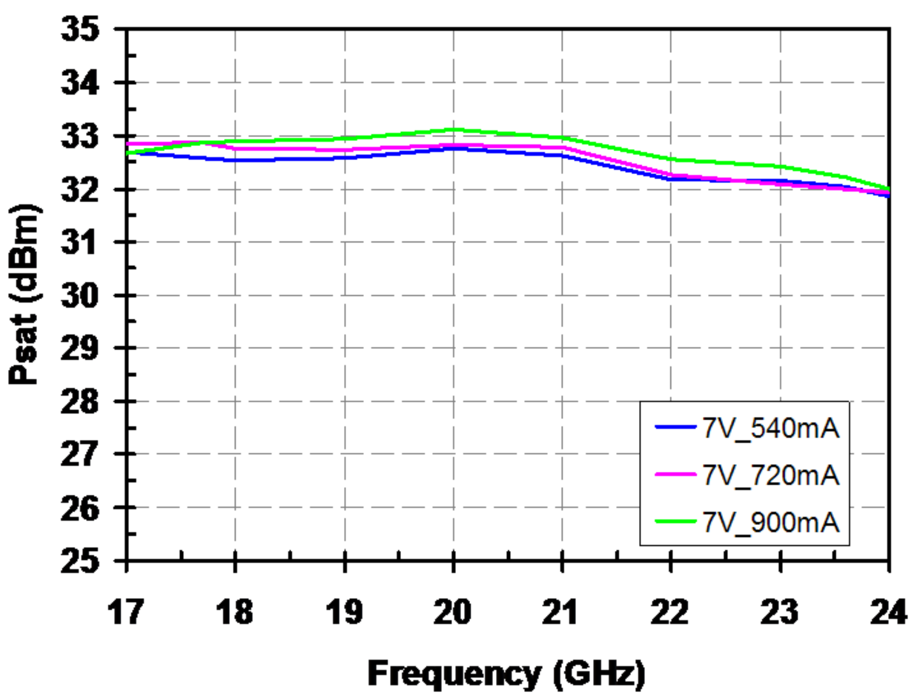
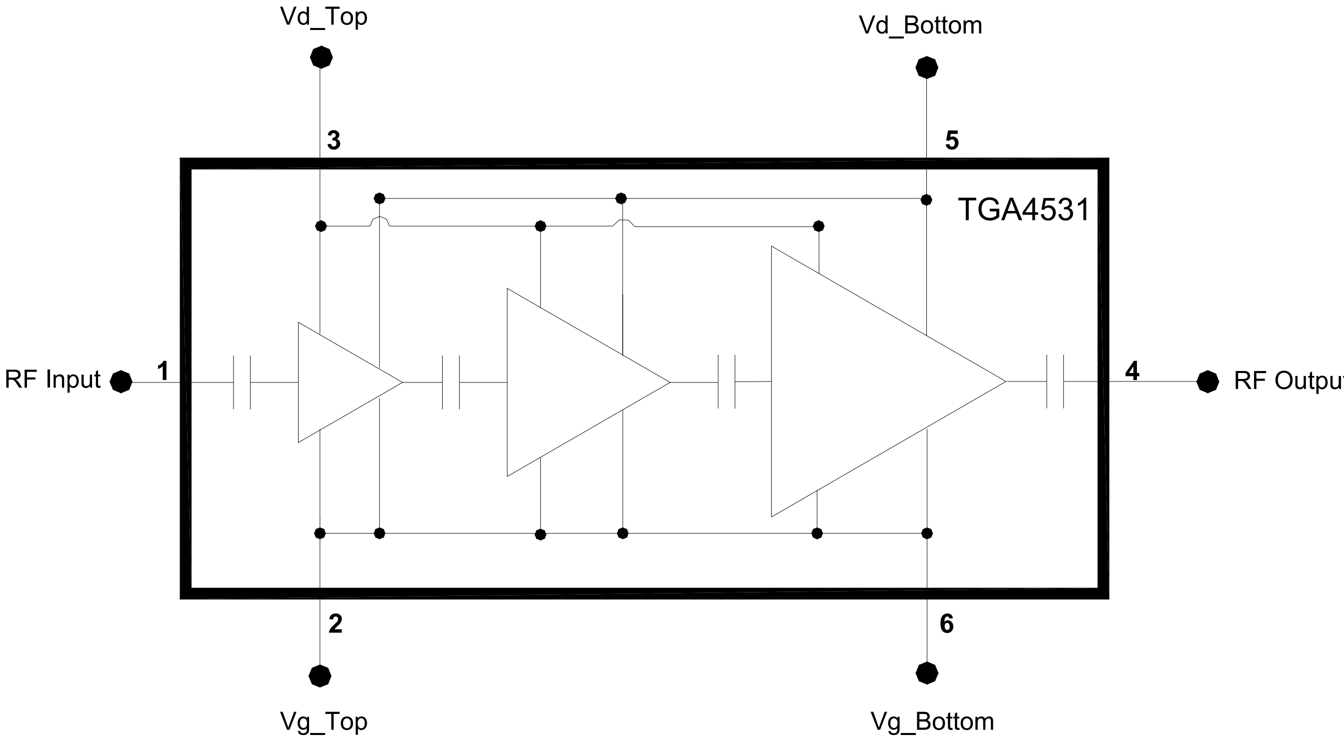




Electrical Schematic



Bias Procedures

Bias-up Procedure

Vg set to -1.5 V

Vd_set to +7 V

Adjust Vg more positive until quiescent Id is 720 mA. This will be ~ Vg = -0.65 V

Apply RF signal to input

Bias-down Procedure

Turn off RF supply

Reduce Vg to -1.5V. Ensure Id ~ 0 mA

Turn Vd to 0 V

Turn Vg to 0 V

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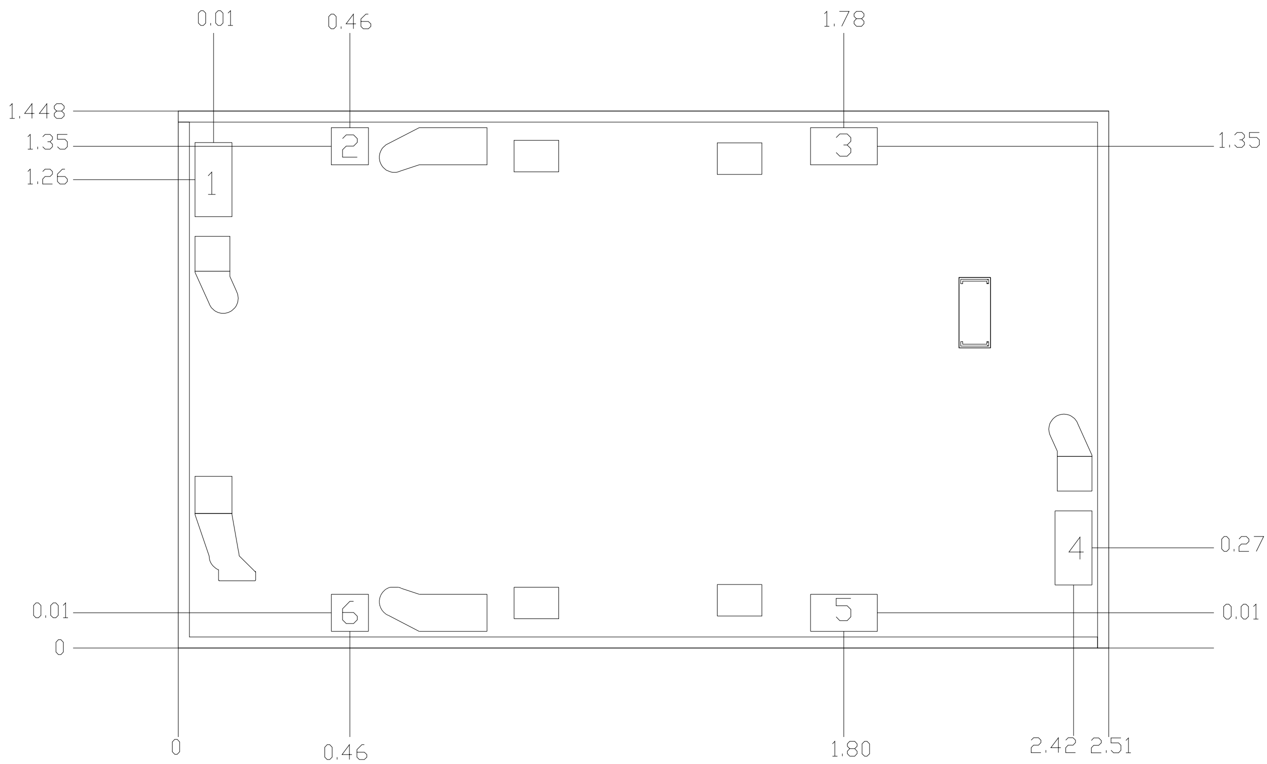
Mechanical Drawing

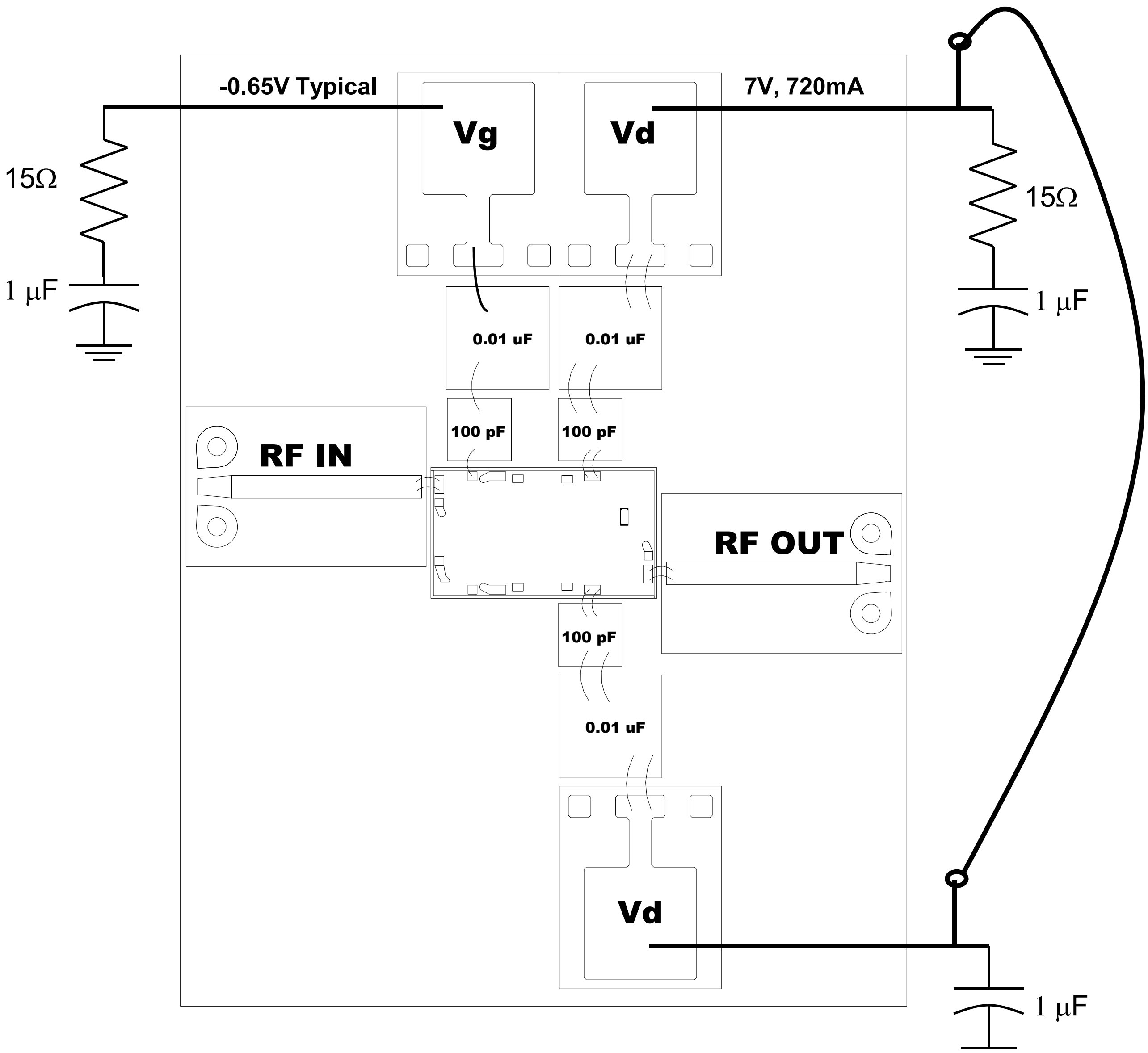


Units: millimeters
Thickness: 0.10
Die x,y size tolerance: +/- 0.050
Chip edge to bond pad dimensions are shown to center of pad
Ground is backside of die

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

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