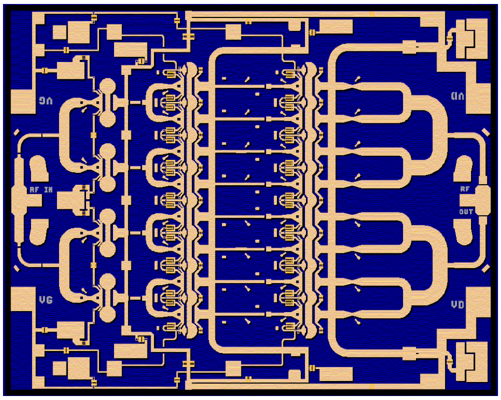
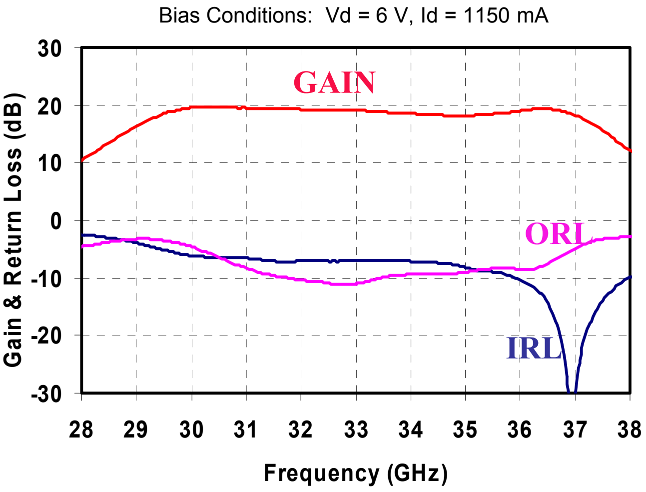
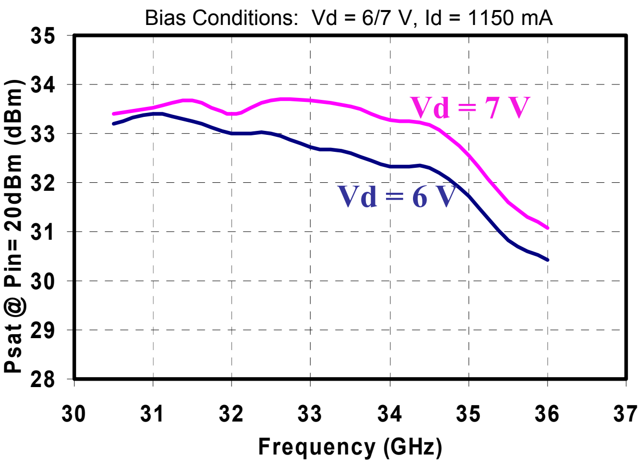
2 Watt Ka-Band Power Amplifier



Measured Performance





Key Features

- Typical Frequency Range: 31 - 35 GHz
- 33.5 dBm Nominal Psat @ Vd = 7V
- 31.5 dBm Nominal P1dB
- IMD3: 31dBc at Pout/tone=22dBm
- 18 dB Nominal Gain
- Bias 6 - 7 V, 1150 mA
- 0.25 um 2MI pHEMT Technology
- Chip Dimensions 4.0 x 3.2 x 0.1 mm
- (0.161 x 0.128 x 0.004) in

Primary Applications

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

Product Description

The TriQuint TGA4514 is Power Amplifier for Ka-band applications. The part is designed using TriQuint's proven standard 0.25 um gate Power pHEMT production process.

The TGA4514 provides a nominal 33.5 dBm of output power at an input power level of 20 dBm with a small signal gain of 18 dB. Nominal IMD3 is 31dBc at Pout/tone of 22 dBm.

The part is ideally suited for low cost markets such as Point-to-Point Radio and Ka-band Sat-Com.

Table I
Absolute Maximum Ratings 1/

Symbol	Parameter	Value	Notes
Vd-Vg	Drain to Gate Voltage	13 V	
Vd	Drain Voltage	8 V	2/
Vg	Gate Voltage Range	-5 to 0 V	
Id	Drain Current	2.5 A	2/
Ig	Gate Current Range	-9 to 210 mA	
Pin	Input Continuous Wave Power	27 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	6 V
Id	Drain Current	1150 mA
Id_Drive	Drain Current under RF Drive	1500 mA
Vg	Gate Voltage	-0.45 V

1/ See assembly diagram for bias instructions.

Table III
RF Characterization Table

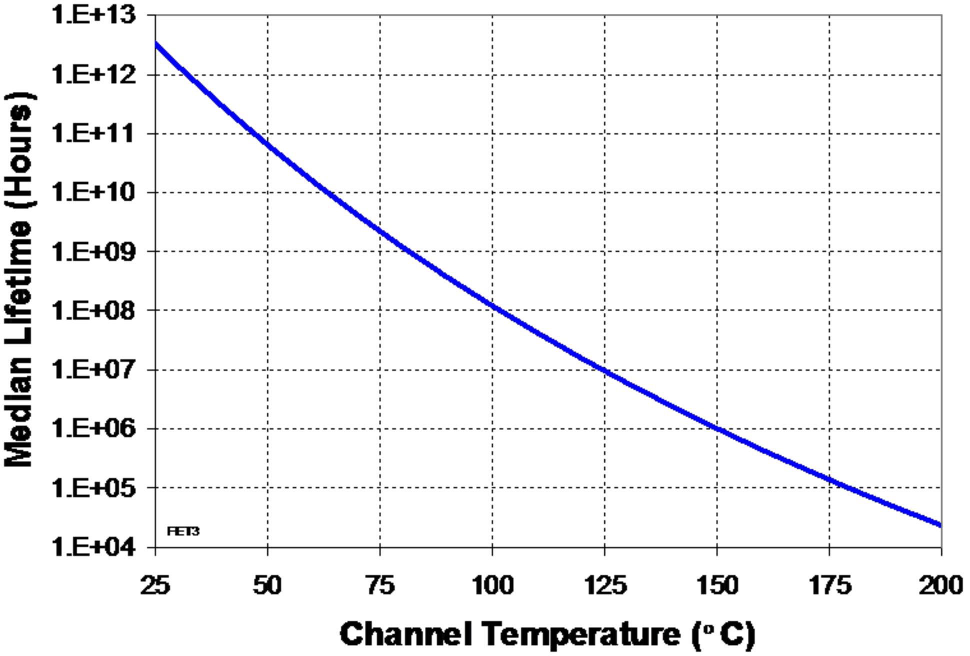
Bias: Vd = 6 V, Id = 1150 mA, Vg = -0.45 V Typical

SYMBOL	PARAMETER	TEST CONDITIONS	NOMINAL	UNITS
Gain	Small Signal Gain	F = 31 - 35 GHz	18	dB
IRL	Input Return Loss	F = 31 - 35 GHz	-7	dB
ORL	Output Return Loss	F = 31 - 35 GHz	-10	dB
Psat	Saturated Output Power @ Pin = 20dBm	F = 31 - 35 GHz	32.5	dBm
P1dB	Output Power @ 1dB Gain Compression	F = 31 - 35 GHz	32	dBm
IMD3	IMD3 @ Pout/Tone = 22dBm, Freq = 33GHz	F = 31 - 35 GHz	31	dBc

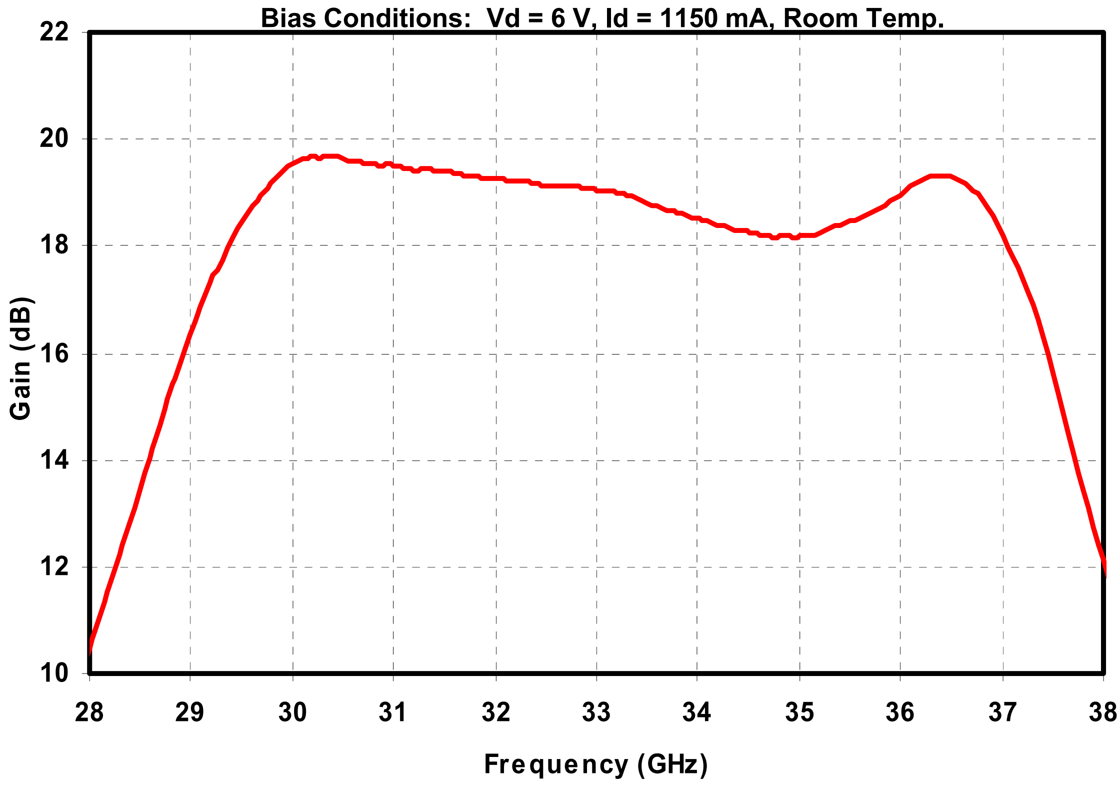
Table IV
Power Dissipation and Thermal Properties

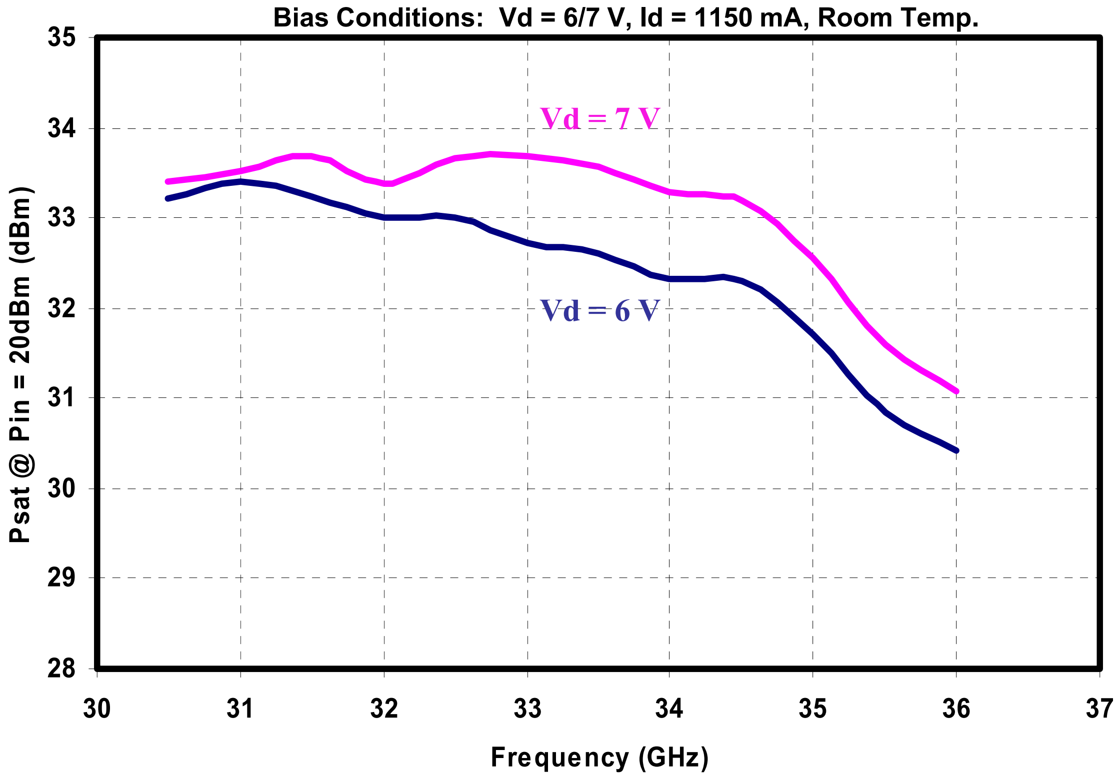
Parameter	Test Conditions	Value
Maximum Power Dissipation	Tbaseplate = 70 °C	Pd = 10 W Tchannel = 199 °C
Thermal Resistance, θjc	Vd = 6 V Id = 1.15 A Pd = 6.9 W Tbaseplate = 70 ºC	θjc = 11.5 °C/W Tchannel = 149 °C Tm = 1.1E+6 Hrs
Thermal Resistance, θjc Under RF Drive @ 33GHz	Vd = 6 V Id = 1.45 A Pout = 32.5 dBm Pd = 6.9 W Tbaseplate = 70 ºC	θjc = 11.5 °C/W Tchannel = 149 °C Tm = 1.1E+6 Hrs
Mounting Temperature	30 Seconds	320 °C
Storage Temperature		-65 to 150 °C

Median Lifetime (Tm) vs. Channel Temperature



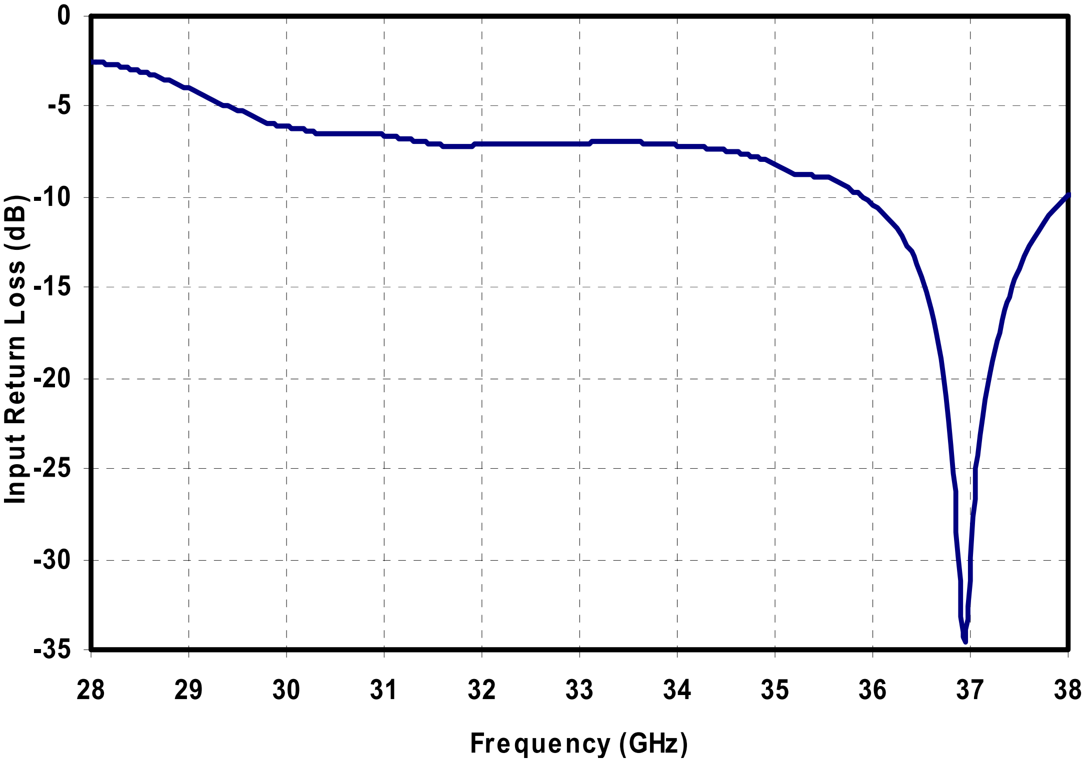
Measured Data

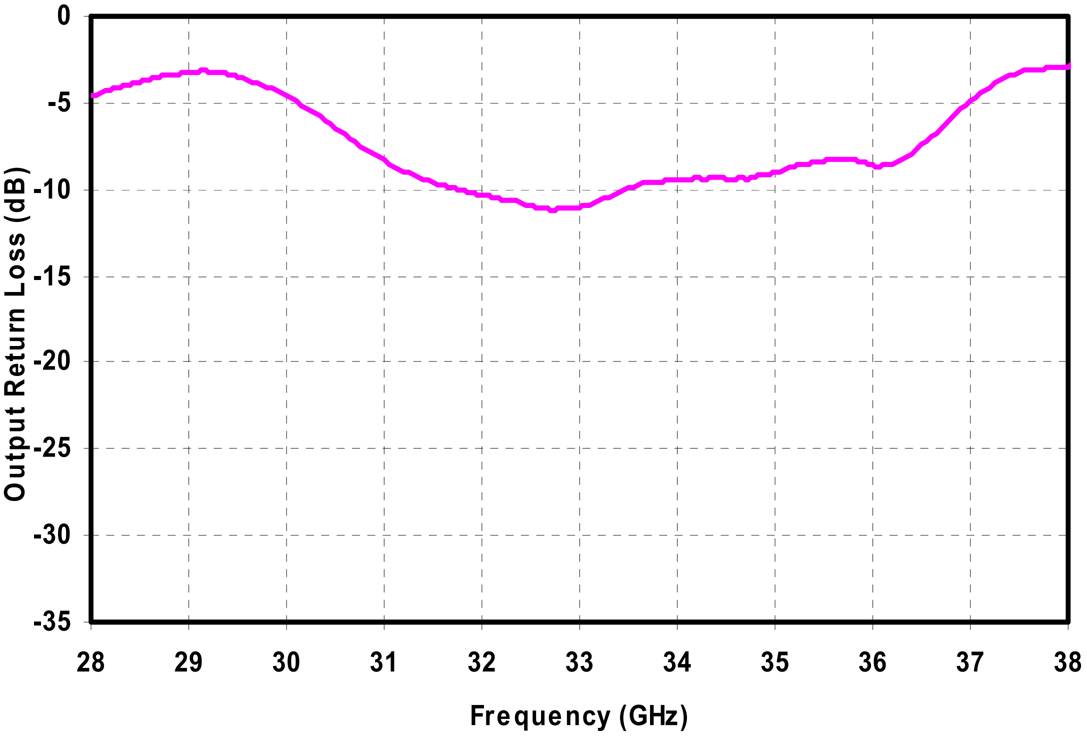




Measured Data

Bias Conditions: Vd = 6 V, Id = 1150 mA, Room Temp.





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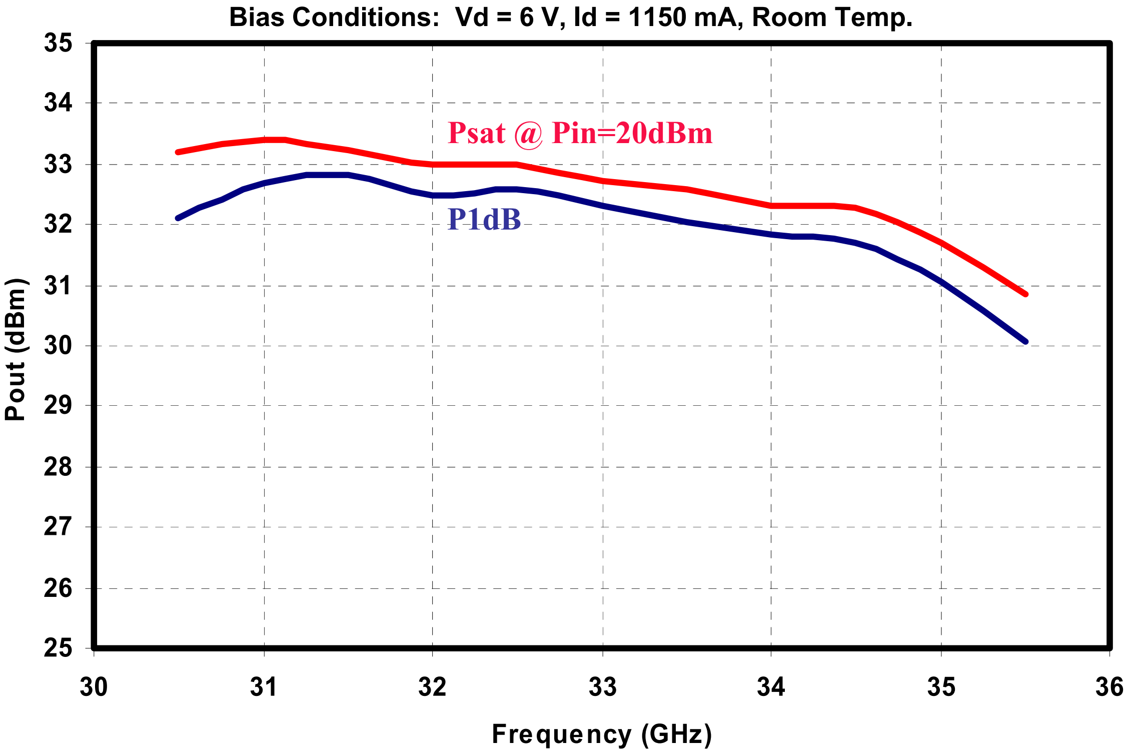

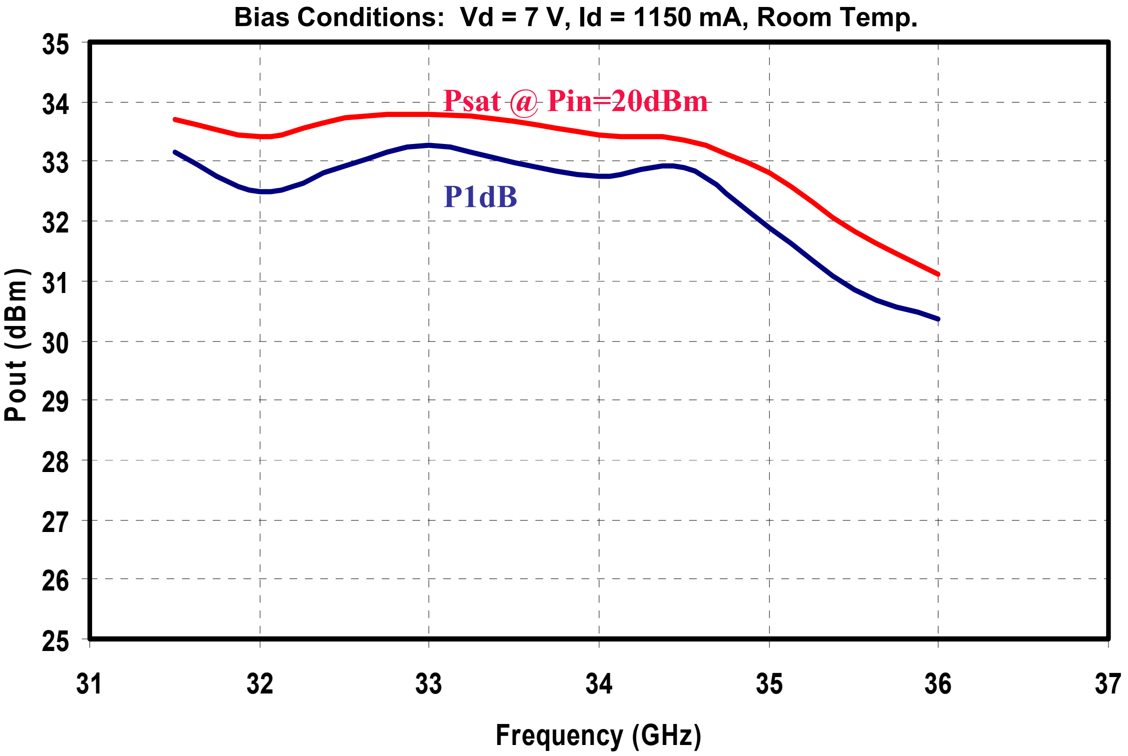

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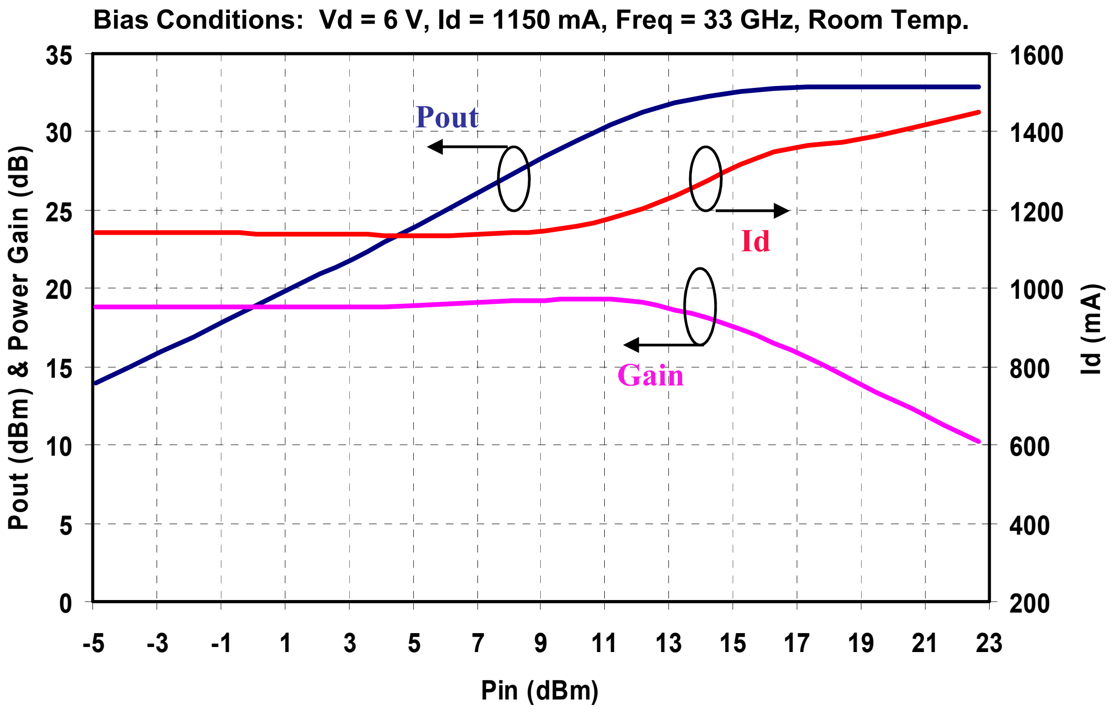
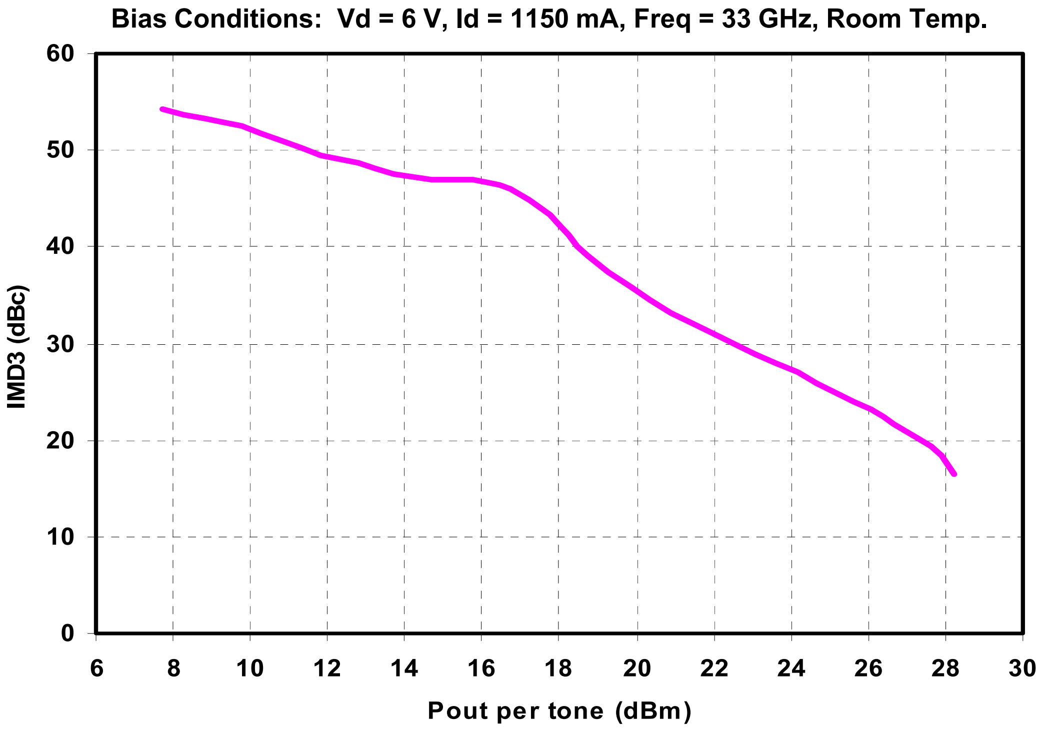
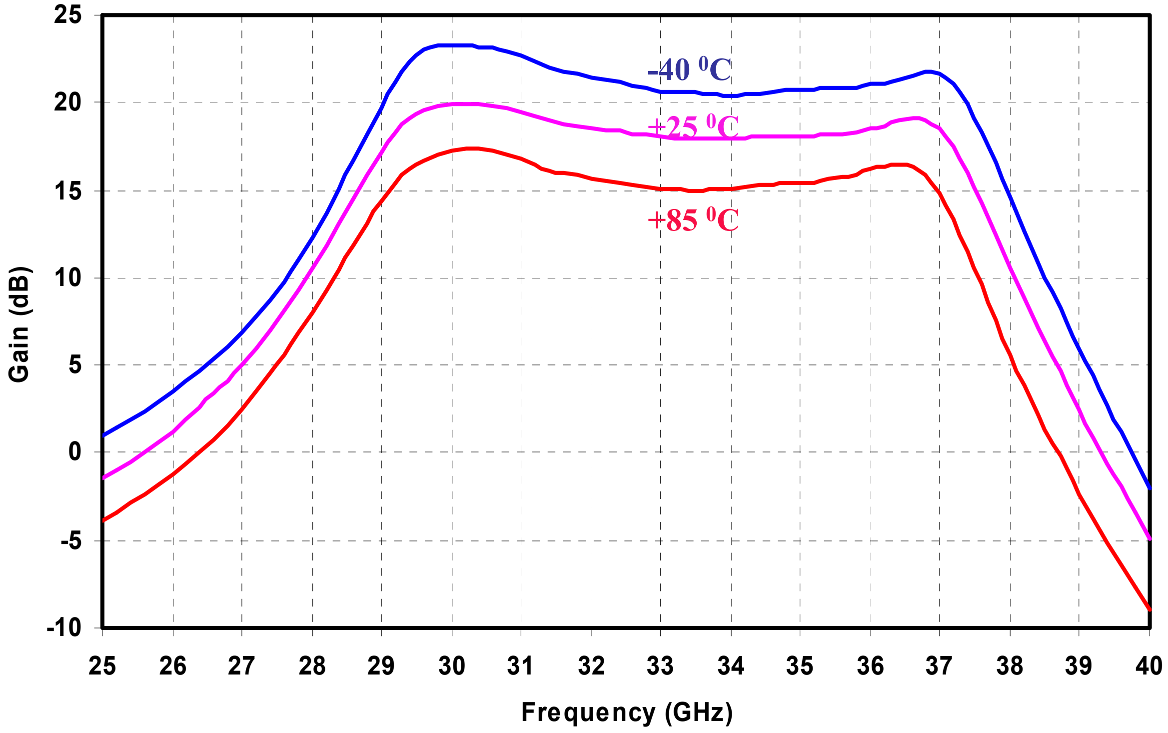

Bias Conditions: Vd = 6 V, Id = 1150 mA, Freq = 33 GHz, Room Temp.

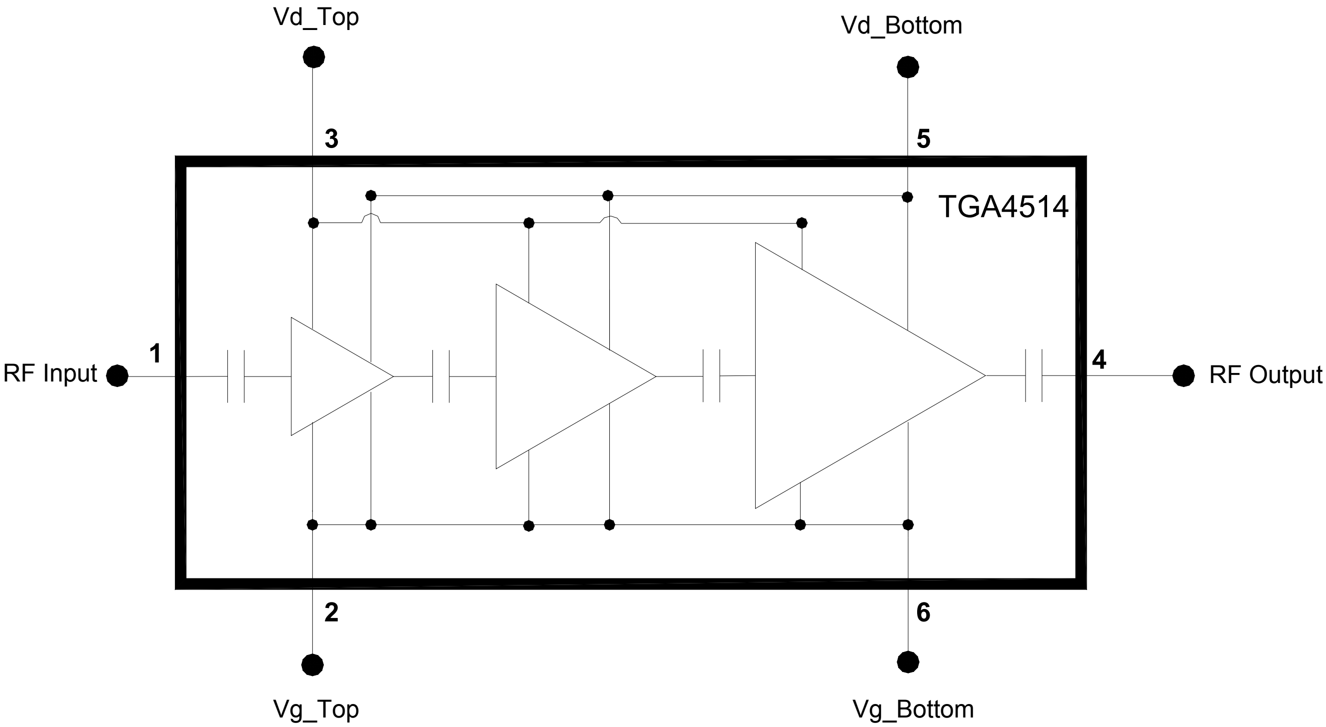

Bias Conditions: Vd = 6 V, Id = 1150 mA, Freq = 33 GHz, Room Temp.

Measured Data

Bias Conditions: Vd = 6 V, Id = 1150 mA



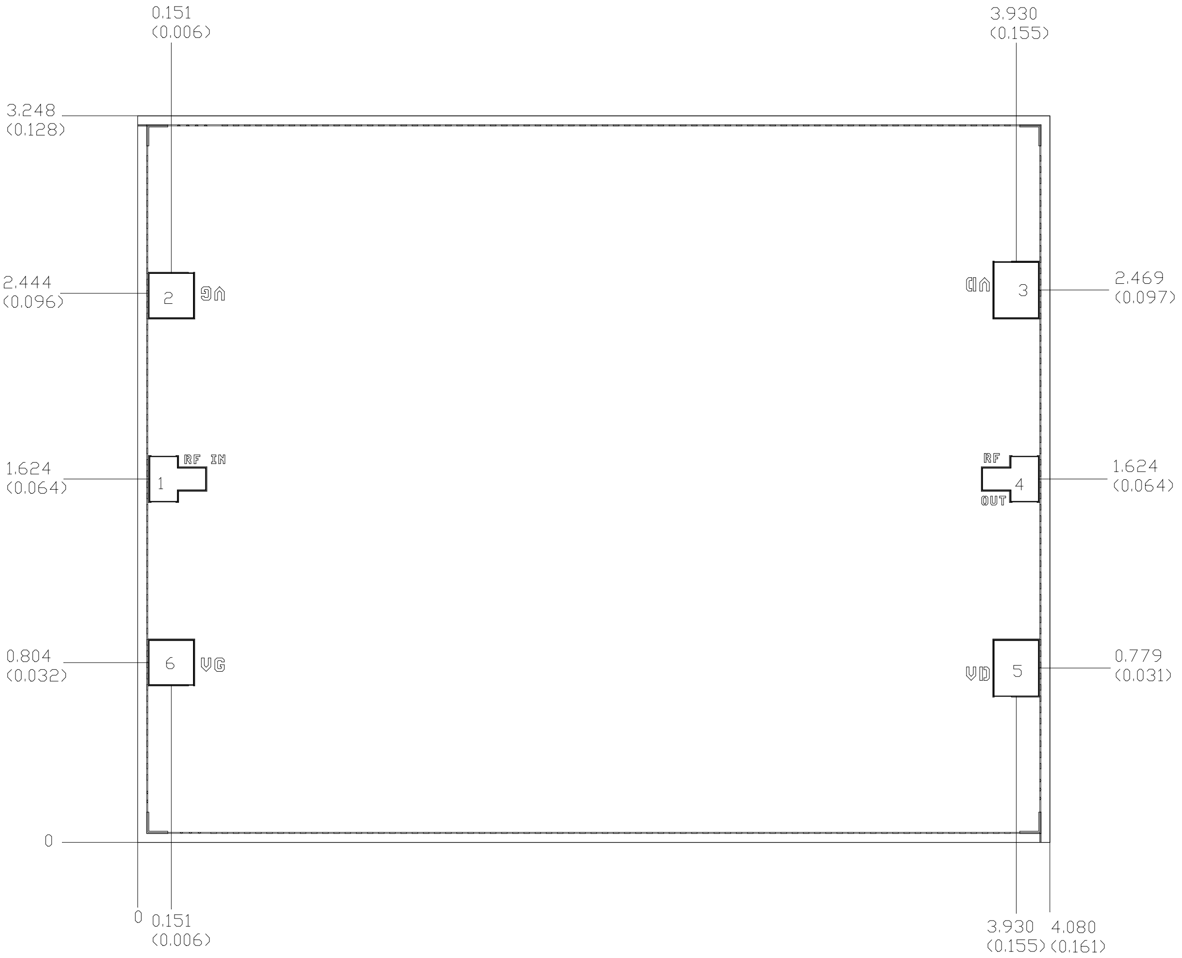
Electrical Schematic



Bias Procedures

Bias-up Procedure	**Bias-down Procedure**
Vg set to -1.5 V	Turn off RF supply
Vd_set to +6 V	Reduce Vg to -1.5V. Ensure Id ~ 0 mA
Adjust Vg more positive until quiescent Id is 1115 mA. This will be ~ Vg = -0.45 V	Turn Vd to 0 V
Apply RF signal to input	Turn Vg to 0 V

Mechanical Drawing

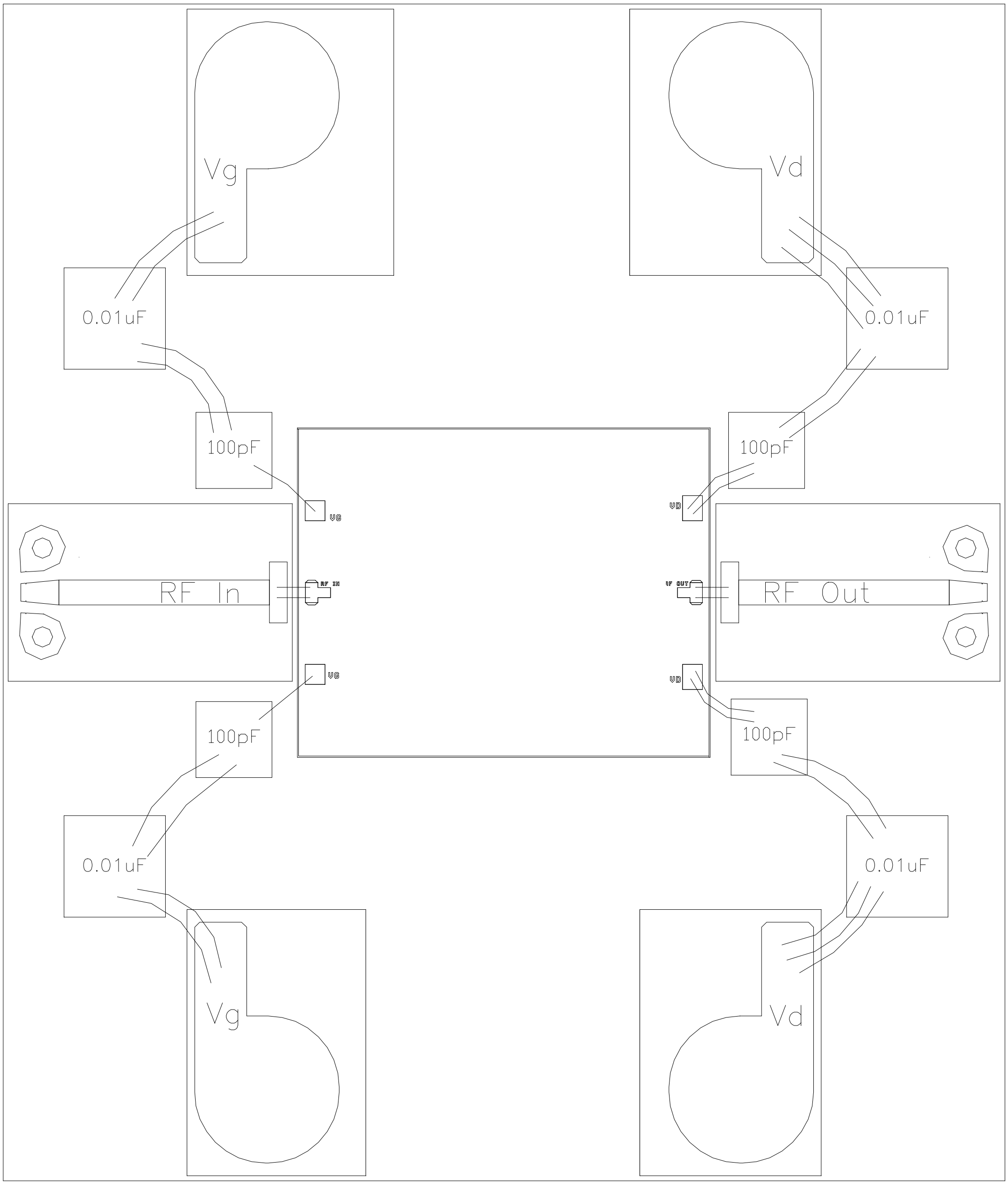


Units: Millimeters (Inches)
Thickness: 0.100 (0.004)
Chip edge to bond pad dimensions are shown to center of bond pad
Chip size tolerance: +/- 0.051 (0.002)
GND is back side of MMIC

Bond pad #1	(RF In)	0.135 x 0.210 (0.005 x 0.008)
Bond pad #2, #6	(Vg)	0.210 x 0.210 (0.008 x 0.008)
Bond pad #4	(RF Out)	0.135 x 0.210 (0.005 x 0.008)
Bond pad #3, #5	(Vd)	0.210 x 0.260 (0.008 x 0.010)

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

Recommended Assembly Diagram



Note: Apply bias for Vd on both sides. Bias may be applied for Vg from either side.

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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
TGA4514	GaAs MMIC Die

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