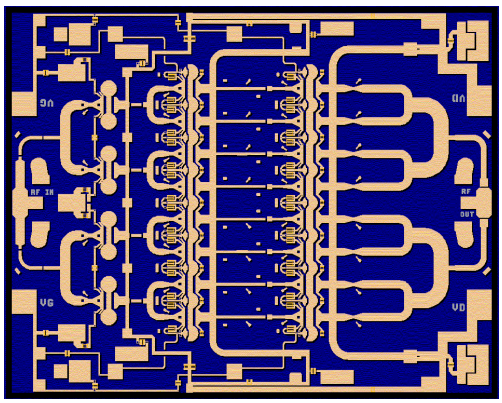
TriQuint SEMICONDUCTOR

TGA4514

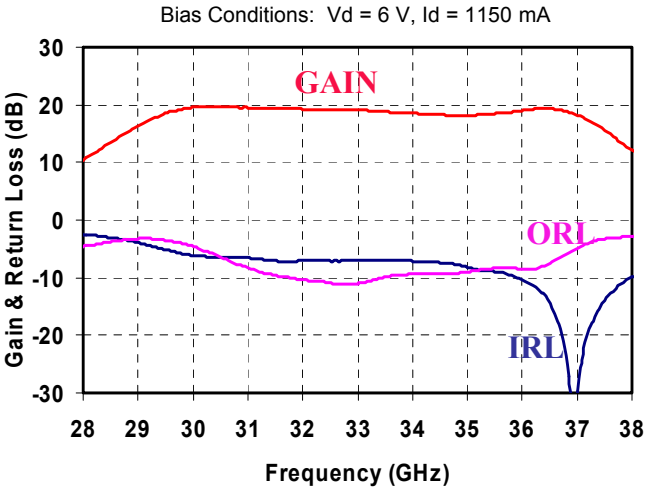
2 Watt Ka-Band Power Amplifier

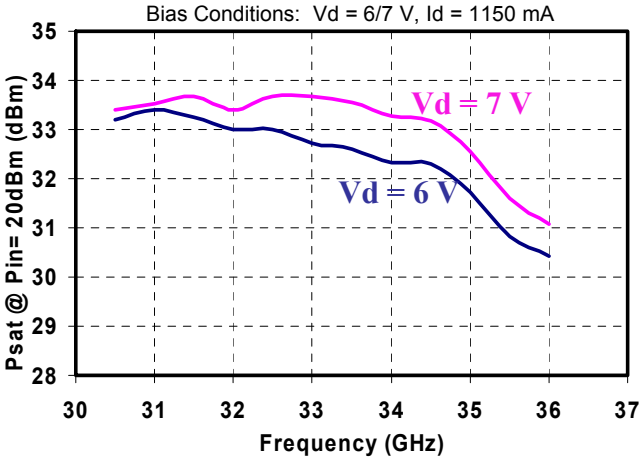


Key Features

- 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

Measured Performance





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.

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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.

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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

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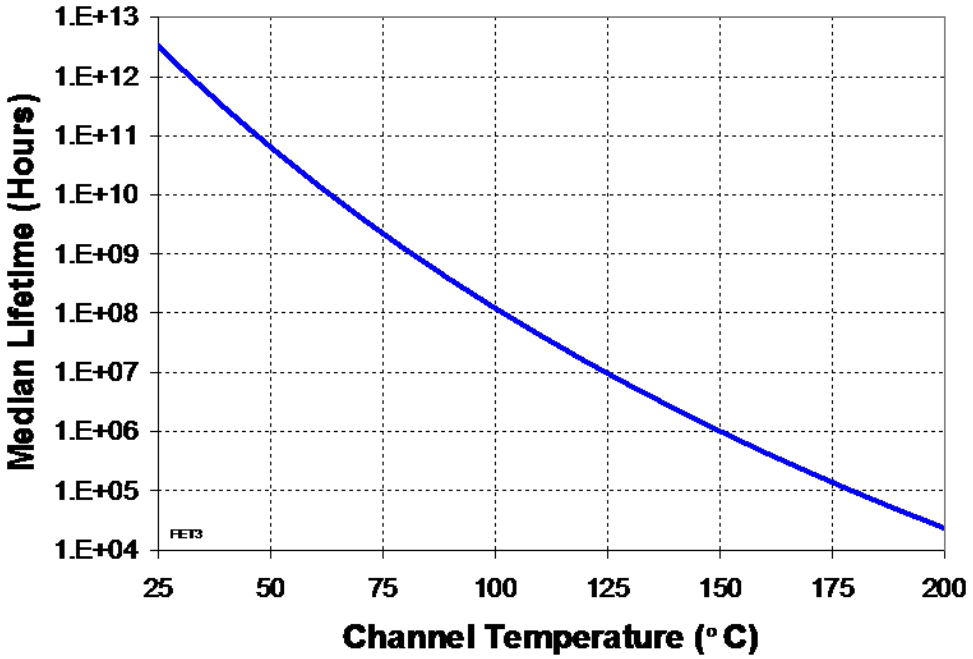
Table IV
Power Dissipation and Thermal Properties

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



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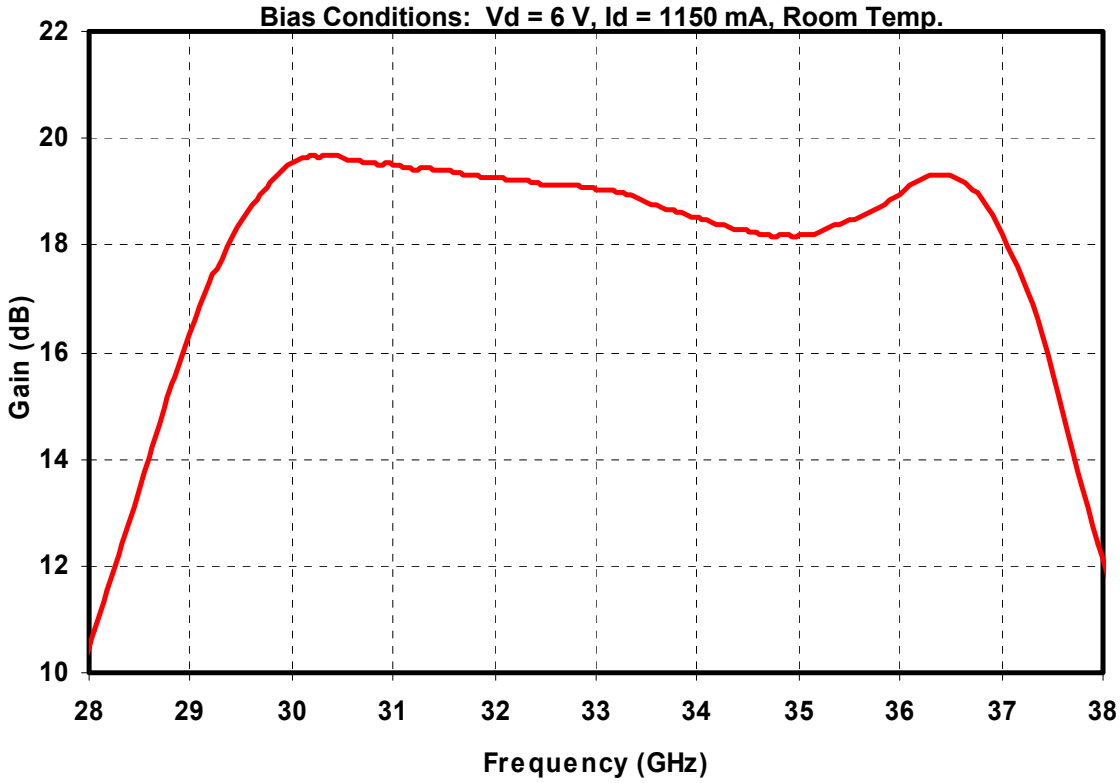
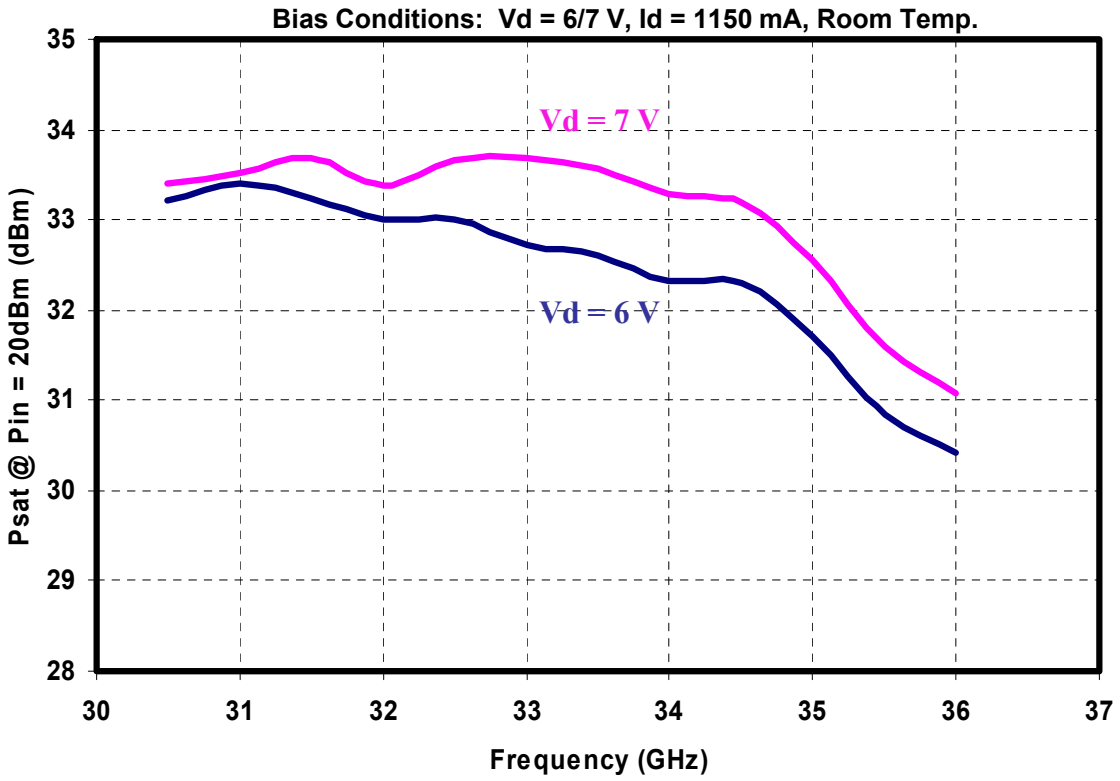
Measured Data





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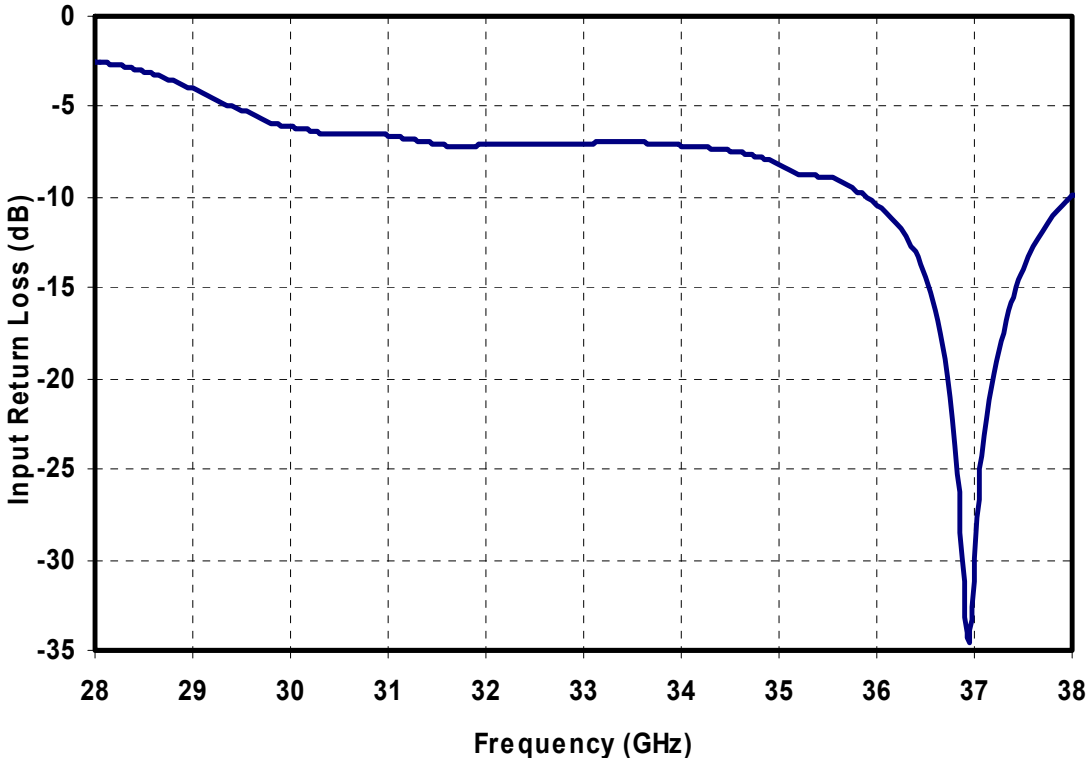
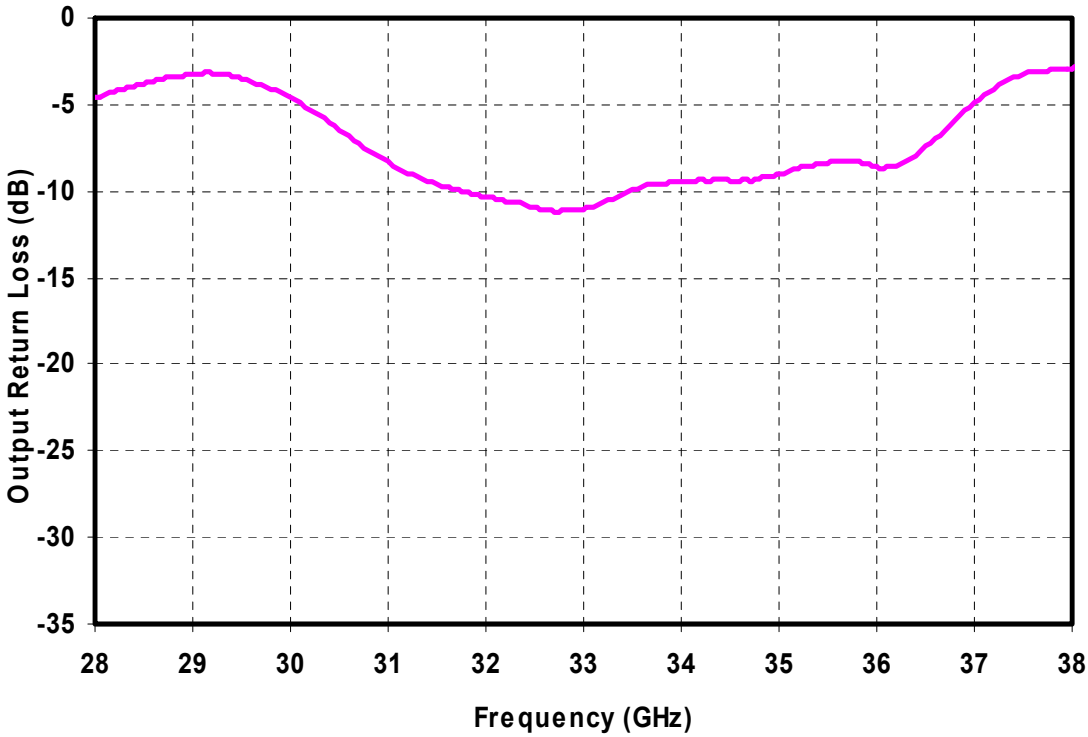
Measured Data

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





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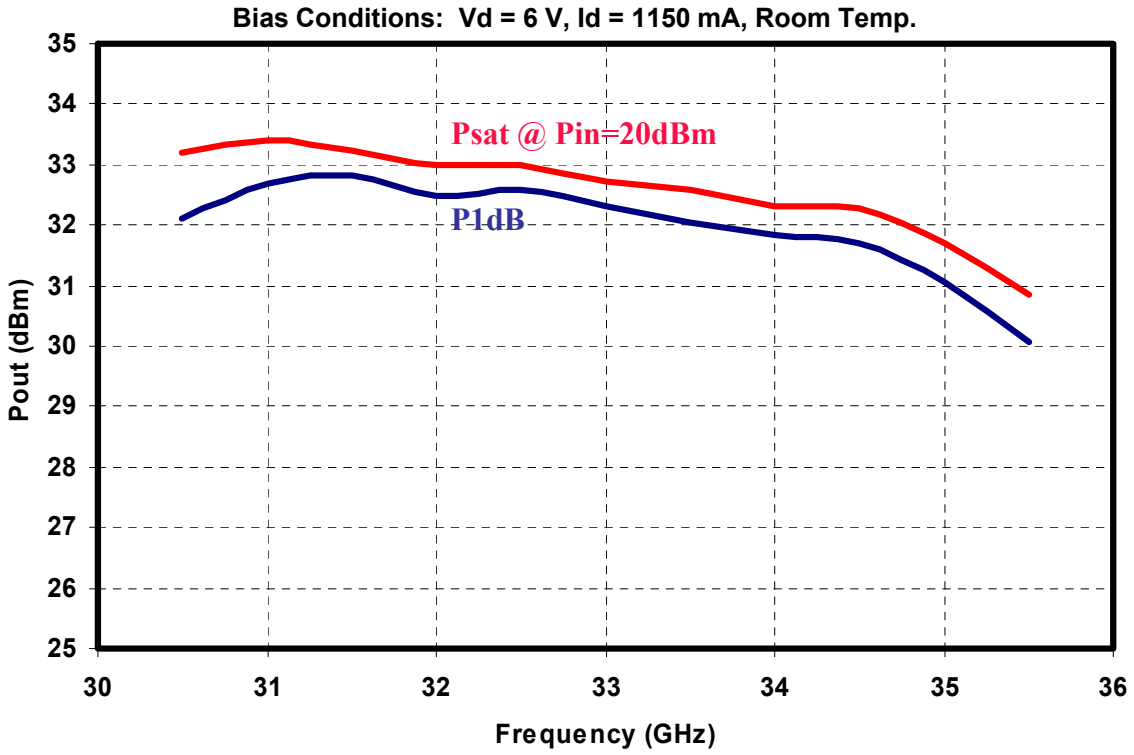
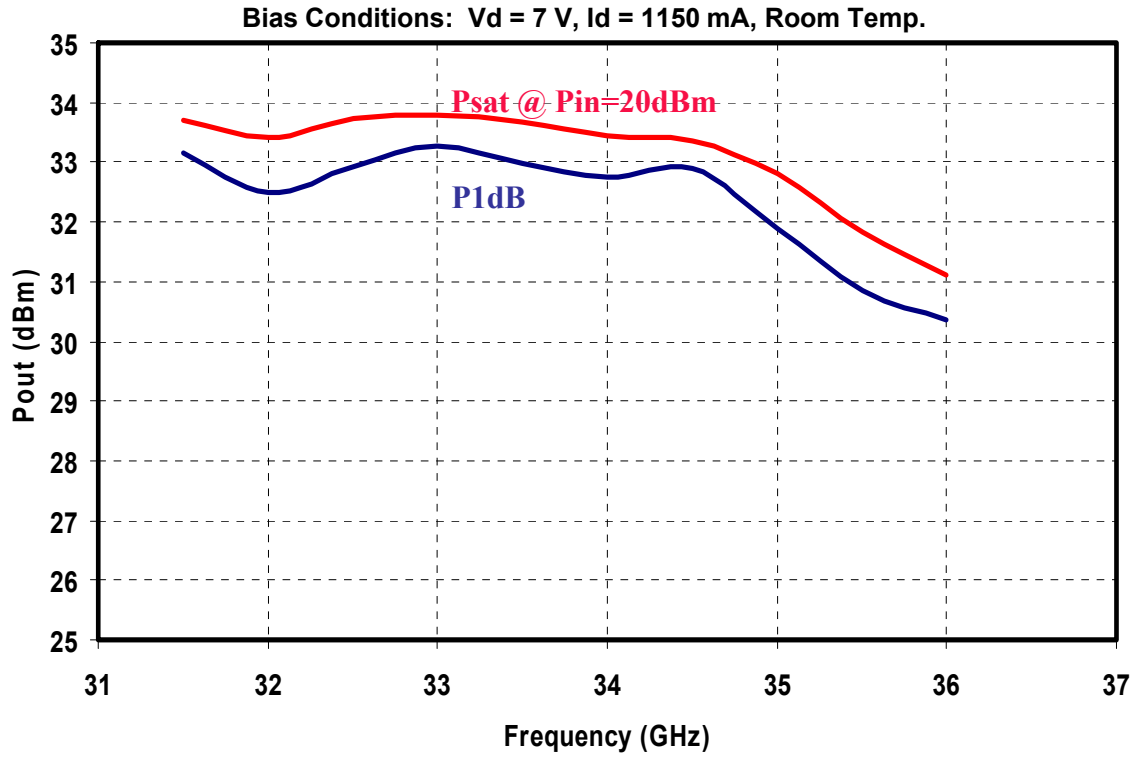
Measured Data





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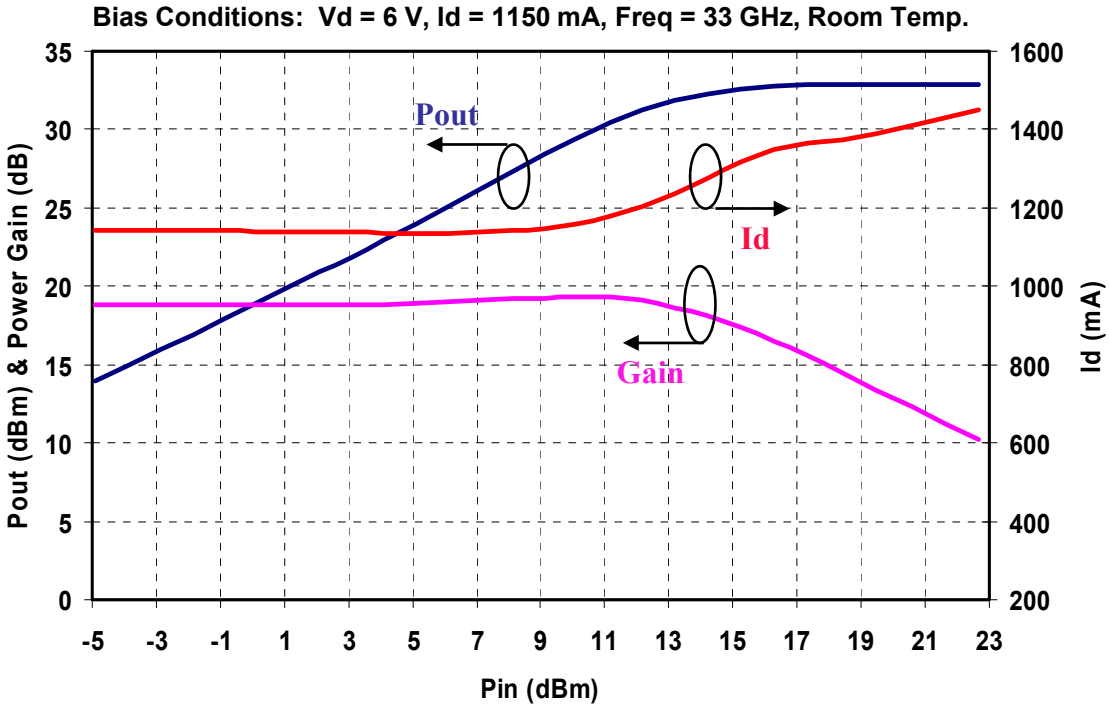
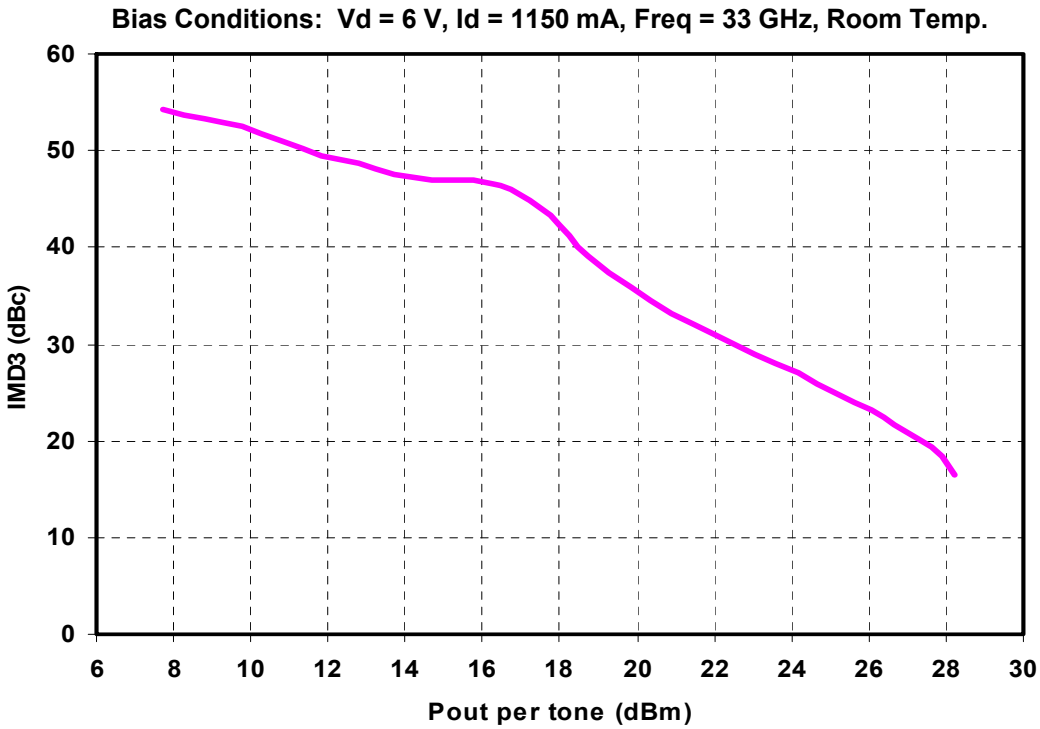
Measured Data





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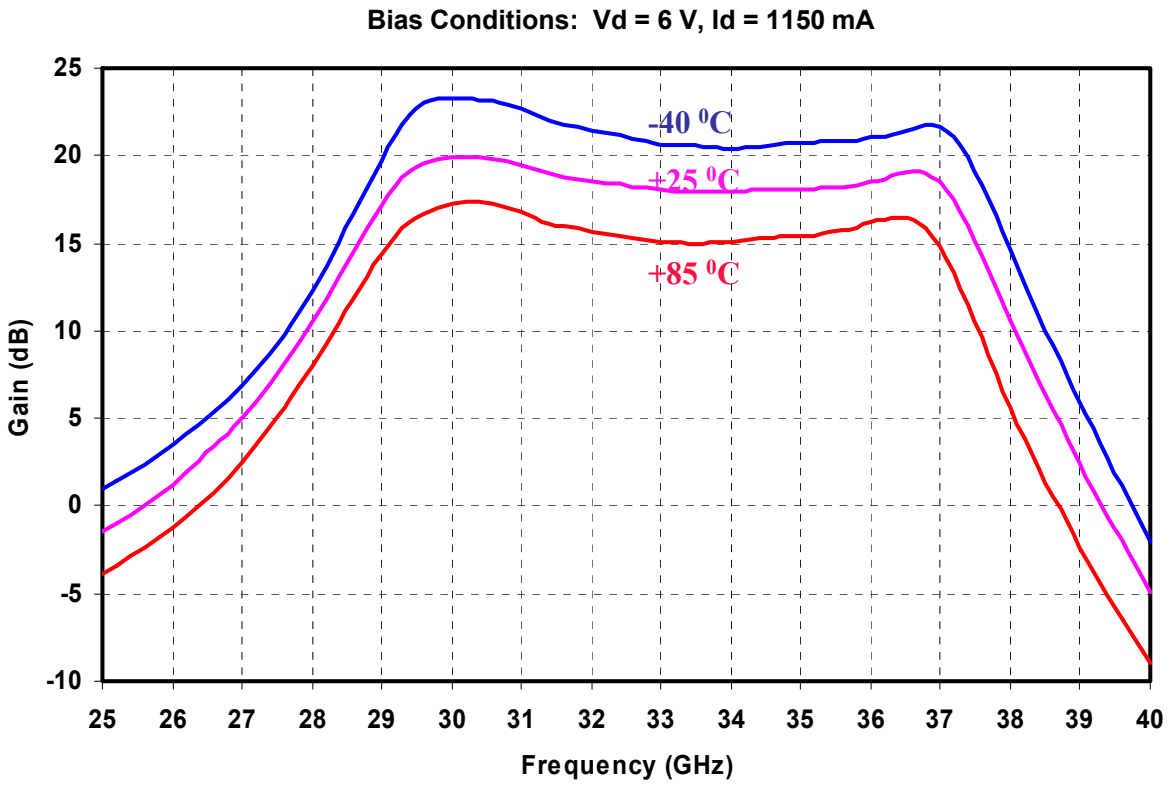

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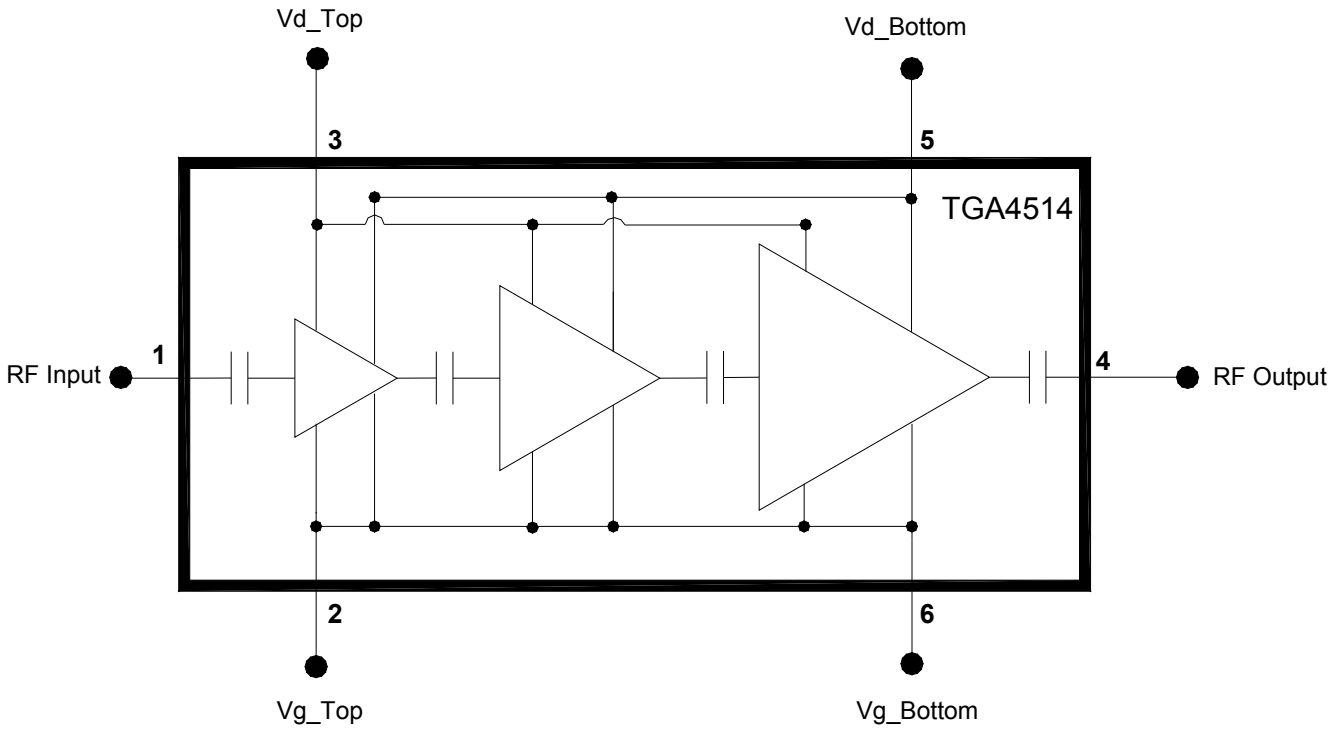
Electrical Schematic



Bias Procedures

Bias-up Procedure

Vg set to -1.5 V

Vd_set to +6 V

Adjust Vg more positive until quiescent Id is 1115 mA.
This will be ~ Vg = -0.45 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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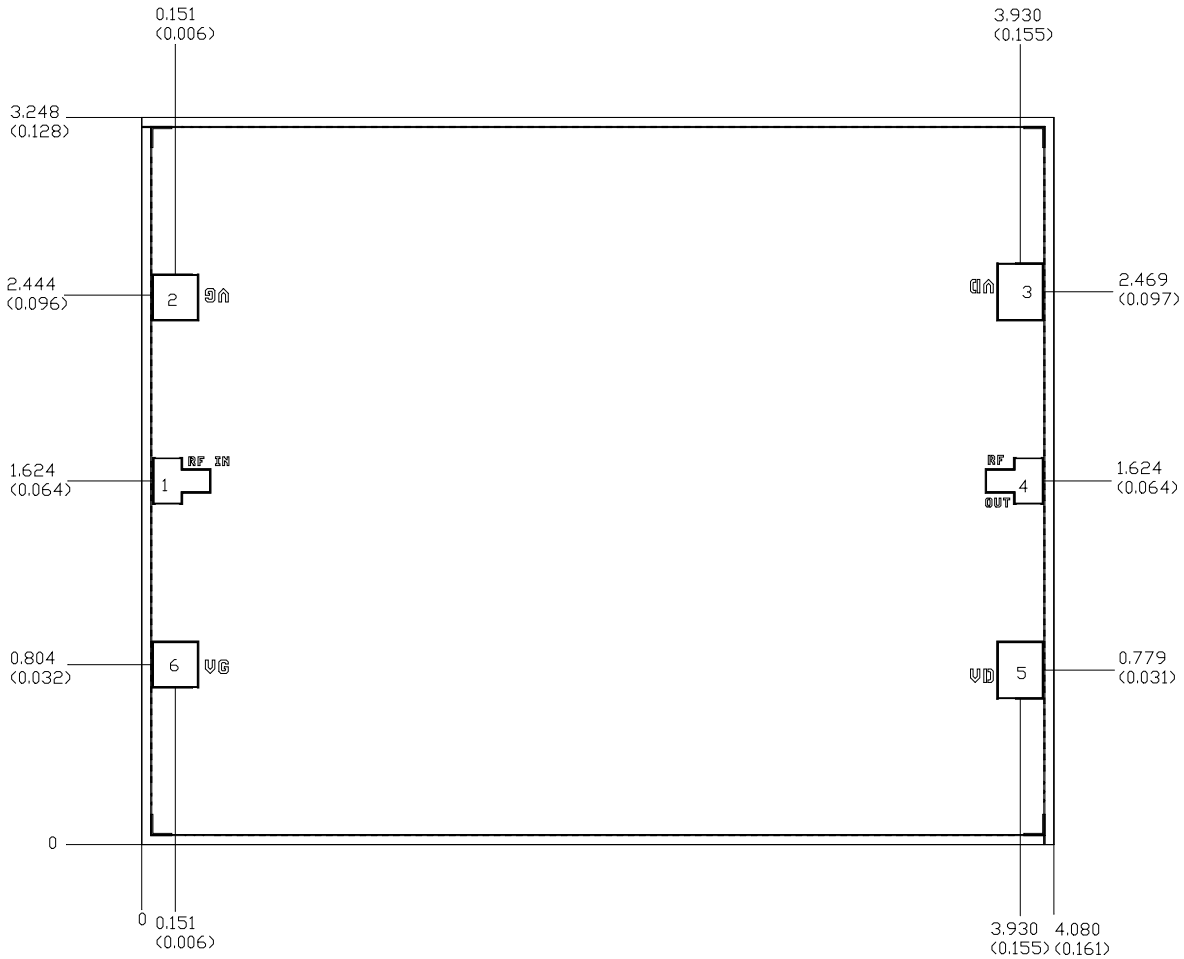
Mechanical Drawing



Units: Millimeters (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 × 0.210 (0.005 × 0.008)
Bond pad #2, #6	(Vg)	0.210 × 0.210 (0.008 × 0.008)
Bond pad #4	(RF Out)	0.135 × 0.210 (0.005 × 0.008)
Bond pad #3, #5	(Vd)	0.210 × 0.260 (0.008 × 0.010)

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

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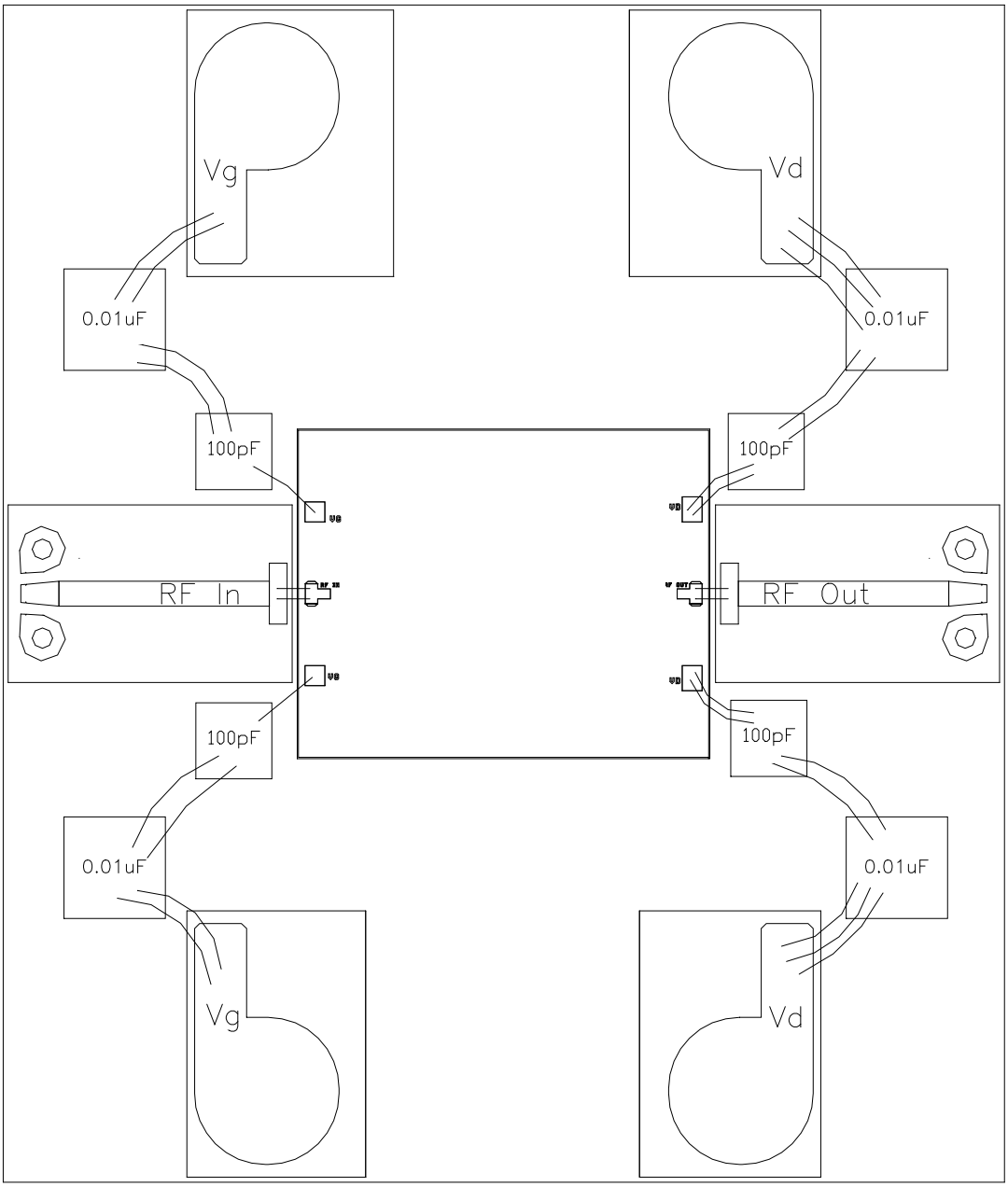
Recommended Assembly Diagram



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

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

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