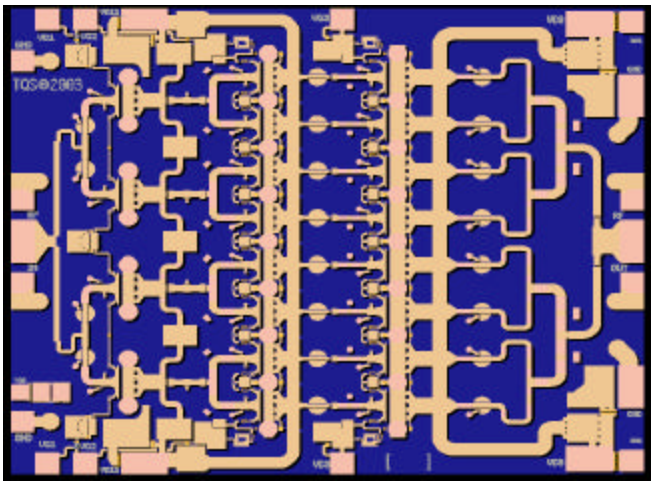
TriQuint SEMICONDUCTOR

Ka-Band 2W Power Amplifier

Advance Product Information
December 2, 2004

TGA4516



Key Features

- 30 - 40 GHz Bandwidth
- > 33 dBm Nominal Psat @ Pin = 20dBm
- 18 dB Nominal Gain
- Bias: 6 V, 1050 mA Idq
  (1.9A under RF Drive)
- 0.15 um 3MI MMW pHEMT Technology
- Chip Dimensions: 2.79 x 2.315 x 0.1 mm
  (0.110 x 0.091 x 0.004) in

Primary Applications

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

Product Description

The TriQuint TGA4516 is a High Power MMIC Amplifier for Ka-band applications. The part is designed using TriQuint's 0.15um power pHEMT process. The small chip size is achieved by utilizing TriQuint's 3 metal layer interconnect (3MI) design technology that allows compaction of the design over competing products.

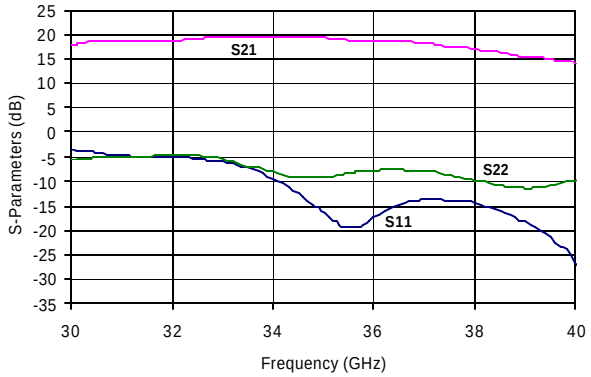
The TGA4516 provides >33 dBm saturated output power, and has typical gain of 18 dB at a bias of 6V and 1050mA (Idq). The current rises to 1.9A under RF drive.

This HPA is ideally suited for many applications such as Military Radar Systems, Ka-band Sat-Com, and Point-to-Point Radios.

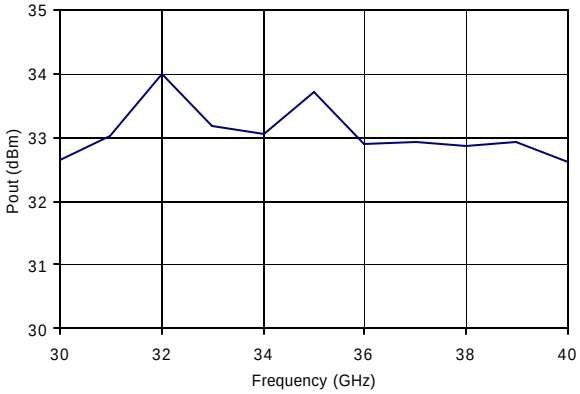
The TGA4516 is 100% DC and RF tested on-wafer to ensure performance compliance.

Preliminary Fixtured Data

V_D = 6V, I_D = 1050mA



Pout @ Pin =20dBm



Note: This Devices 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
V^+	Positive Supply Voltage	8 V	2/
V^-	Negative Supply Voltage Range	-5 TO 0 V	
I^+	Positive Supply Current	3 A	2/ 3/
$\|I_G\|$	Gate Supply Current	85 mA	3/
P_{IN}	Input Continuous Wave Power	267 mW	
P_D	Power Dissipation	7.8 W	2/ 4/
T_{CH}	Operating Channel Temperature	150 ^oC	5/ 6/
T_M	Mounting Temperature (30 Seconds)	320 ^oC	
T_{STG}	Storage Temperature	-65 to 150 ^oC	

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/ Total current for the entire MMIC.

4/ When operated at this bias condition with a base plate temperature of 70 ^oC, the median life is 1E6 hrs.

5/ 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.

6/ These ratings apply to each individual FET.

TABLE II
DC PROBE TESTS
(Ta = 25 °C, Nominal)

SYMBOL	PARAMETER	MIN.	MAX.	UNITS
$I_{DSS,Q1}$	Saturated Drain Current	80	240	mA
$V_{BVGS,Q1}$	Breakdown Voltage Gate-Source	-18	-8	V
$V_{BVGD,Q1-Q6}$	Breakdown Voltage Gate-Drain	-18	-11	V
$V_{P,Q1-Q6}$	Pinch_off Voltage	-1.5	-0.5	V

Q1- Q4 are 400 um FETs, Q5 is 2560 um FET, Q6 is 4160 um FET

TABLE III
ELECTRICAL CHARACTERISTICS
(Ta = 25 °C, Nominal)

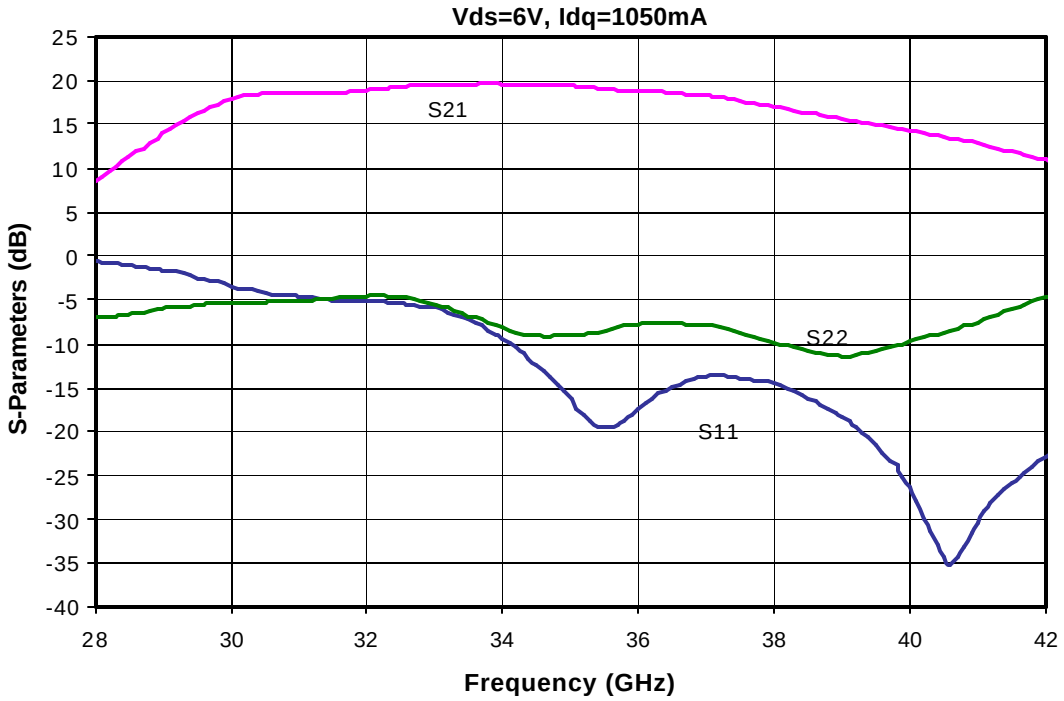
PARAMETER	TYPICAL	UNITS
Drain Operating	6	V
Quiescent Current	1050	mA
Frequency Range	30 - 40	GHz
Small Signal Gain, S21	18	dB
Input Return Loss, S11	10	dB
Output Return Loss, S22	7	dB
Power @ saturated, Psat	33	dBm

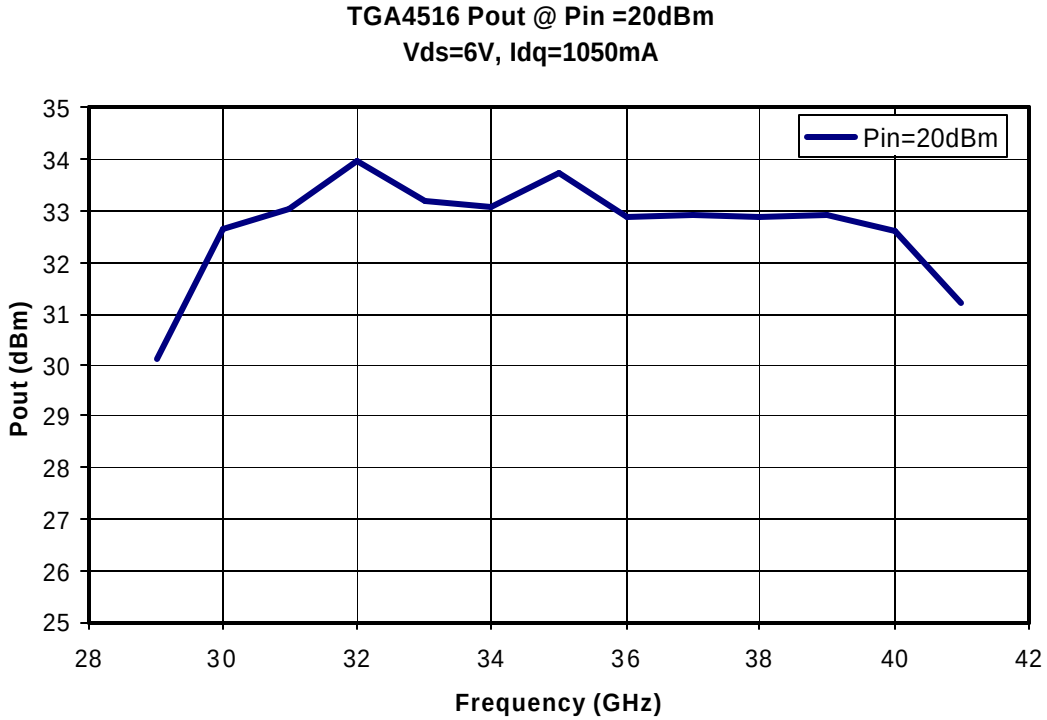
TABLE IV
THERMAL INFORMATION

Parameter	Test Conditions	T_{ch} (°C)	$R_{\theta JC}$ (°C/W)	T_M (HRS)
$R_{\theta JC}$ Thermal Resistance (channel to backside of carrier)	Vd = 6 V Id = 1700 mA Freq = 35 GHz Pdiss = 7.8 W	150	10.2	1E+6

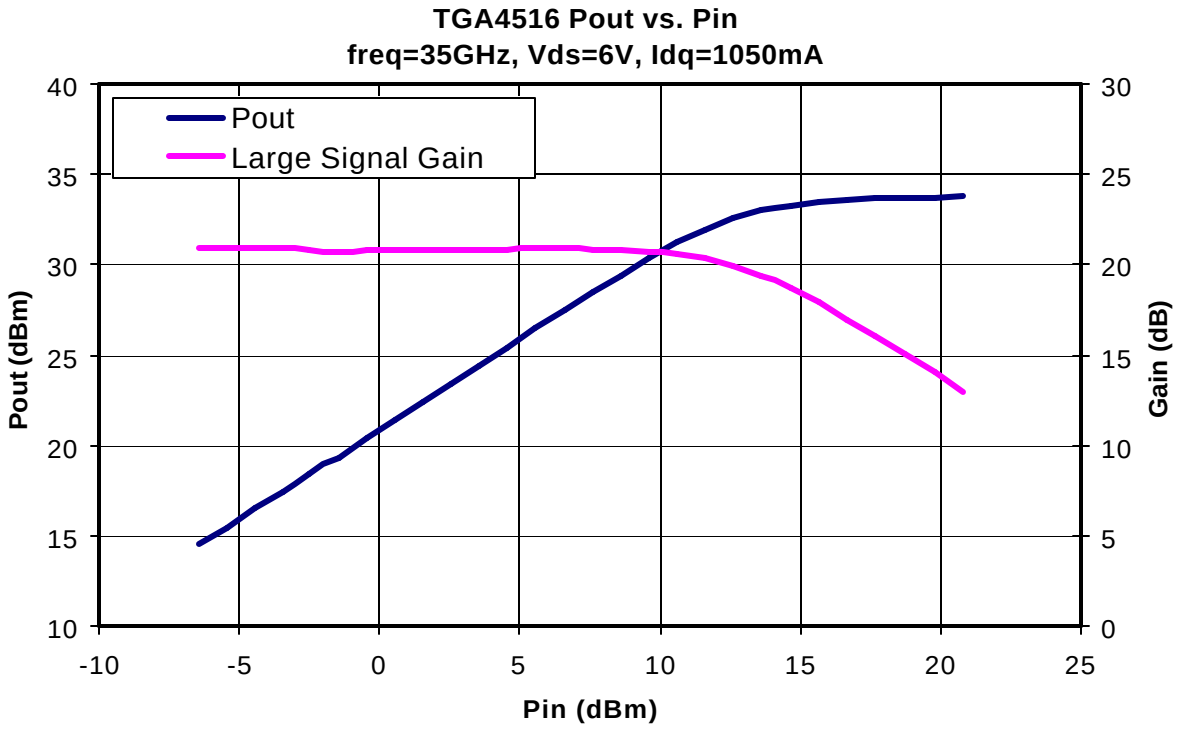
Note: Assumes eutectic attach using 1.5 mil 80/20 AuSn mounted to a 20 mil CuMo Carrier at 70°C baseplate temperature. Worst case is at saturated output power when DC power consumption rises to 10.6 W with 2.3 W RF power delivered to load. Power dissipated is 8.2 W and the temperature rise in the channel is 84 °C. Baseplate temperature must be reduced to 66 °C to remain below the 150 °C maximum channel temperature.

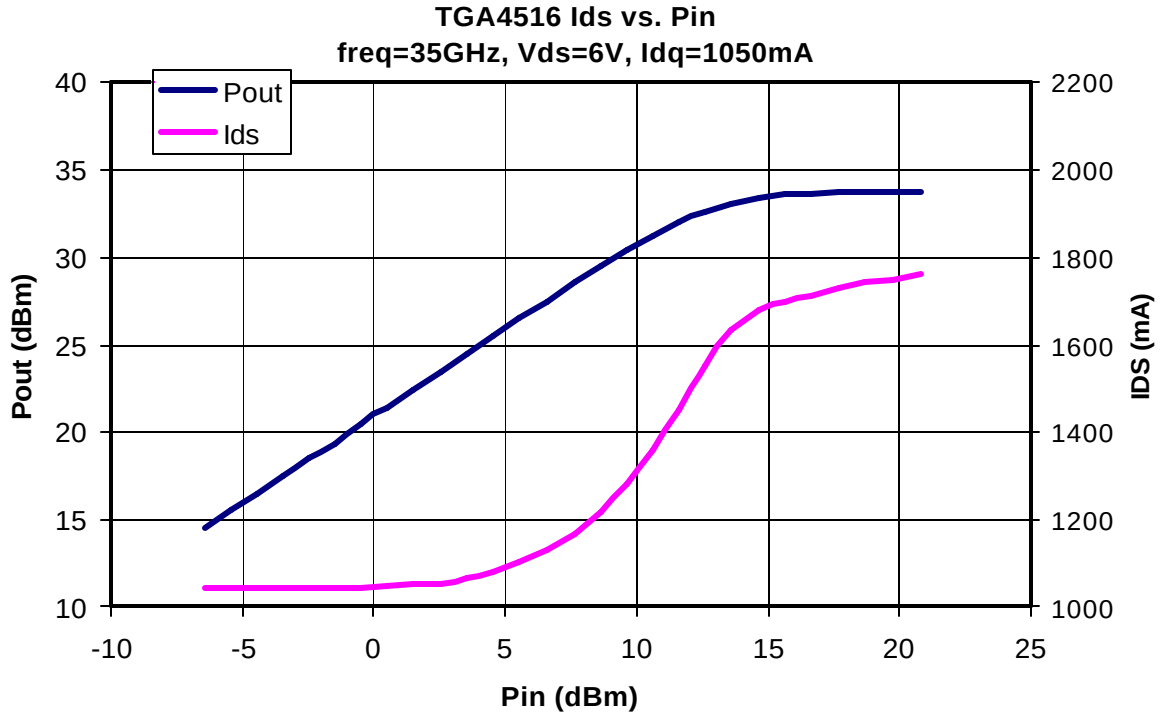
Fixtured Performance



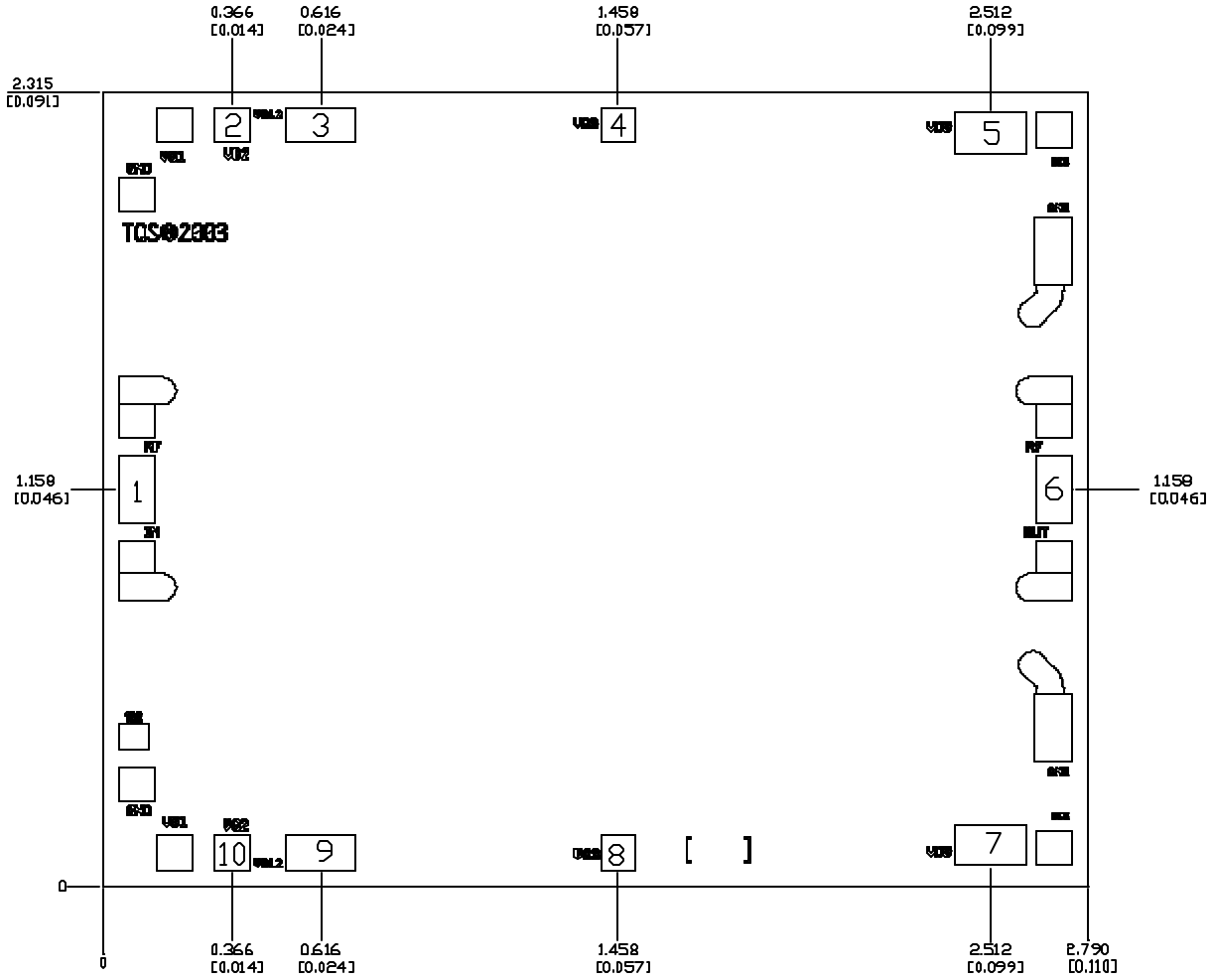


Fixtured Performance





Mechanical Drawing

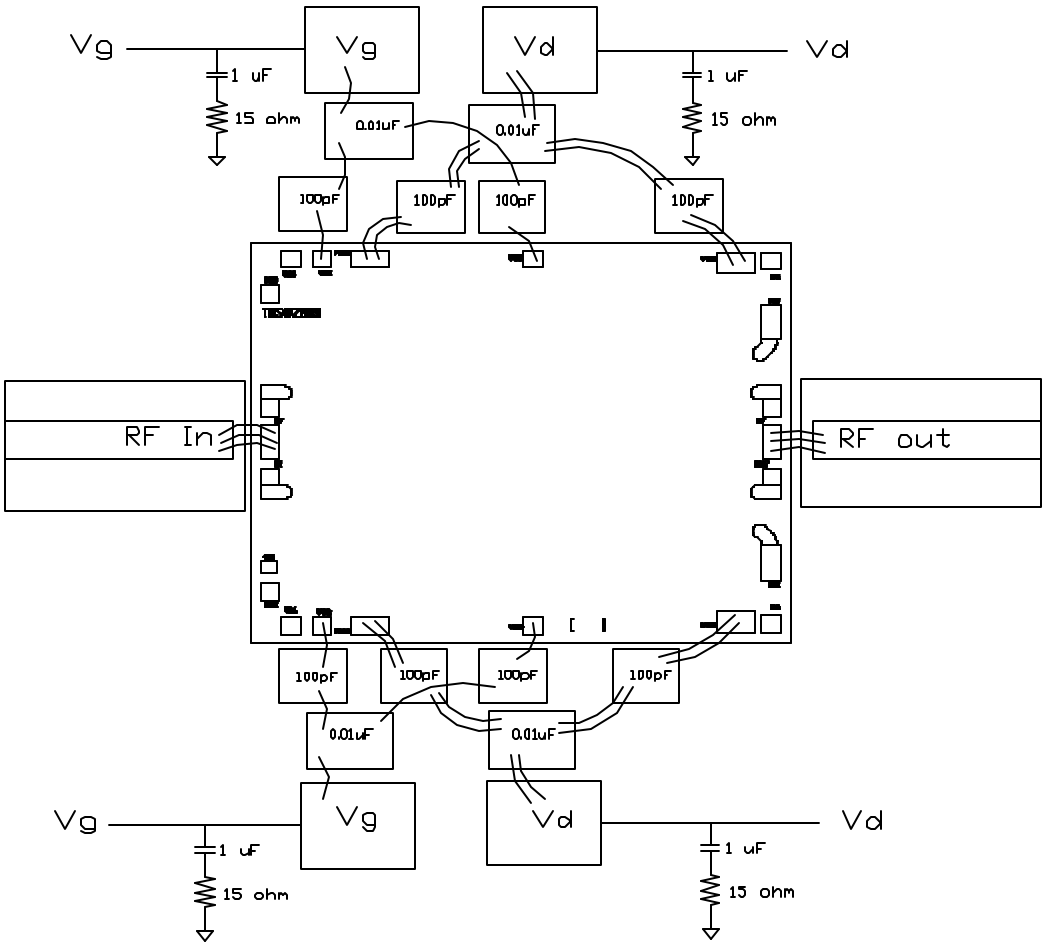


Units: Millimeters [inches]
Thickness: 0.100 [0.004] (reference only)
Chip edge to bond pad dimensions are shown to center of bond pad
Chipsize: 2.79 x 2.315 [0.110 x 0.091] +/- 0.51 [0.002]
RF Ground is backside of MMIC

Bond pad #1	**(RF Input)**	**0.100 x 0.200 [0.004 x 0.008]**
Bond pad #2	**(Vg2)**	**0.100 x 0.100 [0.004 x 0.004]**
Bond pad #3	**(Vd12)**	**0.100 x 0.200 [0.004 x 0.008]**
Bond pad #4	**(Vg3)**	**0.100 x 0.100 [0.004 x 0.004]**
Bond pad #5	**(Vd3)**	**0.100 x 0.100 [0.004 x 0.004]**
Bond pad #6	**(RF Output)**	**0.100 x 0.200 [0.004 x 0.008]**
Bond pad #7	**(Vd3)**	**0.100 x 0.200 [0.004 x 0.008]**
Bond pad #8	**(Vg3)**	**0.100 x 0.100 [0.004 x 0.004]**
Bond pad #9	**(Vd12)**	**0.100 x 0.200 [0.004 x 0.008]**
Bond pad #10	**(Vg2)**	**0.100 x 0.100 [0.004 x 0.004]**

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

Chip Assembly Diagram



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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°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°C.

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