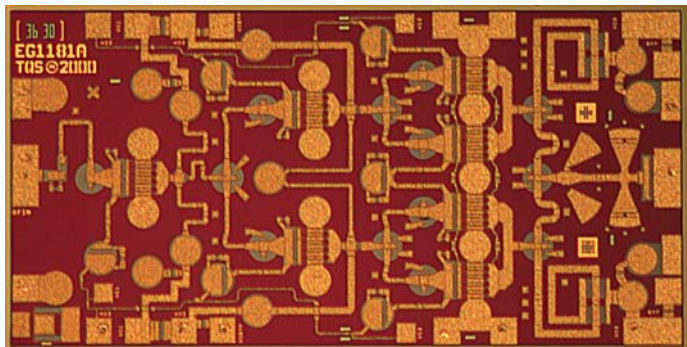


*TriQuint Recommends the TGA4509-EPU be used for New Designs*

## 27 - 32 GHz 1W Power Amplifier

## TGA1172-SCC



Chip Dimensions 2.7 mm x 1.4 mm x 0.1mm

### Product Description

The TriQuint TGA1172-SCC is a three stage HPA MMIC design using TriQuint's proven 0.25 um Power pHEMT process. The TGA1172 is designed to support a variety of millimeter wave applications including point-to-point digital radio and LMDS/LMCS and Ka band satellite ground terminals.

The three stage design consists of a 600um input stage driving a 2 x 600um interstage followed by a 4 x 600um output stage.

The TGA1172 provides 29 dBm nominal output power at 1dB compression across 27-32GHz. Typical small signal gain is 16 dB with typical Input/Output Return Loss of <-10dB.

The TGA1172 requires minimum off-chip components. Each device is 100% DC and RF tested on-wafer to ensure performance compliance. The device is available in chip form.

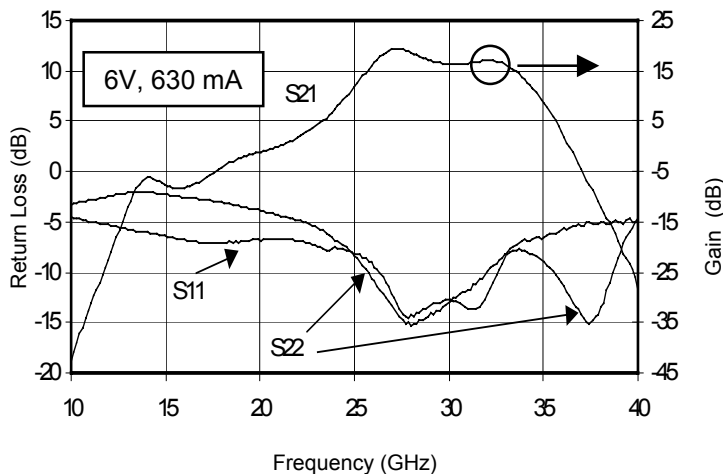
### Key Features

- 0.25 um pHEMT Technology
- 16 dB Nominal Gain
- 29 dBm Nominal P1dB
- 36dBm OTOI typical at 28GHz
- Nominal Input/Output RL < -10 dB
- Bias 6 - 7V @ 630 mA

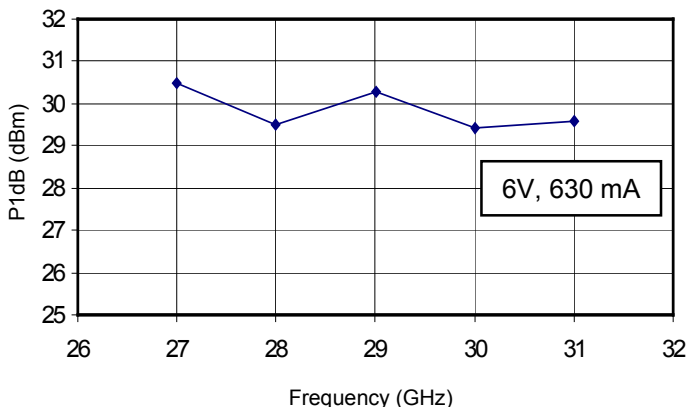
### Primary Applications

- Point-to-Point Radio
- Point-to-Multipoint Communications
- Ka Band Sat-Com

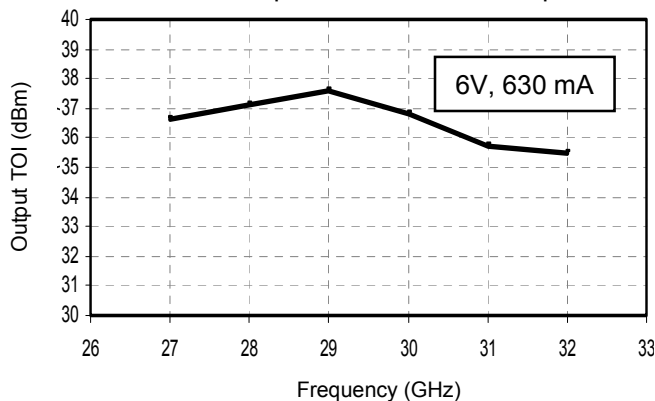
Wideband Small Signal Gain



Output Power at P1dB



Output Third Order Intercept



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TABLE I

MAXIMUM RATINGS

**TGA1172-SCC**

SYMBOL	PARAMETER 4/	VALUE	NOTES
V <sup>+</sup>	POSITIVE SUPPLY VOLTAGE	8 V	
I <sup>+</sup>	POSITIVE SUPPLY CURRENT	840 mA	1/
I <sup>-</sup>	NEGATIVE SUPPLY CURRENT	35.2 mA	1/
P <sub>IN</sub>	INPUT CONTINUOUS WAVE POWER	23 dBm	
P <sub>D</sub>	POWER DISSIPATION	5.0 W	
T <sub>CH</sub>	OPERATING CHANNEL TEMPERATURE	150 °C	2/ 3/
T <sub>M</sub>	MOUNTING TEMPERATURE (30 SECONDS)	320 °C	
T <sub>STG</sub>	STORAGE TEMPERATURE	-65 to 150 °C	

- 1/ Total current for all stages.
- 2/ These ratings apply to each individual FET.
- 3/ Junction operating temperature will directly affect the device median time to failure (T<sub>M</sub>). For maximum life, it is recommended that junction temperatures be maintained at the lowest possible levels.
- 4/ These ratings represent the maximum operable values for the device.

TABLE II  
DC SPECIFICATIONS (100%)  
(T<sub>A</sub> = 25 °C Nominal)

NOTES	SYMBOL	TEST CONDITIONS 2/	LIMITS		UNITS
			MIN	MAX	
	I <sub>DSS1</sub>	STD	60	282	mA
	G <sub>M1</sub>	STD	132	318	mS
1/	V <sub>P1</sub>	STD	0.5	1.5	V
1/	V <sub>P2-3</sub>	STD	0.5	1.5	V
1/	V <sub>P4-7</sub>	STD	0.5	1.5	V
1/	V <sub>BVGD1</sub>	STD	13	30	V
1/	V <sub>BVGD2-3</sub>	STD	13	30	V
1/	V <sub>BVGD4-7</sub>	STD	13	30	V
1/	V <sub>BVGS1</sub>	STD	13	30	V
1/	V <sub>BVGS2-3</sub>	STD	13	30	V
1/	V <sub>BVGS4-7</sub>	STD	13	30	V

- 1/ V<sub>P</sub>, V<sub>BVGD</sub>, and V<sub>BVGS</sub> are negative.
- 2/ The measurement conditions are subject to change at the manufacture's discretion (with appropriate notification to the buyer).

TABLE IV  
RF SPECIFICATIONS  
(T<sub>A</sub> = 25°C Nominal)

NOTE	TEST	MEASUREMENT CONDITIONS 6V @ 630mA	VALUE			UNITS
			MIN	TYP	MAX	
	SMALL-SIGNAL GAIN MAGNITUDE	27 – 32 GHz	13	16		dB
	POWER OUTPUT AT 1 dB GAIN COMPRESSION	28 – 32 GHz	27	29		dBm
	INPUT RETURN LOSS MAGNITUDE	27 – 32 GHz		10		dB
	OUTPUT RETURN LOSS MAGNITUDE	27 – 32 GHz		10		dB
	OUTPUT THIRD ORDER INTERCEPT	28 GHz		36		dBm

TABLE V  
RELIABILITY DATA

PARAMETER	BIAS CONDITIONS		P <sub>DISS</sub> (W)	R <sub>θJC</sub> (C/W)	T <sub>CH</sub> (°C)	T <sub>M</sub> (HRS)
	V <sub>D</sub> (V)	I <sub>D</sub> (mA)				
R <sub>θJC</sub> Thermal resistance (channel to backside of carrier plate)	6	630	3.78	21.35	135.7	3.5E6

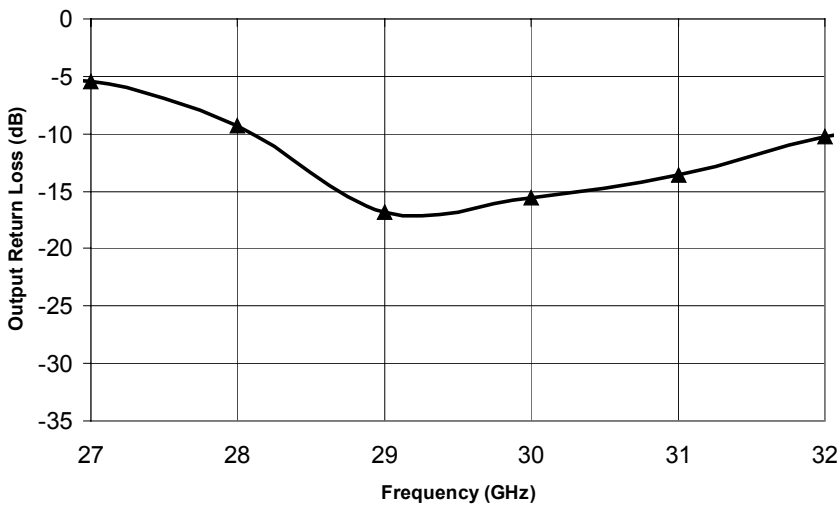
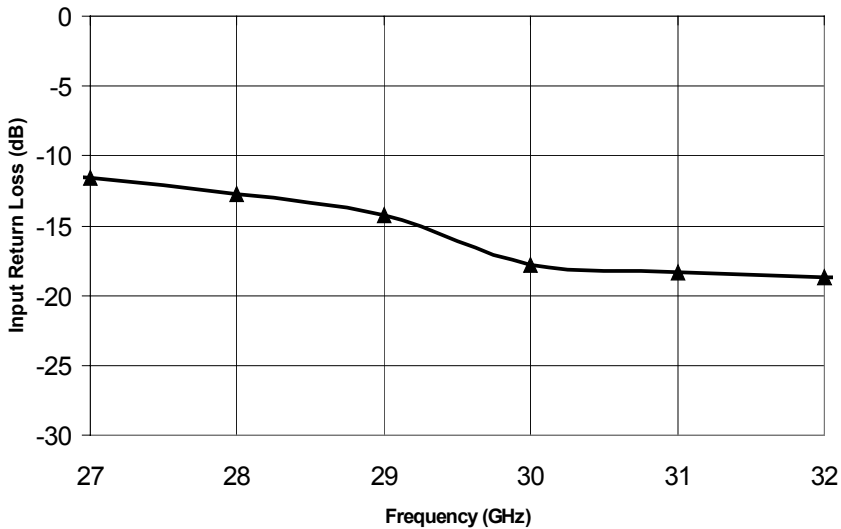
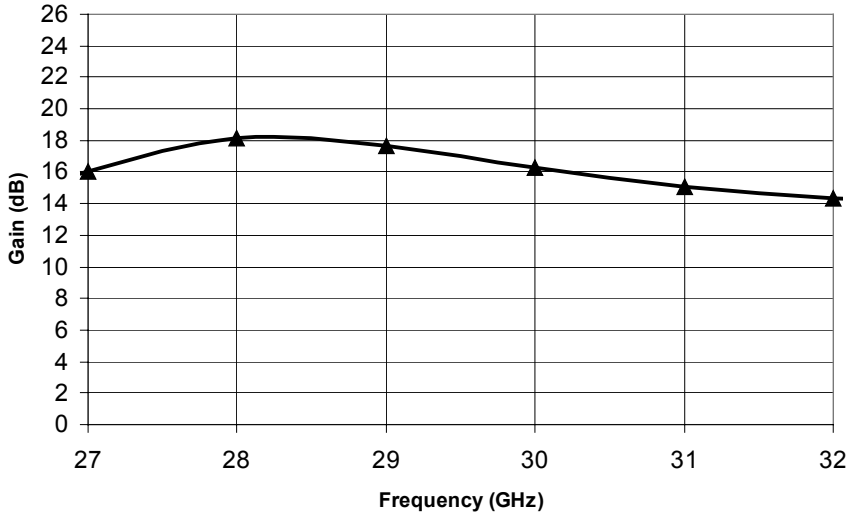
Note: Assumes eutectic attach using 1.5 mil 80/20 AuSn mounted to a 20 mil CuMo Carrier at 55°C baseplate temperature. Worst case condition with no RF applied, 100% of DC power is dissipated.

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**TGA1172 Average On-Wafer Small Signal S-Parameters**

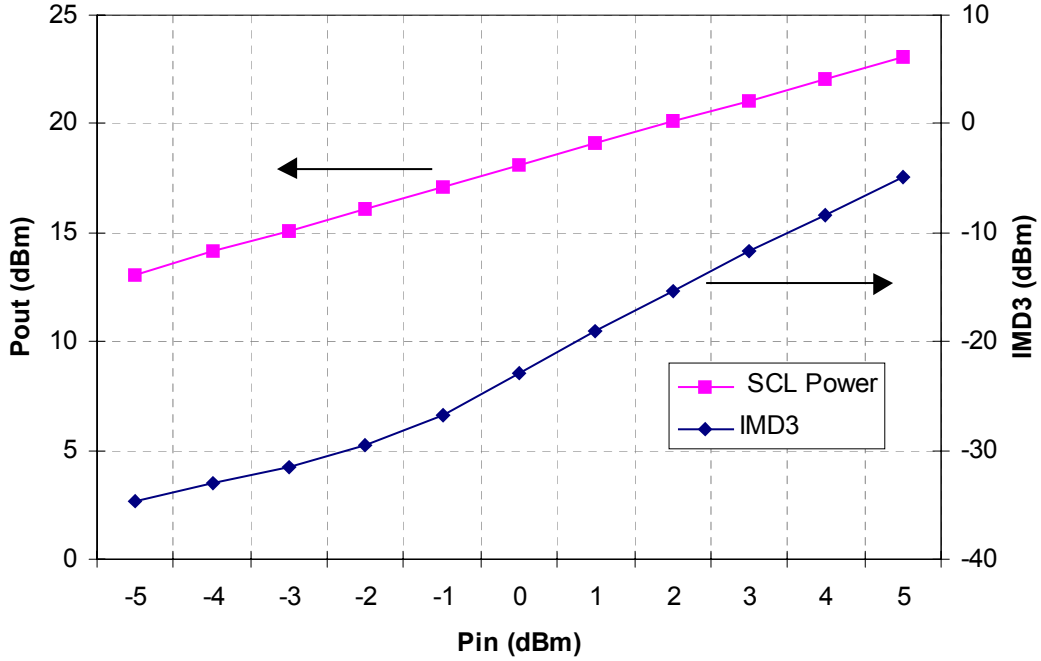
Sample Size = 23K devices

**TGA1172-SCC**



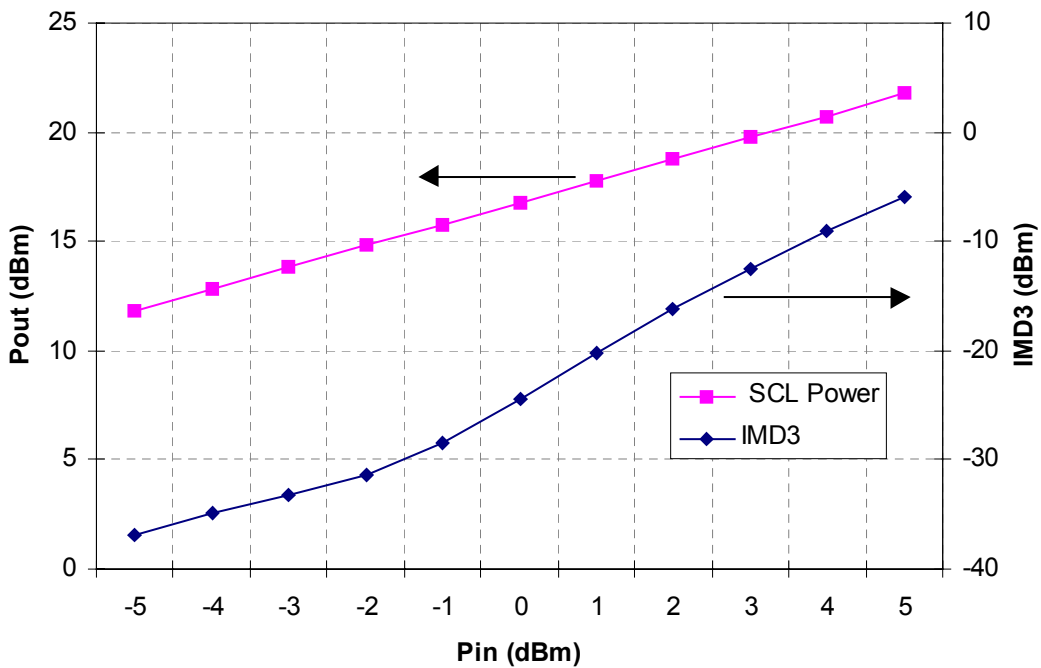
**TGA1172 Single tone pout and IMD3 vs Pin**

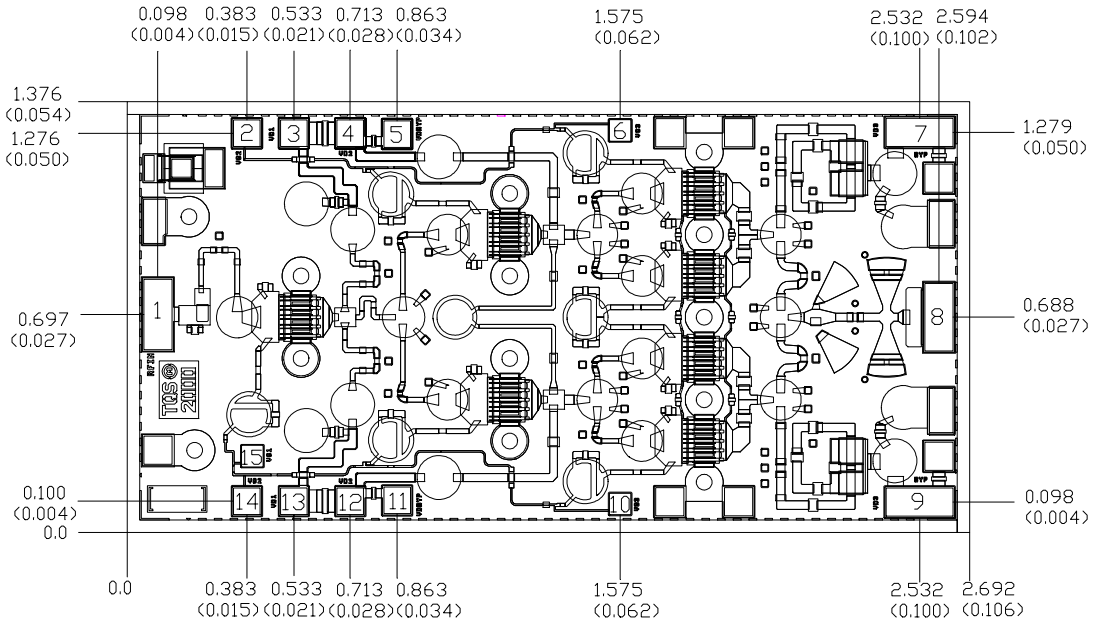
Frequency = 28GHz, 6V, 630 mA



**TGA1172 Single tone pout and IMD3 vs Pin**

Frequency = 31GHz, 6V, 630 mA





Units: millimeters (inches)

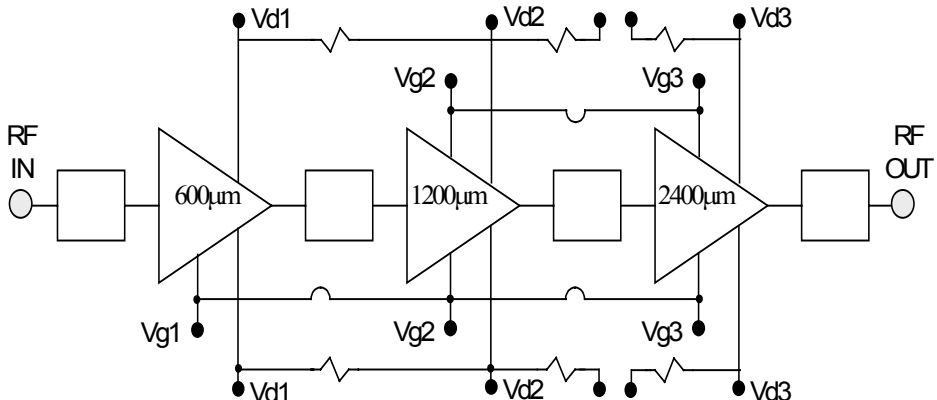
Thickness: 0.1016 (0.004)

Chip edge to bond pad dimensions are shown to center of bond pad

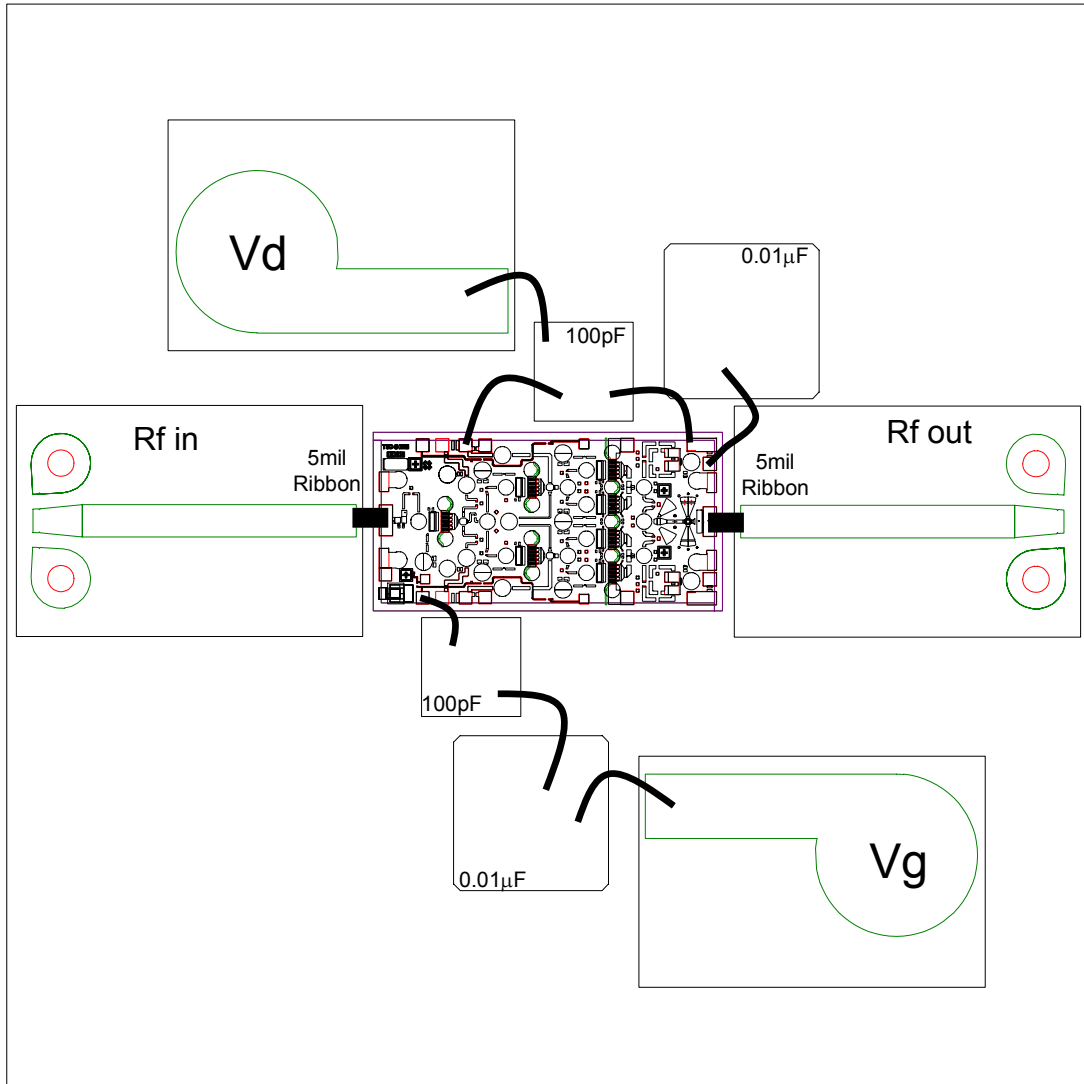
Chip size tolerance: +/- 0.051 (0.002)

Bond Pad #1 (RF Input)	0.105 × 0.240 (0.004 × 0.009)
Bond Pad #2,#14 (VG2)	0.100 × 0.100 (0.004 × 0.004)
Bond Pad #3,#13 (VD1)	0.100 × 0.100 (0.004 × 0.004)
Bond Pad #4,#12 (VD2)	0.100 × 0.100 (0.004 × 0.004)
Bond Pad #5,#11 (VDBYP)	0.100 × 0.100 (0.004 × 0.004)
Bond Pad #6,#10 (VG3)	0.075 × 0.075 (0.003 × 0.003)
Bond Pad #7,#9 (VD3)	0.105 × 0.228 (0.004 × 0.009)
Bond Pad #8 (RF Output)	0.100 × 0.225 (0.004 × 0.009)
Bond Pad #15 (VG1)	0.075 × 0.075 (0.003 × 0.003)

### Mechanical Drawing



### Amplifier Topology



Chip Assembly and Bonding Diagram

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

## Assembly Process Notes

### Reflow process assembly notes:

- Use AuSn (80/20) solder with limited exposure to temperatures at or above 300°C.
- 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.
- Discrete FET devices with small pad sizes should be bonded with 0.0007-inch wire.
- Maximum stage temperature is 200°C.