Not Recommended for New Designs

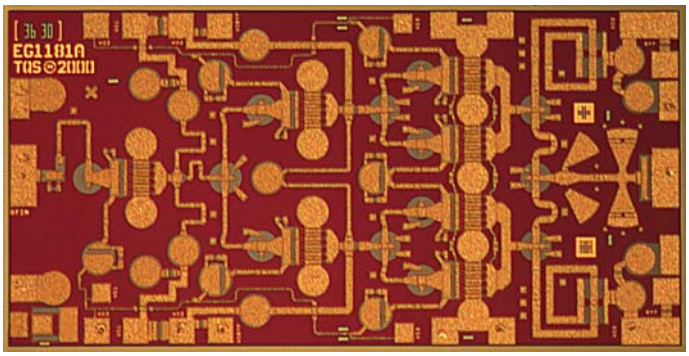
TriQuint SEMICONDUCTOR

Product Datasheet

September 26, 2002

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

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

Product Description

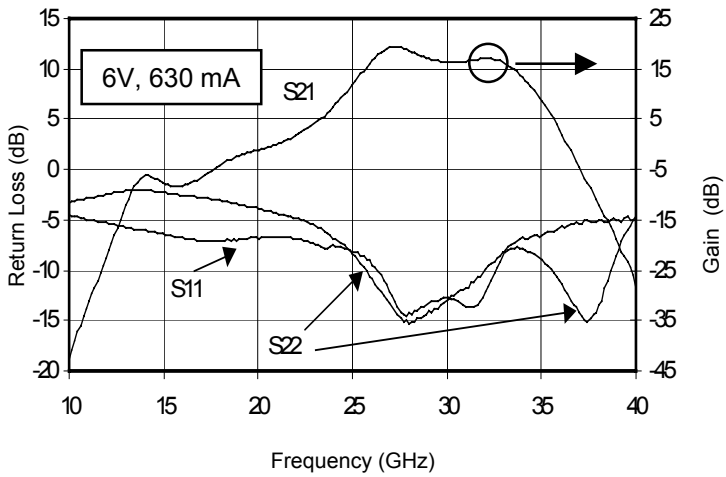
The TriQuint TGA1172-SCC is a three stage HPA MMIC design using TriQuint's proven 0.25 um Power pHEMT process. The TGA1172 is designed to support a variety of millimeter wave applications including point-to-point digital radio and LMDS/LMCS and Ka band satellite ground terminals.

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

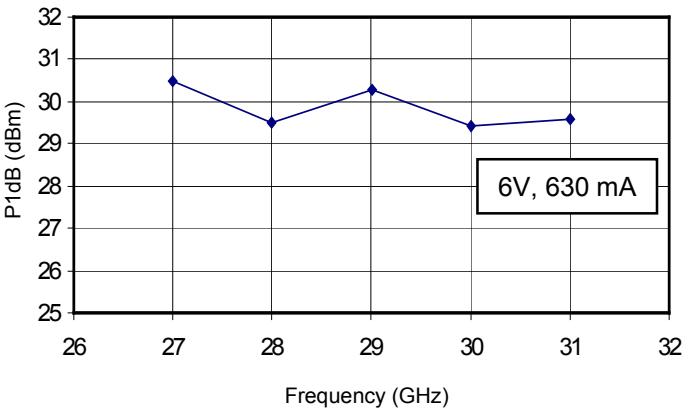
The TGA1172 provides 29 dBm nominal output power at 1dB compression across 27-32GHz. Typical small signal gain is 16 dB with typical Input/Output Return Loss of <-10dB.

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.

Wideband Small Signal Gain



Output Power at P1dB



Output Third Order Intercept

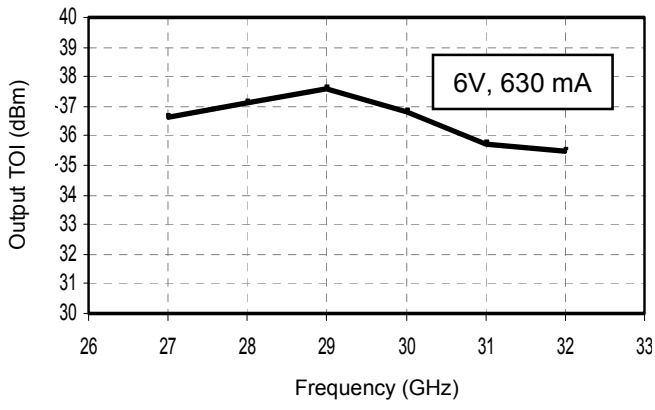


TABLE I
MAXIMUM RATINGS

SYMBOL	PARAMETER 4/	VALUE	NOTES
V^+	POSITIVE SUPPLY VOLTAGE	8 V	
I^+	POSITIVE SUPPLY CURRENT	840 mA	1/
I^-	NEGATIVE SUPPLY CURRENT	35.2 mA	1/
P_{IN}	INPUT CONTINUOUS WAVE POWER	23 dBm	
P_D	POWER DISSIPATION	5.0 W	
T_{CH}	OPERATING CHANNEL TEMPERATURE	150 ^{0}C	2/ 3/
T_M	MOUNTING TEMPERATURE (30 SECONDS)	320 ^{0}C	
T_{STG}	STORAGE TEMPERATURE	-65 to 150 ^{0}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_M). 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_A = 25 °C Nominal)

NOTES	SYMBOL	TEST CONDITIONS 2/	LIMITS		UNITS
			MIN	MAX	
	I_{DSS1}	STD	60	282	mA
	G_{M1}	STD	132	318	mS
1/	$\|V_{P1}\|$	STD	0.5	1.5	V
1/	$\|V_{P2-3}\|$	STD	0.5	1.5	V
1/	$\|V_{P4-7}\|$	STD	0.5	1.5	V
1/	$\|V_{BVGD1}\|$	STD	13	30	V
1/	$\|V_{BVGD2-3}\|$	STD	13	30	V
1/	$\|V_{BVGD4-7}\|$	STD	13	30	V
1/	$\|V_{BVGS1}\|$	STD	13	30	V
1/	$\|V_{BVGS2-3}\|$	STD	13	30	V
1/	$\|V_{BVGS4-7}\|$	STD	13	30	V

1/ V_P, V_{BVGD}, and V_{BVGS} 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_A = 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

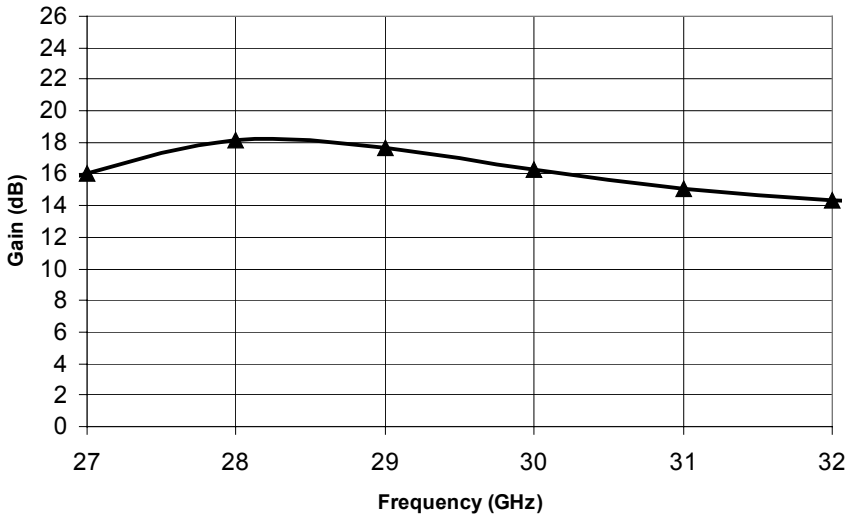
TABLE V
RELIABILITY DATA

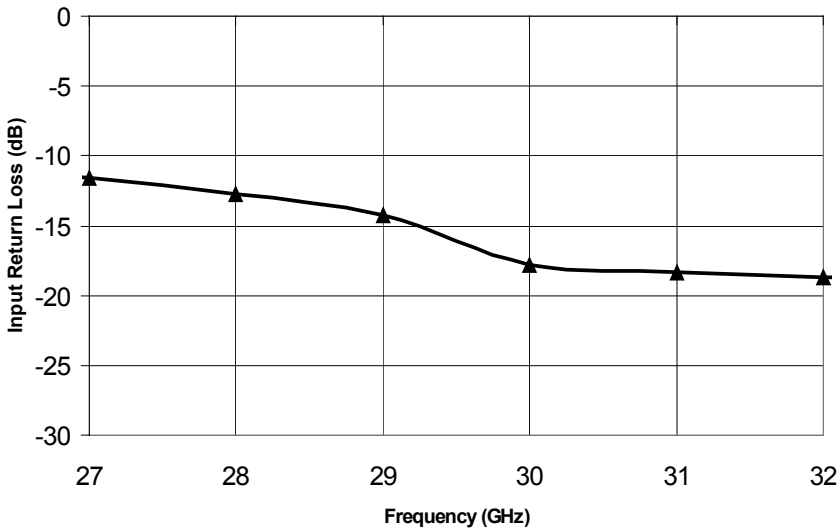
PARAMETER	BIAS CONDITIONS		P_{DISS} (W)	$R_{\theta JC}$ (C/W)	T_{CH} (°C)	T_M (HRS)
	V_D (V)	I_D (mA)				
$R_{\theta JC}$ Thermal resistance (channel to backside of carrier plate)	6	630	3.78	21.35	135.7	3.5E6

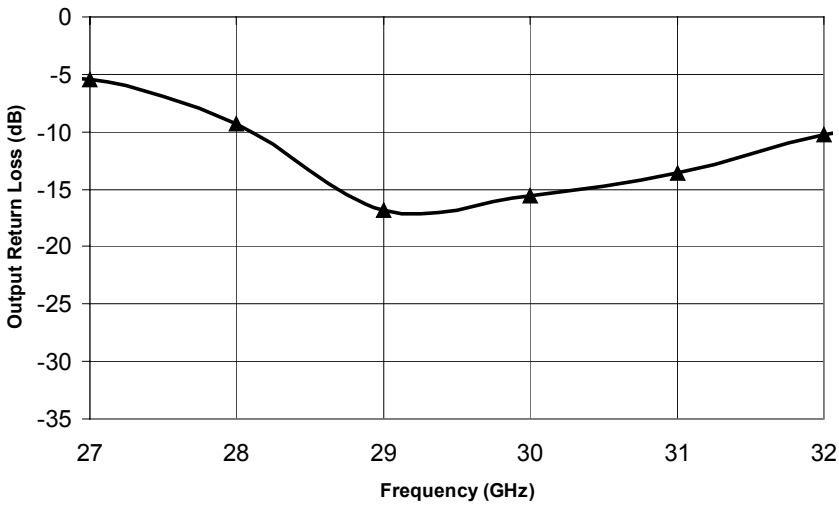
Note: Assumes eutectic attach using 1.5 mil 80/20 AuSn mounted to a 20 mil CuMo Carrier at 55°C baseplate temperature. Worst case condition with no RF applied, 100% of DC power is dissipated.

TGA1172 Average On-Wafer Small Signal S-Parmeters

Sample Size = 23K devices **TGA1172-SCC**

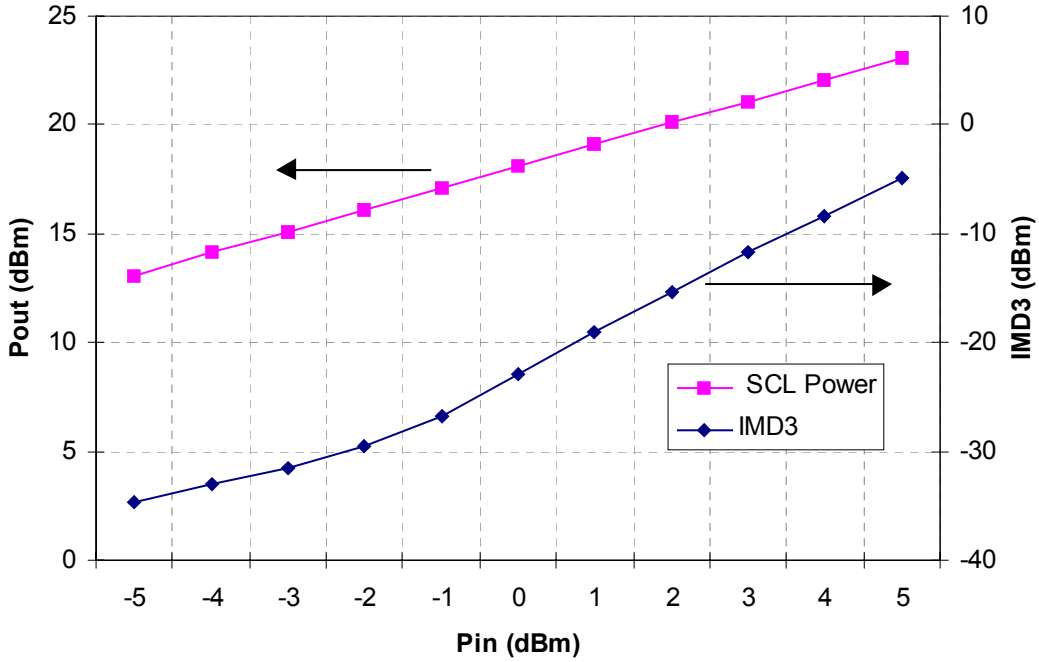






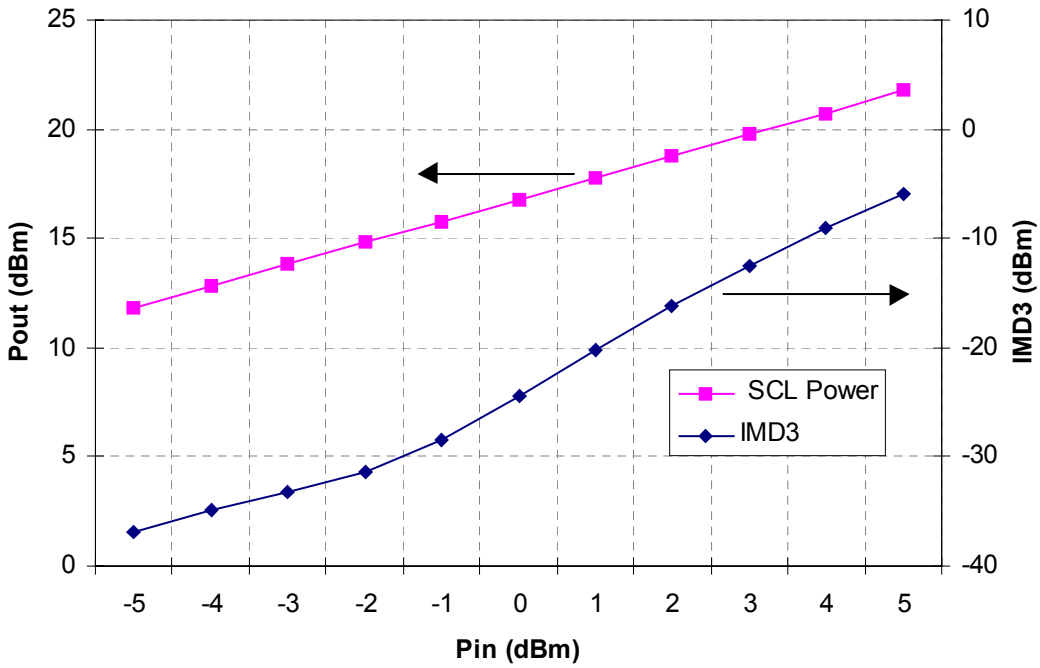
TGA1172 Single tone pout and IMD3 vs Pin

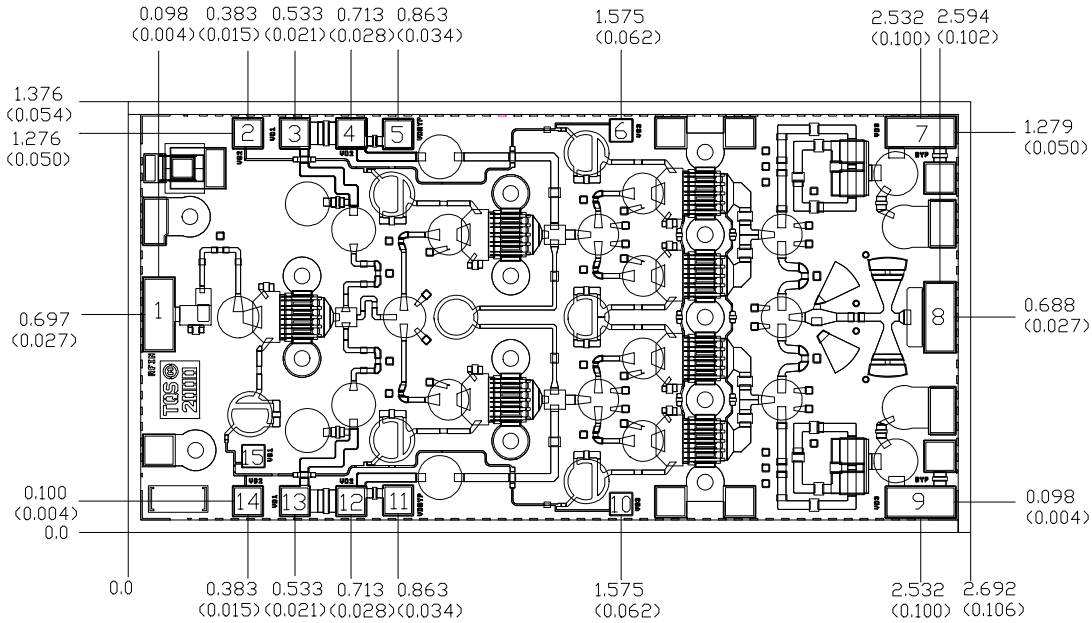
Frequency = 28GHz, 6V, 630 mA



TGA1172 Single tone pout and IMD3 vs Pin

Frequency = 31GHz, 6V, 630 mA

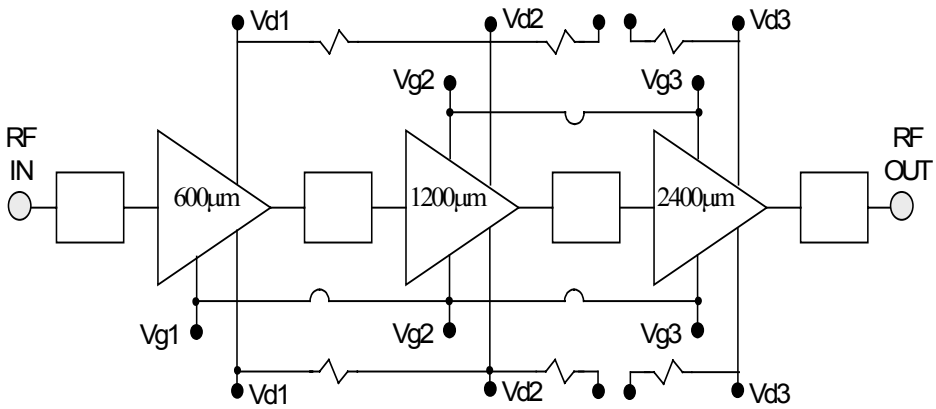




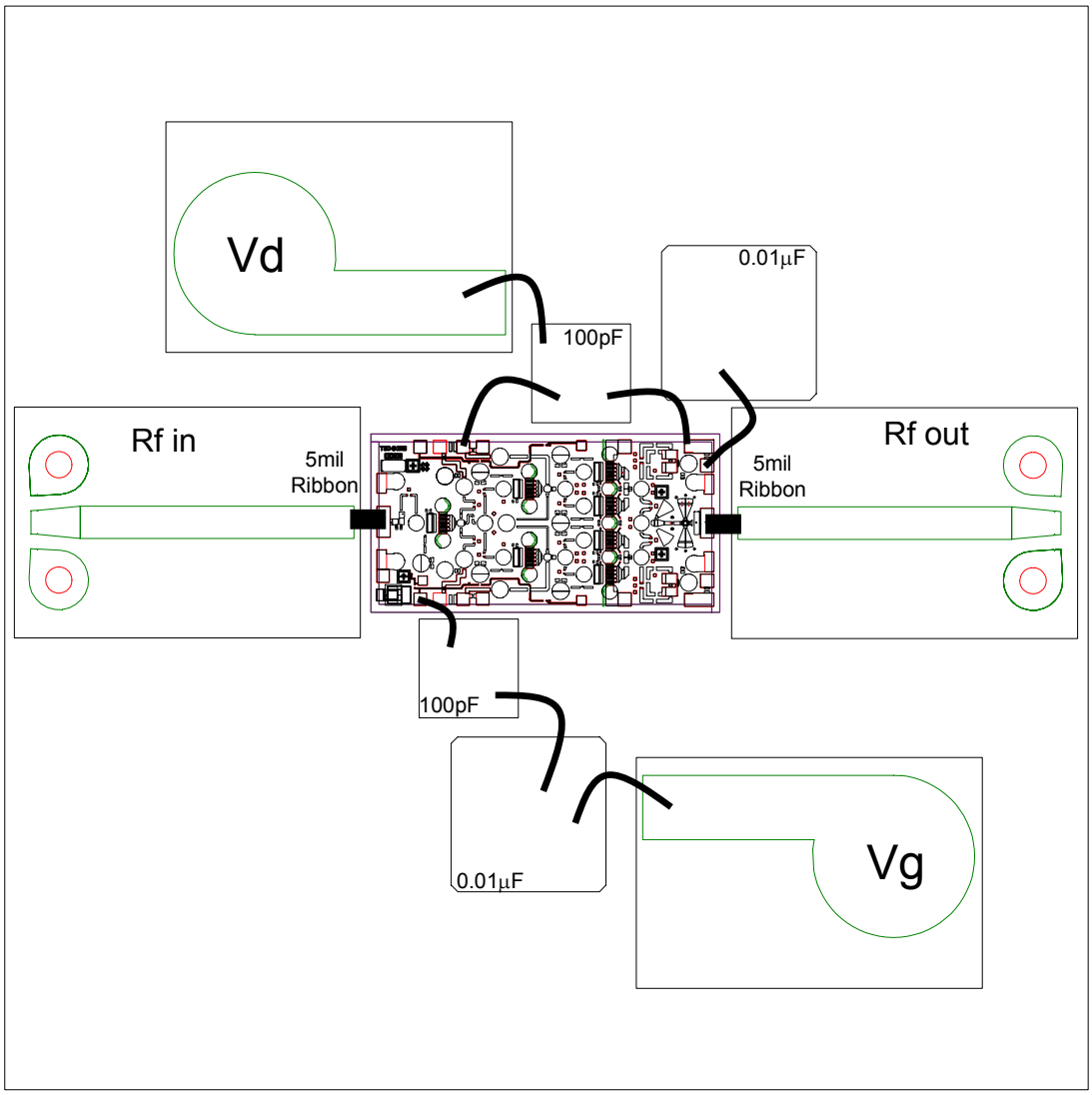
Units: millimeters (inches)
Thickness: 0.1016 (0.004)
Chip edge to bond pad dimensions are shown to center of bond pad
Chip size tolerance: +/- 0.051 (0.002)

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