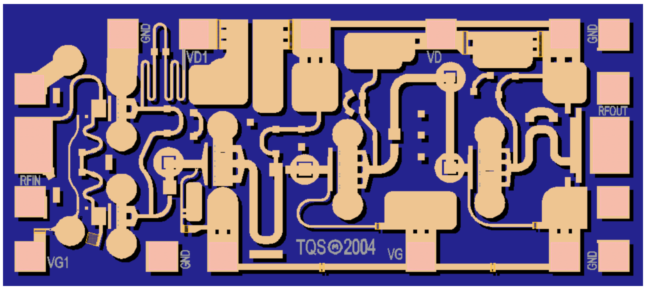
TriQuint SEMICONDUCTOR

TGA4040

17 - 43 GHz MPA / Multiplier



Key Features

- Frequency: 17 - 43 GHz
- 25 dB Nominal Gain @ Mid-band
- 22 dBm Nominal Output P1dB
- 2x and 3x Multiplier Function
- 0.15 um 3MI pHEMT Technology
- Chip Dimensions 1.72 x 0.76 x 0.10 mm (0.068 x 0.030 x 0.004 in)

Primary Applications

- Point-to-point radio
- EW
- Instrumentation
- Frequency Multiplier

Product Description

The TriQuint TG4040 is a Medium Power Amplifier and Multiplier for a wide band of 17 – 43GHz applications. The part is designed using TriQuint's 0.15um power pHEMT production process.

The TGA4040 provides a nominal 25 dB small signal gain with 22 dBm output power @ 1 dB gain compression. For 2x and 3x Multiplier Function, TGA4040 provides 15 dBm typical of Output Power @ 9 dBm Pin.

The part is ideally suited for applications such as Point-to-Point Radio, EW, Instrumentation and frequency multipliers.

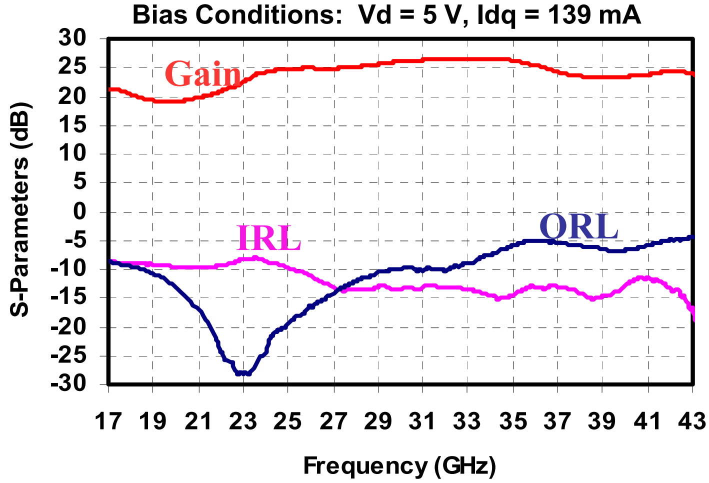
The TGA4040 is 100% DC and RF tested on-wafer to ensure performance compliance.

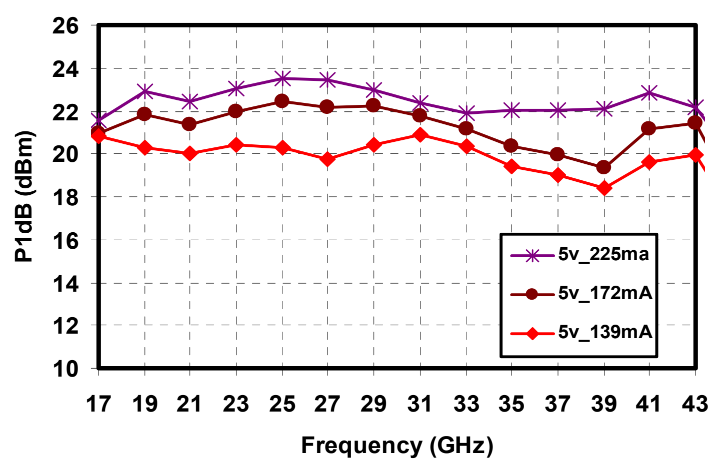
The TGA4040 has a protective surface passivation layer providing environmental robustness.

Lead-Free & RoHS compliant.

Amplifier Performance

Bias Conditions: Vd = 5 V, Idq = 139 mA





Datasheet subject to change without notice

TABLE I
MAXIMUM RATINGS 1/

SYMBOL	PARAMETER	VALUE	NOTES
Vd	Drain Voltage	6 V	2/
Vg	Gate Voltage Range	-2 TO 0 V	
Id	Drain Current	TBD	2/ 3/
$\|Ig\|$	Gate Current	7 mA	3/
P_{IN}	Input Continuous Wave Power	20 dBm	
P_D	Power Dissipation	1.95 W	2/ 4/
T_{CH}	Operating Channel Temperature	200 °C	5/
	Mounting Temperature (30 Seconds)	320 °C	
T_{STG}	Storage Temperature	-65 to 150 °C	

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 power dissipation with a base plate temperature of 70 °C, the median life is 7.3E3 hours.

5/ Junction operating temperature will directly affect the device median time to failure (Tm). For maximum life, it is recommended that junction temperatures be maintained at the lowest possible levels.

TABLE II
ELECTRICAL CHARACTERISTICS
(Ta = 25 ^{0}C Nominal)

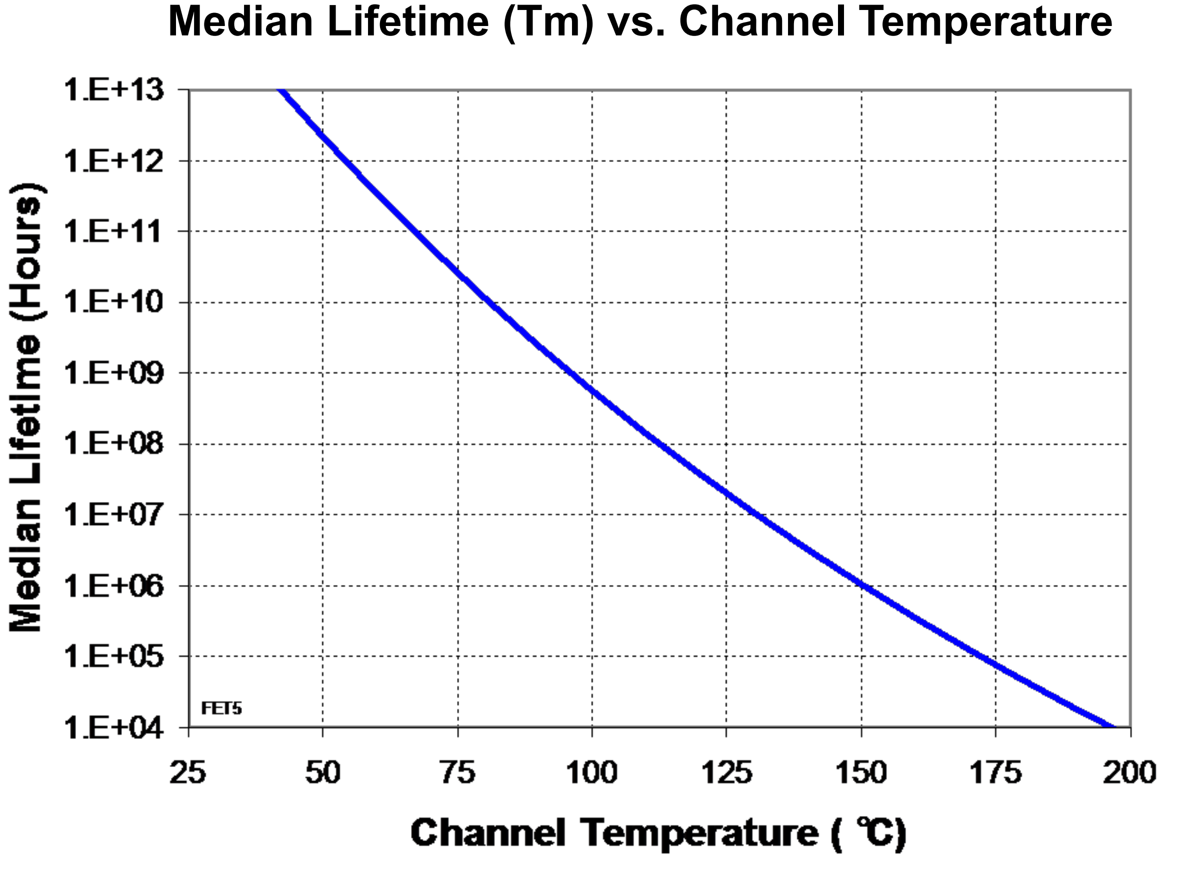
PARAMETER	Amplifier	2x Multiplier	3x Multiplier	UNITS
Frequency Range	17 - 43	9 - 22	6 - 12	GHz
Drain Voltage, Vd1*	-	-	1	V
Drain Voltage, Vd*	5	5	5	V
Total Drain Current*	139	120	160	mA
Gate Voltage, Vg1*	-0.65	-1.1	-0.6	V
Gate Voltage, Vg*		-0.65		V
Small Signal Gain, S21	25	-	-	dB
Input Return Loss, S11	12	-	-	dB
Output Return Loss, S22	8	-	-	dB
Output Power @ 1dB Gain compression, P1dB 5V @ 139mA 5V @ 225mA	 20 22	-	-	dBm
Output TOI	28	-	-	dBm
Output Power @ Pin = 9dBm	-	15	15	dBm
Gain Temperature Coefficient	-0.04	-	-	dB/^{0}C

* See bias plan on page 8 for amplifier and 2x multiplier, page 9 for 3x multiplier

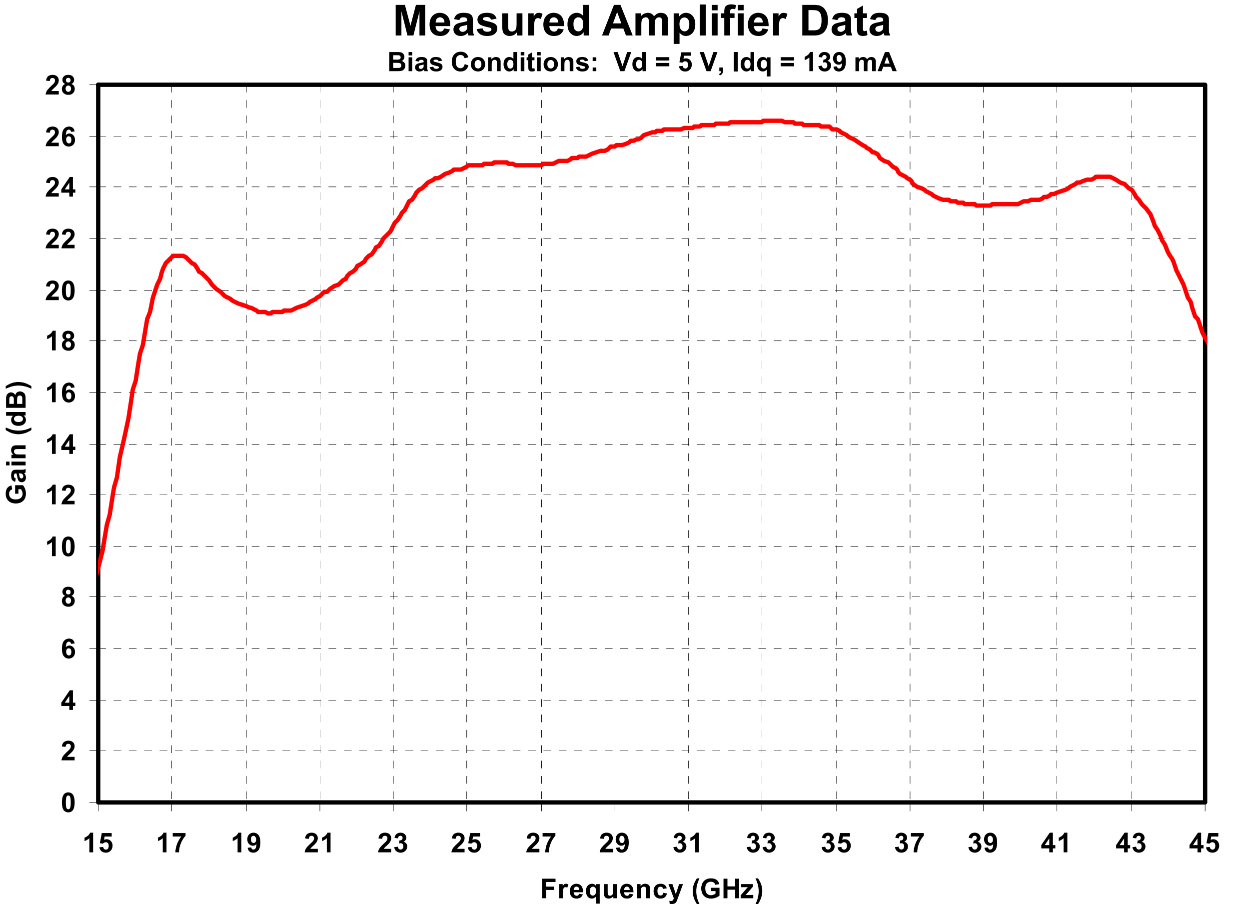
TABLE III
THERMAL INFORMATION

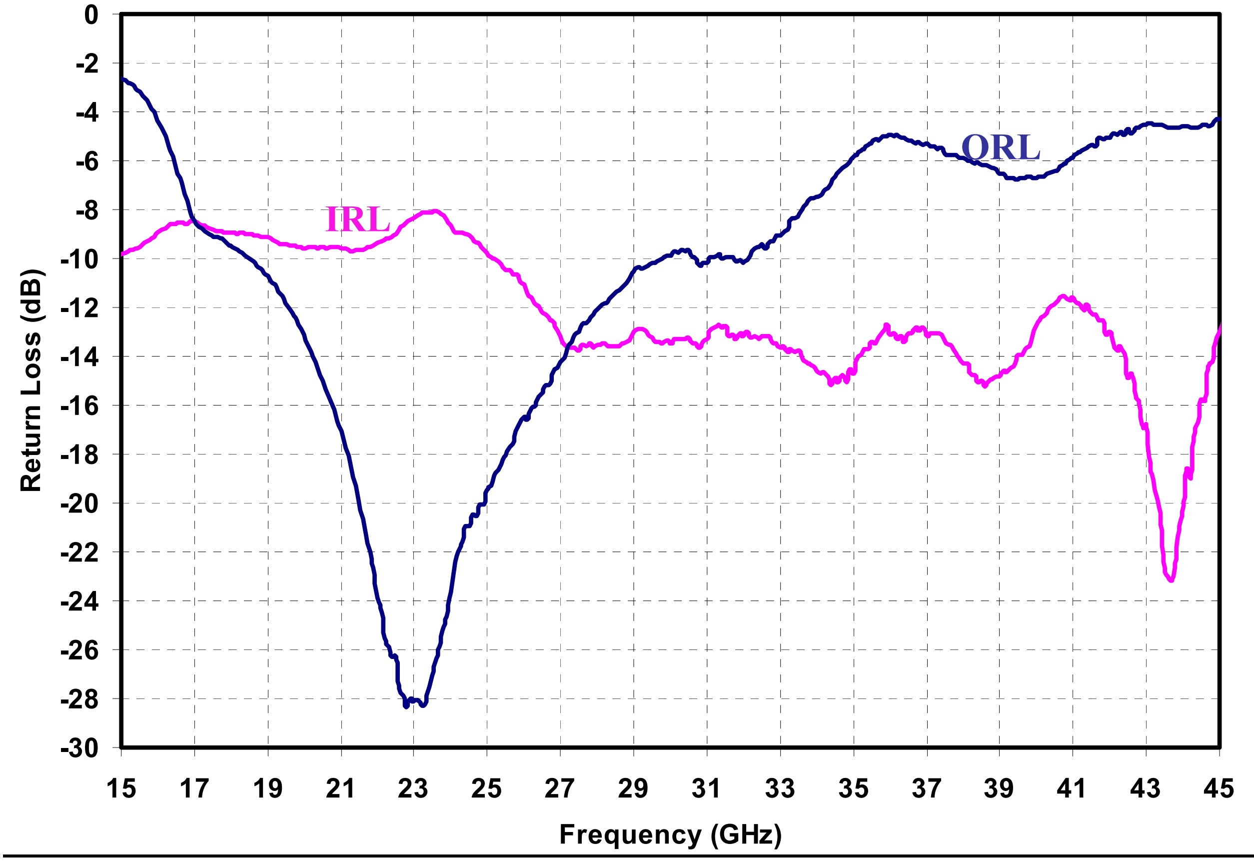
PARAMETER	TEST CONDITIONS	T_{CH} (°C)	θ_{JC} (°C/W)	Tm (HRS)
θ_{JC} Thermal Resistance (channel to Case)	Vd = 5 V Id = 139 mA Pdiss = 0.69 W	116	66.7	6.3E+7

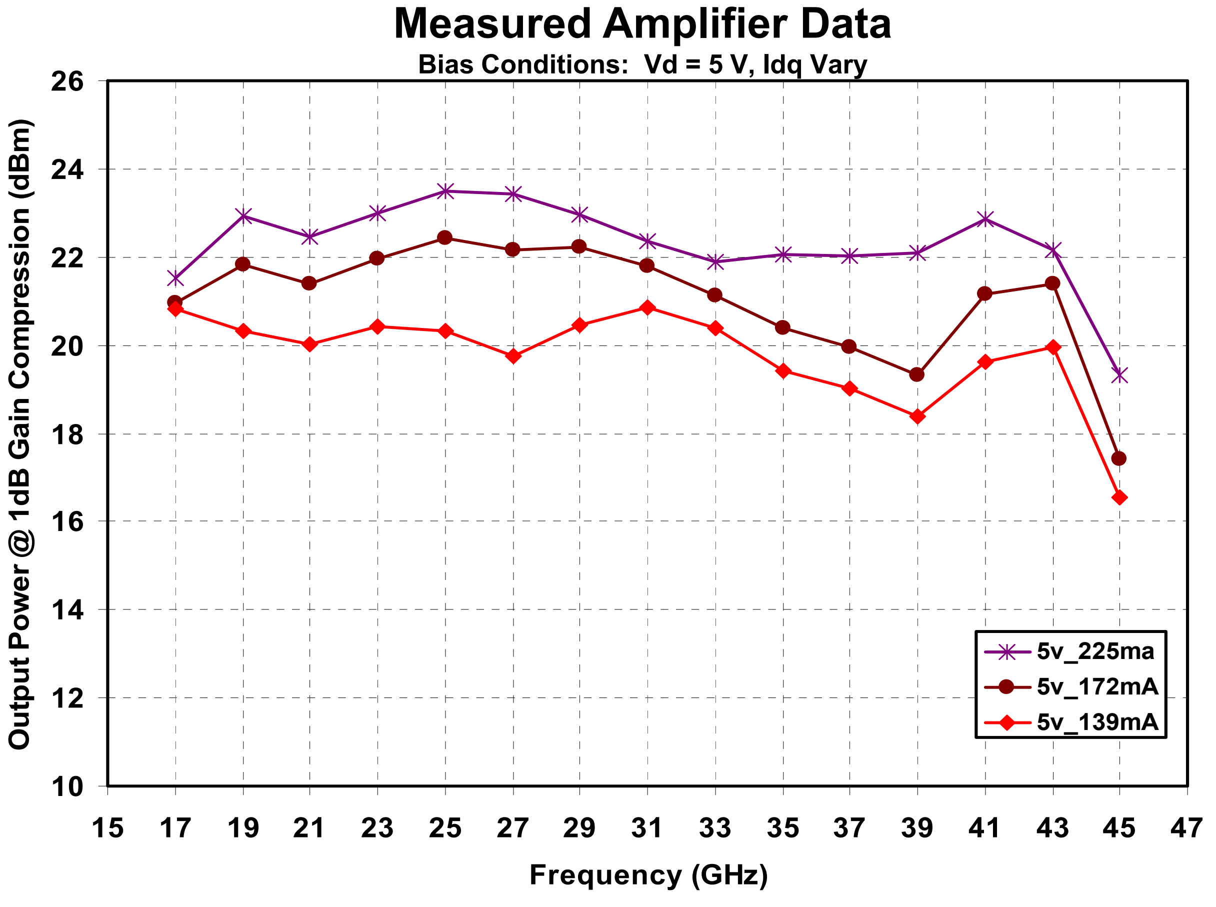
Note: Assumes eutectic attach using 1.5 mil 80/20 AuSn mounted to a 20 mil CuMo Carrier at 70 °C baseplate temperature. Worst case condition with no RF applied, 100% of DC power is dissipated.



Measured Amplifier Data

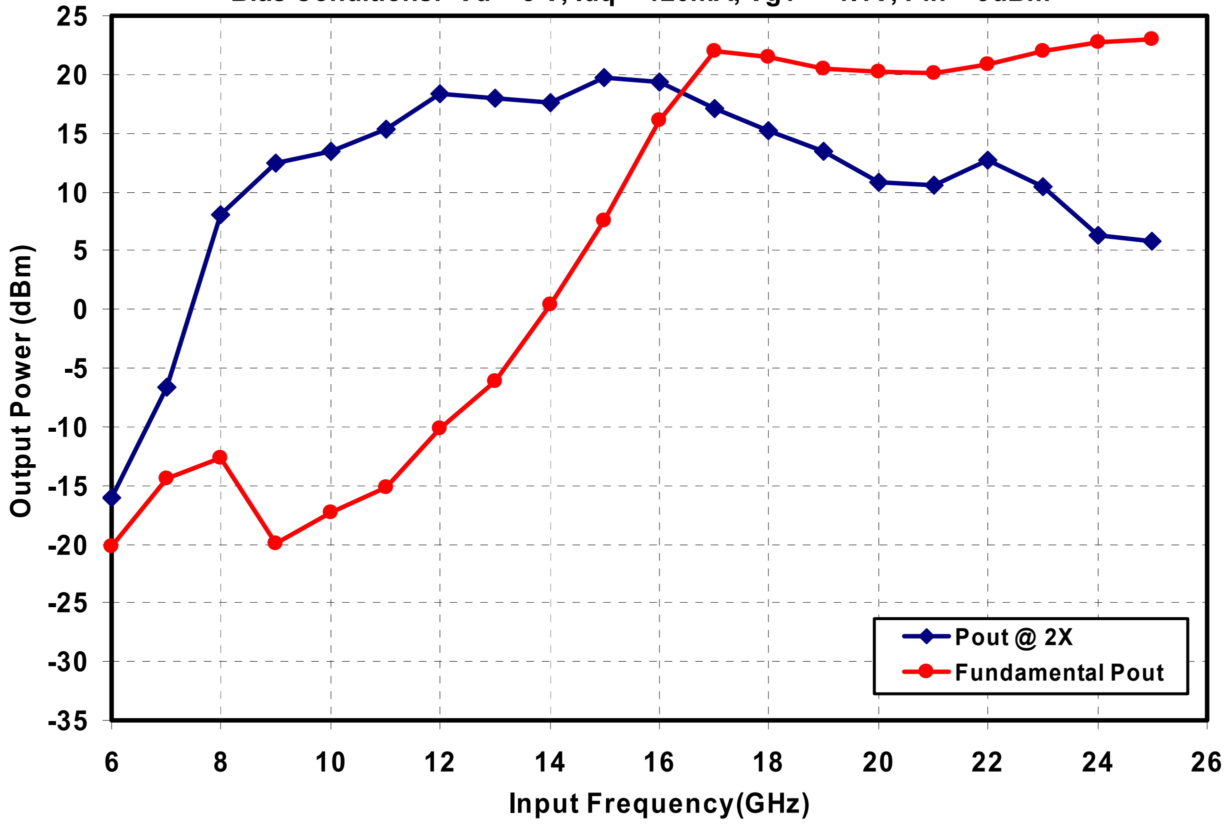





Measured Amplifier Data
Bias Conditions: Vd = 5 V, Idq Vary
Output Power @ 1dB Gain Compression (dBm)
26
24
22
20
18
16
14
12
10
15
17
19
21
23
25
27
29
31
33
35
37
39
41
43
45
47
Frequency (GHz)
5v_225ma
5v_172mA
5v_139mA

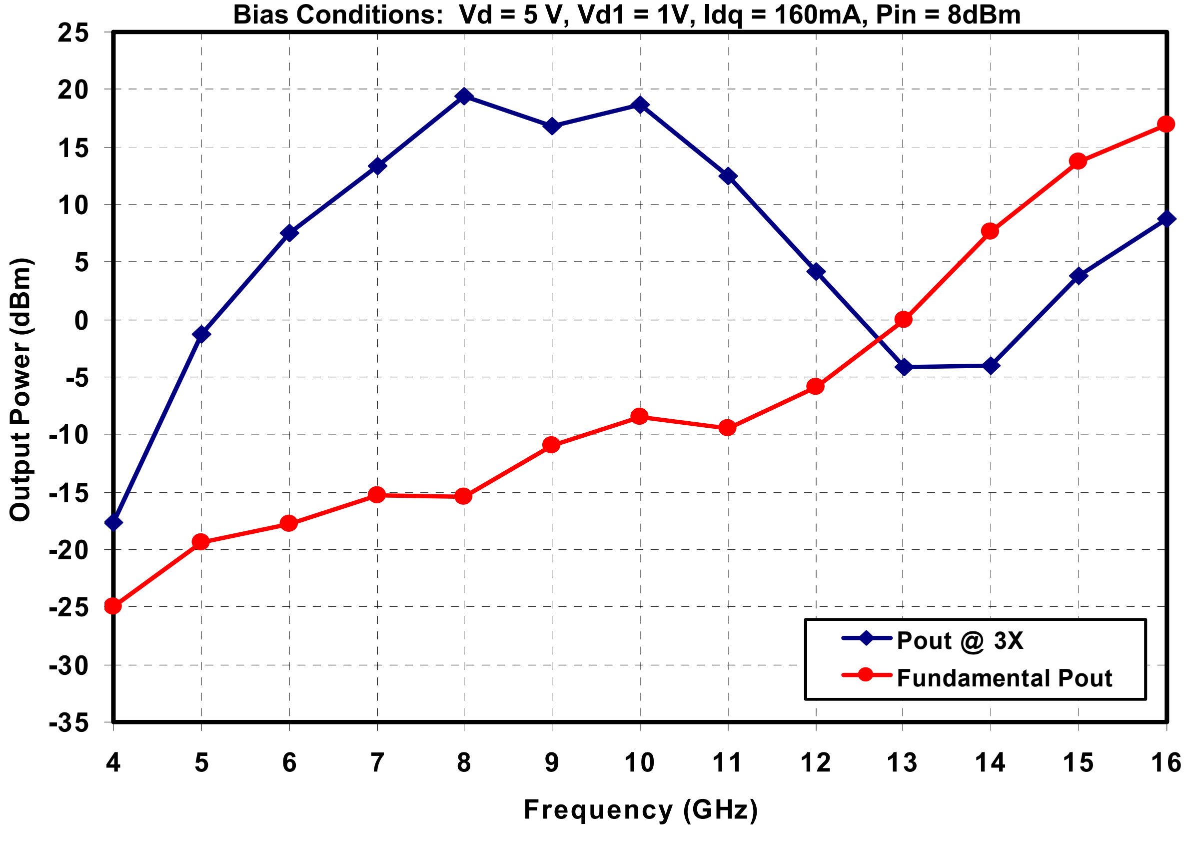
Measured 2X Multiplier Data

Bias Conditions: Vd = 5 V, Idq = 120mA, Vg1 = -1.1V, Pin = 9dBm

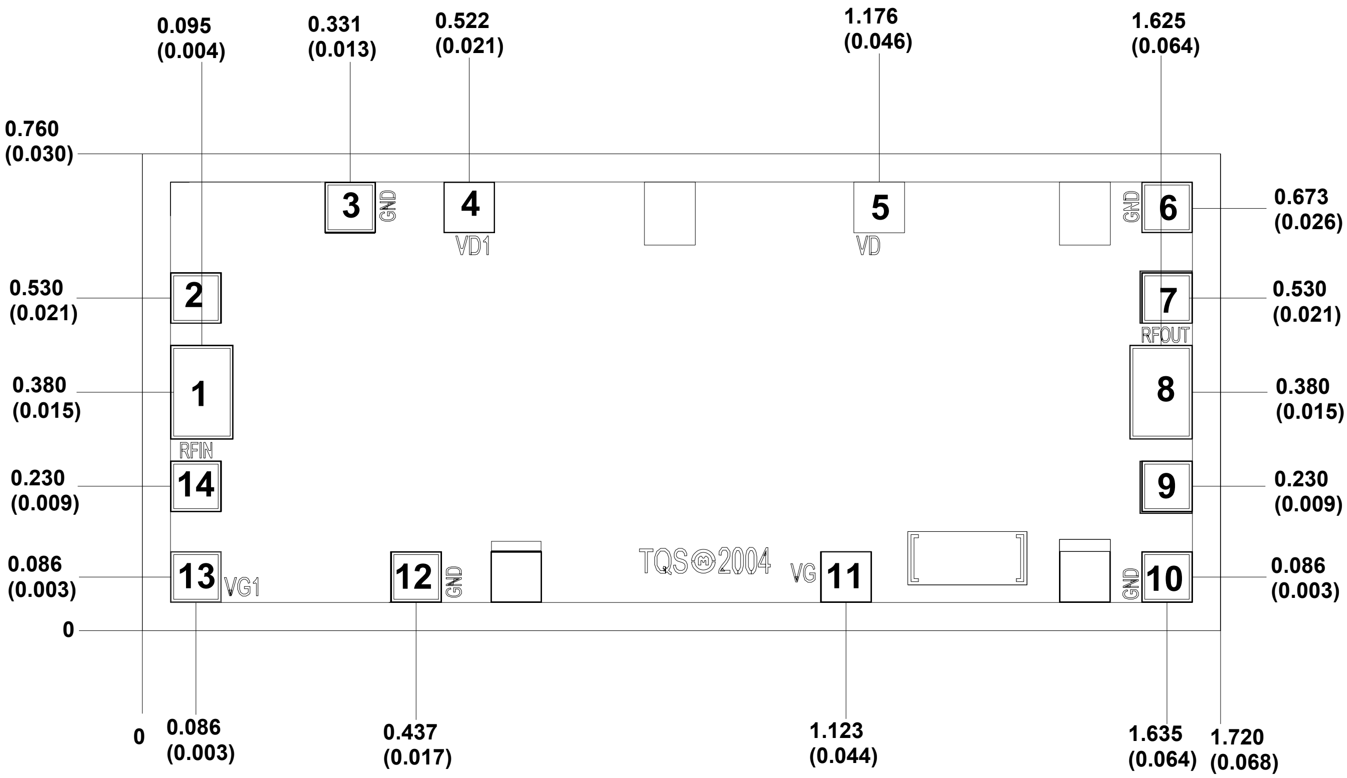


Measured 3X Multiplier Data

Bias Conditions: Vd = 5 V, Vd1 = 1V, Idq = 160mA, Pin = 8dBm



Mechanical Drawing

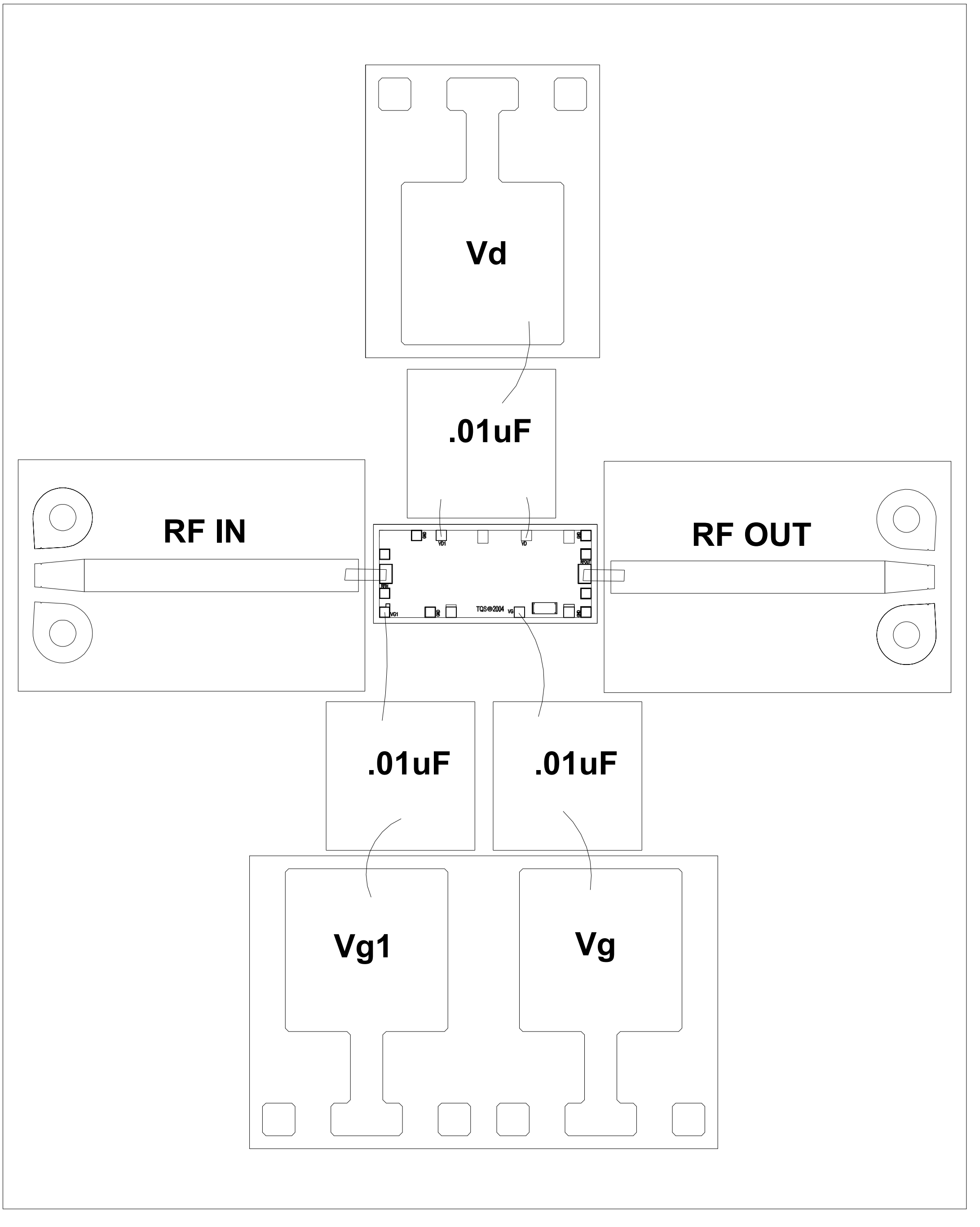


Units: millimeters (inches)
Thickness: 0.100 (0.004)
Chip edge to bond pad dimensions are shown to center of bond pad
Chip size tolerance: +/- 0.051 (0.002)
GND is back side of MMIC

Bond pad #1:	(RF In)	0.100 x 0.150 (0.004 x 0.006)
Bond pad #2, #3, #6, #7, #9, #10, #12, #14:	(GND)	0.081 x 0.081 (0.003 x 0.003)
Bond pad #4:	(Vd1)	0.081 x 0.081 (0.003 x 0.003)
Bond pad #5:	(Vd)	0.081 x 0.081 (0.003 x 0.003)
Bond pad #8:	(RF Out)	0.100 x 0.150 (0.004 x 0.006)
Bond pad #11:	(Vg)	0.081 x 0.081 (0.003 x 0.003)
Bond pad #13:	(Vg1)	0.081 x 0.081 (0.003 x 0.003)

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

Recommended Chip Assembly Diagram
Amplifier & 2x Multiplier

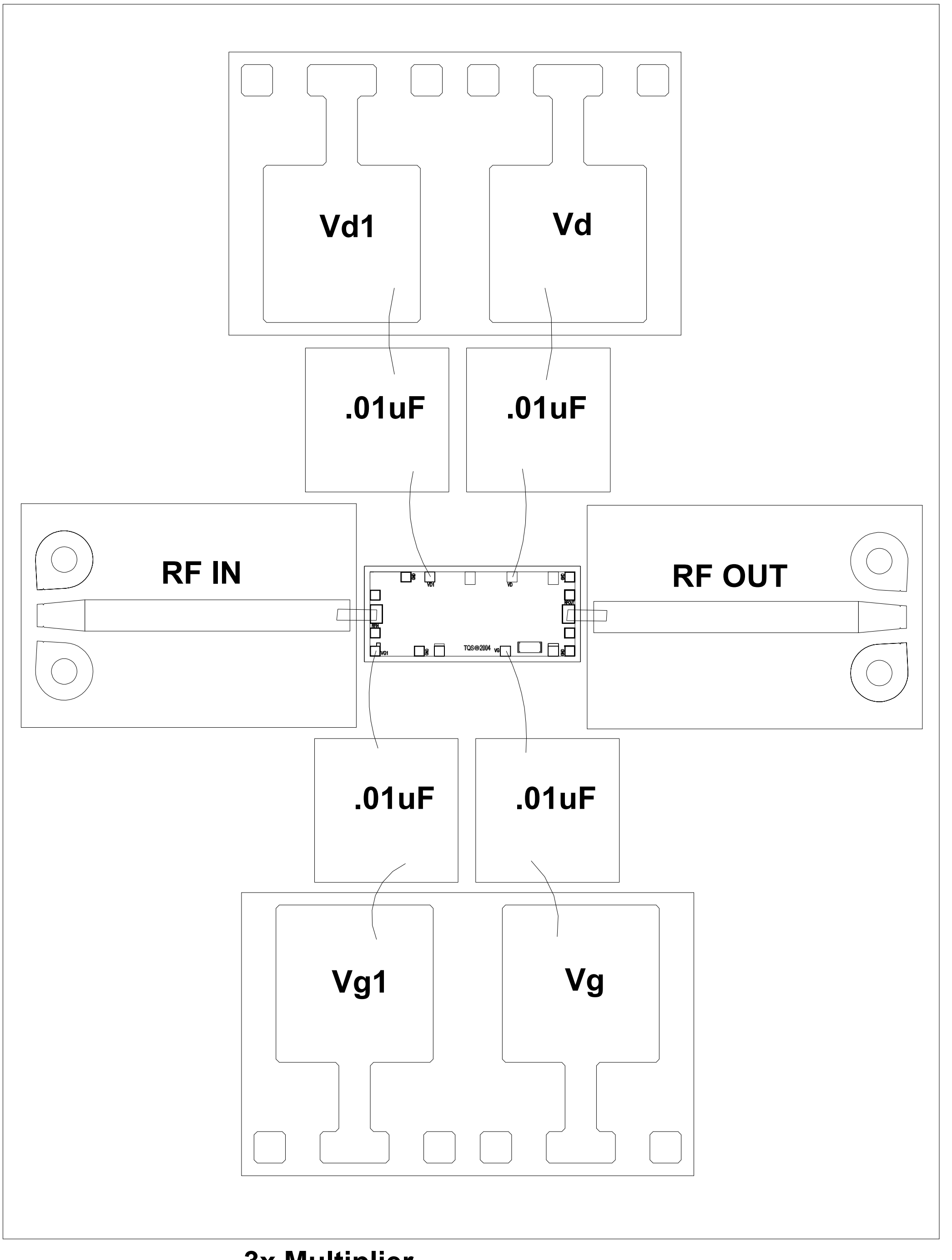


Amplifier
Set Vd = 5.0V
Vary (Vg + Vg1) to achieve Id = 139mA

2x Multiplier
Set Vd = 5.0V
Set Vg1 = -1.1V
Vary Vg to achieve Id = 120mA

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

Recommended Chip Assembly Diagram
3x Multiplier



<u>3x Multiplier</u>
Set Vd = 5.0V
Set Vd1 = 1.0V
Vary (Vg + Vg1) to achieve(Id + Id1) = 160mA

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 300^0C (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 200^0C.

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