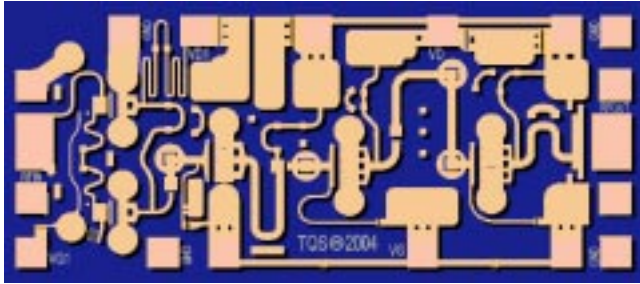


**17 - 43GHz MPA/Multiplier**

**TGA4040**



**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.

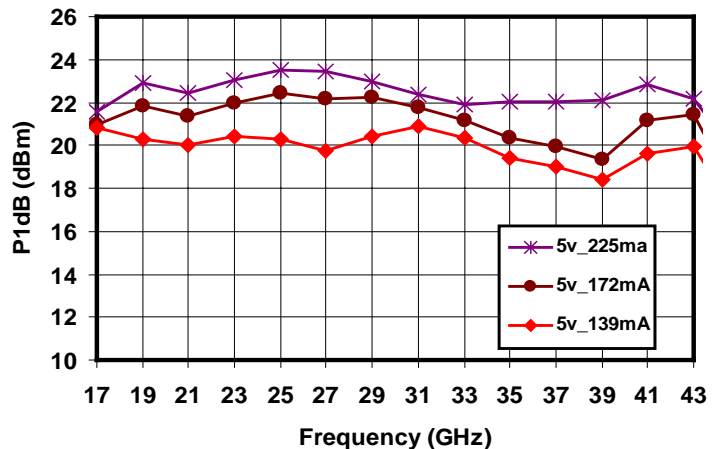
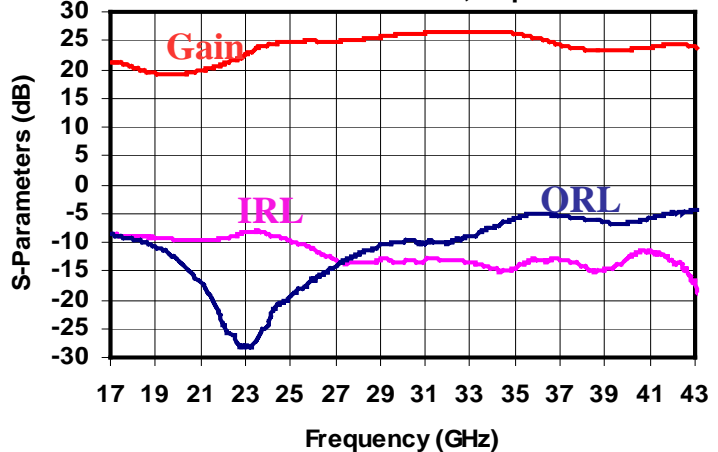
The TGA4040 is 100% DC and RF tested on-wafer to ensure performance compliance.

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

Lead-Free & RoHS compliant.

**Amplifier Performance**

Bias Conditions:  $V_d = 5\text{ V}$ ,  $I_{dq} = 139\text{ mA}$



*Note: 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 <sub>d</sub>	Drain Voltage	6 V	2/
V <sub>g</sub>	Gate Voltage Range	-2 TO 0 V	
I <sub>d</sub>	Drain Current	TBD	2/ 3/
I <sub>g</sub>	Gate Current	7 mA	3/
P <sub>IN</sub>	Input Continuous Wave Power	20 dBm	
P <sub>D</sub>	Power Dissipation	See note 4/	2/
T <sub>CH</sub>	Operating Channel Temperature	150 °C	5/
T <sub>M</sub>	Mounting Temperature (30 Seconds)	320 °C	
T <sub>STG</sub>	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<sub>D</sub>.
- 3/ Total current for the entire MMIC.
- 4/ For a median life time of 1E+6 hrs, Power dissipation is limited to:
- $$P_D(\text{max}) = (150\text{ }^\circ\text{C} - T_{\text{BASE}}\text{ }^\circ\text{C}) / 66.7\text{ (}^\circ\text{C/W)}$$
- Where T<sub>BASE</sub> is the base plate temperature.
- 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.

**TABLE II**  
**ELECTRICAL CHARACTERISTICS**  
(Ta = 25 °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	20	-	-	dBm
5V @ 225mA	22			
Output TOI	28	-	-	dBm
Output Power @ Pin = 9dBm	-	15	15	dBm
Gain Temperature Coefficient	-0.04	-	-	dB/°C

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

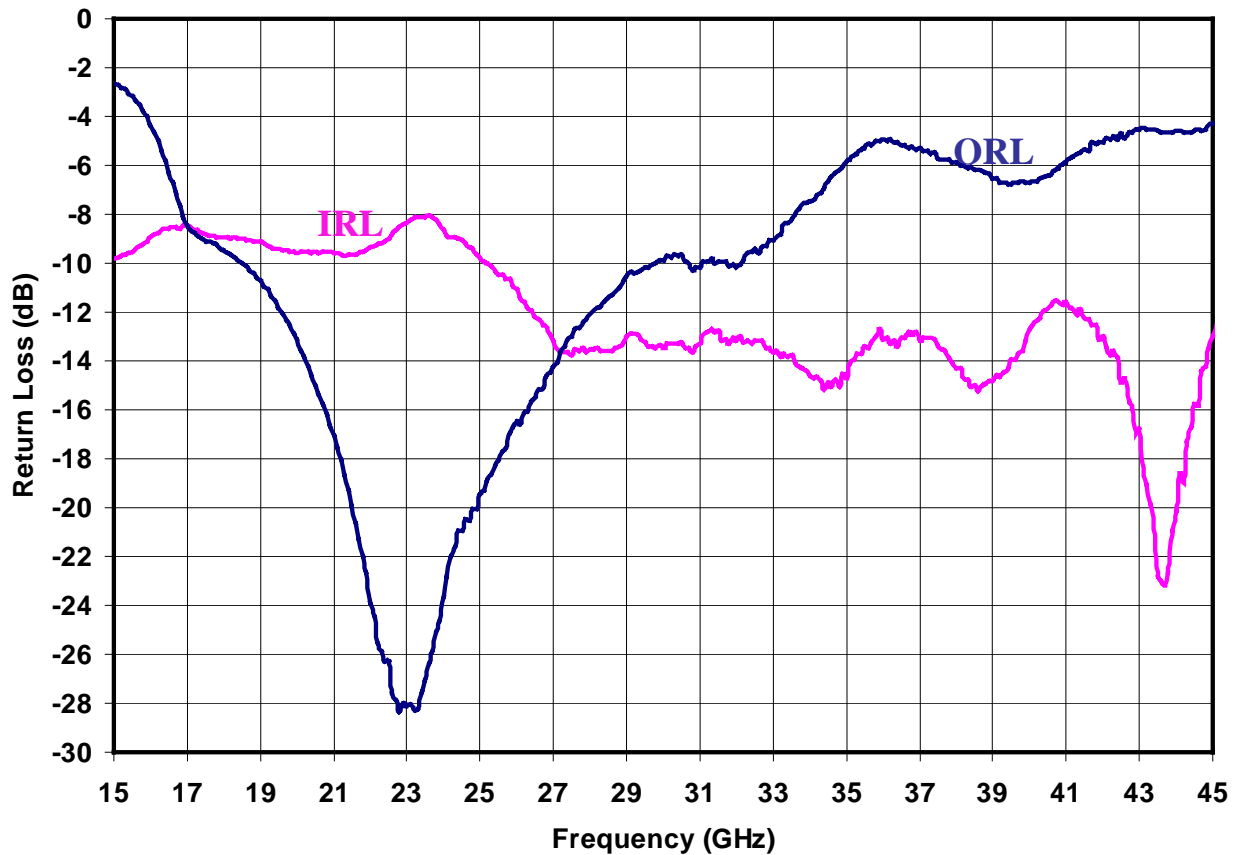
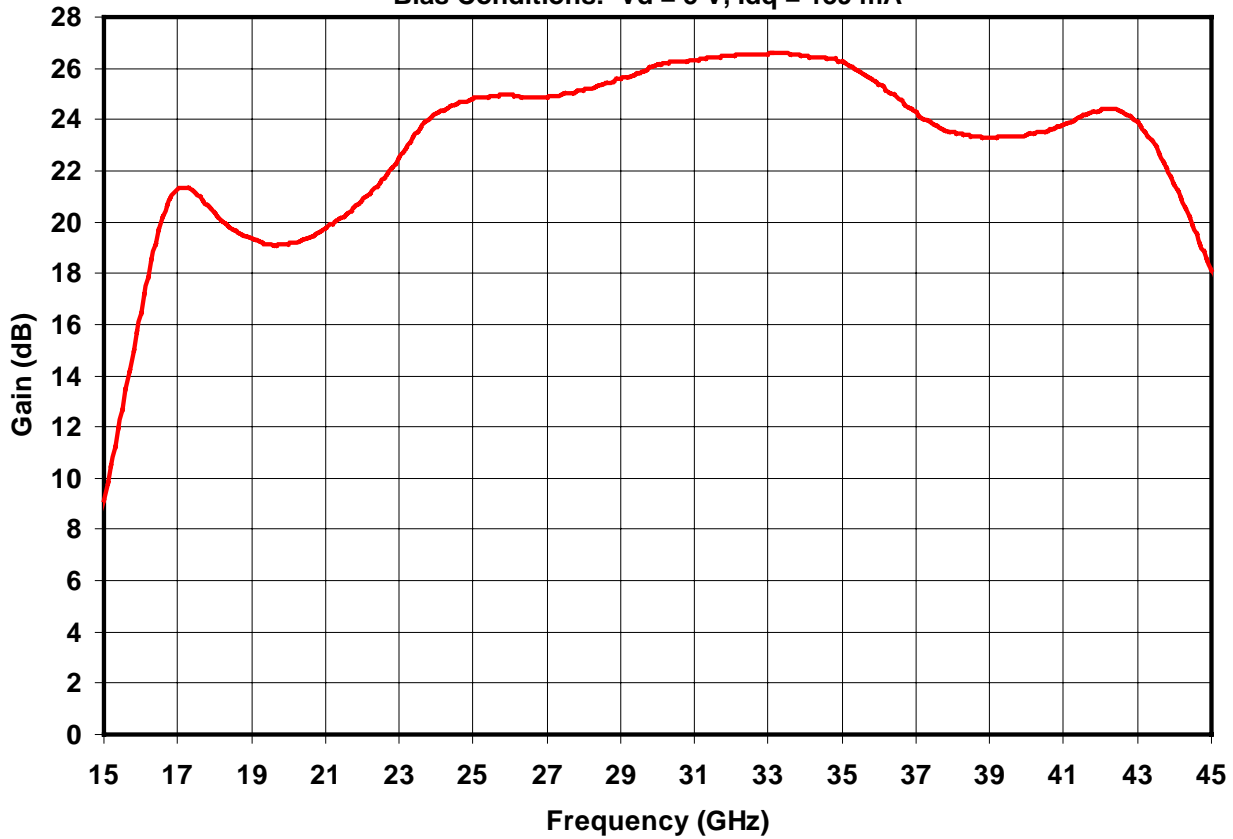
**TABLE III**  
**THERMAL INFORMATION**

PARAMETER	TEST CONDITIONS	T <sub>CH</sub> (°C)	θ <sub>JC</sub> (°C/W)	T <sub>M</sub> (HRS)
θ <sub>JC</sub> Thermal Resistance (channel to Case)	Vd = 5 V Id = 139 mA Pdiss = 0.69 W	116	66.7	2.4E+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.

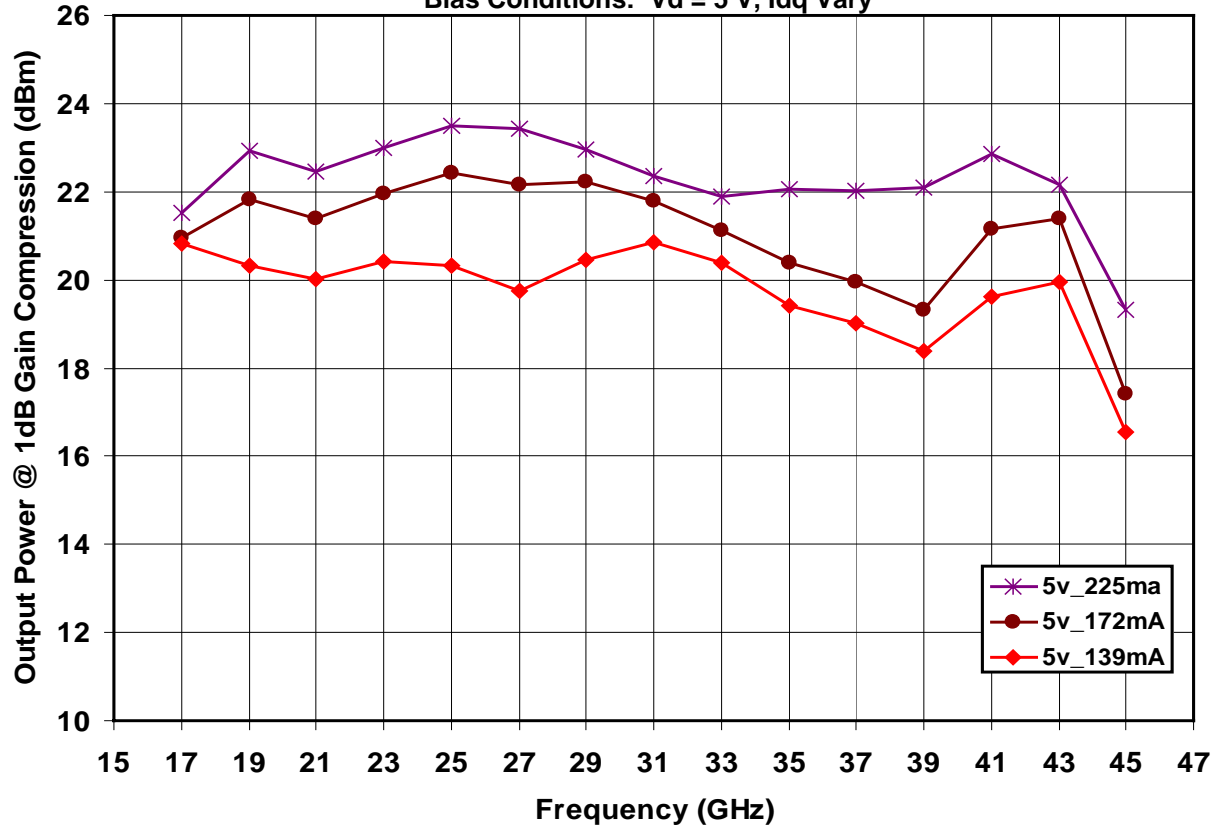
**Measured Amplifier Data**

Bias Conditions:  $V_d = 5\text{ V}$ ,  $I_{dq} = 139\text{ mA}$



**Measured Amplifier Data**

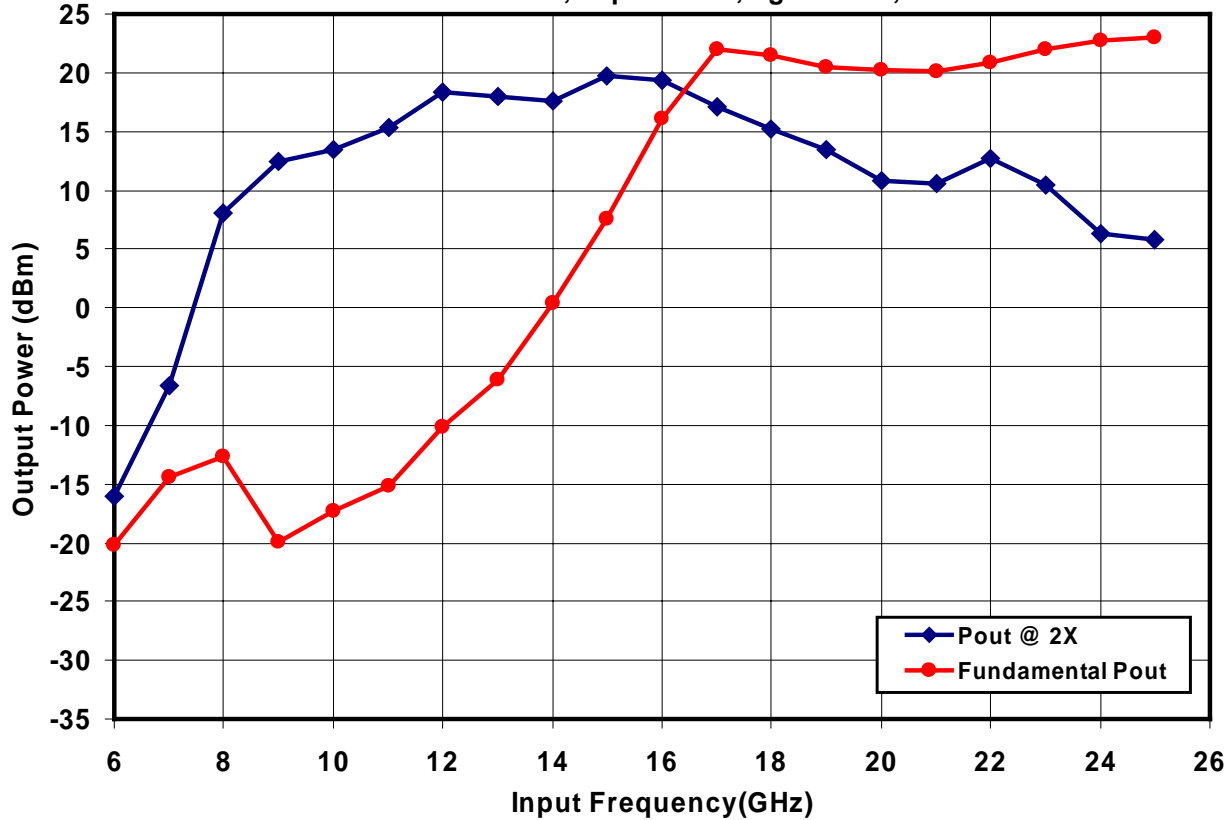
Bias Conditions:  $V_d = 5\text{ V}$ ,  $I_{dq}$  Vary



**Measured 2X Multiplier Data**

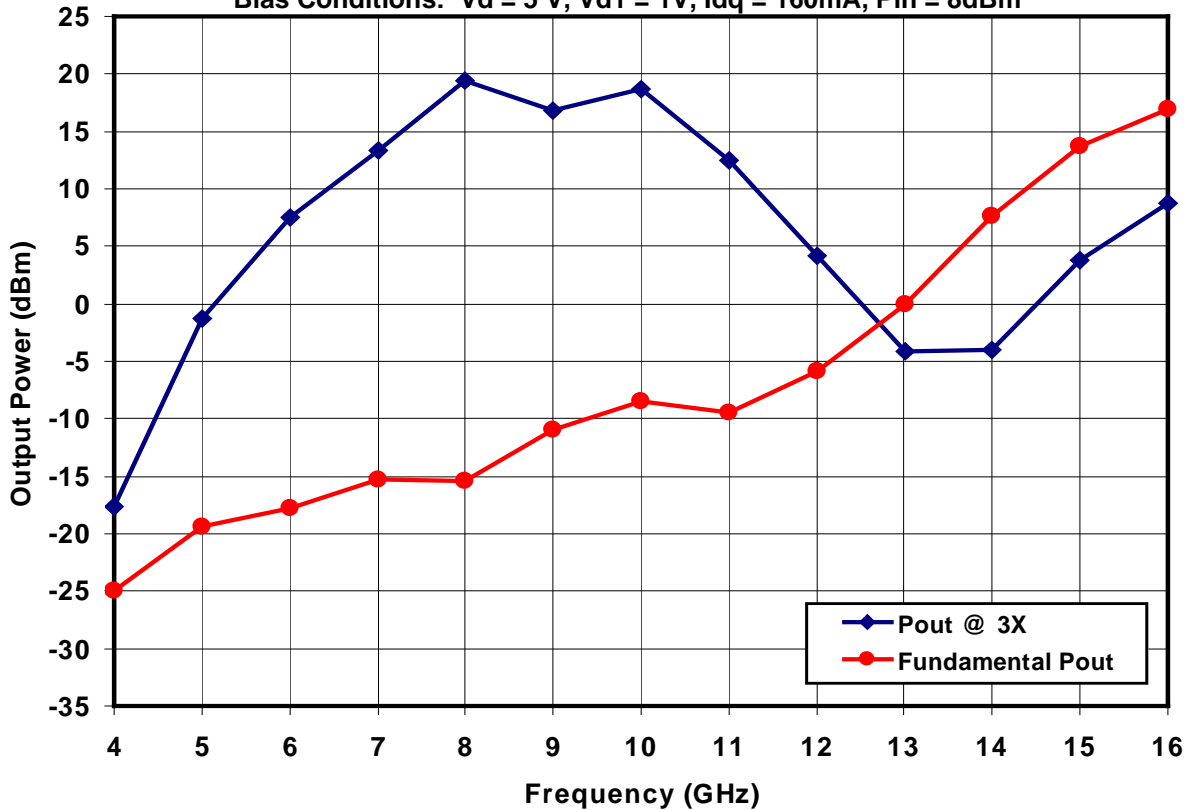
**TGA4040**

Bias Conditions:  $V_d = 5\text{ V}$ ,  $I_{dq} = 120\text{ mA}$ ,  $V_{g1} = -1.1\text{ V}$ ,  $P_{in} = 9\text{ dBm}$

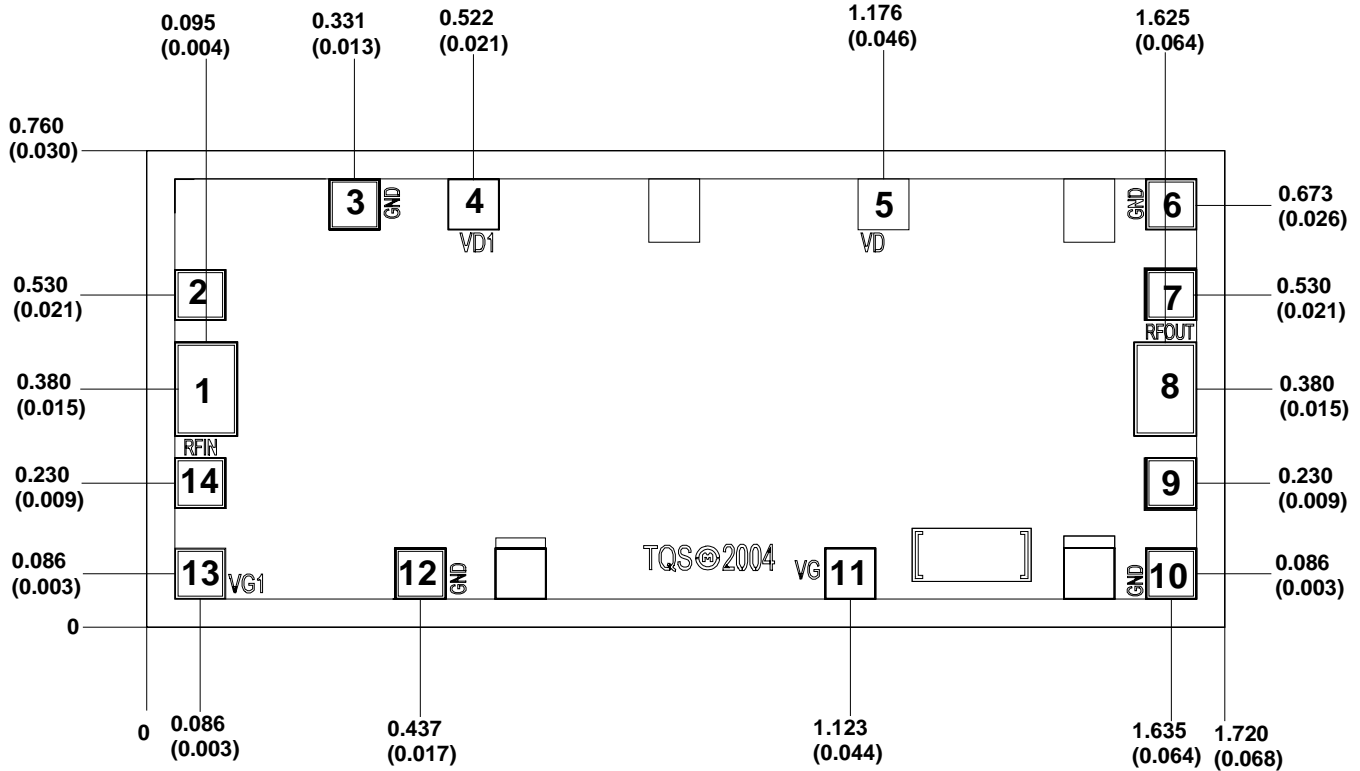


**Measured 3X Multiplier Data**

Bias Conditions:  $V_d = 5\text{ V}$ ,  $V_{d1} = 1\text{ V}$ ,  $I_{dq} = 160\text{ mA}$ ,  $P_{in} = 8\text{ dBm}$



**Mechanical Drawing**

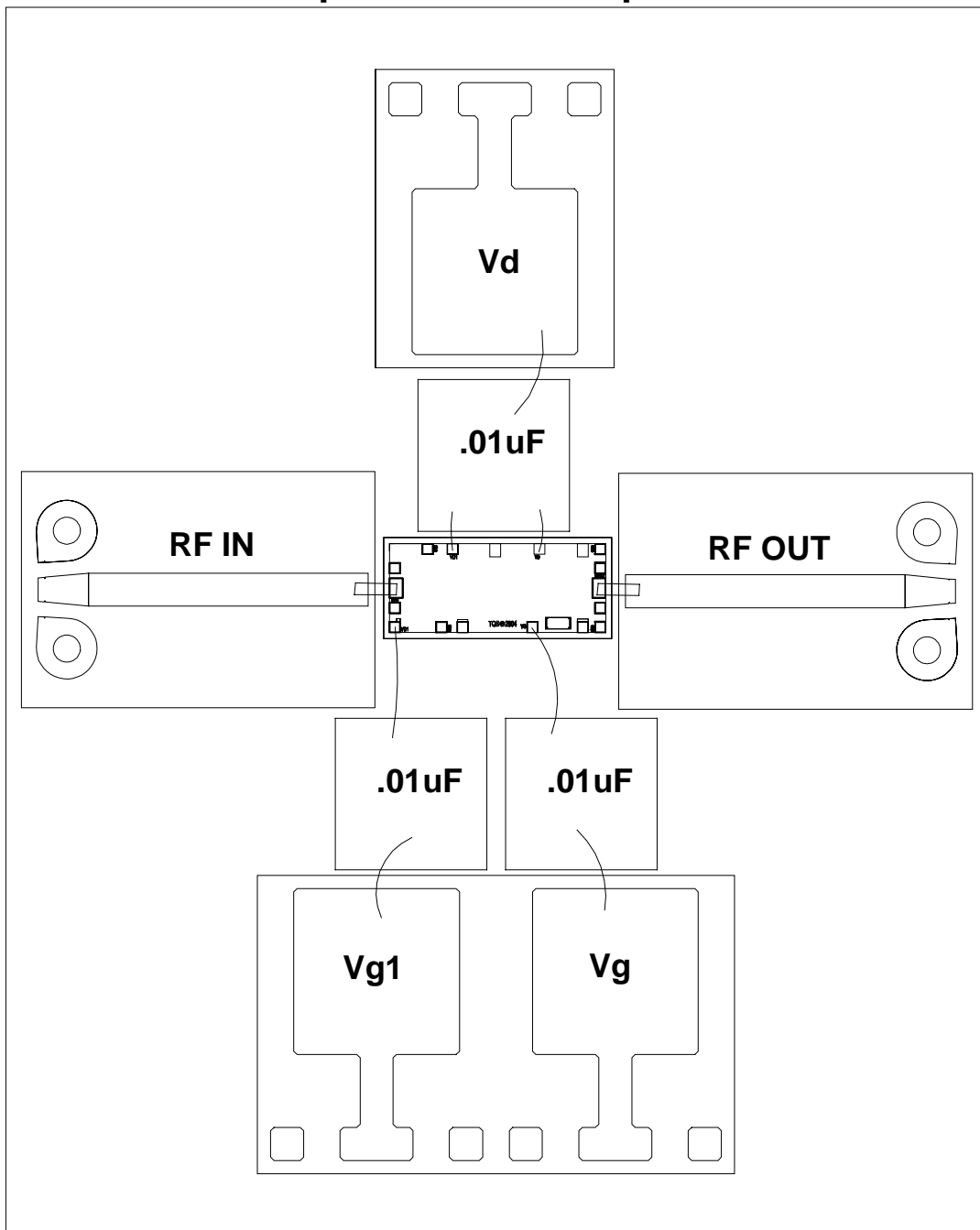


Units: millimeters (inches)  
 Thickness: 0.100 (0.004)  
 Chip edge to bond pad dimensions are shown to center of bond pad  
 Chip size tolerance: +/- 0.051 (0.002)  
 GND is back side of MMIC

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  $V_d = 5.0V$

Vary  $(V_g + V_{g1})$  to achieve  $I_d = 139mA$

**2x Multiplier**

Set  $V_d = 5.0V$

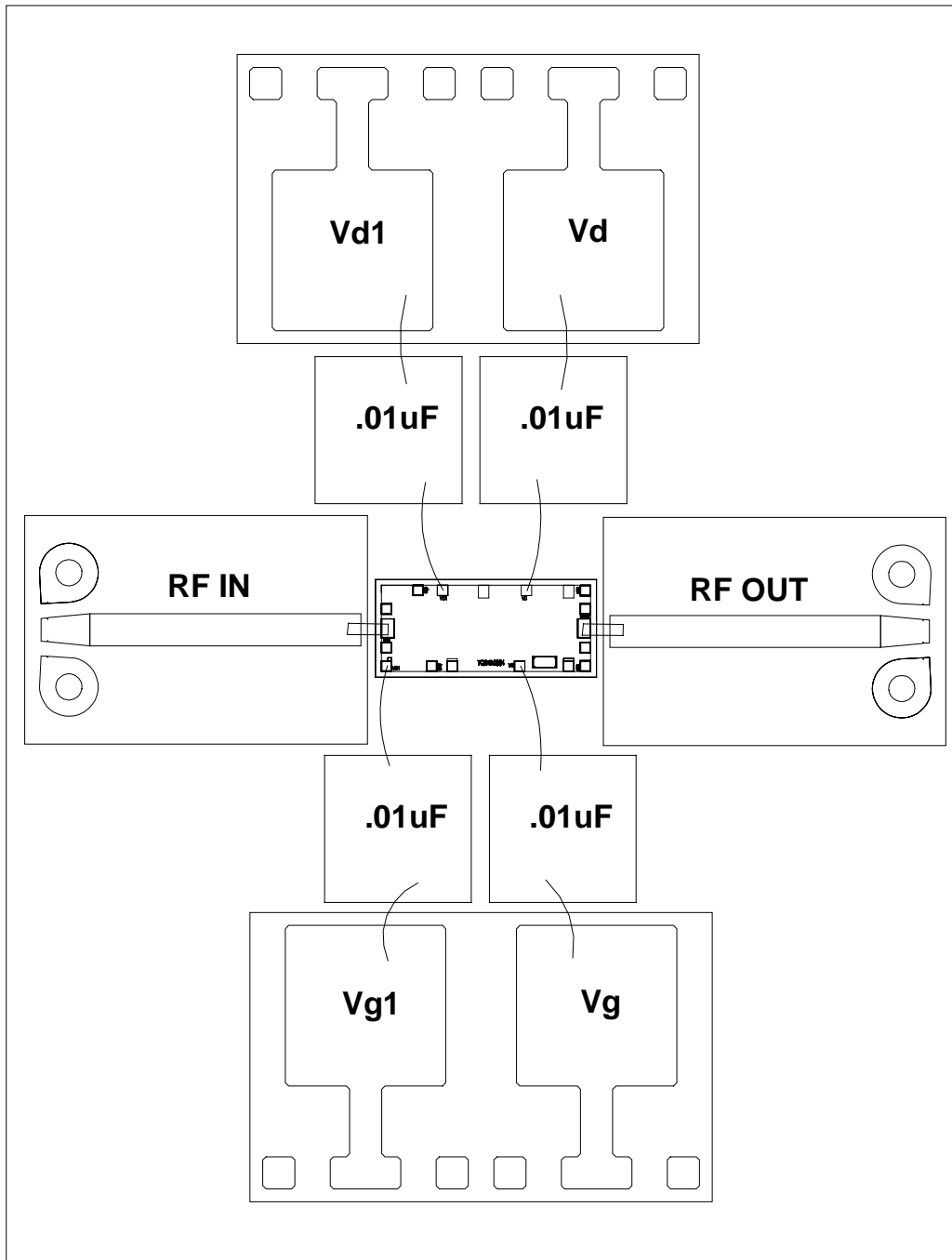
Set  $V_{g1} = -1.1V$

Vary  $V_g$  to achieve  $I_d = 120mA$

*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



**3x Multiplier**

**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<sup>0</sup>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<sup>0</sup>C.

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