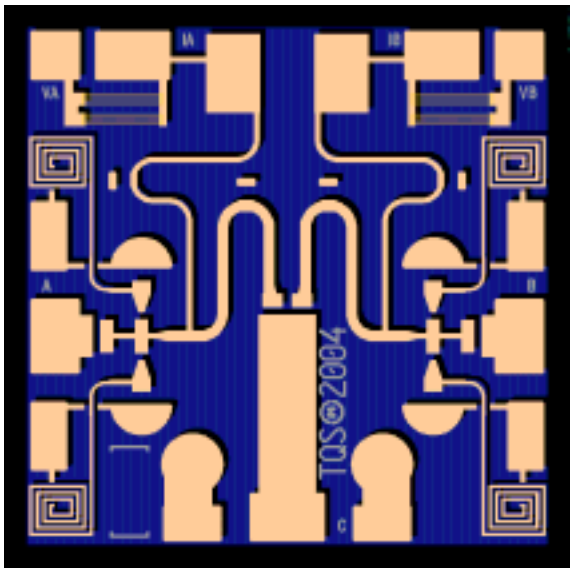
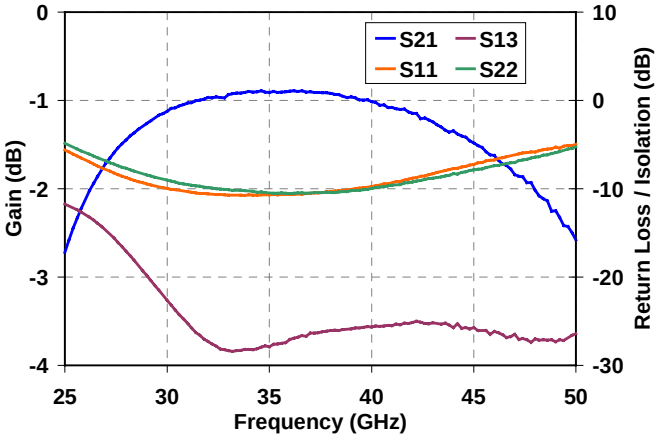
High Power Ka-Band SPDT Switch TGS4302



Preliminary Data

V_A = +5V, I_A ≈ 0mA, V_B = -5V, I_B = 20mA



Key Features and Performance

- 27 - 46 GHz Frequency Range
- > 33 dBm Input P1dB @ V_C = 7.5V
- On Chip Biasing Resistors
- On Chip DC Blocks
- < 0.9 dB Typical Insertion Loss
- < 4ns Switching Speed
- AP640R2-00 Replacement
- VPIN Technology
- Chip Dimensions:
  1.09 x 1.09 x 0.10 mm
  (0.043 x 0.043 x 0.004 inches)

Primary Applications

- Ka-Band Transmit / Receive
- Point-to-Point Radio
- Point-to-Multipoint Radio

Description

The TriQuint TGS4302 is a GaAs single-pole, double-throw (SPDT) PIN mono-lithic switch designed to operate over the Ka-Band frequency range. This switch maintains a low insertion loss with high power handling of 33dBm or greater input P1dB at V_C = 7.5V. These advantages, along with the small size of the chip, make the TGS4302 ideal for use in communication and transmit/receive applications.

Note: This device is early in the characterization process prior to finalizing all electrical and process specifications. Specifications are subject to change without notice.

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TABLE I
MAXIMUM RATINGS

Symbol	Parameter 1/	Value	Notes
V_C	Control Voltage	-5V to +25V	2/, 3/
I_C	Control Current	22.5 mA	2/ 3/
P_{IN}	Input Continuous Wave Power	38 dBm	3/
T_M	Mounting Temperature (30 Seconds)	320 ^{0}C	4/, 5/
T_{STG}	Storage Temperature	-65 to 150 ^{0}C	

1/ These ratings represent the maximum operable values for this device.

2/ V_C and I_C are both per bias pad.

3/ Operation above 30dBm requires control voltages above +5V.

4/ When operated at this bias condition with a base plate temperature of 70 ^{0}C, the median life is TBD hours.

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

TABLE II
DC PROBE TEST
(TA = 25 °C, Nominal)

NOTES	SYMBOL	LIMITS		UNITS
		MIN	MAX	
	R_{FWD}	3.5	6	Ω
	V_{REV}	-30	-60	V

TABLE III
RF CHARACTERIZATION TABLE
(T_A = 25°C, Nominal)
(V_A = +5V, I_A = 0mA, V_B = -5V, I_B = 20mA)

Symbol	Parameter	Test Conditions	Typ	Units	Notes
IL	Insertion Loss	F = 27 – 30 GHz F = 30 – 40 GHz F = 40 – 46 GHz	1.3 0.9 1.3	dB	
RL	Return Loss	F = 27 – 46 GHz	10	dB	
P1dB	Output Power @ 1dB Gain Compression	V_C = +5V V_C = +7.5V V_C = +10V V_C = +15V	31 33 35 38	dBm	1/ 2/

Note: Table III Lists the RF Characteristics of typical devices as determined by fixtured measurements.

1/ Frequency = 30GHz

2/ 10V & 15V points are extrapolated from the data

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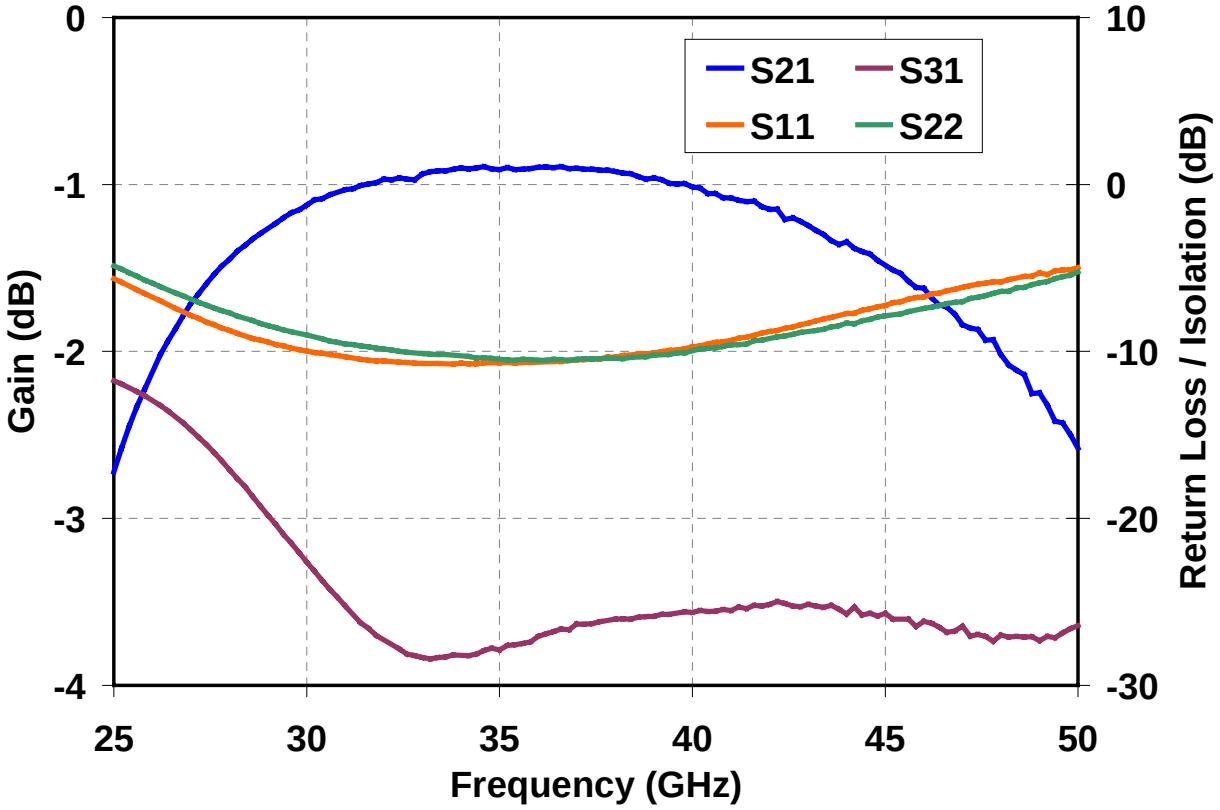

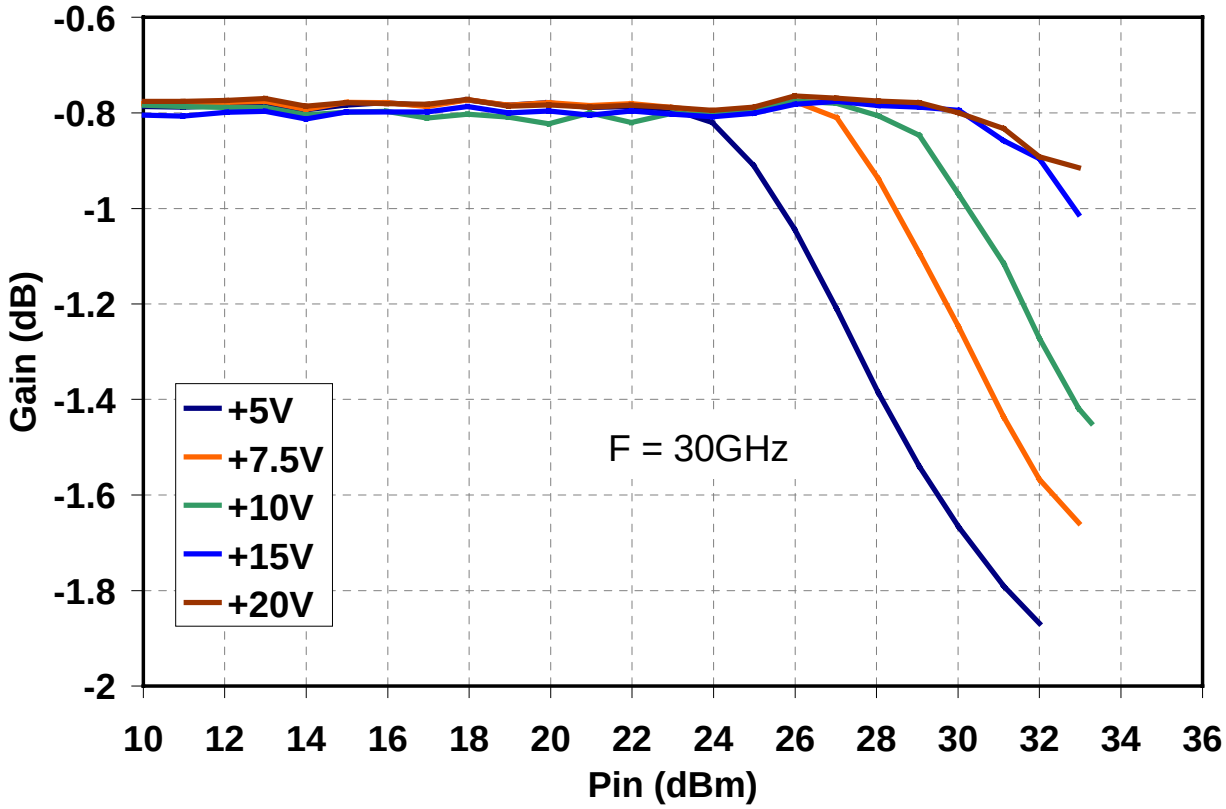

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Preliminary Data

I_A = 0mA, V_B = -5V, I_B = 10mA, F = 30GHz

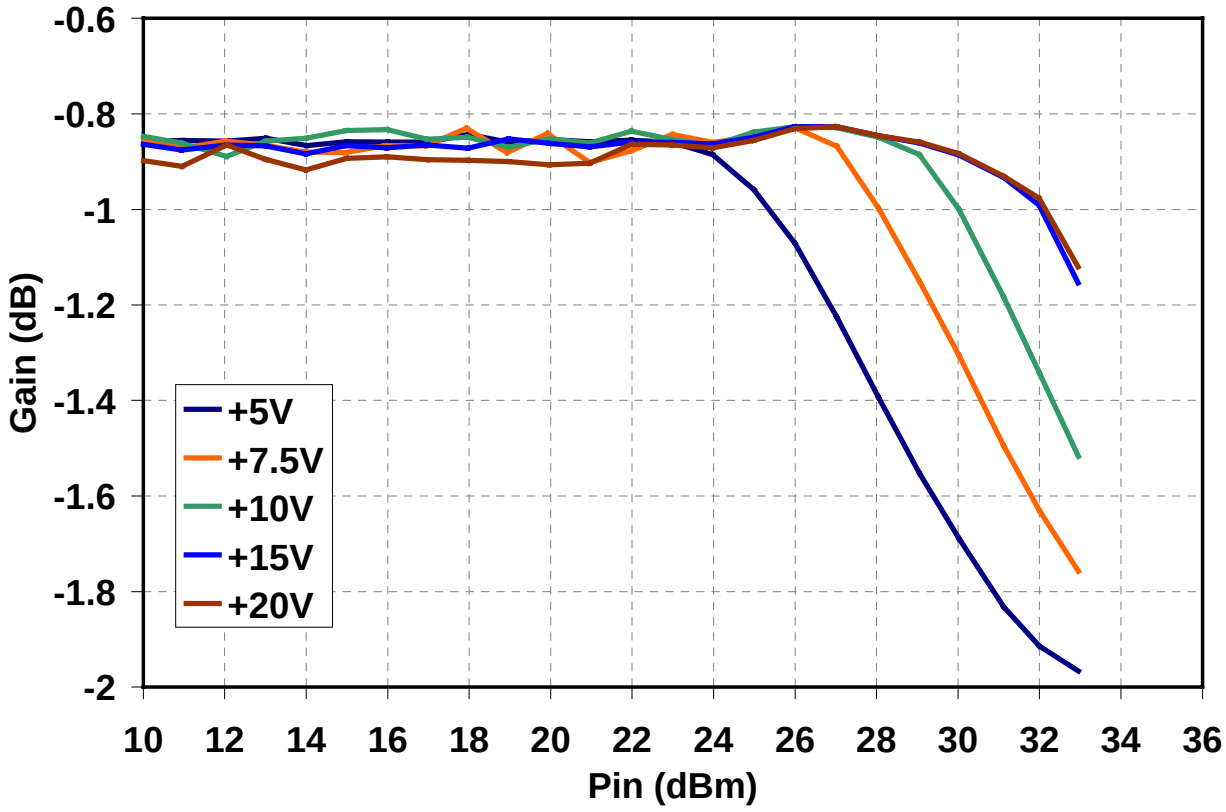

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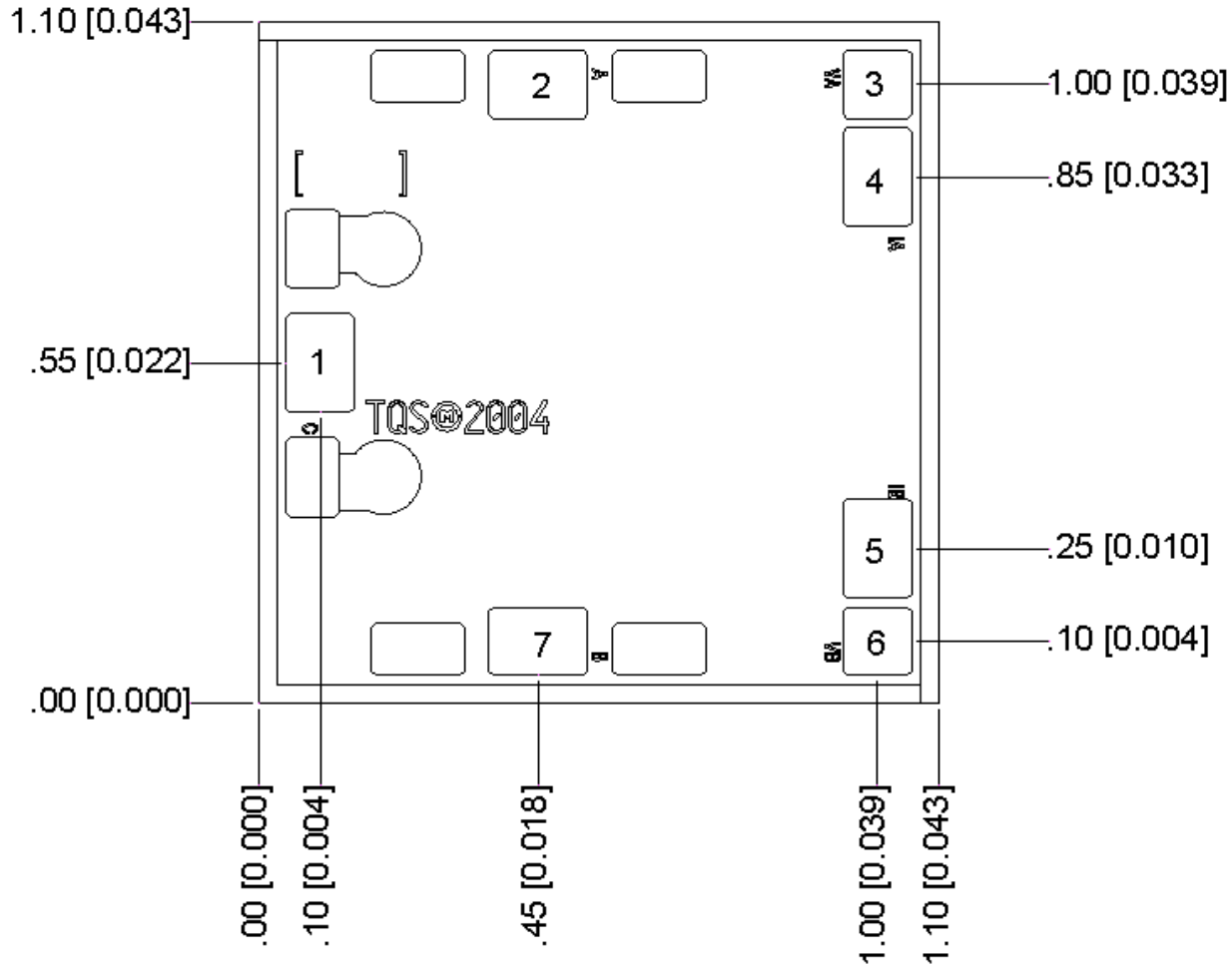
TABLE IV
TRUTH TABLE

Selected RF Output	V_A	V_B
RF Out A	≥ +5V @ ~0mA	-5V @ 20mA
RF Out B	-5V @ 20mA	≥ +5V @ ~0mA

Operation at RF power levels >30 dBm requires increasing the positive voltage level to put a larger reverse bias on the diodes while the negative voltage level remains at -5 V with a current of approximately 20mA.

Bond pads IA and IB bypass the on-chip series resistors to allow adjustment of the current to the diodes in their forward biased state.

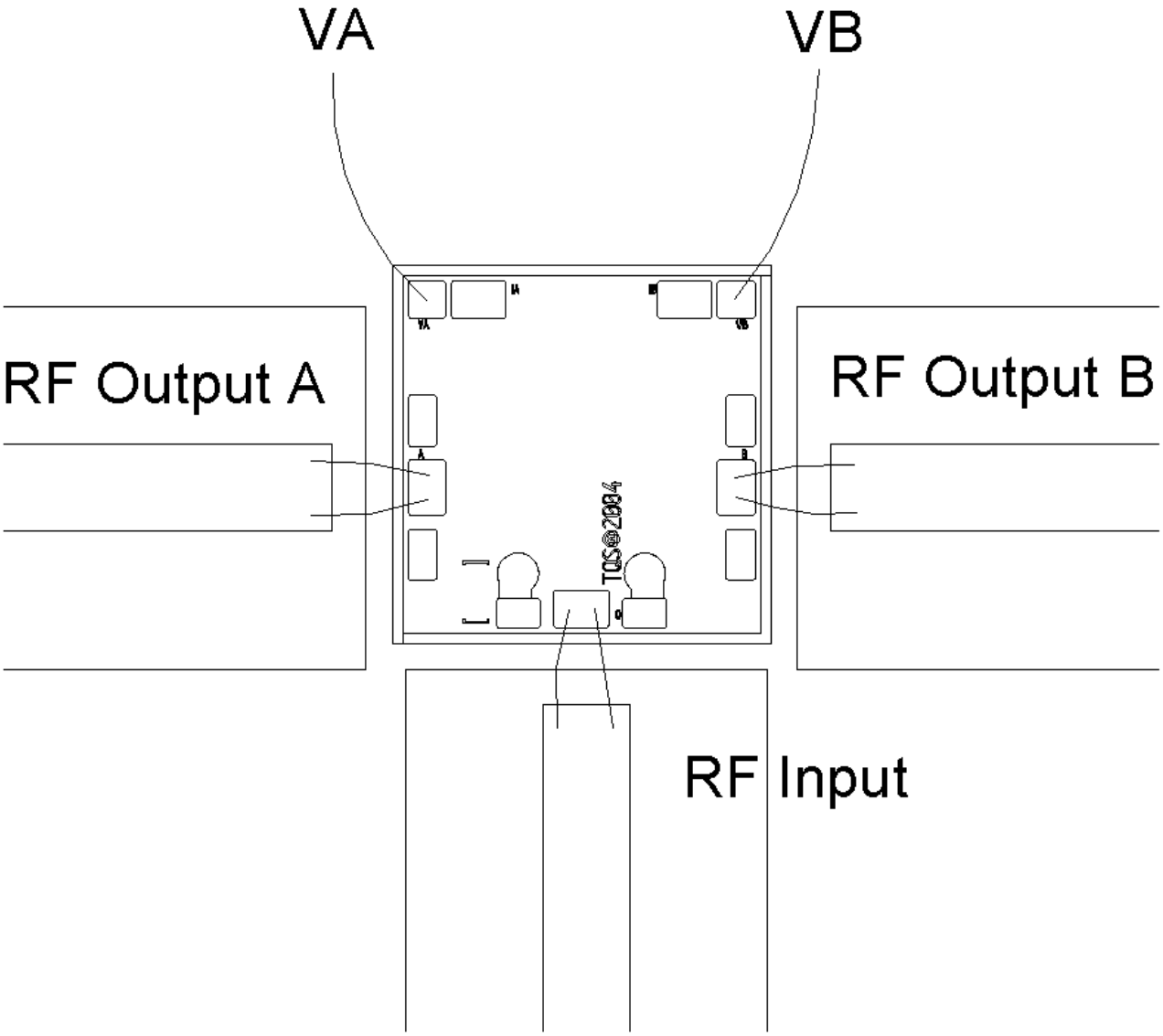
Mechanical Drawing



Units: millimeters [inches]
Thickness: 0.10 [0.004] (reference only)
Chip edge to bond pad dimensions are shown to center of bond pads.
Chip size tolerance: ±0.05 [0.002]
RF ground through backside

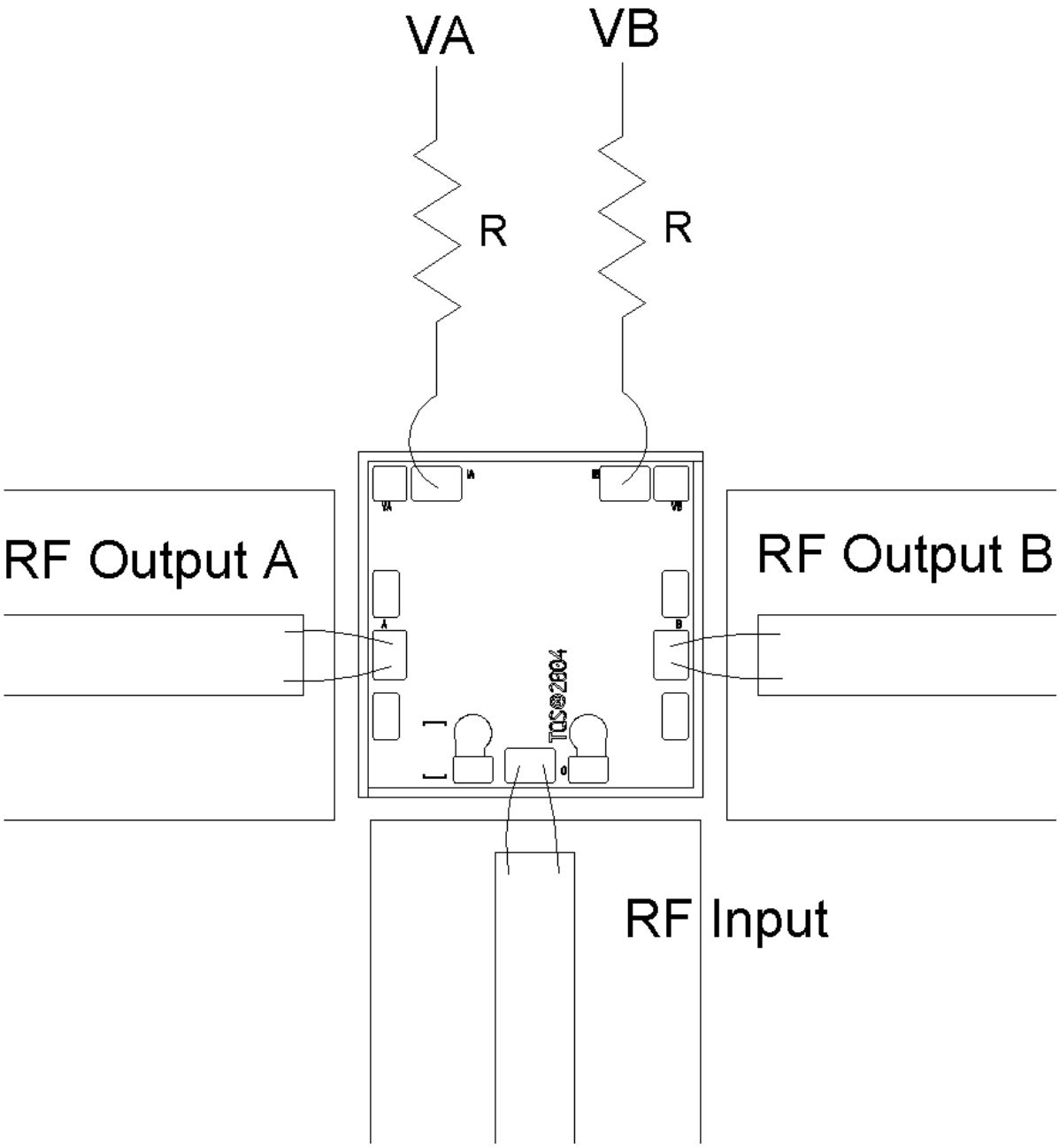
Bond Pad #1	**RF Input**	**0.10 x 0.15**	**[0.004 x 0.006]**
Bond Pad #2	**RF Output A**	**0.10 x 0.15**	**[0.004 x 0.006]**
Bond Pad #3	**VA**	**0.10 x 0.10**	**[0.004 x 0.004]**
Bond Pad #4	**IA**	**0.10 x 0.15**	**[0.004 x 0.006]**
Bond Pad #5	**IB**	**0.10 x 0.15**	**[0.004 x 0.006]**
Bond Pad #6	**VB**	**0.10 x 0.10**	**[0.004 x 0.004]**
Bond Pad #7	**RF Output B**	**0.10 x 0.15**	**[0.004 x 0.006]**

Chip Assembly & Bonding Diagram



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

Alternate Chip Assembly & Bonding Diagram



Refer to Table V for values of R vs. control voltage

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TABLE V
BIAS RESISTOR VALUES

Maximum Negative Bias Voltage	R
-5V	190 Ohms
-7.5V	315 Ohms
-10V	440 Ohms
-15V	690 Ohms
-20V	940 Ohms

Assembly Process Notes

Reflow process assembly notes:

- Use AuSn (80/20) solder with limited exposure to temperatures at or above 300°C. (30 seconds maximum)
- 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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