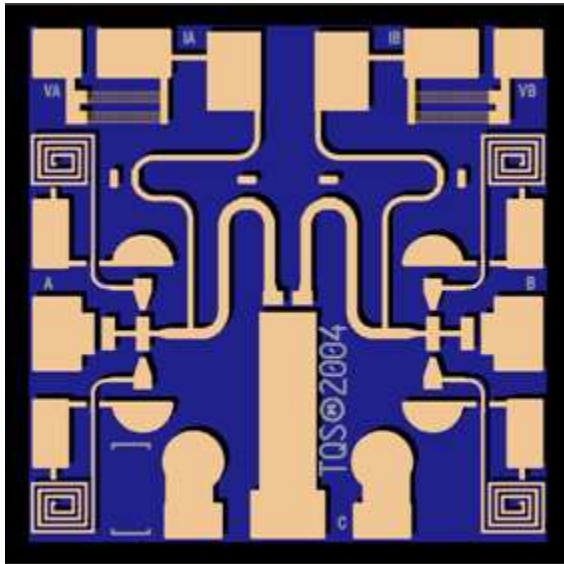


High Power Ka-Band SPDT Switch

TGS4302



Key Features and Performance

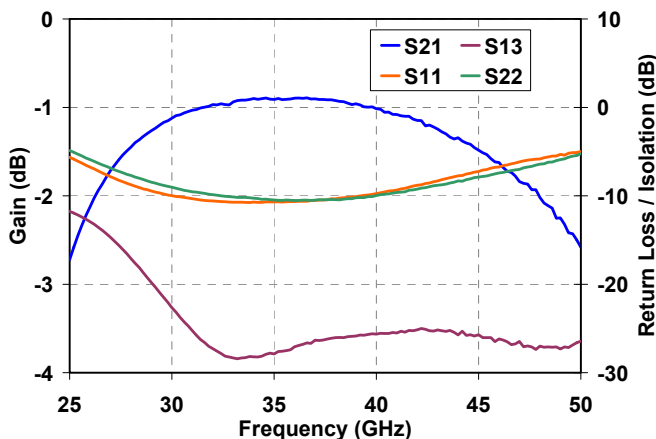
- 27 - 46 GHz Frequency Range
- > 33 dBm Input P1dB @ $V_C = 7.5V$
- On Chip Biasing Resistors
- On Chip DC Blocks
- < 0.9 dB Typical Insertion Loss
- < 4ns Switching Speed
- VPIN Technology
- Chip Dimensions:
1.09 x 1.09 x 0.10 mm
(0.043 x 0.043 x 0.004 inches)

Primary Applications

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

Preliminary Data

$V_A = +5V$, $I_A \approx 0mA$, $V_B = -5V$, $I_B = 20mA$



Description

The TriQuint TGS4302 is a GaAs single-pole, double-throw (SPDT) PIN monolithic 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.

**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	37 dBm	3/
T _M	Mounting Temperature (30 Seconds)	320 °C	4/, 5/
T _{STG}	Storage Temperature	-65 to 150 °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 °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
($T_A = 25^\circ\text{C}$, Nominal)
($V_A = +5\text{V}$, $I_A = 0\text{mA}$, $V_B = -5\text{V}$, $I_B = 20\text{mA}$)

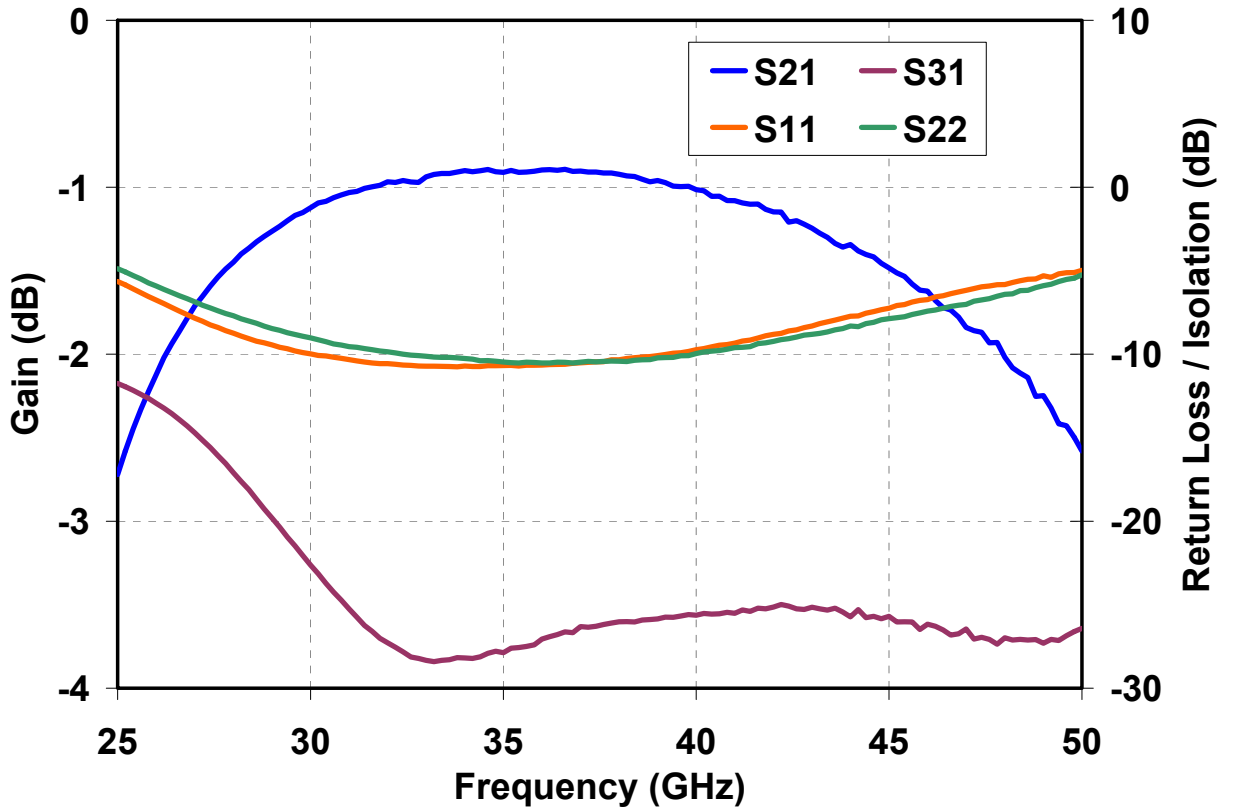
Symbol	Parameter	Test Conditions	Typ	Units	Notes
IL	Insertion Loss	F = 27 – 30 GHz F = 30 – 40 GHz F = 40 – 46 GHz	1.3 0.9 1.3	dB	
RL	Return Loss	F = 27 – 46 GHz	10	dB	
P1dB	Output Power @ 1dB Gain Compression	$V_C = +5\text{V}$ $V_C = +7.5\text{V}$ $V_C = +10\text{V}$ $V_C = +15\text{V}$	31 33 35 36	dBm	<u>1/</u>

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

1/ Frequency = 30GHz

Preliminary Data

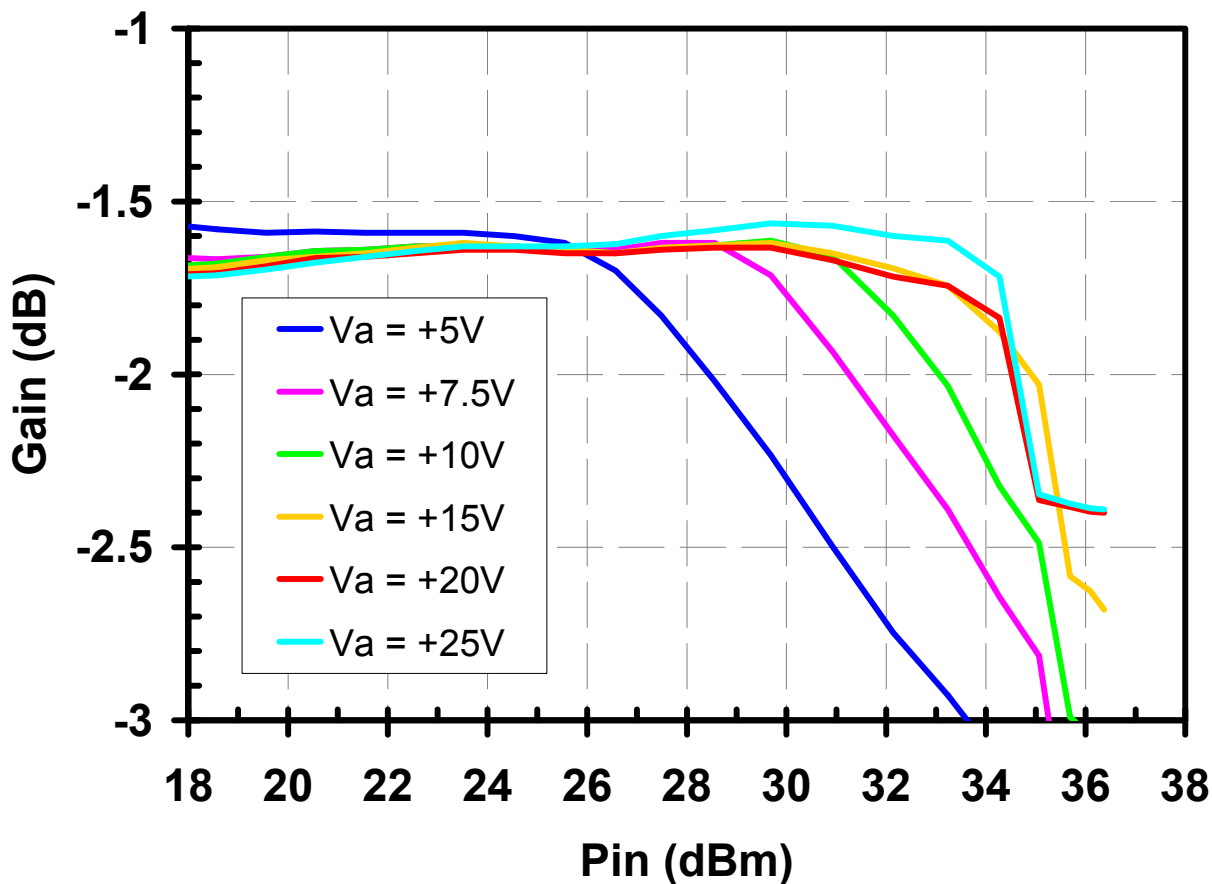
$I_A = 0\text{mA}$, $V_B = -5\text{V}$, $I_B = 20\text{mA}$



Preliminary Data

$I_A = 0\text{mA}$, $V_B = -5\text{V}$, $I_B = 20\text{mA}$, $F = 30\text{GHz}$

Data includes Fixture / connector losses of ~ 1 dB



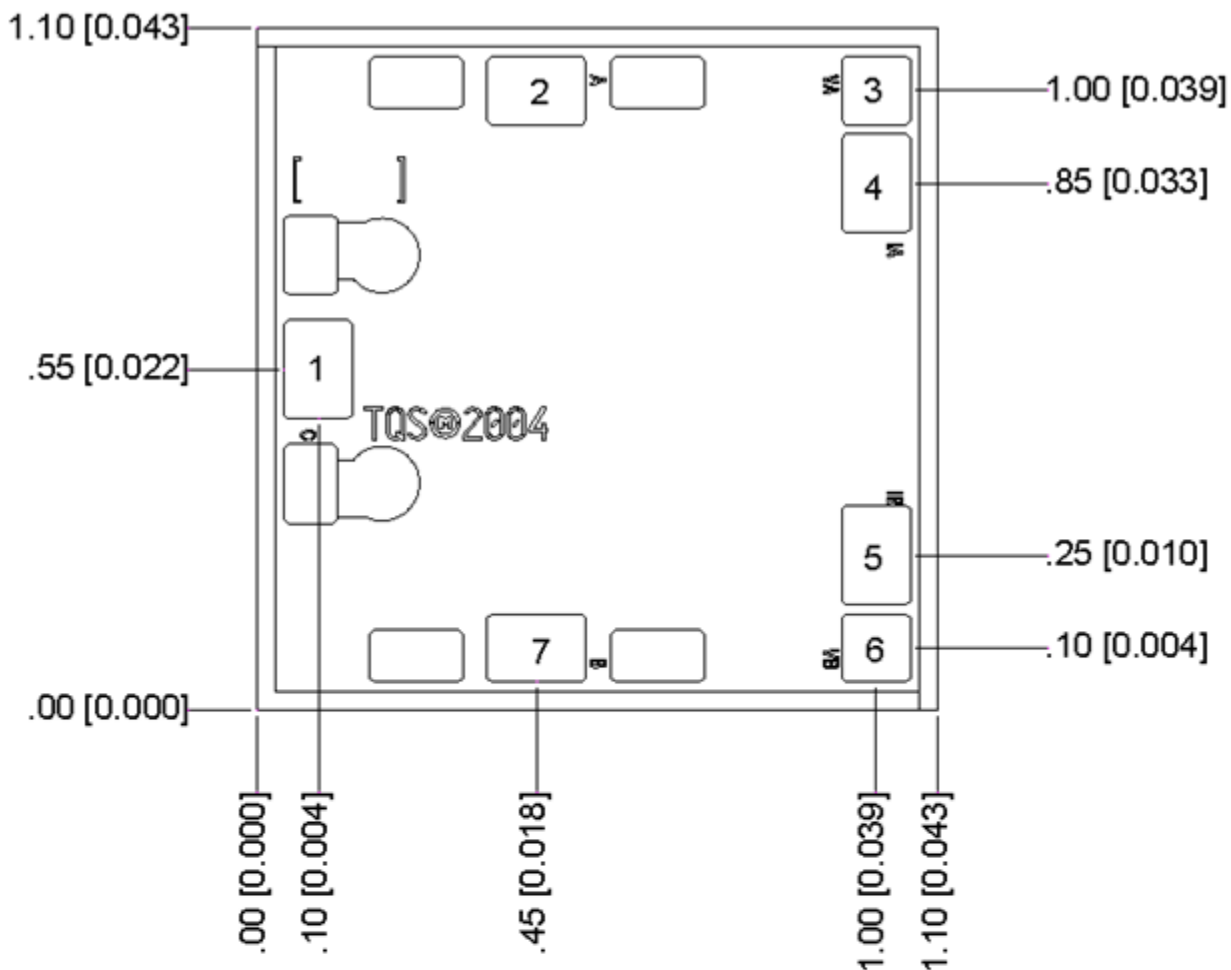
**TABLE IV
TRUTH TABLE**

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.

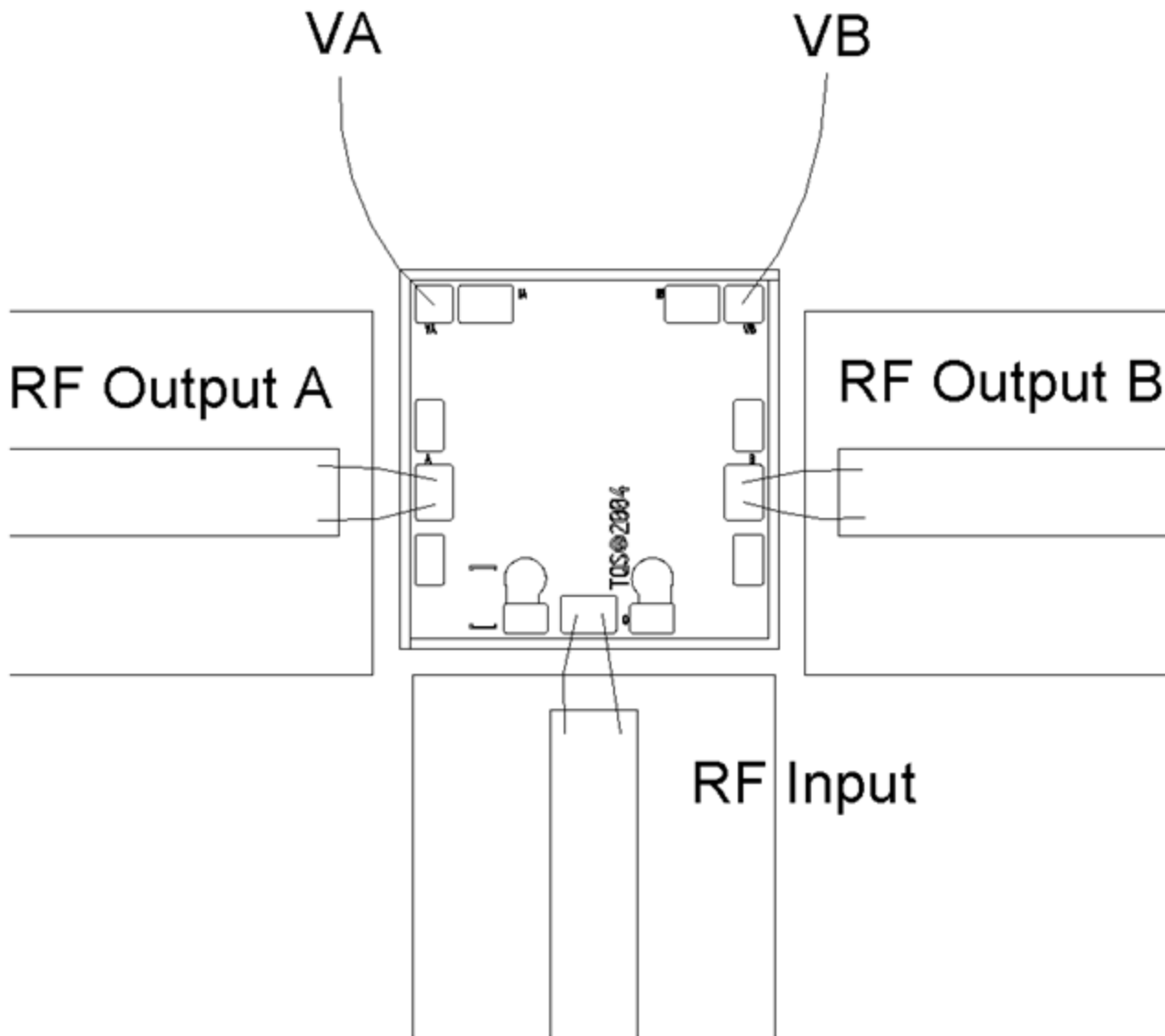
Chip size tolerance: ±0.05 [0.002]

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]

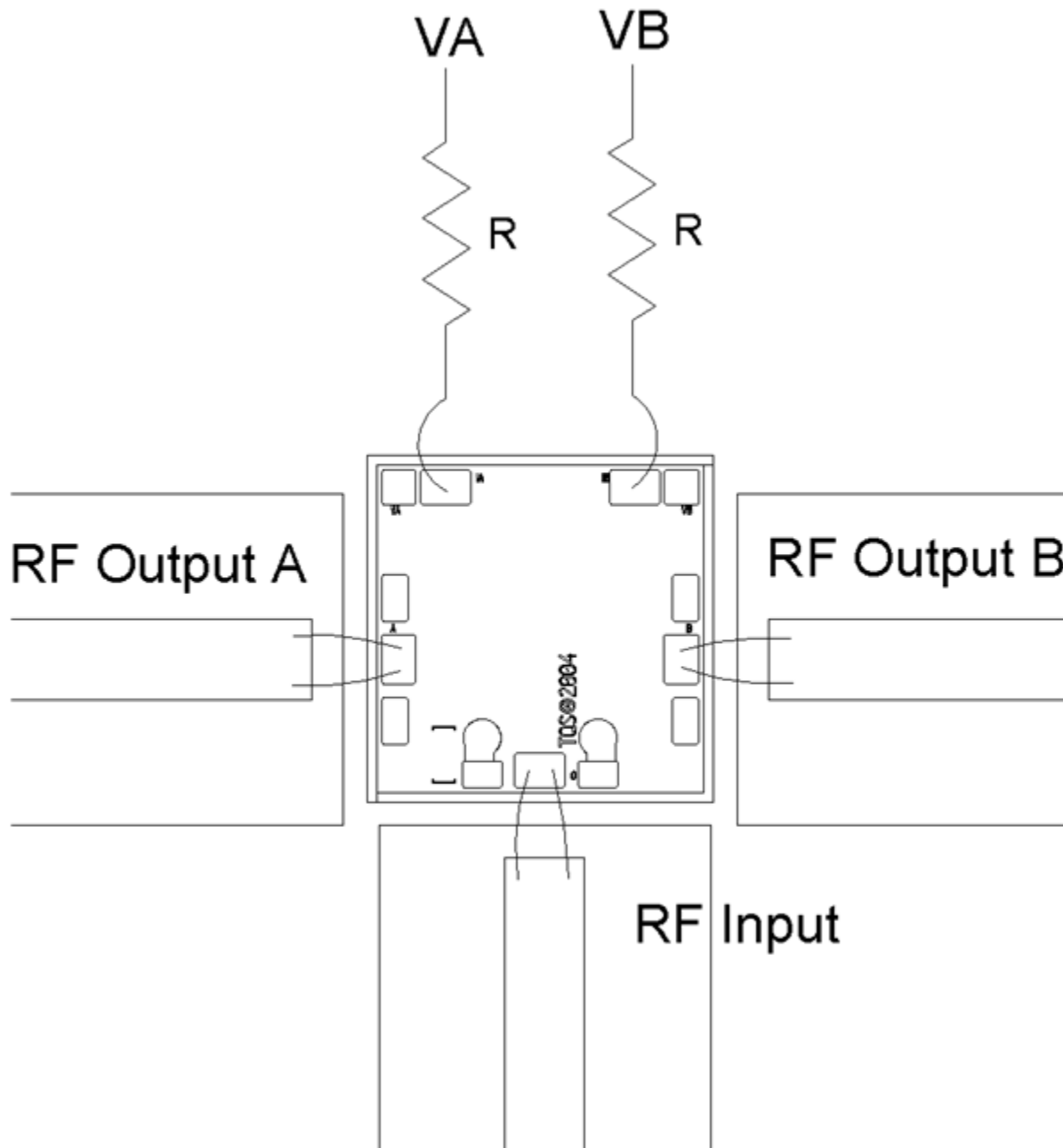
Chip Assembly & Bonding Diagram

TGS4302



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

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.

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