WINSOURCE ELECTRONICS

# THE DATASHEET OF

TGS4302

# TGS4302

## High Power Ka-Band VPIN SPDT Switch

## Product Description

Qorvo's 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 33 dBm or greater input P1dB at $V_C$ = 7.5V.

These advantages, along with small size of the chip, make the TGS4302 ideal for use in communication and transmit/receive applications.

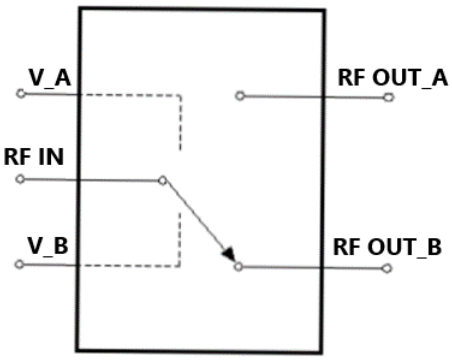



## Product Features

- Frequency Range: 27 - 46 GHz
- Insertion Loss: < 0.9 dB Typical
- Input $P_{1dB}$: >33 dBm @ $V_C$ = 7.5V
- Switching Speed: < 4ns
- On-Chip Biasing Resistors
- DC Blocked at RF ports
- VPIN Technology
- Die Dimensions: 1.10 x 1.10 x 0.10 mm

*Performance is typical across frequency. Please reference electrical specification table and data plots for more details.*

## Block Diagram




## Applications

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

## Ordering Information

| Part No. | Description |
|---|---|
| TGS4302 | 27 - 46 GHz High Power Switch |

## Absolute Maximum Ratings

| Parameter | Value |
|---|---|
| Control Voltage | -5 to +25 V |
| Control Current | 22.5 mA |
| RF Input Power (1), CW, 50 Ω, T = 25ºC | 37 dBm |
| Mounting Temperature (30 sec) | 320 °C |
| Storage Temperature | -65 to 150 |

Operation of this device outside the parameter ranges given above may cause permanent damage. These are stress ratings only, and functional operation of the device at these conditions is not implied.

Notes: (1) Operation above 30 dBm requires control voltage above +5V.

## Recommended Operating Conditions

| Parameter | Min | Typ. | Max | Units |
|---|---|---|---|---|
| Frequency | 27 | | 46 | GHz |
| Control Voltage ($V_A$/$V_B$) | | +5/-5 | | V |
| Control Current ($I_A$/$I_B$) | | 0/20 | | mA |

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

## DC Probe Test

Test conditions unless otherwise noted: Temp= +25 °C

| Symbol | Min | Max | Units |
|---|---|---|---|
| $R_{FWD}$ | 3.5 | 6 | Ω |
| $V_{REV}$ | -60 | -30 | V |

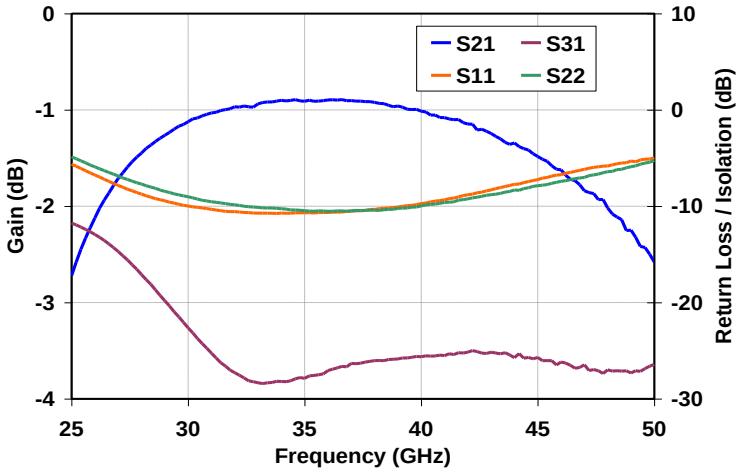
## Electrical Specifications

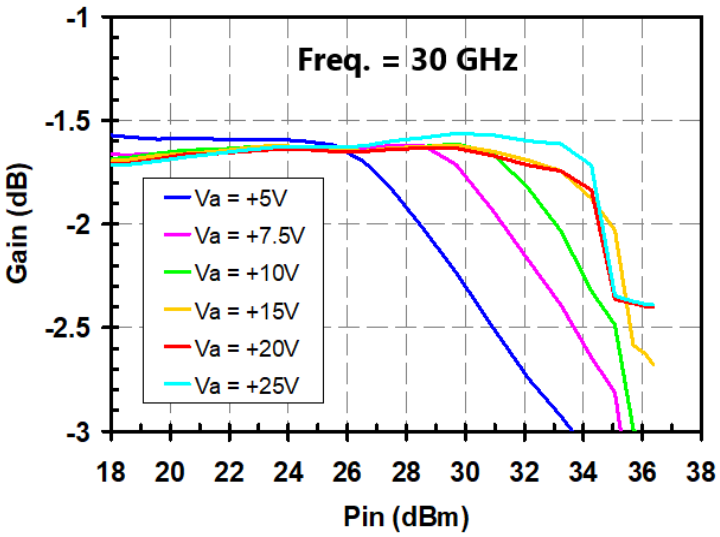
Test conditions unless otherwise noted: Temp= +25 °C, Bias Conditions: $V_A$ = 5 V, $I_A$ = 0 mA, $V_B$ = -5 V, $I_B$ = 20 mA

| Parameter | Conditions | Min | Typical | Max | Units |
|---|---|---|---|---|---|
| Operational Frequency Range | | 27 | | 46 | GHz |
| Insertion Loss | Freq. = 27 to 30 GHz | | 1.3 | | dB |
| | Freq. = 30 to 40 GHz | | 0.9 | | |
| | Freq. = 40 to 46 GHz | | 1.3 | | |
| Return Loss – Common Port RL | Freq. = 27 to 46 GHz | | 10 | | dB |
| Output Power @ $P_{1dB}$ (Freq. = 30 GHz) | $V_C$ = +5 V | | 31 | | dBm |
| | $V_C$ = +7.5 V | | 33 | | |
| | $V_C$ = +10 V | | 35 | | |
| | $V_C$ = +15 V | | 36 | | |

## Performance Plots –

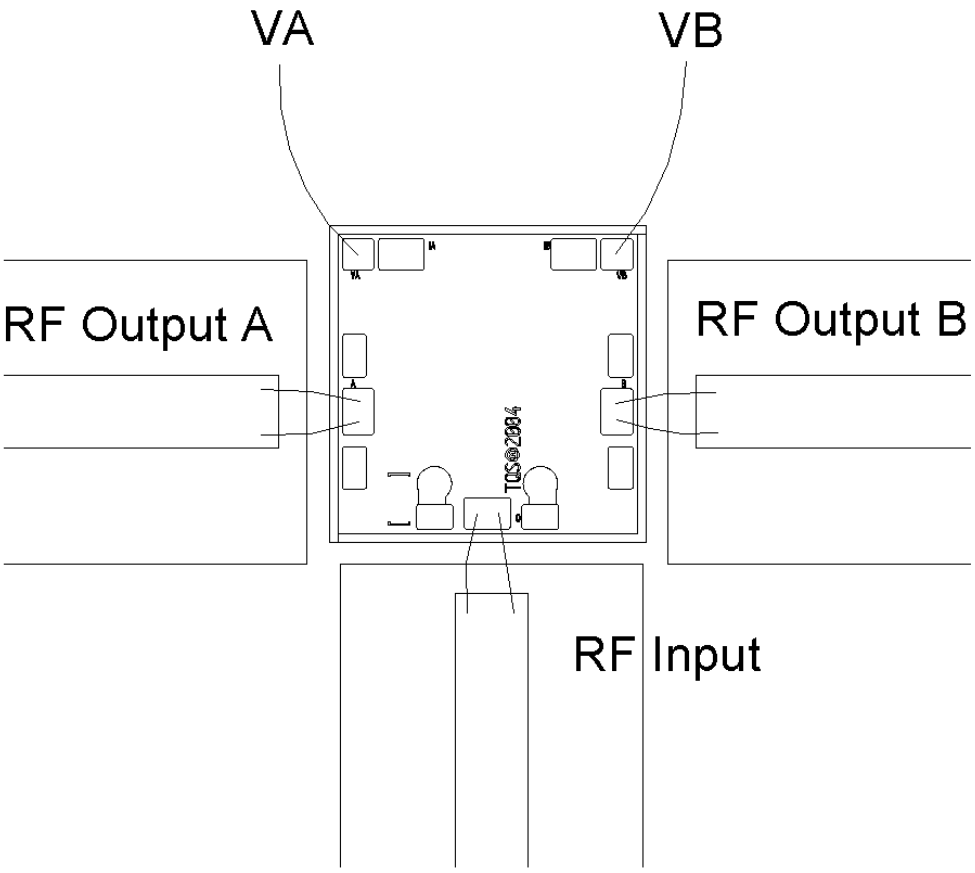
Test conditions unless otherwise noted: Temp= +25 °C, Bias Conditions: $V_A$ = 5 V, $I_A$ = 0 mA, $V_B$ = -5 V, $I_B$ = 20 mA



## Assembly Drawing

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## True Table

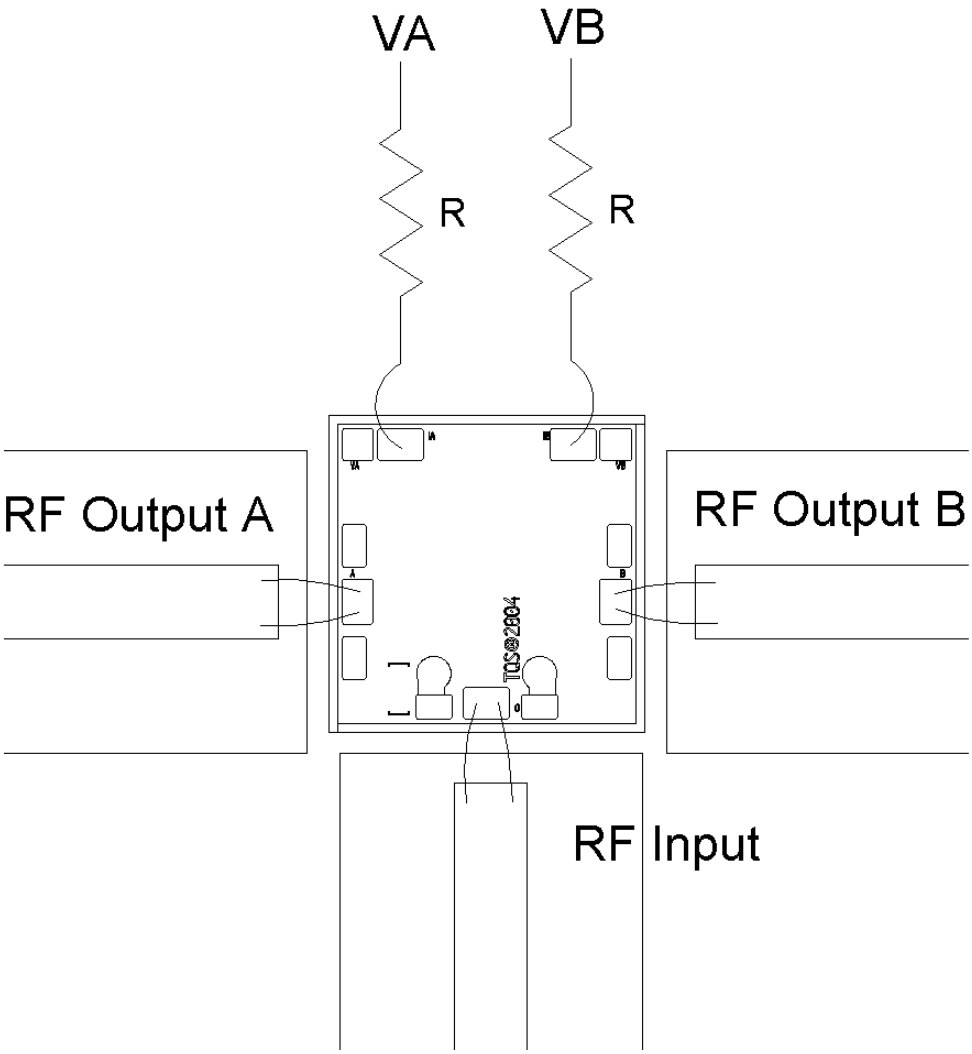
| State | $V_A$ | $V_B$ |
|---|---|---|
| RF Out A | ≥ +5 V @ ~0 mA | -5 V @ 20 mA |
| RF Out B | -5 V @ 20 mA | ≥ +5 V @ ~0 mA |

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 (Alternate Assembly on next page) the on-chip series resistors to allow adjustment of the current to the diodes in their forward biased state.

## Alternate Assembly Drawing

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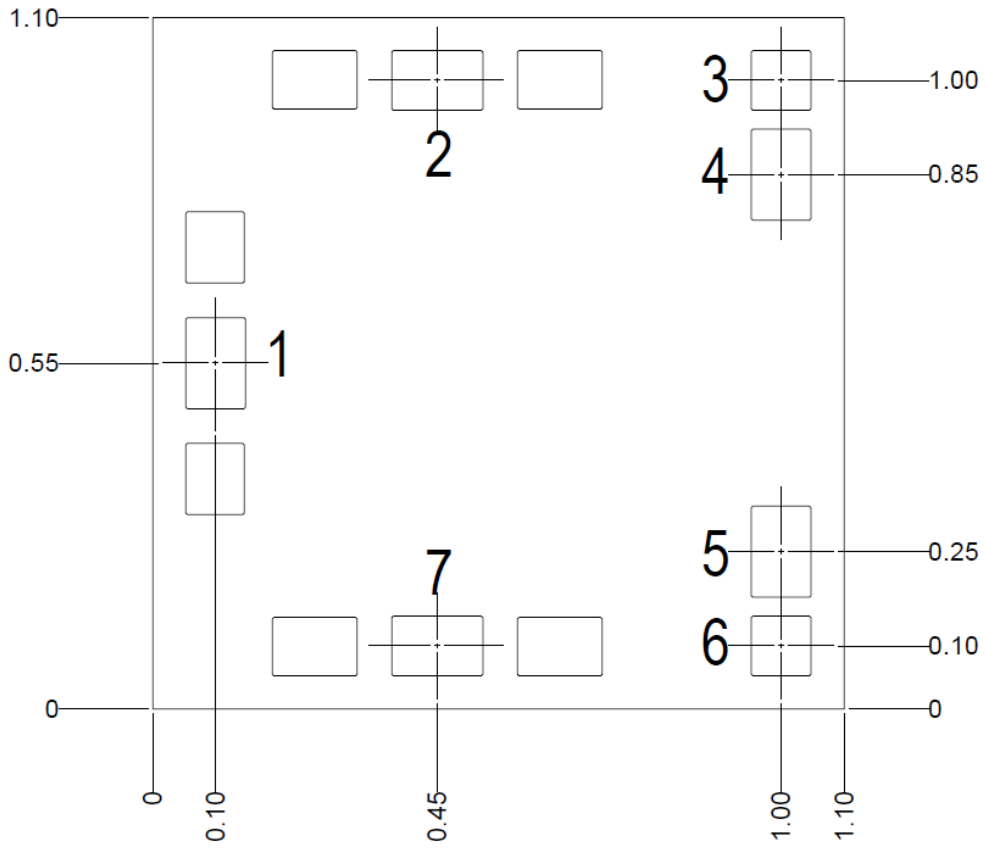



Notes: Refer to Bias Resistor Values Table for values of R vs. Control Voltage.

## Bias Resistor Values

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

## Mechanical Drawing and Bond Pad Description




| Pin No. | Symbol | Description | Pad Size (mm) |
|---|---|---|---|
| 1 | RF In | Input, RF common port; matched to 50 Ω; DC blocked. | 0.095 x 0.145 |
| 2 | RF Out A | Output A, RF switched port A; matched to 50 Ω; DC blocked. | 0.145 x 0.095 |
| 3 | VA | Control voltage A. | 0.095 x 0.095 |
| 4 | IA | Control current A. | 0.095 x 0.145 |
| 5 | IB | Control current B. | 0.095 x 0.145 |
| 6 | VB | Control voltage A. | 0.095 x 0.095 |
| 7 | RF Out B | Output B, RF switched port B; matched to 50 Ω; DC blocked. | 0.145 x 0.095 |

## Assembly Notes

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 (i.e., conductive epoxy) can be used in low-power applications.
- Curing should be done in a convection oven; proper exhaust is a safety concern.

Reflow process assembly notes:

- Use AuSn (80/20) solder and limit exposure to temperatures above 300 °C to 3 – 4 minutes, maximum.
- An alloy station or conveyor furnace with reducing atmosphere should be used.
- Do not use any kind of flux.
- Coefficient of thermal expansion matching is critical for long-term reliability.
- Devices must be stored in a dry nitrogen atmosphere.

Interconnect process assembly notes:

- Thermosonic ball bonding is the preferred interconnect technique.
- Force, time, and ultrasonic are critical parameters.
- Aluminum wire should not be used.
- Devices with small pad sizes should be bonded with 0.0007-inch wire.

## Handling Precautions

| Parameter | Rating | Standard |
|---|---|---|
| ESD – Human Body Model (HBM) | 1A | ESDA / JEDEC JS-001 |



Caution!
ESD-Sensitive Device

## Solderability

Use only AuSn (80/20) solder and limit exposure to temperatures above 300 °C to 3-4 minutes, maximum.

## RoHS Compliance

This product is compliant with the 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), as amended by Directive 2015/863/EU. This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free

## Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

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**Email:** customer.support@qorvo.com

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