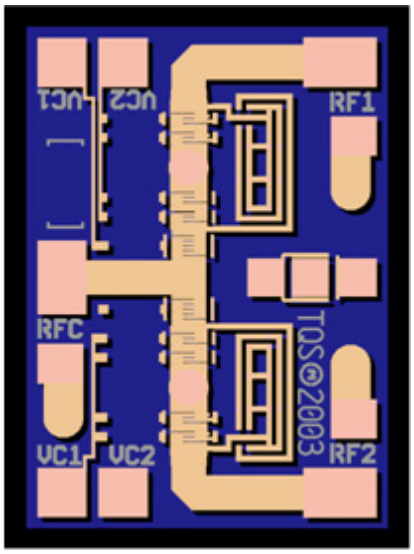
# High Power DC - 18GHz SPDT FET Switch TGS2306

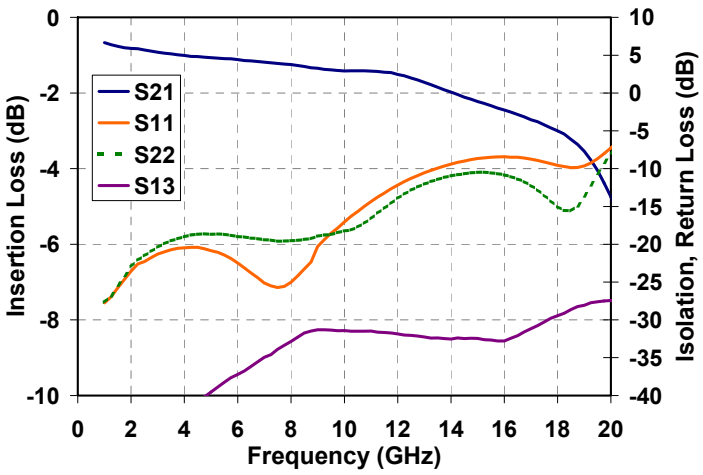



## Key Features and Performance

- DC - 18 GHz Frequency Range
- 29 dBm Input P1dB @ $V_C$ = -5V
- > 30 dB Isolation
- <1 nsec switching speed
- Control Voltage Application from Either Side of MMIC
- -3V or -5V Control Voltage
- 0.5µm pHEMT 3MI Technology
- Chip Dimensions:
  0.83 x 1.11 x 0.10 mm
  (0.033 x 0.044 x 0.004 inches)

## Preliminary Measured Performance

$V_{C1}$ = 0V; $V_{C2}$ = -5V




## Description

The TriQuint TGS2306 is a GaAs single-pole, double-throw (SPDT) FET monolithic switch designed to operate over the DC to 18GHz frequency range. This switch not only maintains a high isolation loss and a low insertion loss across a wide bandwidth, but also has very low power consumption and high power handling of 29dBm or greater input P1dB at $V_C$ = 5V. These advantages, along with the small size of the chip, make the TGS2306 ideal for use in high-speed radar and communication applications.

*Note: Datasheet is subject to change without notice*



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**TABLE I**
**MAXIMUM RATINGS**

| Symbol | Parameter | Value | Notes |
|---|---|---|---|
| $V_C$ | Control Voltage | -7 V | 1/ 2/ |
| $I_C$ | Control Current | 2.25 mA | 1/ 2/ |
| $P_{IN}$ | Input Continuous Wave Power | 29 dBm | 1/ 2/ |
| $P_D$ | Power Dissipation | 1.2 W | 1/ 2/ 3/ |
| $T_{CH}$ | Operating Channel Temperature | 150 $^0$C | 4/ |
| $T_M$ | Mounting Temperature (30 Seconds) | 320 $^0$C | |
| $T_{STG}$ | Storage Temperature | -65 to 150 $^0$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 $P_D$ at a package base temperature of 70°C

3/ When operated at this bias condition with a baseplate temperature of 70°C, the MTTF is reduced to 1.0E+6 hours

4/ 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**
**THERMAL INFORMATION**

| Parameter | Test Conditions | $T_{CH}$ ($^o$C) | $\theta_{JC}$ (°C/W) | $T_M$ (HRS) |
|---|---|---|---|---|
| $\theta_{JC}$ Thermal Resistance (channel to backside of carrier) | RF input =29dBm<br>Insertion Loss ~ 2dB<br>$T_{BASE}$ = 70 $^o$C | 90 | 68 | 3.7 E+8 |

Note: Assumes eutectic attach using 1.5 mil 80/20 AuSn mounted to a 20 mil CuMo Carrier at 70°C baseplate temperature.

**TABLE III**
**TRUTH TABLE**

| Selected RF Output | $V_{C1}$ | $V_{C2}$ |
|---|---|---|
| RF Out 1 | 0 V | -5 V |
| RF Out 2 | -5 V | 0 V |



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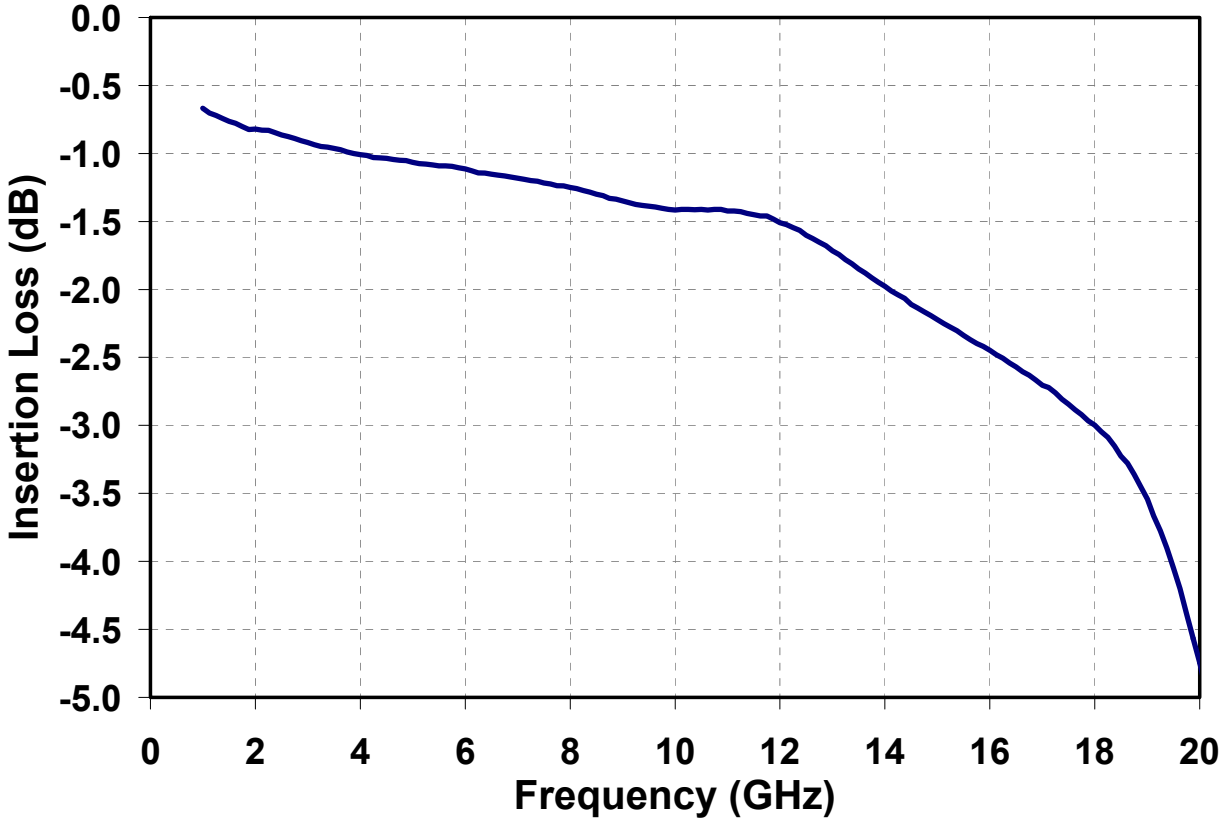
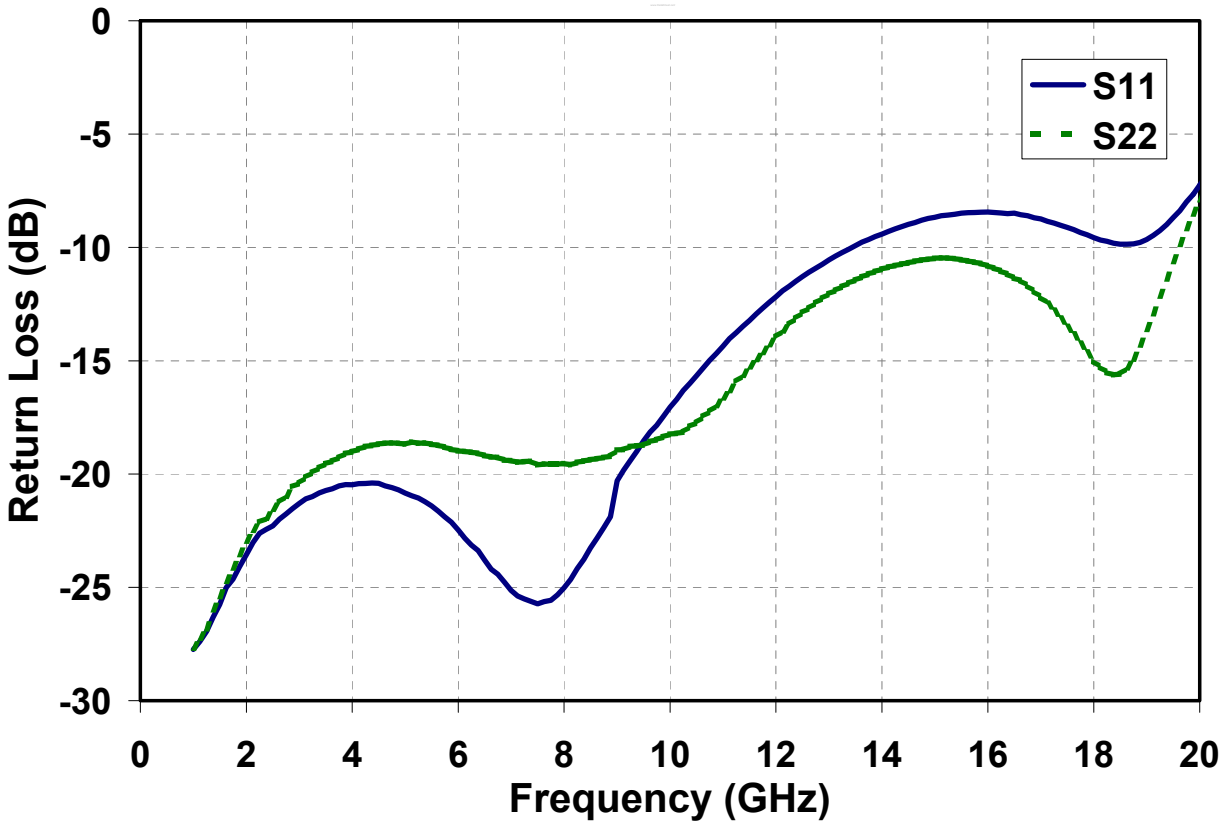
## Fixtured Measurement



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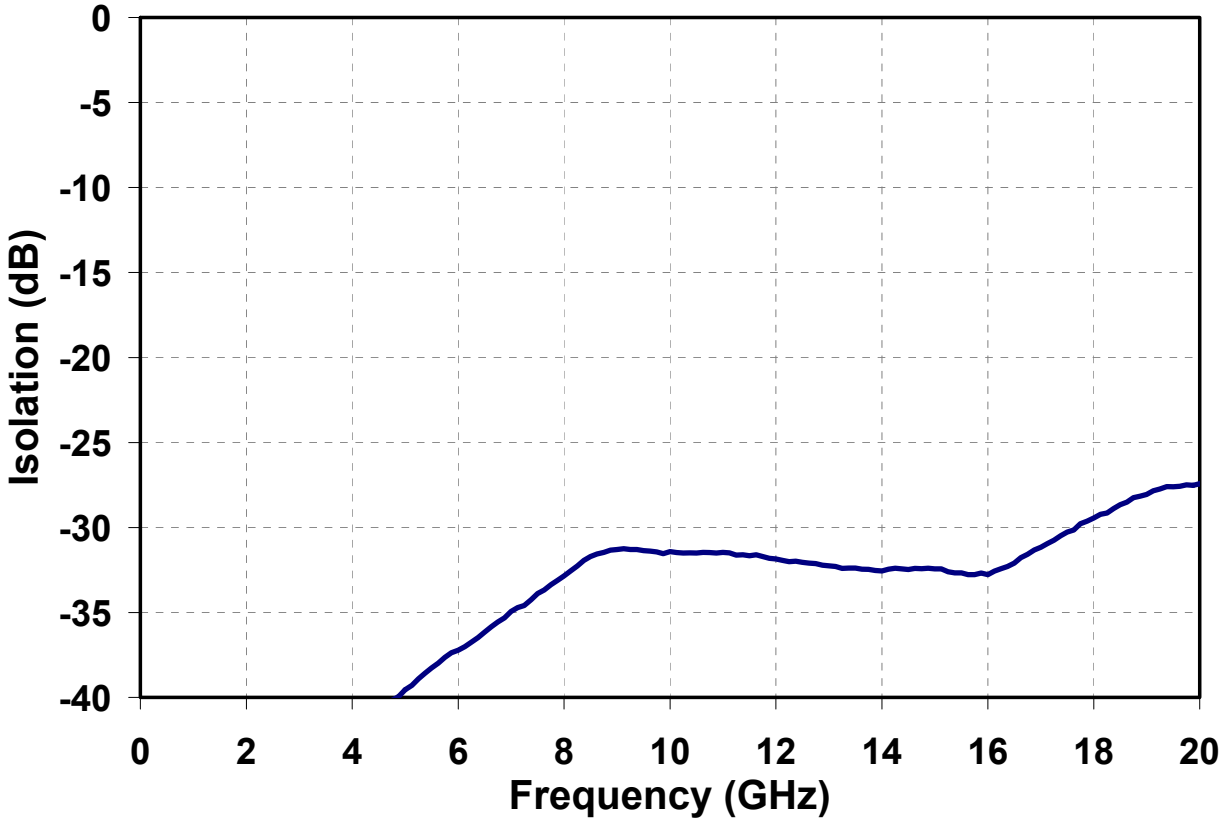


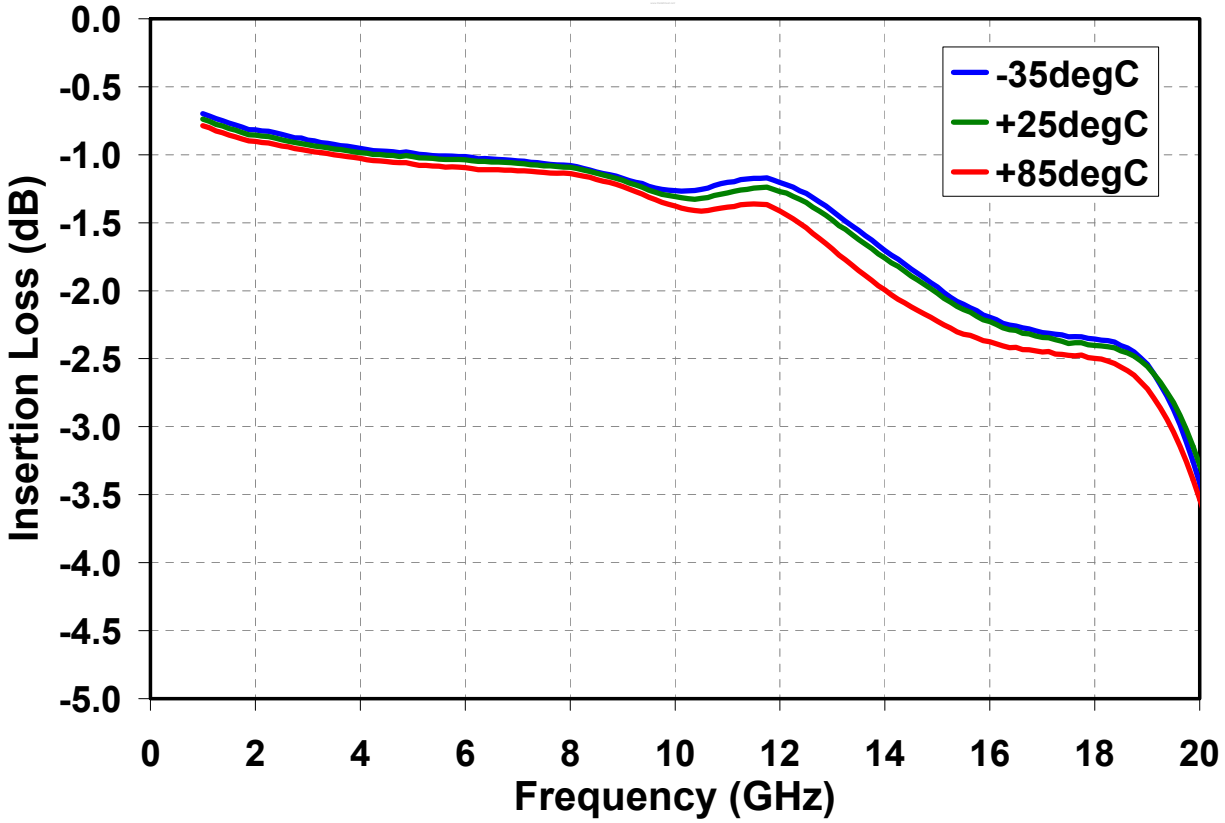




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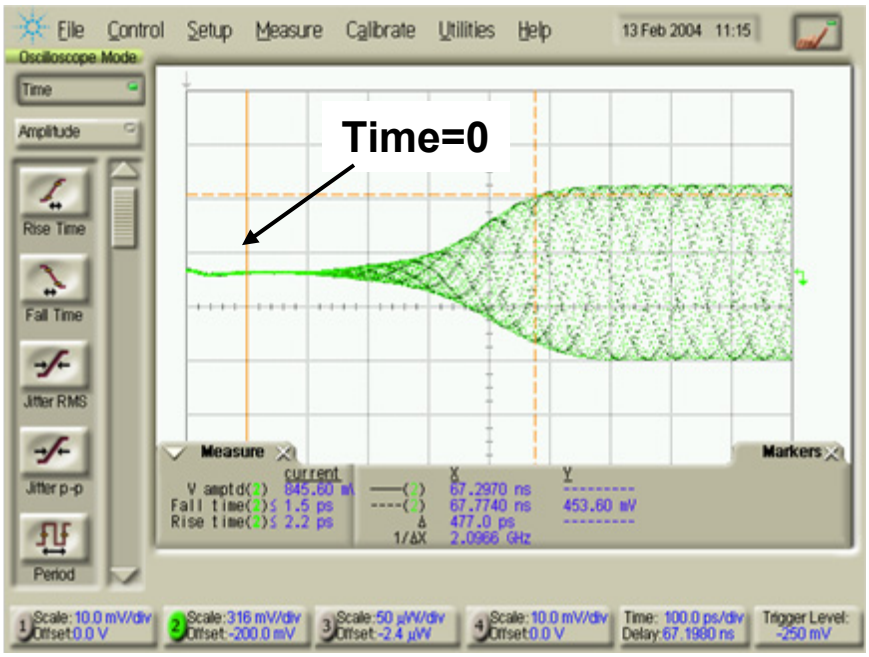
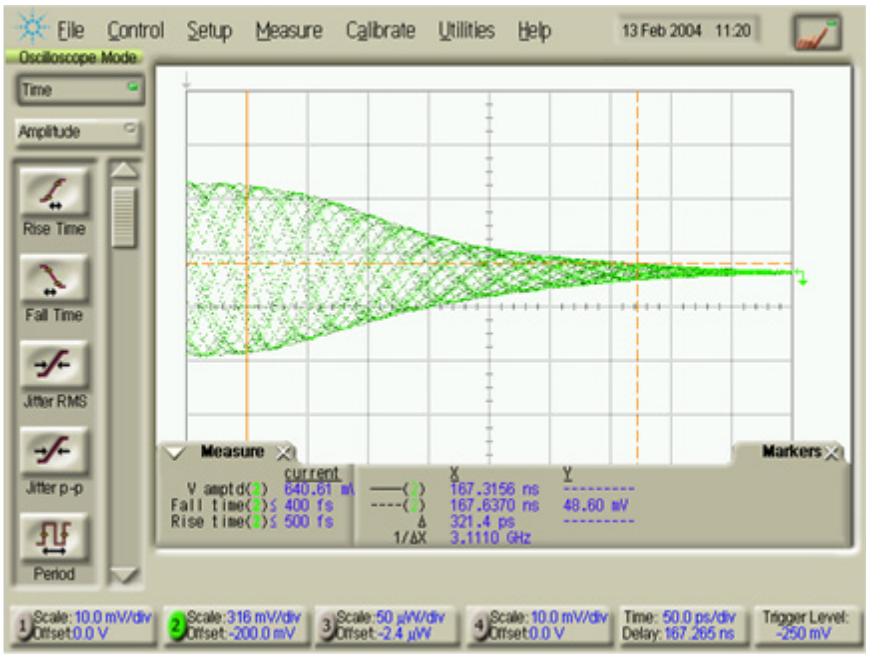
# Switching Speed Measurements




**Off to On**

**50% Control Signal to 90% RF = 480 psec**

**100 psec/div**




**On to Off**

**50% Control Signal to 10% RF = 320 psec**

**50 psec/div**

Measurement performed using a pulse generator with 100 psec rise/fall times driving 50 ohm transmission lines that were terminated in 50 ohms and attached to the VC1 and VC2 control inputs. Pulse generator provided complementary outputs.



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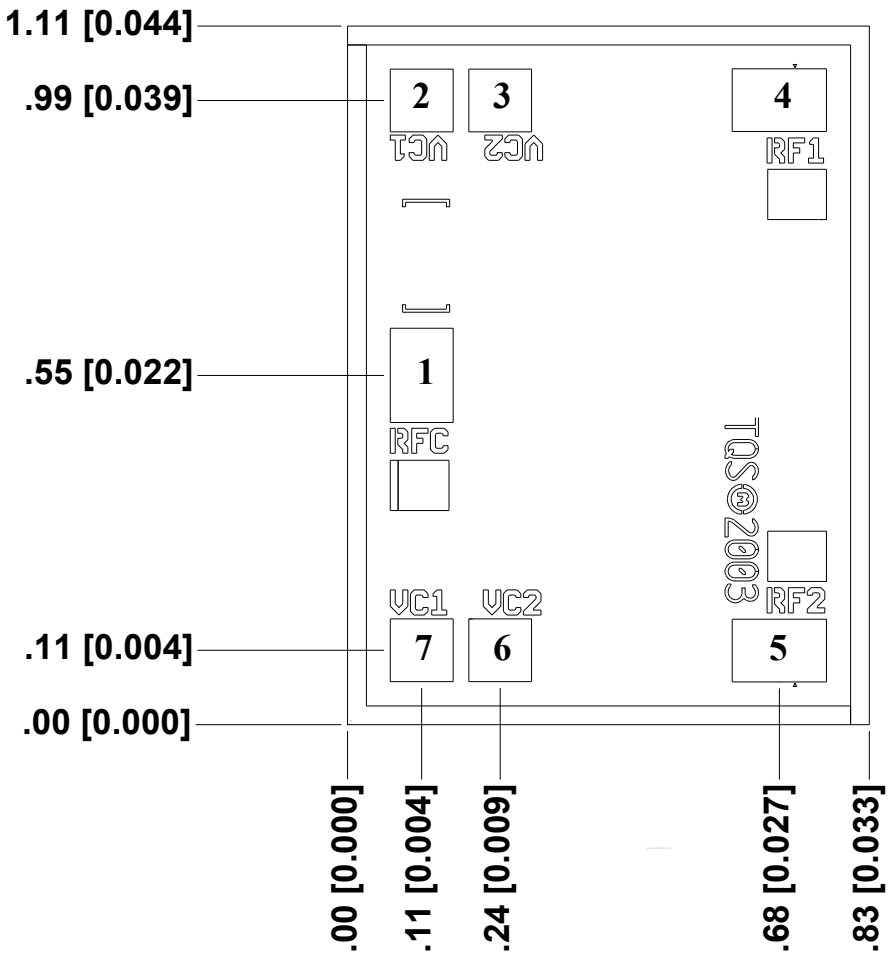
## Mechanical Drawing




**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 0.20** | **[0.004 x 0.008]** |
| **Bond Pad #2** | **VC1** | **0.10 x 0.10** | **[0.004 x 0.004]** |
| **Bond Pad #3** | **VC2** | **0.10 x 0.10** | **[0.004 x 0.004]** |
| **Bond Pad #4** | **RF Output 1** | **0.20 x 0.10** | **[0.008 x 0.004]** |
| **Bond Pad #5** | **RF Output 2** | **0.20 x 0.10** | **[0.008 x 0.004]** |
| **Bond Pad #6** | **VC2** | **0.10 x 0.10** | **[0.004 x 0.004]** |
| **Bond Pad #7** | **VC1** | **0.10 x 0.10** | **[0.004 x 0.004]** |



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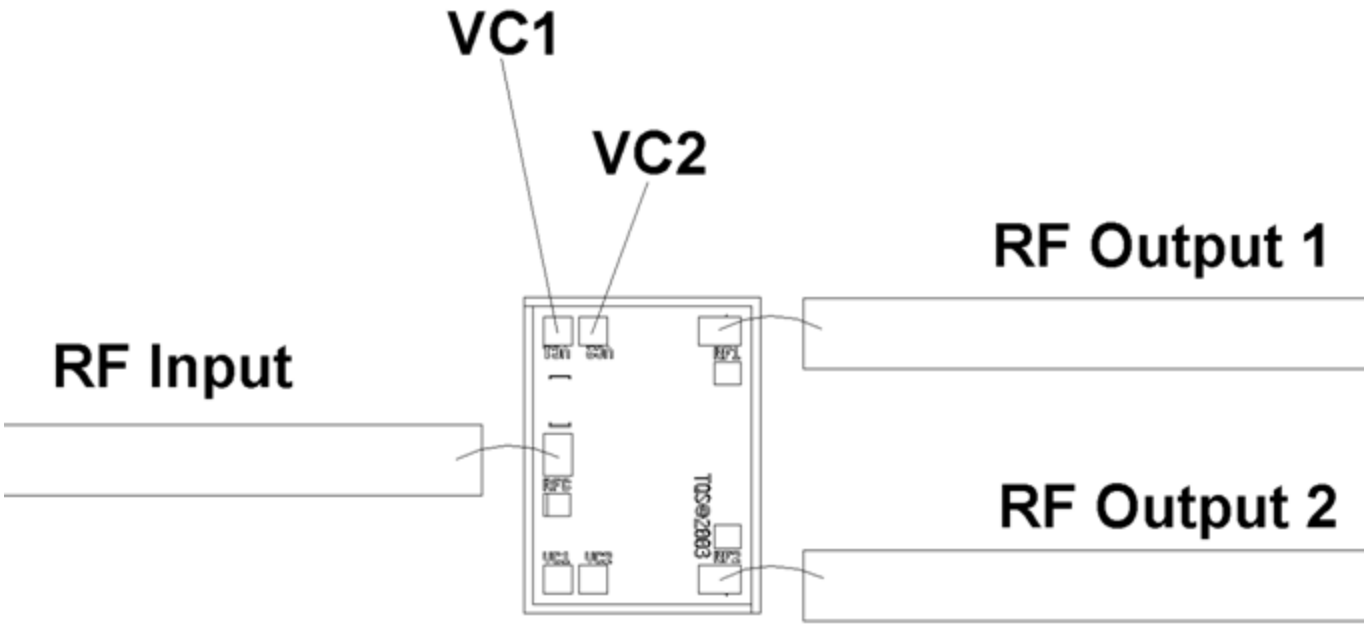
## Chip Assembly & Bonding Diagram




For optimum insertion loss and return loss, a single 0.001” bondwire of length 35 mils should be used. This will be approximately 0.42nH. Differences in bondwire length will have an impact on switch performance.

$V_{C1}$ & $V_{C2}$ can be applied from either side of the MMIC.

DC blocks are required for the RF input and output.

***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°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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