



TGS2353-2

0.5 – 18.0 GHz High Power SPDT Switch

Product Description

Qorvo's TGS2353-2 is a single-pole, double-throw (SPDT) reflective switch fabricated on Qorvo's QGaN25 0.25um GaN on SiC production process.

Operating from 0.5 to 18 GHz, the TGS2353-2 typically provides up to 10W input power handling at control voltages of 0/-40 V. This switch maintains low insertion loss of 1.5 dB or less, and high isolation of 30 dB typical.

The TGS2353-2 performance allows it to be used in a variety of applications across commercial and military markets, low and high power.

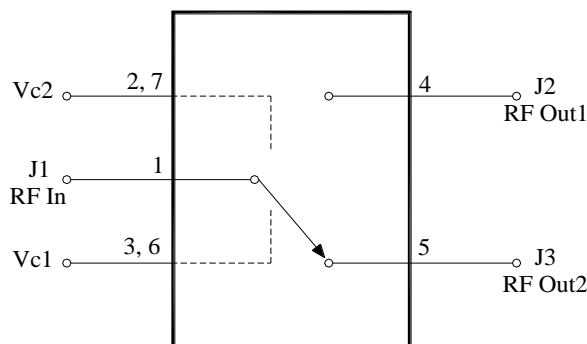


Product Features

- SPDT, Reflective
- Frequency Range: 0.5 - 18 GHz
- Power Handling: up to 10 W
- Insertion Loss: < 1.5 dB
- Isolation: 30 dB typical
- Control Voltages: 0 V/-40 V (from either side of the MMIC)
- Switching Speed: < 35 ns
- Die Dimensions: 1.12 mm x 1.62 mm x 0.10 mm

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

Block Diagram



Applications

- Commercial and Military Radar
- Communications
- Electronic Warfare
- Test Instruments
- General Purpose

Ordering Information

| Part No. | Description |
|---------------|--------------------------------|
| TGS2353-2 | 0.5 - 18 GHz High Power Switch |
| TGS2353-2 EVB | Evaluation Board |



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Absolute Maximum Ratings

| Parameter | Value |
|--|----------------|
| Control Voltage (V_C) | -50 V |
| Control Current (I_C) | -1.5 to 6.0 mA |
| Power Dissipation, (P_{DISS}), CW | 3.5 W |
| RF Input Power, CW, 50 Ω , T = 25°C | 41 dBm |
| Mounting Temperature (30 sec) | 320 °C |
| Storage Temperature | -55 to 150 °C |

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.

Recommended Operating Conditions

| Parameter | Min | Typ. | Max | Units |
|---------------------------|-----|------|-----|-------|
| Frequency | 0.5 | | 18 | GHz |
| Input Power Handling (CW) | | 41 | | dBm |
| Control Voltage | | -40 | | V |
| Temperature Range | -40 | 25 | +85 | °C |

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

Electrical Specifications

Test conditions unless otherwise noted: $T_{BASE} = 25^\circ\text{C}$, $V_{C1} = -40/0\text{ V}$, $V_{C2} = 0/-40\text{ V}$, CW Input Power, see Function Table on page 4

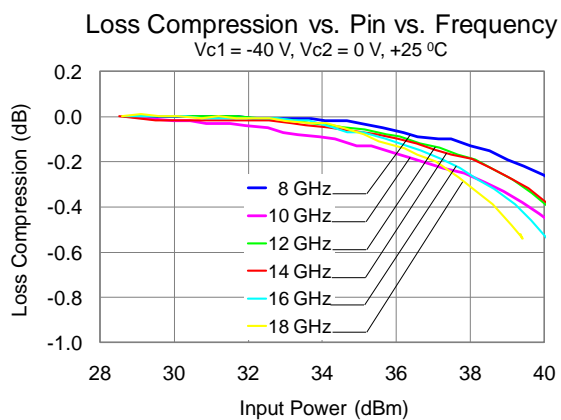
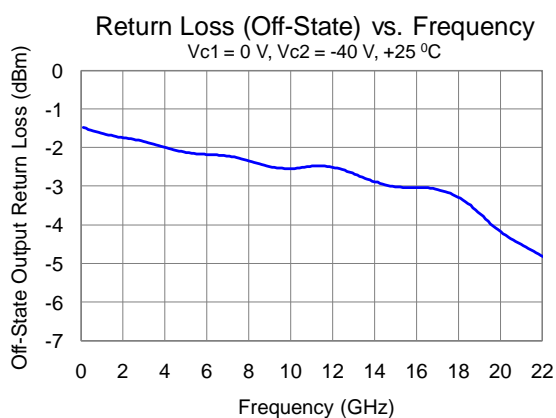
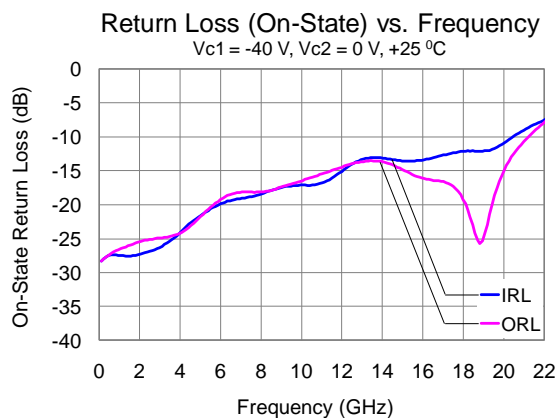
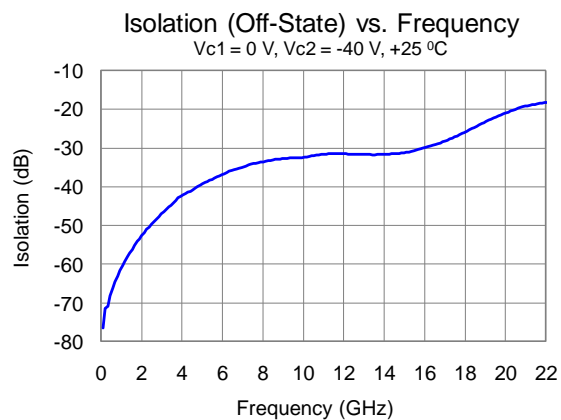
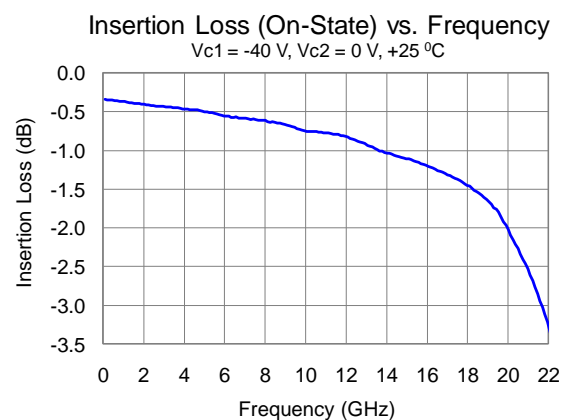
| Parameter | Conditions | Min | Typical | Max | Units |
|--|------------|-----|---------|-----|--------|
| Operational Frequency Range | | 0.5 | | 18 | GHz |
| Insertion Loss | On-State | | < 1.5 | | dB |
| Input Return Loss – Common Port RL | On-State | | 15 | | dB |
| Output Return Loss – Switched Port RL | On-State | | 15 | | dB |
| Isolation | Off-State | | 30 | | dB |
| Output Return Loss – Isolated Port RL | Off-State | | 2.5 | | dB |
| Input Power | | | 40 | | dBm |
| Switching Speed | ON | | 31 | | nS |
| Switching Speed | OFF | | 18 | | nS |
| Insertion Loss Temperature Coefficient | | | 0.003 | | dB/ °C |

Thermal and Reliability Information

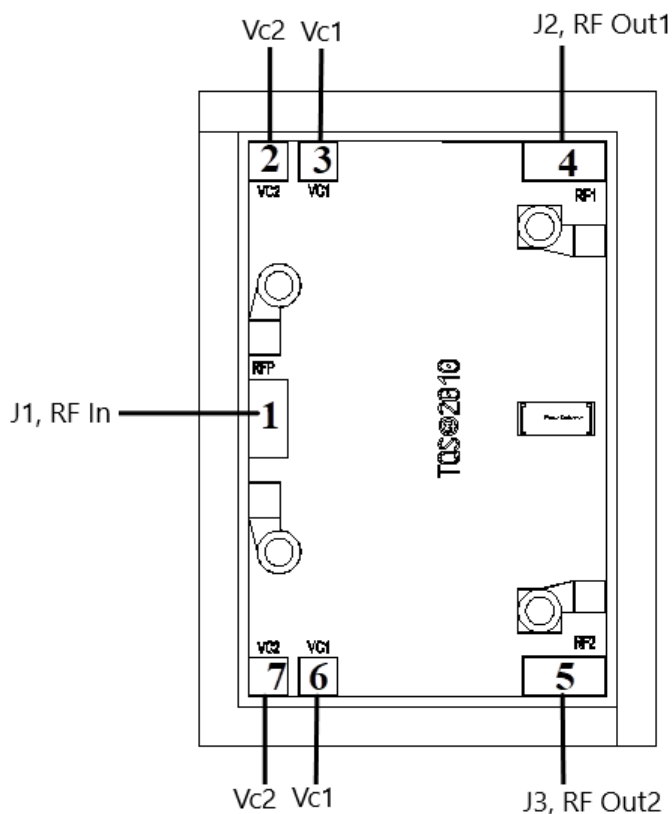
| Parameter | Test Conditions | Value | Units |
|---|--|-------|-------|
| Thermal Resistance (θ_{JC}) ^(1,2) | $T_{BASE} = 85^\circ\text{C}$, $V_{C1} = 0\text{ V}$, $V_{C2} = -40\text{ V}$, freq. = 14 GHz | 19.78 | °C/W |
| Channel Temperature (T_{CH}) ^(1,2) | $P_{IN} = 10\text{ W}$, $P_{DISS} = 3.7\text{ W}$ | 158 | °C |

1. MMIC soldered to 40 mil thick Cu-Mo carrier plate using AuSn solder. Thermal resistance is determined from the channel to the back of the carrier plate (fixed 85 °C temp.).
2. Refer to the following document: [GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates](#)

Performance Plots – Small Signal



Applications Circuit



Notes:

V_{C1} can be biased from either bond pad 3 or 6, and the non-biased bond pad can be left open.
 V_{C2} can be biased from either bond pad 2 or 7, and the non-biased bond pad can be left open.

This switch can be configured as a Single Pole, Single Throw (SPST) by terminating one unused RF switched port with a 50 Ohm load.

Bias Up Procedure

1. V_{C1} or V_{C2} set to 0 V (see Function Table for RF Path)
2. V_{C2} or V_{C1} set to -40 V (see Function Table for RF Path)
3. Apply RF signal to RF Input

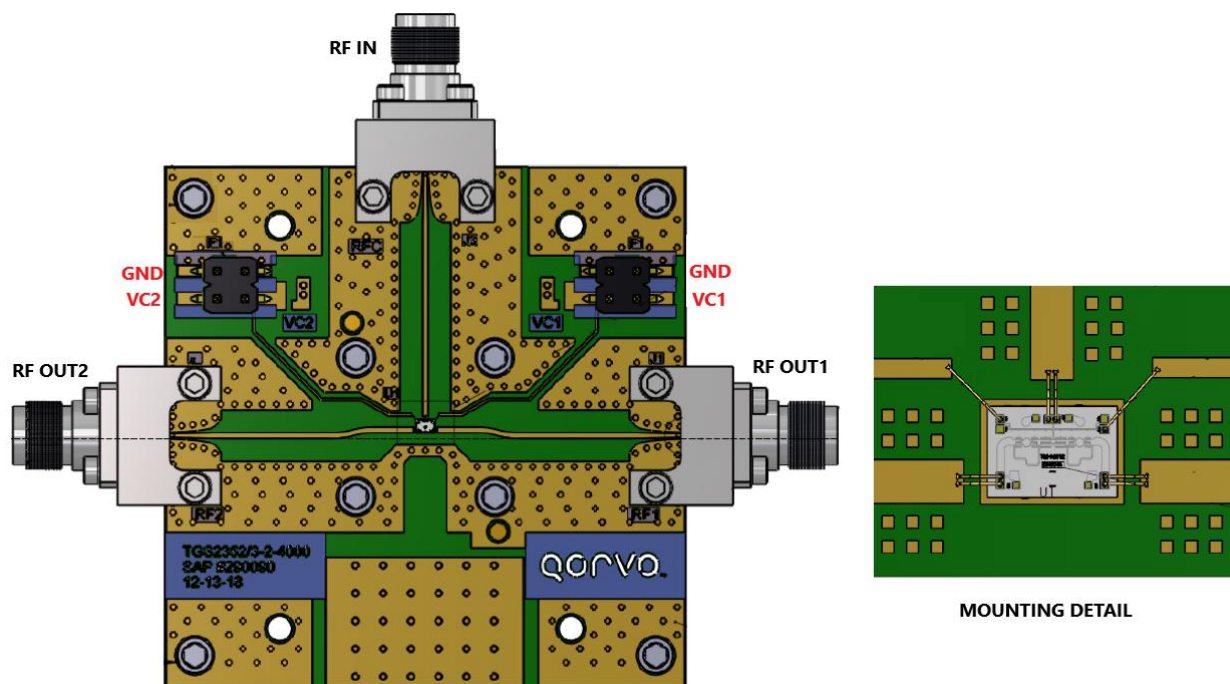
Bias Up Down

1. Turn off RF supply
2. Turn V_{C2} or V_{C1} to 0 V
3. Turn V_{C1} or V_{C2} to 0 V

Function Table

| RF Path | State | V_{C1} | V_{C2} |
|--|---------------------------|----------|----------|
| RF In to RF Out1 (50 Ω load to RF Out2) | On-State (Insertion Loss) | 0 V | -40 V |
| | Off-State (Isolation) | -40 V | 0 V |
| RF In to RF Out2 (50 Ω load to RF Out1) | On-State (Insertion Loss) | -40 V | 0 V |
| | Off-State (Isolation) | 0 V | -40 V |

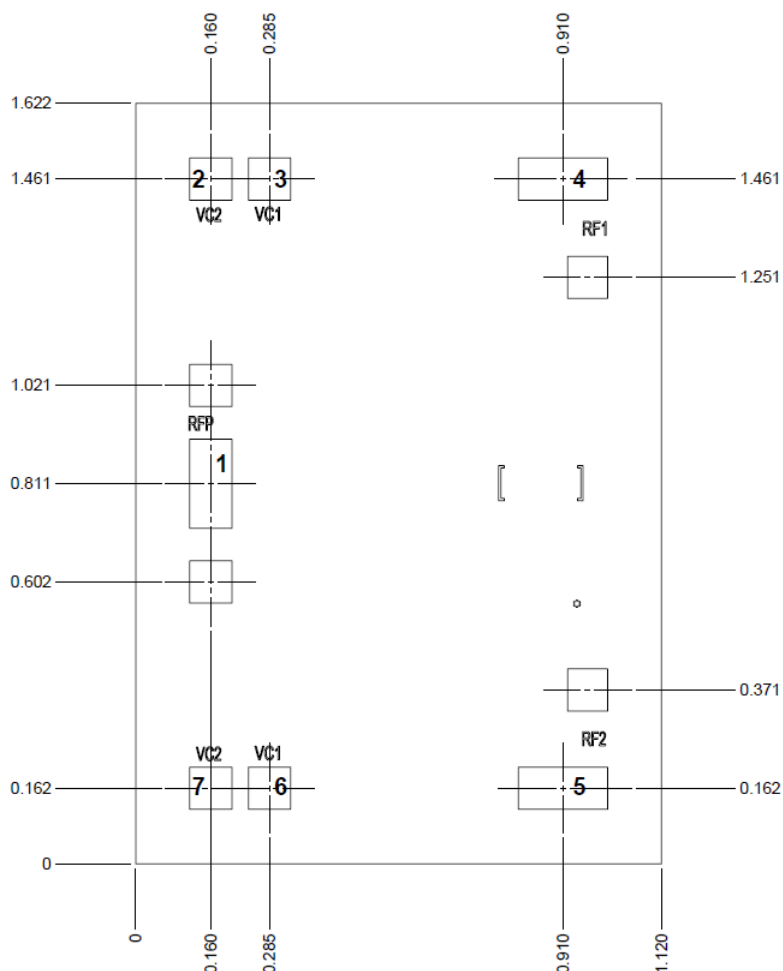
Evaluation Board (EVB) Layout Assembly & Mounting Detail



RF Layer is 0.010" thick Rogers Corp. RO4350B, $\epsilon_r = 3.48$. Metal layers are 0.5 oz. copper. The microstrip line at the connector interface is optimized for the Southwest Microwave end launch connector 1092-02A-5.

The pad pattern shown has been developed and tested for optimized assembly at Qorvo Semiconductor. The PCB land pattern has been developed to accommodate lead and package tolerances. Since surface mount processes vary from company to company, careful process development is recommended.

Mechanical Drawing and Bond Pad Description



Unit: millimeters

Thickness: 0.10

Die x, y size tolerance: +/- 0.050

Chip edge to bond pad dimensions is shown to center of pad

Ground is backside of die

| Pin No. | Symbol | Description | Pad Size (mm) |
|---------|---------|---|---------------|
| 1 | RF In | Input, RF common port; matched to 50 Ω ; DC coupled | 0.100 x 0.200 |
| 2, 7 | VC2 | Control voltage 2; can be biased from either side. | 0.100 x 0.100 |
| 3, 6 | VC1 | Control voltage 1; can be biased from either side. | 0.100 x 0.100 |
| 4 | RF Out1 | Output 1, RF switched port 1; matched to 50 Ω ; DC coupled | 0.200 x 0.100 |
| 5 | RF Out2 | Output 2, RF switched port 2; matched to 50 Ω ; DC coupled | 0.200 x 0.100 |



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 |  | Caution! ESD-Sensitive Device |
|------------------------------|--------|---------------------|---|----------------------------------|
| ESD – Human Body Model (HBM) | 1A | ESDA / JEDEC JS-001 | | |

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 (C₁₅H₁₂Br₄O₂) Free
- PFOS Free
- SVHC Free

Contact Information

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

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