



# TGS2353-2-SM

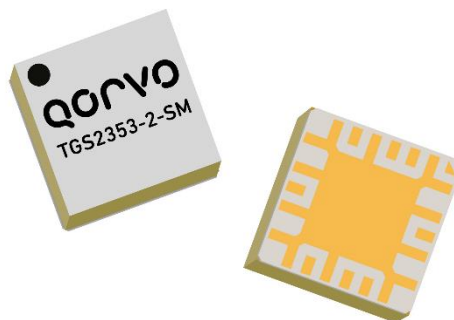
## 0.5 - 18 GHz High Power SPDT Reflective Switch

### Product Overview

Qorvo's TGS2353-2-SM is a single-pole, double-throw (SPDT) reflective switch packaged in a 4x4mm ceramic, air-cavity QFN.

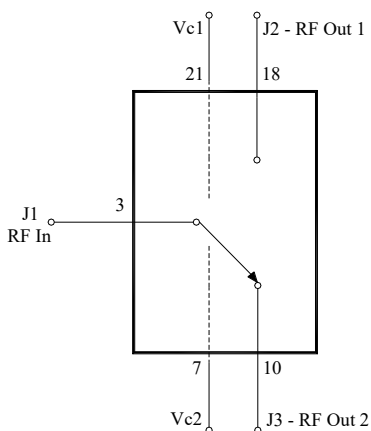
Fabricated on Qorvo's QGaN25 0.25um GaN on SiC production process, the TGS2353-2-SM operates from 0.5-18GHz and can switch up to 10W with low insertion loss and high isolation.

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



QFN 4x4 mm 22L

### Functional Block Diagram



### Key Features

- SPDT, Reflective
- Frequency Range: 0.5 to 18 GHz
- Input Power: up to 10 W
- Insertion Loss: <1.5 dB
- Isolation: 30 dB Typical
- Switching Speed: <35 ns
- Control Voltages: 0 V/-40 V
- Dimensions: 4.0 x 4.0 x 1.42 mm

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

### Applications

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

### Ordering Information

| Part No.     | Description                                  |
|--------------|----------------------------------------------|
| TGS2353-2-SM | 0.5-18 GHz High Power SPDT Reflective Switch |
| 1112206      | TGS2353-2-SM Evaluation Board                |



# TGS2353-2-SM

## 0.5 to 18 GHz High Power SPDT Reflective

### Absolute Maximum Ratings

| Parameter                                   | Rating        |
|---------------------------------------------|---------------|
| Control Voltage ( $V_C$ )                   | -50 V         |
| Control Current ( $I_C$ )                   | -1.5 / 6 mA   |
| Power Dissipation                           | 8.5 W         |
| RF Input Power, CW, 50 $\Omega$ , T = 25 °C | 41 dBm        |
| Mounting Temperature (30 sec)               | 260 °C        |
| Storage Temperature                         | -40 to 150 °C |

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability.

### Recommended Operating Conditions

| Parameter           | Min | Typ          | Max | Units |
|---------------------|-----|--------------|-----|-------|
| $V_{C1}$            |     | -40/0        |     | V     |
| $V_{C2}$            |     | 0/-40        |     | V     |
| $I_{C1}$ / $I_{C2}$ |     | -0.25 to 0.1 |     | mA    |
| 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

| Parameter                              | Conditions <sup>(1)</sup> | Min | Typ    | Max | Units |
|----------------------------------------|---------------------------|-----|--------|-----|-------|
| Operational Frequency Range            |                           | 0.5 |        | 18  | GHz   |
| Input power                            | CW                        |     | 40     |     | dBm   |
| Insertion Loss                         | On-State                  |     | <1.5   |     | dB    |
| Input Return Loss – Common Port        | On-State                  |     | 15     |     | dB    |
| Output Return Loss – Switch Port       | On-State                  |     | 15     |     | dB    |
| Isolation                              | Off-State                 |     | 30     |     | dB    |
| Output Return Loss – Isolated Port     | Off-State                 |     | 2      |     | dB    |
| Insertion Loss Temperature Coefficient |                           |     | -0.004 |     | dB/°C |
| Switching Speed – On                   |                           |     | 31     |     | ns    |
| Switching Speed – Off                  |                           |     | 18     |     | ns    |

Notes:

1. Test conditions unless otherwise noted: Temp = +25°C.  $V_{C1}$  = -40/0 V,  $V_{C2}$  = 0/-40 V, see Function Table on page 6

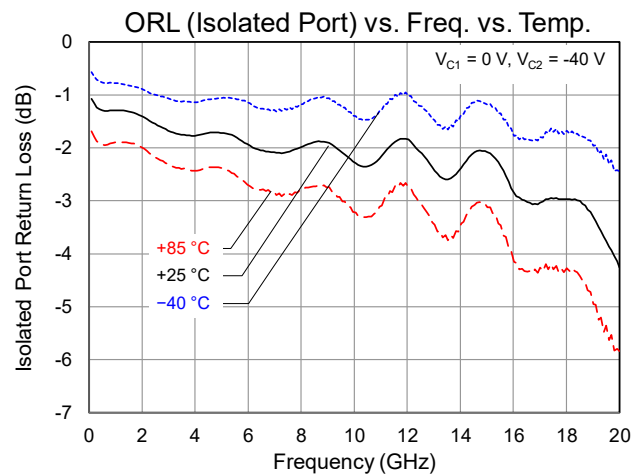
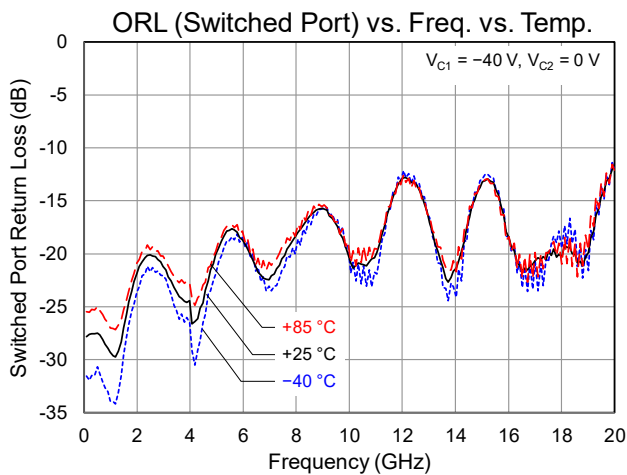
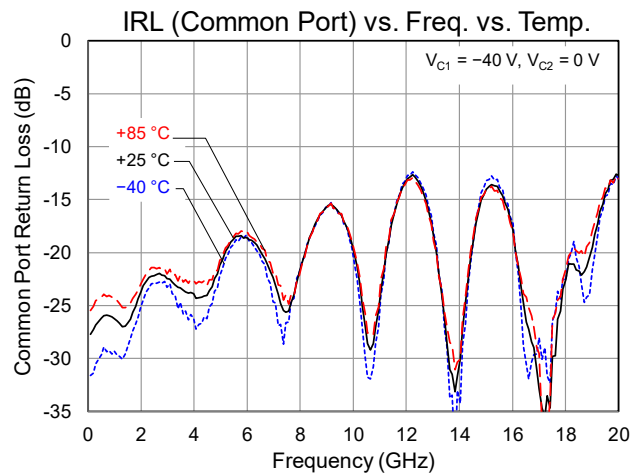
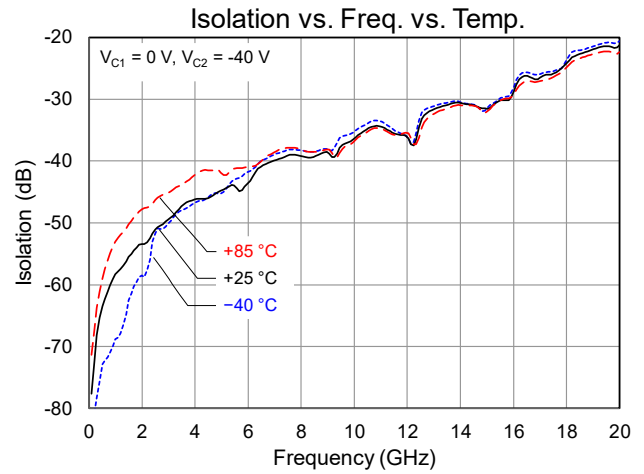
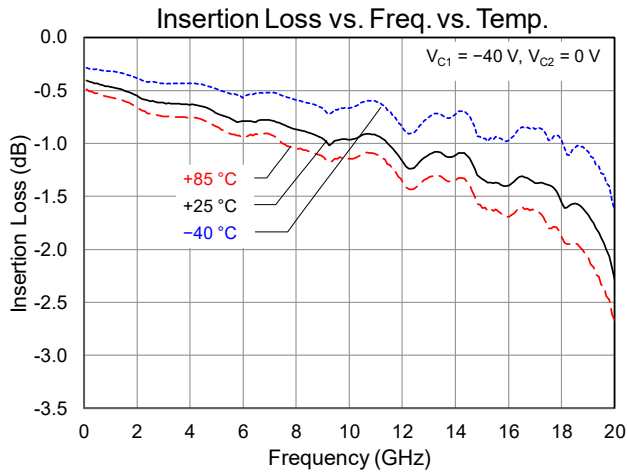
### Thermal and Reliability Information

| Parameter                                             | Test Conditions                                                                                                                            | Value | Units |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|
| Thermal Resistance ( $\theta_{JC}$ ) <sup>(1,2)</sup> | $T_{BASE}$ = 85 °C, $V_{C1}$ = 0 V, $V_{C2}$ = -40 V, Freq. = 14 GHz, CW<br>$P_{IN}$ = 40 dBm, $P_{OUT}$ = 38 dBm, $P_{DISS}$ = 3.69 W     | 19.78 | °C/W  |
| Channel Temperature ( $T_{CH}$ ) <sup>(1,2)</sup>     |                                                                                                                                            | 158   | °C    |
| Thermal Resistance ( $\theta_{JC}$ ) <sup>(1,2)</sup> | $T_{BASE}$ = 85 °C, $V_{C1}$ = 0 V, $V_{C2}$ = -40 V, Freq. = 16 GHz, CW<br>$P_{IN}$ = 39.5 dBm, $P_{OUT}$ = 36.7 dBm, $P_{DISS}$ = 4.24 W | 21.23 | °C/W  |
| Channel Temperature ( $T_{CH}$ ) <sup>(1,2)</sup>     |                                                                                                                                            | 175   | °C    |
| Thermal Resistance ( $\theta_{JC}$ ) <sup>(1,2)</sup> | $T_{BASE}$ = 85 °C, $V_{C1}$ = 0 V, $V_{C2}$ = -40 V, Freq. = 18 GHz, CW<br>$P_{IN}$ = 39.5 dBm, $P_{OUT}$ = 36.2 dBm, $P_{DISS}$ = 4.74 W | 21.52 | °C/W  |
| Channel Temperature ( $T_{CH}$ ) <sup>(1,2)</sup>     |                                                                                                                                            | 187   | °C    |

Notes:

1. Measured to the back of the package.
2. Refer to the following document: [GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates](#)

## Performance Plots – Small Signal

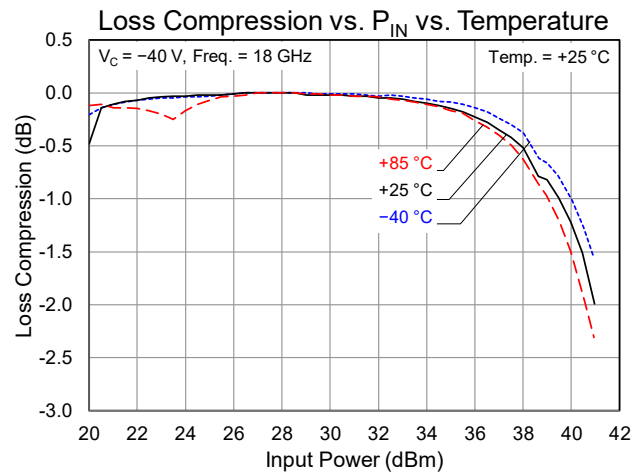
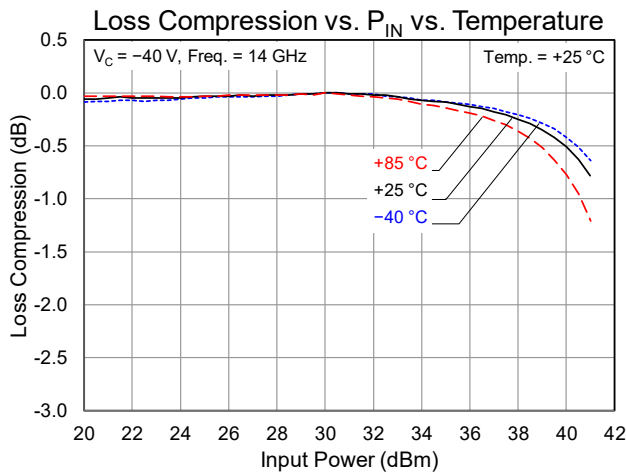
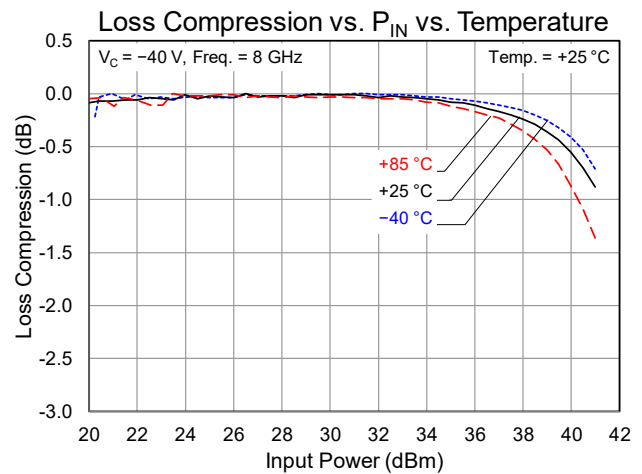
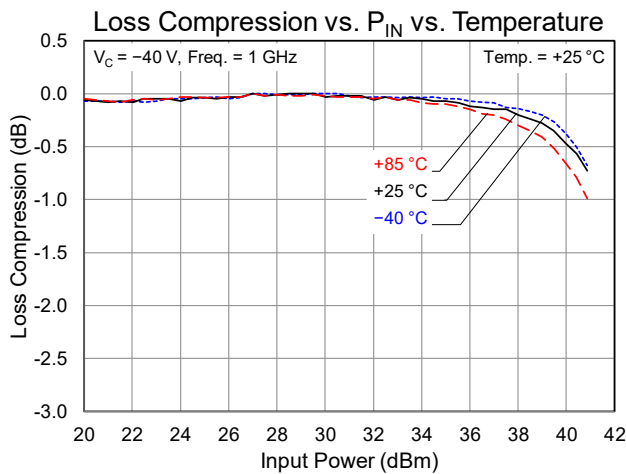
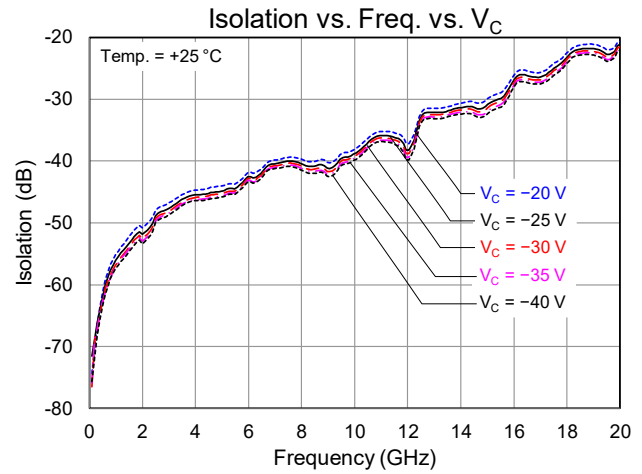
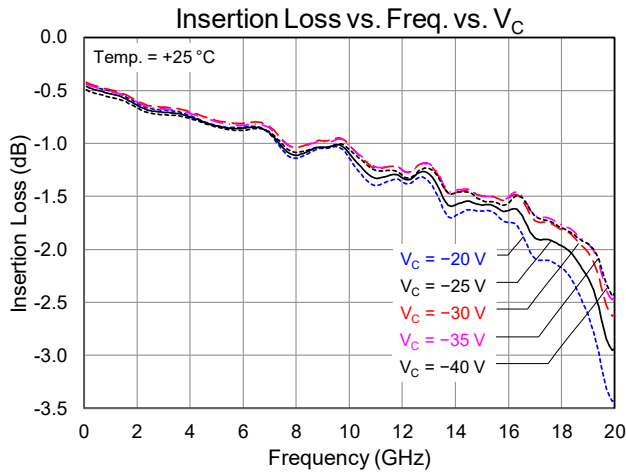




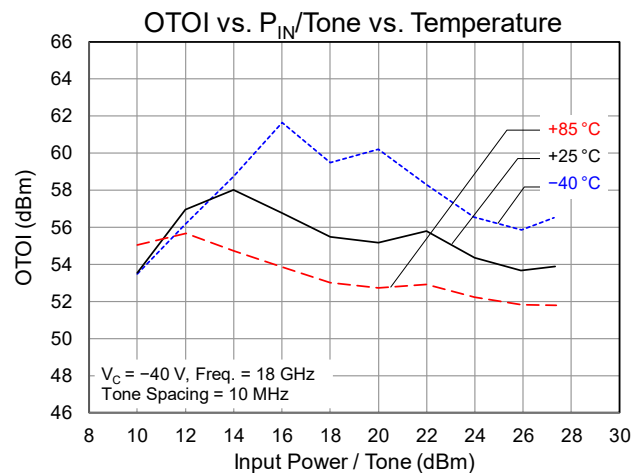
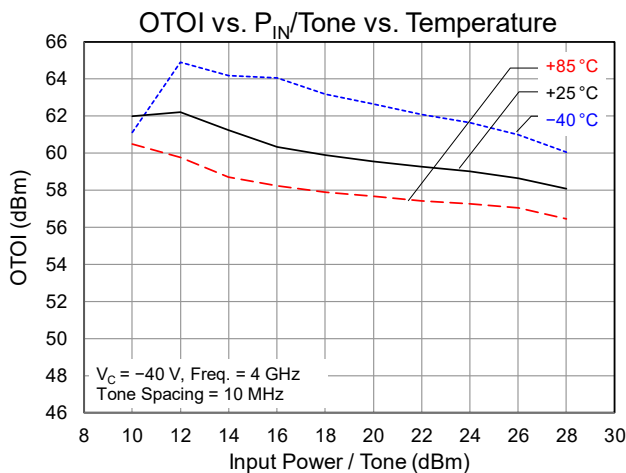
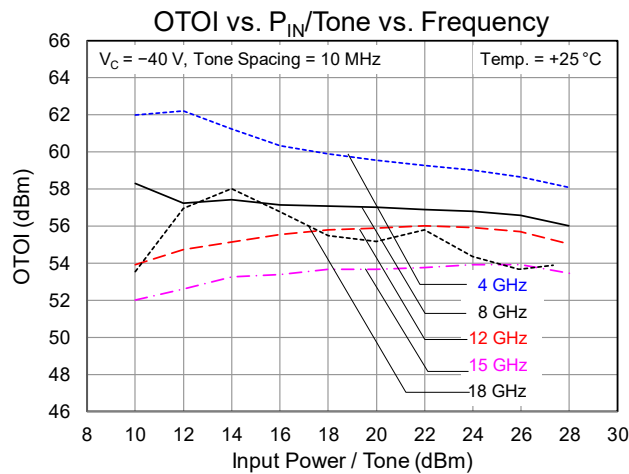
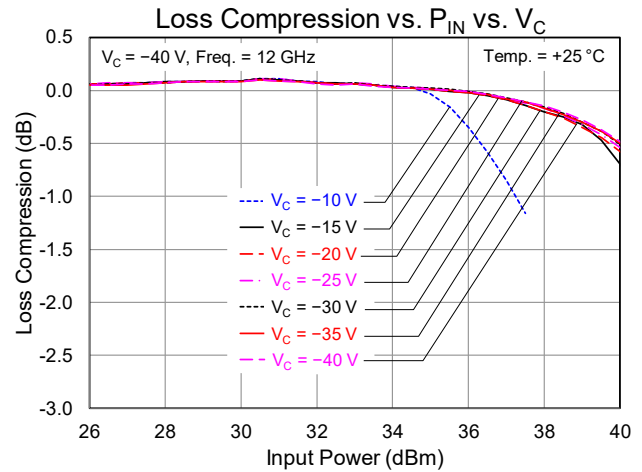
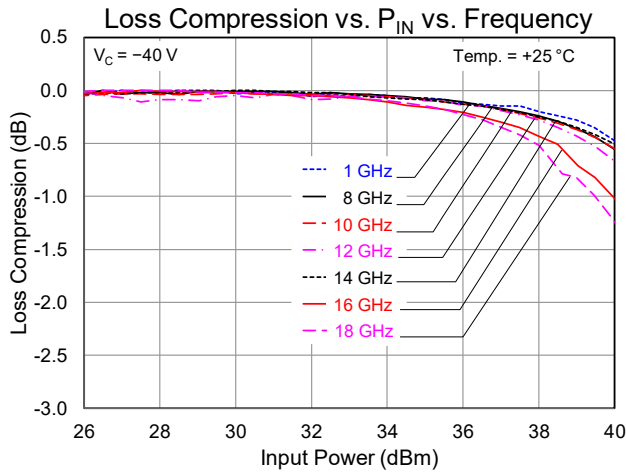
# TGS2353-2-SM

## 0.5 to 18 GHz High Power SPDT Reflective

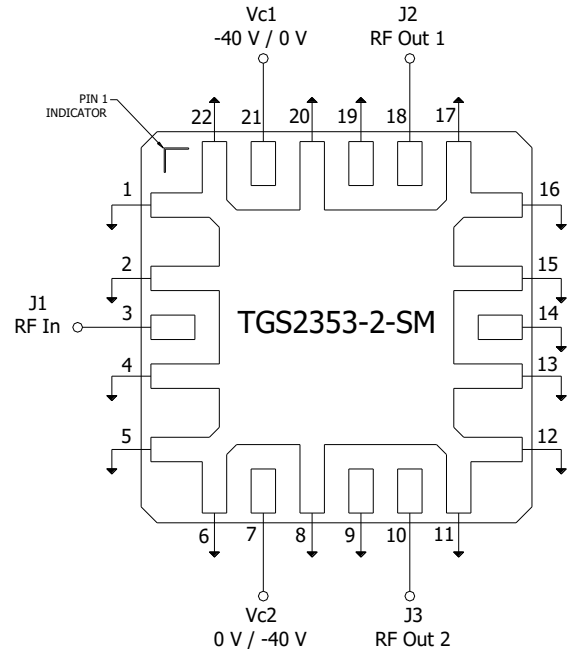
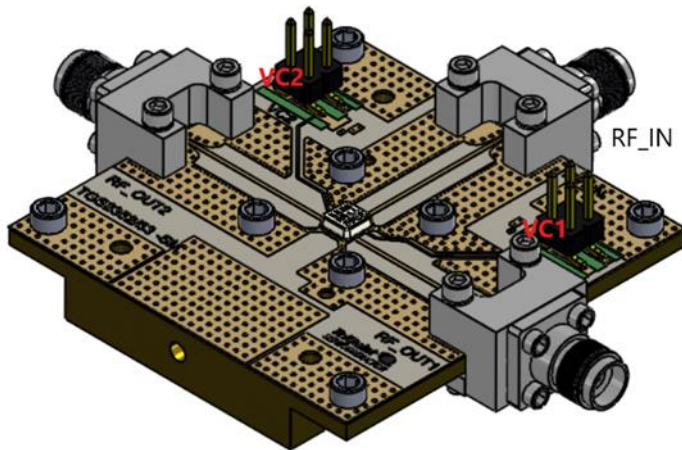
### Performance Plots – Small Signal and Compression



## Performance Plots – Compression and Linearity



## Evaluation Board (EVB) and Application Circuit



Notes:

1. 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

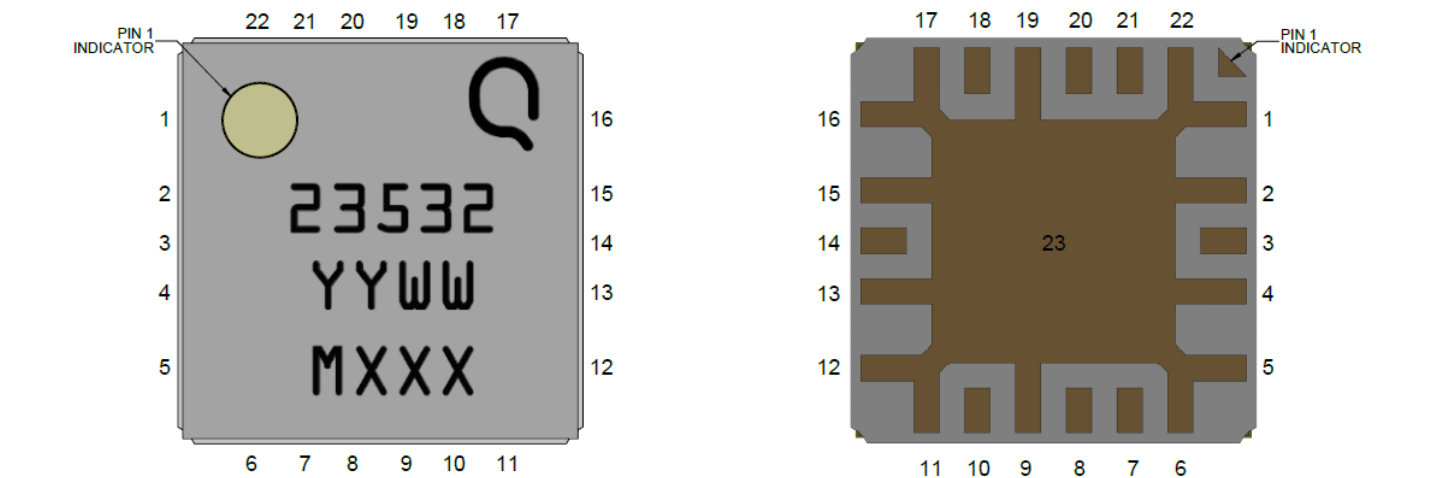
## Bias Up Down

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

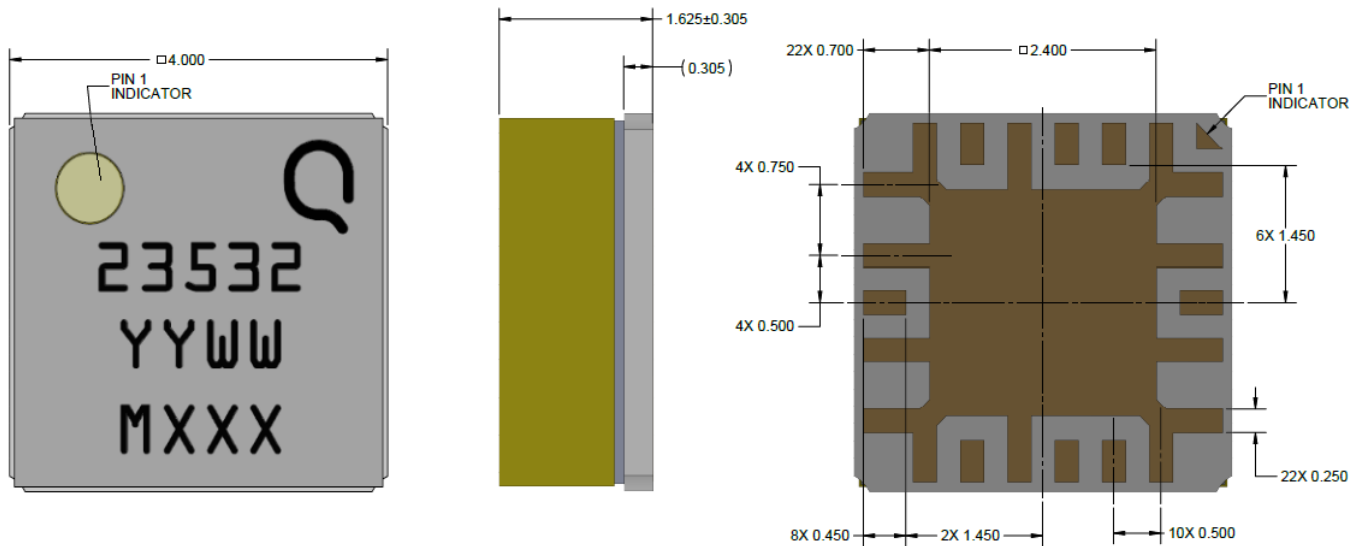
| RF Path                                 | State                     | V <sub>C1</sub> | V <sub>C2</sub> |
|-----------------------------------------|---------------------------|-----------------|-----------------|
| RF In to RF Out1 (50 Ω load to RF Out2) | On-State (Insertion Loss) | 0 V             | -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           |

Pin Configuration and Description



| Pin No.                            | Label           | Description                                                                                      |
|------------------------------------|-----------------|--------------------------------------------------------------------------------------------------|
| 1, 2, 4-6, 8, 9, 11-17, 19, 20, 22 | GND             | Connected to ground paddle (23); must be grounded to PCB to improve isolation.                   |
| 3                                  | RF IN           | RF Input, matched to 50 $\Omega$ ; DC coupled                                                    |
| 7                                  | V <sub>C2</sub> | Control voltage #2; External components are not required                                         |
| 10                                 | RF OUT2         | RF switched port 2; matched to 50 $\Omega$ ; DC coupled                                          |
| 18                                 | RF OUT1         | RF switched port 1; matched to 50 $\Omega$ ; DC coupled                                          |
| 21                                 | V <sub>C1</sub> | Control voltage #1; External components are not required                                         |
| 23                                 | GND             | Backside paddle. Multiple vias should be employed to minimize inductance and thermal resistance. |

## Package Marking and Dimensions



Package lead finish:

Ni / Au plating with minimum gold thickness of 0.5  $\mu$ m

Materials:

Base: Ceramic, Lid: Laminate, Part is epoxy sealed

Part Marking:

23532 = Part Number, YY = Part Assembly Year, WW = Part Assembly Week, MXXX = Batch ID

Unless otherwise specified dimensions are in mm.

Tolerances: XXX =  $\pm 0.127$



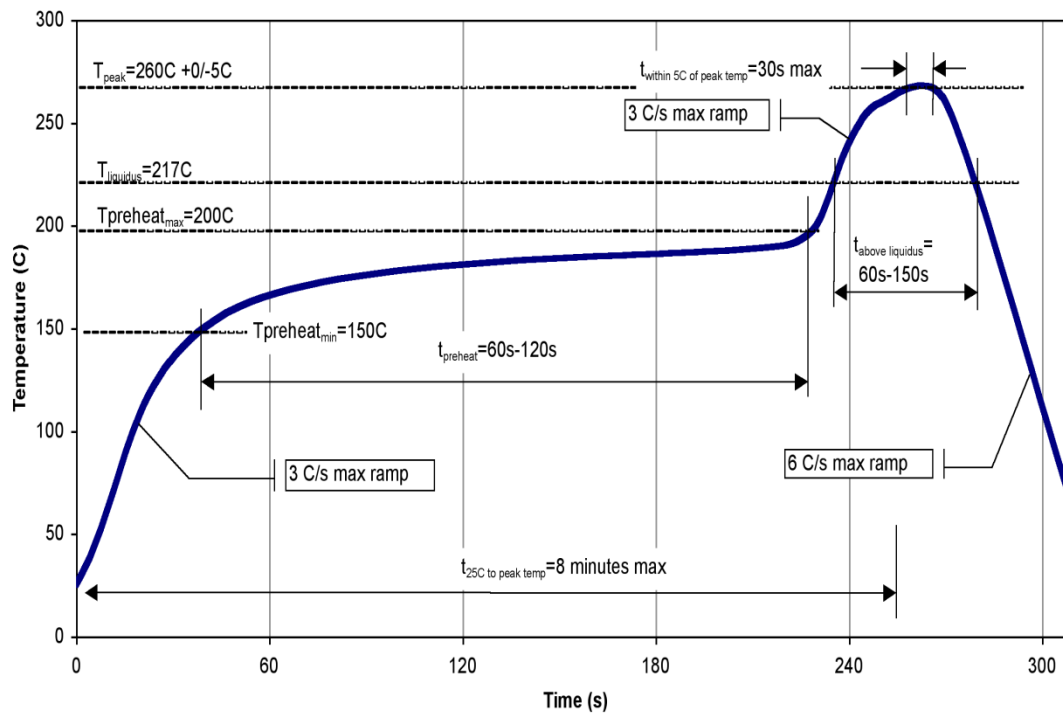
## Assembly Notes

Compatible with lead-free soldering processes with 260°C peak reflow temperature.

This package is air-cavity and non-hermetic, and therefore cannot be subjected to aqueous washing. The use of no-clean solder to avoid washing after soldering is highly recommended.

Contact plating: Ni-Au

## Recommended Soldering Profile





# TGS2353-2-SM

## 0.5 to 18 GHz High Power SPDT Reflective

### Handling Precautions

| Parameter                        | Rating   | Standard                 |
|----------------------------------|----------|--------------------------|
| ESD – Human Body Model (HBM)     | Class 1A | ESDA / JEDEC JESD22-A114 |
| ESD – Charge Device Model (CDM)  | Class 3  | EIA/JESD22-C101          |
| MSL – Moisture Sensitivity Level | Level 3  | IPC/JEDEC J-STD-020      |



Caution!  
ESD-Sensitive Device

### RoHS Compliance

This part is compliant with 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
- Antimony Free
- TBBP-A (C<sub>15</sub>H<sub>12</sub>Br<sub>4</sub>O<sub>2</sub>) Free
- PFOS Free
- SVHC Free

### Contact Information

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

Web: [www.qorvo.com](http://www.qorvo.com)

Tel: 1-844-890-8163

Email: [customer.support@qorvo.com](mailto:customer.support@qorvo.com)

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