



# TGS2352-2-SM

## 0.5 - 12 GHz High Power SPDT Reflective Switch

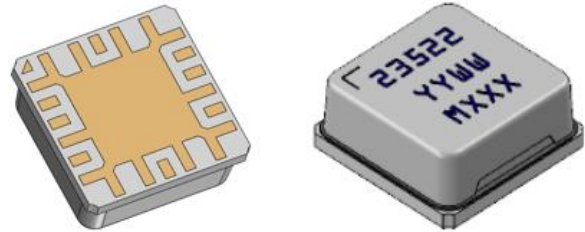
### Product Overview

Qorvo's TGS2352-2-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 TGS2352-2-SM operates from 0.5-12GHz and can switch up to 20W with low insertion loss and high isolation.

The TGS2352-2-SM performance allows it to be used in a variety of applications across commercial and military markets; low and high power.

Lead-free and RoHS compliant.



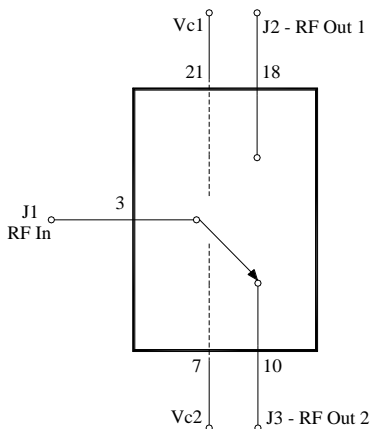
QFN 4x4 mm 22L

### Key Features

- SPDT, Reflective
- Frequency Range: 0.5 to 12 GHz
- Input Power: up to 20 W
- Insertion Loss: <1 dB
- Isolation: -35 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.*

### Functional Block Diagram



### Applications

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

### Ordering Information

Part No.	Description
TGS2352-2-SM	0.5-12 GHz High Power SPDT Reflective Switch
TGS2352-2-SMEVB2	TGS2352-2-SM Evaluation Board

## Absolute Maximum Ratings

Parameter	Rating
Control Voltage ( $V_C$ )	-50 V
Control Current ( $I_C$ )	-1.5 / 6 mA
Power Dissipation	5 W
RF Input Power, CW, 50 $\Omega$ , T = 25 °C	44 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		12	GHz
Insertion Loss	On-State		<1		dB
Input Return Loss – Common Port	On-State		15		dB
Output Return Loss – Switch Port	On-State		15		dB
Isolation	Off-State		35		dB
Output Return Loss – Isolated Port	Off-State		3		dB
Input Power	CW		43		dBm
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

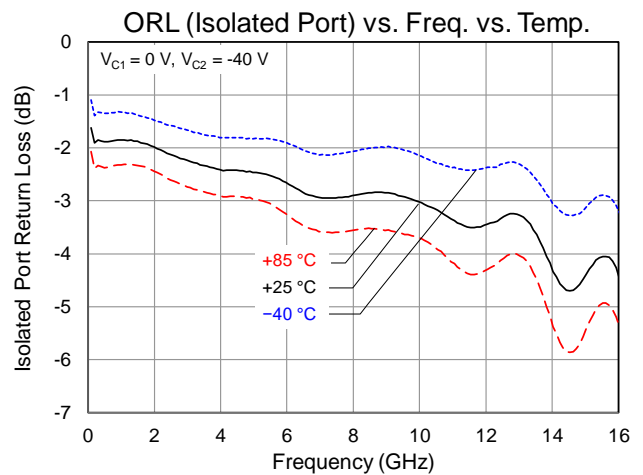
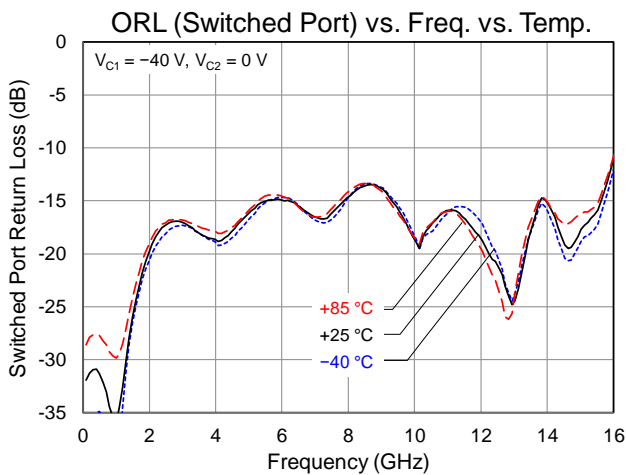
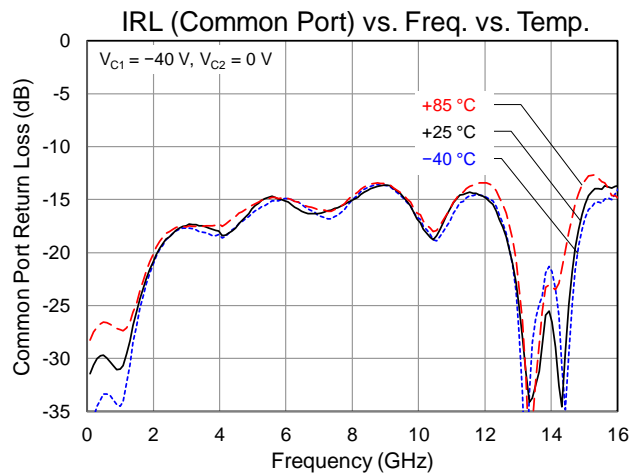
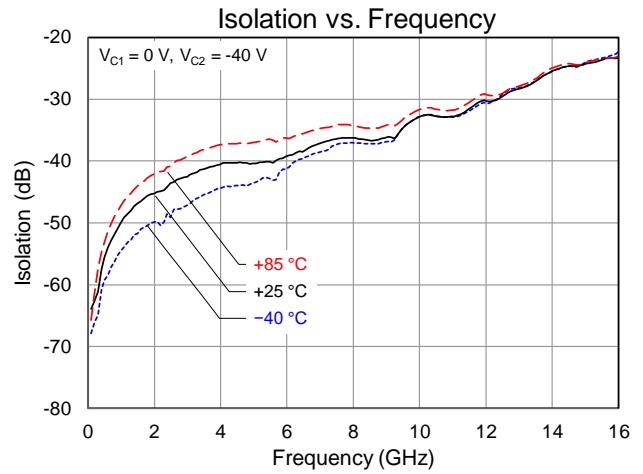
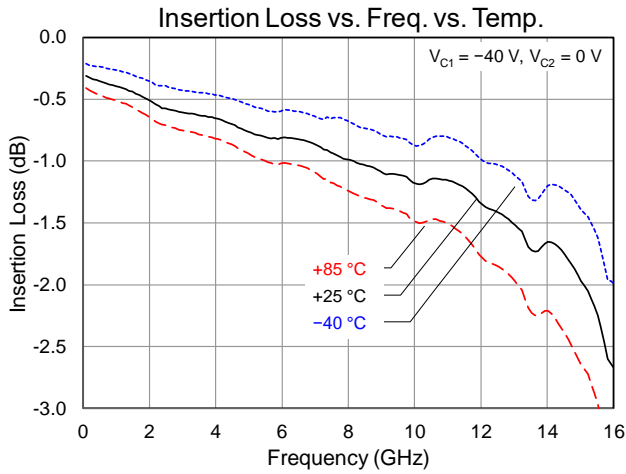
## Thermal and Reliability Information

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. = 4 GHz, CW $P_{IN} = 43$ dBm, $P_{OUT} = 41.95$ dBm, $P_{DISS} = 4.29$ W	22.38	°C/W
Channel Temperature ( $T_{CH}$ ) <sup>(1,2)</sup>		181	°C
Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup>	$T_{BASE} = 85$ °C, $V_{C1} = 0$ V, $V_{C2} = -40$ V, Freq. = 5 GHz, CW $P_{IN} = 42.5$ dBm, $P_{OUT} = 41.2$ dBm, $P_{DISS} = 4.6$ W	22.83	°C/W
Channel Temperature ( $T_{CH}$ ) <sup>(1,2)</sup>		190	°C
Thermal Resistance ( $\theta_{JC}$ ) <sup>(1,2)</sup>	$T_{BASE} = 85$ °C, $V_{C1} = 0$ V, $V_{C2} = -40$ V, Freq. = 8 GHz, CW $P_{IN} = 41$ dBm, $P_{OUT} = 39.15$ dBm, $P_{DISS} = 4.36$ W	22.48	°C/W
Channel Temperature ( $T_{CH}$ ) <sup>(1,2)</sup>		183	°C
Thermal Resistance ( $\theta_{JC}$ ) <sup>(1,2)</sup>	$T_{BASE} = 85$ °C, $V_{C1} = 0$ V, $V_{C2} = -40$ V, Freq. = 10 GHz, CW $P_{IN} = 40.5$ dBm, $P_{OUT} = 38.5$ dBm, $P_{DISS} = 4.14$ W	21.98	°C/W
Channel Temperature ( $T_{CH}$ ) <sup>(1,2)</sup>		176	°C
Thermal Resistance ( $\theta_{JC}$ ) <sup>(1,2)</sup>	$T_{BASE} = 85$ °C, $V_{C1} = 0$ V, $V_{C2} = -40$ V, Freq. = 12 GHz, CW $P_{IN} = 40$ dBm, $P_{OUT} = 37.4$ dBm, $P_{DISS} = 4.5$ W	22.67	°C/W
Channel Temperature ( $T_{CH}$ ) <sup>(1,2)</sup>		187	°C

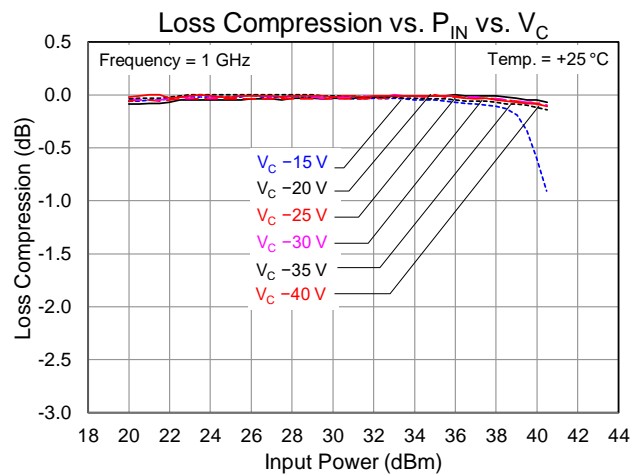
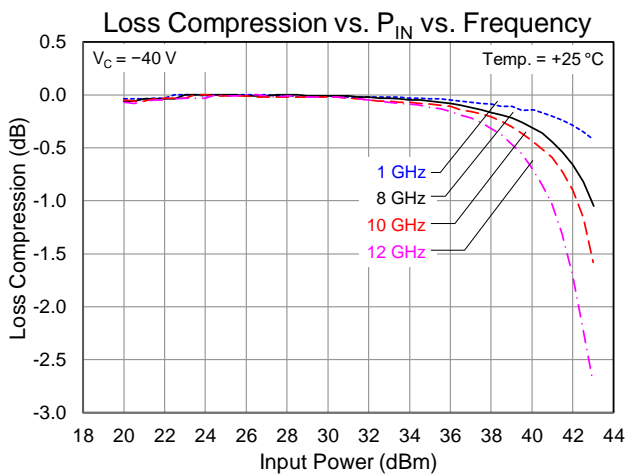
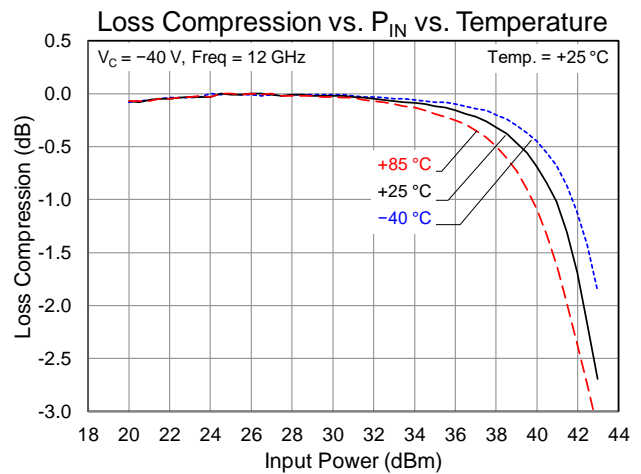
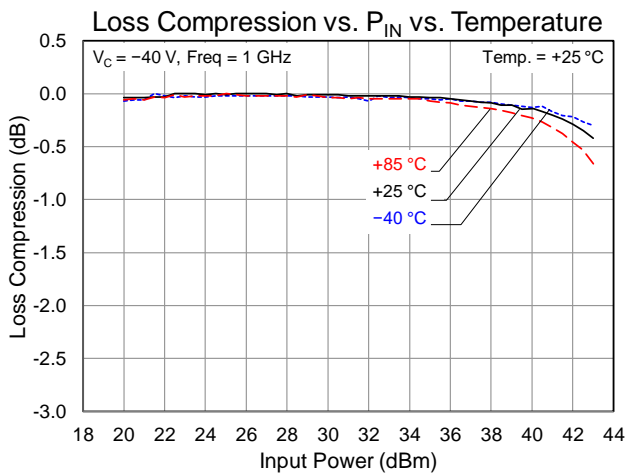
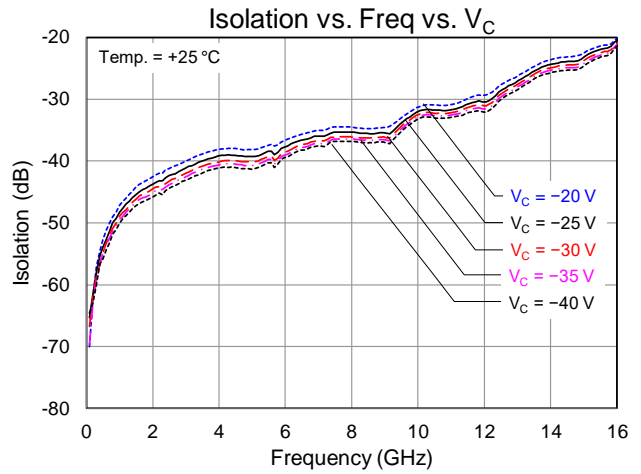
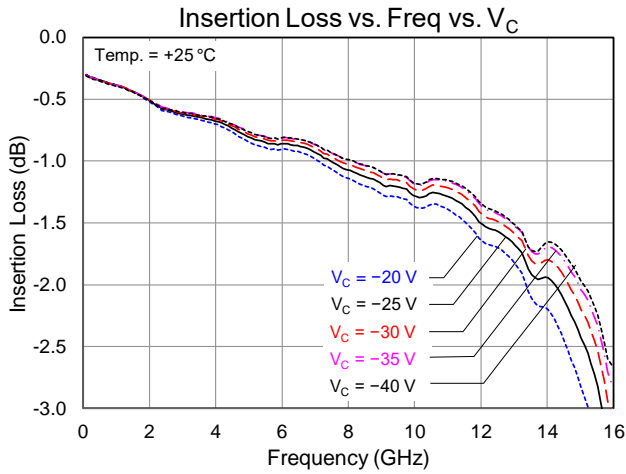
Notes:

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

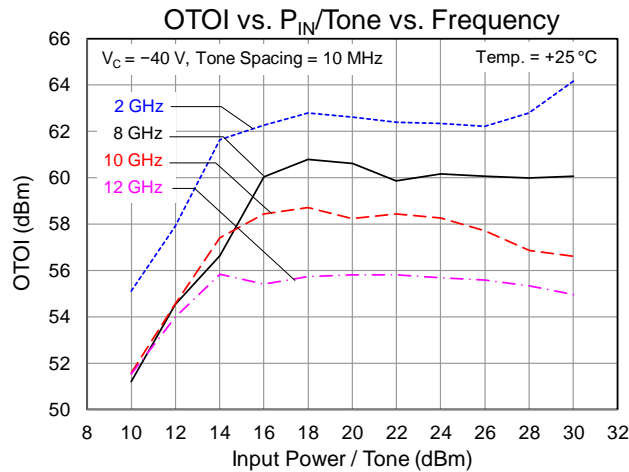
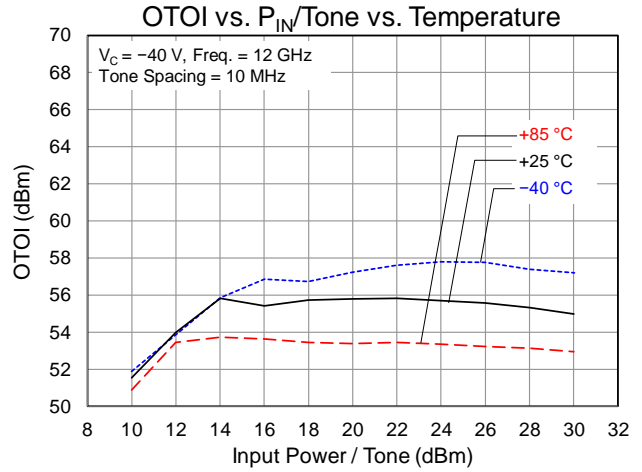
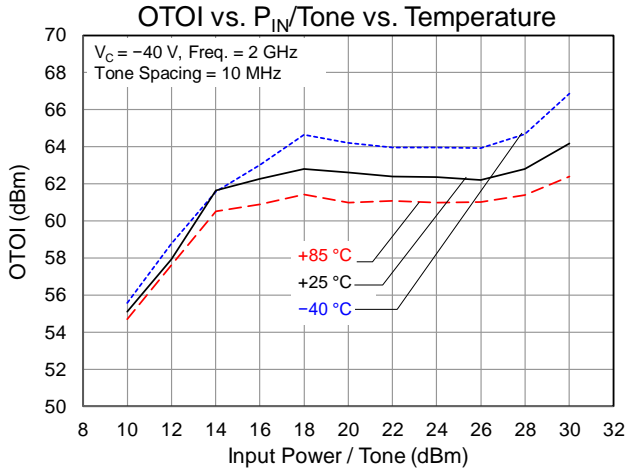
Performance Plots – Small Signal



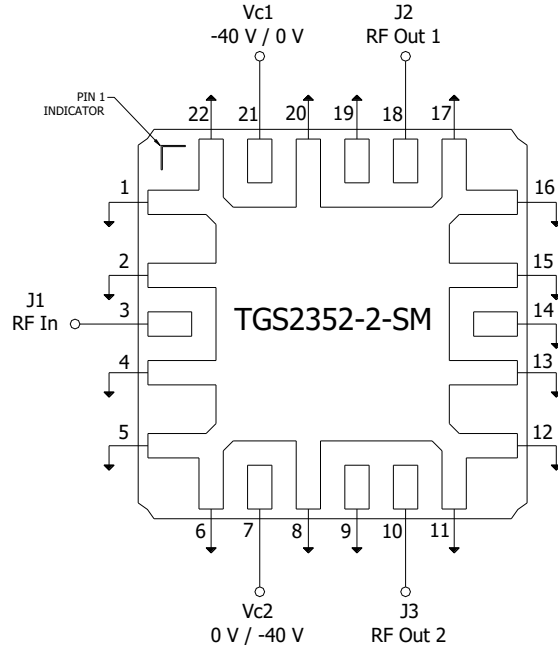
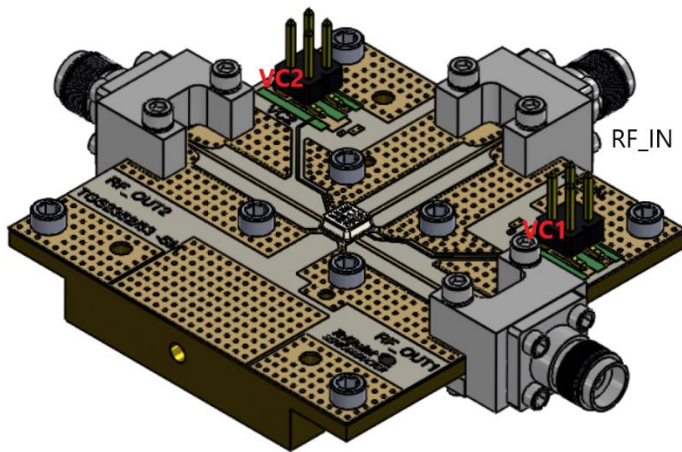
Performance Plots – Small Signal and Compression



**Performance Plots – 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

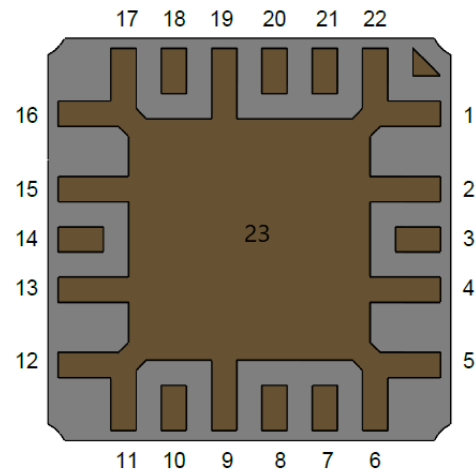
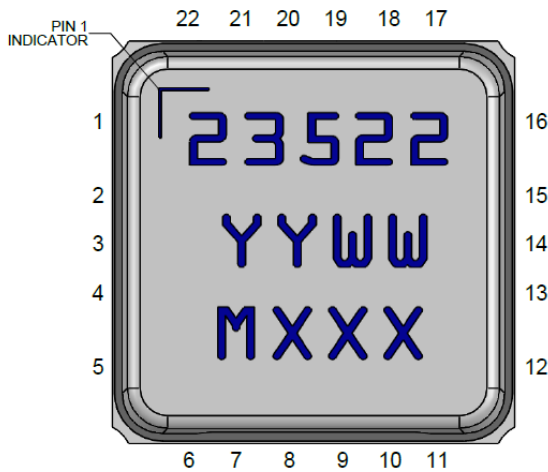
### Bias Up Down

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

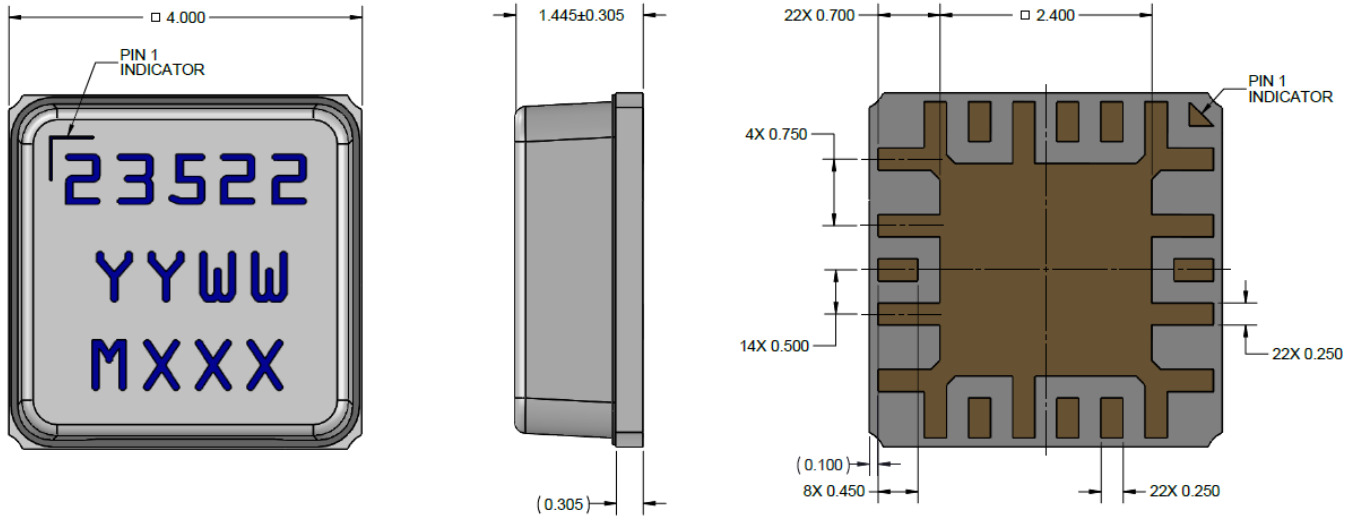
RF Path	State	$V_{C1}$	$V_{C2}$
RF In to RF Out1 (50 $\Omega$ load to RF Out2)	On-State (Insertion Loss)	0 V	-40 V
	Off-State (Isolation)	-40 V	0 V
RF In to RF Out2 (50 $\Omega$ load to RF Out1)	On-State (Insertion Loss)	-40 V	0 V
	Off-State (Isolation)	0 V	-40 V

## 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 μm

Materials:

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

Part Marking:

23522 = Part Number, YY = Part Assembly Year, WW = Part Assembly Week, MXXX = Batch ID

Unless otherwise specified dimensions are in mm.

Tolerances: XXX = ± 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

Solder rework not recommended

**Recommended Soldering Profile**

