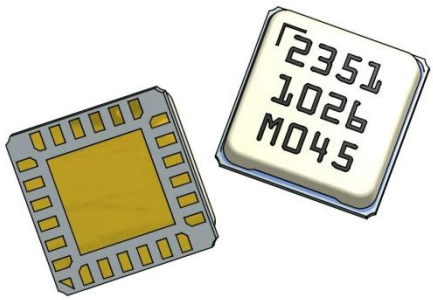
TGS2351-SM

DC – 6 GHz High Power SPDT Switch

Applications

- High Power Switching

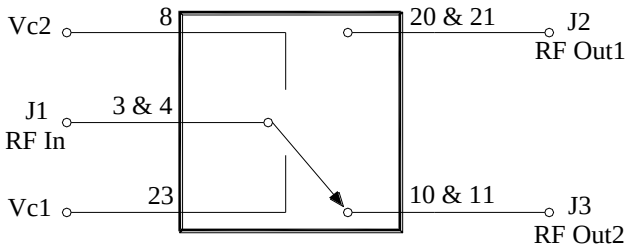


QFN 4x4mm 24L

Product Features

- Frequency Range: DC – 6 GHz
- Power Handling: up to 40 W
- Insertion Loss: < 1 dB
- Isolation: -40 dB typical
- Switching Speed: 50 ns
- Control Voltages: 0 V/-40 V
- Dimensions: 4.0 x 4.0 x 1.43 mm

Functional Block Diagram



General Description

The TriQuint TGS2351-SM is a Single-Pole, Double-Throw (SPDT) Packaged Switch. The TGS2351-SM operates from DC to 6 GHz and is designed using TriQuint's 0.25um GaN on SiC production process.

The TGS2351-SM typically provides up to 40 W input power handling at control voltages of 0/-40 V. This switch maintains low insertion loss < 1 dB, and high isolation -40 dB typical.

The TGS2351-SM is ideally suited for High Power Switching application.

Lead-free and RoHS compliant

Evaluation Boards are available upon request.

Pin Configuration

Pin #	Symbol
1, 2, 5, 6, 7, 9, 12, 13, 18, 19, 22, 24, 25	GND
3 and 4	RF In
8	Vc2
10 and 11	RF Out2
14, 15, 16, 17	N/C
20 and 21	RF Out1
23	Vc1

Ordering Information

Part No.	ECCN	Description
TGS2351-SM	EAR99	DC – 6 GHz High Power SPDT Switch

Specifications

Absolute Maximum Ratings

Parameter	Rating
Control Voltage, Vc	- 50 V
Control Current, Ic	-1 to 7.8 mA
Power Dissipation, Pdiss	10 W
RF Input Power, CW, 50Ω,T = 25ºC	47 dBm
RF Input Power, Hot Switching, 50% switching Duty Cycle	40 dBm
Channel Temperature, Tch	275 °C
Mounting Temperature (30 Seconds)	260 °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	Typical	Max	Units
Vc1		-40 / 0		V
Vc2		0 / -40		V
Ic1 / Ic2		-0.4 to 0.1		mA

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

Electrical Specifications

Test conditions unless otherwise noted: 25ºC, Vc1 = -40/0 V, Vc2 = 0/-40 V,see Function Table at Application Circuit on page 7

Parameter	Min	Typical	Max	Units
Operational Frequency Range	DC		6	GHz
Control Current (Ic1/ Ic2)	-1		0.1	mA
Insertion Loss (On-State): DC to 5 GHz		0.5	1	dB
Insertion Loss (On-State): 6 GHz		0.8	1.2	
Input Return Loss – On-State (Common Port RL)	12	20		dB
Output Return Loss – On-State (Switched Port RL)	12	20		dB
Isolation (Off-State)		-40	-31	dB
Output Return Loss – Off-Sate (Isolated Port RL)		2.5		dB
Input Power [1/]		46		dBm
Output Power @ Pin = 46dBm, 1-6GHz		45		dBm
Insertion Loss Temperature Coefficient		-0.003		dB/°C
Output TOI @ Pin = 23 dBm		50		dBm
Switching Speed – On [2/]		50		ns
Switching Speed – Off [2/]		50		ns

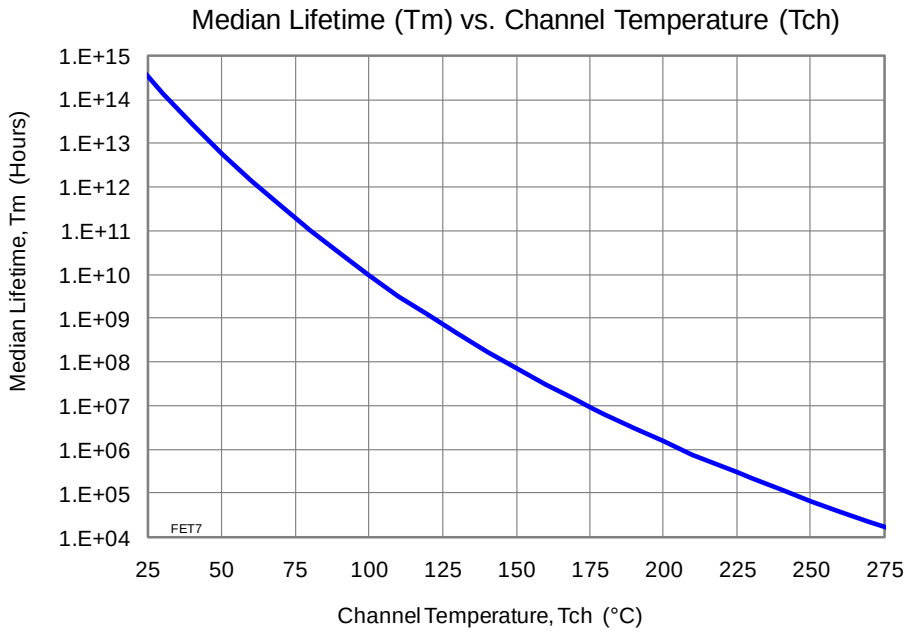
1/ The Input Power will be reduced if < 10 MHz.

2/ These Switching Speed dependent on Switch Driver circuit to deliver Vc = 0/-40 V. The rise and fall time of the Switch Driver which was used to perform for this data is 35 ns, as shown on page 6. For further technical information, see GaN SPDT Switch Drivers Application Note

Specifications (cont.)

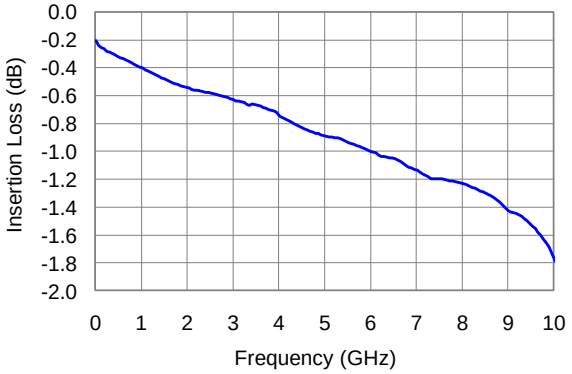
Thermal and Reliability Information

Parameter	Condition	Rating
Thermal Resistance, θ_{JC}, measured to back of package	Tbase = 85 °C	θ_{JC} = 6.1 °C/W
Channel Temperature (Tch), and Median Lifetime (Tm)	Tbase = 85 °C, Vc1 = 0 V, Vc2 = -40 V, Pin = 40 W, Pdiss = 5.3 W	Tch = 118 °C Tm = 1.4 E+9 Hours

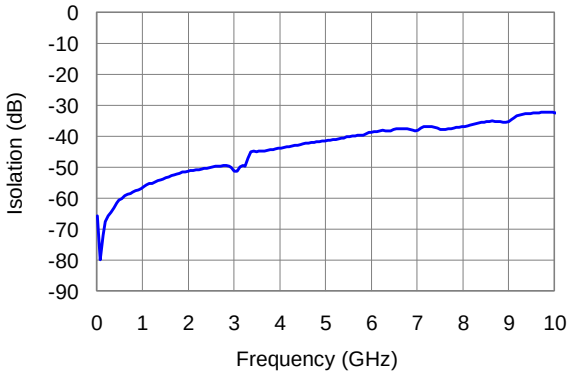


Typical Performance

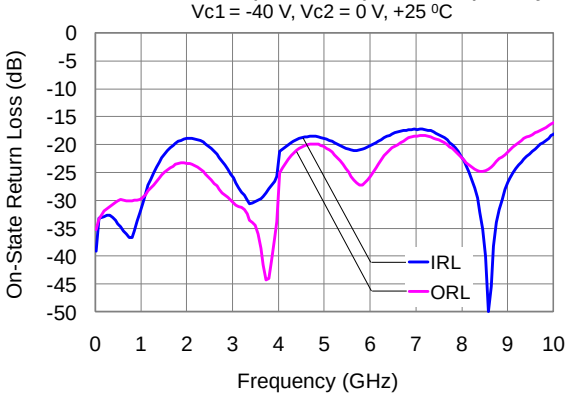
Insertion Loss (On-State) vs. Frequency
Vc1 = -40 V, Vc2 = 0 V, +25 °C



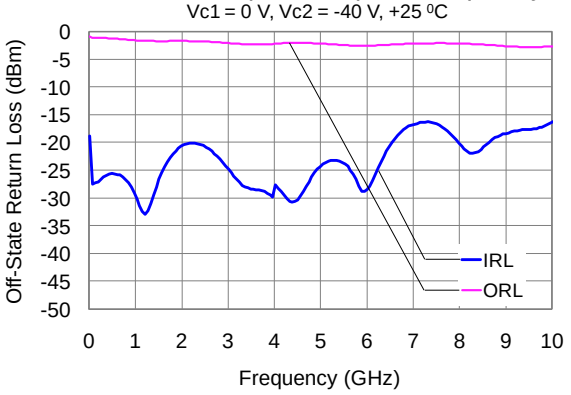
Isolation (Off-State) vs. Frequency
Vc1 = 0 V, Vc2 = -40 V, +25 °C



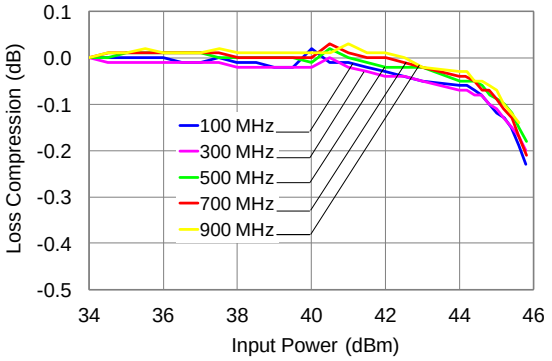
Return Loss (On-State) vs. Frequency
Vc1 = -40 V, Vc2 = 0 V, +25 °C



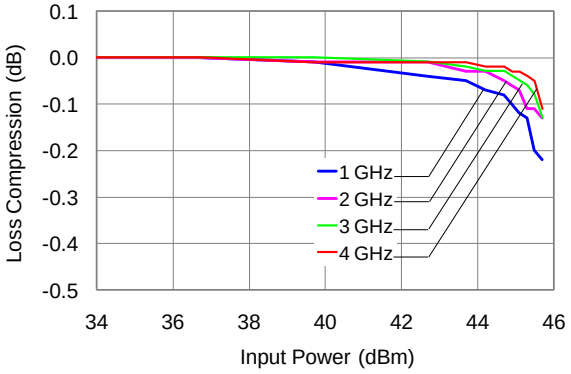
Return Loss (Off-State) vs. Frequency
Vc1 = 0 V, Vc2 = -40 V, +25 °C



Loss Compression vs. Pin vs. Frequency
Vc1 = -40 V, Vc2 = 0 V, +25 °C

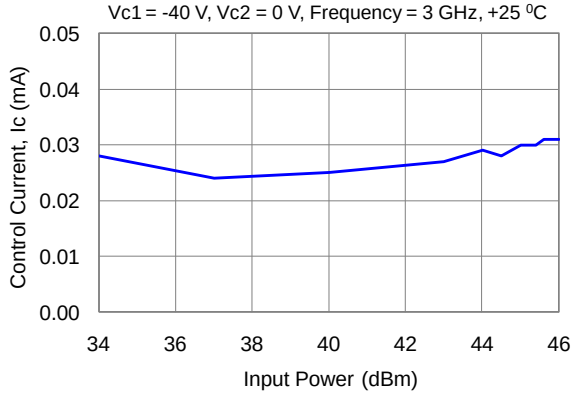


Loss Compression vs. Pin vs. Frequency
Vc1 = -40 V, Vc2 = 0 V, +25 °C

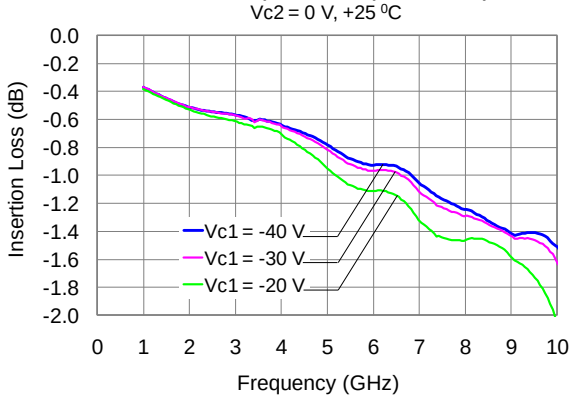


Typical Performance (cont.)

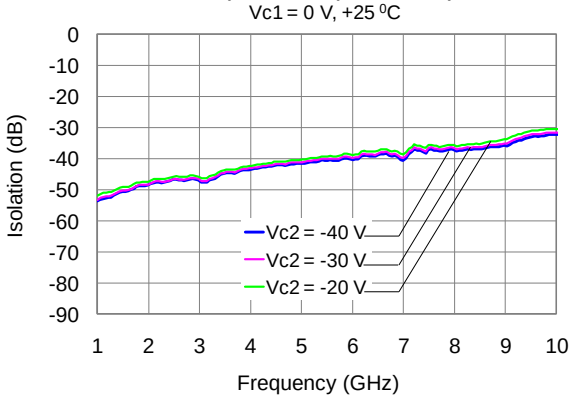
Control Current vs. Pin
Vc1 = -40 V, Vc2 = 0 V, Frequency = 3 GHz, +25 °C



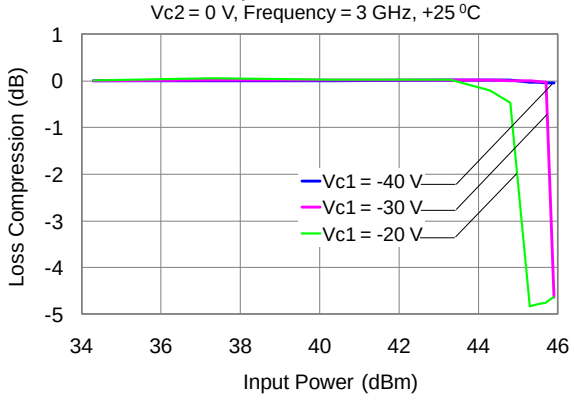
Insertion Loss (On-State) vs. Freq vs. Vc
Vc2 = 0 V, +25 °C



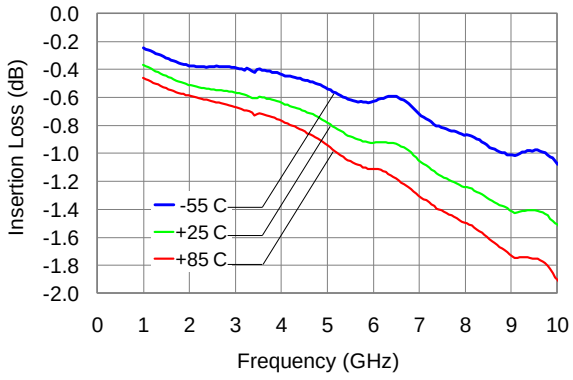
Isolation (Off-State) vs. Freq vs. Vc
Vc1 = 0 V, +25 °C



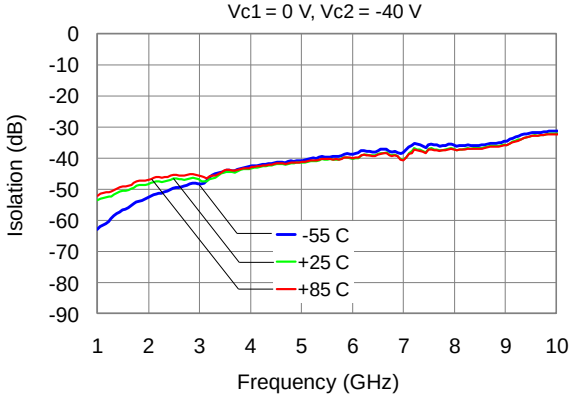
Loss Compression vs. Pin vs. Vc
Vc2 = 0 V, Frequency = 3 GHz, +25 °C



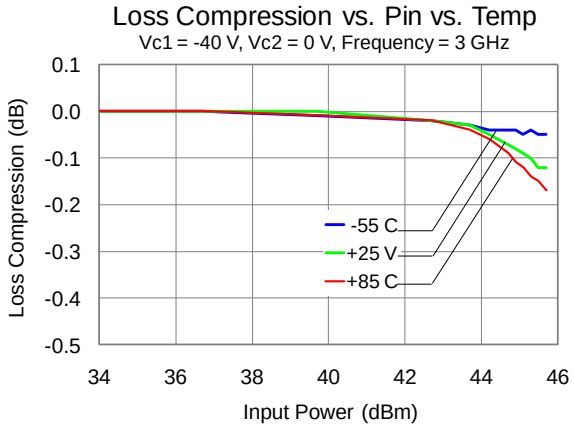
Insertion (On-State) vs. Freq vs. Temp
Vc1 = -40 V, Vc2 = 0 V

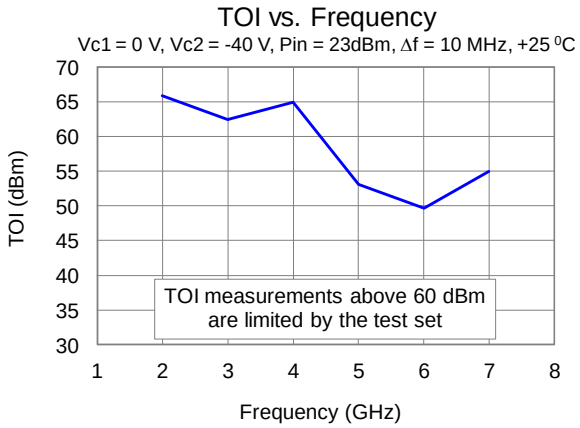


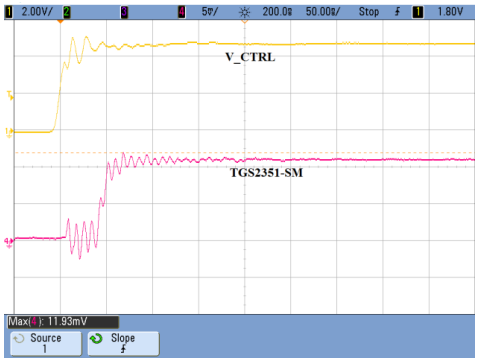
Isolation (Off-State) vs. Freq vs. Temp
Vc1 = 0 V, Vc2 = -40 V



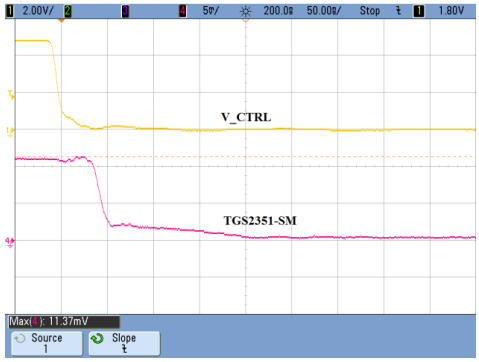
Typical Performance (cont.)





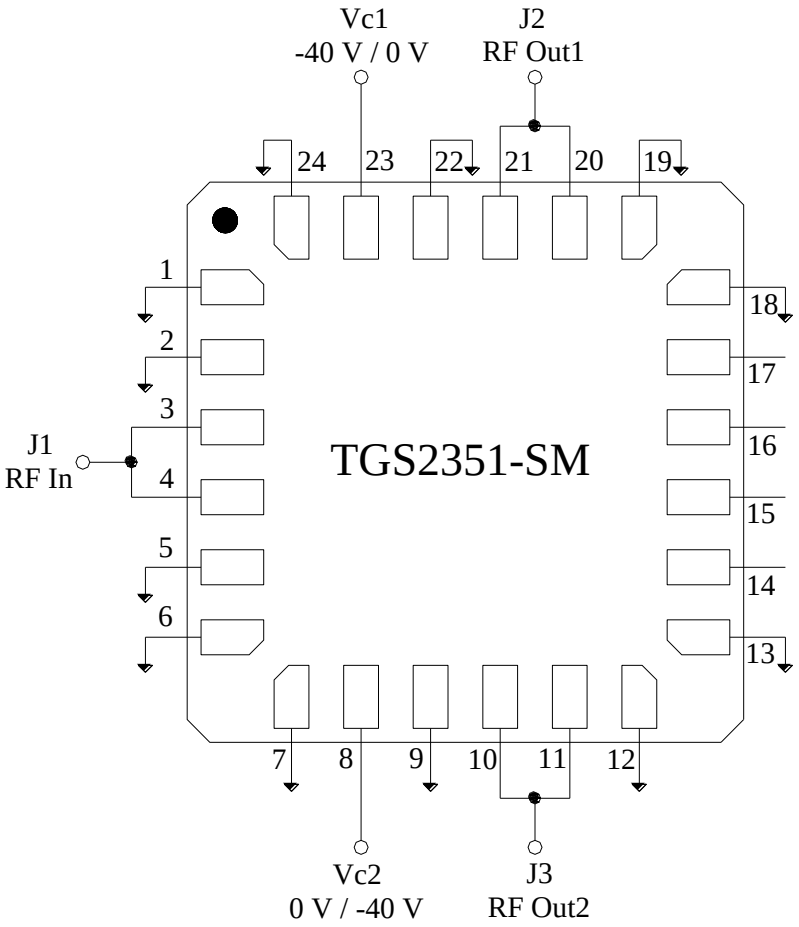


Switching Speed – On 50 ns
Vc = 0/-40 V, Freq = 3 GHz, Pin = 30 dBm, +25 °C



Switching Speed - Off 50 ns
Vc = 0/-40 V, Freq = 3 GHz, Pin = 30 dBm, +25 °C

Application Circuit



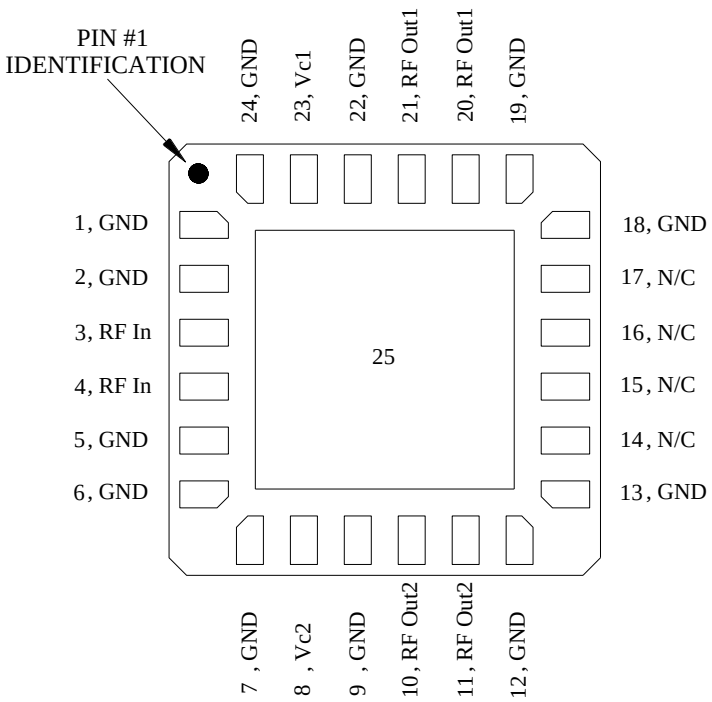
This switch can be configured as a Single Pole, Single Throw (SPST) by terminating one unused RF Out port with a 50 Ohm load.

Bias-up Procedure	Bias-down Procedure
Vc1 or Vc2 set to -40 V (see Function Table below for RF Path)	Turn off RF supply
Vc2 or Vc1 set to 0 V (see Function Table below for RF Path)	Turn Vc1 or Vc2 to 0V
Apply RF signal to RF Input	Turn Vc2 or Vc1 to 0 V

Function Table

RF Path	State	Vc1	Vc2
RF In to RF Out1 (50 Ohm 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 Ohm load to RF Out1)	On-State (Insertion Loss)	-40 V	0 V
	Off-State (Isolation)	0 V	-40 V

Pin Description



Pin	Symbol	Description
1, 2, 5, 6, 7, 9, 12, 13, 18, 19, 22, and 24	GND	No internal connection; must be grounded on PCB
3 and 4	RF In	Input, matched to 50 ohms, DC coupled
9, 22	GND	Connected to GND paddle (pin 25) must be grounded on PCB to improve isolation
8	Vc2	Control voltage #2; see Application Circuit on page 7 as an example
10 and 11	RF Out2	Output #2, matched to 50 ohms, DC coupled
14, 15, 16, and 17	N/C	No internal connection; can be grounded or left open
20 and 21	RF Out1	Output #1, matched to 50 ohms, DC coupled
23	Vc1	Control voltage #1; see Application Circuit on page 7 as an example
25	GND	Backside Paddle. Multiple vias should be employed to minimize inductance and thermal resistance; see Mounting Configuration on page 11 for suggested footprint.

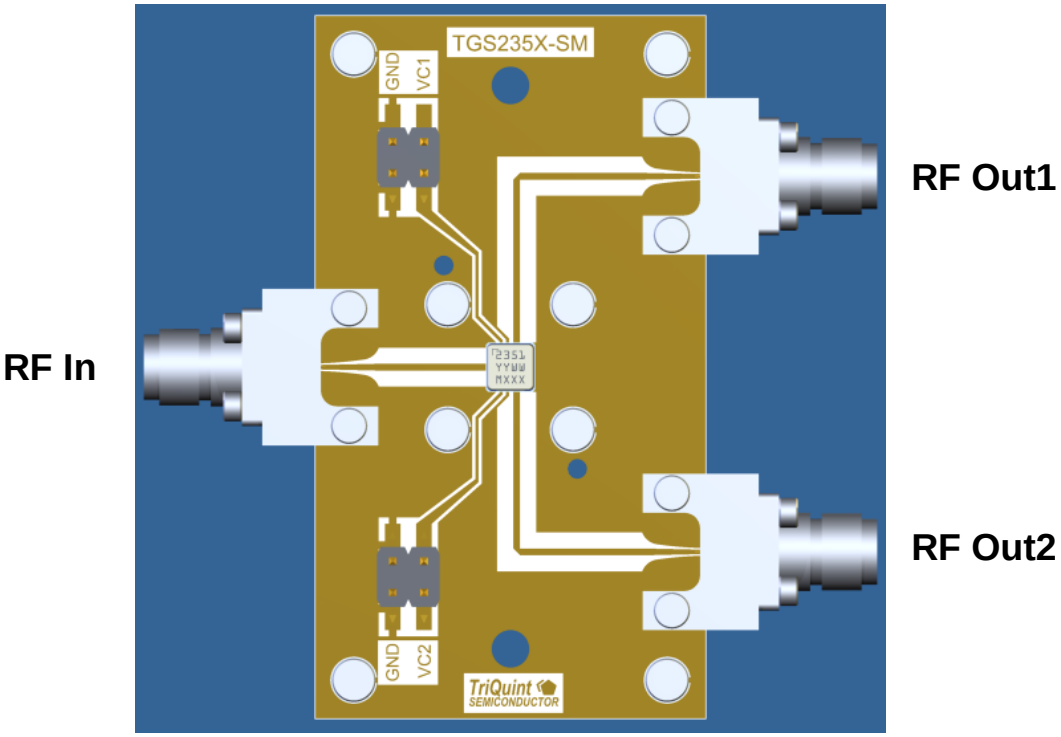
Applications Information

PC Board Layout

Top RF layer is 0.010" thick Rogers 4350, ϵ_r = 3.66. Metal layers are 0.5-oz copper. Microstrip 50 Ω line detail: width = 0.0217".

The pad pattern shown has been developed and tested for optimized assembly at TriQuint 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.

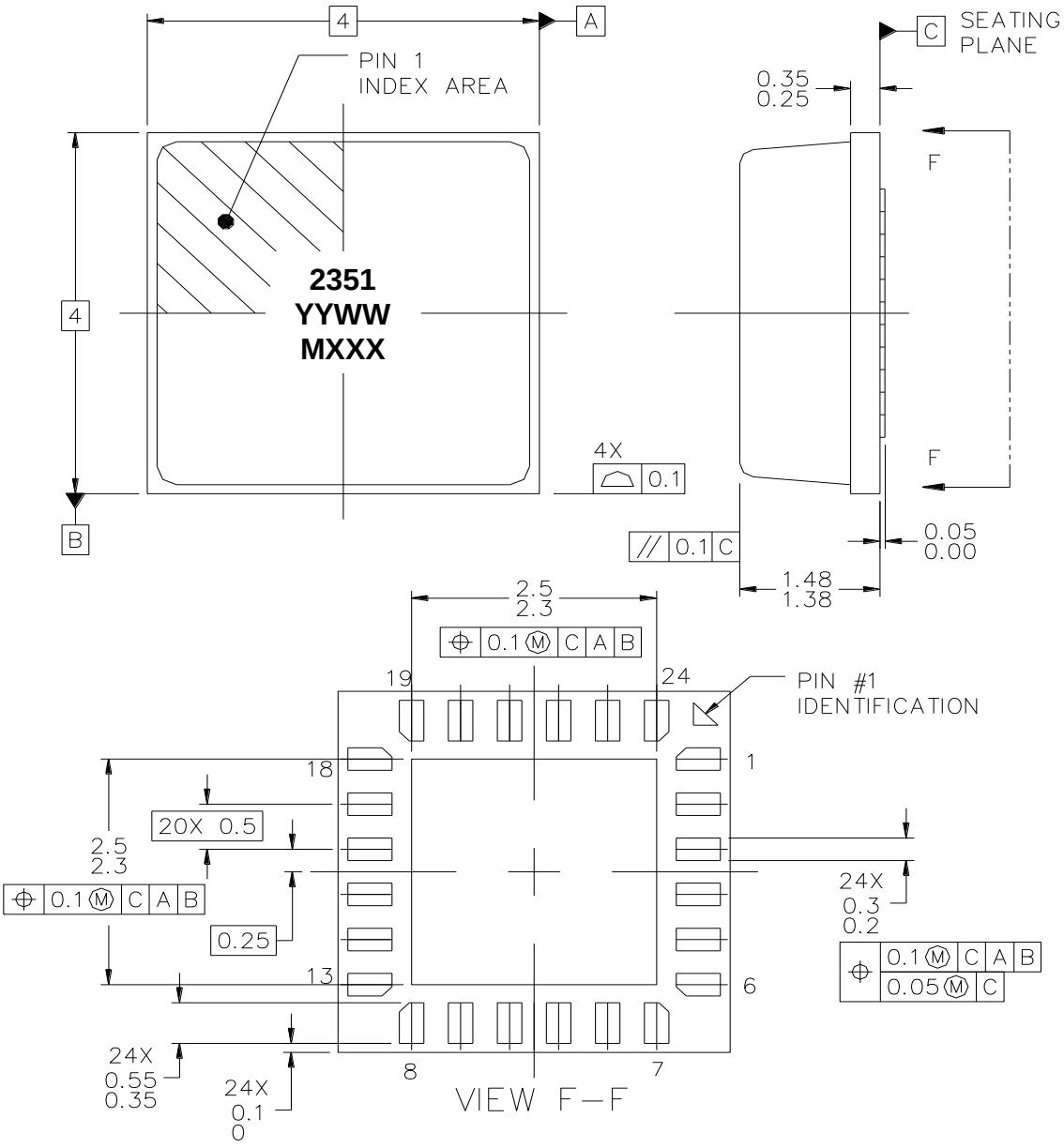
For further technical information, refer to the TGS2351-SM Product Information page.



Mechanical Information

Package Information and Dimensions

All dimensions are in millimeters.



This package is lead-free/RoHS-compliant with a Aluminum Nitride base (AlN), and the plating material on the leads is Electroless Gold (Au) over Electroless nickel (Ni). It is compatible with both lead-free (maximum 260 °C reflow temperature) and tin-lead (maximum 245 °C reflow temperature) soldering processes.

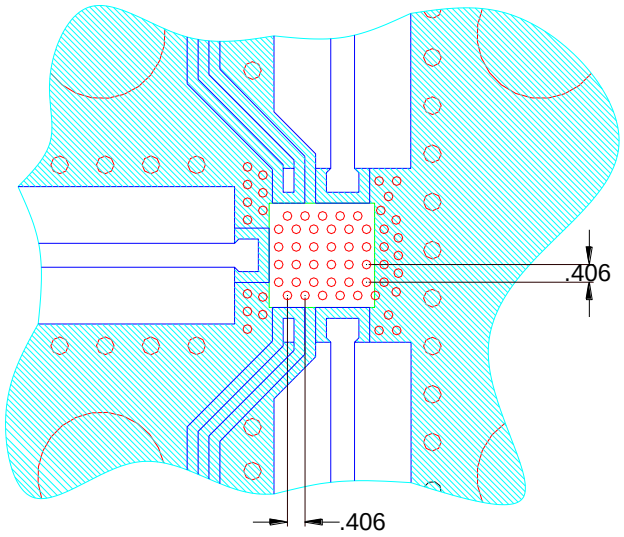
The TGS2351-SM will be marked with the "2351" designator and a lot code marked below the part designator. The "YY" represents the last two digits of the year the part was manufactured, the "WW" is the work week, and the "MXXX" is a supplier code and partial batch ID.

Mechanical Information (cont.)

Mounting Configuration

All dimensions are in millimeters (inches).

Notes:
1. A heatsink underneath the area of the PCB for the mounted device is recommended for proper thermal operation.
2. Ground / thermal vias are critical for the proper performance of this device.
   Vias have a final plated thru diameter of .203 mm (.008”).



Product Compliance Information

ESD Information

Caution! ESD-Sensitive Device

ESD Rating:	Class 1B
Value:	Passes ≥ 500 V min.
Test:	Human Body Model (HBM)
Standard:	JEDEC Standard JESD22-A114

MSL Rating

Level 1 at +260 °C convection reflow
The part is rated Moisture Sensitivity Level TBD at 260°C per JEDEC standard IPC/JEDEC J-STD-020.

ECCN

US Department of Commerce EAR99

Solderability

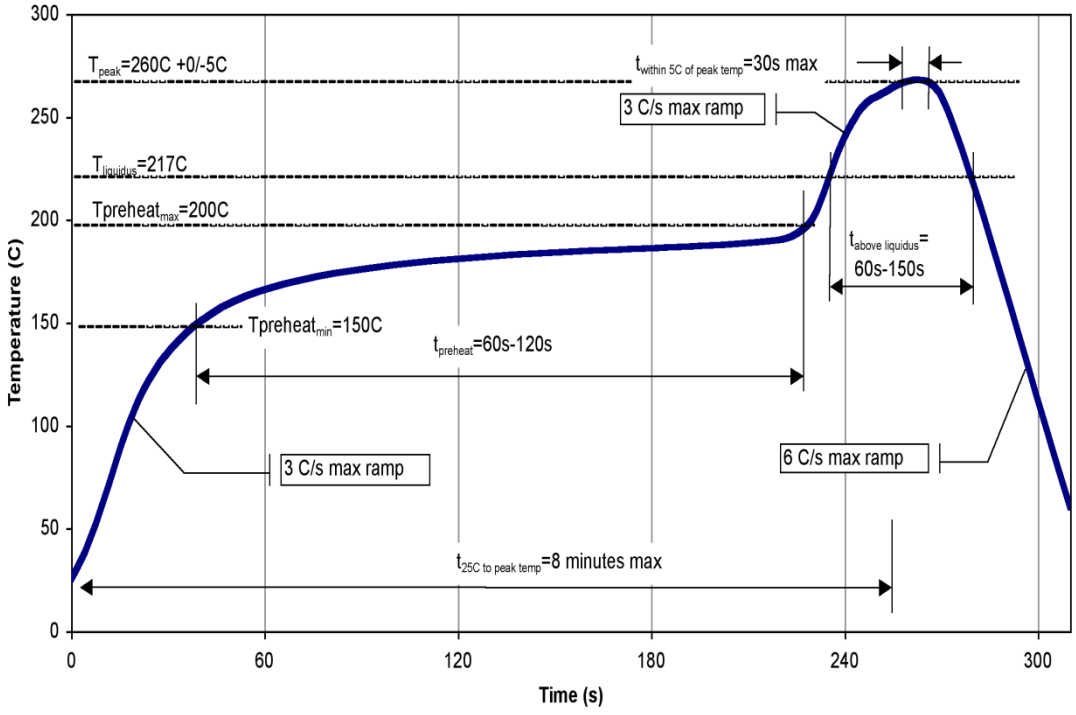
Compatible with the latest version of J-STD-020, Lead free solder, 260°

This part is compliant with EU 2002/95/EC RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

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

Recommended Soldering Temperature Profile



Contact Information

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