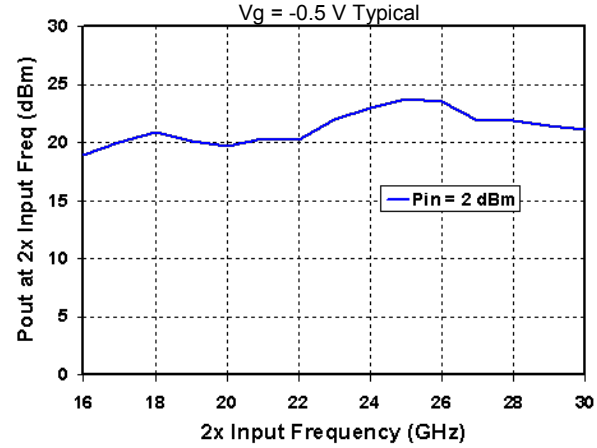
8 - 15 GHz Packaged Doubler with Amplifier

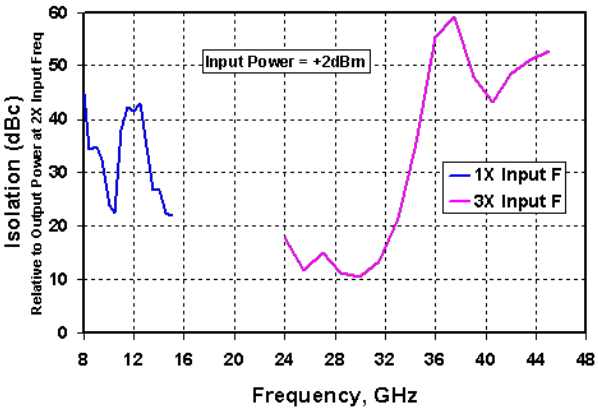
Key Features

- RF Output Frequency Range: 16-30 GHz
- Input Frequency Range: 8 - 15 GHz
- 20 dBm Nominal Pout
- 18 dB Gain
- 30 dBc Input Frequency Isolation
- Bias: Vd = 5 V, Id = 150 mA, Vdbl = -0.8 V, Vg = -0.5 V Typical
- Package Dimensions: 4 x 4 x 0.9 mm

Measured Performance

Bias conditions: Vd = 5 V, Id = 150 mA, Vdbl = -0.8 V, Vg = -0.5 V Typical





Primary Applications

- Point-to-Point Radio
- Ka Band Sat-Com

Product Description

The TriQuint TGC4403-SM packaged MMIC combines a frequency doubler with a 3-stage amplifier, operating at input frequencies of 8 - 15 GHz. With greater than 30 dBc isolation between the input and doubled frequency, the TGC4403-SM achieves 20 dBm output power, with 2 dBm input power. This performance makes this doubler ideally suited for Point to Point Radios and Ka-Band satellite ground terminal applications. The TGC4403-SM provides the frequency doubling function in an compact 4 mm x 4 mm package footprint.

Each device is 100% DC and RF tested on–wafer to ensure performance compliance. The device is available in chip form.

The TGC4403-SM has a protective surface passivation layer on the MMIC providing environmental robustness.

Lead-free and RoHS compliant.

Datasheet subject to change without notice.

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Table I
Absolute Maximum Ratings 1/

Symbol	Parameter	Value	Notes
Vd-Vg	Drain to Gate Voltage	12 V	
Vd	Drain Voltage	8 V	2/
Vdbl	Doubler Voltage Range	-5 to 0 V	
Vg	Gate Voltage Range	-5 to 0 V	
Id	Positive Current	280 mA	2/
Ig	Gate Current Range	-1 to 23 mA	
Idbl	Doubler Current Range	-0.6 to 16.8 mA	
Pin	Input Continuous Wave Power	18.2 dBm	2/

1/ These ratings represent the maximum operable values for this device. Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device and / or affect device lifetime. These are stress ratings only, and functional operation of the device at these conditions is not implied.

2/ Combinations of supply voltage, supply current, input power, and output power shall not exceed the maximum power dissipation listed in Table IV.

Table II
Recommended Operating Conditions

Symbol	Parameter 1/	Value
Vd	Drain Voltage	5 V
Id	Drain Current (quiescent)	150 mA
Id_drive	Drain Current with RF input = 2 dBm	170 mA
Vg	Gate Voltage	-0.5 V
Vdbl	Doubler Voltage	-0.8 V

1/ See assembly diagram for bias instructions.

Table III
RF Characterization Table

Bias: Vd = 5 V, Id = 150 mA, Vg = -0.5 V typcial, Vdbl = -0.8 V fixed

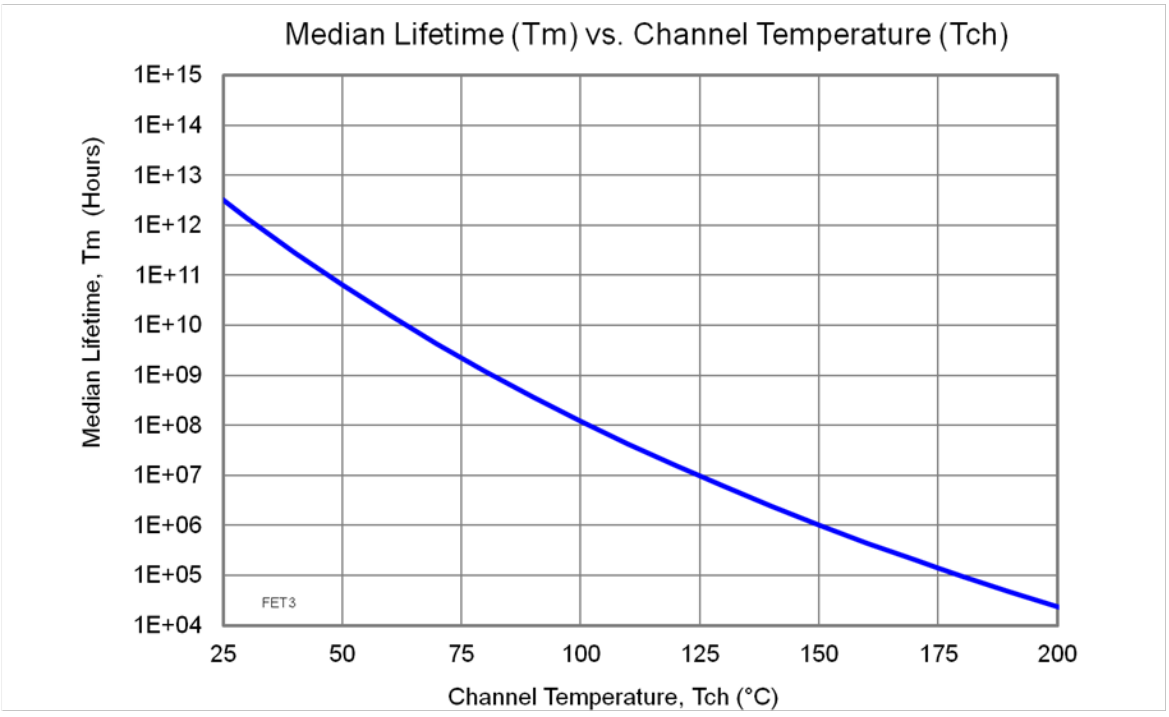
SYMBOL	PARAMETER	TEST CONDITIONS	MIN	NOMINAL	MAX	UNITS
RF_Freq	Input Frequency Range			8 - 15		GHz
CGain	Conversion Gain (RFin = 2 dBm)	Freq_in= 8 – 14.5 GHz Freq_out = 16 - 29 GHz Freq_in= 15 GHz Freq_out = 30 GHz	14 12	18 16		dB
IRL	Input Return Loss	Freq = 8 - 15 GHz		6		dB
ORL	Output Return Loss	Freq = 16 - 30 GHz		4		dB
Pout	Output Power (RFin = 2 dBm)	Freq = 16 - 30 GHz	16	20		dBm
Isol_1x	Isolation, Fundamental	Freq_in= 8 – 14.5 GHz Freq_out = 8 – 14.5 GHz	11	30		dBc
Isol_3x	Isolation, 3rd Harmonic	Freq_in= 8 – 10.5 GHz Freq_out = 24–31.5 GHz	1	10		dBc

Table IV

Power Dissipation and Thermal Properties

Parameter	Test Conditions	Value	Notes
Maximum Power Dissipation	Tbaseplate = 70 °C	Pd = 1.42 W Tchannel = 150 °C Tm = 1.0E+6 Hrs	1/
Thermal Resistance, θjc	Vd = 5 V Id = 150 mA Pd = 0.75 W	θjc = 56.3 (°C/W) Tchannel = 112 °C Tm = 3.4E+7 Hrs	
Thermal Resistance, θjc Under RF Drive	Vd = 5 V Id = 170 mA Pout = 22 dBm Pd = 0.69 W	θjc = 56.3 (°C/W) Tchannel = 109 °C Tm = 4.6E+7 Hrs	
Mounting Temperature	30 Seconds	320 °C	
Storage Temperature		-65 to 150 °C	

1/ Channel operating temperature will directly affect the device median lifetime (Tm). For maximum life, it is recommended that channel temperatures be maintained at the lowest possible levels.



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Measured Data

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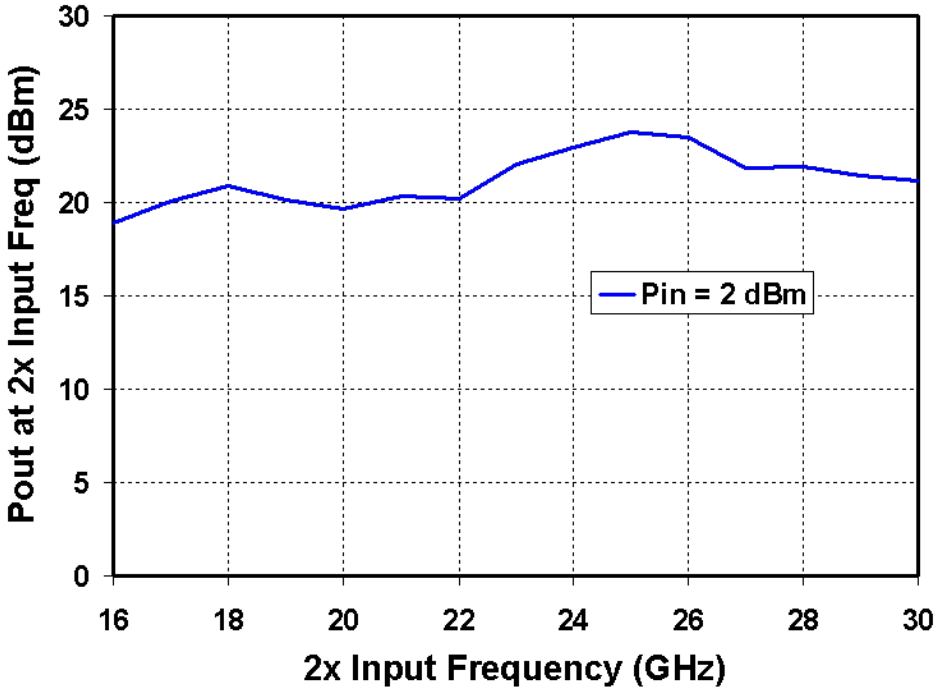

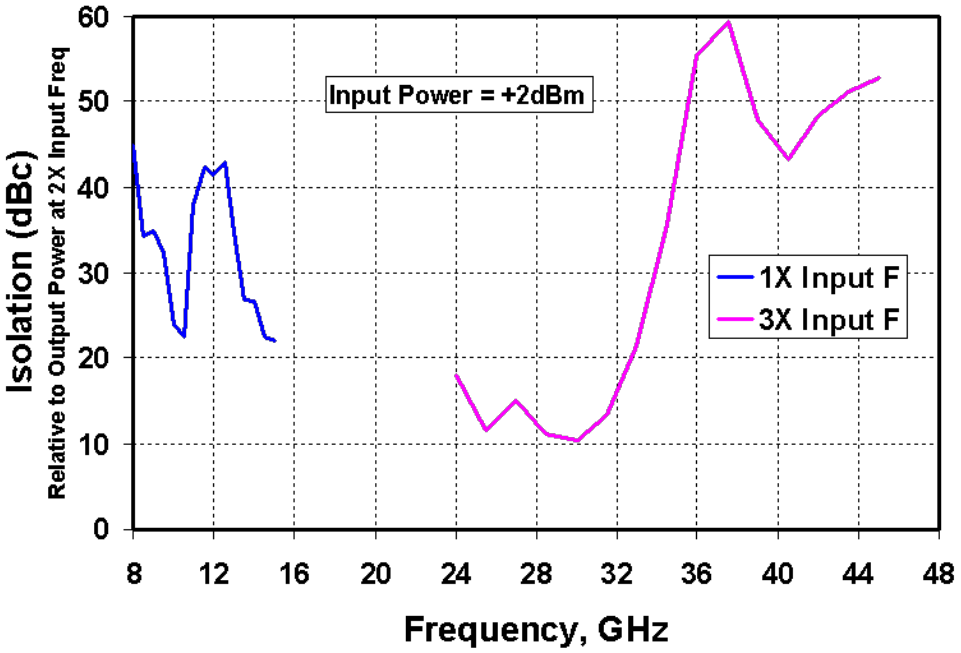

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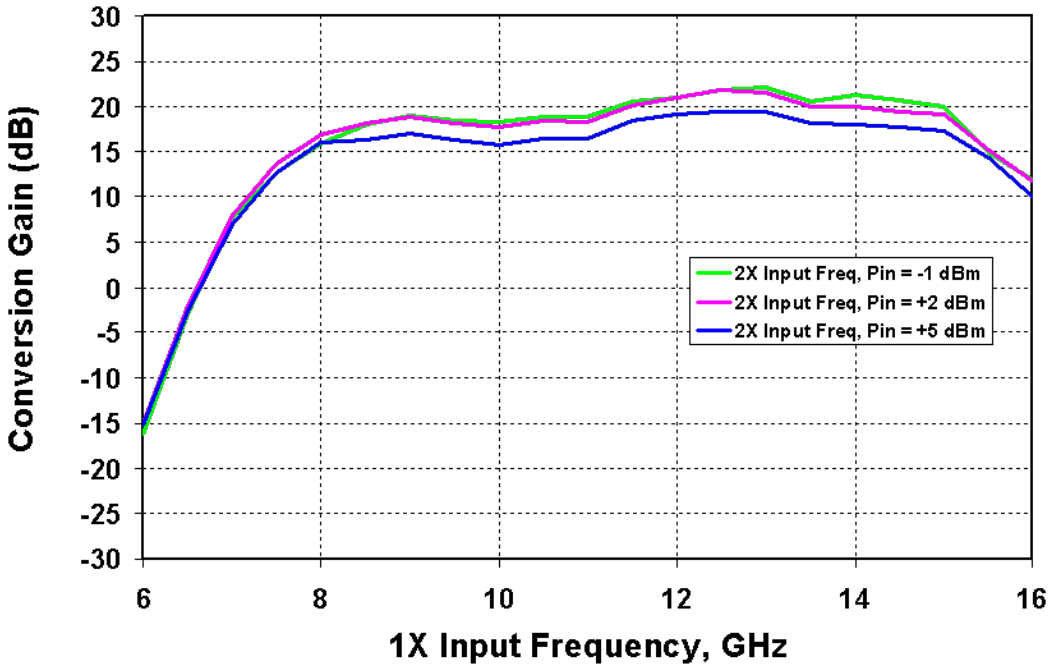

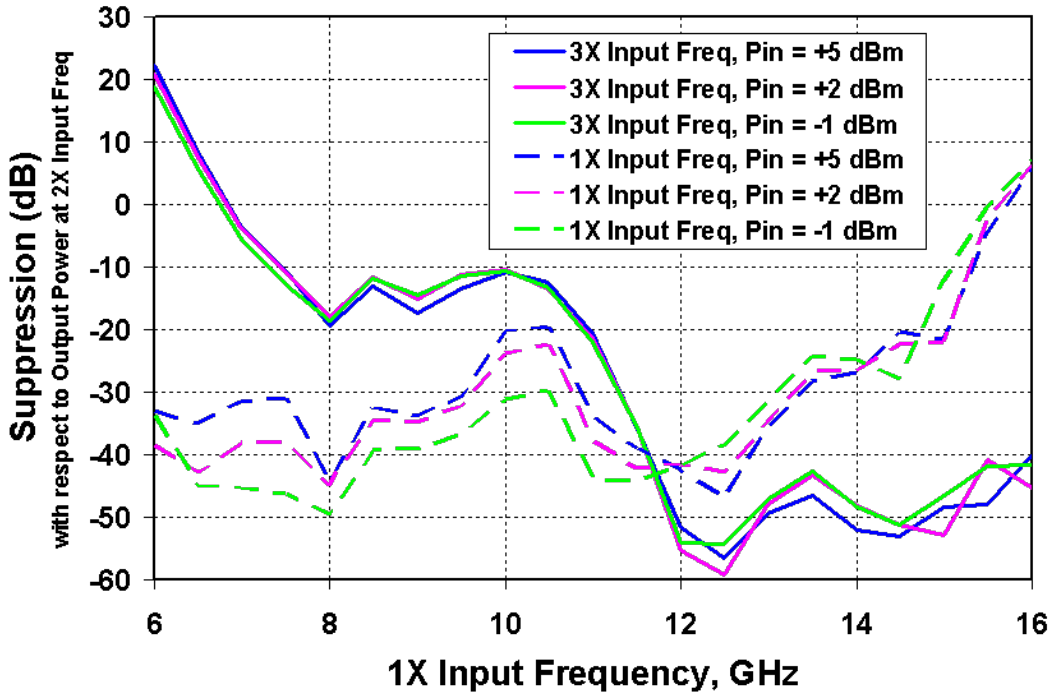

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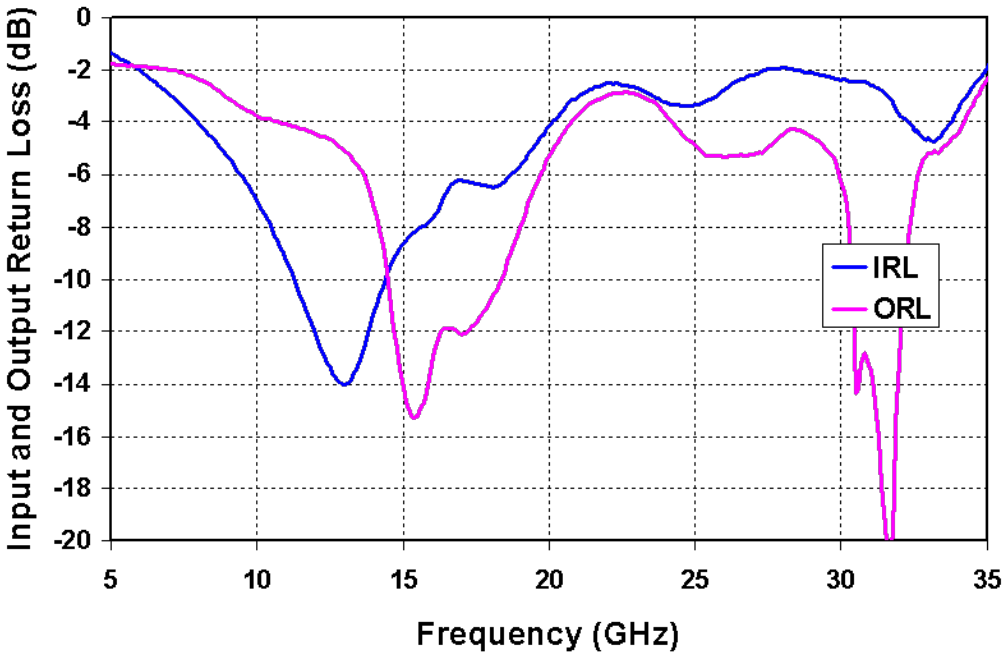

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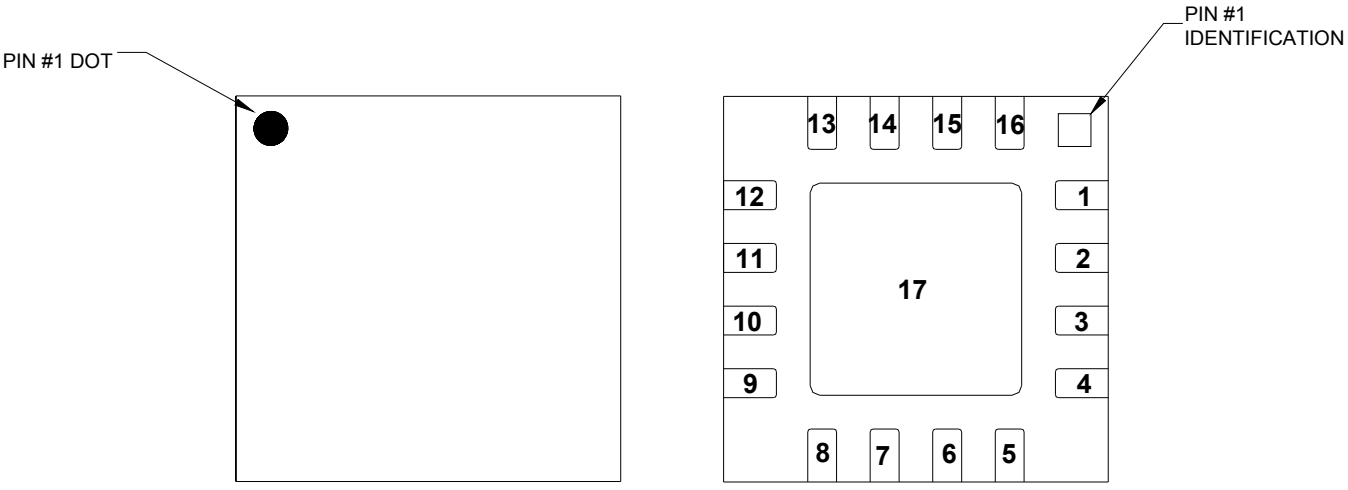
Package Pinout

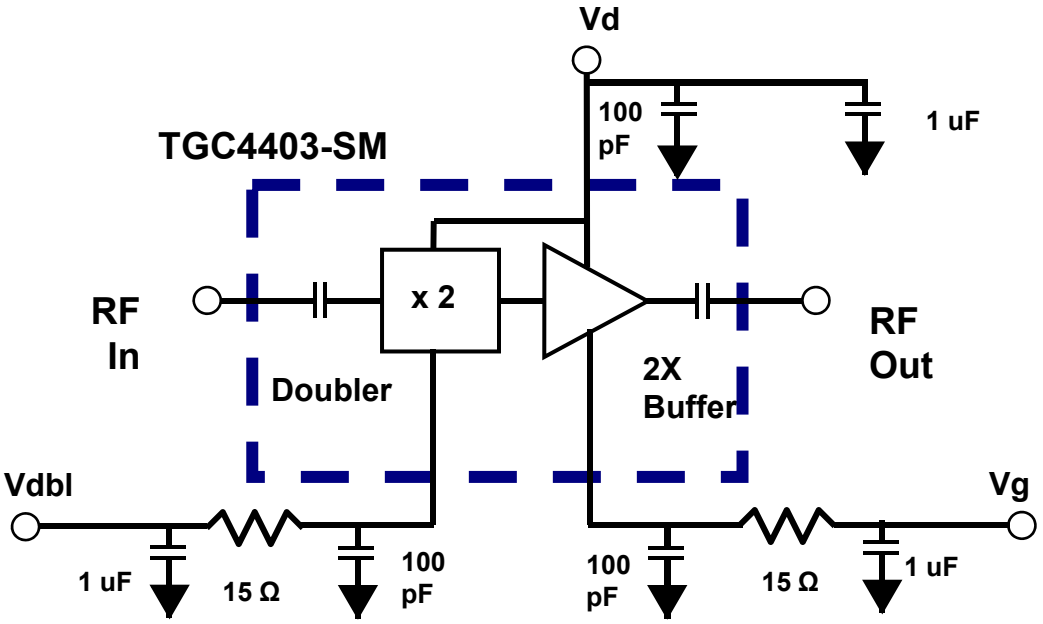


TOP VIEW

BOTTOM VIEW

Pin	Description
1, 2, 4, 7, 8, 9, 11, 12, 13, 15, 16	N/C
3	RF Input
5	Vdbl
6	Vg
10	RF Out
14	Vd
17	GND

Electrical Schematic



Bias Procedures

Bias-up Procedure

- Vg set to -1.5 V
- Vd set to +5 V
- Vdbl set to -0.8 V
- Adjust Vg more positive until Id is 150 mA. This will be ~ Vg = -0.5 V
- Apply signal to input, Id will increase

Bias-down Procedure

- Turn off signal
- Reduce Vg to -1.5V. Ensure Id ~ 0 mA
- Turn Vdbl to 0V
- Turn Vd to 0V
- Turn Vg to 0V

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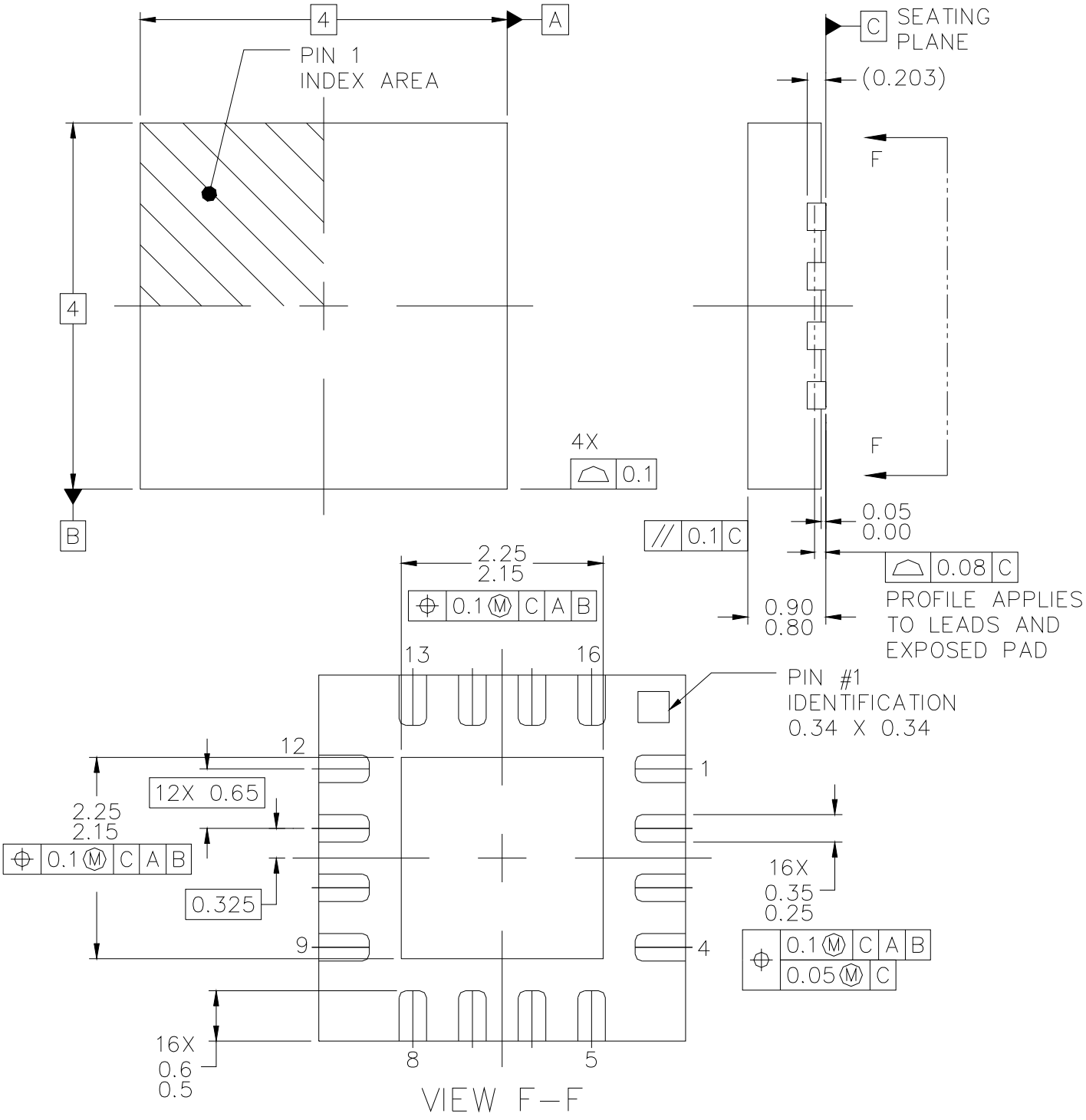
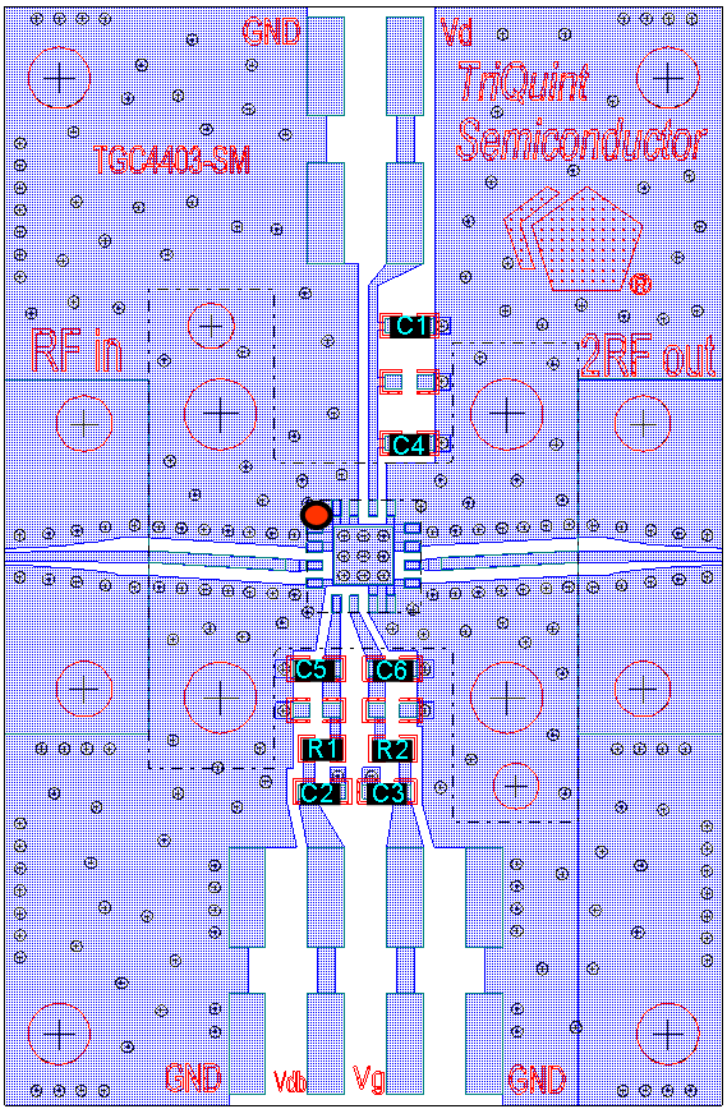
Mechanical Drawing

Units: Millimeters



GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.

Recommended Assembly Diagram



Part	Description
C1,C2,C3	1 uF Capacitor (0402)
C4,C5,C6	100 pF Capacitor (0402)
R1,R2	15 ohm Resistor (0402)

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Assembly Notes

Recommended Surface Mount Package Assembly

- Proper ESD precautions must be followed while handling packages.
- Clean the board with acetone. Rinse with alcohol. Allow the circuit to fully dry.
- TriQuint recommends using a conductive solder paste for attachment. Follow solder paste and reflow oven vendors' recommendations when developing a solder reflow profile. Typical solder reflow profiles are listed in the table below.
- Hand soldering is not recommended. Solder paste can be applied using a stencil printer or dot placement. The volume of solder paste depends on PCB and component layout and should be well controlled to ensure consistent mechanical and electrical performance.
- Clean the assembly with alcohol.

Typical Solder Reflow Profiles

Reflow Profile	SnPb	Pb Free
Ramp-up Rate	3 °C/sec	3 °C/sec
Activation Time and Temperature	60 – 120 sec @ 140 – 160 °C	60 – 180 sec @ 150 – 200 °C
Time above Melting Point	60 – 150 sec	60 – 150 sec
Max Peak Temperature	240 °C	260 °C
Time within 5 °C of Peak Temperature	10 – 20 sec	10 – 20 sec
Ramp-down Rate	4 – 6 °C/sec	4 – 6 °C/sec

Ordering Information

Part	Package Style
TGC4403-SM	QFN 4x4 Surface Mount

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