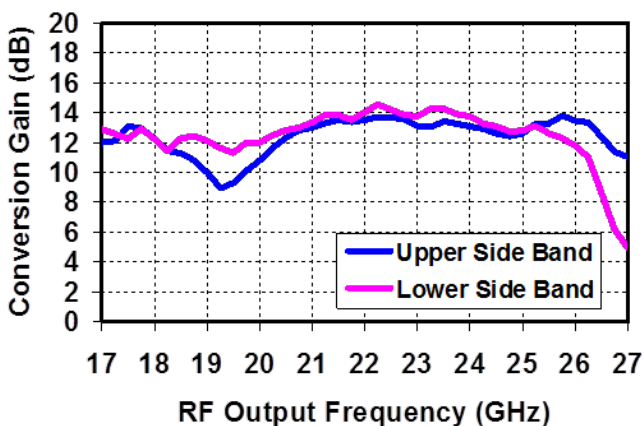


## 17 - 27 GHz Packaged Upconverter

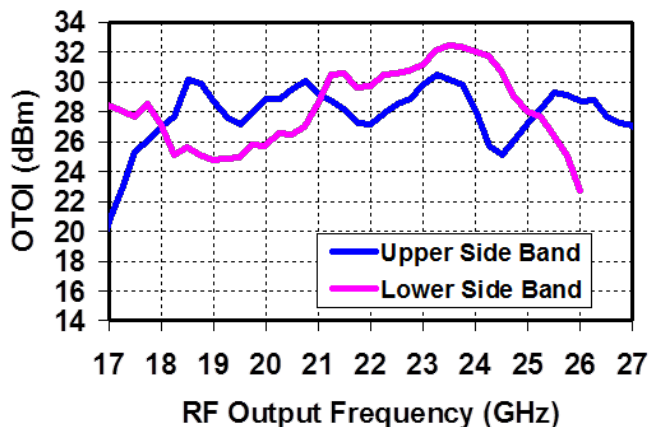


### Measured Performance

Vd = 5V, Idq = 425mA, Vm<sub>xr</sub> = Vd<sub>bl</sub> = -0.9V  
IF = 2GHz @ -8dBm, +2dBm LO



Vd = 5V, Idq = 425mA, Vm<sub>xr</sub> = Vd<sub>bl</sub> = -0.9V  
IF = 2GHz +/- 5MHz @ -8dBm Input/Tone, +2dBm LO



### Key Features

- RF Output Frequency Range: 17 - 27 GHz
- LO Input Frequency Range: 8 - 13 GHz
- IF Input Frequency Range: 0.5 - 3 GHz
- 13 dB Conversion Gain
- 28 dBm OTOI
- Bias: Vd = 5 V, Idq = 425 mA
- Package Dimensions: 4 x 4 x 0.9 mm

### Primary Applications

- Point-to-Point Radio
- K Band Sat-Com

### Product Description

The TriQuint TGC4405-SM is an upconverter with RF output frequencies of 17 to 27 GHz. It contains a frequency doubler and local oscillator (LO) amplifier, operating at LO input frequencies of 8 - 13 GHz. The TGC4405-SM is in a compact 4 mm x 4 mm package footprint.

The TGC4405-SM nominally provides 13 dB conversion gain and 28 dBm OTOI when operated with LO inputs from 2 - 5 dBm.

The TGC4405-SM is ideally suited for low cost markets such as Point-to-Point Radio, and K-band Sat-Com.

The TGC4405-SM has a protective surface passivation layer on the MMIC providing environmental robustness.

Lead-free and RoHS compliant.

*Datasheet subject to change without notice.*

**Table I**  
**Absolute Maximum Ratings 1/**

Symbol	Parameter	Value	Notes
Vd-Vg	Drain to Gate Voltage	12 V	
Vd	Drain Supply Voltage	8 V	2/
Vmxr	Mixer Supply Voltage Range	-5 to 0 V	
Vdbl	Doubler Supply Voltage Range	-5 to 0 V	
Vg	Gate Supply Voltage Range	-5 to 0 V	
Id	Drain Supply Current	817 mA	2/
Ig	Gate Supply Current Range	-3.3 to 56.7 mA	
Imxr	Mixer Supply Current Range	-0.75 to 10.5 mA	
Idbl	Doubler Supply Current Range	-0.6 to 16.8 mA	
Pin <sub>LO</sub>	LO Input Continuous Wave Power	18 dBm	2/
Pin <sub>IF</sub>	IF Input Continuous Wave Power	21 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 Pd (as listed in “Thermal Information”).

**Table II**  
**Recommended Operating Conditions**

Symbol	Parameter	Value
Vd	Drain Voltage	5 V
Idq	Drain Current	425 mA
Vg	Gate Voltage	-0.5 V, typical
Vmxr	Mixer Voltage	-0.9 V
Vdbl	Doubler Voltage	-0.9 V

See assembly diagram for bias instructions.

**Table III**  
**RF Characterization Table**

**Bias:  $V_d = 5\text{ V}$ ,  $I_{dq} = 425\text{ mA}$ ,  $V_{mxr} = V_{dbl} = -0.9\text{V}$ ,  $V_g = -0.5\text{V}$  Typical**

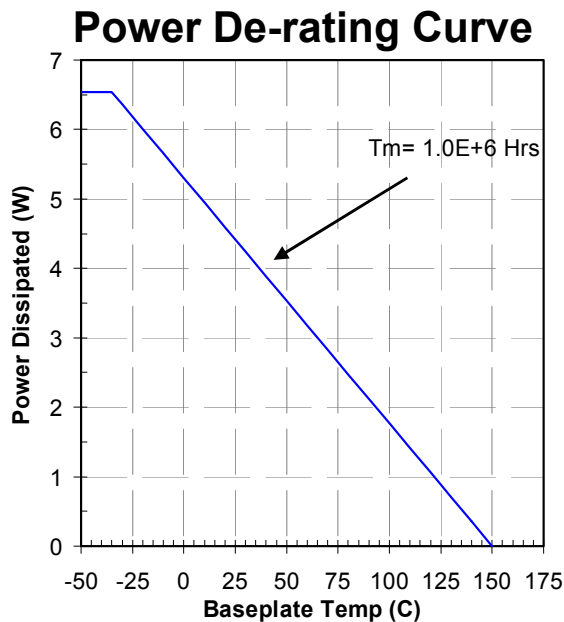
<b>SYMBOL</b>	<b>PARAMETER</b>	<b>TEST CONDITIONS</b>	<b>NOMINAL</b>	<b>UNITS</b>
$F_{LO}$	LO Input Frequency Range		8 - 13	GHz
$F_{IF}$	IF Input Frequency Range		0.5 - 3	GHz
Gain	Conversion Gain	$f = 17 - 27\text{ GHz}$	13	dB
ORL	Output Return Loss	$f = 17 - 27\text{ GHz}$	-10	dB
OTOI	Output Third Order Intercept @ IF Input = -8dBm/Tone	$f = 17 - 27\text{ GHz}$	28	dBm

**Table IV**  
**Power Dissipation and Thermal Properties**

Parameter	Test Conditions	Value	Notes
Maximum Power Dissipation	Tbase = 70 °C	Pd = 2.9 W Tchannel = 150 °C Tm = 1.0E+6 Hrs	1/ 2/
Thermal Resistance, $\theta_{jc}$	Vd = 5 V Id = 425 mA Pd = 2.13 W	$\theta_{jc}$ = 27.4 (°C/W) Tchannel = 128 °C Tm = 7E+6 Hrs	
Mounting Temperature	30 Seconds	320 °C	
Storage Temperature		-65 to 150 °C	

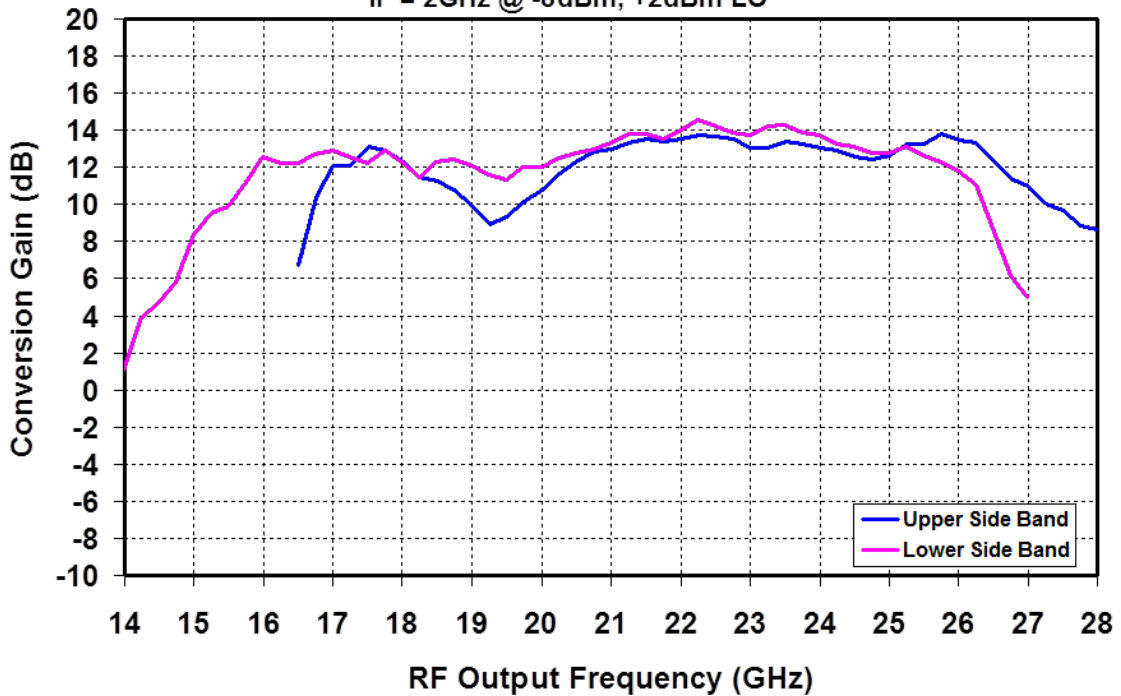
- 1/ For a median life of 1E+6 hours, Power Dissipation is limited to  

$$P_{d(max)} = (150\text{ °C} - T_{base}\text{ °C})/\theta_{jc}.$$
- 2/ Channel operating temperature will directly affect the device median time to failure (MTTF). For maximum life, it is recommended that channel temperatures be maintained at the lowest possible levels.
- 2/ Tbase is defined @ package pin # 17 (ground)

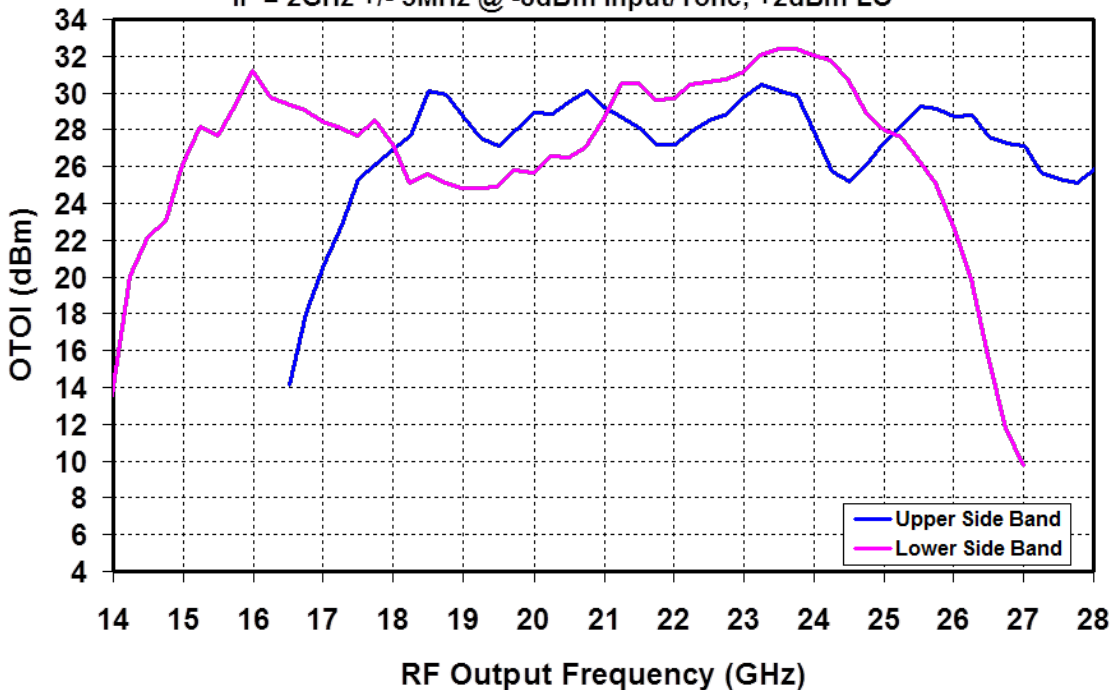


**Measured Data**

Vd = 5V, Idq = 425mA, Vm<sub>xr</sub> = V<sub>dbl</sub> = -0.9V  
 IF = 2GHz @ -8dBm, +2dBm LO

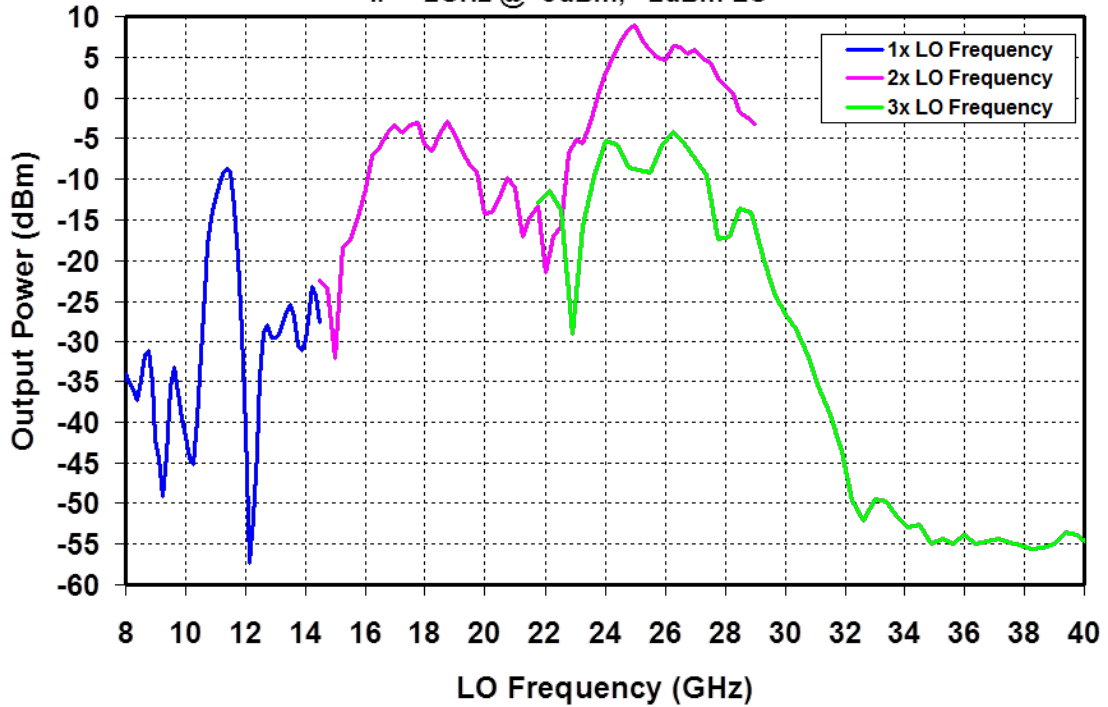


Vd = 5V, Idq = 425mA, Vm<sub>xr</sub> = V<sub>dbl</sub> = -0.9V  
 IF = 2GHz +/- 5MHz @ -8dBm Input/Tone, +2dBm LO

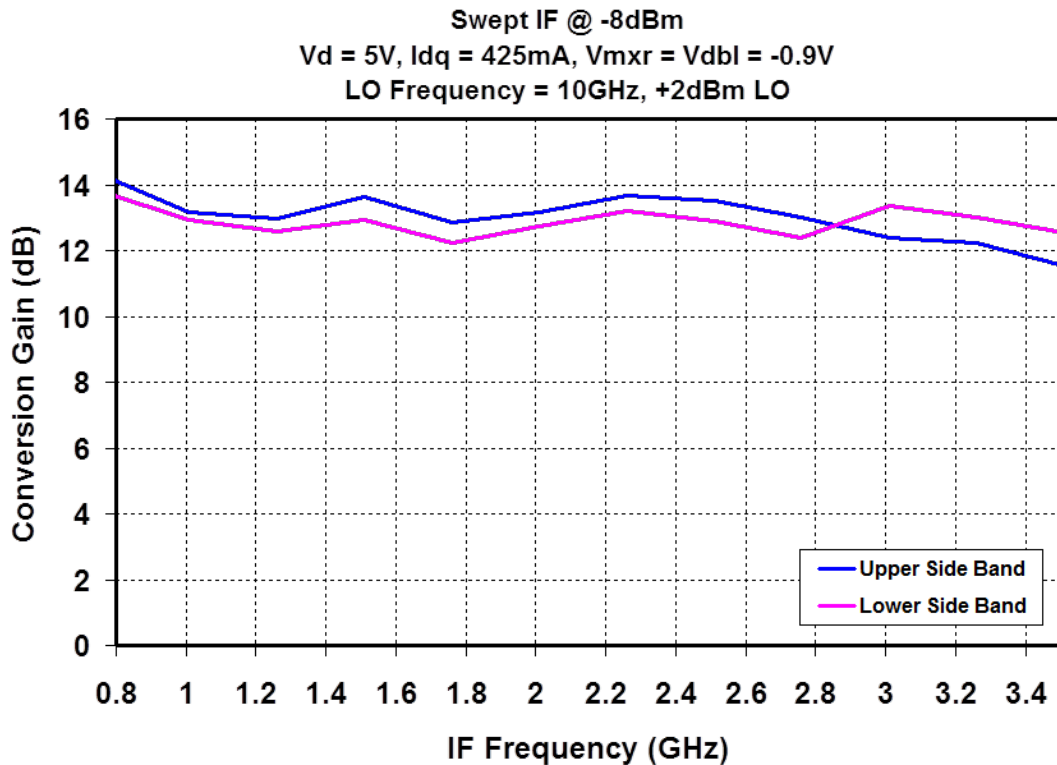
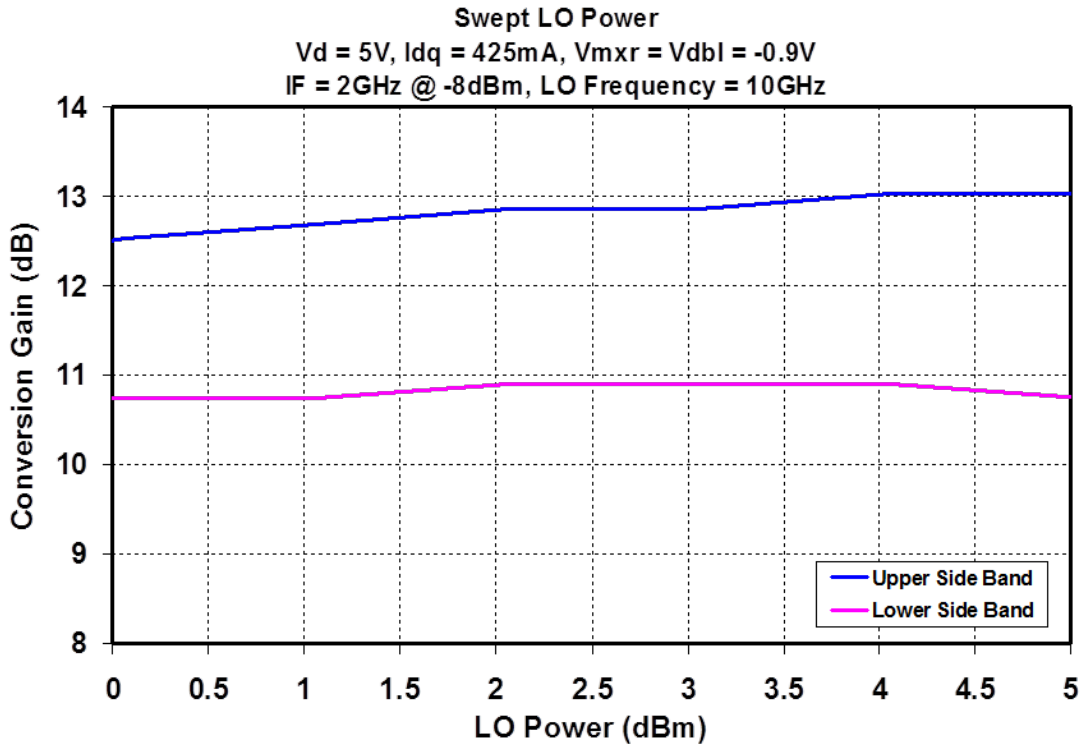


**Measured Data**

Vd = 5V, Idq = 425mA, Vmxr = Vdbl = -0.9V  
IF = 2GHz @ -8dBm, +2dBm LO

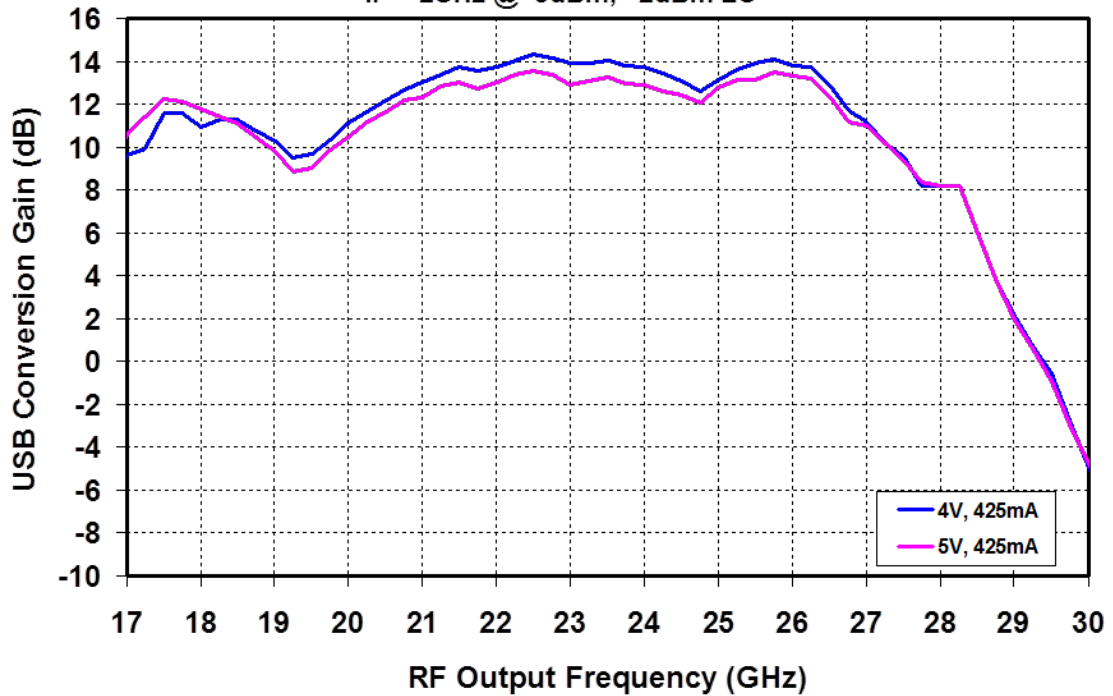


**Measured Data**

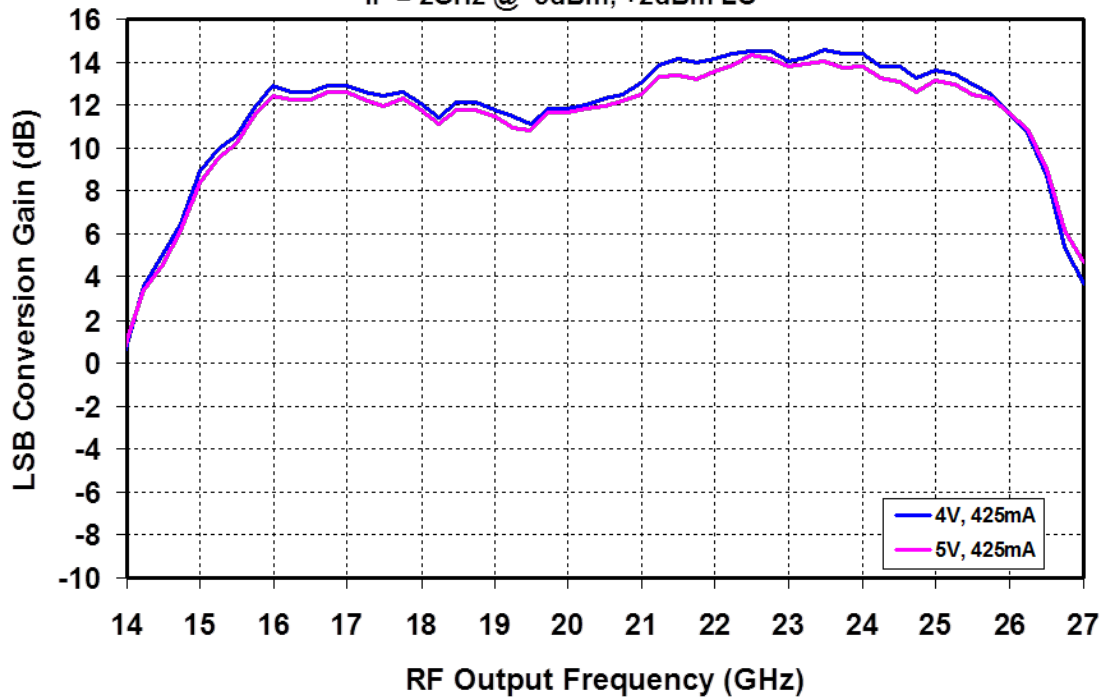


**Measured Data**

Vd = 5V vs. 4V, Idq = 425mA, Vmxr = Vdbl = -0.9V  
 IF = 2GHz @ -5dBm, +2dBm LO



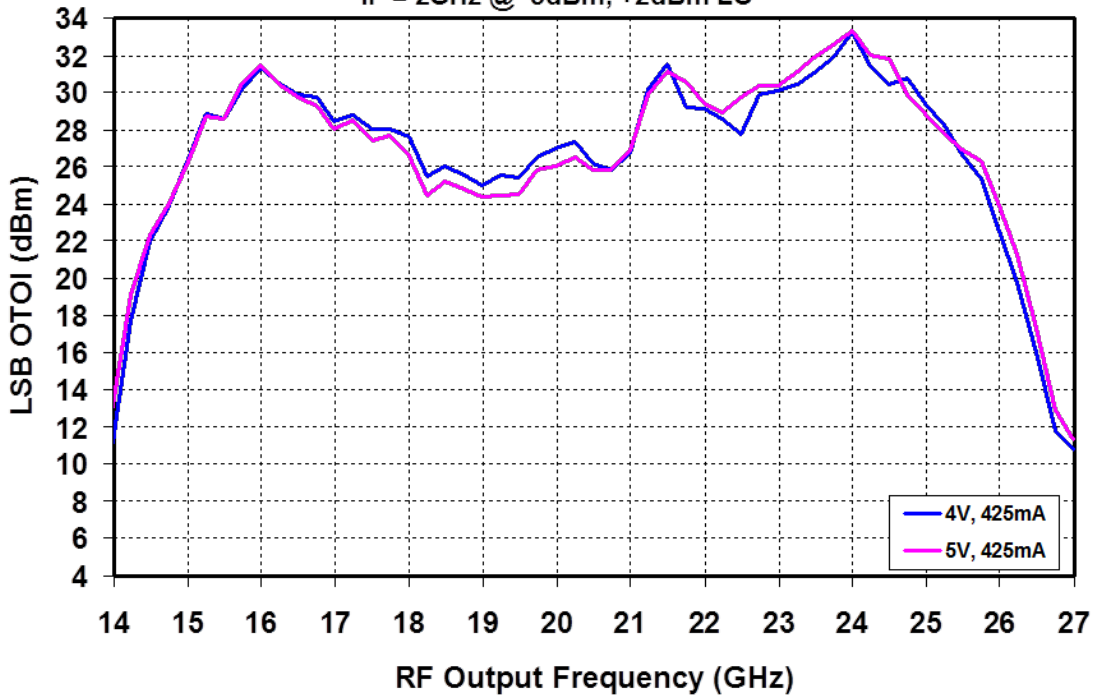
Vd = 5V vs. 4V, Idq = 425mA, Vmxr = Vdbl = -0.9V  
 IF = 2GHz @ -5dBm, +2dBm LO



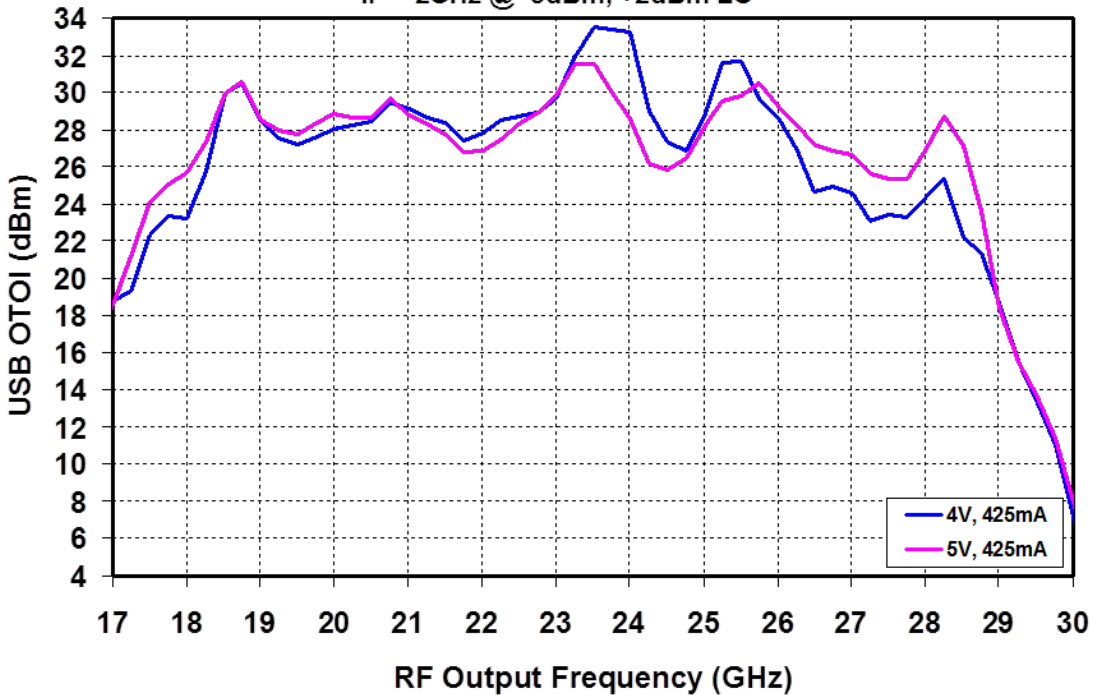


**Measured Data**

Vd = 5V vs. 4V, Idq = 425mA, Vm<sub>xr</sub> = V<sub>dbl</sub> = -0.9V  
 IF = 2GHz @ -5dBm, +2dBm LO

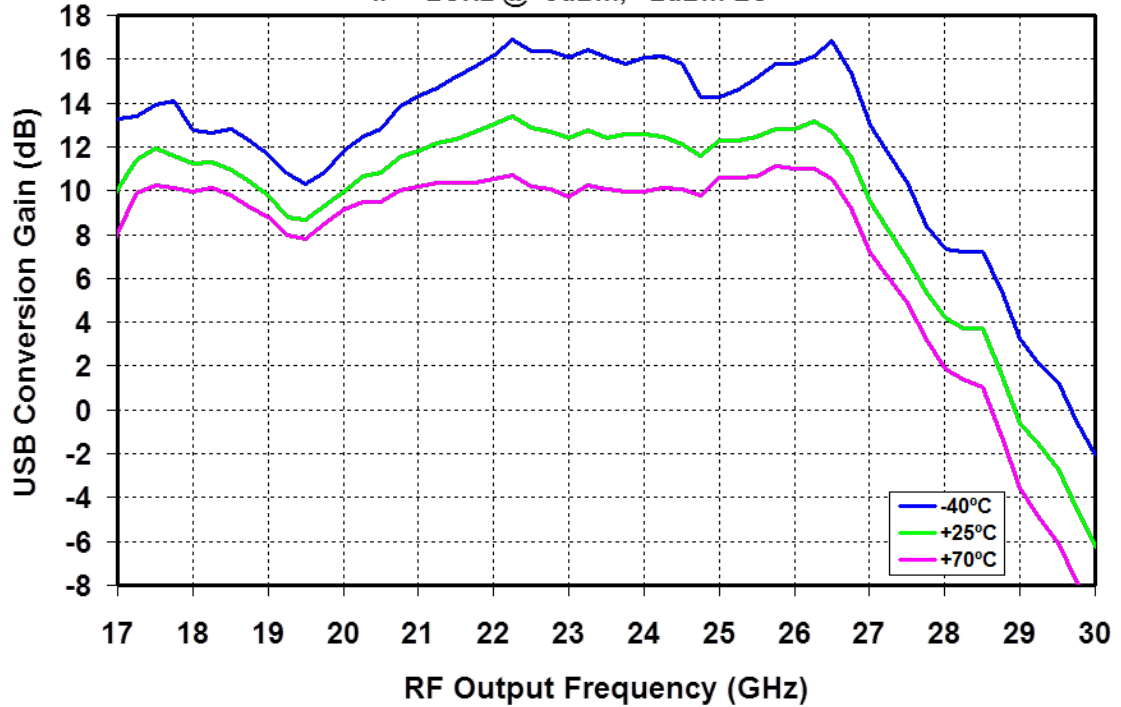


Vd = 5V vs. 4V, Idq = 425mA, Vm<sub>xr</sub> = V<sub>dbl</sub> = -0.9V  
 IF = 2GHz @ -5dBm, +2dBm LO

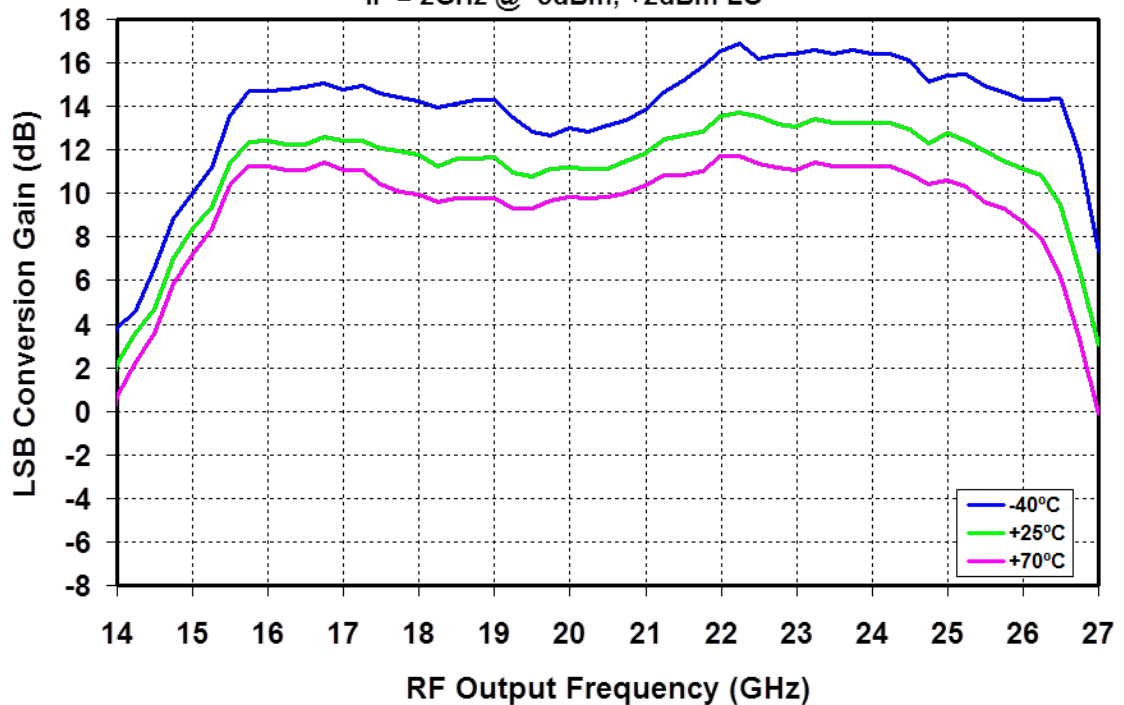


**Measured Data**

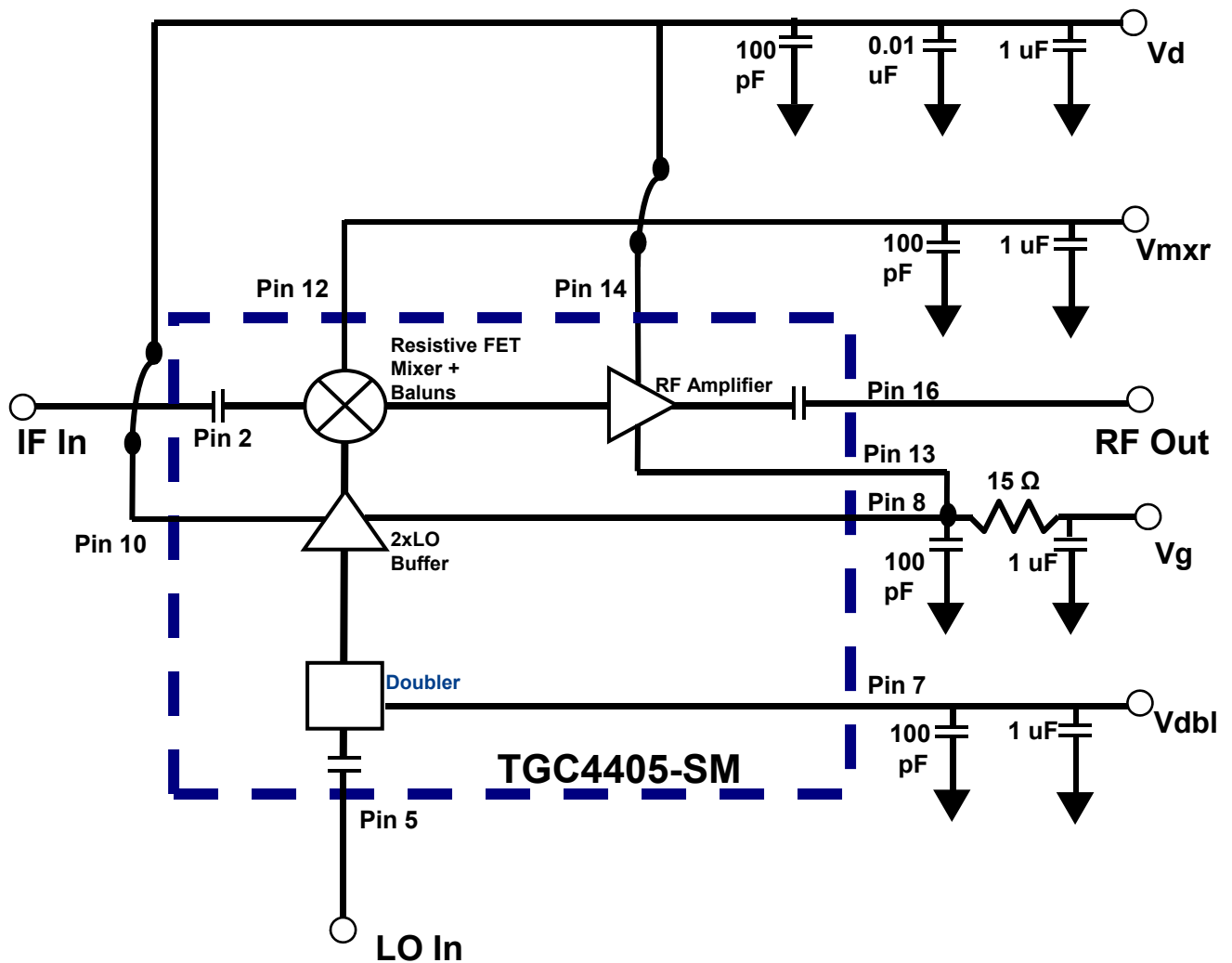
Vd = 5V, Idq = 425mA, Vm<sub>xr</sub> = V<sub>dbl</sub> = -0.9V  
 IF = 2GHz @ -5dBm, +2dBm LO



Vd = 5V, Idq = 425mA, Vm<sub>xr</sub> = V<sub>dbl</sub> = -0.9V  
 IF = 2GHz @ -5dBm, +2dBm LO



**Electrical Schematic**



**Bias Procedures**

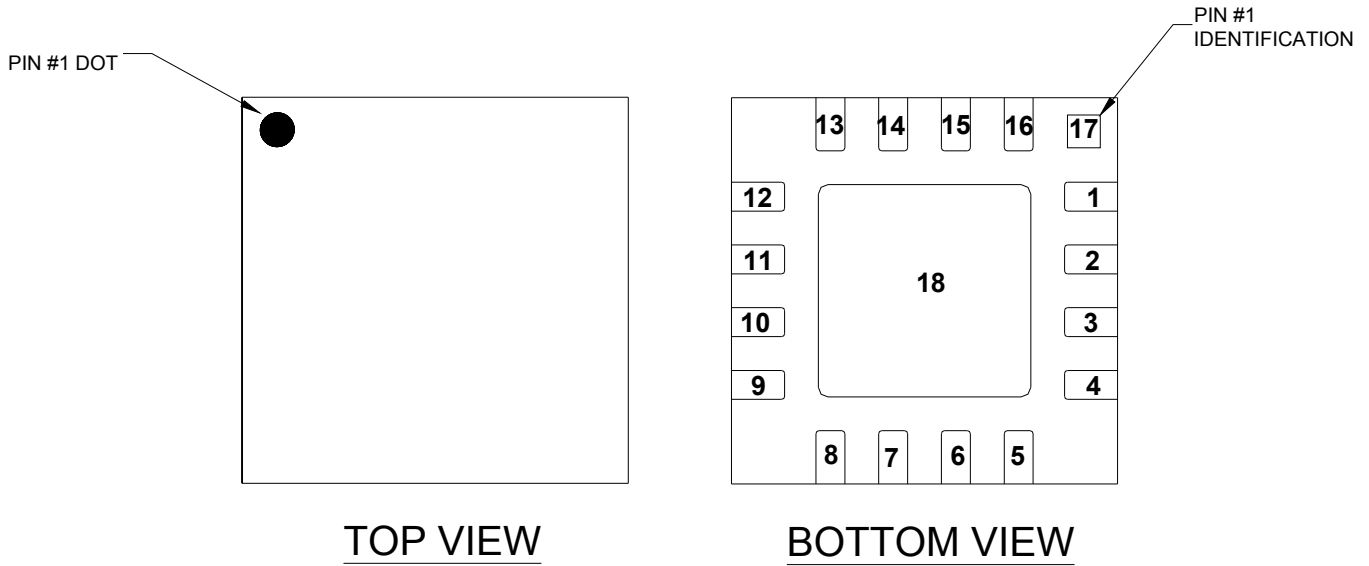
Bias-up Procedure

- Vg set to -1.5 V
- Vmrx set to -0.9V
- Vdbl set to -0.9 V
- Vd set to +5 V
- Adjust Vg more positive until Idq is 425 mA.  
This will be ~ Vg = -0.5 V
- Apply signals to LO and IF input

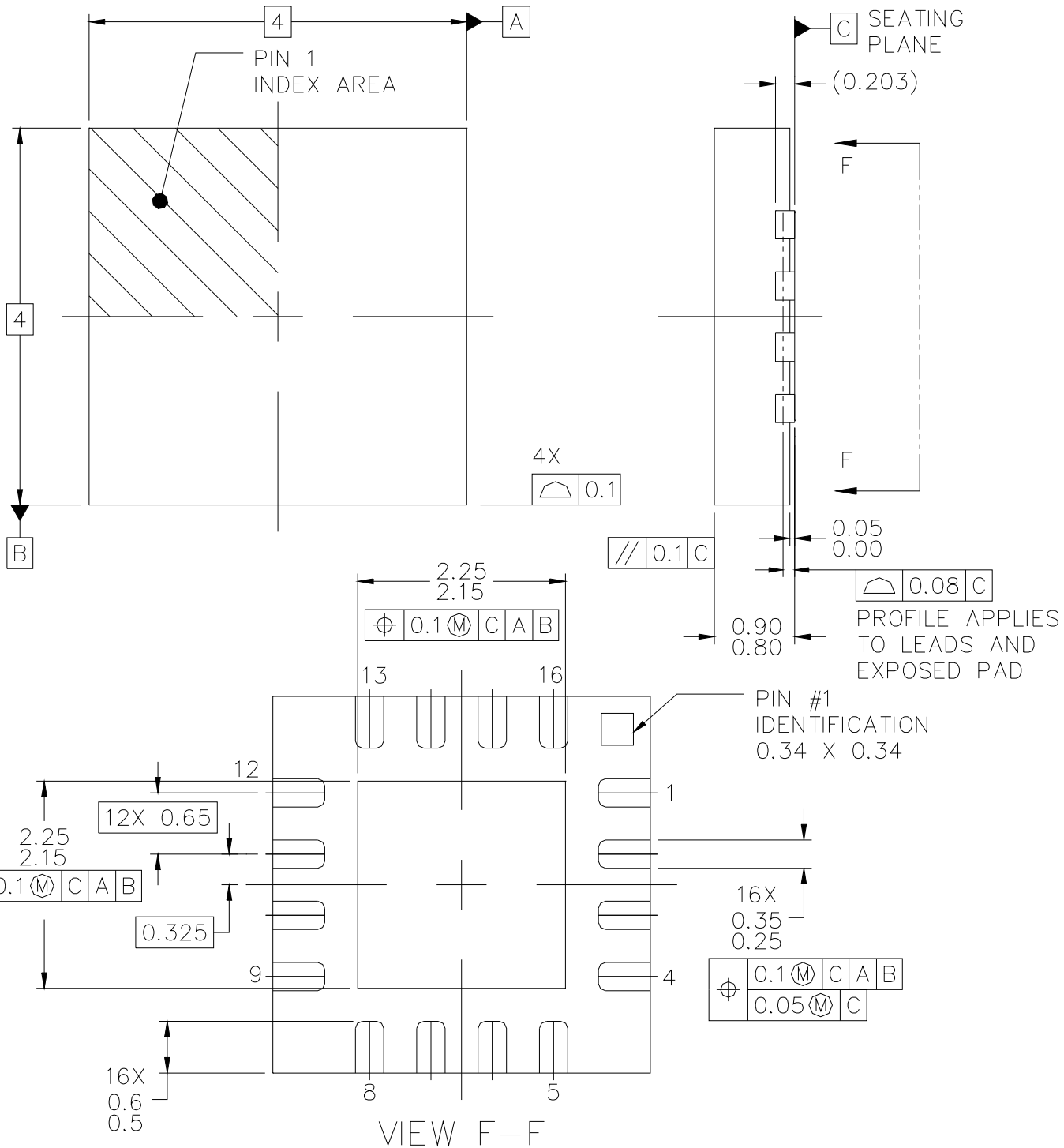
Bias-down Procedure

- Turn off signals
- Turn Vd to 0V
- Turn Vdbl to 0V
- Turn Vmrx to 0V
- Turn Vg to 0V

**Package Pinout**

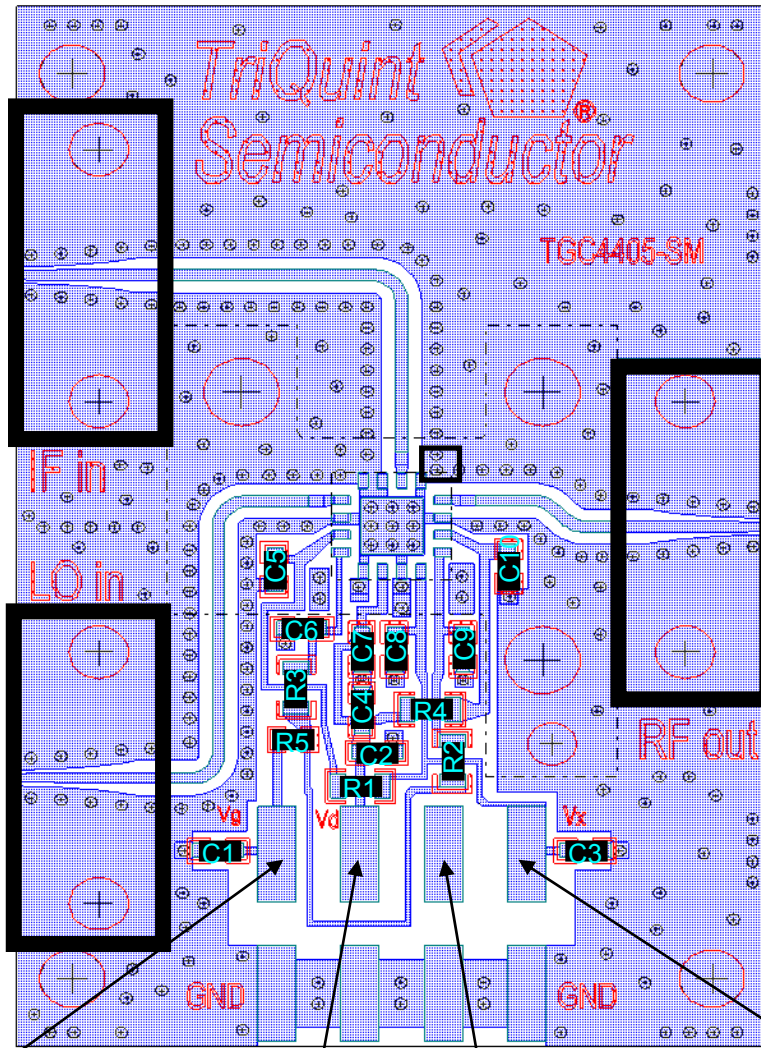


Pin	Description
1, 3, 4, 6, 9, 11, 15, 17, 18	Gnd
2	IF In
5	LO In
7	Vdbl
8, 13	Vg
10, 14	Vd
12	Vmxr
16	RF Out



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

**Recommended Assembly Diagram**



Vg ~ -0.5V  
for Idq = 425mA

Vd = 5V

NC

Vx = Vm<sub>xr</sub> = Vd<sub>bl</sub> = -0.9V  
Vm<sub>xr</sub> and Vd<sub>bl</sub> are  
connected together

Part	Description
C1, C2, C3	1 uF Capacitor (0402)
C4	0.01 uF Capacitor (0402)
C5, C6, C7, C8, C9, C10	100 pF Capacitor (0402)
R1, R2, R3, R4	Jumper (0603)
R5	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
TGC4405-SM	QFN 4x4 Surface Mount

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