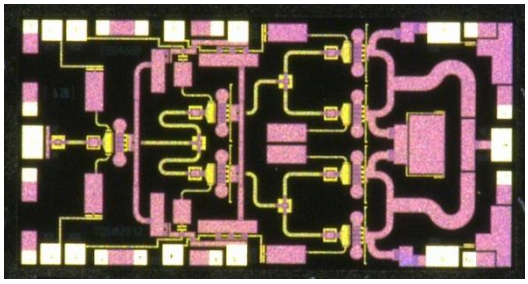
TGA2594

27-31GHz 5W GaN Power Amplifier

Applications

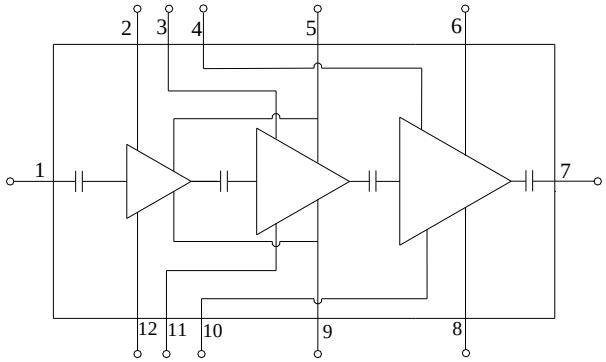
- Satellite Communications



Product Features

- Frequency Range: 27 – 31GHz
- Psat: 37dBm (typical across frequency)
- PAE: 28%
- Small Signal Gain: 23dB
- Input Return Loss: 10dB
- IM3 @ 25dBm/tone: -36dBc
- IM5 @ 25dBm/tone: -45dBc
- Bias: V_D = 20V, I_{DQ} = 140mA, V_G = -3.0V Typical
- Chip Dimensions: 3.24 x 1.74 x 0.10mm

Functional Block Diagram



General Description

TriQuint's TGA2594 is a Ka-band power amplifier fabricated on TriQuint's 0.15um GaN on SiC process. Operating from 27 to 31GHz, it achieves 5W saturated output power with an efficiency of 28% PAE, and 23dB small signal gain. Along with excellent linear characteristics, the TGA2594 is ideally suited to support both commercial and defense related satellite communications.

To simplify system integration, the TGA2594 is fully matched to 50 ohms with integrated DC blocking caps on both I/O ports.

The TGA2594 is 100% DC and RF tested on-wafer to ensure compliance to electrical specifications.

Lead-free and RoHS compliant.

Evaluation Boards are available upon request.

Pad Configuration

Pad No.	Symbol
1	RF In
2, 12	V_{G1}
3, 11	V_{G2}
4, 10	V_{G3}
5, 9	V_{D12}
6, 8	V_{D3}
7	RF Out

Ordering Information

Part	ECCN	Description
TGA2594	3A001.b.2.c	27-31GHz 5W GaN Power Amplifier

Absolute Maximum Ratings

Parameter	Value
Drain Voltage (V_D)	22V
Gate Voltage Range (V_G)	-5 to 0V
Drain Current (I_D)	1400mA
Gate Current (I_G)	-2.8 to 16.5mA
Power Dissipation, 85°C (P_{DISS})	22W
Input Power, CW, 50Ω, 85°C, (P_{IN})	30dBm
Input Power, CW, 10:1 VSWR, (P_{IN})	25dBm
Channel temperature (T_{CH})	275°C
Mounting Temperature (30 Seconds)	320°C
Storage Temperature	-40 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	Value
Drain Voltage (V_D)	20V
Drain Current (I_{DQ})	140mA
Gate Voltage (V_G)	-3.0V Typical

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed overall operating conditions.

Electrical Specifications

Test conditions unless otherwise noted: 25^{0}C, V_D = 20V, I_{DQ} = 140mA, V_G = -3.0V Typical

Parameter	Min	Typical	Max	Units
Operational Frequency Range	27		31	GHz
Small Signal Gain		23		dB
Input Return Loss		10		dB
Output Return Loss		8		dB
Output Power @ P_{IN} = 18dBm		37		dBm
Power Added Efficiency @ P_{IN} = 18dBm		28		%
IM3 @ 25dBm/tone		-36		dBc
IM5 @ 25dBm/tone		-45		dBc
Small Signal Gain Temperature Coefficient		-0.09		dB/°C

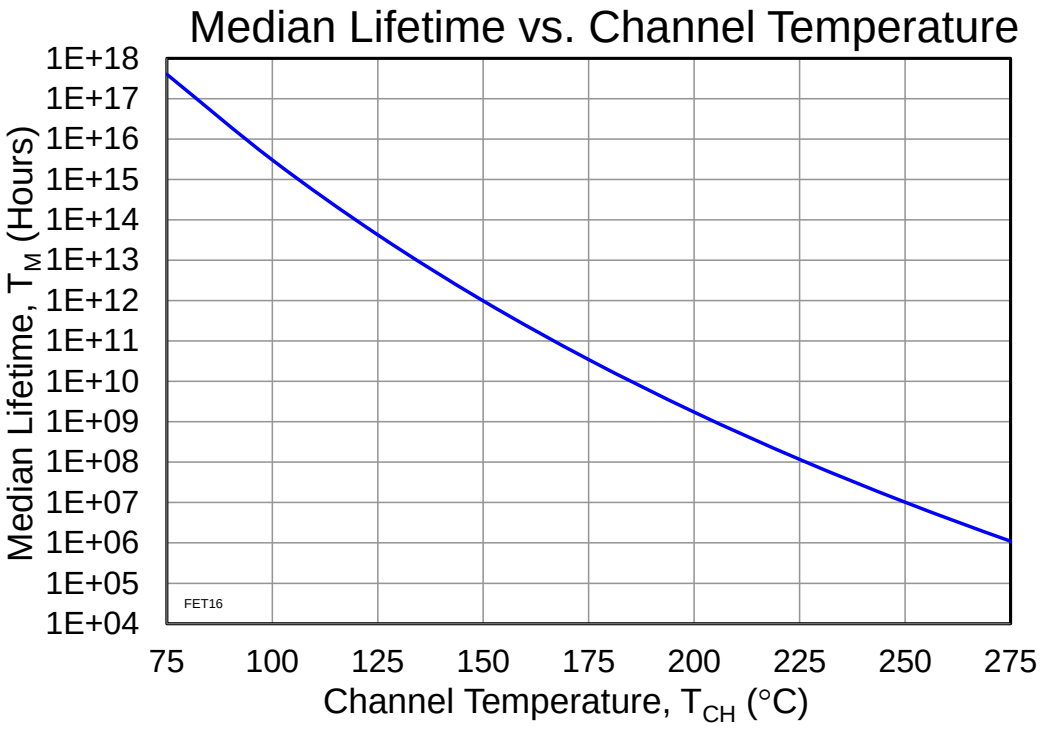
Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	T_{base} = 85°C, V_D = 20V, $I_{D\ Drive}$ = 720mA, P_{OUT} = 35.8W, P_{DISS} = 10.5W	8.7	ºC/W
Channel Temperature, T_{CH} (Under RF Drive)		176	°C
Median Lifetime, T_M (Under RF Drive)		2.76 x 10^10	Hrs

Notes: Thermal resistance measured to back of carrier plate. MMIC mounted on 20 mils CuMo carrier using 1.5 mil 80/20 AuSn.

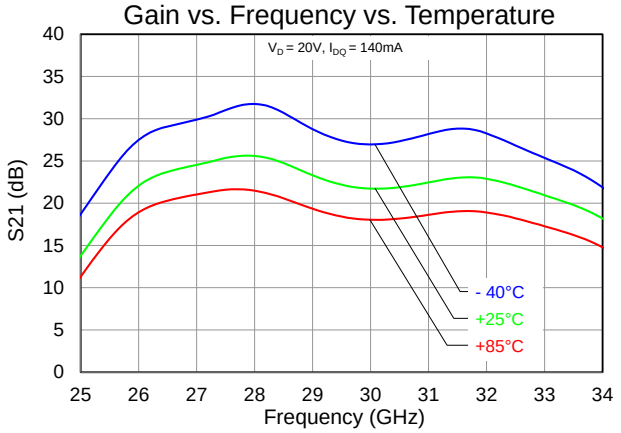
Median Lifetime

Test Conditions: V_D = 22V; Failure Criteria = 10% reduction in I_{D_Max}

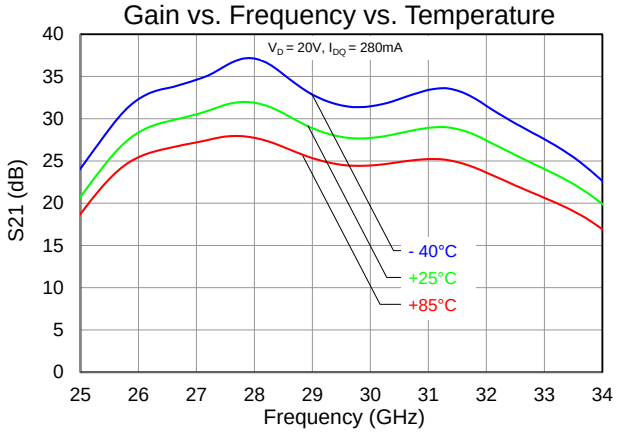


Typical Performance

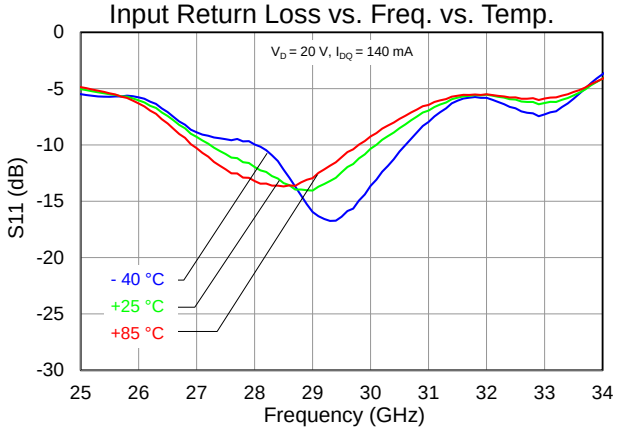
Gain vs. Frequency vs. Temperature



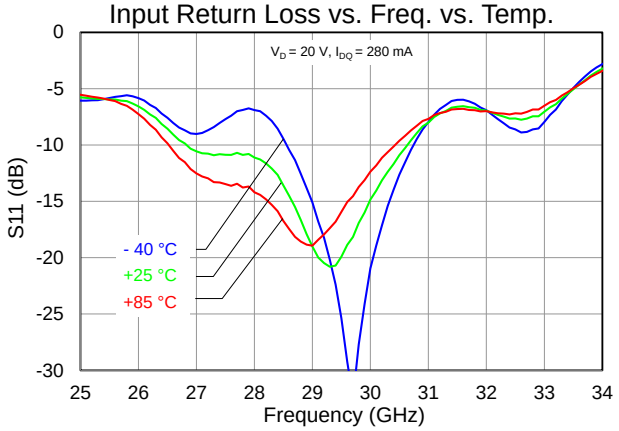
Gain vs. Frequency vs. Temperature



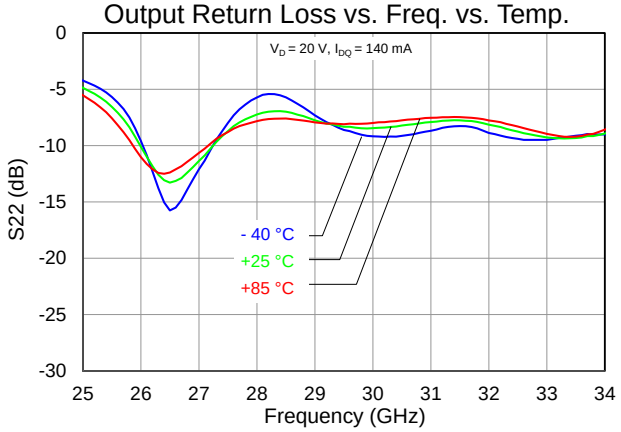
Input Return Loss vs. Freq. vs. Temp.



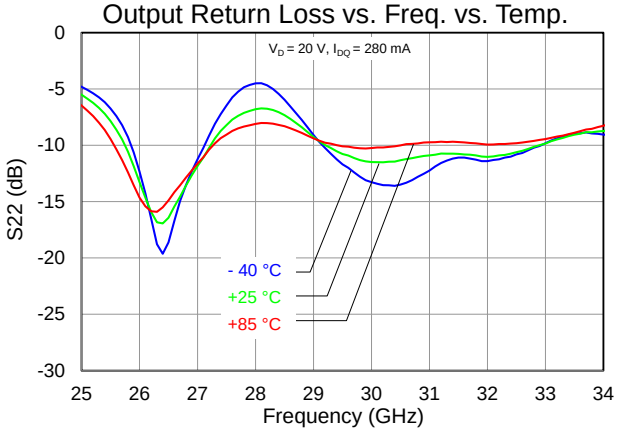
Input Return Loss vs. Freq. vs. Temp.



Output Return Loss vs. Freq. vs. Temp.

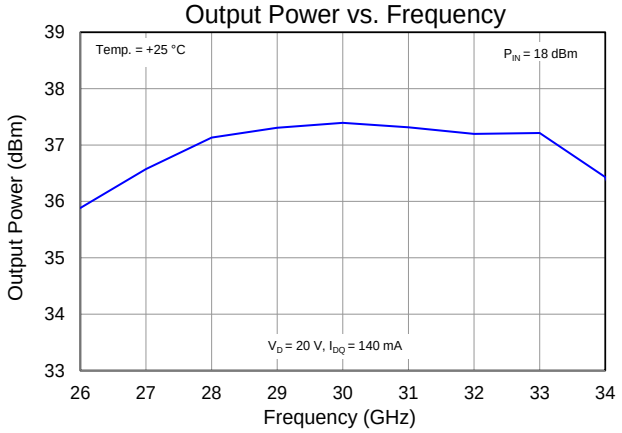


Output Return Loss vs. Freq. vs. Temp.

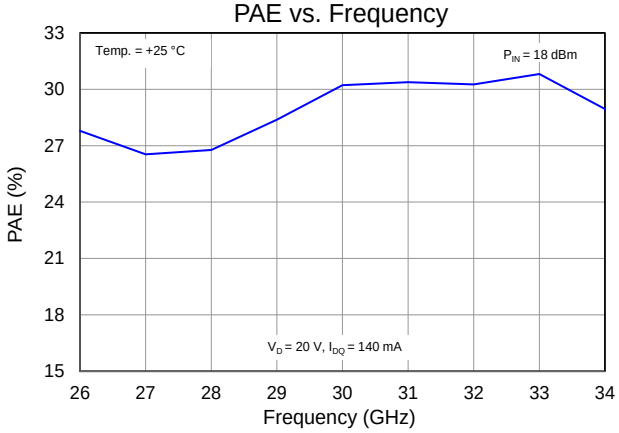


Typical Performance

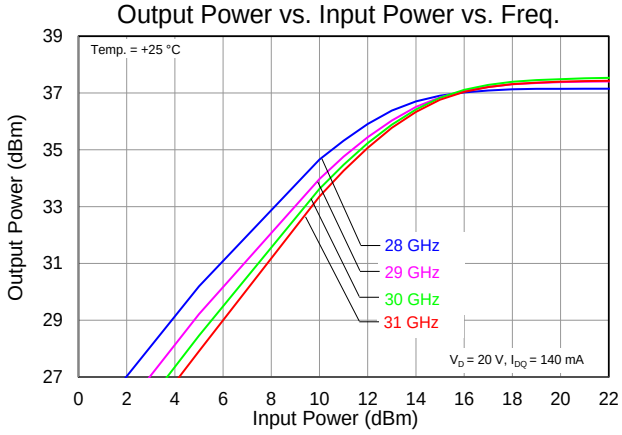
Output Power vs. Frequency



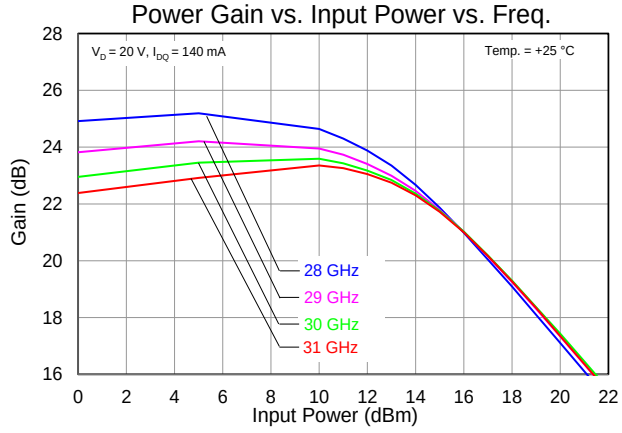
PAE vs. Frequency



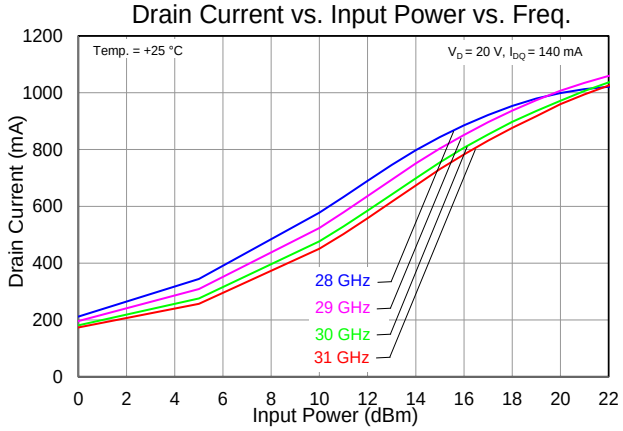
Output Power vs. Input Power vs. Freq.



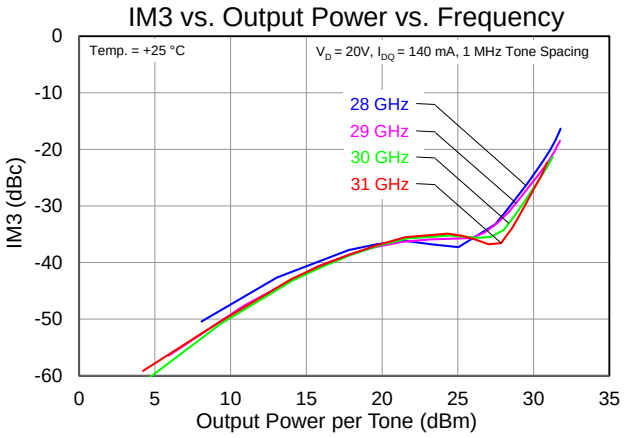
Power Gain vs. Input Power vs. Freq.

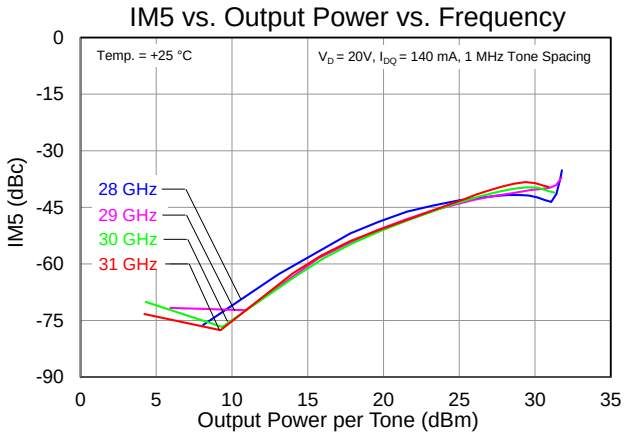


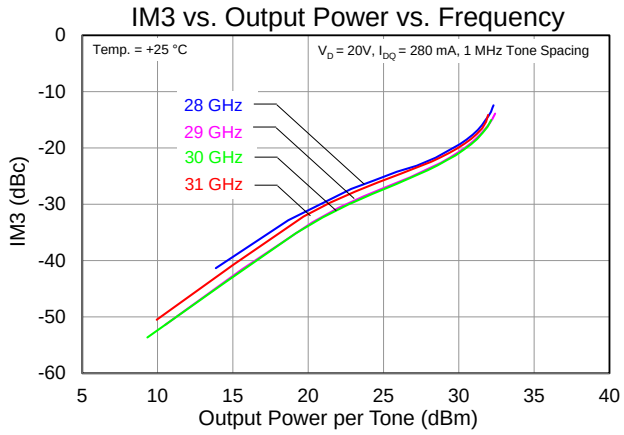
Drain Current vs. Input Power vs. Freq.

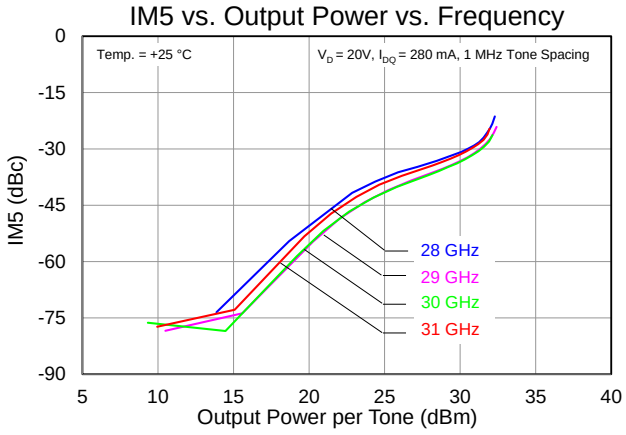


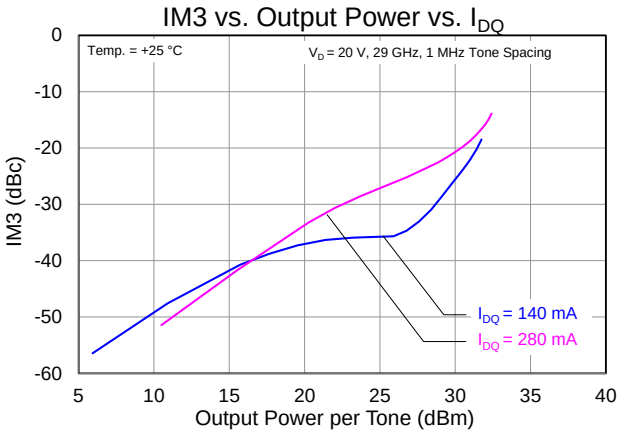
Typical Performance

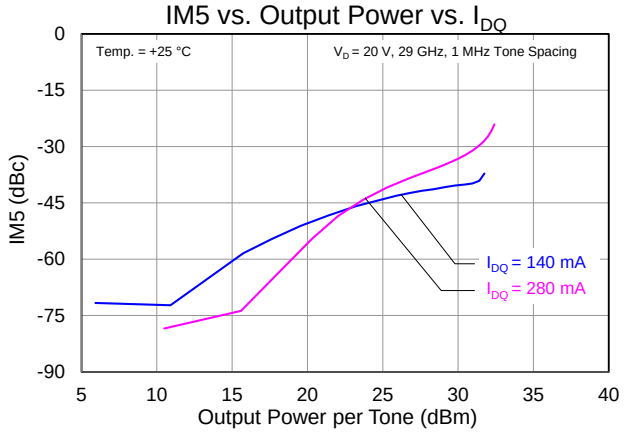




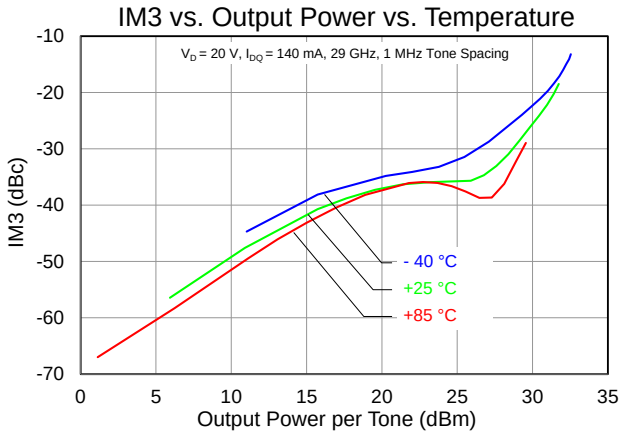


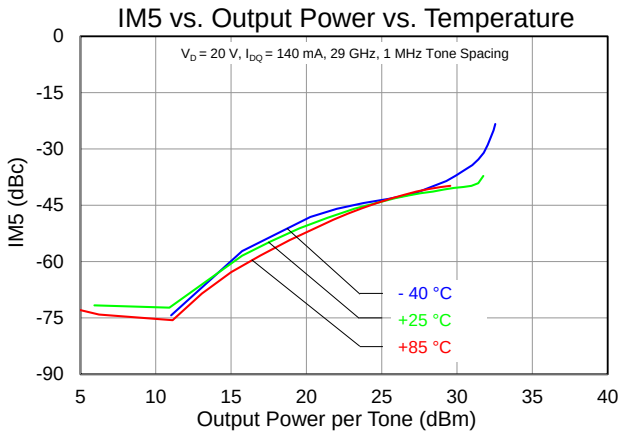


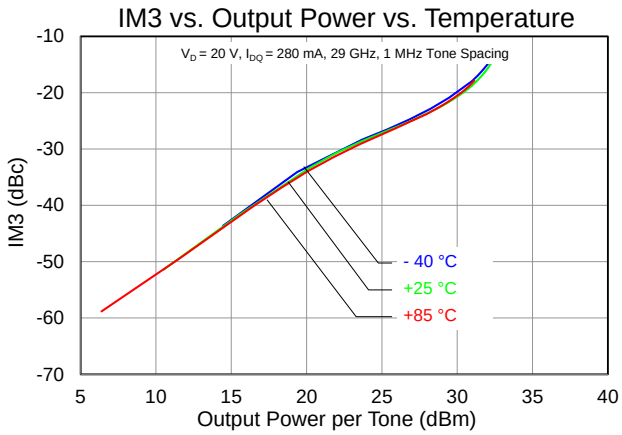


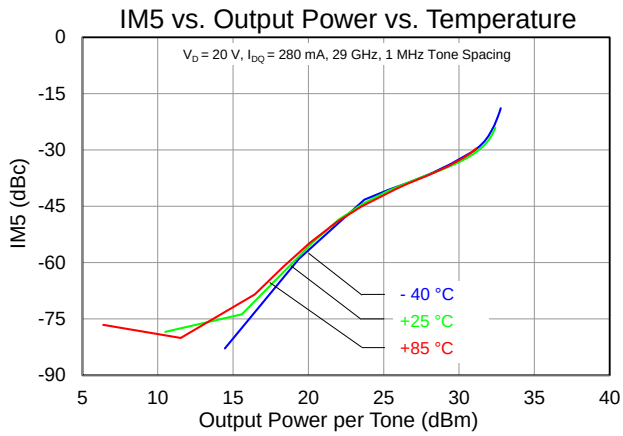


Typical Performance

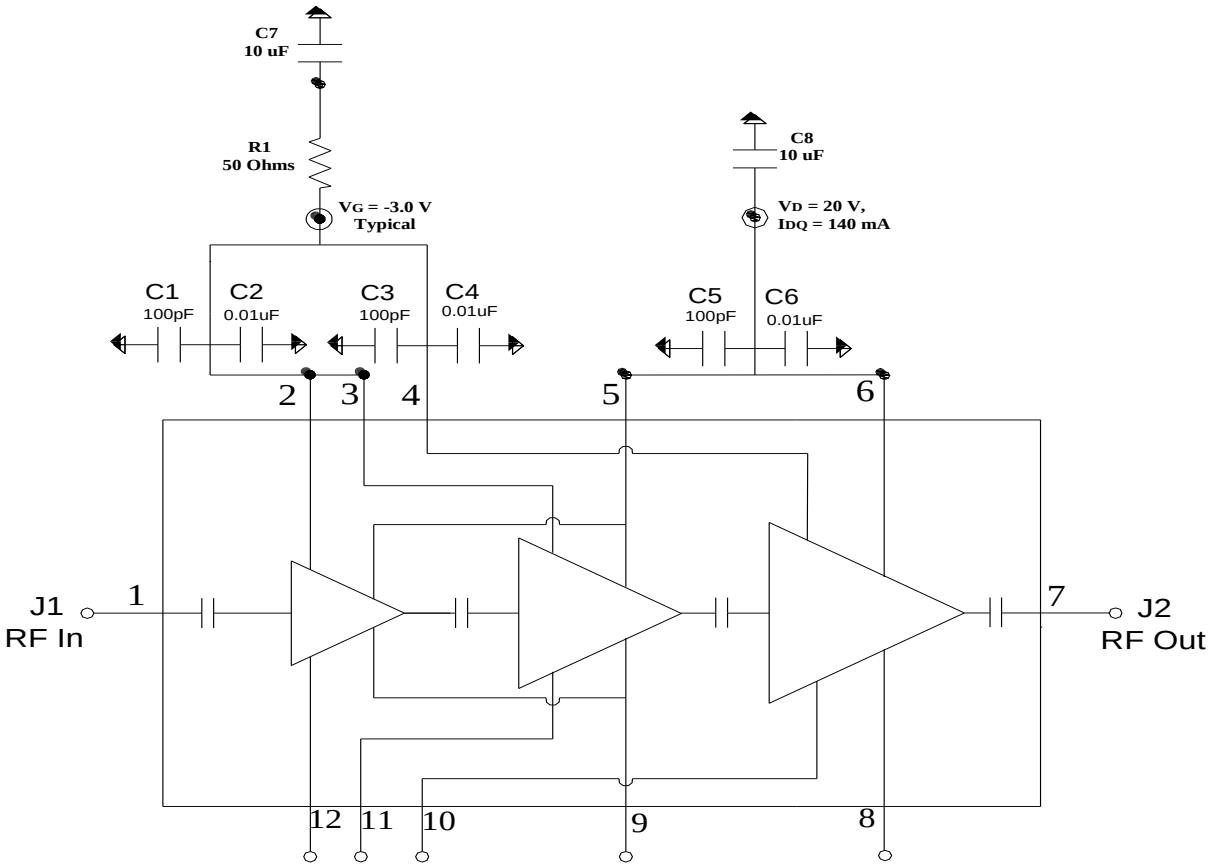








Application Circuit

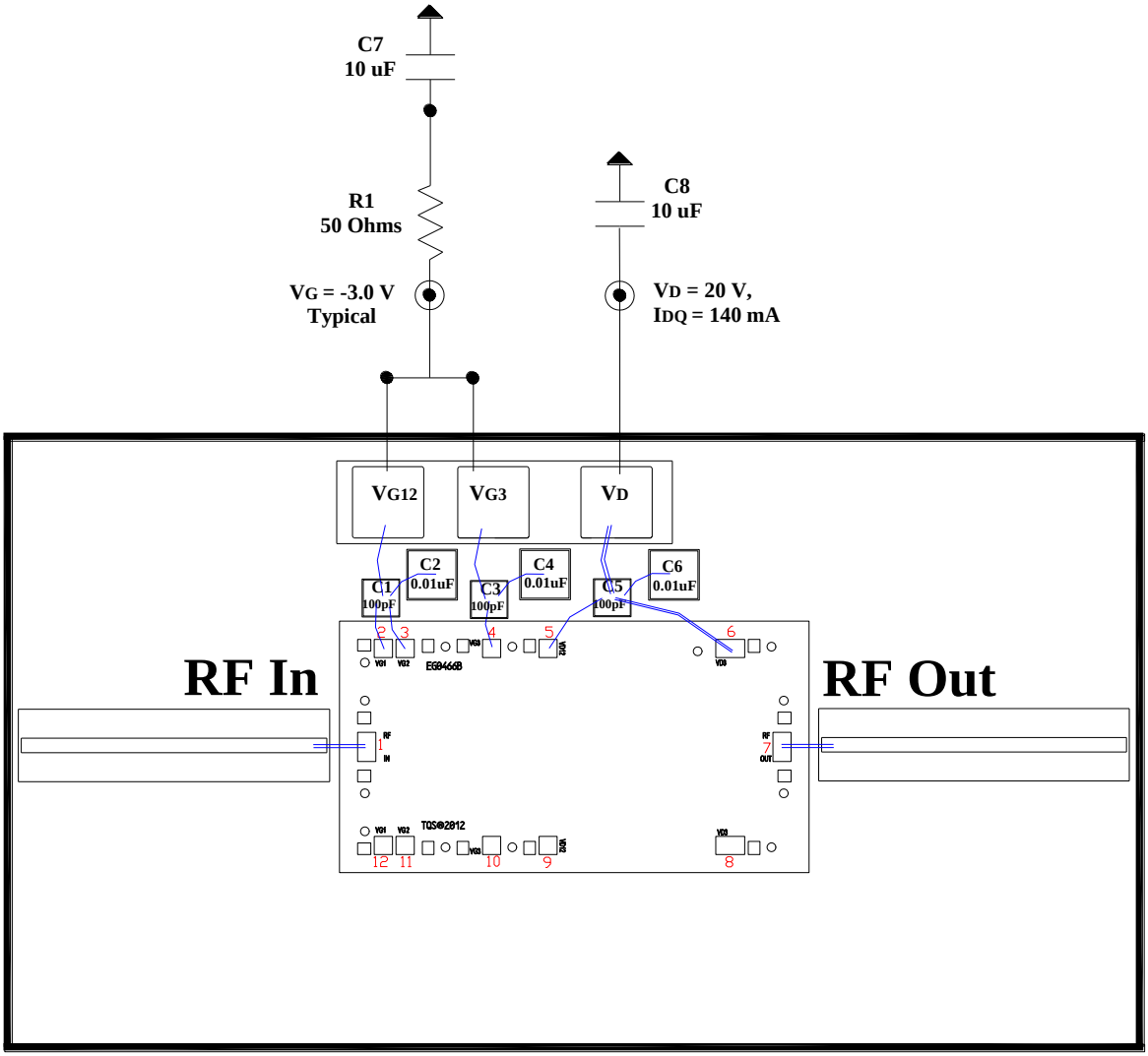


Note: The MMIC can also be biased from the bottom by using the same application bias circuit from the top.

Bias-up Procedure
1. Set I_D limit to 1.2A, I_G limit to 10mA
2. Apply -5.0V to V_G (Combine all Vg's together)
3. Apply +20V to V_D (Combine all Vd's together)
4. Adjust V_G more positive until I_{DQ} = 140mA (V_G ~ -3.0 V Typical)
5. Apply RF signal

Bias-down Procedure
1. Turn off RF signal
2. Reduce V_G to -5.0V. Ensure I_{DQ} ~ 0mA
3. Set V_D to 0V
4. Turn off V_D supply
5. Turn off V_G supply

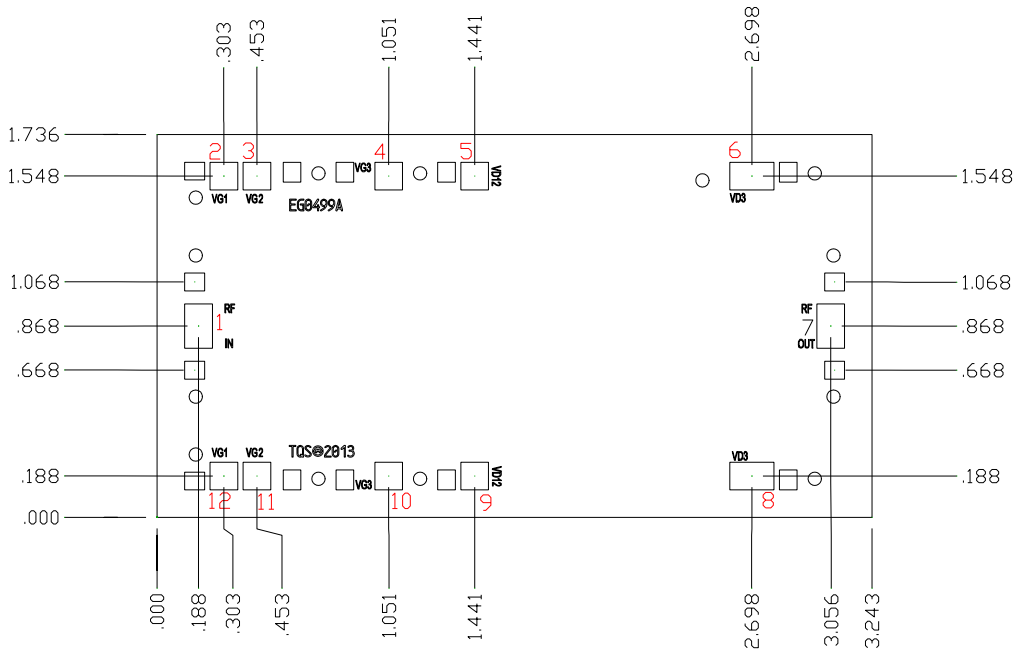
Assembly Drawing



Notes: Minimize RF wirebond lengths to achieve optimum return loss. Options in order of preference are:

1. Short w = 5mil ribbon bonds
2. Multiple short wedge or chisel bonds
3. Multiple ball bonds

Mechanical Drawing & Bond Pad Description



Unit: millimeters
Thickness: 0.10
Die x, y size tolerance: +/- 0.050
Chip edge to bond pad dimensions are shown to center of pad
Ground is backside of die

Bond Pad	Symbol	Pad Size	Description
1	RF In	0.125 x 0.200	Input; matched to 50 ohms; DC blocked.
2, 12	V_{G1}	0.125 x 0.125	Gate voltage, V_{G1} top and bottom. Bias network is required; see Application Circuit on page 8 as an example.
3, 11	V_{G2}	0.125 x 0.125	Gate voltage, V_{G2} top and bottom. Bias network is required; see Application Circuit on page 8 as an example.
4, 10	V_{G3}	0.125 x 0.125	Gate voltage, V_{G3} top and bottom. Bias network is required; see Application Circuit on page 8 as an example.
5, 9	V_{D12}	0.125 x 0.125	Drain voltage, V_{D12} top and bottom. Bias network is required; see Application Circuit on page 8 as an example.
6, 8	V_{D3}	0.200 x 0.125	Drain voltage, V_{D3} top and bottom. Bias network is required; see Application Circuit on page 8 as an example.
7	RF Out	0.125 x 0.200	Output; matched to 50 ohms; DC blocked.

Assembly Notes

Component placement and adhesive attachment assembly notes:

- Vacuum pencils and/or vacuum collets are the preferred method of pick up.
- Air bridges must be avoided during placement.
- The force impact is critical during auto placement.
- Organic attachment (i.e. epoxy) can be used in low-power applications.
- Curing should be done in a convection oven; proper exhaust is a safety concern.

Reflow process assembly notes:

- Use AuSn (80/20) solder and limit exposure to temperatures above 300°C to 3-4 minutes, maximum.
- An alloy station or conveyor furnace with reducing atmosphere should be used.
- Do not use any kind of flux.
- Coefficient of thermal expansion matching is critical for long-term reliability.
- Devices must be stored in a dry nitrogen atmosphere.

Interconnect process assembly notes:

- Thermosonic ball bonding is the preferred interconnect technique.
- Force, time, and ultrasonic are critical parameters.
- Aluminum wire should not be used.
- Devices with small pad sizes should be bonded with 0.0007-inch wire.

Product Compliance Information

ESD Sensitivity Ratings

Caution! ESD-Sensitive Device

ESD Rating: TBD
Value: TBD
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

Solderability

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

ECCN

US Department of Commerce: 3A001.b.2.c

Contact Information

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

Web: www.triquint.com **Tel:** +1.972.994.8465
Email: info-sales@triquint.com **Fax:** +1.972.994.8504

For technical questions and application information: **Email:** info-products@triquint.com

Important Notice

The information contained herein is believed to be reliable. TriQuint makes no warranties regarding the information contained herein. TriQuint assumes no responsibility or liability whatsoever for any of the information contained herein. TriQuint assumes no responsibility or liability whatsoever for the use of the information contained herein. The information contained herein is provided "AS IS, WHERE IS" and with all faults, and the entire risk associated with such information is entirely with the user. All information contained herein is subject to change without notice. Customers should obtain and verify the latest relevant information before placing orders for TriQuint products. The information contained herein or any use of such information does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other intellectual property rights, whether with regard to such information itself or anything described by such information.

TriQuint products are not warranted or authorized for use as critical components in medical, life-saving, or life-sustaining applications, or other applications where a failure would reasonably be expected to cause severe personal injury or death.