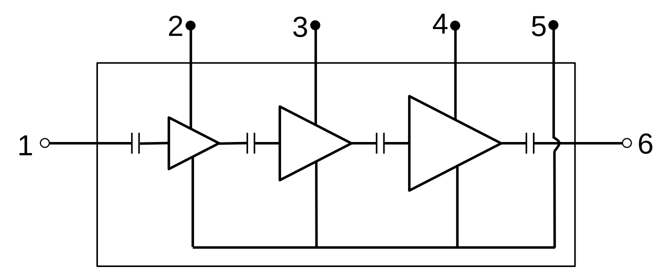
Applications

- Satellite Communications
- Data Links
- Radar
- General Purpose

Product Features

- Frequency Range: 13 - 18 GHz
- Psat: > 33 dBm at P_{IN} = 12 dBm
- PAE: > 25 % at Pin = 12 dBm
- Small Signal Gain: > 25 dB
- Input Return Loss: > 7 dB
- Output Return Loss: > 8 dB
- Bias: V_D = 20 V, I_{DQ} = 70 mA, V_G = -2.7 V Typical
- Chip Dimensions: 1.25 x 2.14 x 0.10 mm
- Performance under CW operation

Functional Block Diagram



General Description

TriQuint's TGA2958 is a driver amplifier fabricated on TriQuint's TQGaN15 GaN on SiC process. The TGA2958 operates from 13 – 18 GHz and achieves 2 W of saturated output power with > 21 dB of large signal gain and at least 25% power-added efficiency .

The TGA2958 is an ideal choice to drive TriQuint's high performing Ku-band GaN HPA's allowing the user to operate the driver and HPA off similar voltage rails.

Fully matched to 50 ohms with integrated DC blocking capacitors on both I/O ports, the TGA2958 is ideally suited for a variety of military and commercial radar and communications applications.

Lead free and RoHS compliant.

Evaluation Boards are available upon request.

Pad Configuration

Pad No.	Symbol
1	RF_{IN}
2	V_{G1}
3	V_{G2}
4	V_{G3}
5	V_D
6	RF_{OUT}

Ordering Information

Part	ECCN	Description
TGA2958	EAR99	13 - 18 GHz 2W GaN Driver Amplifier

Absolute Maximum Ratings

Parameter	Value
Drain Voltage (V_D)	23 V
Gate Voltage Range (V_G)	-5 to 0 V
Drain Current – common drain - 1st Stage (I_{D1}) - 2nd Stage (I_{D2}) - 3rd Stage (I_{D3})	576 mA 72 mA 192 mA 384 mA
Gate Current at Tch = 200 °C: - 1st Stage (I_{G1}) - 2nd Stage (I_{G2}) - 3rd Stage (I_{G3})	 -0.2 to 1.2 mA -0.4 to 2.4 mA -0.8 to 2.4 mA
Power Dissipation (P_{DISS}), 85°C	13 W
Input Power (P_{IN}), CW, 50 Ω, V_D = 22 V, I_{DQ} = 70 mA, 85 °C	27 dBm
Input Power (P_{IN}), CW, VSWR 3:1, V_D = 22 V, I_{DQ} = 70 mA, 85 °C	20 dBm
Channel Temperature (T_{CH})	275 °C
Mounting Temperature (30 Seconds)	320 °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	Value
Drain Voltage (V_D) CW	20 V
Drain Current (I_{DQ})	70 mA
Drain Current Under RF Drive (I_{D_DRIVE})	See plots p. 7
Gate Voltage (V_G)	−2.7 V (Typ.)
Gate Current Under RF Drive (I_{G_DRIVE})	See plots p. 7
Temperature (T_{BASE})	-40 to 85 °C

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

Electrical Specifications

Test conditions unless otherwise noted: 25 °C, V_D = 20 V, I_{DQ} = 70 mA, V_G = −2.7 V Typ, CW.

Parameter	Min	Typical	Max	Units
Operational Frequency Range	13		18	GHz
Small Signal Gain		> 25		dB
Input Return Loss		> 7		dB
Output Return Loss		> 8		dB
Output Power at Pin = 12 dBm		> 33		dBm
Power Added Efficiency at Pin = 12 dBm		> 25		%
Large Signal Gain at Pin = 12 dBm		> 21		dB
IM3 (Pout/tone = 24 dBm, 1 MHz spacing)		-27		dBc
IM5 (Pout/tone = 24 dBm, 1 MHz spacing)		-33		dBc
Small Signal Gain Temperature Coefficient		-0.07		dB/°C
Output Power Temperature Coefficient - at Pin = 0 dBm - at Pin = 12 dBm		 -0.06 -0.01		dBm/°C
Recommended Operating Voltage		20	22	V

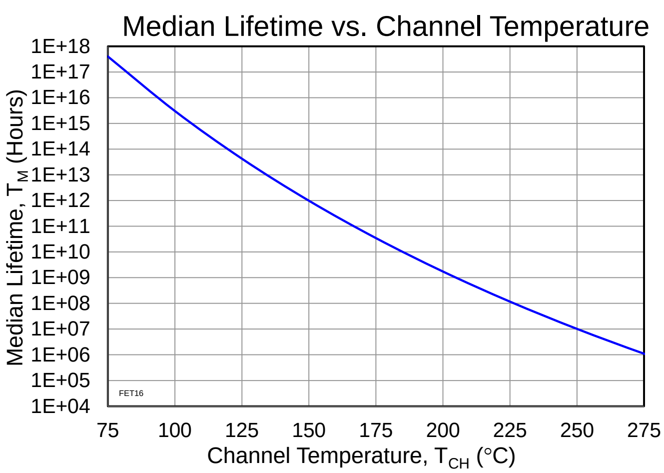
Thermal and Reliability Information

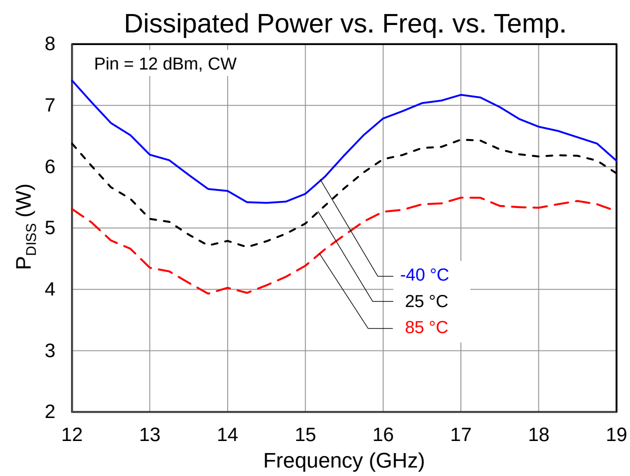
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) [1]	T_{BASE} = 85°C, V_D = 20 V (CW) At I_{DQ} = 70 mA, P_{DISS} = 1.4 W	12.9	°C/W
Channel Temperature (T_{CH}) (Quiescent)		103	°C
Median Lifetime (T_M)		1.8 x 10^15	Hrs
Thermal Resistance (θ_{JC}) [1]	T_{BASE} = 85°C, V_D = 20 V (CW) At Freq = 17 GHz, I_{DQ} = 70 mA, P_{OUT} = 27 dBm, P_{DISS} = 3.2 W	15.6	°C/W
Channel Temperature (T_{CH}) (Under RF drive)		135	°C
Median Lifetime (T_M)		8.3 x 10^12	Hrs
Thermal Resistance (θ_{JC}) [1]	T_{BASE} = 85°C, V_D = 20 V (CW) At Freq = 17 GHz, I_{DQ} = 70 mA, P_{OUT} = 33.5 dBm, P_{DISS} = 7.9 W	14.8	°C/W
Channel Temperature (T_{CH}) (Under RF drive)		202	°C
Median Lifetime (T_M)		1.2 x 10^09	Hrs

Notes:

1. Thermal resistance measured to back of carrier plate. MMIC mounted on a 40 mil CuMo carrier using 1.5 mil 80/20 AuSn.

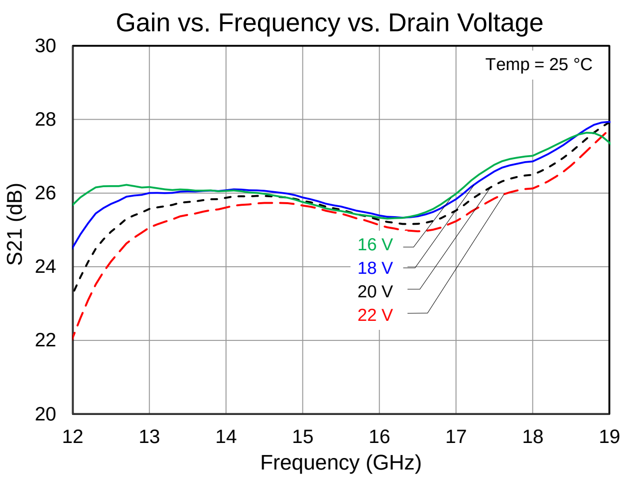
Test Conditions: V_D = 22 V; Failure Criteria = 10% reduction in I_{D_MAX}

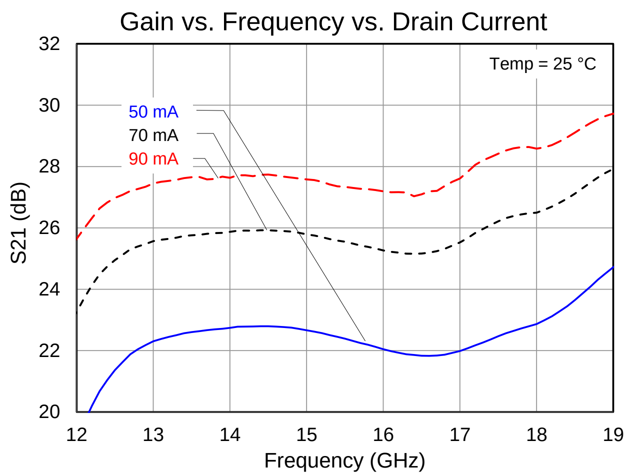


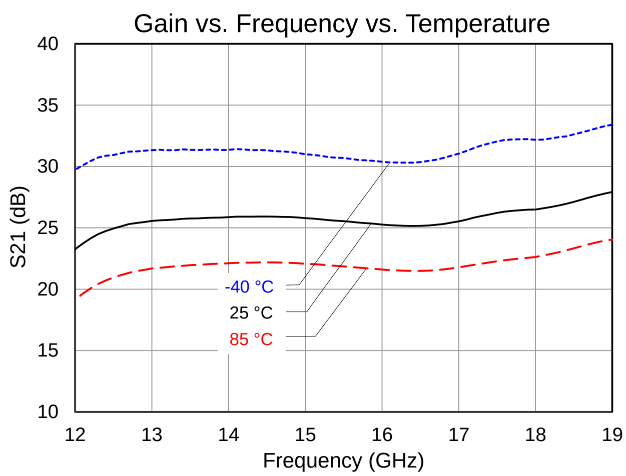


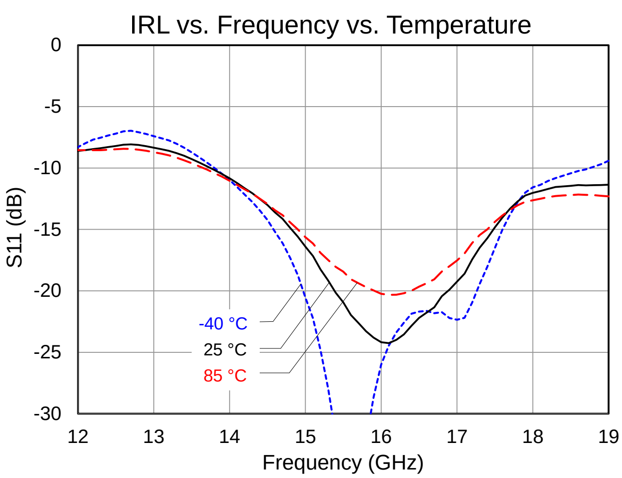
Typical Performance: Small Signal

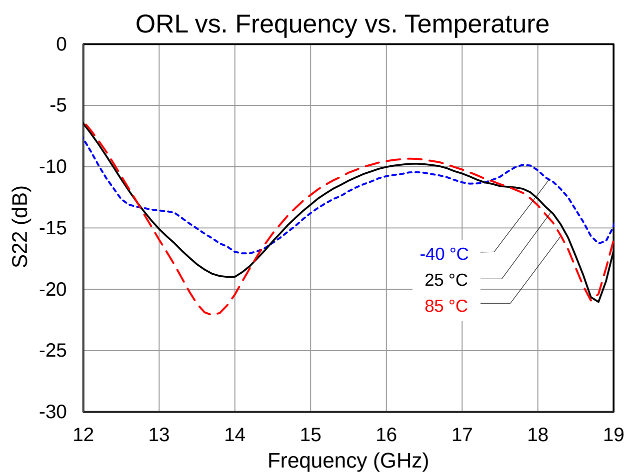
Conditions unless otherwise specified: V_D = 20 V, I_{DQ} = 70 mA, V_G = −2.7 V Typ, CW.







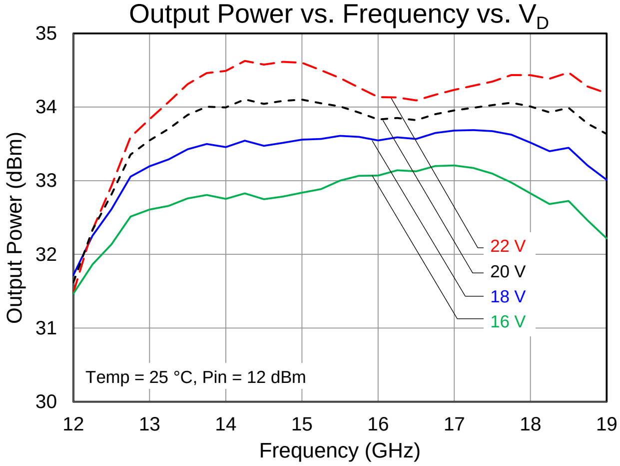




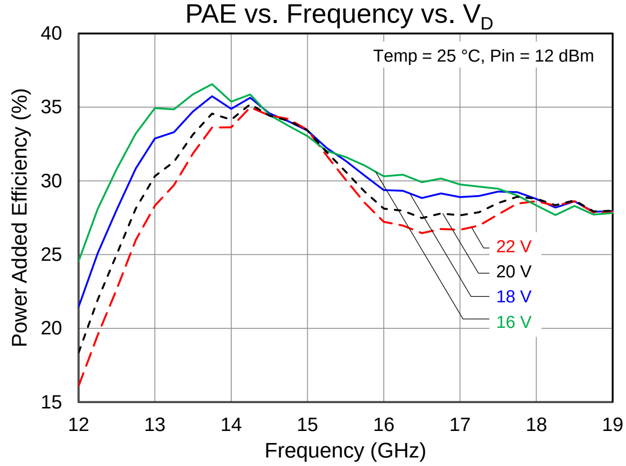
Typical Performance: Large Signal

Conditions unless otherwise specified: V_D = 20 V, I_{DQ} = 70 mA, V_G = −2.7 V Typ, CW .

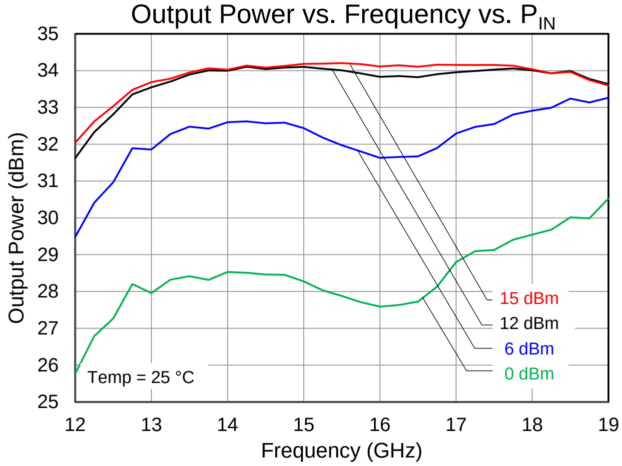
Output Power vs. Frequency vs. V_D



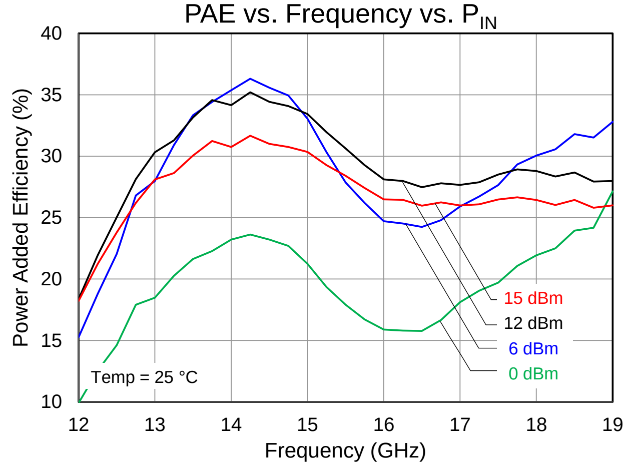
PAE vs. Frequency vs. V_D



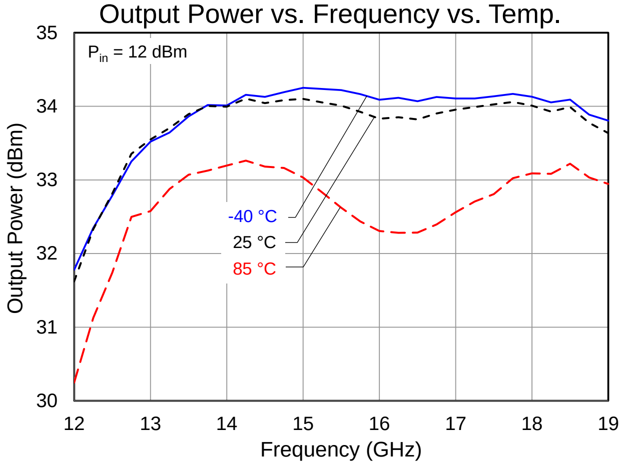
Output Power vs. Frequency vs. P_{IN}



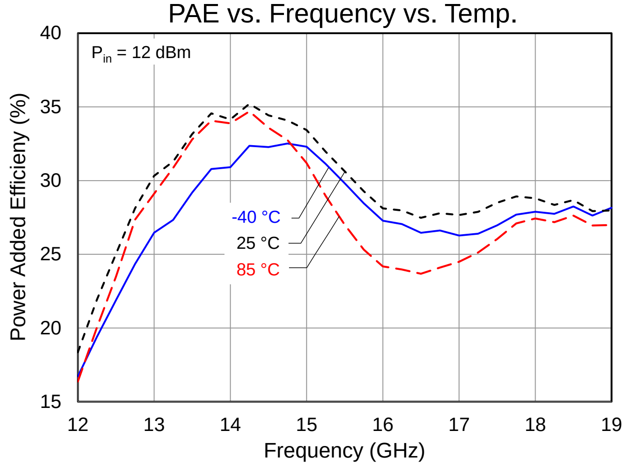
PAE vs. Frequency vs. P_{IN}



Output Power vs. Frequency vs. Temp.

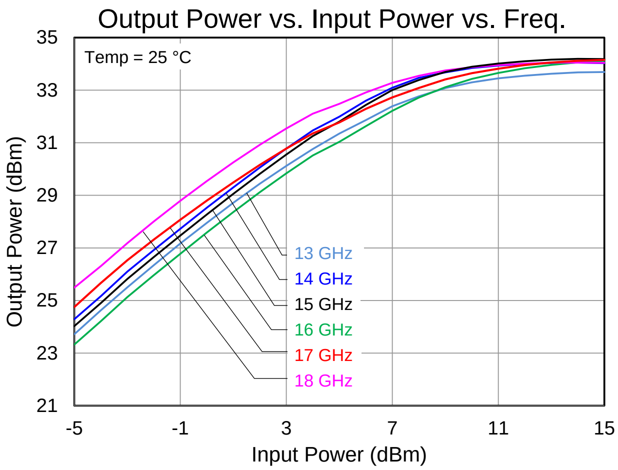


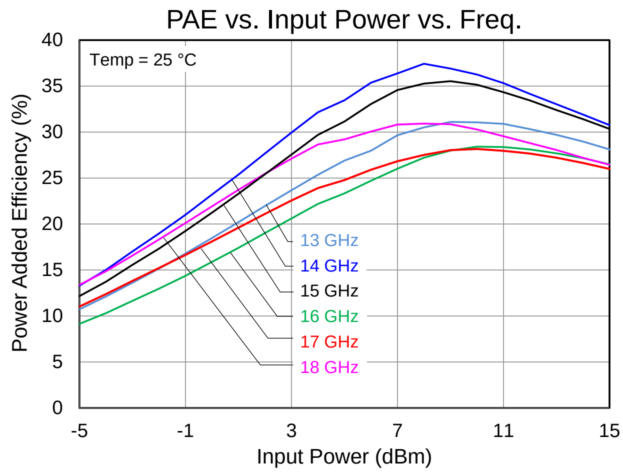
PAE vs. Frequency vs. Temp.

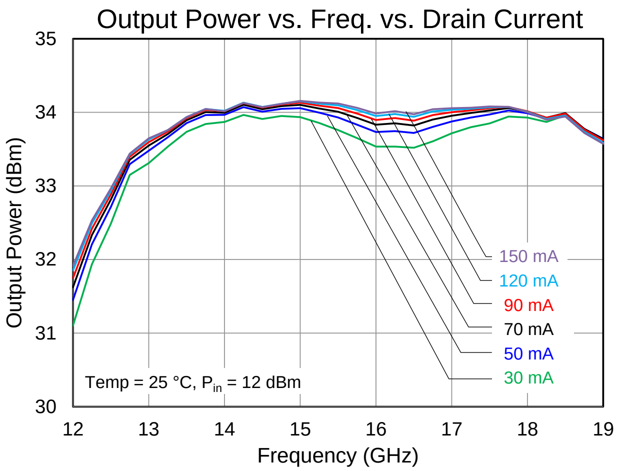


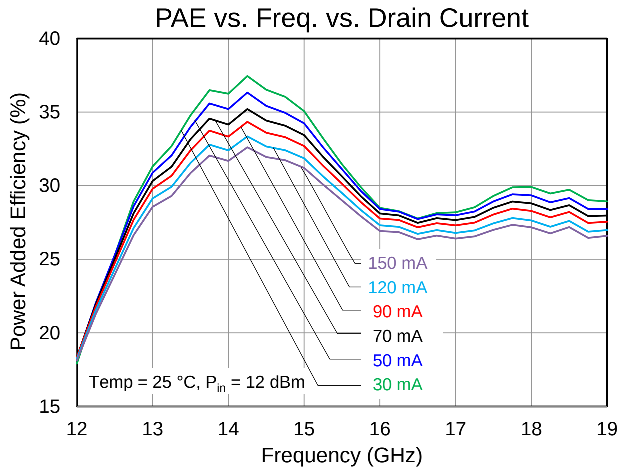
Typical Performance: Large Signal

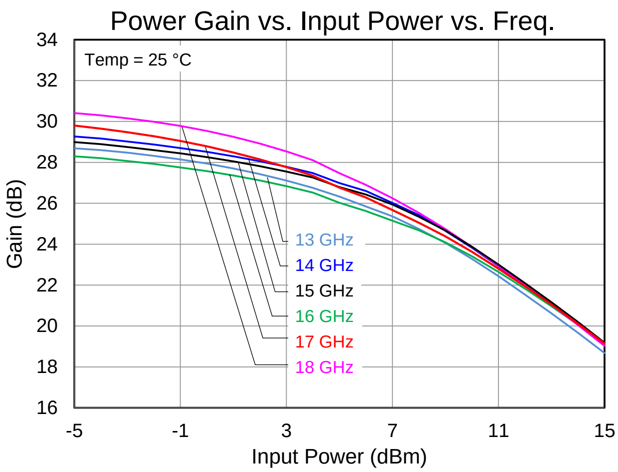
Conditions unless otherwise specified: V_D = 20 V, I_{DQ} = 70 mA, V_G = −2.7 V Typ, CW .

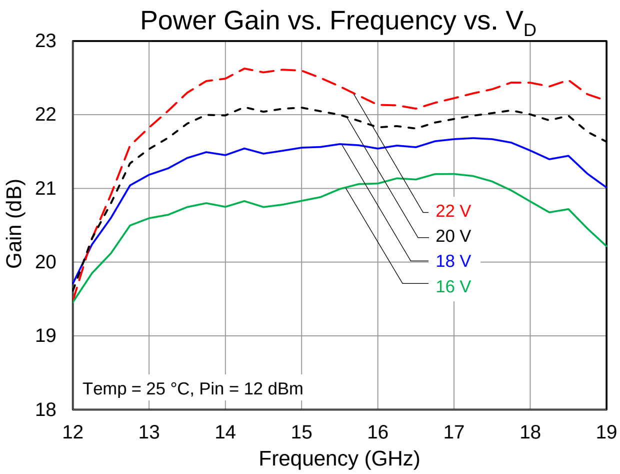






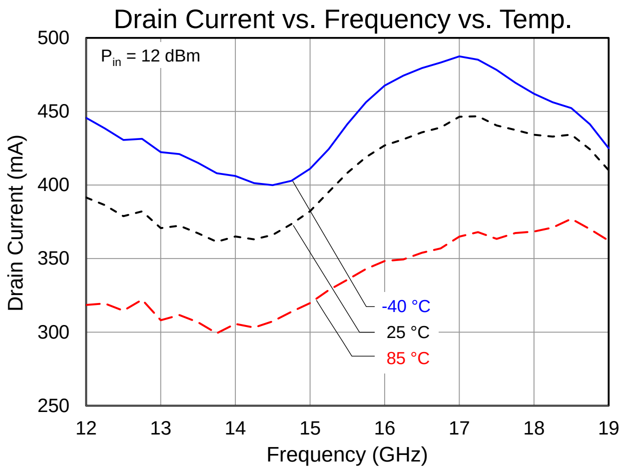


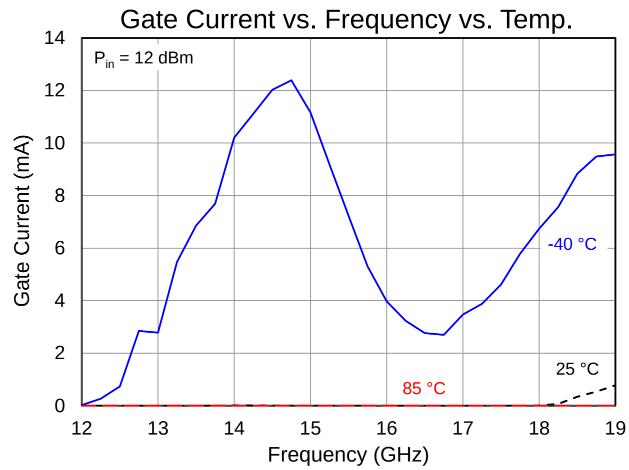


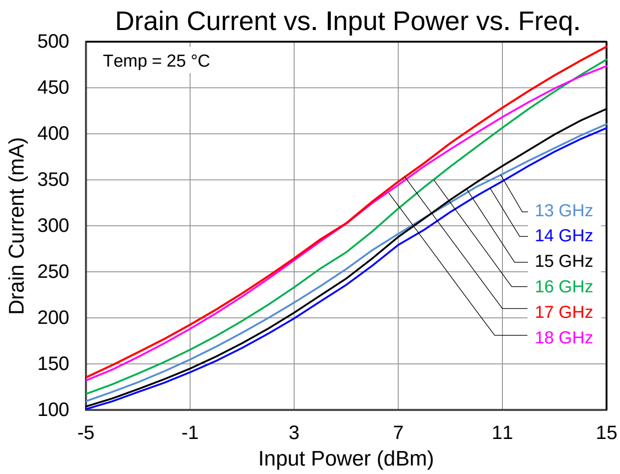


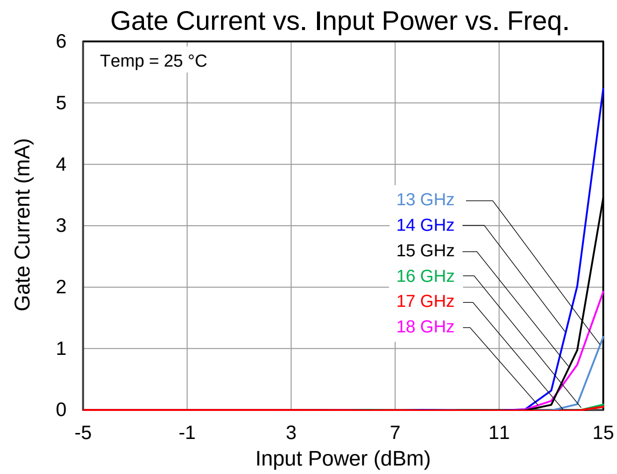
Typical Performance: Large Signal

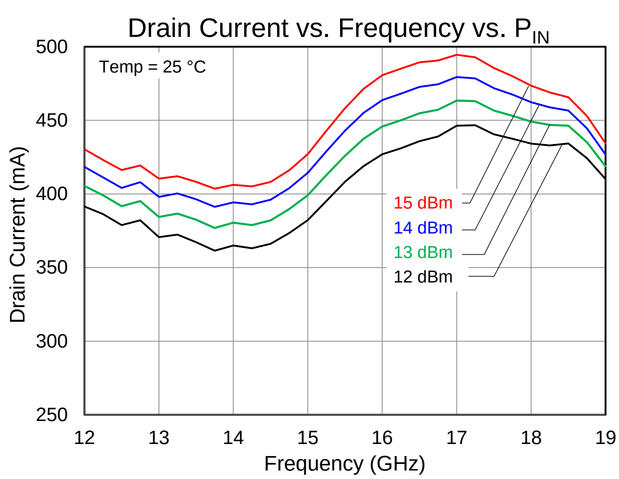
Conditions unless otherwise specified: V_D = 20 V, I_{DQ} = 70 mA, V_G = −2.7 V Typ, CW.

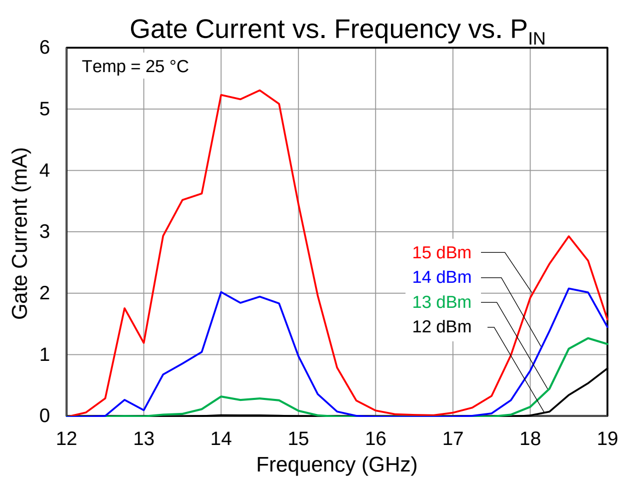






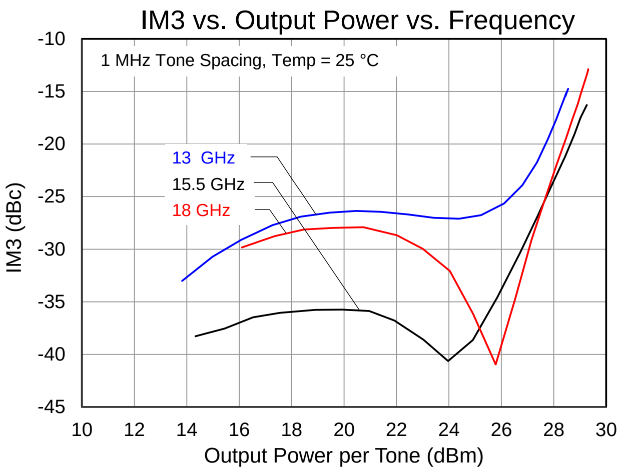


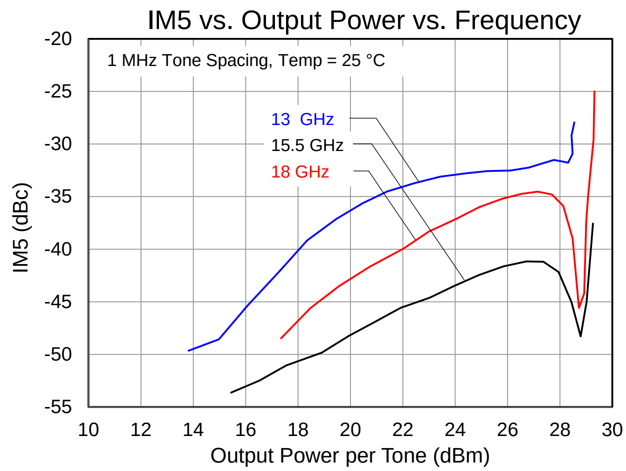


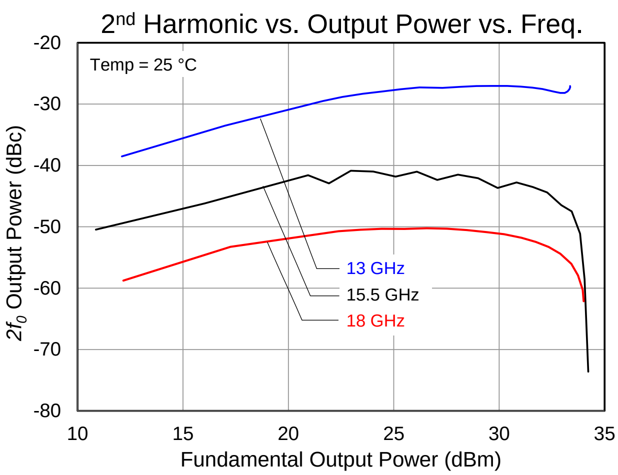


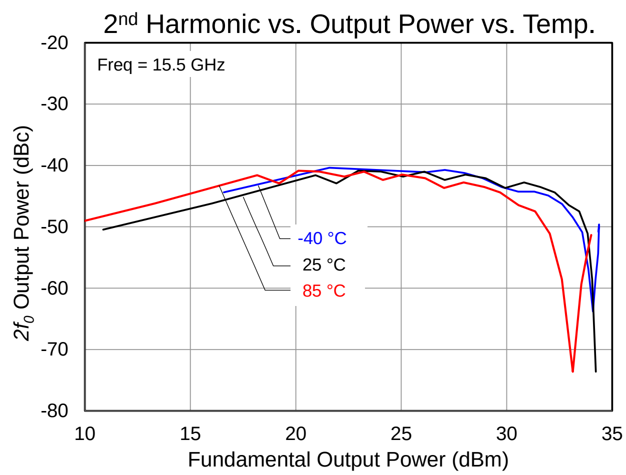
Typical Performance: Linearity

Conditions unless otherwise specified: V_D = 20 V, I_{DQ} = 70 mA, V_G = −2.7 V Typ, CW .

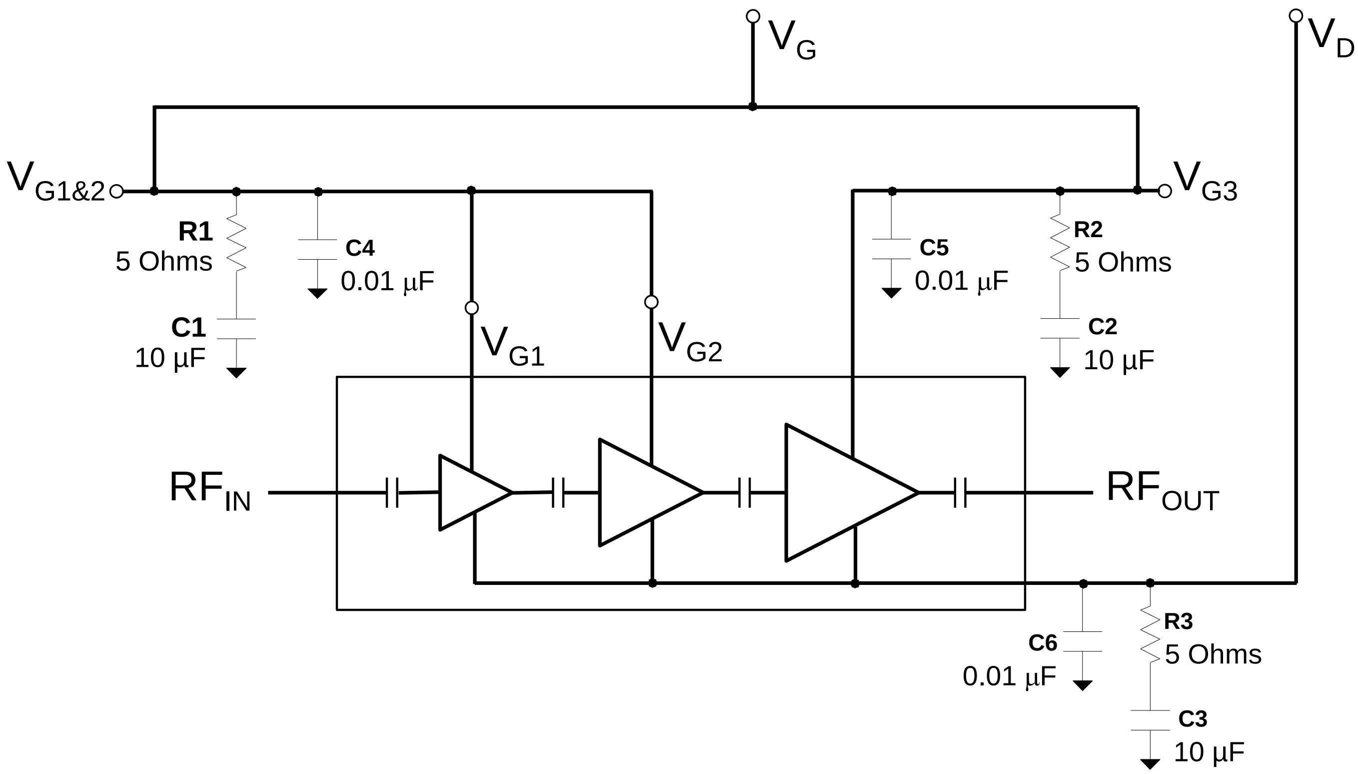








Application Circuit



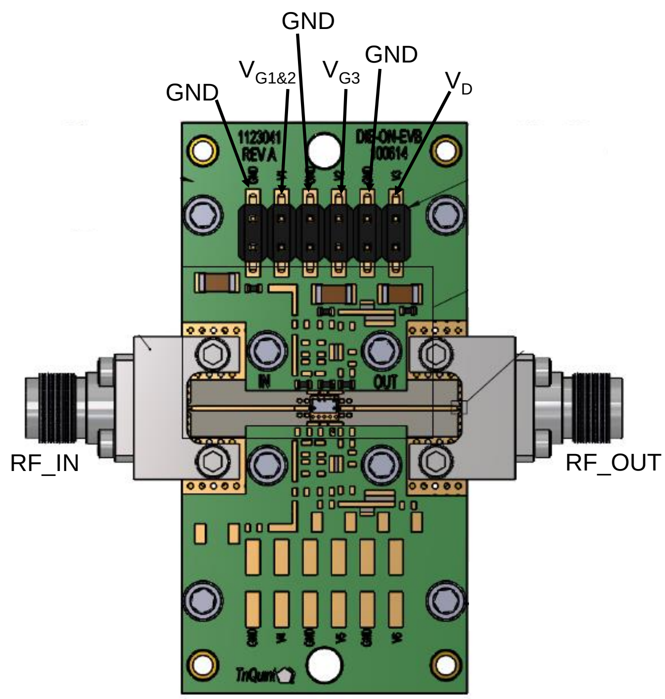
Bias-up Procedure

1. Set I_D limit to 500 mA, I_G limit to 13 mA
2. Apply −5 V to V_G
3. Apply +20 V to V_D; ensure I_{DQ} is approx. 0 mA
4. Adjust V_G until I_{DQ} = 70 mA (V_G ~ −2.7 V Typ.).
5. Turn on RF signal generator

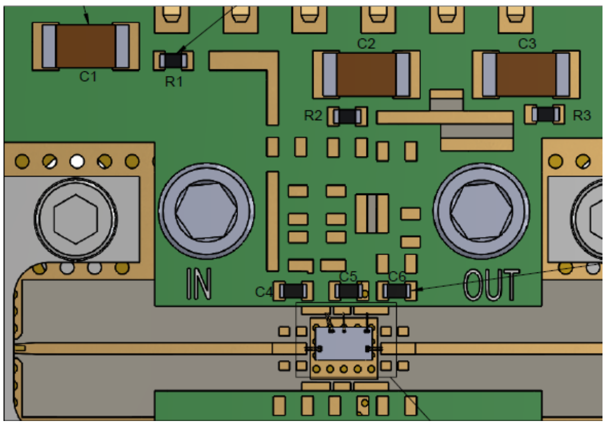
Bias-down Procedure

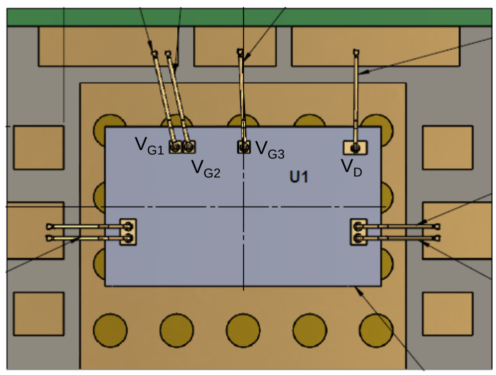
1. Turn off RF signal generator
2. Reduce V_G to −5 V; ensure I_{DQ} is approx. 0 mA
3. Set V_D to 0 V
4. Turn off V_D supply
5. Turn off V_G supply

Assembly Drawing



MMIC bonding detail:

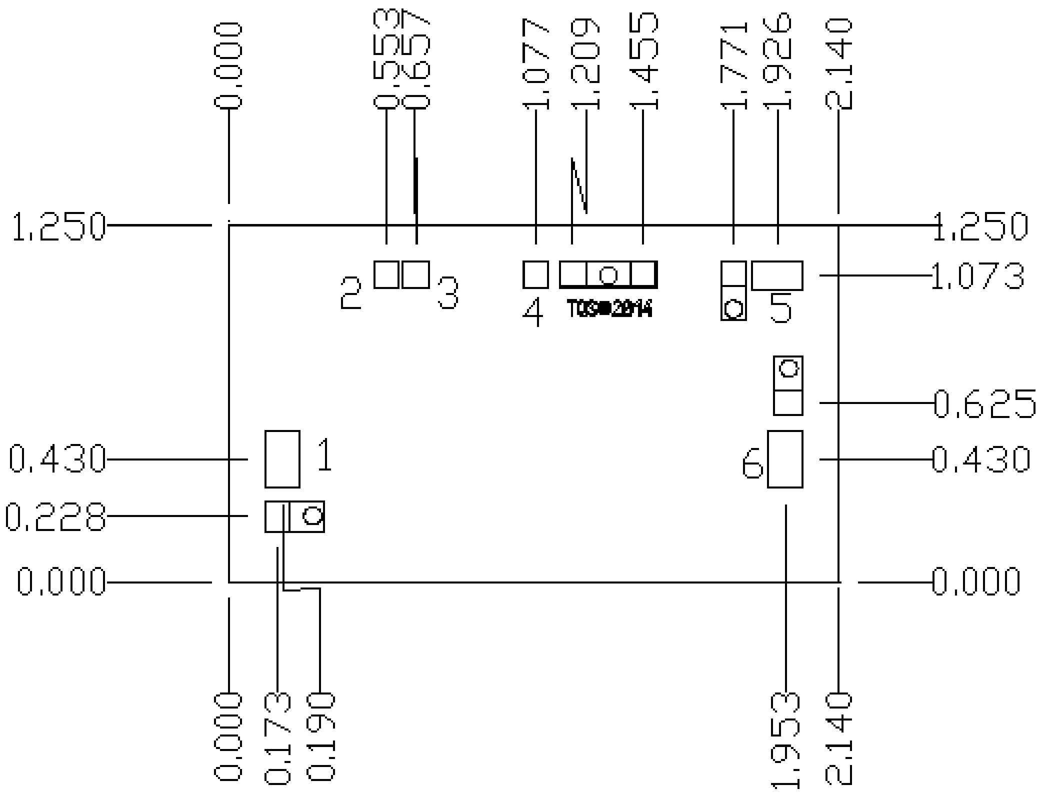




Bill of Material

Reference Des.	Value	Description	Manuf.	Part Number
C1, C2, C3	10 µF	Cap, 1206, 50V, 20%, X5R	Various	
C4, C5, C6	0.01 µF	Cap, 0402, 50V, 10%, X7R	Various	
R1, R2, R3	5.1 Ohms	Res, 0402, 5%	Various	

Mechanical Information



Units: millimeters
Thickness: 0.10
Die x,y size tolerance: ± 0.050

Pad Description

Pad No.	Symbol	Description
1	RF_{IN}	Input; matched to 50 Ω; DC blocked
2	V_{G1} (1), (2)	Gate Voltage; Bias network is required; see recommended Application Information on page 9.
3	V_{G2} (1), (2)	Gate Voltage; Bias network is required; see recommended Application Information on page 9.
4	V_{G3} (2)	Gate Voltage; Bias network is required; see recommended Application Information on page 9.
5	V_D	Drain voltage; Bias network is required; see recommended Application Information page 9.
6	RF_{OUT}	Output; matched to 50 Ω; DC blocked

Notes:
1. Pads 2 & 3 are tied together off-chip.
2. Pads 2,3, & 4 may be tied together for biasing

Ground is backside of die

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

ECCN

US Department of Commerce: EAR99

Solderability

Use AuSn (80/20) solder and limit exposure to temperatures above 300°C to 3-4 minutes, maximum.

RoHS Compliance

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 ($C_{15}H_{12}Br_40_2$) Free
- PFOS Free
- SVHC Free

Contact Information

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

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

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