TGA2813-CP

3.1 to 3.6 GHz, 100W GaN Power Amplifier

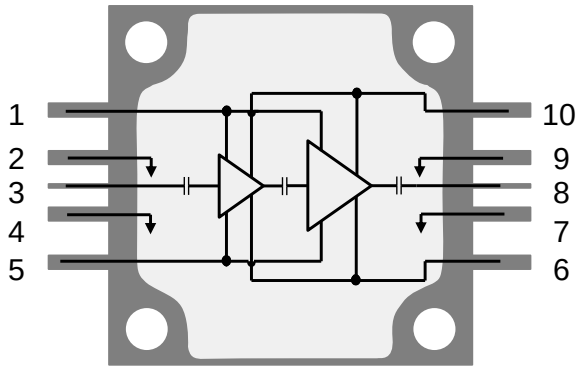
Applications

- Radar

Product Features

- Frequency Range: 3.1 – 3.6 GHz
- Pout: 50 dBm (at P_{IN} = 27 dBm)
- Power Gain: 23 dB (at P_{IN} = 27 dBm)
- PAE: 51 % CW
- Bias: V_D = 30 V pulsed (PW = 15 ms, DC = 30 %), I_{DQ} = 300 mA, V_G = -3 V Typical
- Package Dimensions: 15.2 x 15.2 x 3.5 mm
- Package base is pure Cu offering superior thermal management

Functional Block Diagram



General Description

TriQuint's TGA2813-CP is a packaged high-power S-Band amplifier fabricated on TriQuint's TQGaN25 0.25um GaN on SiC process. Operating from 3.1 to 3.6 GHz, the TGA2813-CP achieves 100 W saturated output power, a power-added efficiency of >50%, and 23 dB power gain.

The TGA2813-CP is packaged in a 10-lead 15x15 mm bolt-down package with a Cu base for superior thermal management. It can support a range of bias voltages and performs well under both short and long pulsed conditions. Both RF ports are internally DC blocked and matched to 50 ohms allowing for simple system integration.

Lead free and RoHS compliant.

Evaluation Boards are available upon request.

Pin Configuration

Pad No.	Symbol
1, 5	V_G
2, 4, 7, 9	GND
3	RF_{IN}
6, 10	V_D
8	RF_{OUT}

Ordering Information

Part	ECCN	Description
TGA2813-CP	3A001.b.2.a	3.1 – 3.6 GHz, 100 W GaN Power Amplifier

Absolute Maximum Ratings

Parameter	Value
Drain Voltage (V_D)	40 V
Gate Voltage Range (V_G)	-8 to 0 V
Drain Current (I_D)	10.4 A
Gate Current (I_G)	-8 to 56 mA
Power Dissipation (P_{DISS}), 85°C	202 W
Input Power, CW, 50 Ω, (P_{IN})	30 dBm
Input Power, CW, VSWR 3:1, V_D = 30 V, 85 °C, (P_{IN})	27 dBm
Channel Temperature (T_{CH})	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	Value
Drain Voltage (V_D) Pulsed: PW = 15 ms, DC = 30 %	30 V
Drain Current (I_{DQ})	300 mA
Drain Current Under RF Drive (I_{D_DRIVE})	See plots p. 8
Gate Voltage (V_G)	−3 V (Typ.)
Gate Current Under RF Drive (I_{G_DRIVE})	See plots p. 8
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 = 30 V (PW = 15 ms, DC = 30 %), I_{DQ} = 300 mA, VG = -3 V typical.

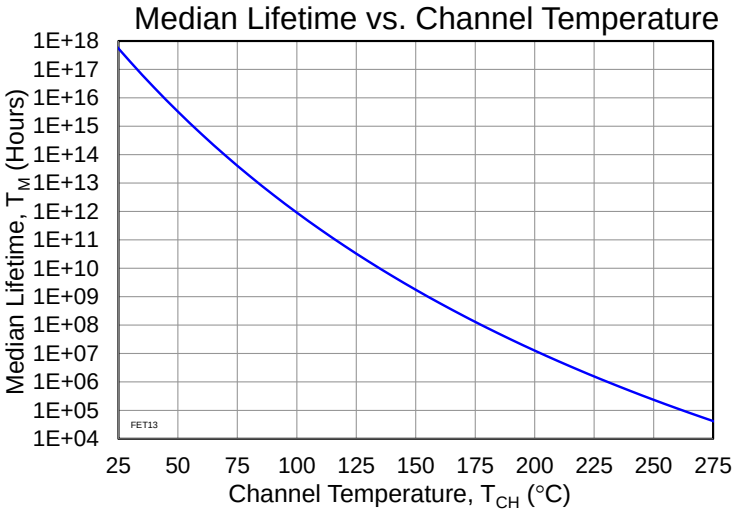
Parameter	Min	Typical	Max	Units
Operational Frequency Range	3.1		3.6	GHz
Input Return Loss		> 7		dB
Output Return Loss		> 4.5		dB
Output Power (at P_{IN} = 27 dBm)		50		dBm
Power Gain (at P_{IN} = 27 dBm)		23		dB
Power Added Efficiency (at Pin = 27 dBm)		51		%
Output Power Temperature Coefficient (constant V_G)		-0.003		dBm/°C

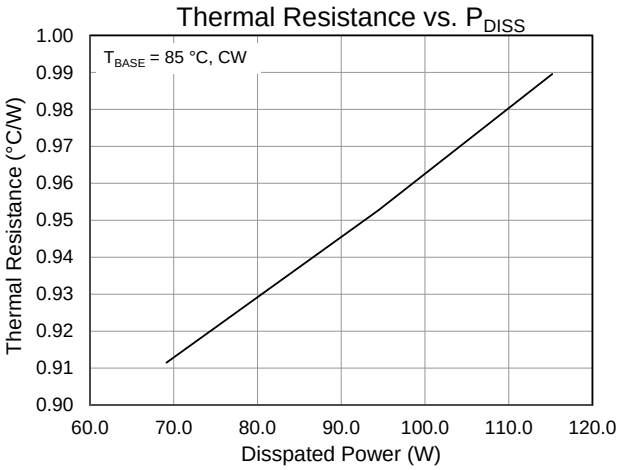
Thermal and Reliability Information

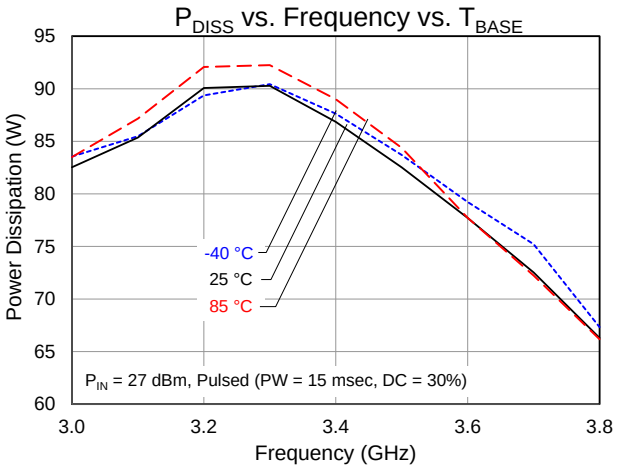
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	T_{BASE} = 85°C, V_D = 30 V (PW = 15 ms, DC = 30%)	0.89	°C/W
Channel Temperature (T_{CH}) (Under RF drive)	At Freq = 3.3 GHz, P_{IN} = 27 dBm: I_{DQ} = 300 mA, I_{D_Drive} = 7.6 A	162	°C
Median Lifetime (T_M)	P_{OUT} = 50.5 dBm, P_{DISS} =86 W	8.7E+7	Hrs

Notes:
1. Thermal resistance measured to back of package.

Test Conditions: V_D = 40 V; Failure Criteria = 10% reduction in I_{D_MAX}



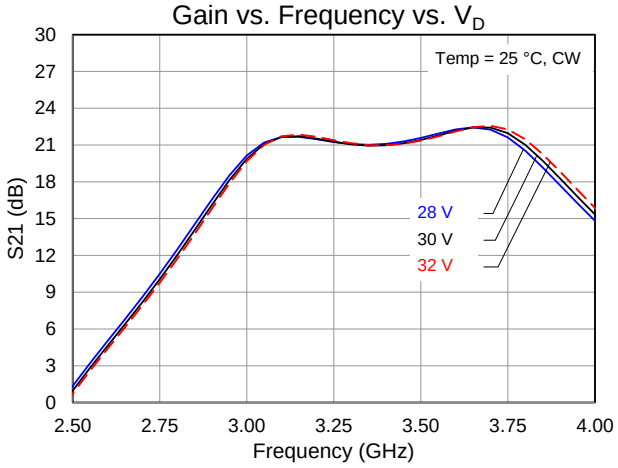




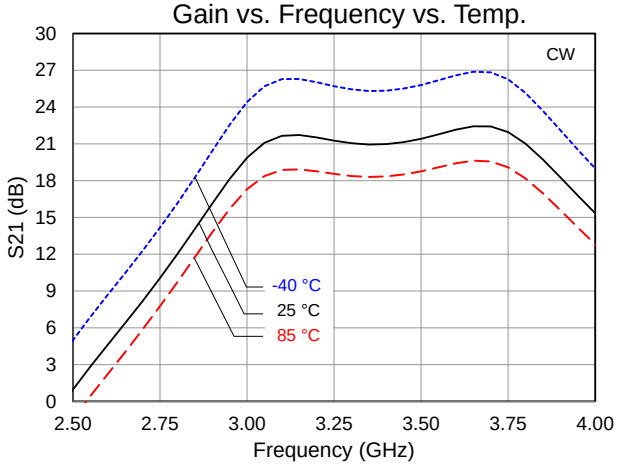
Typical Performance: Small Signal

Conditions unless otherwise specified: V_D = 30 V (PW = 15 ms, DC = 30 %), I_{DQ} = 300 mA, V_G = -3 V typical.

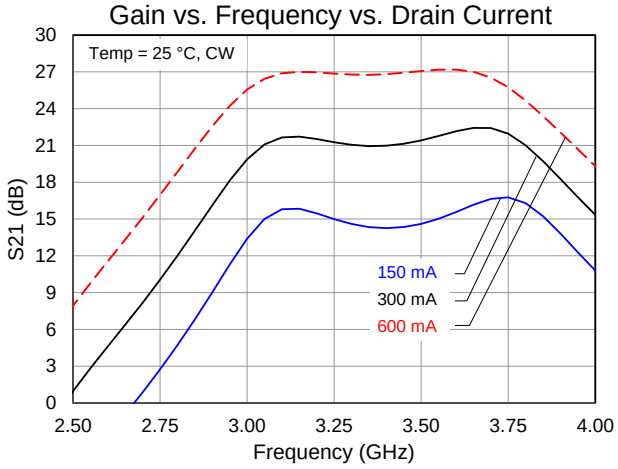
Gain vs. Frequency vs. V_D



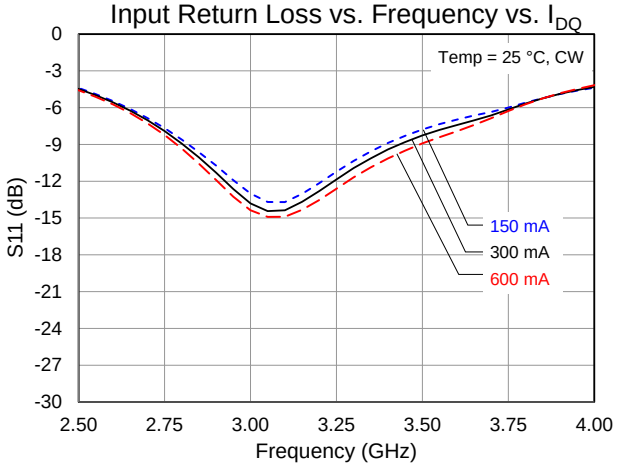
Gain vs. Frequency vs. Temp.



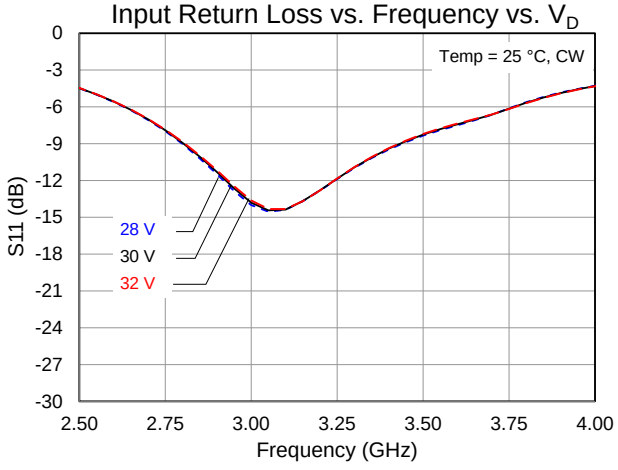
Gain vs. Frequency vs. Drain Current



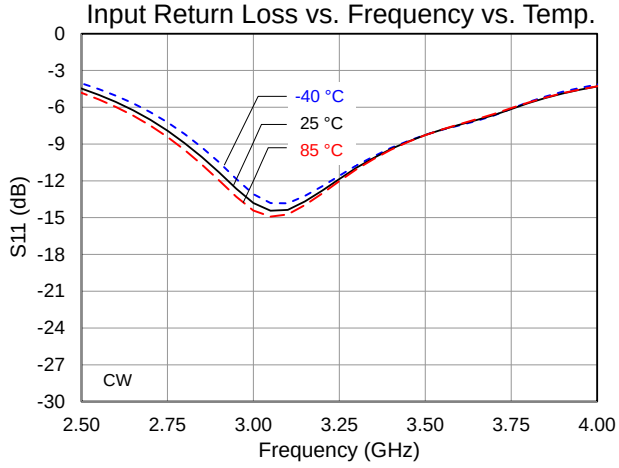
Input Return Loss vs. Frequency vs. I_{DQ}



Input Return Loss vs. Frequency vs. V_D

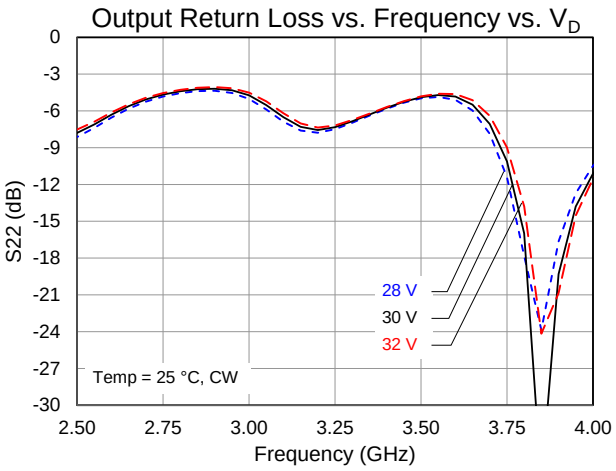


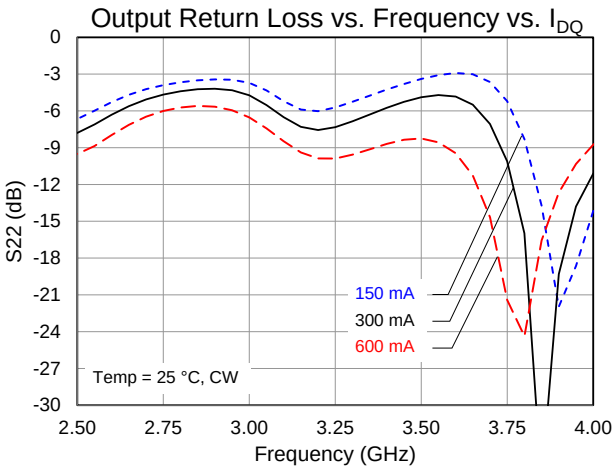
Input Return Loss vs. Frequency vs. Temp.

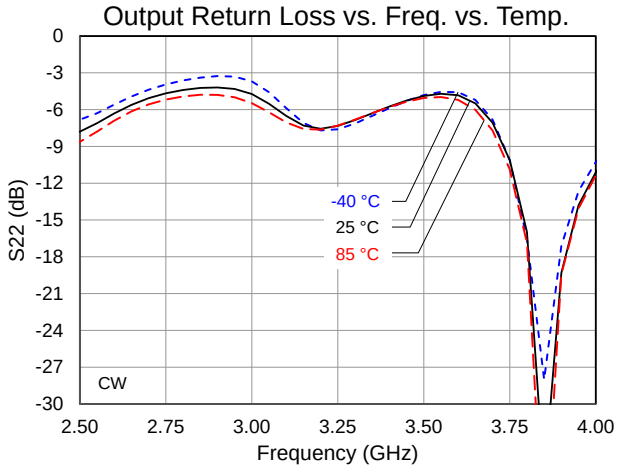


Typical Performance: Small Signal

Conditions unless otherwise specified: V_D = 30 V (PW = 15 ms, DC = 30 %), I_{DQ} = 300 mA, V_G = -3 V typical.



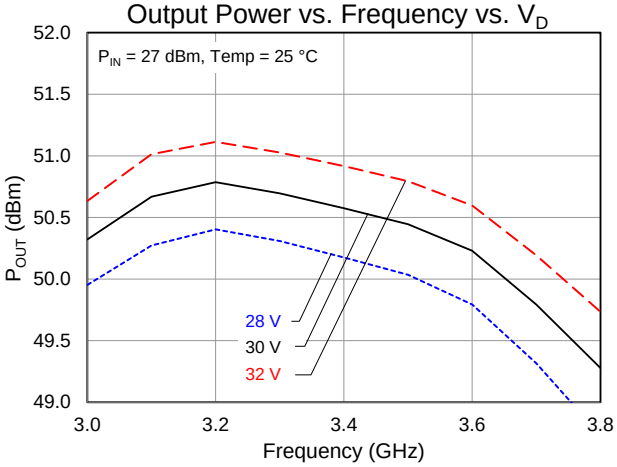




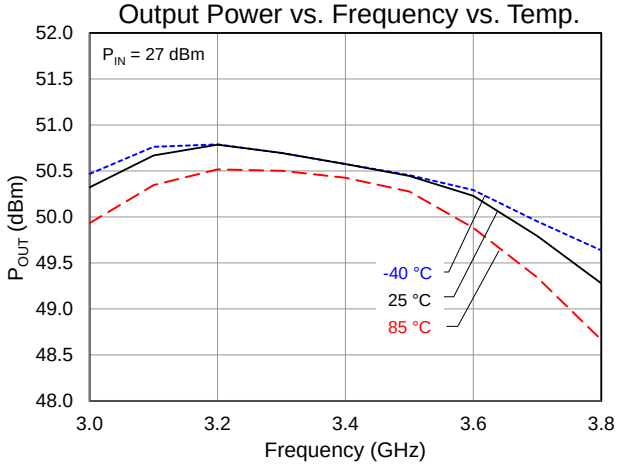
Typical Performance: Large Signal

Conditions unless otherwise specified: V_D = 30 V (PW = 15 ms, DC = 30 %), I_{DQ} = 300 mA, V_G = -3 V typical.

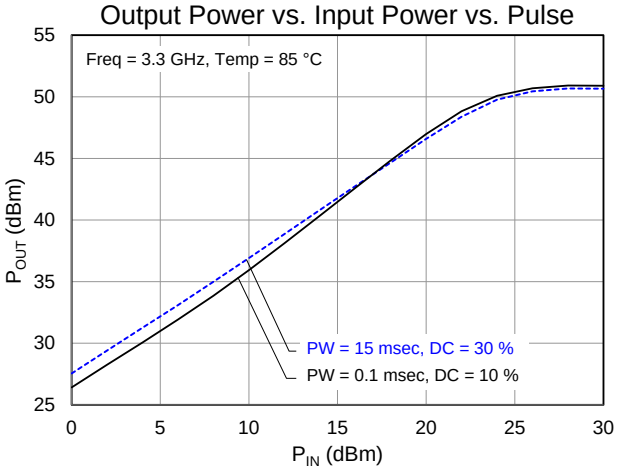
Output Power vs. Frequency vs. V_D



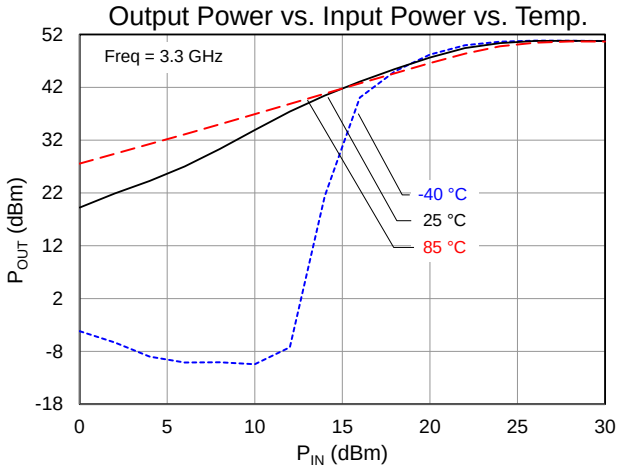
Output Power vs. Frequency vs. Temp.



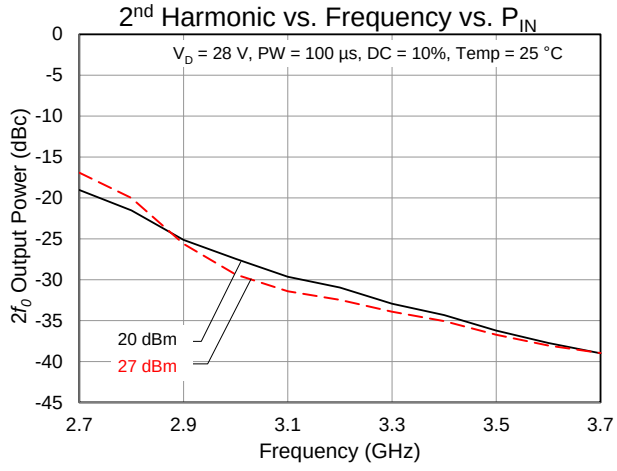
Output Power vs. Input Power vs. Pulse



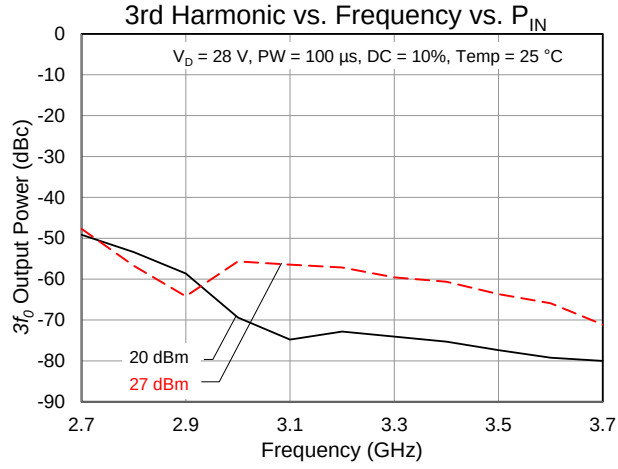
Output Power vs. Input Power vs. Temp.



2nd Harmonic vs. Frequency vs. P_{IN}

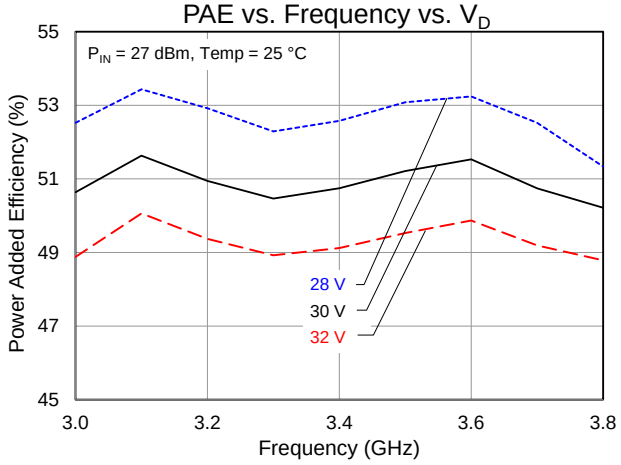


3rd Harmonic vs. Frequency vs. P_{IN}

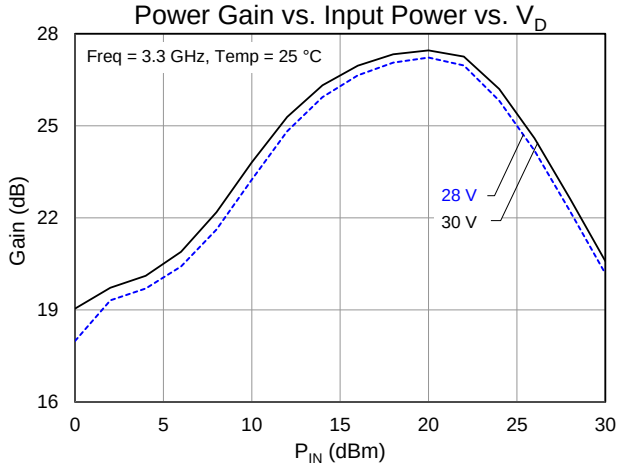


Conditions unless otherwise specified: V_D = 30 V (PW = 15 ms, DC = 30 %), I_{DQ} = 300 mA, V_G = -3 V typical.

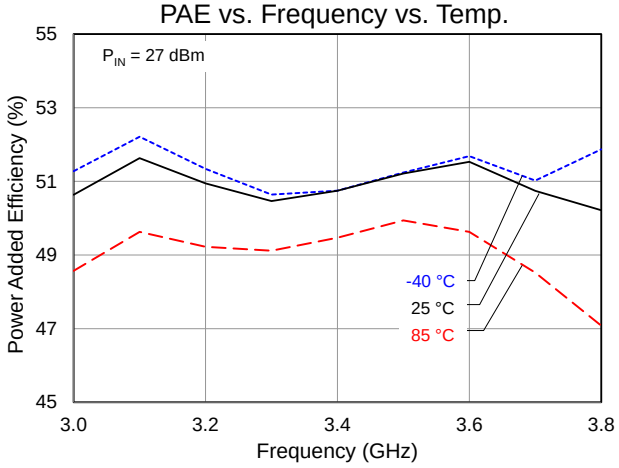
PAE vs. Frequency vs. V_D



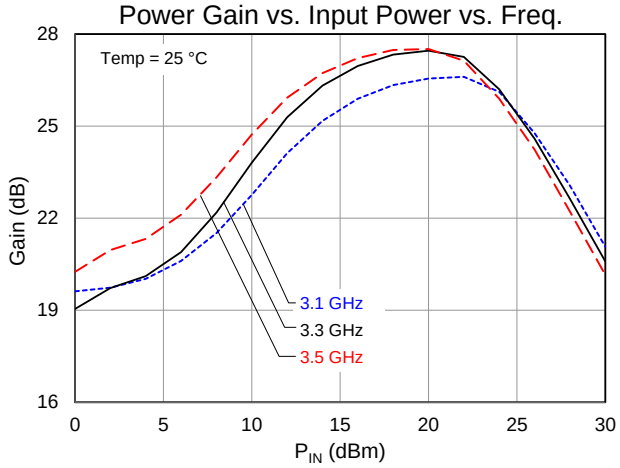
Power Gain vs. Input Power vs. V_D



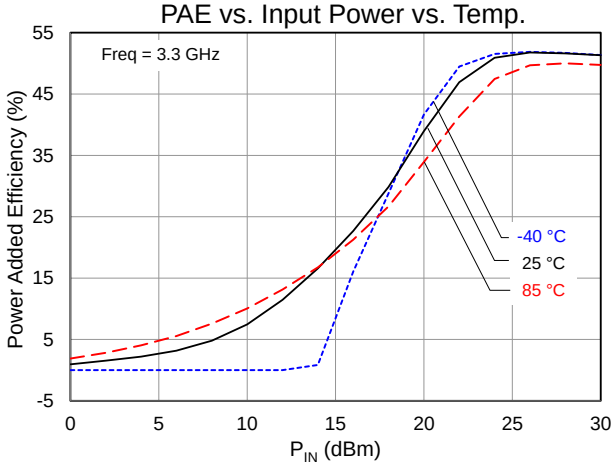
PAE vs. Frequency vs. Temp.



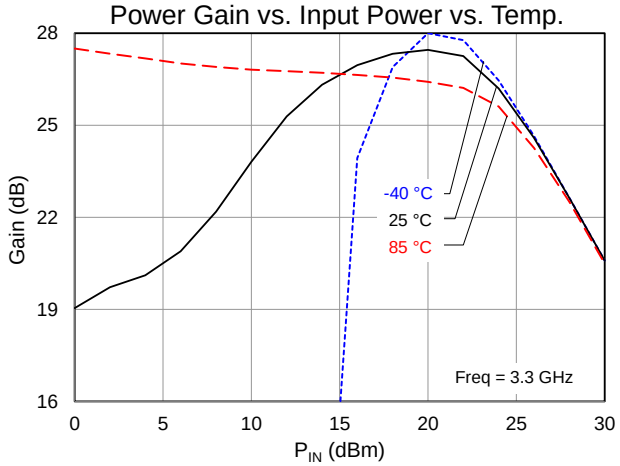
Power Gain vs. Input Power vs. Freq.



PAE vs. Input Power vs. Temp.



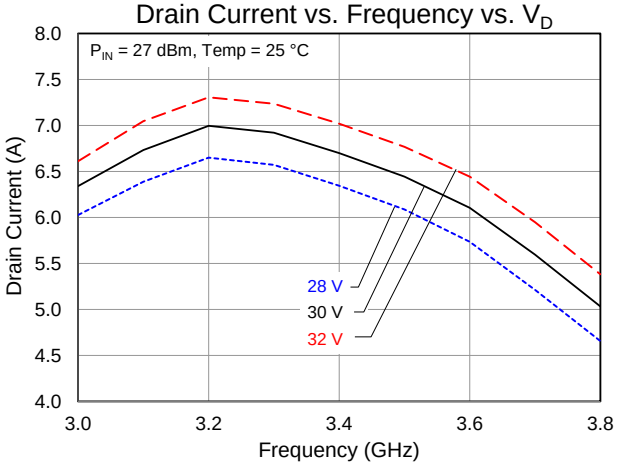
Power Gain vs. Input Power vs. Temp.



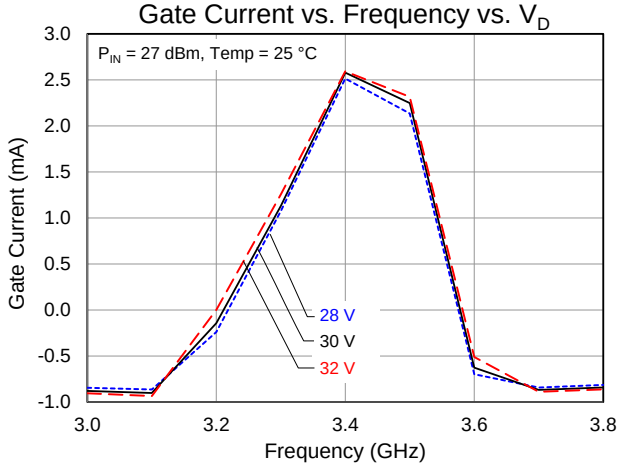
Typical Performance: Large Signal

Conditions unless otherwise specified: V_D = 30 V (PW = 15 ms, DC = 30 %), I_{DQ} = 300 mA, V_G = -3 V typical.

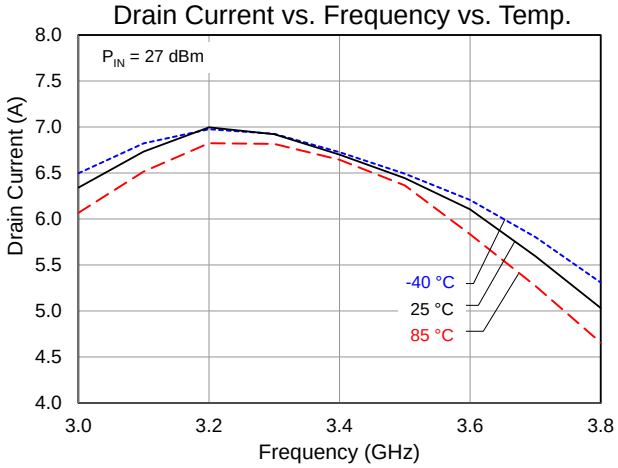
Drain Current vs. Frequency vs. V_D



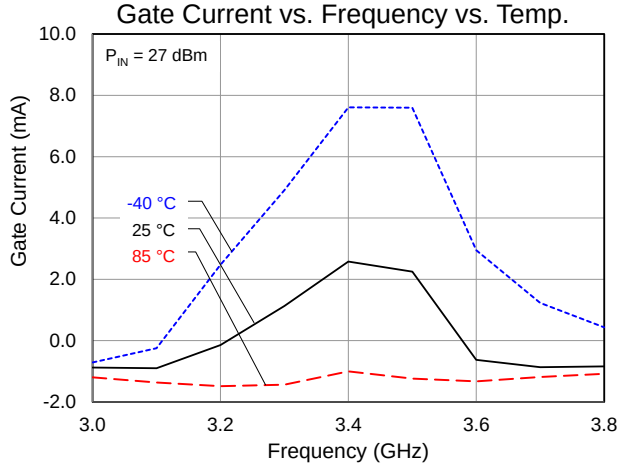
Gate Current vs. Frequency vs. V_D



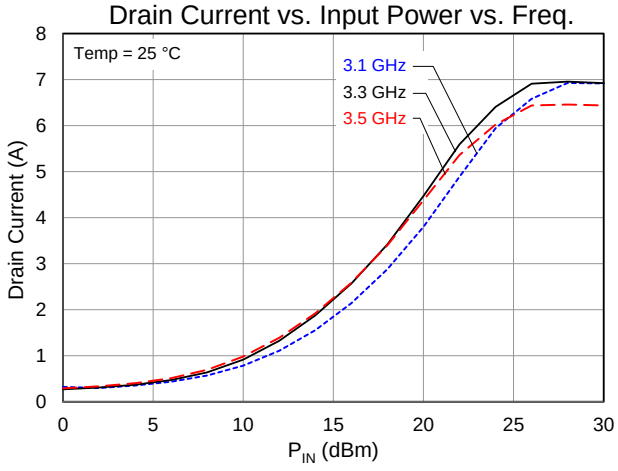
Drain Current vs. Frequency vs. Temp.



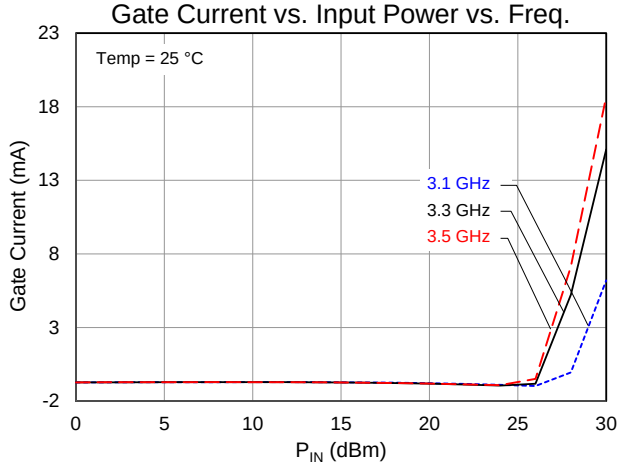
Gate Current vs. Frequency vs. Temp.



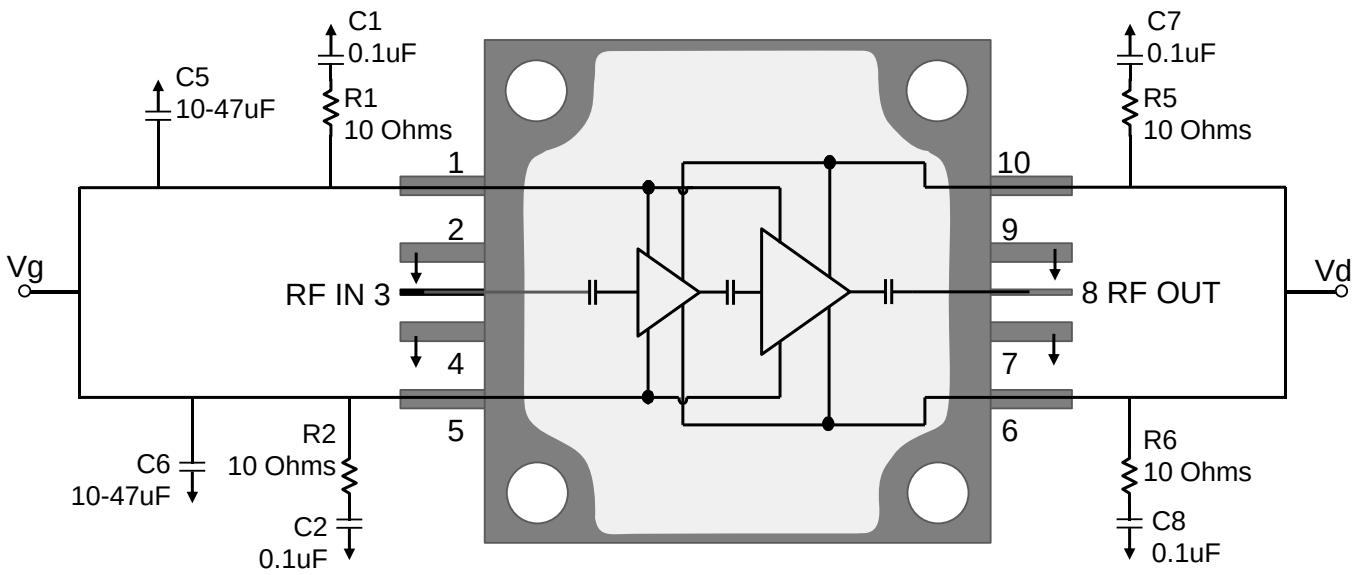
Drain Current vs. Input Power vs. Freq.



Gate Current vs. Input Power vs. Freq.



Applications Information and Pin Layout



Bias-up Procedure

1. Set I_D limit to 10 A, I_G limit to 50 mA
2. Apply −5 V to V_G
3. Apply +30 V to V_D; ensure I_{DQ} is approx. 0 mA
4. Adjust V_G until I_{DQ} = 300 mA (V_G ~ −3 V Typ.).
5. Turn on RF supply

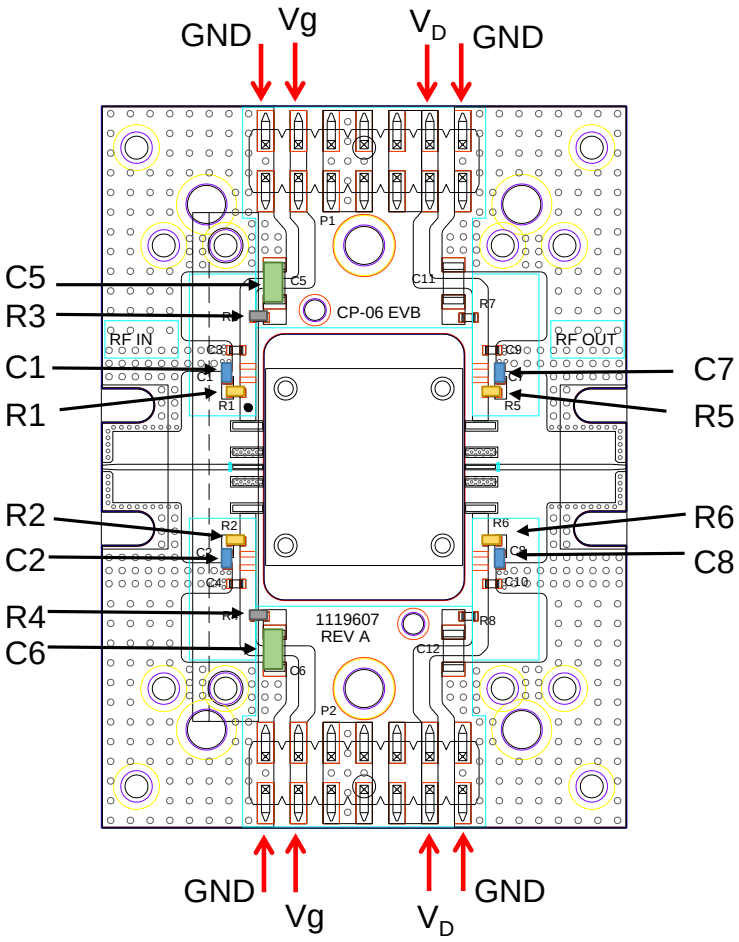
Bias-down Procedure

1. Turn off RF supply
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

Pin Description

Pin No.	Symbol	Description
1,5	V_G	Gate Voltage; Bias network is required; must be biased from both sides; see recommended Application Information above.
3	RF_{IN}	Output; matched to 50 Ω; DC blocked
2,4,7,9	GND	Must be grounded on the PCB.
6,10	V_D	Drain voltage; Bias network is required; must be biased from both sides; see recommended Application Information above.
8	RF_{OUT}	Input; matched to 50 Ω; DC blocked

Evaluation Board



NOTE: Both Top and Bottom Vd and Vg must be biased.

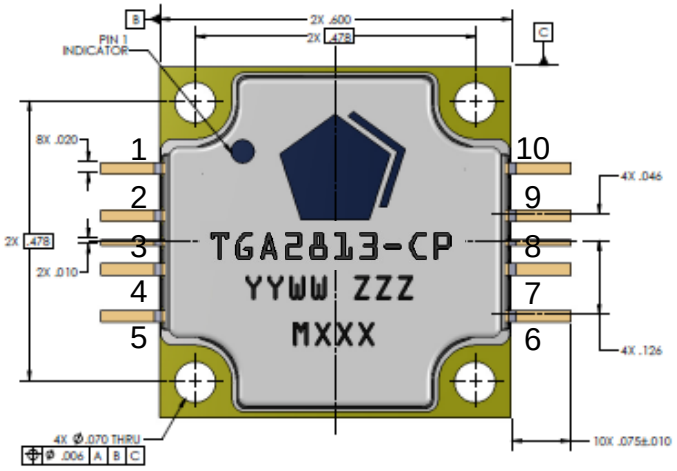
Bill of Material

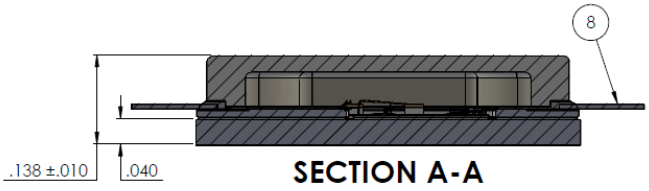
Reference Des.	Value	Description	Manuf.	Part Number
C1, C2, C7, C8	0.1 µF	Cap, 0603, 50 V, 10%, X7R	Various	
C5, C6	10-47 µF	Cap, 1206, 50 V, 20%, X5R (10v is OK)	Various	
R1, R2, R5, R6	10 Ohms	Res, 0402, 50V, 5%	Various	
R3, R4	0 Ohms	Res, 0402, 5% (jumper) required for the above EVB design	Various	

Assembly Notes

1. Clean the board or module with alcohol. Allow it to dry fully.
2. Nylock screws are recommended for mounting the TGA2813-CP to the board.
3. To improve the thermal and RF performance, we recommend the following:
   a. Apply thermal compound or 4 mils indium shim between the package and the board.
   b. Attach a heat sink to the bottom of the board and apply thermal compound or 4 mils indium shim between the heat sink and the board.
4. Apply solder to each pin of the TGA2813-CP.
5. Clean the assembly with alcohol.

Mechanical Information





Units: inches
Tolerances: unless specified
x.xx = ± 0.01
x.xxx = ± 0.005
Materials:
Base: Copper
Lid: Plastic
All metalized features are gold plated
Part is epoxy sealed
Marking:
2813: Part number
YY: Part Assembly year
WW: Part Assembly week
ZZZ: Serial Number
MXXX: Batch ID

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

MSL Rating

Level 5A at 260 °C convection reflow.
The part is rated Moisture Sensitivity Level 5A at 260 °C per JEDEC standard IPC/JEDEC J-STD-020.

ECCN

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

Solderability

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

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 ($C_{15}H_{12}Br_4O_2$) 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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Email: info-sales@triquint.com **Fax:** +1.972.994.8504

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

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