TGA2219-CP

13.4 – 16.5 GHz 25 W GaN Power Amplifier

Product Description

Qorvo's TGA2219-CP is a 3-stage, 25 W power amplifier operating over the 13.4 to 16.5 GHz band. Fabricated on Qorvo's QGaN15 production 0.15 um GaN on SiC process, this high performance amplifier offers > 30 dB small-signal gain with 31% PAE, allowing the system designer to achieve superior performance levels in a cost efficient manner.

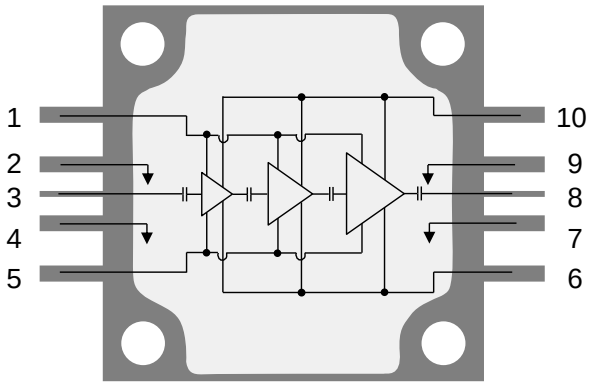
The TGA2219-CP is offered in a 10-lead 15 x 15 mm bolt-down package. Assembled with a pure-copper base, coupled with its high efficiency, the TGA2219-CP minimizes the strain on the system-level cooling requirements, further reducing system operating costs. Superior electrical performance and thermal management makes the TGA2219-CP ideal for supporting communications and radar applications in both commercial and military markets.

Both RF ports have integrated DC blocking capacitors and are fully matched to 50 Ohms.

Product Features

- Frequency Range: 13.4 – 16.5 GHz
- P_{OUT}: 44 dBm (P_{IN} = 16 dBm)
- PAE: > 31 % (P_{IN} = 16 dBm)
- Large Signal Gain: 28 dB (P_{IN} = 16 dBm)
- Small Signal Gain: > 30 dB
- Bias: V_D = +28 V, I_{DQ} = 450 mA
- Package Dimensions: 15.2 x 15.2 x 3.5 mm
- Package base is pure Cu offering superior thermal management

Functional Block Diagram



Applications

- Commercial VSAT
- Military Satcom
- Datalinks
- Radar

Ordering Information

Part No.	Description
TGA2219-CP	13.4 – 16.5 GHz 25 W GaN Power Amplifier
TGA2219-CPEVBP01	TGA2219-CP Evaluation Board

Absolute Maximum Ratings

Parameter	Value / Range
Drain Voltage (V_D)	+29.5 V
Gate Voltage Range (V_G)	−5 to 0 V
Drain Current (I_D)	7.2 A
Gate Current (I_G)	See page 10
Power Dissipation (P_{DISS}), 85 ºC	80 W
Input Power (P_{IN}), CW, 50 Ω, V_D = 28 V, I_{DQ} = 450 mA, 85 ºC	30 dBm
Input Power (P_{IN}), CW, VSWR 3:1, V_D = 28 V, I_{DQ} = 450 mA, 85 ºC	27 dBm
Soldering Temperature (30 Seconds)	260 ºC
Storage Temperature	−55 to 150 ºC

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	Min	Typ.	Max	Units
Drain Voltage (V_D)		+28		V
Drain Current, (I_{DQ})		450		mA
Temperature Range	−40		+85	ºC

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

Electrical Specifications

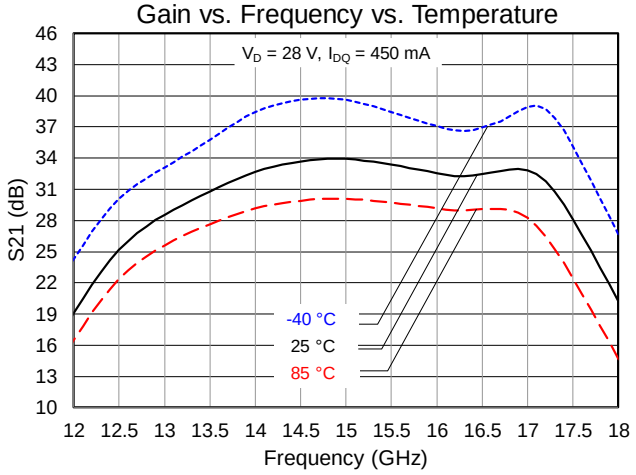
Parameter		Min	Typ	Max	Units
Operational Frequency Range		13.4	–	16.5	GHz
Small Signal Gain		–	> 30	–	dB
Input Return Loss		–	> 15	–	dB
Output Return Loss		–	> 5	–	dB
Output Power (P_{IN} = 16 dBm)	13.4 GHz	44	44	–	dBm
	15.0 GHz	44.3	44.6	–	dBm
	16.5 GHz	43.9	44.2	–	dBm
Power Added Effi. (P_{IN} = 16 dBm)	13.4 GHz	24.8	31.4	–	%
	15.0 GHz	25.0	36.5	–	%
	16.5 GHz	24.8	35.5	–	%
Small Signal Gain Temperature Coefficient		–	-0.08	–	dB/ºC
Output Power Temperature Coefficient (Temp: -40 ºC – +85 ºC @ P_{IN} = 16dBm)		–	−0.011	–	dBm/ºC
Recommended Operating Voltage		–	+20 to +28	+28	V

Test conditions unless otherwise noted: 25 ºC, V_D = +28 V, I_{DQ} = 450 mA, CW

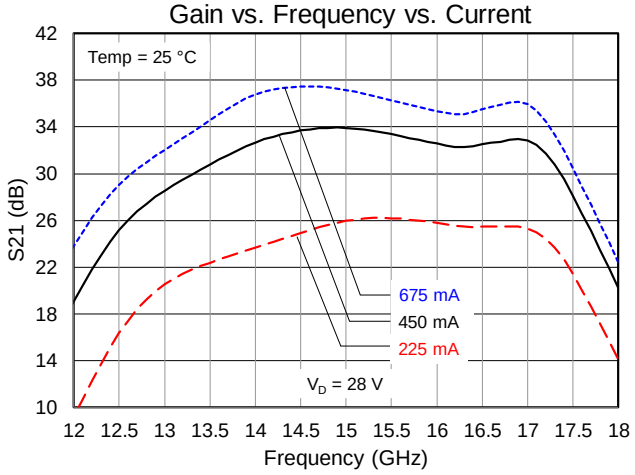
Performance Plots – Small Signal

Conditions unless otherwise specified: V_D = +28 V, I_{DQ} = 450 mA, CW.

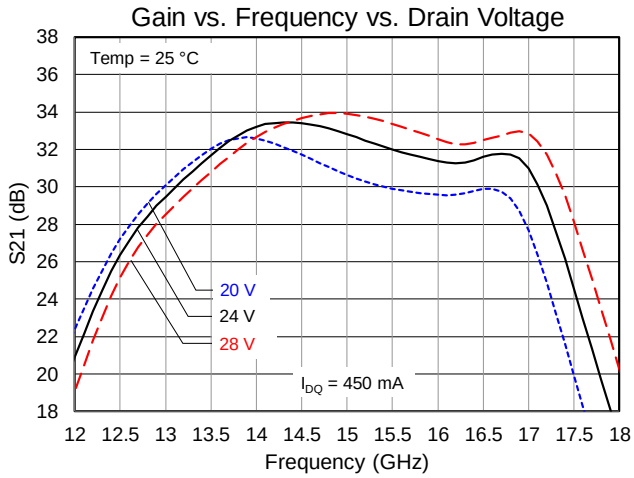
Gain vs. Frequency vs. Temperature



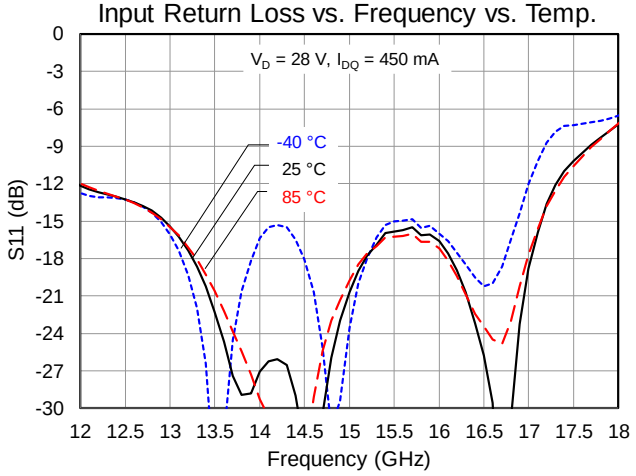
Gain vs. Frequency vs. Current



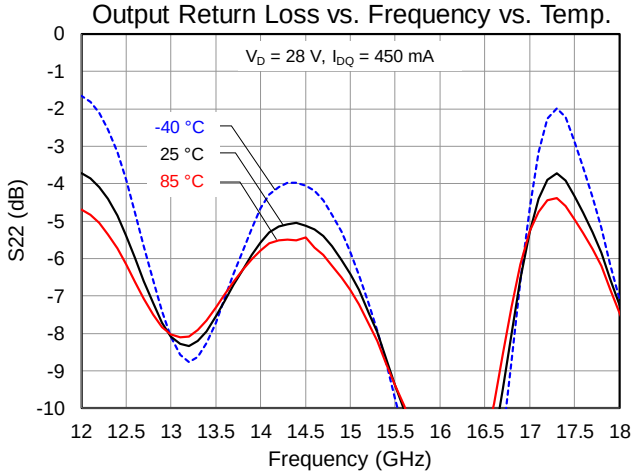
Gain vs. Frequency vs. Drain Voltage



Input Return Loss vs. Frequency vs. Temp.



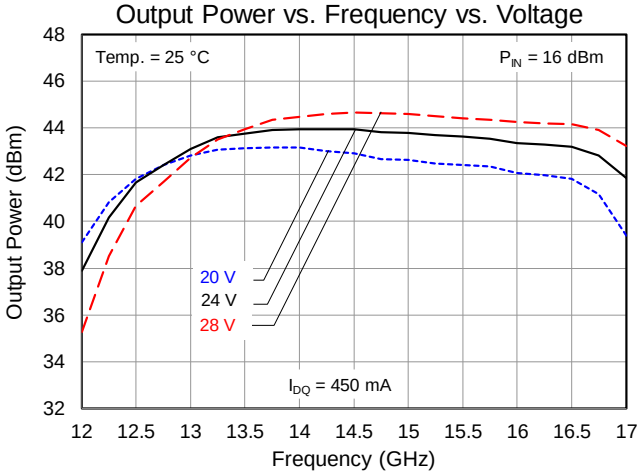
Output Return Loss vs. Frequency vs. Temp.



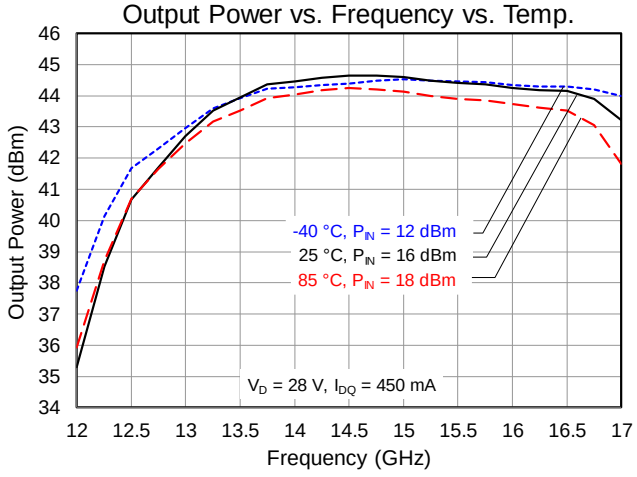
Performance Plots – Large Signal

Conditions unless otherwise specified: V_D = +28 V, I_{DQ} = 450 mA, CW.

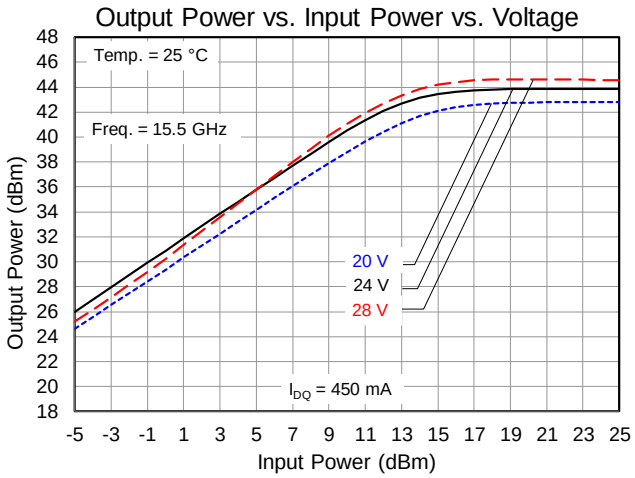
Output Power vs. Frequency vs. Voltage



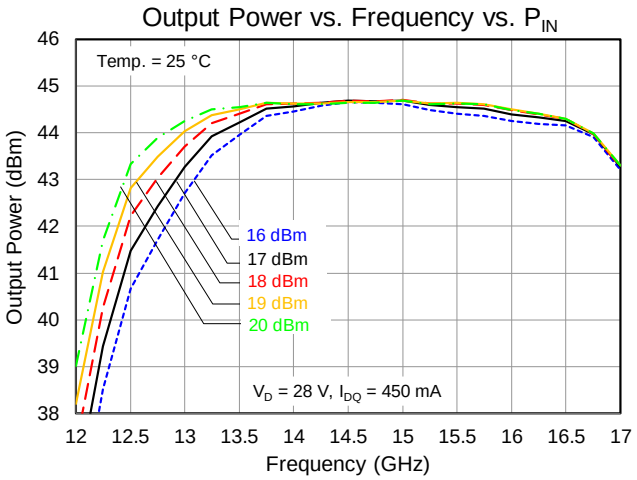
Output Power vs. Frequency vs. Temp.



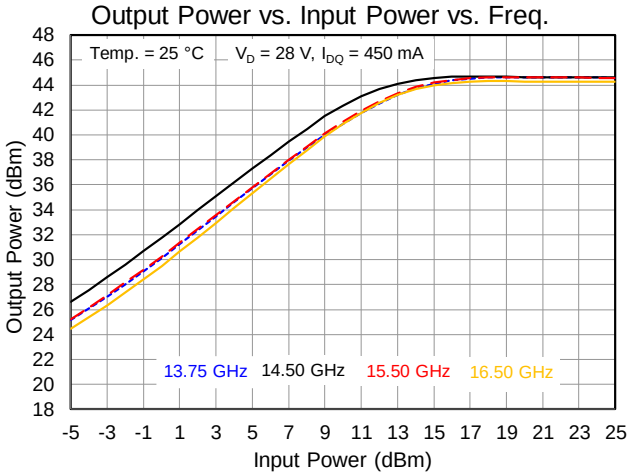
Output Power vs. Input Power vs. Voltage



Output Power vs. Frequency vs. P_{IN}



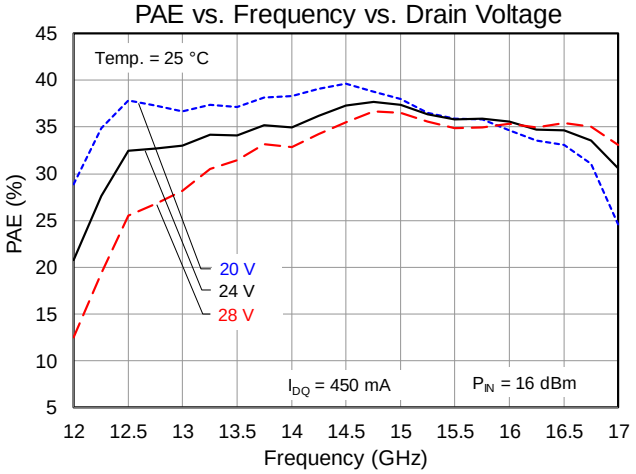
Output Power vs. Input Power vs. Freq.



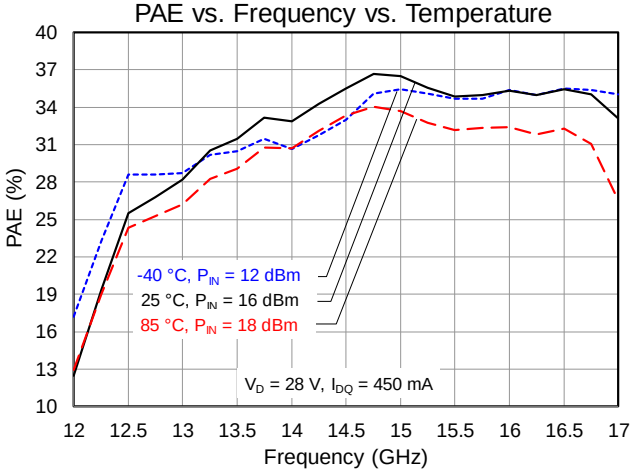
Performance Plots – Large Signal

Conditions unless otherwise specified: V_D = +28 V, I_{DQ} = 450 mA, CW.

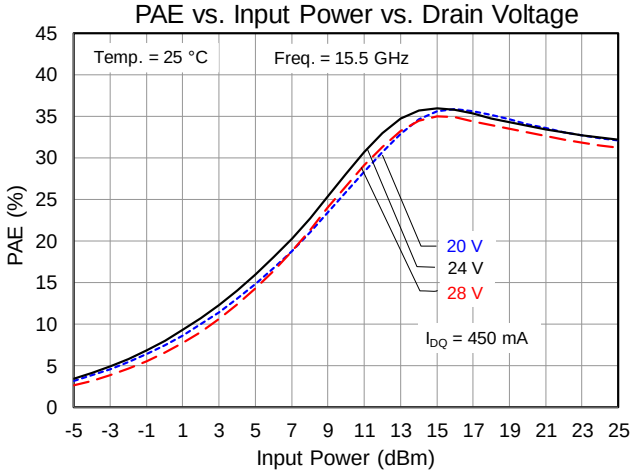
PAE vs. Frequency vs. Drain Voltage



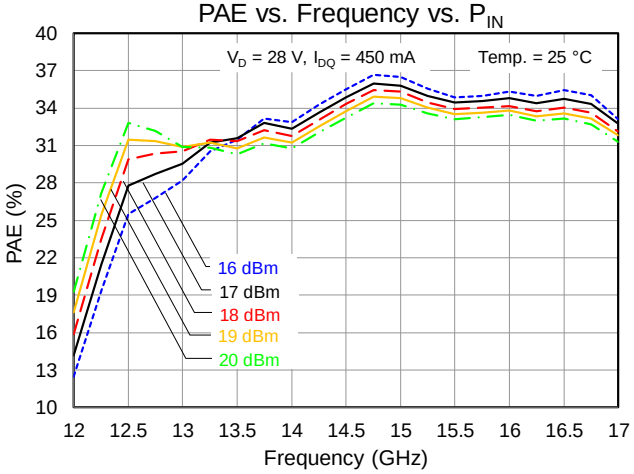
PAE vs. Frequency vs. Temperature



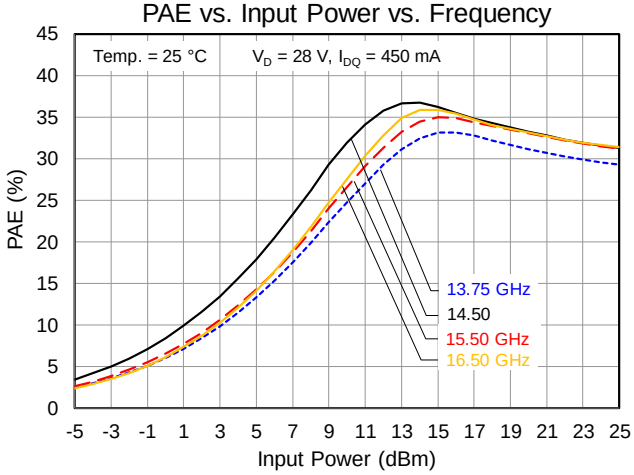
PAE vs. Input Power vs. Drain Voltage



PAE vs. Frequency vs. P_{IN}



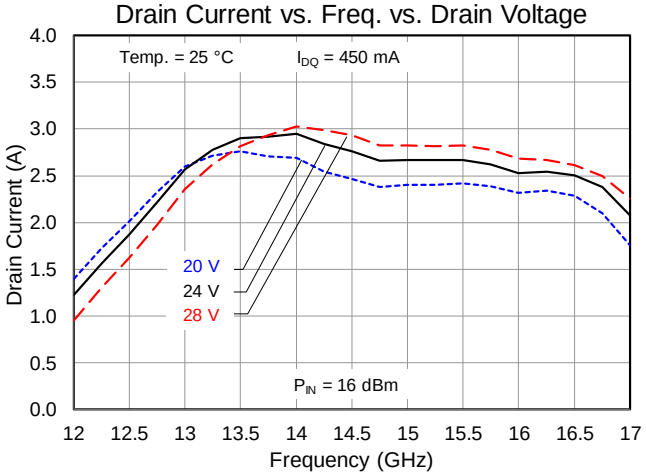
PAE vs. Input Power vs. Frequency



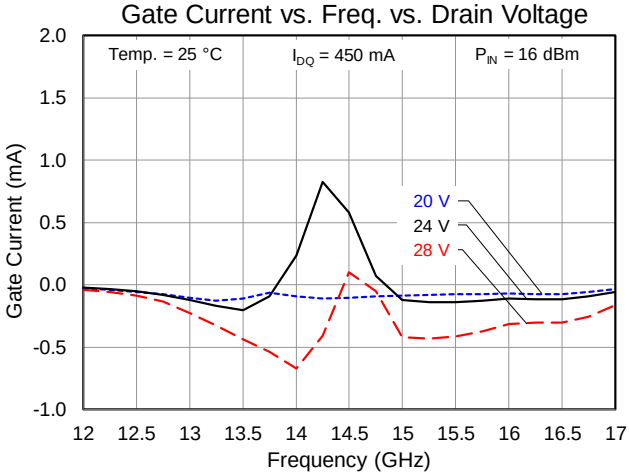
Performance Plots – Large Signal

Conditions unless otherwise specified: V_D = +28 V, I_{DQ} = 450 mA, CW.

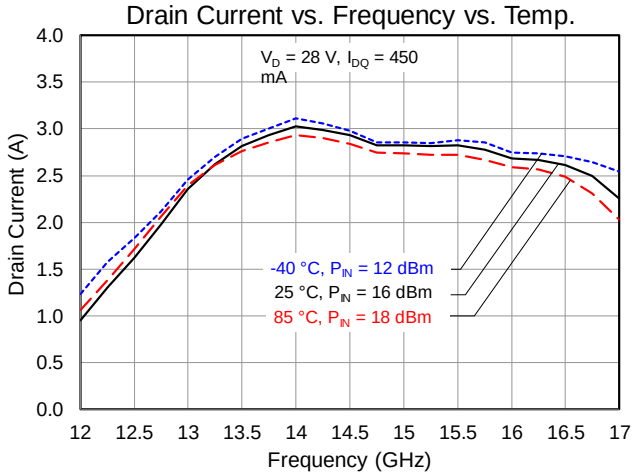
Drain Current vs. Freq. vs. Drain Voltage



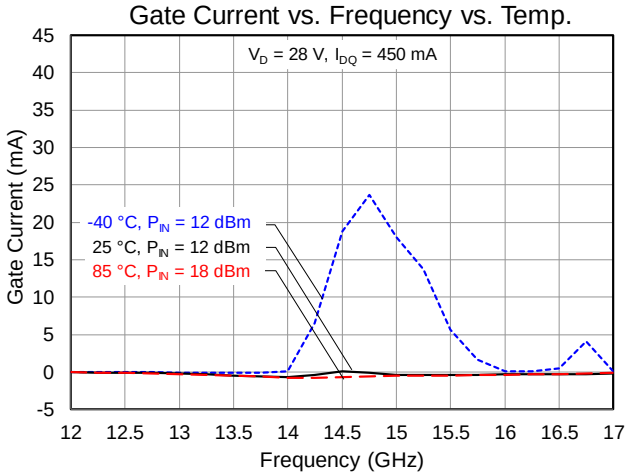
Gate Current vs. Freq. vs. Drain Voltage



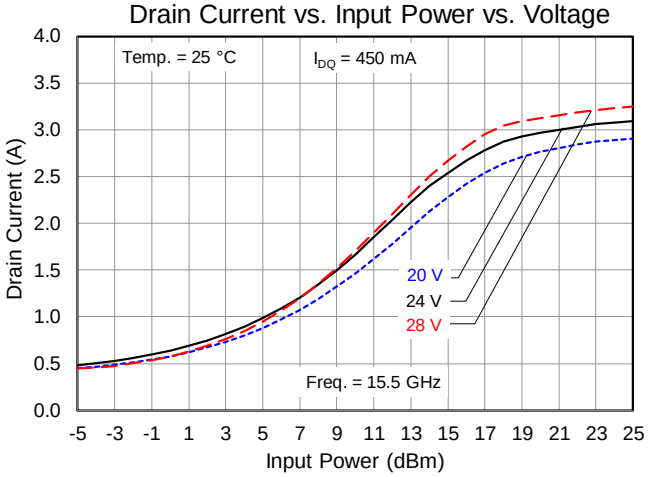
Drain Current vs. Frequency vs. Temp.



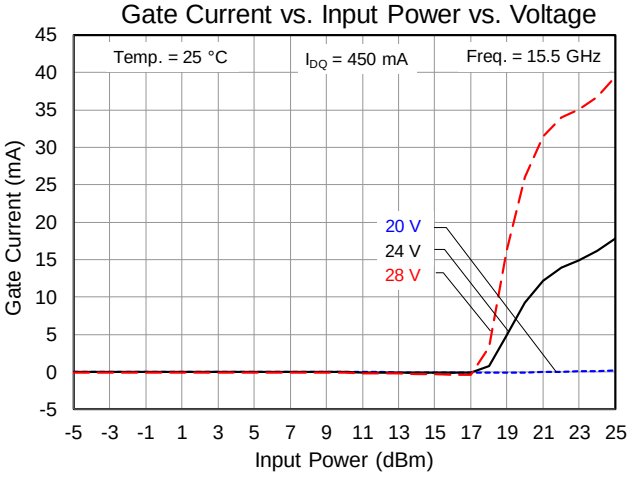
Gate Current vs. Frequency vs. Temp.



Drain Current vs. Input Power vs. Voltage



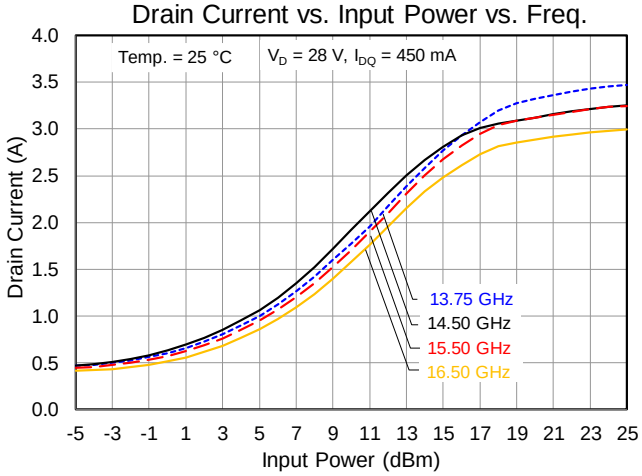
Gate Current vs. Input Power vs. Voltage



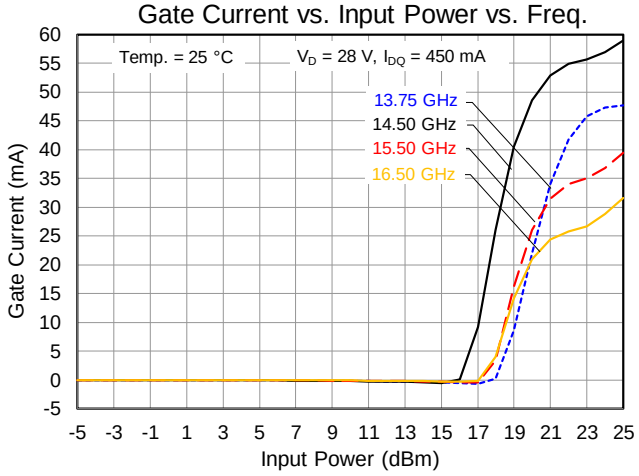
Performance Plots – Large Signal

Conditions unless otherwise specified: V_D = +28 V, I_{DQ} = 450 mA, CW.

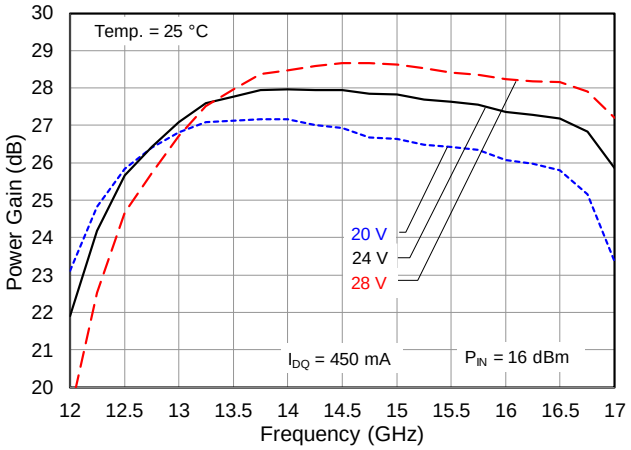
Drain Current vs. Input Power vs. Freq.



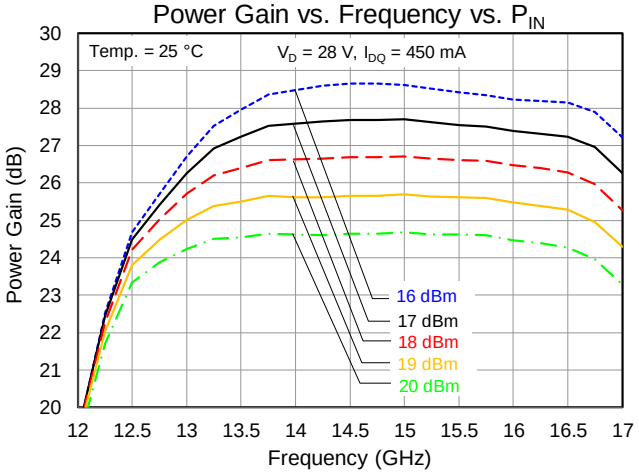
Gate Current vs. Input Power vs. Freq.



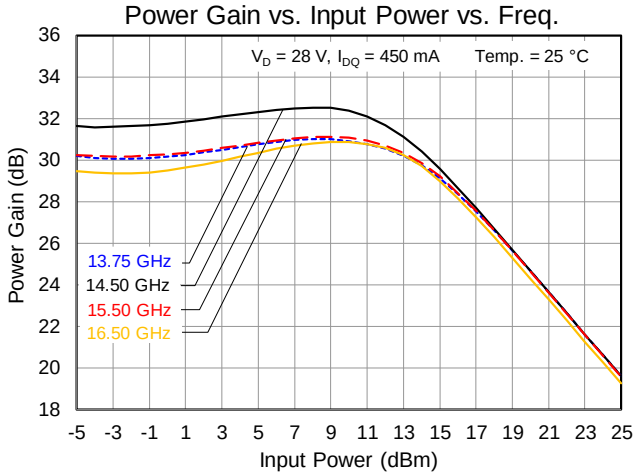
Power Gain vs. Frequency vs. Drain Voltage



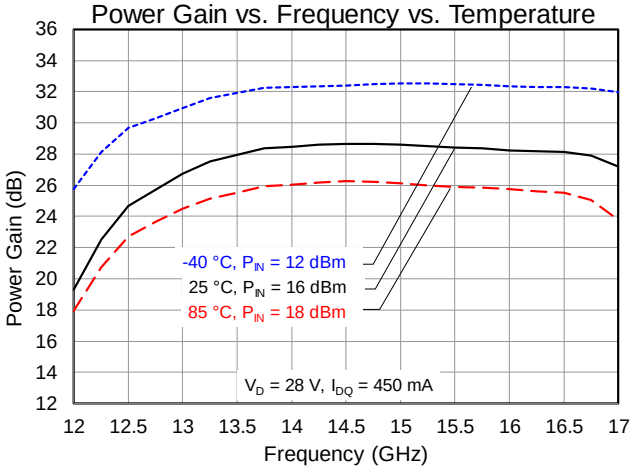
Power Gain vs. Frequency vs. P_{IN}



Power Gain vs. Input Power vs. Freq.



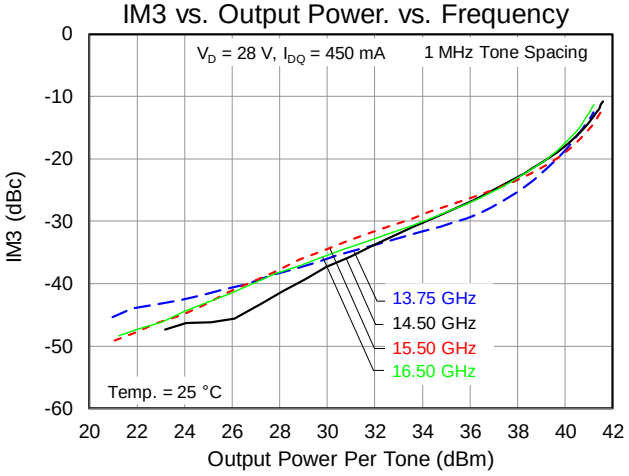
Power Gain vs. Frequency vs. Temperature



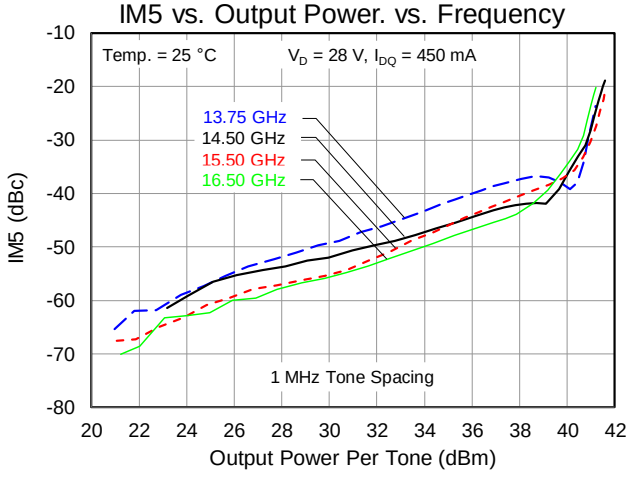
Performance Plots – Linearity

Conditions unless otherwise specified: V_D = +28 V, I_{DQ} = 450 mA, CW.

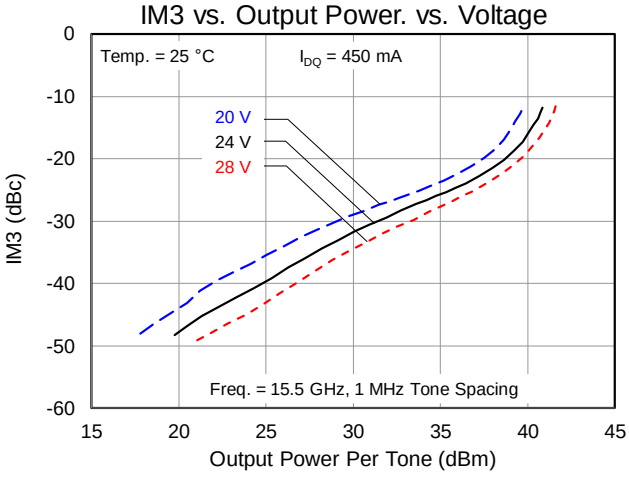
IM3 vs. Output Power. vs. Frequency



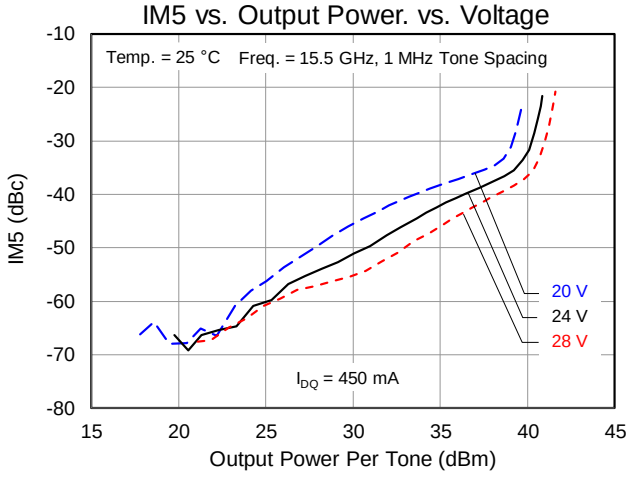
IM5 vs. Output Power. vs. Frequency



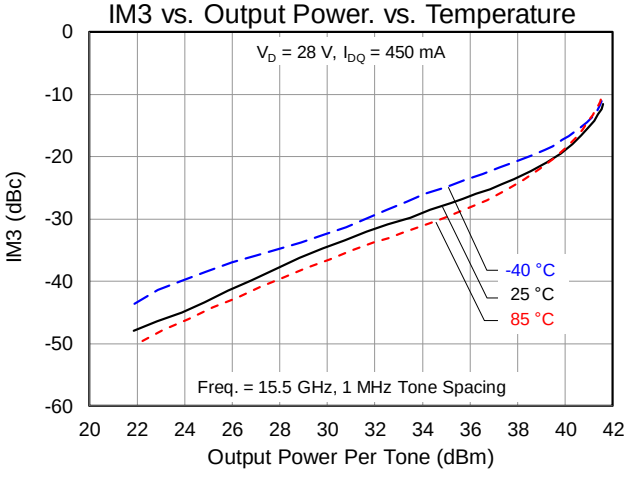
IM3 vs. Output Power. vs. Voltage



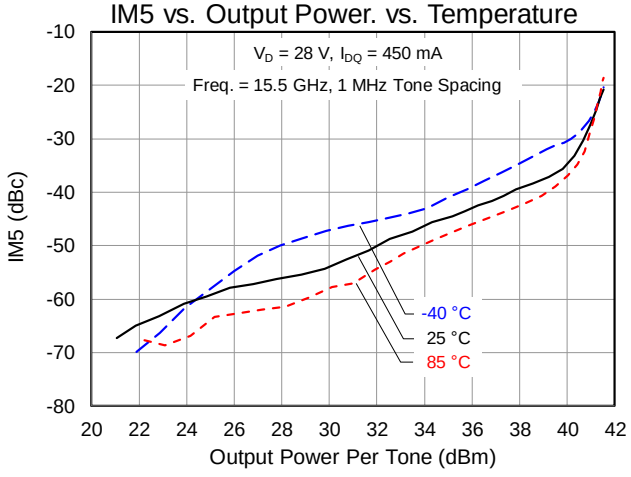
IM5 vs. Output Power. vs. Voltage



IM3 vs. Output Power. vs. Temperature

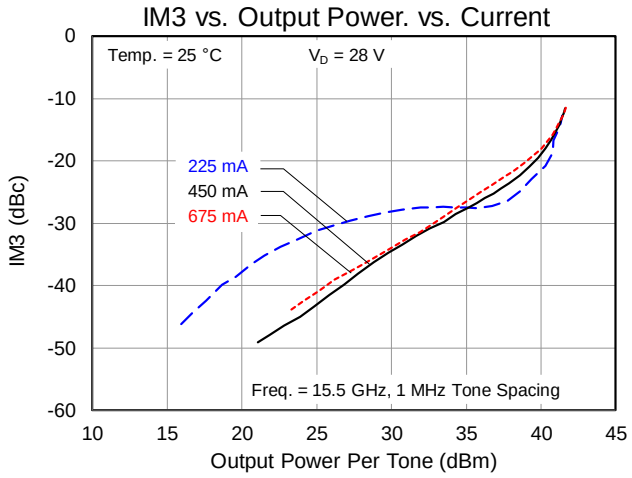


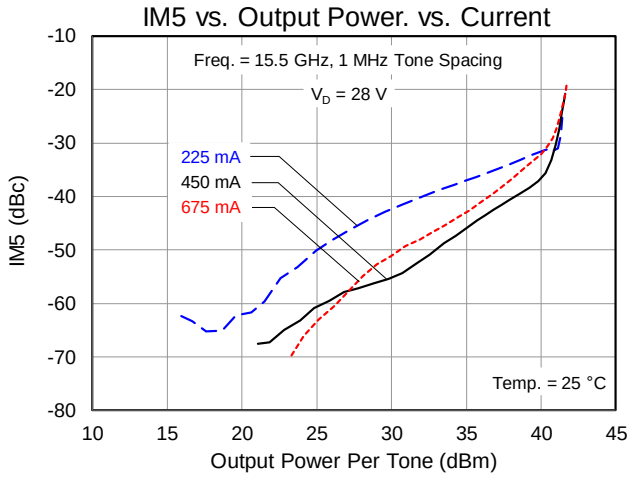
IM5 vs. Output Power. vs. Temperature

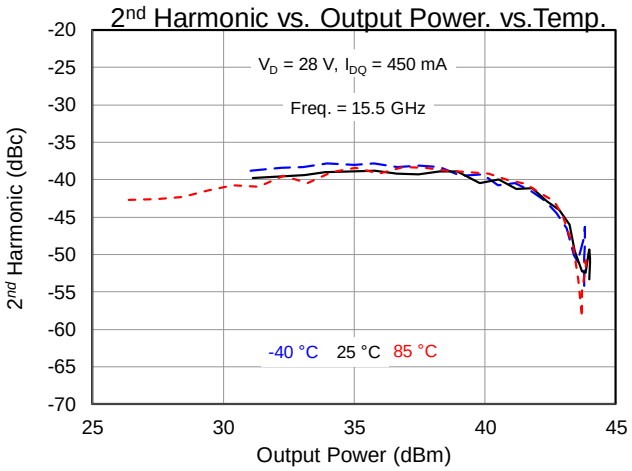


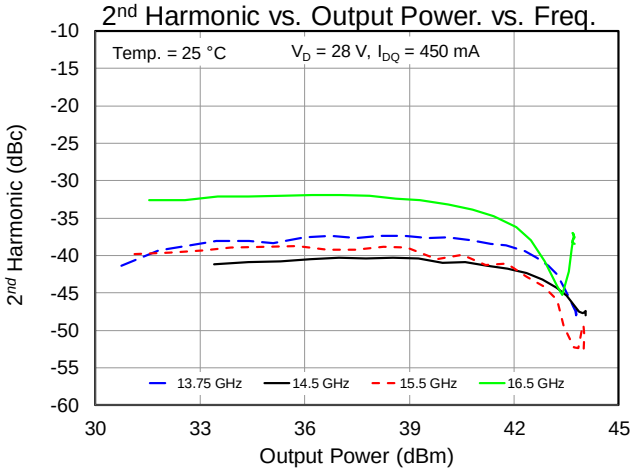
Performance Plots – Linearity

Conditions unless otherwise specified: V_D = +28 V, I_{DQ} = 450 mA, CW.







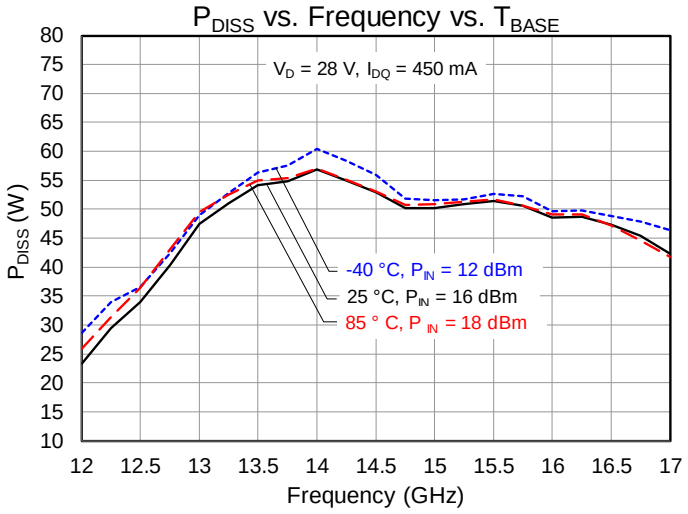


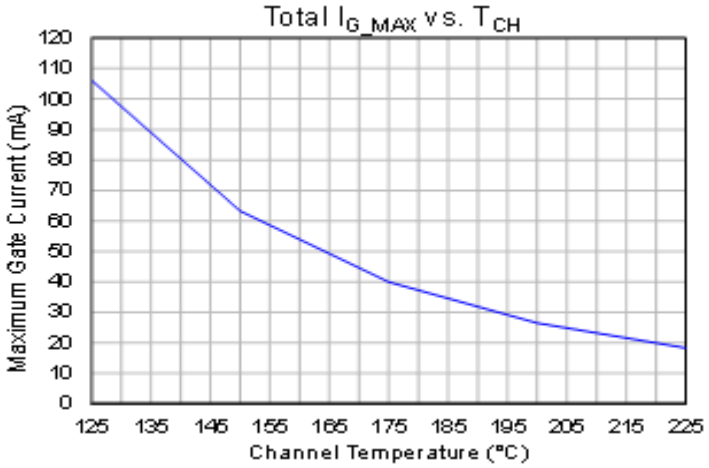
Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	T_{base} = 85 ºC, V_D = 28 V, I_{DQ} = 450 mA, P_{DISS} = 12.8 W, CW, No RF (quiescent DC operation)	1.56	ºC/W
Channel Temperature, T_{CH} (No RF) (2)		105	ºC
Thermal Resistance (θ_{JC}) (1)	T_{base} = 85 ºC, V_D = 28 V, I_{DQ} = 450 mA, CW Freq = 14 GHz, I_{D_Drive} = 2.9 A, P_{IN} = 18 dBm, P_{OUT} = 44 dBm, P_{DISS} = 57 W	1.54	ºC/W
Channel Temperature, T_{CH} (Under RF) (2)		173	ºC

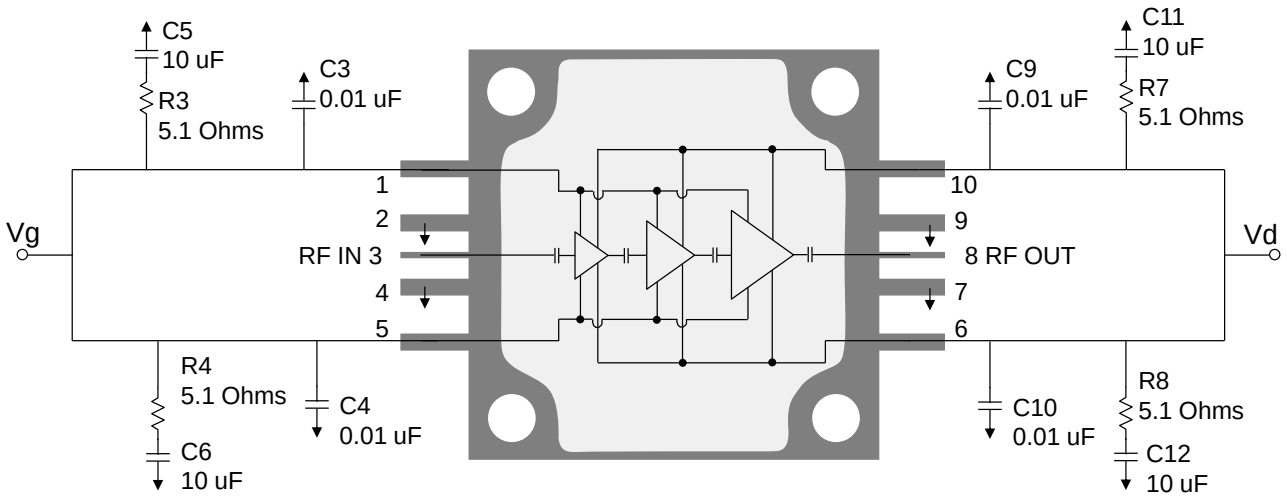
Notes:
1. Thermal resistance is referenced to the back of package (85 ºC)
2. IR Scan equivalent. Refer to the following document: GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates

Dissipated Power and Maximum Gate Current





Applications Information and Pin Layout



Notes: V_G and V_D can be biased from either side of package, top or bottom.

Bias Up Procedure

1. Set I_D limit to 3.5 A, I_G limit to 65 mA
2. Apply −5 V to V_G
3. Apply +28 V to V_D; ensure I_{DQ} is approx. 0 mA
4. Adjust V_G until I_{DQ} = 450 mA (V_G ~ −2.7 V Typ.).
5. Turn on RF supply

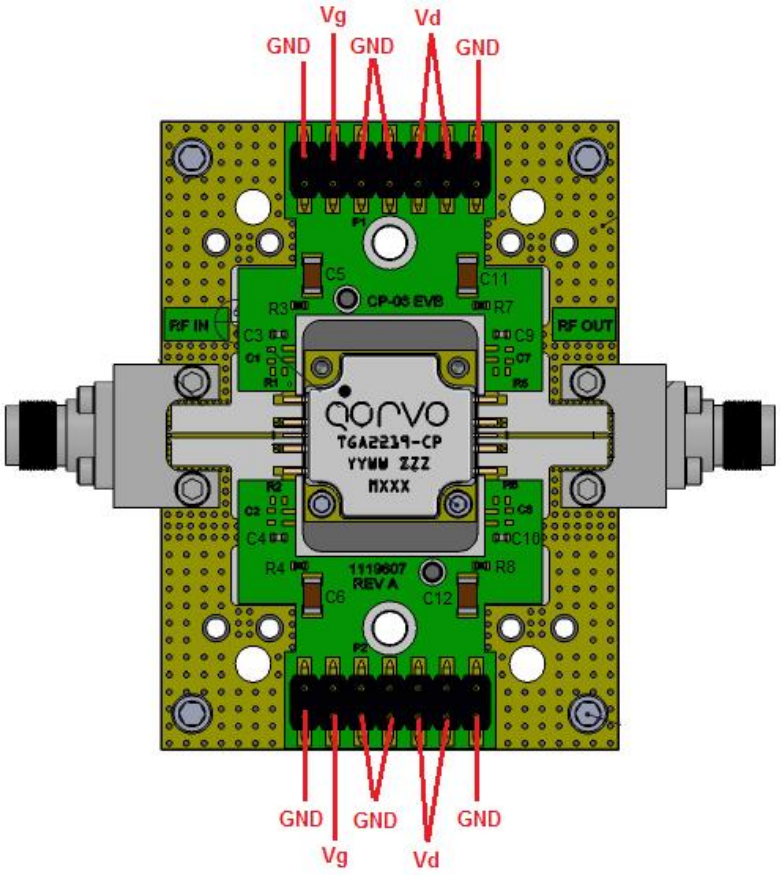
Bias Down Procedure

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

Pad 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.
2,4,7,9	GND	Must be grounded on the PCB
3	RF_{IN}	Input; matched to 50 Ω; DC blocked
6,10	V_D	Drain voltage; Bias network is required; must be biased from both sides; see recommended Application Information above.
8	RF_{OUT}	output; matched to 50 Ω; DC blocked

Evaluation Board



Notes:

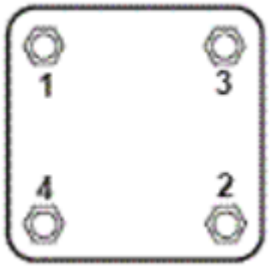
1. PCB is made from Rogers 4003C dielectric, 0.008 inch thick, 0.5 oz. copper both sides.
2. Both V_D and V_G pins can be biased from either side of top or bottom

Bill of Materials

Reference Des.	Value	Description	Manuf.	Part Number
C3, C4, C9, C10	0.01 µF	Cap, 0402, 50 V, 10%, X7R	Various	–
C5, C6, C11, C12	10 µF	Cap, 1206, 50 V, 20%, X5R	Various	–
R3, R4, R7, R8	5.1 Ohm	Res, 0402, 50V, 5%	Various	–

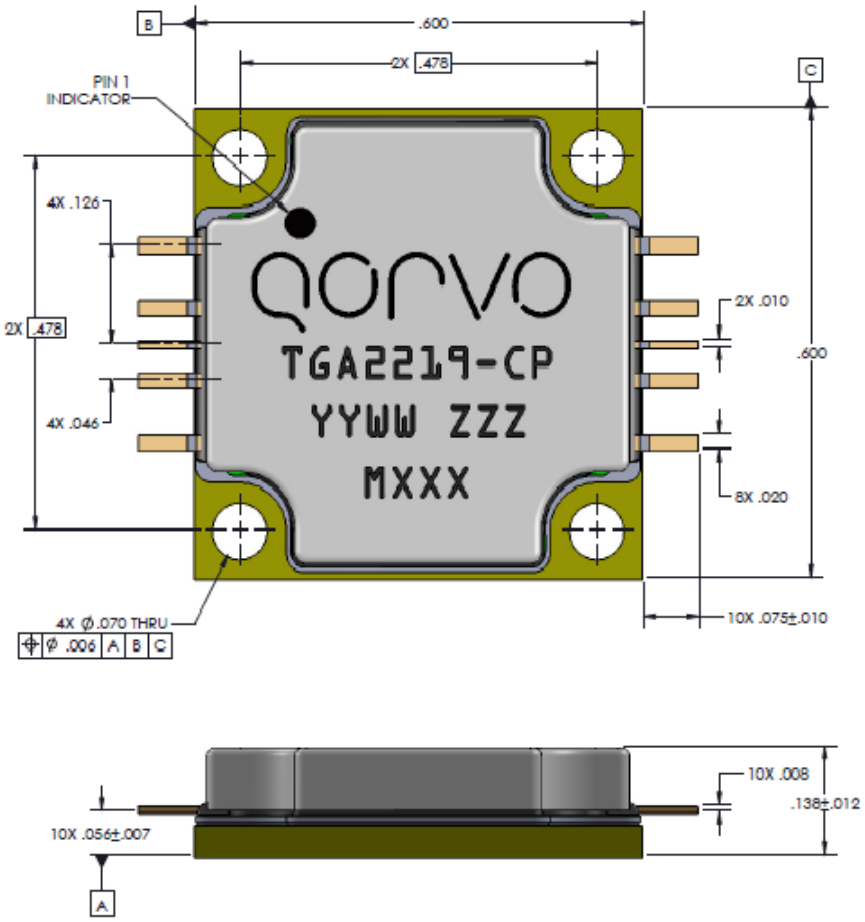
Assembly Notes

1. Carefully clean the PC board and package leads with alcohol. Allow it to dry fully.
2. To improve the thermal and RF performance, Qorvo recommends attaching a heat sink to the bottom of the PCB and apply thermal compound (Arctic Silver 5 recommended) or 4 mil indium shim between the heat sink and the package.
3. (The following is for *information only*. There are many variables in a second level assembly that Qorvo does not control, so Qorvo does not recommend an absolute torque value.) Use screws to attach the component to the heat sink. A suggested torque value is 16 in-oz. for a 0-80 screw. Start with screws finger tight, then torque to 8 in-oz., then torque to final value. Use the following tightening pattern:



4. Apply no-flux solder to each pin of the TGA2219-CP. The component leads should be manually soldered, and the package cannot be subjected to conventional reflow processes. The use of no-clean solder to avoid washing after soldering is recommended.

Mechanical Information and Marking



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:
2219: Part number
YY: Part Assembly year
WW: Part Assembly week
ZZZ: Serial Number
MXXX: Batch ID

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 0B	ANSI/ESD/JEDEC JS-001
ESD – Charge Device Body Model (CDM)	Class C0B	JESD22-C101
MSL – Moisture Sensitivity Level	N/A	

Caution!
ESD-Sensitive Device

Solderability

The component leads should be manually soldered, and the package cannot be subjected to conventional reflow processes. Soldering of the component leads is compatible with the latest version of J-STD-020, lead-free solder, 260 °C. The use of no-clean solder to avoid washing after soldering is recommended.

RoHS Compliance

This product is compliant with the 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), as amended by Directive 2015/863/EU. This product also has the following attributes:

- Product uses RoHS Exemption 7c-I to meet RoHS compliance requirements
- 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:

Web: www.qorvo.com

Tel: 1-844-890-8163

Email: customer.support@qorvo.com

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