

### 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  $\mu\text{m}$  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.

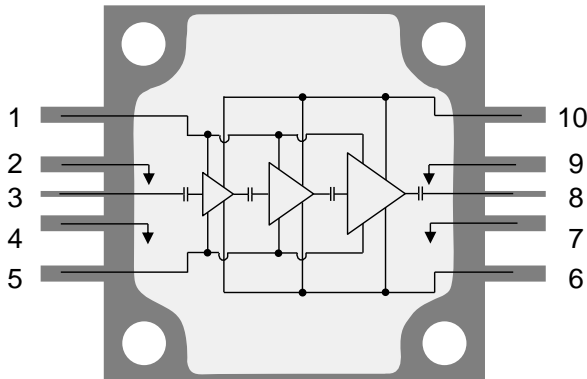
Both RF ports have integrated DC blocking capacitors and are fully matched to 50 Ohms.



### 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



# TGA2219-CP

## 13.4 – 16.5 GHz 25 W GaN Power Amplifier

### 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 °C	80 W
Input Power ( $P_{IN}$ ), CW, 50 $\Omega$ , $V_D = 28$ V, $I_{DQ} = 450$ mA, 85 °C	30 dBm
Input Power ( $P_{IN}$ ), CW, VSWR 3:1, $V_D = 28$ V, $I_{DQ} = 450$ mA, 85 °C	27 dBm
Soldering 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.

### 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/°C
Output Power Temperature Coefficient (Temp: -40 °C – +85 °C @ $P_{IN} = 16$ dBm)		–	-0.011	–	dBm/°C
Recommended Operating Voltage		–	+20 to +28	+28	V

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

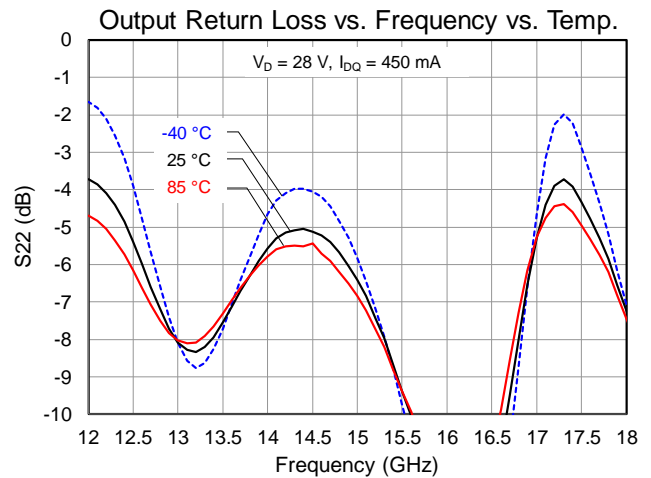
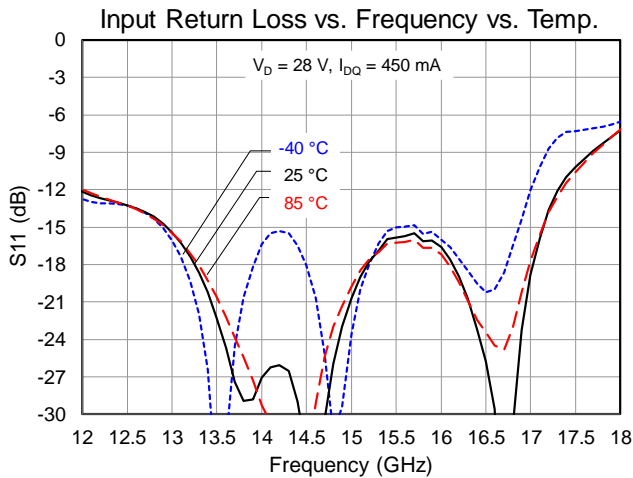
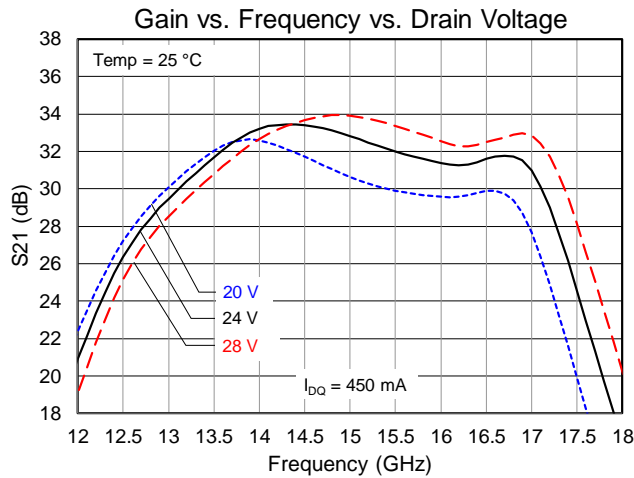
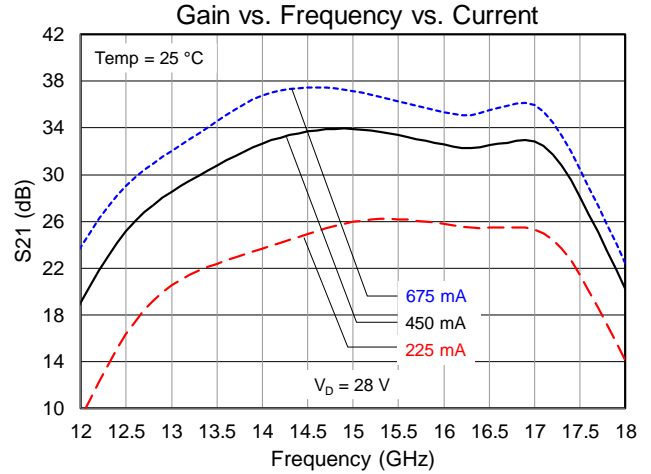
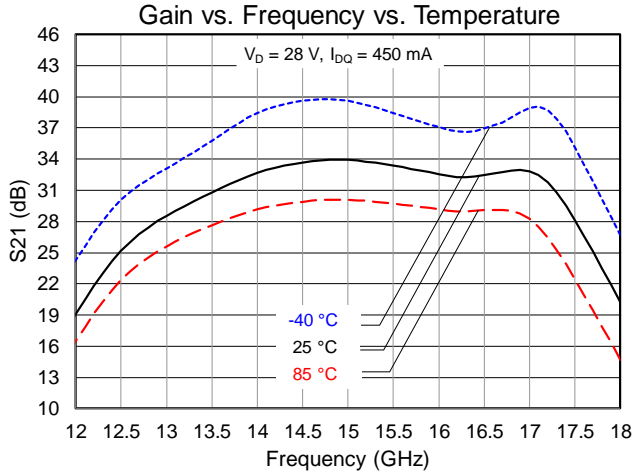
### Recommended Operating Conditions

Parameter	Min	Typ.	Max	Units
Drain Voltage ( $V_D$ )		+28		V
Drain Current, ( $I_{DQ}$ )		450		mA
Temperature Range	-40		+85	°C

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

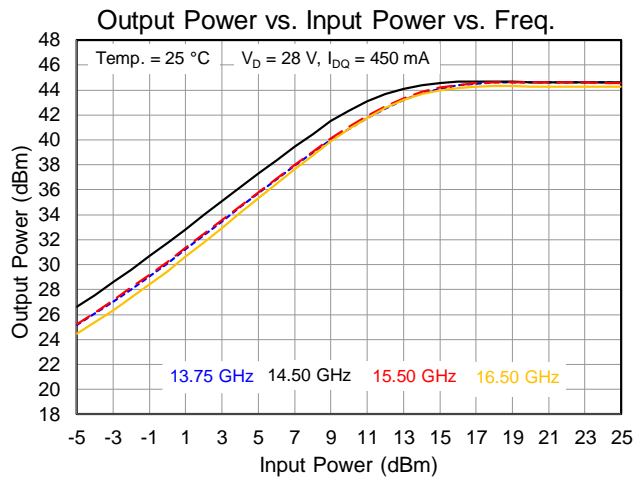
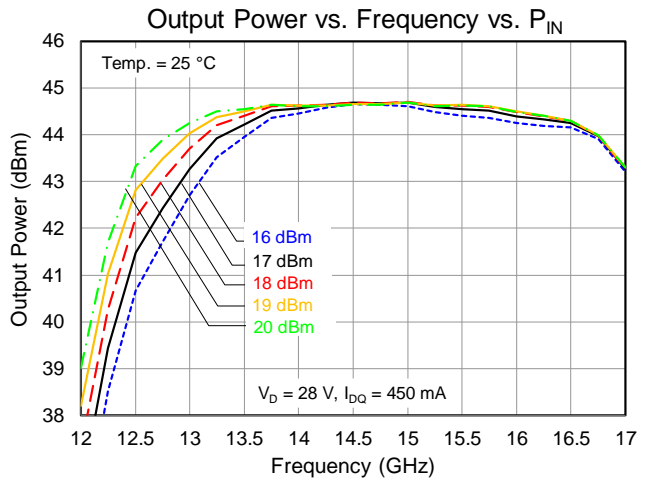
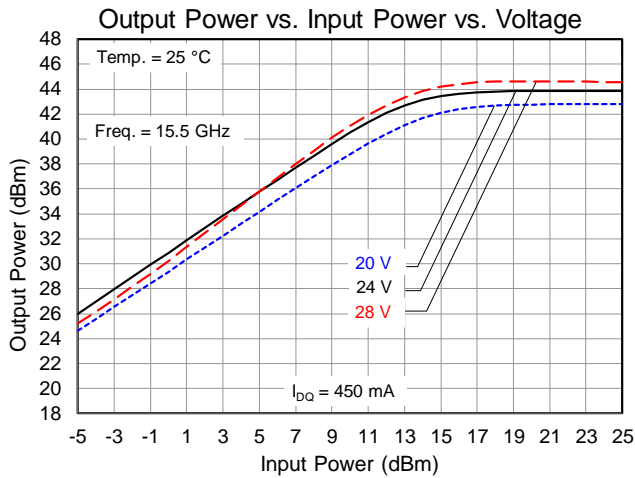
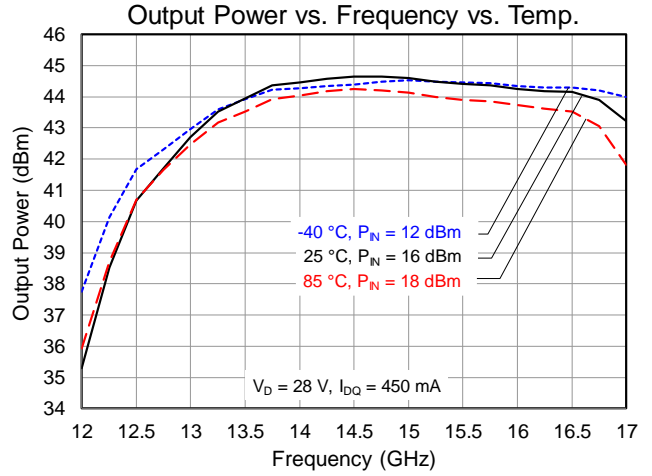
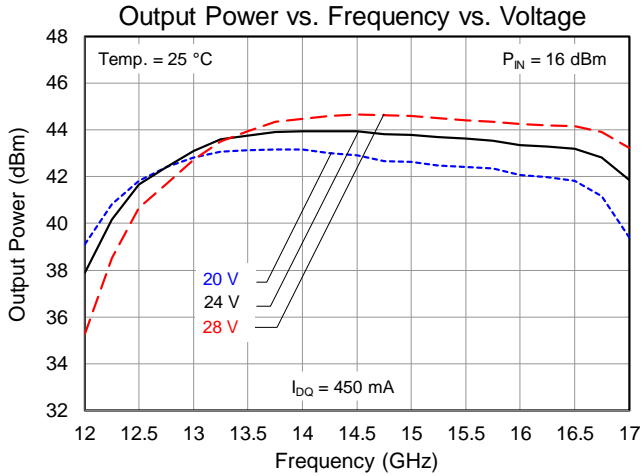
### Performance Plots – Small Signal

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



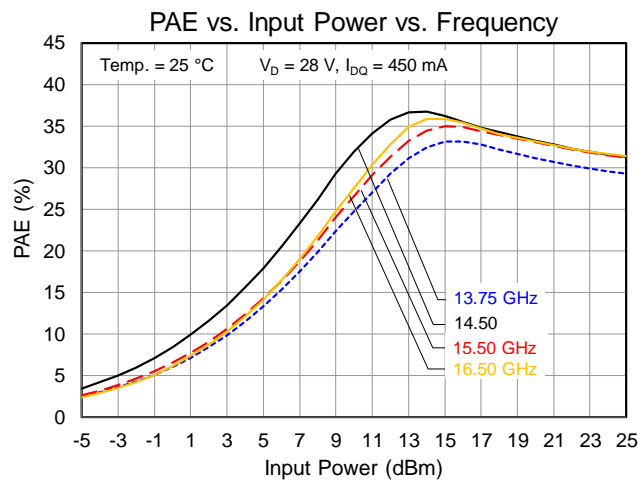
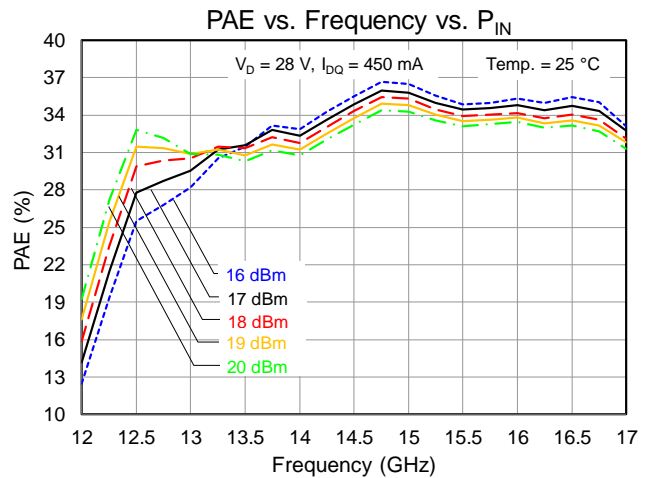
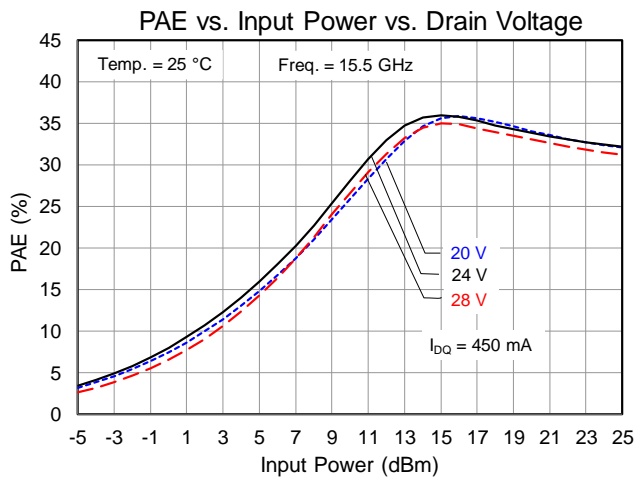
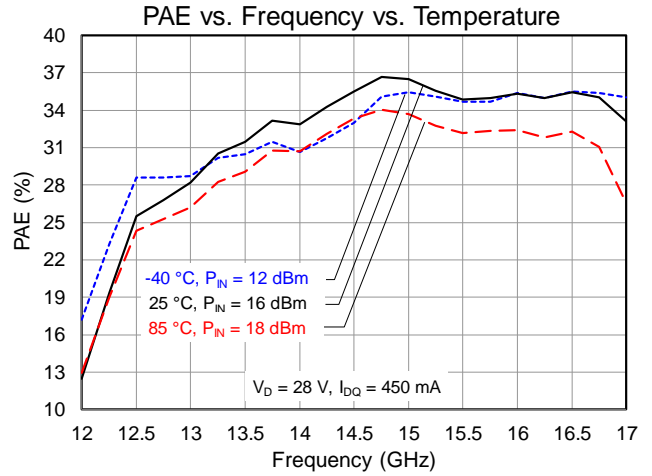
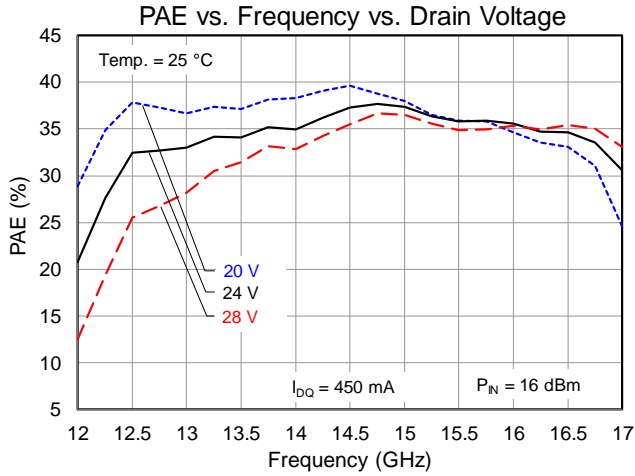
### Performance Plots – Large Signal

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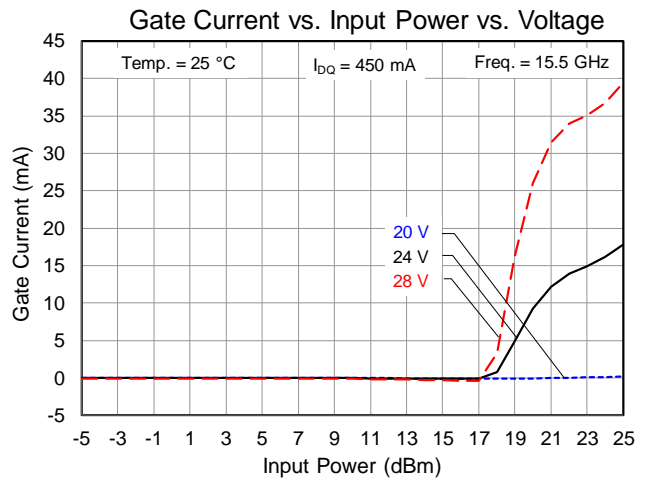
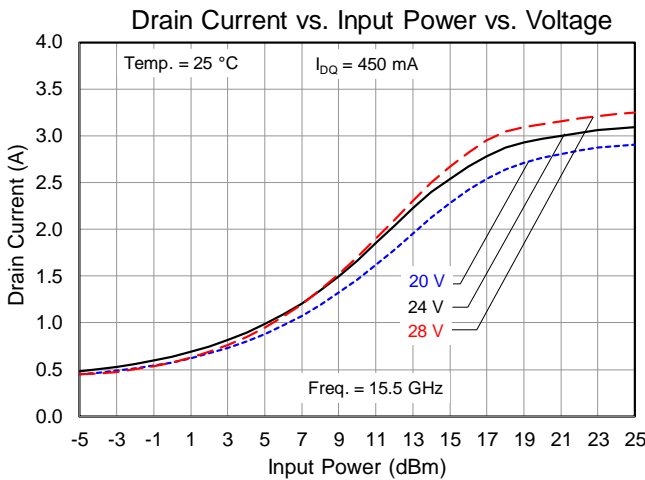
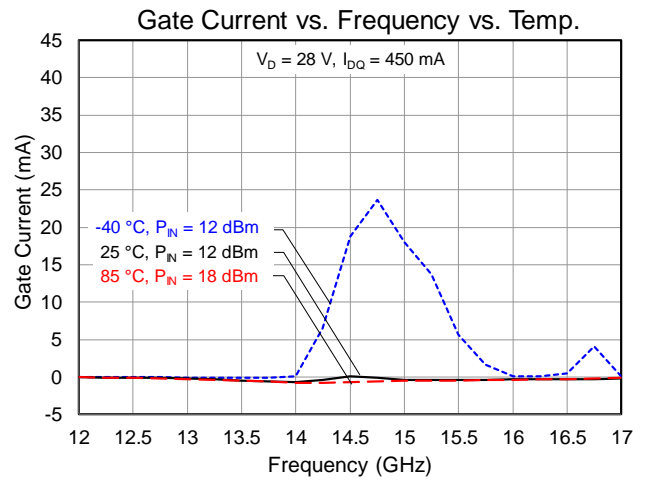
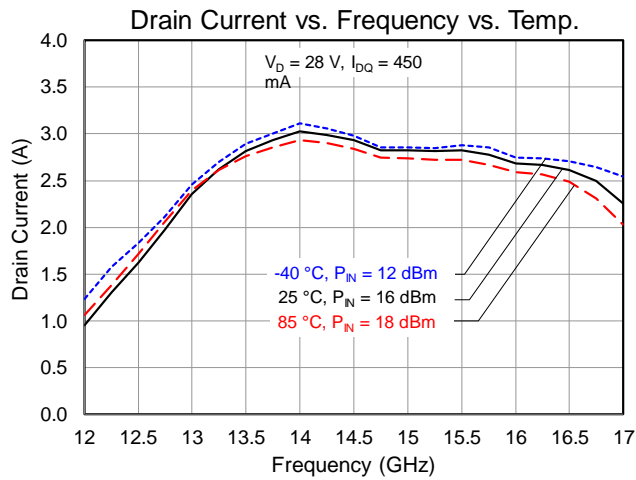
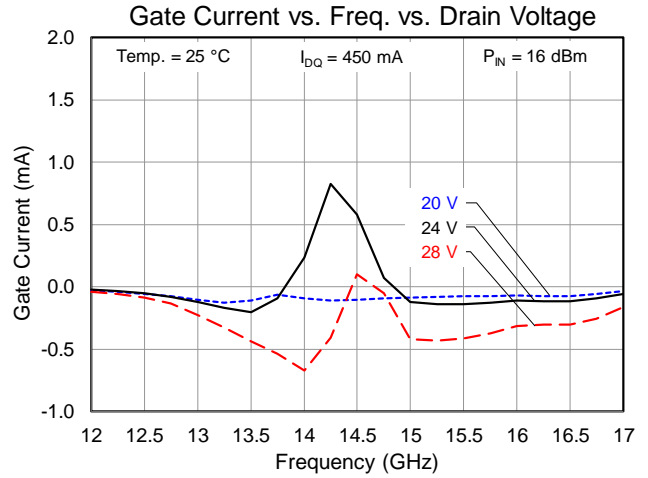
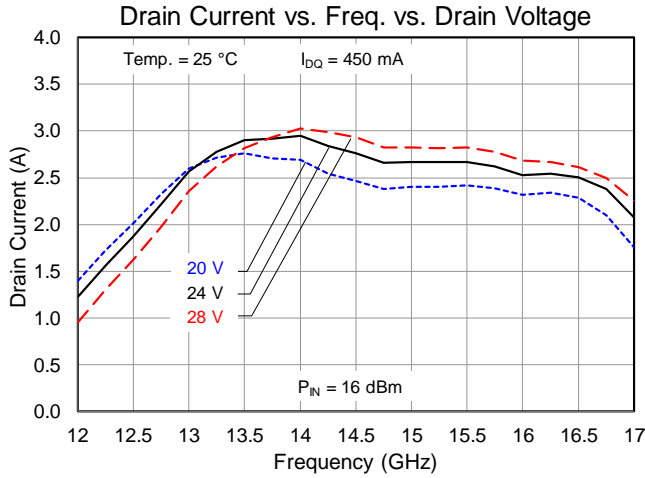
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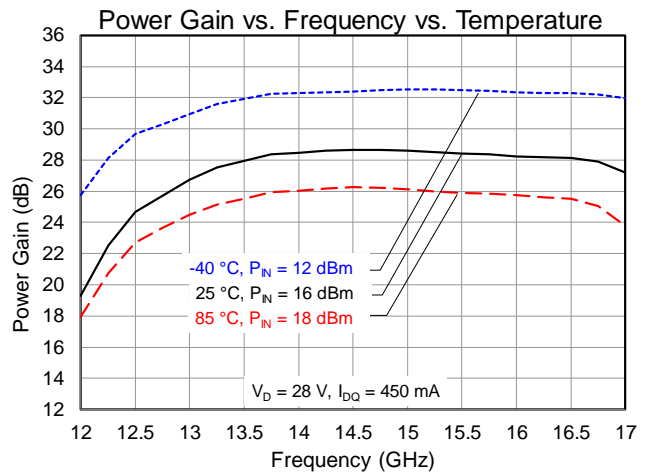
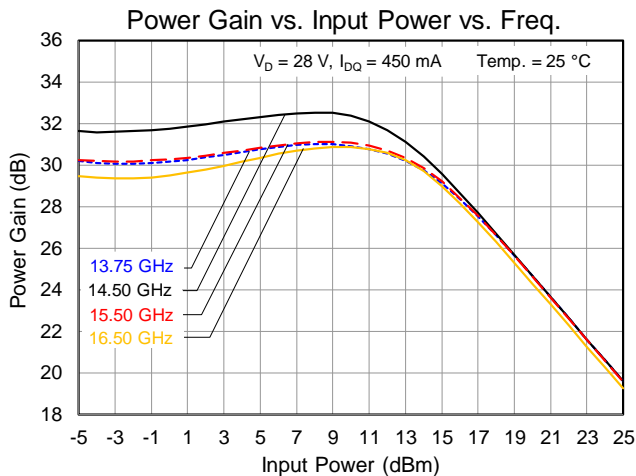
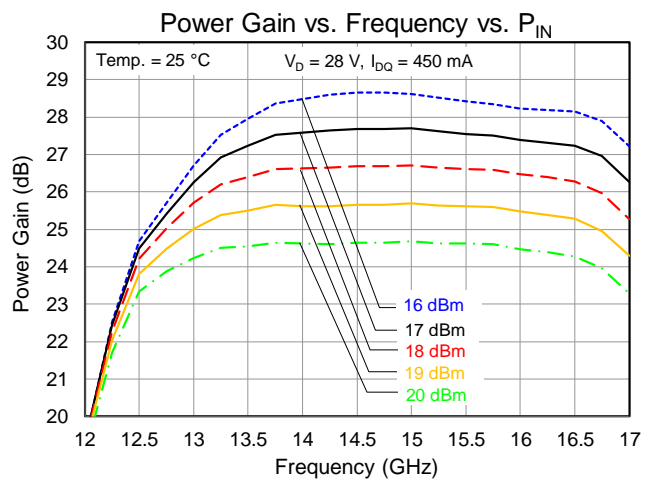
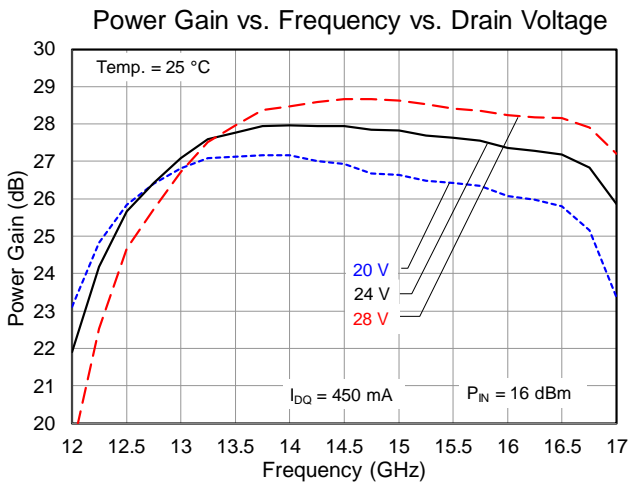
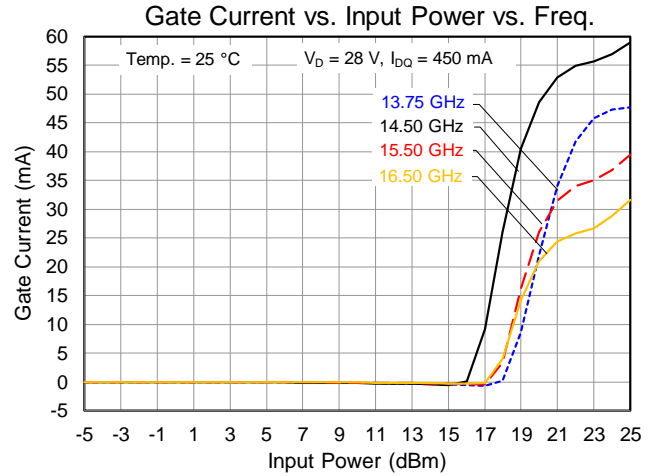
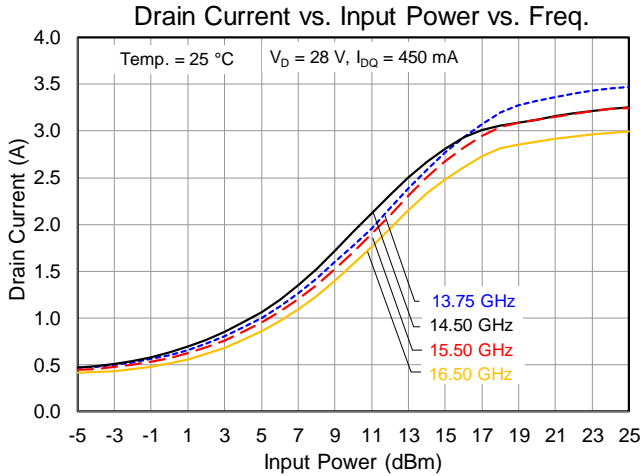
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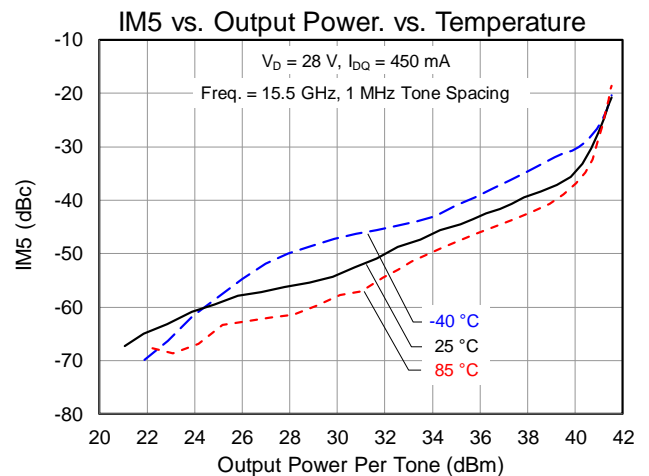
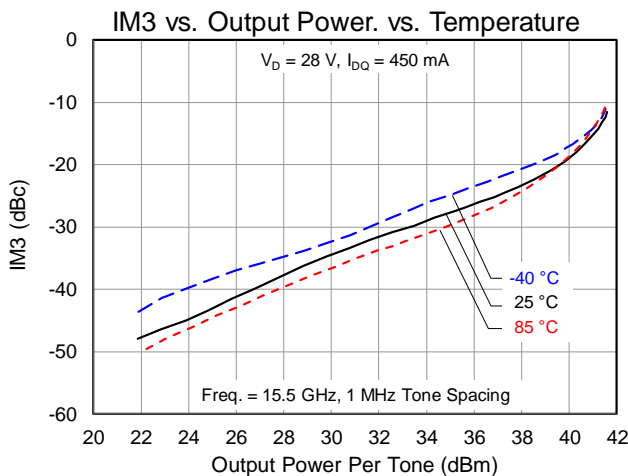
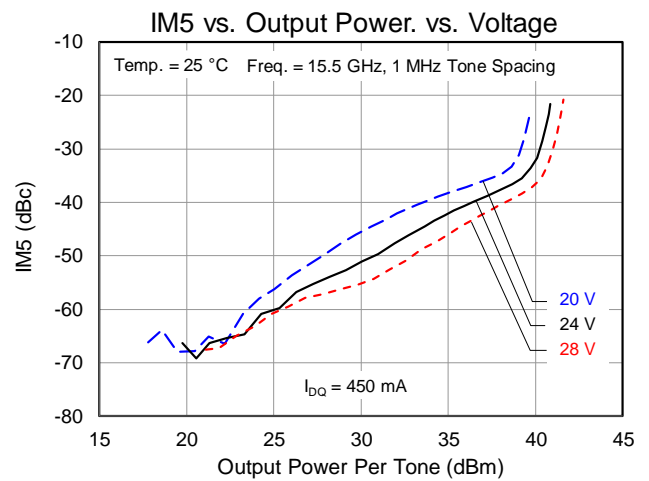
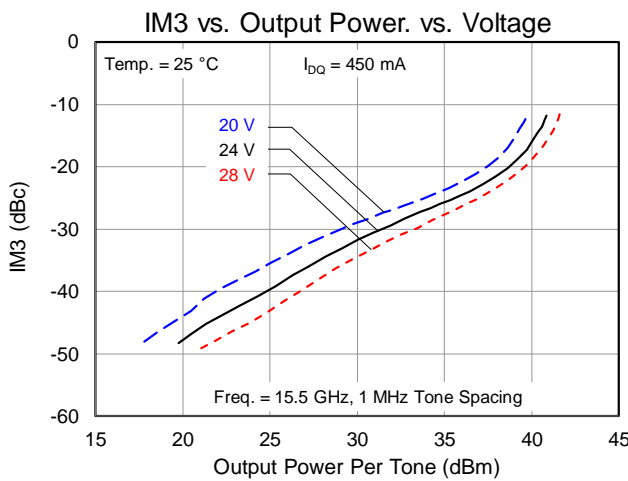
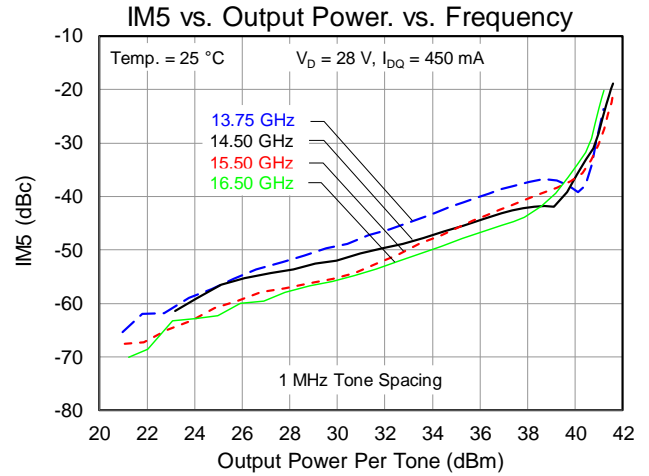
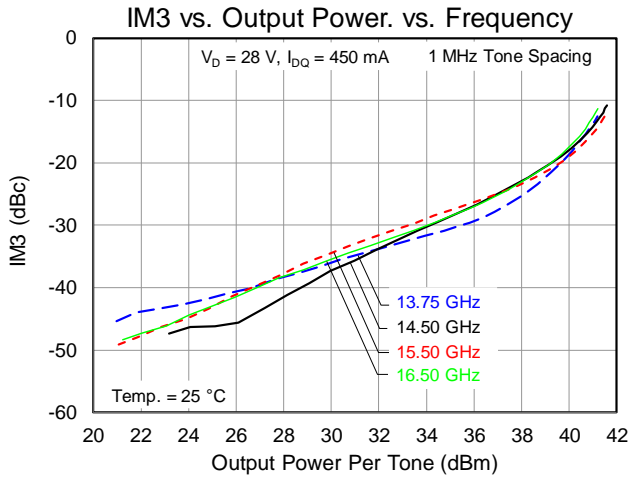
### Performance Plots – Large Signal

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



### Performance Plots – Linearity

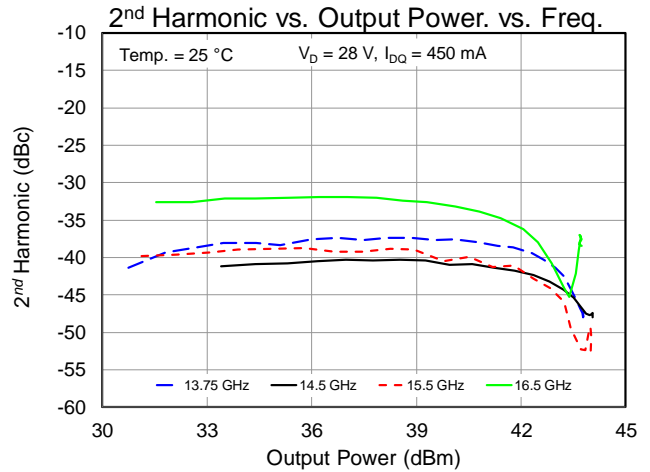
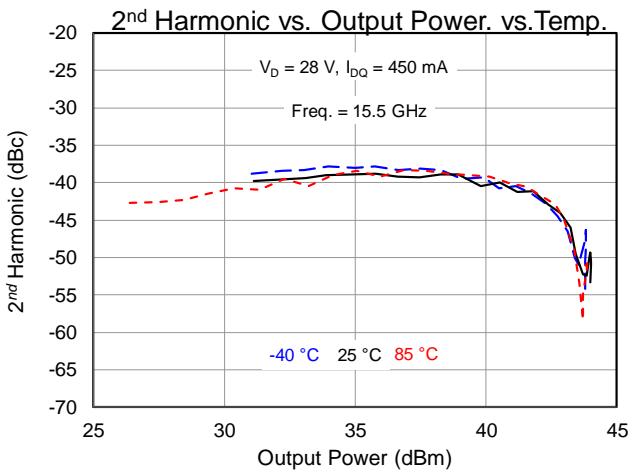
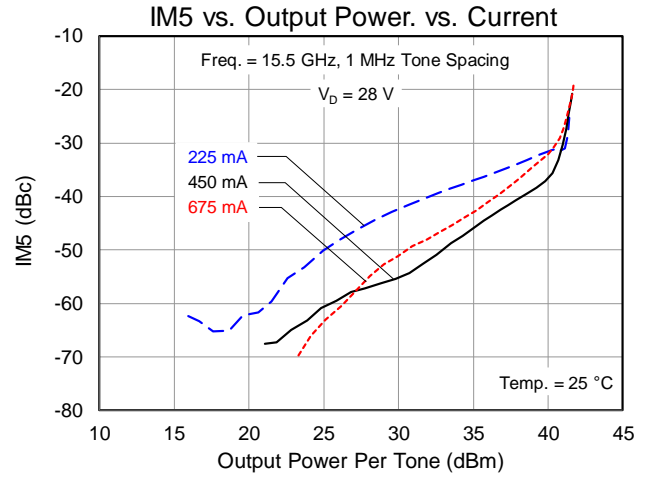
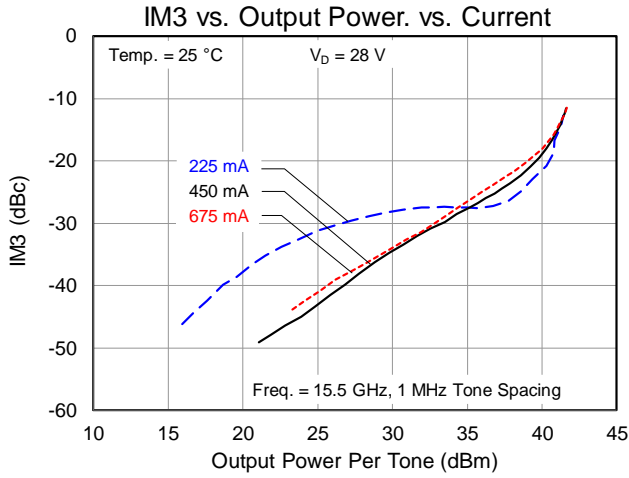
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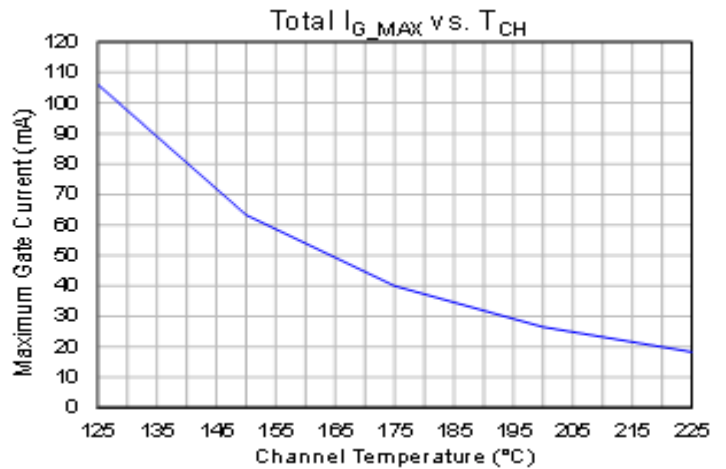
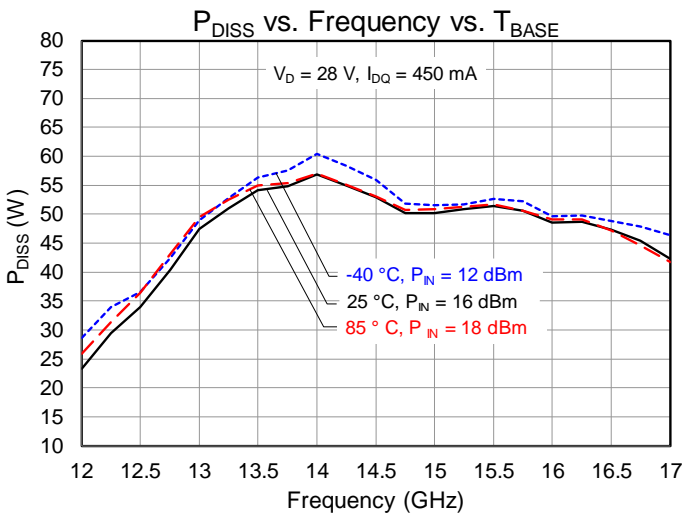
### Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup>	$T_{base} = 85\text{ }^{\circ}\text{C}$ , $V_D = 28\text{ V}$ , $I_{DQ} = 450\text{ mA}$ , $P_{DISS} = 12.8\text{ W}$ , CW, No RF (quiescent DC operation)	1.56	$^{\circ}\text{C/W}$
Channel Temperature, $T_{CH}$ (No RF) <sup>(2)</sup>		105	$^{\circ}\text{C}$
Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup>	$T_{base} = 85\text{ }^{\circ}\text{C}$ , $V_D = 28\text{ V}$ , $I_{DQ} = 450\text{ mA}$ , CW Freq = 14 GHz, $I_{D\_Drive} = 2.9\text{ A}$ , $P_{IN} = 18\text{ dBm}$ , $P_{OUT} = 44\text{ dBm}$ , $P_{DISS} = 57\text{ W}$	1.54	$^{\circ}\text{C/W}$
Channel Temperature, $T_{CH}$ (Under RF) <sup>(2)</sup>		173	$^{\circ}\text{C}$

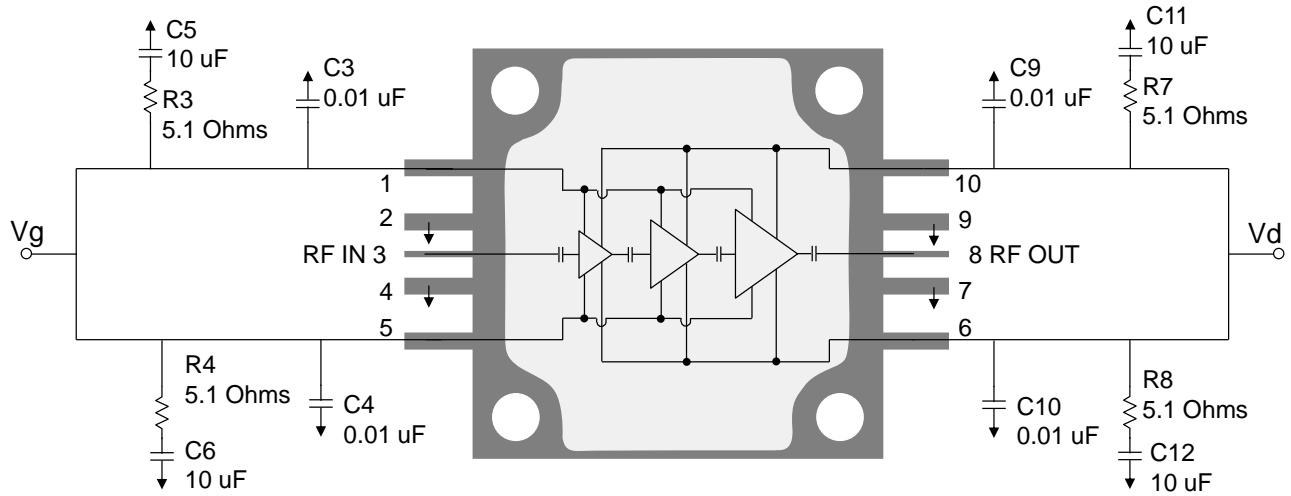
Notes:

1. Thermal resistance is referenced to the back of package ( $85\text{ }^{\circ}\text{C}$ )
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  $-5\text{ V}$  to  $V_G$
3. Apply  $+28\text{ V}$  to  $V_D$ ; ensure  $I_{DQ}$  is approx. 0 mA
4. Adjust  $V_G$  until  $I_{DQ} = 450\text{ mA}$  ( $V_G \sim -2.7\text{ V Typ.}$ ).
5. Turn on RF supply

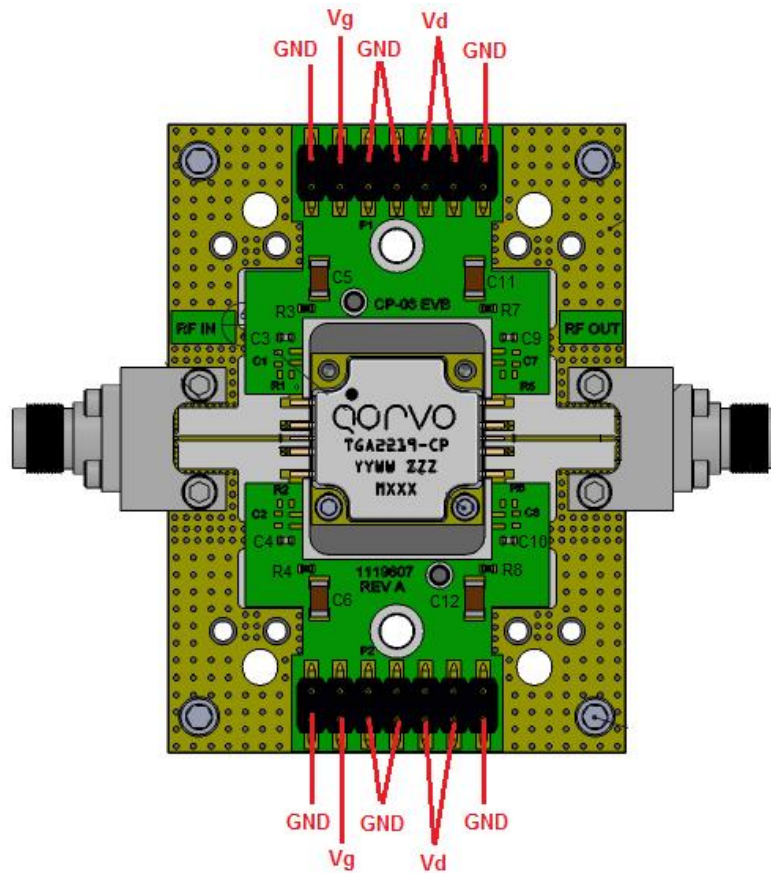
### Bias Down Procedure

1. Turn off RF supply
2. Reduce  $V_G$  to  $-5\text{ V}$ ; 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 $50\ \Omega$ ; 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 $50\ \Omega$ ; 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

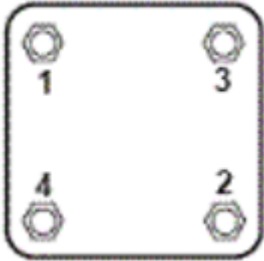
### Bill of Materials

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

### Assembly Notes

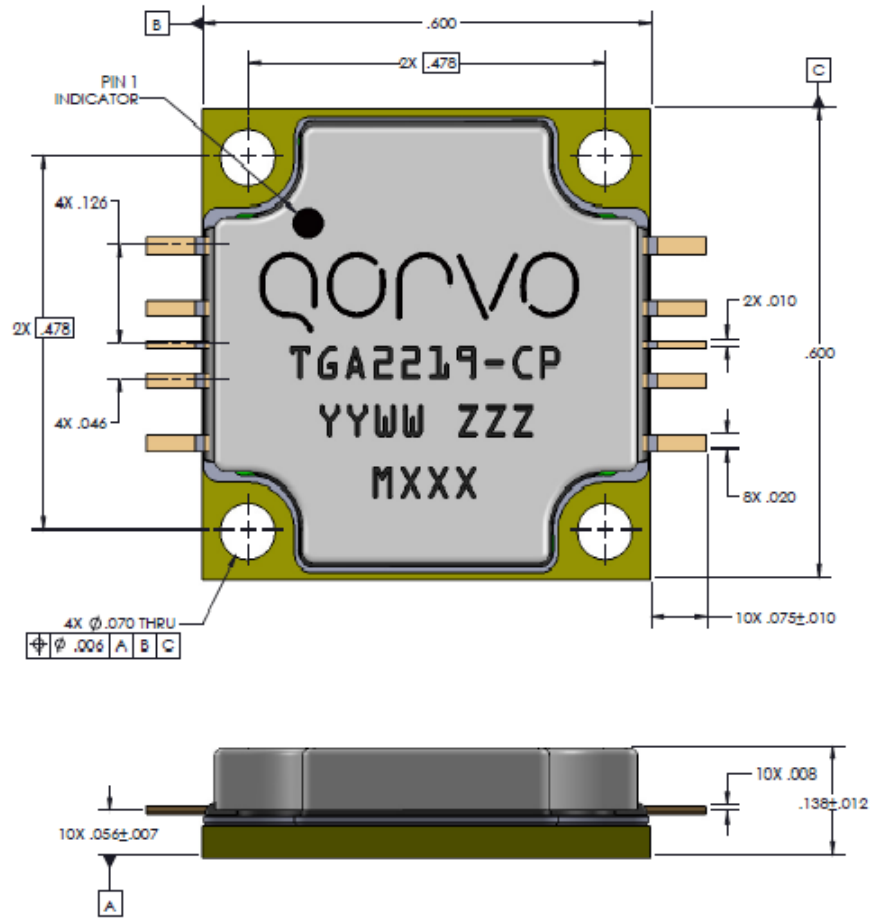
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1. Carefully clean the PC board and package leads with alcohol. Allow it to dry fully.
2. To improve the thermal and RF performance, Qorvo recommends attaching a heat sink to the bottom of the PCB and apply thermal compound (Arctic Silver 5 recommended) 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 =  $\pm 0.01$

x.xxx =  $\pm 0.005$

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