

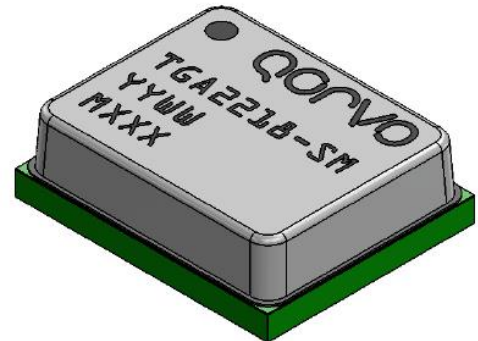
### Product Overview

Qorvo's TGA2218-SM is a packaged Ku-band, high power MMIC amplifier fabricated on Qorvo's production 0.15  $\mu\text{m}$  GaN on SiC process. The TGA2218-SM operates from 13.4–16.5 GHz and provides greater than 12 W of saturated output power with 23 dB of large signal gain and greater than 29% power-added efficiency.

This high performance combination provides system designers the flexibility to improve system performance while reducing size and cost.

The TGA2218-SM is fully matched to 50 Ohms with integrated DC blocking capacitors on the RF ports simplifying system integration. It is ideally suited for military and commercial Ku-band radar and satellite communication systems.

Lead-free and RoHS compliant.



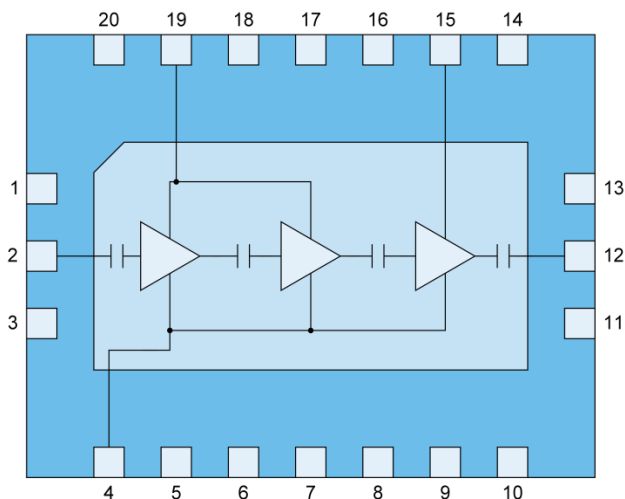
### Key Features

- Frequency Range: 13.4–16.5 GHz
- $P_{\text{SAT}} > 41 \text{ dBm}$  ( $P_{\text{IN}} = 18 \text{ dBm}$ )
- PAE:  $> 29\%$  ( $P_{\text{IN}} = 18 \text{ dBm}$ )
- Large Signal Gain:  $> 23 \text{ dB}$
- Small Signal Gain:  $> 28 \text{ dB}$
- Bias:  $V_{\text{D}} = 28 \text{ V}$ ,  $I_{\text{DQ}} = 225 \text{ mA}$ ,  $V_{\text{G}} = -2.6 \text{ V}$  Typical
- Package Dimensions: 5.50 x 4.50 x 1.67 mm

### Applications

- Satellite Communications
- Data Link
- Radar

### Functional Block Diagram



### Ordering Information

Part No.	Description
TGA2218-SM	13.4–16.5 GHz 12 W GaN Power Amplifier
TGA2218-SM EVB	Evaluation Board

### Absolute Maximum Ratings

Parameter	Value/Range
Drain Voltage ( $V_D$ )	29.5 V
Gate Voltage Range ( $V_G$ )	-8 to 0 V
Drain Current ( $I_{D12}$ )	1.15 A
Drain Current ( $I_{D3}$ )	1.03 A
Gate Current	See plot on page 3
Power Dissipation ( $P_{DISS}$ ), 85 °C, CW	35 W
Input Power ( $P_{IN}$ ), CW, 50 $\Omega$ , $V_D = 28$ V, $I_{DQ} = 225$ mA, 85 °C	30 dBm
Input Power ( $P_{IN}$ ), CW, VSWR 3:1, $V_D = 28$ V, $I_{DQ} = 225$ mA, 85 °C	27 dBm
Mounting Temperature (30 seconds)	260 °C
Storage Temperature	-40°C 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/Range
Drain Voltage ( $V_D$ )	28 V
Drain Current ( $I_{DQ}$ )	225 mA (Total)
Gate Voltage ( $V_G$ )	-2.6 V (Typ.)

### Electrical Specifications

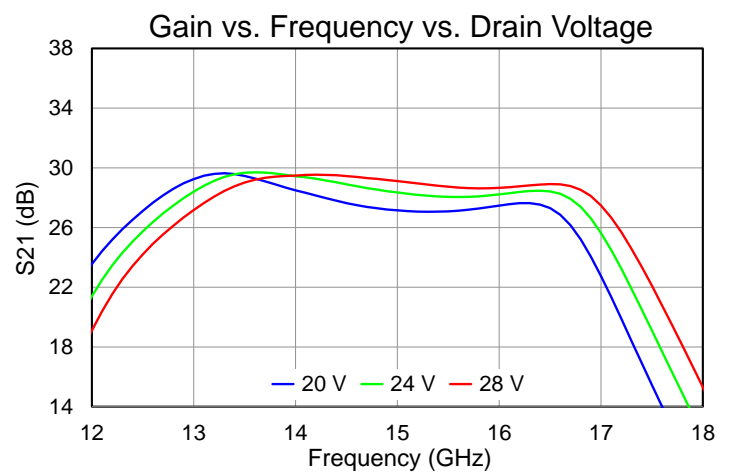
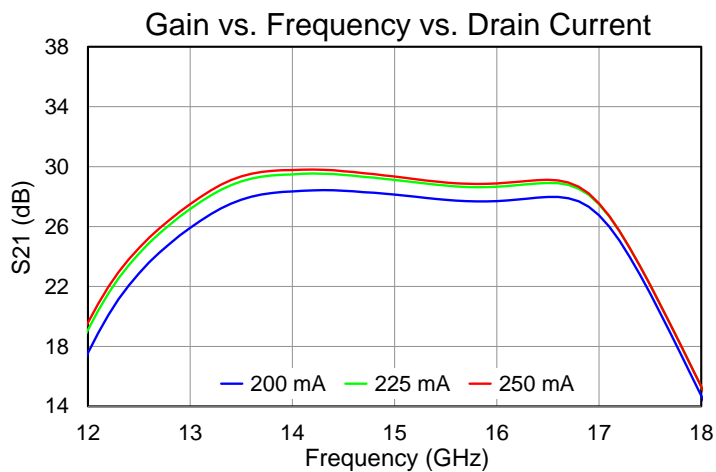
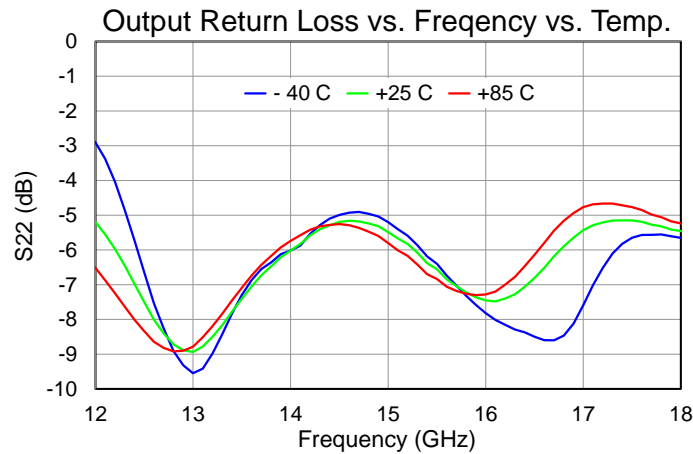
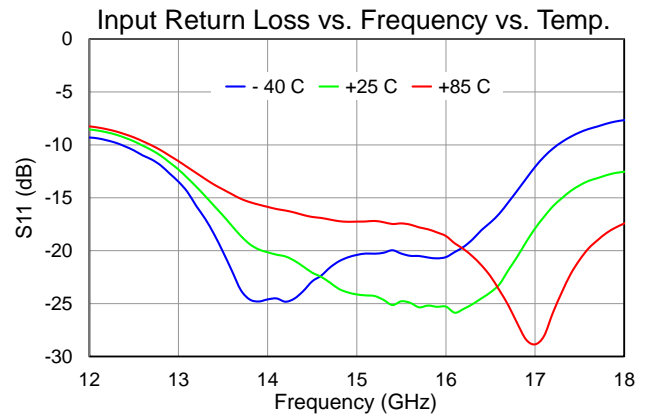
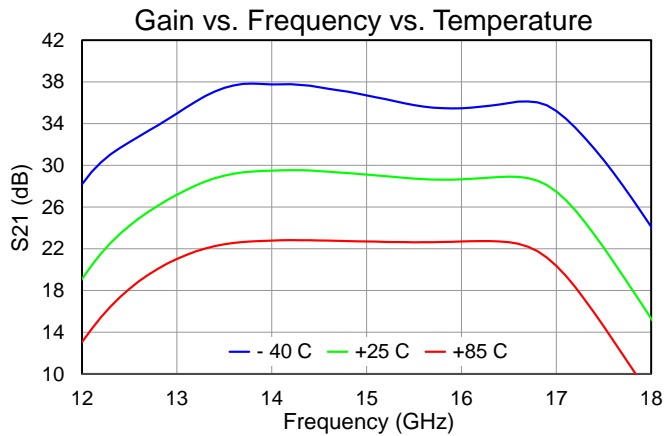
Test conditions unless otherwise noted: 25 °C,  $V_D = 28$  V,  $I_{DQ} = 225$  mA,  $V_G = -2.6$  V Typical, CW

Parameter	Min	Type	Max	Units
Operational Frequency Range	13.4		16.5	GHz
Small Signal Gain		> 28		dB
Input Return Loss		> 15		dB
Output Return Loss		> 5		dB
Power Gain ( $P_{IN} = 18$ dBm)		> 23		dB
Output Power ( $P_{IN} = 18$ dBm)		> 41		dBm
Power Added Efficiency ( $P_{IN} = 18$ dBm)		> 29		%
Small Signal Gain Temperature Coefficient		-0.11		dB/°C
Output Power Temperature Coefficient (Temp: 25 °C – 85 °C @ $P_{IN} = 18$ dBm)		-0.01		dB/°C
Recommended Operating Voltage		20 to 28	28	V

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

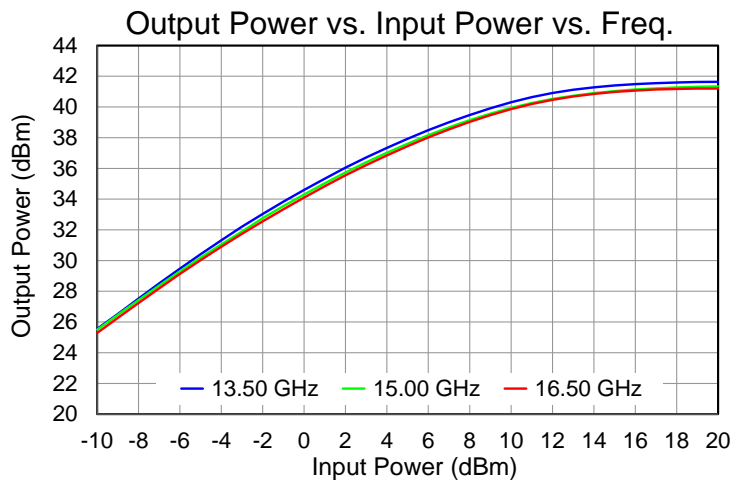
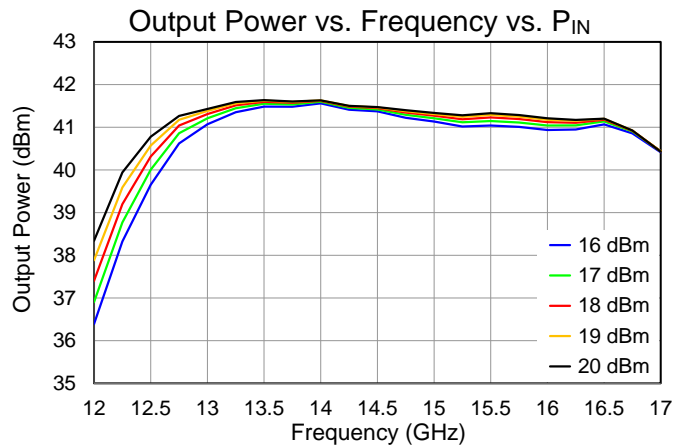
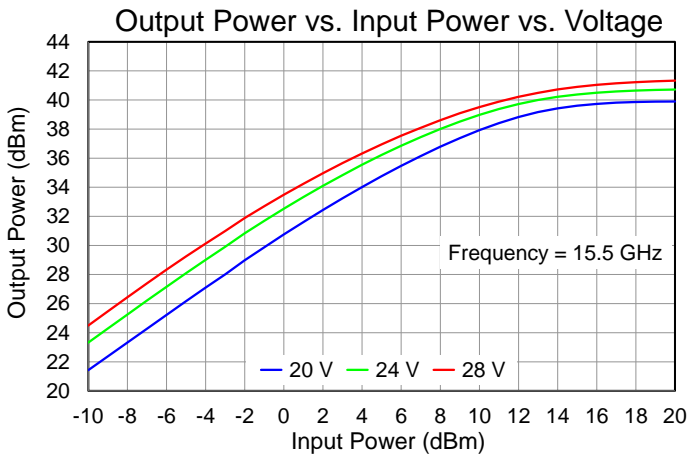
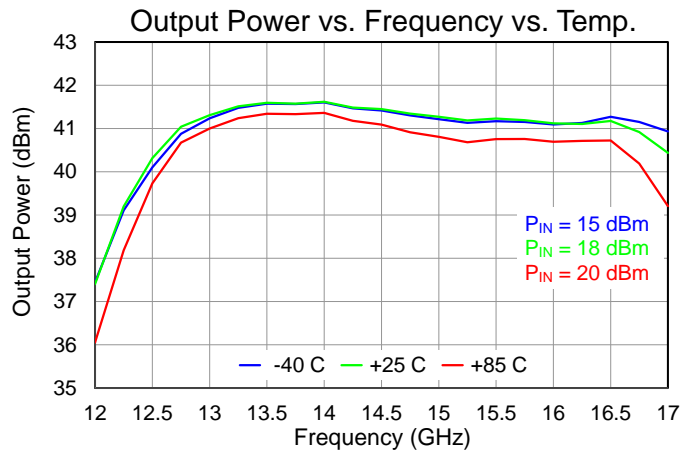
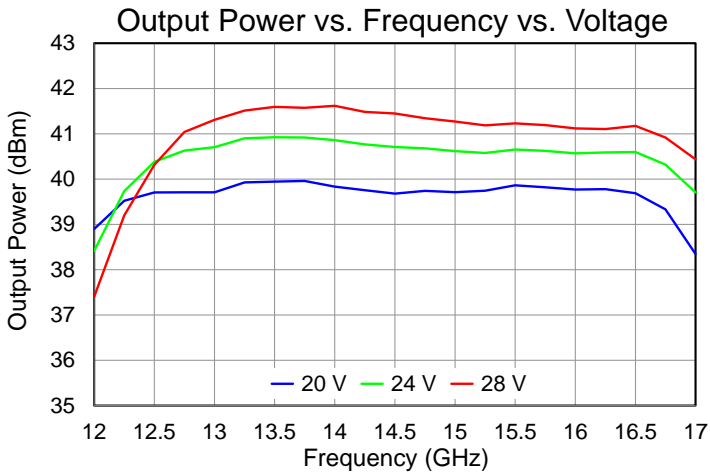
### Typical Performance: Small Signal

Test conditions unless otherwise noted: 25 °C,  $V_D = 28$  V,  $I_{DQ} = 225$  mA, CW



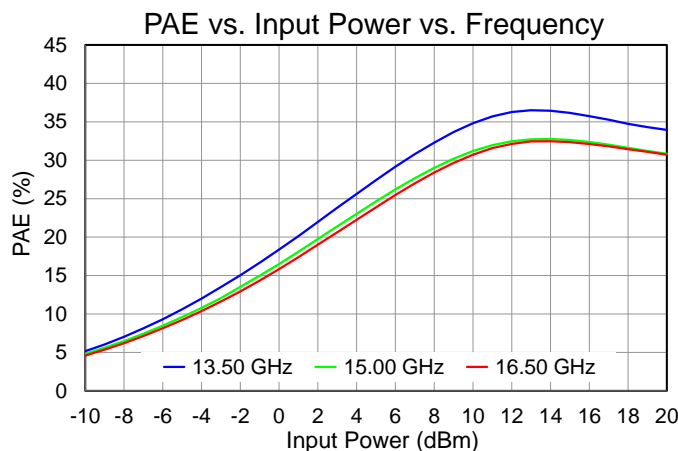
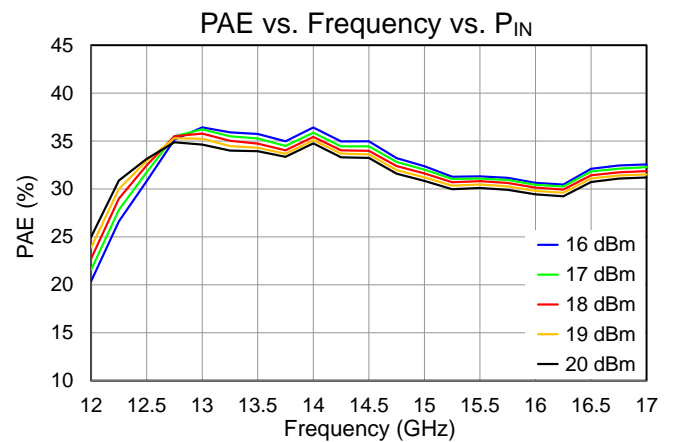
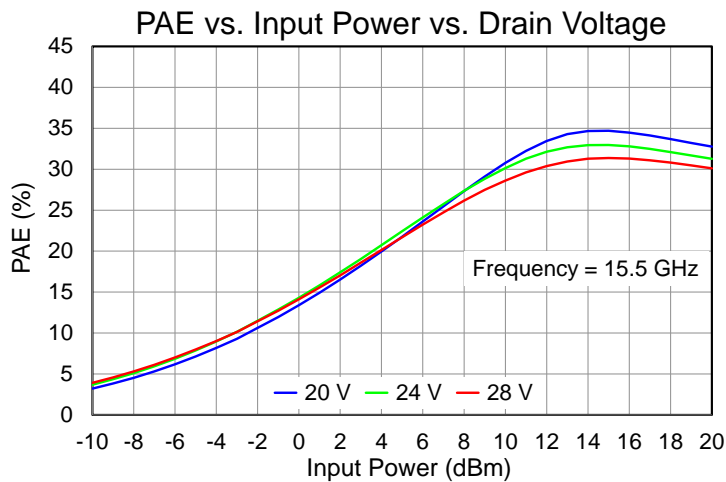
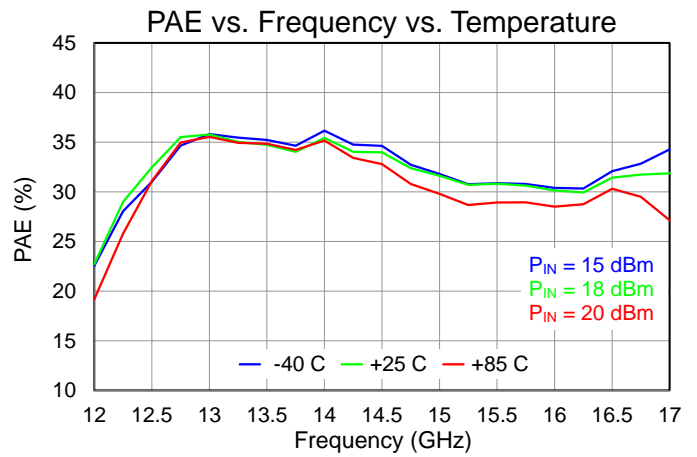
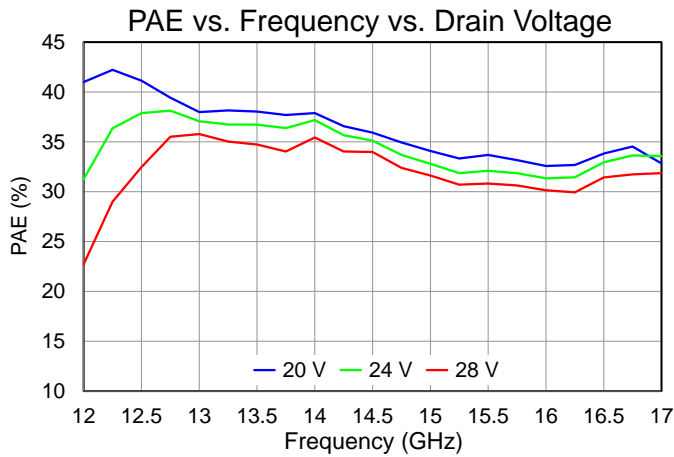
Typical Performance: CW Power Operation

Test conditions unless otherwise noted: 25 °C,  $V_D = 28\text{ V}$ ,  $I_{DQ} = 225\text{ mA}$



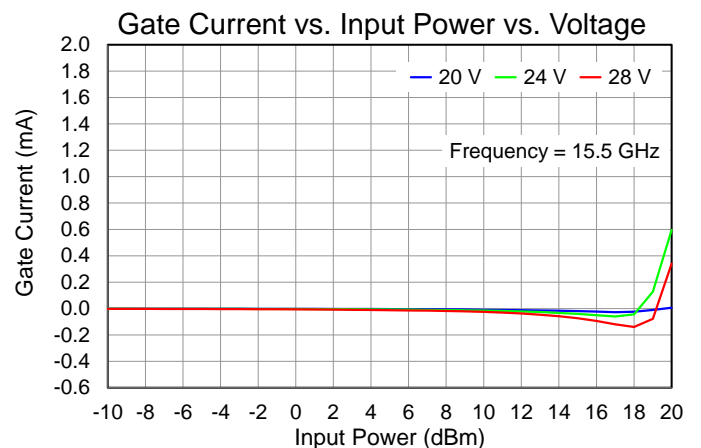
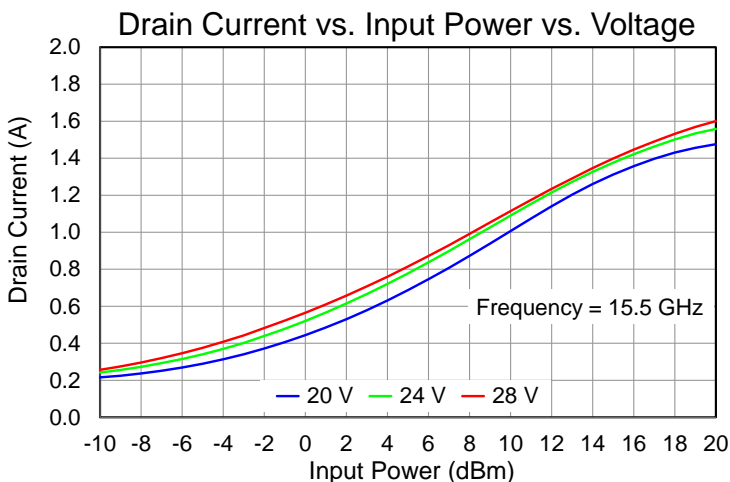
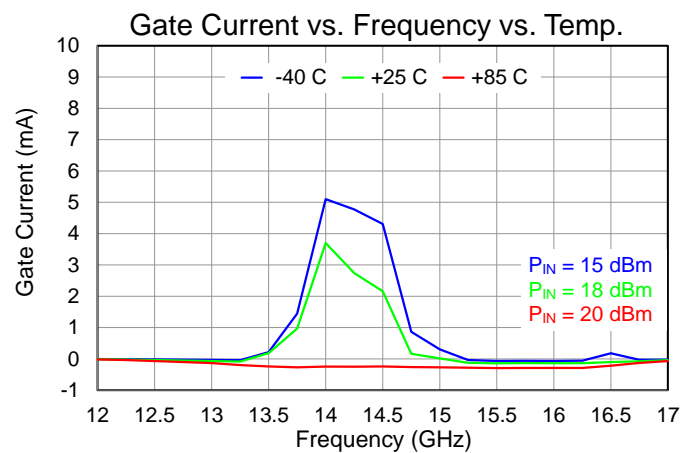
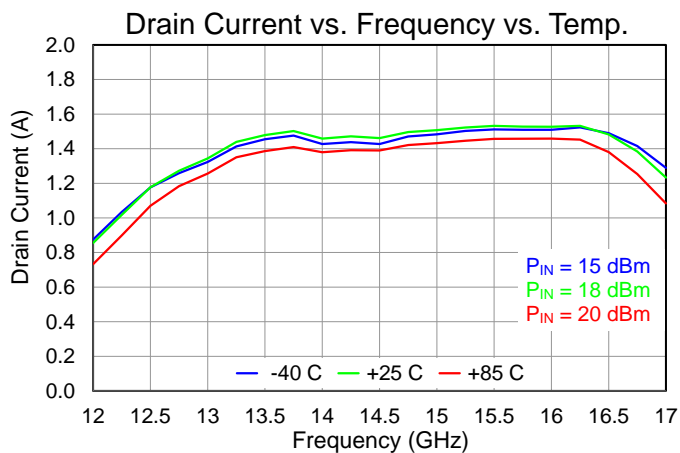
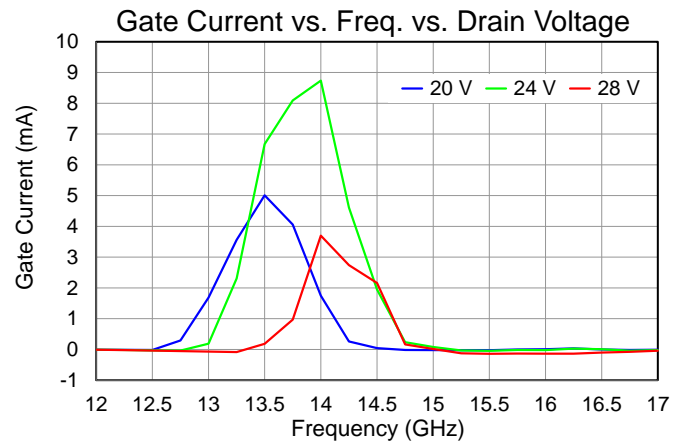
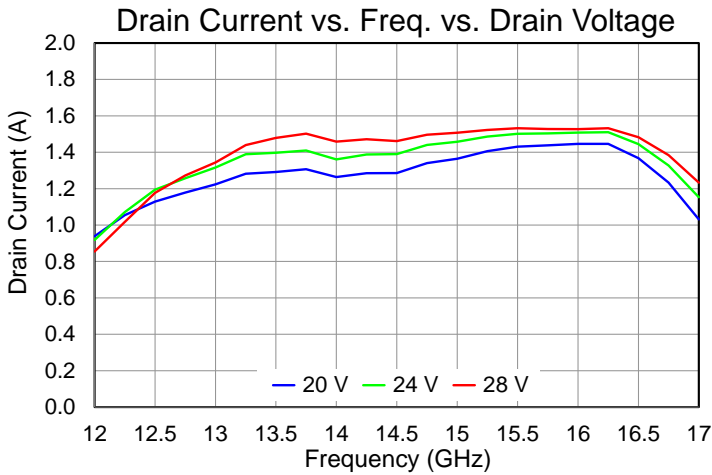
### Typical Performance: CW Power Operation

Test conditions unless otherwise noted: 25 °C,  $V_D = 28$  V,  $I_{DQ} = 225$  mA



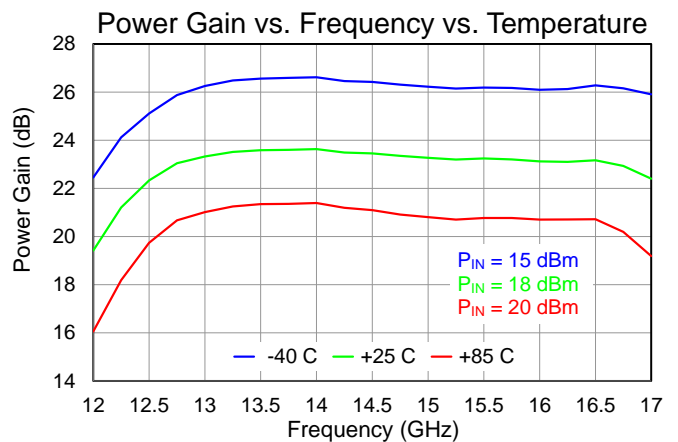
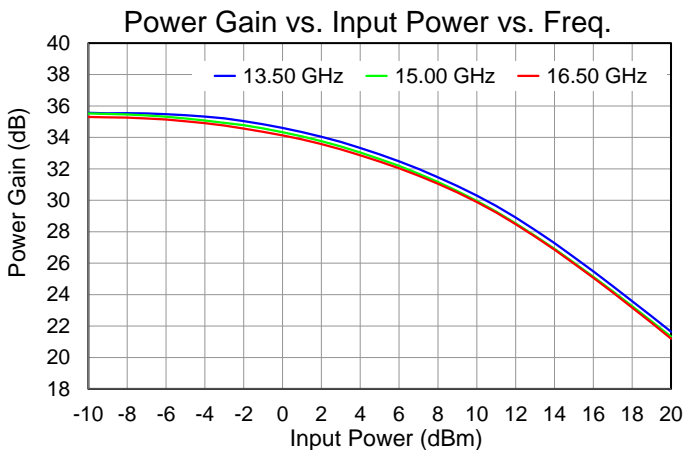
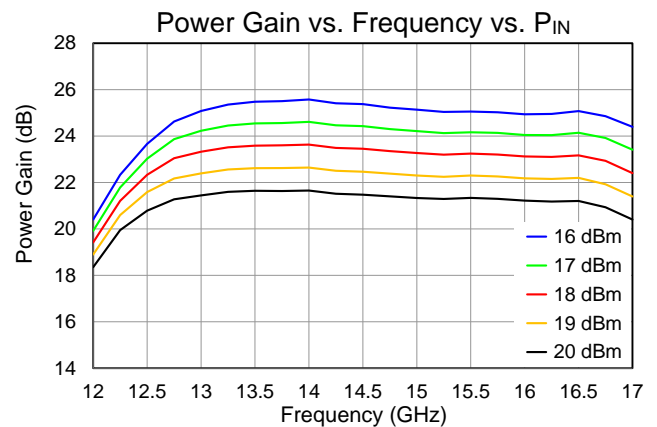
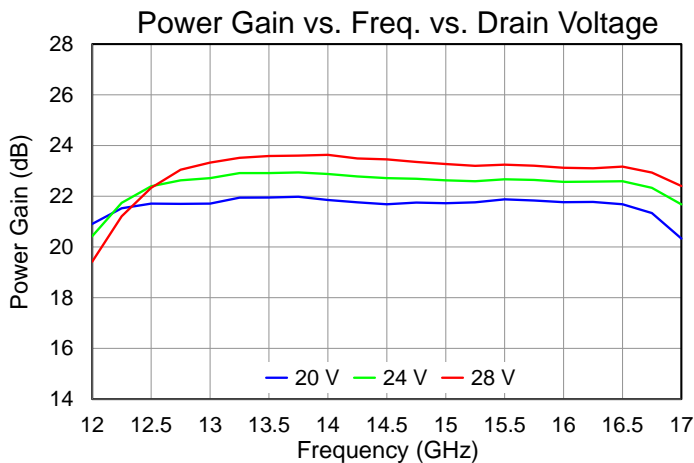
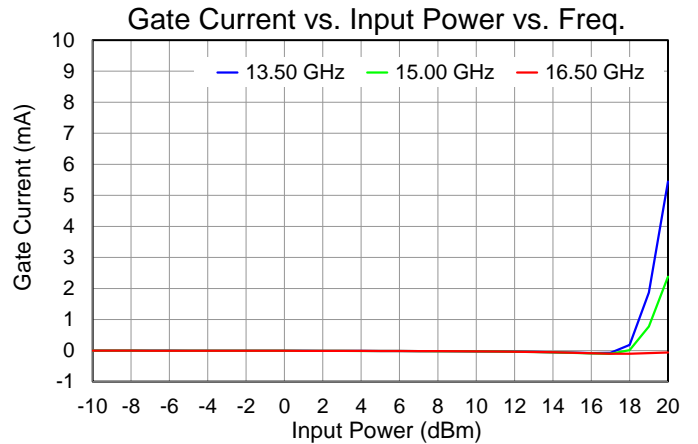
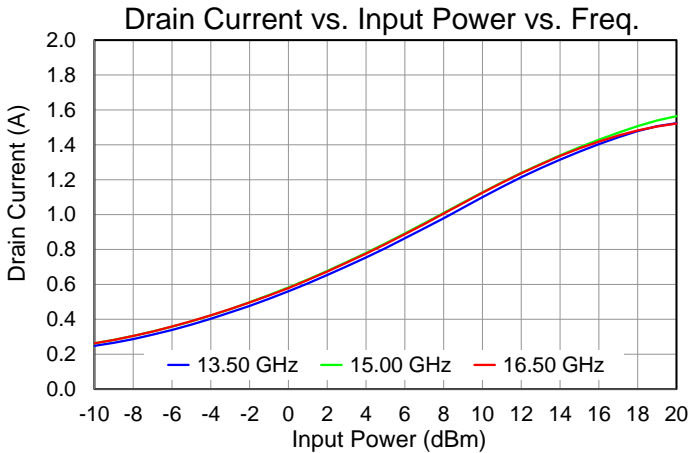
### Typical Performance: CW Power Operation

Test conditions unless otherwise noted: 25 °C,  $V_D = 28$  V,  $I_{DQ} = 225$  mA



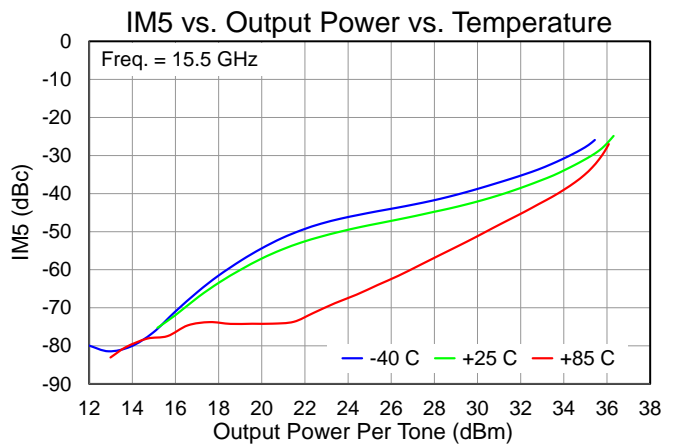
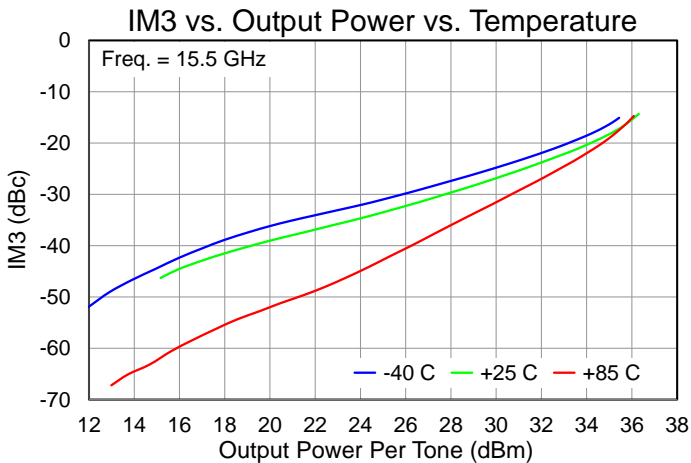
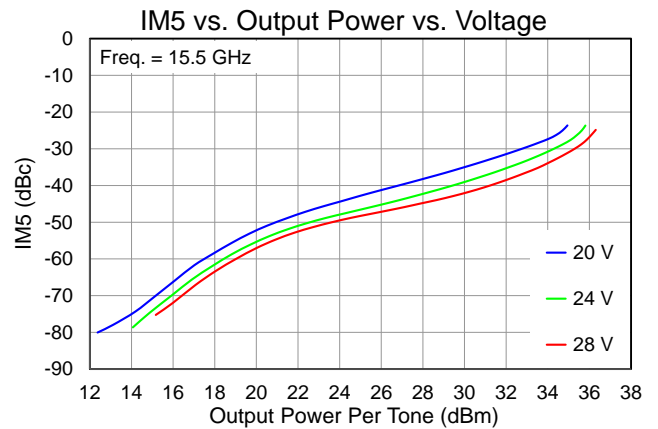
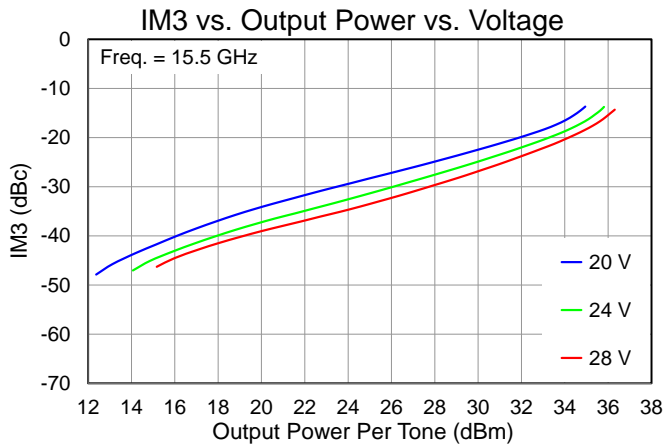
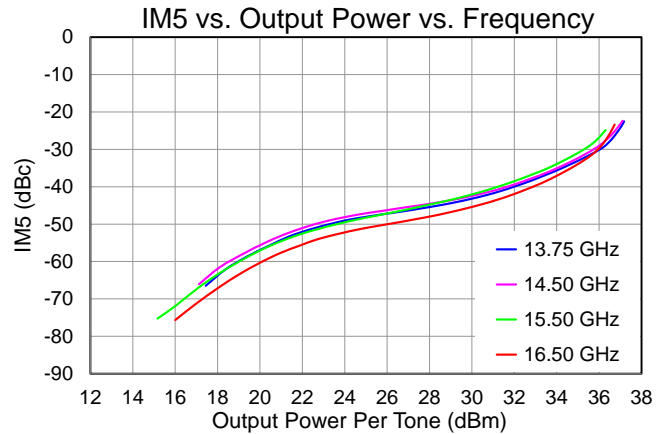
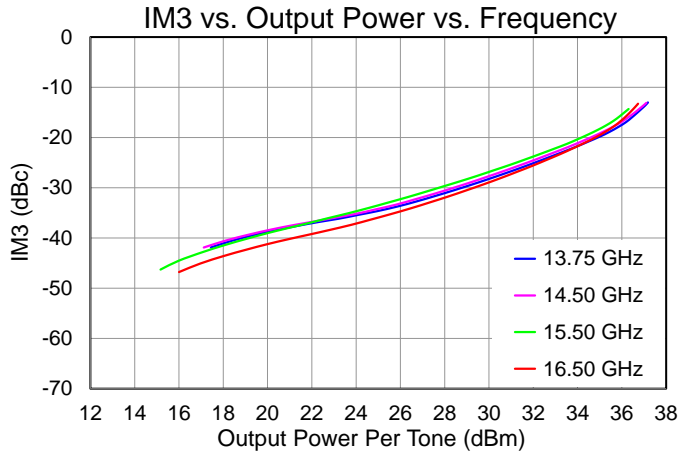
**Typical Performance: CW Power Operation**

Test conditions unless otherwise noted: 25 °C,  $V_D = 28\text{ V}$ ,  $I_{DQ} = 225\text{ mA}$



Typical Performance: Linearity

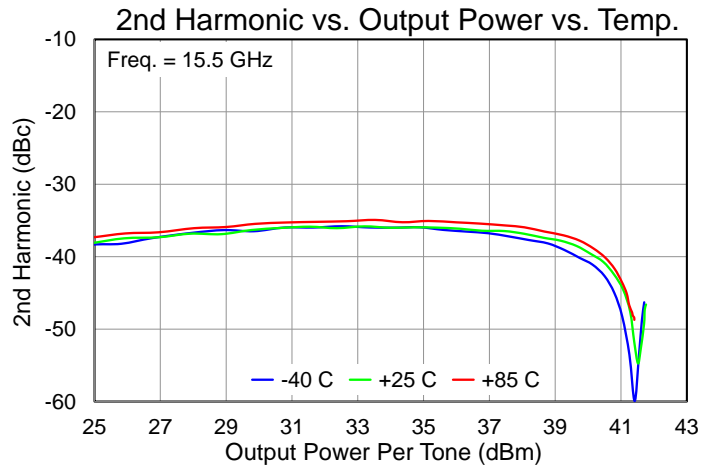
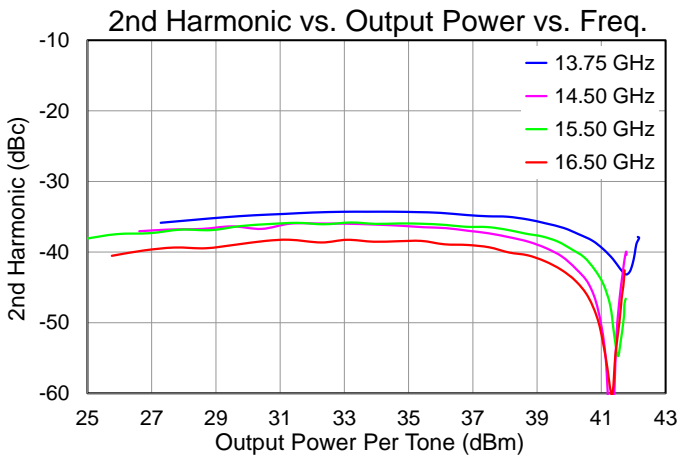
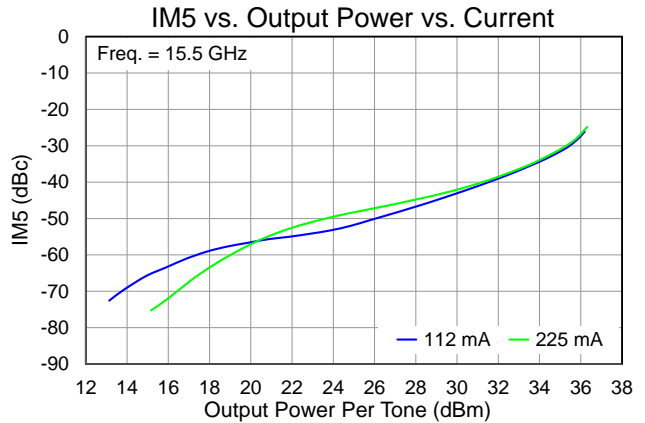
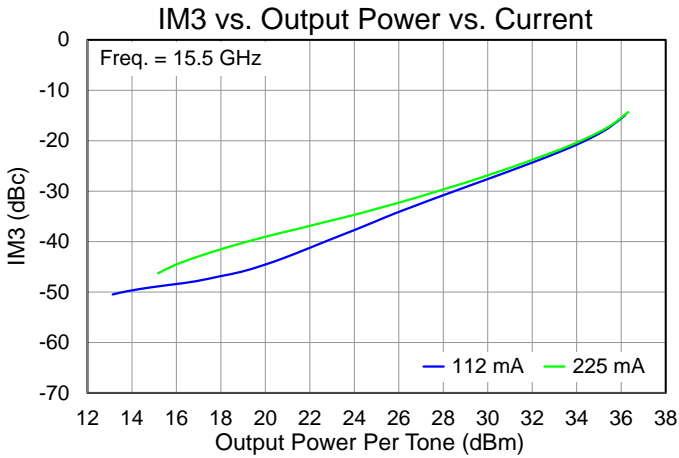
Test conditions unless otherwise noted: 25 °C,  $V_D = 28\text{ V}$ ,  $I_{DQ} = 225\text{ mA}$ , CW, 1 MHz Tone Spacing





### Typical Performance: Linearity

Test conditions unless otherwise noted: 25 °C,  $V_D = 28$  V,  $I_{DQ} = 225$  mA, CW, 1 MHz Tone Spacing



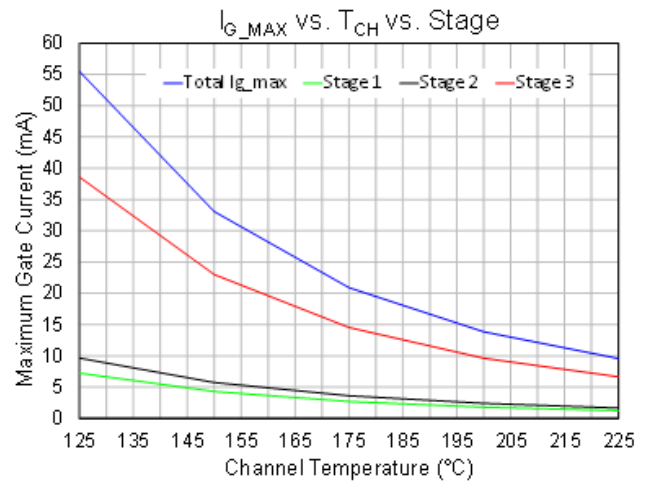
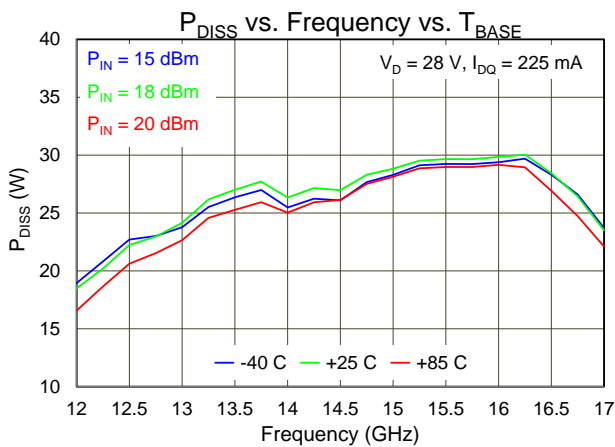
## Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup>	$T_{base} = 85^{\circ}\text{C}$ , $V_D = 28\text{ V}$ , $I_{DQ} = 225\text{ mA}$ $P_{DISS} = 6.3\text{ W}$	2.96	$^{\circ}\text{C/W}$
Channel Temperature ( $T_{CH}$ ) (no RF drive) <sup>(2)</sup>		103.7	$^{\circ}\text{C}$
Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup>	$T_{base} = 85^{\circ}\text{C}$ , CW, $V_D = 28\text{ V}$ , $I_{DQ} = 225\text{ mA}$ Freq = 16 GHz, $I_{D\_Drive} = 1.46\text{ A}$ , $P_{IN} = 20\text{ dBm}$ , $P_{OUT} = 40.7\text{ dBm}$ , $P_{DISS} = 29.16\text{ W}$	2.90	$^{\circ}\text{C/W}$
Channel Temperature ( $T_{CH}$ ) (with RF drive) <sup>(2)</sup>		169.4	$^{\circ}\text{C}$

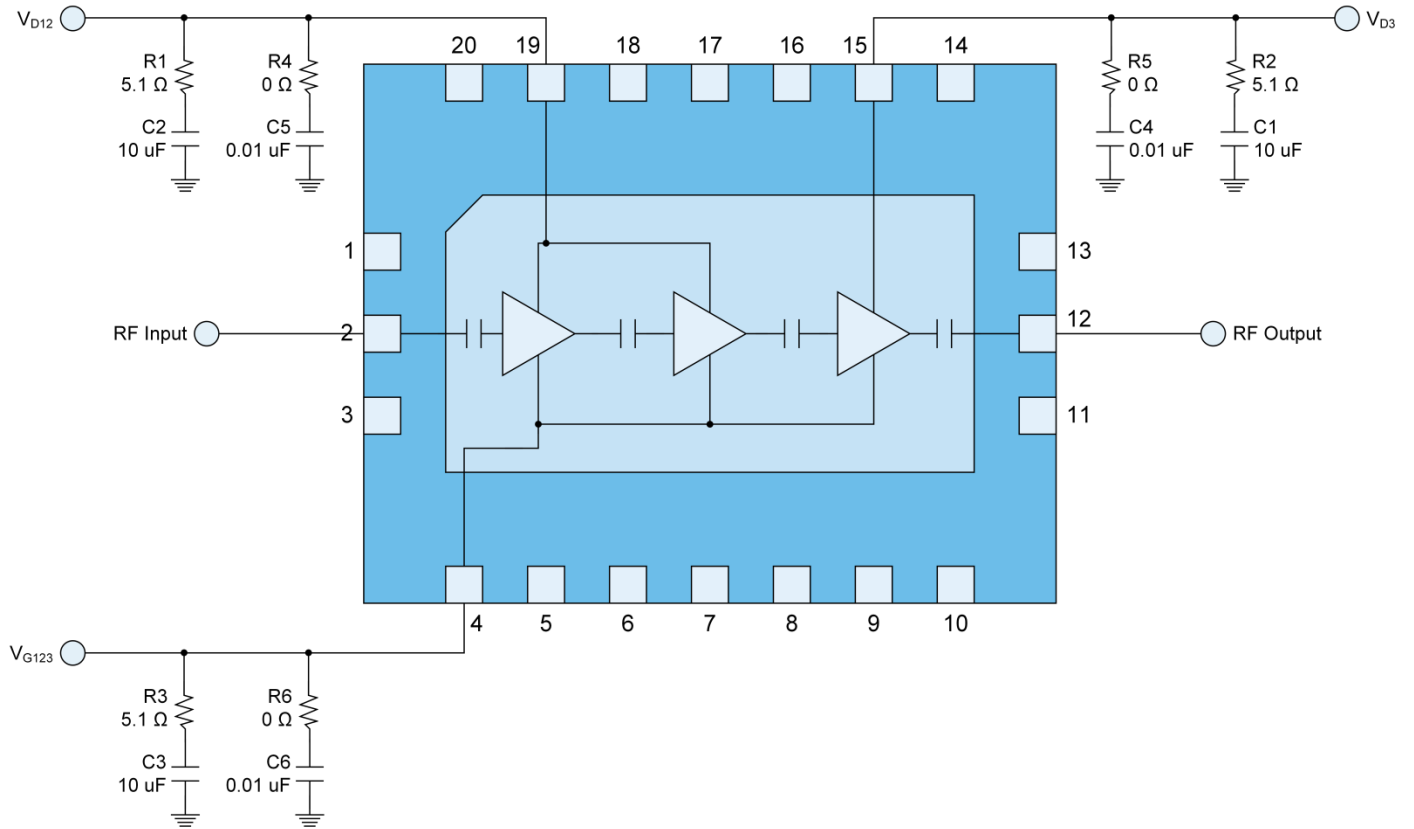
Notes:

1. Thermal resistance measured to back of package.
2. Refer to the following document: [GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates](#)

## Power Dissipation and Maximum Gate Current



Application Circuit



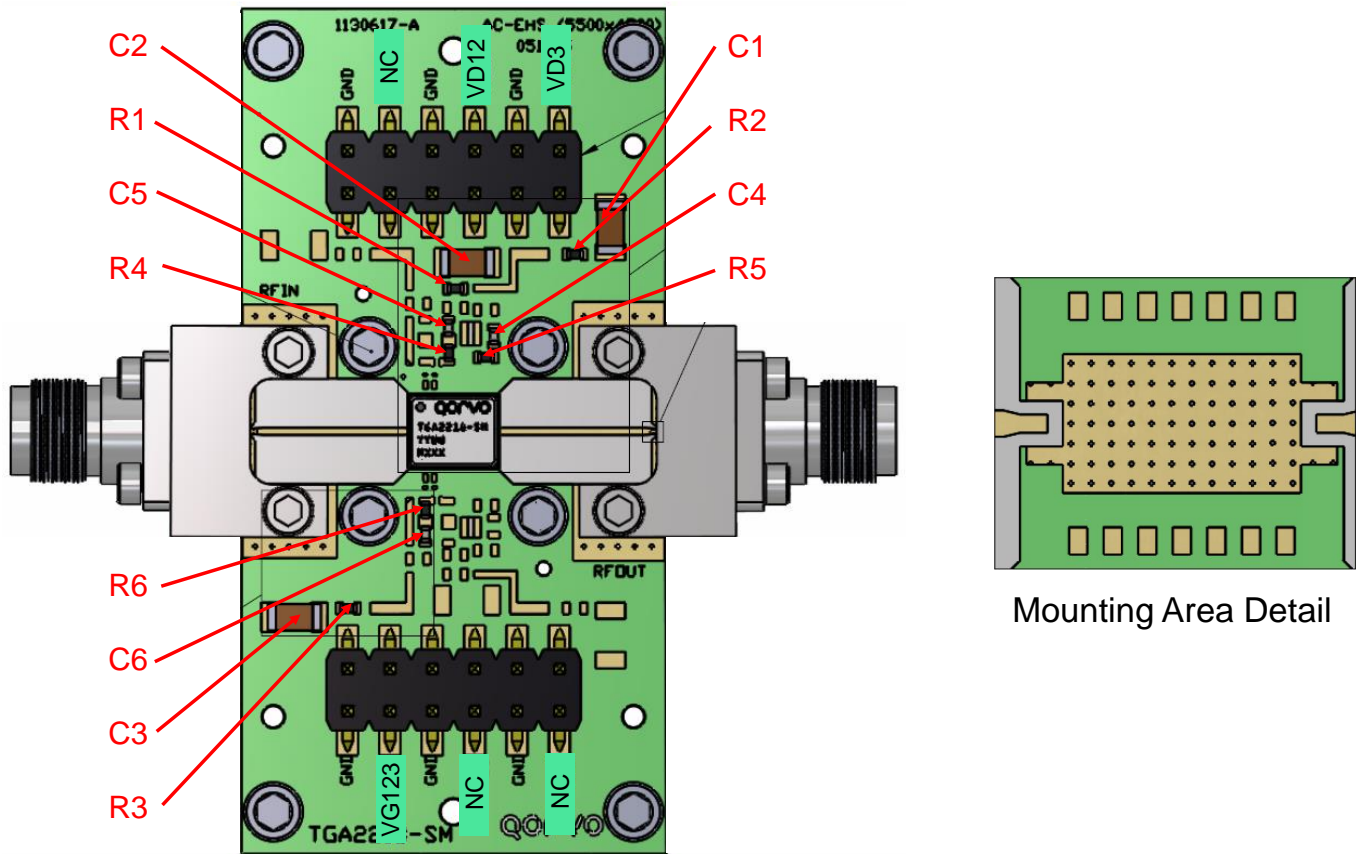
Bias-up Procedure

1. Set  $I_D$  limit to 1800 mA,  $I_G$  limit to 20 mA
2. Set  $V_G$  to  $-5.0$  V
3. Set  $V_D$  +28 V
4. Adjust  $V_G$  more positive until  $I_{DQ} = 225$  mA ( $V_G \sim -2.6$  V Typical)
5. Apply RF signal

Bias-down Procedure

1. Turn off RF signal
2. Reduce  $V_G$  to  $-5.0$  V. Ensure  $I_{DQ} \sim 0$  mA
3. Set  $V_D$  to 0V
4. Turn off  $V_D$  supply
5. Turn off  $V_G$  supply

Evaluation Board and Mounting Detail

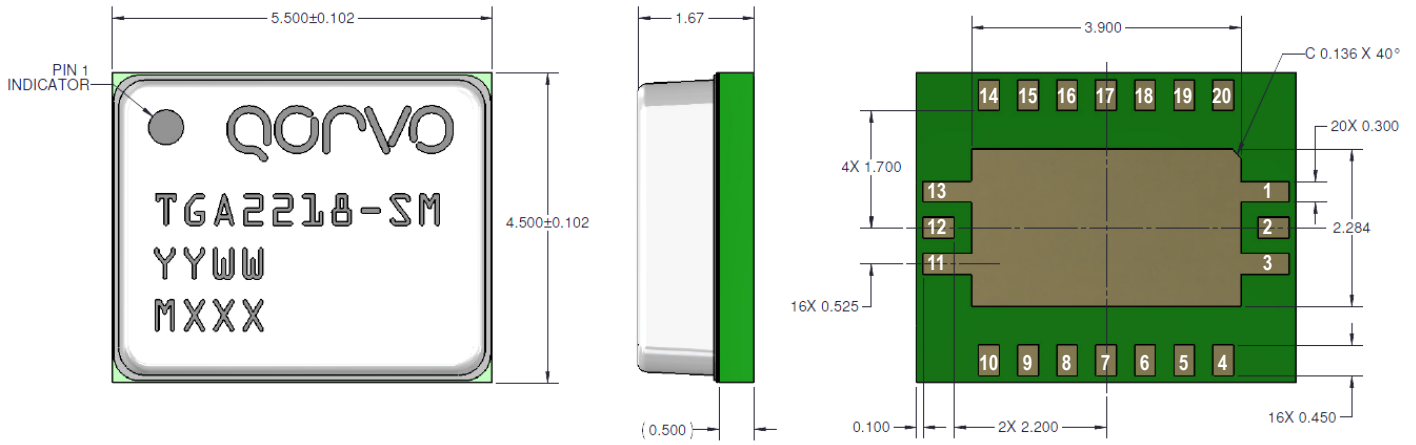


RF Layer is 0.008" thick Rogers Corp. RO40003C ( $\epsilon_r = 3.35$ ). Metal layers are 0.5 oz. copper. The microstrip line at the connector interface is optimized for the Southwest Microwave end launch connector 1092-01A-5.

Multiple vias should be employed under package center paddle to minimize inductance and thermal resistance.

Reference Des.	Component	Value	Manuf.	Part Number
C1 – C3	Surface Mount Cap	10 uF, $\pm 20\%$ , 50 V (1206), X5R	Various	
C4 – C6	Surface Mount Cap	0.01 uF, $\pm 10\%$ , 50 V (0402), X7R	Various	
R1 – R3	Surface Mount Res	5.1 Ohm, $\pm 5\%$ (0402)	Various	
R4 – R6	Surface Mount Res	0.0 Ohm, $\pm 5\%$ (0402)	Various	

### Mechanical Drawing & Pad Description

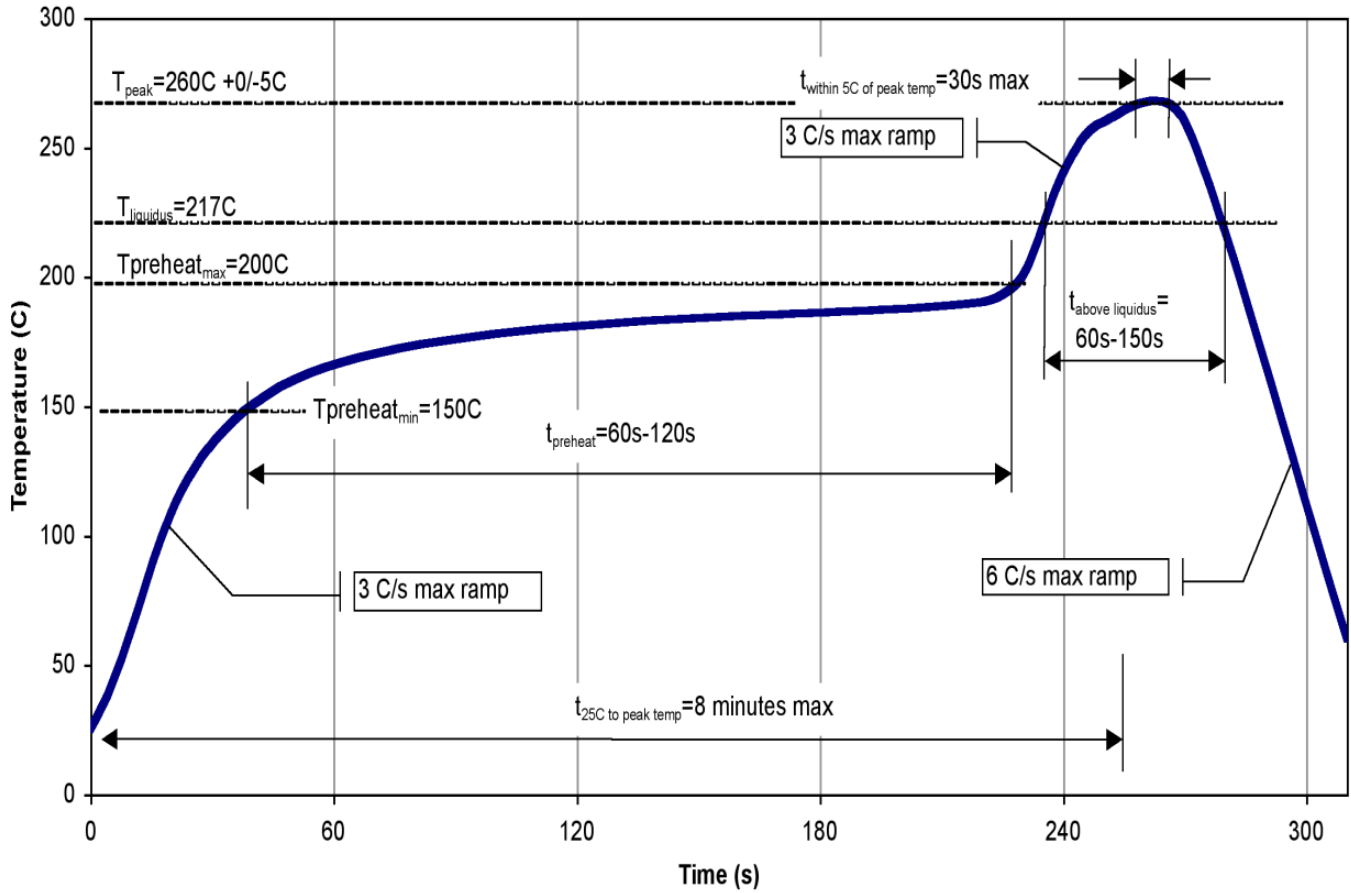


#### PART MARKING

TGA2218-SM: Part Number  
 YY: Part Assembly Year  
 WW: Part Assembly Week  
 MXXX: Batch ID  
 Dimensions in millimeters

Pad Number	Symbol	Description
1, 3, 11, 13	GND	RF Ground (including center pad).
2	RF Input	RF Input; matched to 50 Ω; DC Blocked.
4	V <sub>G123</sub>	Gate voltage stages 1-2-3. Bias network is required; see Application Circuit as an example.
5-10, 14, 16-18, 20	NC	No Connection in package; grounding may improve performance.
12	RF Output	RF Output; matched to 50Ω; DC Blocked.
15	V <sub>D3</sub>	Drain voltage stage 3. Bias network is required; see Application Circuit as an example.
19	V <sub>D12</sub>	Drain voltage stages 1-2. Bias network is required; see Application Circuit as an example.

Recommended Soldering Temperature Profile



## Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	1A	ANSI/ESD/JEDEC JS-001
ESD – Charge Device Model (CDM)	C2A	ANSI/ESD/JEDEC JS-002
MSL – Moisture Sensitivity Level	MSL3	IPC/JEDEC J-STD-020



Caution!

ESD-Sensitive Device

## Solderability

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 part is compliant with 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:

- Lead Free
- Antimony Free
- TBBP-A (C15H12Br4O2) Free
- PFOS Free

## Contact Information

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

**Web:** [www.qorvo.com](http://www.qorvo.com)

**Tel:** 1-844-890-8163

**Email:** [customer.support@qorvo.com](mailto:customer.support@qorvo.com)

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