



# TGA2622-SM

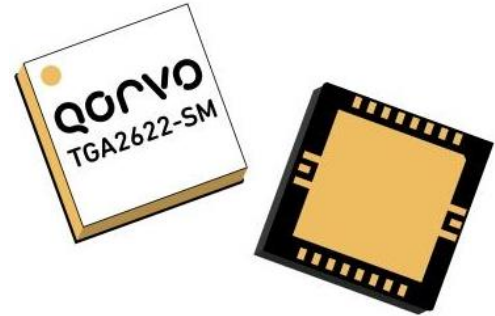
## 9 – 10 GHz 35 Watt GaN Power Amplifier

### Product Description

Qorvo's TGA2622-SM is a packaged, high power X-Band amplifier fabricated on Qorvo's production 0.25um GaN on SiC process. Operating from 9-10GHz, the TGA2622-SM typically generates 35W of saturated output power with a power-added efficiency greater than 42% and 27.5dB of large signal gain.

The TGA2622-SM is packaged in a 7x7mm air-cavity, laminate based QFN. Both RF ports are internally DC blocked and matched to 50 ohms enabling simple system integration. Ideally suited for pulsed applications, the TGA2622-SM offers superior power, PAE and gain performance that can save costs on existing platforms while enabling the development of future systems.

Lead-free and RoHS compliant.



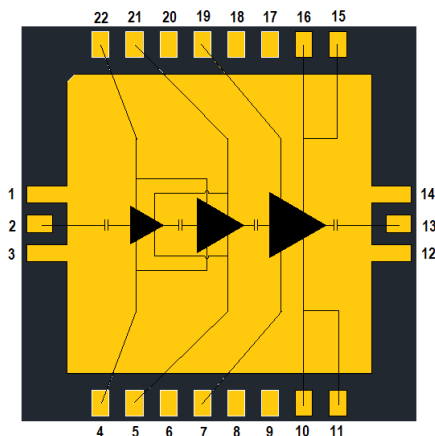
QFN 7x7 mm 22L

### Product Features

- Frequency Range: 9 – 10 GHz
- $P_{SAT}$ : 45.5 dBm @  $P_{IN} = 18$  dBm
- PAE: 42% @  $P_{IN} = 18$  dBm
- Power Gain: 27.5 dB @  $P_{IN} = 18$  dBm
- Bias:  $V_D = 28$  V,  $I_{DQ} = 290$  mA  
(Pulsed  $V_D$ :  $PW = 100$  us and  $DC = 10$  %)
- Package Dimensions: 7 x 7 x 1.75 mm

*Performance is typical across frequency. Please reference electrical specification table and data plots for more details.*

### Functional Block Diagram



### Applications

- Weather and Marine Radar

### Ordering Information

| Part           | Description                         |
|----------------|-------------------------------------|
| TGA2622-SM     | 9 – 10 GHz 35 W GaN Power Amplifier |
| TGA2622-SM EVB | Evaluation Board                    |



# TGA2622-SM

## 9 – 10 GHz 35 Watt GaN Power Amplifier

### Absolute Maximum Ratings

| Parameter                                                  | Value         |
|------------------------------------------------------------|---------------|
| Drain Voltage ( $V_D$ )                                    | 40 V          |
| Gate Voltage Range ( $V_G$ )                               | -8 to 0V      |
| Drain Current ( $I_D$ )                                    | 4.3 A         |
| Gate Current ( $I_G$ )                                     | See page 11   |
| Power Dissipation ( $P_{DISS}$ ), 85°C, CW                 | 88 W          |
| Input Power ( $P_{IN}$ ), CW, 50Ω, $V_D = 28V$ , 85°C      | 24 dBm        |
| Input Power ( $P_{IN}$ ), CW, VSWR 3:1, $V_D = 28V$ , 85°C | 24 dBm        |
| 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 ( $V_D$ )              | 28 V           |
| Drain Current (quiescent, $I_{DQ}$ ) | 290 mA         |
| Gate Voltage Range ( $V_G$ )         | -2.8 to -2.0 V |
| Operating Temperature Range          | -40 to 85 °C   |

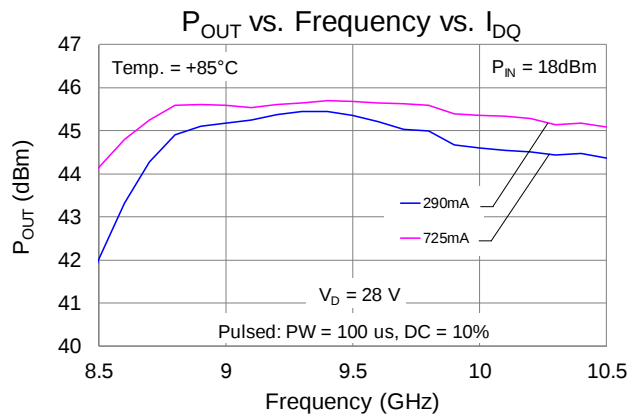
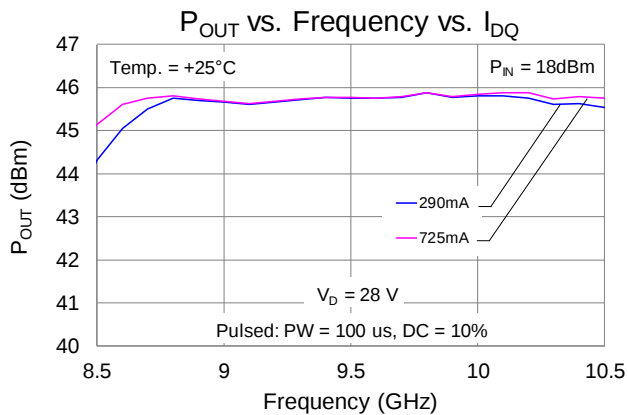
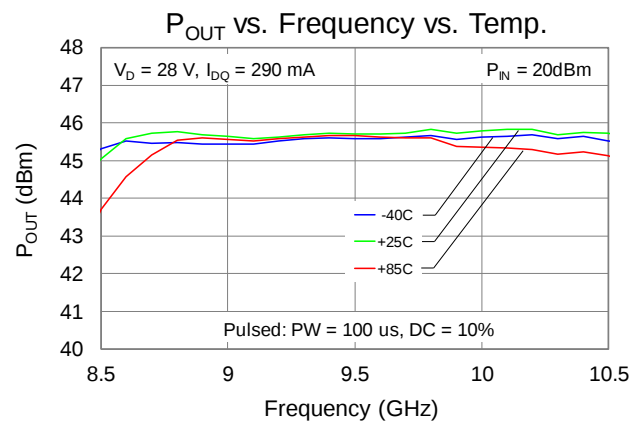
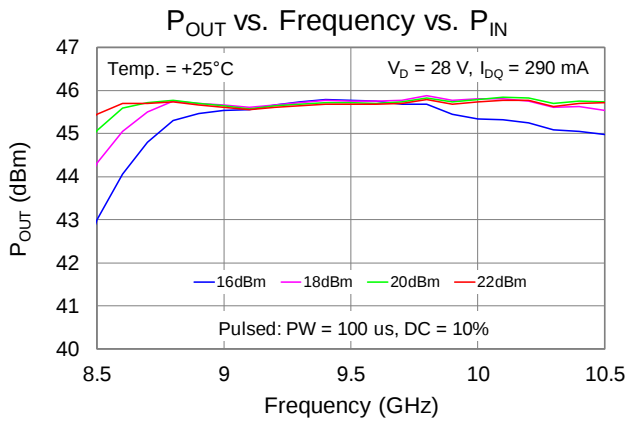
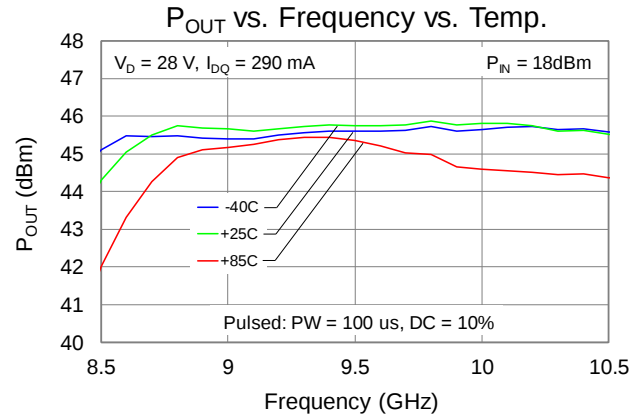
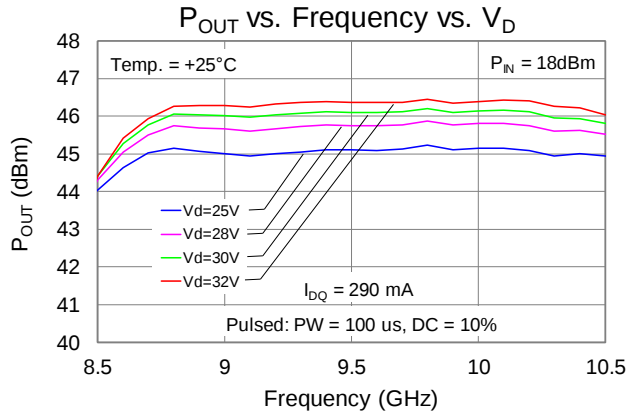
Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

### Electrical Specifications

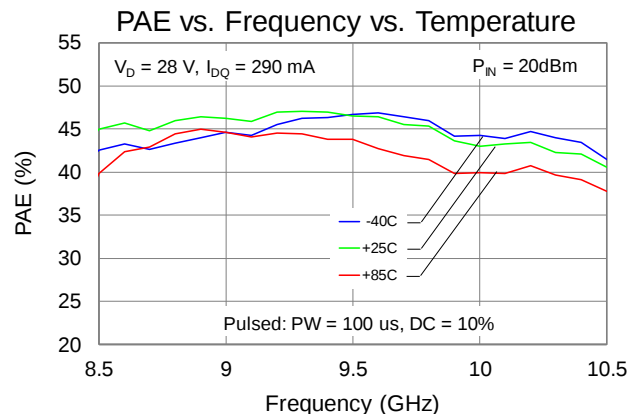
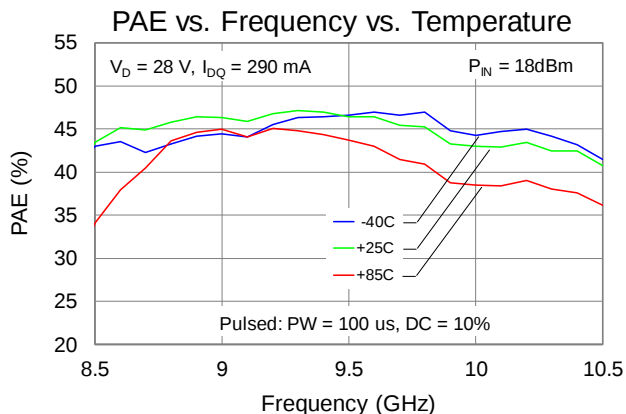
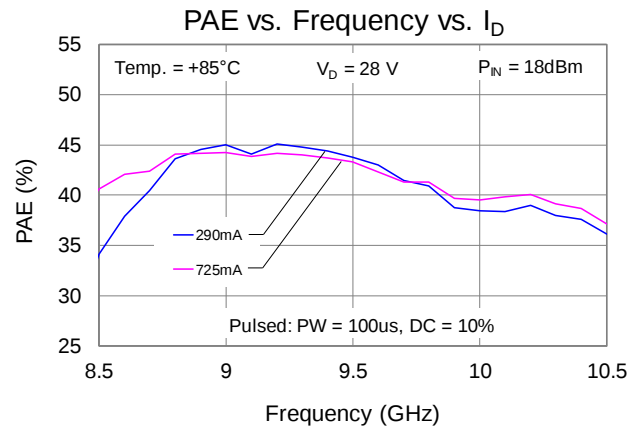
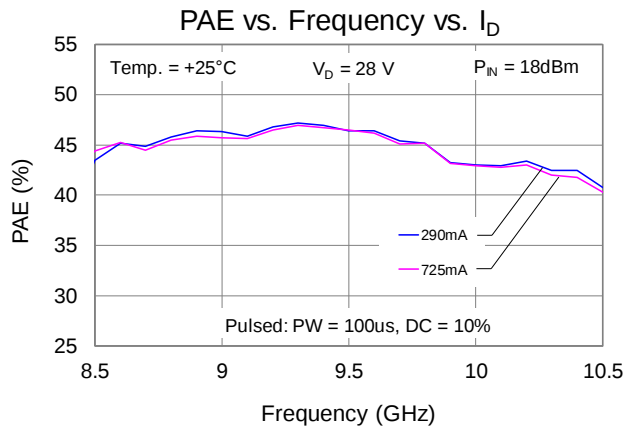
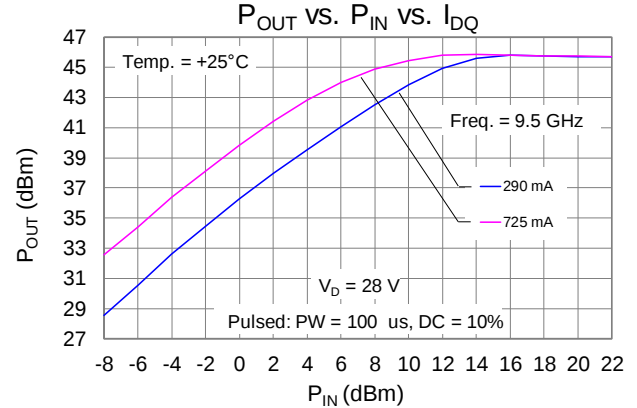
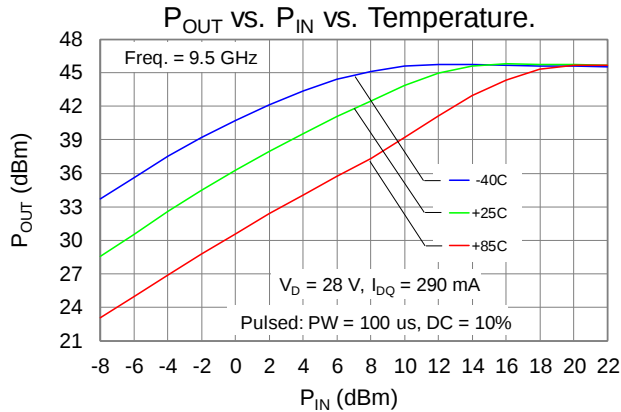
Test conditions unless otherwise noted: 25 °C,  $V_D = 28 V$ ,  $I_{DQ} = 290 mA$ , Pulsed  $V_D$ : PW = 100 us, DC = 10%

| Parameter                                                                   |                     | Min | Typ   | Max | Units  |
|-----------------------------------------------------------------------------|---------------------|-----|-------|-----|--------|
| Operational Frequency Range                                                 |                     | 9   | –     | 10  | GHz    |
| Output Power @ $P_{IN} = 18 dBm$                                            | Frequency = 9 GHz   | 45  | 45.7  | –   | dBm    |
|                                                                             | Frequency = 9.5 GHz | 45  | 45.8  | –   | dBm    |
|                                                                             | Frequency = 10 GHz  | 45  | 45.8  | –   | dBm    |
| Power Added Efficiency @ $P_{IN} = 18 dBm$                                  | Frequency = 9 GHz   | 40  | 46.4  | –   | %      |
|                                                                             | Frequency = 9.5 GHz | 40  | 46.4  | –   |        |
|                                                                             | Frequency = 10 GHz  | 35  | 43    | –   |        |
| Small Signal Gain                                                           | Frequency = 9 GHz   | –   | 31.5  | –   | dB     |
|                                                                             | Frequency = 9.5 GHz | –   | 32.7  | –   |        |
|                                                                             | Frequency = 10 GHz  | –   | 31.4  | –   |        |
| Input Return Loss                                                           | Frequency = 9 GHz   | –   | 14.7  | –   | dB     |
|                                                                             | Frequency = 9.5 GHz | –   | 15    | –   |        |
|                                                                             | Frequency = 10 GHz  | –   | 11    | –   |        |
| Output Return Loss                                                          | Frequency = 9 GHz   | –   | 10.6  | –   | dB     |
|                                                                             | Frequency = 9.5 GHz | –   | 9.3   | –   |        |
|                                                                             | Frequency = 10 GHz  | –   | 12    | –   |        |
| Output Power Temperature Coefficient From 25°C to 85°C ( $P_{IN} = 18dBm$ ) |                     | –   | -0.02 | –   | dBm/°C |

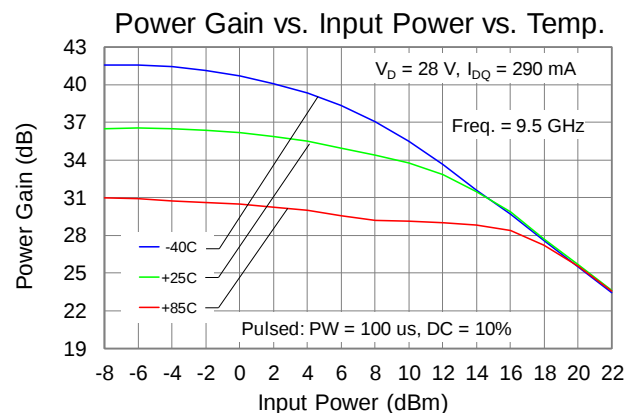
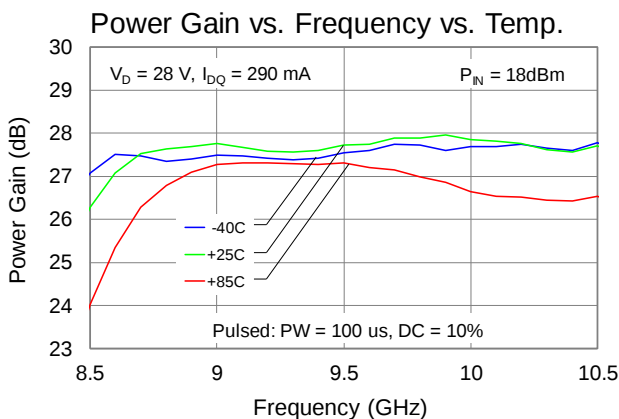
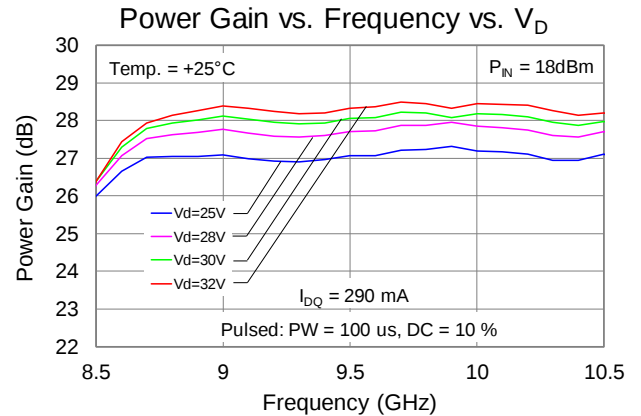
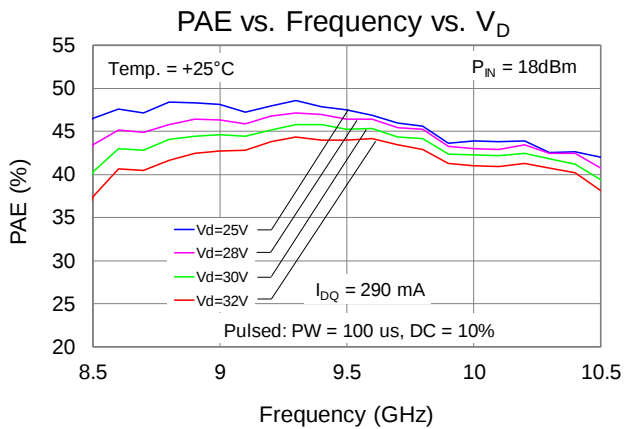
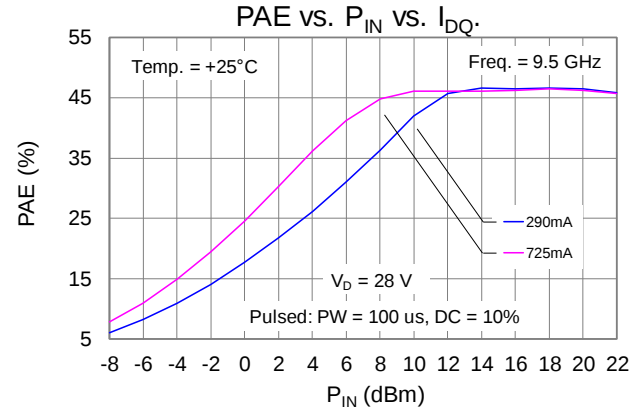
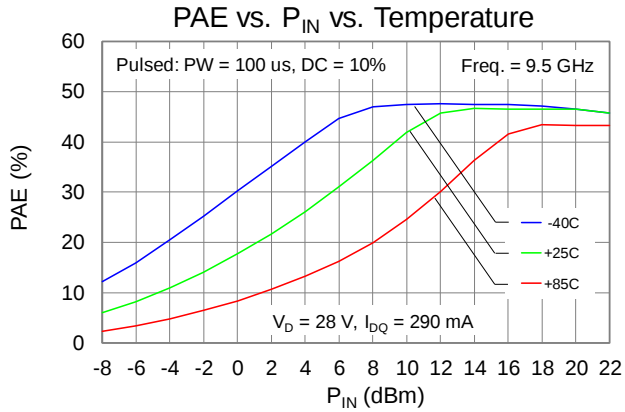
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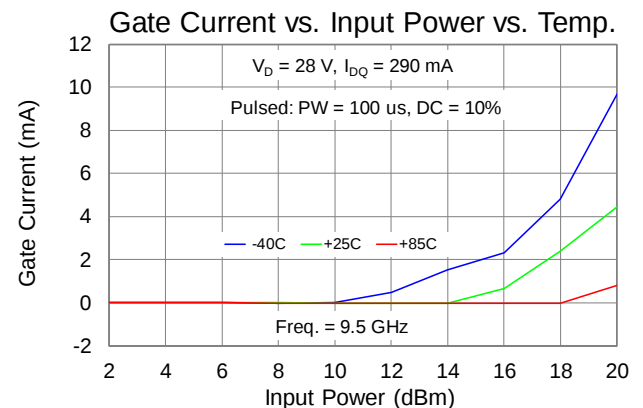
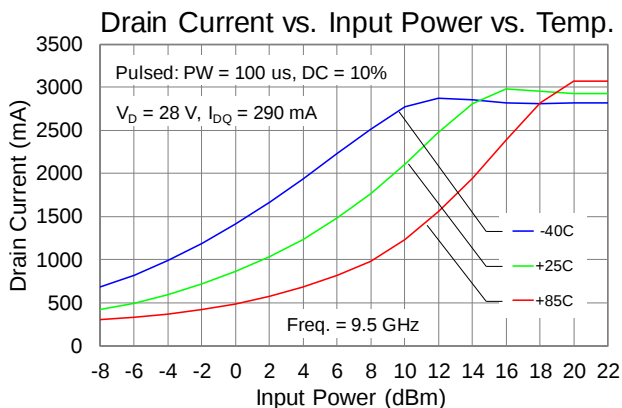
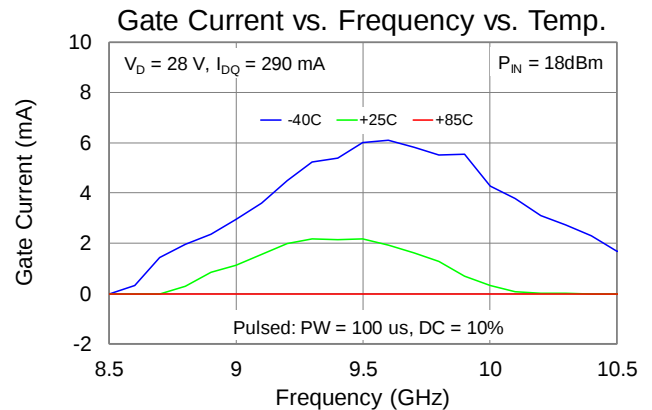
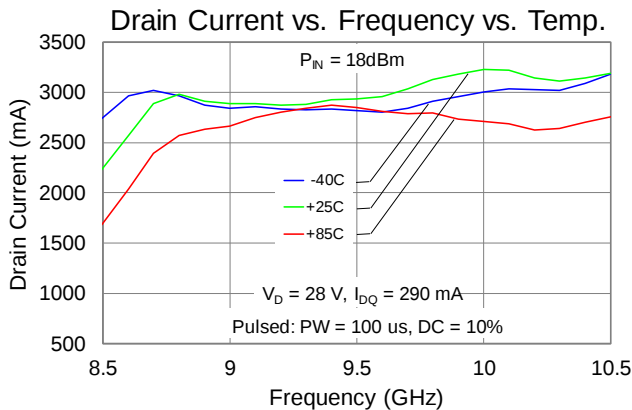
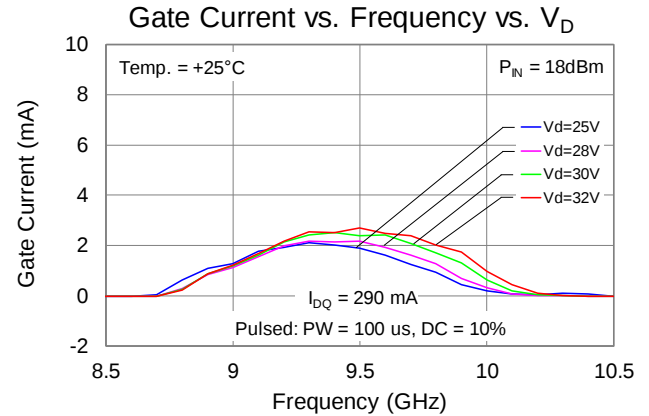
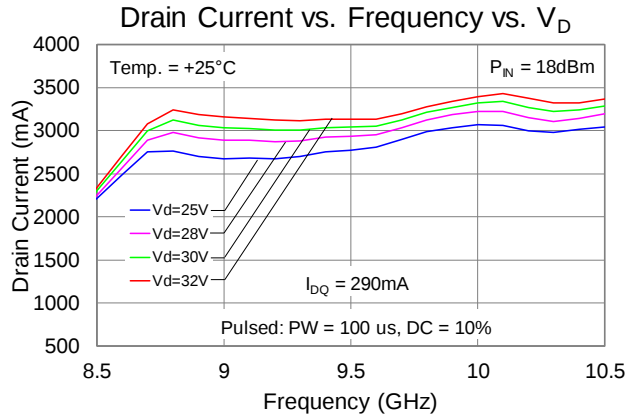
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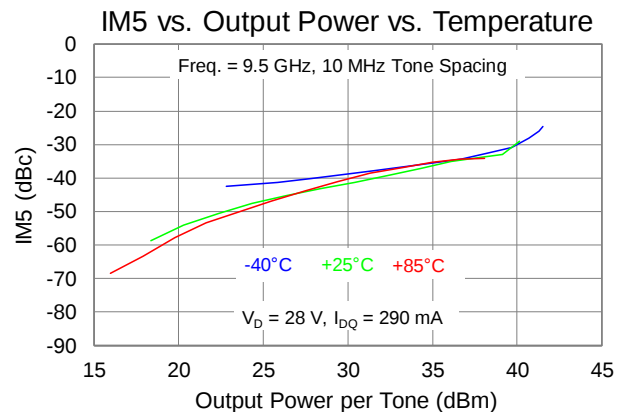
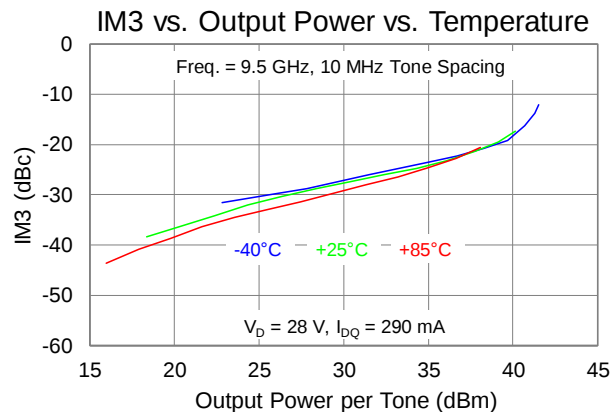
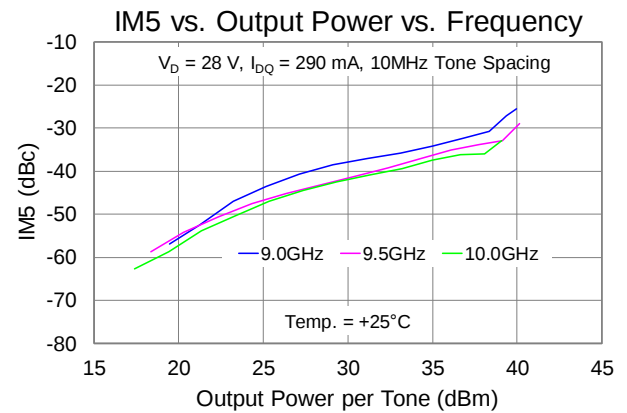
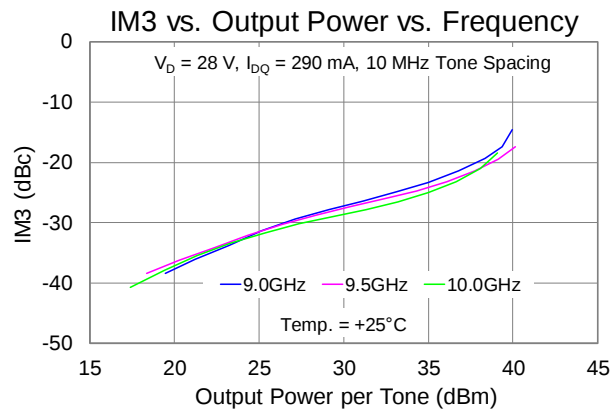
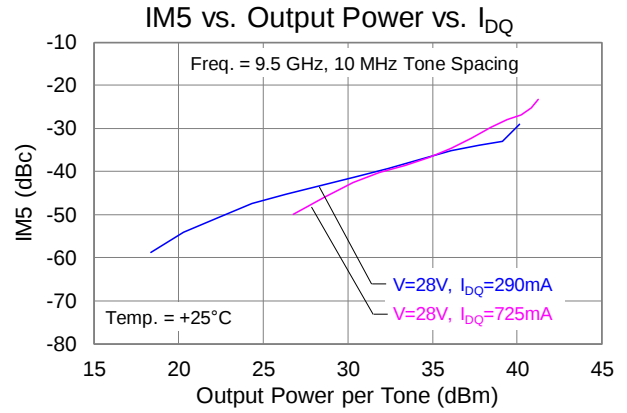
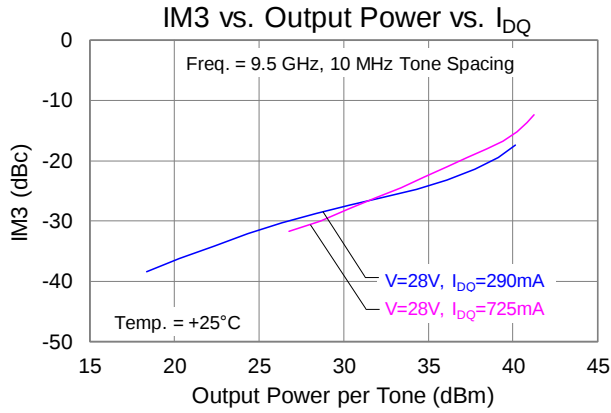
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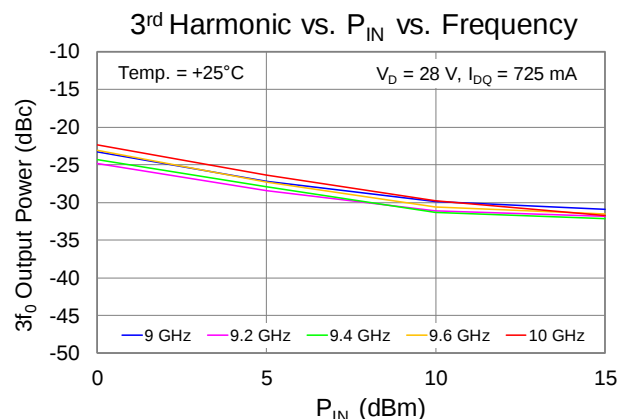
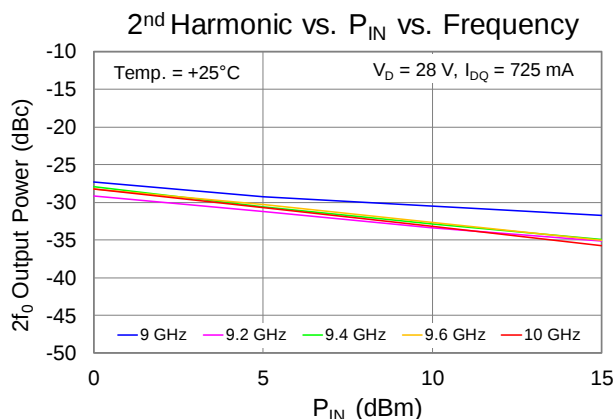
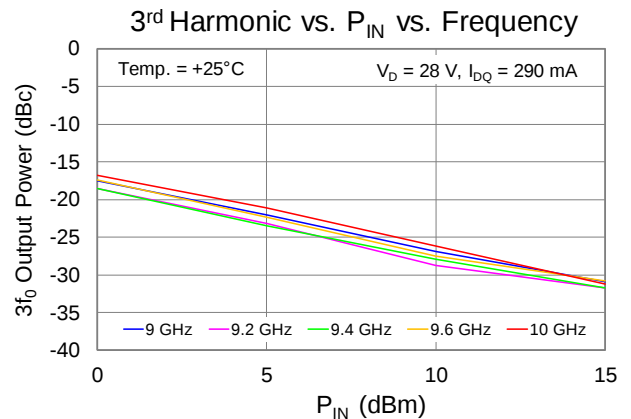
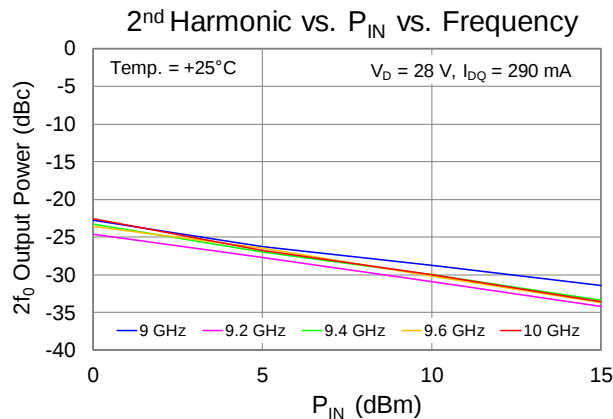
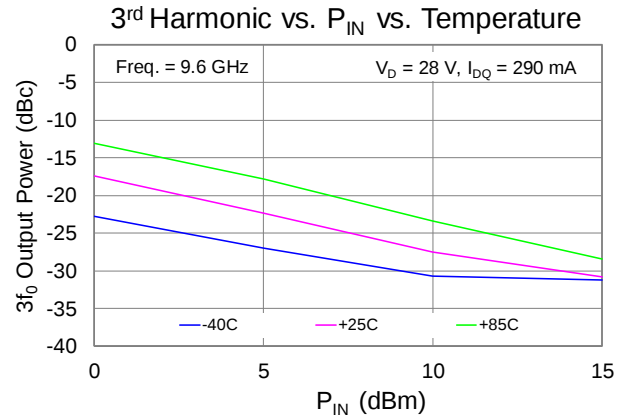
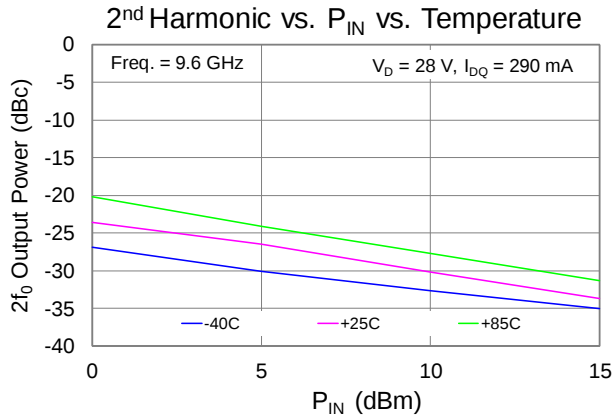
### Performance Plots – Large Signal (Pulsed)



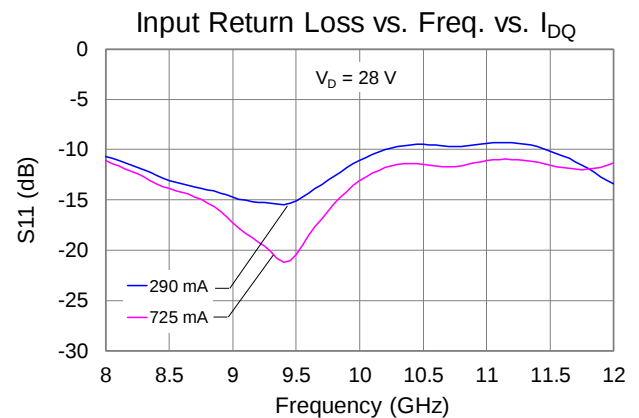
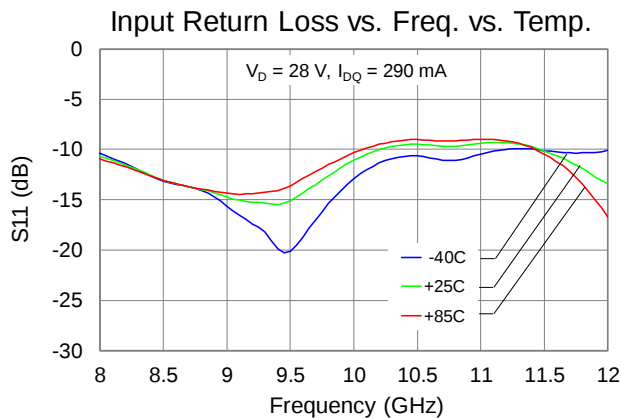
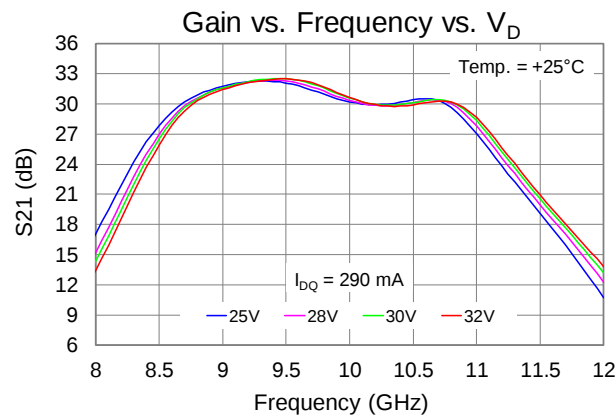
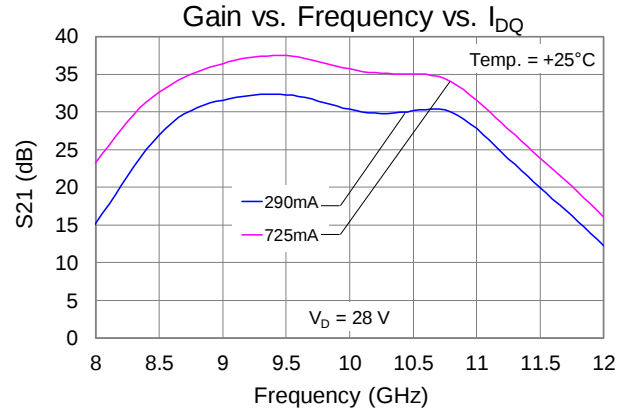
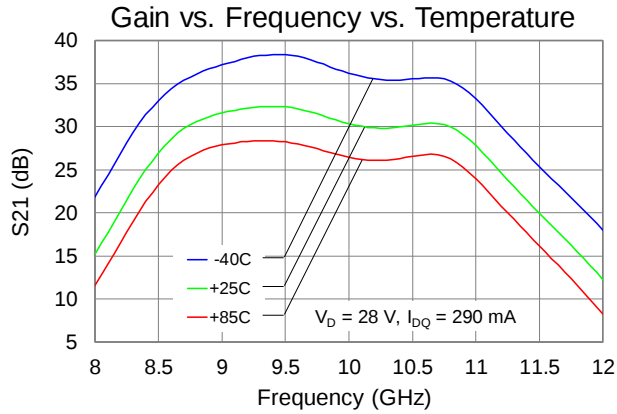
### Performance Plots – Linearity (CW)



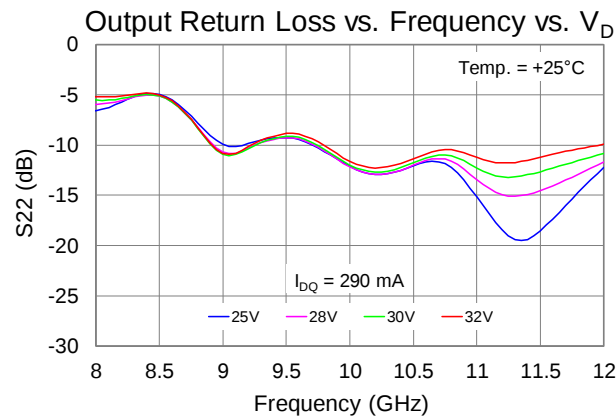
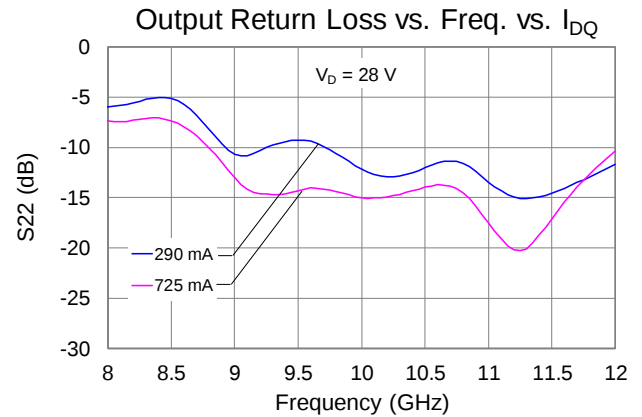
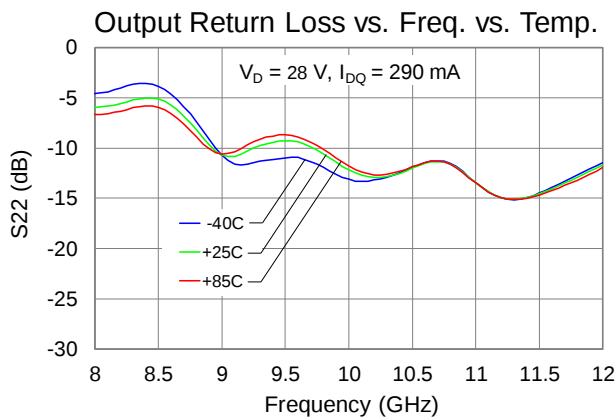
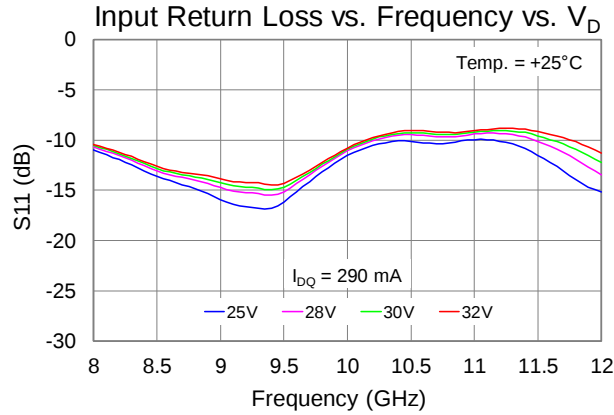
### Performance Plots – Linearity (CW)



### Performance Plots – Small Signal (CW)



### Performance Plots – Small Signal (CW)



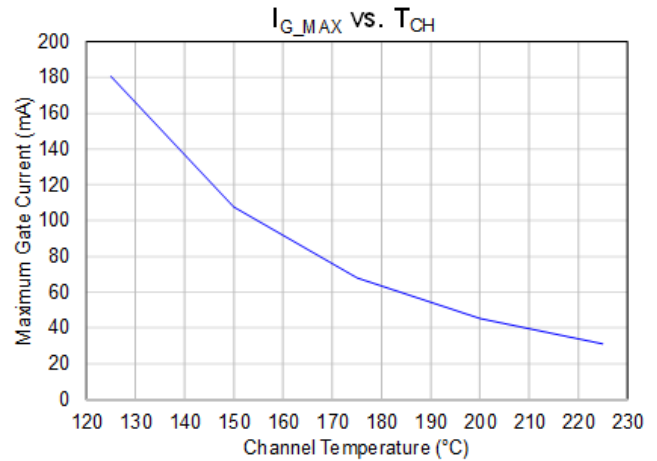
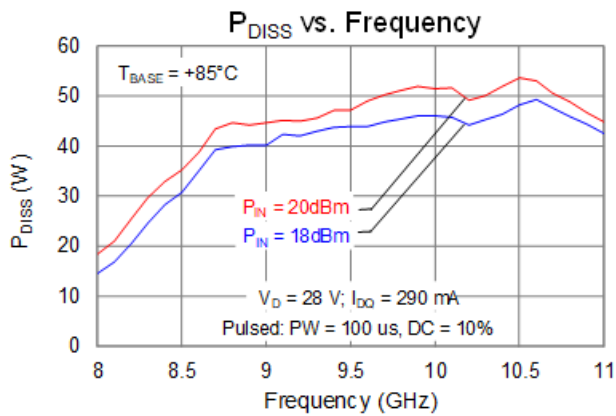
### Thermal and Reliability Information

| Parameter                                                       | Test Conditions                                                                                                                                                                                                                                                  | Value | Units              |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------|
| Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup>             | $V_D = 28\text{ V}$ , $I_{DQ} = 290\text{ mA}$ , (Pulsed $V_D$ : $PW = 100\text{ us}$ , $DC = 10\%$ ), $T_{base} = 85\text{ }^\circ\text{C}$ ; $P_{DISS} = 8.12\text{ W}$                                                                                        | 0.51  | $^\circ\text{C/W}$ |
| Channel Temperature ( $T_{CH}$ ) (No RF drive) <sup>(2)</sup>   |                                                                                                                                                                                                                                                                  | 89.1  | $^\circ\text{C}$   |
| Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup>             | $T_{base} = 85\text{ }^\circ\text{C}$ , $V_D = 28\text{ V}$ , $I_{DQ} = 290\text{ mA}$ , (Pulsed $V_D$ : $PW = 100\text{ us}$ , $DC = 10\%$ ), $I_{D\_Drive} = 3.1\text{ A}$ , $P_{IN} = 20\text{ dBm}$ , $P_{OUT} = 45.4\text{ dBm}$ , $P_{DISS} = 52\text{ W}$ | 0.83  | $^\circ\text{C/W}$ |
| Channel Temperature ( $T_{CH}$ ) (With RF drive) <sup>(2)</sup> |                                                                                                                                                                                                                                                                  | 128.2 | $^\circ\text{C}$   |

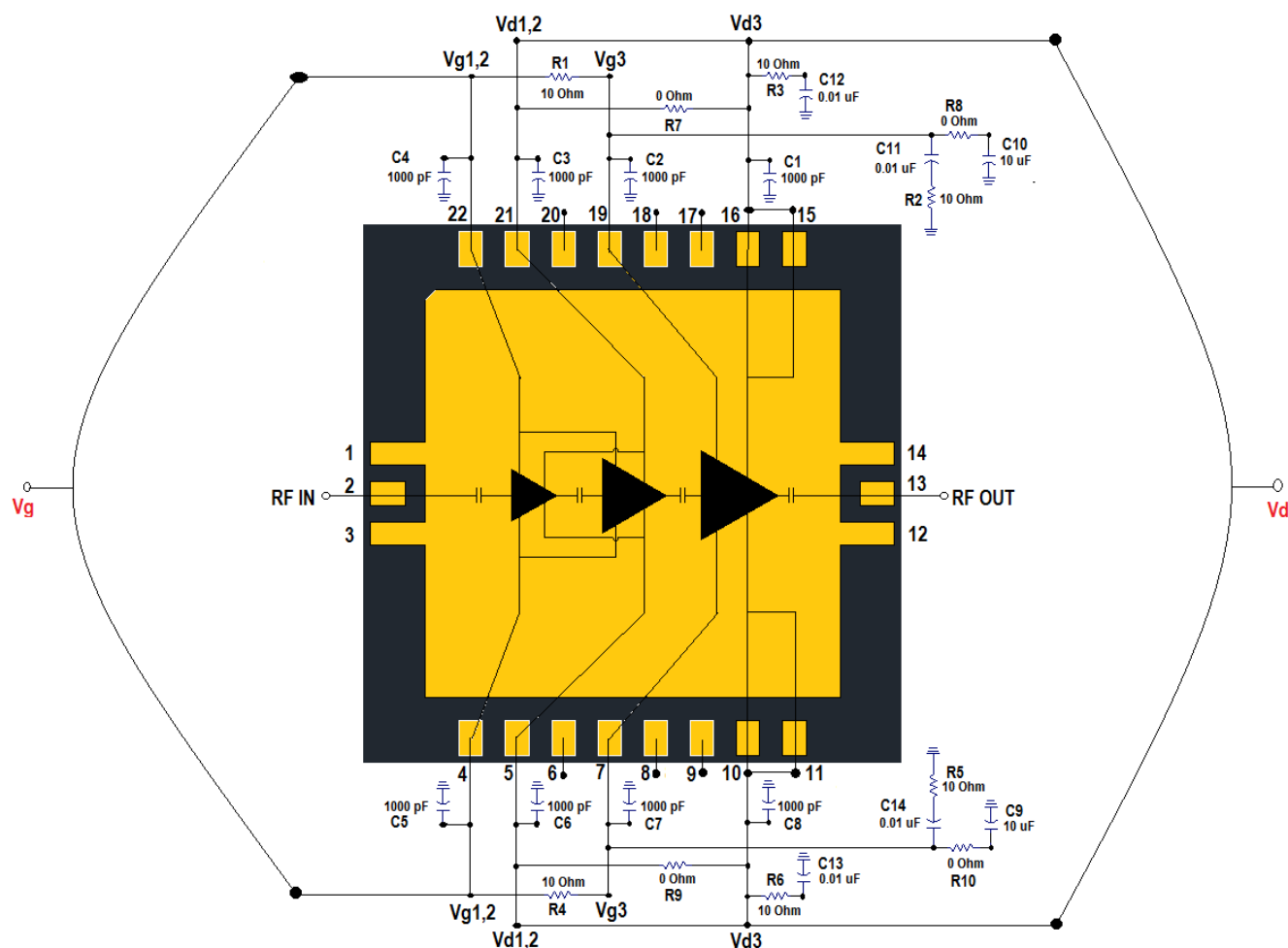
Notes:

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

### Power Dissipation and Maximum Gate Current



### Applications Circuit



#### Notes:

1.  $V_G$ : must be biased from both sides -  $V_{G1,2}$  &  $V_{G3}$  can be tied together.
2.  $V_D$ : must be biased from both sides -  $V_{D1,2}$  &  $V_{D3}$  can be tied together.

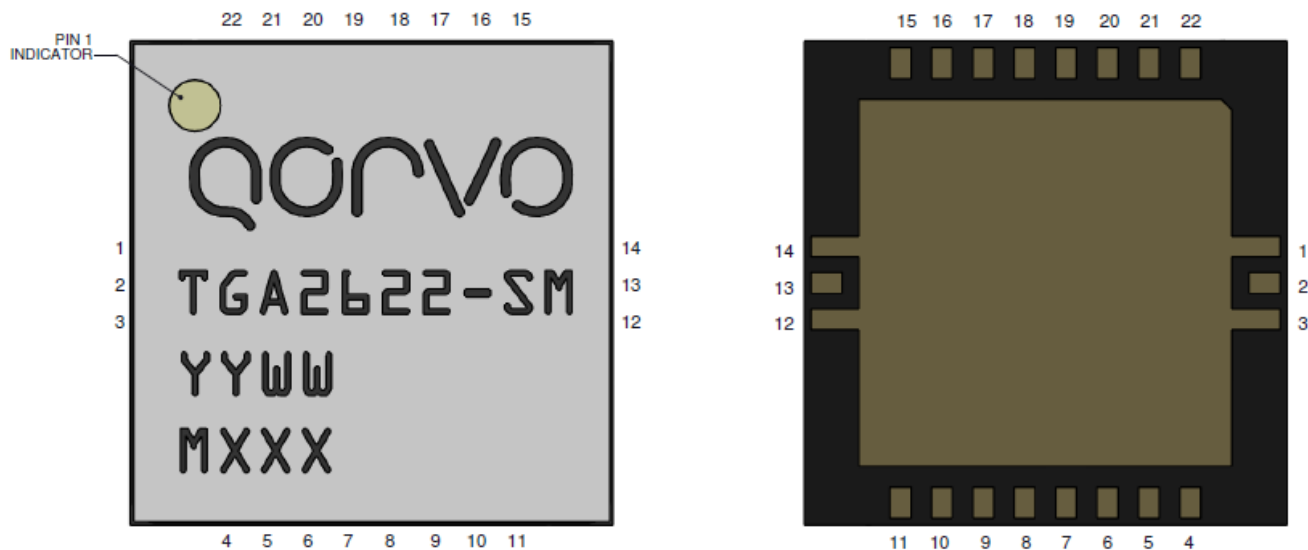
### Bias Up Procedure

1. Set  $I_D$  limit to 3.5 A,  $I_G$  limit to 25 mA
2. Set  $V_G$  to -5.0 V (for pinch-off)
3. Set  $V_D$  +28 V; Ensure  $I_{DQ}$  is approx. 0 mA
4. Adjust  $V_G$  more positive until  $I_{DQ} = 290\text{mA}$  ( $V_G \sim -2.3\text{ V}$  Typical)
5. Apply RF signal

### Bias Down Procedure

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

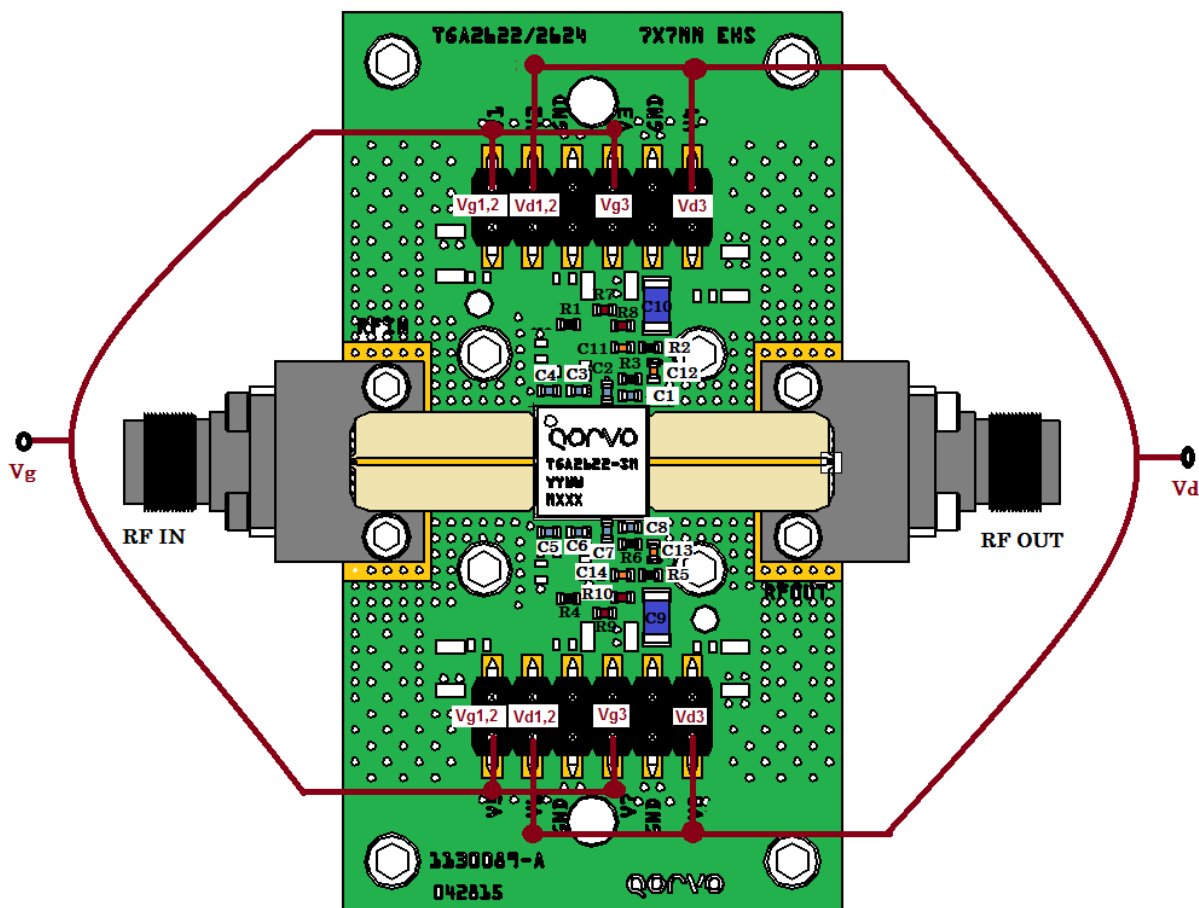
### Pin Layout



### Pin Description

| Pin No.             | Symbol            | Description                                                                                                                       |
|---------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| 1, 3, 12, 14        | GND               | Must be grounded on the PCB                                                                                                       |
| 2                   | RF <sub>IN</sub>  | Input; matched to 50 $\Omega$ ; DC blocked                                                                                        |
| 4, 22               | V <sub>G1,2</sub> | Gate Voltages 1,2; Bias network is required; must be biased from both sides; see recommended Application Information on page 12.  |
| 5, 21               | V <sub>D1,2</sub> | Drain voltages 1,2; Bias network is required; must be biased from both sides; see recommended Application Information on page 12. |
| 6, 8, 9, 17, 18, 20 | N/C               | No internal connection                                                                                                            |
| 7, 19               | V <sub>G3</sub>   | Gate Voltage 3; Bias network is required; must be biased from both sides; see recommended Application Information on page 12.     |
| 10, 11, 15, 16      | V <sub>D3</sub>   | Drain voltage 3; Bias network is required; must be biased from both sides; see recommended Application Information on page 12.    |
| 13                  | RF <sub>OUT</sub> | Output; matched to 50 $\Omega$ ; DC blocked                                                                                       |

### Evaluation Board Layout

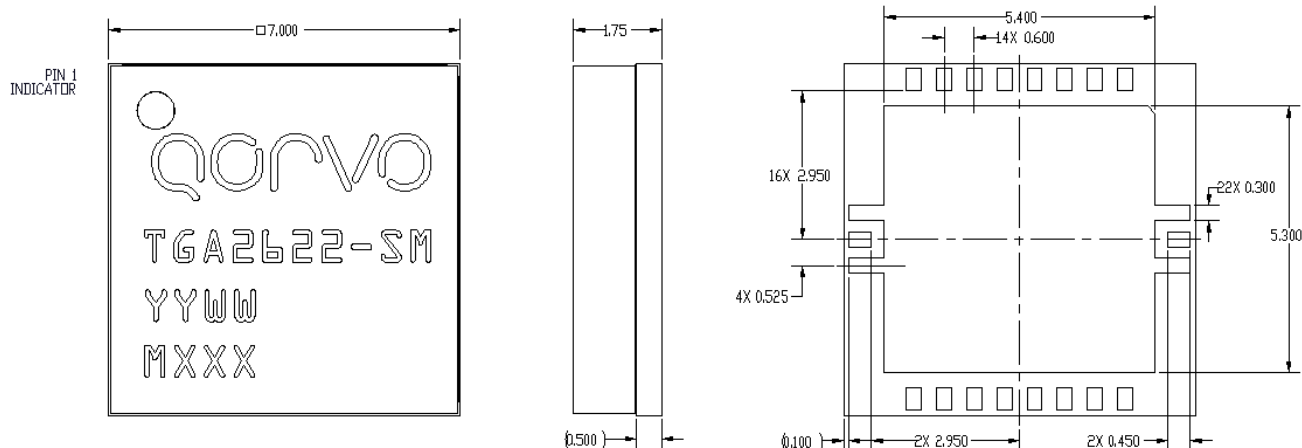


Notes: Both Top and Bottom Vd and Vg must be biased.

### Bill of Materials

| Reference Des. | Value        | Description                                   | Manuf.  | Part Number |
|----------------|--------------|-----------------------------------------------|---------|-------------|
| C1 – C8        | 1000 pF      | Cap, 0402, 100 V, 10%, X7R                    | Various |             |
| C9 – C10       | 10 $\mu$ F   | Cap, 1206, 50 V, 20%, X5R                     | Various |             |
| C11 – C14      | 0.01 $\mu$ F | Cap, 0402, 50 V, 10%, X7R                     | Various |             |
| R1 – R6        | 10 ohms      | Res, 0402, 50 V, 5%, SMD                      | Various |             |
| R7 – R10       | 0 ohms       | Res, 0402, jumpers required for the above EVB | Various |             |

### Mechanical Information



Units: Millimeters (mm)

Tolerances: unless specified

x.xx =  $\pm 0.25$ ; x.xxx =  $\pm 0.100$

Materials:

Base: Laminate Substrate

Lid: Laminate

All metalized features are gold plated

Part is epoxy sealed

Marking:

TGA2622-SM: Part number

YY: Part Assembly year

WW: Part Assembly week

MXXX: Batch ID

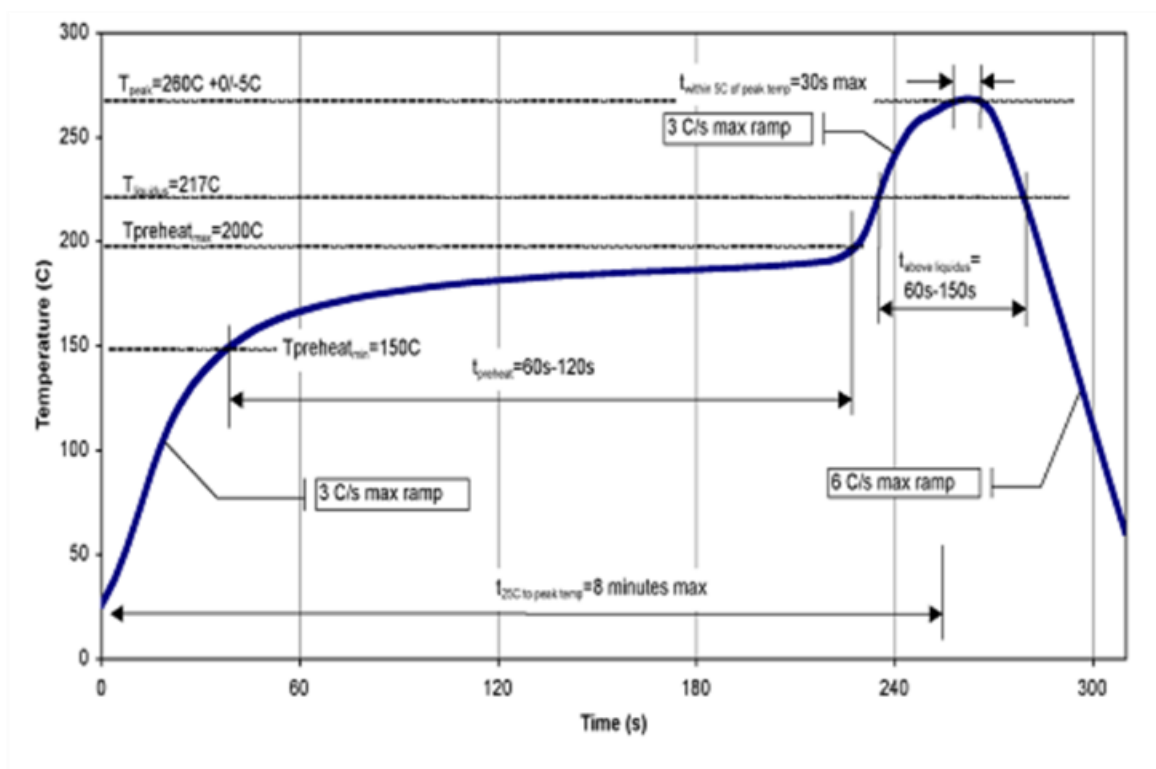
## Assembly Notes

Compatible with lead-free soldering processes with 260°C peak reflow temperature.

This package is air-cavity and non-hermetic, and therefore cannot be subjected to aqueous washing. The use of no-clean solder to avoid washing after soldering is highly recommended.

Contact plating: Ni-Au.

Solder rework not recommended.



Recommended Soldering Temperature Profile



# TGA2622-SM

## 9 – 10 GHz 35 Watt GaN Power Amplifier

### Handling Precautions

| Parameter                        | Rating   | Standard              |
|----------------------------------|----------|-----------------------|
| ESD – Human Body Model (HBM)     | Class 1B | ANSI/ESD/JEDEC JS-001 |
| MSL – Moisture Sensitivity Level | Level 3  | IPC/JEDEC J-STD-020   |



Caution!  
ESD-Sensitive Device

### 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:

- Lead Free
- Antimony Free
- TBBP-A (C<sub>15</sub>H<sub>12</sub>Br<sub>4</sub>O<sub>2</sub>) Free
- PFOS Free

### Contact Information

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

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

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