



TGA2624-SM

9–10 GHz 20 W GaN Power Amplifier

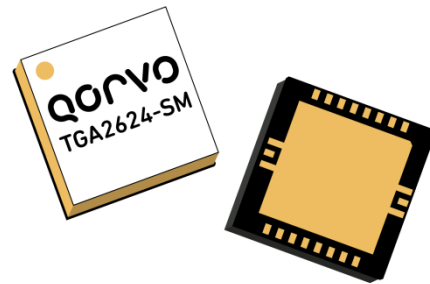
General Description

Qorvo's TGA2624-SM is a packaged, high power X-Band amplifier fabricated on Qorvo's production 0.25 μm GaN on SiC process. Operating from 9-10 GHz, the TGA2624-SM typically generates 20 W of saturated output power with a power-added efficiency greater than 40% and 25 dB of large signal gain.

The TGA2624-SM is packaged in a 7 x 7 mm 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 TGA2624-SM offers excellent power, PAE and gain performance that can save costs on existing platforms while enabling the development of future systems.

Lead-free and RoHS compliant.

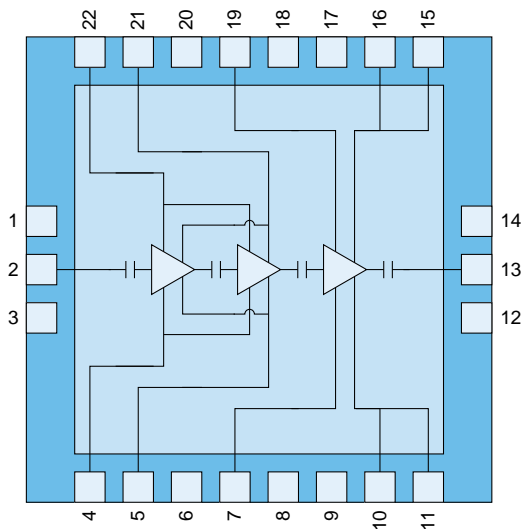
Evaluation boards are available upon request.



Product Features

- Frequency Range: 9–10 GHz
- P_{SAT} : 43 dBm @ $P_{\text{IN}} = 18$ dBm
- PAE: >40% @ $P_{\text{IN}} = 18$ dBm
- Power Gain: 25 dB @ $P_{\text{IN}} = 18$ dBm
- Bias: $V_{\text{D}} = 28$ V, $I_{\text{DQ}} = 365$ mA (Pulsed V_{D} : PW = 100 μs and DC = 10 %)
- Package Dimensions: 7 x 7 x 1.75 mm

Functional Block Diagram



Applications

- Weather and Marine Radar

Ordering Information

| Part | Description |
|----------------|-----------------------------------|
| TGA2624-SM | 9–10 GHz 20 W GaN Power Amplifier |
| TGA2624-SM EVB | Evaluation Board |

Absolute Maximum Ratings

| Parameter | Value/Range |
|---|-----------------|
| Drain Voltage (V_D) | 40 V |
| Gate Voltage Range (V_G) | -8 to 0 V |
| Drain Current (I_D) | 3.8 A |
| Gate Current (I_G) | See plot page 3 |
| Power Dissipation (P_{DISS}), 85 °C, CW | 44 W |
| Input Power (P_{IN}), CW, 50 Ω , $V_D = 28$ V, 85 °C | 25 dBm |
| Input Power (P_{IN}), CW, VSWR 6:1, $V_D = 28$ V, 85 °C | 19 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/Range |
|---------------------------------|----------------|
| Drain Voltage (V_D): Pulsed | 28 V |
| Drain Current (I_{DQ}) | 365 mA |
| Gate Voltage Range (V_G) | -2.8 to -2.0 V |
| Temperature (T_{BASE}) | -40 to 85 °C |

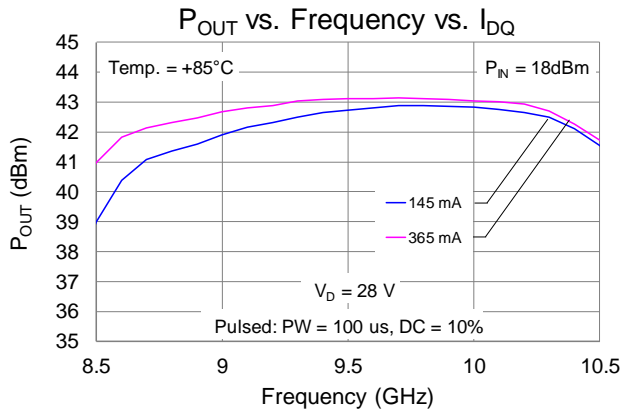
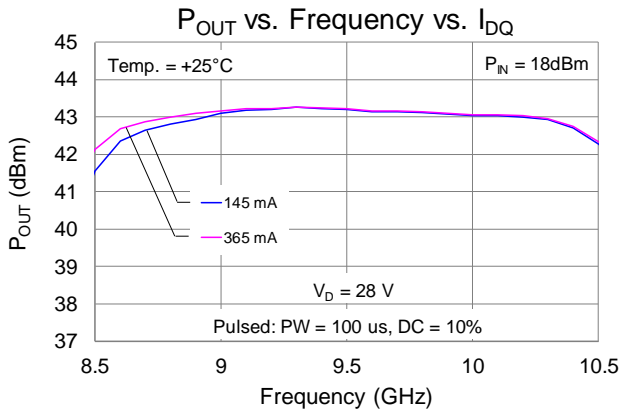
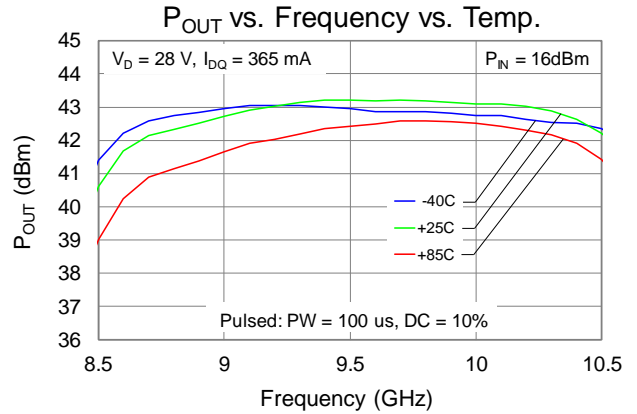
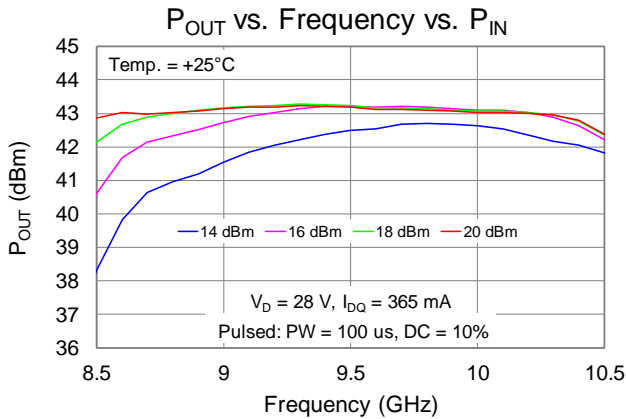
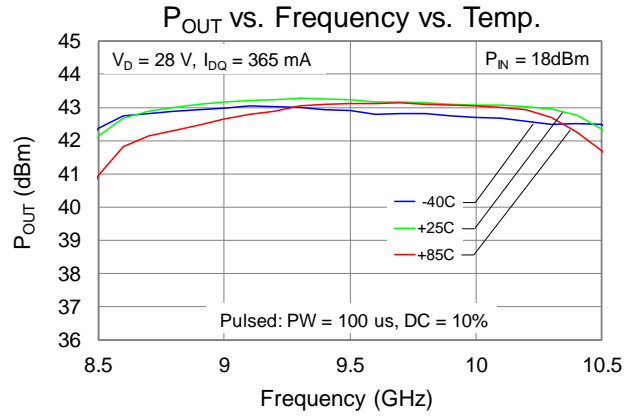
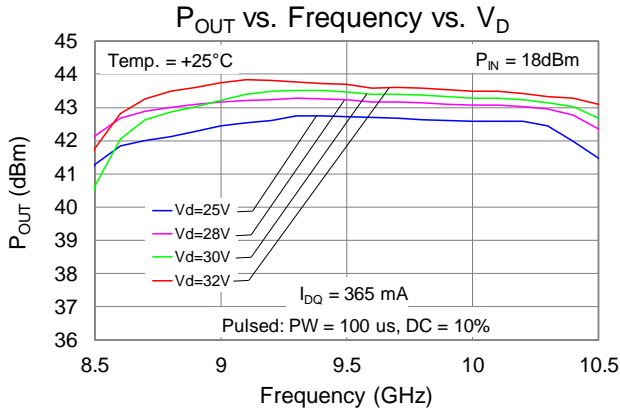
Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

Electrical Specifications

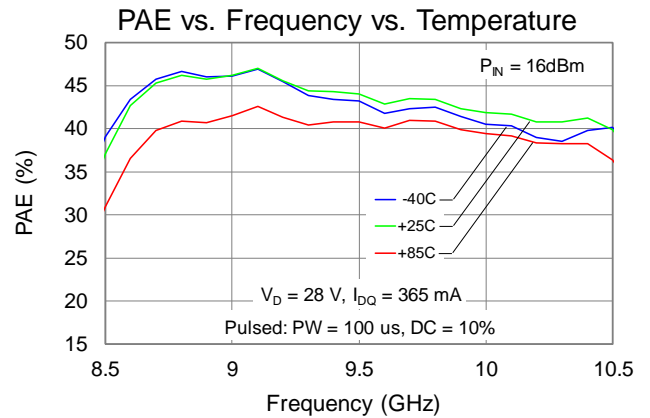
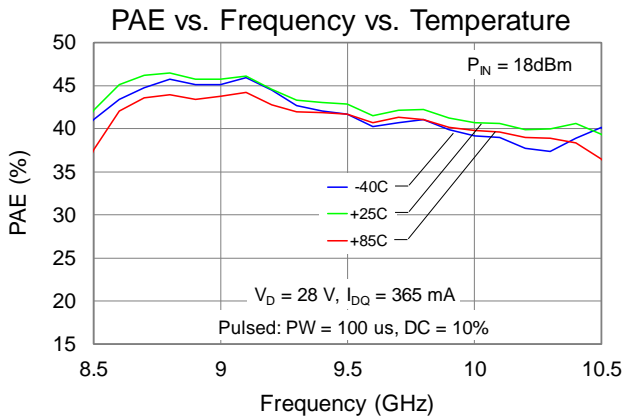
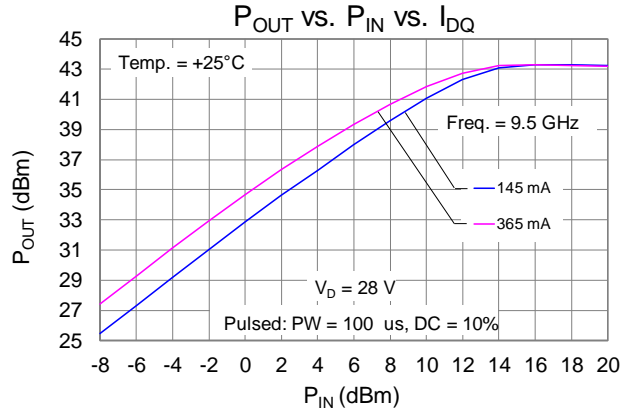
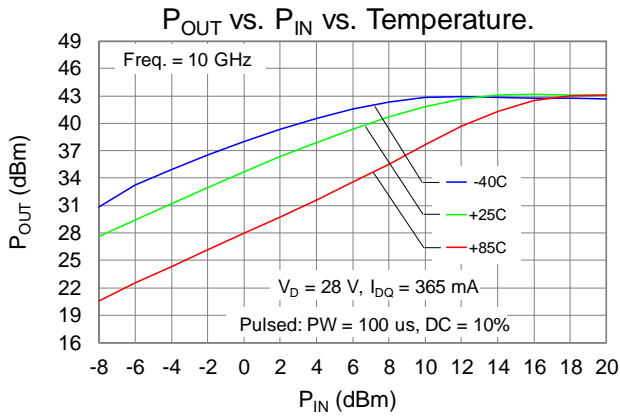
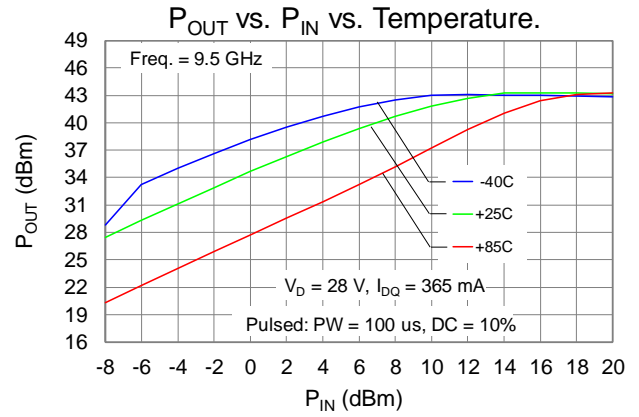
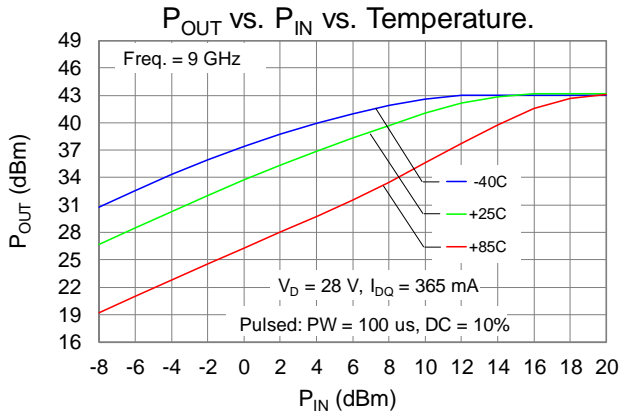
Test conditions unless otherwise noted: 25 °C, $V_D = 28$ V, $I_{DQ} = 365$ mA, Pulsed V_D : PW = 100 us, DC = 10 %

| Parameter | Min | Typical | Max | Units |
|--|------|---------|-----|--------|
| Operational Frequency Range | 9 | | 10 | GHz |
| Small Signal Gain | | >34 | | dB |
| Input Return Loss | | >9 | | dB |
| Output Return Loss | | >8.5 | | dB |
| Output Power ($P_{IN} = 18$ dBm) | 42 | 43 | | dBm |
| Power Added Efficiency ($P_{IN} = 18$ dBm) | 30 | >40 | | % |
| Power Gain ($P_{IN} = 18$ dBm) | | 25 | | dB |
| Output Power Temperature Coefficient From 25 °C to 85 °C ($P_{IN} = 18$ dBm) | | -0.02 | | dBm/°C |
| Recommended Operating Voltage: | 20 | 28 | 32 | V |
| Gate Leakage ($V_D = 10$ V, $V_G = -3.7$ V) | -8.3 | | | mA |

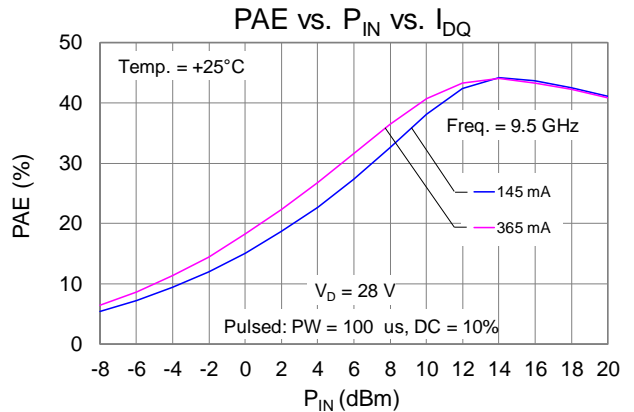
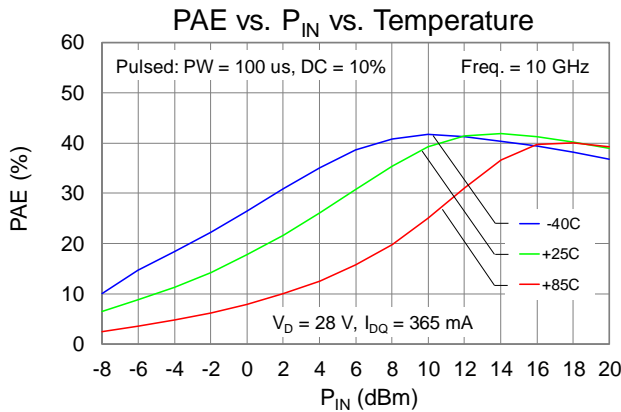
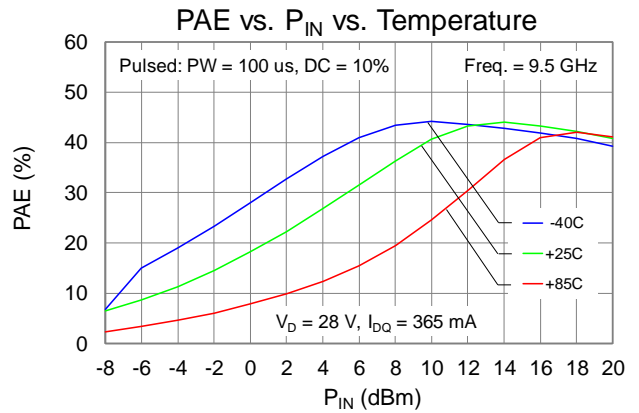
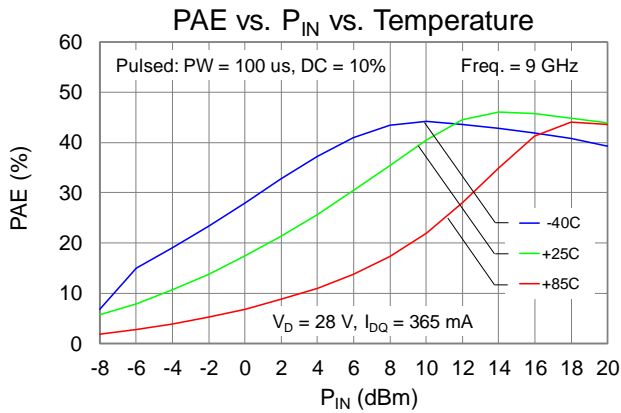
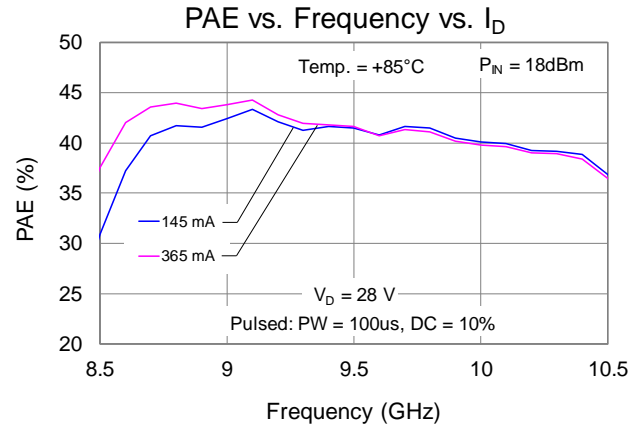
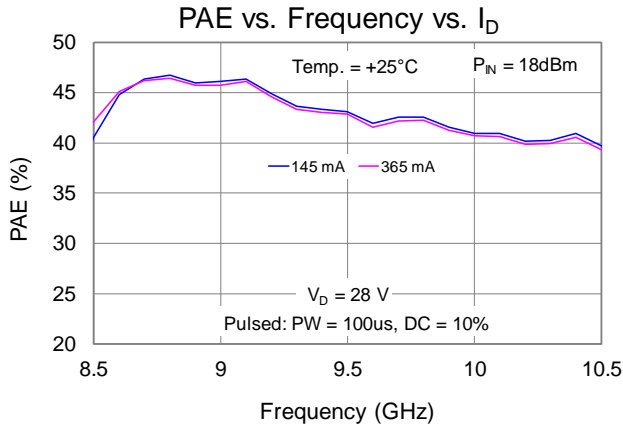
Typical Performance: Large Signal (Pulsed Operation)



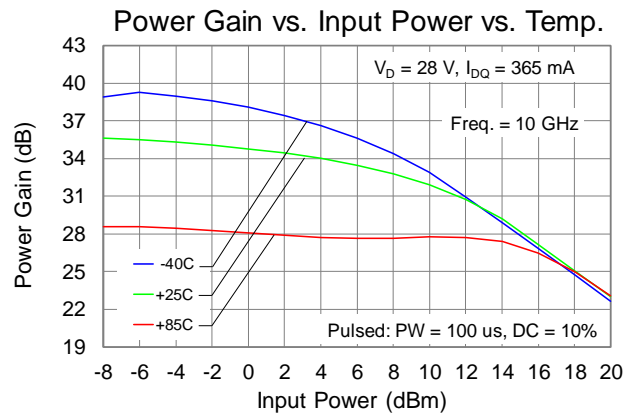
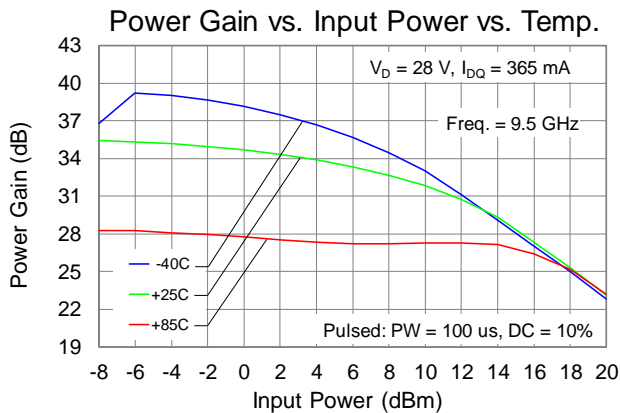
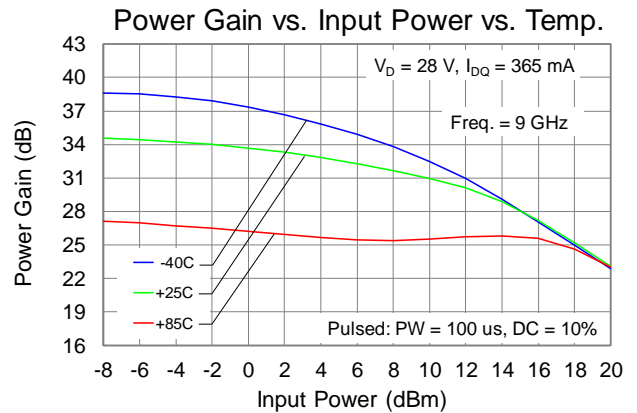
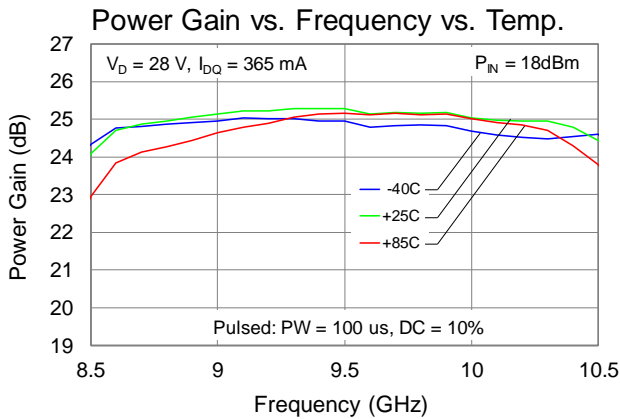
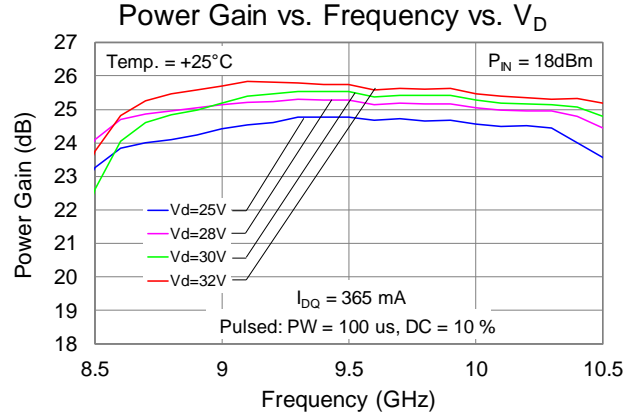
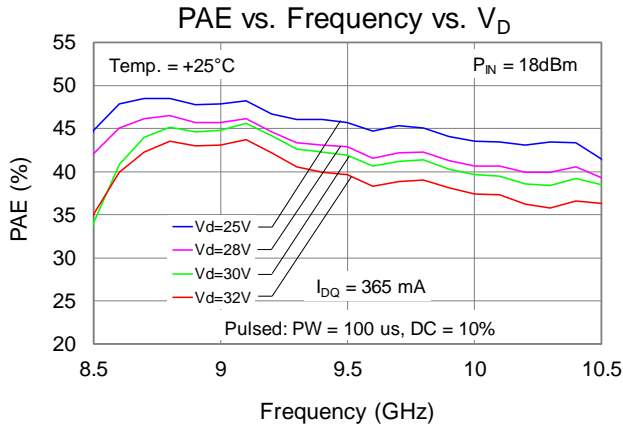
Typical Performance: Large Signal (Pulsed Operation)



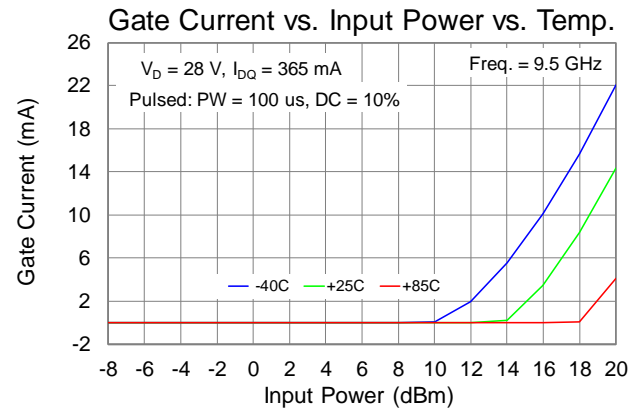
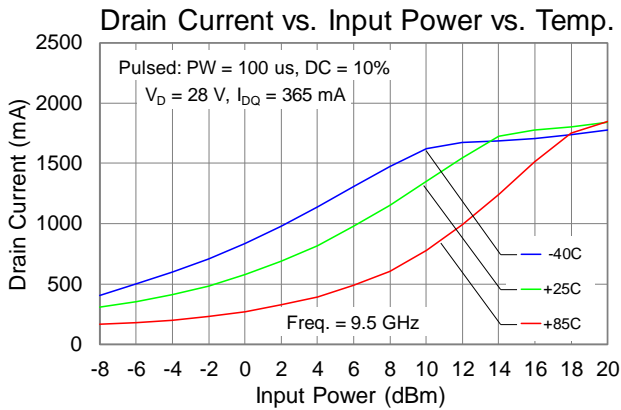
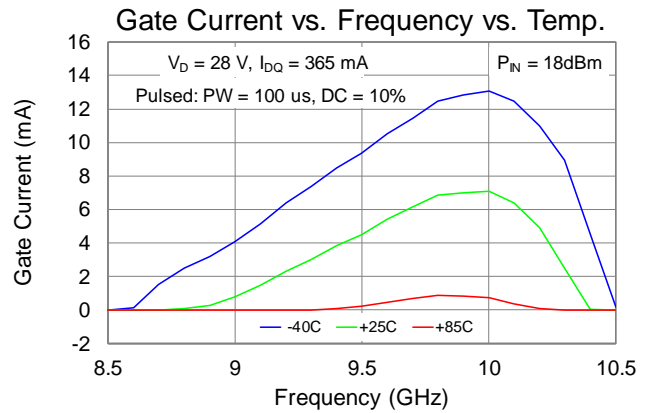
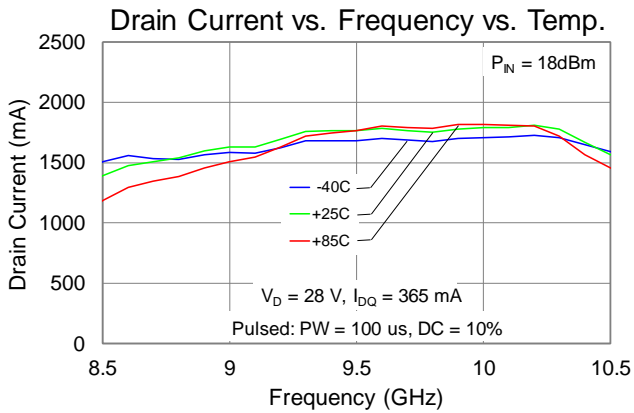
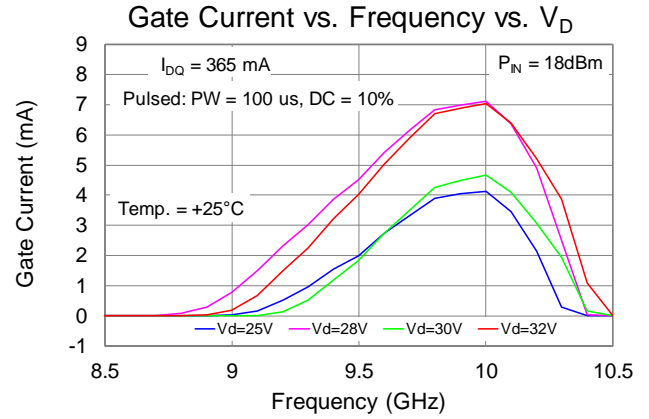
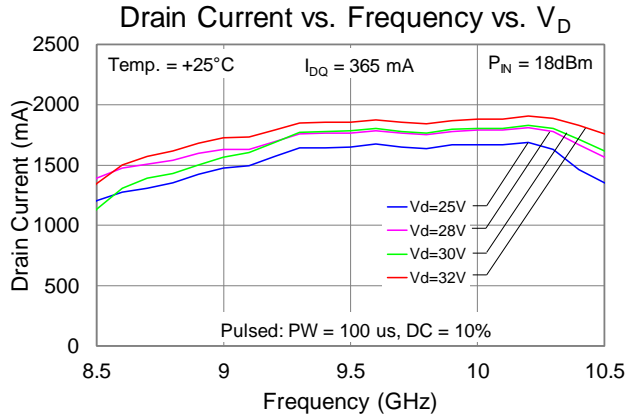
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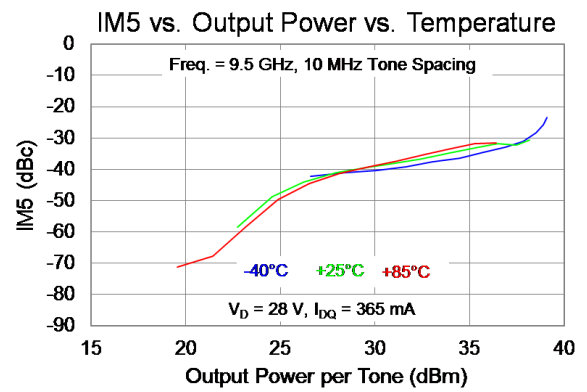
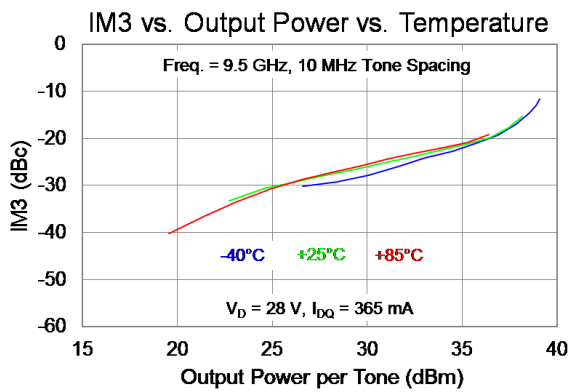
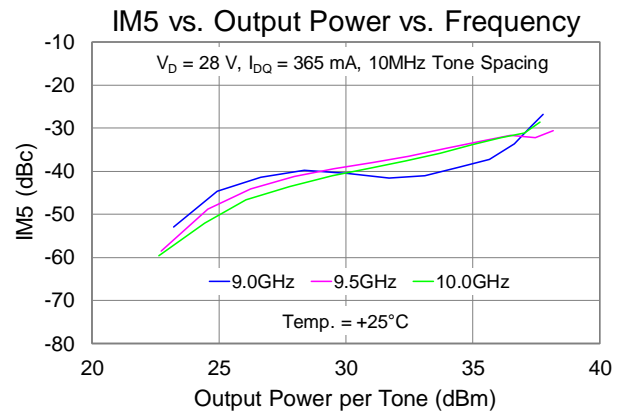
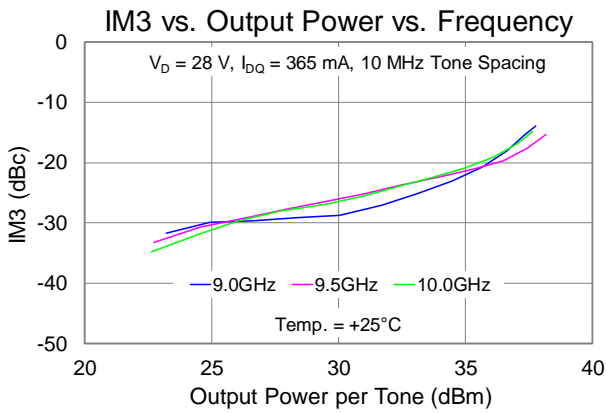
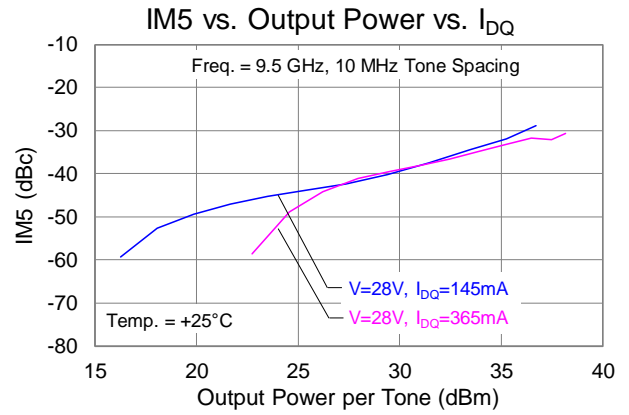
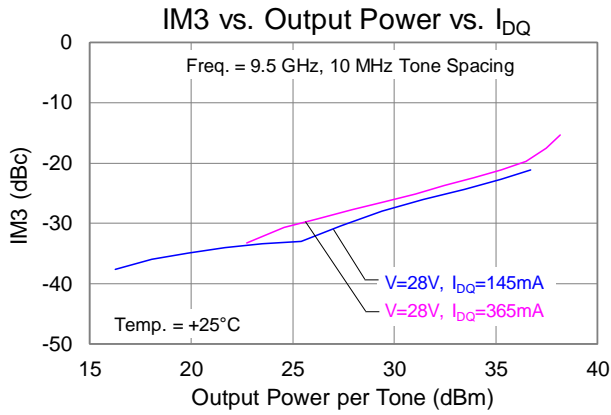
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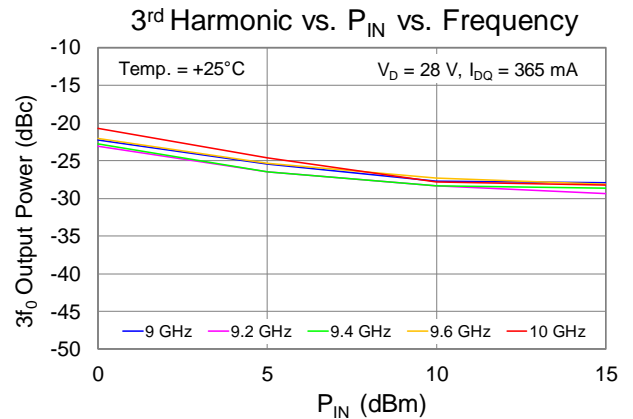
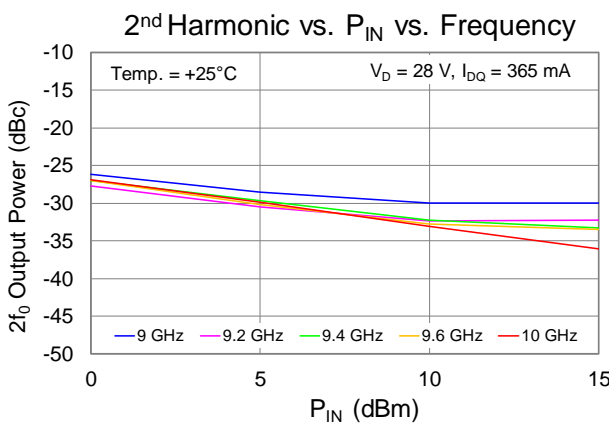
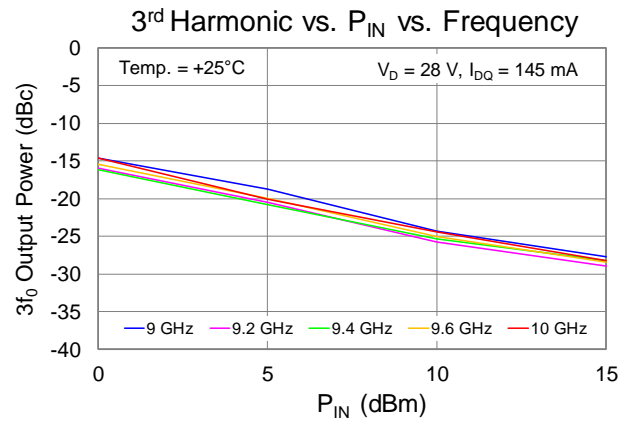
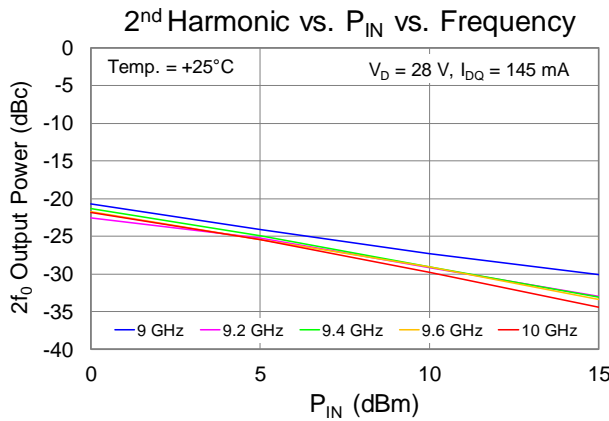
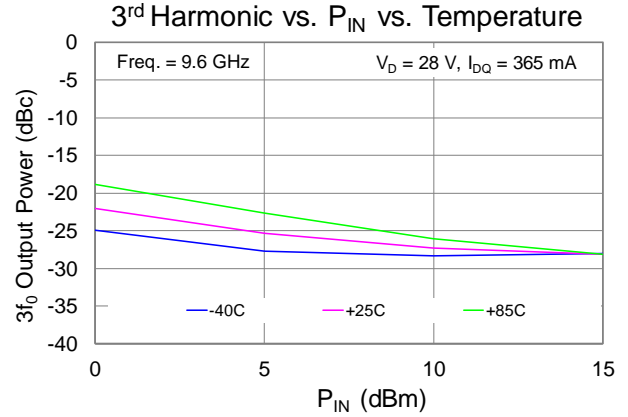
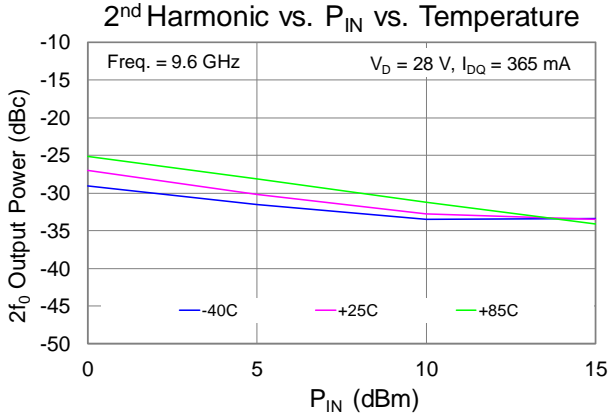
Typical Performance: Large Signal (Pulsed Operation)



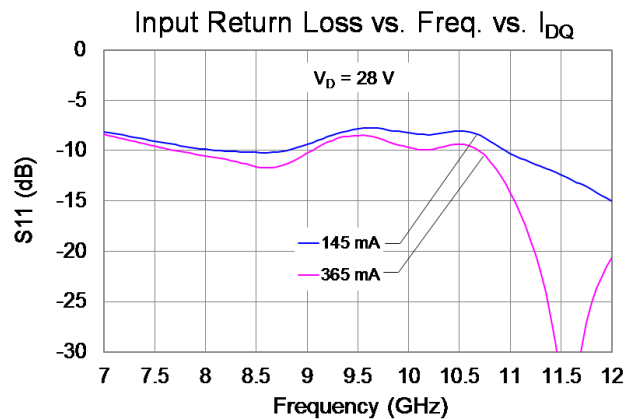
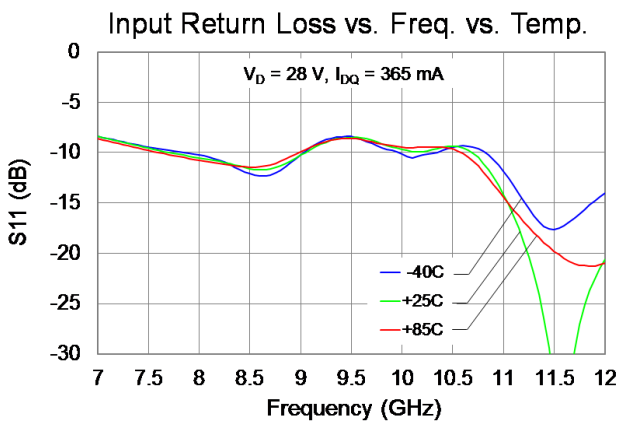
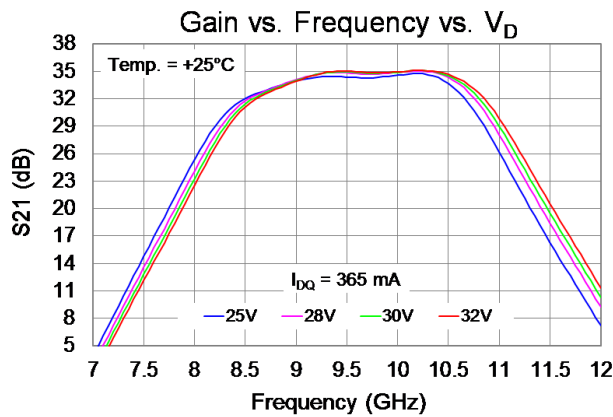
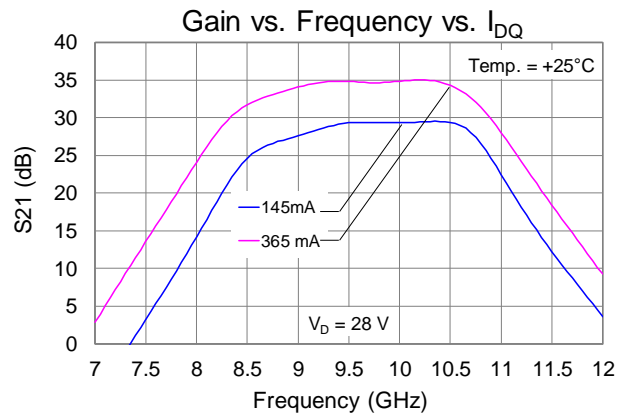
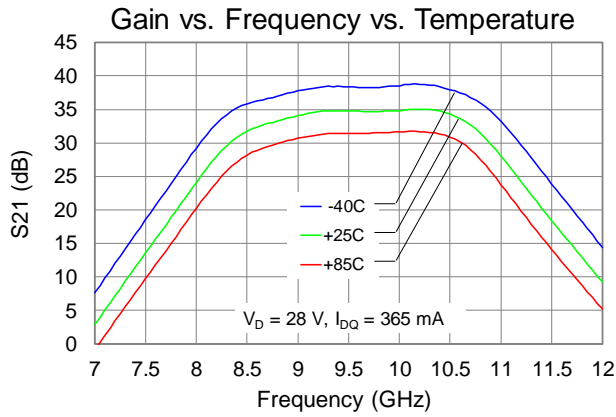
Typical Performance: Linearity (CW Operation)



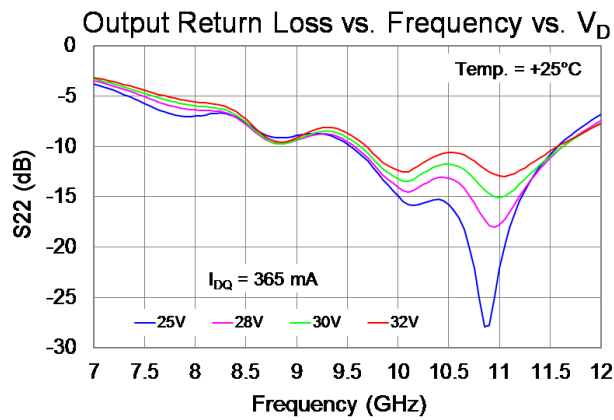
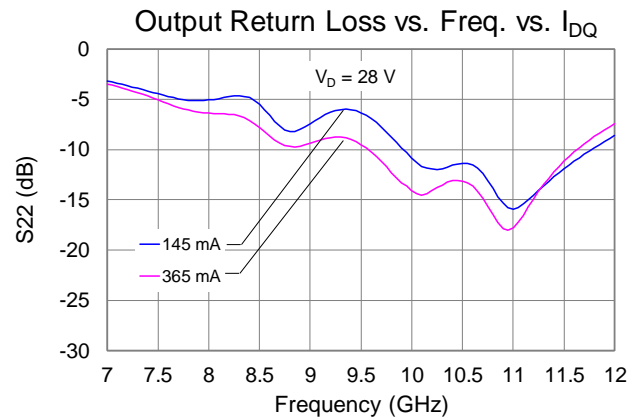
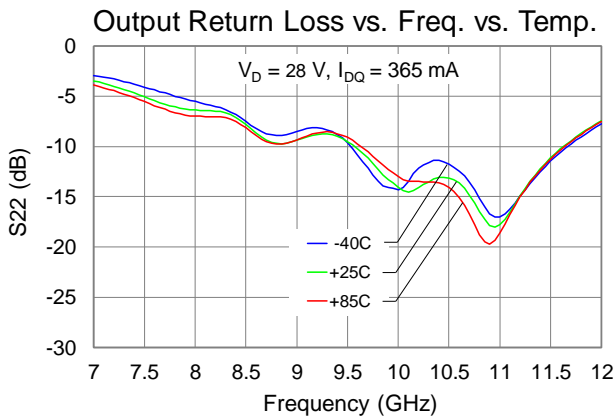
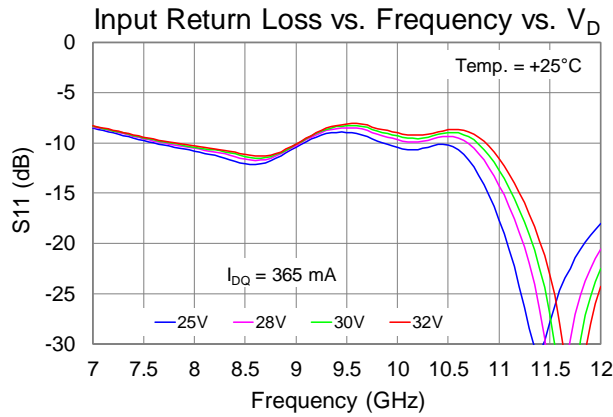
Typical Performance: Linearity (CW Operation)



Typical Performance: Small Signal (CW Operation)



Typical Performance: Small Signal (CW Operation)



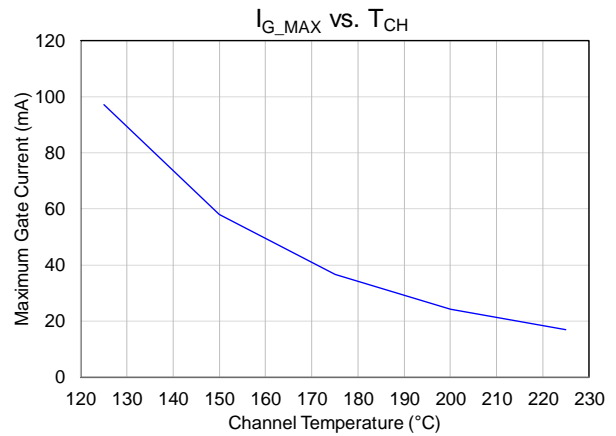
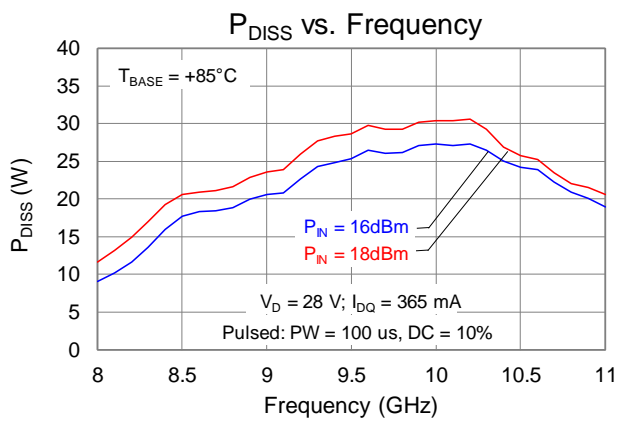
Thermal and Reliability Information

| Parameter | Test Conditions | Value | Units |
|--|---|-------|-------|
| Thermal Resistance (θ_{JC}) ¹ | T _{BASE} = 85 °C; V _D = 28 V, I _{DQ} = 365 mA, (Pulsed V _D : PW = 100 us, DC = 10 %), P _{DISS} = 10.22 W | 1.31 | °C/W |
| Channel Temperature (T _{CH}) (No RF drive) ² | | 98.4 | °C |
| Thermal Resistance (θ_{JC}) ¹ | T _{BASE} = 85 °C; V _D = 28 V, I _{DQ} = 365 mA, (Pulsed V _D : PW = 100 us, DC = 10 %), I _{D_Drive} = 1.8 A, P _{IN} = 18 dBm, P _{OUT} = 43 dBm, P _{DISS} = 30 W | 1.59 | °C/W |
| Channel Temperature (T _{CH}) (Under RF drive) ² | | 132.8 | °C |

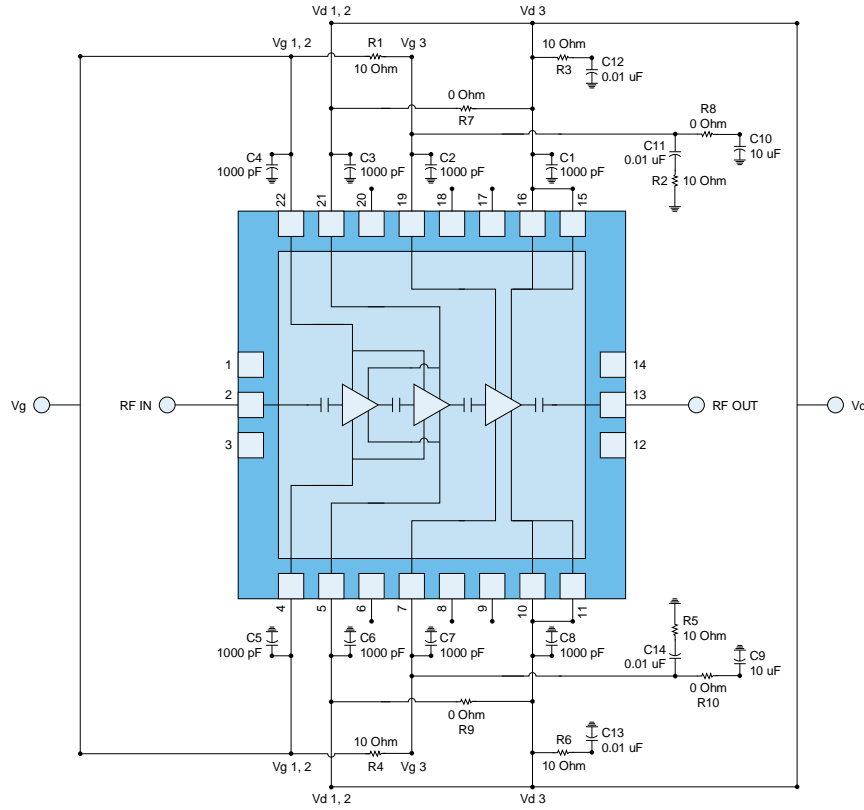
Notes:

1. Thermal Resistance measured to back of 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



Application Information



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.

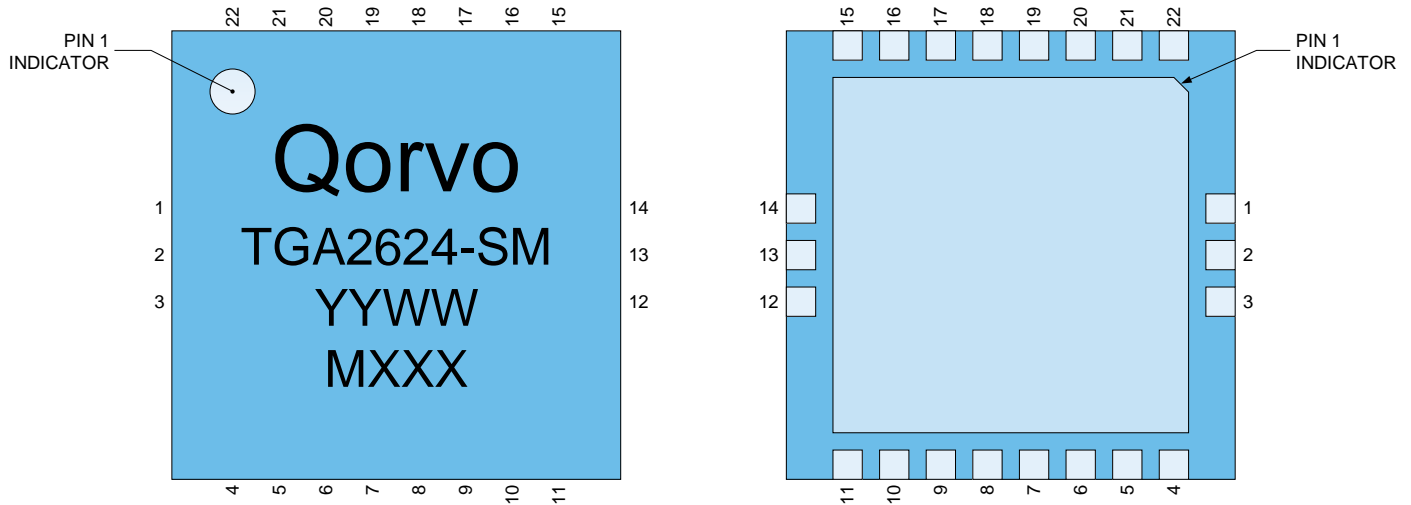
Bias-up Procedure

- Set I_D limit to 2 A, I_G limit to 25 mA
- Apply -5.0 V to V_G (for pinch-off)
- Increase V_D to +28 V; Ensure I_{DQ} is approx. 0 mA
- Adjust V_G more positive until $I_{DQ} = 365$ mA $V_G \sim -2.5$ V typ
- Apply RF signal

Bias-down Procedure

- Turn off RF signal
- Reduce V_G to -5 V; ensure I_{DQ} is approx. 0 mA
- Set V_D to 0 V
- Turn off V_D supply
- Turn off V_G supply

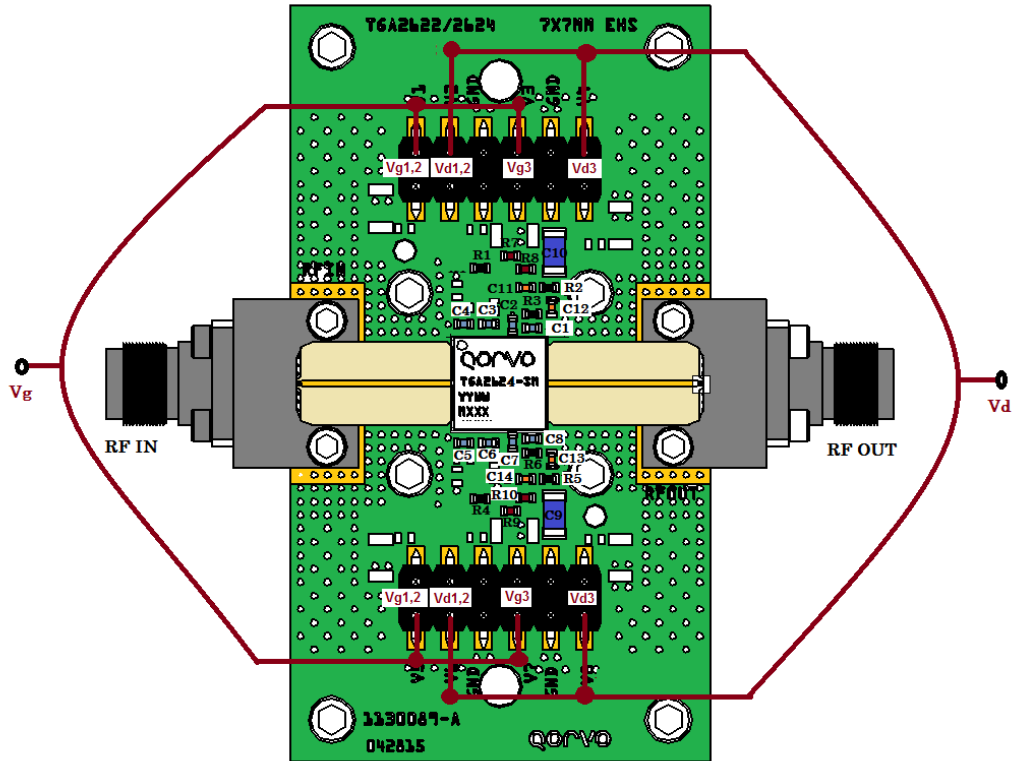
Pin Layout



Pin Description

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

Evaluation Board Layout



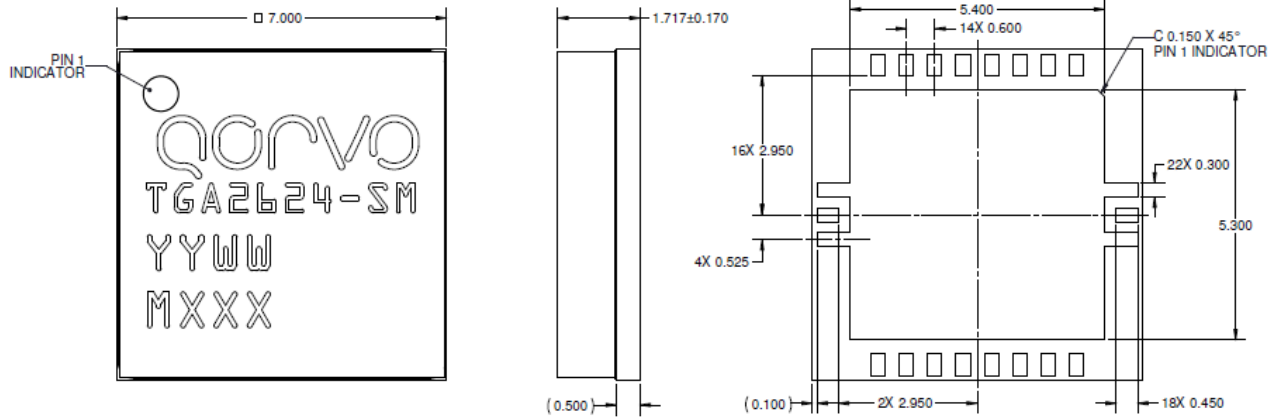
Notes:

- Both Top and Bottom V_D and V_G must be biased

Bill of Material

| Reference Design | Value | Description | Manufacture | Part-Number |
|------------------|--------------|---|-------------|-------------|
| C1–C8 | 1000 pF | Cap, 0402, 100 V, 10%, X7R | Various | |
| C9–C10 | 10 μ F | Cap, 1206, 50 V, 20%, X5R | Various | |
| C11–C14 | 0.01 μ 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 = ± 0.25; x.xxx = ± 0.100
 Materials:
 Base: Laminate Substrate
 Lid: Laminate
 All metalized features are gold plated
 Part is epoxy sealed
 Marking:
 TGA2624-SM: Part number
 YY: Part Assembly year
 WW: Part Assembly week
 MXXX: Batch ID

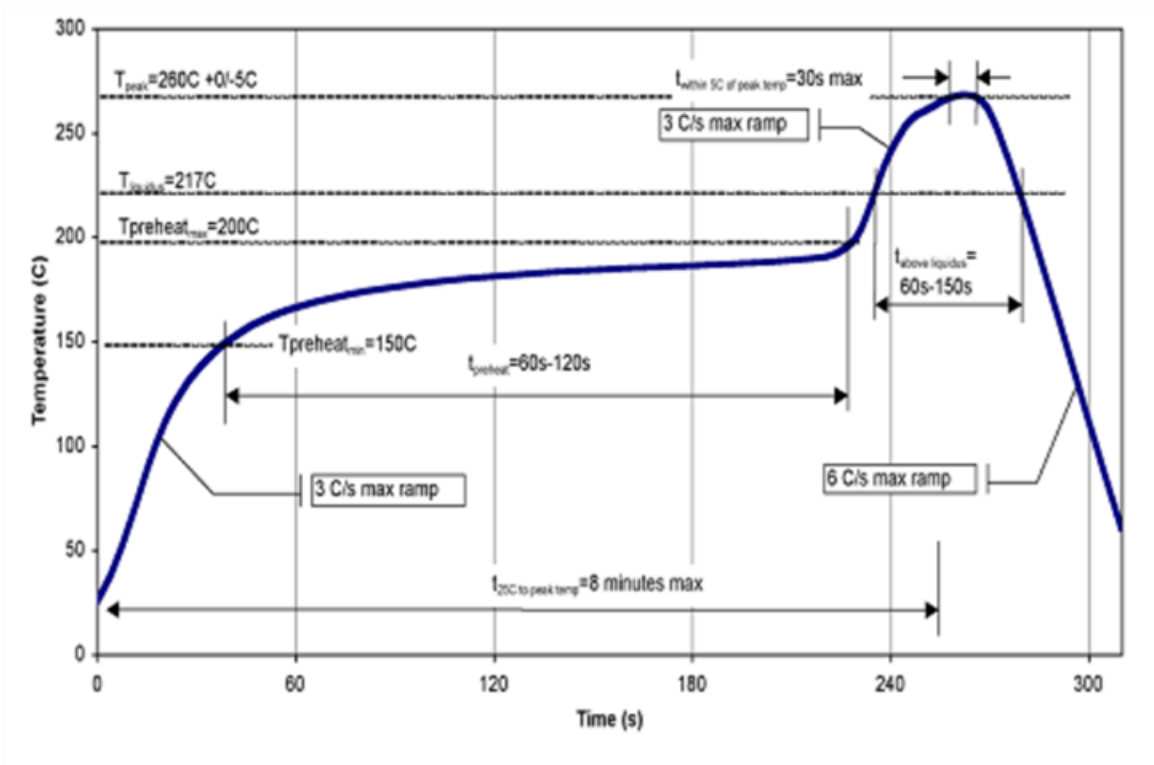
Assembly Notes

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