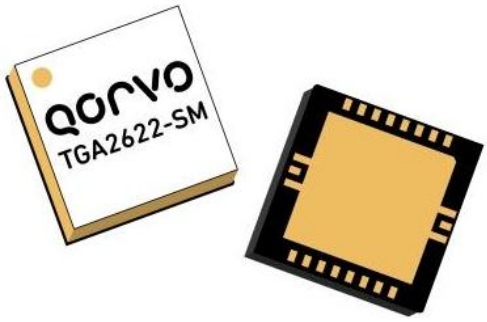
TGA2622-SM

9 – 10 GHz 35 W GaN Power Amplifier

Applications

- Weather and Marine Radar

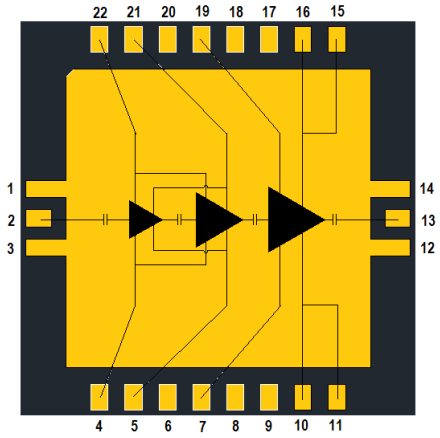


QFN 7x7 mm 22L

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, V_G = -2.3 V Typical (Pulsed V_D: PW = 100 us and DC = 10 %)
- Package Dimensions: 7 x 7 x 1.75 mm

Functional Block Diagram



General 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.

Evaluation boards are available upon request.

Pad Configuration

Pad No.	Symbol
1, 3, 12, 14	GND
2	RF In
4, 22	$V_{G1,2}$
5, 21	$V_{D1,2}$
6, 8, 9, 17, 18, 20	N/C
7, 19	V_{G3}
10, 11, 15, 16	V_{D3}
13	RF Out

Ordering Information

Part	ECCN	Description
TGA2622-SM	3A001.b.2.b	9 – 10 GHz 35 W GaN Power Amplifier

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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 plot page 3
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
Channel Temperature (T_{CH})	275 °C
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.

Notes:

Recommended Operating Conditions

Parameter	Value
Drain Voltage (V_D): Pulsed	28 V
Drain Current (I_{DQ})	290 mA
Gate Voltage (V_G)	-2.3 V (Typ.)
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 ^{0}C, V_D = 28 V, I_{DQ} = 290 mA, V_G = -2.3 V Typical, Pulsed V_D: PW = 100 us, DC = 10 %

Parameter	Min	Typical	Max	Units
Operational Frequency Range	9		10	GHz
Small Signal Gain		>30		dB
Input Return Loss		>10		dB
Output Return Loss		>9		dB
Output Power (Pin = 18dBm)		45.5		dBm
Power Added Efficiency (Pin = 18dBm)		>42		%
Power Gain (Pin = 18dBm)		27.5		dB
Output Power Temperature Coefficient From 25°C to 85°C (Pin = 18dBm)		-0.02		dBm/°C
Recommended Operating Voltage:	20	28	32	V

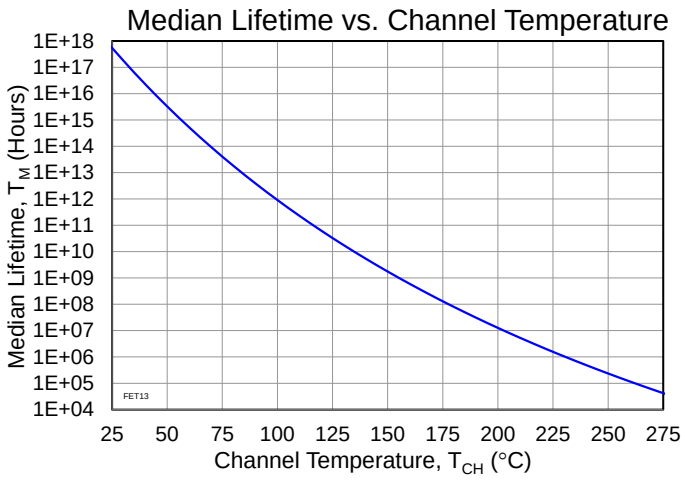
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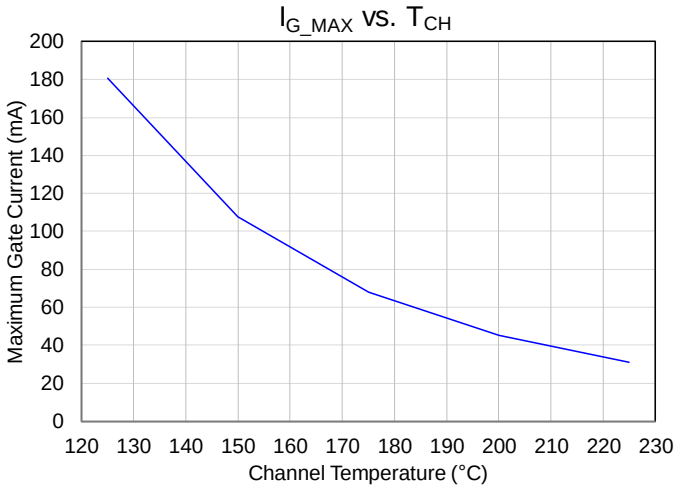
Thermal and Reliability Information

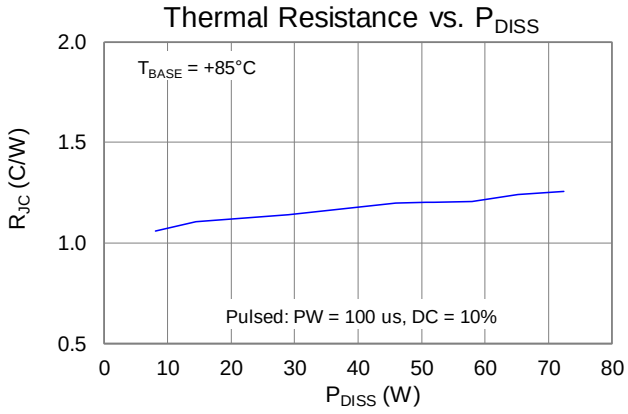
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	V_D = 28 V, I_{DQ} = 290 mA, (Pulsed V_D : PW = 100 us, DC = 10 %), T_{base} = 85 °C; P_{DISS} = 8.12 W	1.06	ºC/W
Channel Temperature (T_{CH}) (No RF drive)		94	°C
Median Lifetime (T_M)		2.16 x 10^12	Hrs
Thermal Resistance (θ_{JC}) (1)	V_D = 28 V, I_{DQ} = 290 mA, (Pulsed V_D : PW = 100 us, DC = 10 %), T_{base} = 85 °C, V_D = 28 V, $I_{D\ Drive}$ = 3.1 A, P_{IN} = 20 dBm, P_{OUT} = 45.4 dBm, P_{DISS} = 52 W	1.21	ºC/W
Channel Temperature (T_{CH}) (Under RF drive)		148	°C
Median Lifetime (T_M)		2.19 x 10^9	Hrs

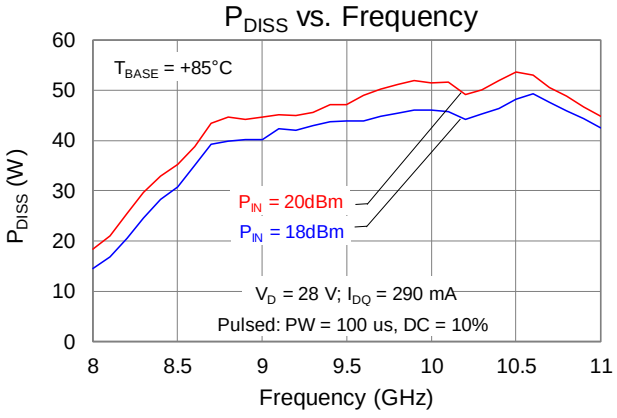
Notes:
1. Thermal Resistance measured to back of package.

Test Conditions: V_D = 40 V; Failure Criteria = 10% reduction in I_{D_MAX}





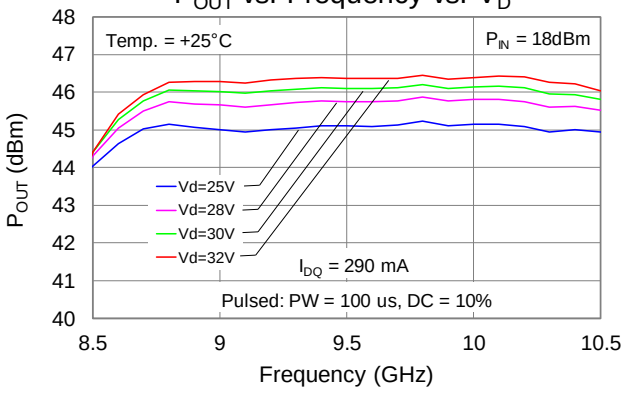




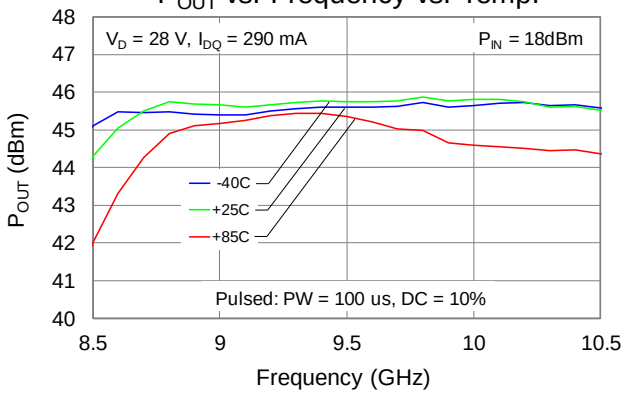
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Typical Performance: Large Signal (Pulsed Operation)

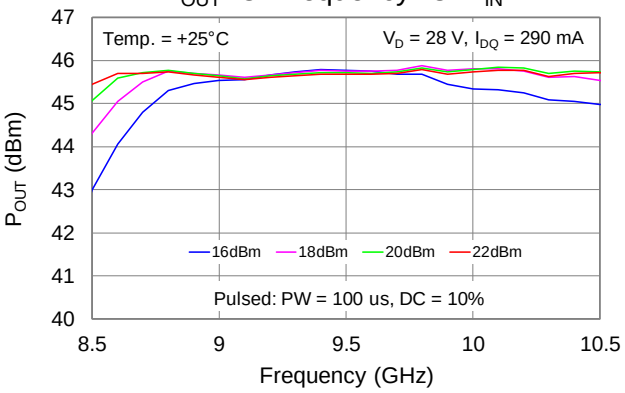
P_{OUT} vs. Frequency vs. V_D



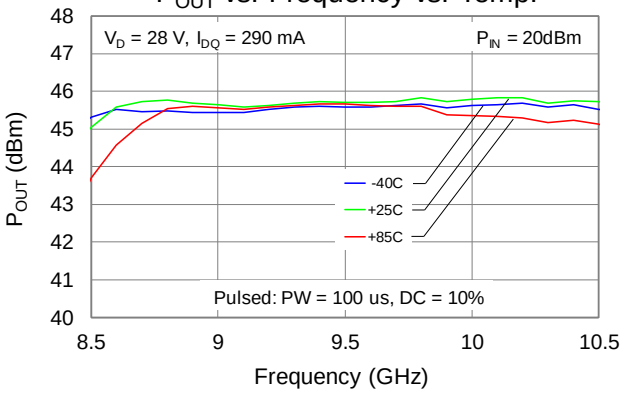
P_{OUT} vs. Frequency vs. Temp.



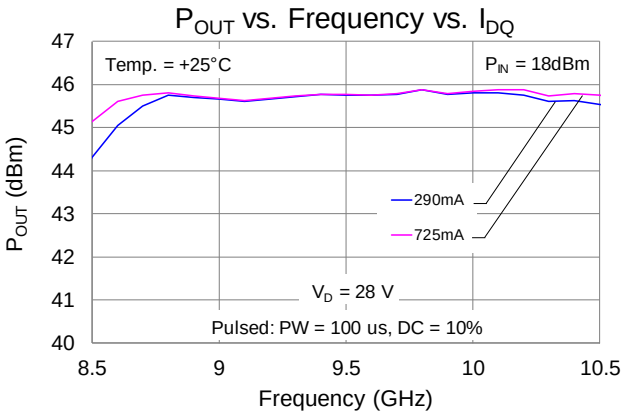
P_{OUT} vs. Frequency vs. P_{IN}



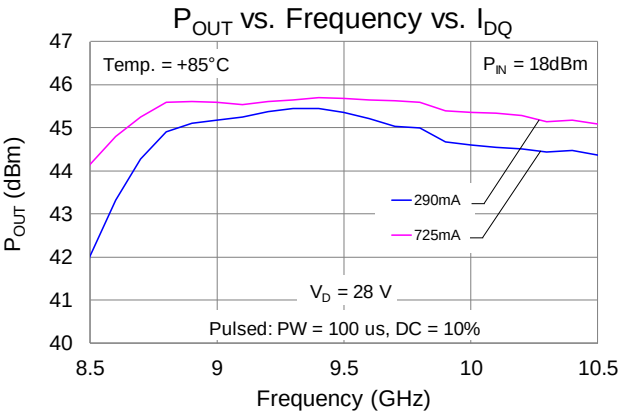
P_{OUT} vs. Frequency vs. Temp.



P_{OUT} vs. Frequency vs. I_{DQ}

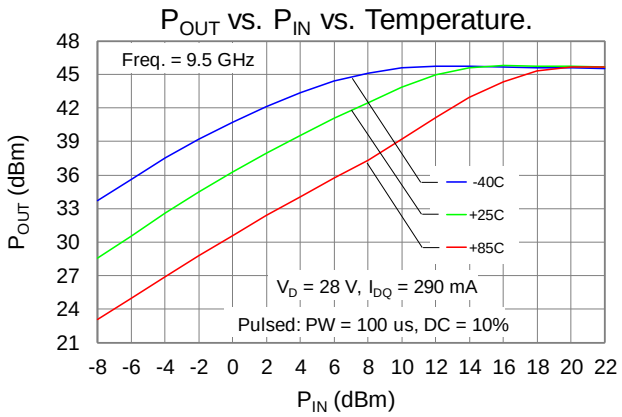


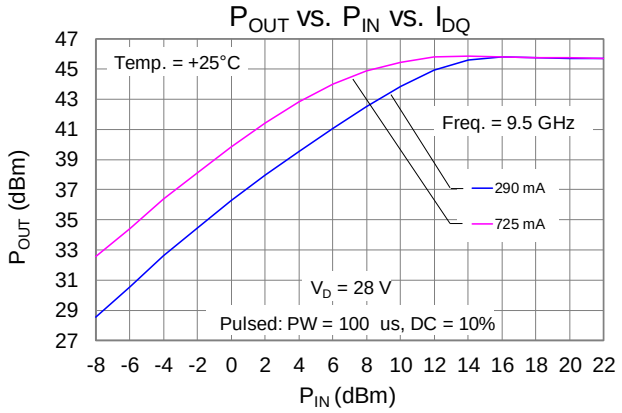
P_{OUT} vs. Frequency vs. I_{DQ}

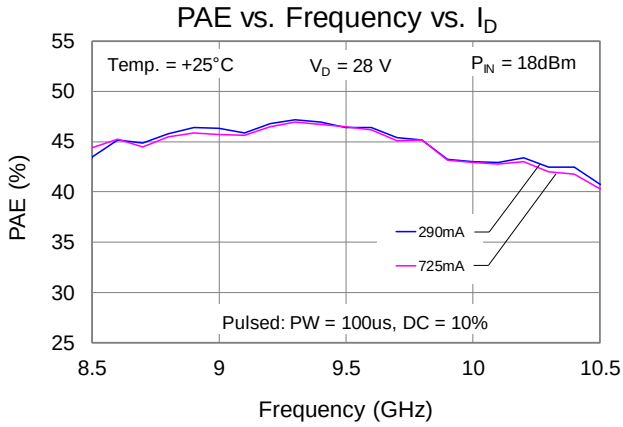


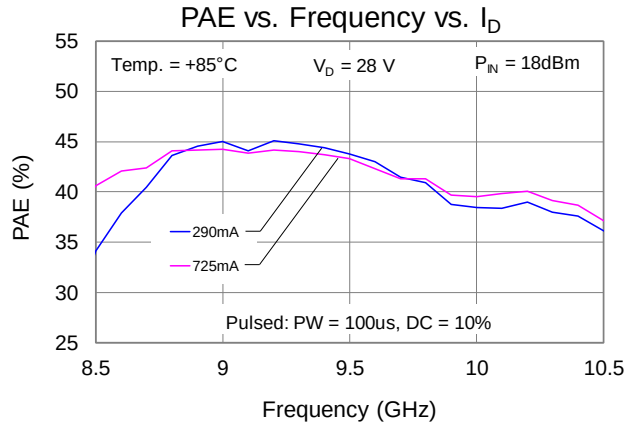
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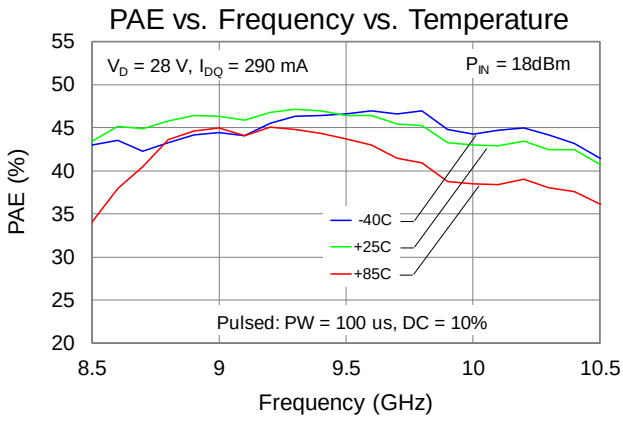
Typical Performance: Large Signal (Pulsed Operation)

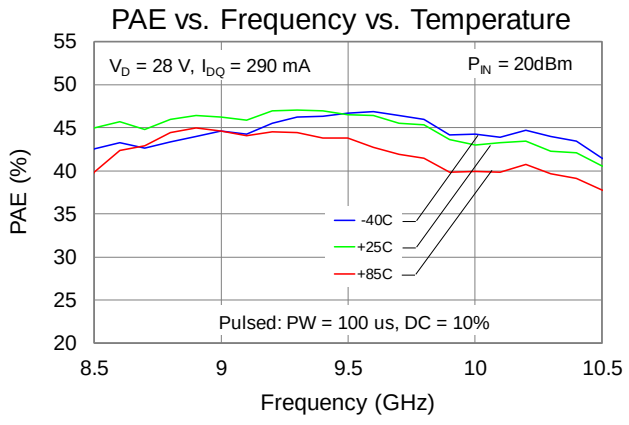








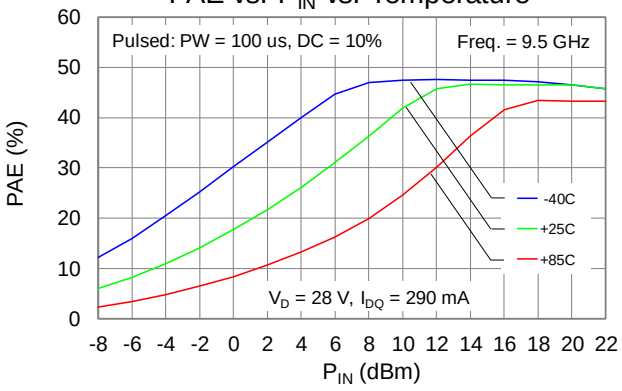




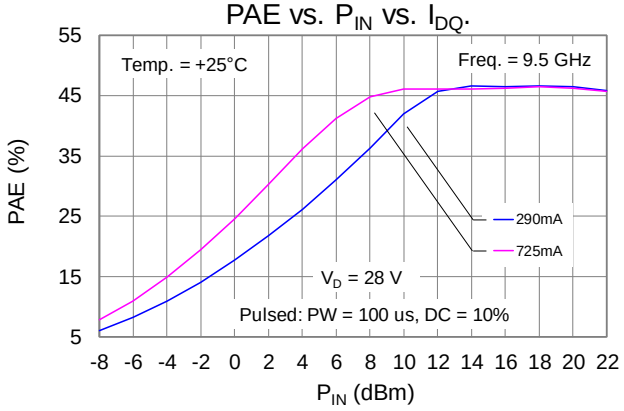
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Typical Performance: Large Signal (Pulsed Operation)

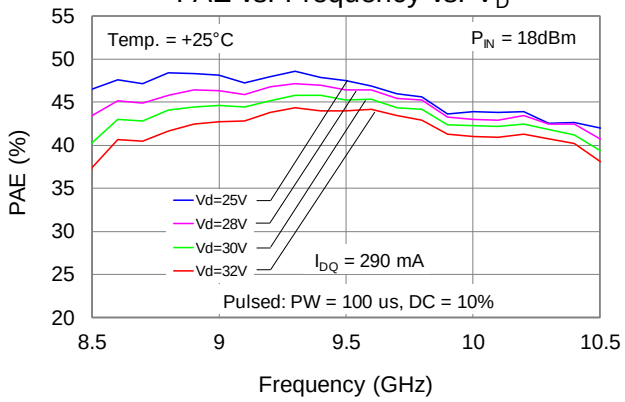
PAE vs. P_{IN} vs. Temperature



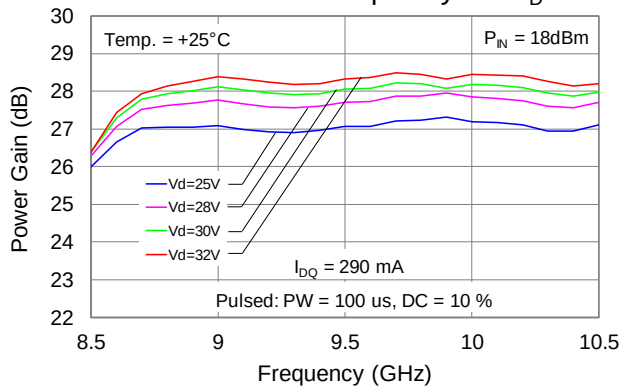
PAE vs. P_{IN} vs. I_{DQ}.



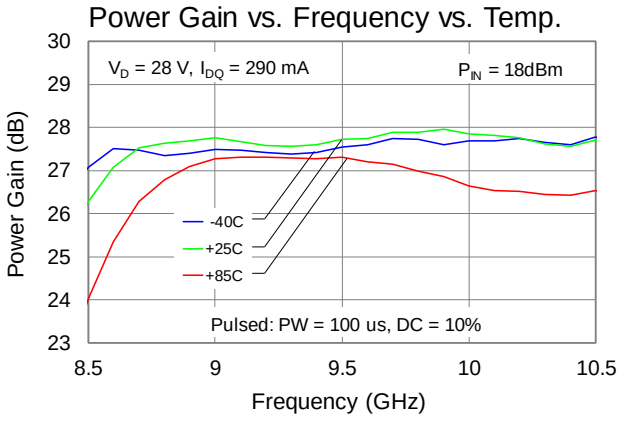
PAE vs. Frequency vs. V_D



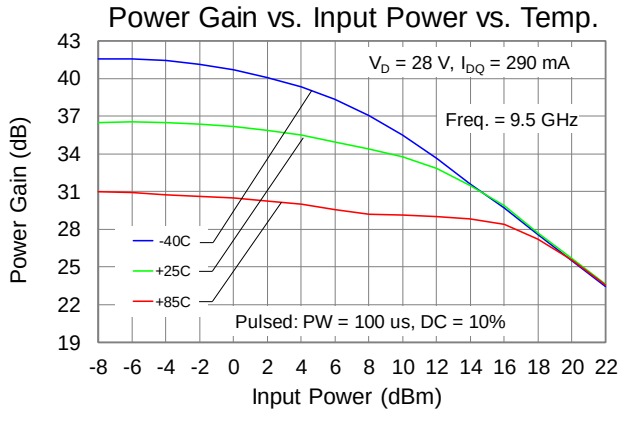
Power Gain vs. Frequency vs. V_D



Power Gain vs. Frequency vs. Temp.



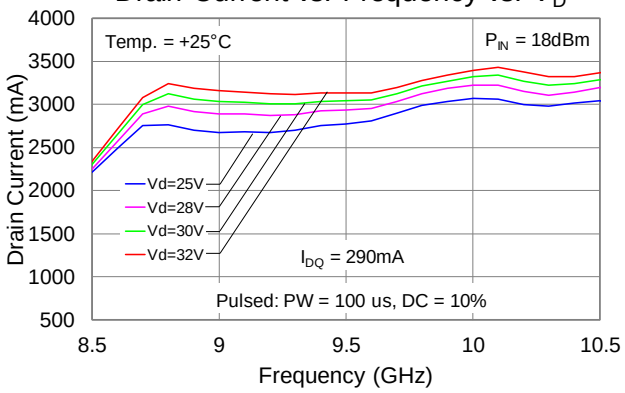
Power Gain vs. Input Power vs. Temp.



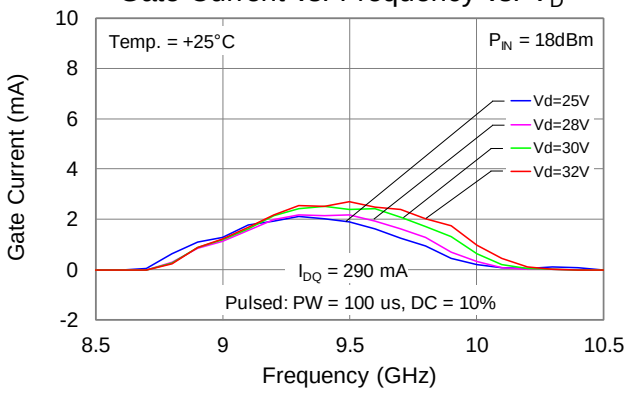
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Typical Performance: Large Signal (Pulsed Operation)

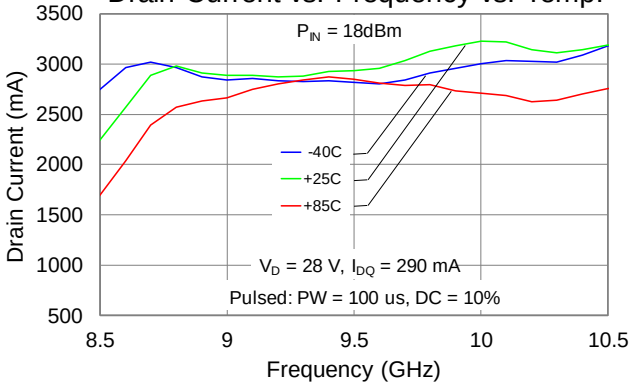
Drain Current vs. Frequency vs. V_D



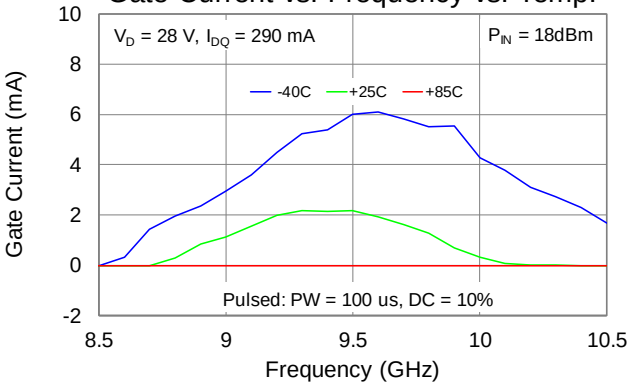
Gate Current vs. Frequency vs. V_D



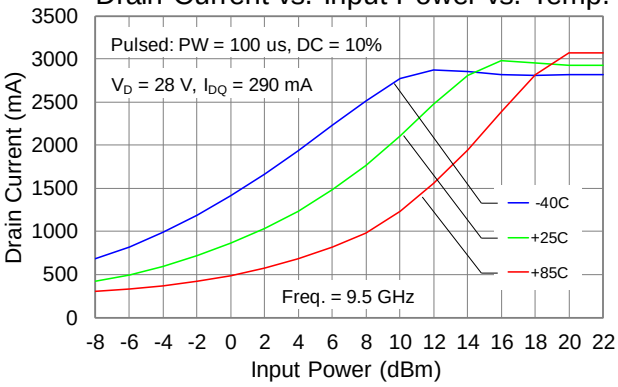
Drain Current vs. Frequency vs. Temp.



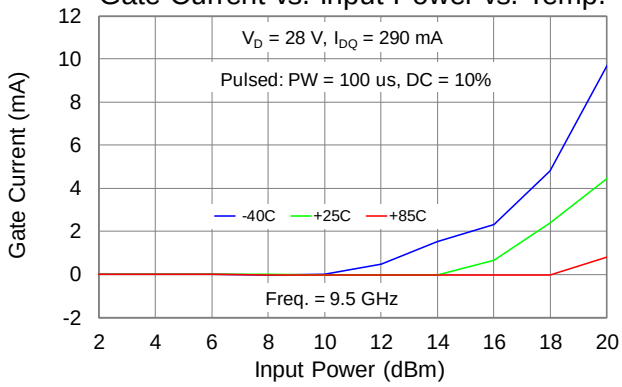
Gate Current vs. Frequency vs. Temp.



Drain Current vs. Input Power vs. Temp.



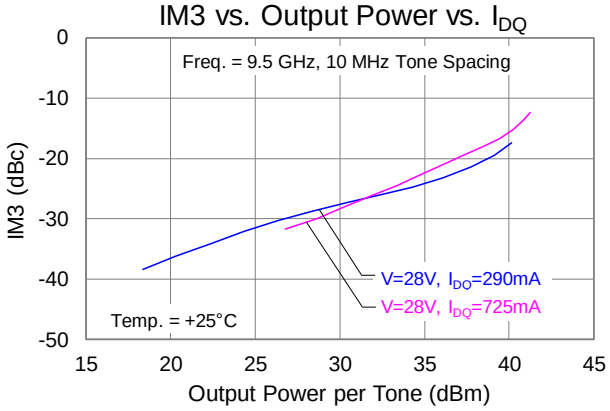
Gate Current vs. Input Power vs. Temp.



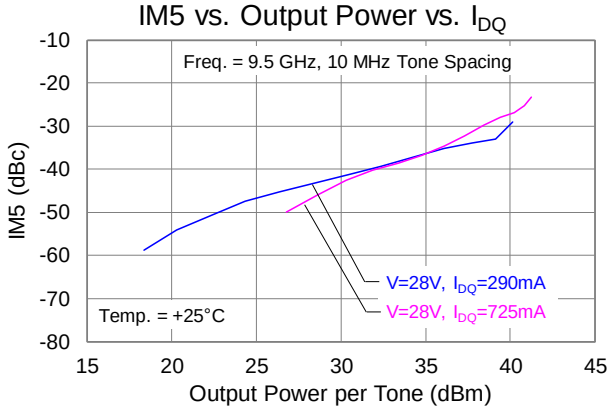
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Typical Performance: Linearity (CW Operation)

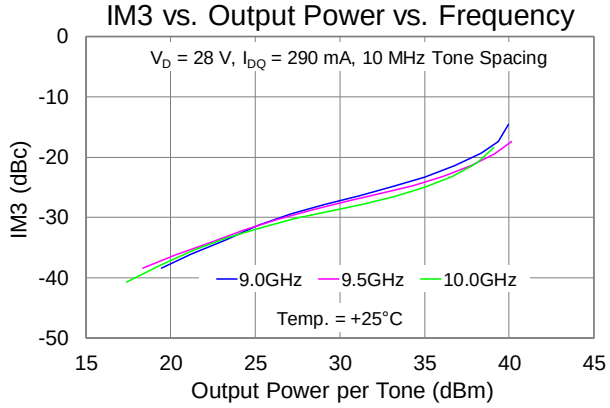
IM3 vs. Output Power vs. I_{DQ}



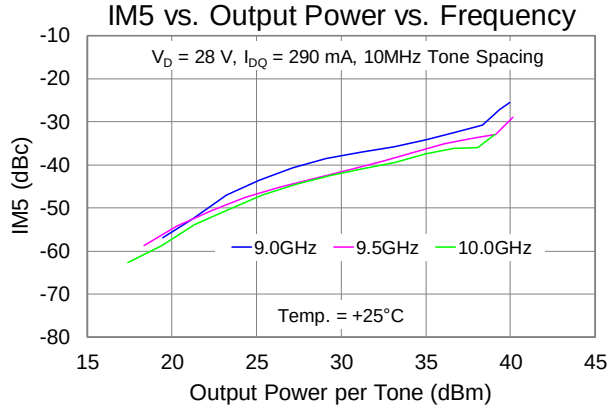
IM5 vs. Output Power vs. I_{DQ}



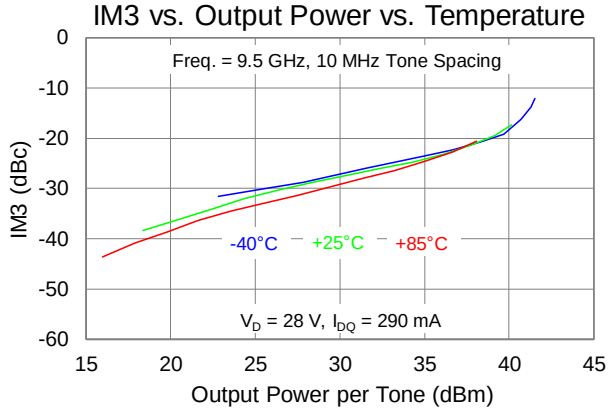
IM3 vs. Output Power vs. Frequency



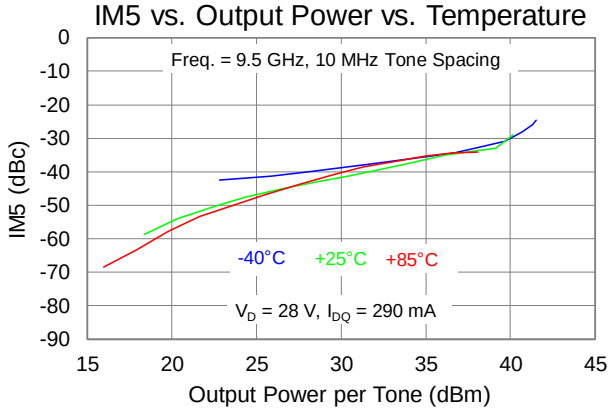
IM5 vs. Output Power vs. Frequency



IM3 vs. Output Power vs. Temperature



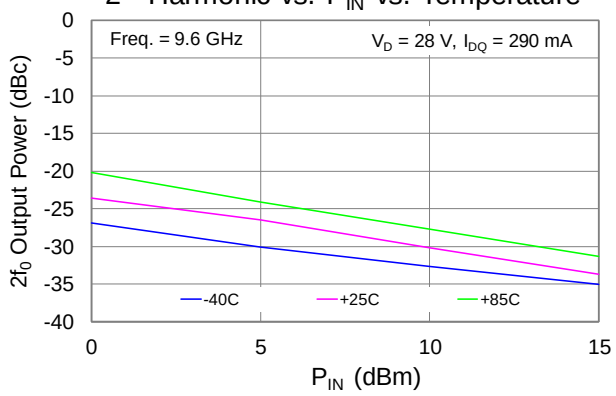
IM5 vs. Output Power vs. Temperature



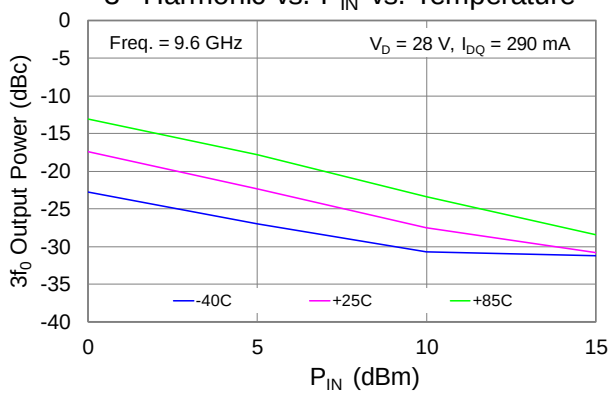
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Typical Performance: Linearity (CW Operation)

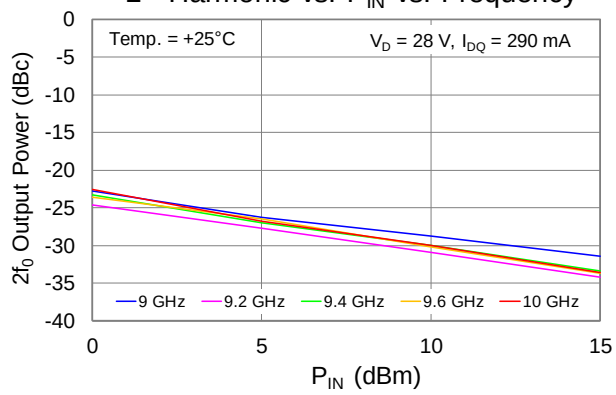
2nd Harmonic vs. P_{IN} vs. Temperature



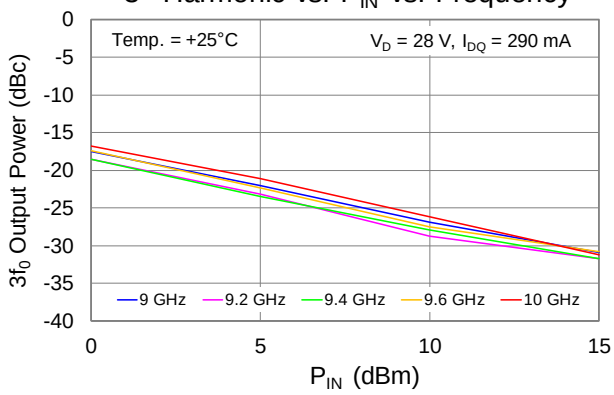
3rd Harmonic vs. P_{IN} vs. Temperature



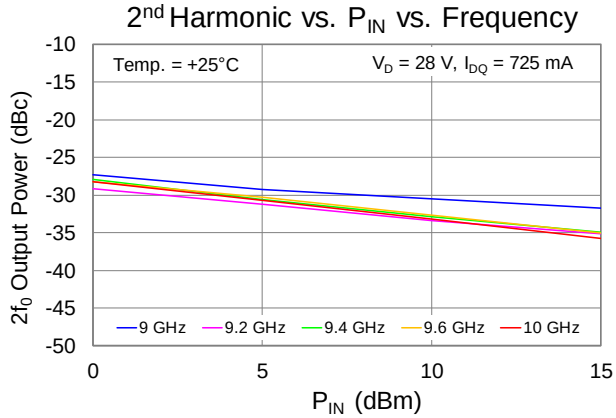
2nd Harmonic vs. P_{IN} vs. Frequency



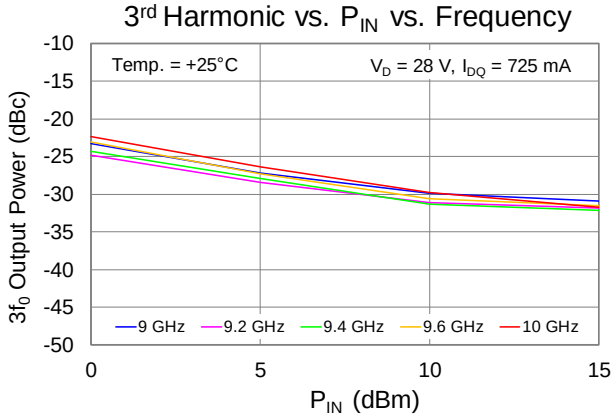
3rd Harmonic vs. P_{IN} vs. Frequency



2nd Harmonic vs. P_{IN} vs. Frequency



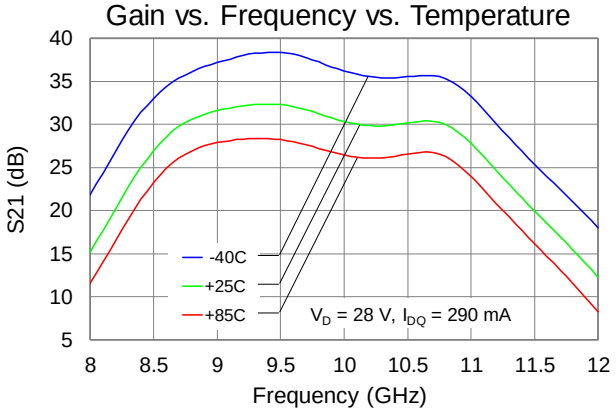
3rd Harmonic vs. P_{IN} vs. Frequency



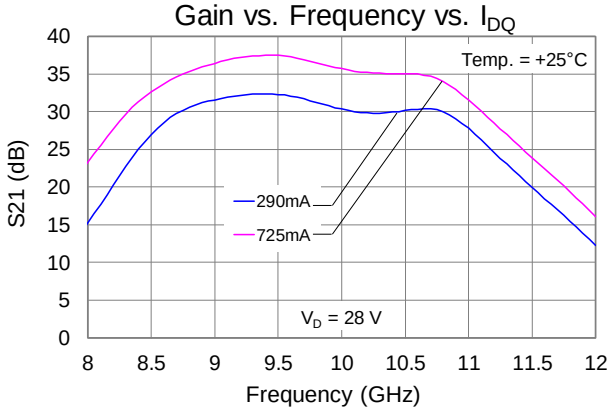
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Typical Performance: Small Signal (CW Operation)

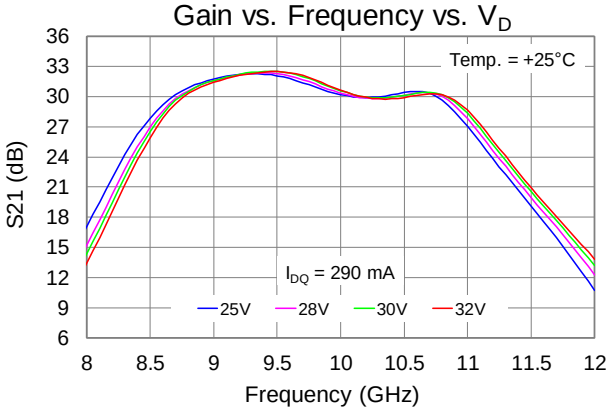
Gain vs. Frequency vs. Temperature



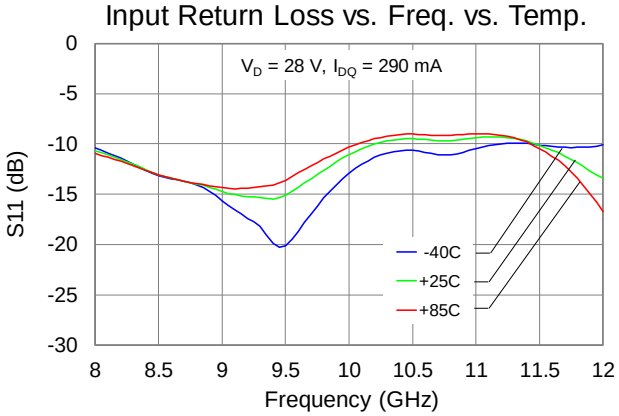
Gain vs. Frequency vs. I_{DQ}



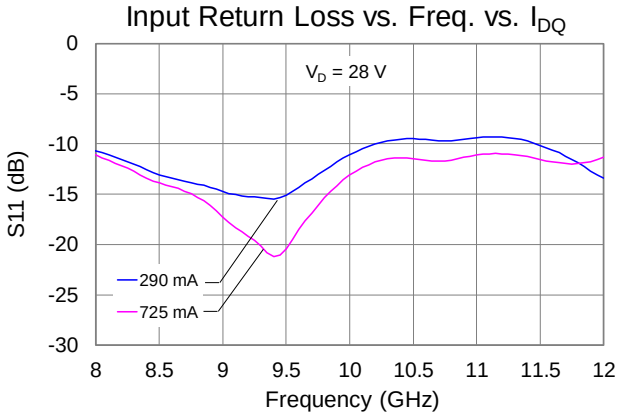
Gain vs. Frequency vs. V_D



Input Return Loss vs. Freq. vs. Temp.

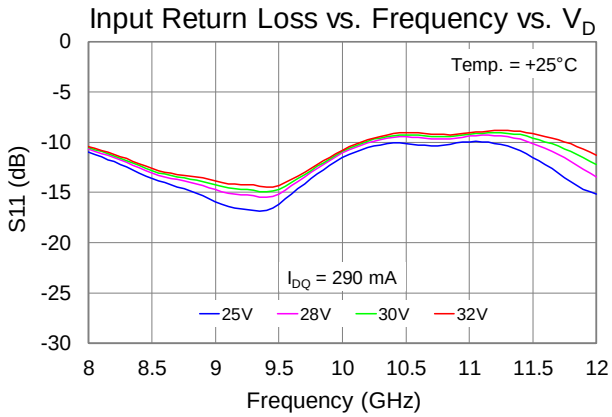


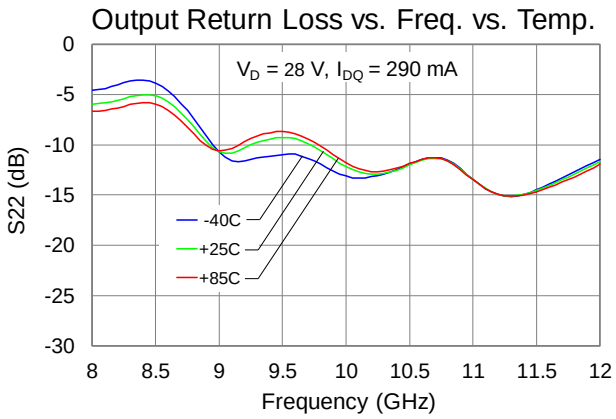
Input Return Loss vs. Freq. vs. I_{DQ}

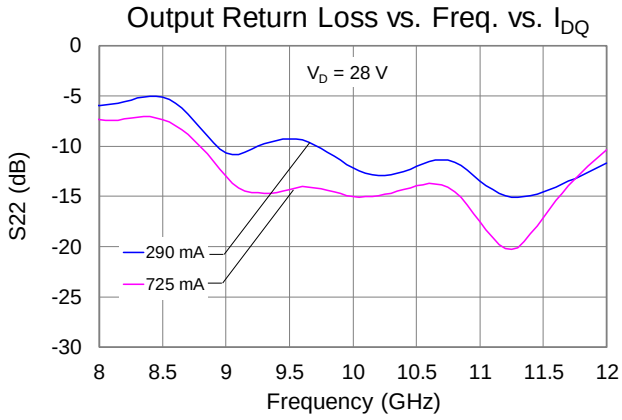


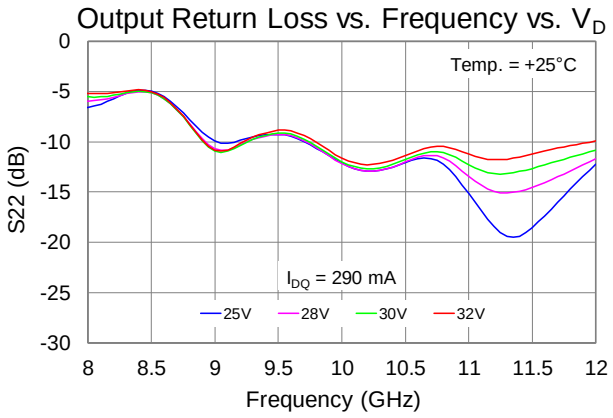
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Typical Performance: Small Signal (CW Operation)



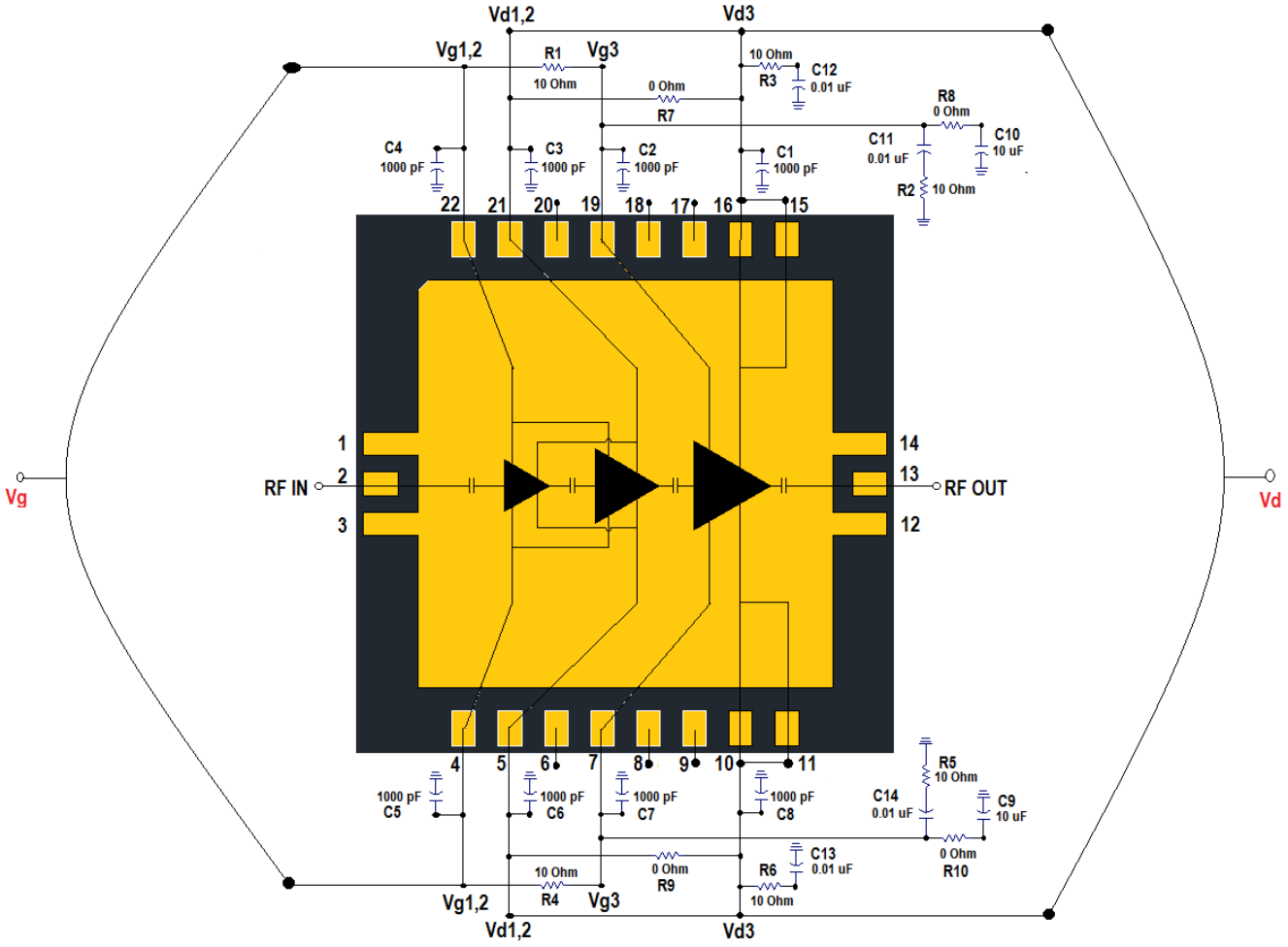






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Applications Information



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

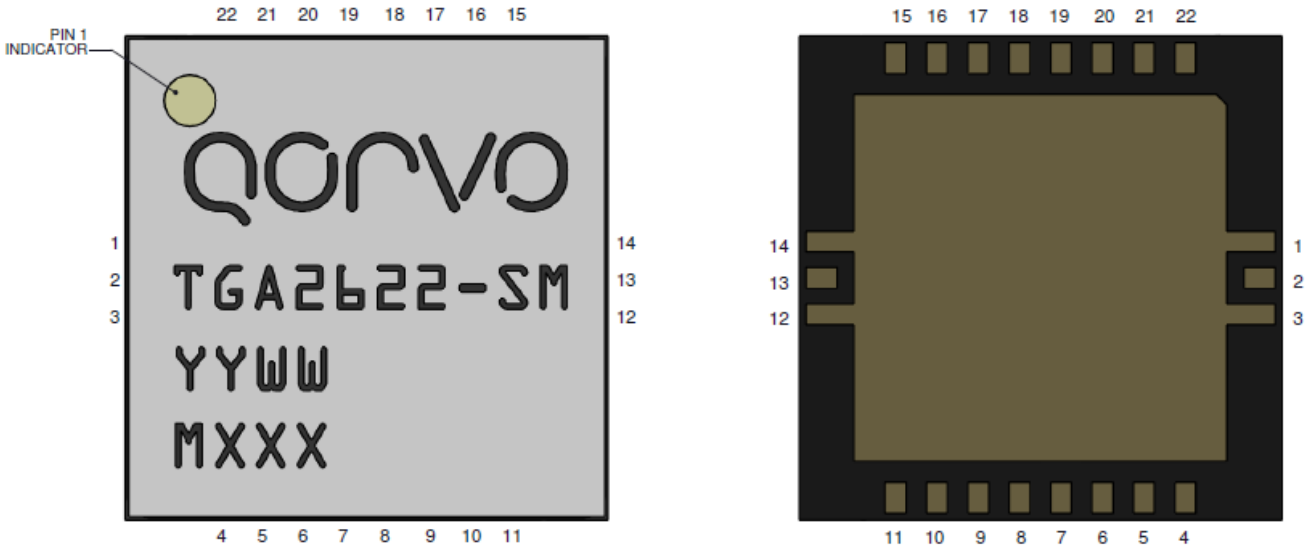
1. Set I_D limit to 3.5 A, I_G limit to 25 mA
2. Apply -5.0 V to V_G (for pinch-off)
3. Increase V_D to +28 V; Ensure I_{DO} is approx. 0 mA
4. Adjust V_G more positive until I_{DQ} = 290 mA V_G ~ -2.3 V typ
5. Apply RF signal

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

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Pin Layout

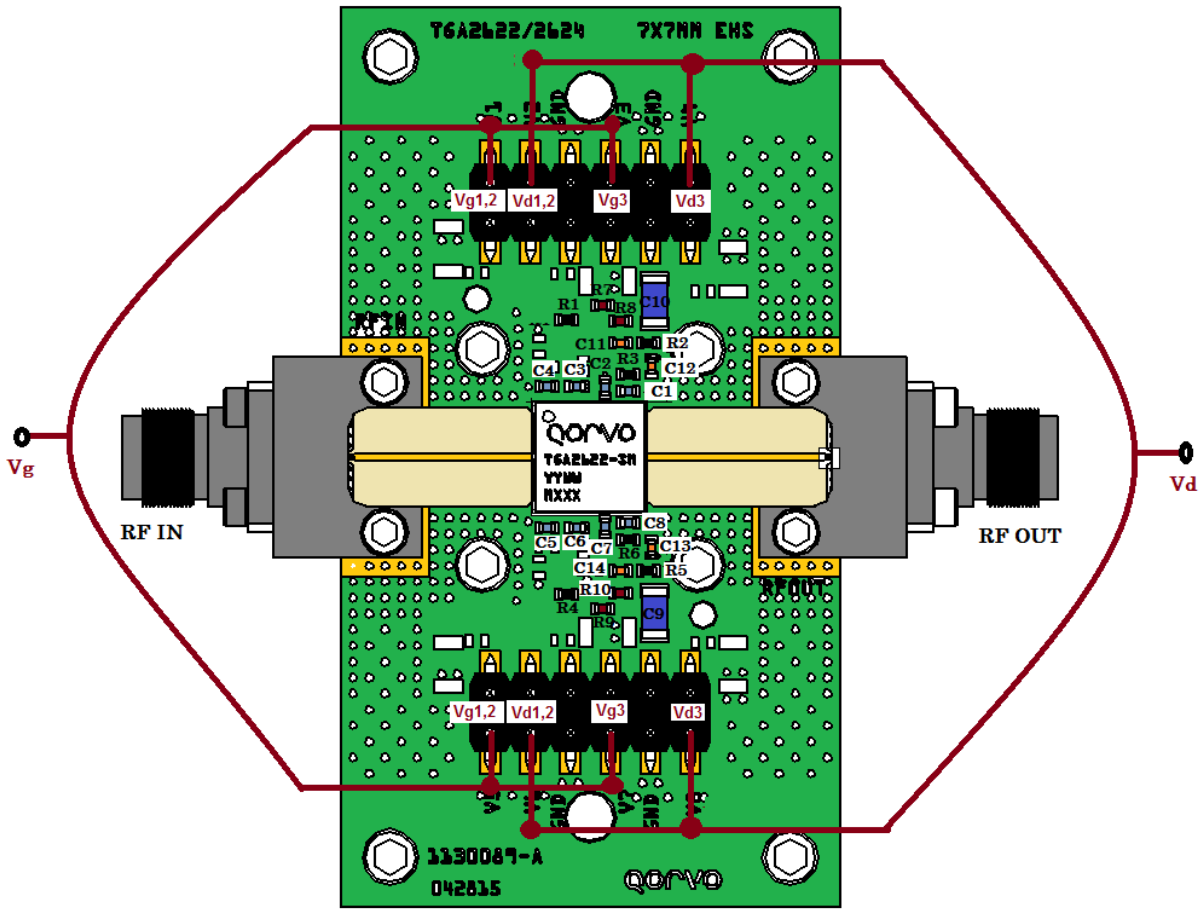


Pin Description

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 12.
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 12.
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 12.
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 12.
13	RF_{OUT}	Output; matched to 50 Ω; DC blocked

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Evaluation Board Layout



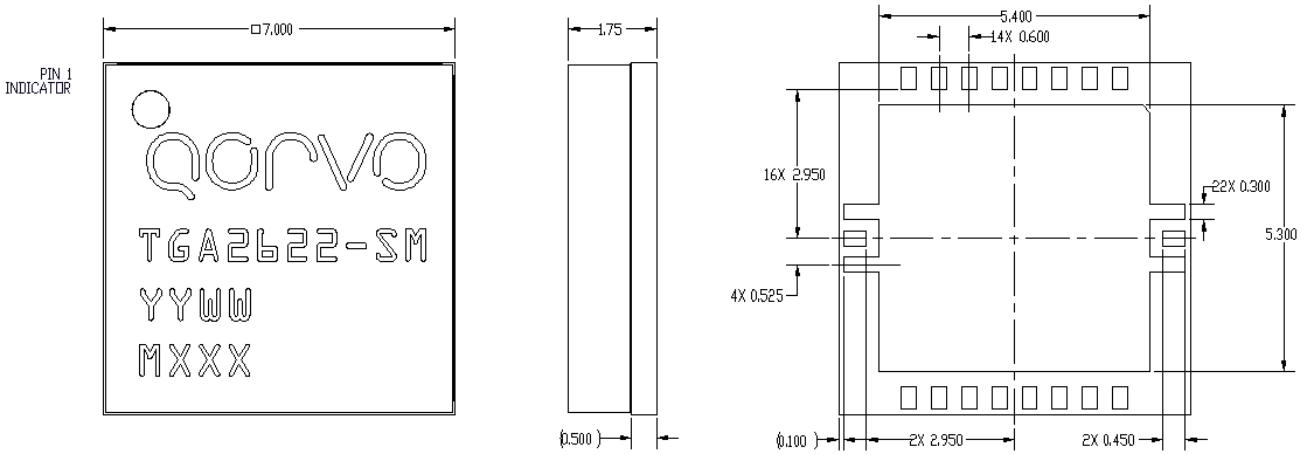
Notes: Both Top and Bottom V_D and V_G must be biased.

Bill of Material

Reference Des.	Value	Description	Manuf.	Part Number
C1 – C8	1000 pF	Cap, 0402, 100 V, 10%, X7R	Various	
C9 – C10	10 µF	Cap, 1206, 50 V, 20%, X5R	Various	
C11 – C14	0.01 µF	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	

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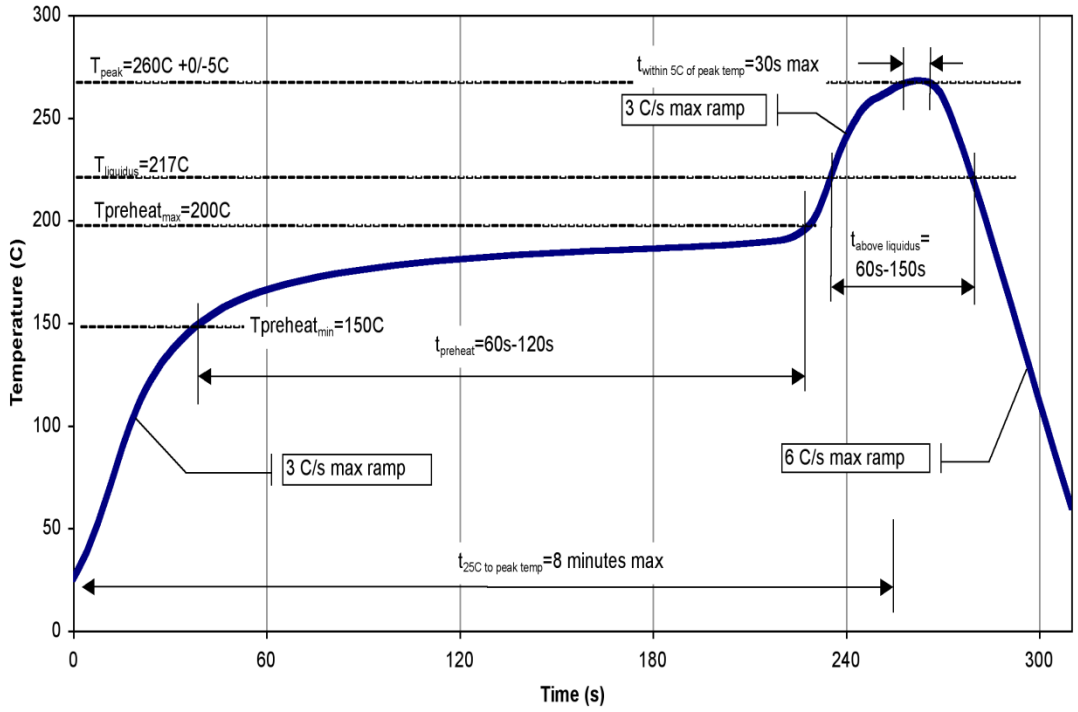
Mechanical Information



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:
TGA2622-SM: Part number
YY: Part Assembly year
WW: Part Assembly week
MXXX: Batch ID

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Recommended Soldering Temperature Profile



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Product Compliance Information

ESD Sensitivity Ratings



Caution! ESD-Sensitive Device

ESD Rating: TBD
Value: TBD
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

MSL Rating

Level 5A at +260 °C convection reflow
The part is rated Moisture Sensitivity Level 5A at 260°C per JEDEC standard IPC/JEDEC J-STD-020

ECCN

US Department of Commerce: 3A001.b.2.b

Solderability

Compatible with the latest version of J-STD-020, Lead-free solder, 260°C

RoHS Compliance

This part is compliant with EU 2002/95/EC RoHS directive (Restrictions on the use of certain Hazardous Substances in Electrical and Electronic Equipment).

This product also has the following attributes:

- Lead Free
- 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, and information about TriQuint:

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For technical questions and application information: **Email:** info-products@triquint.com

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