



TGA2813-SM

3.1 to 3.6 GHz 100 W GaN Power Amplifier

General Description

Qorvo's TGA2813-SM is a packaged high power S-band amplifier which operates from 3.1 to 3.6 GHz. The TGA2813-SM is designed using Qorvo's QGaN25 0.25- μm GaN on SiC process.

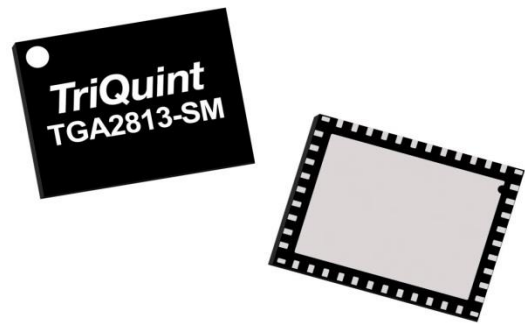
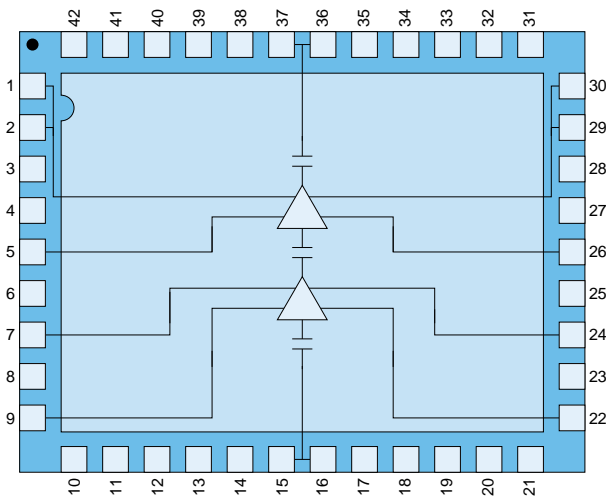
The TGA2813-SM typically provides greater than 100 W of saturated output power, 56% power-added efficiency, and 24 dB power gain.

The TGA2813-SM is available in a low-cost, surface mount 42 lead 7 x 9 Overmold QFN. It is ideally suited to support both commercial and defense related radar applications.

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

Lead-free and RoHS compliant

Functional Block Diagram



QFN 7 x 9 mm 42 L

Product Features

- Frequency Range: 3.1–3.6 GHz
- P_{OUT} : >50 dBm at $P_{IN} = 26$ dBm
- Power Gain: >24 dB at $P_{IN} = 26$ dBm
- PAE: >56 % at $P_{IN} = 26$ dBm
- Bias: $V_D = 30$ V pulsed (PW = 100 μs , DC = 10 %), $I_{DQ} = 300$ mA
- Package Dimensions: 7.0 x 9.0 x 1.1 mm

Applications

- Military Radar
- Commercial Radar

Ordering Information

Part	Description
TGA2813-SM	3.1–3.6 GHz, 100 W GaN Power Amplifier
TGA2813-SM_EVB	TGA2813-SM 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)	10.4 A
Gate Current (I_G)	See Graph (page 9)
Power Dissipation (P_{DISS}), 85 °C	202 W
Input Power, CW, 50 Ω , (P_{IN})	30 dBm
Input Power, CW, VSWR 3:1, $V_D = 30$ V, 85 °C, (P_{IN})	27 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: $PW = 100 \mu s$, $DC = 10 \%$	30 V
Drain Current (I_{DQ})	300 mA
Drain Current Under RF Drive (I_{D_DRIVE})	See plots p. 5-7
Gate Voltage Range (V_G)	-2.8 to -2.0 V
Gate Current Under RF Drive (I_{G_DRIVE})	See plots p. 9
Temperature (T_{BASE})	-40 to 85 °C

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

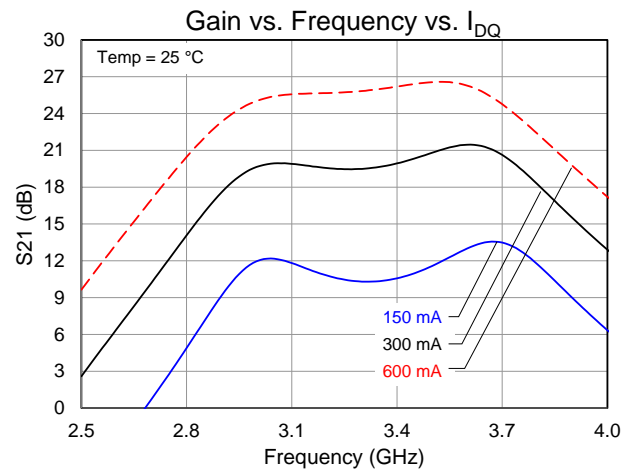
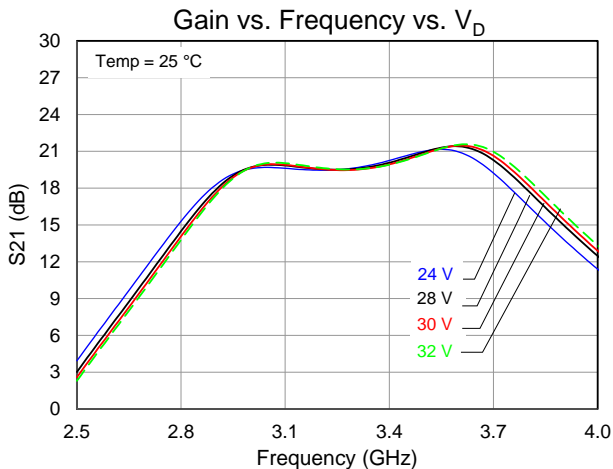
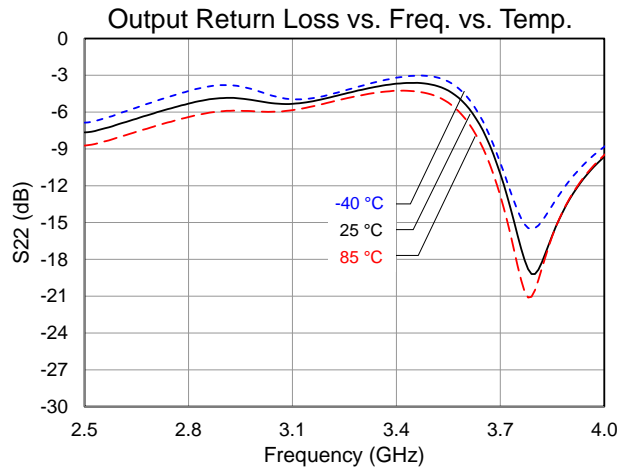
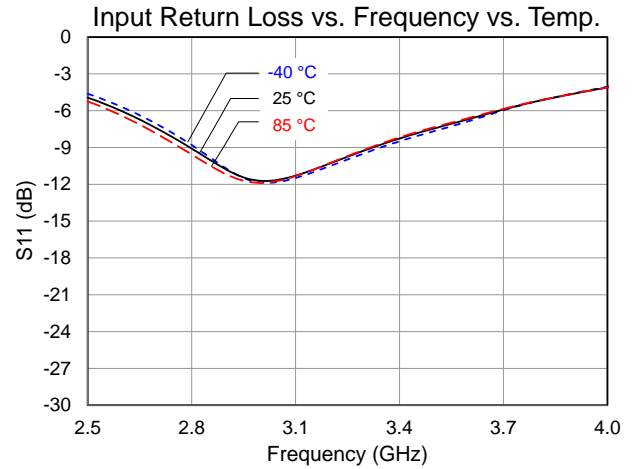
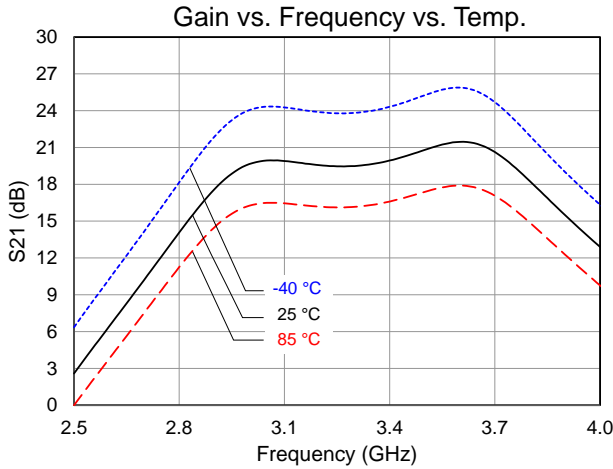
Electrical Specifications

Test conditions unless otherwise noted: 25 °C, $V_D = 30$ V ($PW = 100 \mu s$, $DC = 10 \%$), $I_{DQ} = 300$ mA

Parameter	Min	Typical	Max	Units
Operational Frequency Range	3.1		3.6	GHz
Input Return Loss		>6		dB
Output Return Loss		>3.5		dB
Output Power at $P_{IN} = 26$ dBm	49	>50		dBm
Power Gain at $P_{IN} = 26$ dBm		>24		dB
Power Added Efficiency at $P_{IN} = 26$ dBm	46	>56		%
Gate Leakage ($V_D = 10$ V, $V_G = -3.7$ V)	-52	-3		mA
Output Power Temperature Coefficient		-0.008		dBm/°C

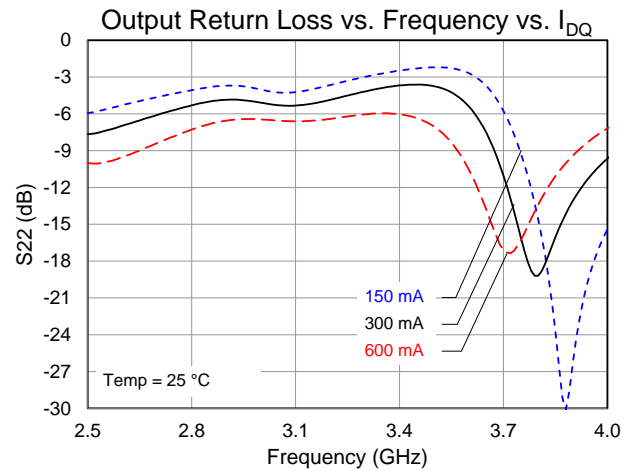
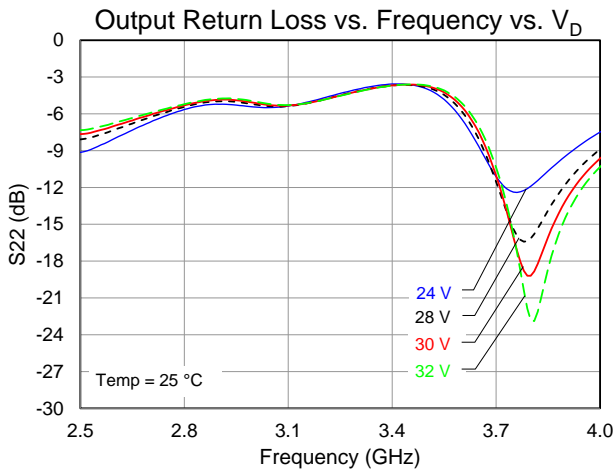
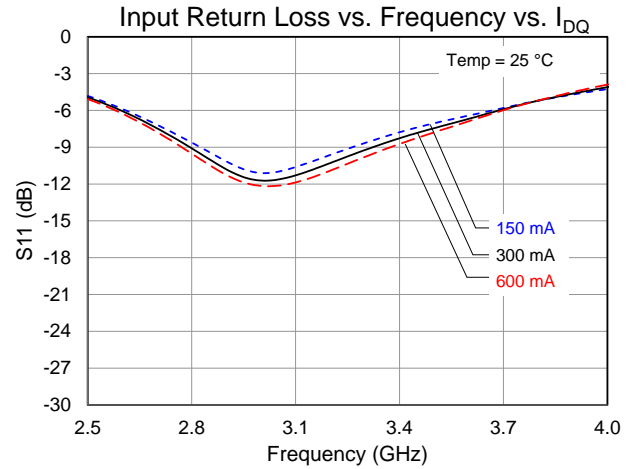
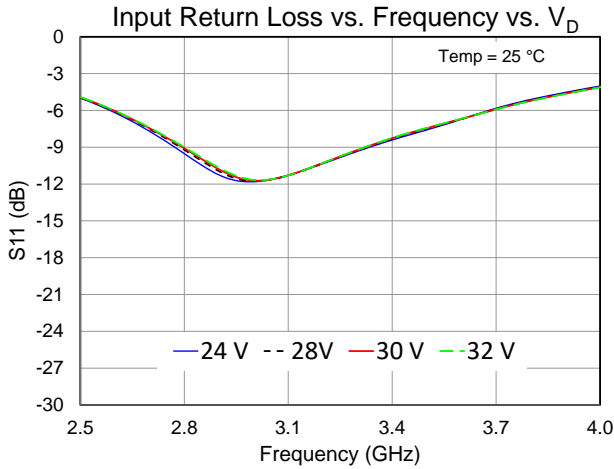
Typical Performance: Small Signal

Conditions unless otherwise specified: $V_D = 30\text{ V}$, $I_{DQ} = 300\text{ mA}$



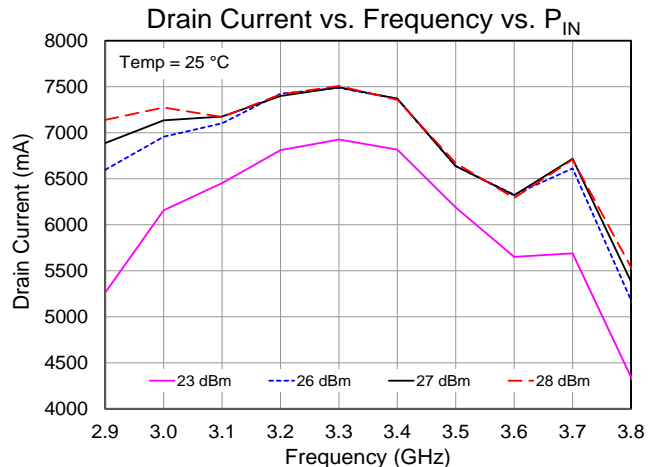
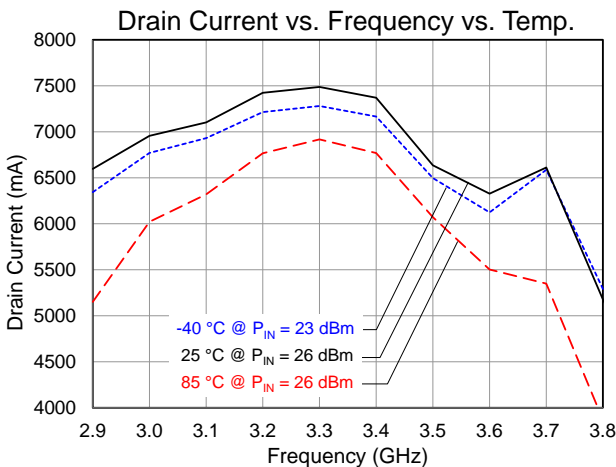
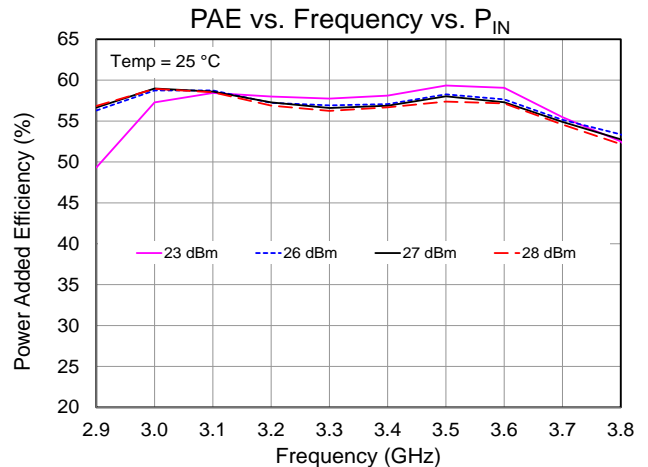
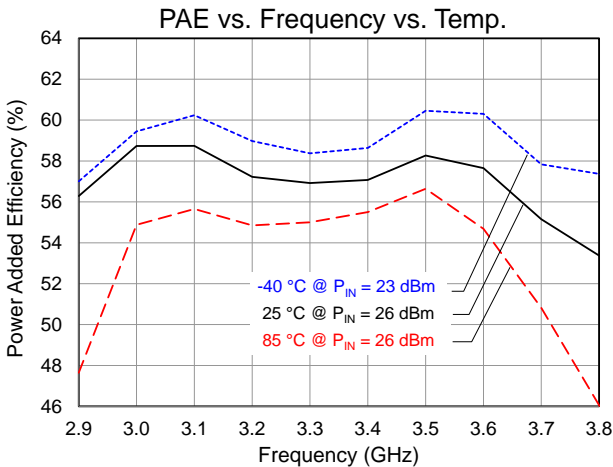
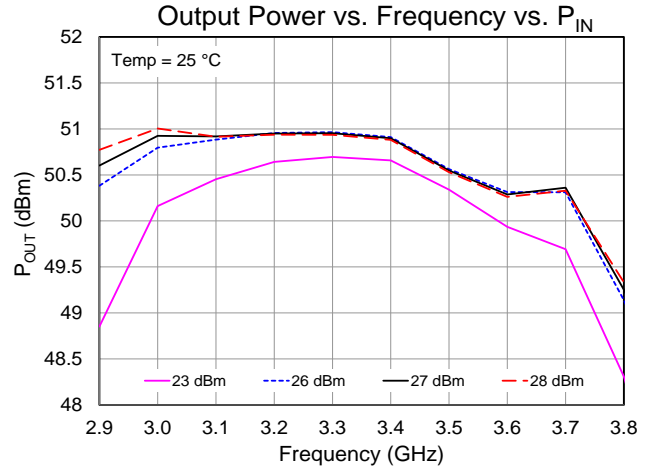
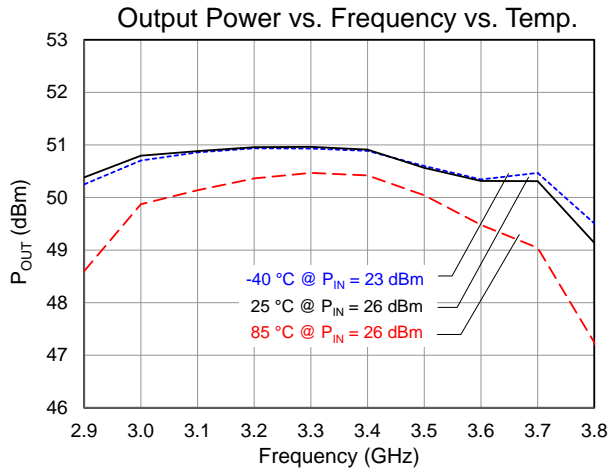
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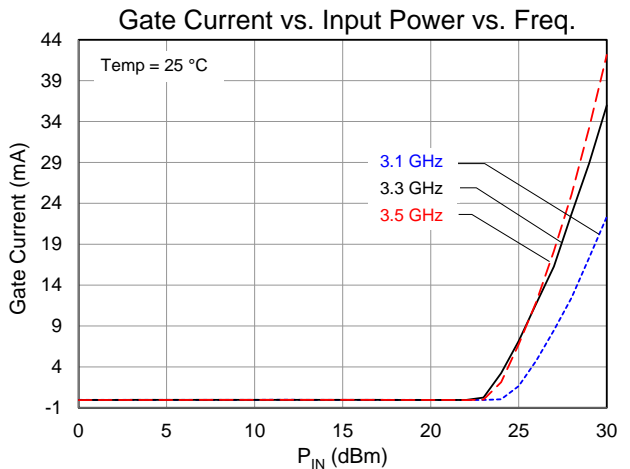
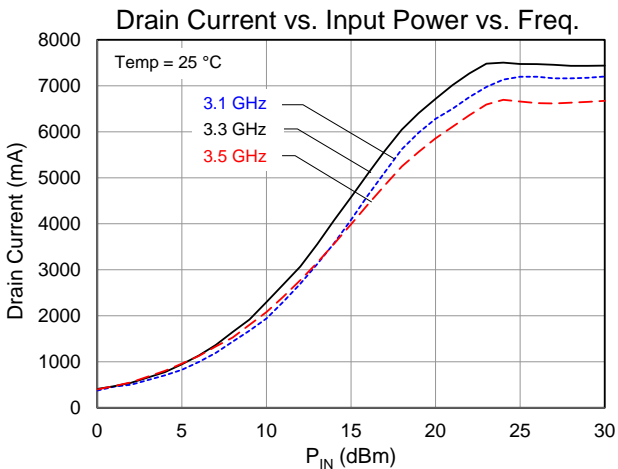
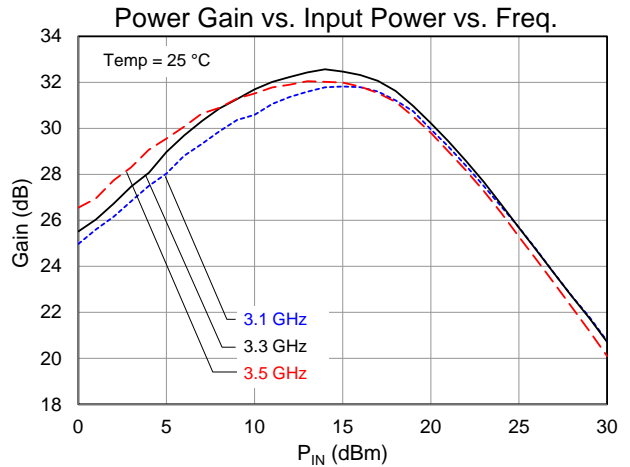
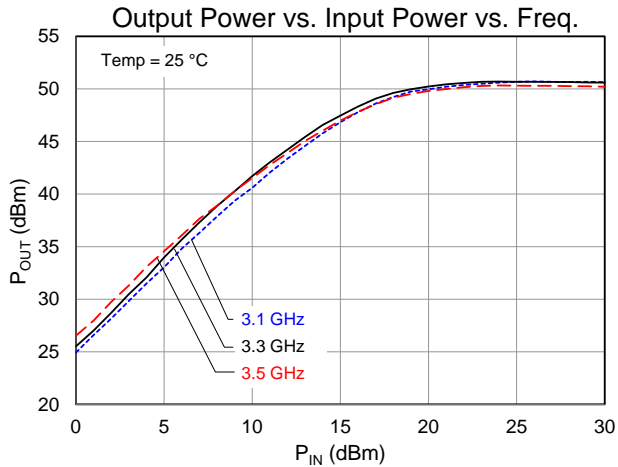
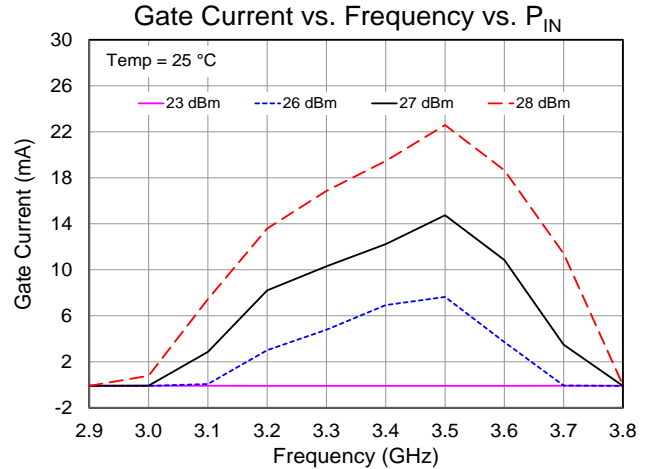
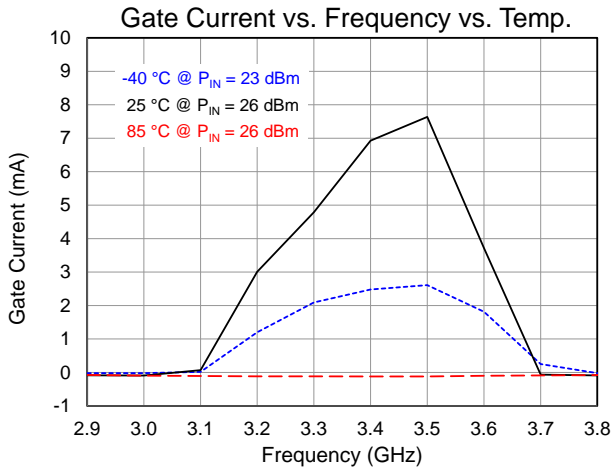
Typical Performance: Large Signal

Conditions unless otherwise specified: $V_D = 30\text{ V}$ ($PW = 100\ \mu\text{s}$, $DC = 10\%$), $I_{DQ} = 300\text{ mA}$



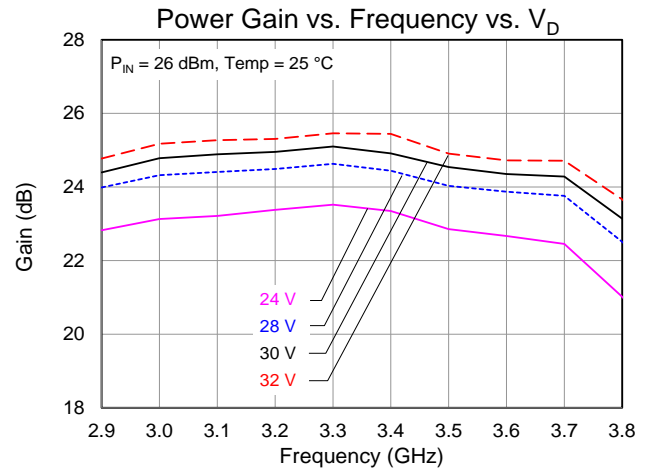
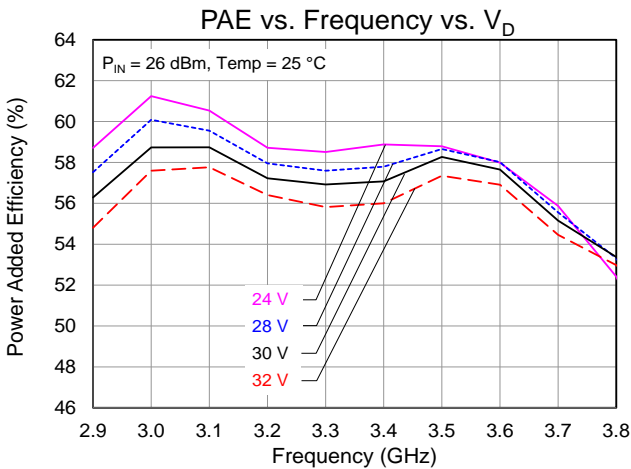
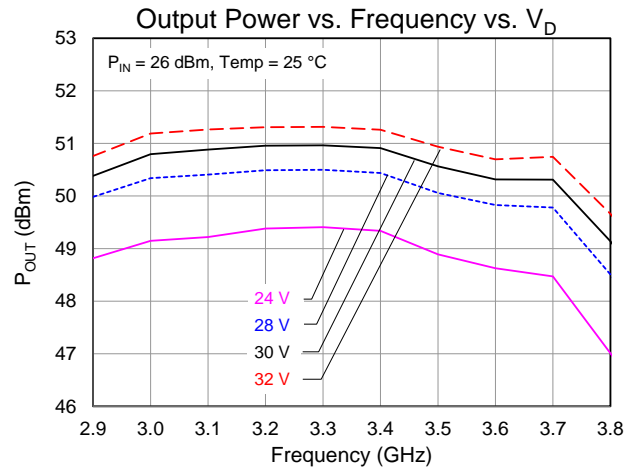
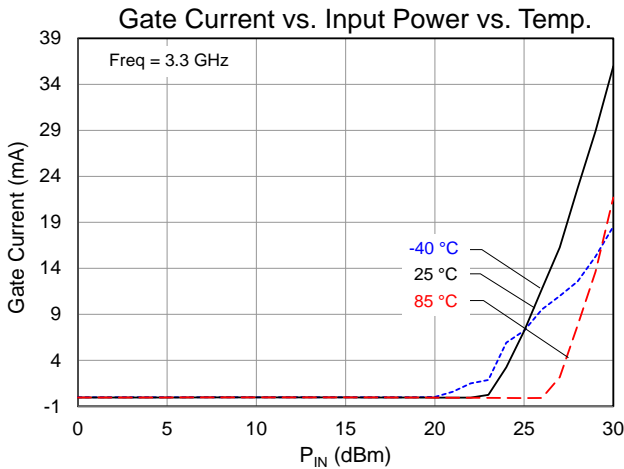
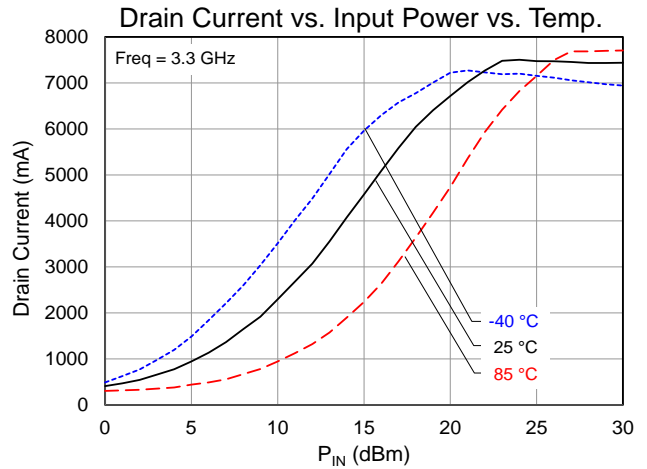
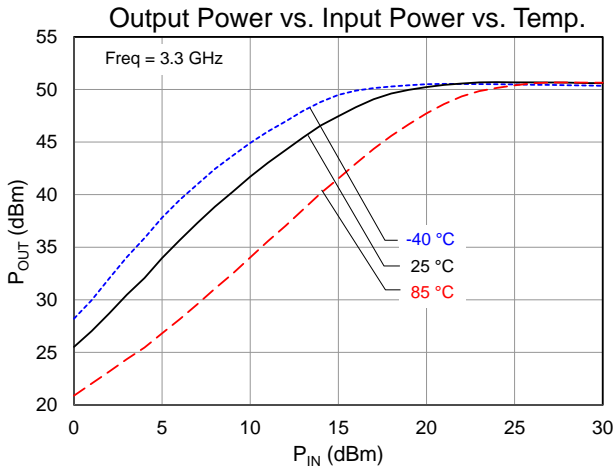
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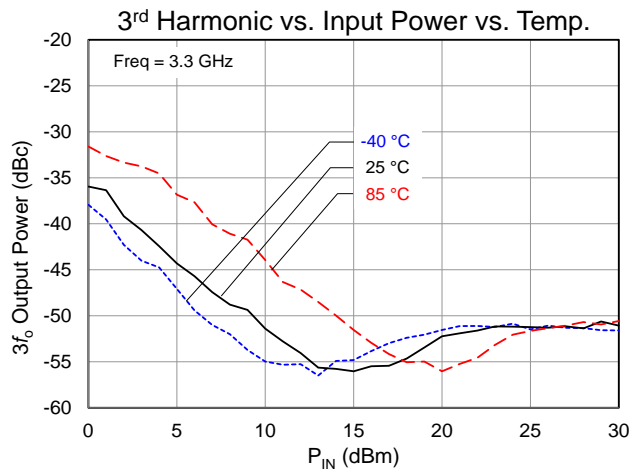
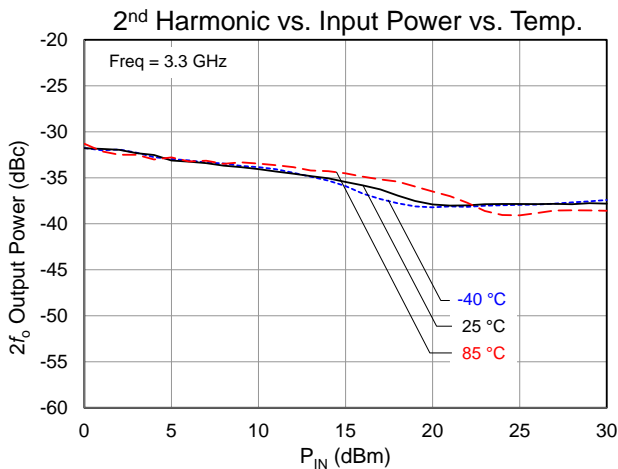
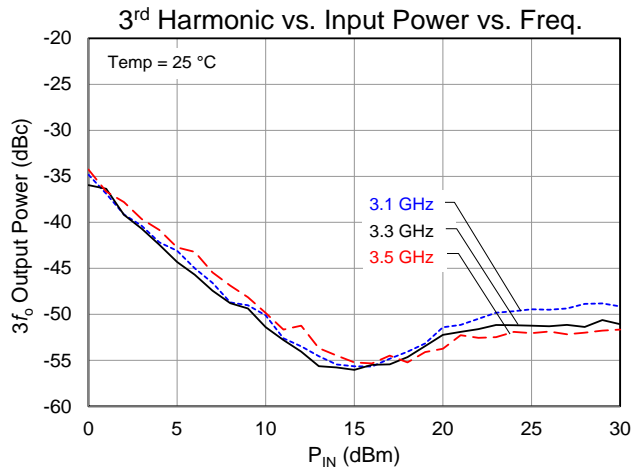
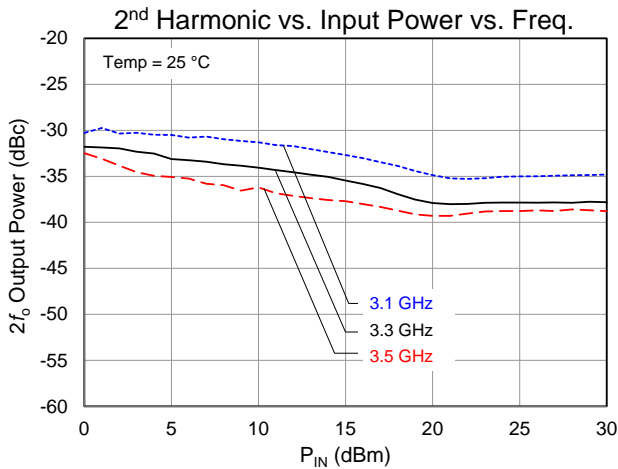
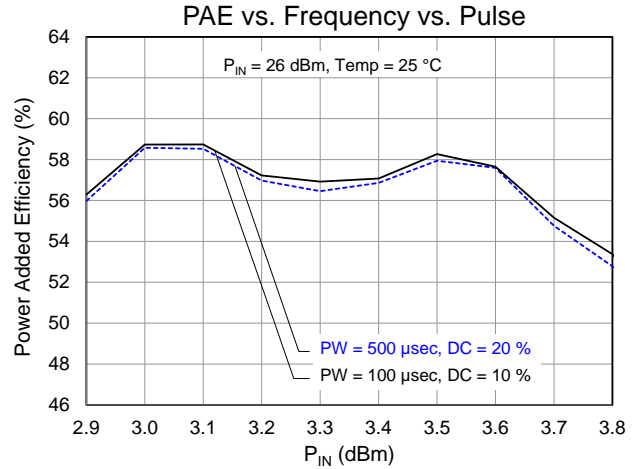
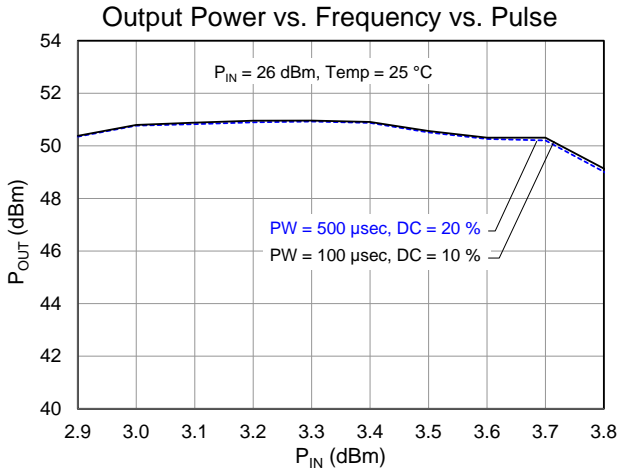
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Typical Performance: Large Signal

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Thermal and Reliability Information

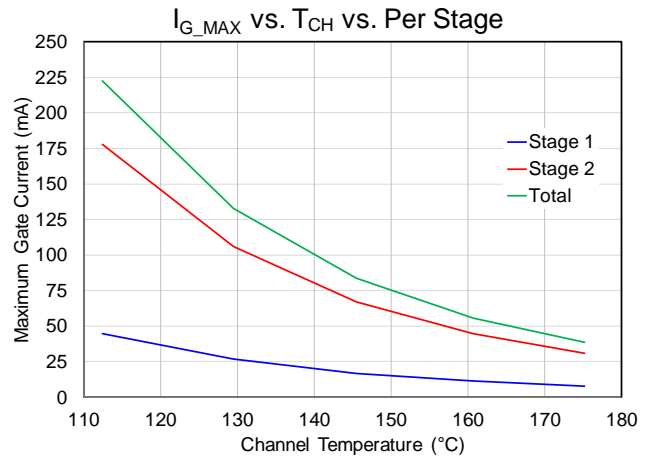
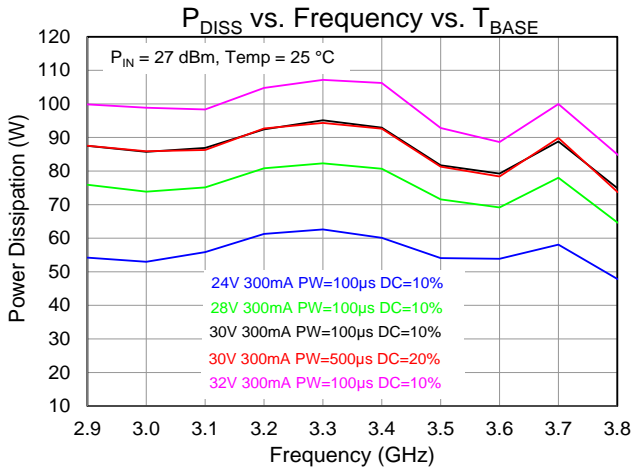
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) ¹	$T_{BASE} = 85\text{ }^{\circ}\text{C}$, $V_D = 30\text{ V}$, $I_{DQ} = 300\text{ mA}$, $P_{DISS} = 9\text{ W}$	0.193	$^{\circ}\text{C/W}$
Channel Temperature (T_{CH}) (No RF drive) ²		86.7	$^{\circ}\text{C}$
Thermal Resistance (θ_{JC}) ¹	$T_{BASE} = 85\text{ }^{\circ}\text{C}$, $V_D = 30\text{ V}$, $I_{D_Drive} = 7.2\text{ A}$, (PW = 100 μs , DC = 10%), Freq. = 3.3 GHz, $P_{IN} = 27\text{ dBm}$, $P_{OUT} = 50.7\text{ dBm}$, $P_{DISS} = 93\text{ W}$	0.248	$^{\circ}\text{C/W}$
Channel Temperature (T_{CH}) (Under RF drive) ²		108.1	$^{\circ}\text{C}$

Notes:

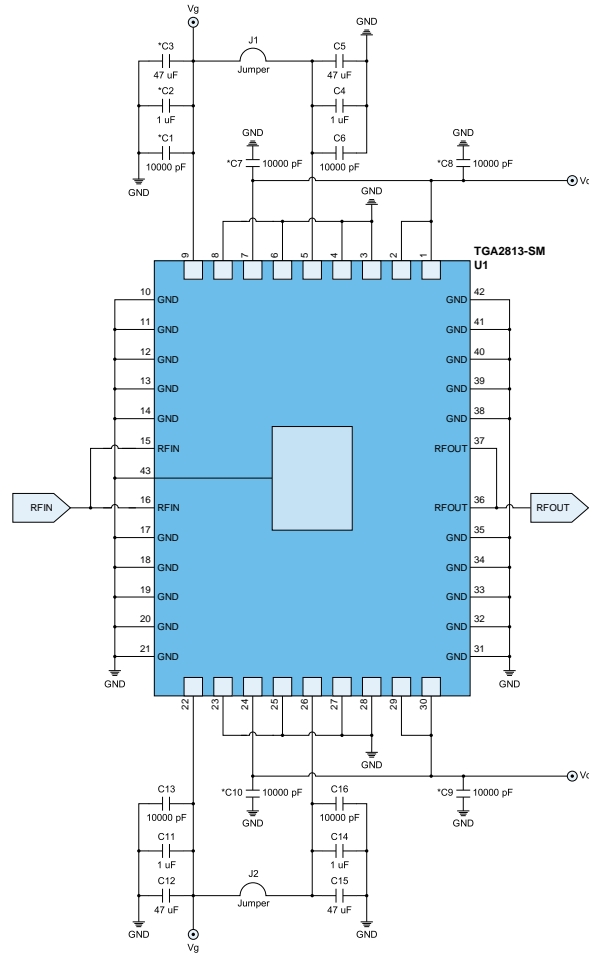
1. Thermal resistance measured to back of package.
2. IR scan equivalent. Refer to the following document: [GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates](#)

Power Dissipation and Maximum Gate Current

Test conditions: $V_D = 40\text{ V}$; Failure Criteria = 10% reduction in I_{D_MAX}



Applications Information



Bias-up Procedure

- Set I_D limit to 10 A, I_G limit to 50 mA

- Apply -5 V to V_G

- Apply $+30\text{ V}$ to V_D ; ensure I_{DQ} is approx. 0 mA

- Adjust V_G until $I_{DQ} = 300\text{ mA}$

- Turn on RF supply

Bias-down Procedure

- Turn off RF signal

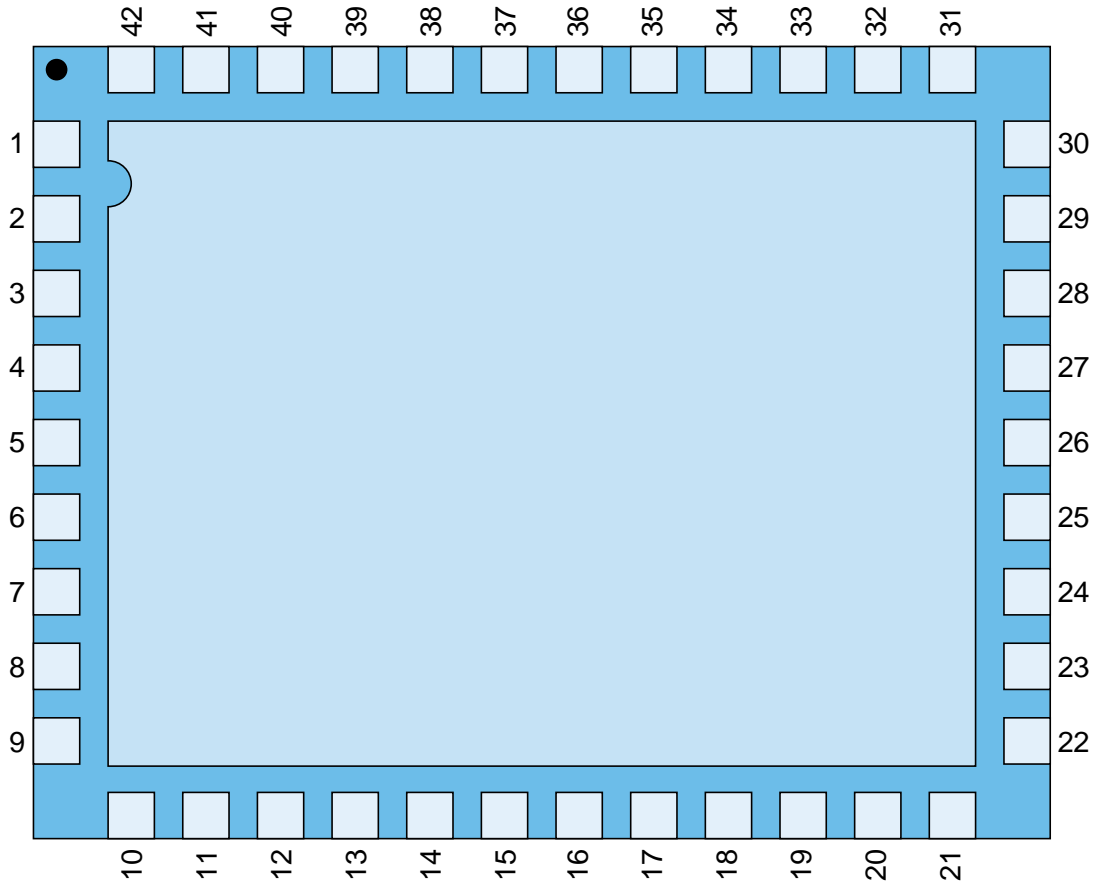
- Reduce V_G to -5 V ; ensure I_{DQ} is approx. 0 mA

- Set V_D to 0 V

- Turn off V_D supply

- Turn off V_G supply

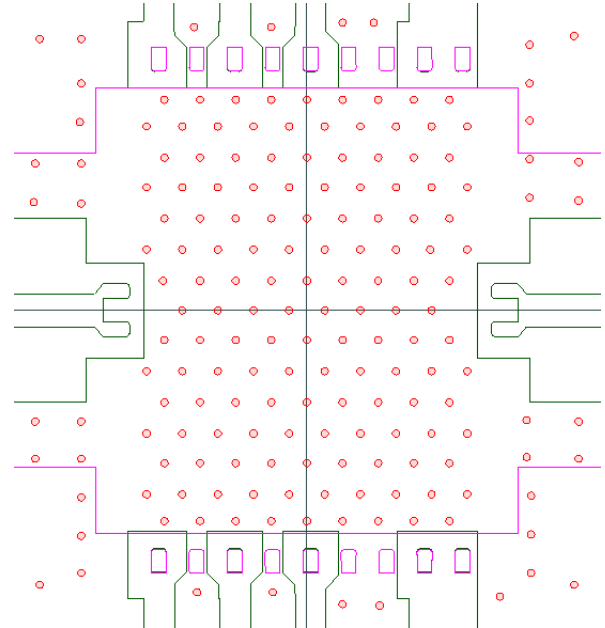
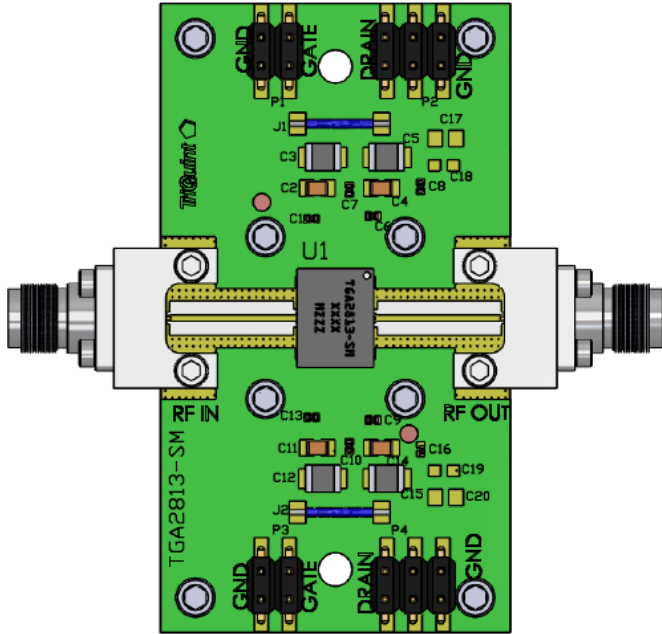
Pin Layout & Description



Pin Description

Pin No.	Symbol	Description
1, 2, 29, 30	V_{D2}	Drain voltage; bias network is required; see recommended Application Information on page 10
5, 26	V_{G2}	Gate voltage; bias network is required; see recommended Application Information on page 10
7, 24	V_{D1}	Drain voltage; bias network is required; see recommended Application Information on page 10
9, 22	V_{G1}	Gate voltage; bias network is required; see recommended Application Information on page 10
15, 16	RF_{IN}	Input; matched to 50 Ω ; DC blocked
36, 37	RF_{OUT}	Output; matched to 50 Ω ; DC blocked. Pad is DC grounded.
3, 4, 6, 8, 10-14, 17-21, 23, 25, 27, 28, 31-35, 38-42	GND	Connected to ground paddle; must be grounded on PCB

Evaluation Board and Board Mounting Detail



Material:

Layer 1: ROGER 4350, 0.010 thick
Metal 1 and Metal 2: 1.0 oz. Copper per layer

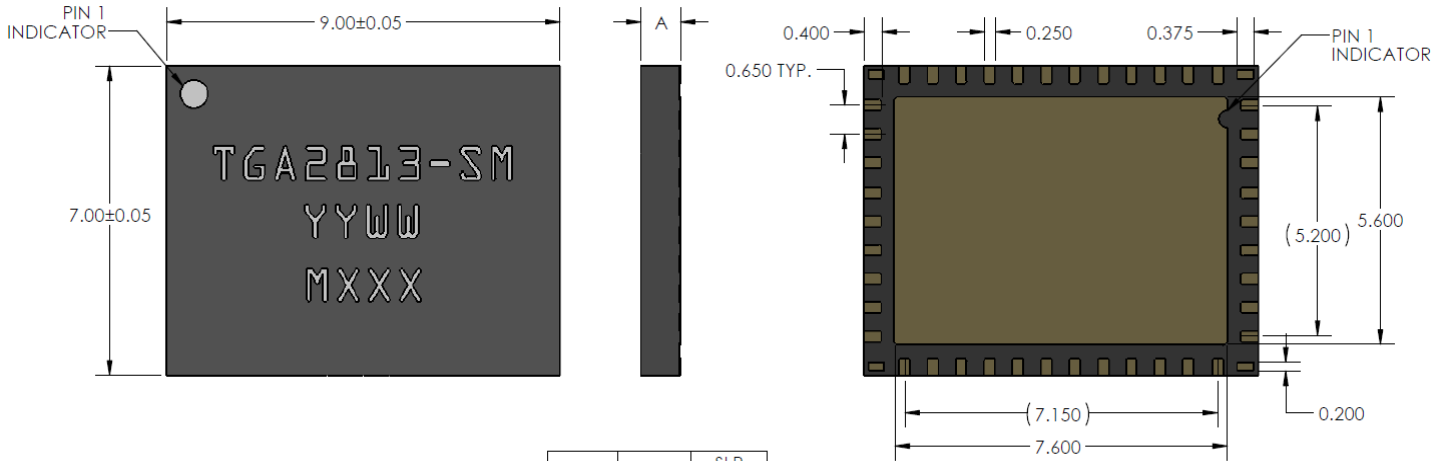
Notes:

- Both Top and Bottom V_D and V_G must be biased

Bill of Material

Reference Design	Value	Description	Manufacture	Part-Number
C1, C6–C10, C13, C16	10000 pF	Cap, 0402, 50 V, 10%, X7R	Various	
C2, C4, C11, C14	1 μ F	Cap, 0805, 25 V, 10%, X7R	Various	
C3, C5, C12, C15	47 μ F	Cap, 1206, 25 V, 20%, X5R	Various	
J1, J2	Jumper Wires	20 AWG	Various	

Mechanical Information

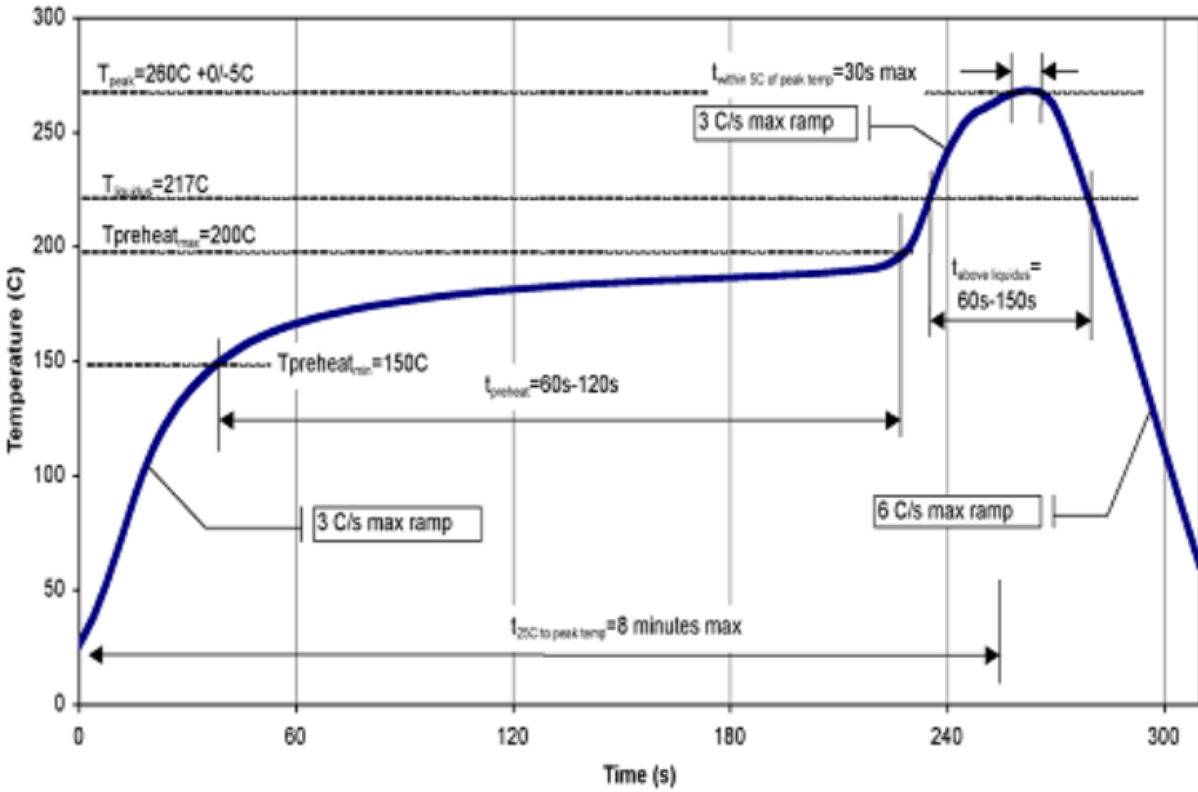


		SLP
A	MAX.	0.900
	NOM.	0.850
	MIN.	0.800

Units: millimeter
Tolerances: unless specified
x.x = ± 0.01
x.xxx = ± 0.005
Package Metal Base and Leads are GOLD PLATED
Marking:
2813-SM: Part number
YY: Part Assembly year
WW: Part Assembly week
MXXX: Lot Number

Assembly Notes

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



Recommended Soldering Temperature Profile

Handling Precautions

Parameter	Rating	Standard
ESD-Human Body Model (HBM)	1C	JS-001-2014
ESD-Charge Device Model (CDM)	C3	JS-002-2014
MSL-Moisture Sensitivity Level	3	JEDEC/IPC/JEDEC J-STD-020



Caution!
 ESD-Sensitive Device

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
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C₁₅H₁₂Br₄O₂) Free
- PFOS Free
- SVHC Free

Contact Information

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

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Tel: 1-844-890-8163

Email: customer.support@qorvo.com

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