TGA2817-SM

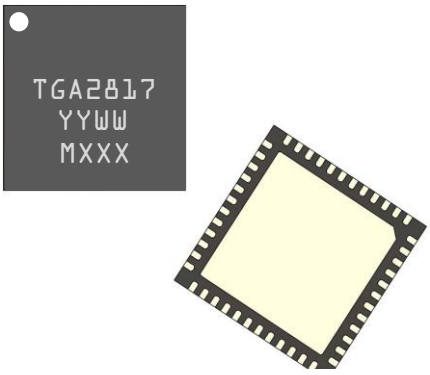
S-Band 60 W GaN Power Amplifier

General Description

Qorvo's TGA2817-SM is a high-power, S-band amplifier fabricated on Qorvo's TQGaN25 0.25 um GaN on SiC production process. Covering 2.9-3.5 GHz, the TGA2817-SM provides > 48 dBm of saturated output power and > 24 dB of large-signal gain while achieving > 54 % power added efficiency.

The TGA2817-SM can also support a variety of operating conditions to best support system requirements. With good thermal properties, it can support a range of bias voltages and will perform well under pulse applications. The TGA2817-SM is matched to 50 ohms with integrated DC blocking caps on both I/O ports. It is ideal for use in both commercial and military radar systems.

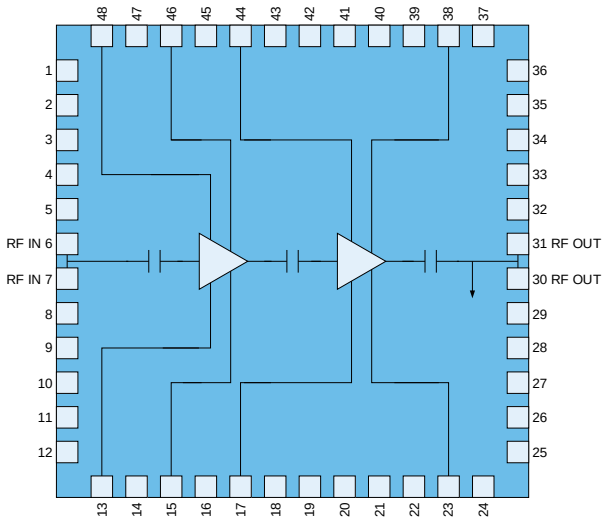
Lead-free and RoHS compliant



Product Features

- Frequency Range: 2.9–3.5 GHz
- P_{OUT}: > 48 dBm (at P_{IN} = 24 dBm)
- Large Signal Gain: > 24 dB (at P_{IN} = 24 dBm)
- PAE: > 54 % (at P_{IN} = 24 dBm)
- Bias: V_D = 28 V, I_{DQ} = 200 mA
- Package Dimensions: 7.00 x 7.00 x 0.85 mm

Functional Block Diagram



Applications

- Military Radar
- Commercial Radar

Ordering Information

Part	Description
TGA2817-SM	S-Band 60 W GaN Power Amplifier
TGA2817-SM_EVB	TGA2817-SM Evaluation Board

Absolute Maximum Ratings

Parameter	Value/Range
Drain Voltage (V_D)	40 V
Drain Current (I_{D1}/I_{D2})	1.4 / 5.8 A
Gate Current (I_G)	See graph, page 8
Dissipated Power (P_{DISS})	92 W
Input Power: 50 Ω, 85 °C (1)	30 dBm
Input Power: 3:1 VSWR, 85 °C (1)	28 dBm
Soldering Temperature	260 °C
Storage Temperature	−55 to 150 °C

Notes:
1. Based on die performance.

Operation of this device outside the parameter ranges given above may cause permanent damage.

Recommended Operating Conditions

Parameter	Value/Range
Drain Voltage (V_D)	28 V
Drain Current (quiescent, I_{DQ})	200 mA
Drain Current (under drive ,I_{D_DRIVE})	4.6 A
Gate Voltage Range (V_G)	−2.8 to −2.0 V
Operating Temperature	−40 to 85 °C

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

Electrical Specifications

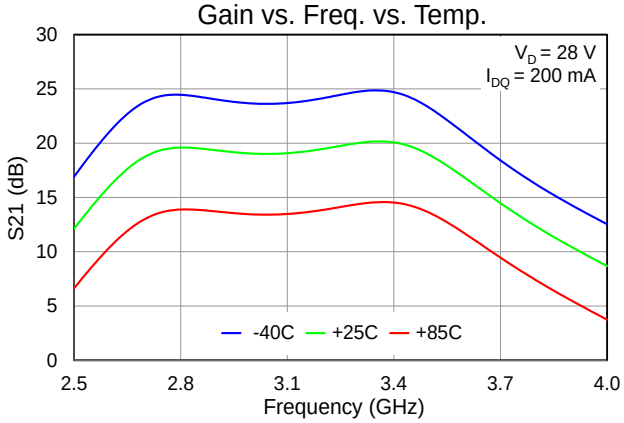
Test conditions, unless otherwise noted: 25 °C, V_D = 28 V, I_{DQ} = 200 mA, Pulse Width = 100 us, Duty Cycle = 10%

Parameter	Condition	Min	Typical	Max	Units
Operational Frequency		2.9		3.5	GHz
Output Power (P_{IN} = 24 dBm)	2.9 GHz	47.2	48		dBm
	3.1 GHz	47.2	48		dBm
	3.3 GHz	47.4	48		dBm
Power Added Efficiency (P_{IN} = 24 dBm)	2.9 GHz	49.5	54		%
	3.1 GHz	48.0	54		%
	3.3 GHz	47.0	54		%
Large Signal Gain (P_{IN} = 24 dBm)			24		dB
Input Return Loss			>8		dB
Gate Leakage (V_D = 10 V, V_G = −3.7 V)		−30.6	−0.46	−0.0001	mA
Output Power Temperature Coefficient			−0.006		dBm/°C

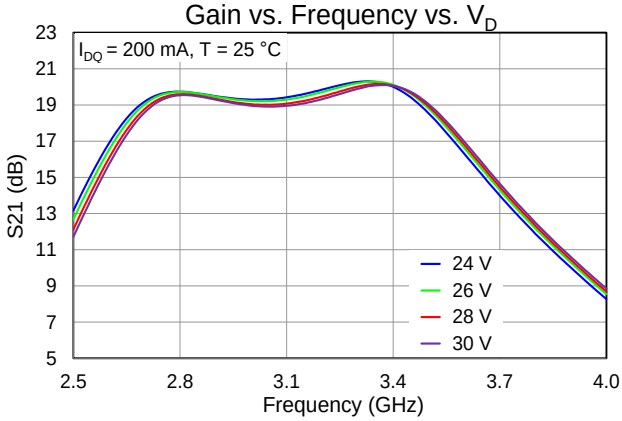
Typical Performance

Test conditions unless otherwise noted: Temp. = 25 °C

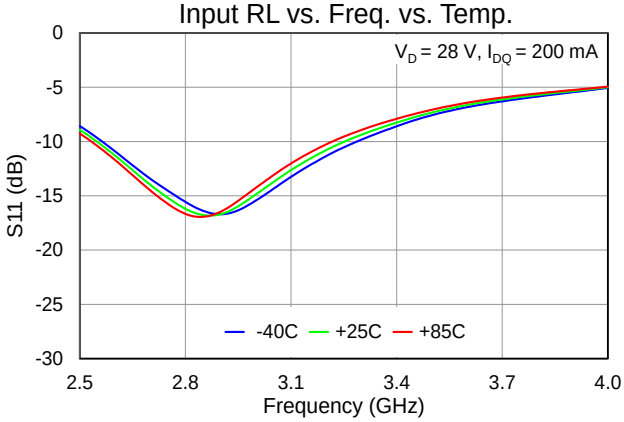
Gain vs. Freq. vs. Temp.



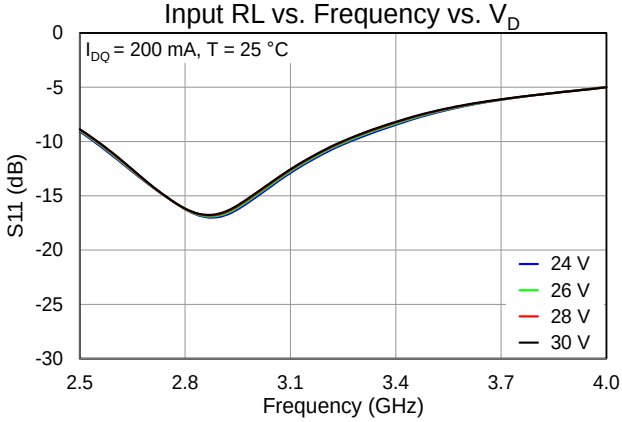
Gain vs. Frequency vs. V_D



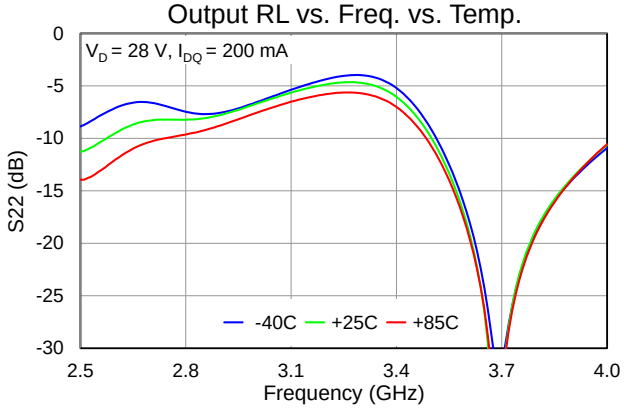
Input RL vs. Freq. vs. Temp.



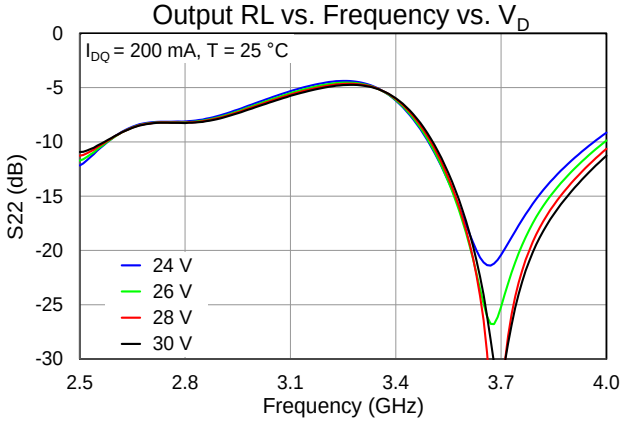
Input RL vs. Frequency vs. V_D



Output RL vs. Freq. vs. Temp.



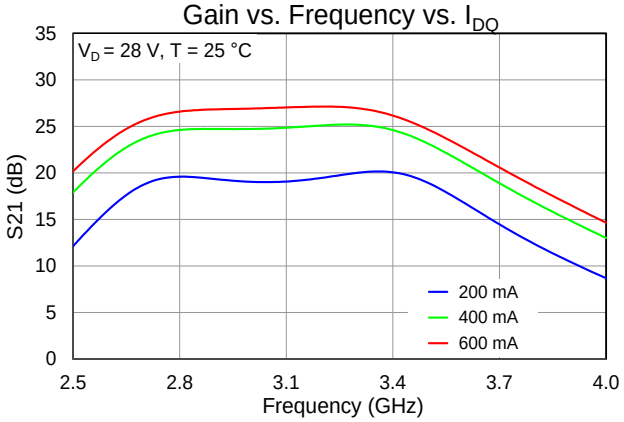
Output RL vs. Frequency vs. V_D



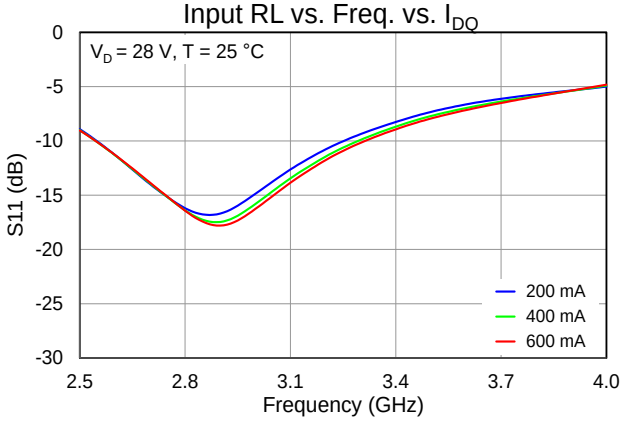
Typical Performance

Test conditions unless otherwise noted: Temp. = 25 °C

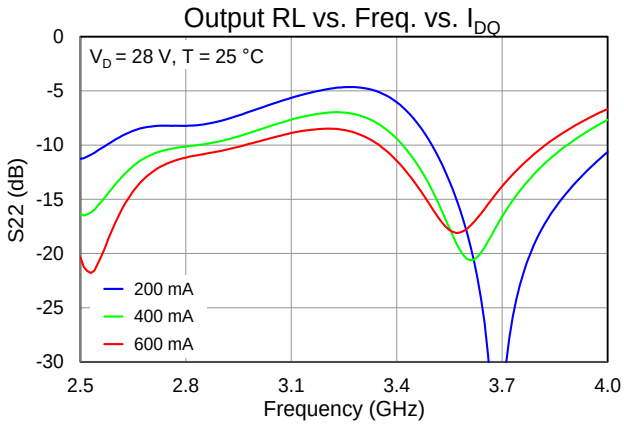
Gain vs. Frequency vs. I_{DQ}



Input RL vs. Freq. vs. I_{DQ}



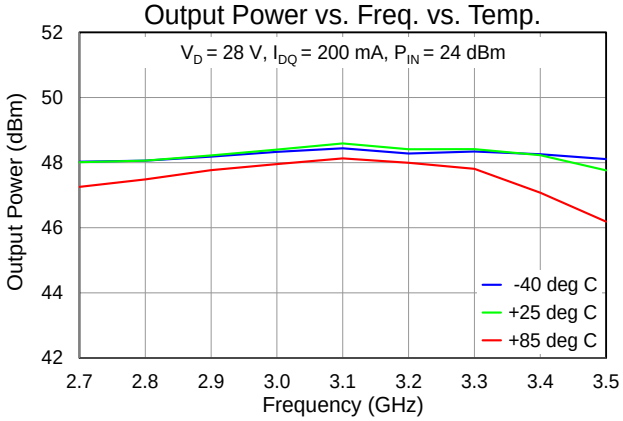
Output RL vs. Freq. vs. I_{DQ}



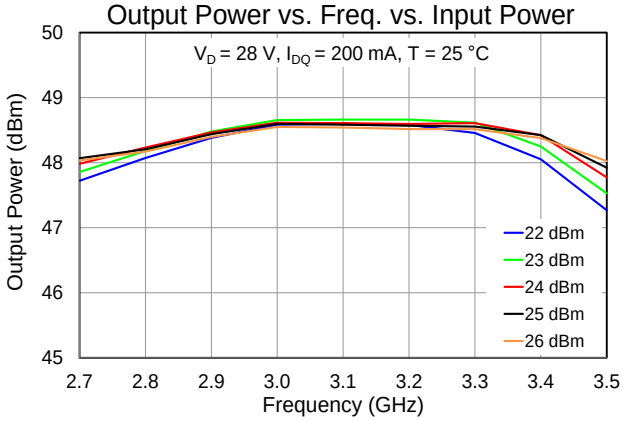
Typical Performance

Test conditions unless otherwise noted: Temp. = 25 °C, Pulsed input power PW = 100 us, Duty Cycle = 10%

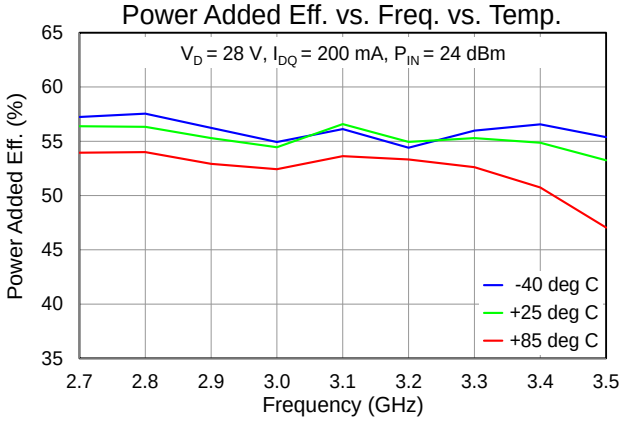
Output Power vs. Freq. vs. Temp.



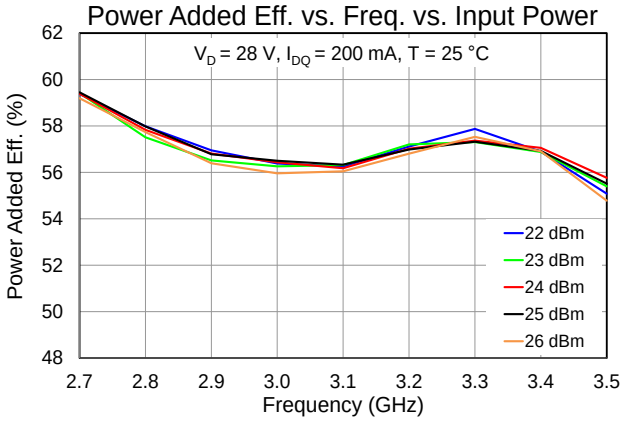
Output Power vs. Freq. vs. Input Power



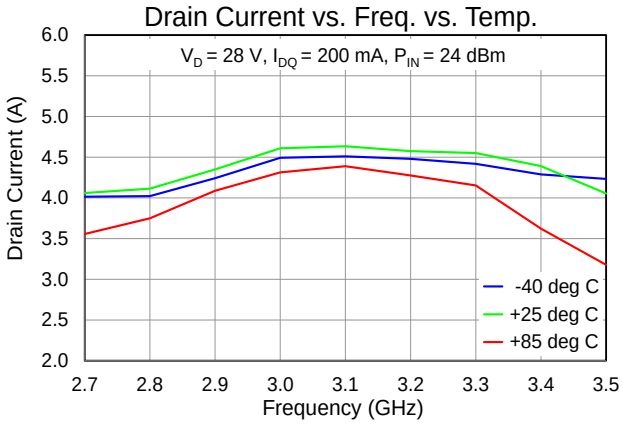
Power Added Eff. vs. Freq. vs. Temp.



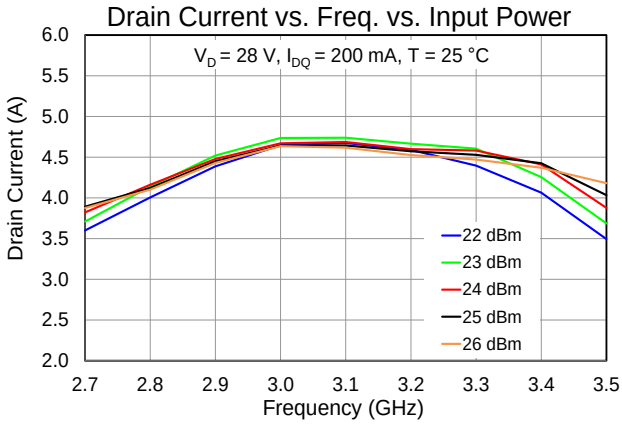
Power Added Eff. vs. Freq. vs. Input Power



Drain Current vs. Freq. vs. Temp.



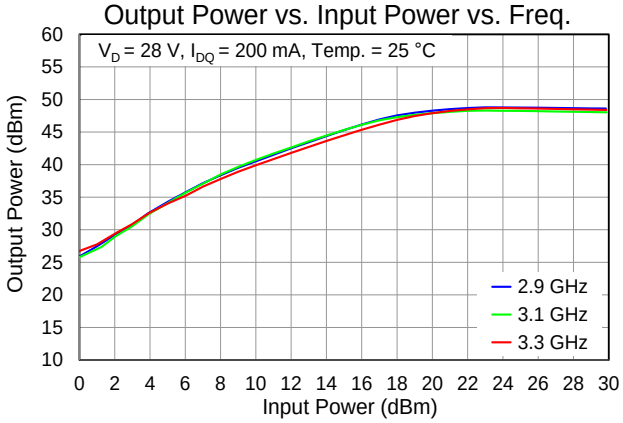
Drain Current vs. Freq. vs. Input Power



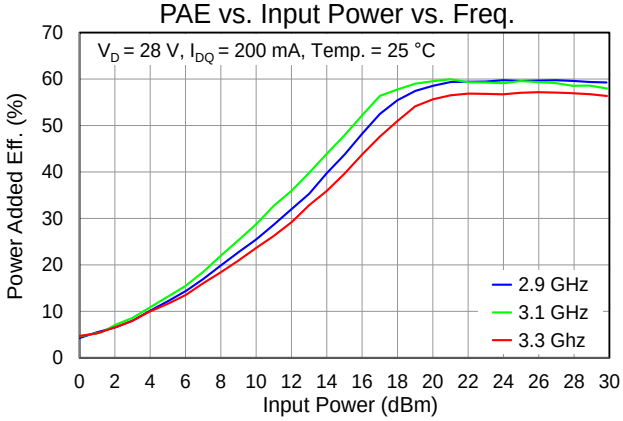
Typical Performance

Test conditions unless otherwise noted: Pulsed input power PW = 100 us, Duty Cycle = 10%

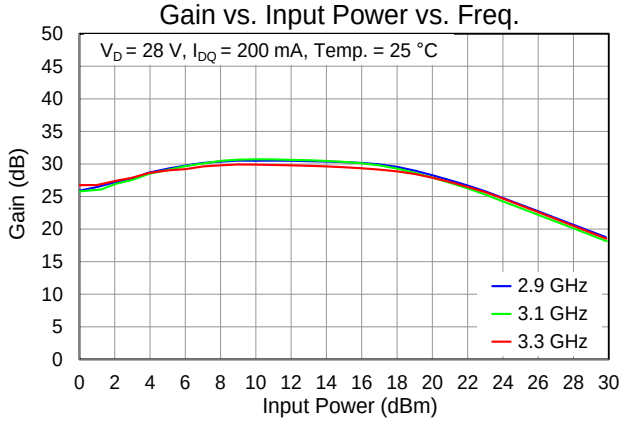
Output Power vs. Input Power vs. Freq.



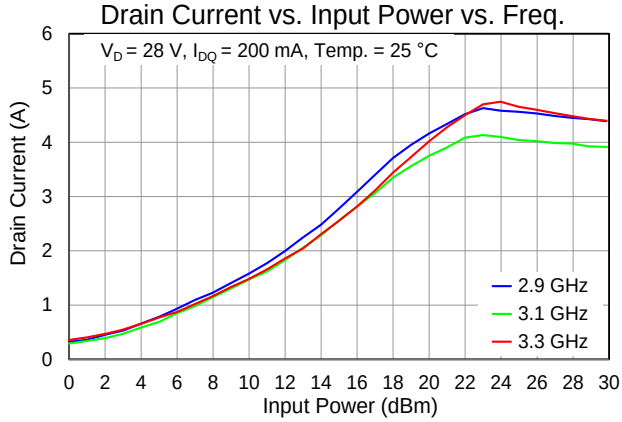
PAE vs. Input Power vs. Freq.



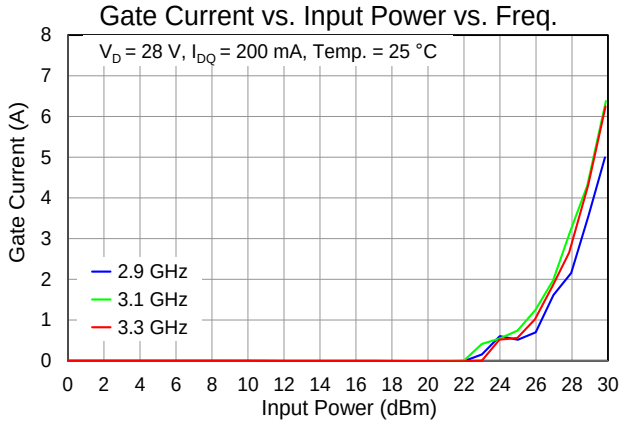
Gain vs. Input Power vs. Freq.



Drain Current vs. Input Power vs. Freq.



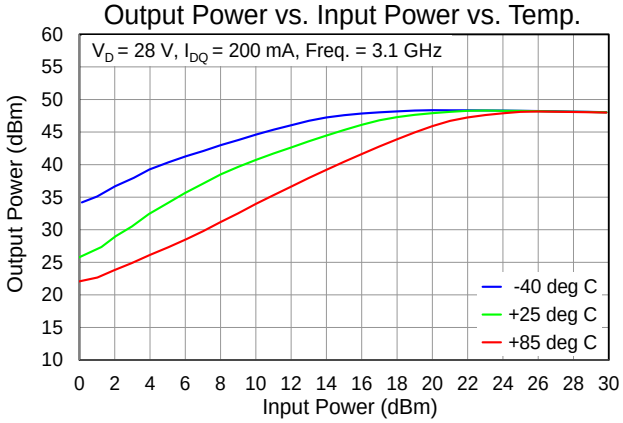
Gate Current vs. Input Power vs. Freq.



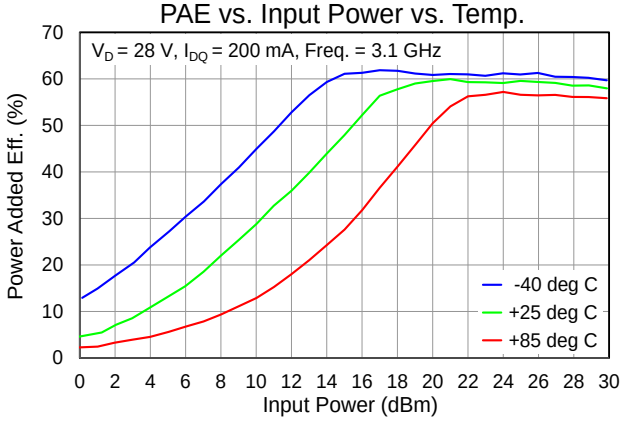
Typical Performance

Test conditions unless otherwise noted: Pulsed input power PW = 100 us, Duty Cycle = 10%

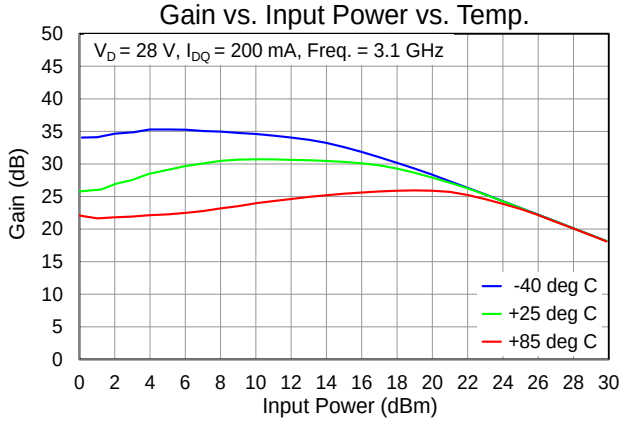
Output Power vs. Input Power vs. Temp.



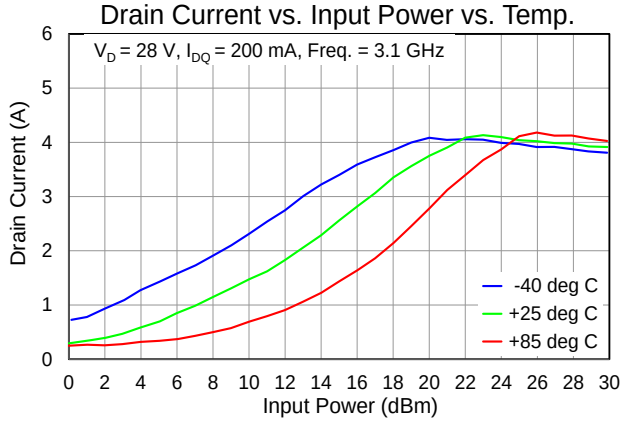
PAE vs. Input Power vs. Temp.



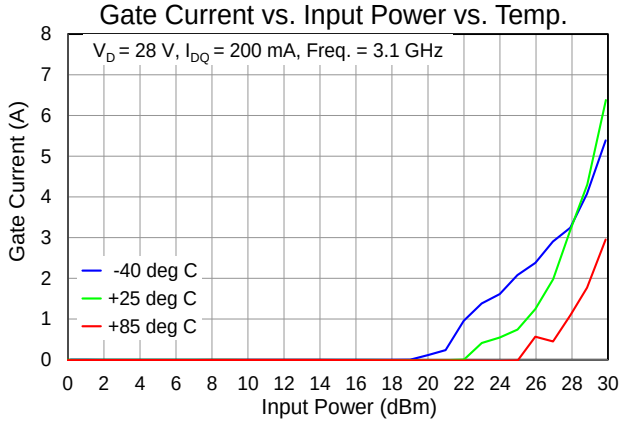
Gain vs. Input Power vs. Temp.



Drain Current vs. Input Power vs. Temp.



Gate Current vs. Input Power vs. Temp.

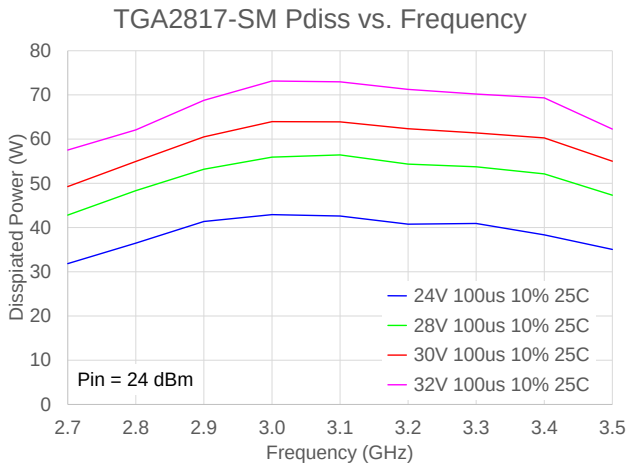


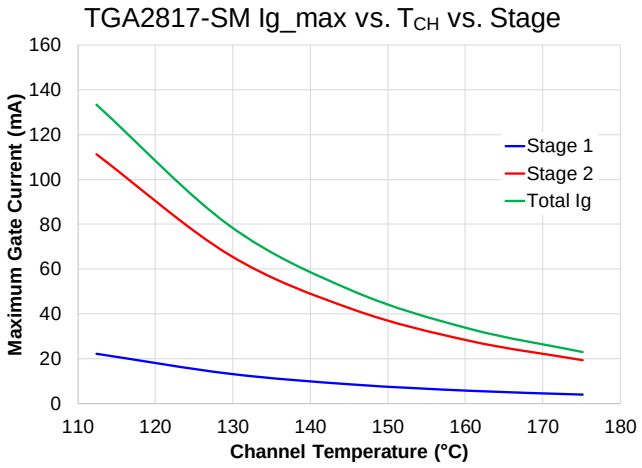
Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	T_{BASE} = 85 °C, V_D = 28 V, I_D = 200 mA (quiescent DC, small signal), P_{DISS} = 6.4 W	0.396	°C/W
Channel Temperature (T_{CH}) (2)		87.5	°C
Thermal Resistance (θ_{JC}) (1)	T_{BASE} = 85 °C, V_D = 28 V, I_D = 4.5 A, P_{IN} = 24 dBm P_{OUT} = 48.5 dBm, PW = 100 us, DC = 10%, P_{DISS} = 53 W	0.476	°C/W
Channel Temperature (T_{CH}) (2)		110.2	°C
Thermal Resistance (θ_{JC}) (1)	T_{BASE} = 85 °C, V_D = 32 V, I_D = 5.1 A, P_{IN} = 24 dBm, P_{OUT} = 49.4 dBm, PW = 100 us, DC = 10%, P_{DISS} = 74 W	0.492	°C/W
Channel Temperature (T_{CH}) (2)		121.4	°C

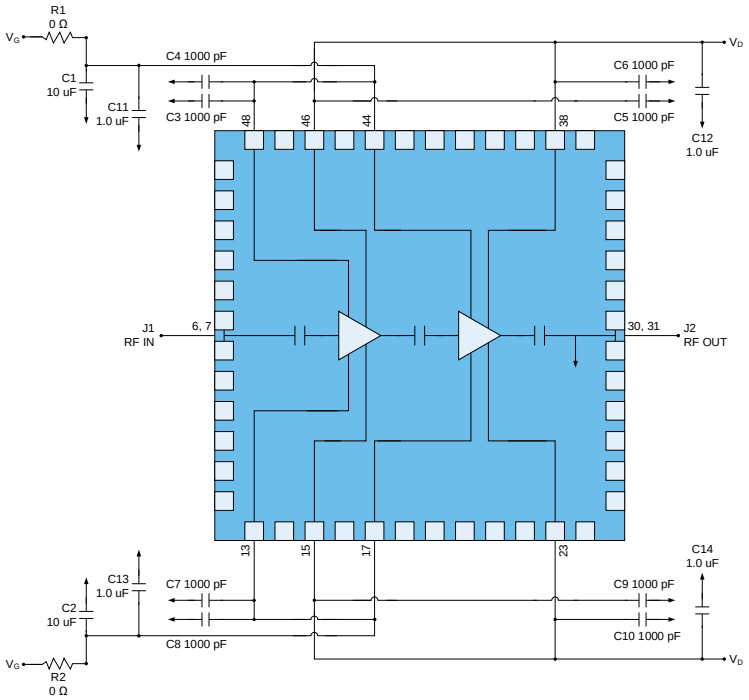
Notes:
1. Thermal resistance is determined to the back of the package (at 85 °C).
2. IR scan equivalent. Refer to the following document: GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates

Power Dissipation and Maximum Gate Current





Application Circuit



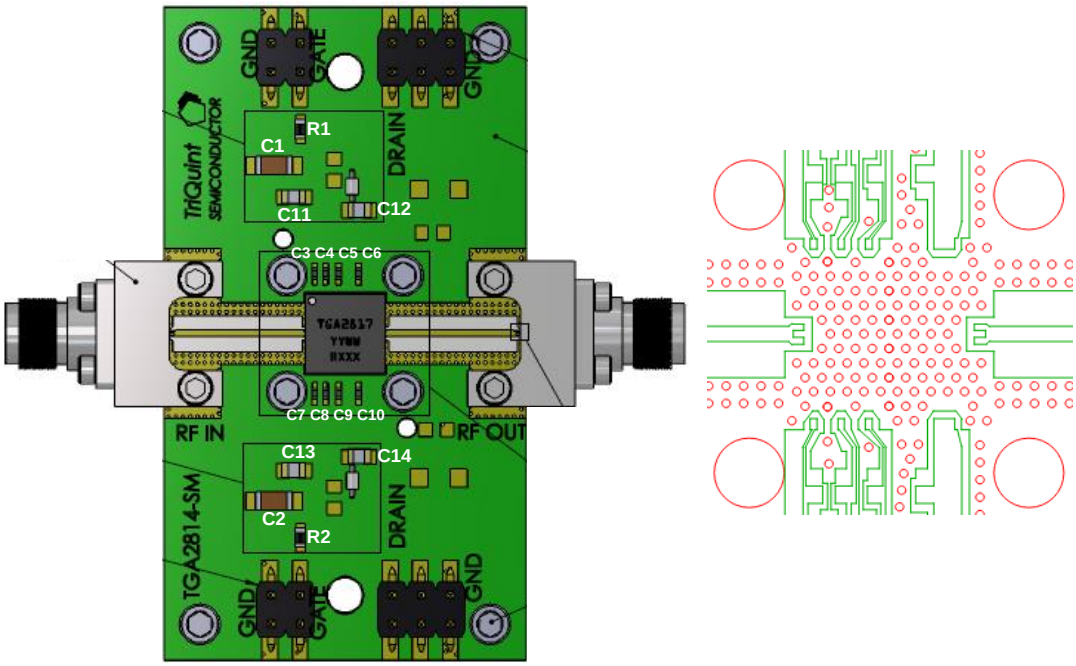
Notes:

1. V_G and V_D must be biased from both sides (top and bottom).

Bias-up Procedure
Set I_D limit to 6000 mA, I_G limit to 40 mA
Set V_G to −6.0 V
Set V_D +28 V
Adjust V_G more positive until I_{DQ} = 200 mA
Apply RF signal

Bias-down Procedure
Turn off RF signal
Reduce V_G to −6.0 V. Ensure I_{DQ} ~ 0 mA
Set V_D to 0 V
Turn off V_D supply
Turn off V_G supply

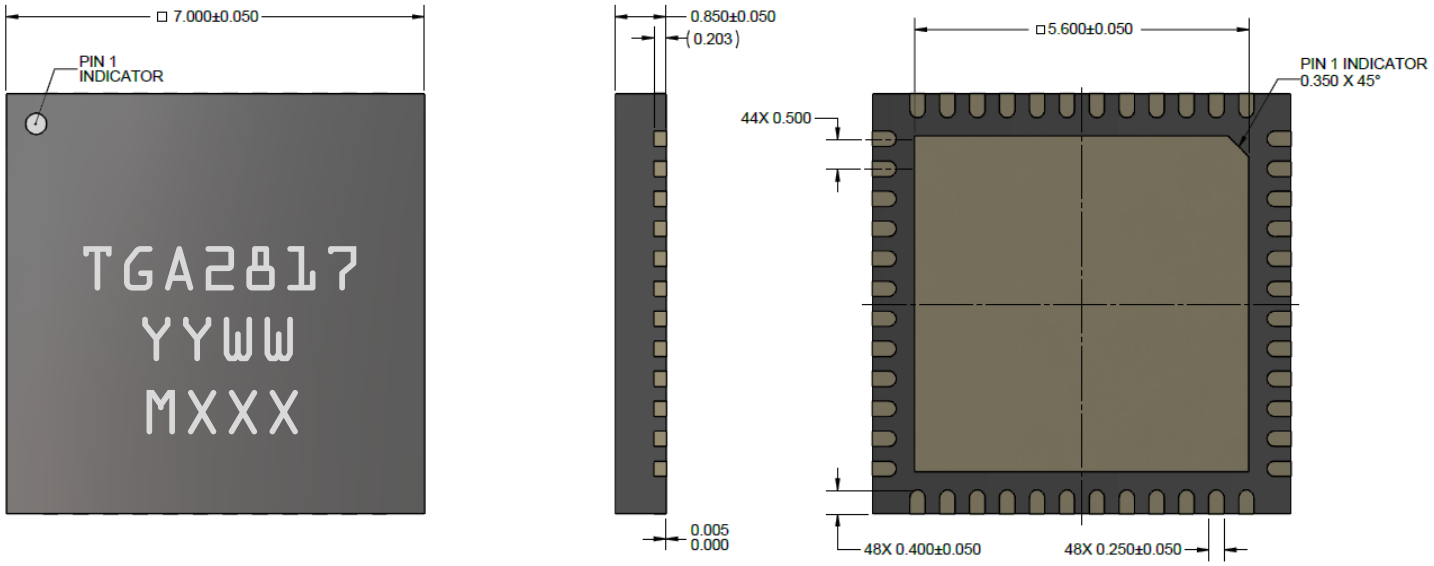
Evaluation Board and Mounting Detail



RF Layer is 0.008" thick Rogers Corp. RO40003C (ε_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 1092-02A-5.

Reference Design	Component	Value	Manufacture	Part Number
C1, C2	Surface Mount Cap	10 uF, 20 %, 50 V (1206), X5R	Various	
C3–C10	Surface Mount Cap	1000 pF, 10 %, 50 V (0402), X7R	Various	
C11–C14	Surface Mount Cap	1.0 uF, 10 %, 25 V (0402), X7R	Various	
R1, R2	Surface Mount Res	0 Ohm, 5 % (0603)	Various	

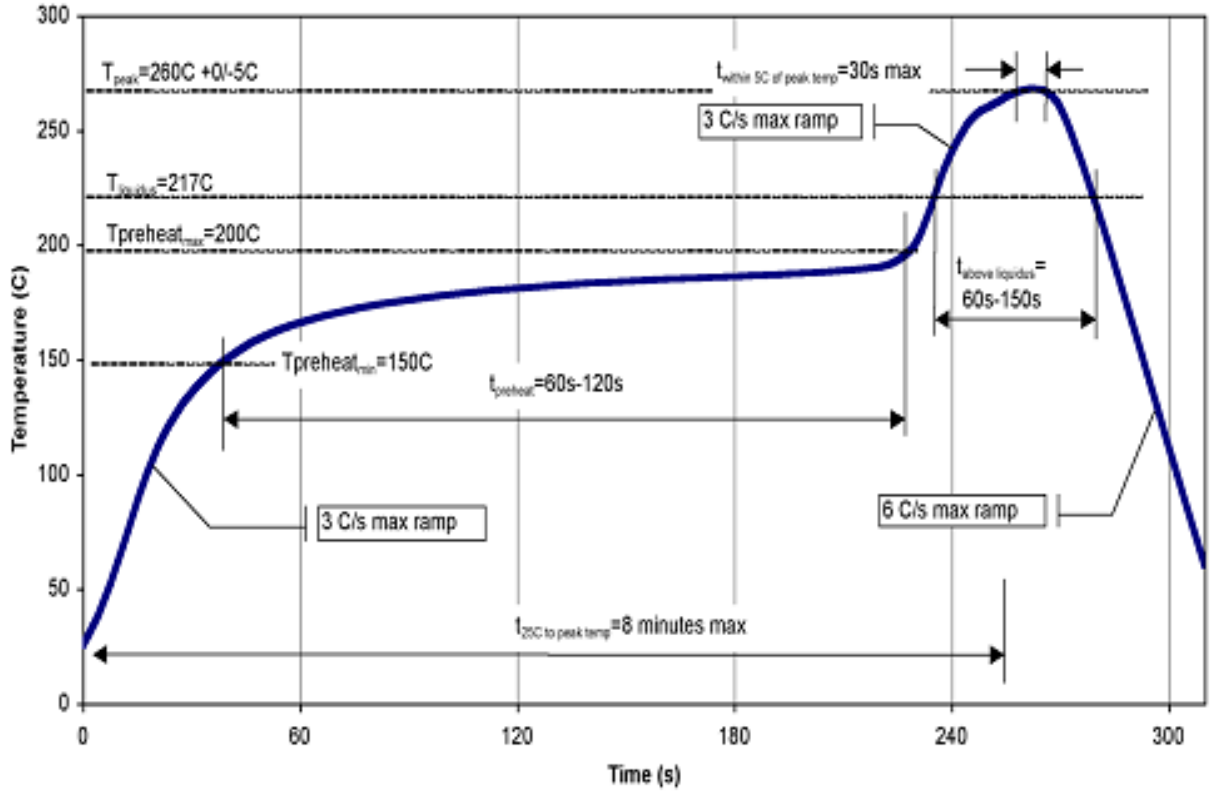
Mechanical Drawing and Pad Description



Package Leads are Gold Plated
Part is Mold Encapsulated
Dimensions are in mm
Tolerances: .XX = ± .25, .XXX = ± .127
Markings:
TGA2817: Part Number
YY: Assembly Year
WW: Assembly Week
MXXX: Batch ID

Pad No.	Symbol	Description
1-5, 8-12, 14, 16, 18-22, 24-29, 32-37, 39-43, 45, 47, 49	GND	Ground connection.
6, 7	RF Input	50 Ohm RF input. Pad is capacitively coupled to block on-chip DC voltages.
13, 48	V_{G1}	1st Stage Gate Voltage; bias network is required; must be biased from both sides (V_{G1} and V_{G2} can be tied together in application)
15, 46	V_{D1}	1st Stage Drain Voltage; bias network is required; must be biased from both sides (V_{D1} and V_{D2} can be tied together in application)
17, 44	V_{G2}	2nd Stage Gate Voltage; bias network is required; must be biased from both sides (V_{G1} and V_{G2} can be tied together in application)
23, 38	V_{D2}	2nd Stage Drain Voltage; bias network is required; must be biased from both sides (V_{D1} and V_{D2} can be tied together in application)
30, 31	RF Output	50 Ohm RF output. Pad is capacitively coupled to block on-chip DC voltages. Pad is DC grounded.

Recommended Soldering Temperature Profile



Handling Precautions

Parameter	Rating	Standard
ESD - Human Body Model (HBM)	1C	JEDEC/JS-001-2014
ESD- Charge Device Model (CDM)	C3	JEDEC/JS-002-2014
MSL - Moisture Sensitivity Level	MSL3	JEDEC/IPC/JEDEC J-STD-020

Caution!
ESD-Sensitive Device

Solderability

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

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 ($C_{15}H_{12}Br_40_2$) Free
- PFOS Free
- SVHC Free

Contact Information

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

Web: www.qorvo.com

Tel: 1-844-890-8163

Email: customer.support@qorvo.com

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