

## Applications

- Military radar
- Commercial radar
  - Avionics
  - Marine
  - Weather

## Product Features

- Frequency: DC to 12 GHz
- Output Power ( $P_{3dB}$ ): 22 W at 9.4 GHz
- Linear Gain: 11 dB at 9.4 GHz
- Typical  $PAE_{3dB}$ : 45% at 9.4 GHz
- Operating Voltage: 32 V
- Low thermal resistance package
- CW and Pulse capable
- 3 x 4 mm package

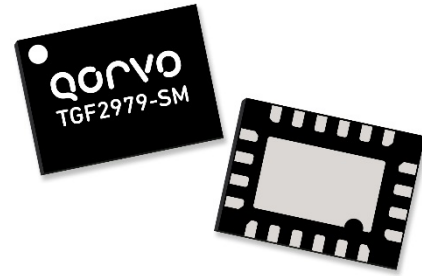
## General Description

The TriQuint TGF2979-SM is a 25 W ( $P_{3dB}$ ) discrete GaN on SiC HEMT which operates from DC to 12 GHz. The device is constructed with TriQuint's proven TQGaN25 process, which features advanced field plate techniques to optimize power and efficiency at high drain bias operating conditions. This optimization can potentially lower system costs in terms of fewer amplifier line-ups and lower thermal management costs.

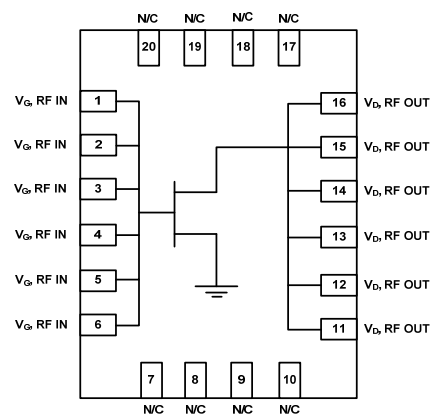
The device is housed in an industry-standard 3 x 4 mm surface mount QFN package.

Lead-free and ROHS compliant

Evaluation boards are available upon request.



## Functional Block Diagram



## Pin Configuration

Pin No.	Label
11 - 16	$V_D$ / RF OUT
1 - 6	$V_G$ / RF IN
7 - 10, 17 - 20	NC
Back side	Source

## Ordering Information

Part	ECCN	Description
TGF2979-SM	3A001b.3.b	QFN Packaged Part
TGF2979-SM-EVB1	EAR99	EVB

## Absolute Maximum Ratings

Parameter	Value
Breakdown Voltage ( $BV_{DG}$ )	100 V min.
Gate Voltage Range ( $V_G$ )	-10 to 0 V
Drain Current ( $I_D$ )	3.6 A
Gate Current ( $I_G$ )	-7.5 to 12.6 mA
Power Dissipation, CW ( $P_D$ )	43 W
RF Input Power, CW, $T = 25^\circ\text{C}$ ( $P_{IN}$ )	37.8 dBm
Channel Temperature ( $T_{CH}$ )	275 °C
Storage Temperature	-40 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 ( $V_D$ )	32 V (Typ.)
Drain Quiescent Current ( $I_{DQ}$ )	150 mA (Typ.)
Peak Drain Current ( $I_D$ )	1800 mA (Typ.)
Gate Voltage ( $V_G$ )	-2.7 V (Typ.)
Channel Temperature ( $T_{CH}$ )	225 °C (Max)
Power Dissipation, CW ( $P_D$ ) <sup>2</sup>	37.2 W (Max)
Power Dissipation, Pulse ( $P_D$ ) <sup>3</sup>	49 W (Max)

<sup>1</sup> Electrical specifications are measured at specified test conditions.

Specifications are not guaranteed over all recommended operating conditions.

<sup>2</sup> Package at 85 °C

<sup>3</sup> 100uS Pulse Width, 10 % Duty Cycle, package at 85 °C

## Pulsed RF Characterization – Load Pull Performance

Test conditions unless otherwise noted:  $T_A = 25\text{ }^\circ\text{C}$ ,  $V_D = 32\text{ V}$ ,  $I_{DQ} = 150\text{ mA}$ , Pulse: 100uS Pulse Width, 10 % Duty Cycle

Symbol	Parameter	Freq	Min	Typical	Max	Units
G <sub>LIN</sub>	Linear Gain, Power Tuned	6 GHz		14.5		dB
		8 GHz		12.7		
		9 GHz		11.8		
		9.4 GHz		10.9		
		10 GHz		10.1		
		12 GHz		9.2		
P <sub>3dB</sub>	Output Power at 3dB compression point, Power Tuned	6 GHz		44.4		dBm
		8 GHz		43.8		
		9 GHz		43.2		
		9.4 GHz		43.5		
		10 GHz		43.7		
		12 GHz		43.4		
PAE <sub>3dB</sub>	Power-Added Efficiency at 3dB compression point, Efficiency Tuned	6 GHz		56.0		%
		8 GHz		51.0		
		9 GHz		49.2		
		9.4 GHz		44.9		
		10 GHz		40.8		
		12 GHz		33.0		
G <sub>3dB</sub>	Gain at 3dB compression point, Power Tuned	6 GHz		11.5		dB
		8 GHz		9.7		
		9 GHz		8.8		
		9.4 GHz		7.9		
		10 GHz		7.1		
		12 GHz		6.2		

## Thermal and Reliability Information - CW <sup>1</sup>

Parameter	Simulated Conditions	Value	Units
Thermal Resistance ( $\theta_{JC}$ )	85 °C Case 45.4 W Pdiss, CW	4.03	°C/W
Maximum Channel Temperature ( $T_{CH}$ )		268	°C
Median Lifetime ( $T_M$ )		7.2E4	Hrs
Thermal Resistance ( $\theta_{JC}$ )	85 °C Case 37.8 W Pdiss, CW	3.78	°C/W
Maximum Channel Temperature ( $T_{CH}$ )		228	°C
Median Lifetime ( $T_M$ )		1.4E6	Hrs
Thermal Resistance ( $\theta_{JC}$ )	85 °C Case 30.2 W Pdiss, CW	3.54	°C/W
Maximum Channel Temperature ( $T_{CH}$ )		192	°C
Median Lifetime ( $T_M$ )		3.3E7	Hrs
Thermal Resistance ( $\theta_{JC}$ )	85 °C Case 22.7 W Pdiss, CW	3.34	°C/W
Maximum Channel Temperature ( $T_{CH}$ )		161	°C
Median Lifetime ( $T_M$ )		7.5E8	Hrs
Thermal Resistance ( $\theta_{JC}$ )	85 °C Case 15.1 W Pdiss, CW	3.18	°C/W
Maximum Channel Temperature ( $T_{CH}$ )		133	°C
Median Lifetime ( $T_M$ )		1.9E10	Hrs
Thermal Resistance ( $\theta_{JC}$ )	85 °C Case 7.6 W Pdiss, CW	3.03	°C/W
Maximum Channel Temperature ( $T_{CH}$ )		108	°C
Median Lifetime ( $T_M$ )		4.9E11	Hrs

Notes:

1. Thermal resistance measured to bottom of package.

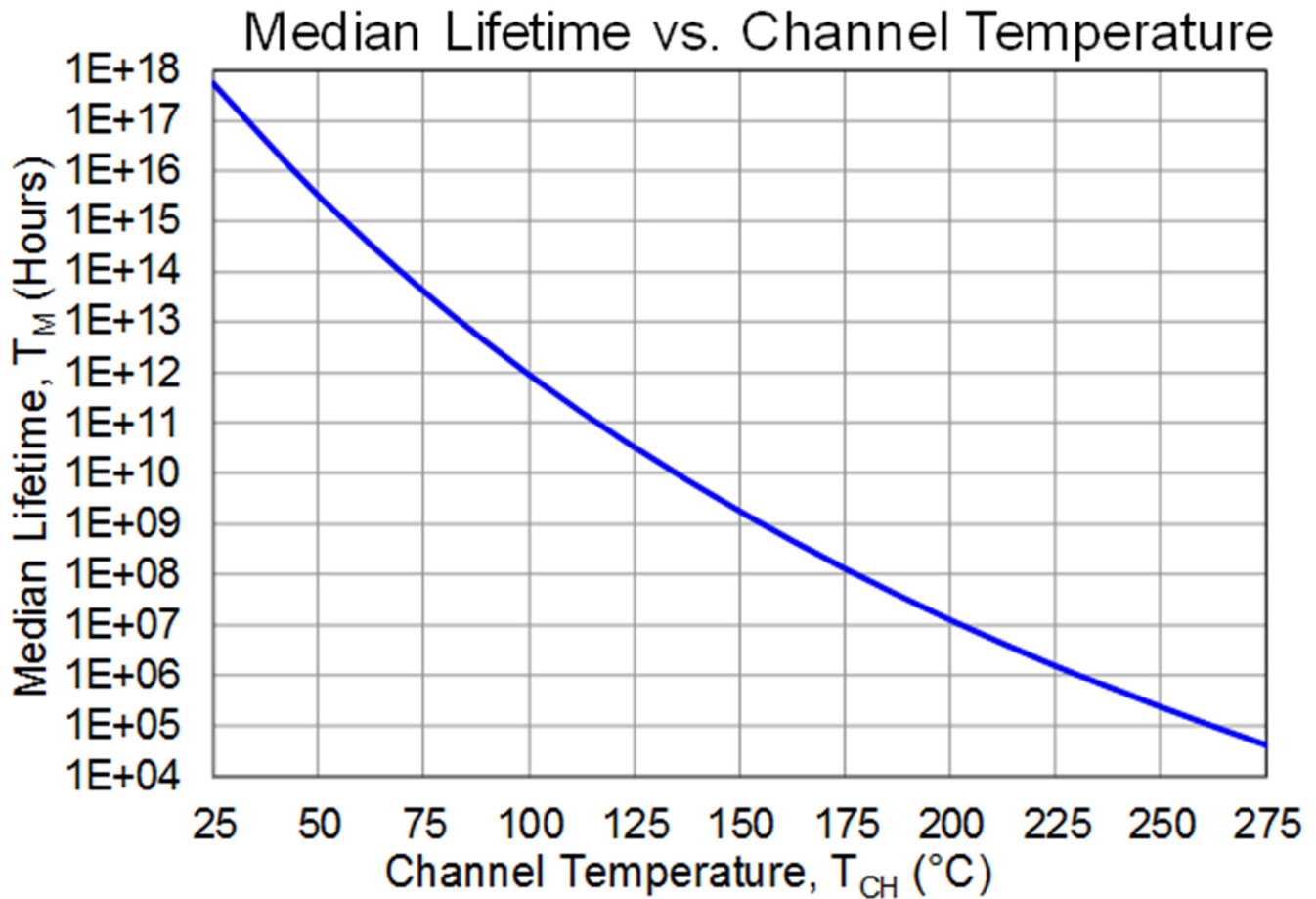
## Thermal and Reliability Information - Pulsed <sup>1</sup>

Parameter	Simulated Conditions	Value	Units
Thermal Resistance ( $\theta_{JC}$ )	85 °C Case 45.4 W Pdiss, 500uS PW, 10%	3.74	°C/W
Maximum Channel Temperature ( $T_{CH}$ )		255	°C
Median Lifetime ( $T_M$ )		1.8E6	Hrs
Thermal Resistance ( $\theta_{JC}$ )	85 °C Case 37.8 W Pdiss, 500uS PW, 10%	3.39	°C/W
Maximum Channel Temperature ( $T_{CH}$ )		213	°C
Median Lifetime ( $T_M$ )		5.0E7	Hrs
Thermal Resistance ( $\theta_{JC}$ )	85 °C Case 45.4 W Pdiss, 100uS PW, 10%	2.80	°C/W
Maximum Channel Temperature ( $T_{CH}$ )		212	°C
Median Lifetime ( $T_M$ )		5.5E7	Hrs
Thermal Resistance ( $\theta_{JC}$ )	85 °C Case 37.8 W Pdiss, 100uS PW, 10%	2.67	°C/W
Maximum Channel Temperature ( $T_{CH}$ )		186	°C
Median Lifetime ( $T_M$ )		5.9E8	Hrs

Notes:

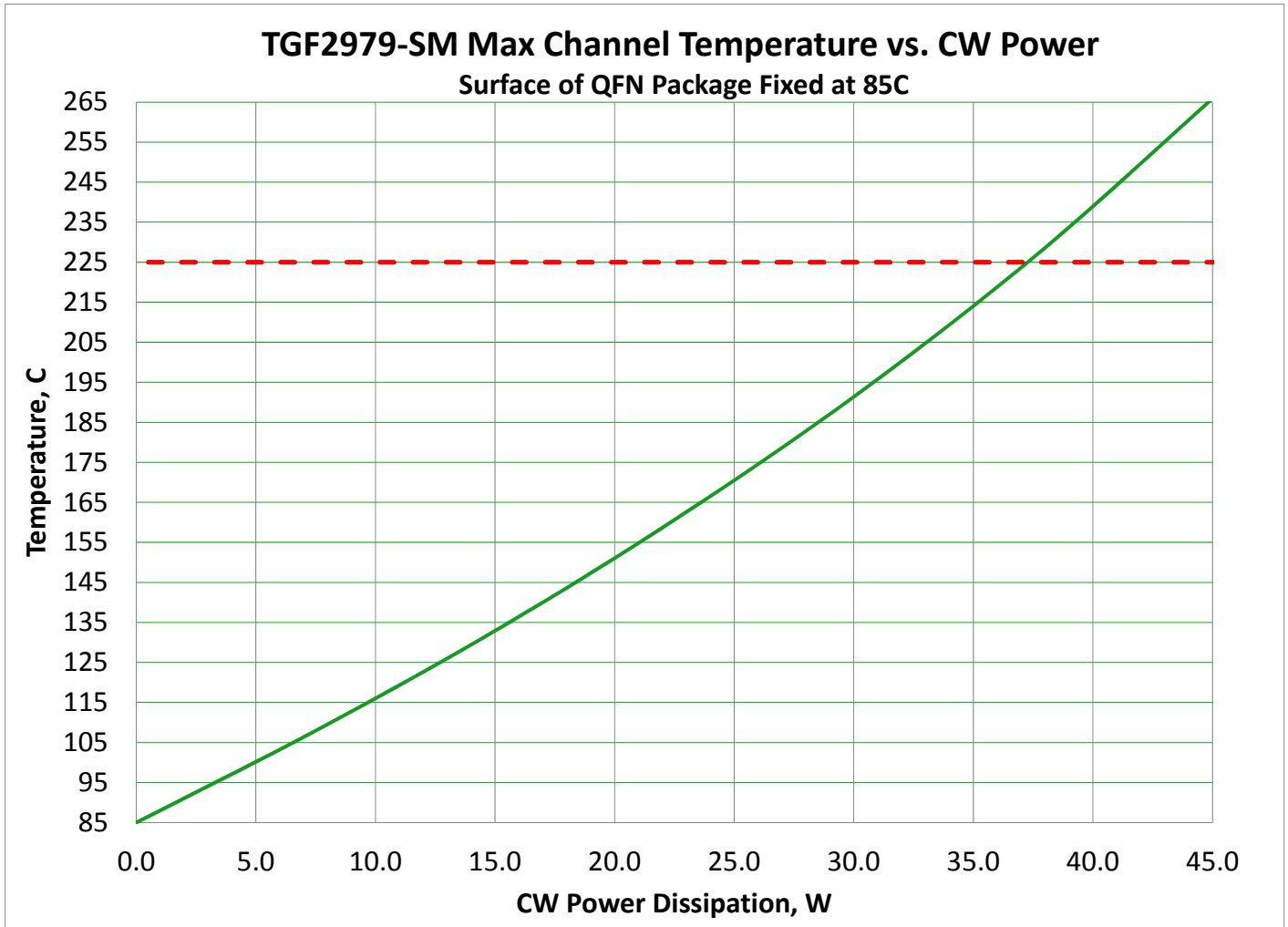
1. Thermal resistance measured to bottom of package.

**Median Lifetime<sup>1</sup>**

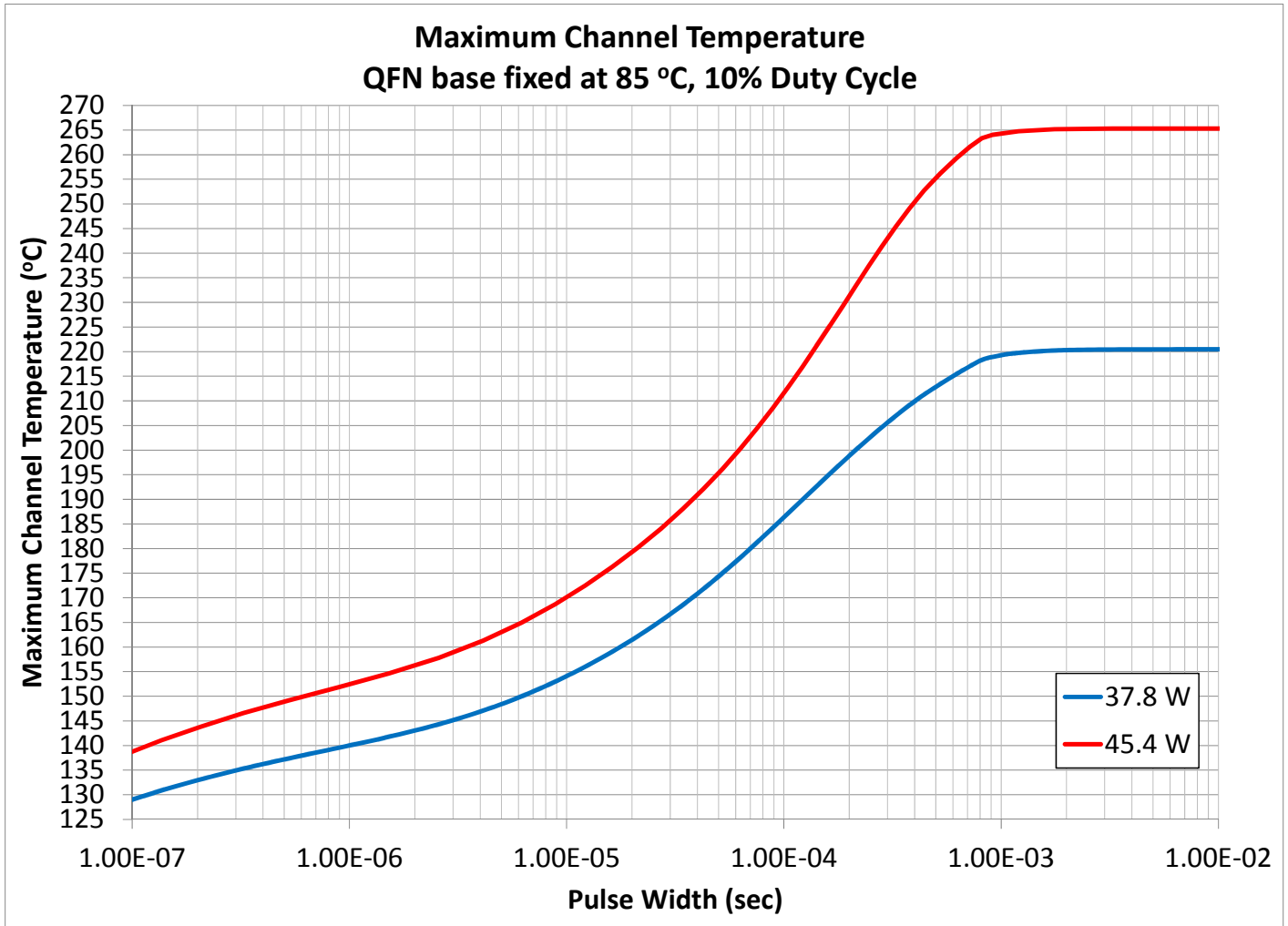


<sup>1</sup> For pulsed signals, average lifetime is average lifetime at maximum channel temperature divided by duty cycle.

**Maximum Channel Temperature, CW**



**Maximum Channel Temperature, Pulsed**



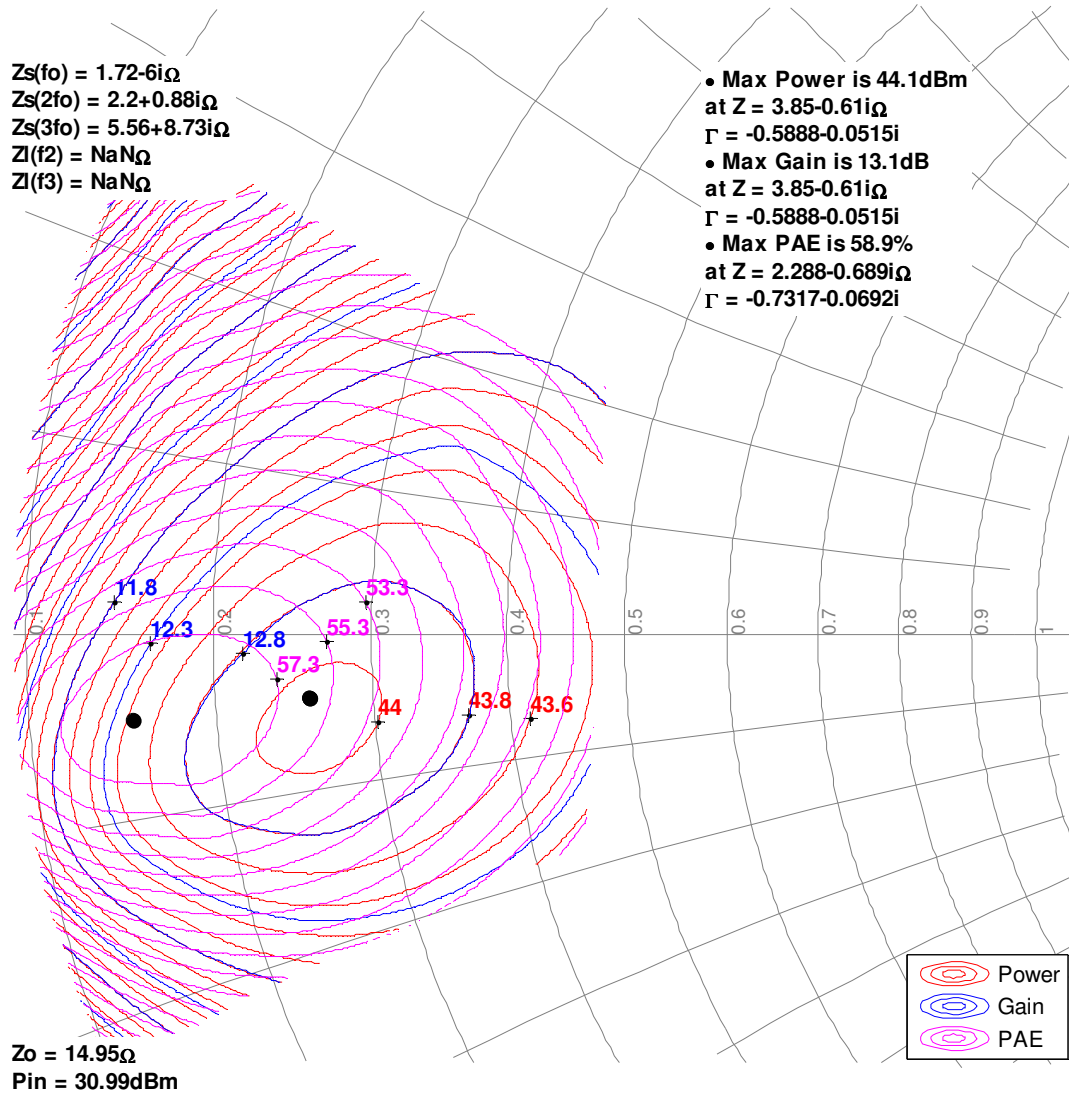
**Load Pull Smith Charts - Pulsed (1, 2, 3)**

RF performance that the device typically exhibits when placed in the specified impedance environment. The impedances are not the impedances of the device, they are the impedances presented to the device via an RF circuit or load-pull system. The impedances listed follow an optimized trajectory to maintain high power and high efficiency.

Notes:

1. 32 V, 150 mA, Pulsed signal with 100 uS pulse width and 10 % duty cycle. Performance is at indicated input power.
2. See page 17 for load pull and source pull reference planes. 15-Ω load pull TRL fixtures are built with 10-mil RO4350B material.
3. NaN means the impedances are either undefined or varying in load-pull system.

**6GHz, Load-pull**





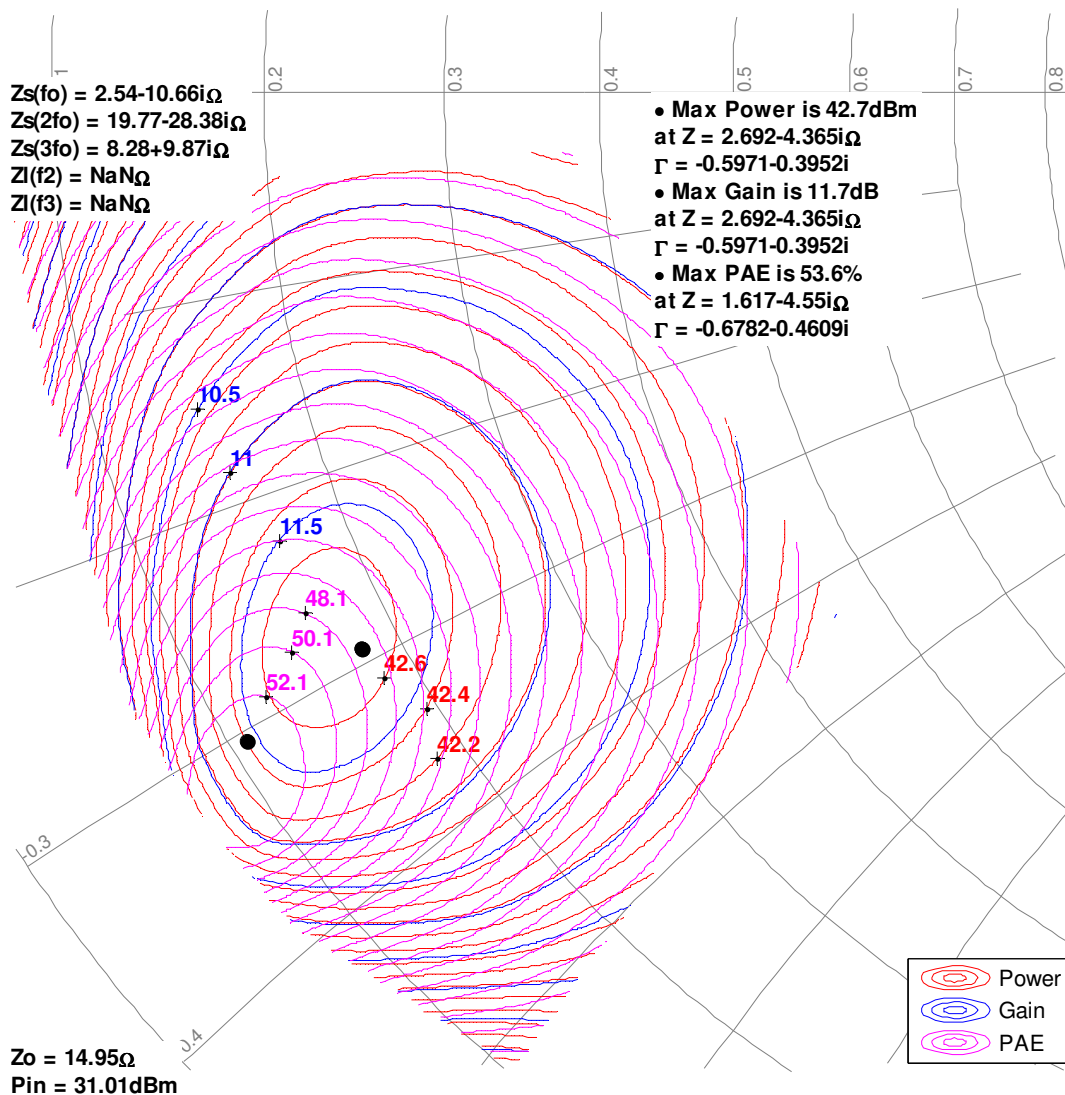
**Load Pull Smith Charts - Pulsed (1, 2, 3)**

RF performance that the device typically exhibits when placed in the specified impedance environment. The impedances are not the impedances of the device, they are the impedances presented to the device via an RF circuit or load-pull system. The impedances listed follow an optimized trajectory to maintain high power and high efficiency.

Notes:

1. 32 V, 150 mA, Pulsed signal with 100 uS pulse width and 10 % duty cycle. Performance is at indicated input power.
2. See page 17 for load pull and source pull reference planes. 15-Ω load pull TRL fixtures are built with 10-mil RO4350B material.
3. NaN means the impedances are either undefined or varying in load-pull system.

**8GHz, Load-pull**



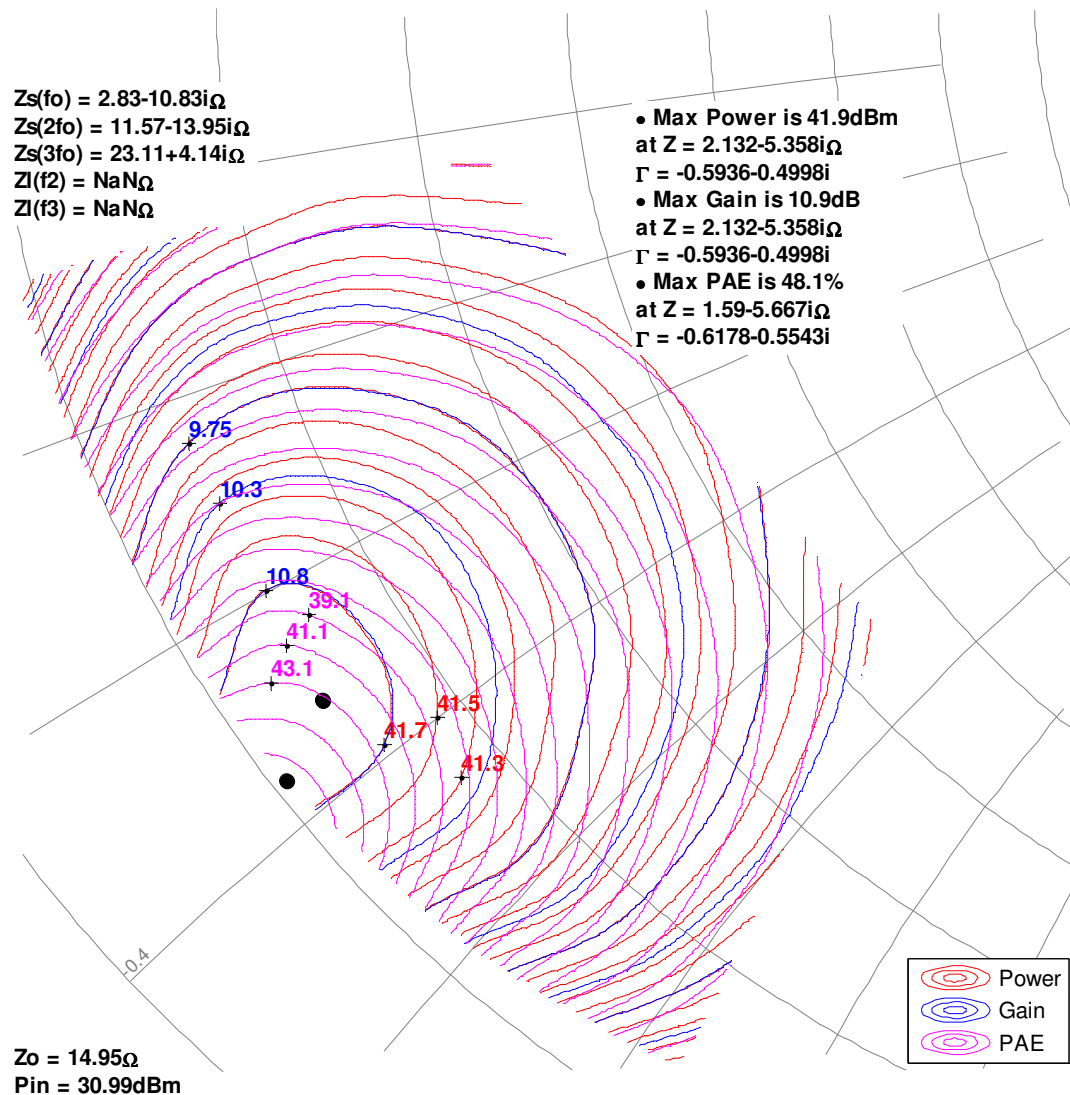
**Load Pull Smith Charts - Pulsed (1, 2, 3)**

RF performance that the device typically exhibits when placed in the specified impedance environment. The impedances are not the impedances of the device, they are the impedances presented to the device via an RF circuit or load-pull system. The impedances listed follow an optimized trajectory to maintain high power and high efficiency.

Notes:

1. 32 V, 150 mA, Pulsed signal with 100 uS pulse width and 10 % duty cycle. Performance is at indicated input power.
2. See page 17 for load pull and source pull reference planes. 15-Ω load pull TRL fixtures are built with 10-mil RO4350B material.
3. NaN means the impedances are either undefined or varying in load-pull system.

**9GHz, Load-pull**



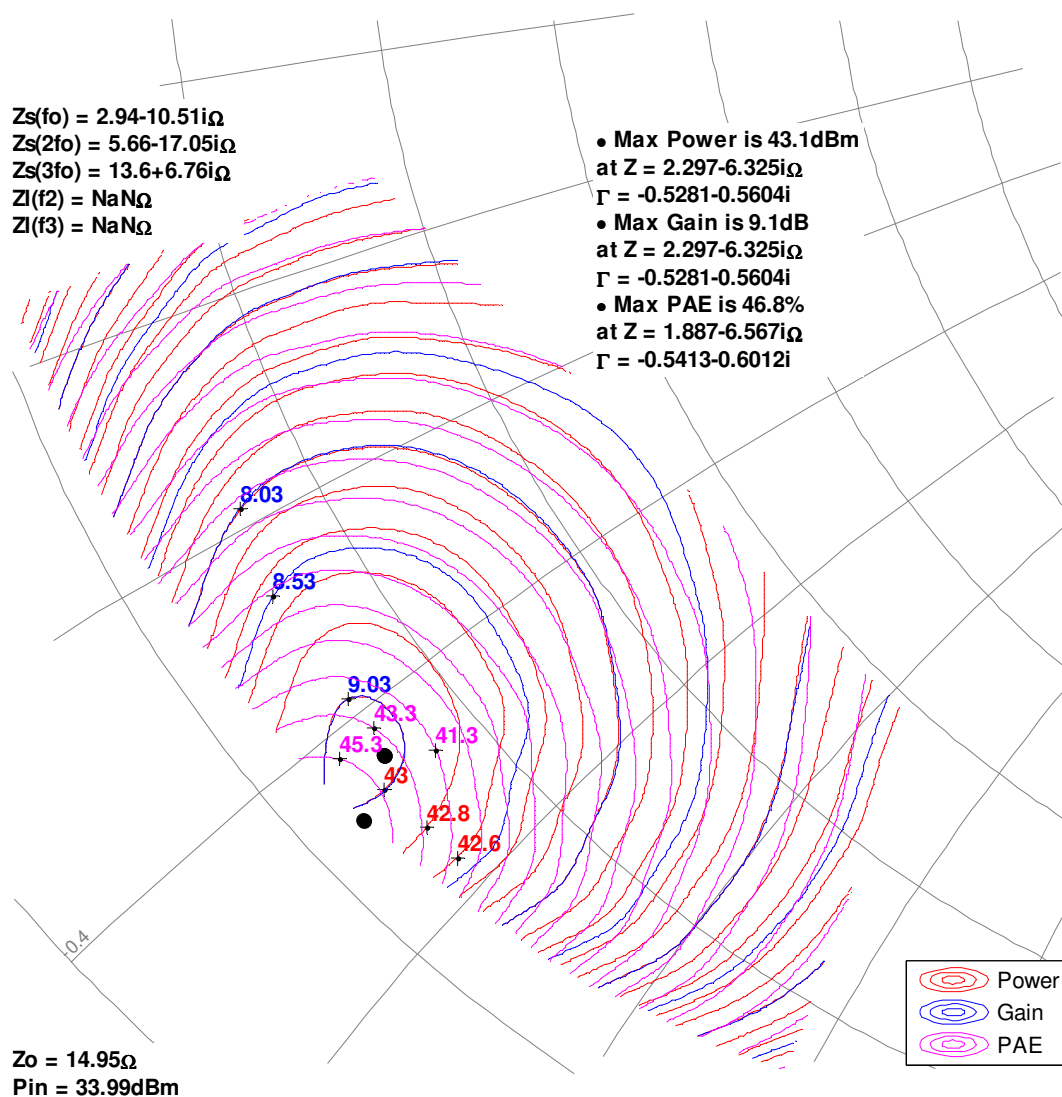
**Load Pull Smith Charts - Pulsed (1, 2, 3)**

RF performance that the device typically exhibits when placed in the specified impedance environment. The impedances are not the impedances of the device, they are the impedances presented to the device via an RF circuit or load-pull system. The impedances listed follow an optimized trajectory to maintain high power and high efficiency.

Notes:

1. 32 V, 150 mA, Pulsed signal with 100 uS pulse width and 10 % duty cycle. Performance is at indicated input power.
2. See page 17 for load pull and source pull reference planes. 15-Ω load pull TRL fixtures are built with 10-mil RO4350B material.
3. NaN means the impedances are either undefined or varying in load-pull system.

**9.4GHz, Load-pull**



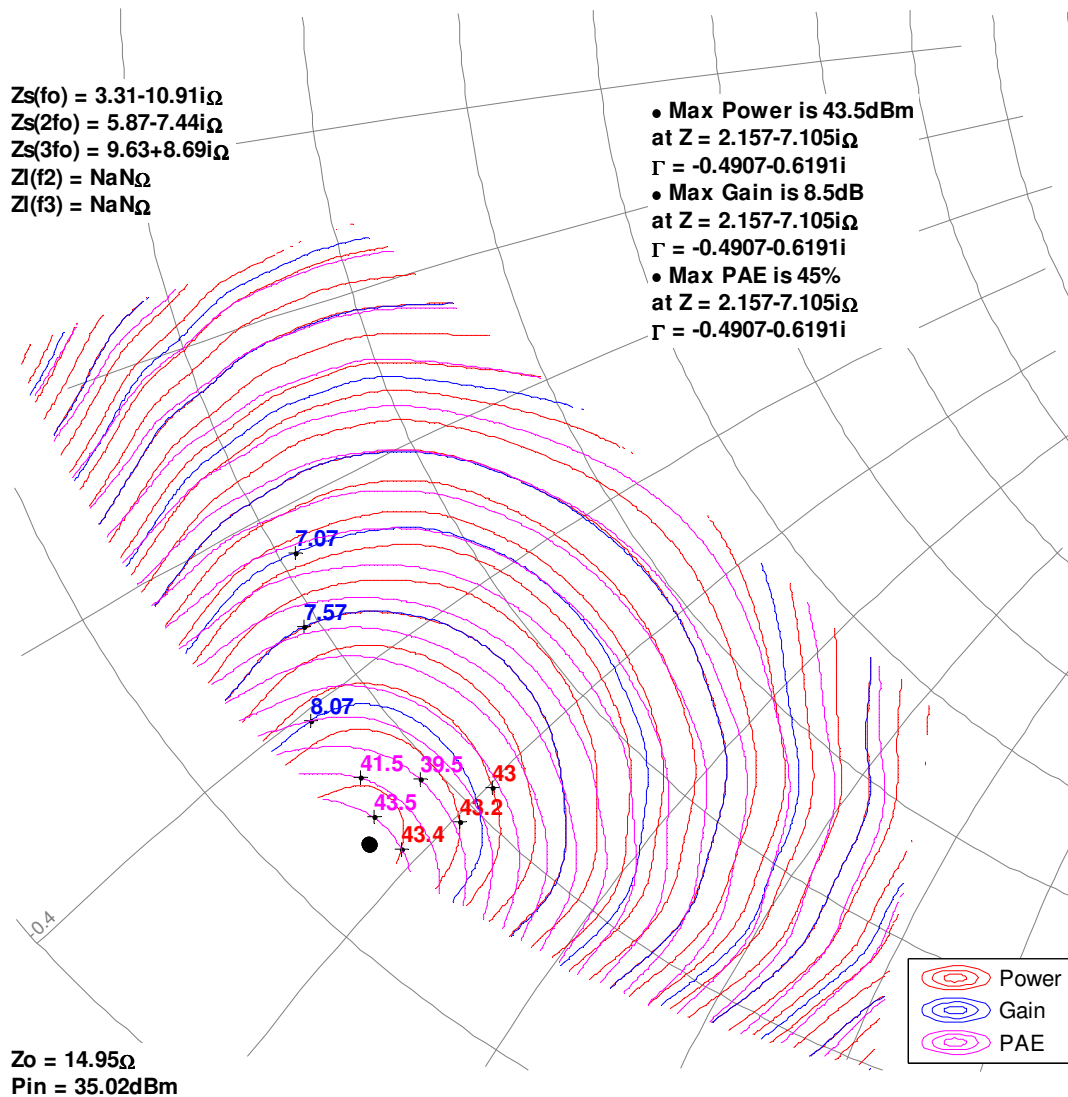
**Load Pull Smith Charts - Pulsed (1, 2, 3)**

RF performance that the device typically exhibits when placed in the specified impedance environment. The impedances are not the impedances of the device, they are the impedances presented to the device via an RF circuit or load-pull system. The impedances listed follow an optimized trajectory to maintain high power and high efficiency.

Notes:

1. 32 V, 150 mA, Pulsed signal with 100 uS pulse width and 10 % duty cycle. Performance is at indicated input power.
2. See page 17 for load pull and source pull reference planes. 15-Ω load pull TRL fixtures are built with 10-mil RO4350B material.
3. NaN means the impedances are either undefined or varying in load-pull system.

**10GHz, Load-pull**



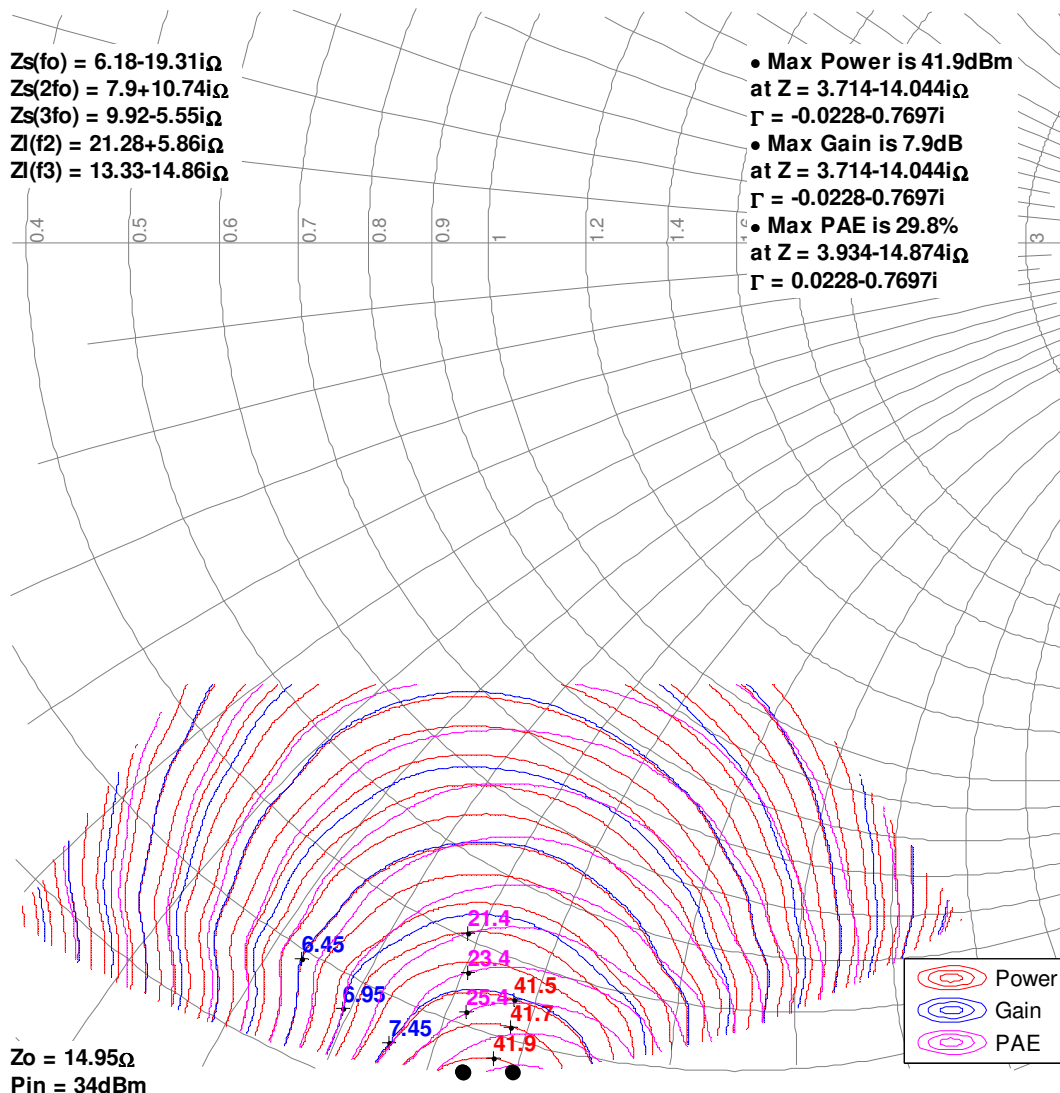
**Load Pull Smith Charts - Pulsed (1, 2, 3)**

RF performance that the device typically exhibits when placed in the specified impedance environment. The impedances are not the impedances of the device, they are the impedances presented to the device via an RF circuit or load-pull system. The impedances listed follow an optimized trajectory to maintain high power and high efficiency.

Notes:

1. 32 V, 150 mA, Pulsed signal with 100 uS pulse width and 10 % duty cycle. Performance is at indicated input power.
2. See page 17 for load pull and source pull reference planes. 15-Ω load pull TRL fixtures are built with 10-mil RO4350B material.
3. NaN means the impedances are either undefined or varying in load-pull system.

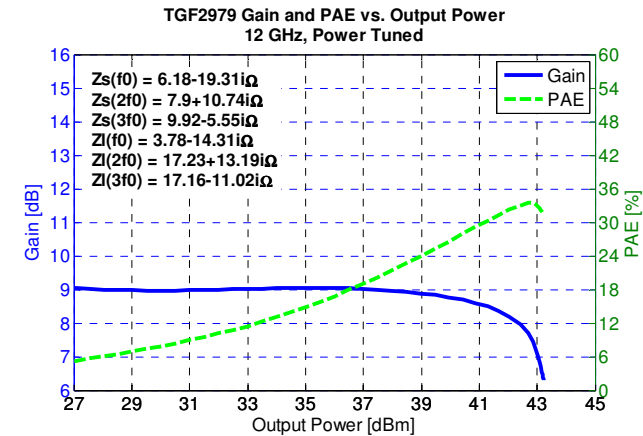
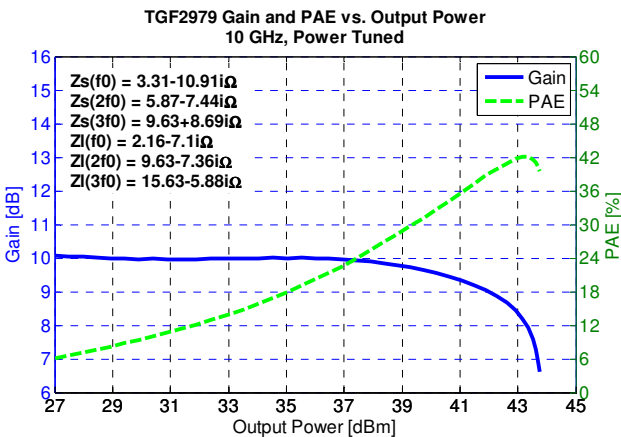
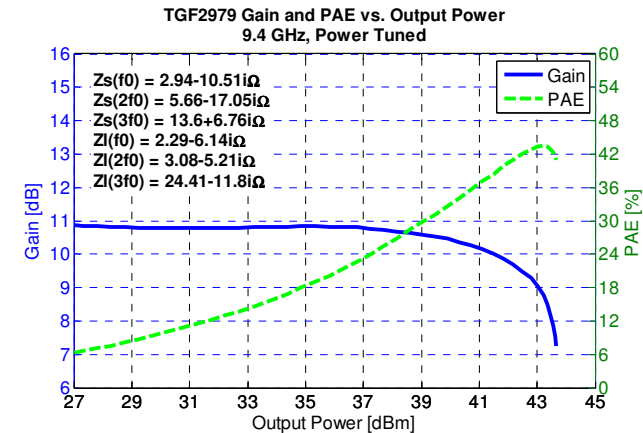
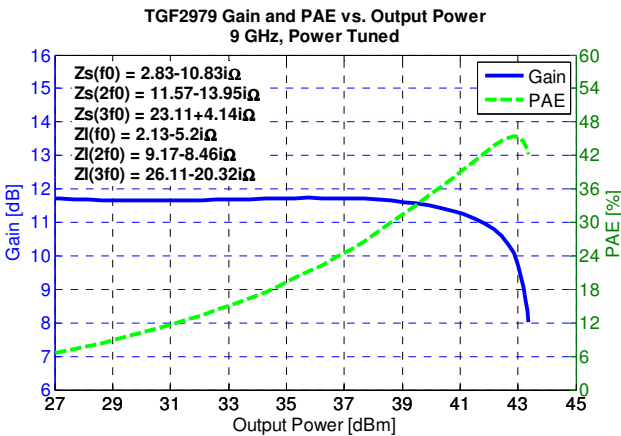
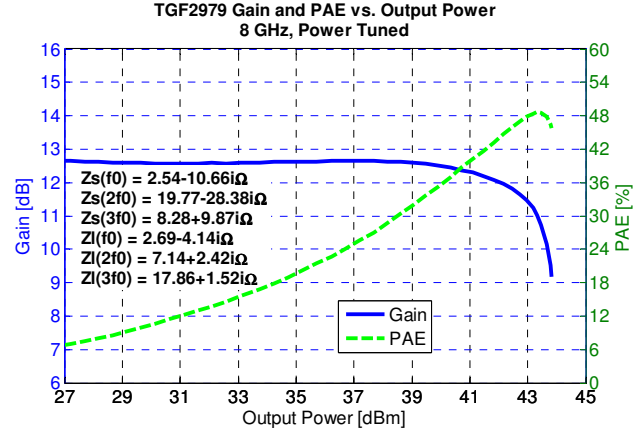
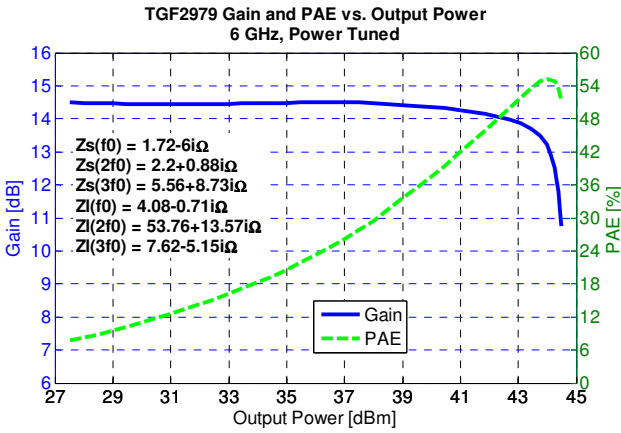
**12GHz, Load-pull**



## Typical Pulsed Performance – Power Tuned<sup>(1,2,3)</sup>

Notes:

1. Pulsed signal with 100 uS pulse width and 10 % duty cycle
2. See page 16 for load pull and source pull reference planes where the performance was measured.
3. Vd = 32 V, Idq = 150 mA

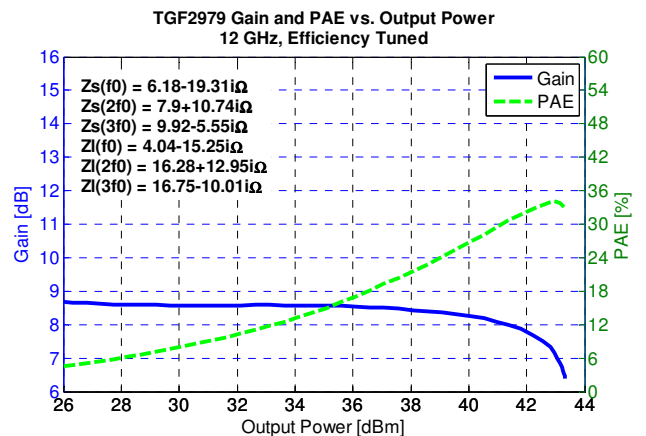
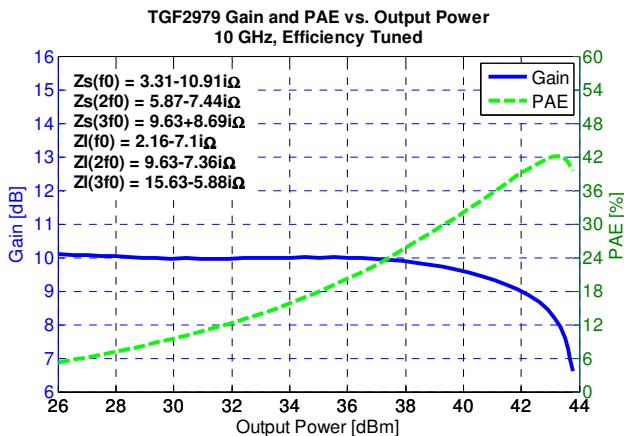
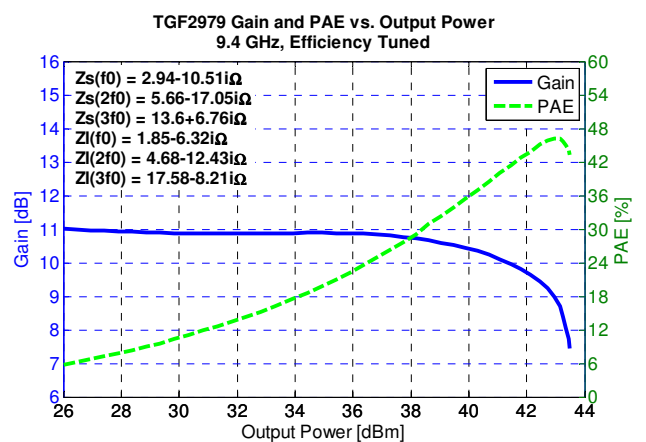
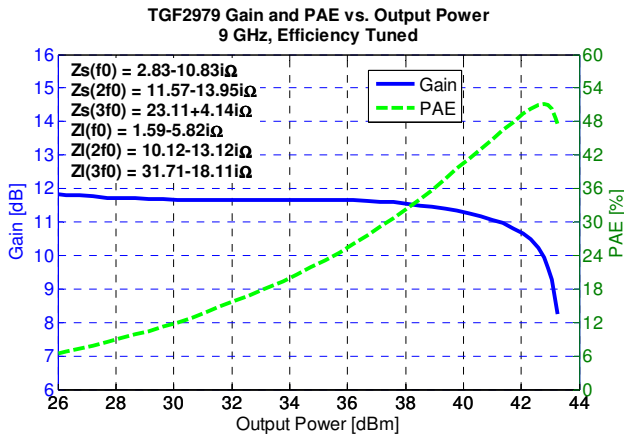
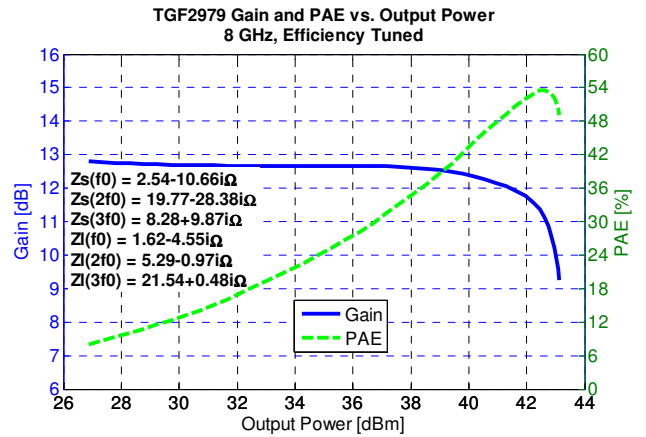
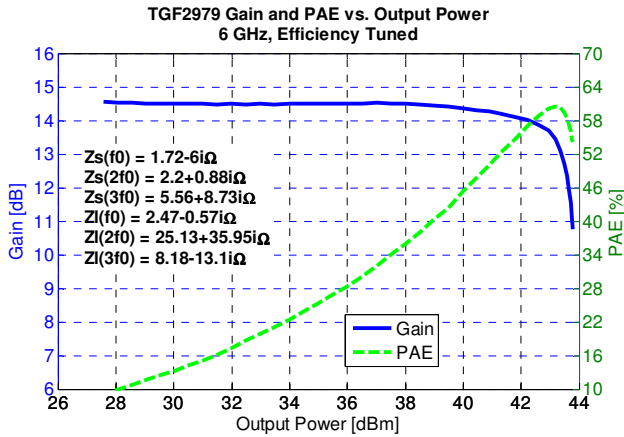




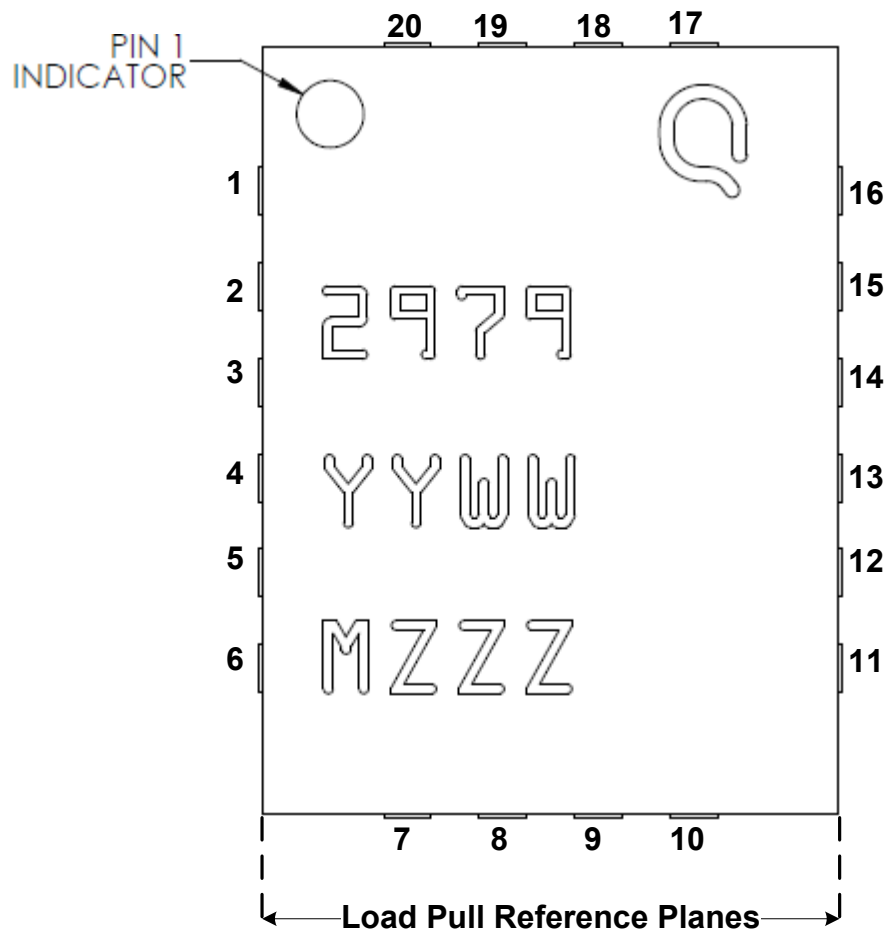
## Typical Pulsed Performance – Efficiency Tuned<sup>(1,2,3)</sup>

Notes:

1. Pulsed signal with 100 uS pulse width and 10 % duty cycle
2. See page 16 for load pull and source pull reference planes where the performance was measured.
3.  $V_d = 32\text{ V}$ ,  $I_{dq} = 150\text{ mA}$



## Pin Layout



## Pin Description

Pin	Symbol	Description
11 - 16	$V_D$ / RF OUT	Drain voltage / RF Output to be matched to 50 ohms; see EVB Layout on page 19 as an example.
1 - 6	$V_G$ / RF IN	Gate voltage / RF Input to be matched to 50 ohms; see EVB Layout on page 19 as an example.
7 - 10, 17 - 20	N/C	Not connected
Back side	Source	Source connected to ground

### Notes:

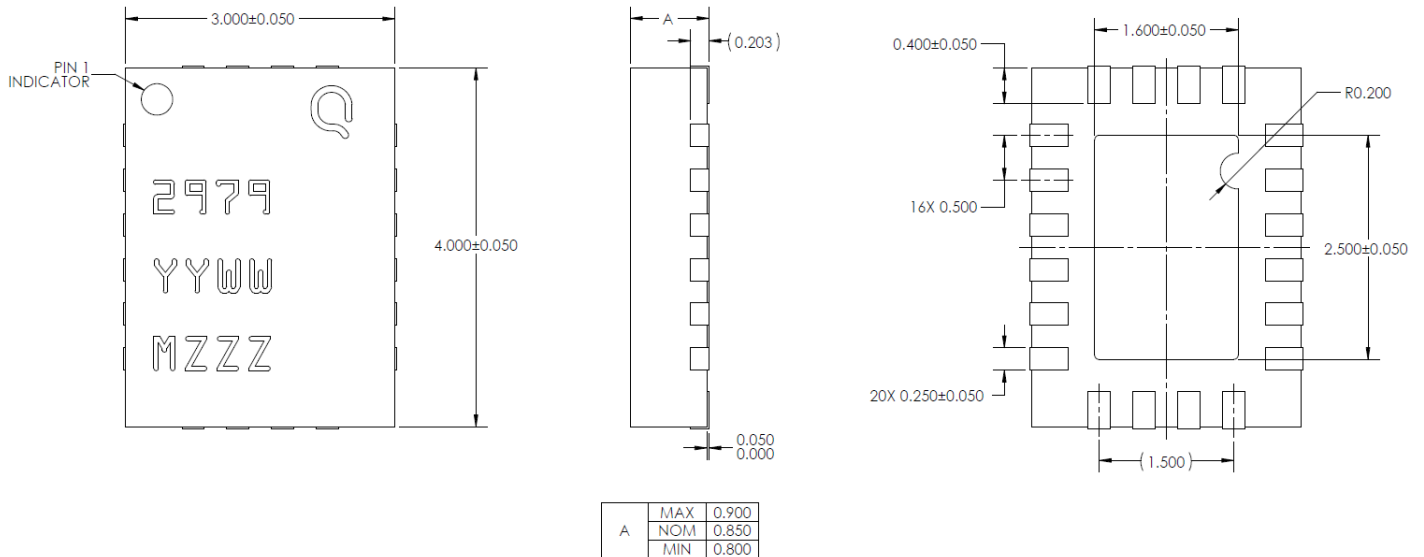
Thermal resistance measured to back side of package

The TGF2979-SM will be marked with the "2979" designator and a lot code marked below the part designator. The "YY" represents the last two digits of the calendar year the part was manufactured, the "WW" is the work week of the assembly lot start, and the "MZZZ" is the production lot number.



**Mechanical Information**

All dimensions are in millimeters.



**Note:**

Unless otherwise noted, all dimension tolerances are  $\pm 0.127$  mm.

This package is lead-free/RoHS-compliant. The plating material on the leads is NiAu. It is compatible with both lead-free (maximum 260 °C reflow temperature) and tin-lead (maximum 245 °C reflow temperature) soldering processes.

## Product Compliance Information

### ESD Sensitivity Ratings



Caution! ESD-Sensitive Device

ESD Rating: Class 1B  
 Value: Passes  $\geq 600$  V  
 Test: Human Body Model (HBM)  
 Standard: JEDEC Standard JESD22-A114

### MSL Rating

The part is rated Moisture Sensitivity Level 3 at 260°C per JEDEC standard IPC/JEDEC J-STD-020.

### ECCN

US Department of Commerce EAR99

### Solderability

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

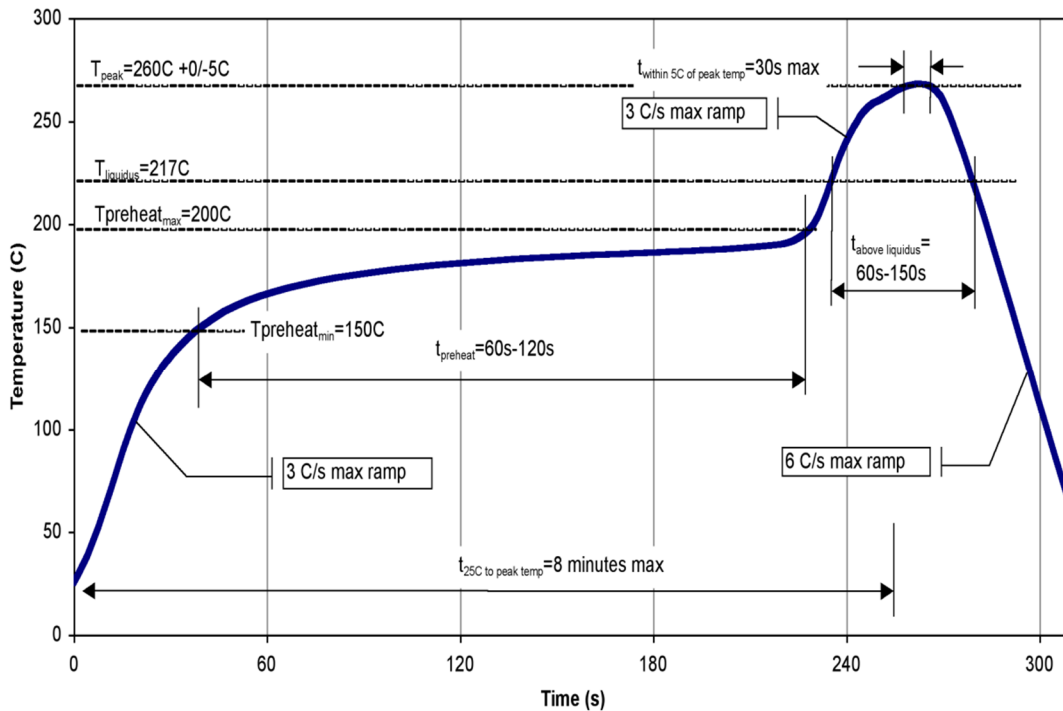
### RoHS Compliance

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
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C<sub>15</sub>H<sub>12</sub>Br<sub>4</sub>O<sub>2</sub>) Free
- PFOS Free
- SVHC Free

## Recommended Soldering Temperature Profile



## Contact Information

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

Web: [www.triquint.com](http://www.triquint.com)  
Email: [info-sales@triquint.com](mailto:info-sales@triquint.com)

Tel: +1.972.994.8465  
Fax: +1.972.994.8504

For technical questions and application information: Email: [info-products@triquint.com](mailto:info-products@triquint.com)

## Important Notice

The information contained herein is believed to be reliable. TriQuint makes no warranties regarding the information contained herein. TriQuint assumes no responsibility or liability whatsoever for any of the information contained herein. TriQuint assumes no responsibility or liability whatsoever for the use of the information contained herein. The information contained herein is provided "AS IS, WHERE IS" and with all faults, and the entire risk associated with such information is entirely with the user. All information contained herein is subject to change without notice. Customers should obtain and verify the latest relevant information before placing orders for TriQuint products. The information contained herein or any use of such information does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other intellectual property rights, whether with regard to such information itself or anything described by such information.

TriQuint products are not warranted or authorized for use as critical components in medical, life-saving, or life-sustaining applications, or other applications where a failure would reasonably be expected to cause severe personal injury or death.