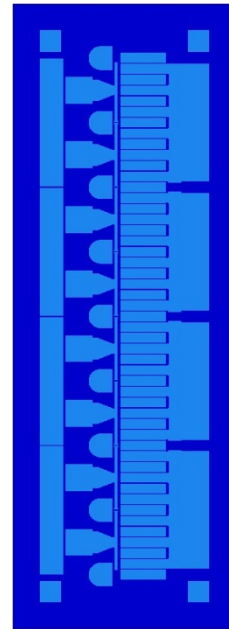


Applications

- Defense & Aerospace
- Broadband Wireless



Product Features

- Frequency Range: DC - 12 GHz
- 47.6 dBm Nominal P_{SAT} at 3 GHz
- 69.7% Maximum PAE at 3 GHz
- 19.3 dB Nominal Power Gain at 3 GHz
- Bias: $V_D = 32$ V, $I_{DQ} = 200$ mA
- Technology: TQGaN25 on SiC
- Chip Dimensions: 1.01 x 2.88 x 0.10 mm

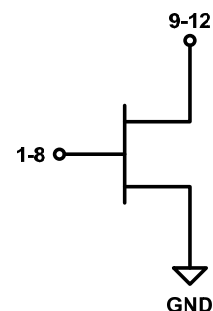
General Description

The TriQuint TGF2956 is a discrete 10.08 mm GaN on SiC HEMT which operates from DC-12 GHz. The TGF2956 is designed using TriQuint's proven TQGaN25 production process. This process features advanced field plate techniques to optimize microwave power and efficiency at high drain bias operating conditions.

The TGF2956 typically provides 47.6 dBm of saturated output power with power gain of 19.3 dB at 3 GHz. The maximum power added efficiency is 69.7 % which makes the TGF2956 appropriate for high efficiency applications.

Lead-free and RoHS compliant.

Functional Block Diagram



Pad Configuration

Pad No.	Symbol
1-8	V_G / RF IN
9-12	V_D / RF OUT
Backside	Source / Ground

Ordering Information

Part	ECCN	Description
TGF2956	3A001b.3.b	55 Watt GaN HEMT

Absolute Maximum Ratings

Parameter	Value
Drain to Gate Voltage (V_{DG})	100 V
Drain Voltage (V_D)	40 V
Gate Voltage Range (V_G)	-10 to 0 V
Drain Current (I_D)	6 A
Gate Current (I_G)	-10 to 16.8mA
CW Power Dissipation (P_D)	53 W
CW Input Power (P_{IN}) @ 10GHz	40 dBm
Channel Temperature (T_{CH})	275 °C
Mounting Temperature (30 Sec.)	320 °C
Storage Temperature	-65 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 Range (V_D)	32 V
Drain Quiescent Current (I_{DQ})	200 mA
Drain Current Under RF Drive (I_D) ⁽¹⁾	3.5 A (Typ.)
Pinch-off Gate Voltage (V_G)	-3.5 V (Typ.)
Channel Temperature (T_{CH})	225 °C (Max.)

(1) 10% pulses at 3GHz, Power Tuned

RF Characterization – Model Optimum Power Tune

Simulation conditions unless otherwise noted: T = 25 °C, Bond wires not included, Pulse: 100uS PW, 10%. See page 17 for reference planes.

Parameter	Typical Value					Units
Frequency (F)	1	3	6	10	15	GHz
Drain Voltage (V _D)	32	32	32	32	32	V
Bias Current (I _{DQ})	200	200	200	200	200	mA
Output P3dB (P _{3dB})	47.6	47.6	47.6	47.7	47.3	dBm
PAE @ P _{3dB} (PAE _{3dB})	65.5	63.5	58.6	53.8	44.9	%
Gain @ P3dB (G _{3dB})	26.5	19.3	14.3	10.6	7.5	dB
Parallel Output Resistance ⁽¹⁾ (R _p)	98.7	95.3	85.2	71.4	40.9	Ω·mm
Parallel Output Capacitance ⁽¹⁾ (C _p)	-0.063	0.137	0.208	0.222	0.239	pF/mm
Load Impedance (Z _L)	9.78-j0.38	8.92+j2.19	5.85+j3.90	3.50+j3.53	2.18+j2.02	Ω
Source Impedance (Z _S)	1.24+j9.36	0.57+j3.05	0.55+j1.22	0.47+j0.28	0.44-j0.42	Ω

Notes:

1. Large signal equivalent output network (normalized).

RF Characterization – Model Optimum Efficiency Tune

Simulation conditions unless otherwise noted: T = 25 °C, Bond wires not included, Pulse: 100uS PW, 10%. See page 17 for reference planes.

Parameter	Typical Value					Units
Frequency (F)	1	3	6	10	15	GHz
Drain Voltage (V _D)	32	32	32	32	32	V
Bias Current (I _{DQ})	200	200	200	200	200	mA
Output P3dB (P _{3dB})	46.1	46.2	46.2	47.1	47.1	dBm
PAE @ P _{3dB} (PAE _{3dB})	71.5	69.7	64.4	56.4	46.1	%
Gain @ P3dB (G _{3dB})	27.8	20.8	15.2	11.0	7.9	dB
Parallel Output Resistance ⁽¹⁾ (R _p)	173.5	159	146.6	100.6	47.3	Ω·mm
Parallel Output Capacitance ⁽¹⁾ (C _p)	0.294	0.283	0.283	0.277	0.251	pF/mm
Load Impedance (Z _L)	15.6+j5.02	9.17+j7.78	4.22+j6.60	2.71+j4.12	2.07+j2.32	Ω
Source Impedance (Z _S)	1.24+j9.36	0.57+j3.05	0.55+j1.22	0.47+j0.28	0.44-j0.42	Ω

Notes:

1. Large signal equivalent output network (normalized).

Thermal and Reliability Information - Pulsed ⁽¹⁾

Parameter	Test Conditions	Value	Units
Thermal Resistance, θ_{JC}	$P_D = 40.3 \text{ W}$, $T_{baseplate} = 85^\circ\text{C}$ Pulse: 100uS, 5%	1.92	$^\circ\text{C/W}$
Channel Temperature, T_{CH}		162.5	$^\circ\text{C}$
Median Lifetime, T_M		6.36E08	Hrs
Thermal Resistance, θ_{JC}	$P_D = 40.3 \text{ W}$, $T_{baseplate} = 85^\circ\text{C}$ Pulse: 100uS, 10%	2.02	$^\circ\text{C/W}$
Channel Temperature, T_{CH}		166.6	$^\circ\text{C}$
Median Lifetime, T_M		4.11E08	Hrs
Thermal Resistance, θ_{JC}	$P_D = 40.3 \text{ W}$, $T_{baseplate} = 85^\circ\text{C}$ Pulse: 100uS, 20%	2.24	$^\circ\text{C/W}$
Channel Temperature, T_{CH}		175.3	$^\circ\text{C}$
Median Lifetime, T_M		1.63E08	Hrs
Thermal Resistance, θ_{JC}	$P_D = 40.3 \text{ W}$, $T_{baseplate} = 85^\circ\text{C}$ Pulse: 100uS, 50%	2.93	$^\circ\text{C/W}$
Channel Temperature, T_{CH}		202.9	$^\circ\text{C}$
Median Lifetime, T_M		1.20E07	Hrs

Notes:

1. Assumes eutectic attach using 1mil thick 80/20 AuSn mounted to a 10 mil CuMo Carrier Plate.

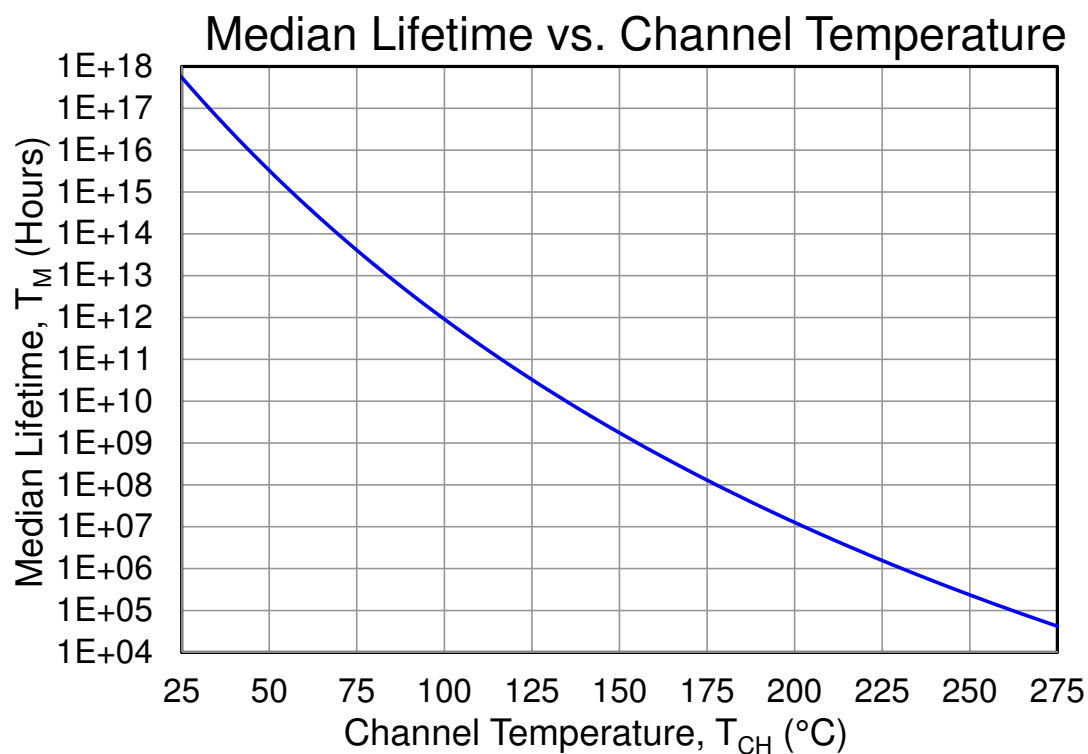
Thermal and Reliability Information - CW⁽¹⁾

Parameter	Test Conditions	Value	Units
Thermal Resistance, θ_{JC}	$P_D = 10.1 \text{ W}$, $T_{baseplate} = 85^\circ\text{C}$ CW	3.47	$^\circ\text{C/W}$
Channel Temperature, T_{CH}		120	$^\circ\text{C}$
Median Lifetime, T_M		9.51E10	Hrs
Thermal Resistance, θ_{JC}	$P_D = 20.2 \text{ W}$, $T_{baseplate} = 85^\circ\text{C}$ CW	3.66	$^\circ\text{C/W}$
Channel Temperature, T_{CH}		159	$^\circ\text{C}$
Median Lifetime, T_M		9.24E08	Hrs
Thermal Resistance, θ_{JC}	$P_D = 30.2 \text{ W}$, $T_{baseplate} = 85^\circ\text{C}$ CW	3.94	$^\circ\text{C/W}$
Channel Temperature, T_{CH}		204	$^\circ\text{C}$
Median Lifetime, T_M		1.09E07	Hrs
Thermal Resistance, θ_{JC}	$P_D = 40.3 \text{ W}$, $T_{baseplate} = 85^\circ\text{C}$ CW	4.29	$^\circ\text{C/W}$
Channel Temperature, T_{CH}		258	$^\circ\text{C}$
Median Lifetime, T_M		1.46E05	Hrs

Notes:

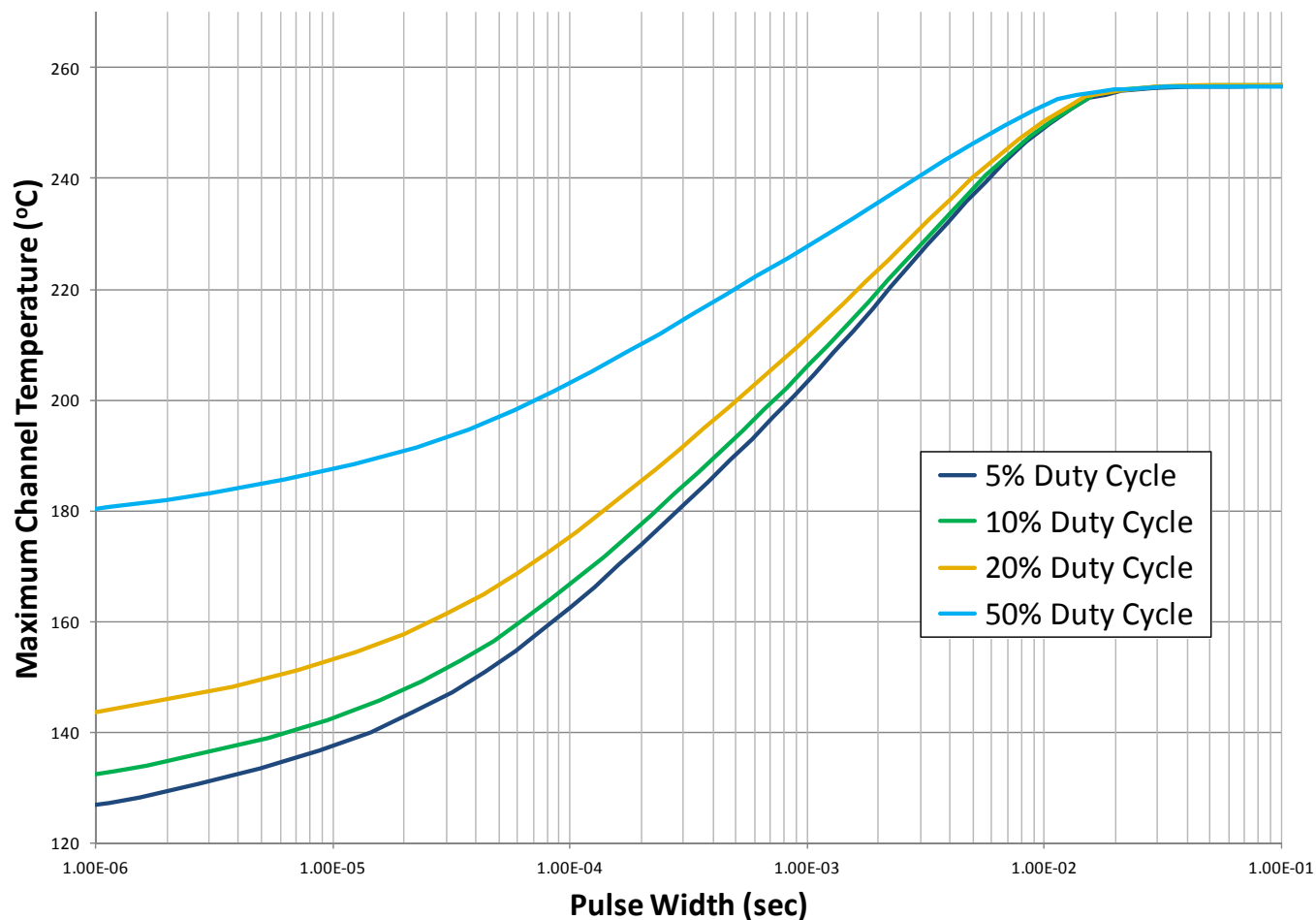
1. Assumes eutectic attach using 1mil thick 80/20 AuSn mounted to a 10 mil CuMo Carrier Plate.

Median LifeTime

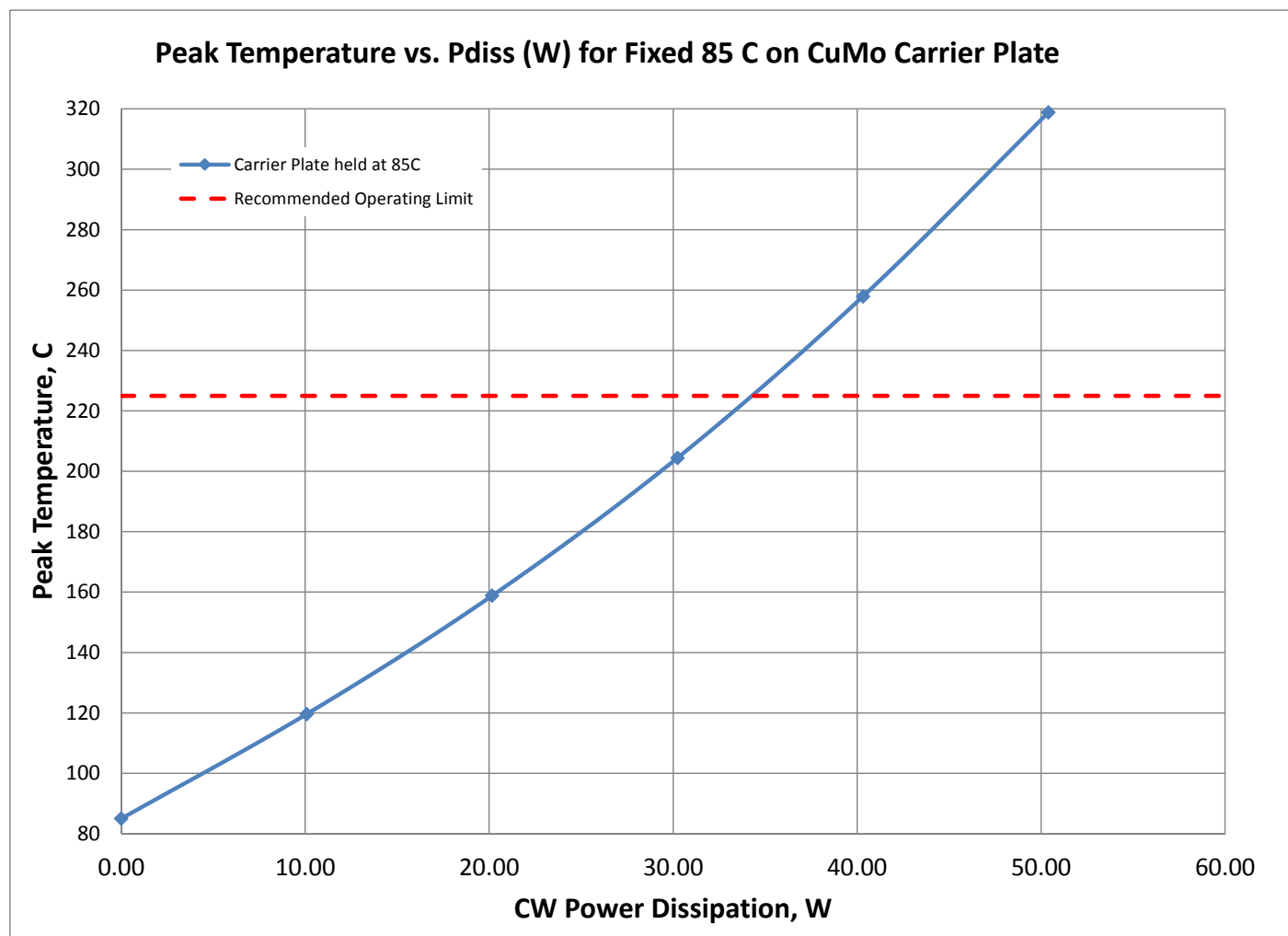


Maximum Channel Temperature – Pulsed

Maximum Channel Temperature
T_{base} = 85°C, P_{diss} = 40.3 W



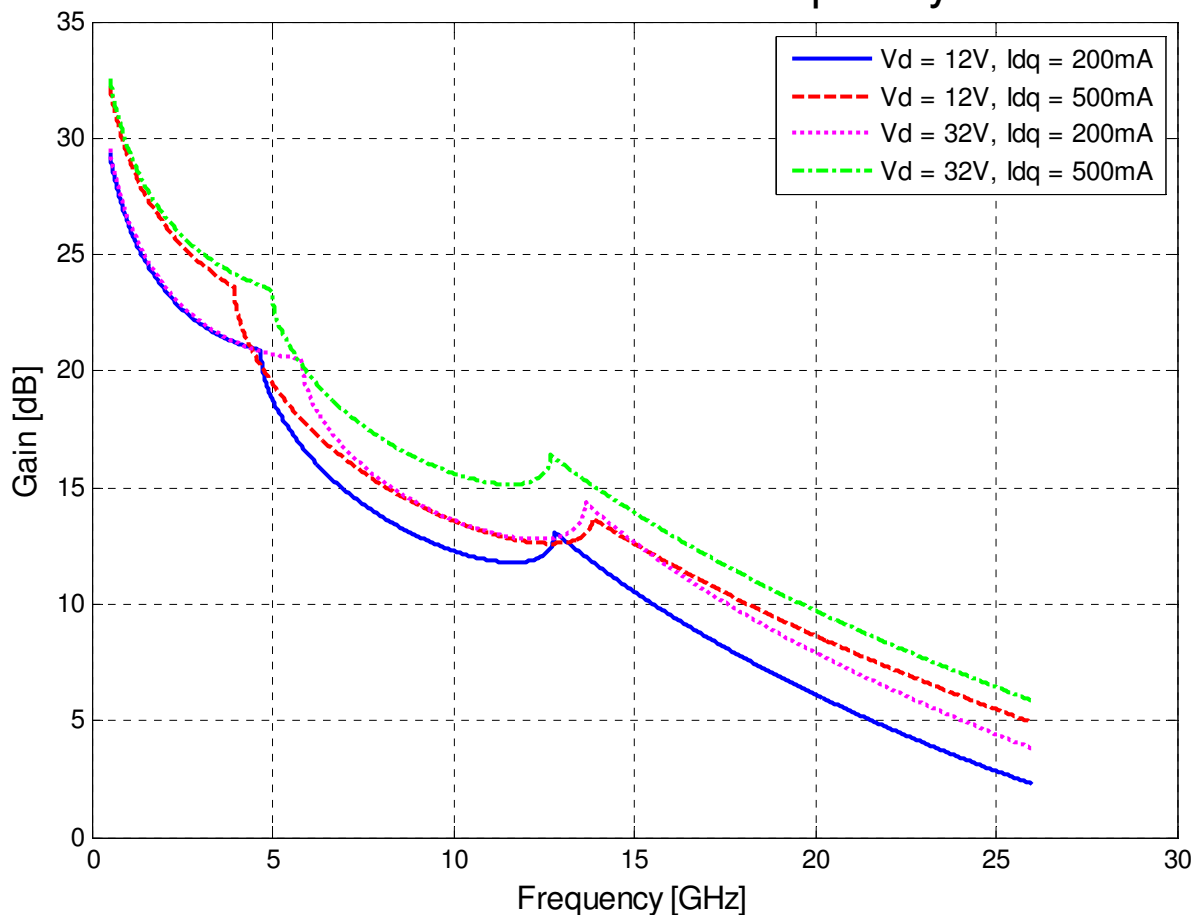
Maximum Channel Temperature – CW



Model Maximum Gain Performance

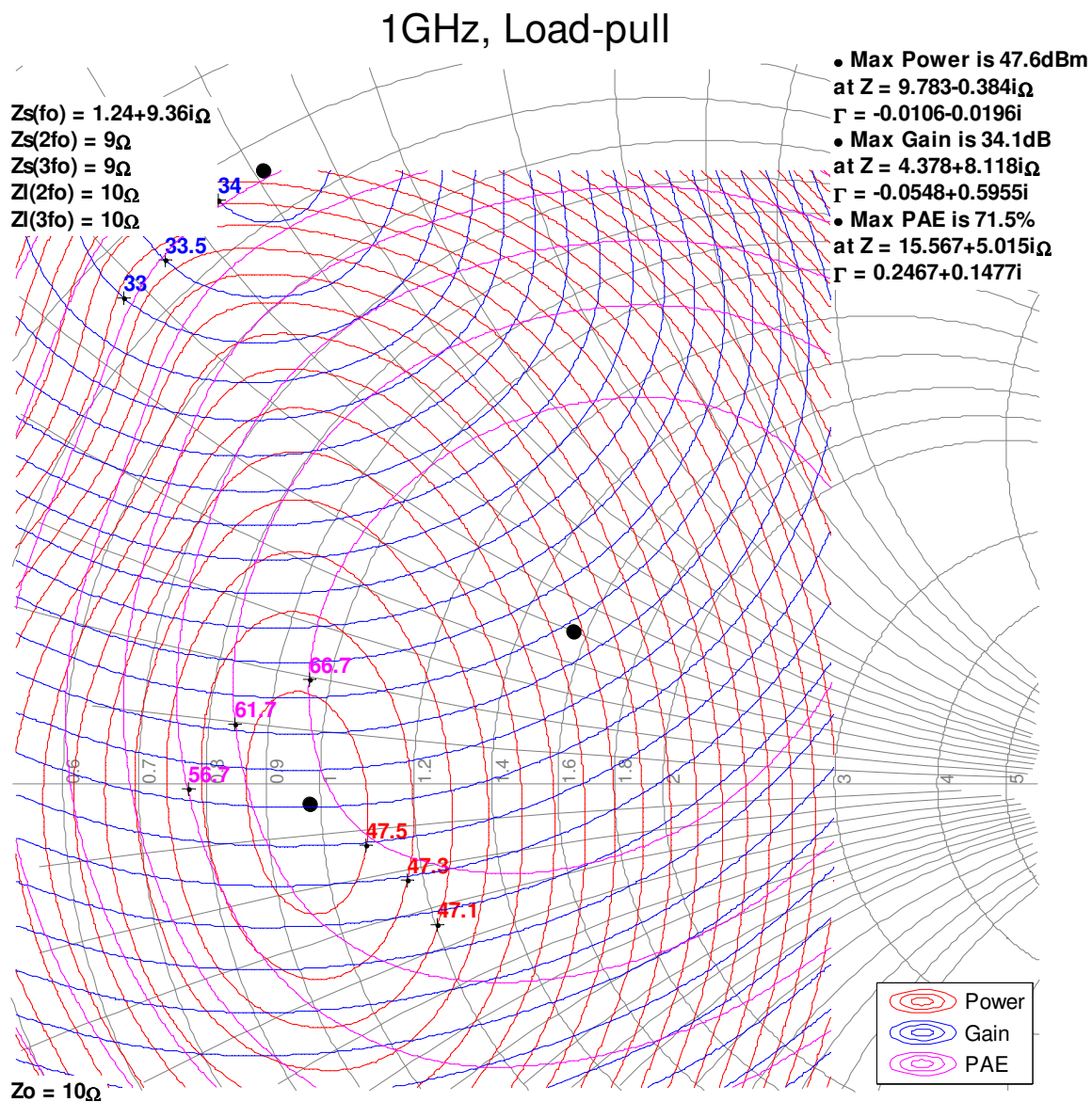
Bondwires not included. See page 17 for reference planes.

Maximum Gain vs. Frequency



Model Load Pull Contours

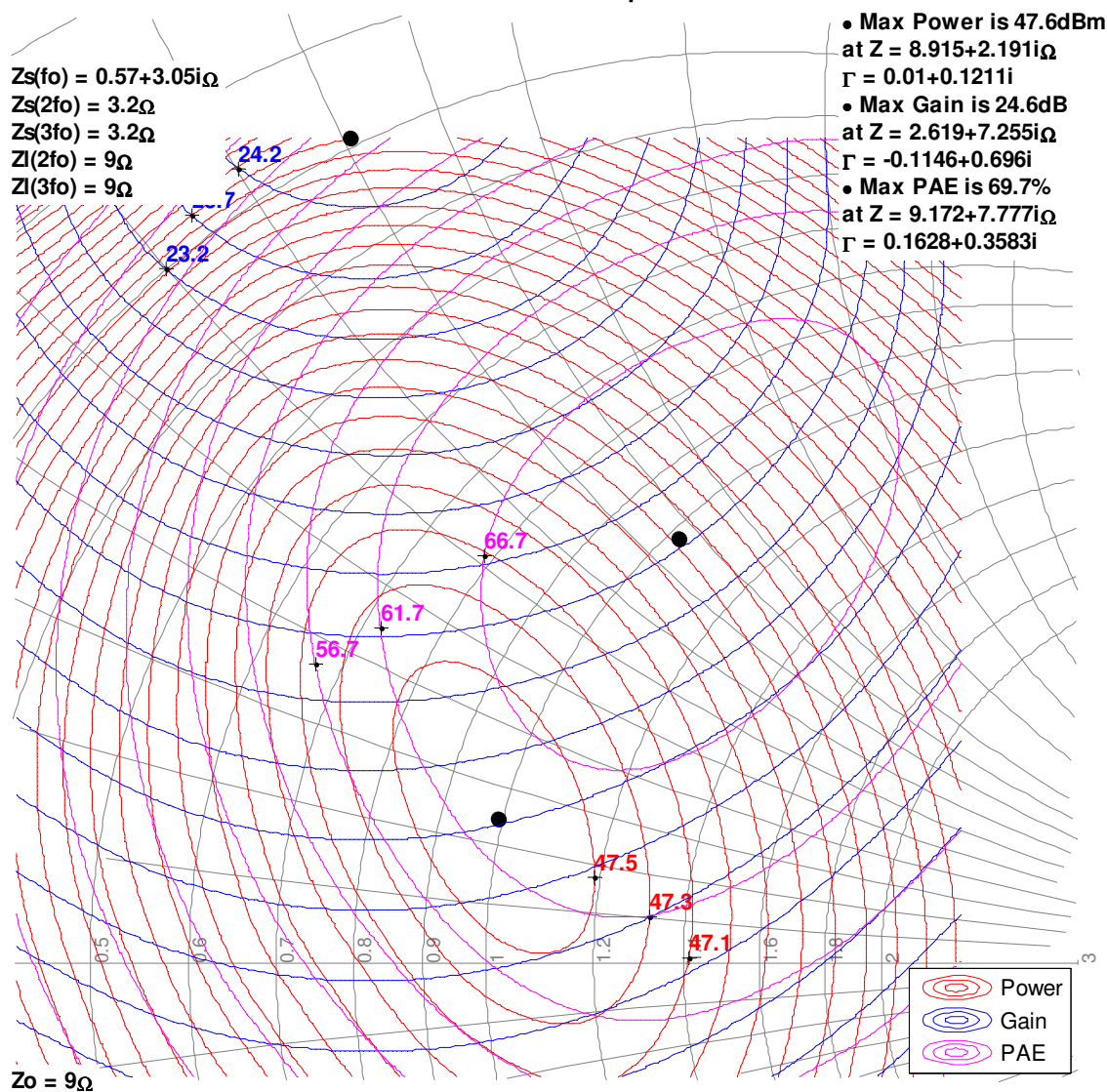
$V_{ds} = 32V$, $I_{dq} = 200mA$. 3dB compression referenced to peak gain.
Simulated signal: 10% pulses. Bond wires not included. See page 17 for reference planes.



Model Load Pull Contours

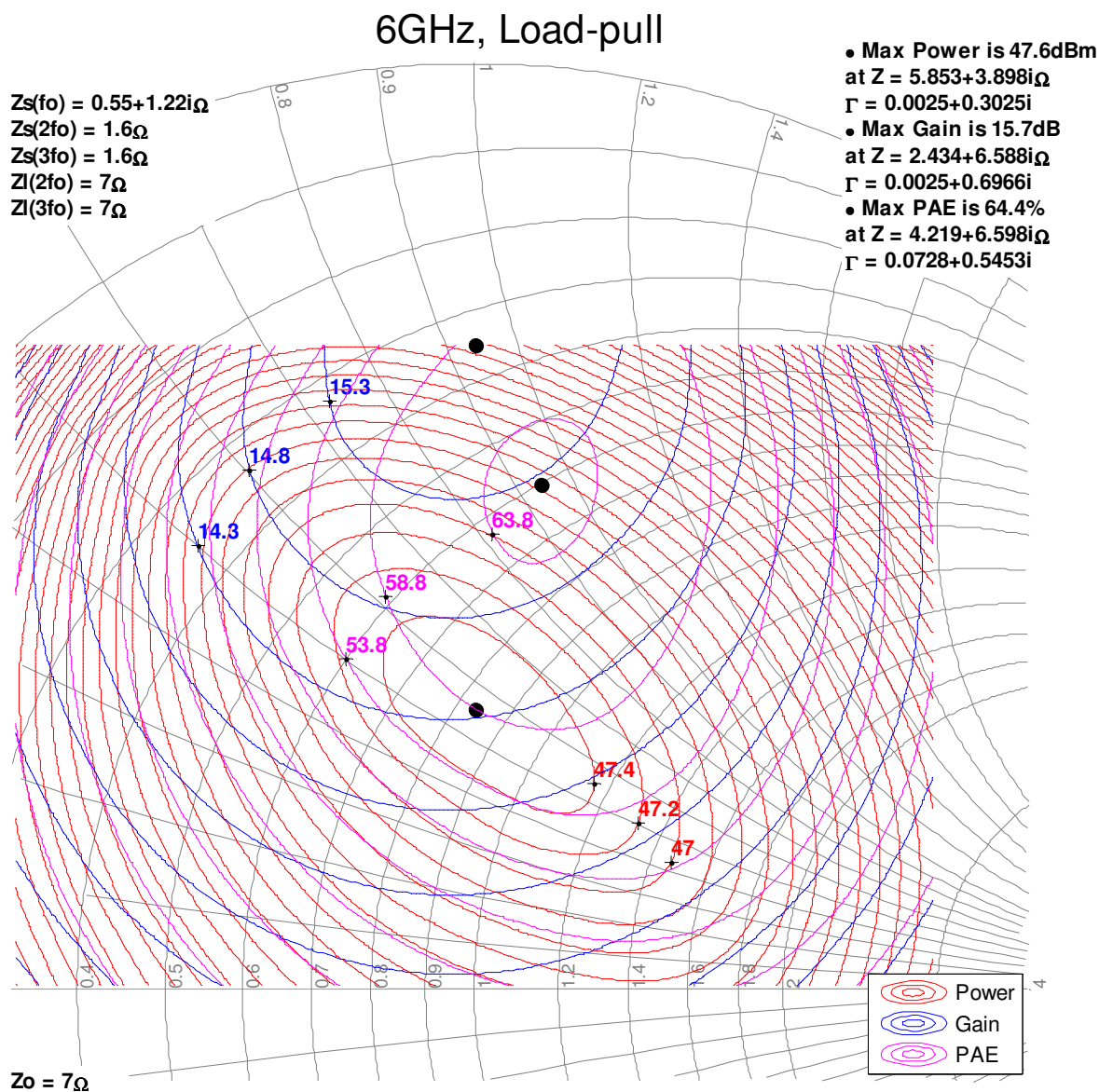
$V_{ds} = 32V$, $I_{dq} = 200mA$. 3dB compression referenced to peak gain.
Simulated signal: 10% pulses. Bond wires not included. See page 17 for reference planes.

3GHz, Load-pull



Model Load Pull Contours

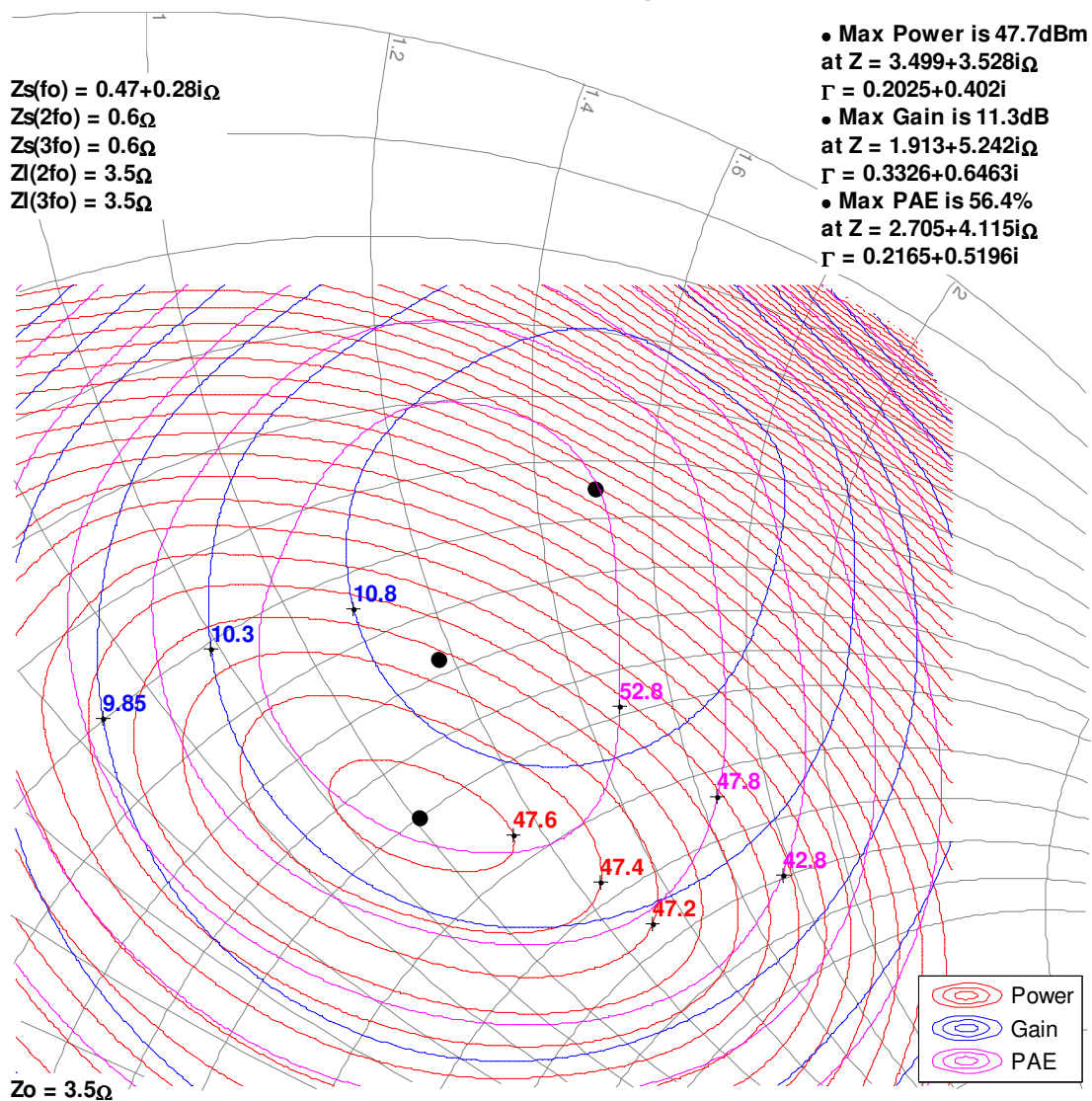
$V_{ds} = 32V$, $I_{dq} = 200mA$. 3dB compression referenced to peak gain.
Simulated signal: 10% pulses. Bond wires not included. See page 17 for reference planes.



Model Load Pull Contours

$V_{ds} = 32V$, $I_{dq} = 200mA$. 3dB compression referenced to peak gain.
Simulated signal: 10% pulses. Bond wires not included. See page 17 for reference planes.

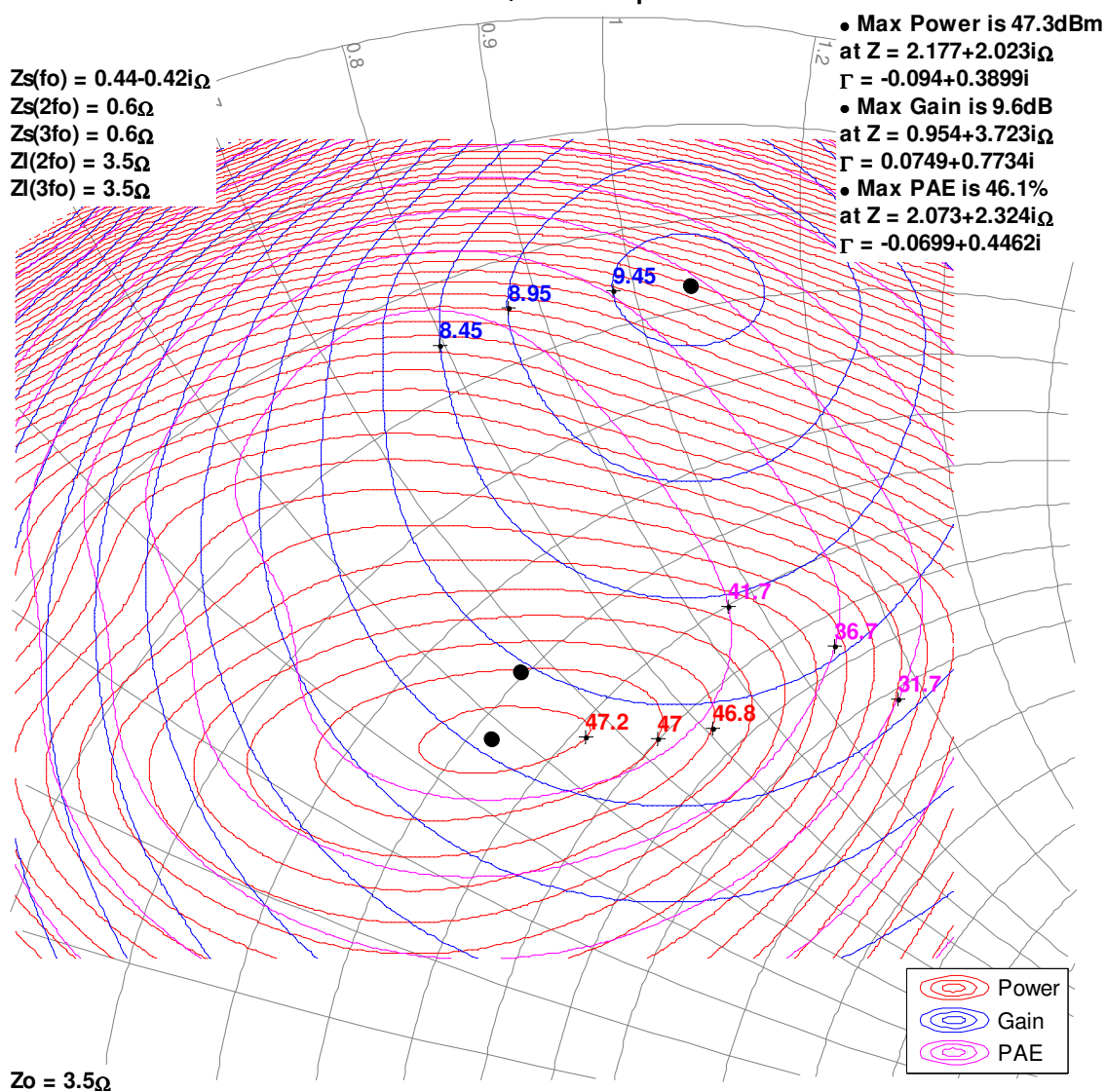
10GHz, Load-pull



Model Load Pull Contours

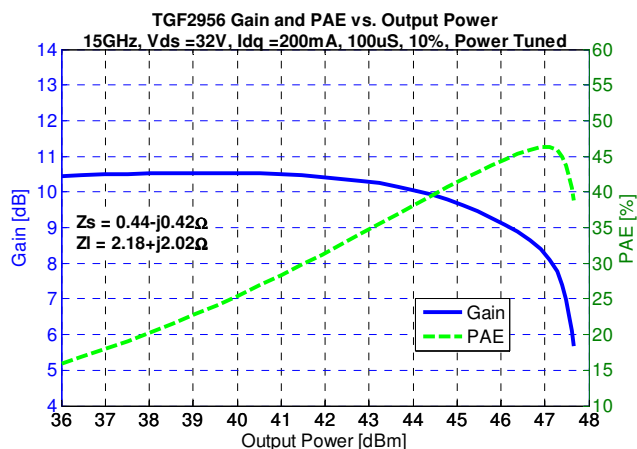
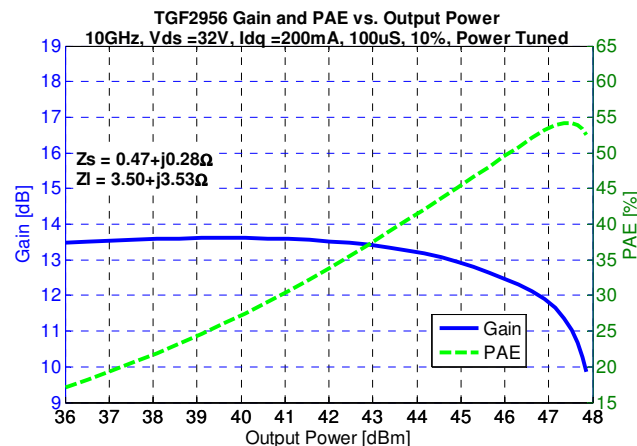
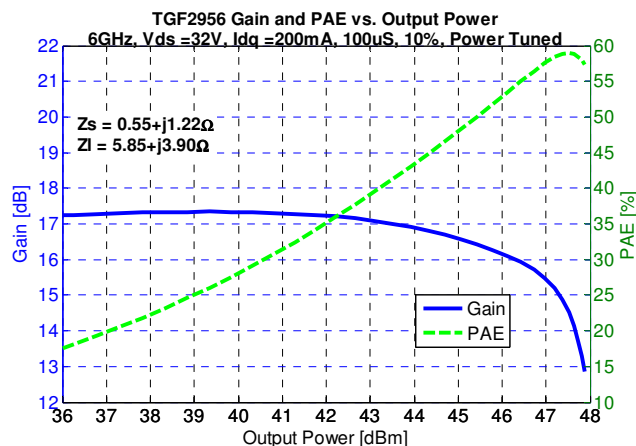
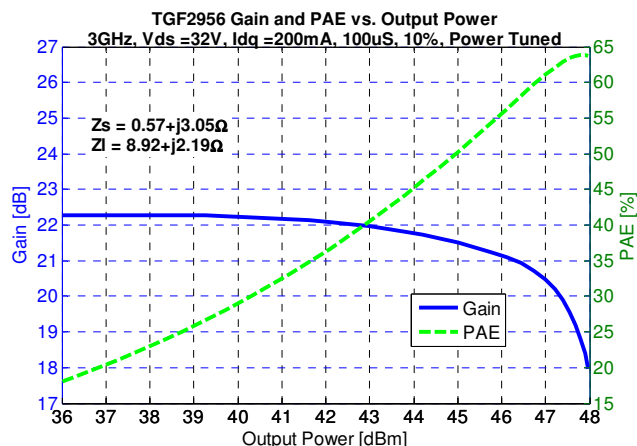
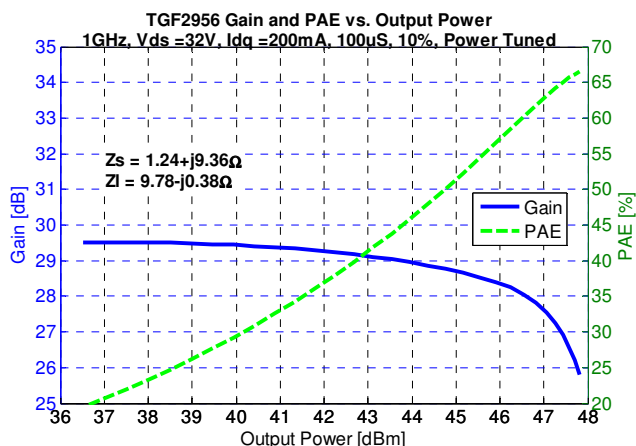
$V_{ds} = 32V$, $I_{dq} = 200mA$. 3dB compression referenced to peak gain.
Simulated signal: 10% pulses. Bond wires not included. See page 17 for reference planes.

15GHz, Load-pull



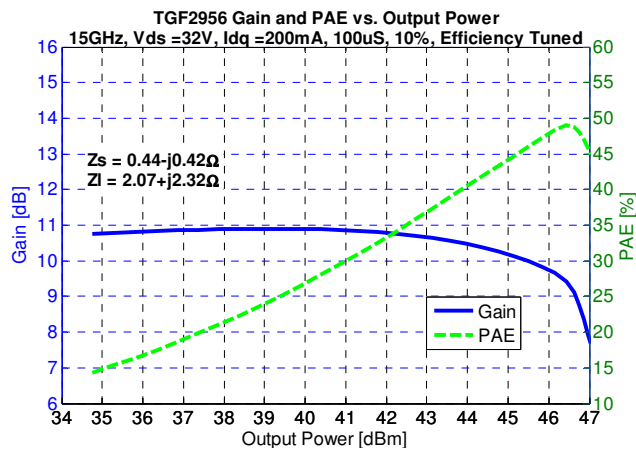
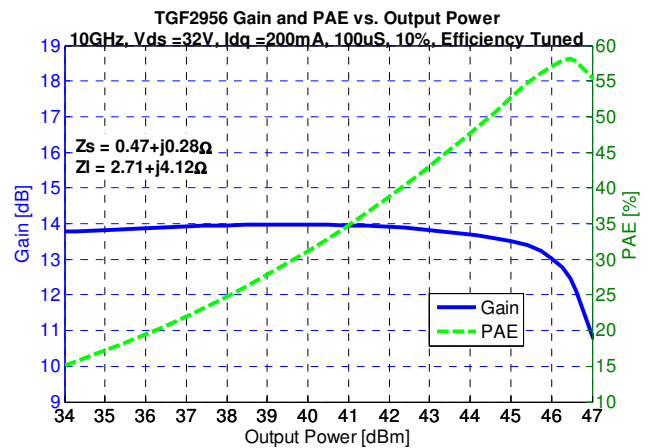
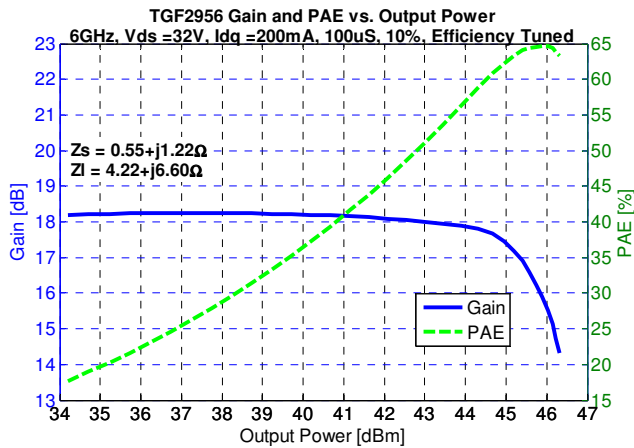
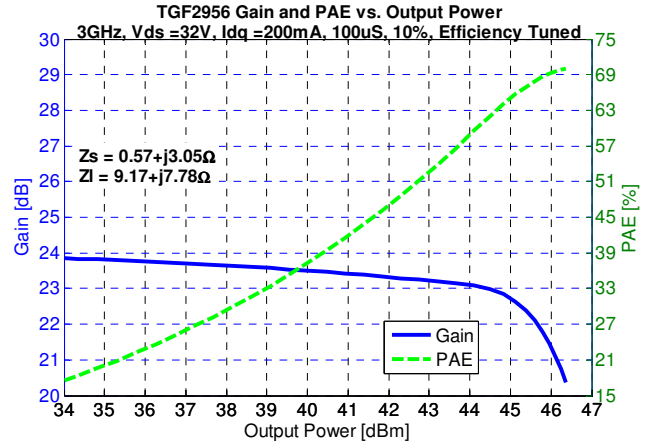
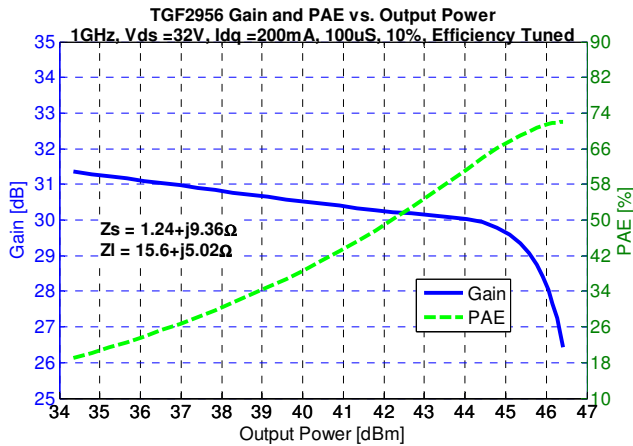
Model Power Tuned Data

Bond wires not included. See page 17 for reference planes.

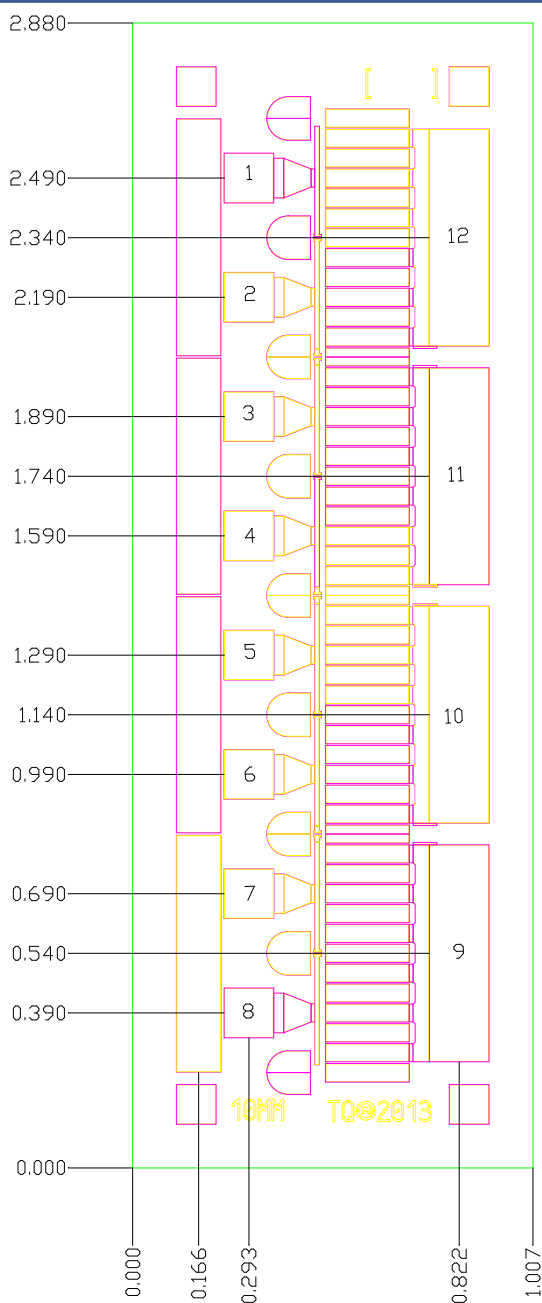


Model Efficiency Tuned Data

Bond wires not included. See page 17 for reference planes.



Mechanical Drawing

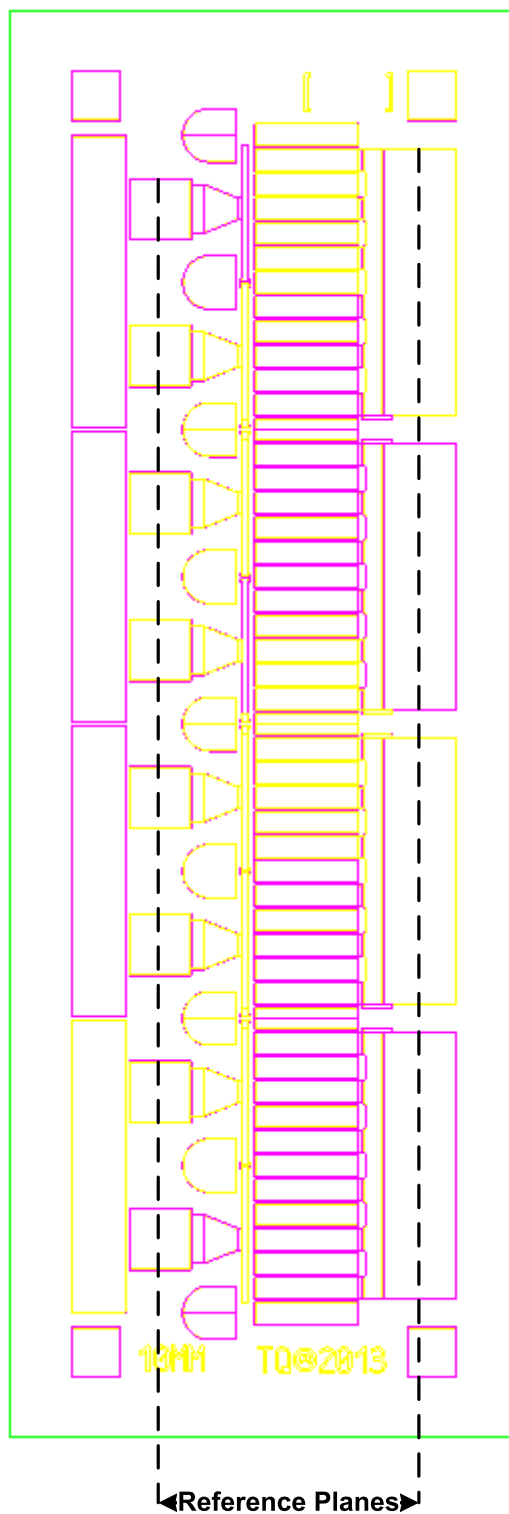


1. Units: millimeters
2. Thickness: 0.100 mm
3. Die xy size tolerance: ± 0.050 mm

Bond Pads

Pad No.	Description	Dimensions
1, 2, 3, 4, 5, 6, 7, 8	Gate	0.125 x 0.125
9, 10, 11, 12	Drain	0.150 x 0.546
Die Backside	Source / Ground	1.007 x 2.880

Reference Planes



Model

A model is available for download from Modelithics (at <http://www.modelithics.com/mvp/Triqunt&tab=3>) by approved TriQuint customers. The model is compatible with the industry's most popular design software including Agilent ADS and National Instruments/AWR applications. Once on the Modelithics web page, the user will need to register for a free license before being granted the download.

Assembly Notes

Component placement and adhesive attachment assembly notes:

- Vacuum pencils and/or vacuum collets are the preferred method of pick up.
- Air bridges must be avoided during placement.
- The force impact is critical during auto placement.
- Organic attachment (i.e. epoxy) not recommended.

Reflow process assembly notes:

- Use AuSn (80/20) solder and limit exposure to temperatures above 300°C to 3-4 minutes, maximum.
- An alloy station or conveyor furnace with reducing atmosphere should be used.
- Do not use any kind of flux.
- Coefficient of thermal expansion matching is critical for long-term reliability.
- Devices must be stored in a dry nitrogen atmosphere.

Interconnect process assembly notes:

- Ball bonding is the preferred interconnect technique, except where noted on the assembly diagram.
- Force, time, and ultrasonics are critical bonding parameters.
- Aluminum wire should not be used.
- Devices with small pad sizes should be bonded with 0.0007-inch wire.

Disclaimer

GaN/SiC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.

Bias-up Procedure

1. V_G set to -5 V.
2. V_D set to 32 V.
3. Adjust V_G more positive until quiescent I_D is 200 mA.
4. Apply RF signal.

Bias-down Procedure

1. Turn off RF signal.
2. Turn off V_D and wait 1 second to allow drain capacitor dissipation.
3. Turn off V_G .

Product Compliance Information

ESD Sensitivity Ratings



Caution! ESD-Sensitive Device

ESD Rating: TBD
Value: TBD
Test: TBD
Standard: TBD

Solderability

Compatible with gold/tin (320°C maximum reflow temperature) soldering processes.

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 (C₁₅H₁₂Br₄O₂) Free
- PFOS Free
- SVHC Free

Contact Information

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

Web: www.triquint.com
Email: 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

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.