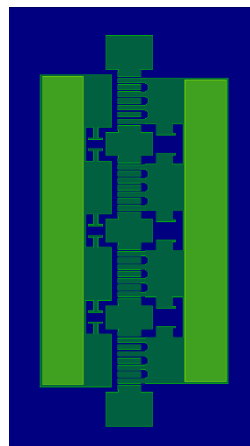


Product Overview

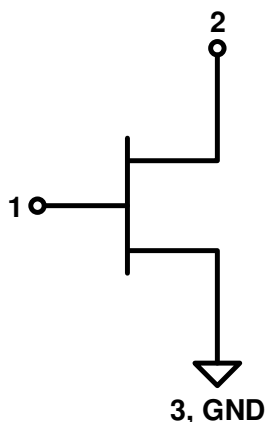
The Qorvo TGF2936 is a 10 W (P_{3dB}) discrete GaN on SiC HEMT which operates from DC to 25 GHz and 28 V supply. The device is constructed with Qorvo's proven QGaN15 process. The device can support pulsed, CW, and linear operations.

Lead-free and ROHS compliant



0.983 x 0.551 x 0.100 mm

Functional Block Diagram



Key Features

- Frequency: DC to 25 GHz
 - Output Power (P_{3dB})¹: 10 W
 - Linear Gain¹: 16 dB
 - Typical PAE_{3dB}¹: 58%
 - Typical Noise Figure¹: 1.3dB
 - Operating Voltage: 28 V
 - CW and Pulse capable
 - Non-linear & Noise Models available
- Note 1: @ 10 GHz

Applications

- Defense and Aerospace
- Broadband wireless
- Low noise amplifier

Ordering info

Part No.	ECCN	Description
TGF2936	3A001b.3.b	DC–25 GHz, 28 V, 10 W GaN RF Transistor

Absolute Maximum Ratings¹

Parameter	Rating	Units
Breakdown Voltage, BV_{DG}	+60	V
Gate Voltage Range, V_G	-7 to +1.5	V
Drain Current, $I_{D_{MAX}}$	2	A
Gate Current Range, I_G	See page 20.	mA
Power Dissipation, CW, P_{DISS}	9.9	W
RF Input Power, CW, 10 GHz, $T = 25\text{ }^{\circ}\text{C}$	+30	dBm
Channel Temperature, T_{CH}	275	$^{\circ}\text{C}$
Mounting Temperature (30 Seconds)	320	$^{\circ}\text{C}$
Storage Temperature	-65 to +150	$^{\circ}\text{C}$

Notes:

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

Recommended Operating Conditions¹

Parameter	Min	Typ	Max	Units
Operating Temp. Range	-40	+25	+85	$^{\circ}\text{C}$
Drain Voltage Range, V_D	+12	+20	+29.5	V
Drain Bias Current, I_{DQ}	40	80	160	mA
Drain Current, I_D	–	700	–	mA
Gate Voltage, V_G ³	–	-2.8	–	V
Channel Temperature (T_{CH})	–	–	250	$^{\circ}\text{C}$
Power Dissipation, CW (P_D) ²	–	–	8.9	W

Notes:

1. Electrical performance is measured under conditions noted in the electrical specifications table. Specifications are not guaranteed over all recommended operating conditions.
2. Package base at 85 $^{\circ}\text{C}$
3. To be adjusted to desired I_{DQ}

Model Load Pull Performance – Power Tuned¹

Parameter	Typical Values								Units
Frequency, F	3		6		10		18		GHz
Drain Voltage, V_D	20	28	20	28	20	28	20	28	V
Drain Bias Current, I_{DQ}	80	80	80	80	80	80	80	80	mA
Output Power at 3dB compression, P_{3dB}	38.7	40.2	38.7	40.1	38.7	40.1	38.2	39.9	dBm
Power Added Efficiency at 3dB compression, PAE_{3dB}	61.2	61	61.8	61.9	56.1	57.8	51.8	49.8	%
Gain at 3dB compression, G_{3dB}	19.2	21.2	15.9	16.7	11.3	12.7	7.3	8.2	dB
Load Reflection Coefficient ⁽²⁾ , Γ_L	0.45 $\angle$ 153°	0.22 $\angle$ 117°	0.58 $\angle$ 149°	0.57 $\angle$ 135°	0.67 $\angle$ 153°	0.72 $\angle$ 146°	0.85 $\angle$ 159°	0.85 $\angle$ 159°	--

Notes:

1. CW, bondwires not included
2. Characteristic Impedance, $Z_0 = 50 \Omega$.

Model Load Pull Performance – Efficiency Tuned¹

Parameter	Typical Values								Units
Frequency, F	3		6		10		18		GHz
Drain Voltage, V_D	20	28	20	28	20	28	20	28	V
Drain Bias Current, I_{DQ}	80	80	80	80	80	80	80	80	mA
Output Power at 3dB compression, P_{3dB}	37.3	39.8	38.2	39.5	37.8	39.9	38.2	39.9	dBm
Power Added Efficiency at 3dB compression, PAE_{3dB}	67.4	66.3	65.3	63.7	60.2	57.9	51.8	49.8	%
Gain at 3dB compression, G_{3dB}	19.0	21.4	17.0	19.3	12.0	13.2	7.3	8.2	dB
Load Reflection Coefficient ⁽²⁾ , Γ_L	0.45 $\angle$ 117°	0.45 $\angle$ 117°	0.64 $\angle$ 141°	0.71 $\angle$ 135°	0.81 $\angle$ 150°	0.81 $\angle$ 150°	0.85 $\angle$ 159°	0.85 $\angle$ 159°	--

Notes:

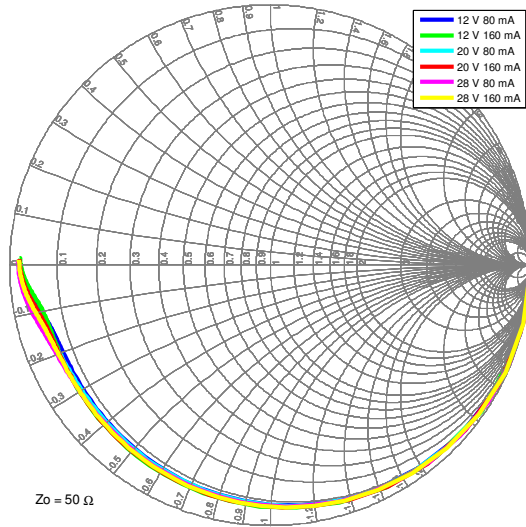
1. CW, bondwires not included
2. Characteristic Impedance, $Z_0 = 50 \Omega$.

Model S-parameters¹

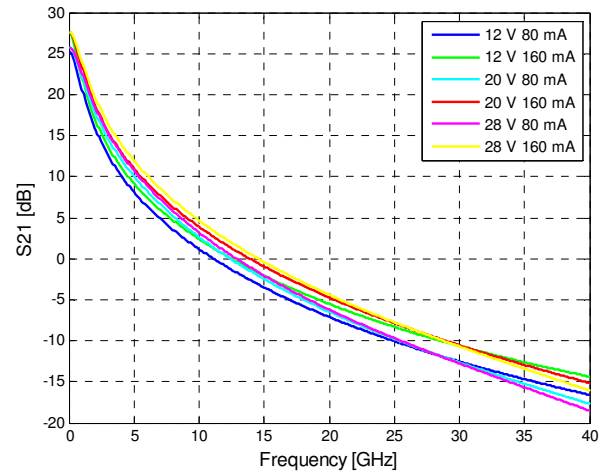
Notes:

1. Bondwires are not included. T = 25 °C.

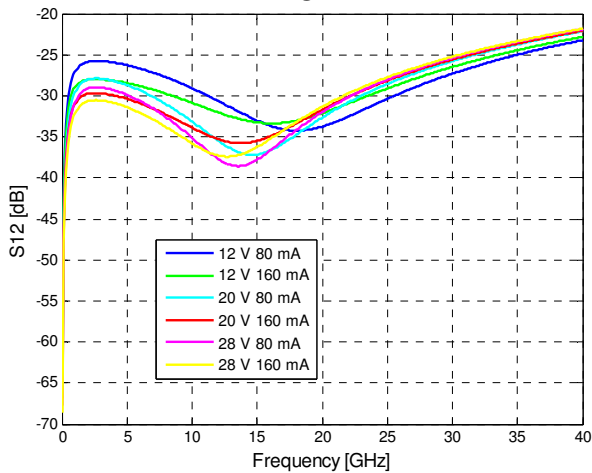
S11 from 0.01 GHz to 40 GHz



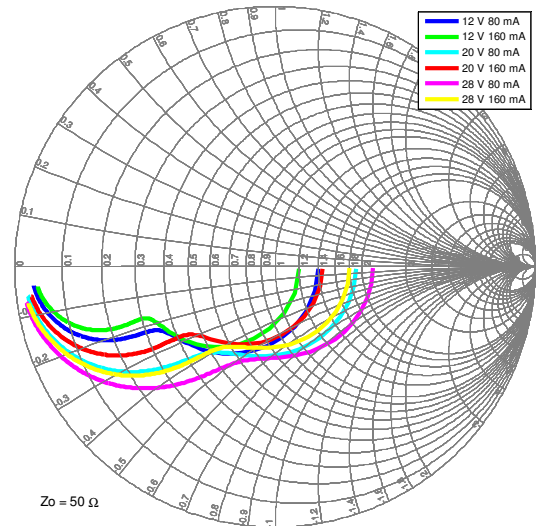
S21



S12



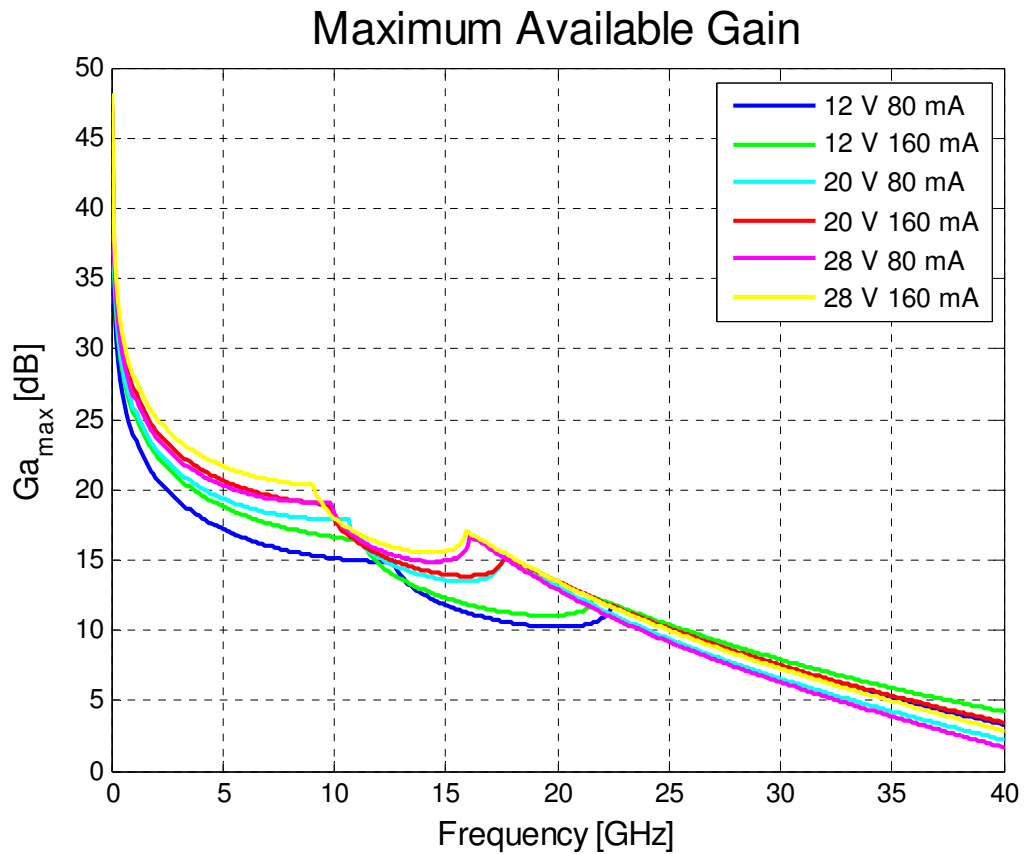
S22 from 0.01 GHz to 40 GHz



Model Maximum Available Gain¹

Notes:

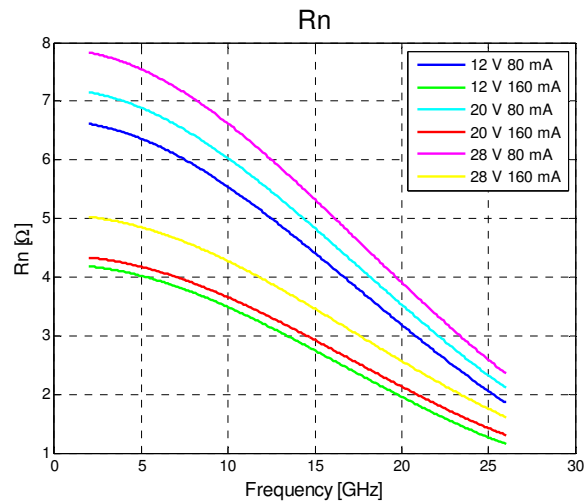
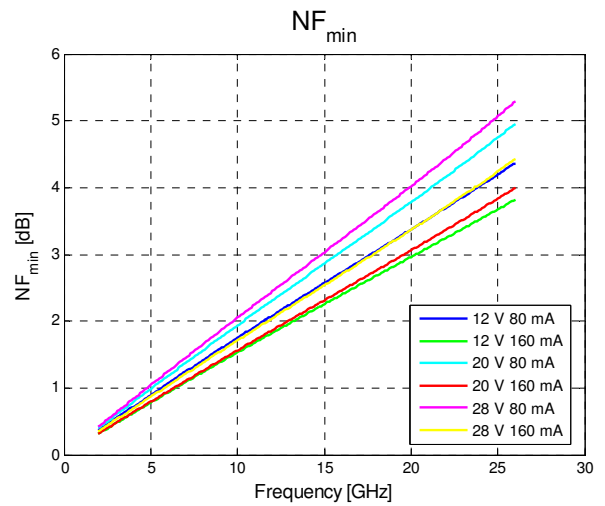
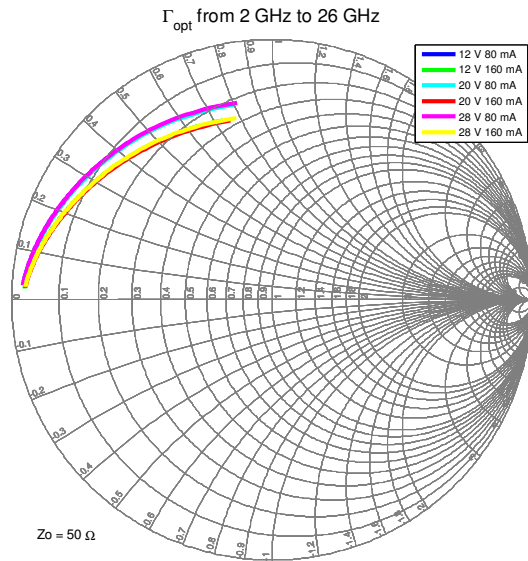
1. Bondwires are not included. T = 25 °C.



Model Noise¹

Notes:

- Bondwires are not included. T = 25 °C.

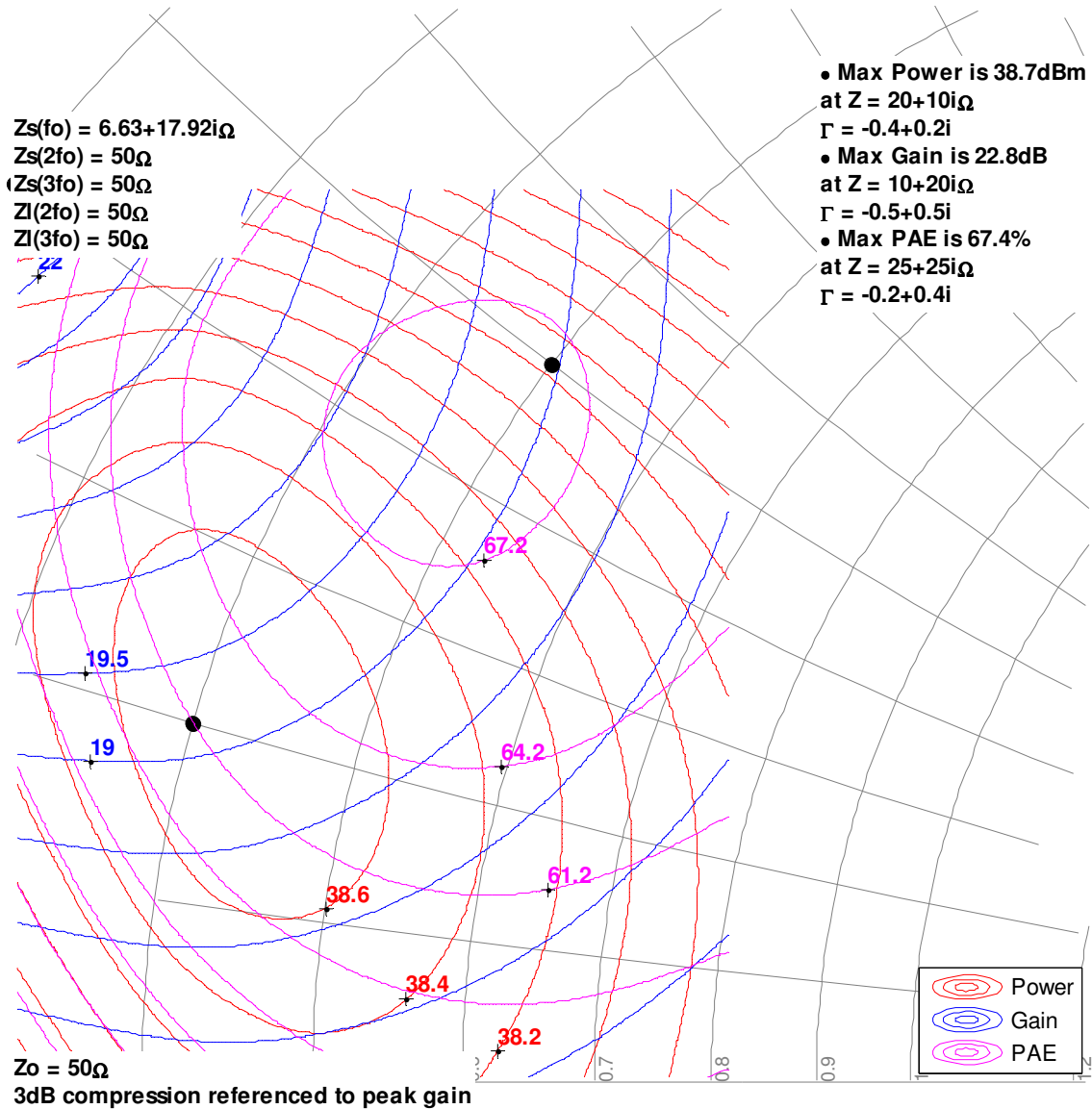


Model Load-Pull Smith Charts^{1, 2}

Notes:

1. Test Conditions: $V_D = 20$ V, $I_{DQ} = 80$ mA, CW, Bondwires not included
2. See page 22 for load pull reference planes where the performance was simulated.

3GHz, Load-pull



Model Load-Pull Smith Charts^{1, 2}

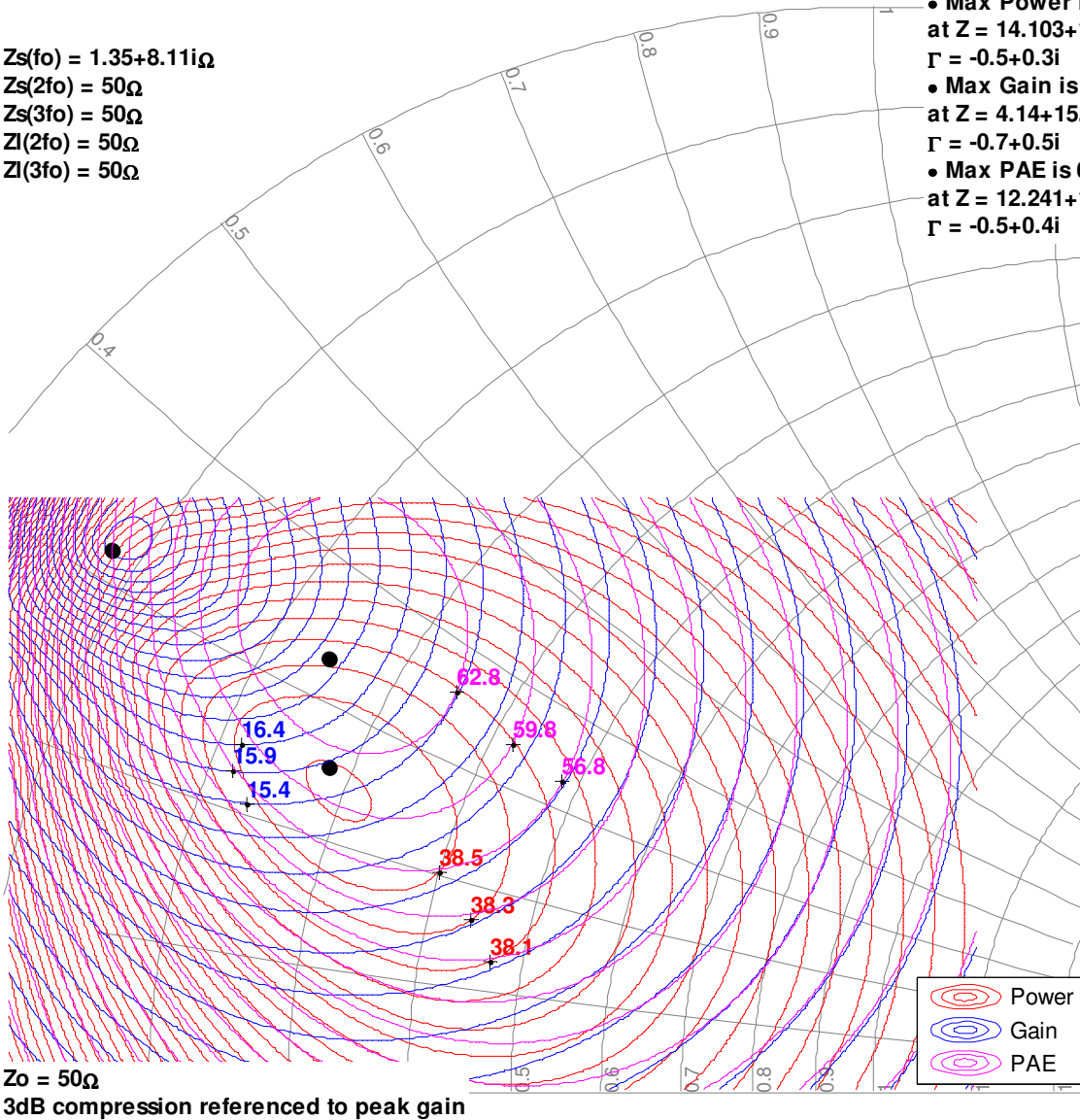
Notes:

1. Test Conditions: $V_D = 20$ V, $I_{DQ} = 80$ mA, CW, Bondwires not included
2. See page 22 for load pull reference planes where the performance was simulated.

6GHz, Load-pull

$Z_s(f_0) = 1.35 + 8.11i\Omega$
 $Z_s(2f_0) = 50\Omega$
 $Z_s(3f_0) = 50\Omega$
 $Z_l(2f_0) = 50\Omega$
 $Z_l(3f_0) = 50\Omega$

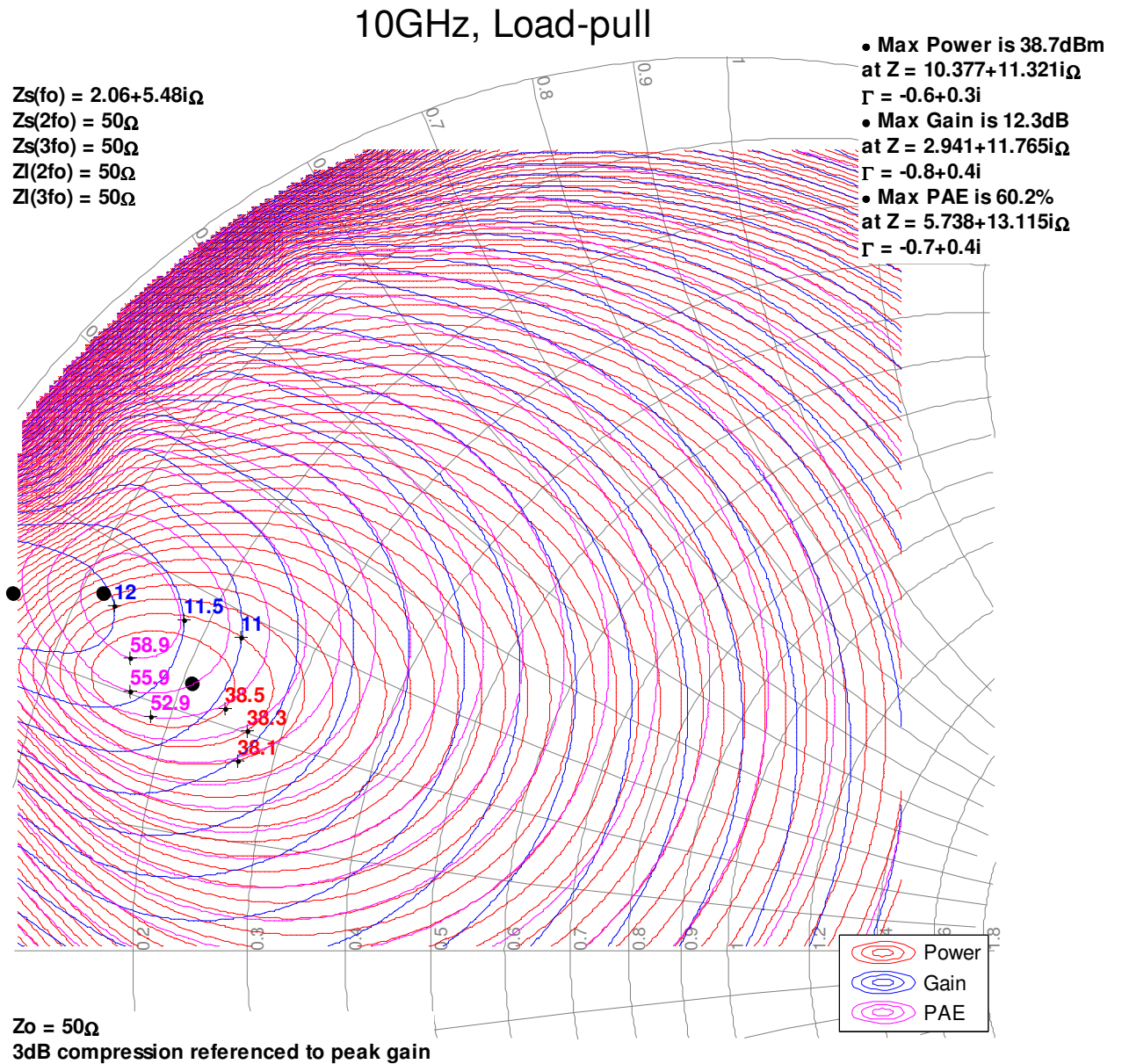
- Max Power is 38.7dBm at $Z = 14.103 + 12.82i\Omega$
 $\Gamma = -0.5 + 0.3i$
- Max Gain is 22.6dB at $Z = 4.14 + 15.923i\Omega$
 $\Gamma = -0.7 + 0.5i$
- Max PAE is 65.3% at $Z = 12.241 + 16.597i\Omega$
 $\Gamma = -0.5 + 0.4i$



Model Load-Pull Smith Charts^{1, 2}

Notes:

1. Test Conditions: $V_D = 20$ V, $I_{DQ} = 80$ mA, CW, Bondwires not included
2. See page 22 for load pull reference planes where the performance was simulated.

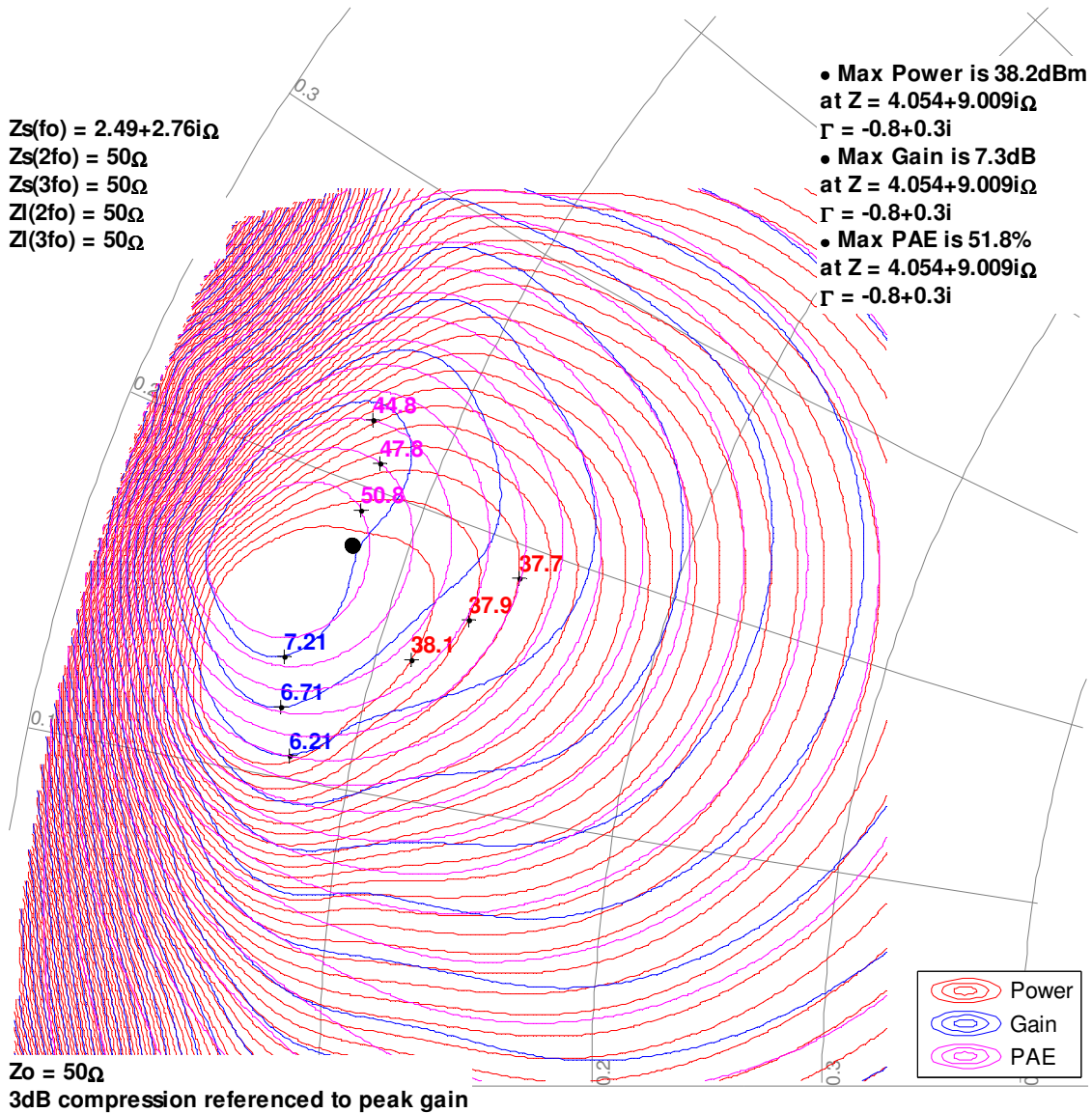


Model Load-Pull Smith Charts^{1,2}

Notes:

1. Test Conditions: $V_D = 20$ V, $I_{DQ} = 80$ mA, CW, Bondwires not included
2. See page 22 for load pull reference planes where the performance was simulated.

18GHz, Load-pull

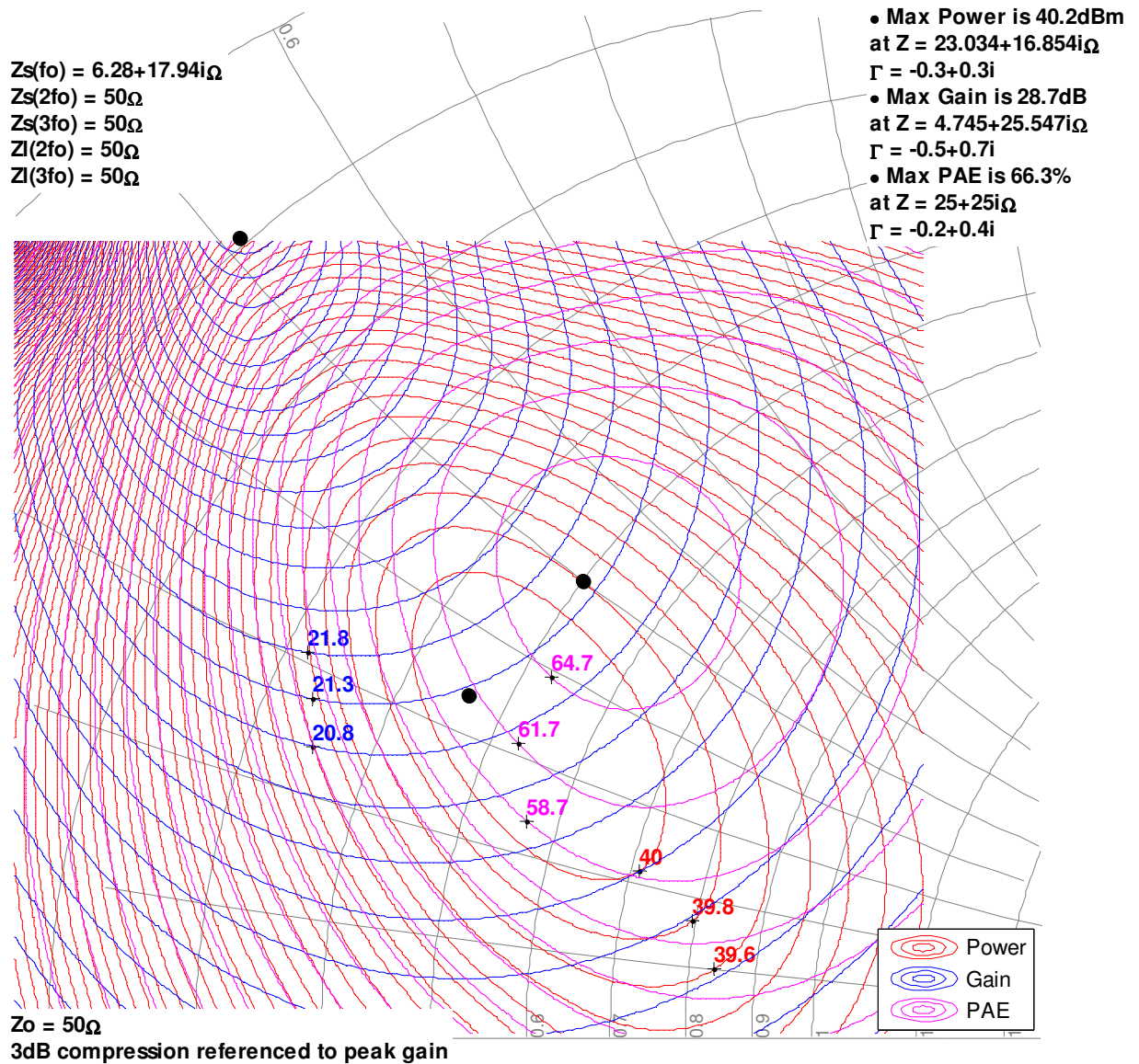


Model Load-Pull Smith Charts^{1, 2}

Notes:

1. Test Conditions: $V_D = 28$ V, $I_{DQ} = 80$ mA, CW, Bondwires not included
2. See page 22 for load pull reference planes where the performance was simulated.

3GHz, Load-pull



Model Load-Pull Smith Charts^{1, 2}

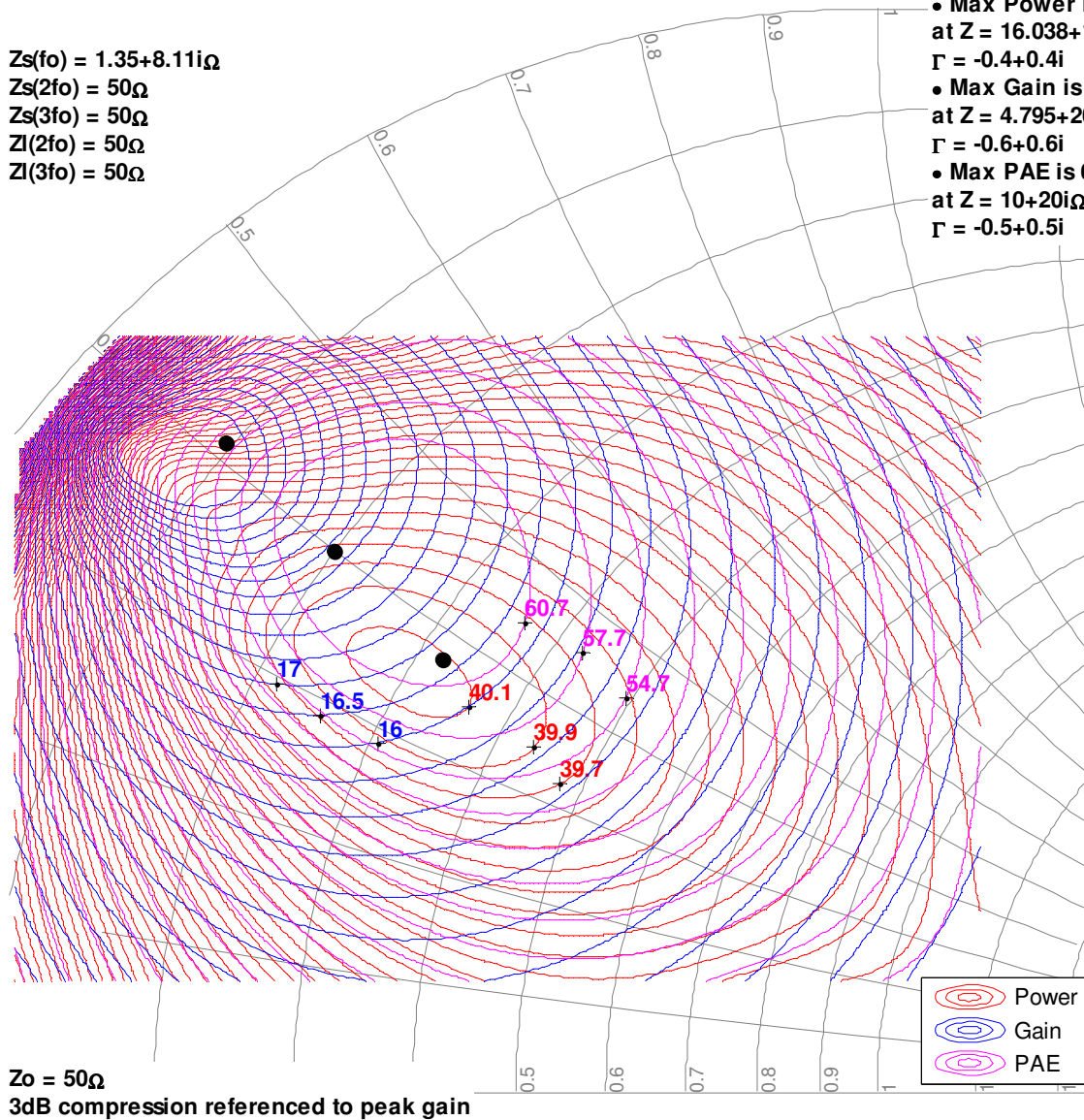
Notes:

1. Test Conditions: $V_D = 28$ V, $I_{DQ} = 80$ mA, CW, Bondwires not included
2. See page 22 for load pull reference planes where the performance was simulated.

6GHz, Load-pull

$Z_s(f_0) = 1.35 + 8.11i\Omega$
 $Z_s(2f_0) = 50\Omega$
 $Z_s(3f_0) = 50\Omega$
 $Z_l(2f_0) = 50\Omega$
 $Z_l(3f_0) = 50\Omega$

- Max Power is 40.1dBm at $Z = 16.038 + 18.868i\Omega$
 $\Gamma = -0.4 + 0.4i$
- Max Gain is 23dB at $Z = 4.795 + 20.548i\Omega$
 $\Gamma = -0.6 + 0.6i$
- Max PAE is 63.7% at $Z = 10 + 20i\Omega$
 $\Gamma = -0.5 + 0.5i$



Model Load-Pull Smith Charts^{1,2}

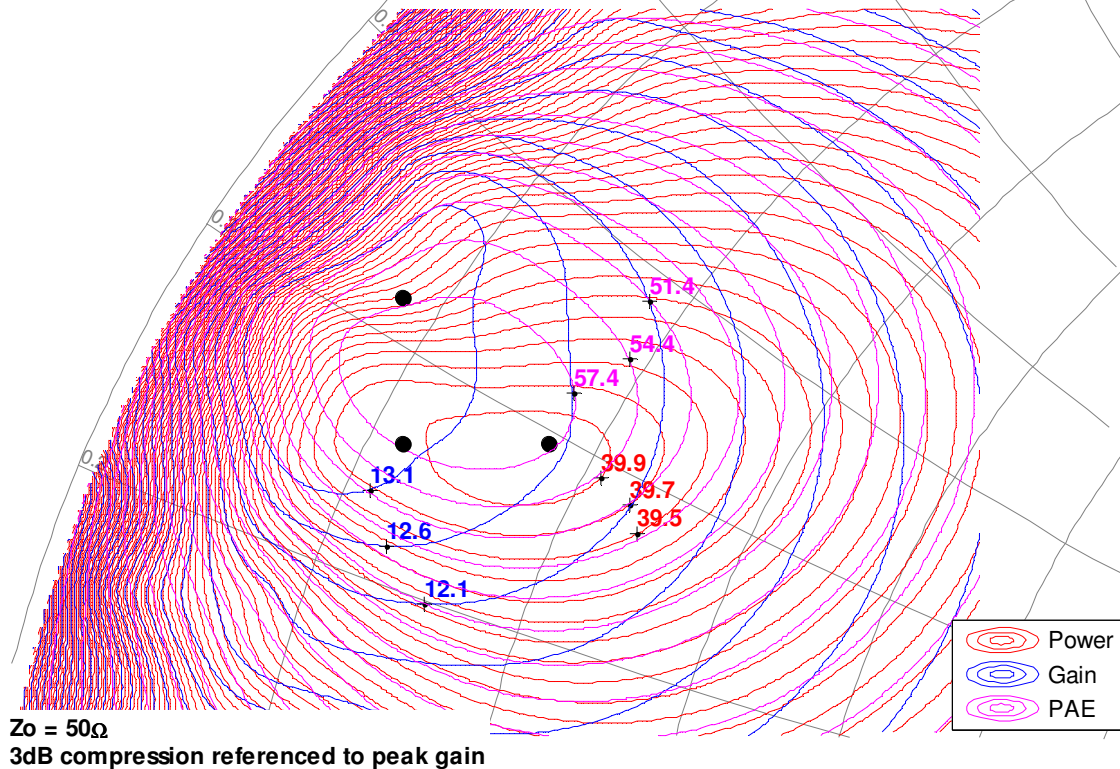
Notes:

1. Test Conditions: $V_D = 28$ V, $I_{DQ} = 80$ mA, CW, Bondwires not included
2. See page 22 for load pull reference planes where the performance was simulated.

10GHz, Load-pull

$Z_s(f_0) = 2.06 + 5.48i\Omega$
 $Z_s(2f_0) = 50\Omega$
 $Z_s(3f_0) = 50\Omega$
 $Z_l(2f_0) = 50\Omega$
 $Z_l(3f_0) = 50\Omega$

- Max Power is 40.1dBm at $Z = 8.824 + 14.706i\Omega$
 $\Gamma = -0.6 + 0.4i$
- Max Gain is 13.3dB at $Z = 4.14 + 15.923i\Omega$
 $\Gamma = -0.7 + 0.5i$
- Max PAE is 57.9% at $Z = 5.738 + 13.115i\Omega$
 $\Gamma = -0.7 + 0.4i$

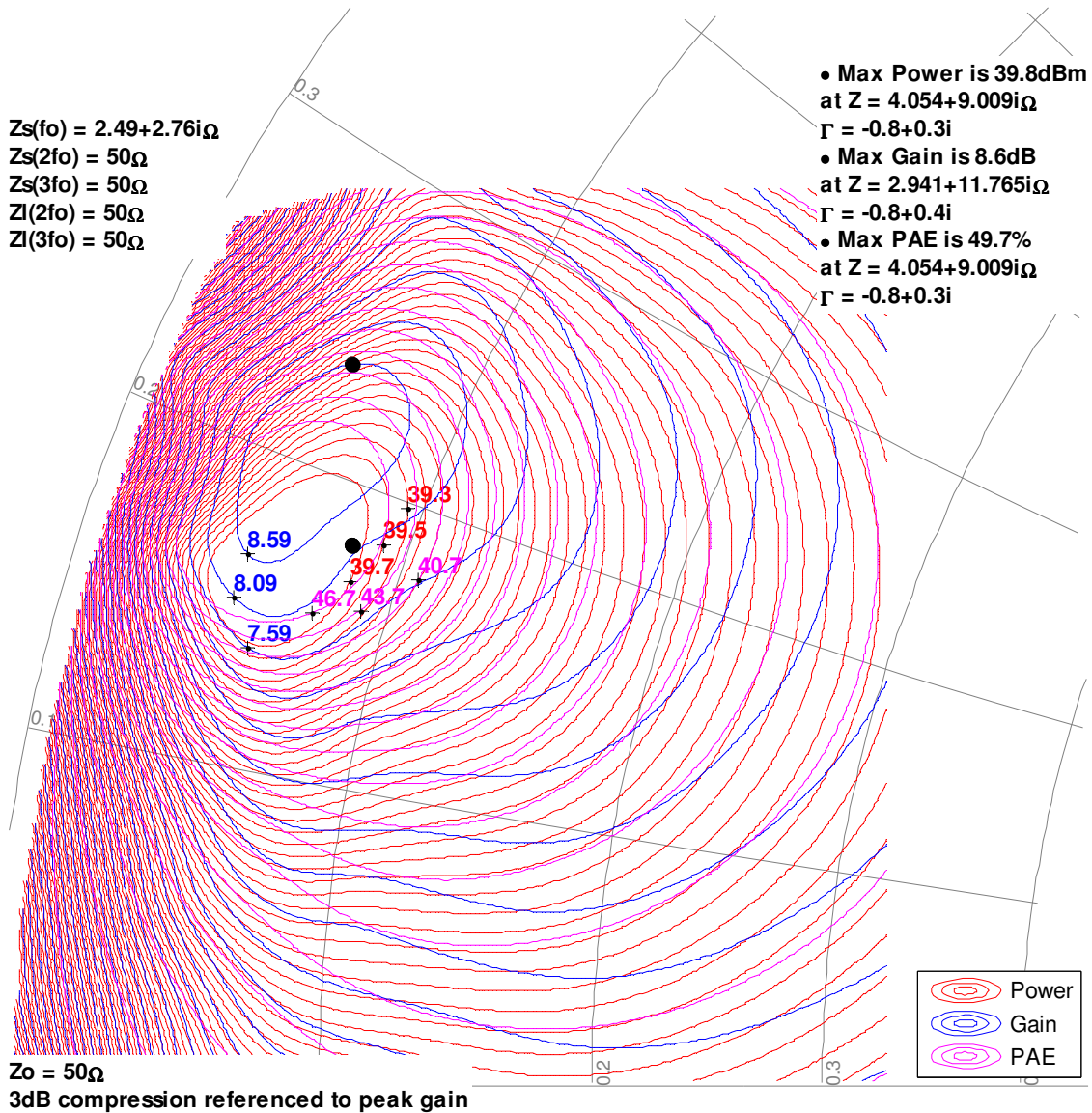


Model Load-Pull Smith Charts^{1,2}

Notes:

1. Test Conditions: $V_D = 28$ V, $I_{DQ} = 80$ mA, CW, Bondwires not included
2. See page 22 for load pull reference planes where the performance was simulated.

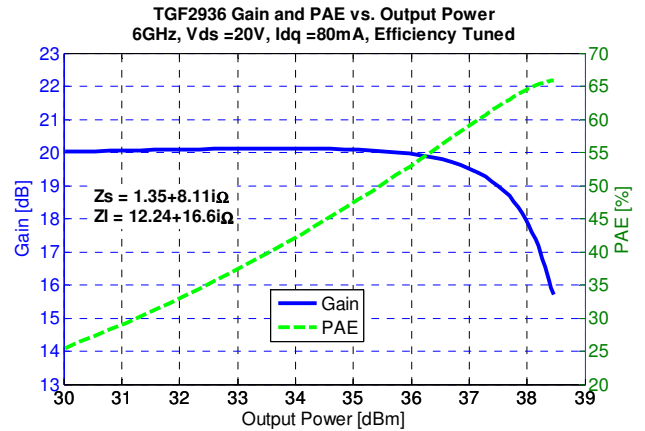
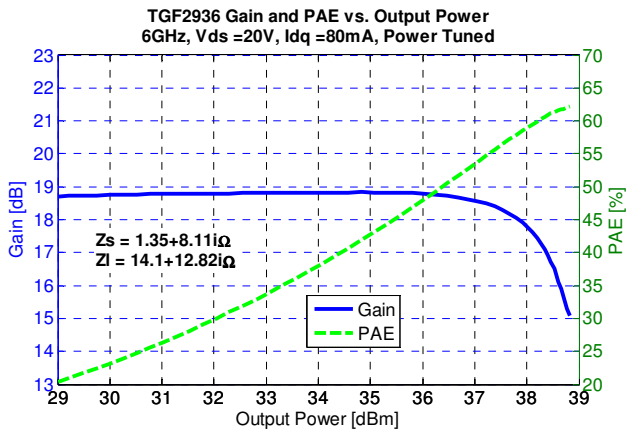
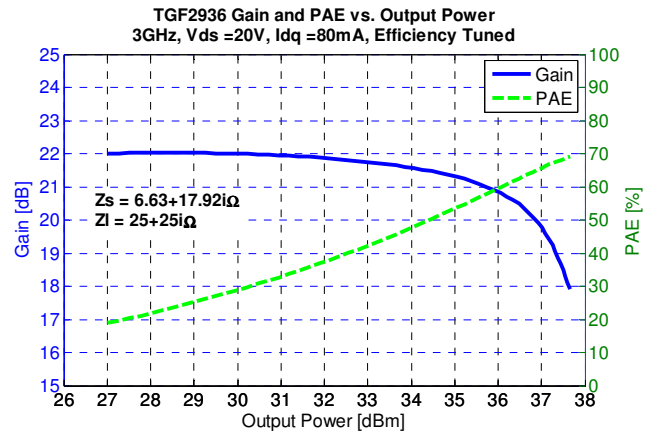
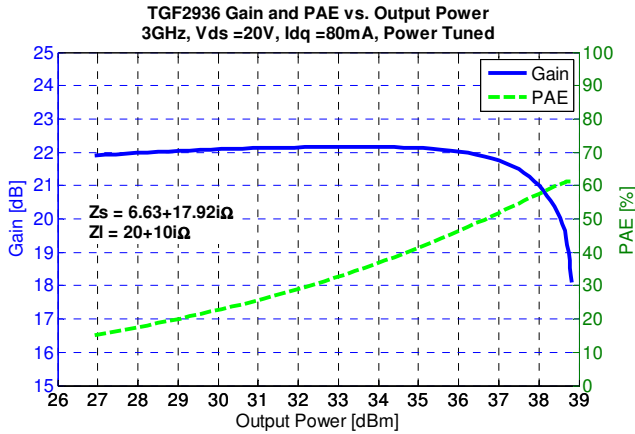
18GHz, Load-pull



Typical Model Performance – Load-Pull Drive-up^{1,2}

Notes:

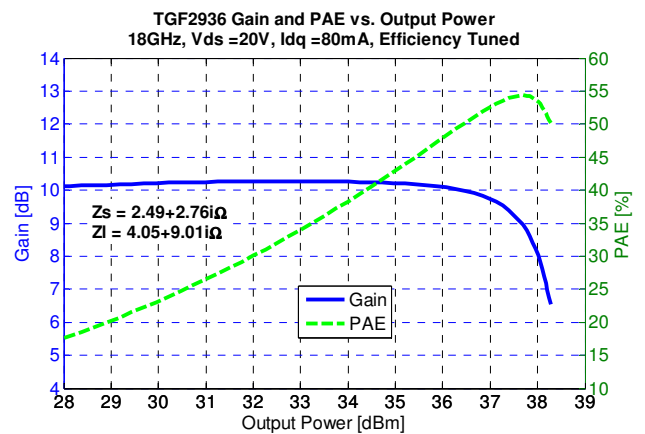
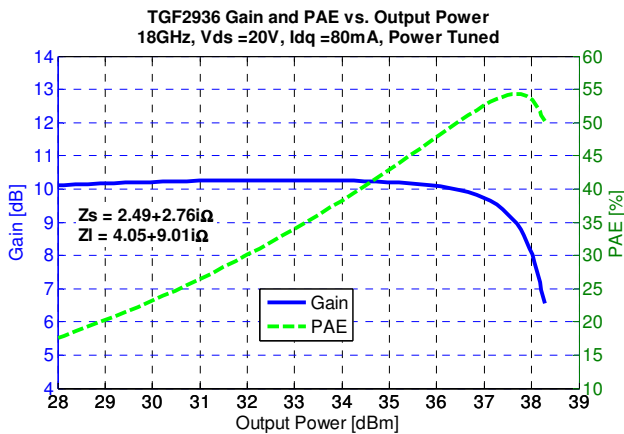
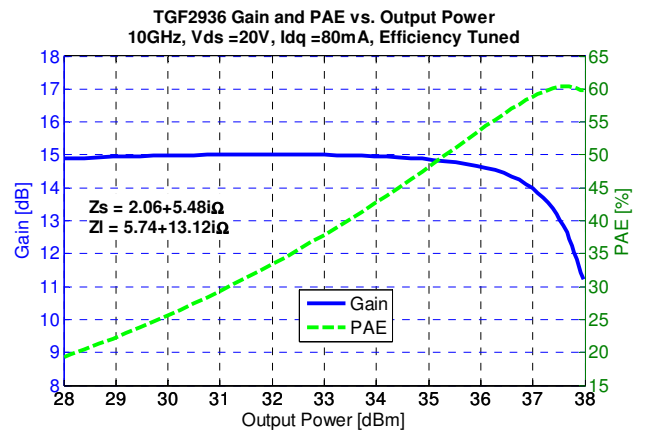
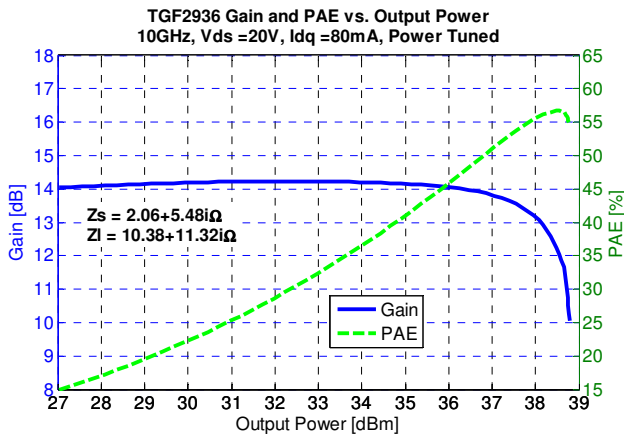
1. CW, Bondwires not included
2. See page 22 for load-pull and source-pull reference planes where the performance was measured.



Typical Model Performance – Load-Pull Drive-up^{1,2}

Notes:

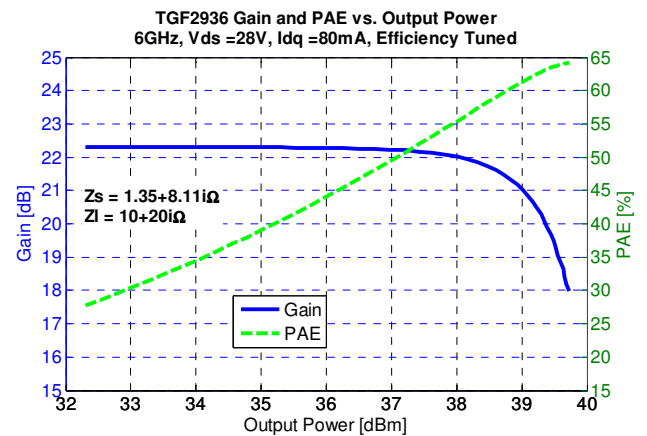
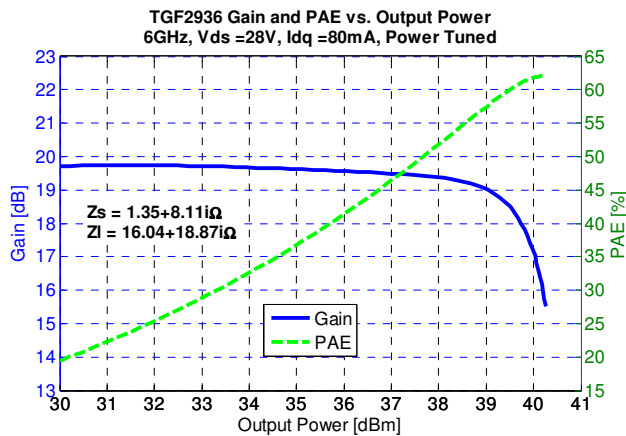
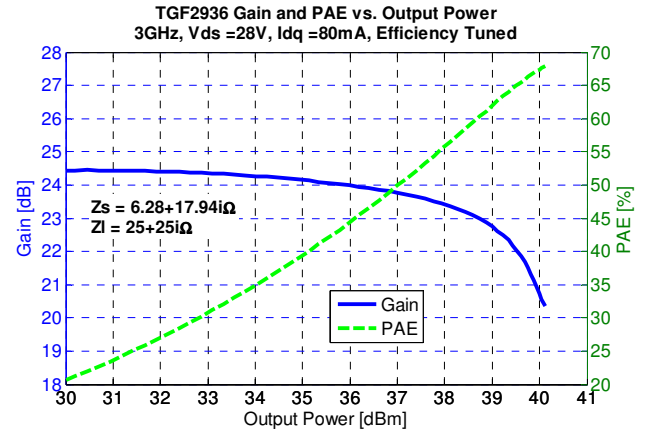
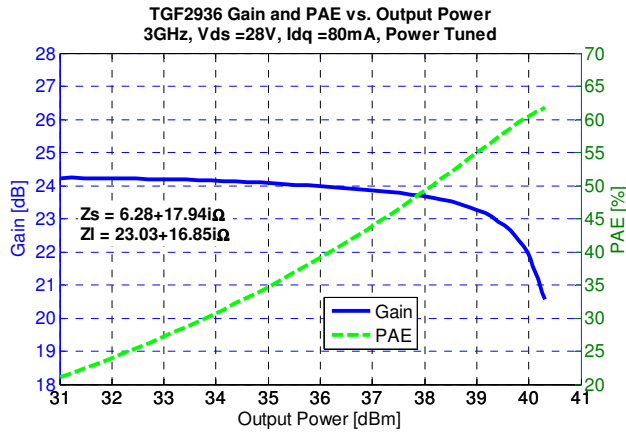
1. CW, Bondwires not included
2. See page 22 for load-pull and source-pull reference planes where the performance was measured.



Typical Model Performance – Load-Pull Drive-up^{1,2}

Notes:

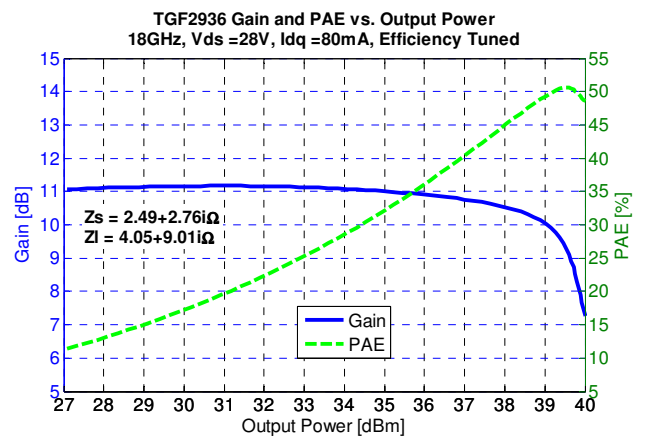
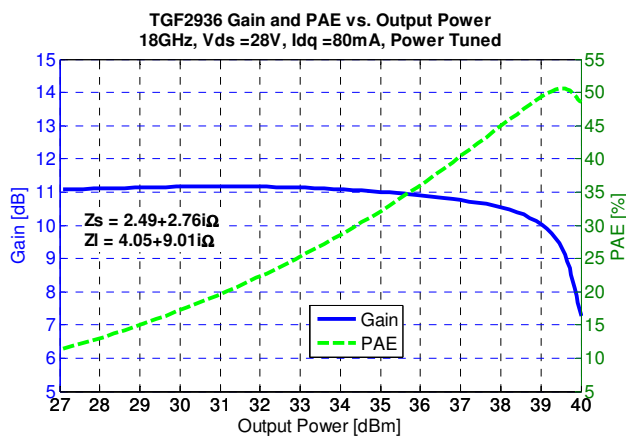
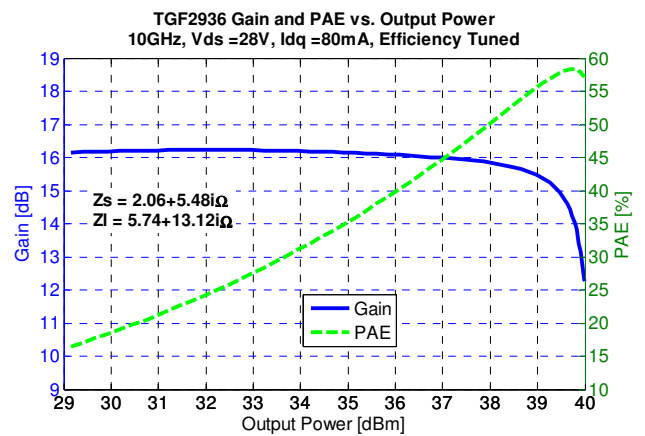
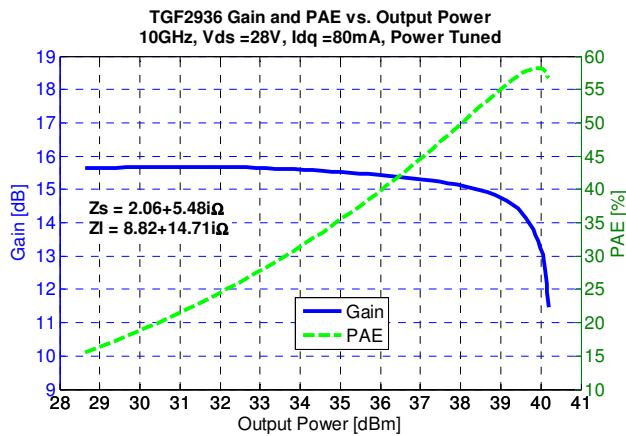
1. CW, Bondwires not included
2. See page 22 for load-pull and source-pull reference planes where the performance was measured.



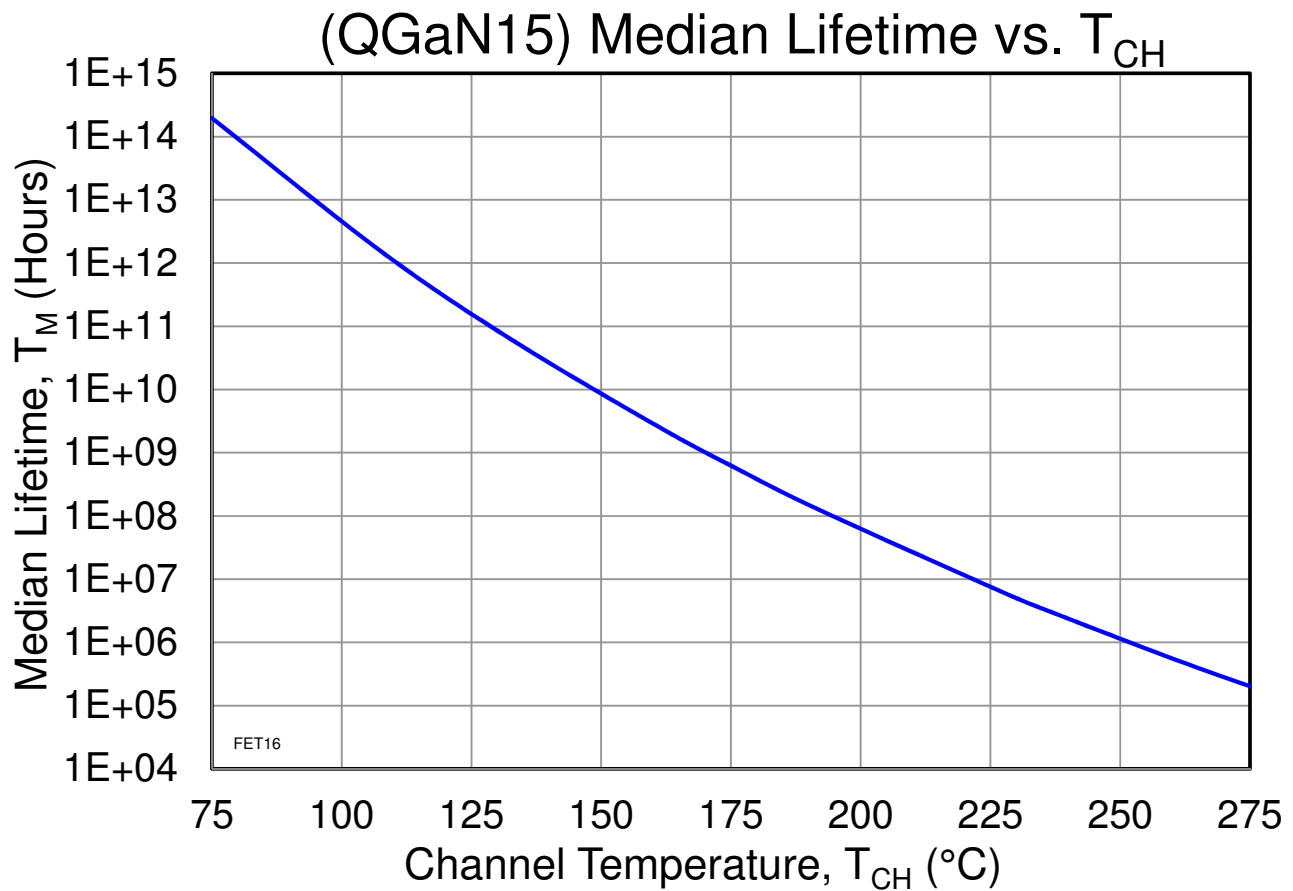
Typical Model Performance – Load-Pull Drive-up^{1, 2}

Notes:

1. CW, Bondwires not included
2. See page 22 for load-pull and source-pull reference planes where the performance was measured.



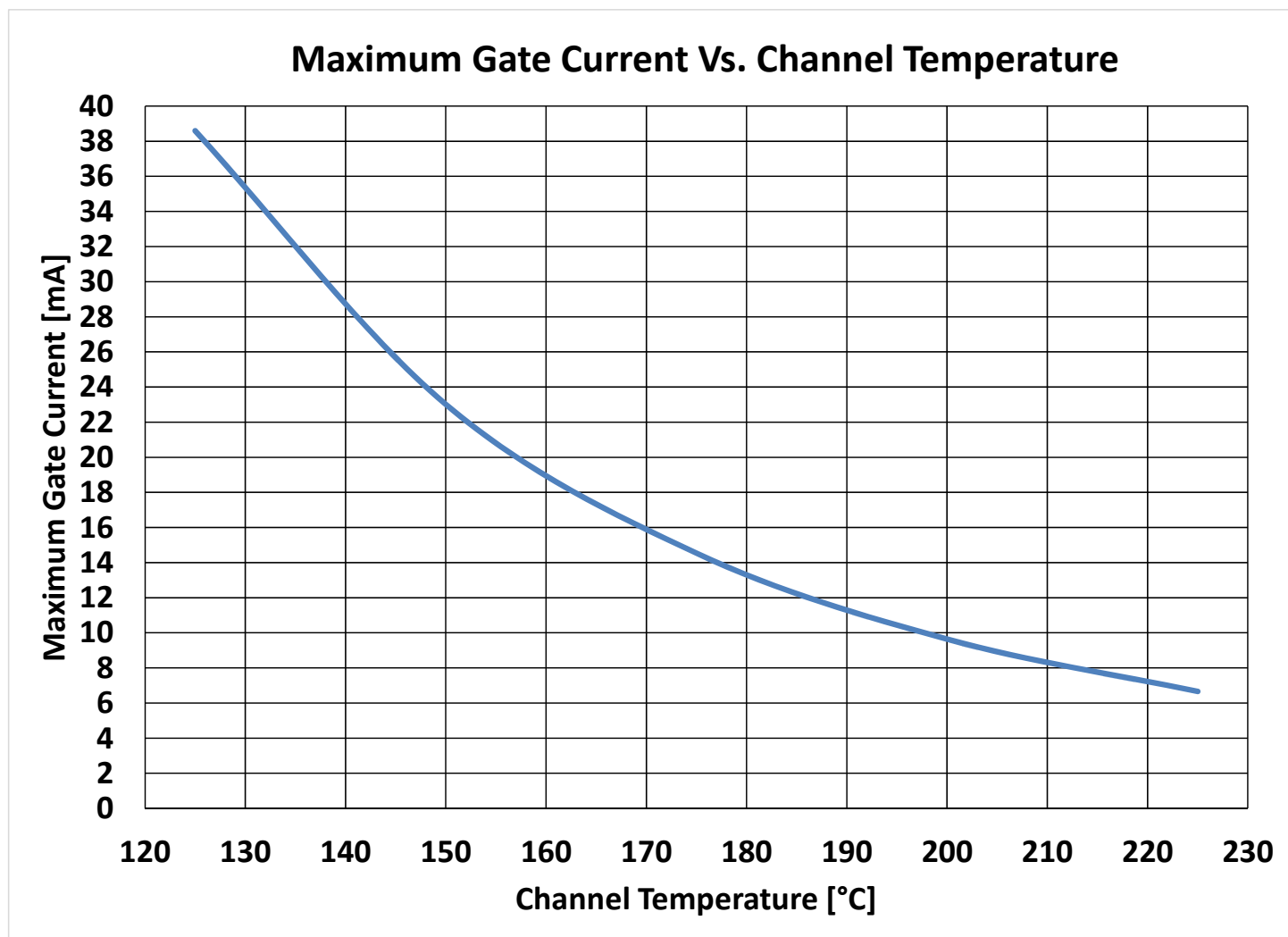
Median Lifetime¹



Notes:

1. Test Conditions: $V_D = +28$ V; Failure Criteria = 10 % reduction in I_{D_MAX} during DC Life Testing .

Maximum Gate Current

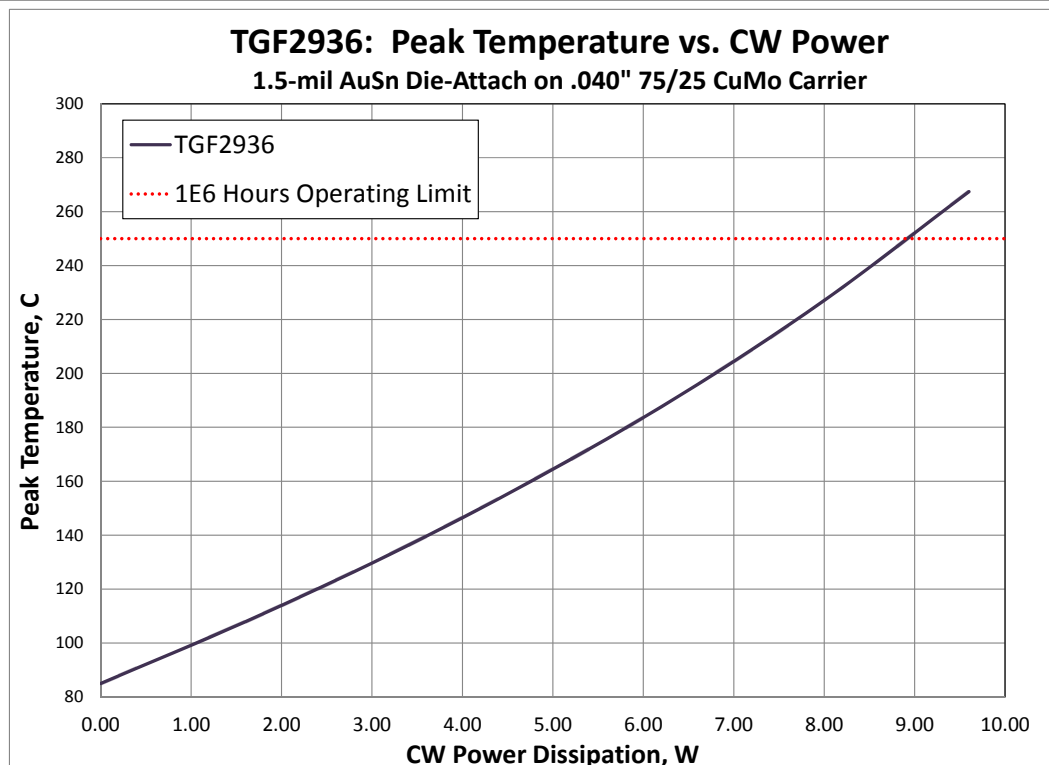


Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance, θ_{JC} ⁽¹⁾	CW	14.4	°C/W
Channel Temperature, T_{CH}	$T_{baseplate} = +85\text{ °C}$	108	°C
Median Lifetime, T_M	$P_{DISS} = 1.6\text{ W}$	1.4E12	Hrs
Thermal Resistance, θ_{JC} ⁽¹⁾	CW	15	°C/W
Channel Temperature, T_{CH}	$T_{baseplate} = +85\text{ °C}$	133	°C
Median Lifetime, T_M	$P_{DISS} = 3.2\text{ W}$	6.0E10	Hrs
Thermal Resistance, θ_{JC} ⁽¹⁾	CW	15.8	°C/W
Channel Temperature, T_{CH}	$T_{baseplate} = +85\text{ °C}$	161	°C
Median Lifetime, T_M	$P_{DISS} = 4.8\text{ W}$	2.6E9	Hrs
Thermal Resistance, θ_{JC} ⁽¹⁾	CW	16.7	°C/W
Channel Temperature, T_{CH}	$T_{baseplate} = +85\text{ °C}$	192	°C
Median Lifetime, T_M	$P_{DISS} = 6.4\text{ W}$	1.2E8	Hrs
Thermal Resistance, θ_{JC} ⁽¹⁾	CW	17.8	°C/W
Channel Temperature, T_{CH}	$T_{baseplate} = +85\text{ °C}$	227	°C
Median Lifetime, T_M	$P_{DISS} = 8\text{ W}$	6.4E6	Hrs
Thermal Resistance, θ_{JC} ⁽¹⁾	CW	19.0	°C/W
Channel Temperature, T_{CH}	$T_{baseplate} = +85\text{ °C}$	267	°C
Median Lifetime, T_M	$P_{DISS} = 9.6\text{ W}$	3.4E5	Hrs

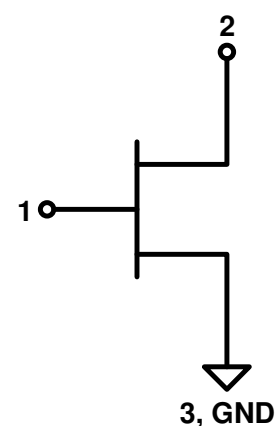
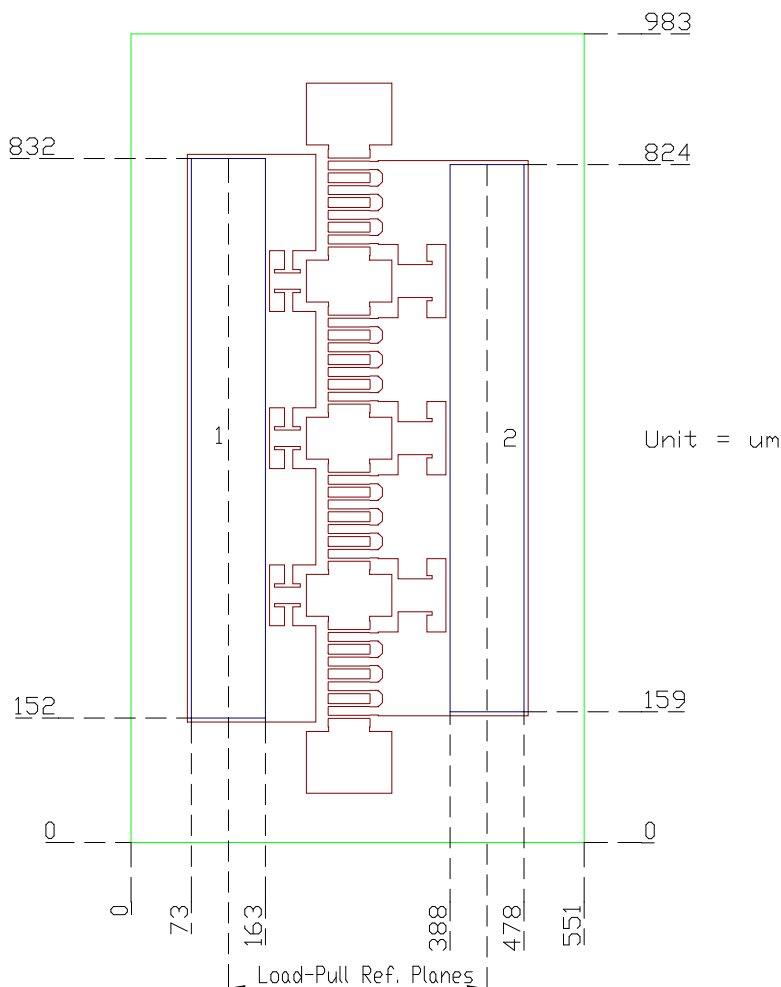
Notes:

1. Thermal resistance measured at back of package.



Pin Configuration and Description¹

Notes: 1. Die size tolerance is ± 0.015 mm.



Pin Description

Pin	Symbol	Description	Dimension
1	RF IN / V_G	Gate	0.680 x 0.090 mm
2	RF OUT / V_D	Drain	0.665 x 0.090 mm
3	Source	Source / Ground / Backside of die	0.983 x 0.551 mm

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. Set V_G to -4 V.
2. Set I_D limit to 100 mA.
3. Slowly adjust V_G until I_D reaches 80 mA.
4. Set I_D limit to 800 mA.
5. Apply RF signal.

Bias-down Procedure

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

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	N/A	ESDA / JEDEC JS-001-2012
ESD – Charged Device Model (CDM)	N/A	JEDEC JESD22-C101F
MSL – Moisture Sensitivity Level	N/A	IPC/JEDEC J-STD-020



Caution!
ESD-Sensitive Device

Solderability

Compatible with both lead-free (260°C max. reflow temp.) and tin/lead (245°C max. reflow temp.) soldering processes. Solder profiles available upon request.

Contact plating: NiPdAu

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, and information about Qorvo:

Web: www.Qorvo.com
Email: info-sales@qorvo.com

Tel: +1.972.994.8465
Fax: +1.972.994.8504

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

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