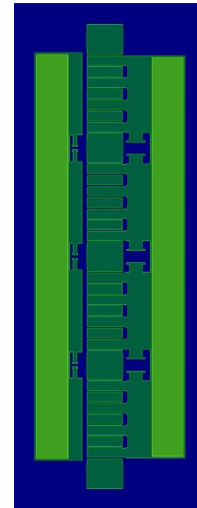


Product Overview

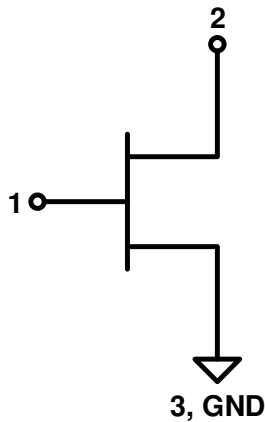
The Qorvo TGF2934 is a 14 W (P_{3dB}) discrete GaN on SiC HEMT which operates from DC to 25 GHz and 28 V supply. The device is constructed with Qorvo’s proven QGaN15 process. The device can support pulsed, CW, and linear operations.

Lead-free and ROHS compliant



1.457 x 0.551 x 0.100 mm

Functional Block Diagram



Key Features

- Frequency: DC to 25 GHz
 - Output Power (P_{3dB})¹: 14 W
 - Linear Gain¹: 14 dB
 - Typical PAE_{3dB}¹: 49%
 - Typical Noise Figure¹: 1.5 dB
 - 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
TGF2934	3A001b.3.b	DC–25 GHz, 28 V, 3.5 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, $I_{D_{MAX}}$	4	A
Gate Current Range, I_G	See page 20.	mA
Power Dissipation, CW, P_{DISS}^2	17.4	W
RF Input Power, CW, 10 GHz, $T = 25\text{ }^\circ\text{C}$	+33	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.
2. Base temperature at 85 $^\circ\text{C}$

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}	80	160	320	mA
Drain Current, I_D	-	1000	-	mA
Gate Voltage, V_G^3	-	-2.8	-	V
Channel Temperature (T_{CH})	-	-	250	$^\circ\text{C}$
Power Dissipation, CW (P_D) ²	-	-	15.8	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
	3		6		10		18		
Frequency, F									GHz
Drain Voltage, V_D	20	28	20	28	20	28	20	28	V
Drain Bias Current, I_{DQ}	160	160	160	160	160	160	160	160	mA
Output Power at 3dB compression, P_{3dB}	40.7	41.6	40.8	41.7	40.8	41.5	39.5	41.8	dBm
Power Added Efficiency at 3dB compression, PAE_{3dB}	56.9	51.7	55.0	51.3	51.4	49.3	43.7	44.9	%
Gain at 3dB compression, G_{3dB}	18.7	21.5	13.3	15.4	8.9	11.2	5.9	6.9	dB
Load Reflection Coefficient ⁽²⁾ , Γ_L	$0.63 \angle 162^\circ$	$0.45 \angle 153^\circ$	$0.73 \angle 164^\circ$	$0.67 \angle 153^\circ$	$0.82 \angle 166^\circ$	$0.85 \angle 159^\circ$	$0.92 \angle 167^\circ$	$0.92 \angle 167^\circ$	--

Notes:

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

Model Load Pull Performance – Efficiency Tuned¹

Parameter	Typical Values								Units
	3		6		10		18		
Frequency, F									GHz
Drain Voltage, V_D	20	28	20	28	20	28	20	28	V
Drain Bias Current, I_{DQ}	160	160	160	160	160	160	160	160	mA
Output Power at 3dB compression, P_{3dB}	40.2	41.3	40.1	41.7	40.8	41.5	39.5	41.8	dBm
Power Added Efficiency at 3dB compression, PAE_{3dB}	58	53.1	57.5	51.3	51.4	49.3	43.7	44.9	%
Gain at 3dB compression, G_{3dB}	18.4	23.0	13.6	15.4	8.9	11.2	5.9	6.9	dB
Load Reflection Coefficient ⁽²⁾ , Γ_L	$0.67 \angle 153^\circ$	$0.50 \angle 143^\circ$	$0.76 \angle 157^\circ$	$0.67 \angle 153^\circ$	$0.82 \angle 166^\circ$	$0.85 \angle 159^\circ$	$0.92 \angle 167^\circ$	$0.92 \angle 167^\circ$	--

Notes:

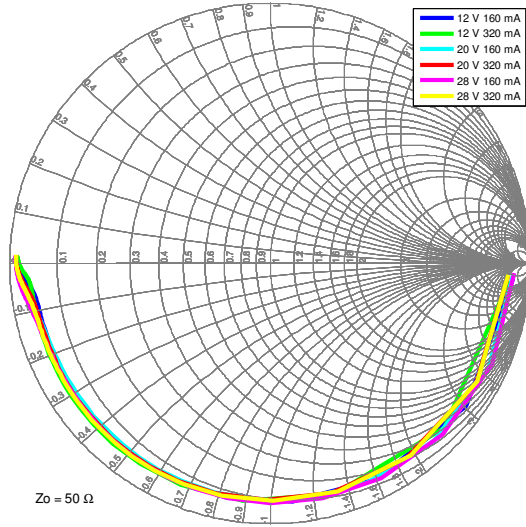
1. CW, bondwires not included
2. Characteristic Impedance, $Z_0 = 50 \Omega$.

Model S-parameters¹

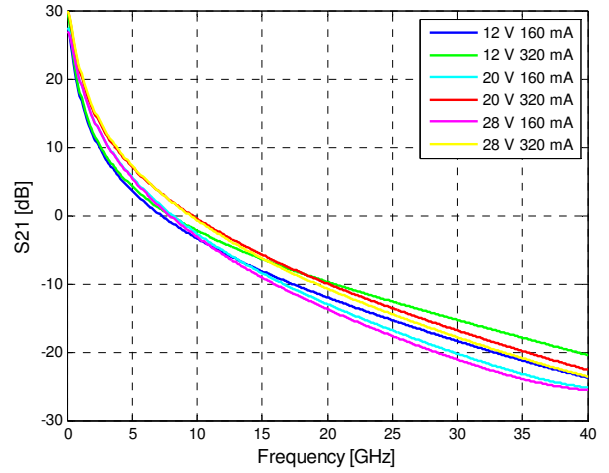
Notes:

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

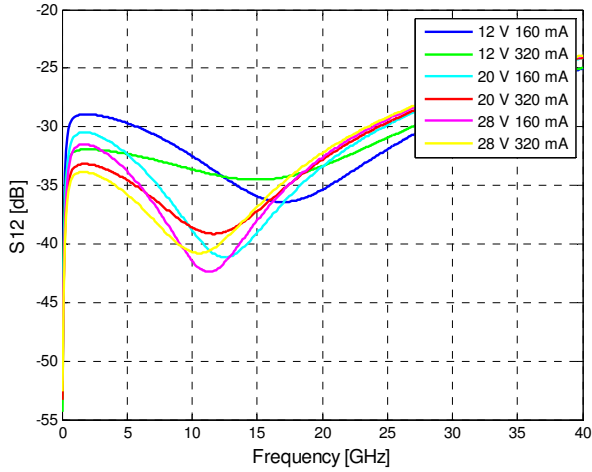
S11 from 0.01 GHz to 40 GHz



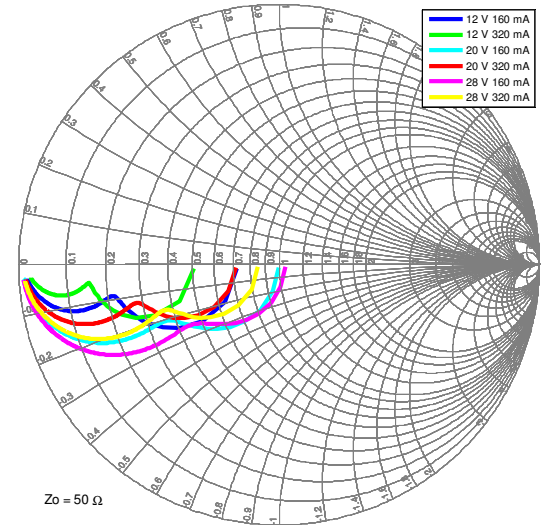
S21



S12



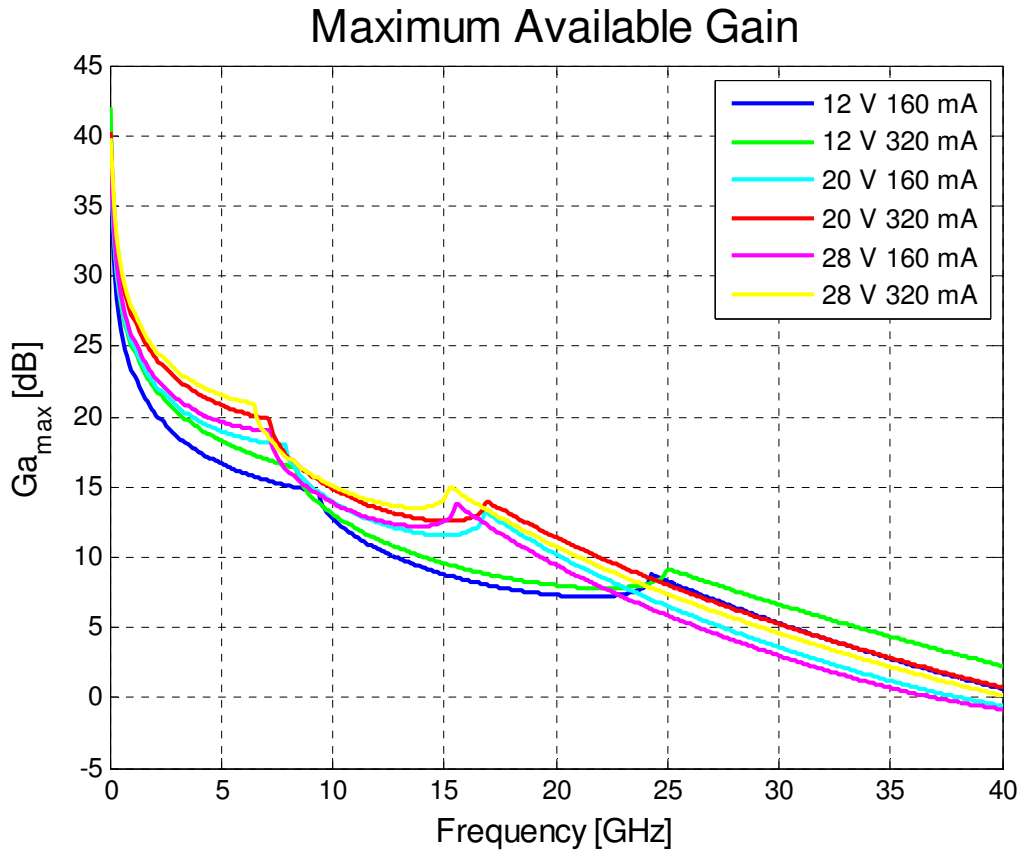
S22 from 0.01 GHz to 40 GHz



Model Maximum Available Gain¹

Notes:

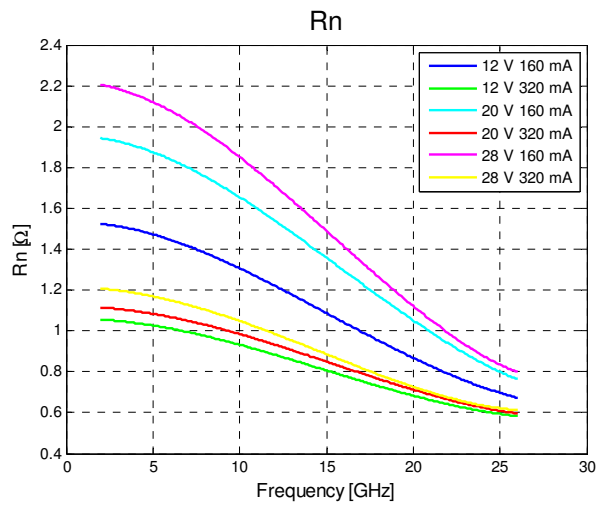
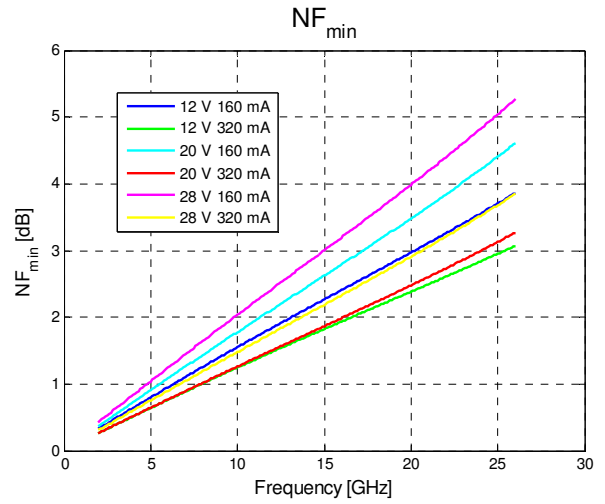
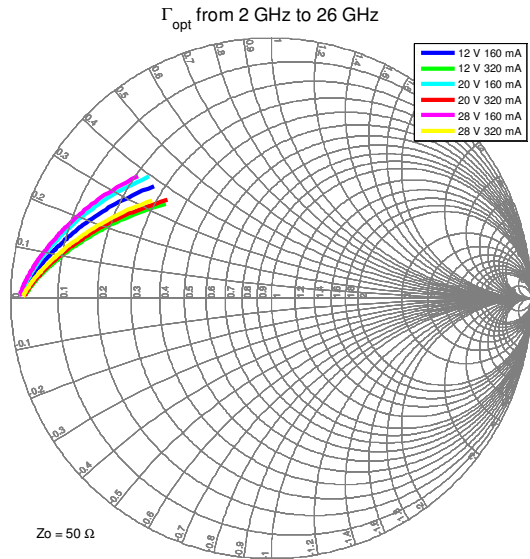
1. Bondwires are not included. T = 25 °C.



Model Noise¹

Notes:

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

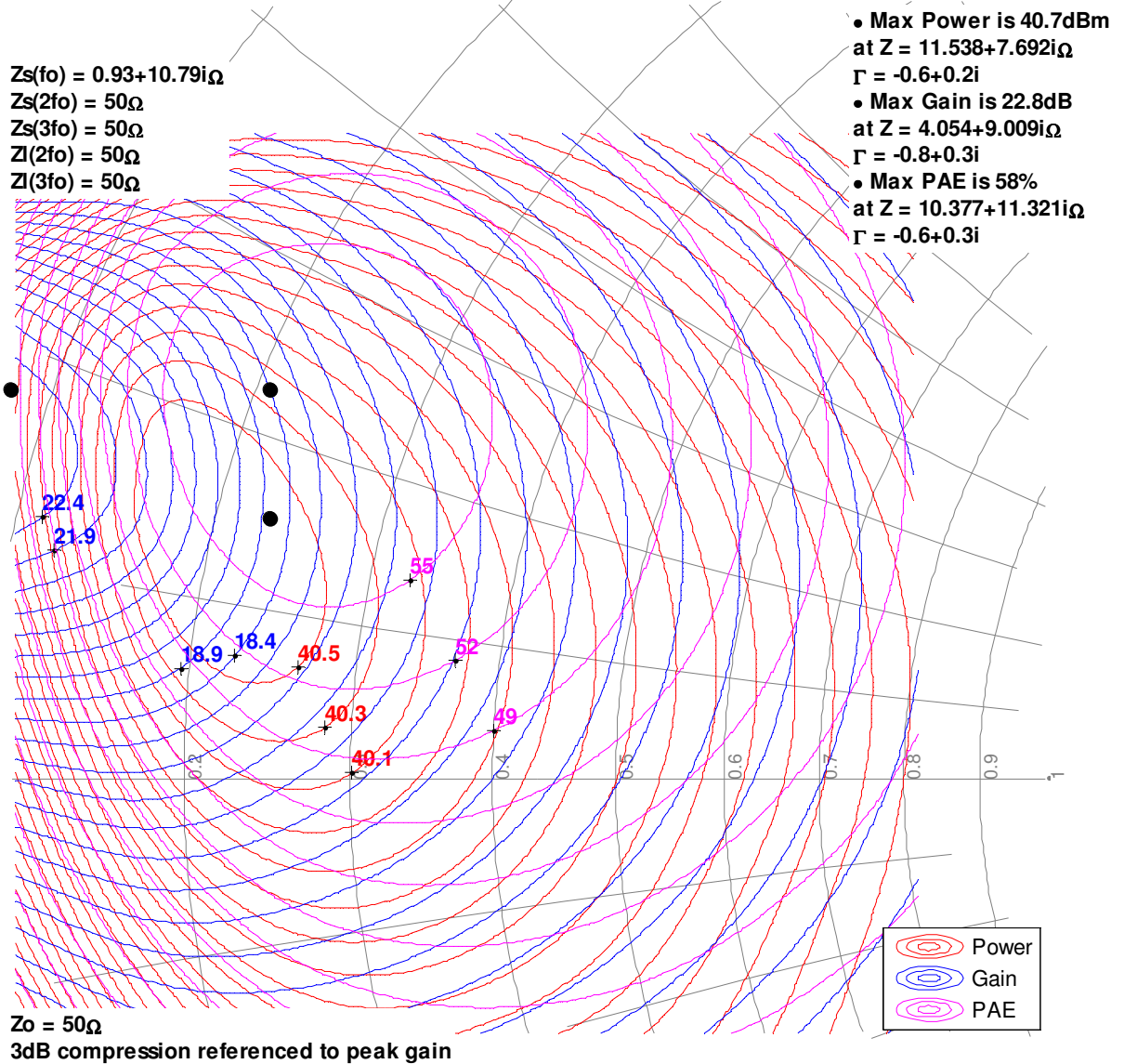


Model Load-Pull Smith Charts^{1, 2, 3}

Notes:

1. Test Conditions: $V_D = 20\text{ V}$, $I_{DQ} = 160\text{ mA}$, 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}

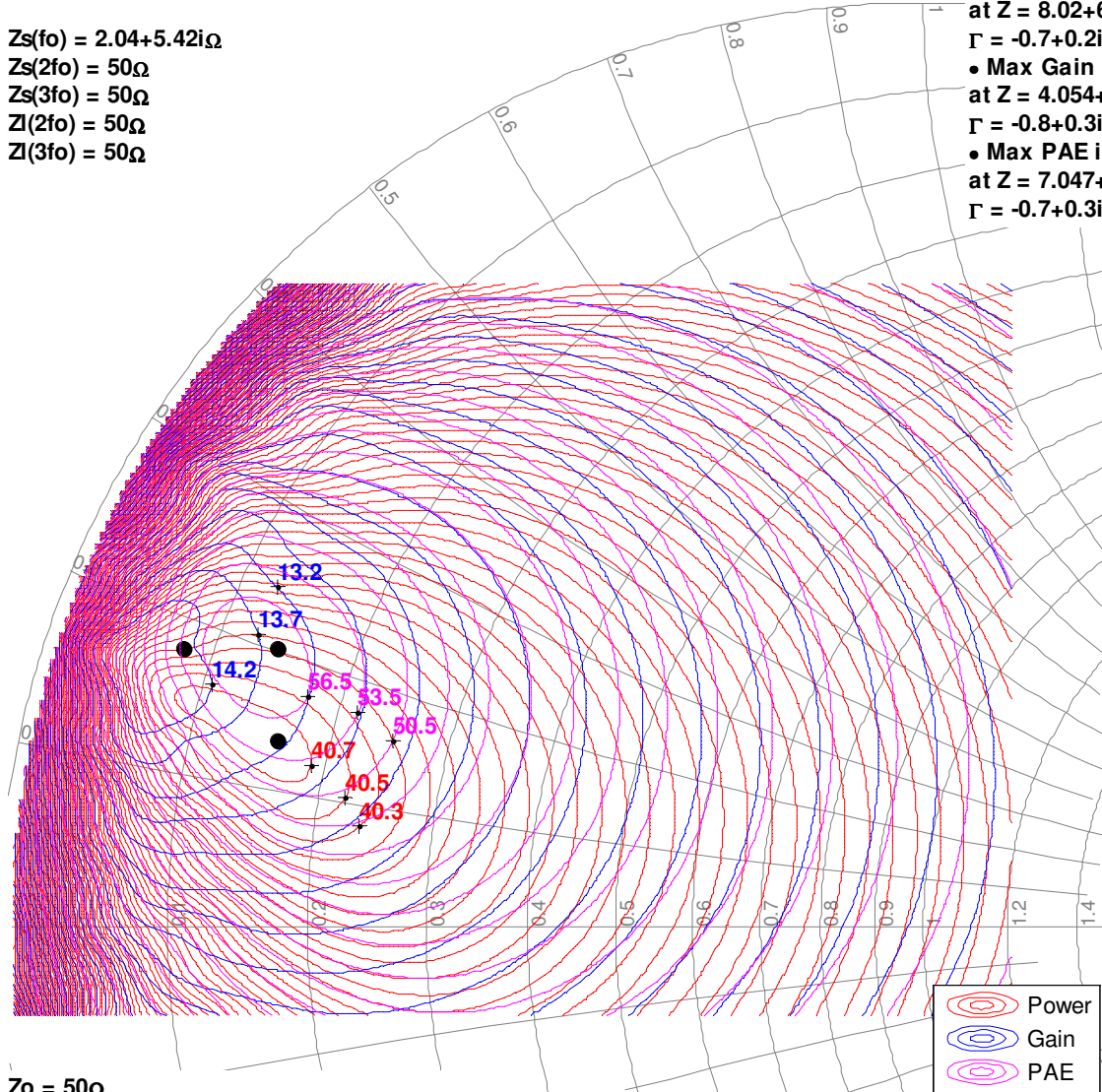
Notes:

1. Test Conditions: $V_D = 20\text{ V}$, $I_{DQ} = 160\text{ mA}$, CW, Bondwires not included
2. See page 22 for load pull reference planes where the performance was simulated.

6GHz, Load-pull

$Z_s(f_0) = 2.04 + 5.42i\Omega$
 $Z_s(2f_0) = 50\Omega$
 $Z_s(3f_0) = 50\Omega$
 $Z_l(2f_0) = 50\Omega$
 $Z_l(3f_0) = 50\Omega$

- Max Power is 40.8dBm at $Z = 8.02 + 6.826i\Omega$
 $\Gamma = -0.7 + 0.2i$
- Max Gain is 14.3dB at $Z = 4.054 + 9.009i\Omega$
 $\Gamma = -0.8 + 0.3i$
- Max PAE is 57.5% at $Z = 7.047 + 10.067i\Omega$
 $\Gamma = -0.7 + 0.3i$



$Z_0 = 50\Omega$
 3dB compression referenced to peak gain

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

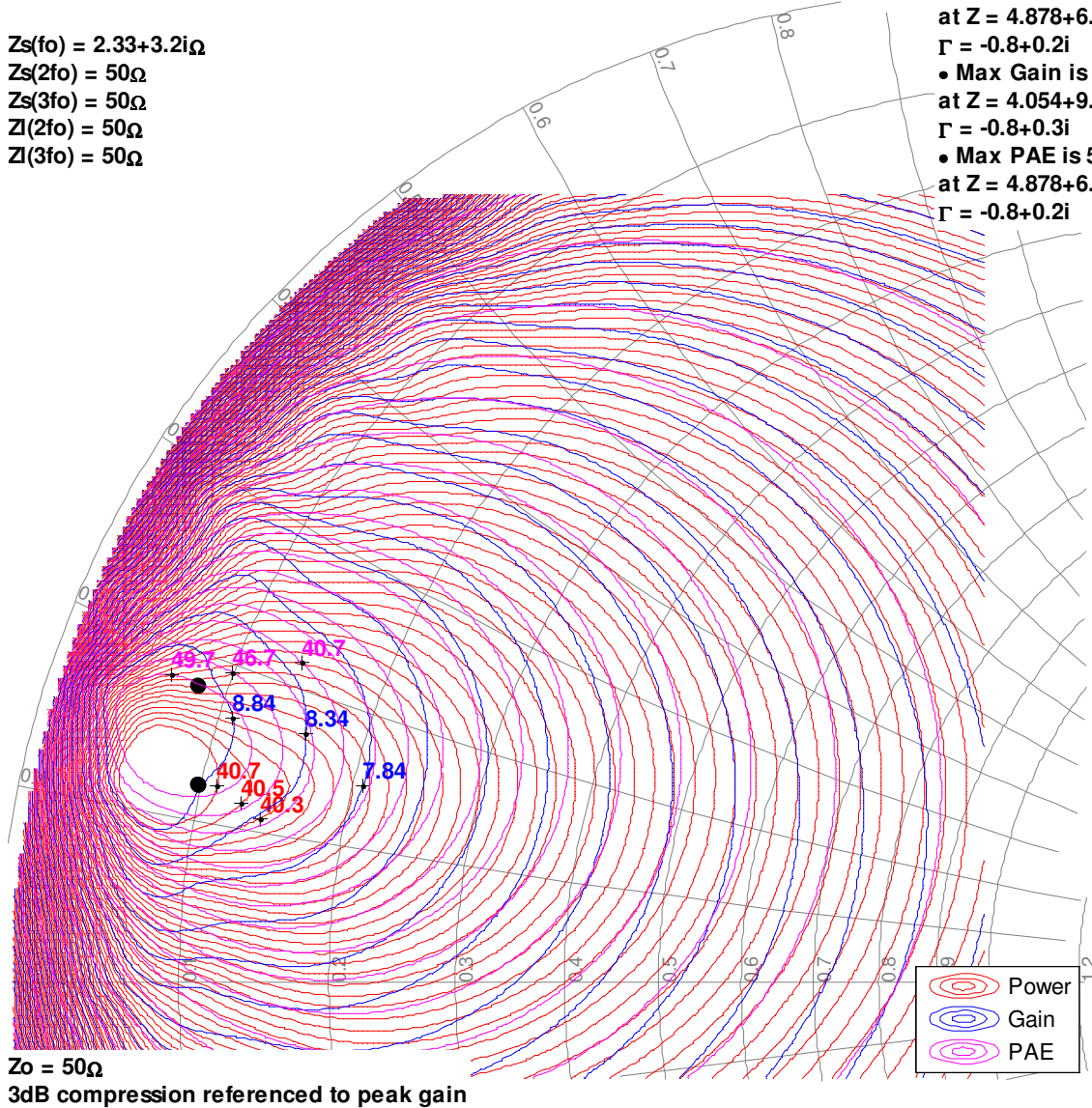
Notes:

1. Test Conditions: $V_D = 20\text{ V}$, $I_{DQ} = 160\text{ mA}$, CW, Bondwires not included
2. See page 22 for load pull reference planes where the performance was simulated.

10GHz, Load-pull

$Z_s(f_0) = 2.33 + 3.2i\Omega$
 $Z_s(2f_0) = 50\Omega$
 $Z_s(3f_0) = 50\Omega$
 $Z_l(2f_0) = 50\Omega$
 $Z_l(3f_0) = 50\Omega$

- Max Power is 40.8dBm at $Z = 4.878 + 6.097i\Omega$
 $\Gamma = -0.8 + 0.2i$
- Max Gain is 9dB at $Z = 4.054 + 9.009i\Omega$
 $\Gamma = -0.8 + 0.3i$
- Max PAE is 51.4% at $Z = 4.878 + 6.097i\Omega$
 $\Gamma = -0.8 + 0.2i$

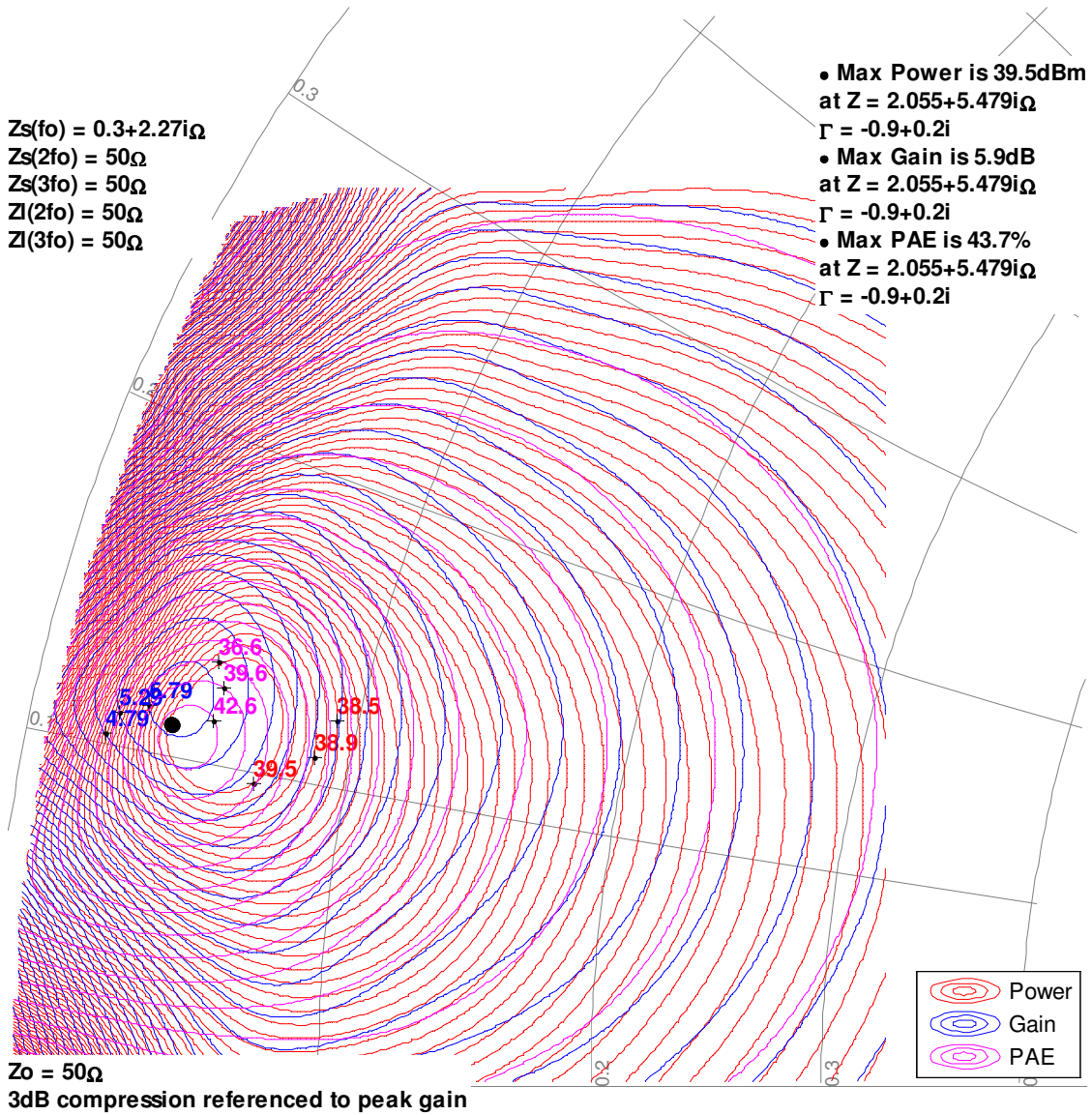


Model Load-Pull Smith Charts^{1,2}

Notes:

1. Test Conditions: $V_D = 20\text{ V}$, $I_{DQ} = 160\text{ mA}$, CW, Bondwires not included
2. See page 22 for load pull reference planes where the performance was simulated.

18GHz, Load-pull

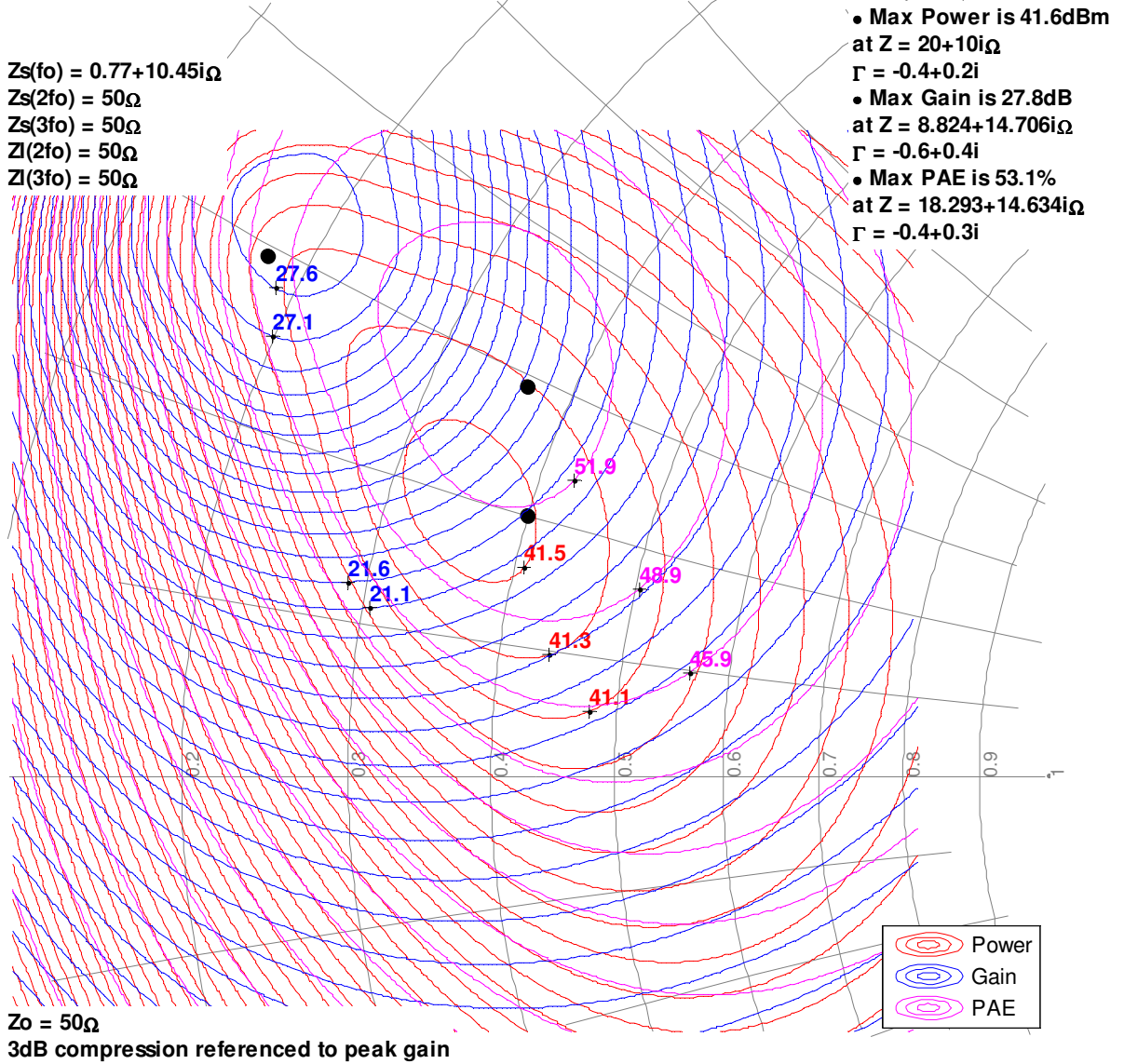


Model Load-Pull Smith Charts^{1,2}

Notes:

1. Test Conditions: $V_D = 28\text{ V}$, $I_{DQ} = 160\text{ mA}$, 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}

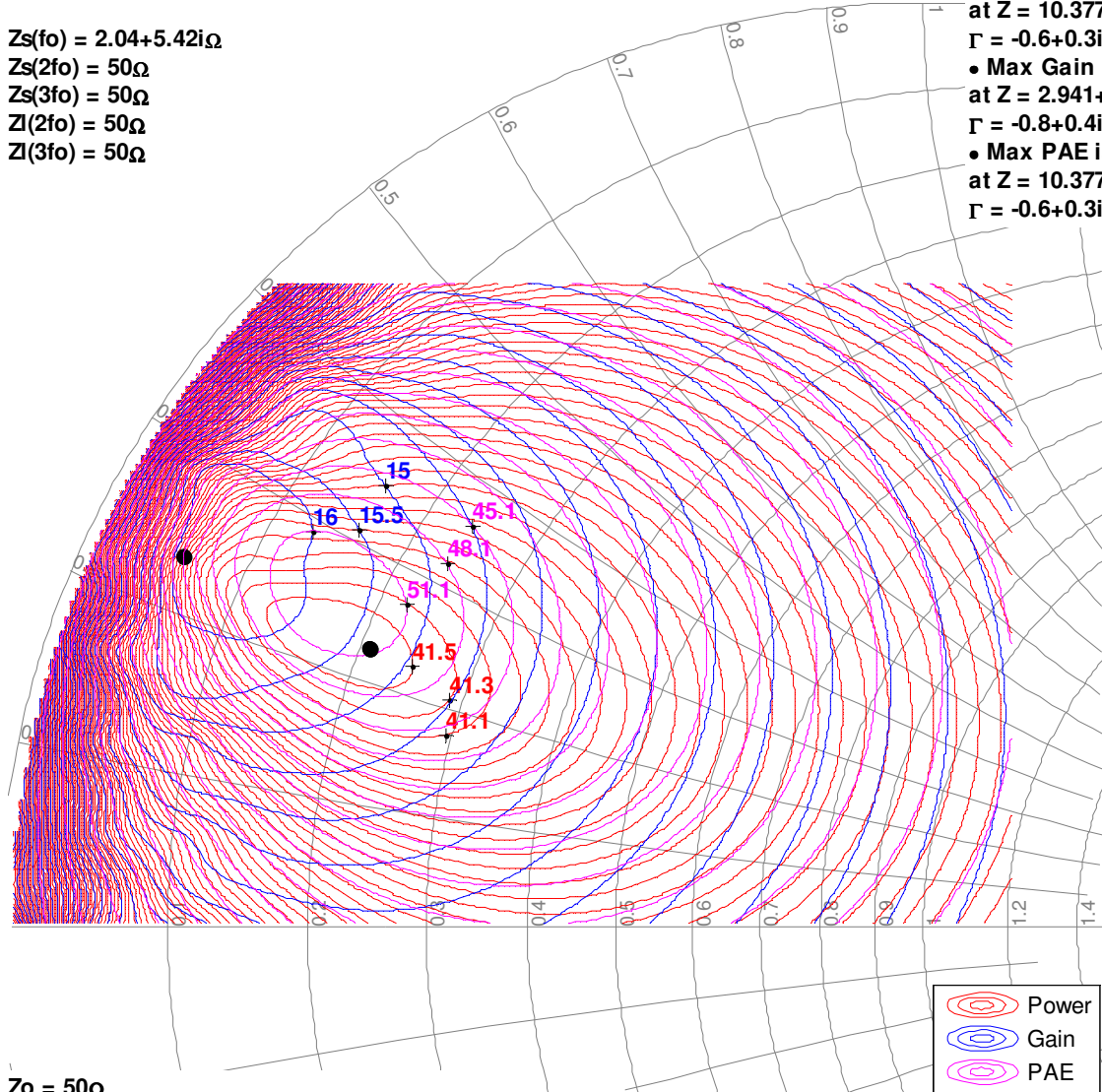
Notes:

1. Test Conditions: $V_D = 28\text{ V}$, $I_{DQ} = 160\text{ mA}$, CW, Bondwires not included
2. See page 22 for load pull reference planes where the performance was simulated.

6GHz, Load-pull

$Z_s(f_0) = 2.04 + 5.42i\Omega$
 $Z_s(2f_0) = 50\Omega$
 $Z_s(3f_0) = 50\Omega$
 $Z_l(2f_0) = 50\Omega$
 $Z_l(3f_0) = 50\Omega$

- Max Power is 41.7dBm at $Z = 10.377 + 11.321i\Omega$
 $\Gamma = -0.6 + 0.3i$
- Max Gain is 16.4dB at $Z = 2.941 + 11.765i\Omega$
 $\Gamma = -0.8 + 0.4i$
- Max PAE is 51.4% at $Z = 10.377 + 11.321i\Omega$
 $\Gamma = -0.6 + 0.3i$



$Z_0 = 50\Omega$
 3dB compression referenced to peak gain

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

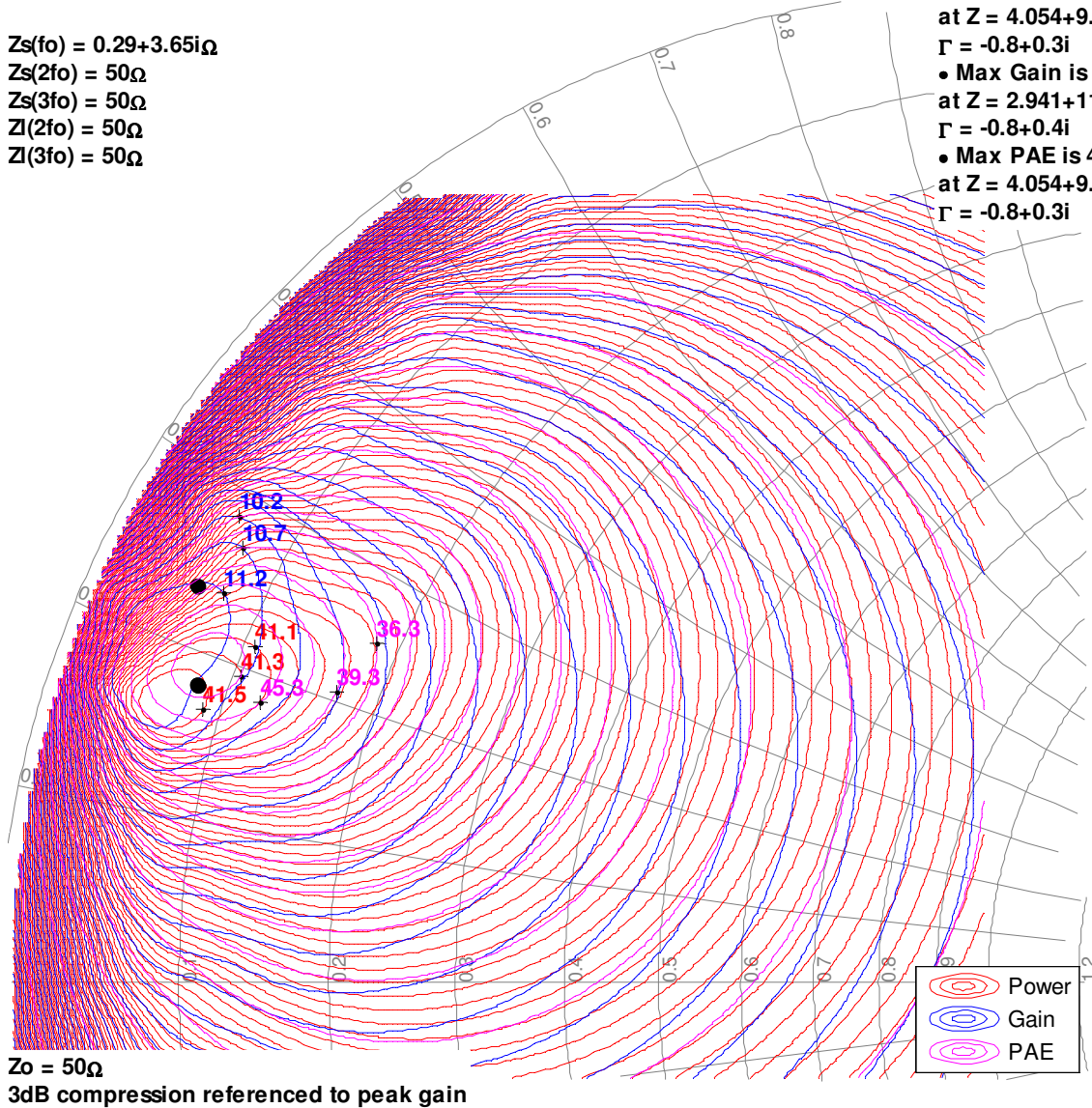
Notes:

1. Test Conditions: $V_D = 28\text{ V}$, $I_{DQ} = 160\text{ mA}$, CW, Bondwires not included
2. See page 22 for load pull reference planes where the performance was simulated.

10GHz, Load-pull

$Z_s(f_0) = 0.29 + 3.65i\Omega$
 $Z_s(2f_0) = 50\Omega$
 $Z_s(3f_0) = 50\Omega$
 $Z_l(2f_0) = 50\Omega$
 $Z_l(3f_0) = 50\Omega$

- Max Power is 41.5dBm at $Z = 4.054 + 9.009i\Omega$
 $\Gamma = -0.8 + 0.3i$
- Max Gain is 11.3dB at $Z = 2.941 + 11.765i\Omega$
 $\Gamma = -0.8 + 0.4i$
- Max PAE is 49.1% at $Z = 4.054 + 9.009i\Omega$
 $\Gamma = -0.8 + 0.3i$

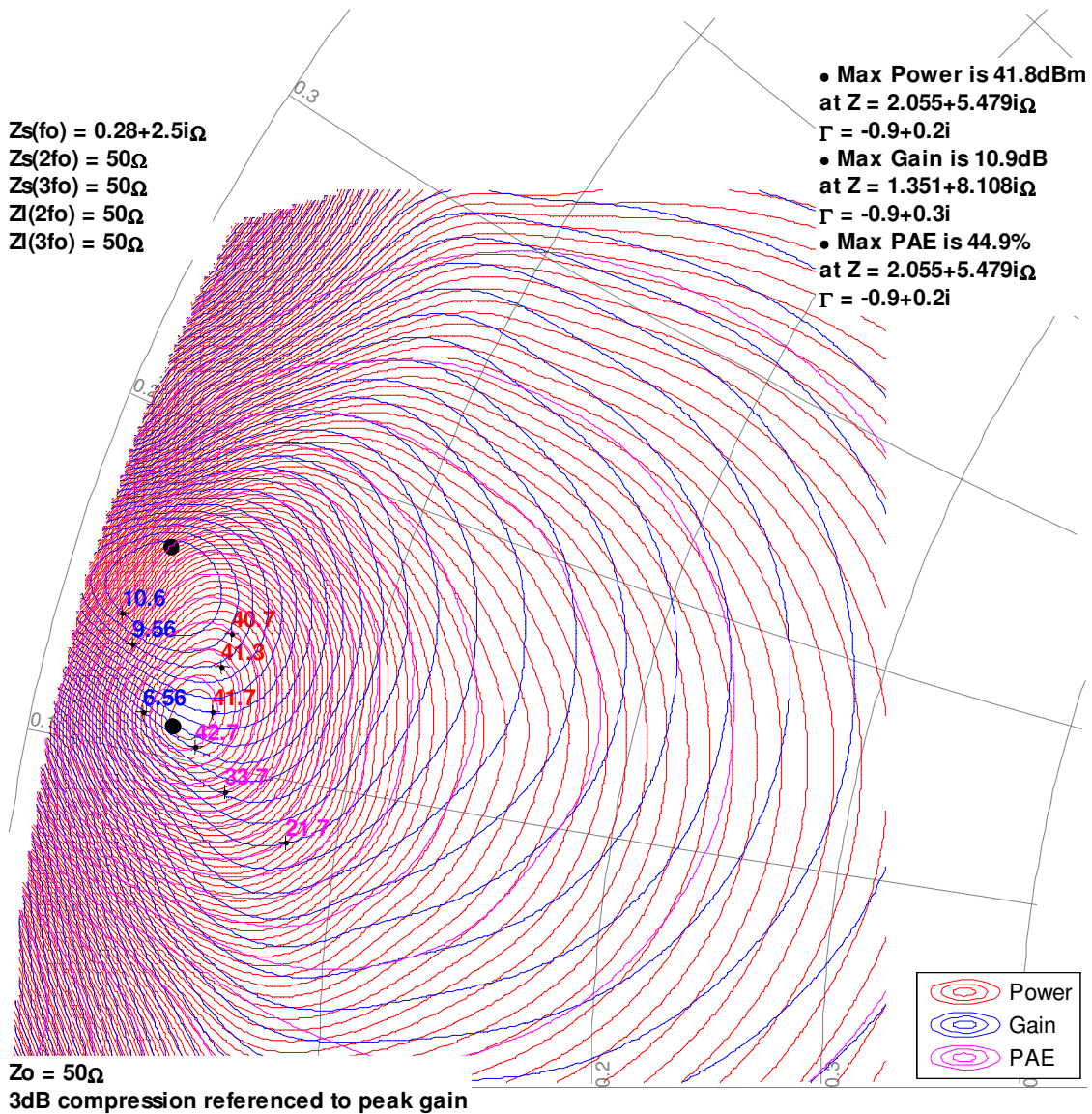


Model Load-Pull Smith Charts^{1, 2}

Notes:

1. Test Conditions: $V_D = 28\text{ V}$, $I_{DQ} = 160\text{ mA}$, CW, Bondwires not included
2. See page 22 for load pull reference planes where the performance was simulated.

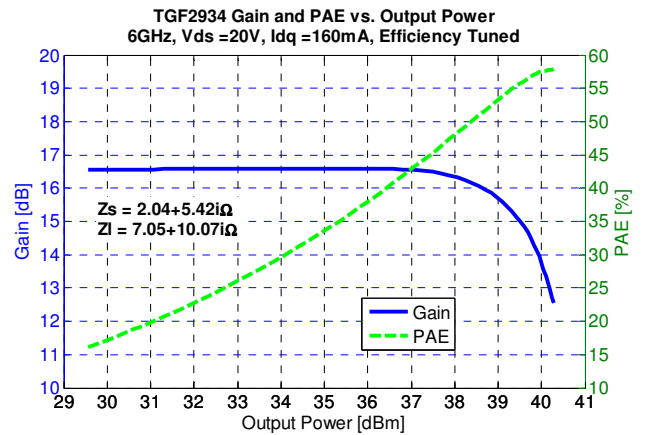
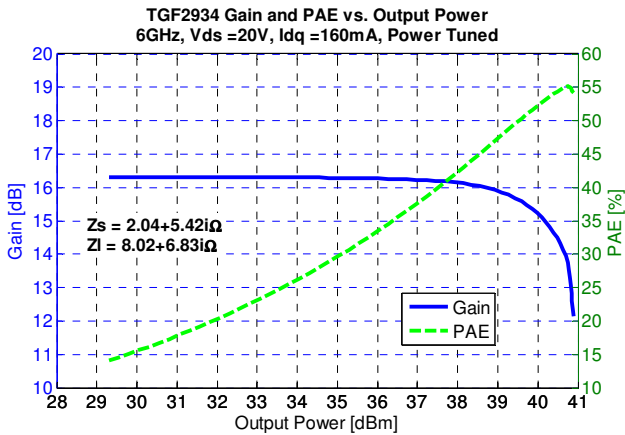
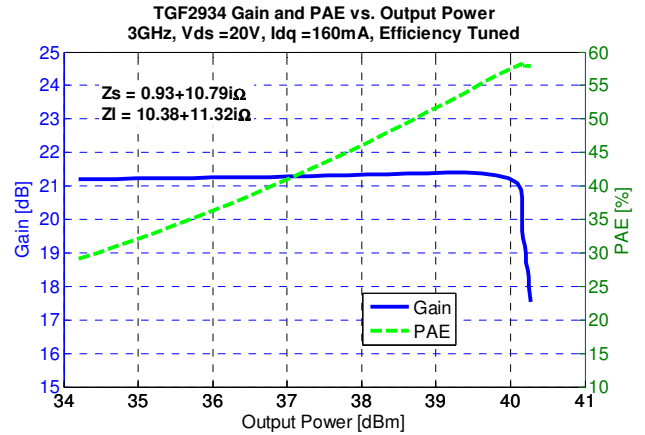
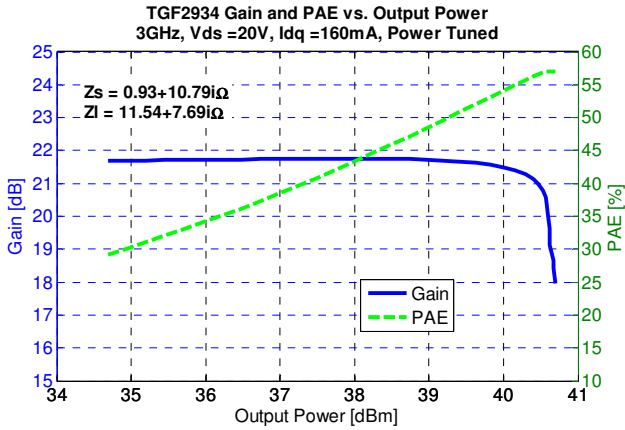
18GHz, Load-pull



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

Notes:

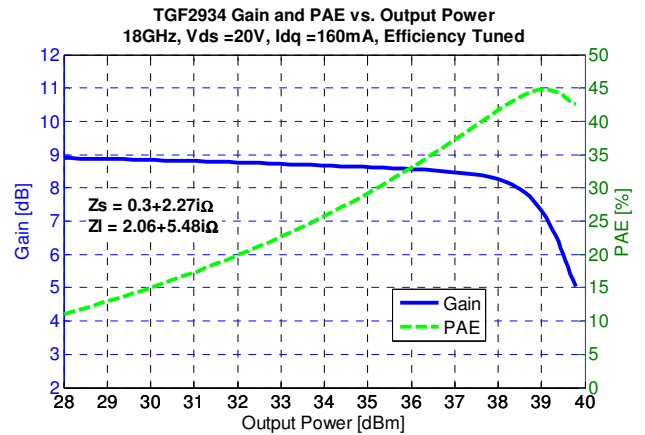
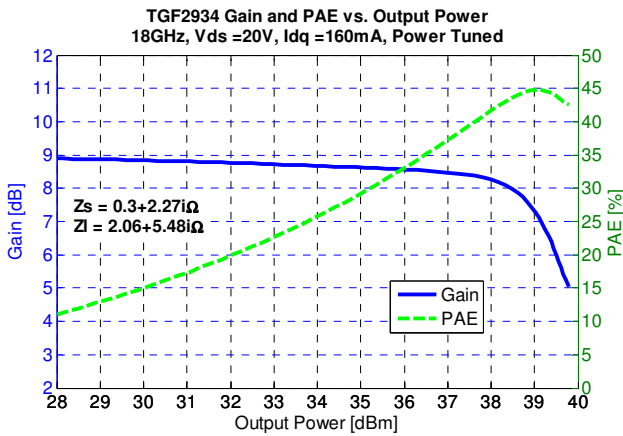
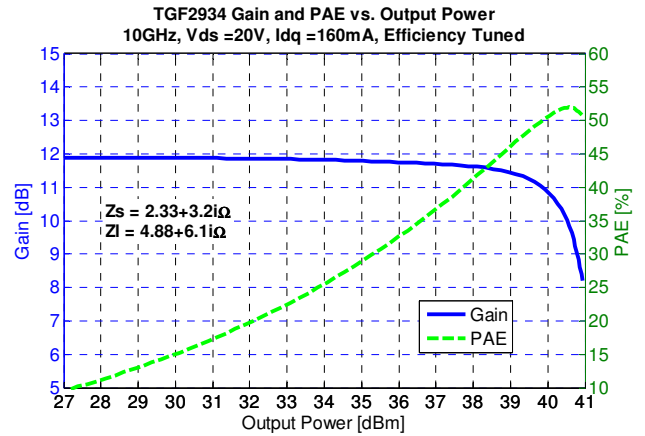
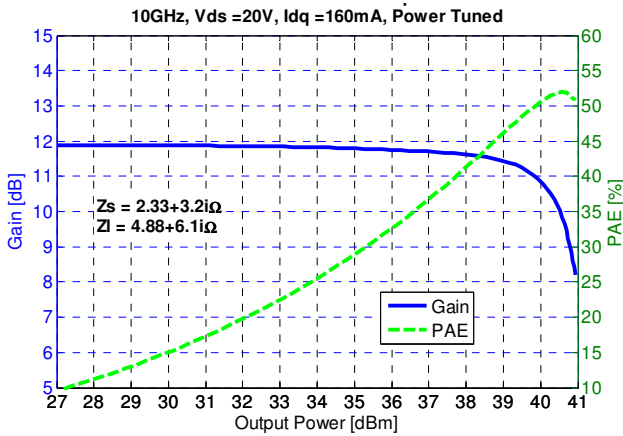
1. CW, Bondwires not included
2. See page 22 for load-pull and source-pull reference planes where the performance was measured.



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

Notes:

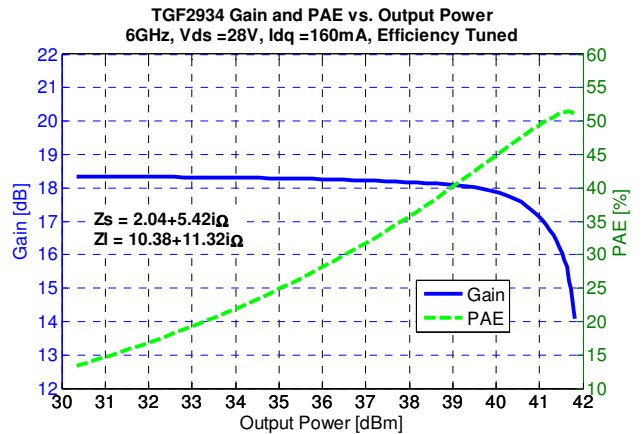
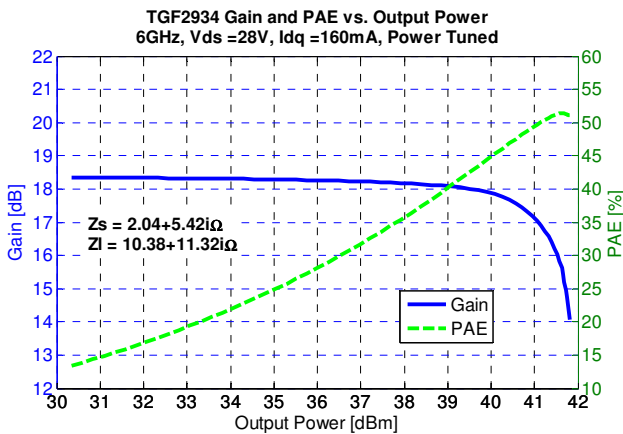
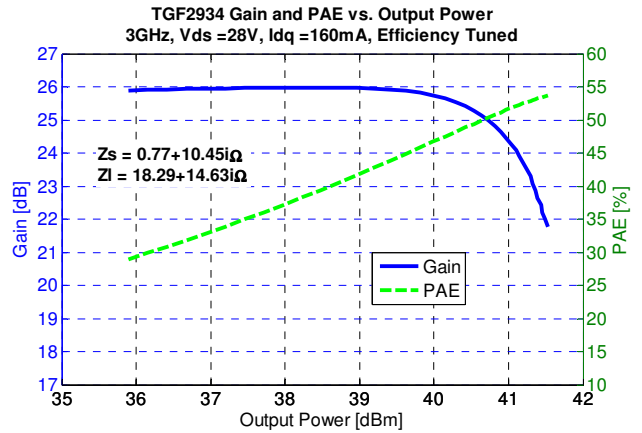
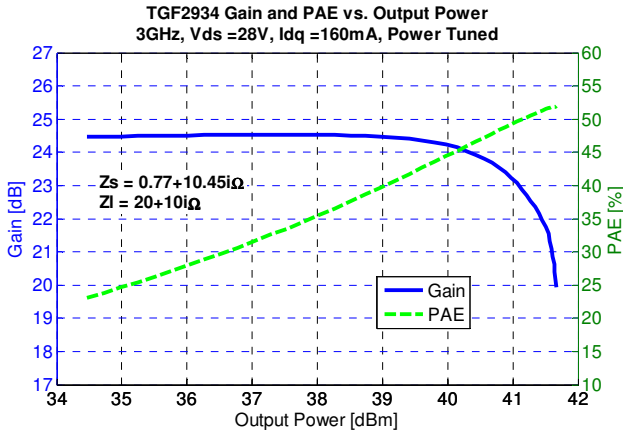
1. CW, Bondwires not included
2. See page 22 for load-pull and source-pull reference planes where the performance was measured.



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

Notes:

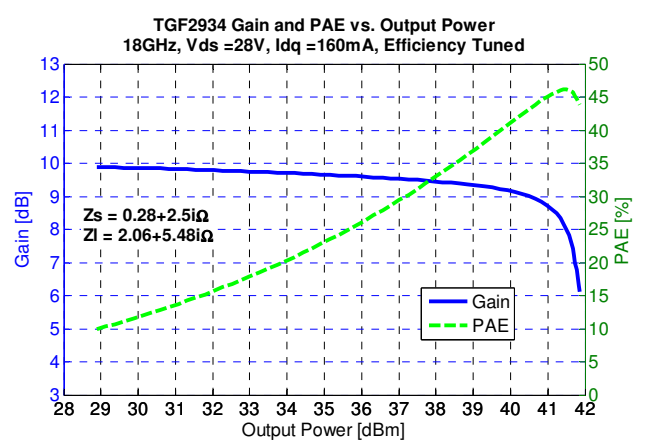
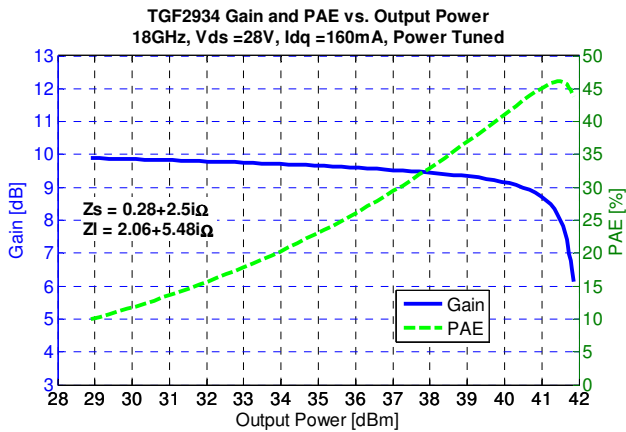
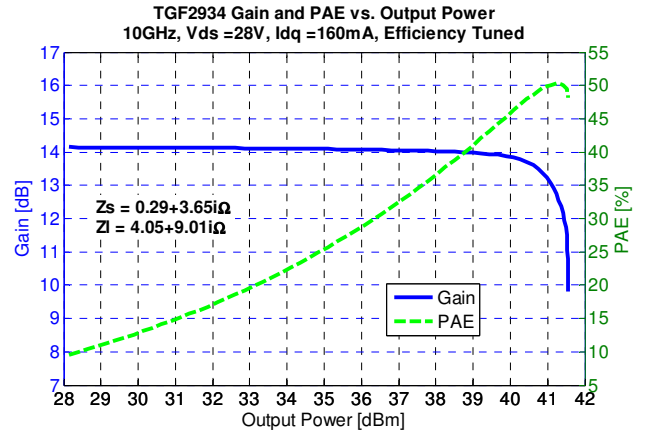
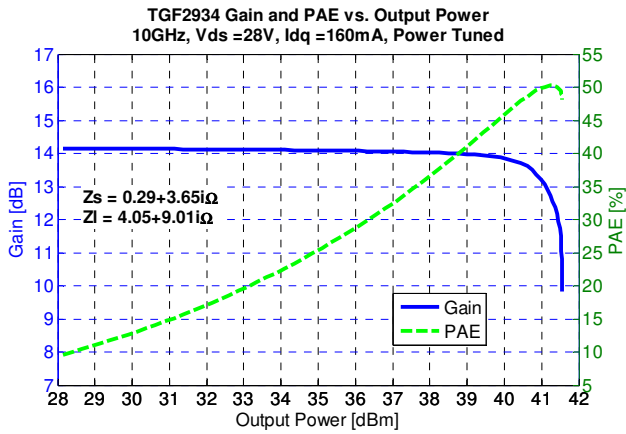
1. CW, Bondwires not included
2. See page 22 for load-pull and source-pull reference planes where the performance was measured.



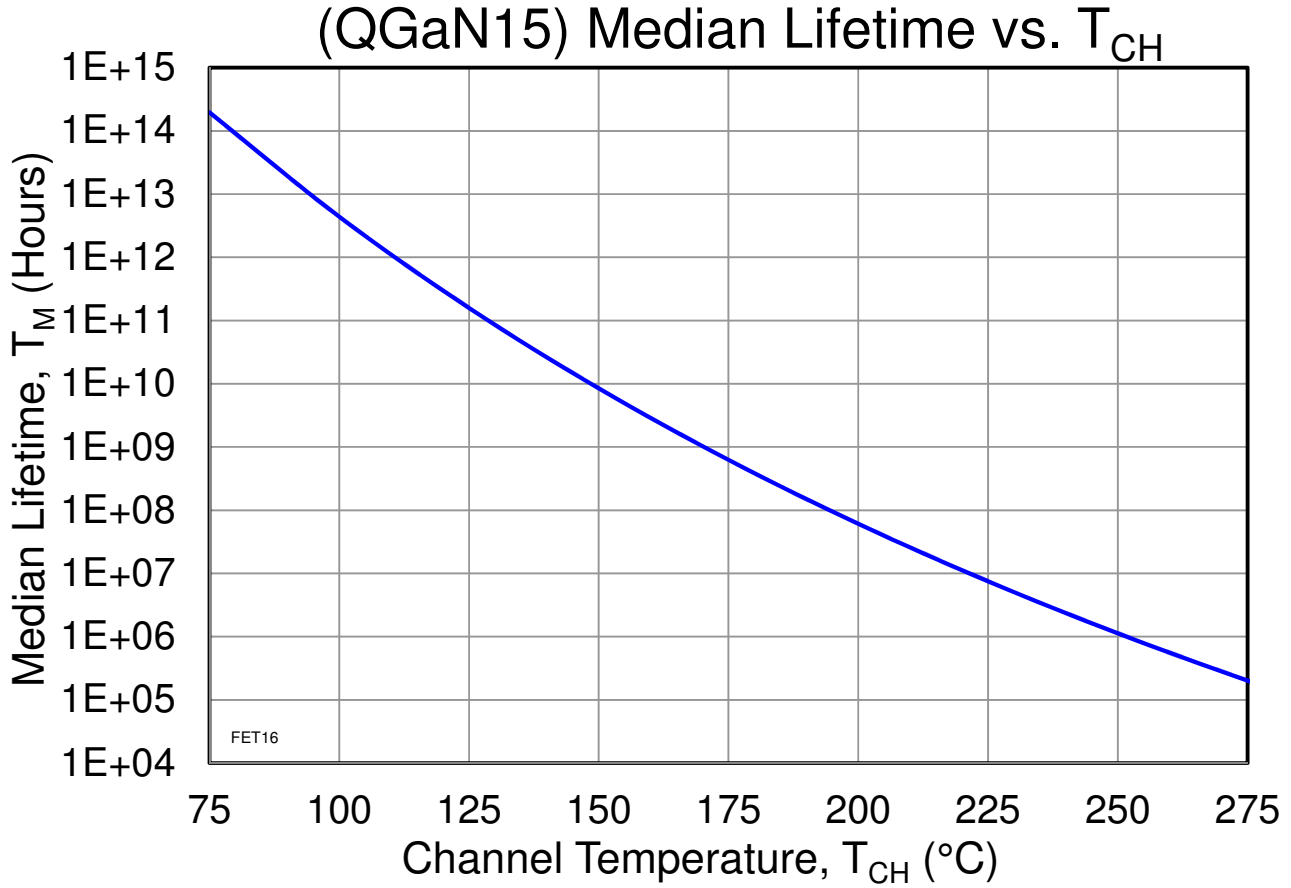
Typical Model Performance – Load-Pull Drive-up^{1,2}

Notes:

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



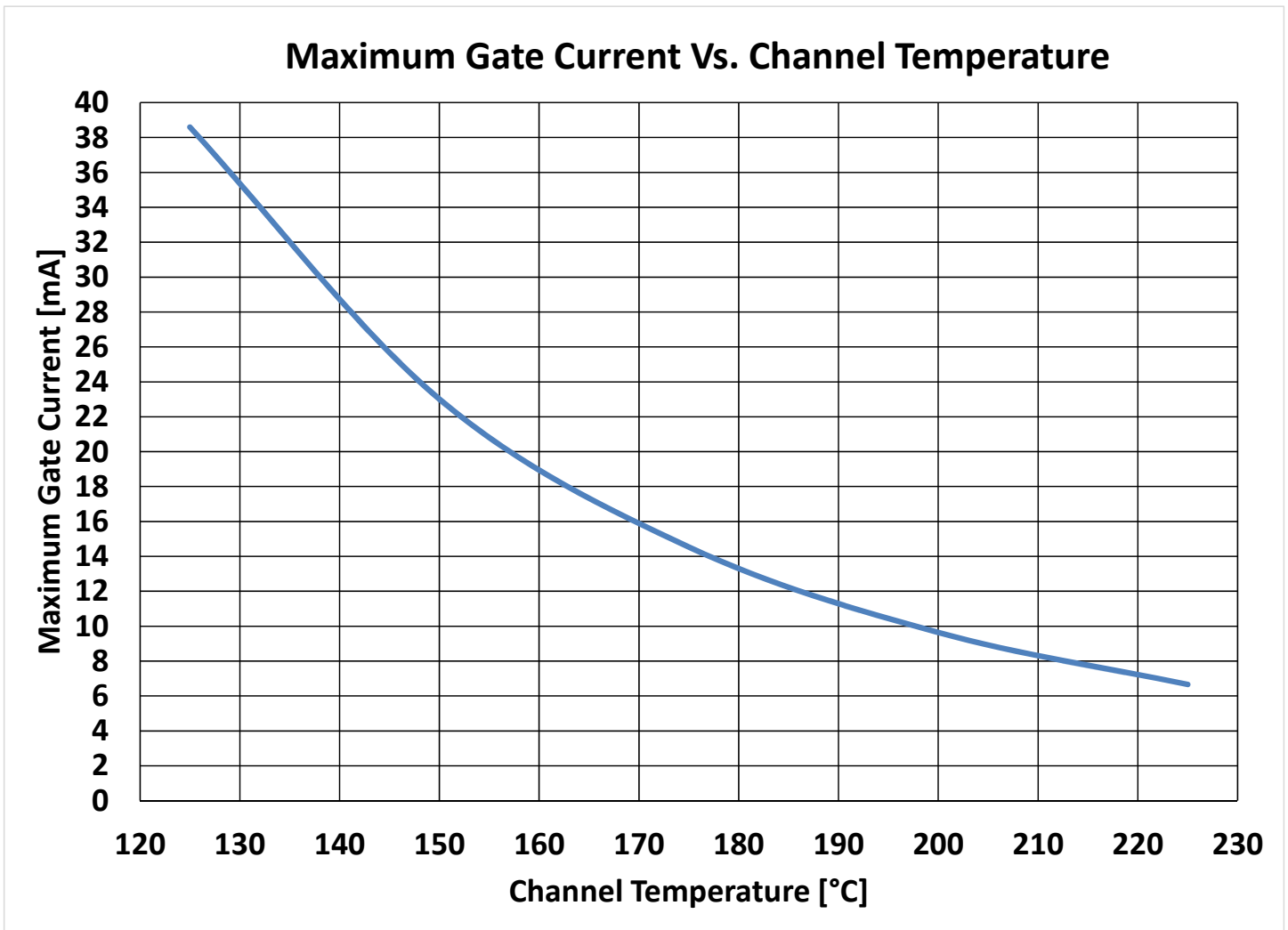
Median Lifetime¹



Notes:

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

Maximum Gate Current

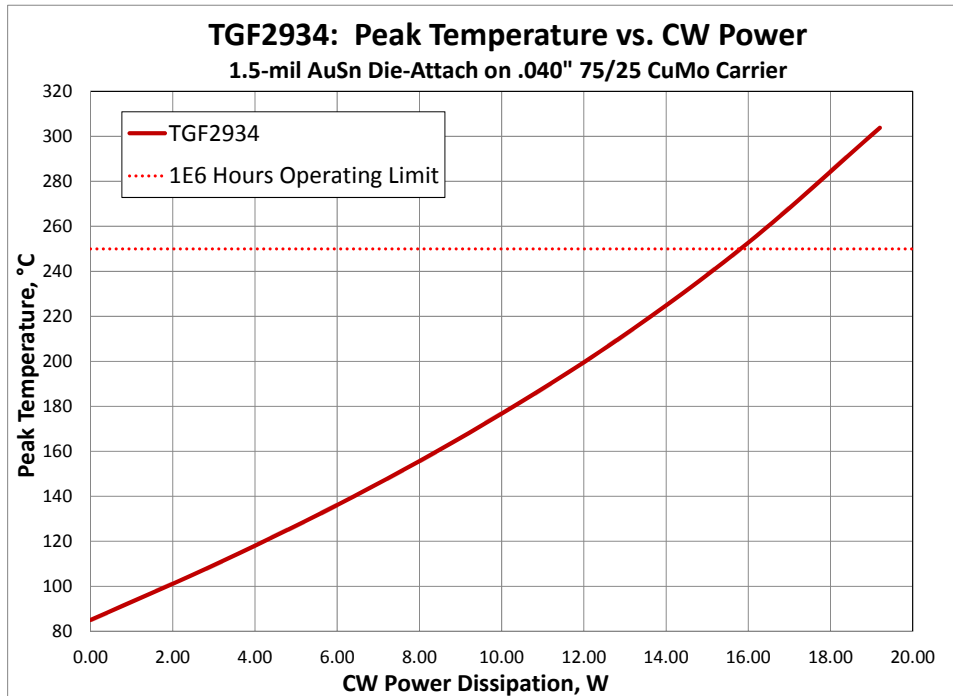


Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance, θ_{JC} ⁽¹⁾	CW	8.1	°C/W
Channel Temperature, T_{CH}	$T_{baseplate} = +85$ °C	111	°C
Median Lifetime, T_M	$P_{DISS} = 3.2$ W	9.7E11	Hrs
Thermal Resistance, θ_{JC} ⁽¹⁾	CW	8.6	°C/W
Channel Temperature, T_{CH}	$T_{baseplate} = +85$ °C	140	°C
Median Lifetime, T_M	$P_{DISS} = 6.4$ W	2.6E10	Hrs
Thermal Resistance, θ_{JC} ⁽¹⁾	CW	9.1	°C/W
Channel Temperature, T_{CH}	$T_{baseplate} = +85$ °C	172	°C
Median Lifetime, T_M	$P_{DISS} = 9.6$ W	8.4E8	Hrs
Thermal Resistance, θ_{JC} ⁽¹⁾	CW	9.7	°C/W
Channel Temperature, T_{CH}	$T_{baseplate} = +85$ °C	209	°C
Median Lifetime, T_M	$P_{DISS} = 12.8$ W	2.8E7	Hrs
Thermal Resistance, θ_{JC} ⁽¹⁾	CW	10.5	°C/W
Channel Temperature, T_{CH}	$T_{baseplate} = +85$ °C	253	°C
Median Lifetime, T_M	$P_{DISS} = 16$ W	9.1E5	Hrs
Thermal Resistance, θ_{JC} ⁽¹⁾	CW	11.4	°C/W
Channel Temperature, T_{CH}	$T_{baseplate} = +85$ °C	304	°C
Median Lifetime, T_M	$P_{DISS} = 19.2$ W	3.3E4	Hrs

Notes:

1. Thermal resistance measured at back of package.



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	Bias-down Procedure
<ol style="list-style-type: none"> 1. Set V_G to -4 V. 2. Set I_D limit to 200 mA. 3. Slowly adjust V_G until I_D reaches 160 mA. 4. Set I_D limit to 1200 mA. 5. Apply RF signal. 	<ol style="list-style-type: none"> 1. Turn off RF signal. 2. Turn off V_D and wait 1 second to allow drain capacitor discharge. 3. Turn of 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:

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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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