TGF2929-FS
100W, 28V, DC–3.5 GHz, GaN RF Power Transistor

Product Overview

The Qorvo TGF2929-FS is a 107 W (P3dB) discrete GaN on SiC HEMT which operates from DC to 3.5 GHz. The device 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.

Lead-free and ROHS compliant.

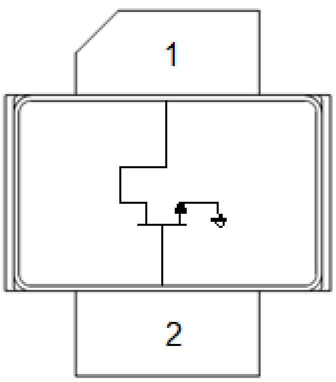
Evaluation boards are available upon request.

Key Features

- Frequency: DC to 3.5 GHz
- Output Power (P_{3dB})[1]: 107 W
- Linear Gain[1]: 17 dB
- Typical $DEff_{3dB}$[1]: 60.8%
- Operating Voltage: 28 V
- Low thermal resistance package
- Pulse capable

Note 1: @ 3.5 GHz

Functional Block Diagram



Applications

- Military radar
- Civilian radar
- Professional and military radio communications
- Test instrumentation
- Wideband or narrowband amplifiers
- Jammers

Part No.	Description
TGF2929-FS	DC–3.5 GHz RF Power Transistor
TGF2929-FSEVB01	3.1 – 3.5 GHz Evaluation Board

Absolute Maximum Ratings[1]

Parameter	Rating	Units
Breakdown Voltage, BV_{DG}	+145	V
Gate Voltage Range, V_G	-7 to +2	V
Drain Current	12	A
Gate Current Range, I_G	See page 4.	mA
Power Dissipation, 20% DC 500 uS PW, P_{DISS}, T = 85°C	144	W
RF Input Power, CW, T = 25 °C	+39.8	dBm
Mounting Temperature (30 Seconds)	320	°C
Storage Temperature	−65 to +150	°C

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

Recommended Operating Conditions[1]

Parameter	Min	Typ	Max	Units
Operating Temp. Range	−40	+25	+85	°C
Drain Voltage Range, V_D	+12	+28	+50	V
Drain Bias Current, I_{DQ}	–	260	–	mA
Peak Drain Current, I_D[3]	–	7.2	–	A
Gate Voltage, V_G[4]	–	−2.7	–	V
Power Dissipation, CW (P_D)[2]	–	–	82	W
Power Dissipation, Pulsed (P_D)[2, 3]	–	–	140	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 °C
3. Pulse Width = 100 uS, Duty Cycle = 20%
4. To be adjusted to desired I_{DQ}

Pulsed Characterization – Load-Pull Performance – Power Tuned[1]

Parameters	Typical Values				Unit
Frequency, F	1.0	2.0	3.0	3.5	GHz
Linear Gain, G_{LIN}	21.2	16.7	15.6	15.8	dB
Output Power at 3dB compression point, P_{3dB}	100	132	120	107	W
Drain Efficiency at 3dB compression point, $DEff_{3dB}$	61.0	60.4	57.6	54.4	%
Gain at 3dB compression point	18.2	13.7	12.6	12.8	dB

Notes:
1. Test conditions unless otherwise noted: V_D = +28 V, I_{DQ} = 260 mA, Temp = +25 °C

Pulsed Characterization – Load-Pull Performance – Efficiency Tuned[1]

Parameters	Typical Values				Unit
Frequency, F	1.0	2.0	3.0	3.5	GHz
Linear Gain, G_{LIN}	22.3	17.2	16.9	17.0	dB
Output Power at 3dB compression point, P_{3dB}	47.8	50.1	49.8	48.9	W
Drain Efficiency at 3dB compression point, $DEff_{3dB}$	76.6	66.9	68.3	60.8	%
Gain at 3dB compression point, G_{3dB}	19.3	14.2	13.9	14.0	dB

Notes:
1. Test conditions unless otherwise noted: V_D = +28 V, I_{DQ} = 260 mA, Temp = +25 °C

RF Characterization – 3.1 – 3.5 GHz EVB Performance At 3.3 GHz[1]

Parameter	Min	Typ	Max	Units
Linear Gain, G_{LIN}	–	15.0	–	dB
Output Power at 3dB compression point, P_{3dB}	–	106	–	W
Power-Added Efficiency at 3dB compression point, PAE_{3dB}	–	51.3	–	%
Gain at 3dB compression point, G_{3dB}	–	12.0	–	dB

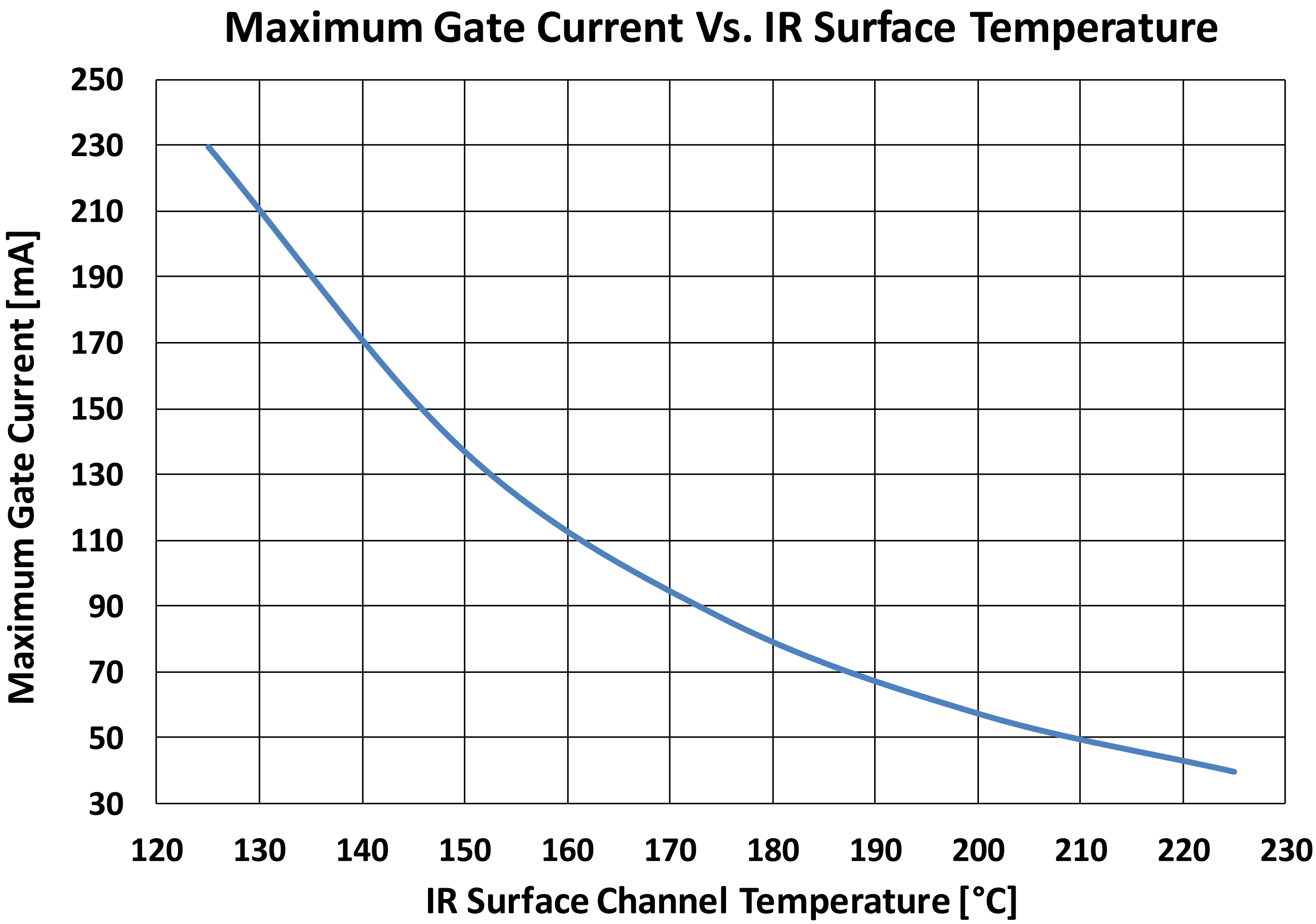
Notes:
1. V_D = +28 V, I_{DQ} = 260 mA, Temp = +25 °C, 100 µS, 20%

RF Characterization – Mismatch Ruggedness at 3.5 GHz[1]

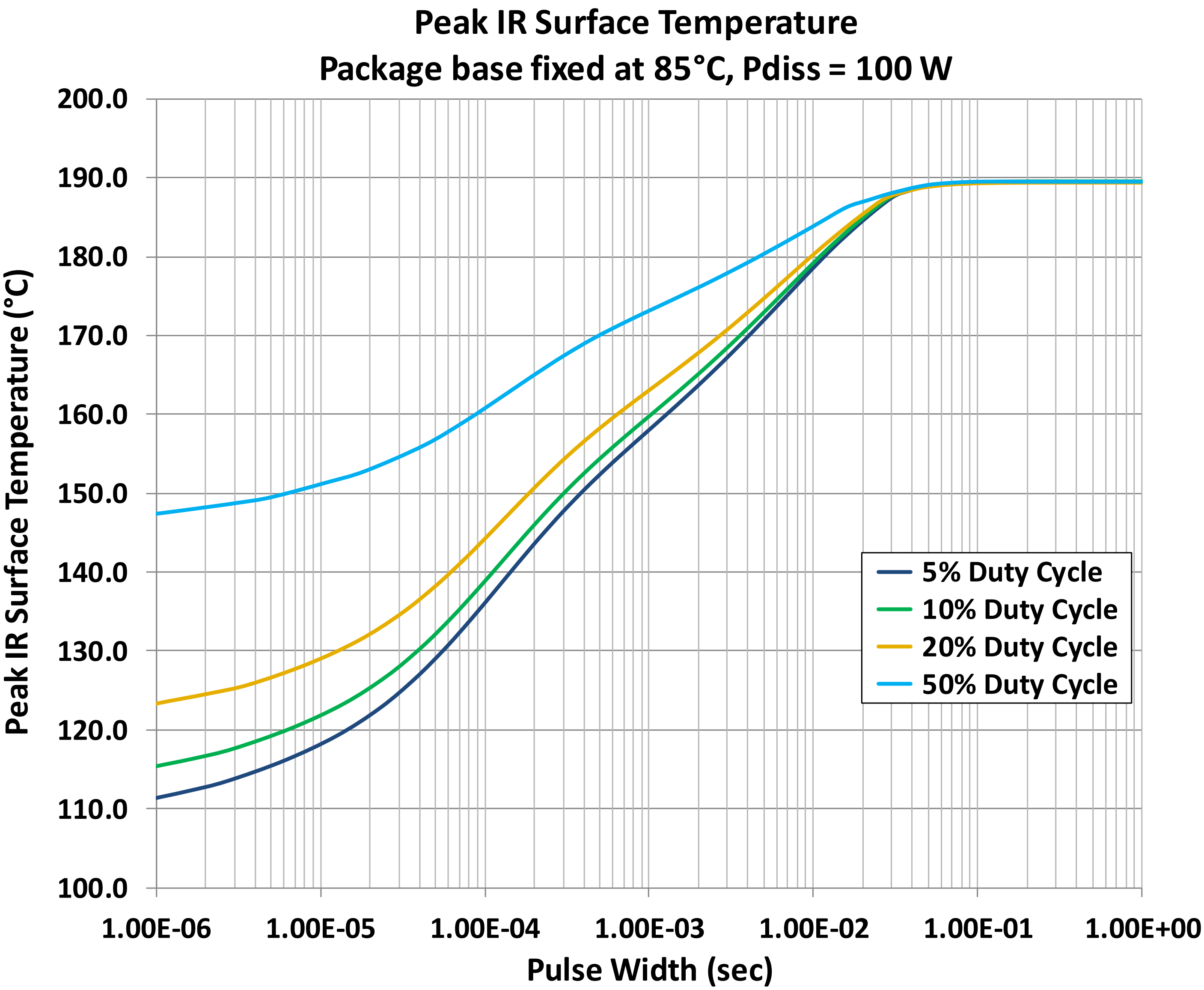
Symbol	Parameter	dB Compression	Typical
VSWR	Impedance Mismatch Ruggedness	3	10:1

Notes:
1. Test conditions unless otherwise noted: T_A = 25 °C, V_D = 28 V, I_{DQ} = 260 mA, 100 µS PW, 20% DC
2. Driving input power is determined at pulsed compression under matched condition at EVB output connector.

Maximum Gate Current



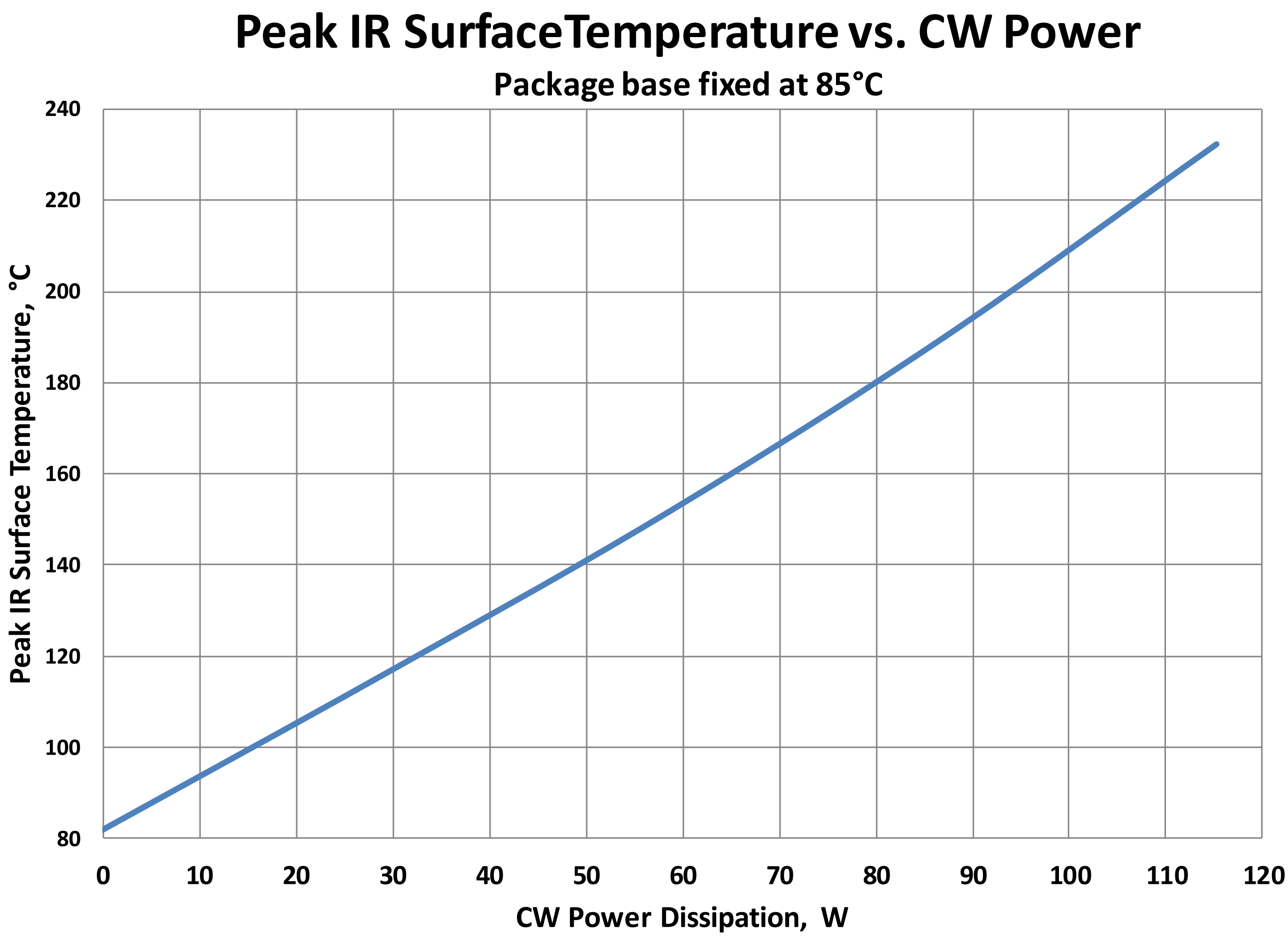
Thermal and Reliability Information – Pulsed



Parameter[1]	Conditions	Values	Units
Thermal Resistance, IR (θ_{JC})	85 °C back side temperature	0.73	°C/W
Peak IR Surface Temperature (T_{CH})	100 W Pdiss, 1 mS PW, 5% DC	158	°C
Thermal Resistance, IR (θ_{JC})	85 °C back side temperature	0.75	°C/W
Peak IR Surface Temperature (T_{CH})	100 W Pdiss, 1 mS PW, 10% DC	160	°C
Thermal Resistance, IR (θ_{JC})	85 °C back side temperature	0.78	°C/W
Peak IR Surface Temperature (T_{CH})	100 W Pdiss, 1 mS PW, 20% DC	163	°C
Thermal Resistance, IR (θ_{JC})	85 °C back side temperature	0.88	°C/W
Peak IR Surface Temperature (T_{CH})	100 W Pdiss, 1 mS PW, 25% DC	173	°C

[1]Refer to the following document GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates

Thermal and Reliability Information – CW



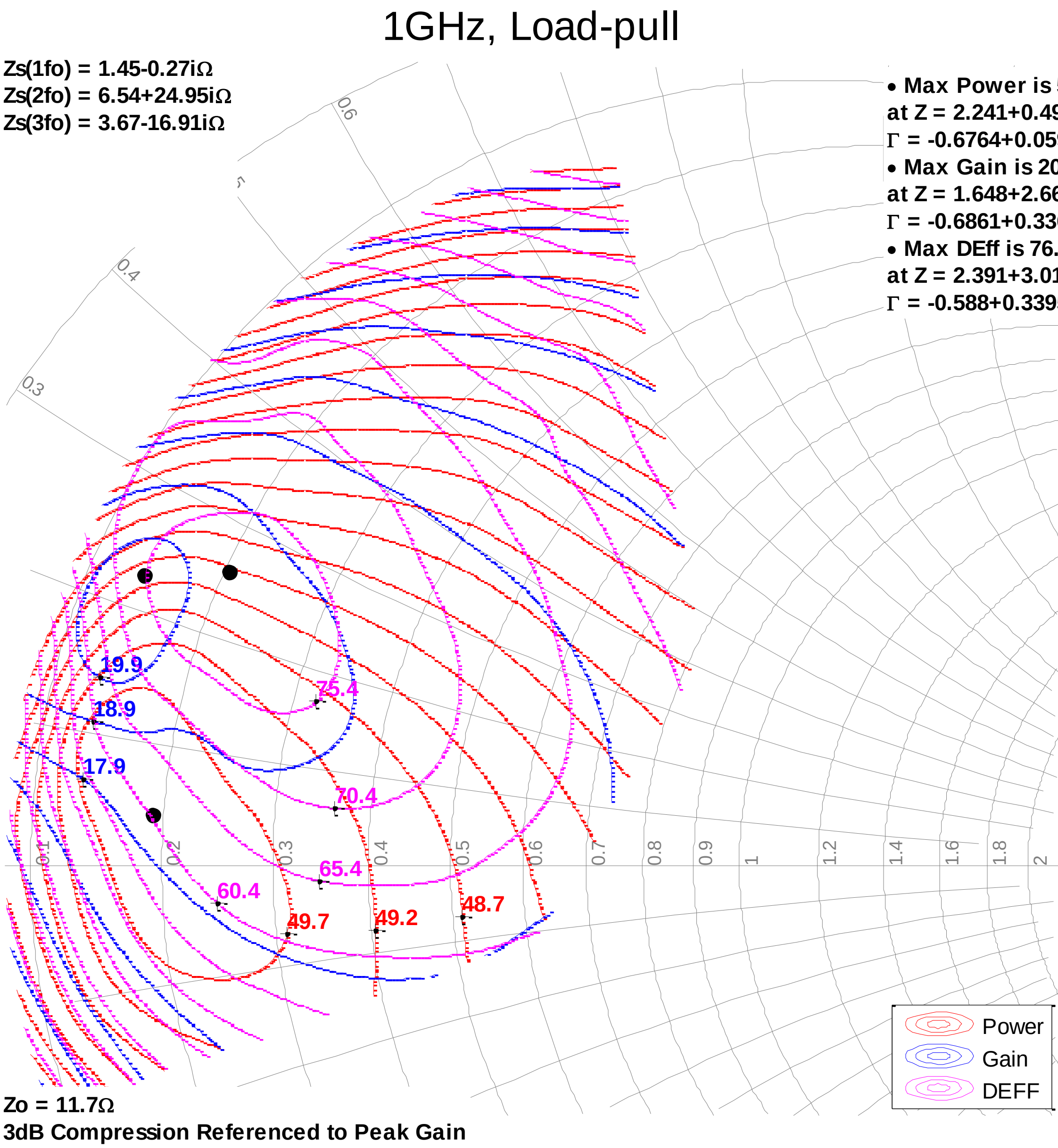
Parameter[1]	Conditions	Values	Units
Thermal Resistance, IR (θ_{JC})	85 °C back side temperature	1.08	°C/W
Peak IR Surface Temperature (T_{CH})	28.8 W Pdiss	116	°C
Thermal Resistance, IR (θ_{JC})	85 °C back side temperature	1.15	°C/W
Peak IR Surface Temperature (T_{CH})	57.6 W Pdiss	151	°C
Thermal Resistance, IR (θ_{JC})	85 °C back side temperature	1.20	°C/W
Peak IR Surface Temperature (T_{CH})	86.4 W Pdiss	189	°C
Thermal Resistance, IR (θ_{JC})	85 °C back side temperature	1.28	°C/W
Peak IR Surface Temperature (T_{CH})	115 W Pdiss	232	°C

[1]Refer to the following document GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates

Load-Pull Smith Charts[1, 2]

Notes:

1. V_D = 28 V, I_{DQ} = 260 mA, 100 µS PW, 20% DC pulsed. Performance is at 3dB gain compression referenced to peak gain.
2. See page 15 for load-pull and source-pull reference planes. 11.7-Ω load-pull TRL fixtures are built with 20-mil RO4350B material.



Load-Pull Smith Charts[1, 2]

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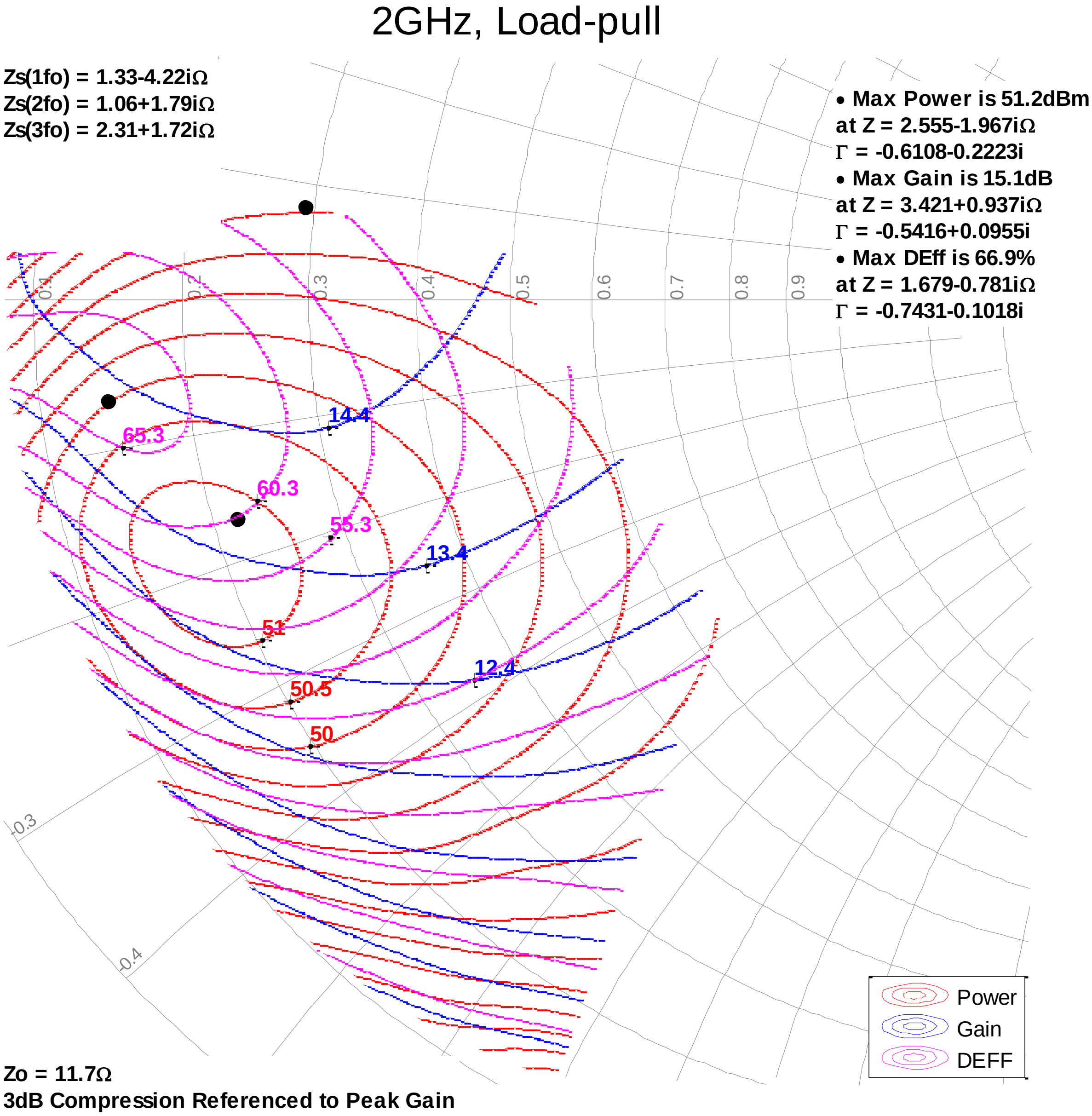

Load-Pull Smith Charts[1, 2]

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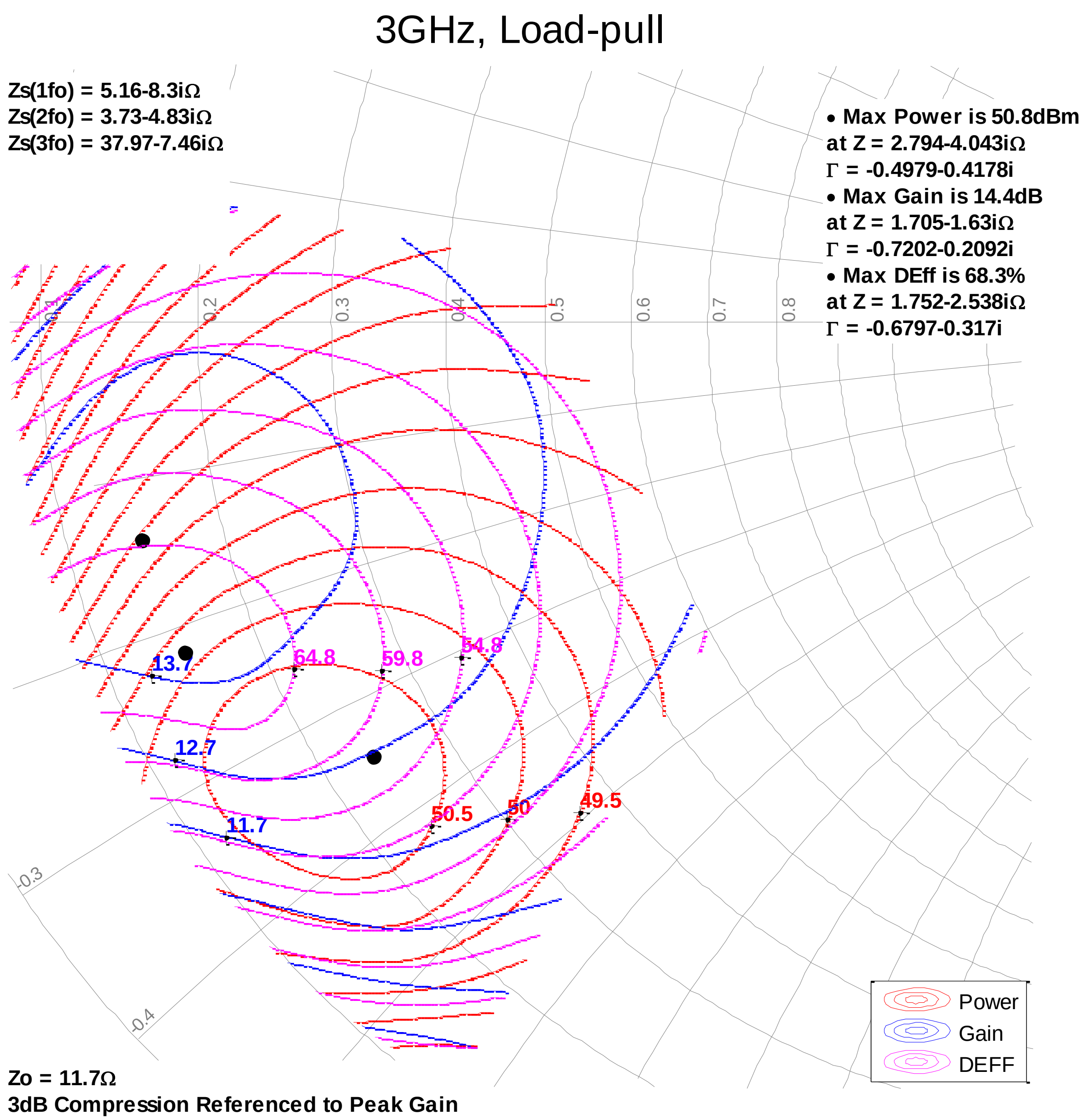
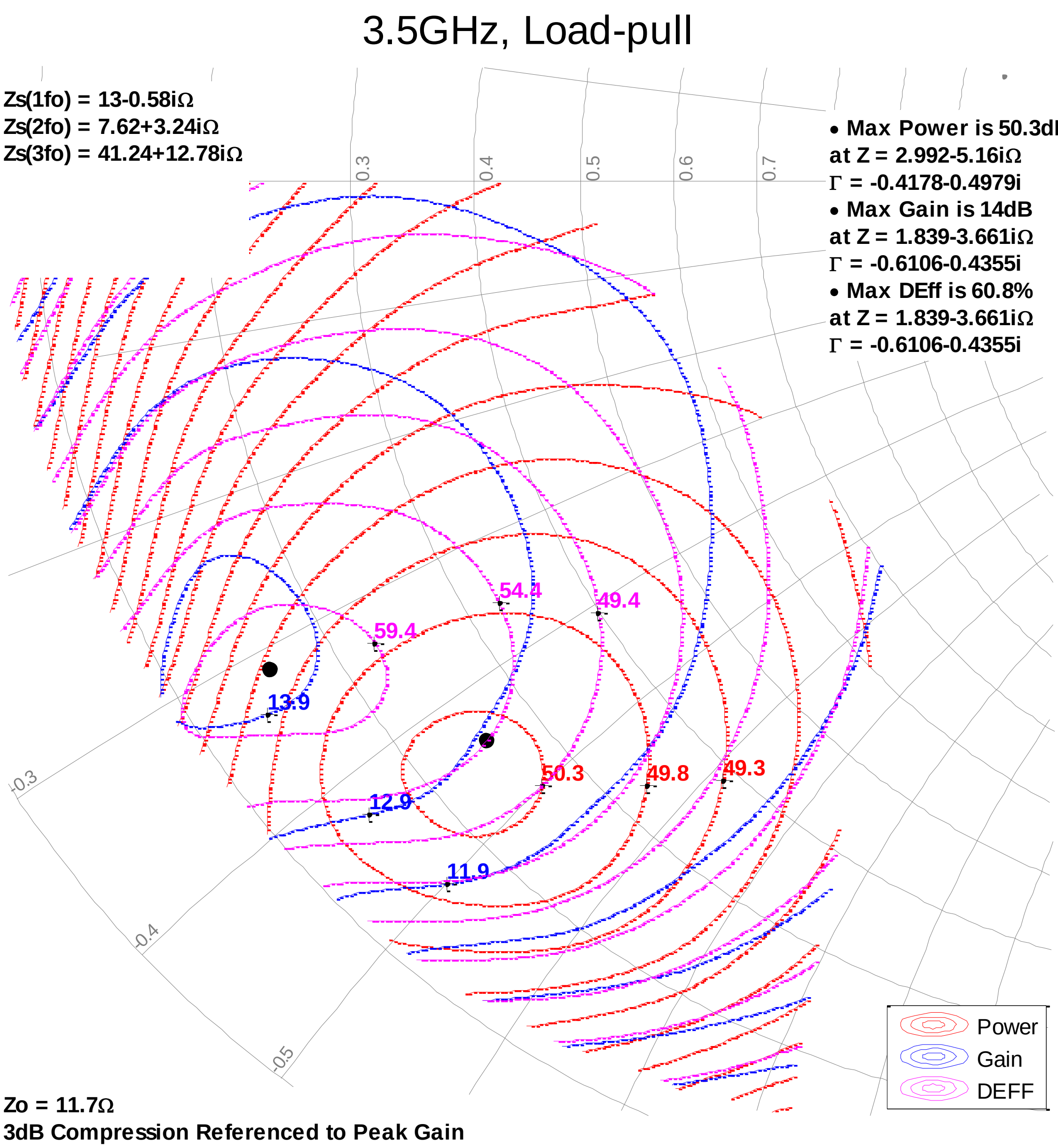


Load-Pull Smith Charts[1, 2]

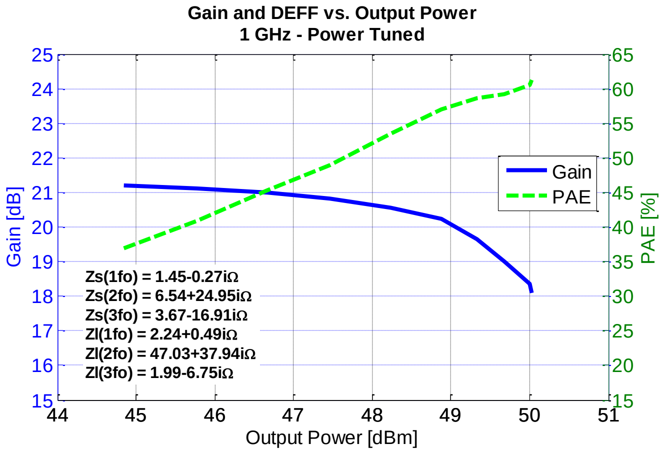
Notes:

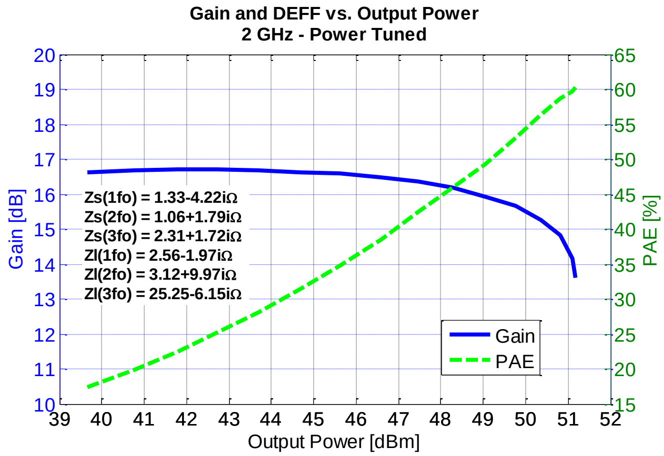
3. V_D = 28 V, I_{DQ} = 260 mA, 100 µS PW, 20% DC pulsed. Performance is at 3dB gain compression referenced to peak gain.
4. See page 15 for load-pull and source-pull reference planes. 11.7-Ω load-pull TRL fixtures are built with 20-mil RO4350B material.

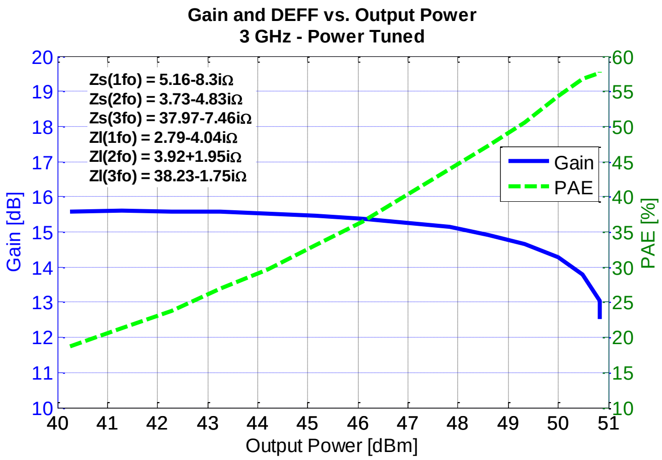


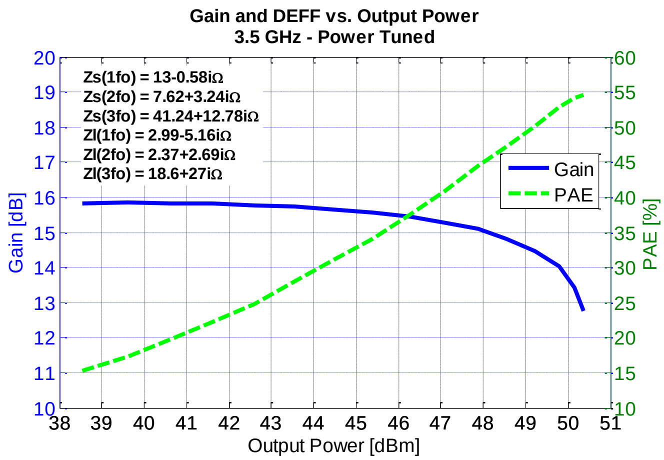
Typical Performance – Load-Pull Drive-up[1, 2]

Notes:
1. 100 µS PW, 20% DC pulsed signal, V_D = 28 V, I_{DQ} = 260 mA
2. See page 15 for load-pull and source-pull reference planes where the performance was measured.





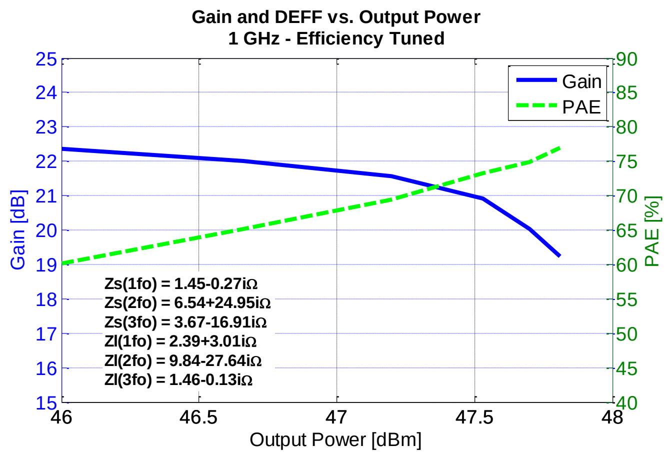


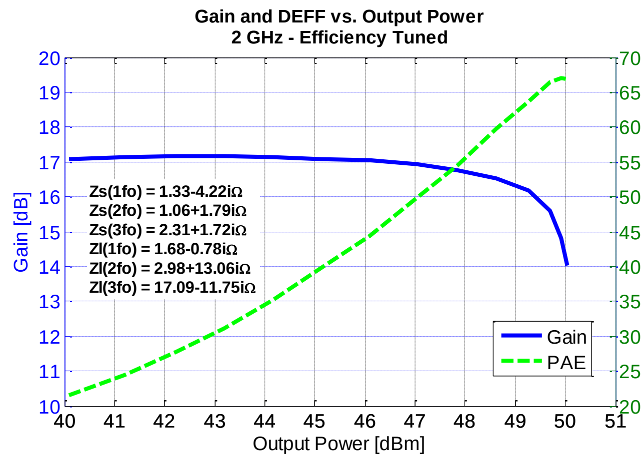


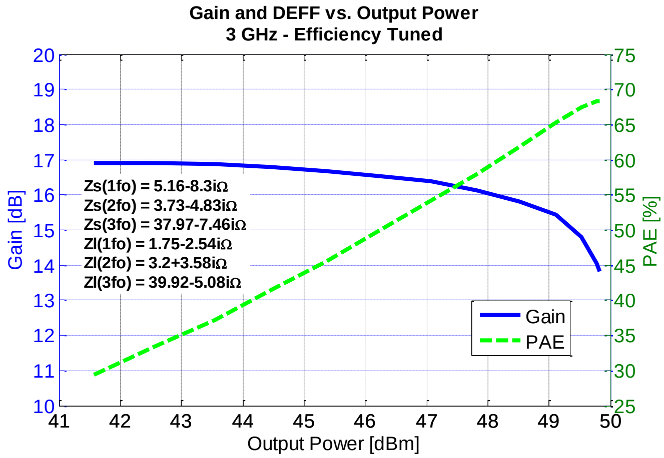
Typical Performance – Load-Pull Drive-up[1, 2]

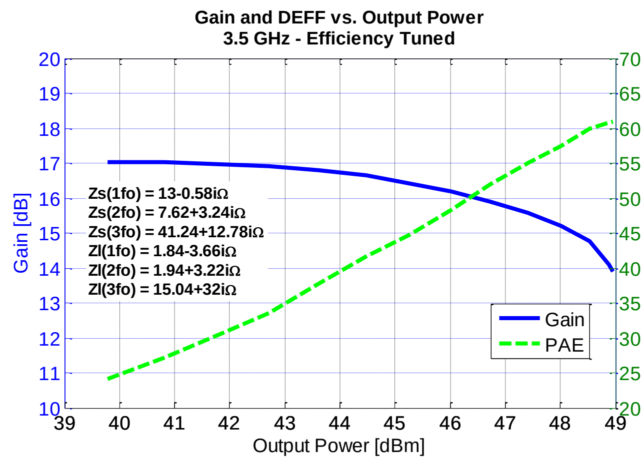
Notes:

1. 100 µS PW, 20% DC pulsed signal, V_D = 28 V, I_{DQ} = 260 mA
2. See page 15 for load-pull and source-pull reference planes where the performance was measured.





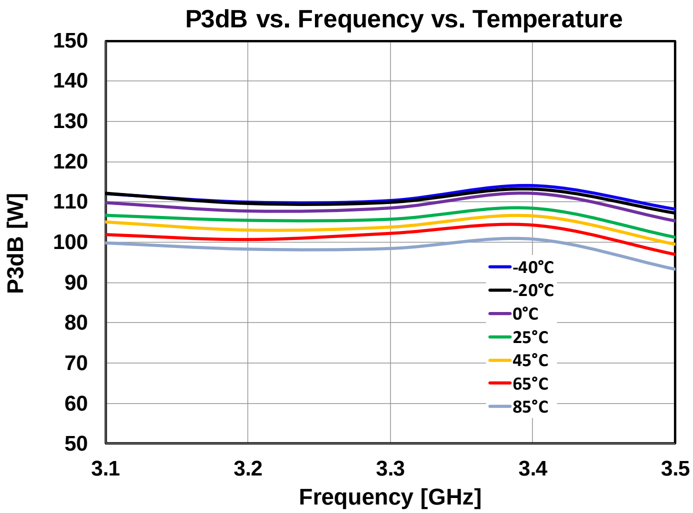


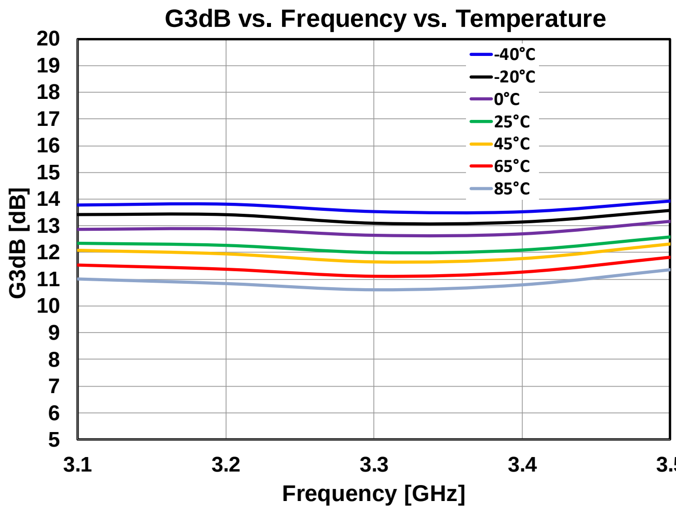


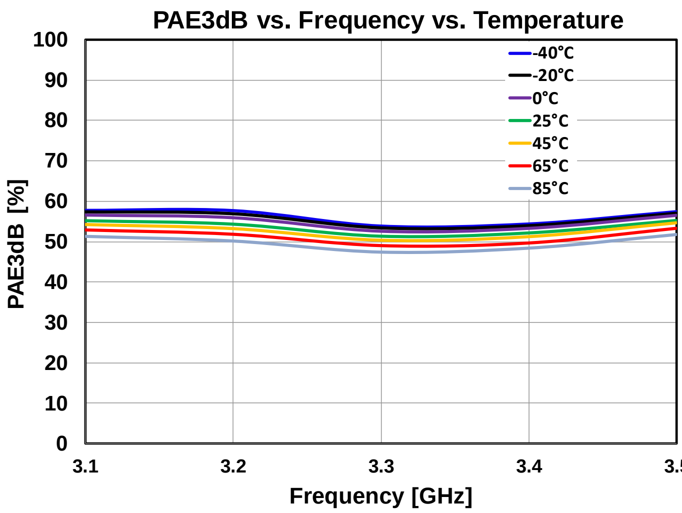
Power Drive-up Performance Over Temperatures Of 3.1 – 3.5 GHz EVB[1]

Notes:

1. V_D = 28 V, I_{DQ} = 260 mA, 100 µS PW, 20% DC



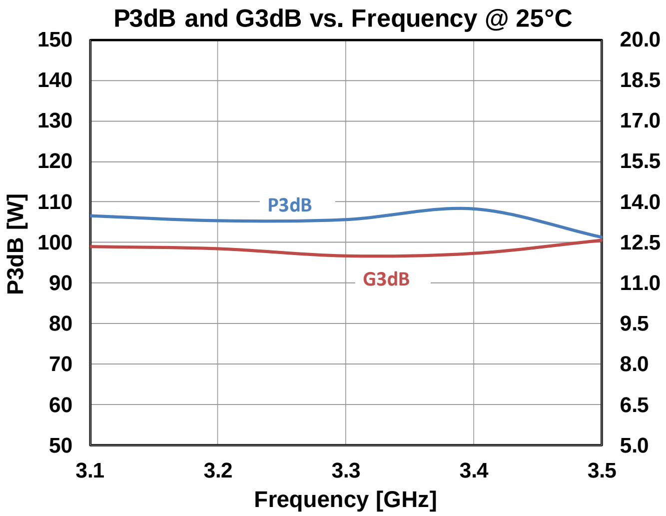


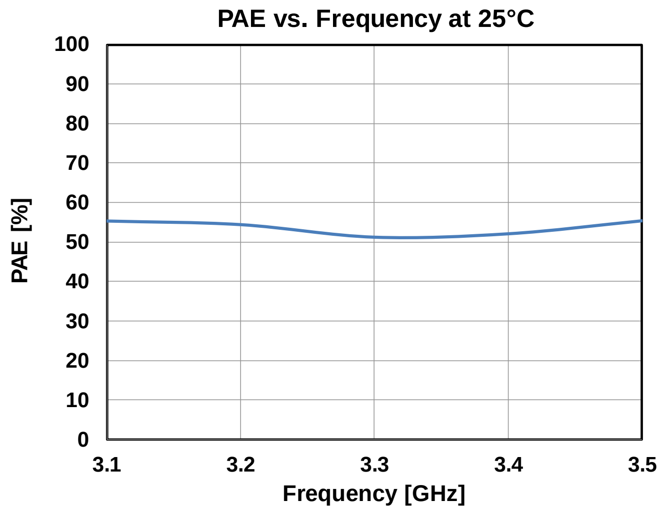


Power Drive-up Performance At 25 °C Of 3.1 – 3.5 GHz EVB[1]

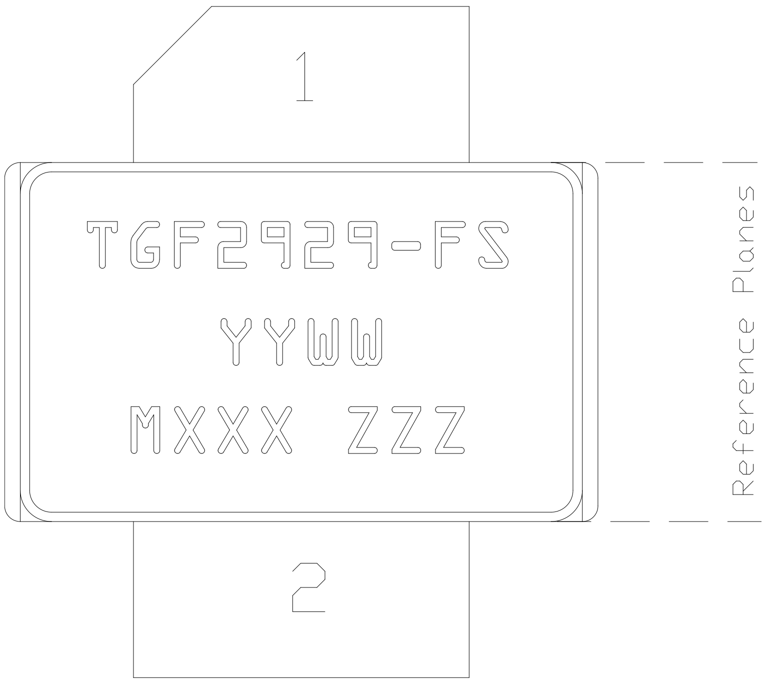
Notes:

1. V_D = 28 V, I_{DQ} = 260 mA, 100 µS PW, 20% DC





Pin Configuration and Description, and Package Marking[1]



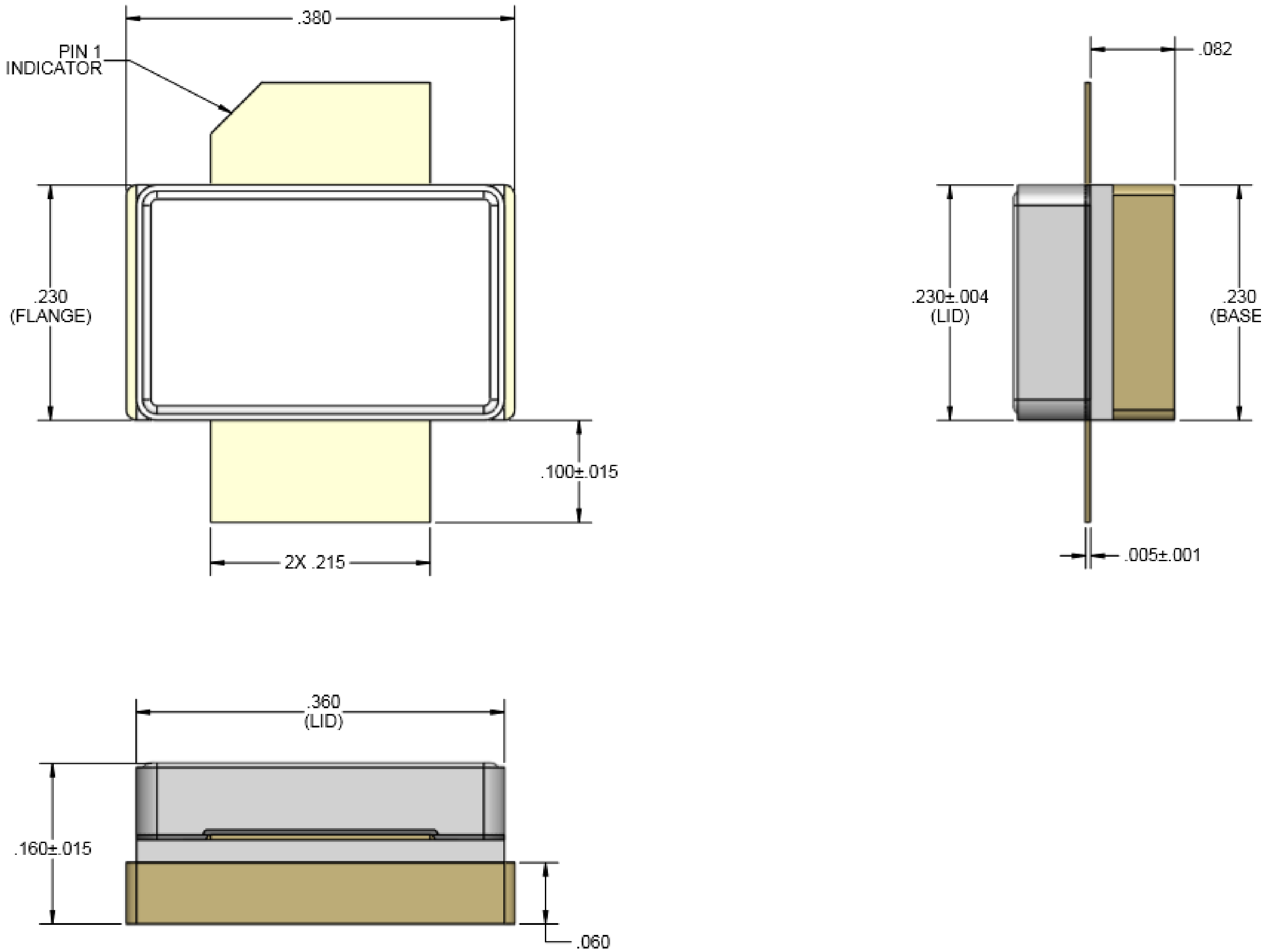
Notes:

1. The TGF2929-FS will be marked with the "TGF2929-FS" 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, the "MXXX" is the production lot number, and the "ZZZ" is an auto-generated serial number represents the last three digits of the calendar year the part was manufactured, the "WW" is the work week of the assembly lot start, the "MXXX" is the production lot number.

Pin Description

Pin	Symbol	Description
1	V_D / RF OUT	Drain voltage / RF Output
2	V_G / RF IN	Gate voltage / RF Input
3	Base	Source connected to ground

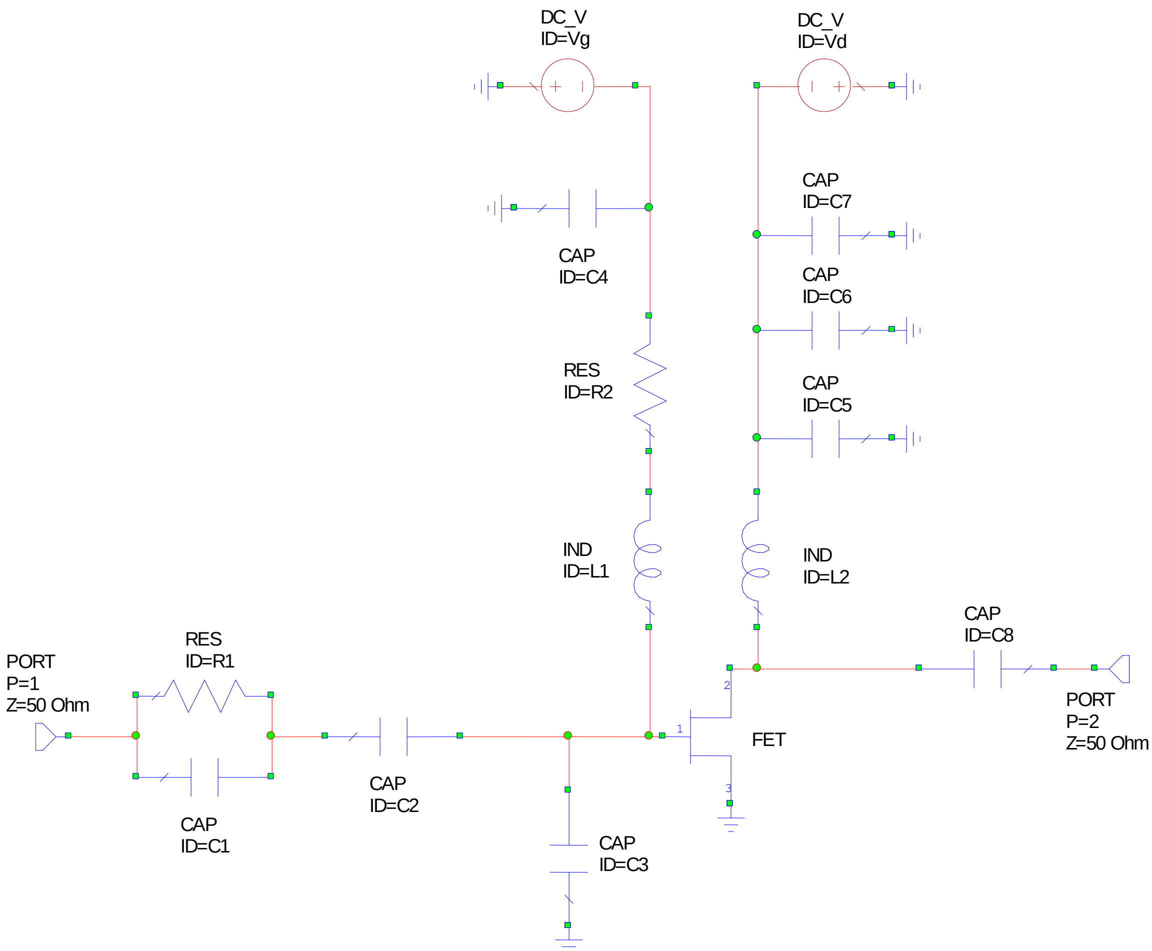
Package Dimensions[1, 2, 3, 4]



Notes:

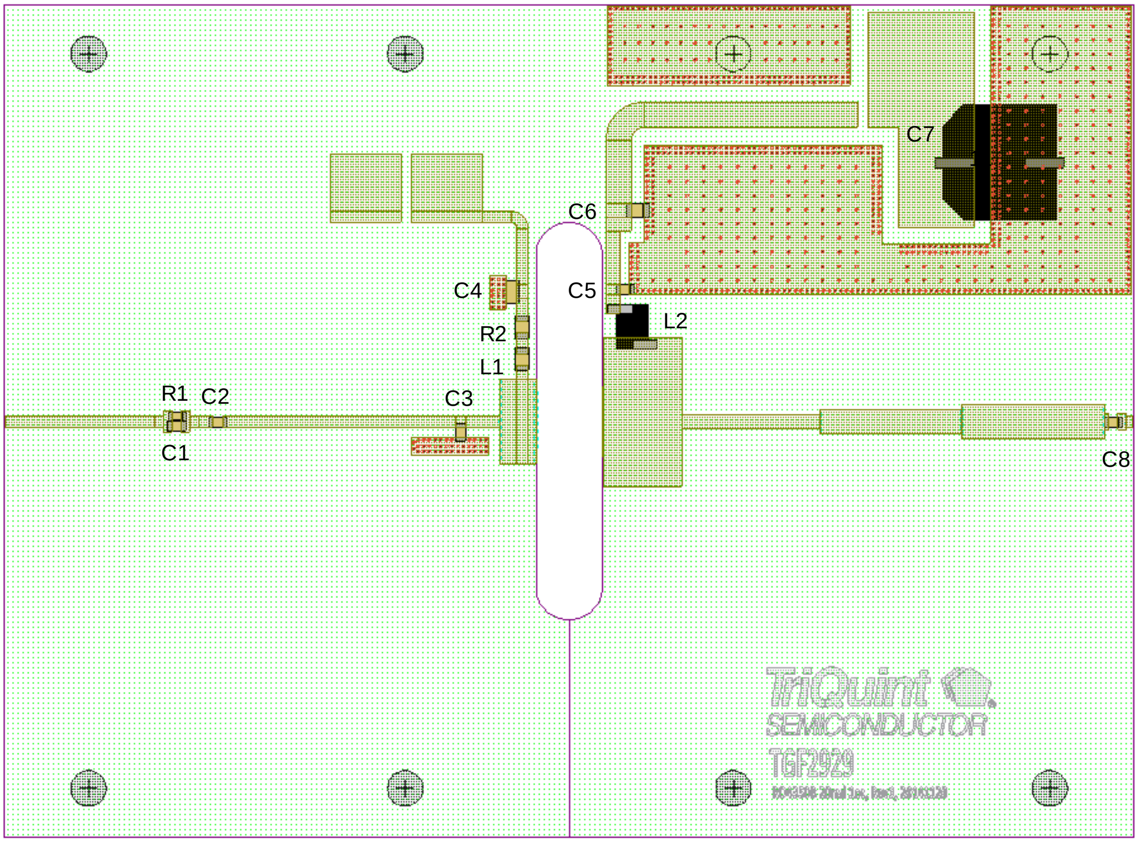
1. Unless otherwise noted, the tolerance is ±0.005 inch.
2. Package metal base and leads are gold plated.
3. Part is epoxy sealed.
4. Part meets Industry NI360 footprint.

Schematic – 3.1 – 3.5 GHz EVB



Bias-up Procedure	Bias-down Procedure
1. Set V_G to -4 V.	1. Turn off RF signal.
2. Set I_D current limit to 300 mA.	2. Turn off V_D
3. Apply 28 V V_D.	3. Wait 2 seconds to allow drain capacitor to discharge
4. Slowly adjust V_G until I_D is set to 260 mA.	4. Turn off V_G
5. Set I_D current limit to 2 A	
6. Apply RF.	

3.1 – 3.5 GHz EVB[1]



Notes:
1. PCB Material: RO4350B, 20 mil thickness, 1 oz copper cladding

Bill Of material – 3.1 – 3.5 GHz EVB

Ref Des	Value	Qty	Manufacturer	Part Number
R1	100 Ω	1	Vishay/Dale	CRCW0603100RJNEA
C1, C2	5.6 pF	2	ATC	600S5R6BT
C3	1.0 pF	1	ATC	600S1R0BT
L1	22 nH	1	Coilcraft	0805CS-220X-LB
R2	10 Ω	1	Vishay/Dale	CRCW060310R0JNEA
C4	10 uF	1	Murata	C1632X5R0J106M130AC
L2	12 nH	1	Coilcraft	A04T_L
C5	2400 pF	1	Murata	C08BL242X-5UN-X0T
C6	1000 pF	1	ATC	800B102JT50XT
C7	220 uF	1	United Chemi-Con	EMVY500ADA221MJA0G
C8	15 pF	1	ATC	600S150JT250XT

Recommended Solder Temperature Profile