

Product Overview

The Qorvo QPD1025 is a 1800 W (P_{3dB}) discrete GaN on SiC HEMT which operates from 0.96 to 1.215 GHz. Input pre-match within the package results in ease of external board match and saves board space. The device is in an industry standard air cavity package and is ideally suited for IFF, avionics and test instrumentation. The device can support both CW and pulsed operations.

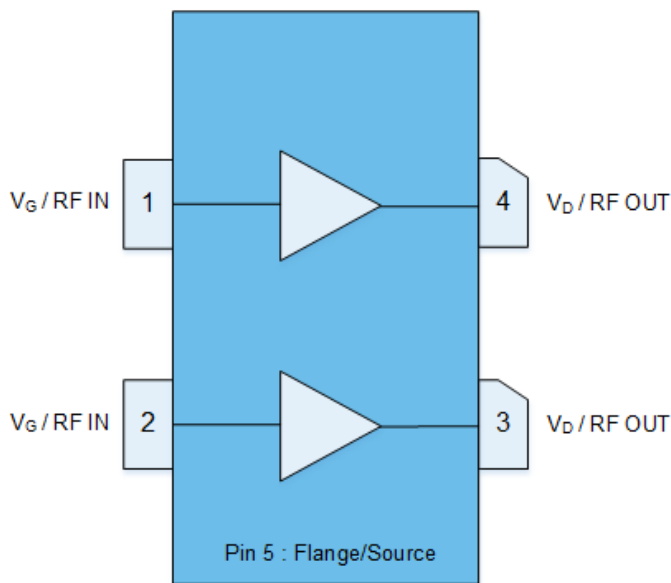
RoHS compliant

Evaluation boards are available upon request.



4-lead NI-1230 Package (Earless)

Functional Block Diagram



Key Features

- Frequency: 0.96 to 1.215 GHz
- Output Power (P_{3dB})¹: 1862 W
- Linear Gain¹: 22.5 dB
- Typical PAE_{3dB}¹: 77.2%
- Operating Voltage: 65 V
- CW and Pulse capable

Note 1: @ 1.0 GHz Load Pull

Applications

- IFF Transponders
- DME radar
- Avionics

Ordering info

Part No.	Description
QPD1025	1.0 – 1.1 GHz Transistor
QPD1025S2	2 Piece Sample Bag
QPD1025EVB1	1.0 – 1.1 GHz Evaluation Board
QPD1025EVB2	0.96 – 1.215 GHz Evaluation Board



Absolute Maximum Ratings ^{1, 2, 3}

Parameter	Rating	Units
Breakdown Voltage, BV_{DG}	225	V
Gate Voltage Range, V_G	-7 to +2	V
Drain Current, $I_{D_{MAX}}$	142	A
Gate Current Range, I_G	See pg. 12	mA
Power Dissipation, Pulsed, P_{DISS}^2	758	W
RF Input Power, Pulsed, P_{IN}^3	46.2	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
2. Pulsed, 1000us PW, 20% DC, Package base at 85 °C
3. Pulsed, 100us PW, 10% DC, T = 25 °C

Recommended Operating Conditions ^{1, 2, 3, 4}

Parameter	Min	Typ	Max	Units
Operating Temp. Range	-40	+25	+85	°C
Drain Voltage Range, V_D	-	+65	+70	V
Drain Bias Current, I_{DQ}		1.5		A
Drain Current, I_D^4	-	28	-	A
Gate Voltage, V_G^3	-	-2.8	-	V
Power Dissipation (P_D) ^{2,4}	-	-	685	W
Power Dissipation (P_D), CW ²	-	-	496	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. To be adjusted to desired I_{DQ}
4. Pulsed, 1000us PW, 20% DC

Measured Load Pull Performance – 65V Power Tuned ^{1, 2}

Parameter	Typical Values				Units
	0.915	1.0	1.1	1.2	
Frequency, F	0.915	1.0	1.1	1.2	GHz
Output Power at 3dB compression, P_{3dB}	59.9	59.7	59.7	59.8	dBm
Power Added Efficiency at 3dB compression, PAE_{3dB}	63.2	62.8	65.7	61.9	%
Gain at 3dB compression, G_{3dB}	17.9	17.5	17.3	17.2	dB

Notes:

1. Test conditions unless otherwise noted: $T_A = 25\text{ °C}$, $V_D = 65\text{ V}$, $I_{DQ} = 750\text{ mA}$ (half device) Pulsed, 100 us Pulse Width, 10% Duty Cycle.

Measured Load Pull Performance – 65V Efficiency Tuned ^{1, 2}

Parameter	Typical Values				Units
	0.915	1.0	1.1	1.2	
Frequency, F	0.915	1.0	1.1	1.2	GHz
Output Power at 3dB compression, P_{3dB}	57.5	57.7	58.5	58.3	dBm
Power Added Efficiency at 3dB compression, PAE_{3dB}	77.6	77.2	77.0	74.6	%
Gain at 3dB compression, G_{3dB}	19.7	19.5	18.7	19.0	dB

Notes:

1. Test conditions unless otherwise noted: $T_A = 25\text{ °C}$, $V_D = 65\text{ V}$, $I_{DQ} = 750\text{ mA}$ (half device) Pulsed, 100 us Pulse Width, 10% Duty Cycle.

Measured Load Pull Performance – 50V Power Tuned ^{1, 2}

Parameter	Typical Values				Units
	0.915	1.0	1.1	1.2	
Frequency, F	0.915	1.0	1.1	1.2	GHz
Output Power at 3dB compression, P _{3dB}	58.9	58.6	58.5	58.6	dBm
Power Added Efficiency at 3dB compression, PAE _{3dB}	66.8	60.1	66.1	62.6	%
Gain at 3dB compression, G _{3dB}	17.6	17	17	16.8	dB

Notes:

2. Test conditions unless otherwise noted: T_A = 25 °C, V_D = 50 V, I_{DQ} = 750 mA (half device)
Pulsed, 100 us Pulse Width, 10% Duty Cycle.

Measured Load Pull Performance – 50V Efficiency Tuned ^{1, 2}

Parameter	Typical Values				Units
	0.915	1.0	1.1	1.2	
Frequency, F	0.915	1.0	1.1	1.2	GHz
Output Power at 3dB compression, P _{3dB}	78.2	74.7	76.6	71.8	dBm
Power Added Efficiency at 3dB compression, PAE _{3dB}	55.2	55.6	56.5	56.8	%
Gain at 3dB compression, G _{3dB}	19.2	19	18.6	18.2	dB

Notes:

2. Test conditions unless otherwise noted: T_A = 25 °C, V_D = 50 V, I_{DQ} = 750 mA (half device)
Pulsed, 100 us Pulse Width, 10% Duty Cycle.

RF Characterization – 1.0 – 1.1 GHz EVB1 Performance at 1.05 GHz ¹

Parameter	Min	Typ	Max	Units
Linear Gain, G_{LIN}	–	21.2	–	dB
Output Power at 3dB compression point, P3dB	–	1461	–	W
Drain Efficiency at 3dB compression point, DEFF3dB	–	73.2	–	%
Gain at 3dB compression point, G3dB	–	18.2	–	dB

Notes:

- $V_D = 65\text{ V}$, $I_{DQ} = 1.5\text{ A}$ (combined), Temp = +25 °C, Pulse Width = 100 us, Duty Cycle = 10%

RF Characterization – 0.96 – 1.215 GHz EVB2 Performance ¹

Parameter	Typ 0.96 GHz	Typ 1.08 GHz	Typ 1.2GHz	Units
Linear Gain, G_{LIN}	20	19.5	19.6	dB
Output Power at 2dB compression point, P2dB	1800	1678	1570	W
Drain Efficiency at 2dB compression point, DEFF2dB	64	68	66	%
Gain at 3dB compression point, G2dB	18	17.5	17.6	dB

Notes:

- $V_D = 65\text{ V}$, $I_{DQ} = 1.5\text{ A}$ (combined), Temp = +25 °C, Pulse Width = 100 us, Duty Cycle = 10%

RF Characterization – Mismatch Ruggedness at 1.0 GHz ^{1, 2, 3}

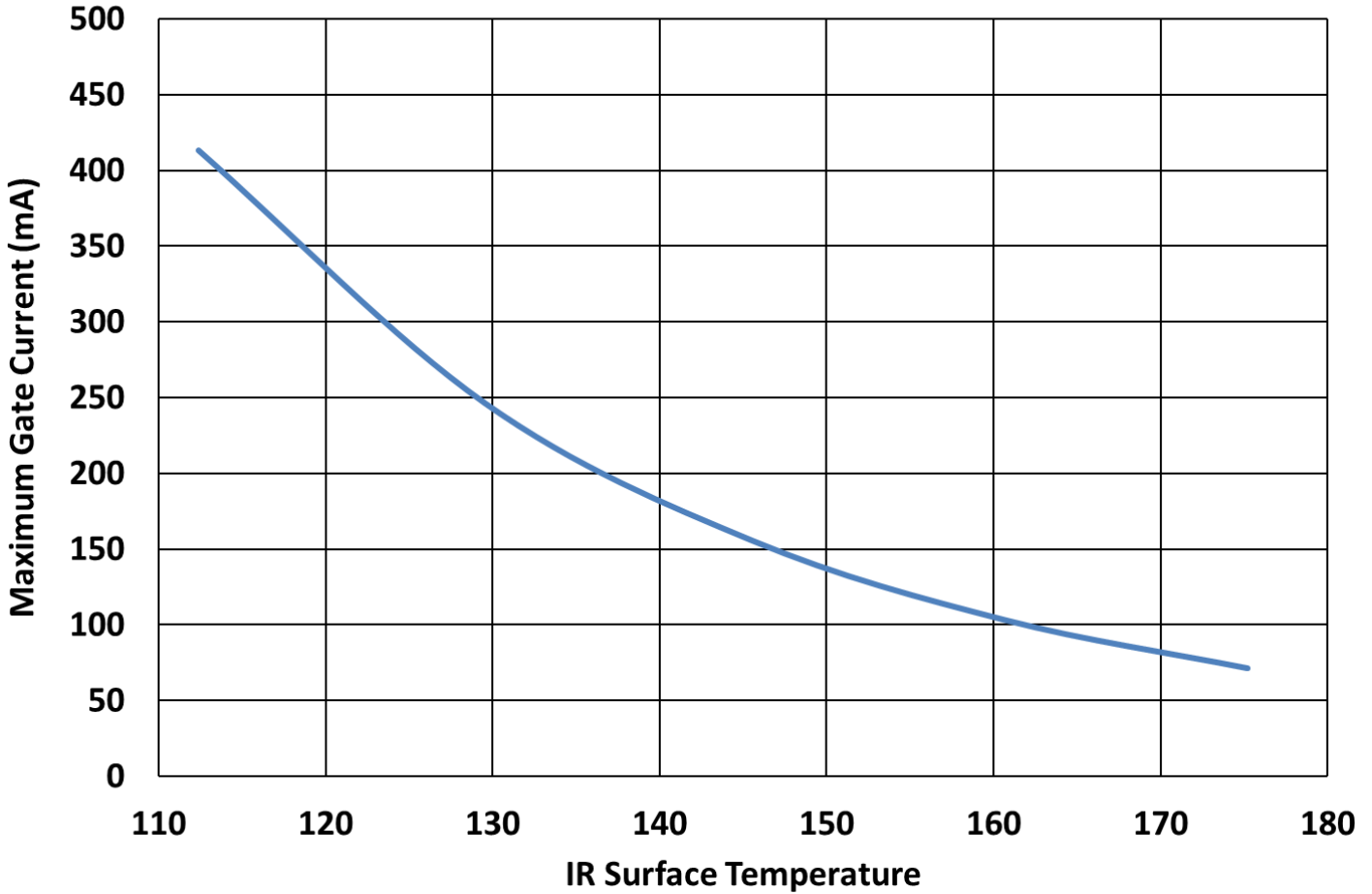
Symbol	Parameter	dB Compression	Typical
VSWR	Impedance Mismatch Ruggedness	3	10:1

Notes:

- Test conditions unless otherwise noted: $T_A = 25\text{ °C}$, $V_D = 65\text{ V}$, $I_{DQ} = 1.5\text{ A}$ (combined)
- Input drive power is determined at pulsed 3dB compression under matched condition at EVB output connector
- Pulse: 100us, 10% Duty cycle

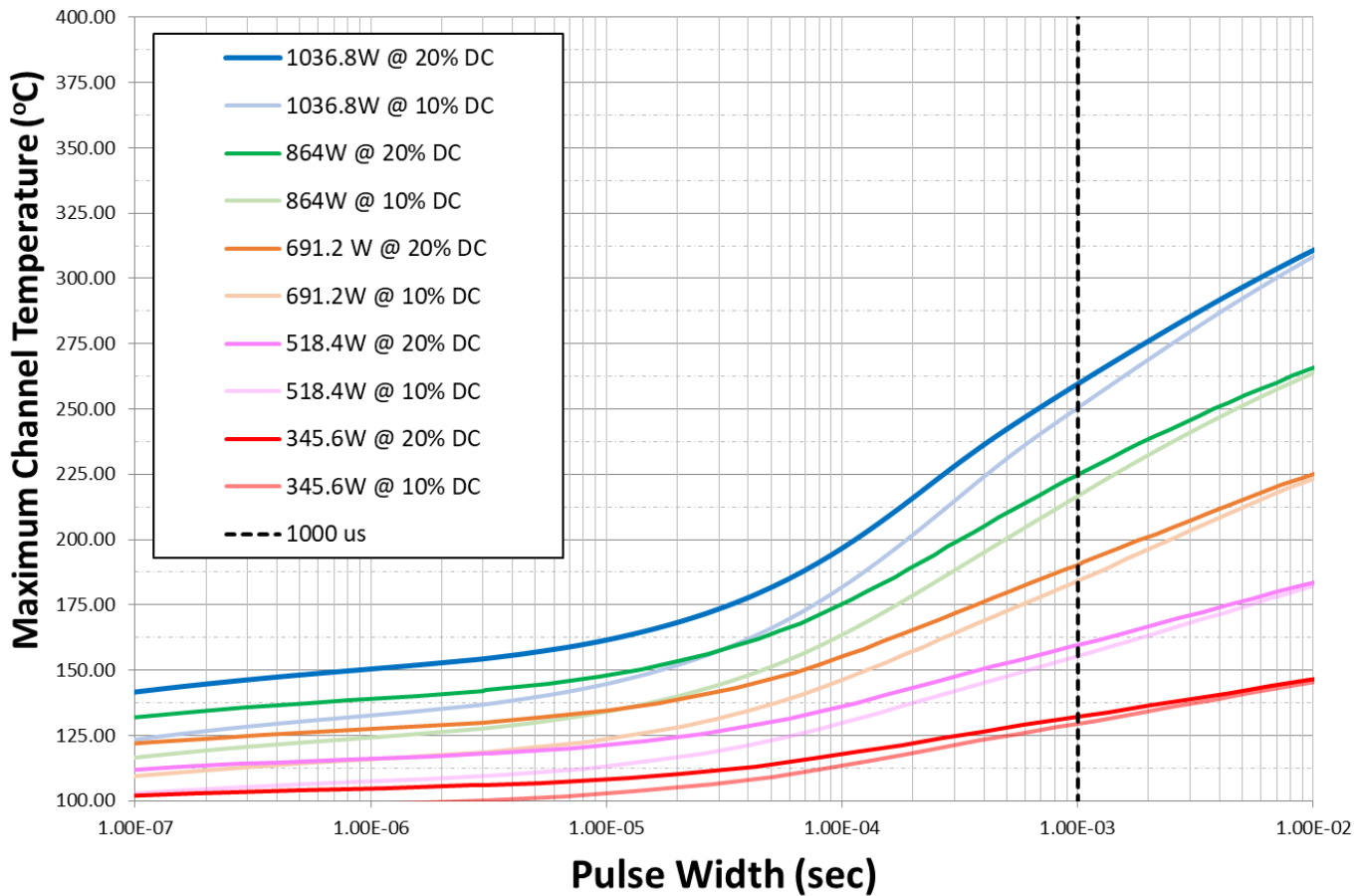
Maximum Gate Current

Maximum Gate Current vs. IR Surface Temperature



Thermal and Reliability Information – Pulsed ¹

Peak IR Surface Temperature vs. Pulse Width
 Base temperature fixed at 85 °C, P_{diss} Varies



Parameter	Conditions	Values	Units
Thermal Resistance, IR ¹ (θ_{JC})	85 °C Case backside Temperature	0.10	°C/W
Peak IR Surface Temperature ¹ (T_{ch})	P _{diss} = 518 W, Pulse: 100 us PW, 10% DC	131	°C

Notes:

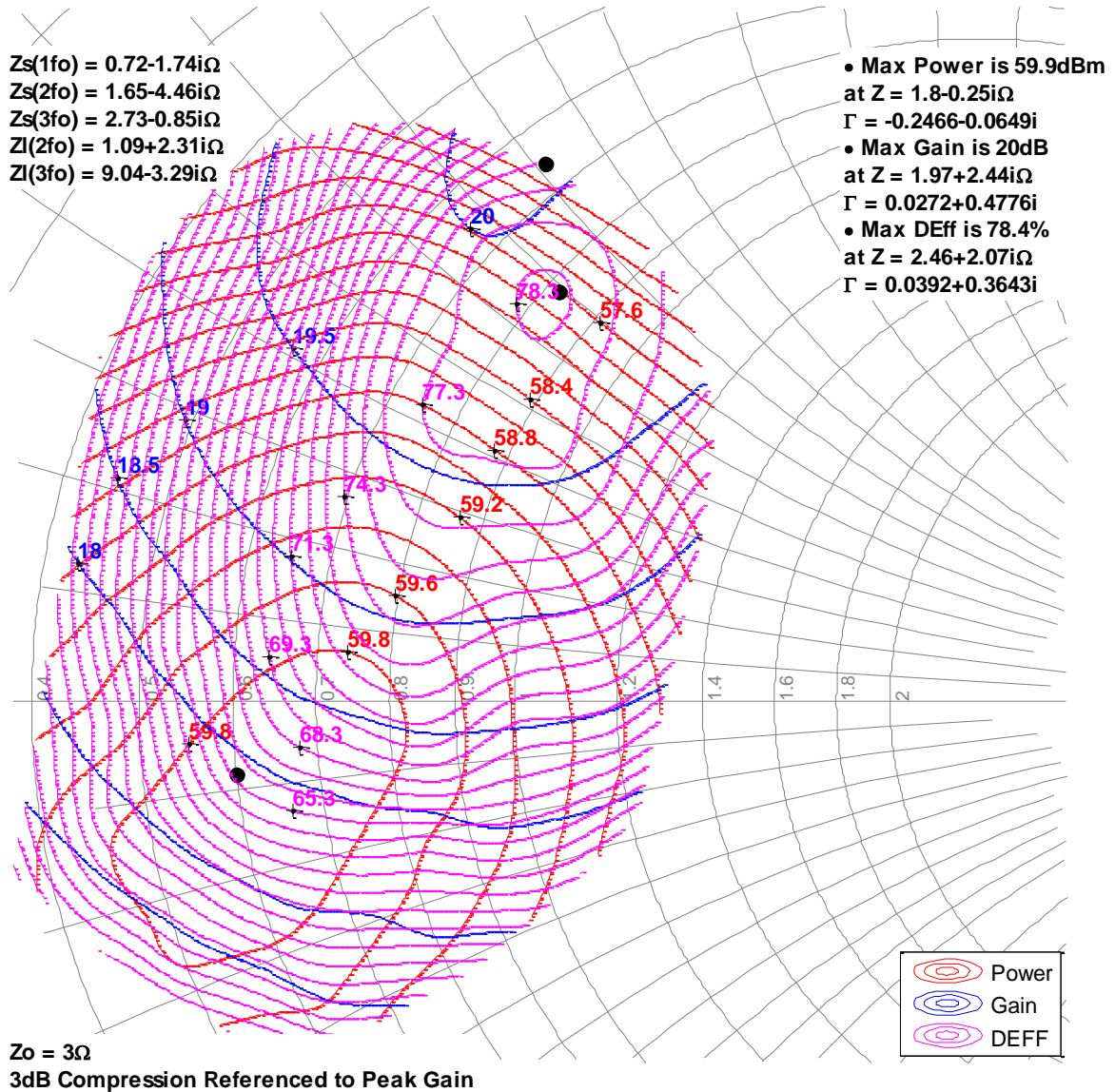
1. Refer to the following document [GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates](#)

Measured Load-Pull Smith Charts at 65V ^{1, 2, 3}

Notes:

1. Test Conditions: $V_D = 65\text{ V}$, $I_{DQ} = 750\text{ mA}$, 100 us Pulse Width, 10% Duty Cycle, Temp = 25°C.
2. The performance shown below is for only half of the device out of the two independent amplification paths.
3. See page 18 for load pull reference planes where the performance was measured.

0.915GHz, Load-pull

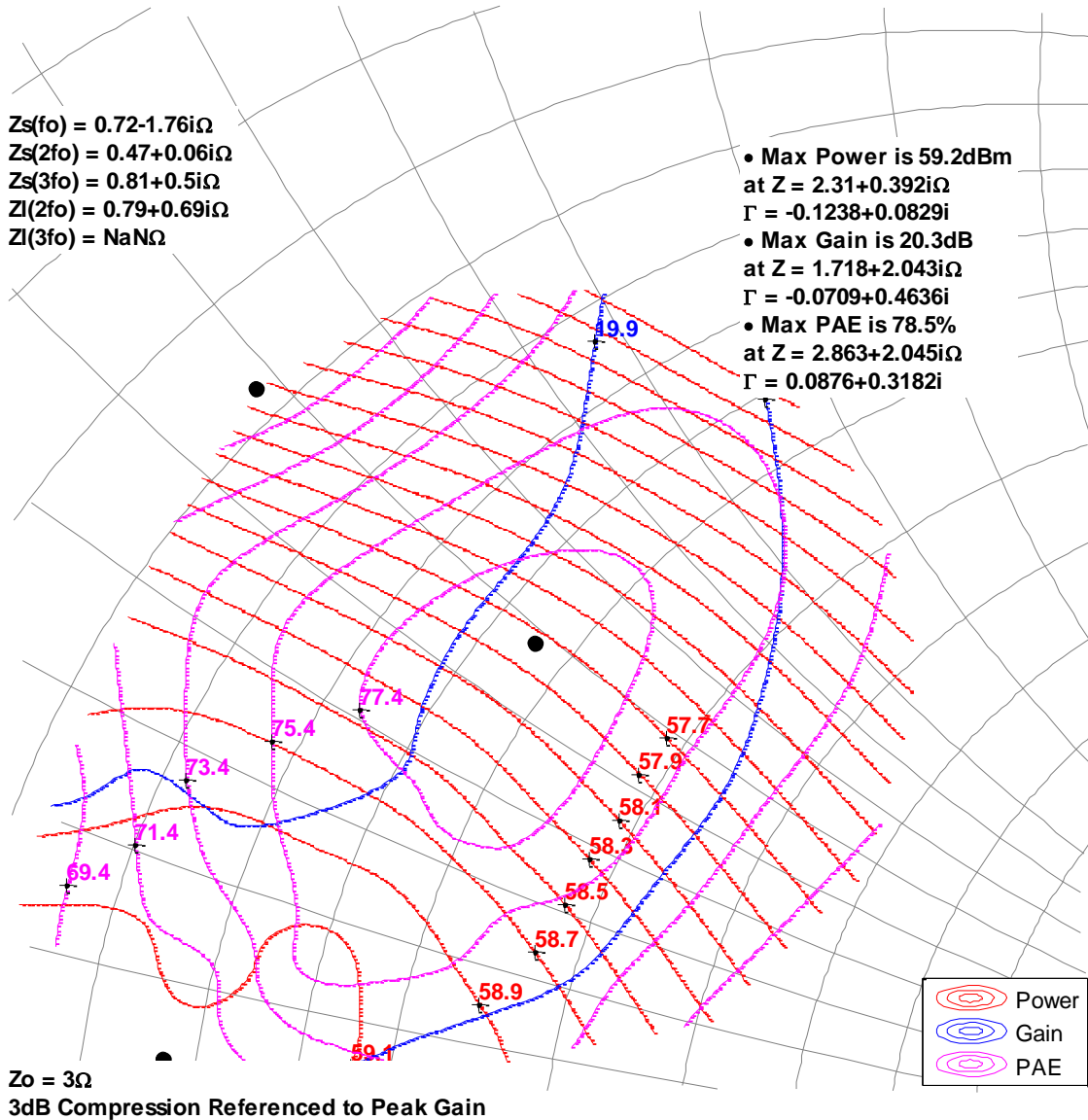


Measured Load-Pull Smith Charts at 65V ^{1, 2, 3}

Notes:

5. Test Conditions: $V_D = 65\text{ V}$, $I_{DQ} = 750\text{ mA}$, 100 us Pulse Width, 10% Duty Cycle, Temp = 25°C.
6. The performance shown below is for only half of the device out of the two independent amplification paths.
7. See page 18 for load pull reference planes where the performance was measured.

1.0GHz, Load-pull

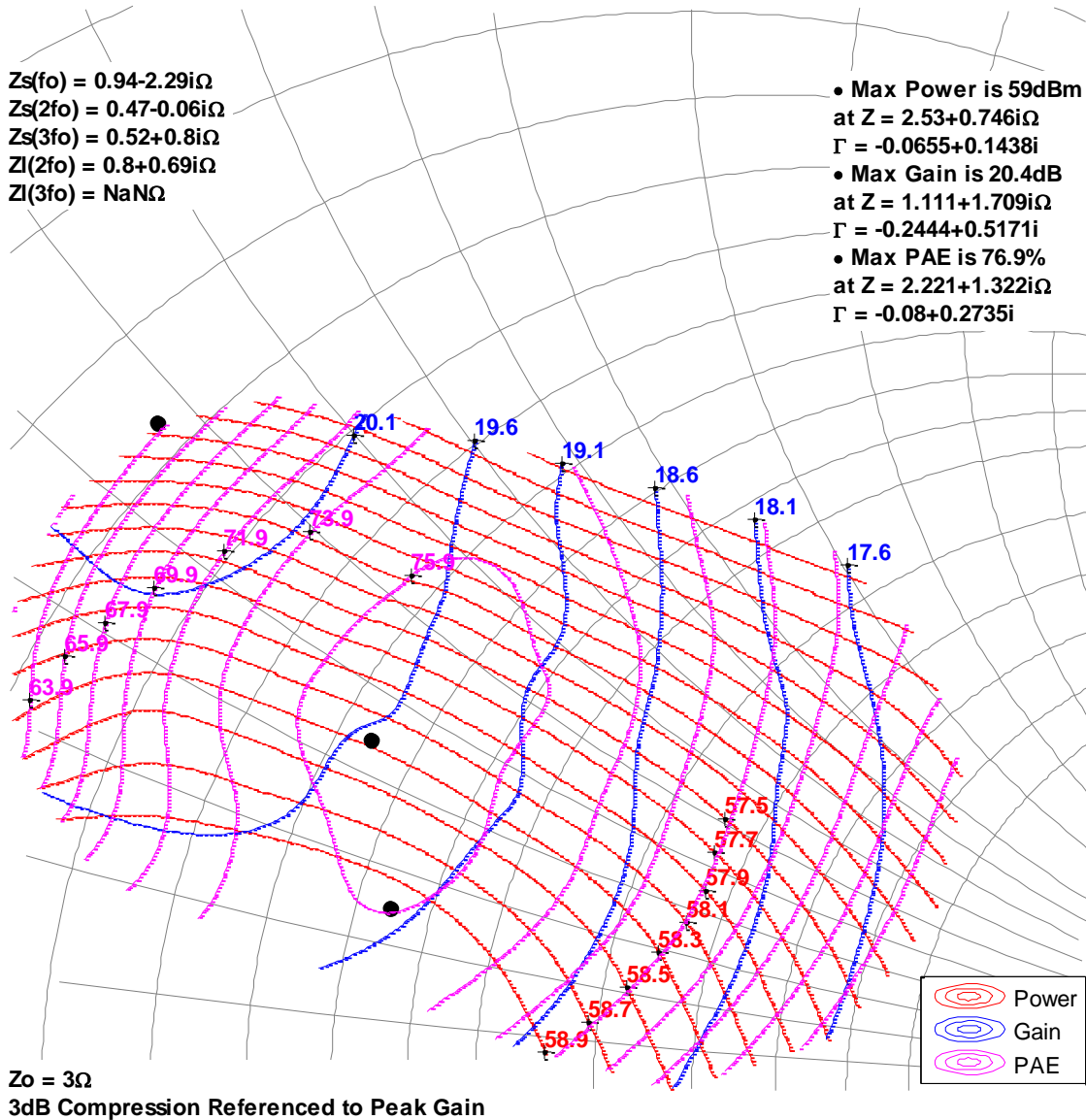


Measured Load-Pull Smith Charts at 65V ^{1, 2, 3}

Notes:

1. Test Conditions: $V_D = 65\text{ V}$, $I_{DQ} = 750\text{ mA}$, 100 us Pulse Width, 10% Duty Cycle, Temp = 25°C.
2. The performance shown below is for only half of the device out of the two independent amplification paths.
3. See page 18 for load pull reference planes where the performance was measured.

1.1GHz, Load-pull

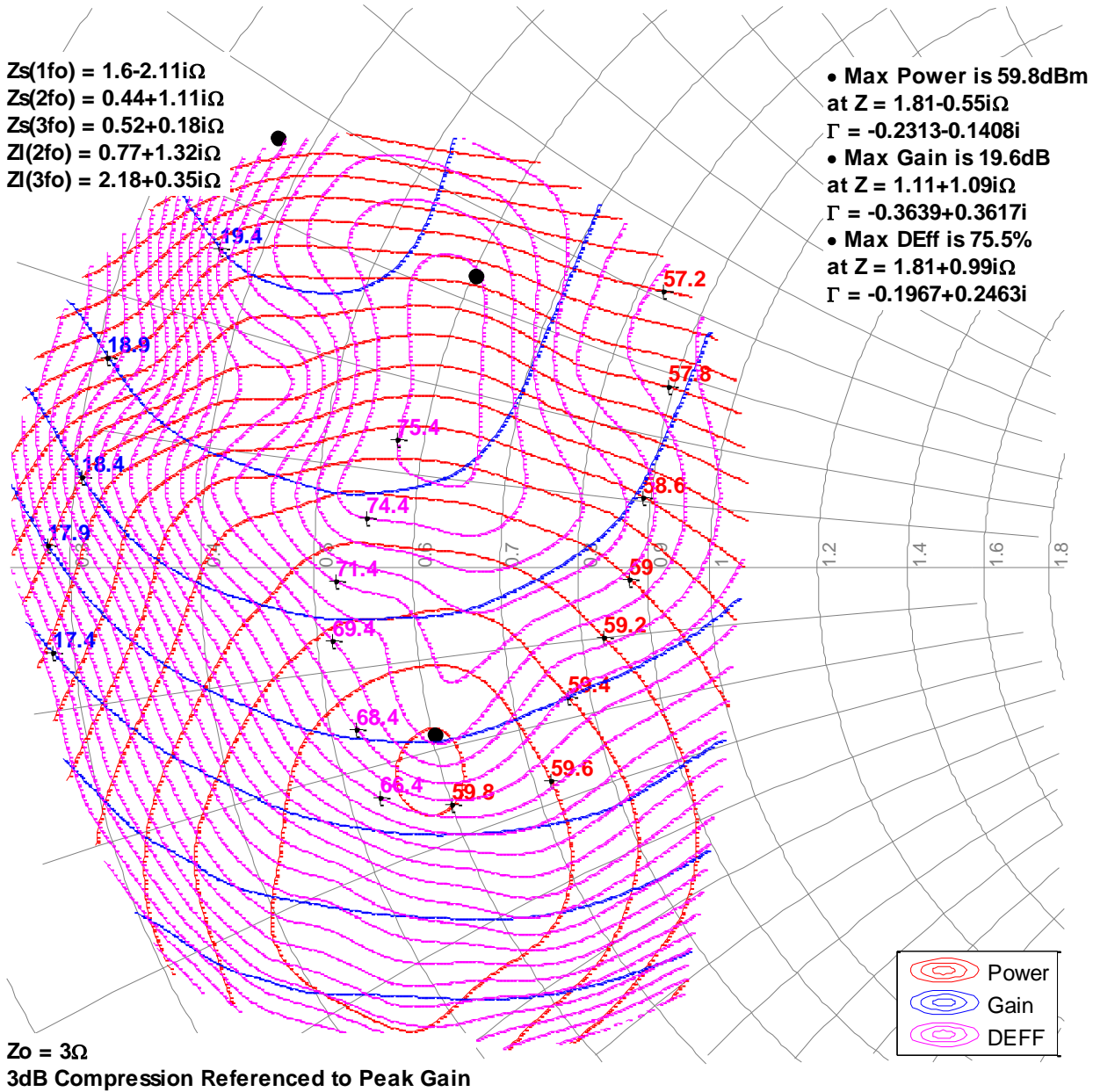


Measured Load-Pull Smith Charts at 65V ^{1, 2, 3}

Notes:

1. Test Conditions: $V_D = 65\text{ V}$, $I_{DQ} = 750\text{ mA}$, 100 us Pulse Width, 10% Duty Cycle, Temp = 25°C.
2. The performance shown below is for only half of the device out of the two independent amplification paths.
3. See page 18 for load pull reference planes where the performance was measured.

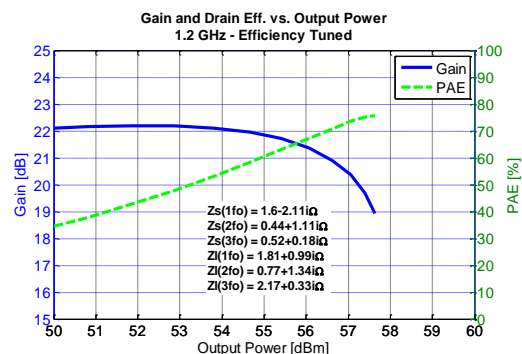
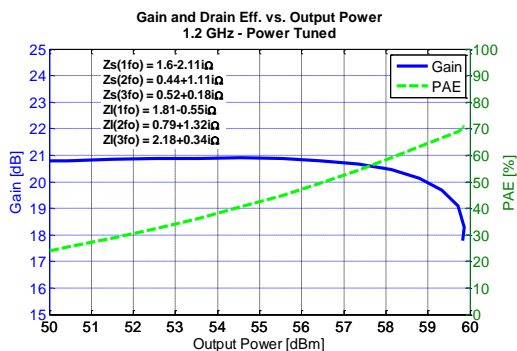
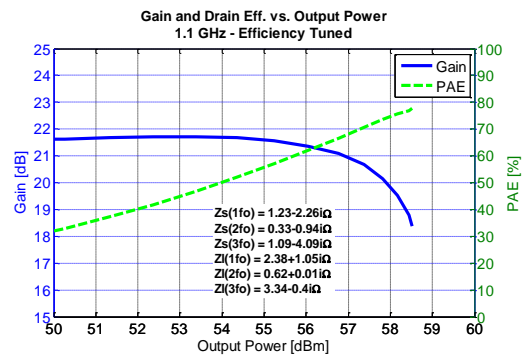
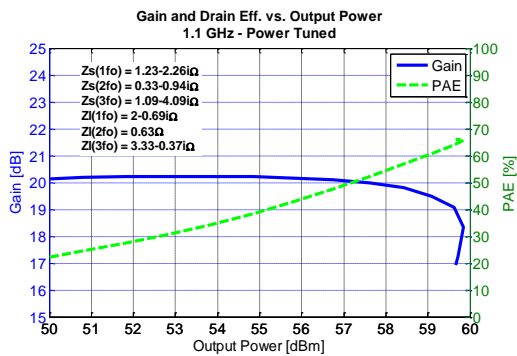
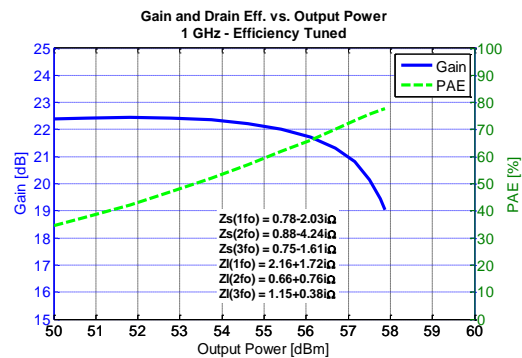
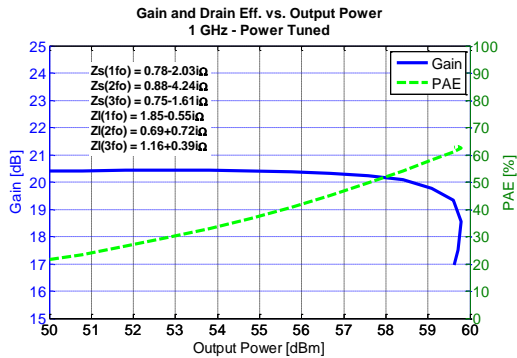
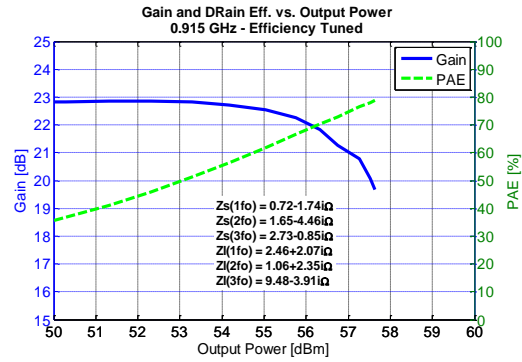
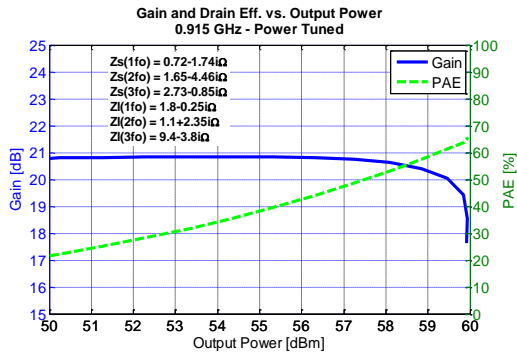
1.2GHz, Load-pull



Typical Measured Performance – Load-Pull Drive-up at 65V ^{1, 2, 3}

Notes:

1. Test Conditions: $V_D = 65\text{ V}$, $I_{DQ} = 750\text{ mA}$, 100 us Pulse Width, 10% Duty Cycle, Temp = 25°C.
2. The performance shown below is for only half of the device out of the two independent amplification paths.
3. See page 18 for load pull reference planes where the performance was measured.

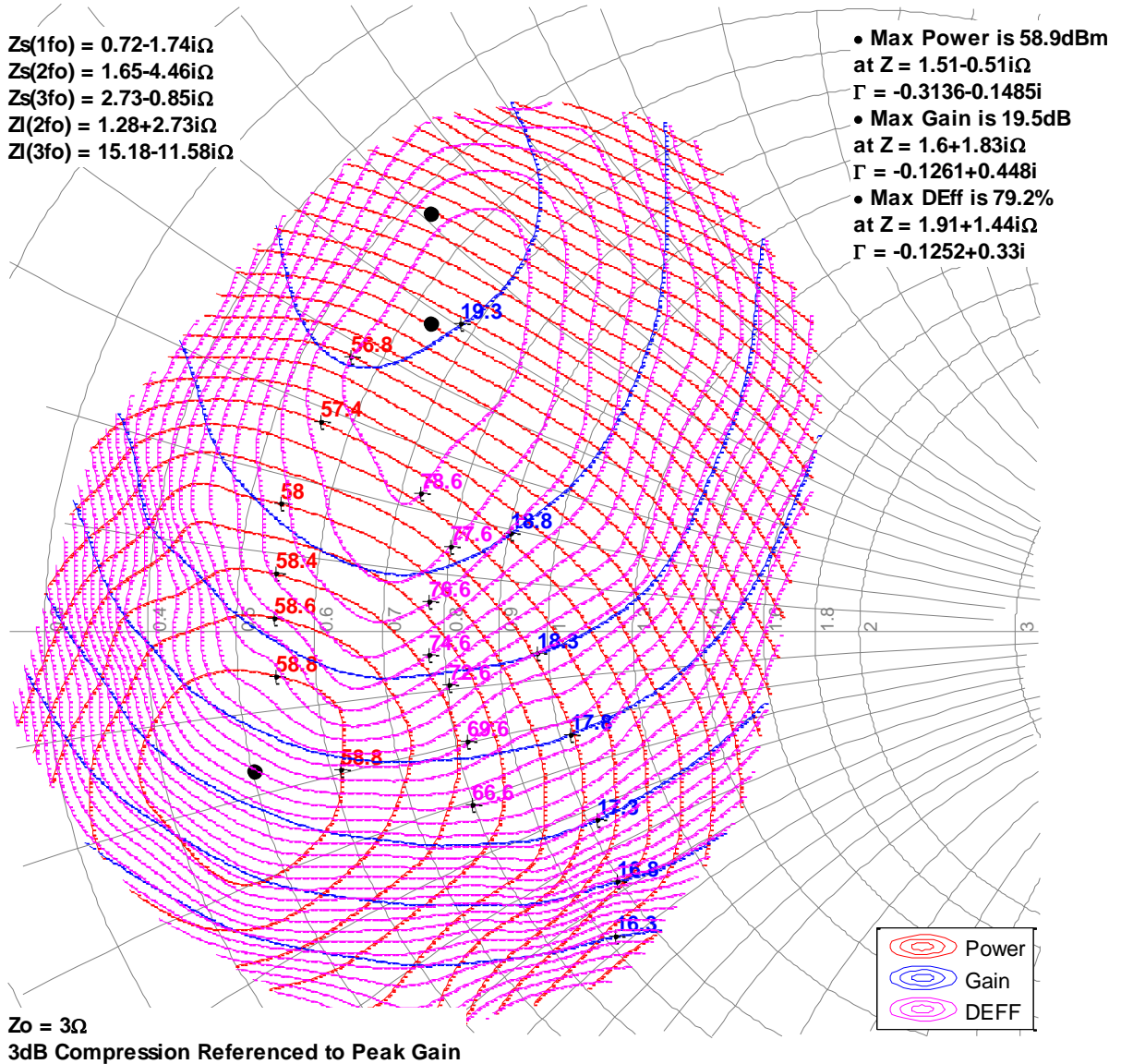


Measured Load-Pull Smith Charts at 50V ^{1, 2, 3}

Notes:

1. Test Conditions: $V_D = 50\text{ V}$, $I_{DQ} = 750\text{ mA}$, 100 us Pulse Width, 10% Duty Cycle, Temp = 25°C.
2. The performance shown below is for only half of the device out of the two independent amplification paths.
3. See page 18 for load pull reference planes where the performance was measured.

0.915GHz, Load-pull

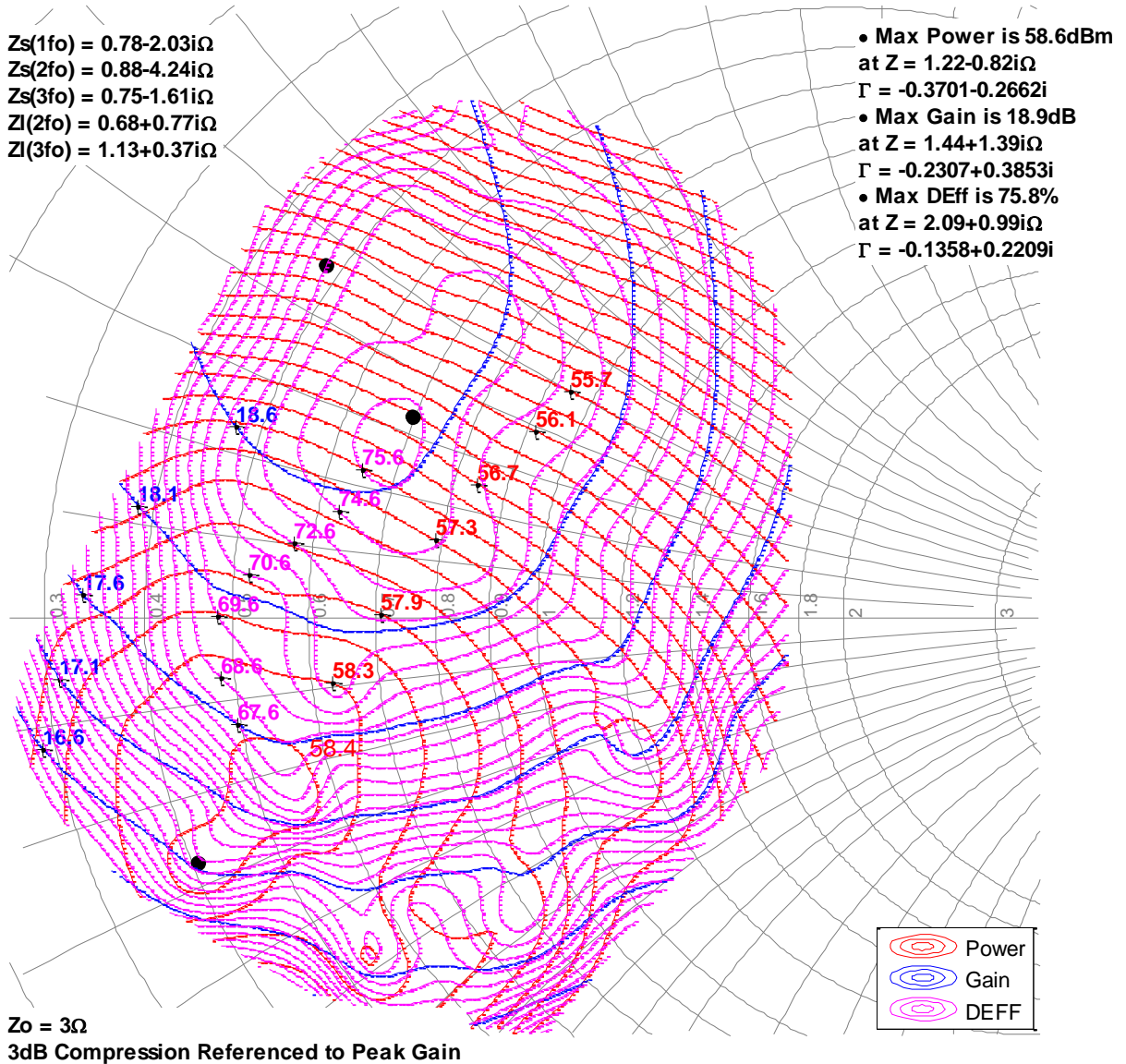


Measured Load-Pull Smith Charts at 50V ^{1, 2, 3}

Notes:

5. Test Conditions: $V_D = 50\text{ V}$, $I_{DQ} = 750\text{ mA}$, 100 us Pulse Width, 10% Duty Cycle, Temp = 25°C.
6. The performance shown below is for only half of the device out of the two independent amplification paths.
7. See page 18 for load pull reference planes where the performance was measured.

1GHz, Load-pull

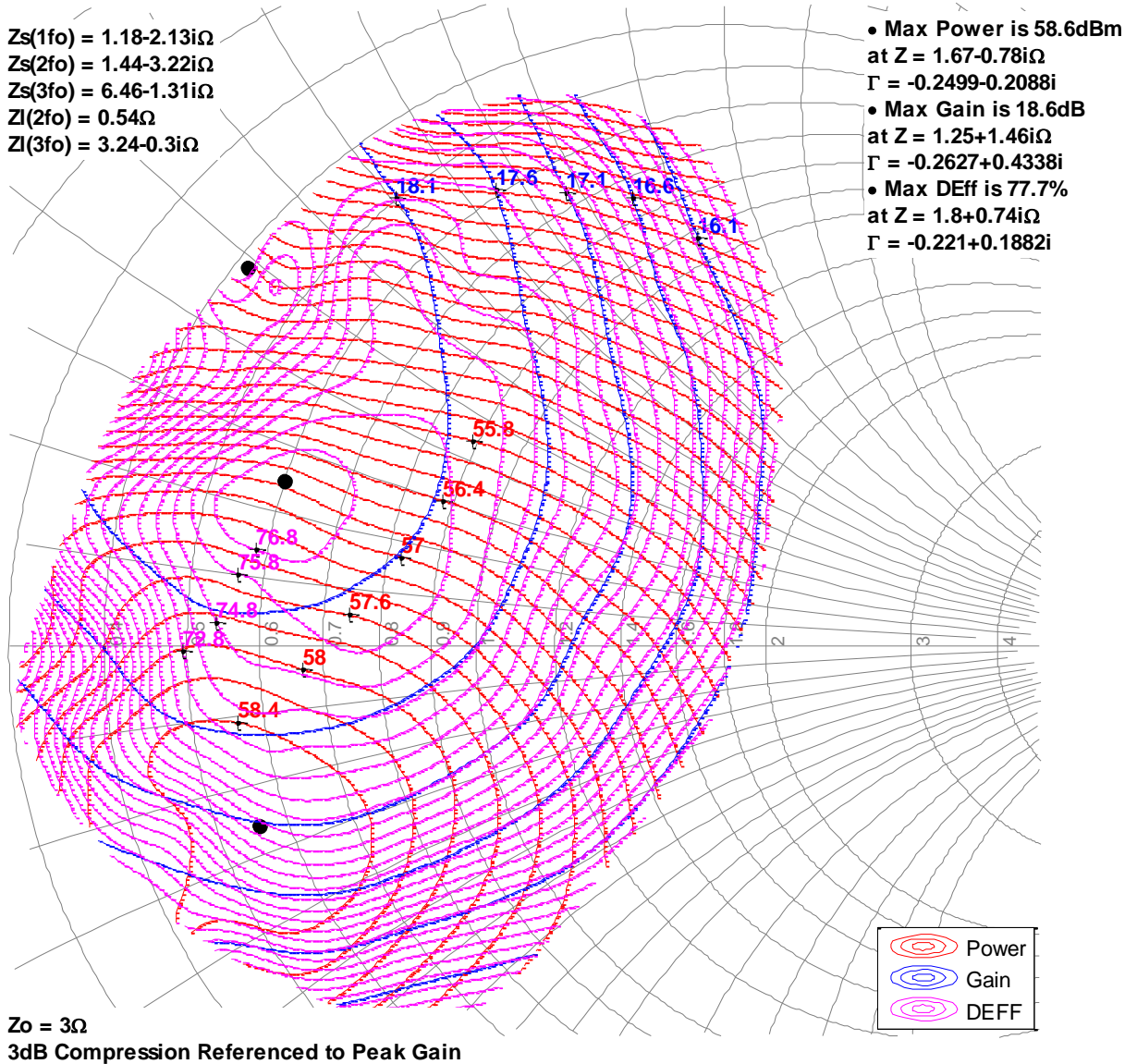


Measured Load-Pull Smith Charts at 50V ^{1, 2, 3}

Notes:

1. Test Conditions: $V_D = 50\text{ V}$, $I_{DQ} = 750\text{ mA}$, 100 us Pulse Width, 10% Duty Cycle, Temp = 25°C.
2. The performance shown below is for only half of the device out of the two independent amplification paths.
3. See page 18 for load pull reference planes where the performance was measured.

1.1GHz, Load-pull

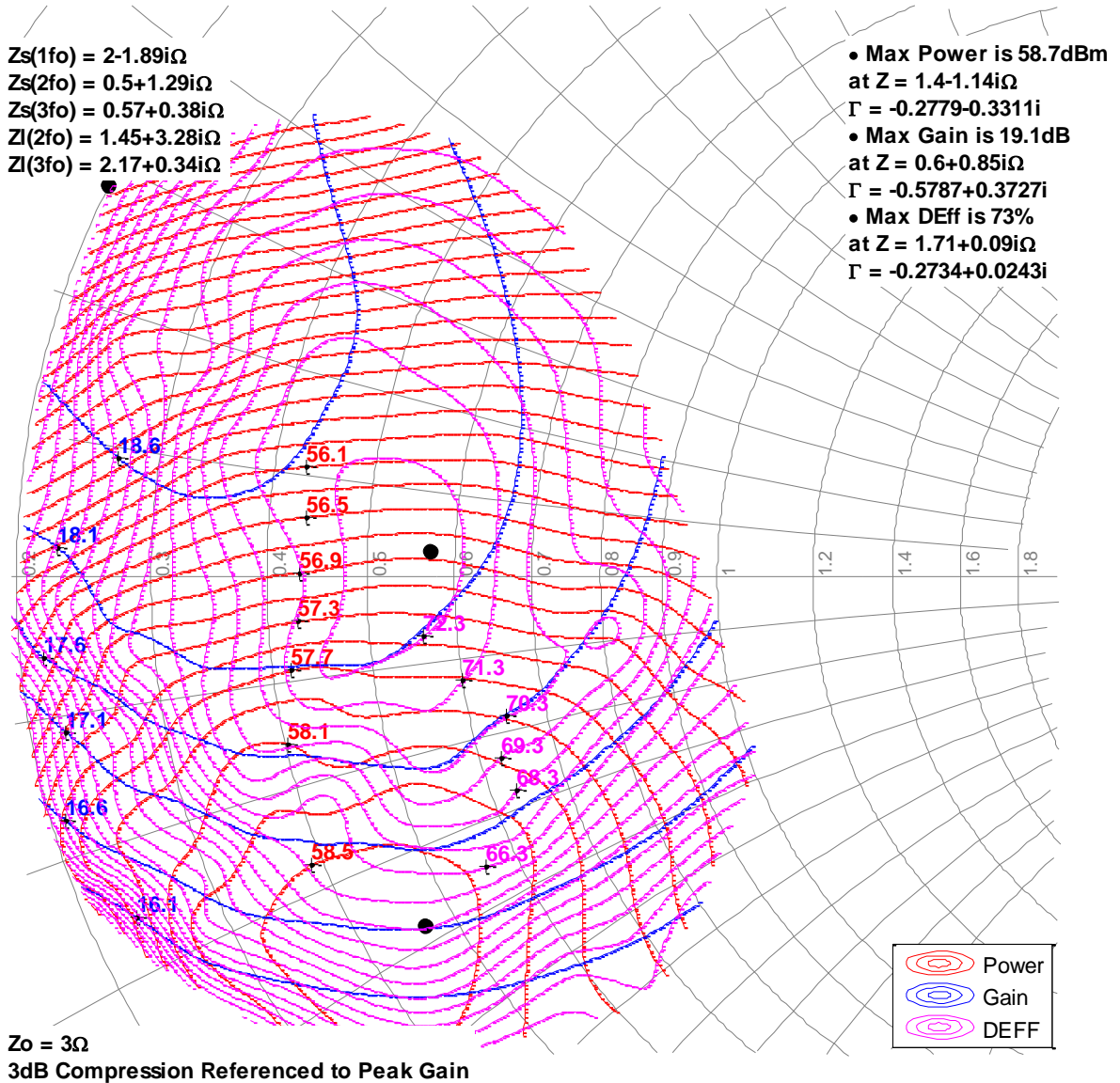


Measured Load-Pull Smith Charts at 50V ^{1, 2, 3}

Notes:

1. Test Conditions: $V_D = 50\text{ V}$, $I_{DQ} = 750\text{ mA}$, 100 us Pulse Width, 10% Duty Cycle, Temp = 25°C.
2. The performance shown below is for only half of the device out of the two independent amplification paths.
3. See page 18 for load pull reference planes where the performance was measured.

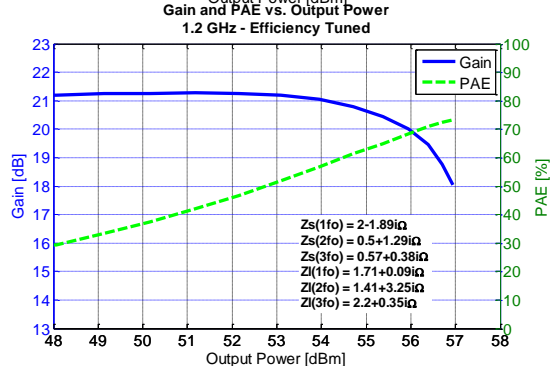
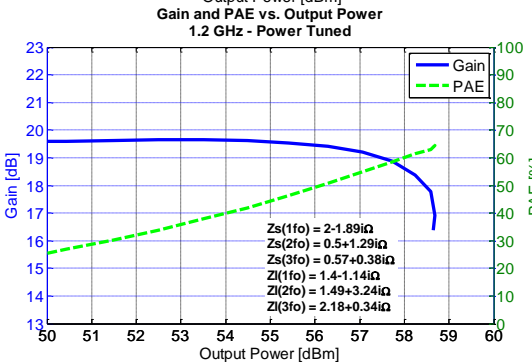
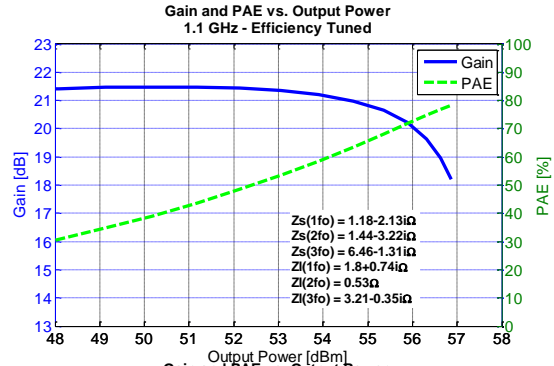
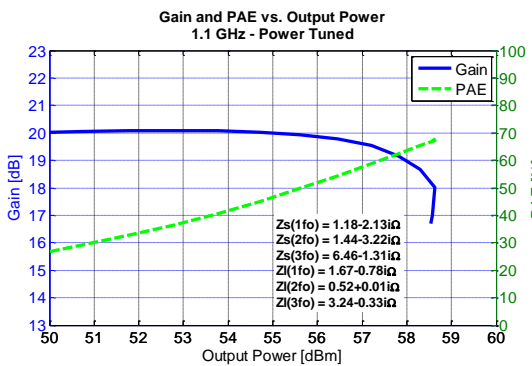
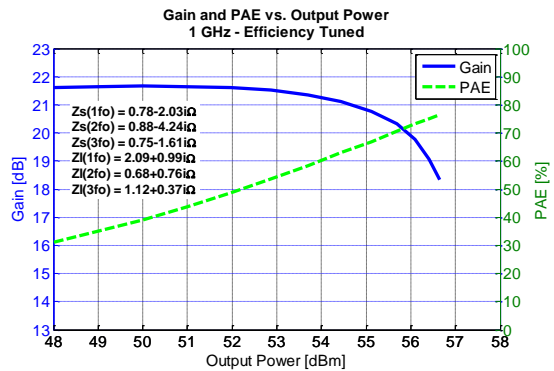
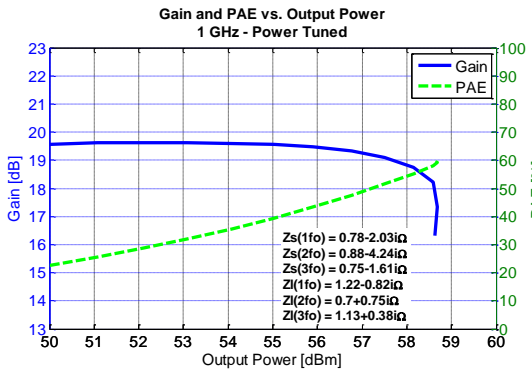
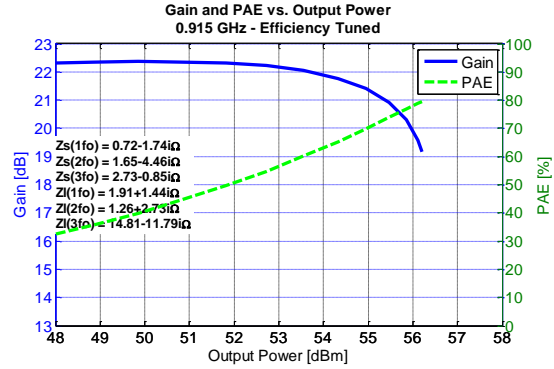
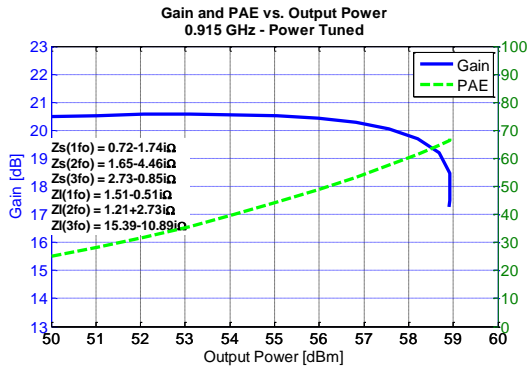
1.2GHz, Load-pull



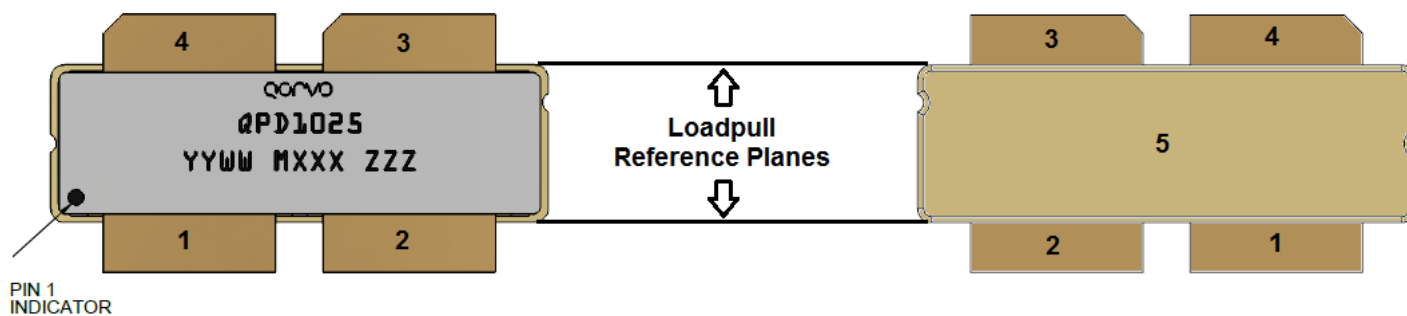
Typical Measured Performance – Load-Pull Drive-up at 50V ^{1, 2, 3}

Notes:

1. Test Conditions: $V_D = 50\text{ V}$, $I_{DQ} = 750\text{ mA}$, 100 us Pulse Width, 10% Duty Cycle, Temp = 25°C.
2. The performance shown below is for only half of the device out of the two independent amplification paths.
3. See page 18 for load pull reference planes where the performance was measured.



Pin Configuration and Description ¹

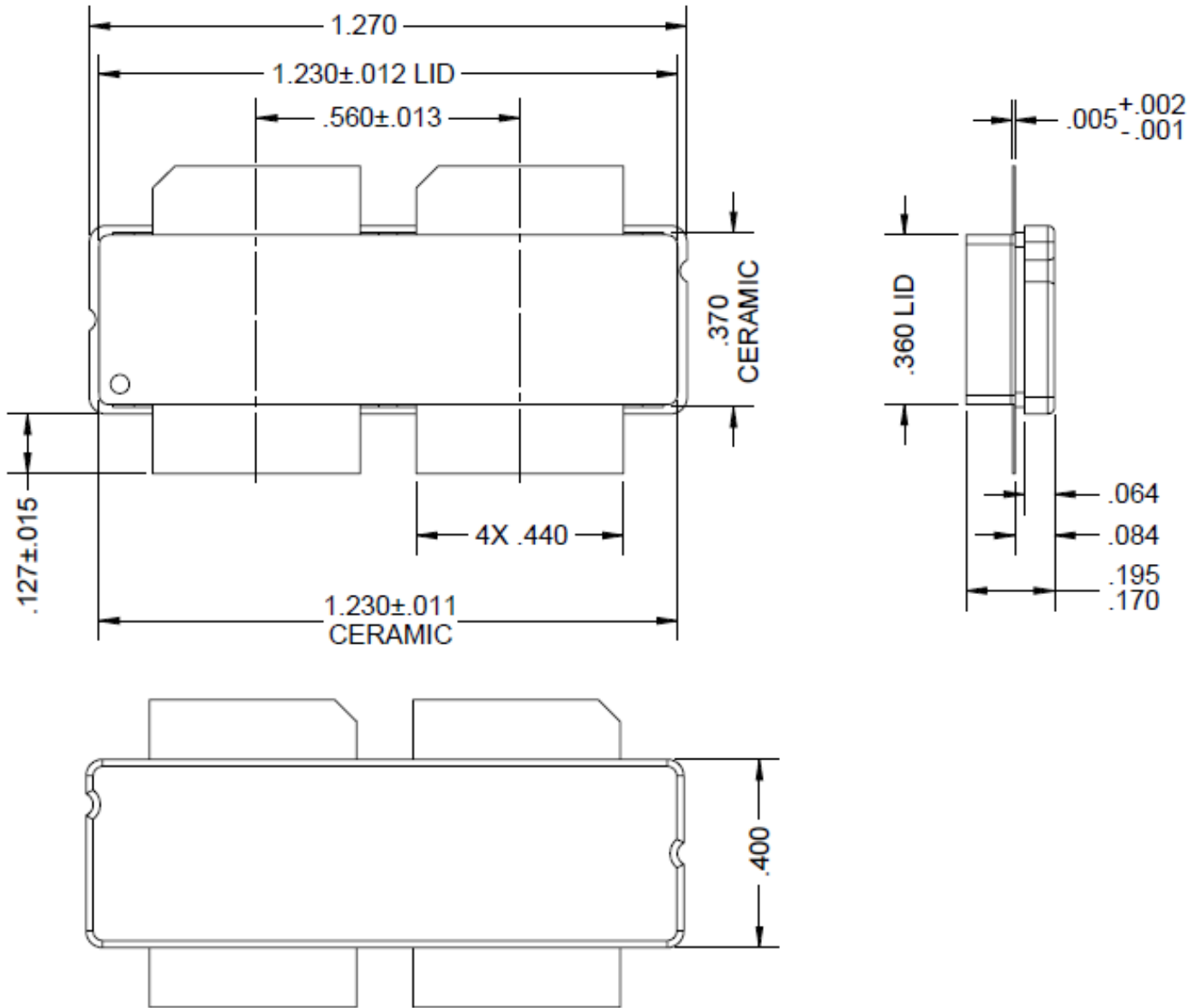


Note:

- 1- The QPD1025 will be marked with the “QPD1025” 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.

Pin	Symbol	Description
1, 2	RF IN / V_G	Gate
3, 4	RF OUT / V_D	Drain
5	Source	Source / Ground / Backside of part

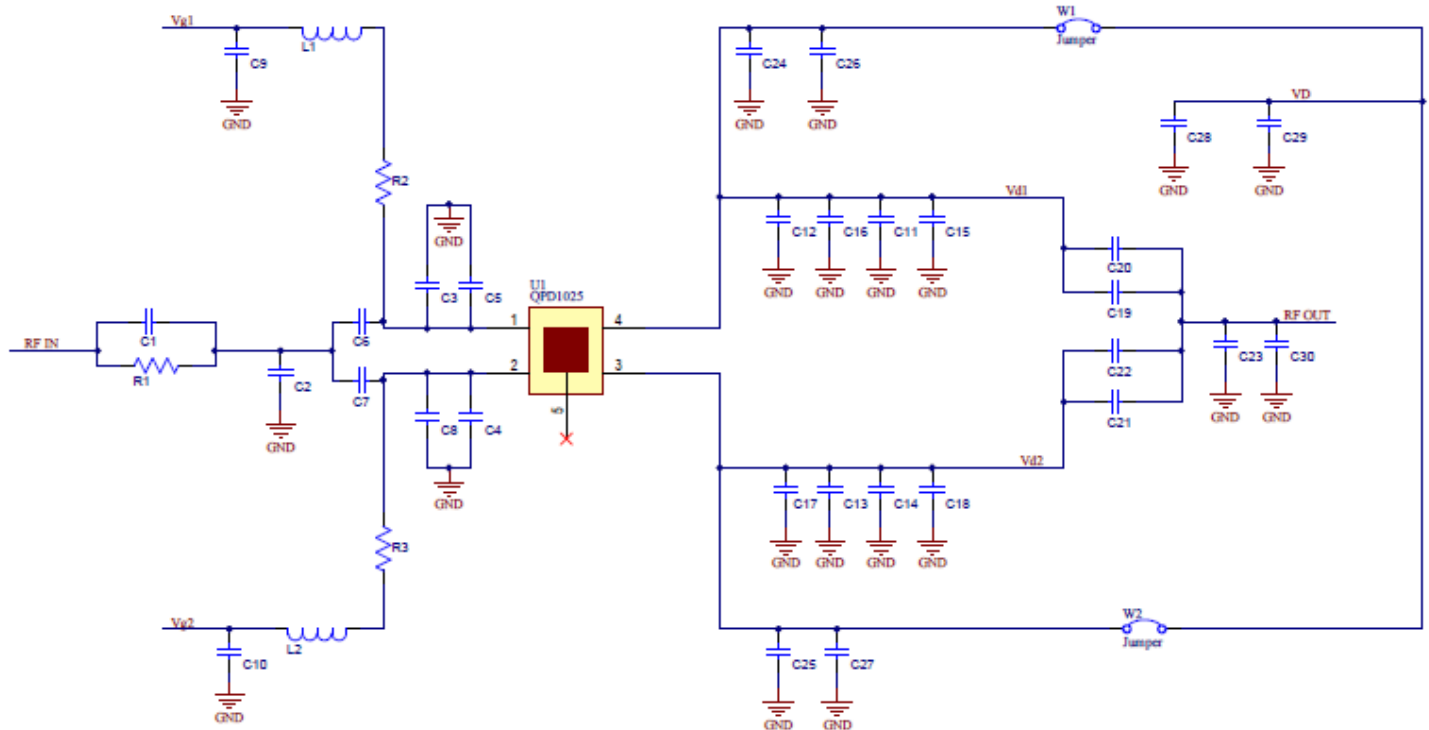
Mechanical Drawing ¹



Note:

1- All dimensions are in inches. Dimension tolerance is ± 0.005 in, unless noted otherwise.

1.0 – 1.1 GHz Application Circuit - Schematic

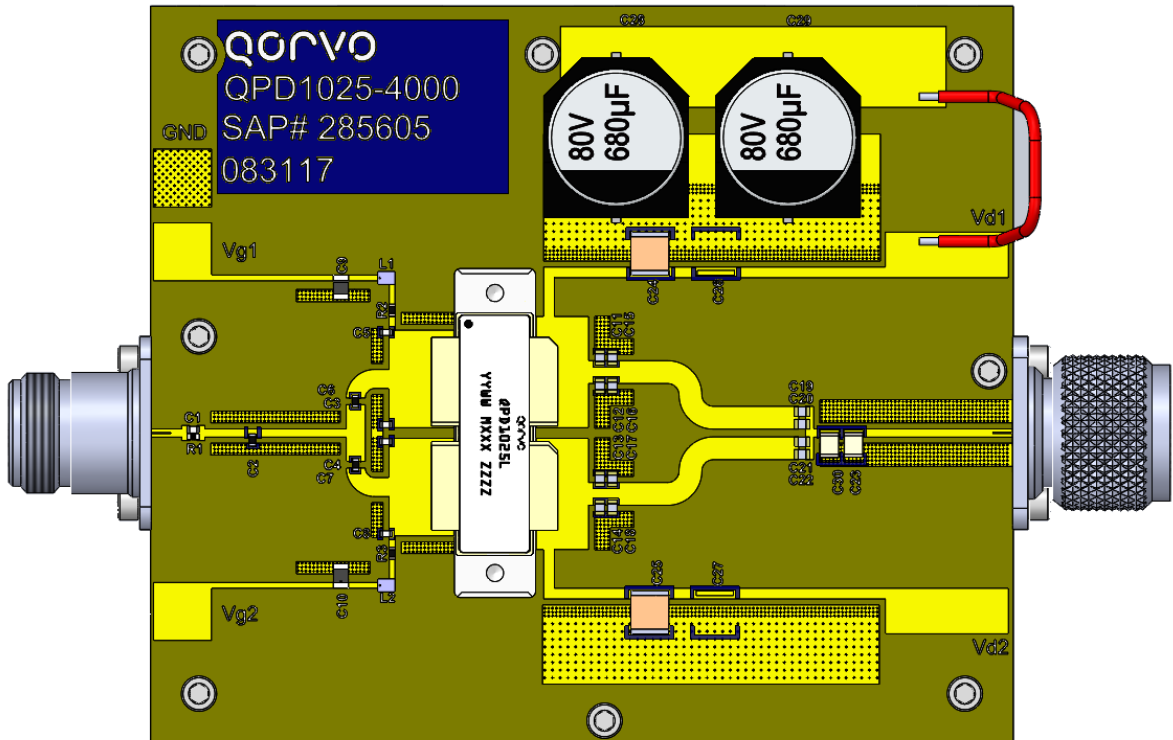


Bias-up Procedure	Bias-down Procedure
1. Set V_G to -5 V.	1. Turn off RF signal.
2. Set I_D current limit to 4 A.	2. Turn off V_D
3. Apply 65 V V_D .	3. Wait 2 seconds to allow drain capacitor to discharge.
4. Slowly adjust V_G until I_D is set to 1.5 A.	4. Turn off V_G
5. Apply RF.	

1.0 – 1.1 GHz Application Circuit EVB1 – Layout ^{1,2}

Notes:

1. PCB material is RO4350B 0.020" thick, 2 oz. copper each side.
2. The two gates could be tied together or (optionally) adjusted independently.



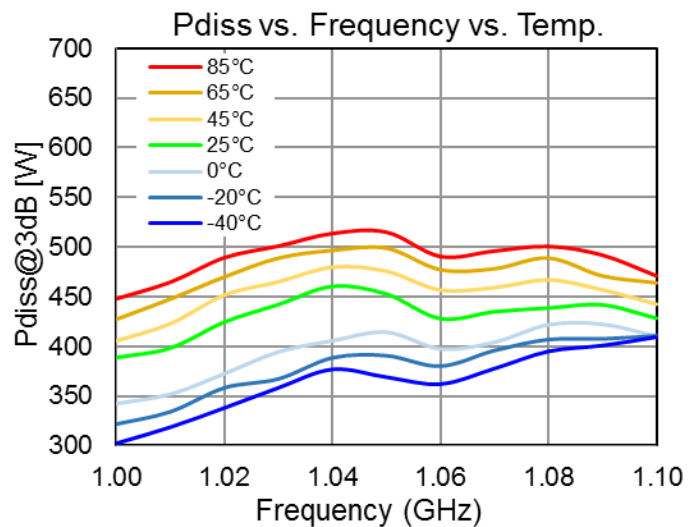
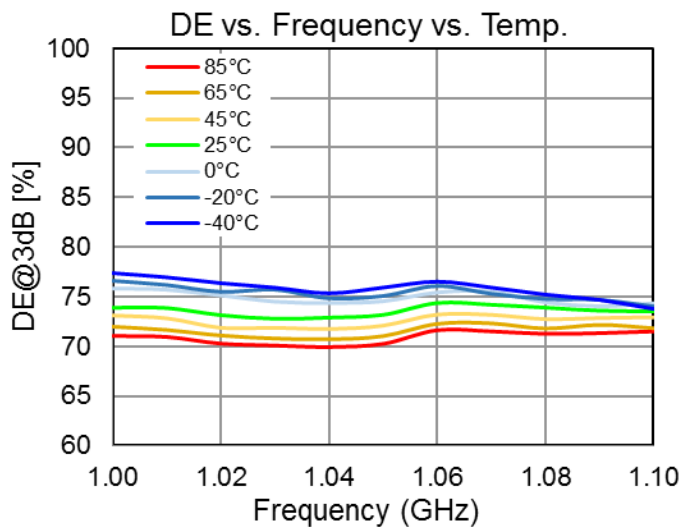
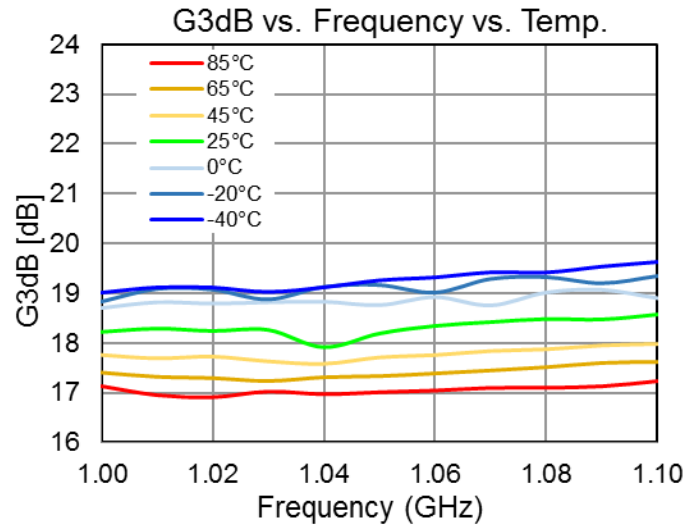
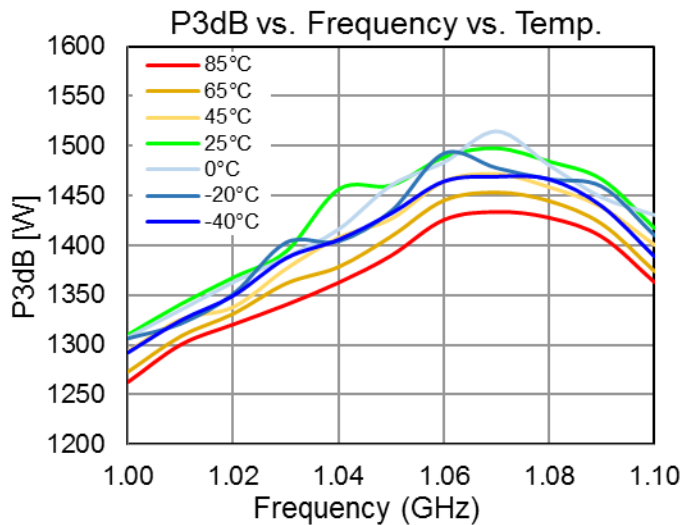
1.0 – 1.1 GHz Application Circuit – Bill of Material EVB1

Reference Design	Value	Qty	Manufacturer	Part Number
C15,C16,C17,C18	8.2 pF	4	American Technical Ceramics	600F8R2BT250T
C1	10 pF	1	American Technical Ceramics	600S100FT250XT
C2,C3,C4	6.8 PF	3	American Technical Ceramics	600S6R8BT250T
C9,C10	4.7 uF	2	Murata Electronics	GRM31CR71H475KA12L
C19,C20,C21,C22	7.5 pF	4	American Technical Ceramics	600F7R5BT250XT
C26,C27	10 uF	2	TDK Singapore (Pte) Ltd	C5750X7S2A106M230KB
C5,C6,C7,C8	9.1 pF	4	American Technical Ceramics	600S9R1BT250XT
C28,C29	680 uF	2	Vishay Americas Inc	MAL215099708E3
C11,C12,C13,C14	6.8 pF	4	American Technical Ceramics	600F6R8BT250XT
C23,C30	3.0 pF	2	American Technical Ceramics	800B3R0BT500XT
R1	100 Ohm	1	Panasonic Industrial Devices	ERJ-3EKF1000
R2,R3	10 Ohm	2	Vishay Dale Electronics	CRCW060310R0FKEA
L1,L2	110 nH	2	Coilcraft, Inc.	0805CS-111XJBC
Connectors	N-Type	2	Huber+Suhner, Inc.	1101055

Power Driveup Performance over Temperatures of 1.0 – 1.1 GHz EVB1 ¹

Notes:

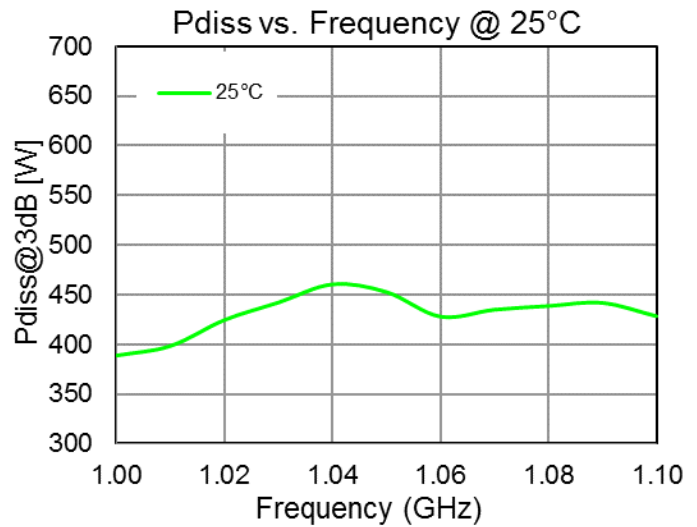
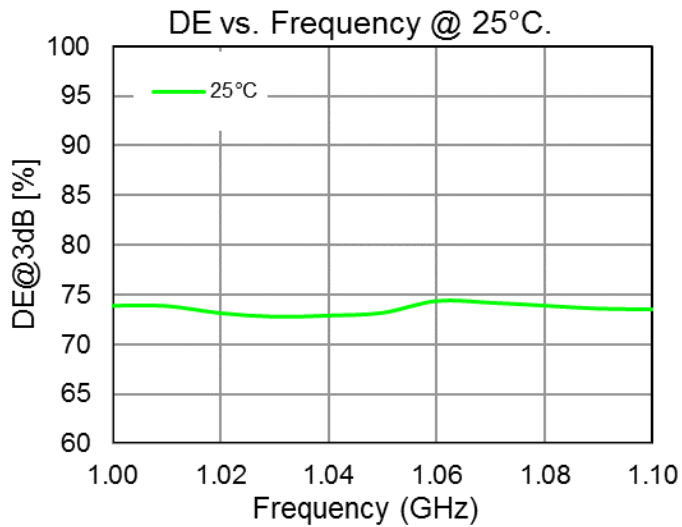
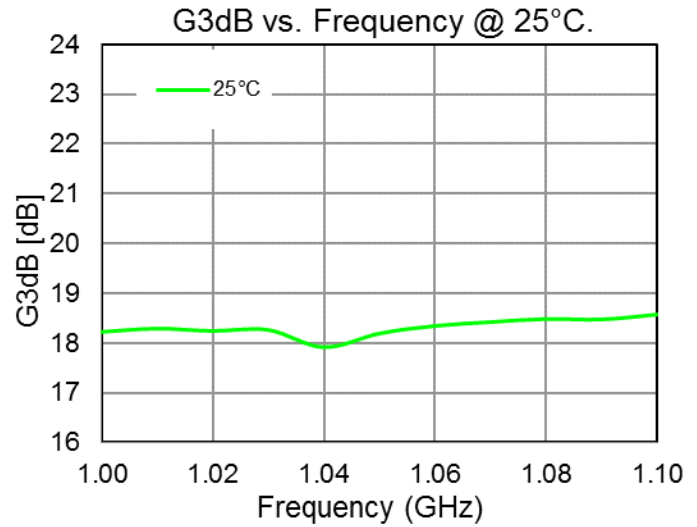
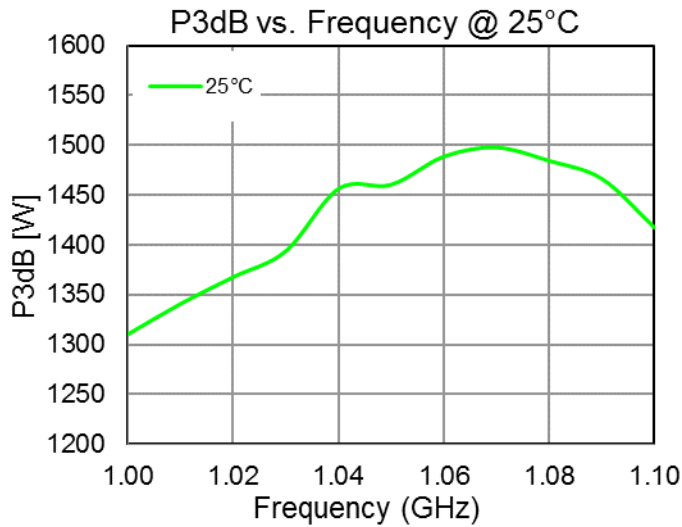
1. Test Conditions: $V_D = 65\text{ V}$, $I_{DQ} = 1.5\text{ A}$, 100 us Pulse Width, 10% Duty Cycle.



Power Driveup Performance at 25°C of 1.0 – 1.1 GHz EVB1 ¹

Notes:

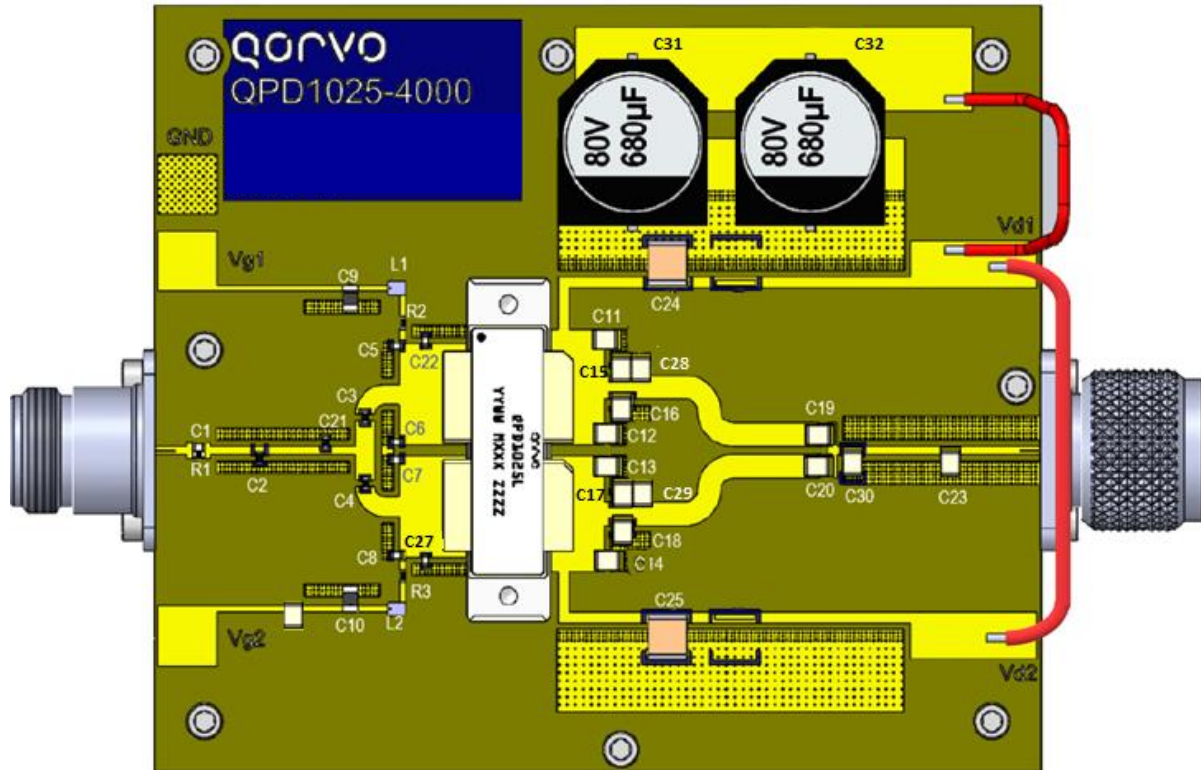
1. Test Conditions: $V_D = 65\text{ V}$, $I_{DQ} = 1.5\text{ A}$, 100 us Pulse Width, 10% Duty Cycle.



0.96 – 1.215 GHz Application Circuit EVB2– Layout ^{1, 2}

Notes:

1. PCB material is RO4350B 0.020" thick, 2 oz. copper each side.
2. The two gates could be tied together or (optionally) adjusted independently.



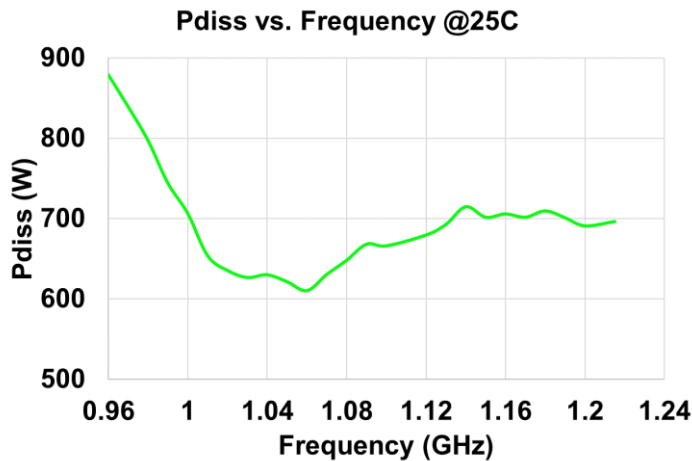
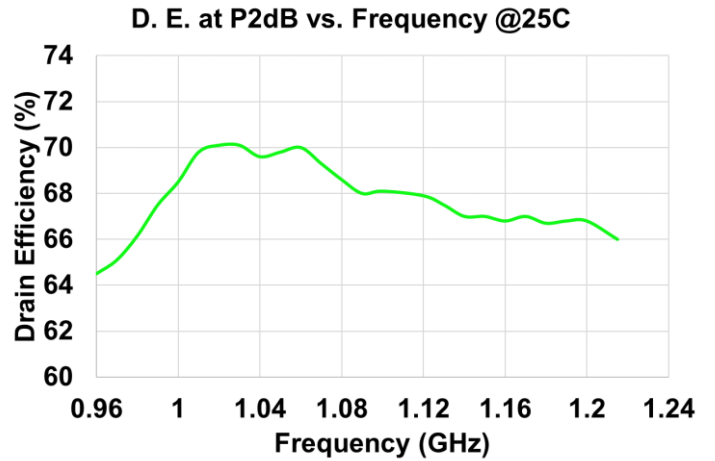
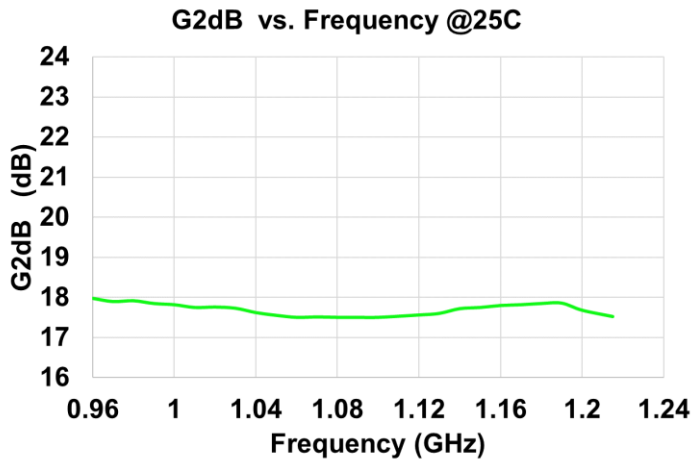
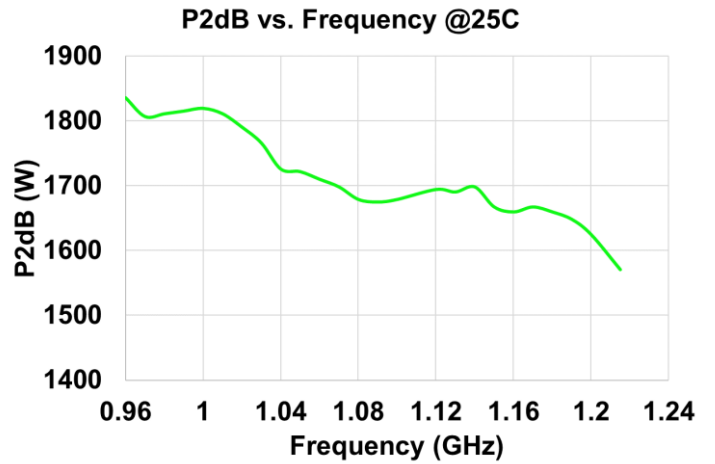
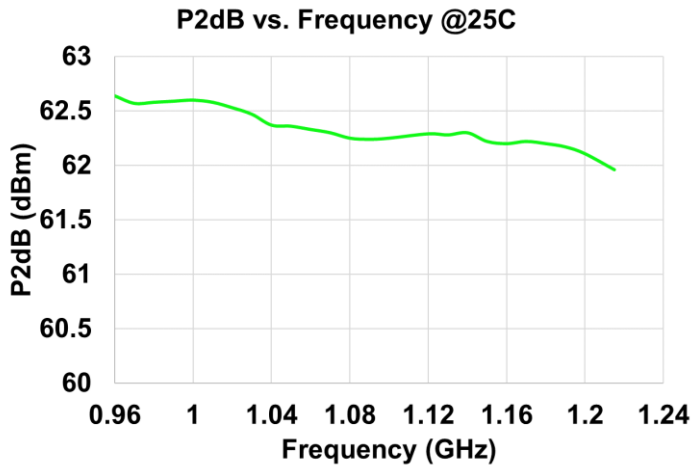
0.96 – 1.215 GHz Application Circuit – Bill of Material

Reference Designator	Value	Qty	Manufacturer	Part Number
L1,L2	110nH	2	Coilcraft, Inc	0805CS-111XJBC
C2	0.7pF	1	American Technical Ceramics	600S0R7FT250XT
C3,C4	20pF	2	American Technical Ceramics	600S200T250T
C6,C7	5.6pF	2	American Technical Ceramics	600S5R6T250T
C21, C22, C27	6.8pF	3	American Technical Ceramics	600S6R8FT250XT
C1, C5,C8	8.2pF	3	American Technical Ceramics	600S8R2FT250XT
C19,C20	12pF	2	American Technical Ceramics	800B120BC500XT
C23	1.5pF	1	American Technical Ceramics	800B1R5BC500XT
C30	1.8pF	1	American Technical Ceramics	800B1R8BT500XT
C28,C29	2.4pF	2	American Technical Ceramics	800B2R4BC500XT
C12,C13,C15,C16,C17,C18	5.6pF	6	American Technical Ceramics	800B5R6BC500XT
C11,C14	8.2pF	2	American Technical Ceramics	800B8R2BC500XT
C24,C25	10uF	2	TDK Singapore (Pte) Ltd	C5750X7S2A106M230KB
R2,R3	10 Ohms	2	Vishay Dale Electronics	CRCW060310R0FKEA
Connectors	N type	2	Huber+Suhner, Inc	CRCW060310R0FKEA
R1	47 Ohms	1	Panasonic Industrial Devices	ERJ-3EKF47R0
C9,C10	4.7uF	2	Murata Electronics	GRM31CR71H475KA12L
C31, C32	680uF	2	Vishay Americas Inc	MAL215099708E3

Performance at 25°C of 0.96 – 1.215 GHz EVB2 ¹

Notes:

1. Test Conditions: $V_D = 65\text{ V}$, $I_{DQ} = 1.5\text{ A}$, 100 us Pulse Width, 10% Duty Cycle.



Recommended Solder Temperature Profile

