QPD1013

150W, 65V, DC – 2.7 GHz, GaN RF Transistor

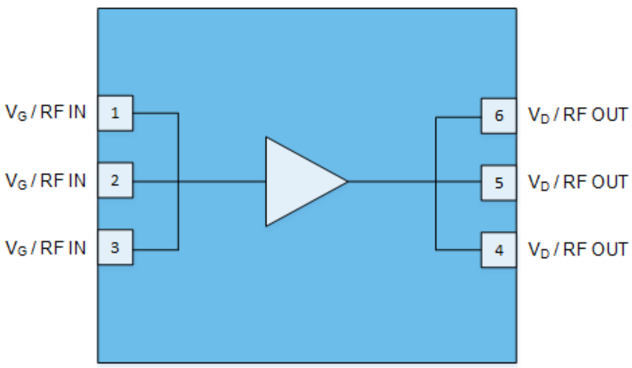
General Description

The Qorvo QPD1013 is a 150 W (P_{3dB}) discrete GaN on SiC HEMT which operates from DC to 2.7 GHz. This is a single stage unmatched power amplifier transistor in an over-molded plastic package. The high power and wide bandwidth of the QPD1013 makes it suitable for many different applications from DC to 2.7 GHz. The device is housed in an industry-standard 7.2 x 6.6 mm surface mount DFN package.

Lead-free and ROHS compliant

6 Pin DFN (7.2 x 6.6 x 0.9 mm)

Functional Block Diagram



Product Features

- Frequency: DC to 2.7 GHz
- Output Power (P_{3dB}): 178 W[1]
- Linear Gain: 21.8 dB[1]
- Typical PAE_{3dB}: 64.8 %[1]
- Operating Voltage: 65 V
- Low thermal resistance package
- CW and Pulse capable
- 7.2 x 6.6 mm package

  Note 1: @ 1.8 GHz (Loadpull)

QPD1013EVB01 Performance

Freq.(GHz)	P_{3dB}(W)	G_{3dB}(dB)	DE_{3dB}(%)
1.2	172.7	13.9	65.6
1.3	160.2	14.3	59.4
1.4	156.8	14.8	58.7
1.5	150.1	15.1	55.3
1.6	141.3	15.1	55.3
1.7	139.9	14.8	55.2
1.8	126.0	14.8	52.9

Pulse Width = 100us, Duty Cycle = 10%,
V_D = 65 V, I_{DQ} = 240 mA, 25°C base temperature

Applications

- Military radar
- Land mobile and military radio communications
- Test instrumentation
- Wideband or narrowband amplifiers
- Jammers

QPD1013EVB04 Performance

Freq.(GHz)	P_{3dB}(W)	G_{3dB}(dB)	DE_{3dB}(%)
0.96	170.6	18.7	68.0
1.00	164.8	19.0	69.0
1.10	155.2	17.9	64.7
1.20	152.4	19.0	56.6
1.215	146.2	19.0	54.4

Pulse Width = 100us, Duty Cycle = 10%,
V_D = 50 V, I_{DQ} = 200 mA, 25°C base temperature

Ordering Information

Part No.	Description
QPD1013S2	2 Piece Sample Bag
QPD1013SQ	25 Piece Sample Bag
QPD1013SR	100 Piece 7" Reel
QPD1013EVB01	1.2 – 1.9 GHz EVB
QPD1013EVB02	0.136 – 0.944 GHz EVB
QPD1013EVB03	2.55 – 2.75 GHz EVB
QPD1013EVB04	0.96 – 1.215 GHz EVB

Absolute Maximum Ratings[2]

Parameter	Rating	Units
Breakdown Voltage, BV_{DG}	225	V
Gate Voltage Range, V_G	-8 to +2	V
Drain Current, I_D	9	A
Gate Current Range, I_G[1]	19.2	mA
Power Dissipation, CW, P_{DISS}	74	W
RF Input Power at 1.6 GHz, CW, 50 Ω, T = 25 °C	+39	dBm
Channel Temperature, T_{CH}	275	°C
Mounting Temperature (30 Seconds)	320	°C
Storage Temperature	−65 to +150	°C

Notes:
1. At Channel temperature of 200°C.
2. 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	–	+65	+70	V
Drain Bias Current, I_{DQ}	–	240	–	mA
Drain Current, I_D	–	1.7	–	A
Gate Voltage, V_G[4]	–	−2.8	–	V
Channel Temperature (T_{CH})	–	–	250	°C
Power Dissipation, CW (P_D)[2]	–	–	67.0	W
Power Dissipation, Pulsed (P_D)[2, 3]	–	–	120.0	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. Back plane of package at 85 °C
3. Pulse Width = 100 us, Duty Cycle = 10%
4. To be adjusted to desired I_{DQ}

Pulsed Characterization – Load Pull Performance – Power Tuned – 65 V[1]

Parameters	Typical Values					Unit
Frequency, F	1.2	1.5	1.8	2.3	2.7	GHz
Linear Gain, G_{LIN}	23.7	22.3	20.3	18.1	15.2	dB
Output Power at 3dB compression point, P_{3dB}	52.7	52.5	52.5	52.3	52.1	dBm
Power-Added-Efficiency at 3dB compression point, PAE_{3dB}	61.5	58.1	53.7	51.1	43.2	%
Gain at 3dB compression point	20.7	19.3	17.3	15.1	12.2	dB

Note 1: Test conditions unless otherwise noted: V_D = +65 V, I_{DQ} = 240 mA, Temp = +25 °C

Pulsed Characterization – Load Pull Performance – Efficiency Tuned – 65V[1]

Parameters	Typical Values					Unit
Frequency	1.2	1.5	1.8	2.3	2.7	GHz
Linear Gain, G_{LIN}	25.3	23.7	21.8	19.3	16.8	dB
Output Power at 3dB compression point, P_{3dB}	50.6	50.2	51.1	51.1	50.9	dBm
Power-Added-Efficiency at 3dB compression point, PAE_{3dB}	70.9	69.4	64.8	57.5	52.3	%
Gain at 3dB compression point, G_{3dB}	22.3	20.7	18.8	16.3	13.8	dB

Note 1: Test conditions unless otherwise noted: V_D = +65 V, I_{DQ} = 240 mA, Temp = +25 °C

Pulsed Characterization – Load Pull Performance – Power Tuned – 50 V[1]

Parameters	Typical Values				Unit
Frequency, F	1.2	1.5	1.8	2.7	GHz
Linear Gain, G_{LIN}	22.5	21.9	19.7	15.2	dB
Output Power at 3dB compression point, P_{3dB}	51.5	51.5	51.6	51.4	dBm
Power-Added-Efficiency at 3dB compression point, PAE_{3dB}	62.8	56.8	50.5	50.9	%
Gain at 3dB compression point	19.5	18.9	16.7	12.2	dB

Note 1: Test conditions unless otherwise noted: V_D = +50 V, I_{DQ} = 240 mA, Temp = +25 °C

Pulsed Characterization – Load Pull Performance – Efficiency Tuned – 50 V[1]

Parameters	Typical Values				Unit
Frequency, F	1.2	1.5	1.8	2.7	GHz
Linear Gain, G_{LIN}	23.7	23.3	21.0	16.2	dB
Output Power at 3dB compression point, P_{3dB}	49.9	50.4	49.6	50.8	dBm
Power-Added-Efficiency at 3dB compression point, PAE_{3dB}	73.1	67.7	64.6	58.1	%
Gain at 3dB compression point	20.7	20.3	18.0	13.2	dB

Note 1: Test conditions unless otherwise noted: V_D = +50 V, I_{DQ} = 240 mA, Temp = +25 °C

RF Characterization – 1.2 – 1.9 GHz EVB Performance At 1.6 GHz[1]

Parameter	Min	Typ	Max	Units
Linear Gain, G_{LIN}	–	18.1	–	dB
Output Power at 3dB compression point, P_{3dB}	–	51.5	–	dBm
Drain Efficiency at 3dB compression point, $DEFF_{3dB}$	–	55.3	–	%
Gain at 3dB compression point, G_{3dB}	–	15.1	–	dB

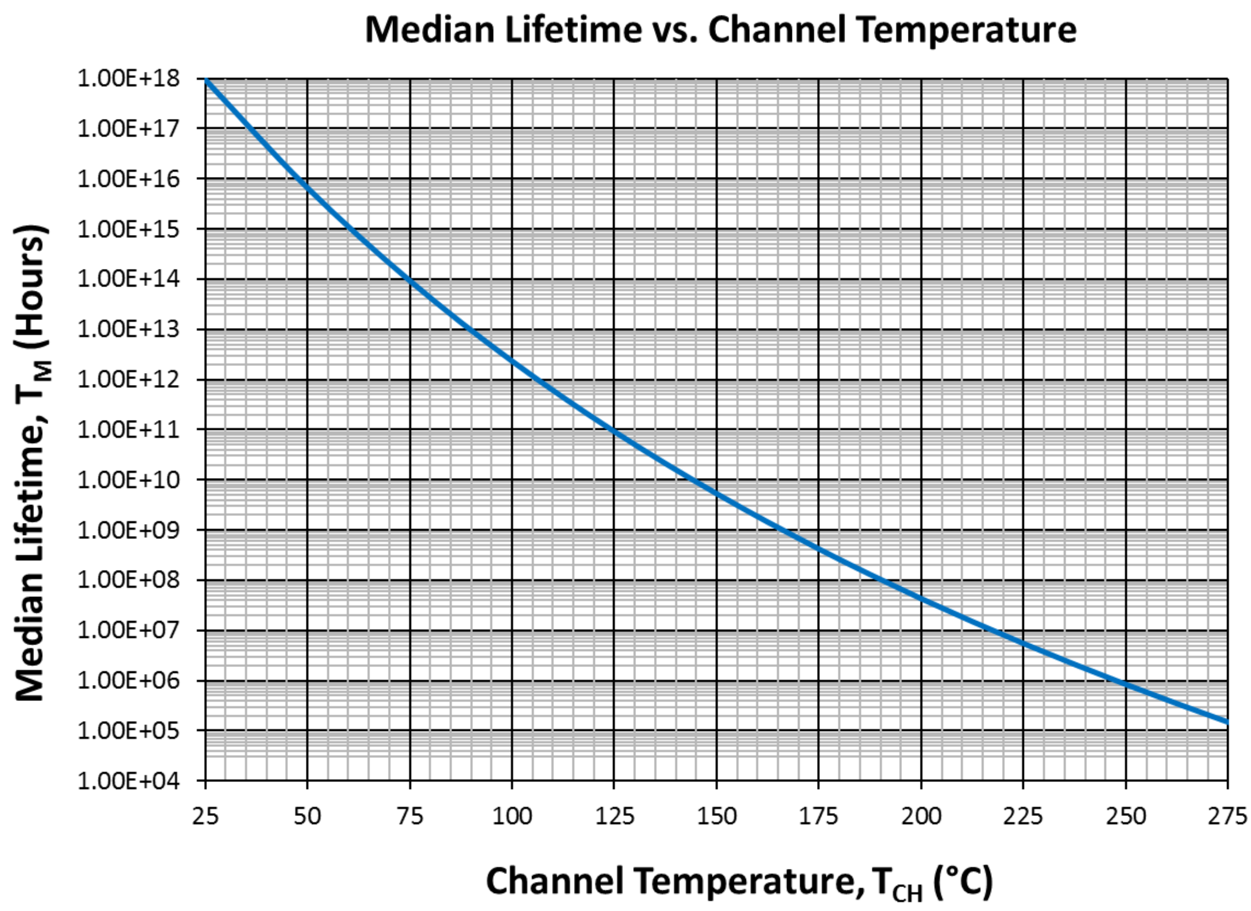
Notes:
1. V_D = +65 V, I_{DQ} = 240 mA, Temp = +25 °C, Pulse Width = 100 us, Duty Cycle = 10%

RF Characterization – Mismatch Ruggedness at 1.6 GHz[1,2]

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 = 65 V, I_{DQ} = 240 mA
2- Driving input power is determined at pulsed compression under matched condition at EVB output connector.

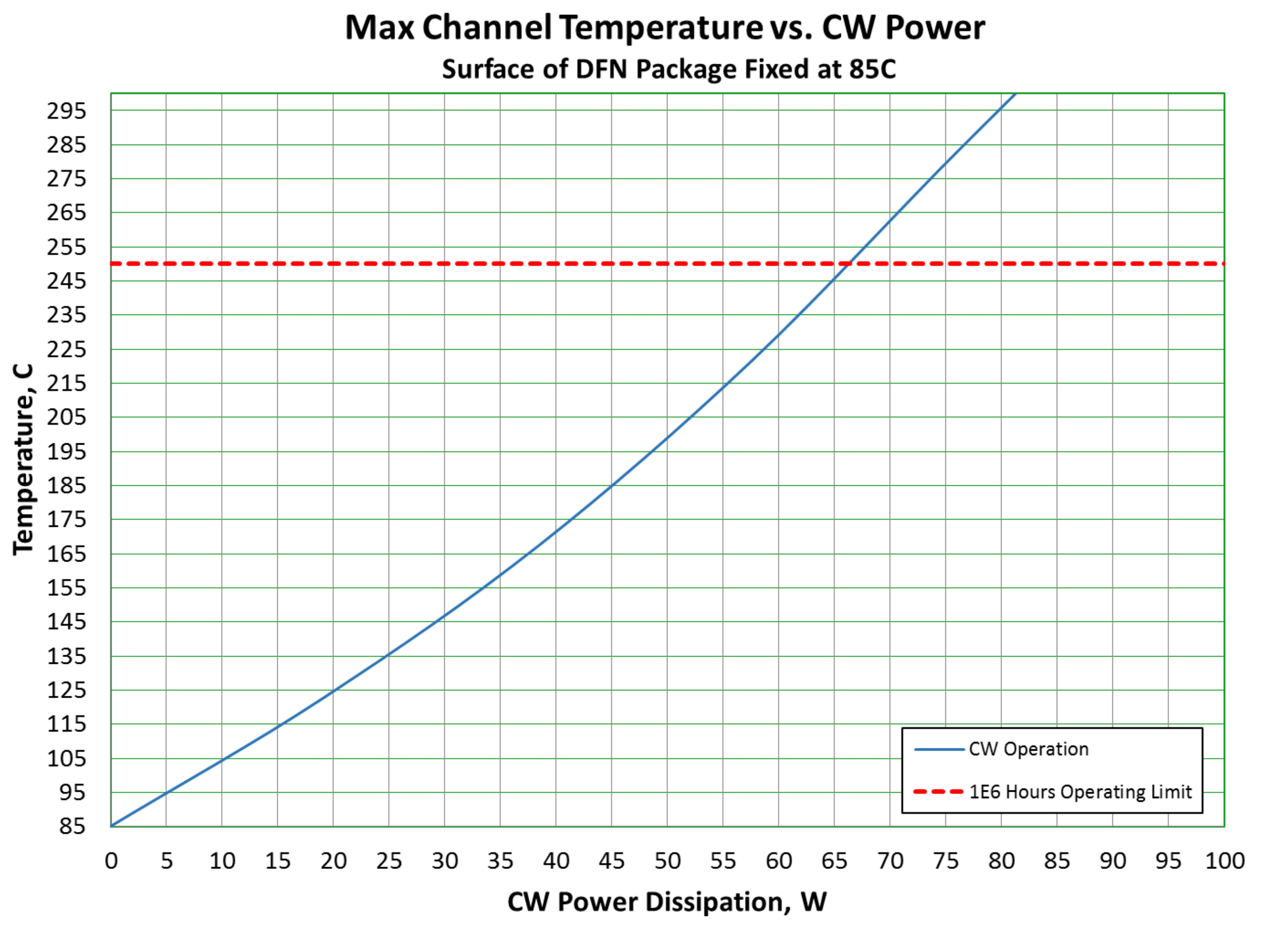
Median Lifetime[1]



Notes:

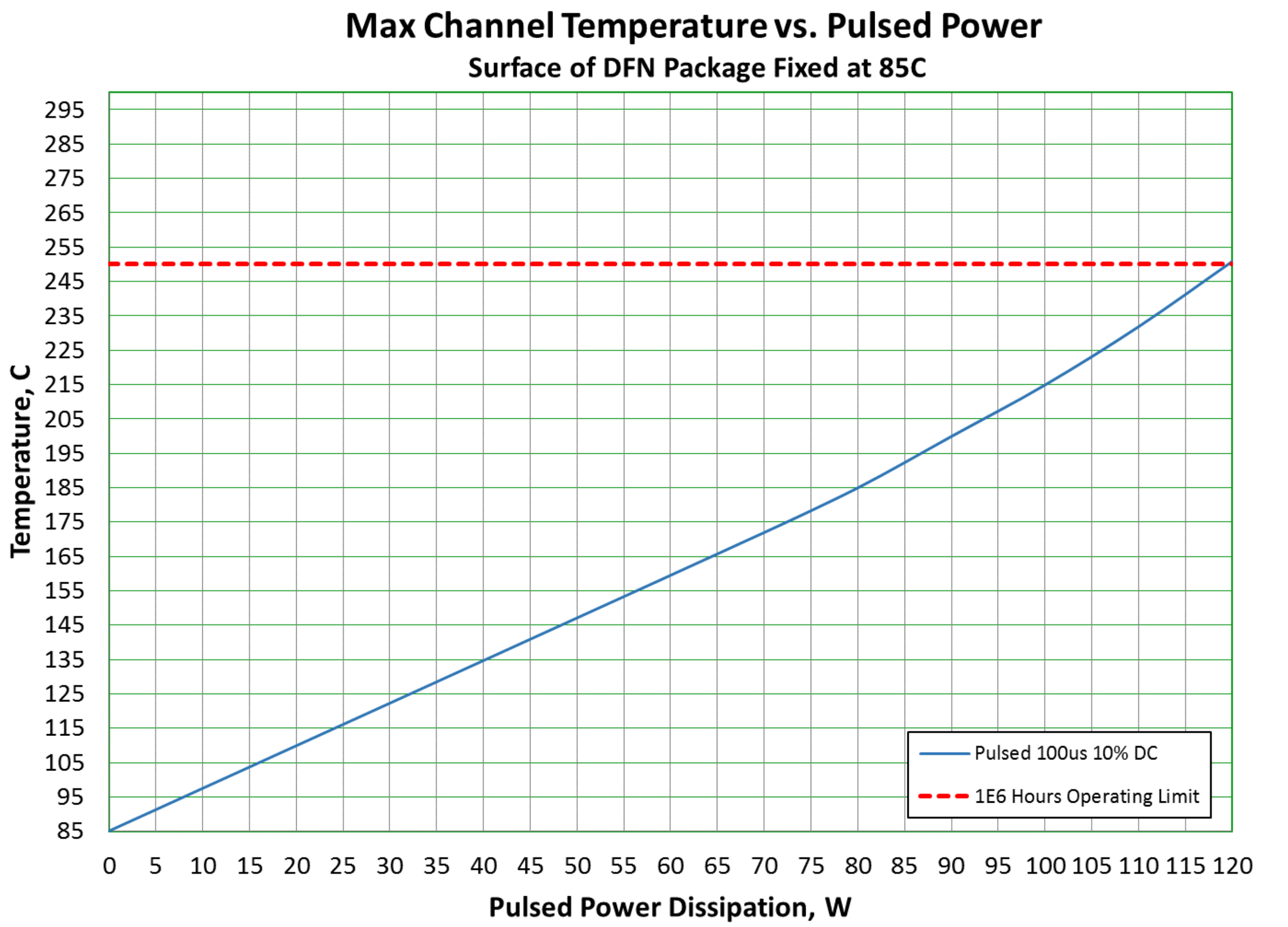
1- For pulsed signals, average lifetime is average lifetime at maximum channel temperature divided by duty cycle.

Thermal and Reliability Information - CW



Parameter	Conditions	Values	Units
Thermal Resistance (θ_{JC})	85 °C Case 19.2 W Pdiss, CW	2.0	°C/W
Maximum Channel Temperature (T_{CH})		124	°C
Median Lifetime (T_M)		9.0E10	Hrs
Thermal Resistance (θ_{JC})	85 °C Case 38.4 W Pdiss, CW	2.2	°C/W
Maximum Channel Temperature (T_{CH})		168	°C
Median Lifetime (T_M)		7.0E8	Hrs
Thermal Resistance (θ_{JC})	85 °C Case 57.6 W Pdiss, CW	2.4	°C/W
Maximum Channel Temperature (T_{CH})		222	°C
Median Lifetime (T_M)		7.0E6	Hrs
Thermal Resistance (θ_{JC})	85 °C Case 76.8 W Pdiss, CW	2.6	°C/W
Maximum Channel Temperature (T_{CH})		285	°C
Median Lifetime (T_M)		7.0E4	Hrs

Thermal and Reliability Information - Pulsed

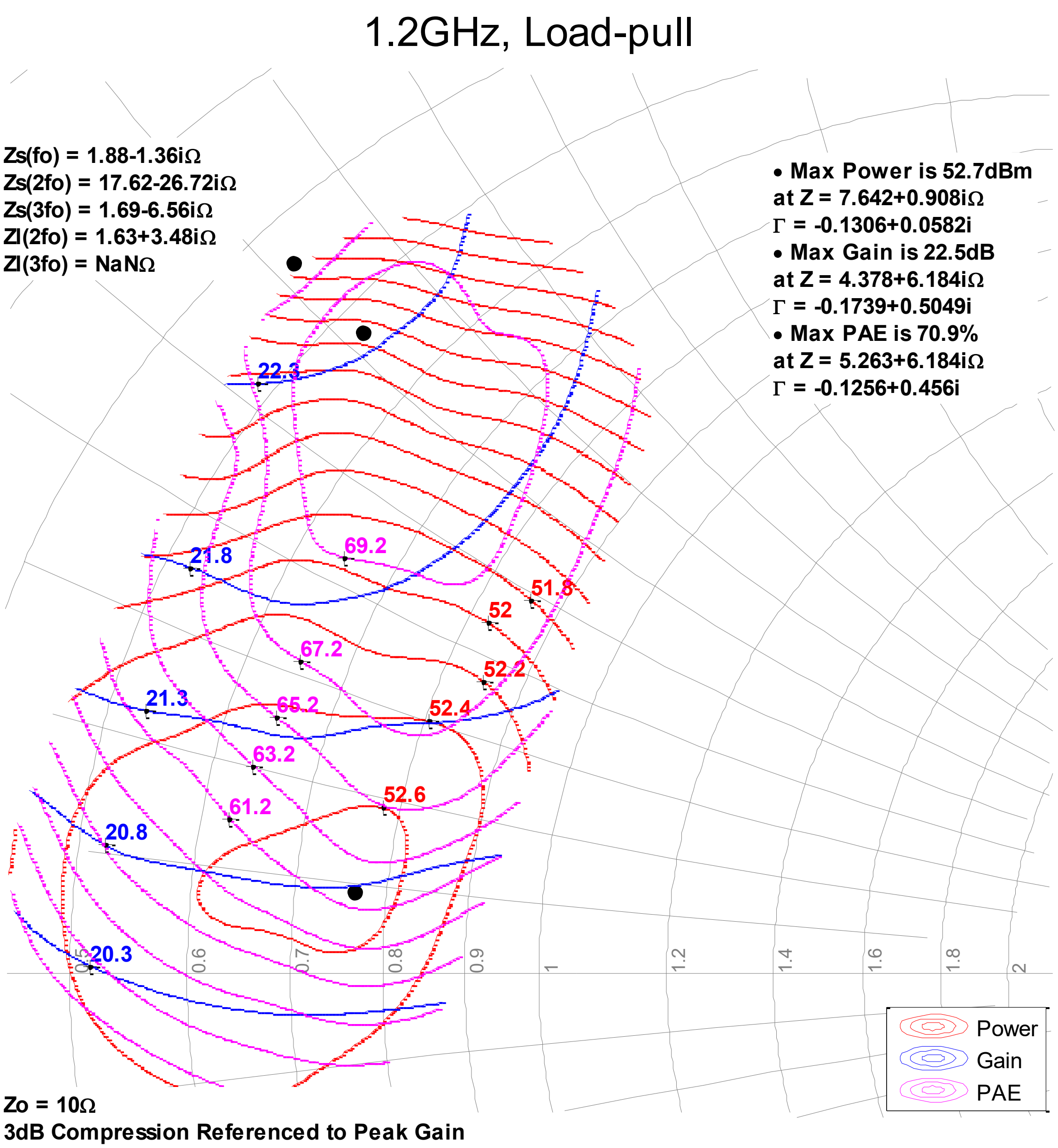


Parameter	Conditions	Values	Units
Thermal Resistance (θ_{JC})	85 °C Case 90 W Pdiss, Pulsed 100us 10% DC	2.0	°C/W
Maximum Channel Temperature (T_{CH})		200	°C
Median Lifetime (T_M)		4.0E8	Hrs
Thermal Resistance (θ_{JC})	85 °C Case 100 W Pdiss, Pulsed 100us 10% DC	1.7	°C/W
Maximum Channel Temperature (T_{CH})		215	°C
Median Lifetime (T_M)		1.0E8	Hrs
Thermal Resistance (θ_{JC})	85 °C Case 110 W Pdiss, Pulsed 100us 10% DC	1.5	°C/W
Maximum Channel Temperature (T_{CH})		232	°C
Median Lifetime (T_M)		3.0E7	Hrs
Thermal Resistance (θ_{JC})	85 °C Case 120 W Pdiss, Pulsed 100us 10% DC	1.4	°C/W
Maximum Channel Temperature (T_{CH})		251	°C
Median Lifetime (T_M)		8.0E6	Hrs

Load Pull Smith Charts[1, 2]

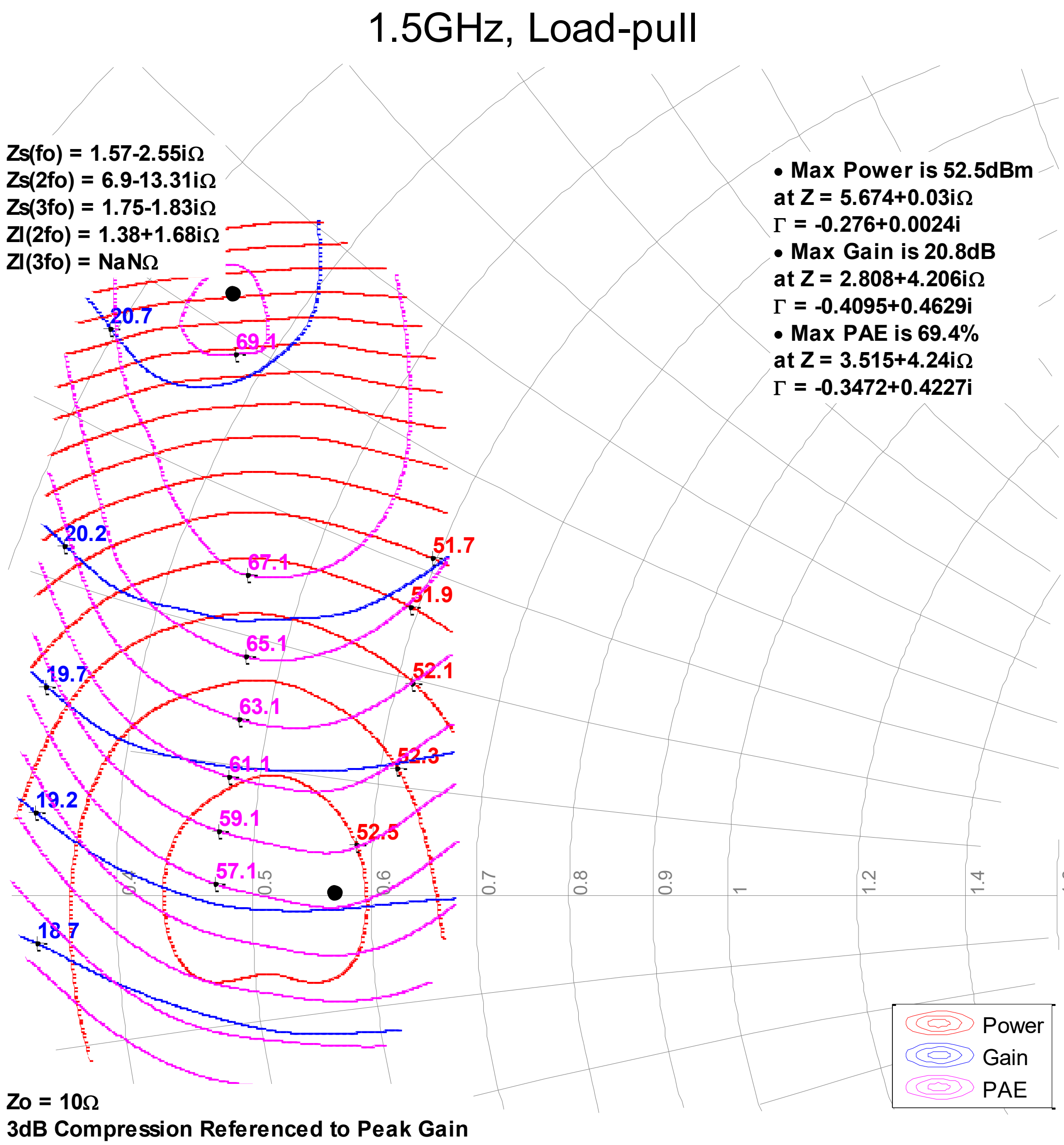
Notes:

1. Vd = 65 V, I_{DQ} = 240 mA, Pulsed signal with 100 us pulse width and 10 % duty cycle.
2. See page 20 for load pull and source pull reference planes.



Load Pull Smith Charts[1, 2]

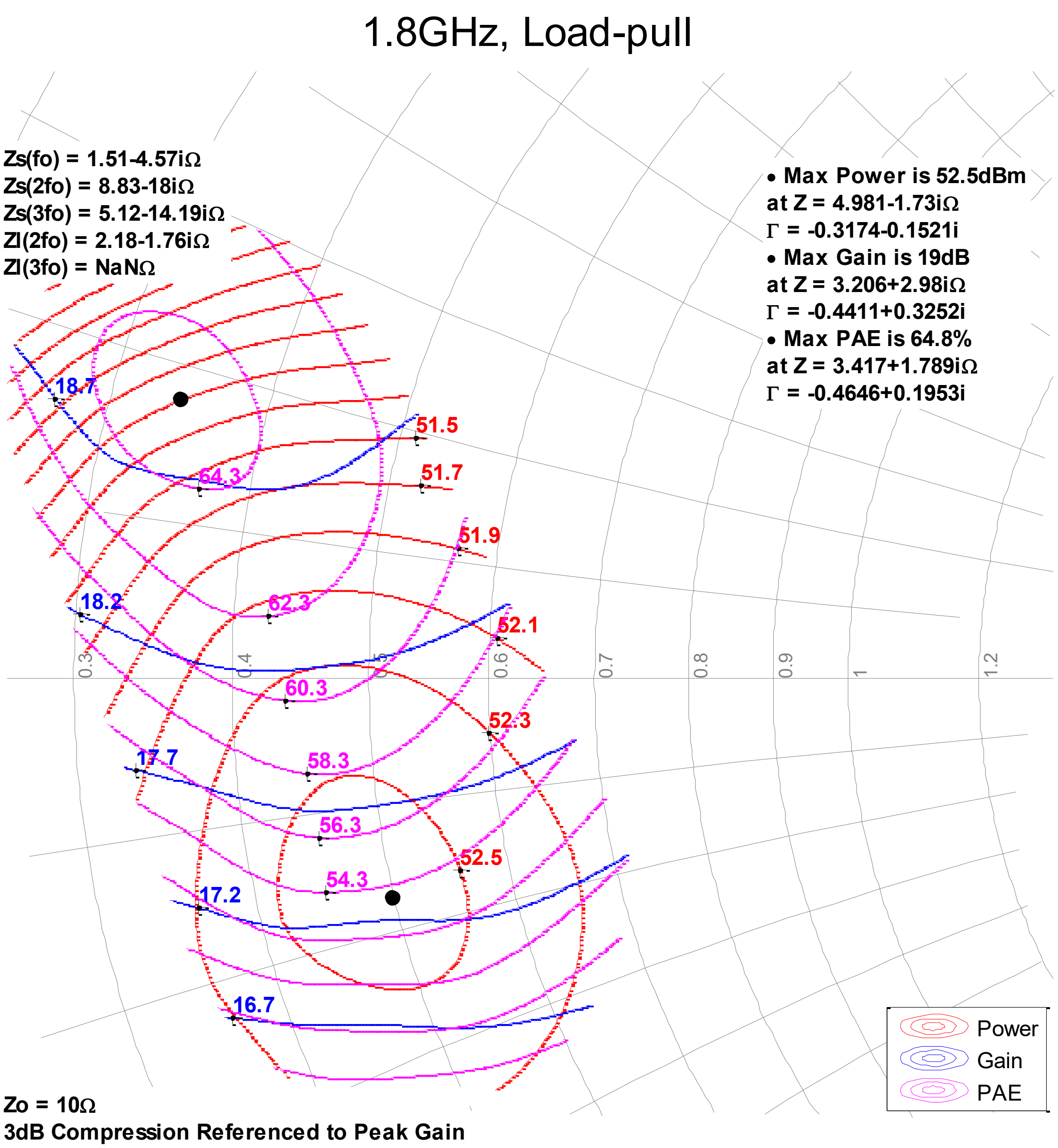
Notes:
1. Vd = 65 V, I_{DQ} = 240 mA, Pulsed signal with 100 us pulse width and 10 % duty cycle.
2. See page 20 for load pull and source pull reference planes.



Load Pull Smith Charts[1, 2]

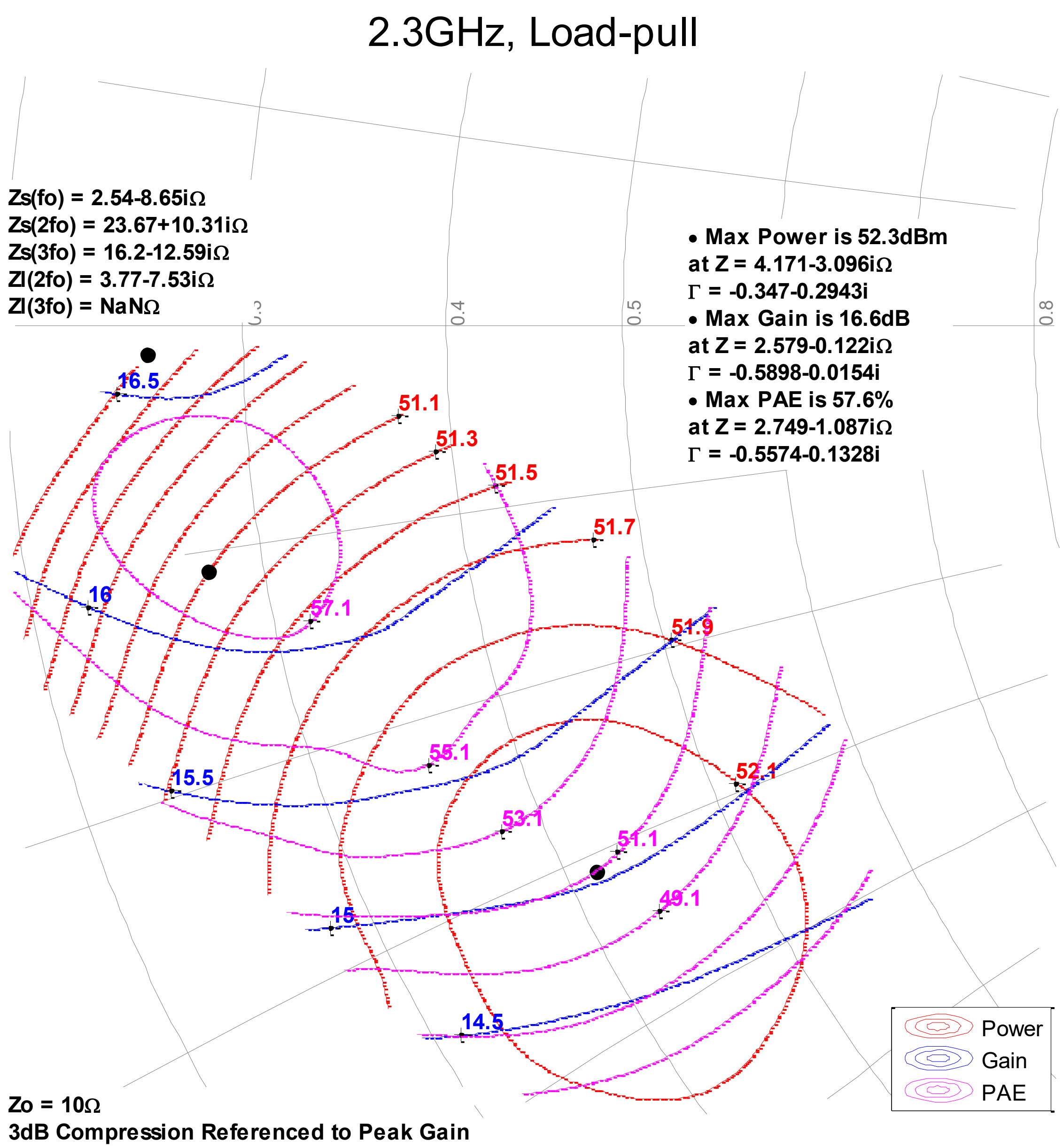
Notes:

1. Vd = 65 V, I_{DQ} = 240 mA, Pulsed signal with 100 us pulse width and 10 % duty cycle.
2. See page 20 for load pull and source pull reference planes.



Load Pull Smith Charts[1, 2]

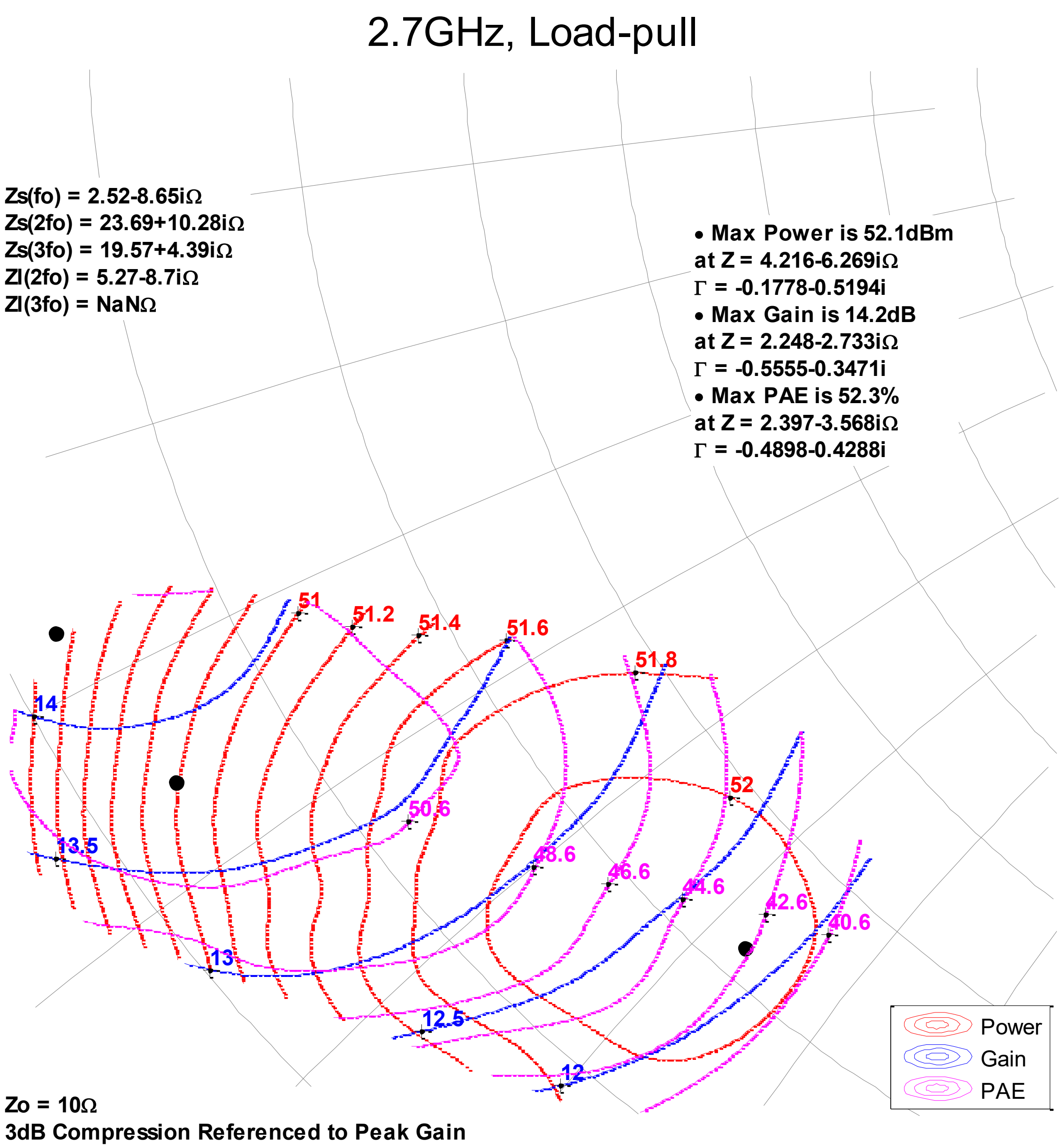
Notes:
1. Vd = 65 V, I_{DQ} = 240 mA, Pulsed signal with 100 us pulse width and 10 % duty cycle.
2. See page 20 for load pull and source pull reference planes.



Load Pull Smith Charts[1, 2]

Notes:

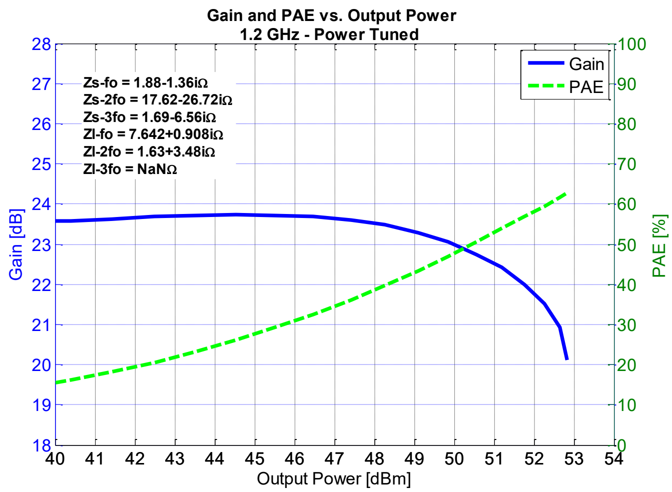
1. Vd = 65 V, I_{DQ} = 240 mA, Pulsed signal with 100 us pulse width and 10 % duty cycle.
2. See page 20 for load pull and source pull reference planes.

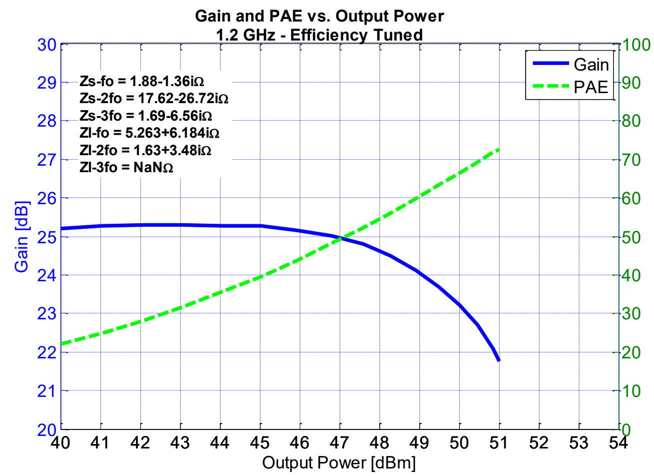


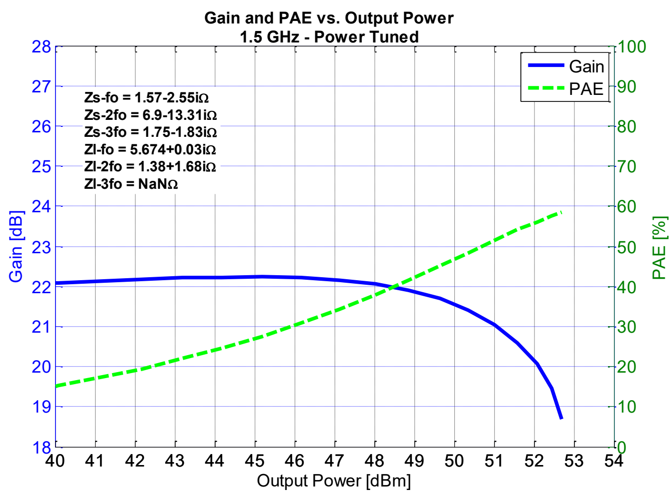
Typical Performance – Load Pull Drive-up

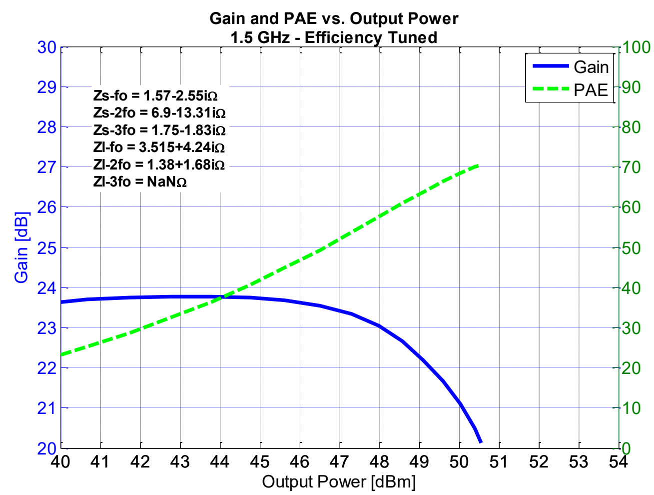
Notes:

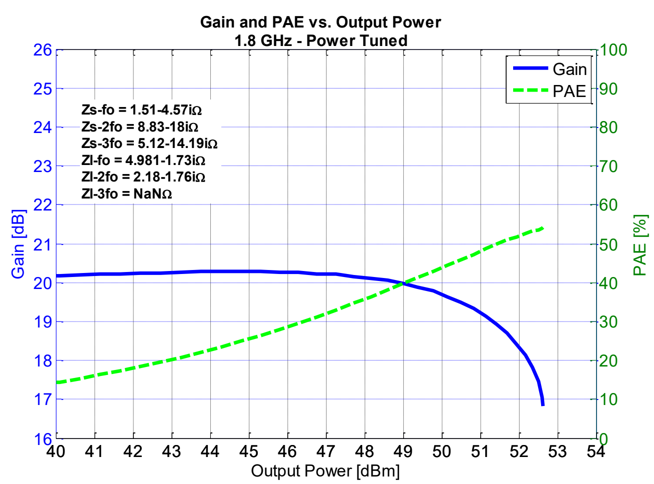
1. Pulsed signal with 100 us pulse width and 10 % duty cycle, Vd = 65 V, I_{DQ} = 240 mA
2. See page 20 for load pull and source pull reference planes where the performance was measured.

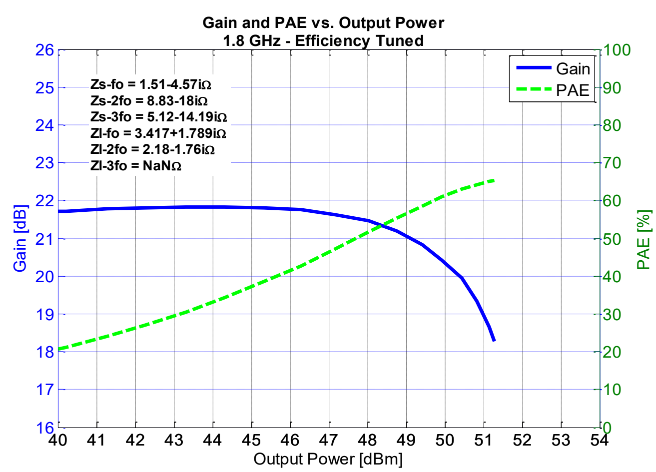








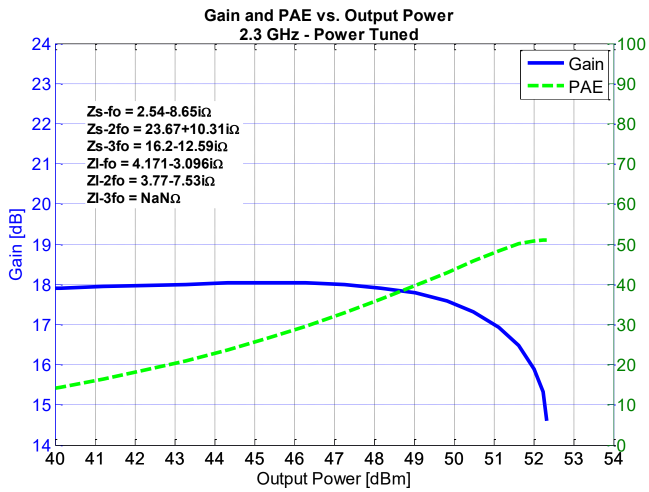


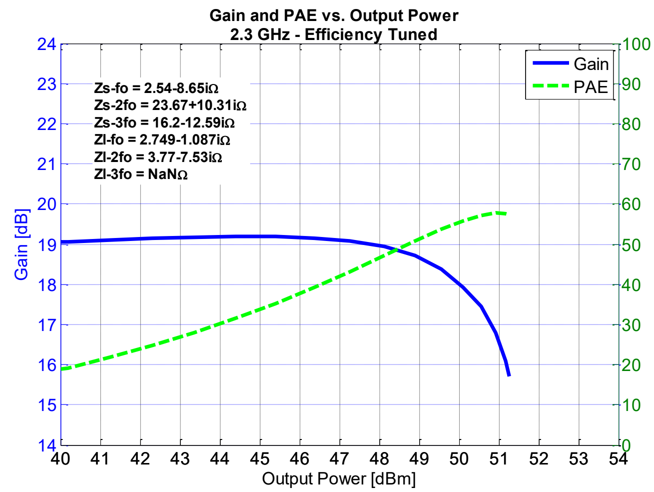


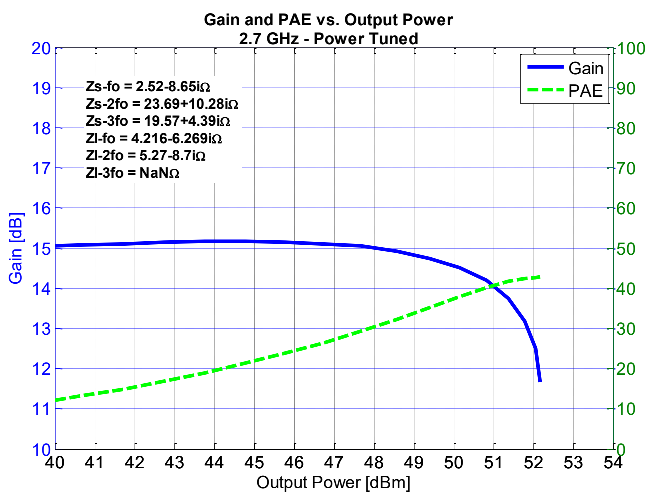
Typical Performance – Load Pull Drive-up

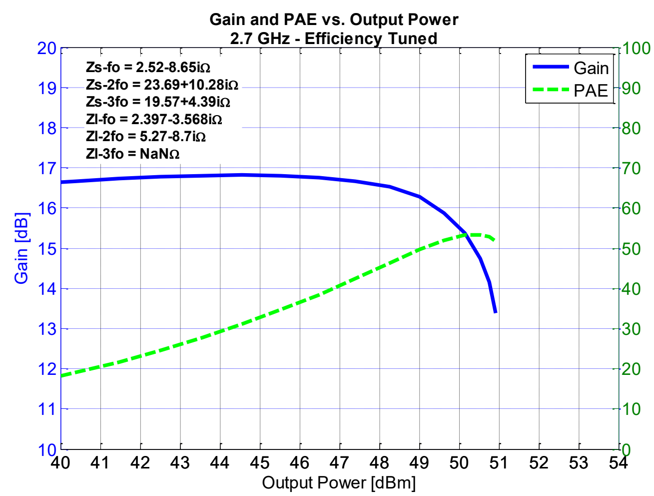
Notes:

1. Pulsed signal with 100 us pulse width and 10 % duty cycle, Vd = 65 V, I_{DQ} = 240 mA
2. See page 20 for load pull and source pull reference planes where the performance was measured.





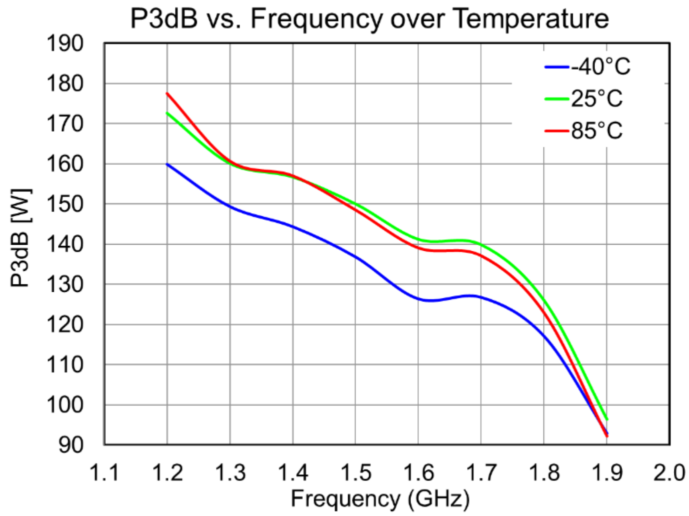


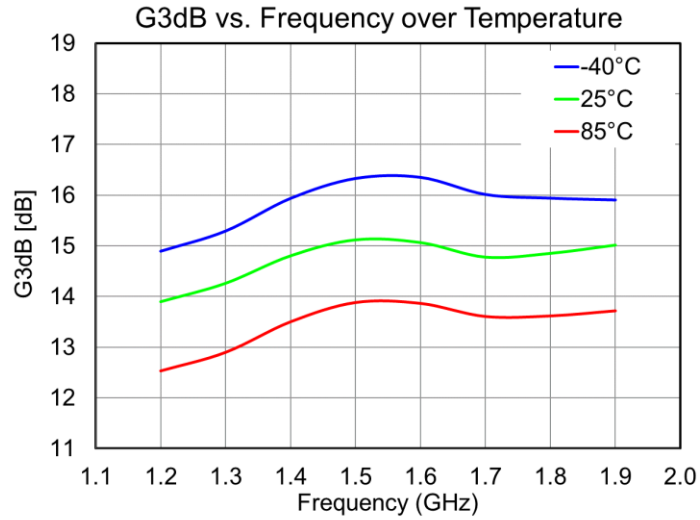


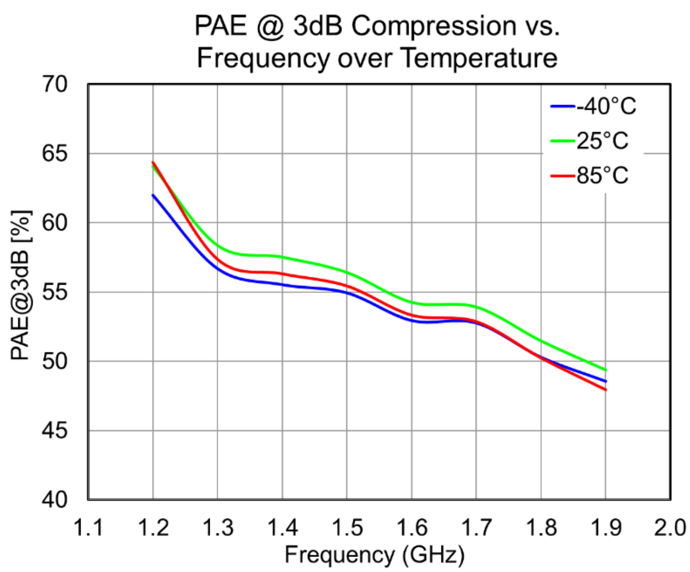
Power Driveup Performance Over Temperatures of 1.2 – 1.9 GHz EVB – 65 V[1]

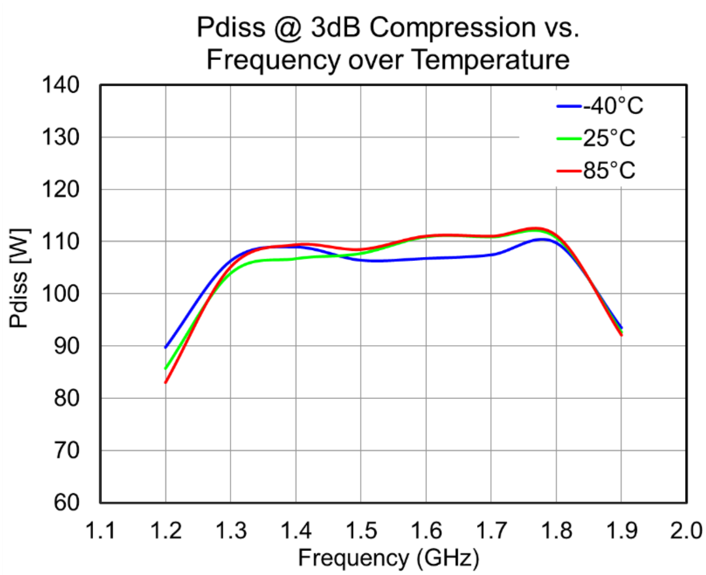
Notes:

1- Vd = 65 V, I_{DQ} = 240 mA, Pulse Width = 100 us, Duty Cycle = 10 %





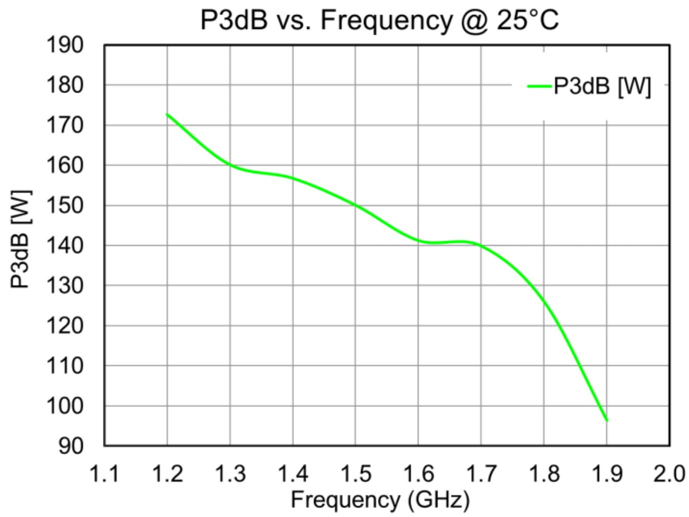


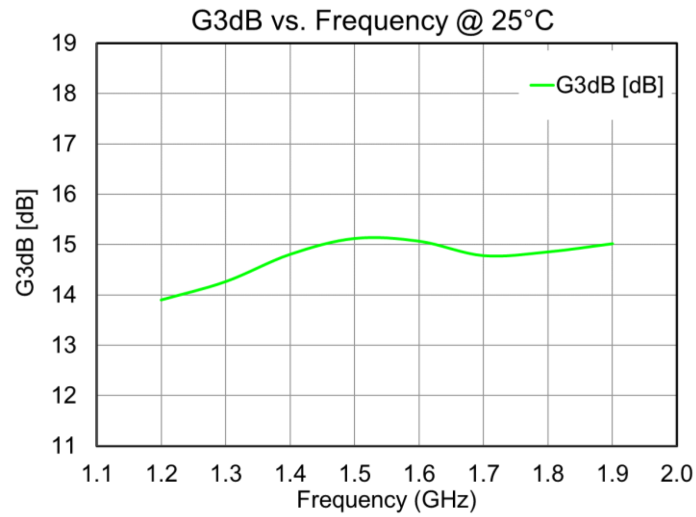


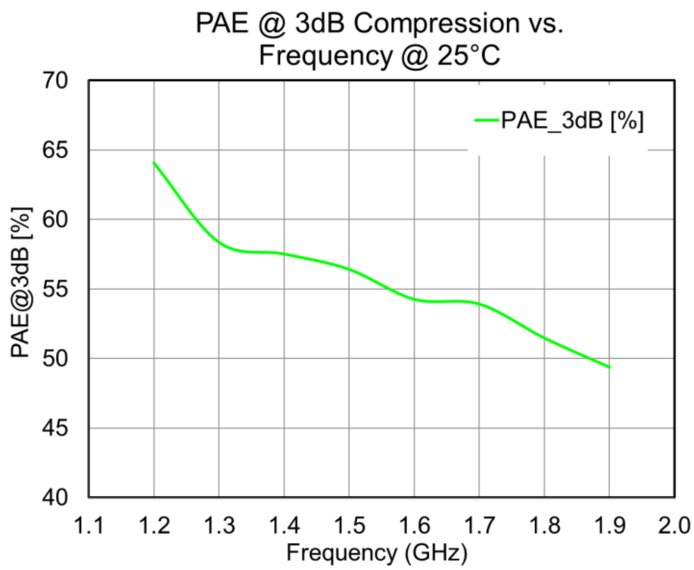
Power Driveup Performance at 25 °C of 1.2 – 1.9 GHz EVB – 65 V[1]

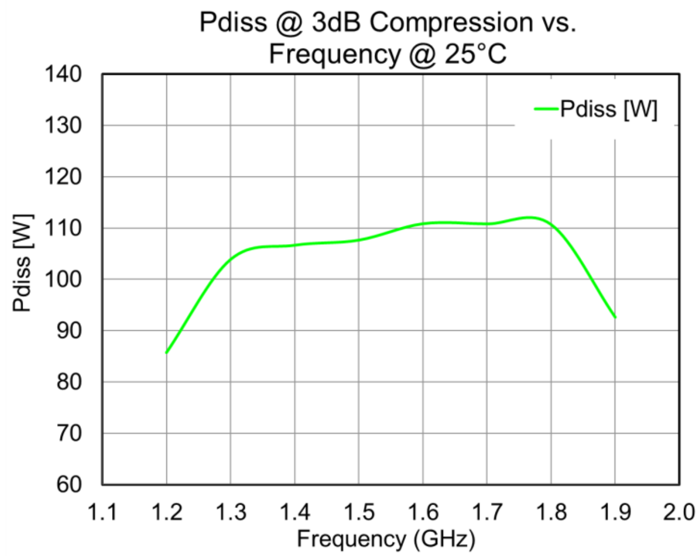
Notes:

1- Vd = 65 V, I_{DQ} = 240 mA, Pulse Width = 100 us, Duty Cycle = 10 %



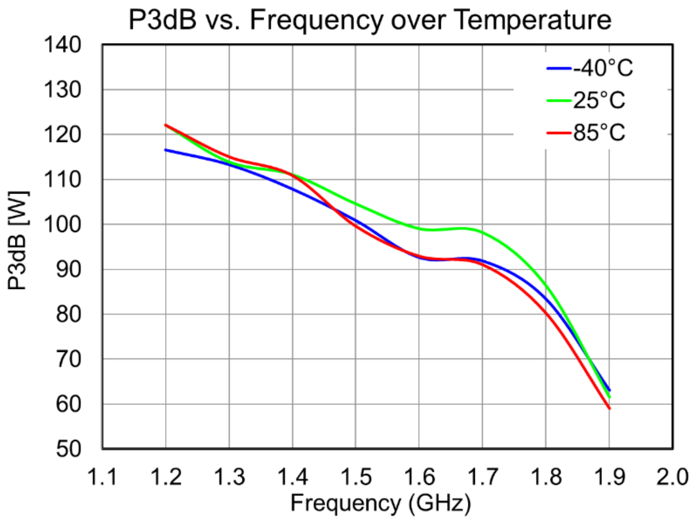


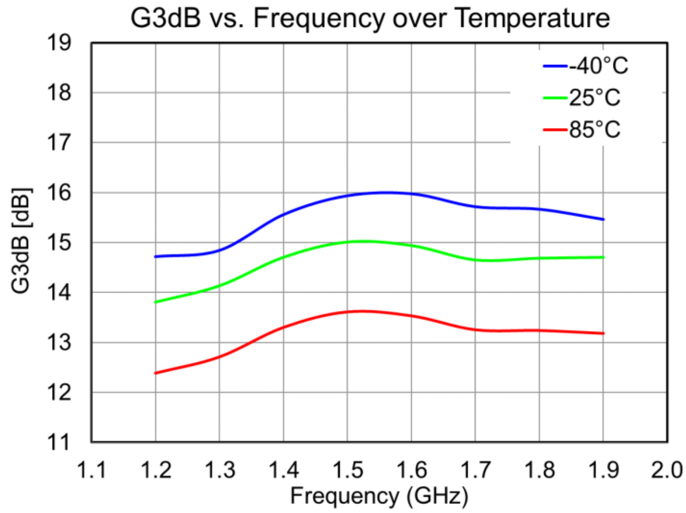


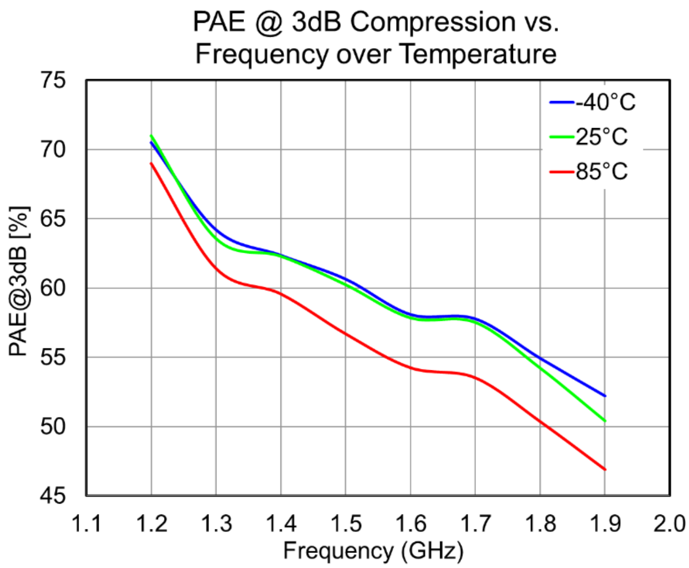


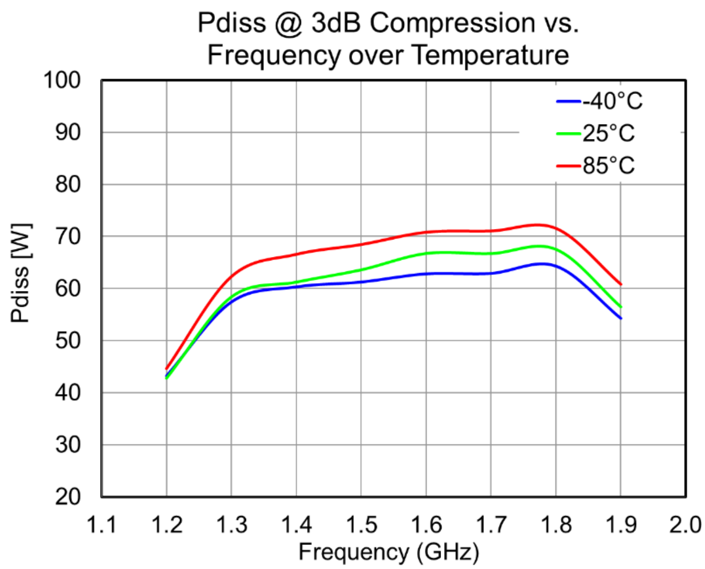
Power Driveup Performance Over Temperatures of 1.2 – 1.9 GHz EVB – 50 V[1]

Notes:
1- Vd = 50 V, I_{DQ} = 240 mA, Pulse Width = 100 us, Duty Cycle = 10 %





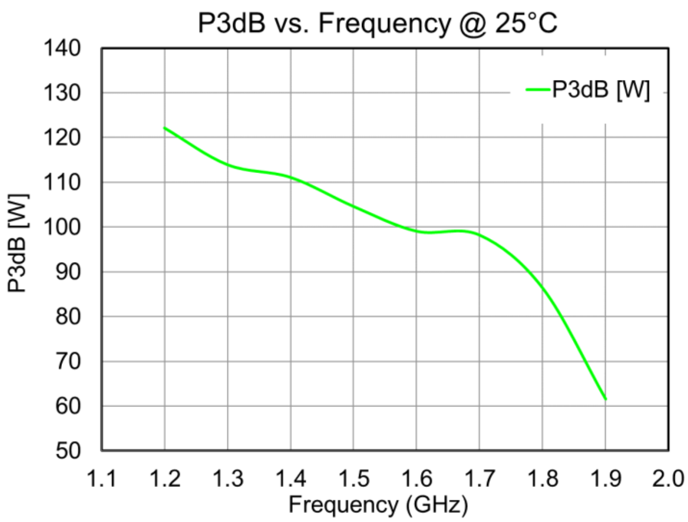


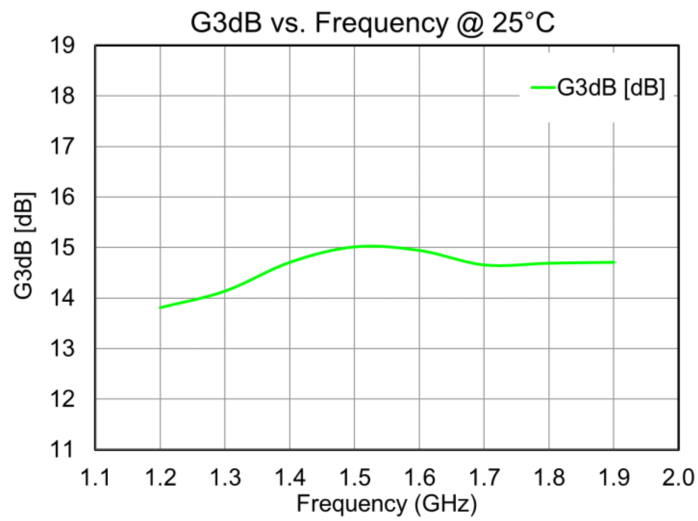


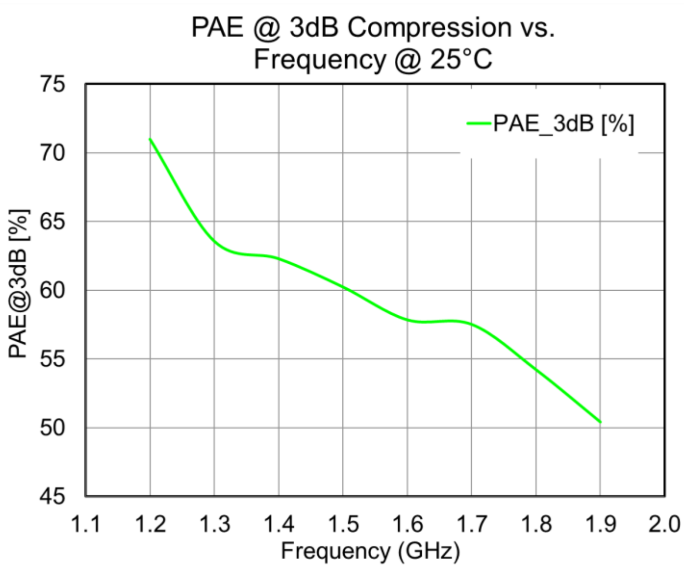
Power Driveup Performance at 25 °C of 1.2 – 1.9 GHz EVB – 50 V[1]

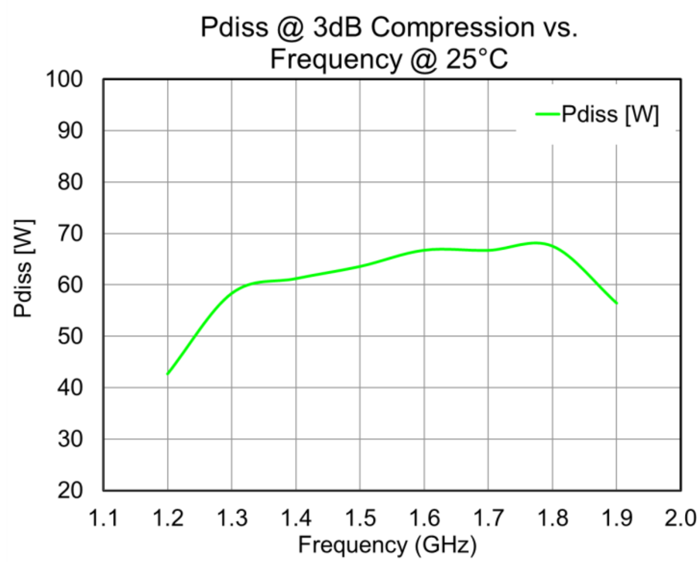
Notes:

1- Vd = 50 V, I_{DQ} = 240 mA, Pulse Width = 100 us, Duty Cycle = 10 %



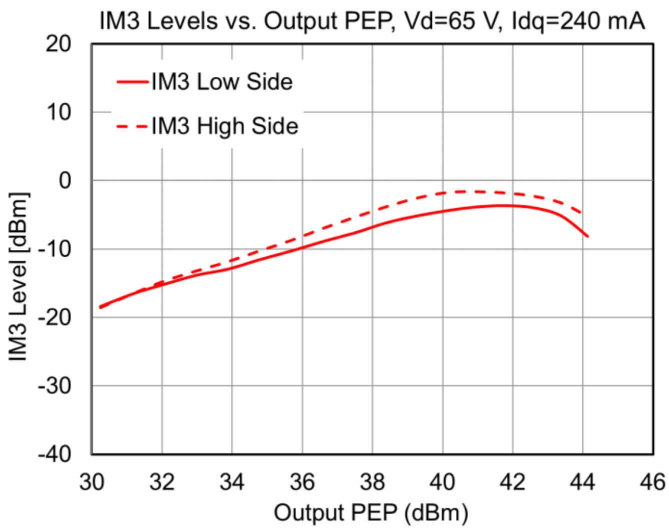


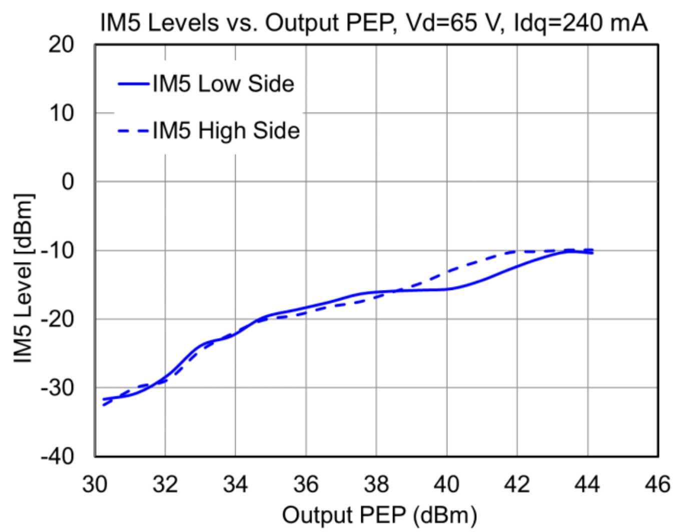




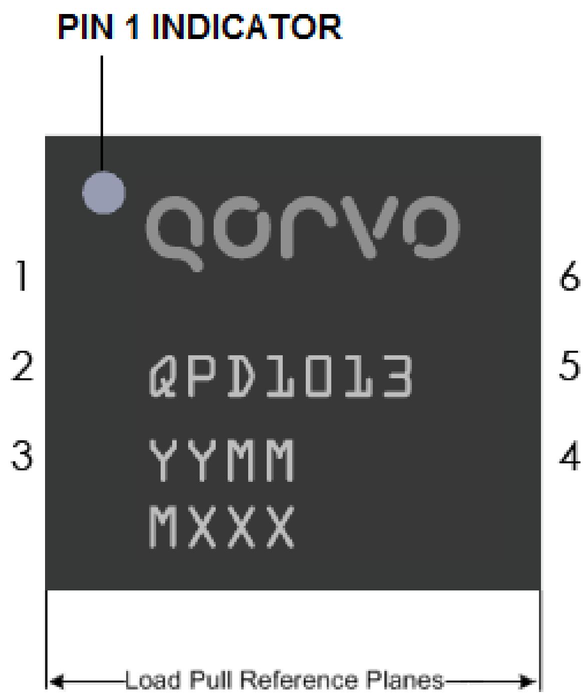
Two-Tone Performance at 25 °C of 1.2 – 1.9 GHz EVB[1]

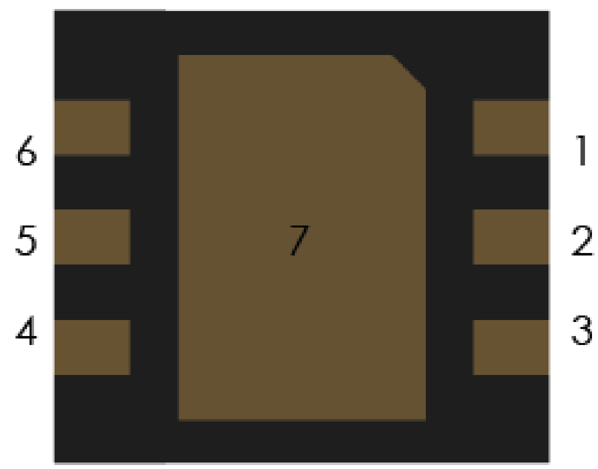
Notes:
1- Center Frequency = 1.5 GHz. Tone Seperation = 1 MHz.





Pin Layout [1]





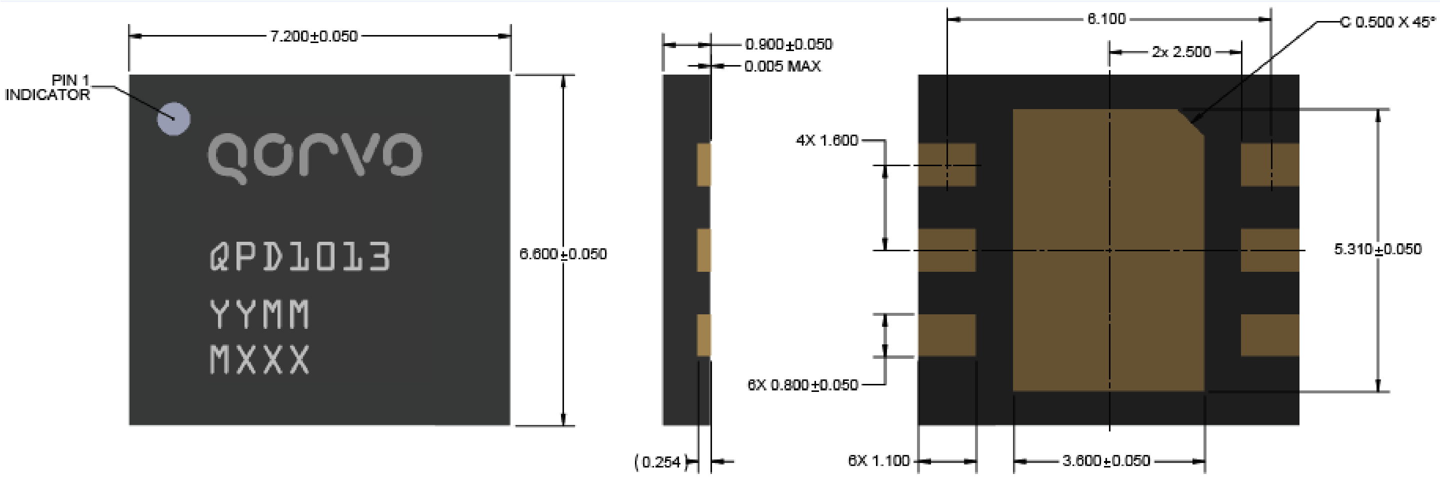
Notes:

1. The QPD1013 will be marked with the "QPD1013" 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 "MM" is the work week of the assembly lot start, the "MXXX" is the batch ID.

Pin Description

Pin	Symbol	Description
1 – 3	VG / RF IN	Gate voltage / RF Input
4 – 6	VD / RF OUT	Drain voltage / RF Output
7	Back Plane	Source to be connected to ground

Mechanical Drawing



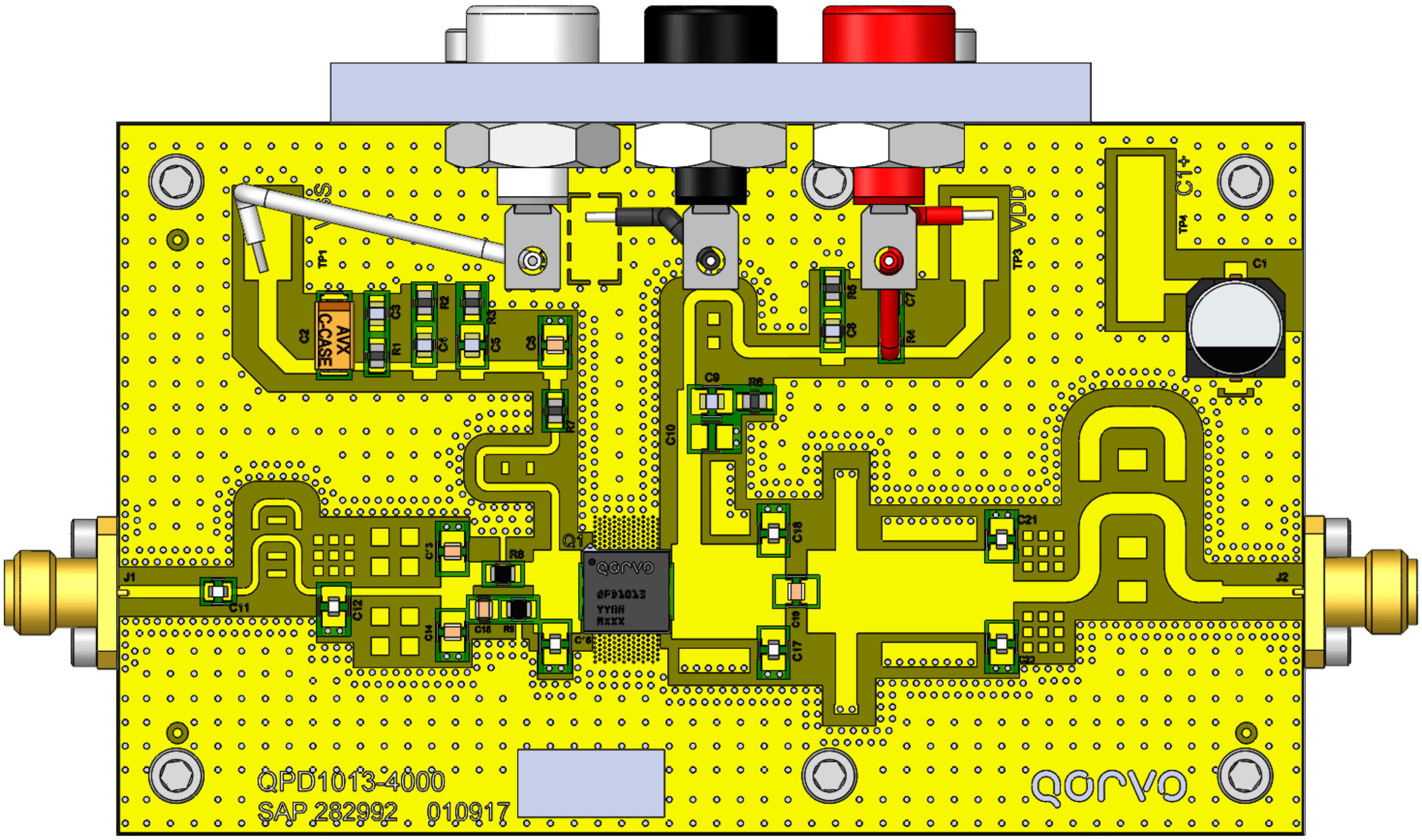
Notes:

1- All dimensions are in mm, otherwise noted. Tolerance is ±0.050 mm.

Bias-up Procedure	Bias-down Procedure
1. Set V_G to -4 V.	1. Turn off RF signal.
2. Set ID current limit to 500 mA.	2. Turn off VD
3. Apply 65 V VD.	3. Wait 2 seconds to allow drain capacitor to discharge
4. Slowly adjust VG until ID is set to 240 mA.	4. Turn off VG
5. Set ID current limit to 3 A	
6. Apply RF.	

QPD1013EVB01 PCB Layout – 1.2 – 1.9 GHz EVB

Note: PCB Material is RO4350B, 20 mil thick substrate, 1 oz. copper each side.

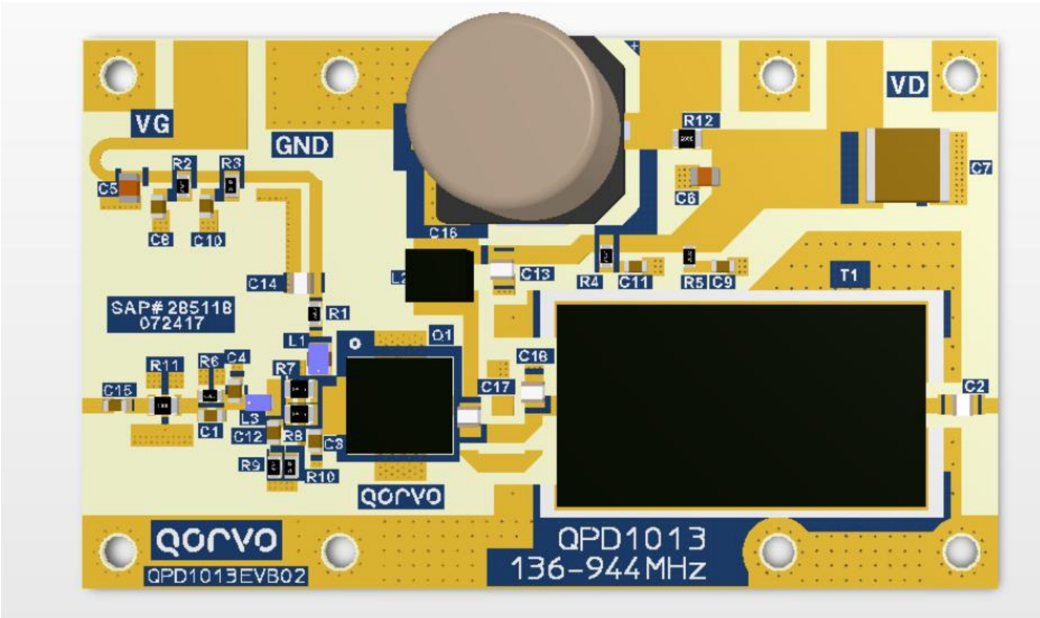


QPD1013EVB01 Bill Of material – 1.2 – 1.9 GHz EVB

Ref Des	Value	Description	Manufacturer	Part Number
C1	33 uF	80V 20% SVP Capacitor	Panasonic	EEE-FK1K330P
C2	10 uF	16V 10% Tantalum Capacitor	AVX	TPSC106KR0500
C4, C8	1000 pF	X7R 100V 5% 0805 Capacitor	AVX	08051C102JAT2A
C3, C7	0.01 uF	X7R 100V 5% 0805 Capacitor	AVX	08051C103JAT2A
C5, C9	100 pF	C0G 250VDC 5% Capacitor	AVX	600F101JT250XT
C6	22 pF	C0G 250VDC 5% Capacitor	AVX	800A220JT250XT
C10	22 pF	NPO 250VDC 5% Capacitor	AVX	600F220JT250XT
C11	4.7 pF	NPO 250VDC ± 0.1 pF Capacitor	AVX	600S4R7BT250XT
C12	2 pF	NPO 250VDC ± 0.1 pF Capacitor	AVX	600S2R0BT250XT
C13, C14	1.2 pF	NPO 250VDC ± 0.1 pF Capacitor	AVX	800A1R2BT250XT
C15, C19	12 pF	C0G 250VDC 5% Capacitor	AVX	800A120JT250XT
C16	3 pF	NPO 250VDC ± 0.1 pF Capacitor	AVX	600S3R0BT250XT
C17, C18	3 pF	NPO 250VDC ± 0.1 pF Capacitor	AVX	600F3R0BT250XT
C20, C21	1.5 pF	NPO 250VDC ± 0.1 pF Capacitor	AVX	600S1R5BT250XT
R1 – R6	5.1 Ohm	1/8W 1% Thick Film Resistor	Vishay	CRCW08055R10FKEA
R7	3.0 Ohm	1/8W 1% Thick Film Resistor	Vishay	CRCW08053R00FKEA
R8	3.0 Ohm	16W 5% Thick Film Resistor	IMS	NGC-0805CS3R00J
R9	5.0 Ohm	16W 5% Thick Film Resistor	IMS	NGC-0805CS5R00J

QPD1013EVB02 PCB Layout – 136 – 944 MHz EVB

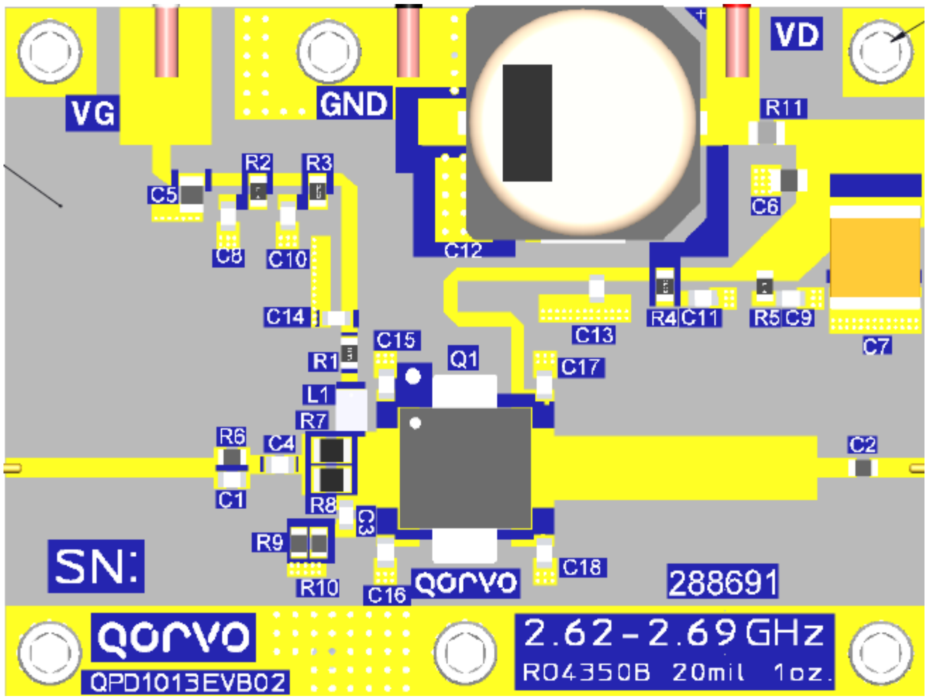
Note: PCB Material is RO4350B, 20 mil thick substrate, 1 oz. copper each side.



QPD1013EVB02 Bill Of material – 136 – 944 MHz EVB

Ref Des	Value	Description	Manufacturer	Part Number
C1	22 pF	250V, 5%, 0603	AVX	600S220JT250XT
C2,C13,C14,C17	240 pF	250V, 5%, 0805	AVX	600F241JT250XT
C3	3.3 pF	250V, +/-0.1pF, 0603	AVX	600S3R3BT250XT
C4	8.2 pF	250V, +/-0.1pF, 0603	AVX	600S8R2BT250XT
C5,C6	1 uF	100V, 10%, 0805	TDK	CGA4J3X7S2A105K125AB
C7	10 uF	100V, 10%, X7S, 2220	TDK	C5750X7S2A106K230KB
C8,C9	0.1 uF	100V, 10%, X7R, 0603	Murata	GRM188R72A104KA35D
C10,C11,C12,C15	100 pF	250V, 5%, X7R, 0603	AVX	600S101JT250XT
C16	100 uF	100V, 20%, Alum Elec	BC Components	MAL215099907E3
C18	12 pF	250V, 1%, 0805	AVX	600F120FT250XT
R1 – R5	10 Ohm	1/10W, 5%, 0603	KOA Speer	RK73B1JTTD100J
R6	27 Ohm	1/16W, 1%, 0603	Vishay	CRCW060327R0FKEAHP
R7,R8	5.1 Ohm	1/8W, 1%, 0805	Vishay	CRCW08055R10FKEA
R9, R10	240 Ohm	1/10W, 1%, 0603	Samsung	RC1608F241CS
R11	10 Ohm	1/2W, 1%, 0805	Vishay	CRCW080510R0FKEAHP
R12	0 Ohm	1/2W, 0805	Kamaya	RMC1/10JPTP
L1	68 nH	5%, 0805	Coilcraft	0805CS-680XJLC
L2	82 nH	5%, Mini-spring	Coilcraft	1515SQ-82NJEC
L3	1.8 nH	5%, 2.1A, 0603	Coilcraft	0603HP-1N8XJLW
T1		Balun Transformer, 50-12.5 Ohm	TTM Anaren	XMT0310B5012

QPD1013EVB03 PCB Layout – 2.55 – 2.75 GHz EVB

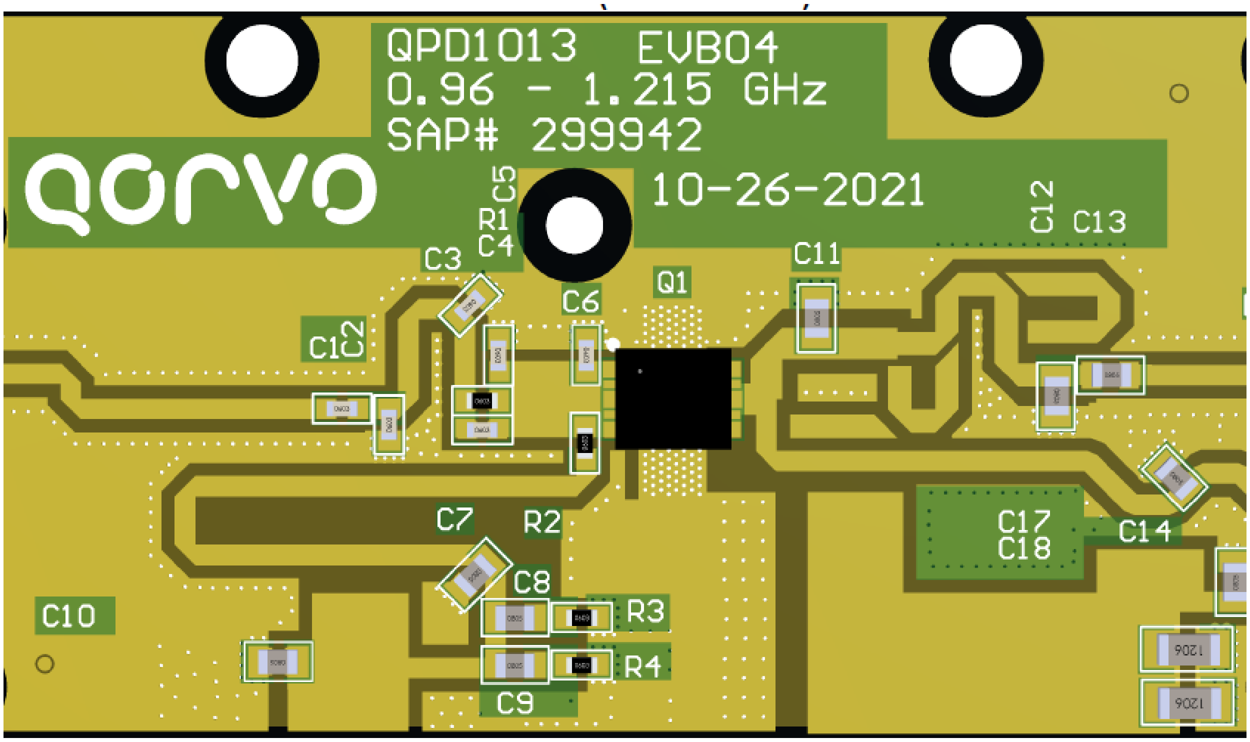


QPD1013EVB03 Bill Of material – 2.55 – 2.75 GHz EVB

Ref Des	Value	Description	Manufacturer	Part Number
C1	10 pF	250V, 5%, 0603	AVX	600S100JT250XT
C2	5.6 pF	250V, +/-0.1pF, 0603	AVX	600S5R6BT250XT
C4	0.9 pF	250V, +/-0.05pF, 0603	AVX	600S0R9AT250XT
C5,C6	1 uF	100V, 10%, X7S, 0805	TDK	CGA4J3X7S2A105K125AB
C7	10 uF	100V, 10%, X7S, 2220	TDK	C5750X7S2A106K230KB
C8,C9	0.1 uF	100V, 10%, X7R, 0603	Murata	GRM188R72A104KA35D
C3,C10,C11	100 pF	250V, 5%, X7R, 0603	AVX	600S101JT250XT
C12	100 uF	100V, 20%, Alum Elec	BC Components	MAL215099907E3
C13,C14	4.7 pF	250V, +/-0.1pF, 0603	AVX	600S4R7BT250XT
C15,C16	1.0 pF	250V, +/-0.05pF, 0603	AVX	600S1R0AT250XT
C17,C18	1.8 pF	250V, +/-0.1pF, 0603	AVX	600S1R8BT250XT
R1 – R5	10 Ohm	1/10W, 5%, 0603	KOA Speer	RK73B1JTTD100J
R6,R9,R10	1000 Ohm	1/16W, 1%, 0603	Panasonic	ERJ3EKF1001V
R7,R8	2.2 Ohm	1/8W, 5%, 0805	Panasonic	ERJ6GEYJ2R2V
R11	0 Ohm	1/2W, 0805	Kamaya	RMC1/10JPTP
L1	12 nH	5%, 0805	Coilcraft	0805CS-120XJLC

QPD1013EVB04 PCB Layout – 0.96 – 1.215 GHz EVB

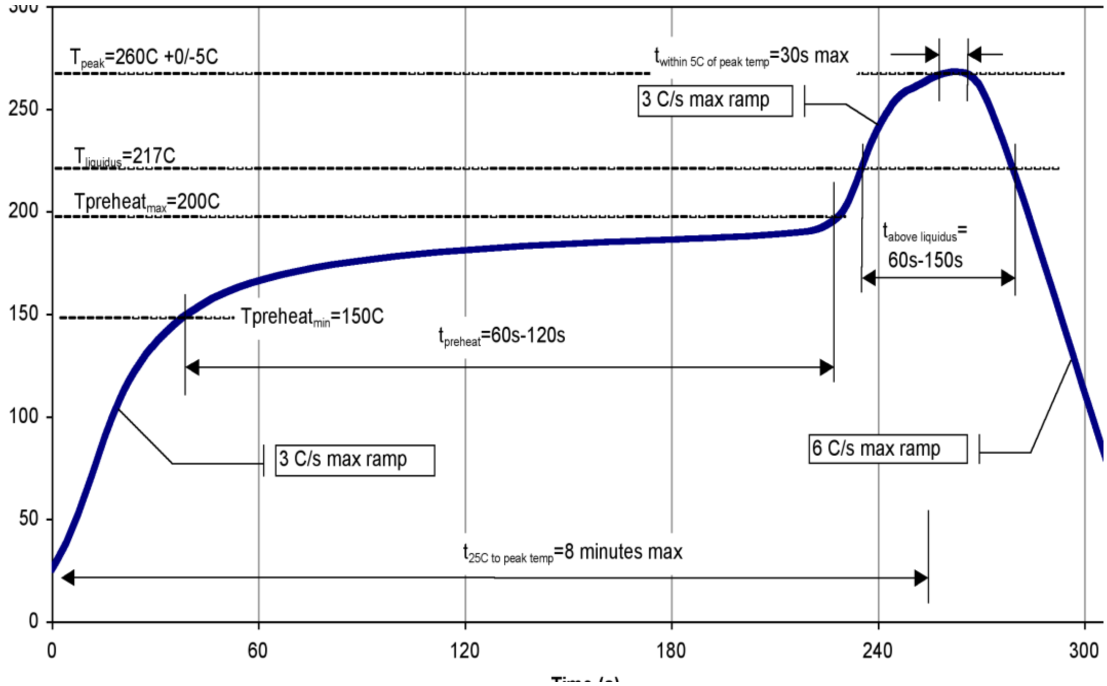
Note: PCB Material is RO4350B, 20 mil thick substrate, 1 oz. copper each side.



QPD1013EVB04 Bill Of material – 0.96 – 1.215 GHz EVB

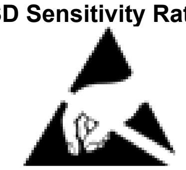
Ref Des	Value	Description	Manufacturer	Part Number
C1	68 pF	250V, 5%, 0603	AVX	600S680JT250XT
C2,C3	6.2 pF	250V, +/-0.1pF, 0603	AVX	600S6R2BT250XT
C4	18 pF	250V, +/-5%, 0603	AVX	600S180JT250XT
C5	12 pF	250V, +/-5%, 0603	AVX	600S120JT250XT
C6	15 pF	250V, +/-1%, 0603	AVX	600S150FT250XT
C7,C15	82 pF	250V, +/-2%, 0805	AVX	600F820GT250XT
C8	1000 pF	100V, 5%, X7R, 0603	AVX	06031C102JAT2A
C9,C10	1 uF	50V, 10%, X7R, 0805	Kemet	C0805C105K5RACTU
C11	12 pF	250V, 5%, 0805	AVX	600F120JT250XT
C12	4.3 pF	250V, +/-0.1pF, 0805	AVX	600F4R3BT250XT
C13,C14	68 pF	250V, 5%, 0805	AVX	600F680JT250XT
C16	0.1 uF	100V, 10%, X7R, 0805	TDK	C2012X7R2A104K125AA
C17,C18	4.7 uF	100V, 10%, X7R, 1206	Capax Tech	1206X475K101SNT
R1 – R4	10 Ohm	1/4W, 1%, 0603	Vishay Dale	RCA060310R0FKEAHP

Recommended Solder Temperature Profile



Product Compliance Information

ESD Sensitivity Ratings



Caution! ESD Sensitive Device

ESD Rating

ESD Rating:	Class 1A
Value:	450 V
Test:	Human Body Model (HBM)
Standard:	ANSI/ESDA/JEDEC Standard JS-001

MSL Rating

MSL Rating:	MSL3
Test:	260 °C convection reflow
Standard:	IPC/JEDEC Standard J-STD-020

Solderability

Compatible with lead free soldering processes, 260 °C maximum reflow temperature.

Package lead plating: NiPdAu

The use of no-clean solder to avoid washing after soldering is recommended.

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 ($C_{15}H_{12}Br_4O_2$) 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: customer.support@qorvo.com
Tel: 1-844-890-8163

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