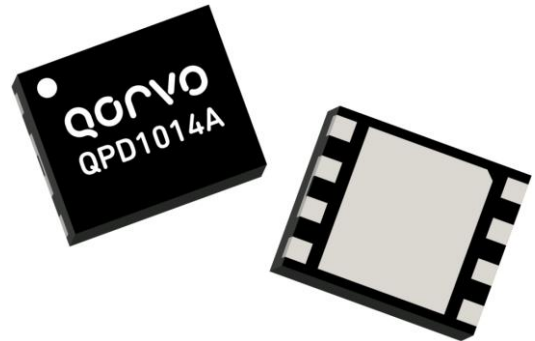


1. Product Overview and Benefits

The Qorvo QPD1014A is a 15W (P_{3dB}), 50Ω input matched discrete GaN on SiC HEMT which operates from 30MHz to 1.2GHz on a 50V supply rail. The integrated input matching network enables wideband gain and power performance, while the output can be matched on board to optimize for power and efficiency for any region within the band.

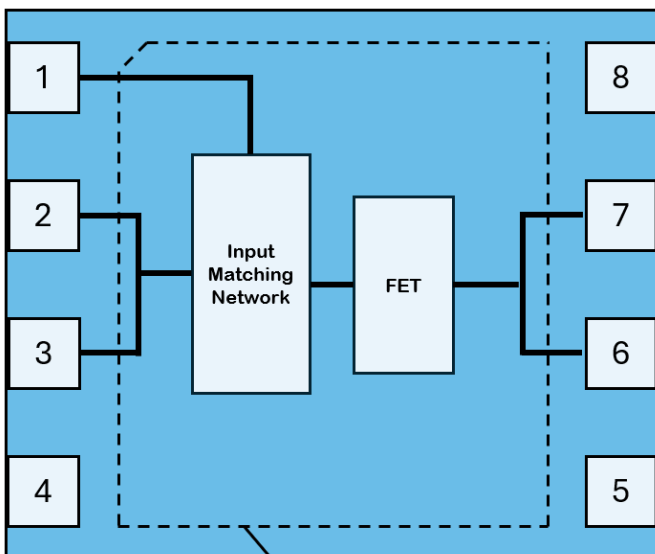
The device is housed in a 6 x 5 mm leadless SMT package that saves real estate of already space-constrained handheld radios.

Evaluation boards are available upon request.



6 x 5 x 0.85mm DFN Package

2. Functional Block Diagram



Package Backside Ground Pad Pin 9

Top View

3. QPD1014AEVB Performance

Freq.(GHz)	P_{3dB} (W)	G_{3dB} (dB)	DE_{3dB} (%)
0.1	19.4	15.3	69.9
0.5	15.1	15.3	60.9
1.0	12.3	16.7	66.2

At Bottom of Baseplate Temperature of 25°C, Signal Type: CW
 $V_D = 50V$, $I_{DQ} = 25mA$

See [Evaluation Board – 100 – 1000MHz](#) for more details.

4. Key Features

- Operating Voltage: 50V
- Low Thermal Resistance Package
- CW and Pulse Capable
- 6 x 5mm Package

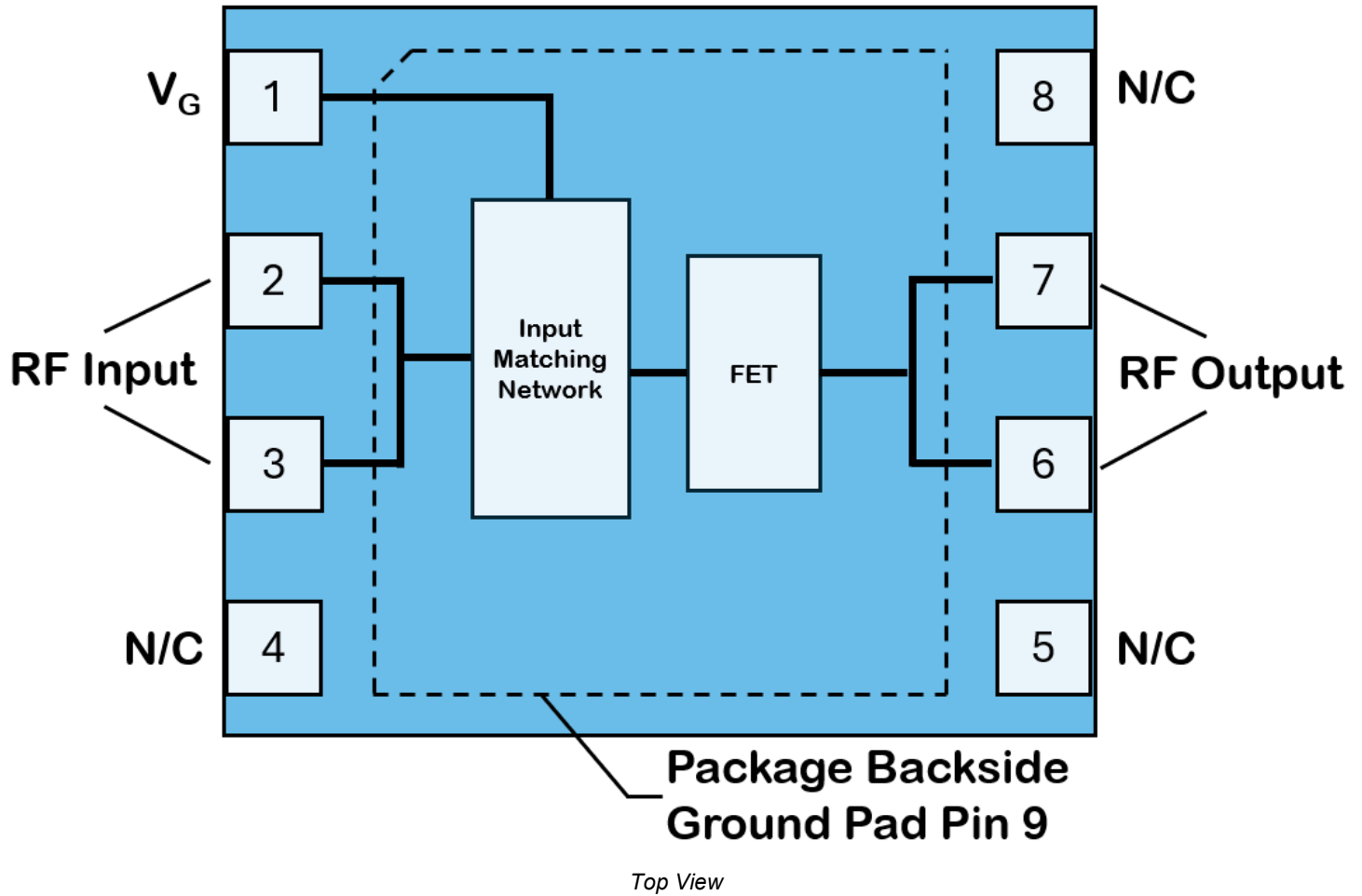
5. Applications

- Basesation
- Active Antenna
- Military Radar
- Civilian Radar
- Land Mobile and Radio Communications
- Jammers

6. Ordering Information

Part Number	Description
QPD1014AS2	2 pcs. WP Sample
QPD1014ASR	100 pcs. 7" Short Reel
QPD1014ATR7	750 pcs. 7" Reel
QPD1014AEVB	100 – 1000MHz Evaluation Board

7. Pin Configuration and Description

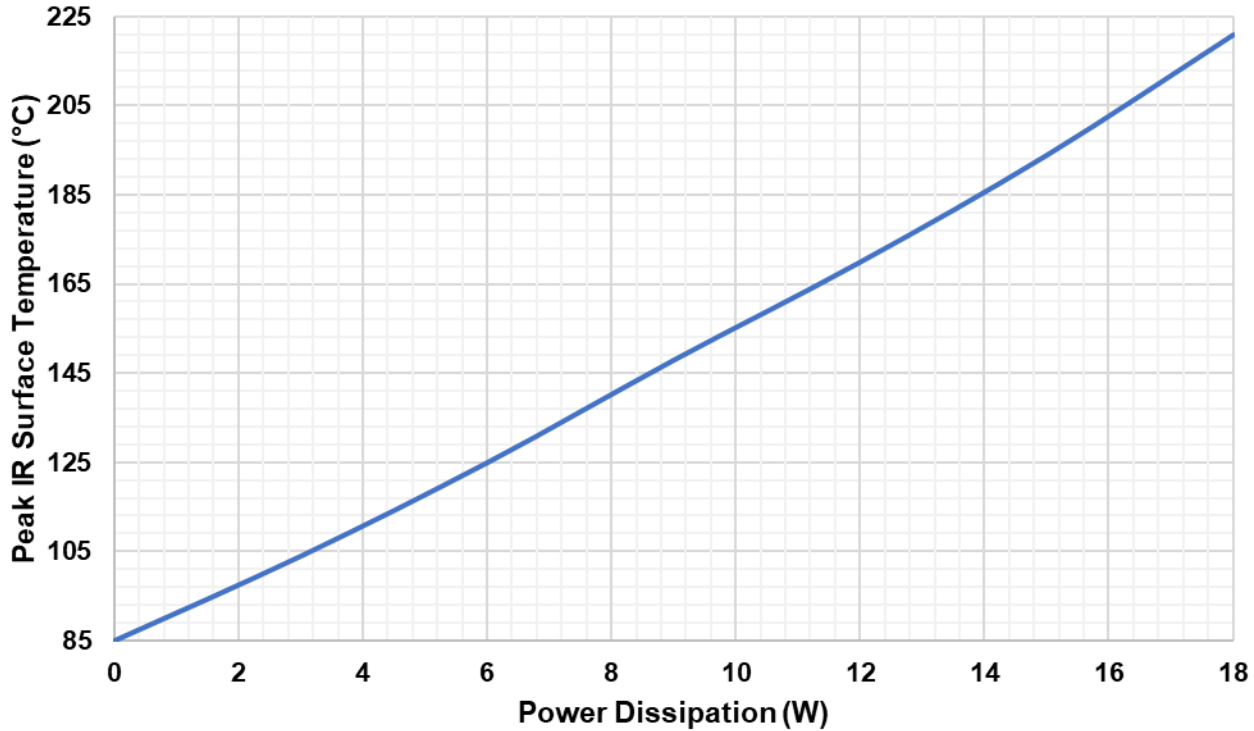


Pin Number	Label	Description
1	V _G	Gate Supply
2, 3	RF _{IN}	RF Input Port 50 OHM
6, 7	RF _{OUT}	Drain Supply, RF Output Port
9	GND	Ground Pad
4, 5, 8	N/C	No connections required. Can be used for reflow alignment.

8. Thermal and Reliability Information

8.1. Continuous Wave

**Peak IR Surface Temperature vs Power Dissipation
Backside of DFN Fixed at 85°C**



Parameter	Conditions	Values	Unit
IR Thermal Resistance, θ_{JC}	85°C backside temperature	6.48	°C/W
Peak IR Surface Temperature, T_{CH}	2.5 W P _{diss} , CW	101.2	°C
IR Thermal Resistance, θ_{JC}	85°C backside temperature	6.64	°C/W
Peak IR Surface Temperature, T_{CH}	5.0 W P _{diss} , CW	118.2	°C
IR Thermal Resistance, θ_{JC}	85°C backside temperature	6.8	°C/W
Peak IR Surface Temperature, T_{CH}	7.5 W P _{diss} , CW	136.0	°C
IR Thermal Resistance, θ_{JC}	85°C backside temperature	6.96	°C/W
Peak IR Surface Temperature, T_{CH}	10.0 W P _{diss} , CW	154.6	°C
IR Thermal Resistance, θ_{JC}	85°C backside temperature	7.12	°C/W
Peak IR Surface Temperature, T_{CH}	12.5 W P _{diss} , CW	174.0	°C
IR Thermal Resistance, θ_{JC}	85°C backside temperature	7.3	°C/W
Peak IR Surface Temperature, T_{CH}	15.0 W P _{diss} , CW	194.5	°C

Please refer to the following document [GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates](#)

9. Electrical Characteristics

9.1. Absolute Maximum Ratings

Parameter	Rating	Unit
Breakdown Voltage, BV_{DG}	+145	V
Gate Voltage Range, V_G	-8 to +2	V
Drain Current	1	A
Gate Current Range, I_G^2	3.6	mA
Power Dissipation, CW, P_{DISS}	15.8	W
RF Input Power, P_{IN}^1	+31	dBm
Mounting Temperature (30 Seconds)	320	°C
Storage Temperature	-40 to +150	°C

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

Note:

1. Continuous Wave(CW), $T = 25^\circ\text{C}$, 1GHz
2. At FEA Channel Temperature of 200°C

9.2. Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Units
Operating Temperature Range	-40	+25	+85	°C
Drain Voltage Range, V_D	+12	+50	+55	V
Drain Bias Current, I_{DQ}	-	25	-	mA
Gate Voltage, V_G^1	-	-2.8	-	V
Channel Temperature (T_{CH})	-	-	+250	°C
Power Dissipation, CW (P_{DISS}) ³	-	-	14.4	W

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

Note:

1. To be adjusted to desired I_{DQ}
2. Back side of package at 85°C

9.3. Load Pull Performance – Power Tuned

Parameters	Typical Values				Unit
	0.6	0.8	1.0	1.2	
Frequency, Freq.	0.6	0.8	1.0	1.2	GHz
Linear Gain, G_{LIN}	20.1	21.0	21.5	20.8	dB
Output Power at 3dB Compression, P_{3dB}	41.9	42.4	42.7	42.3	dBm
Power Added Efficiency at 3dB Compression, PAE_{3dB}	65.0	62.0	63.0	60.0	%
Gain at 3dB Compression	17.1	18.0	18.5	17.8	dB

Note:

1. Test conditions: Pulsed Continuous Wave(Pulsed CW), Pulse Width = 100us, Duty Cycle = 10%, $V_D = +50\text{V}$, $I_{DQ} = 25\text{mA}$, Temperature = $+25^\circ\text{C}$.



9.4. Load Pull Performance – Efficiency Tuned

Parameters	Typical Values				Unit
Frequency, Freq.	0.6	0.8	1.0	1.2	GHz
Linear Gain, G_{LIN}	21.8	22.6	23.0	21.2	dB
Output Power at 3dB Compression, P_{3dB}	39.0	39.7	41.2	40.7	dBm
Power Added Efficiency at 3dB Compression, PAE_{3dB}	79.2	70.7	72.6	70.4	%
Gain at 3dB Compression	18.8	19.6	20.0	18.2	dB

Note:

1. Test conditions: Pulsed Continuous Wave(Pulsed CW), Pulse Width = 100us, Duty Cycle = 10%, $V_D = +50V$, $I_{DQ} = 25mA$, Temperature = +25°C.



QPD1014A

15W, 50V, 30 – 1200MHz, GaN Input Matched Transistor

9.5. RF Characterization – 100 – 1000 MHz EVB Performance at 900MHz

Parameter	Min	Typ	Max	Units
Linear Gain, G_{LIN}	18.0	19.9	-	dB
Output Power at 3dB Compression, P_{3dB}	40.0	41.9	-	dBm
Drain Efficiency at 3dB Compression, DE_{3dB}	56.0	68.4	-	%
Gain at 3dB Compression, G_{3dB}	15.0	16.9	-	dB

Notes:

1. Test conditions unless otherwise noted: $V_D = +50V$, $I_{DQ} = 25mA$, Continuous Wave(CW), Bottom of Baseplate Temp = 25°C.

9.6. RF Characterization – Mismatch Ruggedness at 1000 MHz

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

Notes:

1. Test conditions unless otherwise noted: Bottom of Baseplate Temp = 25°C, $V_D = 50V$, $I_{DQ} = 25mA$, Continuous Wave(CW). Driving input power is determined at CW compression under matched condition at EVB output connector.

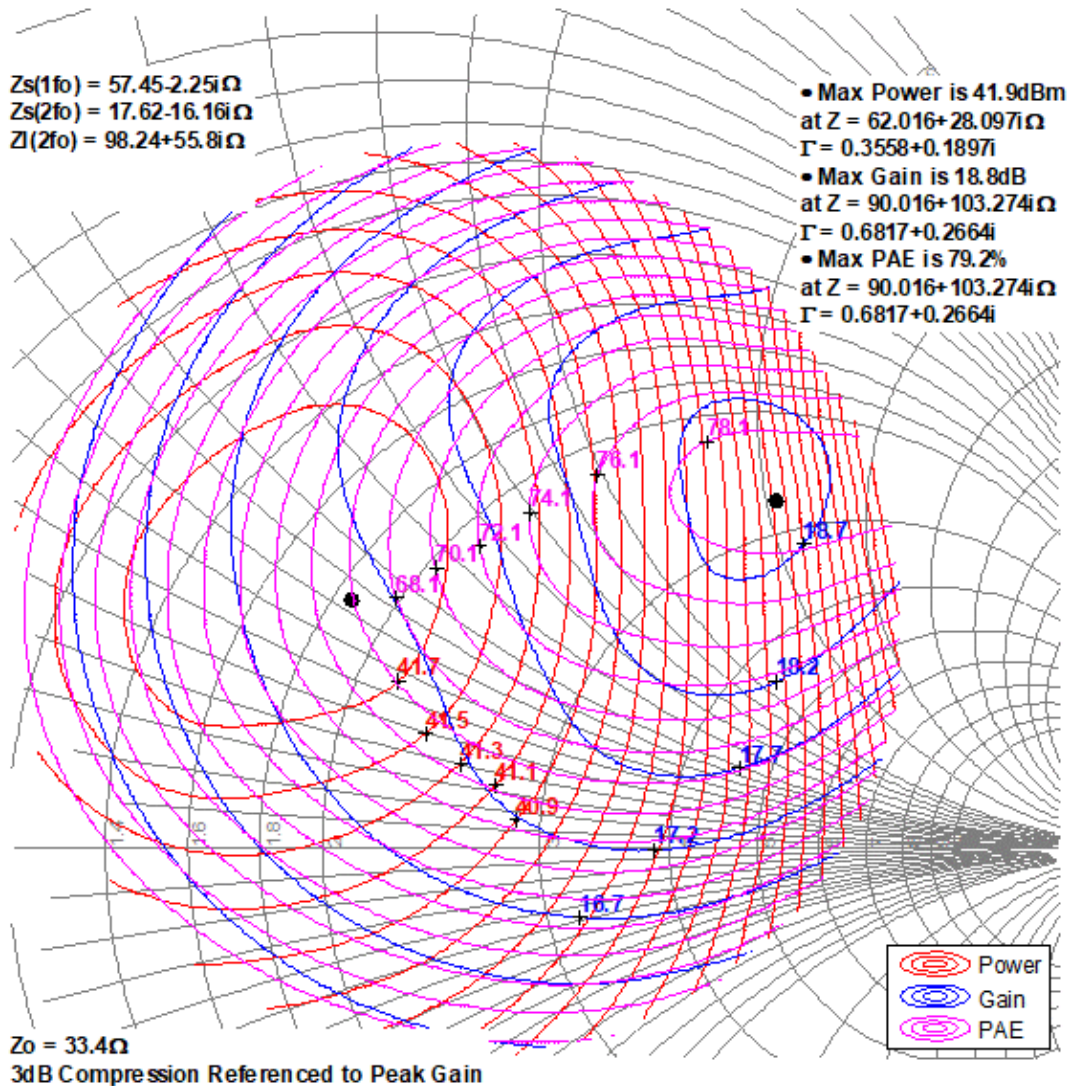
9.7. Load Pull Contours

9.7.1. 600MHz

Notes:

1. $V_D = 50V$, $I_{DQ} = 25mA$, Pulsed CW, Pulse Width = 100us, Duty Cycle = 10%. Performance is at 3dB compression referenced to peak gain.
2. See [Recommended Package Footprint](#) for load pull and source pull reference planes. 50OHM load pull fixtures are built with 20-mil RO4350B material.
3. NaN means the impedances are either undefined or varying in load pull system.

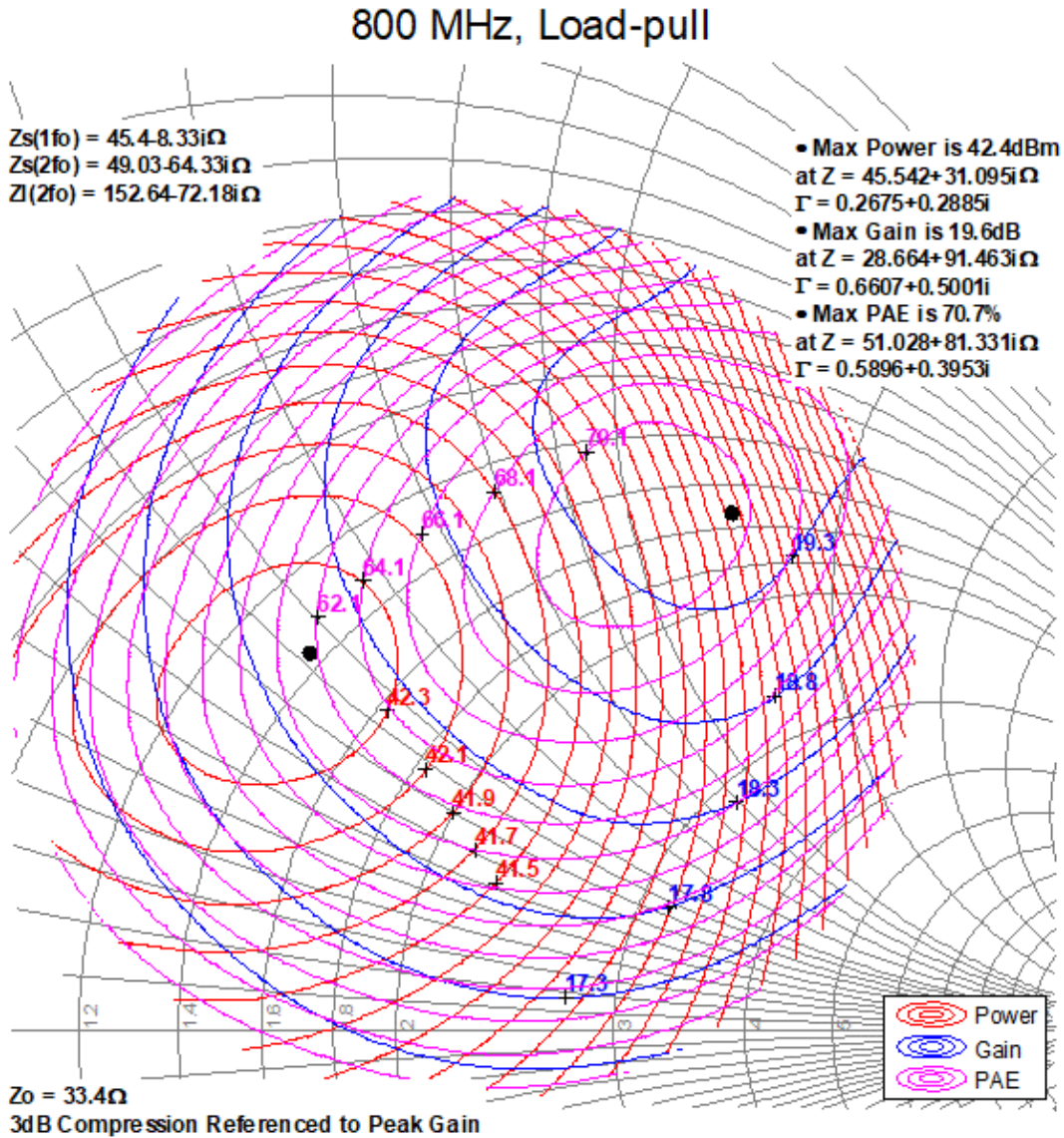
600 MHz, Load-pull



9.7.2. 800MHz

Notes:

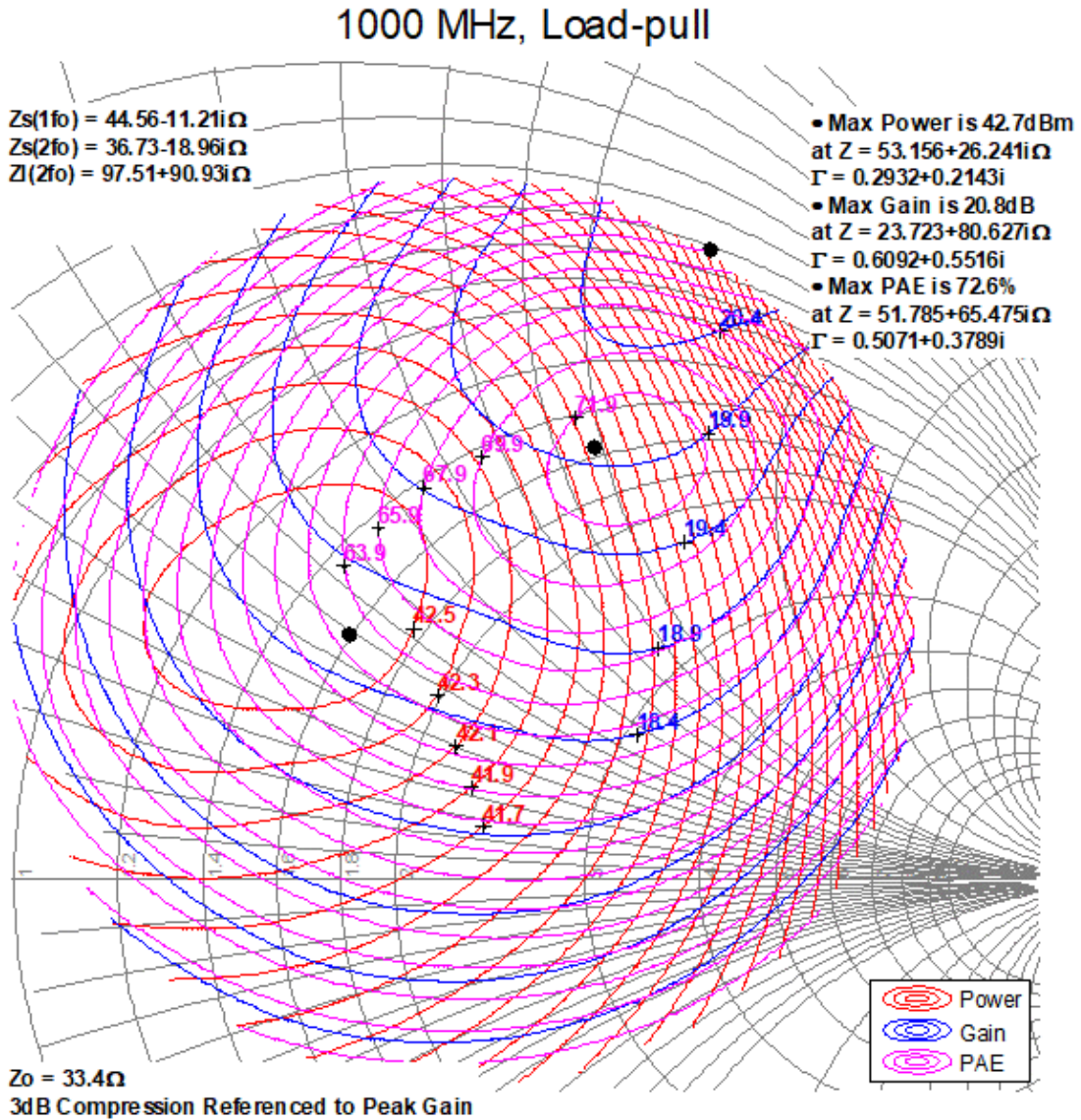
1. $V_D = 50V$, $I_{DQ} = 25mA$, Pulsed CW, Pulse Width = 100us, Duty Cycle = 10%. Performance is at 3dB compression referenced to peak gain.
2. See [Recommended Package Footprint](#) for load pull and source pull reference planes. 50OHM load pull fixtures are built with 20-mil RO4350B material.
3. NaN means the impedances are either undefined or varying in load pull system.



9.7.3. 1000MHz

Notes:

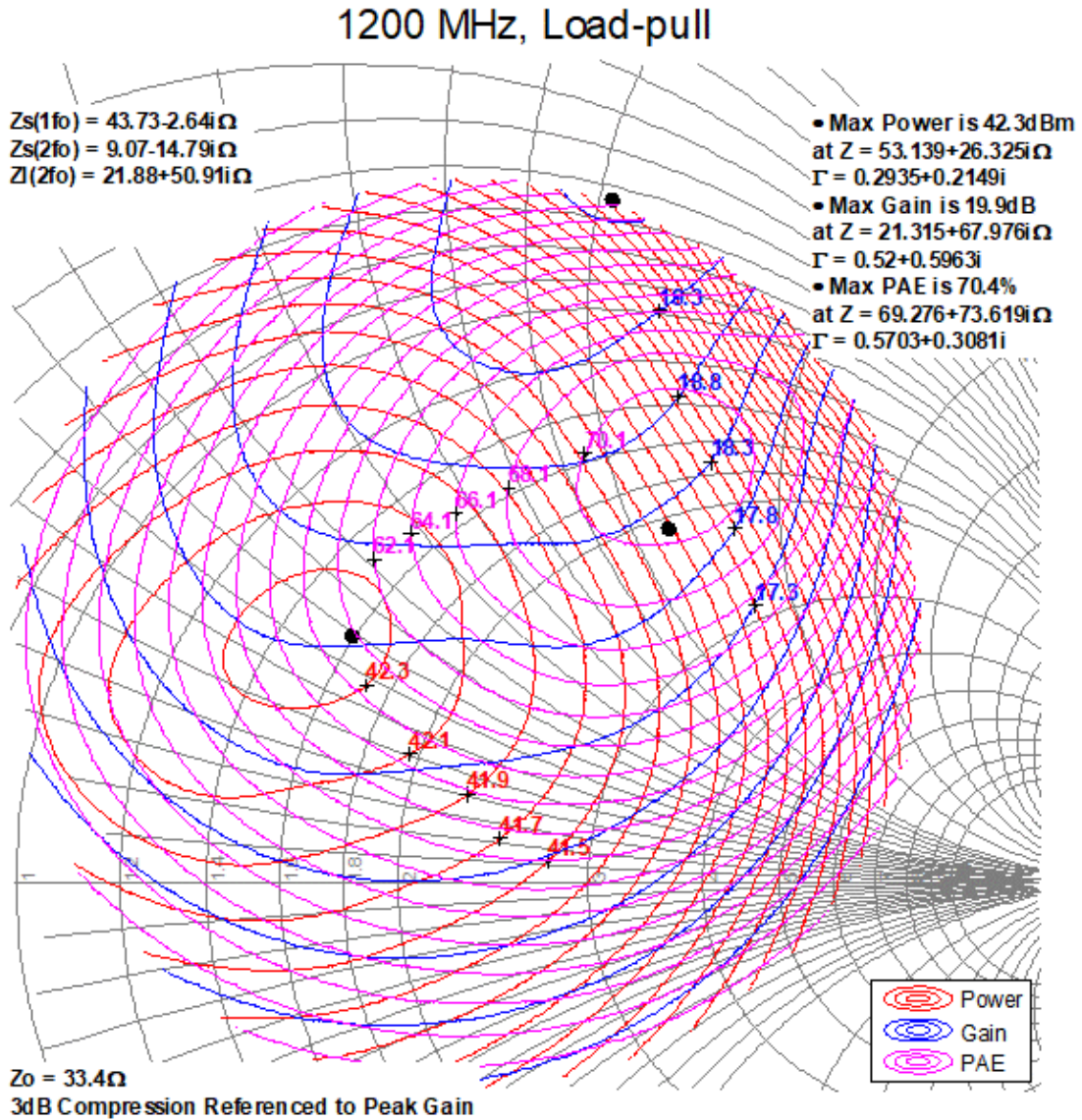
1. $V_D = 50V$, $I_{DQ} = 25mA$, Pulsed CW, Pulse Width = 100us, Duty Cycle = 10%. Performance is at 3dB compression referenced to peak gain.
2. See [Recommended Package Footprint](#) for load pull and source pull reference planes. 50OHM load pull fixtures are built with 20-mil RO4350B material.
3. NaN means the impedances are either undefined or varying in load pull system.



9.7.4. 1200MHz

Notes:

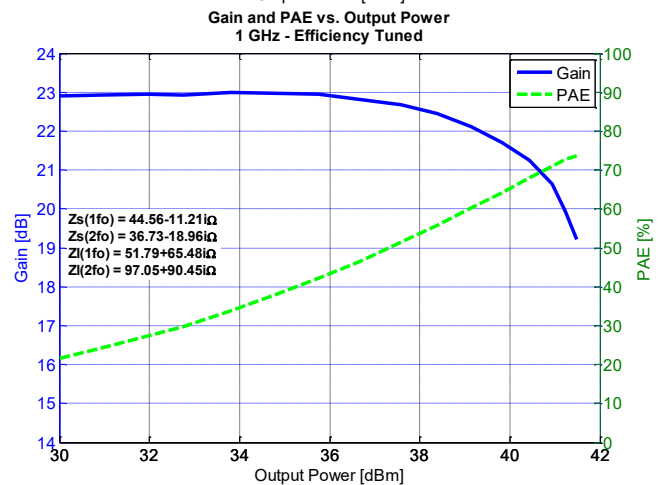
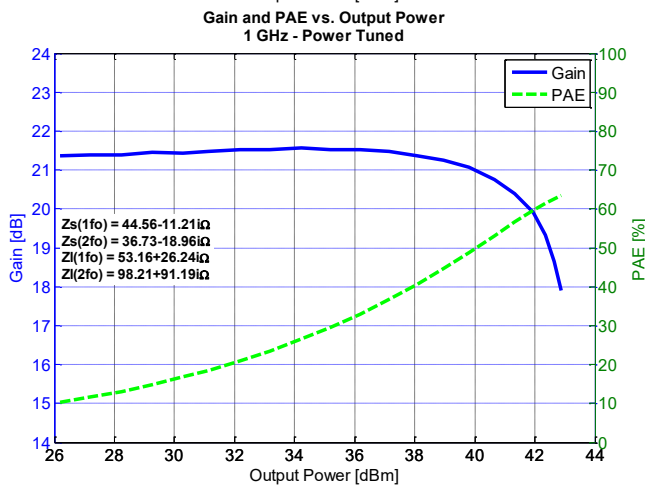
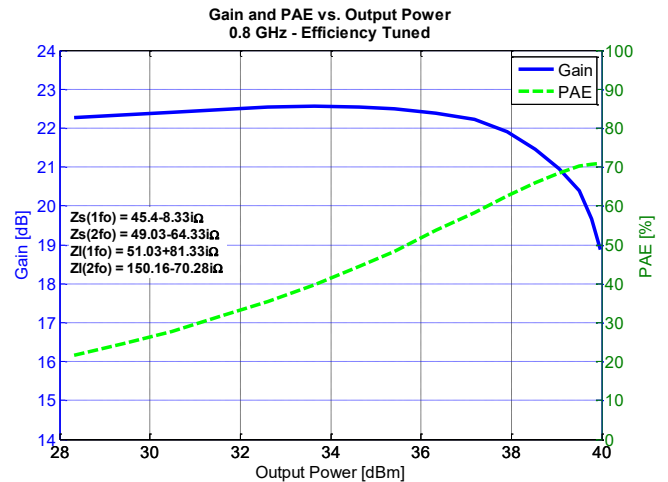
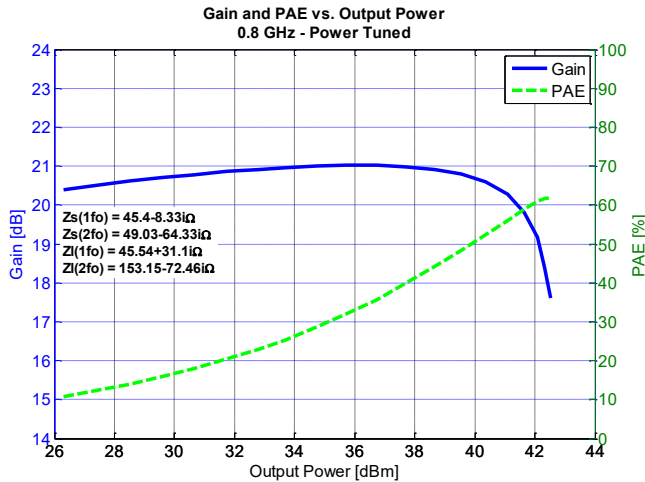
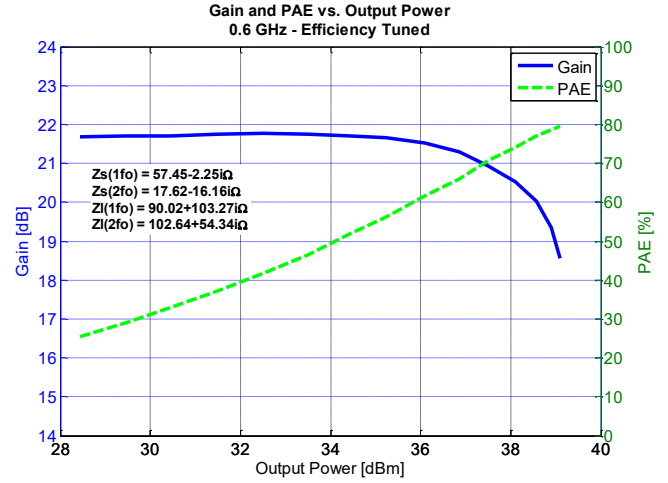
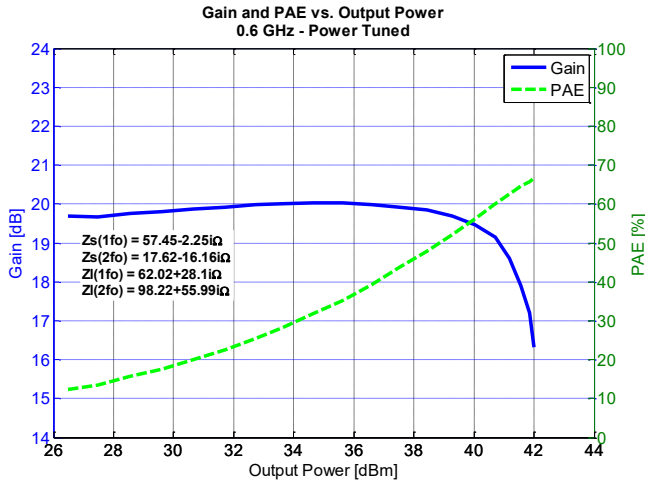
1. $V_D = 50V$, $I_{DQ} = 25mA$, Pulsed CW, Pulse Width = 100us, Duty Cycle = 10%. Performance is at 3dB compression referenced to peak gain.
2. See [Recommended Package Footprint](#) for load pull and source pull reference planes. 50OHM load pull fixtures are built with 20-mil RO4350B material.
3. NaN means the impedances are either undefined or varying in load pull system.



9.8. Load Pull Drive-up^{1,2}

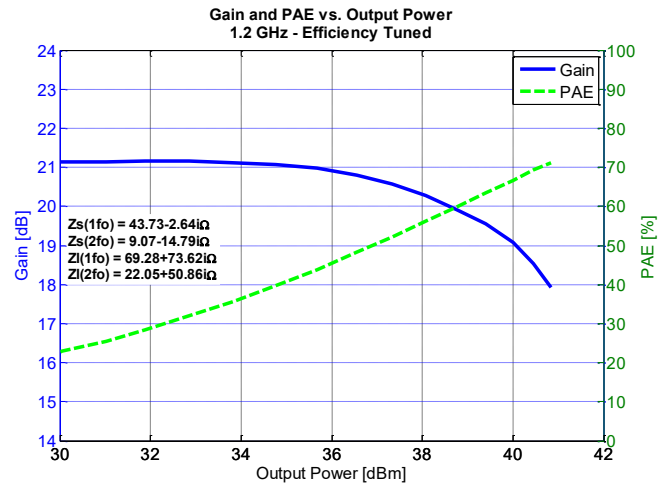
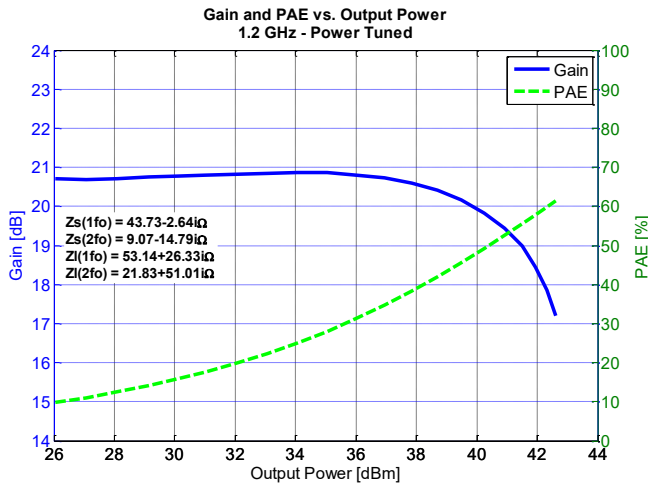
Notes:

1. Pulsed CW, Pulse Width = 100us, Duty Cycle = 10%, $V_D = 50V$, $I_{DQ} = 25mA$
2. See [Recommended Package Footprint](#) for load pull and source pull reference planes where the performance was measured.





QPD1014A 15W, 50V, 30 – 1200MHz, GaN Input Matched Transistor

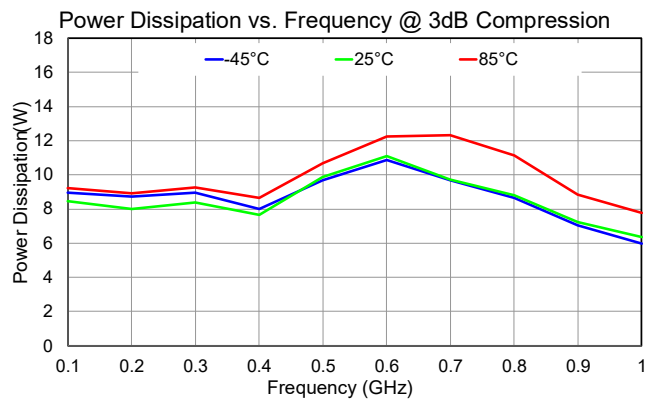
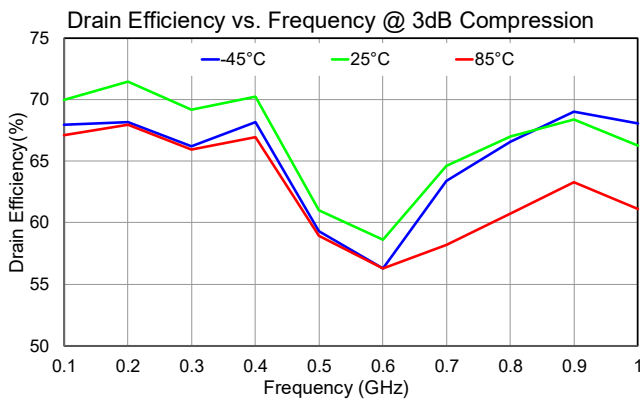
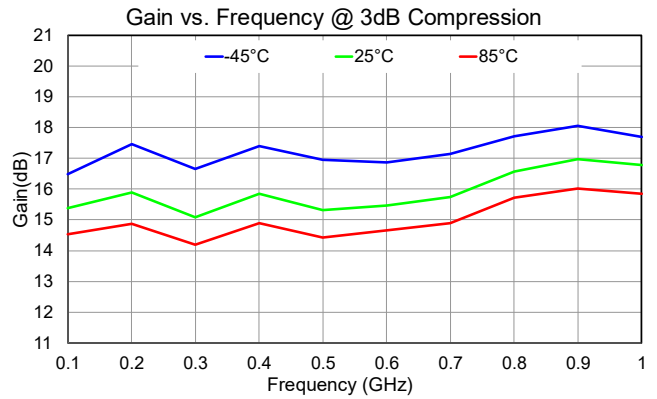
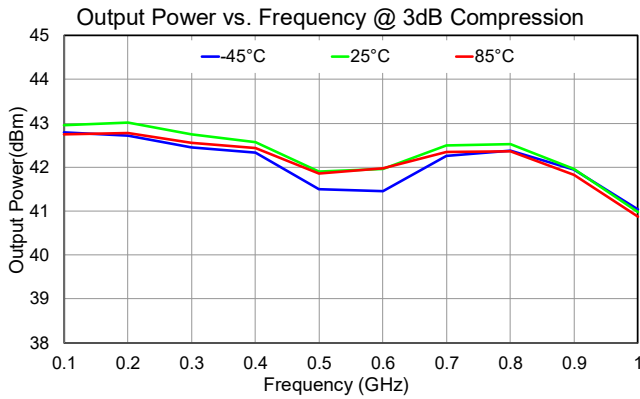


10. Evaluation Board – 100 – 1000MHz

10.1.1. Power Drive-up Performance Over Temperature

Notes:

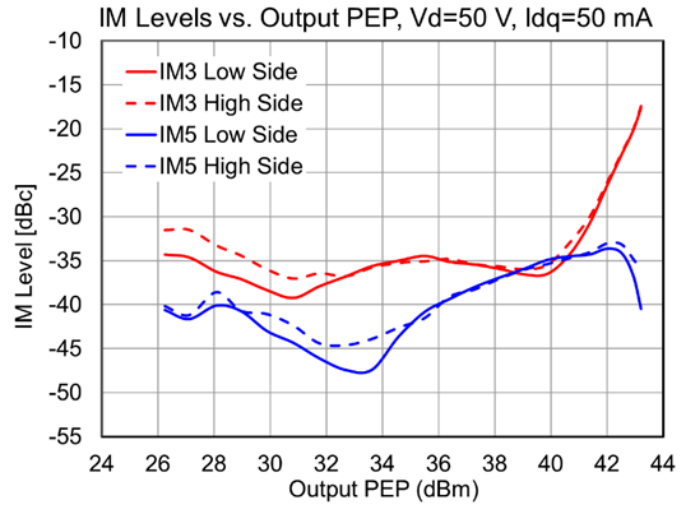
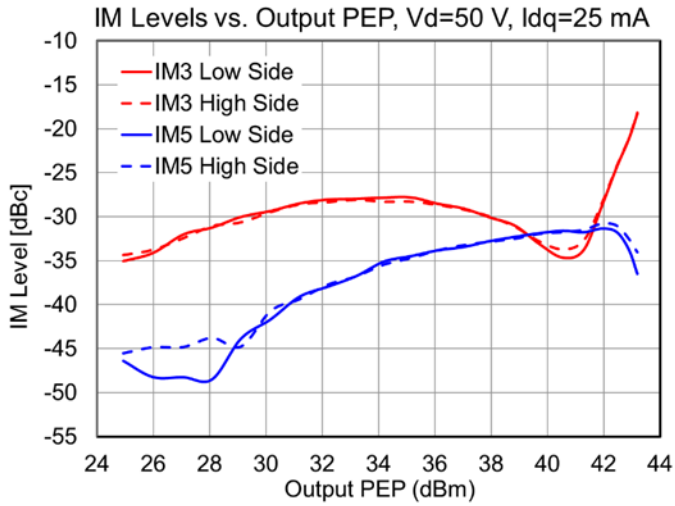
- $V_D = 50V$, $I_{DQ} = 25mA$, Continuous Wave(CW)



10.1.2. Two-Tone Performance at 25°C

Notes:

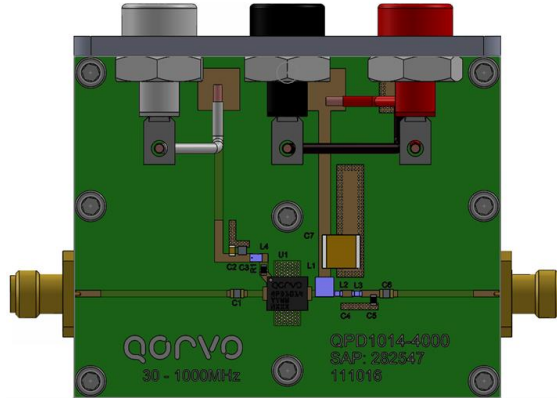
1. Data based on QPD1014A's predecessor: QPD1014 50 – 1000MHz Evaluation Board.



10.1.3. PCB Layout – 100 – 1000MHz

Notes:

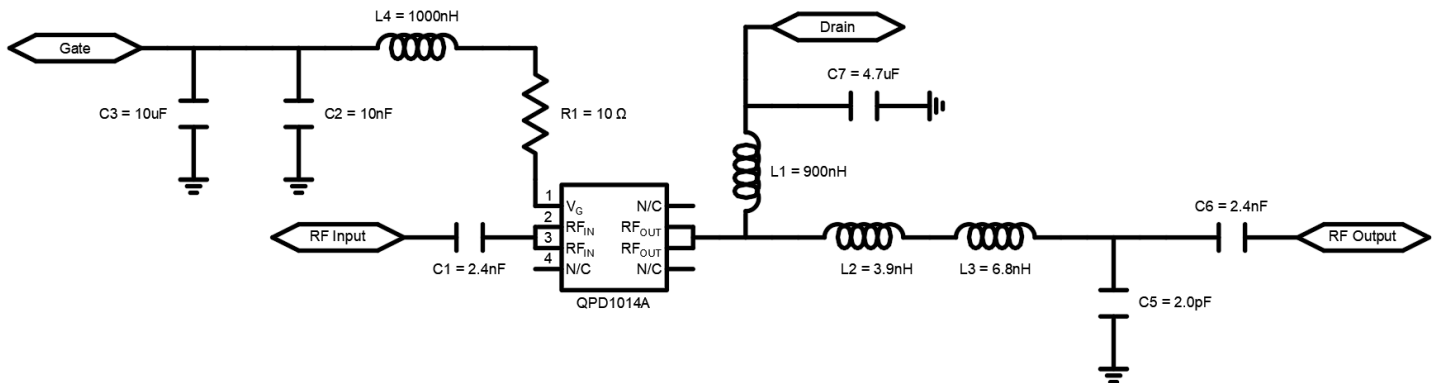
1. PCB Material: RO4350B, 20mil thickness, 0.5oz copper cladding.



10.1.4. Bill of Material

Reference Designator	Value	Quantity	Manufacturer	Part Number
R1	10 OHM	1	Vishay	CRCW060310R0JNEA
C2	10 nF	1	AVW	0603YC103KAT2A
C3	10 uF	1	Murata	GRM21BR71A106KE51L
C1, C6	2400 pF	2	Dielectric Labs	C08BL242X-5UN-X0T
C5	2.0 pF	1	ATC	600S2R0BT250XT
C7	4.7 uF	1	Murata	GRM55ER72A475KA01L
L1	900 nH	1	Coilcraft	1008AF-901XJLC
L2	3.9 nH	1	Coilcraft	0603HC-3N9XGLW
L3	6.8 nH	1	Coilcraft	0603HC-6N8XGJE
L4	1000 nH	1	Coilcraft	0603LS-102XGLC

10.1.5. Circuit Schematic



11. Application Information

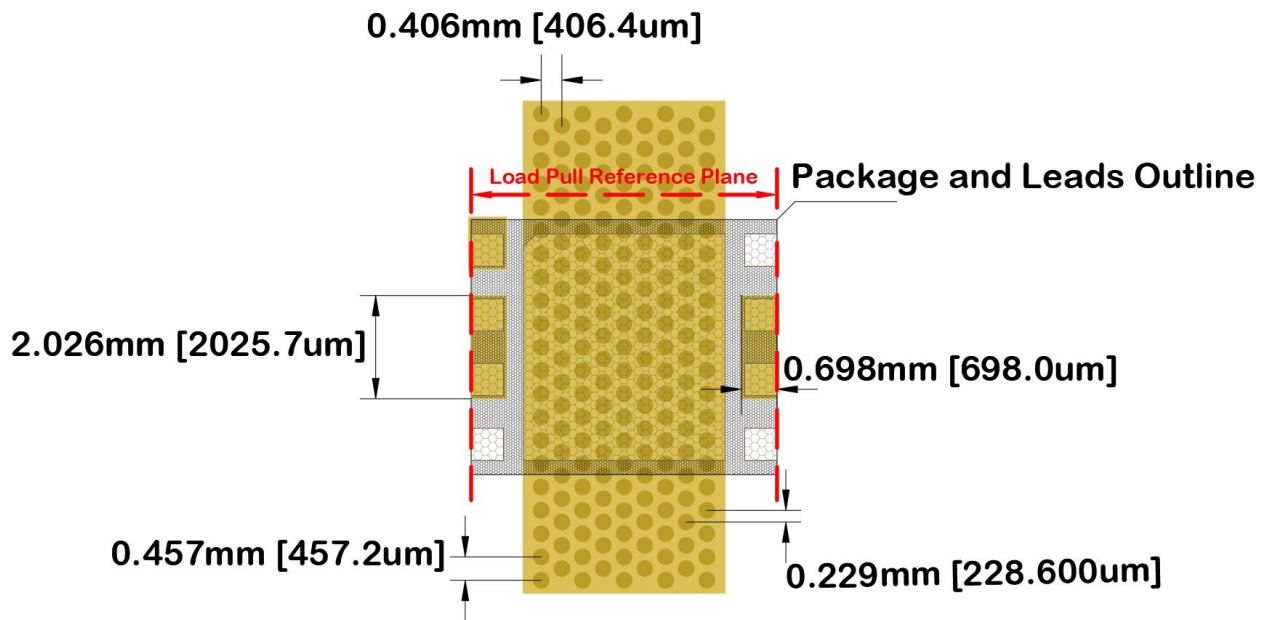
11.1. Biasing Sequence

Bias Up Sequence	Bias Down Sequence
1. Set V_G to -4V	1. Turn off RF
2. Set I_D current limit to 40mA	2. Set V_G to -5V
3. Set V_D to 50V	3. Set V_D to 0V
4. Slowly adjust V_G until I_{DQ} is set to 25mA	4. Wait until drain voltage supplying the device is discharged to 0V
5. Set I_D current limit to 1A	5. Turn off Drain Supply
6. Apply RF	6. Turn off Gate Supply

Note:

- The above biasing sequence is based on typical biasing condition of $V_D = 50V$, $I_{DQ} = 25mA$

11.2. Recommended Package Footprint



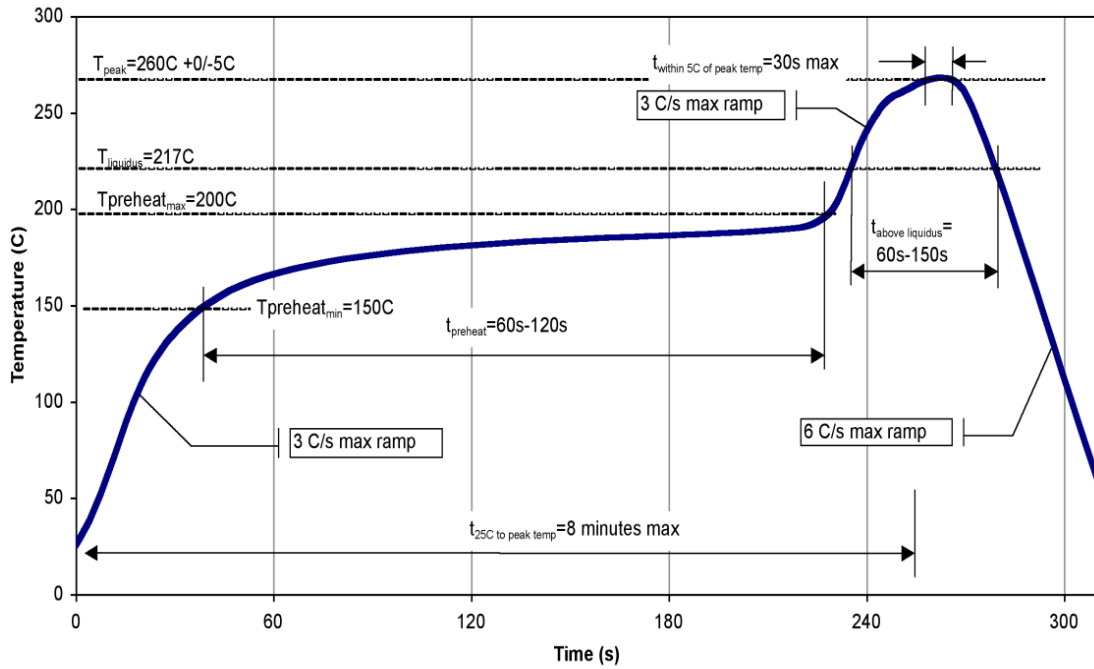
LAYER STACK LEGEND

Material	Layer	Thickness	Dielectric Material	Type
	SILKSCREEN_TOP			Legend
Surface Material	SOLDERMASK_TOP	0.0010in	Solder Resist	Solder Mask
Copper	METAL1_TOP	0.0007in		Signal
Core		0.0200in	RO4350B	Dielectric
Copper	METAL2_BOT	0.0007in		Signal
Total thickness: 0.0224in				

Note:

- All vias shown in the package footprint are copper filled.

11.3. Recommended Solder Temperature Profile

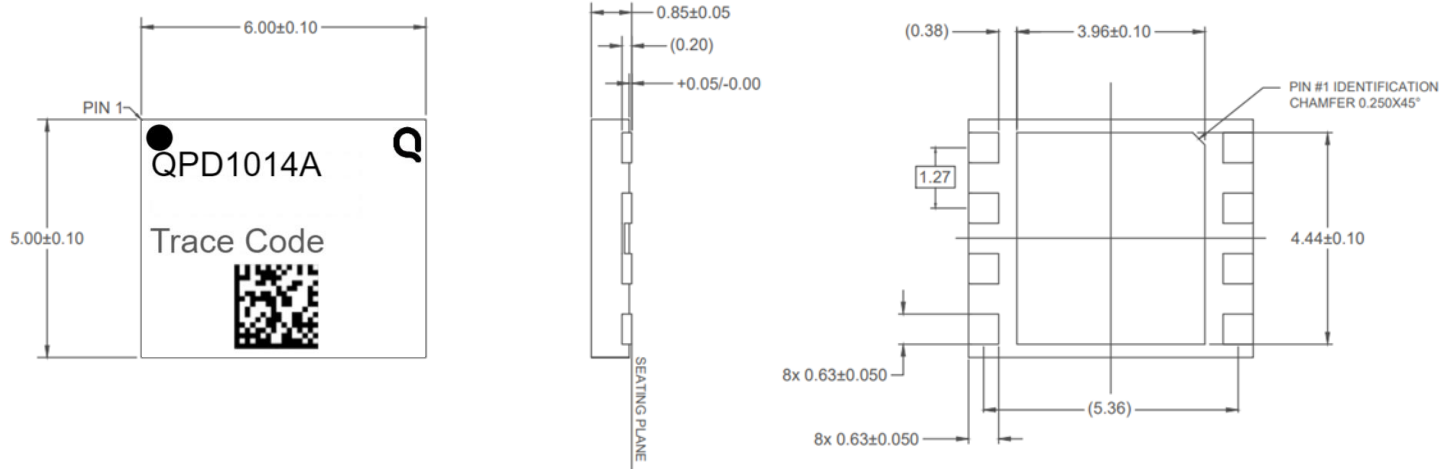


12. Packaging and Ordering Information

12.1. Device Marking and Package Dimensions

Marking: Part number – QPD1014A

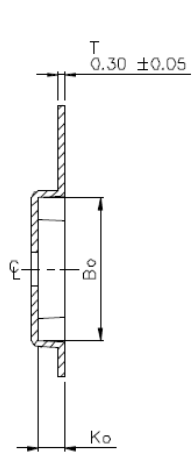
Trace code – QR Code Format



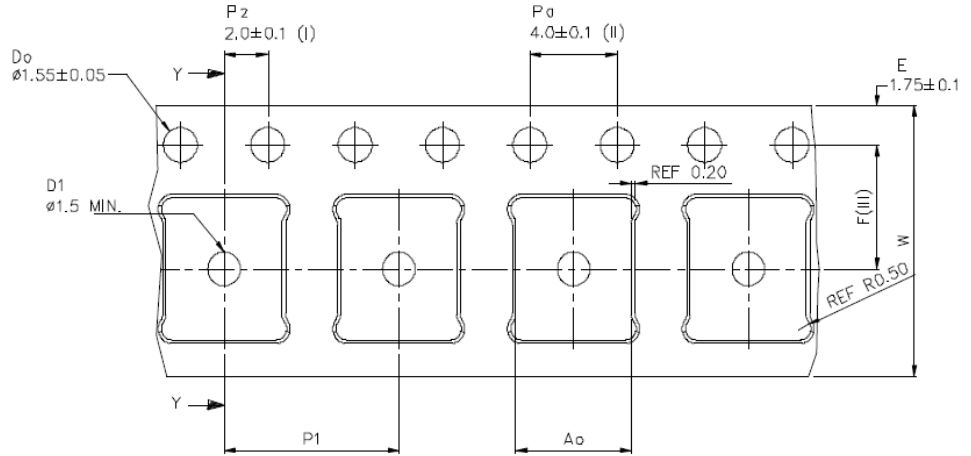
Notes:

1. Package leads are gold plated.
2. Part is mold encapsulated.
3. All units are in millimeter.

12.2. Tape and Reel Information



SECTION Y-Y



A ₀	5.30 +/− 0.1
B ₀	6.30 +/− 0.1
K ₀	1.20 +/− 0.1
F	5.50 +/− 0.1
P ₁	8.00 +/− 0.1
W	12.00 +/− 0.3

- (I) Measured from centreline of sprocket hole to centreline of pocket.
- (II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
- (III) Measured from centreline of sprocket hole to centreline of pocket.
- (IV) Other material available.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

13. Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	250V	ANSI/ESD/JEDEC JS-001
ESD – Charged Device Model (CDM)	1000V	ANSI/ESD/JEDEC JS-001
MSL – Moisture Sensitivity Level	Level 3	JESD J-STD-020



Caution!
 ESD sensitive device

14. Solderability

Compatible with both lead-free (260 °C max. reflow temperature) and tin/lead (245 °C max. reflow temperature) soldering processes.
 Contact Plating: NiPdAu

15. Environmental Compliance

This part is compliant with the 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
- SVHC Free
- PFOS Free





16. Revision History

Revision	Description
A	Datasheet Release
B	Added minimum specification to Section 9.5



Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

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Tel: +1 844-890-8163

Email: customer.support@qorvo.com

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