RFPA1012

400MHz to 2700MHz GaAs HBT Power Amplifier

Product Overview

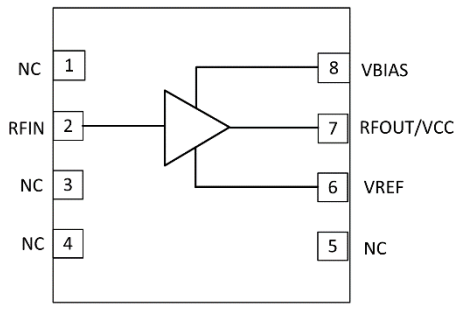
The RFPA1012 is GaAs HBT linear power amplifier specifically designed for wireless infrastructure applications. Using a highly reliable GaAs HBT fabrication process, this high performance single-stage amplifier achieves ultra-high linearity over a broad frequency range. It also offers low noise figure making it an excellent solution for 2nD and 3rd stage LNAs.

8 Pad 2 x 2 mm DFN Package

Key Features

- High Linearity OIP3 44 dBm at 900 MHz
- Low Noise: NF 3.5 dB at 900 MHz
- Lower DC Power: 5 V 90 mA
- 400 MHz to 2700 MHz Operation

Functional Block Diagram



Top View

Applications

- Pre-Driver for Base Station Amplifiers
- PA Stage for Commercial Wireless Infrastructure
- Class AB Operation for DCS, PCS, UMTS and WiFi Transceiver Applications
- 2nd or 3rd Stage LNA for Wireless Infrastructure

Ordering Information

Part No.	Description
RFPA1012TR7	2,500 pieces on a 7” reel (standard)
RFPA1012SR	100 pieces on a 7” sample reel

Absolute Maximum Ratings

Parameter	Rating
Storage Temperature	−55 to +150 °C
RF Input Power, CW, 2:1 Output VSWR	+23 dBm
Output Load VSWR at P3dB	5:1
Device Voltage (V_{CC} and V_{BIAS})	6.5 V
Device DC Current (I_C)	256 mA
Reference Current (I_{REF})	5 mA

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability.

Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
Device Voltage (V_{CC})		+5.0	+6.0	V
T_{CASE}	−40		+105	°C
Tj			+160	°C

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

Electrical Specifications

Test conditions unless otherwise noted: $V_{CC} = V_{REF}$ = +5.0 V, I_{CQ} = 90 mA, Temp = +25 °C, Qorvo Evaluation circuit, 50 Ω system.

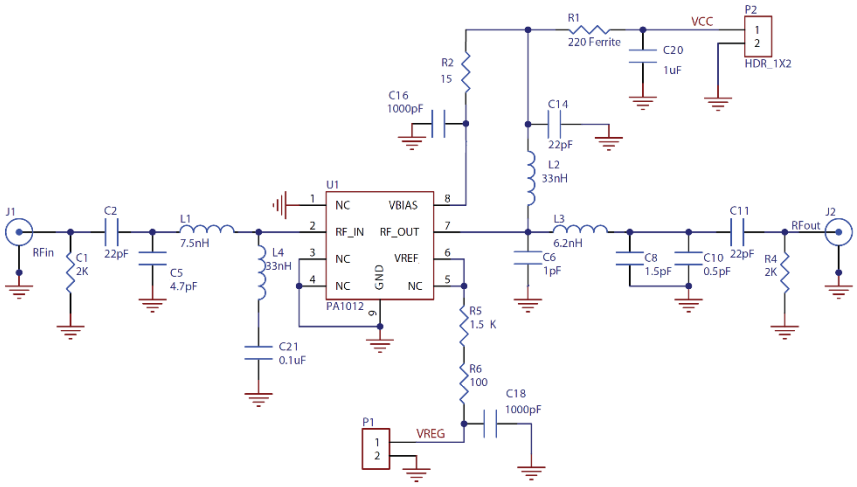
Parameter	Conditions	Min	Typ	Max	Units
Operational Frequency Range		400		2700	MHz
Test Frequency			900		MHz
Gain		14.5	16	17.5	dB
Input Return Loss			16		dB
Output Return Loss			11		dB
Output P1dB		23.5	25		dBm
Output IP3	Pout = +6 dBm/tone, Δf = 1 MHz	39	44		dBm
Noise Figure	T = 25 °C		3.5		dB
Quiescent Current, I_{CQ}	V_{CC} = 5 V		90	115	mA
Power Down Current				10	µA
Thermal Resistance, θ_{jc}	Junction to case at quiescent, no RF		93.5		°C/W

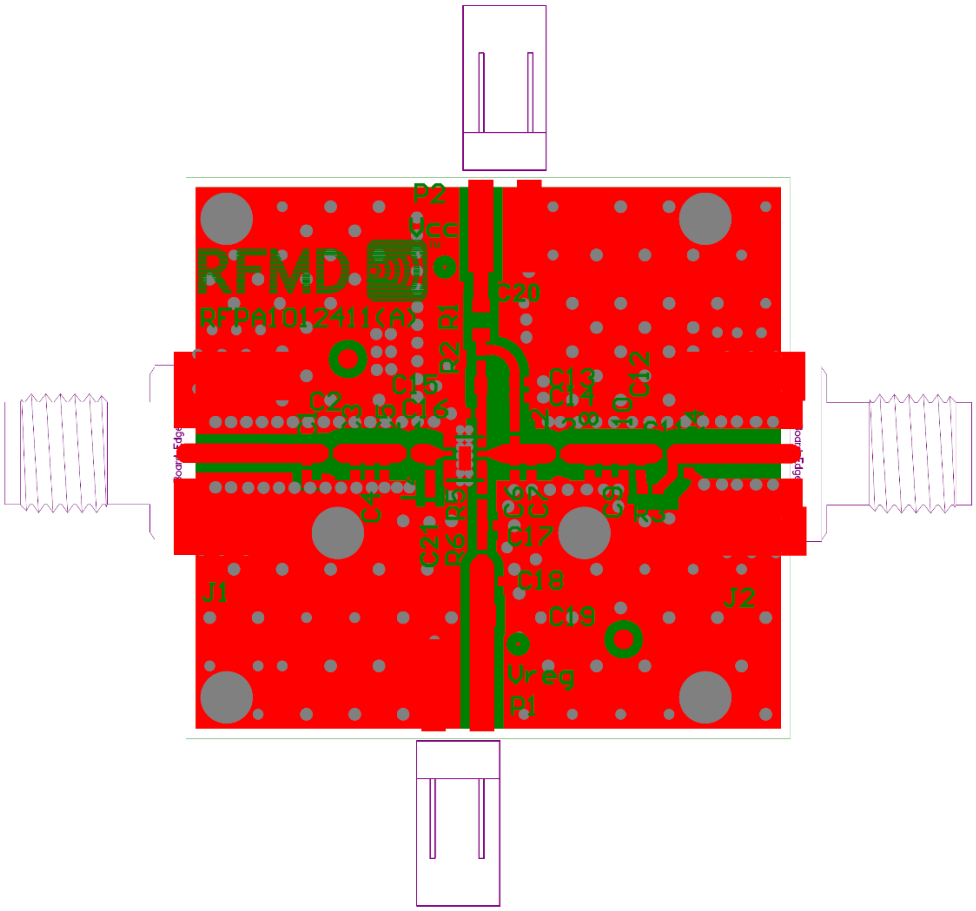
Typical Performance

Parameter	Conditions [1]	Typical Value						Units
Frequency Band		698-716	880-915	1710-1785	1920-1980	2110-2170	2500-2570	MHz
Gain		15.5	16.3	14.0	14.0	13.9	13.5	dB
Input Return Loss		22	20	15	15	11	15	dB
Output Return Loss	IP3 Optimized	7	6	8	8	11	13	dB
Output P1dB		23	25	23	23.5	22.5	23.5	dBm
Output IP3	Pout= +6 dBm/tone, Δf=1 MHz	44.5	45	43	43	42	41.5	dBm
Noise Figure		4.2	3.0	3.5	3.3	3.2	3.3	dB

Notes:
1. Test conditions unless otherwise noted: $V_{CC} = V_{REF}$ = +5.0 V, I_{CQ} = 90 mA, Temp = +25 °C, Qorvo Evaluation circuit, 50 Ω system.

860 MHz to 960 MHz Evaluation Board – RFPA1012PCK411



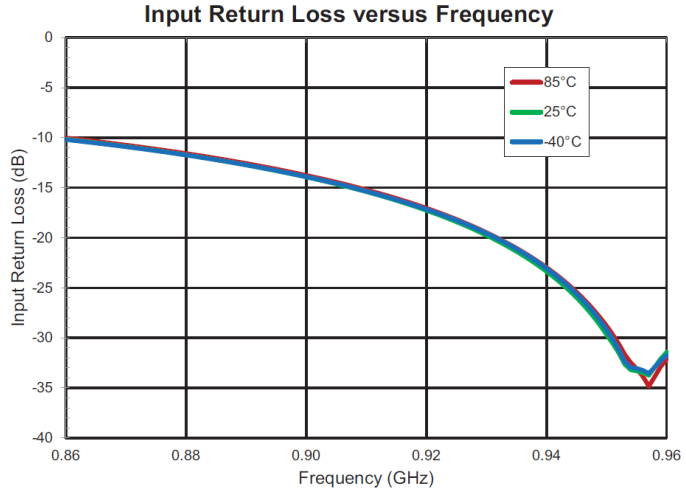


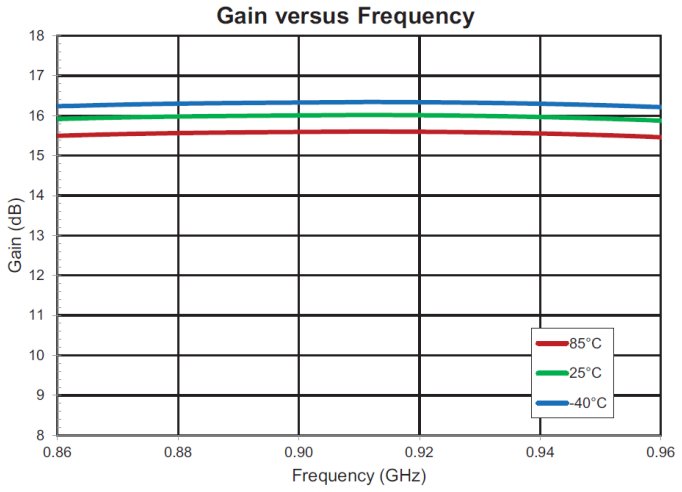
Bill of Material – RFPA1012PCK411, 860 MHz to 960 MHz

Reference Des.	Value	Description	Manuf.	Part Number
PCB		Printed Circuit Board	Qorvo	RFPA1012411(A)
U1		Amplifier, RFPA1012, DFN pkg.	Qorvo	RFPA1012
C21	0.1 µF	CAP, 0.1 µF, 10%, 16V, X7R, 0402	Murata	GRM155R71C104KA88D
C20	1 µF	CAP, 1 µF, 10%, 10V X5R, 0402	Murata	GRM155R61A105KE15D
C16, C18	1000 pF	CAP, 1000 pF, 10%, 50V, X7R, 0402	Murata	GRM155R71H102KA01D
C10	0.5 pF	CAP, 0.5 pF, ±0.1 pF, 50V, Hi-Q, 0402	Johanson	500R07S0R5BV4SD
C2, C11, C13	22 pF	CAP, 22 pF, 5%, 50V, Hi-Q, 0402	Johanson	500R07S220JV4RD
C5	4.7 pF	CAP, 4.7 pF, ±0.25 pF, 50V, Hi-Q, 0402	Johanson	500R07S4R7CV4TD
C6	1.0 pF	CAP, 1.0 pF, ±0.1 pF, 50V, Hi-Q, 0402	Johanson	500R07S1R0BV4SD
C8	1.5 pF	CAP, 1.5 pF, ±0.25 pF, 50V, Hi-Q, 0402	Johanson	500R07S1R5CV4TD
L1	7.5 nH	IND, 7.5 nH, ±0.1 nH, Thin Film, 0402	Murata	LQP15MN7N5B02D
L3	6.2 nH	IND, 6.2 nH, ±0.1 nH, Thin Film, 0402	Murata	LQP15MN6N2B02D
L2, L4	33 nH	IND, 33 nH, 2 %, Thin Film, 0402	Murata	LQP15MN33NG02D
R1	220 Ω	Ferrite Bead, 220 Ω, 2 A, 0603	Murata	BLM18EG221SN1D
R4, C1	2 KΩ	RES, 2 KΩ, 5%, 1/16 W, 0402	Panasonic	ERJ2GEJ202
R2	15 Ω	RES, 15 Ω, 1 %, 1/16 W, 0402	Panasonic	ERJ-2RKF15R0X
R5	1.5 KΩ	RES, 1.5 KΩ, 1 %, 1/16 W, 0402	Panasonic	ERJ-2RKF1501X
R6	100 Ω	RES, 100 Ω, 1 %, 1/16 W, 0402	Panasonic	ERJ-2RKF1000X
P1, P2		CONN., HDR, ST. PLRZD, 2-PIN, 0.100”	ITW Pancon	MPSS100-2-C
J1, J2		CONN., SMA, END LNCH, FLT, 0.062”	Emerson	142-0701-821

Performance Plots – RFPA1012PCK411, 860 MHz to 960 MHz

Test conditions unless otherwise noted: V_{CC} = V_{PD} = +5 V, I_{CQ} = 90 mA, Temp.=+25 °C

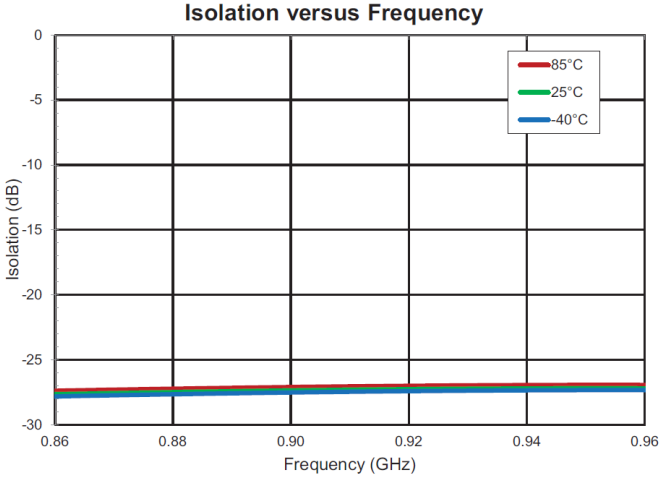




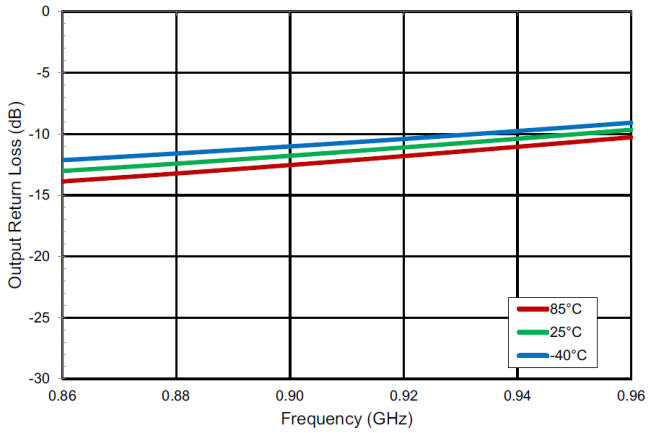
Performance Plots – RFPA1012PCK411, 860 MHz to 960 MHz (continue)

Test conditions unless otherwise noted: V_{CC} = V_{PD} = +5V, I_{CQ} = 90 mA, Temp.=+25 °C

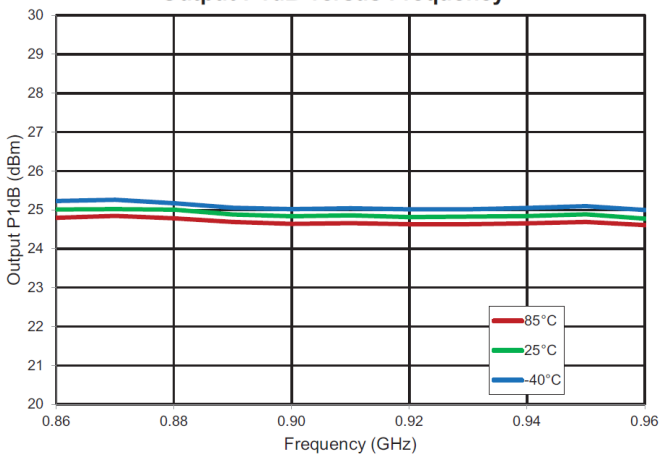
Isolation versus Frequency



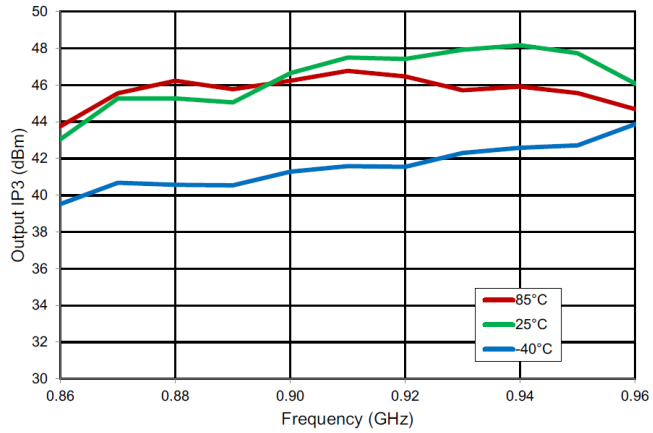
Output Return Loss versus Frequency



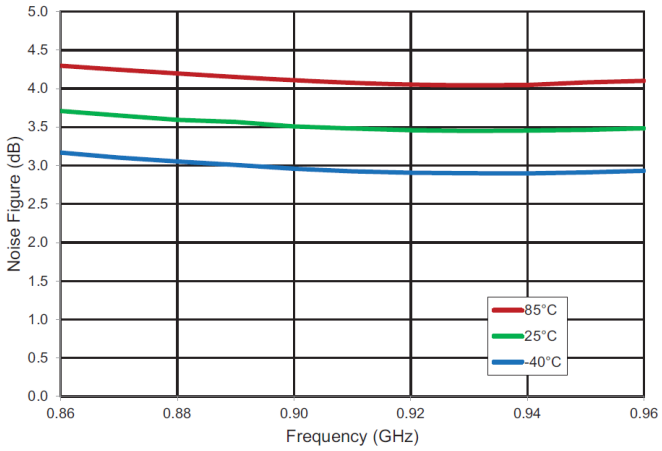
Output P1dB versus Frequency



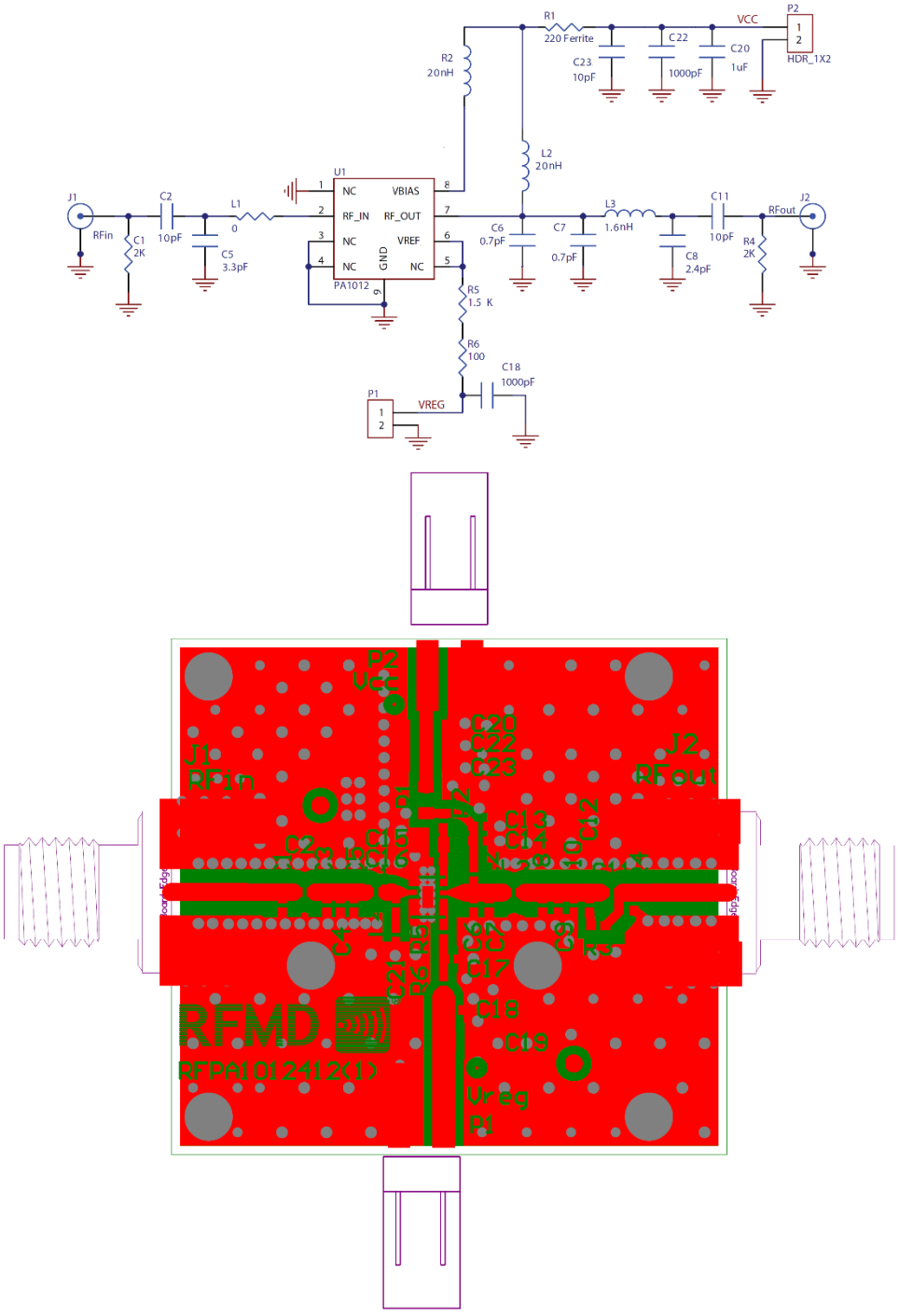
Output IP3 versus Frequency



Noise Figure versus Frequency



2110 MHz to 2170 MHz Evaluation Board – RFPA1012PCK412



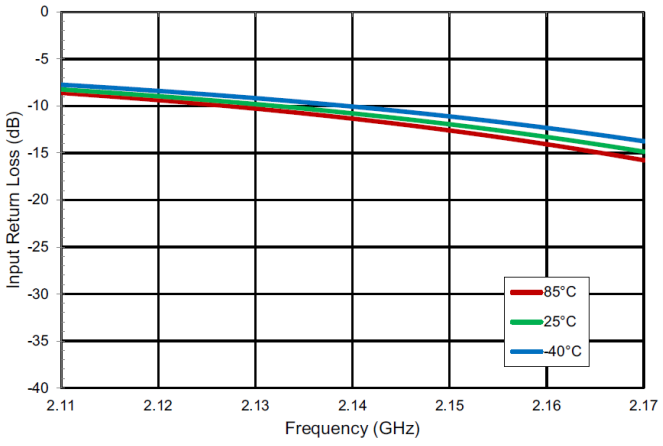
Bill of Material – RFPA1012PCK412, 2110 MHz to 2170 MHz

Ref. Des.	Value	Description	Manuf.	Part Number
PCB		Printed Circuit Board	Qorvo	RFPA1012-412(A)
U1		Amplifier, RFPA1012, DFN pkg.	Qorvo	RFPA1012
C2, C11, C23	10 pF	CAP, 10 pF, 5%, 50V, C0G, 0402	Johanson	500R07S100JV4TD
C5	3.3 pF	CAP, 3.3 pF, ±0.1 pF, 50V, Hi-Q, 0402	Johanson	500R07S3R3BV4TD
C6, C7	0.7 pF	CAP, 0.7 pF, ±0.1 pF, 50V, Hi-Q, 0402	Johanson	500R07S0R7BV4TD
C8	2.4 pF	CAP, 2.4 pF, ±0.1 pF, 50V, Hi-Q, 0402	Johanson	500R07S2R4BV4TD
C18, C22	1000 pF	CAP, 1000 pF, 10%, 50V, X7R, 0402	Murata	GRM155R71H102KA01E
C20	1 µF	CAP, 1 µF, 10%, 10V X7R, 0402	Murata	GRM155R61A105KE15D
L1	0 Ω	RES, 0 Ω, 0402	Kamaya	RMC1/16SJPTH
L2, R2	20 nH	IND, 20 nH, 5%, Wire Wound, 0402	Coilcraft	0402CS-20NXJLW
L3	1.6 nH	IND, 1.6 nH, ±0.1 nH, Thin Film, 0402	Murata	LQP15MN1N6B02D
R1	220 Ω	Ferrite Bead, 220 Ω, 2 A, 0603	Murata	BLM18EG221SN1D
R4, C1	2 KΩ	RES, 2 KΩ, 5%, 1/16 W, 0402	Panasonic	ERJ2GEJ202
R5	1.5 KΩ	RES, 1.5 KΩ, 1 %, 1/16 W, 0402	Panasonic	ERJ-2RKF1501X
R6	100 Ω	RES, 100 Ω, 1 %, 1/16 W, 0402	Panasonic	ERJ-2RKF1000X
P1, P2		CONN., HDR, ST. PLRZD, 2-PIN, 0.100”	ITW Pancon	MPSS100-2-C
J1, J2		CONN., SMA, END LNCH, FLT, 0.062”	Emerson	142-0701-821

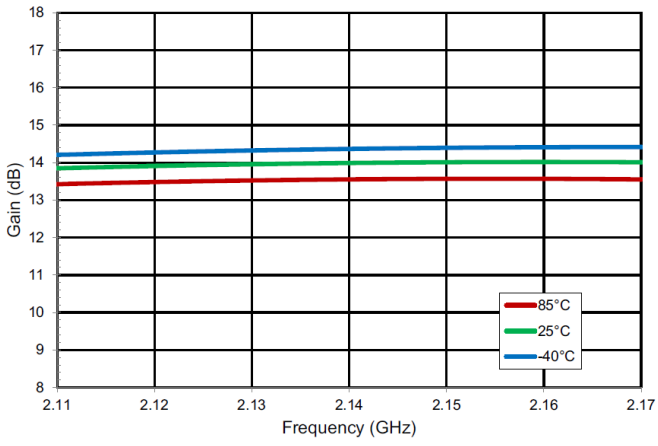
Performance Plots – RFPA1012PCK412, 2110 MHz to 2170 MHz

Test conditions unless otherwise noted: $V_{CC} = V_{PD} = +5$ V, $I_{CQ} = 90$ mA, Temp.=+25 °C

Input Return Loss versus Frequency



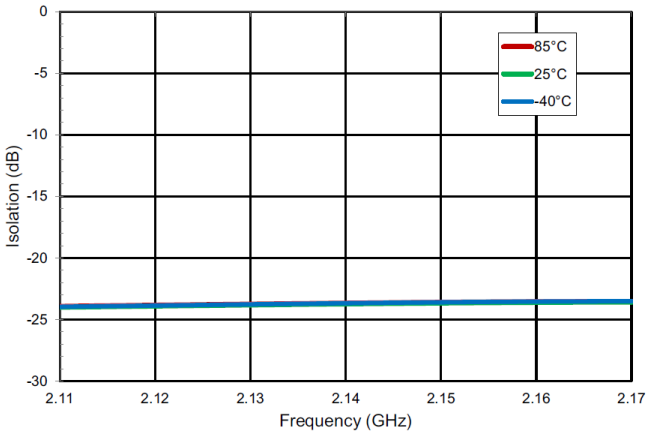
Gain versus Frequency



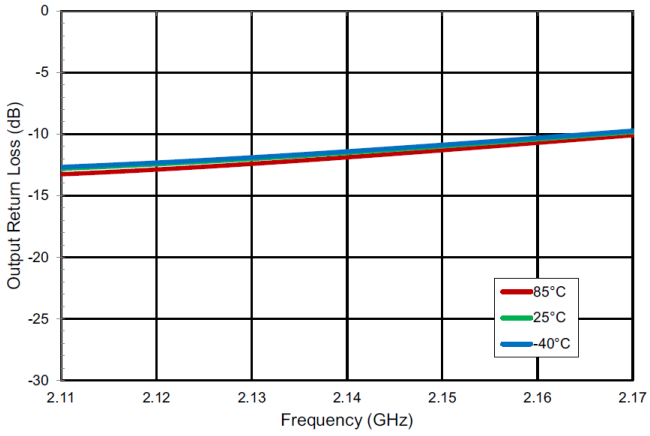
Performance Plots – RFPA1012PCK412, 2110 MHz to 2170 MHz (continue)

Test conditions unless otherwise noted: V_{CC} = V_{PD} = +5V, I_{CQ} = 90 mA, Temp.=+25 °C

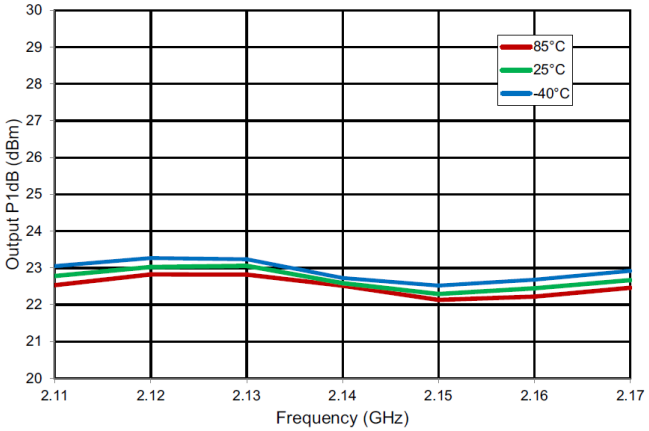
Isolation versus Frequency



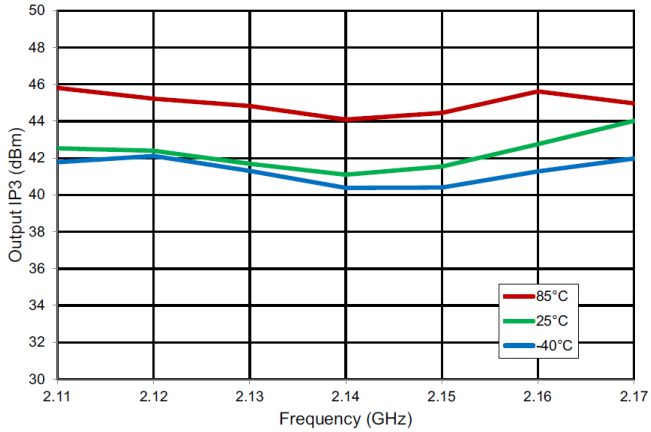
Output Return versus Frequency



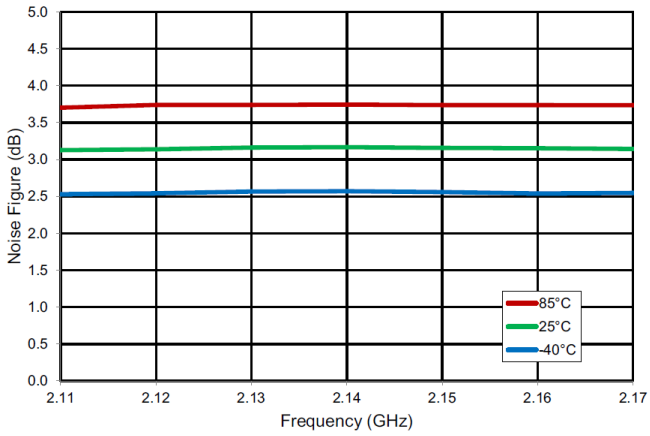
Output P1dB versus Frequency



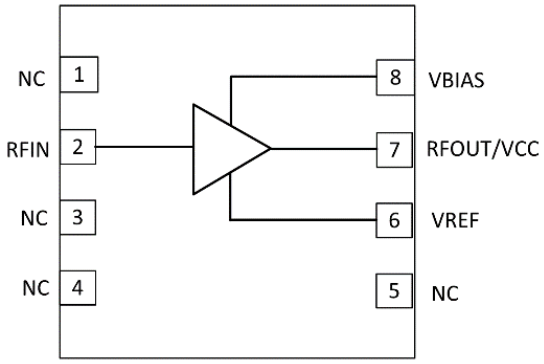
Output IP3 versus Frequency



Noise Figure versus Frequency



Pad Configuration and Description



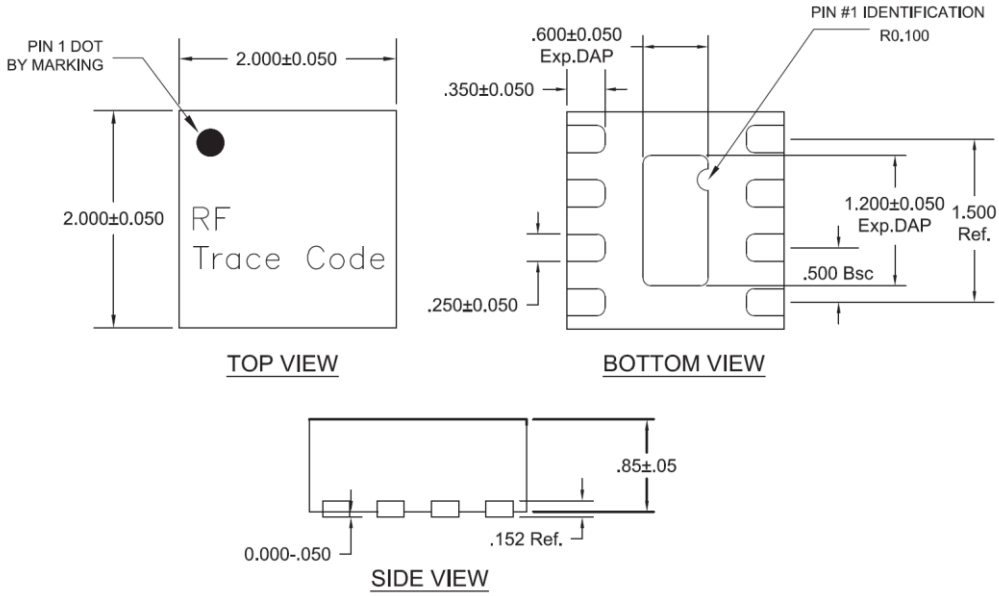
Top View

Pad No.	Label	Description
1 3, 4, 5	NC	No Internal Connection. Land pads should be provided for PCB mounting integrity.
2	RF IN	RF Input. External DC Block required.
6	VREF	Voltage Input to the active bias circuit to set the I_{CQ}. Can be used to power down device.
7	RF OUT/VCC	RF Output. Device Collector. External DC Block and bias voltage required.
8	VBIAS	Supply voltage for active bias circuit
Backside Paddle	GND	RF and DC ground. Must be soldered to ground plane with via holes to minimize inductance and thermal resistance for performance.

Package Marking and Dimensions

Marking:

Trace Code – Assigned by Sub Contractor



Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012.
3. Contact plating: Matte Sn

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 1B	ESDA / JEDEC JS-001-2012
ESD – Charged Device Model (CDM)	Class C3	JEDEC JESD22-C101F
MSL – Moisture Sensitivity Level	Level 1	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: Matte Sn

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:

- 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:

Web: www.qorvo.com **Tel: 1-844-890-8163**

Email: customer.support@qorvo.com

For technical questions and application information:

Email: appsupport@qorvo.com

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