



QPA9122M

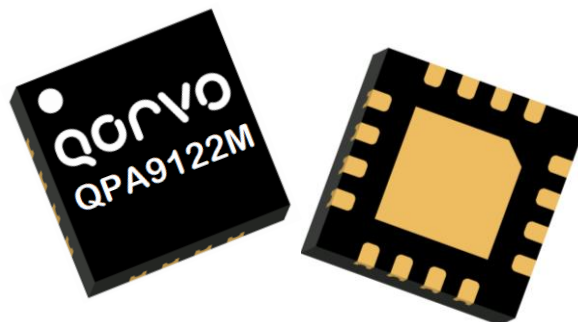
2.3 – 5.0 GHz 0.5 W Linearity Improved Driver

Product Overview

The QPA9122M is a wideband, high gain and high linearity driver amplifier. It provides 36.5dB gain at 2.6GHz and achieves a peak power of 27dBm P3dB. The amplifier can provide good DPD linearity performance with wideband signals of up to 200 MHz wide 5G NR signals, making it perfectly suited for m-MIMO applications.

The QPA9122M is internally match to 50Ω over the entire operating frequency band of 2.3 – 5.0 GHz and incorporates a shut-down function through the V_{PD} pin. QPA9122M also has external bias control capability for linearity optimization.

The QPA9122M is housed in a 16-pin 3X3mm SMT package and is footprint and pin-compatible to QPA9120, QPA9121 and QPA9122.

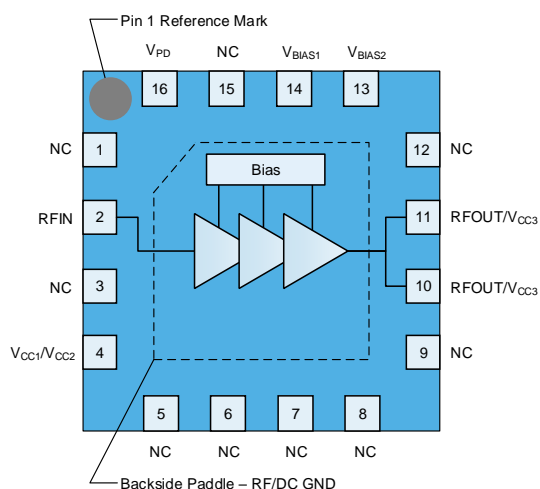


16 Pad 3 x 3 mm Laminate Package

Key Features

- 2.3–5.0 GHz Operational Frequency
- 50Ω Matched RF Input and Output
- +27 dBm P3dB
- 36.5 dB Gain at 2.6 GHz
- +5 V Single Supply, I_{CQ} adjustable
- DC Power Shutdown Feature

Functional Block Diagram



Top View

Applications

- 5G m-MIMO
- Mobile Infrastructure
- General Purpose Wireless
- TDD / FDD System

Ordering Information

Part No.	Description
QPA9122MTR7	2500 pcs on 7" reel (standard)
QPA9122MEVB-01	Evaluation Board

Absolute Maximum Ratings

Parameter	Rating
Storage Temperature	-65 to +150°C
T _{CASE}	-40 to +125°C
RF Input Power, ON state, CW, T=25 °C, 2:1 VSWR, In-band	+10
RF Input Power, OFF state, CW, T=25 °C, 2:1 VSWR, In-band	+10
Device Voltage (V _{CC1})	+6 V

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

Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
Supply Voltage (V _{CC})	+4.75	+5	+5.25	V
T _{CASE}	-40		+105	°C
T _j for >10 ⁶ hours MTTF			+218	°C

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions. Application of conditions to the device outside the Recommended Operating Conditions may reduce device reliability and performance.

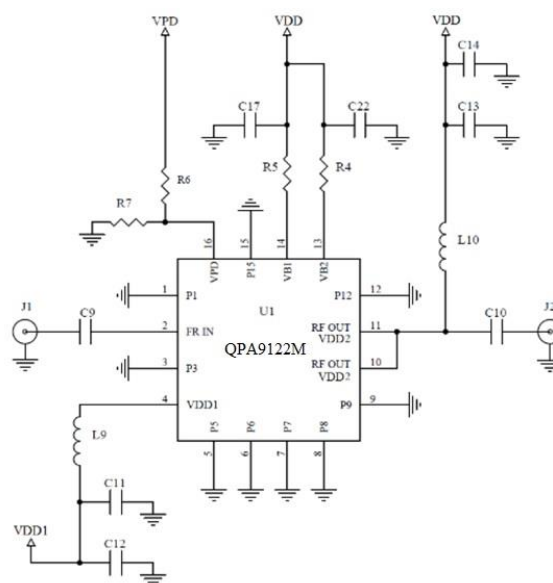
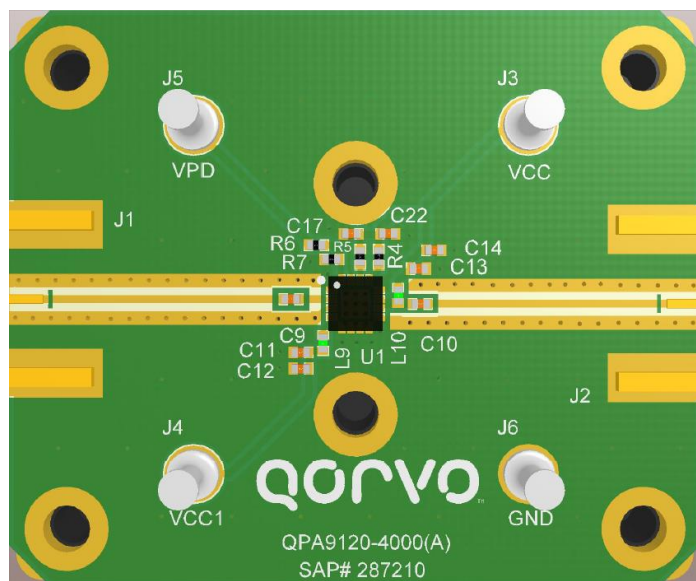
Electrical Specifications

Parameter	Conditions ⁽¹⁾	Min	Typ	Max	Units
Operational Frequency Range		2300		5000	MHz
Gain	At 2.6 GHz	33.7	36.5	39.7	dB
	At 3.6 GHz	34	37.3	40	dB
Gain Flatness	Any 100 MHz BW within band			0.8	dB
Input Return Loss			15		dB
Output Return Loss			12		dB
Reverse Isolation	ON state		50		dB
Forward Isolation	OFF state		45		dB
Output P _{1dB}	At 2.6 GHz	24.5	25.5		dBm
	At 3.6 GHz	24.5	25.6		dBm
Output P _{3dB}	At 2.6 GHz	25.5	27.2		dBm
	At 3.6 GHz	25.5	27.3		dBm
ACPR	At 2.6 GHz, P _{out} =+15 dBm, 1C LTE 20MHz, 8dB PAR		-45.1	-40	dBc
	At 3.6 GHz, P _{out} =+15 dBm, 1C LTE 20MHz, 8dB PAR		-42.7	-37	dBc
Noise Figure	At 3.6 GHz		5.2		dB
Quiescent Current, I _{CQ}		90	120	160	mA
Device Current, OFF	V _{PD} = 0 V		1.9	4	mA
V _{PD} , Logic Low		0		0.63	V
V _{PD} , Logic High		1.17		V _{CC}	V
Device ON or OFF Timing	50% Ctrl to 10/90% RF		0.45		μs
Thermal Resistance, θ _{Jc}	Junction to case		40		°C/W

Notes:

1. Test conditions unless otherwise noted: V_{CC} = +5.0 V, V_{PD} = +1.8 V, I_{CQ} = 120 mA, R_S = 1.2 kΩ, Temp = +25 °C, 50 Ω system.

Evaluation Board



Notes:

1. Components shown on PCB layout but not on the schematic are not used.

Bill of Materials

Reference Des.	Value	Description	Manuf.	Part Number
n/a	-	Printed Circuit Board	Qorvo	
U1	-	High Gain Driver Amplifier	Qorvo	QPA9122M
C9, C10	18 pF	CAP, 5%, 50V, C0G, 0402	Murata	GRM1555C1H180JA01D
C12, C14	1 μ F	CAP, 10V, X5R, CER, 0402	Various	
C11, C13, C17, C22	100 pF	CAP, 5%, 50V, C0G, 0402	Murata	GRM1555C1H101JA01D
R4	51 Ω	RES, 5%, 1/16W, 0402	Various	
R6	0 Ω	RES, 1/10W, 0402	Various	
L9	8.2 Ω	RES, 5%, 1/16W, 0402	Various	
L10	12 nH	IND, 5%, 0402	Coilcraft	0402CS-12NXJLW
J1, J2	-	Conn, SMA F STRT .062"	Cinch Connectivity	142-0701-851
R7	DNP	n/a	n/a	n/a
R5	Variable	Adjustable to set I _{cq}	Various	

R5 Resistor Values for Various I_{CQ} settings

I _{CQ} (mA)	85	90	100	110	120	130	140	150
R ₅ (Ω)	0	100	260	500	1.2K	1.6K	3.2K	DNP

Logic Table

Parameter, V _{PD}	High	Low
Device State	ON	OFF

Typical Performance

Parameter	Conditions	Typical Value			Units
Frequency		2600	3600	4900	MHz
Gain		37.1	36.9	34.7	dB
Input Return Loss		14.4	18.5	16.7	dB
Output Return Loss		17.5	17.7	12.8	dB
Output P1dB		25.6	25.8	25.5	dB
Output P3dB		27.2	27.4	27.0	dBm
ACPR	Pout=+15 dBm, 1C LTE, 20MHz, 8.5dB PAR	-45.1	-42.9	-39.6	dBc
Noise Figure		5.2	5.2	5.5	dB
Device Current	V _{CC} and V _{CC1} combined	120			mA

Notes:

1. Test Conditions unless otherwise noted: V_{CC} and V_{CC1} on EVB = +5.0 V, I_{CQ} = 120 mA, V_{PD} = +1.8 V, Temp.=+25 °C

Typical Performance – 2600 MHz

Parameter	Conditions	Typical Value			Units
Quiescent Current		90	120	150	mA
Gain		35.8	37.1	37.8	dB
Input Return Loss		13.5	14.4	15.0	dB
Output Return Loss		20.4	17.5	16.4	dB
Output P1dB		25.7	25.6	25.7	dB
Output P3dB		27.3	27.2	27.2	dBm
ACPR	Pout=+15 dBm, 1C LTE, 20MHz, 8.5dB PAR	-38.3	-45.1	-50.8	dBc
Noise Figure		5.1	5.2	5.4	dB

Notes:

1. Test Conditions unless otherwise noted: V_{CC} and V_{CC1} on EVB = +5.0 V, V_{PD} = +1.8 V, Temp.=+25 °C

Typical Performance – 3600 MHz

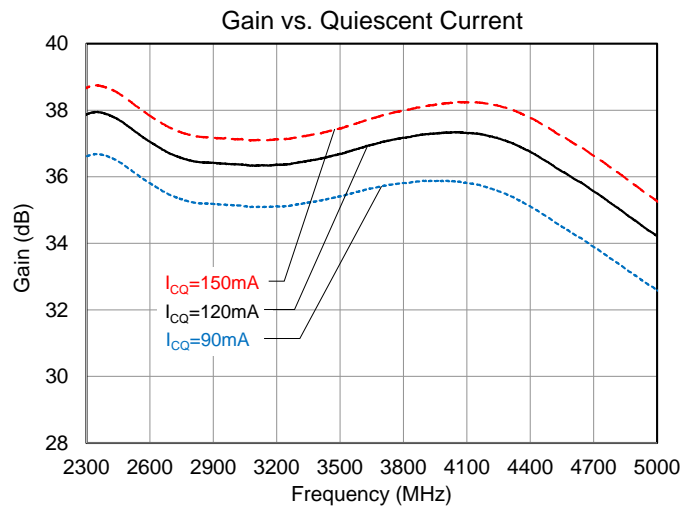
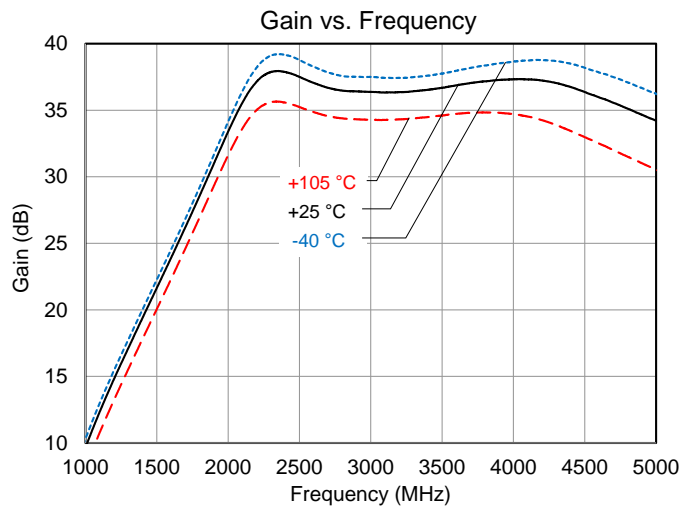
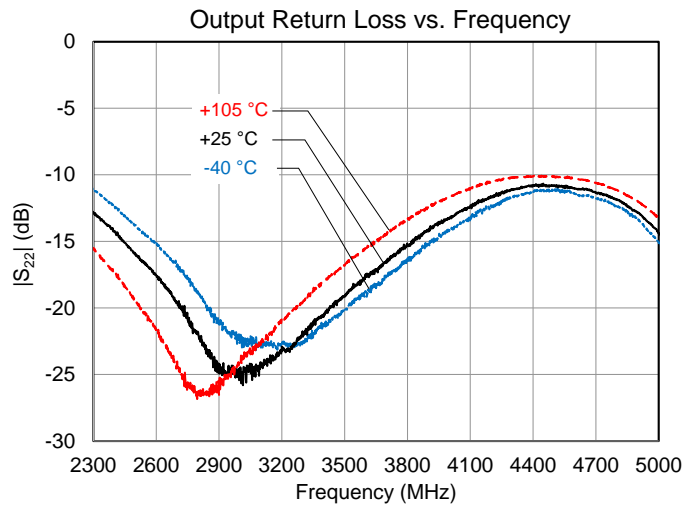
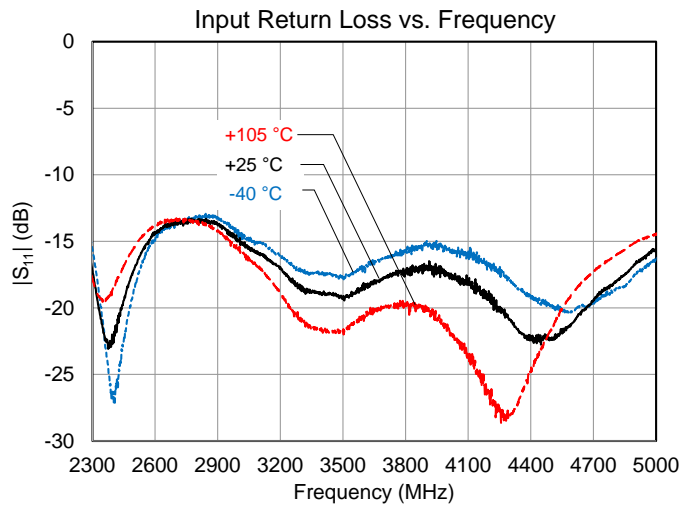
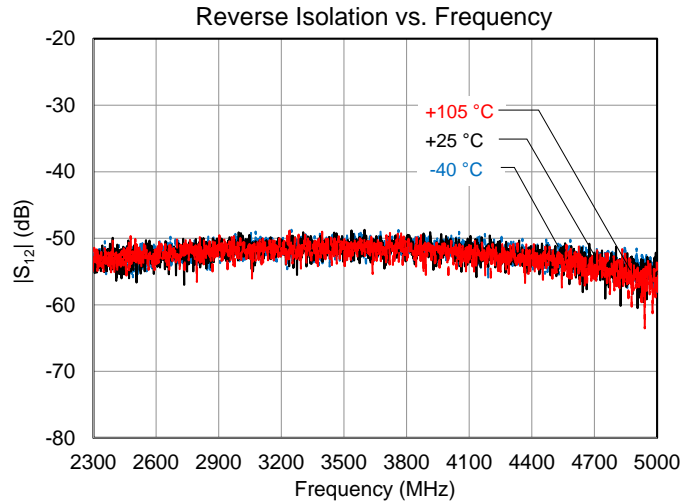
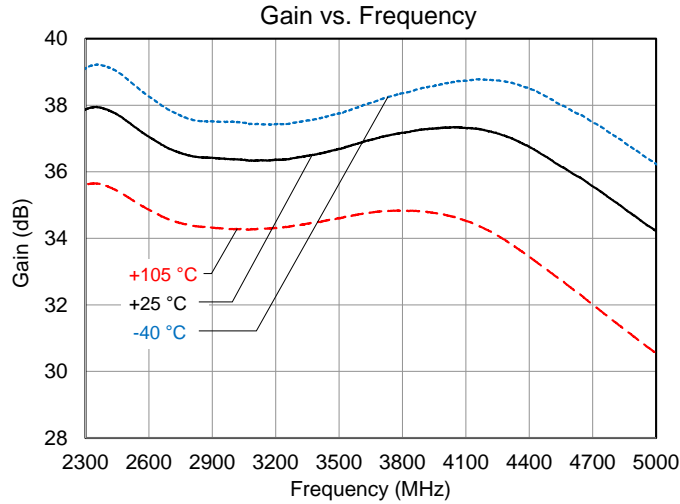
Parameter	Conditions	Typical Value			Units
Quiescent Current		90	120	150	mA
Gain		35.6	36.9	37.7	dB
Input Return Loss		18.6	18.5	18.3	dB
Output Return Loss		15.6	17.7	18.7	dB
Output P1dB		25.9	25.8	26.0	dB
Output P3dB		27.5	27.4	27.5	dBm
ACPR	Pout=+15 dBm, 1C LTE, 20MHz, 8.5dB PAR	-35.6	-42.9	-50.0	dBc
Noise Figure		5.1	5.2	5.3	dB

Notes:

1. Test Conditions unless otherwise noted: V_{CC} and V_{CC1} on EVB = +5.0 V, V_{PD} = +1.8 V, Temp.=+25 °C

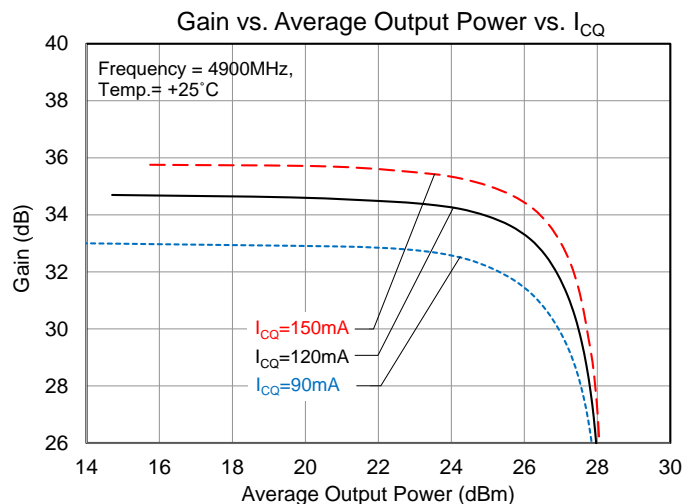
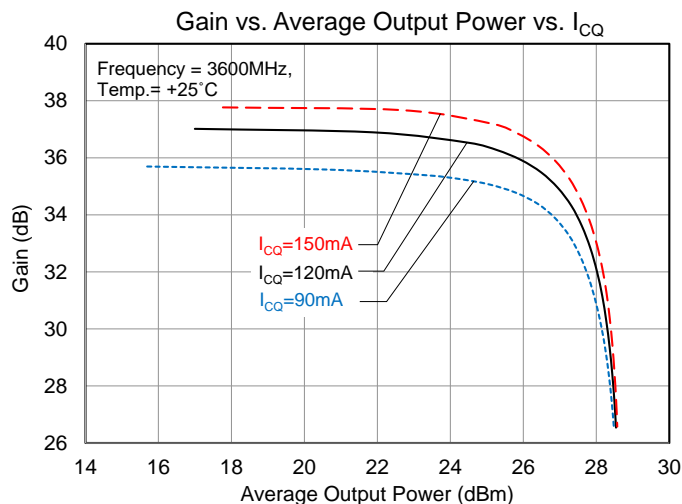
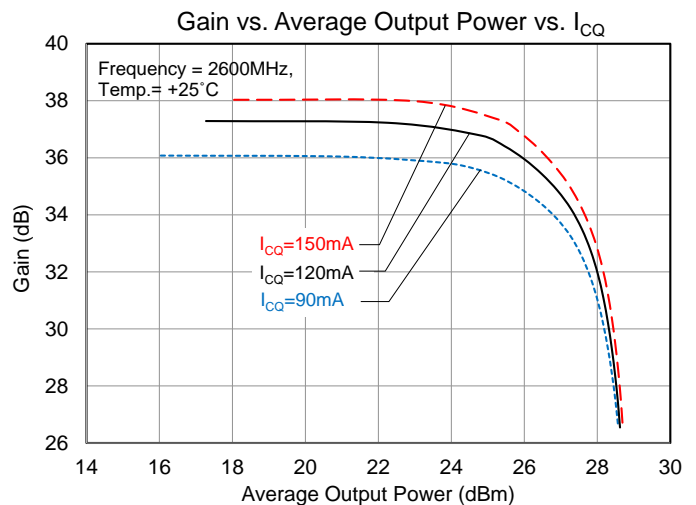
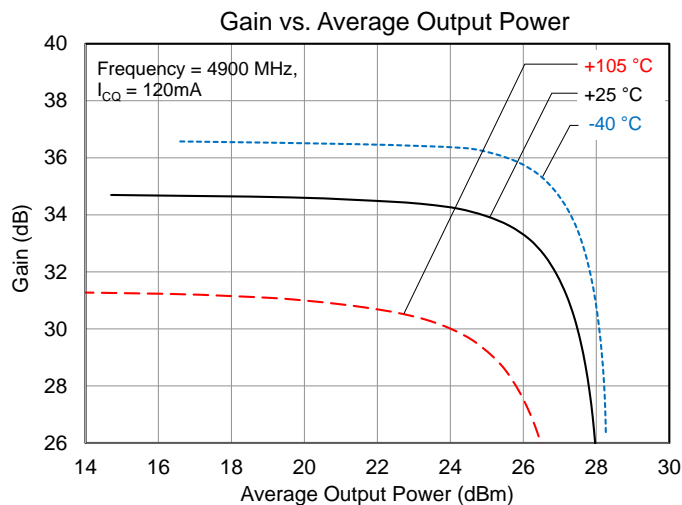
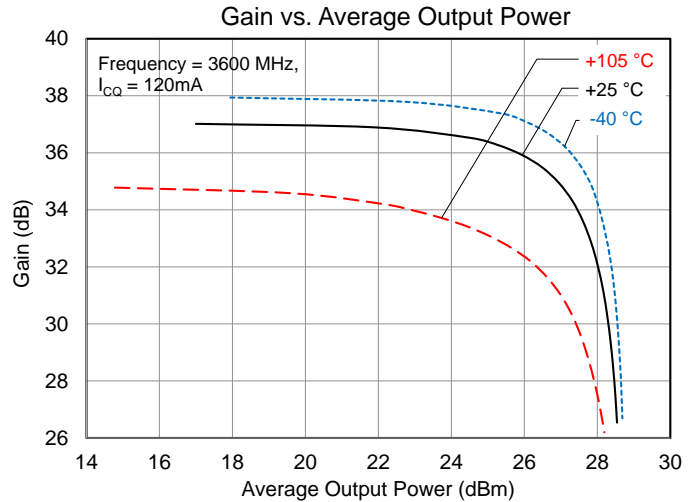
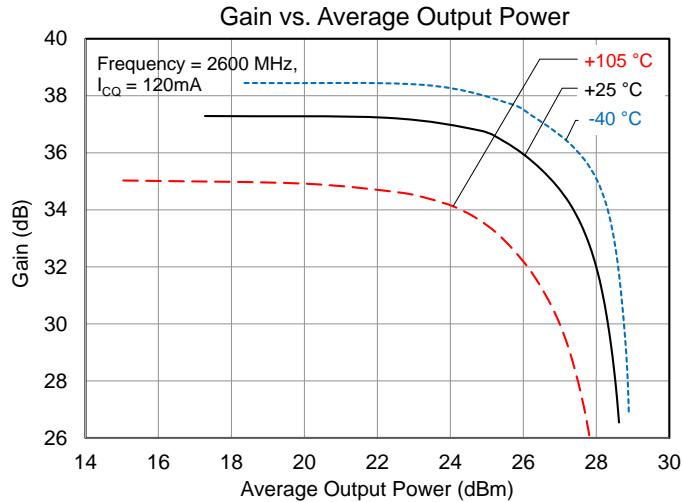
Performance Plots

Test conditions unless otherwise noted: V_{CC} and V_{CC1} on EVB = +5.0 V, V_{PD} = +1.8 V, Temp. = +25 °C, I_{CQ} = 120mA



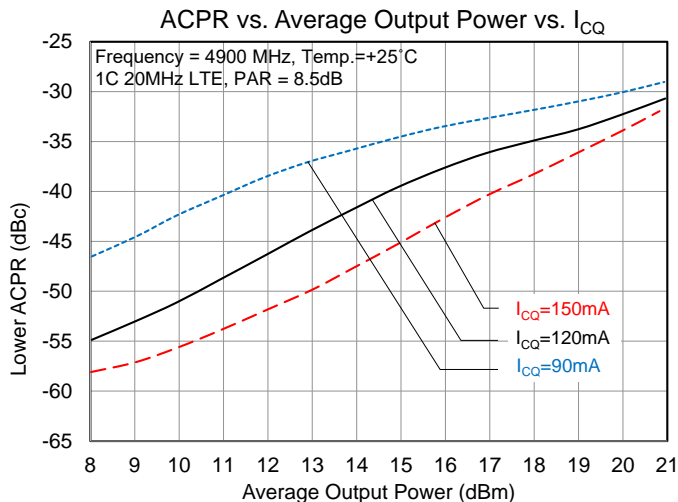
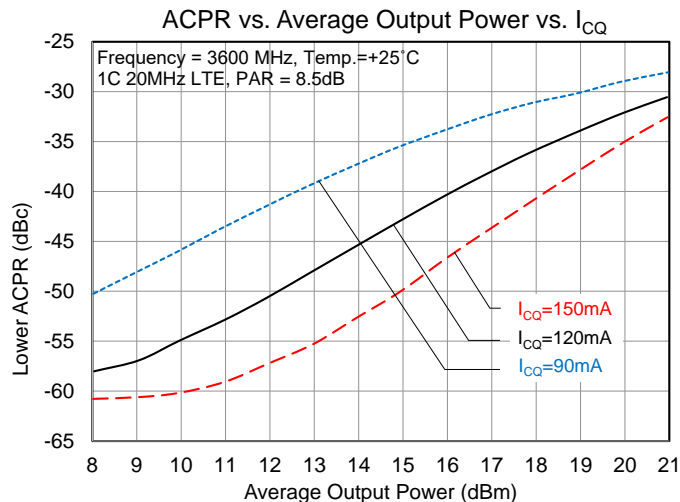
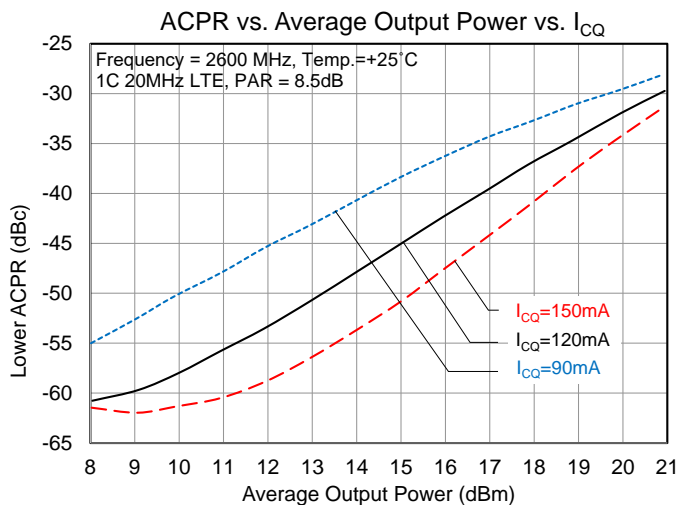
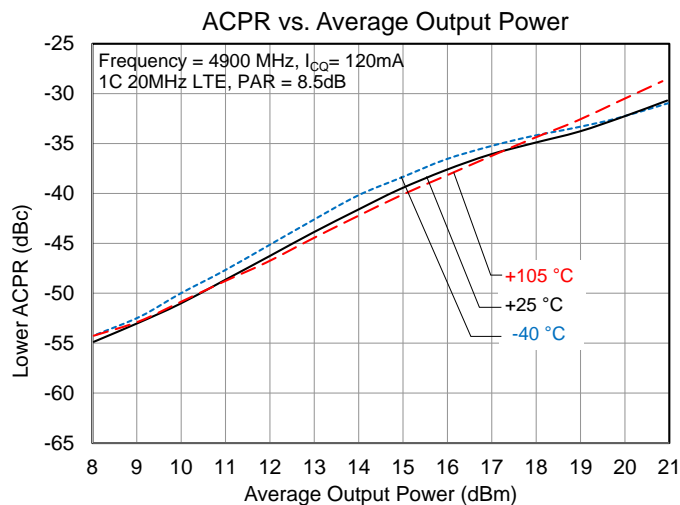
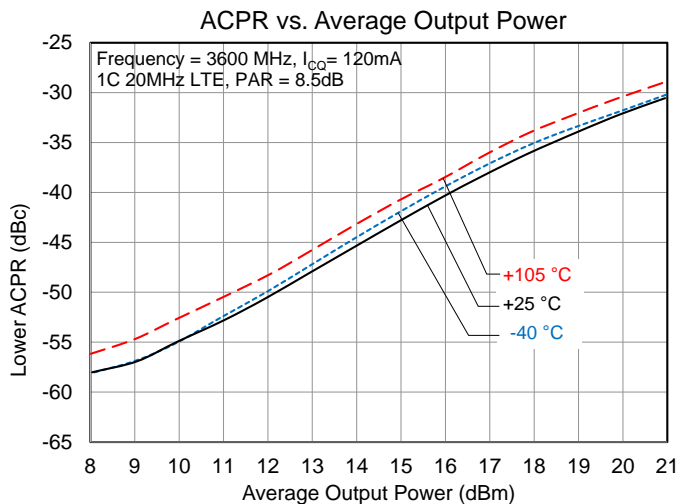
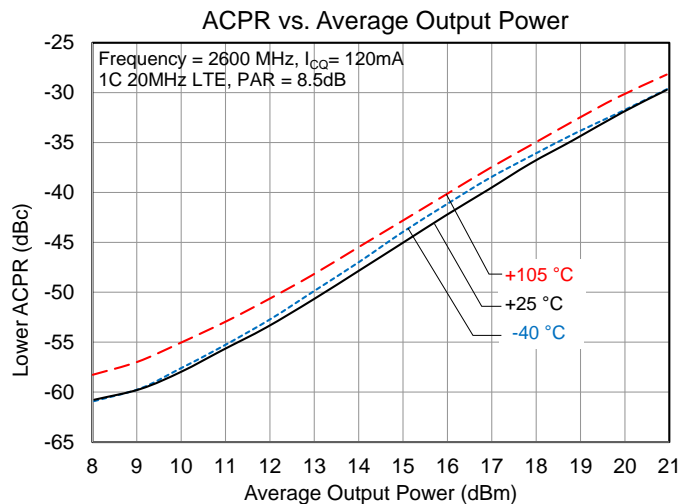
Performance Plots – Continued

Test conditions unless otherwise noted: V_{CC} and V_{CC1} on EVB = +5.0 V, V_{PD} = +1.8 V, Temp. = +25 °C, I_{CQ} = 120mA



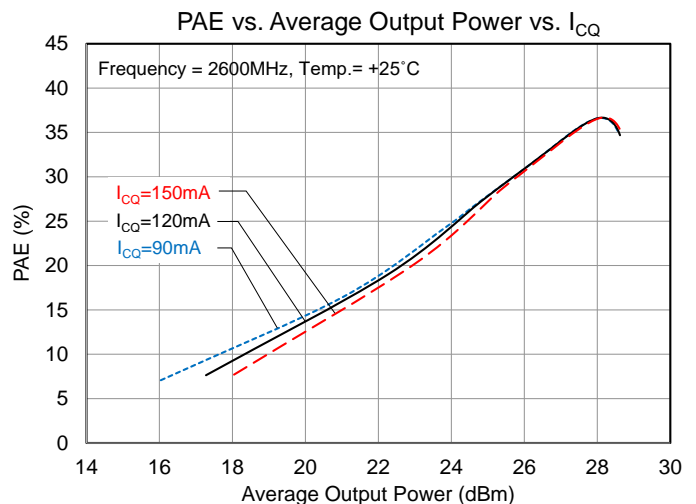
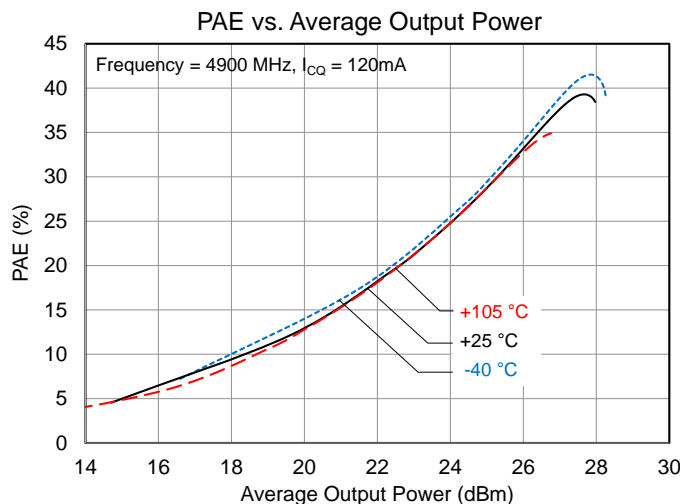
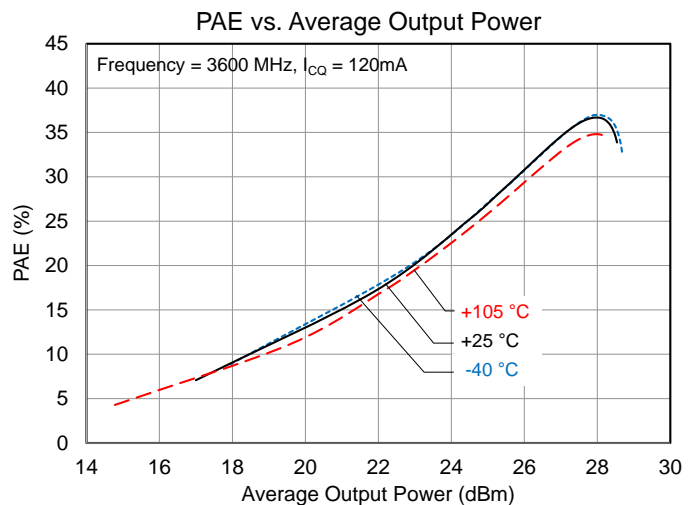
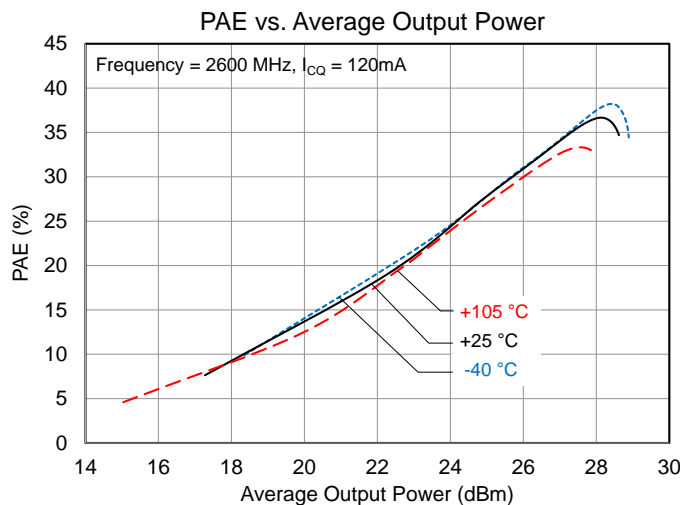
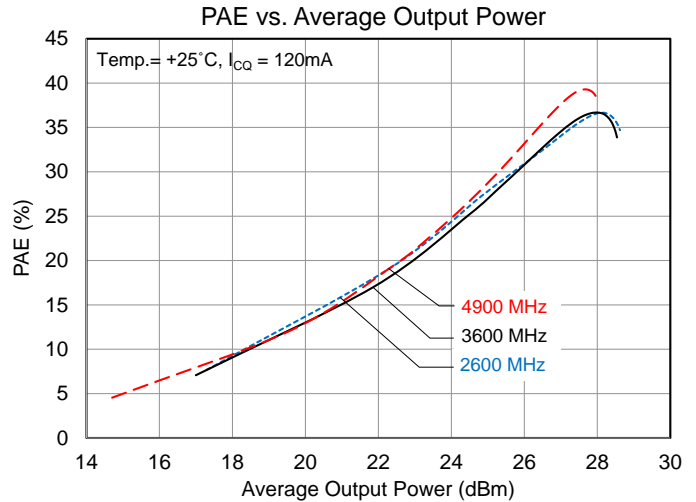
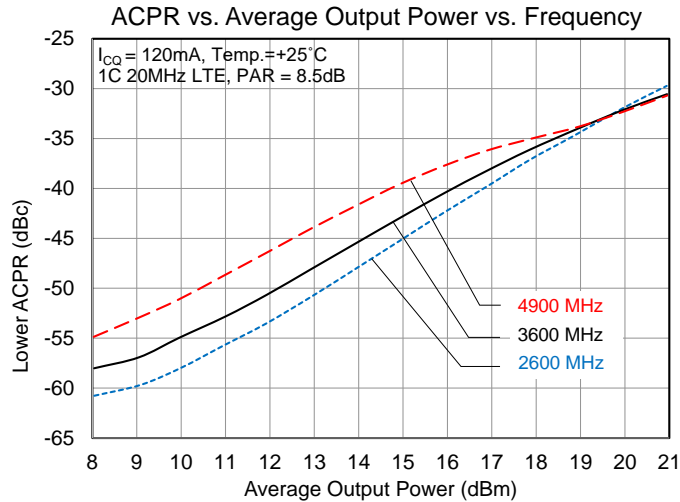
Performance Plots – Continued

Test conditions unless otherwise noted: V_{CC} and V_{CC1} on EVB = +5.0 V, V_{PD} = +1.8 V, Temp. = +25 °C, I_{CQ} = 120mA



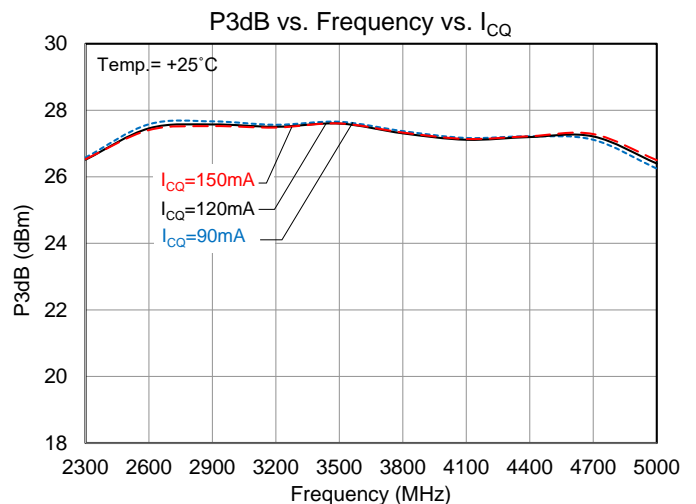
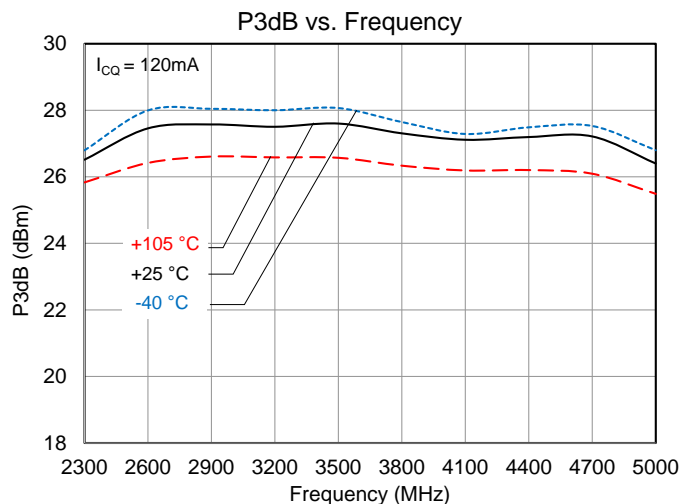
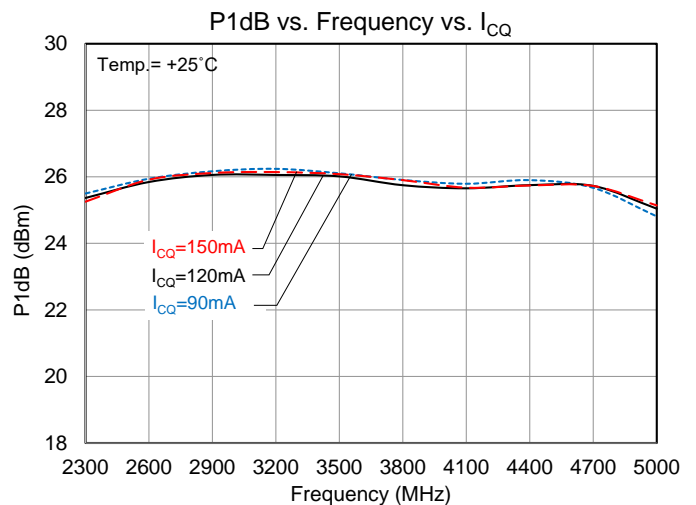
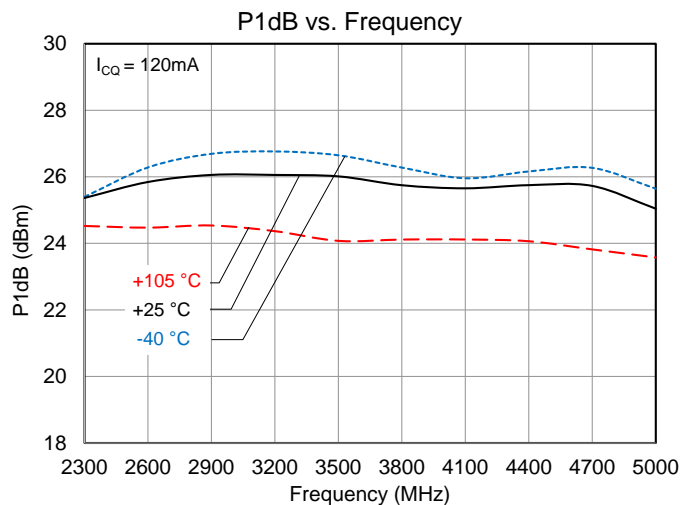
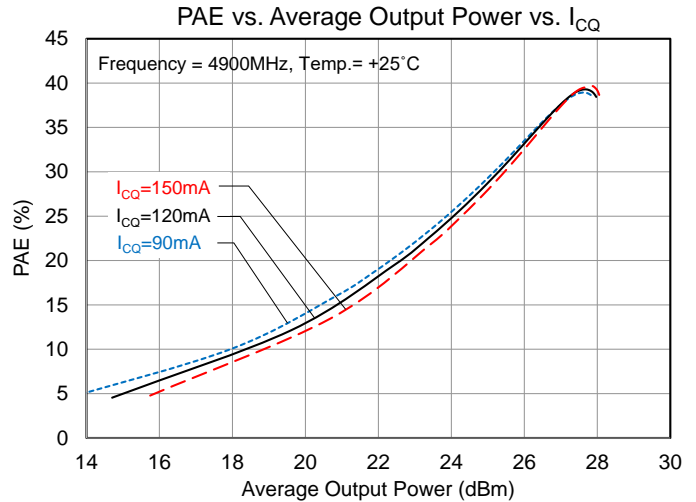
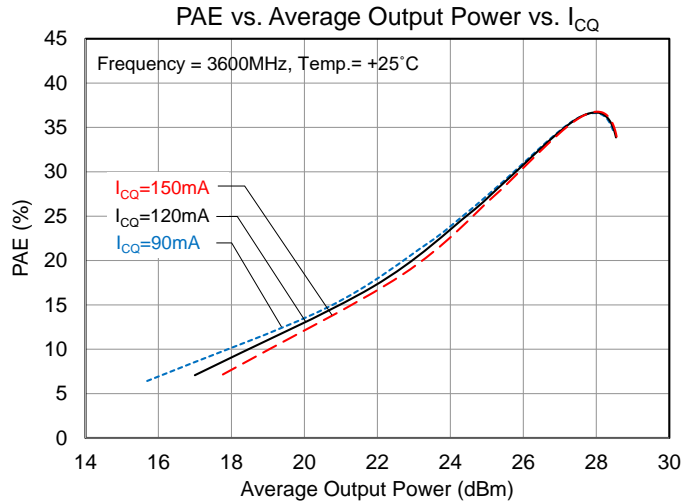
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Test conditions unless otherwise noted: V_{CC} and V_{CC1} on EVB = +5.0 V, V_{PD} = +1.8 V, Temp. = +25 °C, I_{CQ} = 120mA



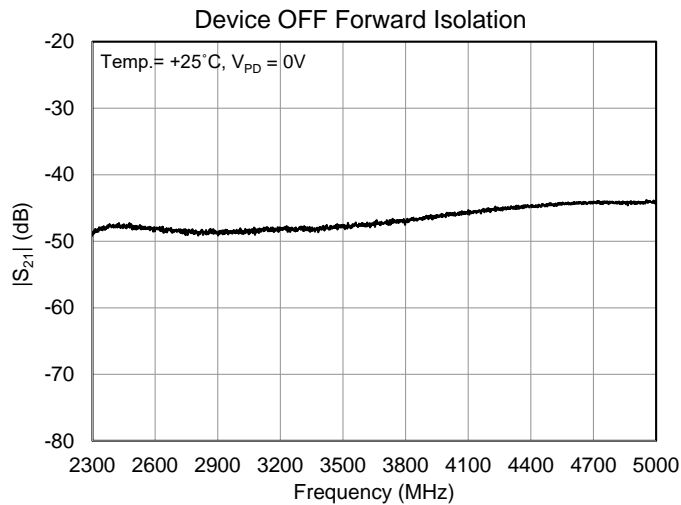
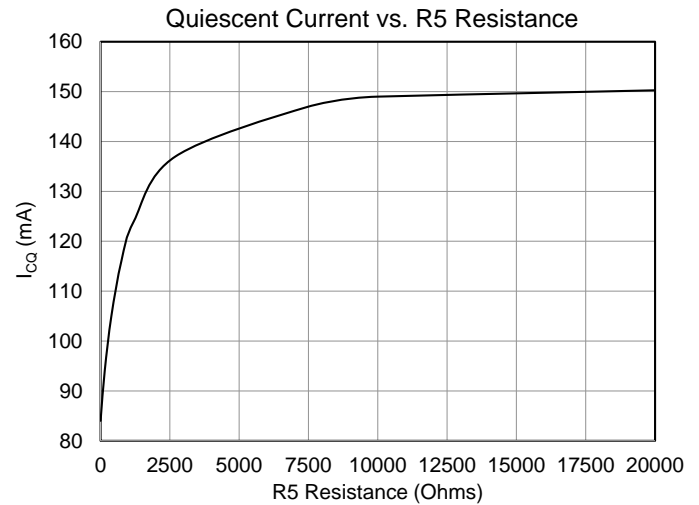
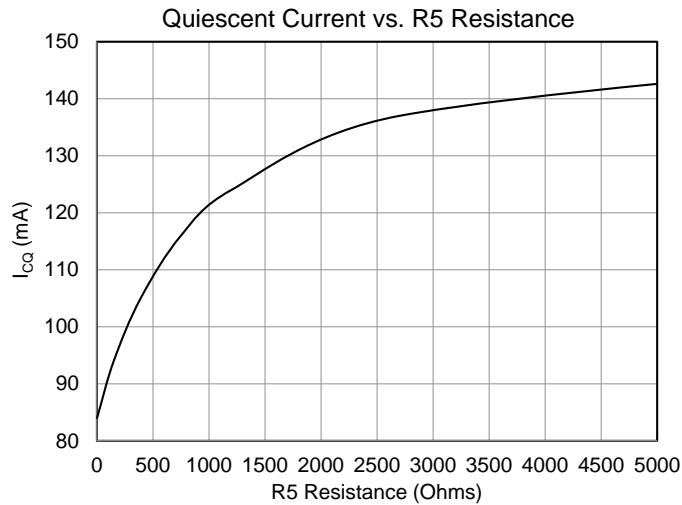
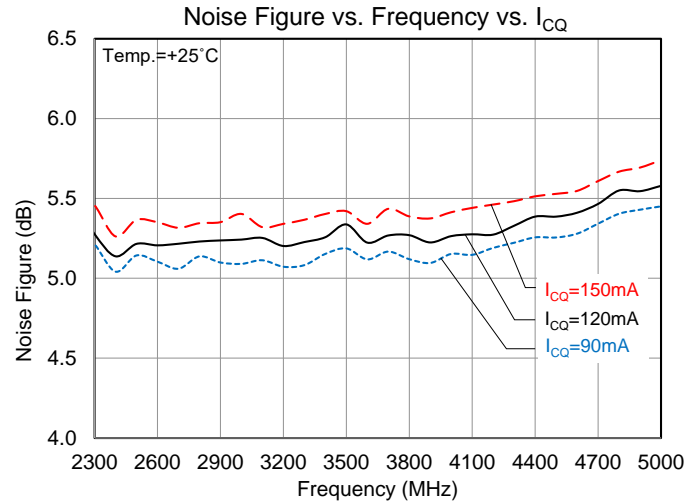
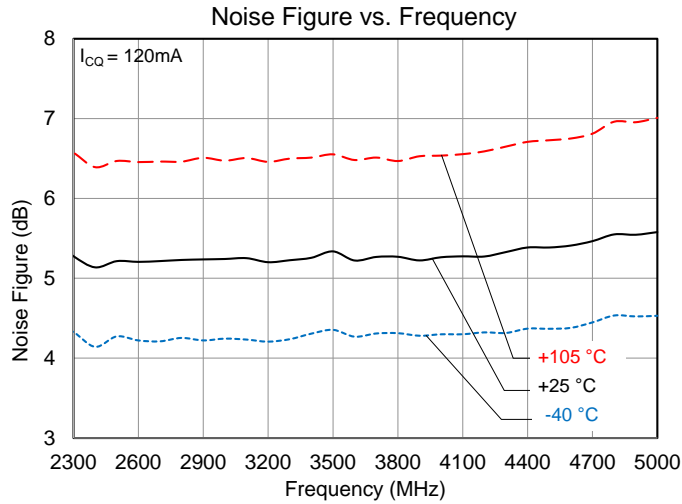
Performance Plots – Continued

Test conditions unless otherwise noted: V_{CC} and V_{CC1} on EVB = +5.0 V, V_{PD} = +1.8 V, Temp. = +25 °C, I_{CQ} = 120mA

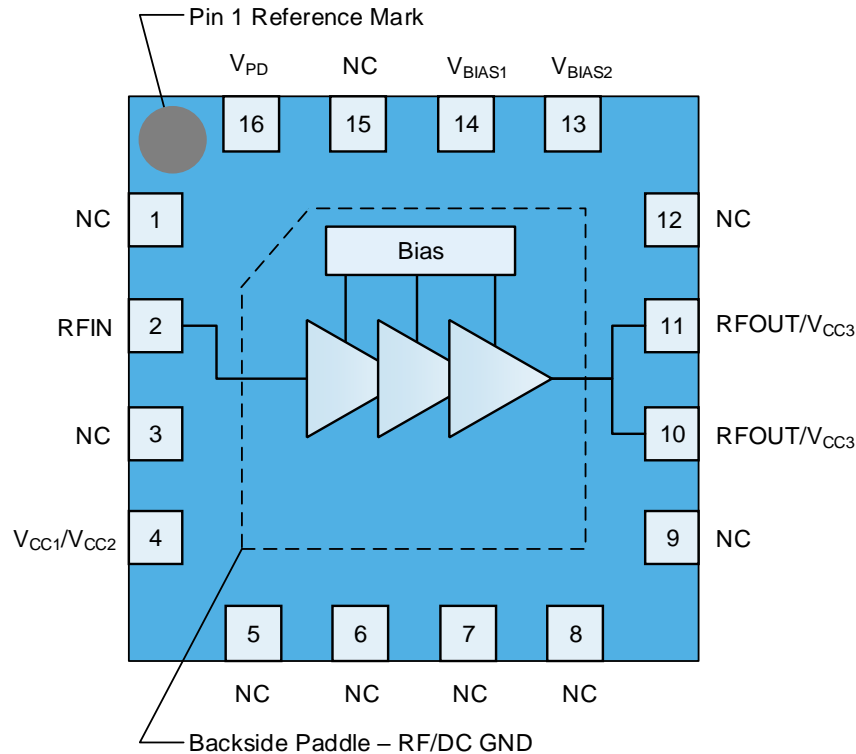


Performance Plots – Continued

Test conditions unless otherwise noted: V_{CC} and V_{CC1} on EVB = +5.0 V, V_{PD} = +1.8 V, Temp. = +25 °C



Pad Configuration and Description



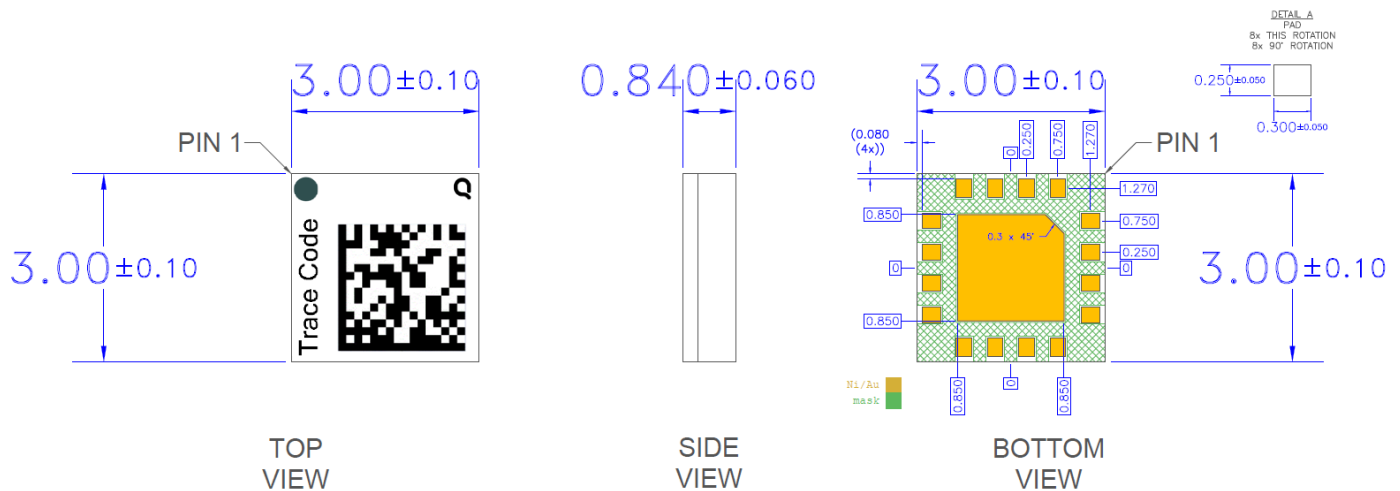
Top View

Pad No.	Label	Description
1, 3, 5, 6, 7, 8, 9, 12, 15	NC	No electrical connection internally. It may be left floating or connected to ground. Land pads should be provided for PCB mounting integrity.
2	RF IN	RF input. External DC block required.
4	V _{CC1} / V _{CC2}	First and second stage DC supply.
10, 11	RFOUT / V _{CC3}	RF output and third stage DC supply. External choke and DC block capacitor required.
13	V _{BIAS2}	Bias circuit supply voltage.
14	V _{BIAS1}	Sets the quiescent current of the AMP. Needs external series resistor, tied to VCC, to set the voltage.
16	V _{PD}	PA on/off logic control.
Backside Paddle	GND	RF/DC ground connection. The back side of the package should be connected to the ground plane through as short of a connection as possible. PCB vias under the device as many as possible are recommended.

Package Marking and Dimensions

Marking: QR Code – Contains device traceability information

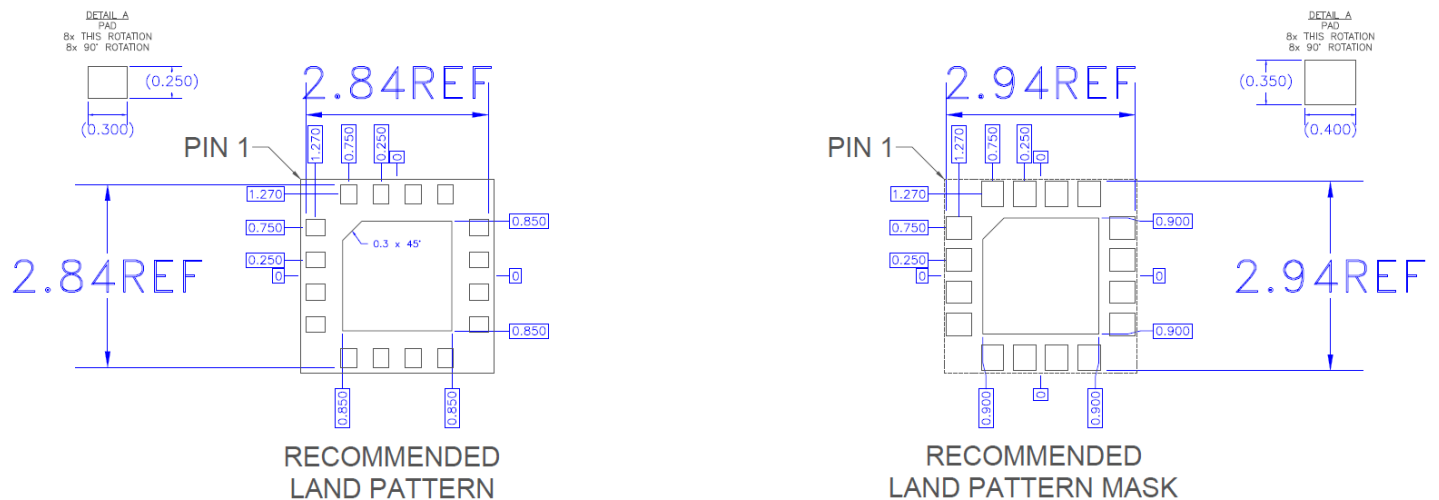
Trace Code – XXXX up to 4 Characters assigned by sub-contractor



Notes:

2. All dimensions are in millimeters. Angles are in degrees.
3. The terminal #1 identifier and terminal numbering conform to SPE-000677.
4. Contact plating: ENEPIG

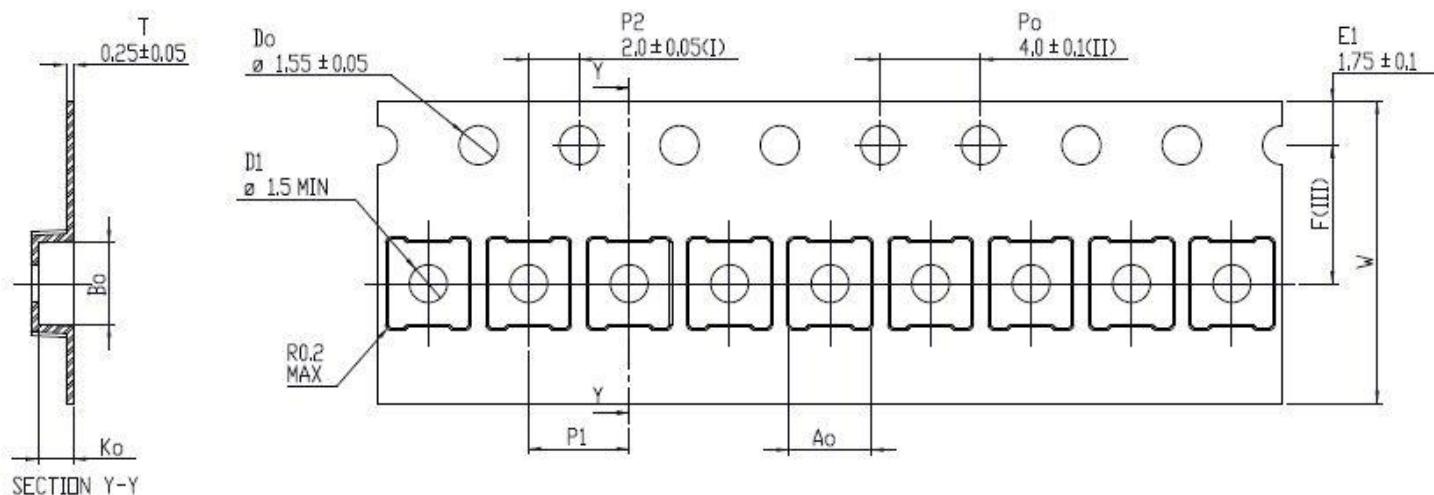
Recommended PCB Layout Pattern



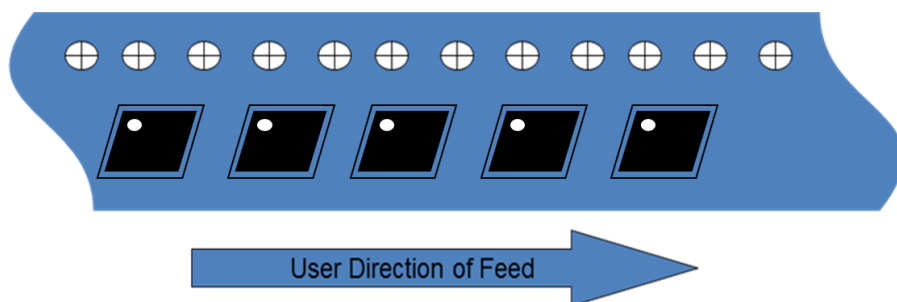
Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. Use 1 oz. copper minimum for top and bottom layer metal.
3. Via holes are required under the backside paddle of this device for proper RF/DC grounding and thermal dissipation. We recommend a 0.35mm (#80/.0135") diameter bit for drilling via holes and a final plated thru diameter of 0.25 mm (0.01").
4. Ensure good package backside paddle solder attach for reliable operation and best electrical performance.

Tape and Reel Information – Carrier and Cover Tape Dimensions

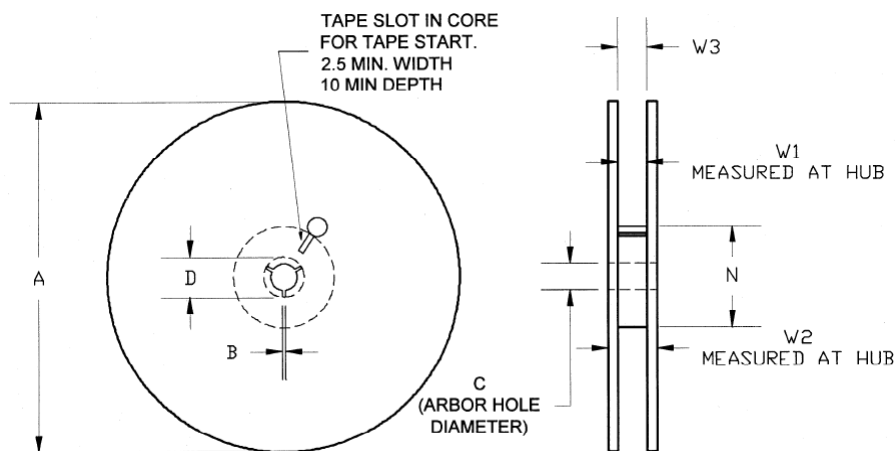


Feature	Measure	Symbol	Size (in)	Size (mm)
Cavity	Length	A0	0.128	3.25
	Width	B0	0.128	3.25
	Depth	K0	0.055	1.40
	Pitch	P1	0.157	4.00
Centerline Distance	Cavity to Perforation - Length Direction	P2	0.079	2.00
	Cavity to Perforation - Width Direction	F	0.217	5.50
Cover Tape	Width	C	0.362	9.20
Carrier Tape	Width	W	0.472	12.00



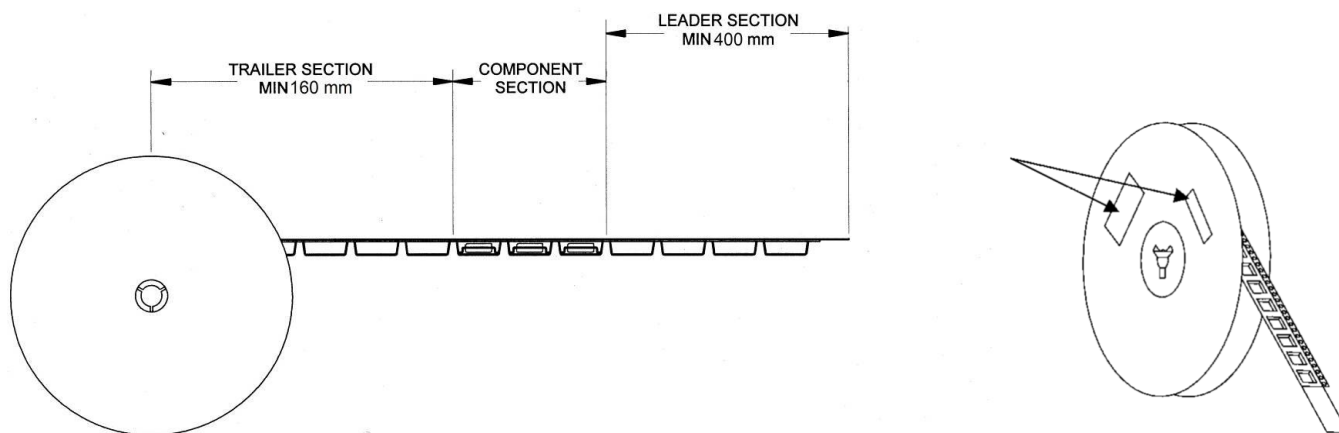
Tape and Reel Information – Reel Dimensions

Standard T/R size = 2,500 pieces on a 7" reel.



Feature	Measure	Symbol	Size (in)	Size (mm)
Flange	Diameter	A	6.969	177.0
	Thickness	W2	0.717	18.2
	Space Between Flange	W1	0.504	12.8
Hub	Outer Diameter	N	2.283	58.0
	Arbor Hole Diameter	C	0.512	13.0
	Key Slit Width	B	0.079	2.0
	Key Slit Diameter	D	0.787	20.0

Tape and Reel Information – Tape Length and Label Placement



Notes:

1. Empty part cavities at the trailing and leading ends are sealed with cover tape. See EIA 481-1-A.
2. Labels are placed on the flange opposite the sprockets in the carrier tape.

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	1B	ESDA / JEDEC JS-001-2017
ESD – Charged Device Model (CDM)	C3	JEDEC JESD22-C101F
MSL – Moisture Sensitivity Level	MSL3	IPC/JEDEC J-STD-020



Caution!
ESD-Sensitive Device

Solderability

Compatible with both lead-free (260°C max. reflow temperature) and tin/lead (245°C max. reflow temperature) soldering processes. Solder profiles available upon request.

Contact plating: ENEPIG

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:

- Product uses RoHS Exemption 7c-I to meet RoHS Compliance requirements
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C₁₅H₁₂Br₄O₂) 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

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