QPA3503

3 W, 28 V, 3.4 – 3.6 GHz GaN PA Module

Product Description

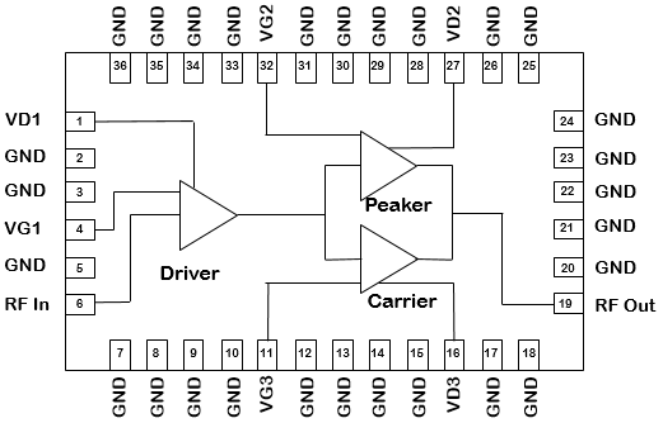
The QPA3503 is an integrated 2-stage Power Amplifier Module designed for massive MIMO applications with 3 W RMS at the device output covering frequency range from 3.4 to 3.6 GHz.

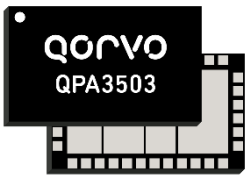
The module is 50 Ω input and output and requires minimal external components. The module is also compact and offers a much smaller footprint than traditional discrete component solutions.

The QPA3503 incorporates a Doherty final stage delivering high power added efficiency for the entire module at 3 W average power.

RoHS compliant.

Functional Block Diagram





36 Pin 6x10 mm Plastic Package

Product Features

- Operating Frequency Range: 3.4 - 3.6 GHz
- Operating Drain Voltage: +28 V
- 50 Ω Input / Output
- Integrated Doherty Final Stage
- Gain at 3 W avg.: 32 dB
- Power Added Efficiency at 3 W avg.: 33%
- 6x10 mm Plastic Surface Mount Package

Applications

- 5G Massive MIMO
- W-CDMA / LTE
- Macrocell Base Station Driver
- Microcell Base Station
- Small Cell Final Stage
- Active Antenna
- General Purpose Applications

Ordering Information

Part No.	Description
QPA3503SB	Sample Bag – 5 Pieces
QPA3503SR	Short Reel – 100 Pieces
QPA3503TR13	13” Reel – 2500 Pieces
QPA3503EVB01	Tested 3.4-3.6 GHz EVB

Absolute Maximum Ratings[2]

Parameter	Range / Value	Units
Breakdown Voltage, BV_{DG}	120	V
Gate Voltage ($V_{G1,2,3}$)	−7 to +2	V
Drain Voltage ($V_{D1,2,3}$)	+40	V
RF Input Power (1)	+25	dBm
VSWR Mismatch, P3dB Pulse (10 % duty cycle, 100 µ width), T = 25 °C	10:1	
Storage Temperature	−65 to +150	°C

1. Tested at 3.5 GHZ, T = +25°C, single-carrier, 20 MHz LTE signal with 7.8 dB PAR @ 0.01% CCDF.
2. Operation of this device outside the parameter ranges given above may cause permanent damage.

Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
Gate Voltage (V_{G1})		−2.6		V
Gate Voltage (V_{G2})		−4.5		V
Gate Voltage (V_{G3})		−2.6		V
Drain Voltage ($V_{D1,2,3}$)		+28		V
Quiescent Current (I_{DQ1})		50		mA
Quiescent Current (I_{DQ3})		75		mA

Electrical performance is measured under conditions noted in the electrical specifications table. Specifications are not guaranteed over all recommended operating conditions.

Electrical Specifications

Parameter	Conditions	Min	Typ	Max	Units
Frequency Range		3.4		3.6	GHz
Driver Quiescent Current			50		mA
Carrier Quiescent Current			75		mA
Gain	P_{AVG} = 34.8 dBm		32		dB
P3dB	3 dB PAR compression		44		dBm
Power Added Efficiency	P_{AVG} = 34.8 dBm		33		%
Raw ACLR	P_{AVG} = 34.8 dBm		−28		dBc

Test conditions unless otherwise noted: $V_{D1,2,3}$ = +28 V, I_{DQ1} = 50 mA, I_{DQ3} = 75 mA, V_{G2} = −4.5 V, T = +25°C, single-carrier, 20 MHz LTE signal with 7.8 dB PAR @ 0.01% CCDF, de-embedded from EVB measurements.

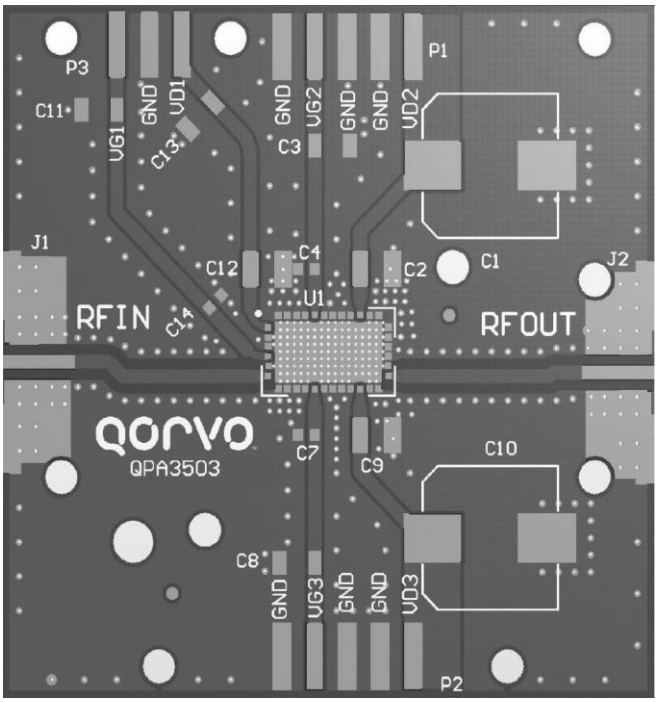
Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Peak IR Surface Thermal Resistance at Average Power (θ_{JC})	T_{CASE} = +85°C, T_{CH} = 101°C CW: P_{DISS} = 6.1 W, P_{OUT} = 3 W	2.6	°C / W

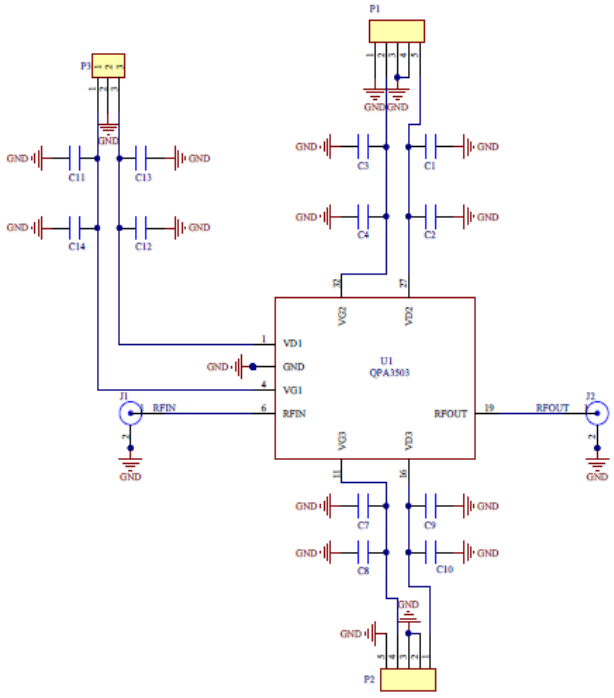
Notes:
1. Thermal resistance measured to package backside.
2. Based on expected carrier amplifier efficiency of Doherty.
3. P_{OUT} assumes 20% peaking amplifier contribution of total average Doherty rated power.
4. Refer to the following document: GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates

QPA3503 3.4 – 3.6 GHz Reference Design

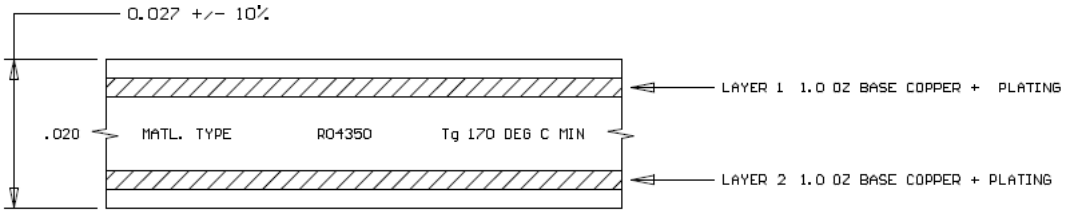
EVB Layout



EVB Schematic



PCB Stackup and Material

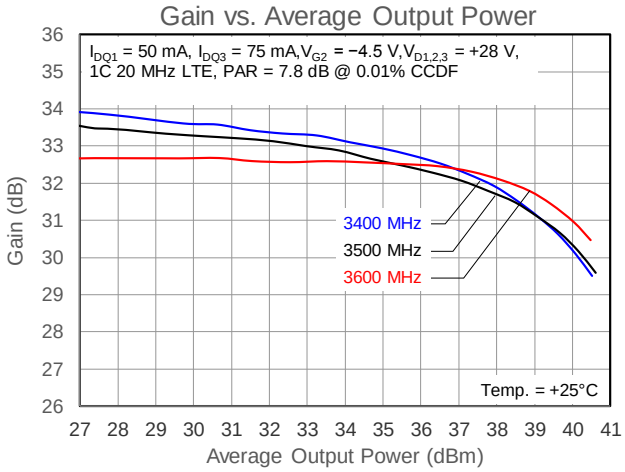


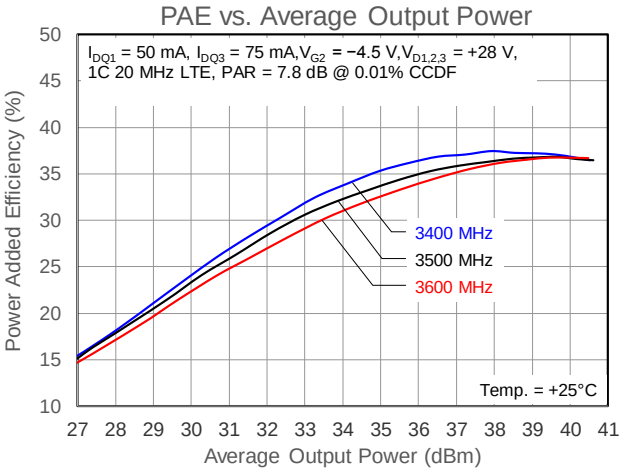
Notes:
1. All dimensions are in inches.
2. PCB is soldered on a 2 inch by 2 inch copper base plate with 0.25 inch thickness.

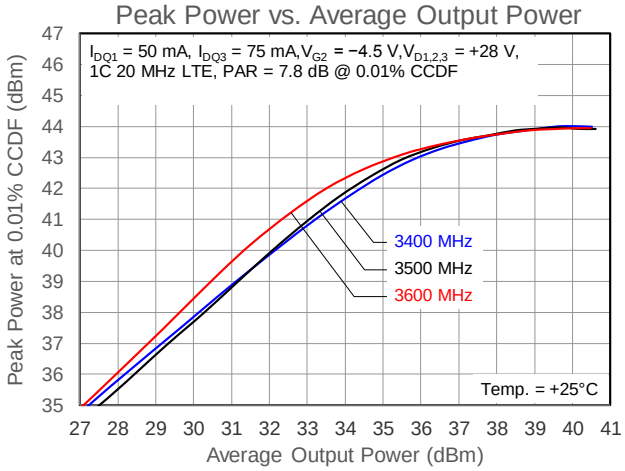
Bill of Materials – QPA3503 3.5 GHz Evaluation Board

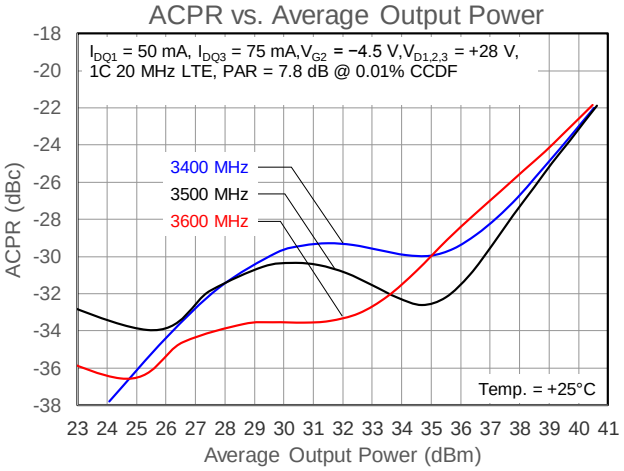
Reference Des.	Value	Description	Manuf.	Part No.
C1, C10	220 µF	Capacitor, 220 µF, electrolytic 50 V	Panasonic	EEEFK1H221P
C4, C7, C14	22,000 pF	Capacitor, 22,000 pF, 10%, 50 V, X7R, 0603	Murata	GRM188R71H223KA01D
C3, C8, C11, C13	4.7 µF	Capacitor, 4.7 µF, 10%, 50 V, X7R, 1206	Murata	GRM31CR71H475KA12L
C2, C9, C12	10 µF	Capacitor, 10 µF, 10%, 50 V, X7R, 1210	Murata	GRM32ER71H106KA
J1, J2		Connector, SMA, 4-Hole Panel Mount Jack	Gigalane	PAF-S00-000
P1, P2		Connector, HDR, ST, PLRZD, 5-Pin, 0.100”	ITW Pancon	MPSS100-5-C
P3		Connector, HDR, ST, 3-PIN, T/H	Molex	22-28-4033
U1		3W 3.5GHz PA Module	Qorvo	QPA3503

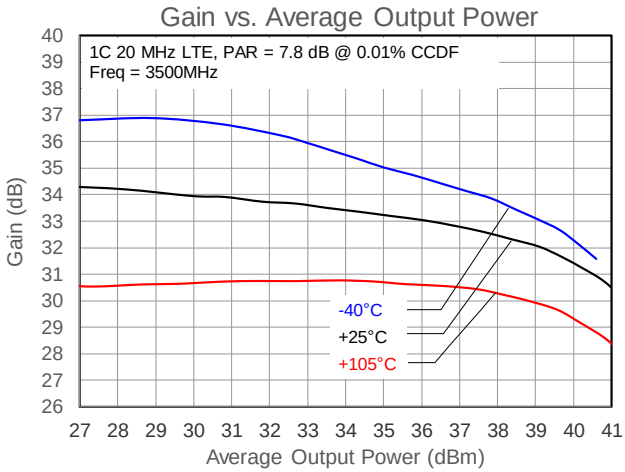
Performance Plots

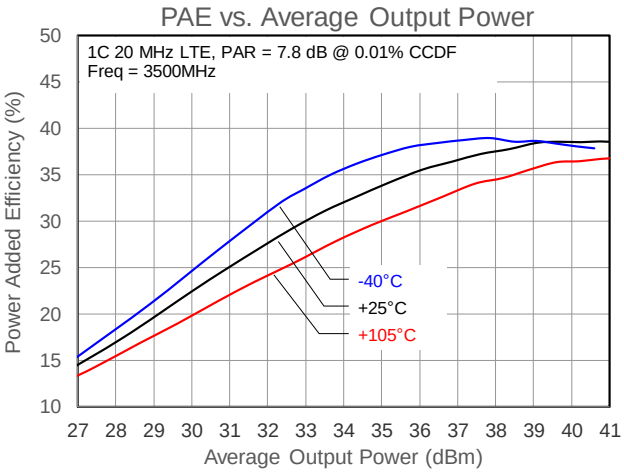












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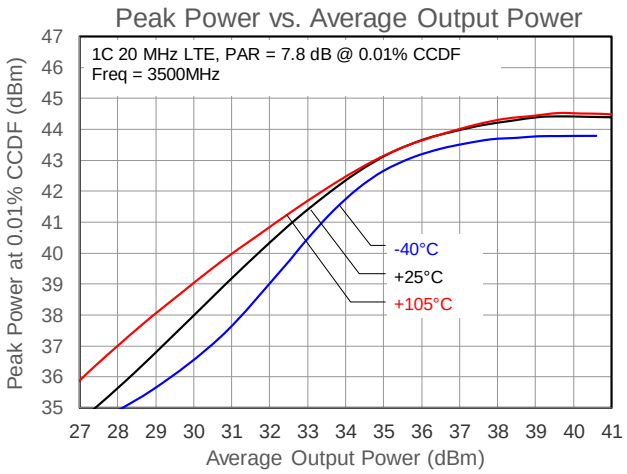
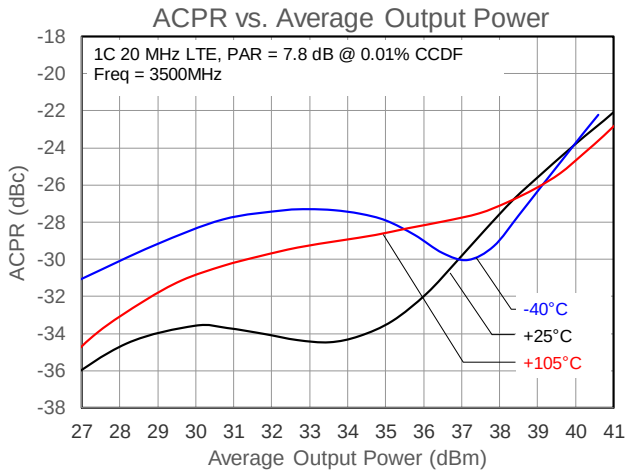
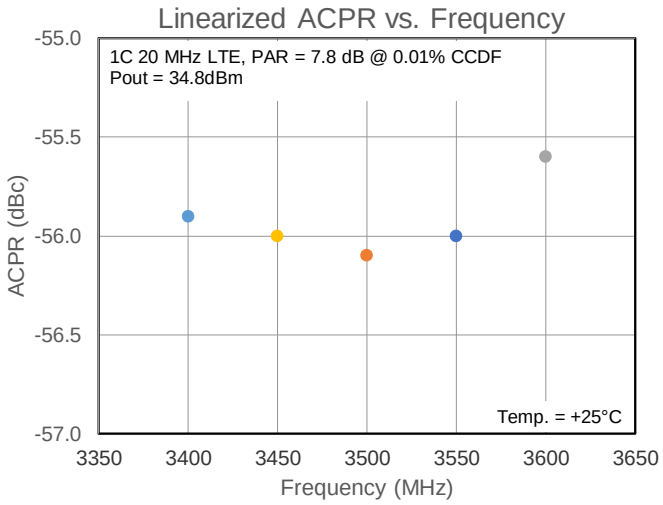
Performance Plots







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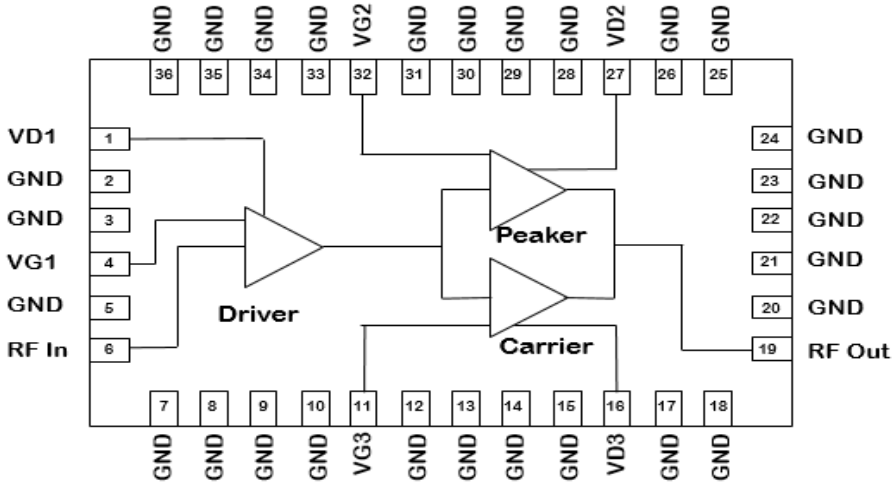
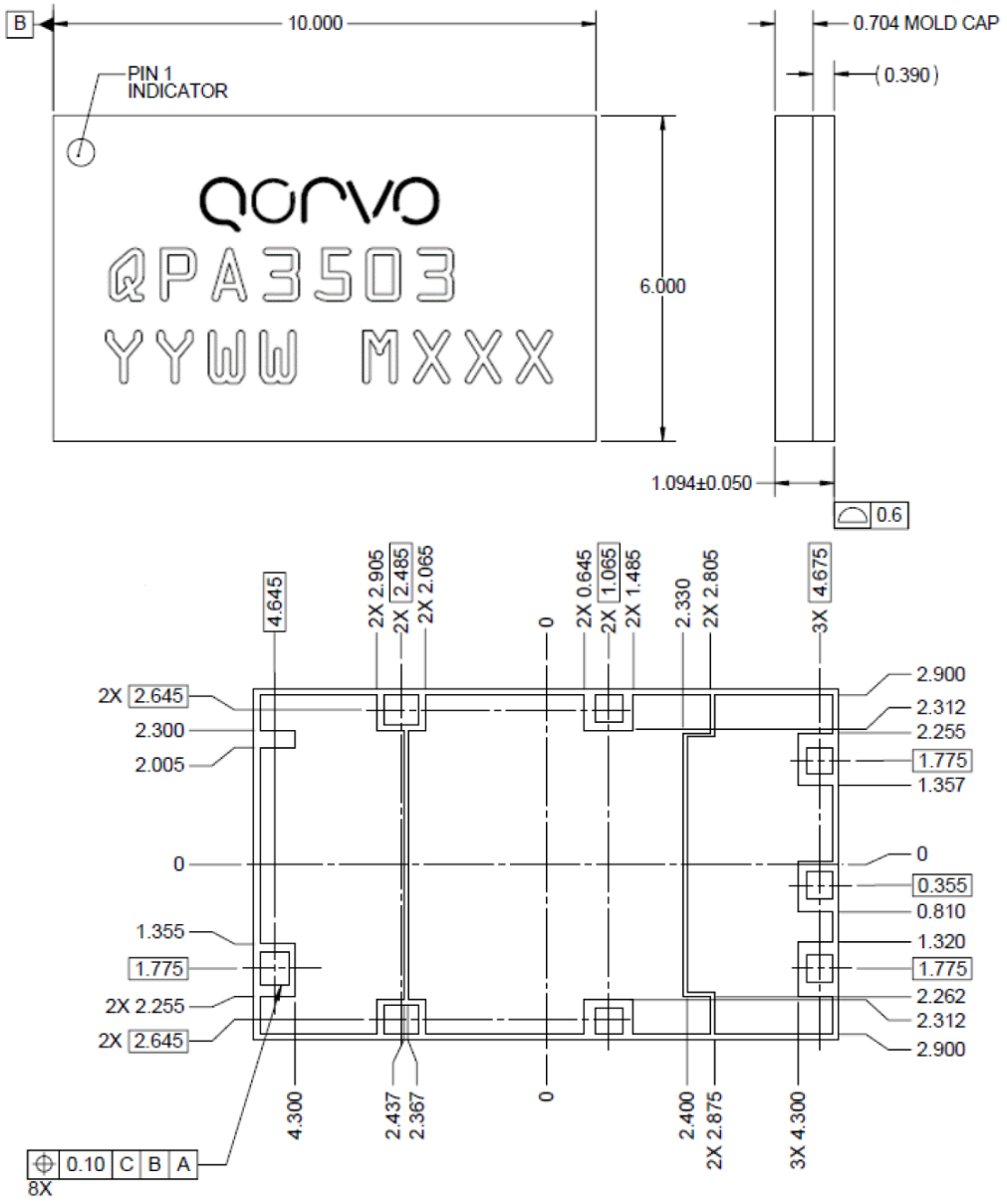
Pin Configuration and Description



Pin No.	Label	Description
1	VD1	Driver Amplifier, Drain Bias
4	VG1	Driver Amplifier, Gate Bias
6	RF IN	RF Input
11	VG3	Carrier Amplifier, Gate Bias
16	VD3	Carrier Amplifier, Drain Bias
19	RF OUT	RF Output
27	VD2	Peaking Amplifier, Drain Bias
32	VG2	Peaking Amplifier, Gate Bias
2-3, 5, 7-10, 12-15, 17-18, 20-26, 28-31, 33-36	GND	Internal Grounding, recommend connecting to Epad ground
EPAD	GND	DC/RF Ground. Must be soldered to EVB ground plane over array of vias for thermal and RF performance. Solder voids under EPAD will result in excessive junction temperatures causing permanent damage.

Package Marking and Dimensions

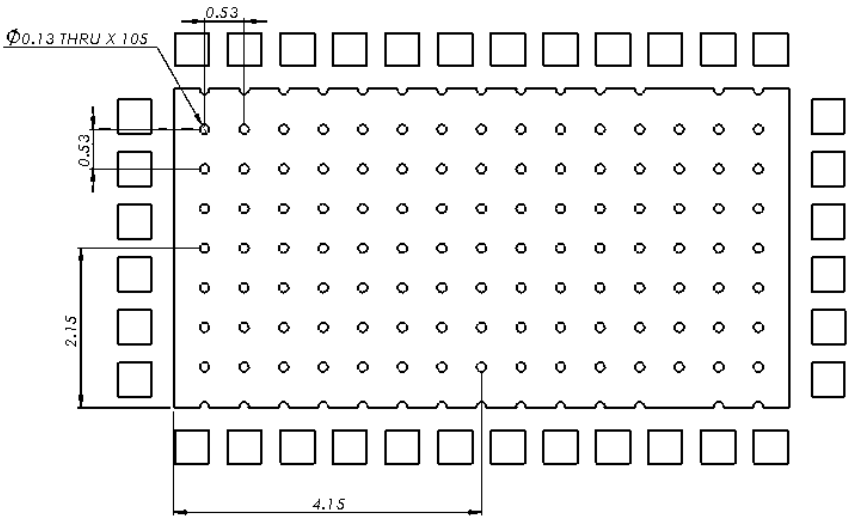
Marking: Qorvo Logo
Part Number – QPA3503
Date Code – YYWW
Batch Code – MXXX



Notes:

1. General tolerance is ±0.100.
2. All dimensions are in mm. Angles are in degrees.
3. Material:
   - Package Base: Laminate
   - Package Lid: Mold
4. Exposed metallization is NiPdAu plated. Au thickness is 0.095 µm.
5. Part is mold sealed.

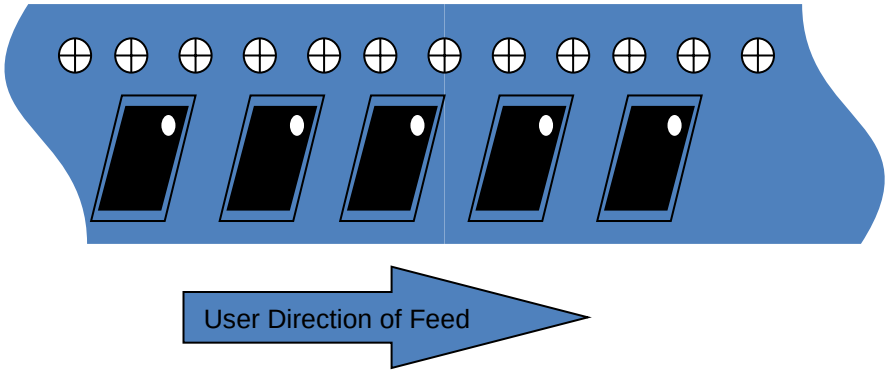
Mounting Footprint Pattern

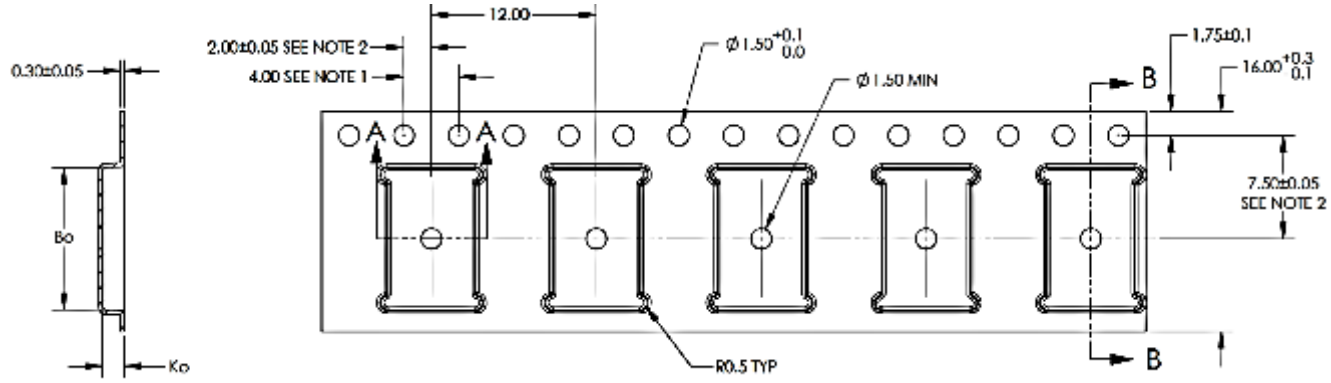


Notes:

1. All dimensions are in mm. Angles are in degrees.
2. Vias are required under the backside paddle of this device for proper RF/DC grounding and thermal dissipation. ALL vias are PTH to ground.
3. Ensure good package backside paddle solder attach for reliable operation and best electrical performance.

Tape and Reel Information – Carrier and Cover Tape Dimensions

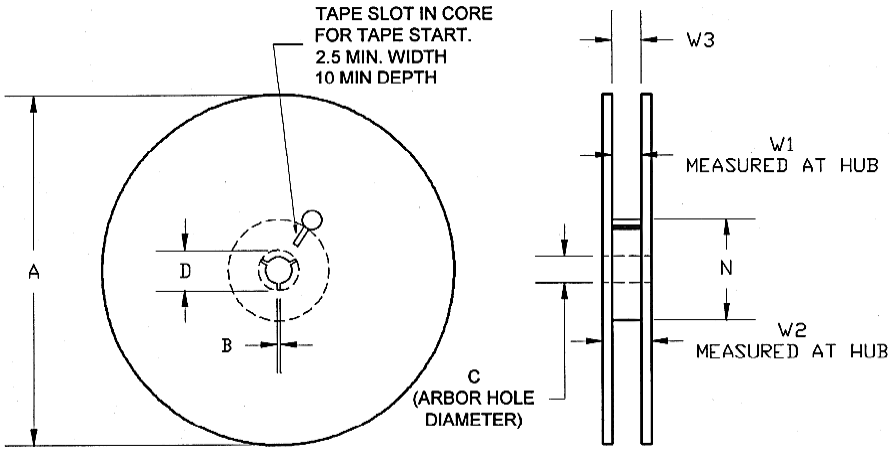




Feature	Measure	Symbol	Size (in)	Size (mm)
Cavity	Length	A0	0.248	6.30
	Width	B0	0.406	10.3
	Depth	K0	0.061	1.55
	Pitch	P1	0.472	12.0
Centerline Distance	Cavity to Perforation – Length Direction	P2	0.079	2.00
	Cavity to Perforation – Width Direction	F	0.295	7.5
Cover Tape	Width	C	0.524	13.3
Carrier Tape	Width	W	0.630	16.0

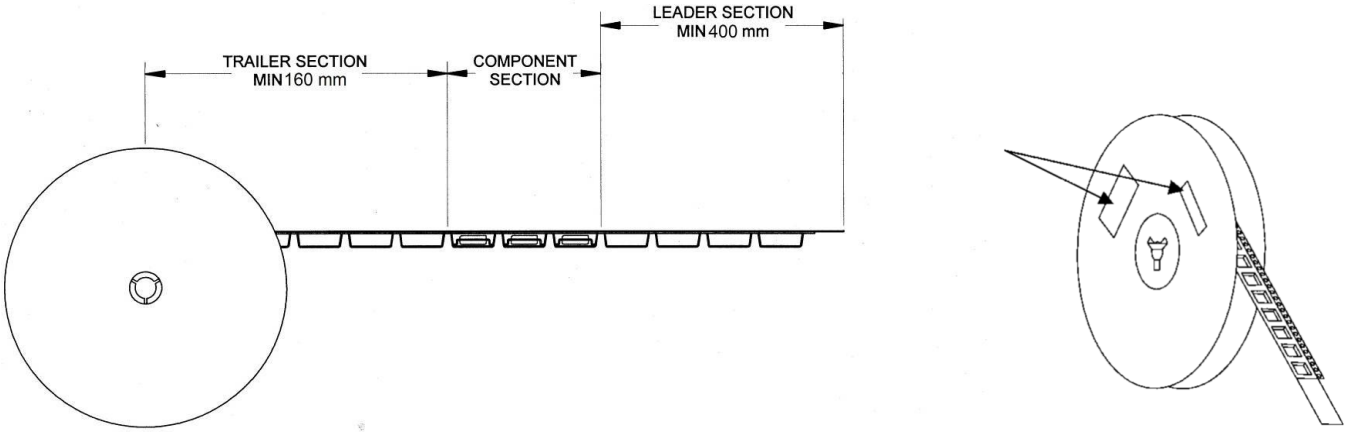
Tape and Reel Information – Reel Dimensions

Standard T/R size = 2500 pieces on a 13” reel.



Feature	Measure	Symbol	Size (in)	Size (mm)
Flange	Diameter	A	12.992	330.0
	Thickness	W2	0.874	22.2
	Space Between Flange	W1	0.661	16.8
Hub	Outer Diameter	N	4.016	102.0
	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)	Class 1A	ANSI/ESDA/JEDEC Standard JS-001
ESD – Charged Device Model (CDM)	Class C3	ANSI/ESDA/JEDEC Standard JS-002
MSL – 260°C Convection Reflow	MSL3	IPC/JEDEC Standard J-STD-020

Caution!
ESD-Sensitive Device

Solderability

Compatible with both lead-free (260°C maximum reflow temperature) soldering processes.
Package lead plating is NiPdAu. Au thickness is 0.095 µm.

RoHS Compliance

This product 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:

- Product uses RoHS Exemption 7c-I to meet RoHS Compliance requirements.
- 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 **Tel:** 1-844-890-8163
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For technical questions and application information:

Email: BTSApplications@qorvo.com

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«FORSTAR» (основан в 1998 г.)

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FORSTAR®

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