



# QPA4563A

## DC – 3500 MHz Cascadable SiGe HBT Amplifier

### Product Overview

The QPA4563A is a high performance SiGe HBT MMIC amplifier. A Darlington configuration provides high FT and excellent thermal performance. The heterojunction increases breakdown voltage and minimizes leakage current between junctions. Cancellation of emitter junction non-linearities results in higher suppression of intermodulation products.

The QPA4563A may be operated from a variety of supply voltages by using a voltage dropping resistor. Two DC-blocking capacitors, bypass capacitors and an optional RF choke complete the circuit required for operation of this internally matched 50 ohm device.

The QPA4563A is assembled in an industry standard SOT-363 package that is lead-free and RoHS-compliant.

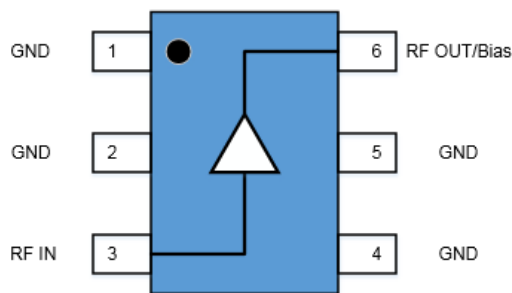


6 Lead SOT-363 Package

### Key Features

- DC to 3500 MHz Operation
- Single Positive Voltage Supply
- Gain: 20.4 dB at 1950 MHz
- Output IP3: +29.4 dBm typical at 1950 MHz
- Noise Figure: 2.5 dB Typical at 1950 MHz
- Robust 1000 V Class 1C HBM ESD Rating
- Lead-free/RoHS-compliant SOT-363 Package

### Functional Block Diagram



Top View

### Applications

- Cellular, PCS, GSM, UMTS
- PA Driver Amplifier
- IF/RF Buffer Amplifier
- Wireless Data, Satellite

### Ordering Information

Part No.	Description
QPA4563ASQ	25 Piece Sample Bag
QPA4563ASR	100 Pieces on 7" Reel
QPA4563ATR7	3000 pieces on a 7" reel
QPA4563APCK401	850 MHz, EVB with 5 Piece Sample Bag

## Absolute Maximum Ratings

Parameter	Rating
Storage Temp	–55 to +150 °C
Device Voltage (V <sub>D</sub> )	+5 V
Device Current (I <sub>D</sub> )	90 mA
RF Input Power (Z <sub>L</sub> = 50 Ω)	+18 dBm

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.

Bias Conditions should also satisfy the following expression:

$$I_D \times V_D < (T_{JUNCTION} - T_{LEAD}) / R_{TH}$$

## Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
Operating Temperature	–40		+105	°C
Junction Temperature (T <sub>J</sub> )			+125	°C

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

## Electrical Specifications

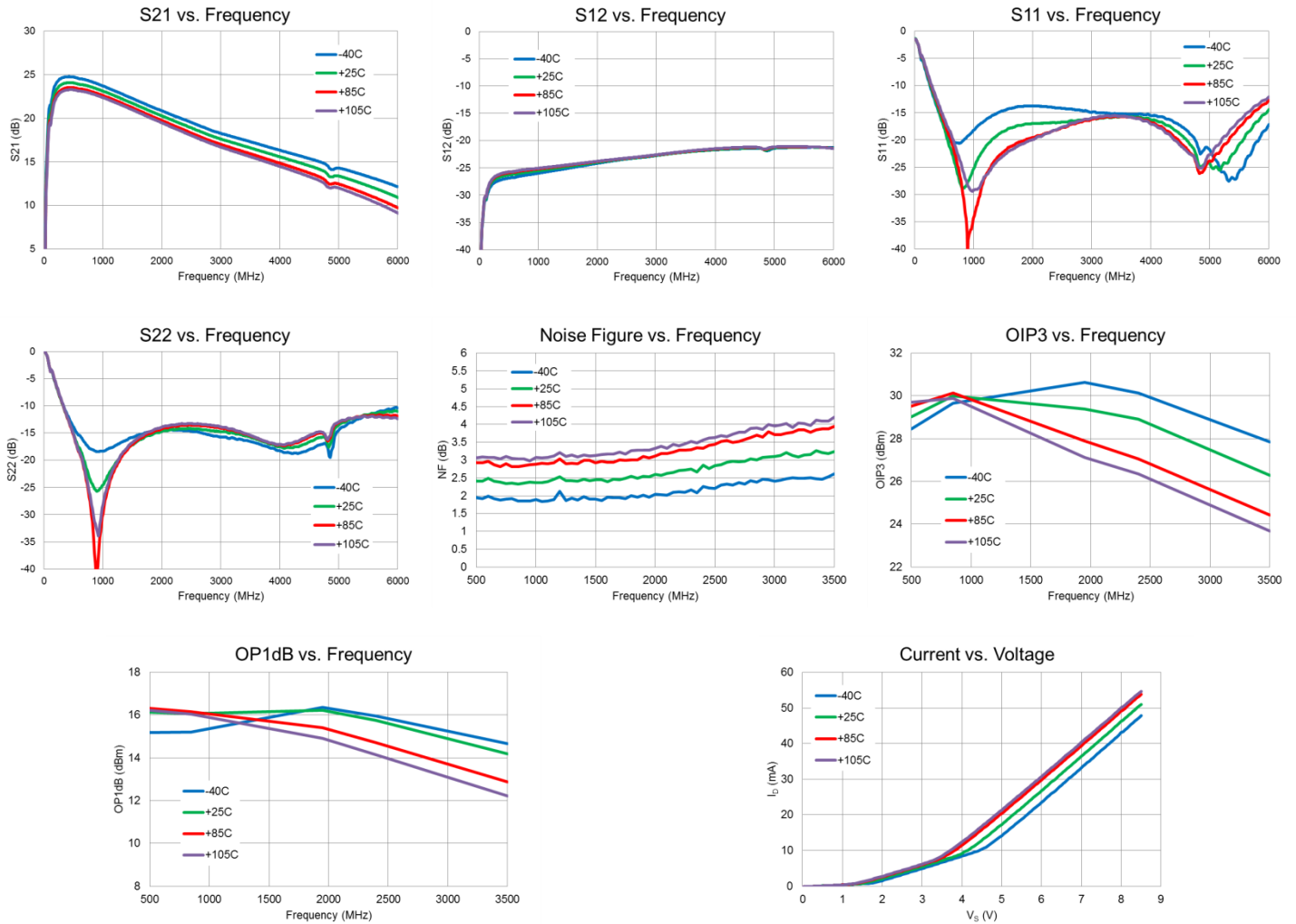
Parameter	Conditions	Min	Typ	Max	Units
Small Signal Gain	850 MHz	20.5	23.5	26	dB
	1950 MHz	17.5	20.4	22.5	
	2400 MHz <sup>(2)</sup>	16.0	19.2	22.0	
Output Power at 1dB Compression	850 MHz <sup>(2)</sup>	+14.0	+16.0		dBm
	1950 MHz	+14.0	+16.2		
	2400 MHz <sup>(2)</sup>	+14.0	+15.8		
Output Third Intercept Point	850 MHz <sup>(2)</sup>	+23.0	+30.0		dBm
	1950 MHz	+23.0	+29.4		
	2400 MHz <sup>(2)</sup>	+23.0	+28.9		
Input Return Loss,  S <sub>11</sub>	850 MHz		28.7		dB
	1950 MHz		17.1		
	2400 MHz		16.9		
Output Return Loss,  S <sub>22</sub>	850 MHz		25.0		dB
	1950 MHz		14.9		
	2400 MHz		14.2		
Reverse Isolation,  S <sub>12</sub>	850 MHz		25.8		dB
	1950 MHz		24.1		
	2400 MHz		23.5		
Noise Figure	850 MHz <sup>(2)</sup>		2.3	4.2	dB
	1950 MHz		2.5	4.4	
	2400 MHz <sup>(2)</sup>		2.8	4.7	
Device Operating Voltage			+3.5		V
Device Operating Current		40	45	50	mA
Thermal Resistance			124		°C/W

Notes:

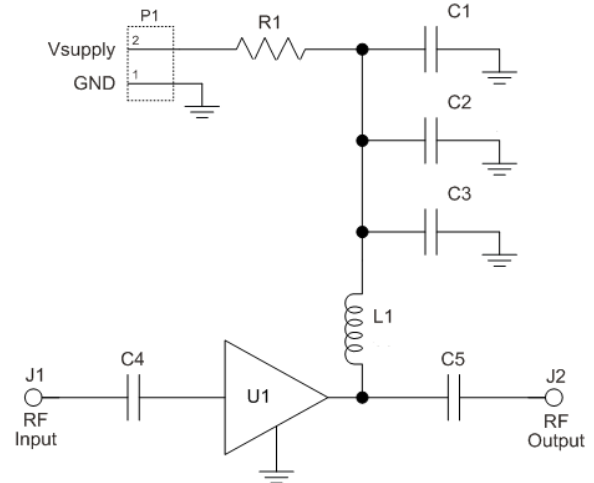
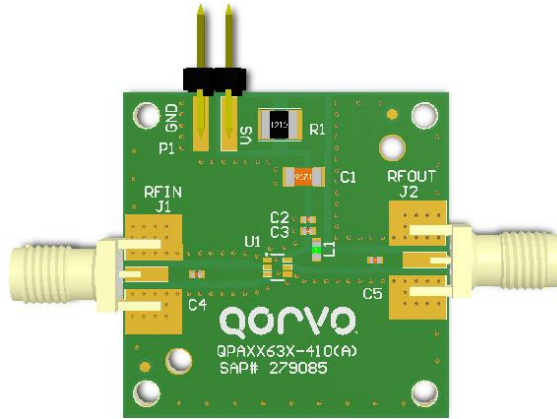
- Test conditions unless otherwise noted: V<sub>S</sub> = +8 V, R<sub>BIAS</sub> = 100 Ω, V<sub>D</sub> = +3.5 V, I<sub>D</sub> = 45 mA Typ., OIP3 Tone Spacing = 1 MHz, P<sub>OUT</sub>/tone = –10 dBm, T<sub>LEAD</sub> = +25°C, Z<sub>S</sub> = Z<sub>L</sub> = 50 Ω
- Minimum or maximum specification listed is guaranteed by design. Not tested in production.

## Performance Plots – 850 MHz Application Circuit

Test conditions unless otherwise noted:  $V_S = +8\text{ V}$ ,  $R_{BIAS} = 100\ \Omega$ ,  $I_D = 45\text{ mA Typ}$



## Evaluation Board and Schematic – 850 MHz Application Circuit



## Bill of Material – 850 MHz Application Circuit

Reference	Value	Description	Manufacturer	Part Number
n/a	n/a	PCB	Qorvo	QPAXX63X-410(A)
U1	n/a	HBT MMIC Amplifier	Qorvo	QPA4563A
C1	1 uF	CAP, 10%, 25V, X7R, 1206	Murata Electronics	GRM31MR71E105KA01L
C2	1000 pF	CAP, 10%, 50V, X7R, 0402	Murata Electronics	GRM155R71H102KA01D
C3	68 pF	CAP, 5%, 50V, C0G, 0402	Murata Electronics	GRM1555C1H680JA01D
C4, C5	100 pF	CAP, 5%, 50V, C0G, 0402	Murata Electronics	GRM1555C1H101JA01D
R1	100 Ω	RES, 5%, 1/2W, 1210	Panasonic Industrial Devices	ERJ-14YJ101U
L1	33 nH	IND, 5%, M/L, 0603	Murata Electronics	LL1608-FSL33NJ
J1, J2	n/a	CONN, SMA, EL, FLT, 0.068" SPE-000318	Amphenol RF Asia Corp	901-10426
P1	n/a	CONN, HDR, ST, 1x2, 0.100", Hi-temp, T/H	Samtec Inc	HTSW-102-07-G-S

## Component Values for Specific Frequencies

Reference Designator	500 MHz	850 MHz	1950 MHz	2400 MHz	3500 MHz
C4, C5	220 pF	100 pF	68 pF	56 pF	39 pF
C3	100 pF	68 pF	22 pF	22 pF	15 pF
L1	68 nH	33 nH	22 nH	18 nH	15 nH

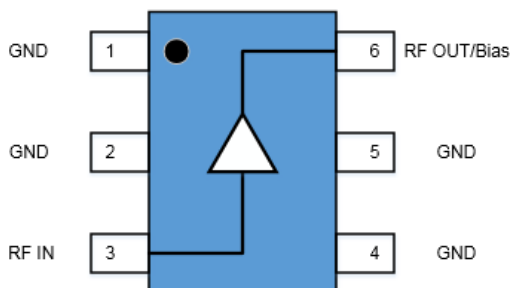
## Bias Resistor Values for Specific Supply Voltages

Reference Designator	V <sub>S</sub> =+6 V	V <sub>S</sub> =+8 V	V <sub>S</sub> =+10 V	V <sub>S</sub> =+12 V
R1 ( R <sub>BIAS</sub> ) <sup>(1,2)</sup>	51 Ω	100 Ω	150 Ω	180 Ω

Notes:

1. Bias resistor improves current stability over temperature
2. Bias Resistance =  $R_{BIAS} + R_{LDC} = (V_S - V_D) / I_D$

## Pin Configuration and Description

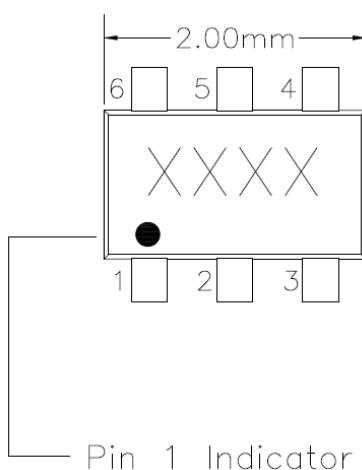


Top View

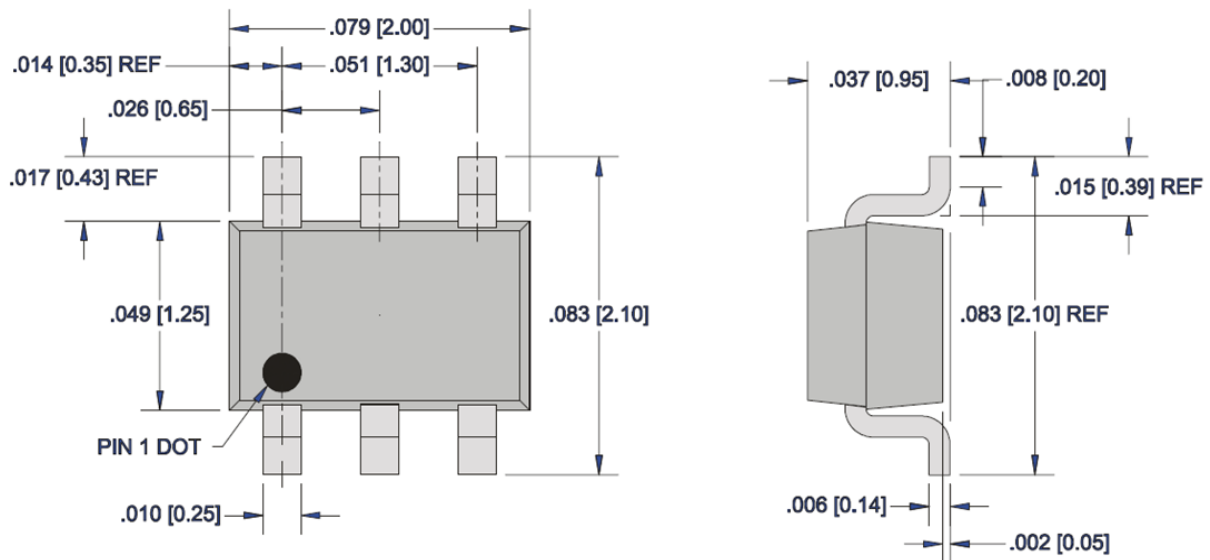
Pad No.	Label	Description
1, 2, 4, 5	GND	Connection to ground. Use via holes in PCB for best performance to reduce lead inductance as close to ground leads as possible
3	RF <sub>IN</sub>	RF Input Pin. DC voltage is present on this pin therefore this pin requires the use of an external DC blocking capacitor chosen for the frequency of operation.
6	RF <sub>OUT</sub> /Bias	RF Output and Bias Pin. DC voltage is present on this pin therefore this pin requires the use of an external DC blocking capacitor chosen for the frequency of operation.

## Package Marking

XXXX is an Alpha-numeric trace code.



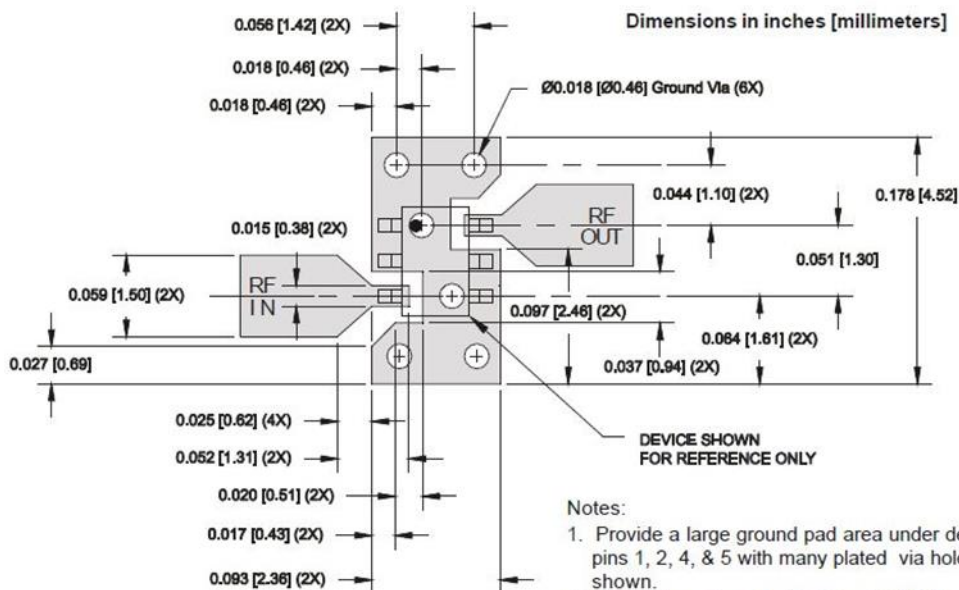
## Package Dimensions



### Notes:

1. All dimensions are in inches (millimeters). Angles are in degrees.
2. Dimension and tolerance formats conform to ASME Y14.5-2009.

## PCB Mounting Pattern



### Notes:

1. Provide a large ground pad area under device pins 1, 2, 4, & 5 with many plated via holes as shown.
2. Dimensions given for 50 Ohm RF I/O lines are for 31 mil thick Getek. Scale accordingly for different board thicknesses and dielectric constants.
3. We recommend 1 or 2 ounce copper. Measurements for this data sheet were made on a 31 mil thick Getek with 1 ounce copper on both sides.

## Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 1C	ESDA / JEDEC JS-001-2014
ESD – Charged Device Model (CDM)	Class C3	ESDA / JEDEC JS-002-2014
MSL – Moisture Sensitivity Level	Level 1	IPC/JEDEC J-STD-020



Caution!  
ESD-Sensitive Device

## Solderability

Compatible with lead-free (260°C max. reflow temp.) soldering process.

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:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C<sub>15</sub>H<sub>12</sub>Br<sub>4</sub>O<sub>2</sub>) Free
- PFOS Free
- SVHC Free



## Contact Information

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

**Web:** [www.qorvo.com](http://www.qorvo.com)

**Tel:** 1-844-890-8163

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