

## DC-3500 MHz Cascadable SiGe HBT Amplifier

#### **Product Overview**

The QPA4463A 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 QPA4463A 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 QPA4463A is assembled in an industry standard SOT-363 package that is lead-free and RoHS-compliant.

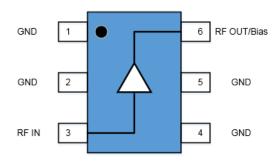


6 Lead SOT-363 Package

#### **Key Features**

- DC to 3500 MHz Operation
- Single Positive Voltage Supply
- Gain: 16.3 dB at 1950 MHz
- Output IP3: +29.5 dBm typical at 1950 MHz
- Noise Figure: 2.8 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
QPA4463ASQ	25 Piece Sample Bag
QPA4463ASR	100 Pieces on 7" Reel
QPA4463ATR7	3000 pieces on a 7" reel
QPA4463APCK401	850 MHz, EVB with 5 Piece Sample Bag



## DC-3500 MHz Cascadable SiGe HBT Amplifier

#### **Absolute Maximum Ratings**

Parameter	Rating
Storage Temperature	−55 to +150 °C
Device Voltage (V <sub>D</sub> )	+5 V
Device Current (I <sub>D</sub> )	90 mA
RF Input Power ( $Z_L = 50 \Omega$ )	+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:  $I_D\,x\,\,V_D<(T_{JUNCTION}\,\,{}^-\!T_{LEAD})\,/\,\,R_{TH}$ 

#### **Recommended Operating Conditions**

Parameter	Min	Тур	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	Тур	Max	Units	
	850 MHz		18.3			
Small Signal Gain	1950 MHz		16.3		dB	
	2400 MHz	2400 MHz 15.6			-	
	850 MHz		+15.0			
Output Power at 1dB Compression	1950 MHz		+14.9		dBm	
	2400 MHz		+14.9			
	850 MHz		+30.8			
Output Third Intercept Point	1950 MHz		+29.5		dBm	
	2400 MHz		+28.6		-	
	850 MHz		20.5		dB	
Input Return Loss, S11	1950 MHz		17.3			
	2400 MHz		18.0			
	850 MHz		36.0		dB	
Output Return Loss, S22	1950 MHz		13.2			
	2400 MHz		13.4			
	850 MHz		21.1		dB	
Reverse Isolation, S12	1950 MHz		20.3			
	2400 MHz		20.0			
	850 MHz	2.7				
Noise Figure	1950 MHz		2.8		dB	
	2400 MHz		3.1			
Device Operating Voltage		+2.9	+3.2	+3.5	V	
Device Operating Current			45		mA	
Thermal Resistance			124		°C/W	

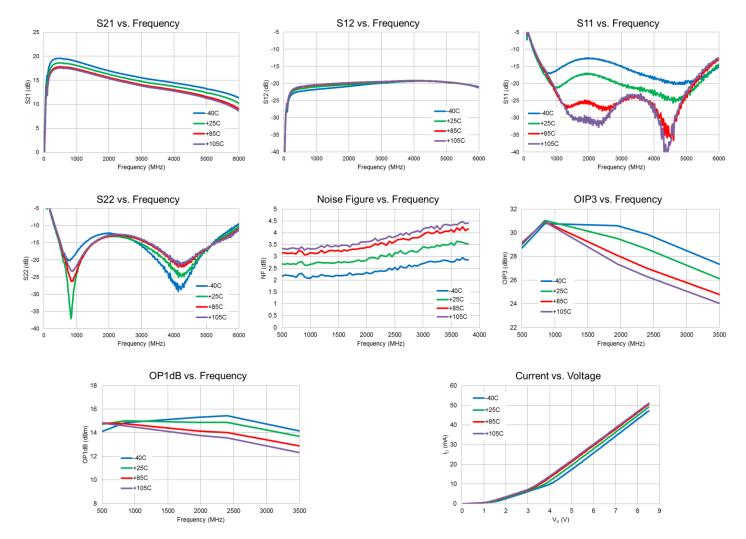
#### Notes:

<sup>1.</sup> Test conditions unless otherwise noted:  $V_S = +8 \text{ V}$ ,  $R_{BIAS} = 110 \Omega$ ,  $I_D = 45 \text{ mA Typ.}$ , OIP3 Tone Spacing = 1 MHz,  $P_{OUT}$  per tone = -5 dBm,  $T_{LEAD} = +25^{\circ}\text{C}$ ,  $Z_S = Z_L = 50 \Omega$ 



## **Performance Plots - 850 MHz Application Circuit**

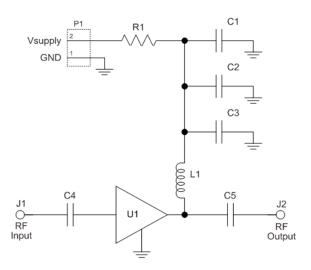
Test conditions unless otherwise noted:  $V_S$  = +8 V,  $R_{BIAS}$  = 110  $\Omega$ ,  $I_D$  =45 mA Typ





## **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	QPA4463A
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	110 Ω	RES, 5%, 1/2W, 1210	various	
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	Vs=+6 V	Vs=+8 V	Vs=+10 V	Vs=+12 V
R1 ( Rbias) (1,2)	62 Ω	110 Ω	150 Ω	200 Ω

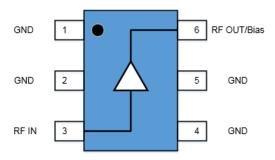
#### Notes:

- 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**

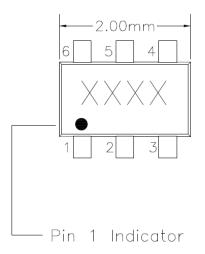


Top View

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**

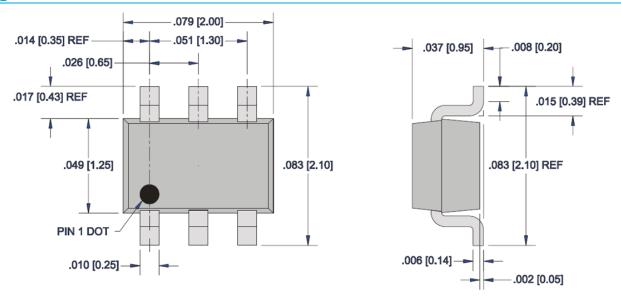
XXXX is an Alpha-numeric trace code.







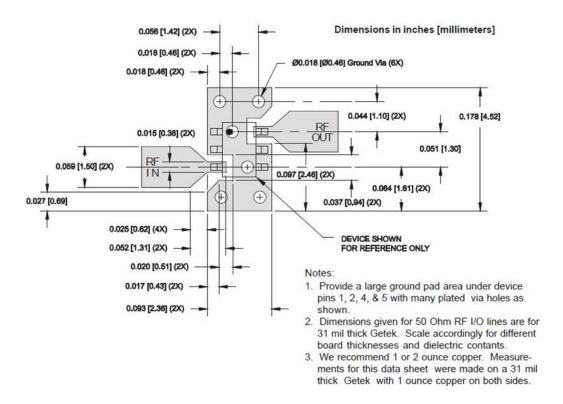
#### **Package Dimensions**



#### 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**







#### **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: <u>www.qorvo.com</u>
Tel: 1-844-890-8163

Email: customer.support@qorvo.com

For technical questions and application information: **Email:** sicapplications.engineering@gorvo.com

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