



QPA0163L

100 – 1300 MHz Cascadable SiGe HBT Amplifier

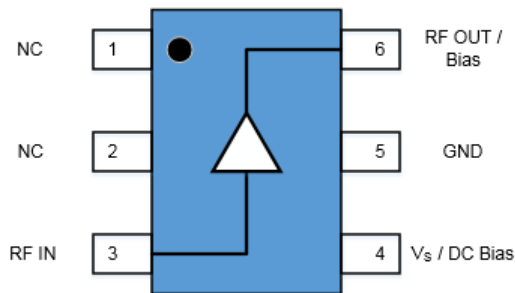
Product Overview

The QPA0163L is a high performance SiGe HBT MMIC amplifier. An internal temperature compensation circuit allows operation from a supply voltage as low as +2.5V. The QPA0163L has been characterized at $V_S=+3V$ for low power and $V_S=+4V$ for medium power applications.

Two DC-blocking capacitors, bypass capacitors and an optional RF choke complete the circuit required for 800–1300 MHz operation of this internally matched 50 ohm device.

The QPA0163L is assembled in an industry standard SOT-363 package that is lead-free and RoHS-compliant.

Functional Block Diagram



Top View



6 Lead SOT-363 Package

Key Features

- 100 to 1300 MHz Operation
- Internally Matched To 50 Ω 800 MHz to 1300 MHz
- Single Positive Voltage Supply
- Low Current Draw: 14 mA at $V_S=+3V$
- Input IP3: +11.1 dBm typical at 900 MHz
- Low Noise Figure: 1.5 dB Typical at 900 MHz
- Internal Temperature Compensation
- Lead-free/RoHS-compliant SOT-363 Package

Applications

- Receivers, GPS, RFID
- Cellular, Fixed Wireless, Land, Mobile

Ordering Information

Part No.	Description
QPA0163LSQ	25 Piece Sample Bag
QPA0163LSR	100 Pieces on 7" Reel
QPA0163LTR7	3000 pieces on a 7" reel
QPA0163LPCK401	800–1300 MHz EVB with 5 Pc. Sample Bag

Absolute Maximum Ratings

Parameter	Rating
Storage Temp	-55 to +150 °C
Device Voltage (V_D)	+5 V
Device Current (I_D)	45 mA
RF Input Power ($Z_L = 50 \Omega$)	+10 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_J)			+125	°C

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

Electrical Specifications

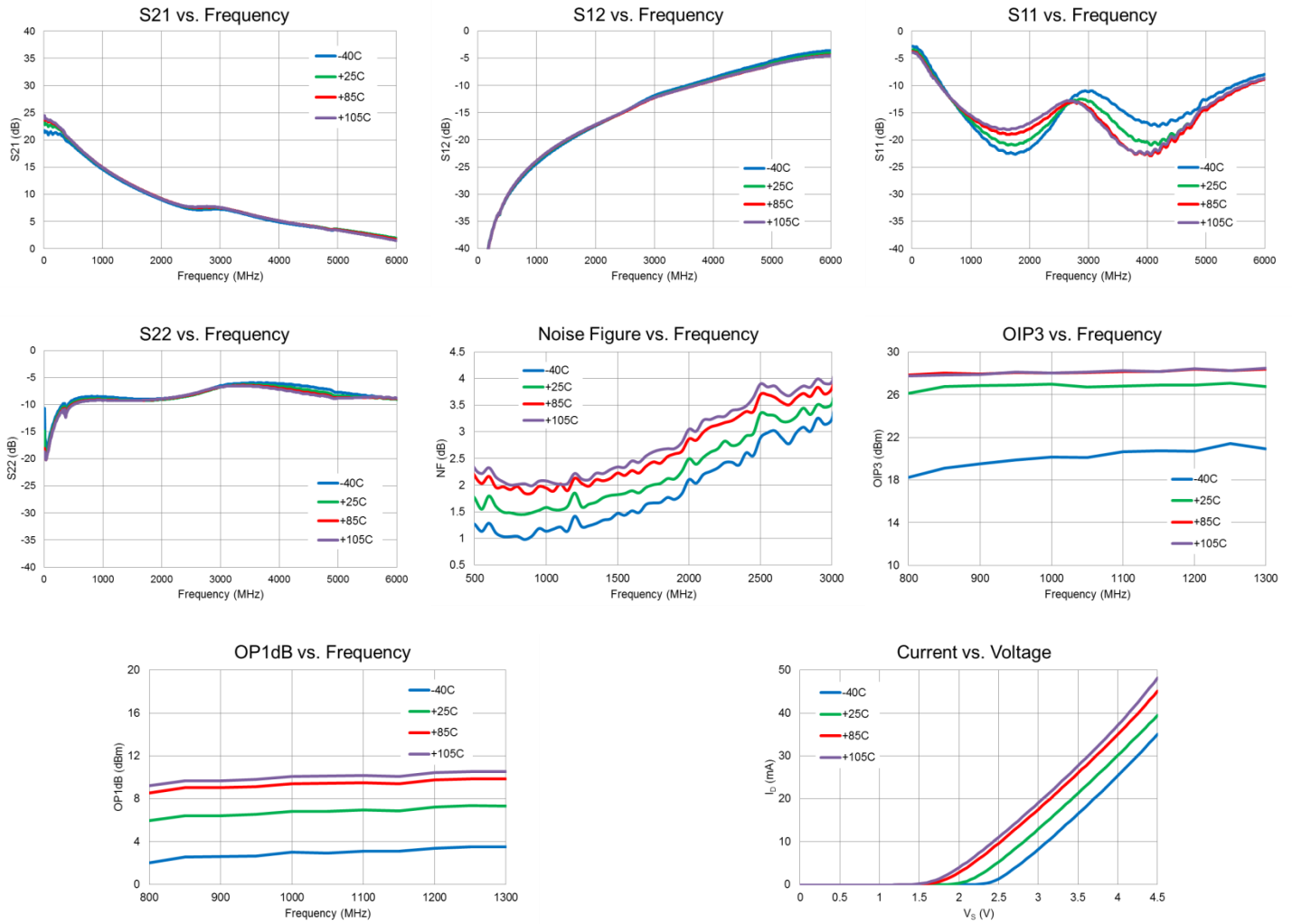
Parameter	Conditions	$V_S = +3V$			$V_S = +4V$			Units
		Min	Typ	Max	Min	Typ	Max	
Small Signal Gain	800 MHz		16.5			17.7		dB
	900 MHz		15.7			16.8		
	1000 MHz		14.9			16.0		
Output Power at 1dB Compression	800 MHz		+6.0			+13.2		dBm
	900 MHz		+6.4			+13.7		
	1000 MHz		+6.8			+14.0		
Input Third Intercept Point	800 MHz		+9.6			+12.7		dBm
	900 MHz		+11.1			+14.2		
	1000 MHz		+12.1			+15.3		
Input Return Loss, S11	900 MHz		15.4			12.8		dB
Output Return Loss, S22	900 MHz		9.0			9.4		dB
Reverse Isolation, S12	900 MHz		25.0			24.6		dB
Noise Figure	800 MHz		1.45			2.7		dB
	900 MHz		1.48			2.6		
	1000 MHz		1.58			2.5		
Device Operating Voltage		+2.5		+4.5	+2.5		+4.5	V
Device Operating Current			13.8			30.7		mA
Thermal Resistance			150			150		°C/W

Notes:

1. Test conditions unless otherwise noted: OIP3 Tone Spacing=1 MHz, P_{OUT} per tone = -13 dBm, 50 Ω system, Temp. = +25 °C.

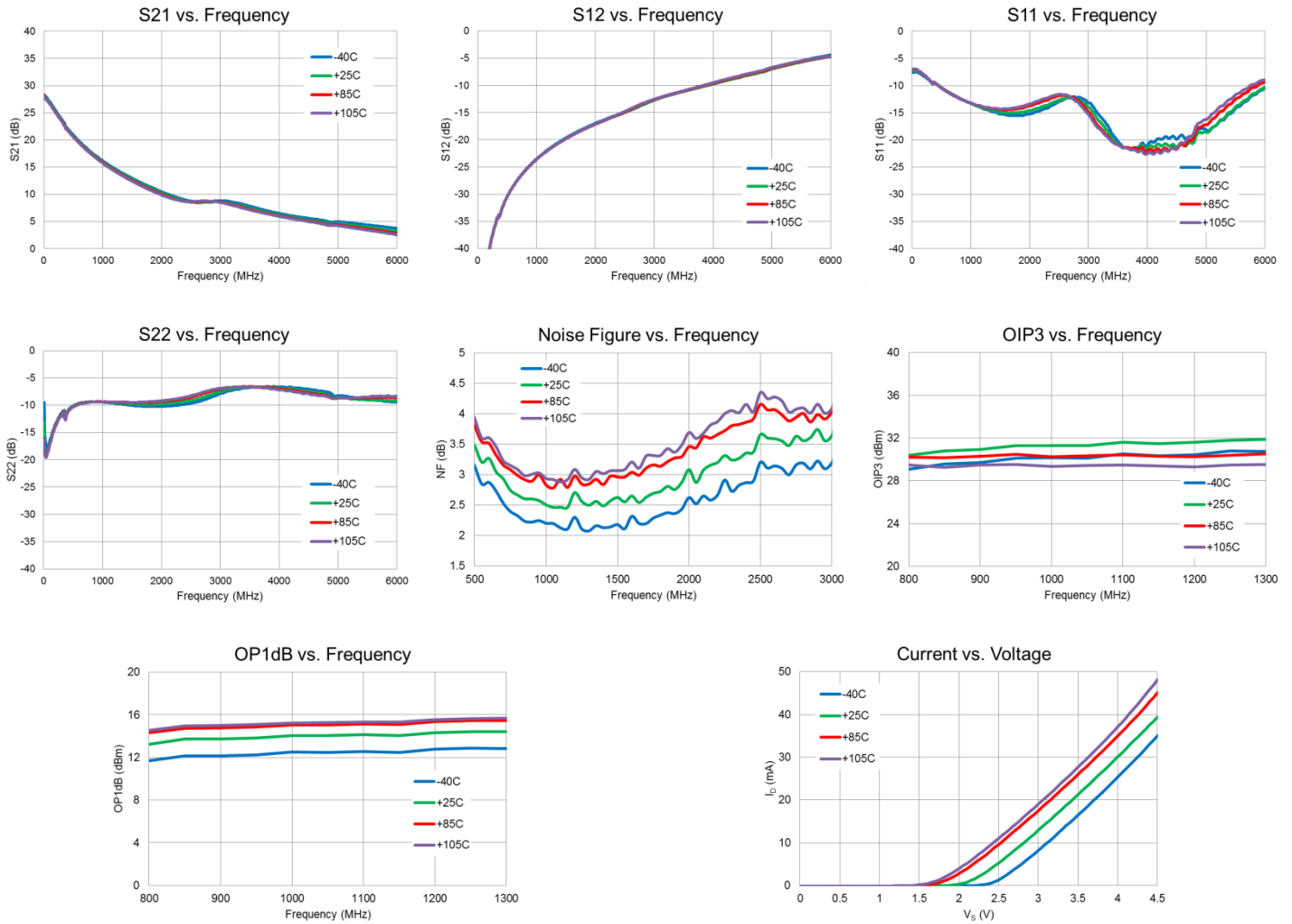
Performance Plots - 800 – 1300 MHz Application Circuit, $V_S=+3\text{ V}$

Test conditions unless otherwise noted: $V_S = +3.0\text{ V}$, $I_D = 13.8\text{ mA}$ (Typ.)

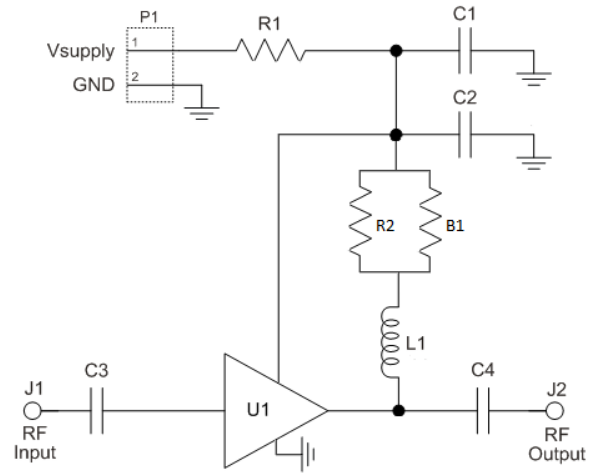
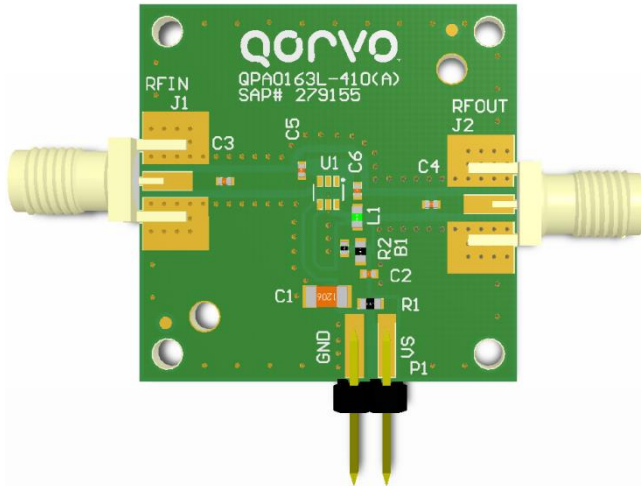


Performance Plots - 800 – 1300 MHz Application Circuit, $V_S = +4\text{ V}$

Test conditions unless otherwise noted: $V_S = +4.0\text{ V}$, $I_D = 30.7\text{ mA}$ (Typ.)



Evaluation Board and Schematic - 800 – 1300 MHz Application Circuit

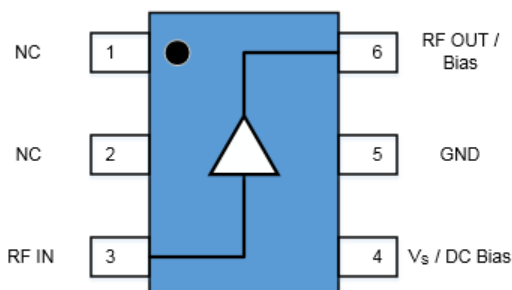


Bill of Material - 800 – 1300 MHz Application Circuit

Reference	Value	Description	Manufacturer	Part Number
n/a	n/a	PCB	Qorvo	QPA0163L-410(A)
U1	n/a	HBT MMIC Amplifier	Qorvo	QPA0163L
C1	0.1 uF	CAP, 5%, 25V, C0G, 1206	Murata Electronics	GRM31C5C1E104JA01L
C2	100 pF	CAP, 5%, 50V, C0G, 0402	Murata Electronics	GRM1555C1H101JA01D
C3, C4	0.1 uF	CAP, 10%, 16V, X7R, 0402	Murata Electronics	GRM155R71C104KA88D
B1 ⁽¹⁾	1500 Ω	FER, BEAD, 1500 Ohm, 500mA, 0603	Murata Electronics	BLM18HE152SN1D
R1	0 Ω	JMPR, 0 Ohm, 0603	Panasonic Industrial Devices	ERJ-3GEY0R00
R2 ⁽¹⁾	47 Ω	RES, 47 Ohm, 5%, 1/16W, 0402	Panasonic Industrial Devices	ERJ-2GEJ470
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

- Notes:
1. B1 and R2 provide improved K-factor and are optional. R1 may be used as a dropping resistor for use with supply voltages greater than the desired bias voltage. C5 and C6 are shown on PCB as options for the feedback loop in 100MHz to 800MHz applications

Pin Configuration and Description

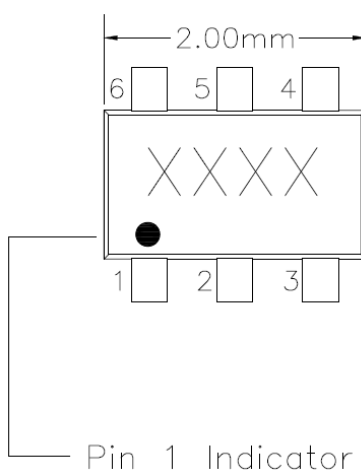


Top View

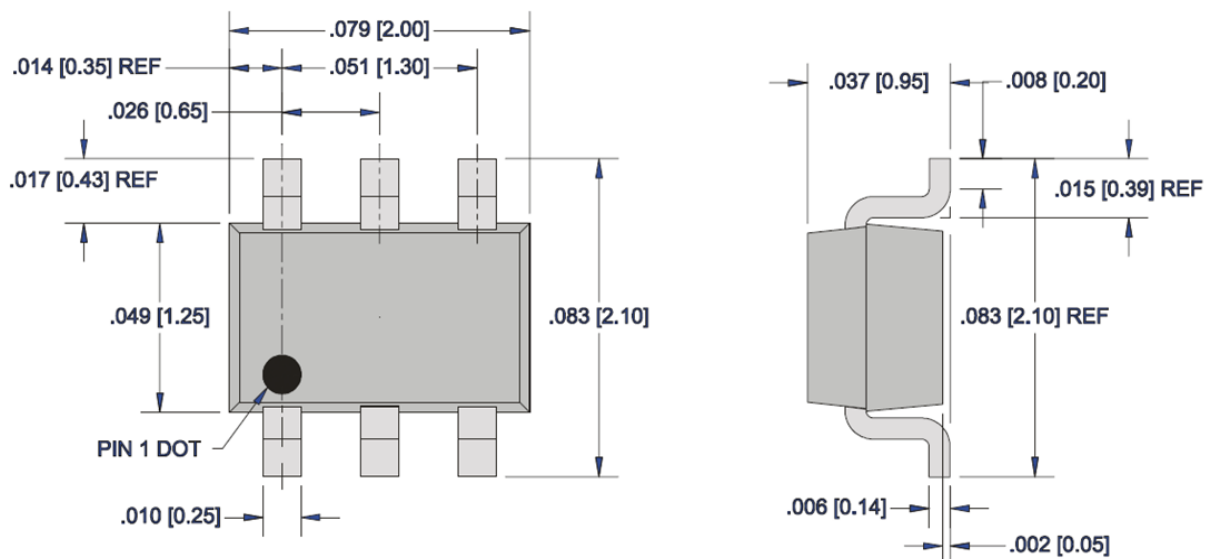
Pad No.	Label	Description
1, 2	NC	No Connection. Must be left floating and not connected to ground. This pin should be provided with an isolated ungrounded solder pad for mounting and integrity of the circuit.
3	RF IN	RF Input pin. This pin requires the use of an external DC blocking capacitor as shown in the application schematic.
4	DC BIAS	Direct Current Bias and Voltage Supply pin. Bypass with suitable capacitors.
5	GND	Ground. Connect to ground per application circuit drawing. For best performance, vias should be used as shown in the recommended pad layout.
6	RF OUT/BIAS	RF Output and Bias pin. Bias will be supplied to this pin through an external RF choke. A DC blocking capacitor is necessary on the RF output as shown in the application circuit.

Package Marking

XXXX is an Alpha-numeric trace code.



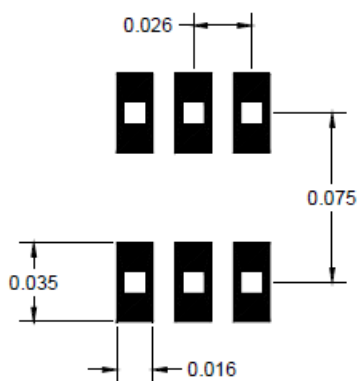
Package Dimensions



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 ground pad area under device pin 5 with plated via holes to the PCB ground plane.
2. We recommend 1 or 2 ounce copper.

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	1C	ESDA / JEDEC JS-001-2014
ESD – Charged Device Model (CDM)	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 (C₁₅H₁₂Br₄O₂) Free
- PFOS Free
- SVHC Free



Contact Information

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

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Email: customer.support@qorvo.com

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

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