QPA9510 - 400MHz Reference Design for Maximum Gain

Product Overview

The QPA9510 is a high-power, high-gain, high-efficiency power amplifier. The device is manufactured with Qorvo's advanced GaAs process. The amplifier provides 44.5 dB of max gain and able to achieve +31.5 dBm of P1dB along with flexibility in bias settings.

QPA9510 is designed for use as the final RF amplifier in GSM hand-held equipment in 900 MHz band and other applications in the UHF bands. An analog on-board power controller provides over 70 dB range of gain adjustment. This control also allows for power down with a voltage equal to the logic "Low" to set the device in standby mode.

The QPA9510 is tunable over any sub-bands in the operating range to optimize performance. The amplifiers sit in a 3mm x 3mm compact QFN package.

Referenced Documents

The reference documents below take precedence over the contents of this application note and should always be consulted for the latest information.

QPA9510 Data Sheet.

Typical Performance

Parameter	Conditions		Typical Value		Units
Operational Frequency		380	400	420	MHz
Gain	P_{IN} = -30 dBm, Small Signal	45.2	44.3	43.1	dB
Input Return Loss		-14.7	-13.8	13.3	dB
Output Return Loss		-15.5	-12.0	-8.7	dB
P1dB		33.1	31.5	29.8	dBm
P3dB		33.4	32.2	30.9	dBm
Efficiency	At Maximum Output Power		41		%

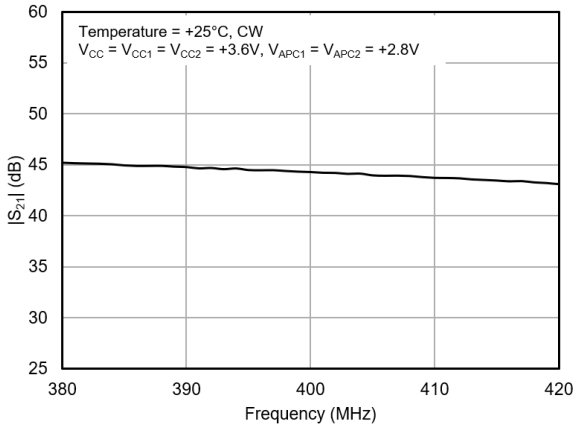
Notes:

1. Test conditions unless otherwise noted: V_{CC} = V_{CC1} = V_{CC2} = +3.6 V; V_{APC1} and V_{APC2} = 2.8V; CW Temp = +25 °C; 50 Ω system.

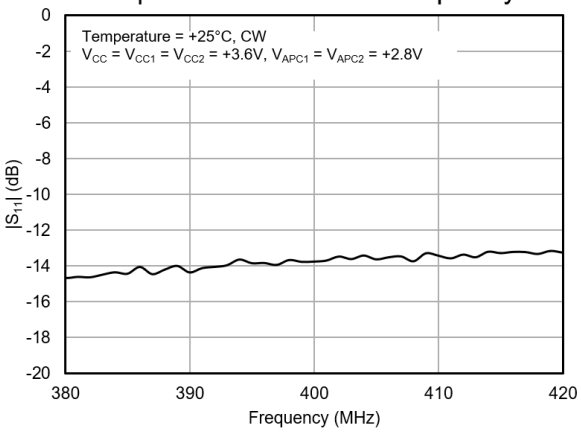
Performance Plots

Test conditions unless otherwise noted: V_{CC} = V_{CC1} = V_{CC2} = +3.6 V, V_{APC1} = V_{APC2} = +2.8 V, I_{CQ} = 230 mA, Temp = +25 °C, 50 Ω system.

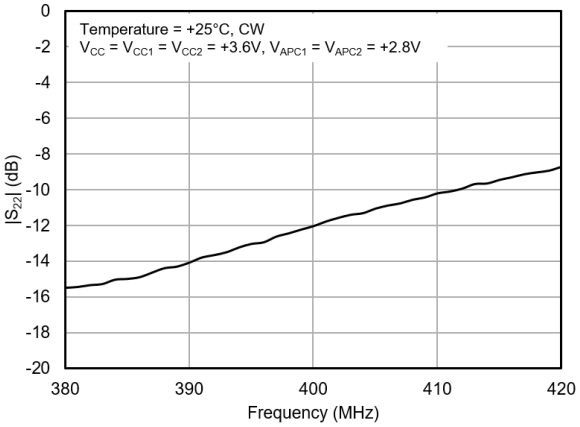
Gain vs. Frequency



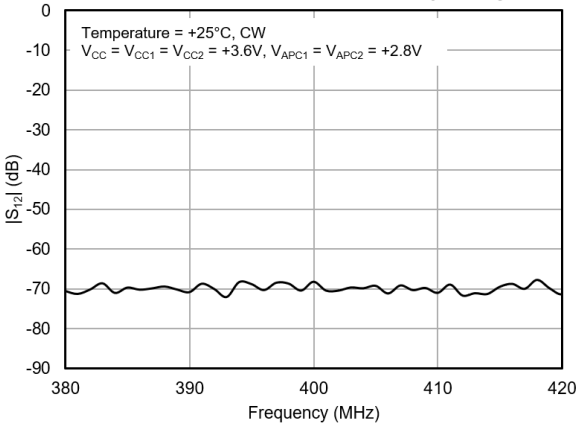
Input Return Loss vs. Frequency



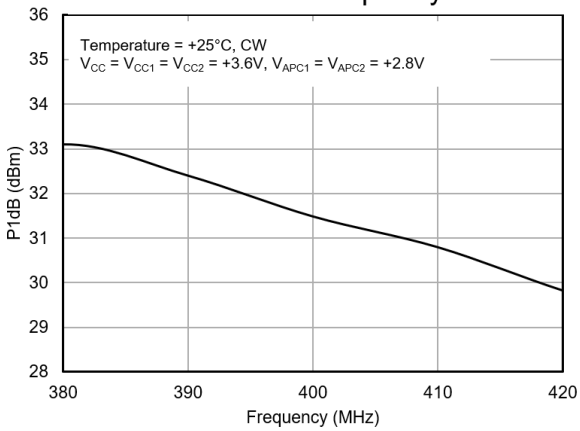
Output Return Loss vs. Frequency



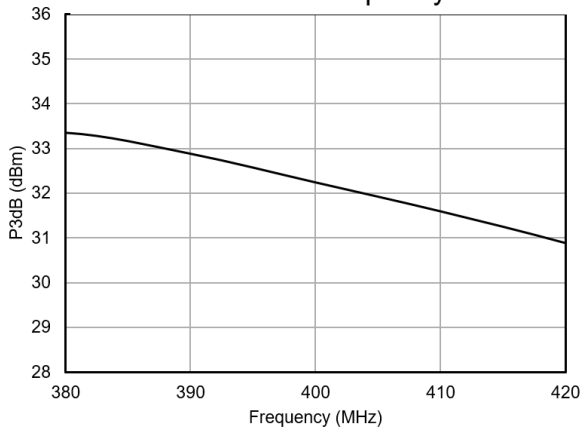
Reverse Isolation vs. Frequency



P1dB vs. Frequency

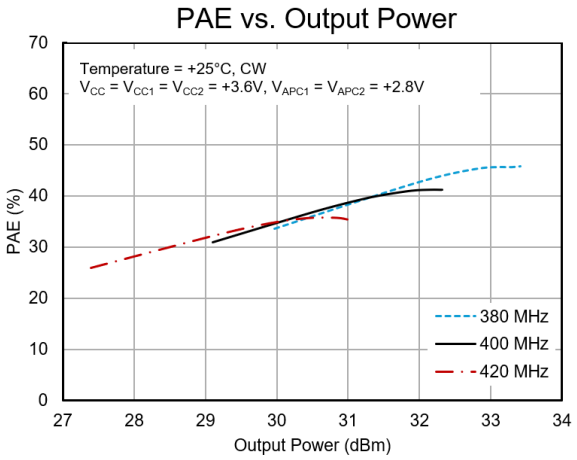


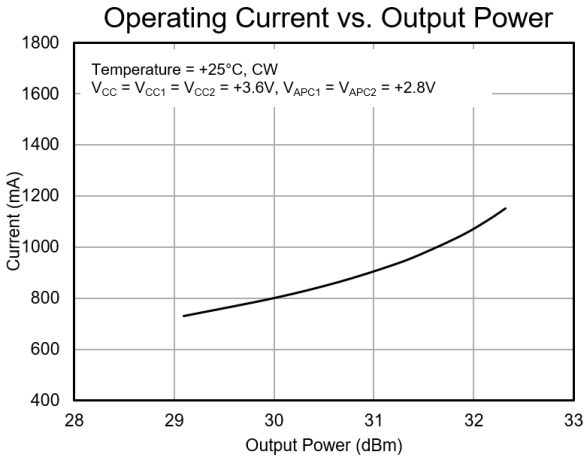
P3dB vs. Frequency



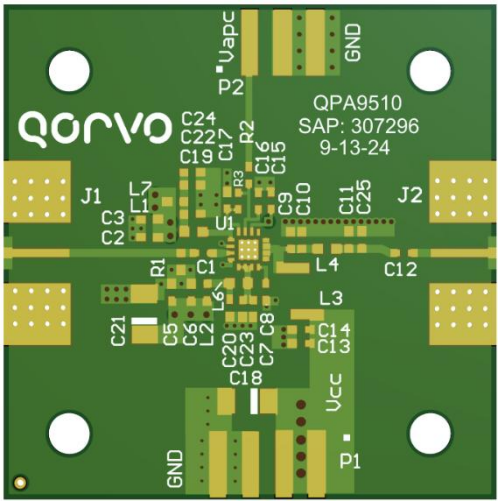
Performance Plots (Continued)

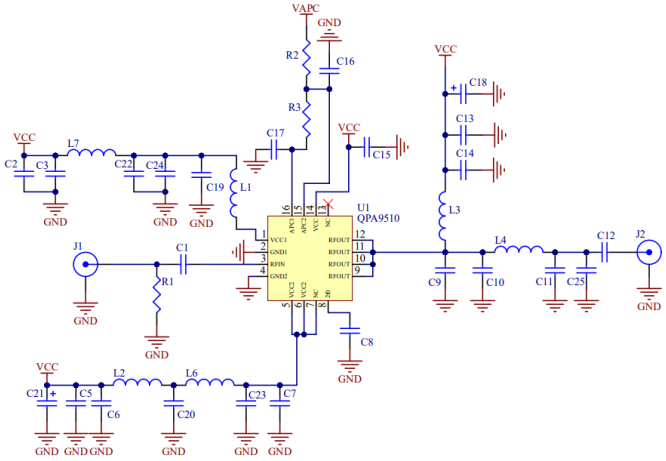
Test conditions unless otherwise noted: V_{CC} = V_{CC1} = V_{CC2} = +3.6 V, V_{APC1} = V_{APC2} = +2.8 V, I_{CQ} = 230 mA, Temp = +25 °C, 50 Ω system.





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	n/a	Printed Circuit Board	Qorvo	
U1	n/a	QPA9510 Amplifier, QFN pkg.	Qorvo	QPA9510
C1, C12	56pF	CAP, 56pF, 0402, 5%, 50V, C0G	Murata	GRM1555C1H560JA01D
C3, C6, C13	1000pF	CAP, 1000pF, 0402, 5%, 50V, C0G	Murata	GRM155R71H102KA01D
C2, C5, C16, C17	10000pF	CAP, 10000pF, 0402, 10%, 50V, X7R	Murata	GRM155R71E103KA01D
C10	33pF	CAP, 33pF, 0402, 5%, 50V, C0G	Murata	GRM1555C1H330JZ01
C11	27pF	CAP, 27pF, 0402, 5%, 50V, C0G	Murata	GRM1555C1H270JZ01
C14	47pF	CAP, 47pF, 0402, 1%, 50V, C0G	Murata	GRM1555C1H470JA01D
C15	100pF	CAP, 100pF, 0402, 1%, 50V, C0G	Murata	GRM1555C1H101FA01D
C18, C21	3.3uF	CAP, 3.3uF, TANT-A, 20%, 25V	Kyocera	TAJA335M025RNJ
C19, C20	330pF	CAP, 330pF, ±20%, 100V, X7R, 0402	Taiyo	MSASH105SB7331MFNA01
C25	2.2pF	CAP, 2.2pF, 0402, 50V	Murata	GRM1555C1H2R2CZ01
R1	180Ω	RES, 180 OHM, 0402, 5%, 1/10W	Kamaya	RMC1/16S-181JTH
R2, R3, L2, L7	0Ω	RES, 0 OHM, 0402, 1/10W	Kamaya	RMC1/16SJPTH
L1	12nH	IND, 12nH, 0603, 5%, W/W	Coilcraft	0603CS-12NXJLW
L3	1uH	IND, 1uH, 1606, 5%, W/W	-	-
L4	3.6nH	IND, 3.6nH, 0603, 5%, W/W	-	-
L6	6.8nH	IND, 6.8nH, 0603, 5%, W/W	Coilcraft	0603CS-6N8XJRW
C7, C8, C9, C22, C23, C24	DNP	n/a	n/a	

Additional Information

For information on ESD, Soldering Profiles, Packaging Standards or Handling and Assembly, please contact Qorvo for general guidelines.

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

Important Notices

The information contained in this document and any associated documents ("Document Information") is believed to be reliable; however, Qorvo® makes no warranties regarding the Document Information and assumes no responsibility or liability whatsoever for the use of or reliance on said information. All Document Information is subject to change without notice. Customers should obtain and verify the latest relevant Document Information before placing orders for Qorvo products. Information concerning Qorvo's product life cycles is available at https://www.qorvo.com/support/product-lifecycle-information. Document Information or the use thereof does not grant, explicitly, implicitly or otherwise any rights or licenses with respect to patents or any other intellectual property whether with regard to such Document Information itself or anything described by such information.

Qorvo grants you permission to use this document and any associated resources only to develop an application that uses the Qorvo products described in the Document and any associated resources. Other reproduction and display of this Document and any associated resources is prohibited.

Qorvo's products are provided subject to Qorvo's Terms of Sale or provided in conjunction with such Qorvo products. Qorvo objects to and rejects any additional or different terms customer may have proposed regarding the purchase of Qorvo products.

DOCUMENT INFORMATION DOES NOT CONSTITUTE A WARRANTY WITH RESPECT TO THE PRODUCTS DESCRIBED HEREIN, AND QORVO HEREBY DISCLAIMS ANY AND ALL WARRANTIES WITH RESPECT TO SUCH PRODUCTS WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Without limiting the generality of the foregoing, Qorvo products are not warranted or authorized for use as critical components in medical, life-saving, or life-sustaining applications, or other applications where a failure would reasonably be expected to cause severe personal injury or death. Applications described in the Document Information are for illustrative purposes only. Customers are responsible for validating that a particular product described in the Document Information is suitable for use in a particular application.