

## **Applications**

- 802.11a/n/ac Wireless LAN Systems
- CPE (Set Top Box, Gateways)
- Access Points
- Telematics
- Gaming and Infotainment
- Portable Devices

#### **Product Features**

- Fully Integrated, 802.11ac power amplifier module
- Internally matched input/output
- Temperature Compensated Bias Network
- High Gain = 32dB
- Integrated CMOS compatible logic and shutdown
- Typ. P<sub>OUT</sub> = 23.5 dBm, EVM = −30 dB MCS7/HT40 802.11n
- Typ. P<sub>OUT</sub> = 16 dBm, EVM = -40 dB MCS9/VHT80 802.11ac
- Typ. P<sub>OUT</sub> = 21 dBm, EVM = -35 dB, MCS9/VHT80 802.11ac
- Leadless 4.0 x 4.0 x 0.85 mm SMT Pb-Free

#### **General Description**

The TQP5523 is high power WLAN power amplifier module that contains internally matched 3-stage PA, compensated DC biasing circuit and output power detector. This PA module provides high gain (32dB), high linearity, industry leading EVM floor, and excellent spectral purity for wideband OFDM applications. The architecture and interface are optimized for most stringent VM requirements of next generation 802.11.ac WLAN devices.

The PA module features chipset logic compatible control voltages that draw very low current to facilitate ease of use and compatibility with current and future transceiver generation. With its optimized power dissipation, the amplifier module is well suited for implementation into next generation MIMO configurations and well designed to work with or without digital pre-distortion (DPD).

The TQP5523 is manufactured in TriQuint's high-reliability HBT technology and is assembled in a small footprint  $4.0 \times 4.0 \times 0.85$  mm 20-pin QFN package.



4x4mm 20-pin leadless SMT Package

## **Functional Block Diagram**



# Pin Configuration

Pin No.	Label
1, 6, 7, 8, 9	NC
2, 4, 11,12,14,15,16,17	GND
3	RFIN
5	PA_EN
10	DET
13	RFOUT
18	VCC3
19	VCC2
20	VCC1
Backside Paddle	RF/DC Ground

# **Ordering Information**

Part No.	Description	
TQP5523	High Power WLAN PA	
TQP5523-EVB	Evaluation Board	
Standard T/R size = TBD		



## Absolute Maximum Ratings

Parameter	Rating
Storage Temperature	−40 to 150°C
Case Temperature, Survival	-40 to 100°C
RF Input Power, CW, 50 $\Omega$ , T = 25°C	+5 dBm
Device Voltage	+6.0 V

Operation of this device outside the parameter ranges given above may cause permanent damage.

## **Recommended Operating Conditions**

Parameter	Min	Тур	Max	Units
$V_{CC1}, V_{CC2}, V_{CC3}$	3.3	5	5.25	V
T <sub>AMB</sub>	-30	25	+85	°C
Тј			160	°C

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

# **Electrical Specifications – DC Characteristics**

Test conditions unless otherwise noted:  $V_{DD1}$ ,  $V_{DD2}$ ,  $V_{DD3}$  =+5.0 V, Temp=+25°C.

Parameter	Conditions	Min	Тур	Max	Units
Quiescent Current	No RF		195		mA
Operational Current	Pout = +21dBm,11ac, MCS9, HT80		300		mA
TX Shut Down Current	PA_EN= Low, No RF		8		μA
PA Enable Voltage	Input Voltage for High State	1.8	3.0	V <sub>CC1</sub>	V
	Input Voltage for Low State		0	0.45	V
PA Enable Current			20	100	μA
Rise/Fall Time			0.4	0.8	uS
Thermal Resistance, $\theta_{jc}$	Junction to backside paddle		35		°C/W



## **Electrical Specifications**

Test conditions unless otherwise noted: 25°C, Vcc1, Vcc2, Vcc3 = 5.0V, PA Enable High = 3.0V, TQ EVB , -45dBm EVM source

Parameter	Conditions	Min Typ Max		Units	
Operational Freq. Range		4900		5925	MHz
3dB Bandwidth	At each 11ac VHT80 channel	4850		6430	MHz
Saturation Bower (Beat)	f =4900-5250 MHz		26.5		dBm
	f =5250-5925 MHz		31		dBm
Small Signal Gain	f =4900-5250 MHz		28		dB
	f =5250-5925 MHz		32		dB
Gain OoB	Absolute gain, f =3433–3917 MHz		0		dB
	Absolute gain, f=1716–1959 MHz		-50		dB
Gain Flatness Across Band	For any 80MHz BW, 11ac VHT80		+/- 0.3		dB
Spectral Emission Mask Margin	Pout = +20 dBm, f =5150-5250 MHz		5		dB
Relative to 11ac standard	Pout = +22 dBm, f =5250-5725 MHz		5		dB
11ac, MCS0, HT20	Pout = +24 dBm, f =5725-5925 MHz		5		dB
PA Noise Figure			8		dB
Input Return Loss			8		dB
Output Return Loss			10		dB
CW Signal Phase Variation	Pout = 15dBm to 21dBm		1.0		deg
	Pout = +20 dBm, f =5150-5250 MHz		-45		dBm/MHz
12  Harmonics(20)	Pout = +22 dBm, f =5250-5725 MHz		-45		dBm/MHz
	Pout = +24 dBm, f =5725-5925 MHz		-45		dBm/MHz
TV Hormonics (2fo)	Pout = +20 dBm, f =5150-5250 MHz		-45		dBm/MHz
$1 \land \text{Harmonics}(30)$ 11ac MCS9 HT80	Pout = +22 dBm, f =5250-5725 MHz		-45		dBm/MHz
	Pout = +24 dBm, f =5725-5925 MHz		-40		dBm/MHz
DEVM (11n / HT40 / MCS7)	Pout = +23.5 dBm		-30		dB
	Pout = +16 dBm		-40		dB
	Pout = +21 dBm		-35		dB
DEVM (11ac / HT20 / MCS0)	Pout = +24.5 dBm		-28		dB
Detector Voltage	No RF		0.35		V
	Pout = +24dBm		0.9		V
Stability	Pout = +24.5 dBm, VSWR = 6:1, all phases	All non-harmonically related outputs < -50 dBc/100 kHz		-	
RuggednessPout = +24.5 dBm,VSWR = 6:1, all phases		No Damage		-	

# Logic Truth Table

PA Mode	PA_EN
Disabled	Low
Enabled	High



# **Application Circuit**





## **Bill of Material**

Ref Des	Value	Description	Manuf.	Part Number
n/a	n/a	Printed Circuit Board		
U1	n/a	High Power WLAN 5GHz PA	TriQuint	TQP5523
C5, C6	1000 pF	Capacitor, Chip, 0402, 5%	various	
C1, C3, C4	0.1 uF	Capacitor, Chip, 0402, 10%	various	
C2	10 uF	Capacitor , Chip, 0402, 10%	various	
R2	27 Ω	Resistor, Chip, 0402, 5%, 1/16W, See Note 1.	various	
R1	30 KΩ	Resistor, Chip, 0402, 5%, 1/16W	various	

Note 1: R2 is only required for 5V operation. Replace with 0ohm for lower voltage operation.



## **Pin Configuration and Description**



Pin No.	Label	Description
1	NC	No Connection (Can be GND or Floating)
2	GND	Ground
3	RF_IN	RF Input
4	GND	Ground
5	PA_EN	PA Enable
6	NC	No Connection (Can be GND or Floating)
7	NC	No Connection (Can be GND or Floating)
8	NC	No Connection (Can be GND or Floating)
9	NC	No Connection (Can be GND or Floating)
10	DET	Detector Output
11	GND	Ground
12	GND	Ground
13	RF_OUT	RF Output
14	GND	Ground
15	GND	Ground
16	GND	Ground
17	GND	Ground
18	VCC3	Supply voltage for third stage PA
19	VCC2	Supply voltage for second stage PA
20	VCC1	Supply voltage for first stage PA
Backside Paddle	RF/DC GND	FEM RF/DC ground. Use recommended via pattern to minimize inductance and thermal resistance. See PCB Mounting Pattern for suggested footprint.



#### **Package Marking and Dimensions**



MAX

А

BURR.



Notes:

- 1. All dimensions are in millimeters.
- 2. Contact plating: NiPdAu.



## **Product Compliance Information**

## **ESD Sensitivity Ratings**



Caution! ESD-Sensitive Device

ESD Rating:	1C
Value:	Passes 1000V to <2000V
Test:	Human Body Model (HBM)
Standard:	JEDEC Standard JESD22-A114

ESD Rating:C3Value:Passes ≥ 1000 VTest:Charged Device Model (CDM)Standard:JEDEC Standard JESD22-C101

# **MSL** Rating

MSL Rating:	Level 1
Test:	260°C convection reflow
Standard:	JEDEC Standard IPC/JEDEC J-STD-020

## **Solderability**

Compatible with both lead-free (260°C maximum reflow temperature) and tin/lead (245°C maximum reflow temperature) soldering processes.

Contact plating: NiPdAu

## **RoHS Compliance**

This part is compliant with EU 2002/95/EC RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

This product also has the following attributes:

- Lead Free
- 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 TriQuint:

Web:	www.triquint.com	Tel:	+1.503.615.9000
Email:	info-sales@triquint.com	Fax:	+1.503.615.8902

For technical questions and application information:

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