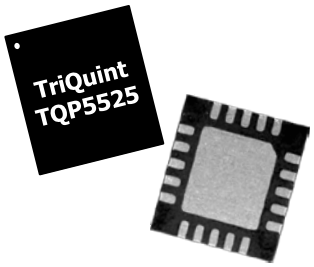
TQP5525

High Power 5 GHz WLAN Power Amplifier

Applications

- 802.11a/n/ac Wireless LAN Systems
- CPE (Set Top Box, Routers, Gateways)
- WiFi Access Points and Small Cells
- Telematics
- Gaming and Infotainment
- Point-to-point and Backhaul
- ISM Band

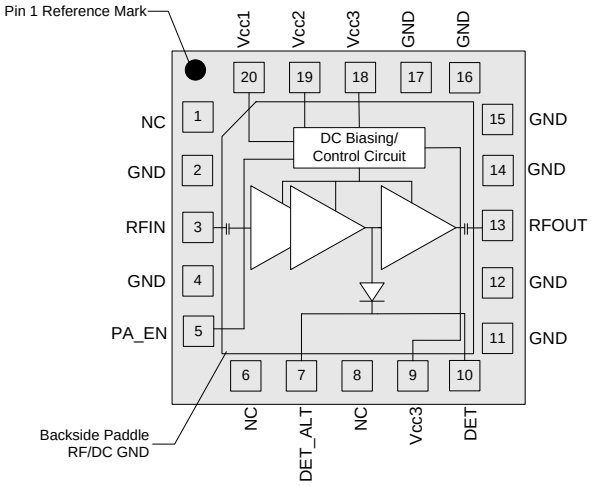


4x4 mm 20-pin Leadless QFN Package

Product Features

- Fully Integrated 802.11ac Power Amplifier Module With Power Detector
- Internally Matched Input / Output
- Temperature Compensated Bias Network
- High Gain = 32 dB
- Integrated CMOS Compatible Logic and Shutdown
- Typ. P_{OUT}=+25 dBm Pout, 35 dB EVM, MCS9/VHT80 802.11ac
- Typ. P_{OUT}=+18 dBm, EVM=−40 dB, MCS9/VHT80 802.11ac
- Typ. P_{OUT} = +26 dBm, EVM = −30 dB, MCS7/HT40 802.11n
- Supply Voltage: +3.3 V to +5.0 V
- Leadless 4.0 x 4.0 x 0.85 mm Pb-Free QFN Package

Functional Block Diagram



General Description

The TQP5525 is high power WLAN power amplifier module containing an internally matched 3-stage PA, compensated DC biasing circuit and output power detector. This PA module provides high gain (32 dB), high linearity, industry leading EVM floor, and excellent spectral purity for wideband OFDM applications. The architecture and interface are optimized for the most stringent EVM requirements of next generation 802.11.ac WLAN devices.

The TQP5525 features chipset logic compatible control voltages and buffered PA enable pin (PAEN) all of which draw very low current to facilitate ease of use and compatibility with current and future transceiver generations. With its optimized power dissipation, this 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 TQP5525 is assembled in a small footprint 4.0 x 4.0 x 0.85 mm 20-pin QFN package.

Pin Configuration

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

Ordering Information

Part No.	Description
TQP5525	High Power 5 GHz WLAN PA
TQP5525-EVB	Evaluation Board

Standard T/R size = 2500 pieces on 13” reel

Absolute Maximum Ratings

Parameter	Rating
Storage Temperature	−40 to 150 °C
Case Temperature, Survival	−40 to 100 °C
RF Input Power, CW, 50 Ω, 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	Typ	Max	Units
V_{CC1}, V_{CC2}, V_{CC3}	+3.15	+5	+5.25	V
T_{AMB}	−40	25	+85	°C
Tj (for>10^6 hours MTTF)			170	°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: Vcc_1, Vcc_2, Vcc_3 =+5.0 V, Temp.=+25°C.

Parameter	Conditions	Min	Typ	Max	Units
Quiescent Current	No RF	250	350	450	mA
Operational Current	Pout = +24 dBm,11ac, MCS9, HT80	300	600	800	mA
	Pout = +27.5 dBm,11ac, MCS0, HT20	500	800	1000	
TX Shut Down Current	PA_EN= Low, No RF		8		µA
PA Enable Voltage	Input Voltage for High State	1.8	3.0	V_{CC1}	V
	Input Voltage for Low State		0	+0.45	
PA Enable Current			20	100	µA
Rise/Fall Time			0.4	0.8	uS
Thermal Resistance, θ_{jc}	Junction to backside paddle		20		°C/W

Logic Truth Table

PA Mode	PA_EN
Disabled	Low
Enabled	High

Electrical Specifications

Test conditions unless otherwise noted: Vcc1, Vcc2, Vcc3 = +5.0 V, Temp. = +25 °C, Measured on TQP5525-EVB, PA Enable High = +3.0 V, −45 dBm EVM source

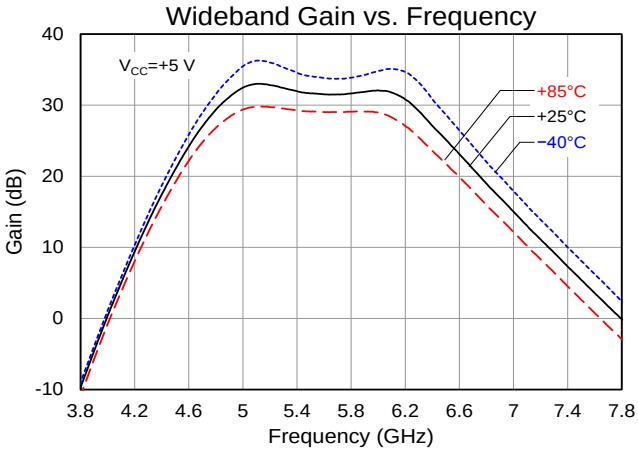
Parameter	Conditions	Min	Typ	Max	Units
Operational Freq. Range		4900		5925	MHz
3dB Bandwidth	At each 11ac VHT80 channel	4740		6100	MHz
Saturation Power (Psat)	f =4900 – 5250 MHz		+31.5		dBm
	f =5250 – 5925 MHz		+34		
Small Signal Gain	f =4900 – 5250 MHz	28	31	35	dB
	f =5250 – 5925 MHz	29	32	37	
Gain OOB	Absolute gain, f =3433 – 3917 MHz		0		dB
	Absolute gain, f=1716 – 1959 MHz		−50		
Gain Flatness Across Band	For any 80MHz BW, 11ac VHT80		± 0.25		dB
Spectral Emission Mask Margin Relative to 11ac standard 11ac, MCS0, HT20	Pout = +24 dBm, f =5150 – 5250 MHz		5		dB
	Pout = +26.5 dBm, f =5250 – 5725 MHz		5		
	Pout = +27.5 dBm, f =5725 – 5925 MHz		5		
PA Noise Figure			7		dB
Input Return Loss			10		dB
Output Return Loss			10		dB
CW Signal Phase Variation Harmonics ($2f_0$)	Pout = +18 dBm to +24 dBm		1.0		Deg.
TX Harmonics (2fo) 11ac, MCS0, HT20	Pout = +22 dBm, f =5150 – 5250 MHz		−45		dBm/ MHz
	Pout = +26.5 dBm, f =5250 – 5725 MHz		−45		
	Pout = +27.5 dBm, f =5725 – 5925 MHz		−45		
TX Harmonics (3fo) 11ac, MCS0, HT20	Pout = +22 dBm, f =5150 – 5250 MHz		−45		dBm/ MHz
	Pout = +26.5 dBm, f =5250 – 5725 MHz		−45		
	Pout = +27.5 dBm, f =5725 – 5925 MHz		−45		
DEVM (11n / VHT40 / MCS7)	Pout = +25 dBm		−33		dB
DEVM (11ac / VHT80 / MCS9)	Pout = +18 dBm		−40	−36	dB
	Pout = +24 dBm		−36	−31	
DEVM (11ac / HT20 / MCS0)	Pout = +27 dBm		−26		dB
Detector Voltage	No RF	+0.25	+0.35	+0.38	V
	Pout = +27.5 dBm	+0.8	+0.9	+1.2	
Stability	Pout = +28 dBm, VSWR = 6:1, all phases	All non-harmonically related outputs < –50 dBc/100 kHz			-

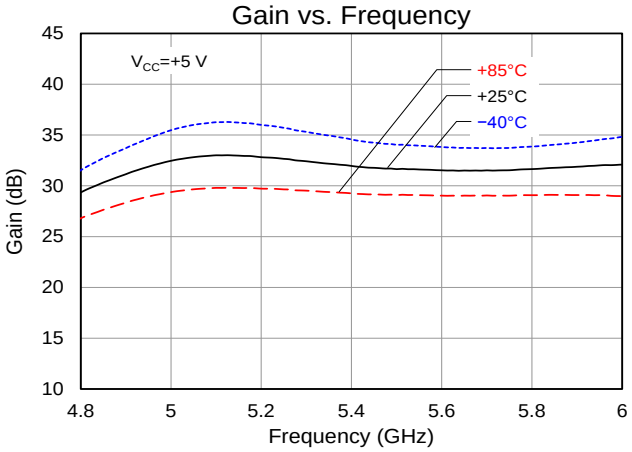
Performance Over Voltage

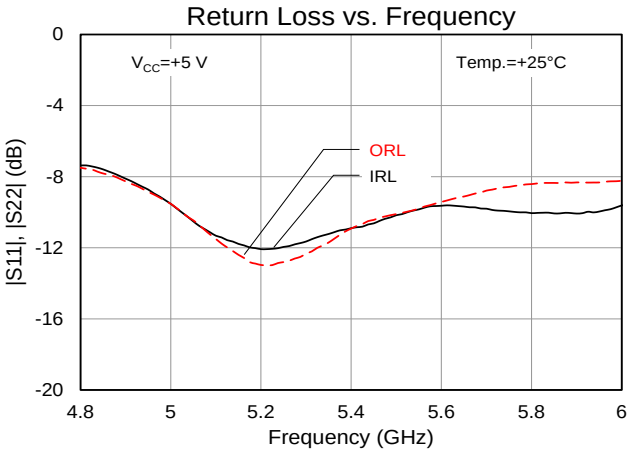
Test conditions unless otherwise noted: Temp=+25°C.

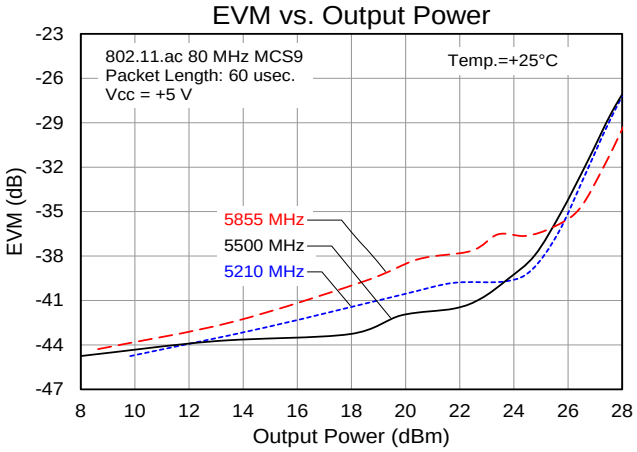
Parameter	Conditions	Typical Value			Units
Voltage (Vcc1, Vcc2, Vcc3)		+3.3	+4.2	+5.0	Volts
Small Signal Gain	f =5250-5925 MHz	30.5	31.5	32	dB
Pout (11ac / VHT80 / MCS9)	DEVM = −35dB	+22	+24	+25	dBm
Pout (11ac / HT20 / MCS0)	DEVM = −30dB	+24	+26	+27	dBm
Operating Current	VHT80, MCS9, DEVM = −35dB	470	540	600	mA

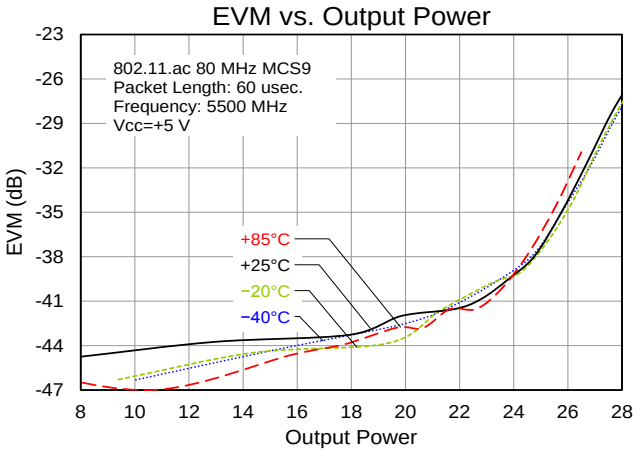
Performance Plots Vcc= +5 V

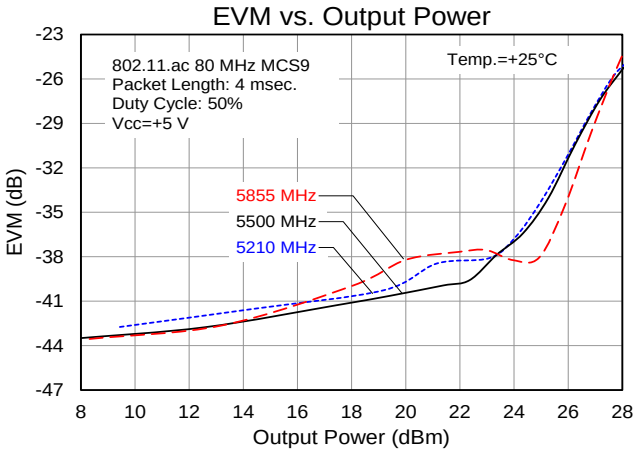




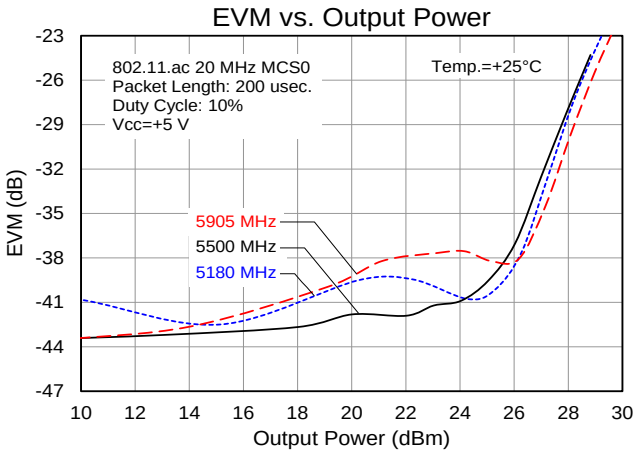


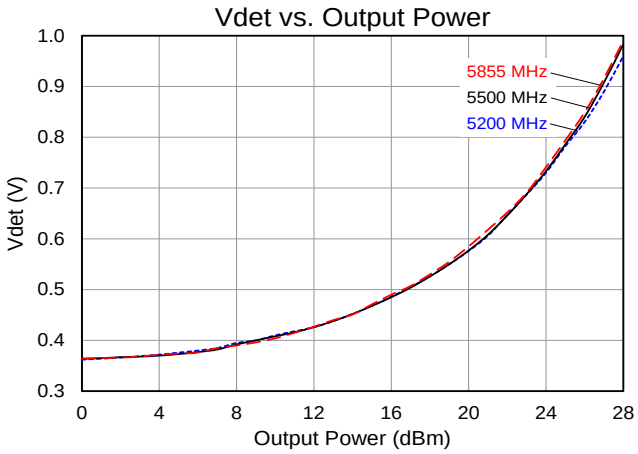




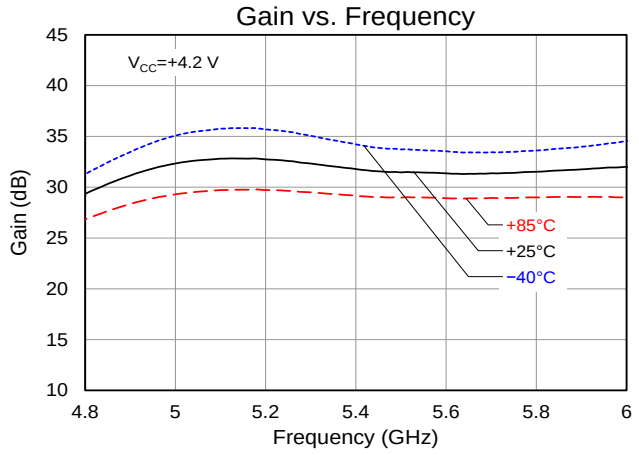


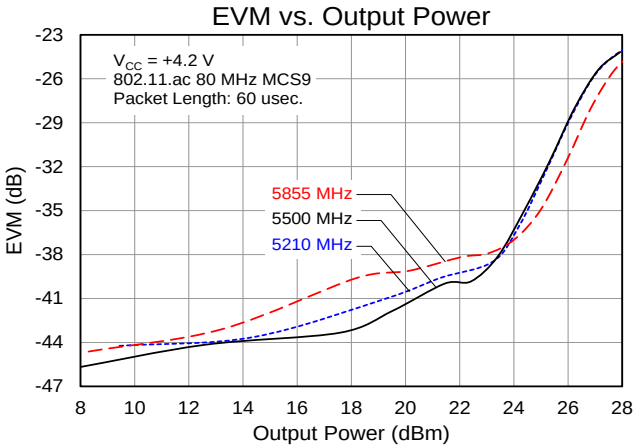
Performance Plots Vcc= +5 V (cont.)



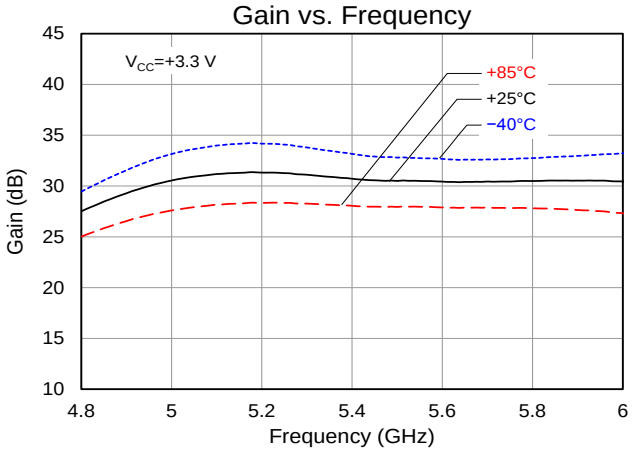


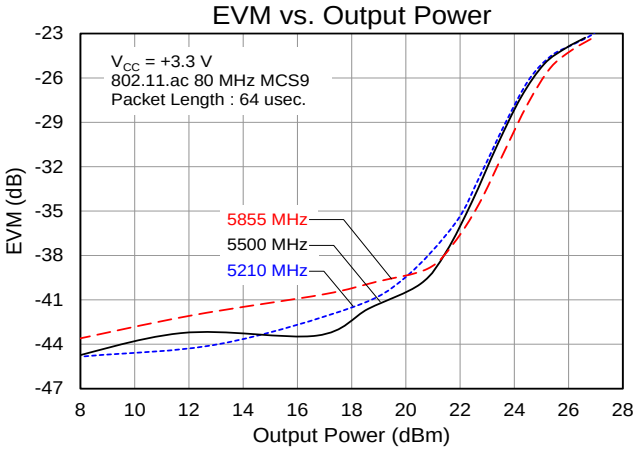
Performance Plots Vcc = +4.2 V



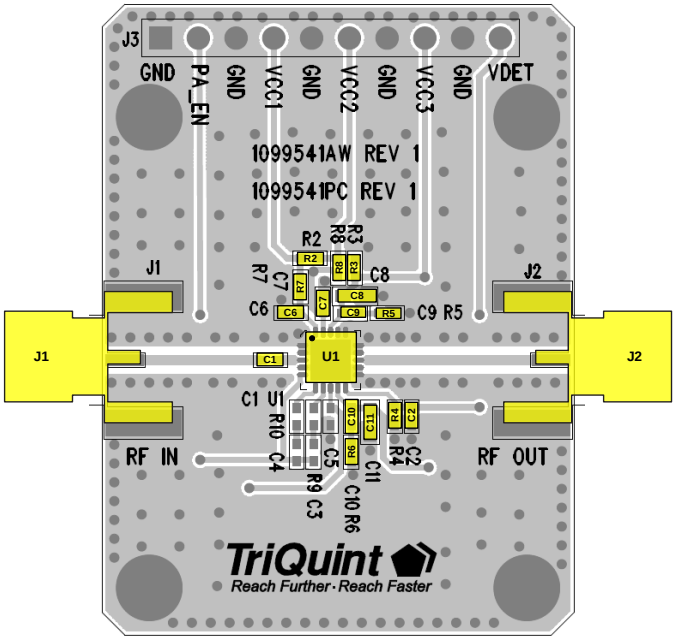


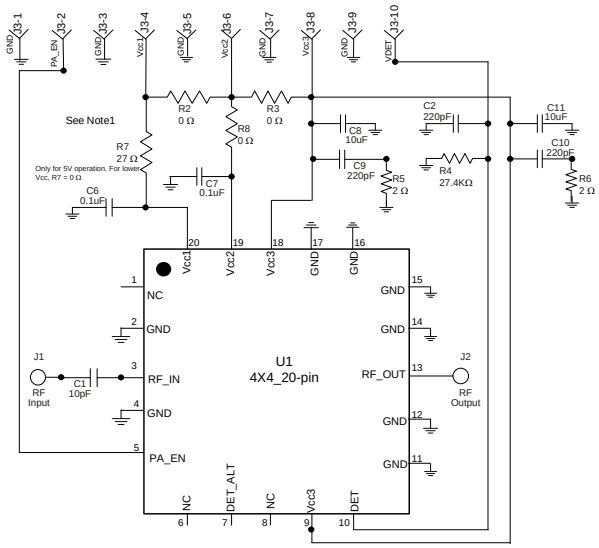
Performance Plots Vcc = +3.3 V





Application Circuit



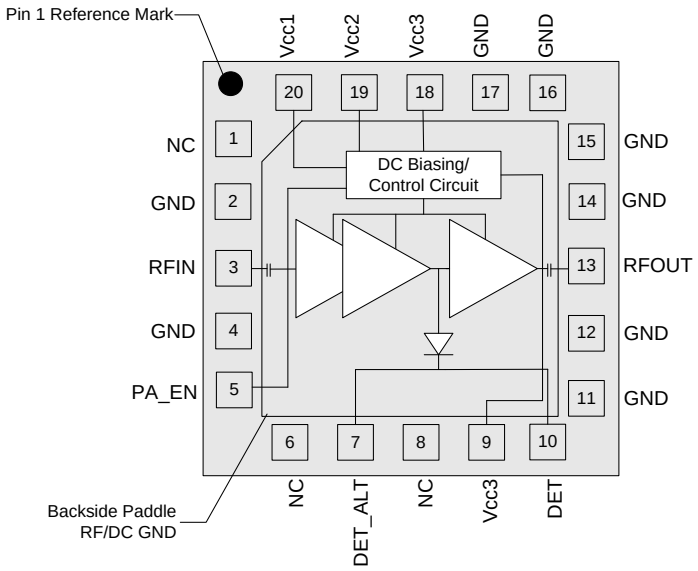


Bill of Material

Ref Des	Value	Description	Manuf.	Part Number
n/a	n/a	Printed Circuit Board		1099541
U1	n/a	High Power WLAN 5GHz PA	TriQuint	TQP5525
R2, R8, R3	0 Ω	Resistor, Chip, 04023, 5%	various	
C1	10 pF	Capacitor, Chip, 0402, 5%	various	
C6, C7	0.1 uF	Capacitor, Chip, 0402, 10%	various	
C8, C11	10 uF	Capacitor , Chip, 0402, 10%	various	
C9, C10, C2	220 pF	Capacitor, Chip, 0402, 10%	various	
R7 (1)	0 to 27 Ω	Resistor, Chip, 0402, 5%, 1/10W	various	
R5, R6 (2)	2 Ω	Resistor, Chip, 0402, 5%, 1/16W	various	
R4	27.4 KΩ	Resistor, Chip, 0402, 5%, 1/16W	various	

Notes:
1. For Vcc1>4.5V, value of R7 may be varied between 0 and 27 Ohms for EVM floor optimization.
2. R5 and R6 are de-Q resistors.

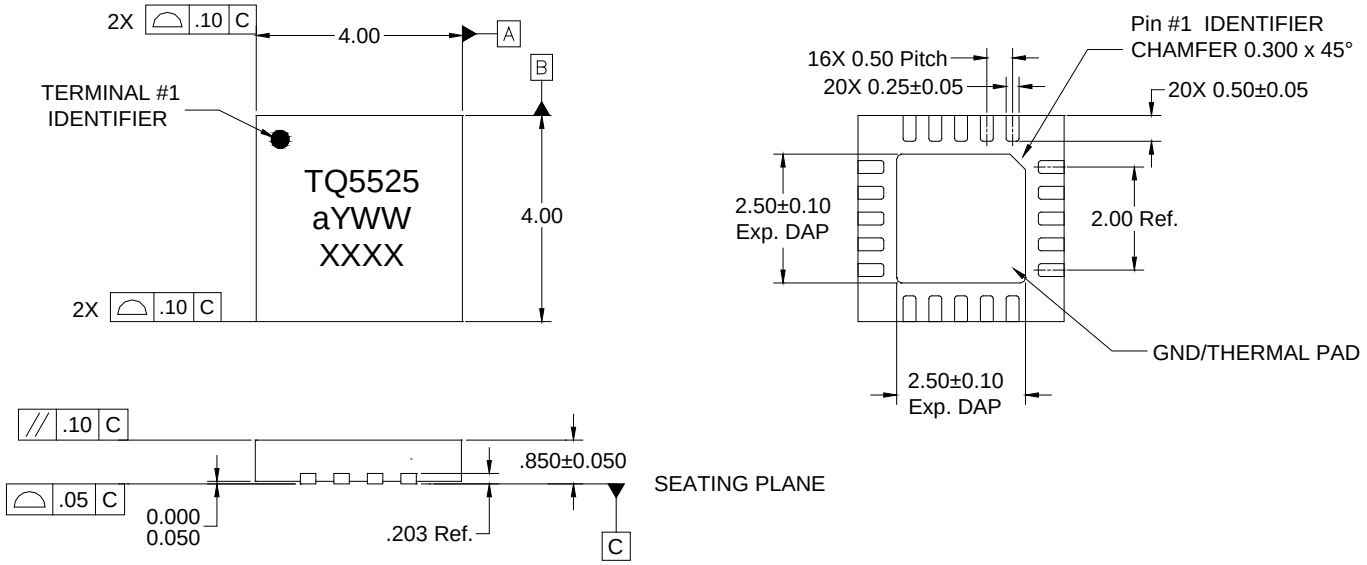
Pin Configuration and Description



Pin No.	Label	Description
1	NC	No internal connection. This pin can be grounded or N/C on PCB.
2	GND	Ground
3	RF_IN	RF Input
4	GND	Ground
5	PA_EN	PA Enable
6	NC	No internal connection. This pin can be grounded or N/C on PCB.
7	DET_ALT	Alternate Detector Output
8	NC	No internal connection. This pin can be grounded or N/C on PCB.
9	VCC3	Supply voltage for third stage PA
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.

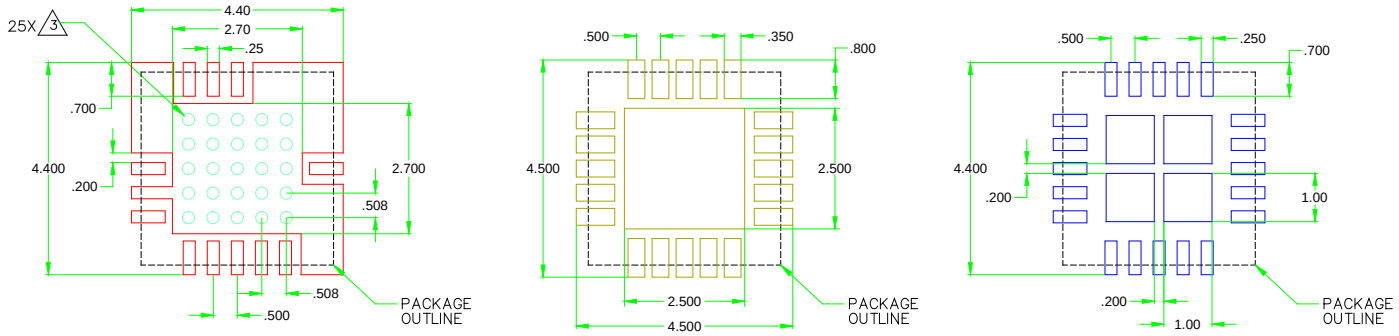
Package Marking and Dimensions

Marking: Part number: TQ5525
Assembly code: aYWW
a = C or T
Y = Last # in Year (ex. 2013= 3)
WW = workweek
Lot code: XXXX



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

PCB Mounting Pattern



BOARD METAL & VIA PATTERN
TOP VIEW

SOLDER MASK
TOP VIEW

STENCIL APERATURE
TOP VIEW (NOTE 4)

Notes:
1. All dimensions are in millimeters. Angles are in degrees.
2. Use 1 oz. copper minimum for top and bottom layer metal.
3. Vias are required under the backside paddle of this device for proper RF/DC grounding and thermal dissipation. We recommend a 0.35mm (#80/.0135") diameter bit for drilling via holes and a final plated thru diameter of 0.25 mm (0.10").
4. Ensure good package backside paddle solder attach for reliable operation and best electrical performance.

Product Compliance Information

ESD Sensitivity Ratings

Caution! ESD-Sensitive Device

ESD Rating: 1C
Value: ≥ 1000 V to < 2000 V
Test: Human Body Model (HBM)
Standard: ESDA/JEDEC Standard JS-001-2012

ESD Rating: C3
Value: ≥ 1000 V
Test: Charged Device Model (CDM)
Standard: JEDEC Standard JESD22-C101F

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:

Email: sjcapplications.engineering@triquint.com

Important Notice

The information contained herein is believed to be reliable. TriQuint makes no warranties regarding the information contained herein. TriQuint assumes no responsibility or liability whatsoever for any of the information contained herein. TriQuint assumes no responsibility or liability whatsoever for the use of the information contained herein. The information contained herein is provided "AS IS, WHERE IS" and with all faults, and the entire risk associated with such information is entirely with the user. All information contained herein is subject to change without notice. Customers should obtain and verify the latest relevant information before placing orders for TriQuint products. The information contained herein or any use of such information does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other intellectual property rights, whether with regard to such information itself or anything described by such information.

TriQuint 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.