

### Applications

- 2G / 3G / 4G Wireless Infrastructure
- LTE / WCDMA / CDMA / EDGE
- General Purpose Wireless

### Product Features

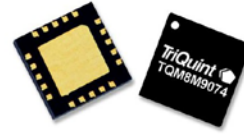
- Integrates Amp + VVA + Amp Functionality
- 700 – 2800 MHz
- 23 dB Gain at 2.14 GHz
- 3.4 dB Noise Figure at Max Gain Setting
- +27.5 dBm P1dB
- +43 dBm OIP3
- +5 V Supply Voltage
- 240 mA Quiescent Current
- MTTF > 1000 Years

### General Description

The TQM8M9074 is a high dynamic range analog controlled variable gain amplifier (VGA) which operates from 0.7 to 2.8 GHz. The VGA is able to achieve high performance with +43 dBm OIP3 and +27.5 dBm P1dB over a wide gain variation range while only consuming 225 mA current.

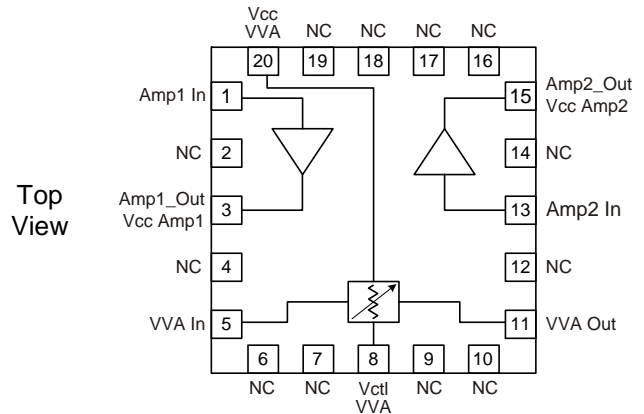
The TQM8M9074 integrates a high linearity, low noise amplifier for the first stage, followed by a broadband voltage variable attenuator, and then with a high performance ½ W P1dB amplifier. The input and output of the various individual stages are accessible with external pins to allow for optimization of performance at any sub-band across the VGA's 0.7 to 2.8 GHz operating frequency range. The TQM8M9074 is packaged in a RoHS-compliant, compact 5 x 5 mm surface-mount leadless package. Superior thermal design allows the product to have a minimum MTTF rating of 1000 years at a mounting temperature of +85 °C.

The TQM8M9074 is targeted for use in wireless infrastructure where high linearity, medium power, and high efficiency are required.



20 Pin 5 x 5 mm Leadless SMT Package

### Functional Block Diagram



### Pin Configuration

Pin No.	Label
1	Amp1_In
2, 4, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19	NC (No Connect)
3	Amp1_Out / Vcc Amp1
5	VVA_In
8	Vctrl_VVA
11	VVA_Out
13	Amp2_In
15	Amp2_Out / Vcc Amp2
20	Vcc_VVA
Backside Paddle	RF/DC Ground

### Ordering Information

Part No.	Description
TQM8M9074	½ W Variable Gain Amplifier
TQM8M9074-PCB2140	2140 MHz Eval Board

Standard T/R size: 2500 pieces on a 13" reel.

### Absolute Maximum Ratings

Parameter	Rating
Storage Temperature	-65 to 150 °C
RF Input Power, CW, 50 Ω, T = 25°C	+10 dBm
Supply Voltage (V <sub>cc</sub> )	+6 V

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

### Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
V <sub>cc</sub>	+4.75	+5	+5.25	V
I <sub>cc</sub>		240		mA
Operating Temp. Range	-40		+85	°C
T <sub>J</sub> (for >10 <sup>6</sup> hours MTTF)			+170	°C

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

### Electrical Specifications

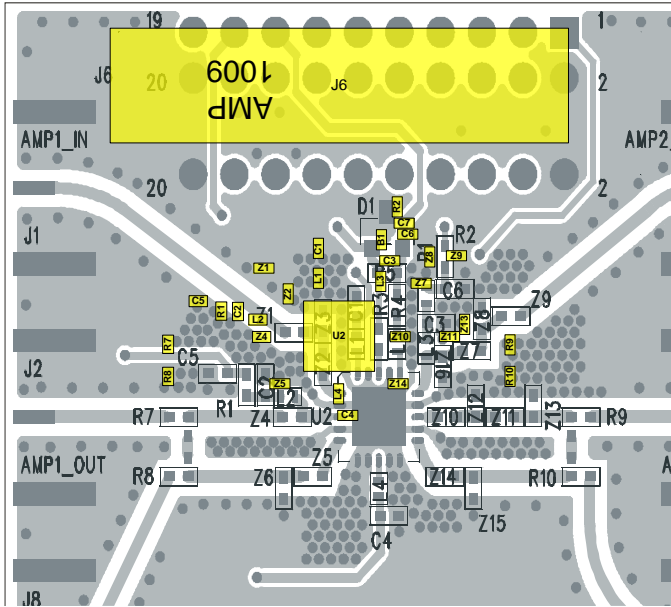
Test conditions unless otherwise noted: V<sub>cc</sub> = +5 V, V<sub>ctrl</sub> = +0 V, Temp. = +25 °C

Parameter	Conditions	Min	Typical	Max	Units
Operational Frequency Range		700		2800	MHz
Test Frequency			2140		MHz
Gain		21	23.2	25	dB
Gain	V <sub>ctrl</sub> = 4.021 V	3.5	6.5	9.5	dB
Gain Variation Range	Note 1	25	30		dB
Gain Flatness	2140 +/- 60 MHz		0.5		dB
Input Return Loss			14		dB
Output Return Loss			15		dB
Output P1dB			+27.5		dBm
Output IP3	Note 2		+43		dBm
Pout at -50 dBc ACLR	Note 3		+18.6		dBm
Noise Figure	At max gain level		3.4		dB
Voltage Control Range	0V = max gain level	0		+5	V
Supply Voltage			+5		V
Amplifier Current (Pin 3 plus 15)	Notes 4 & 5	160	240	280	mA
VVA Current (Pin 8) at minimum attenuation	Note 6		3.6	6	mA
Thermal Resistance (jnc. to case) θ <sub>jc</sub>				40	°C/W

#### Notes:

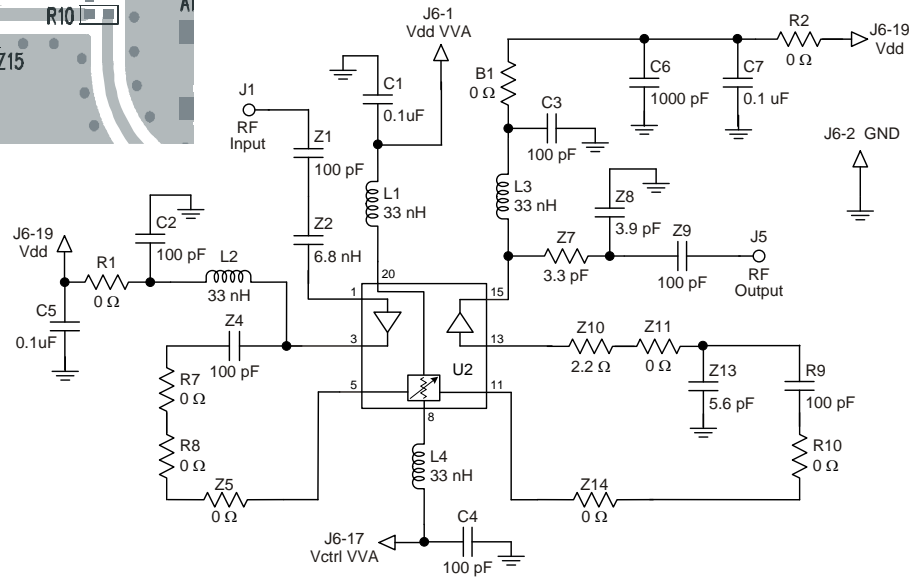
- The gain variation range is measured as the difference in gain with V<sub>ctrl</sub> = +5 V and V<sub>ctrl</sub> = 0 V.
- OIP3 measured with two tones at an output power of +11 dBm / tone separated by 1 MHz. The suppression on the largest IM3 product is used to calculate the OIP3 using a 2:1 rule.
- 3GPP WCDMA, 1±64DPCH, 3.84 MHz BW, PAR=10.2 dB at 0.01% Probability, single carrier.
- Amp1 current (pin 3) is typically 75 mA.
- Amp2 current (pin 15) is typically 150 mA.
- VVA typical current is 3.6 mA for min attenuation and 1.6 mA for max attenuation.

### 920 MHz Reference Design (869-960 MHz)



**Notes:**

1. See Evaluation Board PCB Information section for PCB material and stack-up.
2. Zero Ohm resistors may be replaced with copper traces in end user application layouts.



### Bill of Material – 920 MHz Reference Design

Reference Des.	Value	Description	Manuf.	Part Number
U2	N/A	Variable Gain Amplifier	TriQuint	TQM8M9074
L1, L2, L3, L4	33 nH	Inductor, 0402	various	
B1, R1, R2, R7, R8, R10, Z5, Z11, Z14	0 Ω	Resistor, 0402	various	
C1, C5, C7	0.1 uF	Capacitor, 0402	various	
C2, C3, C4, Z1, Z4, Z9, R9	100 pF	Capacitor, 0402	various	
C6	1000 pF	Capacitor, 0402	various	
Z2	6.8 nH	Inductor, 0402	various	
Z7	3.3 pF	Capacitor, 0603	various	
Z8	3.9 pF	Capacitor, 0402	various	
Z10	2.2 Ω	Resistor, 0402	various	
Z13	5.6 pF	Capacitor, 0402	various	

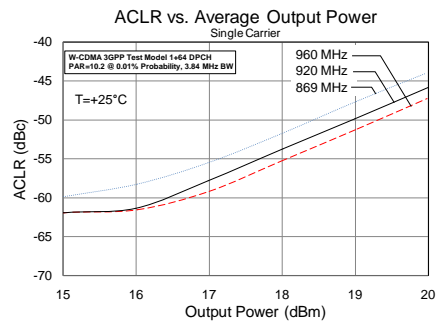
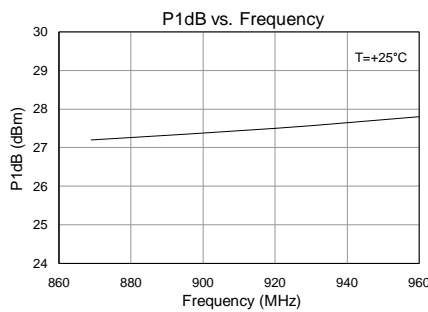
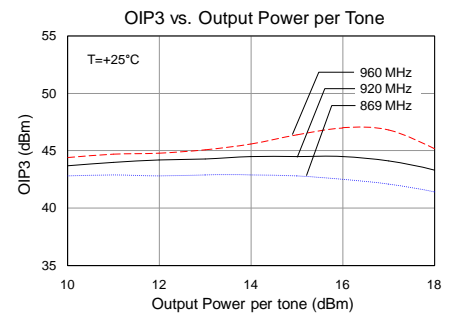
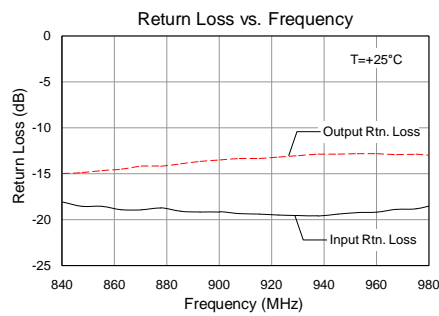
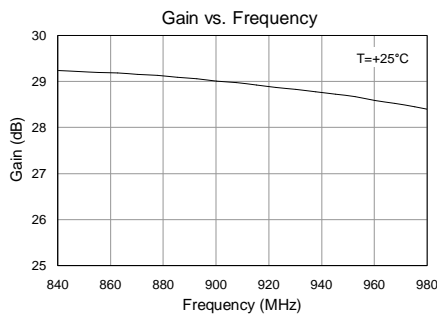
### Typical Performance – 920 MHz Reference Design

Test conditions unless otherwise noted:  $V_{CC}=+5\text{ V}$ ,  $I_{CC}=240\text{ mA}$  (typ.),  $Temp=+25\text{ }^{\circ}\text{C}$

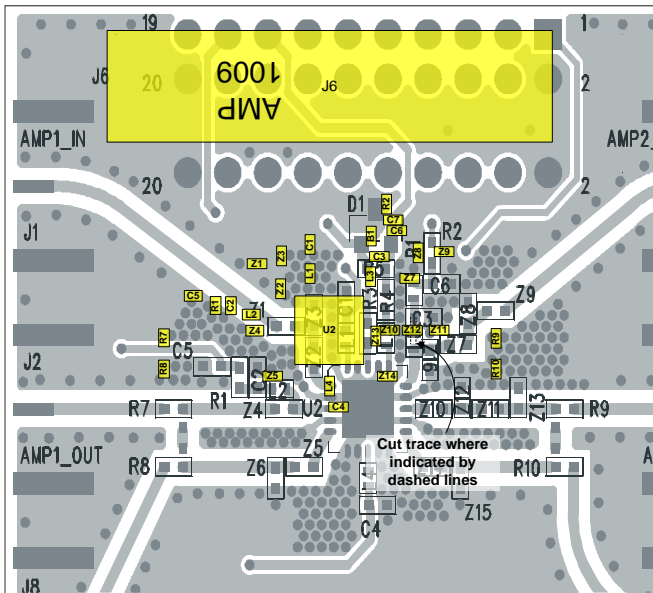
Parameter	Conditions	Typical Value			Units
Frequency		869	920	960	MHz
Gain		29.2	28.9	28.6	dB
Input Return Loss		18.9	19.4	19.2	dB
Output Return Loss		14.2	13.2	12.8	dB
Output P1dB		+27.2	+27.5	+27.8	dBm
Output IP3	Pout=+16 dBm/ tone, 1 MHz tone spacing	+42.5	+44.5	+47.0	dBm
Pout	ACLR=-50 dBc, Single carrier, 10.2 PAR	+18.4	+19.0	+19.3	dBm

### Performance Plots – 920 MHz Reference Design

Test conditions unless otherwise noted:  $V_{CC}=+5\text{ V}$ ,  $I_{CC}=240\text{ mA}$  (typ.),  $Temp=+25\text{ }^{\circ}\text{C}$

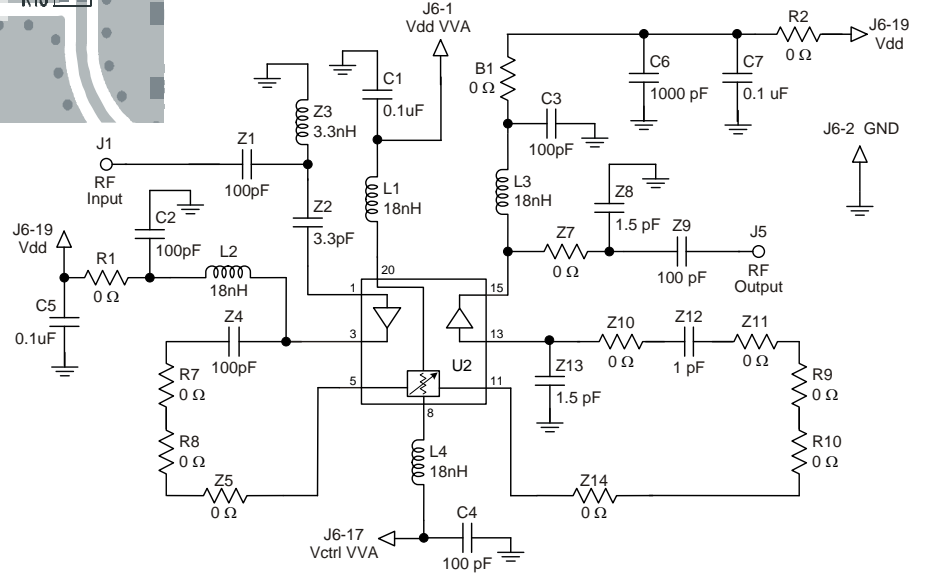


### TQM8M9074-PCB2140 (2110-2170 MHz)



**Notes:**

1. See Evaluation Board PCB Information section for PCB material and stack-up.
2. Zero Ohm resistors may be replaced with copper traces in end user application layouts.



### Bill of Material – TQM8M9074-PCB2140

Reference Des.	Value	Description	Manuf.	Part Number
U2	N/A	Variable Gain Amplifier	TriQuint	TQM8M9074
L1, L2, L3, L4	18 nH	Inductor, 0402	various	
Z3	3.3 nH	Inductor, 0402	various	
B1, R1, R2, R7 – R10, Z5, Z7, Z10, Z11, Z14	0 Ω	Resistor, 0402	various	
C1, C5, C7	0.1 uF	Capacitor, 0402	various	
C2, C3, C4, Z1, Z4, Z9	100 pF	Capacitor, 0402	various	
C6	1000 pF	Capacitor, 0402	various	
Z2	3.3 pF	Capacitor, 0402	various	
Z8	1.5 pF	Capacitor, 0402	various	
Z12	1.0 pF	Capacitor, 0402	various	
Z13	1.5 pF	Capacitor, 0402	various	

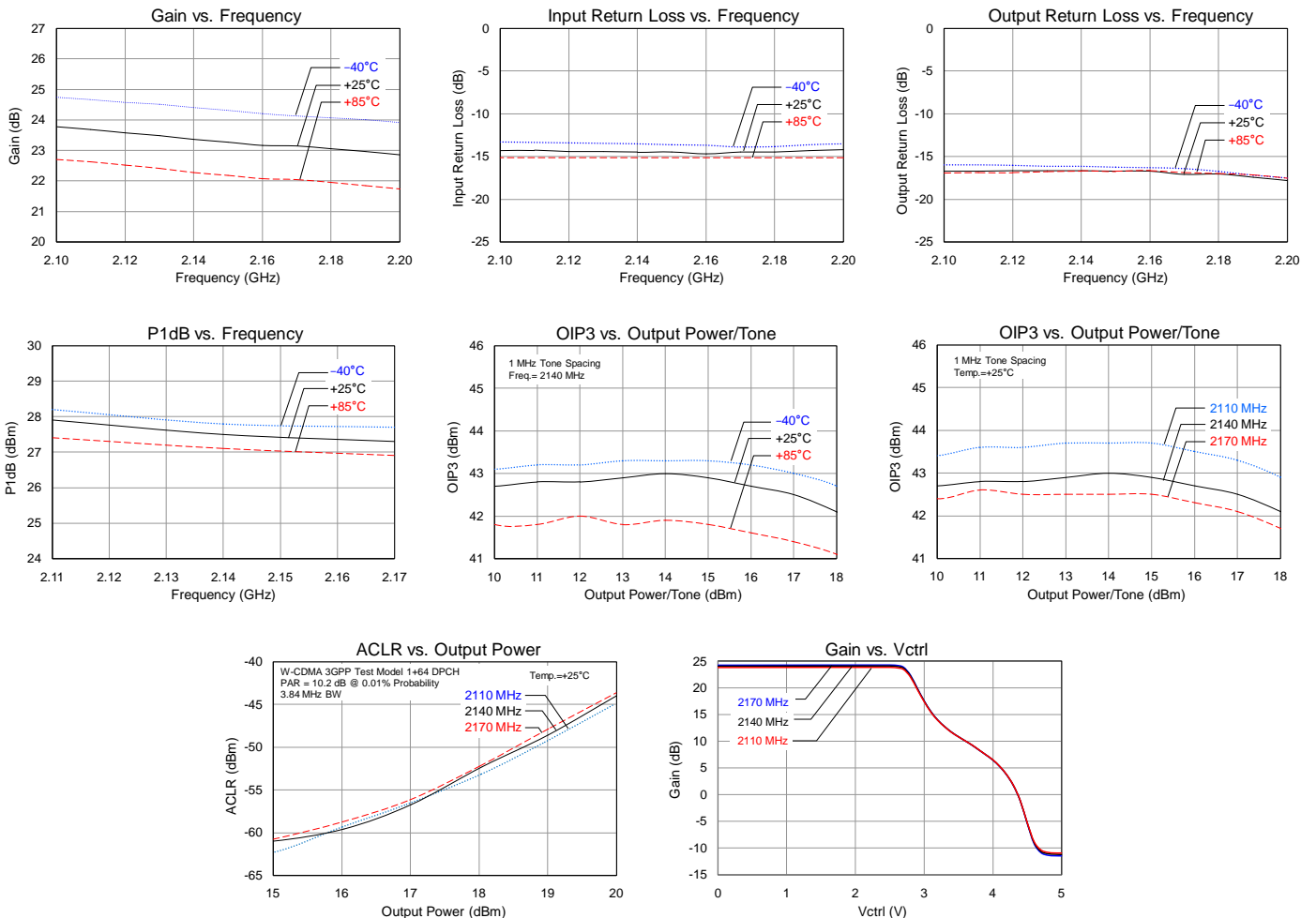
### Typical Performance – TQM8M9074-PCB2140

Test conditions unless otherwise noted:  $V_{CC}=+5\text{ V}$ ,  $I_{CC}=240\text{ mA}$  (typ.),  $Temp=+25\text{ }^{\circ}\text{C}$

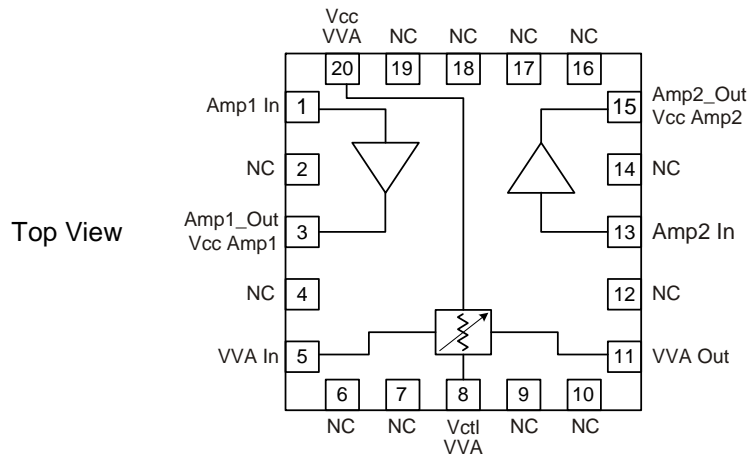
Parameter	Conditions	Typical Value			Units
Frequency		2110	2140	2170	MHz
Gain		23.6	23.2	23.0	dB
Input Return Loss		15.3	15.6	15.7	dB
Output Return Loss		16.6	16.5	16.7	dB
Output P1dB		+28.0	+27.5	+27.4	dBm
Output IP3	Pout=+11 dBm/ tone, 1 MHz tone spacing	+43.6	+42.9	+42.5	dBm
Pout	ACLR=-50 dBc, Single carrier, 10.2 PAR	+18.8	+18.6	+18.5	dBm

### Performance Plots – TQM8M9074-PCB2140

Test conditions unless otherwise noted:  $V_{CC}=+5\text{ V}$ ,  $I_{CC}=240\text{ mA}$  (typ.),  $Temp=+25\text{ }^{\circ}\text{C}$



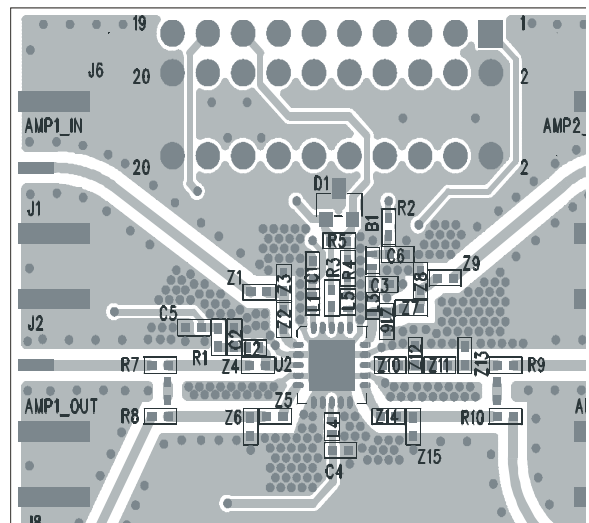
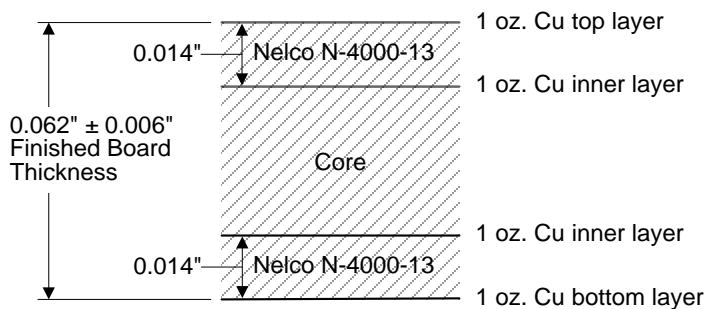
### Pin Configuration and Description



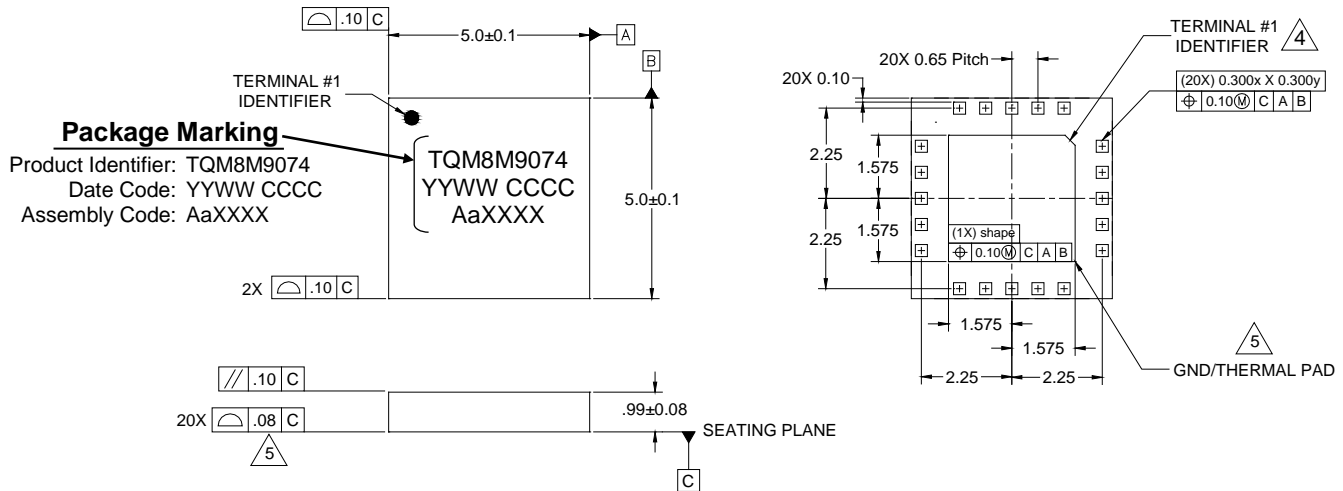
Pin No.	Symbol	Description
1	Amp1_In	RF input (Amp1). Band-specific matching circuit required.
2, 4, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19	NC (No Connect)	No electrical connection. Land pads should be provided for PCB mounting integrity.
3	Amp1_Out/Vcc	RF output / DC supply (Amp1).
5	VVA_In	RF input (VVA).
8	Vctrl_VVA	Analog input for voltage controlled amplifier.
11	VVA_Out	RF output (VVA).
13	Amp2_In	RF input (Amp2). Band-specific matching circuit required.
15	Amp2_Out/Vcc	RF output / DC supply (Amp2). Band-specific matching circuit required.
20	Vcc_VVA	DC supply for voltage controlled amplifier.
Backside Paddle	RF/DC Ground	RF/DC ground. Provide recommended via pattern (see page 8) and ensure good solder attach for best thermal and electrical performance.

### Evaluation Board PCB Information

TriQuint PCB 1078786 Material and Stack-up



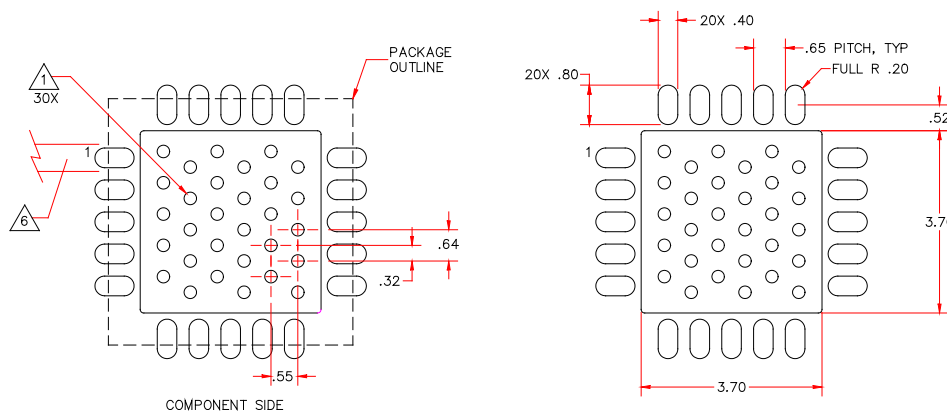
### Package Marking and Dimensions



#### Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. Except where noted, this part outline conforms to JEDEC standard MO-220, Issue E (Variation VGGC) for thermally enhanced plastic very thin fine pitch quad flat no lead package (QFN).
3. Dimension and tolerance formats conform to ASME Y14.4M-1994.
4. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012.

### PCB Mounting Pattern



#### 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: Class 1B  
Value:  $\geq 500$  V to  $< 1000$  V  
Test: Human Body Model (HBM)  
Standard: ESDA/JEDEC Standard JS-001-2012

ESD Rating: Class C3  
Value:  $\geq 1000$  V  
Test: Charged Device Model (CDM)  
Standard: JEDEC Standard JESD22-C101F

### MSL Rating

MSL Rating: Level 3  
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: Electrolytic plated Au over Ni

### 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<sub>15</sub>H<sub>12</sub>Br<sub>4</sub>O<sub>2</sub>) Free
- PFOS Free
- SVHC Free

## Contact Information

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**Email:** [sjcappliations.engineering@triquint.com](mailto:sjcappliations.engineering@triquint.com)

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