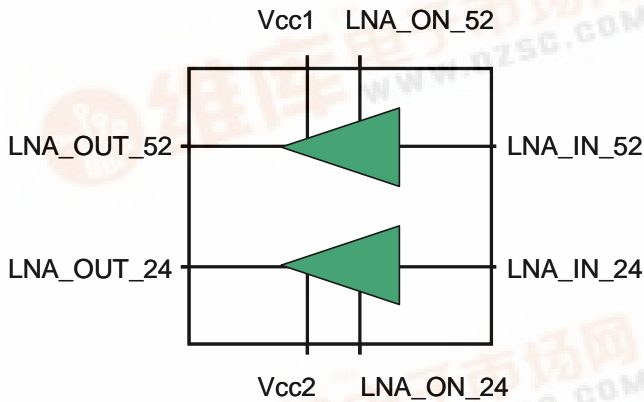


**802.11a/b/g Low Noise Amplifier Module**

**Functional Block Diagram**



**Product Description**

The TQM3M7001 is the first of TriQuint's Dualband WLAN Low Noise Amplifier's in an ultra small 3mm x 3mm footprint package for 802.11a/b/g applications. The architecture and interface are optimized for next generation dual-band WLAN transceivers requiring external LNA's. The LNA module features a single LNA supply voltage and a CMOS compatible LNA shutdown voltage to facilitate ease of use. With its low power dissipation in both frequency bands, the LNA Module contributes to the extended battery life of next generation WLAN solutions. The Low Noise amplifier is manufactured in TriQuint's high-reliability PHEMT technology and is assembled in an industry standard 3mm x 3mm x 0.9mm VQFN-12 Pb-Free package.

**Electrical Specifications**

Parameter	Min	typ	max	units
Frequency Range	2400	-	2500	MHz
Gain		16.5		dB
Noise Figure		1.2		dB
IIP3		6		dBm

Parameter	Min	typ	max	units
Frequency Range	4900	-	5950	MHz
Power Gain		22.5		dB
Noise Figure		1.5		dB
IIP3		1		dBm

**Features**

- Fully Integrated, Dualband Low Noise Amplifier Module for 802.11a/b/g WLAN Systems
- Internally Matched input/output
- No External Components Required
- Full World Band Frequency Operation
- Temperature Compensated Bias Network
- LNA Shutdown Control
- Single 3.3V supply
- Leadless 3.0 x 3.0 x 0.9 mm SMT Pb-Free Package

Test Conditions: Ta=25°C; Vcc=3.3V LNA\_ON=3.3V

Data Sheet: Subject to change without notice

For additional information and latest specifications, see our website: [www.triquint.com](http://www.triquint.com)

Revision C, October 18, 2005

## 802.11a/b/g Low Noise Amplifier Module

### Absolute Maximum Ratings

Parameter	Symbol	Value		Unit
		min	max	
Power Supply Voltage	$V_{cc1}, V_{cc2}$	0	6.0	V
DC Voltage at GND Ports	$V_{GND}$	-0.3	0.3	V
Power Dissipation	$P_{diss}$		0.2	W
Storage Temperature	$T_{STORAGE}$	-55	150	°C
Operating Temperature	$T_a$	-40	85	°C
Maximum Input Power (When LNA is ON) (When LNA is OFF)	$P_{I_{max\_ON}}$		0	dBm
	$P_{I_{max\_OFF}}$		5	dBm
DC on signal for 2.4GHz LNA	LNA_ON_24	-0.3	5	V
DC on signal for 5GHz LNA	LNA_ON_52	-0.3	5	V

### General Electrical Characteristics, 2.4GHz Band Low Noise Amplifier<sup>1</sup>

Parameter	min	typ	max	Unit
Frequency Range	2400	-	2500	Mhz
Gain	15	16.5	17.5	dB
Gain Variation vs. Temperature		-0.9 (25°C to 85°C) -0.4 (25°C to 55°C) +0.4 (25°C to -5°C)		dB
Gain Flatness (in any 50MHz band)		+/- 0.4		dB
Out of Band Rejection				
1.0GHz		20		dB
1.75GHz		9		dB
2.0GHz		4		dB
3.2GHz		5		dB
4.0GHz		12.5		dB
Gain Variation vs. Supply Voltage		+/- 0.3		dB
Noise Figure		1.2	1.45	dB
Noise Figure Variation vs. Temperature		0.45 (25°C to 85°C) 0.2 (25°C to 55°C) -0.2 (25°C to -5°C)		dB
Input Return Loss		15		dB
Output Return Loss		15		dB
Input P1dB		-8.5		dBm
Input IP3		6		dBm

<sup>1</sup> AC performance is guaranteed at the following conditions:  $T_a=25^\circ\text{C}$ ,  $f=2450\text{MHz}$ ,  $V_{cc1}=V_{cc2}=3.3\text{V}$ , LNA\_ON\_2.4=H, LNA\_ON\_52=L

## 802.11a/b/g Low Noise Amplifier Module

### General Electrical Characteristics – 5GHz Band Low Noise Amplifier<sup>2</sup>

Parameter	min	typ	max	Unit
Frequency Range	4900	-	5950	Mhz
Gain (at 5.2GHz)	21	22.5	23.5	dB
Gain Variation vs. Temperature		-1.7 (25°C to 85°C) -0.8 (25°C to 55°C) +0.8 (25°C to -5°C)		dB
Gain Flatness (in any 100MHz band)		+/- 0.4		dB
Out of Band Rejection				
3.7GHz		10		dB
7.5GHz		5		dB
Gain Variation vs. Supply Voltage		+/- 0.5		dB
Noise Figure		1.5	1.7	dB
Noise Figure vs. Temperature		0.55 (25°C to 85°C) 0.25 (25°C to 55°C) -0.25 (25°C to -5°C)		dB
Input Return Loss		10		dB
Output Return Loss		9		dB
Input P1dB		-10		dBm
Input IP3		1		dBm

<sup>2</sup> AC performance is guaranteed at the following conditions:  $T_a=25^\circ\text{C}$ ,  $f=5500\text{MHz}$ ,  $V_{cc1}=V_{cc2}=3.3\text{V}$ ,  $LNA\_ON\_2.4=L$ ,  $LNA\_ON\_52=H$

**802.11a/b/g Low Noise Amplifier Module**

*DC Electrical Performance – 2.4GHz Band Low Noise Amplifier*

Parameter	min	typ	max	Unit
V <sub>cc2</sub> Operating Voltage Supply Range	3.0	3.3	3.6	V
I <sub>cc2</sub> Total Supply Current (LNA_ON_24=H) <sup>3</sup>	9	11.5	17	mA
I <sub>cc2</sub> Total Supply Current (LNA_ON_24=L)			5	uA
LNA_ON_24 (H)	3.0	3.3	3.6	V
LNA_ON_24 (L)	-0.3	0	0.8	V
I <sub>LNA_ON_24</sub> (H)		0.4		mA

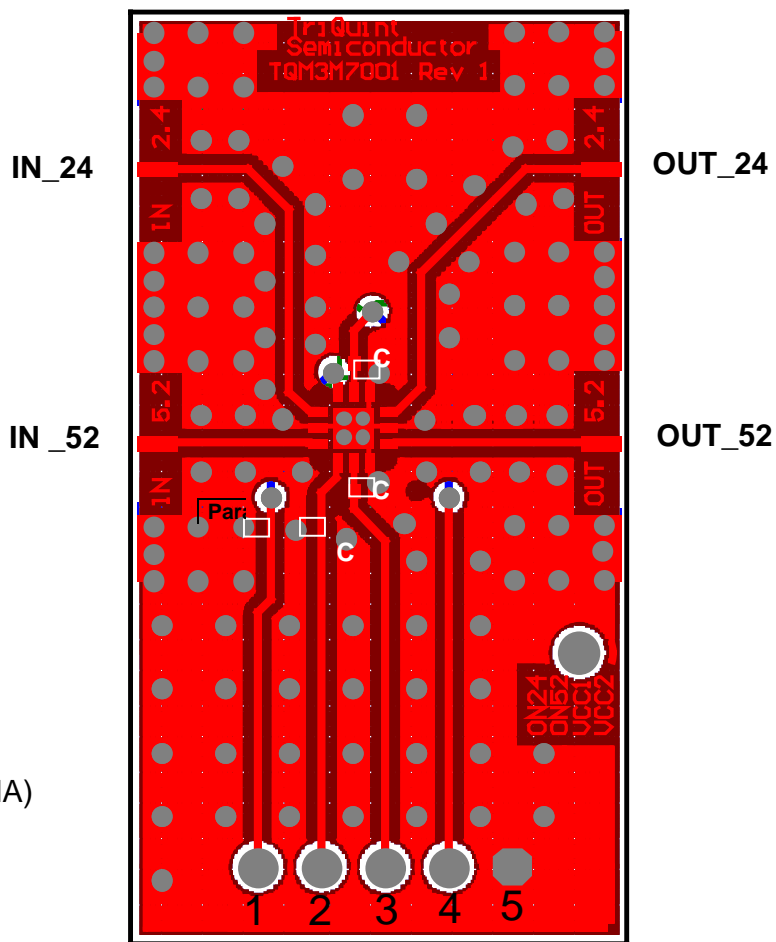
*DC Electrical Performance – 5GHz Band Low Noise Amplifier*

Parameter	min	typ	max	Unit
V <sub>cc1</sub> Operating Voltage Supply Range	3.0	3.3	3.6	V
I <sub>CC1</sub> Total Supply Current (LNA_ON_52=H) 3	16	18.5	25	mA
I <sub>CC1</sub> Total Supply Current (LNA_ON_52=L)			5	uA
LNA_ON_52 (H)	3	3.3	3.6	V
LNA_ON_52 (L)	-0.3	0	0.8	V
I <sub>LNA_ON_52</sub> (H)		0.6		mA

<sup>3</sup> Min and Max of total supply current is guaranteed at the following conditions: T<sub>a</sub>=25°C, V<sub>cc1</sub>= V<sub>cc2</sub>=3.3V,

**802.11a/b/g Low Noise Amplifier Module**

Layout and BOM of TQM3M7001 Evaluation board



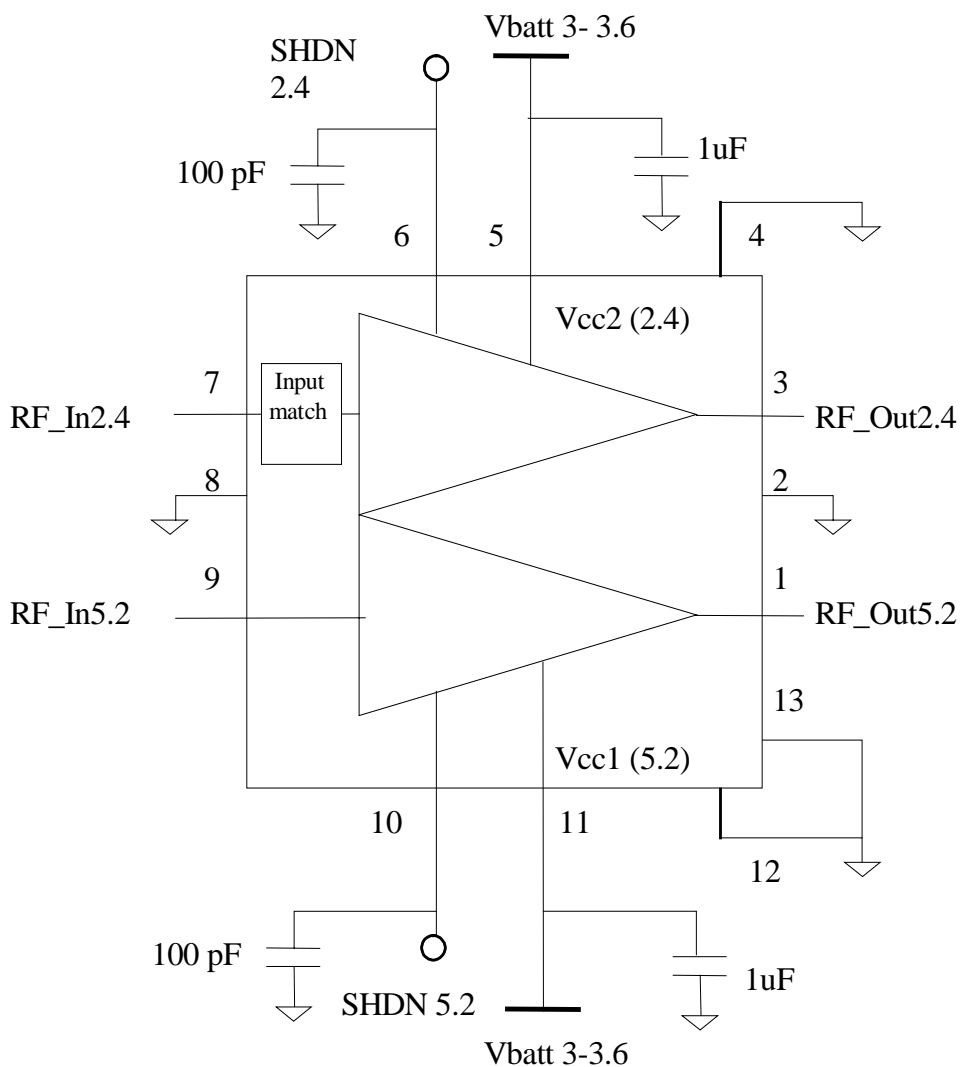
Pin 1: ON\_24  
 Pin 2: ON\_52  
 Pin 3: VCC1 (for 5 GHz LNA)  
 Pin 4: VCC2 (for 2.4 GHz LNA)

**BOM- TQM3M7001 Evaluation board**

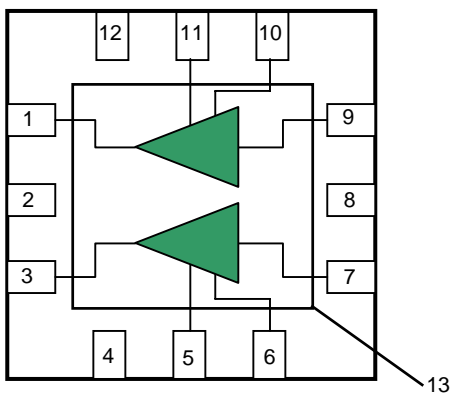
C1, C2 (on Vcc1 and Vcc2): 1uF bypass capacitor  
 C3, C4 (on ON\_24 and ON\_52): 100 pF bypass capacitor

**802.11a/b/g Low Noise Amplifier Module**

Schematic- TQM3M7001 Evaluation board



**802.11a/b/g Low Noise Amplifier Module**



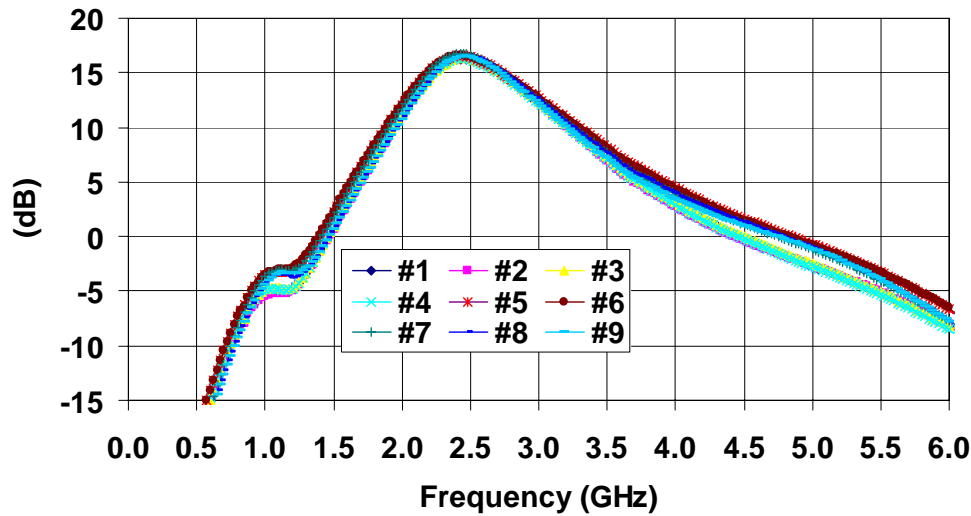
*Pin Assignments*

PIN	Symbol	Description
1	RF_OUT_52	RX output, 4.9-6GHz LNA
2	N/C	No Connect (Can be left open or grounded on board)
3	RF_OUT_24	RX output, 2.4GHz LNA
4	N/C	No Connect (Can be left open or grounded on board)
5	Vcc2	2.4GHz LNA Power Supply Voltage
6	LNA_ON_24	2.4GHz LNA Enable, Active High (H)
7	RF_IN_24	RX input, 2.4GHz LNA
8	N/C	No Connect (Can be left open or grounded on board)
9	RF_IN_52	RX input, 4.9-6GHz LNA
10	LNA_ON_52	4.9-6GHz LNA Enable, Active High (H)
11	Vcc1	4.9-6GHz LNA Power Supply Voltage
12	N/C	No Connect (Can be left open or grounded on board)
13	GND	Ground Paddle

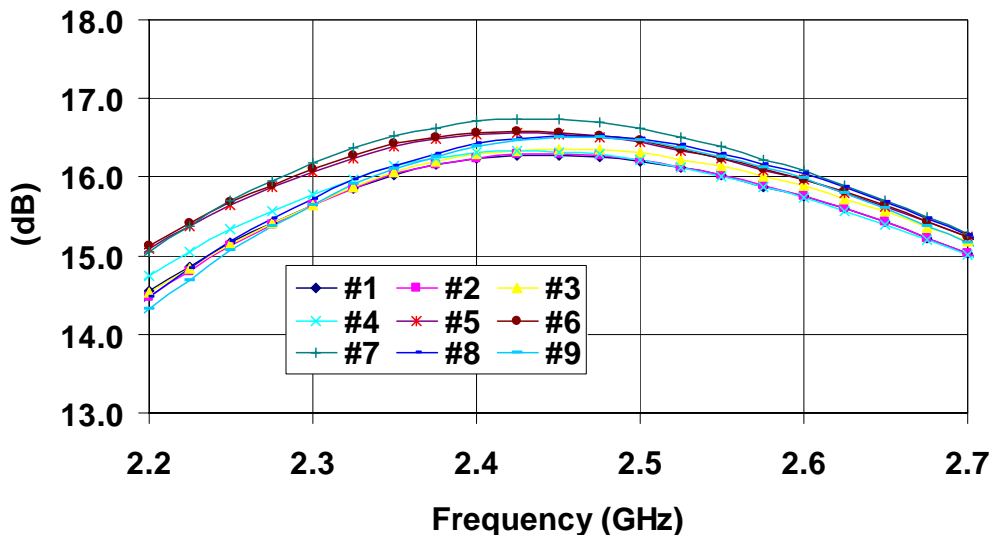
**802.11a/b/g Low Noise Amplifier Module**

*TQM3M7001 – Measured 2.4GHz Small Signal performance; in TriQuint Evaluation Board  
Measurement Conditions: Ta = 25°C, Vcc1=Vcc2=3.3V, LNA\_ON\_24=H, LNA\_ON\_52=L*

**2.4 GHz LNA Gain - Broadband (25C)**



**2.4 GHz LNA Gain (25C)**

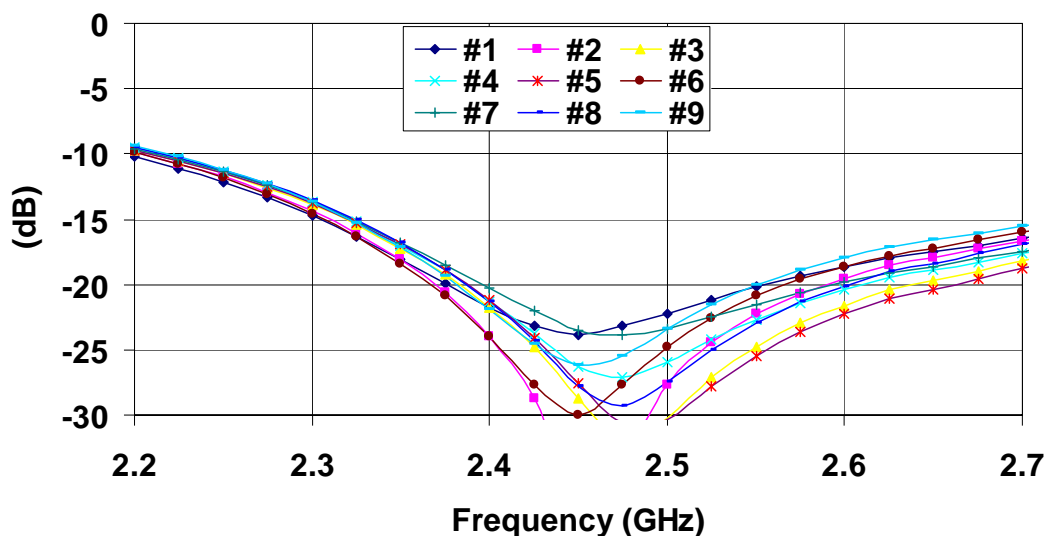




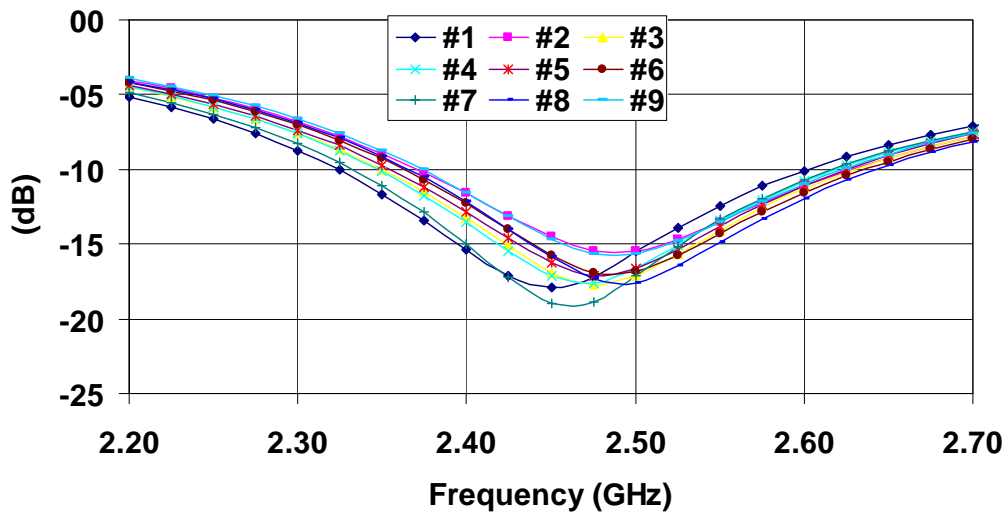
**802.11a/b/g Low Noise Amplifier Module**

*TQM3M7001 – Measured 2.4GHz Small Signal performance; in TriQuint Evaluation Board  
Measurement Conditions: Ta = 25°C, Vcc1=Vcc2=3.3V, LNA\_ON\_24=H, LNA\_ON\_52=L*

**2.4 GHz LNA Input Match (25C)**



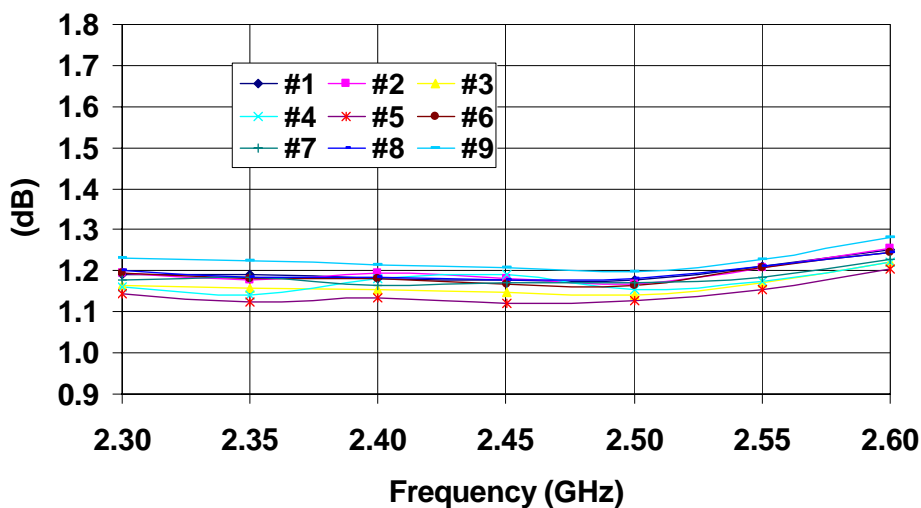
**2.4 GHz LNA Output Match (25C)**



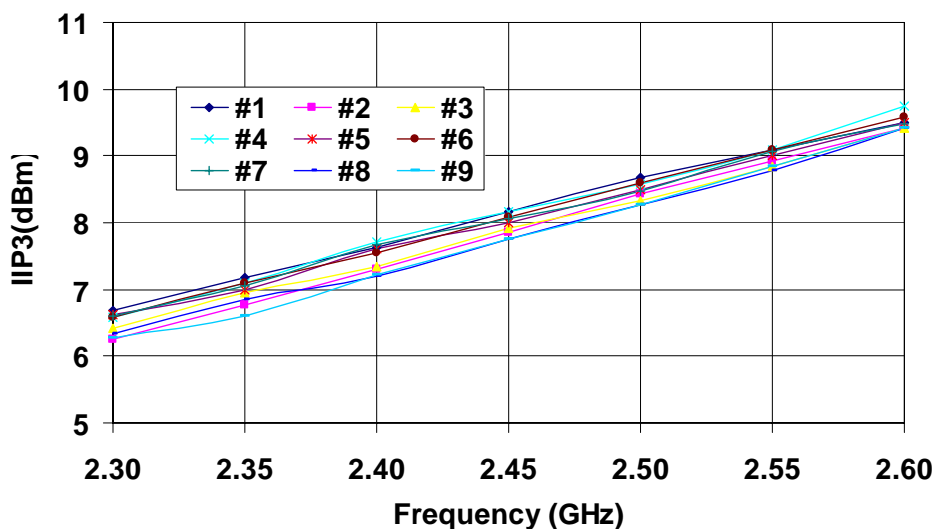
**802.11a/b/g Low Noise Amplifier Module**

TQM3M7001 – Measured 2.4GHz Small Signal performance; in TriQuint Evaluation Board  
Measurement Conditions:  $T_a = 25^\circ\text{C}$ ,  $V_{cc1}=V_{cc2}=3.3\text{V}$ , LNA\_ON\_24=H, LNA\_ON\_52=L

**2.4 GHz LNA NF (25C)**



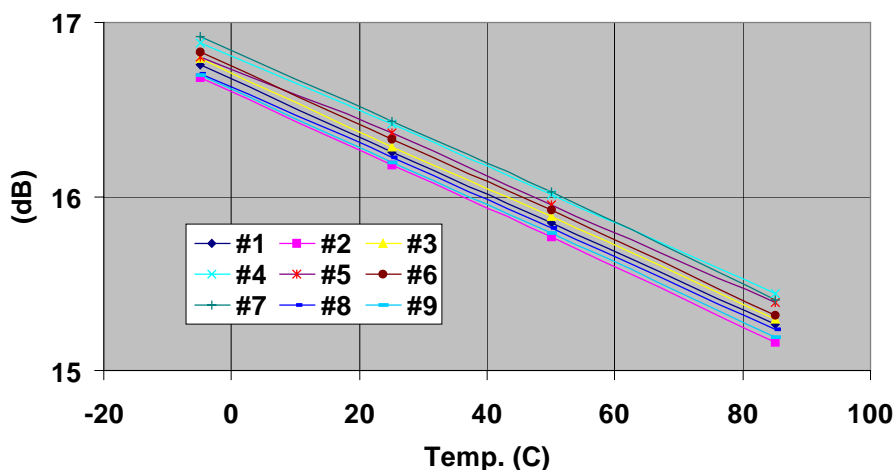
**2.4 GHz LNA IIP3 (25C)**



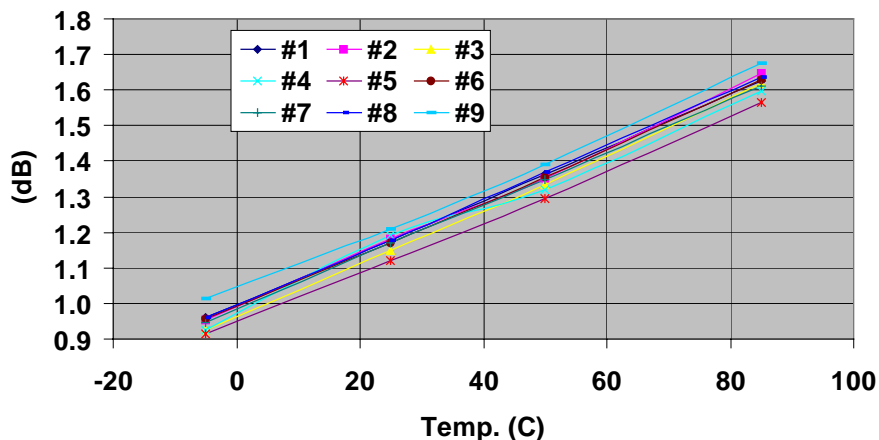
**802.11a/b/g Low Noise Amplifier Module**

TQM3M7001 – Measured 2.4GHz Small Signal performance; in TriQuint Evaluation Board  
Measurement Conditions: Vcc1=Vcc2=3.3V, LNA\_ON\_24=H, LNA\_ON\_52=L

**2.4 GHz LNA Gain Over Temp. at Volt=3.3 (2.45GHz)**



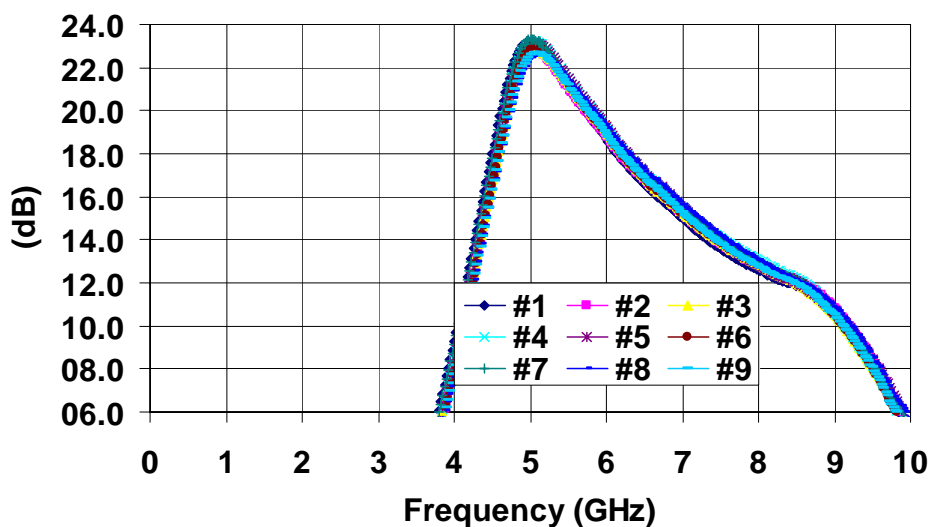
**2.4 GHz LNA NF Over Temp. at Volt=3.3 (2.45GHz)**



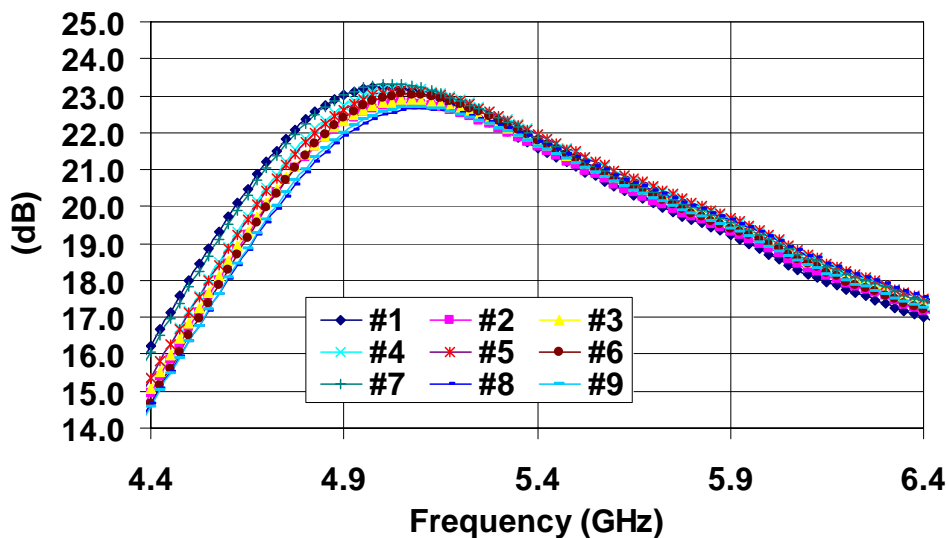
**802.11a/b/g Low Noise Amplifier Module**

*TQM3M7001 – Measured 5GHz Small Signal performance; in TriQuint Evaluation Board  
Measurement Conditions: Ta = 25°C, Vcc1=Vcc2=3.3V, LNA\_ON\_24=L, LNA\_ON\_52=H*

**5.2 GHz LNA Gain - Broadband (25C)**



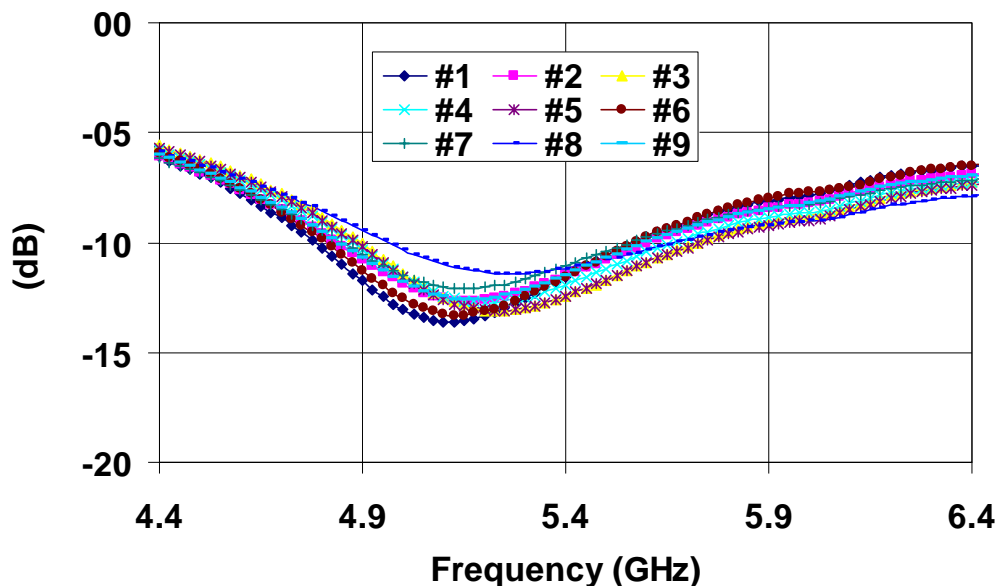
**5.2 GHz LNA Gain (25C)**



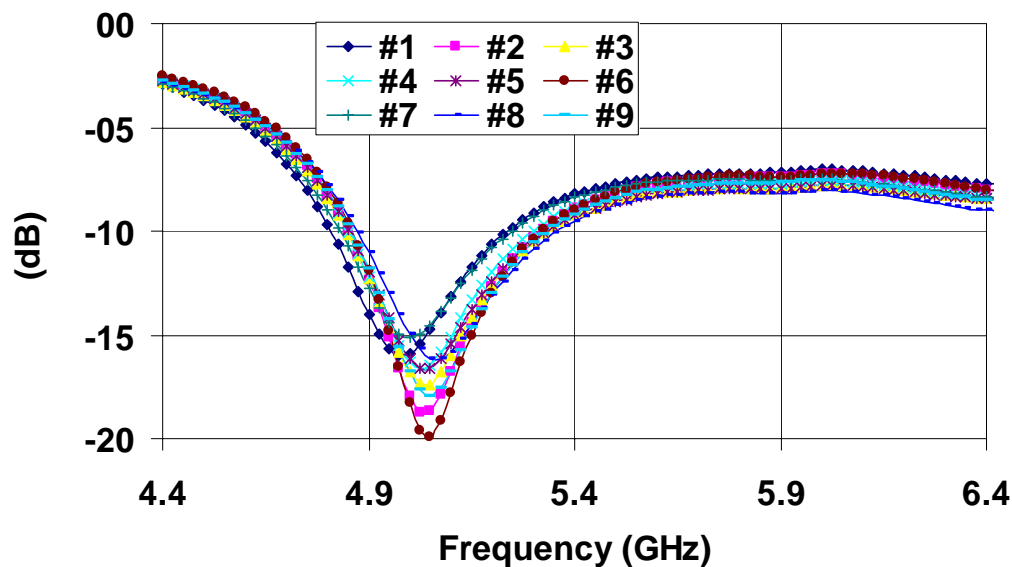
**802.11a/b/g Low Noise Amplifier Module**

*TQM3M7001 – Measured 5GHz Small Signal performance; in TriQuint Evaluation Board  
Measurement Conditions: Ta = 25°C, Vcc1=Vcc2=3.3V, LNA\_ON\_24=L, LNA\_ON\_52=H*

**5.2 GHz LNA Input Match (25C)**



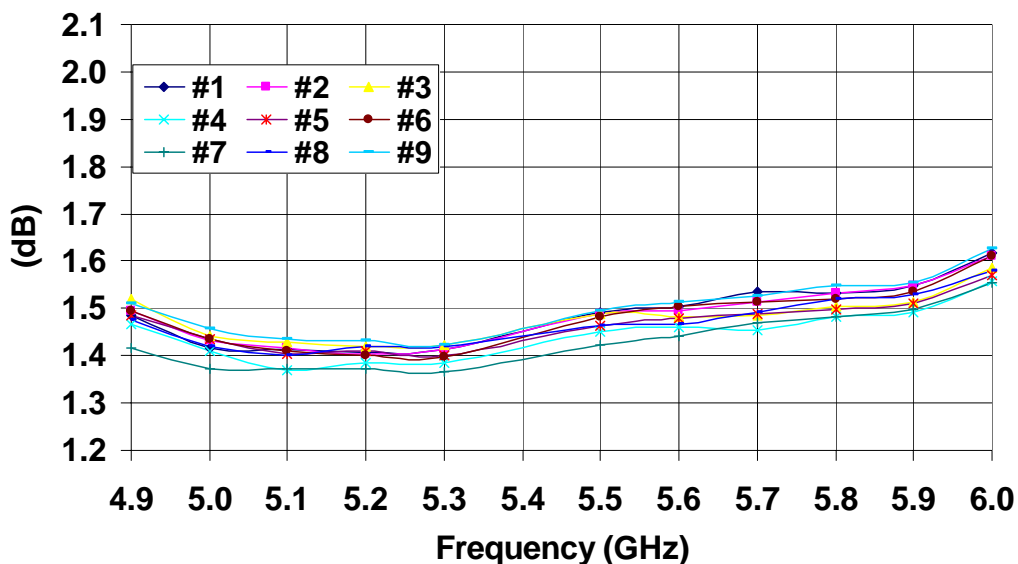
**5.2 GHz LNA Output Match (25C)**



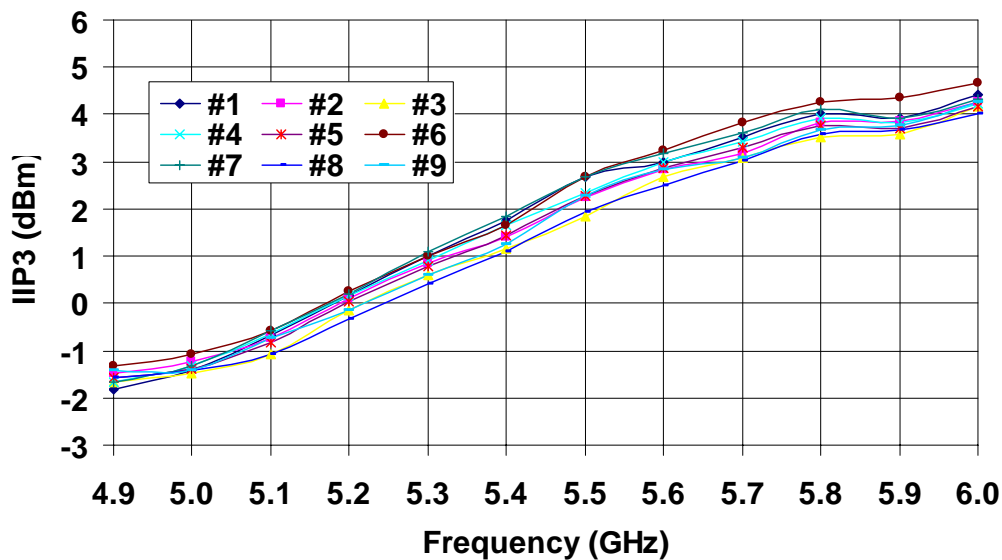
**802.11a/b/g Low Noise Amplifier Module**

*TQM3M7001 – Measured 5GHz Small Signal performance; in TriQuint Evaluation Board  
Measurement Conditions:  $T_a = 25^\circ\text{C}$ ,  $V_{cc1}=V_{cc2}=3.3\text{V}$ ,  $LNA\_ON\_24=L$ ,  $LNA\_ON\_52=H$*

**5.2 GHz LNA NF (25C)**



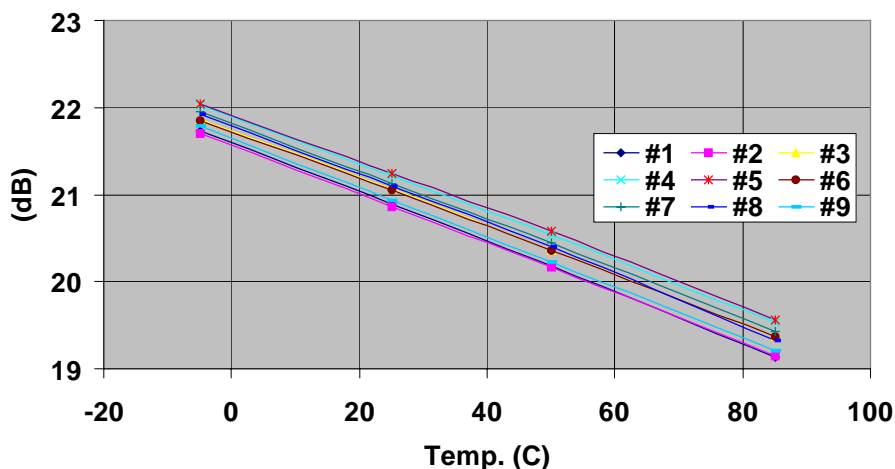
**5.2 GHz LNA IIP3 (25C)**



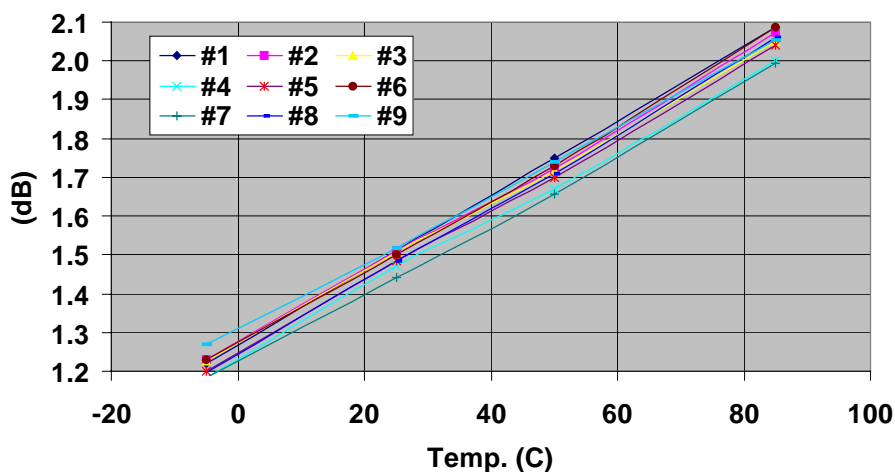
**802.11a/b/g Low Noise Amplifier Module**

TQM3M7001 – Measured 5GHz Small Signal performance; in TriQuint Evaluation Board  
Measurement Conditions: Vcc1=Vcc2=3.3V, LNA\_ON\_24=L, LNA\_ON\_52=H

**5.2 GHz LNA Gain Over Temp. at Volt=3.3 (5.5GHz)**

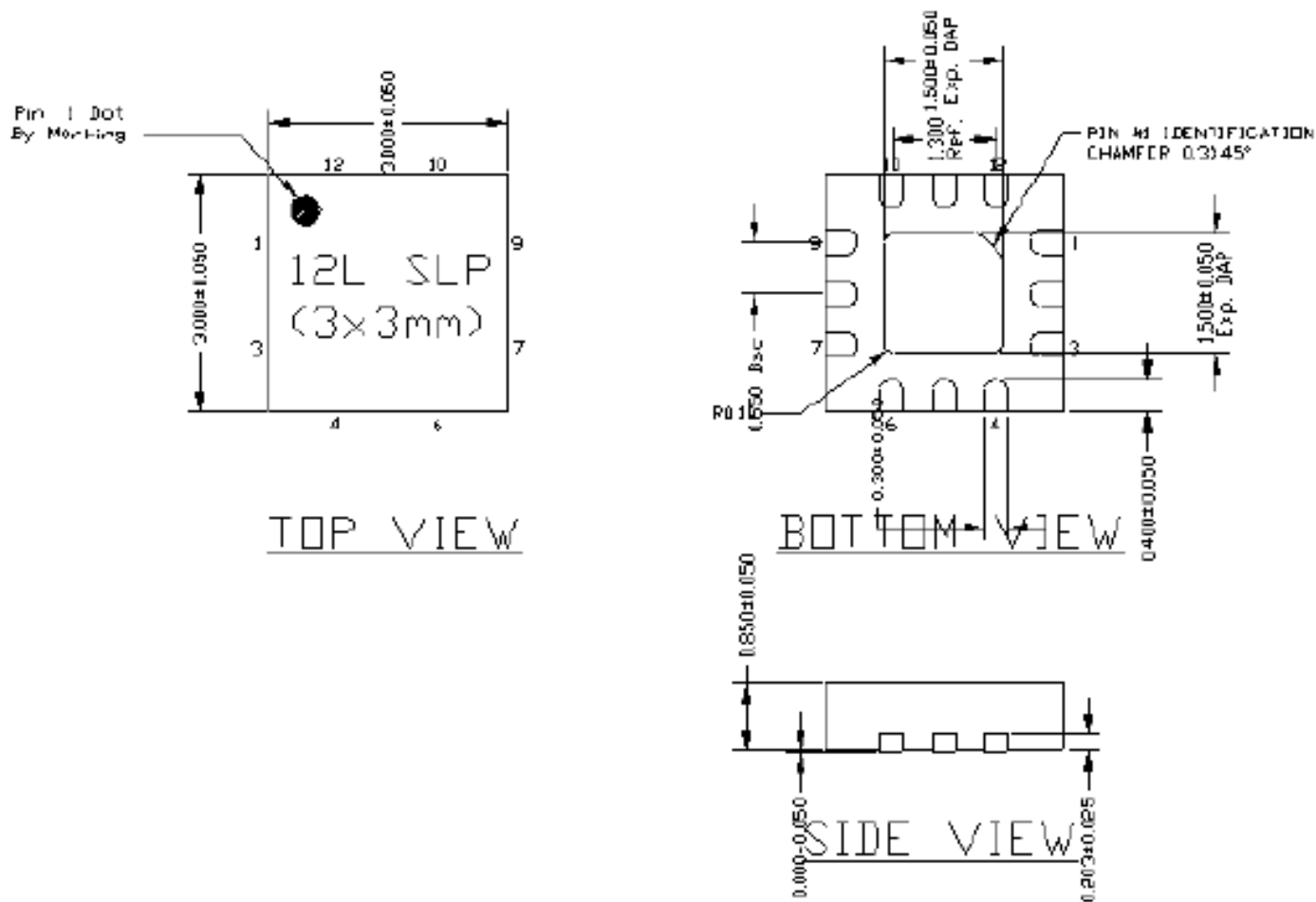


**5.2 GHz LNA NF Over Temp. at Volt=3.3 (5.5GHz)**

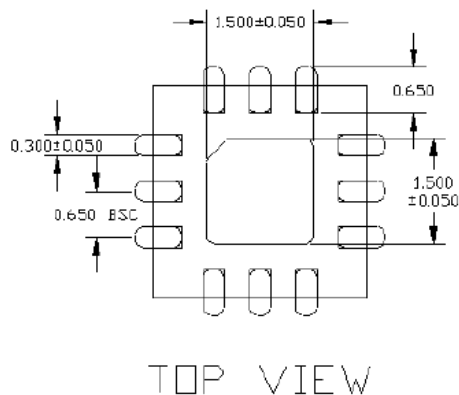


**802.11a/b/g Low Noise Amplifier Module**

*Package Outline*



*Recommended Land Pattern*





**802.11a/b/g Low Noise Amplifier Module**

*Package Marking*

Pin 1



Line 1: 3M71  
Line 2: XXXX TriQuint Assembly Lot Number  
Line 3: Manufacturing year and work week

**Ordering Information:**

Type	Marking	Package
<b>TQM3M7001</b>	<b>3M71</b>	<b>VQFN-12</b>

**Caution: Electrostatic discharge sensitive. Observe handling Precautions!**

1 For latest specifications, additional product information, worldwide sales and distribution locations, and information about TriQuint:

Web: [www.triquint.com](http://www.triquint.com)

Tel: (503) 615-9000

Email: [info\\_wireless@tqs.com](mailto:info_wireless@tqs.com)

Fax: (503) 615-8902

For technical questions and additional information on specific applications:

Email: [info\\_wireless@tqs.com](mailto:info_wireless@tqs.com)

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