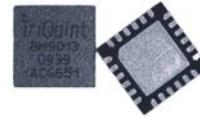


# AH315

## 3.3 – 3.8 GHz WiMAX 2W Driver Amplifier

### Applications

- 802.16 WiMAX infrastructure

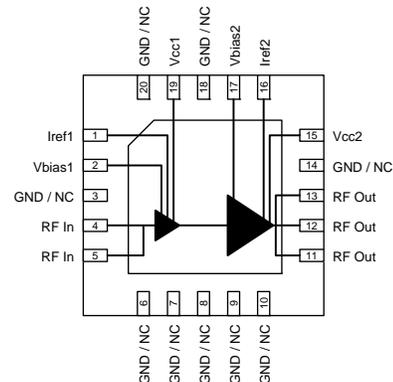


24-pin 5x5mm leadless QFN SMT package

### Product Features

- 3.3 – 3.8 GHz
- 25 dB Gain
- EVM <2.5 % @ 25 dBm Pout
- Internal Active Bias
- +5V Single Supply Voltage
- +33 dBm P1dB
- RoHS-compliant/Lead-free
- 5x5 mm QFN SMT package

### Functional Block Diagram



### General Description

The AH315 is a high dynamic range broadband driver amplifier in a surface mount package. The two-stage amplifier has 25 dB of gain, while achieving +25 dBm of linear output power for 3.3–3.8 GHz WiMAX/WiBro applications.

AH315 uses a high reliability +5V InGaP/GaAs HBT process technology. The device incorporates proprietary bias circuitry to compensate for variations in linearity and current draw over temperature. The device does not require any negative bias voltage; an internal active bias allows the AH315 to operate directly off a commonly used single +5V supply. The RoHS-compliant/Lead-free 5x5mm QFN package is surface mountable to allow for low manufacturing costs to the end user.

The AH315 is targeted for use in a configuration for the driver stage amplifier in 802.16 WiMAX base stations where high linearity and medium power is required.

### Pin Configuration

Pin No.	Function
1	Iref1
2	Vbias1
4, 5	RFIn
3, 6, 7, 8, 9, 10, 14, 18, 20	GND/NC
11, 12, 13	RFout
15	Vcc2
16	Iref2
17	Vbias2
19	Vcc1
Backside Paddle	GND

### Ordering Information

Part No.	Description
AH315-G	3.3 – 3.8 GHz WiMAX 2W Driver Amp
AH315-PCB	3.4 – 3.6 GHz Evaluation Board

Standard T/R size = 1000 pieces on a 7" reel.

# AH315

## 3.3 – 3.8 GHz WiMAX 2W Driver Amplifier

### Specifications

#### Absolute Maximum Ratings

Parameter	Rating
Storage Temperature	-55 to +125 °C
RF Input Power, CW, 50Ω, T = 25°C	+19 dBm
Device Voltage, V <sub>cc</sub> , V <sub>bias</sub>	+8 V
Collector Current, I <sub>cc</sub> (I <sub>cc1</sub> + I <sub>cc2</sub> )	1600 mA
I <sub>ref 1</sub>	100 mA
I <sub>ref 2</sub>	50 mA
Device Power	8 W
Thermal Resistance R <sub>TH</sub>	14.4 °C/W

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	+6	V
I <sub>cc</sub> @ 24 dBm		700		mA
T <sub>J</sub> (for >10 <sup>6</sup> hours MTTF)			+200	°C
Operating Temp. Range	-40		+85	°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: 25°C, +5V V<sub>supply</sub>, 3.4 – 3.6 GHz, in tuned application circuit.

Parameter	Conditions	Min	Typical	Max	Units
Operational Frequency Range		3.3		3.8	GHz
Test Frequency			3.5		GHz
Power Gain			25		dB
Input Return Loss			-15.2		dB
Output Return Loss			-11.3		dB
EVM	See Note 1.		2.3	2.5	%
Efficiency			8		%
Output P1dB			+33		dBm
Noise Figure			7.3		dB
Device Voltage, V <sub>cc</sub>			+5		V
I <sub>ref 1</sub>			27		mA
I <sub>ref 2</sub>			10		mA
Quiescent Current, I <sub>q</sub>	See Note 2.		600		mA

Notes:

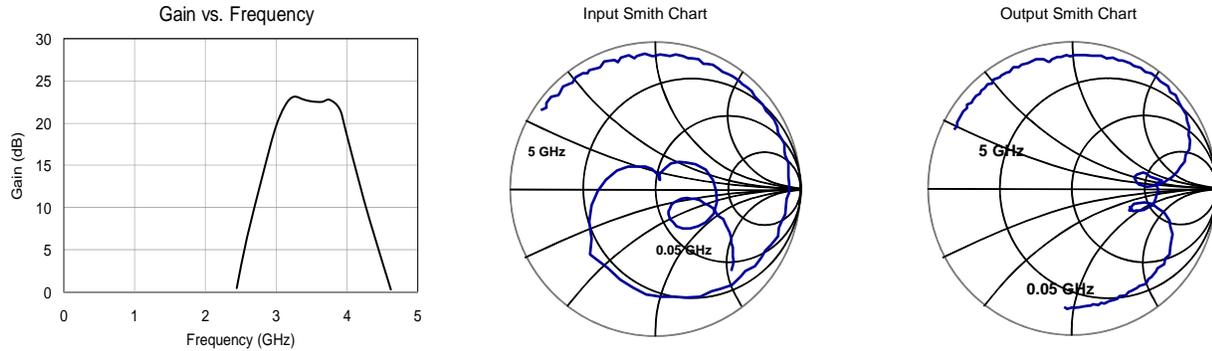
- Using an 802.16-2004 OFDMA, 64QAM-1/2, 1024-FFT, 20 symbols, 30 subchannels.
- This corresponds to the quiescent current or operating current under small-signal conditions with bias resistor R1=70Ω off pin 1 and R2=150Ω off pin 16.

# AH315

## 3.3 – 3.8 GHz WiMAX 2W Driver Amplifier

### Device Characterization Data

$V_{CC} = +5\text{ V}$ ,  $I_{CQ} = 600\text{ mA}$ ,  $T = 25\text{ }^{\circ}\text{C}$ , unmatched 50 ohm system, calibrated to device leads



#### Notes:

The gain for the unmatched device in 50ohm system is shown as the trace in blue color. The impedance plots are shown from 0-5 GHz, with markers placed at 0.05 and 5 GHz.

### S-Parameter Data

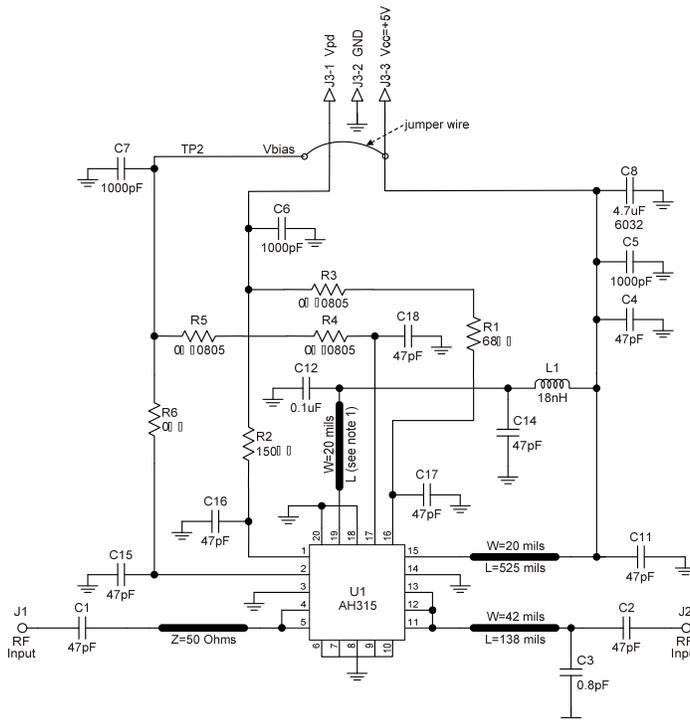
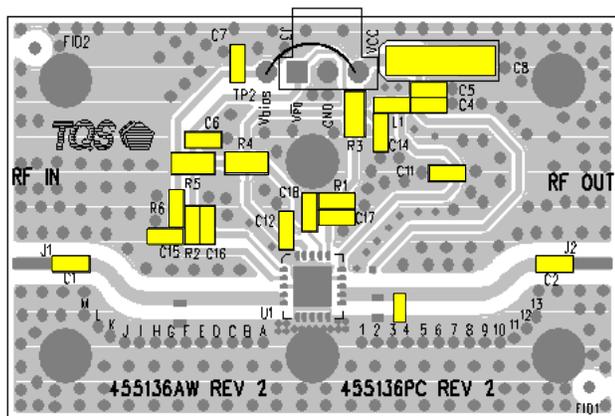
$V_{CC} = +5\text{ V}$ ,  $I_{CQ} = 600\text{ mA}$ ,  $T = 25\text{ }^{\circ}\text{C}$ , unmatched 50 ohm system, calibrated to device leads

Freq (MHz)	S11 (dB)	S11 (ang)	S21 (dB)	S21 (ang)	S12 (dB)	S12 (angle)	S22 (dB)	S22 (ang)
3200	-7.15	-47.75	24.62	-121.57	-46.71	81.59	-4.82	65.17
3250	-8.30	-67.91	25.04	-142.33	-45.76	65.79	-4.33	64.24
3300	-9.03	-85.52	25.23	-161.71	-45.35	52.08	-4.13	63.23
3350	-10.02	-100.73	25.25	179.97	-45.27	38.15	-4.18	62.35
3400	-10.60	-114.25	25.16	163.19	-45.49	25.90	-4.38	62.37
3450	-11.13	-121.9	25.05	147.33	-45.94	14.60	-4.68	63.12
3500	-11.83	-128.99	24.95	132.15	-46.35	3.68	-5.00	64.61
3550	-12.06	-133.37	24.84	117.52	-46.84	-6.51	-5.32	66.87
3600	-12.42	-133.94	24.79	103.11	-47.68	-18.83	-5.62	69.29
3650	-12.56	-134.22	24.71	89.24	-48.26	-29.21	-5.84	72.04
3700	-12.37	-132.5	24.67	75.18	-49.27	-43.37	-6.05	74.47
3750	-11.85	-131.84	24.70	61.44	-50.2	-58.07	-6.24	76.46
3800	-10.99	-131.88	24.73	47.15	-51.31	-77.27	-6.49	77.95
3850	-10.10	-134.27	24.90	32.58	-51.77	-99.53	-6.82	78.63
3900	-9.19	-139.24	25.02	17.14	-52.57	-125.81	-7.38	79.17
3950	-8.41	-146.73	25.29	0.702	-51.90	-156.29	-8.19	80.03
4000	-7.90	-157.43	25.43	-17.44	-50.26	173.75	-9.28	83.45

# AH315

## 3.3 – 3.8 GHz WiMAX 2W Driver Amplifier

### 3.4 – 3.6 GHz Application Circuit (AH315-PCB)



#### Notes:

1. C12 to be placed as close as possible to the device.
2. C11 = 47 pF is critical. Do Not Replace with other value.
3. Place C19 between marking 3 and 4.
4. See PC Board Layout on page 8 for more details.

### Bill of Material

Ref Des	Value	Description	Manufacturer	Part Number
U1		WiMax 2W Driver Amplifier	TriQuint	AH315-G
C1, C2, C4, C11, C15, C16, C17, C18	47 pF	Cap, Chip, 0805, 2%, 50V	various	
C3	0.8 Pf	Cap, Chip, 0603, ± 0.05 pF, 50V, Accu-P	AVX	06035J0R8ABTTR
C5, C6, C7	1000 pF	Cap, Chip, 0603, 5%, 50V, NPO-COG	various	
C8	4.7 uF	Cap, Chip, 6032, 20%, 35V, TANT	various	
C12	0.1 uF	Cap, Chip, 0805, 5%, 25V, X7R	various	
L1	18 nH	Ind, Chip, 0603, 5%, multilayer	TOKO	LL1608-FSL18NJ
R1	68	Res, Chip, 0603, 5%, 1/16W	various	
R2	150	Res, Chip, 0603, 5%, 1/16W	various	
R3, R4, R5	0	Res, Chip, 0805, 1/10W	various	
R6	0	Res, Chip, 0603, 5%, 1/16W	various	

# AH315

## 3.3 – 3.8 GHz WiMAX 2W Driver Amplifier

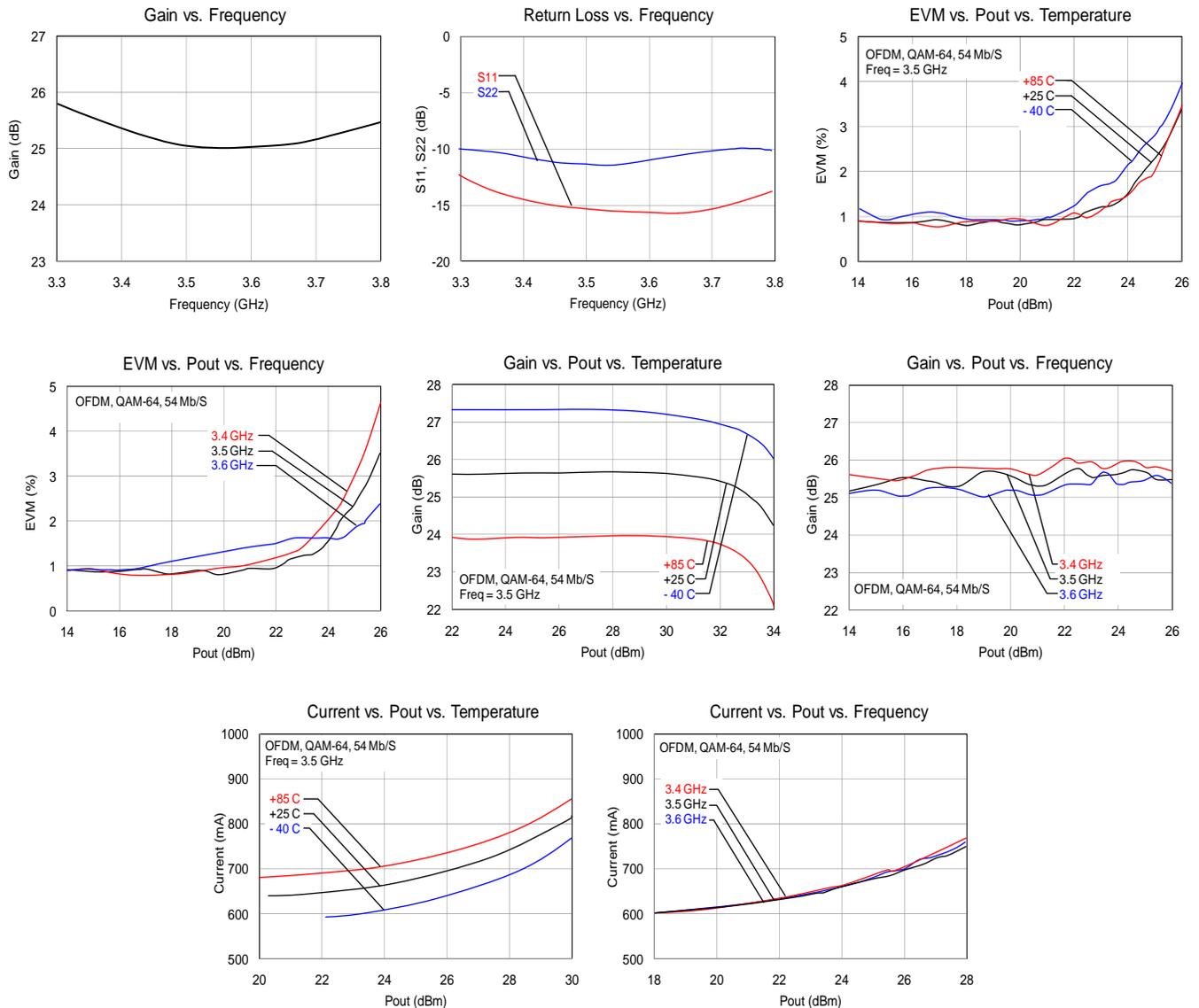


### Typical Performance 3.4 – 3.6 GHz

Test conditions unless otherwise noted:  $V_{pd}$ ,  $V_{bias}$ ,  $V_{cc} = 5V$ ,  $I_{CQ} = 700\text{ mA}$ ,  $+25\text{ }^{\circ}\text{C}$

Frequency	MHz	3.4	3.5	3.6
Gain	dB	25.4	25	25
Input Return Loss	dB	14	15.2	15
Output Return Loss	dB	10	11.3	10
Noise Figure	dB		7.3	
Output P1dB	dBm		+33	
EVM @ 25 dBm Pout (1)	%		2.3	

Note: 1. Using an 802.16-2004 OFDMA, 64QAM-1/2, 1024-FFT, 20 symbols, 30 subchannels.



# AH315

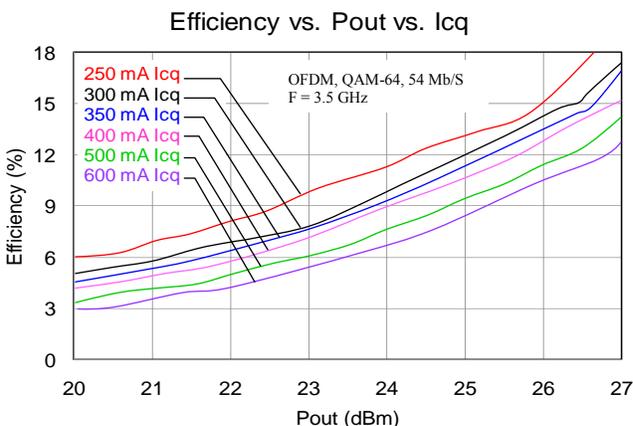
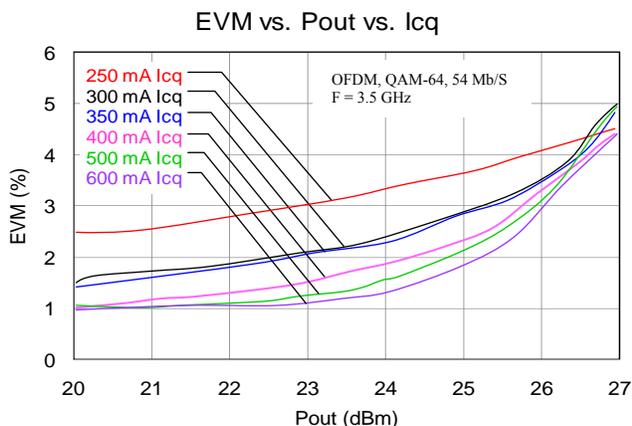
## 3.3 – 3.8 GHz WiMAX 2W Driver Amplifier



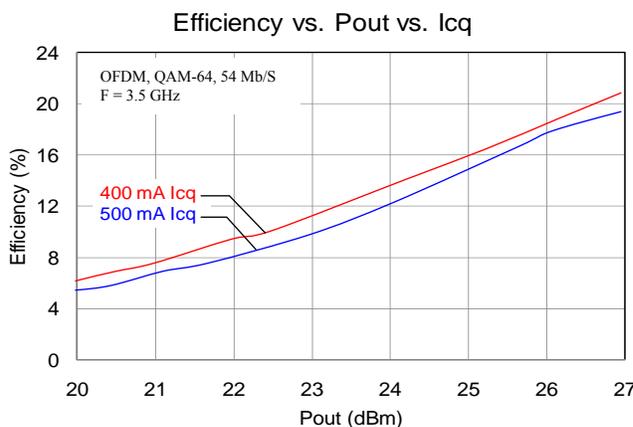
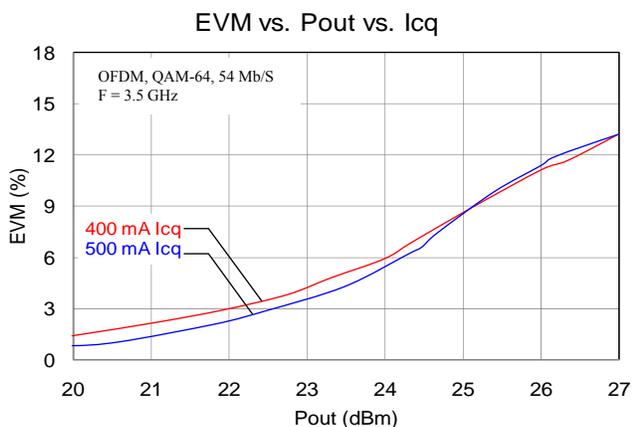
### 3.3 – 3.7 GHz Applications Note: Changing $I_{cq}$ Biasing Configurations at +5V

The AH315 can be configured to operate with lower bias current by varying the bias-adjust resistors R1 & R2. The recommended circuit configurations shown previously in this datasheet have the device operating with a 600 mA as the quiescent current ( $I_{cq}$ ). This biasing level represents a tradeoff in terms of EVM and efficiency. Lowering  $I_{cq}$  will improve upon the efficiency of the device, but degrade the EVM performance. Measured data shown in the plots below represents the AH315 measured and configured for 3.5 GHz applications. It is expected that variation of the bias current for other frequency applications will produce similar performance results.

R1 (ohms)	R2 (ohms)	$I_{cq}$ (mA)	Vbias (V)
68	150	600	+5
80	180	500	+5
101	300	400	+5
133	230	350	+5
167	230	300	+5
177	546	250	+5



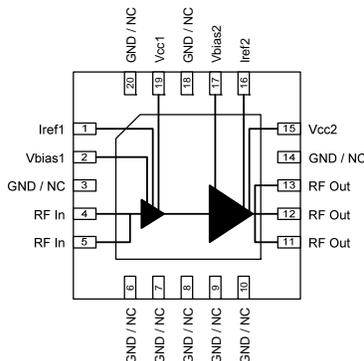
### 3.3 – 3.7 GHz Applications Note: Changing $I_{cq}$ Biasing Configurations at +3.3V



# AH315

## 3.3 – 3.8 GHz WiMAX 2W Driver Amplifier

### Pin Description



Pin	Symbol	Description
1	Iref 1	Reference current into internal active bias current mirror. Current into Iref sets device quiescent current. Also, can be used as on/off control. (for amp 1)
2	Vbias1	Voltage supply for active bias for amp 1. Connect to same supply voltage as Vcc1.
4, 5	RFin	RF Input
3, 6, 7, 8, 9, 10, 14, 18, 20	GND/NC	No internal connection. This pin can be grounded or N/C on PCB. Land pads should be provided for PCB mounting integrity.
11, 12, 13	RFout	RF Output
15	Vcc2	Supply Voltage for Amp2
16	Iref 2	Reference current into internal active bias current mirror. Current into Iref sets device quiescent current. Also, can be used as on/off control. (for amp 2)
17	Vbias2	Voltage supply for active bias for amp 2. Connect to same supply voltage as Vcc2.
19	Vcc1	Supply Voltage for Amp1
Backside Paddle	GND	RF/DC Ground. Ensure good solder attach for best thermal and electrical performance.

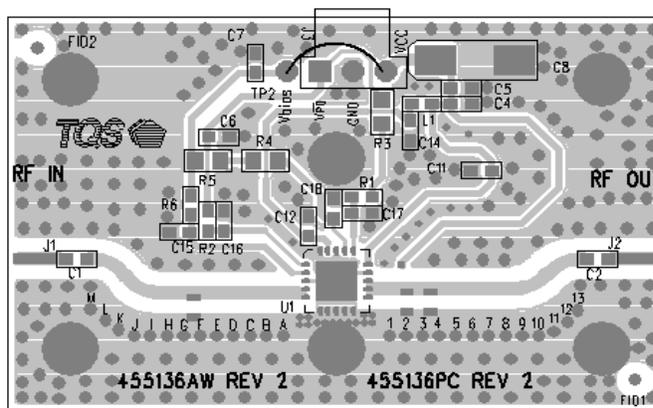
### Applications Information

#### PC Board Layout

PCB Material: 0.0147" Rogers Ultralam 2000, single layer, 1 oz Cu,  $\epsilon_r = 2.45$  Microstrip line details: width = .042", spacing = .050".

The silkscreen markers 'A', 'B', 'C', etc. and '1', '2', '3', etc. are used as place markers for critical tuning components

The pad pattern shown has been developed and tested for optimized assembly at TriQuint Semiconductor. The PCB land pattern has been developed to accommodate lead and package tolerances. Since surface mount processes vary from company to company, careful process development is recommended.



For further technical information, Refer to [http://www.triquint.com/prodserve/more\\_info/default.aspx?prod\\_id=AH315](http://www.triquint.com/prodserve/more_info/default.aspx?prod_id=AH315)

# AH315

## 3.3 – 3.8 GHz WiMAX 2W Driver Amplifier

### Mechanical Information

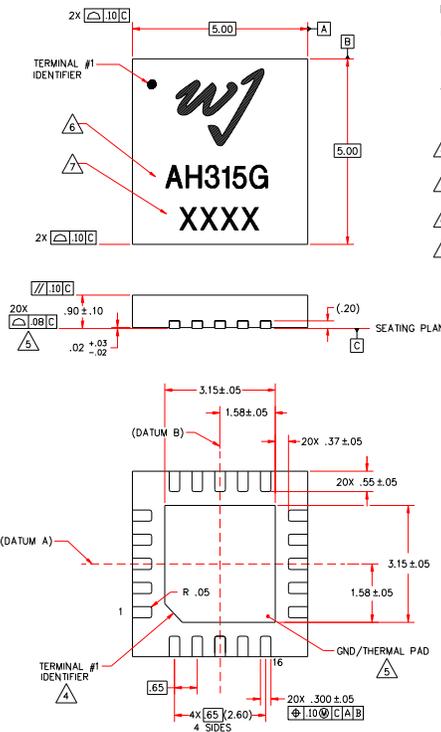
#### Package Information and Dimensions

Lead-free/Green/RoHS-compliant.

Package pin plating - Annealed matte tin over copper.

Compatible with lead-free ( $T_{max}=260^{\circ}\text{C}$ ) and lead ( $T_{max}=245^{\circ}\text{C}$ ) soldering processes.

The AH315-G will be marked with an “AH315G” designator on the top surface of the package. An alphanumeric lot code (“XXXX”) is also marked below the part designator.



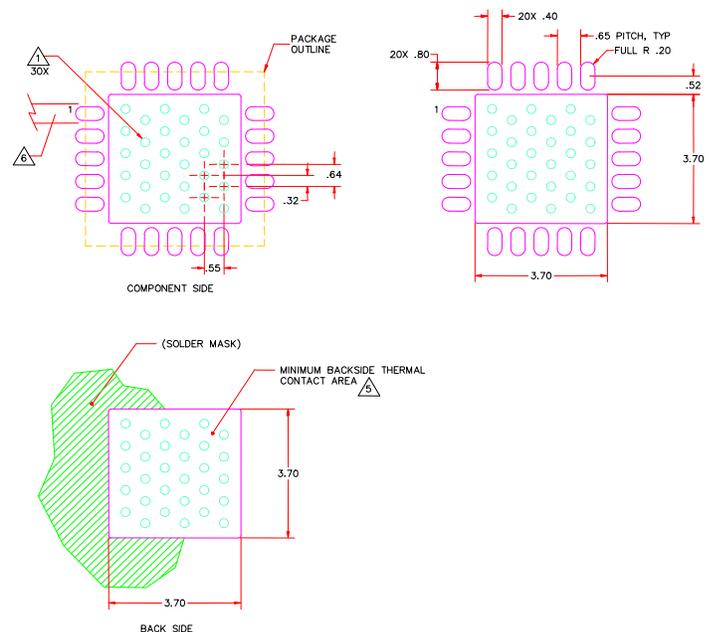
#### NOTES:

- EXCEPT WHERE NOTED, THIS PART OUTLINE CONFORMS TO JEDEC STANDARD MO-220, ISSUE E (VARIATION VWHC) FOR THERMALLY ENHANCED PLASTIC VERY THIN FINE PITCH QUAD FLAT NO LEAD PACKAGE (QFN).
- DIMENSIONING & TOLERANCING CONFORM TO ASME Y14.4M-1994.
- ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
- THE TERMINAL #1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION CONFORM TO JEDEC 95-1 SPP-012.
- COPLANARITY APPLIES TO THE EXPOSED GROUND/THERMAL PAD AS WELL AS THE TERMINALS.
- PART NUMBER
- ALPHA-NUMERIC LOT CODE.

#### Mounting Configuration

Notes:

- All dimensions are in millimeters (inches). Angles are in degrees
- Ground/Thermal vias are critical for the proper performance of this device. Vias should be .35mm (#80/.135”) diameter drill and have a final plated thru diameter of .25mm (.010”).
- Add as much copper as possible to inner and outer layers near the part to ensure optimal thermal performance.
- To ensure reliable operation, device ground paddle-to-ground pad solder joint is critical
- Add mounting screws near the part to fasten board to a heat sink. Ensure that the ground/thermal via region contacts the heat sink
- Do not put solder mask on the backside of the PC Board in the region where the board contacts the heat sink.
- RF trace width depends upon the PC board construction and material
- Use 1oz copper minimum



### Product Compliance Information

#### ESD Information



#### Caution! ESD-Sensitive Device

ESD Rating: Class 1B  
Value: Passes between 500 and 1000V  
Test: Human Body Model (HBM)  
Standard: JEDEC Standard JESD22-A114

ESD Rating: Class IV  
Value: Passes between 1000V and 2000V  
Test: Charged Device Model (CDM)  
Standard: JEDEC Standard JESD22-A114

#### Solderability

Compatible with the latest version of J-STD-020, Lead free solder, 260°

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

#### MSL Rating

Level 2 at +260 °C convection reflow  
JEDEC standard J-STD-020.

### Contact Information

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

**Web:** [www.triquint.com](http://www.triquint.com)  
**Email:** [info-sales@tqs.com](mailto:info-sales@tqs.com)

**Tel:** +1.503.615.9000  
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For technical questions and application information:

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

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