

AH314

2.3-2.9 GHz 2W 5V Linear Driver Amplifier

Applications

- WCDMA / WiMAX / WiBro / WiFi / LTE
- Wireless infrastructure

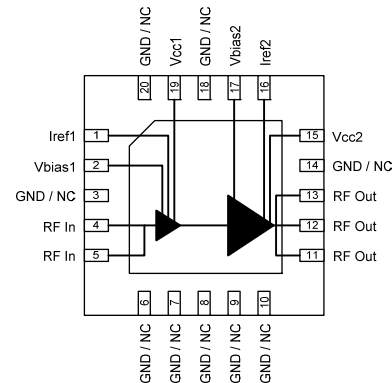


24-pin 5x5mm leadless QFN SMT package

Product Features

- 2.3 – 2.9 GHz
- 23 dB Gain
- EVM <2.5 % @ 25 dBm Pout
- <0.2 dB Gain Flatness Across 200 MHz BW
- +33dBm P1dB
- Internal Active Bias
- +5V Single Supply Voltage
- Lead-free/RoHS-compliant 5x5 mm QFN Package

Functional Block Diagram



General Description

The AH314 is a high dynamic range broadband driver amplifier in a surface mount package. The two-stage amplifier has 23 dB of gain, while achieving +25 dBm of linear output power for 2.3–2.9 GHz applications.

AH314 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. An internal active bias allows the AH314 to operate directly off a commonly available +5V supply. The RoHS-compliant/lead-free 5x5mm QFN package is surface mountable to allow for low manufacturing costs to the end user. The AH314 is also package and pin compatible with the 3.3-3.8 GHz AH315 and the 0.7-2.7 GHz AH323.

The AH314 is targeted for use in a configuration for the driver stage amplifier in next generation base stations where high linearity and medium power is required.

Pin Configuration

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

Ordering Information

Part No.	Description
AH314-G	2.3-2.9 GHz 2W 5V Linear Driver Amplifier
AH314-PCB	2.5-2.7 GHz Evaluation Board

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

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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 _{cc} , V _{bias}	+8 V
Collector Current, I _{cc} (I _{cc1} + I _{cc2})	1600 mA
I _{ref 1}	100 mA
I _{ref 2}	50 mA
Device Power	8 W
Thermal Resistance R _{TH}	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 _{cc}	+4.75	+5	+6	V
I _{cc}		600		mA
T _J (for >10 ⁶ 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_{supply}, 2.6 GHz, in tuned application circuit.

Parameter	Conditions	Min	Typical	Max	Units
Operational Frequency Range		2.3		2.9	GHz
Test Frequency			2.6		GHz
Power Gain		20.5	23		dB
Input Return Loss			8.2		dB
Output Return Loss			16.7		dB
EVM @ 24 dBm	See Note 1.		2.0	2.5	%
Efficiency @ 24 dBm			6.6		%
Output P _{1dB}			+33		dBm
OIP ₃ (@ 18 dBm/Tone, , Δf = 1 MHz)			+42		dBm
Noise Figure			6.4		dB
Device Voltage, V _{cc}			+5		V
I _{ref 1}			24		mA
I _{ref 2}			10		mA
Quiescent Current, I _q	See Note 2.	550	600	650	mA

Notes:

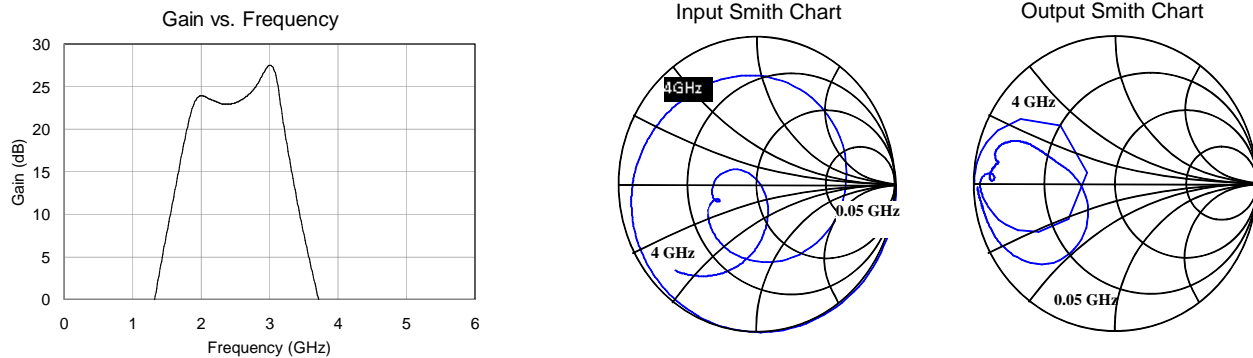
- Using an 802.16-2004 OFDMA, 64QAM-1/2, 1024-FFT, 20 symbols, 30 subchannels.
- This corresponds to the quiescent current or operating current under small-signal conditions with bias resistor R1=68Ω off pin 1 and R2=150Ω off pin 16.

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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 – 4 GHz with markers placed at 0.05 GHz and 4 GHz.

S-Parameter Data

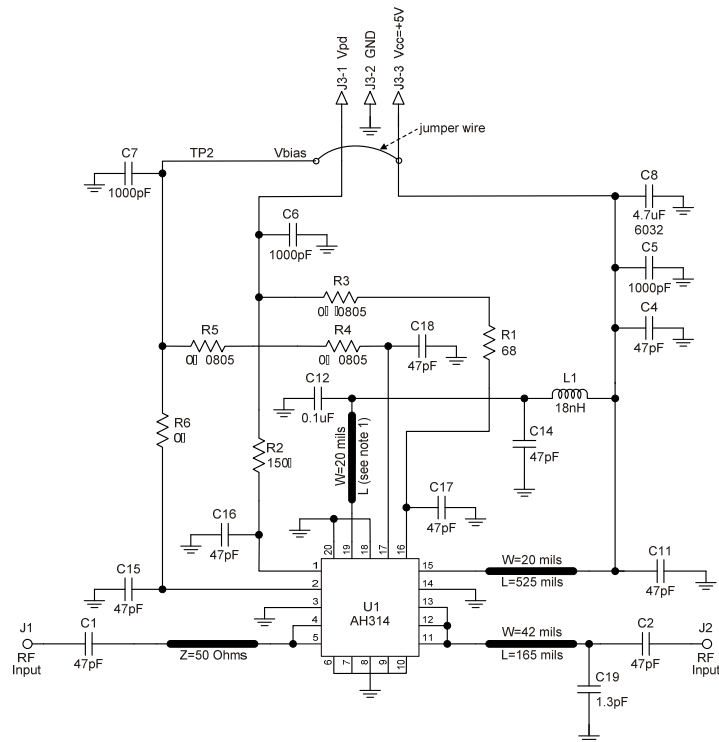
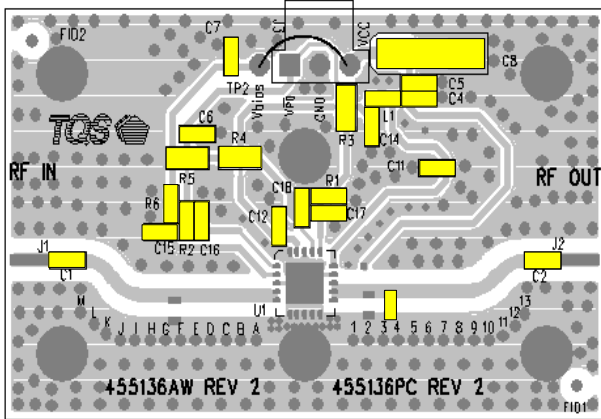
$V_{CC} = +5\text{ V}$, $I_{CQ} = 600\text{ mA}$, $T = 25\text{ }^{\circ}\text{C}$, unmatched 50 ohm system, calibrated to device leads

Freq (MHz)	S11 (dB)	S11 (ang)	S21 (dB)	S21 (ang)	S12 (dB)	S12 (angle)	S22 (dB)	S22 (ang)
2200	-6.45	-120.54	23.31	-145.39	-48.04	60.39	-2.33	157.17
2250	-6.78	-130.36	23.13	-158.46	-47.97	52.65	-2.65	156.54
2300	-7.13	-138.36	22.99	-170.95	-48.01	45.37	-2.98	156.14
2350	-7.45	-144.94	22.95	177.21	-48.10	38.67	-3.31	155.90
2400	-7.81	-150.37	22.95	165.61	-48.27	31.91	-3.65	155.85
2450	-8.23	-154.71	23.00	154.08	-48.56	24.85	-4.01	155.98
2500	-8.68	-158.06	23.09	142.57	-48.96	17.33	-4.39	156.31
2550	-9.18	-160.55	23.28	131.04	-49.41	8.81	-4.78	156.65
2600	-9.69	-161.94	23.51	119.35	-49.99	-0.931	-5.19	157.10
2650	-10.16	-162.13	23.78	107.23	-50.72	-12.17	-5.65	157.78
2700	-10.53	-161.30	24.11	94.68	-51.59	-26.06	-6.17	158.54
2750	-10.73	-159.84	24.53	81.54	-52.51	-43.81	-6.8	159.55
2800	-10.68	-158.59	25.03	67.41	-53.25	-67.29	-7.77	161.17
2850	-10.36	-158.56	25.69	52.45	-53.15	-96.50	-9.09	164.03
2900	-9.90	-161.62	26.43	35.26	-51.90	-128.68	-11.10	172.59
2950	-9.64	-169.83	27.14	14.38	-49.90	-160.49	-12.82	-160.65
3000	-10.22	175.73	27.49	-10.77	-48.05	168.76	-9.75	-129.23

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2.5 – 2.7 GHz Application Circuit (AH314-PCB)



Notes:

1. C12 to be placed as close as possible to the device
2. C11 = 47 pF is critical. Do Not Replace with any 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		2W Driver Amplifier	TriQuint	AH314-PCB
C1, C2, C4, C11, C15, C16, C17, C18	47 pF	Cap, Chip, 0805, 2%, 50V	various	
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	
C19	1.9 pF	Cap, Chip, 0603, ± 0.05 pF, 50VAccu-P	AVX	06035J1R3ABTTR
L1	18 nH	Ind, Chip, 0603, 5%, multilayer	TOKO	LL1608-FSL18NJ
R1	68 Ω	Res, Chip, 0603, 5%, 1/16W	various	
R2	150 Ω	Res, Chip, 0603, 5%, 1/16W	various	
R3, R4, R5	0 Ω	Res, Chip, 0805, 1/10W	various	
R6	0 Ω	Res, Chip, 0603, 5%, 1/16W	various	

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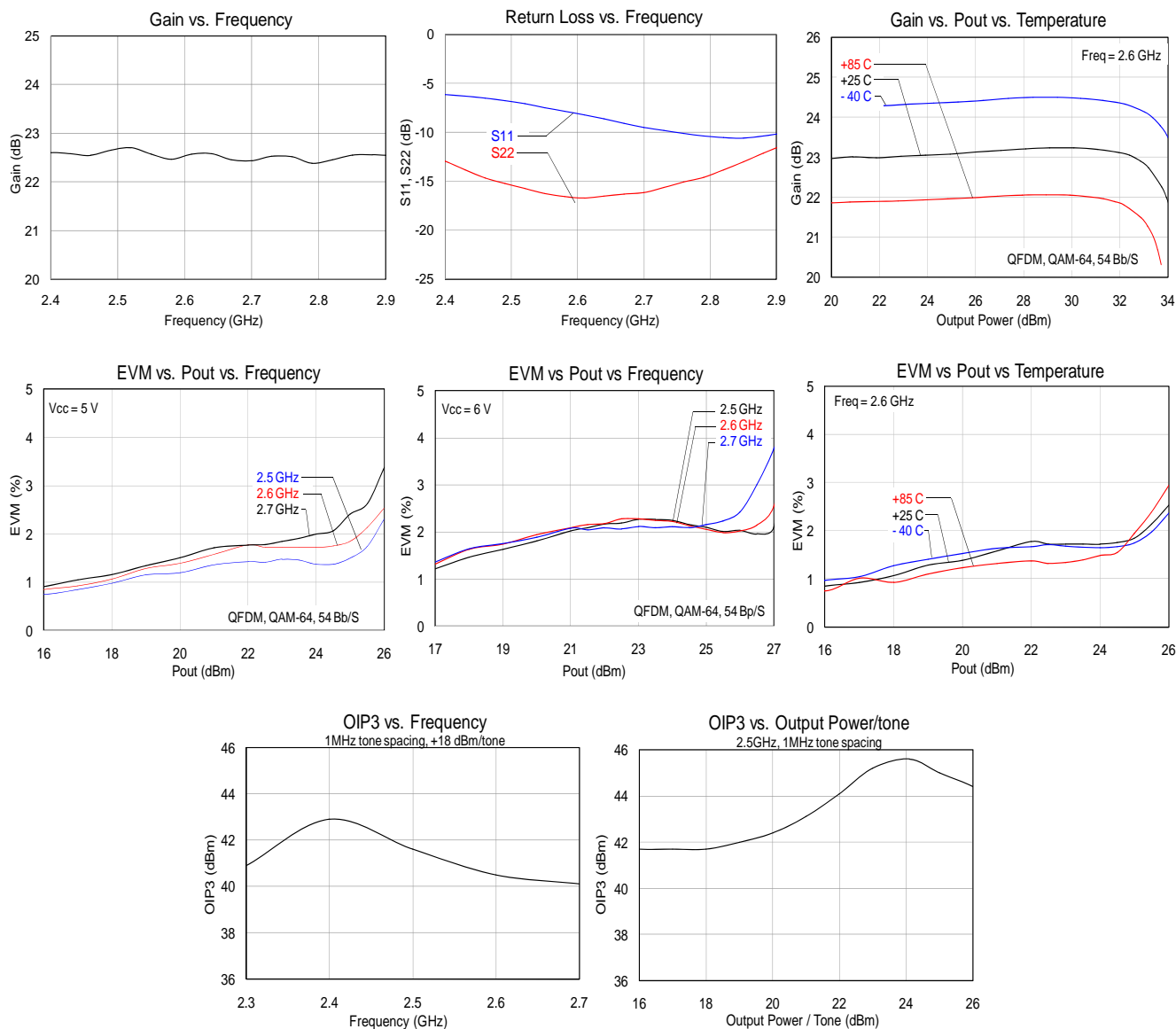


Typical Performance 2.5 – 2.7 GHz (AH314-PCB)

Test conditions unless otherwise noted: V_{pd} , V_{bias} , $V_{cc} = 5V$, $I_{CC} = 600\text{ mA}$, $+25\text{ }^\circ\text{C}$

Frequency	GHz	2.5	2.6	2.7
Gain	dB	22.5	23	22.5
Input Return Loss	dB	7	8.2	10
Output Return Loss	dB	15	16.7	12
Noise Figure	dB		6.4	
Output P1dB	dBm		+33	
EVM @ 24 dBm (1)	%		2	2.5
OIP3 @ 18 dBm/Tone, $\Delta f = 1\text{ MHz}$	dBm	+41	+42	+40

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



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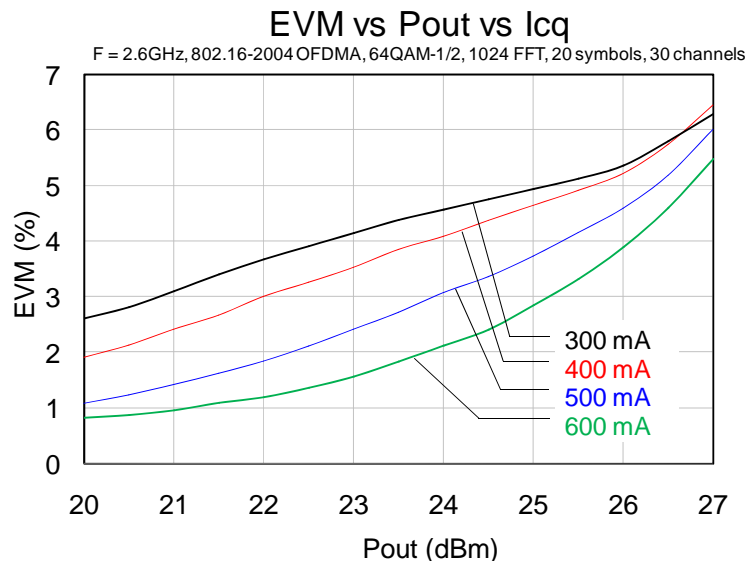
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2.3 – 2.7 GHz Applications Note: Changing Icq Biasing Configurations at +5V

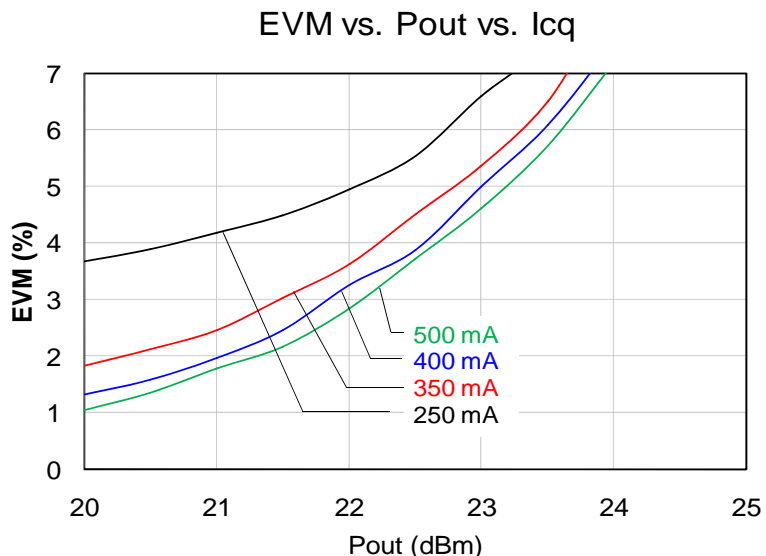
The AH314 can be configured to operate with lower bias current by varying the bias-adjust resistors R1 & R2. R1 sets the quiescent current in the output stage, while R2 sets the quiescent current in the input stage. The recommended circuit configurations shown previously in this datasheet have the device 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. Raising I_{CQ} will improve the EVM performance, but degrade the efficiency of the device. Measured data shown in the plots below represents the AH314 measured and configured for 2.6 GHz applications. It is expected that variation of the bias current for other frequency applications will produce similar performance results.

R1 (ohms)	R2 (ohms)	Icq (mA)	Vbias (V)
68	150	600	+5
86	180	500	+5
110	300	400	+5
160	330	300	+5



2.3 – 2.7 GHz Applications Note: Changing Icq Biasing Configurations at +3.3V

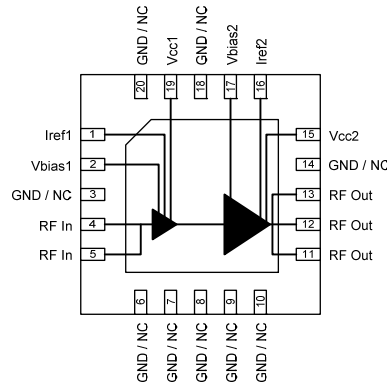
R1 (ohms)	R2 (ohms)	Icq (mA)	Vbias (V)
3	3	500	+3.3
11	15	400	+3.3
17	24	350	+3.3
43	45	250	+3.3



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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.

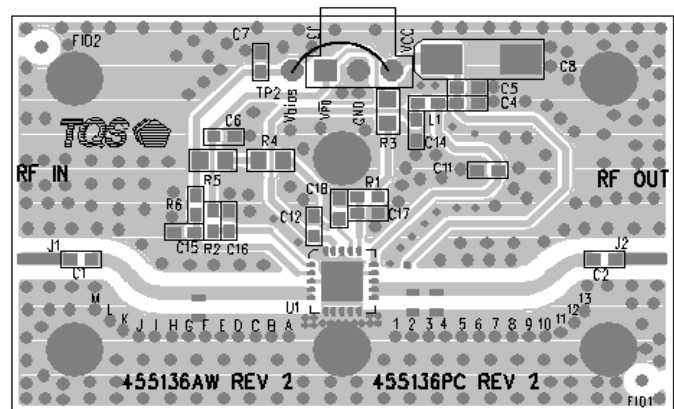
Applications Information

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/prodserv/more_info/default.aspx?prod_id=AH314

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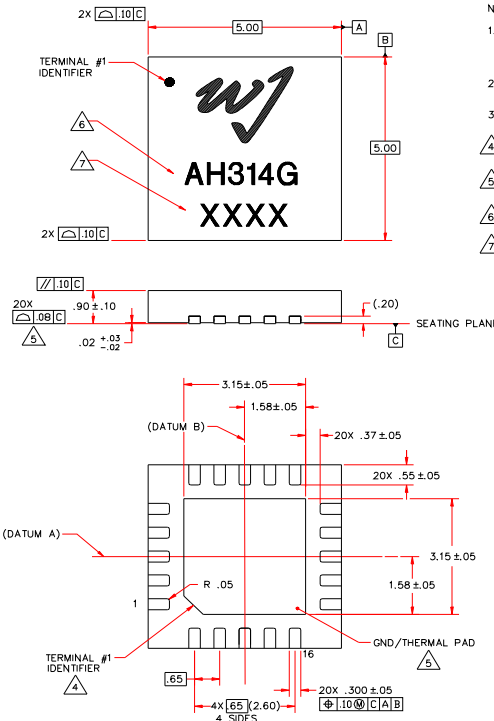
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Mechanical Information

Package Information and Dimensions

Lead-free/Green/RoHS-compliant.
Package pin plating - NiPdAu.
Compatible with lead-free ($T_{max}=260^{\circ}\text{C}$)
and lead ($T_{max}=245^{\circ}\text{C}$) soldering processes.

The AH314-G will be marked with an
“AH314G” designator on the top surface of
the package. An alphanumeric lot code
(“XXXX”) is also marked below the part
designator.



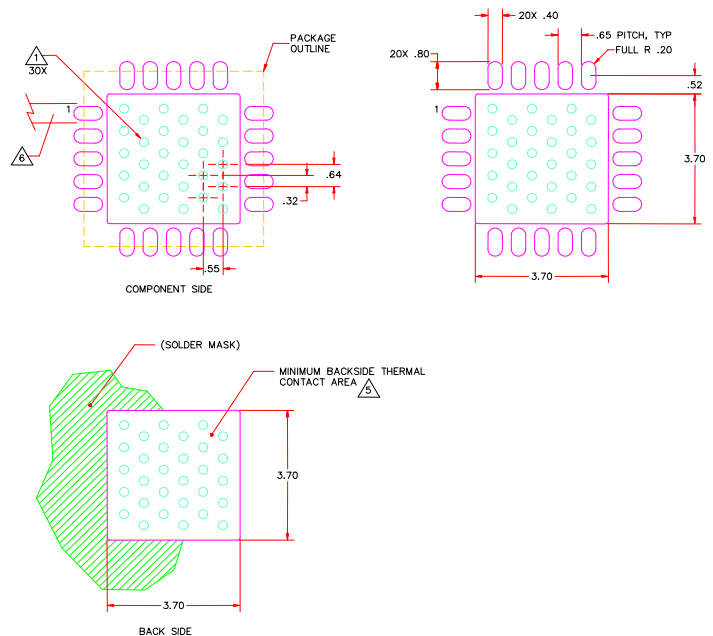
NOTES:

- EXCEPT WHERE NOTED, THIS PART OUTLINE CONFORMS TO JEDEC STANDARD MO-220, ISSUE E (VARIATION WHIC) 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



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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 (C₁₅H₁₂Br₄O₂) 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:

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