Data Sheet

RTC5636H

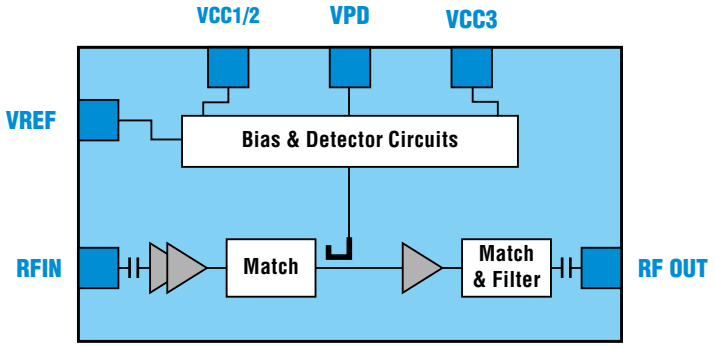
5 GHz Power Amplifier for 802.11a/n/ac

Feb. 2017 - Ver. 0.2

Description

The RTC5636H is a 5 GHz power amplifier designed for 802.11a/n/ac WLAN applications, which operates from a single 3.3V or 5V power supply. The amplifier consists of 3 gain stages with integrated input and output matching network and on-chip power detector for close loop power control operation. The device is capable to deliver +23 dBm linear power under 802.11ac 256QAM, HT80, MCS9, 1.8% DEVM by single supply voltage 5 V.
RTC5636H is packaged in 20-lead surface mount package QFN 4.0mm x 4.0mm x 0.8mm(max) with lead-free RoHS compliant.

Functional Block Diagram



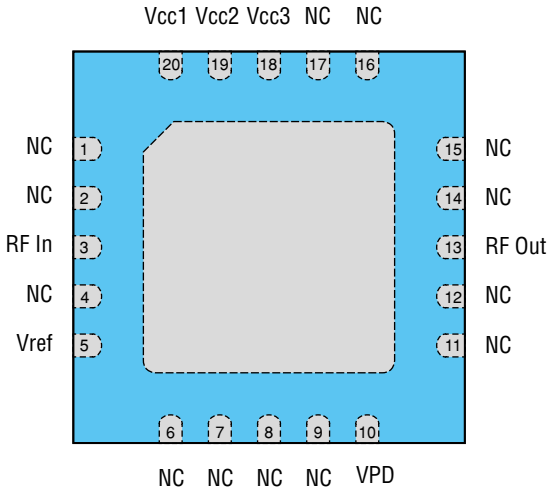
Features

- Frequency Range: 5.15 – 5.85 GHz
- 3.3 V or 5V single supply voltage
- 34 dB high gain @ 5V
- +23 dBm linear output power for 802.11ac 256QAM, HT80, MCS9, 1.8% DEVM @ 5V
- Input and output fully 50 ohm matching
- 20L QFN-4.0mm x 4.0mm x 0.8mm(max) Package
- RoHS Compliant, Pb-free, Halogen Free
- Moisture Sensitivity Level : MSL 3

Applications

- IEEE 802.11a/n/ac Wireless LAN Systems
- 5 GHz ISM Band Applications
- Cardbus, miniPCI, PCIe, AP Applications

Pin Assignments



Top View

Pin No.	Pin Name	Description
3	RF In	RF input pin
5	Vref	Bias control voltage for 1st, 2nd & 3rd stage
10	VPD	PA detector output
13	RF Out	RF output pin
18	Vcc3	Voltage supply for 3rd stage
19	Vcc2	Voltage supply for 2nd stage
20	Vcc1	Voltage supply for 1st stage
1, 2, 4, 6, 7, 8, 9, 11, 12, 14, 15, 16, 17	NC	Not connected inside the package For the best performance please connect these pins to ground on PCB
Exposed Pad		Must be connected to Ground through PCB via

Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Supply voltage (VCC)	VCC	6.0	V
Bias Control Voltage (Vref)	Vref	3.3	V
Input Power (Pin)	Pin	6	dBm
Operating Temperature	T_A	-40 to +85	°C
Storage Temperature	T_{STG}	-40 to +150	°C
ESD (HBM, JESD22-A114, All pins)	ESD_HBM	TBD	V

NOTE: Stresses above those conditions listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only. Functional operation of the device above those conditions indicated in the Absolute Maximum Ratings is not implied. The functional operation of the device at the conditions in between Recommended Operating Ratings and Absolute Maximum Ratings for extended periods may affect device reliability.

Recommended Operating Ranges

T_A = +25°C, unless otherwise noted

Parameter	Symbol	Min	Typ	Max	Unit
Frequency Range	f	5.15		5.85	GHz
Supply Voltage	Vcc1, Vcc2, Vcc3	3	3.3 or 5.0	5.5	V
Reference Voltage	Vref	2.9	3.0	3.2	V

NOTE: Recommended Operating Ratings indicate conditions for which the device is intended to be functional, but does not guarantee specific performance limits.

5V Electrical Specifications

T_A= +25°C, Vcc1 = Vcc2 = Vcc3 = 5.0 V, Vref = 3.0 V, as measured on the evaluation board, unless otherwise Noted

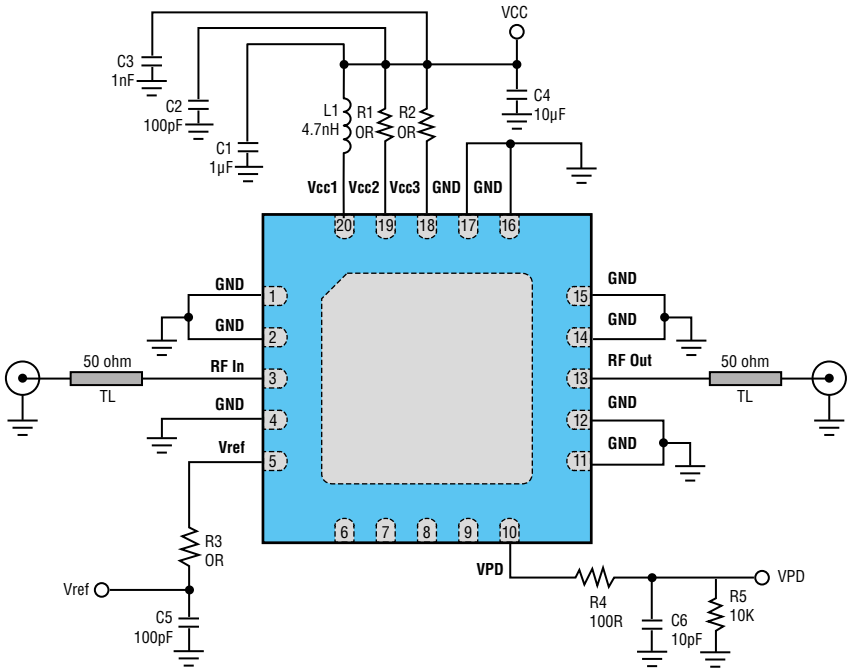
Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Frequency Range	f		5.15		5.85	GHz
Output Power	Pout	802.11ac, MCS9, HT80 DEVM = 1.8% 256QAM rate 5/6	+21	+23		dBm
		802.11ac, MCS9, HT160 DEVM = 1.8% 256QAM rate 5/6	+20	+22		dBm
		802.11ac, MCS11, HT160 DEVM = 1.2% 1024QAM rate 5/6	+16	+18		dBm
		802.11n, MCS7, HT40 DEVM = 3%	+21	+23		dBm
		802.11n, 20MHz, MCS0 Spectral Mask	+25	+27		dBm
Small Signal Gain	G	Pin = -30 dBm	33	35		dB
Gain Variation Over the Full Band	ΔG	5.15 – 5.85 GHz		±2		dB
1 dB Gain Compression Point	P1dB	5.15 – 5.85 GHz		+30		dBm
Return Loss	|S11|	Input Return Loss		12		dB
	|S22|	Output Return Loss		8.5		dB
2nd Harmonics	2fo	802.11a, 6 Mbps Pout = 26 dBm		-22		dBm/ MHz
3rd Harmonics	3fo	802.11a, 6 Mbps Pout = 26 dBm		-32		dBm/ MHz
Power Detector Output	Vpd	No RF		0.11		V
		Pout = 23 dBm		0.62		V
		Pout = 28 dBm		0.85		V
Supply Current	Icq	Quiescent (no RF)		325		mA
Vref Current	Iref	Quiescent (no RF)		4.2		mA
Supply Current, Transmit Mode	Icc	Pout = 23 dBm, 100% duty cycle		400		mA
		Pout = 25 dBm, 100% duty cycle		450		mA
		Pout = 28 dBm, 100% duty cycle		550		mA
Rise Time	t_R	10% – 90% RF		320		ns
Stability	Stab	Pout = +23 dBm, CW, VSWR=6:1, all phase	All non-harmonically related ouptputs < -35 dBm			–
Ruggedness	Ru	Pin = +10 dBm, 10:1 VSWR	No Permanent Damage			–

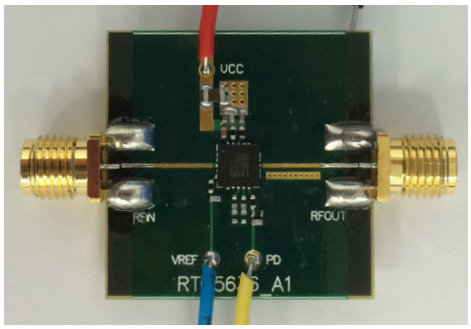
3.3V Electrical Specifications

T_A= +25°C, Vcc1 = Vcc2 = Vcc3 = 3.3 V, Vref = 3.0 V, as measured on the evaluation board, unless otherwise Noted

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Frequency Range	f		5.15		5.85	GHz
Output Power	Pout	802.11ac, MCS9, HT80 DEVM = 1.8% 256QAM rate 5/6	+17	+19		dBm
		802.11ac, MCS9, HT160 DEVM = 1.8% 256QAM rate 5/6	+16	+18		dBm
		802.11ac, MCS11, HT160 DEVM = 1.2% 1024QAM rate 5/6	+15	+17		dBm
		802.11n, MCS7, HT40 DEVM = 3%	+18	+20		dBm
		802.11n, 20MHz, MCS0 Spectral Mask	+21	+23		dBm
Small Signal Gain	G	Pin = -30 dBm	32	34		dB
Gain Variation Over the Full Band	ΔG	5.15 – 5.85 GHz		±2		dB
1 dB Gain Compression Point	P1dB	5.15 – 5.85 GHz		+28		dBm
Return Loss	|S11|	Input Return Loss		10		dB
	|S22|	Output Return Loss		7.5		dB
2nd Harmonics	2fo	802.11a, 6 Mbps Pout = 23 dBm		-34		dBm/ MHz
3rd Harmonics	3fo	802.11a, 6 Mbps Pout = 23 dBm		-40		dBm/ MHz
Power Detector Output	Vpd	No RF		0.11		V
		Pout = 22 dBm		0.55		V
		Pout = 25 dBm		0.78		V
Supply Current	Icq	Quiescent (no RF)		287		mA
Vref Current	Iref	Quiescent (no RF)		3.9		mA
Supply Current, Transmit Mode	Icc	Pout = 18 dBm, 100% duty cycle		332		mA
		Pout = 20 dBm, 100% duty cycle		349		mA
		Pout = 22 dBm, 100% duty cycle		394		mA
Rise Time	t_R	10% – 90% RF		340		ns
Stability	Stab	Pout = +20 dBm, CW, VSWR=6:1, all phase	All non-harmonically related ouptputs < -35 dBm			–
Ruggedness	Ru	Pin = +10 dBm, 10:1 VSWR	No Permanent Damage			–

Evaluation Board and Application Circuits



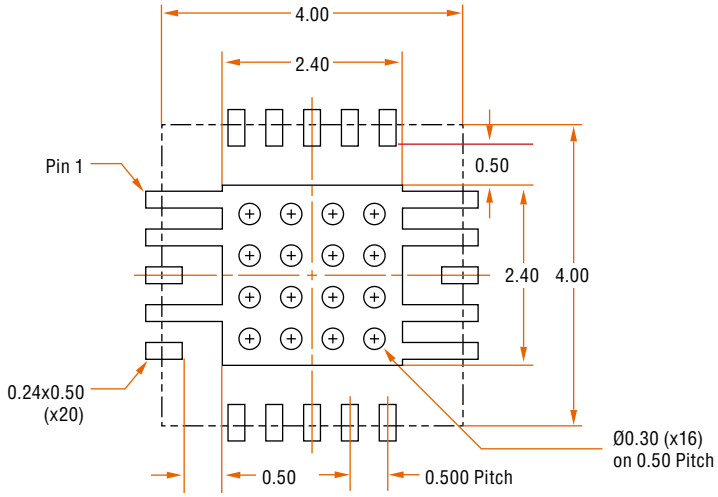


NOTE: Information in the above application is for reference only, and does not guarantee the mass production design of the device.

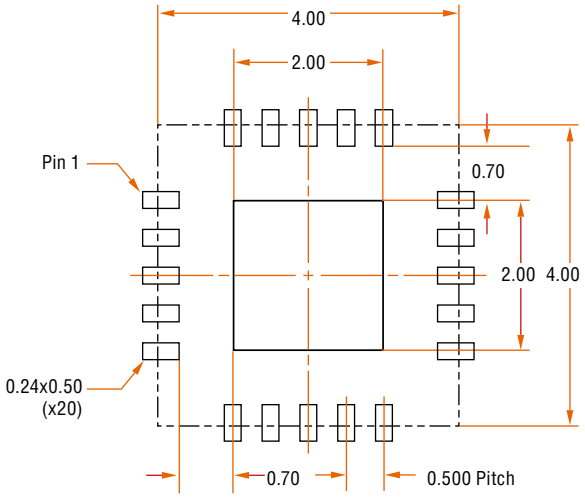
Evaluation Board Bill of Material

Component	Value	Description	Supplier	Part Number
IC		RTC5636H	RichWave	
C2, C5	100pF	Decoupling capacitor	Walsin	0402N101J500LT
C3	1nF	Decoupling capacitor	Walsin	0402B102K500CT
C4	10uF	Decoupling capacitor	Walsin	0805X106K6R3CT
C6	10pF	Decoupling capacitor	Walsin	0402N100J500
C1	1uF	Decoupling capacitor	Walsin	0402X105K6R3CT
L1	4.7nH	Matching inductor	ACX	HI1005-1C4N7SMT
R1, R2, R3	0R		Walsin	WR04X000PTL
R4	100R		Walsin	WR04X1000FTL
R5	10K		Walsin	WR04X103JTL

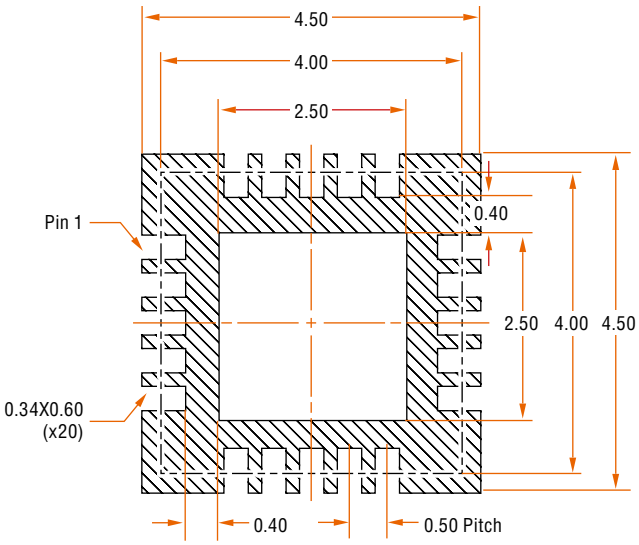
Recommended Footprint Patterns



PCB Board Metal & Via Pattern
Top View



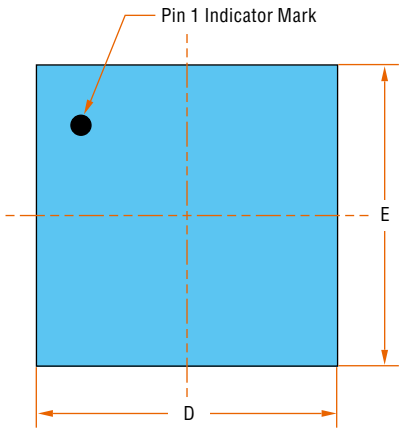
PCB Stencil Pattern
Top View
69% solder coverage on Pad



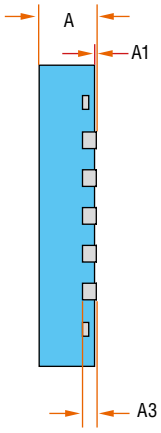
PCB Solder Mask Pattern
Top View

NOTE: All dimensions are measured in millimeters.

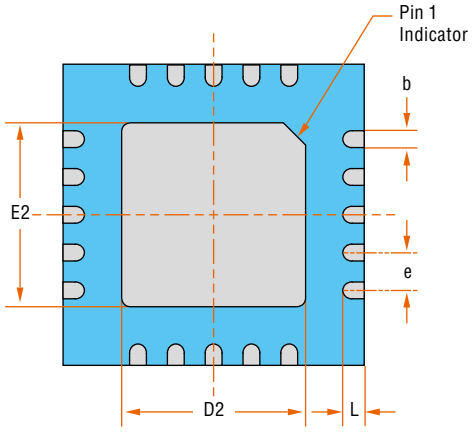
Package Dimensions



Top View



Side View



Bottom View

20L QFN 4 X 4 X 0.8 - B		
SYMBOL	**MIN**	**MAX**
A	0.700	0.800
A1	0.000	0.050
A3	0.200REF	
b	0.180	0.300
D	3.900	4.100
D2	2.300	2.600
e	0.500BSC	
E	3.900	4.100
E2	2.300	2.600
L	0.200	0.400

NOTE :

1. All dimensions are measured in millimeters.
2. Drawing is not to scale.

Customer Service

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