Data Sheet

RTC7637

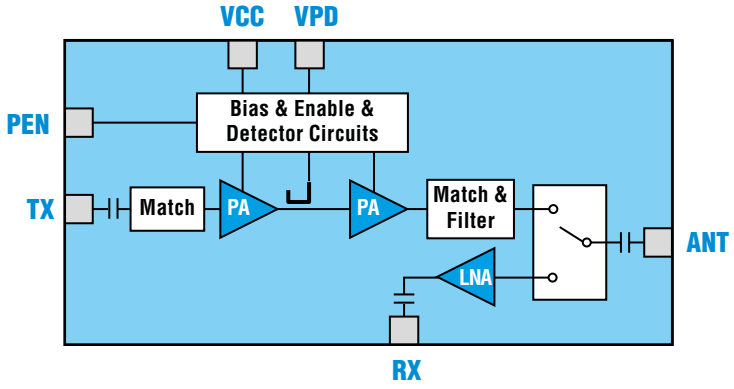
5 GHz Front End Module for 802.11a/n/ac

AUG 2017 - Ver. 0.4

Description

The RTC7637 is a RF front-end module (FEM) with transmit/receive chains for 802.11a/n/ac WLAN applications. The device consists of a power amplifier (PA) with a power detector, a low-pass filter (LPF) for harmonic rejection, a T/R switch and a RX low-noise amplifier (LNA). The antenna ports are switched between transmit and receive paths. In transmit path, the FEM has a typical gain of 27 dB and delivers 16 dBm linear output power under -35dB DEVM with 802.11ac HT80/MCS9 waveform. In receive path, the FEM can provide a 13 dB high gain and 2.6 dB low noise figure. The RTC7637 is packaged in 16-lead surface mount package QFN 2.3mm x 2.3mm x 0.4mm (max) with lead-free RoHS compliant.

Functional Block Diagram



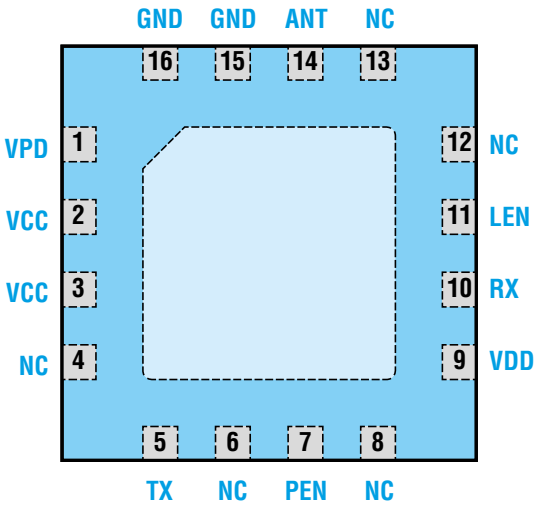
Features

- Frequency Range: 5.15 – 5.85 GHz
- Integrated high performance PA, LNA,harmonic filter and SPDT switch
- Input & output fully 50 ohm matching
- Output Power 16 dBm @ -35 dB DEVM, 802.11ac, HT80/MCS9
- 13 dB gain and 2.6 dB noise figure for RX path
- Compact & low profile package in 16L QFN-2.3mm x 2.3mm x 0.4mm (max)
- RoHS Compliant, Pb-free, Halogen Free
- Moisture Sensitivity Level : MSL 3

Applications

- IEEE 802.11a/n/ac Wireless LAN Systems
- 5GHz ISM Band Applications
- Cardbus, miniPCI, PCIe, and AP Applications
- Smart phones, Mobile Phones, and other Mobile Devices

Pin Assignments



Top View

Pin No.	Pin Name	Description
1	VPD	PA detector output
2	VCC	PA Supply voltage
3	VCC	PA Supply voltage
5	TX	RF output port for PA
7	PEN	Control voltage for PA
9	VDD	Supply voltage for LNA
10	RX	RF input port for LNA
11	LEN	Control voltage for LNA
14	ANT	Antenna output
15	GND	Ground
16	GND	Ground
4, 6, 8, 12, 13	NC	Not connected inside the package For the best performance please connect these pins to ground on PCB
Exposed Paddle		It must be connected to a ground through PCB via for best performance

Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Supply voltage	VCC, VDD	5.5	V
PA Enable Voltage	PEN	4	V
LNA Enable Voltage	LEN	4	V
TX Input Power (50Ω load)	P_{IN}	10	dBm
Operating Temperature	T_A	-40 ~ +85	°C
Storage Temperature	T_{STG}	-40 ~ +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 Ranges for extended periods may affect device reliability.

Recommended Operating Ranges

T_A = +25°C, unless otherwise noted

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage	VCC, VDD	3.2	3.7	4	V
PA enable voltage (High)	PEN(H)	2.75	2.85	3.3	V
PA enable voltage (Low)	PEN(L)	-0.2	0	0.3	V
LNA Enable Voltage (High)	LEN(H)	1.6	2.85	3.6	V
LNA Enable Voltage (Low)	LEN(L)	-0.2	0	0.3	V

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

Truth Table

PEN	LEN	Mode
High	Low	802.11 a/n/ac TX
Low	High	802.11 a/n/ac RX Gain
Low	Low	802.11 a/n/ac RX Bypass

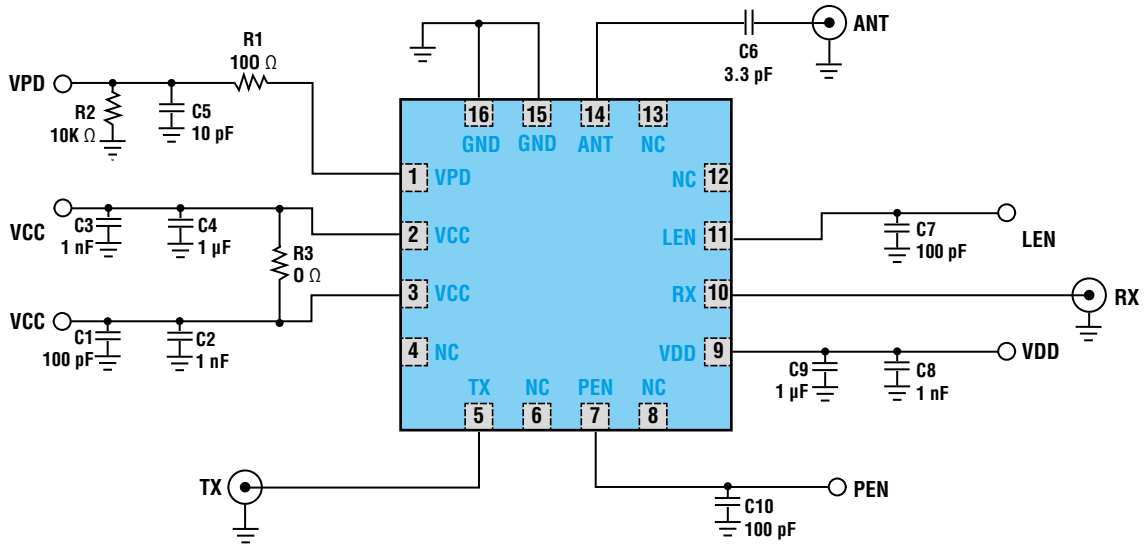
NOTE: Any modes other than those listed above are not supported.

Electrical Specification

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Transmit Mode (TX – ANT) T_A = +25 °C, VCC = VDD = 3.7 V, PEN = 2.85 V, LEN = 0 V. All unused RF ports terminated in a 50 Ω load, unless otherwise noted						
Operating Frequency	f		5.15		5.85	GHz
Output Power, High Linearity Mode	Pout	802.11ac, MCS9, HT80 DEVM = -35 dB	14.5	16		dBm
		802.11n, MCS7, HT20/40 DEVM = -30 dB	16.5	18		dBm
		802.11n, MCS0, HT20 Spectral Mask Power	20	22		dBm
		802.11a, 6 MHz, Spectral Mask Power	20	22		dBm
		802.11ac, MCS0, 80 MHz, Spectral Mask Power	20	21.5		dBm
Small Signal Gain	G	Pin = -20 dBm	25	27		dB
Gain Flatness	ΔG	Gain Variation Over the Full Band			3	dB
1 dB Output Compression Point	P1dB	1 dB Power Compression		25		dBm
Input Return Loss	|S11|	Pin = -20 dBm		6		dB
Output Return Loss	|S22|	Pin = -20 dBm		8		dB
Power Detector Output	Vpd	Pout = 10 dBm		0.5		V
		Pout = 20 dBm		1.4		V
Isolation, ANT to RX	ISO_1	Switch in TX mode		2.0		dB
Isolation, TX to RX	ISO_2	Switch in TX mode		10		dB
PA Enable Current	Ien	Quiescent (no RF)		4		mA
Leakage Current	I_{LEAK}	VCC = 3.7 V, No RF applied, PEN & LEN = Low		0.6		mA
Supply Current	Icq	Quiescent (no RF)		220		mA
Supply Current	Icc	Pout = 19 dBm, 802.11n, HT20		260		mA
		Pout = 17 dBm 802.11ac, HT80		240		mA
2nd harmonics	2fo	802.11a, 6 Mbps Pout = 20 dBm (No external harmonic filter)		-13		dBm/MHz
3rd harmonics	3fo			-25		dBm/MHz
Stability	S	CW, Pout = 25 dBm, 0.1 – 20 GHz load VSWR = 6:1		< -43 dBm/MHz		

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Ruggedness	Ru	CW, P_{IN} = +10 dBm, load VSWR = 10:1		No permanent damage		
Switching On Time	t_{ON}	50% V to 90% RF		170		ns
Receive High Gain Mode T_A = +25 °C, VCC = VDD = 3.7 V, PEN = 0 V, LEN = 2.85 V. All unused RF ports terminated in a 50 Ω load, unless otherwise noted						
Operating Frequency	f		5.15		5.85	GHz
RX Gain	G	High Gain Mode	11	13		dB
Input Return Loss	|S11|	Pin = -20 dBm		9		dB
Output Return Loss	|S22|	Pin = -20 dBm		6		dB
Noise Figure	NF	High Gain Mode		2.6	2.9	dB
Isolation, ANT to TX	ISO	RX Mode		27		dB
1 dB Input Compression Point	IP1dB	1dB Gain Compression		-4		dBm
Supply Current	Idd	RX Mode		14		mA
Receive Bypass Mode T_A = +25 °C, VCC = VDD = 3.7 V, PEN = LEN = 0 V. All unused RF ports terminated in a 50 Ω load, unless otherwise noted						
Operating Frequency	f		5.15		5.85	GHz
RX Gain	G	High Gain Mode		-7		dB
Input Return Loss	|S11|	Pin = -20 dBm		8		dB
Output Return Loss	|S22|	Pin = -20 dBm		10		dB

Application Circuits

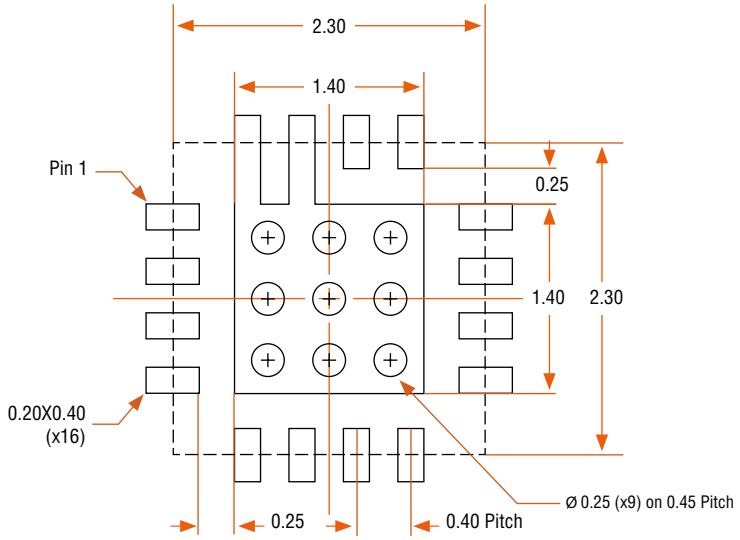


NOTE: Information in the above application is for reference only, and does not guarantee the mass production design of the device.

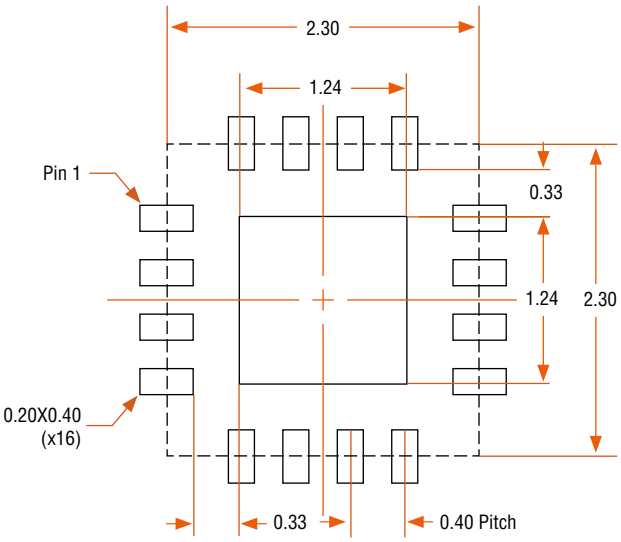
Evaluation Board Bill of Material

Component	Value	Description	Supplier	Part Number
IC		RTC7637	RichWave	
C2, C3, C8	1 nF	Decoupling capacitor	Walsin	0402B102K500CT
C1, C7, C10	100 pF	Decoupling capacitor	Walsin	0402N101J500LT
C4, C9	1 µF	Decoupling capacitor	Walsin	0402X105K6R3CT
C5	10 pF	Decoupling capacitor	Walsin	0402N100J500LT
C6	3.3 pF	DC blocking capacitor	Walsin	0402N3R3C500LT
C3	0 Ω		Walsin	WR04X00R0PTL
R1	100 Ω		Walsin	WR04X1000FTL
R2	10K Ω		Walsin	WR04X10R0FTL

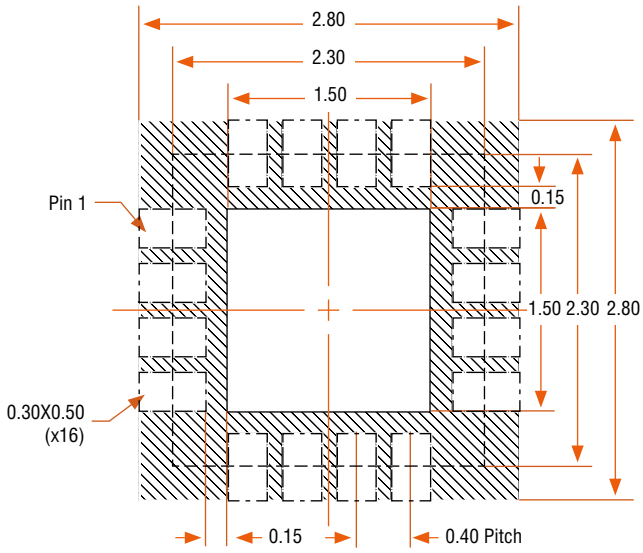
Recommended Footprint Patterns



PCB Board Metal & Via Pattern
Top View



PCB Stencil Pattern
Top View
72% solder coverage on Pad

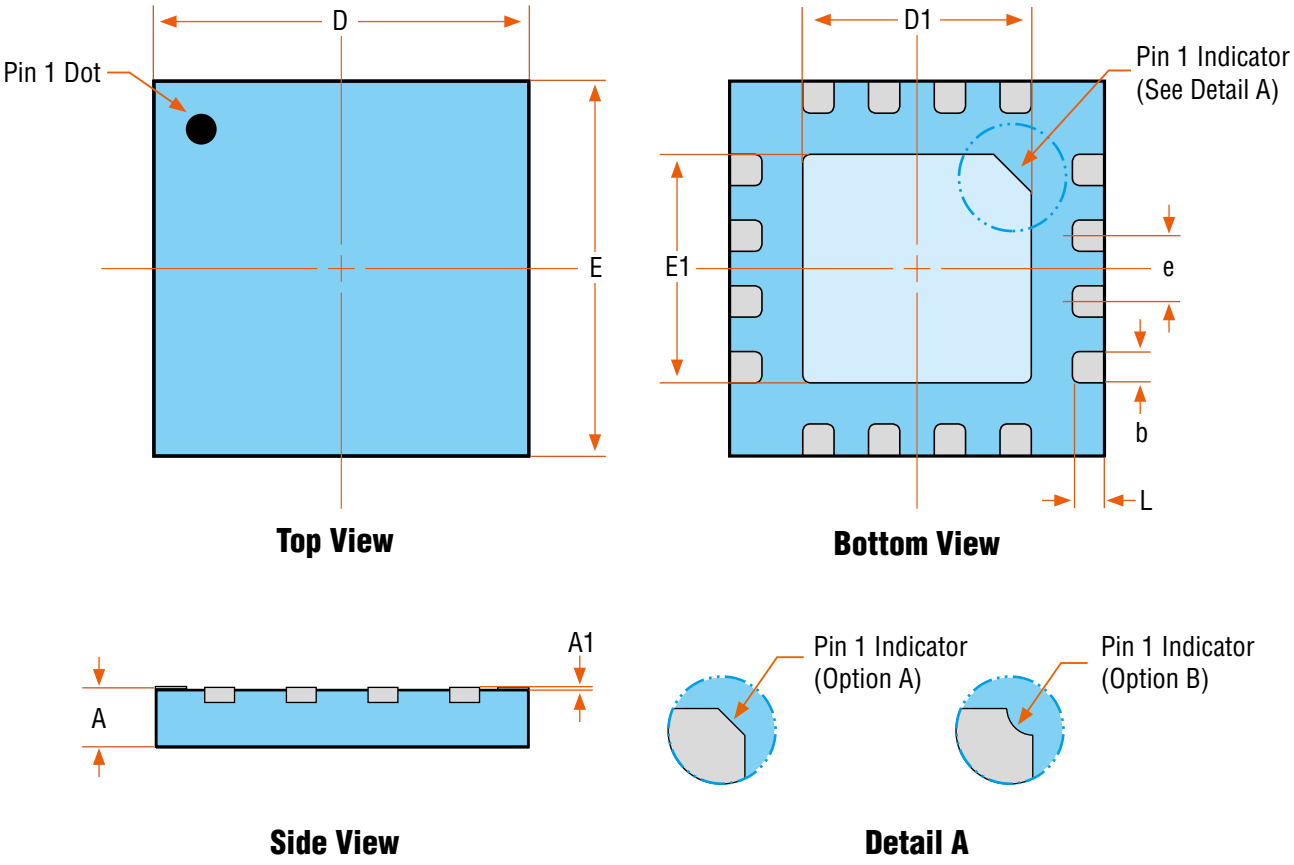


PCB Solder Mask Pattern
Top View

NOTE :

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

Package Dimensions



16L QFN 2.3 X 2.3 X 0.4 - A		
SYMBOL	**MIN**	**MAX**
A	0.320	0.400
A1	0.000	0.050
b	0.150	0.250
D	2.200	2.400
D1	1.300	1.500
e	0.400 BSC	
E	2.200	2.400
E1	1.300	1.500
L	0.150	0.250

NOTE :

1. All dimensions are measured in millimeters
2. Drawing is not to scale
3. The shape of the Pin 1 Indicator can be either Option A or Option B, but it must be located within the zone indicated

Customer Service

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