Data Sheet

RTC5639C

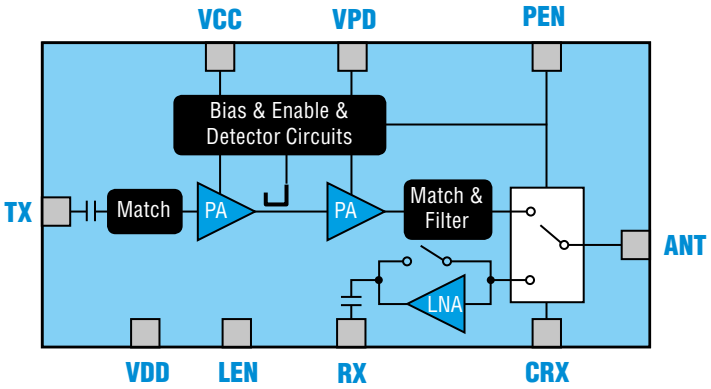
5 GHz Front End Module for 802.11a/n/ac

MAR 2018 - Ver. 0.1

Description

The RTC5639C is a RF front-end module (FEM) with transmit/receive chain for 802.11a/n/ac WLAN applications. The device consists of a power amplifier (PA) with power detector, a low-pass filter (LPF) for harmonic rejection, a T/R switch and a RX low-noise amplifier (LNA) with bypass mode. All RF ports have integrated DC blocking caps and are fully matched to 50 ohms which make system integration easy and simple. The antenna port is switched between transmit and receive. The RTC5639C is packaged in 16-lead surface mount package QFN 3.0mm x 3.0mm x 1.0mm (max) with lead-free RoHS compliant.

Functional Block Diagram



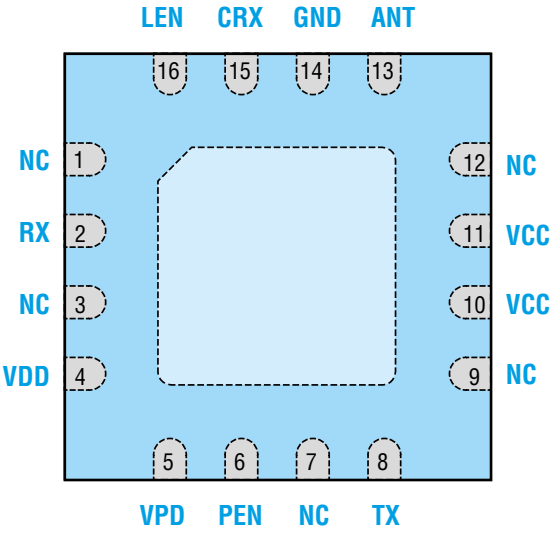
Features

- Frequency Range : 5.15 – 5.85 GHz
- 3.3 V single supply voltage
- Integrated high performance PA, LNA with bypass function, harmonic filter and SPDT switch
- Input & output fully 50 ohm matching
- Output Power :
  - +16 dBm @ 1.8% DEVM, MCS9 VHT80
  - +18 dBm @ 3% DEVM, MCS7 HT20/40
- High RX Gain & Linearity with Good Noise Figure
- Package in 16L QFN 3.0mm x 3.0mm x 1.0mm (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, AP Applications

Pin Assignments



Top View Through Package

Pin No.	Pin Name	Description
2	RX	RF output port for LNA
4	VDD	Supply voltage for LNA
5	VPD	PA detector output
6	PEN	Control voltage for PA and TX switch
8	TX	RF input port for PA
10	VCC	PA Supply voltage
11	VCC	PA Supply voltage
13	ANT	Antenna output
14	GND	Ground
15	CRX	Control voltage for RX switch
16	LEN	Control voltage for LNA
1, 3, 7, 9, 12	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	4.0	V
PA Enable Voltage	PEN	3.3	V
LNA Enable Voltage	LEN	4.0	V
Control Voltage	CRX	4.0	V
TX Input Power (50Ω load)	P_{IN_TX}	+10	dBm
ANT Input Power (50Ω load)	P_{IN_RX}	+20	dBm
Operating Temperature	T_A	-40 to +85	°C
Storage Temperature	T_{STG}	-40 to +150	°C

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 Ranges and Absolute Maximum Ratings for extended periods may affect device reliability.

Recommended Operating Ranges

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage	VCC, VDD	3	3.3	3.6	V
PA Enable Voltage (High)	PEN(H)	2.7	2.8	3.0	V
PA Enable Voltage (Low)	PEN(L)	-0.2	0	0.3	V
LNA Enable Voltage (High)	LEN(H)	2.5	3.3	3.6	V
LNA Enable Voltage (Low)	LEN(L)	-0.2	0	0.3	V
Switch Control Voltage (High)	CRX(H)	2.5	3.3	3.6	V
Switch Control Voltage (Low)	CRX(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	CRX	Mode
High	Low	Low	TX
Low	High	High	RX High Gain
Low	Low	High	RX Bypass
Low	Low	Low	All Off

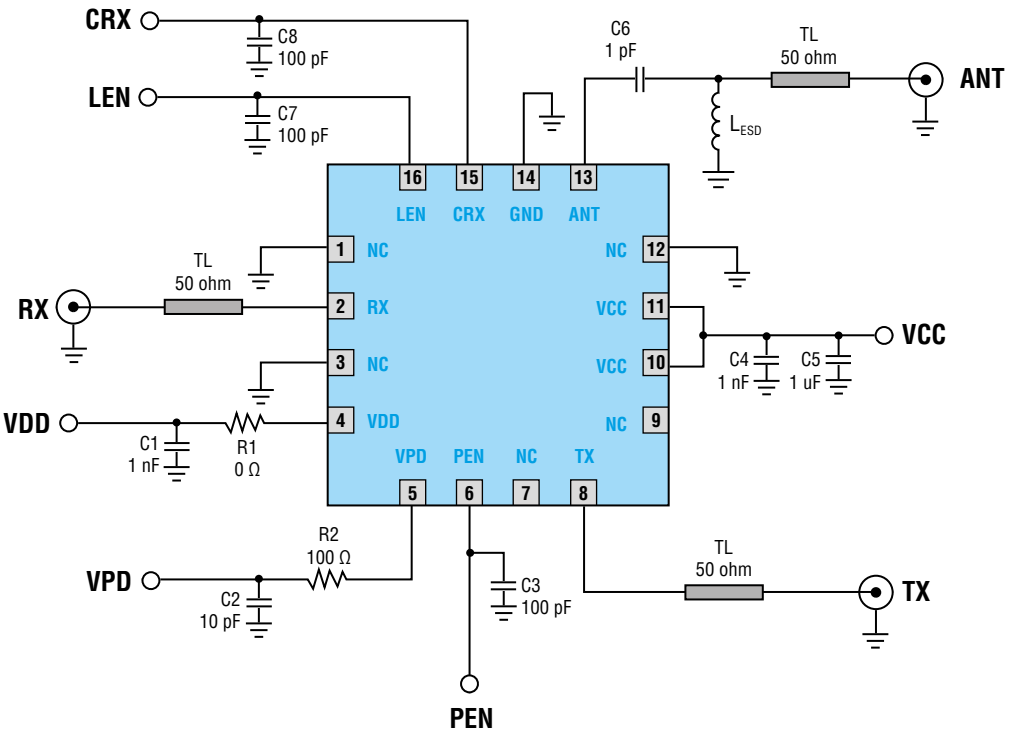
NOTE: Any modes other than those listed above are not supported.

Electrical Specifications

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Transmit Mode (TX – ANT) T_A = +25 °C, VCC = VDD = 3.3 V, PEN = 2.8 V, LEN = CRX = 0 V. All unused RF ports are terminated in a 50 Ω load, unless otherwise noted						
Operating Frequency	f		5.15		5.85	GHz
Output Power	Pout	802.11ac, MCS9, VHT80 DEVM = 1.8% 256QAM rate 5/6	+14	+16		dBm
		802.11n, MCS7, HT20/40 DEVM = 3%	+16	+18		dBm
		802.11ac, 80MHz, MCS0 Spectral Mask	+17	+19		dBm
		802.11n, 20MHz, MCS0 Spectral Mask	+18	+20		dBm
Small Signal Gain	G		28	31		dB
Gain Flatness	ΔG	Gain variation over the full band			2	dB
1 dB Output Compression Point	P1dB	1 dB gain compression		24		dBm
Input Return Loss	|S11|	at TX port	7			dB
Output Return Loss	|S22|	at ANT port	4			dB
2nd Harmonics	2fo	802.11a, 6 Mbps Pout = 20 dBm (No external harmonic filter)		-33		dBm/MHz
3rd Harmonics	3fo			-38		dBm/MHz
Isolation ANT – RX	ISO			23		dB
Power Detector Output	Vpd	Pout = 0 dBm		0.13		V
		Pout = 10 dBm		0.23		V
		Pout = 20 dBm		0.59		V
PA Enable Current	Ien	Quiescent (no RF)		3	5	mA
Supply Current, Transmit Mode	Icc	Quiescent (no RF)		215	245	mA
		Pout = 22 dBm, 802.11n, HT20, 100% duty cycle		325	360	mA
		Pout = 20 dBm, 802.11ac, VHT80, 50% duty cycle		270	305	mA
Switch On/Off Time	ton, toff	On, Off (50% V to 90%/10% RF)		120		ns

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Receive High Gain Mode (RX – ANT) T_A = +25 °C, VCC = VDD = 3.3 V, PEN = 0 V, LEN = CRX = 3.3 V. All unused RF ports are 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|	at ANT port	10			dB
Output Return Loss	|S22|	at RX port	6			dB
Isolation ANT – TX	ISO			29		dB
Noise Figure	NF	High Gain Mode		2.8		dB
Input P1dB	IP1dB	1dB Gain Compression		-11		dBm
Supply Current	I_{DD}	RX Gain Mode		8	11	mA
Receive Bypass Mode T_A = +25 °C, VCC = VDD = 3.3 V, PEN = 0 V, LEN = O V, CRX = 3.3 V. All unused RF ports are terminated in a 50 Ω load, unless otherwise noted						
Operating Frequency	f		5.15		5.85	GHz
RX Gain	G	Bypass Mode		-7		dB
1 dB Input Compression Point	IP1dB	1dB Gain Compression		22		dBm
Isolation	ISO	ANT - TX	39	44		dB
Input Return Loss	|S11|	at ANT port	13			dB
Output Return Loss	|S22|	at RX port	11			dB

Application Circuits



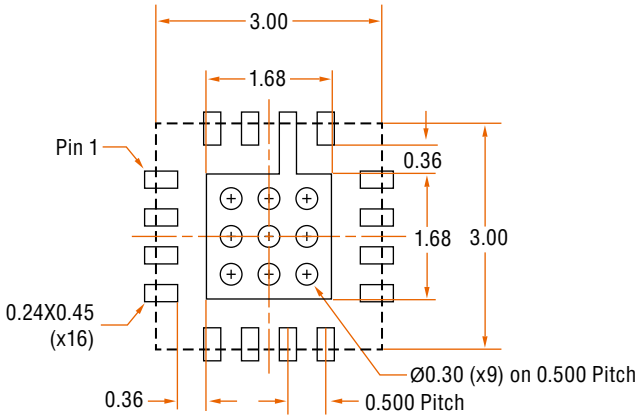
NOTE:

1. It is recommend to add L_{ESD} to provide a good approach for increasing the ESD protection on a specific RF port, typically the port attached to the antenna.
2. The L_{ESD} value may be tailored to provide specific electrical responses.
3. 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

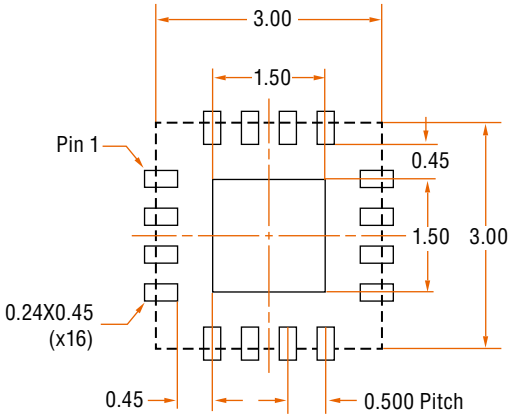
Component	Value	Description	Supplier	Part Number
IC		RTC5639C	RichWave	
C1, C4	1 nF	De-coupling capacitor	Walsin	0402B102K500CT
C2	10 pF	De-coupling capacitor	Walsin	0402N100J500LT
C3, C7, C8	100 pF	De-coupling capacitor	Walsin	0402N101J500LT
C5	1 µF	De-coupling capacitor	Walsin	0402X105K6R3CT
C6	1 pF	DC blocking capacitor	Walsin	0402N1R0C500LT
R1	0 Ω		Walsin	WR04X00R0PTL
R2	100 Ω		Walsin	WR04X1000FTL

Recommended Footprint Patterns



PCB Board Metal & Via Pattern

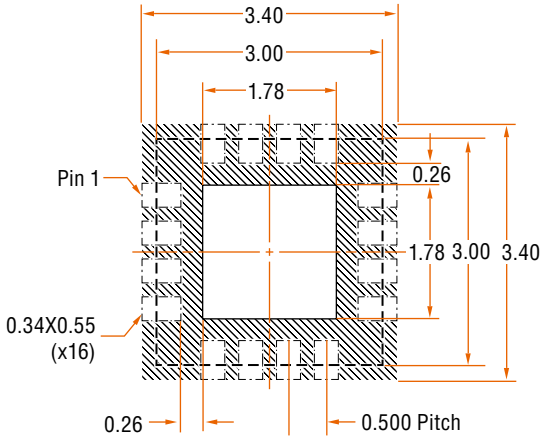
Top View



PCB Stencil Pattern

Top View

80% Solder Coverage on Pad



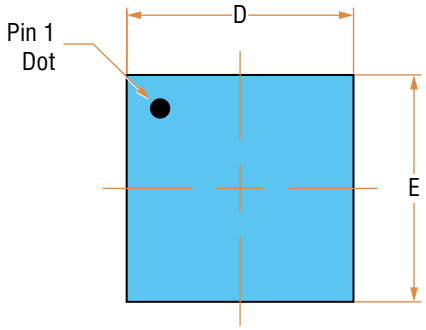
PCB Solder Mask Pattern

Top View

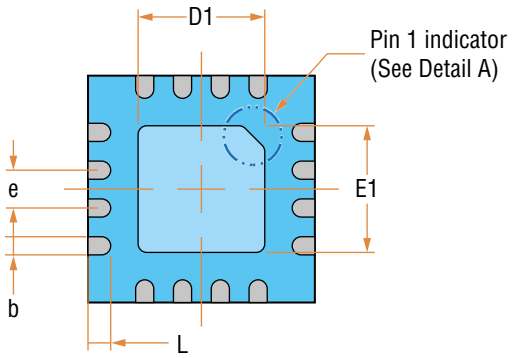
NOTE :

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

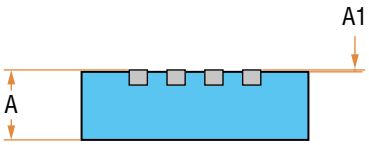
Package Dimensions



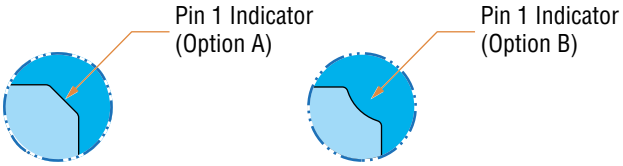
Top View



Bottom View



Side View



Detail A

16L QFN 3 X 3 X 1 - A		
SYMBOL	**MIN**	**MAX**
A	0.800	1.000
A1	0.000	0.050
b	0.180	0.300
D	2.900	3.100
D1	1.550	1.800
e	0.500 BSC	
E	2.900	3.100
E1	1.550	1.800
L	0.200	0.400

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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