Data Sheet

RTC5633C

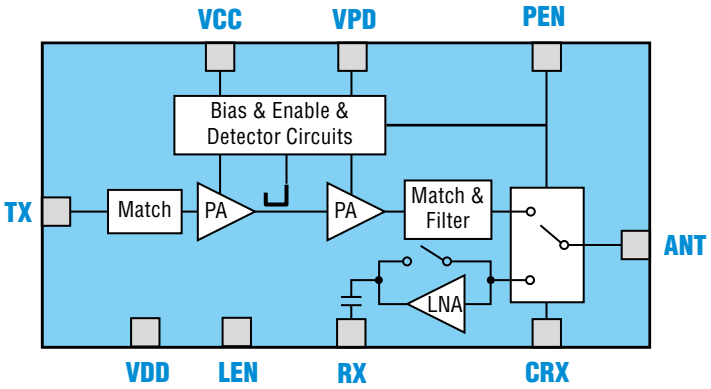
5 GHz Front End Module for 802.11a/n/ac

Apr. 2017 - Ver. 1.4

Description

The RTC5633C 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 an RX low-noise amplifier (LNA) with bypass mode. A digital enable/disable function is also included in both PA and LNA, which allows power savings during off mode. The antenna ports are switched between transmit and receive. In the transmitting path, the FEM has a typical gain of 30 dB and delivers 16 dBm linear output power under 1.8% EVM 802.11ac 256QAM modulation. In the receiving path, the FEM can provide a typical gain of 12 dB and 2.6 dB noise figure. The RTC5633C is packaged in 16-lead surface mount package QFN 3mm x 3mm x 0.8mm (max) with lead-free RoHS compliant.

Functional Block Diagram



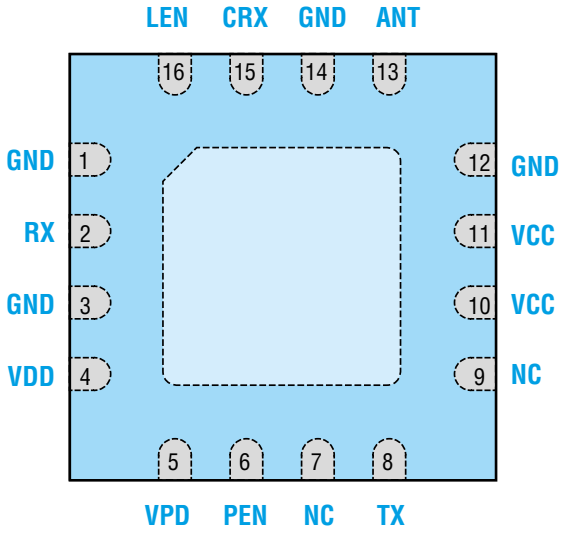
Features

- Frequency Range: 5.15 – 5.85 GHz
- 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% EVM, 802.11ac, HT80, MCS9
- Digital Enable/Disable control
- 12 dB gain and 2.6 dB NF for RX path
- Compact & low profile package in 16L QFN-3mmx3mmx0.8mm(max)
- RoHS, Pb-free, Halogen Free Compliant
- 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
15	CRX	Control voltage for RX switch
16	LEN	Control voltage for LNA
1, 3, 12, 14	GND	Ground
7, 9	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	V
PA Enable Voltage	PEN	3.6	V
LNA Enable Voltage	LEN	3.6	V
TX Input Power (50 ohm load)	P_{IN}	+5	dBm
Operating Ambient 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	3.0	3.3	3.6	V
PA Enable Voltage (High)	PEN	2.8	3	3.3	V
PA Enable Voltage (Low)	PEN	0		0.3	V
LNA Enable Voltage (High)	LEN	2	3	3.3	V
LNA Enable Voltage (Low)	LEN	0		0.3	V
Switch Control Voltage (High)	CRX	2.8	3	3.3	V
Switch Control Voltage (Low)	CRX	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

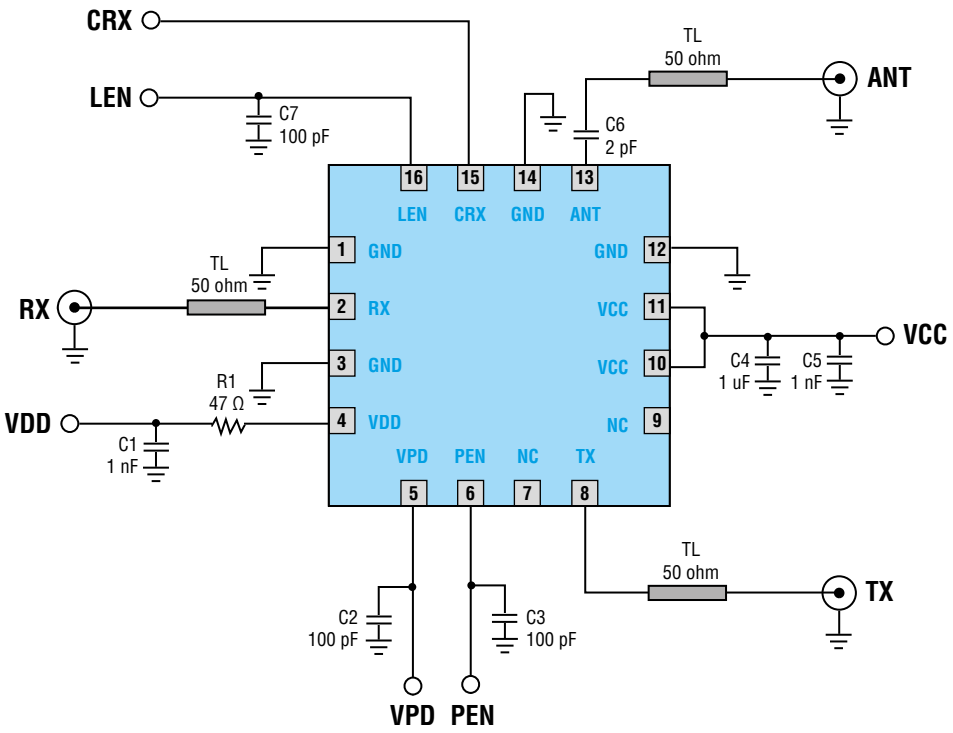
PEN	LEN	CRX	Mode
High	Low	Low	TX
Low	High	High	RX High Gain
Low	Low	High	RX Bypass

Electrical Specifications

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Transmit Mode (TX – ANT) T_A = +25 °C, VCC = VDD = 3.3 V, PEN = 3 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, H/L=3.3V	Pout	802.11a, 64QAM/54Mbps, EVM = 3%	16	18		dBm
		802.11n, MCS7, HT20/40 EVM = 3%	16	18		dBm
		802.11ac, MCS9, HT80, EVM = 1.8%	14	16		dBm
		802.11a, 6Mbps spectral mask compliant	18	20		dBm
		802.11n, MCS0, HT20/40 spectral mask compliant	16	18		dBm
Small Signal Gain	G	Pin = -30dBm	27	30		dB
Gain Flatness	ΔG	Gain Variation Over 50MHz BW	-0.5		+0.5	dB
1 dB Output Compression Point	P1dB	1dB power Compression	23	25		dBm
Return Loss	|S11|	Input Return Loss	3	5		dB
	|S22|	Output Return Loss	10	16		dB
2nd & 3rd harmonics	2fo	Pout = 20 dBm, 6Mbps, 802.11a		-36	-30	dBm/MHz
	3fo	Pout = 20 dBm, 6Mbps, 802.11a		-45	-35	dBm/MHz
Isolation	ISO	From Ant to either TX or RX pin	30	40		dB
Power Detector Output	Vpd	MCS9 HT80 Pout = 10 dBm		0.32		V
		MCS9 HT80 Pout = 20 dBm		0.88		V
PA Enable Current	Ien	Quiescent (no RF)		5	10	μA
Supply Current, Transmit Mode	Icq	Quiescent (no RF)		185	285	mA
	Icc	Pout = 18 dBm, 802.11a, 64QAM		260	360	mA
	Icc	Pout = 16 dBm, 802.11ac, 256QAM		250	350	mA

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Receive High Gain Mode (RX – ANT) T_A = +25 °C, VDD = 3.3 V, LEN = CRX = 3 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	10	12		dB
Return Loss	|S11|	Input Return Loss	4	6.5		dB
	|S22|	Output Return Loss	5	9		dB
Noise Figure	NF	High Gain Mode		2.6	2.8	dB
1 dB Input Compression Point	IP1dB	1dB Gain Compression	-8	-5		dBm
Supply Current	Idd	RX ON		7	11	mA
Receive Bypass Mode (RX – ANT) T_A = +25 °C, VDD = 3.3 V, LEN = 0 V, CRX = 3 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	Bypass Mode		-7		dB
Return Loss	|S11|	Input Return Loss	7	9		dB
	|S22|	Output Return Loss	5	6		dB
Supply Current	Idd	RX ON		3.5	10	µA

Application Circuits

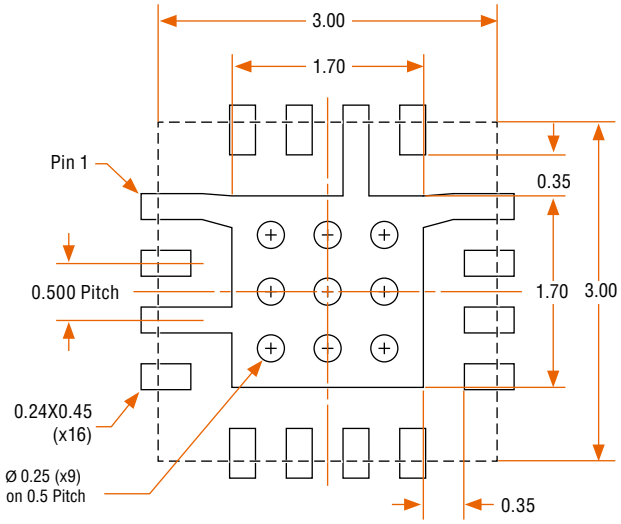


NOTE : Information in the above application is for reference only, and does not guarantee the mass production design of the device.

Evaluation Board Bill of Material

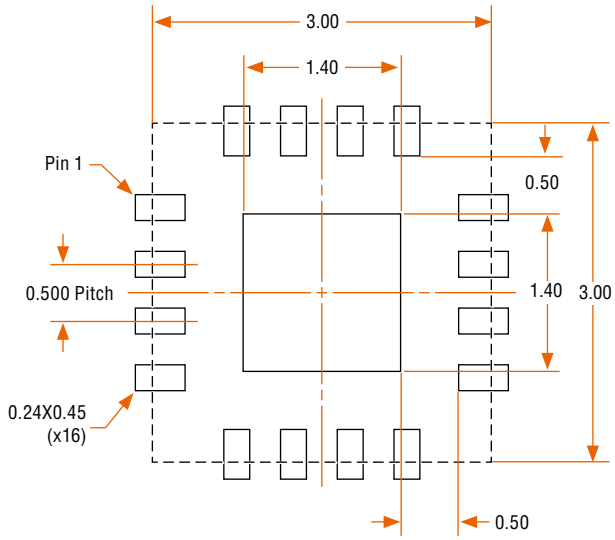
Component	Value	Description	Supplier	Part Number
IC		RTC5633C	RichWave	
C1, C5	1 nF	De-coupling capacitor	Walsin	0402B102K500CT
C2, C3, C7	100 pF	De-coupling capacitor	Walsin	0402N101J500LT
C4	1 µF	De-coupling capacitor	Walsin	0402X105K6R3CT
C6	2 pF	DC Blocking capacitor	Walsin	0402N2R0C500LT
R1	47 Ω		Walsin	WR04X4702FTL

Recommended Footprint Patterns



PCB Board Metal & Via Pattern

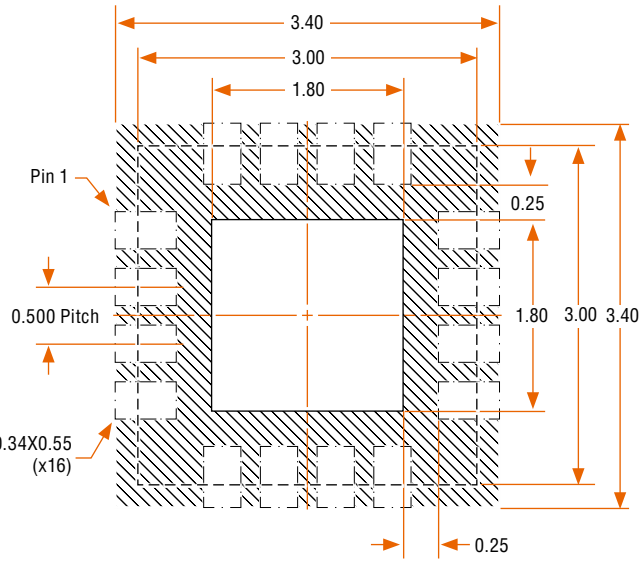
Top View



PCB Stencil Pattern

Top View

68% Solder Coverage on Pad



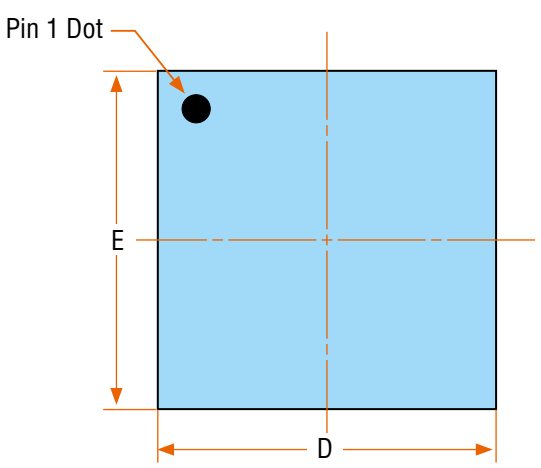
PCB Solder Mask Pattern

Top View

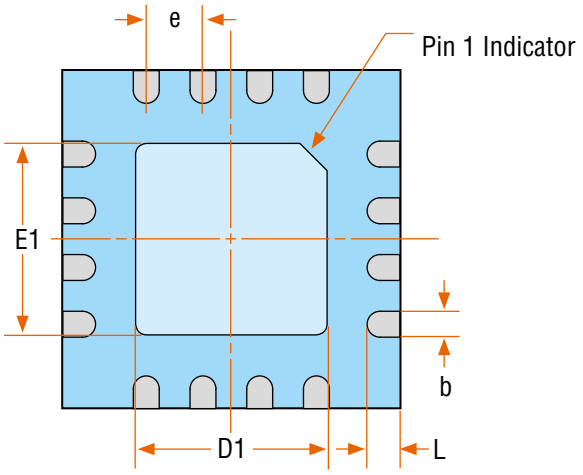
NOTE :

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

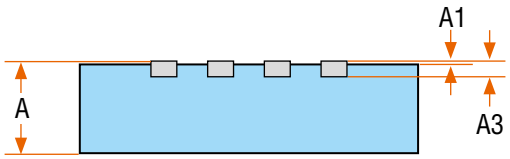
Package Dimensions



Top View



Bottom View



Side View

16L QFN 3 X 3 X 0.8 - A		
SYMBOL	**MIN**	**MAX**
A	0.700	0.800
A1	0.000	0.050
A3	0.100	0.200
b	0.180	0.300
D	2.900	3.100
D1	1.600	1.800
e	0.500 BSC	
E	2.900	3.100
E1	1.600	1.800
L	0.224	0.376

NOTE :

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

Customer Service

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