Technical Description of the Circuit:

The product can divide into two part, RF and Baseband, the RF circuit is a single conversion, super-heterodyne architecture receiver IC. The incoming RF signal received by the antenna is fed to the RF input terminal of the IC RX3310A, then the RF signal is then amplified by the LNA in the IC RX3310A. The amplified signal will fed to the mixer input, the LO for the mixer is generated by the external LC tank circuit, in the above circuit, the LO is 432.12MHz, the IF (F_{RF}-F_{LO}) is then demodulated by the demodulator in the IC RX3310A and the IC RX 3310A provide the raw data. The data is then fed to the baseband MCU TM8706 for decoding and the MCU TM8706 will display the decoded temperature and rain information at the LCD.

Description

The RX3310A is a fully integrated, amplitude-shift-keying (ASK) modulation, single chip receiver. It is designed to operate in a variety of low power radio applications. All popular radio frequencies from 250 MHz to 450 MHz may be supported by simply choosing the appropriate external components. Particular emphasis has been placed on low current consumption.
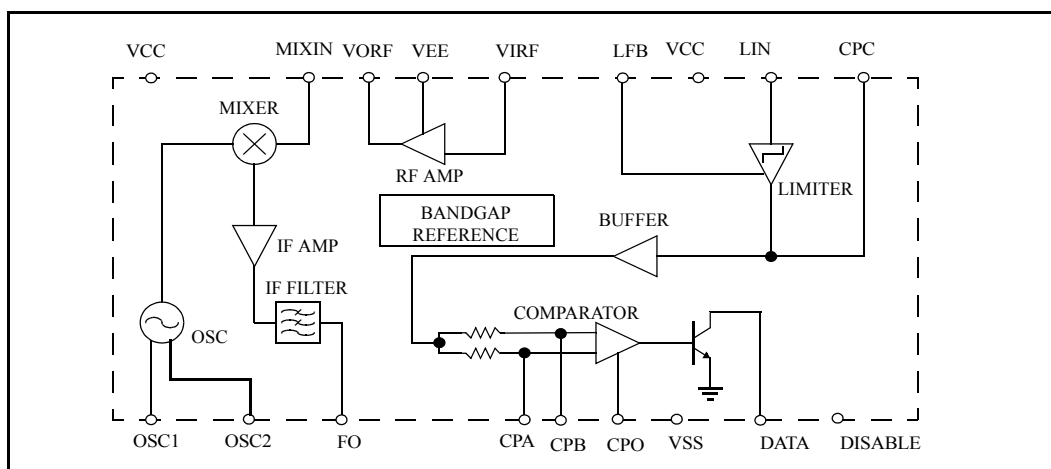
Features

◆ Wide frequency range: 250 MHz to 450 MHz

◆ High sensitivity

◆ Low power consumption

◆ Automotive temperature range

◆ High integration level requiring few and inexpensive external components

◆ SOP 18L package or SSOP 20L (150 mil) package

Applications

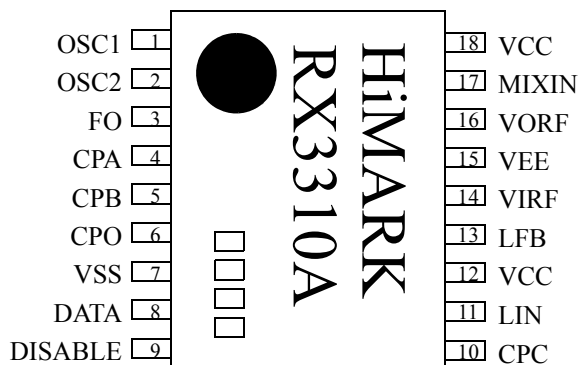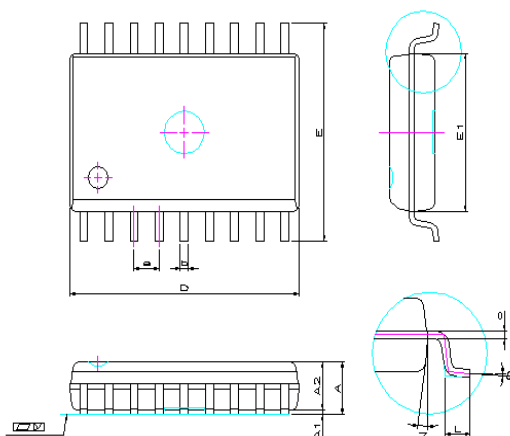◆ Remote control systems

◆ Car alarm and other security systems

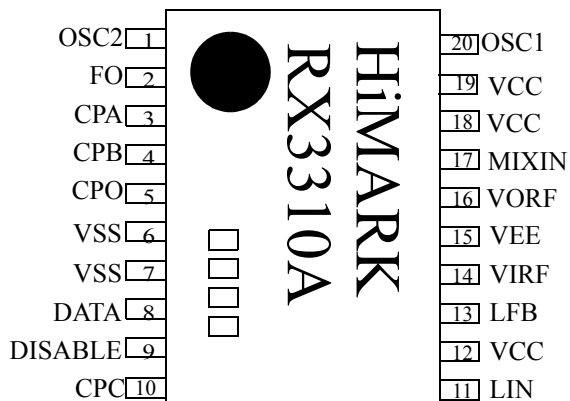◆ Baby finder, wireless doorbell, wireless toys

Block Diagram

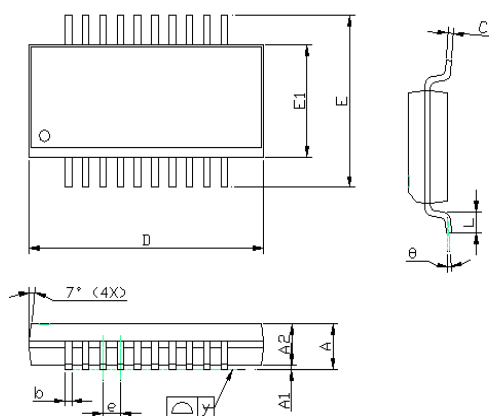## Package and Pin Assignment: SOP 18L or SSOP 20L

SOP 18L package

OSC1	1		18	VCC
OSC2	2		17	MIXIN
FO	3	HiMARK RX3310A	16	VORF
CPA	4		15	VEE
CPB	5		14	VIRF
CPO	6		13	LFB
VSS	7		12	VCC
DATA	8		11	LIN
DISABLE	9		10	CPC

SSOP 20L package

OSC2	1		20	OSC1
FO	2		19	VCC
CPA	3		18	VCC
CPB	4	HiMARK RX3310A	17	MIXIN
CPO	5		16	VORF
VSS	6		15	VEE
VSS	7		14	VIRF
DATA	8		13	LFB
DISABLE	9		12	VCC
CPC	10		11	LIN

Symbols	SOP 18L (dimensions in mm)			SOP 18L (dimensions in inch)			SSOP 20L (dimensions in mm)			SSOP 20L (dimensions in inch)		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	---	---	2.640	---	---	0.104	1.35	1.60	1.75	0.053	0.064	0.069
A1	0.100	---	---	0.004	---	---	0.1	---	0.25	0.004	---	0.010
A2	2.190	2.290	2.390	0.086	0.090	0.094	---	1.45	---	---	0.057	---
b	0.360	0.410	0.460	0.014	0.016	0.018	0.20	0.25	0.30	0.008	0.010	0.012
C	0.242	0.250	0.258	0.007	0.010	0.013	0.19	---	0.25	0.007	---	0.010
D	11.46	11.56	11.66	0.451	0.455	0.459	8.55	---	8.75	0.337	---	0.344

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Sym bols	SOP 18L (dimensions in mm)			SOP 18L (dimensions in inch)			SSOP 20L (dimensions in mm)			SSOP 20L (dimensions in inch)		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
E	10.04	10.34	10.64	0.395	0.407	0.419	5.80	---	6.20	0.228	---	0.244
E1	7.390	7.490	7.590	0.291	0.295	0.299	3.80	---	4.00	0.150	---	0.157
e	1.220	1.270	1.320	0.048	0.050	0.052	---	0.64	---	---	0.025	---
L	0.640	0.840	1.040	0.025	0.033	0.041	0.40	---	1.27	0.016	---	0.050
θ	0°	---	8°	0°	---	8°	0°	---	8°	0°	---	8°
y	---	---	0.050	---	---	0.002	---	---	0.10	---	---	0.004

RX3310A Chip Window
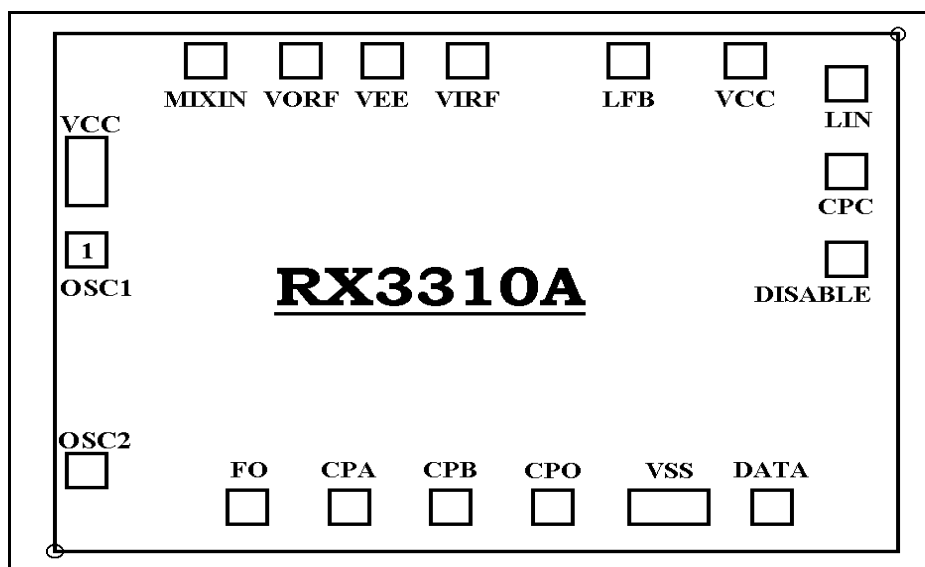
Pin Descriptions

Number (18L SOP)	Number (20L SSOP)	Name	I/O	Description
1	20	OSC1	IO	Oscillator tank connection
2	1	OSC2	IO	Oscillator tank connection
3	2	FO	O	IF filter output
4	3	CPA	I	Comparator input A
5	4	CPB	I	Comparator input B
6	5	CPO	I	Comparator offset adjustment
7	6,7	VSS	GND	Ground
8	8	DATA	O	Data output
9	9	DISABLE	I	Disable input. See *Electrical Characteristics (cont.)* on page 6
10	10	CPC	I	Comparator input C
11	11	LIN	I	Limiter input
12	12	VCC	POWER	Positive supply voltage
13	13	LFB	IO	Limiter feedback B
14	14	VIRF	I	RF amplifier input (requires external ac decoupling capacitor)
15	15	VEE	GND	Ground for RF amplifier
16	16	VORF	O	RF amplifier output
17	17	MIXIN	I	Mixer input (requires external ac decoupling capacitor)
18	18,19	VCC	POWER	Positive supply voltage

Absolute Maximum Ratings

$V_{SS} = 0$ V

Parameter	Symbol	Rating	Unit
Supply voltage	V_{CC}	$V_{SS} - 0.3$ to $V_{SS} + 6.0$	V
Operating temperature range	T_{OPR}	–60 to 85	°C
Storage temperature range	T_{STG}	–60 to 125	°C
Soldering temperature range	T_{SLD}	255	°C
Soldering time range	t_{SLD}	10	s

Recommended Operating Conditions

$V_{SS} = 0$ V

Parameter	Symbol	Value			Unit
		min.	typ.	max.	
Supply voltage range	V_{CC}	2.0	3.0	6.0	V
Operating temperature	T_A	–40	25	85	°C

Receiver Characteristics

(V_{CC} = 2.0 to 6.0 V, **LO-RF=1.8MHz**, All tests at T_A = 25 $^\circ$C unless otherwise noted)

Parameter	Symbol	Condition	Value			Unit
			min.	typ.	max.	
Sensitivity	P_{sens}	V_{CC} = 3.0 V, T_A = 27 $^\circ$C, AM 99%, sine wave (ASK square wave)	-100 (-104)	-98 (-102)		dBm
Maximum input power	$P_{in,max}$			-35	-30	dBm
Receiver turn-on time	t_{ON}				5	ms

Electrical Characteristics

(V_{CC} = 3.0 V, V_{SS} = 0 V, All tests at T_A = 25 $^\circ$C unless otherwise noted)

Parameter	Symbol	Condition	Value			Unit
			min.	typ.	max.	
Supply current	I_{CC}			3	4.5	mA
Standby current	$I_{CC,sb}$	DISABLE = high		5	10	µA
Disable pin input logic high [a]	V_{DIH}		2.0	2.4		V
Disable pin input logic low [a]	V_{DIL}				0.8	V
Data output logic high	V_{OH}		V_{PP}[b] – 0.3 V			V
Data output logic low	V_{OL}				0.3	V

a. Note: If the Disable pad is connected to an off-chip signal (open), then the pad is internally grounded.
b. Note: V_{PP} is the pull-up voltage for open collector data output. It may be as high as 13 V.

Electrical Characteristics (cont.)

(V_{CC} = 5.0 V, V_{SS} = 0 V, All tests at T_A = 25°C unless otherwise noted)

Parameter	Symbol	Condition	Value			Unit
			min.	typ.	max.	
Supply current	I_{CC}			4.5	5.0	mA
Standby current	$I_{CC,sb}$	DISABLE = high		5	10	µA
Disable pin input logic high [a]	V_{DIH}		2.0	2.4		V
Disable pin input logic low [a]	V_{DIL}				0.8	V
Data output logic high	V_{OH}		V_{PP}[b] – 0.3 V			V
Data output logic low	V_{OL}				0.3	V

a. Note: If the Disable pad is connected to an off-chip signal (open), then the pad is internally grounded.
b. Note: V_{PP} is the pull-up voltage for open collector data output. It may be as high as 13 V.

Functional Description

RF amplifier
The RF amplifier uses a common emitter configuration with a separate emitter connection (VEE). The input signal (VIRF) should be ac-coupled externally. The output of the amplifier is open collector so that the gain may be set with an external tuned load.

Mixer
The mixer is doubly-balanced configuration and has an ac-coupled input.

Oscillator
A balanced oscillator configuration is used with an L-C tank externally connected across the OSC1 and OSC2 pins. The frequency of the oscillator is determined by the external capacitor, C1, and inductor, L1 (please refer to application circuit schematic).

IF amplifier
The IF amplifier is a differential input, single-ended output emitter-coupled pair. It is used to provide additional gain in order to reduce the influence of the noise of the succeeding limiter amplifier on the total receiver noise figure.

IF filter
To minimize external component costs, an active IF filter is fully integrated.

Limiter
The limiting amplifier consists of several dc-coupled amplifier stages and outputs an RSSI signal.

Comparator
Following the limiting amplifier, the RSSI signal is passed through an additional buffer stage and is then fed to the comparator's positive and negative terminals, which possess different R-C filter time constants. A larger off-chip capacitor is used at the negative comparator input and hence, its terminal voltage represents the average value of the RSSI signal. A smaller off-chip capacitor is used at the positive comparator input and this allows the positive input to follow the RSSI signal instantaneously. When the received RSSI signal exceeds its average value (when an ASK **on** signal is received), the comparator output is switched on.

Band gap reference
A band gap reference provides precise biasing of the entire chip over temperature.
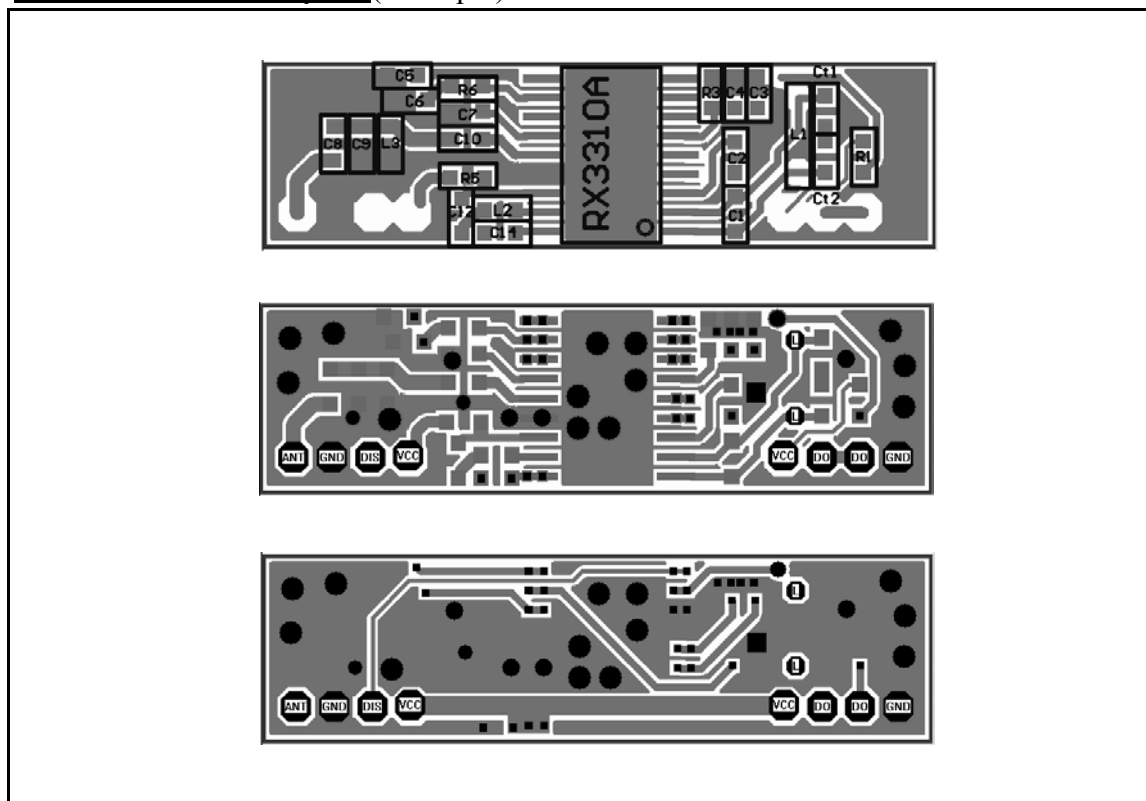
Application Circuit SOP 18L
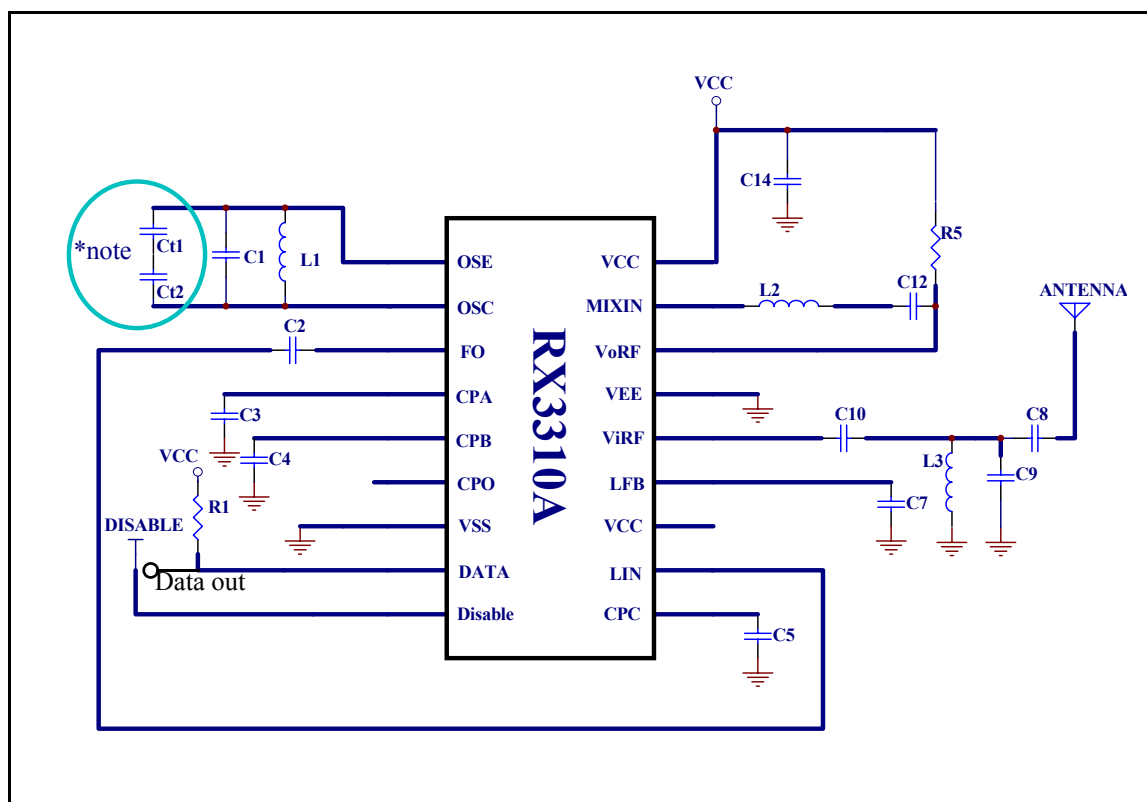
* note:Ct1,Ct2 are added for the temperature compensation. Not necessary.

External Components

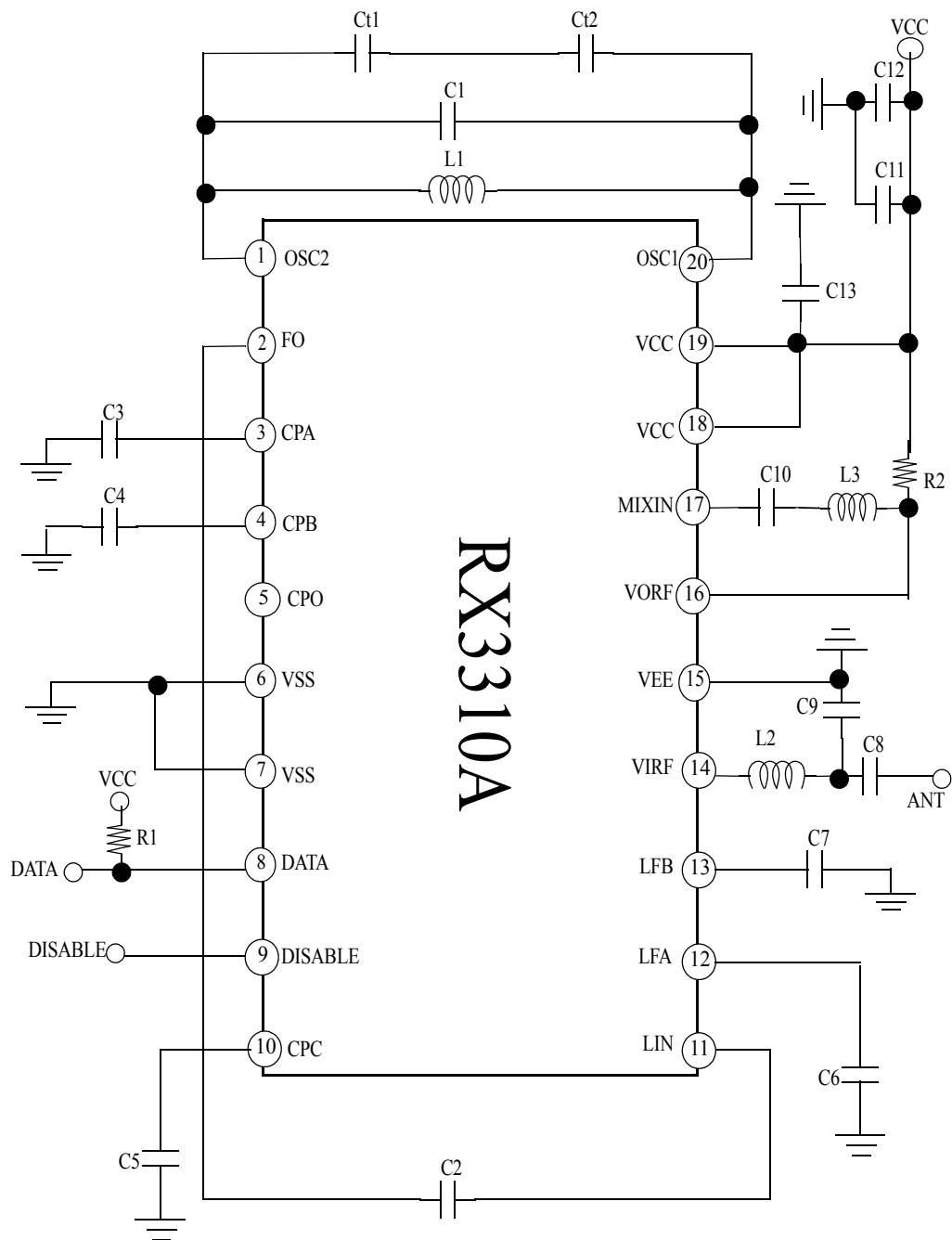| Component	Frequency Band (MHz)				Unit	Tolerance	Remark
	303	315	418	434			
C1	6.8	6.8	6.8	5.6	pF	+/-0.5pF	TC=NPO
C2	68	68	68	68	pF	+/-5%	TC=NPO
C3	470	470	470	470	pF	+/-10%	TC=X7R
C4	1	1	1	1	μF	+/-10%	TC=Y5V
C5	470	470	470	470	pF	+/-10%	TC=X7R
C7	10	10	10	10	nF	+/-10%	TC=X7R
C8	2.2	1.8	1.8	1.5	pF	+/-0.25pF	TC=NPO
C9	1.8	1.5	1.2	1.2	pF	+/-0.25pF	TC=NPO
C10	22	18	22	10	pF	+/-5%	TC=NPO
C12	82	82	82	82	pF	+/-5%	TC=NPO
C14	1	1	1	1	μF	+/-10%	TC=Y5V
Ct1	3	3	3	3	pF		GRM4DUJ030C50
Ct2	8.2	8.2	8.2	8.2	pF		TC=NPO
R1	100	100	100	100	KΩ	+/-5%	TC=+/-200 ppm
R5	1	1	1	1	KΩ	+/-5%	TC=+/-200 ppm
L1	2.5	2.5	1.5	1.5	T		tunable
L2	100	100	100	82	nH		
L3	33	33	18	18	nH		

note: All components are SMD 0805 type.

Evaluation Board Layout (Example)

1. From top to bottom: Component side of printed-circuit board, top side, bottom side.
2. Copy this page by the factor of 50%, the real size printed-circuit board is available.(Real-size:11.8mm*43.5mm)
3. Suggested board material: FR4, thickness: 0.8mm

Application Circuit SSOP 20L

* note:Ct1,Ct2 are added for the temperature compensation. Not necessary.

External Components

| Component	Frequency (MHz)		Unit	Tolerance	Remark
	315	434			
C1	8.2	6.8	pF	+/-0.5pF	TC=NPO
C2	100	100	pF	+/-5%	TC=NPO
C3	560	560	pF	+/-10%	TC=X7R
C4	1	1	μF	+/-10%	TC=Y5V
C5	1	1	nF	+/-10%	TC=X7R
C6	10	10	nF	+/-10%	TC=X7R
C7	10	10	nF	+/-10%	TC=X7R
C8	100	100	pF	+/-0.25pF	TC=NPO
C9	4.7	8.2	pF	+/-0.25pF	TC=NPO
C10	100	120	pF	+/-5%	TC=NPO
C11	10	10	nF	+/-10%	TC=X7R
C12	3.3	3.3	uF	+/-10%	TC=Y5V
C13	470	470	pF	+/-10%	TC=X7R
Ct1					
Ct2					
R1	100	100	KΩ	+/-5%	TC=+/-200 ppm
R2	680	680	Ω	+/-5%	TC=+/-200 ppm
L1	2.5	1.5	T		tunable
L2	100	56	nH		
L3	100	68	nH		

note: All components are SMD 0603 type.

* note:Ct1,Ct2 are added for the temperature compensation. Not necessary.

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Evaluation Board Layout (Example)
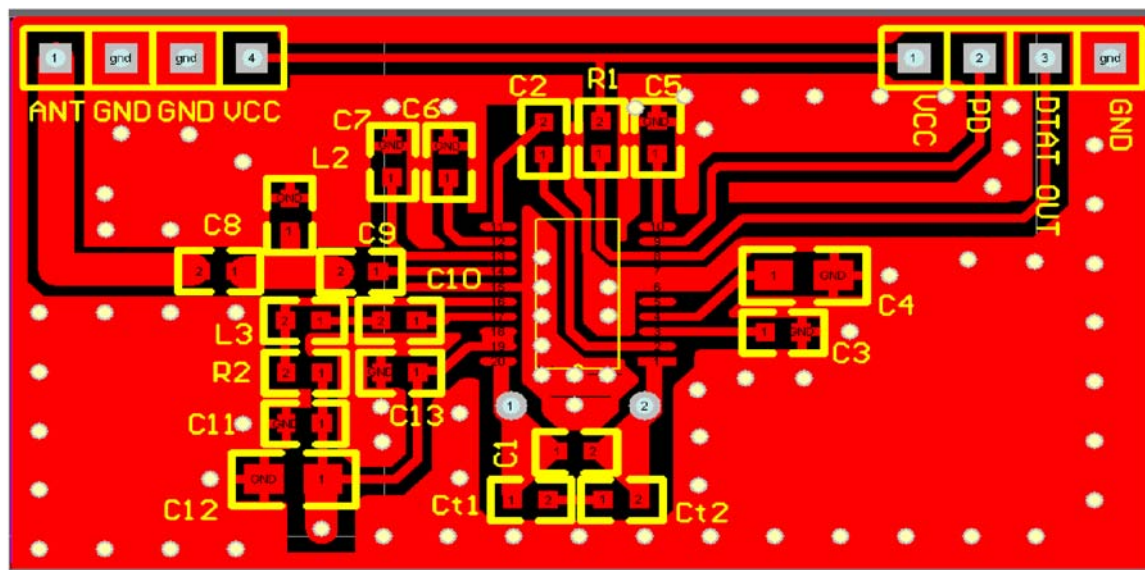
RX3310A PCB Top Layer
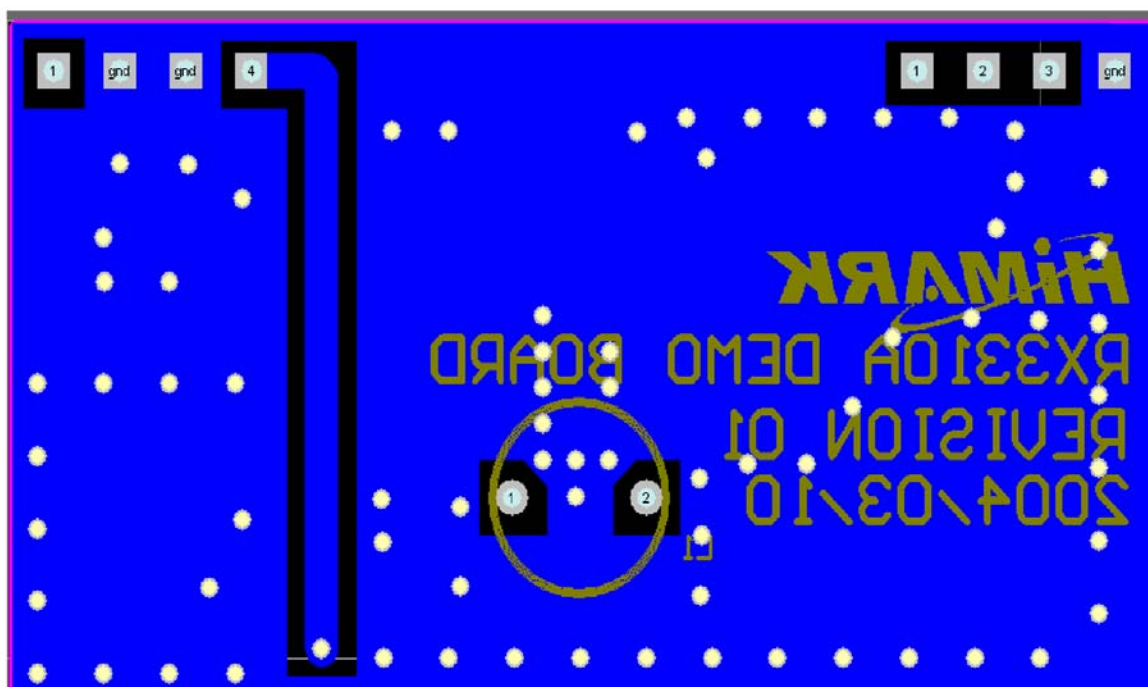
RX3310A PCB Bottom Layer

1. From top to bottom: Component side of printed-circuit board, top side, bottom side.
2. The PCB protel file is available. The real size printed-circuit board is available.(Real-size:1753 mil*934mil)
3. Suggested board material: FR4, thickness: 1.0mm