

## COMPONENT DESCRIPTION :

## Master PCBA

| Category           | IC no.    | (Label) | Name            | DESCRIPTION                                                  |
|--------------------|-----------|---------|-----------------|--------------------------------------------------------------|
| INTEGRATED CIRCUIT | SN8P1707Q | (IC4)   | Master MCU      | Radio, Voice Memo, , RF(Rx) and Weather Forecast             |
| INTEGRATED CIRCUIT | SNAD02    | (U3)    | A/D Converter   | A/D Converter                                                |
| INTEGRATED CIRCUIT | SN6A296   | (IC1)   | Voice MCU       | PWM Output, Talking, Clock and Calendar Operation Controller |
| INTEGRATED CIRCUIT | HT1621    | (IC3)   | LCD Driver      | 4 com X 32 seg LCD driver                                    |
| SENSOR             | MPXA6115A | (U5)    | Pressure Sensor | Read Pressure                                                |
| CRYSTAL            | 16.384MHz | (X2)    | 30-PPM          | for Master MCU                                               |
| CRYSTAL            | 32.768KHz | (X1)    | 10-PPM          | for Voice MCU                                                |
| INTEGRATED CIRCUIT | RX3310A   | (U1)    | RF Recevier     | RF Decode                                                    |

## Radio PCBA

| Category           | IC no.    | (Label)    | Name                    | DESCRIPTION                                         |
|--------------------|-----------|------------|-------------------------|-----------------------------------------------------|
| INTEGRATED CIRCUIT | LA1823    | (IC1)      | FM / AM Tuner           | FM / AM Receiver                                    |
| INTEGRATED CIRCUIT | TC9812    | (IC2)      | PLL (Phase Locked Loop) | Stereo Decode                                       |
| INTEGRATED CIRCUIT | IC8227    | (IC4)      | Operation Amplifier     | MIC Per-Amplifier, Radio Amplifier, Voice Amplifier |
| INTEGRATED CIRCUIT | MC2800    | (IC5)      | Slave MCU               | Master MCU Connection                               |
| FILTER             | LT10.7MA5 | (CF1)      | Ceramic Filter          | FM Filter                                           |
| FILTER             | 455KHz    | (CF3)      | Ceramic Filter          | AM Filter                                           |
| CRYSTAL            | 75KHz     | (Y1)       | 10-PPM                  | Slave MCU                                           |
| VARACTOR DIODE     | BB910     | (ZD4, ZD5) | FM Tuning Diode         | Phase Locked Loop Voltage                           |
| VARACTOR DIODE     | SVC321SPA | (ZD2, ZD3) | AM Tuning Diode         | Phase Locked Loop Voltage                           |



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### 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.

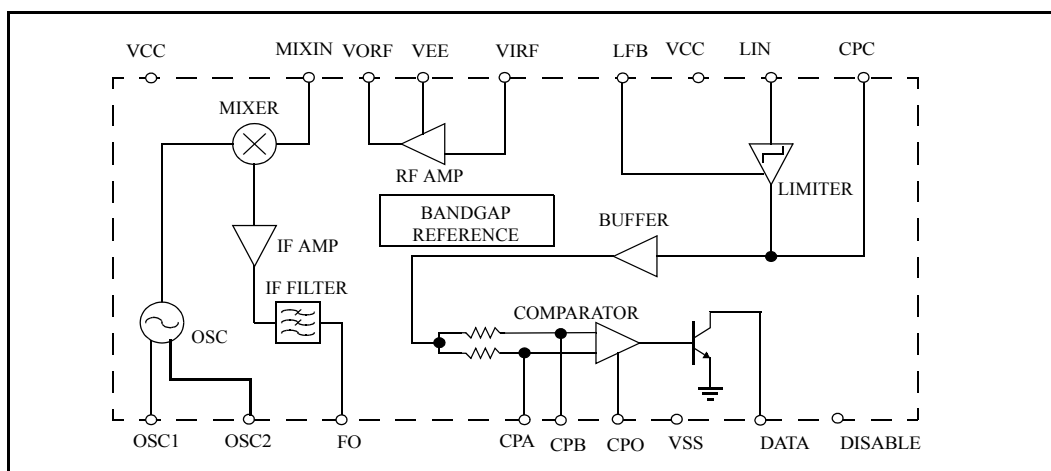
### Features

- ◆ 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

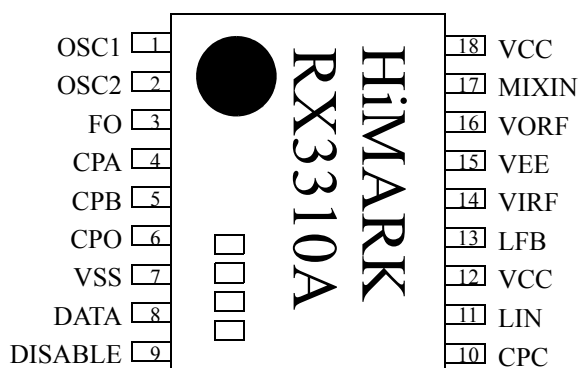
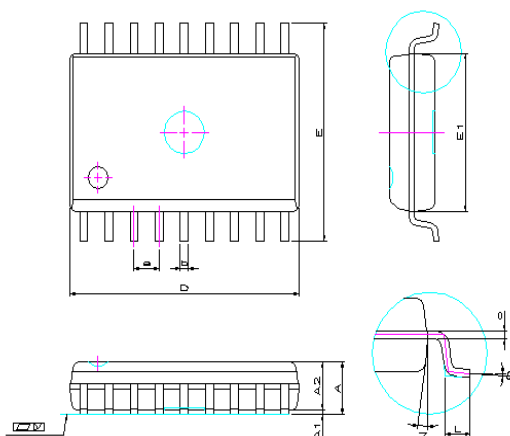
- ◆ Remote control systems
- ◆ Car alarm and other security systems
- ◆ Baby finder, wireless doorbell, wireless toys

### Block Diagram

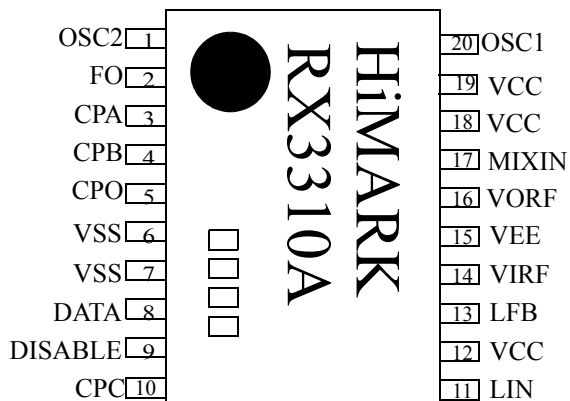
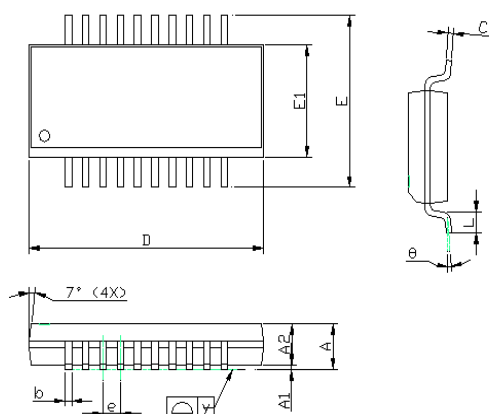


## Package and Pin Assignment: SOP 18L or SSOP 20L

### SOP 18L package



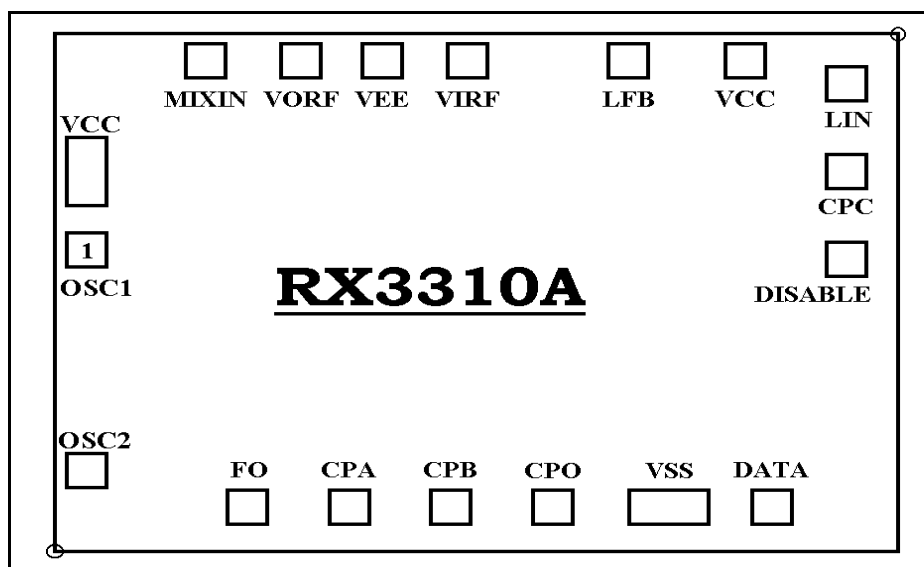
### SSOP 20L package



| Sym<br>bols | SOP 18L<br>(dimensions in mm) |       |       | SOP 18L<br>(dimensions in inch) |       |       | SSOP 20L<br>(dimensions in mm) |      |      | SSOP 20L<br>(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 |

| Sym<br>bols | SOP 18L<br>(dimensions in mm) |       |       | SOP 18L<br>(dimensions in inch) |       |       | SSOP 20L<br>(dimensions in mm) |      |      | SSOP 20L<br>(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 |
| $\theta$    | 0°                            | ---   | 8°    | 0°                              | ---   | 8°    | 0°                             | ---  | 8°   | 0°                               | ---   | 8°    |
| y           | ---                           | ---   | 0.050 | ---                             | ---   | 0.002 | ---                            | ---  | 0.10 | ---                              | ---   | 0.004 |

## RX3310A Chip Window



## Pin Descriptions

| Number<br>(18L SOP) | Number<br>(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 <i>Electrical Characteristics (cont.)</i> 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

 $V_{SS} = 0\text{ V}$ 

| 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

 $V_{SS} = 0\text{ V}$ 

| 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  $T_A = 25$  °C unless otherwise noted)

| Parameter             | Symbol       | Condition                                                                  | Value          |               |      | Unit |
|-----------------------|--------------|----------------------------------------------------------------------------|----------------|---------------|------|------|
|                       |              |                                                                            | min.           | typ.          | max. |      |
| Sensitivity           | $P_{sens}$   | $V_{CC} = 3.0$ V, $T_A = 27$ °C,<br>AM 99%, sine wave<br>(ASK square wave) | -100<br>(-104) | -98<br>(-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  $T_A = 25$  °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 <sup>a</sup> | $V_{DIH}$    |                | 2.0                  | 2.4  |      | V    |
| Disable pin input logic low <sup>a</sup>  | $V_{DIL}$    |                |                      |      | 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 <sup>a</sup> | $V_{DIH}$    |                | 2.0                  | 2.4  |      | V    |
| Disable pin input logic low <sup>a</sup>  | $V_{DIL}$    |                |                      |      | 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.

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## 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.

The diagram illustrates the RX3310A module with the following components and connections:

- Components:**
  - Capacitors: C1, C2, C3, C4, C5, C7, C8, C9, C10, C12, C14.
  - Inductors: L1, L2, L3.
  - Resistors: R1, R5.
- Pin Connections:**
  - OSE:** Connected to a parallel combination of C1 and C2, and in series with L1.
  - OSC:** Connected to C2.
  - FO:** Connected to C3.
  - CPA:** Connected to C4.
  - CPB:** Connected to C3.
  - CPO:** Connected to C4.
  - VSS:** Connected to ground.
  - DATA:** Connected to the "Data out" terminal.
  - Disable:** Connected to the "DISABLE" terminal.
  - VCC:** Connected to the top VCC supply.
  - MIXIN:** Connected to L2, which is in series with C12.
  - VoRF:** Connected to C12.
  - VEE:** Connected to ground.
  - ViRF:** Connected to C10.
  - LFB:** Connected to C7.
  - VCC:** Connected to the bottom VCC supply.
  - LIN:** Connected to C5.
  - CPC:** Connected to C5.
- Antenna:** Connected to C8, which is in series with C9.
- Other Connections:**
  - R1 is connected between VCC and the "DISABLE" terminal.
  - R5 is connected between VCC and C12.
  - L3 is connected between C10 and C9.

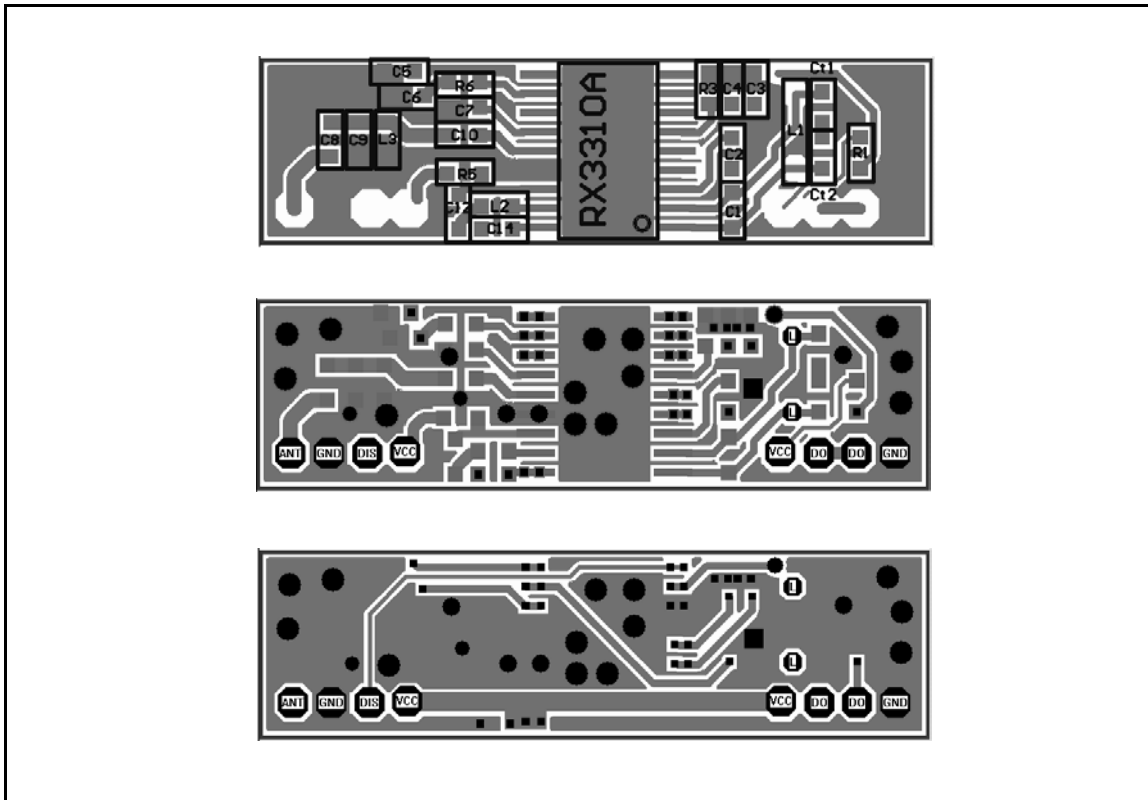
April 2004

## 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   |           |               |

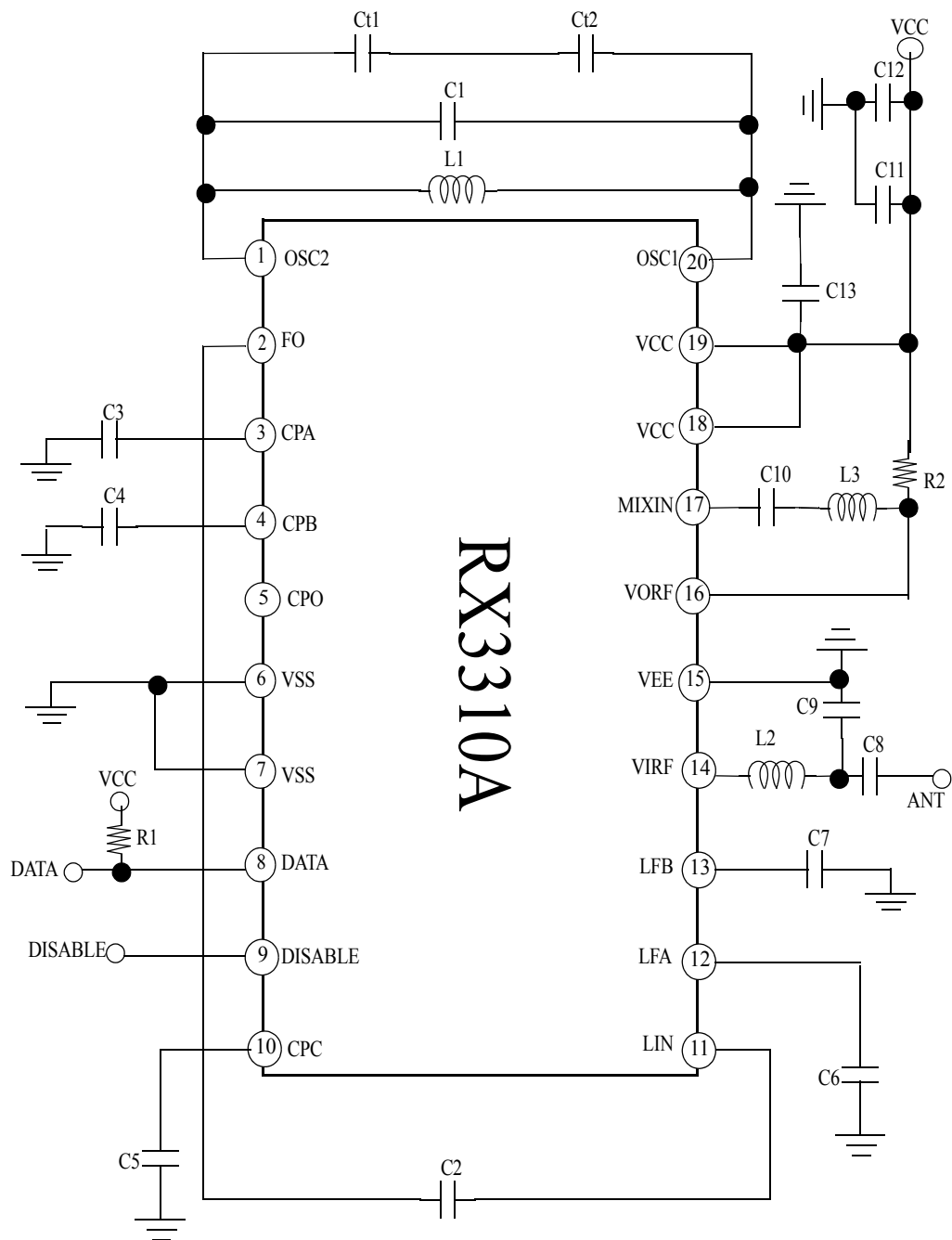
note: All components are SMD 0805 type.

### 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.

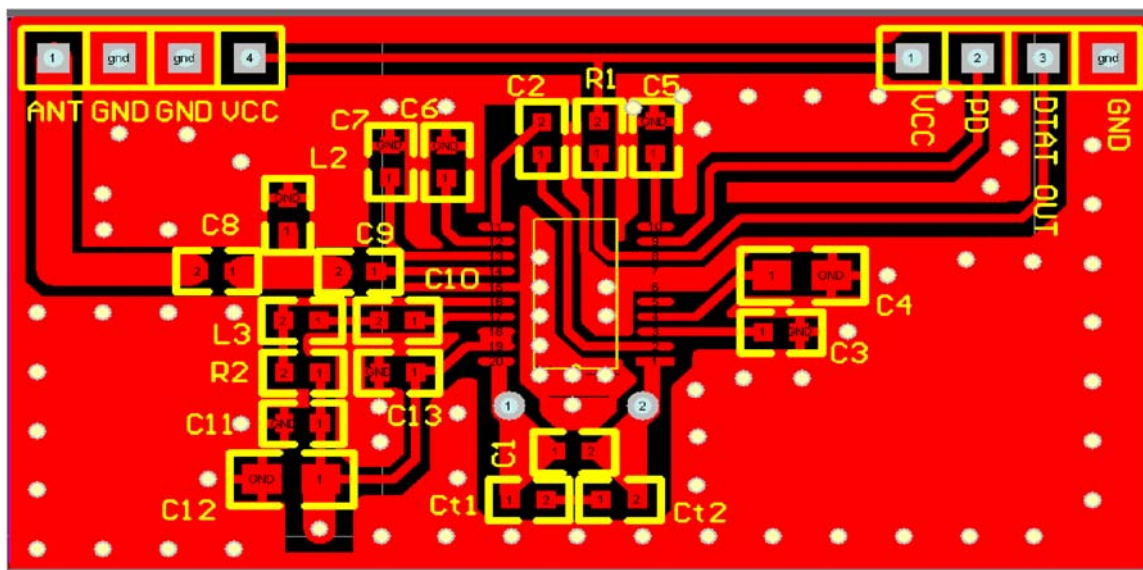
## External Components

| 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   |           |               |

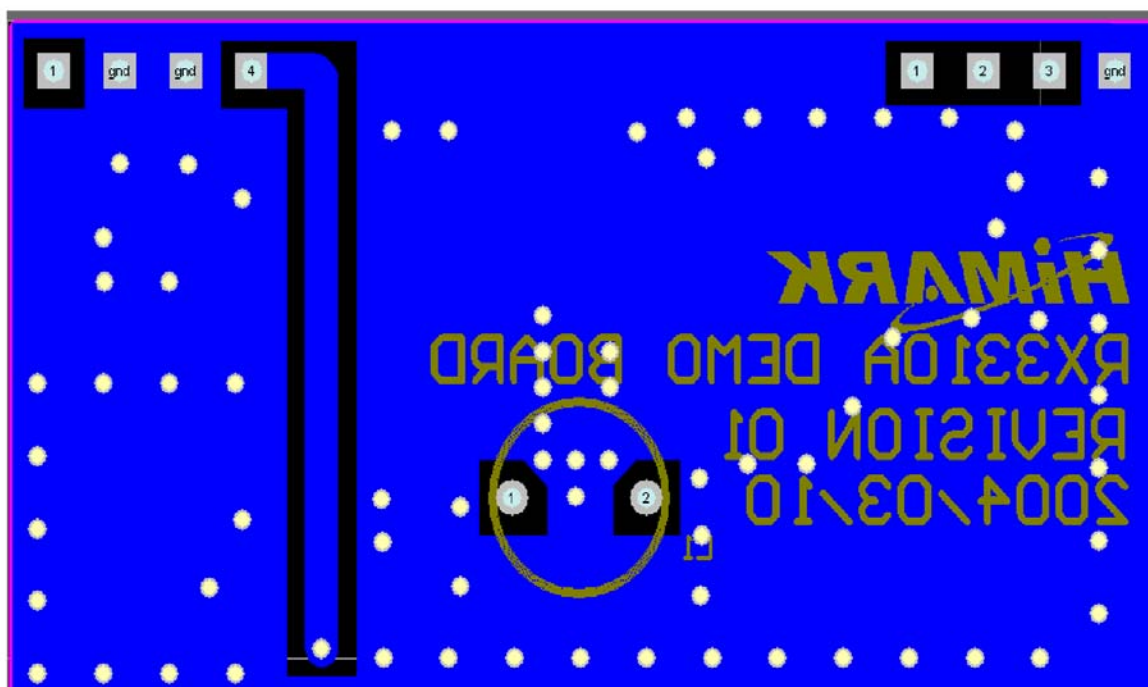
note: All components are SMD 0603 type.

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

### 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