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## Description

The RX3930 is a low power 433/868/915 MHz FM/FSK receiver IC which is suitable for use in the North American 915 MHz and the European 433 and 868 MHz ISM bands.

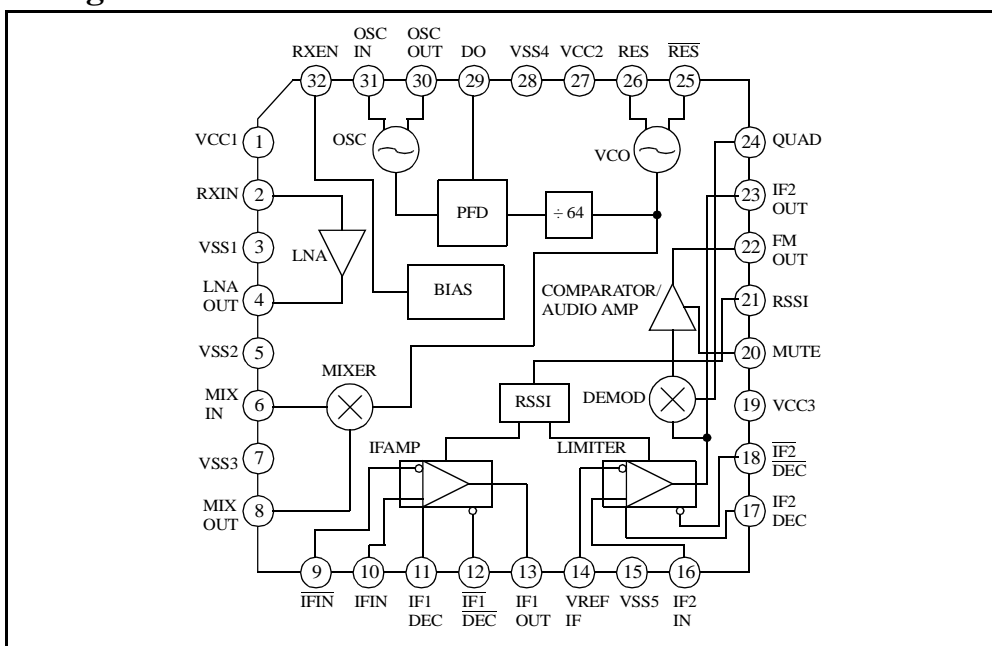
## Features

- ◆ Integrated VCO with fixed  $\div 64$  prescaler, phase/frequency detector, and reference oscillator forming complete phase-locked loop
- ◆ User selectable FM or FSK output
- ◆ RSSI output with 70 dB dynamic range
- ◆ Receiver enable pin for power saving
- ◆ TQFP-32 package (5mm x 5mm)

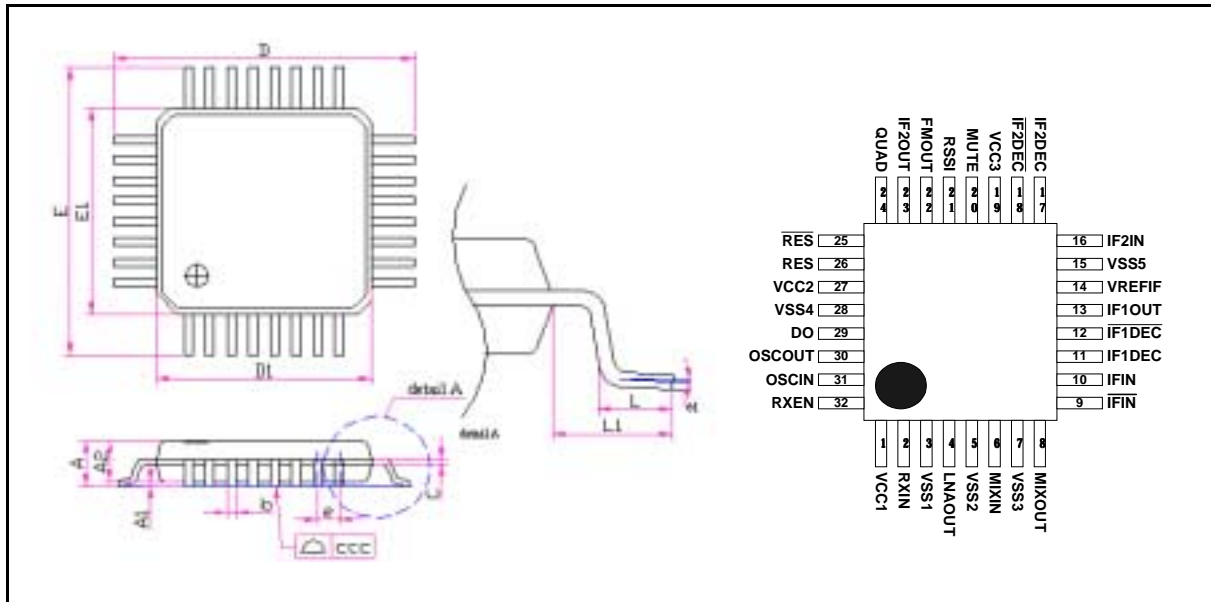
## Applications

- ◆ Wireless mouse
- ◆ Wireless amplifier/ speaker/ earphone/ microphone
- ◆ Wireless car alarm system

## Block Diagram



**Package and Pin Assignment: TQFP-32**



Symbols	Dimensions in mm			Dimensions in inch		
	min.	nom.	max.	min.	nom.	max.
A	—	—	1.20	—	—	0.047
A1	0.05	—	0.15	0.002	—	0.006
A2	0.95	1.00	1.05	0.037	0.039	0.041
b	0.17	0.22	0.27	0.007	0.009	0.011
C	0.09	—	0.20	0.003	—	0.008
D1	4.90	5.00	5.10	0.193	0.197	0.201
D	6.80	7.00	7.20	0.267	0.275	0.283
E1	4.90	5.00	5.10	0.193	0.197	0.201
E	6.80	7.00	7.20	0.267	0.275	0.283
e	—	0.50(typ)	—	—	0.02(typ)	—
L	0.45	0.60	0.75	0.018	0.024	0.029
L1	—	1.00(ref.)	—	—	0.039(ref.)	—
θ1	0°	3.5°	7°	0°	3.5°	8°
ccc	—	—	0.008	—	—	0.003

## Pin Descriptions

Number	Name	I/O	Description
1	VCC1	POWER	Supply DC bias for RF amplifier
2	RXIN	I	RF amplifier input
3	VSS1	GND	Ground for RF amplifier
4	LNAOUT	O	LNA output
5	VSS2	GND	Ground for 40dB IF limiting amplifier
6	MIXIN	I	RF input to RF Mixer
7	VSS3	GND	Ground for RF Mixer
8	MIXOUT	O	IF output from RF Mixer
9	$\overline{\text{IFIN}}$	I	IF input (required 10nF DC blocking capacitor)
10	IFIN	I	Same as pin 9 except non-inverting node amplifier input
11	IF1DEC	I/O	DC feedback for 40dB limiting amplifier (required 100nF bypass capacitor)
12	$\overline{\text{IF1DEC}}$	I/O	See pin 11
13	IF1OUT	O	IF output from the 40 dB limiting amplifier
14	VREFIF	O	DC voltage reference for the IF limiting amplifier (required 0.1 $\mu\text{F}$ capacitor)
15	VSS5	GND	Ground for 60dB IF limiting amplifier
16	IF2 IN	I	Inverting input to the 60dB limiting amplifier (required 10nF DC blocking capacitor)
17	IF2DEC	I/O	DC feedback node for the 60dB limiting amplifier (required 100nF bypass capacitor)
18	$\overline{\text{IF2DEC}}$	I/O	See pin 17
19	VCC3	POWER	Supply DC bias to the 60dB IF limiting amplifier
20	MUTE	I	Select FM, FSK, or mute at the FM OUT pin. (to Ground: FSK OUTPUT; floating: FM OUTPUT; to Vcc: muting)
21	RSSI	O	Proportional DC voltage (0.5V~2.5V) output
22	FMOUT	O	Demodulated output
23	IF2OUT	O	IF output from the 60dB limiting strip
24	QUAD	I	FM demodulator input (not AC coupled)
25	$\overline{\text{RES}}$	I/O	Supply DC voltage to VCO
26	RES	I/O	See pin 25
27	VCC2	POWER	Supply DC bias to the VCO, prescaler, and PLL
28	VSS4	GND	Ground shared by the VCO, prescaler, and PLL
29	DO	I/O	Output of the charge pump, and input to the VCO

Number	Name	I/O	Description
30	OSCOUT	I/O	Connected to the reference oscillator transistor base
31	OSCIN	I/O	Connected to the emitter of the reference oscillator transistor
32	RXEN	I	Power up or down the RX3930. (logic high powers up the receiver and PLL; logic low powers down circuit to stand by mode)

### Absolute Maximum Ratings

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

Parameter	Symbol	Rating	Unit
Supply voltage	$V_{CC1}$ $V_{CC2}$	$V_{SS} - 0.5$ to $V_{SS} + 5.5$	V
Operating temperature range	$T_{OPR}$	-40 to 85	°C
Storage temperature range	$T_{STG}$	-40 to 150	°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	$V_{CC1}$	2.7	3.6	5.0	V
	$V_{CC2}$	2.7	3.6	5.0	V
	$V_{CC3}$	2.7	3.6	5.0	V
Operating temperature	$T_A$	-10	25	60	°C

## Receiver Characteristics

( $V_{CC1}, V_{CC2}, V_{CC3} = 2.7$  to  $5.0$  V,  $V_{SS} = 0$  V,  $RXEN = \text{high}$ ,  $T_A = -10$  to  $60$  °C unless otherwise noted)

Parameter	Symbol	Condition	Value			Unit
			min.	typ.	max.	
Input RF frequency range			300		1000	MHz
Sensitivity	$P_{\text{sens}}$	$BW_{\text{IF}} = 150$ KHz, $f_{\text{RF}} = 915$ MHz, SNR = 8 dB		-97		dBm
LO leakage	$\alpha_{\text{LO}}$			-55		dBm

## Electrical Characteristics

( $V_{CC1}, V_{CC2}, V_{CC3} = 2.7$  to  $5.0$  V,  $V_{SS} = 0$  V,  $RXEN = \text{high}$ ,  $T_A = -10$  to  $60$  °C,  $f_{\text{RF}} = 915$  MHz unless otherwise noted)

Parameter	Symbol	Condition	Value			Unit
			min.	typ.	max.	
<b>Power supply</b>						
VCC1 supply voltage	$V_{CC1}$		2.7	3.6	5.0	V
VCC2 supply voltage	$V_{CC2}$		2.7	3.6	5.0	V
VCC3 supply voltage	$V_{CC3}$		2.7	3.6	5.0	V
Total dc current (normal operation)	$I_{\text{DC}}$			10		mA
Total dc current (stand-by mode)	$I_{\text{standby}}$	$RXEN = \text{low}$			1	$\mu\text{A}$
<b>LNA</b>						
Power gain	$G_{\text{LNA}}$	Matched to $50 \Omega$		17		dB
Noise figure	$NF_{\text{LNA}}$			3.8		dB
Input third-order intermodulation intercept point	$IIP3_{\text{LNA}}$			-8		dBm
<b>Mixer</b>						
Conversion power gain	$G_{\text{C}}$	Matched to $50 \Omega$		7		dB
Noise figure (SSB)	$NF_{\text{MIX}}$			17		dB
Input third-order intermodulation intercept point	$IIP3_{\text{MIX}}$			-15.5		dBm
<b>VCO</b>						
Frequency range		External varactor	300		1000	MHz

Parameter	Symbol	Condition	Value			Unit
			min.	typ.	max.	
<b>PLL</b>						
N-divider ratio				64		
Reference frequency	$f_{REF}$				17	MHz
Charge pump current	$I_{CP}$		-40		40	$\mu$ A
Lock time	$\tau_{lock}$	PLL's lock time set by bandwidth of external loop filter		10		ms
<b>IF amplifier</b>						
Frequency range			0.1	10.7	25	MHz
Input impedance	$Z_{in,IF}$			330		$\Omega$
Output impedance	$Z_{out,IF}$			330		$\Omega$
<b>Limiter</b>						
Frequency range			0.1	10.7	25	MHz
Input impedance	$Z_{in,IF}$			330		$\Omega$
Output impedance	$Z_{out,IF}$			330		$\Omega$
<b>RSSI</b>						
RSSI dynamic range				70		dB
RSSI dc output range		$R_{load} = 51\text{ K}\Omega$	0.5		2.5	V
<b>FM/FSK Demodulator</b>						
Demodulated output level (audio)	$V_{OD}$			70		mV <sub>rms</sub>
FSK output duty ratio			40	50	60	%

**Application Circuit (906 MHz)**

