Low Power ISM-Band FM/FSK Receiver IC

Description

The SSRX3930 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.

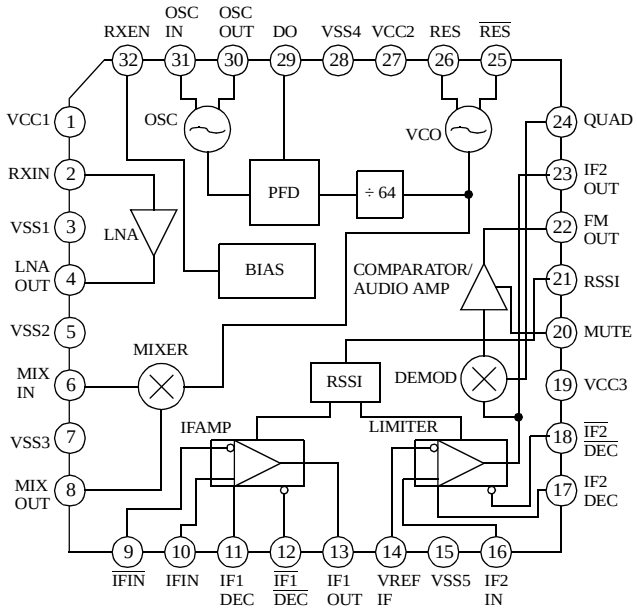
Features

- Integrated VCO with fixed ÷ 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)

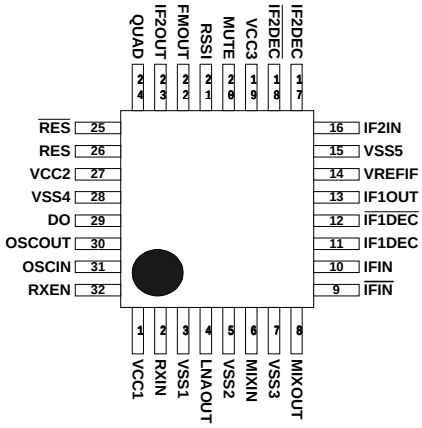
Applications

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

Block Diagram



Pin Out Diagram



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 µF 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. (logic high powers up the receiver and PLL; logic low powers down circuit to stand by mode)

Absolute Maximum Ratings

V_{SS} = 0 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 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 = 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_{sens}	BW_{IF} = 150 KHz, f_{RF} = 915 MHz, SNR = 8 dB		–97		dBm
LO leakage	α_{LO}			–55		dBm

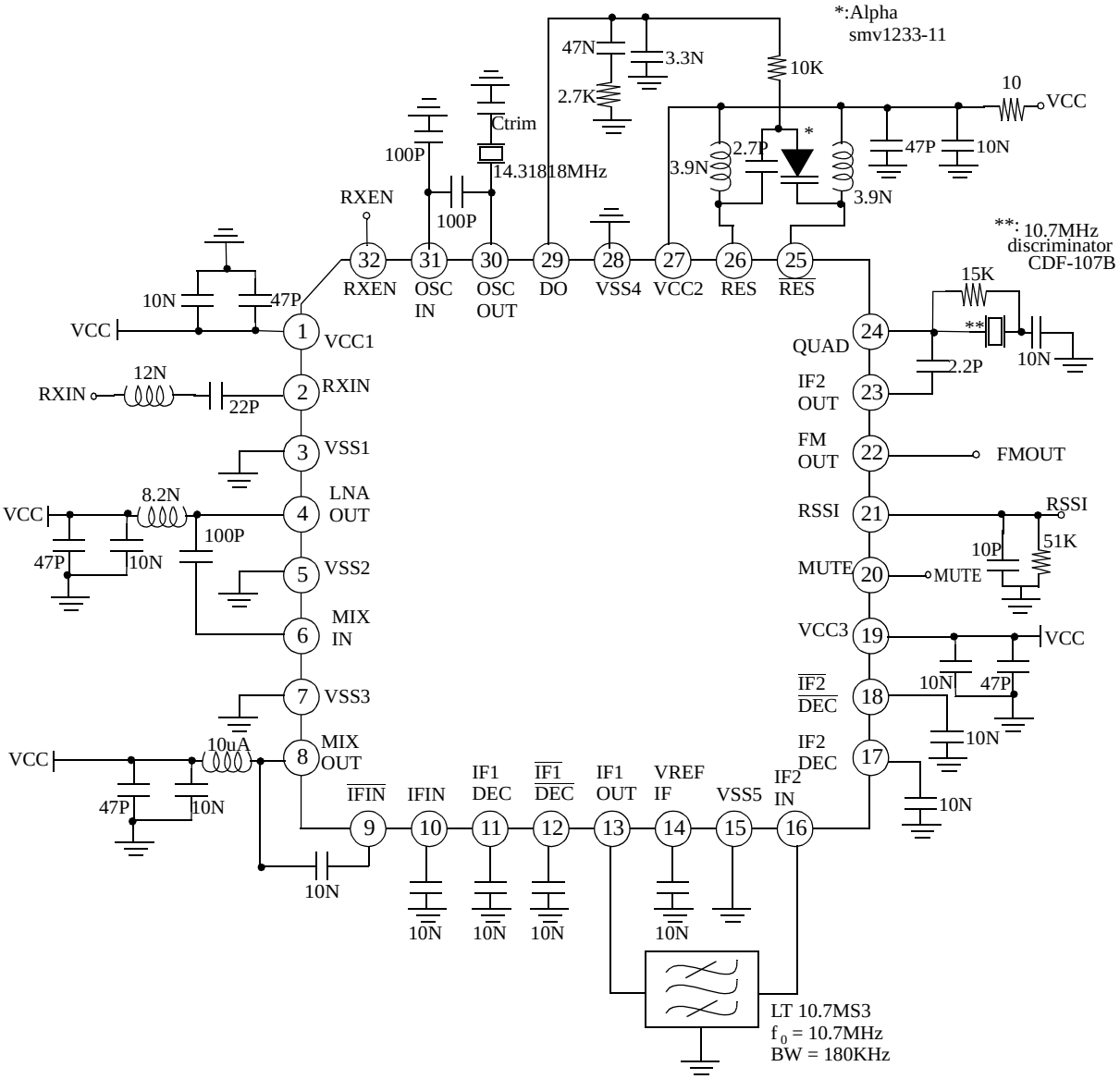
Electrical Characteristics

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

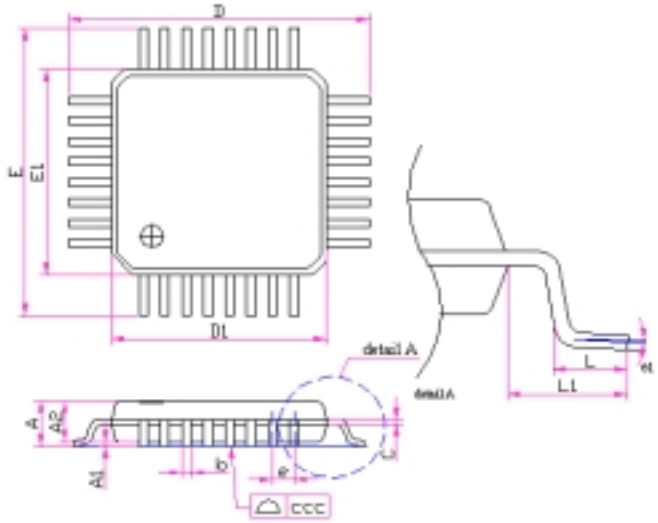
Parameter	Symbol	Condition	Value			Unit
			min.	typ.	max.	
Power supply						
VCC1 supply voltage	V_{CC1}		2.7	3.6	5.0	V
VCC2 supply voltage	V_{CC2}		2.7	3.6	5.0	V
VCC3 supply voltage	V_{CC3}		2.7	3.6	5.0	V
Total dc current (normal operation)	I_{DC}			10		mA
Total dc current (stand-by mode)	$I_{standby}$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

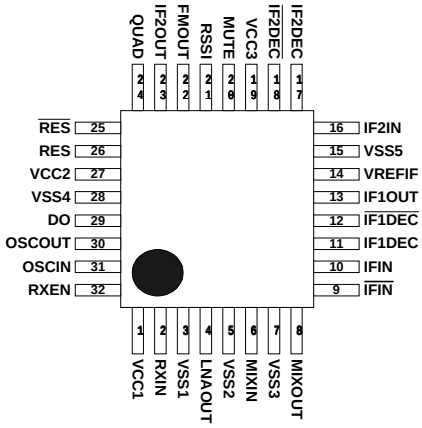
Parameter	Symbol	Condition	Value			Unit
			min.	typ.	max.	
PLL						
N-divider ratio				64		
Reference frequency	f_{REF}				17	MHz
Charge pump current	I_{CP}		–40		40	µA
Lock time	τ_{lock}	PLL's lock time set by bandwidth of external loop filter		10		ms
IF amplifier						
Frequency range			0.1	10.7	25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

Application Circuit (906 MHz)



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

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