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Low Power 315/433 MHz OOK/ASK Superheterodyne Receiver with SAW-based Oscillator

PT4317

DESCRIPTION

The PT4317 is a low power consumption single chip OOK/ASK superheterodyne receiver for the 315 MHz and 434 MHz frequency bands and which offers a high level of integration and requires few external components. The PT4317 consists of a low-noise amplifier (LNA), mixer, SAW-based local oscillator, on-chip gm-C band-pass filter, intermediate frequency (IF) limiting amplifier stage with received-signal-strength indicator (RSSI), and analog baseband data recovery circuitry (data filter, peak detector, and data slicer). The PT4317 is available in a 16-pin SSOP package.

FEATURES

- Low current consumption (4.3 mA at VDD = 5.0 V)
- 2.4 V to 5.5 V supply voltage operation range
- Optimized for 315 MHz or 434 MHz ISM Band
- Saw-based oscillator with low frequency drift
- On-chip IF filter with better adjacent channel rejection capability
- Power down mode with very low supply current (<1 μA)
- Low external parts count
- 16-pin SSOP package

APPLICATIONS

- Keyless entry systems
- Remote control systems
- Garage door openers
- Alarm systems
- Security systems
- Wireless sensors

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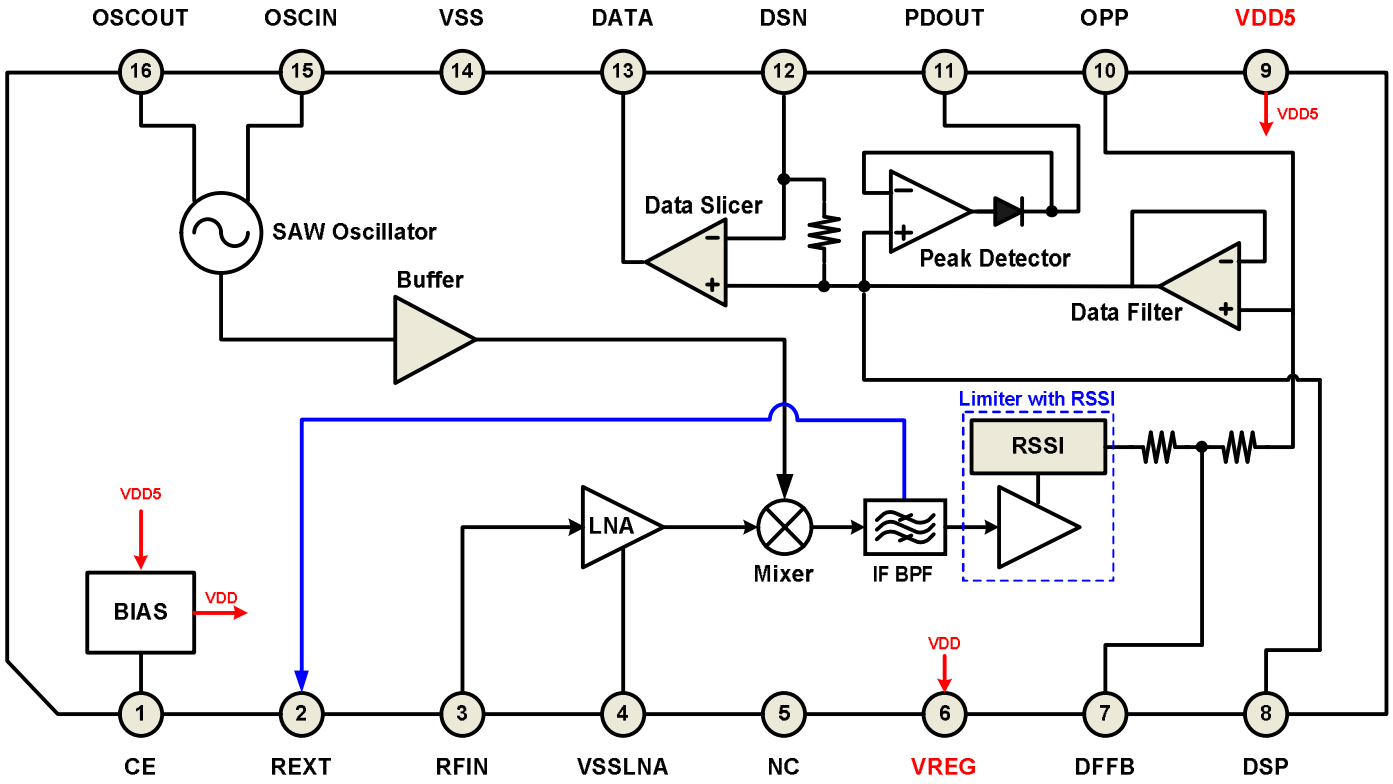
BLOCK DIAGRAM

PT4317 simplified block diagram



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PIN DESCRIPTION

Pin Number	Pin Name	I/O	Description
1	CE	I	Chip enable
2	REXT	O	IF filter tuning resistor
3	RFIN	I	RF input
4	VSSLNA	G	Ground for LNA
5	NC	--	No connection
6	VREG	I	Voltage regulator output
7	DFFB	I	Data filter feedback point
8	DSP	I	Positive input of data slicer (data filter output)
9	VDD	P	Power supply voltage
10	OPP	I	Non-inverting op-amp input
11	PDOUT	O	Peak detector output
12	DSN	I	Negative input of data slicer
13	DATA	O	Data output
14	VSS	G	Ground
15	OSCIN	I	SAW oscillator input
16	OSCOUT	O	SAW oscillator output

ABSOLUTE MAXIMUM RATINGS

V_{SS} = 0 V

Parameter	Symbol	Rating	Unit
Supply Voltage Range	V_{DD}	V_{SS} – 0.3 to V_{SS} + 6.0	V
Operating Temperature Range	T_{OPR}	–40 to 85	°C
Storage Temperature Range	T_{STG}	–55 to 125	°C
Soldering Temperature	T_{SLD}	225	°C
Soldering Time	t_{STG}	10	s

RECOMMENDED OPERATING CONDITIONS

V_{SS} = 0 V

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Supply Voltage Range	V_{DD}	2.4	5.0	5.5	V
Operating Temperature	T_A	–40	27	85	°C

ELECTRICAL CHARACTERISTICS

Nominal conditions: V_{DD}= 5.0 V, V_{SS} = 0 V, CE = "HIGH", Temp= +27 °C, f_{RF} = 433.92 MHz

Parameter	Symbol	Condition	Value			Unit
			Min.	Typ.	Max.	
General Characteristics						
Frequency Range	f_{RF}		250		500	MHz
Maximum Receiver Input Level	$P_{RF, MAX}$		–20	–10		dBm
Sensitivity[a]	S_{IN}	ASK[b], peak power level		–106	–103	dBm
		OOK, peak power level		–100	–97	dBm
Data Rate[c]	D_{Rate}			1	50	Kb/s
Power Supply						
Supply Voltage	V_{DD}		2.4	5.0	5.5	V
Consumption DC Current	I_{DD}	CE = "HIGH"		4.3	4.8	mA
Standby DC Current	$I_{stand-by}$	CE = "LOW"			1.0	µA
RF Front-End						
Conversion Voltage Gain	G_{RF}		45	50	55	dB
Noise Figure (SSB)	NF_{RF}		6	7	8	dB
IF Band-Pass Filter						
Filter Center Frequency	f_{FLT}			1.8		MHz
Bandwidth	BW_{FLT}		580	630	680	kHz
SAW Oscillator						
Start-Up Time	$T_{OSC,start}$				500	µs
IF Limiting Amplifier						
IF Frequency	f_{IF}			1.8		MHz
Gain	G_{LIM}		64	70	76	dB
Bandwidth	BW_{LIM}			5		MHz
RSSI Dynamic Range	DR_{RSSI}		60	70	80	dB
RSSI Curve Slope	SL_{RSSI}			10	12	mV/dB
RSSI Level	V_{RSSI}	P_{RF} < –110 dBm		1.2		V
		P_{RF} > –30 dBm		2.0		
Data Filter						
Bandwidth	BW_{DF}			1	50	KHz
Data Slicer						
Data Rate	D_{Rate}			1	50	Kb/s
Maximum Load Capacitance	$C_{Load,DS}$				20	pF

Note:
a. BER = 1e-3, data rate = 2 Kb/s.
b. Use AM 99% with square wave modulation (if limited by capabilities of signal generator).
c. Data rate selection affects choice of component values for data filter, peak detector and slicer.