3.4.4 Crystal Oscillator

Table 3-6 lists the crystal oscillator electrical characteristics.

Table 3-6. Crystal Oscillator Electrical Characteristics

	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Crystal Characteristics						
f_{osc}	Crystal frequency	@ specified load capacitor value		32768		Hz
	Crystal tolerance	T = 25°C	−20	0	20	ppm
B	Secondary temperature coefficient		−0.04	−0.035	−0.03	ppm/°C$_2$
R_{ESR}	Crystal series resistor	@ fundamental frequency			90	kΩ
DL	Operating drive level		0.1		0.5	µW
C_L	Crystal load capacitor (according to crystal data sheet)			12.5		pF
C_{shunt}	Shunt capacitor			1.4	2.6	pF
Q	Quality factor		8000		80000	
Crystal Oscillator External Components						
	VRTC power supply external filtering capacitor	OSC32KCAP	0.6	2.2	2.7	µF
C_{Load}	Load capacitors on OSC32KIN and OSC32KOUT External capacitor includes the parasitics of PCB	Normal and high-performance (HP) mode: External capacitor Internal capacitance	9 8	15 10	17 12	pF
		Backup mode: External capacitor Internal capacitance	9 0	15 0	17 0	
	Frequency accuracy (taking into account crystal tolerance and internal load capacitors variation)	@ 25°C, normal and HP modes	−30	0	30	ppm
		@ 25°C, backup mode	−80	0	80	
	Oscillator capacitor ratio: $C_{OSC32KIN}/C_{OSC32KOUT}$			1		
Square Wave Input Clock for Bypass						
	Input bypass clock OSC32KIN input OSC32KOUT floating	Frequency		32768		Hz
		Duty cycle	40	50	60	%
		Rise and fall time (10% to 90%)		10	20	ns
		Setup time			1	ms
Crystal Oscillator Characteristics						
	Frequency temperature coefficient	Oscillator contribution in normal and HP modes (not including the crystal variations)		±0.5		ppm/°C
	SSB phase noise at a 1-kHz offset from the carrier	HP mode OSC_HPMODE = 1			−125	dBc/Hz
	SSB phase noise at a 100-Hz offset from the carrier	HP mode OSC_HPMODE = 1			−105	dBc/Hz
	Cycle jitter short term (peak-to-peak)	Normal mode OSC_HPMODE = 0			25	ns
	Integrated jitter (HP mode)	20 Hz to 20 kHz flat			0.86	ns_{RMS}
		80 Hz to 20 kHz flat			0.43	
$T_{startup}$	Startup time for power on	Shunt capacitor ≤ 1.4 pF			300	ms
		Shunt capacitor 1.4 to 2.6 pF			400	
	Sixth harmonic mode rejection RS32/RS200	Oscillator ratio between negative resistance @ 32 kHz and negative resistance @ 200 kHz (sixth harmonic)	10			