LN CSAC

Low-Noise Chip-Scale Atomic Clock

Summary

The Low-Noise Chip-Scale Atomic Clock (LN CSAC) combines the accuracy of an atomic clock with the spectral purity of an ovenized crystal oscillator in a compact size requiring low input power.

Microchip, the developer of the CSAC, has incorporated a low-power OCXO within the frequency control loop of the atomic clock enabling exceptional performance for both Allan deviation and phase noise. This level of performance cannot be achieved using external phase locked loops.

The LN CSAC provides a 10 MHz sine wave output and 1 PPS output, with short-term stability (Allan deviation) of 3×10^{-11} @ TAU = 1 second, long–term aging of $\leq 9 \times 10^{-10}$/month, and maximum frequency change of $\pm 5 \times 10^{-10}$ over an operating temperature range of –10°C to 70°C.

The LN CSAC accepts a 1 PPS input that may be used to synchronize the unit's 1 PPS output to an external reference clock with ±100 ns accuracy. The LN CSAC can also use the 1 PPS input to discipline its phase and frequency to within 1 ns and 1.0×10^{-12} respectively.

A standard RS-232 serial interface is built in to the LN CSAC. This is used to control and calibrate the unit and also to provide a comprehensive set of status monitors. The interface is also used to set and read the LN CSAC's internal time-of-day clock.

The LN CSAC acts as a frequency and timing subsystem while requiring limited size, weight and power. This device is not rated for space applications. Contact your Microchip representative for more details.

Features

- Power consumption ≤295 mW
- Less than 46 cc volume, 2.0" × 2.0" × 0.70"
- 10 MHz sine wave output
- 1 PPS output and 1 PPS input for synchronization
- RS-232 interface for monitoring and control
- Short term stability (Allan deviation) of $\leq 3 \times 10^{-11}$ @ TAU = 1 sec
- Phase noise - sine wave
  - ≤–85 dBc/Hz @ 1 Hz
  - ≤–120 dBc/Hz @ 10 Hz
  - ≤–140 dBc/Hz @ 100 Hz
  - ≤–145 dBc/Hz @ 1 kHz
  - ≤–150 dBc/Hz @ 10 kHz
  - ≤–155 dBc/Hz @ ≥100 kHz

Applications

- Underwater sensor systems
- GPS receivers
- Dismounted radios
- Dismounted IED jamming systems
- Autonomous sensor networks
- Unmanned vehicles

Specifications

All specifications are at 25°C, Vcc = 3.3 VDC unless otherwise specified.

Electrical Specifications

RF Output	
Frequency	10 MHz
Format	Sine wave
Amplitude	6–9 dBm
Load impedance	50Ω
Quantity	1
1 PPS Output	
Rise/fall time (10%–90%) at load capacitance 10 pF	≤10 ns
Pulse width	100 µs
Level	0V to Vcc
Logic high (V^{OH}) minimum	2.80V
Logic low (V^{OL}) maximum	0.30V
Load impedance	1 MΩ
Quantity	1
1 PPS Input	
Format	Rising edge
Low level	≤0.5V
High level	2.5V to Vcc
Input impedance	1 MΩ
Quantity	1
Serial Communications	
Protocol	RS232
Format	CMOS 0V to Vcc
Tx/Rx impedance	1 MΩ
Baud rate	57600
Number of data bits	8
Number of stop bits	1
Parity	None

Built-in Test Equipment (BITE) Output	
Format	CMOS 0V to Vcc
Load impedance	1 MΩ
Logic	0 = Normal operation 1 = Alarm
Power Input	
Operating	≤295 mW
Warmup	≤775 mW
Input voltage (Vcc)	3.3 ± 0.1 VDC

Environmental Specifications	
Operating temperature	–10°C to 70°C
Maximum frequency change over operating temperature range (maximum rate of change 0.5°C/minute)	$\pm 5 \times 10^{-10}$
Frequency change over allowable input voltage range	$\leq 4 \times 10^{-10}$
Magnetic sensitivity (≤2.0 Gauss)	$\leq 9 \times 10^{-11}$/Gauss
Humidity	0 to 95% RH per MIL-STD-810, Method 507.5
Storage and Transport (Non-Operating)	
Temperature	–40°C to 85°C
Shock	MIL-STD-202, 30g, half sine, 11 ms
Vibration	MIL-STD-810, Method 514.6, Figure 514.6E-1, 7.7 grms (General Minimum Integrity Exposure)

Physical Specifications	
Size	2.0" × 2.0" × 0.70"
Weight	75g

Performance Parameters

Frequency Stability (Allan Deviation)	
TAU = 1 second	3×10^{-11}
TAU = 10 seconds	5×10^{-11}
TAU = 100 seconds	3×10^{-11}
RF Output Phase Noise (SSB)	
1 Hz	≤–85 dBc/Hz
10 Hz	≤–120 dBc/Hz
100 Hz	≤–140 dBc/Hz
1000 Hz	≤–145 dBc/Hz
10000 Hz	≤–150 dBc/Hz
≥100000 Hz	≤–155 dBc/Hz
Frequency Accuracy	
Maximum offset at shipment	$\pm 5 \times 10^{-11}$
Maximum retrace (48 hrs off)	$\pm 5 \times 10^{-10}$
Aging[2], monthly[1]	$\leq 9 \times 10^{-10}$, typical
Aging[2], yearly	$\leq 1 \times 10^{-8}$, typical
1 PPS Sync	±100 ns
Digital Tuning	
Range	$\pm 1E^{-6}$
Resolution	1×10^{-12}
Time to lock	≤4 minutes

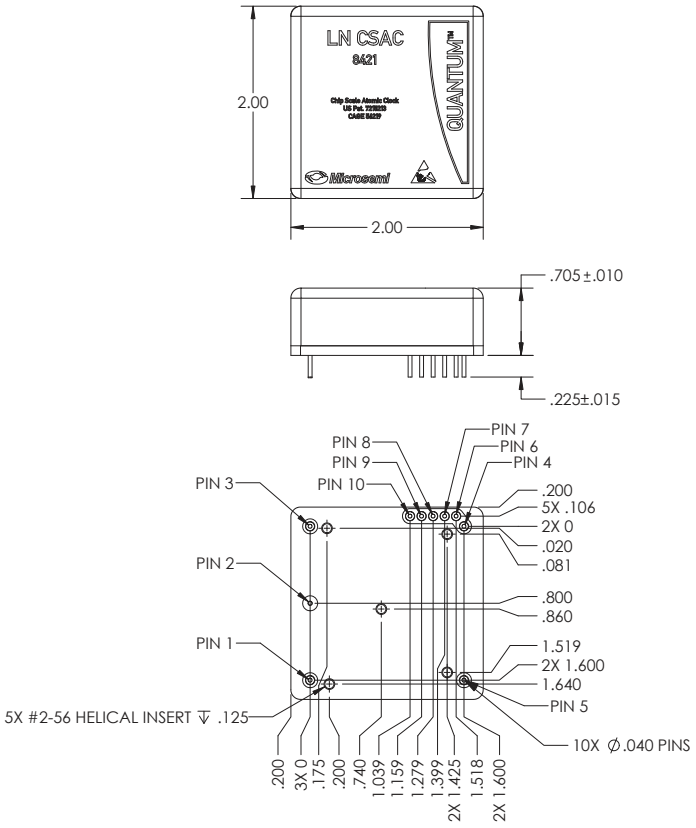
[1]After 30 days of continuous operation.

[2]All CSAC units are tested for aging per the datasheet and meet the specifications at the time of shipment. However, continuous operation of CSAC over extended period of time may yield unpredictable aging performance, resulting in failure to meet the specifications and may not be suitable for certain applications.

Pinout Definition

Pin Number	Function
1	No Connection
2	GND
3	10 MHz SINE OUT
4	GND
5	+3.3 ±0.1 VDC
6	BITE
7	TXD
8	RXD
9	1 PPS IN
10	1 PPS OUT

Mechanical Specifications



Ordering Information: Part number 090-03054-000

For More Information

www.microsemi.com