Quantum™ LN CSAC

Low Noise Chip Scale Atomic Clock

Microsemi invented portable atomic timekeeping with QUANTUM™, the world's first family of miniature and chip scale atomic clocks.

Choose QUANTUM™ class for best-in-class stability, size, weight, and power consumption.

Features

- Power consumption ≤295 mW
- Less than 46 cc volume, 2.0" × 2.0" × 0.70"
- 10 MHz sine wave output
- 1PPS output and 1PPS input for synchronization
- RS-232 interface for monitoring and control
- Short term stability (Allan deviation) of $\leq 3 \times 10^{-11}$ at TAU = 1 sec
- Phase noise—sine wave

  ≤–85 dBc/Hz at 1 Hz
  ≤–120 dBc/Hz at 10 Hz
  ≤–140 dBc/Hz at 100 Hz
  ≤–145 dBc/Hz at 1 kHz
  ≤–150 dBc/Hz at 10 kHz
  ≤–155 dBc/Hz at ≥100 kHz

Applications

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

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 (OCXO) in a compact size that requires low input power.

Microsemi, the original 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 1PPS output, with short-term stability (Allan deviation) of $\leq 3 \times 10^{-11}$ at TAU = 1 sec, long-term aging of $\leq 9 \times 10^{-10}$/month (typical), and a 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 1PPS input that may be used to synchronize the unit's 1PPS output to an external reference clock with ±100 ns accuracy. The LN CSAC can also use the 1PPS input to discipline its phase and frequency to within 1 ns and 1.0×10^{-12}, respectively.

The LN CSAC has a built-in standard RS-232 serial interface. 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 Microsemi representative for more details.

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Specifications

All specifications are at 25 °C, V_{CC} = 3.3 VDC, unless otherwise specified.

Electrical

- RF output
  - Frequency: 10 MHz
  - Format: Sine wave
  - Amplitude: 6 dBm–9 dBm
  - Load impedance: 50 Ω
  - Quantity: 1
- 1PPS output
  - Rise/fall time (10%–90%) at load capacitance of 10 pF: ≤10 ns
  - Pulse width: 100 µs
  - Level: 0 V to V_{CC}
  - Logic high (V_{OH}) minimum: 2.80 V
  - Logic low (V_{OL}) maximum: 0.30 V
  - Load impedance: 1 MΩ
  - Quantity: 1
- 1PPS input
  - Format: Rising edge
  - Low level: ≤0.5 V
  - High level: 2.5 V to V_{CC}
  - Input impedance: 1 MΩ
  - Quantity: 1
- Serial communications
  - Protocol: RS232
  - Format: CMOS 0 V to V_{CC}
  - 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 0 V to V_{CC}
  - Load impedance: 1 MΩ
  - Logic: 0 = Normal operation
1 = Alarm
- Power input
  - Operating: ≤295 mW
  - Warm-up: ≤775 mW
  - Input voltage (Vcc): 3.3 ± 0.1 VDC

Environmental

- 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, 30 g, half sine, 11 ms
  - Vibration: MIL-STD-810, Method 514.6, Figure 514.6E-1, 7.7 grms (general minimum integrity exposure)

Physical

- Size: 2.0" × 2.0" × 0.70"
- Weight: 75 g

Performance Parameters

Frequency Stability (Allan Deviation)

Time	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)

Frequency	Phase Noise
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

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- Frequency accuracy
  - Maximum offset at shipment — $\pm 5 \times 10^{-11}$
  - Maximum retrace[1] (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)
  - 1PPS sync — ±100 ns
- Digital tuning
  - Range — $\pm 1 \times 10^{-6}$
  - 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.

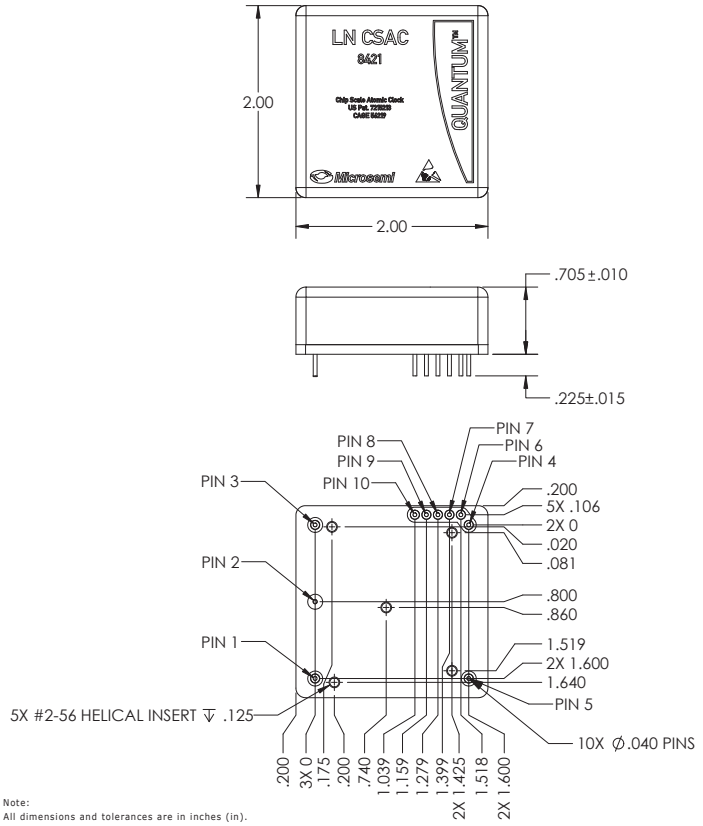
Pinout Definition

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	1PPS IN
10	1PPS OUT

Ordering Information

- Part number — 090-03054-000

Mechanical Specifications



Note:
All dimensions and tolerances are in inches (in).

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