Quantum™ LN CSAC
Low Noise Chip Scale Atomic Clock

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 ≤3 × 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 ≤3 × 10⁻¹¹ at TAU = 1 sec, long-term aging of ≤9 × 10⁻¹⁰/month (typical), and a maximum frequency change of ±5 × 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.
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Specifications
All specifications are at 25 °C, Vcc = 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 VCC
  - Logic high (VOH) minimum 2.80 V
  - Logic low (VOL) 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 VCC
  - Input impedance 1 MΩ
  - Quantity 1
- Serial communications
  - Protocol RS232
  - Format CMOS 0 V 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 0 V to Vcc
  - 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) ±5 × 10⁻¹⁰
- Frequency change over allowable input voltage range ≤4 × 10⁻¹⁰
- Magnetic sensitivity (≤2.0 gauss) ≤9 × 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

<table>
<thead>
<tr>
<th>Frequency Stability (Allan Deviation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
</tr>
<tr>
<td>TAU = 1 second</td>
</tr>
<tr>
<td>TAU = 10 seconds</td>
</tr>
<tr>
<td>TAU = 100 seconds</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>RF Output Phase Noise (SSB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>1 Hz</td>
</tr>
<tr>
<td>10 Hz</td>
</tr>
<tr>
<td>100 Hz</td>
</tr>
<tr>
<td>1000 Hz</td>
</tr>
<tr>
<td>10000 Hz</td>
</tr>
<tr>
<td>≥100000 Hz</td>
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</tbody>
</table>
Microsemi Corporation (Nasdaq: MSCC) offers a comprehensive portfolio of semiconductor and system solutions for aerospace & defense, communications, data center and industrial markets. Products include high-performance and radiation-hardened analog mixed-signal integrated circuits, FPGAs, SoCs and ASICs; power management products; timing and synchronization devices and precise time solutions, setting the world's standard for time; voice processing devices; RF solutions; discrete components; enterprise storage and communication solutions, security technologies and scalable anti-tamper products; Ethernet solutions; Power-over-Ethernet ICs and midspans; as well as custom design capabilities and services. Microsemi is headquartered in Aliso Viejo, California and has approximately 4,800 employees globally. Learn more at www.microsemi.com.

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Low Noise Chip Scale Atomic Clock

- 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) \( \leq 9 \times 10^{-10} \) (typical)
  - Aging\(^2\) (yearly) \( \leq 1 \times 10^{-8} \) (typical)
  - 1PPS sync \( \pm 100 \) ns
- Digital tuning
  - Range \( \pm 1 \times 10^{-6} \)
  - Resolution \( 1 \times 10^{-12} \)
- Time to lock \( \leq 4 \) 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

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
</tr>
<tr>
<td>3</td>
<td>10 MHz SINE OUT</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
</tr>
<tr>
<td>5</td>
<td>+3.3 ( \pm 0.1 ) VDC</td>
</tr>
<tr>
<td>6</td>
<td>BITE</td>
</tr>
<tr>
<td>7</td>
<td>TXD</td>
</tr>
<tr>
<td>8</td>
<td>RXD</td>
</tr>
<tr>
<td>9</td>
<td>1PPS IN</td>
</tr>
<tr>
<td>10</td>
<td>1PPS OUT</td>
</tr>
</tbody>
</table>

Ordering Information
- Part number 090-03054-000

Mechanical Specifications

<table>
<thead>
<tr>
<th>Pin Number</th>
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<tbody>
<tr>
<td>PIN 1</td>
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<tr>
<td>PIN 2</td>
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<td>PIN 3</td>
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<td>PIN 9</td>
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<tr>
<td>PIN 10</td>
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</tr>
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Note:
All dimensions and tolerances are in inches (in).

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