LN-CSAC

Low-Noise Chip-Scale Atomic Clock

The Low-Noise Chip-Scale Atomic Clock (LN-CSAC)

The Low-Noise Chip-Scale Atomic Clock (LN-CSAC) model SA65-LN combines the spectral purity of a crystal with the accuracy and stability of an atomic clock into a single device, saving board space, power and design time.

Microchip, the developer of CSAC, has integrated its 3rd generation low power evacuated miniature crystal oscillator (EMXO) into the design, enabling a lower profile height of ½ inch (12.7 mm) that it is well suited for narrow VPX-style chassis. Its impressive power consumption (<295 mW) and wide temperature range enables battery-powered operation in diverse environmental conditions.

Rapid Calibration

The LN-CSAC accepts a 1 PPS input to automatically calibrate the phase and frequency to an external reference clock to within 1 ns and 1×10^{-12}, respectively. The loop settings can be easily adjusted by the user, saving board space and software development time.

Field Deployable

The low power consumption and wide temperature range (option -002) make the LN-CSAC ideal for battery powered and temperature-exposed applications. The temperature stability of the EMXO is improved by the CSAC, maintaining a maximum frequency tolerance of $\pm 3 \times 10^{-10}$ regardless of external temperature changes. This is especially important when the LN-CSAC is in free-running "holdover" mode and cannot be calibrated to a primary reference clock.

Features

- CSAC accuracy and temperature stability
- Sine wave output
  - ADEV @ 1s < 3×10^{-11}
  - Phase Noise @ 10 Hz < −120 dBc /Hz
- Wide temperature (option -002) −40°C to +80°C
- Height < ½ inch (12.7 mm)
- Power < 295 mW

Applications

- Low SWaP VPX designs
- Mobile radar
- Dismounted radios
- Dismounted IED jamming systems
- Autonomous sensor networks
- Unmanned vehicles

CLOCKSTUDIO™

This product is compatible with Microchip's Clockstudio™ software tool for control and analysis of atomic clocks: microchip.com/clockstudio

Specifications[1]

Electrical

RF Output (Pin 3)	
Frequency	10 MHz
Format	Sine Wave
Amplitude	6–9 dBm
Load Impedance	50Ω
Quantity	1
1PPS Output (Pin 10)	
Rise/fall Time	<10 ns
Pulse Width (programmable)	20 µs (10 µS - 500 mS, 10 µS step)
Level	0V to 3V
Logic High (V^{OH}) Min	2.80V
Logic Low (V^{OL}) Max	0.30V
Load Impedance	1 MΩ
Quantity	1
1PPS Input (Pin 9)	
Format	Rising edge
Low Level	<0.5V
High Level	2.5V to 3.3V
Load Impedance	1 MΩ
Quantity	1
Serial Communications (Pins 7, 8)	
Protocol	RS-232
Format	CMOS 0V to 3V
Tx/Rx Impedance	1 MΩ
Baud Rate	57600
Built-In Test Equipment (BITE) Output (Pin 6)	
Format	CMOS 0V to 3V
Load Impedance	1 MΩ
Logic	0= Normal operation 1= Alarm
Power Input (Pin 5)	
Operating	≤295 mW
Warmup	<850 mW
Input Voltage (Vcc)	3.3 ±0.1 VDC

[1]At input voltage VCC = 3.3 VDC and ambient temperature = 25 °C, unless otherwise specified.

Performance Parameters

Specification	Details
Time to Lock	<180s
Digital Tuning	Range: $\pm 1 \times 10^{-6}$ Resolution: 1×10^{-12}
Maximum Offset at Shipment	$\pm 5 \times 10^{-11}$
Maximum Retrace (48 hrs Off)	$\pm 5 \times 10^{-10}$

Stability

Observation Time	ADEV
τ = 1 s	$<3 \times 10^{-11}$
τ = 10 s	$<5 \times 10^{-11}$
τ = 100 s	$<3 \times 10^{-11}$

Frequency Drift[2]	
Monthly Rate	$<9 \times 10^{-10}$
Yearly Rate	$<1 \times 10^{-8}$

[2]Typical after 30 days of continuous operation.

Offset	Phase Noise (SSB)
***f* = 1 Hz**	<–85 dBc/Hz
***f* = 10 Hz**	<–120 dBc/Hz
***f* = 100 Hz**	<–140 dBc/Hz
***f* = 1 kHz**	<–145 dBc/Hz
***f* = 10 kHz**	<–150 dBc/Hz
***f* = 100 kHz**	<–155 dBc/Hz

Environmental

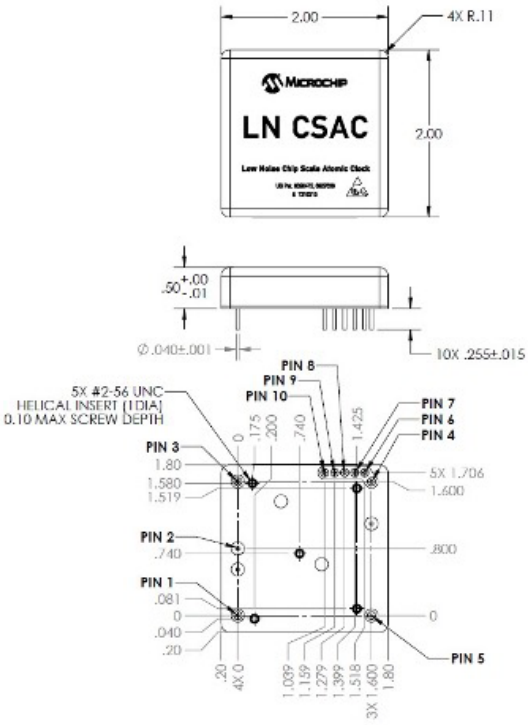
Operating Temperature[4]	–40°C to +80°C
TempCo [3,4] - Total Sensitivity of Frequency to Temperature over specified range	±3 × 10^{-10}
Total Sensitivity of Frequency to Voltage over specified range	±4 × 10^{-10}
Magnetic sensitivity (≤2.0 Gauss)	±9 × 10^{-11}/Gauss
Radiated Emissions	Compliant to FCC part 15, Class B
Vibration	Maintains lock under MIL-STD-810G, Operational, 7.7 grms per Figure 514.7E-1. Category 24
Humidity	0%–95% RH per MIL-STD-810, Method 507.5
Non-Operating (Storage and Transport)	
Temperature	–55°C to +105°C
Vibration	MIL-STD-810, Method 514.6, Figure 514.6E-1, 7.7 grms (General Minimum Integrity Exposure)
Shock	MIL-STD-202, 30g, half sine, 11 ms

Physical

Specification	Details
Weight	<85 g
Size	2.0" × 2.0" × 0.5" (51 × 51 × 12.7 mm)
MTBF	>100,000 hours

[3] Maximum Rate of Change 0.5°C per Minute

[4] Option -002



Pinout Definition

Pin Number	Function
1	N/C
2	GND
3	10 MHz SINE OUT
4	GND
5	Input Supply
6	BITE
7	TXD
8	RXD
9	1 PPS IN
10	1 PPS OUT

Ordering Information

Part Number	Description	TempCo	Temp Range
090-04018-001	LN-CSAC - (SA65-LN, base)	±5 × 10^{-10}	–10°C to +65°C
090-04018-002	LN-CSAC - (SA65-LN, wide temp. option)	±3 × 10^{-10}	–40°C to +80°C