

CSAC SA65

Chip-Scale Atomic Clock



Features

- Wide temperature range -40°C to $+80^{\circ}\text{C}$
- Power consumption $<120\text{ mW}$
- Less than 17 cc volume,
 $1.6" \times 1.39" \times 0.45"$
- 10 MHz CMOS-compatible output
- 1PPS output and 1PPS input for synchronization
- Comprehensive monitoring and control interface
- Short term stability (Allan Deviation) of 3.0×10^{-10} at $\tau = 1\text{ sec}$

Applications

- GPS receivers
- Backpack radios
- Anti-IED jamming systems
- Autonomous sensor networks
- Unmanned vehicles
- Underwater sensor systems
- Stability for various other communication and transmission applications
- Space option available (Option -007)

The Chip-Scale Atomic Clock (CSAC)

With extremely low power consumption of $<120\text{ mW}$ and a volume of $<17\text{ cc}$, the Microchip Chip Scale Atomic Clock (CSAC) brings the accuracy and stability of an atomic clock to portable applications.

The CSAC provides RF and 1PPS outputs at standard CMOS levels, with short-term stability (Allan Deviation) of 3.0×10^{-10} at $\tau = 1\text{ sec}$, typical long-term aging of $<9 \times 10^{-10}/\text{month}$, and maximum frequency change of $\pm 3 \times 10^{-10}$ over the operating temperature range of -40°C to $+80^{\circ}\text{C}$. Additionally, it accepts a 1PPS input for easy calibration to an external reference clock such as a GNSS derived timing signal.

Comprehensive control, monitoring, and calibration of the SA65 is accomplished via a standard CMOS-level RS-232 serial interface built in to the SA65. The interface is also used to set and read the CSAC's internal time-of-day clock.



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

Specifications¹

Electrical

RF Outputs	
Frequency	10 MHz
Format	CMOS
Amplitude	0V to V _{CC}
Load Impedance	1 MΩ
Quantity	1
1PPS Output	
Rise/fall Time (10%–90%) at Load Capacitance 10 pF	<10 ns
Pulse Width	100 μs
Level	0V to V _{CC}
Logic High (VOH) Min	2.80V
Logic Low (VOL) Max	0.30V
Load Impedance	1 MΩ
Quantity	1
1PPS Input	
Format	Rising edge
Low Level	<0.5V
High Level	2.5V to V _{CC}
Load Impedance	1 MΩ
Quantity	1
Serial Communications	
Protocol	RS-232
Format	CMOS 0V to V _{CC}
Tx/Rx Impedance	1 MΩ
Baud Rate	57600
Built-In Test Equipment (BITE) Output	
Format	CMOS 0V to V _{CC}
Load Impedance	1 MΩ
Logic	0= Normal operation 1= Alarm
Power Input ²	
Operating	<120 mW
Warmup	<140 mW
Input Voltage (V _{CC})	3.3 ±0.1 V _{DC} (5V absolute maximum)

¹At input voltage V_{CC} = 3.3 V_{DC} and ambient temperature = 25 °C, unless otherwise specified.

Performance Parameters

Specification	Details
Time to Lock	<180s
Analog Tuning	Range: $\pm 2.2 \times 10^{-8}$ Resolution: 1×10^{-11} Input: 0V–2.5 V into 100 kΩ
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 ³
$\tau = 1 \text{ s}$	3×10^{-10}
$\tau = 10 \text{ s}$	1×10^{-10}
$\tau = 100 \text{ s}$	3×10^{-11}
$\tau = 1000 \text{ s}$	1×10^{-11}

Aging

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

²Typical after 30 days of continuous operation.

³CSAC - Industrial.

Offset	Phase Noise (SSB)
1 Hz	<–44 dBc/Hz
10 Hz	<–64 dBc/Hz
100 Hz	<–110 dBc/Hz
1 kHz	<–128 dBc/Hz
10 kHz	<–135 dBc/Hz
100 kHz	<–140 dBc/Hz

Environmental

Specification	Details
Operating Temperature	-40°C to +80°C
Total Sensitivity of Frequency to Temperature over specified range ⁴	$\pm 3 \times 10^{-10}$
Total Sensitivity of Frequency to Voltage over specified range	$\pm 4 \times 10^{-10}$
Magnetic sensitivity (≤ 2.0 Gauss)	$\pm 9 \times 10^{-11}$ /Gauss
Radiated Emissions	Compliant to FCC part 15, Class B, when mounted properly onto host PCB
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 507.4

Storage and Transport (Non-operating)	
Temperature	-55°C to +105°C
Vibration	MIL-STD-810G, 7.7 grms per Figure 514.7E-1. Category 24
Shock	MIL-STD-202-213A, Condition E, 1000 g

⁴Maximum Rate of Change 0.5°C per Minute

Physical

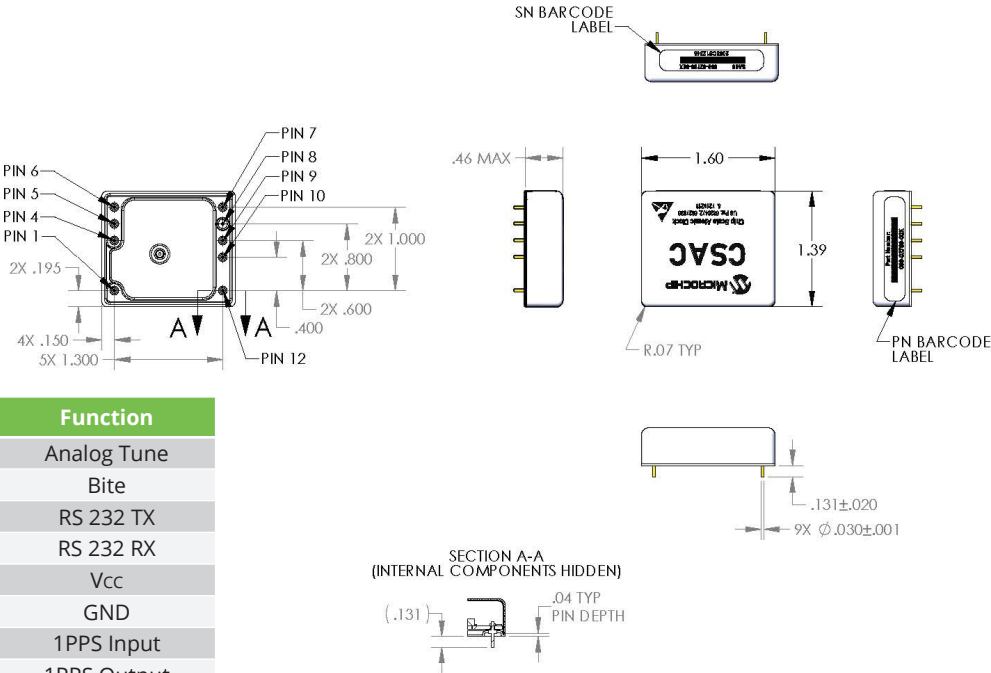
Type	Details
Weight	<35 g (<1.23 oz)
Size	1.6" × 1.39" × 0.45"
MTBF	>100,000 hours

Solder

Type	Details
RoHS Compliant	Hand solder using 96.5/3/0.5 tin/ silver/ copper with maximum solder tip temperature of 370 °C (698 °F) and a dwell time of <5 s

Ordering Information

Part Number	Description	Output Frequency	Allan Deviation	Temp Range
090-02789-002	CSAC - Industrial, RoHS 3	10 MHz	$\leq 3 \times 10^{-10} \tau=1$ $\leq 1.0 \times 10^{-10} \tau=10$ $\leq 3 \times 10^{-11} \tau=100$	-40°C to +80°C
090-02789-001	CSAC - Commercial, RoHS 3	10 MHz	$\leq 4 \times 10^{-10} \tau=1$ $\leq 1.5 \times 10^{-10} \tau=10$ $\leq 4 \times 10^{-11} \tau=100$	-10°C to +65°C



Pin No.	Function
1	Analog Tune
4	Bite
5	RS 232 TX
6	RS 232 RX
7	Vcc
8	GND
9	1PPS Input
10	1PPS Output
12	RF Output