CSAC SA65

Chip-Scale Atomic Clock

Features

- Wide temperature range –40°C to +80°C
- Power consumption <120 mW
- Less than 17 cc volume,
  1.6" × 1.39" × 0.45"
- 10 MHz CMOS-compatible output
- 1PPS output and 1PPS input for synchronization
- RS-232 interface for monitoring and control
- Short term stability (Allan Deviation) of 3.0×10^{-10} at $\tau = 1$ sec

Applications[1]

- GPS receivers
- Backpack radios
- Anti-IED jamming systems
- Autonomous sensor networks
- Unmanned vehicles
- Underwater sensor systems
- Stability for various other communication and transmission applications

[1]The CSAC is not tested, qualified, or rated for space applications.

With extremely low power consumption of <120 mW and a volume of <17 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 $\tau = 1$ sec, typical long-term aging of $<9 \times 10^{-10}$/month, and maximum frequency change of $\pm 3 \times 10^{-10}$ over the operating temperature range of –40°C to +80°C.

The 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. It may also use the 1PPS input to discipline its phase and frequency to within 1 ns and 1.0×10^{-12}, respectively.

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.

Specifications[1]

Electrical

RF Outputs	
Frequency	10 MHz
Format	CMOS
Amplitude	0V to Vcc
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 Vcc
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 Vcc
Load Impedance	1 MΩ
Quantity	1
Serial Communications	
Protocol	RS-232
Format	CMOS 0V to Vcc
Tx/Rx Impedance	1 MΩ
Baud Rate	57600
Built-In Test Equipment (BITE) Output	
Format	CMOS 0V to Vcc
Load Impedance	1 MΩ
Logic	0= Normal operation 1= Alarm
Power Input	
Operating	<120 mW
Warmup	<140 mW
Input Voltage (Vcc)	3.2–5.1 VDC (3.3V Recommended)

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

Environmental

Specification[2]	Details
Operating Temperature	–40°C to +80°C
Total Sensitivity of Frequency to Temperature over specified range	$\pm 3 \times 10^{-10}$
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

Performance Parameters

Specification	Details
Time to Lock	<120s
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}

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

Phase Noise (SSB)

Frequency	SA65
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
Frequency Accuracy	
Maximum Offset at Shipment	$\pm 5 \times 10^{-11}$
Maximum Retrace (48 hrs Off)	$\pm 5 \times 10^{-10}$
1 PPS Sync	±100 ns

Aging

Type[2]	SA65
Monthly	$<9 \times 10^{-10}$
Yearly	$<1 \times 10^{-8}$

[2]Typical after 30 days of continuous operation.

Short-Term Stability (Allan Deviation)

Type	SA65
τ = 1 s	3×10^{-10}
τ = 10 s	1.5×10^{-10}
τ = 100 s	3×10^{-11}
τ = 1000 s	1.5×10^{-11}

Physical

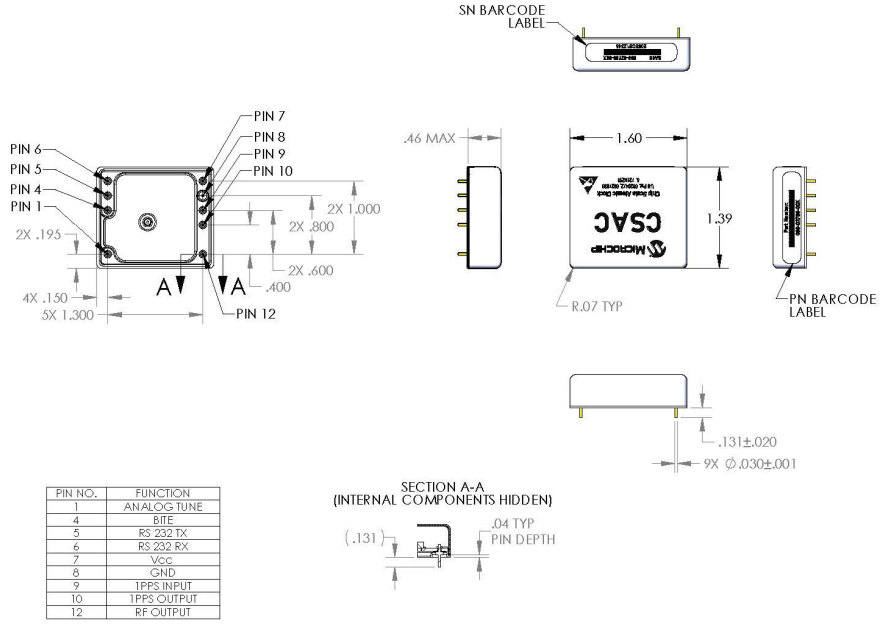
Type	SA65
Weight	<35 g (<1.23 oz)
Size	1.6" × 1.39" × 0.45"
MTBF	>100,000 hours

Solder

Type	Details
Standard	Hand solder using 63/37 tin/lead solder with maximum soldering tip of 329°C (625°F)
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 **090-02789-012**	CSAC - Industrial, RoHS 3 CSAC - Industrial, Standard	10 MHz	≤ 3×10^{-10} τ=1 ≤ 1.0×10^{-10} τ=10 ≤ 3×10^{-11} τ=100	−40°C to +80°C
090-02789-001 **090-02789-011**	CSAC - Commercial, RoHS 3 CSAC - Commercial, Standard	10 MHz	≤ 4×10^{-10} τ =1 ≤ 1.5×10^{-10} τ=10 ≤ 4×10^{-11} τ =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