

SA.31m, SA.33m, and SA.35m

Quantum™ Miniature Atomic Clock (MAC)



Quantum™

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

- High-precision atomic clock
- Small form factor (standard OCXO pinout)
- 1.5 μ s typical holdover over temperature (SA.35m)
- Low power consumption
- RoHs 6/6-compliant

Applications

- Stand-alone (free-run) stable frequency source for audio equipment, LTE base stations, smart grid, and enterprise network Infrastructure
- Extended holdover for CDMA and WiMAX base stations
- Stability for various other communication and transmission applications

Newly Enhanced Quantum™ MAC

SA.3Xm Family

The Microsemi SA.3Xm marks a major step forward in the evolution of rubidium atomic clocks. Based on a new generation of atomic clock technology, the SA.3Xm family has a unique package that enables unprecedented miniaturization in a rubidium clock. It is suitable for applications requiring compact design, low power consumption, extended aging, and precision in an economical and easily adaptable package.

Smallest Commercially Available Rubidium Clock

Microsemi has leveraged the significant advances in miniaturization and integration to design the world's first commercially available miniature atomic clock. The SA.3Xm has physical dimensions and packaging of a small ovenized crystal oscillator (OCXO), measuring 50.8 mm x 50.8 mm (2" x 2") and standing at a mere 18.3 mm (0.72"). The MAC is the world's first commercially available rubidium coherent population trapping atomic clock. It consumes less power and has wide-spectrum temperature operation. This makes it useful for a range of timing and synchronization applications—wireless base stations, wire line network infrastructure, defense systems, and test and measurement devices. The small

size of the SA.3Xm enables it to be easily mounted to a PCBA.

SA.31m

The SA.31m is targeted for applications that require an economical solution for frequency stability, such as audio equipment in studio applications. It can also be used as an independent frequency source for next generation base stations, smart grid infrastructure and Enterprise network infrastructure. It enables transition from costly TDM backhaul transport to economic and efficient Ethernet transport.

SA.33m

The SA.33m has superior aging and tempco, and better stability and phase noise than the SA.31m. The SA.33m may be deployed in existing rubidium applications such as extended holdover (for CDMA/CDMA 2000 or WiMAX).

SA.35m

The SA.35m is the premium grade of the entire SA.3Xm family. It has the best tempco and greatest performance amongst all the versions of the family. The SA.35m is suited for applications such as extended hold over for LTE-TDD base stations and other applications that require precision frequency and long hold-over. Economical for its performance level, the SA.35m delivers premium performance at an excellent price.

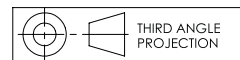
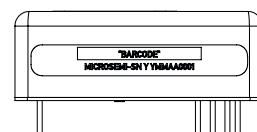
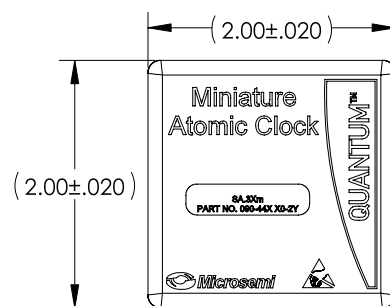
Technical drawing of a 2x8 pin connector. The drawing shows the top view of the connector with dimensions and callouts for pins 1 through 8. The dimensions are as follows:

- Overall width: 1.80
- Overall height: 1.519
- Pin pitch (center-to-center): .740
- Pin 1 to Pin 8 dimensions (from left to right):
 - Pin 1: .20
 - Pin 2: .800
 - Pin 3: 1.80
 - Pin 4: 1.706
 - Pin 5: 1.600
 - Pin 6: 1.425
 - Pin 7: .518
 - Pin 8: .399
- Pin 9 to Pin 16 dimensions (from left to right):
 - Pin 9: .20
 - Pin 10: .175
 - Pin 11: 0
 - Pin 12: .200
 - Pin 13: .740
 - Pin 14: 1.425
 - Pin 15: 1.600
 - Pin 16: .518
- Pin 17 to Pin 24 dimensions (from left to right):
 - Pin 17: .20
 - Pin 18: .175
 - Pin 19: 0
 - Pin 20: .200
 - Pin 21: .740
 - Pin 22: 1.425
 - Pin 23: 1.600
 - Pin 24: .518

Callouts for pins 1 through 8 are shown. The drawing also includes a note for the pin dimensions: 5X 2-56 UNC - 2B .07 MAX.

PIN NO.	FUNCTION
1	INPUT FREQUENCY CONTROL
2	CASE GROUND
3	RF OUTPUT
4	GROUND (SUPPLY AND SIGNAL)
5	INPUT SUPPLY (+5VDC)
6	BI TE
7	RS-232 TX
8	RS-232 RX

-
- Technical drawing of a rectangular component, likely a PCB or a small electronic module. The component is 1/2 inch wide and 1/4 inch high. It features a central rectangular area with rounded corners. On the left side, there are two horizontal mounting tabs, each 8X .26 inches wide. On the right side, there are two horizontal mounting tabs, each 8X .26 inches wide. The bottom edge has a dimension of .72 ± .02 inches. The top edge has a dimension of 8X .26 inches. The drawing includes dimension lines and arrows indicating the measurements.



Note: Connect Pin 2 to GND externally. Pin 2 and Pin 4 are not connected together internally.

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Specifications¹

Electrical

RF Output

- Frequency 10 MHz
- Waveform CMOS square wave, 0 V_{DC}–5 V_{DC(max)}
- Logic level V_{OL(max)} 0.55 V, V_{OH(min)} 2.3 V
- Rise/fall time <10 ns (15 pf, 1MΩ load)
- Duty cycle 50% ± 10%

Built-in Test Equipment Output

- Format CMOS
- Logic 0 = Normal Operation
1 = Alarm

Serial Communications

- Protocol RS232
- Format CMOS 0 V to 5 V_{DC}
- Baud rate 57600 (8, N, 1)

Power Input

- Supply voltage/current 5 V_{DC} ± 0.1 V_{DC}, max current <2.8 A
- Power consumption Warm-up: 14 W max (–10 °C to 75 °C)

Operating: 8 W at 10 °C, 5 W at 25 °C, 5 W at 75 °C baseplate
- Voltage coefficient <2 × 10^{–11} peak-to-peak (+5 V_{DC} ± 0.1 V_{DC})

Environmental

- Operating temperature –10 °C to 75 °C baseplate
- Magnetic field sensitivity <±7 × 10^{–11}/Gauss (up to ±2 Gauss)
- Humidity GR-63-CORE, issue 4, April 2012, section 4.1.2
- Vibration (operating) 7.7 g_{rms}, at 1 hour/axis MIL-STD-810, figure 514.7E-1, category 24 (General Minimum Integrity Exposure) No loss of lock
- Shock (operating) 30 g, 11 ms half-sine pulse per MIL-STD-202, Method 213, Test Condition J. Frequency perturbation ≤4 × 10^{–9} momentary

Storage and Transport (Non-operating)

- Temperature –55 °C to 100 °C
- Vibration (non-operating, unpackaged) 10.9 g_{rms} at 1 hour/axis per MIL-STD-810, figure 514.7E-1, Cat 24
- Shock (non-operating, unpackaged) 50 g, 11 ms half-sine pulse per MIL-STD-202, Method 213, Test Condition A

Performance Parameters

- Warm-up time <15 min (typical at 25 °C) (time to <1 × 10^{–9})
- Retrace <±5 × 10^{–11} (on-off-on: 24 hours, 48 hours, 12 hours at 25 °C)
- Analog tuning Range: ±1 × 10^{–8}
Input: 0 V–5 V into 5 kΩ
- Digital tuning Range: ±2 × 10^{–8}
(resolution ±1 × 10^{–12})
- Time drift in a 24 hr period (SA.35m) 1.5 μs, typical (–10 °C to 70 °C, 16 °C/hr)
- MTBF Per MIL-HDBK-217F:
 - ≥20 years at 40 °C (ground, benign, GB)
 - ≥17 years at 40 °C (ground, fixed, GF)
 Per Telcordia SR-332, Issue 1:
 - ≥20 years at 40 °C (ground, fixed, uncontrolled)
- Accuracy at shipment <±5 × 10^{–11} (25 °C)

¹At 25 °C and 5 V_{DC}, unless otherwise specified.

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Phase Noise (SSB)

Frequency	Sa.35/SA.33m	SA.31m
1 Hz	<-70 dBc/Hz	<-65 dBc/Hz
10 Hz	<-87 dBc/Hz	<-85 dBc/Hz
100 Hz	<-114 dBc/Hz	<-112 dBc/Hz
1 kHz	<-130 dBc/Hz	<-130 dBc/Hz
10 kHz	<-140 dBc/Hz	<-140 dBc/Hz

- Spurious (non-harmonic) <-85 dBc

Temperature Coefficient (Peak-to-Peak)

Temperature	SA.35m	SA.33m	SA.31m
0 °C to 70 °C	$\leq 7 \times 10^{-11}$	$\leq 1 \times 10^{-10}$	$\leq 7 \times 10^{-10}$
-10 °C to 75 °C	$\leq 1 \times 10^{-10}$	$\leq 1.5 \times 10^{-10}$	$\leq 1 \times 10^{-9}$

Aging

Type	SA.35m/SA.33m	SA.31m
Daily ²	$\pm 2.5 \times 10^{-11}$	$\pm 4 \times 10^{-11}$
Monthly ²	$\pm 1 \times 10^{-10}$	$\pm 3 \times 10^{-10}$
Yearly	$\pm 1 \times 10^{-9}$	$\pm 1.5 \times 10^{-9}$

²After 1 day and 1 month of operation, respectively.

Short-Term Stability (Allan Deviation)

Type	SA.35m/SA.33m	SA.31m
t = 1 s	$\leq 3 \times 10^{-11}$	$\leq 5 \times 10^{-11}$
t = 10 s	$\leq 1.6 \times 10^{-11}$	$\leq 2.5 \times 10^{-11}$
t = 100 s	$\leq 8 \times 10^{-12}$	$\leq 1 \times 10^{-11}$

Physical

- Weight <85 g (<3 oz)
- Size 18.3 mm × 50.8 mm × 50.8 mm
- Volume <49.5 cm³ (< 3.0 in³)

RoHS Compliance

- 6/6 RoHS-compliant

Ordering Information

Part Number	Description ³
090-44310-31	SA.31m Rubidium Clock, AT Disabled
090-44310-32	SA.31m Rubidium Clock, AT Enabled
090-44330-31	SA.33m Rubidium Clock, AT Disabled
090-44330-32	SA.33m Rubidium Clock, AT Enabled
090-44350-31	SA.35m Rubidium Clock, AT Disabled
090-44350-32	SA.35m Rubidium Clock, AT Enabled
090-44300-00	SA.3Xm Developer's Kit

³AT = analog tuning



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