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

Quantum™ Miniature Atomic Clock (MAC)

Miniature Rubidium Atomic Clock

Features

- High precision atomic clock
- Smallest form factor (smaller than most OCXOs)
- Standard quartz oscillator pinouts
- 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

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.

Newly Enhanced Quantum™ MAC SA.3X 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" × 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 station, wire line network infrastructure, defense system, 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.

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Specifications

Electrical Specification

Output Frequency/Waveform:	10 MHz 3.3 Vpp (Max = 4 Vpp) ACMOS square wave (15 pF load)
Logic Level:	VL <0.5 V, VH >2.7 V (15 pf load)
Rise/Fail Time:	<10 ns
Duty Cycle:	50%+/-10%

Phase Noise (SSB)

	SA.35m/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 Coeffient [peak to peak]:

	SA.35m	SA.33m	SA.31m
(0°C to 70°C)	≤7E-11	≤1E-10	≤7E-10
(-10°C to 75°C)	≤1E-10	≤1.5E-10	≤1E-9

Accuracy at shipment:	<±5E-11 (25°C)
Retrace:	<±5E-11(on-off-on: 24 hour, 48 hour, 12 hour @25°C)
Control range:	
With analog input:	±1E-8, 0-5 V into 5 kΩ
With digital input:	±2E-8 (with resolution ±1E-12)
Warm-up time:	time to <1E-9 @25°C: <7.5 min (if mounted on the developer's kit heat sink: ≤9 min)
Supply voltage/current:	+5 Vdc ±0.1 Vdc, Max. current <2.8 A
Power consumption:	Warm-up: 14 W max (-10°C to +75°C); Operating: 8 W @ 10°C, 5 W @ 25°C, 5 W @ 75°C baseplate
Voltage coefficient:	+5 Vdc ±0.1 Vdc: Magnitude (df/f) <2E-11 peak-to-peak
Test/status:	Built-in self-test (BITE)
ACMOS:	Service/fault-unlock
Serial Port:	Microsemi specific serial port protocol for status and control

Aging:

Type	SA.35m/SA.33m	SA.31m
Daily*	±2.5E-11	±4E-11
Monthly*	±1E-10	±3E-10
Yearly	±1E-9	±1.5E-9

(*After 1 day and 1 month of operation respectively)

Short Term Stability (Allan deviation):

Type	SA.35m / SA.33m	SA.31m
t=1 s	≤3E-11	≤5E-11
t=10 s	≤1.6E-11	≤2.5E-11
t=100 s	≤8E-12	≤1E-11

Time drift in a 24 hr period (SA.33m and SA.35m only): <7 µs over 0°C to +60°C

MTBF:

Per MIL-HDBK-217F:
≥20 years @ 40°C (Ground, benign, GB)
≥17 years @ 40°C (Ground, fixed, GF)

Per Telcordia SR-332, Issue 1:
≥20 years @ 40°C (Ground, fixed, uncontrolled)

Connector: 5 Pins match standard OCXO configurations

Pin 1: Input frequency control
Pin 2*: Baseplate (connect to GND externally)
Pin 3: Output signal
Pin 4*: Ground (signal and supply)
Pin 5: Input supply (+)
*Pin 2 and Pin 4 are not connected together internally

Three (3) additional pins for added functionality:

Pin 6: BITE
Pin 7: RS232 transmit (Tx)
Pin 8: RS232 receive (Rx)

Environmental

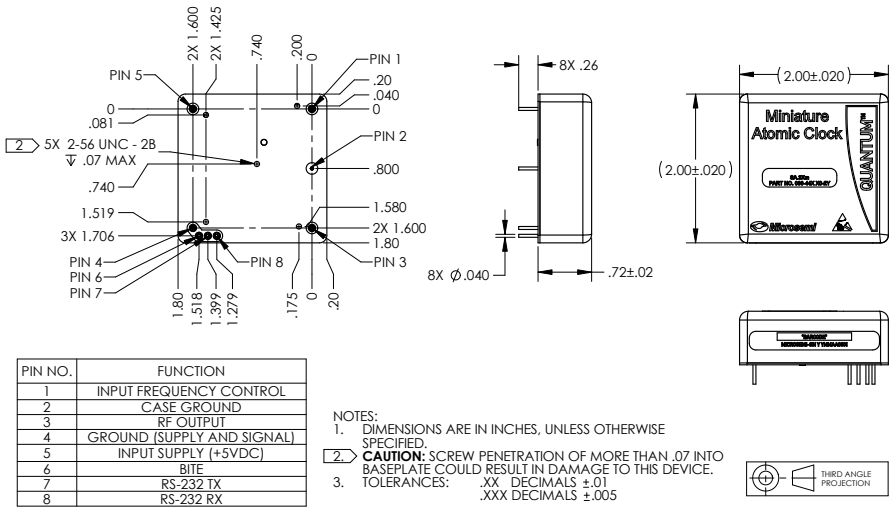
Operating temperature:	-10°C to +75°C base-plate
Magnetic field sensitivity:	<±7E-11/Gauss (up to ±2 Gauss)
Humidity:	GR-63-CORE, issue 4, April 2012, section 4.1.2
Vibration (operating):	7.7 grms, @ 1 hour/axis MIL-STD-810, figure 514.7E-1, category 24 (General Minimum Integrity Exposure) No loss of lock
Shock (operating):	30 g, 11 ms half-sine pulse per MIL-STD-202, Method 213, Test Condition J. Frequency perturbation ≤1e-9 momentary
Storage and transport (non operating):	
Temperature:	-55°C to +100°C
Vibration (non-operating unpackaged):	10.9 grms @ 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

Physical

Weight:	<85 g (<3 oz)
Size:	18.3 mm x 50.8 mm x 50.8 mm (0.72" × 2" × 2")
Volume:	<49.5 cm³ (< 3.0 in³)

RoHS Compliance

- SA.31m, SA.33m, and SA.35m are 6/6 RoHS compliant



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

NOTES:
1. DIMENSIONS ARE IN INCHES, UNLESS OTHERWISE SPECIFIED.
2. **CAUTION:** SCREW PENETRATION OF MORE THAN .07 INTO BASEPLATE COULD RESULT IN DAMAGE TO THIS DEVICE.
3. TOLERANCES: .XX DECIMALS ±.01
   .XXX DECIMALS ±.005

THIRD ANGLE PROJECTION

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

Part Number Table

Part Number	Description
090-44310-21	SA.31m Rubidium Clock, AT Disabled
090-44310-22	SA.31m Rubidium Clock, AT Enabled
090-44330-21	SA.33m Rubidium Clock, AT Disabled
090-44330-22	SA.33m Rubidium Clock, AT Enabled
090-44330-23	SA.33m Rubidium Clock, AT Enabled ROHS 6/6 (Measured Time To Lock <7 min)
090-44330-24	SA.33m Rubidium Clock, AT Disabled ROHS 6/6 (Measured Time To Lock <7 min)
090-44350-21	SA.35m Rubidium Clock, AT Disabled
090-44350-22	SA.35m Rubidium Clock, AT Enabled
090-44300-00	SA.3Xm Developer's Kit
Note: *AT= Analog Tuning*	

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