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

Miniature Atomic Clock (MAC) SA.3Xm

Features

- High-precision atomic clock
- Small form factor (standard OCXO pinout)
- 1.5 µs 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 MAC SA.3Xm Family

The Microchip 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, low aging, and precision in an economical and easily adaptable package.

Smallest Commercially Available Rubidium Clock

Microchip 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 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, tempco, and stability 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.

Specifications[1]

Electrical

RF Outputs	
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/Fail 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	$<2 \times 10^{-11}$ peak-to-peak (+5 V_{DC} ± 0.1 V_{DC})

[1]At 25 °C and 5 VDC, unless otherwise specified.

Environmental

Specification	
Operating Temperature	–10 °C to 75 °C baseplate
Magnetic Sensitivity	$<\pm 7 \times 10^{-11}$/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
Humidity 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

Specification	
Warm-up Time (Time to $<1 \times 10^{-9}$)	<15 min (typical @25C)
Retrace	$<\pm 5 \times 10^{-11}$ (on-off-on: 24 hours, 48 hours, 12 hours)
Analog Tuning	Range: $\pm 1 \times 10^{-8}$ Input: 0 V–5 V into 5 kΩ
Digital Tuning	Range: $\pm 2 \times 10^{-8}$ (resolution $\pm 1 \times 10^{-12}$)
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	$<\pm 5 \times 10^{-11}$

Phase Noise (SSB)

Frequency	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 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	$\pm 1 \times 10^{-9}$	$\pm 1.5 \times 10^{-9}$

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

Short-Term Stability (Allan Deviation)

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

Physical

Specification	Details
Weight	<85 g (<3 oz)
Size	18.3 mm × 50.8 mm × 50.8 mm
Volume	<49.5 cm^3 (< 3.0 in^3)

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

[3]AT = Analog Tuning

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