

GPS-3500, GPS-3300, and GPS-3100

SA.3Xm Rubidium-Based GPS Disciplined Oscillators, Featuring the QUANTUM™ Rubidium MAC



Features

- High-performance GNSS receiver
- QUANTUM™ Rubidium Miniature Atomic Clock (MAC)
- Ultra-low noise post filter crystal
- Unparalleled holdover: typically $\pm 0.6 \mu\text{s}$ over 24 hrs. at 25 °C (GPS-3500)
- Low power consumption: <5.6 W at 25 °C
- Fast warmup time: rubidium <8 min, typical
- Industry-leading 1PPS accuracy: $\pm 10 \text{ ns}$ to UTC RMS (1-sigma), GPS locked, position-hold mode
- Small footprint and low profile: only 3.4" x 4.4" x 1.0"

Applications

- Unmanned aerial vehicles (UAVs)
- IED jammers: fixed, mounted, dismounted
- Radar systems
- Aircraft guidance systems
- Tactical radios
- Underwater systems that use GPS for initialization

With the ability to receive up to three GNSS systems concurrently, the Microsemi GPS-3x00 series of devices are the preeminent solutions for demanding mobile GNSS applications. Their height of 1 inch makes them ideal for applications such as military man-pack radios, MILSATCOM terminals, avionics payloads for unmanned autonomous systems (UAS), and high-acceleration applications, such as jet fighters. All of these applications are increasingly expected to deliver mission-critical performance, even in GNSS-denied environments. Other applications include network timing in stationary applications, such as base stations.

The GPS-3500, GPS-3300, and GPS-3100 are 10 MHz MAC-based GPS-disciplined oscillators (GPSDOs). They cover a temperature range of $-20 \text{ }^\circ\text{C}$ to $70 \text{ }^\circ\text{C}$, measured at the baseplate. These products utilize Microsemi's QUANTUM series SA.3Xm miniature atomic clock (MAC) as their frequency reference, which enables unparalleled holdover capability, best-in-class Tempco, and a very fast warmup time of <8 minutes. The built-in high-performance GNSS receiver can operate in a base station position-hold mode using an auto survey feature, which allows operation with

just a single satellite in view, thereby improving timing stability.

Standard outputs are one buffered 10 MHz sine wave and two unbuffered low-noise direct OCXO sine wave outputs. Other option features* include RS422 (10 MHz out, 1PPS out, 1PPS in, serial output), LCD port, 10 MHz sine wave, 5 MHz CMOS, and USB. The units can be powered from standard aircraft or vehicle power with an 8 V to 36 V operating range, with built-in reverse polarity protection.

*Accessible internally to enclosure.

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Specifications (Typical Values)

Frequency and Timing Characteristics

- Long-term oscillator aging (without GNSS, Zero aging with GNSS) <0.1 ppb/month (GPS-3500 and GPS-3300) <0.3 ppb/month (GPS-3100)
- 1PPS stability ±10 ns to UTC RMS (1-Sigma, GPS locked in Position Hold mode after 72 hours)
- Holdover stability <±0.6 µS over 24 hour period at 25 °C (after 48 hours with GPS lock, GPS-3500 version)

Note: Holdover stability measured under static conditions (no vibration), in still air (unit shielded from airflow), after a minimum warmup of 48 hours.

Stability, ADEV¹

Time	ADEV
0.1 S	<4 × 10 ⁻¹³
1 S	<5 × 10 ⁻¹³
10 S	<8 × 10 ⁻¹³
100 S	<2.5 × 10 ⁻¹²
1 kS	<2 × 10 ⁻¹²
10 kS	<5 × 10 ⁻¹³
100 kS	<8 × 10 ⁻¹⁴

¹GPS-3500 OXCO option, 96+ hours GPS-locked, 25 °C, no airflow, no vibration, no tilt.

Phase Noise

Frequency	GPS-3500 ULN ²	GPS-3300 LN ²	GPS-3100 STD PN ²
1 Hz	114 dBc/Hz	108 dBc/Hz	70 dBc/Hz
10 Hz	145 dBc/Hz	141 dBc/Hz	98 dBc/Hz
100 Hz	155 dBc/Hz	152 dBc/Hz	125 dBc/Hz
1 kHz	162 dBc/Hz	160 dBc/Hz	145 dBc/Hz
10 kHz	165 dBc/Hz	163 dBc/Hz	153 dBc/Hz
100 kHz	167 dBc/Hz	165 dBc/Hz	154 dBc/Hz

²Measured under static conditions (no vibration), in still air (unit shielded from airflow), after a minimum warmup of 48 hours.

Power Supply

- Supply voltage 8 VDC to 36 VDC, 12 VDC nominal
- Power consumption <5.6 W at 25 °C steady-state <17.5 W warm-up

GNSS Characteristics

- GNSS receiver 72 channels, GPS, Glonass, Galileo, BEiDou, QZSS, SBAS: WAAS/EGNOS/MSAS/GAGAN

GNSS Characteristics (continued)

- GNSS sensitivity Acquisition: -148 dBm Tracking: -167 dBm (GPS and Glonass)
- GPS receiver motion adaptive filter settings Optimized depending on vehicle velocity (auto-sensing, auto-switching options)
- GNSS frequency, antenna L1 GPS/Glonass, passive or active antenna 5 V

Environmental

- Operating temperature -20 °C to 70 °C baseplate temperature
- Frequency stability over temperature (0 °C to 70 °C) <0.07 ppb (GPS-3500) <0.1 ppb (GPS-3300) <0.7 ppb (GPS-3100)
- g-sensitivity Rubidium <0.2 ppb/g/axis Filter OXCO <1 ppb/g/axis
- Magnetic sensitivity <0.07 ppb per Gauss
- Storage temperature -55 °C to 100 °C

Health Monitoring and Communication

- TTL alarm output GNSS unlock and hardware failure indicator
- USB, LCD support (accessible inside enclosure only) RS-232 or USB-controlled, supports 16 × 2 LCD displays
- RS-232/USB control SCPI-99 control at 9.6 K, 19.2 K, 38.4 K, 57.6 K 115.2 K
- RS-232/RS-422/USB NMEA output sentences NMEA 0183 rev. 2.3, sentences: GGA, RMC, ZDA, GSV, PASHR, and others

Miscellaneous

- Dimensions 3.4" × 4.4" × 1.0"
- Warm-up time/stabilization time without GPS <2 × 10⁻¹⁰ <20 min at 25 °C accuracy
- Rubidium retrace error (24 hrs on, 48 hrs off, 12 hrs on) <0.05 ppb at 25 °C
- MTBF >200,000 hrs at 40 °C

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Electrical

- 1PPS input
 - 1PPS outputs (rubidium or OCXO steered)
 - 10 MHz outputs
- Jitter <2 ns (recommended)
- Two 5 V CMOS outputs
One internal RS-422
- 13 dBm ± 2 dBm³
5 dBm to 10 dBm⁴

³One buffered 10 MHz sine wave.

⁴Two unbuffered low-noise direct OCXO sine waves.

Ordering Information

Part Number	Description
090-02775-000	GPS-3500 rubidium-based GPSDO, ultra-low phase noise.
090-02776-000	GPS-3300 rubidium-based GPSDO, low phase noise
090-02777-000	GPS-3100 rubidium-based GPSDO with TCXO filtered phase noise

Options (Available Internally)

- RS-422 (10 MHz out, 1PPS out/in, Serial out)
- LCD port
- 10 MHz sine wave (13 dBm)
- 5 MHz CMOS
- USB



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