

# GPS-3500 and GPS-3300

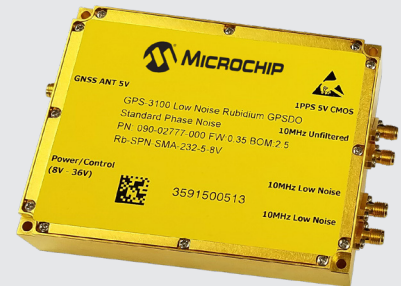
10 MHz GNSS Disciplined Oscillators, Featuring the Miniature Atomic Clock (MAC)

## Summary

With the ability to receive up to three GNSS systems concurrently, the 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 and GPS-3300 are 10 MHz GNSS disciplined oscillators (GPSDOs). They cover a temperature range of  $-20^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$ , measured at the baseplate. These products utilize 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 SMA-style connectors are provided to connect a GNSS antenna and also to output three 10 MHz signals and one 1PPS signal. Power is supplied to the 16-pin J1 connector, which also has RS-232 communication, NMEA data stream, health status, 1PPS input and an additional 1PPS output. For even more flexibility, the lid may be removed to access additional features including differential RS422 outputs, a 5MHz CMOS output or attachment of an LCD screen for monitoring and control.



## Features

- High-performance GNSS receiver
- Rubidium Miniature Atomic Clock (MAC)
- Ultra-low noise post filter crystal
- Unparalleled holdover: typically  $\pm 0.6 \mu\text{s}$  over 24 hrs. at  $25^{\circ}\text{C}$  (GPS-3500)
- Fast warmup time: rubidium  $<8$  minutes, typical
- Industry-leading 1PPS accuracy:  $\pm 10$  ns to UTC RMS (1-sigma), GPS locked, position-hold mode
- Small footprint and low profile: only  $3.4" \times 4.4" \times 1.0"$
- 5 MHz CMOS output (internal connection)
- Wide 8 to 36 Voltage range

## Applications

- Unmanned Aerial Vehicles (UAVs)
- IED jammers: fixed, mounted, dismounted
- Radar systems
- Aircraft guidance systems
- Tactical radios
- Underwater systems that use GNSS for initialization

## Specifications (Typical Values)

Frequency and Timing Characteristics	
Long term oscillator aging (Zero aging with GNSS)	<0.1 ppb/month (without GNSS)
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 GNSS lock)

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

## Stability, ADEV<sup>1</sup>

Time	ADEV
0.1 s	<4 × 10 <sup>-13</sup>
1 s	<5 × 10 <sup>-13</sup>
10 s	<8 × 10 <sup>-13</sup>
100 s	<2.5 × 10 <sup>-12</sup>
1 ks	<2 × 10 <sup>-12</sup>
10 ks	<5 × 10 <sup>-13</sup>
100 ks	<8 × 10 <sup>-14</sup>

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

## Phase Noise

Frequency	GPS-3500	GPS-3300
1 Hz	-114 dBc/Hz	-108 dBc/Hz
10 Hz	-145 dBc/Hz	-141 dBc/Hz
100 Hz	-155 dBc/Hz	-152 dBc/Hz
1 kHz	-162 dBc/Hz	-160 dBc/Hz
10 kHz	-165 dBc/Hz	-163 dBc/Hz
100 kHz	-167 dBc/Hz	-165 dBc/Hz

<sup>2</sup>Measured 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	<7.5W at 25°C steady-state <17.5W warm-up

## GNSS Characteristics

GNSS receiver	72 channels, GPS, Glonass, Galileo, BEiDou, QZSS, SBAS: WAAS/EGNOS/MSAS/ GAGAN
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 5V

## 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)
g-sensitivity (static)	Rubidium <0.2 ppb/g/axis Filter OCXO <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
LCD support (accessible inside enclosure only)	RS-232 or controlled, supports 16 × 2 LCD displays
RS-232 control	SCPI-99 control at 9.6 K, 19.2 K, 38.4 K, 57.6 K 115.2 K
RS-232/RS-422 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 <math>2 \times 10^{-10}</math> accuracy	Rubidium <math>< 8</math> minutes, filter <math>< 20</math> min at 25°C
Rubidium retrace error (24 hours on, 48 hours off, 12 hours on)	<math>< 0.05</math> ppb at 25°C
MTBF	200,000 hours at 40°C

## Electrical

1PPS inputs	Jitter <math>< 2</math> ns (recommended)
1PPS outputs (rubidium or OCXO steered)	5V CMOS and Differential RS-422 (internal)
10 MHz outputs	13 dBm ± 2 dBm <sup>3</sup> 5 dBm to 10 dBm <sup>4</sup>
5 MHz output	5V CMOS (internal only)

<sup>3</sup>One buffered 10 MHz sine wave.

<sup>4</sup>Two 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

## Additional Internal Connections (must remove lid to access)

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