

mRO-50 Ruggedized

Low SWaP-C Mini-Rubidium Oscillator

The mRO-50 Ruggedized is a breakthrough microwave optical double resonance (MODR) low SWaP-C Miniaturized Rubidium Oscillator designed to meet the latest commercial, military and aerospace requirements where time stability and power consumption are critical.

It provides a one day holdover below 1 μ s and a retrace below 1E-10 in a form factor (50.8 x 50.8 x 20mm) that takes up only 51 cc of volume (about one-third of the volume compared to standard rubidiums) and consumes only 0.36W of power, which is about ten times less than existing solutions with similar capabilities.



Miniature, Low SWaP-C, ultra-portable high precision & performance Atomic Frequency Source

Key Features

Frequency Stability - ADEV

1s < 4E-11 (Option S)
100s < 4E-12 (Option S)

Phase Noise (SSB)

10Hz < -97 (Option S)
100Hz < -120 (Option S)
1KHz < -135 (Option S)

Aging (After 30 days)

Per day < (option A) 5E-12 / day

Warm up time

< 2 min

Operating Temp

-40° to +80°C

DC power

0.45W @5V
and 0.36W @3.3V (option)

Cell lifetime/MTBF

10 years/155860 hours at +25°C

Vibration

7.7 grms/axis per MIL-STD-810,
Fig 514.7E-1, Category 24

Shock

MIL-STD-202G, Test Condition A,
50g, 11 ms, half sine

Applications

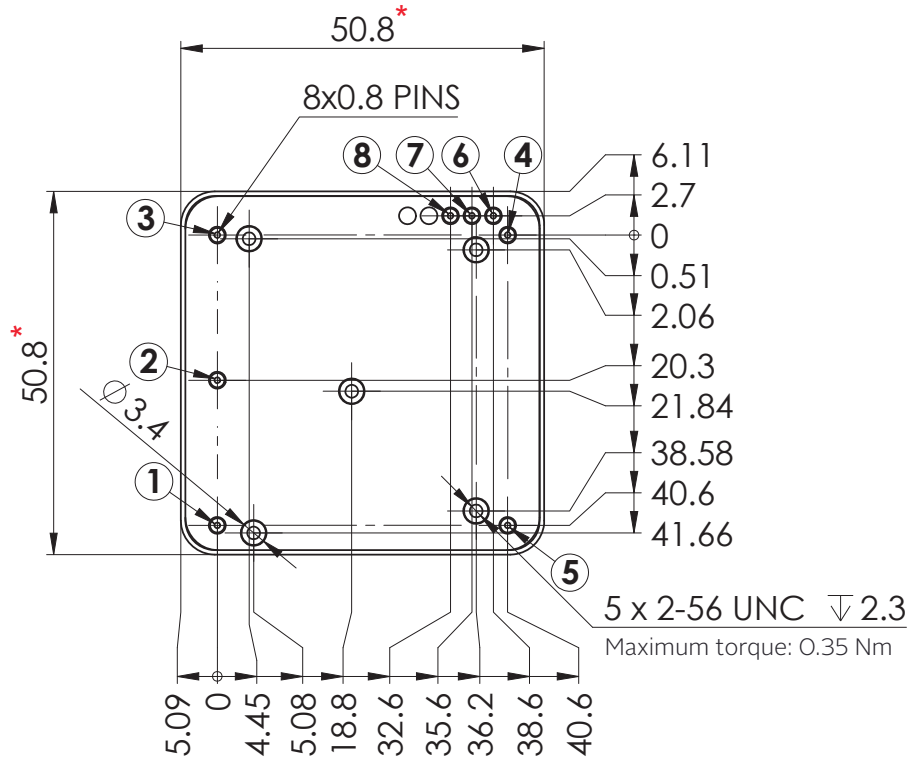
The mRO-50 Ruggedized Oscillator provides accurate frequency and precise time synchronization to mobile applications, such as military radio-pack systems in GNSS denied environments. Its wide-ranging operating temperature of -40° to +80°C is also ideal for UAVs and underwater applications.

Applications : Military comms , Radars, Low Earth Orbit, Electronic Warfare, Airborn & Avionics, UAV/UGV/USV/UUV and other harsh environments.

mRO-50 Ruggedized

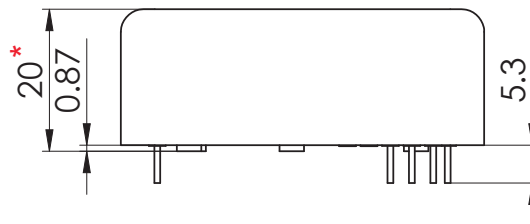
Package:

(all dimensions in mm)



* \pm 0.4 mm

All other quotes are \pm 0.2 mm



Pin Layout:

PIN	FUNCTION
1	Frequency Adjust (Analog 0-3V)
2	GND
3	10MHz square output (0-3V)
4	GND
5	Power 5V or 3.3V depending on model
6	/LOCK (Bit)
7	TxD
8	RxD

Patent numbers:

China : ZL 2014 8 0075019.0

USA : 10,191,452 B2

EU : 3102983

Japan : JP 6416921

SPECIFICATIONS

ELECTRICAL

Type	mRO-50 Ruggedized	
	Standard version	Options
Frequency	10 MHz	
Frequency change within operating temperature range	$\leq 6 \times 10^{-10}$ over -40°C to $+80^{\circ}\text{C}$	
Linear drift measured over minimum 14 days After 3 months operations :	$< 1 \times 10^{-11}$ / day	(option code A) $< 5 \times 10^{-12}$ / day
Short term stability	1 sec $\leq 6 \times 10^{-11}$ 10 sec $\leq 1.9 \times 10^{-11}$ 100 sec $\leq 6 \times 10^{-12}$	(option code S) $\leq 4 \times 10^{-11}$ $\leq 1.3 \times 10^{-11}$ $\leq 4 \times 10^{-12}$
Phase noise (10 MHz) in dBc/Hz	1 Hz ≤ -66 10 Hz ≤ -95 100 Hz ≤ -120 1000 Hz ≤ -135 10000 Hz ≤ -140	(option code S) ≤ -70 ≤ -97 ≤ -120 ≤ -135 ≤ -140
Frequency retrace (in stable temperature, gravity, pressure and magnetic field conditions)	$< 1 \times 10^{-10}$ within 1 h after 24 h off	
Warm-up time	Lock < 2 minutes at over the full temperature range	
Analog frequency adjustment. For stable operation, an external voltage shall be applied (cf. the manual of the mRO-50 for electrical scheme)	$1 \times 10^{-8} \pm 20\%$ (3.3V) $1 \times 10^{-8} \pm 20\%$ (5V)	
Digital frequency adjustment range with serial RS-232 port.	Fine: $\pm 7 \times 10^{-9}$ (resolution: 3×10^{-12}) Coarse: $\pm 1 \times 10^{-7}$ (resolution: 1.24×10^{-9})	
Output level	Square wave 0-3V	
Spurious $f_0 \pm 100\text{kHz}$	$< -80\text{dBc}$	
Supply voltage Max Power Supply Ripple	5V < 50 mV peak to peak (from 1Hz to 1MHz frequency band)	3.3V (option code 3.3 V) < 5 mV peak to peak (from 1Hz to 1MHz frequency band)
Input power @ 25°C	0.45W steady state 1.5W start-up	0.36W steady state 1W start-up
Lock Indicator	Unlocked > 3 V Locked < 0.4 V	

ENVIRONMENTAL

Type	mRO-50 Ruggedized
Magnetic field sensitivity	$< 1 \times 10^{-10}$ / Gauss
Storage Temperature	-55°C to $+105^{\circ}\text{C}$
Operating Temperature	-40°C to $+80^{\circ}\text{C}$ (maximum temperature of the thermal chamber with air flow around unit)
Overall Environment Effects Altitude (qualification ongoing) Vibration, Shocks (qualification ongoing)	Meets or exceeds: MIL-STD-810H, Method 500.6 MIL-STD-810H, Test Condition A, Method 514.8 Annex E general exposure $7.7g_{\text{RMS}}$ (no loss of lock) MIL-STD-202G, 50g, 11 ms, half sine
Humidity (qualification ongoing)	MIL-STD-810H, Method 507.6 35°C , 95% relative humidity
g-tip-over test	2×10^{-10} / g on worst sensitive axis

PHYSICAL

Type	mRO-50 Ruggedized
Size	50.8 x 50.8 x 20 mm (± 0.4 mm) 2" x 2" x 0.787"
Weight	80 g max. 2.82 oz. max.
Volume	< 52 cc

MBTF

Type	mRO-50 Ruggedized
Cell lifetime / MTBF	10 years / 155860 hours at +25°C

MORE ON APPLICATIONS

The mRO-50 Ruggedized design has been improved to reduce power consumption and size to meet the latest requirements necessary to support various levels of military and commercial applications.



AEROSPACE

- GNSS operation through interfere
- Low Earth Orbit satellite missions



MILITARY

- Military communication systems
- Key Infrastructure Emergency Vel
- Radars
- Aircraft and UAVs



COMMERCIAL

- Secured telecom
- Underwater geological applicatiion
- Autonomous cars
- Aircrafts