

## RK410 Mini USO

The RK410 is a  $10^{-10}$  stability class Mini USO (Ultra Stable Oscillator) designed specifically for space applications. This high reliability compact Space OXCO delivers an outstanding frequency stability of  $\pm 0.5$  ppb (under vacuum). Its short-term stability (ADEV) achieves  $2 \times 10^{-13}$  at  $\tau = 1$  s, and the  $\pm 20$  ppb/year long-term stability is guaranteed.

Operating in harsh environments, the RK410 Mini USO is able to deliver a stable frequency source for over 15 years, making it a qualified reference oscillator. It is a great solution for any application for which stable frequency signals and accurate timing performances are crucial, such as precision instruments, altimeters, navigation and positioning systems.

### Features

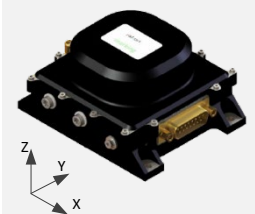
- Frequency: 4.5 to 12 MHz
- ADEV (5 MHz)
  - @ 1 to 10s:  $2 \times 10^{-13}$
  - @ 100s:  $5 \times 10^{-13}$
  - @ 1000s:  $7 \times 10^{-13}$
- Warm up consumption: 8 W max
- Steady state consumption: 2 W under vacuum and 4W under atmospheric pressure @25°C
- Frequency stability vs. temperature:  $\pm 5 \times 10^{-11}$  under vacuum
- Ageing:  $\pm 100$  ppb over 15 years at 5 or 10 MHz
- Supply voltage: +15 V
- Output waveform: sine 50  $\Omega$
- Output level from 0 to 4 dBm
- Component selected as per ECSS-Q-ST-60C
- Materials selected as per ECSS-Q-ST-70
- Manufactured and tested following the guidelines of the ECSS-Q-ST-70-08C standard

### Applications

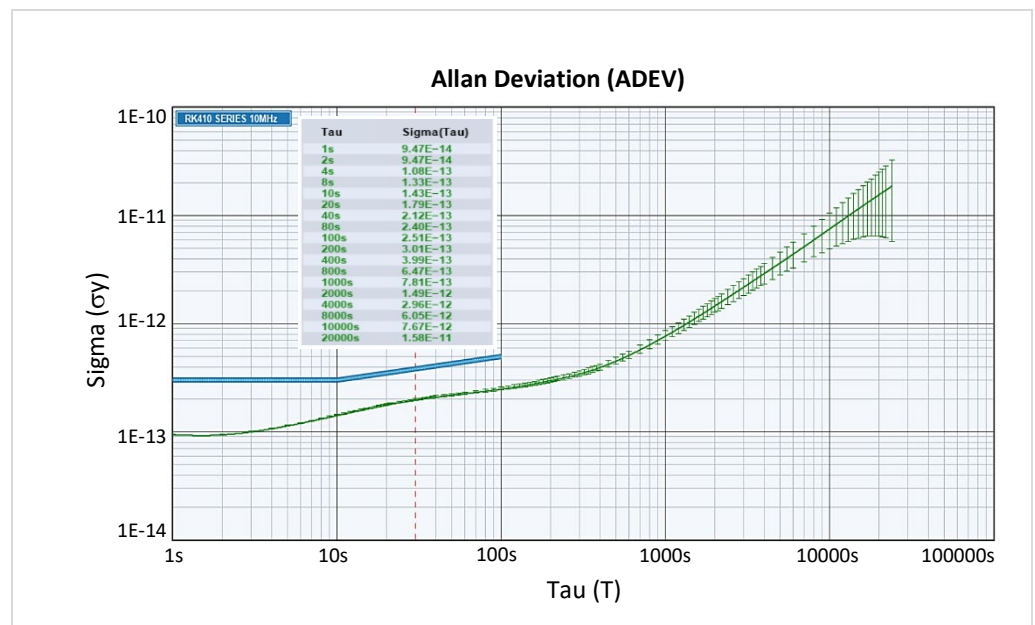
- Master clocks
- Navigation
- Compact reference for MRO/FGU
- Deep space exploration
- Gravitational waves
- High precision altimetry
- High precision instruments

99 x 88 x 54 mm

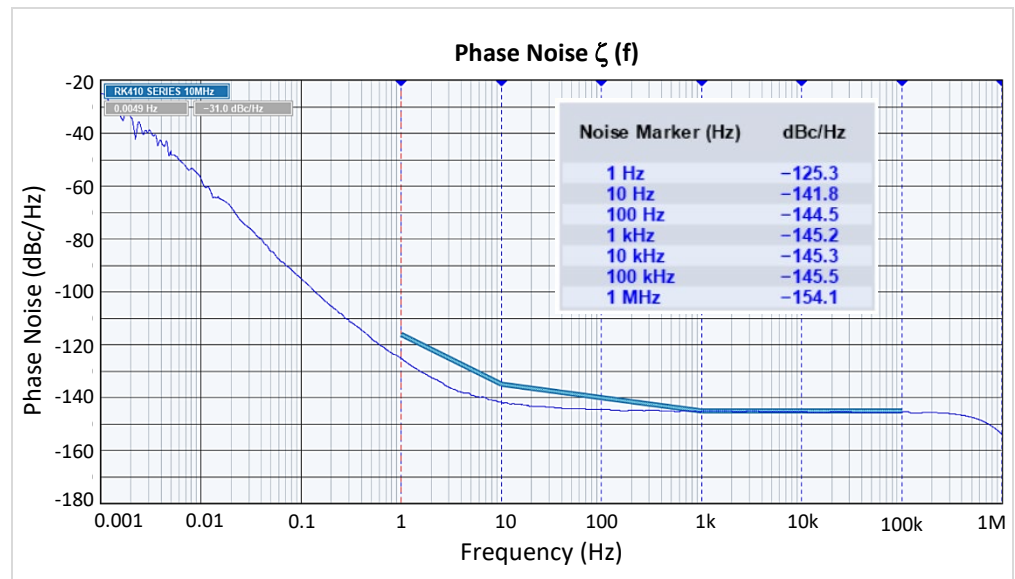
Mini USO



### Allan Deviation (ADEV)



## Phase Noise $\zeta(f)$



## Environmental Conditions

Parameter	Condition / Remarks	Min.	Typ.	Max.	Unit
Operating temperature	TO <sub>P</sub>	-20	25	50	°C
Switch-on temperature	TS <sub>O</sub>	-30	-	70	°C
Non-operating temperature	TNO <sub>P</sub>	-40	-	85	°C
Random vibration	> 20 – 100 Hz: +3 dB/oct > 100 – 400 Hz: 0,7 g <sup>2</sup> /Hz > 400 – 2000 Hz: -3 dB/oct > Duration: 2 minute per axis Global level: 26.4grms				
Sine vibration	Level as per MIL-STD-202 Method 204 (20 g from 20 to 100 Hz)				
Mechanical shock	Level as per MIL-STD-202, Method 213: Half sine with a peak acceleration of 800g / 0.5ms				
Radiation	Total Ionizing Dose (TID) of 100 krad, low dose rate. No SEL up to LET = 60 MeV.cm <sup>2</sup> /mg				

## Electrical Interface

Parameter	Condition / Remarks	Min.	Typ.	Max.	Unit
Power supply	-	14.25	15	15.75	V
Load impedance	-	45	50	55	Ω
Reference voltage (Vref)	1 mA max	6.5	7	7.5	V
Control voltage (Vc)	When Vc option is selected	0	-	Vref	V

## Frequency Characteristics @5 & 10 MHz

Parameter	Condition / Remarks	Min.	Typ.	Max.	Unit
Nominal frequency (Fn)	-	-	5 / 10	-	MHz
Steady state input current power	Vacuum @ -20°C	-	-	3.5	W
Warm up supply power	-	-	-	8	W
Initial frequency accuracy	-	-	-	±50	ppb
Frequency stability over temperature	-	-	-	±0.05	ppb
Frequency stability vs. acceleration	According to MIL-PRF-55310 / method 2g tip over	-	±0.5	±1	ppb
Retrace	48h Power ON / 24h Power OFF / 24h Power ON Vacuum @25°C	-	±0.2	±5	ppb
Supply voltage stability	Over operating temperature – Vcc ±5%	-	-	±0.05	ppb
Load sensitivity	Over operating temperature – VSWR 1.1	-	-	±0.05	ppb
Pressure sensitivity	Over operating temperature	-	-	±30	ppb
Ageing	Over 1 year Over 15 years According to the MIL-PRF-55310 issue C	-	-	±10 ±100	ppb
Allan variance (ADEV)	tau = 1 – 10s tau = 100s	-	2 4	3 5	10 <sup>-13</sup>
Frequency warm up	-	-	-	30	mn
Output waveform	Sine	-	-	-	-
Output level	EoL (End of Life)	0	-	4	dBm
Harmonics level	-	-	-	-40	dBc
Non harmonics level	-	-	-	-85	dBc
Phase noise @5MHz	1 Hz offset	-	-130	-122	dBc
	10 Hz offset	-	-148	-142	dBc
	100 Hz offset	-	-150	-146	dBc
	1 kHz offset	-	-152	-150	dBc
	10 kHz offset	-	-152	-150	dBc
Phase noise @10MHz	1 Hz offset	-	-125	-116	dBc
	10 Hz offset	-	-142	-135	dBc
	100 Hz offset	-	-145	-140	dBc
	1 kHz offset	-	-145	-145	dBc
	10 kHz offset	-	-145	-145	dBc
	100 kHz offset	-	-146	145	dBc
	1 MHz offset	-	-154	-148	dBc

## Model Outline and Pin Connections

Parameter	Remarks
Package size	99 x 88 x 54 mm
Net weight	550 g typ.
STEP file	<a href="#">RK410 3D model</a> To open or view the STP file, you will need to import it into one of the following software programs: Autodesk Fusion 360, CATIA, SolidWorks, Solid Edge, TurboCAD, Kubotek KeyCreator, FreeCAD, ABViewer, ShareCAD, or eMachineShop.

### Model outline

Pin	Connections
1	F <sub>OUT</sub> Frequency output
2	GND Electrical and mechanical ground
3	GND, V <sub>CC</sub> , V <sub>ref</sub> , V <sub>c</sub> Sub-D 15 with Ground, Power supply, Reference voltage, Voltage Control

