

## RK410 Mini USO

The RK410 is a  $10^{-10}$  stability class Mini USO (Ultra Stable Oscillator) dedicated to the space market. This high reliability compact Space OCXO 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 offers an alternative solution for other applications where stable frequency signal and accurate timing performances are crucial (E.g., precision instruments, altimeters, navigation and positioning systems).

### Features

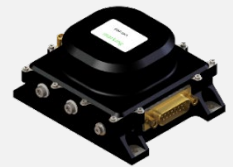
- Frequency: 4.5 to 12 MHz
- ADEV (5 MHz)
  - @ 1 to 10s:  $2 \times 10^{-13}$
  - @ 100s:  $5 \times 10^{-13}$
  - @ 1000s:  $7 \times 10^{-13}$
- Warm up consumption: 8 W max
- Steady state consumption: 2 W under vacuum and 4 W under atmospheric pressure @25 °C
- Frequency stability vs. temperature:  $\pm 5 \times 10^{-11}$  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 and the equipment related standards

### 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



### 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<br>> 100 – 400 Hz: 0,7 g <sup>2</sup> /Hz<br>> 400 – 2000 Hz: -3 dB/oct<br>> Duration: 2 minute per axis Global level: 26.4 grms |      |      |      |      |
| 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 800 g / 0.5 ms  |      |      |      |      |
| 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    | $\Omega$ |
| Reference voltage (V <sub>REF</sub> ) | 1 mA max                               | 6.5   | 7    | 7.5   | V        |
| Control voltage (V <sub>C</sub> )     | When V <sub>C</sub> option is selected | 0     | -    | Vref  | V        |

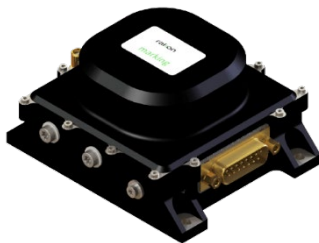
## Frequency Characteristics @5 & 10 MHz

| 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 2 g tip over                       | -    | ±0.5   | ±1          | ppb               |
| Retrace                              | 48 h Power ON / 24 h Power OFF / 24 h Power ON<br>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<br>Over 15 years<br>According to the MIL-PRF-55310 issue C | -    | -      | ±10<br>±100 | ppb               |
| Allan variance (ADEV)                | tau = 1 – 10 s<br>tau = 100 s  | -    | 2<br>4 | 3<br>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 @5 MHz                   | 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 @10 MHz                  | 1 Hz offset  | -    | -122   | -116        | dBc               |
|                                      | 10 Hz offset   | -    | -140   | -135        | dBc               |
|                                      | 100 Hz offset  | -    | -145   | -140        | dBc               |
|                                      | 1 kHz offset   | -    | -146   | -145        | dBc               |
|                                      | 10 kHz offset  | -    | -146   | -145        | dBc               |

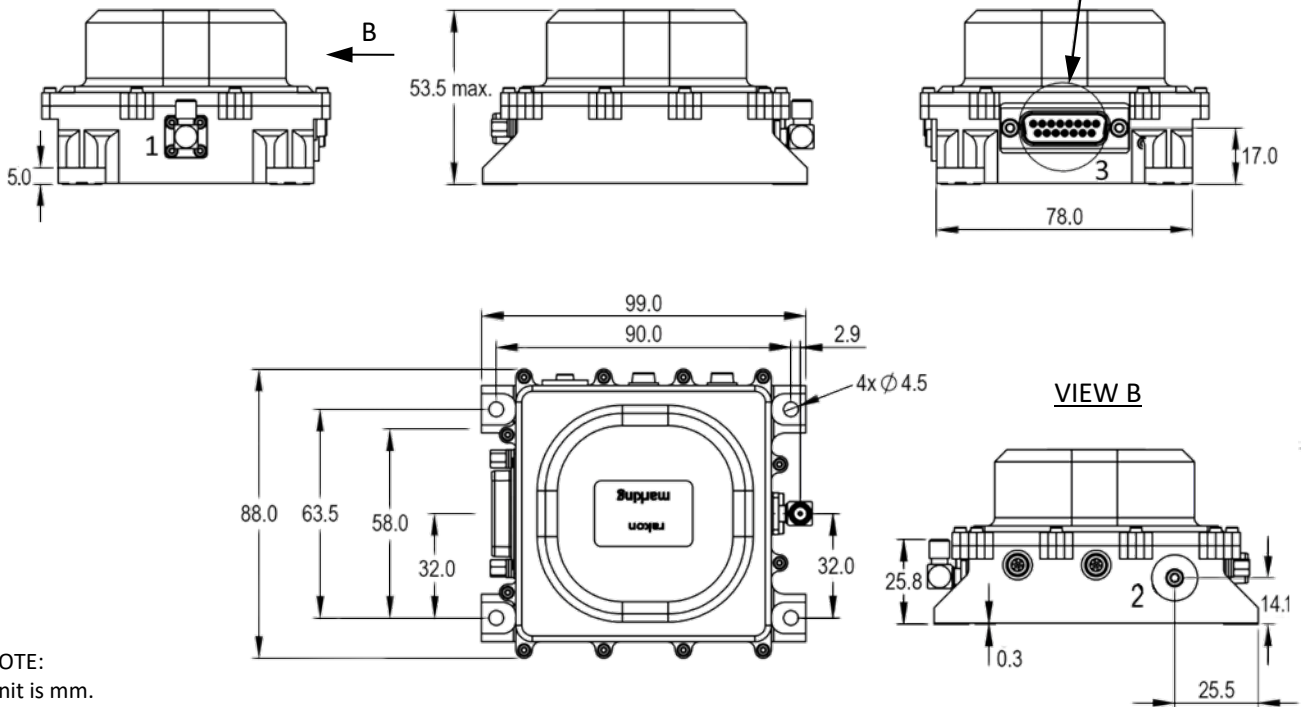
## Model Outline and Pin Connections

| Parameter    | Remarks  |
|--------------|--|
| Package size | 99 x 88 x 54 mm  |
| Net weight   | 550 g typ.   |
| STEP file    | <a href="#">RK410 3D model</a><br>To open or view the STP file, you will need to import it into one of the following software programs:<br>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 |



NOTE:  
Unit is mm.  
General tolerance  $\pm 0.2$  mm.