

## RK409GP

The RK409GP is a compact, stable oscillator designed specifically for the space market, offering 10<sup>-9</sup> class frequency stability. The high-end oscillator achieves short-term stability of 8E-13 at tau 1 s, making it ideal for applications such as Space Clocks, Navigation and Positioning Systems. The RK409GP is used in various systems, including GPS receivers, digital cards, board calculators, down and up converters and synthesizers. It provides exceptional frequency stability of ±1 ppb over operating temperature ranges of -20 to 70°C under vacuum.

As a dedicated oscillator for demanding space applications, the RK409GP delivers stable frequency sources for extended durations. For example, a 10 MHz RK409GP guarantees long-term stability of ±150 ppb over 18 years, ensuring reliable performance in harsh environments.

Two package options cater to different system requirements: the SubD<sup>1</sup> & SMA (SS) weigh 120 g, while the Pin-through hole (PTH) package weighs 90g. The oscillator’s low mass is an additional advantage, complementing its high performance for space-grade applications.

### Features

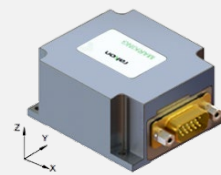
- Frequency: 10 to 50 MHz
- Allan Variance: 8E-13 @ 1 s
- Warm-up consumption: 7 W max.
- FvT: ±1 ppb typ. under vacuum
- Ageing: ±150 ppb max over 18 years at 10 MHz
- Supply voltage: 12 V
- Output waveform: sine 50 Ω
- Output level from 2 to 10 dBm
- Weight: ≤130 g
- TID Limit: 100 krad
- Latch-up free up to LET: 62 MeV.cm<sup>2</sup>/mg

### Applications

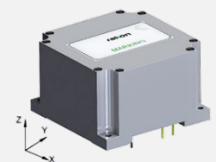
- PNT
- GNSS
- Earth Observation
- Navigation
- Compact reference for MRO/FGU

### Packages

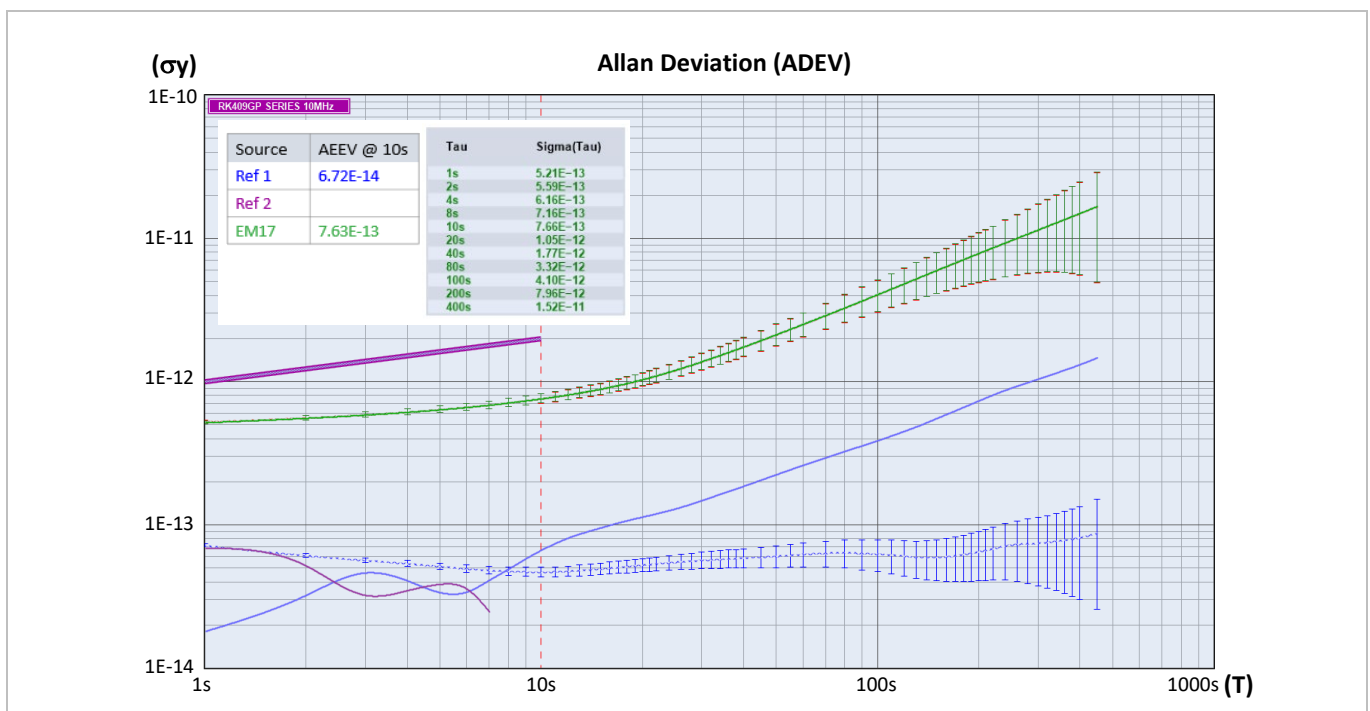
SubD SMA (SS)  
50 x 55 x 30 mm



Pin-through hole (PTH)  
50 x 50 x 30 mm

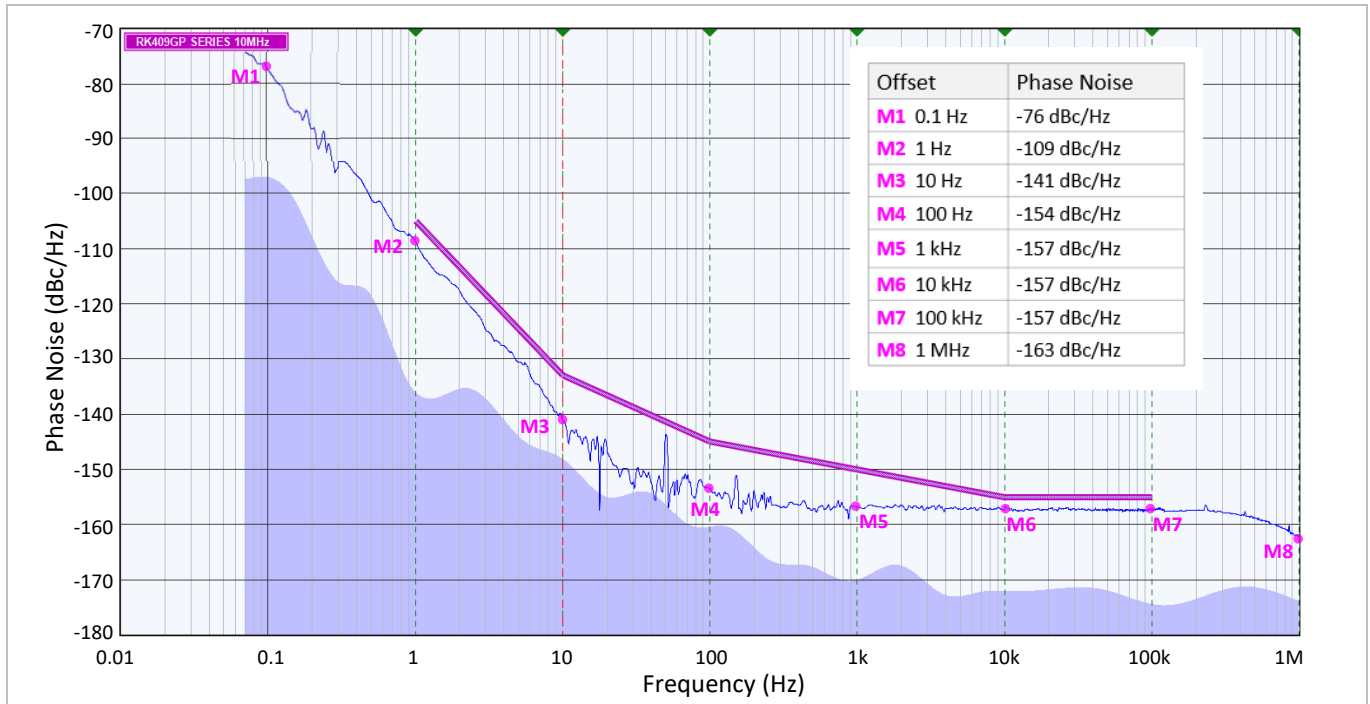


### Allan Deviation (ADEV) at 10 MHz



<sup>1</sup> SubD: Subminiature D connector.

### Phase Noise at 10MHz



### Environmental Conditions

Parameter	Condition / Remarks	Min.	Typ.	Max.	Unit
Operating temperature (T <sub>OP</sub> )	Option A	-10	25	+60	°C
	Option B	-20	25	+70	
	Option C	-40	25	70	
Switch-on temperature (T <sub>SO</sub> )	-	-40	-	+80	°C
Non-operating temperature (T <sub>NOP</sub> )	-	-45	-	+85	°C
Random vibration	MIL-STD-202 Method 214, conditions I-K: 50 – 100 Hz +6 dB/oct, 100 – 1000 Hz 1.5 g <sup>2</sup> /Hz 1000 – 2000 Hz -6 dB/oct, duration: 60 s/axis				
Sine vibration	MIL-STD-202 Method 204, condition D: 10 – 79 Hz 1.5 mm peak, 79 – 2000 Hz 20 g Sweep rate: 0.5 oct/mn up and down, 3 axis				
Mechanical shock	Level as per MIL-STD-202, Method 213, conditions: half sine with a peak acceleration of 1200 g for a duration of 0.5 ms				
Radiation	Total Ionizing Dose (TID) is 100 krad, with a low dose rate. No SEL up to LET = 62 MeV.cm <sup>2</sup> /mg				

### Electrical Interface

Parameter	Condition / Remarks	Min.	Typ.	Max.	Unit
Power supply <sup>2</sup>	-	11.4	12	12.6	V
Load impedance	VSWR 1.1	45	50	55	Ω
Reference voltage (V <sub>REF</sub> )	-	7.5	8	8.5	V
Reference voltage load	-	-	-	1	mA
Control voltage (V <sub>CTRL</sub> )	When V <sub>CTRL</sub> option is selected	0	-	V <sub>REF</sub>	V
Control voltage impedance	-	10	-	-	kΩ
Telemetry	-	0	-	V <sub>REF</sub>	V
Telemetry load	-	-	-	1	mA

<sup>2</sup> A 15 V ±5% power supply is available upon specific request.

## Frequency Characteristics

Parameter	Condition / Remarks	Min.	Typ.	Max.	Unit
Standard frequency	Custom option available on request	10	10, 10.23, 10.24	50	MHz
Steady-state input power	Vacuum	-	-	3	W
Warm-up supply power	-	-	-	7	W
Initial frequency accuracy	-	-	-	±100	ppb
Frequency adjustment	Positive slope	±350	-	±600	ppb
Frequency stability over temperature	Option A [-10 °C to +60 °C]	-	±0.3	±0.5	ppb
	Option B [-20 °C to +70 °C]	-	±0.5	±1	
	Option C [-40 °C to +70 °C]	-	±2	±10	
Supply voltage stability	Over operating temperature	-	-	±0.1	ppb
Load sensitivity	Over operating temperature	-	-	±0.1	ppb
Pressure	-	-	-	±50	ppb
Ageing	Over 1 day	-	-	±0.1	ppb
	Over 1 year	-	-	±50	
	Over 18 years	-	-	±300	
Allan variance	At 10MHz	-	-	10	E-12
	tau = 0.01 s		-	10	
	tau = 0.1 s		0.6	1	
	tau = 1 s		1	2	
	tau = 10 s		5	-	
tau = 100 s	-	-	-		
Frequency warm-up	Vacuum @ -40 °C	-	-	30	mn
Output waveform	Sine	-	-	-	-
Output level	EOL (End of Life)	2	-	10	dBm
Harmonics level	From DC to 500 MHz	-	-40	-30	dBc
Sub-harmonics level	From DC to 500 MHz	-	-	-30	dBc
Non-harmonics level	From DC to 3 GHz	-	-	-85	dBc

## Phase Noise

Parameter	Condition / Remarks	@ 10 MHz	@ 36 MHz	@ 50 MHz	Unit
Phase noise <sup>3</sup> (max.)	1 Hz offset	-105	-95	-85	dBc/Hz
	10 Hz offset	-133	-120	-115	dBc/Hz
	100 Hz offset	-145	-137	-135	dBc/Hz
	1 kHz offset	-150	-147	-145	dBc/Hz
	10 kHz offset	-155	-147	-145	dBc/Hz
	100 kHz offset	-155	-147	-145	dBc/Hz

<sup>3</sup> Better phase noise performance products can be delivered if needed.

### Ordering Part Example

**RK 409 GP PTH A 12 V T EM 10M000000**

**Product Series**

**RK** = Rakon  
**409** = Low PN OCXO  
**GP** = General purpose

**Package Type**

**SS** = Sub-D + SMA  
**PTH** = Pin-through hole

**Temperature Range**

**A** = -10 °C to +60 °C  
**B** = -20 °C to +70 °C  
**C** = -40 °C to +70 °C

**Supply voltage**

**12** = 12V

**Frequency (Fn)\***

**10M000000** = 10 MHz

\* Standard frequencies are 10, 10.23, MHz.

**Model**

**EM** = Engineering model  
**EQM** = Engineering qualification model  
**FM** = Flight model  
**FM-C** = Flight model qualified through launch acceptance test (LAT)

**Telemetry**

**x** = No telemetry,  
**V** = With telemetry

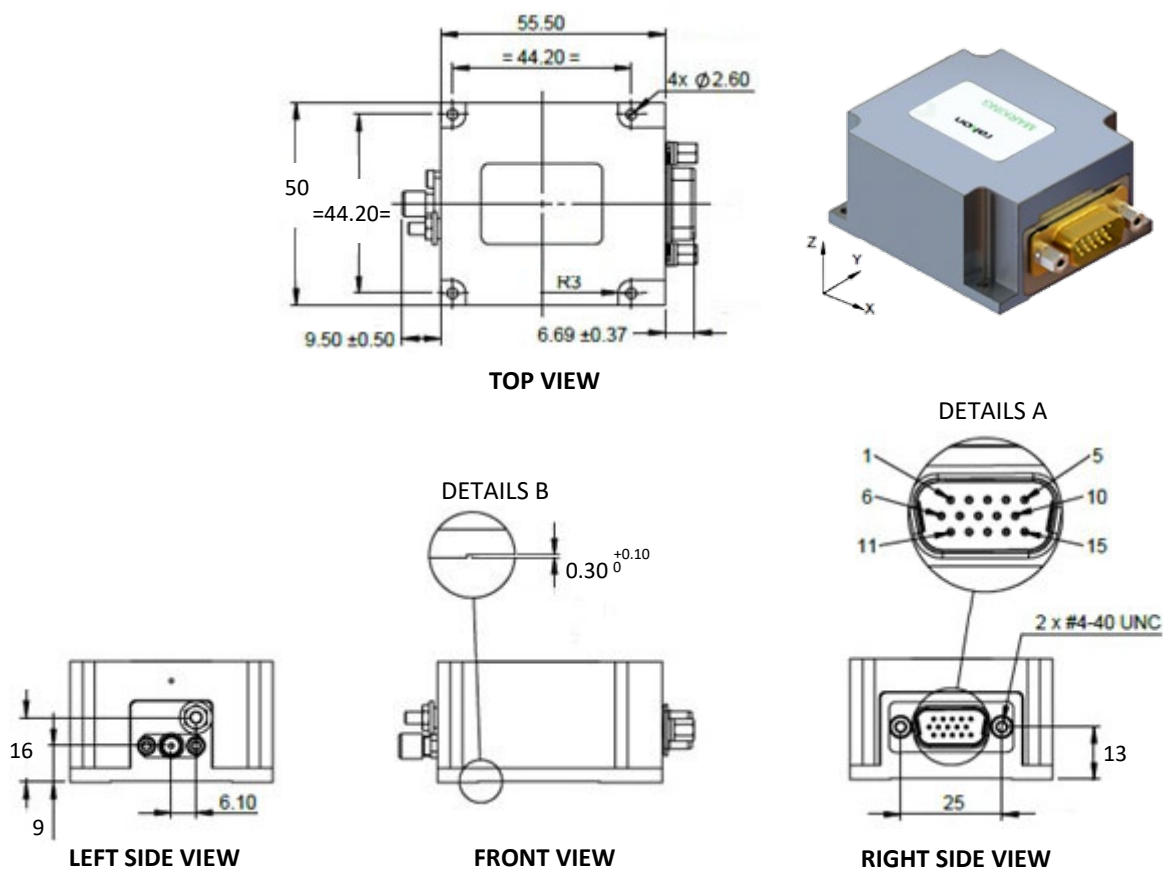
**Control Voltage**

**x** = No frequency control,  
**V** = With frequency control

### Model Outline and Pin Connections – Sub-D (SS) SMA Package

Parameter	Package
Package size	50 x 55.5 x 30 mm
Net weight	120 g (Typ), 130 g (Max)
STEP file	<a href="#">RK409GP SS 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



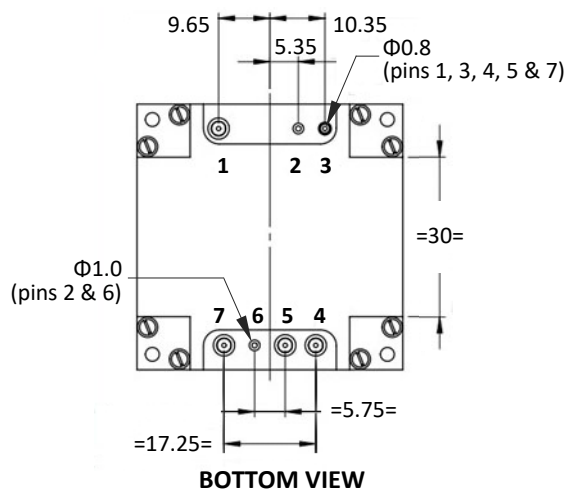
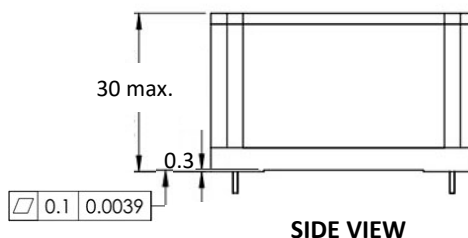
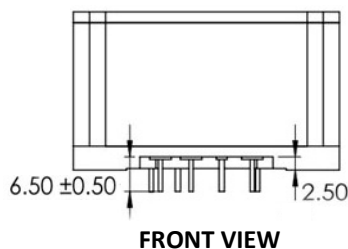
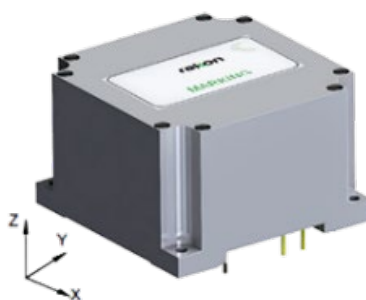
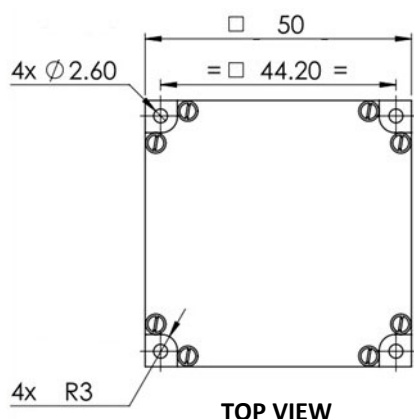
Pin	Symbol	Connections
1	VCTRL	Voltage control for electrical
3	TM	Telemetry
5	Vcc	Supply voltage
6	GND	Electrical & mechanical ground
11	Vref	Reference voltage
2, 4, 7 to 10, 12 to 15	NC	Do not connected

**NOTE:**  
 • Unit: mm  
 • General tolerance: ±0.1 mm

### Model Outline and Pin Connections – Pin-Through Hole (PTH) Package

Parameter	Package
Package size	50 x 50 x 30 mm
Net weight	90 g (Typ), 100 g (Max)
STEP file	<a href="#">RK409GP PTH 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	Symbol	Connections
1	TM	Telemetry
2, 6	GND	Electrical & mechanical ground
3	F <sub>OUT</sub>	Frequency output
4	V <sub>CTRL</sub>	Voltage control for electrical
5	V <sub>REF</sub>	Reference voltage
7	V <sub>CC</sub>	Supply voltage

- NOTE:
- Unit: mm
  - General tolerance: ±0.1 mm