ROM1490X

The ROM1490X is a Stratum 3E compliant OCXO which delivers ±3 ppb stability over an extended operating temperature range of -40 to 95°C. Designed specifically for data centre synchronisation, 5G Base Stations and Small Cells, 5G Advanced and 6G Radio Access Networks (RAN), it is Rakon's first OCXO to incorporate its proprietary Mercury[™] ASIC and XMEMS[®] resonator technologies, providing increased stability and holdover performance.

The ROM1490X builds on Rakon's expertise in miniature ASIC based OCXOs, XMEMS[®] crystal resonators, electric circuit design, thermal packaging, quality manufacturing processes, and high-resolution testing methods. The small form factor OCXO in footprint size 14 x 9 mm achieves an 8-hour phase holdover (1.5 μ s). It delivers a low-frequency slope of 0.05 ppb/°C and guarantees long-term stability of ±2.5 ppm over 20 years.

Equipped with a thermal protection package, the ROM1490X can withstand increased low/high temperatures and strong airflows, while maintaining reliable frequency signals and timing synchronisation. Exceeding the Stratum 3E requirement of ± 5 ppb and offering an advanced stability of $\leq \pm 3$ ppb, the ROM1490X emerges as the optimal choice for demanding telecommunications applications in performance and reliability.

Key specifications

- Package: 14.2 x 9.2 x 6.5 mm, 6-pad, SMD
- Frequency (Fn): 10 to 50 MHz
- Frequency stability (FvT): ±3 ppb
- Operating temperature: -40 to 95°C
- Long term stability: ±2.5 ppm / 20 year
- Frequency slope (ΔF/ΔT): 0.05 ppb/°C
- Floor noise (@10 MHz): -160 dBc/Hz
- Output waveform: CMOS
- Voltage supply: 2.7 to 5 V

Frequency Stability (FvT)

 ≤±1.5 ppb (-40 to 95°C) available upon request

Applications

- Radio access networks / O-RAN
- Stratum 3E, IEEE 1588
- Switches and data centres
- PTP enabled ethernet switches and routers
- Cable modem CMTS and remote PHYs
- G.8262, G.8262.1, G.8263, G.8273.2,
 G.8273.3, G.8273.4
- Test and measurement





Phase Noise @ 10 MHz

- 1 Hz offset: -85 dBc/Hz
- Floor noise: -160 dBc/Hz



ROM1490X

1.0 Absolute Maximum Rating¹

Parameter	Min.	Тур.	Max.	Unit	Test Condition / Description
a. Storage temperature	-55		125	°C	
b. Supply voltage (Vcc)	-0.5		6	V	
c. Power dissipation			2	W	
d. Load			50	pF	

2.0 Frequency Characteristics²

Ра	rameter	Min.	Тур.	Max.	Unit	Test Condition / Description
e.	Nominal frequency (Fn)		10 - 50		MHz	Standard frequencies 10, 19.2, 19.44, 20, 38.4, 38.88 & 40MHz
f.	Frequency calibration			±0.2	ppm	At 25°C \pm 2°C, at time of shipment, reference to the nominal frequency
g.	Reflow shift			±0.2	ppm	After 1 hour recovery at 25°C
h.	Operating temperature range	-40		+95	°C	
i.	Frequency stability over temperature (in still air)			±3	ppb	Reference to (FMAX + FMIN)/2
j.	Frequency slope $\Delta F / \Delta T$ in still air		±0.05	±0.1	ppb/°C	Temperature ramp ≤ 1°C/minute
k.	All causes stability			±3	ppm	Including calibration, temperature, supply voltage & load changes and 20 years life, reference to Fn
I.	Supply voltage stability		±1		ppb	±1% variation, reference to frequency at 3.3V
m.	Load sensitivity		±5		ppb	±10% variation, reference to frequency at 15pF
n.	Warm-up time ³		15	180	sec	
0.	Long term stability (Ageing)		±0.2	±0.5 ±0.3 ±2.5	ppb ppm	Per day, after 30 days of continuous operation First year 20 years
p.	Acceleration sensitivity		0.9		ppb/g	Gamma vector of all three axes from 30Hz to 1500Hz
q.	Holdover ^{4, 5, 6}	6	8		hours	Constant temperature condition
		3	6		hours	Temperature change of +1°C or -1°C after holdover starts; temperature rate ±0.5°C/minute
		1.5	3.5		hours	Temperature change of +2.8°C or -2.8°C after holdover starts; temperature rate ±0.5°C/minute

¹ Operating beyond this limit may result in change or permanent damage to the device.

⁶ No supply voltage or load changes, after 30 days of continuous operation.

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² The characteristics of the component may be temporarily affected by the processes of assembly and soldering. The frequency specifications apply after 48 hours of continuous operation after assembly. Nominal conditions (T=25°C, Vcc=3.3V, C_{load}=15pF) apply unless otherwise stated.

³ Time needed for frequency to be within ±20 ppb reference to frequency after 1 hour, at 25°C. Parameter is frequency, assembly and operating history dependent.

⁴ Referenced to the midpoint between minimum and maximum frequency value over the specified temperature range. The temperature varied at a maximum of 1°C per minute.

⁵ Parts should be shielded from drafts causing unexpected thermal gradients. Temperature changes due to ambient air currents on the oscillator can lead to short-term frequency drift

Specifications are subject to change without notice.

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r.	Wander generation ⁷	TDEV compliant with GR-1244 fig 5-4 & G.812 types II & III fig 2
		MTIE compliant with GR-1244 fig 5-5 & G.812 types II & III fig 1
		TDEV & MTIE compliant with G.8262, G.8262.1, G.8263, G.8273.2, G.8273.3, G.8273.4

3.0 Power Supply

Ра	rameter	Min.	Тур.	Max.	Unit	Test Condition / Description
a.	Supply voltage (Vcc)		2.7 – 5		V	±5%
b.	Input power (Warm up)		1200	1500	mW	At Vcc = 3.3V
C.	Input power (Steady state in still air at 25°C)		400	440	mW	At Vcc = 3.3V

4.0 Oscillator Output – Regulated CMOS 1.0V

Parameter	Min.	Тур.	Max.	Unit	Test Condition / Description
a. Output voltage level low (V_{OL})	0		0.1	V	
b. Output voltage level high (V_{OH})	0.9		1.1	V	
c. Rise and fall time			2	ns	10% to 90% level
d. Duty cycle	45		55	%	At 50% level
e. Load		15		pF	Nominal

f. Waveform screenshot (example at 20MHz)



5.0 Oscillator Output – Regulated CMOS 1.8V

Parameter	Min.	Тур.	Max.	Unit	Test Condition / Description
g. Output voltage level low (V_{OL})	0		0.15	V	
h. Output voltage level high (V_{OH})	1.65		1.95	V	
i. Rise and fall time		1	2	ns	10% to 90% level
j. Duty cycle	45		55	%	At 50% level
k. Load		15		pF	Nominal

⁷ Oscillator stabilised 24 hours at constant temperature (±1°C, still air). Data subjected to relevant loop filter values (-3dB cut-off, 2nd order high pass).

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6.0 Oscillator Output – Regulated CMOS 2.5V

Parameter	Min.	Тур.	Max.	Unit	Test Condition / Description
m. Output voltage level low (V $_{\text{OL}})$	0		0.2	V	
n. Output voltage level high (V_{OH})	2.3		2.7	V	
o. Rise and fall time		1	2	ns	10% to 90% level
p. Duty cycle	45		55	%	At 50% level
q. Load		15		pF	

r. Waveform screenshot (example at 20MHz)



7.0 Oscillator Output – Regulated CMOS 3.3V

Ра	rameter	Min.	Тур.	Max.	Unit	Test Condition / Description
s.	Output voltage level low (V_{OL})			10% Vcc	V	
t.	Output voltage level high (V_{OH})	90% Vcc			V	

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8.0 SSB Phase Noise (Typical value at 25°C)

Parameter	10.0MHz	20.0MHz	38.4MHz	Unit.	Test Condition / Description
1Hz offset	-85	-75	-70	dBc/Hz	
10Hz offset	-116	-105	-102	dBc/Hz	
100Hz offset	-143	-135	-132	dBc/Hz	
1kHz offset	-158	-155	-150	dBc/Hz	
10kHz offset	-160	-158	-155	dBc/Hz	
100kHz offset	-160	-159	-157	dBc/Hz	
1MHz offset	-160	-160	-159	dBc/Hz	

9.0 Marking

Parameter	Marking	Description
а. Туре		Laser marked
b. Line 1	[R FFFF YM]	Rakon identifier R, Frequency FFFF (M=MHz, e.g. 38M4=19.44MHz), Year Y (A=2010, B=2011,), Month M (1=Jan, 2=Feb,, A=Oct, B=Nov, C=Dec)
c. Line 2	[• XXXXXX]	Pin 1 •, alphanumeric serial number XXXXXX

10.0 Manufacturing Information

Parameter	Test Condition / Description
a. Reflow soldering	IPC/JEDEC J-STD-020, see Pb-free solder reflow profile attached
b. Soldering orientation	Solder part in upright position on top of PCB only and do not let it go through any further reflow in an inverted position. Part is not suitable for inverted reflow
c. Packaging description	Tape & Reel (see drawing attached)
d. Net weight	1.84 g/pc

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e. Application note	Follow the instructions in the Mercury series oscillator application note for optimum
	performance

11.0 Environmental Specification⁸

Parameter	Test Condition / Description
a. RoHS	Parts are fully compliant with the European Union directives 2011/65/EU and 2015/863/EU (amending annex II to directive 2011/65/EU) on the restriction of the use of certain hazardous substances in electrical and electronic equipment
b. Solderability	IPC/ECA J-STD-002, method 2, precondition 150°C, 16 hours
c. Moisture resistance	JESD22-A113I, MSL = 1
d. Latch up	EIA/JESD78, tested at room temperature and maximum ambient operating temperature
e. Electrostatic discharge (ESD)	Human Body Model (HBM), JEDEC JS-001-2012, ≥ 2000V Charged Device Model (CDM), JESD22-C101, ≥ 1000V Machine Model (MM), JESD22-A115, ≥ 200V
f. Low temperature storage	JESD22-A119, 1000 hours at -55°C, unbiased
g. Thermal shock	JESD22-A104 / MIL-STD-883, method 1010, 15 cycles from -55°C to 125°C
h. Temperature cycling	JESD22-A104 / MIL-STD-883, method 1010, 1000 cycles, -55°C to +125°C, non-operating, 15- minute soak
i. High temperature operating life	JESD22-A108, ≥ 2000 hours at 125°C & max. Vcc
j. Cold power cycling	Rakon standard, -40°C, 12 minutes OFF, 4 minutes ON, 1000 cycles
k. Frequency ageing	MIL-PRF-55310, 1008 hours
I. Mechanical shock	MIL-STD-202 (method 213), 1500g, 0.5ms duration, 18 shocks total
m. Vibration	JESD22-B103 (section 4.2.2), test Fc: 20g, 20 to 2000Hz, 4-minute sweep, 4 sweeps x 3 axes

⁸ For all relevant tests the units are pre-conditioned as per JESD22-A113 (5 temperature cycles -40°C to +60°C + bake for 24 hours at T = +125°C + moisture soak for 168 hours at +85°C / 85% RH + 3x reflow at T_{MAX} = +245°C).

– Ø1.6 (x6)

12.0 Model Outline

MODEL OUTLINE





FRONT VIEW









SIDE VIEW



RECOMMENDED PAD LAYOUT (TOP VIEW)

54 6

1	Do not connect (GND optional) / Vc (special request)
2	Do not connect (GND optional)
3	GND
4	RF Output
5	NC
6	Supply Voltage (Vcc), for correct operation decouple the supply voltage with a $10\mu F$
	capacitor close to the oscillator

- -

TEST CIRCUIT



TITLE: ROM1490 Mercury+™ IC OCXO (Hermetic, H = 6.5mm)	FILENAME:	CAT1105	TOLER	ANCES:	
RELATED DRAWINGS:	REVISION :	В	X.X	- = ±0.2	
	DATE:	09-Jun-2021	X.XX	$= \pm 0.10$	rakon
	SCALE:	2:1	X.XXX X°	= ±0.05 =	
	Millimetres		Hole	=	© 2017 Rakon Limited

13.0 **3D Model**

Parameter	Remarks
Package size	14.2 x 9.2 x 6.5 mm
STEP file	<u>ROM1490X 3D model</u> 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.

14.0 Optional Bias Network to convert Regulated 2.5V CMOS to Standard CMOS Levels

Parameter	Vcc = 3.135V		Vcc = 3.3V	c = 3.3V		
Bias network	Without	With	Without	With	Without	With
Vон	≥ 2.3V	≥ 2.76V	≥ 2.3V	≥ 2.85V	≥ 2.3V	≥ 2.93V
Voн [%Vcc]	≥ 73%	≥ 88%	≥ 70%	≥ 86%	≥ 66%	≥ 73%
Vol	≤ 0.2V	≤ 0.36V	≤ 0.2V	≤ 0.45V	≤ 0.2V	≤ 0.53V
Vol [%Vcc]	≤ 6.4%	≤ 12%	≤ 6.1%	≤ 14%	≤ 5.8%	≤ 15%



TITLE: Mercury+™ IC OCXO Optional Bias Network Output to Standard	FILENAME: CAT977	
RELATED DRAWINGS:	REVISION: A	
	DATE: 07-Apr-2015	Iakon
	SCALE: NTS	
	Millimetres	© 2015 Rakon Limited

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TITLE: 1490 Series Tape & Reel (H: 7.20 mm)	FILENAME:	CAT976	TOLER	ANCES:	
RELATED DRAWINGS:	REVISION:	С	X.X	- = ±0.2	
	DATE:	28-Aug-2019	X.XX	$= \pm 0.10$	rakon
	SCALE:		X.XXX X°	= ±0.05 =	
	Millimetres		Hole	$= \pm 0.10$	© 2016 Rakon Limited

16.0 Reflow



Note:

- The Pb-free Reflow follows the guidelines of IPC/JEDC J-STD-020.
- The product has been tested to withstand the Reflow Profile shown. The Reflow Profile used to solder Rakon products is determined by the solder paste Manufacturer's specification. It is recommended that the Reflow Profile used does not exceed the one shown above.

TITLE: Pb-Free Crystal & Oscillator Reflow (Classification Temperature Tc = 260°C) FILENAME: CAT541	
RELATED DRAWINGS:	REVISION: C	
	DATE: 16-May-2019	rakon
	SCALE: NTS	
	Millimetres	© 2013 Rakon Limited
17.0 Disclaimer		

Parameter	Test Condition / Description
a. Disclaimer	"Samples supplied according to this specification are supplied from our development or pre- production programme and are not qualification approved products. No condition, warranty or representation regarding quality, suitability, performance, life or continuation of supply is given or implied and Warranty in clause 7 of our standard Conditions of Sale is not applicable. The right is reserved to change the design or specification or cease supply without notice." Rakon Limited