

## EWOS4501

Low Power OCXO for Space Applications, ESA Class 2, Flight Proven

### PRODUCT OVERVIEW

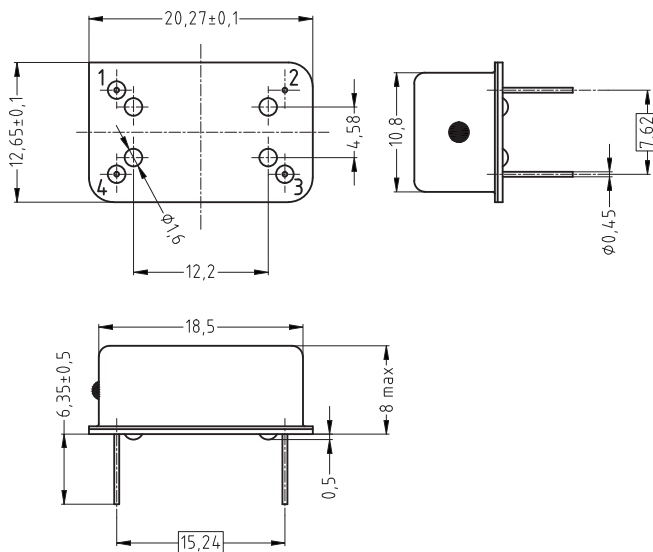
The EWOS4501 is a low power OCXO delivering an ultra-stable frequency of 32.768 MHz. It is flight proven and used in Class 3 and Class 2 satellite radios of Syrlinks. EWOS4501 is assembled using space grade passive components and is following a specific manufacturing flow chart with screening before and after hermetic sealing. EWOS4501 is used in Spacecraft with LEO orbits, and recommended for Class 3 / Class 2 space applications requiring TID up to 100 krad (10 years or more).



#### KEY FEATURES

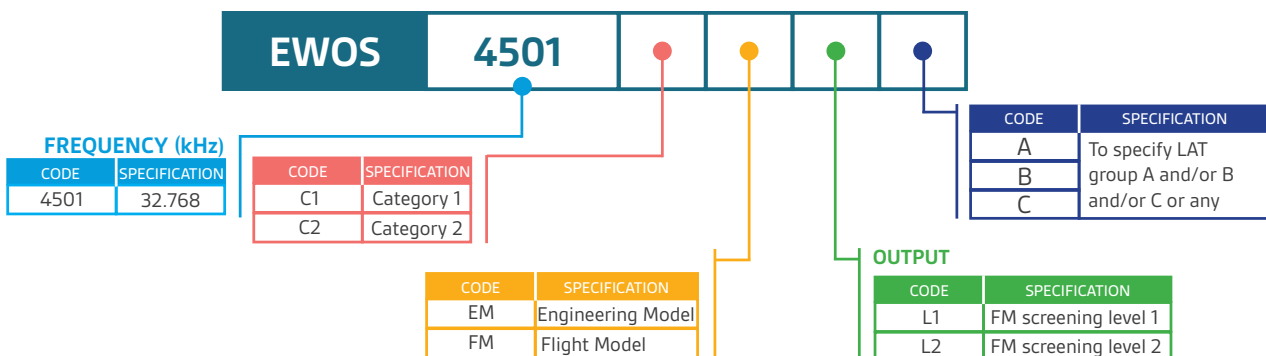
- 32,768 MHz
- $\pm 0,1$  ppm (typ.) thermal sensitivity
- 300 mW @  $-40^{\circ}\text{C}$  (typ.)
- $\pm 1$  ppb/day after 30 days (typ.)
- High mechanical robustness: MIL-STD-883 M2002 Cond B: 1500g / 0.5ms / 1/2 sine
- 100 krad
- Latch-up immune up to 67.7 MeV / mg /  $\text{cm}^2$

### DIMENSIONS & PIN-OUT



PIN NUMBER	FUNCTION
1	Frequency control
2	Ground
3	RF Out
4	Power Supply

### ORDERING INFORMATION



**ELECTRICAL CHARACTERISTICS**

PARAMETERS	Unit	Min	Typ.	Max	Note	Comments
<b>Output Frequency</b>	MHz		32.768		1	Nominal frequency
<b>Frequency Tolerance</b>	ppm		±0.5	±2.5	1	+25°C
<b>Temperature Range</b>						
• Operating	°C	-40		+60	1	
• Storage	°C	-55		+125		
<b>Supply Voltage</b>	V		5 ± 5%			
<b>Supply Current (Under vacuum or atmospheric pressure)</b>						
• Warm-up	mA		200	250	1	Quiet environment During 10 seconds
• Steady state / -40°C	mA		60	80	1	
• Steady state / +25°C	mA		30	40	1	
• Steady state / +60°C	mA		10	20	1	
<b>Warm-up time</b>						
	s			60	2	1E-7 accuracy referred to frequency measured at 25°C. To achieve
	mn			15	2	1E-10 short term stability - quiet environment
<b>Frequency Stability</b>						
• Vs temperature variation						
	Category 1	ppm	±0.1	±0.2/0.4	1	-40°C to +60°C
	Category 2	ppm		±0.4/0.6	1	-40°C to +60°C
• Vs supply voltage variation						
		ppm	±0.05	±0.1	2	5V ±5%
• Vs load variation						
		ppm	±0.05	±0.1	2	(10 KΩ//10 pF) ± 10%
• Short-term						
	Category 1			1E-10	1	Allan deviation / 1s
	Category 2			2E-10	1	Allan deviation / 1s
• Aging						
		ppb	±1	±5	2	Over 1 day
		ppm	±0.25	±0.5	2	Over 1 year
		ppm	±2.5			Over 10 years
• Total variation frequency						
		ppm	±2.7	±4		Over 10 years all causes
<b>Frequency sensitivity to acceleration</b>						
			5E-9/g		2	All 3 axes, root mean square value
<b>Phase noise</b>						
<b>Category 1</b>						
• 10 Hz offset from carrier		dBc/Hz	-95	-90	1	
• 100 Hz offset from carrier		dBc/Hz	-125	-120	1	
• 1 kHz offset from carrier		dBc/Hz	-148	-145	1	
• 10 kHz offset from carrier		dBc/Hz	-152	-148	1	
<b>Category 2</b>						
• 10 Hz offset from carrier		dBc/Hz	-90	-85	1	
• 100 Hz offset from carrier		dBc/Hz	-120	-115	1	
• 1 kHz offset from carrier		dBc/Hz	-144	-140	1	
• 10 kHz offset from carrier		dBc/Hz	-149	-145	1	
<b>Control Voltage</b>						
	V	0		5		Frequency control
<b>Frequency Shift</b>						
	ppm		-10/+7		1	Referred to nominal frequency measured at 25°C. Control voltage 0V to 5V - Positive slope
<b>Tuning Input Impedance</b>						
	kΩ		100		2	
	pF		2		2	
<b>Output level</b>						
	Vpp		0.5		1	Clipped sine wave - Dc cut Load 10 kΩ // 10pF Note: LC Network recommended at output (see typical application drawing)
<b>Output Impedance</b>						
	kΩ		1		2	
	pF		5		2	
<b>Radiation - Total Ionizing Dose</b>						
	krad		-		2	±3 ppm frequency drift
<b>Single Event - Latch-Up Immunity</b>						
	MeV/Mg/cm <sup>2</sup>	67.7			2	

**Notes**

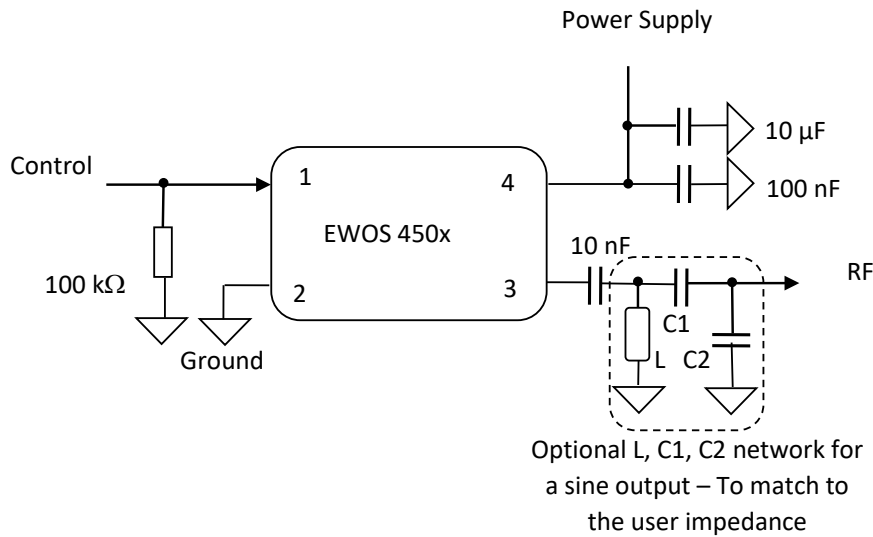
- Parameter inspected at 100%
- Parameter inspected by sampling

### ABSOLUTE MAXIMUM RATINGS

- Supply Voltage VCC: 0V / 5.5V
- Control Voltage VCTRL: 0V / 5.5V
- ESD sensitive device - 2kV - Human body model - 1.5 kΩ in series with 100 pF

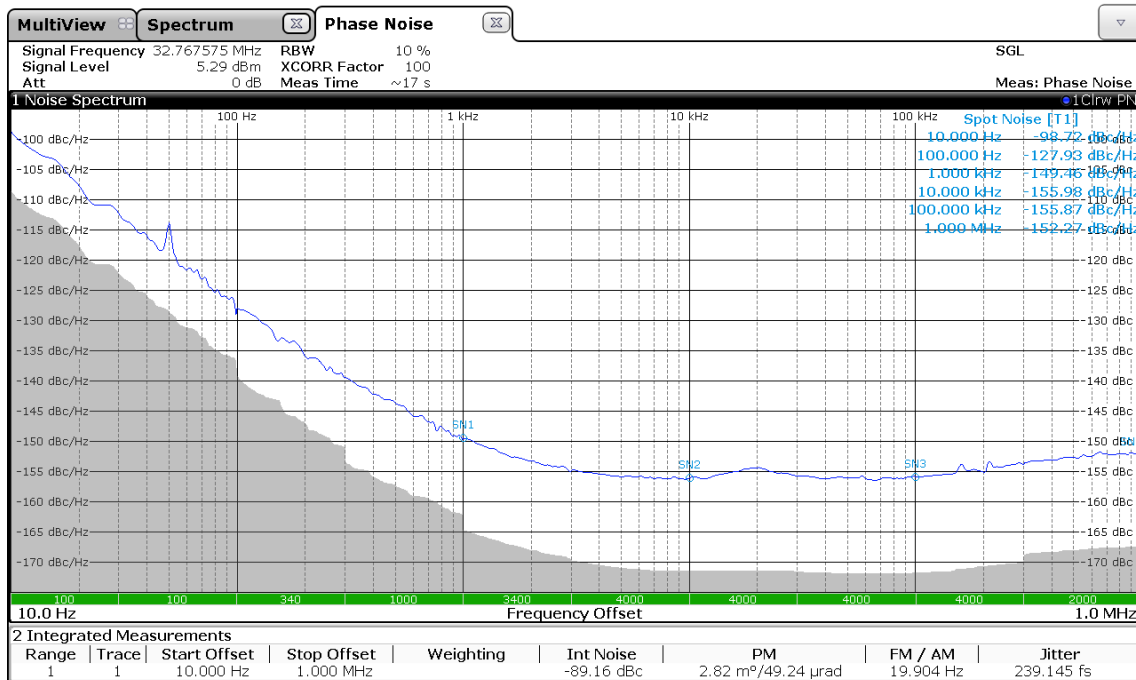
Operation of the device beyond these limits may affect device reliability or may cause permanent damage.

### TYPICAL APPLICATION



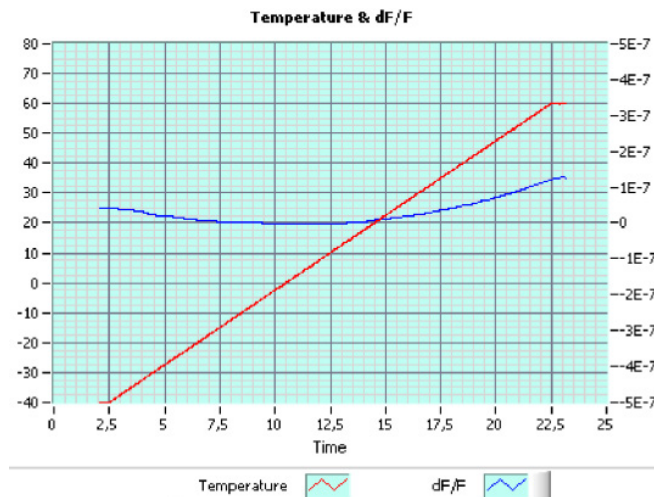
Rated performance requires using good high frequency board layout techniques. It is recommended to connect decoupling capacitors (100 nF ceramic and 10μF capacitors) to the supply pin. Oscillator case has to be mechanically maintained or glued on the equipment board in order not to be damaged by environment vibrations and shocks.

### TYPICAL PHASE NOISE



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**TYPICAL FREQUENCY STABILITY OVER -40°C/60°C TEMPERATURE RANGE**



**PROCESS FLOW**

	Engineering Model	Flight Model	Conditions
Individual parts supply	x	x	
Assembly	x	x	
Non-Destructive bonding pulling test		x	MIL-STD-883 Method 2023 Sampling: 5 parts +2 parts destructive bonding pull tests
Pre-seal ageing - Crystal stabilization	x	x	125°C, 240 hours - Device ON
Internal Visual Inspection	x	x	MIL-STD-883 Method 2017 EM: Class H FM: Class K ECSS-Q-ST-70-38 for SMD
Unit sterilization	x	x	
Customer Inspection Point		x	
Hermetic closure	x	x	
Particle Impact Noise Detection (PIND) test	x	x	MIL-STD-883 Method 2020 Condition A
Leakage test - Fine and gross leak	x	x	MIL-STD-883 Method 1014 Condition A2 MIL-STD-883 Method 1014 Condition C1
External Visual Inspection	x	x	MIL-STD-883 Method 2009
Dimensions measurement		x	MIL-STD-883 Method 2016
Final electrical test under atmospheric pressure	x	x	According to detail spec 9005360-000-024 Range temperature: -40 / +60°C

**SCREENING FLOW - FLIGHT MODEL**

Test	Test Method Condition	Nulber of parts	Level 1	Level 2	Comments
Electrical test under atmospheric pressure		100%	x	x	
Thermal cycling	MIL-STD-883 Method 1010 Cond.B 10 cycles	100%	x	x	
Electrical functional test		100%	x	x	@ room temperature According to detail spec 9005360-000-024
Mechanical shock	MIL-STD-883 Method 2002 Condition B 1/2 sine, 1500g, 0.5ms	100%	x	x	Y1 axis only
Electrical functional test		100%	x	x	@ room temperature According to detail spec 9005360-000-024
Burn-It at low temperature (device On)	25°C 168 hours		x	x	According to detail spec 9005360-000-024

Test	Test Method Condition	Nulber of parts	Level 1	Level 2	Comments
<b>Electrical test under atmospheric pressure</b>		100%	x	x	According to detail spec 9005360-000-024
<b>Burn-In (device On)</b>	125°C 240 hours for level 1 168 hours for level 2	100%	x	x	According to detail spec 9005360-000-024
<b>Electrical test under atmospheric pressure</b>		100%	x	x	
<b>Parameter drift calculation</b>		100%	x		
<b>PDA</b>			x	x	5% max on Burn-In @ 125°C
<b>Particle Impact Noise Detection (PIND) test</b>	MIL-STD-883 Method 2020 Cond. A	100%	x	x	
<b>X-Ray inspection</b>	MIL-STD-883 Method 2012	100%	x	x	
<b>Fine Leak</b>	MIL-STD-883 Method 1014 Cond. A2	100%	x	x	
<b>Gross leak</b>	MIL-STD-883 Method 1014 Cond. C1	100%	x	x	
<b>External visual inspection</b>	MIL-STD-883 Method 2009	100%	x	x	

## LOT ACCEPTANCE TEST FLOW

Item	Operation	Requirements & Conditions	Rate or Number of parts
<b>Group A</b>			
1	Electrical test	See electrical specifications	100%
2	Visual and Physical Properties	MIL-STD-883 Method 2009	100%
3	Solderability	MIL-STD-883 Method 2003	1 unit
<b>Group B</b>			
4	Electrical test	See electrical specifications	
5	Life test	MIL-STD-883 Method 1005 125°C, 1 000 hours, device On	3 units
6	Electrical test	See electrical specifications	
7	Frequency and power consumption drift analysis	See electrical specifications for success criteria	
<b>Group C</b>			
8	Electrical test	See electrical specifications	
9	Random vibrations	MIL-STD-202 Method 214 Condition I-D 11.6grams	
10	Electrical test	See electrical specifications - @25°C	
11	Sine vibrations	MIL-STD-883 Method 2007 Condition A, 20g	
12	Electrical test	See electrical specifications - @25°C	
13	Mechanical shocks	MIL-STD-883 Method 2002 Condition B 1/2 sine, 1500g, 0.5ms, 18 shocks (3 in each direction)	1 unit
14	Particle Impact Noise Detection (PIND)	MIL-STD-883 Method 2002 Condition A	
15	Electrical test	See electrical specifications - @25°C	
16	Thermal cycling	MIL-STD-883 Method 1010 Condition B -55°C/+125°C/10mn dwell time/10 cycles	
17	Electrical test	See electrical specifications	
18	External visual inspection	MIL-STD-883 Method 2009.8	
19	Destructive Physical Analysis (DPA)	See DPA tablee	

**DESTRUCTIVE PART ANALYSIS**

N°	Test	MIL-STD	Method	Test Condition and remarks	Comments
19a	External visual inspection	883	2009		Specifically on: -Glass bids -Closing
19b	Radiography (X-Ray)	883	2012		In Y and Z axis
19c	Internal water vapour content	883	1018	Initial and final DPA	
19d	Delidding	883	5009		
19e	Internal visual	883	2017	Class K	
		883	2010	Condition B. Or ESCC equivalent for monolithic devices	
		750	2072		
		750	2073		
		750	2074		
19e	Internal visual	883	2032		
		883	2018	Provide photos of typical assemblies, non conformances and anomalies	
		883	2011	Pull all wires	Limit value: 2gF
		883	2019	Shear all chips	PErformed on: - Resistor (limit value 0.6kgF) - Capacitor (size 0805, limit value 3.23 kgF) - Crystal (limit value 5 kgF)
19i	Micro-sections	-		Micro-sectioning shall be performed to evaluate: multilayer substrates (conductors, dielectric, vias), assembly of added-on parts, cross-overs, local encapsulations, hermetic sealing (seal joint and feed-through).	
20	Solderability	202	208	Tree terminals per test item	
21	Soldering heat	883	2036	Visual inspection (x30 minimum) to verify that terminals, glass seals, connections or substrate are not damaged. Conditions A	
		883	2004	Rigid feed-throughs in packages: - Diameter ≤ 1mm condition A, F(N) = 30 x S (mm <sup>2</sup> ) (F: strength, S: lead section)	