EX-421

Evacuated Miniature Crystal Oscillator

Description

The EX-421 provides exceptionally low aging rates and tight temperature stabilities in an extremely small package over a wide range of environmental conditions. This EMXO series bridges the gap between current large, high precision OCXO's and smaller TCXO's. The EX-421 Series becomes the most economical choice where there is a need for spectral purity, short and long term stability, along with small size and dramatically reduced power consumption.

Features

- Low Power Consumption Precision Oscillator
- Fast Warm-Up
- Low Phase Noise
- Good Aging
- Small Form Factor
- SMD and Thru-Hole Mounting Option
- RoHS Compliant
- Standard Frequencies: 10MHz, 20MHz and 100MHz
- Design/Material Sourcing/Manufacture/Test in MHS,PA COO:USA
- No ITAR Restriction for Importing EAR99
- Previous Model Number: EX-620, EX-420 Series

Applications

- Mobile Data Communications
- Military Portable Radio
- Satellite Communications
- Airborne Equipment
- Avionics
- Instrumentation
- Marine/Land Seismic

Performance Specifications

Parameter	Min	Typ	Max	Units	Condition
Frequency Stabilities[1]					
vs. operating temperature range (See temperature & stability table)			±10 ±20 ±30	ppb ppb ppb	0… +50°C -20… +70°C -40… +85°C
vs. aging / day (See aging table) vs. aging / per year vs. aging / 10 years			±1.0 ±100 ±1	ppb ppb ppm	after 30 days of operation
Initial Accuracy vs. supply voltage change vs. load change	-0.2 -5 -5		+0.2 +5 +5	ppm ppb ppb	at time of shipment VS ± 5% Load ± 5%
Warm-up Time			45 60	sec. sec.	to ± 1 ppm of final frequency (1 hour) to ± 100 ppb of final frequency (1 hour)
Supply Voltage (Vs)					
Supply voltage (Standard)	4.75	5.0	5.25	VDC	
Supply voltage (Option)	3.14	3.3	3.46	VDC	
Power Consumption			1.5 0.25 0.30	Watts Watts Watts	during warm-up steady state @ +25°C / 3.3 Vdc steady state @ +25°C / 5.0 Vdc

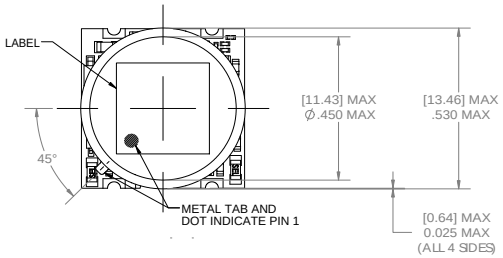
Performance Specifications

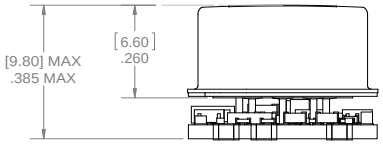
Parameter	Min	Typ	Max	Units	Condition
Signal [Standard]		**HCMOS**			
Load		15		pF	
Signal Level (Vol)			0.1 Vs	VDC	
Signal Level (Voh)	0.8 Vs 0.8 Vs			VDC VDC	Vs = 3.3 Vdc Vs = 5.0 Vdc
Rise \ Fall Time			5	ns	10MHz to 29.999MHz , (10 % - 80 %)
Rise \ Fall Time			3	ns	30MHz to 100MHz , (10 % - 80 %)
Duty cycle	45		55	%	
Signal [Standard]		**Sinewave**			
Load		50		ohm	
Output Power [Standard] Output Power [Option] Output Power [Option]	0 +3 +5		+4 +7 +9	dBm dBm dBm	50 Ohm load 50 Ohm load 50 Ohm load
Harmonics			-30	dBc	50 Ohm load
Frequency Tuning (EFC)					
Reference Voltage (Vref)	2.7 4.2		2.9 4.4	VDC VDC	Vs = 3.3 Vdc Vs = 5.0 Vdc
Tuning Voltage	0		+Vref	VDC	
Tuning Range		See tuning range table			
Tuning Slope		Positive			
Additional Parameters					
Phase Noise (10 MHz)		-90 -125 -145 -160 -165		dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz	1 Hz 10 Hz 100 Hz 1 KHz 10 KHz
Phase Noise (100 MHz)		-95 -125 -150 -160 -165		dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz	10 Hz 100 Hz 1 KHz 10 KHz 100 KHz
Allan Deviation (10 MHz)			0.02	ppb	Tau = 1 sec
Acceleration Sensitivity			1.0	ppb/g	Total Gamma
Weight			5	grams	
Absolute Maximum Ratings					
Supply Voltage			5.5	VDC	
Output Load			50	pF	
Operable temperature range	-55		+85	°C	
Storage temperature range	-55		+85	°C	

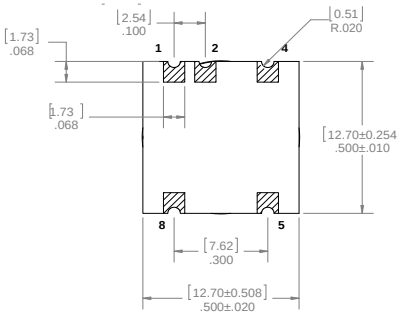
Standard Environmentals	
Vibration Sine	MIL-STD-202, Method 204, Condition G (30g peak, 10Hz-2000Hz)
Vibration Random	MIL-STD-202, Method 214, Condition I-H (30g RMS, 10Hz-2000Hz)
Shock	MIL-STD-202, Method 213, Condition E (1000 g, 0.5ms, 1/2 sine)
Solderability	MIL-STD-883, Method 2003

Outline Drawing / Enclosure

Surface Mount

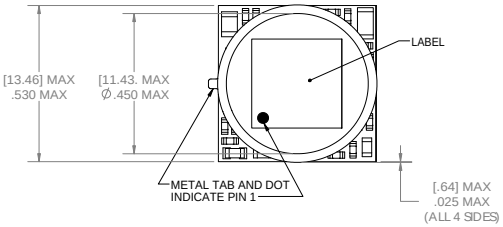


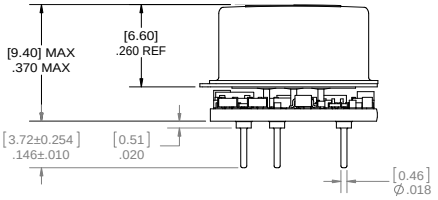


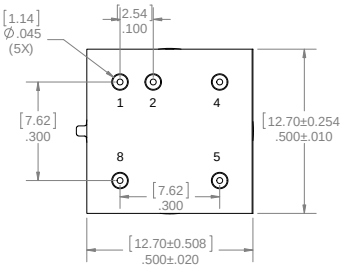


Pin Connections		
Pin	EFC OPTIONS	FIX FREQ. OPTIONS
1	EFC Input	No Connection
2	Vref Output	No Connection
4	Ground (Case)	Ground (Case)
5	RF Output	RF Output
8	Supply Voltage Input	Supply Voltage Input

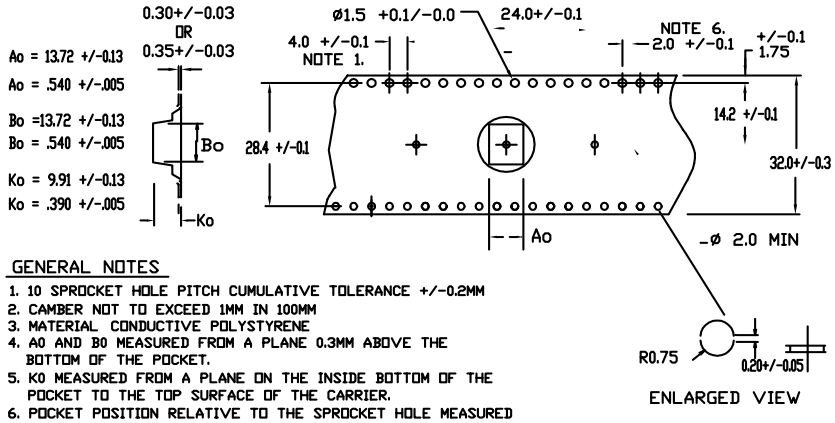
Thru-hole





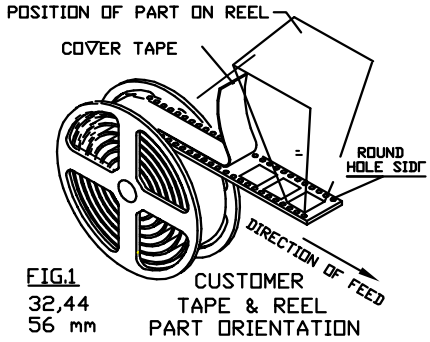


Standard Shipping Method (surface mount)

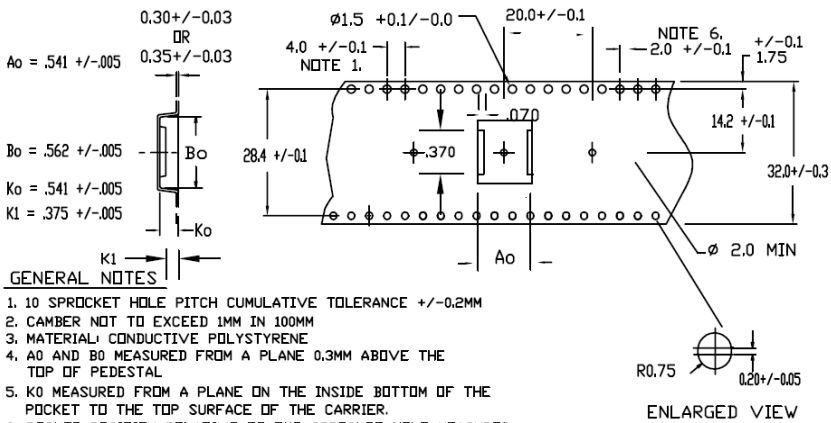


GENERAL NOTES

1. 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE +/-0.2MM
2. CAMBER NOT TO EXCEED 1MM IN 100MM
3. MATERIAL CONDUCTIVE POLYSTYRENE
4. A0 AND B0 MEASURED FROM A PLANE 0.3MM ABOVE THE BOTTOM OF THE POCKET.
5. K0 MEASURED FROM A PLANE ON THE INSIDE BOTTOM OF THE POCKET TO THE TOP SURFACE OF THE CARRIER.
6. POCKET POSITION RELATIVE TO THE SPROCKET HOLE MEASURED AS TRUE POSITION OF THE POCKET, NOT THE POCKET HOLE.

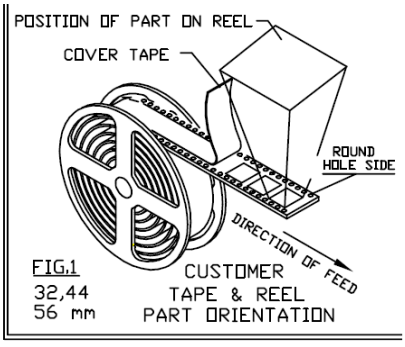


Standard Shipping Method (thru-hole)

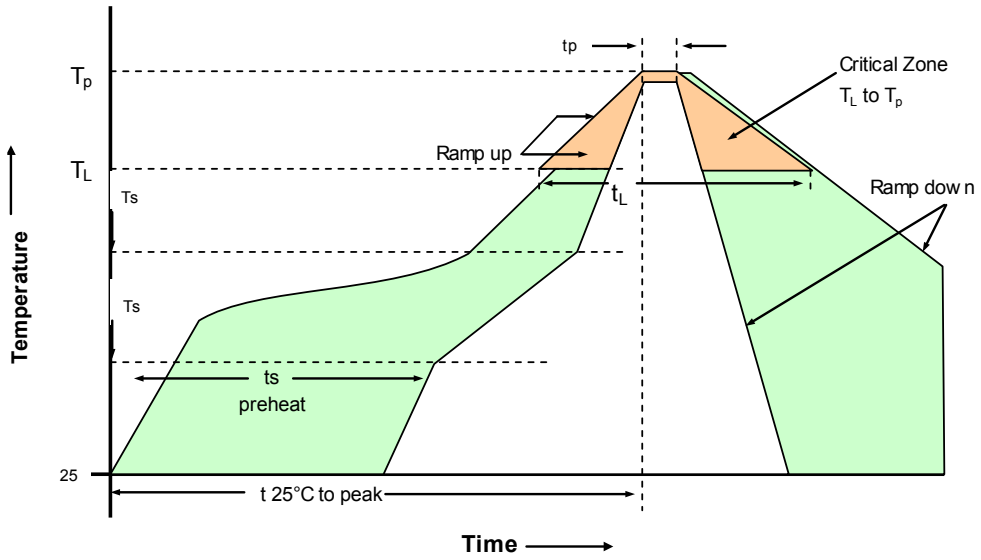


GENERAL NOTES

1. 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE +/-0.2MM
2. CAMBER NOT TO EXCEED 1MM IN 100MM
3. MATERIAL: CONDUCTIVE POLYSTYRENE
4. A0 AND B0 MEASURED FROM A PLANE 0.3MM ABOVE THE TOP OF PEDESTAL
5. K0 MEASURED FROM A PLANE ON THE INSIDE BOTTOM OF THE POCKET TO THE TOP SURFACE OF THE CARRIER.
6. POCKET POSITION RELATIVE TO THE SPROCKET HOLE MEASURED AS TRUE POSITION OF THE POCKET, NOT THE POCKET HOLE.



Recommended Reflow Profiles for Pb-Free & Sn-Pb



230°C Reflow Profile

Profile Feature	Sn-Pb Assembly	Profile Feature	Sn-Pb Assembly
Average ramp-up rate (TL to TP)	3°C/seconds max.	Time 25°C to Peak Temperature	4 minutes max.
Preheat - Temperature min Tsmin - Temperature Min Tsmax - Time (min to max) (ts)	135°C 155°C 60-90 seconds	Time maintained above - Temperature (TL) - Time (tL)	 183°C 45-60 seconds
Tsmax to TL -Ramp-up Rate	3°C/seconds max.		
Time maintained above - Temperature (TL) - Time (TL)	183°C 40-60 seconds	Time within 5°C of actual Peak Temperature (tp)	10-20 seconds max.
Peak Temperature (Tp)	max 230°C	Ramp-down Rate	6°C/seconds max.
Note: All temperatures refer to topside of the package, measured on the package body surface.			

260°C Reflow Profile

Profile Feature	Pb-Free Assembly	Profile Feature	Pb-Free Assembly
Average ramp-up rate (TL to TP)	3°C/seconds max.	Time 25°C to Peak Temperature	8 minutes max.
Preheat - Temperature min Tsmin - Temperature min Tsmax - Time (min to max) (ts)	150°C 200°C 60-180 seconds	Time maintained above - Temperature (TL) - Time (tL)	 217°C 60-150 seconds
Tsmax to TL -Ramp-up Rate	3°C/seconds max.		
Time maintained above - Temperature (TL) - Time (TL)	217°C 60-150 seconds	Time within 5°C of actual Peak Temperature (tp)	20-40 seconds max.
Peak Temperature (Tp)	max 260°C	Ramp-down Rate	6°C/seconds max.
Note: All temperatures refer to topside of the package, measured on the package body surface.			

Ordering Information

EX - 421 0 - D A P - 108 0 - 10M0000000

- **Product Family**: EX: EMXO
- **Package**: 13x 13mm
- **Configuration**: 0: Surface Mount; 1: Thru-hole
- **Supply Voltage**: D: 5 Vdc; E: 3.3 Vdc
- **RF Output Code**: A: HCMOS; E: Sinewave
- **Temperature Range**: A: -55°C to +85°C; E: -40°C to +85°C; J: -20°C to +70°C; P: 0°C to +50°C
- **Stability Code**: 108: ±10ppb; 208: ±20ppb; 308: ±30ppb; 508: ±50ppb; 758: ±75ppb; 107: ±100ppb
- **Frequency Control**: 0: Fixed Frequency (HCMOS); 1: Fixed Frequency (0 dBm); 2: Fixed Frequency (+3 dBm); 3: Electrical Tuning (HCMOS); 4: Electrical Tuning (0 dBm); 5: Electrical Tuning (+3 dBm); 6: Fixed Frequency (+5 dBm); 7: Electrical Tuning (+5 dBm)
- **Frequency**

Temperature Range and Stability Table

(Temperature Stability Reference to (F_{max}-F_{min})/2)

Stability/Temperature	A: -55°C to +85°C	E: -40°C to +85°C	J: -20°C to +70°C	P: 0°C to +50°C
108 (+/-10ppb)				10-20MHz
208 (+/-20ppb)			10-20MHz	10-20MHz
308 (+/-30ppb)	10-20MHz	10-20MHz	10-20MHz	10-20MHz
508 (+/-50ppb)	10-50MHz	10-50MHz	10-50MHz	10-50MHz
758 (+/-75ppb)	10-80MHz	10-100MHz	10-100MHz	10-100MHz
107 (+/-100ppb)	10-100MHz			

Aging Table

Frequency Range	Daily Rate (ppb/day)	Yearly Rate (ppb/year)	Tuning Range (ppm)
10MHz to 15MHz	± 1	± 100	± 1
>15MHz to 100MHz	± 2	± 200	± 2

Notes:

1. Contact factory for improved stabilities or additional product options. Not all options and codes are available at all frequencies.
2. Unless other stated all values are valid after warm-up time and refer to typical conditions for supply voltage, frequency control voltage, load, temperature (25°C).
3. Phase noise degrades with increasing output frequency.
4. Subject to technical modification.
5. Contact factory for availability.

Contact Information

USA:
100 Watts Street
Mt Holly Springs, PA 17065
Tel: 1.717.486.3411
Fax: 1.717.486.5920

Europe:
Landstrasse
74924 Neckarbischofsheim
Germany
Tel: +49 (0) 7268.801.0
Fax: +49 (0) 7268.801.281