

Helping Customers Innovate, Improve & Grow



EX-421

## 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

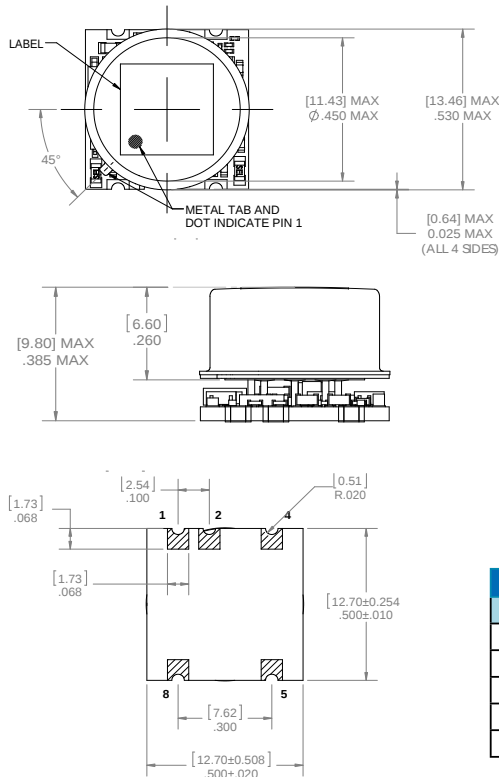
| Frequency Stabilities <sup>1</sup>                                                |                  |     |                     |                         |                                                                                    |
|-----------------------------------------------------------------------------------|------------------|-----|---------------------|-------------------------|------------------------------------------------------------------------------------|
| Parameter                                                                         | Min              | Typ | Max                 | Units                   | Condition                                                                          |
| vs. operating temperature range<br>(See temperature & stability table)            |                  |     | ±10<br>±20<br>±30   | ppb<br>ppb<br>ppb       | 0... +50°C<br>-20... +70°C<br>-40... +85°C                                         |
| vs. aging / day (See aging table)<br>vs. aging / per year<br>vs. aging / 10 years |                  |     | ±1.0<br>±100<br>±1  | ppb<br>ppb<br>ppm       | after 30 days of operation                                                         |
| Initial Accuracy<br>vs. supply voltage change<br>vs. load change                  | -0.2<br>-5<br>-5 |     | +0.2<br>+5<br>+5    | ppm<br>ppb<br>ppb       | at time of shipment<br>VS ± 5%<br>Load ± 5%                                        |
| Warm-up Time                                                                      |                  |     | 45<br>60            | sec.<br>sec.            | to ± 1 ppm of final frequency (1 hour)<br>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<br>0.25<br>0.30 | Watts<br>Watts<br>Watts | during warm-up<br>steady state @ +25°C / 3.3 Vdc<br>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<br>0.8 Vs       |                                     |            | VDC<br>VDC                                     | Vs = 3.3 Vdc<br>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]    | 0                      |                                     | +4         | dBm                                            | 50 Ohm load                                   |
| Output Power [Option]      | +3                     |                                     | +7         | dBm                                            | 50 Ohm load                                   |
| Output Power [Option]      | +5                     |                                     | +9         | dBm                                            | 50 Ohm load                                   |
| Harmonics                  |                        |                                     | -30        | dBc                                            | 50 Ohm load                                   |
| Frequency Tuning (EFC)     |                        |                                     |            |                                                |                                               |
| Reference Voltage (Vref)   | 2.7<br>4.2             |                                     | 2.9<br>4.4 | VDC<br>VDC                                     | Vs = 3.3 Vdc<br>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<br>-125<br>-145<br>-160<br>-165 |            | dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz | 1 Hz<br>10 Hz<br>100 Hz<br>1 KHz<br>10 KHz    |
| Phase Noise (100 MHz)      |                        | -95<br>-125<br>-150<br>-160<br>-165 |            | dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz | 10 Hz<br>100 Hz<br>1 KHz<br>10 KHz<br>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                                             |                                               |

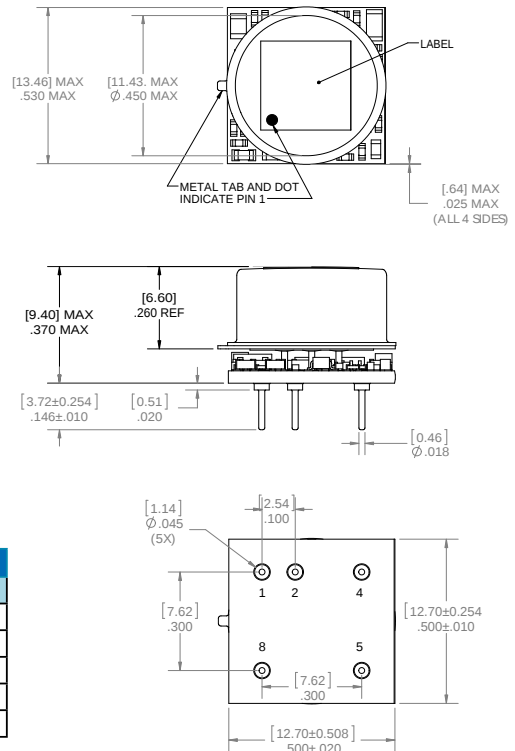
| <b>Standard Environmentals</b> |                                                               |
|--------------------------------|---------------------------------------------------------------|
| Vibration Sine                 | MIL-STD-202, Method 204, Condition G (30g peak, 10Hz-2000Hz)  |
| Vibration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

## Surface Mount

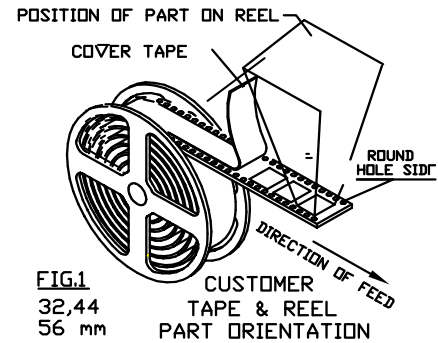
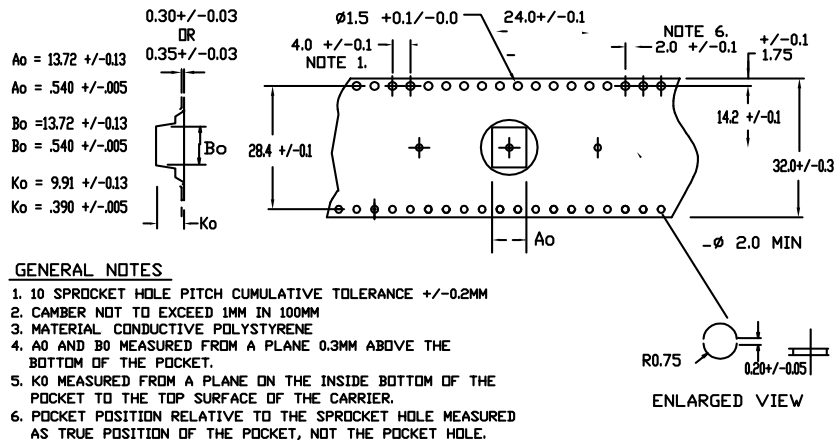


| Pin Connections |                      |                      |
|-----------------|----------------------|----------------------|
| Pin             | EFC OPTIONS          | FIX FREQ. OPTIONS    |
| 1               | EFC Input            | No Connection        |
| 2               | Vref Output     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

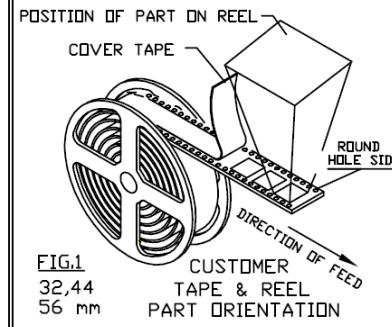
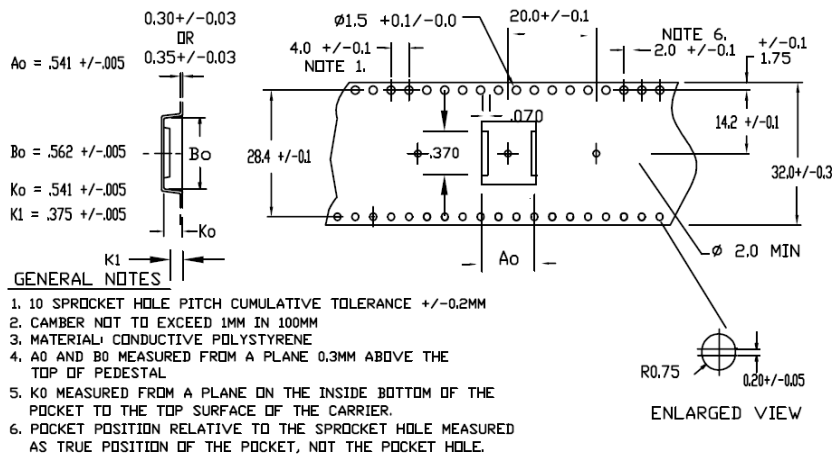
## Thru-hole



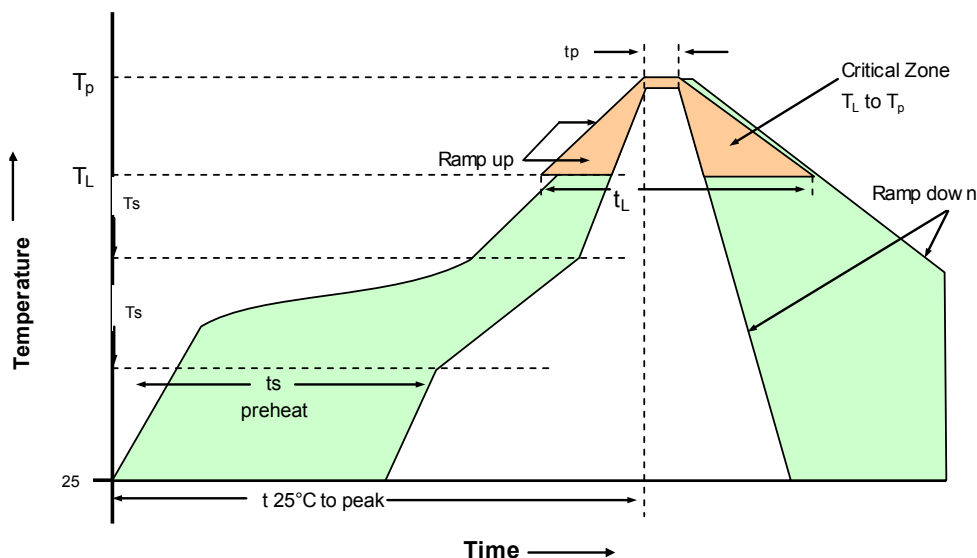
## Standard Shipping Method (surface mount)



## Standard Shipping Method (thru-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 T <sub>min</sub> | 135°C            | Time maintained above         |                    |
| - Temperature Min T <sub>max</sub>         | 155°C            | - Temperature (TL)            | 183°C              |
| - Time (min to max) (ts)                   | 60-90 seconds    | - Time (tL)                   | 45-60 seconds      |
| T <sub>max</sub> to TL -Ramp-up Rate       | 3°C/seconds max. |                               |                    |
| Time maintained above - Temperature (TL)   | 183°C            | Time within 5°C of actual     | 10-20 seconds max. |
| - Time (TL)                                | 40-60 seconds    | Peak Temperature (tp)         |                    |
| Peak Temperature (Tp)                      | max 230°C        | Ramp-down Rate                | 6°C/seconds max.   |

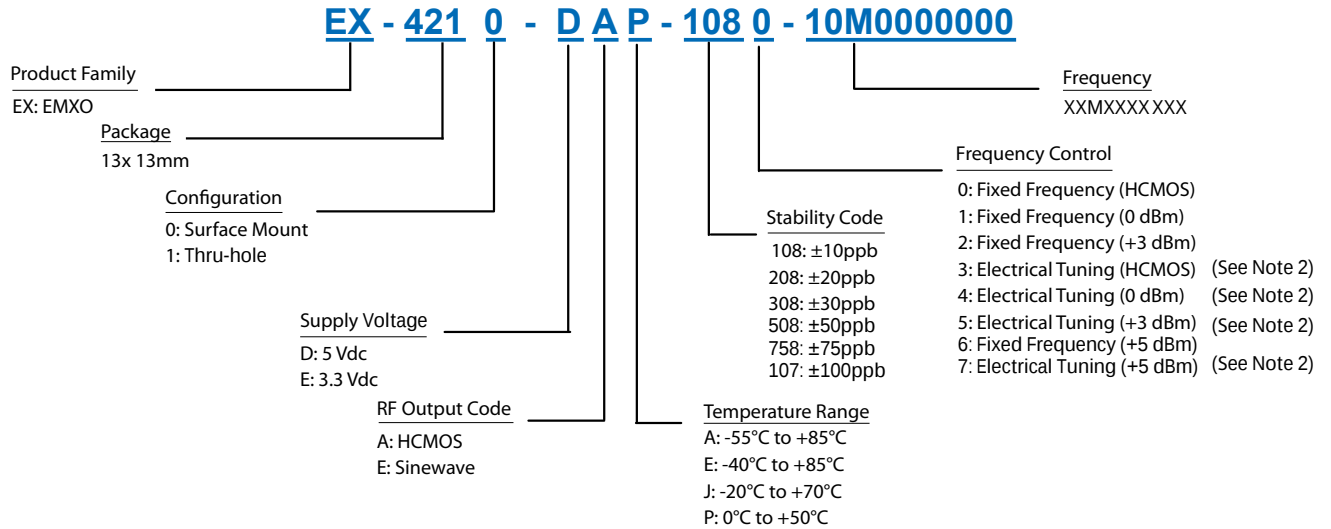
**Note:** All temperatures refer to topside of the package, measured on the package body surface.

### 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 T <sub>min</sub> | 150°C            | Time maintained above         |                    |
| - Temperature min T <sub>max</sub>         | 200°C            | - Temperature (TL)            | 217°C              |
| - Time (min to max) (ts)                   | 60-180 seconds   | - Time (tL)                   | 60-150 seconds     |
| T <sub>max</sub> to TL -Ramp-up Rate       | 3°C/seconds max. |                               |                    |
| Time maintained above - Temperature (TL)   | 217°C            | Time within 5°C of actual     | 20-40 seconds max. |
| - Time (TL)                                | 60-150 seconds   | Peak Temperature (tp)         |                    |
| 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



| 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        |
| 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         | 10-100MHz         | 10-100MHz         | 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 50MHz  | ± 2                  | ± 200                  | ± 2                |
| >50MHz to 100MHz | ± 2                  | ± 200                  | Not Available      |

## Notes:

- Contact factory for improved stabilities or additional product options. Not all options and codes are available at all frequencies.
- Electrical Tuning Option available up to 50MHz. Only fixed Frequency Option beyond 50MHz output frequency.
- Unless otherwise stated, all values are valid after warm-up time and refer to typical conditions for supply voltage, frequency control voltage, load, and temperature (25°C).
- Phase noise degrades with increasing output frequency.
- Subject to technical modification.
- Contact factory for availability.

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