

## EX-380 Series 4 Pin DIP & SMD Evacuated Miniature Crystal Oscillator EMXO™



### Features

- **Supply Voltage:** 3.3 Vdc or 5 Vdc
- **Aging:**  $<1 \times 10^{-9}$  /day,  $<1 \times 10^{-7}$  /year (@ 10 MHz)
- **Temperature Stability:** to  $\pm 7.5 \times 10^{-8}$  over  $-20^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$
- **Acceleration Sensitivity:**  $1 \times 10^{-9}$ /g, Total Gamma
- **Uses SC Family 3rd Overtone Crystal**
- **Low Power Consumption:**  $<0.35$  watts @  $+25^{\circ}\text{C}$
- **Frequencies:** 10 to 80 MHz for HCMOS or Sinewave outputs
- **Fast Warm-up:** 1 to 2 minutes
- **Patented Technique\***

### Applications

- SONET/SDH, DWDM, FDM, ATM, 3G
- Telecom Transmission and Switching Equipment
- Wireless Communication Equipment
- Military Airborne and Mobile systems

### Description

The model EX-380 Series is a low profile DIP or SMD, Evacuated Miniature Oven Controlled Crystal Oscillator (EMXO), available in frequencies from 10 MHz to 80 MHz.

The EX-380 Series provides exceptionally low aging rates and high temperature stabilities in an extremely small package over a wide range of environmental conditions. The through hole unit measures only 20.8mm x 13.2mm x 7.6mm (0.82" x 0.52" x 0.30"), @ 10 MHz provides aging rates of  $<1 \times 10^{-9}$ /day average,  $<1 \times 10^{-7}$  for the first year and  $<1 \times 10^{-6}$  for 10 years with temperature stabilities to  $\pm 1 \times 10^{-7}$  over  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ . Wider temperature ranges are available from  $-55^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ . This is achieved by the application of new resonator design concepts and technological breakthroughs. This series of EMXO's bridges the gap between current large, high precision OCXO's and smaller TCXO'S. The EX-380 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.

Standard supply voltages for the EX-380 series are 3.3 Vdc and 5Vdc, with HCMOS or Sinewave output options. A surface mount version of this oscillator is available (EX-381/5). Sinewave output is only available in the surface mount, EX-381, version.

Notes: 1. We acknowledge the support of the U.S. Army for work on resonators associated with this product under contract #1 X66001 - 97-C-8635.

\*U.S. Patent 5,917,272.

# EX-380 Evacuated Miniature Oven Controlled Crystal Oscillator

## Performance Characteristics for frequencies in the range 10 to 20.48 MHz

Parameter	Characteristics												
<b>Available Frequencies</b>	10 to 20.48 MHz (See Page 6 for specific Freq's)												
<b>Size</b>	See page 4 for outline Drawings and Dimensions												
<b>Supply Voltage</b>	(C) 5.0 Vdc $\pm$ 5% (D) 3.3 Vdc $\pm$ 5%												
<b>Supply Current (Steady State)</b>	< 70 mA @ +25°C and 5 Vdc , <90 mA @+25C and 3.3Vdc <120 mA @ -40°C and 5 Vdc, <150 mA @-40C and 3.3Vdc												
<b>Turn-on current</b>	300 mA maximum @ 5.0 Vdc , 450 mA maximum @ 3.3V												
<b>Output Type</b>	(A) HCM0S, (G or H) Sinewave into 50 ohms												
<b>Levels</b>	(A) <0.4 Volts, >0.9 Vdd, (G) 0 dBm, (H) +3 dBm												
<b>Symmetry (at 50% Vdd)</b>	(A) 50/50 $\pm$ 10%												
<b>Rise/Fall Time (10%-90%)</b>	(A) <7 ns												
<b>Stability vs. Temperature</b>	<p><b>D-107</b> = <math>\pm</math>0.1 ppm over -20°C to +70°C  <b>D-ST3</b> = Stratum 3 over -20°C to +70°C  <b>F-ST3</b> = Stratum 3 over -40°C to +85°C  <b>F-107</b> = <math>\pm</math>0.1 ppm over -40°C to +85°C  <b>x-ST3</b> = Stratum 3 Holdover stability per GR-1244-CORE                      280 ppm pk-pk over temperature, &lt; 40 ppb drift.</p>												
<b>NOTE:</b> Tighter stabilities and wider temperature ranges are available, please consult the factory.													
<b>Aging</b> (10 MHz Typical)	<1 x 10 <sup>-9</sup> /day average, <1 x 10 <sup>-7</sup> /year, <1 x 10 <sup>-6</sup> /10 years												
<b>Short -Term Stability (Allan Deviation)</b>	<5 x 10 <sup>-10</sup> , 0.1 seconds to 10 seconds												
<b>Phase Noise (Static Conditions)</b>	<table border="0"> <tr> <td>Offset</td> <td>PhaseNoise</td> </tr> <tr> <td>10 Hz</td> <td>-100 dBc/Hz</td> </tr> <tr> <td>100 Hz</td> <td>-130 dBc/Hz</td> </tr> <tr> <td>1 kHz</td> <td>-140 dBc/Hz</td> </tr> <tr> <td>10 kHz</td> <td>-145 dBc/Hz</td> </tr> <tr> <td>100 kHz</td> <td>-150 dBc/Hz</td> </tr> </table>	Offset	PhaseNoise	10 Hz	-100 dBc/Hz	100 Hz	-130 dBc/Hz	1 kHz	-140 dBc/Hz	10 kHz	-145 dBc/Hz	100 kHz	-150 dBc/Hz
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10 Hz	-100 dBc/Hz												
100 Hz	-130 dBc/Hz												
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10 kHz	-145 dBc/Hz												
100 kHz	-150 dBc/Hz												
<b>Frequency vs. Supply</b>	<2.5 x 10 <sup>-9</sup> per percent change												
<b>Warm-up (Restabilization)</b> (frequency relative to that 1 hour after turn-on, following 24 hours off time, at +25°C)	<table border="0"> <tr> <td></td> <td>Standard</td> <td>Optional (consult factory)</td> </tr> <tr> <td>&lt; <math>\pm</math>1 x 10<sup>-6</sup></td> <td>60 seconds</td> <td>45 seconds</td> </tr> <tr> <td>&lt; <math>\pm</math>1 x 10<sup>-7</sup></td> <td>120 seconds</td> <td>90 seconds</td> </tr> </table>		Standard	Optional (consult factory)	< $\pm$ 1 x 10 <sup>-6</sup>	60 seconds	45 seconds	< $\pm$ 1 x 10 <sup>-7</sup>	120 seconds	90 seconds			
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< $\pm$ 1 x 10 <sup>-6</sup>	60 seconds	45 seconds											
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<b>Electrical Frequency Adjust</b>	A: $\pm$ 1 ppm range with 0 to Vdd input voltage												
<b>Initial Accuracy for Fixed Frequency</b>	F: $\pm$ 1 ppm @ +25°C												
<b>Acceleration Sensitivity</b> (10 MHz)	1 x 10 <sup>-9</sup> /g Total Gamma, standard (5 x 10 <sup>-10</sup> /g available at 10 MHz consult factory)												

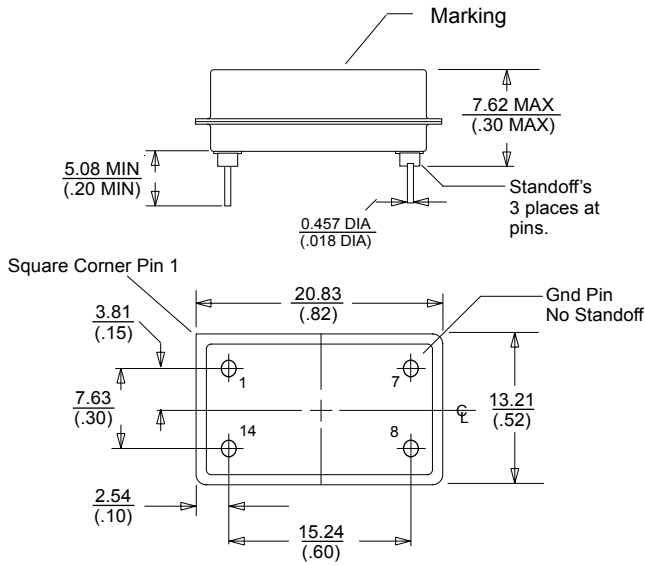
# EX-380 Evacuated Miniature Oven Controlled Crystal Oscillator

## Performance Characteristics for frequencies in the range 20.5 to 80 MHz

Parameter	Characteristics									
<b>Available Frequencies</b>	20.5 to 80 MHz (See Page 6 for specific Freq's)									
<b>Size</b>	See page 4 for outline Drawings and Dimensions									
<b>Supply Voltage</b>	(C) 5.0 Vdc ±5% (D) 3.3 Vdc ±5%									
<b>Supply Current (Steady State)</b>	< 70 mA @ +25°C and 5 Vdc, <90 mA @+25C and 3.3Vdc <120 mA @ -40°C and 5 Vdc, <150 mA @-40C and 3.3Vdc									
<b>Turn-on current</b>	300 mA maximum @ 5.0 Vdc, 450 mA maximum @ 3.3V									
<b>Output Type</b>	(A) HCMOS, (G or H) Sinewave into 50 ohms									
<b>Levels</b>	(A)<0.4 Volts, >0.9 Vdd (G) 0 dBm, (H) +3 dBm									
<b>Symmetry (at 50% Vdd)</b>	(A) 50/50 ±10%									
<b>Rise/Fall Time (10-90%)</b>	(A) <5 ns									
<b>Stability vs. Temperature</b>	<b>D-ST3</b> = Stratum 3 over -20°C to +70°C <b>D-107</b> = ±0.1 ppm over -20°C to +70°C (< 50 MHz) <b>F-507</b> = ±0.5 ppm over -40°C to +85°C <b>F-147</b> = ±0.14 ppm over -40°C to +85°C (<50 MHz) x-ST3 = Stratum 3 Holdover stability per GR-1244-CORE. 280 ppm pk-pk over temperature, <40 ppb drift.									
<b>NOTE:</b> Tighter stabilities and wider temperature ranges are available, please consult the factory.										
<b>Aging (38.88 MHz Typical)</b>	<3 x 10 <sup>-9</sup> /day average, <3 x 10 <sup>-7</sup> / year, <3 x 10 <sup>-6</sup> /10 years									
<b>Short Term Stability (Allan Deviation)</b>	<5 x 10 <sup>-10</sup> , 0.1 seconds to 10 seconds									
<b>Phase Noise (Static Conditions)</b>	Offset                      Phase Noise 10 Hz                        -80 dBc/Hz 100 Hz                       -110 dBc/Hz 1 kHz                        -130 dBc/Hz 10 kHz                       -135 dBc/Hz 100 kHz                      -140 dBc/Hz									
<b>Frequency vs. Supply</b>	<2.5 x 10 <sup>-9</sup> per percent change									
<b>Warm-up (Restabilization)</b> (frequency relative to that 1 hour after turn-on, following 24 hours off time, at +25°C)	<table border="0"> <tr> <td></td> <td><u>Standard</u></td> <td><u>Optional</u> (consult factory)</td> </tr> <tr> <td>&lt; ±1 x 10<sup>-6</sup></td> <td>60 seconds</td> <td>45 seconds</td> </tr> <tr> <td>&lt; ±1 x 10<sup>-7</sup></td> <td>120 seconds</td> <td>90 seconds</td> </tr> </table>		<u>Standard</u>	<u>Optional</u> (consult factory)	< ±1 x 10 <sup>-6</sup>	60 seconds	45 seconds	< ±1 x 10 <sup>-7</sup>	120 seconds	90 seconds
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< ±1 x 10 <sup>-6</sup>	60 seconds	45 seconds								
< ±1 x 10 <sup>-7</sup>	120 seconds	90 seconds								
<b>Electrical Frequency Adjust</b>	<b>A:</b> >±3 ppm range with 0 to Vdd input voltage									
<b>Initial Accuracy for Fixed Frequency</b>	<b>F:</b> ±1.5 ppm @ +25°C									
<b>Acceleration Sensitivity</b>	1 x 10 <sup>-9</sup> /g Total Gamma, standard									

# EX-380 Evacuated Miniature Oven Controlled Crystal Oscillator

## Outline Drawing

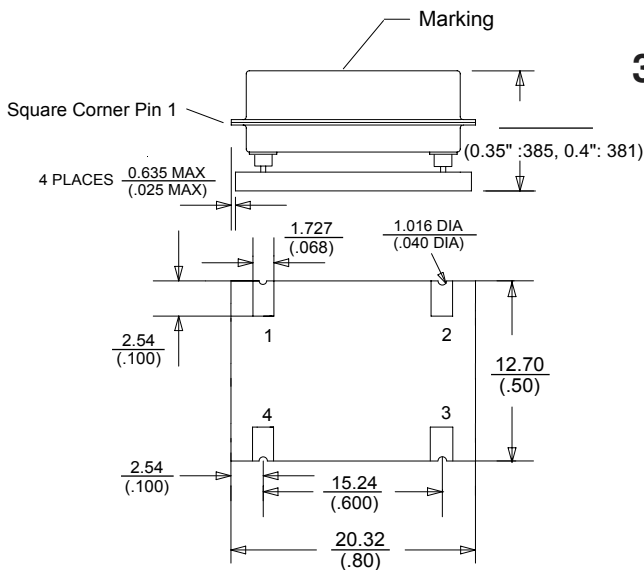


mm  
(in.)

### 380 Package

Pin	Function
1	Frequency Adjust *
7	GND, Case
8	Output
14	Supply

Pin Numbers do not appear on the unit.  
\* Pin 1 is the Oven Alarm with option G.



mm  
(in.)

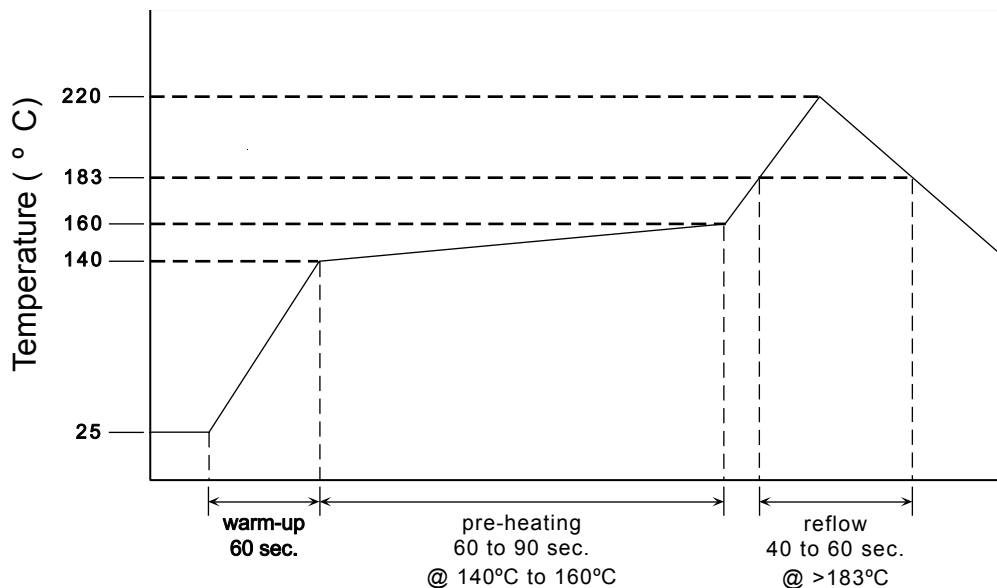
### 381(ht= 0.4") ,385 (ht=0.35") Package

Pin	Function
1	Frequency Adjust*
2	GND, Case
3	Output
4	Supply

Pin Numbers do not appear on the unit.  
\* Pin 1 is the Oven Alarm with option G.

# EX-380 Evacuated Miniature Oven Controlled Crystal Oscillator

## Recommended Reflow Profile



Note: EMXO's are precision subsystems with tolerances measured to  $\pm 0.001$  ppm. The EX-381/5 series has been designed for pick and place reflow soldering. The suggested reflow profile is shown above. The EX-381/5 may be reflowed one time in the non-inverted state. VI recommends waiting at least two hours after reflow before measuring the unit.

## Handling Precautions

Although protection circuitry has been designed into this device, proper precautions should be taken to avoid exposure to electrostatic discharge (ESD) during handling and mounting. VI employs a human-body model (HBM) and a charged-device model (CDM) for ESD-susceptibility testing and protection design evaluation. ESD voltage thresholds are dependent on the

circuit parameters used to define the mode. Although no industry-wide standard has been adopted for the CDM, a standard HBM (resistance = 1500 ohms, capacitance = 100pf) is widely used and therefore can be used for comparison purposes. The HBM ESD threshold presented here was obtained by using these circuit parameters.

ESD Threshold Voltage		
Model	Threshold	Unit
Human-Body (HBM)	500	V min
Charged-Device	500	V min

# EX-380 Evacuated Miniature Oven Controlled Crystal Oscillator

## Ordering Information

EX - 380 - D A F - ST3 - A - 12.800 MHz

**Package**  
 380 = Thru Hole  
 381,385 = SMD

**Supply Voltage**  
 C: +5 Vdc ± 5%  
 D: +3.3Vdc ± 5%

**Output Type**  
 A = HCMOS, G\*=0 dBm, H\*=+3 dBm/ 50 ohms (\*=381 only)

**Output Frequencies**

10.000 MHz	19.440 MHz	77.760 MHz
10.230 MHz	20.000 MHz	80.000 MHz
12.800 MHz	20.480 MHz	
13.000 MHz	38.880 MHz	
16.384 MHz	40.000 MHz	

Consult with Factory about availability of frequencies not listed.

**Other Options**  
 A = Standard, No Options (Default)  
 F = Fixed Frequency, No Frequency Adjust  
 G= Fixed Frequency Option & Oven Alarm Option.

**Temperature & Stability**  
**D-107** = ±0.1 ppm over -20°C to +70°C (<50 MHz)  
**D-ST3** = Stratum 3 over -20°C to +70°C  
**F-507** = ±0.5 ppm over -40°C to +85°C  
**F-147** = ±0.14 ppm over -40°C to +85°C (<50 MHz)  
NOTE: Tighter stabilities and wider temperature ranges are available, please consult the factory.

Note: Oven Alarm (into 10k ohm load):  
 Normal: > 0.8Vdd, Error: <0.1Vdd  
 Oven alarm is not available when EFC is specified.

Visit our website at [www.vectron.com](http://www.vectron.com)

For additional information please contact:



[www.vectron.com](http://www.vectron.com)

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