



**Technology**

MTI combines proprietary technology with high volume manufacturing, so that your oscillators precisely meet your design parameters. Whatever your requirement, such as meeting thermal stability, phase noise performance or a unique frequency, we can accommodate you. By purchasing oscillators from MTI, you will receive a high quality, precise, and stable frequency control product that will allow you to push your systems to their next level of performance.

**Service**

This catalog represents a sampling of our base model products. Call MTI with design questions, application issues, or even complete system requirements. We are here to help by servicing your needs and delivering the best possible oscillator for your application. All of our products are designed for manufacture in high volume while maintaining the highest of quality standards.

**Applications**

With applications ranging from portable battery powered cellular systems to satellite navigation and global telecommunication networks, MTI products are found in thousands of programs around the world. As the demands of the marketplace increase, MTI is ready to meet your challenges. We are committed to on-going internal research and development programs that focus on both product innovation and enhanced manufacturing processes.

**Location**

Visit our new modern facility. All of our products are designed, developed, and manufactured just north of Boston in historic Newburyport, Massachusetts. Please call our Technical Sales Team with your requests. We look forward to satisfying your system requirements with MTI oscillators.

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**Modify Base Model Performance Ranges Online**

Base Models can be modified by visiting our website at  
[www.mti-milliren.com](http://www.mti-milliren.com)

See performance ranges for each product series in this catalog.



Our latest product development is a new compact rubidium rival. Base models are shown below and can be fine tuned to your specifications. Contact the MTI Technical Sales Team or visit our website at [www.mti-milliren.com](http://www.mti-milliren.com) for the latest information.

## 270 Series Ultra Stable Rubidium Rival

The 270 Series is an ultra high stability, high reliability double oven controlled crystal oscillator (OCXO). This series is designed with the industry standard Euro CO-08 footprint and is a drop in replacement for the 230 Series product line. This allows the system performance to be upgraded to meet new demanding requirements without the need for a redesign. Housed in a 1.423"L x 1.071"W x 0.765"H (36.1 x 27.2 x 19.4mm) package, the 270 Series offers the same ultra high stability as our 260 Series with a higher MTBF. The 270 Series boasts a thermal stability performance of 2.0E-10 to 5.0E-09 over a 100°C ambient temperature range rivaling Rubidium atomic clock performance. Look for the complete 270 Series Product Launch in the Fall of 1999.

## Frequency Range

- 4.8 MHz to 90 MHz

## Features

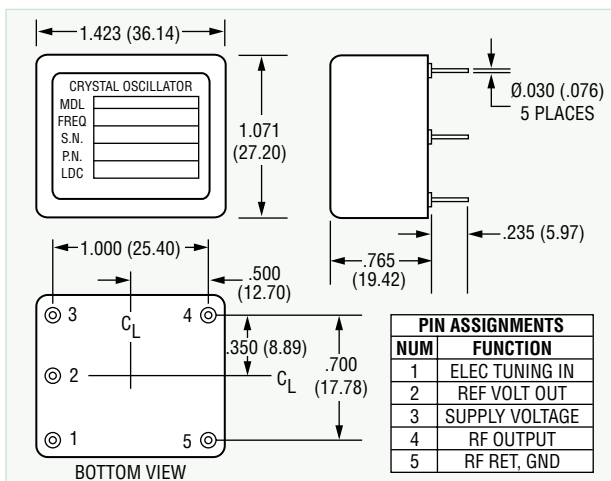
- STRATUM II, IIIe+ Performance
- Ultra High Stability
- High MTBF

## Applications

- STRATUM II, IIIe+ Telephony
- GPS Receivers
- TDMA PCS Base Stations
- Atomic Standard Replacement
- Timing and Frequency Standards
- Quasi Synchronous Radio



## 270 Interface Control Drawing



## 270 Series Base Model Performance Guide

MTI Model #	Frequency MHz	Crystal Cut	Thermal Stability*	Aging Rate per Day	Aging Rate per Year	Output	Phase Noise @ offsets (dBc/Hz)					
							1Hz	10Hz	100Hz	1kHz	10kHz	100kHz
270-0224	5.000	SC	2.00E-10	1.00E-10	3.00E-08	9dBm Sine	-110	-140	-150	-155	-155	-155
270-0225	10.000	SC	2.00E-10	5.0E-010	3.00E-08	9dBm Sine	-95	-120	-145	-150	-155	-155

(Continued)	Short Term Stability	dF/dV	dF/dL	Warm Up Time (Min)	Warm Up dF/F	Warm Up Power (W)	Cont. Power (W)	Tuning (Electrical)
270-0224	1.00E-12	1.00E-10	1.00E-10	10	2.00E-08	5	1.7	±4.00E-07
270-0225	1.00E-11	1.00E-10	1.00E-10	10	2.00E-08	5	1.7	±5.00E-07

\* Temperature Range is from -30°C to +70°C



# 400 Series TCXO

## Description

If your system requires uncompromising phase noise performance, MTI's 400 Series temperature compensated crystal oscillators (TCXO) deliver. The 400 Series phase noise performance rivals many AT cut OCXOs at a fraction of the cost. MTI offers a large number of choices for specifying thermal stability, temperature range, supply voltage, and output.

## Frequency Range

- 64 KHz to 60 MHz

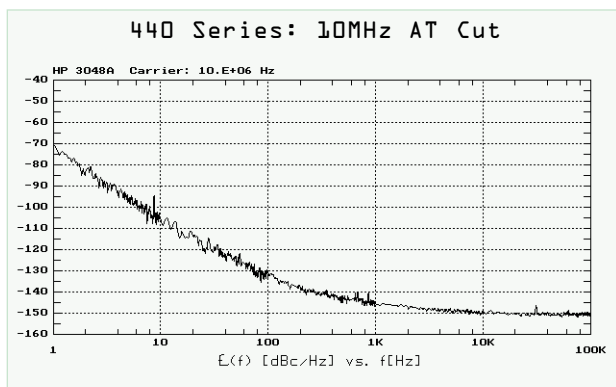
## Applications

- STRATUM IV
- Mobile Radios
- PCS Systems
- Home Meter Reading

## Typical Performance

Frequency Stability vs. Supply V ( $\pm 5\%$ )	$\pm 0.4$ ppm
Frequency Stability vs. Load ( $\pm 5\%$ )	$\pm 0.4$ ppm
Aging	$\pm 1$ ppm/year
Power Consumption	30mW (clipped sine)
Phase Noise 1Hz	-55dBc
@ 1 Hz BW 10Hz	-85dBc
100Hz	-115dBc
1KHz	-130dBc
10KHz	-140dBc
100KHz	-140dBc
Tuning Slope	Positive
Mechanical Tuning	$\pm 3$ ppm
Electrical Tuning	$\pm 3$ ppm

## Phase Noise



The following guide can be used to determine your requirements.

**1 2 - C 4 A 1**

**Package**

1  $\blacklozenge$  = .720 x .465 x .220  
 2 = .720 x .465 x .365  
 3  $\blacklozenge^0$  = .449 x .449 x .154  
 4 $^0$  = .815 x .515 x .394

**Tuning**

1 $^0$  = mech. tuning  
 2 = elec. tuning

**Thermal Stability**

A =  $\pm 10$ ppm  
 B =  $\pm 5.0$ ppm  
 C =  $\pm 3.5$ ppm  
 D =  $\pm 2.5$ ppm  
 E  $\bullet$  =  $\pm 1.5$ ppm  
 F  $\bullet$  =  $\pm 1.0$ ppm

**Notes:**

1. A unique model number will be assigned upon order placement.
2. Options with the same marker may not be combined with each other.
3. Recommended tuning tool: Voltronics P/N TT200
4. Combination mech. and elec. tuning available upon request.

**Output**

1 = clipped sine  
 2  $\blacklozenge$  = HCMOS  
 3  $\square$  = 0dBm sine  
 4  $\square$  = +3dBm sine  
 5  $\square$  = +7dBm sine  
 6  $\blacktriangledown$  = +10dBm sine

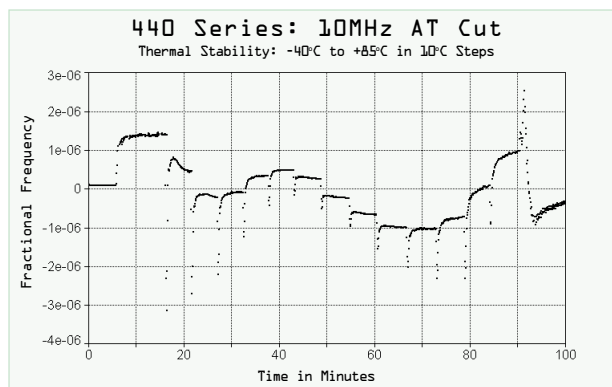
**Supply V**

A  $\square$  = +3.3V  
 B  $\blacktriangledown$  = +5V  
 C = +10V  
 D = +12V  
 E = +15V  
 F = +18V

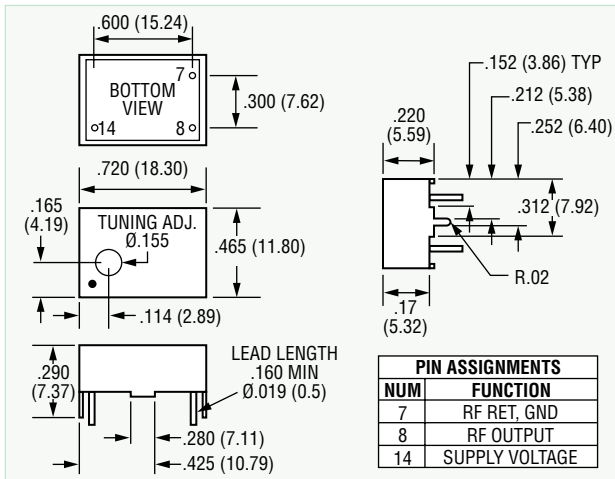
**Temperature**

1 = 0 to 50°C  
 2 = 0 to 70°C  
 3 = -10 to 60°C  
 4 = -20 to 70°C  
 5 = -30 to 70°C  
 6 = -30 to 75°C  
 7  $\bullet$  = -40 to 85°C

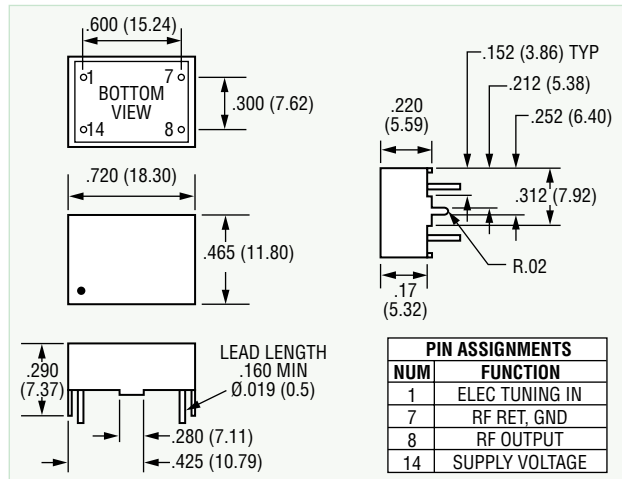
## Thermal Stability



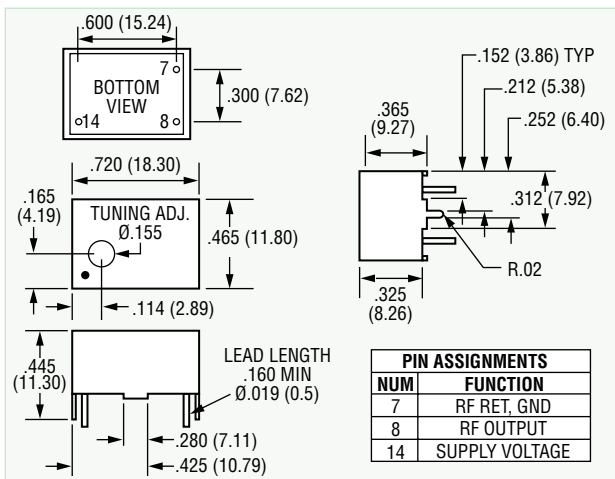
### 440 Interface Control Drawing (Package 1)



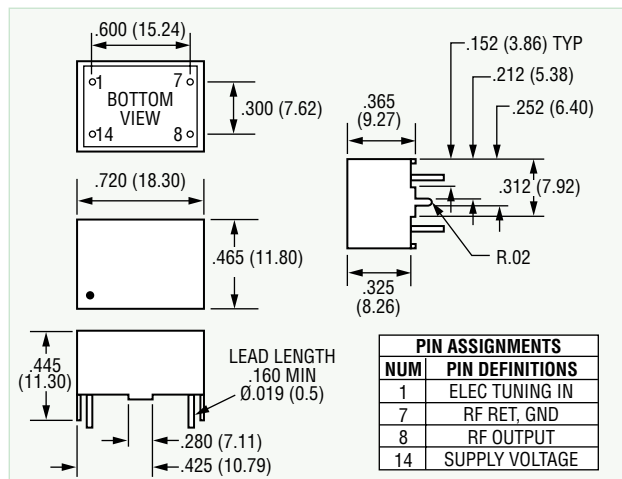
### 443 Interface Control Drawing (Package 1)



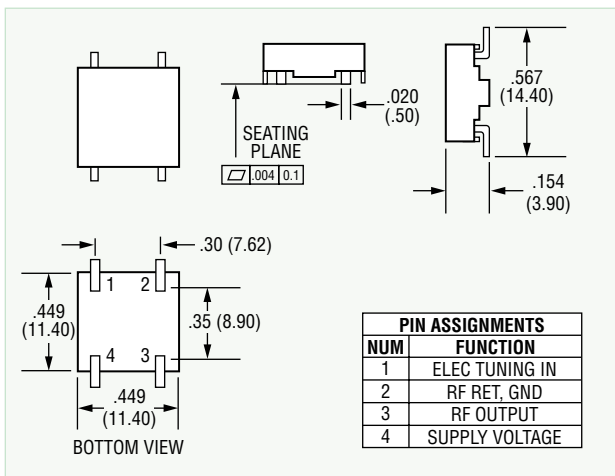
### 450 Interface Control Drawing (Package 2)



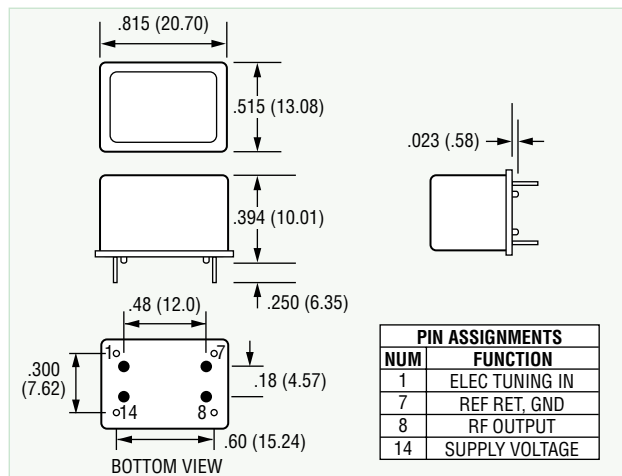
### 453 Interface Control Drawing (Package 2)



### 474 Interface Control Drawing (Package 3)



### 452 Interface Control Drawing (Package 4)



# 500 Series VCXO

## Description

The 500 Series voltage controlled crystal oscillator (VCXO) is designed to meet the requirements of phase locked loops (PLL) for clock recovery and frequency synthesis. Tuning ranges are available from  $\pm 25$ ppm to  $\pm 400$ ppm, with excellent tuning linearity. The 500 Series VCXO is available in a variety of packages including 14-pin DIP, surface-mount and hermetically sealed.

## Frequency Range

- 64 KHz to 160 MHz

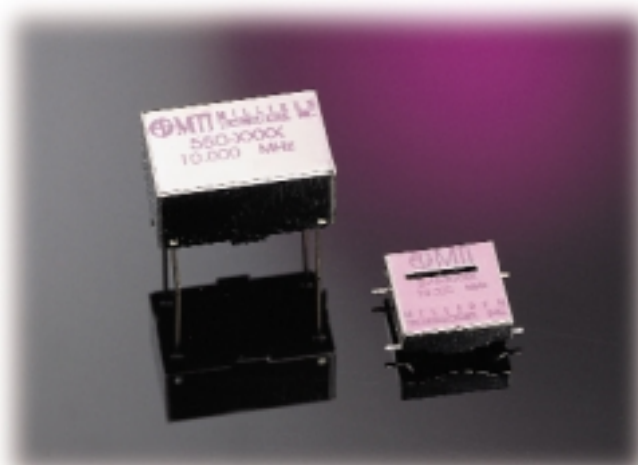
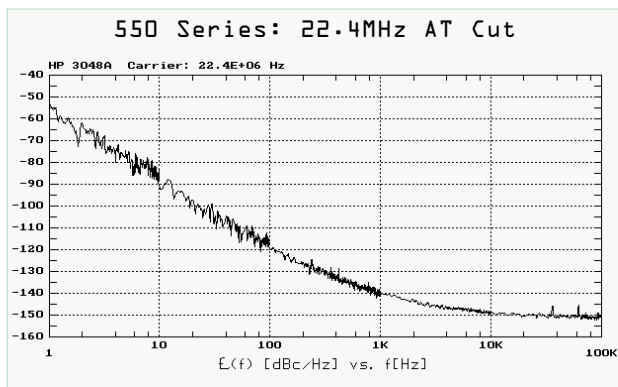
## Applications

- Phase Locked Loops (PLL)
- Digital Telephony
- SARSAT Beacon

## Typical Performance

Frequency Stability vs. Supply V ( $\pm 5\%$ )	$\pm 0.5$ ppm
Frequency Stability vs. Load ( $\pm 5\%$ )	$\pm 0.5$ ppm
Aging	$\pm 2$ ppm/year
Power Consumption	30mW (clipped sine)
Phase Noise	1Hz -50dBc
@ 1 Hz BW	10Hz -80dBc
	100Hz -110dBc
	1KHz -125dBc
	10KHz -140dBc
	100KHz -140dBc
Tuning Slope	Positive

## Phase Noise



The following guide can be used to determine your requirements.

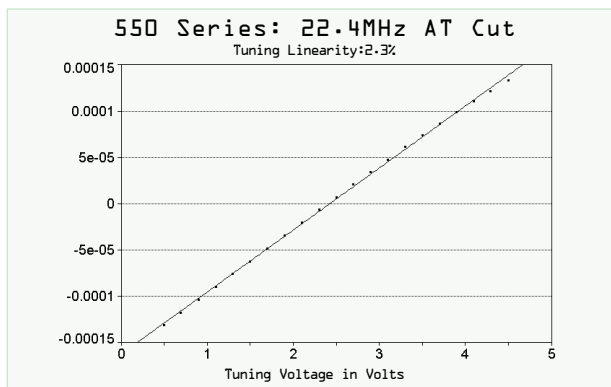
**1 3 - D 5 C 4**

<b>Package</b>	<b>Output</b>
1 $\diamond$ = .720 x .465 x .220	1 $\diamond$ = clipped sine
2 = .720 x .465 x .365	2 $\nabla$ = HCMOS
3 $\diamond$ = .449 x .449 x .154	3 $\nabla$ = 0dBm sine
4 = .815 x .515 x .394	4 $\nabla$ = +3dBm sine
	5 $\nabla$ = +7dBm sine
	6 $\nabla$ = +10dBm sine
<b>Tuning</b>	<b>Supply V</b>
1 = $\pm 25$ to $\pm 50$ ppm	A $\diamond$ = +3.3V
2 = $\pm 50$ to $\pm 100$ ppm	B $\blacksquare$ = +5V
3 = $\pm 100$ to $\pm 200$ ppm	C = +10V
4 = $\pm 200$ to $\pm 400$ ppm	D = +12V
	E = +15V
	F = +18V
<b>Thermal Stability</b>	<b>Temperature</b>
A $\blacktriangle$ = $\pm 5.0$ ppm	1 = 0 to 50°C
B $\blacktriangle$ = $\pm 10$ ppm	2 $^{\circ}$ = 0 to 70°C
C $\blacktriangle$ = $\pm 25$ ppm	3 $^{\circ}$ = -10 to 60°C
D = $\pm 50$ ppm	4 $^{\circ}$ = -20 to 70°C
E = $\pm 100$ ppm	5 $^{\circ}$ = -30 to 70°C
	6 $^{\circ}$ $\blacktriangle$ = -30 to 75°C
	7 $^{\circ}$ $\blacktriangle$ = -40 to 85°C

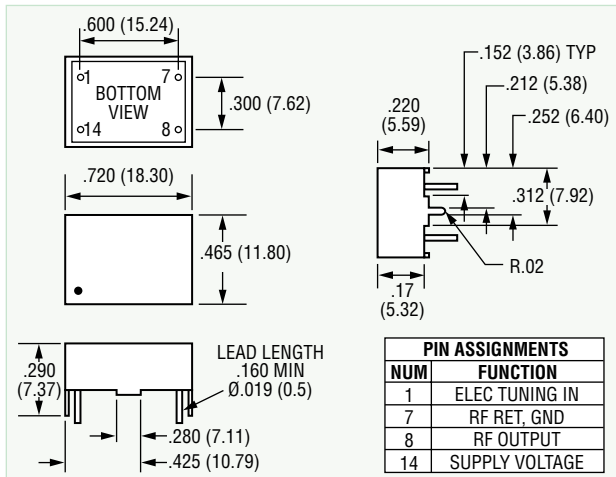
**Notes:**

1. A unique model number will be assigned upon order placement.
2. Options with the same marker may not be combined with each other.

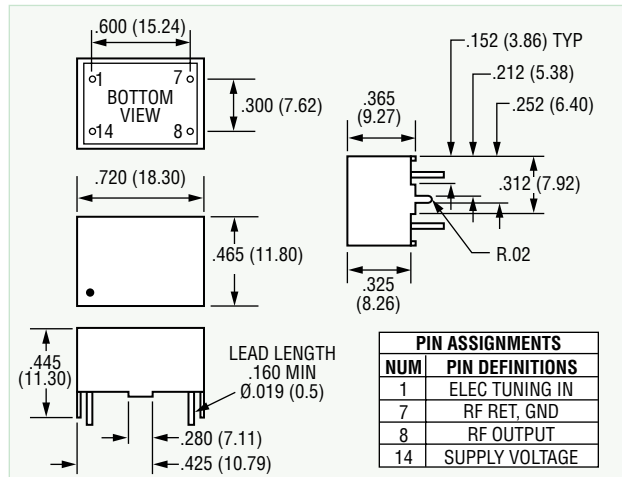
## Tuning Linearity



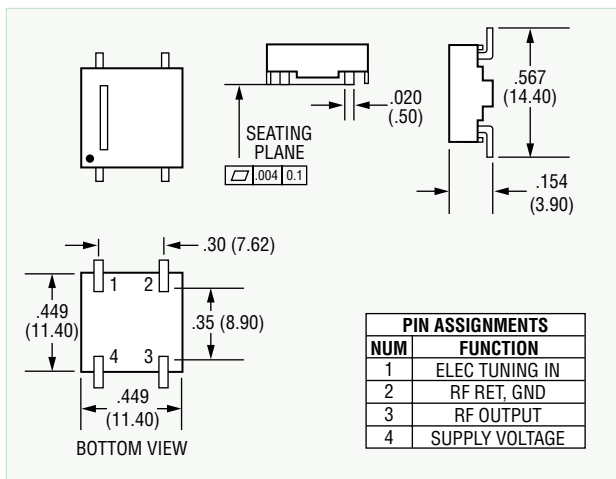
### 540 Interface Control Drawing (Package 1)



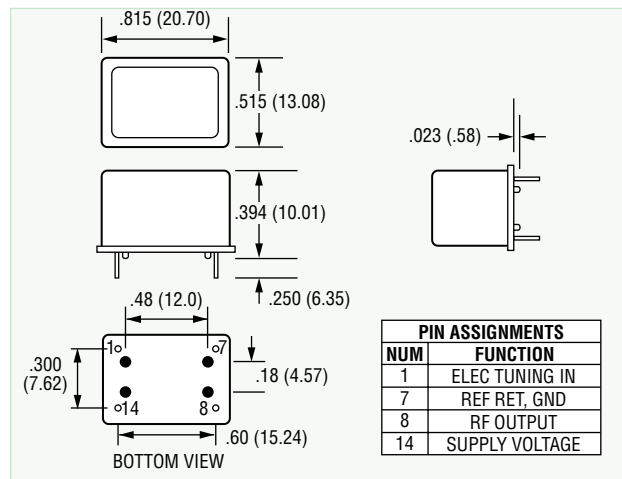
### 550 Interface Control Drawing (Package 2)



### 574 Interface Control Drawing (Package 3)



### 552 Interface Control Drawing (Package 4)



# 205 Series OCXO - Hermetically Sealed Mini OCXO

## Description

The 205 Series is the most compact OCXO in the industry. The hermetically sealed package measures only 0.815"L x 0.515"W x 0.394"H (20.7 x13.1 x 10.0mm). The 205 Series offers a thermal stability of  $\pm 3.5E-06$  over 100°C temperature range, warms up in less than 5 minutes, and consumes less than 0.45W at +25°C, making it exceptional for battery powered applications. Phase noise is -50dBc/Hz at 1 Hz offset with a noise floor of -160dBc/Hz. Frequency range is 8 MHz to 200MHz.



## Features

- Low Phase Noise
- Low Power Consumption
- Compact Package
- Hermetically Sealed

## Applications

- Mobile Radios
- PCS Systems
- Home Meter Reading
- Stratum III.5
- Battery Powered Applications

## Performance Range

Parameters	Available Range
Frequency	8 MHz to 200 MHz
Thermal Stability	$\pm 1.00E-06$ to $\pm 7.00E-06$
Operating Temperature	-40°C to +85°C
Output	+7dBm Sine
Supply Voltage	+12 Volt
Tuning Voltage	0 to +10V (DC)

## Design Note:

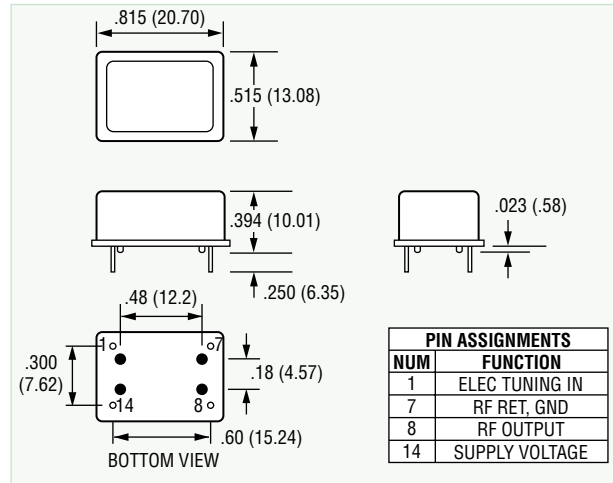
Base Models can be customized to your specifications using the performance range for this series.

## 205 Series Base Model Performance Guide

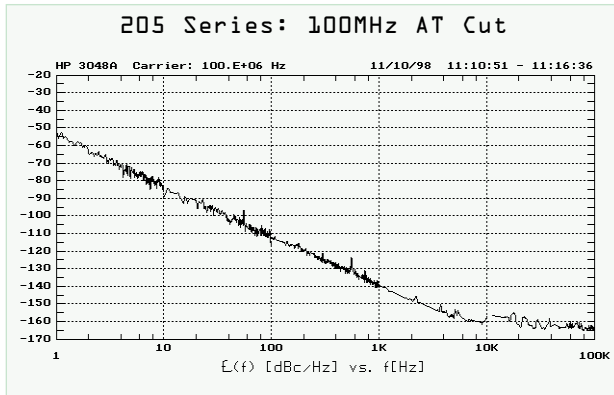
Frequency MHz	Crystal Cut	Thermal Stability*	Aging Rate per Day	Aging Rate per Year	Output	Phase Noise @ offsets (dBc/Hz)					
						1Hz	10Hz	100Hz	1kHz	10kHz	100kHz
40.000	AT	$\pm 3.50E-06$	5.00E-09	5.00E-07	7dBm Sine	-50	-80	-110	-140	-150	-160
50.000	AT	$\pm 3.50E-06$	5.00E-09	5.00E-07	7dBm Sine	-50	-80	-110	-140	-150	-160
65.536	AT	$\pm 3.50E-06$	5.00E-09	5.00E-07	7dBm Sine	-50	-80	-110	-140	-150	-160
77.760	AT	$\pm 5.00E-06$	5.00E-09	5.00E-07	7dBm Sine	-45	-75	-105	-130	-140	-150
80.000	AT	$\pm 5.00E-06$	5.00E-09	5.00E-07	7dBm Sine	-45	-75	-105	-130	-140	-150
100.000	AT	$\pm 5.00E-06$	5.00E-09	5.00E-07	7dBm Sine	-45	-75	-105	-130	-140	-150

\* Temperature Range is from -30°C to +70°C

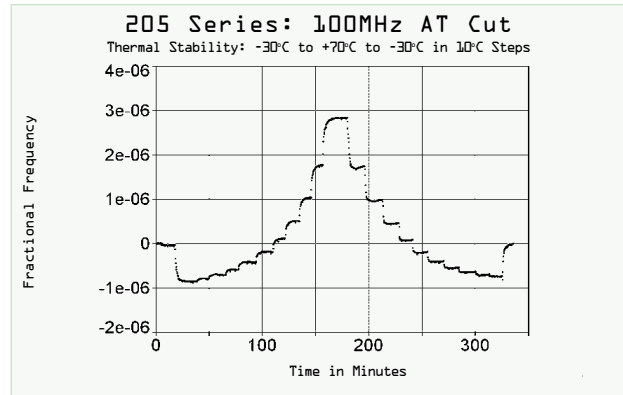
## 205 Interface Control Drawing



## Phase Noise



## Thermal Stability



Short Term Stability	dF/dV	dF/dL	Warm Up Time (Min)	Warm Up dF/F	Warm Up Power (W)	Continuous Power (W) @25°C	Tuning (Min)	MTI Model #
5.00E-10	5.00E-07	5.00E-07	5	2.00E-07	2.5	0.45	±5.00E-06	205-0108
5.00E-10	5.00E-07	5.00E-07	5	2.00E-07	2.5	0.45	±5.00E-06	205-0109
5.00E-10	5.00E-07	5.00E-07	5	2.00E-07	2.5	0.45	±5.00E-06	205-0106
5.00E-10	5.00E-07	5.00E-07	5	2.00E-07	2.5	0.45	±5.00E-06	205-0112
5.00E-10	5.00E-07	5.00E-07	5	2.00E-07	2.5	0.45	±5.00E-06	205-0107
5.00E-10	5.00E-07	5.00E-07	5	2.00E-07	2.5	0.45	±5.00E-06	205-0110



# 210 Series OCXO - Mini OCXO in a 14 Pin DIP Package

## Description

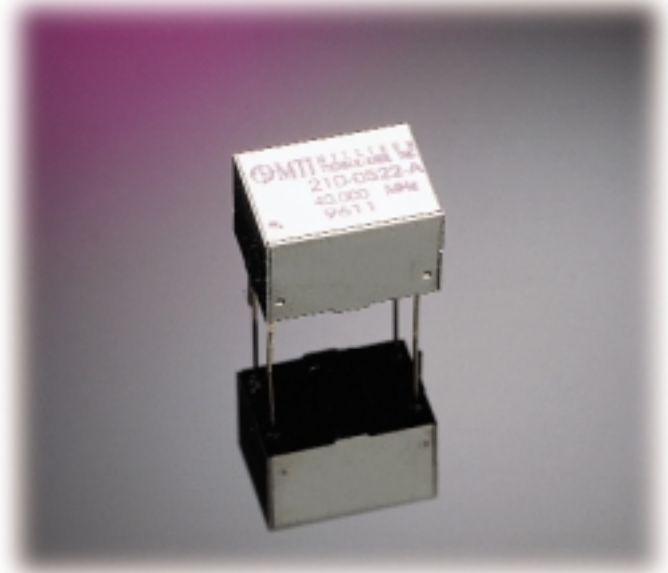
The 210 Series is an ideal replacement for any 14-pin DIP clock oscillator or TCXO where superior performance is required. The 210 Series offers ovenized performance with a thermal stability of  $5.0E-07$  over  $100^{\circ}\text{C}$  temperature range and  $0.70\text{W}$  continuous power consumption @  $25^{\circ}\text{C}$ . The low power consumption makes the 210 Series ideal for instrumentation, point-to-point wireless, and battery powered applications.

## Features

- STRATUM III Performance
- Low Phase Noise
- Low Power Consumption
- 14-Pin DIP Package

## Applications

- STRATUM III, IIIe Telephony
- Microwave Radios
- V-SAT Terminals
- GPS Receivers
- SONET Clocks
- Instrumentation



Performance Range	
Parameters	Available Range
Frequency	32 KHz to 120 MHz
Thermal Stability	$1.00E-07$ to $1.00E-06$
Operating Temperature	$-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$
Output	HCMOS/ACMOS 0 to +9dBm Sine
Supply Voltage	+5 to +15V (DC)
Tuning Voltage	+0.50 to +10V (DC)

## Design Note:

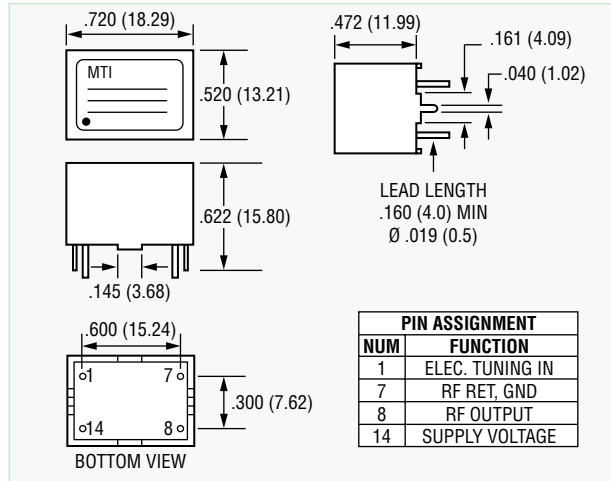
Base Models can be customized to your specifications using the performance range for this series.

## 210 Series Base Model Performance Guide

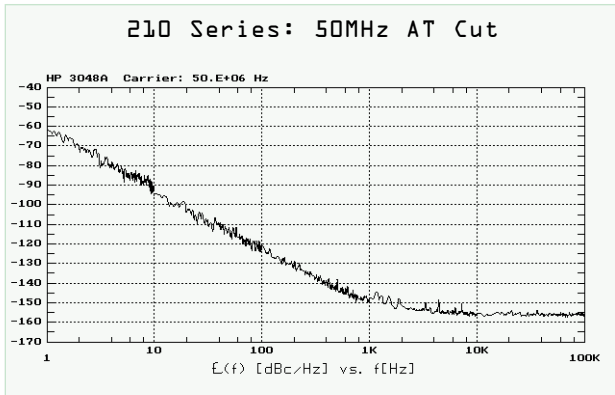
Frequency MHz	Crystal Cut	Thermal Stability*	Aging Rate per Day	Aging Rate per Year	Output	Phase Noise @ offsets (dBc/Hz)					
						1Hz	10Hz	100Hz	1kHz	10kHz	100kHz
9.600	AT	$5.00E-07$	$5.00E-09$	$5.00E-07$	7dBm Sine	-60	-90	-120	-150	-155	-155
10.000	AT	$5.00E-07$	$5.00E-09$	$5.00E-07$	HCMOS	-70	-100	-125	-140	-145	-150
10.000	AT	$5.00E-07$	$5.00E-09$	$5.00E-07$	7dBm Sine	-60	-90	-120	-150	-155	-155
12.800	AT	$5.00E-07$	$5.00E-09$	$5.00E-07$	7dBm Sine	-60	-90	-115	-140	-150	-150
13.000	AT	$5.00E-07$	$5.00E-09$	$5.00E-07$	7dBm Sine	-60	-90	-115	-140	-150	-150
16.384	AT	$5.00E-07$	$5.00E-09$	$5.00E-07$	7dBm Sine	-55	-85	-115	-140	-150	-150
38.880	AT	$5.00E-07$	$5.00E-09$	$5.00E-07$	HCMOS	-55	-85	-115	-140	-150	-150
50.000	AT	$5.00E-07$	$5.00E-09$	$5.00E-07$	7dBm Sine	-50	-80	-110	-140	-150	-150
65.536	AT	$5.00E-07$	$5.00E-09$	$5.00E-07$	7dBm Sine	-45	-75	-105	-135	-145	-150
77.760	AT	$5.00E-07$	$5.00E-09$	$5.00E-07$	7dBm Sine	-40	-70	-100	-130	-140	-150
80.000	AT	$5.00E-07$	$5.00E-09$	$5.00E-07$	3dBm Sine	-40	-70	-100	-130	-140	-150
100.000	AT	$5.00E-07$	$5.00E-09$	$5.00E-07$	5dBm Sine	-40	-70	-100	-130	-140	-150

\* Temperature Range is from  $-30^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$

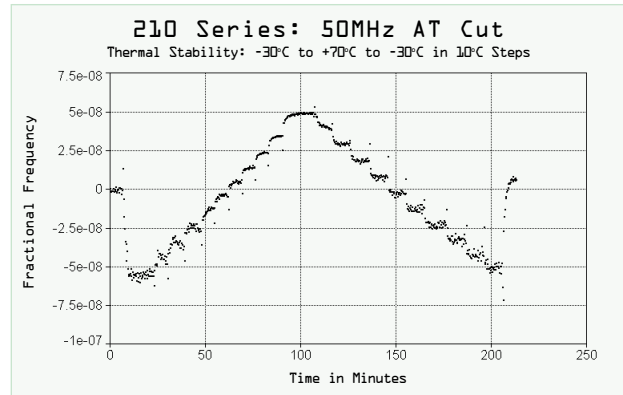
## 210 Interface Control Drawing



## Phase Noise



## Thermal Stability



Short Term Stability	dF/dV	dF/dL	Warm Up Time (Min)	Warm Up dF/F	Warm Up Power (W)	Continuous Power (W) @25°C	Tuning (Min)	MTI Model #
1.00E-10	5.00E-08	2.00E-08	15	1.00E-07	2.5	0.7	±5.00E-06	210-0595
1.00E-10	5.00E-08	2.00E-08	15	1.00E-07	2.5	0.7	±5.00E-06	210-0663
1.00E-10	5.00E-08	2.00E-08	15	1.00E-07	2.5	0.7	±5.00E-06	210-0501
5.00E-10	2.00E-07	1.00E-07	15	1.00E-07	2.5	0.7	±5.00E-06	210-0507
5.00E-10	2.00E-07	1.00E-07	15	1.00E-07	2.5	0.7	±8.00E-06	210-0506
1.00E-09	2.00E-07	2.00E-07	15	1.00E-07	2.5	0.7	±5.00E-06	210-0508
1.00E-09	1.00E-07	5.00E-08	15	1.00E-07	2.5	0.7	±8.00E-06	210-0664
1.00E-09	1.00E-07	5.00E-08	15	1.00E-07	2.5	0.7	±5.00E-06	210-0520
1.00E-09	1.00E-07	5.00E-08	15	1.00E-07	2.5	0.7	±5.00E-06	210-0661
1.00E-08	5.00E-07	1.00E-07	15	1.00E-07	2.5	0.7	±5.00E-06	210-0662
1.00E-08	5.00E-07	1.00E-07	15	1.00E-07	2.5	0.7	±5.00E-06	210-0577
1.00E-08	5.00E-07	1.00E-07	15	1.00E-07	2.5	0.7	±5.00E-06	210-0599

# 220 • 221 Series OCXO - Hermetically Sealed 16-Pin DIP & SMT

## Description

The 220 Series 16-Pin DIP OCXO is available with an AT or SC cut crystal. Housed in a hermetically sealed package that measures only 0.975"L x 0.800"W x 0.500"H (24.8 x 20.3 x 12.7mm), this series is offered as both through-hole (220 Series) and surface mount (221 Series). The 220 Series performs to STRATUM III, IIIe standards. It is ideal for applications requiring low power consumption and space restrictive environments. The 220 Series offers a thermal stability of 2.0E-08 over a 100°C temperature range, warms up in less than 5 minutes and consumes less than 1.0W at a noise floor of -155dBc/Hz.



## Features

- STRATUM III, IIIe Performance
- Low Phase Noise
- Compact Package
- Hermetically Sealed
- High Reliability
- Surface Mount
- Available on Tape and Reel

## Applications

- STRATUM III, IIIe Telephony
- GPS Receivers
- Instrumentation, PC, VXI/VME
- V-SAT Terminals
- Rack Mounted Applications
- Cellular Paging Base Stations

Performance Range	
Parameters	Available Range
Frequency	4.8 MHz to 100 MHz
Thermal Stability	5.00E-09 to 5.00E-07
Operating Temperature	-40°C to +85°C
Output	HCMOS/ACMOS 0 to +9dBm Sine
Supply Voltage	+5 to +15V (DC)
Tuning Voltage	0 to +10V (DC)

### Design Note:

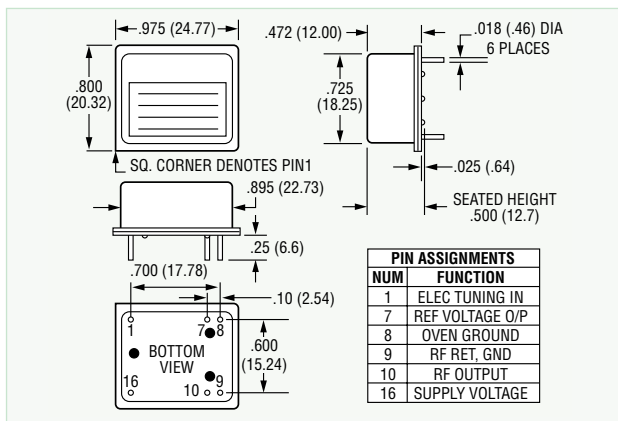
Base Models can be customized to your specifications using the performance range for this series.

## 220 Series Base Model Performance Guide

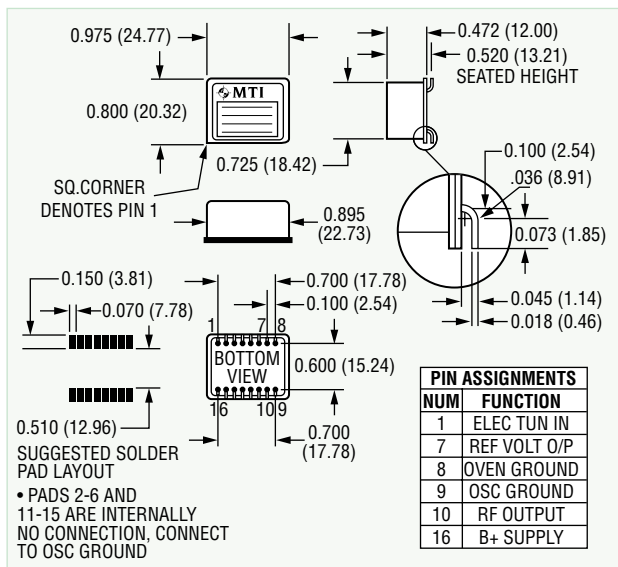
Frequency MHz	Crystal Cut	Thermal Stability*	Aging Rate per Day	Aging Rate per Year	Output	Phase Noise @ offsets (dBc/Hz)					
						1Hz	10Hz	100Hz	1kHz	10kHz	100kHz
5.000	AT	2.00E-07	1.00E-09	2.00E-07	HCMOS	-70	-100	-125	-145	-155	-155
5.000	SC	2.00E-08	4.00E-10	5.00E-08	9dBm Sine	-100	-125	-140	-150	-155	-155
8.192	AT	2.00E-07	2.00E-09	2.00E-07	9dBm Sine	-80	-110	-130	-140	-150	-155
8.192	SC	2.00E-08	5.00E-10	7.00E-08	9dBm Sine	-90	-120	-140	-150	-155	-155
9.600	AT	2.00E-07	2.00E-09	2.00E-07	HCMOS	-80	-110	-130	-140	-150	-155
9.600	SC	2.00E-08	1.00E-09	1.00E-07	9dBm Sine	-85	-115	-140	-150	-155	-155
10.000	AT	2.00E-07	1.00E-09	2.00E-07	9dBm Sine	-80	-110	-130	-140	-150	-155
10.000	SC	2.00E-08	1.00E-09	1.00E-07	HCMOS	-85	-115	-140	-150	-155	-155
12.800	AT	2.00E-07	2.00E-09	2.00E-07	HCMOS	-80	-110	-130	-140	-150	-155
12.800	SC	2.00E-08	1.00E-09	1.00E-07	9dBm Sine	-85	-115	-140	-150	-155	-155
13.000	AT	2.00E-07	2.00E-09	2.00E-07	9dBm Sine	-80	-110	-130	-140	-150	-155
13.000	SC	2.00E-08	1.00E-09	1.00E-07	HCMOS	-85	-115	-140	-150	-155	-155
16.384	AT	2.00E-07	2.00E-09	2.00E-07	HCMOS	-70	-100	-125	-140	-150	-155
16.384	SC	2.00E-08	1.00E-09	1.00E-07	9dBm Sine	-85	-115	-140	-150	-155	-155
38.880	AT	5.00E-07	4.00E-09	4.00E-07	9dBm Sine	-65	-95	-125	-140	-150	-155
38.880	SC	5.00E-08	4.00E-09	4.00E-07	ACMOS	-65	-95	-125	-135	-145	-155
40.000	AT	5.00E-07	4.00E-09	4.00E-07	ACMOS	-65	-95	-125	-140	-150	-155
40.000	SC	5.00E-08	4.00E-09	3.00E-07	9dBm Sine	-65	-95	-125	-135	-145	-155
50.000	AT	5.00E-07	4.00E-09	4.00E-07	9dBm Sine	-60	-90	-120	-140	-150	-155
50.000	SC	5.00E-08	4.00E-09	4.00E-07	ACMOS	-60	-90	-120	-135	-145	-155
100.000	AT	5.00E-07	5.00E-09	1.00E-06	9dBm Sine	-50	-80	-110	-130	-140	-150

\* Temperature Range is from -30°C to +70°C

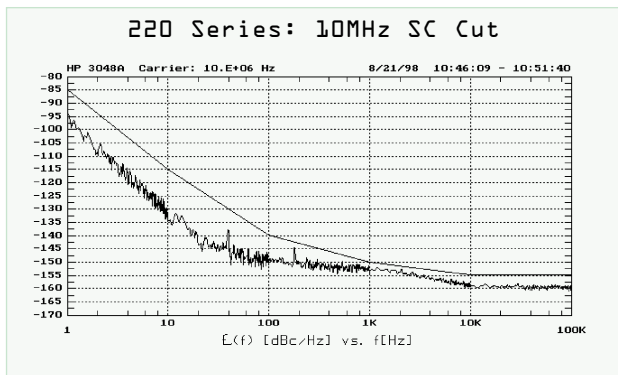
## 220 Interface Control Drawing



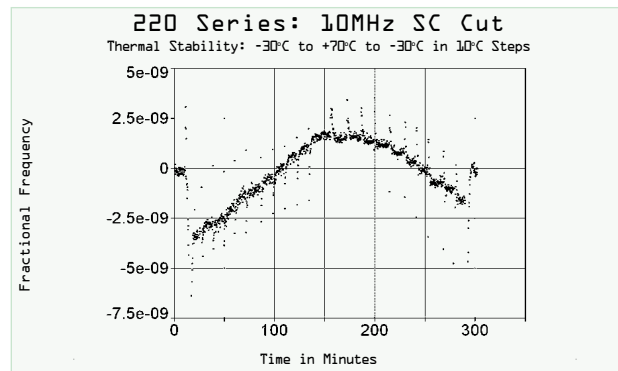
## 221 Interface Control Drawing



## Phase Noise



## Thermal Stability



Short Term Stability	dF/dV	dF/dL	Warm Up Time (Min)	Warm Up dF/F	Warm Up Power (W)	Continuous Power (W) @25°C	Tuning (Min)	MTI Model #
3.00E-11	1.00E-08	1.00E-08	10	2.00E-08	3	0.8	±1.20E-06	220-0151
5.00E-12	2.00E-09	2.00E-09	5	5.00E-08	3	0.8	±5.00E-07	220-0102
2.00E-11	1.00E-08	1.00E-08	10	2.00E-08	5	0.8	±1.20E-06	220-0153
3.00E-11	4.00E-09	4.00E-09	5	5.00E-08	5	0.8	±1.20E-06	220-0108
2.00E-11	1.00E-08	1.00E-08	10	2.00E-08	3	0.8	±3.00E-06	220-0156
1.00E-11	5.00E-09	5.00E-09	3	5.00E-08	3	0.8	±1.20E-06	220-0109
2.00E-11	1.00E-08	1.00E-08	10	2.00E-08	3	0.8	±3.00E-06	220-0103
1.00E-11	5.00E-09	5.00E-09	3	5.00E-08	3	0.8	±1.20E-06	220-0116
2.00E-11	1.00E-08	1.00E-08	10	2.00E-08	3	0.8	±3.00E-06	220-0158
1.00E-11	5.00E-09	5.00E-09	3	5.00E-08	3	0.8	±1.20E-06	220-0110
2.00E-11	1.00E-08	1.00E-08	10	2.00E-08	3	0.8	±3.00E-06	220-0159
1.00E-11	5.00E-09	5.00E-09	3	5.00E-08	3	0.8	±1.20E-06	220-0118
2.00E-11	1.00E-08	1.00E-08	10	2.00E-08	3	0.8	±3.00E-06	220-0161
1.00E-11	5.00E-09	5.00E-09	3	5.00E-08	3	0.8	±1.20E-06	220-0112
2.00E-11	1.00E-08	1.00E-08	10	2.00E-08	3	0.8	±3.00E-06	220-0163
1.00E-10	1.00E-08	1.00E-08	5	1.00E-08	3	0.8	±4.00E-06	220-0174
2.00E-11	1.00E-08	1.00E-08	10	2.00E-08	3	0.8	±3.00E-06	220-0166
1.00E-10	1.00E-08	1.00E-08	5	1.00E-07	3	0.8	±4.00E-06	220-0107
2.00E-11	1.00E-08	1.00E-08	10	2.00E-08	3	0.8	±3.00E-06	220-0167
1.00E-10	1.00E-08	1.00E-08	5	1.00E-07	3	0.8	±4.00E-06	220-0176
1.00E-08	1.00E-07	1.00E-07	10	1.00E-07	3	0.9	±5.00E-06	220-0207

Sinewave output is into a 50ohm load with harmonics less than -20 dBc and spurious less than -80dBc. Standard supply Voltage is +12V ±5%.

# 230 Series OCXO - Compact and High Performance

## Description

The 230 Series provides high stability in a 1.423"L x 1.071"W x 0.765"H (36.1 x 27.2 x 19.4 mm) package. The 230 Series SC cut offers a thermal stability of  $1.50E-08$  over a  $100^{\circ}\text{C}$  temperature window and 10 MHz phase noise performance of  $-115\text{dBc}/\text{Hz}$  @ 10Hz offset. The 230 Series is perfect for base stations, GSM, and instrumentation applications.

## Features

- STRATUM III, IIIe Performance
- Low Phase Noise

## Applications

- STRATUM III, IIIe Telephony
- GPS Receivers
- Cellular/Paging Base Stations
- PCS
- GSM
- CDMA
- Encryption
- Instrumentation



Performance Range	
Parameters	Available Range
Frequency	32 KHz to 60 MHz
Thermal Stability	$5.00E-09$ to $5.00E-07$
Operating Temperature	$-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$
Output	HCMOS/ACMOS 0 to +17dBm Sine
Supply Voltage	+5 to +15V (DC)
Tuning Voltage	-10 to +10V (DC)

## Design Note:

Base Models can be customized to your specifications using the performance range for this series.

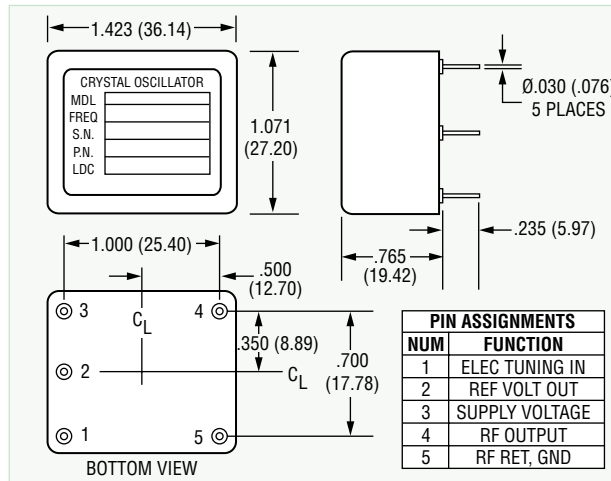
## 230 Series Base Model Performance Guide

Frequency MHz	Crystal Cut	Thermal Stability*	Aging Rate per Day	Aging Rate per Year	Output	Phase Noise @ offsets (dBc/Hz)					
						1Hz	10Hz	100Hz	1kHz	10kHz	100kHz
5.000	AT	$2.00E-07$	$1.00E-09$	$1.00E-07$	9dBm Sine	-90	-125	-140	-145	-155	-155
5.000	SC	$1.00E-08$	$5.00E-10$	$7.00E-08$	9dBm Sine	-95	-125	-145	-150	-160	-160
8.192	SC	$2.50E-08$	$7.00E-10$	$1.00E-07$	HCMOS	-85	-115	-140	-150	-160	-160
10.000	AT	$2.00E-07$	$1.00E-09$	$2.00E-07$	9dBm Sine	-75	-105	-135	-150	-155	-155
10.000	SC	$2.50E-08$	$7.00E-10$	$1.00E-07$	9dBm Sine	-85	-115	-140	-150	-160	-160
13.000	AT	$2.00E-07$	$1.00E-09$	$3.00E-07$	9dBm Sine	-70	-100	-120	-145	-155	-155
13.000	SC	$1.50E-08$	$7.00E-10$	$1.00E-07$	HCMOS	-80	-110	-135	-145	-155	-155
16.384	AT	$2.00E-07$	$1.00E-09$	$3.00E-07$	9dBm Sine	-65	-95	-120	-150	-155	-155
16.384	SC	$2.50E-08$	$7.00E-10$	$1.00E-07$	HCMOS	-80	-110	-135	-145	-155	-155
26.000	SC	$2.50E-08$	$7.00E-10$	$1.00E-07$	9dBm Sine	-75	-100	-130	-140	-145	-145
30.000	SC	$2.50E-08$	$1.00E-09$	$1.00E-07$	9dBm Sine	-75	-100	-130	-140	-145	-145

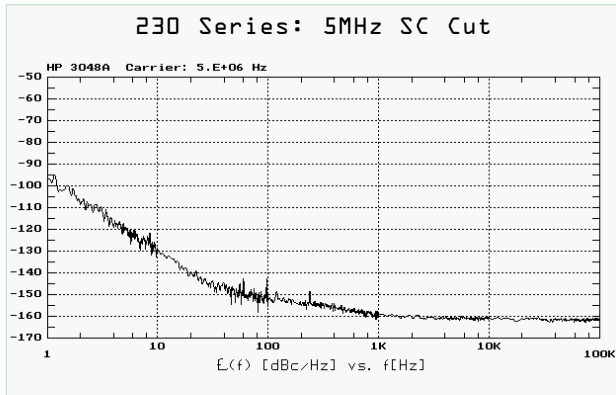
\* Temperature Range is from  $-30^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$



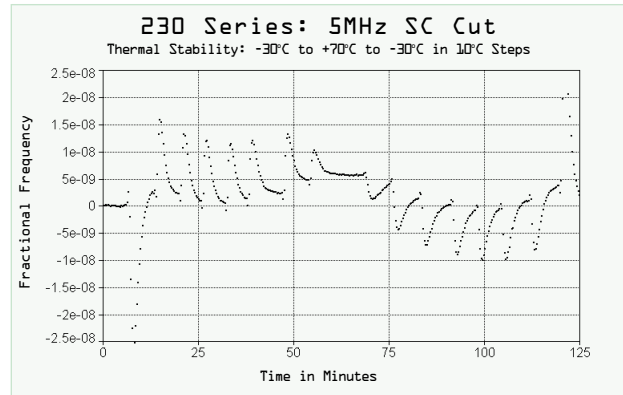
## 230 Interface Control Drawing



### Phase Noise



### Thermal Stability



Short Term Stability	dF/dV	dF/dL	Warm Up Time (Min)	Warm Up dF/F	Warm Up Power (W)	Continuous Power (W) @25°C	Tuning (Min)	MTI Model #
2.00E-11	1.00E-08	2.00E-08	10	2.00E-08	5.0	1.4	±2.00E-06	230-0506
1.00E-11	5.00E-10	5.00E-10	5	2.00E-08	5.0	1.4	±3.00E-07	230-0666
2.00E-11	1.00E-09	1.00E-09	5	2.00E-08	5.0	1.4	±2.00E-07	230-0663
1.00E-10	1.00E-08	2.00E-08	10	2.00E-08	5.0	1.4	±1.20E-06	230-0501
2.00E-11	1.00E-09	1.00E-09	5	2.00E-08	5.0	1.4	±7.00E-07	230-0503
1.00E-10	1.00E-08	2.00E-08	10	2.00E-08	5.0	1.4	±2.00E-06	230-0510
2.00E-11	1.00E-09	1.00E-09	5	2.00E-08	5.0	1.4	±7.00E-07	230-0664
1.00E-10	1.00E-08	5.00E-08	10	2.00E-08	5.0	1.4	±3.00E-06	230-0515
2.00E-11	1.00E-09	1.00E-09	5	2.00E-08	5.0	1.4	±7.00E-07	230-0665
2.00E-11	1.00E-09	1.00E-09	5	2.00E-08	5.0	1.8	±7.00E-07	230-0662
2.00E-11	1.00E-09	1.00E-09	5	2.00E-08	5.0	1.8	±7.00E-07	230-0661

# 240 • 241 Series OCXO - Low Profile Package

## Description

These product lines are the choice when a low profile package for rack mounted or portable applications is needed. Available with an AT or SC cut resonator the 240 and 241 Series rivals the performance of units with much higher profiles.

## Features

- STRATUM III, IIIe Performance
- Low Profile
- Low Phase Noise

## Applications

- STRATUM III, IIIe Telephony
- VME/VXI
- PC Card Instrumentation
- Rack Mounted Applications
- VSAT
- INMARSAT



Performance Range	
Parameters	Available Range
Frequency	75 KHz to 30 MHz
Thermal Stability	1.00E-08 to 5.00E-07
Operating Temperature	-40°C to +85°C
Output	HCMOS/ACMOS 0 to +9dBm Sine
Supply Voltage	+11 to +28V (DC)
Tuning Voltage	-10 to +10V (DC)

## Design Note:

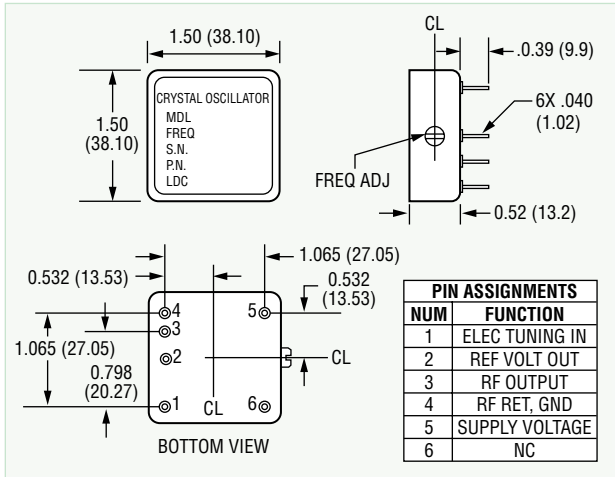
Base Models can be customized to your specifications using the performance range for this series.

## 240 Series Base Model Performance Guide

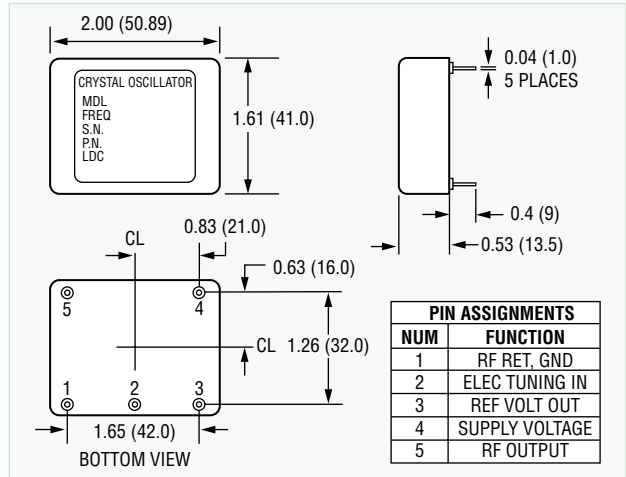
Frequency MHz	Crystal Cut	Thermal Stability*	Aging Rate per Day	Aging Rate per Year	Output	Phase Noise @ offsets (dBc/Hz)					
						1Hz	10Hz	100Hz	1kHz	10kHz	100kHz
10.000	AT	2.00E-07	1.00E-09	2.00E-07	9dBm Sine	-75	-105	-135	-145	-155	-155
10.000	SC	2.50E-08	5.00E-10	1.00E-07	9dBm Sine	-85	-115	-140	-150	-160	-160
13.000	AT	5.00E-07	1.00E-09	3.00E-07	HCMOS	-65	-95	-120	-145	-155	-155
13.000	SC	2.50E-08	5.00E-10	1.00E-07	9dBm Sine	-80	-110	-135	-150	-155	-160
16.384	AT	5.00E-07	1.00E-09	3.00E-07	9dBm Sine	-65	-95	-120	-140	-155	-155
16.384	SC	5.00E-08	7.00E-10	1.00E-07	HCMOS	-80	-110	-135	-150	-155	-160
20.000	AT	5.00E-07	5.00E-09	5.00E-07	9dBm Sine	-55	-85	-115	-140	-150	-150
20.000	SC	5.00E-08	1.00E-09	3.00E-07	9dBm Sine	-80	-110	-135	-145	-155	-155

\* Temperature Range is from -30°C to +70°C

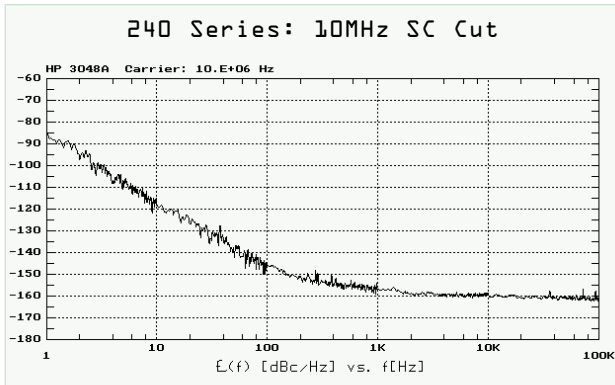
## 240 Interface Control Drawing



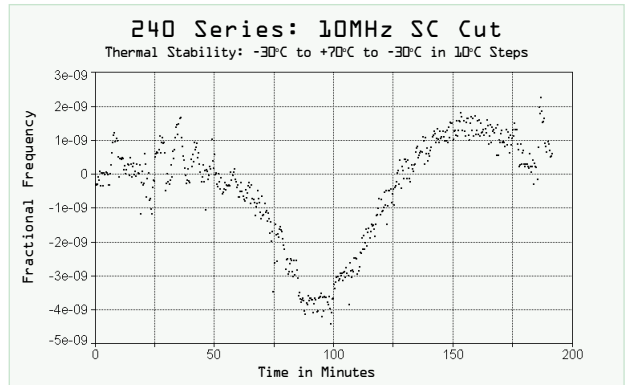
## 241 Interface Control Drawing



## Phase Noise



## Thermal Stability



Short Term Stability	dF/dV	dF/dL	Warm Up Time (Min)	Warm Up dF/F	Warm Up Power (W)	Continuous Power (W) @25°C	Tuning (Min)	MTI Model #
1.00E-10	3.00E-08	1.00E-08	10	2.00E-08	6.0	1.8	±5.00E-07	240-0501
2.00E-11	3.00E-09	1.00E-09	5	2.00E-08	6.0	1.8	±3.00E-07	240-0514
1.00E-10	3.00E-08	1.00E-08	10	2.00E-08	6.0	1.8	±5.00E-07	240-0564
2.00E-11	3.00E-09	1.00E-09	5	2.00E-08	6.0	1.8	±3.00E-07	241-0532
1.00E-10	3.00E-08	1.00E-08	10	2.00E-08	6.0	1.8	±5.00E-07	240-0526
4.00E-11	3.00E-09	1.00E-09	5	2.00E-08	6.0	1.8	±1.20E-06	241-0531
1.00E-11	3.00E-08	1.00E-08	10	2.00E-08	6.0	1.8	±1.00E-06	240-0526
5.00E-11	5.00E-09	5.00E-09	5	2.00E-08	6.0	1.8	±5.00E-07	241-0533



# 250 • 251 • 252 • 253 • 254 Series OCXO-Industry Standards

## Description

These product lines have set the industry standards for low-cost/high stability OCXOs. Developed with versatility in mind, the designs have enabled MTI to readily meet the changing demands of the marketplace. Utilized throughout the world in telecommunications and instrumentation applications, this family of products evolved from the tried and true design of the industry leading 250. The product lines offer numerous options in footprint, profile, and performance and are easily adapted to various applications.

## Features

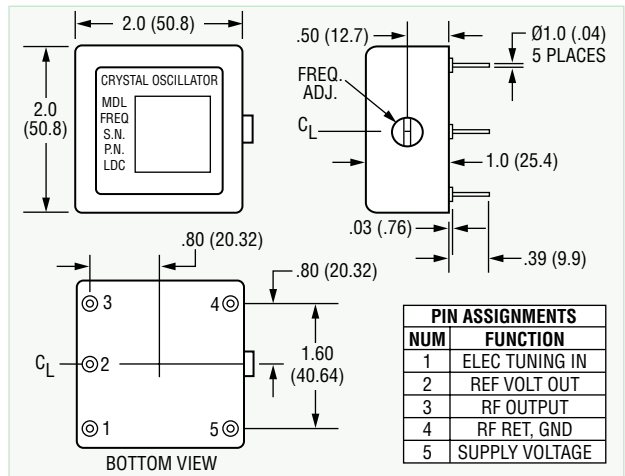
- STRATUM IIIe+ Performance
- Low Phase Noise
- Mounting & Connection Options

## Applications

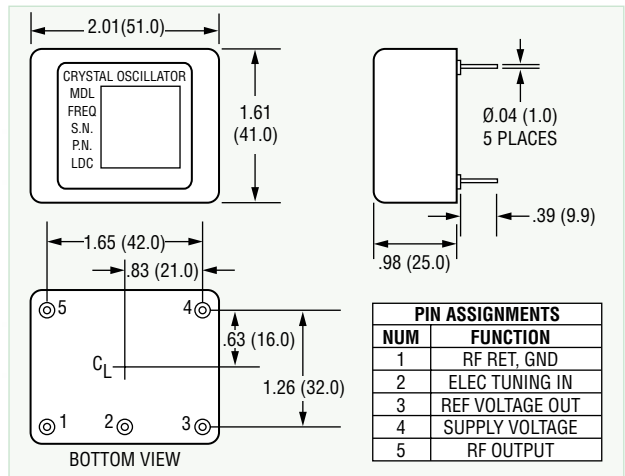
- STRATUM IIIe+ Telephony
- Point-to-Point Wireless
- GPS Receivers
- INMARSAT
- V-SAT
- Instrumentation
- Aerospace



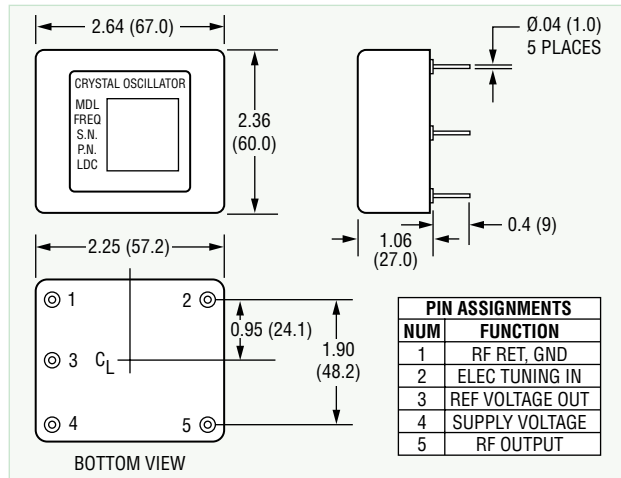
## 250 Interface Control Drawing



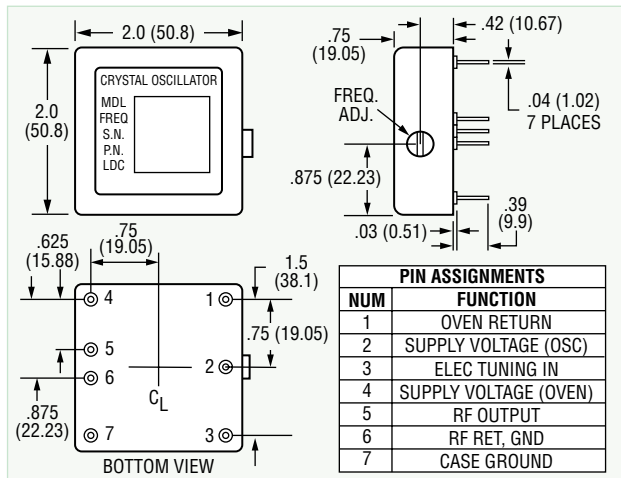
## 251 Interface Control Drawing



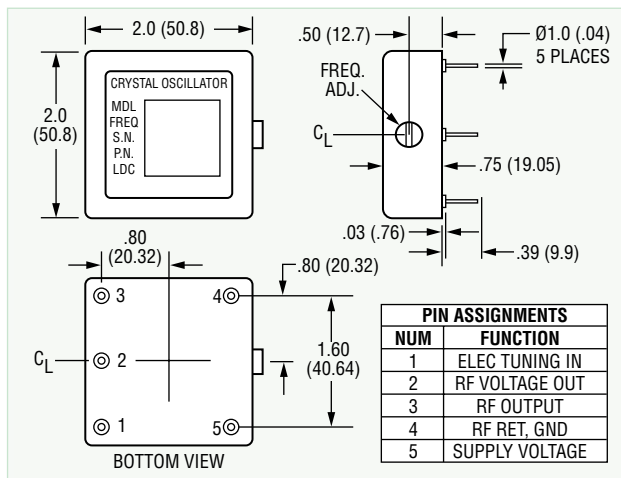
### 252 Interface Control Drawing



### 253 Interface Control Drawing



### 254 Interface Control Drawing

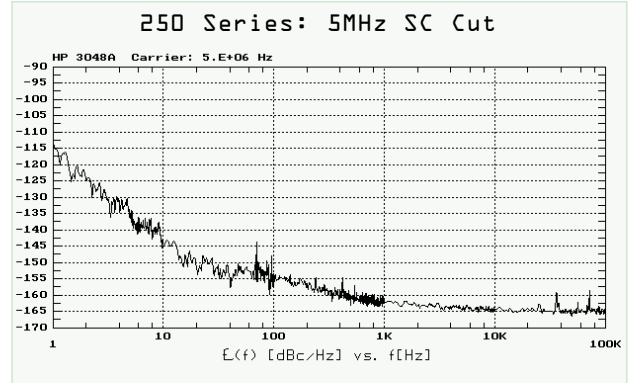


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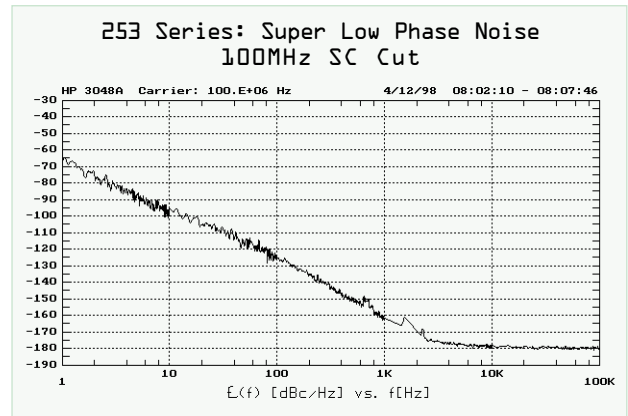
# 250 • 251 • 252 • 253 • 254 Series OCXO-Industry Standards



## Phase Noise



## Super Low Phase Noise Model



Performance Range	
Parameters	Available Range
Frequency	32 KHz to 60 MHz
Thermal Stability	2.00E-09 to 5.00E-07
Operating Temperature	-40°C to +85°C
Output	HCMOS/ACMOS 0 to +17dBm Sine
Supply Voltage	+11 to +28V (DC)
Tuning Voltage	-10 to +10V (DC)

### Design Note:

Base Models can be customized to your specifications using the performance range for this series.

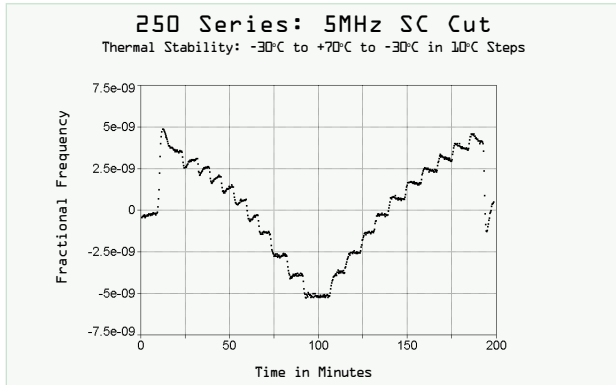
## 250 Series Base Model Performance Guide

Frequency MHz	Crystal Cut	Thermal Stability*	Aging Rate per Day	Aging Rate per Year	Output	Phase Noise @ offsets (dBc/Hz)					
						1Hz	10Hz	100Hz	1kHz	10kHz	100kHz
4.096	SC	1.50E-08	1.00E-10	3.00E-08	9dBm Sine	-100	-130	-145	-155	-160	-160
5.000	AT	5.00E-08	1.00E-09	1.00E-07	9dBm Sine	-80	-110	-130	-140	-150	-150
5.000	SC	1.50E-08	1.00E-10	3.00E-08	9dBm Sine	-100	-130	-145	-155	-160	-160
5.000	AT	5.00E-08	1.00E-09	1.00E-07	HCMOS	-80	-110	-130	-140	-150	-150
5.000	SC	5.00E-09	8.00E-11	2.50E-08	9dBm Sine	-100	-130	-145	-155	-160	-160
6.144	SC	1.50E-08	2.00E-10	4.00E-08	9dBm Sine	-95	-125	-140	-150	-160	-160
8.192	SC	1.50E-08	1.00E-09	1.00E-07	HCMOS	-90	-120	-140	-155	-160	-160
10.000	AT	1.00E-07	3.00E-09	5.00E-07	9dBm Sine	-65	-95	-125	-140	-150	-150
10.000	SC	1.50E-08	1.00E-09	1.00E-07	9dBm Sine	-90	-120	-140	-155	-160	-160
10.000	SC	1.00E-08	8.00E-10	8.00E-08	9dBm Sine	-90	-120	-140	-155	-160	-160
10.000	SC	1.50E-08	1.00E-09	1.00E-07	HCMOS	-90	-120	-140	-155	-160	-160
13.000	SC	1.50E-08	2.00E-10	2.00E-08	HCMOS	-85	-115	-130	-140	-145	-145
13.000	SC	1.50E-08	2.00E-10	2.00E-08	9dBm Sine	-85	-115	-130	-140	-145	-145
16.384	AT	1.00E-07	3.00E-09	5.00E-07	HCMOS	-65	-95	-125	-140	-150	-150
16.384	SC	1.50E-08	1.00E-10	3.00E-08	9dBm Sine	-85	-115	-130	-140	-150	-150
16.384	SC	1.50E-08	1.00E-09	1.00E-07	9dBm Sine	-80	-110	-130	-140	-150	-155
30.000	AT	1.00E-07	3.00E-09	5.00E-07	5dBm Sine	-60	-90	-120	-135	-145	-150
39.000	AT	1.00E-07	3.00E-09	5.00E-07	5dBm Sine	-60	-90	-120	-135	-140	-145
50.000	AT	2.00E-07	5.00E-09	8.00E-07	5dBm Sine	-60	-90	-115	-130	-140	-145

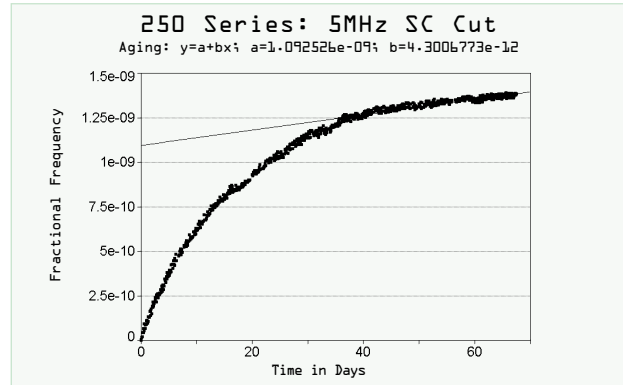
\* Temperature Range is from -30°C to +70°C



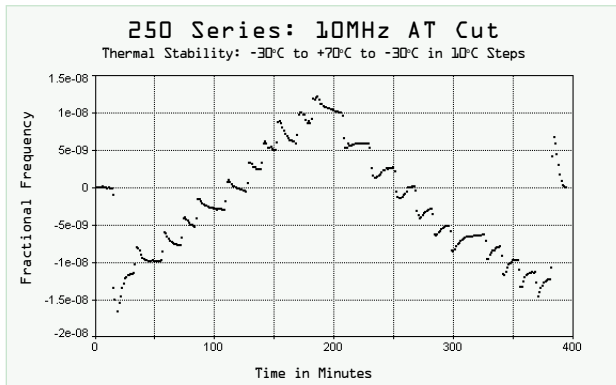
## Thermal Stability



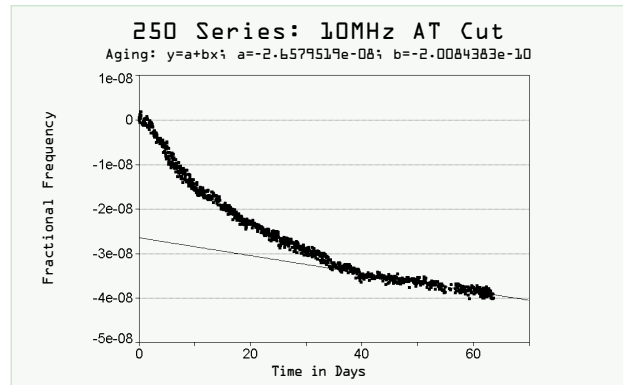
## Aging



## Thermal Stability



## Aging



Short Term Stability	dF/dV	dF/dL	Warm Up Time (Min)	Warm Up dF/F	Warm Up Power (W)	Continuous Power (W) @25°C	Tuning (Min)	MTI Model #
2.00E-12	5.00E-10	5.00E-10	7	2.00E-08	5.0	1.7	±3.00E-07	250-0787
2.00E-11	1.00E-09	1.00E-09	5	2.00E-08	5.0	1.7	±1.30E-06	250-0503
2.00E-12	5.00E-10	5.00E-10	7	2.00E-08	5.0	1.7	±3.00E-07	250-0504
2.00E-11	1.00E-09	1.00E-09	10	2.00E-08	5.0	2.0	±1.00E-07	251-1507
2.00E-12	5.00E-10	5.00E-10	7	2.00E-08	5.0	1.7	±3.00E-07	250-0788
4.00E-12	5.00E-10	5.00E-10	7	2.00E-08	5.0	1.7	±5.50E-07	252-1133
1.00E-11	5.00E-10	5.00E-10	7	2.00E-08	5.0	1.7	±8.80E-07	253-0518
5.00E-11	4.00E-09	2.00E-09	10	2.00E-08	5.0	1.7	±3.60E-06	250-0501
1.00E-11	5.00E-10	5.00E-10	5	2.00E-08	5.0	1.7	±8.80E-07	250-0502
1.00E-11	5.00E-10	5.00E-10	7	2.00E-08	5.0	1.7	±7.00E-07	251-1553
1.00E-11	5.00E-10	5.00E-10	7	2.00E-08	5.0	1.7	±8.80E-07	254-0508
2.00E-12	5.00E-10	5.00E-10	7	2.00E-08	5.0	2.2	±3.00E-07	250-0789
2.00E-12	5.00E-10	5.00E-10	7	2.00E-08	5.0	2.2	±3.00E-07	253-0519
5.00E-11	4.00E-09	4.00E-09	7	2.00E-08	5.0	1.7	±3.60E-06	254-0512
5.00E-12	5.00E-10	5.00E-10	7	2.00E-08	5.0	2.2	±5.00E-07	251-1554
3.00E-11	2.00E-09	2.00E-09	7	2.00E-08	5.0	1.7	±7.00E-07	252-1134
7.00E-11	4.00E-09	4.00E-09	7	2.00E-08	5.0	2.2	±3.60E-06	250-0790
7.00E-11	4.00E-09	4.00E-09	7	2.00E-08	5.0	2.2	±3.60E-06	250-0791
7.00E-11	4.00E-09	4.00E-09	7	2.00E-08	5.0	2.2	±3.60E-06	250-0792

# 260 Series OCXO - Ultra Stable Atomic Standard Replacement

## Description

The 260 Series is an ultra high stability/high reliability oven controlled crystal oscillator (OCXO). The 260 Series offers thermal stabilities from 2.0E-010 to 4.0E-009 over a 100°C temperature range, rivaling Rubidium atomic clock performance without the wearout phenomena associated with Rubidium standards. The 260 Series has been used in many applications worldwide as a direct replacement for atomic clocks, providing a substantial cost savings both in the short and long term.



## Features

- STRATUM II, IIIe+ Performance
- PCB Mount, Industry Standard Footprint

## Applications

- STRATUM II, IIIe+ Telephony
- Atomic Standard Replacement
- GPS Receivers
- Timing and Frequency Standards
- TDMA PCS Base Stations
- Quasi Synchronous Radio

Performance Range	
Parameters	Available Range
Frequency	32 KHz to 30 MHz
Thermal Stability	2.00E-10 to 4.00E-09
Operating Temperature	-40°C to +85°C
Output	HCMOS/ACMOS 0 to +13dBm Sine
Supply Voltage	+11 to +28V (DC)
Tuning Voltage	-10 to +10V (DC)

## Design Note:

Base Models can be customized to your specifications using the performance range for this series.

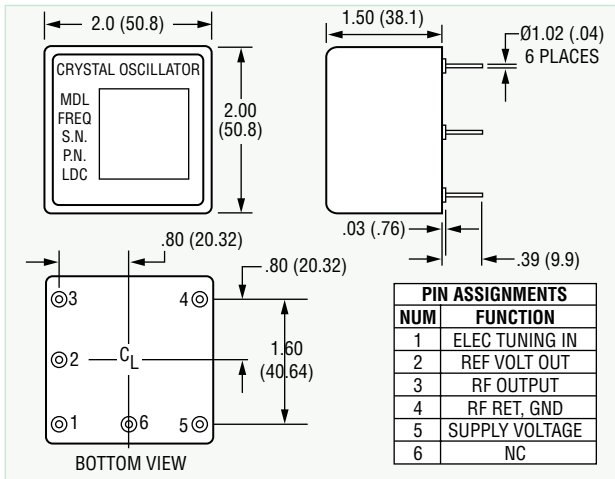
## 260 Series Base Model Performance Guide

Frequency MHz	Crystal Cut	Thermal Stability*	Aging Rate per Day	Aging Rate per Year	Output	Phase Noise @ offsets (dBc/Hz)					
						1Hz	10Hz	100Hz	1kHz	10kHz	100kHz
5.000	AT	2.00E-09	5.00E-10	1.00E-07	9dBm Sine	-85	-115	-140	-150	-150	-160
5.000	SC	2.00E-10	5.00E-11	3.00E-08	9dBm Sine	-110	-140	-150	-157	-160	-160
5.000	SC	1.00E-09	1.00E-10	3.00E-08	9dBm Sine	-100	-130	-145	-155	-160	-160
8.192	SC	2.00E-10	3.00E-10	6.00E-08	HCMOS	-95	-125	-145	-155	-160	-160
10.000	AT	2.00E-09	3.00E-09	5.00E-07	9dBm Sine	-70	-100	-125	-140	-150	-150
10.000	SC	2.00E-10	3.00E-10	6.00E-08	HCMOS	-95	-125	-145	-155	-160	-160
10.000	SC	2.00E-10	5.00E-11	3.00E-08	9dBm Sine	-90	-120	-140	-150	-155	-155
10.240	SC	2.00E-10	5.00E-11	3.00E-08	9dBm Sine	-90	-120	-140	-150	-155	-155
13.000	SC	2.00E-10	5.00E-11	3.00E-08	9dBm Sine	-90	-120	-130	-140	-145	-145
15.000	SC	2.00E-10	5.00E-11	3.00E-08	9dBm Sine	-90	-120	-130	-140	-150	-150
16.384	SC	2.00E-10	5.00E-11	3.00E-08	HCMOS	-90	-120	-130	-140	-150	-150

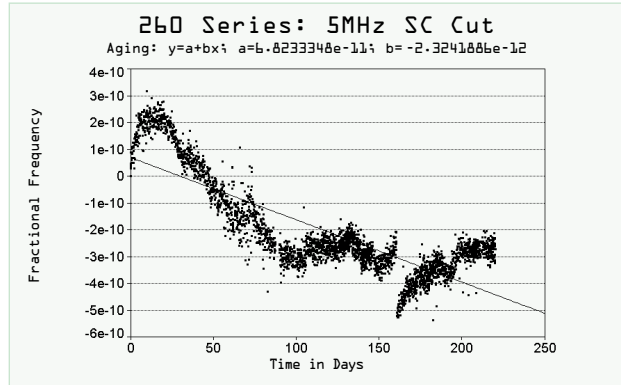
\* Temperature Range is from -30°C to +70°C



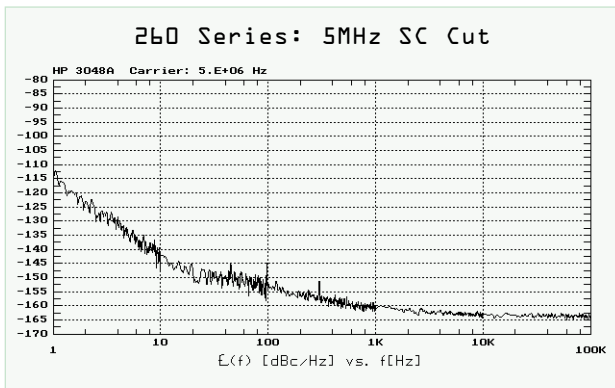
## 260 Interface Control Drawing



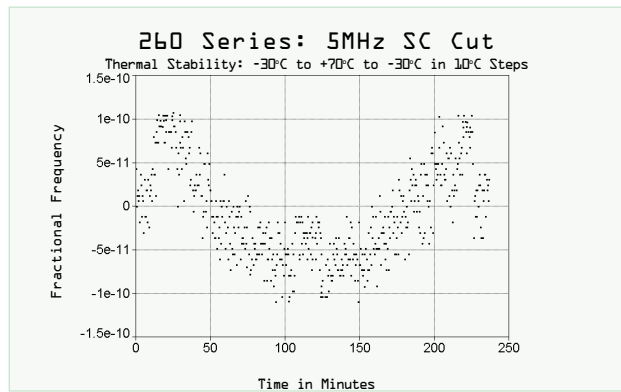
## Aging



## Phase Noise



## Thermal Stability



Short Term Stability	dF/dV	dF/dL	Warm Up Time (Min)	Warm Up dF/F	Warm Up Power (W)	Continuous Power (W) @25°C	Tuning (Min)	MTI Model #
2.00E-11	1.00E-09	1.00E-09	15	2.00E-08	12.0	2.7	±1.50E-06	260-0503
1.00E-12	2.00E-11	5.00E-11	15	2.00E-08	12.0	2.7	±5.00E-07	260-0504
2.00E-12	1.00E-10	1.00E-10	15	2.00E-08	12.0	2.7	±3.00E-07	260-0511
7.00E-12	2.00E-10	5.00E-10	15	2.00E-08	12.0	2.7	±7.00E-07	260-0614
5.00E-11	5.00E-10	2.00E-09	15	2.00E-08	12.0	2.7	±2.00E-06	260-0501
7.00E-12	2.00E-10	5.00E-10	15	2.00E-08	12.0	2.7	±7.00E-07	260-0620
2.00E-12	2.00E-11	5.00E-11	15	2.00E-08	12.0	2.9	±5.00E-07	260-0618
2.00E-12	2.00E-11	5.00E-11	15	2.00E-08	12.0	2.9	±5.00E-07	260-0616
2.00E-12	2.00E-11	5.00E-11	15	2.00E-08	12.0	2.9	±5.00E-07	260-0560
2.00E-12	2.00E-11	5.00E-11	15	2.00E-08	12.0	2.9	±5.00E-07	260-0617
2.00E-12	2.00E-11	5.00E-11	15	2.00E-08	12.0	2.9	±5.00E-07	260-0619