

# Precision Sub-Miniature 5.0x3.2mm TCXO / VCTCXO



## Designed for Telecom Applications

### Description

The Connor-Winfield 5.0x3.2mm Temperature Compensated Crystal Oscillators and Voltage Controlled Temperature Compensated Crystal Oscillators are designed for use in applications requiring tight frequency stability in a small package. Through the use of Analog Temperature Compensation, this device is capable of holding sub 1-ppm stabilities over wide temperature ranges.



### Features:

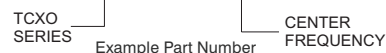
- 3.3V Operation
- LVC MOS or Clipped Sinewave Output Logic
- Sub-Miniature 5.0x3.2mm SMT Package
- Frequency Stabilities Available:
  - ±0.28ppm with STRATUM 3 Holdover,
  - ±0.50ppm or ±1.00ppm
- Temperature Ranges Available:
  - 0 to 70°C
  - 40 to 85°C
- Low Power <10mA
- Low Jitter <1pS RMS
- Tape and Reel Packaging
- RoHS Compliant / Lead Free
- Recommended for new designs

### Applications

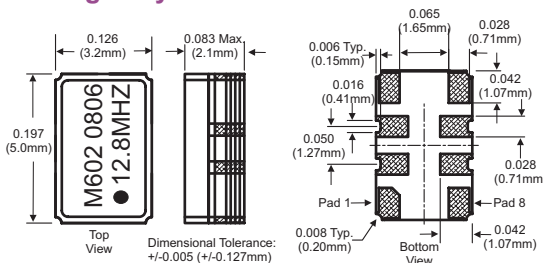
- STRATUM 3 Applications
- GPS Receivers
- Instrumentation
- Femtocells
- FTTH, FTTC

### Ordering Information

M602 - 012.8M



### Package Layout



### Pad Connections

Pad	Connection
1	Voltage Control or N/C
2	Do not connect
3	Do not connect
4	Ground
5	Output
6	Do not connect
7	Do not connect
8	Supply, Vcc

### Ordering Information

<b>M</b>	<b>6</b>	<b>0</b>	<b>2</b>	-	<b>012.8M</b>
<b>Type:</b> Precision TCXO VCTCXO 3.2x5mm	<b>Temperature Range:</b> 5 = 0 to 70° C 6 = -40 to 85° C	<b>Frequency Stability:</b> 0 = ± 0.28 ppm 1 = ± 0.50 ppm 2 = ± 1.00 ppm	<b>Features:</b> 2 = TCXO, LVC MOS, 3.3Vdc. 3 = TCXO, Clipped Sinewave, 3.3Vdc. 4 = VCTCXO, LVC MOS, 3.3Vdc. 5 = VCTCXO, Clipped Sinewave, 3.3Vdc.		<b>Output Frequency:</b> Frequency Format -xxx.xM Min.* -xxx.xxxxxM Max.* *Amount of numbers after the decimal point. M = MHz



Example:  
M602-012.8M = 3.2x5mm, TCXO, LVC MOS, 3.3Vdc, -40 to 85C, +/-0.28ppm, Output Frequency 12.8MHz

To order an M602 with an output frequency of:  
 6.4 MHz = M602-006.4M  
 20 MHz = M602-020.0M  
 38.88 MHz = M602-038.88M

Consult the factory for available frequencies.

Specifications subject to change without notice. All dimensions in inches. © Copyright 2008 The Connor-Winfield Corporation

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Date	<b>05 Sep 2008</b>

## Model Specifications

Model Number	M502	M503	M504	M505	Notes
Output Type	LVC MOS	Clipped Sinewave	LVC MOS	Clipped Sinewave	
TCXO / VCTCXO	TCXO	TCXO	VCTCXO	VCTCXO	
Frequency Range	6.4 to 40 MHz				
Frequency Stability	±0.28ppm				1
Supply Voltage	3.3Vdc				
Temperature Range	0 to 70°C				
Holdover Stability	±0.32ppm				2

Model Number	M602	M603	M604	M605	Notes
Output Type	LVC MOS	Clipped Sinewave	LVC MOS	Clipped Sinewave	
TCXO / VCTCXO	TCXO	TCXO	VCTCXO	VCTCXO	
Frequency Range	6.4 to 40 MHz				
Frequency Stability	±0.28ppm				1
Supply Voltage	3.3Vdc				
Temperature Range	-40 to 85°C				
Holdover Stability	±0.32ppm				2

Model Number	M512	M513	M514	M515	Notes
Output Type	LVC MOS	Clipped Sinewave	LVC MOS	Clipped Sinewave	
TCXO / VCTCXO	TCXO	TCXO	VCTCXO	VCTCXO	
Frequency Range	6.4 to 40 MHz				
Frequency Stability	±0.50ppm				1
Supply Voltage	3.3Vdc				
Temperature Range	0 to 70°C				

Model Number	M612	M613	M614	M615	Notes
Output Type	LVC MOS	Clipped Sinewave	LVC MOS	Clipped Sinewave	
TCXO / VCTCXO	TCXO	TCXO	VCTCXO	VCTCXO	
Frequency Range	6.4 to 40 MHz				
Frequency Stability	±0.50ppm				1
Supply Voltage	3.3Vdc				
Temperature Range	-40 to 85°C				

Model Number	M522	M523	M524	M525	Notes
Output Type	LVC MOS	Clipped Sinewave	LVC MOS	Clipped Sinewave	
TCXO / VCTCXO	TCXO	TCXO	VCTCXO	VCTCXO	
Frequency Range	6.4 to 52 MHz				
Frequency Stability	±1.00ppm				1
Supply Voltage	3.3Vdc				
Temperature Range	0 to 70°C				

Model Number	M622	M623	M624	M625	Notes
Output Type	LVC MOS	Clipped Sinewave	LVC MOS	Clipped Sinewave	
TCXO / VCTCXO	TCXO	TCXO	VCTCXO	VCTCXO	
Frequency Range	6.4 to 52 MHz				
Frequency Stability	±1.00ppm				1
Supply Voltage	3.3Vdc				
Temperature Range	-40 to 85°C				

### Notes:

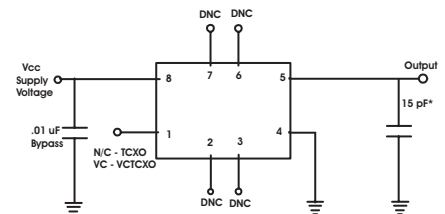
- 1) Frequency stability vs. change in temperature.  $[\pm(F_{max} - F_{min})/2.F_0]$ .
- 2) Inclusive of frequency stability, supply voltage change (±1%), aging, for 24 hours.



## Features

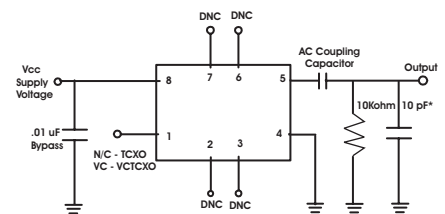
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## LVC MOS Test Circuit



DNC = Do Not Connect  
 \* NPO Grade Component

## Clipped Sinewave Test Circuit



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## Electrical Specifications for all Models

### ABSOLUTE MAXIMUM RATINGS

PARAMETER	UNITS	MINIMUM	NOMINAL	MAXIMUM	UNITS	NOTE
Storage Temperature		-55	-	85	°C	
Supply Voltage	(Vcc)	-0.5	-	6.0	Vdc	
Input Voltage	(Vc)	-0.5	-	Vcc+0.5	Vdc	

### Operating Specifications

Parameter	Minimum	Nominal	Maximum	Units	Notes	
TCXO Frequency Calibration @ 25 C	-1.00	-	1.00	ppm	1	
Supply Voltage Variation. (Vcc±5%)	-0.2	-	0.2	ppm		
Load Coefficient, ±5%	-0.2	-	0.2	ppm		
Static Temperature Hysteresis	-0.4	-	0.4	ppm	2	
Total Frequency Tolerance	-4.60	-	4.60	ppm	3	
Supply Voltage	(Vcc)	3.135	3.3	3.465	Vdc	4
Supply Current	(Icc)	-	6	10	mA	
Period Jitter	-	3	5	ps rms		
Integrated Phase Jitter (BW=12kHz to 20MHz)	-	0.3	1.0	ps rms		
SSB Phase Noise at 10Hz offset	-	-80	-70	dBc/Hz		
SSB Phase Noise at 100Hz offset	-	-110	-100	dBc/Hz		
SSB Phase Noise at 1KHz offset	-	-135	-130	dBc/Hz		
SSB Phase Noise at >10KHz offset	-	-150	-145	dBc/Hz		
SSB Phase Noise at >100KHz offset	-	-150	-150	dBc/Hz		
Start Up Time	-	-	10	ms		

### Input Characteristics For Voltage Control (Pad 1)

Parameter	Minimum	Nominal	Maximum	Units	Notes
Control Voltage Range (Vcc = 3.3V)	(Vc) 0.3	1.65	3.0	Vdc	
Frequency Tuning	±10	-	-	ppm	5
Linearity	±5	-	-	%	
Slope	Positive				

### LVC MOS Output Characteristics

Parameter	Minimum	Nominal	Maximum	Units	Notes
LOAD	-	15	-	pF	6
Voltage (High)	(Voh) 90%Vcc	-	-	Vdc	
(Low)	(Vol) -	-	10%Vcc	Vdc	
Current (High)	(Ioh) -4	-	-	mA	
(Low)	(Iol) -	-	4	mA	
Duty Cycle at 50% of Vcc	45	50	55	%	
Rise / Fall Time 10% to 90%	-	-	8	ns	

### Clipped Sinewave Output Characteristics

Parameter	Minimum	Nominal	Maximum	Units	Notes
Load	-	-	-		7
Output Load Resistance	-	10K	-	Ohms	8
Output Load Capacitance	-	10	-	pF	8
Output Voltage	1.00	-	-	V pk-pk	

#### Notes

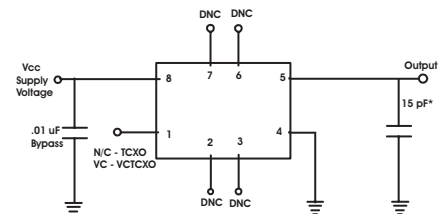
- 1) TCXO: Initial calibration @ 25 C. Specifications at time of shipment after 48 hours of operation.
- 2) Frequency change after reciprocal temperature ramped over the operating range. Frequency measured before and after at 25°C.
- 3) Inclusive of calibration @ 25 C, frequency vs. change in temperature, change in supply voltage (±5%), load change (±5%), reflow soldering process and 20 years aging.
- 4) For best in application performance, careful selection of an external power source is critical. Select an external regulator that meets or exceeds to following specifications regarding voltage regulation tolerance, initial accuracy, temperature coefficient, voltage noise, and low voltage noise density. **Factory Test Conditions:** Initial Accuracy ±2mv, Noise (0.1Hz to 10 KHz) 15uV p-p, Voltage Noise Density = 50nV/(Square root Hz), Temperature Coefficient < 5ppm°C.
- 5) Additional pull ranges are available; please contact the factory for additional information.
- 6) For best performance it is recommended that the device connected to this output should have an equivalent input capacitance of 15pF.
- 7) Output is DC coupled.
- 8) For best performance it is recommended that the device connected to this output should have an equivalent input capacitance of 10pF.



## Features

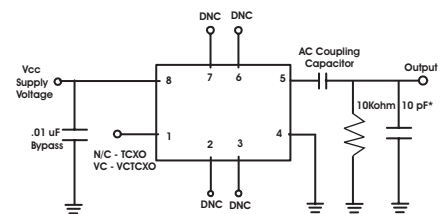
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## LVC MOS Test Circuit



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## Clipped Sinewave Test Circuit



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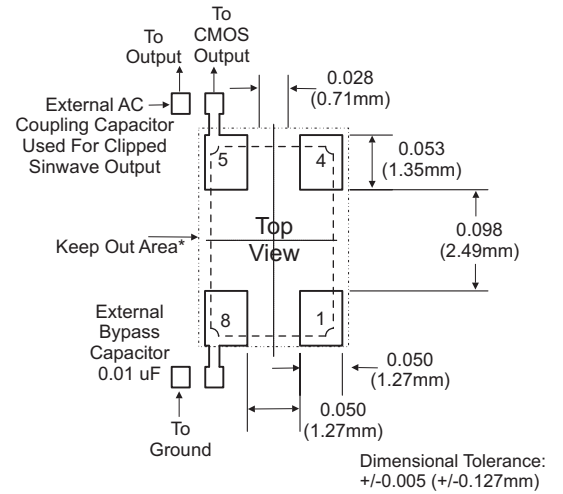
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Date 05 Sep 2008

## Environmental Characteristics

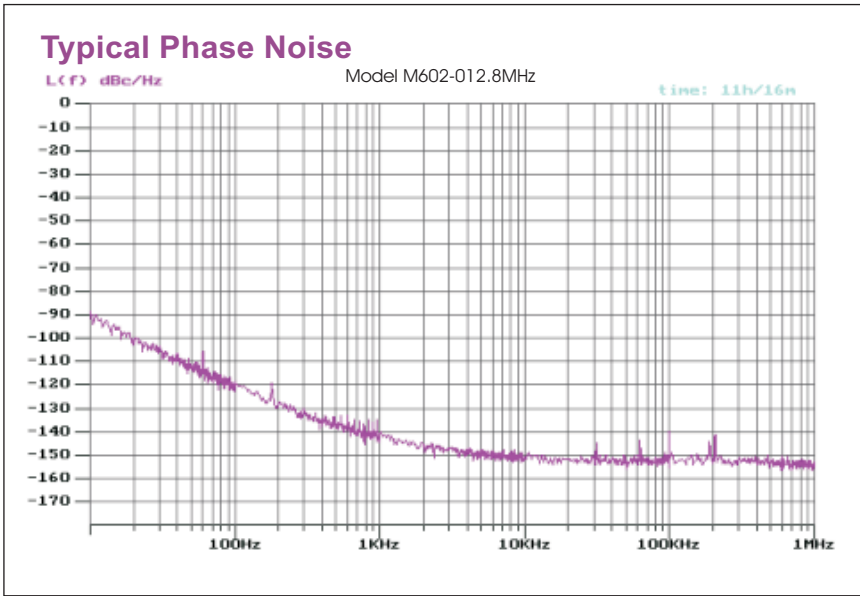
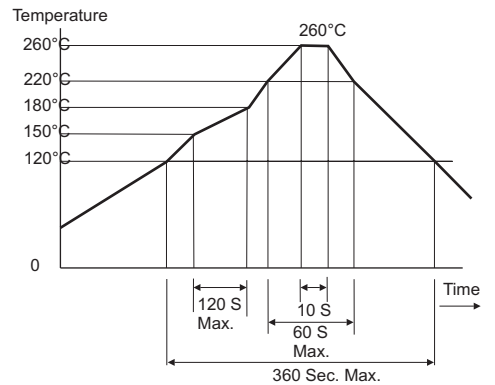
Vibration:	Vibration per Mil Std 883E Method 2007.3 Test Condition A
Shock:	Mechanical Shock per Mil Std 883E Method 2002.4 Test Condition B.
Soldering:	SMD product suitable for Convection Reflow soldering. Peak temperature 260 C. Maximum time above 220 C, 60 seconds.
Solderability:	Solderability per Mil Std 883E Method 2003

## Suggested Pad Layout

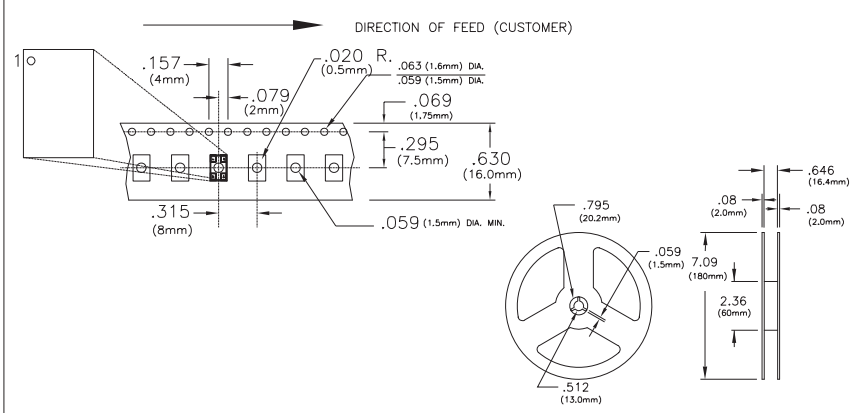


\* Do not route any traces in the keep out area. It is recommended the next layer under the keep out area is to be ground plane.

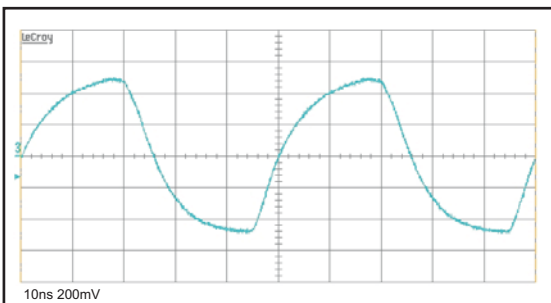
## Solder Profile



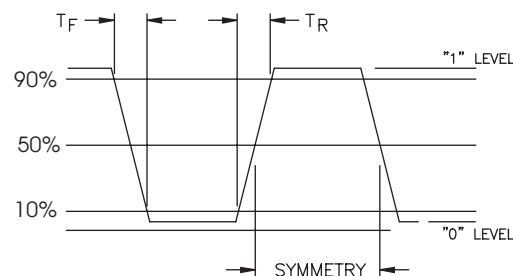
## Tape and Reel Specifications



## Clipped Sinewave Output Waveform



## LVC MOS Output Waveform



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