# Precision Frequency Standard

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## PF-Series
## Oven Controlled Crystal Oscillators
## 3.3V / 5.0V Series
## LVCMOS / HCMOS Series
## Adjustable / Fixed



### 14 Pin DIP Package
### OCXO Series

#### Description

The Connor-Winfield 14 Pin DIP Oven Stabilized Crystal Controlled Oscillators (OCXO) series and Voltage Controlled Oven Stabilized Crystal Controlled Oscillators (VCOCXO) series are designed for use in applications requiring stabilities of +/-0.05ppm to +/-0.25ppm over the commercial or the industrial temperature ranges.

#### Features

Frequency Range: 1.6 MHz to 20 MHz
OCXO - Fixed Frequency
VCOCXO - Voltage Controlled
3.3V or 5.0V Operation
LVCMOS or HCMOS Output Logic
Frequency Stabilities Available:
PF150xx Series: ±0.05ppm
PF151xx / PF161xx Series: ±0.10ppm
PF152xx / PF162xx Series: ±0.15ppm
PF153xx / PF163xx Series: ±0.20ppm
PF154xx / PF164xx Series: ±0.25ppm
Temperature Ranges Available:
PF15xxx Series: 0 to 70°C
PF16xxx Series: -40 to 85°C
Low Jitter <1pS RMS
14 Pin DIP Package
RoHS Compliant / Lead Free

### 14x20mm Surface Mount Package
### OCXO Series

#### Description

The Connor-Winfield 14x20mm Oven Stabilized Crystal Controlled Oscillators (OCXO series) and Voltage Controlled Oven Stabilized Crystal Controlled Oscillators (VCOCXO series) are designed for use in applications requiring stabilities of +/-0.05ppm to +/-0.25ppm over the commercial or the industrial temperature ranges.

#### Features

Frequency Range: 1.6 to 20 MHz
OCXO - Fixed Frequency
VCOCXO - Voltage Controlled
3.3V or 5.0V Operation
LVCMOS or HCMOS Output Logic
Frequency Stabilities Available:
PF250xx Series: ±0.05ppm
PF251xx / PF261xx Series: ±0.10ppm
PF252xx / PF262xx Series: ±0.15ppm
PF253xx / PF263xx Series: ±0.20ppm
PF254xx / PF264xx Series: ±0.25ppm
Temperature Ranges Available:
PF25xxx Series: 0 to 70°C
PF26xxx Series: -40 to 85°C
Low Jitter <1pS RMS
Surface Mount Package
Tape and Reel Packing
RoHS Compliant / Lead Free

RoHS COMPLIANT

### Standard Frequencies that are Available*

| | | | |
|---|---|---|---|
| 6.4 MHz | 8.192 MHz | 9.72 MHz | 10.0 MHz |
| 12.8 MHz | 16.384 MHz | 19.44 MHz | 20.0 MHz |

### Ordering Information

| PF | 1 | 5 | 1 | L | F | - | 010.0M |
|---|---|---|---|---|---|---|---|
| Type:<br>Precision Frequency Standard<br>OCXO<br>VCOCXO | Package Type:<br>1 = 14 Pin DIP<br>2 = SMT 20x14mm | Temperature Range:<br>5 = 0 to 70° C<br>6 = -40 to 85° C | Frequency Stability:<br>0 = +/-0.05ppm<br>1 = +/-0.10ppm<br>2 = +/-0.15ppm<br>3 = +/-0.20ppm<br>4 = +/-0.25ppm | Supply Voltage / Output:<br>L = 3.3Vdc / LVCMOS<br>H = 5.0Vdc / HCMOS | Output:<br>F = Fixed Frequency<br>V = Voltage Controlled | | Output Frequency:<br>M = MHz<br>xxx.xxM |

Frequencies available from the factory for small quantities or quick deliveries, addition frequencies are available.



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# Model Specifications

## PF15xxx / PF16xxx - Series


## PF25xxx / PF26xxx - Series


| DIP Package Model Number | PF150LF | PF150HF | PF150LV | PF150HV | Note: |
|---|---|---|---|---|---|
| SM Package Model Number | PF250LF | PF250HF | PF250LV | PF250HV | |
| Frequency Range | 1.6 to 20 MHz | | | | |
| Frequency Stability | ±0.05ppm | | | | 1.2 |
| Temperature Range | 0 to 70°C | | | | |
| Supply Voltage | 3.3 Vdc | 5.0 Vdc | 3.3 Vdc | 5.0 Vdc | |
| OCXO / VCOCXO | OCXO | OCXO | VCOCXO | VCOCXO | |

| DIP Package Model Number | PF151LF | PF151HF | PF151LV | PF151HV | Note: |
|---|---|---|---|---|---|
| SM Package Model Number | PF251LF | PF251HF | PF251LV | PF251HV | |
| Frequency Range | 1.6 to 20 MHz | | | | |
| Frequency Stability | ±0.10ppm | | | | 1.2 |
| Temperature Range | 0 to 70°C | | | | |
| Supply Voltage | 3.3 Vdc | 5.0 Vdc | 3.3 Vdc | 5.0 Vdc | |
| OCXO / VCOCXO | OCXO | OCXO | VCOCXO | VCOCXO | |

| DIP Package Model Number | PF161LF | PF161HF | PF161LV | PF161HV | Note: |
|---|---|---|---|---|---|
| SM Package Model Number | PF261LF | PF261HF | PF261LV | PF261HV | |
| Frequency Range | 1.6 to 20 MHz | | | | |
| Frequency Stability | ±0.10ppm | | | | 1.2 |
| Temperature Range | -40 to 85°C | | | | |
| Supply Voltage | 3.3 Vdc | 5.0 Vdc | 3.3 Vdc | 5.0 Vdc | |
| OCXO / VCOCXO | OCXO | OCXO | VCOCXO | VCOCXO | |

| DIP Package Model Number | PF152LF | PF152HF | PF152LV | PF152HV | Note: |
|---|---|---|---|---|---|
| SM Package Model Number | PF252LF | PF252HF | PF252LV | PF252HV | |
| Frequency Range | 1.6 to 20 MHz | | | | |
| Frequency Stability | ±0.15ppm | | | | 1.2 |
| Temperature Range | 0 to 70°C | | | | |
| Supply Voltage | 3.3 Vdc | 5.0 Vdc | 3.3 Vdc | 5.0 Vdc | |
| OCXO / VCOCXO | OCXO | OCXO | VCOCXO | VCOCXO | |

| DIP Package Model Number | PF162LF | PF162HF | PF162LV | PF162HV | Note: |
|---|---|---|---|---|---|
| SM Package Model Number | PF262LF | PF262HF | PF262LV | PF262HV | |
| Frequency Range | 1.6 to 20 MHz | | | | 1.2 |
| Frequency Stability | ±0.15ppm | | | | |
| Temperature Range | -40 to 85°C | | | | |
| Supply Voltage | 3.3 Vdc | 5.0 Vdc | 3.3 Vdc | 5.0 Vdc | |
| OCXO / VCOCXO | OCXO | OCXO | VCOCXO | VCOCXO | |

| DIP Package Model Number | PF153LF | PF153HF | PF153LV | PF153HV | Note: |
|---|---|---|---|---|---|
| SM Package Model Number | PF253LF | PF253HF | PF253LV | PF253HV | |
| Frequency Range | 1.6 to 20 MHz | | | | |
| Frequency Stability | ±0.20ppm | | | | 1.2 |
| Temperature Range | 0 to 70°C | | | | |
| Supply Voltage | 3.3 Vdc | 5.0 Vdc | 3.3 Vdc | 5.0 Vdc | |
| OCXO / VCOCXO | OCXO | OCXO | VCOCXO | VCOCXO | |

| DIP Package Model Number | PF163LF | PF163HF | PF163LV | PF163HV | Note: |
|---|---|---|---|---|---|
| SM Package Model Number | PF263LF | PF263HF | PF263LV | PF263HV | |
| Frequency Range | 1.6 to 20 MHz | | | | |
| Frequency Stability | ±0.20ppm | | | | 1.2 |
| Temperature Range | -40 to 85°C | | | | |
| Supply Voltage | 3.3 Vdc | 5.0 Vdc | 3.3 Vdc | 5.0 Vdc | |
| OCXO / VCOCXO | OCXO | OCXO | VCOCXO | VCOCXO | |

| DIP Package Model Number | PF154LF | PF154HF | PF154LV | PF154HV | Note: |
|---|---|---|---|---|---|
| SM Package Model Number | PF254LF | PF254HF | PF254LV | PF254HV | |
| Frequency Range | 1.6 to 20 MHz | | | | |
| Frequency Stability | ±0.25ppm | | | | 1.2 |
| Temperature Range | 0 to 70°C | | | | |
| Supply Voltage | 3.3 Vdc | 5.0 Vdc | 3.3 Vdc | 5.0 Vdc | |
| OCXO / VCOCXO | OCXO | OCXO | VCOCXO | VCOCXO | |

| DIP Package Model Number | PF164LF | PF164HF | PF164LV | PF164HV | Note: |
|---|---|---|---|---|---|
| SM Package Model Number | PF264LF | PF264HF | PF264LV | PF264HV | |
| Frequency Range | 1.6 to 20 MHz | | | | |
| Frequency Stability | ±0.25ppm | | | | 1.2 |
| Temperature Range | -40 to 85°C | | | | |
| Supply Voltage | 3.3 Vdc | 5.0 Vdc | 3.3 Vdc | 5.0 Vdc | |
| OCXO / VCOCXO | OCXO | OCXO | VCOCXO | VCOCXO | |

Note:
1.2) Frequency stability vs. change in temperature.

## FEATURES

OCXO - Fixed Frequency
VCOCXO - Voltage Controlled
Frequency Range: 1.6 to 20 MHz
3.3V or 5.0V Operation
LVCMOS / HCMOS Output Logic
PF15xxx / PF16xxx Series -14 Pin DIP Package
PF25xxx / PF26xxx Series -Surface Mount Package
Frequency Stabilities Available:
- PF150xx / PF160xx Series: ±0.05ppm
- PF151xx / PF161xx Series: ±0.10ppm
- PF251xx / PF261xx Series: ±0.10ppm
- PF152xx / PF162xx Series: ±0.15ppm
- PF252xx / PF262xx Series: ±0.15ppm
- PF153xx / PF163xx Series: ±0.20ppm
- PF253xx / PF263xx Series: ±0.20ppm
- PF154xx / PF164xx Series: ±0.25ppm
- PF254xx / PF264xx Series: ±0.25ppm

Temperature Ranges Available:
- PF15xxx: 0 to 70°C
- PF16xxx: -40 to 85°C

Low Jitter <1pS RMS
Tape and Reel Packaging
RoHS Compliant / Lead Free

## PIN CONNECTIONS

| Pin | Function |
|---|---|
| 1 | OCXO – N/C<br>VCOCXO - Voltage Control |
| 7 | Ground (Case) |
| 8 | Output |
| 14 | Vcc |

## ORDERING INFORMATION

PF151LF - 010.0 M

OCXO SERIES

CENTER FREQUENCY

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| | |
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| Revision | 00 |
| Date | 21 May 2008 |

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# 3.3V LVCMOS Model Specifications

**ABSOLUTE MAXIMUM RATINGS** TABLE 1.3

| PARAMETER | UNITS | MINIMUM | NOMINAL | MAXIMUM | UNITS | NOTE |
|---|---|---|---|---|---|---|
| Storage Temperature | | -55 | - | 125 | °C | |
| Supply Voltage | (Vcc) | -0.5 | - | 4.5 | Vdc | |
| Control Voltage | (Vc) | -0.5 | - | 4.5 | Vdc | |

**OPERATING SPECIFICATIONS** TABLE 2.3

| PARAMETER | | MINIMUM | NOMINAL | MAXIMUM | UNITS | NOTE |
|---|---|---|---|---|---|---|
| Frequency Calibration | | -1.0 | | 1.0 | ppm | 1.3, 4.3 |
| Frequency Stability | | | See Page 2 | | ppm | 2.3 |
| Frequency vs. Change in Supply Voltage | | -0.05 | - | 0.05 | ppm | 3.3 |
| Aging (Daily) | | -30 | - | 30 | ppb | 4.3 |
| Aging (1st year) | | -1.0 | - | 1.0 | ppm | |
| Total Frequency Tolerance (20 years) | | -4.6 | - | 4.6 | ppm | 5.3 |
| Supply Voltage | (Vcc) | 3.13 | 3.3 | 3.47 | Vdc | |
| Supply Power (0 to 70°C) | | - | - | 1.5 | Watts | |
| Supply Power (-40 to 85°C) | | - | - | 2.7 | Watts | |
| Phase Jitter (BW =10Hz to Fo/2) | | - | - | 3 | pS RMS | |
| Phase Jitter (BW =10KHz to Fo/2) | | - | - | 1 | pS RMS | |
| Period Jitter | | - | - | 1 | pS RMS | |
| Allan Variance (1 Second) | | - | 1.00 E-10 | - | | |
| SSB Phase Noise at 10Hz offset | | - | -90 | - | dBc/Hz | 6.3 |
| SSB Phase Noise at 100Hz offset | | - | -120 | - | dBc/Hz | 6.3 |
| SSB Phase Noise at 1KHz offset | | - | -140 | - | dBc/Hz | 6.3 |
| SSB Phase Noise at 10KHz offset | | - | -150 | - | dBc/Hz | 6.3 |
| Start-Up Time: Oscillator | | - | - | 35 | ms | |
| Warm Up Time | | - | - | 5 | Minutes | 7.3 |

**VCOCXO CHARACTERISTICS** TABLE 3.3

| PARAMETER | | MINIMUM | NOMINAL | MAXIMUM | UNITS | NOTE |
|---|---|---|---|---|---|---|
| Control Voltage Range | (Vc) | 0.3 | 1.5 | 3.0 | Vdc | |
| Frequency at Vc=0.3 Vdc | | - | -7 | -5 | ppm | 8.3 |
| Frequency at Vc=3.0 Vdc | | 5 | 7 | - | ppm | 8.3 |
| Slope of Frequency Adjust | | 3.7 | - | - | ppm/V | |
| Input Impedance | | 100k | - | - | Ohm | |

**LVCMOS OUTPUT CHARACTERISTICS** TABLE 4.3

| PARAMETER | | | MINIMUM | NOMINAL | MAXIMUM | UNITS | NOTE |
|---|---|---|---|---|---|---|---|
| LOAD | | | - | 15 | - | pF | |
| Voltage | (High) | (Voh) | 2.6 | - | - | Vdc | |
| | (Low) | (Vol) | - | - | 0.4 | 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% | | | - | - | 6 | nS | |

**PACKAGE CHARACTERISTICS** TABLE 5.3

| | |
|---|---|
| PF1xxxx-Series DIP Package | 14 pin DIP, hermetically sealed, grounded, welded package. |
| PF2xxxx-Series Surface Mount Package | Surface Mount, Non-hermetic package consisting of an FR4 substrate with grounded metal cover. |

Notes:
1.3) Initial calibration @ 25C. VCOCXO model Vc = 1.50 Vdc.
2.3) Frequency stability vs. Change in temperature, referenced to 25C.
3.3) Frequency stability per 5% change in supply voltage.
4.3) At the time of shipment after 48 hours of operation.
5.3) Inclusive of calibration, operating temperature range, supply voltage change, shock and vibration 20 years aging, VCOCXO models Vc=1.5V.
6.3) Typical phase noise, results will vary depending on center frequency. The phase noise shown are typical for 20 MHz.
7.3) Measured @ 25C, within 5 minutes, the unit will be within +/-0.1ppm of its reference frequency, measured after 30 minutes of continuous operation at a stable 25C.
8.3) VCOCXO models pullability referenced to Fo @ 25°C, Positive Transfer Characteristic.

# 5.0V HCMOS Model Specifications

**ABSOLUTE MAXIMUM RATINGS** TABLE 6.3

| PARAMETER | UNITS | MINIMUM | NOMINAL | MAXIMUM | UNITS | NOTE |
|---|---|---|---|---|---|---|
| Storage Temperature | | -55 | - | 125 | °C | |
| Supply Voltage | (Vcc) | -0.5 | - | 4.5 | Vdc | |
| Control Voltage | (Vc) | -0.5 | - | 4.5 | Vdc | |

**OPERATING SPECIFICATIONS** TABLE 7.3

| PARAMETER | | MINIMUM | NOMINAL | MAXIMUM | UNITS | NOTE |
|---|---|---|---|---|---|---|
| Frequency Calibration | | -1.0 | | 1.0 | ppm | 9.3, 12.3 |
| Frequency Stability | | | See Page 2 | | ppm | 10.3 |
| Frequency vs. Change in Supply Voltage | | -0.05 | - | 0.05 | ppm | 11.3 |
| Aging (Daily) | | -30 | - | 30 | ppb | 123 |
| Aging (1st year) | | -1.0 | - | 1.0 | ppm | |
| Total Frequency Tolerance (20 years) | | -4.6 | - | 4.6 | ppm | 13.3 |
| Supply Voltage | (Vcc) | 4.75 | 5.0 | 5.25 | Vdc | |
| Supply Power (0 to 70°C) | | - | - | 1.5 | Watts | |
| Supply Power (-40 to 85°C) | | - | - | 2.7 | Watts | |
| Phase Jitter (BW =10Hz to Fo/2) | | - | - | 3 | pS RMS | |
| Phase Jitter (BW =10KHz to Fo/2) | | - | - | 1 | pS RMS | |
| Period Jitter | | - | - | 1 | pS RMS | |
| Allan Variance (1 Second) | | - | 1.00 E-10 | - | | |
| SSB Phase Noise at 10Hz offset | | - | -90 | - | dBc/Hz | 14.3 |
| SSB Phase Noise at 100Hz offset | | - | -120 | - | dBc/Hz | 14.3 |
| SSB Phase Noise at 1KHz offset | | - | -140 | - | dBc/Hz | 14.3 |
| SSB Phase Noise at 10KHz offset | | - | -150 | - | dBc/Hz | 14.3 |
| Start-Up Time: Oscillator | | - | - | 35 | ms | |
| Warm Up Time | | - | - | 5 | Minutes | 15.3 |

**VCOCXO CHARACTERISTICS** TABLE 8.3

| PARAMETER | | MINIMUM | NOMINAL | MAXIMUM | UNITS | NOTE |
|---|---|---|---|---|---|---|
| Control Voltage Range | (Vc) | 0.5 | 2.0 | 4.1 | Vdc | |
| Frequency at Vc=0.5 Vdc | | - | -7 | -5 | ppm | 16.3 |
| Frequency at Vc=4.1 Vdc | | 5 | 7 | - | ppm | 16.3 |
| Slope of Frequency Adjust | | 3.7 | - | - | ppm/V | |
| Input Impedance | | 100k | - | - | Ohm | |

**HCMOS OUTPUT CHARACTERISTICS** TABLE 9.3

| PARAMETER | | | MINIMUM | NOMINAL | MAXIMUM | UNITS | NOTE |
|---|---|---|---|---|---|---|---|
| LOAD | | | - | 15 | - | pF | |
| Voltage | (High) | (Voh) | Vcc-0.5 | - | - | Vdc | |
| | (Low) | (Vol) | - | - | 0.4 | 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% | | | - | - | 6 | nS | |

**PACKAGE CHARACTERISTICS** TABLE 10.3

| | |
|---|---|
| PF1xxxx-Series DIP Package | 14 pin DIP, hermetically sealed, grounded, welded package. |
| PF2xxxx-Series Surface Mount Package | Surface Mount, Non-hermetic package consisting of an FR4 substrate with grounded metal cover. |

Notes:
9.3) Initial calibration @ 25C. VCOCXO model Vc = 2.0 Vdc.
10.3) Frequency stability vs. Change in temperature, referenced to 25C.
11.3) Frequency stability per 5% change in supply voltage.
12.3) At the time of shipment after 48 hours of operation.
13.3) Inclusive of calibration, operating temperature range, supply voltage change, shock and vibration 20 years aging, VCOCXO models Vc=2.0V.
14.3) Typical phase noise, results will vary depending on center frequency. The phase noise shown are typical for 20 MHz.
15.3) Measured @ 25C, within 5 minutes, the unit will be within +/-0.1ppm of its reference frequency, measured after 30 minutes of continuous operation at a stable 25C.
16.3) VCOCXO models pullability referenced to Fo @ 25°C, Positive Transfer Characteristic.

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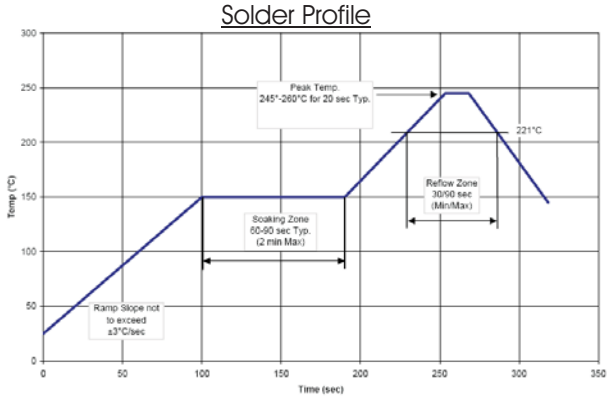
# 14 Pin DIP Package Environmental Characteristics

**ENVIRONMENTAL CHARACTERISTICS**
Temperature Cycle: Per MIL-STD-883, Method 1010, Condition B. -55°C to 125°C, 300 cycles, 10 minute dwell, 1minute transition.
Gross Leak Test: Per MIL-STD-202, Method 112, Condition D. No Bubbles in flourinert (FC-43) at 125°C ±5°C for 20 seconds.
**SOLDERING**
Pin Solderability: Per MIL-STD-883, Method 2003. 8 hour steam age prior to 254°C ±5°C Solder pot dip, 95% Coverage.
Resistance to Solder Heat: Per MIL-STD-202, Method 210, Condition C. Wave: Topside board-mount product, 260°C ±5°C for 20 seconds.
**MECHANICAL CHARACTERISTICS**
Vibration: Per MIL-STD-202, Method 204, Condition A. 10G's peak, 10Hz to 500Hz, 15 minute cycles 12 times each perpendicular axis.
Shock: Per MIL-STD-202, Method 213, Condition F. 1500G's, 0.5ms, half sine, 3 shocks per direction.
Moisture Resistance: Per MIL-STD-202, Method 106. 95% RH @ 65°C, 10 cycles 10°C to 65°C.

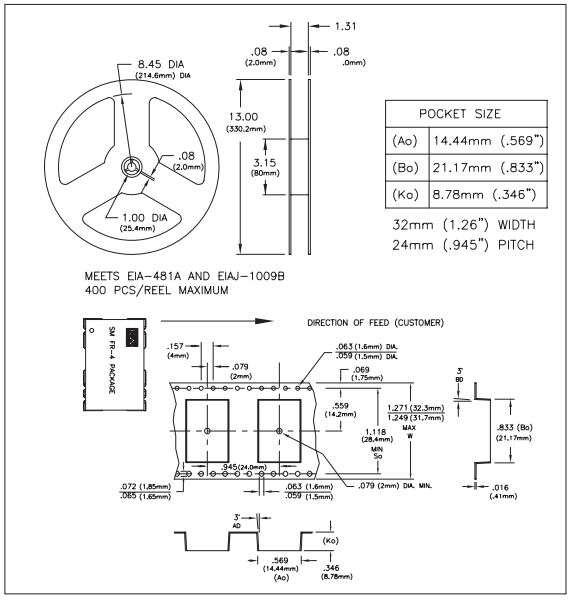
# Surface Mount Package Environmental Characteristics

**ENVIRONMENTAL CHARACTERISTICS**
Temperature Cycle: Per MIL-STD-883, Method 1010, Condition B. -55°C to 125°C, 300 cycles, 10 minute dwell, 1minute transition.
**MECHANICAL CHARACTERISTICS**
Vibration: Per MIL-STD-202, Method 204, Condition A. 10G's peak, 10Hz to 500Hz, 15 minute cycles 12 times each perpendicular axis.
Shock: Per MIL-STD-202, Method 213, Condition F. 1500G's, 0.5ms, half sine, 3 shocks per direction.
Moisture Resistance: Per MIL-STD-202, Method 106. 95% RH @ 65°C, 10 cycles 10°C to 65°C.

## Solder Profile



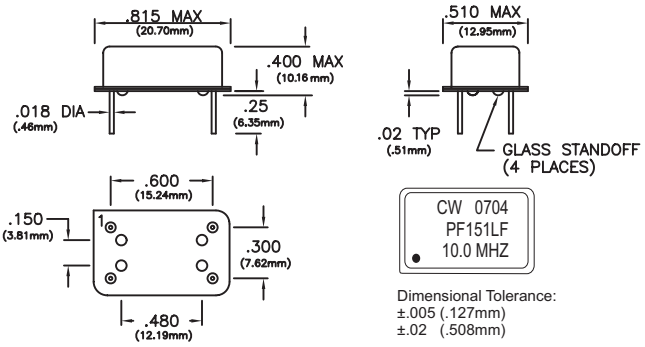

## Tape and Reel Information




| POCKET SIZE | |
|---|---|
| (Ao) | 14.44mm (.569") |
| (Bo) | 21.17mm (.833") |
| (Ko) | 8.78mm (.346") |

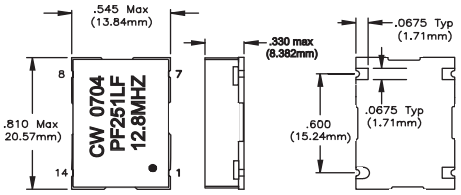
32mm (1.26") WIDTH
24mm (.945") PITCH

## 14 Pin DIP Package Outline

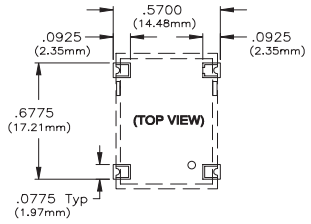



Dimensional Tolerance:
±.005 (.127mm)
±.02 (.508mm)

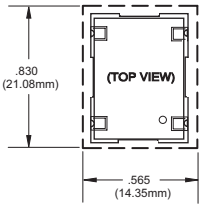
## Surface Mount Package Outline



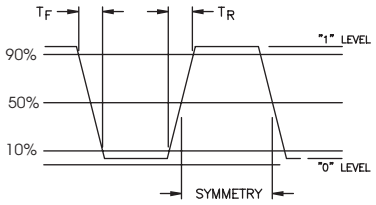

## Suggested Pad Layout




## Keep Out Area



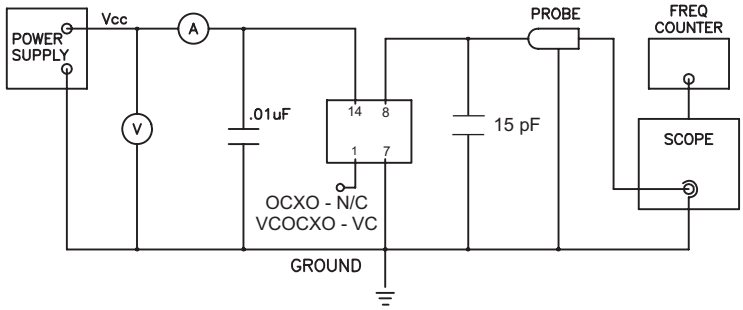

## Output Waveform




## Pin Connections

| Pin | Function |
|---|---|
| 1 | OCXO – N/C<br>VCOCXO - Voltage Control |
| 7 | Ground (Case) |
| 8 | Output |
| 14 | Vcc |

## Test Circuit

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