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# Surface Mount Oven Stabilized Oscillator DOC Series

OCXO / VCOCXO

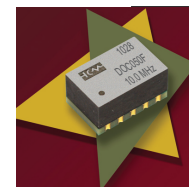
CONNOR  
WINFIELD

## Description:

Connor-Winfield's high stability DOC series are exceptionally precise frequency standards, excellent for use in cellular base stations, test equipment, Synchronous Ethernet and VSAT applications.

These true surface mount OCXO / VCOCXO oscillators provide frequency stabilities in the range of  $\pm 20$  ppb to  $\pm 100$  ppb, over the commercial, extended commercial or the industrial temperature range.

The DOC series is available with a CMOS output and a Voltage Controlled Option. These oscillators provide outstanding phase noise characteristics that will meet the most stringent requirements.



## Features:

OCXO - Fixed Frequency  
VCOCXO - Voltage Controlled Option

3.3 Vdc Operation

SMT Package

Frequency Stabilities Available:

$\pm 20$  ppb,  $\pm 50$  ppb or  $\pm 100$  ppb

Temperature Ranges Available:

0 to 70°C, -20 to 75°, -40 to 85°C  
or -40 to 70°C

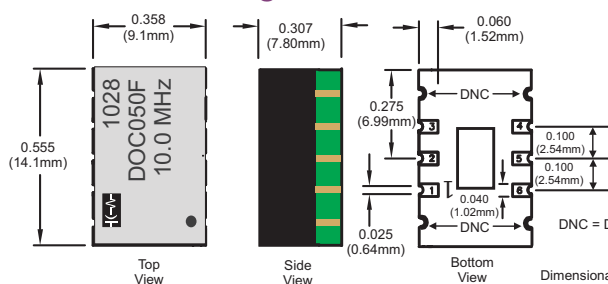
Low Phase Noise

LVC MOS Output

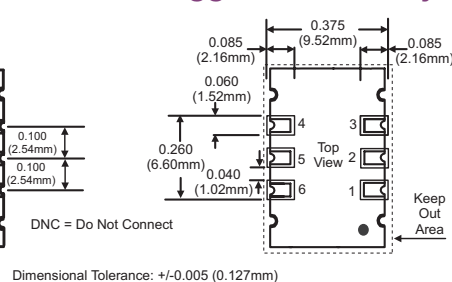
Optional Electronic Frequency Tuning

RoHS Compliant / Lead Free

## Package Outline



## Suggested Pad Layout



Attention: System Designers please review Application Note AN2093:  
System Design Information and Printed Circuit Board Layout Guidelines for OCXO Oscillators.  
@ [www.conwin.com/technologies.html](http://www.conwin.com/technologies.html)

## Pad Connections

- 1: N/C or Voltage Control (Vc)
- 2: Do Not Connect\*
- 3: Ground:
- 4: Output
- 5: Do Not Connect\*
- 6: Supply Voltage (Vcc)

\*DO NOT connect "DNC" pads to ground or supply rails.

## Ordering Information

| DOC                                       | 05                                                                                 | 0                                                                      | F                                                         | -010.0M                                                |
|-------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------|-----------------------------------------------------------|--------------------------------------------------------|
| Oscillator Type                           | Frequency Stability                                                                | Temperature Range                                                      | Voltage Control Option                                    | Output Frequency                                       |
| 3.3 Vdc LVC MOS Output Surface Mount OCXO | 02 = $\pm 20$ ppb<br>05 = $\pm 50$ ppb<br>10 = $\pm 100$ ppb<br>25 = $\pm 250$ ppb | 0 = 0 to 70°C<br>1 = -20 to 75°C<br>2 = -40 to 85°C<br>3 = -40 to 70°C | F = OCXO (Fixed Freq.)<br>V = VCOCXO (Voltage Controlled) | Frequency Format<br>-xxx.xM Min.*<br>-xxx.xxxxxxM Max* |

\*Amount of numbers after the decimal point.  
M = MHz

Example Part Numbers:

DOC050F-010.0M = 9x14mm package,  $\pm 50$  ppb, 0 to 70°C, 3.3 Vdc, CMOS Output, OCXO, Output Frequency 10.0 MHz  
DOC022V-020.0M = 9x14mm package,  $\pm 20$  ppb, -40 to 85°C, 3.3 Vdc, CMOS Output, VCOCXO, 20.0 MHz



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## Absolute Maximum Ratings

| Parameter                      | Minimum | Nominal | Maximum | Units | Notes |
|--------------------------------|---------|---------|---------|-------|-------|
| Storage Temperature            | -55     | -       | 125     | °C    |       |
| Supply Voltage - 3.3 Vdc (Vcc) | -0.5    | -       | 4.5     | Vdc   |       |
| Control Voltage (Vc)           | -0.5    | -       | Vcc+0.5 | Vdc   |       |

## Operating Specifications

| Parameter                                                                 | Minimum                                      | Nominal | Maximum  | Units   | Notes |
|---------------------------------------------------------------------------|----------------------------------------------|---------|----------|---------|-------|
| Center Frequency: (Fo)                                                    | 10, 12.8, 19.44, 20, 25, 38.88, 40, 50 or 80 |         |          | MHz     |       |
| Frequency Stability vs. Change in Temperature: (See Ordering Information) |                                              |         |          |         |       |
| Stability Code 02                                                         | -20.0                                        | -       | 20.0     | ppb     | 1     |
| Stability Code 05                                                         | -50.0                                        | -       | 50.0     | ppb     | 1     |
| Stability Code 10                                                         | -100.0                                       | -       | 100.0    | ppb     | 1     |
| Operating Temperature Range: (See Ordering Information)                   |                                              |         |          |         |       |
| Temperature Code 0                                                        | 0                                            | -       | 70       | °C      |       |
| Temperature Code 1                                                        | -20                                          | -       | 75       | °C      |       |
| Temperature Code 2                                                        | -40                                          | -       | 85       | °C      |       |
| Temperature Code 3                                                        | -40                                          | -       | 70       | °C      |       |
| Frequency Calibration:                                                    | -1.0                                         | -       | 1.0      | ppm     | 2     |
| Frequency Stability vs Load                                               | -20                                          | -       | 20       | ppb     | ±5%   |
| Frequency Stability vs Voltage                                            | -20                                          | -       | 20       | ppb     | ±5%   |
| Aging: Daily:                                                             | -10                                          | -       | 10       | ppb/day | 3     |
| Aging: First Year:                                                        | -300                                         | -       | 300      | ppb     | 3     |
| Total Frequency Tolerance (20 Years)                                      | -4.60                                        | -       | 4.60     | ppm     | 4     |
| Supply Voltage: (Vcc)                                                     | 3.13                                         | 3.30    | 3.47     | Vdc     | 5     |
| Power Consumption: Vcc = Nominal Voltage                                  |                                              |         |          |         |       |
| Commercial Temperature Range, 0 to 70 °C                                  |                                              |         |          |         |       |
| Turn On                                                                   | -                                            | -       | 2.5      | W       |       |
| Steady State @ 25°C                                                       | -                                            | -       | 1.1      | W       |       |
| Industrial Temperature Range, -40 to 85 °C                                |                                              |         |          |         |       |
| Turn On                                                                   | -                                            | -       | 3.0      | W       |       |
| Steady State @ 25°C                                                       | -                                            | -       | 1.3      | W       |       |
| Phase Jitter: (BW: 12 KHz to Fo/2)                                        | -                                            | 0.5     | 1.0      | ps RMS  |       |
| Short Term Stability                                                      | -                                            | -       | 1.0E-9/s |         |       |
| Start-Up Time:                                                            | -                                            | -       | 10       | ms      |       |
| Warm Up Time (Within Specification @ 25°C)                                | -                                            | -       | 60       | s       |       |
| Warm Up Time (Within Specification @ -40°C)                               | -                                            | -       | 90       | s       |       |

## CMOS Output Characteristics

| Parameter                    | Minimum | Nominal | Maximum | Units | Notes |
|------------------------------|---------|---------|---------|-------|-------|
| Load                         | -       | 15      | -       | pF    | 6     |
| Output Voltage:              |         |         |         |       |       |
| Output Voltage: High (Voh)   | 2.7     | -       | -       | V     |       |
| Low (Vol)                    | -       | -       | 0.3     | V     |       |
| Output Current:              |         |         |         |       |       |
| High (Ioh)                   | -       | -       | -4      | mA    |       |
| Low (Iol)                    | -       | -       | 4       | mA    |       |
| Duty Cycle at 50% of Vcc     | 45      | 50      | 55      | %     |       |
| Rise / Fall Time: 10% to 90% | -       | -       | 6.5     | ns    |       |

## Input Characteristics - Voltage Controlled Option

| Parameter              | Minimum | Nominal | Maximum | Units | Notes |
|------------------------|---------|---------|---------|-------|-------|
| Control Voltage Range: | 0.30    | 1.65    | 3.00    | V     | 7     |
| Frequency Pullability: | ±10.0   | -       | -       | ppm   | 8     |
| Input Impedance        | 100K    | -       | -       | Ohms  |       |
| Linearity              | ±5      | -       | -       | %     |       |



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## Phase Noise Characteristics

### Typical Phase Noise for DOC050F - 010.0M

| Parameter        | Minimum | Nominal | Maximum | Units  | Notes |
|------------------|---------|---------|---------|--------|-------|
| @ 1 Hz offset    | -       | -67     | -       | dBc/Hz |       |
| @ 10 Hz offset   | -       | -100    | -       | dBc/Hz |       |
| @ 100 Hz offset  | -       | -130    | -       | dBc/Hz |       |
| @ 1 KHz offset   | -       | -148    | -       | dBc/Hz |       |
| @ 10 KHz offset  | -       | -154    | -       | dBc/Hz |       |
| @ 100 KHz offset | -       | -155    | -       | dBc/Hz |       |

## Package Characteristics

|             |                                                                                                                                                                       |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DOC Package | Package consisting of a FR-4 substrate and Ryton-R-4 cover. Water Resistant package, non-hermetic seal. (Engineering Properties of Ryton R-4 Application Note AN2100) |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Environmental Characteristics

|                      |                                                                                                    |
|----------------------|----------------------------------------------------------------------------------------------------|
| Shock                | 500 G's 1ms, Halfsine, 3 shocks per direction, per MIL-STD 202G, Method 213B Test Condition D.     |
| Sinusoidal Vibration | 0.06" D.A. or 10G's Peak, 10 to 500 Hz, per MIL-STD-202G, Method 204D, Test Condition A.           |
| Random Vibration     | 5.35 G's rms. 20 to 2000 Hz per MIL-STD-202G, Method 214, Test Condition 1A, 15 minutes each axis. |
| Moisture             | 10 cycles, 95% RH, Per MIL-STD-202G, Method 112.                                                   |
| Marking Permanency   | Per MIL-STD-202G, Method 215J.                                                                     |

Solder Process Recommendations: RoHS compliant, lead free. See solder profile on page 4.

|                       |                                                                                                                                                                                                                                                                                              |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| In-line reflow:       | Refer to recommended reflow pre-heat and reflow temperatures on page 4. Package material consist of Ryton R-4 high temperature cover with FR4 substrate. Component solder is Pb free high temperature eutectic alloy with a melting point of 221°C.]                                         |
| In-line oven profile: | We recommend using KIC profiler or similar device placing one of the thermocouples on the device to insure that the internal package temperature does not exceed 221°C.                                                                                                                      |
| Removal of device:    | If for any reason the device needs to be removed from the board, use a temperature controlled repair station with profile monitoring capabilities. Following a monitored profile will insure the device is properly pre-heated prior to reflow. Refer to IPC 610E for inspection guidelines. |

Recommended Cleaning Process: (If required)

Device is non-hermetic, water resistance with four weep holes, one in each corner to allow moisture to be removed during the drying cycle. We recommend in-line warm water wash with air knife and drying capabilities. If cleaner does not have drying capability, then use hot air circulated oven. Boards should be placed in the oven vertically for good water runoff

**Device must be dried properly prior to use!**

Note: If saponifier is used make sure the device is rinsed properly to insure all residues are removed. PH of saponifier should not exceed 10.

Drying Temperature: Between 85 to 100°C.

Drying Time: Time will vary depending on the board size.

**Caution: Do not submerge the device!**

## Notes:

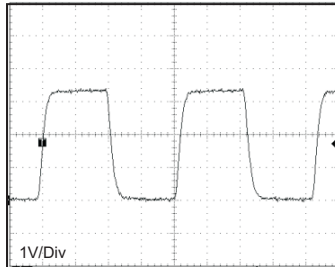
1. Frequency stability vs. change in temperature.  $[\pm(F_{max} - F_{min})/(2 \cdot F_0)]$ .
2. Initial calibration @ 25°C. For OCXO with EFT, the control voltage must be fixed.
3. After 30 days of operation
4. Inclusive of calibration @ 25°C, frequency vs. change in temperature, change in supply voltage ( $\pm 5\%$ ), load change ( $\pm 5\%$ ), shock and vibration and 20 years aging
5. Minimum "Power On Time" after rail rises from 0 to within  $\pm 5\%$  of  $V_{cc} = 1$  second.  
 $V_{cc}$  ramp rate must be  $< 0.3$  volts per millisecond.
6. Attention: To achieve optimal frequency stability, and in some cases to meet the specification stated on this data sheet, it is required that the circuit connected to this OCXO output must have the equivalent input capacitance that is specified by the nominal load capacitance. Deviations from the nominal load capacitance will have a graduated effect on the stability of approximately 20 ppb per pF load difference.
7. Positive slope. (Frequency increases as  $V_c$  voltage increases. To ensure proper operation of VCOCXO's, the control voltage input must be biased the nominal control voltage. Failure to bias the  $V_c$  input will cause an unstable output condition.
8. Referenced to  $F_0$ .



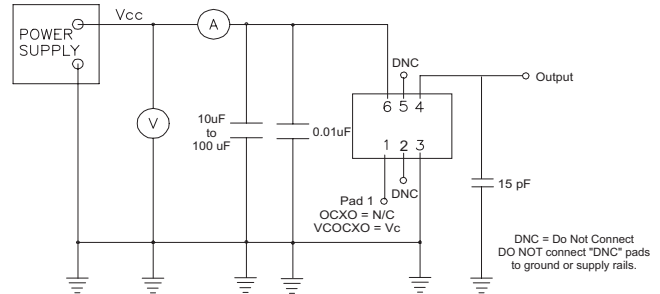
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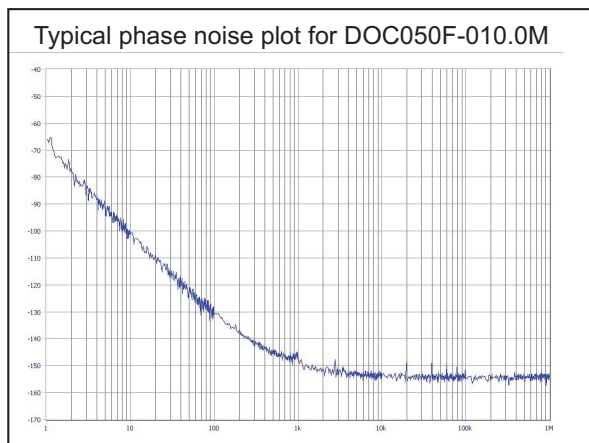
## CMOS Output Waveform



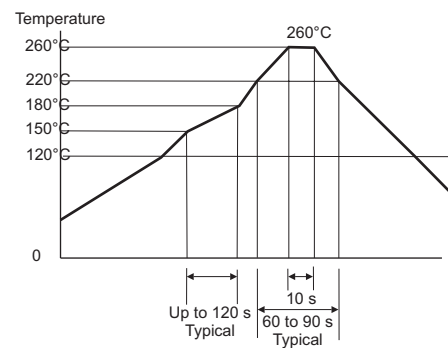
## CMOS Test Circuit



## Phase Noise Plot



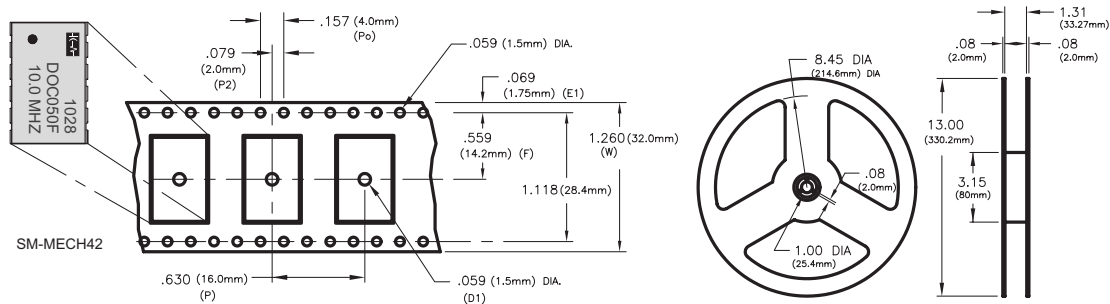
## RoHS Solder Profile



## Tape and Reel Information

MEETS EIA-481A & EIAJ-1009B  
500 PCS/REEL MAXIMUM

DIRECTION OF FEED (CUSTOMER)



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