



# Surface Mount Oven Stabilized Oscillator DOCSC Series

**OCXO or VCOCXO**

# CONNOR WINFIELD



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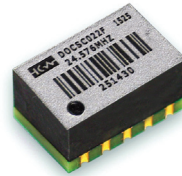
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## Description:

Connor-Winfield's high stability DOCSC Series is an exceptionally precise frequency standard, excellent for use in cellular base stations, test equipment, Synchronous Ethernet and VSAT applications.

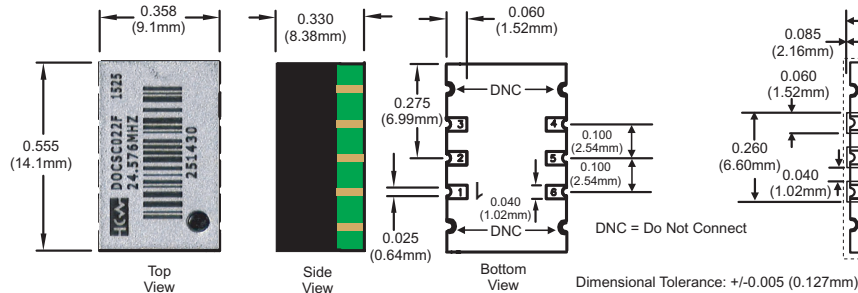
Based on an SC-cut crystal, the DOCSC Series offers low aging and tight stability in a 9x14mm surface mount package.



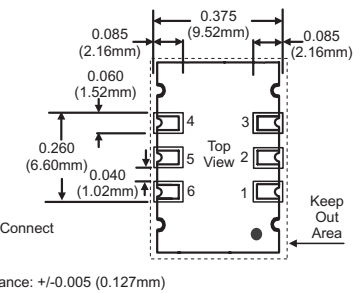
## Features:

- OCXO or VCOCXO
- 3.3 Vdc Operation
- SMT Package
- Frequency Stability  $\pm 20$  ppb
- Temperature Ranges:  
0 to 70°C, -20 to 75°C or -40 to 85°C
- Low Phase Noise
- LVC MOS Output
- RoHS Compliant / Lead Free

## Package Outline



## Suggested Pad Layout



## Pad Connections

- 1: N/C or Voltage Control
- 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

|   |  |  |   |  |
|---|--|--|---|--|
| <b>DOCSC</b>  | <b>02</b>                                  | <b>0</b>   | <b>F</b>  | <b>-024.576M</b>   |
| Oscillator Type<br>3.3 Vdc<br>LVC MOS Output<br>Surface Mount<br>OCXO | Frequency Stability<br>02 = $\pm 20.0$ ppb | Temperature Range<br>0 = 0 to 70°C<br>1 = -20 to 75°C<br>2 = -40 to 85°C | Voltage Control Option<br>F = OCXO (Fixed Freq.)<br>V = VCOCXO (Voltage Controlled) | Output Frequency<br>Frequency Format<br>-xxx.xM Min *<br>-xxx.xxxxxM Max * |

\* Number of allowable digits after the decimal point.  
M = 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      | -       | 40      | MHz     |       |
| Frequency Stability vs. Change in Temperature<br>Option 02                                     | -20     | -       | 20      | ppb     | 1     |
| Operating Temperature Range<br>Option 0  | 0       | -       | 70      | °C      |       |
| Option 1   | -20     | -       | 75      | °C      |       |
| Option 2   | -40     | -       | 85      | °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   | -5.0    | -       | 5.0     | ppb/day | 3     |
| Aging: First Year  | -0.3    | -       | 0.3     | ppm     |       |
| Total Frequency Tolerance (20 Years)   | -3.0    | -       | 3.0     | ppm     | 4     |
| Supply Voltage (Vcc)   | 3.13    | 3.30    | 3.47    | Vdc     | 5     |
| Power Consumption Vcc = Nominal Voltage<br>Commercial Temperature Range: 0 to 70 °C<br>Turn On | -       | -       | 2.5     | W       |       |
| Steady State @ 25°C  | -       | -       | 1.1     | W       |       |
| Industrial Temperature Range: -40 to 85 °C<br>Turn On  | -       | -       | 3.0     | W       |       |
| Steady State @ 25°C  | -       | -       | 1.3     | W       |       |
| Phase Jitter: (BW: 12 KHz to 5MHz @ Fo=40.0MHz)  | -       | 0.25    | 0.35    | ps RMS  |       |
| Allan Deviation (Tau=1s)   | -       | 3.0E-11 | -       |         |       |
| 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<br>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    |       |

## Typical Phase Noise Characteristics

| Parameter        | Fo=10 MHz | Fo=24.576MHz | Fo=40.0MHz | Units  | Notes |
|------------------|-----------|--------------|------------|--------|-------|
| @ 1 Hz offset    | -72       | -70          | -67        | dBC/Hz |       |
| @ 10 Hz offset   | -100      | -96          | -90        | dBC/Hz |       |
| @ 100 Hz offset  | -128      | -125         | -116       | dBC/Hz |       |
| @ 1 KHz offset   | -145      | -145         | -139       | dBC/Hz |       |
| @ 10 KHz offset  | -151      | -151         | -147       | dBC/Hz |       |
| @ 100 KHz offset | -154      | -154         | -153       | dBC/Hz |       |
| @ 1MHz offset    | -155      | -155         | -153       | dBC/Hz |       |



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## Input Characteristics - Voltage Controlled Option

| Parameter              | Minimum | Nominal | Maximum | Units | Notes |
|------------------------|---------|---------|---------|-------|-------|
| Control Voltage Range: | 0.30    | 1.65    | 3.00    | V     | 7     |
| Frequency Pullability: | ±3.0    | -       | ±10.0   | ppm   | 8     |
| Input Impedance        | 100K    | -       | -       | Ohms  |       |
| Linearity              | -       | -       | ±5      | %     |       |

## 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

|  |  |
|--|--|
| <b>Shock</b>                           | 500 G's 1ms, Halfsine, 3 shocks per direction, per MIL-STD 202G, Method 213B Test Condition D.   |
| <b>Sinusoidal Vibration</b>            | 0.06" D.A. or 10G's Peak, 10 to 500 Hz, per MIL-STD-202G, Method 204D, Test Condition A.   |
| <b>Random Vibration</b>                | 5.35 G's rms. 20 to 2000 Hz per MIL-STD-202G, Method 214, Test Condition 1A, 15 minutes each axis.   |
| <b>Moisture</b>                        | 10 cycles, 95% RH, Per MIL-STD-202G, Method 112.   |
| <b>Marking Permanency</b>              | Per MIL-STD-202G, Method 215J.   |
| <b>Solder Process Recommendations:</b> | RoHS compliant, lead free. See solder profile on page 4.   |
| <b>In-line reflow:</b>                 | 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.  |
| <b>In-line oven profile:</b>           | 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.  |
| <b>Removal of device:</b>              | 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 voltage control option, the control voltage must be fixed.
3. After 10 days of operation
4. Inclusive of calibration @ 25°C, frequency vs. change in temperature, change in supply voltage (±5%), load change (±5%), shock and vibration and 20 years aging
5. Minimum "Power On Time" after rail rises from 0 to within +/-5% of Vcc = 1 second. Vcc 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 Vc voltage increases). To ensure proper operation of VCOCXO's, the control voltage input must be biased the nominal control voltage. Failure to bias the Vc input will cause an unstable output condition.
8. Referenced to Fo.

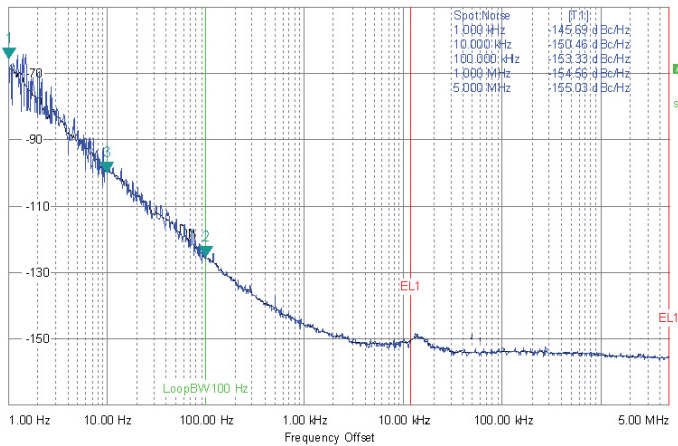


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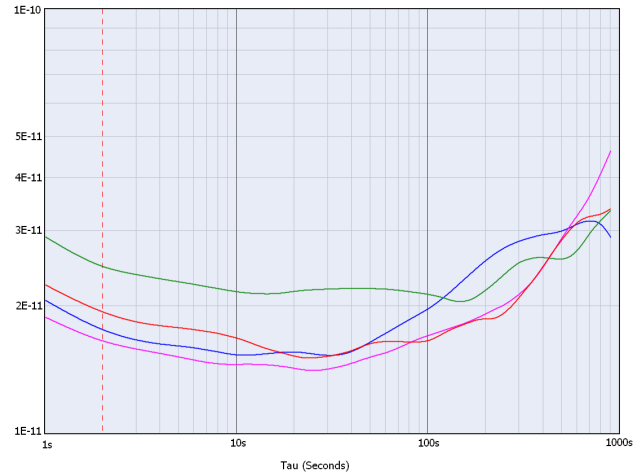
## Phase Noise Plot

Typical Phase Noise for DOCSC022V-024.576M

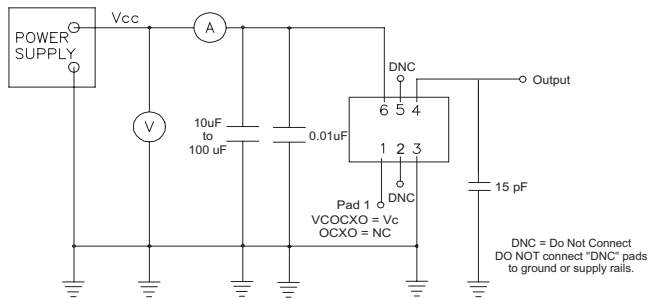


## Allan Deviation Plot

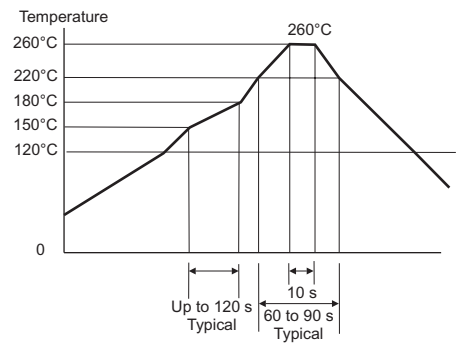
Allan Deviation DOCSC022F-024.576M



## LVC MOS Test Circuit



## RoHS Solder Profile

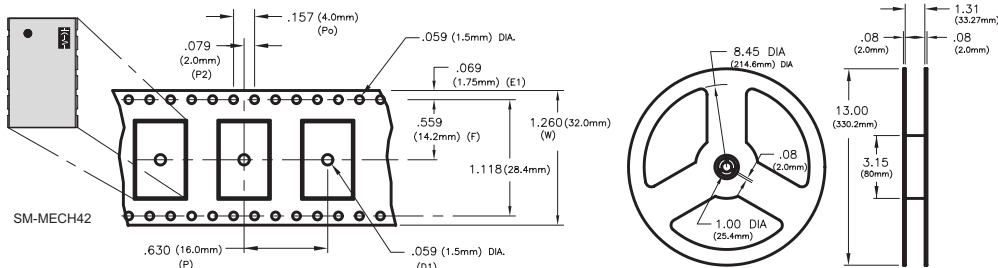


Meets IPC/JEDEC J-STD-020C

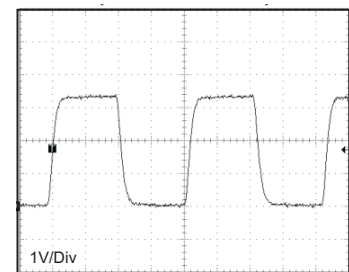
## Tape and Reel Information

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

→ DIRECTION OF FEED (CUSTOMER)



## CMOS Output Waveform



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