MICROCHIP

Vectron Oscillators

# OX-4011-EAE-0580-20M000

OCXO




**Nominal frequency (f0)** **20 MHz**

## Features

- SC Cut Crystal
- hermetically sealed
- SMD

## Application

- Wander generation (Standard / ZLAN Group) MTIE & TDEV compliant with: - G.812 (zO1) - G.8273.4 (zO4;zO5) - G.8263 (zO6);
- S3E compliant according GR1244

## Performance Specifications

| Frequency stabilities | | | | | |
|---|---|---|---|---|---|
| Parameter | Min | Typical | Max | Units | Condition |
| Over all (df/f0) | -1.5 | | +1.5 | ppm | -40...85°C include: Temp. Stab, supply, load stab, inital, 20 years aging |
| vs. operating temp. range (df/f@25°C) | -5 | | +5 | ppb | -40...85°C |
| initial tolerance (df/f0) | -200 | | +200 | ppb | @25 °C |
| vs. supply voltage change (df/f) | -5 | | +5 | ppb | static; 3.3 V ±5 % |
| vs. load change (df/f)) | -5 | | +5 | ppb | static; Load +5 % -5 % |
| vs. aging / day (df/f) | -1 | | +1 | ppb | after 30 days ; @ 25 °C |
| vs. aging / year (df/f) | -100 | | +100 | ppb | after 30 days ; @ 25 °C |
| vs. aging / 20 years (df/f) | -1.5 | | +1.5 | ppm | after 30 days ; @ 25 °C |
| Holdover/Drift over 8 hours | | | 6 | µsec | temperature change of +5°C or -5°C after Holdover starts. (slope 0,5°C/ min); no voltage supply change and load change; To fulfill with an 4 sigma (99.38%) probability |

| Frequency stabilities | | | | | |
|---|---|---|---|---|---|
| Parameter | Min | Typical | Max | Units | Condition |
| Holdover/Drift over 4 hours | | | 2.25 | $\mu$sec | temperature change of +5°C or -5°C after Holdover starts. (slope 0,5°C/ min); no voltage supply change and load change; To fulfill with an 4 sigma (99.38%) probability |
| | | | 1.5 | $\mu$sec | temperature change of +2°C or -2°C after Holdover starts. (slope 0,5°C/ min); no voltage supply change and load change; To fulfill with an 4 sigma (99.38%) probability |
| | | | 1.6 | $\mu$sec | temperature change of +5°C or -5°C after Holdover starts. (linear change; slope: 0.02083°C/min); no voltage supply change and load change; To fulfill with an 4 sigma (99.38%) probability |
| Holdover/Drift over 1 hours | | | 0.75 | $\mu$sec | temperature change of +5°C or -5°C after Holdover starts. (slope 0,5°C/ min); no voltage supply change and load change; To fulfill with an 4 sigma (99.38%) probability |
| | | | 0.25 | $\mu$sec | temperature change of +2°C or -2°C after Holdover starts. (slope 0,5°C/ min); no voltage supply change and load change; To fulfill with an 4 sigma (99.38%) probability |
| | | | 0.25 | $\mu$sec | temperature change of +5°C or -5°C after Holdover starts. (linear change; slope: 0.02083°C/min); no voltage supply change and load change; To fulfill with an 4 sigma (99.38%) probability |

| Frequency stabilities | | | | | |
|---|---|---|---|---|---|
| Parameter | Min | Typical | Max | Units | Condition |
| Holdover/Drift over 30 minutes | | | 0.18 | $\mu$sec | temperature change of +5°C or -5°C after Holdover starts. (slope 0,5°C/ min); no voltage supply change and load change; To fulfill with an 4 sigma (99.38%) probability |
| | | | 0.12 | $\mu$sec | temperature change of +2°C or -2°C after Holdover starts. (slope 0,5°C/ min); no voltage supply change and load change; To fulfill with an 4 sigma (99.38%) probability |
| | | | 0.13 | $\mu$sec | temperature change of +5°C or -5°C after Holdover starts. (linear change; slope: 0.02083°C/min); no voltage supply change and load change; To fulfill with an 4 sigma (99.38%) probability |
| Note: | For all Holdover/ Drift parameter a minimum power on time is required: see appendix page "recommended power on time after x days of power of" | | | | |
| slope | -0.4 | ±0.05 | +0.4 | ppb/°C | Temperature ramp <=1°C/ minute |

| RF output | | | | | |
|---|---|---|---|---|---|
| Parameter | Min | Typical | Max | Units | Condition |
| Signal | | LVCMOS | | | |
| Load | 13.5 | 15 | 16.5 | pF | |
| Fan out | | 3 | | | |
| Rise Time | | | 10 | ns | @10 to 90 %Vout |
| Fall Time | | | 10 | ns | @90 to 10 %Vout |
| Duty cycle | 45 | | 55 | % | @1.65 V |
| V Low | | | 0.4 | V | |
| V High | 2.4 | | | V | |
| Spurious | | | -80 | dBc | |

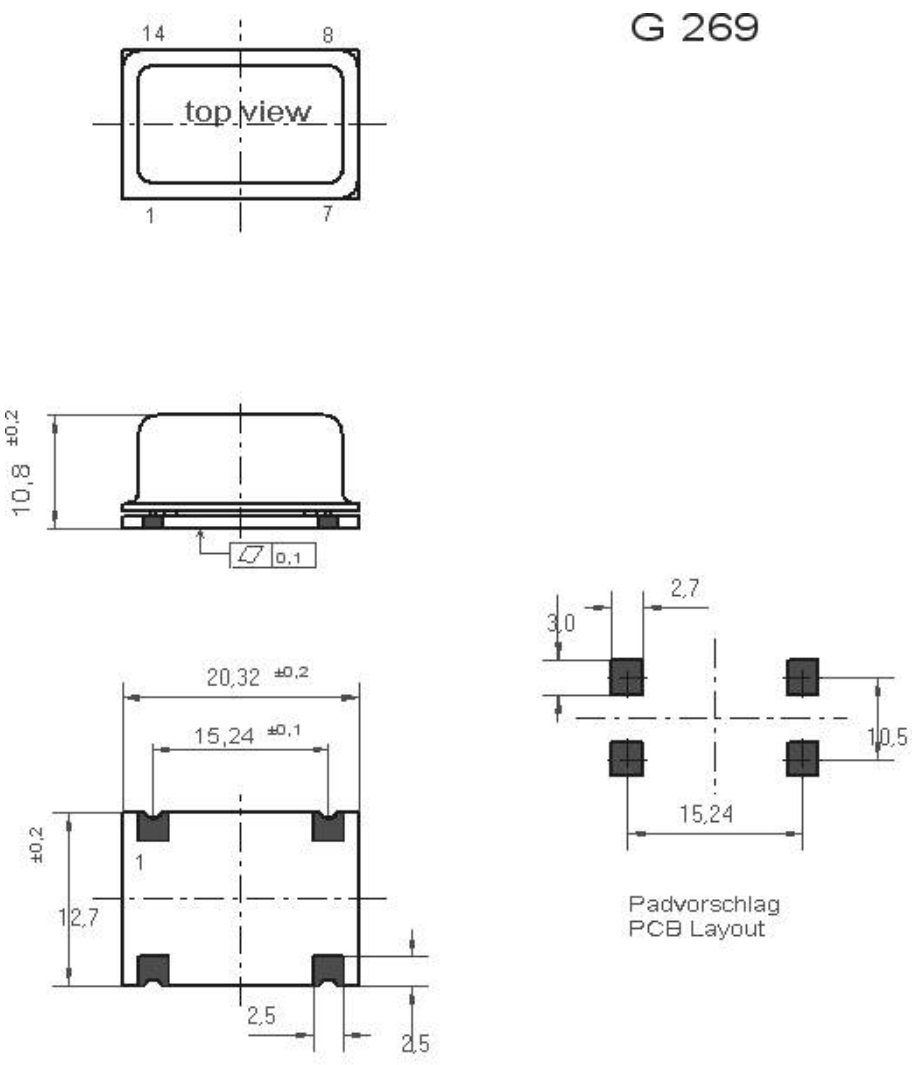
| Supply voltage | | | | | |
|---|---|---|---|---|---|
| Parameter | Min | Typical | Max | Units | Condition |
| Supply voltage (Vs) | 3.14 | 3.3 | 3.47 | V | |
| Current consumption steady state | | | 350 | mA | @ Vsnom & 25 °C |
| Current consumption during warm up | | | 850 | mA | @ Vs |

| Additional Parameters | | | | | |
|---|---|---|---|---|---|
| Parameter | Min | Typical | Max | Units | Condition |
| Warm up time | | | 3 | min | @ 25 °C to final frequency |
| Phase Noise | | -85 | -70 | dBc/Hz | @1Hz |
| | | -121 | -110 | dBc/Hz | @10Hz |
| | | -140 | -130 | dBc/Hz | @100Hz |
| | | -152 | -145 | dBc/Hz | @1kHz |
| | | -155 | -150 | dBc/Hz | @10kHz |
| Jitter | | 0.44 | 0.6 | psec (RMS) | @ 12kHz to 5MHz |
| Processing & Packing | handling&processing note | | | | |

| Additional Environmental Conditions | |
|---|---|
| Parameter | Description |
| RoHS compliance | 100% RoHS 6 compliant |
| Washable | yes |
| MSL-Level | 1 |
| ESD HBM | JESD22-A114F Class 1C - 10* 2000V |
| Mechanical Shock | MIL-STD-202 Meth 213B Cond. C - 100g 6ms 6 shocks in each direction |
| Vibration, Sine | MIL-STD-883 Meth 2007 Cond A - 20g 20-2000Hz 4x in each 3 axis 4min sweep time |
| Moisture Sen. Level | JESD22-A113-B - only if > MSL 1 |
| Solderabiltiy | J-STD-002C Cond. A, Through hole device; Cond.B, SMD ( correspond to MIL-STD-883 Meth 2003) - 255°C (diving Time 5 ±0,5sec.) Dip&Look with 8h damp pre-treatment: solder wetting >95% |
| High temp operating life(HTOL) | MIL-STD-202 Meth108A Cond C - 1000h @ 105°C power on |
| Low temp operating life(LTOL) | IEC 60068-2-1 Cond. Ae - 1000h @ -40°C power on |
| Reflow Simulation Test | MIL-STD-202G Meth 210F Cond. K - Total 3x Lead free profile (for SMD) |
| Temperature Cycling | JESD22-A104-D Cond.G - 700cycles -40/125°C; cycle time 30 min. |

| Absolute Maximum Ratings | | | | | |
|---|---|---|---|---|---|
| Parameter | Min | Typical | Max | Units | Condition |
| Supply voltage (Vs) | | | 5.5 | V | |
| Operable temperature range | -40 | | +85 | °C | |
| Storage temperature range | -40 | | +85 | °C | |

## Enclosure




all units in mm

| Enclosure Info | |
|---|---|
| Parameter | Description |
| Type | G269 |
| Height (H) | 10.8 mm |
| Weight | 5 g |
| Pin Connections | 1: I.C. (Do not connect)<br>7: GND(Case)<br>8: RF-Output<br>14: Vs (supply voltage) |
| Marking | OX-4011-EAE-0580<br>20M000<br>* VI AYYWW<br>* pin-1 marking |
| Package cover material | Metal |
| Package base material | Metal |

# Solder profile

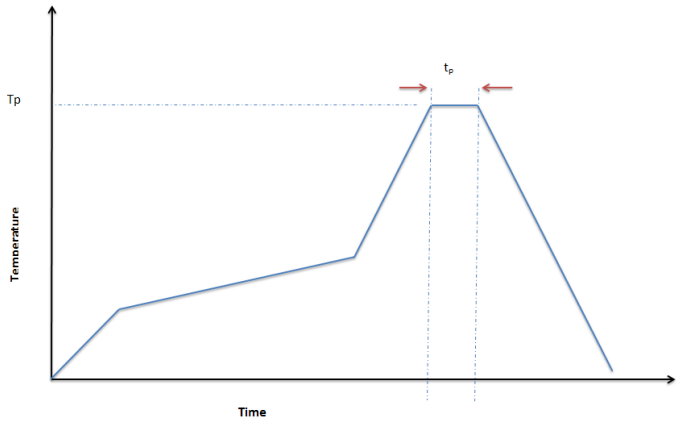
TP: max 260°C (@ solder joint, customer board level)

$T_p$: max: 10…30 sec

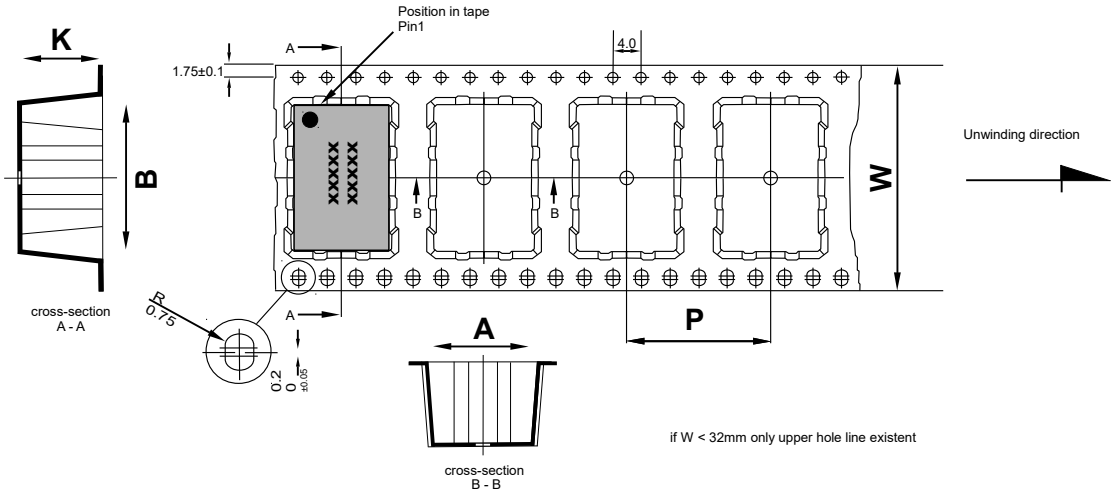
Additional Information:

This SMD oscillator has been designed for pick and place reflow soldering

SMD oscillators must be on the top side of the PCB during the reflow process.



# Standard shipping method



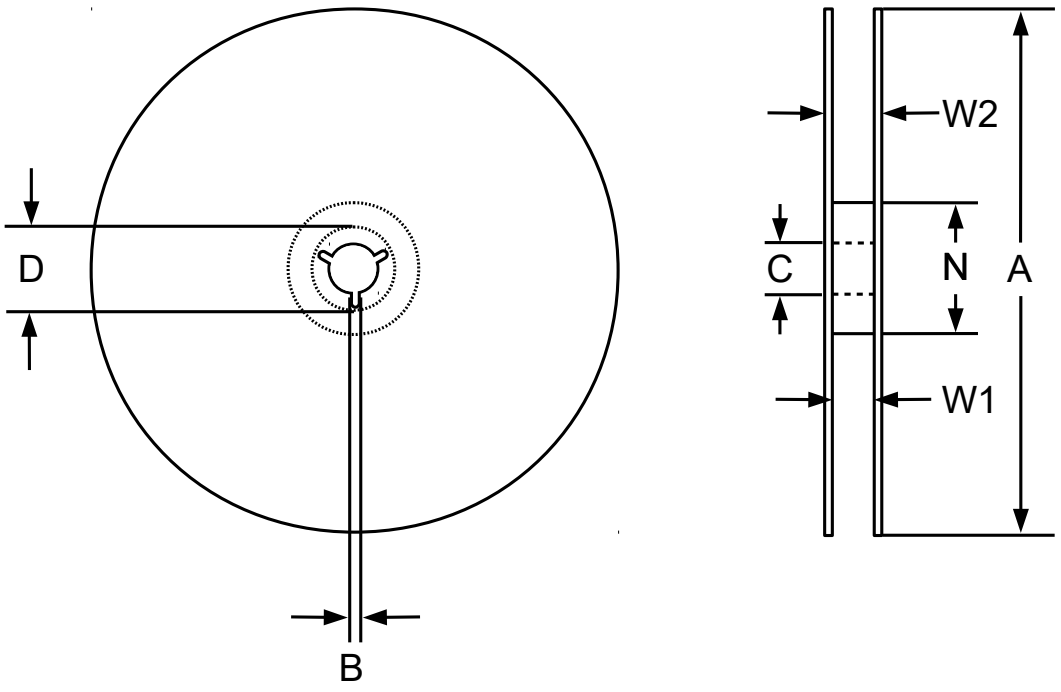

Dimension in mm:

A, B and K are dependent uppon component dimensions

production tolerance complying DIN IEC 286-3

All dimensions in millimeters unless otherwise stated

| Tape Info | | | | | | |
|---|---|---|---|---|---|---|
| Tape width W [mm] | Quantity per meter | Quantity per reel | P [mm] | A [mm] | B [mm] | K [mm] |
| 32 | 50 | 250 | 20 | 13.35 | 20.95 | 11.4 |




| Reel Info | | | | | | |
|---|---|---|---|---|---|---|
| A [mm] | B [mm] | Size C [mm] | D [mm] | N [mm] | W1 [mm] | W2 [mm] |
| 330 | 1.5 | 13 | 20.2 | 100 | 33.5 | 37.1 |

**Notes:** Unless otherwise stated all values are valid after warm-up time and refer to typical conditions for supply voltage, frequency control voltage, load, temperature (25°C).
Subject to technical modification.

## Contact Information


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# Appendix

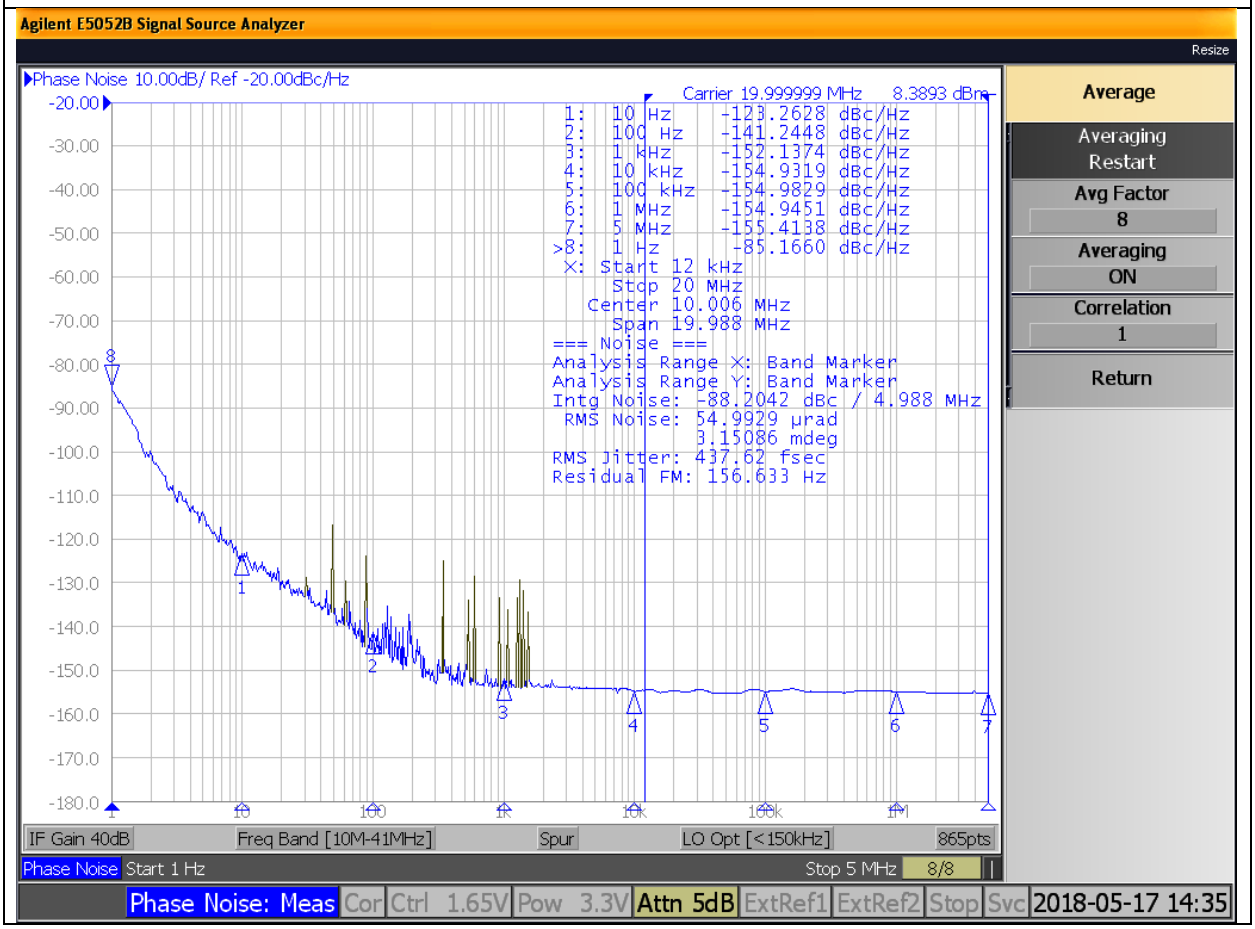
## List of appendices


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| Appendix_OX-4011-EAE-0580-20M000_Jitter | II |
| Appendix_OX-4011-EAE-0580-20M000_OX-401-9016-20M000_OX-4011-EAE-0580-10M000_MTIE_TDEV | III |
| Appendix_OX-221-OX-40x_Power_on_time | XI |
| Appendix handling&processing note | XII |

# Typical Performance Data

## Typical Phase Noise and Jitter

**OX-4011-EAE-0580-20M000**



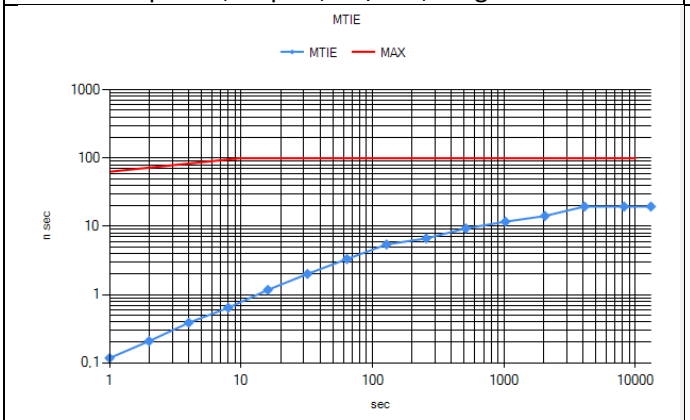
## Typical MTIE & TDEV performance

The following MTIE TDEV plots were generated from data collected on production devices over the course of a year and represent typical performance. Frequency is measured every second and converted to phase using Microchip's golden standard TimeMonitor software. Filtering is applied to the data per standards requirements, and limits where applicable, are shown in red. Additional information on standards and oscillator recommendations can be found in ZLAN-830 and ZLAN-3467 (formerly ZLAN-442 and ZLAN-68).

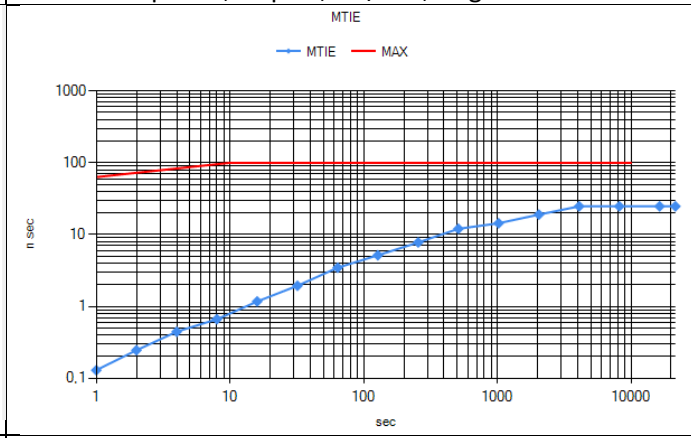
## Typical MTIE & TDEV performance for Oscillator Group zO1 (G.812) requirements

### Typical MTIE performance; Oscillator group zO1 ( loop bandwidth 1mHz)

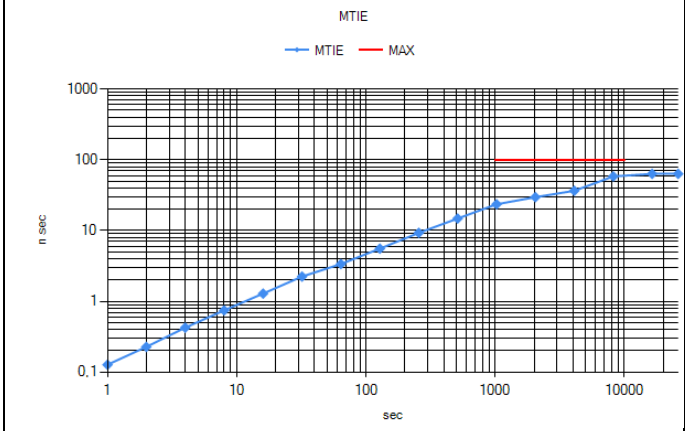
Const. Temp ±1°K; slope 0,1°C/min, range 21..23°C



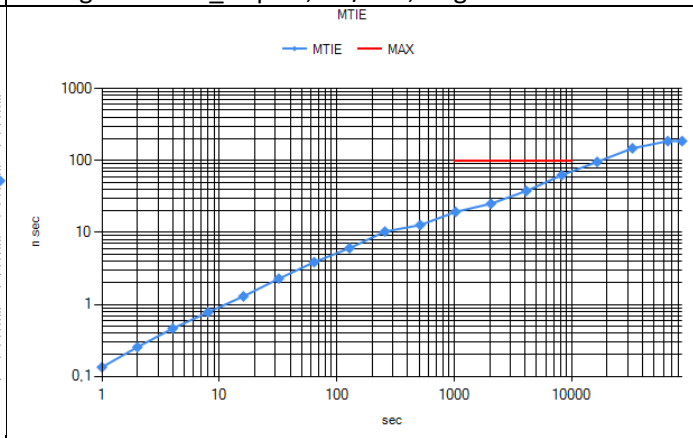

Const. Temp ±5°F; slope 0,1°C/min,range 19.22..24.78°C

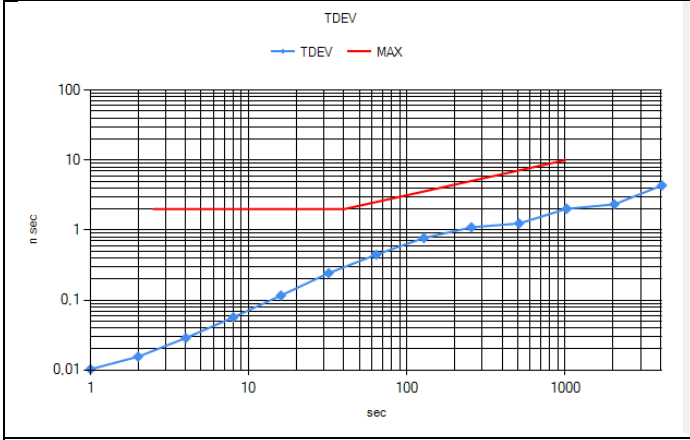
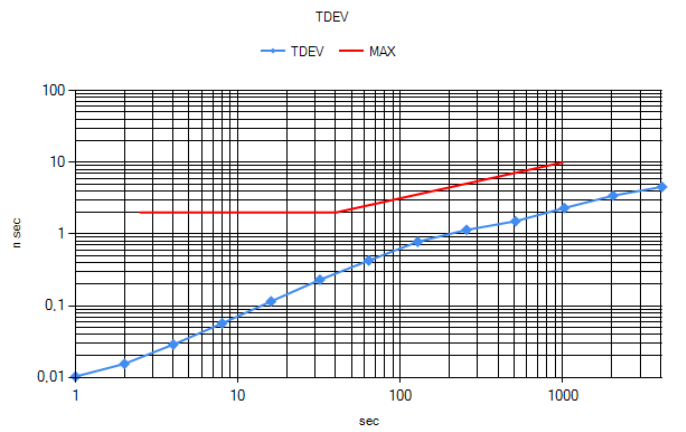
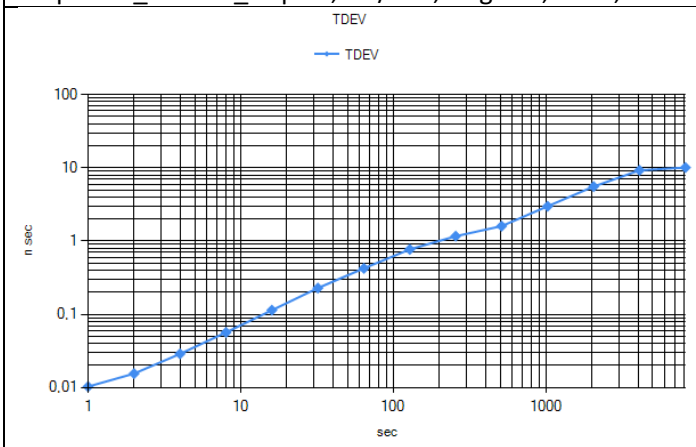
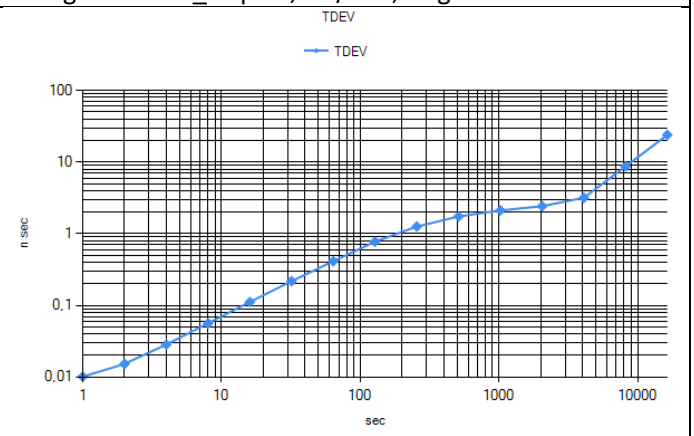



Trapezoid_Pattern_slope 0,5°C/min,range +2,5...42,5°C




Triangle-Pattern_slope 0,2°C/min,range -40...85°C

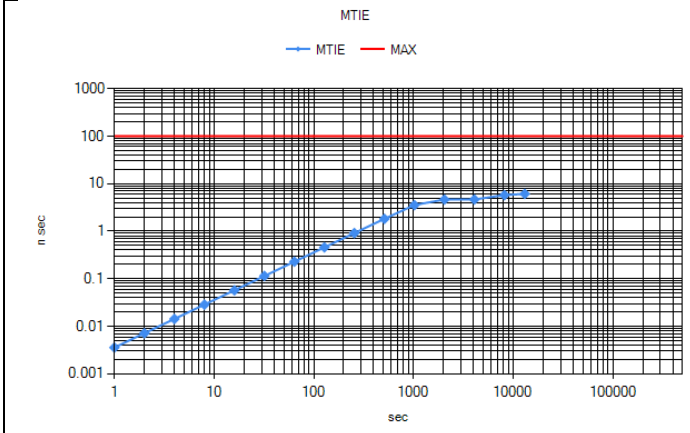


| Typical TDEV performance; Oscillator group zO1 ( loop bandwidth 1mHz) | |
|---|---|
| Const. Temp ±1°K; slope 0,1°C/min, range 21..23°C | Const. Temp ±5°F; slope 0,1°C/min,range 19.22..24.78°C |
|  |  |
| Trapezoid_Pattern_slope 0,5°C/min,range +2,5...42,5°C | Triangle-Pattern_slope 0,2°C/min,range -40...85°C |
|  |  |

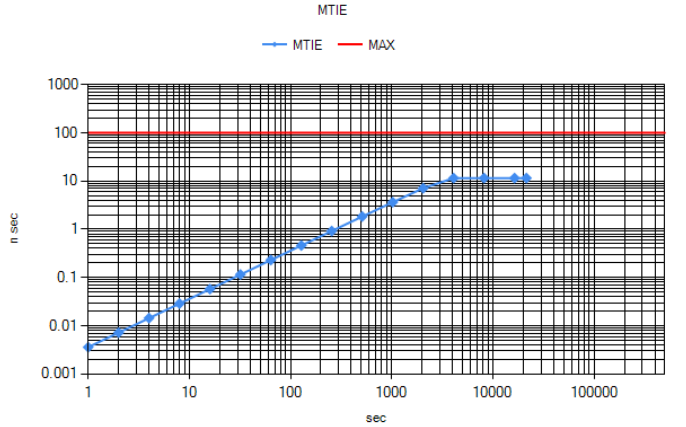
## Typical MTIE & TDEV performance for Oscillator Group zO4 (G8273.4)requirements

### Typical MTIE performance; Oscillator group zO4 ( loop bandwidth 1mHz)

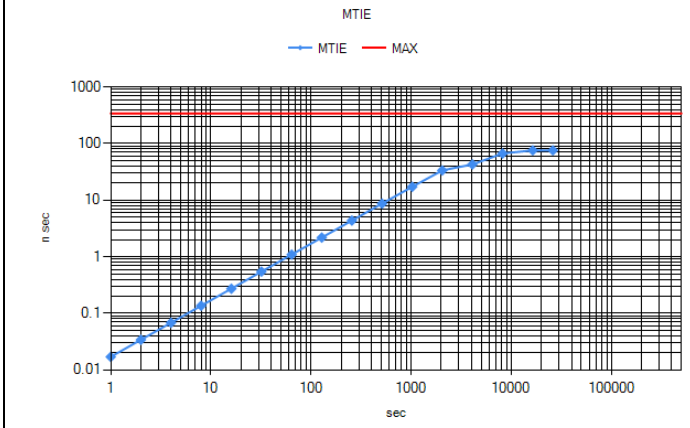
Const. Temp ±1°K; slope 0,1°C/min, range 21..23°C



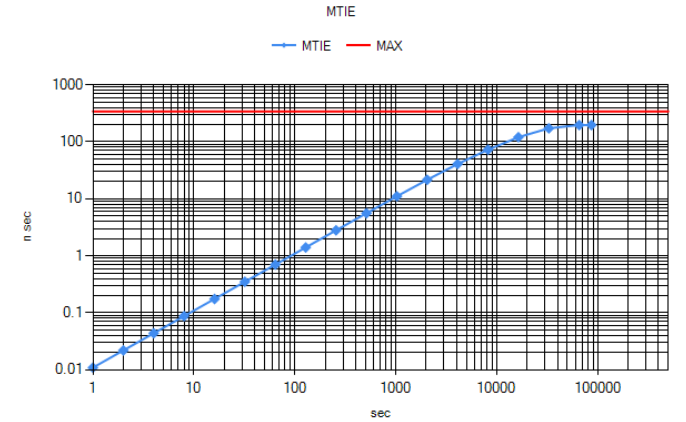

Const. Temp ±5°F; slope 0,1°C/min,range 19.22..24.78°C

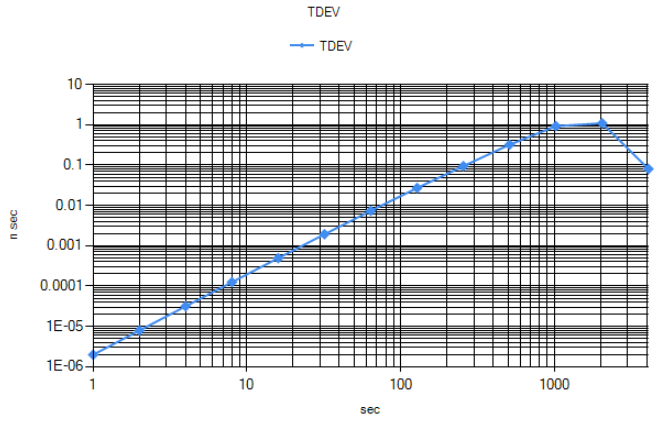
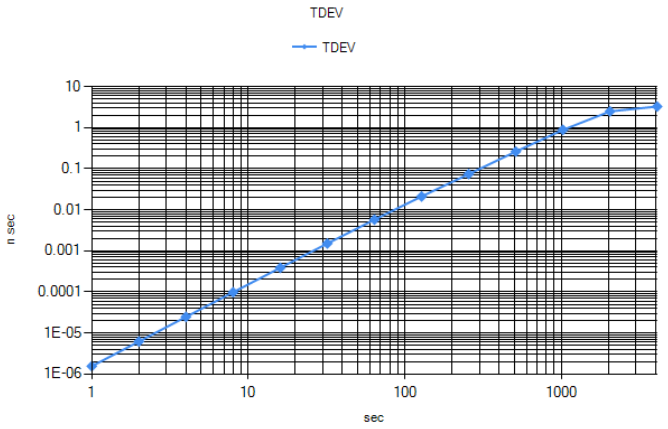
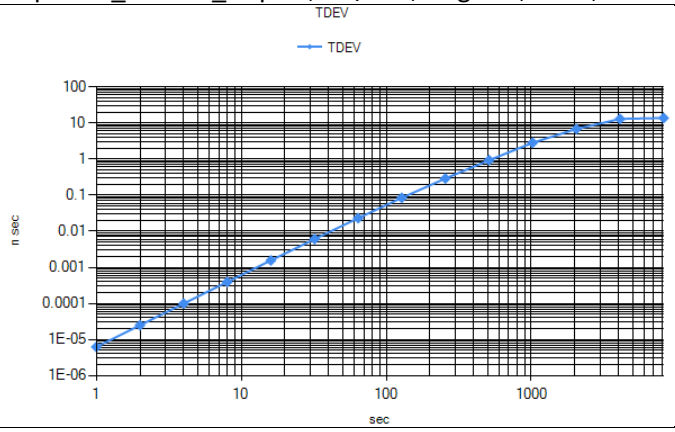
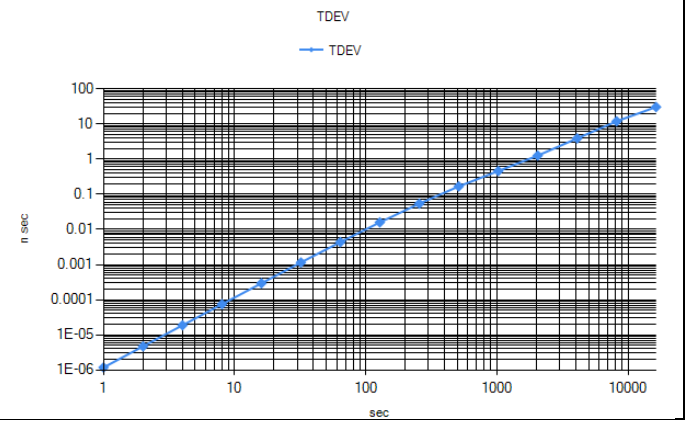



Trapezoid_Pattern_slope 0,5°C/min,range +2,5...42,5°C




Triangle-Pattern_slope 0,2°C/min,range -40...85°C

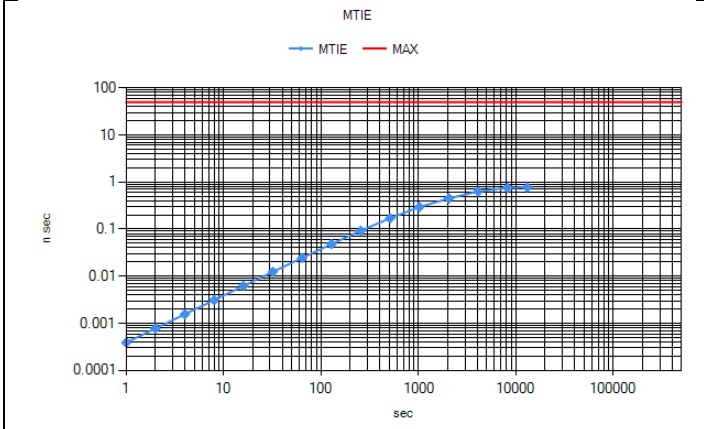


| Typical TDEV performance; Oscillator group zO4( loop bandwidth 1mHz) | |
|---|---|
| Const. Temp ±1°K; slope 0,1°C/min, range 21..23°C | Const. Temp ±5°F; slope 0,1°C/min,range 19.22..24.78°C |
|  |  |
| Trapezoid_Pattern_slope 0,5°C/min,range +2,5...42,5°C | Triangle-Pattern_slope 0,2°C/min,range -40...85°C |
|  |  |

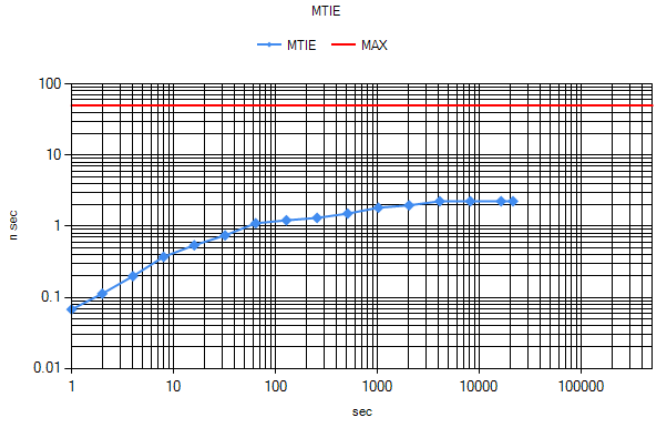
## Typical MTIE & TDEV performance for Oscillator Group zO5 (G8273.4) requirements

### Typical MTIE performance; Oscillator group zO5 ( loop bandwidth 10mHz)

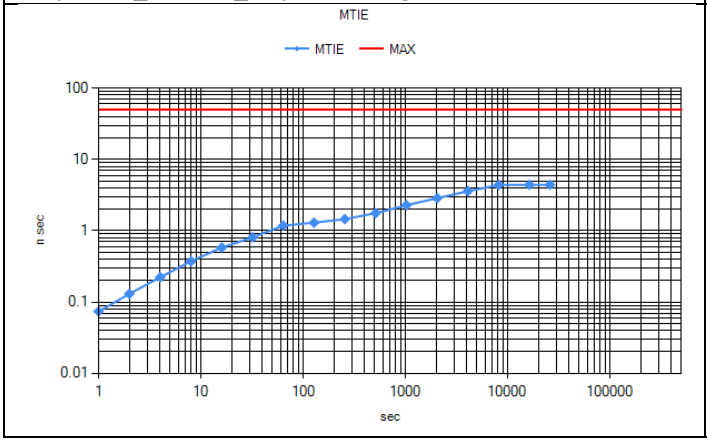
Const. Temp ±1°K; slope 0,1, range 21..23°C



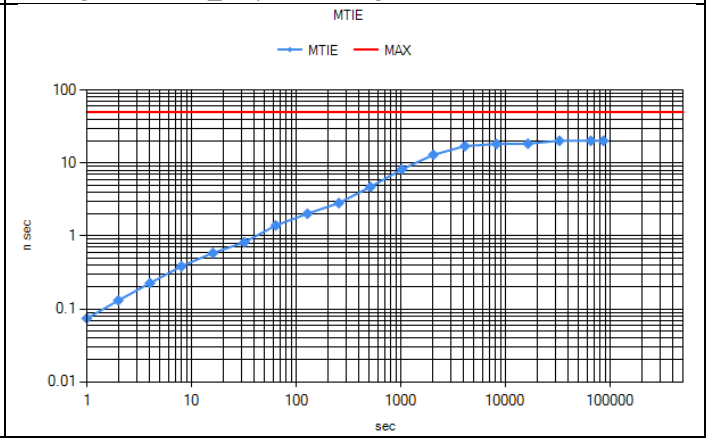

Const. Temp ±5°F; slope 0,1,range 19.22..24.78°C

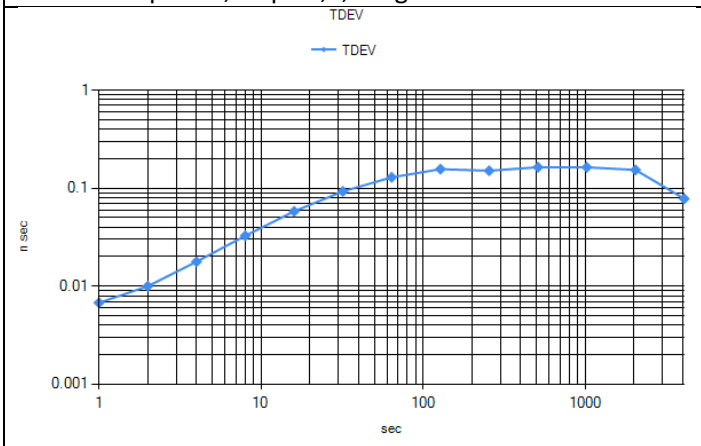
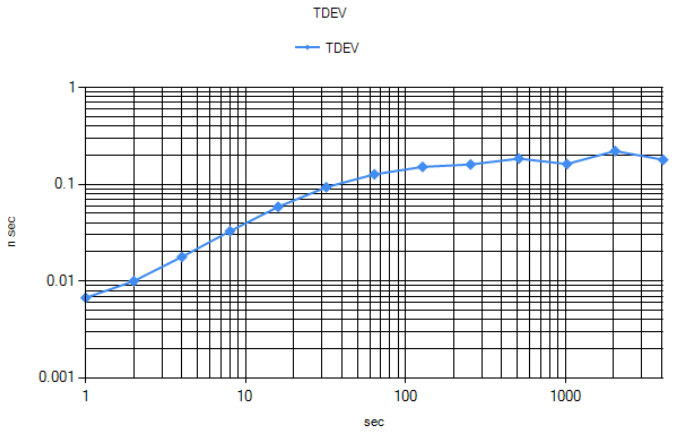
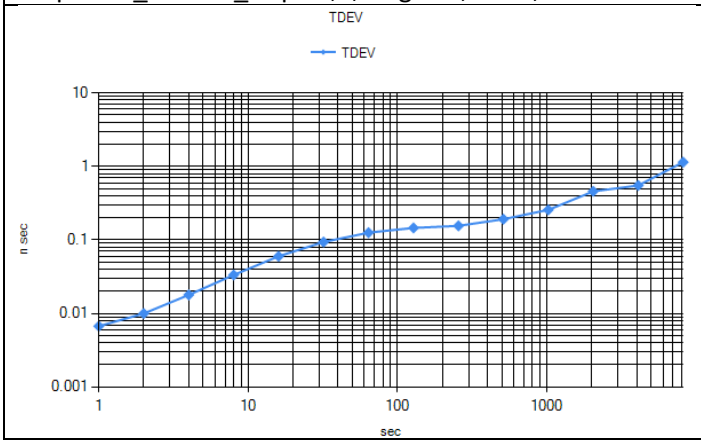
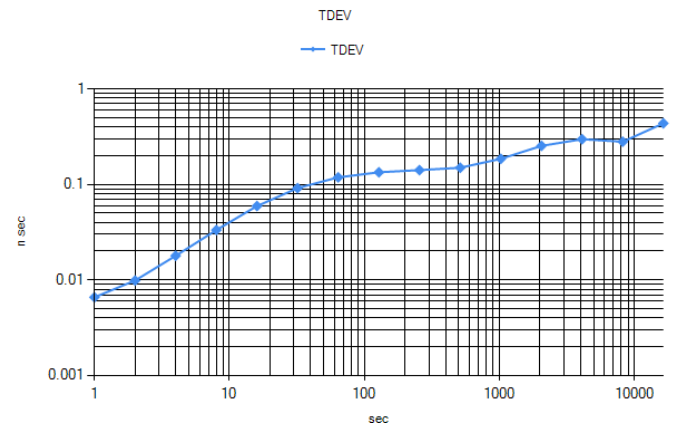



Trapezoid_Pattern_slope 0,5,range +2,5...42,5°C




Triangle-Pattern_slope 0,2,range -40...85°C

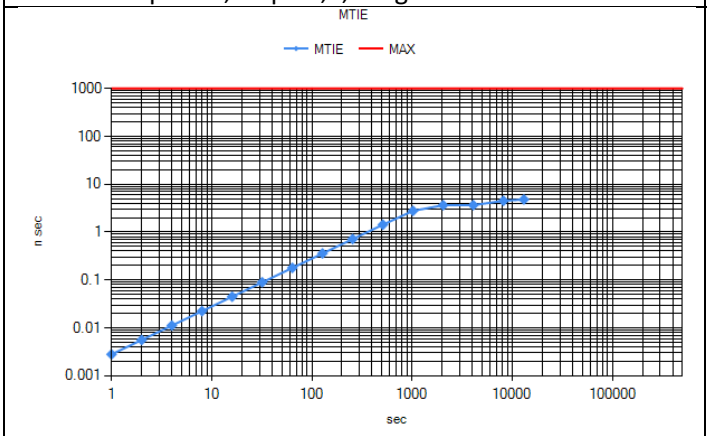


| Typical TDEV performance; Oscillator group zO5( loop bandwidth 10mHz) | |
|---|---|
| Const. Temp ±1°K; slope 0,1, range 21..23°C | Const. Temp ±5°F; slope 0,1,range 19.22..24.78°C |
|  |  |
| Trapezoid_Pattern_slope 0,5,range +2,5...42,5°C | Triangle-Pattern_slope 0,2,range -40...85°C |
|  |  |

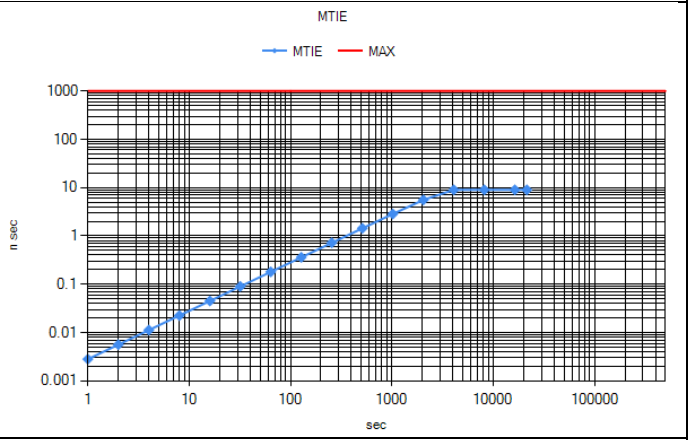
## Typical MTIE & TDEV performance for Oscillator Group zO6 (G.8263) requirements

### Typical MTIE performance; Oscillator group zO6 ( loop bandwidth 1mHz)

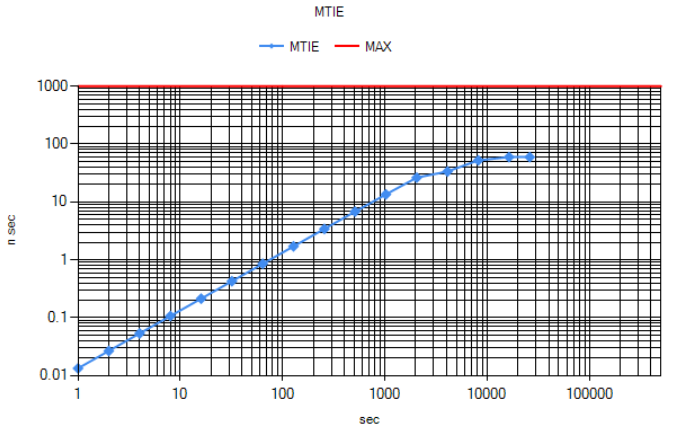
Const. Temp ±1°K; slope 0,1, range 21..23°C



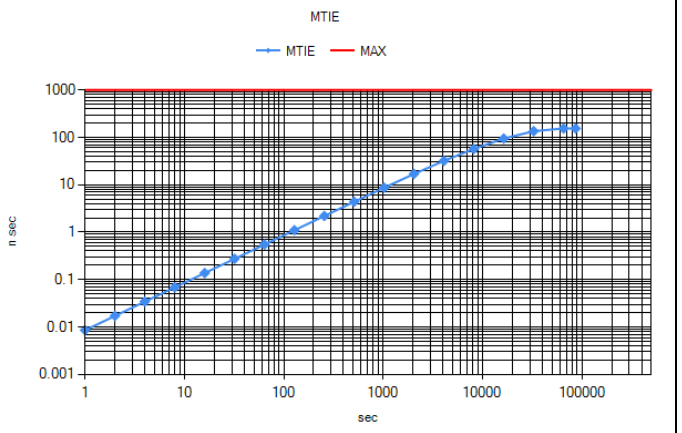

Const. Temp ±5°F; slope 0,1,range 19.22..24.78°C

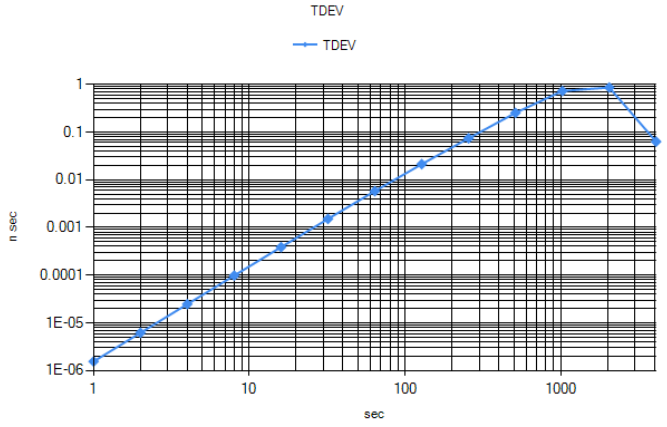
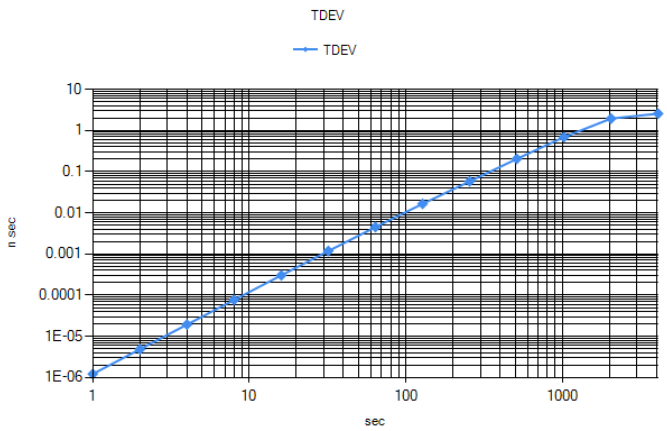
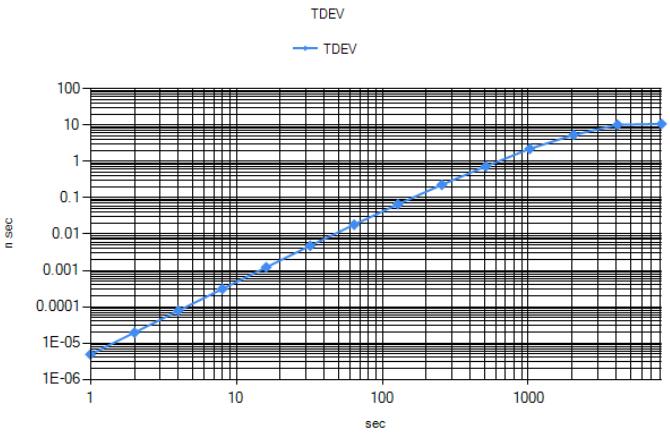
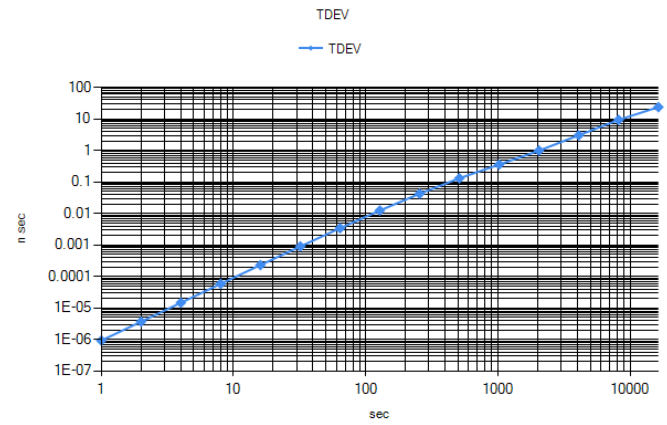



Trapezoid_Pattern_slope 0,5,range +2,5...42,5°C

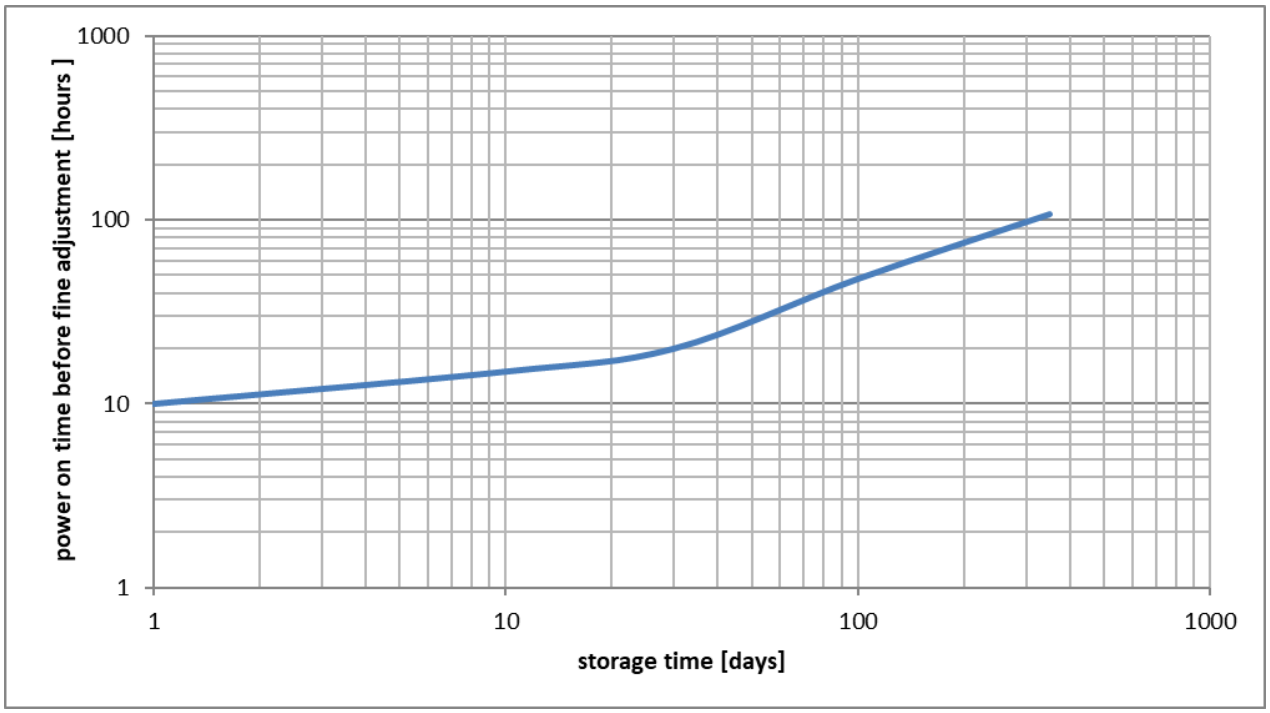



Triangle-Pattern_slope 0,2,range -40...85°C



| Typical TDEV performance; Oscillator group zO6 ( loop bandwidth 1mHz) | |
|---|---|
| Const. Temp ±1°K; slope 0,1, range 21..23°C | Const. Temp ±5°F; slope 0,1,range 19.22..24.78°C |
|  |  |
| Trapezoid_Pattern_slope 0,5,range +2,5...42,5°C | Triangle-Pattern_slope 0,2,range -40...85°C |
|  |  |

## recommended power on time after x days of power of



# Handling and Processing Note Oscillators

## Application

Unless otherwise noted, the products listed in the catalogue are designed for use with ordinary electrical devices, such as stationary and portable communication, control, measurement equipment etc.. They are designed and manufactured to meet a high degree of reliability (lifetime more than 15 years) under normal „commercial“ application conditions. Products dedicated for automotive and H-Rel applications are specifically identified for these applications.

If you intend to use these „commercial“ products for airborne, space or critical transport applications, nuclear power control, medical devices with a direct impact on human life, or other applications which require an exceptionally high degree of reliability or safety, please contact the manufacturer.

## Electrostatic Sensitivity

Crystal oscillators are electrostatic sensitive devices. Proper handling according to the established ESD handling rules as in IEC 61340-5-1 and EN 100015-1 is mandatory to avoid degradations of the oscillator performance due to damages of the internal circuitry by electrostatics. If not otherwise stated, our oscillators meet the requirements of the Human Body Model (HBM) according to JESD22-A114F.

## Handling

Excessive mechanical shocks during handling as well as manual and automatic assembly have to be avoided. If the oscillator was unintentionally dropped or otherwise subject to strong shocks, please verify that the electrical function is still within specification.

Improper handling may also detoriate the coplanarity of bended leads of SMD components.

## Soldering

Oscillators can be processed using conventional soldering processes such as wave soldering, convection, infrared, and vapour phase reflow soldering under normal conditions. Solderability is guaranteed for one year storage under normal climatic conditions (+5°C to +35°C @ 40% to 75% relative humidity), however typically sufficient solderability –depending on the process – is maintained also for longer time periods. In cases of doubt, components older than one year should undergo a sample solderability test.

The recommended reflow solder profile  for SMT componets is according IPC/JEDEC J-STD-020 (latest revision)

SMD oscillators must be on the top side of the PCB during the reflow process.

After reflow soldering the frequency of the products may have shifted several ppm, which relaxes after several hours or days, depending on the products. For details please contact the manufacturer.

## Cleaning

Cleaning is only allowed for hermetically sealed oscillators. Devices with non hermetical enclosures (e.g. with trimmer holes) shall not be cleaned by soaking or in vapour, because residues from the cleaning process may penetrate into the interior, and degrade the performance.

Our products are laser marked. The marking of our oscillators is resistant to usual solvents, such as given in IEC 60068-2-45 Test XA. For applicable test conditions see IEC 60679-1.

Ultrasonic cleaning is usually not harmful to oscillators at ultrasonic frequencies of 20kHz at the sound intensities conventional in industry. Sensitive devices may suffer mechanical damage if subjected to 40kHz ultrasound at high sound pressure. In cases of doubt, please conduct tests under practical conditions with the oscillators mounted on the PC board.

## Hermetical Seal

If the device is specified as hermetically sealed, it meets the requirements of IEC 60679-1, i.e. for enclosures with a volume smaller than 4000mm³ the leak rate is below 5*10-8 bar cm3/s, for larger enclosures it is below 1*10-6 bar c bar cm3/s, tested according to IEC 60068-2-17 Test Qk.

Glass feed-throughs may be damaged as a result of mechanical overload, such as bending the connection leads or cutting them with an unappropriated tool. In order to avoid microcracking, the wire must be held fixed in position by a pressure pad between glass feed-through and the bending point during the bending process. Check: there should be no damaged edges on the glass feed-through after the bending.

## Tape & Reel

The packing in tape and reel is according to IEC 60286-3.

Details see tape & reel data sheets.

## Qualification

Vectron products are undergoing regular qualification/reliability tests as per product family definition. Results are available upon request. Customer specific qualification tests are subject to agreement.

If not otherwise stated, the product qualifications are performed according to IEC 60679-5 or other valid industry standards.

## Screening

Our oscillators are 100% tested, and all key manufacturing processes are controlled by Statistical Process Control (SPC). Additional screening is therefore usually not required.

On request, we can perform screening tests according to MIL-PRF-55310, class B for discrete or hybrid constructions of commercial (COTS) products. For special requirements see the High Reliability Clock section.

**Demounting/Desoldering of Ocsillator device for analysis**:

The removal or desoldering of oscillators from customer application after SMT process may cause damage to the device if not handeld appropriately. It may lead to parametric change such as frequency shift (like OCXO: up to +/- 200 ppb) . It is utmost important to minimize the direct heat exposure to the device in order to avoid such effects. Use of hot air gun for desoldering should be avoided.
A mechanical stress could also destroy the part, if exposed to excessive mechanical shock after removal process. Appropriate shock protection & ESD designated packaging must be used to avoid any external mechanical shock for FA return process.

In general, the products* withstand the tests listed in the following Table 1, which are based on valid industry standards.

***Additional note**: Test conditions could vary for different product families and individual product specifications depending on the customer as well as product requirements.

## Recommended Environmental Test Conditions

## Table 1

| Test | Test condition | Test Standard |
|---|---|---|
| Dimensions | acc. outline drawing | MIL-STD-883 Meth2016 |
| External visual | no visible damage | MIL-STD-883 Meth2009 |
| Internal visual | 30-50x | MIL-STD-883 Meth2014 |
| Electrostatic discharge (ESD) sensitivity testing Human Body Model (HBM) | 10 discharges, both polarities, 1kV...8kV | JESD 22-A114F |
| Seal Fine/Gross Leak | only for hermetically sealed parts 100% tested | MIL-STD-883 Meth1014 A1/C4 |
| Solderabiltiy | 255°C (diving Time 5 ±0,5sec.) Dip&Look with 8h damp pre-treatment: solder wetting >95% | J-STD-002C Cond. A, Trough hole device; Cond. B,<br>SMD ( correspond to MIL-STD-883 Meth 2003) |
| Reflow Simulation Test | 3X Lead free profile | J-STD-020D |
| Mechanical Shock | 1. 100g 6ms 6 shocks in each direction;<br>2. 1500G 0,5ms 6 shocks in each direction. | 1. MIL-STD-202 Meth 213B Cond. C;<br><br>2. MIL-STD-202 Meth 213B Cond. F (for ceramics parts). |
| Free fall | Test Ed procedure 1, 2 drops from 1m height | IEC 600068-2-32 |
| Vibration, Sine | 20g 20-2000Hz 4x in each 3 axis 4min sweep time | JESD22-B103 Cond.1 |
| Vibration, random | optional on customers request | MIL-STD-202 Meth214A Figure 214-1 |
| Temperature Cycling | 1.1000 cycles -55/+125°C; cycle time 30 min.;<br>2.1000 cycles -40/+125°C;cycle time 30 min. | 1. MIL-STD-883G Meth1010.8 Cond. B<br><br>2. JESD22-A104-D Cond. G |
| Low temperature operating Life (LTOL) | 'Ta= -40°C, >1000 h | IEC 60068-2-1 |
| Steady State Temperature Humidity Bias Life Test | Non hermetic parts 85°C/85% RH 1008h | JESD22-A101-C |
| High Temperature Storage Operating Life (HTOL)) | 1000h @ 105°C under voltage | MIL-STD-202 Meth108A Cond C |
| Aktive Aging at Elevated Temperatures | 1000h @ 85°C with fit calculation (for not OCXO) | MIL-PRF-55310 Meth.4.8.35 |
| Aktive Aging at Room Temperture | 1000h with fit calculation- only for OCXO @crystal operating temp. | MIL-PRF-55310 Meth.4.8.35 |
| Immersion in cleaning solvents | | IEC 60068-2-45 Test Xa ;<br>IEC 60068-2-70 Test Xb (rubbing finger) |