# Model 149

## Stratum 3E, 9x14 mm OCXO

### Features

- 10 to 50 MHz Frequency Range
- Compliant to Stratum 3E of GR-1244-CORE
- Surface Mount
- 3.3V or 5.0V operation
- Low Jitter/Phase Noise
- Tape and Reel Packaging

Part Dimensions: 9.7 × 14.9 x 7.0 mm

### Applications

- Telecom Switching
- Wireless Communication
- Timing over Packet

### Description

The CTS Model 149 is a low cost, small size, high performance OCXO. The high quality SC Quartz Crystal used in this OCXO offers high stability and low jitter/phase noise, making it the ideal choice for any telecommunications system.

### Ordering Information – Table 1

| Model | Temp Range | Stability* | Supply Voltage | Electronic Freq Control | Frequency Code |
|---|---|---|---|---|---|
| 149 | B | T | E | N | 20M000 |

| Code | Temp range |
|---|---|
| A | 0 to 50°C |
| B | 0 to 70°C |
| C | -10 to 60°C |
| D | -20 to 70°C |
| G | -40 to 85°C |

| Code | Stability (ppb) |
|---|---|
| R | ±100 |
| T | ±50 |
| U* | ±20 |
| V* | ±10 |
| W* | 10 (pk-pk) |

| Code | Supply |
|---|---|
| D | 5.0V ±5% |
| E | 3.3V ±5% |

| Code | Spec |
|---|---|
| V | EFC |
| N | No EFC |

| Code | Frequency (MHz) |
|---|---|
| 20M000 | 20.000 |
| XXMXXX | XX.XXX |

| Standard Frequencies (MHz) |
|---|
| 10.000 |
| 12.800 |
| 19.200 |
| 20.000 |
| 24.576 |
| 25.000 |
| 49.152 |

* For full GR-1244 Stratum 3E holdover and wander generation performance, choose:
Stability option U for compliance over any 25°C change, or
Stability option V for compliance over any 40°C change, or
Stability option W for compliance over -40°C/+85°C.

**Part Number Example:**
149BTEN20M000

Note: Not all stabilities are available for all frequencies. Please consult factory.

## Electrical Specifications

| Parameter | Conditions & Remarks | Min | Typical | Max | Unit |
|---|---|---|---|---|---|
| **Operating Conditions** | | | | | |
| Operating Temperature Range | $T_{OP}$ | -40 | - | 85 | °C |
| Supply Voltage | $V_{CC}$: 3.3V or 5.0V | 3.135<br>4.75 | 3.3<br>5.0 | 3.465<br>5.25 | Vdc |
| Power Consumption | Warm-up<br>Steady State; $T_A$ = 25°C | -<br>- | -<br>0.7 | 2.7<br>1 | W |
| Load | | 13.5 | 15 | 16.5 | pF |
| **Frequency Stability** | | | | | |
| Frequency | $F_{NOM}$ | 10 | - | 50 | MHz |
| Initial Frequency Tolerance | @25°C, at time of shipment | - | - | ±0.200 | ppm |
| Freq. vs Temperature<br>(See Table 1) | -40°C to 85°C (ref to +25C)<br>4°C change (option V) | -<br>- | -<br>- | ±10<br>1 | ppb<br>ppb pk-pk |
| Freq. vs Supply Voltage | $V_{CC}$ ±5% | - | ±1 | ±5 | ppb |
| Freq. vs Load | 15 pf ±5% | - | ±1 | ±5 | ppb |
| Freq. vs Time (Aging ) | After 30 days of operation<br>(for 19.2 MHz) | -<br>-<br>- | -<br>-<br>- | ±1<br>±150<br>±1.2 | ppb/day<br>ppb/year<br>ppm/10 yrs |
| Free run accuracy | All causes – 10 years | - | - | ±1.6 | ppm |
| Frequency Retrace | 0.5 hours on after 24 hrs off, preceded by 24 hrs on. Ref to turn off frequency. | - | - | ±50 | ppb |
| Short Term Stability (ADEV) | 1.0 sec | - | - | 0.05 | ppb |
| Warm-up time | @ 25°C, After 5 mins referenced to the freq after 1 hour on | - | - | ±50 | ppb |
| Holdover Stability (24 hours) | For any 40°C change over the operating temperature range (Stability options U and V. See Table 1) | - | - | 11 | ppb, pk-pk |
| Wander Generation | Meets Stratum 3E MTIE and TDEV per Telcordia GR-1244-CORE | | | | |
| **Output Parameters** | | | | | |
| CMOS Output Levels | 3.3V (LVCMOS)<br>5.0V (HCMOS) | $V_{OL}$<br>$V_{OL}$<br>$V_{OH}$<br>$V_{OH}$ | -<br>-<br>2.4<br>3.0 | -<br>-<br>-<br>- | 0.4<br>0.4<br>-<br>- | Vdc |
| Rise/Fall Times | 10% to 90%, 15pf load | | - | - | 5 | ns |
| Duty Cycle | @50% of output signal | | 45 | 50 | 55 | % |

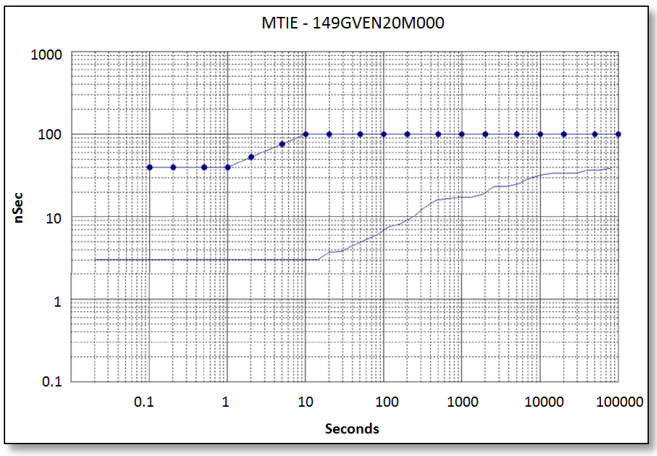
## Electrical Specifications (Continued)

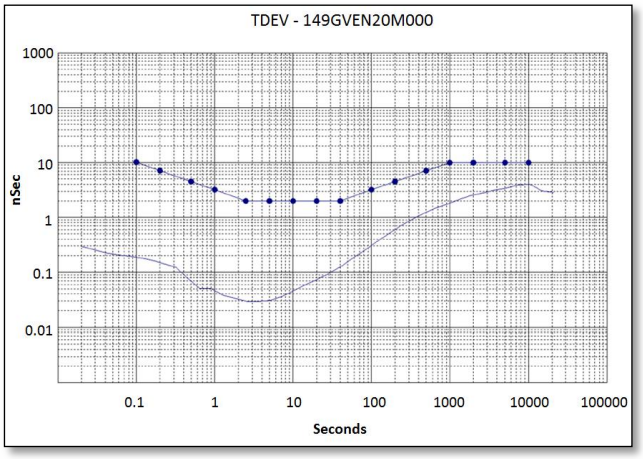
| Parameter | Conditions & Remarks | | Min | Typical | Max | Unit |
|---|---|---|---|---|---|---|
| Phase Noise (Typical for 19.20 MHz) | | 1 Hz | - | -85 | - | dBc/Hz |
| | | 10 Hz | - | -115 | - | |
| | | 100 Hz | - | -138 | - | |
| | | 1 kHz | - | -148 | - | |
| | | 10 kHz | - | -152 | - | |
| | | 100 kHz | - | -154 | - | |

## Electronic Frequency Control - EFC (Optional)

| | | | | | | |
|---|---|---|---|---|---|---|
| EFC Control Voltage | $V_C$ | 3.3V | 0.0 | 1.65 | 3.3 | Volts |
| | | 5.0V | 0.0 | 2.5 | 5.0 | |
| Frequency Adjust Range | | | ±2.0 | - | ±4.0 | ppm |
| Slope | Positive, monotonic | | - | - | - | |
| Input Impedance | $Z_{IN}$ | | 100 | - | - | Kohms |
| Linearity | | | - | - | 10 | % |

### Typical Stratum 3E Wander Generation performance per Telcordia GR-1244-CORE (locked through a 0.001Hz loop bandwidth)



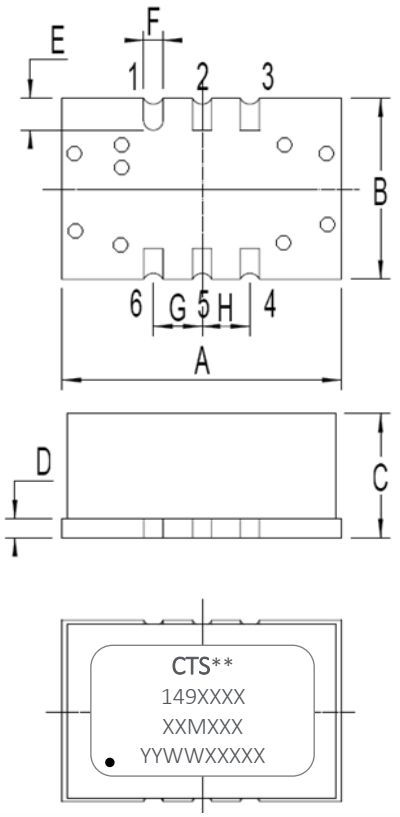



## Mechanical and Environmental

| | | |
|---|---|---|
| Storage Temperature Range | -55°C to +105°C | |
| Operating Temperature Range | -40°C to +85°C | |
| Reflow Profile | Per IPC/JEDEC J-STD-020D; >217°C, 1.5min and 245°C (Absolute max temperature), 10 secs.<br>**Note:** This product is not designed to be reflowed in an inverted position. | |
| Mechanical Shock | 100g, 6ms, 1/2 sinewave, 3 shocks each direction along 3 mutually perpendicular planes. | |
| Drop | 10 cm height, 3 times onto hard board with thickness of 3 cm. - IEC60028-2-32 test Ed. | |
| Bumping | 40g, 6mS, 4000 ±10 times in each of three mutually perpendicular axes | |
| Mechanical Vibration | Random: | Frequency range: 1Hz-4Hz-100Hz-200Hz<br>Acceleration: 0.0001g²/Hz - 0.01g²/Hz - 0.01g²/Hz - 0.001g²/Hz<br>Grms=1.15g. Duration: 30 minutes (per axis) |
| | Sine: | 10 - 55 Hz, 0.75mm DA, Sweep time 30 minutes per axis |
| Thermal Shock | -40°C ~ +85°C. 0.5 hour dwells with <30 second transitions. 100 cycles | |
| RoHS | Lead Free, and fully compliant to RoHS Directive 2011/65/EU | |
| MSL | Level 2 | |

## Mechanical Specifications

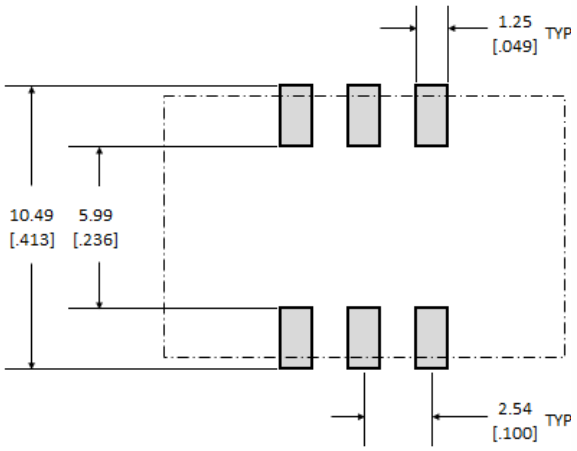
Pad termination finish: Gold flash < 10 µ inch, over Ni plated Cu




| Dimension (mm) | | |
|---|---|---|
| Symbol | Min | Max |
| A | - | 14.9 |
| B | - | 9.7 |
| C | - | 7.0 |
| D | 0.9 | 1.1 |
| E | 1.6 | 1.8 |
| F | 0.9 | 1.1 |
| G | 2.54 nominal | |
| H | 2.54 nominal | |

| Pad | Connection |
|---|---|
| 1 | Vc or N/C |
| 2 | N/C |
| 3 | Ground |
| 4 | Output |
| 5 | N/C |
| 6 | Vcc |

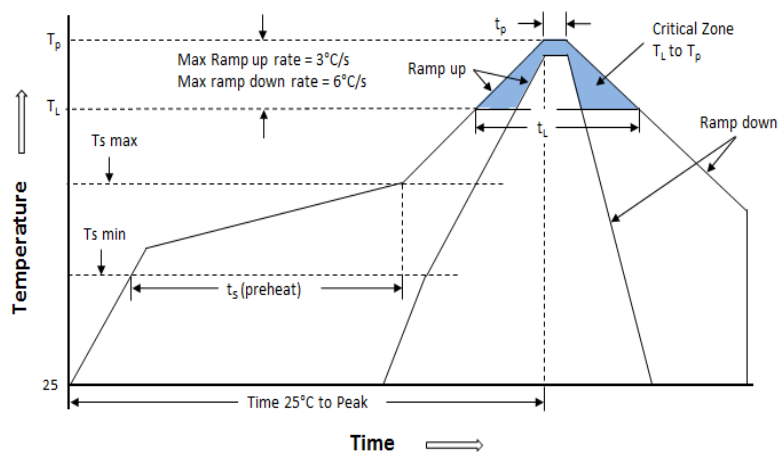
### Recommended Solder Pad Geometry




All dimensions are mm [inches]
All dimensions are nominal

| Marking Key | |
|---|---|
| ** | Mfg site code |
| YYWWXXXXX | Serial Number (mfg date code = first 4 digits) |

## Solder Reflow




| | |
|---|---|
| Ts max to TL(Ramp-up Rate) | 3°C/s max |
| Preheat | |
| Temperature Min (Ts min) | 150°C |
| Temperature typ (Ts) | 175°C |
| Temperature max (Ts max) | 200°C |
| Time ($t_S$) | 60-120 seconds |
| Ramp-up Rate ($T_L$ to $T_P$) | 3°C/s max |
| Time maintained above: | |
| --Temperature ($T_L$) | 217°C |
| --Time ($t_L$) | 90 seconds max |
| Peak Temperature | 245°C max for 10 seconds |
| Time within 5°C of peak ($t_P$) | 20 seconds |
| Ramp-down Rate | 6°C/s max |
| Time 25°C to Peak Temp (t) | 8 minutes max |

Note: Temperatures represent device body temperature.

## Packing: Tape and Reel