# Model 680 Series

## Extended Temperature/COTS, Tight Stability

### Crystal Clock Oscillator, 5.0V, 3.3V, 2.5V, or 1.8V

CTS ELECTRONIC COMPONENTS

## Features

- 20kHz to 100MHz frequency range
- 5x7 SMD form factor
- Hermetically sealed for rugged environmental conditions
- Extremely wide operating temperature range accommodates harsh environments
- Crystals are processed with tight angle control to assure best frequency-temperature characteristics
- Units are vacuum baked before sealing at 145°C for 16 hours to eliminate moisture traces and pre-age units for superior stability
- Tristate feature optional


RoHS Status

RoHS 6/6

## Applications

- Applications that require an HCMOS clock and might be exposed to extremely harsh environmental conditions.
- Military/Avionics
- Engine Control
- Down-hole Drilling Equipment
- Industrial Process Control
- Geophysical Services

## Description

The **Model 680** series is a set of small sized, light weight, and rugged HCMOS extended temperature/COTS crystal clock oscillators with 5.0, 3.3, 2.5, or 1.8 supply voltage for operations under stringent environments. They are used in applications that take advantage of their extended temperature range and tight temperature stability. They combine excellent long-term reliability, loading characteristics, and superior start-up performance.

## Electrical Specifications

| Parameter | Symbol | Condition | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|
| **Frequency Range** | F | 1.8V<br>2.5V<br>3.3V, 5.0V | 4<br>1<br>0.02 | | 50 | MHz | Low jitter |
| | | 3.3V, 5.0V | >50 | | 100 | | |
| **Frequency Stability** | ΔF/F | Overall condition including calibration, temperature voltage and load variation | ±35 | | ±125 | ppm | See “How to Order” |
| **Operating Temperature** | T | | -55 | | +200 | °C | See “How to Order” |
| **Aging** | | First Year<br>After First Year | | 3<br>1 | | ppm<br>ppm/yr | +80°C |
| **Supply Voltage** | $V_{CC}$ | | 1.71<br>2.375<br>3.135<br>4.5 | 1.8<br>2.5<br>3.3<br>5.0 | 1.89<br>2.625<br>3.465<br>5.5 | V | See “How to Order” |
| **Output** | | All units, full range 15pF CMOS | | | | | |

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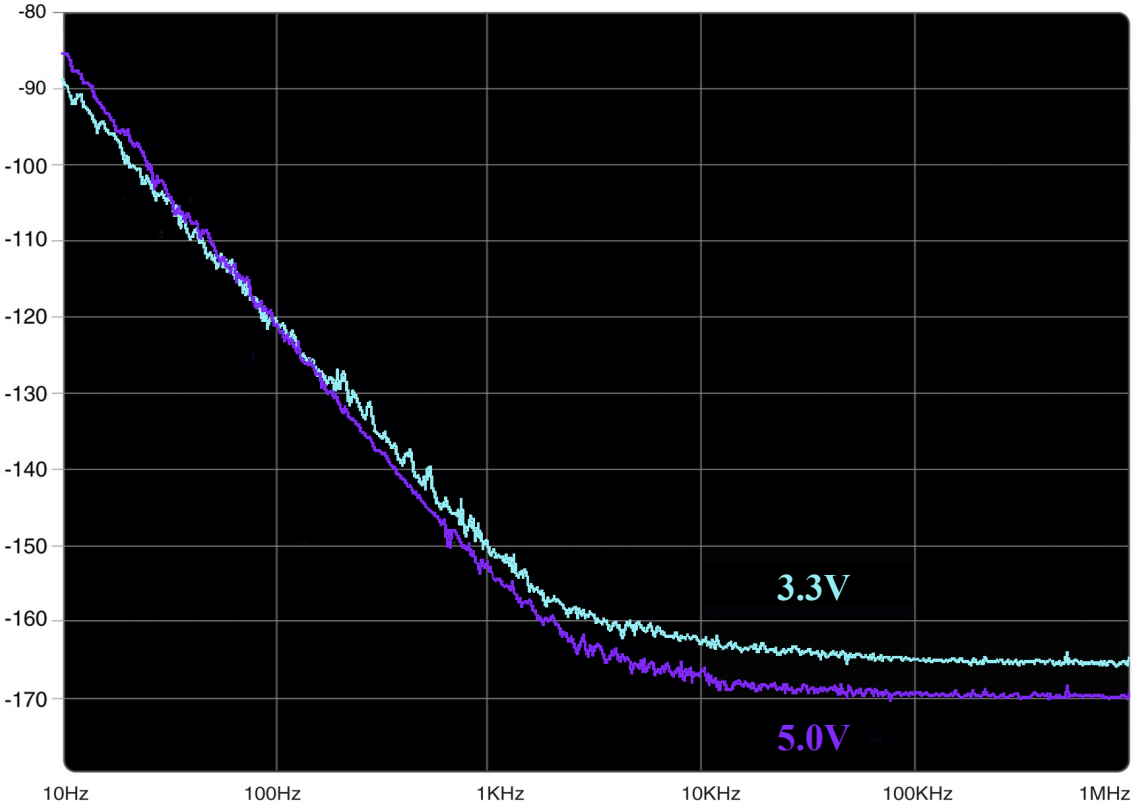
## Electrical Specifications

| Parameter | Symbol | Condition | Min | Typ | | | Max | Unit | Note |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 2.5V | 3.3V | 5.0V | | | |
| **Phase Noise** | | 10Hz<br>100Hz<br>1kHz<br>10kHz<br>100kHz<br>1MHz | | -92<br>-125<br>-150<br>-158<br>-161<br>-162 | -89<br>-121<br>-151<br>-163<br>-165<br>-165 | -85<br>-121<br>-154<br>-167<br>-169<br>-170 | | dBc/Hz | @ 32MHz (typical) *See Phase Noise Plots Below* |
| **Integrated RMS Jitter** | | | | 2.5V | 3.3V | 5.0V | | *f*sec | |
| | | | | <120 | <80 | <55 | | | |
| **Symmetry** | | CMOS, @ 50% $V_{DD}$ | | 40/60 | | | | % | |
| **Rise and Fall Times** | | From 0.2 to 0.8$V_{DD}$ | | | | | 5 | ns | |
| **Input Requirement for Pin.1** | | Output enable – High<br>Output disable (Tristate) | | Pin 1 may float or 2.8$V_{DD}$ min<br>Pin 1 requires 0.4$V_{DD}$ max | | | | | |

## Phase Noise Comparison (carrier frequency 32.000MHz)




### 3.3V Supply Voltage

10Hz -89.7391 dBc/Hz
100Hz -121.0454 dBc/Hz
1kHz -151.4366 dBc/Hz
10kHz -163.4179 dBc/Hz
100kHz -165.8097 dBc/Hz
1MHz -165.7216 dBc/Hz

RMS Jitter 75.6985 fsec

### 5.0V Supply Voltage

10Hz -86.2119 dBc/Hz
100Hz -121.8572 dBc/Hz
1kHz -154.0653 dBc/Hz
10kHz -167.5332 dBc/Hz
100kHz -169.9343 dBc/Hz
1MHz -170.2667 dBc/Hz

RMS Jitter 46.558 fsec

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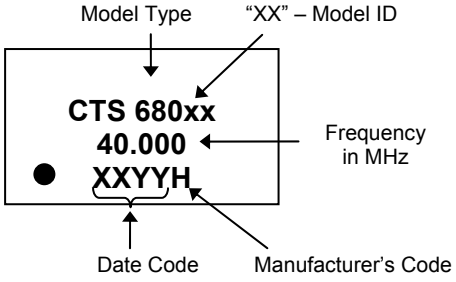
## Environmental and Mechanical Conditions

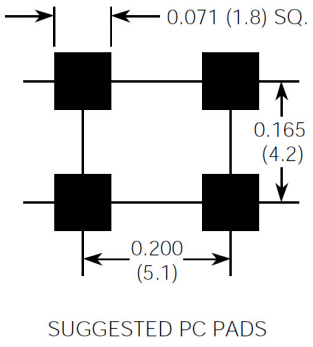
| Parameter | Condition |
|---|---|
| **Shock** | 1000 Gs, 0.35 ms, ½ sine wave, 3 shocks in each plane |
| **Vibration** | 10-2000 Hz of 0.06" d.a. or 20 Gs, whichever is less |
| **Humidity** | Resistant to 85° R.H. at 85°C |
| **Gross Leak** | Each unit checked in 125°C fluorocarbon |
| **Fine Leak** | Mass spectrometer leak rate less than $2x10^{-8}$ atm, cc/sec of helium |
| **Case** | Ceramic with glass hermetic seal |
| **Pads** | 40 micro inch of gold over nickel |
| **Marking** | Epoxy ink or laser engraved |
| **Resistance to Solvents** | MIL STD 202, Method 215 |

## Pin Assignments

| Pin | Non-Tristate Models | Tristate Models |
|---|---|---|
| 1 | NOT USED | Floating or 1 : Oscillator runs<br>Ground or 0 : Disable or Tristate |
| 2 | Ground and Case | |
| 3 | Output | |
| 4 | $V_{DD}$ | |

## Marking Specification

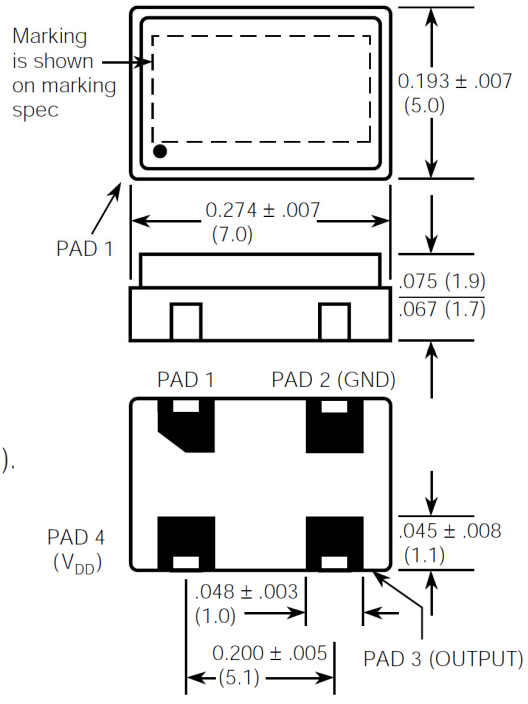



SUGGESTED PC PADS

Millimeters are shown in ( ).

## Package Outline



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## How to Order

680 – 5 – N L D – FREQUENCY

**Stability**

| Code | Specification |
|---|---|
| 9 | 125 ppm |
| 6 | 100 ppm |
| 8 | 75 ppm |
| 5 | 50 ppm |
| 4 | 40 ppm |
| Z | 35 ppm |

**Temperature Range**

| Code | Specification |
|---|---|
| U | -20°C to +180°C |
| S | -55°C to +180°C |
| T | -55°C to +175°C |
| K | 0°C to +175°C |
| Q | 0°C to +200°C |
| V | -55°C to +200°C |
| R | -40°C to +175°C |

**Supply Voltage**

| Code | Specification |
|---|---|
| S | 5.0V |
| L | 3.3V |
| N | 2.5V |
| M | 1.8V |

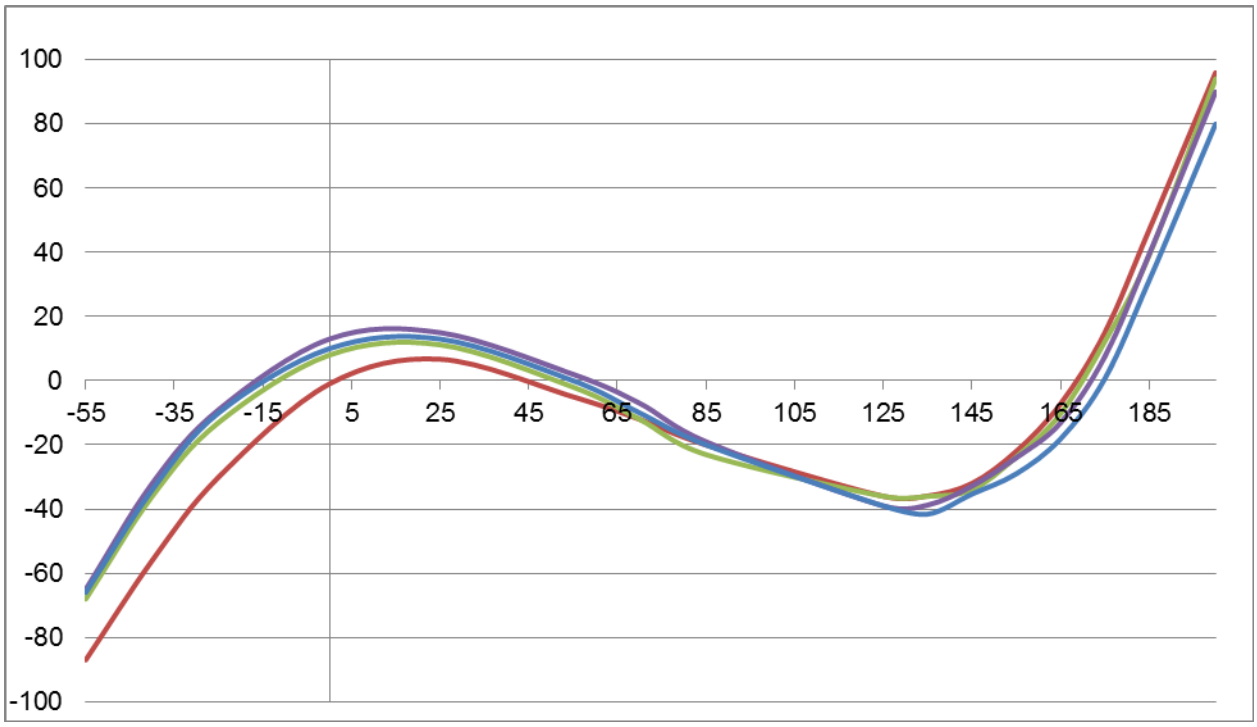
**Enable/Disable**

| Code | Specification |
|---|---|
| E | Enable High, Tristate |
| N | Non-Enable |

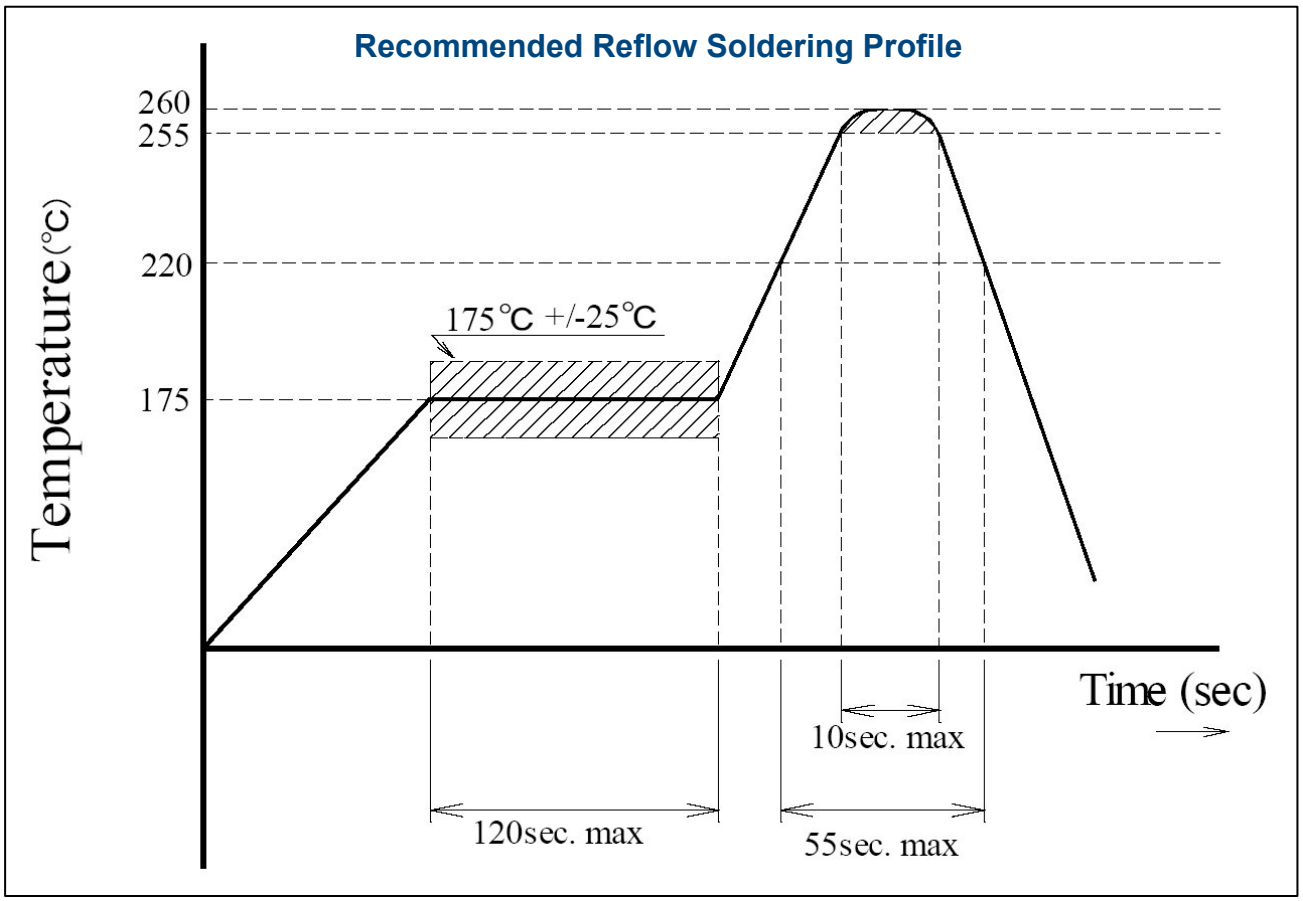
## Available Temperature vs. Frequency Stability

| Temperature vs. Stability | ±35 ppm | ±40 ppm | ±50 ppm | ±75 ppm | ±100 ppm | ±125 ppm |
|---|---|---|---|---|---|---|
| 0°C to +175°C (K) | Z | 4 | 5 | | | |
| -40°C to +175°C (R) | | 4 | 5 | 8 | | |
| -20°C to +180°C (U) | | 4 | 5 | 8 | | |
| -55°C to +175°C (T) | | | 5 | 8 | | |
| -55°C to +180°C (S) | | | 5 | 8 | | |
| 0°C to +200°C (Q) | | | | 8 | 6 | |
| -55°C to +200°C (V) | | | | | 6 | 9 |
| -55°C to +235°C | Consult factory for availability | | | | | |

### Frequency vs. Temperature Performance




### Recommended Reflow Soldering Profile



## TABLE 2
## Reliability Test Procedures and Conditions for Quartz Crystal Oscillators

**1. Group A**

Electrical Characteristics at 25°C

Frequency at nominal supply voltage and endpoints
- Input current
- Symmetry (Duty Cycle)
- Zero/One levels
- Rise/Fall times
- Frequency (verify frequency at the temperature extremes)

Physical Dimensions
- Length/width
- Height
- Package finish (Corrosion, discoloration, etc.)
- Marking placement/legibility

**2. Group B**

1000 hrs at or above 125°C, nominal voltage, proper load (sample size by MIL -PRF-55310 table 6, max. aging within 15 years requirement without catastrophic failures)

**3. Group C- All units have passed Group A testing**

**A. Subgroup 1: 8 pcs.**

| Standard | Condition | Description | End Point Measurement |
|---|---|---|---|
| MIL-STD-883 | Method 2002 COND.B | Mechanical Shock 1500 g's, 0.5ms 5 drops, 6 axis | Frequency Output waveform |
| MIL-STD-883 | Method 2007 COND. A | Vibration, var. freq. 20 g's, 0.06" disp., 20-20, 000-20 Hz | Frequency Output waveform |
| MIL-STD-883 | Method 2003 | Solderability | Visual 95% Coverage |

**B. Subgroup 2: 4 pcs (One-half of Subgroup 1)**

| Standard | Condition | Description | End point Measurement |
|---|---|---|---|
| MIL-STD-883 | Method 1011 COND. B | Thermal Shock Liq. To liq. 15 cycles | Frequency Output waveform |
| MIL-STD-202 | Method 105 COND. B | Altitude, 3.44 inch Hg. 12 hrs | Frequency Output waveform |
| MIL-STD-883 | Method 1004 | Moisture resist. with supply voltage applied 25°C to 65°C, 90 to 100% RH, 10 cycles | Frequency Output waveform |
| MIL-STD-202 | Method 210 COND. A | Resistance to Solder Heat Immersion @350ºC 3.5 sec | Frequency Output waveform |

**C. Subgroups 3: 4 pcs. (One half of Subgroup 1)**

| Standard | Condition | Description | End point Measurement |
|---|---|---|---|
| | Storage Temp. No. Oper | 24 hrs. @ -55°C 24 hrs. @ 125°C | Frequency Output waveform |
| MIL-STD-883 | Method 1009 COND. A | Salt Atmosphere 24 hrs. @ 35°C 0.5-3.0% Solution | Frequency Output waveform Visual |
| MIL-STD-883 | Method 1014 COND. A | Fine Leak | Qs <5 X$10^{-8}$ |
| MIL-STD-883 | Method 1014 COND. C | Gross Leak | Visual in 125°C Detector fluid |

Test data is available for additional cost.