

Helping Customers Innovate, Improve &amp; Grow



TX-709

## Description

The TX-709 Series TCXO combines innovative manufacturing and the latest technology to provide low phase noise and excellent g-sensitivity. The fully hermetic assembly includes a dual crystal circuit to cancel opposing g-sensitivity vectors enclosed in a 5x7mm ceramic package.

## Features

- Standard Temperature Range -40°C to +85°C
- Extended Temperature Range -55°C to +125°C
- Low Phase Noise, Low g-sensitivity 0.1ppb/g
- Frequency Range: 8 MHz to 52 MHz & 96 MHz to 160 MHz
- Fully Hermetic Seal
- High Shock Survival up to 20k g
- Surface Mount, Low Profile
- Fully RoHS Compliant

## Applications

- Military Portable Radios
- GPS Telemetry
- Test and Measurement Equipment
- Missile systems
- GNSS
- SATCOM



## Performance Specifications

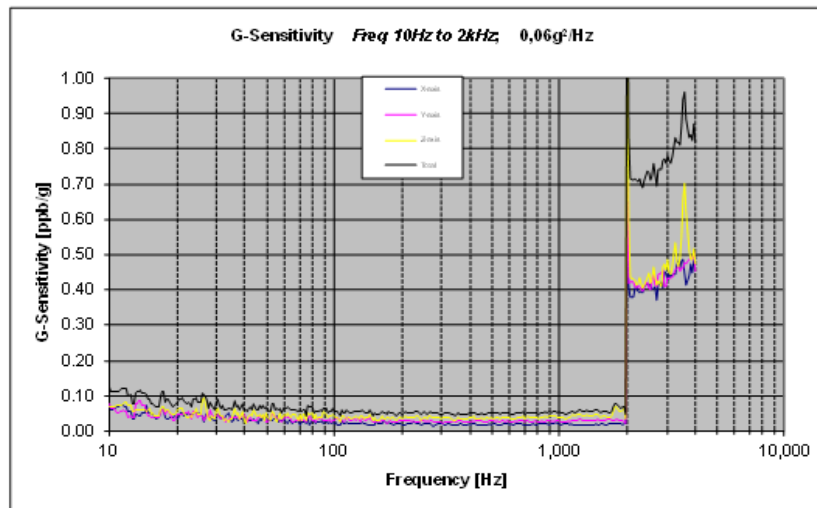
| Parameter                                                | Min        | Typ     | Max          | Units      | Condition                                                                            |
|----------------------------------------------------------|------------|---------|--------------|------------|--------------------------------------------------------------------------------------|
| Frequency Stabilities <sup>1</sup>                       |            |         |              |            |                                                                                      |
| vs. operating temperature range<br>(referenced to +25°C) | -1<br>-2   |         | +1<br>+2     | ppm<br>ppm | -40... +85°C<br>-55... +125°C (8 MHz to 52 MHz only)                                 |
| Initial Tolerance                                        | -1.0       |         | +1.0         | ppm        | at time of shipment, nominal EFC<br>Vs ± 5%<br>Load ± 10%<br>@ +40°C<br>for 15 years |
| vs. supply voltage change                                | -0.25      |         | +0.25        | ppm        |                                                                                      |
| vs. load change                                          | -0.25      |         | +0.25        | ppm        |                                                                                      |
| vs. aging / 1 year                                       |            | ±1      |              | ppm        |                                                                                      |
| vs. aging                                                |            |         | 4.0          | ppm        |                                                                                      |
| Supply Voltage (Vs)                                      |            |         |              |            |                                                                                      |
| Supply voltage                                           | 3.135      | 3.3     | 3.465        | VDC        |                                                                                      |
| Current consumption                                      |            | 5<br>25 | 10<br>35     | mA<br>mA   | 8 MHz to 52 MHz output frequencies<br>96 MHz to 160 MHz output frequencies           |
| Absolute Maximum Ratings                                 |            |         |              |            |                                                                                      |
| Supply voltage (Vs)                                      | -0.3       |         | 4.6          | V          | Damage may occur beyond this level                                                   |
| Control Voltage                                          | 0          |         | Vs           | V          |                                                                                      |
| Operable temperature range                               | -60<br>-40 |         | +125<br>+105 | °C<br>°C   | for tuning options A, B, C, D<br>for tuning options E, F, G, H                       |
| Storage temperature range                                | -55        |         | +125         | °C         |                                                                                      |

## Performance Specifications

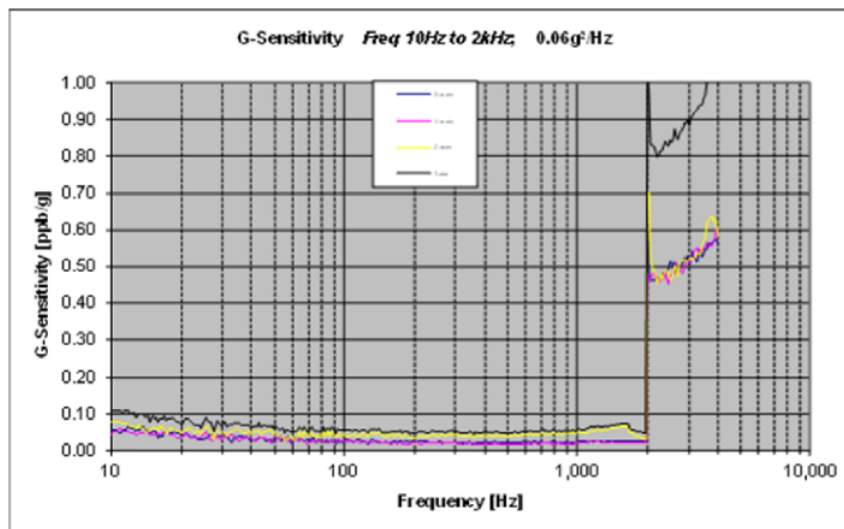
| Parameter                                                                        | Min              | Typ                                 | Max                                 | Units                                          | Condition                                                                            |
|----------------------------------------------------------------------------------|------------------|-------------------------------------|-------------------------------------|------------------------------------------------|--------------------------------------------------------------------------------------|
| RF Output                                                                        |                  |                                     |                                     |                                                |                                                                                      |
| Signal                                                                           | HCMOS            |                                     |                                     |                                                |                                                                                      |
| Load                                                                             |                  | 15                                  |                                     | pF                                             |                                                                                      |
| Signal Level (Vol)                                                               |                  |                                     | 0.1*Vs                              | V                                              |                                                                                      |
| Signal Level (Voh)                                                               | 0.9*Vs           |                                     |                                     | V                                              |                                                                                      |
| Rise/Fall Time                                                                   |                  |                                     | 5                                   | ns                                             | @ nominal Load and 10% to 90% of waveform                                            |
| Duty cycle                                                                       | 40               | 50                                  | 60                                  | %                                              | @ nominal Load and @ 50% level                                                       |
| Sub-Harmonics                                                                    |                  |                                     | -20                                 | dBc                                            | 96 MHz to 160 MHz output frequencies                                                 |
| Signal                                                                           | Clipped Sinewave |                                     |                                     |                                                | Frequencies of 15 MHz to 52 MHz only                                                 |
| Level                                                                            |                  | 1                                   |                                     | Vpp                                            | with nominal Load                                                                    |
| Load R                                                                           |                  | 10                                  |                                     | kohm                                           |                                                                                      |
| Load C                                                                           |                  | 10                                  |                                     | pF                                             |                                                                                      |
| Electronic Frequency Control (EFC)                                               |                  |                                     |                                     |                                                |                                                                                      |
| Tuning Range (options A, C, E, G)                                                | Fixed; No adjust |                                     |                                     |                                                |                                                                                      |
| Tuning Range (options B, D, F, H)                                                | ±5.0             |                                     | ±25                                 | ppm                                            |                                                                                      |
| Tuning Slope                                                                     | Positive         |                                     |                                     |                                                |                                                                                      |
| Control Voltage Range                                                            | 0.0              |                                     | Vs                                  | VDC                                            |                                                                                      |
| Freq. control input impedance                                                    | 10               |                                     |                                     | kohm                                           |                                                                                      |
| Additional Parameters <sup>1</sup>                                               |                  |                                     |                                     |                                                |                                                                                      |
| Phase Noise <sup>3</sup> (@ 50 MHz - no vibration)<br>Tuning options A, B, C, D  |                  | -80<br>-112<br>-134<br>-146<br>-150 | -78<br>-109<br>-132<br>-144<br>-148 | dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz | 10 Hz<br>100 Hz<br>1 kHz<br>10 kHz<br>100 kHz                                        |
| Phase Noise <sup>3</sup> (@ 50 MHz - no vibration)<br>Tuning options E, F, G, H  |                  | -82<br>-113<br>-135<br>-152<br>-156 | -81<br>-110<br>-134<br>-148<br>-154 | dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz | 10 Hz<br>100 Hz<br>1 kHz<br>10 kHz<br>100 kHz                                        |
| Phase Noise <sup>3</sup> (@ 100 MHz - no vibration)<br>Tuning options E, F, G, H |                  | -82<br>-113<br>-134<br>-145<br>-147 | -76<br>-108<br>-131<br>-140<br>-142 | dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz | 10 Hz<br>100 Hz<br>1 kHz<br>10 kHz<br>100 kHz                                        |
| Jitter (RMS) @ 150 MHz                                                           |                  | 350                                 |                                     | fs                                             | BW (12 kHz to 20 MHz)                                                                |
| g-sensitivity                                                                    |                  | 0.2                                 |                                     | ppb/g                                          | per axis (tuning options A, B, E, F)                                                 |
|                                                                                  |                  |                                     | 0.1                                 | ppb/g                                          | per axis (tuning options C, D, G, H)<br>parts 100% tested with 100 Hz sine vibration |
| Shock                                                                            |                  |                                     |                                     |                                                | MIL-STD-883G; Method 2002.4; Condition F                                             |
| Vibration Sine                                                                   |                  |                                     |                                     |                                                | MIL-STD-202G, METHOD 204D, Test Condition D                                          |
| Thermal Cycling                                                                  |                  |                                     |                                     |                                                | MIL-STD-202, METHOD 107, Test Condition A                                            |

## G-Sensitivity Performance

TX-709 @ 50MHz

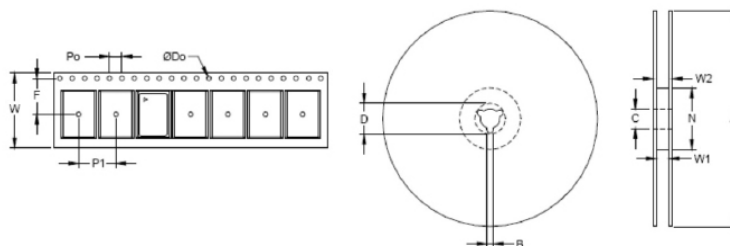


TX-709 @ 100MHz

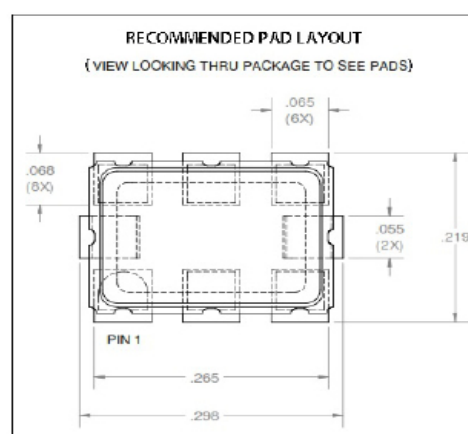
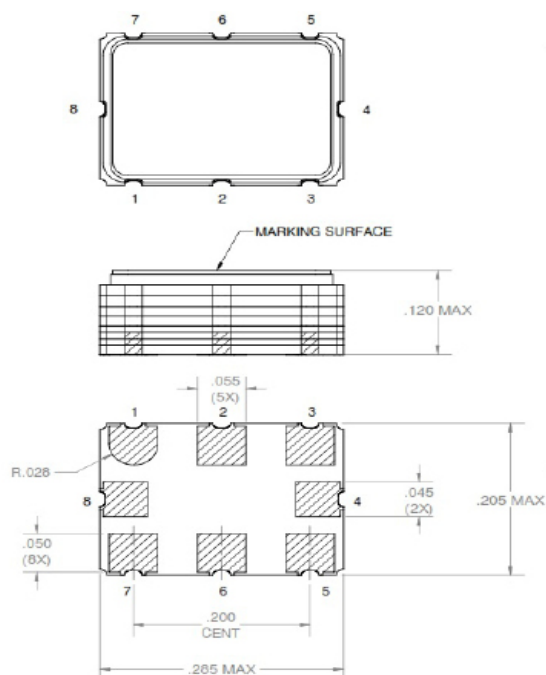


## Standard Shipping Method

| Tape and Reel Information |     |     |    |    | Reel Dimensions (mm) |     |    |      |    |      |      |
|---------------------------|-----|-----|----|----|----------------------|-----|----|------|----|------|------|
| Tape Dimensions (mm)      |     |     |    |    | Reel Dimensions (mm) |     |    |      |    |      |      |
| W                         | F   | Do  | Po | P1 | A                    | B   | C  | D    | N  | W1   | W2   |
| 16                        | 7.5 | 1.5 | 4  | 8  | 180                  | 1.5 | 13 | 20.2 | 60 | 16.4 | 20.4 |



## Outline Drawing / Enclosure



### Plating Composition of TX-709 pads:

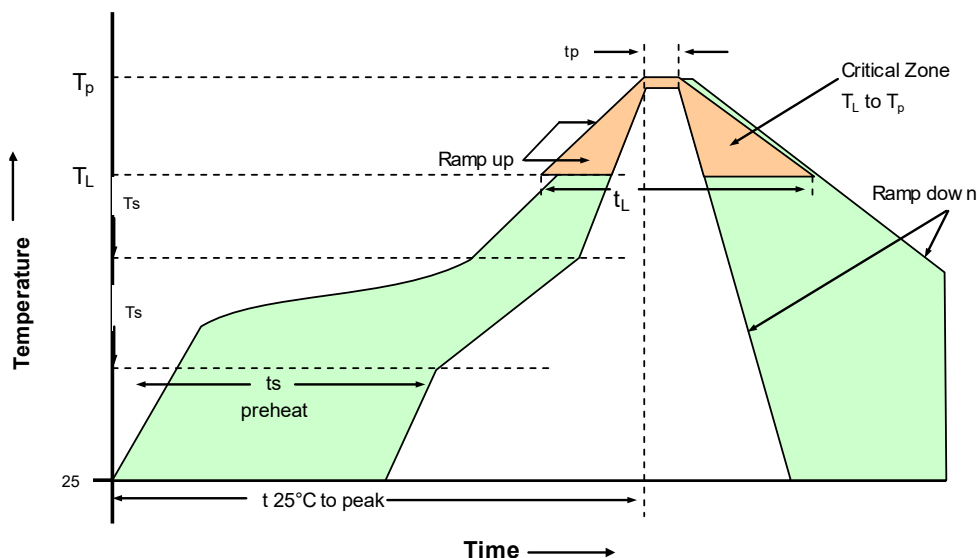
30-90 microinches electroless Gold over 50-350 microinches electroless Nickel  
Contact factory for tin dipped parts. Tinning increases overall height of units to 0.130 Max

### Dimensions in inches

| TX-709 Pin Connections |                                                          |
|------------------------|----------------------------------------------------------|
| 1                      | Electronic Frequency Control (EFC) Option or No Connect* |
| 2                      | No connect*                                              |
| 3                      | Ground                                                   |
| 4                      | No connect*                                              |
| 5                      | RF Output                                                |
| 6                      | No Connect*                                              |
| 7                      | Supply Voltage                                           |
| 8                      | No Connect*                                              |

\* Do not connect to this pin - Vectron reserved

## Recommended Reflow Profiles for Pb-Free & Sn-Pb



### 230°C Reflow Profile

| Profile Feature                             | Sn-Pb Assembly | Profile Feature               | Sn-Pb Assembly    |
|---------------------------------------------|----------------|-------------------------------|-------------------|
| Average ramp-up rate (TL to TP)             | 3°C/secod max. | Time 25°C to Peak Temperature | 4 minutes max.    |
| Preheat - Temperature min T <sub>smin</sub> | 135°C          | Time maintained above         |                   |
| - Temperature Min T <sub>smax</sub>         | 155°C          | - Temperature (TL)            | 183°C             |
| - Time (min to max) (ts)                    | 60-90 seconds  | - Time (tL)                   | 45-60 seconds     |
| T <sub>smax</sub> to TL -Ramp-up Rate       | 3°C/secod max. |                               |                   |
| Time maintained above - Temperature (TL)    | 183°C          | Time within 5°C of actual     | 10-20 seonds max. |
| - Time (TL)                                 | 40-60 seconds  | Peak Temperature (tp)         |                   |
| Peak Temperature (Tp)                       | max 230°C      | Ramp-down Rate                | 6°C/second max.   |

**Note:** All temperatures refer to topside of the package, measured on the package body surface.

## 260°C Reflow Profile

| Profile Feature                            | Pb-Free Assembly | Profile Feature               | Pb-Free Assembly  |
|--------------------------------------------|------------------|-------------------------------|-------------------|
| Average ramp-up rate (TL to TP)            | 3°C/secod max.   | Time 25°C to Peak Temperature | 8 minutes max.    |
| Preheat - Temperature min T <sub>min</sub> | 150°C            | Time maintained above         |                   |
| - Temperature min T <sub>max</sub>         | 200°C            | - Temperature (TL)            | 217°C             |
| - Time (min to max) (ts)                   | 60-180 seconds   | - Time (tL)                   | 60-150 seconds    |
| T <sub>max</sub> to TL -Ramp-up Rate       | 3°C/secod max.   |                               |                   |
| Time maintained above - Temperature (TL)   | 217°C            | Time within 5°C of actual     | 20-40 seonds max. |
| - Time (TL)                                | 60-150 seconds   | Peak Temperature (tp)         |                   |
| Peak Temperature (Tp)                      | max 260°C        | Ramp-down Rate                | 6°C/second max.   |

**Note:** All temperatures refer to topside of the package, measured on the package body surface.

## Ordering Information

### **TX - 7090 - E A E - 106 A - 10M0000000**

|                                                                                               |  |  |  |  |                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------------------|--|--|--|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Product Family</b><br>TX: TCXO                                                             |  |  |  |  |                                                                                                                                                                 | <b>Frequency</b>                                                                                                                                                                                                                                                                                                                                       |
| <b>Package</b><br>5x7 mm                                                                      |  |  |  |  |                                                                                                                                                                 | <b>Tuning and g sensitivity option</b><br>A: No Tuning 0.2 ppb/g<br>B: Electrical Tuning 0.2ppb/g<br>C: No Tuning 0.1 ppb/g<br>D: Electrical Tuning 0.1ppb/g<br>E: Low Phase Noise; No Tuning 0.2 ppb/g<br>F: Low Phase Noise; Electrical Tuning 0.2ppb/g<br>G: Low Phase Noise; No Tuning 0.1 ppb/g<br>H: Low Phase Noise; Electrical Tuning 0.1ppb/g |
| <b>Height</b><br>0: 2.8 mm<br>1: 3.0 mm (Sn/Pb coated pads)                                   |  |  |  |  | <b>Stability Code</b><br>106: $\pm 1$ ppm (E Temp code only)<br>206: $\pm 2$ ppm                                                                                |                                                                                                                                                                                                                                                                                                                                                        |
| <b>Supply Voltage</b><br>E: 3.3 Vdc                                                           |  |  |  |  | <b>Temperature Range</b><br>E: -40°C to +85°C<br>C: -55°C to +125°C (only available with A, B, C, or D tuning options, 8 MHz to 52 MHz output frequencies only) |                                                                                                                                                                                                                                                                                                                                                        |
| <b>RF Output Code</b><br>A: HCMOS<br>F: Sinewave, clipped (for Frequencies 15 to 52 MHz only) |  |  |  |  |                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                        |

#### Notes:

1. Contact factory for improved stabilities or additional product options. Not all options and codes are available at all frequencies.
2. Unless otherwise stated, all values are valid after warm-up time and refer to typical conditions for supply voltage, frequency control voltage, load, and temperature (25°C).
3. Phase noise degrades with increasing output frequency.
4. Subject to technical modification.
5. Contact factory for availability.
6. Frequencies not listed above will require NRE charges and additional lead times.

## Contact Information

#### USA:

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Mt Holly Springs, PA 17065  
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