# PRODUCT SPECIFICATION SHEET


| | | | |
|---|---|---|---|
| **Customer** | | | |
| **Customer P/N** | - | | |
| **Product Type** | Temperature Compensated Crystal Oscillator | | |
| **Part Number** | 9T384H1004 | **Version** | S1 |
| **Part Description** | SMD TCXO 2.0 x 1.6 | | |
| **Nominal Frequency** | 38.400000MHz | | |

| | |
|---|---|
| **Prepared** | Li Xiang |
| **Reviewed** | Kuro Peng |
| **Approved** | Liu Feng |
| **Date** | 2024-11-8 |

**Customer's Approval & Date：**

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RoHS&HF COMPLIANT

Pb Lead-Free

**Moisture Sensitivity Level 1**

**CONTENTS**





* Attention

If you intend to use products on the controlling equipment that relate to medical, aeronautical, aerospace, military science, space and etc, please make sure to let us know your intentions in advance.

Ultrasonic related process may cause damage to crystal blank by resonance itself. If ultrasonic related process is used, we strongly recommend to assess the damage risk under related ultrasonic conditions before use in production.

## 1. History of Specification Revision

| Ver. | Contents | Date | Reviser | Remark |
|---|---|---|---|---|
| S0 | Initial released | 2024-9-30 | Li Xiang | |
| S1 | Update package dimensions | 2024-11-8 | Li Xiang | |
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## 2. Electrical Specifications

### 2.1 Operation conditions

| # | Parameters | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| 1 | Nominal frequency | | 38.400000 | | MHz | - |
| 2 | Supply voltage ($V_{DD}$) | 2.75 | 2.80 | 2.85 | V | - |
| 3 | Current consumption | - | - | 3.5 | mA | - |
| 4 | Operating temperature range | -30 | - | 85 | ℃ | - |
| 5 | Storage temperature range | -55 | - | 125 | ℃ | - |
| 6 | Electrostatic discharge (HBM) | 2000 | - | - | V | R=1.5KΩ, C=100pF |

### 2.2 Output characteristics

| # | Parameters | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| 1 | Output type | | Clipped sine wave | | - | Decoupling capacitor is required in external circuit |
| 2 | Standard output Load | | 10 KΩ//10 pF | | - | - |
| 3 | Output level | 0.8 | - | - | $V_{pp}$ | - |
| 4 | Duty cycle | 40 | 50 | 60 | % | - |
| 5 | Harmonics | - | - | -10 | dB | - |
| 6 | Start-up time | - | - | 10 | ms | - |

### 2.3 Frequency stability characteristics

| # | Parameters | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| 1 | Nominal frequency | | 38.400000 | | MHz | - |
| 2 | Frequency tolerance after reflow | -1.5 | - | +1.5 | ppm | At 25±2℃ after 2 times reflow, refer to nominal frequency. |
| 3 | Frequency stability vs. temperature | -0.5 | - | +0.5 | ppm | Refer to frequency at 25 ℃ within operating temperature range. |
| 4 | Frequency slope vs. temperature | -0.1 | - | +0.1 | ppm/℃ | Minimum of one measurement every 2°C |
| 5 | Frequency stability vs. supply voltage | -0.1 | - | +0.1 | ppm | ±0.1V $V_{DD}$ variation. |
| 6 | Frequency slope vs. load | -20 | - | +20 | ppb/pF | 10 kΩ // 10 pF ±10% |
| 7 | Frequency aging | -1.0 | - | +1.0 | ppm/1st year | - |
| | | -3.0 | - | +3.0 | ppm/5 years | - |
| 8 | Frequency drift rate @ temperature variation | -5 | - | 5 | ppb/s | Temperature variation rate = 0.05℃/sec |
| 9 | Frequency drift rate after $V_{DD}$ power applied @ Vcc=1.8V | -0.005 | - | +0.005 | ppm/s | From 1.5s onwards |

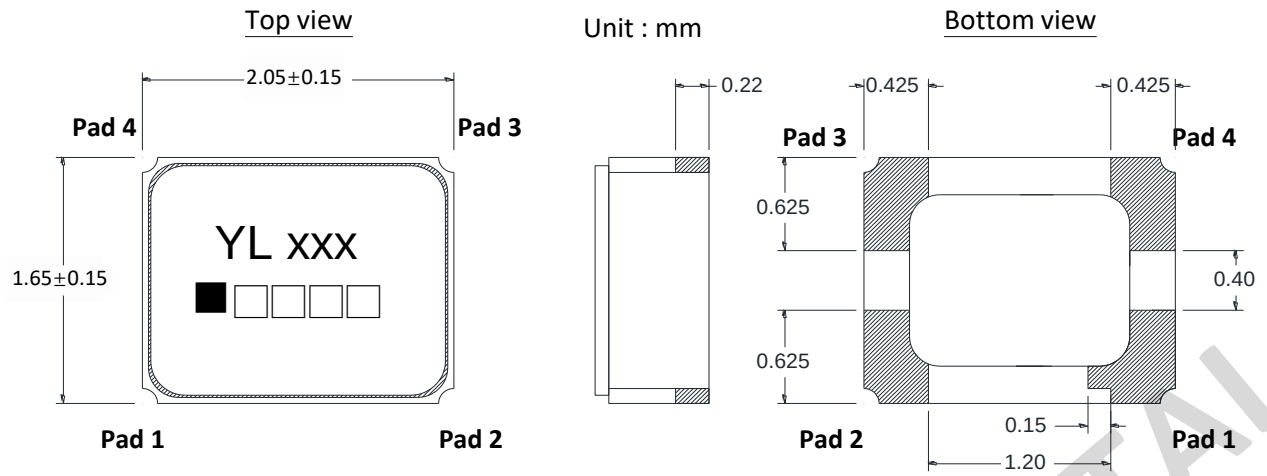
## 2. Electrical Specifications (Cont.)

### 2.4 Phase noise and jitter characteristics

| # | Parameters | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| 1 | Phase noise at 1kHz offset | - | - | -135 | dBc/Hz | At 25±2°C. |
| 2 | Phase noise at 10kHz offset | - | - | -149 | dBc/Hz | At 25±2°C. |
| 3 | Phase noise at 100kHz offset | - | - | -156 | dBc/Hz | At 25±2°C. |
| 4 | Phase noise at 1MHz offset | - | - | -156 | dBc/Hz | At 25±2°C. |
| 5 | Integrated phase noise | - | - | 8.5 | ps-rms | From 10 Hz to 1 MHz. |

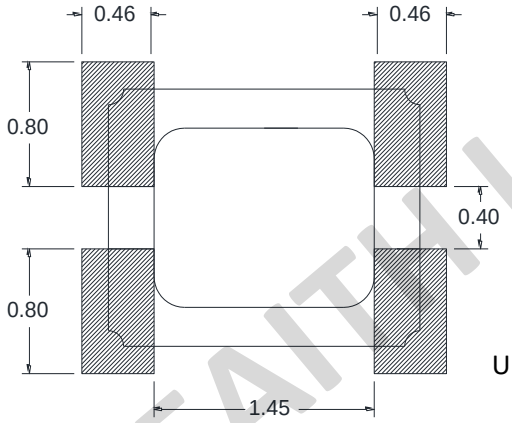
## 3. Product Design

### 3.1 Package dimensions and pad functions

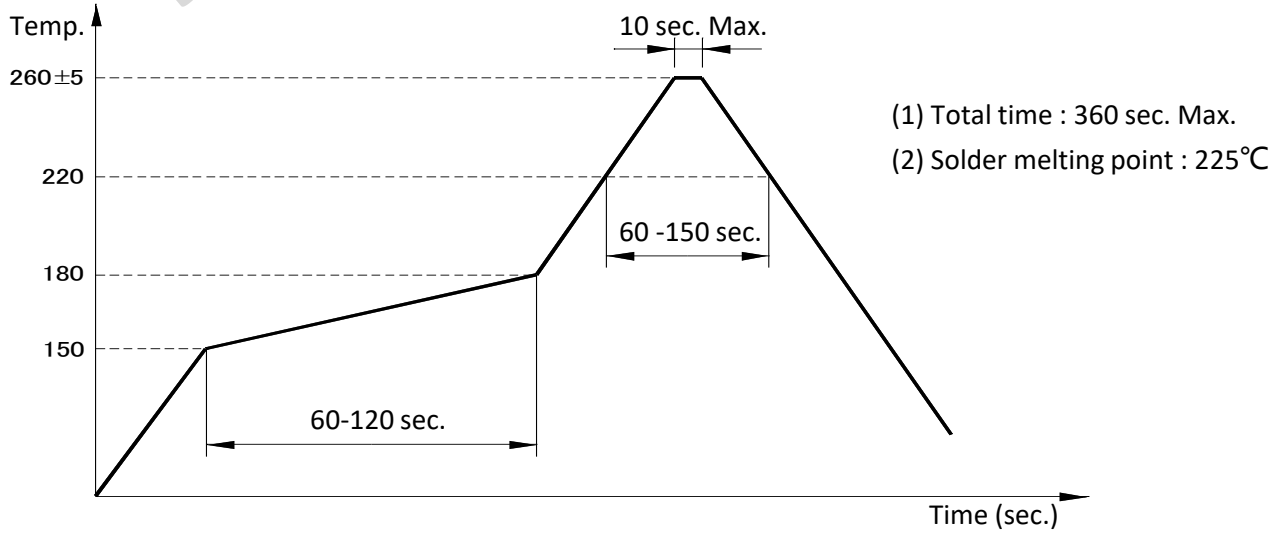



| Pad | Function | Symbol |
|---|---|---|
| 1 | NC or GND (Ground recommanded) | NC |
| 2 | Ground | GND |
| 3 | Output | OUT |
| 4 | Supply voltage | $V_{DD}$ |

### 3.2 Recommended land pattern



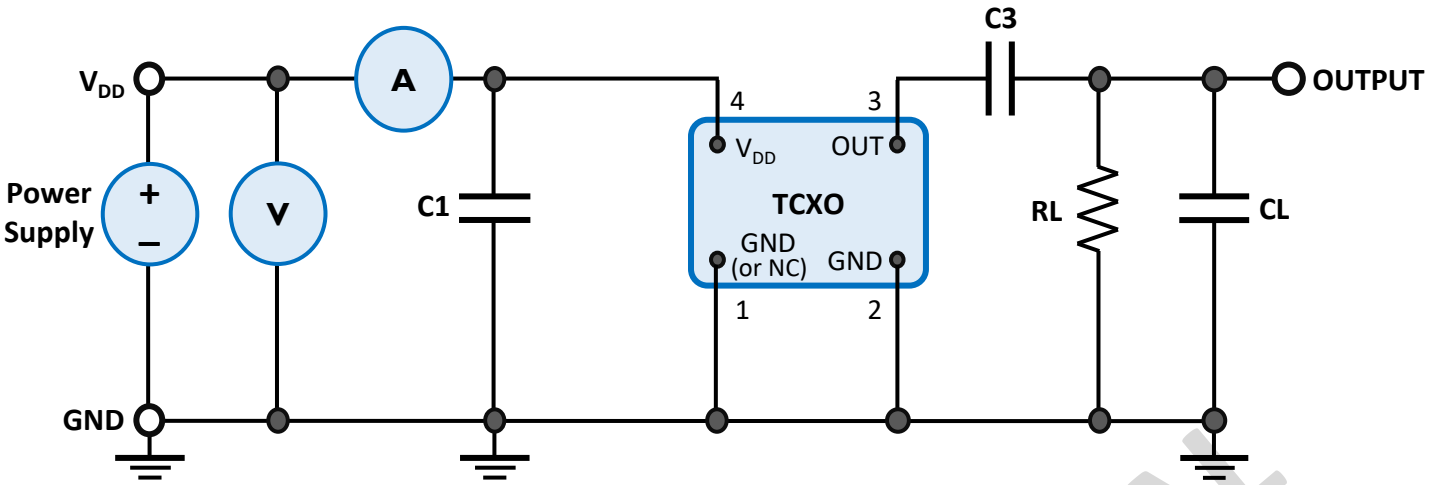

### 3.3 Recommended reflow profile




(1) Total time : 360 sec. Max.

(2) Solder melting point : 225℃

## 4. Testing Circuit




External Components:

| Parts | Function | Recommended |
|---|---|---|
| C1 | AC noise bypass for $V_{DD}$ | 100nF |
| C3 | DC block for output | 10nF |
| RL | Load resistance | 10KΩ |
| CL | Load capacitance | 10pF |

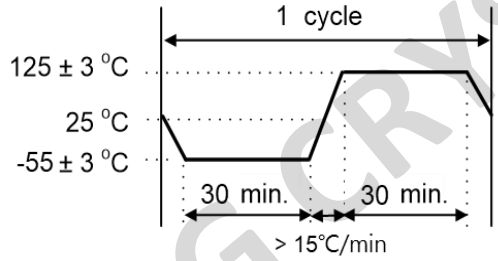
## 5. Reliability

### 5.1 Mechanical endurance

| # | Item | Test Condition | Reference |
|---|---|---|---|
| 1 | Mechanical shock | Acceleration : 100 g<br>Duration : 6.0 ms half sine shock pulse<br>Test cycles : 3 times for all 3 directions | JESD47F_JEDECB |
| 2 | Vibration | Acceleration : 20 g<br>Duration : 4 hours/each direction<br>Frequency range : 10 ~ 55 Hz and 55 ~ 2,000 Hz<br>Amplitude : 0.75 mm (for 10 ~ 55 Hz)<br>Direction : X, Y, Z, 3 directions | JESD47F_JEDECB |
| 3 | Gross leak | Standard Sample For Automatic Gross Leak Detector.<br>Test Pressure: 2kg /$cm^2$ | MIL-STD-883E |
| 4 | Fine leak | Helium bombing 4.5 kgf / $cm^2$ for 2 hours | MIL-STD-883E |

## 5. Reliability (Cont.)

### 5.2 Environmental endurance

| # | Item | Test Condition | Reference |
|---|---|---|---|
| 1 | High temperature storage | Temperature : +125°C ± 3°C<br>Duration : 1,000 hours | JESD47F_JEDECB |
| 2 | Low temperature storage | Temperature : -40°C ± 3°C<br>Duration : 1,000 hours | JESD47F_JEDECB |
| 3 | High temperature & humidity | Temperature : 85°C ± 3°C<br>Humidity : RH 85%<br>Duration : 1,000 hours | JESD47F_JEDECB |
| 4 | Thermal shock<br>(air to air) | Total 500 cycles of the following temperature cycle<br>  | JESD47F_JEDECB |
| 5 | Highly accelerated stress test<br>(un-bias) | Temperature : 130°C ± 3°C<br>Humidity : RH 85%<br>Pressure : 2 atms<br>Duration : 96 hours | JESD47F_JEDECB |
| 6 | Aging | Temperature : 105°C ± 3°C<br>Duration : 1,000 hours<br>Voltage input by specification | JESD47F_JEDECB |

## 6. Marking and Packing

### 6.1 Marking definition

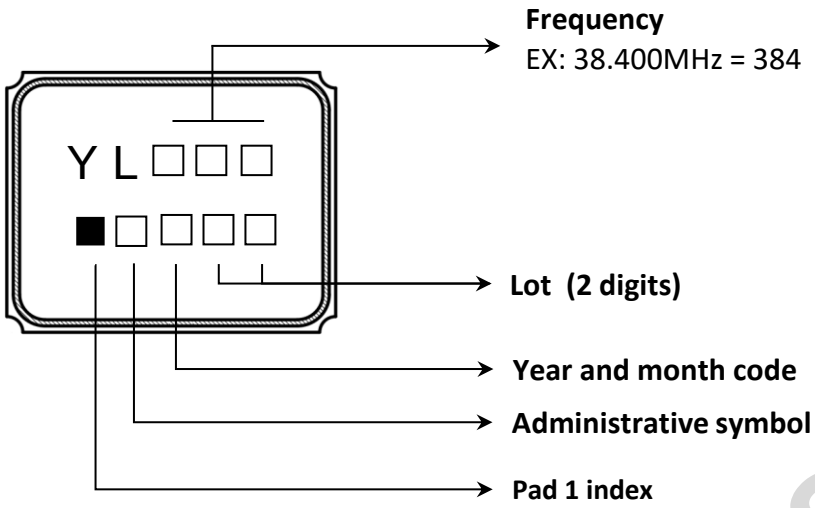
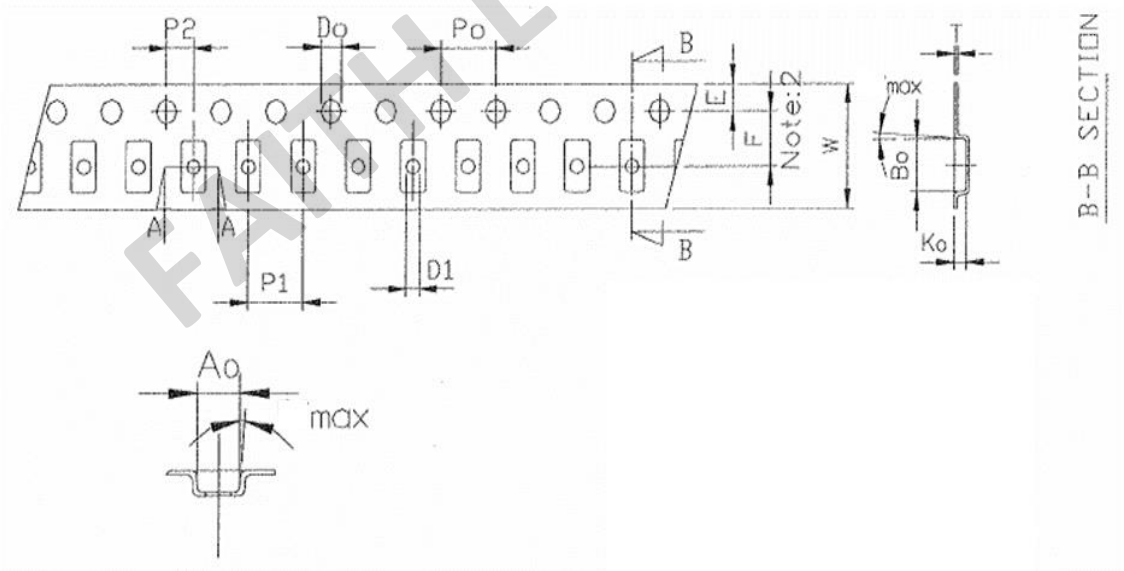



Table of Year and Month code

| Year \ Month | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2021 | 2025 | A | B | C | D | E | F | G | H | J | K | L | M |
| 2022 | 2026 | N | P | Q | R | S | T | U | V | W | X | Y | Z |
| 2023 | 2027 | a | b | c | d | e | f | g | h | j | k | l | m |
| 2024 | 2028 | n | p | q | r | s | t | u | v | w | x | y | z |

### 6.2 Packing (EIA-481-2)




| PKG Type | Dimension (Unit : mm) | | | | | | |
|---|---|---|---|---|---|---|---|
| 2016 (8mm) | $A_0$ | $B_0$ | $K_0$ | T | W | E | F |
| | 1.90±0.1 | 2.30±0.1 | 0.65±0.1 | 0.25±0.05 | 8.00±0.3 | 1.75±0.2 | 3.50±0.1 |
| | P1 | P2 | D1 | $D_0$ | $P_0$ | | |
| | 4.00±0.1 | 2.00±0.1 | 1.00±0.1 | 1.55±0.05 | 4.00±0.1 | | |

Standard Reel Quantity is 3000 pcs per reel.

## 6. Marking and Packing (Cont.)

### 6.2 Packing (EIA-481-2) (Cont.)

The inspection standard of tape tension

| Item | | Defect | Method |
|---|---|---|---|
| Appearance | All | 1. The tape is not coincidence<br>2. The bubble | Visual inspection |
| Tape tension | 8045, 7050<br>6035-12mm<br>5032-12mm<br>3225-12mm | Overstep 61±5g (55 to 67g) | Pull test |
| | 3225-8mm | Overstep 40±5g (35 to 45g) | |
| | 2520-8mm | Overstep 55±6g (49 to 61g) | |
| | 2016-8mm | Overstep 34±6g (28 to 40g) | |
| | 1612-8mm | Overstep 34±6g (28 to 40g) | |
| | 6035-16mm<br>5032-16mm | Overstep 60±6g (54 to 66g) | |