

Handling Notes for Quartz Crystals

In general, quartz crystals are designed to be quite insensitive against environmental conditions. Nevertheless, care should be taken during transportation, storing and production to avoid deteriorations of the crystal performance, or even destruction of the crystal component.

1. Storage conditions and moisture

Quartz crystals are a hermetically sealed device; therefore no humidity gets inside the cavity of the crystal package. Since the handling conditions and the pre-production conditioning defined in JEDEC J-STD-020 only apply to non-hermetic devices, they do not apply to quartz crystal components. However, long storage of quartz crystals at hot and humid conditions should be avoided.

Therefore, we recommend storing our leaded quartz crystals within the conditions described as MSL level 2, to avoid slight oxidation of the component's contact pins. As for SMD crystals with gold-plated contact pads, they are even less susceptible to pad oxidation, so that storage temperature and humidity conditions according to MSL level 1 may be applied.

During storage, the storage conditions should never exceed the temperature limits as specified in the catalog or datasheets. Preferably, please keep the storage temperature between +10° ~ +45°C (50°F ~ 115°F) and below 60% RH. If the components were stored over a long period or the storage conditions were not appropriate, before using, please make sure that the crystal components still comply with their specifications by performing visual and electrical inspections.

2. Transportation and Handling

During transportation and the manufacturing process, please avoid high shock and vibration levels on the component, which are exceeding its maximum specifications. Severe drops or being hit with a hard object could also cause damages to the component. Crystals that have suffered from excessive shocks and vibrations may show partial or full cracks of their internal crystal plate, or partial cracks of their cementing points, which might lead to intermittent failures of the component.

3. Mounting

A. *Leadless SMD components*

Please make sure not to exceed the appropriate re-flow conditions as recommended in the component specification, such as the peak temperature, the maximum duration, the number of exposures, the rate of temperature change vs. time, etc. Hand Soldering can be performed at a temperature of 260°C maximum for 10 sec. maximum. Soldering of the metallic package surface (for example for mechanical fixation) is not allowed.

Fortiming Corporation

B. Leaded pin type components

Please do not apply excessive soldering heat or soldering duration on crystal terminals. Please refer to the recommended wave soldering conditions. Hand Soldering can be performed at a temperature of 260°C maximum for 10 sec. maximum. Soldering of the metallic package surface (for example for mechanical fixation) is not allowed. Do not apply excessive force to cut or bend leads. Doing so could crack the glass insulation causing a leak, which deteriorates the crystal performance. When bending crystal leads for SMD mount, please do not bend the pins directly at the crystal package, which might cause a crack in the glass insulation at the body of the package. We recommend using an appropriate bending tool to keep a safe distance between the component body and the bending point.

4. Cleaning

A. AT-cut quartz crystals (not tuning fork crystals)

Ultrasonic cleaning should be avoided due to the risk of damage to the crystal blank. If ultrasonic cleaning is used, there is a risk of generating mechanical resonance, which may cause an intermittent or permanent damage of the crystal component. Please be aware that ultrasonic waves propagate over a board in a way that is not under control of the crystal manufacturer. Therefore it is impossible for us to confirm each customer's mounting and cleaning conditions, such as the mechanical resonance conditions of the board, the cleaner's type, the applied power, the time, the placement in the cleaning tank and so on. Consequently, we are unable to define general conditions for cleaning or guidelines to protect our component against damages.

If ultra-sonic waves are used during cleaning or manufacturing, please make sure to perform an appropriate inspection to make sure that the quartz crystal still meets its specification. Moreover, if there is a change in cleaning conditions, board or placement of the component after a redesign of the board, please be sure to perform the same inspection for confirmation.

B. Tuning Fork Crystals

It is strongly recommended not to apply ultrasonic waves during cleaning or manufacturing to tuning fork crystals, as their resonance frequencies lie close to the ultrasonic frequencies being typically used during ultrasonic cleaning or manufacturing. Tuning fork crystal blanks might easily get partially or fully cracked by ultrasonic cleaning or welding.

C. Cleaning Solvents

It is recommended that aqueous cleaning methods such as de-mineralized water or high pressure water cleaning be used in order to avoid physical damage caused by solvents. Some aggressive solvents (such as those containing Chlorine) may cause an oxidation of the metallic crystal packages or a discoloration on the component surface or marking. Do not exceed a temperature of +50°C (120°F) during cleaning.

Fortiming Corporation

5. Packing Method (ESD)

Although quartz crystals are not ESD sensitive, we deliver our products in anti-static bags for better protection in ESD compliant production environments. We use various ESD compliant packing methods such as anti-static tube, foam, tape and reel, ammo packing on our products. We recommend opening packaging tubes or bags with care to avoid damage to products.

6. Operating Conditions

A. Operating temperature

All crystals should be operated within the temperature limits as specified in the catalog or datasheet.

B. Drive level

All crystals should be operated within the maximum power as specified in the catalog or datasheets. Excessive drive levels could affect the long-term frequency stability or even destroy the crystal blank.

Side Note for Tuning Fork Crystals

Please note that tuning fork crystals have a maximum drive level as low as $0.5\mu\text{W}$ ~ $1.0\mu\text{W}$ (depending on package size). Please make sure that appropriate driving circuits are used, which limit the drive level. In case of doubt, please contact the IC or circuit supplier. Please be aware that if drive levels over $\sim 2\mu\text{W}$ are applied to a tuning fork crystal, the frequency may shift down and the internal crystal blank may be broken.

C. PCB layout

We recommend to layout crystal connections close to the chip or driver circuit inputs. Preferably avoid long traces, and signal traces, which could interfere to the crystal clock signal. In multiplayer boards, avoid stray inductance and capacitance by leaving out inner traces in the area of the crystal. Please be aware that our pad layout suggestions are given for your reference. Please use them as a design suggestion and apply your companies' design rules. Pins that are identified as NC should remain unconnected.