Jauch
THE PULSE OF PROGRESS

# HANDLING NOTES FOR QUARTZ CRYSTALS


## DOCUMENT

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## 1. General handling instructions

Generally, 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.

## 2. Storage conditions and moisture

A crystal is a hermetically sealed device; therefore no humidity gets inside the cavity of the crystal package. As the handling conditions and the pre-production conditioning being defined in JEDEC J-STD-020 do only apply to non-hermetic devices, they basically do not apply to quartz crystal components.

Nevertheless, long storage of quartz crystals at hot and humid conditions should be avoided. Therefore, we recommend storing our quartz crystals with tinned wires within the conditions described as MSL level 2, to avoid slight oxidation of the component's contact pins.
SMD crystals with gold-plated contact pads are even less susceptible to pad oxidation, and storage temperature and humidity conditions according to MSL level 1 may be applied.

During storage of the component, the storage conditions should never exceed the temperature limits as specified in the catalog or datasheets. Please note that the storage temperature range applies to the component only.
Preferably, please keep the storage temperature between +10° ~ +45°C (50°F ~ 115°F) and below 60% RH as long as the component is packed and reeled.

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 to their specifications by performing visual and electrical inspections.

## 3. Transportation and Handling

During transportation and during the manufacturing process, please avoid high shock and vibration levels to 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 which have suffered from excessive shocks and vibrations may show partial or full cracks of their internal crystal plate (crystal blank), or partial cracks of their cementing points, which might lead to intermittent failures of the component.

## 4. Mounting

- **SMD components**

  Please make sure not to exceed the appropriate reflow 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 350°C max. for 3 sec. max.
  Soldering of the metallic package surface (for example for mechanical fixation) is not allowed.
  Please avoid extreme deformations of the board. Deformations may result in a detachment of the PCB contact pad, a detachment of the SMD crystal terminals or cracks in the solder joints.
  Full attention is requested especially when splitting the board with the component already mounted. Any deformation or bending of the board should be avoided.
  Should an automatic mounting system be used, please select an equipment with minor shock generation, and check for the intensity of the shock before use.

- **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 350°C max. for 3 sec. max.
  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 or resin seal and cause 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.

## 5. Cleaning

- **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 resonances, 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 which 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 damage.
  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.

- **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.

- **Cleaning Solvents**

  It is recommended that aqueous cleaning methods such as demineralized water or high-pressure water cleaning is 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.

## 6. Packing Method (ESD)

Although quartz crystals are not ESD sensitive, we deliver most of our products in anti-static packaging 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

## 7. Operating Conditions

- **Operating temperature**

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

- **Drive level**

  All crystals should be operated within the maximum power as specified in the catalogue 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 max. drive level as low as 0.5µW ~ 1.0µW (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 2µW are applied to a tuning fork crystal, the frequency may shift down and the internal crystal blank may be broken.

- **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 multilayer 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 company's design rules. Pins that are identified as NC should remain unconnected.

- **Oscillation Safety Factor or Negative Resistance**

  Please refer to the appropriate documents which you can find on the technical section of our homepage (www.jauch.com).

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