

# Tuning Fork Crystals (Cylinder type) Handling Precaution

This document describes how to properly solder cylinder (vacuum-sealed) type crystals.

## 1. Background information:(Sealing methodology - Cold Weld)

### Cylinder Type crystal (Thru-hole)

The encapsulating raw materials with solder are coated at the joint of the base.

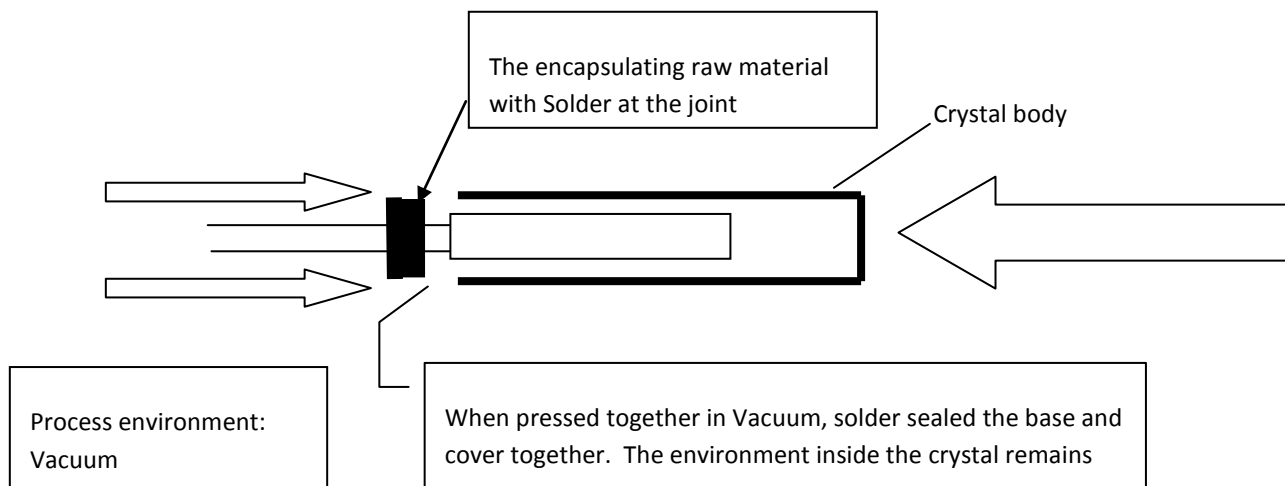


Fig 1 the sealing process

After the sealing process, if the body of this crystal had been directly subjected to 200°C or above, the properties of the solder such as grain size and hardness will be changed, which may deteriorate the characteristics of this crystal or cause leakage problem. To avoid this, crystal body are forbidden to have direct contact with hot soldering iron or conduct any soldering; the conduction temperature of the crystal body should not be 200°C or above.

## 2. Improper soldering process

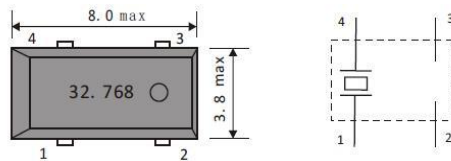
### 2.1 Thru-hole package of this crystal on reflow process:

During the reflow process, the normal thru-hole type crystal (such as 2T and 3T etc) will be subjected to temperature higher than 200 °C, it may cause damage the product and undesirable quality problem.



### **Recommendation**

- ✓ ***If reflow process is necessary, Plastic or Ceramic SMD type product is strongly recommended.***
- ✓ ***Use Plastic SMD type such as M3& M6 or Ceramic SMD type such as M8 & P8. They are applicable for the reflow soldering process. For further information is needed, please contact our sales representative.***



*Don't connect #2 and #3 to external circuit including Ground*

Fig 2 Example Layer of 32K -160K series SMD Crystal

(HKC M3 – Type)

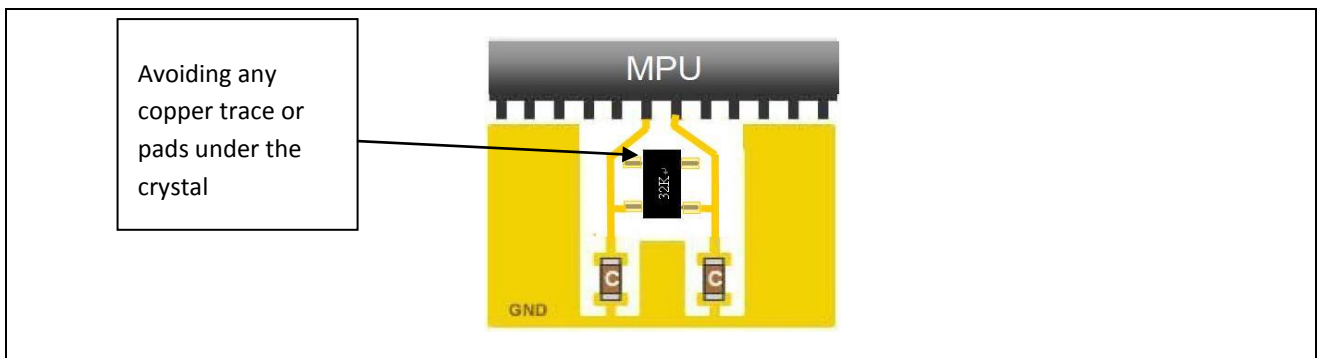
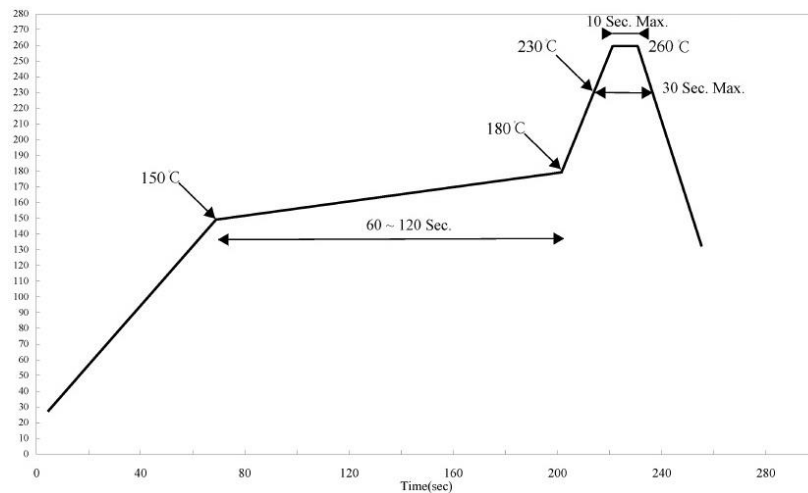


Fig 3 Example of PCB Layout (Reference only)

Recommended Reflow Profile for SMD Products(reference only)



Remark:

The reflow profile provided is for reference only. The reflow profile should be optimized depending on the configurations of reflow system, the components loading and the layout of the board including the board density, board size to achieve the satisfactory reflow process yield

2.2 Crystal for Ground mounting :

Regarding below two processes, it is hard to control the manual soldering time and temperature. Overheating on the crystal body can deteriorate the internal structure of the crystal.

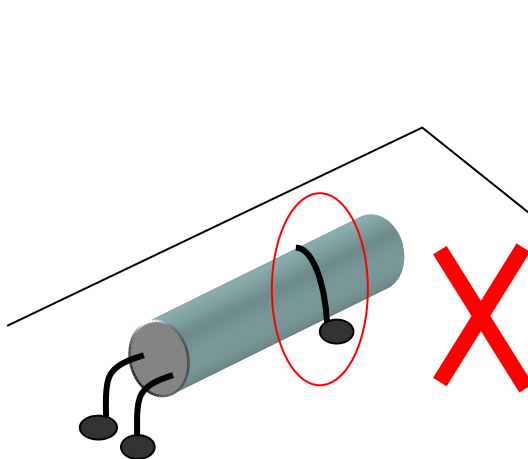


Fig 4

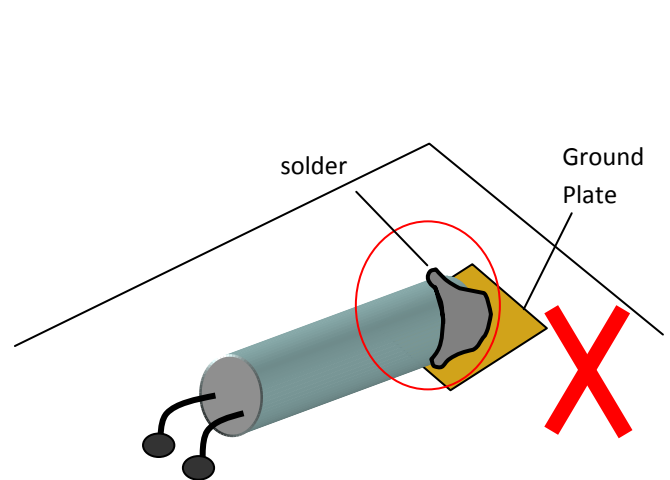


Fig 5

**Recommendation**

- ✓ For Ground mounting purposes, it is suggested to solder SMT metal clip on PCB board near the end position of the cylinder crystal (such as 2T and 3T).
- ✓ SJ product is strongly recommended for grounding purpose. If reflow soldering is necessary, high temperature type SJ is required. For further information, please contact our sales representative.

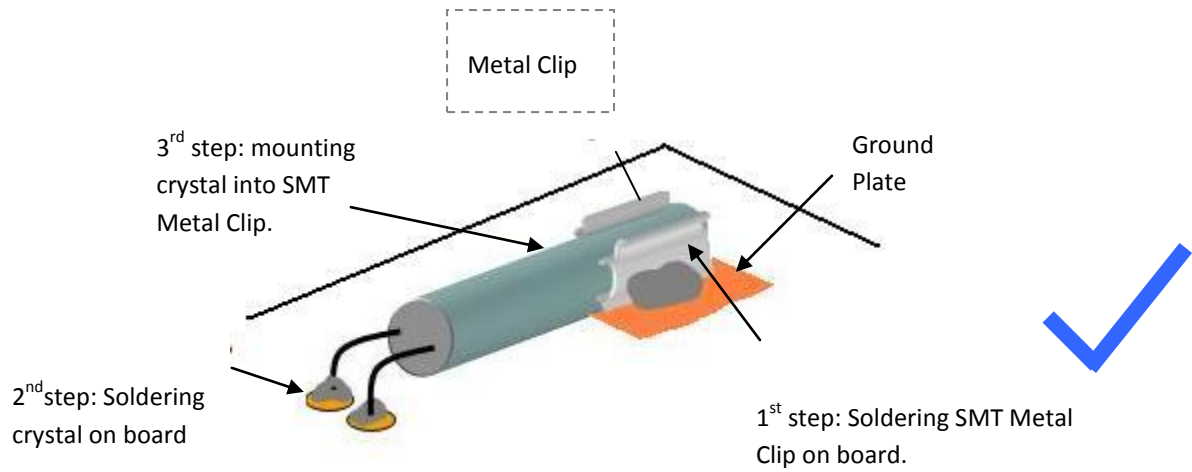


Fig 6 Example of adding Metal Clip for ground mounting



Fig 7 Landing pattern of SJ type crystal

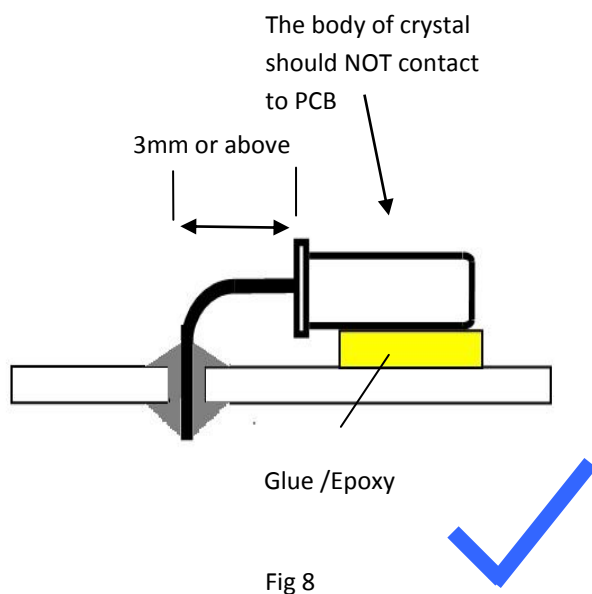
### 3. Proper soldering process

#### 3.1 Hand soldering

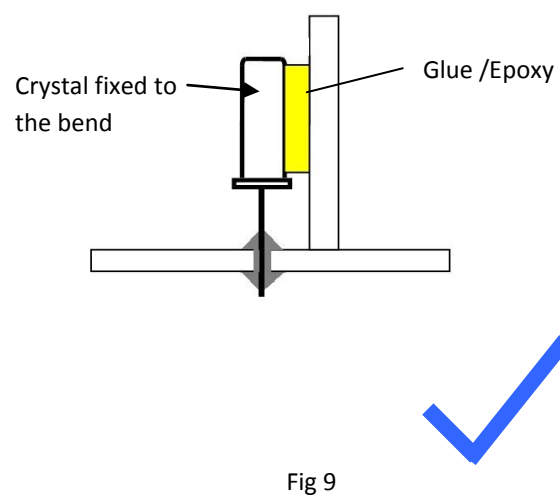
- Hand soldering should be done at a lead length of at least 3 mm from the base (and landing pad of metal jacket for SJ type), and max. 280 °C, max 5 seconds; below 260 °C, max. 10 seconds.

Model	Hand Soldering conditions
[Thru-hole type] 2T, 3T	+280°C or under, Max. 5sec
SJ, ST	<b>Do not heat the body at more than +200°C</b>

- The body of the crystal should not be subjected to 200°C, for any duration of time.
- After soldering, apply glue or epoxy to the body of the crystal so as to fix the crystal onto the PCBA.
- Make sure the process of applying the glue/epoxy, or during its curing/settling, **the crystal body is not subjected to 200 °C, for any duration of time.**



After soldering, apply elastic glue/ epoxy to fix crystal on PCBA, and also absorb shock.



Crystal is fixed on the bend by glue or epoxy, avoid striking the crystal to the PCB during shock

### 3.2 Alternative process for wave soldering:

- Design the PCB carefully, such as **avoiding any copper trace or pads under the crystal**(on both side of the PCB), or **increasing the PCB thickness.....etc.**, so as to minimize the heat transfer from the wave solder bath to the crystal;
- Glue the crystals on to the PCBA, making sure that **the body of crystal is NOT touching the PCB**, and **choosing some glue that has low heat conductivity and can withstand the temperature throughout the whole process.**
- Optionally, consider placing a heat insulator between the crystal and the PCB before applying the glue, this will surely control that the crystal will not touch the PCB. Or, optionally use a high-temperature-tape.
- Adjust and control carefully the whole wave soldering process, so as to make sure that the body of crystal has never reached 200°C.
- If the wave soldering machine is equipped with double side heaters, add a heat shield to the crystal during the process.
- If possible, perform dummy test runs with temperature sensors attached to the crystal and monitor the temperature throughout the process.

The above alternative process is only for reference. There are too many variables and unknowns in this process. All these factors are out of HKC's (or any crystal makers') control and knowledge, hence HKC is not in a position to comment or advice on your production process.

### 4. Shock and Mechanical vibration

Crystal products are designed to resist physical shocks. However, the crystal will become fatal if it is subjected to excessive impact such as dropping or receiving shocks during mounting. Please ensure the crystal unit functions normally before use if the crystal units have been dropped or subjected to excessive mechanical shocks.

To minimize the effect of mechanical vibration to crystal products, please avoid assembling crystals near piezo buzzer source or cutting edge of PCB etc..

## 5. Lead Cutting and Lead Forming

Please keep your lead cutter in good condition. Do not pull the lead excessively when bending a lead or removing a crystal unit (see fig 10). If forming the leads, please not to add excessive stress to the root of lead wire or do not press sealing areas, otherwise the crack of glass at the base or the leak may be caused.

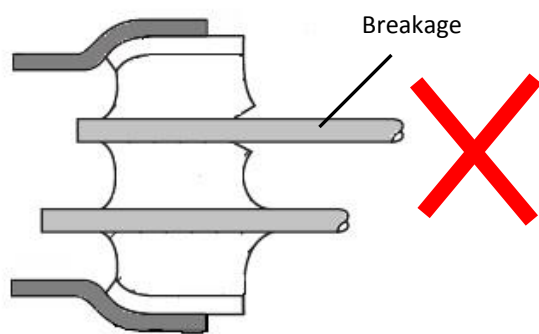


Fig 10

Excess pull the lead, it may break the crystal chip.

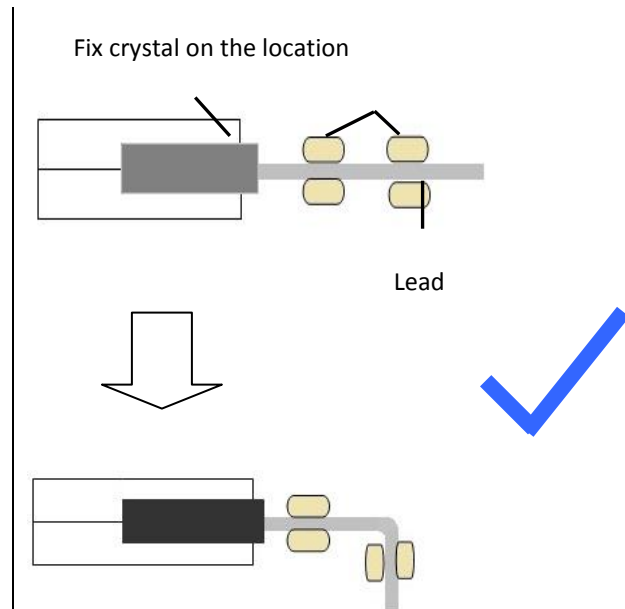


Fig 11

- Hold the crystal tightly & pick the part with tweezers
- Bend the lead 90° by tweezers without pulling the lead strongly.

## 6. Cleaning

Tuning fork crystal cannot be guaranteed if cleaned by ultrasonic methods because crystal chip may be destroyed. Some kind of cleaners and solvents may adversely affect the crystal product. Please ensure to check suitability of the solvents in advance.

## **7. Storage**

Storage of crystal products at high temperature or high humidity for a long time may affect frequency stability or solderability. Please do not store the crystal products under high temperature and humidity, do not expose to direct sunlight and dew condensation, and mount them as soon as possible after unpacking.

Please carefully handle the inner and outer boxes or reel package etc. External pressure may cause deformation of the reel or tape package.

## **8. Drive Level**

High driving level of crystal unit may cause deterioration of characteristics. For cylinder type TF products, max. drive level of 1uW is recommended.