■ Precautions for Use

2. To satisfy functional performance requirements

According to the particular internal structure, the inside of the holder of a crystal unit is evacuated or filled with inert gas to maintain its characteristics.

2-1 Ultrasonic welding machine usage

Ultrasonic welding machine usage can cause degradation of operational characteristics due to ultrasonic resonance in crystal pieces. Please ask your sales representative for details of our resonance-proof products.

2-2 Mounting of surface-mount type crystal unit

(1) Severe temperature change

Under prolonged and repeated severe temperature changes solder may crack; this is caused by expansion due to the different temperature coefficients of the print wire board material and surface-mount type crystal unit ceramic package.

If such conditions are anticipated and to avoid such problems, please contact us beforehand for temperature conditions, etc.

(2) Shock from automatic mounting

Please take note, during automatic mounting, such processes as adsorption, chucking, or mounting to the circuit board, may administer too great a mechanical shock to the crystal unit, and the electrical characteristics may change or deteriorate.

(3) Stress caused by bending the PC board

If after a crystal unit is soldered to the PC board, the board is bent, the mechanical stress may cause the soldered part to peel away or the crystal unit package to crack.

(4) Grounding terminal

If the crystal unit is provided with a grounding terminal, be sure to solder it to GND or to the power supply terminal. If it is not grounded, the correct frequency may not be obtained.

2-3 Soldering and ultrasonic cleaning

The soldering temperature conditions of a crystal unit are designed so as to allow the simultaneous processing of other electronic components, but depending upon the product type the conditions may be subject to restrictions. Confirm the conditions prior to use. Basically, the ultrasonic cleaning of flux is allowed, but in some cases, the resonance with the oscillation frequency of the ultrasonic wave cleaner might cause the characteristics of the crystal unit to deteriorate. Please check all conditions before cleaning.

2-4 Effect of corrosive materials

When a crystal unit contacts salt or corrosive materials or is exposed for long periods to certain substances in the atmosphere such as chloride or sulfide-based gases, this may cause a serious flaw such as the package losing its airtight seal due to corrosion.

Exercise great care when selecting an adhesive or potting agent to be used at the perimeter of a crystal unit.

2-5 Mounting a lead-mount type crystal unit

(1)Mount a crystal unit on the PC board so that the height of the unit is lower than those of other parts; this will prevent the holder-base glass from breakage caused by shocks given from the upper side. Breakage of the glass may affect the airtight seal causing a deterioration of performance.

(2) When mounting a lead-mount type crystal unit in contact with a PC board, the distance between the holes on the PC board should equal the distance between the terminals of the crystal unit to be mounted.

The slightest error in pitch may cause cracks in the glass section of the crystal unit holder.

(3) When mounting a lead-mount type crystal unit, we recommend that the unit should make contact with the PC board and be soldered in such a way as to prevent fatigue and breakage of the leads due to mechanical resonance (see Fig. 13).

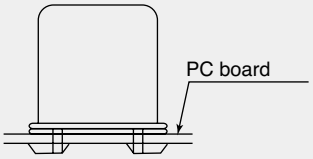


Fig. 13 Crystal Unit Mounting Method

(4) After installation of a crystal unit on a PC board, moving the unit as shown in Fig. 14 causes the holder-base glass to crack resulting in the deterioration of characteristics. Do not move the crystal unit in this way.

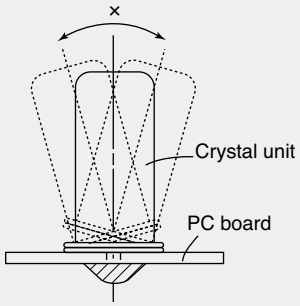


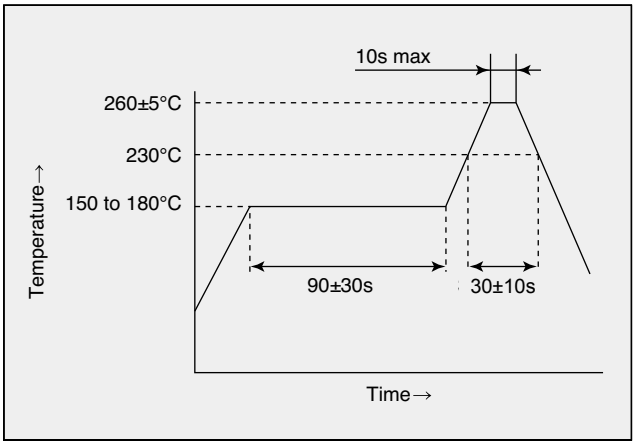
Fig. 14 Care to be Taken After Mounting a Crystal Unit

■ Precautions for Use

3. Reflow Soldering

The figure below shows the standards for reflow soldering temperature profiles of surface-mount type crystal units.

● Examples of soldering conditions



●Soldering conditions
Peak-temperature: 260±5 °C Max. 10 seconds
Heating conditions: Min 230 °C 30 ±10 seconds
Warm-up rate: Max. 3 °C/second
Cool-down rate: Max. 6 °C/second
Preheating conditions: 150 to 180 °C 90 ±30 seconds

Precautions

Never use these products under any conditions that exceed the following limits; such use may cause the product's characteristics to deteriorate or the product may break.

Heat Resistance of SMD Crystal Products
[Reflow Soldering Heat Resistance]
Peak-temperature: 265 °C, 10 sec.
Heating conditions: Min. 230 °C, 40 sec.
Warm-up rate: 3 °C/second
Cool-down rate: 6 °C/second
Preheating conditions: 150 to 180 °C, 120 seconds
Number of reflow passes: 2

[Manual Soldering Heat Resistance]
Use condition: Apply 400 °C soldering iron to product terminal electrode for 4 seconds.
Number of applications: 2

(1) Glass-sealed product
When using a soldering iron for soldering glass-sealed products, apply the iron tip below the sealed part to prevent the iron touching the sealed glass part
(if the iron tip touches the glass part, the glass may melt and the inner airtight seal may be destroyed).

(2) Au/Sn-sealed product
Do not touch the tip of a soldering iron to the sealed part of an Au/Sn-sealed product.
(The iron tip may melt the sealant and break the airtight seal.)
In addition, if possible, it is recommended that this product it to be mounted with reflow without using a soldering iron or an air-heater.
In purpose of reworking crystal unit, during removing from the board or module, or removing module from board, any excessive heat may melt the Au/Sn sealant, resulting in the deterioration of characteristics or the breaking of the airtight seal. Therefore, please handle this product with particular care to the above precautions. However, in case an air-heater is need to be used, do not exceed below heating conditions.
Air-heater temperature: 280 °C, time: 10 seconds

Heat Resistance of Crystal Products other than SMD
[Reflow Soldering Heat Resistance]
Soldering temperature: 265 °C, 10 sec.
Number of flow applications: 2
[Manual Soldering Heat Resistance]
Use conditions: Apply 400 °C soldering iron to product terminal electrode for 4 seconds.
Number of applications: 2

■ Precautions for Use

4. Guaranteed items

The environmental and mechanical characteristics of our crystals are guaranteed thanks to testing for resistance to temperature extremes, humidity, shock and other influences depending on the product. Guarantee conditions relate to crystal forms, characteristics, applications, usage environments and the like.

(*) General consumer products: items commonly used in general machines, such as AVs and OAs

No.	Test Items	Conditions	Specifications
1	High-temperature resistance	720 hours at +85 ± 3°C	*1
2	Low-temperature resistance	500 hours at -40 ± 3°C	*1
3	High-temperature and high-humidity resistance	500 hours at +60 ± 3°C and humidity 90 – 95%	*1
4	Thermal-shock resistance	-40 ± 3°C/+85 ± 3°C 500 cycles each for 30 minutes as one cycle	*1
5	Vibration resistance	Frequency range: 10 – 55 Hz Total amplitude or acceleration: 1.52 mm Cycle: 1 minute Frequency: three orthogonal directions for two hours each	*1
6	Mechanical-shock resistance	Shock: 981 m/s2, 6 ms, half-wave sine wave Frequency: six XYZ directions three times each	*1
7	Drop impact resistance	Three releases from a height of 75 cm onto a hard wooden board (30 mm or thicker)	*1
8	Solderability	Pre heating temperature: +150 ± 10°C; Pre heating duration: 6–120 seconds SMD temperature: 30 ± 1 seconds after achievement of a regular temperature of +215°C Peak temperature: +240 ± 5°C Solder type: lead-free (Sn-3.0 Ag-0.5 Cu) Flux: methanol solution containing rosin (rosin:methanol = 1:4).	At least 90% of electrode soldered parts to be covered with solder
9	Reflow heat resistance	Pre heating temperature: +150 – 180°C; Pre heating duration: 90 ± 30 seconds Regular heating temperature: +230°C or higher; Regular heating duration: up to 30 seconds; Peak temperature: +260 ± 5°C; Peak duration: up to 10 seconds	*1

(*1) $\Delta F/F \leqq \pm 5\times10^{-6}$、$\Delta CI \leqq \pm 15\%$ or 5Ω , whichever is greater

Contact us for details of individual products.

■ Precautions for Use

5. Matters to be addressed before product return

We are committed to supporting our crystal users via timely identification of root causes behind any issues that may arise. Accordingly, customers are asked to address the following matters before returning products.

5-1 Cross-checking to identify potential issues (crystals/ oscillator circuit parts)

Compare a print circuit board with the failure (PCB (A)) and one without it (PCB (B)).
Swap the crystal oscillators between the two boards and check performance.

Case 1: After the swap, PCB (B) has issues but PCB (A) does not.
To double-check, swap the crystals back. If PCB (A) then has issues, it is likely that the relevant crystal has problems, or there may be matching problems between the crystal and the oscillator circuit.

Case 2: After the swap, PCB (A) has issues but PCB (B) does not.
To double-check, swap the oscillators back. If PCB (A) then has issues, it is likely that parts other than the crystal have problems. Identify abnormal parts based on cross-checking of components such as the IC.

Case 3: Situations other than Case 1 and Case 2 – Both PCBs have issues, neither has issues, or no reproducibility is observed from repeated crystal swapping. There may be matching problems between the crystal and the PCB (oscillator circuit).

5-2 Provision of information on abnormal conditions identified

In Cases 1 and 3 above, there may be issues with the crystal itself or with the usage conditions; please provide information on the abnormalities identified.
1. Description of PCB abnormalities (output disruption, defective images, noise, etc.)
2. When a malfunction occurs at a specific temperature,such as low temperature, high temperature, the temperature at which it becomes defective.
3. Any particular crystal characteristics associated with PCB failure (e.g., frequency drift)
4. Other details of failures (number of incidences, affected lots, etc.). Please include photos of the display and the label on the defective product.

5-3 Return of defective products

Return the defective product (attn: Sales Contact) with the above information and any results from your own monitoring of the relevant crystal characteristics.

For crystals mounted on a PCB, analysis will be conducted to determine whether the problem relates to issues with the crystal itself or to matching issues.

5-4 Circuit analysis

If matching issues between the oscillator circuit and the crystal are identified, clients will be provided with proposals for resolution of the relevant abnormalities (e.g., oscillation frequency drift/ oscillation instability) based on changes in circuit constants or other measures. Such proposals will require the client's provision of information on the connection method (V_{CC}, earth, output, etc.) for circuit examination.

Please advise if application involves the use of crystal as standard parts on different PCBs, as separate circuit analysis will need to be conducted.

For an outline of oscillator circuits, see oscillator Circuits in the Application Notes.