Crystal Unit Structure

A quartz crystal unit includes a small strip or disk of quartz that is processed to an exact size and thickness dependent on the customer specified resonating frequency. The quartz is plated with conducting electrodes and mounted in a hermetically sealed protective enclosure (see Figure 1).

The electrodes connect to leads that pass through the base assembly via glass-to-metal seals or, in the case of a SMD ceramic package (see Figure 1); the electrodes connect to the pads via layered plated ceramic.

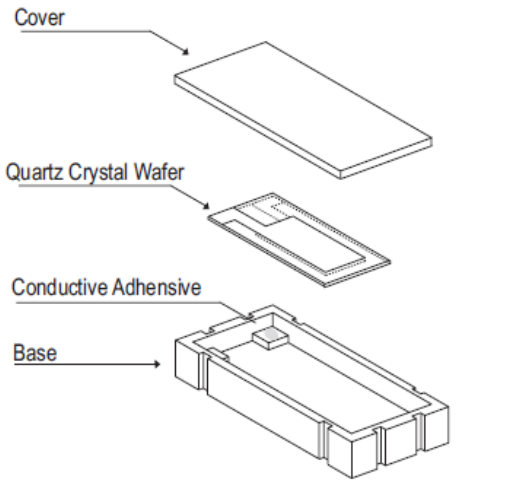
Crystal units are often encapsulated together with other circuitry to realize a fully functional module, e.g. an oscillator or a complex filter. Figures 2 and 3 illustrate simple crystal oscillators. Because of the nature of the crystal unit, correct handling is very important.

Mechanical shock

Crystal components are manufactured to withstand a certain level of mechanical shock. These levels are outlined in the environmental specifications for each individual component type throughout the specification sheets.

Excessive levels of shock can cause a change to the electrical characteristics, most likely manifesting as a frequency change. Severe mistreatment, such as dropping onto a hard surface, may result in the actual breakage of the quartz blank. In the case of ceramic-packaged components it is also possible that the ceramic may crack, resulting in a loss of hermeticity.

Figure 1



SMD Ceramic Package Crystal

Figure 2

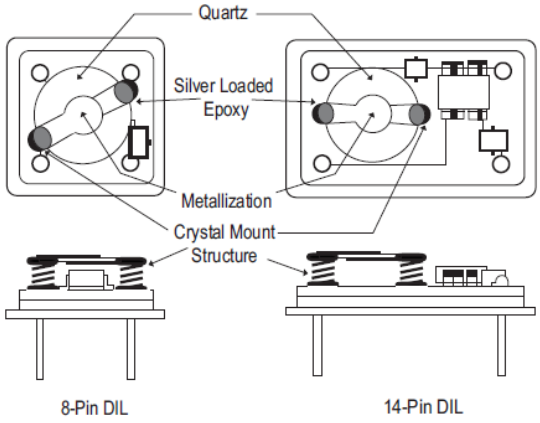
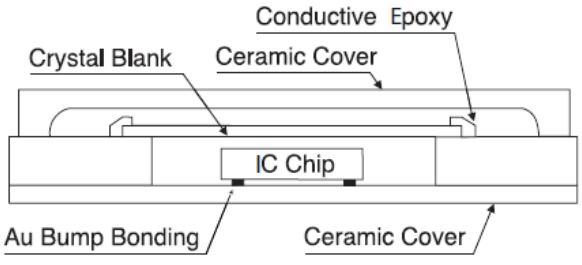


Figure 3



SMD Ceramic Package Osciliator

APPLICATION NOTE - Crystal Handling Precautions

Handling leads

Excessive bending of leads can cause damage to the glass-to-metal seal, which can result in loss of hermeticity of the enclosure. Enclosures are filled with a dry inert gas and loss of hermeticity will result in a rapid deterioration of the product due to atmospheric contamination. Care should therefore be taken when handling a crystal not to pull or bend the leads. If the component needs to be moved in a way that involves bending, the lead should be bent slightly away from the glass seal to avoid cracking it. The recommended minimum radius of curvature is product dependent, e.g. 2mm for HC49 crystals and 1mm for UM1s.

Tape-and-reel product

Before using crystal components on automated placement machines, tests should be undertaken to assess the level of shock that the crystal devices will be subjected to during the placement process. If necessary the shock level should be reduced.

Temperature

If crystals are subjected to extreme temperatures outside storage temperature limits, the electrical performance can be affected, resulting in eventual failure. During soldering it will be necessary to subject the components to high temperatures for limited periods of time, please refer to the RoHS Status of IQD Products document for maximum limiting values.

Electrostatic discharge (ESD)

Only at extreme voltages can static electricity be seen, heard or even felt, but even the lowest voltages can damage electronic circuits. The damage caused to oscillators as a result of ESD may not immediately be evident but can be delayed, causing the oscillator circuitry to degrade, which in turn can cause failure of the oscillator in the field.

Although quartz is not necessarily susceptible to ESD damage, the associated electronic circuitry contained within an oscillator is, and should be considered as an Electro Static Discharge Sensitive (ESDS) device. ESDS devices should only be handled in an ESD Protected Area (EPA), where proper precautions against ESD damage are taken.

Cracked HC49

Broken Watch Crystal

info@IQDfrequencyproducts.com IQDfrequencyproducts.com
Head Office UK: +44 (0) 1460 270200 Germany: +49 (0) 7942 945 4912

IQD Frequency Products Ltd, Station Road, Crewkerne, Somerset TA18 8AR UK

APPLICATION NOTE - Crystal Handling Precautions

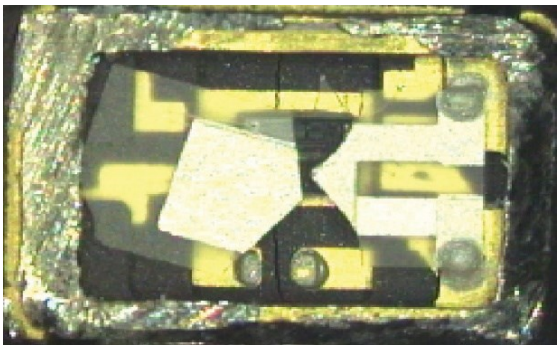
Any transportation should be undertaken using the appropriate protective packaging. All packaging should be marked with a warning notice, and protective measures and packaging should conform to BS EN 61340-5-1. For a more detailed breakdown of the precautions that should be taken, please contact our Customer Support Department.

Moisture Sensitivity Level Protection

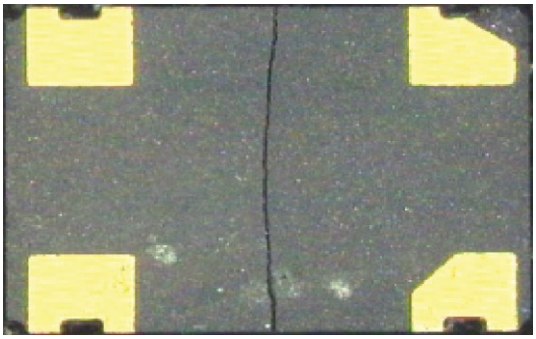
A small number of oscillators sold by IQD Frequency Products are sensitive to moisture ingress. This means that they can absorb moisture from the atmosphere, then during reflow soldering the moisture expands into steam and can crack the package thus resulting in permanent damage.

Levels of sensitivity to this type of damage are quantified with reference to JDEC-STD-020 and the relevant MSL level will be given on the device data sheet. On occasions when product is sensitive to this type of damage the product will arrive with to you packaged and marked in accordance with JDEC-STD-033. Storage and handling of these products should continue to be performed in accordance with JDEC-STD-033 to avoid damage to the product during reflow.

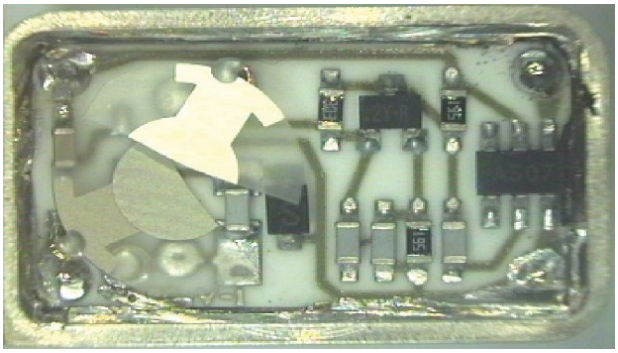
Cracked Strip Resonator



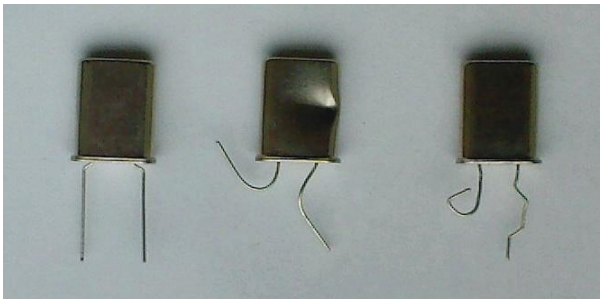
Cracked Ceramic Package



Cracked 14-pin DIL



Bent Leads



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