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Stack Chip Components
Handling and Usage

Storage and Transportation

A selected number of components are available 'Tape and Reel' packed. The storage and handling of these components is as for normal chip capacitors.

Unless supplied 'Tape and Reel' packed, all stack chip components will be supplied packed in a protective foam environment in individual cells, to prevent damage by contact during transportation.

It is recommended that the components are stored in the original packing until used.

If stored in the original packing, the components should be able to withstand all reasonable handling associated with transportation.

When removing components from the packaging, care must be taken to prevent damage to the legs due to snagging. The recommended method of removal is :

> Carefully remove the foam packing pieces individually from the box. When the loaded packing piece is on the bench, gently push each component from the packing piece onto the bench. Do not allow the components to drop. It is preferable to place empty packing pieces on the bench, so as to protect units as they are removed.

Take special care when removing 'L' leaded components, as the legs will be sandwiched between packing pieces. If the components are removed from the wrong side of the packing piece, damage will occur to the legs.

Under no circumstances should the components be gripped with pliers, or similar, to remove them from the packing. This is liable to cause severe damage to the component and may effect reliability.

Handling and Usage

The components should always be handled with care (see mechanical considerations).

Recommended pad designs for surface mounted and SM leaded components are available from Syfer on request.

These components are designed for assembly using all proprietary soldering methods such as hot air reflow or vapour phase soldering. Surface mount and SM leaded components are NOT considered suitable for assembly using a soldering iron – particularly 'J' leaded devices - as damage will almost certainly occur due to the thermal shock caused by the proximity of the soldering iron to the ceramic capacitors. If hand soldering is necessary, a hot air pencil should be carefully used, following the guidelines below. 'S' leaded components may be suitable for assembly with a soldering iron, provided the iron is applied to the opposite side of the boards to the component, and sensible care is taken as to the choice of iron tip and temperature settings.

On surface mount leaded components, any solder fillet should be to maintained to the foot of the leg (that part in contact with the board) only. Any meniscus to the vertical leg should be minimised to prevent the solder from reinforcing the leg and preventing the optimum stress decoupling from occurring.

The soldering process should be controlled such that the component does not experience any thermal shocks that may induce cracks into the ceramic dielectric.

The pre-heat temperature rise of the component should be kept to around 2^{O}C per second. In practise successful temperature rises tend to be in the region of 1.5^{O}C to 4^{O}C per second dependant upon the substrate and components. The pre-heat temperature should be close to the maximum soldering temperature (within 50^{O}C minimum) and the component should be stable at the pre-heat temperature prior to the final rise to reflow temperature.
Reflow time should be minimised, and the temperature controlled to a maximum of 220^{O}C. Cooling to ambient temperature should be allowed to occur naturally. Natural cooling allows a gradual relaxation of the thermal mismatch stresses in the solder and epoxy joints. Draughts should be avoided. Forced air cooling can induce thermal breakage, and cleaning with cold fluids immediately after a soldering process may result in cracked components. If soldering jigs have been used for support and to control the temperature gradients, the components should not be removed from the jigs until cooling to ambient temperature is complete.

The components are compatible with solder types Sn60 / Sn62 or similar. Leaded components are compatible with typical lead free solder alloys such as SAC. Unleaded components, terminated with PdAg termination, may exhibit leaching with lead free solders and we recommend that customers carry out their own trials.

The components are designed to be compatible with conventional cleaning processes – but it is the customers responsibility to ensure that there is compatibility with any specific cleaning solvents or processes.

Mechanical Considerations

These components, by their very nature, are large, delicate pieces of ceramic. All multi element, and large area, ceramic components should be considered fragile and handled with appropriate care. Any product dropped or mishandled should be considered suspect and only used advisedly.

Designers should also consider the geometry and relatively high mass of this type of component. Devices that are mis-specified, and unsuitable for use, may be susceptible to damage in high vibration or shock environments. This may be dramatic to the extent of leg or stack shearing. Tall multi chip stacked components, where the height / base aspect ratio is particularly high, are especially at risk. Dependant on the intended use, it may be advisable to strap, or otherwise support, the device, to ensure satisfactory operation. If strapping is used, then care must be taken to ensure that the ceramic is not cracked or chipped by excessive pressure exerted by the strap. If it is considered preferential to support the chip by the use of an adhesive to bond the component to the substrate, then care must be taken to ensure that there are no thermal mismatch stresses exerted on the ceramic by this bond.

The use of stand off legs on the larger components will provide a degree of stress relief during such operations as board de-panalisation, and may help prevent cracking occurring if board flexing takes place.

Thermal Considerations

The soldering requirements for these components are given earlier (see Handling Considerations).

All these components are large when compared to conventional ceramic capacitors. This size makes the ceramic potentially susceptible to thermal shock cracking if they are subjected to rapid changes of temperature, as temperature deltas can be generated within the build of the capacitors, causing a build up of stress.
It is not possible to state specific limits for the rate of temperature change, as this will be largely dependant on such factors as the thermal mass of the substrate to which the component is mounted and the degree to which the component is shielded from direct exposure to severe temperature environments. However, the rate of temperature change should be restricted to $< 4^{O}C$ / second in all cases.

The main causes of thermal cracking is mismatched Coefficients of Thermal Expansion (CTE) between the capacitors and their surrounding environment. For example a capacitor mounted directly onto a PCB will have a different CTE to the PCB upon which it is mounted. As the assembly undergoes temperature changes, the board and the capacitor expand and contract at different rates, causing a build up of stress at the interconnection point. If the rate of temperature change is too great, or the CTE mismatch too great, then the stress build up at this point may be sufficient to cause cracking of the ceramic in the assembly.

This effect worsens as the assemblies increase in size, as the stress force acts over a greater area. For this reason we do not recommend mounting chip sizes >= to 3640 directly to boards, but advocate the use of stand off legs for these components.

The use of stand off legs will minimise any reaction between the capacitor assembly and any PCB by allowing the legs to compensate for mismatch by flexing.