Surface Mount Multilayer Ceramic Chip Capacitors

SOLDERING RECOMMENDATIONS

1. Termination Selection:

A. Our tin-plated termination (terminations code "X") is recommended for all attachment methods which use solder. Vishay termination code "X" has a nickel barrier layer to prevent leaching of silver during the wave solder process.

B. Palladium silver (termination code "F") is the termination for conductive epoxy installation used for hybrid applications.

C. Tin/Lead termination with a minimum 4 % lead is available for Military, Aerospace and HiRel applications.

2. Chip Size vs. Solder Profile:

A. 0402, 0603, 0805 1206 and 1210 (thickness ≤ 0.049", 1.24 mm) can be used in all three solder systems shown on the following page.
1210 (thickness > 0.049", 1.24 mm) and case size ≥ 1808 should only be used in reflow or vapor phase soldering.

B. Solder profiles should be properly controlled to minimize any thermal shock to the capacitor(s).

(See recommended solder profiles on the following page.)

3. Soldering Flux:

Use mildly activated rosin flux RMA or RA types or low residue liquid fluxes (no-clean flux). Flux residues from no-clean flux can be removed with aqueous cleaners. During wave soldering ensure that the majority of solvents are removed at preheat.

4. Solder Type:

Both, lead containing solders, such as Sn60, Sn62 or Sn63 and lead free solders, such as SnAgCu, can be used with our MLCCs.

5. Soldering Techniques:

Follow the soldering curves shown on next page.

6. Soldering With a Solder Iron:

Attachment by soldering iron is not recommended - (Reflow, wave or vapor phase systems are recommended) however, if used, the following precautions should be followed:

A. Preheat the chip capacitor to + 150 °C minimum. Use hot plate or hot air flow for preheat.

B. Use a low wattage temperature controlled iron (30 W maximum).

C. Use the lowest tip temperature setting possible (+ 280 °C maximum) and a maximum soldering time of 5 seconds.

D. Use a soldering tip no greater than 0.120" [3.0 mm] in diameter. Apply the transmission of heat through the soldering material.

E. When removal of chip capacitor is necessary, a hot air pencil is the preferred tool.

7. Cool Down:

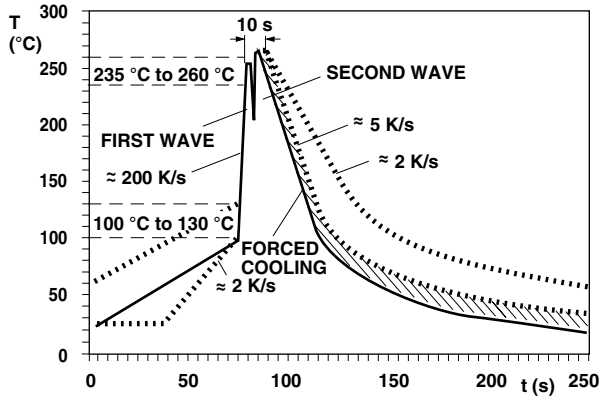
After soldering, allow the chip to cool at room ambient conditions. Using forced cool air or refrigerated air for expediting the cooling process is not recommended and can create thermal shock cracks and may facilitate board bend stresses.

8. Cleaning:

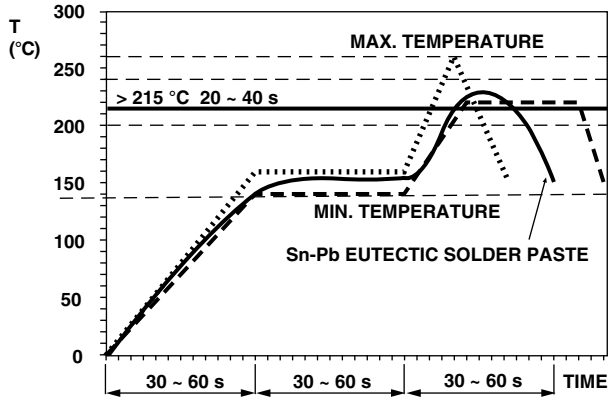
Selection of an appropriate cleaning solvent is dependent upon the type of flux used. Cleaning in alcohol, water, hydrocarbons or any of the common, halogenated degreaser solvents is not detrimental to Vishay chip capacitors.

WAVE AND REFLOW SOLDERING GRAPHS

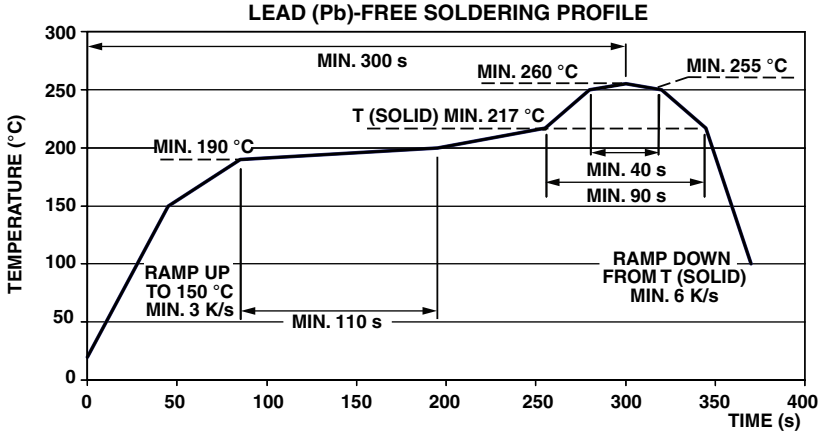
WAVE SOLDERING



IR REFLOW WITH SnPb SOLDER



LEAD (Pb)-FREE SOLDERING PROFILE



WAVE AND REFLOW SOLDERING

WAVE SOLDERING

Vishay offers the following recommendations:

1. Set dwell time in the solder wave 2 s to 3 s. Solder pot set at + 240 °C to + 260 °C. Belt speed at 3 feet/min to 5 feet/min.
2. Adjust Flux station (foam, spray or wave) topside preheat at + 80 °C to + 105 °C.
3. Set preheat ≈ + 160 °C below the solder wave temperature. Usually maximum underside PC board temperature at last preheat zone is + 150 °C. Preheat rate should be 1.5 °C/s to 2.5 °C/s.
4. Do not force cool the PC board. Maintain a uniform profile.
5. Finally check that the delta difference between the solder temperature and the temperature as the PC board leaves the last preheat zone is + 160 °C or less. Chip size and mass make some types more prone to thermal shocking during the soldering operation, leading to insulation resistance (IR) failures in use.

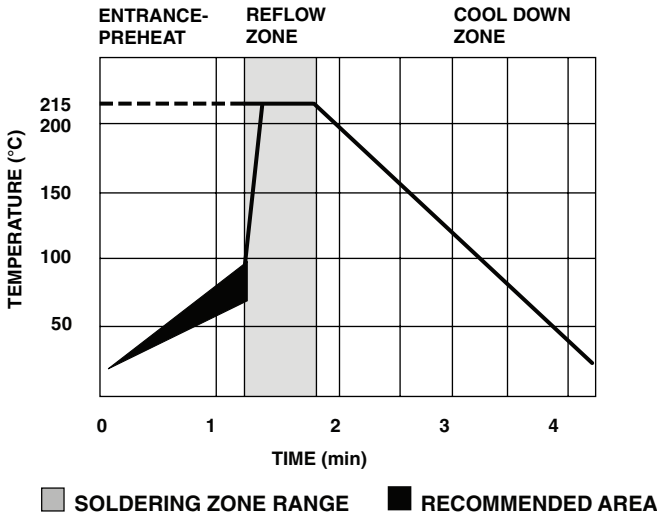
   Vishay does not recommend wave soldering for chip size 1210 (thickness ≥ 0.049", 1.24 mm) and case size ≥ 1808.

REFLOW SOLDERING

The reflow soldering process using no-clean solder paste for mounting ceramic chip capacitors has wide acceptance. Chip capacitors may develop thermally induced cracks if the temperature changes in reflow process are not controlled. Vishay offers the following recommendations:

1. Set peak reflow temperature at + 215 °C to + 260 °C based on paste melting point.
2. First preheat zone temperature elevation at + 150 °C ± 10 °C, ramp rate 3 °C/s.
3. Second preheat zone temperature + 150 °C ± 10 °C, ramp rate of 0.1 °C/s. Set preheat for ≤ 60 s. Long preheat times could cause solder balls near the capacitor/other components.
4. Adjust reflow zone temperatures to + 150 °C ± 10 °C to + 225 °C ± 5 °C at ramp of 4 °C/s to 5 °C/s. Total time at reflow over + 200 °C should not exceed 15 s to 20 s.
5. Use natural cooling at the final cooling zone. Maintain a uniform profile no more than - 3 °C/s.

VAPOR PHASE REFLOW



With vapor phase reflow, heat reaches the product uniformly and quickly because of vapor condensation heating. During condensation heating a dense vapor condenses on all exposed surfaces. Due to the inherent low boiling point (+ 215 °C) for liquids used in vapor phase, ceramic chips can be reflowed without thermal shock damage. Vishay offers the following recommendations:

1. Preheat or pre-bake zone duration should be about 1.5 min to 2 min. Infrared heating can be used for preheat sections.
2. Vapor phase zone maximum temperature is + 215 °C with typical settings at + 210 °C.
3. Total duration is typically 4 min to 5 min, use natural cooling at the final cooling zone.