Surface Mount Multilayer Ceramic Chip Capacitors

SOLDERING RECOMMENDATIONS

1. Termination Selection [1]

- The termination selected depends on the assembly method to be used and the requirements of the application
- Reflow solder assembly: select termination code “X”. For CDR-MIL-PRF 55681 product, select termination code “W” or “Y”
- Wave solder assembly: select termination code “X”. For CDR-MIL-PRF 55681 product, select termination code “W” or “Y”
- Additional board flex protection: select the polymer, flexible termination codes “B” or “W”
- Conductive epoxy assembly: select termination code “F” and “E”
  For CDR-MIL-PRF 55681 and DSCC product, select termination code “M”
- Non-magnetic requirements: select termination code “C” for reflow solder assembly and “E” for conductive epoxy assembly
- Lead-bearing requirements: select termination code “L”
  For CDR-MIL-PRF 55681 and DSCC product, select termination code “Z” or “U”

Note

[1] Where applicable, see datasheets

2. Chip Size vs. Solder Profile

A. 0402, 0505, 0603, 0805, 1111, 1206 (thickness ≤ 0.049", 1.24 mm) can be used in all three solder systems shown on the following page.
1206, 1111 with a thickness > 0.049" (1.24 mm) and ≥ 1210 and larger case sizes should not be wave soldered.

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.

In case of non-magnetic termination code “C”, use lead containing or lead (Pb)-free SAC405 solders.

5. Soldering Techniques

Generalized soldering curves shown on next page.

6. Soldering with a Solder Iron

Attachment by soldering iron is not recommended. A heat shock may cause a crack in the MLCC chip capacitors, however, if solder iron is used, the following precautions should be taken:

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.

C. Tip temperature setting ≤ 280 °C and a maximum soldering time of 5 s.

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.

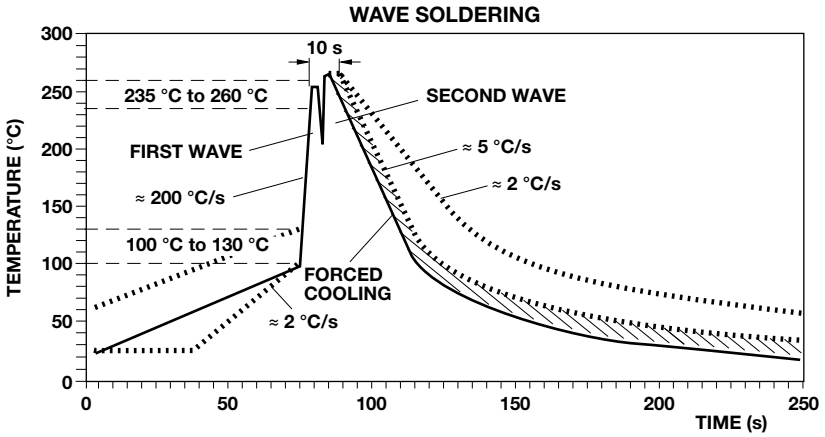
7. Cool Down

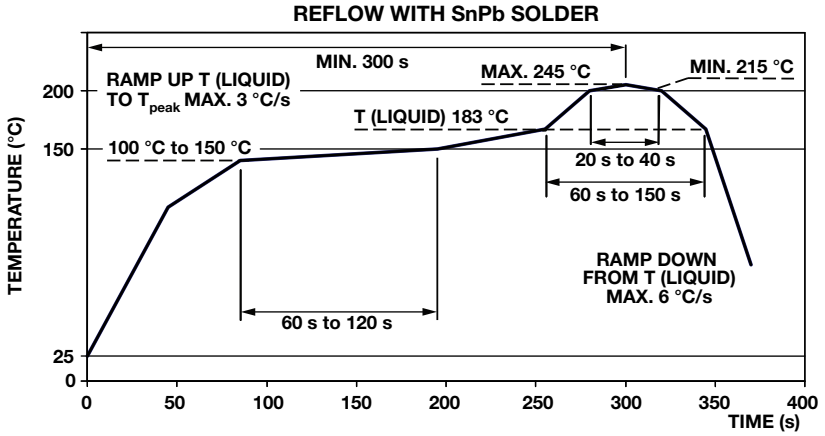
After soldering, allow the chip to cool at room ambient conditions. Using forced cool air or refrigerated air for expediting the cooling process is not recommended and can create thermal shock cracks and may facilitate board bend stresses.

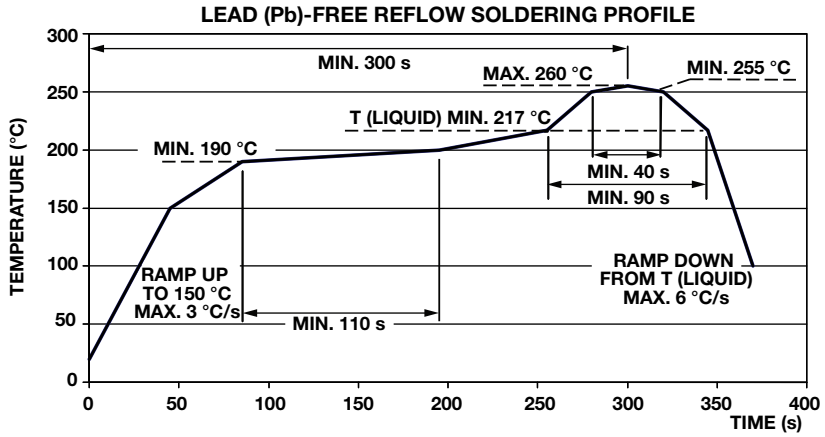
8. Cleaning

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 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.

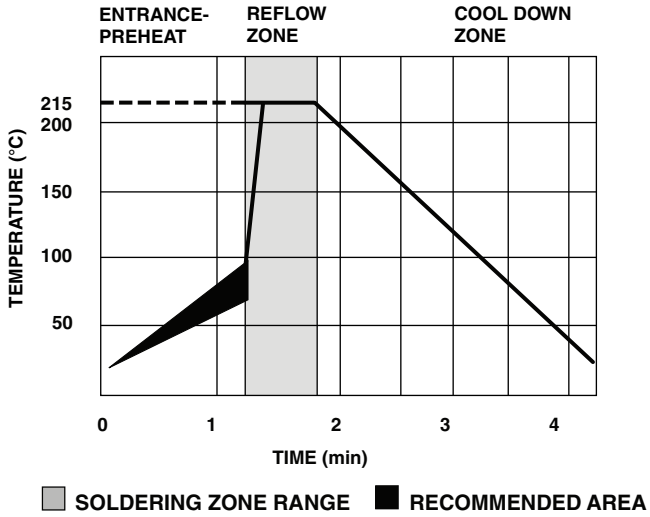
1206, 1111 with a thickness > 0.049" (1.24 mm), 1210, and larger case sizes should not be wave soldered.

REFLOW SOLDERING (SnPb - Solder)

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.