

STORAGE

To preserve the solderability of terminations, observe the following storage conditions :

- Indoors at 5–40°C and 20–70% relative humidity.
- Free from harmful gases (sulfuric acid, ammonia, hydrogen sulfide, chlorine).
- Original sealed packaging until use; re-seal opened packs as soon as possible.

Tape-and-reel products must be stored away from direct sunlight, which can degrade the carrier tape or the cover adhesive.

Use within 24 months from shipment. For longer storage, perform a solderability check before mounting (terminal Sn dipping test per IPC J-STD-002).

HANDLING

MLCCs are dense, hard, brittle ceramic bodies, abrasive against soft materials. They are sensitive to mechanical shock and to PCB bending stress after assembly. Handle with care to avoid cracks, chips, and metallization damage :

- Use plastic or vacuum tweezers. Metal tweezers can scratch the terminations or chip the ceramic edge.
- Do not stack loose parts in trays — chip-against-chip contact during transport produces micro-cracks.
- Tape-and-reel packaging is suitable for automatic pick-and-place equipment.
- For SMD stacks, large case sizes, and radial leaded parts, single-piece handling and dedicated trays are recommended.

After mounting, avoid board flexing during depaneling, tightening, or testing. Chip cracks induced by board bending remain the dominant failure mode in service.

PREHEAT

Preheat brings the entire assembly to a uniform intermediate temperature before solder melting, limiting the thermal gradient at the moment the solder reaches liquidus. The temperature differential between the solder and the component surface (ΔT) must be kept as small as possible.

- Standard ramp-up rate : $\leq 3^\circ\text{C/s}$.
- Fragile profile ramp-up rate : $\leq 2^\circ\text{C/s}$.
- The preheat plateau (T_{min} to T_{max} for reflow; T_{pre} for wave and vapour phase) must be held long enough for the component body to reach equilibrium with the board.

Refer to the applicable profile graph and parameter table.

SOLDERING FLUX

Use mildly activated rosin (RMA) or no-clean (RA without active halides) fluxes. Avoid strongly activated or water-soluble fluxes, which leave corrosive residues incompatible with high-reliability applications.

- Halide content < 0.2 wt% (chlorine equivalent).
- Rosin-based, pH-neutral residues.
- For AgPd terminations (code F), use fluxes free of strong organic acids to limit silver leaching during the time above liquidus.

Solder volume must be controlled to avoid stress between the solder fillet, the component, and the substrate. Excessive solder height transmits board flex directly to the ceramic body and is the most frequent cause of installation cracks.

SOLDERING TYPE

The following solder alloys are compatible with SRT MLCCs:

- SnPb eutectic (Sn63/Pb37, Sn62/Pb36/Ag2) — standard for SnPb terminations (code S). Peak $\leq 215^\circ\text{C}$.
- Lead-free SAC305 (Sn96.5/Ag3.0/Cu0.5) and equivalent standard for Sn terminations (codes X). Peak $\leq 245^\circ\text{C}$.
- High-Ag SnPb ($\geq 2\%$ Ag) — recommended for AgPd terminations (code F) to limit silver leaching.
- Au-Sn eutectic (Au80/Sn20) — required for bonding gold terminations (code G). Reflow under N₂ atmosphere is mandatory.

For non-magnetic terminations (code C), use SnPb or lead-free SAC305 only.

SOLDERING ATMOSPHERE

Soldering atmosphere affects wetting quality and oxidation of sensitive metallizations :

- **Air**: standard for Sn, NiSn, and SnPb terminations on chip MLCCs ≤ 1812 .
- **Nitrogen (N₂)** is recommended for:
 - All fragile profile applications.
 - AgPd terminations (code R) — limits silver tarnishing.
 - Gold terminations (code G) — required to control AuSn₄ intermetallic growth.
 - Microflex polymer terminations — preserves the polymer matrix.
 - Lead-free reflow of SMD stacks and large case sizes (≥ 2225).

Target oxygen level for N₂-protected reflow : ≤ 1000 ppm.

SOLDERING HEIGHT

Solder fillet height must comply with IPC-A-610 (Class 2 or 3 per application) :

- Minimum solder climb on the termination : 25% of chip thickness or 500 µm, whichever is less.
- Maximum solder climb : 100% of chip thickness, not exceeding the top metallization wrap.
- For SMD stacks and radial leaded parts, refer to the part-specific datasheet for recommended footprint dimensions and fillet geometry.

Excessive fillet height transmits PCB bending forces to the ceramic body and is the leading cause of in-service crack failures.

COOLING

After soldering, cool the assembly gradually to room temperature :

- Standard ramp-down rate : $\leq 6^{\circ}\text{C/s}$ for SnPb reflow, $\leq 4^{\circ}\text{C/s}$ for lead-free reflow.
- Fragile profile ramp-down rate : $\leq 2^{\circ}\text{C/s}$.
- Natural cooling in still air is recommended.
- Forced cooling, immediate fluid immersion, or direct contact with cold surfaces are prohibited — the resulting thermal shock causes ceramic and solder joint cracks.

CLEANING

When a cleaning step is used, all flux residues must be removed to prevent surface electrolytic corrosion. Compatible cleaning processes :

- Vapour-phase or spray cleaning with electronic-grade solvents (semi-aqueous, modified alcohol, or fluorinated).
- Ultrasonic cleaning is acceptable for chip MLCCs, but must be avoided for SMD stacks and radial leaded parts — mechanical resonance of the lead-frame or leadwires can fatigue the solder joint.
- Temperature differential between the assembly and the cleaning fluid : $\Delta T \leq 100^{\circ}\text{C}$.
- Immersion time ≤ 5 min for vapour solvents, ≤ 2 min for ultrasonic.

No-clean fluxes leave benign residues and do not require cleaning, provided the chosen flux is qualified for the application's reliability requirements.

SOLDERING CONDITIONS

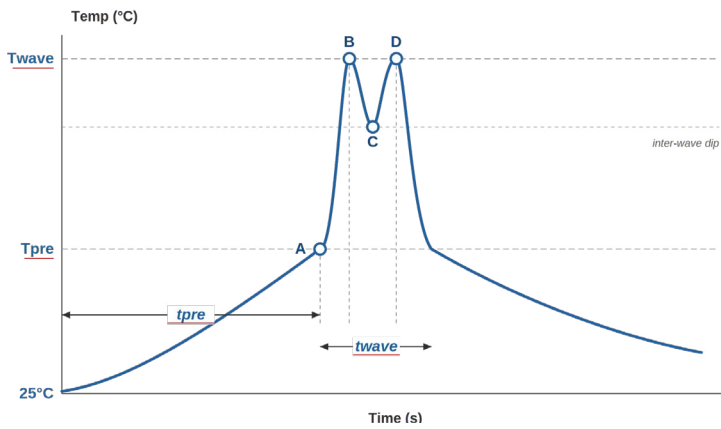
Product family	wave	Reflow standard	Reflow fragile	Hand soldering ¹
Chip MLCC 0201, 0402, 0505, 0603	✓	✓		✓
Chip MLCC 0805, 1111, 1206, 1210 – $t < 1.25$ mm	✓	✓		✓
Chip MLCC 0805, 1111, 1206, 1210 – $t \geq 1.25$ mm		✓		✓
Chip MLCC 1812, 2220		✓	recommended	✓
Chip MLCC ≥ 2225 (3640 to 80150)			required	with extreme care
EMI filters (≤ 2220)		✓		✓
High compact and SRMC/SRTV stacks ≤ 2220		✓	recommended	✓
SRMC/SRTV stacks > 2220			required	with extreme care
Radial leaded (through-hole)	✓ ²			✓ ³

¹ Hand soldering is always a last resort; refer to the Hand soldering section.

² Wave possible only for standard radial sizes; preheat to within 100°C of wave temperature.

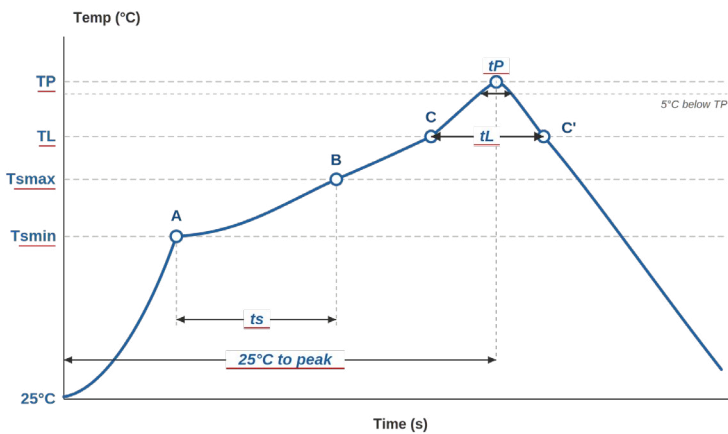
³ Mandatory part preheat to 150°C minimum; for HV radials, within 50°C of iron temperature.

WAVE SOLDERING PROFILE



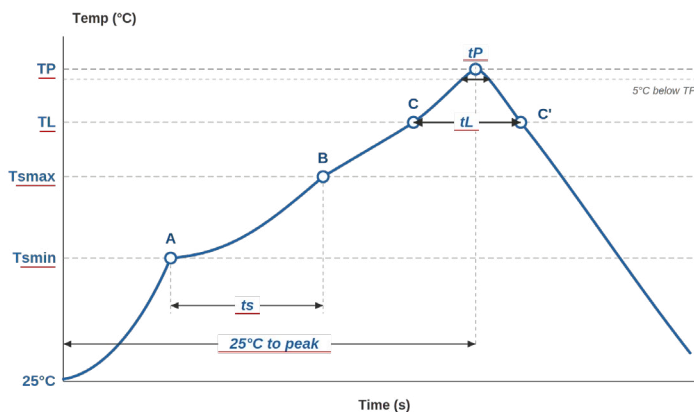
Parameter	Standard
Tpre (A) – bottom-side preheat	100–130°C
Ramp-up to A	≤ 3°C/s
tpre – preheat dwell	60–120 s
Twave (B / D) – wave temperature	235–260°C
Number of waves	2 (turbulent + laminar)
Contact time per wave	1–3 s
twave – total contact time	≤ 10 s
Inter-wave dip (C)	≥ 200°C
Ramp-down rate (forced air)	≤ 4°C/s
Max passes	2
Atmosphere	N ₂ recommended for AgPd terminations
Note	Not applicable to fragile parts. Refer to reflow profile.

LEADFREE REFLOW SOLDERING PROFILE (SAC305)



Parameter	Standard	Fragile
Tsmmin (A)	150°C	150°C
Tsmmax (B)	190°C	190°C
ts (A→B)	60–120 s	≥ 120 s
Ramp-up rate	≤ 3°C/s	≤ 2°C/s
TL (C)	217°C	217°C
tL (C→C')	40–90 s	30–60 s
TP	245°C max	240°C max
tP (within 5°C of TP)	≤ 10 s	≤ 5 s
Ramp-down rate	≤ 4°C/s	≤ 2°C/s
25°C to peak	≤ 8 min	≤ 8 min
Max reflow passes	3	2
Atmosphere	air or N ₂	N ₂ recommended

SNPB REFLOW SOLDERING PROFILE



Parameter	Standard	Fragile
Tsmmin (A)	100°C	100°C
Tsmmax (B)	150°C	150°C
ts (A→B)	60–120 s	≥ 120 s
Ramp-up rate	≤ 3°C/s	≤ 2°C/s
TL (C)	183°C	183°C
tL (C→C')	60–90 s	30–60 s
TP	215°C max	210°C max
tP (within 5°C of TP)	≤ 10 s	≤ 5 s
Ramp-down rate	≤ 6°C/s	≤ 2°C/s
25°C to peak	≤ 6 min	≤ 6 min
Max reflow passes	3	2
Atmosphere	air or N ₂	N ₂ recommended