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 12 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 depanelling, 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 : ≤ 3°C/s.
- Fragile profile ramp-up rate : ≤ 2°C/s.
- The preheat plateau (Tsmin to Tsmax for reflow; Tpre 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 ≤ 215°C.
- Lead-free SAC305 (Sn96.5/Ag3.0/Cu0.5) and equivalent standard for Sn terminations (codes X). Peak ≤ 245°C.
- High-Ag SnPb (≥ 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 N_2 atmosphere is mandatory.

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

SOLDERING ATMOSPHERE

SRT MLCCs reflow normally in air. Nitrogen atmosphere (N_2, O_2 ≤ 1000 ppm) is not required but is common practice in high-reliability assembly (space, defense, medical) where it improves solder wetting and limits oxidation, especially in lead-free reflow at high temperatures. Specific termination considerations:

- AgPd terminations (code F) — silver leaching is the primary concern. SRT recommends SnPb solder with ≥ 2% Ag content. N_2 atmosphere is helpful but does not eliminate leaching. For applications requiring no soldering stress, conductive silver epoxy is the preferred attachment method.
- Gold terminations (code G/W) — N_2 atmosphere is recommended to limit gold dissolution in the solder and the growth of brittle $AuSn_4$ intermetallics. Time above liquidus must be minimized.
- Microflex polymer terminations — N_2 recommended to preserve the polymer matrix at peak temperature.

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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 : ≤ 6°C/s for SnPb reflow, ≤ 4°C/s for lead-free reflow.
- Fragile profile ramp-down rate : ≤ 2°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 : ΔT ≤ 100°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.

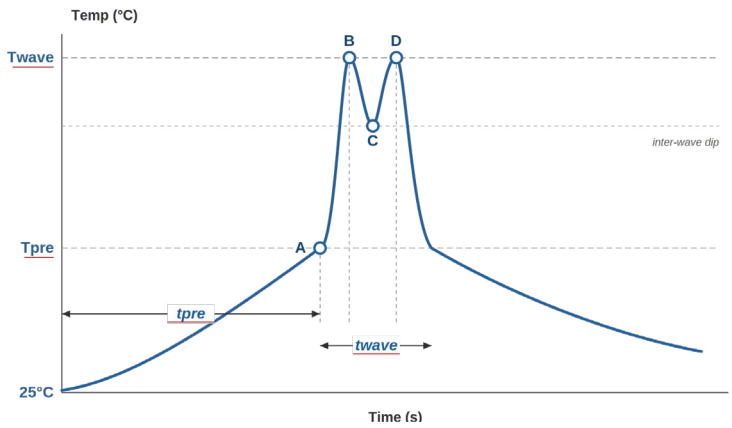
SOLDERING CONDITIONS

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 ≥ 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.

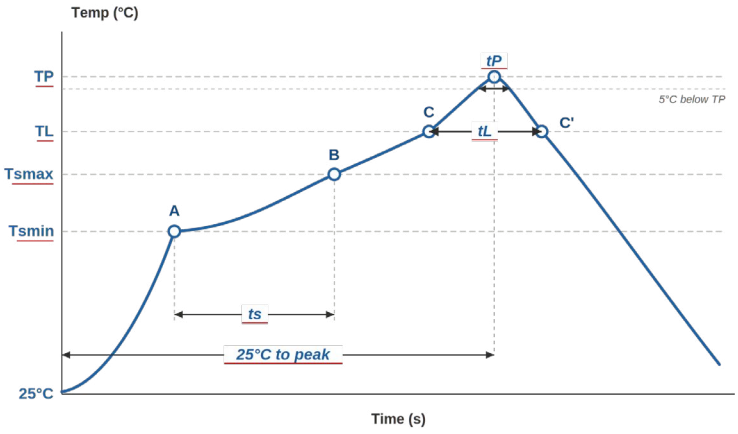
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WAVE SOLDERING PROFILE



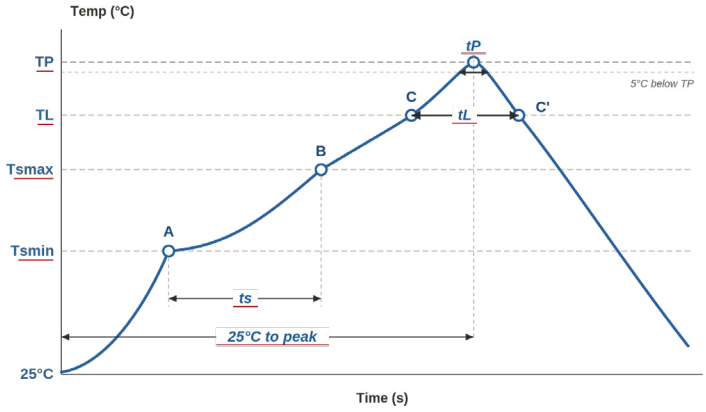
Parameter	Standard
Tpre (A) – bottom-side preheat	100–130°C
Ramp-up to A	≤ 3°C/s
tpre – preheat dwell	60–120 s
Twave (B / D) – wave temperature	235–260°C
Number of waves	2 (turbulent + laminar)
Contact time per wave	1–3 s
twave – total contact time	≤ 10 s
Inter-wave dip (C)	≥ 200°C
Ramp-down rate (forced 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
Tsmin (A)	150°C	150°C
Tsmax (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	≤ 10 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

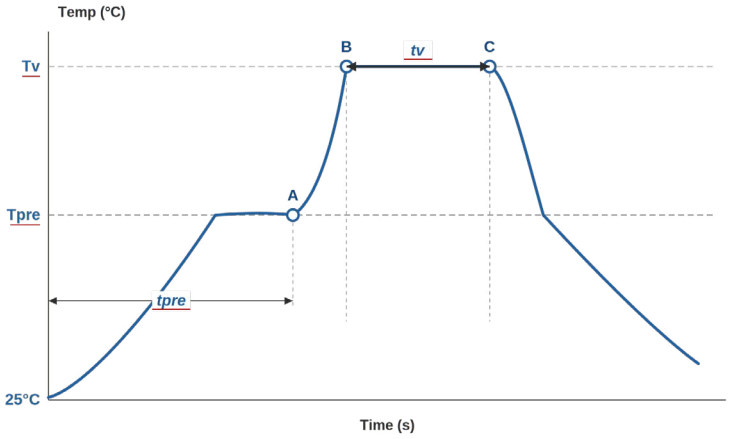
SNPB REFLOW SOLDERING PROFILE



Parameter	Standard	Fragile
Tsmin (A)	100°C	100°C
Tsmax (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	215°C max
tP (within 5°C of TP)	≤ 10 s	≤ 10 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

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VAPOUR PHASE REFLOW PROFILE



Parameter	Standard	Fragile
Tpre (A) – preheat plateau	100–130°C	100–130°C
Ramp-up to A	≤ 3°C/s	≤ 2°C/s
tpre – preheat dwell	60–120 s	≥ 120 s
Tv (B / C) – vapor temperature	215°C (SnPb) or 230°C (SAC305)	215°C (SnPb) or 230°C (SAC305)
tv (B→C) – time in vapor	30–60 s	30–45 s
Ramp-down rate (after C)	≤ 4°C/s	≤ 2°C/s
Max reflow passes	3	2
Atmosphere	process vapor (inert)	process vapor (inert)

HAND SOLDERING

Hand soldering is not recommended; localized thermal shock can crack the ceramic body. Hot-air pencil reflow is preferred for rework. When a soldering iron must be used, observe the following procedure :

- Soldering iron tip diameter ≤ 3.0 mm; wattage ≤ 20 W.
- Pre-heat the component to 150°C minimum before iron contact.
- Iron tip temperature ≤ 280°C; contact time ≤ 5 s per termination.
- Pre-tin the iron tip with the required volume of solder; do not feed solder wire onto the part.
- Do not touch the ceramic body directly with the iron tip — apply heat to the termination metallization only.
- After soldering, allow the part to cool gradually at room temperature.
- Forced cooling is not allowed.

For fragile parts (SMD stacks > 2220, case sizes ≥ 2225, radial leaded HV, AgPd or gold terminations), additional precautions apply :

- Preheat the part to within 50°C of the iron tip temperature.
- Total iron contact time ≤ 3 s per termination.
- Single hand-soldering operation only; rework requires part replacement.

RADIAL LEADED SOLDERING

Through-hole radial leaded capacitors are soldered by wave or by hand. Reflow is not applicable to leaded parts — no surface pads are available for solder paste deposition.

For wave soldering of standard radial sizes :

- Preheat the PCB underside to within 100°C of the wave temperature.
- Wave temperature : 235–260°C; total contact time ≤ 10 s.
- Two waves (turbulent + laminar) typically applied.

For high-voltage radials and large lead diameters, wave soldering **is not recommended**. Use hand soldering with the procedure above, including :

- Part preheat to within 50°C of the iron tip temperature.
- Iron contact time ≤ 5 s per lead.
- Allow each lead to cool before soldering the next.

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