Application Note

SR100 Series WLCSP & FCCSP Reflow Profile and Assembly Guidance

Abstract: This application note provides reflow profile and assembly guidance for Synaptics SR100 Series WLCSP and FCCSP packages—specifically 84-ball WLCSP (0.4 mm pitch) and 122-ball FCCSP (0.386 mm pitch). It defines recommended thermal profiles including ramp-up, soak, peak, and cooling stages for SAC305 alloy, along with critical SMT process parameters such as stencil design, solder paste type, placement accuracy, and inspection methods. These guidelines are intended to ensure optimal solder joint reliability, minimize defects, and support consistent high-yield manufacturing.

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SMT Process Parameters - 122-balls FCCSP (0.386 mm pitch, 7 mm × 4.5 mm) and 84-balls WLCSP (0.4 mm pitch, 5.2 mm x 2.7 mm).

1.1. Recommend Reflow Profile for 122-balls FCCSP, 0.386 mm pitch

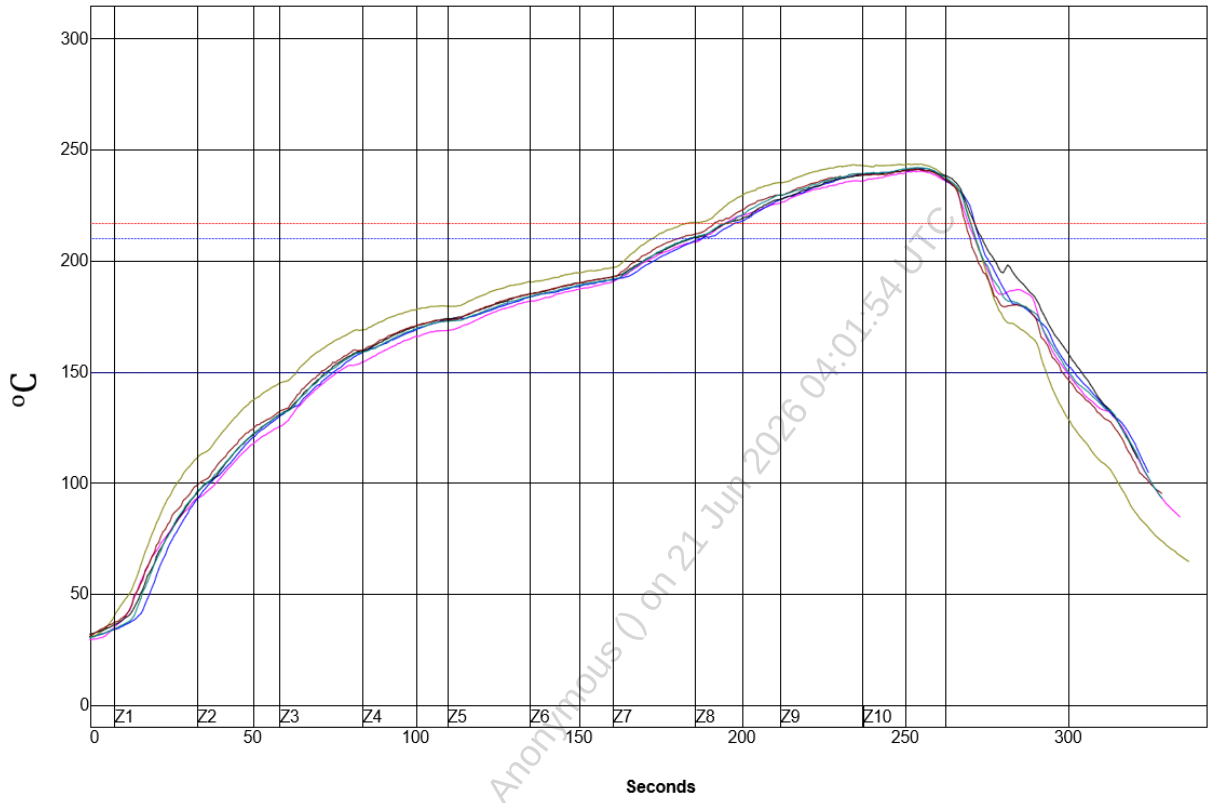

Figure 1. Typical Reflow Profile for FCCSP

For SAC305 alloy:

- Ramp-up: 1.0–2.5 °C/sec 25°C to 150 °C
- Soak: 150–180 °C for 90–120 s
- Ramp to Peak: 180°C -> 245°C, 1.0–2.0 °C/sec
- Peak: 240–250 °C (target 245 °C), 10 - 20 sec
- Time above liquidus (>217 °C): 45–75 sec
- Cooling: 245°C -> 100°C, ≤2 °C/sec

1.2. Profile Worksheet for FCCSP

Includes zone-specific temperature targets, durations, and ramp rates tailored to FCCSP's thermal mass and solder joint reliability.

Table 1. Recommended Reflow Profile Parameters for 122-ball FCCSP (0.386 mm pitch)

Zone	Target Temperature (°C)	Rate or Duration	Purpose / Notes
Ramp-Up	25 -> 150	1.0-2.5 °C/sec	Rapid yet controlled heating of FCCSP body
Soak Start	150	N/A	Start flux activation
Soak End	180	90-120 sec	Uniform temperature equilibration
Ramp to Peak	180 -> 245	1.0-2.0 °C/sec	Controlled ramp to avoid excessive delta-T
Peak	245 (±5)	10 - 20 sec	Complete reflow of solder balls
Time Above Liquidus	>217	45-75 sec	Ensure proper wetting and intermetallic formation
Cooling	245 -> 100	2 °C/sec	Avoid brittle phases and thermal shock

1.3. SMT Process Parameters for FCCSP

Covers stencil design, solder paste, print setup, placement, inspection, and optional cleaning steps.

Table 2. Recommended SMT Process Parameters for FCCSP Assembly

Process Step	Recommended Values / Settings	Notes
Stencil Design	Stencil thickness: 0.12 mm, Aperture: 0.20 mm circular (laser cut, electro-polished)	Optimized for 0.4 mm pitch FCCSP
Solder Paste	Type 4 or 5 SAC305, no-clean, low voiding	Ensure consistent volume and reflow performance
Printer Setup	Snap-off: 1-2 mm; Print speed: 25-50 mm/sec	Minimize stencil clogging, maintain aperture definition
Pick-and-Place	Placement accuracy: ±30 µm, force: <2 N	Avoid die cracking or shift during placement
Reflow	See reflow profile for FCCSP	Use validated oven profiling
Inspection	X-ray for voids, AOI for alignment	Critical for hidden joint inspection
Cleaning (if required)	Not typically required for no-clean paste; validate if needed	Only if flux residues interfere with functionality

2. WLCSP Reflow Profile

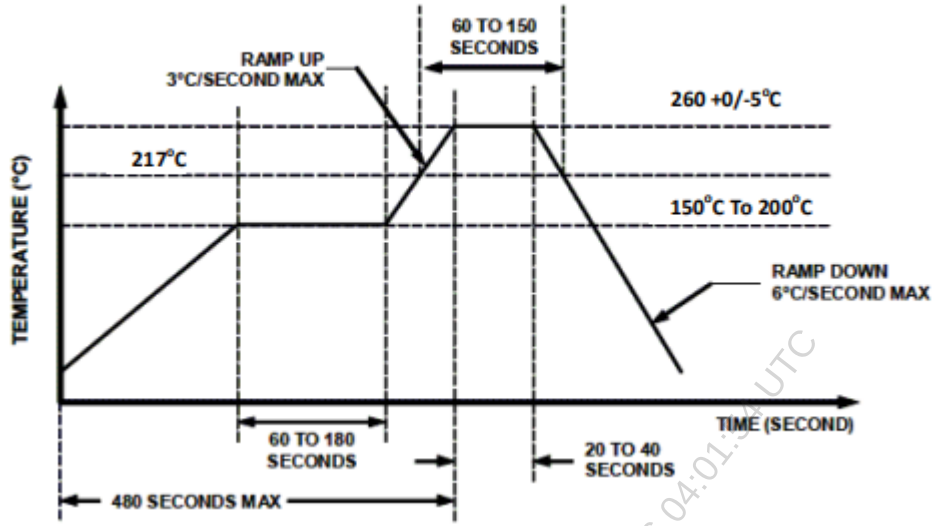

Figure 2. Typical Reflow Profile for WLCSP

2.1. Recommended Reflow Profile for 84-balls WLCSP, 0.4 mm pitch

For SAC305 alloy:

- Ramp-up: 0.5–1.0°C/sec to 150°C
- Soak: 150–180°C for 90–120s
- Ramp to Peak: 0.5–1.0°C/sec
- Peak: 235–245°C (target 240°C)
- Time above liquidus (>217°C): 30–60s
- Cooling: <4°C/sec

Tight control ensures solder integrity and mitigates die stress or bridging.

2.2. Profiling Worksheet for WLCSP

A detailed worksheet defines zone-specific parameters for temperature ramp, soak, peak, and cooling.
It helps guide oven setup and thermocouple placement to ensure adherence to thermal requirements.

Table 3. Recommended Reflow Profile Parameters for 84L WLCSP (0.4 mm Pitch)

Zone	Target Temperature (°C)	Rate or Duration	Purpose / Notes
Ramp-Up	25 → 150	0.5–1.0 °C/sec	Controlled heating to reduce stress
Soak Start	150	N/A	Start of flux activation
Soak End	180	90–120 sec	Uniform temperature, volatiles removal
Ramp to Peak	180 → 240	0.5–1.0 °C/sec	Controlled ramp to avoid die stress
Peak	240 (±5)	10–20 sec	Full solder melt with thermal margin
Time Above Liquidus	>217	30–60 sec	Ensure full wetting without overcooking
Cooling	240 → 100	2–4 °C/sec	Prevent solder cracks; refine grain structure

2.3. SMT Process Parameters for WLCSP

Key recommendations:

- Stencil Thickness: 0.1–0.12 mm
- Aperture Size: 0.18 mm circular (80–90% of ball diameter)
- Type: Laser-cut, electro-polished fine grain stainless steel
- Finish: Nickel or nano-coated

These ensure proper paste release and consistent volume, reducing bridging risks.

Table 4. Recommended SMT Process Parameters for WLCSP Assembly

Parameter	Recommended Value	Notes
Pitch	0.4 mm	Standard for WLCSP
Ball Diameter	0.2 mm	Standard for 0.4 mm pitch
Stencil Thickness	0.1–0.12 mm	Thin stencil for controlled paste height
Aperture Size	0.18 mm circular	80–90% of ball diameter for consistent paste volume
Aperture Type	Laser-cut, Electro-polished	Improved release, reduced bridging
Stencil Type	Fine Grain Stainless Steel	High dimensional stability
Stencil Finish	Nickel or Nano-coated	Improved paste release and anti-adhesion

3. Revision History

Revision	Description
A	Initial release.

PN: 506-001628-01 Rev A