INTRODUCING FCT SOLDER'S NEWEST INNOVATION:

AMP Micro

Ultra-Fine Feature No-Clean Lead-Free Solder Paste

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Outline/Agenda

- Introduction
  - Overview of AMP Micro
  - Miniaturization of electronics & the need for Type 6 solder paste
  - Challenges of formulating Type 6 solder paste
- Discussion Topics
  - Experimental design to challenge the solder paste
- Results of Experiments
  - IPC Testing Results
  - Reflow data and photos
  - Tack Life Results
  - 8-hour Print & Pause/Stencil Life Data
  - Voiding Results
- Conclusions
- Q&A

AMP Micro Overview

- No-clean flux
- Halide and halogen-free
- Compatible with industry standard lead-free alloys including SAC305 and SN100CV
- Excellent printability through ultra-fine apertures
- Air reflow compatible – no nitrogen (N_2) reflow costs required with T6 solder powder
- Complete coalescence in convection air reflow down to 4 mils (102 µm) aperture sizes
- Best in class voiding performance
- Long lasting stencil life ≥ 6 hours
- High tack that is stable for 72 hours ensuring component holding force over time

Introduction

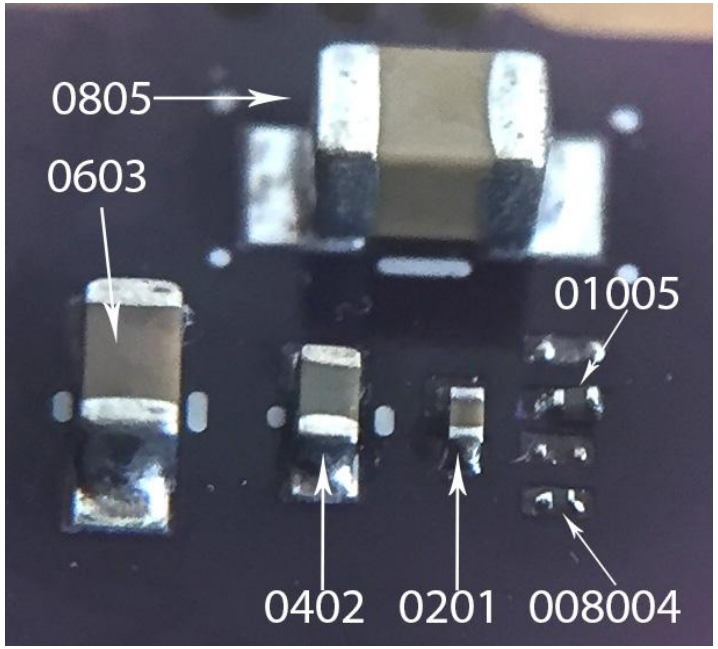
- Electronics are getting smaller – finer powder sizes are necessary!
- Progressive miniaturization in packaging has driven the shift toward finer powders to support UHDI and semiconductor-level assembly.

Powder Type	Particle Size (µm)	Typical Application	Packaging Relevance
Type 3	25–45	Standard SMT	SOIC, QFP
Type 4	20–38	Fine-pitch SMT	BGA, CSP
Type 5	15–25	Ultra-fine pitch	PoP, micro-BGA
Type 6	5–15	Miniature apertures	SiP, wafer bumping
Type 7+	<11	Sub-100 µm pads	Flip chip, UHDI

Era	Packaging Type	Typical Component	Key Characteristics	Industry Impact
1970s–1980s	Through-Hole (DIP, SIP)	14-pin ICs, axial resistors	Large lead spacing, manual assembly	Low density, high reliability
1980s–1990s	Surface Mount Technology (SMT)	SOIC, PLCC, QFP	Reduced board space, automated reflow	Smaller boards, faster assembly
1990s–2000s	BGA, CSP	BGA256, QFN	Area-array interconnects, smaller pitch	Increased I/O count, better performance
2000s–2010s	PoP, SiP	Stacked memory + processor	3D integration, compact design	Higher density, smaller footprint
2010s–Present	Flip Chip, Wafer-Level Packaging	Micro-bump die attach	Ultra-fine pitch, semiconductor precision	UHDI, advanced integration

Introduction

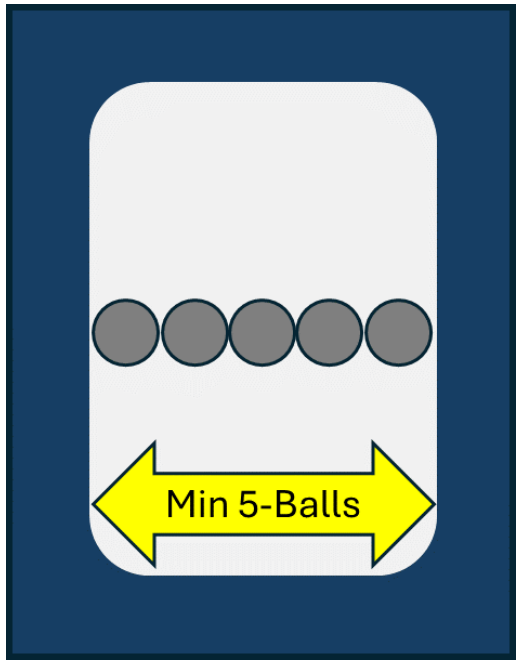
- Printing through these small of apertures requires smaller powder sizes.



Component (Imperial):	Approx. Size (inches):	Approx. Size (mils):
008004	0.010 x 0.005	10 x 5
01005	0.016 x 0.008	16 x 8
0201	0.02 x 0.01	20 x 10
0402	0.04 x 0.02	40 x 20
0603	0.06 x 0.03	60 x 30
0805	0.08 x 0.05	80 x 50

Introduction

- Solder powder size and the “5-ball” rule



IPC Type	Size (µm)	Size (mils)	Smallest Aperture 5-Ball Rule (mils)	Smallest Aperture Recommended (mils)
2	45 - 75	1.8 - 3.0	15.0	16 - 17
3	25 - 45	1.0 - 1.8	9.0	10 - 11
4	20 - 38	0.8 - 1.5	7.5	9 - 10
5	15 - 25	0.6 - 1.0	5.0	6 - 7
6	5 - 15	0.2 - 0.6	3.0	4 - 5
7	2 - 11	0.1 - 0.4	2.0	3 - 4

Introduction

Challenges of formulating flux for Type 6 solder pastes:

- High surface area of powder leading to higher oxide content
- Increased activity needed to remove oxide
- Oxidation barrier/flux shell
- Rheology tuned for application

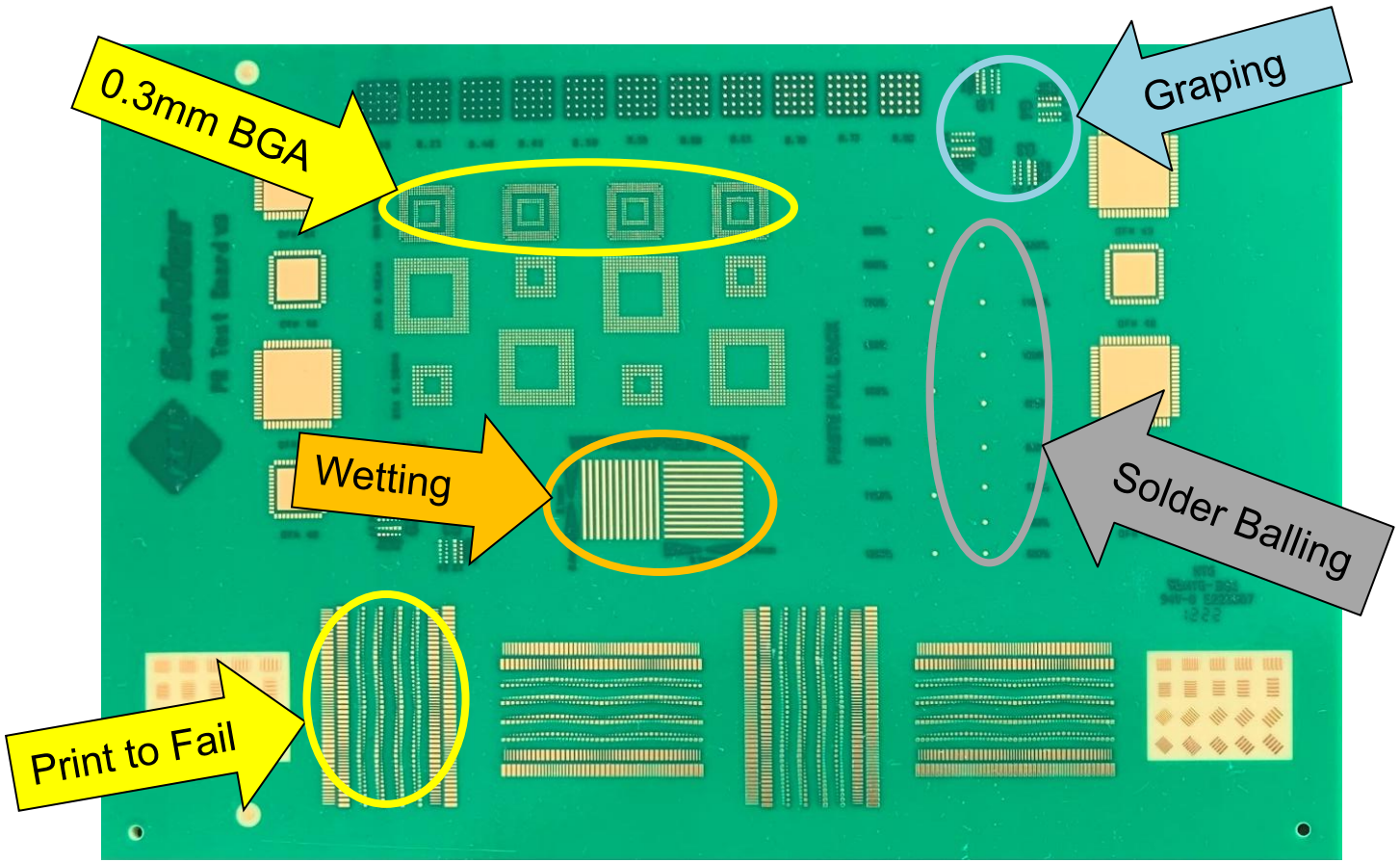
Solder Powder Size (IPC Type)	Size Range of > 80% (µm)	Middle Surface Area of 1Kg (m^2)	Amount of Surface Area Over T3
Type 3	25 - 45	22.9	-
Type 4	20 - 38	27.7	1.2x
Type 5	15 - 25	40.2	1.7x
Type 6	5 - 15	80.3	3.5x

Experimental Design – Print & Reflow Parameters

Print Parameter	Value
Print speed (mm/sec)	30 mm/sec
Blade length (mm)	300 mm
Print pressure (kg)	6.0 – 8.0 Kg
Separation speed (mm/sec)	3 mm/sec
Separation distance (mm)	2 mm
Dwell Height / Blade Lift Height (mm)	15 mm

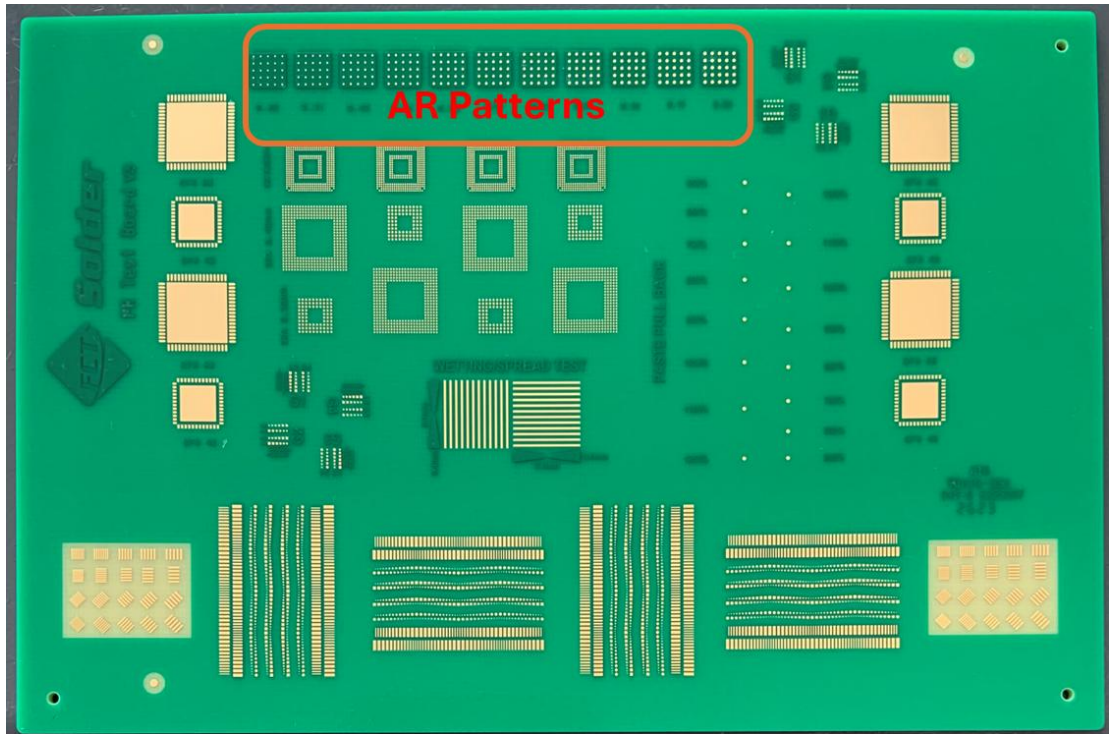
Reflow Parameter	SAC305 Ramp to Spike (RTS)
Soak Time (150-200°C)	76 to 78 sec
Time Above Liquidus (>220°C)	57 to 59 sec
Peak Temperature	241 to 244°C
Time from 25°C to Peak	4.4 to 4.6 min

Experimental Design



Experimental Design – 8-hour print and pause test

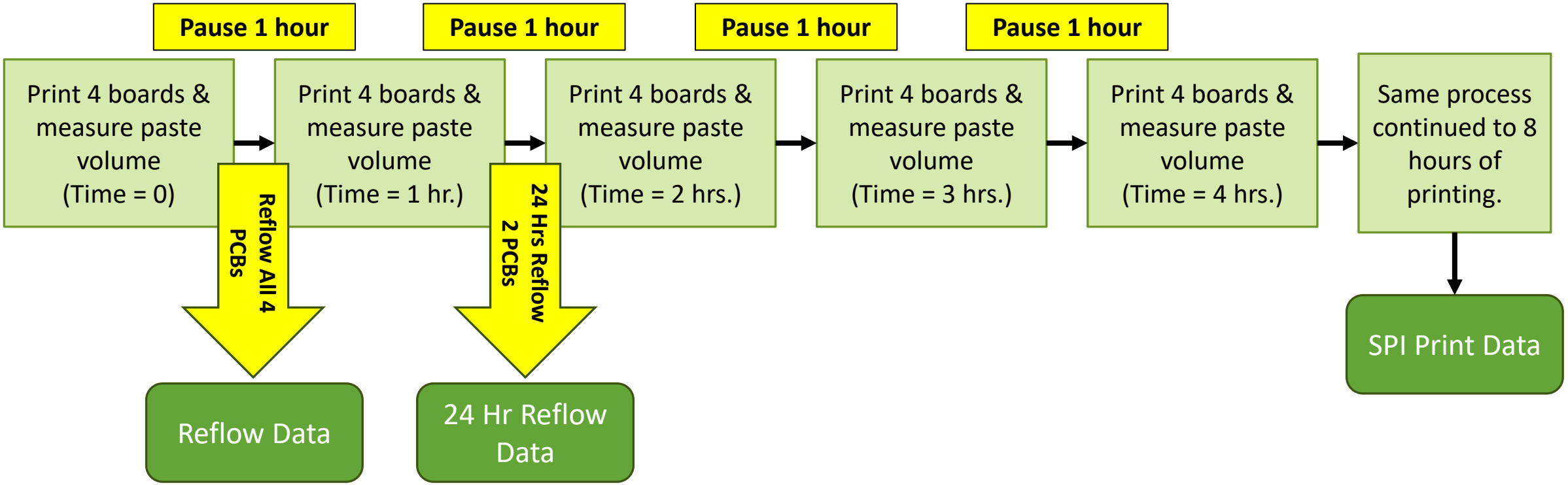
50.8-micron (2 mil) laser cut FG stencil, SMD pads



Area Ratio*	Aperture Size (mils)	Theoretical Vol (mils^3)	# Type 6 "Balls"	Aspect Ratio*
0.50	4.0	32.0	6.8	2.00
0.56	4.5	40.5	7.6	2.25
0.63	5.0	50.0	8.5	2.50
0.69	5.5	60.5	9.3	2.75
0.75	6.0	72.0	10.2	3.00
0.81	6.5	84.5	11.0	3.25
0.88	7.0	98.0	11.9	3.50
0.94	7.5	112.5	12.7	3.75
1.00	8.0	128.0	13.5	4.00

Experimental Design - Process

Stencil Life - 8 Hour Print & Pause



Experimental Design

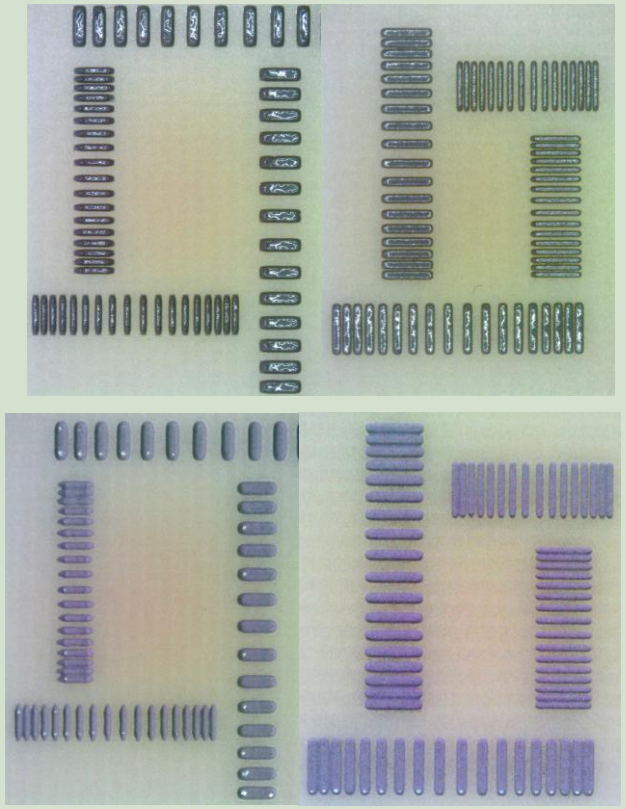
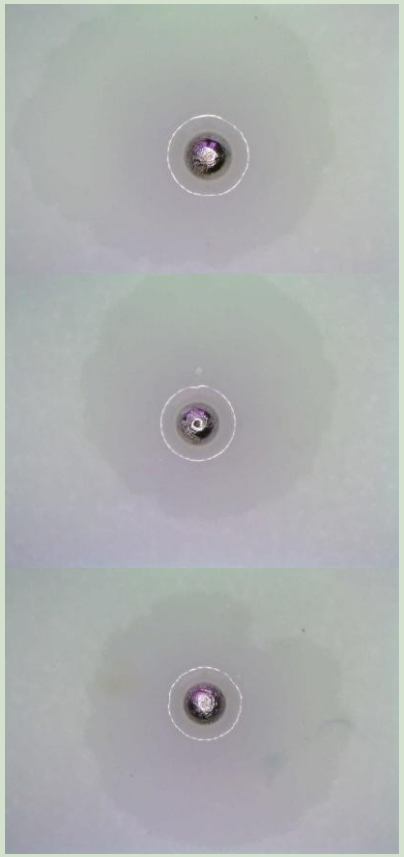
IPC Tests including:

- IPC 2.4.34 - Viscosity – Brookfield
- IPC 2.3.32 – Copper Mirror
- IPC 2.4.35 - Slump - frosted glass
- IPC 2.4.43 - Solder balling - frosted glass
- IPC 2.4.45 - Wetting – copper
- IPC 2.4.44 - Tack force – frosted glass
- IPC 2.6.3.7 & 2.6.14.1 – Surface Insulation Resistance & Electrochemical Migration

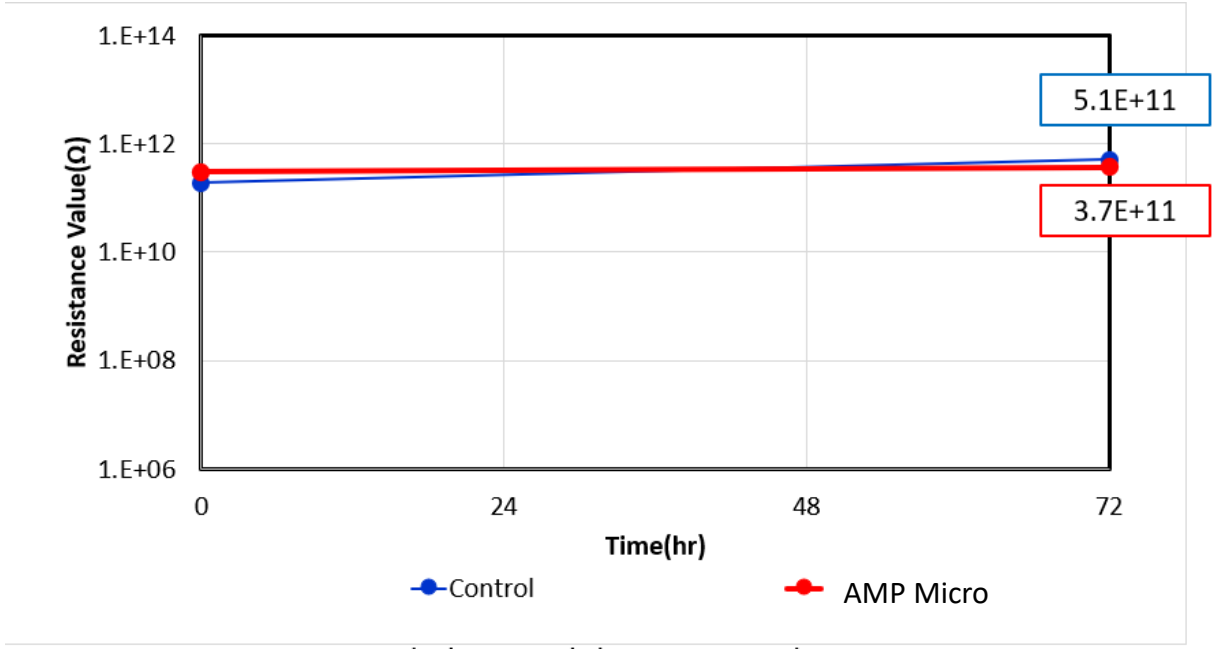
8-hour print and pause test (Stencil Life)

Reflow data under standard SAC305 RTS profile

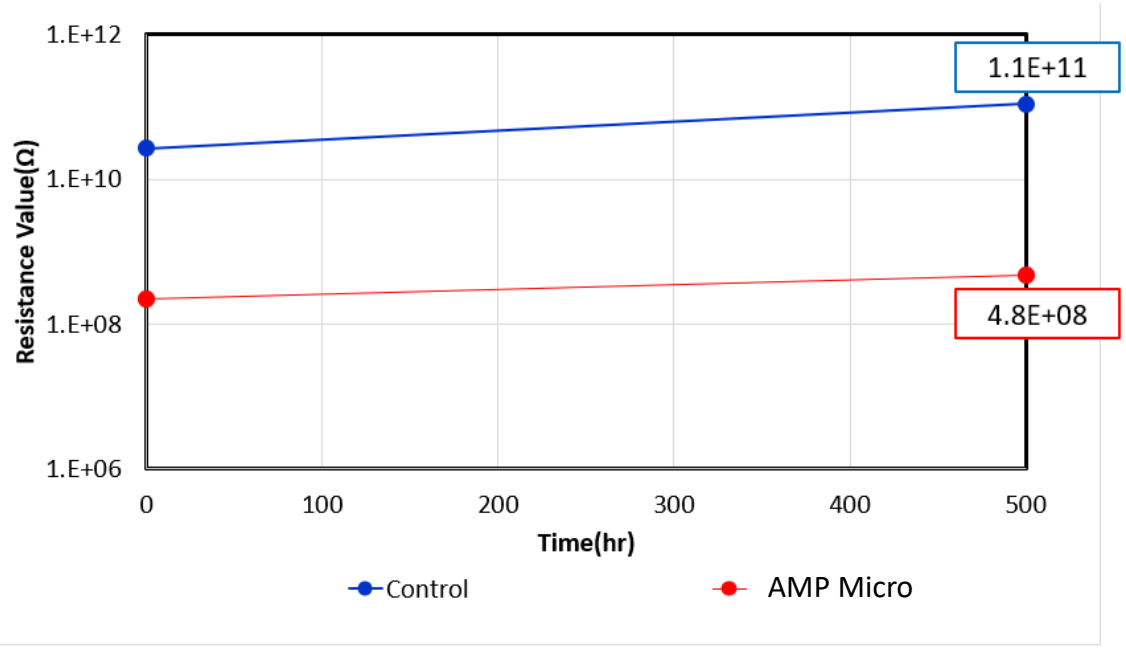
IPC Testing Results

Viscosity	Copper Mirror	Slump – Frosted Glass	Solder Balling – 0.1mm – Frosted Glass	Wetting – Copper
Brookfield: 750 - 1000 Kcps Malcom: 174.0 PaS (1740 Poise)	LOW – No copper breakthrough	**PASS** @ 	Initial: **Preferred** 4hr @ RT: **Preferred** 4hr @ 50% RH: **Preferred** 	**PASS, no evidence of dewetting** 

IPC SIR and ECM Testing Results



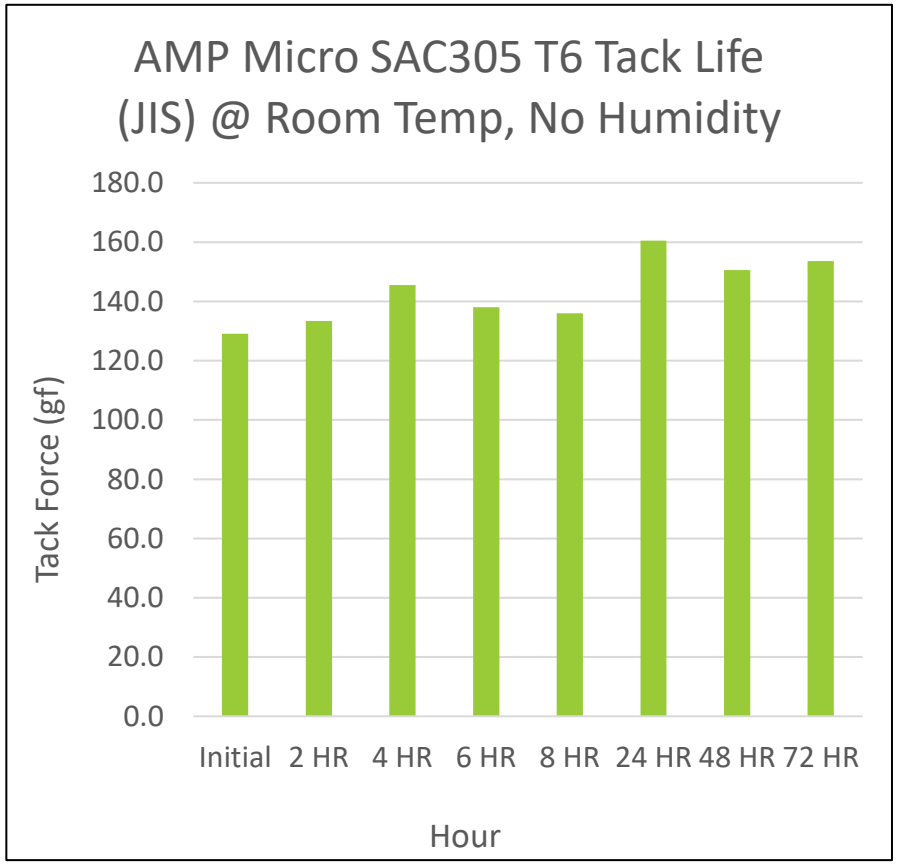
IPC-TM-650 2.6.3.7, 40℃, 90% RH, 168 Hours

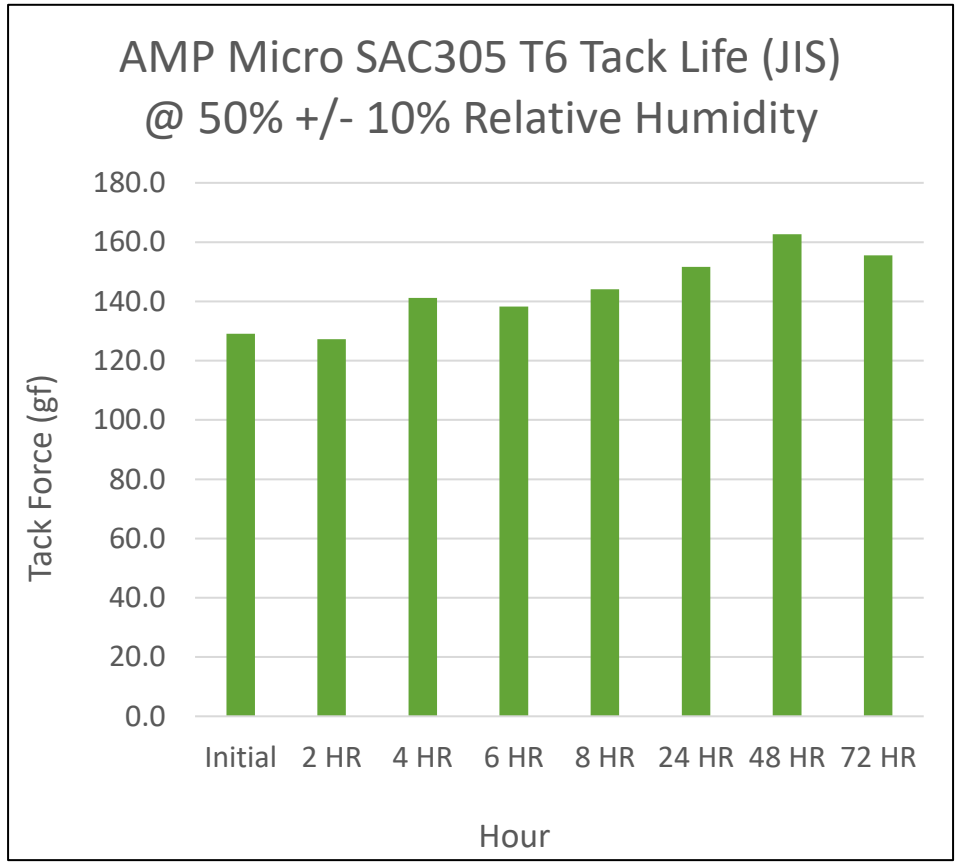


IPC-TM-650 2.6.14.1, 65℃, 85% RH, 500 Hours

Passes SIR and ECM Testing Without Cleaning Flux Residue

Tack Life Results – ≥72 hours

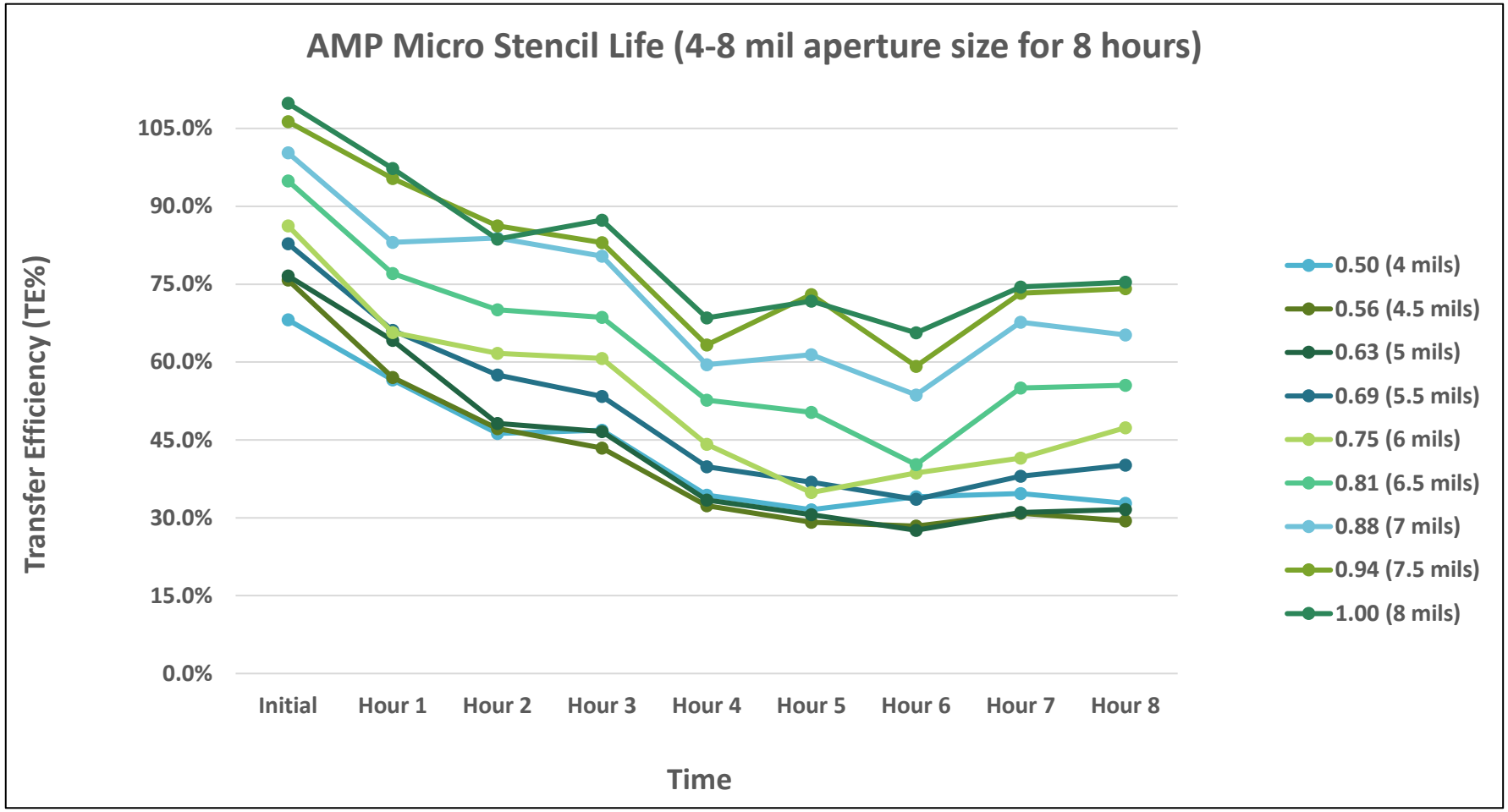




AMP Micro IPC Tack Force = 97 gf

AMP OnePT IPC Tack Force = 56 gf
Tack Life = ≥48 hours at 100-110 gf

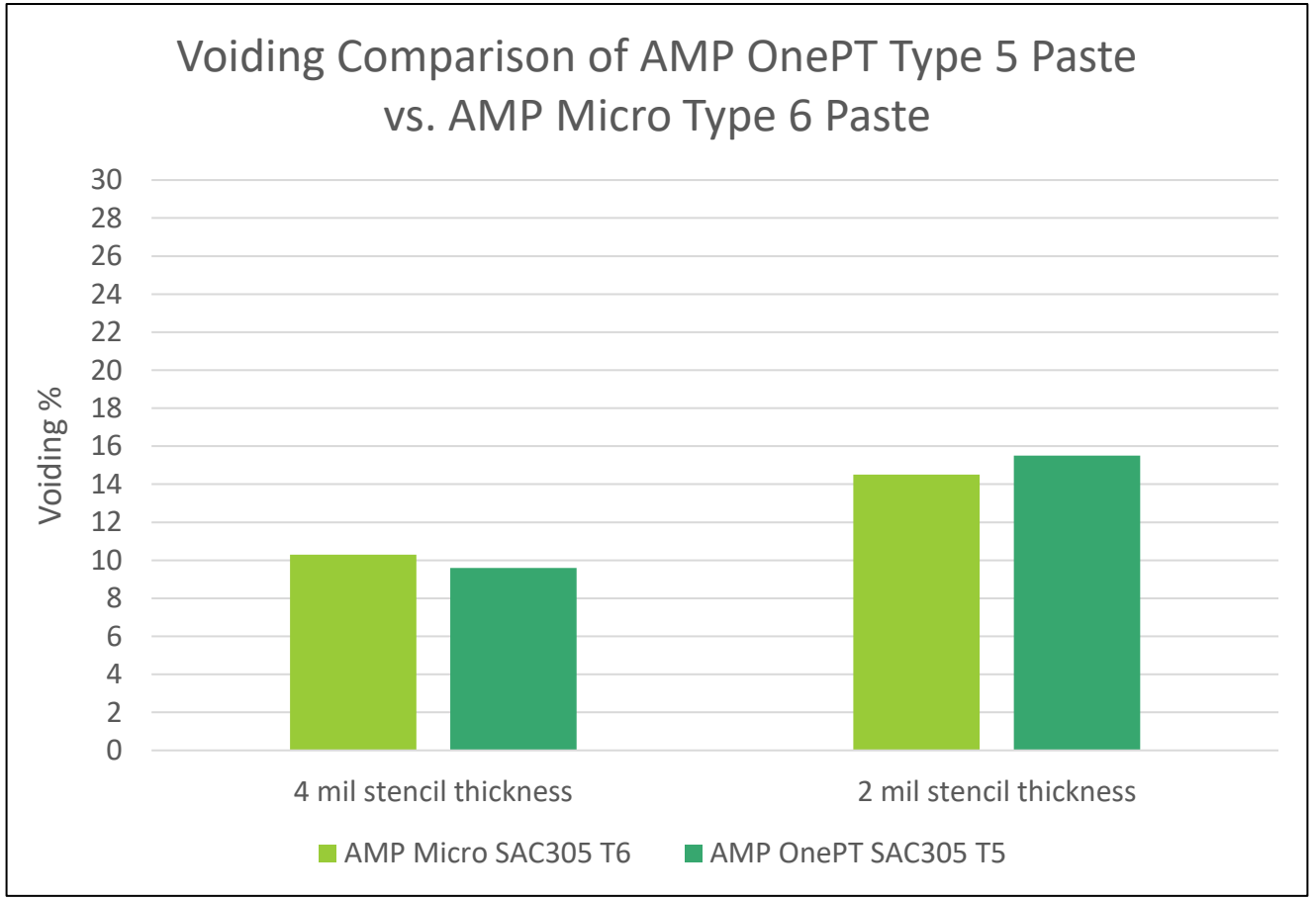
8-hour Stencil Life/Print and Pause Results



- No underside stencil cleaning.
- No fresh paste added during test.

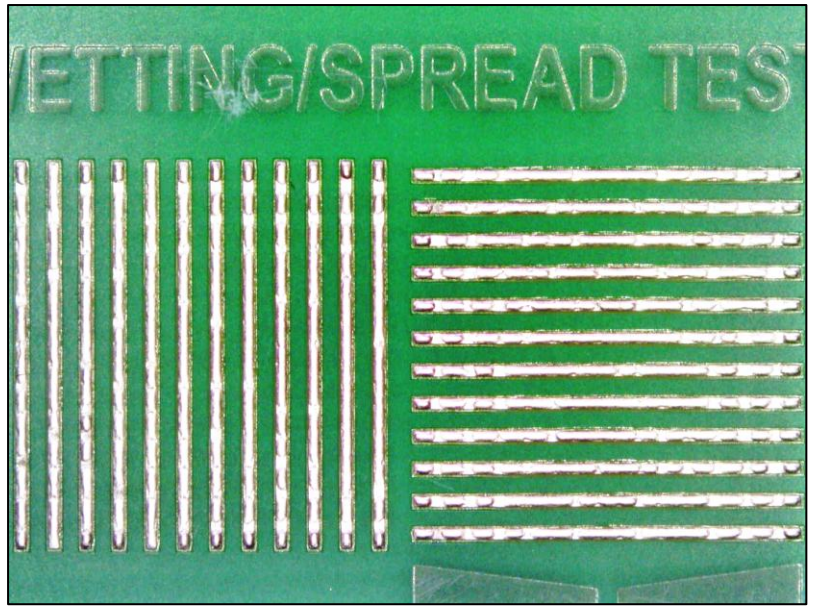
AMP OnePT Stencil Life on 6-16 mil apertures is ≥8 hours with a ~% drop in volume fro Ars???

AMP Micro Voiding Results

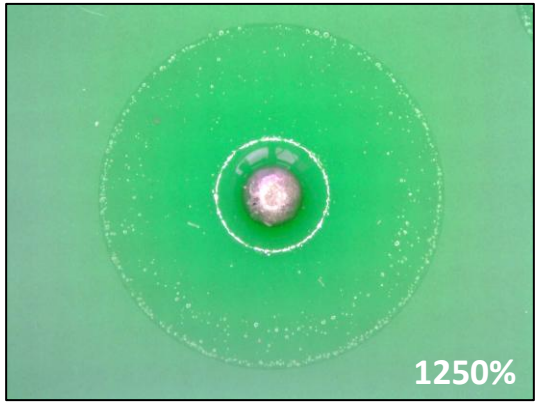


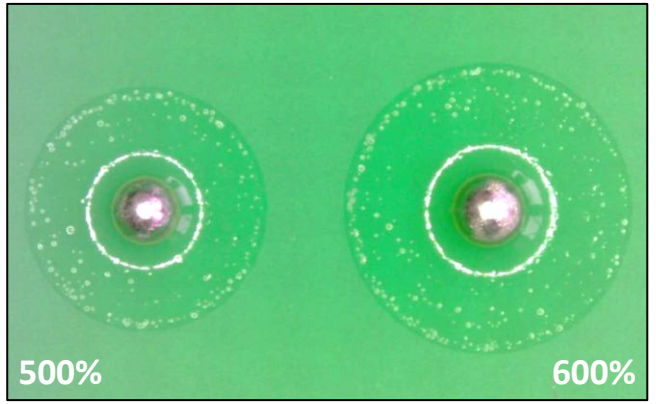
Convection Air Reflow Results

Wetting

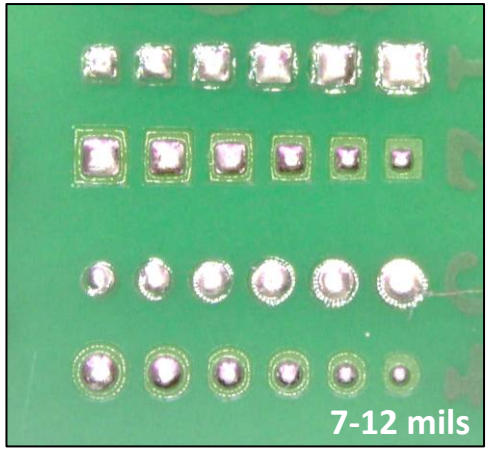


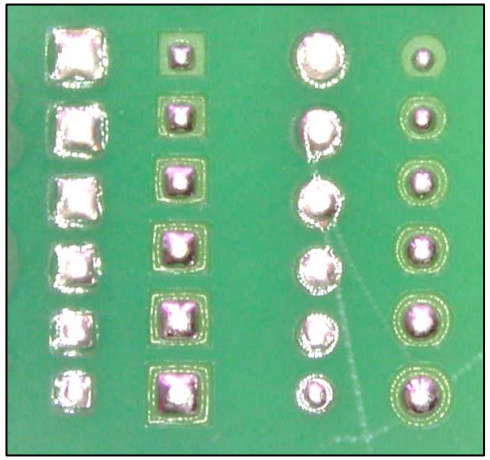
Solder Balling





Graping





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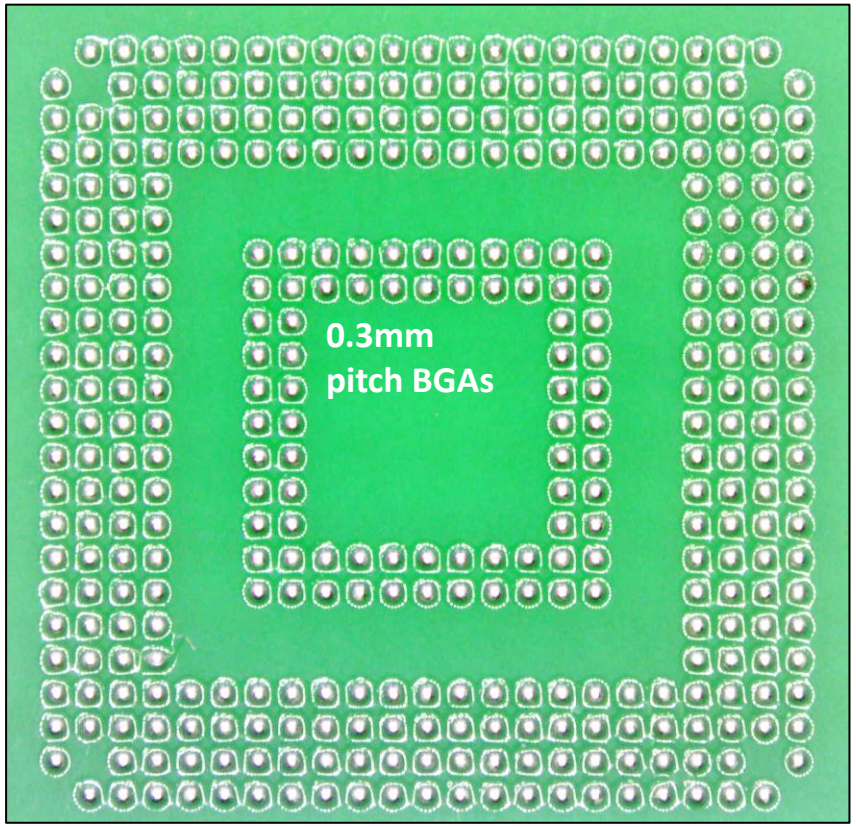

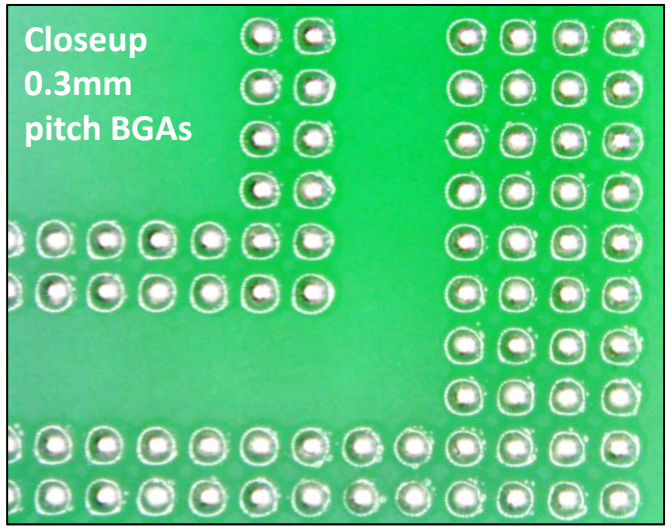

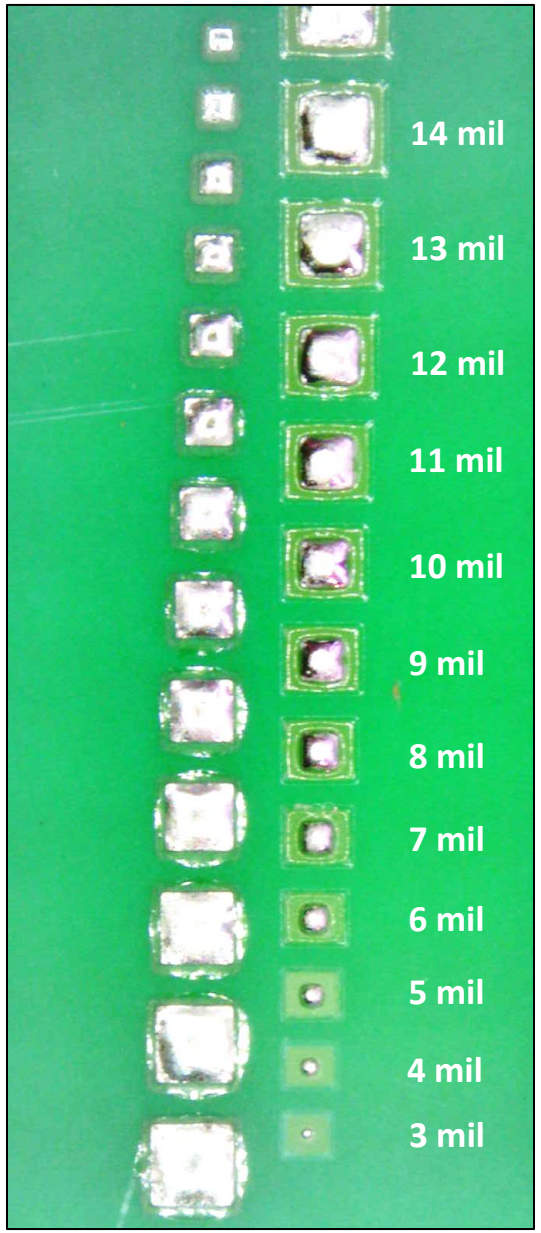

Conclusions

- AMP Micro is formulated for **advanced miniaturization**, supporting HDI and UHDI applications including SiP, PiP, flip chip, and semiconductor manufacturing.
- AMP Micro enables **convection air reflow**, eliminating the need for costly N_2 reflow environments.
- AMP Micro offers **excellent printability** through ultra-fine apertures needed for the industry's smallest packages including 008004 Imperial component sizes.
- AMP Micro, like FCT's AMP OnePT paste, offers **best in class voiding** performance.
- AMP Micro maintains **high tack stability** for up to 72 hours, ensuring consistent holding force needed for ultra-fine components.

Thank You!

We appreciate your time and attention.

Questions or Comments?

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